Experts at Work: 
The Canadian State, North American Environmentalism, and 

by

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Abstract

This study examines the emergence of sustainable development and renewable energy in Canada during the 1970s and the interplay between environmental politics, state structures, and intellectual discourse which made this emergence possible. The dissertation focuses on two events, the construction of the New Alchemists’ Ark on Prince Edward Island with the help of the provincial and federal governments, and the Department of Energy, Mines, and Resources’ $600 million (in 1978 dollars) subsidy program for renewable energy. These events provide a lens into North American environmental politics, the policymaking of Pierre Elliott Trudeau’s government, and the intellectual influence of Cold War science on the early foundations of sustainability in the 1970s.

I make four interconnected arguments about the nature of environmental politics, expert authority, the Trudeau government, and sustainability in this dissertation. First, the Trudeau government embraced the Cold War rationality of the 1960s and attempted to reorganize Canadian governance around objective analysis in an effort to transform policymaking into an exercise in calculation rather than political compromise. This privileging of technical and scientific knowledge that enhanced the authority of experts leads to my second argument. The state’s ability to shape discourse through ideology and policy feedbacks encouraged specific forms of environmental politics and, as a result, privileged an influential minority of environmentalists in the 1970s. Third, rather than rejecting or attacking this highly technocratic approach to policy, some environmentalists embraced it. These groups employed the technical knowledge preferred by the Trudeau government – modeling and forecasting – to conceptualize and advocate sustainable development. Fourth, government advisors worked directly with these technocratic environmentalists to champion renewables, thereby making Canadian sustainable development a co-production of government analysts and environmental advocates. Furthermore, the successes of renewable energy and sustainability in the 1970s rested upon the work of Cold War scientists, a formalist approach to rationality, and a belief in the efficacy of planning, as much as environmental concern.
Preface

This dissertation has made substantial use of images and illustrations. When these illustrations have not come from government documents, I have contacted the copyright holders and gained their permission to reproduce the images I have used. The Friends of the Earth granted permission to reproduce images from Amory Lovins and John H. Price's book, Non-Nuclear Futures: The Case for an Ethical Energy Strategy, published by San Francisco: Ballinger Publishing Co., 1975. Nancy Jack Todd, the editor of the Journal of the New Alchemists, has very kindly given permission to reproduce illustrations and photographs from issues of the Journal of the New Alchemists. Denis Meadows, a co-author of The Limits to Growth (New York: Universe Books, 1972), provided permission to reproduce images of the World3 Model's forecasts published in The Limits to Growth. Finally, Stewart Brand has provided permission to reproduce photographs published in his article “The New Class,” CoEvolution Quarterly 3 (Spring 1977): 8-39. I would like to thank each of these individuals or organizations for their permission to reproduce their work and for their important contributions to my dissertation.
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**Abbreviations**

**Organizations:**
- Economic Council of Canada: ECC
- Prince Edward Island Economic Improvement Corporation: EIC
- Department of Energy, Mines, and Resources: EMR
- Institute of Man and Resources: IMR
- New Alchemy Institute: NAI
- National Energy Board: NEB
- Office of Energy Conservation: OEC
- Research and Development Corporation: RAND
- Science Council of Canada: SCC

**Archives:**
- Iowa State University Special Collections: ISUSC
- Jimmy Carter Library and Museum: JCL
- Library and Archives Canada: LAC
- Prince Edward Island Public Archives and Records Office: PEIPARO
- University of Prince Edward Island Special Collections: UPEIS
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Introduction

Those who are concerned about the future of mankind are haunted by three questions: will there be enough food, will we have enough energy, and can we produce both without destroying the environment; without making the earth a place that is not good to live upon? The Ark – which I have the great pleasure of declaring officially open this morning – the Ark is answering “Yes!” to those three questions. And that is why I consider it a very exciting moment.¹

Prime Minister Pierre Elliott Trudeau spoke these hopeful words to an excited crowd and curious TV crew on September 21, 1976 at Spry Point, Prince Edward Island (PEI). Trudeau’s inspiring address marked the opening of a large futuristic structure, dominated by solar panels, greenhouses, and aquaponics tanks. The PEI Ark, dubbed a “spaceship to the future” by local journalists and heavily funded by the Trudeau government, was the first building of its kind in Canada, and with its solar heaters, wind turbines, and composting toilet it would not be out of place beside contemporary green architecture.² Designed to replicate a NASA space capsule, the Ark used the latest in ecological science, and its builders promised it would be almost completely sustainable as it recycled its inhabitants’ waste while providing them with food and energy in a closed loop of ecological feedback.³

The presence of the Canadian Prime Minister, hundreds of thousands of dollars in federal funding, futuristic technology, and promises of long-term sustainability might lead one to expect the involvement of NASA scientists or, at the very least, a leading research university. However, the New Alchemists, a group of scientists dedicated to helping hippies go “back to the land,” planned and built the Ark.⁴ Led by the charismatic biologist John Todd, the New Alchemists convinced federal and provincial governments

⁴ “New Alchemy Institute, Articles of Incorporation, San Diego, California, 1970,” Box 1, Folder 11, New Alchemy Institute Records (NAI Records), ISUSC.
to fund their work and make their futuristic structure the centerpiece of a new approach to
development designed to ensure long-term environmental sustainability and economic
growth in the face of the 1970s oil shocks.

Concern about “the future of mankind” motivated more than just pioneering
experiments with green architecture. Two years later, Alistair Gillespie, the minister of
the Department of Energy, Mines, and Resources (EMR), announced a $600 million (in
1978 dollars) subsidy program intended to create a Canadian solar heating industry. The
EMR’s plan seems even more astonishing given the relative novelty of solar heating in
Canada, where experimentation with the technology only began in 1971, and it remained
little known into the mid 1970s. Disregarding solar technology’s unconventionality,
Gillespie and the federal government promised the new solar heating industry would

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5 When adjusted for inflation the amount equals $1.9 billion today. This calculation was made using the
http://www.bankofcanada.ca/rates/related/inflation-calculator/.

6 E.W. Hoffman, “Four Years Operation of a Solar House” (paper presented at The Potential of Solar
Energy for Canada organized by the Solar Energy Society of Canada in cooperation with the National
provide tens of thousands of jobs for Canadians and supply roughly five percent of the
country’s energy needs by the 1990s, a scant twelve years in the future.7

The federal government did not simply pick this ambitious program out of the air. Environmental groups and government advisors, often using sophisticated computer analyses, worked together to convince EMR that renewable energy would dominate the future. Amory Lovins, a member of Friends of the Earth, used futurology to rethink mainstream energy policy and champion a shift to renewable energy. He had a substantial influence on this groundbreaking plan for sustainable development by helping to build a consensus around both renewable energy and the utility of alternative approaches to
development.8 The surprising transformation of renewables from a set of little known technologies to the recipient of more than half-a-billion dollars in funding also had roots in the conserver society. The Science Council of Canada, a crown corporation staffed by scientists and engineers that championed scientifically informed policymaking and the development of “national technologies,” popularized this approach to development.9

Fear of environmental limits and economic collapse connected the politicians, hippies, bureaucrats, scientists, and environmentalists who constructed and implemented these audacious programs of sustainable development. In the 1970s a shared form of rationality, approach to governance, and set of technical practices mediated these actors’ concerns about the future. Their shared ideology grew out of the pressures of the early Cold War, which created a very specific understanding of rationality as it sought to contain the irrationalities of human reason and mute political disagreement.10 Under the aegis of the Cold War, natural and social scientists redefined rationality as a machine-like ability to employ algorithms to maximize benefit while minimizing risk and used this idealization of human behavior to guide both military strategy and civilian policymaking.11 Above all, this understanding of reason and its emphasis on abstract and

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11 Paul Erickson, Judy Klein, Lorraine Daston, Rebecca Lemov, Thomas Sturn, and Michael Gordin, How Reason Almost Lost its Mind: The Strange Career of Cold War Rationality (Chicago: University of
formalist processes encouraged attempts to transform decision making into exercises in calculation. Seeming to promise a means to end political conflict and to improve governance, this conception of rationality, with its emphasis on technical knowledge, spread from the RAND Corporation and the Pentagon to general North American political discourse. In Canada, this hyper-rationality defined politics under the Trudeau government. Working to depoliticize policy and improve governance, the Trudeau government centralized power and privileged technical knowledge in an attempt to transform policymaking into reasoned debate governed by “knowledge power.”

For those committed to this ideology the practice of quantitative modeling, most notably scenario building, provided the means of analyzing the present and gaining the insight into the future necessary for long-term planning.

The Club of Rome and its famous Limits to Growth report, which helped define political discourse in the 1970s, provides perhaps the best example of this abstract rationalism in action. Designed by renowned computer programmer and former defense scientist Jay Forrester, the World3 model that Limits to Growth used in its forecasts was a breathtaking exercise in abstraction. Breaking the world down into five “levels” (population, resources, industry, food, and pollution), the computer program calculated systems of feedback to construct the first global model and forecast the dire consequences of exponential growth more than a hundred years in the future.

Models and their abstract and formalist approach dominated two of the central debates of the

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14 Fernando Elichirigoity, Planet Management: Limits to Growth, Computer Simulation, and the Emergence of Global Spaces (Evanston, IL: Northwestern University Press, 1999).
1970s as they helped push the environment into mainstream political discussion and framed the energy crisis that came to define the decade. Analysts interpreted the 1973 OPEC embargo and price shocks as the new normal and constructed forecasts, first of scarcity and then the end of oil. As these models defined the future and created concern, they also provided those able to use them with a means to outline an alternative – sustainable development – and use a politically privileged methodology to construct compelling arguments for this alternative.

Figure 2: The World3 Model Standard Run. Note the rapid collapse it projects in the late twentieth century.


Despite the hundreds of millions of dollars involved, the highly public government support for sustainable development, and the guiding hand of hyper-rationalist forecasting and governance, this episode has remain unexamined. My analysis of the combination of political power, rationalist ideology, technical knowledge, and environmental advocacy contributes significantly to environmental history, Canadian political history, and the history of science. It demonstrates the active participation of the state in the first programs of sustainable development, highlights the significant influence of the state on environmental politics, and offers a state-centered approach to studying the
actions of important, but often overlooked, environmentalists. Similarly, countercultural scientists’ and technocratic environmentalists’ embrace of rationalist ideology and technical knowledge developed by military scientists during the Cold War challenges the common perception that 1960s environmentalists abhorred modern technology and suggests that technical practices, such as futurology, defined environmentalists’ successful advocacy of renewable energy and the formulation of sustainability in the 1970s.

This analysis of hyper-rationalism rooted in Cold War research also contributes to Canadian political history, by expanding the existing scholarly discussion of the Trudeau government’s attempt to use scientific knowledge and expert authority to rationalize policymaking and depoliticize politics and the ways in which these efforts framed Canadian politics during the decade. As this scientism privileged certain political actors, namely those able to manipulate technical knowledge, it reshaped political discourse and shifted the foundations of political power. Paying attention to the influence of this specific interpretation of rationality and the application of technical knowledge, which had a central role in pioneering programs of sustainable development, also extends analysis of expert authority and quantification by illustrating the politicization of knowledge and its employment as a tool in political debate. Just as importantly, the fundamental significance of modeling to the construction of alternative energy policies challenges the common dismissal of forecasting as an inaccurate tool of obfuscation by demonstrating the role of modeling and future studies in developing new policies and challenging the status quo in the 1970s.

**Environmentalism, the State, and Technical Knowledge**

This dissertation’s study of the employment of highly technical analysis, the shared commitment to Cold War rationality, and the activity of the Canadian government at both the federal and provincial levels, which enabled the extensive renewable energy program and the construction of the PEI Ark, redefines historical analysis of environmentalism in two significant ways. First, it suggests that the Canadian state played a significant role in environmentalism’s intellectual development and actively participated in Canadian environmental politics during the 1970s. Second, it underlines the importance of technical knowledge to modern environmentalism, including
technologies such as energy analysis and futurology that are not commonly associated with environmental activism.

This dissertation understands environmentalism as any effort to protect the natural environment through technological, philosophical, or political action. I embrace this broad view of environmentalism to highlight the emergence of environmental activity from policies and approaches not popularly associated with environmentalism and not always designed exclusively to preserve the environment. This approach more effectively incorporates influential, but atypical, environmental actors, such as the New Alchemists and the Science Council of Canada, which helped shape Canadian environmentalism in the 1970s, but have received little analysis. Although the New Alchemists and many of the other groups this dissertation examines fall outside the norms of environmentalism in the period, their influence on environmental politics and the role the played in the emergence of sustainable development in Canada means they must be taken seriously as environmentalist actors and participants in Canadian environmental debates. Just as importantly, their use of technical knowledge to justify their activities and generate support for their projects further expands scholarly analysis of the philosophical and political foundations of environmentalism.

Environmental historians have long debated the place of science in modern environmentalism. Seeing the environmental movement as a successor to the peace movement and the New Left, environmental historian Frank Zelko has drawn on Theodore Roszak’s classic, *The Making of a Counter Culture*, to argue that in the 1970s environmentalists viewed technology with suspicion and associated science with the military industrial complex and the construction of nuclear weapons.16 Although not all historians go as far as Zelko, his work is part of a broader approach to studying environmentalism that connects it to criticism of modern technology and the application of New Left inspired tactics of protest.17 More recently, however, environmental

historians and historians of science have challenged this analysis through a broader reassessment of the counterculture’s politics and its relationship with technology in the 1960s and 1970s. Environmental historian Andrew Kirk, for example, has outlined an alternative assessment of what he calls “countercultural environmentalism” that highlights its pragmatic approach to technology and even suggests leaders of countercultural environmentalism drew on long standing themes of technological progress to argue that innovation and the extensive application of green technology were central to any attempt to protect the environment and provide Americans with fulfilling lives.\(^\text{19}\)

Outside of this debate over the values the many different groups or philosophical approaches to environmentalism have assigned to technology, scholars have also examined the influence of scientific research and scientist activists on environmentalism in the 1960s and beyond. Historian Michael Egan, for example, convincingly shows that biologist Barry Commoner, along with other activist scientists, substantially expanded environmentalism by educating the American public about the dangers of nuclear fallout and communicating the importance of the precautionary principle within modern industrial societies.\(^\text{20}\) As a result of these efforts as well as the popularization of ecology as a “subversive subject” in the late 1960s, the science based activism of ecologists, biologists, and chemists has largely framed environmental historians’ analysis of science.\(^\text{21}\) While fundamental to the history of modern environmentalism, this focus obscures the importance of other forms of scientific and technical knowledge to environmental thought and action, particularly the practices of futurology and

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555; Philip van Huizen, “Flooding the Border: Development, Politics, and Environmental Controversy in the Canadian-U.S. Skagit Valley” (PhD diss., University of British Columbia, 2013).


21 Egan, Barry Commoner and the Science of Survival, 49.

quantitative modeling.

As Jacob Hamblin has suggested, the focus on ecology and activism has led environmental historians to overlook the connections between environmentalism and Cold War military science, particularly the computer modeling involved in the development of global environmental analysis.\(^\text{23}\) Expanding upon Hamblin’s work, I show how the practices of futurology and quantitative modeling significantly affected environmentalism by demonstrating how environmentalists employed models to understand the world and how this technical approach framed their analysis, lent it authority, and allowed them to communicate their concerns to policymakers who relied on these forms of investigation. My analysis also suggests that this influential minority of environmentalists employed other forms of Cold War science to experiment with methods of architecture and sustainable agriculture suited to the limited world of “spaceship earth.”\(^\text{24}\) Todd and the New Alchemists designed the PEI Ark by using “cabin ecology” research developed through NASA’s experiments with space capsules during the 1960s.\(^\text{25}\) In a similar vein Amory Lovins, as I mentioned above, deftly employed the technical practices of energy analysis to critique energy experts’ calculations. He also built futurological scenarios to illustrate what he believed were the horrible consequences of embracing nuclear power as well as the substantial advantages that he thought would accrue from renewable energy. Without the future studies pioneered by military scientists at the RAND Corporation, a central institution of Cold War military science, Lovins could not have carried out his analysis. These examples of the combination of complex technology and rationalistic ideology inherent in these efforts to live in a sustainable way were characteristic of a technocratic undercurrent present in some strands of environmentalism during the 1970s.

Besides broadening environmental historians’ study of technical knowledge and underlining the significance of previously overlooked methods of inquiry, my research rethinks the foundations of sustainability by connecting it to Cold War science and


modernization. I argue that the idea of sustainability developed out of a combination of environmental concern and computer assisted analysis of the future and received significant ideological support from attempts to manage human society with machine-like efficiency and rationally direct its development.\textsuperscript{26} The central importance of Cold War military research initially undertaken in the service of the vast geopolitical struggle also suggests that the state had a more active and influential role in modern environmentalism than scholars have previously recognized because of the emphasis scholars, such as Andrew Kirk, have placed on environmentalism’s libertarian sensibilities.\textsuperscript{27}

The necessity of rethinking the importance of the state to modern environmentalism is an odd task. Environmental historians have skillfully examined the influence of the state upon the natural world and the complex ways in which state power has framed human interactions with the environment.\textsuperscript{28} Tina Loo and Meg Stanley, for instance, have brilliantly analyzed how local environmental knowledge, state planning, and communities of globally transient experts shaped dam building in Canada.\textsuperscript{29} This extensive and insightful analysis of the state, however, has yet to figure prominently in environmental historians’ study of postwar environmentalism.\textsuperscript{30}

Instead of drawing on analysis of the state, scholars of environmentalism adopt an approach that political sociologist Theda Skocpol has described as “society centered.”\textsuperscript{31}

\textsuperscript{26} Nils Gilman, \textit{Mandarins of the Future: Modernization Theory in Cold War America} (Baltimore: Johns Hopkins University Press, 2003).
\textsuperscript{27} Kirk, \textit{Counterculture Green}, 18.
\textsuperscript{29} Tina Loo and Meg Stanley, “An Environmental History of Progress: Damming the Peace and Columbia Rivers,” \textit{The Canadian Historical Review} 92, 3 (September 2011): 399-427.
\textsuperscript{30} The state figures much more prominently in histories of earlier forms of environmental protection and management, such as the conservation movement of the Progressives. See Brian Balogh, “Scientific Forestry and the Roots of the Modern American State: Gifford Pinchot’s Path to Progressive Reform,” \textit{Environmental History} 7, 2 (April 2002): 198-225.
\textsuperscript{31} See Skocpol, “Bringing the State Back in: Strategies of Analysis in Current Research,” in \textit{Bringing the State Back In}, eds. Peter Evans, Dietrich Rueschemeyer, and Theda Skocpol (Cambridge: Cambridge University Press, 1985). Peter Evans and Daniel Carpenter, among others, have expanded upon Skocpol’s
As a result, the literature on environmentalism has largely dismissed the state as an independent actor and instead conceptualized it as an expression of society or as a prize fought over and controlled by competing social forces – often business interests and environmental movements. 32 The society centered approach has led scholars to understand environmentalism as a social movement and to focus their analysis on how it caused social and cultural change that reshaped expectations and forced policy modification. 33 Society centered analysis has helped historians investigate the myriad ways that environmentalism has transformed western views of the environment and the means with which concerned citizens have mobilized to effect change. This focus on social change at the expense of state agency, however, has sometimes led to a narrow understanding of both the environmental actors and the structures that shaped environmental politics.

In the Canadian context, historians have often cited Prime Minister Pierre Trudeau’s avid canoeing as part of Canadians’ changing “life styles” and the transformation of their approach to the environment, but scholars have largely ignored the Trudeau government’s profound effect on Canadian politics during the period that saw the blossoming of Canadian environmental advocacy. 34 In fact, the only political scholar who has attempted an extensive examination of the impact the Canadian state had on environmentalism, Kathryn Harrison, assumed changes in public opinion dictated the state’s interests. 35 While she offers an excellent analysis of the constraints the structure of work by arguing that political outcomes should be understood as co-productions of political and social factors. See Evans, Embedded Autonomy: States and Industrial Transformation (Princeton, N.J.: Princeton University Press, 1995); Carpenter, The Forging of Bureaucratic Autonomy: Reputations, Networks, and Policy Innovation in Executive Agencies, 1862-1928 (Princeton, N.J.: Princeton University Press, 2001).

32 Paul Milazzo, who examines the significance of the state to American environmental action in the 1960s, is one of the few scholars who focuses on the state as an active participant environmentalism. See Milazzo, Unlikely Environmentalists: Congress and Clean Water, 1945-1972 (Lawrence: University Press of Kansas, 2006).


confederation placed on federal action, Harrison’s narrow definition of environmental activity – passing legislation directly related to pollution or preservation – and her focus on public opinion as the primary motivation for governmental action artificially confined the state’s agency. For example, her account overlooks the influence of the state on political discourse as well as the significance of energy and development policy to environmentalism.

By taking the state seriously as an actor, this dissertation illustrates the important, and occasionally central, role the government sometimes played in Canadian environmentalism in the late 1960s and the 1970s. Focusing on the Canadian state as an organization with agency and a substantial influence on political culture, I analyze how state actors at the federal and provincial levels participated in environmental debates, contributed to environmental groups’ intellectual development, and framed Canadian environmental politics. In particular, I argue that pioneering programs of sustainable development emerged from the government’s efforts to plan development and its ideological commitment to employing technical knowledge to reshape Canadian society and politics. The PEI Ark, for instance, emerged because the provincial Premier was able to mobilize state power in support of a program of sustainable development that he believed would benefit his province both economically and environmentally.

Rationalist Ideology, Technical Knowledge, and the Trudeau Government

The Trudeau government dominated Canadian politics from the end of the late 1960s until the early 1980s. It presided over the culmination of the Canadian social welfare state, profoundly reshaped the structure of the Canadian state, and outlined a conception of Canadian federalism that resulted in open conflict with the provinces over energy policy and the repatriation of the Canadian constitution. As a result, the Trudeau legacy still shapes contemporary Canadian politics. Indeed, the fascinating and polarizing figure of Trudeau himself has a dominant place in the historical analysis of Canadian

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politics in the period. Biographies and studies explore this towering and complex figure and analyze the incongruencies of his romantic and rebellious public image and his personal commitment to rational action, among other aspects of his personality and politics. Historians have been less interested in the ideology of his government and how it affected Canadian politics in the 1970s. The work of Canadian political scientists, however, suggests that by setting the terms of political debate through its privileging those able to manipulate technical knowledge, the ideology and organization of the government profoundly affected policy, particularly energy policy and economic development. Furthermore, the French Canadian literature emphasizes the growing importance of technocratic management in Canadian politics of the period.

To build on this analysis and move away from personality-dominated accounts of the Trudeau government, I draw extensively on the work of Theda Skocpol. Voicing a need for an alternative methodology to analytical outlooks focused on social or cultural forces, Skocpol has outlined a state centered approach and highlighted how it enables a more complete analysis of states as actors in their own right and how their institutional structures shape politics. Her analysis forms the foundation of my approach to politics throughout my dissertation, particularly her emphasis on the ability of the state to mould political discourse. To paraphrase Skocpol, the state matters because its organizational configuration and its actions shape political culture, which in turn privileges specific


ideas and groups over others, thus making it possible to raise certain political issues or policy approaches, but not others. In short, the state is the primary determinant of political culture, and it frames both how policies are discussed and which are likely to succeed.

By drawing on Skocpol, I am able to demonstrate the importance of Cold War science – particularly its attempts to discover and institute rational policymaking processes – to Canadian political discourse under the Trudeau government. The ideological preeminence of objective knowledge and scientific analysis enhanced the political power of expert advisors and made technical knowledge a valuable tool within Canadian political discourse during the 1970s. My emphasis on the connections between the rationalism of the Trudeau government and Cold War science expands on existing accounts by highlighting the application of formalist theories of decision-making designed to systematize and improve decision making, and by showing how the Trudeau government attempted to transform Canadian governance by depoliticizing the policy process to ensure that decisions relied upon the objective analysis of facts rather than bureaucratic inertia or political favoritism.

Central to my analysis is the failure of the government’s efforts to depoliticize Canadian politics, a common outcome of such efforts to make politics efficient and systematic. This point, however, is only the beginning of my examination. A discourse that privileged technical knowledge continued to dominate governmental judgment and shape politics. Guided by historian of science Theodore Porter’s study of quantification and expert authority and Skopcol’s focus on the state’s influence, I argue that rather than depoliticizing politics, this discourse enhanced the power of groups equipped to manipulate technical knowledge and claims to objectivity. In short, the Trudeau government did not make politics a process of objective judgment founded in fact, but

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rather it made forms of investigation that constructed evidence and promised objectivity – namely futurology and quantitative modeling – powerful tools within Canadian politics.

The importance of this technical knowledge and the diverse set of advisors which used it leads me to an expansive understanding of the state. I approach the state as the enduring structures of governance which are able to maintain the legitimacy of their martial, legislative, and administration power. However, these structures are both porous and dynamic. In the 1960s and 1970s the authority of different structures, such as government departments, changed, and the intellectual foundations upon which the state based its decisions were altered. These reforms often blurred the boundaries of the state as advisory bodies which were theoretically meant to operate at arm's length, such as the Science Council of Canada, were closely involved in policy, experts moved in and out of departments, and their advice was incorporated into the policy process. In fact, the Trudeau government’s efforts to incorporate scientific knowledge into policy gave experts and advisors substantial authority and, even though they were not always incorporated into the structures of the state, it is difficult to understand political debates or policy decisions in the 1970s without taking their actions into account. By drawing on this inclusive view of the state, I show how its preferences influenced the presentation of environmental ideas, but also enabled those who could mobilize the preferred technical knowledge to take part in political debate and in some instances shape policy.

This approach to the state allows me to analyze the influence of state discourse and to extend analysis of Canadian politics in the period. Most importantly, I am able to show how state discourse was constructed and how it gave agency to technically skilled experts willing to work closely with the government. The structure and ideology privileged technically skilled environmental groups, which allowed their studies of Canada’s energy future to reshape federal policy and frame commitments to renewable energy. For instance, Amory Lovins drew on this Cold War rationality to analyze energy policy, and his approach and conclusions were widely adopted by both environmentalists and advisors within the Canadian government. In short, the state bounded discussion, but if the desired forms of knowledge were used by networks of bureaucrats and environmentalists they could substantially reshape policy.

A state centered approach also allows me to analyze how the government of PEI
manipulated federal development policy by appealing to then current theories of modernization in order to direct federal investment into development projects desired by the provincial government.\footnote{Richard Phidd and G. Bruce Doern, \textit{The Politics and Management of Canadian Economic Policy} (Toronto: Macmillan, 1978), 324. For a discussion of development policy on PEI specifically, see Donald Nemetz, “Managing Development,” in \textit{The Garden Transformed: Prince Edward Island, 1945-1980}, eds. Smitheram, Milne, and Dasgupta (Charlottetown: Ragweed Press, 1982).} In short, the federal government’s “objective” policymaking enhanced the power of provincial governments that were able to mobilize the correct expertise and vocabulary. This analysis challenges scholarship which approaches the federal government’s efforts to encourage economic development and “modernize” Atlantic Canada as an almost purely federal endeavor by suggesting it underestimates the participation of the provinces and their ability to redirect, if not entirely control, development projects.\footnote{Savoie, \textit{Visiting Grandchildren}; Miriam Wright, \textit{A Fishery for Modern Times: The State and The Industrialization of the Newfoundland Fishery, 1934-1968} (Toronto: Oxford University Press, 2000).} During the late 1960s and early 1970s, the government of PEI proved particularly adept at this method of manipulation when it mobilized the Trudeau government’s commitment to regional development and its ideology of rational management by enlisting economists and other development experts to construct policies that attracted tens of millions of dollars in funding.\footnote{Edward Macdonald, \textit{If You’re Stronghearted: Prince Edward Island in the Twentieth Century} (Charlottetown: PEI Museum and Heritage Foundation, 2000); Wayne MacKinnon, \textit{Between Two Cultures: The Alex Campbell Years} (Stratford, PEI: Tea Hill Press, 2005).} The countercultural scientists of the New Alchemists also participated in and benefited from this manipulation of the federal government’s modernization efforts by helping to outline policies of local sustainable development, and they earned extensive government funding as a result.

My analysis of the state’s influence on various environmental groups also highlights the vulnerabilities created by reliance on technical expertise and the manipulation of state discourse. While the Trudeau government remained in power and committed to rationalizing the policy process, it privileged technocratic environmentalists and scientific advisors, thereby giving them substantial political power. The influence of these groups, however, rested on the state. If the government decided to shift its policy goals or change the intellectual and structural foundations around which it made decisions, advisors could quickly find themselves isolated and no longer regarded as useful. Advocates of renewable energy found themselves in this position in the early
1980s, when the government refocused its energy policy on oil development and clashed with the provinces over the federal government’s authority over resource exploitation. Similarly, on PEI, where the provincial government undertook Canada’s first program of sustainable development, the programs relied substantially on the political power of Premier Campbell and his closest advisors. When Campbell left office in 1979, these pioneering efforts began to dissolve, and in the 1980s the newly elected government, led by Campbell’s political opponents, defunded the primary institution created to oversee experimentation with renewables.\(^49\) The environmentalists' efforts to work with the state and the state's own actions were integral to Canadian environmentalism in the 1970s, but the problems the expert environmentalists faced in the 1980s underlines the reality that the power of technical knowledge remains contingent upon the state and, while instrumental, it cannot overcome the power of a hostile government.

**Expert Authority, Modeling, and Sustainability**

Although fragile, expert authority and technical knowledge played a fundamental role in Canadian politics during the 1970s. By focusing on the employment of technical knowledge and expert authority in political debates, this dissertation challenges scholarship that argues technical expertise inevitably enhances state power and limits dissent.\(^50\) On a more specific level, it also suggests that analysis which focuses on the inaccuracy of futurology and modeling in the 1970s overlooks the fundamental importance of these Cold War techniques to the formulation of sustainable development. In Canada, for instance, solar technologies were not constructed through a development process defined by solar technology itself. Rather, the computerized technologies of energy analysis and economic simulation and the experts who employed them shaped federal efforts to create a solar industry.\(^51\) To understand the unusual history of renewable energy and sustainable architecture in the 1970s, it is necessary to take the influence of


\(^51\) Trim, “Brief Periods of Sunshine.”
simulation seriously, especially because it operated as the means through which scientists and some environmentalists asserted the bright future of these technologies and outlined detailed programs for their development.\(^{52}\) Focusing on technologically mediated narratives of progress to guide my examination of the New Alchemists and their Ark, I argue that its success rested upon the group’s ability to construct networks connecting the counterculture and elite funding organizations, such as the Rockefeller Foundation, and leverage their scientific knowledge into extensive financial support. More broadly, my analysis of Canadian efforts to construct a solar industry and experiment with sustainable architecture underlines the importance of projects to predict and manage the future and shows how these techniques defined alternative approaches to development.\(^{53}\)

Scholarly analysis of forecasting, however, has tended to move quickly past its capacity to shape policy or encourage experimentation and focus instead on its inaccuracy and its ability to provide a veneer of objectivity to self-serving decisions.\(^{54}\) The very real inaccuracies of energy forecasts, which first predicted Canada had a surplus of natural gas, then a deficit, then a surplus again all in the same decade, has led scholars to note their influence, but dismiss them without examining the longer history and the deeper intellectual and political reasons why simulation had such power in the 1970s.\(^{55}\) To these scholars, technical expertise functions as a tool of domination and almost invariably subverts the democratic process and narrows political debate. To paraphrase John Robinson, a scholar of public policy, energy forecasting functioned not as a means of gathering information and making informed policy, but as a method of hiding political


decisions behind the mantle of objectivity while extending the power of the state.\textsuperscript{56} While broadly accurate, this view of forecasting, and expert authority more generally, which closely reflects anthropologist and political scientist James Scott’s analysis of expert authority, provides a one-sided view of expertise.\textsuperscript{57} Notably, it undervalues the agency of experts and assumes the state is a monolithic entity without internal conflicts. This analysis might accurately describe an authoritarian state without civil society or countervailing centers of knowledge production, but it does not describe politics in postwar Canada.

Scholars of expertise within the history of science provide a more nuanced approach useful to investigating the complex politics of technical knowledge and expert authority in the 1970s. These scholars’ central argument, which guides my work, is that expertise and the production of technical knowledge do not stop political debate.\textsuperscript{58} Even the production of a single metric, such as the cost of living, can enable decades of fervent political debate.\textsuperscript{59} Rather than transforming policy into a formal process of calculation, experts’ construction of quantitative metrics expands and complicates political debate by producing points of disagreement and introducing new actors. As political theorist Yaron Ezrahi suggests, the state’s employment of scientific or technical knowledge both enhances and limits state power, as it allows the state to draw on the authority of expertise to legitimate its actions, but also forces the state to adhere to the practices of the expert community or risk losing the ability to claim expert status.\textsuperscript{60} In short, the state’s employment of expertise and technical knowledge neither silences debate nor depoliticizes politics, but rather it expands political conflicts by enhancing the authority of those able to establish themselves as experts and employ privileged technical knowledge.

\textsuperscript{57} Scott, \textit{Seeing Like a State}.
\textsuperscript{59} Stapleford, \textit{The Cost of Living in America}.
The use of futurology and simulation models by environmentalists, such as Amory Lovins, to enter the energy debates of the 1970s and introduce arguments for renewable energy illustrates how forecasting broadened political debate and the complex politics of expertise. Rather than simply allowing the state to ignore criticism, futurology and economic forecasting enabled environmentalists and advocates of renewables to criticize government policy and construct quantitatively founded arguments capable of appealing to both elite policymakers and Canadian and American citizens. As I indicated above, the Science Council of Canada (SCC) outlined the conserver society, an approach to sustainable development it called on the Trudeau government to adopt, by using simulation.61

The SCC relied heavily on both its scientific authority and the futurological approach of environmentalists and organizations – particularly Lovins and the Club of Rome – to construct its program of sustainable development. Drawing on forecasts of future scarcity and simulations of renewable technologies' development, it argued sustainable development would benefit Canadians more than the Trudeau government’s efforts to encourage growth through resource exploitation. This use of simulation buttressed the SCC’s authority within the political culture set by the Trudeau government and positioned the Science Council as an expert on Canada’s future. With its authority established, it employed formalist approaches of “systems analysis” privileged by the state to examine the future and, on the basis of its analysis, argue rationally for a shift to sustainable development.62 Among its reasons for the shift was the opportunity to create a degree of “technological sovereignty” against American domination and position Canadian industry to benefit from the coming end of oil.63 This reasoning drew heavily on national debates over Canada’s neo-colonial relationship with the United States and self-consciously attempted to enhance Canadian scientific research and employ Canadian

62 SCC, Natural Resource Policy, 12.
scientists and engineers. These nationalist goals would play a key role in Canadian alternative development in the 1970s.

Canadian programs of alternative development in the 1970s do not fit easily into the accepted chronology of sustainable development, which focuses on the 1987 Brundtland Commission and its famous report *Our Common Future*. This circumstance raises the following question: Is it reasonable to refer to Canadian alternative development programs in the 1970s as sustainable development? The concept of “sustainable development” is difficult to precisely define and, as Deb Debal and other scholars of development have argued, elements of the concept are both long standing and politically contentious, which makes any definition problematic. Nonetheless, the Brundtland Commission can be said to have set the tone of the United Nations’ understanding of sustainability and sustainable development, and the UN’s approach continues to dominate contemporary discussions of the concept. The Commission defined “sustainable development” as “development that meets the needs of the present without compromising the ability of future generations to meet their own needs.”

Sustainability, in this definition, rested on a compromise between growth and multigenerational access to the necessities for a reasonably healthy and comfortable life. It saw the careful management of resources and the mindful development of technology as central to the successful adaptation of human society to the limits of the natural world.

This understanding of sustainability drew heavily upon earlier analyses of the world and its environmental and social problems, most notably Barbara Ward's and René Dubos' *Only One Earth: The Care and Maintenance of a Small Planet*, which they wrote for the 1972 UN Conference on the Human Environment. Concerns about the world and its future as well as discussions of how to ensure long-term survival, however, were not confined to the UN or environmental groups. As early as 1968, the Science Council of

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Canada began to voice concern about resource depletion and suggested the need for programs designed to conserve or replenish resources. In the early 1970s, the Science Council fleshed out its concerns about the future and called for “long-range policies for integrated management of resource and the environment,” and it based this call on the “perception [that] the world is a finite host to humanity, and from our recognition of increasing global interdependence.” The Council also began to use the term “sustainable” to refer to management practices designed to ensure sustained yields over the long term or technological and policy innovations that could help Canadians to adapt to the limits of the natural world. The SCC was not the only group using the term sustainable in this way before 1987. Amory Lovins, in his widely read book *Soft Energy Paths*, used the term in a similar fashion as he argued for the development of renewable energy and the institution of long-term plans to balance environmental protection and economic development. In my view, this use of the term “sustainability,” combined with the similarity between the goals of alternative development in the 1970s and later goals of sustainable development, justifies the use of the term to describe activities during the period, even though they were not characterized as “sustainable development” at the time.

While the existence of sustainability more than a decade before its codification is interesting, the political foundations of Canadian programs are far more intriguing. These projects were closely connected to nationalist efforts to develop Canadian technology and industry. The nationalism of Canadian sustainable development suggests that scholarly focus on international environmental meetings and debates over the right to growth in the global south, which dominate discussions of sustainable development, overlooks extensive experimentation with concepts of sustainable development in North America.

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As ideas about sustainability became an appealing means of addressing potential environmental and economic problems within Canada, they intersected with rationalist ideology, nationalist desires to expand Canadian industry, and government efforts to apply modernization theory to Atlantic Canada and ensure the country’s energy self-sufficiency. By examining these motivations for sustainable development, I argue that nationalist attempts to position the country to benefit from future oil shortages, as much as concerns about the global south or environmental collapse, generated interest in sustainable development. By focusing on this important combination of nationalist politics, Cold War rationalism, and futurology, scholars deepen their understanding of the history of sustainable development.

To extend historians’ analysis of the role that expertise played in the political success of sustainable development, I focus on how the Trudeau government’s hyper rationalism intersected with modeling and technological optimism to push solar energy from the visions of government advisors and environmentalists into concrete policy in the late 1970s. By drawing on a computer model of solar technology’s development – WATSUN – the Office of Energy Conservation (OEC), a small office of marginal importance, introduced solar technology into Canadian energy policy and, with the help of environmentalists and advisory groups, such as the SCC, convinced the Trudeau government to allocate hundreds of millions of dollars towards solar heating and other renewables. WATSUN enabled this group within the EMR to turn a little known technology into an abstract, but definable entity that experts could analyze and knowledgably insert into the energy department’s development plans. In short, WATSUN’s seeming ability to model an emerging technology and define its future enabled the politically marginal OEC to reshape energy policy.

Even as they highlight the power of expertise within Canadian political discourse in the 1970s, WATSUN and the OEC also underline expertise’s limits. The authority of the OEC quickly crumbled in the 1980s when its predictions of solar technology’s

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success failed to materialize, the threat of scarcity waned, and priorities within the EMR shifted. While mistakes and a changing global situation caused problems for energy experts who advocated solar, the brittle character of their political power emphasizes the politically contingent nature of expertise. The power of technical knowledge and facts to change policy relies upon the government’s recognition and privileging of that knowledge over other viewpoints. In politics, the attitude of the state matters as much as the validity of the facts themselves.

Dissertation Outline

This dissertation makes four interconnected arguments. First, I argue that the Trudeau government applied its interpretation of the rational application of knowledge to governance in an attempt to depoliticize Canadian politics and make policy decisions more objective. To reshape the country’s politics, the Trudeau government drew upon a variety of sources, including broader Cold War efforts to systematize decision making through the application of abstract knowledge. This “knowledge power” framed energy policy in the 1970s, as the Trudeau government used economic and energy forecasts in an attempt to justify government intervention into oil and gas development, and multinationals employed the same techniques to defend their position in Canada’s oil industry. In short, the Trudeau government politicized forms of technical knowledge that promised to assist efforts to make rational and fact based decisions.

The state’s privileging of supposedly objective judgment significantly affected environmental politics by enhancing the influence of those who possessed the technical training to provide seemingly objective knowledge. This privileging of expertise leads me to my second main argument: the Canadian state played a central role in environmental politics during the 1970s. The state was significant in two fundamental ways. First, it actively participated in environmental politics as provincial and federal governments pursued policies of economic and energy development. Second, the ability of the state to shape the culture of politics through ideology and policy feedbacks privileged specific approaches and groups within Canadian environmental politics. In Canada, the government of PEI directly contributed to environmental politics on the island by modifying its development policy to pursue Canada’s first program of sustainable development. Just as importantly, the provincial government’s actions were constrained
by the dominant federal discourse on both development and effective policymaking. To receive the federal support necessary to undertake their experiments with environmentally sustainable development, the PEI government manipulated the highly rational and technical approach encouraged by the Trudeau government.

The constrained actions of the provincial government represent just one example of how the Canadian state shaped environmental politics. The SCC, part of the broadly defined Canadian State, also contributed directly to environmental politics by formulating an approach to sustainability, which it went on to popularize among environmentalists and government departments. Both the Science Council and the government of PEI assisted environmental groups by supporting their efforts to receive federal funding and by soliciting and publicizing environmentalists’ analyses of Canada’s future, an activity that brought their policy advice to the attention of the Trudeau government as well as many Canadians. This assistance, however, selected environmental groups with specific abilities, namely the training and skill to manipulate abstract knowledge.

The privileging of environmental groups with technical training leads to this dissertation’s third major argument: an influential minority of environmentalists employed technical knowledge, especially future studies and simulation, to both conceptualize policy alternatives and construct persuasive narratives about the prospects of renewable energy and sustainable living. These environmentalists’ use of technical knowledge suggests that while parts of this diverse movement expressed suspicion about science and technology and only made an exception for the “subversive” science of ecology, other groups drew heavily on Cold War research and its formalist and abstract approach to understanding the world. These methodologies, with their heavy reliance on mathematics and quantitative analysis, provided these environmentalists with an influential intellectual and political tool, a tool that allowed some of them to participate in debates over energy and development policy in the 1970s. By deploying this technical knowledge, environmentalists altered Canadian policy not through public protest (although they did that as well), but by acting as advisors – technocrats – capable of providing insightful analysis and constructing effective policies and new technologies.

designed to provide economic growth while protecting the environment.

This technocratic strand of environmentalism also played a fundamental role in the conceptualization of sustainable development. In 1970s Canada, alternative development emerged as a method of providing Canadians with jobs and insulating the country from rising oil prices and not primarily as a means of protecting the environment or assisting the global south. Sustainability’s most effective advocates went beyond international environmental concern in their arguments, to employ economic forecasts and simulations of sustainable technologies’ commercial potential. Presenting renewables, such as solar heating, as technologies of the future, they successfully enlisted government assistance to help Canadians conquer new and potentially profitable industries before others beat them to the market.

The political influence of abstract and technical knowledge behind these arguments for sustainability allows me to make my fourth argument. Rather than narrowing political debate or depoliticizing politics, future studies and modeling, as forms of technical knowledge, allowed environmentalists and government advisors to identify and define scarcity as a problem and devise creative responses. While hubris and error characterized much of their analysis, it also fashioned a space for discussions of the country’s future and its potential problems, as well as providing the impetus for policy experimentation. The use of models in this inventive way underlines a point central to the history of science and this dissertation, namely that expert analysis and quantification are political actions and frequently the starting points of long debates. While politically powerful in the right circumstances, expertise and evidence do not depoliticize politics, but rather they set the terms of the dispute and privilege those with access to the requisite forms of knowledge.

This dissertation develops these arguments through six chapters placed in rough chronological order from the late 1960s to the early 1980s. The first chapter examines the Canadian state under the Trudeau government and asserts that the Trudeau government’s application of mechanical objectivity and regime of rationalization reshaped Canadian political discourse. Using the Trudeau government’s energy policy as a lens, I illuminate the structures and policy feedbacks – technically trained advisors and simulation – that shaped Canadian politics, particularly discussions of energy, in the 1970s. This chapter
concludes by contending that the Trudeau government failed in its efforts to control energy policy as well as in its attempt to depoliticize policymaking. Instead it created a political discourse that helped government bureaucrats, and later, scientists, politicians, and environmentalists, to criticize federal policy and propose alternatives.

Chapter two builds on the first chapter by examining how the PEI government drew on and manipulated the Trudeau government’s political discourse in its experiments with sustainable development. I argue that the Campbell government’s approach to development in its massive Comprehensive Development Plan grew out of a commitment to economic modernization and rational planning. Redirecting rather than abandoning this project of modernization and transformation, the Campbell government shifted from centralized industrial development to a focus on environmental sustainability and small-scale renewable energy technology. Expanding upon this point, I show how alternative development emerged out of a desire to manage changing global circumstances while maintaining economic growth. Working with the Campbell government and explicitly supporting its rationalistic approach, environmental groups effectively functioned as technocratic advisors for the state, a fact that underlines the diversity of the environmental movement. Furthermore, I contend that this participation as technical advisors directly challenges the antipathy that some historians have argued existed between appropriate technology groups and the state.

Continuing the theme of state influence on environmental politics, the third chapter examines the development of the conserver society and the impact of the SCC on environmentalism. Connecting the SCC to the Trudeau government’s desire for rational management, I argue the SCC sought both to help the state mobilize science in a nationalist effort to assist economic growth and to develop Canadian research programs that could employ scientists and engineers. It pursued these actions with a quantitative approach to analyzing Canada and simulating its economic and environmental future. This methodology enabled the SCC’s development of the conserver society concept and indelibly linked sustainability in Canada with Cold War science and the efforts to institute regimes of rational planning it inspired in the 1960s and 1970s. As I examine this early approach to sustainable development, I show that both environmentalists and government ministries adopted the conserver society as a means of outlining a viable
long-term approach to development and as an influential method of popularizing their policy goals in the 1970s. In particular, the SCC’s conserver society played a significant role in the Trudeau government’s decision to fund solar energy at the end of the decade.

Chapter four shifts focus from the state to environmental actors and reveals how John Todd and the New Alchemists deftly used scientific knowledge to construct a network of support, including the Canadian government, which enabled their experimentation with sustainable technologies. I begin by analyzing the construction of the New Alchemy Institute on Cape Cod. The Institute, part commune and part research institution, provided these countercultural environmentalists with a springboard from which Todd could enlist the financial support required to pioneer green architecture. After analyzing the New Alchemy Institute’s knitting together of a network of support using Todd’s rhetoric and scientific credentials, the chapter turns to the PEI Ark. Building on chapter two, I argue the Campbell government and Todd clashed on the purpose of the PEI Ark as the former saw it as the centerpiece of its sustainable development program and the latter as an opportunity to experiment with the “biotechnic” systems he and his colleagues had developed to moderate human impacts on the environment. These conflicting desires ultimately led to an unhappy rupture between the province and the countercultural environmentalists of New Alchemy. Todd and the New Alchemists would leave PEI to continue the development of the systems they had pioneered in the Ark and play a small, but significant, part in the development of what Michael Bess has called the “light-green society.”

This dissertation’s fifth chapter examines Amory Lovins’ approach to environmentalism and his influence in Canada. It begins by focusing directly on the close connections between Lovins and his conception of sustainability, on the one hand, and the Cold War development of futurology, on the other. By comparing Lovins and futurologist Herman Kahn, I contend that futurology and energy analysis formed the foundation of Lovins’ work, and I suggest that environmental historians need to broaden their assessment of technical knowledge to understand the significance of these important, but little examined, ways of knowing employed by environmentalists. Lovins’

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“soft energy path” and the way in which he used models to construct an accessible and compelling narrative about America’s energy future further underlines the importance of this technical style of environmentalism. Returning to my broader argument that technical knowledge and the Canadian state played a central role in 1970s environmental politics, I show how Lovins and his methods impacted Canadian environmentalists and government advisors by provided them with a vocabulary and analytic approach which they used to understand the potential of renewable energy.

Chapter six’s examination of the Trudeau government’s substantial commitments to solar energy continues my analysis of expert authority and futurological models. This chapter brings my investigation of modeling and state power together to explore the employment of modeling in the context of the Trudeau government. Focusing on the Department of Energy, Mines, and Resources, it examines how the OEC used the WATSUN model to study and then project solar technology’s development in Canada and convince the EMR to fund solar technology. Underlining the importance of the Trudeau government’s scientism and the influence of networks of expertise, this chapter also emphasizes the limits and fragility of appeals to knowledge within political debate by examining the collapse in support for solar technology in the early 1980s.

My conclusion continues this discussion of the political limits of expertise by examining the reaction of Andrew Wells, the central actor in PEI’s experiments with sustainability, to the challenges renewable energy faced in the late 1970s. For Wells, the mobilization of expertise and the manipulation of the Trudeau government’s scientism provided a means to introduce sustainable development into policy debates and generate support for solar and other renewables. This influence, however, was fundamentally limited. While technical knowledge could reshape policy, thanks largely to its privileged place in political discourse, it could not smoothly transform Canadian society or provide irrefutable solutions to environmental problems. These profoundly political questions would require extensive debate drawing upon both evidence and ideology. The dispute continues to this day.
Chapter 1:


Pierre Elliott Trudeau's government marked the apogee of the activist liberal state in Canada. Formed in 1968, it promised to use the state’s power to reorganize the government and provide Canadians with a “just society,” a powerful, but ill-defined vision of a united, egalitarian, and liberal country.77 The Trudeau government saw efficient and rational governance as the key to creating a better society for Canadians. As it guided the country through the economic turmoil and the energy shocks of the 1970s and into the more conservative 1980s, the Trudeau government reshaped Canadian governance around an ideal of rational decision-making and refashioned political discourse around the application of expertise. This reframing of Canadian politics indelibly marked Canadian energy policy and created a space for the discussion of energy conservation and the country’s first experiments with sustainable development.

The history of the Trudeau government and its impact on the period remains strangely fractured. Biographers and historians have dissected the man, noting his commitment to federal power, his charisma, and the contradictory nature of his romantic appeal to Canadian youth and his personal devotion to rationality.78 Other historians have broadened their focus to examine how his government responded to a changing Canadian society. Focusing on the influence of social actors, they argue that the Trudeau government reflected, but did not shape new ideas of sexuality and individual identity, or an emerging national consciousness founded on multiculturalism.79 Political scientists have noted how the Trudeau government actively reorganized the Canadian state and

concentrated power in the office of the Prime Minister and the cabinet. Political analysts have also highlighted the Trudeau government’s ethic of “rational management” and its efforts to make policymaking more “objective” and less political. Oddly, historians have largely ignored these structural analyses. Instead, they have remained focused on either Trudeau the individual or how his government responded to social and cultural changes in the 1970s. Environmental historians, for example, link Trudeau’s enjoyment of wilderness adventures to an emerging Canadian environmental consciousness, but offer little analysis of how the structure and ideology of his government affected environmental policy.

This chapter places the Trudeau government in the context of the growth of the social welfare state and its efforts to apply mechanical objectivity to the policy process, and it argues that the centralized structure and the scientistic ideology of the Trudeau government shaped Canadian politics in the 1970s by framing policy discourse and privileging specific types of knowledge. It focuses on the Canadian state’s attempts to make “objective” policy based on expert analysis and carefully developed forecasts designed to enable long-term planning in place of bureaucratic custom or political expediency. This approach enables my analysis of the Trudeau government’s reshaping of Canadian political discourse and its profound effects on energy policy and Canadian environmental politics.

My examination of Canadian state draws heavily on the work of Theda Skocpol. In particular, I analyse what she has described as the effects of state structures. As Skocpol argues:

…states matter not simply because of the goal oriented activities of state officials. They matter because their organizational configurations, along with their overall patterns of activity, affect political culture, encourage some kinds of group formation and collective political actions (but not others), and make

82 In his history of Canadians’ relationship with the environment, Neil Forkey focuses on environmental groups and only briefly discusses the influence of the state, and even then, he highlights Trudeau’s individual actions. See Forkey, Canadians and the Natural Environment to the Twenty-First Century (Toronto: University of Toronto Press, 2012), 103.
possible the raising of certain political issues (but not others).\textsuperscript{83}
Furthermore, Skocpol argues that the ideology of the state frames both political discourse and governments’ internal practices.\textsuperscript{84} Thus, the structures of the state, primarily its centralization and its embrace of “rational management” deeply influenced Canadian policy by privileging expert knowledge.

To investigate how the Trudeau government’s rationalistic approach shaped Canadian political discourse in the 1970s, this chapter focuses on a central issue of the decade: energy policy.\textsuperscript{85} Using energy policy as a lens into policymaking, I argue that the Trudeau government attempted to employ its program of rational management to exert federal control over oil and gas development.\textsuperscript{86} This approach, however, proved unable to legitimize the government’s intervention into energy policy. Drawing on Theodore Porter’s fundamental insight that “limiting the play of politics” through mechanical objectivity is the outcome not of “the megalomania of experts” but rather of bureaucratic conflict and public mistrust, I show how knowledge of energy resources and supply and demand forecasts became tools of contestation, both within the federal government and between government and industry.\textsuperscript{87}

In fact, forecasts and economic simulation became tools of the politically weak rather than a means of expanding state power. However, since forecasts and economic simulation remained fundamental to energy policy, the Trudeau government could not easily abandon the application of these forms of expert knowledge. The limited ability of the state to achieve its ideal of “objective” decision-making or control the application of expertise created opportunities for both manipulation and cooperation.\textsuperscript{88} Adopting these

\textsuperscript{83} Theda Skocpol, “Bringing the State Back in: Strategies of Analysis in Current Research,” in Bringing the State Back In, ed., Peter Evans, Dietrich Rueschemyer, and Theda Skocpol (Cambridge: Cambridge University Press, 1985), 21.
\textsuperscript{84} Theda Skocpol, “Bringing the State Back In: Retrospect and Prospect,” Scandinavian Political Studies 31, 3 (2008): 111.
\textsuperscript{85} G. Bruce Doern and Glen Toner, The Politics of Energy: The Development and Implementation of the NEP (Toronto: Methuen, 1985); John Fossum, Oil, the State, and Federalism: The Rise and Demise of Petro-Canada as a Statist Impulse (Toronto: University of Toronto Press, 1997); James Laxer, Oil and Gas: Ottawa, the Provinces and the Petroleum Industry (Toronto: James Lorimer & Co., 1983); Paul Chastko, Developing Alberta’s Oil Sands: From Karl Clark to Kyoto (Calgary: University of Calgary Press, 2004).
\textsuperscript{86} Fossum, Oil, the State, and Federalism, 5-6.
\textsuperscript{88} Porter, Trust in Numbers, 86.
new technical and rhetorical tools, government advisors, industry analysts, and environmentalists marshaled scientific and technical data to criticize government policy and propose alternatives, including energy conservation and renewables. In short, the actions and structure of the state imprinted a specific pattern on Canadian politics that enhanced the influence of those with certain types of expertise and created a space for debate, particularly over technical subjects, such as Canada’s energy future.

This chapter’s examination of how the structures of the Canadian state expanded the influence of expert knowledge and made it central to conflicts over policy provides an excellent opportunity to engage with recent discussions of state power among environmental historians. James Scott’s analysis of state power dominates environmental historians’ discussion of the state’s impact on the environment and the role of expertise in the extension of state power. \(^{89}\) To paraphrase Scott, experts employed by the state cooperate to construct an edifice of synoptic knowledge that, while flawed, dominates the national territory and both legitimizes and directs state power. \(^{90}\)

In the Canadian context, environmental historians have drawn on Scott to emphasize the importance of state power and expert knowledge and have argued that a “high modernist” approach characterized the period stretching from the 1940s through the 1960s. Using the concept of high modernism, defined by Scott as “rational engineering of all aspects of social life in order to improve the human condition,” scholars have explored how the co-production of expert knowledge by scientists, engineers, and planners has made Canada “legible” and amenable to state intervention. \(^{91}\) Engaging with this discussion of state power, my analysis provides environmental historians with an alternative approach to the state and its employment of expertise that

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\(^{90}\) Scott, *Seeing Like a State*, 4-6.

more effectively analyzes the Canadian state in the 1960s and 1970s. In this period, the seamless cooperation between expert and government assumed by Scott’s “high modernism” did not exist. Although state experts adhered to a common faith in the benefits of modernity and the utility of technical knowledge, they often used their expertise to construct critiques of government policy and propose alternatives. Rather than enhancing the power of the state by controlling knowledge and limiting political debate, the Trudeau government’s effort to rationalize governance enabled disagreement by enhancing the power of those who were politically weak, but able to use technical knowledge. That group included government advisors critical of Canadian energy policy and anxious to propose sustainable alternatives.

This chapter’s analysis of the Canadian state, politics, and energy policy proceeds in three sections. The first introduces the postwar Canadian state and connects the Trudeau government’s approach to policymaking with the broader history of attempts to apply mechanical objectivity and regimes of rationalization to the state. I contend that these developments presented the possibility of rationalizing the postwar state and shaped the Trudeau government’s view of expert knowledge. Shifting focus to the Trudeau government’s energy policy, I analyze the development, implementation, and conflicts that occurred over energy policy in the early 1970s. This section illuminates the structures and policy feedbacks that shaped Canadian energy development in the 1970s as it shows how the Trudeau government’s critics used simulations of Canadian energy needs and possible supply development to contest policy. The final section of the chapter illustrates how the structures of Trudeau government and its less than successful attempts to control energy policy – and more broadly, depoliticize policymaking – enabled government advisors and later scientists, politicians, and environmentalists, to criticize federal policy and propose alternatives.

The Structures and Politics of the Trudeau Government

Two changes stand out in the Canadian postwar period: the massive expansion of the Canadian state and the attempted rationalization of governance with the goal of making “objective” policy. Together these changes dictated how the state made policy and how it understood and justified its interventions in Canadian society, from social welfare to energy policy. The government’s approach to policy resulted in specific areas
of flux within the state where groups could gain purchase and attempt to influence decisions.

In both these areas, programs in the United States motivated and shaped similar developments north of the 49th parallel. During the postwar period, the United States continued its construction of the welfare state and attempted to manage rationally the growing size and complexity of the state while making policy an “objective” practice of problem solving. As historian Michael Bernstein notes, this belief in the ability of expertise to mitigate political interest has a history stretching back to the progressive era if not earlier.92 During the 1950s and 1960s, it became a central element of the postwar consensus. Proponents understood policymaking as a technical practice of problem solving and, according to historian Nils Gilman, “celebrated... the power of science, the importance of control, and the possibility of achieving progress through the application of human will and instrumental reason” as a method of overcoming inefficiencies and schisms of politics.93 This idealization of progress through the application of reason reached its apogee in the 1960s.94

In this era, analytical management techniques, most famously the RAND Corporation’s methods of systems analysis, spread from the Pentagon to other parts of the American state. This methodology understood decision making as a matter of calculation that could be solved with the application of the correct algorithm. Stripping down decision making to a formal process of yes/no propositions or abstracting complex human motivations to arrive at Homo economicus’ min/max calculations, RAND theorists attempted to construct heuristics capable of cutting through human irrationality and making decisions based on objective analysis.95 John F. Kennedy’s Secretary of Defence Robert McNamara and his “whiz kids” present the most famous example of this approach

applied uncritically to the goal of rational, efficient, and apolitical policymaking when the group famously attempted to convert military procurement into a process of calculation rather than compromise and pork barrel politics.96

This application of knowledge and technique seemed to promise the ability to manage the huge and ever growing complexity of the Cold War state and direct its vast powers. These techniques, with their underlying belief in the potential of rational management, became part of the policy process in America. Lyndon B. Johnson’s Great Society programs, for example, were organized and managed according to systems theory.97 The approach, however, proved ill suited as its hierarchical organization devolved into conflicts over turf, and cost benefit analysis proved unable to analyze the anti-poverty program or allocate funds effectively.98 The politics of the Cold War, which sought to suppress political dissent and avoid open discussion of political ideology, also placed a premium on depoliticizing policymaking as the Cold War state distanced itself from earlier politics of the progressive left and open ideological debate of the New Deal era.99

The methods of Cold War military planners, particularly their use of mathematical models and computer simulations, reshaped the practices of American science along with the state. Andrew Pickering and other historians of science have argued the Cold War saw the transformation of American science into what Pickering has termed the “cyborg sciences.”100 This newly dominant approach to science inaugurated intimate cooperation between the defense industry and academic sciences and saw the spread of computers, which massively increased data processing and blurred or even erased the boundary between social and mechanical systems. The discipline of economics, for instance, avidly embraced these new tools and became dominated by mathematical models and computer

simulations that collapsed the differences between society and models. As economics grew in importance during the postwar period, it brought this abstract form of analysis into the very heart of policymaking and political debate.

The ideal of “objective” planning and rational management proved compelling in American municipal politics as well. In the mid 1960s, civic planners embraced the tools of “Cold Warriors” from RAND and the rest of the defense establishment. Employing computer systems and theories of cybernetics developed to fight the Cold War, urban planners created models of American metropolises to understand the dynamics of cities and plan their development. As Jennifer Light notes, these large-scale computer models proved unable to fully capture the complexities of urban development, yet remained influential throughout the 1960s and 1970s.

Faith in the ability of these new techniques and technologies to enable extensive research and rational planning on a massive scale reached their zenith in the early 1970s with the emergence of futurology and world modeling. One defence scientist turned civic planner, Jay Forrester, took these applications of computer modeling to a global scale and even extended them hundreds of years into the future. He produced one of the first and best-known global simulations and exercises in “future studies,” the World3 model at the center of the (in)famous Limits to Growth report. The model brought the use of computer simulation full circle. The Club of Rome, a technocratic environmental group, used the very techniques of knowledge production and claims of mechanical objectivity that had formerly justified and encouraged rapid growth, to mount a trenchant attack on rapid material progress and inaugurate the ongoing debate over natural limits.

104 Light, From Warfare to Welfare, 61-62.
106 Fernando Elichirigoity, Planet Management: Limits to Growth, Computer Simulation, and the Emergence of Global Spaces (Evanston, IL: Northwestern University Press, 1999).
In Canada, buffeted by ideas south of border, the development of the social welfare state and efforts to make policy “objectively” followed a similar path. During the postwar period, the Canadian state expanded rapidly as it implemented the Canadian Pension Program and Unemployment Insurance in the 1940s, which together established the foundations of the Canadian welfare state. The government of Lester B. Pearson, goaded by the New Democratic Party, and conscious of the growing social welfare state in the United States, added the finishing touches to Medicare and other programs. The Pearson government also expanded support for education, funded economic development, and signed trade agreements to preserve the Canadian automotive industry. According to David French, the implementation of these far-reaching programs made planning the government’s raison d’être, and both the practice of planning and the government’s organizational abilities expanded rapidly in the late 1960s and early 1970s.

The Pearson government recruited economists and statisticians, in particular, to assist its growing efforts to manage and direct the expanding state and ensure continued economic growth. The founding of the Economic Council of Canada (ECC) in 1963 highlights the growing cooperation between economic experts and government policy makers in the 1960s. Tasked with providing the government with expert advice about the economy’s medium- to long-term prospects, the ECC sought to help the government ensure that steady economic growth continued for the foreseeable future. As a leading

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108 In Canada, however, the postwar consensus did not collapse in the late 1960s, and it continued to define Canadian governance throughout the 1970s.  
Canadian statistician put it in 1967, “contemporary Canadian society has set far more exacting standards for the performance of the economy than in the recent past.”

In the interest of meeting these “exacting standards,” the ECC, in coordination with the National Energy Board (NEB) and the Bank of Canada, began to develop a computer database of Canadian economic information. Recognizing the potential utility of this data, econometricians at the ECC constructed the Canadian Disaggregated Interdepartmental Econometric Model (or CANDIDE Model). Begun in the mid 1960s and completed in 1972, CANDIDE purported to be capable of simulating the entire Canadian economy, including the accurate prediction of the economy’s response to government expenditure. Government planners would use it to forecast the development of the Canadian economy in the 1970s. The late 1960s and early 1970s were heady days for economics in Canada. Citizens and government expressed faith in the predictive ability of econometricians and their computer oracles while growth continued to raise Canadians’ standard of living. As Theodore Porter notes, this vision of well-ordered progress has long been a goal of statisticians and advocates of quantification.

As the Pearson government provided Canadians with social welfare and worked with the ECC to manage economic growth, it also sought to replicate Americans’ ability to turn scientific research into economic benefit and, more importantly for this chapter, to inform and improve government policy. In the mid 1960s, the Pearson government sought ways to strengthen Canadian scientific research and apply it more effectively, both as an aid to policy making and as a national resource for economic growth. While tripling federal funding for scientific research during the 1960s, the Pearson government also set up new advisory bodies, most notably the Science Council of Canada (SCC), to assist in the development of a coherent science policy and to advise the government on scientific matters. The SCC, a semi-independent advisory body composed of Canada’s

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114 McDowall, The Sum of the Satisfactions, 138.
115 McDowall, The Sum of the Satisfactions, 141.
116 Mike McCracken, An Overview of the CANDIDE Model 1.0 (Ottawa: Economic Council of Canada, 1973), 5.
117 McDowall, The Sum of the Satisfactions, 145.
leading academic scientists and engineers and charged with offering objective advice on scientific issues, quickly became a significant voice in Canadian politics. Its members interpreted their mandate broadly, and the Council began publishing reports on everything from industrial research to the natural environment. Anxious to ensure the hundreds of millions the government invested annually in government research were being well spent, the Pearson government also commissioned a series of substantive reports on Canadian science.

The most influential of these commissions, the Senate Special Committee on Science Policy (the Lamontagne Commission) set up in 1967, presented the government with a series of substantive recommendations that helped cement the influence of what Peter Aucoin has called “rational management” when the Trudeau government came to power. Acting on the Lamontagne Commission’s advice, the federal government established the Ministry of State for Science and Technology (MOSST) in 1971. MOSST sought to systematize Canadian science policy and ensure that the government employed scientific knowledge effectively in policymaking. In theory at least, MOSST would replace the ad-hoc science policy of the 1960s with a coherent system of decision-making by providing cabinet ministers and the Prime Minister with any scientific information relevant to policy. As Peter Aucoin and Richard French note, this advisory structure was built on the belief that “knowledge is power” and assumed “that research, information and analysis will carry the day ...against the traditional sources of political and bureaucratic power.” This structure remained fundamental to policymaking in the Trudeau government.

When Pierre Elliott Trudeau became Prime Minister in 1968, a position he would hold for sixteen years, he inherited a large, powerful state, committed to an active role in

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123 Aucoin, Organizational Change in the Machinery of Canadian Government,” 12.
Canadian society and similarly devoted to rationalizing governance and employing expert knowledge to manage Canada’s future. Trudeau, who was also personally committed to these goals, would expand upon them during his years in office. Writing about the Canadian state just before he became Prime Minister, Trudeau expressed hope that “emotionalism” could be removed from decision making and looked forward to a time when Canadian governance functioned more like “advanced technology and scientific investigation, as applied to the fields of law, economics, social psychology, international affairs, and other areas of human relations.”

Fitting perfectly within the postwar consensus, Trudeau’s ethic of “rational management” sought to make policy through the pragmatic exchange of ideas rather than through any adherence to a specific political ideology. According to political scientist Donald Savoie, Trudeau and his allies used the power of the Prime Minister’s office to transform the cabinet into a focus group where he and his ministers could formulate policy through (at least in theory) a rational and informed debate. This centralization of power placed inordinate political authority in the hands of the Prime Minister and cabinet and huge burdens on ministers as it deluged them with information. Trudeau himself famously read nearly a thousand pages of briefing documents every week.

The Trudeau government’s efforts to mobilize information had their inclusive and democratic side as well. The famed Liberal Party Conference held at Harrison Hot Springs in 1969 attempted to transform the Party into “society’s radar” by using the then fashionable discipline of cybernetics. Speaking at the conference, Trudeau told party members that “with the refinement of our techniques for forecasting and planning we are coming to realize that the image we hold of our future is itself an important element of that future.”

He then invited party members to “go to where the people are” and generate discussion about Canada’s future to provide feedback about government policy.

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127 Savoie, *Governing From the Center*, 74. According to Savoie, centralizing power in the Prime Minister’s Office became the accepted norm in subsequent Canadian governments.
and to allow the government to address Canadians’ concerns.\textsuperscript{131} This effort proved unworkable in practise and quickly fell apart, but it exemplified the breadth of the Trudeau government’s attempts to reorganize Canadian governance.

As Donald Savoie and Peter Aucoin note, Trudeau’s centralizing approach placed a check on both the authority of individual ministers and the influence of bureaucratic “mandarins” because it subjected all policy decisions to rigorous review within cabinet from a variety of viewpoints.\textsuperscript{132} By limiting bureaucratic and ministerial autonomy in this way, the Trudeau government forced departments to supply both cabinet and their ministers with the strongest possible arguments for specific policies if they wished to prevail in cabinet discussions. This competitive use of research created a powerful incentive for government departments to hire staff or consultants with backgrounds in economics, policy analysis, and long range planning.\textsuperscript{133} Although this structure was designed to depoliticize politics and instead make policy based on a careful analysis of the facts, in actuality it only shifted the grounds of political debate as technical knowledge became central to policy, and thus political conflict.\textsuperscript{134}

The extensive planning exercise in the aftermath of a substantial Liberal victory in the 1974 election provides an excellent example of these new structures in action. Designed to set priorities for the incoming government, it instead became a massive and largely sterile exercise in state planning.\textsuperscript{135} The effort began by formally gathering information from the Liberal party caucus, the central agencies, and leading ministers to establish priorities. The planning process then required each department to carry out a review of its policies and to report how prospective programs contributed to a list of established priorities.\textsuperscript{136} This “heroic attempt to plan,” as Richard French describes it, required departments to assess how their policies contributed to such goals as “a more just, tolerant Canadian society” or made a “more rational use of resources and [was]...
sensitive to the natural and human environment.”

Unsurprisingly, given such broad priorities, this attempt at planning devolved into disorganization and failed to produce a coordinated set of programs. During the mid 1970s, as the federal government struggled to produce systematic policies, it gave departments a strong incentive to tailor their suggestions to fit the government’s stated goals. As the final section of the chapter will demonstrate, savvy bureaucrats seeking to redirect government priorities could take advantage of the systematic effort to plan by presenting seemingly “objective” arguments for new policy directions. The Office of Energy Conservation, in particular, would prove adept at using the technical discourse privileged by the Trudeau government to advocate new policies of energy conservation at odds with the government’s commitments to rapid economic growth.

Together with the creation of MOSST, the SCC, and the ECC, these changes gave the Trudeau government a specific structure and created a powerful set of incentives and policy feedbacks that reconfigured Canadian politics by privileging those who could use technical knowledge. The widely recognized failure of the Trudeau government’s reforms to depoliticize policymaking and the substantial problems, most notably bureaucratic confusion, political scientists have documented within the Trudeau government would seem to minimize the importance of these reforms. These failures, however, do not diminish the historical significance of the Trudeau government’s commitment to “rational management.” This combination of philosophy and organization framed how the government made decisions in the 1970s, and seriously affected Canadian politics of the period. In short, the Trudeau government’s commitment to rational management, through both its structure and ideology, framed its efforts to exert authority over energy policy, as well as provided opportunities for its critics both inside and outside of government to propose alternatives.

Rational Discourse: the Energy Sector and the Trudeau Government

The Trudeau government and its “rational management” substantially changed the policymaking apparatus and political significance of the Department of Energy, Mines, Mines,

137 French, How Ottawa Decides, 79.
139 French, How Ottawa Decides, 149.
and Resources (EMR). This restructuring also underwrote the government’s efforts to assert federal control over the energy sector, which made the EMR central to the political employment of expertise in the 1970s.\(^\text{140}\) The first step in the federal government’s entrance into energy policy transformed the EMR, formerly known by the derisive moniker “rocks Canada,” from a minor department primarily concerned with granting mining licences into a fully-fledged energy department capable of constructing a coherent energy policy for Canada. This reorganization illustrates how the structure and ideology of the Canadian state affected policy and created unintended opportunities for political conflict as it politicized energy forecasting. The Trudeau government’s struggles to use technical knowledge, especially econometric simulations of medium- and long-term development, also underline the conflicts inherent in programs of standardization and the weaknesses that lie at their foundation.\(^\text{141}\) Finally, examination of the Trudeau government’s entrance into energy policy through the lens of its structure and approach highlights the influence of the Trudeau government’s broader goals and their impact on Canadian energy policy and politics.

In the 1960s, the National Oil Policy (NOP) governed Canada’s loosely defined energy policy and the federal government’s minimal authority. The NOP placed control of the industry in the hands of business and largely consisted of a laissez-faire approach focused on expanding the exploitation of oil and gas, which reflected the federal and provincial governments’ lack of both the political will and the knowledge necessary to shape the development of Canadian fossil fuels.\(^\text{142}\) The main purpose of the NOP was to guarantee a market for expensive Canadian oil and gas. To this end, the policy financed pipelines from Alberta, which produced the vast majority of Canada’s oil, to consumers in Ontario and the United States. A two-price system was also set up in Canada, with Canadians west of Ottawa relying on more expensive Canadian oil and Canadians east of

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\(^{141}\) Porter, *Trust in Numbers*, 33.

Ottawa importing cheaper oil from the world market. This system integrated Canadian oil into the continental market and benefited the oil industry, which gradually expanded production.

The National Energy Board (NEB), set up in 1959, administered this policy of continentalization. A quasi-independent regulatory agency, the NEB reported directly to cabinet, which seemed to insure government oversight and control of the energy sector. In reality, the NEB’s main clients and advisors, the major multinationals that dominated the Canadian oil industry, quickly co-opted the board. Lulled by the “symbolic reassurance” of the NEB’s independence and supposed expertise, the federal government largely ignored energy throughout the 1960s. The result, according to Canadian critics of the NEB, was a resource giveaway that made Imperial Oil, Gulf Oil, Shell, and Texaco the biggest players in the Canadian oil industry.

The laissez-faire approach began to change soon after the formation of the Trudeau government. Trudeau’s election corresponded with rising concerns about both Canada’s economic position in the world and its relationship with the United States. In the late 1960s and early 1970s, Canada’s economic relationship with the United States came under a great deal of suspicion from Canadian nationalists. Influential authors such as Kari Levitt and George Grant even argued that foreign investment had transformed Canada into an American colony. This criticism of Canada’s neo-colonial status was by no means a marginal viewpoint. In 1967, Walter Gordon, Pearson’s former Minister of Finance, organized a task force to review American investment in Canada. Predictably, given his long-standing economic nationalism, when the report arrived in 1968, it called

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147 Fossum, *Oil, the State, and Federalism*, 26-27.
for much tighter controls on foreign investment and the creation of the Canadian Development Corporation to help Canadian industry.\textsuperscript{151} While the Trudeau government by no means abandoned international trade or rejected foreign investment, it prioritized economic equality and expansion of Canadian ownership as part of its “just society.”\textsuperscript{152} Efforts to increase Canadian ownership would remain a focus of government policy for much of the 1970s as nationalists and the SCC championed the development of Canadian science and industry.

To provide itself with a counterbalance to industry and a complement to the NEB’s supervisory role, the Trudeau government constructed an alternative center of expertise through which it could formulate energy policy. A newly invigorated EMR, staffed with new and talented advisors and an aggressively nationalist minister, Donald Macdonald, became the center for policymaking and the agent through which the Trudeau government would attempt to assert federal authority over the energy sector. Heading the list of new recruits were Wilbert Hopper, Jack Austin, and Joel Bell. All highly educated with backgrounds in the oil and gas industries, these men and the many others who joined EMR in the early 1970s, became the department’s energy experts and greatly enhanced its ability to formulate policy.\textsuperscript{153} Bell, for instance, was the lead author of the EMR’s first comprehensive policy analysis of Canadian energy, \textit{An Energy Policy for Canada: Phase 1}.\textsuperscript{154} The new Minister, Donald Macdonald, joined them in 1972. An aggressive, Cambridge educated MP, Macdonald remained a fixture on the Priorities and Planning Committee of Cabinet, Trudeau’s inner circle of powerful ministers, throughout the early 1970s.\textsuperscript{155} He also shared Trudeau’s deep federalism and had even more nationalist economic views.\textsuperscript{156} This infusion of skill, knowledge, and political power transformed the EMR into a powerful department moulded to satisfy the Trudeau

\textsuperscript{153} Fossum, \textit{Oil, the State, and Federalism}, 36-38.
\textsuperscript{155} Radwanski, \textit{Trudeau}, 11; English, \textit{Just Watch Me}, 193.
\textsuperscript{156} English, \textit{Just Watch Me}, 223.
government’s emphasis on management through scientific knowledge and rational planning.

As it transformed itself into a policy making body, the EMR made every effort to gain access to information and scientific expertise and thus bring itself into line with the Trudeau government’s “rational management” and enable it to contribute actively to policymaking within the structures of the Canadian state. One group with which it built a close relationship was the SCC, a leading scientific authority and a strong supporter of national technological development. Key advisors on oil and gas policy and experts in energy analysis, such as R.B. Toombs and R.P. Charbonnier, moved between the department and the advisory body, thereby transferring expertise and allowing the SCC to assist the EMR in studying Canada’s energy options and help formulate policy. The relationship grew so close, in fact, that in 1971 Charbonnier, who now worked for the EMR, asked the SCC’s committee on energy to begin a study designed to complement the EMR’s forthcoming assessment of Canadian energy policy by examining the “long term scientific and philosophical aspects” of energy in Canada. Because of its study and their other extensive work with energy and resources, the SCC exercised an indirect, but significant, influence on Canadian energy policy through the information it provided, and it became an important advocate for renewable energy.

The newly expanded department and its technically sophisticated staff produced an exhaustive study of Canadian energy: An Energy Policy for Canada: Phase 1. This extensive and highly technical report examined every aspect of Canada’s energy sector from hydroelectricity to gas and from exploration to pipeline construction. A “strategic report” rather than a pure statement of policy, the study perfectly represented the Trudeau government’s “rational management” in action as it collected and synthesized huge quantities of information in an effort to provide cabinet with an “objective” foundation

158 Lloyd, “Canada’s Search for a Science Policy,” 172.
160 See Science Council of Canada, Report No. 23: Canada’s Energy Opportunities (Ottawa: Information Canada, 1975). The SCC’s advocacy of renewable energy and the conservener society will be examined in depth in chapter three.
for policymaking. As the EMR put it in the report’s introduction:

The challenge can be stated simply – to have energy policies ensuring the best management of our resources for the general welfare of Canadians. …Energy policies must be developed on the foundation of thorough analyses of various options and impact of those options on the industry itself, and most importantly on all aspects of Canadian economic and social policies.

The EMR also assured Canadians that “the studies on which the document is based are being improved as the basic data are refined” and they represented “the best analyses available,” thus giving *An Energy Policy for Canada* pre-eminence as the basis for policy.

When published in May 1973, the report effectively stated the government’s view of the “facts” about Canada’s energy sector and its future. Reflecting the Trudeau government’s views, *An Energy Policy for Canada* explicitly stated that the policies of NOP required re-examination, particularly policies relating to royalties, land-rights, and federal provincial responsibilities. The study also assumed that, as the ultimate representative of Canada, the federal government had the right as well as the ability to oversee energy policy. This assertion of federal supremacy and the government’s desire to examine royalties, land-rights, and constitutional responsibilities made the government’s view of energy highly contentious in Canada’s regionally dominated politics.

This conflict arose because the confederation awards ownership of mineral resources to the provinces. The federal government, however, administers trade, which makes cooperation necessary between different levels of government. In this context of divided responsibility, the EMR’s *An Energy Policy for Canada* provides a stunning example of how the Trudeau government asserted both the federal government’s right to

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165 Regional and constitutional conflict is the focus of Doern’s and Toner’s *Politics of Energy*, the leading analysis of this aspect of Canadian energy policy in the 1970s.
change the foundations of energy policy and the EMR’s ability to manage Canada’s energy development. The contentious nature of both assertions made the report’s justification of its desired policy changes and its demonstration of the government’s ability to oversee energy policy an important element of Canadian energy history in the 1970s.

In its efforts to assert federal authority over the energy sector, the Trudeau government employed the same hyper-rationalistic ideology that it applied to other areas of Canadian governance. Specifically, the EMR employed systems theory and econometric analysis to demonstrate how energy intersected with and affected nearly every aspect of Canadians’ lives. Asserting “energy policy is everybody’s concern,” the EMR argued that the development of Canadian energy resources could no longer be left solely under provincial and industry control since its national impact superseded any

Figure 3: A Forecast of Canada’s Oil Reserves and Demands. The EMR used simulations to analyze Canada’s energy future and communicate its findings to Canadians.

regional or private interests. Quantification, simulation, and econometric analysis became the lens through which the EMR approached energy in An Energy Policy for Canada and the department’s primary methodology for examining energy and overseeing its development.

The government adopted simulation to examine the energy sector and formulate its first approach to energy policy for both ideological and political reasons. In part, the EMR’s analysis continued the work of the NEB, which had continually gathered information from oil and gas companies in an attempt to develop an overall picture of Canadian reserves and possible future development. The EMR, however, expanded upon the NEB’s efforts to examine all energy policy with the goal of ensuring that Canadians had the resources required to live in the society they desired.

As John Robinson and Clifford Hooker argue, modeling had a central place in the EMR’s approach since it offered the only method of analyzing long-term supply and demand and incorporating economic consequences. Vaclav Smil, a leading historian of energy, concurs with this analysis. Although highly critical of modeling and forecasting, he notes that in the 1970s such analytical tools had a central place in energy policy and despite criticisms and failures remained influential throughout the decade. As Smil suggests, the authority of modeling and forecasting rests upon both the desire to render the world legible and manageable and the hubris that such an achievement is possible. These assumptions were foundational to the Trudeau government’s “rational management” and encouraged by the government’s structure in the 1970s. Since simulation seemed to offer the “objective” information the Trudeau government required and also had the potential to support the government’s claims for the necessity of federal intervention, the EMR embraced it.

Employing this abstract approach in an effort to make the Canadian energy sector legible and amenable to management, An Energy Policy for Canada conceptualized the energy sector as a complex system of inputs and outputs interconnected with nearly every

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171 Smil, Energy at the Crossroads, 178.
aspect of the larger whole of Canadian society.\textsuperscript{172} To emphasize these connections, the report even included a feedback model that the EMR had made of the energy sector. This model, borrowing from cybernetics, graphically displayed the complex multivariate feedback loops that the EMR believed characterized the Canadian energy sector and its relationship with Canadian society.\textsuperscript{173} Emphasizing the extensive feedback between such distinct entities as capital, Canada-U.S. relations, the environment, and Canadian quality of life, this diagram encapsulated the federal government’s argument for policy intervention.

To strengthen its analysis, the EMR also incorporated simulations by the ECC’s CANDIDE Model, which it employed to understand the connections between energy

\textsuperscript{172} EMR, \textit{An Energy Policy for Canada}, 1: 7-24.

\textsuperscript{173} EMR, \textit{An Energy Policy for Canada}, 1: 5.
policy and economic growth. According to *An Energy Policy for Canada*, this model’s simulations demonstrated that energy played a fundamental role in the function of Canada’s economy, and that if something interrupted continued energy development Canada’s economy would suffer. In the report’s view, leaving Canadian energy policy in the hands of foreign business interests courted disaster. Thankfully, the report suggested, the well-informed federal government with its “knowledge of the facts” could “[formulate] the best energy policies” and ensure energy was available to support “Canadian aspirations.” In short, quantifying Canada’s energy needs and resources enabled the federal government to justify the expansion of federal authority upon its assertion of “objective” knowledge and expertise.

The report’s systems analysis also incorporated the environmental impacts of energy development, which introduced environmental costs as a factor in Canadian policy making for the first time. Although not carefully calculated or a primary factor in the report’s analysis, its inclusion and the report’s open discussion of the necessity of balancing quality of life and economic growth reflected the growing influence of environmentalism and its connection to changing lifestyle expectations of Canadians. This recognition of the environment, however, was not without its political calculus. The spotlight on the environmental impacts of energy development strengthened the federal government’s argument for intervention, since the federal government theoretically possessed the greatest ability to regulate the environmental impact of energy development. Beyond presenting the federal government’s argument for its involvement in the energy sector, the report acted as a demonstration of the EMR’s policymaking ability and the government’s mastery of the complexity of the Canadian energy sector.

At the foundation of the EMR’s and the federal government’s claim to administer

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Canada’s oil and gas development lay a series of projections outlining the future of Canadian energy needs and supplies up to 1990 and, in some long-term simulations, up to the year 2050. The purpose of these forecasts was to outline Canada’s energy future and demonstrate that the EMR could manage the development of nuclear, hydro, uranium, and most importantly oil and gas to meet Canadians’ present and future needs.\textsuperscript{179} To make these projections the EMR relied primarily on econometric and linear programming models. In fact, such models were so important to \textit{An Energy Policy for Canada} that the second volume pointedly stated that with a more advanced forthcoming computer simulation, the department would achieve even greater “sensitivity [of] analysis” and thus more accurate forecasts.\textsuperscript{180} With such tools, energy policy would be reduced to an exercise in planning.

Employing econometric and linear programming models and using data provided by the Canadian Geological Survey, the Canadian Energy Board, and industry, the EMR constructed multiple scenarios of oil and gas reserves available at different price points.\textsuperscript{181} To calculate the future resources available in Canada, the EMR’s models integrated geophysical data collected by geological surveys with a logarithmic formula the department had devised based on past oil finds to project Canada’s total oil and gas reserves, including Canadian frontier lands and coastal areas yet to be explored.\textsuperscript{182} Starting from this mathematically defined level of resources, the EMR then employed its models to analyze the most cost effective method of bringing oil and gas to market.\textsuperscript{183} Then the EMR used the CANDIDE Model to simulate the economic impacts of energy development on Canada and its future prospects.\textsuperscript{184} Unsurprisingly, the report concluded that the Canadian arctic, where it projected much of Canada’s future oil and gas development, might be beyond the powers of private industry to exploit due to the degree of risk and high costs.\textsuperscript{185} Federal support would be required to assure Canada’s energy

\textsuperscript{179} EMR, \textit{An Energy Policy for Canada}, 1: 64-80.
\textsuperscript{180} EMR, \textit{An Energy Policy for Canada}, 2:90.
\textsuperscript{181} EMR, \textit{An Energy Policy for Canada}, 2:74.
\textsuperscript{182} EMR, \textit{An Energy Policy for Canada}, 2:74-75.
\textsuperscript{183} Linear programming models would remain a mainstay of the EMR’s policymaking throughout the 1970s. They were believed to “assure public confidence” in policy decisions and insure the “orderly development of Canada energy systems,” according to William Brown. Brown, “Energy Allocation: A Canadian Experience,” Vol. 3, File Energy Policy References, 1974, R.B. Toombs Fonds, LAC.
\textsuperscript{184} EMR, \textit{An Energy Policy for Canada}, 1: 206-207.
The report’s highly technical vocabulary and emphasis on long-term forecasting set the standard for how the EMR would approach policymaking and the character of future energy discussions within the Canadian government. The Trudeau government’s next major report, *An Energy Strategy for Canada: Policies of Self Reliance*, published in 1976, employed a similar methodology.\(^{186}\) It focused on total energy supply and demand and again emphasized the integral nature of energy to Canadian life. According to the 1976 report, energy’s importance, coupled with complexities of its development in the aftermath of the 1973 oil shock, made coordinating “energy-policy planning and other

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social and economic goals” more important than in the past. In other words, the Trudeau government’s technocratic policymaking and its goal of objective management framed its energy policy throughout the 1970s. Its emphasis on mechanical objectivity, or at least its appearance, would provide environmentalists and advocates of renewable energy opportunities to manipulate federal policy in the late 1970s.

Beyond its statement of the Trudeau government’s approach to energy policy, An Energy Policy for Canada provided the last statements of limitless growth in Canada before the energy crisis and the efforts of environmentalists changed the terms of discussion. The report projected a quadrupling of Canada’s energy use in the year 2000 as the population increased and economic growth and energy use continued to accelerate. To supply this massive increase in energy use, the EMR believed Canadians would require between three and six times as much oil, twice as much hydroelectricity, and a staggering five hundred times as much nuclear energy. As absurd as a five hundred-fold increase in nuclear energy production seems, nuclear agencies around the world proposed similar increases. This rapid growth in energy use was widely accepted and a central part of “growth liberalism” in the postwar period. Among nuclear advocates and policymakers, it was an item of faith that nuclear energy would provide the world with unlimited energy and endless prosperity. In fact, without this astronomical increase in nuclear energy, along with optimistic projections of Canada’s potential oil and gas reserves, there would be no way of meeting Canada’s projected energy demands.

Noting this possibility, the EMR explained that if exploration for oil and gas in Canada’s “frontier lands” did not reveal large supplies or if oil sands development experienced delays, its simulations showed that Canada would not be able to meet her own energy demands by 1985. It is important to note the dual function of simulation in

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188 EMR, An Energy Policy for Canada, 71.
191 Collins, More, 46.
192 EMR, An Energy Policy for Canada, 95. “Frontier lands” was a phrase used by the EMR to refer to
An Energy Policy for Canada: mathematical models provided proposals for massive increases in nuclear energy with a semblance of reality while at the same time they outlined the dangers of exponentially growing energy demands. As the decade wore on, Canadian government advisors and environmentalists concerned about long-term sustainability would take a chapter from the Club of Rome and use these forecasts to challenge the “politics of growth.”

The report’s admission that increasing energy consumption might be impossible to support foreshadowed coming energy problems, and the specter of oil shortages emerged as analysts grew alarmed by increasing demands and stagnating supplies. In fact, the EMR’s muted concerns about the future of Canadian oil were far from the only examples of growing pessimism about Canadian oil reserves in the early 1970s. In late 1972, the NEB released pessimistic estimates of Canada’s oil reserves which warned of possible shortfalls by 1986. In the spring of 1973, the Canadian media briefly noticed the issue when Maclean’s argued that the government needed to begin conservation and reduce oil exports. According to EMR records, the department was well aware of potential shortfalls in oil production. However, based on its projections of the frontier lands’ potential oil reserves and quick development of the oil sands, the Department remained confident that Canada’s long-term potential remained vast and capable of contributing towards the country’s economic growth. Validated by its forecasts of Canada’s potential and anxious to support the Trudeau government’s assertion of federal authority over Canada’s energy industry, the EMR published An Energy Policy for Canada with an optimistic view of Canada’s prospects.

Only four months after the EMR published An Energy Policy for Canada: Phase 1, the oil shock of 1973 struck. The Trudeau government had planned to announce a new national energy policy for Canada in late 1973 or 1974, so the oil shock provided the federal government with an opportunity to expand federal authority, albeit somewhat

areas outside of established oil bearing areas in Alberta, Saskatchewan, and British Columbia. Generally they included the Northwest Territories, the Arctic, and areas of the shores of Newfoundland and Labrador.

193 Collins, More, 139.
hurriedly, now that some sort of national policy had become necessary to blunt the pain of rapid price increases.\textsuperscript{197} The supply interruptions and resulting price spikes of the Yom Kippur war and OPEC’s embargo had effectively demonstrated a point that the EMR attempted to make with systems theory. Energy, in the form of oil, was fundamental to Canadian, indeed, all western economic and social life.\textsuperscript{198} Today this point seems banal, but in a world accustomed to declining energy prices and turning up the oil furnace or electric heater at the first chill, it was groundbreaking. In Canada, the oil shock forced questions of energy onto the national agenda and intensified a debate between the interests of Canadian and multinational oil producers and Canadian consumers. This debate would soon expand to include environmentalists and advocates of energy conservation and renewable energy.

On December 6, 1973, Trudeau announced a new energy policy that would define his government’s efforts to manage the energy sector for the remainder of the decade: energy self-reliance.\textsuperscript{199} Focusing on the rough equivalency between Canada’s oil exports and imports, Trudeau’s government outlined a plan to freeze oil prices over the winter, create a national market, construct pipelines to connect producing and consuming provinces, invest heavily in Canadian production, and create a national oil company, Petro Canada, to lead new exploration and speed the extraction of non-conventional oil.\textsuperscript{200} Only the price freeze and export tax controls went into immediate effect.\textsuperscript{201} Funds received from these taxes subsidised the importation of oil in Eastern Canada and allowed Canadians to adjust gradually to new prices. With this set of policies, the Trudeau government hoped to shield Canada’s economy and Canadians’ prosperity from price instability. For the remainder of the 1970s the government worked to ensure domestic supply through price manipulation and development incentives.

\textsuperscript{201} Doern and Toner, \textit{Politics of Energy}, 91.
Technical Knowledge and Political Debate

The preceding sections have shown how the Trudeau government restructured the state around its “rational management” approach and embraced technical knowledge. These changes constructed a highly technical discourse around policymaking and made mobilizing expertise and rationalistic analyses central to political debate. Expanding upon my argument, this section examines how the structure of the state created policy feedbacks that government bureaucrats, followed by environmentalists and advocates of renewable energy in the late 1970s, exploited to criticize government policy and propose alternatives. In short, political discourse privileged Canadian groups that possessed the scientific or economic training upon which the Trudeau government attempted to base its policy and reshaped political discourse, particularly around energy. This privileging of technical knowledge had the effect of strengthening the influence of politically marginal groups inside and outside of government able to use simulation and systems analysis to examine policy and mobilize them to suggest alternatives.

The energy crisis and the announcement of a national energy policy unleashed far more debate over the state of Canada’s oil and gas industry than the Trudeau government had anticipated. Much to its surprise, the dispute directly challenged the EMR’s simulations and development forecasts, the “facts” upon which the Trudeau government had hoped to make policy. In this conflict, the Trudeau government would find that technical knowledge and “rational management” neither removed political conflict nor effectively demonstrated the state’s ability to make policy or justify its interventions. Rather, its assertions of knowledge would become central to the conflict when first the petroleum industry, and later government advisors and environmentalists, used the government’s method to criticize its conclusions and propose their own.

In late 1973 and early 1974 this conflict centered on the government's price manipulation and export controls. As noted above, Canadian petroleum had historically been more expensive than oil on the world market. With price jumps in the fall of 1973, Canadian resources had suddenly become cheap. For the provinces with fossil fuel reserves and the multinationals that produced them, the Trudeau government’s price freeze and export taxes stood in the way of substantial profits and seemed intolerable regardless of the benefits other Canadians received from artificially low oil prices. The
provinces, supported by powerful multinational corporations, argued that the terms of
confederation gave them ownership of mineral resources, and in response the federal
government asserted its authority to regulate trade, which set off a decade of acrimonious
negotiation.202

The large multinationals that controlled the Canadian oil industry instituted a
second tactic, which took advantage of their extensive knowledge of Canada’s oil
resources and targeted the Trudeau government’s assertion of objective knowledge. This
approach was particularly well suited to attacking the EMR’s claims that it could manage
Canadian energy development. It also exploited the government’s relative inexperience
with energy and its inability to collect information directly about Canada’s oil reserves or
actively develop them.

As the Trudeau government outlined its policy, oil companies began speculating
publicly that if oil prices did not rise they would be unable to finance further exploration,
which could result in oil shortages within a decade. In its 1974 Annual Report, Texaco,
one of the major multinationals working in Canada, outlined the industry position:

The prices for Canadian crude had not been permitted to rise as rapidly as foreign
crude prices... To retain Canada’s present self-sufficiency in petroleum, Texaco
Canada and others in the oil industry have been asserting repeatedly for several years
that long lead times and staggering amounts of risk capital are needed to find,
develop and deliver new oil and natural gas from frontier and offshore regions and to
extract synthetic oil from the tar sands and other non-conventional sources.203

Making their assertion an explicit threat, the multinationals supported their position with
estimates that projected national oil shortages by the mid 1980s.204 These industry
projections directly contradicted earlier appraisals of Canada’s oil reserves, which had
confidently stated that Canada would have enough oil to last until well into the twenty-
first century, in an effort to convince the NEB to support increased exportation of oil. As
James Laxer notes, Texaco and other multinationals used these estimates to pressure the
government to move to the higher international price by promising they could afford to

202 See Doern and Toner, Politics of Energy and Fossum, Oil, the State, and Federalism for extensive
discussions of this conflict.
203 Texaco Annual Report, quoted in Laxer, Oil and Gas, 42.
204 Laxer, Oil and Gas, 45.
supply Canada with oil if prices increased to international levels. Simulations of Canada’s oil supplies had thus become a tool of open political conflict.

This major setback in the Trudeau government’s attempt to expand federal authority through the employment of objective knowledge, the result highlights the weakness of expertise as a means of domination and standardization. As political theorist Yaron Ezrahi argues, by relying on the authority of scientific or economic expertise to legitimate its decisions, the state opens itself to criticism from groups able to use that form of expertise to interrogate its claims. Rather than enhancing the power of the state, as Scott and many environmental historians argue, computer simulations and supply forecasts actually broadened debates because they allowed a large and diverse group of experts to comment on government policy.

The Trudeau government, with no way to assert the superiority of its numbers over those of the oil industry, particularly since it partially relied on the industry for information, had to consider industry criticisms. To make matters worse for the federal government, the NEB, which relied upon the figures provided by the oil industry, concurred with the multinationals’ drastically reduced estimates of Canada’s oil reserves. In its 1974 report to the EMR on the exportation of oil, the NEB strengthened its earlier warnings of possible shortages and issued further estimates that Canadian production could be 950,000 barrels below demand by 1982. Contrary to industry wishes, it recommended curtailing exports altogether, a response which might have helped self-sufficiency, but would have removed an important source of federal revenue.

Recognizing that it had been outmaneuvered, the Trudeau government responded by moving ahead with its plans to form a national oil company, Petro Canada. Although defeated in its attempt to use econometric simulation and energy forecasting as a tool that would depoliticize energy policy and allow objective management of oil and gas development, the Trudeau government remained committed to a broader approach of “rational management” and determined to expand Canadians’ control over the country’s

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205 Laxer, Oil and Gas, 46.
206 Ezrahi, The Descent of Icarus, 35.
oil industry. In this context, Petro Canada should be understood as both a statist effort to assert federal authority and a means of supporting the Trudeau government’s regime of policymaking, which relied on access to accurate information. The national oil company would improve the government's knowledge of Canadian oil and gas reserves and, as its abilities developed, threaten multinationals with replacement if they refused to undertake new exploration and development.

The EMR’s response to the new estimates strengthens this interpretation of the Trudeau government’s actions. Embarrassed by its suddenly overly optimistic analysis of Canada’s potential, it launched an investigation into the data the oil and gas industry had provided it to see if it had been willfully misled about the state of Canada’s reserves. The resulting report concluded that although industry estimates had been varied substantially, they had not been purposefully inaccurate. More importantly for the ongoing debate, its current pessimistic estimates remained within the range provided by government analysts, a point that An Energy Policy for Canada had recognized before the oil crisis. However, rather than abandoning simulation and forecasting as flawed, the EMR attempted to improve its understanding of oil and gas. Throughout the remainder of the decade, it carried out further studies of oil supply. The department even reaffirmed its determination to improve its abilities and provide the Trudeau government with more accurate information in its 1976 An Energy Strategy for Canada. Addressing past problems head on, the report’s foreword noted the EMR’s past mistakes over estimation of supply, but asserted that EMR’s methods had developed and it was possible to model accurately Canada’s energy needs and manage development.

The Trudeau government’s ideology of rational management and reliance on quantification played a central role in policymaking and political conflict in the 1970s. The failure of the Trudeau government’s effort to establish an agreed upon set of “facts” from which it could make policy underlines how assertions of objectivity and technical expertise were employed to both legitimate and contest government policy. Technical knowledge became a political tool when non-government experts contested the state’s claims. The government advisors who enabled a state to “see” its subjects and execute its

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209 Fossum, Oil, the State, and Federalism, 52.
210 Memo to Minister, Toombs Fonds LAC.
designs also employed their expertise to challenge government policy and suggest alternatives. In fact, as analysis of the problems posed by the energy crisis led to multiple conclusions, government advisors and federal bureaucrats who disagreed with the Trudeau government’s emphasis on growth and resource exploitation used the government’s own analysis to attack its policies as short sighted. These advisors’ cooption of the Trudeau government’s rationalistic discourse to enhance their otherwise marginal political position helped start some of the first discussions of sustainable development in the 1970s.

The Office of Energy Conservation (OEC) was one of the first to take advantage of the openings provided by Canadian political discourse when it pushed long-term sustainability into policy. The OEC was a minor office within the EMR, created as part of the government’s attempts to manage the energy crisis in late 1973. Charged with devising ways for Canadians to conserve energy, the OEC quickly found itself working against the EMR’s and the Trudeau government’s primary policy goal: the increase of energy supplies. Newly formed, politically marginal, and bearing an unpopular message, the OEC cast about for a means of making itself heard in policy discussions. In 1974, it hit upon the office’s technical expertise, particularly in economics, and thereafter the OEC took advantage of the privileged place of technical knowledge within the Trudeau government to champion energy conservation. Its members used their expertise to attack the very foundations of energy policy and question the most fundamental goals of the Trudeau government, indeed of the postwar consensus, namely, rapid economic and energy growth.

David Brooks, the first director of the OEC, played a central role in championing these iconoclastic positions. A relatively new employee of the EMR, Brooks joined the department just before the Trudeau government reorganized it in the early 1970s. Although he originally worked in the EMR’s mining section, he had a strong interest in environmental problems and was concerned by the government’s plans for resource

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212 The OEC would be renamed the Renewable Energy and Conservation Branch in 1976. Continuing its efforts to change policy, it would manipulate the government’s growing concern over energy scarcity and its continued reliance on simulation to make solar heating a part of Canadian energy policy. This development is discussed in chapter six.

213 The EMR connected energy use with economic growth. Indeed, it assumed that economic growth required increased energy use in its energy analysis in the early 1970s. EMR, An Energy Policy for Canada, 1: 29.
exploitation. An economist by training, Brooks focused on the economic justifications for energy conservation. To argue against the central goals of federal energy and economic policy, Brooks focused on two closely connected ideas: First, that “low energy growth” would not disrupt the economy, and second, that heavy investment in energy production, primarily fossil fuels, did not represent a cost effective use of capital. Conservation, according to Brooks, could provide energy at a much lower cost. Agitating within the EMR and publishing his views publicly, Brooks and the OEC began making the case for conservation.214

In a paper co-authored with Josette Doe, another economist at the OEC, Brooks compared Canada to other industrialised nations in order to highlight the potential for energy conservation. Using the EMR’s own estimates as the basis of their comparisons, the two economists discussed three levels of conservation: efficiency increases, demand moderation, and political or macroeconomic questions about how Canadians used energy.215 Taking on the all-important macroeconomic question of the relationship between energy use and economic growth, Brooks and Doe asserted that contrary to popular belief, a causal relationship did not exist between energy use and economic growth.216 To demonstrate their assertion, they compared Canada to Sweden, which had achieved exactly the same level of economic growth while using half the energy. Brooks and Doe argued that Canadians, beginning with the federal government, needed to alter their investment patterns to address the social and political structures that led to such inefficiency.217 Stating that energy prices would invariably increase in the future, they suggested that focusing on lifetime costs rather than initial costs would make Canada radically more energy efficient, since it would accurately reflect increased future costs, encourage investment in efficiency, and reduce environmental damage as well.218

With this starting point, Brooks and the OEC then expanded their position.

214 Brooks also co-authored an article in the iconoclastic journal *Alternatives* which embraced the countercultural argument of E.F. Schumacher that Canada should avoid large scale energy projects because of their unsustainable expense and their threat to local self-reliance and democratic choice. See Brooks and Alma Norman, “A Question of Choice,” *Alternatives* 3, 2 (Winter 1974): 2-10.
Utilizing the EMR’s econometric models of energy in a deft act of policy jiu jitsu, Brooks suggested that not only was heavy investment in oil and gas unlikely to meet Canadian needs, but it also would draw investment away from other priorities. This assertion conflicted with federal policy, which hinged on massive investment in oil and gas exploration and production. Focusing on the high opportunity costs, Brooks and the OEC outlined how such investment undermined the government’s own stated priorities in 1974, which included the “rational use of resources” and a “balance in the distribution of people and ...wealth.” Energy conservation, according to OEC, would be effective anywhere and cost less, which enabled greater social investment and would actually support the government’s stated goals of equality and long-term management. Furthermore, since it conserved resources for future use, it allowed greater flexibility.

As Brooks attempted to convince the EMR that energy conservation was possible and even profitable, other members of the OEC worked to enhance the office’s marginal position within the department. In 1974, they delved into the emerging practice of energy analysis and began to use it to evaluate Canadian decisions about energy. Energy analysis developed in the early 1970s as a hybrid practice which drew upon foundations in systems analysis, ecology, and input-output models. The publication of Howard Odum’s controversial book Environment Power, and Society brought energy analysis to a wider audience. Odum, however, cannot be credited as its creator since the practice really consisted of a repurposing of input-output models pioneered in the 1940s by economist Wassily Leontief and applying them to energy use. Regardless of its derivative origins, energy analysis proved extremely useful as a systematic means of examining energy efficiency. As questions of energy scarcity took on importance in the 1970s, energy analysis became an extremely powerful tool for both government advisors and

technically sophisticated environmentalists. For example, as Chapter five will discuss, Amory Lovins employed similar techniques to argue nuclear power was inefficient.\textsuperscript{224} For the OEC, energy analysis had two specific advantages. It “provided [the means] to look at a total system and optimize energy use of the whole system,” and it offered a way of measuring net energy, the energy gained minus the energy used to produce a given unit of energy.\textsuperscript{225} The ability to measure Canada’s total energy and critically examine different forms of energy production to determine which promised the greatest efficiency made energy analysis a useful tool in an office tasked with formulating conservation policy. Just as significantly, it provided the OEC with a method of supporting its arguments for energy conservation in a highly technical manner and communicating its positions as the results of objective thermodynamic calculations. Within the Trudeau government, with its emphasis on technical knowledge and the application of science to policymaking, energy analysis gave OEC a tool it could use to advance its views within the EMR and help them receive the best response from cabinet. By both taking advantage of the office’s economic expertise and manipulating the larger structures of the Trudeau government, the tiny OEC gained a voice in policymaking.

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{energy_analysis_model.png}
\caption{Energy Analysis Model. This diagram represents the energy flows associated with a generic energy facility. By applying this input-output analysis, the OEC could calculate the efficiency of any source of energy.}
\end{figure}

\textsuperscript{225} OEC, \textit{Energy Analysis}, 19, 35.
By 1976 Brooks’ and the OEC’s efforts began to affect Canadian energy policy. In that year the EMR’s energy policy announcement made energy conservation a formal element of policy. The EMR set a target of a less than 3.5 percent increase in energy consumption, a significant decrease from the 5.5 increase of the previous fifteen years.\textsuperscript{226} The department also began to distribute guides touting the economic benefits of conserving energy in an effort to cut Canadian oil consumption.\textsuperscript{227} The Trudeau government, however, still invested in the exploration and development of Canada’s oil and continued to see resource exploitation as a central driver of economic growth, as it had been for generations.\textsuperscript{228}

Anxious to dedicate himself more directly to environmental advocacy, Brooks left the OEC in 1976. He quickly founded Friends of the Earth Canada and became a leading member of Pollution Probe’s sister organization, Energy Probe, and he continued to champion conservation. At these environmental organizations, his expertise in the field of economics and his knowledge of government culture remained extremely valuable as a means to guide the groups’ efforts to change federal policy. While leading these environmental organizations, he also continued to consult with the EMR on energy. In 1977, for instance, Brooks served as a member of the National Advisory Committee on Conservation and Renewable Energy convened by the EMR to advise its efforts to “moderate energy demand through conservation policies and increase the supply from renewable sources.”\textsuperscript{229} In the early 1980s, he also oversaw \textit{2025: Soft Energy Futures for Canada}, an expansive government study of renewable energy and conservation, which aimed to provide a plan for moving away from oil.\textsuperscript{230} Brooks’ knowledge of Canada’s energy policy and the structure of its government would provide invaluable assistance to the Campbell government of Prince Edward Island and advocates of solar energy in their efforts to convince the federal government to fund renewable energy in the late 1970s.

Changing energy prospects and economic expertise enabled the tiny OEC to have

\textsuperscript{226} EMR, \textit{An Energy Strategy for Canada}, 129, 149.  
\textsuperscript{227} OEC and EMR, \textit{Keeping the Heat in: How to Re-Insulate your Home to Save Energy and Money} (Weston, ON: Southam Murray Printing, 1976).  
\textsuperscript{228} EMR, \textit{An Energy Policy for Canada}, 148.  
a small, but significant, effect on energy policy. Although unable to reverse entirely the Trudeau government’s commitment to growth, OEC advisors, and later environmentalists, effectively employed technical knowledge to question government policy and suggest alternatives. Advocates of renewable energy and conservation used their technical expertise to force their way into discussions of energy policy and economic development. Once there, they pushed the federal government to fund renewable energy and by the late 1970s convinced it to provide hundreds of millions of dollars to develop solar heating and create a Canadian solar industry. In short, the highly technical discourse constructed by the Trudeau government enabled Canadians’ discussion of environmental limits and underwrote the country’s first program of sustainable development.

Conclusion

This chapter has made two central arguments: that technical knowledge is a zone of political conflict rather than a tool of social domination and that regimes of quantification and expert authority encourage manipulation by those groups with the requisite expertise. In areas such as energy policy, where knowledge of physical environments and the economics of their exploitation are integral to state policy, knowledge becomes both a means of analysis and a tool of political debate. Furthermore, these conflicts can destabilize state policy, as in the oil industry’s employment of energy forecasts to undermine the Trudeau government’s policy goals. Even more significantly, this malleability enables groups to employ the very legibility created by technical knowledge, in this instance knowledge of energy supplies, to challenge the state and outline alternatives.

This analysis suggests the modern Canadian state is neither an all-powerful and monolithic entity, nor a passive entity buffeted by social groups and political interests. Rather, it is a powerful, but conflicted, actor fractured by both internal struggles and its ongoing efforts to establish and maintain its authority. Approaching the Canadian state as a central, but circumscribed actor helps historians analyze how government policies are constructed and how the groups within and outside of the state mobilize to exploit the terms of political discourse set by the state and the types of knowledge it privileges. Even as it makes certain ideas hegemonic, such as a modernist faith in the knowledge of
economists, scientists, and state planners, challenges to the state or efforts to manipulate it will still emerge and sometimes succeed. In short, rather than enabling state domination, technocrats can provide the most effective means to reshape state policy. They can also help critics to use the sources of the state’s power – claims to objective knowledge – against it.

Finally, this chapter suggests that the Trudeau government’s approach to policy, its “rational management,” represents one of its most important undertakings. However, this approach was not significant because it achieved its goals – it failed in its efforts to depoliticize policymaking – rather it stands as an example of the problematic reality of “objectivity” in action. The importance of “rational management” lay not it its attempt to make policy more rational, but instead in its influence on the pattern of Canadian politics. Its privileging of technical knowledge reshaped political discourse by enhancing the power of some bureaucrats and political groups over others and strengthening the influence of otherwise marginal groups of experts. The authority assigned to those who could effectively employ scientific expertise made these experts important political actors able to challenge and, in the case of the OEC, to change government policy. The discursive frame created by the Trudeau government’s restructuring of the state and its scientistic ideology enabled arguments over energy, growth, and sustainability. Throughout the 1970s, government advisors and environmentalists would use technical knowledge to manipulate this framing of political debate. In the early 1970s, the politically marginal government of Prince Edward Island adopted the OEC’s methods to exploit federal development policy and reshape modernization efforts on PEI into Canada’s pioneering program of alternative development. The Campbell government’s nuanced embrace of technocratic politics reshaped PEI and reframed ideas of development in 1970s Canada.
Chapter 2:

An Alternative on Prince Edward Island: Environmentalism, Sustainable Development, and the Campbell Government

On May 28th, 1973, Premier Alexander (Alex) Campbell revised his plans to transform Prince Edward Island’s (PEI) future. In his landmark “Between Two Cultures” speech, Campbell questioned his earlier decision to commit his government to modernization and rapid growth. Musing about the environmental and social problems associated with rapid industrialization, he confided to his listeners that his earlier view “that rapid industrialization necessarily produces a better quality of life” was a “fallacy.” He quickly followed his surprising words with action. Less than two years later, Campbell and his closest advisor, Andrew (Andy) Wells, outlined a program of alternative development built around renewable energy and sustainability.

Premier Campbell’s actions contradicted the relationship between environmentalism and the state discussed by environmental scholars and complicates the history of sustainable development. Historians have often portrayed the history of environmental activism as a story of protest against modernity. The iconic tale about John Muir’s and the Sierra Club’s fight against the building of the Hetch Hetchy dam near San Francisco in the early twentieth century often defines the movement. State funded and organized development projects, particularly dams, continued to function as a central antagonist for environmentalism in the 1960s and 1970s. Their importance rested on a combination of the physical changes dams wrought upon the landscape and their symbolic significance as the centerpieces of modernization programs designed to bring electricity, jobs, and industry – modernity – to supposedly underdeveloped regions the world over. This connection between environmental degradation and state supervised

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231 Honourable Alexander Campbell, “Notes for an Address to the Charlottetown Rotary Club,” Charlottetown, May 28, 1973, Premier Alex Campbell Speeches Vertical File, UPEISC.
modernization programs has shaped environmental historians’ analysis of development and led to a focus on the destructiveness of development and environmentalists’ efforts to stop such plans, including the employment of New Left inspired public protest in the 1960s and 1970s. In this reading the work of environmentalists, such as E.F. Schumacher, who championed a “small is beautiful” approach and rejected big, complex, and modern technologies – dams and nuclear plants – in favour of small, simple, and often traditional technologies – solar power – represent an effort to reject state led modernization projects and transform conceptions of development.

Through this framework of conflict, scholars often understand the emergence of sustainable development as the result of global environmentalism’s rejection of earlier theories of development and its assertion of the importance of environmental and social justice. The 1972 Stockholm Conference and the 1987 Brundtland Conference supports this interpretation by bringing together environmental groups and government representatives critical of earlier modernization efforts to discuss and formulate a global response to environmental and social problems. The Brundtland Commission on north-south issues, for instance, famously outlined sustainable development in its report Our Common Future and argued this approach would finally provide beneficial growth in the

Mekong Delta (Seattle: University of Washington Press, 2010).
global south while addressing the world’s environmental problems.\textsuperscript{238} While this focus on
globalized efforts to rethink development are of fundamental importance to both the
environmental movement and contemporary debates over development, it ignores a less
studied, but no less important aspect of environmentalism’s history: state led sustainable
development in North America.

New Deal progressives’ efforts to alleviate poverty in the Southern regions of the
United States relied heavily upon infrastructure and agricultural assistance. These
programs, along with the longer history of development, helped define modernization
efforts in North America. According to historian Nils Gilman, this approach, which
framed modernization as the re-construction of the American postwar experience, formed
an important strand of modernization programs that development experts attempted to
apply to nations and regions all over the world in the 1950s and 1960s.\textsuperscript{239} Canada’s
Atlantic Provinces experienced the full force of this push for modernization. Viewed by
the federal government as underdeveloped and traditional, efforts to modernize industries
in the region and reconstruct its residents as citizens capable of succeeding in a modern,
educated, and industrialized country proceeded apace in the twentieth century.\textsuperscript{240} With
the election of Pierre Elliott Trudeau on the platform of a “just society” that promised to
correct Canada’s “chronic regional imbalances” of wealth and power, addressing
underdevelopment became a priority for federal policy.\textsuperscript{241} This history of regional
disparity and the epistemology of modernization, which equated underdevelopment,
poverty, and tradition, framed PEI’s engagement with environmentalism and the
province’s experiments with sustainable development.

This chapter places Campbell and Wells’ program of alternative development in
the context of broader Canadian efforts to “modernize” Atlantic Canada, and argues that
alternative development on PEI was not a rejection of modernization, but rather its
reformulation along environmentalist lines. For a Premier desperate to improve the
economic conditions in his province and faced with a growing global energy crisis,
renewable energy and alternative development provided an appealing means of addressing economic problems while taking a less heavy-handed approach to modernization. This understanding of sustainability highlights a different side of alternative development, connecting it not to concern about the global south or international environmental preservation, but to Canadian attempts to address “underdevelopment” in Atlantic Canada and insulate the country against global market forces. In short, sustainability emerged in the 1970s as an effort to manage future risk and ensure economic growth while preserving the environment. This reformulation of regional development efforts underlines the influence of modernization in framing Canada’s understanding of development in the 1970s and it suggests the significance of national and economic objectives to the history of sustainable development.

The Campbell government’s experiments with renewable energy and sustainable development also emphasize the complex role the state played in both environmentalism and regional development. As Alan MacEachern’s excellent analysis of the Institute of Man and Resources (IMR) has shown, a provincial government can be a significant environmental actor.\textsuperscript{242} This chapter expands on MacEachern’s study of the IMR, by focusing on the refashioning of modernization, and showing how the provincial government worked with environmentalists to construct its program of alternative development. Drawing on the networks of countercultural environmental groups that played a central role in North American countercultural environmentalism and appropriate technology, the Campbell government used environmentalists’ expertise to outline and provide the initial projects for its program of sustainable development.\textsuperscript{243} The provincial government’s cooperative relationship with environmentalist advocates of the “small is beautiful” approach to development highlights the pragmatism of these environmentalists who, contrary to their common portrayal as anti-modern and libertarian, avidly participated in government development programs as technocrats and

\textsuperscript{242} Alan MacEachern, \textit{An Environmental Fable: The Institute of Man and Resources} (Charlottetown: Island Studies Press, 2003). I would also like to thank Dr MacEachern for his assistance with my research for this chapter. Paul Milazzo makes a similar argument for the importance of government environmentalists in Milazzo, \textit{Unlikely Environmentalists: Congress and Clean Water, 1945-1972} (Lawrence: University Press of Kansas, 2006).

\textsuperscript{243} Kirk, \textit{Counterculture Green}, 42.
entrepreneurs.\textsuperscript{244} Politically astute and intimately familiar with the federal government’s development programs, the Campbell government used environmentalists’ suggestions to manipulate federal policy and finance its program of alternative development. The ability of tiny PEI to maneuver within the existing politics of regional development challenges scholars’ depiction of the unequal relationship between the Atlantic Provinces and the federal government, by showing that even though the central government did dominate the policy process, it could not simply dictate to the provinces, since they could influence federal decision making and reshape policy to their economic advantage.\textsuperscript{245}

This chapter examines the rise of alternative development on PEI in four sections. The first introduces the Campbell government’s plans to industrialize PEI, which preceded its shift to alternative development. I argue that the Campbell government’s approach to development in the massive Comprehensive Development Plan (CDP) grew out of a modernizing desire to use the power of the state to transform the island. The second section turns to the opposition the CDP faced on PEI. In contrast to earlier studies, I show that the Campbell government’s shift from modernization to its focus on alternative development and small-scale renewable energy technology emerged as an extension of efforts to plan development, and not the influence of popular protest. The third section expands upon this point as the chapter examines how networks of environmental and appropriate technology groups worked with the Campbell government, supported its rationalistic approach, and even functioned as advisors for the province’s development programs. The final section continues to expand upon this theme as it examines the Campbell government’s successful efforts to manipulate federal policy and attract funding for its alternative development projects. Finally, I underline the centrality of the Campbell government to experimentation with sustainable development by briefly discussing the collapse in support for these initiatives after Campbell retired from power in 1979.

\textsuperscript{244} Kirk, \textit{Counterculture Green}, 184; Zelko, “Making Greenpeace,” 214.
The Attempted Modernization of PEI

Appointed in 1966, Alex Campbell came to office determined to strengthen his tiny province’s place in Canada. At thirty-three, he was the youngest premier in the province’s history; his opponent, Walter Shaw, was the oldest at seventy-eight. Working off this contrast, Campbell carefully positioned himself as the personification of energy, new ideas, and the island’s bright and modern future, themes that would dominate his political career. The scion of one of the island’s elite families, Campbell’s background played an important role in his early political success. His father served as the Liberal party leader and provincial premier from 1936 to 1943 and went on the serve as the chief justice of PEI’s Supreme Court. This long history gave the younger Campbell cachet in both the Liberal party and PEI society. In the same mold as his father, Alex Campbell studied law and practised on the island while overseeing Liberal campaigns in his district during both provincial and federal elections in the late 1950s and early 1960s. In 1965, Campbell successfully ran as the Liberal candidate in a by-election and entered the provincial legislature. With his family’s good reputation, his growing political abilities, and an excellent campaign organization headed by Andy Wells, whose father had organized Campbell’s father’s campaigns, Campbell won a Liberal leadership race in late 1965 and went on to become premier in 1966.

The mid 1960s was a fortuitous moment for the election of a young premier dedicated to transforming his province. At the time of Campbell’s appointment, PEI was one of Canada’s poorest provinces. Unemployment, for example, stubbornly remained 3% to 7% above the national average, with substantial minorities of islanders experiencing seasonal unemployment due to the rhythms of traditional farming and fishing. While common in the Maritimes and Newfoundland, the federal government singled out such labour patterns as the reason for the region’s poor economic condition and the “limited aspirations” of its people. In fact, the federal government had viewed the region as underdeveloped for decades. As historian Miriam Wright has argued, the

246 Wayne MacKinnon, Between Two Cultures: The Alex Campbell Years (Stratford, PEI: Tea Hill Press, 2005), 17.
247 MacKinnon, Between Two Cultures, 18.
248 MacKinnon, Between Two Cultures, 19.
249 Department of Regional Economic Expansion, Agreement Covering the Development Plan for Prince Edward Island (Ottawa, Queen’s Printer for Canada, 1969), 23.
250 MacKinnon, Between Two Cultures, 98.
drive to industrialize and modernize has been an important theme in the history of Atlantic Canada since the 1940s, and the federal government made substantial efforts to improve what it regarded as a backward and underdeveloped region throughout the postwar period.  

The late 1950s saw an intensification of interest in Atlantic Canada’s economic problems as rapid economic growth in the rest of the country increased regional disparities. The landmark Royal Commission on Canada’s Economic Prospects, headed by Walter Gordon, focused attention on the region’s problems in 1957. Although it highlighted troubles in Atlantic Canada, Gordon’s report said little about how federal development policy, which concentrated investment in industrial Ontario, contributed to the region’s difficulties. For members of PEI’s provincial government, the reasons for the declining fortunes of the Island’s farmers and fishermen (the two largest industries) were partially if not wholly the fault of federal and international policies that made it difficult for the small farms and fishing companies of the island to compete. Gordon’s report did not see things quite that way, citing the need for “adjustment.” Nevertheless, the federal government and the provinces did agree upon the need to take action. Consequently, a veritable flood of federal agencies and development programs emerged in the 1960s. These included the Agricultural Rehabilitation and Development Act, the Maritime Marshlands Rehabilitation Agency, the Atlantic Development Board, and the Fund for Regional Economic Development. The creation of these agencies and programs marked the beginning of what Janine Brodie calls “compensatory policies,” which used the welfare state to reimburse regions for policies or markets that damaged its prospects. For PEI and the other Atlantic provinces, these policies represented an important source of funds and an opportunity to attract or create new industries.

251 Wright, A Fishery for Modern Times, 7.
254 MacKinnon, Between Two Cultures, 101.
256 MacKinnon, Between Two Cultures, 102. These agencies and programs would be rolled into the Department of Regional Economic Expansion under the Trudeau government. Brodie, The Political Economy of Canadian Regionalism, 172.
257 Brodie, The Political Economy of Canadian Regionalism, 164. Canadian equalization payments are the most prominent example of compensatory policies.
Forming his government just as these assistance programs took shape, Campbell immediately set about attracting as much federal funding as possible. The Campbell government also benefited from reforms that professionalized the province’s bureaucracy and removed the spoils system that had stymied effective governance. Taking advantage of its growing abilities the provincial government immediately launched an intensive study of PEI designed to formulate development plans able to draw federal funds. To concentrate its efforts, in 1967 the provincial government set up a special department, the Prince Edward Island Economic Improvement Corporation (EIC), to study PEI and devise a development plan. Led by Del Gallagher, an economist and friend of the Premier, this new body had the authority to plan every aspect of the island’s transformation, and it quickly set about comprehensively studying the island’s potential and carefully constructing development programs to diversify PEI’s economy and help islanders catch up to the rest of Canada. Gallagher’s lack of patience or concern for local views and his quest for exhaustive data about the island would define the effort as an exercise in technocratic planning.

These experts’ work resulted in the White Paper on Economic Planning and Development, which argued the government must do everything possible to expand the provincial economy “to bring to the population the full measure of the benefits of economic growth which prevail generally in Canadian society.” The Comprehensive Development Plan emerged from this study; it would become the provincial government’s primary vehicle for both attracting federal funds and transforming the lives of islanders throughout the early 1970s.

For Campbell, Wells, and the provincial government, the CDP, or the Plan as it came to be known, represented an opportunity to drastically improve the lives of their constituents. Well aware of PEI’s declining economic position relative to the rest of the country – provincial per capita income was half of the Canadian average in 1967 – the Campbell government believed PEI needed to change. In its view, the province’s

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260 MacKinnon, Between Two Cultures, 104.
261 MacKinnon, Between Two Cultures, 105.
262 Brodie, The Political Economy of Canadian Regionalism, 166.
difficulties started with the farming and fishing industries, specifically the traditional and inefficient organization of these industries. For Campbell this analysis translated into a desire to transform his province into the industrialized, prosperous, and above all modern society that he believed the rest of Canada had become. This restructuring, he and his government felt, would allow the islanders to prosper and perhaps even induce those who had abandoned PEI to search for opportunities in industrial Ontario to return to the province.

To make its desired transformation of PEI a reality, the Campbell government took the EIC’s plan to the federal government in 1968 in an effort to win support. The Plan received approval in 1969 when the federal and provincial governments signed the Agreement Covering the Development Plan for Prince Edward Island. The Plan itself focused on rationalizing and modernizing the fishing and farming industries, improving education, and expanding the island’s infrastructure. The goal of all this reorganization was “to create conditions in which the people of PEI can create viable economic enterprises for themselves.” To implement these programs the provincial and federal governments launched a new office, the Department of Development, outside of the regular structure of the provincial civil service. Reporting to the PEI Executive Council (Campbell’s Cabinet) and to the federal government, the new Department enabled federal oversight and gave the Premier and his closest advisors the ability to pursue development with little regard for the provincial legislature or local politics. Elated by the acceptance of the Plan and the assurance of federal support for his beleaguered province, Campbell half jokingly remarked to reporters that now, “every person in every square inch of the province would come within the application of the plan.”

A near perfect example of the power of the state in postwar North America, Campbell’s efforts fit seamlessly with both the ideology of “rational management” and

264 Milne, “Politics in a Beleaguered Garden,” 42.
268 Nemetz, “Managing Development,” 158.
269 MacKinnon, Between Two Cultures, 183.
the aggressive development policies pursued by the Trudeau government.\textsuperscript{270} Under Trudeau, efforts to modernize and develop Canada’s Atlantic Provinces took on a special urgency because the Liberals had been elected on a platform of national unity and promised to address regional disparities across Canada.\textsuperscript{271} Connecting economic development to his government’s focus on national unity, Prime Minister Trudeau made improving the Atlantic economy a priority immediately after his election. To this end, he rolled regional development programs into a new department, the Department of Regional Economic Expansion, and appointed Jean Marchand, a powerful figure in Ottawa, as its minister.\textsuperscript{272} Embracing the belief that the state could direct economic development, Trudeau boldly stated:

Economic equality ...[is] just as important as equality of language rights ... If the underdevelopment of the Atlantic Provinces is not corrected, not by charity or subsidy, but by helping them become areas of economic growth, then the unity of the country is almost as surely destroyed as it would be by the French-English confrontation.\textsuperscript{273}

Reflecting the view that the state had the duty and ability to improve the lives of its citizens through the management large of scale projects, the CDP attempted to do just that.

Expansive in temporal and financial scope, the CDP laid out a fifteen-year strategy and proposed $722.7 million in spending.\textsuperscript{274} The costs of the first five-year phase of the program, which focused on studying the island and constructing the educational, institutional, and infrastructural foundations necessary for later development, ran an estimated $243 million split between the provincial and federal governments. This infusion of funds represented a significant windfall for the island, since the province’s entire budget in 1968 was only $55 million.\textsuperscript{275}


\textsuperscript{271} Savoie, \textit{Visiting Grandchildren}, 85; Brodie, \textit{The Political Economy of Canadian Regionalism}, 172.

\textsuperscript{272} Savoie, \textit{Visiting Grandchildren}, 81; Brodie, \textit{The Political Economy of Canadian Regionalism}, 173.


\textsuperscript{274} DREE, \textit{Development Plan for Prince Edward Island}, 7.

\textsuperscript{275} Nemetz, “Managing Development,” 159.
The Plan expected this funding to have a significant effect on PEI. It forecast an annual 7% increase in the rate of growth beyond what the province could naturally expect, and it promised to expand residents’ per capita income by nearly a thousand dollars annually. These benefits, however, mandated substantial changes according to the CDP. Local agricultural practices, for instance, required substantial reforms to become economically successful. According to the plan, “the historical pattern of land ownership” needed to change since it was “badly adapted to the need of modern technology for agricultural, forestry, and tourist development” because scattered smallholdings inefficiently allocated land to these industries. Passing over the possible reactions of farmers and residents to land reallocation without comment, the Plan took pains to outline the extensive training and education required to work in the Department of Development, which had been tasked with the implementation of its various

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276 DREE, *Agreement Covering the Development Plan*, 28. It is worth noting that the federal transfers did increase Islanders’ incomes by 6% relative to the Canadian average by the mid 1970s. Brodie, *The Political Economy of Canadian Regionalism*, 166.

programs.\textsuperscript{278} Expertise, it seems, would allow the Department to rise above local politics and tradition and transform PEI for the better.

Pleased by their success, Campbell’s Liberals ran on the new Development Plan in the 1970 provincial election. They won in a landslide, gaining the largest popular majority ever received by a political party on PEI.\textsuperscript{279} In the early 1970s, PEI seemed set to follow the Campbell government’s carefully devised and centrally managed program designed to transform the island into an industrial, urban, and above all modern province akin to rapidly growing Ontario. The Plan, however, was not universally loved. Its promise of rapid transformation and the prominent place of abrasive experts, such as Gallagher, troubled islanders, who worried that the island’s traditions would be lost and resented being shut out of discussions about how their province should be changed. Just as the Plan started to take effect, rising inflation and the energy crisis also conspired to challenge this program of development.

**Alternative Development and the Provincial Government**

After the CDP received approval and began to transform PEI, Campbell and his government seemed to distance themselves from its program of modernization, and the Plan became a lightning rod for debate in the early 1970s.\textsuperscript{280} By 1973, Campbell had gone so far as to state publicly that the Plan’s efforts to industrialize PEI might be misguided.\textsuperscript{281} To explain the Campbell government’s apparent change of heart, scholars have pointed to local protests and linked them with the wider turn against centralized modernization programs, which accompanied the rise of the counterculture and the modern environmental movement.\textsuperscript{282} At first glance, this reasoning seems to provide a compelling argument, particularly since Campbell and Wells embraced the “small is beautiful” rhetoric popular among the counterculture and environmental movement. In my view, however, this explanation overstates the extent of the change in the Campbell

\textsuperscript{278} DREE, *Agreement Covering the Development Plan*, 73.
\textsuperscript{279} MacKinnon, *Between Two Cultures*, 135.
\textsuperscript{280} Milne, “Politics in a Beleaguered Garden,” 48; MacEachern, *An Environmental Fable*, 17-19; MacDonald, *If You’re Stronghearted*, 319, 335.
\textsuperscript{281} Campbell, "Notes for an Address to the Charlottetown Rotary Club," Charlottetown, May 28, 1973.
government’s approach to development and underrepresents the agency of the provincial government. Rather than being forced into abandoning its modernization efforts by local protests and rejecting the centralized, expert-driven approach, Campbell and Wells turned to appropriate technology and a different set of experts to modernize the island through a program of alternative development.\(^{283}\)

The assertion that protest forced the transformation of the Plan rests primarily on the actions of the National Farmers Union and the Brothers and Sisters of Cornelius Howatt. Guided by agrarian populism and a combination of New Left politics and environmentalism respectively, these protest groups employed direct action and political theater to attack the CDP and the Campbell government’s attempts to modernize PEI. Carefully using the linked forces of counterculture and environmentalism, the Brothers and Sisters of Cornelius Howatt attacked the Campbell government and the Plan mercilessly in a series of very public protests during the early 1970s. Their name lionized Cornelius Howatt, a member of the legislative assembly who had opposed confederation with Canada, in an attempt to draw attention to the loss of provincial autonomy caused by the Development Plan. Comprised primarily of students, the Brothers and Sisters of Cornelius Howatt formed in 1972 in order to protest the “egregious silliness of the Centennial celebrations,” as well as the high-handed practices of the CDP.\(^{284}\)

Inspired by the New Left’s attention-grabbing political theater, the group dramatized islanders’ loss of control to planning experts by holding a mock referendum on the question of home rule. The group reported that the polling station, an outhouse, had seen a landslide vote in favour of local sovereignty.\(^{285}\) The Brothers and Sisters of Cornelius Howatt also attacked Campbell in newspaper articles for trying to destroy the local culture and damaging its environment in what they viewed as a futile effort to “keep up with the rest of Canada.”\(^{286}\) Deeply suspicious of the Plan’s single-minded efforts to rapidly increase economic growth, the group asserted that “economic prosperity [was] not the solution to all our human ills,” and that growth could even exacerbate problems if its

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\(^{283}\) Alex Campbell Interview, August 12, 1999, Series 11, Alan MacEachern Interviews, IMR Fonds, PEIPARO.

\(^{284}\) MacKinnon, *Between Two Cultures*, 204. The centennial in question celebrated PEI’s joining of Canada in 1873. The group drew its name from one of the two island representatives who voted against joining Canada.

\(^{285}\) MacKinnon, *Between Two Cultures*, 205.

\(^{286}\) MacKinnon, *Between Two Cultures*, 205.
social and environmental costs became too large.\textsuperscript{287}

The National Farmers Union similarly protested against the Plan. The Union represented PEI’s farmers, particularly the small family farmers who were most threatened by the Plan’s efforts to reorganize landownership and improve the efficiency of local agriculture.\textsuperscript{288} In 1970, government development agencies had begun to purchase large tracts of land in an effort to change land use patterns and consolidate farms in the name of economic growth.\textsuperscript{289} On August 12, 1971, after the Campbell government had refused the Union’s requests for financial support for its members’ efforts to preserve small family farms, the NFU organized a tractor blockade of the Trans-Canada Highway near Borden, then the site of PEI’s main ferry terminal.\textsuperscript{290} According to historian Ryan O’Connor, this protest dampened the Liberal government’s enthusiasm for the “modernizing ethos embodied in the CDP.”\textsuperscript{291} To make his point, O’Connor points to Campbell’s personal takeover of the ministry of agriculture in 1972 and the creation of the Family Farm Development Policy, which provided grants for farm development, as evidence of the protest’s influence.\textsuperscript{292}

Campbell’s famous “Between Two Cultures” speech, discussed at the beginning of this chapter, also seems to suggest that these protests had a significant influence on him and his government. In the speech, Campbell acknowledged criticisms leveled by the Brothers and Sisters of Cornelius Howatt, and he agreed with their assertion that industrial growth had thus far failed to solve social problems or improve Canadians’ “quality of life.”\textsuperscript{293} Campbell also recognized Canadians’ changing regard for their “total environment” and noted that the thousands who traveled hundreds of miles every summer to enjoy PEI’s natural beauty should give pause to those anxious to industrialize the island.\textsuperscript{294} Based on these events and this speech, it is tempting to conclude that the protests worked and to present Campbell as a flexible politician bowing to his constituents’ wishes.

\textsuperscript{287} Macdonald, \textit{If You’re Stronghearted}, 319.
\textsuperscript{288} DREE, \textit{Agreement Covering the Development Plan}, 33-38.
\textsuperscript{289} Macdonald, \textit{If You’re Stronghearted}, 310.
\textsuperscript{290} O’Connor, “Agrarian Protest and Provincial Politics,” 31.
\textsuperscript{291} O’Connor, “Agrarian Protest and Provincial Politics,” 33.
\textsuperscript{292} O’Connor, “Agrarian Protest and Provincial Politics,” 51.
\textsuperscript{293} Campbell, “Notes for an Address to the Charlottetown Rotary Club.”
\textsuperscript{294} Campbell, “Notes for an Address to the Charlottetown Rotary Club.”
That conclusion, however, would ignore several important aspects of the provincial political landscape as well as the manner in which the Campbell government embraced sustainable development. As I stated above, the Campbell Liberals won a huge majority in the 1970 election as they took twenty-seven of the island’s thirty-two seats and received fifty-eight percent of the popular vote. During that election campaign, Campbell faced direct criticism about the CDP. The Conservative party, his main opposition, even promised to re-negotiate the plan. In response, Campbell flatly stated, “I cannot see any reason to re-negotiate a standard of living and quality of life second to none anywhere in Canada,” and he won a landslide victory while championing his CDP.

Campbell and his government remained nearly as popular in the 1974 election, held less than two years after the protests that supposedly forced him to rethink his “modernizing ethos” and abandon his highhanded approach to policymaking. In the 1974 election, the Liberals won twenty-six seats in the provincial legislature and maintained a more than four to one majority over the main opposition, the Conservatives. This electoral dominance does not suggest that angry constituents pushed the Premier to the edge of defeat and forced him to change his governing philosophy. The Campbell government’s approach to development did change in the 1970s, but it shifted through a process of conscious evolution undertaken by Campbell and his closest advisors, not one forced on him by protestors.

The protests that allegedly ended the Campbell government’s modernization and industrial development of PEI also become less impressive when one examines their direct results. The activism of both the Brothers and Sisters of Cornelius Howatt in 1973 and the National Farmers Union in 1971 was short lived. The Union’s protests, for instance, only lasted five days. This demonstration did elicit a promise of subsidies for family farms. The quid pro quo, however, required farmers to take part in “five-year development plans” to help family farms modernize, a primary goal of Campbell’s agricultural policy before the protests. The widespread selling of unprofitable farmland

295 MacKinnon, Between Two Cultures, 136.
296 Quoted in MacKinnon, Between Two Cultures, 134.
298 MacDonald, If You’re Stronghearted, 311.
that occurred in the early 1970s also accomplished much of the Plan’s “integrated land management” as farms dropped in number and grew in size.\footnote{DREE, Agreement Covering the Development Plan, 35.} In the case of the Brothers and Sisters of Cornelius Howatt, the group disbanded after the 1973 centennial celebrations.\footnote{MacKinnon, Between Two Cultures, 208.}

As O’Connor notes, these protests could be characterized as outbursts of anti-modernism aimed at the changing political and economic circumstances of socio-economic groups on PEI rather than a coherent criticism of specific policies undertaken by the provincial government.\footnote{O’Connor, “Agrarian Protest and Provincial Politics,” 55.} While anti-modern protest did pose an important challenge to the CDP, particularly its technocratic approach and its underlying goals, it is difficult to see these objections as the primary factor in the Campbell government’s changing approach to development. Nor does it seem reasonable to conclude that this public activism forced Campbell to abandon his “modernist ethos” or his reliance on technocratic management.

Instead, the change in approach reflected the conscious evolution of the Campbell government’s longstanding efforts to modernize and develop the island, not a radical break with the CDP forced on the government by angry constituents. Sustainable development on PEI did not entail the rejection of expert knowledge, long term planning, or the exercise of state power. Rather, it embraced all of these elements of Campbell’s “modernist ethos” and coupled technical expertise with political acumen in an attempt to devise a development strategy able to both preserve local quality of life and improve PEI’s standard of living. The importance of the Campbell government’s leadership cannot be underestimated, since the government and the institute it created to spearhead alternative development defined sustainable development on the island. As Alan MacEachern has noted, the provincial government, led by Campbell and Wells, worked continually to convince islanders of the merits of renewable energy and faced criticism motivated by both legitimate concern and obscurantism.\footnote{MacEachern, An Environmental Fable, 117-118.} Modernist and sustainable, alternative development on PEI had a great deal in common with the Plan’s focus on modernization, including the active leadership of the state.
Drawing selectively on environmental and countercultural thought, the Campbell government formulated a response to what it believed to be changing environmental and economic circumstances, particularly growing anxiety over scarcity. These concerns made the 1970s a tumultuous period for those attempting to modernize the so-called underdeveloped regions of Canada and the rest of the world. In Canada, the federal government remained committed to addressing regional disparities, but shifted away from efforts to transform traditional society to a less ambitious approach focused more narrowly on creating competitive enterprises or new industries. As Nils Gilman observes, modernization theory started to recede in importance globally as the liberal consensus that had driven it began to crumble in the face of disasters in Vietnam and challenges from both the right and left, most notably the New Left and the environmental movement. The rise of modern environmentalism, particularly its apocalyptic predictions of environmental and economic collapse, directly challenged the exhortations of development experts, such as Del Gallagher, for rapid industrial growth.

Concerns about the long-term viability of industrial society received perhaps their greatest expression in 1972, when the Club of Rome published its landmark report, *Limits to Growth*. On the basis of intricate computer simulations, the environmental group concluded that a social and environmental collapse would occur during the twenty-first century unless resource use, population growth, and pollution decreased dramatically. In the same year, the United Nations Stockholm Conference on the Human Environment

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reached similar conclusions. Organized by Maurice Strong, the director of the Canadian International Development Agency and the UN Undersecretary in charge of organizing the Stockholm Conference, it received substantial coverage in the Canadian press, which popularized fears that continued rapid industrial development might not be sustainable. These indictments of industrial society’s long-term prospects by leading international organizations and public intellectuals, as well as the public protests of environmental groups, such as Pollution Probe, provided a powerful critique of modernist visions of future growth and unending progress. For the Campbell government they suggested the Plan’s program of modernization required refashioning to succeed in a world characterized by scarcity.

Andy Wells, the Premier’s closest advisor and speechwriter, emerged as the central figure who reformulated the government’s efforts to transform the island. Together since Campbell’s first campaign in 1966, Wells and Campbell had a close relationship throughout the period. Wells, an Islander who had grown up in Ottawa and returned to PEI in the early 1960s, was the more philosophical of the two and highly skilled at backroom politicking, qualities which complemented Campbell’s pragmatism and affable public persona. As Alan MacEachern puts it, Wells was “Machiavelli to Campbell’s prince.” Together these two relatively young and optimistic men (both were in their thirties) would wrestle with two of the biggest problems of their day: how could the state help to provide Canadians with a better life, and how could Canadians’ quality of life and environment be maintained over the long term? Their solution, a program of alternative development, reflected their creative merger of mainstream and countercultural responses to these questions.

In the early 1970s, Wells became increasingly alarmed by global environmental problems and the failings of large-scale industrial programs, and he began to urge Campbell to make changes on PEI. An avid reader and something of an iconoclast,

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310 MacEachern, *An Environmental Fable*, 19.

311 Alan MacEachern, Andy Wells interview, July 27, 1999, Series 11 Alan MacEachern interviews, IMR Fonds, PEIPARO.
Wells combined elements of the environmental movement and the counterculture with his and Campbell’s desire to modernize the local economy to construct the intellectual foundations of the Campbell government’s alternative development policy. The ideas of E.F. Schumacher, the founder of the appropriate technology movement, had the greatest influence.312 A critic of large-scale industrialization, Schumacher had laboured for much of the 1950s and 1960s to devise an alternative to the centralized industrial development that characterized PEI’s CDP.313 Expressing his conclusions forcefully in his book Small is Beautiful, Schumacher asserted that rapid industrial development, the approach pursued by most international development programs, suffered from a series of fundamental flaws.314 The most important cause of failure, according to Schumacher, was the adoption of technology unsuited to the developing country’s society or environment. In his view, providing poor third world communities with advanced farm machinery designed for large-scale industrial agriculture would have meager benefits, since local communities lacked the infrastructure, knowledge, and capital to use such technologies effectively. Even worse, in Schumacher’s view, standard development strategies would likely force many out of work, rapidly degrade the environment, and erode regional political power because local people could not use or maintain the technology, which forced them into a colonial relationship with western engineers and companies.315

Instead of large-scale industrial development, Schumacher suggested adoption of technologies appropriate to the needs of the people. According to Schumacher, smaller scale technologies that local people could understand and control, consumed fewer resources and more labour, and relied upon renewable sources of energy, could better serve the needs of both the developing and developed world. With this “appropriate technology” went a commitment to slower growth and economic equity, which Schumacher termed “Buddhist economics.”316 This technologically focused approach formed the centerpiece of his “small is beautiful” philosophy of development which

315 Schumacher, Small is Beautiful, 18-19.
316 Schumacher, Small is Beautiful, 58.
became highly popular among the counterculture.\footnote{Schumacher, \textit{Small is Beautiful}, 64-66.}

Skeptics of this philosophy have rightly pointed out that this focus on the local could be autarkic and if pursued too far might become unworkable as local communities tried to become almost completely self-sufficient.\footnote{Kleiman, "The Appropriate Technology Movement in American Political Culture," 20.} Critics of appropriate technology have also perceptively noted that the movement’s focus on technology as a method of addressing social and environmental problems led it to overlook the importance of the political process.\footnote{Langdon Winner, "The Political Philosophy of Alternative Technology: Historical Roots and Present Prospects," \textit{Technology and Society} 1, 1 (1979): 75-86.} The point is important because it suggests that even while appropriate technologists decried large-scale technology and the undemocratic influence of non-local expertise, they ascribed to a form of technological determinism and relied heavily on their expertise in small-scale technologies.\footnote{David Dickson’s \textit{Alternative Technology and the Politics of Technical Change} (Glasgow: Fontana Collins, 1974) provides an excellent example of the technological determinism within this philosophy.} In short, the movement embraced a technocratic approach by predicking its programs of decentralized development adapted to local conditions on different technology and employment of technical expertise that it argued would have greater success and benefit local communities.

In the context of PEI in the early 1970s, this “small is beautiful” approach seemed to offer a means of enhancing islanders’ quality of life without destroying the province’s culture or environment. The appeal of appropriate technology, indeed the entire shift in the government’s in method, rested upon the belief that rapid growth could not continue and environmental collapse would occur soon. Convinced by his reading of philosopher of technology Lewis Mumford and “cracks in the concept of the [CDP] and its grand schemes” that PEI and the rest of Canada had taken a flawed approach to development, Wells shared his desire for a more diverse strategy with the Premier, who quickly embraced his proposal.\footnote{Alan MacEachern, Andy Wells interview, July 27, 1999, Series 11 Alan MacEachern interviews, IMR Fonds; Alex Campbell interview, August 12, 1999, Series 11 Alan MacEachern interviews, IMR Fonds.} Anxious to convince the rest of cabinet, Wells deluged it with information about the world’s environmental problems and the dangers of exponential growth, including a film version of the \textit{Limits to Growth} report that forecast global scarcity and economic and environmental collapse.\footnote{MacEachern, \textit{An Environmental Fable}, 20.}
These fears of collapse received a significant boost in late 1973 with the advent of the first oil shock. Completely reliant on imported oil for its energy needs, PEI faced price instability that undermined the potential competitiveness of any industrial development on the island. Despite the Trudeau government’s initial decision to freeze prices, by 1974 the Canadian price of oil had risen from $3.80 to $6.50 a barrel, and it would pass ten dollars by 1977.\textsuperscript{323} The energy crisis provided a solid foundation for the Campbell government’s concerns about the future viability of large-scale industrial development. In this changing material context, the Campbell government re-focused efforts to modernize the island around the somewhat amorphous concept of development through the application of appropriate technology.\textsuperscript{324}

Alternative development on PEI thus emerged as a means of adapting the Plan’s modernization program to changing local and global circumstances. Although the new approach embraced ideas popular among the counterculture and environmental movements, the Campbell government maintained control over its methods. In fact, the Premier’s closest advisor played the leading role in shifting the government’s approach to development. The government’s leadership of this pioneering program of sustainable development exemplifies the fundamental role the state played in the history of Canadian environmentalism. Wells’ and Campbell’s readiness to embrace the ideas of the appropriate technology movement and environmentalist critiques of industrial society did not mean they abandoned their goal of transforming the island or their willingness to use the state’s powers and resources to manage this transformation. As the next section will illustrate, rather than renouncing rational planning Campbell re-applied these elements of the CDP to this very different path of development with the creation of semi-independent institutes staffed with experts. As a result, the “small is beautiful” approach became a means of achieving the economic growth promised by the CDP.


\textsuperscript{324} Although many of the ideas behind the shift in policy originated with Wells, Campbell clearly understood them and saw the shift in approach as the most reasonable way to improve the future of his constituents. Alan MacEachern, Andy Wells interview; Alan MacEachern, Alex Campbell interview, August 12, 1999, Series 11 Alan MacEachern interviews, IMR Fonds, PEIPARO; The Honourable Alexander Campbell, “Notes for an Address to the Alpha Y’s Men,” Charlottetown, January 16, 1975, PEI Collection, UPEISC.
Expert Environmentalists and Sustainable Development on PEI

In 1974, the Campbell government committed the province to alternative development by opting out of New Brunswick’s plans to build a nuclear power plant at Point Lepreau. Now committed to alternative development, the government faced the twin challenges of defining the new approach to development policy and creating a means to achieve it. The novelty of what the Campbell government was attempting in the early 1970s should not be underestimated. At the time, Canadians had little experience with renewable energy, besides hydro and wood stoves. In fact, the first Canadian solar heating system only became operational in 1971, and Canadian wind power remained almost entirely experimental in the early 1970s.\(^{325}\) The Department of Energy, Mines, and Resources (EMR), which was responsible for Canadian energy policy and future energy development, did not become interested in renewable energy until 1975 and would not release its first study of renewable energy’s potential until 1976.\(^{326}\) Similarly, the Campbell government’s efforts to address environmental, social, and economic concerns through a carefully planned approach to development prefigured the generally accepted beginning of sustainable development programs in the Brundtland Commission by more than a decade.\(^{327}\)

As a small and poor province, PEI lacked the funds necessary to undertake new policy ventures or research and commercialize new technologies. The funds received through the initial CDP agreement were already committed, and the provincial government could not reappropriate them without federal permission. Furthermore, its reliance on out of province experts and federal funds meant PEI did not have the scientific community or infrastructure to engineer new technologies or pioneer a new approach to development. Luckily for the Campbell government, a pool of expertise it


could draw upon already existed in the environmentalist and appropriate technology communities.

Within those communities, Campbell’s and Wells’ interest in alternative development received an immediate and positive response. Public officials genuinely concerned about environmental and social problems and enthusiastic about trying a new approach were uncommon at the time, which made Campbell and Wells figures of interest among groups anxious to experiment with alternative development. Invitations to environmental, energy, and development conferences across both Canada and the United States began to arrive in the early 1970s.328 For instance, MIT engineering professor Frank Davidson invited the Premier to speak at a conference on “the use of smallness” hosted by the Institute for Man and Science in Rensselaer, New York.329 By attending such conferences, Campbell and Wells began to tap into a network of scientists, hippies, and environmentalists that had developed around appropriate technology and a “small is beautiful” approach to development. Centered on the two poles of Stewart Brand’s Whole Earth Catalog and E.F. Schumacher’s long-standing crusade for “Buddhist economics,” this quirky and dynamic association of likeminded thinkers and tinkers spread among numerous communes and environmental groups, including Friends of the Earth, led by a former physicist called Amory Lovins.330 This network provided Campbell and Wells with invaluable intellectual support. More importantly, when the growing energy crisis expanded these groups’ reach and elite institutions, such as the Ford Foundation, began to express interest in renewable energy, it gave Campbell and Wells an idea.331

The two men saw the explosion of environmental awareness and budding research on small-scale development, renewables, and energy conservation in the early 1970s as an economic opportunity for PEI. Realizing that Canadians were only beginning to pursue these technologies and methods of development, Campbell and Wells surmised that PEI could become a national hub for appropriate technology and alternative

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328 MacEachern, The Institute of Man and Resources, 20.
329 The Guardian [Charlottetown], August 14, 1975.
330 For a discussion of this network of countercultural environmentalists and designers, see Peder Anker, From Bauhaus to Ecohouse: A History of Ecological Design (Baton Rouge LA: Louisiana State University Press, 2010); Kirk, Counterculture Green; Kleiman, “The Appropriate Technology Movement in American Political Culture.” I will explore the development of this network in greater detail in chapters four and five.
A center for the study of small-scale development and renewable energy, they thought, might bring much-needed jobs to PEI. It could also guide the tiny province’s efforts to cope with the rising costs the energy crisis leveled on local prospects. Finally, it might position the province at the forefront of what could be an important industry, if predictions about the world’s diminishing resources and growing environmental problems turned out to be correct. Alternative development further seemed to promise economic success without undermining the “island way of life” since, at least in theory, small-scale renewable energy would enhance islanders’ economic and political position by allowing them to recapture a degree of their former self-sufficiency. Embracing this potential win-win situation, the Campbell government began to search for those with the technical or scientific expertise to allow PEI to establish itself as the leading center for appropriate technology and sustainable development in Canada.

To plan this venture, the Campbell government hired a group of New York consultants who had impressed the Premier at the conference in Rensselaer. On PEI, this group and members of the Campbell government gathered for an intensive two-day planning session in late 1974. They emerged with a series of recommendations for the island, including most significantly, the idea that the Campbell government form a non-profit institution to research and develop renewable energy and experiment with small-scale approaches to development. Pleased with this recommendation, Campbell announced that his government would found an independent Institute of Man and Resources (IMR) in January 1975.

Wells, who had first championed this approach to transforming PEI, became the director of this nominally independent institute and shouldered the responsibility for making the vision of alternative development he had

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332 Alex Campbell Interview, by Alan MacEachern, Series 11, IMR Fonds, PEIPARO; Andy Wells interview, by Alan MacEachern, Series 11, IMR Fonds, PEIPARO.
334 The PEI Provincial Archives provide very little information about this group of consultants. Beyond organizing the planning session, which resulted in the recommendation to found a provincial development institute, the group seems to have had little effect on PEI’s experiments with sustainable development. See MacEachern, The Institute of Man and Resources, 20-21.
In Campbell’s view, the new organization would help PEI overcome its energy problems while also carrying out research relevant to every country struggling with the environmental and social costs of modernization and industrial development. Optimistic about the future of the IMR, Campbell announced that the institute would lead research and demonstration projects while disseminating information locally, nationally, and even internationally. The IMR, Campbell stated in phrasing reminiscent of John F. Kennedy, might allow islanders to worry less about what Canada did for them and more about what they could do for Canada. Those associated with the institute took this goal of local development seriously. As one internal report put it, the IMR would reduce “the island’s subservience to economic and political forces beyond its control.” By proving alternative development could succeed, the provincial government hoped to garner economic returns for PEI, enhance its political influence in Canada, and help address the world’s pressing environmental and energy problems.

To organize this institute for alternative development, the Campbell government drew directly upon its experiences developing the CDP. Replicating its creation of the EIC staffed by Gallagher and other development experts, the provincial government had once again created a quasi-governmental institute which relied primarily on experts “from away” for advice, and acted largely on its own recognizance. Apparently, Campbell saw little need for public consultation, and since his government held an overwhelming majority in the provincial parliament, it had no need to seek permission from the public for its decisions. The Campbell government’s approach also maintained the CDP’s emphasis on long-term planning by institutionalizing this commitment in the IMR. In effect, sustainable development on PEI embraced what Gilman has described as a central characteristic of postwar modernization policy, namely, the effort to achieve

336 Board of Directors Meeting, Oct 29 1975, Series 2 Subseries 1, Board of Directors Meetings, 1975-1979, IMR Fonds, PEIPARO.
337 The Guardian, January 17, 1975. The Act incorporating the IMR specifically states that the Institute will engage in work of a “scientific and educational character”. The act incorporating the Institute of Man and Resources is available at http://www.gov.pe.ca/law/statutes/pdf/i-03.pdf
338 MacEchern, The Institute of Man and Resources, 21.
“progress through the application of human will and instrumental reason.”\(^{340}\) Even as it pioneered sustainability, the Campbell government remained convinced of the efficacy of expertise and government-mediated development.

This modernist ethos and emphasis on careful planning indelibly shaped the IMR. To carry out its program of “socially desirable and ecologically sustainable” development the Institute focused on the following:

- the analysis, adaptation, testing and implementation of appropriate energy systems … with a view to improving knowledge of such systems, their social, economic, and environmental costs and benefits, and further with a view to providing a better basis for public policy and programs and for institutional and private decisions in the field of renewable energy use.\(^{341}\)

Similar to the EIC and the other departments set up to plan and carry out the CDP’s program for industrialization, the IMR was designed to gather information, devise policy, and assist its implementation. It is important to note, however, that the IMR’s focus on planning and expert knowledge was not just a product of modernist ideology. The IMR dealt with concepts and technologies new to PEI and much of Canada, which made a degree of reliance on expertise and institutionalized planning necessary to its work.\(^{342}\).

After its establishment, the Institute dedicated itself to appropriate technologies, with an emphasis of solar power and other small-scale forms of renewable energy.\(^{343}\)

The Campbell government’s program of modernization through alternative development, particularly its embrace of environmentalists as advisors, highlights the diversity of environmentalism as it challenges common depiction of environmentalism as anti-modern and the ascription of staunch libertarian politics to advocates of appropriate technology. Historian Jordan Kleiman, for instance, asserts that the “small is beautiful” approach worked to recreate a “Jeffersonian America” of small, self-sufficient communities and despised both the large scale development projects favoured by

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\(^{341}\) The Institute of Man and Resources Act 1975, 1. [http://www.gov.pe.ca/law/statutes/pdf/i-03.pdf](http://www.gov.pe.ca/law/statutes/pdf/i-03.pdf)

\(^{342}\) The Institute of Man and Resources Act 1975, 1-2.

modernization theory and government-led reform efforts in the vein of President Lyndon B. Johnson’s “Great Society.” Similarly, the leading historian of countercultural environmentalism, Andrew Kirk, suggests the network of environmentalists centered on the *Whole Earth Catalog* embraced appropriate technologies as a libertarian and technologically pragmatic attempt to resist centralized “technocracy” and use technology to remedy environmental destruction. The Campbell government’s focus on renewable energy technologies’ economic prospects and their reliance on environmentalists from these networks for intellectual support and expert advice suggest that the relationship between countercultural environmentalists, the state, and modernizing development was far closer and more complex in practice than historians’ assertions of environmentalism’s libertarianism and anti-modernism allow.

The centerpiece of PEI’s alternative development, the PEI Ark, epitomized the connections between the Campbell government’s alternative development program and this network of environmental groups, as well as environmentalists’ embrace of efforts to develop the island through appropriate technology. The New Alchemists, a group of hippie scientists based in Cape Cod, Massachusetts, built the PEI Ark. Their history will be examined in detail in chapter four. For now, it is important to note that they were close associates of both E.F. Schumacher and Stewart Brand and relied heavily on the scientific training of their founding members.

The scientific expertise of the New Alchemy’s founders, John Todd and William McLarney, both of whom were biologists – Todd was even briefly the dean of biology at San Diego State University – set this group apart from the average appropriate technology enthusiasts. Anxious to gain support for their experiments with solar and wind power and their research on greenhouses and small-scale aquaculture, the New Alchemists worked to attract the attention of government sponsors and funding

344 Kleiman, “The Appropriate Technology Movement in American Political Culture,” 6. This focus on libertarian politics is also an important theme in the literature studying the back to the land movement of the 1960s and 1970s. See Timothy Miller, *The 60s Communes: Hippies and Beyond* (Syracuse NY: Syracuse University Press, 1999); Christopher Manes, *Green Rage: Radical Environmentalism and the Unmaking of Civilization* (Boston: Little Brown, 1990).


organizations in both Canada and the United States. The New Alchemists first attracted the attention of Canadian journalists writing for the widely circulating *Canadian Magazine* in early 1974. A visit from Robert Durie, the head of Environment Canada’s Advanced Concepts Center, an avid supporter of the Science Council of Canada’s conserver society, and an advocate of appropriate technology, quickly followed. Durie’s visit led to an invitation for Todd to speak in Ottawa about his work and the promise of renewable energy.

While in Ottawa Todd and Wells met at a conference, and the two men realized that they could help each other immensely. Todd could provide expertise solar and wind technology, the sort of research the IMR wanted to encourage. Wells, for his part, could help Todd and the New Alchemists get access to the funds necessary for their research. Taking advantage of the interest Todd’s work garnered within the federal government, Campbell and Wells suggested an Ark would complement their development efforts on PEI and encourage growth in the Atlantic provinces, a key goal of the federal government. With statements of support from the PEI government, the Advanced Concepts Center of Environment Canada, and the Canadian Urban Demonstration Program, Todd and the Campbell government had little trouble financing the construction of a New Alchemy center on PEI as a joint federal-provincial project funded through Environment Canada and the Canadian Urban Demonstration Program.

The resulting structure, PEI’s “Ark to the future,” physically combined this combination of politicking, government largess, and environmentalism by connecting promises of sustainability with the development of new technology capable of creating

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351 MacEachern, *The Institute of Man and Resources*, 23.

352 Wills interview, Series 11, IMR Fonds; Savoie, *Visiting Grandchildren*, 87.

new industries and research programs on the island.\textsuperscript{354} The brainchild of Todd, the Ark project seemed to offer the perfect starting point for alternative development on PEI.\textsuperscript{355} Using what Todd characterized as a “spaceship’ approach to energy utilization and food culture,” the Ark promised to provide islanders with an advanced technological system that combined small-scale farming, aquaculture, wind power, and family housing.\textsuperscript{356} According to Todd, the Ark represented “a small scale, decentralized, holistically derived strategy for coping with fuel costs.”\textsuperscript{357} In essence, new environmentally and socially appropriate technology would not only allow PEI to survive the coming end of oil, but would also enable islanders to benefit from the catastrophe.

The New Alchemists’ promises of economic growth and environmental sustainability, as well as the support their work received from the federal government, gave Wells and Campbell something tangible to discuss with constituents when they attempted to explain their new approach to development and its potential benefits for PEI. As MacEachern states, in 1975 there had been significant discussion of the IMR and the promise of alternative development, but few immediate results.\textsuperscript{358} In the mid 1970s the IMR remained largely a paper entity while the Campbell government worked to gather funds and define its mission. The IMR’s slow start made the New Alchemists and their Ark the standard-bearer for the Campbell government’s development program.

At a meeting with students and professors at the University of PEI in November 1975, Wells described how he hoped the Ark and its scientist environmentalists would help the island.\textsuperscript{359} Riffing upon local criticisms of industrialization and central planning, Wells argued that the Ark and the IMR would enhance PEI’s political power and economic resilience by encouraging provincial self-sufficiency and enabling the province to eschew the “mega-technology” and centralized development that the rest of Canada

\textsuperscript{355} The New Alchemists were relatively well known in Canada during the early 1970s, thanks to positive media coverage. See Barry Conn Hughes, “The World that Feeds Itself,” \textit{The Canadian Magazine}, February 9, 1974; “The New Alchemists,” \textit{Time} 105 (November, 1975): 100.
\textsuperscript{357} Todd, \textit{An Ark for Prince Edward Island}.
\textsuperscript{358} MacEachern, \textit{The Institute of Man and Resources}, 27.
\textsuperscript{359} Andrew Wells (audio recording), “The New Alchemy Institute Ark in PEI and the IMR,” November 19, 1975, PEI Collection, UPEISC.
had embraced and which the energy crisis threatened. In keeping with the CDP’s and the Campbell government’s earlier focus on economic growth, Wells also promoted the possible economic benefits of the Ark, and eventually the IMR’s work. For example, Wells highlighted the Ark’s proposed wind turbines, and told his audience that such technology “had tremendous possibility for PEI” since it would enable the island to produce its own power sustainably and could become the basis of local industry. Indeed, in their proposal for the Ark, the New Alchemists optimistically stated their Hydrowind power system would eventually be able to meet the island’s electricity needs.

The Campbell government’s alternative development combined the CDP and environmentalists’ advocacy of appropriate technology. While this fusion of countercultural environmentalism and modernization might seem contradictory on an

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360 Wells, “The New Alchemy Institute Ark in PEI and the IMR.”
361 Wells, “The New Alchemy Institute Ark in PEI and the IMR.”
362 Todd, An Ark for Prince Edward Island.
intellectual level, on a practical level it presented both environmentalists and the provincial government with significant benefits. It enabled the Campbell government to continue its efforts to transform the lives of islanders and position PEI to survive and even prosper from the environmental catastrophes and resource scarcity experts predicted. While this alternative development focused on economic growth and continued earlier programs of government intervention and regional modernization, it also presented environmentalists with an opportunity to pioneer new technologies and new methods of balancing growth and conservation. It also offered the possibility of generous government funding, which would allow environmental groups to undertake projects they could never have financed on their own. For the New Alchemists, and the many other environmentalists who participated in alternative development on PEI, the Campbell government’s willingness to try new ideas even if it did not completely abandon the old was enough. Economic growth based on wind power and sustainable agriculture was far better than the alternative and, in their view, could be the first step away from the consumerism and centralization that caused so many problems.363

Alternative development on PEI relied on more than the merging of regional development and environmentalists’ experimental technologies. It also drew heavily on Campbell’s and Wells’ considerable political skills and understanding of the Canadian political system, which they used to manipulate the structures of Canadian politics to their advantage. Beyond allowing them to take advantage of federal interest in projects such as the Ark, their political acumen helped them position PEI as a leader in the federal government’s efforts to respond to the energy crisis and to continue to benefit from the Trudeau government’s regional development initiatives. The Campbell government, for example, proved extremely successful in attracting financial support. It received over $800 million in regional development funds by the mid 1970s, more than double the $386 million the next highest recipient, New Brunswick, acquired.364 Moreover, as much as this ability to attract regional development funds was instrumental to alternative development on PEI, Campbell and Wells’ ability to manipulate federal energy policy would also prove fundamental.

Campbell and Wells began their machinations at the First Ministers Conference on Energy in April 1975. Campbell made headlines at the gathering by breaking dramatically with his fellow premiers. While his compatriots jockeyed with the federal government for control over Canada’s resources and fought for the narrow interests of their provinces, he delivered an impassioned speech highlighting the finite nature of the resources other premiers fought over and the need for a new approach less reliant upon limited assets and endless growth. Stating he would avoid the problems of industrial development and energy policy’s dependence on non-renewable energy, Campbell announced that PEI would take a different approach and begin researching and developing renewable energy immediately to ensure the province was prepared for when the “oil ran out.”

Asserting that Canadians must be made aware of their reliance on quickly diminishing resources, Campbell supported Trudeau’s plans to let the price of oil increase. To this pledge of support for federal policy, Campbell added the caveat that federal funds must be invested immediately in renewable energy to speed Canada’s necessary transition away from oil. Since the Trudeau government had made energy security a top priority in 1975, Campbell’s public discussion of renewable energy and self-sufficiency positioned PEI to benefit from this policy focus. The Premier’s support for federal plans also endeared him to Alistair Gillespie, the Minister of EMR, a connection that Campbell would later exploit.

Campbell and Wells also used their knowledge of federal politics to forge alliances with those advisory bodies and departments that shared their goals. In 1975, for example, the Campbell government sponsored a meeting of the Science Council of Canada (SCC) on PEI to discuss Canadian science policy and the potential of the

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366 Bruce, “Gardener of the Gulf.”
367 Background Paper on Canadian Energy Situation, prepared by the Government of Canada for the Conference of First Ministers, April 9-10, 1975, EMR Minister’s Office, Vol. 311, EMR Files, LAC.
368 Bruce, “Gardener of the Gulf.”
Council’s conserver society to address the country’s energy problems. In his opening address, Campbell carefully linked the foundation of the IMR and its mission with the SCC’s own study of Canada’s energy sector, particularly its championing of energy conservation and alternatives to fossil fuels. Wells, for his part, worked to expand his connections with Urban Affairs and Environment Canada. These departments shared the Campbell government’s interest in technology that would not damage the environment, and they had money to help finance projects, such as the New Alchemists’ construction of the Ark on PEI.

Campbell’s and Wells’ politicking may seem mundane, put it played an irreplaceable role in the emergence of alternative development on PEI. As political historian Daniel Carpenter states, the pragmatic construction of such networks of influence has been fundamental to the modern state, particularly the ability to achieve a degree of autonomy and carry out specific policies. For Campbell and Wells, alliances with like-minded organizations and government departments laid the groundwork for the province’s successful efforts to convince the federal government, namely the EMR, to fund their alternative development program.

The Campbell government’s network building between various federal departments has significance beyond its importance to alternative development on PEI. Its ability to maneuver within the constraints of Canadian federalism complicates the history of economic development in Canada and its focus on federal control of development projects. In particular, it challenges claims that centralization characterizes Canadian development and that federal assistance has led Ontario to grow at the expense of other provinces. Political scientist Donald Savoie’s analysis of economic development in Atlantic Canada, for instance, argues that the federal government and its alignment of

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371 The Science Council of Canada’s “conserver society” will be examined in detail in chapter three.
373 MacEachern, Wells Interview, IMR Fonds, PEIPARO.
374 Environment Canada was also caught up in Canadian interest in renewable energy and produced studies of appropriate technology. Bruce McCallum, Environmentally Appropriate Technology: Renewable Energy and Other Developing Technologies for a Conserver Society in Canada (Ottawa: Fisheries and Environment Canada, 1977).
interests with central Canada has shaped the country’s economic growth. While the Campbell government’s manipulation of federal interests does not dismiss the importance of the federal government or central Canada, it de-centres this narrative by showing that in the right circumstances peripheral provinces could exploit the federal system to their advantage.

From this seemingly contradictory foundation of federal-provincial politics, environmentalism, and modernization, emerged Canada’s first program of alternative development. This basis seems a fitting one since sustainable development itself is difficult to define as it attempts to both preserve a viable future and insure a prosperous present, a balancing act that entails a complex regime of negotiation and compromise. On PEI, this program sought to improve economic prospects and create new industries, but at the same time it attempted to protect the island’s environment and pioneer technologies capable of enhancing PEI’s autonomy within Canada. Fascinating in itself, the province’s alternative development also highlights the contingent nature of environmentalism in Canada and its nuanced relationship with the state as groups such as the New Alchemists worked closely with federal and provincial governments to further the research they believed would make a sustainable and libertarian world possible. The IMR embodied this compromise as it sought to employ the methodology that had guided the initial Comprehensive Development Plan to undertake sustainable development.

**Energy Days and the IMR’s Successful Bid for National Support**

Anxious to enlist federal funds and dispel any lingering confusion over its purpose, the IMR organized an expansive conference in the spring of 1976. Planned with the support of the Campbell government, Wells designed this meeting to inform islanders of the tremendous energy problems PEI and Canada faced and show how appropriate technologies could address these difficulties and even provide a prosperous future. In effect, the gathering continued and expanded upon their efforts to build support for alternative development by enlisting leading experts on appropriate technology and renewables and presenting the IMR as an authority on energy in Canada. Energy Days, as Wells decided to name the conference, was one of the most extensive public meetings on

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energy in Canada during the 1970s. Held in the provincial legislature and attended primarily by provincial members of the legislative assembly (MLAs) and the press, the four-day event featured Canadian and international experts on energy technology and policy, and it generated substantial national attention for the IMR and its program of alternative development.

As I argued above, alternative development on PEI emerged from a combination of the Campbell government’s efforts to modernize the island and its concern over oil scarcity and environmental problems. To define its program of development, the province drew on the expertise of environmentalists and advocates of small-scale development who worked in a manner very similar to the technocrats of the CDP as they advised the government on how to encourage the technological innovation and social changes necessary to transform the island. However, as I noted above, sustainable development also relied heavily on the Campbell government’s political ability as the provincial government manipulated the federal government’s energy policy and regional development programs to its advantage. Energy Days continued this merger of environmentalists’ expertise and Campbell’s and Wells’ political acumen.

The conference mobilized energy and small-scale development experts to provide provincial legislators (and other Canadians) with a crash course on energy in Canada. It discussed energy use on PEI and in the rest of the country and analyzed Canada and PEI’s possible responses to the energy crisis. As Alan MacEachern has perceptively noted, the conference’s organization presented a highly specific narrative. It started with a discussion of PEI’s reliance on oil before moving on to energy conservation and an increasingly unpopular vision of the future in which nuclear energy dominated. In the last days of the conference, discussion then shifted to alternative energy and energy futures. In effect, Wells, who organized the conference, presented a narrative arc that pointed towards renewable energy as the island’s future.

Wells’ desire to present “the facts” in a manner favourable to the IMR shaped the conference. On its first day, David Brooks, the director of the Office of Energy

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Conservation (OEC), made a compelling case for cutting energy use. To make his case, Brooks presented islanders with a variety of different scenarios of Canada’s energy future. Starting from the present, he illustrated how Canadians’ use of energy had been growing rapidly, actually doubling every twelve years for the last three decades. Focusing on oil and hydroelectricity, since Canadians relied primarily on those sources of energy, Brooks showed that regardless of the scenario, maintaining this rapid rate of energy growth was impossible. According to the OEC, Canada had neither the resources nor the capital to invest in more environmentally destructive oil production or new hydroelectric generation without dramatically reducing investments in other areas of the Canadian economy.

Once Brooks broached the topic of limits, it became a leitmotif of the conference. Nearly every speaker elaborated on the belief that Canada’s oil, gas, and even coal supplies, while plentiful, were already committed and could not continue to support rapid increases in energy use. Wells, in particular, commented regularly on the limited nature of Canada’s resources and suggested that oil shortages would likely occur. Surprisingly, even the expert on nuclear power, sent by the Science Council of Canada, argued that the high capital costs of nuclear power made relying on it to meet future energy growth a risky proposition. This dreary conclusion provided the advocates of renewable energy Wells had gathered with the opportunity to expound upon a better alternative for the future in the final days of the conference.

The OEC, for instance, argued that limits did not prefigure doom. Its calculations suggested massive inefficiencies existed in Canadian energy use. According to Brooks, Canadians could heat their houses to the same temperature with only minor improvements, while saving half the energy and between $800 and $1,000 (in 1976 dollars) over five years. Since PEI was completely reliant on expensive imported oil,
this finding generated considerable interest among the audience. Provincial MLAs Melvin McQuaid and Vernon Macintyre, for example, both pressed Brooks for further details about how islanders could conserve energy and save money.387 Accepting Brooks’ claims, Macintyre asked, “I’m wondering what you foresee between what we’ve already done and what we can do in the future to save this $800 to $1,000.”388 Wells noticed the appeal of energy conservation, and when the IMR began research projects to meet PEI’s energy needs, efficiency improvements figured prominently.389

Building upon the OECs’ call for conservation, Peter Middleton, an environmentalist and energy consultant from Pollution Probe of Toronto, argued that the adoption of solar energy logically proceeded from conservation.390 In Middleton’s view, solar, an inexhaustible, environmentally safe energy source able to produce heat or electricity, was the future. He further pointed out that since solar and other renewables remained largely undeveloped, a substantial possibility for financial gain existed if PEI could develop and market an effective form of renewable energy technology.391 Hammering on this point, which echoed the Campbell government’s own arguments, Middleton suggested any policy designed to safeguard Canada’s energy should incorporate substantial research and development programs for renewable energy. These programs would have to be quite extensive, but he asserted that they would likely have speedy results since technologies were already technically viable and could be commercially competitive with a few years of work.392 The Campbell government, at least according to the speakers at Energy Days, had picked the right approach to development.

To wrap up the conference, Energy Days launched into a discussion of PEI’s and Canada’s “energy futures.” On the last day islanders heard from three speakers who passionately argued renewable energy and small-scale development would not only succeed on PEI, but would soon change the rest of Canada. Two of these speakers,

389 Minutes of IMR Board of Directors Meeting, December 5, 1976, Directors Files, 1975-1984, Series 1, IMR Fonds, PEIPARO; “Invitation to Participate” June 9, 1976, Background Information, Series 3, Subseries 4, IMR Fonds, PEIPARO.
environmentalists John Todd and Amory Lovins, would later have a substantial influence on renewable energy development in Canada when they provided solar technology and defined the potential of solar energy.  

A third, George McRobie, worked with E.F. Schumacher at the Intermediate Technology Development Group in Britain and on Gandhi’s village centers. This relationship with Schumacher made McRobie’s talk the high point of the afternoon. Focusing squarely on the problem of local development, McRobie argued that everything relied on “three factors of production: land, labour, [and] capital.” In a somewhat condescending effort to put his argument in terms relevant to PEI, McRobie drew an analogy to the fishing industry:

> A very good example would be you either make your own fishing boats, which fit into your own society or you go outside and buy much bigger ones. I think, in the case of PEI you have chosen to make your own, quite correctly. What it does do is to avoid an enormous load of indebtedness. [...] If you have the knowledge, you can make it yourself. Now most of the pieces of equipment are of the kind where local communities can in one way or another mobilize the resources for self-help technology.

When asked by an MLA how to develop this technology, McRobie suggested focusing on the processing of local agricultural outputs and forming voluntary panels of “people from government, industry, and the universities to advise on the best technologies.” Whether by design or coincidence, this suggestion once again suggested that the Campbell government’s approach was the right one. McRobie’s advice also emphasized similarities between how the IMR sought to adapt the development methods of the leading advocates of “small is beautiful.”

> It is difficult to say if this optimistic narrative about the future of PEI swayed islanders or the provincial legislature. The conference transcript suggests that MLAs accepted experts’ claims about PEI’s energy future and were interested in the potential of renewables, particularly the money saving conservation suggested by Brooks. Little more

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393 Douglas and Pratt, *Energy Days*, 279-297, 310-324. Todd’s and Lovins’ work will be discussed extensively in chapters four and five respectively.


395 Campbell, “An Address to the Science Council of Canada.”


than that can be inferred from such an incomplete source. However, since the Liberal party controlled PEI, and Campbell and Wells dominated the party, the IMR could count on provincial support. More importantly, Energy Days made the IMR a household name among those Canadians interested in renewable energy. In a letter to his friend Alistair Gillespie, the minister of Energy, Mines, and Resources, for example, Campbell related the feeling of elation the conference gave those who attended and the continual phone calls he received congratulating him on the conference and asking about the potential of renewables. This success cemented the network of support that Campbell and Wells had been building among advocates of renewables and departments interested in conservation since 1974.

This network of support proved instrumental to the IMR’s successful pursuit of government funds. Middleton’s consulting group, for instance, provided the EMR with the first assessment of the potential of Canada’s renewable energy resources in 1976. Well aware of this relationship, Wells hired Middleton and Associates to take advantage of the federal government’s reliance on this advisor’s knowledge of renewable energy. This position gave the consultant, as one of EMR’s main experts on renewable energy, a substantial amount of influence within the EMR, at least when discussing renewable energy. Along with the marshalling of expert authority at Energy Days, Middleton provided the IMR with the technical knowledge to take part in the expert-dominated discourse encouraged by the Trudeau government. Copying the OEC’s employment of technical analysis to take part in discussion of energy policy, the IMR presented itself as qualified to contribute to Canadian energy development. That the Minister of the EMR also knew and trusted both Campbell and Middleton personally further helped matters. In fact, as one of EMR’s leading advisors on renewable energy and the IMR’s head

399 MacKinnon, Between Two Cultures, 226.
400 Letter from Alex Campbell to Alistair Gillespie, May 17, 1976, Background Information, Series 3, Subseries 4, IMR Fonds, PEIPARO.
401 Middleton Associates concluded that renewable energy had a great deal of potential in Canada despite the energy intensity of its economy and its cold climate. See Peter Middleton, et al. Canada’s Renewable Energy Resources: An Assessment of Potential (Toronto: Middleton Associates, 1976); Letter to Andy Wells from Peter Middleton, Re: the IMR and funding, Series 12, Miscellaneous, 1975-1983, IMR Fonds, PEIPARO.
403 Alan MacEachern, Peter Middleton interview, October 1, 2001, Series 11, IMR Fonds, PEIPARO.
consultant, Middleton effectively controlled the negotiating process. As Middleton chuckled in a later interview, “I was negotiating with myself.”

Changes in the Trudeau government’s approach to energy underlay Middleton’s ability to manipulate the EMR on the IMR’s behalf. In 1975, Trudeau and the Liberals had come under fire from the opposition for a perceived lack of leadership on energy policy. Cabinet decided the government needed to demonstrate its ability to outline a national energy policy. As a result, the EMR announced a new national energy strategy built around “energy self-reliance” in 1976. Although it only briefly discussed renewable energy, the new emphasis on self-reliance opened possibilities for the development of renewables as part of oil substitution programs and as means of creating long-term energy independence. This policy shift, along with national coverage of Energy Days, the publication of federal studies lauding renewable energy, and the public advocacy of other groups, such as the Solar Energy Society of Canada, made some investment in renewable energy politically appealing. Funding the IMR offered the department and the federal government a way of demonstrating their commitment to both the environment and energy self-reliance at minimal cost. Furthermore, such a program fit perfectly with the Trudeau government’s efforts to encourage economic and social development in Atlantic Canada and continue the support it had pledged through the CDP seven years earlier.

At the beginning of 1977, the federal and provincial governments signed the Canada-PEI Agreement on Renewable Energy Development. The final agreement saw the federal government provide $3 million in funding to the IMR over three years with

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404 Middleton interview, October 1, 2001, IMR Fonds, PEIPARO.
408 In the summer of 1976, the renewable energy advocacy group Solar Energy Society of Canada held a five day joint conference with the International Solar Energy Society in Winnipeg and made sure to inform the EMR and the Canadian press about the future potential of renewable energy for Canada. See Kar Böer, ed. “Sharing the Sun: Solar Technology in the Seventies,” Conference proceedings August 15-20, 1976, Winnipeg, Vols. 1-10. These changes in the federal government’s approach to energy policy in the mid to late 1970s will be examined in chapter 6.
410 MacEachern, Institute of Man and Resources, 33.
the province promising to supply a matching amount over the course of the agreement. The IMR, for its part, promised to implement a six point program: 1. Development of Wood as an Energy Source; 2. Determine Wind Power Potential; 3. Develop Solar Heating; 4. Reduce Energy Demand; 5. Determine Low-Head Hydro Potential; 6. Develop Low Energy Community Concept. Together these programs allowed the province to expand Canada’s understanding of how Canadians used energy and how much they actually needed. More importantly for the province, the program also promised to develop four different sources of renewable energy, which could relieve the island’s reliance on oil and create local industries and economic growth for the island. While $3 million was not a ground breaking amount of funding, that these little known technologies along with a completely novel approach to development received support at all was impressive.

The Campbell government had at last outlined its vision for an alternative approach to development for PEI and succeeded in creating and funding an institute to implement it. Although the IMR now had the funds to pursue its research independently, the institute and Wells remained closely connected to Campbell and his government. Even the Globe and Mail, a leading national newspaper, commented on their friendship and shared advocacy of the “conserver society.” The IMR benefited substantially from this close connection to the provincial government for the first two years of the agreement. Working closely with the provincial government, it experimented with solar heating, built some of Canada’s first solar heated apartments, and designed superefficient homes around passive solar and heavy insulation. Keeping up its promise to generate local industry, it also worked with the forestry department on bio fuel projects and eventually helped to develop and popularize a highly efficient pellet stove. The relationship between Campbell and Wells remained strong as well. Wells even took time

413 “Inmates will be Foresters in Hollow,” Globe and Mail, August 14, 1978.
414 “Housing,” Institute of Man and Resources Vertical File, UPEISC; “Solar Energy,” IMR Vertical File, UPEISC.
415 “Wood Energy,” IMR Vertical File, PEI Collection UPEISC.
off from the IMR to help Campbell run for a third term in 1978.

The close relationship between Campbell and Wells would cost the IMR, however, when Campbell’s Liberals finally began to lose control of island politics after thirteen years of dominance. The Liberals won the election in 1978, but only captured seventeen of thirty-two seats. Later that year Campbell decided to step down as party leader, which isolated Wells and the IMR when islanders once again went to the polls. In 1979, the Conservatives won control of the province by running on a platform that promised a “rural renaissance.” While this platform might seem to provide an opportunity for the IMR, the institute’s close association with the Campbell government undermined its opportunities. Many Conservatives also had personal scores to settle with Wells, Campbell’s former campaign manager. As a result, the new government marginalized the IMR, and when its funding agreement with the federal government came up for renewal in 1980, the provincial government refused to support the institute’s bid for a new contract. Since the EMR had by this time launched its own program for the development of solar and bio fuels, it saw little need for IMR despite its recognized contributions to raising awareness about renewables and research in the field. The IMR would limp on until 1990, but was a shell of its former self. Created by the Campbell government and its desire to transform PEI, the institute and its program of alternative development failed when its patron and the broader goal of transformation lost sway.

**Conclusion**

Led by two young and audacious politicians, the PEI provincial government pioneered sustainable development in Canada. Campbell and Wells had a vision of a modern and prosperous future and worked to transform their agrarian province throughout the 1960s and 1970s. They revised their quest for transformation in the early 1970s when the two adapted their plans to account for what seemed to be dramatic

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416 MacEachern, *The Institute of Man and Resources*, 66.
417 Kennedy Wells, “Sermons, but no solutions at Man and Resources Institute,” *Atlantic Insight*, 1, 6 (September, 1979): 16.
418 Peter Meinke Interview, 3 August 1999, IMR Fonds, PEIPARO. See also George MacDonald’s discussion of the 1979 election in *If You’re Stronghearted*.
420 Don Strange Interview, 7 June 2000, IMR Fonds, PEIPARO.
421 MacEachern, *The Institute of Man and Resources*, 100.
changes in Canada’s future prospects. Their approach resulted in a shift from industrialization and agricultural modernization to a focus on environmentally sustainable and socially appropriate technology. However, the methodology employed by Campbell and Wells to realize their transformed vision remained unaffected. Using expert planning and state intervention, which had characterized their initial efforts, the Campbell government sought to ensure PEI could survive the world’s changing environmental realities and even realize the potential to lead Canada as the nation prepared for the end of cheap oil.

The Campbell government’s pioneering effort to devise and implement a program of sustainable development, coupled with the central advisory role played by some environmentalists and appropriate technologists, suggests that historians need to challenge the dominant view that equates environmentalism with protest and sees state-led development as the primary antagonist of environmentalists. An important minority of environmentalists and appropriate technologists, such as the New Alchemists, significantly influenced policy not though protest or the rejection of technology and modernization. Rather, they acted as advisors and research scientists as they outlined new policy approaches and provided the new technology upon which the Campbell government built its development program. The willingness of countercultural environmentalists to embrace the role of technocrat and work closely with a development program that remained heavily influenced by earlier modernization attempts underlines the importance of recognizing environmentalists’ relationships with state power and their ambivalence to authority and political power of experts when it achieved environmental ends. Rather than being concerned anti-modernists anxious to stop development, the environmentalists whose network centred around the Whole Earth Catalog and the work of E.F. Schumacher proved quite happy to compromise. They gladly helped PEI undertake a development program designed to encourage economic growth, provided it also spread renewable energy and enabled sustainability.

Alternative development on PEI emerged not from a rejection of modernization, but from the continuation of earlier efforts to transform PEI. Presented with an opportunity to improve the lives of his constituents by the federal government’s commitment to regional development, Premier Campbell seized the opportunity and
proved extremely good at attracting federal funds. As the energy crisis and threats of environmental collapse altered Canada’s expected future, Campbell and his government changed their approach, but continued to benefit from a steady flow of federal financing for local development. In short, PEI profited substantially from federal development projects and proved quite adept at channeling funds into the projects it favoured. Rather than being destroyed by federal authority and modernization, this tiny province took advantage of the situation and achieved a substantial degree of latitude and economic success. PEI’s efforts, moreover, were far from the only attempt to define a different approach to development in Canada during the 1970s. As the next chapter will discuss, the Science Council of Canada, a crown corporation, outlined a similar program that would provide a new approach to Canadian environmentalists by constructing and popularizing a program of sustainable development around nationalism and scientific expertise.
Chapter 3:
Sustaining Canada: The Science Council of Canada and State Sponsored Environmentalism in the 1970s

In early 1973, the Science Council of Canada informed Canadians that “[they] as individuals, their governments, institutions and industries, [must] begin the transition from a consumer society preoccupied with resource exploitation to a conserver society engaged in more constructive endeavors.” Taking its call for sustainability a step further, the Science Council of Canada (SCC) suggested that Canada should embrace its recent involvement in global environmentalism at the 1972 Stockholm Conference and “provide the leadership necessary to work toward more equitable distribution of the benefits of natural resources to all mankind.” To support these dramatic statements, the SCC outlined a vision combining ecological sustainability, social equity, and long-term economic growth: a program of sustainable development.

This “conserver society” caught Canadians’ attention and quickly became a popular idea. As a result, these “unlikely environmentalists” at a crown corporation staffed by scientists, economists, and bureaucrats decided to expand the concept and by the late 1970s had constructed an influential version of sustainable development. Environmentalists and Canadian citizens embraced the concept of the conserver society in the 1970s because it defined a long-term approach to economic development and presented compelling arguments for investment in renewable energy.

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425 “Ottawa Will Set Example in Energy Saving Steps,” Globe and Mail, February 7, 1975; John Marshall, “Aiming for the Efficient, No-Waste Society,” Globe and Mail, December 13, 1976. Although the documentary record is fragmentary, the conserver society concept seems to have caught the imagination of environmentalists, Canadian citizens, and the federal government as it received substantial support and gave all three a means of discussing their concerns about the future. See Cathy Starss, Canadians in
environmental group Pollution Probe, for example, published *The Conserver Solution*, which exhaustively outlined how Canada should be reconstructed as a conserver society for the benefit of all Canadians.\(^{426}\) By the late 1970s, *Science Forum, Quebec Science*, and *Canadian Consumer* had all discussed and praised the conserver society concept, and it had even been read into the U.S. Congressional Record.\(^{427}\)

The SCC’s advocacy of sustainability coupled with its position at the pinnacle of the scientific establishment and the Canadian government presents a unique opportunity to examine how the state contributed to environmentalism and the conceptualization of sustainable development in Canada during the 1970s. Contemporary environmentalists and scholars are familiar with the exhortation “to think globally and act locally.” Fewer, however, are familiar with the Cold War expansion of science, which actually made it possible to think of the world as a globally integrated system and to analyze the potential impacts of human actions. Building on a growing literature within the history of science and environmental history, my analysis connects the emergence of concern over environmental limits – sustainability – to defense and communications systems pioneered by scientists and economic planners.\(^{428}\) I argue that the Canadian postwar expansion of the state, particularly its embrace of economic planning and its efforts to incorporate scientific knowledge into policy, fundamentally shaped Canadian environmental politics.

Building upon my examination of environmentalism’s relationship with the state in the previous chapters, this analysis challenges interpretations of environmentalism that have minimized the significance of the state by overlooking its intellectual and political contributions to Canadian environmentalism. Political scientist Kathryn Harrison’s

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analysis of the Trudeau government’s lack of leadership on environmental issues, for example, asserts that the federal separation of powers constrained the government’s ability to act. Harrison further narrowly defines environmental action as legislative oversight and states that public opinion forced the federal government to undertake its reluctant efforts to enact environmental regulations. As a result of her restricted definition of environmental action and her focus on public opinion, she concludes that the state had very little impact on Canadian environmental politics. Following Harrison, other scholars have seen little place for the state in the history of the Canadian environmental movement beyond its role as a reluctant regulator and the symbolic importance of Prime Minister Pierre Elliott Trudeau’s enjoyment of canoeing.

In contrast, this chapter broadens historical examination of environmentalism to include questions of development and connects environmental politics to national debates over economic growth and Canadian economic independence. By widening analysis in this way, I am able to show how the state exerted a significant influence on Canadian environmental politics. Policy debates over development, in particular, framed environmental issues around the government’s efforts to encourage economic growth. Through these debates over development policy, government advisors, such as the SCC, contributed to Canadian environmental politics as they outlined and popularized alternatives, including an early form of sustainable development. In short, the Canadian government’s construction of an elaborate advisory apparatus and its efforts to privilege scientific knowledge in policymaking encouraged government agencies to debate policy alternatives and provided substantial support to environmentalism in Canada.

Finally, this chapter’s analysis of the significance of highly charged debates over economic development in Canada also illustrates the importance of the national political

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430 Harrison, *Passing the Buck*, 56.
context to Canadian environmentalism. Canadian environmentalism was part of an international environmental movement, and it deeply felt the influence of American expatriates and anti-war protests.\textsuperscript{433} The local context and national politics, however, shaped its actions. For instance, the deft manipulation of nationalism by environmentalists in Skagit Valley turned a minor local protest into a national cause.\textsuperscript{434} Similarly, nationalism and projections of scarcity motivated the SCC’s conserver society. Using this concept, the Science Council questioned both the wisdom of rapidly destroying the environment and the politics of using international capital to finance the exploitation of Canadian resources to service distant economic markets, a practice fundamental to past Canadian economic development.\textsuperscript{435} These assertions make the SCC’s conserver society and the Canadian history of sustainable development difficult to examine outside of broader debates over Canadian neo-colonial economic status and political subordination to the United States in the 1960s and 1970s.\textsuperscript{436}

Thus, the SCC’s formulation of sustainability underlines the influence of the Canadian state on environmentalism as it illustrates the state’s framing of environmental politics. It also speaks to the important internal conflicts within the Trudeau government and the surprising willingness of government advisors to question policy and suggest, even publicly champion, alternatives. This experimentation and disagreement within the Canadian state provided an important source of intellectual support for Canadian environmentalism. The SCC’s conserver society also illustrates some of the uniquely Canadian aspects of this episode of environmental action and sustainable development in the 1970s. In particular, it drew on a national debate over Canadian economic development to champion its alternative approach and link environmental and national politics. In short, this chapter argues that a dynamic combination of environmental concern, nationalism, Cold War science, and government policy analysis shaped

\textsuperscript{434} Philip van Huizen “Flooding the Border: Development, Politics, and Environmental Controversy in the Canadian-U.S. Skagit Valley” (PhD diss. University of British Columbia, 2013).
\textsuperscript{435} Liza Piper, \textit{The Industrial Transformation of Subarctic Canada} (Vancouver: UBC Press, 2009), 7.
Canadian environmentalism and constructed the concept of sustainability in the 1970s. It is also important to underline the fact that the Science Council developed and championed the conserver society to transform Canadian economic development into something that was viable for the long term. In fact, the SCC explicitly referred to its actions means of making Canadian society "sustainable." Although the term "sustainable development" would not become widely used until after the Brundtland Commission in 1987, the SCC, along with the Campbell government on PEI and select groups of environmentalists, had pioneered the concept and worked towards identical goals in the 1970s. By taking seriously the contributions of government advisors, such as SCC, and Cold War science to environmentalism as well as the significance of nationalist concerns over economic dependence, this chapter brings to light a largely forgotten episode in Canadian history and illuminates the significance of an overlooked set of actors to Canadian environmentalism.

This chapter examines the development of the conserver society and the influence of the Science Council on environmentalism in four sections. The first two introduce the SCC and the foundations of its approach to sustainability. Connecting the SCC to the Trudeau government’s desire for rational management, I contend the SCC sought both to help the state mobilize science to assist economic growth and to develop national research programs, which could employ scientists and engineers. At the foundation of these efforts lay a quantitative approach to analyzing Canada and simulating its economic and environmental future. Focusing on this aspect of the SCC’s work, I show how its methodology enabled the SCC to develop the conserver society concept and added legitimacy to the idea. This technical approach indelibly links sustainability with the spread of Cold War research and the efforts to institute regimes of rational planning in the 1960s and 1970s. The third and fourth sections examine how the forces of economic nationalism and rational planning shaped this early conception of sustainable development. As I examine this approach to sustainable development, I show that both environmentalists and government ministries adopted the conserver society as a method of outlining a viable long-term approach to development and as an influential means of

voicing environmental and economic policy advice. Underlining the influence of the state on Canadian environmental politics, the construction and popularization of the conserver society broadened conceptions of development and made the Trudeau government’s later decision to fund solar energy in the late 1970s possible.

### Planning Development: The Nationalist Foundations of the Conserver Society

The SCC’s conserver society emerged from its broader efforts to provide the government with scientifically based policy advice. The SCC itself was founded as a result of the Glassco Commission, which Prime Minister Lester B. Pearson appointed to review Canadian science policy in the early 1960s. The Commission recommended the creation of an independent, but federally funded advisory council to engage Canadian scientists, coordinate a more extensive employment of science by the Canadian government, and improve the adoption of new research and technology by industry.\(^{438}\) Its first chairperson, Omond Solandt, had a distinguished career in Canadian science, serving on the Defence Research Board during the Second World War and acting as the founding member of the Canadian Operational Research Society in 1958. Building on his wartime exposure to British operations research, Solandt dedicated himself to developing Canadian expertise in mathematical modeling to enhance industry’s and the government’s ability to study and organize Canadian society.\(^{439}\) Beyond Solandt, the Science Council’s membership spanned the disciplinary spectrum with a concentration in academic science and engineering as well as a smattering of technically trained executives. In short, the SCC emerged from the same Cold War rationalism and emphasis on depoliticized policymaking that shaped the Trudeau government.

Initially, the Science Council worked very closely with the Canadian government and focused narrowly on its mission to improve Canadian science policy. It embarked on an extensive study of Canadian industry’s application of science and technology and sought ways of making Canadian research more accessible to industry with the hope of copying America’s successful transfer of academic and military research to industry.\(^{440}\) In


1968, just as it published its fourth report, *Towards a National Science Policy in Canada*, the council underwent an important change, by becoming a crown corporation.\(^{441}\) This reorganization gave the SCC more independence and provided it with greater financing and a professional support staff. Taking advantage of its increased resources, the SCC began to reinterpret its rather vague mandate – to advise the government on science and science policy and engage Canadians in discussions about science – and apply it more broadly. To this end, it rapidly set up special committees to study a variety of topics, such as the Committee on Resources, which first outlined the concept of a conserver society.\(^{442}\) The SCC also began to produce prodigious volumes of information about Canada and what the Council saw as the country’s problems. By 1973, less than five years after it had become a crown corporation, the SCC had produced twenty-one reports covering subjects ranging from forest management to Canadian industrial innovation, as well as twenty-nine special studies examining more specific topics such as the impact of foreign investment on scientific research and the prospects of Canadian scientists and engineers.

More than just academic interest motivated this copious production of information and scientifically founded (at least in theory) advice. Beginning in the mid 1960s and throughout much of the 1970s Canadians debated their national identity, particularly their economic relationship with the United States.\(^{443}\) After the Second World War, rapidly growing economic ties with the United States, encouraged by the General Agreement on Tariffs and Trade, brought the North American economies closer together. This continentalist trend culminated with the 1965 Auto Pact, which guaranteed continued automobile production in Canada, but ensured that American companies and their branch plants dominated the Canadian market.\(^{444}\) As historian Dimitry Anastakis states, this agreement helped to make the question of Canadian economic independence an epicentre


of political debate by placing a substantial portion of Canadian manufacturing under the control of American companies.445

The nationalistic optimism surrounding the 1967 centennial celebrations broadened and popularized the debate over economic independence that had emerged with the negotiations surrounding the Auto Pact. In the somewhat overwrought view of journalist Pierre Berton, 1967 was Canada’s “last good year,” a high point in Canadian postwar national achievement when anything seemed possible.446 A substantial portion of this surge of nationalism rested upon the growing contrast between Canadian optimism and orderly prosperity and civil dissent and disorder in the United States, particularly over Vietnam.447 Although inchoate, this national assertiveness, particularly its anti-Americanism, sometimes had a powerful influence on Canadian politics during the period. Philip van Huizen, for instance, has shown how environmental groups in British Columbia used this anti-Americanism to turn a primarily local dispute about the flooding of the Skagit Valley into a provincial and then national cause.448

The economic iteration of this nationalist sentiment received official recognition and support from the Task Force on Foreign Ownership and the Structure of Canadian Investment that Walter Gordon, Pearson’s nationalist former Minister of Finance, organized in 1967.449 Chaired by Gordon’s associate Mel Watkins, this task force studied the effect of foreign investment in Canada, and in 1968, it released a report sharply critical of the distorting influence of foreign investment.450 As I noted in chapter one, the Trudeau government responded by creating a Canadian Development Corporation to support Canadian industry.451

The creation of the CDC should not be taken to mean the Trudeau government

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446 Pierre Berton, 1967, the Last Good Year (Toronto: Doubleday Canada, 1997).
449 Azzi, Walter Gordon and the Rise of Canadian Nationalism, 149-150
wholeheartedly embraced economic nationalism, since it remained committed to international trade and investment. Nonetheless, concern over Canada’s economic independence helped to shape its highly political interventions into the energy industry, which culminated in the creation of a national oil company, Petro Canada, and the regulation of foreign investment.\textsuperscript{452} As political scientist Richard French puts it, “the expression of an ‘industrial strategy’ [was] about as important as any [political issue] facing Canada in the closing decades of the twentieth century.”\textsuperscript{453} In sum, the SCC gained the freedom to study the long-term prospects of Canada at a moment when the nation argued over both how Canada’s economy might grow in the future as well as the ends towards which economic development should be directed.

In the context of this national dispute, the SCC saw itself and its advice as central to the formulation of an effective “industrial strategy” and successful economic development.\textsuperscript{454} In 1967, Solandt, the SCC’s chairman, weighed in on the debate to call for a closer relationship between Canadian scientists, engineers, and industries. Advocating the avoidance of direct competition with established American industries and the creation of national priorities for research and development through government support and industrial cooperation, he stated:

> By concentrating on a relatively small number of fields, [Canadians] can do outstanding work that will not only attract international attention, but even more importantly will provide challenging and exciting careers for our own best scientists and engineers. For instance, we cannot win the space race, but we could have the best internal satellite communication system in the world.\textsuperscript{455}

This focus on nationally important and commercially promising areas of research would continue to shape the SCC’s understanding of economic development in Canada.


\textsuperscript{453} French, \textit{How Ottawa Decides}, 86.


\textsuperscript{455} Quoted in Lévi-Lloyd, “Canada’s Search for a Science Policy,” 216.
throughout the 1970s as it sought technologies or research areas with the potential to create jobs and new industries in Canada. In fact, this approach would frame the Science Council’s assessment of renewable energy when it identified the energy sector as nationally important due to forecasts of oil scarcity and suggested that renewable technology could provide a commercial opportunity for Canadian industry where minimal international competition existed.

Solan’s statement marked the beginning of an ongoing effort to reshape Canadian “industrial strategy” along nationalist lines. SCC’s interest in so-called “industrial strategy” rested on a combination of patriotism and concern for its members. If Canada developed new high tech industries, engineers and scientists – the bulk of its membership – could remain in the country and contribute to Canada’s further growth rather than departing for more lucrative opportunities in the United States. This concern motivated the SCC to devote considerable attention to economic development in Canada and the impact of foreign investment and branch plants on Canadian science and scientists.456

Branch plants, in particular, became a focus of its concern. The SCC concluded that the Auto Pact and agreements like it impeded innovation and research in Canada because the development of new products occurred at research facilities outside of Canada.457 As sociologist J. Ann Lévi-Lloyd puts it, the Council was convinced that “to adapt to changing global economic conditions, Canadians would have to regain control over the direction and use of technology in their economy.”458 For this group of patriotic and self-interested scientists and engineers, finding the correct science policy and industrial strategy was a matter of national survival. By 1971, these technocrats took their concerns seriously enough to make them part of their mission to “engage Canadians,” and they began to drum up press coverage for their views on national development.459

As the SCC looked for nationally important fields and promising industries or technologies for research and development, it turned to Canadian resource industries. As

the Science Council was well aware, natural resources supplied much of Canada’s
exports and provided potential areas where Canadian scientists and engineers could
contribute to economic development and possibly help Canada become a world leader in
the science and technology required to exploit minerals, crops, and forests. 460 This focus
on resource exploitation and scientific study reflected longer-term efforts to develop
subarctic Canada in the 1950s and 1960s, which accompanied the Cold War explosion of
interest in northern Canada when it became a strategic area crisscrossed by military
communications networks and containing important resources, such as uranium. 461 This
subarctic area, according to historian Edward Jones-Imhotep, provided Canadian
scientists with a research field where they could assert their independence and carve out a
niche in the study of the ionosphere. 462 The leaders of the SCC saw this work, a topic
instrumental to satellite communications, as an example of how Canadian research and
development could make itself felt internationally. However, as environmental historian
Stephen Bocking has pointed out, scientists’ expanding knowledge about the north
provided more than an area in which Canadians could assert their intellectual
significance. It also created tension between scientists and advocates of northern
development as the potentially disastrous environmental impacts of mineral extraction
and oil pipelines became better known. 463

Anxious to shape “industrial strategy” and to protect Canadian independence
while providing useful employment for Canadian scientists and engineers, the SCC
analyzed possible avenues for Canadian scientific and industrial development from space
technology to oceanographic research. 464 It settled on the mundane, if reasonable, view
that resource development would play a significant role in Canada’s future. With this
focus, the SCC quickly grew concerned by what it saw as the mismanagement of

460 See Science Council of Canada, Report No. 8, Seeing the Forest and the Trees (Ottawa: Information
Canada, 1970); Science Council of Canada, Report No.12, Two Blades of Grass: The Challenge Facing
461 Piper, The Industrial Transformation of Subarctic Canada, 115.
462 Edward Jones-Imhotep, “Communicating the North: Scientific Practice and Canadian Postwar Identity,”
463 Stephen Bocking, “Science and Spaces in the Northern Environment,” Environmental History 12, 4
464 Science Council of Canada, Report No. 1, A Space Program for Canada (Ottawa: Information Canada,
1967); Science Council of Canada, Report No.10, Canada, Science and the Oceans (Ottawa: Information
Canada, 1970).
Canadian resources and the growing threat of resource scarcity and global environmental problems.\textsuperscript{465} However, to the SCC, with its focus on developing “scientifically based” solutions, Canada and the rest of the world’s environmental problems also represented an opportunity.

**Analyzing the Future: The Technical Foundations of the SCC’s Sustainability**

Environmental concern reshaped the SCC’s analysis of Canadian resources in the early 1970s. The SCC first extensively examined and forcefully voiced concern about Canada’s environment in 1972 with the Council’s sixteenth report, *It Is Not Too Late – Yet*. Focusing on the natural environment, pollution, and resource depletion, the report informed Canadians that their country faced serious and worsening environmental problems. Framed by its concerns about Canadian economic and scientific development, the SCC understood global environmental problems as both a danger and an opportunity. The Council reasoned that if Canada could devise technical or managerial solutions to these global problems, it would contribute substantially to Canadian development and provide means of employing Canadian scientists and engineers. To analyze the environment, SCC embraced the newly popular science of ecology and combined it with its longstanding interest in operations research and systems management. Drawing on these intellectual foundations, its study underlined the importance of interactions within and between ecological and human systems. The SCC, for instance, criticized intensive agriculture for relying on monoculture, high fertilizer use, and “biocides,” which it believed disrupted natural systems and undermined long-term sustainability.\textsuperscript{466}

Determined to formulate “a reasonable and easily understood solution,” the SCC looked to new technology and improved state regulation or industrial management as solutions to Canada’s environmental issues.\textsuperscript{467} The Council argued, as one might expect from an elite body of scientists, that environmental problems needed greater study. Building on this point, the group suggested that if Canadians and their government embraced scientists’ and planners’ growing understanding of environmental, social, and

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\textsuperscript{465} These concerns received their fullest treatment in a background paper by K.J. Rea which forcefully called for a socially and environmentally inclusive approach to planning. See Rea, *Special Study No.36, The Political Economy of Northern Development* (Ottawa: Minister of Supply Services Canada, 1976).

\textsuperscript{466} SCC, *It Is Not Too Late – Yet*, 18.

\textsuperscript{467} SCC, *It Is Not Too Late – Yet*, 39.
economic problems, effective solutions would be found. The SCC concluded on this technocratic note:

In the long view, it is abundantly clear that environmental problems are here to stay. The increasing numbers of people in the world and the increasing rate of consumption are beginning to show in a multitude of ways, so that man must now develop the techniques of living with himself and the environments he creates. ...we will need a huge carefully assessed, technological effort to tide us over until we develop new philosophies for civilizations with equilibrium populations and stable economics.\(^{468}\)

In short, environmental problems required immediate and substantial technological, as well as eventual social and economic, change. Addressing these problems might provide scientists and engineers with a nationally significant field of research capable of providing substantial profits given the global nature of environmental problems and energy scarcity.

Building on its assertion that economic and environmental needs could be reconciled through more effective and better-informed management, the SCC suggested the government employ two analytical tools: input-output analysis and systems analysis.\(^{469}\) According to the SCC’s report, *Natural Resources: Policy Issues in Canada*, these two techniques could significantly improve government decision making when it came to resource development and environmental protection, since they allowed policymakers to outline the possible consequences of policies before implementing them and enabled the examination of relationships within a complex system.\(^{470}\) For instance, the SCC argued that because an input-output model could represent “the flow of commodities throughout the Canadian economy, it has the latent potential to incorporate external costs, particularly those associated with pollution.”\(^{471}\) These externalities, as they are called today, could then be taxed or otherwise discouraged. Cognizant of “a range of reactions from agreement to incredulity and outright opposition” that would greet its

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\(^{468}\) SCC, *It Is Not Too Late – Yet*, 38.


recommendations, the SCC also hoped that these analytical techniques, which gave an ability to “predict with some confidence,” would lend authority to its advice by enabling it to quantify the potential benefits of conservation.472

The SCC’s faith in the objective clarity of mathematical analysis and simulation may seem naive, but it reflected the rationalistic norms of the expanding postwar Canadian state. In the 1960s, Statistics Canada and the Economic Council of Canada (ECC) had begun modeling Canada’s economy and society in an effort to quantify the country as a whole and make governance more rational, even mechanical.473 In the early 1970s, the ECC continued its efforts to construct a simulation of the nation and devised the expansive CANDIDE model of the entire Canadian economy.474 As discussed in the first chapter, these efforts to simulate and even manage the Canadian economy through the application of abstract analysis were part of the Trudeau government’s “rational management” approach and its efforts to apply scientific knowledge to policy making. Developing just as the SCC became interested the management of potentially scarce natural resources, these efforts to model Canada shaped the SCC’s approach to sustainable development as it used the ECC’s analysis to define its conserver society concept. This political culture framed the SCC’s thinking as it privileged a technocratic approach and the application of quantifiable knowledge. It also placed the SCC squarely within a broader history of the spread and application of “Cold War rationality” in the 1950s, 1960s, and 1970s.475

It may seem surprising that mathematical simulations designed to calculate Canada’s “industrial product” and economic growth would have a central place in the development of a concept that emphasized environmental protection and long-term sustainability.476 However, the application of systems analysis and computer modeling played a central role in the study and popularization of ecological limits and even

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environmental concern in the 1960s and 1970s. As historians Fernando Elichirigoity and Jacob Hamblin have demonstrated, the very same Cold War military establishment that produced nuclear weapons also developed the simulations that identified increasing worldwide pressure on the environment. These simulations and their suggestion that the natural world might have limits spurred environmental discussions throughout the 1970s.

The work of Jay Forrester and the Club of Rome provides perhaps the best example of the interconnections between Cold War science and environmentalism. The Club of Rome, an influential environmental group comprised of technocrats and industrialists, began searching for a method of studying and illuminating the “world

Figure 9: A Schematic of the World3 Computer Model. Note abstract representation of the human and non-human world as a feedback system made up of five components.


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problematique,” as the Club put it, in the early 1970s.\textsuperscript{479} Much to the Club’s delight, Forrester offered to construct a system dynamics model to demonstrate the world’s looming problems of pollution and resource depletion in 1971.\textsuperscript{480} Forrester, one of the architects of NORAD’s SAGE air defence system as well as a renowned computer scientist and advocate of systems analysis, had began applying his programming skills to manufacturing systems and city planning at the Urban Systems Laboratory at MIT in the mid 1960s.\textsuperscript{481} As Elichirigoity points out, the Club of Rome embraced Forrester’s work primarily because it felt his analysis would both accurately simulate present and future world problems and carry weight with world leaders due to its “objective” nature.\textsuperscript{482} The Science Council echoed these reasons almost verbatim when it advocated the same methods in 1973.\textsuperscript{483} Both, it seems, sought to leverage quantification and the appearance of mechanical objectivity to enhance their limited political influence.\textsuperscript{484}

Forrester and his modeling group at MIT expanded his earlier work into the World3 model, the heart of the famous \textit{Limits to Growth Report}.\textsuperscript{485} This simulation forecast global development by measuring the interactions of five main variables: population, capital, agriculture, non-renewable resources, and pollution.\textsuperscript{486} Much like the ECC’s CANDIDE model, World3 simulated present and future problems by placing the five variables within a complex multivariate feedback system in which changes in the value of one variable would affect all the others and in turn would cause a change in the original variable.\textsuperscript{487} It is worth noting that this simulation of the world bore a very strong resemblance to the systems ecology of Howard Odum, a celebrated ecologist, who similarly focused on feedback systems to examine the change and stability in

\begin{footnotesize}
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\item Grober, \textit{Sustainability}, 156.
\item Jennifer Light, \textit{From Warfare to Welfare: Defense Intellectuals and Urban Problems in Cold War America} (Baltimore: Johns Hopkins University Press, 2003), 51.
\item Elichirigoity, \textit{Planet Management}, 78.
\item SCC, \textit{Natural Resources}, 18–19.
\item Theodore Porter makes the argument that those with little political power are the most anxious to assert regimes of quantifiable knowledge, since these regimes can enhance their political influence and obscure their exercise of power. See Porter, \textit{Trust in Numbers: The Pursuit of Objectivity in Science and Public Life} (Princeton, N.J.: Princeton University Press, 1995), 149.
\item Meadows, Richardson, and Bruckmann, \textit{Groping in the Dark}, 24.
\item Meadows, Richardson, and Bruckmann, \textit{Groping in the Dark}, 26-28.
\end{enumerate}
\end{footnotesize}
ecosystems. In the view of Odum and many other ecologists of the period, feedback would naturally guide an ecosystem through its development until it reached a stable climax state somewhat analogous to a steady state economy. However, according to the World3 model’s simulation of the world’s feedback systems, exponentially increasing population growth and resource use had disrupted this natural balance and these new conditions would destabilize the world during the twenty-first century and result in a classic example of “overshoot and collapse.”

The report and its dire conclusions generated immediate and widespread debate and helped expand the chorus of concern over future scarcity. Attacks on rapid growth had been growing since Kenneth Boulding’s seminal 1966 essay, “The Coming Economics of Spaceship Earth,” and had become more strident in the late 1960s and early 1970s. The Club of Rome’s *Limits to Growth* presented one of the most direct attacks on commitments to growth, and the Club continued to expand and clarify its criticism of growth with its second report, *Mankind and the Turning Point*, in 1974. According to economic historian Robert Collins, Americans largely accepted these criticisms, and economists started to hedge their emphasis on growth without entirely rejecting it. Canadian governments at the provincial and federal level reacted similarly. As I discussed in the previous chapter, the Campbell government on PEI responded by beginning to plan for a future characterized by scarcity. For its part, the SCC disapproved of *Limits to Growth*’s “doom and gloom” but embraced its criticism of rapid growth and its highly technical methodology. In its view “the rate of deterioration of the environment, the increase in population…, and our rate of resource consumption” sent clear warnings of future problems.

The quantitative methodology that *Limits to Growth* employed to arrive at its shocking conclusions was its most significant contribution to the SCC. The ability to

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494 SCC, *Natural Resources*, 38.
simulate the entire world and “predict with some confidence” potential futures
represented exactly the application of analytical techniques the SCC believed necessary
to analyze Canadian environmental problems and provide sufficiently objective
information to enable policymakers to rely on their results.495 This technocratic
methodology also reflected the wider efforts in postwar Canada to rationalize governance
and manage economic development. In particular, the SCC’s approach highlights the
influence of the Trudeau government’s ideology of “rational management,” which
pushed the group to embrace practices of knowledge creation that it believed would be
privileged by bureaucrats and taken seriously by Trudeau’s cabinet.

Convinced by its analysis of the Canadian environment that it was necessary to
transition “from a consumer society preoccupied with resource exploitation to a
conserver society engaged in more constructive endeavors,” the SCC concluded that
conservation presented an opportunity to pioneer new technologies and systems of
management capable of improving Canadians’ lives and ensuring their economic
independence.496 The centrality of highly technical analysis and economic nationalism to
the emergence of the Conserver Society and its conception of sustainability underlines
the significance of national politics to environmentalism. In short, national politics, the
application of technical knowledge, and the structure of the state framed Canadian
environmentalism in the 1970s.

Defining a Future: Developing the Conserver Society Concept

Excited by public interest in the conserver society and its potential as a research
project, the SCC established a committee to define and outline the idea of a conserver
society at the forty-second meeting of the SCC in 1973.497 In early 1975, SCC officially
reiterated its commitment to the conserver society and began to flesh out the concept. It
justified its interest in this way:

The concept of a Conserver Society arises from a deep concern for the future, and
the realization that decisions taken today, in such areas as energy and resources, may
have irreversible and possibly destructive impacts in the medium to long term. The

495 SCC, Natural Resources, 40.
496 SCC, Natural Resource, 39.
497 SCC, Canada as a Conserver Society, 13.
necessity for a Conserver Society follows from our perception of the world as a finite host to humanity, and from our recognition of increasing global interdependence.\textsuperscript{498}

The committee’s preliminary definition of sustainability revolved around “economy of design” and employed the Science Council’s knowledge of ecosystems to devise prices that reflected total costs (including externalities, such as pollution). Through these financial disincentives and other tweaks to the economic system, it hoped to moderate consumer demand and buy Canadians time to develop new technology and eventually make their society sustainable.

Fleshing out these themes of efficiency, the finite nature of the earth, and the importance of long-term planning, the SCC constructed a call for environmental sustainability that reflected the Trudeau government’s strong emphasis on employing scientific knowledge when devising policy. This analysis of the influence of the Trudeau government’s approach to policymaking on the SCC’s continues my examination of the state’s impact of Canadian environmentalism as I show how the state’s ideology framed the discussions of sustainable development in the 1970s by dictating the methodology and vocabulary necessary to take part in policy discussions or propose alternatives.

Rather than limiting internal conflict and debate over policy, the Trudeau government’s efforts to incorporate scientific knowledge into governance and to make evidence based policy actually expanded internal policy discussion. While historians and political scientists often emphasize the state’s ability to use scientific or technical knowledge to obfuscate and enhance its authority, this is not the only effect of expertise.\textsuperscript{499} As political theorist Yaron Ezrahi puts it, “actions [can be made] authoritative more by virtue of references to their sources than to their intended or manifest results.”\textsuperscript{500} The referential nature of its legitimizing function means that the employment of expertise to justify policy can actually expose a government to scrutiny because it forces the state to maintain the authority of the expertise it uses, which

\textsuperscript{498} SCC, \textit{Canada as a Conserver Society}, 13.
\textsuperscript{499} For a discussion of states’ employment of science to enhance their power, see James Scott, \textit{Seeing Like a State: How Certain Schemes to Improve the Human Condition Have Failed} (New Haven: Yale University Press, 1998).
involves its review by others with that expertise. Historian Theodore Porter makes a similar point, as he notes the ability of quantification to both act as a “smokescreen” for technocrats and to provide a means to assess the political and social costs of a decision.\textsuperscript{501} By legitimating its actions through an appeal to “scientific” knowledge, the Trudeau government exposed itself to criticism from groups known to possess similar expertise. As a result, advisors from the Science Council could openly criticize government policy while justifying their actions though appeals to the same intellectual foundations the state used to construct policy. In this way, the use of technical knowledge legitimated criticism and forced the government to either acknowledge the SCC’s criticisms or risk undermining its claims to be making “science based” decisions.

The SCC built its conserver society around long-term planning that the systems analysis it favoured seemed to make possible. Appealing for better preparation for the future, it stated that Canadians were not concerned enough about the coming problems, “particularly, when we possess the technical and scientific knowledge to foresee the consequences of our actions with reasonable certainty.”\textsuperscript{502} According to the SCC, continuing to take a short-term view and rely on the ability to “muddle through” was no longer responsible or even feasible. Instead, Canadians had to start conserving to keep their options open and, above all, “be a ‘smart’ society taking advantage of new opportunities in science and technology to find new ways of doing things that will hold for the long term.”\textsuperscript{503} Becoming this sort of “smart” society, it argued, entailed “building into the decision framework not only a view of the future, but the mechanisms that could allow for the reversal or modification of decisions which prove unwise.”\textsuperscript{504}

The SCC’s focus on assessing and planning Canada’s development and carefully managing its resources to ensure socially desirable results had a very strong resemblance to the Trudeau government’s An Energy Policy for Canada: Phase 1. The Ministry of Energy, Mines, and Resources’ 1973 report, discussed in chapter one, similarly forecast Canada’s energy resources and needs and then planned a means to develop Canadian

\textsuperscript{501} Porter, Trust in Numbers, 116.
\textsuperscript{502} SCC, Canada as a Conserver Society, 24.
\textsuperscript{503} SCC, Canada as a Conserver Society, 24-25.
\textsuperscript{504} Science Council of Canada, Toward a Conserver Society: A Statement of Concern (Ottawa: Science Council of Canada, 1976), 12.
energy resources rationally over the coming decades.\textsuperscript{505} This resemblance is unsurprising since members of the Science Council helped draft the report, and its technocratic approach meshed with many leading members’ backgrounds in operations research and their emphasis on the importance of technical expertise.\textsuperscript{506} This highly technical political discourse would guide the SCC’s engagement with sustainability throughout the 1970s.

The SCC’s emphasis on management and efficiency may remind environmental historians of the conservation movement of the early twentieth century. While parallels exist between these approaches to resource management, most notably their emphasis on scientifically informed management and state intervention, a fundamental difference separated the SCC vision of sustainability from that of the progressive movement. The conserver society aimed to adapt Canadian society to the demands of a limited world, whereas Progressives sought to manage the environment to meet society’s needs.\textsuperscript{507} The emphasis of the former on adaptation subtly changed its calls for efficiency, improved design, and better planning by shifting the focus from society to “an appreciation of the total system.”

This holistic analysis underlay the SCC’s desire for “smart” societies and effective “decision frameworks” and led it to construct a critique of consumerism around poor design, inefficiency, and ineffective planning. Convinced that the high and increasing rates of consumption could not be maintained physically in a finite world, the Council focused its analysis on the organizational structures it believed encouraged consumption. Inspired by John Kenneth Galbraith, it charged that corporate and government strategy had carefully encouraged Canadians to embrace frivolous consumerism.\textsuperscript{508} In this analysis, the wasteful destruction of the environment was not an accidental aspect of postwar society, but rather a component of the very structures that made it so productive. Postwar capitalism, with its focus on high throughput and the

\textsuperscript{506} Lévi-Lloyd, “Canada’s Search for a Science Policy,” 172-174.
provision of cheap resources inevitably resulted in waste and rapidly depleted resources. Advertising, “planned obsolescence,” and poor design exacerbated these unsustainable demands and pushed Canadian society out of sync with the finite natural world.509

In the SCC’s view, Canadian society, including the economy, had to be reorganized in a way that considered “the total system” in order to have any reasonable long-term prospects. As a first step towards sustainability, the Council advocated the “recognition of total costs.”510 To the SCC, prices that reflected both environmental and social externalities as well as replacement costs offered the best means to allow the market to respond to price incentives, which accurately represented true costs and remove the most egregious distortions in Canadian markets. This market centered approach would play an important role as the SCC sought to address scarcity by redirecting economic growth. Going further, the Council also saw a central role for federal and provincial government, namely that they needed to act on scientists’ and planners’ projections of future problems, begin unwinding the structural incentives to consume, and use legislation to induce Canadians to conserve.511

This top down approach to sustainability pushed the SCC towards two methods of improving Canada’s long-term environmental prospects. One was the education of Canadians. The Council assumed Canadians would accept its view of their interests and pressure the government to adopt sustainability. The second entailed an industrial policy, which gradually shifted the country from reliance on extractive resource industries to industries reliant on renewable resources. Both constituted an attempt to insert the environment and its fragile and finite character into Canadian politics and clashed with consumerism and the federal and provincial governments’ past policies of encouraging rapid growth.

The SCC first outlined the importance of a sustainable industrial policy in its report Canada’s Energy Opportunities, which sharply criticized the Trudeau government’s energy policy for short sightedness. Using its own systems analysis of Canadian energy use and drawing upon the EMR’s growing concerns about Canada’s

509 SCC, Toward a Conserver Society, 15.
510 SCC, Toward a Conserver Society, 8.
511 SCC, Toward a Conserver Society, 17.
energy future, the Council argued that although Canada might have substantial reserves of oil and gas, these would remain useless unless the country rapidly engaged in substantial technological development and staggering investments in infrastructure.\textsuperscript{512} The massive costs of such investments, however, raised another long-term problem according to the SCC, because they distracted Canadians from preparing for the day when oil and gas resources became depleted and too expensive to use. In the SCC’s view, investing in non-renewables squandered resources that the country needed for the transition away from oil.\textsuperscript{513} The Council also explicitly criticized the EMR’s willingness to accept the potentially massive environmental costs of rapid oil development in Canada’s fragile north.\textsuperscript{514} To insure the nation’s future, the SCC argued that Canadians needed to drastically reduce their energy demands through conservation and, even more importantly, develop new “inexhaustible” energy sources that caused less environmental harm.\textsuperscript{515} In their view, renewable energy sources, such as solar, offered the best long-term investment for Canada.\textsuperscript{516}

To the SCC, much like the Campbell government, this transition held important opportunities for Canadian economic growth. Most importantly, constructing a new foundation for the country around renewable energy could be the beginning of a national industrial renaissance. This possibility excited the SCC, since it had been calling for efforts to encourage Canadian ownership and control of the country’s manufacturing companies and resource sector since its first report in 1967.\textsuperscript{517} In its understated style, the Council argued that Canadian control of industry and technology became “somewhat more possible and plausible in a scenario where very many new industries and technologies will be deployed and where selective growth becomes the central policy thrust of our industrial strategy.”\textsuperscript{518} The challenges of developing new technologies and new industries also promised to address the “truncated” character of Canadian industry that it believed branch plants caused and to provide jobs for Canadian engineers and

\textsuperscript{513} SCC, \textit{Canada’s Energy Opportunities}, 19.
\textsuperscript{514} Lévi-Lloyd, “Canada’s Search for a Science Policy,” 180.
\textsuperscript{515} Science Council of Canada, \textit{Canada’s Energy Opportunities}, 12.
\textsuperscript{516} Science Council of Canada, \textit{Canada’s Energy Opportunities}, 68-69.
\textsuperscript{517} Clowater, “Canadian Science Policy and the Retreat from Transformative Politics,” 118-119.
\textsuperscript{518} SCC, \textit{Canada as a Conserver Society}, 56.
The Council saw particular relevance for renewable energy and better resource management in the Canadian subarctic and arctic, which had been the focus of development projects throughout the 1960s and early 1970s. Advocating a “mixed” approach to northern development, the SCC placed special emphasis on renewables, stating that they could be the foundation of a balanced economy less dependent on the boom and bust cycles of resource extraction. Responding to the national debate about Northern development that the Mackenzie Valley Pipeline Inquiry fostered when it established First Nations communities’ right to be part of northern development plans, the Science Council shifted further away from earlier calls for development and advocated an extensive study of the north designed to bring about greater recognition of northern perspectives of development. As Lévi–Lloyd notes, the SCC saw research into renewable energy as a useful focus for the “University of the North” that it recommended as the centerpiece of a broader strategy of economic diversification in Northern Canada.

Finally, these “new technologies” and policies of “selective growth” promised positions for scientists and engineers and opportunity for the Canadian research and development industry in general. As the Council noted, even developing comparatively simple solar heating and wind power technologies posed a considerable challenge, since they were almost unknown in Canada and had received little concentrated attention internationally. Solar and wind technology required research into physics, aerodynamics, and electrical and mechanical engineering. This novelty would also necessitate organizing research and development centers at Canadian universities and the provision of technical assistance to emerging industries, thus employing scientists and engineers across Canada. Just as importantly, because there had been relatively little

523 SCC, Canada as a Conserver Society, 76.
research on renewables anywhere in the world at the time, the field promised to be a lucrative area where Canadian scientists could innovate and patent new technologies.\(^{524}\) In short, the development of renewables seemed to be a perfect field for Canadian scientists and engineers to create the “technological sovereignty” the SCC had long advocated in its recommendations for Canadian industrial strategy.\(^{525}\)

The SCC’s calls for technological sovereignty did not go uncriticized. Economists led by Kristian Palda of the Fraser Institute, a right wing champion of free markets, attacked the Science Council for involving itself in industrial policy, which he argued lay outside its mandate.\(^{526}\) Other critics argued the SCC misunderstood the impact of foreign ownership and asserted that it had become little more than a lobby for scientists and engineers who wanted greater access to funding and employment in Canada. As historian G. Brent Clowater notes, these critics prefigured a shift away from state intervention in the 1980s, when the Progressive Conservatives replaced the Trudeau government and calls for technological sovereignty fell from political favor.\(^{527}\)

To the SCC and its supporters in the 1970s, the conserver society did more than outline how Canada could become sustainable. It presented a far-reaching argument about Canadian sovereignty, the importance of escaping Canada’s traditional reliance on resource development, and the active role the Canadian state should play in the Canadian economy. Sustainability, in short, was about more than the environment. Its adherence to long-term planning and nationalist industrial policy responded to national debates over development and drew heavily upon techniques of quantification and rational planning privileged by the Canadian state in the 1960s and 1970s.

To generate support for its conserver society and pressure a government still committed to rapid resource development and consumption, the SCC tried to re-educate Canadians. Its informational program underlined the significant latitude the Council enjoyed thanks to its privileged position within the structures of the Trudeau government.

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\(^{524}\) SCC, *Canada as a Conserver Society*, 77.
\(^{525}\) Clowater, “Canadian Science Policy and the Retreat from Transformative Politics,” 123.
\(^{526}\) Kristian Palda, *The Science Council’s Weakest Link: A Critique of the Science Council’s Technocratic Industrial Strategy for Canada* (Vancouver: The Fraser Institute, 1979), x.
\(^{527}\) Clowater, “Canadian Science Policy and the Retreat from Transformative Politics,” 122.
and its broad mission to examine science in Canada. The SCC’s attempts to inform Canadians about sustainability also highlight the state’s engagement with environmentalism as this crown corporation carried out an educational campaign very similar to those of contemporary mainstream Canadian environmental groups, such as the David Suzuki Foundation. Its arguments affected both government and public discussion of development and provided Canadian environmentalists with a new vocabulary through which they could call for sustainability.

The Science Council’s instructional efforts revolved around Conserver Society Notes, a serial publication begun in late 1975 and distributed widely until 1978. Dr. Ursula Franklin, a socially active physicist and metallurgist who took over the SCC’s conserver society committee in 1975, oversaw this attempt to appeal to the Canadian public. Deeply committed to engaging Canadians in discussions about their society and its future, Franklin later become a well-known public intellectual with her Massey Lecture series on the “real world of technology.” In the 1970s, her efforts inaugurated a publicity campaign designed to build a “national consensus for the future of Canada” around the conserver society. The campaign generated immediate interest. While the second issue of Conserver Society Notes only had a circulation list of seven hundred, this included members of parliament, provincial premiers, environmental groups, and government advisors. Expanding the SCC’s public voice, the journal introduced readers to the idea of sustainability, outlined the Council’s reasons for criticizing consumerism, and suggested how Canadians could balance environmental and economic needs. Aimed at “concerned lay persons” of an educated middle class background, it adopted a serious, but accessible, style and worked hard to make energy and environmental issues directly relevant to its readers by giving them advice they could use in their everyday lives. For instance, it drew on David Brooks’ and the EMR Office of

528 SCC, Towards a National Science Policy for Canada, 1.
Energy Conservation’s (OEC) analysis of energy losses from Canadian buildings to stress how something as simple as proper insulation gave everyone an immediate way to save money and conserve limited resources. Such advice consciously appealed to readers’ self-interest and approached them as concerned citizens anxious to do their part, but in need of expert guidance. In fact, the SCC’s benevolent prodding strongly reminds the reader of the contemporary Suzuki Foundation’s current admonishments to recycle electronics and reduce one’s carbon footprint by unplugging laptops and installing better insulation.

In its calls for conservation and attacks on the wastefulness of consumerism, Conserver Society Notes walked a fine line between encouraging economic growth and conserving resources. The criticism of economic growth was obviously central to its application of conservation would also find favour at the Institute of Man and Resources' Energy Days, which I discussed in the previous chapter.


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534 This application of conservation would also find favour at the Institute of Man and Resources' Energy Days, which I discussed in the previous chapter.

discussion of the conserver society, but the journal also sought to assure its readers that although it wanted social and economic change, it did not seek to undermine the advantages gained from a modern society. To do so it outlined the potential of doing “more with less,” which would mitigate the most wasteful aspects of consumerism and the most egregious destruction of the environment without necessitating drastic change. Disposable products, for instance, received sharp criticism. In one amusing and thought provoking article, the journal went so far as to attack the excessive consumption and wastefulness of Christmas.  

536 It remained ever cautious, however, and while criticizing the extravagance of the holiday season, it assured readers – particularly business and labour – that although a conserver society would require technological and labour shifts, as any technological change would, these changes would not damage the economy and would likely improve the prospects of labour.

Drawing on the SSC’s wider advocacy of a nationalist development policy, *Conserver Society Notes* also emphasized the potential of new technologies to create new jobs and industries while making Canada more sustainable and independent. In its first volume published in October 1975, the journal introduced solar energy, then almost unheard of in Canada, and lauded the technology. It also asserted that Canada could use renewables to continue to grow economically without damaging the environment by using minimal resources. To support this optimistic argument, the journal introduced Premier Alex Campbell and his government’s interest in renewable energy and conservation to show readers that the sort of sustainable development envisioned by the conserver society was already underway in Canada.  

537 This publicity both helped the Science Council agitate for change and supported alternative development on PEI by throwing the authority of Canada’s leading group of scientists behind Campbell’s efforts. This network of assistance between like-minded governments, advisory bodies, and environmentalists would play a central role in the influence they had on Canadian environmental politics.

As it introduced readers to sustainability, the *Conserver Society Notes* also

asserted the importance of holistic systems analysis. Following the systems ecology approach of the SCC, the journal avoided any call to return to the land or any rejection of technology. Instead, its vision of a conserver society combined environmental concern with the embrace of scientific knowledge and technological innovation. For example, it discussed the Limits to Growth ’75 conference, which further elaborated on the Club of Rome’s iconic predictions of collapse, to emphasize the rational nature of concern over the dangers of rapid growth and the scientific credentials of those who projected future environmental and economic problems. Environmental concern, in its view, was the result of careful study and had little to do with the counterculture. To underline the importance of its technocratic approach to the environment, Conserver Society Notes introduced its readers to Howard Odum’s “new math” of energy analysis, which it argued gave experts the ability to accurately assess total energy use and thus manage the development of energy resources as effectively as possible.

Through the Conserver Society Notes and its many other studies and reports on the conserver society, the SCC outlined the potential of sustainable development for Canadians in the 1970s and defined what the Council believed to be the country’s best opportunity for a bright future. This episode in Canada’s environmental history shows how the state framed environmental thought in Canada and highlights the central role of government advisors in the construction and popularization of sustainability. The conserver society also underlines the significance of the SCC’s scientific credentials. Its credentials privileged the Science Council’s work within the Trudeau government’s scientistic political culture, which allowed the SCC to expand the discussion of the novel topics of sustainability and environmental limits.

Contesting the Future: Environmentalism and Energy Policy

The SCC’s call for sustainable development competed with other, more dominant approaches to development. Powerful ministries of the Trudeau government – including the EMR, which oversaw energy and resources – remained committed to rapid growth

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539 Potworowski, “Energy Analysis: Keeping Count of the BTUs,” 6. As I discussed in chapter one, the OEC also championed Howard Odum’s energy analysis as a means to guide energy conservation.
and the development of oil and gas regardless of its environmental consequences throughout the 1970s. In fact, growing concerns over price instability and global oil scarcity often heightened interest in the now even more valuable resources under Canadian soil and off its shores.\textsuperscript{540} The Prime Minister and his cabinet also remained committed to rapid economic expansion and undertook substantial programs to modernize Canada’s “underdeveloped” areas, such as the Atlantic Provinces.\textsuperscript{541} However, as the success of the Campbell government in manipulating federal policy suggests, these official views did not necessarily constrain those anxious to champion alternatives. Despite the conflict between the SCC’s conserver society and the overall goals of the Trudeau government’s economic policy, the SCC still enjoyed substantial support and worked closely with federal departments to develop conserver approaches to development. Just as importantly, it acted as a center of support for Canadian environmentalism and provided environmental groups with a well-known alternative to continued reliance on non-renewable resources and rapid growth. As a result, critics could use the SCC’s work to challenge the government’s policy and frame environmental politics in Canada during the 1970s.

While the SCC developed the conserver society in the mid 1970s and advocated the dampening of consumer demand and shifting to renewables, the oil industry, the government of Alberta, and the EMR argued for exactly the opposite policy. Both were responding to exactly the same projections of future resource scarcity, but the difference lay in how each viewed the world. The SCC, along with its environmentalist supporters, privileged the environment and sought to ensure social and ecological stability by minimizing the destabilizing influence they assumed scarcity would have.\textsuperscript{542} They reached this conclusion through the employment of systems analysis and forecasting, which allowed them to focus resolutely on long-term rather than short-term benefits.\textsuperscript{543}

\textsuperscript{540} James Laxer, \textit{Oil and Gas: Ottawa, the Provinces, and the Petroleum Industry} (Toronto: James Lorimer and Co., 1983), 39-40. The Trudeau government had always seen oil and gas development as an important contributor to the Canadian economy and explicitly argued increased revenues should be used to improve the lot of all Canadians. See Memo to Cabinet: An Energy Policy for Canada – Phase 1, April 5, 1973, Vol. 3, File Energy Policy, 1973, Tombs Fonds, LAC.
\textsuperscript{541} Donald Savoie, \textit{Visiting Grandchildren: Economic Development in the Maritimes} (Toronto: University of Toronto Press, 2006), 85.
\textsuperscript{542} SCC, \textit{Canada as a Conserver Society}, 19.
\textsuperscript{543} SCC, \textit{Canada as a Conserver Society}, 24.
According to their view, this rational management of resources coupled with greater state intervention could enhance equality and national sovereignty, as well as enable the development of environmentally sustainable industries.544

The oil industry and most federal departments, on the other hand, viewed scarcity through the lens of capitalist economics and private property.545 Possible scarcity, from an economic perspective, offered those who owned the commodity a short-term opportunity to profit handsomely from rising prices. As noted in chapter one, to take advantage of rising prices and shelter Canadians from their effects, the Trudeau government froze the Canadian price of oil in December 1973 and instituted an export tax on oil to recoup the cost of subsidies from the rising profits of exports.546 The Trudeau government, however, recognized that this policy was a temporary expedient and that the price of oil in Canada would need to increase, yet it still hoped that Canadians could benefit from the rising price of their resources and the government could enjoy increased tax revenues.547 To this end, it employed the power of the state to encourage rapid resource exploitation while it remained possible.

In 1976, the Trudeau government announced a new energy strategy designed to achieve energy self-reliance.548 The centerpiece of this policy was a doubling of “exploration and development activity in the frontier regions of Canada.”549 To support this massive program, the EMR foresaw spending roughly two billion (in 1976 dollars) per year over the next decade.550 As forecasts suggested that Canadian oil and gas reserves in the west would soon be exhausted, the majority of this exploration and development was planned for the “frontier,” or more accurately, crown lands in Canada’s northern territories. These lands had the added advantage of being under federal rather

544 SCC, Canada as a Conserver Society, 55.
545 Laxer, Oil and Gas, 39-40. The Trudeau government had always seen oil and gas development as an important contributor to the Canadian economy and explicitly argued increased revenues should be used to improve the lot of all Canadians. See Memo to Cabinet: An Energy Policy for Canada – Phase 1, April 5, 1973, Vol. 3, File Energy Policy, 1973, Tombs Fonds, LAC.
549 EMR, An Energy Strategy for Canada, 133.
than provincial jurisdiction, thus allowing the government greater influence over this planned oil and gas bonanza.\footnote{Fossum, \textit{Oil, the State, and Federalism}, 54.} The Trudeau government also founded Petro-Canada to help overcome the huge financial risks of exploration and exploitation and ensure that a Canada company controlled the country’s energy future.\footnote{Fossum, \textit{Oil, the State, and Federalism}, 75.} This policy seemed to commit the Canadian government to national economic growth through shared state and industry management of oil development.\footnote{Chapter six will show that this policy of energy self-reliance also opened the door to the development of renewable energy.}

Although the SCC’s conserver society contradicted this commitment to resource-fueled growth, this implicit criticism did not to preclude it from receiving considerable support and generating significant interest within government ministries. Environment Canada, for instance, drew heavily on the conserver society. A relatively new department created from sections of the Department of Fisheries and Forestry and parts of the EMR in 1971, Environment Canada used the discussion surrounding the conserver society to define its mission and outline how it could help Canadians understand their relationship with the environment and construct a sustainable future.\footnote{Cathy Starrs, \textit{Canadians in Conversation about the Future: A Working Document for the Conserver Society Theme of the Advanced Concepts Center} (Ottawa: Environment Canada, 1976), 7.}

In order to gauge how Canadians’ understanding of the environment and their expectations were changing, Environment Canada’s Advance Concepts Center carried out a study of Canadian opinion in 1974.\footnote{Starrs, \textit{Canadians in Conversation about the Future}, 7.} Seeking a “futures perspective,” Advanced Concepts used the conserver society as a metric to analyze Canadians’ understanding of “alternative futures” and the possible reception of new environmental policy.\footnote{Starrs, \textit{Canadians in Conversation about the Future}, 9.} This use of a category devised by an elite group of scientists to explore Canadians’ perception of the future underlines the popularity of the conserver society and the SCC’s impact on discussions of the environment and development in the 1970s. Environment Canada’s report revealed that Canadians had deep concerns about the future and a contradictory view of the government. They looked to their Prime Minister and cabinet to address environmental problems while expressing great skepticism in their leaders’ abilities.\footnote{Starrs, \textit{Canadians in Conversation about the Future}, 130.}
The study, however, offered almost no concrete policy recommendations to Environment Canada.

Despite this failure, the Advanced Concepts Center continued to make the conserver society central to its analysis of Canada’s future. In 1975, it began investigating what it called “environmentally appropriate technology,” in an attempt to assist the development of a conserver society.558 Echoing the SCC’s technical approach to sustainability, Advanced Concepts argued:

Because of [our] inability to live harmoniously with the natural environment, it should not be argued that we should simply leave all natural environments in the pristine state. While preserving nature is a worthy objective, we cannot live on the planet in large numbers without altering much of the environment. We must strive to change it from its original balanced and relatively stable state to a human-conductive and relatively stable system. What is being put forward here is not a simple technological fix. Rather, we are talking about technological tools and approaches with which we could meet the challenge of survival in the twenty-first century. Technology much be seen as only one element of a complex structure that comprises human society on the planet earth.559

This program of technological development was eventually transferred to the National Research Council and the EMR since it duplicated research undertaken there. Before this move, however, the Advanced Concepts Center, led by Robert W. Durie, helped to organize federal funding for the New Alchemists – the group that built the famous PEI Ark – and avidly supported these countercultural scientists’ melding of technology and nature.560 By borrowing the alternative approach to development that the SCC had outlined, Environment Canada engaged in government discussion of technological innovation and helped legitimate experimentation with sustainable development. The emergence of new centers of support for the conserver society would both help make it part of government policy and magnify its effect on environmental groups by becoming a means of generating discussion about alternative development.

559 McCallum, Environmentally Appropriate Technology, 4.
Drawing upon the conserver society to define its position, the EMR’s Office of Energy Conservation (OEC), which would soon be renamed the Conservation and Renewable Energy Resources Branch, also championed energy conservation in the mid 1970s and succeeded in making conservation a small, but important, part of Canada’s 1976 energy strategy. Anxious to publicize its success and the continued centrality of both conservation and environmental protection, the OEC even published a newsletter, *The Conserver*, which it circulated at the EMR. Modeled on *Conserver Society Notes*, *The Conserver* informed the bureaucrats and ministers who read it of the regulations the EMR enacted to curb energy consumption and suggested future conservation policies. One newsletter also included editorialized excerpts of one of David Brooks’ articles in which the director of the OEC laid out the necessity of energy conservation and the need for the federal government to embrace a leadership role. While it is difficult to gauge if the newsletter made a significant contribution to policy, the employment of the conserver society as a concept around which to organize discussions of energy policy and argue for sustainability suggests the SCC’s idea reframed policy makers’ discussion of energy development and expanded it to include renewables and sustainability.

As noted above, the conserver society called for technological sovereignty, a cause that had some support within the Liberal party as the Trudeau government attempted to regulate foreign ownership and champion national industrial projects. Employing the conserver society to advocate for the development of Canadian renewable energy industries - in effect sneaking conservation in by way of national development - would become a preoccupation of environmental groups in the 1970s. As the later chapters will show, this approach achieved a substantial degree of success when the federal government eventually committed hundreds of millions of dollars to development programs for renewables by the end of the decade.

While bureaucrats used the conserver society to outline alternative approaches to energy development, the SCC employed it to expand Canadian environmental politics to include energy development. Perhaps the most far reaching of the Council’s initiatives

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was one undertaken in its *Conserver Society Notes*. For this publication, the SCC drew on the same network of countercultural environmentalists the Campbell government used in 1974 to outline its program of alternative development. In late 1975, the SCC invited a member of Friends of the Earth and well-known energy analyst, Amory Lovins, to help the Council and the OEC study Canada’s energy future. Lovins, much like the SCC, focused on the problem of limits and approached the environment through systems analysis. He also championed technical solutions, which coincided with the SCC’s effort to address environmentalism from within the confines of the Trudeau government’s scientism. Lovins and his contributions to Canadian environmentalism and sustainable development will be examined in detail in a later chapter, but it is important to note that his work shaped arguments for the development of renewable energy in Canada in the late 1970s. By bringing him to Canada and assisting his research, the Science Council made a strong commitment to generating debate about Canada’s energy and environmental future. It also provided very public assistance and a degree of legitimacy to a high profile environmentalist who had ruffled more than a few feathers, particularly among advocates of nuclear energy.

Environmentalists in Canada also responded to the SCC’s efforts to define sustainable development and adopted the conserver society as both a principle to organize around and an alternative method of development through which to analyze government policy. In the mid-1970s a broad range of environmental groups, from Friends of the Earth Canada to the back-to-the-landers at the countercultural *Harrwsmith* magazine, embraced the conserver society. The Toronto based sister organizations Pollution Probe and Energy Probe also avidly adopted the conserver society. The two were the leading Canadian environmental organizations at the time, which magnified the

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significance of their decision to embrace the SCC’s work.\textsuperscript{569}

In a report to the Royal Commission on Electrical Power Planning, for example, Energy Probe drew on the conserver society as well as the work of David Brooks to argue that conventional energy policy was the fundamental cause of the energy crisis.\textsuperscript{570} According to the report, government and corporate policy had encouraged Canadians to use energy inefficiently, thus wasting Canada’s natural bounty. Repeating the SCC’s calls for efficiency and echoing the \textit{Conserver Society Notes}’ indictment of materialism, Energy Probe recommended that Canada become a conserver society and immediately fund the development of renewable energy.\textsuperscript{571} Further underscoring the SCC’s influence, Energy Probe’s report extensively examined the importance of planning and argued that more accurate long-term forecasting incorporating “a wide range of socioeconomic indicators” presented the best hope for a more rational and effective energy policy.\textsuperscript{572} The environmental group seems to have assumed that any policy that both protected the environment and enabled long-term stability would require rational planning and substantial government intervention.

It was Pollution Probe, however, which fully engaged with the conserver society’s attempt to refashion development around environmental limits. In its 1976-1977 statement of objectives, the Pollution Probe Foundation stated it would undertake a program “to promote and demonstrate the conserver society ethic.”\textsuperscript{573} The conserver society was to be the centerpiece of its environmental advocacy as it focused on more efficient resource management and the development of renewable energy in Canada. Pollution Probe even planned a “conserver education” program in Toronto that emphasized the problems of waste and over consumption, central themes in the SCC’s own attempts to educate Canadians about sustainability.\textsuperscript{574}

\textsuperscript{571} Crow, Szegedy-Maszak, and Conway, \textit{Energy Planning in a Conserver Society}, 86
\textsuperscript{574} Pollution Probe Foundation, “Objectives: 1976-1977.”
As part of the Pollution Probe Foundation’s efforts to popularize the conserver society and pressure the government, one member, Lawrence Solomon, carefully constructed a detailed argument for the conserver society in the group’s book *The Conserver Solution*. Seeing the conserver society as the best method of reconciling Canada’s environmental and economic needs, Solomon introduced the concept to his readers by stating:

[The conserver society] is the only basis for sustained economic growth. Without assured supplies of energy (which we no longer have) and assured supplies of mineral resources (which we no longer have) economic growth cannot be assured. Our progress is illusory – woefully short-term and won at the expense of some other part of our system. Conserver principles only reconcile our environment with our economy; our ends with our means. Having a base from which we can progress without later being pulled back can let us systematically solve our present economic problems – unemployment, inflation, and our foreign debt – while assuring a sound future economy.  

This focus on the conserver society as both an economic and environmental program continued as Pollution Probe built on the SCC’s assertion that investing in conservation technology and a renewable energy industry would have substantial economic and social benefits. The environmental group, for instance, echoed the SCC’s concerns about the lack of industry and scientific research in Canada and similarly pointed to renewables as a profitable area of emerging technology in which Canadians could become world leaders with the right system of government support. Environmental and social progress, in short, relied on technological development and long-term planning, which in the view of Pollution Probe, the state had a duty to provide.

**Conclusion**

This chapter has reframed the analysis of Canadian environmentalism around the influence of the SCC and national debates over economic development. This rethinking challenged the view that the Canadian state had little influence on the environmental movement and asserted that government ideology and national politics shaped Canadian

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environmental concerns. This analysis of environmental politics reveals that, in fact, the Canadian government, through its employment of science and its efforts to plan economic development, played an important role in environmentalism by encouraging environmental groups to express their arguments using economics, nationalist sentiments, and technical knowledge. As a result, this technocratic, but anti-consumerist, approach to environmentalism shaped Canadian environmental politics and the discussion of sustainability in the 1970s.

My reframing leads to several conclusions important to the history of environmentalism. It reveals a new group of historical actors – government advisors – who, with the financial and institutional support of the state, analysed Canada’s environmental future and suggested ways of mitigating environmental destruction. The resulting advice, although not always accepted, encouraged debate over alternative policies and acted as a source of support for experimental projects, such as Environment Canada’s environmentally appropriate technology research. Perhaps more importantly, these well-financed and largely independent centers of policy analysis contributed substantially to public discussion of issues, namely Canada’s national development and its environmental prospects. The SCC’s conserver society, while undeniably technocratic and skewed towards the interests of scientists and engineers, helped introduce Canadians to the question of sustainability and generated discussion of the country’s economic, social, and environmental future and the potential consequences of varying policies. Finally, these government advisors provided direct and indirect support to Canadian environmentalists. The SCC’s decision to bring a member of Friends of the Earth to Ottawa and to provide Lovins with information and funds to enable his analyses of Canada’s energy future contributed substantially to Canadian interest in renewable energy. In fact, as I will discuss in chapter five, the SCC decision to subsidize Lovins’ analysis would shape both environmentalists’ and bureaucrats’ view of renewables and help lay the foundation for generous funding of solar energy in the late 1970s. Although they remained outside of the Canadian environmental movement, the Science Council and other government advisors deeply affected environmental politics as they defined an authoritative vocabulary for environmentalists to use, created space where development policy could be debated, and assisted environmentalists’ efforts to challenge
unsustainable economic policies.

My building on my highlights the significance of the Trudeau government’s efforts to incorporate scientific knowledge into policy and plan Canadian development. This chapter illustrates how the postwar desire to use science as an engine of economic growth and rationalization and the belief that the proper application of science could improve Canadians’ lives ran framed the SCC’s work. Ironically, the SCC’s technocratic approach, particularly its adoption of systems analysis and long-term forecasting, motivated its criticism of Trudeau’s policies and its move toward sustainability by demonstrating the impossibility of endless growth in a finite system, a conclusion reached in a similar manner by many environmental groups, including the Club of Rome. As this analysis pushed the SCC towards this sobering conclusion, the Canadian state’s emphasis on planning also provided a potential solution, and the SCC championed the abandonment of the politics of growth and a shift to a system of state encouraged conservation and sustainable development. In short, the Trudeau government’s ideology of “rational management,” with its privileging of technical knowledge and planning over politics, framed Canada’s engagement with sustainability in the 1970s.\footnote{Peter Aucoin, “Organizational Change in the Machinery of Canadian Government: From Rational Management to Brokerage Politics,” \textit{Canadian Journal of Political Science} 19, 1 (March 1986): 3-27; Richard French, \textit{How Ottawa Decides: Planning and Industrial Policy Making, 1968-1984} (Toronto: James Lorimer & Co., 1984).}

Finally, this chapter highlights the importance of politics, particularly nationalism, to Canadian environmentalism in the 1970s. Sustainability was more than a means to ensure Canadian society would exist long into the future. It presented a method of asserting Canadian economic and intellectual independence from the US. For the SCC and its many supporters, the conserver society imbued sustainable development with a restorative quality. The possibility of creating new, Canadian owned industries and sovereign technologies made the proposed conserver society a world of exciting innovation, which promised greater social equity rather than a world of limits and diminished expectations. While this view was not without its strident critics, it illustrates the significance of the broader national context in which the concept of sustainability developed. Although a reflection of global environmentalism, Canadian environmental politics were national. Making sustainability palatable challenged advocates of renewable
energy and ecological design in the 1970s. The fashioning of sustainability as a means of economic and social, as well as environmental, rebirth runs through the next chapter’s analysis of John Todd and the New Alchemists. In a manner similar to the SCC’s development of the conserver society, these environmentally concerned scientists drew on a combination of NASA research and appropriate technology to present sustainable development as a quest for progress. Led by Todd, the group would mobilize both the support of environmentalists and both levels Canadian government for their space age Ark.
Chapter 4:
A Quest for Permanence: John Todd and the New Alchemy Institute

“Eco-Catastrophe!” screamed the title of Paul Ehrlich’s jeremiad in the September 1969 issue of *Ramparts*. In the scenario Ehrlich imagined, pesticides killed the oceans as population growth, food shortages, and pollution unleashed calamity across the globe. Among the millions frightened by Ehrlich’s grim prediction were ethologist John Todd, his wife Nancy Jack, and his friend and colleague ichthyologist William McLarney. Fed up with the “doom watch” biology he practised at San Diego State University, which only allowed him to catalog the biosphere’s ills and mainstream society’s increasing destructiveness, the group decided to take action and attempt to save the world from eco-catastrophe.

Determined to help Americans and Canadians live within the world’s ecological limits, Todd and McLarney founded the New Alchemy Institute (NAI) and incorporated it as a non-profit scientific institution in 1970. The NAI’s articles of incorporation stated it would “engage in scientific research in the public interest on ecologically and behaviourally planned agriculture systems [and]…on methods to reduce environmental contamination and to restore natural waters and landscapes.” Led by Todd, the countercultural scientists of the NAI imagined an environmentaly sustainable future and, going a step further than most, designed and built the technological systems they believed would make such a future possible. In the 1970s, Todd and the New Alchemists pioneered “living machines,” highly efficient systems of greenhouse aquaponics, and constructed their iconic Ark bioshelters. By the 2000s, Todd’s living machines were

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581 New Alchemy Institute, “Articles of Incorporation,” San Diego, California, 1970, Box 1, Folder 11, New Alchemy Institute (NAI) Records, ISUSC. Todd, being a Canadian, hoped his work would influence all of North America.
582 New Alchemy Institute, Articles of Incorporation, NAI Records, ISUSC.
adapted for biofiltration and urban farming, but perhaps more importantly his work helped to define and launch the ecological design movement.\textsuperscript{584}

The New Alchemists’ embrace of a techno-ecological sublime challenges the dominant understanding of both environmentalism and the counterculture. Charles Reich’s and Theodore Roszak’s description of the counterculture as a “subversion of the scientific world view” has defined it as suspicious of science, particularly anything produced by the big science of the Cold War military industrial complex.\textsuperscript{585} Similarly, Roszak and other scholars have suggested that an almost religious concern for wilderness and an antipathy for technology bordering on anti-modernism defined environmentalism.\textsuperscript{586} As a result, scholars present countercultural environmentalists in two primary ways: as indolent apolitical hippies communing with nature on isolated communes or as angry radicals out to tear down North America’s techno-scientific systems and declare the idea of human progress misguided.\textsuperscript{587} While there is some truth to these depictions, they tend to perpetuate an oversimplified understanding of both. Most problematically, such representations assume countercultural environmentalists always conceptually divided nature and culture and attempted to protect some iteration of pure nature from the invariably corrupting influences of humans and technology.\textsuperscript{588}

Todd and the New Alchemists rejected the idea of pure nature, and they employed science and technology to construct a sustainable fusion of human culture and the non-human environment. Expanding on my contention that the state actively influenced environmentalism and environmentalists employed extensive and complex technical


\textsuperscript{588} The examination of the tangled existence of nature and culture has been a major theme in environmental history since the 1990s. See William Cronon, “The Trouble with Wilderness; or, Getting Back to the Wrong Nature,” in \textit{Uncommon Ground: Rethinking the Human Place in Nature}, ed. William Cronon (New York: W.W. Norton & Co., 1995).
knowledge, this chapter examines the New Alchemists’ merger of technology, nature, and humanity to construct an alternative to declensionist forms of environmentalism and countercultural rejections of science.\(^{589}\) Todd’s combination of scientific knowledge and ecological vision defies easy analysis as it straddled the lines between futurology, scientific optimism, and catastrophic environmentalism. Todd embraced environmentalist concerns about ecological catastrophe and actively criticized mainstream applications of big science as a central cause of social and environmental problems. Yet he also grounded his work in painstaking research, developed new technologies, and tirelessly promoted his optimistic vision of technologically mediated sustainability.

W. Patrick McCray’s concept of “visioneering” offers a particularly useful lens through which to approach Todd’s seemingly contradictory mixing of science, environmentalism, and imagination. McCray devised the concept to analyze Gerard O’Neill’s and K. Eric Drexler’s optimistic attempts to design, produce, and promote space colonies, nanotechnology, and a limitless future. He describes visioneering as:

- developing a broad and comprehensive vision for how the future might be radically changed by technology, doing research and engineering to advance this vision, promoting one’s ideas to the public and policy makers in the hopes of generating attention and perhaps even realization.\(^{590}\)

Todd and his New Alchemists did exactly this as they attempted to define and engineer a sustainable future. Todd and visioneer O’Neill also belonged to the same community of technological optimists and pragmatic environmentalists connected by networks surrounding Stewart Brand’s \textit{Whole Earth Catalog}.\(^{591}\) Although Todd’s ultimate goals differed, he shared O’Neill’s optimistic belief that new “technologies could shape future societies, upend traditional economic models, and radically transform the human condition.”\(^{592}\) Todd also possessed a similar charisma and willingness to tirelessly


\(^{592}\) McCray, \textit{The Visioneers}, 10.
promote an alternative vision of the future.

The lens of visioneering allows me to broaden the history of the counterculture as I examine Todd’s work by emphasizing the significant influence that science, particularly NASA’s big science research, had within the counterculture. This approach also highlights the importance some environmentalists attached to the concept of progress and illustrates how they adapted the idea commonly associated with endless expansion to a world characterized by environmental limits. Finally, by approaching Todd as a visioneer, this chapter takes seriously the difficulties of financing research and underlines the close connections between the countercultural environmentalists and mainstream funding organizations and governments. Much like O’Neill and Drexler, Todd was a scientist on the margins with radical ideas for how to save the world. To legitimize his ideas and make his vision concrete, he founded institutions and built networks of intellectual and financial support that connected the counterculture to the mainstream. These links illustrate how the relationships of cooperation between countercultural environmentalism and governments that I have discussed in the previous chapters emerged from Todd and others who used scientific and technical expertise to make a place for their ideas within the broader technocratic political discourse of the 1970s. This network of countercultural environmentalists and government advisors provided states with new ideas and, by the end of the decade, came to dominate discussions of renewable energy and sustainability.

My examination of Todd and the New Alchemists’ employment of scientific knowledge and their construction of networks of support, including the Canadian government, proceeds in five short sections. I begin with the construction of the New Alchemy Institute on Cape Cod. The Institute, part commune and part research institution, provided these countercultural environmentalists with a springboard from which Todd could enlist the financial support required to experiment with sustainable technologies. The second and third sections analyze how Todd melded ecologically based, “small is beautiful” rhetoric with NASA research into an optimistic vision of

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technologically mediated sustainability and employed this vision to gain support from members of the counterculture, elite private donors, and the Canadian and American governments. Turning from the New Alchemy Institute’s knitting together of this network of support using Todd’s rhetoric and scientific credentials, the fourth section examines the PEI Ark. In chapter two I discussed the substantial hopes for provincial development the Campbell government placed on the Ark as the centerpiece of its sustainable development program. To Todd and the New Alchemists, however, it represented an opportunity to experiment with “biotechnic” systems and the potential of NASA cabin ecology to moderate human impacts on the environment. These conflicting desires would lead to an unhappy rupture between the province and the countercultural environmentalists of New Alchemy when their research conflicted with the public demonstrations the province wanted and failed to live up to these the group's promises. The final section continues the story of New Alchemy and the Todds’ work by examining the continued development of the systems he pioneered in the Ark and concludes that his work played a small, but significant, part in the development of what Michael Bess has called the “light-green society.”

**Building the New Alchemy Institute**

Immediately after founding NAI in 1970, John Todd, Nancy Jack Todd, and William McLarney left San Diego for Woods Hole, Massachusetts. Todd and McLarney joined the prestigious Woods Hole Oceanographic Institution on Cape Cod to undertake intensive research away from the demands of teaching and administration. The three, however, did not give up on their nascent institute or their desire to save the world. After settling on Cape Cod, the small group quickly found a run down eleven-acre farm near Woods Hole where their Institute could at last take on physical existence. An assortment of similarly concerned scientists and graduate students, as well as a cross-section of organic agricultural devotees, countercultural tinkerers, and architects joined the Todds and McLarney to staff the NAI over the course of the 1970s. Their research

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focused on renewable energy, principally solar and wind power, small-scale organic farming, primarily greenhouse vegetables, and aquaculture, which the group gradually combined with hydroponics to produce fish and leafy greens as efficiently as possible.

Starting in 1971 the Todds, McLarney, their friends and colleagues, and an assortment of back-to-the-land enthusiasts began building the physical structures of the NAI. The Institute began with a dilapidated barn, overgrown fields, and scavenged refrigerators serving as aquaculture tanks. This institute of countercultural science started to take physical shape in the first year, when the group assembled a geodesic dome greenhouse for year round aquaculture and agriculture experiments.\(^{597}\) As historian Peder Anker has noted, these geodesic domes represented the iconic structures of the counterculture, and their designer, R. Buckminster Fuller, became something of a countercultural visionary and a leading populariser of efforts to conceive of the earth as a vast spaceship requiring careful scientific management.\(^{598}\) True to the countercultural style of the Institute, the construction of the first large geodesic dome involved a barn rising in which communards and hippies, including one experienced dome builder called Multi-Facet, gathered to assemble the conspicuous structure. Soon the New Alchemists and their friends had built multiple greenhouses and geodesic domes, laid out fields, dug fishponds for their tilapia and trout, and even designed and built a series of water pumping and electricity generating windmills.\(^{599}\)

Around these structures grew a staff of researchers determined to “restore the lands, protect the seas, and inform the earth’s stewards.”\(^{600}\) In many ways, the Institute became a New Age Mecca. Officially rejecting the hierarchical organization of academic science, the NAI adopted a flat organizational structure based on the participatory models of the New Left and the communes of the counterculture that made all members equal.\(^{601}\)

\(^{600}\) This was the NAI’s motto throughout the 1970s. John Todd, “Introduction,” *New Alchemy Institute Bulletin* 1 (Fall 1970): 1.
\(^{601}\) John Todd, “Realities from Ideas, Dreams and a Small New Alchemy Community,” *New Alchemy Newsletter* 2 (1973): 5-6. For a discussion of the participatory models of the New Left and the
This official equality attracted a number of communards, students, and young scholars who shared the group’s environmental and social concerns and their optimistic view of science and technology. Research projects were to be undertaken voluntarily and to be the specific responsibility of the individual who initiated them. To make decisions that involved more than one New Alchemist and to provide a minimal degree of accountability, weekly meetings with mandatory attendance were organized. Adhering to the New Left models, each member participated in all decisions. Unsurprisingly, these meetings often became disorganized and lengthy affairs. Nancy Jack Todd, the group’s official record keeper and the editor of the *Journal of the New Alchemists*, pointedly observed that William McLarney had a habit of nodding off when group discussion did not involve aquaculture.602

Figure 11: A Map of the New Alchemy Institute on Cape Cod in the late 1970s. Note the multiple Geodesic domes, fishponds, and windmills as well as the old farmhouse.

*Journal of the New Alchemists* 5 (1979)

In John Todd’s view, the interconnected nature of ecological systems and the holistic philosophy of Taoism inspired this attempt to integrate science and society in a counterculture, see Francesca Polletta, *Freedom is an Endless Meeting: Democracy in American Social Movements* (Chicago: University of Chicago Press, 2002), 122-130 and Timothy Miller, *The 60s Communes: Hippies and Beyond* (Syracuse NY: Syracuse University Press, 1999), 67-69, 89-90.  
holistic community. The group even decorated its first newsletter with a Taoist yin-yang symbol.603 Similarly, the name “New Alchemy” referred to medieval and early modern practices of science, which Todd and McLarney believed approached knowledge construction from an interdisciplinary perspective better suited to solving the world’s environmental problems.604 In effect, the NAI imagined itself as an egalitarian and holistic commune bringing together scientists, engineers, and philosophers to save the world.

The combination of optimistic scientific and technical research with a lighthearted countercultural vibe almost immediately drew visitors. Soon after the first Dome took shape and the New Alchemists began their “biotechnic” research, a menagerie of hippies, back to the land groups, and curious middle class families began to appear at the NAI. Ever on the lookout for assistance, the New Alchemists often put visitors to work weeding or helping to construct or repair greenhouses. As the number of visitors continued to grow in 1973-1974, the New Alchemists abandoned this informal practice and organized official tours every Saturday. This schedule allowed the New Alchemists to focus on their research during the week and then provide a carefully structured tour capable of showing off their recent projects and providing brief talks on the wider value of holistic science and the importance of sustainability.605 Even as the tours became structured and educational, the countercultural feel remained in the form of post-tour potluck lunches and informal conversation with guests and New Alchemists.

The reality of the NAI, however, diverged substantially from this ideal of equality and holism. Contrary to the NAI’s rhetorical commitment to egalitarianism, Todd dominated the Institute. His ideas defined it, he led its research, and he was its public face. One could accurately think of Todd as a sort of guru who blended scientific expertise and countercultural concern while leading a band of friends and followers in a quest to save the world.606 Todd actively embraced the persona of the countercultural

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604 Letter from William McLarney to New Alchemists, “What NAI Means,” Box 38, Folder 12, NAI Records, ISUSC.
606 As Miller notes, a dominant charismatic leader was common among countercultural groups, even though
guru as he experimented with ideas and tried to generate support for the NAI’s work. With shoulder length blond hair, an intense manner, and a penchant for hyperbole, he certainly looked and sounded the part. Allusions to Taoism and extensive discussions of society’s potential for improvement through a holistic approach and the right technology further accentuated his guru like qualities.607

Todd, however, was far more than a countercultural guru able only to turn people on to the holistic reality of the world. He had considerable successes in academia. Todd, who grew up near Hamilton, Ontario, had been intrigued by sustainable farming from a young age, and he studied agriculture during his undergraduate studies at McGill, but pursued biology at the University of Michigan under the guidance of Marston Bates.608 Todd’s doctoral research, which examined how DDT pollution damaged the communal behaviour of fish, was well received and published in *Science*.609 At San Diego State, he became the dean of biology while still in his thirties. Todd remained active as a scientist throughout the 1970s and beyond. He worked at the prestigious Woods Hole Oceanographic Institute early in the decade, participated in most NAI experiments, and oversaw further research into his living machines in the 1980s and 1990s. Todd’s charisma and scientific expertise created a potent combination. Andy Wells, who worked closely with Todd on PEI, remembers him as an absorbing speaker and compelling thinker who seemed to possess the technical knowledge to support his big ideas.610 This willingness to think big and undertake highly experimental research coupled with a talent for self-promotion would be the foundation of Todd’s success.

**Todd’s Vision**

Todd’s visioneering began in earnest with the publication of his paper entitled “A Modest Proposal.” As his wife, Nancy Jack, later remembered, this article, published in 1971 in the thick sepia toned and yin-yang bedecked pages of *New Alchemy Institute*

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607 Todd, “Pioneering for the 21st Century: A New Alchemist’s Perspective.”
610 Alan MacEachern, Andy Wells interview, July 27, 1999, Series 11 Alan MacEachern interviews, IMR Fonds, PEIPARO.
Bulletin, generated national interest in the group for the first time and defined the
Institute’s goals and approach.611 The self published New Alchemy Institute Bulletin, New
Alchemy Newsletter, and Journal of the New Alchemists functioned as the primary means
through which the NAI presented its research and Todd’s ideas to supporters. A
membership fee designed to help generate revenue for the NAI’s research supported their
publication. These journals were advertised by the iconic Whole Earth Catalog and seem
to have helped the NAI gain supporters and generate revenue.612 Specific articles, such as
“A Modest Proposal”, circulated widely, but it is difficult to say if other articles received
substantial exposure within the counterculture.613 Instead of advertising the NAI, these
publications functioned primarily as a repository of its research and ideas that the group
could send to prospective supporters and charitable organizations as examples of its work
and future plans.

Figure 12: Dr John Todd in 1974


Institute, Inc, 1971), 180.
613 The NAI’s records provide very little information about their publication practices or circulation of their
journals and newsletters or those who subscribed to them. Some documents, however, mention the journals
were used to assist with fundraising efforts.
In “A Modest Proposal,” Todd accomplished two things. He embraced science and technology as a means of positive environmental change, and he outlined a vision of a sustainable society. This image would guide his work and gain him support throughout the 1970s and beyond. View ing earth through the eyes of an “ecologist-philosopher” from another planet, Todd began his article as a classic environmental narrative of decline. Borrowing from systems ecology and the language of the space age, he identified the loss of “the required amount of biological variability in our life-support bases” as a serious threat to environmental stability and human society.

According to Todd, this loss of diversity resulted from human ignorance and disregard for the fundamental laws of ecology. Pointing to agribusiness, Todd argued that large-scale industrial science had carefully removed diversity from ecological systems through its narrow search for productivity and control. In his view, this disregard for ecology’s basic law – diversity produces stability and uniformity produces instability – ensured that the distorted systems North Americans relied upon for their sustenance would collapse. Riffing on the counterculture’s critique of the large-scale technology and the concentrated bureaucratic power of the military-industrial complex, Todd added an ecological twist by likening them to the monocultures of agribusiness and connecting the cultural alienation and instability that resulted from social conformity to the ecological instability that resulted from uniformity. Ecology, in Todd’s view, provided a means of addressing both social and the environmental problems.

After describing the world’s ecological problems, Todd shifted gears to provide readers with an optimistic model for creating the sustainable communities of the future. Extolling a techno-scientific solution, Todd imagined a technological system that combined renewable energy and intensive organic agriculture and aquaculture to provide food and energy to a community without damaging the environment. Carefully modeled

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614 Kirk, Counterculture Green, 158. Visioneers also used the trope of the frontier to depict space as a place possible to colonize and the crucible of a new American society. See McCray, The Visioneers, 68-72.
on leading ecologists Eugene and Howard Odum’s studies of natural ecosystems, Todd’s proposed “biotechnology” included plants, animals, and fish to create a technologically mediated stable climax ecosystem. Human users also had a central palace in Todd’s eco-technology by actively moving nutrients throughout the system. They would employ technology to ensure each feedback loop functioned effectively. Managing such hybrid systems would, in Todd’s view, allow users to gain ecological knowledge and become both users of nature’s resources and agents of the biosphere’s overall stability.

Todd’s vision of sustainability drew heavily on perhaps the most iconic product of Cold War Big Science in the 1960s: the NASA space program. As part of the Apollo program, NASA adapted earlier experiments with enclosed environments on submarines and bomb shelters to the challenges of keeping astronauts alive for long periods by experimenting with self-sustaining space capsules. These efforts to understand and minutely control human/machine/environment interaction to create a stable feedback system of “cabin ecology” provided the basis for Todd’s “biotechnical” system. Imagined as something similar to a space capsule, Todd’s “biotechnology” was supposed to function as a complete system capable of both providing sustenance for its users and recycling their waste. In effect, Todd’s vision took Kenneth Boulding’s idea of “spaceship earth” literally and imagined community-sized systems, which merged technology and biology, as the foundation of a future sustainable society.

To Todd these “biotechnological” systems offered a means of transforming America through a re-colonization of the North American landscape. Todd thought of North America as a landscape doomed to ecological and social collapse by resource depletion and pollution. Echoing and inverting contemporary ideas of space as a new frontier where Americans could revitalized their society through the potential of

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technological liberation, he redefined the troubled North American landscape as a frontier ripe for the spread of new technologies and ecological science. In his view, this new terrestrial frontier offered possibilities for reinvention similar to those of space, since it would unleash the energy of twenty-first century pioneers who would use his “biotechnical” systems to create a truly sustainable society and ensure humanity a permanent place on spaceship earth.

Todd’s embrace of the visioneering principle that the “future might be radically changed by technology” and his merger of machine and nature contradicts approaches to environmentalism that attacked technology and sought to protect nature from human influence. His thinking, however, had a substantial following within countercultural environmentalism. As Kirk argues, a significant part of the counterculture saw technology as an effective means of preserving the environment and achieving social change. In particular, this minority believed that technology could transform humanity’s relationship with the environment by mediating human interactions with nature. Thus, rather than representing an apolitical disengagement from society, the technological experimentation of these countercultural groups was a carefully chosen means for them to attempt to transform America and Canada. Defining technology as the key to saving the environment, Todd asserted that his integrated “biotechnic” systems provided the most effective means of “re-establishing [a] much needed link with the organic world” and creating a sustainable future.

Combining big science research, environmentalism, and technological optimism, Todd’s vision internalized several fundamental contradictions, notably the centralized political power represented by big science and the desire for decentralization expressed by the counterculture and the back to the land movement. Todd, for example, criticized big science when used by the military or agribusiness, while he adopted NASA research and Eugene and Howard Odums’ ecosystems ecology, which originated from their efforts to trace radioactive material through the environment for the Atomic Energy

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627 Todd, “Pioneering for the 21st Century.”
628 Kirk, “Cosmic Bricoleurs.”
The Odums themselves, particularly Howard Odum, further enhanced the technocratic politics of their ecological theories as they suggested that ecology’s ability to model and, in theory, manipulate systems enabled the management of both human society and the natural environment to ensure environmental suitability. Indeed, a fundamental conclusion of their work held that the feedback between humans and the environment necessitated careful scientific management of this interconnected system.

While reasonable from their point of view and perfectly in tune with Cold War rationalism of the period, this approach flies in the face of Theodore Roszak’s understanding of the countercultural and environmental movements as anti-technology and deeply suspicious of centralized authority.

The New Alchemists’ reliance on big science as well as its connections to ecology, a central foundation of environmentalism, highlights the influence of Cold War science within the counterculture and environmentalism. The network of groups the NAI worked with avidly employed the knowledge produced by big science projects while at same time criticizing big science and associating with radical back to the land groups that rejected any centralization of power. While such contradictions should not be ignored, neither should they be used to dismiss or marginalize Todd and other pragmatic countercultural environmentalists simply because these groups defy easy categorization. Their willingness to borrow and combine contradictory ideas enabled their creativity and the pragmatic solutions they offered in the 1970s. Instead of rejecting or attempting to escape the influence of big science, Todd and others attempted to repurpose ideas and technologies to construct a workable alternative and paid little attention to intellectual provenance. In their view, the possibility of creating alternative technologies outweighed concerns about their underlying politics.

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632 For a broader discussion of the connections between Cold War science and ecology, see Kingsland, The Evolution of American Ecology.

633 Kirk, Counterculture Green, 16.
Building a Support Network

With his vision of an eco-technical future outlined, Todd set about promoting his work and building a network of support. An indispensible activity for any visioneer, as McCray argues, is the ability to imagine and shape the future. Todd’s work highlights the importance of the seemingly routine activities of building networks, seeking media attention, and generating financial support and suggests it had an important role in the success of pragmatic environmentalists. Todd proved highly skilled at all of these activities, and he built a support network that embraced the counterculture, environmental movement, as well as elite charitable foundations and government policymakers. Todd’s vision, hard work, and personal charisma, along with the NAI’s scientific research and eye catching publications, ultimately enabled the group to construct the technologies Todd hoped would make the New Alchemists’ “biotechnological” vision a reality.

Todd’s approach and his focus on the practical application of science and technology quickly gained him a following among the countercultural environmentalist community. Soon after publishing “A Modest Proposal,” Todd convinced the Rodale Foundation to fund the NAI’s research into organic agriculture. Writing in the Rodale Press’ Organic Gardening and Farming, Todd argued that an alternative to ecologically dangerous factory farming could only be created through intensive scientific research. Forming a small program of citizen science, Todd recruited gardeners and farmers across America to help him develop techniques of intensive aquaculture and organic pest control that he believed would enable the construction of self-sustaining enclosed ecosystems. These two research projects, first developed as part of this foray into citizen science, would play a central role in the NAI’s future as the Institute built on these experiments to construct an integrated approach to aquaculture and greenhouse agriculture. These efficient systems, which applied ecological feedback to management of intensive small scale fish culture and greenhouse gardening, would provide the foundation for the NAI’s

634 McCray, The Visioneers, 12.
“cabin ecology” approach to self-sufficiency through the recycling of almost all waste.

Another source of support for Todd’s research materialized when Steward Brand visited the NAI in 1973. Impressed by what he saw, as well as Todd’s plans to expand the NAI’s research to include solar and wind energy, Brand promised the NAI $16,000 in funding from the Point Foundation. After 1973, the NAI would continue to have a close relationship with Brand’s Whole Earth Catalog and the network of countercultural environmentalists and eco-pragmatists it supported. Todd, for instance, took part in the community’s debates over space colonies. His work also provided Brand with a useful example of the potential of the holistic merger of technology and ecology he advocated in the Whole Earth Catalog. In the late 1970s the two groups grew even closer when J. Baldwin, the editor of CoEvolution Quarterly, joined New Alchemy with the hope of helping the NAI commercialize the technologies it had developed.

The NAI’s research also received attention outside of the counterculture. In the early 1970s, international concern over environmental limits and ecological collapse exploded with the publication of the Club of Rome’s Limits to Growth and the Stockholm Conference on the Human Environment, and worries continued to grow with the oil shocks of 1973. Reporters began to arrive at the NAI with questions about what sort of solutions these extraordinary scientists and their solar heated fishponds might have for the world’s problems. In 1973, the New York Times reported that “a group of oceanographers” had managed to “create a decentralized, nature-loving, but still comfortable way of life.” Time and Science published similarly flattering reviews that praised the group’s commitment to design with ecology in mind. Todd did everything he could to expand this interest. According to David Bergmark, an architect who helped

638 Kirk, Counterculture Green, 145.
640 Kirk, Counterculture Green, 165.
design and build the NAI’s Arks, Todd succeeded. The crowds that came to see the NAI’s experiments with enclosed ecosystems included astronauts curious about space capsules and representatives of Du Pont who thought Todd might be interested in new transparent and durable plastics under development.645

The allure of Todd’s work spread to Canada as well. An article in the *Canadian Magazine* encapsulated the appeal of the New Alchemists’ research. It argued that Todd’s ecosystem approach might hold the best promise of future survival if energy and resource shortages actually occurred.646 Impressed by the NAI’s superefficient combination of aquaculture and vegetable production in geodesic greenhouses, Barry Conn Hughes suggested the group had found an alternative to the wasteful and energy intensive food production of industrial agriculture in his article “The World That Feeds Itself.” In 1974, Alex Durie, the director of Environment Canada’s Advanced Concepts Branch, traveled to Cape Cod to see the New Alchemists’ work firsthand and assess its relevance to Canada. He left convinced that Todd’s vision had great potential and the group’s research could help Canadians adapt to a future dominated by environmental limits.647 Through Durie, Todd and the NAI met other Canadian policymakers, most notably Andy Wells, and became an important part of the network of government advisors, scientists, and environmentalists that championed sustainability in Canada. As part of this network, Durie’s support would eventually play an instrumental role in the decision to provide the hundreds of thousands of dollars in federal funds necessary to build the Prince Edward Island Ark.

Anxious to impress visitors and potential supporters and ensure this positive publicity continued, the NAI started self-publishing the *Journal of the New Alchemists* in 1973. The *Journal* amalgamated different styles as it brought together DIY magazines, countercultural newspapers, and scientific journals in a single publication.648 Aesthetically the *Journal of the New Alchemists* resembled two classic countercultural magazines, the *San Francisco Oracle* and the *Great Speckled Bird*. It emulated their

645 Alan MacEachern, David Bergmark interview, July 29, 1999, Series 11, IMR Fonds, PEIPARO.
647 Letter to John Todd from Robert Durie, Re: visit to the New Alchemy Institute on Cape Cod, October 28, 1974, Background 1974-1981, Series 5, Sub-series 2, IMR Fonds, PEIPARO.
visual, even psychedelic style as unicorns, phoenixes, and fishes decorated its covers and Celtic inspired designs and artistic illustrations adorned its articles. The journal also lent physicality to the Institute with numerous black and white pictures. Printed in a large twelve by eight and a half inch format on thick paper and running close to a hundred and fifty pages on average, the publication represented a substantial investment on the part of the NAI.

The journal’s articles covered a range of topics. The majority presented detailed reports of John Todd’s, McLarney’s, and other NAI scientists' research in an academic tone and manner. For instance, in the second volume of the *Journal of the New Alchemists*, McLarney presented a short, but highly technical and extensively researched, article describing his work on midge larvae cultivation as a food source for the NAI’s aquaculture.649 The Woods Hole Oceanographic Institute, where McLarney and Todd worked in the early 1970s, actually funded this research since McLarney’s and Todd’s aquaculture experiments at the NAI overlapped with their professional scientific careers at Woods Hole. Along with these academic articles, the NAI also occasionally used the journal and its newsletters to give instructions for DIY projects, including windmills, integrated agriculture and aquaculture systems, and solar collectors.650 One early newsletter consisted almost entirely of carefully illustrated, step-by-step instructions for constructing a methane digester capable of turning waste into usable gas.651 Nearly every volume also included essays in which Todd expounded upon his vision of a sustainable future and fleshed out his theories of how humans, technology, and nature could be merged to achieve ecological permanence.652

For the New Alchemists, particularly Nancy Jack, the *Journal of the New Alchemists* was more than just promotional literature; it provided an outlet for her and the other New Alchemists’ artistic or philosophical side. Poems and short reminiscences, including Lawrence Ferlinghetti’s “Populist Manifesto: For Poets with Love,” filled the pages between articles about the NAI’s scientific research. Beyond presenting the New Alchemists and their work in detail, these additions enabled Nancy Jack to tell the group’s story as she catalogued the growth of New Alchemy and the trials this group of “earth gypsies” faced as the seasons changed their daily farm chores and their various research projects slowly developed. The journal also helped the New Alchemists to move beyond the directly scientific questions that animated the Institute. Nancy Jack, for example, published a thoughtful piece about feminism that connected women’s

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consciousness with the natural world. Finally, the *Journal of the New Alchemists* allowed the group, particularly Todd, to theorize about the place of their work within the network of countercultural environmentalists and its potential impact on North America. Along with the New Alchemists, other notable countercultural or environmental figures, including cultural philosopher William Irwin Thompson of the Lindisfarne Association and Amory Lovins, published articles in the journal.

The NAI’s investment in the journal, helped by Todd’s determination and salesmanship, paid off in the mid 1970s. With a beautiful and informative journal to present and a growing list of research projects to laud, Todd proved adept at impressing foundations and gaining financial support. By 1974, the NAI reached a two-year agreement worth $50,000 with the Rockefeller Brothers Foundation, along with pledges of support from other less prestigious foundations. Grants from the National Science Foundation and the Canadian government followed in 1975 and 1978. This growing support enabled a dramatic expansion of the NAI’s facilities, and new greenhouses, aquaculture tanks, and more advanced windmills and solar collectors soon appeared at the NAI. These grants also gave Todd the financial stability to leave Woods Hole and dedicate himself full time to making his vision of a sustainable future a reality.

The majority of this time and money went into research on enclosed ecosystems. Determined to better understand these systems and create technologies capable of integrating man into nature’s feedback networks, Todd turned to NASA’s experiments with self-sustaining ecosystems. To overcome the problems of long-distance space travel, ecologist Eugene Odum and other scientists attempted to design self-contained ecosystems capable of traveling the massive distances of space. Envisioned as “a little

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657 Letter to Michaela Walsh (Rockefeller Brothers Foundation) from John Todd, October 4, 1974, Box 26, Folder 21, NAI Records, ISUSC. Todd included a copy of the *Journal of the New Alchemists* with his letter asking for support.
658 Rockefeller Brothers Fund, “Proposed Grant to New Alchemy Institute,” December 6, 1974, Box 26, Folder 21, NAI Records, ISUSC.
piece of this biosphere,” space cabins were constructed as stable-climax ecosystems with a carrying capacity capable of supporting a small number of astronauts.661 Seeking to replicate NASA’s systems, Todd and the New Alchemists experimented with terrestrial versions of these space cabins. Building on their earlier research with the Rodale Foundation, the New Alchemists constructed “living machines,” large plastic cylinders of algae and herbivorous fish that employed hydroponic gardens for purification as plants filtered the nutrient rich water and returned it to the fish.662 This integrated system, which recycled wastes and provided food for human “passengers” of these terrestrial space cabins, would be the heart of the NAI’s bioshelters.

As the NAI’s resources and research expanded, Todd began crisscrossing North America to present his research and elaborate on his vision. Throughout the 1970s, Todd attended conferences ranging from a symposium on political ecology organized by anarchist Murray Bookchin in Vermont, to Denis Meadow’s more prestigious Limits to Growth ‘75 conference in Texas.663 Todd’s writings, research, speeches, and his circumambulations established him as an important figure within the small community of ecological designers and pragmatic environmentalists. Peder Anker, who has written extensively about ecological design, notes that Todd’s growing corpus of work with cabin ecology ably brought together ecological designers’ interest in cybernetics and ecology and placed him at the leading edge of the movement in the mid-1970s.664

Todd also used the NAI’s expanding research and his increasingly detailed vision of the future to gain the support of policymakers. In Canada, Todd leveraged his scientific credentials, the NAI’s expanding support network, and contemporary concerns over shortages to make his vision attractive to federal and provincial policymakers.

Anxious to impress, Todd highlighted the connections between his ecological designs and NASA’s cabin ecology. He explicitly identified his work as a “spaceship” approach and emphasized the high-tech character of his designs, which employed “micro-

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664 Anker, From Bauhaus to Ecohouse, 109.
computers” as “control elements.”665 According to Todd, his advanced designs could act as a sort of space-age ark to preserve entire communities, if energy supplies or resources started to run out. Impressed by Todd’s work, which he encountered at a conference in Ottawa, and well aware of Environment Canada’s support for his ecosystems approach, Wells brought Todd and the New Alchemists to the attention of PEI’s Premier, Alexander Campbell, who agreed Todd’s research might offer a possible solution to PEI’s dependence on expensive imported oil.666

Todd’s designs offered the provincial government more than an insurance policy: he promised they could reshape local economies by meeting the “food, shelter and power needs of urban and rural families” and provide the technology to found local wind energy and sustainable housing industries.667 This vision of ecological and economic transformation, coming from a successful scientist with his own institute, as well as the support of the ecological design community and the Rockefeller Foundation, fit perfectly with the desires of provincial and federal governments anxious to encourage regional economic development and favourably predisposed towards scientifically informed management. The New Alchemists’ assertions also corresponded to the efforts of the Science Council of Canada to advocate sustainable development as a means of creating new opportunities for both Canadian scientists and business people. In 1975, the Canadian government provided the NAI with land and promised all the financial support necessary to construct Todd’s proposed space age Ark on PEI.668

Todd’s ability to draw substantial support from diverse sources made the NAI’s research possible. The importance of mainstream funding sources to Todd’s visioneering challenges scholars’ belief that significant distance existed between mainstream science and the counterculture. Todd’s ability to generate both mainstream interest and financial commitments suggests that translation occurred in the area of ecological design as

666 Alan MacEachern, The Institute of Man and Resources: An Environmental Fable (Charlottetown, PEI: Island Studies Press, 2003), 23.
scientists moved between academic biology and the counterculture with the support of elite funding organizations. Nor were the projects of eco-pragmatists only the purview of grassroots or countercultural groups. The Canadian government played an instrumental role in funding one of the most important ecological design projects of the decade. Rather than separating themselves from the mainstream, countercultural scientists engaged in constant dialog as they both criticized and worked with mainstream institutions in an attempt to transform North America through the development and application of their eco-technology.

**Constructing Terrestrial Space Cabins**

Todd’s efforts to transform North American society reached their apogee with the PEI Ark. This Ark bioshelter stands as a milestone in ecological design in the 1970s, and its design and construction illustrates the popularity of NASA research among the counterculture as well as the ways in which environmentalists adapted the concept of progress to a limited world. The ecological design movement in the 1970s focused its efforts on recreating the modern home along ecological lines. Ecological designers, including Todd, believed that by refashioning this ubiquitous technology, they could transform the foundations of American society by reconnecting people with nature and providing the personal means to live in a sustainable manner. To re-imagine the home, these countercultural and environmentalist designers drew heavily on the spaceship earth concept popular in the 1970s.

The connection between space and ecological design had several foundations. One emerged from Stewart Brand’s own campaign for a photograph of the earth from space, which he hoped would transform humans’ understanding of their fragile planet and usher in an age of ecology. The work of Buckminster Fuller, the design guru for much of the counterculture, provided another connection to space through his popularization of the idea of “spaceship earth.” He even argued explicitly that the planet should be

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669 David Kaiser’s work demonstrates that translation also occurred between elite scientific institutions and new age groups to the benefit of both. See Kaiser, *How the Hippies Saved Physics: Science, Counterculture, and the Quantum Revival* (New York: W.W. Norton, 2011).

670 Anker, *From Bauhaus to Ecohouse*, 116.

managed according to the principles of NASA’s cabin ecology. Eugene Odum, one of the founders of systems ecology, gave this claim a stronger scientific foundation by applying systems ecology to human societies and asserting that American society could be managed in a manner analogous to a stable climax ecosystem on a space capsule. In fact, to Howard Odum, “the biosphere [was] really an overgrown space capsule” amenable to the same methods of scientific management. In effect, this “spaceship” approach to environmental problems assumed that living in harmony with nature was possible if one adopted the technology and lifestyle of astronauts and transitioned to the steady state economy of a climax ecosystem.

The New Alchemists used this “spaceship” approach to environmental problems to design and construct a series of unique bioshelters. The most advanced of the NAI’s “life support systems” was the PEI Ark. The Ark embodied the merger of human, machine, and nature that Todd had envisioned years earlier in “A Modest Proposal,” namely the idea of an almost completely self-sufficient system capable of providing twenty-first century pioneers with abundant food, comfortable shelter, and inexhaustible energy while restoring the surrounding environment. In sharp contrast to efforts to protect the environment by separating humanity and nature, the New Alchemists optimistically believed technology could solve environmental problems and allow humanity to overcome scarcity. The New Alchemists’ approach placed a heavy burden of high level performance on the technologies they developed and optimistically promised would protect the environment and overcome scarcity. Their entire program of transformation depended upon their success.

“Weaving together the sun, wind, biology, and architecture,” the NAI’s space cabin design fit contemporary concerns about limits perfectly through its promise to produce fish, vegetables, and energy efficiently, with almost no fossil fuel, by recycling...

672 R. Buckminster Fuller, Operating Manual for Spaceship Earth (Carbondale, IL: Southern Illinois University Press, 1969). For a critical discussion of Buckminster Fuller and his ideas, see Anker, “Buckminster Fuller as Captain of Spaceship Earth.”
674 Odum, Environment, Power and Society, 125.
675 Anker, “Ecological Colonization of Space,” 246.
676 Todd, An Ark for Prince Edward Island.
nutrients. To optimize its energy usage, the NAI carefully employed Howard Odum’s theories of energy flow to design the Ark along ecological lines. When constructed, the Ark’s feedback system was a living machine, which integrated a series of solar fishponds, a small greenhouse, a solar heating system, and water pumping and electricity-generating windmills. A barn-like plastic and wood structure sunken into the ground to maximize thermal efficiency enclosed these complex components. It also included a well-equipped three-bedroom house, a workshop/garage, and a laboratory for “21st century pioneers.” In effect, the Ark merged an ecological cabin with a suburban home to come as close as possible to being its own ecosystem, able to support its inhabitants comfortably and preserve spaceship earth.

In effect, the Ark merged an ecological cabin with a suburban home to come as close as possible to being its own ecosystem, able to support its inhabitants comfortably and preserve spaceship earth.

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Figure 14: Ark Bioshelter Energy Flow Diagram. In this energy flow diagram, the New Alchemists used Howard Odum’s cybernetic approach to ecology to conceptualize how their Ark might function as a stable ecosystem.


Excited by the construction of a structure which incorporated every aspect of his vision, Todd wrote a triumphant article entitled “Tomorrow is our Permanent Address”

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678 Angevine, Barnhart, John Todd, “New Alchemy’s Ark,” 42.
679 NAI, An Ark for Prince Edward Island.
680 NAI, An Ark for Prince Edward Island.
that described how his Ark could transform North America. According to Todd, the Ark was an “adaptive structure” which “optimized personal lives” through ecological design. 681 Embodying his attacks on destructive large-scale technologies and the alienating and emasculating influence of industrial society, Todd claimed the Ark functioned on the small-scale and enhanced local and personal self-sufficiency by providing food and energy. In his view, it also counteracted social alienation by directly involving its users in what he believed to be the most meaningful activities of all, providing for oneself and restoring the environment. 682 Todd also carefully pointed out that all these results could be accomplished because the NAI did not reject science, but rather “redefined it and redirected it” to achieve a “new synthesis” of human, technology, and landscape. 683

With this “new synthesis,” Todd reconceptualised progress to fit within the limits of spaceship earth. He asserted that temporal expansion could replace the physical expansion normally associated with exploration and suggested that ensuring human existence through sustainability would be as great an achievement as exploring new worlds. Similarly, he argued that a society rebuilt around his sustainable technology represented both scientific progress, particularly the extension of biology and ecology, and an improvement in the human condition, because Arks or similar technology helped people overcome their destructive artificial separation from nature and recognize their place in the greater holistic unity of nature.

Despite his optimism and discussion of sustainability as progress, the question of economic growth remained an unresolved tension in Todd’s work and ran through the larger network of environmentalists, scientists, and advisors that included the New Alchemists. The provincial government of PEI, for instance, explicitly identified renewable energy as an engine of economic growth. 684 For Todd and the NAI, the development and application of new technologies, not profit, was their primary goal. However, they were far from opposed to economic gain. They cooperated with J. Baldwin to attempt to commercialize their work in the 1970s, and they explicitly

681 Todd, “Tomorrow is our Permanent Address,” 89.
682 Todd, “Tomorrow is our Permanent Address,” 102.
683 Todd, “Tomorrow is our Permanent Address,” 90.
684 Andrew Wells (audio recording), “The New Alchemy Institute Ark in PEI and the IMR,” November 19, 1975, PEI Collection, UPEISC.
championed their technologies' potential to create new agricultural or power industries.

While the New Alchemists’ ambivalence towards growth may have been slightly out of step with government sponsors, it represented a widely held position in the 1970s. A debate between mass consumption and slow growth raged throughout the decade. In fact, nearly a third of Americans supported sustainability over growth in the 1970s and continued their support into the present. As I have mentioned previously, this debate drew heavily on the technical knowledge privileged by Cold War rationality and embraced by the Trudeau government in Canada. This political discourse made concern over environmental limits a respectable position, particularly when expressed as a scientific or management problem amenable to a technical or organizational solution. In this context, suspicion of materialism did not mean opposition to scientific progress or the improvement of the human condition. Rather, concern about future scarcity emerged and received substantial support from the highly technical discourse that characterized Canadian politics in the 1970s, as well as the results of military research during the Cold War. Ecological designers, including Todd, remained committed to improving the lives of those who used the technology they designed as they struggled to enable humanity to live comfortably within the limits of spaceship earth.

Unfortunately for Todd, only some of the technologies within the Ark performed as well as he had promised. In its first year of operation, the central component of the Ark, its living machines, worked well and produced fish, vegetables, and seedlings for reforestation projects. The systems with which the NAI had less experience, however, did not operate quite so effectively. The Ark’s solar heating system malfunctioned when piping connecting the solar collectors in the living area leaked, which caused a cascade of problems that undermined the rest of its heating systems. In fact, the structure’s complexity meant that managing its operation required a considerable degree of training and knowledge, an ironic result, considering Todd’s desire to produce technologies that individuals and communities could operate with little formal training.

As disappointing as this malfunction was, it did not compare with the failure of the Ark’s wind turbines. Developed by the NAI, the turbines employed a novel system that used hydraulics to control the blades and generate electricity. Despite their emphasis on experimentation and research, the New Alchemists did not test them in their rush to complete the Ark. Pierre Trudeau wanted to open the Ark in a grand ceremony in early September 1976, and not wishing to disappoint the Prime Minister, the New Alchemists rushed construction. Soon after the big event at which both Trudeau and Todd lauded the bioshelter’s potential, PEI’s high winds overwhelmed the untried turbines, and their hydraulics seized up. This failure forced the Ark to draw electricity from PEI’s grid, an ignoble result for a structure promoted as self-sufficient. The debacle badly damaged the credibility of the New Alchemists on PEI. The fact that the provincial government and the Institute of Man and Resources presented the turbines as the potential foundation for a local industry further compounded the failure.

This view of the Ark’s turbines points to a deeper reason for the disintegration of the relationship between the New Alchemists and PEI. From its founding, the mission of the Ark as well as its ownership remained a point of confusion. For Todd and the New Alchemists it was a private research institution managed by the New Alchemists, but funded by the government. In contrast, the provincial government saw it as a public structure designed to demonstrate sustainable living and help the IMR develop renewable energy technology. The differing emphasis on research and demonstration may not sound overly problematic. However, when thousands of people visited the Ark every year, and it became something of a pilgrimage site among the back-to-the-land movement, the New Alchemists could not find time for the research that they saw as the primary purpose of the Ark. Their attempt to deal with the problem as they had on Cape Cod, by restricting visitation to a single day, exacerbated the conflict as visitors and the provincial government replied that the structure, which they saw as publicly owned,

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690 Wells, “Discussion of the New Alchemy Institute’s ARK in PEI and the Institute of Man and Resources.”
691 Durie, “Technical Review Meeting.”
needed to be made available to carry out its educational mission. Because of this confusion, every minor setback became an occasion to bicker over how to use the Ark and what the New Alchemists did with their time.

When coupled with the growing hostility between PEI residents and the New Alchemists, the breakdown of the wind turbines became an inadmissible betrayal in the eyes of locals. This judgement may seem harsh for an experimental project, but was reasonable considering Todd’s promises of space age technology and new industries. For the poor province, the $354,000 in federal funds provided to build the Ark and the tens of thousands of dollars in annual costs rankled, and locals began to see the project as at best an expensive boondoggle. By 1978, the New Alchemists faced suggestions in the local press that they had wasted tax dollars and even swindled the Canadian government.

Frightened by collapsing local support for the Ark, the federal and provincial governments attempted to take a more active role in the project. To this end, they instituted strict controls on the New Alchemists’ budget. Todd and the New Alchemists, who had been enticed by the possibility of generous funding, resented provincial interference in what they saw as the NAI’s affairs, which they believed might threaten their world-saving research. After a year of internal struggles during which the provincial government and the IMR worked to rein in the New Alchemists’ spending, the purchase of a $21,000 computer for monitoring the Ark’s feedback systems became a point of conflict, and Todd asserted that he had never been informed of these limits. As a result, the NAI and the IMR broke irrevocably. Taking a parting shot at the government that had recently lavished support on him, Todd told the local paper that the parochial province would regret abandoning the opportunity he had provided.

The IMR took over the Ark and operated it as a research and public

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692 Memo from David Catmur to Nancy Willis, “Re: the organization of the Ark,” 4 July 1977, Series 5 sub-series 2, IMR Fonds PEIPARO.
693 MacEachern, Institute of Man and Resources, 53.
694 Durie, “Technical Review Meeting.”
696 MacEachern, Institute of Man and Resources, 57.
697 Letter to Andy Wells from John Todd, RE: Taking over the Ark, February, 1978, Series 5, sub-series 2, IMR Fonds, PEIPARO.
698 MacEachern, Institute of Man and Resources, 58.
demonstration facility until 1981, when the Ark closed permanently.\textsuperscript{699} Due to the project’s acrimonious end, most locals have remembered Todd for his aggressive “salesmanship,” which they believed hid flaws with his designs.\textsuperscript{700} Nationally the Ark received far more latitude and remained a disappointing, but intriguing, attempt to live sustainably.\textsuperscript{701} Similarly, the ecological design community saw the Ark as a successful experiment and interpreted both its successes and failures as a demonstration of ecological design’s growing potential to combine humanity, nature, and technology for the benefit of all.\textsuperscript{702}

**Ecological Design and Living Machines**

Undeterred and largely unscathed by the failures of the PEI Ark, Todd refused to give up on his vision, and he continued to promote the transformative potential of sustainable designs. Inspired by the anthropologist Margaret Mead’s interest in the Ark’s melding of nature, technology, and humanity, the New Alchemists decided they needed to apply Todd’s designs on a larger scale, starting with small communities and eventually moving to large cities and entire bio-regions.\textsuperscript{703} To this end, the NAI hosted a large conference in 1979 to discuss ecological design and its potential to solve North American social and environmental problems. Organizing the event around the concept of “the village as solar ecology,” Todd managed to involve influential members of the counterculture, the environmental movement, and the ecological design community, including solar energy advocate Amory Lovins, anthropologist Mary Catherine Bateson, the daughter of the well-known anthropologist and systems theorist Gregory Bateson, and designer J. Baldwin.\textsuperscript{704}

Building on Todd’s visioneering, the group extended his systems to encompass entire communities. Baldwin extolled the possibilities of community-sized geodesic dome bioshelters. Imagining a twenty-first century village built around a one and a half


\textsuperscript{700} MacEachern, *Institute of Man and Resources*, 121.


\textsuperscript{703} Todd and Todd, *Bioshelters, Ocean Arks, City Farming*, 12.

\textsuperscript{704} Chris Zelov and Phil Cousineau include all three as important contributors to ecological design. See Zelov and Cousineau, eds. *Ecological Design: Inventing the Future*. 182
acre bioshelter, Baldwin argued that such a design could extend many of the advantages of Todd’s Arks to a larger scale. Theorizing a recreation of the PEI Ark on a grand scale, Baldwin suggested connecting houses in a ring around the edge of a huge domed bioshelter. The enormous structure could heat the solar or wind powered houses while their inhabitants provided their own food using the intensive agriculture and aquaculture techniques the NAI had developed for greenhouses. Echoing Todd’s arguments, Baldwin claimed the imagined design’s transformative properties would enable the development of self-sufficient and ecologically sustainable communities while cutting fossil fuel consumption and undermining mainstream consumer culture. The “village as solar ecology” conference and the PEI Ark, along with other ecopragmatist meetings, created the foundations of the ecological design movement. For this group of countercultural environmentalists gathered around the Whole Earth Catalog, experiments with New Alchemy inspired bioshelters continued into the late 1970s and early 1980s and these efforts gradually created a new approach to urban design and architecture.

Nancy Jack and John Todd’s book, Bioshelters, Ocean Arks, City Farming, played an important role in the Todds’ role in the movement by distilling John’s vision and the NAI’s research into a theory of ecological design. Refashioning John Todd as an architectural visionary rather than a countercultural science guru, the Todds outlined nine “precepts” for the future of ecological construction. Their vision of sustainable design largely restated the New Alchemists’ earlier work. The primary precepts incorporated the NAI’s merger of humanity, environment, and technology by asserting the principles that “the living world is the matrix for all design,” “design should be sustainable through the integration of living systems,” and “design should follow a sacred ecology.” Readers listened. According to Peder Anker, this book, along with John Todd’s extensive work in the field, helped the Todds shape the ecological design movement.

In contrast, the NAI had a more difficult time reinventing itself in the 1980s. As concerns over limits faded, its funding started to dry up. As Senator Paul Tsongas, the

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706 Anker, From Bauhaus to Ecohouse, 111-112.
707 Todd and Todd, Bioshelters, Ocean Arks, City Farming. Todd’s design precepts are discussed in primarily chapter three of book.
708 Anker, From Bauhaus to Ecohouse, 111-112.
Massachusetts senator from 1979 to 1985 and advocate of environmentalism, told the New Alchemists during a visit to the NAI on Cape Cod, there simply was not money for anything unless it involved the military. Confronted with these financial problems, Todd realized that the substantial levels of funding required for large projects like the PEI Ark were unlikely to materialize in the future. Shifting his focus to defining and championing ecological design and experimenting with his “living machines” on a smaller scale, Todd and his wife left the NAI to found Ocean Arks International in 1982. Anxious to keep his research on sustainable systems relevant and uphold his vision of a sustainable future, John and Nancy Todd began to write extensively about ecological design and published their first book on the subject in 1984.

In the 1990s, as ecological design professionalized and became more popular, Todd continued to contribute to its merging of living and mechanical systems. Todd and his wife wrote a second book outlining his approach to ecological design, From Eco-Cities to Living Machines: Principles of Ecological Design, which once again advocated Todd’s technologically mediated approach to sustainability. His ideas continued to receive attention in the field when the journal Ecological Engineering republished his work in a series of articles. Drawing on his continued research with “living machines,” Todd identified and elaborated upon twelve “principles required for the design of task-oriented mesocosms.” These articles brought mainstream attention to Ocean Arks International, which enjoyed a brief surge of interest in the 1990s. As a result, Todd was offered a faculty position at the University of Vermont in the Rubensteine School of Environment and Natural Resources, which he accepted.

While Todd contributed to ecological design in the 1980s and 1990s, he continued to develop the integrated aquaculture and agriculture systems that had been the

709 Speech By Paul Tsongas, 1982, Audio/Visual Material, Box 14, Folder 2, NAI Records, ISUSC.
710 Memo From John Todd to New Alchemists, “Another Damn Modest Proposal,” November 20, 1980, Box 38, Folder 12, NAI Records, ISUSC; Board Meeting Re: Finances, October 8, 1982, Box 2, Folder 1, NAI Records ISUSC; Letter from J. Baldwin to Gary Hershberg, December, 14, 1981, Box 38, Folder 12, NAI Records, ISUSC.
711 John Todd to the NAI Board, Re: the Presidency, December 4, 1981, Box 2, Folder 1, NAI Records, ISUSC; Todd and Todd, Bioshelters, Ocean Arks, City Farming, 12.
714 Nancy Todd, A Safe and Sustainable World, 164.
foundation of his work since the early 1970s. In the mid 1980s, Todd shifted his focus from constructing terrestrial space cabins able to carry their users through ecological catastrophe to the more mundane, but widely needed, work of waste treatment. Employing the living machines he had pioneered at NAI, Todd once again recreated tropical estuaries, this time for their ability to purify. By 1989 he had managed to produce a system capable of treating the sewage of a small community. In the early 1990s, he redesigned this system to fit on a small floating platform and bio-filter industrial wastewater lagoons. Tyson Foods put this system to the test in a lagoon attached to a poultry processing plant in 2001. After successfully bringing the poultry facility’s wastewater within EPA standards, Todd’s filtration system began to spread, and it has been copied by former employees and others interested in a biological approach to waste treatment.

Besides being commercialized as bio-filtration systems, Todd’s living machines would be copied, albeit largely unknowingly, by urban farmers using “aquaponics” in the 2000s. This newly recognized branch of aquaculture has recreated or copied the Arks’ combination of hydroponics and aquaculture to culture fish and grow vegetables almost exactly as the NAI did in the 1970s. In 2008, Will Allen, an urban farmer from Milwaukee, received a $500,000 genius fellowship from the MacArthur Foundation for using aquaponics to supply the city’s food deserts with fish and vegetables. This new approach to farming adopted Todd’s original “spaceship” approach by recycling nutrients to pack high productivity into solar greenhouses adapted to the small spaces and marginal resources of urban or personal farms. Today kits for such systems can be found on the internet, an achievement eco-pragmatists would surely find fitting.

Despite this success, biofiltration and aquaponics remain a long way from a society dedicated to using cabin ecology to live sustainably. Nonetheless, Todd’s

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717 Nancy Todd, *A Safe and Sustainable World*, 175.
visioneering remains important. Predicated on the merger of human, machine, and nature, Todd offered a pragmatic vision of sustainability. Occupying a middle ground between the limitless growth imagined by space enthusiasts and the declensionist dreams of many environmentalists, Todd provided a path towards modern living within earthly limits. Todd’s pragmatic vision captured the attention of environmentalists, hippies, and politicians, and it became central to an influential community of eco-pragmatists seeking solutions to the world’s environmental problems. Garnering support and substantial funds, Todd was able to experiment with his ideas and even create the system he hoped would give North American society a sustainable future. Not all of these systems worked. Much to the disappointment of Canadians, the complexity of self-sufficient systems defeated him and his fellow designers on PEI. However, other technologies and ideas contributed to ecological design, industrial biopurification, and urban farming. Todd’s visioneering should be seen as an important contribution to what some environmental historians have characterized as the “light-green society.”

This hybrid of environmentalism and industrial modernity created through the blurring of the boundaries between culture and nature resulted from efforts like Todd’s and could have few better exemplars than his living machines.

Conclusion

Todd’s visioneering reveals an often-overlooked side of the counterculture and environmentalism. Above all, it illustrates the importance of science and technology to countercultural environmentalism. In this chapter, I have used the New Alchemists’ work to pinpoint the fundamentally problematic character of any analysis that attempts to understand the counterculture or the environmentalism of the 1970s as anti-science. While condemning some applications of science and technology and even openly discussing the collapse of American civilization, Todd, and many other members of the counterculture and environmental movements, never abandoned the concept of progress or the conviction that solutions to the world’s problems could be found through the pragmatic application of science.

Beyond illustrating the importance of science and technology to countercultural

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environmentalism, Todd’s visioneering highlights the surprising degree of communication and support that existed between the counterculture and mainstream science in the 1970s. Parallels exist between Todd and better-known countercultural figures, such as the physicist Fritjof Capra, who drew out and expanded upon the connections between the counterculture and quantum physics. Working in the medium of ecology rather than physics, Todd used his scientific training and talent for promotion to enlist governments, countercultural groups, and elite institutions in support of his technologically mediated vision of sustainability.

The ease with which Todd and his ideas moved between these communities and the fundamental importance of large financial contributions underlines the presence of cooperative relationships between governments, elite institutions, and countercultural environmentalists and their significant impact on environmental politics. Without this support the PEI Ark, one of the most iconic efforts to live sustainably and a foundational project in ecological design, could not have been constructed. Cooperative and mutually beneficial relationships existed and even thrived alongside the better-known conflicts between governments and countercultural environmentalists. This reality speaks to larger argument this dissertation has made. The Cold War rationality that framed political discourse in the 1970s, particularly in Canada, where the Trudeau government privileged technical knowledge and long term planning, enabled the connections that Todd and others built between governments, scientists, and the counterculture and environmental movements. Amory Lovins, who worked with the New Alchemists and the Science Council of Canada, similarly used techniques developed by Cold War analysts to attack nuclear energy and challenge energy policies that focused on rapid growth. Emphasizing his use of future studies borrowed from the RAND Corporation to develop and describe a program of sustainable development, I argue technical knowledge played an instrumental role in environmentalism during the 1970s as Lovins used it to break into and broaden debates over energy and popularize an influential approach to sustainable development in the 1970s.

723 Kaiser, How the Hippies Saved Physics, xxiii.
Chapter 5: Sustainable Futures: Amory Lovins, Future Studies, and Environmentalism

On December 1st, 1976, Herman Kahn and Amory Lovins vehemently argued about energy at Governor Jerry Brown’s office in Sacramento. At the time Lovins was the Friends of the Earth’s lead energy analyst, an advocate of conservation, and a vocal figure in the anti-nuclear movement. In contrast, Kahn, a veteran of the RAND Corporation, was a self-proclaimed optimist who believed in growth, technological progress, and prosperity. To paraphrase Stewart Brand, Lovins and Kahn fought a quantitative duel with pocket calculators that evening as they threw estimations of growth rates, energy needs, and technical minutiae back and forth. Significantly, despite coming from different political and intellectual universes, the two believed solutions to Americans’ problems could be found through careful calculation and rational planning. Quantification, abstraction, and simulation framed their methods for thinking and arguing about America’s prospects. Just as importantly, Lovins and Kahn received invitations to the governor’s office because Governor Brown and his advisors took expertise in future studies extremely seriously.

Using the abstract and formalist approach on display at the Governor’s office, Lovins constructed models that told a technically founded and compelling narrative about the coming success of solar energy and sustainable development in North America. Lovins’ assertions and his methods would make him an influential figure in the energy debates of the 1970s. His ideas led to invitations to the White House to meet with President Jimmy Carter, brought him to Energy Days on Prince Edward Island, and saw the Science Council of Canada solicit his analysis of Canada’s energy future. In short, this small, rumpled, Woody Allen-esque figure with his pocket calculator became an

724 Their presence was part of a parade of “intellectually luminous characters,” including Milton Friedman and E.F. Schumacher, who Stewart Brand, acting as a special advisor, brought to stimulate the Governor’s staff, cabinet, and department heads. Stewart Brand, “The New Class,” CoEvolution Quarterly 3 (Spring 1977): 8.
energy expert prized by the environmental community, respected by politicians, and feared by the nuclear industry.\textsuperscript{727} Future studies and an abstract approach to reasoning, which mirrored that of Herman Kahn, a figure detested by the environmental movement and the counterculture, provided the heart of Lovins‘ success.

Lovins and his technical approach sit awkwardly with the dominant historical treatments of the environmental movement. Scholars’ focus on environmentalists as agents of social change guided by New Left tactics of protest has rendered technocratic figures, such as Lovins, largely absent from the historiography.\textsuperscript{728} Even in their analysis of the anti-nuclear movement, historians have focused on the importance of local politics and the fragmentation and decreasing influence of expert authority. Thomas Wellock, for instance, analyzes David Brower and Friends of the Earth’s deft manipulation of local politics to oppose nuclear energy.\textsuperscript{729} Despite his connections to Friends of the Earth, local

\textsuperscript{729} Thomas Wellock, \textit{Critical Masses: Opposition to Nuclear Power in California, 1958-1978} (Madison:
politics meant little to Lovins. He did, however, benefit significantly from the fracture and growing internal conflicts of the “proministrative state,” by drawing directly on the internal conflicts between state experts in order to criticize nuclear power. That said, his efforts to champion alternatives to nuclear energy relied on precisely the same abstract and technical approach state technocrats employed. In fact, Lovins’ method exemplified in many ways what some historians have called “Cold War rationality,” a style of reasoning which attempted to contain human irrationality and ease decision making through simplification, formalization, and simulation. Lovins’ use of this style of reasoning illustrates a very different side of the environmental group Friends of the Earth and suggests the ostensibly radical group actually held a pragmatic view of science. Focusing on Lovins’ pragmatism and technicality, this chapter contributes to recent scholarship that has argued that expediency and technological utopianism characterized significant portions of the counterculture and the environmental movement.

Lovins’ influence in the 1970s also underlines the importance of technical knowledge, in the form of energy analysis and simulation, which environmental historians have generally overlooked when examining the intellectual foundations and political tools of the environmental movement. Stephen Bocking, for instance, have shown that scientists and ecological science shaped the environmental movement and environmental politics throughout the 1960s and beyond, but has paid less attention to the influence of mathematical modeling, future studies or other highly quantitative forms of technical knowledge. Lovins’ impact in the 1970s suggests that these types of inquiry, particularly technical and mechanistic methodologies that some environmental scholars

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730 Balogh, Chain Reaction, 12.
have disparaged as antithetical to nature, had a central role in environmental politics and the emergence of sustainable development.735

Lovins used his mathematical skills to build models and scenarios to simulate society and analyze its potential futures. As noted above, he also used them to tell compelling stories about the world, its future, and the development of new technologies such as solar heating. This mix of compelling argumentation and technical knowledge would help to shape how Canadians (and Americans) thought about their future and the prospects of renewable energy in the 1970s. Lovins’ combination of rhetoric and technical analysis may seem incongruous. Mary Morgan, a historian of science and economics, however, asserts that the construction of compelling explanation, including its ability to tell a convincing story, is actually an important function of modeling for both economists and scientists.736

In Morgan’s view, models explain or clarify stories about cause and effect by enabling the investigation of abstract principles or ideas. She describes models as “fitting out laws, just as a fable fits out an abstractly stated moral.”737 According to Morgan, this “fitting out” allows economists and other modellers to both fully appreciate the complexity of a theory, but more importantly to connect it directly to the real world, thus allowing it to provide explanation. Going further, she states that narratives “provide the possible correspondence links between the demonstrations made with the model and the events, processes and behaviour of the world that the model represents.”738 When Lovins used models, he drew directly on their twin abilities to guide the analysis of complex problems through abstraction and to demonstrate concrete relationships between seemingly unconnected events, such as growth in energy use and political centralization. Just as importantly, the technicality of modeling also allowed Lovins to take advantage of the privileged place of technical knowledge within North American political discourse


during the 1960s and 1970s. Models enhanced both his analysis and his rhetoric, which allowed Lovins to seize a place in energy and development debates and popularize his program of sustainable development.

This chapter will examine how Lovins used energy analysis and built scenarios to both study the world and construct arguments that made compelling connections between his models and the real world. Lovins’ ability to move from the abstract to the real and to do so with ease played a central role in his influence on energy policy in the late 1970s. This intellectual agility also calls attention to the similarities of methodology and practice between Lovins and the paragons of “Cold War rationality.” Herman Kahn’s similar skill at moving from the abstract scenario to the real world, for example, helped him shock and fascinate Americans with his discussions of nuclear war and made him into a household name during much of the postwar period, which allowed Kahn to popularize future studies and start his own institute of strategic analysis.739

This chapter examines Amory Lovins’ approach to environmentalism and his influence in Canada in four sections. I begin by focusing directly on the close connections between Lovins and his conception of sustainability and Cold War analysts’ development of futurology. Drawing a comparison between Lovins and Kahn, I focus on how the technical practices of futurology and energy analysis formed the foundation of Lovins’ work. This examination broadens environmental historians’ analysis of knowledge by demonstrating its diversity and provenance through an exploration of the fundamental place of Cold War science in environmental politics. The second section examines how Lovins employed his technical knowledge to debate policy in leading political and scientific journals and through these discussions established himself as a knowledgeable, if radical, energy analyst. The third section shifts to analyze his construction of the “soft energy path” and the ways in which Lovins employed models to construct an accessible and compelling narrative about America’s energy future. Returning to my broader argument that technical knowledge – modeling and futurology – guided and lent authority to environmental politics in 1970s, the final section traces the impact of Lovins and his methodology in Canada, where it gained traction with both

739 For an excellent analysis of Herman Kahn, his intellectual foundations, and his impact, see Sharon Ghamari-Tabrizi, The Worlds of Herman Kahn: The Intuitive Science of Thermonuclear War (Cambridge, MA: Harvard University Press, 2005).
environmentalists and governments and helped frame discussions of renewable energy in the late 1970s.

**Future Studies and the Rise of Amory Lovins**

In the 1960s and 1970s, futurology moved from the boardrooms and laboratories of military scientists and analysts to become central to political discourse as governments in the United States and Canada reached the apex of their efforts to plan development and manage social problems.\(^{740}\) The practice emerged from the American defense establishment and grew with the influence of defense intellectuals who turned their skills to city planning, industrial management, and governance in postwar civilian society.\(^{741}\) In Canada, this technical approach, with its emphasis on scenario building and scientific knowledge, played an important role in the Trudeau government’s program of “rational management.” The practice of futurology, put simply, is the study of trends with the intent of developing insight into the future. This definition, however, does not do justice to the emergence of the practice or the reasons for its influence during the period.

Future studies emerged from the RAND Corporation’s research into technological development and nuclear strategy in the early 1950s. As a form of systems analysis, futurology had roots in the early Monte Carlo calculations, which simulated the behavior of random systems. The success of this stochastic modeling in creating thermonuclear weapons helped to justify and popularize the approach to scientific experimentation, which derived evidence from “experiments” simulated mathematically on new electronic

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computers. At RAND, analysts combined this approach with game theory and economics to construct scenarios about nuclear conflict and weapons development and thus explore various potential real world outcomes. Ultimately RAND analysts hoped these efforts would lead to a formal set of strategic rules to guide decision-making and contain the “irrationalities” of human thought, thus forestalling an accidental nuclear apocalypse. As historian Sharon Ghamari-Tabrizi argues, this ability to conduct experiments through simulation and potentially to understand random systems from nuclear fusion to future wars provided scientists, economists, and mathematicians at RAND with a means to analyze military strategy, technological development, and, at its most ambitious, the future of the world.

Herman Kahn, perhaps the most famous defense intellectual at RAND, expanded these initial efforts far beyond the narrow bounds of nuclear conflict in an attempt to study how American society might respond to and even survive a thermonuclear war. The wide-ranging scenarios this project constructed to examine the possible impacts of a thermonuclear war led Kahn and his civil defense team to move far beyond the confines of game theory or even operations research. They constructed entire theoretical worlds to model and think through the problems of saving Americans from instant death and ensuring they could continue the struggle against Communism in an irradiated world.

When Kahn left RAND in 1961 to form the Hudson Institute, this approach, with its sprawling scenarios and combination of intuitive guesswork and data dependent analysis, became his trademark and a central component of his future studies. At the Hudson Institute, he publicly launched futurology and helped popularize it as a profession. Writing in his 1967 opus on futurology, *The Year 2000: A Framework for Speculation on the Next Thirty-Three Years*, he explained the field’s importance:

If it is desirable for a decision-maker to be able to ‘muddle through,’ how – in this world of accelerating changes and global political involvements – does he acquire the capability for muddling through? …One answer is to plan in a way that

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743 Erickson, et al., *How Reason Almost Lost its Mind*, 50.
746 Ghamari-Tabrizi, *The Worlds of Herman Kahn*, 146.
accommodates a large range of events. Options should be provided not only for the important long-run choices which are most likely to occur, but also for less likely choices insofar as they would present significant dangers or opportunities, and if preserving the options would not require giving up too much in current terms.747

In short, Kahn believed that future studies could do more than understand warfare, it could guide Americans’ fumbling efforts to respond to the social and economic problems of the 1960s and enable their leaders to build a better future for all Americans.

Kahn’s faith in the potential of rational planning, assisted by futurology’s combination of blue-sky theorizing and data dependent simulation as well as his concerns about the rapid pace of change, was shared by both Canadian and American policymakers in the 1960s and 1970s. According to historian Matthew Connelly, Americans reacted with both fear and hope to what they perceived as a rapidly changing world, and they embraced futurology as a means of navigating these uncertain times.748 The large and diverse following that grew around futurology included the vehemently anti-nuclear environmental group, Friends of the Earth. Led by a former physics graduate student, Amory Lovins, the group used energy analysis and Kahn’s “intuitive science” to criticize nuclear power and government energy policy. Building on his initial attacks on nuclear energy, Lovins would employ a variant of futurology to conceive and champion sustainable development.

Lovins took a circuitous route to becoming a renowned environmentalist. During his youth, he seemed destined for a career in physics, perhaps even in the very industry he came to abhor. Born in Washington D.C. in 1947, Lovins spent his time focused on academic achievement in mathematics and physics.749 The ability of physics to explain the world fascinated him, and he quickly passed through school and into postsecondary education. While pursuing graduate studies in Britain, Lovins gradually grew disenchanted with the narrowness of academic physics and began to search for something more inclusive. This disappointment led him to drop out of graduate studies and to take

part in local environmental campaigns.\textsuperscript{750}

His involvement in a fight to preserve Snowdonia National Park in Wales brought him into contact with David Brower, the founder of the radical environmental group Friends of the Earth, and Lovins quickly became a staunch environmentalist and the head of the British branch of Brower’s organization.\textsuperscript{751} Merging his knowledge of physics and his passion for the environment, Lovins threw himself into the study of then current environmental issues and quickly became the organization’s leading spokesman on energy, ecological systems, and resource scarcity. Deeply influenced by Brower, he also became a vocal critic of nuclear energy, a widely held position among the countercultural and the environmental movements of the 1960s and 1970s.\textsuperscript{752} Eventually he would establish himself as a leading figure within the countercultural environmentalist network that revolved around Steward Brand’s \textit{Whole Earth Catalog} and experimented with technological solutions to environmental problems. The technical skills Lovins learned as a graduate student set him apart and helped him to become an influential environmentalist and energy analyst. Lovins, much like Kahn, came to rely on the technical side of futurology, namely, its quantification and mathematical modeling, to give his scenarios authority within the technocratic political discourse that characterized energy policy in the 1970s.\textsuperscript{753}

Lovins’ first experiences with scenario building and simulation came in 1971, when he edited \textit{Only One Earth: An Introduction to the Politics of Survival}, which the Friends of the Earth published in cooperation with the UN Secretariat during the lead up to the 1972 Conference on the Human Environment.\textsuperscript{754} This project gave him the opportunity to work closely with a growing community of modelers, including the systems ecologist Howard Odum, futurist Alvin Toffler, and Jay Forrester, the leader of

\textsuperscript{750} Plowboy Interviews, “Amory Lovins.”
\textsuperscript{751} Amory Lovins and Philip Evans, \textit{Eryi, the Mountains of Longing} (San Francisco: Friends of the Earth, 1971).
\textsuperscript{753} Amory Lovins never completed his graduate studies in physics. However, he has since received numerous honorary degrees and held many visiting professorships. See Amory B. Lovins, Rocky Mountain Institute, accessed March 18, 2014, \texttt{http://www.rmi.org/Amory+B.+Lovins}.
\textsuperscript{754} Friends of the Earth, \textit{Only One Earth: An Introduction to the Politics of Survival} (London: Earth Island Limited, 1972).
the team that constructed the World3 model for the Club of Rome. This experience awakened Lovins to the possibility of using the technical practice of modeling as a means of analyzing and commenting authoritatively on mainstream energy policy and the potential dangers of its focus on large-scale technologies and rapid growth.

Lovins picked a fortuitous moment to take up futurology and modeling. Forrester’s World3 model and Limits to Growth generated widespread discussion of natural limits across Europe and North America, and to take advantage of the authority futurology had at the time, Friends of the Earth founded a “team of experts” to study energy policy in 1973. Set up in Britain, this group included Lovins, physicist John H. Price and Peter Champman from the Open University’s Energy Research group. Together they studied the United Kingdom’s plans to develop nuclear power and published the results as Non-Nuclear Futures: The Case for an Ethical Energy Strategy. This book’s analysis established Lovins as a critic of rapid energy growth and nuclear power. It also started a series of debates between Lovins and advocates of nuclear power that enhanced his position within the environmental movement and helped establish him as an energy expert.

Energy analysis formed the foundation of this work. Popularized by Howard Odum, energy analysis employed input-output models to determine the net energy created by nuclear power and other energy producing technologies. It worked by constructing a massive, but highly simplified, model of society, which measured net energy by painstakingly calculating every projected energy input into a technological system – a nuclear plant – and subtracting that from its projected energy output. In effect it amounted to approaching the world as a purely thermodynamic system and using net energy as the primary criterion of utility. The point was to carefully manage sources of energy within the closed system of the world.

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755 Elichirigoity, Planet Management, 86.
758 As Peder Anker notes, this approach drew heavily upon conceptualizations of the earth as a space capsule, which emphasized the importance of managing the world as a stable closed system. See Anker,
model could quickly become dizzingly complex, as different forms of energy (oil and
electricity) had to be rendered commensurable, standard ratios of energy production for
different sources calculated and agreed upon, and huge amounts of data about everything
from the energy density of different sources of uranium to the efficiency of reactors had
to be gathered.\footnote{Lovins and Price, Non-Nuclear Futures, 113.}

In the early 1970s, energy analysts’ assumptions about ever growing future
energy needs rested at the very center of energy policy in Britain and played a
fundamental role in the consensus that the country needed massive investments in nuclear
energy. According to the Central Electricity Generating Board, a postwar institution
charged with insuring Britain’s electrical supplies and a major player in energy policy,
the nation’s demand for electricity would quadruple from $800 \times 10^6$ MWh in 1970 to
roughly $2400 \times 10^6$ MWh by 2000.\footnote{Lovins and Price, Non-Nuclear Futures, 114.}
Furthermore, the Board projected that almost all of this astronomical increase would have to come from nuclear generation as increasing
demand depleted fossil fuels over the course of the century. In Canada, the United States,
and Britain, the two assumptions of rapidly growing energy needs and the future
necessity of using nuclear energy to meet demand had an almost unquestioned place at
the center of energy policy.\footnote{In the early 1970s, the EMR held similar views and projected accelerating energy demands. See Minister of Energy, Mines, and Resources, An Energy Policy for Canada: Phase 1, Volumes 1-2 (Ottawa: Information Canada, 1973). In the United States the Bechtel Corporation’s Energy Supply Planning Model, which provided the foundation of President Gerald Ford’s energy policy in 1975, projected a similarly massive increase in energy demand and called for a rapid expansion of nuclear generation to supply it. See Bechtel Corporation, Energy Supply Planning Model (Springfield, VA: National Technical Information Service, 1975).}

Using energy analysis, Lovins and Price attacked the “combination of assumed
rapid growth in demand…and [the implied] exceptionally rapid sustained growth for
nuclear power” head on.\footnote{Lovins and Price, Non-Nuclear Futures, 114.} In their view, energy analysis provided the perfect means to
investigate the flaws in the “traditional view of nuclear power,” because it allowed
analysts to measure whether nuclear technology could, in fact, produce these

\begin{quote}
\end{quote}
astronomical increases in net energy.\textsuperscript{763} Lovins and Price used energy analysis to focus squarely on the net energy nuclear plants produced and, in light of the projected rapid construction of plants and exponentially growing energy demands, the amount of energy from each nuclear station’s output that would be required to build the next plant. According to their model and its projections, the energy inputs necessary to construct a new facility required roughly half of the previous plant’s energy output.\textsuperscript{764} Furthermore, they calculated that the number of facilities would need to double every three and a half years or the construction of nuclear reactors would “continuously consume more energy/year than it produces.”

| Table 12-1. Energy Investment in an Exponential Program as a Percentage of Energy Output from the Same Program, and Time Required Before the Program’s Output has Repaid the Cumulative Investment Energy, for the Best ($P_p/P_i = 3.30$) and Worst ($P_p/P_i = 2.11$) Reactors Using Fuel Processed from High Grade Ore |
|---|---|---|---|---|---|
| $T_B = 4$ Years | $T_B = 5$ Years | $T_B = 6$ Years |
| $P_i/P_p$ | Percent Output to Investment\textsuperscript{a} | Years to Pay Debt | Percent Output to Investment\textsuperscript{a} | Years to Pay Debt | Percent Output to Investment\textsuperscript{a} | Years to Pay Debt |
| 2.11\textsuperscript{b} | 78 | 14.7 | 54 | 11.7 | 42 | 10.7 |
| 3.30\textsuperscript{b} | 50 | 10.0 | 35 | 9.1 | 27 | 8.7 |

\textsuperscript{a}These percentages apply from the start of operation until one must start to build new reactors to replace obsolete ones (after 25 years). The increase arising from such replacement is small (see Appendix II-1).

\textsuperscript{b}These values may well be too high: see the second section of this chapter.

| Table 12-2. Energy Investment in an Exponential Program as a Percentage of Energy Output from the Same Program, and Time Required Before the Program’s Output has Repaid the Cumulative Investment Energy, for the Best ($P_p/P_i = 1.56$) and Worst ($P_p/P_i = 0.77$) Reactors Using Fuel Processed from Chattanooga Shale |
|---|---|---|---|---|---|
| $T_B = 4$ Years | $T_B = 5$ Years | $T_B = 6$ Years |
| $P_i/P_p$ | Percent Output to Investment\textsuperscript{a} | Years to Pay Debt | Percent Output to Investment\textsuperscript{a} | Years to Pay Debt | Percent Output to Investment\textsuperscript{a} | Years to Pay Debt |
| 0.77\textsuperscript{b} | 213 | never | 149 | never | 114 | never |
| 1.56\textsuperscript{b} | 106 | never | 74 | never | 56 | never |

\textsuperscript{a}These percentages apply from the start of operation until one must start to build new reactors to replace obsolete ones (after 25 years). The increase arising from such replacement is small (see Appendix II-1).

\textsuperscript{b}These values may well be too high: see the second section of this chapter.

Figure 16: Calculation of Investment Costs. Amory Lovins and John Price suggested the high cost of nuclear energy in Britain would make it impossible to recoup investments. 


These were damning conclusions for a construction program that was supposed to provide almost unlimited energy. Lovins would return continually to this analysis as he advocated energy conservation. These startling judgements and Lovins’ ongoing assertions about nuclear energy did not go unnoticed by other analysts, and pro-nuclear scientists soon formulated answers to refute Lovins’ claims. This response set off a

\textsuperscript{763} Lovins and Price, \textit{Non-Nuclear Futures}, 117.

\textsuperscript{764} They arrived at the conclusion by calculating $X(T)/X_o(T)$ where $X(T) = P_i n_o(T)$ and $X_o(T) = P_i N_0 e^{aT}$ for the first generation and $X(T) = P_i N_0 (1 - e^{-aT}) (1 + e^{-aT} + e^{-2aT}) e^{aT}$ in subsequent generations. See Lovins and Price, \textit{Non-Nuclear Futures}, 176.
lengthy debate that legitimated Lovins as an energy expert in the eyes of most North Americans, including the scientific community.

**Debating Energy Futures: Lovins, His Critics, and Expert Authority**

Energy analysts, particularly those who favoured nuclear energy, attacked Lovins’ and Price’s criticisms of nuclear energy and the problematic assumptions of mainstream energy policy. By the mid 1970s, Lovins found himself parrying and replying to criticism almost full time. In fact, Lovins would carry on simultaneous debates with his critics in *Nature, Science, Foreign Affairs, and Energy Policy*. Although neither Lovins nor his critics can be said to have triumphed, these exchanges in some of the leading scientific and political journals of the period significantly benefited Lovins, by positioning him as a leading critic of nuclear energy. Just as importantly, his ability to defend his analysis through a combination of rhetoric and technical information established his credibility as an energy expert.

Lovins disputed the merits of nuclear power and mainstream energy policy more generally during his itinerant travels in Canada and the United States in the mid 1970s, as well as appearances in Japan and across Western Europe. In a manner similar to John Todd, he spoke everywhere, sometimes at the same conferences as Todd, including Denis Meadow’s Limits to Growth ’75 conference in Texas and Energy Days on PEI. This combination of extensive travels, innumerable presentations and speeches, and a steady stream of articles made Lovins impossible to ignore and set him on a collision course with advocates of nuclear power and defenders of a high energy society.

These debates took off in 1976 when Alvin Weinberg, the director of the Institute for Energy Analysis at Oak Ridge Associated Universities, reviewed *Non-Nuclear Futures: The Case for an Ethical Energy Strategy* in *Energy Policy*. That Weinberg, an eminent physicist and one of leading advocates of nuclear power in the United States, believed it necessary to rebut Lovins’ analysis publicly speaks to the environmental activist’s growing stature in the mid 1970s. In his review, Weinberg took aim squarely at Lovins’ energy analysis and at his and Price’s assertion that nuclear energy could not supply Britain’s projected energy demands. Weinberg’s criticism bears quoting at length as it illustrates the technical nature of their debate:

> I do not quarrel with their raw data: For a [Pressurized Water Reactor] using 0.3%
uranium ore, the ratio $P_o/P_i$ is around 3 and the total energy ratio over a 25 year period is around 15. Moreover, as the authors say, energy inputs into the PWR are largely from fossil fuel. But even to suggest that a nuclear reactor in this sense extracts only twice as much energy from fossil fuel as would a fossil fuelled plant of the same capacity can only be described as outrageous: the actual factor is more like 15\(^765\)

Weinberg went on to note that Lovins and Price also accurately calculated the problems associated with doubling time, but then applied them to the wrong issue. In his view, the substantial energy inputs nuclear reactors required did not cause trouble because they still relieved pressure on the limited supplies of fossil fuel.

Weinberg also accused Lovins and Price of hiding their outrageous assertions behind a veil of “high sounding phraseology.”\(^766\) In particular, Lovins’ and Price’s claim that “Energy analysis is a tool for examining the many energy implications of policy, just as economic analysis is a tool for examining many of the fiscal implications of policy” deeply upset him since it gave appearance of objectivity, but fell short of this standard.\(^767\) According to Weinberg, this statement was completely vacuous, since Lovins and Price did not compare Britain’s nuclear program with a non-nuclear program, but simply attacked it.

What angered Weinberg most, however, was Lovins’ and Price’s skillful employment of the internal criticisms voiced by nuclear scientists and their ability to couple them with their energy analysis in a way that made it nearly impossible to “prove the authors to be wrong.”\(^768\) Rather, the issues Lovins and Price raised fell into a category that Weinberg categorized as “trans-science.”\(^769\) This category, he admitted sadly, meant that while nuclear advocates and critics could debate the merits and problems of nuclear and other sources of energy indefinitely, it was beyond the ability of contemporary science to prove either side correct. This admission emphasized the limits of scientific


\(^766\) Weinberg, review of *Non-Nuclear Futures*, 364.

\(^767\) Weinberg, review of *Non-Nuclear Futures*, 364.

\(^768\) Weinberg, review of *Non-Nuclear Futures*, 363.

knowledge in the debate over energy. While factual information about resources and technology remained fundamental, politics loomed large as the broad social and economic consequences of energy policy could not be contained by attempts to provide objective analysis. Rather than attempting to construct a true account, both sides expanded and complicated the debate with new information and claimed their solution held more benefits for American society.

Lovins embraced the uncertain foundations that surrounded these energy debates. Rather than trying to prove conclusively that he was correct, he sought to show that neither side held a monopoly on facts and that many alternatives to nuclear power existed. Responding to Weinberg in the same Energy Policy review article, Lovins carefully rebutted Weinberg’s primary criticisms. In response to the assertion that energy analysis was nothing but a “high-sounding” phrase, Lovins stated that Non-Nuclear Futures had indeed focused almost exclusively on nuclear technology, but he had recently published an extensive article in Foreign Affairs, which outlined a solar alternative in great detail and calculated its energy efficiency. Furthermore, he argued that his analysis was not designed to analyze nuclear technology’s ability to extend the life of oil reserves, but to show that “fission is not, as often portrayed, a prompt, abundant, and independent source of energy” and to suggest that limiting energy use might be more effective. Weinberg implicitly conceded this point when he noted that scientists needed to raise serious questions about how much energy society truly needed.

The conflict between Weinberg and Lovins started a string of debates. This technically fluent environmentalist quarreled over energy policy and the futures of solar and nuclear technology with government bureaucrats, scientists, and industry representatives. Of the many disputes Lovins was involved in, his argument with Hans Bethe, the Nobel Prize winning physicist, best illustrates the criticisms he faced and his

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770 This article will be discussed below. See Amory Lovins, “Energy Strategy: The Road Not Taken,” Foreign Affairs 55, 1 (October 1976): 65-96.
efforts to refute them. The debate between Lovins and Bethe revolved around questions of energy costs, both for solar heating and nuclear power, in Lovins’ landmark article “Energy Strategy: The Road Not Taken,” published in Foreign Affairs.

Accusing Lovins of “soft’ arithmetic and wishful thinking,” Bethe drew on the work of an old associate at Los Alamos Scientific Laboratory who had experimented with solar technology to assert that Lovins underestimated the cost of solar heating by a “factor of four to five.” Warming to his critique, Bethe turned to refute Lovins’ calculations of the price of investing in nuclear energy. Bethe calculated that it took roughly $1,200 of investment to deliver a kilowatt of electricity from a nuclear reactor. Converting this calculation into barrel of oil per day (Lovins’ chosen energy unit), Bethe arrived at a figure of $83,000 of investment to deliver the energy equivalent of a barrel of oil per day to Americans. This was significantly less than the $250,000 investment Lovins estimated. From this discrepancy, Bethe argued that Lovins misunderstood the electrical industry and that the “diseconomy of scale” that Lovins described did not exist in the electrical industry. In Bethe’s view, rather than being fragile, as Lovins argued, central electrical stations and large companies actually made the industry more robust, since they could afford to employ the trained work force required to maintain a large electrical grid. Although expressed in technical terms, Bethe and Lovins’ disagreement over centralization points to a deeper political conflict surrounding the authority of experts and ability of the state. Lovins’ concerns about centralized political and economic power would play a central role in the alternatives to nuclear energy he and likeminded environmentalists proposed.

Unintimidated by the physicist, Lovins responded with numbers of his own. Admitting that his calculations of the cost of solar diverged radically from those of Bethe’s associate, he suggested that the discrepancy resulted from “some combination of a moderately inefficient collector, high losses, suboptimal orientation or working

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774 Lovins and Bethe, “Energy Strategy,” 636. It is difficult to tell if Bethe was correct. His figures were old and did not take into account improvements in the technology. Lovins, however, certainly provided very low cost estimates for his calculations of solar, which made it likely that his calculated costs were lower than the average solar user could expect.
temperature, or a poorly insulated home.\textsuperscript{776} Going further, Lovins claimed that the Office of Technology Assessment and the Energy Research and Development Administration (the precursor to the U.S. Department of Energy) agreed with his cost estimates and projected even lower prices for solar heating systems by 1980.\textsuperscript{777} Bethe’s associate, according to Lovins, had carried out less than exemplary research, which was now out of date.

The impetuous environmentalist similarly defended his higher appraised costs for nuclear energy. The difference in projections, according to Lovins, grew from how he analysed a nuclear power system. He “[computed] the cost of a complete nuclear system per kWe delivered (emphasis in original).”\textsuperscript{778} This estimate, which Lovins implicitly suggested was more accurate, included transmission costs and the price of fuel-cycle facilities among other things that large a centralized nuclear plant needed. Driving home his point, Lovins noted that dispersed solar systems provided energy directly to consumers without such costs. As the two continued to correspond in a private attempt to reconcile their views, Lovins mollified Bethe somewhat by providing extensive information about solar heating projects in Denmark. These projects, previously unknown to Bethe, suggested that Lovins’ cost calculations for solar heating were plausible.\textsuperscript{779}

As in the debate with Weinberg, neither Bethe nor Lovins could disprove the other, which made technical knowledge of greater political than scientific consequence. By continually enlarging the debate with new evidence and appealing to authorities, such as the Office of Technology Assessment or nuclear scientists themselves, Lovins held his own against his critics. Gradually he established himself as an intelligent and effective critic of nuclear power and an important contributor to global debates over energy policy in the 1970s. As energy analyst Allen Hammond put it in an examination of the debate for the prestigious journal \textit{Science}, Lovins’ work generated extensive controversy, but “[his] critique is easily the most comprehensive and technically sophisticated attempt to put together an energy program compatible with environmental values.”\textsuperscript{780} Significantly,

\textsuperscript{777} Lovins and Bethe, “Energy Strategy,” 638.
\textsuperscript{778} Lovins and Bethe, “Energy Strategy,” 638.
\textsuperscript{779} Nash, ed., \textit{The Energy Controversy}, 79.
many outside the environmental movement listened to this assessment. Lovins’ calculations of nuclear power’s costs even appeared in President Jimmy Carter’s speeches on nuclear energy, where his high projected costs annoyed advocates of nuclear power to no end.781

When examining these debates over energy policy, it is important to note that substantial uncertainty surrounded all of the proposed technologies, whether solar or nuclear, due to the price instability caused by the energy crisis. Experts also hotly debated the question of Americans’ and Canadians’ energy needs as various representatives from environmental organizations, industries, and governments presented radically different assessments throughout the decade. At one point, the electrical industry actually estimated that Americans would need double the energy which Lovins and other environmentalists projected.782 This divergence caused consternation among policy makers, but the lengthy planning required by large energy projects or any substantial change in how Americans and Canadians generated energy forced governments to continue to use forecasts to plan energy development.783 This reliance raised the stakes for Lovins and his critics. A decision not to build a nuclear plant or to shift to renewables could commit the country to one approach or another. In fact, the “path dependent” character of energy policy would become a central part of Lovins’ arguments for renewable energy.784

Although fundamental to his acceptance as an energy analyst, his ability to argue technical details with scientists and carry out energy analysis gradually became less important than Lovins’ skill at turning these technical details into stories about the world, which both explained its problems and proposed compelling solutions. Without this talent for rhetoric and persuasion, it is difficult to believe he could have had such a significant influence on the discussion of energy. In the mid 1970s, Lovins would employ his technical knowledge and energy analysis to construct projections and scenarios about the

782 Smil, Energy at the Crossroads, 141.
784 Lovins did not draw directly on academic treatments of “path dependency.” However, his understanding of the structural or political advantages which can lead to success or make a technology very difficult to replace mirrored later academic discussions of “path dependency.” See Scott Page, “Path Dependence,” Quarterly Journal of Political Science 1, 1 (2006): 87-115.
future that sketched a path out of the energy crisis and the threat of coming scarcity, which loomed over the decade.

**Model Rhetoric: The Soft Energy Path**

As Lovins defended his analysis against its critics, he constructed a compelling argument about a different approach to energy policy and the bright future of solar technology. Gradually he developed a detailed and compelling scenario about solar technology and the world’s energy future. Paralleling Kahn’s futurological explorations of thermonuclear war, Lovins built his analysis upon a combination of intuitive guesswork and technical data. This study of a “sane energy future” developed from his energy analysis and near encyclopedic knowledge of solar technology. It appealed to the environmental movement as well as to Canadians and Americans searching for a means of sustainable economic development during a period of unstable energy prices. Drawing on the authority of forecasting and the political weight accorded to technical knowledge by the political discourse of the 1970s, Lovins provided an easily understood approach to the problems surrounding energy and a straightforward, if radical, plan for managing future energy development.

Lovins began to build his scenario of alternative energy development in two articles in the *Bulletin of the Atomic Scientists*. At the center of these essays lay a call for long-term planning informed by future studies and energy analysis. In his view, Britain’s and North America’s willingness to invest in nuclear technology incapable of adding substantially to net energy recourses could be traced back to a shortsighted and “ad-hoc” method of making policy. This unplanned approach led countries to drift aimlessly while responding to supply and market changes at the last minute without any sort of plan. As a result they continued to invest in technology they had on hand (nuclear and oil/coal) without examining the long-term consequences.

Clearly stating his argument for a planned approach to energy analysis, Lovins declared:

> Finally, we must keep more clearly in mind the ways in which the time-scale we select for planning can affect our choice of strategies. Pursuing a short term goal

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(such as independence from imported oil) can foreclose long-term options and lead to similar, but less tractable problems several decades hence, just as we are severely restricted now by short-term planning in the past. Planning is a process of formal procrastination, and its aim in an uncertain world must be to keep as many energy options open [emphasis in original] as possible. Present energy policies, however tacit and ill-constructed they may be, are quickly destroying the options that mankind, living and unborn, will need for millennia. 787

Echoing Kahn’s emphasis on the importance of long-term thinking to “preserve options” for the future, Lovins would use futurology and extensive timescales because they allowed him to illustrate the radically different options available to North American policymakers. 788 In fact, the expansiveness of futurology played a central role in his work as its extensive timeframe allowed him to outline polices that would take years, even decades, to implement and have his suggestions taken seriously by policymakers.

Working with the Science Council of Canada (SCC) in the mid 1970s, Lovins also sharpened his criticism of the narrow thinking of Canadian (and American) energy forecasts. 789 In the mid 1970s, Canadian energy policy relied heavily on econometric simulations produced by the Canadian Disaggregated Interdepartmental Econometric (CANDIDE) Model, which provided policymakers with projections of Canadians’ energy needs. These projections set targets for supply-side efforts to increase energy production to meet assumed rising demands. 790 According to Lovins, these models had “a rigidly fixed structure; worse, they lead to sterile arguments over a desired annual growth rate of X% or Y%, and these numbers seem abstract and hard to translate into everyday terms.” 791 In his view, this purely quantitative method of making energy policy narrowed analysts’ vision and trapped the government in its misguided investments in large-scale, centralized nuclear and fossil fuel technologies designed to produce ever-greater amounts of energy while hiding the shortsightedness of the government’s plans behind the

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788 Kahn and Wiener, The Year 2000, 3.
impressive instrumentality of its models and projections of never-ending growth.

To confront the path dependency and narrow thinking of “ad-hoc” policy, Lovins employed futurological analysis. This response might seem odd, since the approach he attacked shared the same quantitative foundations as futurology. While respectably quantitative, the practice of future studies also allowed intuitive leaps and extensive theorizing about potential strategies. This methodology gave Lovins the methodological space to ignore the technological constraints of the present and suggest alternatives while maintaining his reputation for technical knowledge and remaining within the bounds of Canadian and American political discourses’ emphasis on science and rational action.

By using future studies, Lovins could emphasize both the importance of qualitative discussions about the consequences of energy policy and the quantitative analysis of their prospects. In this way, he transformed planning from a method of maintaining the status quo into a means of asserting his view and, if followed, achieving sweeping change. He argued that citizens and policymakers needed to start from a set of goals and an idea of the future society they desired rather than being confined by a “few arbitrarily assumed numbers.” Lovins called his methodology, required government planners to set a broad qualitative goal, such as reliance on renewable energy by 2025, and work backward from the endpoint to examine how to achieve it. In his view, governments could pursue such a distant and sweeping goal because quantitative forecasts provided accurate estimates of what sort of energy supply Canadians and Americans might need and how capital could be used to achieve the desired ends over the chosen – fifty year – time scale.

Lovins first used his somewhat novel approach to futurology in his landmark 1976 article “Energy Strategy: The Road Not Taken,” which reached a wide audience and established Lovins as an energy expert and the voice of environmentally conscious energy policy. The article revolved around two starkly contrasting policy scenarios, the “hard path” and the “soft path.” These two energy “paths” fleshed out economic, political, and environmental consequences of his abstract criticisms and calls for new methods and new technology, which allowed Lovins to construct a compelling case for

793 Lovins would further expand the central arguments of this article in his book *Soft Energy Paths.*
change. An achievement of rhetoric and analysis, Lovins’ “soft path” successfully defined renewable energy because it provided straightforward explanation of wider consequences of energy development, connected energy development with criticism of centralized economic and political power, suggested a solution that drew on powerful ideals of progress, and perfectly fit the political ideology of Canadian and American governments.

Beginning with the “hard path,” which supposedly modeled official U.S. energy policy and its goal of continuing energy growth through the rapid expansion of coal, oil and gas, and nuclear power, Lovins outlined what he believed motivated this ad hoc position and its consequences for Americans. The centerpiece of the so-called “hard path” was exponentially growing energy use, which required a massive supply side expansion. Hundreds of oil wells, coal mines, gas plants, and nuclear stations would have to be built or dug over the next ten years. Moreover, the rate of expansion would need to increase continually, and by the twenty-first century, America would require as many as eight hundred reactors (including fast breeder reactors) to power the country’s massive energy demands. 794

Combining official figures from the Energy Research and Development Administration, the Federal Energy Administration, as well as large oil and electricity companies, Lovins calculated the energy requirements and rough technological mix of the “hard path.” Extending these calculations to the year 2025 to achieve the fifty-year time scale he thought necessary to plan energy policy properly, Lovins produced the graph below. 795 It suggested that official energy policy would yoke Americans (or Canadians) to an endless obligation to produce more and more energy in an effort to keep up with their burgeoning demands. 796

Working to present a balanced argument, Lovins admitted the scenario had many factors in its favor despite his belief it would eventually destroy whoever followed it. Most importantly, the majority of the technology it used was mature and well understood. In fact, nuclear technology had been receiving substantial subsidies, which made it

difficult politically and psychologically to abandon these sunk costs. Furthermore, the infrastructure required for the “hard path” existed; pipelines and power lines already crisscrossed North America. Finally, the perceived relationship between energy use and economic growth encouraged the connection of high-energy use and prosperity, even though the economic success that Europe and Japan had achieved while using substantially less energy than North Americans had begun to shake this assertion.797

Lovins’ “hard path” scenario, however, suggested that these benefits came with substantial problems, particularly cost. Expanding upon his earlier analysis of nuclear energy, Lovins estimated the capital required to construct the vast technologies and infrastructural systems would come to roughly $300,000 (in 1976 dollars) to deliver the equivalent of a barrel of oil worth of energy per day. This cost, he argued, represented a one hundred percent increase over earlier fossil fuel systems.798 According to Lovins, the capital required to construct and to maintain the vast electrical and fossil fuel infrastructure, as well as all the new nuclear and coal plants, meant that few countries could afford them without investing a substantial portion of their GDP. The lower levels of investment in other areas of society caused by these high costs led to the central assertion of his analysis and the rhetorical power of his scenarios.

Where, he asked his readers, would the funds necessary to build the complex and expensive technologies required by the “hard path” come from? Citing a flurry of economic statistics, Lovins examined the financial consequences of President Gerald Ford’s 1976 official energy plan. If implemented, this strategy would necessitate over a trillion dollars in initial investments and, according to Lovins’ calculations, absorb roughly three quarters of private domestic investments.799 With a note of glee, Lovins pointed out that a program of this scale would increase inflationary pressure and likely lead the government to increase taxes or substantially cut spending in other areas. Noting the chequered financial history of electrical utilities and the necessity of passing some of these costs on to consumers, he cited British industry analysts who argued electrical

As frightening as the prospect of higher taxes, higher prices, and less social spending was, Lovins’ scenario highlighted even more damaging consequences of the “hard path.”

Environmental destruction, for example, would be considerable. Lovins, however, focused more on the unrecognized political and social costs. Drawing on the appropriate technology movement, Lovins argued that the ways the technologies used in the “hard path” were designed undermined democratic practices. In an example of technological determinism, he asserted that the extensive deployment of nuclear technology would entail the use of “quasi-war powers” to police the movement and storage of fissile material around the country. This deterministic view of technology also carried a strong critique of centralization and the potential dangers of unchecked expert authority reminiscent of the New Left criticisms of C. Wright Mills. In Lovins’ view, the scale and complexity of nuclear power placed communities at the mercy of distant plants and unknown experts. He suggested that the “hard path,” in fact, placed all Americans in the hands of an unelected and largely unaccountable “bureaucratic elite.” Even more frighteningly, the size and centralized nature of the technology made it vulnerable to disruption through terrorism or disaster and ensured that if such an unlikely event occurred, it would paralyze entire cities if not a large section of the country.

With the consequences of the “hard path” scenario that closely resembled government policy in America and Canada outlined, Lovins turned to his proposed alternative: the “soft path.” Constructing a radically different future of energy development, his scenario introduced readers to new technologies and a different approach to energy consumption. Lovins’ scenario of alternative energy development

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801 The appropriate technology movement, popularized by E.F. Schumacher, believed society was shaped by its technological systems. Large centralized systems (i.e. nuclear power) concerned the appropriate technology movement above all else, since it viewed these structures as inherently authoritarian due to their hierarchical design and management by closed cadres of experts. In its view, small, decentralized technological systems could counteract this threat to democratic politics because they encouraged self-dependence and could be easily understood by anyone interested. See David Dickson, *Alternative Technology and The Politics of Technical Change* (Glasgow: William Collins & Sons, 1974); Jordan Kleiman, “The Appropriate Technology Movement in American Political Culture” (PhD diss. University of Rochester, 2000).
suggested that while untried, these new technologies fit closely with American political and economic values and entailed less actual risk than the “hard path.” Presenting both evidence and interpretation, Lovins’ analysis of America’s energy future provided a new way of thinking about energy policy. Perhaps more importantly, it produced an effective argument for renewables that drew on the authority technical knowledge had in the 1970s and presented renewables as an engine of future growth as well as a solution to the energy crisis and environmental problems.

The “soft path” took a fundamentally different approach to energy consumption. Rather than seeking to meet rising energy demands by increasing production, it attempted to restrain energy use or even decrease energy consumption to the point where it became static. According to Lovins, energy use could decrease without harming the economy in two ways: technical fixes and energy matching. The energy matching consisted of connecting the production of energy directly to its use whenever possible. Drawing on his thermodynamic abstraction of energy systems, Lovins claimed that Americans used 58% of all energy for heating. According to this analysis, burning uranium or coal to create heat to generate electricity and then distributing that across the country only to turn it back into simple heat wasted nearly half of the energy in transmission and the inefficient process of producing thermal energy and transforming it into electricity. What Americans needed, he asserted, was a way to produce the heat they wanted right where they used it without the inefficiency of generation and conversion or the cost of infrastructure. Lovins claimed that by using this technique the U.S. could cut its energy consumption by almost a quarter overnight.

Energy matching led him to his favorite technical fix: solar heating. Instead of building massive nuclear plants and electrical distribution infrastructure to provide Americans with heat, simple solar heaters equipped with storage systems could provide the same heat at a fraction of the cost and without either endangering the environment or distorting America’s financial system. Just as importantly, harnessing solar power would permanently increase Americans’ net energy, something his analysis showed neither

nuclear power nor fossil fuels could do. With further technical fixes, often as simple as installing effective insulation or incorporating passive solar design into new buildings, Lovins estimated the energy efficiency of the United States could be increased “by a factor of at least three or four.”\(^{808}\) Going further, he claimed that his scenarios showed that Americans could spend several hundred billion dollars on improving energy efficiency, create many new jobs all over the country in the process, and still save money compared to the costs imposed by increasing energy supply. In Lovins’ models, conservation, through a combination of technical change and precise management of energy itself, provided an ideal solution to the daunting problems of cost and sustainability that his models suggested lay in America’s future.

To underline what he saw as the benefits of this “soft path,” Lovins extended his policy scenario fifty years into the future as he had done with the “hard path.” This approach, according to Lovins’ projections, would allow Americans (or people in any other industrialized nation) to maintain their standard of living while using only a fraction of the energy required by the “hard path.”\(^{809}\) Using this fifty-year time frame to illustrate his “soft path,” he outlined how America could gradually transition to soft technologies, which he defined as small scale, capable of energy matching, and reliant on renewable energy, in the twenty-first century.\(^{810}\) To both environmentalists and policy makers in the 1970s, this plan for a transition to renewables held special importance as the energy crisis generated very real fears of scarcity and underlined the problems of relying on foreign sources of energy.\(^{811}\)

Besides providing a solution to the energy crisis at a projected fraction of the cost of nuclear power, investment in solar and other renewables had a number of other beneficial consequences. According to the “soft path” scenario, solar technology would create innumerable jobs and spread them across the country as new industries emerged to construct and service everyone’s solar heaters. Using his long-term viewpoint to turn reliance on new technologies into a benefit, Lovins suggested that as the solar industry matured it would become increasingly efficient at production, and the technology would

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811 As chapter two illustrated, concerns over energy prices generated interest in renewable energy on Prince Edward Island.
improve in quality.\footnote{Lovins, “Energy Strategy,” 80.} Drawing an analogy with the auto industry, Lovins suggested that the small scale of solar and other renewable energy technologies would allow them to be mass produced in an open market where competition and innovation could further drive down the price over time.

If the potential to solve the energy crisis and create new industries without damaging the environment or bankrupting the country did not interest his reader, Lovins’ “soft path” scenario promised one final benefit. It could strike a blow against “the operation of the machine” that the New Left and the counterculture had begun attacking in the Berkeley Free Speech Movement.\footnote{Margot Adler, “My Life in FSM: Memories of a Freshman,” in The Free Speech Movement: Reflections on Berkeley in the 1960s, eds. Robert Cohen and Reginald Zelnik (Berkeley: University of California Press, 2002), 119.} This machine, according to its critics, included universities, the federal government, and the military in a vast centralized structure that controlled Americans’ lives and made them complicit in both the nuclear standoff of the Cold War and the horrors of Vietnam.\footnote{Peter Braunstein and Michael William Doyle, “Introduction: Historicizing the American Counterculture of the 1960s and 1970s,” in Imagine Nation: The American Counterculture of the 1960s and 1970s, eds. Peter Braunstein and Michael William Doyle (New York: Routledge, 2002).} To break its hold on America, the New Left and the counterculture, along with some strands of free market conservatism, protested, attempted legislative change, or “dropped out.”\footnote{George Nash, “The Historical Roots of Contemporary American Conservatism,” Modern Age 26, 3 (Summer 1982): 297-303; Timothy Miller, The 60s Communes: Hippies and Beyond (Syracuse: Syracuse University Press, 1999); Thomas Wellock, Critical Masses: Opposition to Nuclear Power in California, 1958-1978 (Madison: The University of Wisconsin Press, 1998).} Appropriate technologists, including E.F. Schumacher, John Todd, and Amory Lovins, took a more direct strategy.\footnote{Kleiman, “The Appropriate Technology Movement,” 118.} They suggested replacing the large, complex, and centralized technologies of the military industrial complex – particularly nuclear power – with small-scale decentralized technologies that they believed were inherently democratic due to their low cost and ease of operation.\footnote{Langdon Winner, Autonomous Technology: Technics-Out-of-Control As a Theme in American Thought (Cambridge, MA: MIT Press, 1977).}

Conscious that he was writing in the wake of the Vietnam War and Watergate, when suspicion of centralized power in the United States reached previously unseen heights, Lovins drew on the appropriate technologists’ theories to assert that shifting to small-scale technologies for distributed energy generation would counteract the inherent
corruption and authoritarian politics of centralization and bureaucratization. If Americans could supply the majority of their own energy needs with simple, easily available technologies, there would be no need for the cadres of experts required to run a nuclear industry. Just as importantly, he suggested, dispersed energy production would enhance local power by enabling a level of self-reliance unheard of since the days of the early republic. 818

The suspicion of centralized power, which characterized John Todd and the other technological optimists who formed a loose network around the Whole Earth Catalog, led them to an important intellectual and political compromise when they decided to draw on the knowledge produced by the military industrial complex to criticize political centralization and outline alternatives. 819 This compromise shaped Lovins’ method of argumentation and his approach to sustainability. Anxious to change society, but with a critical view of party politics and government bureaucracy, he avoided directly entering politics and instead sought to strengthen his position and influence by wielding technical knowledge. Seeking to remain outside the system but act upon it, Lovins embraced technocratic discourse in an attempt to use its own techniques of analysis – futurology – to expose its problems and gradually transform the technological and social structures of North America.

Lovins’ popularity among countercultural environmentalists as well as among the wider environmental movement underlines the enthusiasm for technical knowledge that some environmental historians have noted. The popularity of his vision, communicated through futurological analysis, provides further illustration of these countercultural environmentalists’ employment of Cold War techno-science. 820 It also highlights their fascination with visions of the future shaped by the abstraction and formalism of Cold War rationality. 821 Most importantly, however, Lovins’ work points to intellectual and political reasons for this interest in modeling and futurology: it provided a politically authoritative means to examine the consequences of current policy and propose alternatives that American and Canadian energy experts and government advisors would

819 Kirk, Counterculture Green, 101.
820 Kirk, Counterculture Green, 14.
take seriously.

By modeling America’s energy future, Lovins could enter into experts’ discussion of energy policy, identify problems, and thoroughly outline alternatives. The simplicity of his models and his powerful rhetoric allowed him to transcend expert debate and appeal to a broad section of environmentalists. Using his “hard path” scenario, Lovins identified serious flaws in American energy policy and demonstrated how problems grew worse as they extended into the future. In the narrative which accompanied this analysis, he was able to connect the relatively abstract problems of cost and sustainability with concrete concerns over rising taxes and prices, as well as the philosophical question of how nuclear technologies might reshape America. By using a model to “fit out” abstract future energy development, as Morgan suggests economists do, Lovins helped an audience that included environmentalists, energy analysts, and government advisors to appreciate the possible consequences of energy policy. Responding to earlier criticisms that he lacked a reasonable alternative, Lovins used the same approach to highlight potential real world solutions through his theoretical alternative: the “soft path.” To make this future world more concrete, he populated it with real world solar technologies (among others) and offered it as a solution to the energy crisis, which he asserted the “hard path” had exacerbated.

In his telling, an “ad hoc” approach to energy constructed by experts insulated by their technocratic authority had placed North Americans on the road to ruin. This short-sightedness explained investment in technologies his analysis had shown to be economically and energetically wasteful and socially and environmentally damaging. It also suggested that if this problem were addressed, North Americans could reap extensive benefits. By clearly explaining the consequences of energy policy and linking them to environmental, political, and economic concerns, Lovins presented his new energy policy as the best means of improving Americans’ lives and providing them with a truly sustainable future. By using the futurology pioneered to experiment with thermonuclear war, he modeled a sustainable future and constructed a compelling

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823 Hammond, “‘Soft Technology’ Energy Debate,” 660. Lovins would continue to campaign for his “soft path” for the next four decades as he gradually placed stronger emphasis on free market innovation rather than government regulation and planning. See Paul Hawking, Hunter Lovins and Amory Lovins, Natural Capitalism: Creating the Next Industrial Revolution (Boston: Little, Brown, and Co., 1999).
argument that rhetorically connected his projections and technical claims to the real world and refashioned energy policy as a means of solving economic, social, and environmental problems facing Americans and Canadians. In short, Lovins’ use of technical knowledge positioned the “soft path” as a means for environmentalists critical of aggressive resource exploitation to enter into the debate over development. His approach, however, also appealed to governments by providing them with a means of ensuring their countries’ economic growth and energy security in the face of a global crisis. The diverse support this combination of technical analysis and optimistic rhetoric created would play a central role in Lovins’ influence in Canada.

The Soft Path in Canada

Interest in Lovins and his “soft path” peaked between 1976 and 1979. In those years he published “Energy Strategy: The Road Not Taken” and his most popular book, *Soft Energy Paths: Towards a Durable Peace*. In 1977, the *New York Times* even ran a two-page article summarizing his views and noting the support the “soft path” received in Congress. Lovins’ extensive travels added to this visibility as he spoke everywhere from the provincial legislature of PEI to the Oval Office of the White House, and as policymakers, including President Jimmy Carter, solicited his views.

In Canada, Lovins became an important part of the network of environmentalists, government advisors, and scientists that championed renewable energy. Working with David Brooks, Andrew Wells, and the Science Council of Canada (SCC), Lovins raised awareness about renewables and helped to justify investment in solar technology. As the leading voice of sustainable development he corresponded with numerous provincial and federal officials, including energy minister Alastair Gillespie and Prime Minister Pierre Trudeau. In fact, within the Department of Energy, Mines, and Resources (EMR) Lovins’ influence with the energy minister generated internal debate when Gillespie

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recommended that department staff read his books, which caused considerable consternation among advocates of nuclear energy and rapid growth.\footnote{Memo to Gillespie from Ross Campbell of Atomic Energy of Canada Limited, Vol 165, File Armory Lovins, 1977-78, Gillespie Fonds, LAC.}

Outside of the EMR, Lovins and his “soft path” also garnered extensive Canadian interest. Lovins’ broader influence in Canada began with the SCC. The Science Council’s interest in Lovins emerged from its development of the conserver society.\footnote{J. Ann Lévi-Lloyd, “Canada’s Search for a Science Policy and the Role of the Science Council of Canada in Articulating Science Policy Issues from 1966 to 1980” (PhD diss. Université de Montréal, 1988).} As I argued in chapter three, its focus on planning the future led the SCC to voice concern over resource depletion and suggest scientific and technological solutions to the energy crisis, the primary suggestion being a shift to its conserver society that, similar to Lovins’ “soft path,” called for the rapid development of renewable energy.\footnote{Science Council of Canada, Report 19, Natural Resource Policy Issues in Canada (Ottawa: Information Canada, 1973).} As Lovins began to rise to prominence in early 1976, the Science Council invited him to Ottawa, where he spoke to the SCC and the EMR’s Office of Energy Conservation (OEC) about energy futures. Impressed by the talk, the SCC provided Lovins with information about Canada’s energy industries, Canadians’ energy use, and the country’s potential supplies and asked him to work with the SCC and the OEC to produce a study of Canada’s energy futures.\footnote{Jean-André Potworowski, “Editorial: Back to the Drawing Board,” Conserver Society Notes 1, 4 (May-June 1976): 3-4.}

In the “soft path,” the SCC saw a win-win opportunity. Lovins’ abstract methodology fit perfectly with the Science Council’s technocratic approach to sustainability, and his growing fame provided the group with a means to boost the visibility of its conserver society. His championing of solar technology as a “technical fix” for Canada’s unsustainable reliance on oil also perfectly supported the SCC’s interest in developing new technologies as part of a national industrial policy designed to maintain Canadian independence from the United States and to employ Canadian scientists and engineers.\footnote{Lovins, “Exploring Energy Efficient Futures for Canada,” 6; Science Council of Canada, Report No.15, Innovation in a Cold Climate: The Dilemma of Canadian Manufacturing (Ottawa: Information Canada, 1971) and F.J. Kelly, Special Study No. 20, Prospects for Scientists and Engineers in Canada (Ottawa: Information Canada, 1971). The Science Council of Canada and the conserver society are discussed in chapter three.} As a result, the “soft path” extended and straightened calls for a conserver society and connected them to Lovins’ well-defined plan for energy...
development. In return, the Council provided Lovins with the time, money, and data to enhance his analysis as well as burnishing his scientific credentials by providing the visible support of a prestigious scientific organization. Drawing on Lovins, the SCC championed investment in solar technologies as a means of undertaking truly sustainable economic and industrial development.  

With the visibility of his research on Canada for the SCC and his international reputation, Lovins’ ideas had a substantial impact on environmentalists in Canada. One group even published a guide to future studies modeled on the “soft path” to assist environmentalists anxious to employ Lovins’ methodology in their own critiques of energy or development policy. This influence is important for two reasons. First, it underlines the central role technical knowledge, particularly future studies, played in Canadian environmentalism and its influence in the 1970s. Second, it illustrates how Lovins’ rhetoric effectively framed the prospects of renewable energy and sustainable development during the late 1970s. In short, Lovins and his “soft path” provided a vocabulary and a methodology that environmental groups could use to manipulate the Trudeau government’s technocratic discourse and to take a more active part in discussions of energy policy.

Recognizing the persuasive power of Lovins’ optimistic rhetoric and the effectiveness of his technically founded criticism, Canadian environmentalists worked hard to adopt it. David Brooks, formerly the head of OEC and at the time a leading figure in both Energy Probe and Friends of the Earth Canada, led Canadian environmentalists’ efforts to employ Lovins’ approach. Brooks met Lovins in 1976 while the latter worked with the OEC and SCC on his energy analysis of Canada. The two also attended Energy Days, the provincial conference that helped the PEI government launch its renewable energy program, where they both advocated conservation and investment in solar energy. Furthermore, as a trained economist, Brooks was at home with Lovins’ use of forecasting and energy projections. In fact, he himself outlined similar arguments to

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832 Science Council of Canada, Report 27, Canada as a Conserver Society (Ottawa: Minister of Supply Services, 1977), 77.
support a central role for conservation in Canada’s energy future. This method of argumentation had influence for two primary reasons. It brought together a small, but influential, network that helped to direct alternative development on PEI and outlined Canadian sustainable development. More significantly, Lovins’ embrace of Cold War rationality and abstraction positioned his approach to succeed within Canadian political discourse and development policy.

Well aware of the importance of this technical discourse, Brooks and fellow environmentalist Sean Casey decided to help other Canadian environmentalists to follow Lovins’ lead. Writing in the environmentalist journal *Alternatives*, published with the support of the Friends of the Earth Canada, Brooks and Casey carefully laid out detailed instructions for environmentalists interested in undertaking a “soft energy path study” with the structure of Lovins’ analysis. The centerpiece of these studies was a combination of technical knowledge and optimistic rhetoric about the potential of renewable energy and the unsustainability of large-scale energy projects. They also copied Lovins’ approach in “Energy Strategy: The Road Not Taken” by using both as many technical details as could be marshaled and a futurological approach carefully crafted to outline how Canada’s energy future could develop if the soft energy path were pursued. Brooks’ and Casey’s guidelines even went so far as to explain how to construct the graphs and flow charts which Lovins often used to great effect. The guide also emphasized the importance of attacking industry or government plans on a technical level, as well as on environmental and social grounds.

Lovins himself helped teach Canadian environmentalists to replicate the futurological approach of his analysis. In the fall of 1978, he attended a workshop on soft energy paths at Trent University in Peterborough, Ontario. Speaking at the workshop, Lovins outlined his soft energy path and emphasized the importance of thermal matching as a foundation of his larger argument and as a means through which renewables could

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rapidly compete with oil, coal, and nuclear. Lovins also exhorted those at the workshop to use the soft energy path to challenge the assumptions and path dependency of mainstream energy policy by highlighting the irrationality and short-term nature of mainstream policy. As part of his extensive travels in the 1970s, Lovins presented his work at other Canadian energy conferences, including the Solar Energy Society of Canada, a group of scientists who advocated solar energy and would help shape Canadian renewable energy development in the late 1970s. At the conference, he emphasized his expertise as an energy analyst, as well as the technically flawed and ad hoc character of Canadian energy policy.

Canadian environmental groups adopted Lovins’ technical soft energy path approach wholeheartedly. For instance, in Energy Planning in a Conserver Society: The Future’s Not What it Used to Be, Energy Probe drew extensively on Lovins’ work. The group used his work to formulate alternative energy and development plans which it submitted to Trudeau’s Cabinet. Energy Probe also used his methods to outline a strategy that sought to transform Ontario into a province almost 100% reliant on renewable energy. Borrowing directly from Lovins’ thermodynamic abstraction of energy use, the group divided Ontario’s energy supply based on thermal quality to argue that Ontarians’ energy needs could be met effectively by solar and other renewable technologies. In short, Canadian environmentalists accepted Lovins’ ideas and reproduced his work as a tool in debates over energy development.

In fact, in Canada Lovins’ approach remained relevant among both environmentalists and policymakers well into the 1980s. In 1983, just as fears of oil scarcity began to fade, the federal government commissioned a national soft energy path study, 2025: Soft Energy Futures of Canada. Under the supervision of the EMR and Environment Canada, and with the support of Energy Probe and Friends of the Earth,

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842 Howard, “We’re on the Road to Ruin: Trudeau Energy Advisor.”
David Brooks, John Robinson, and Ralph Torrie produced the twelve-volume report. A masterpiece of futurology, it carefully examined Canadian national development and then analyzed the needs of each province to project an energy future and design both a national program as well as detailed regional plans for Canadian soft energy path development.

Lovins' soft energy path and his long-term analysis had a substantial influence on Canadian energy policy. The EMR’s energy analysts took Lovins’ ideas seriously. H. Swain, R. Overend, T.A. Ledwell and J.G. Hollins, the leading members of the EMR’s Conservation and Renewable Energy Branch, drew heavily on his work and through their reports; the Renewables Branch framed the Department’s examination of renewable energy around Lovins’ optimistic analysis of renewable energy’s future. For example, the Renewables Branch’s position paper on “Canadian Renewable Energy Prospects,” which outlined the EMR’s understanding of renewable energy and department policy in the late 1970s, borrowed extensively from Lovins’ optimistic view of North America’s energy future as it projected the successful development of solar technology. While slightly less bullish about the prospects for renewable energy than Lovins, the paper nevertheless stated that renewables provided the best long-term solution to the threat of high oil prices and energy scarcity in the 1980s.

In the view of these energy experts, renewables presented a potentially beneficial response to the energy crisis and a future world of unstable oil prices. Perhaps more importantly, the report also embraced elements of Lovins’ vocabulary and identified options as “soft” and “hard.” The paper’s use of what it called “Lovins Malleability” to grade different technologies and energy sources suggests that his terminology and models had been accepted by the Renewables Branch and helped to define how the EMR approached Canada’s energy future. The paper also wholeheartedly echoed his criticism of short-term planning and called for the institution of life-cycle calculations, which it

argued more accurately represented the long-term costs of energy technology.  

The acceptance of vocabulary and elements of Lovins’ analysis into official government reports underlines both the importance of technical knowledge to environmentalists and the ways in which Lovins’ optimistic rhetoric about energy sources shaped Canadian conceptions of sustainable development. As the following chapter will discuss, Lovins’ thinking about renewables and his approach to energy policy would help to justify the federal government’s decision to rapidly develop renewables, including the allocation of $130 million dollars (in 1978 dollars) in financing to start a solar heating industry. The funding program, which borrowed extensively from Lovins’ soft energy path, even projected solar heating would become a multimillion-dollar industry and employ thousands of Canadians by the 1990s.

Conclusion

Lovins had a unique and powerful voice in the 1970s environmental movement. He began where many environmentalists did in the late 1960s and early 1970s, by attacking the idea of endless growth. Rather than appealing to people’s desire to preserve the world’s natural beauty or protect human health from atomic radiation, however, and instead of drawing on ecological science to criticize nuclear power’s potential impact on the environment, Lovins turned to algorithms and simulations. Futurology, first pioneered at the RAND Corporation, allowed Lovins to imagine and convincingly sketch alternative energy futures. Constructing an abstract and vastly simplified model of nuclear energy, he attacked the belief that the atom could provide almost limitless power and instead argued that it presented a false promise that would impoverish rather than enrich. To drive home this point, he broke the world down into technological systems and energy inputs and outputs to present an alternative, and then he charted its theoretical success well into the twenty-first century to demonstrate its potential.

Framed by futurology, Lovins’ story of redemption through soft technology and

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renewable energy called on both citizens and policymakers to rethink energy. Energy itself was more than just a means to economic growth. It was a scarce and valuable commodity in its own right, which required extensive investment as well as socially and environmentally disruptive technologies to produce it. Thus energy policy, rather than being a realm to be trusted to unresponsive industry or the vagaries of the market, required extensive analysis and probing debate of experts’ suggestions to ensure that the necessary long-term planning occurred and that it actually served the interests of all.

To make this argument without relying on the NIMBYism of local politics, Lovins calculated $X_i(T)/X_o(T)$, where $X_i(T) = P_i n_i(T)$ and $X_o(T) = P_i N_0 e^{aT}$ for the first generation and $X_o(T) = P_i N_0 (1 - e^{-aT}) (1 + e^{-aT} + e^{-2aT}) e^{aT}$ for subsequent generations of nuclear reactors, to show that nuclear technology could never provide limitless energy.\(^{854}\) However, he moved smoothly from this abstract quantification of nuclear power’s future to a straightforward discussion of energy futures. Connecting his calculations and scenarios to the real world and using them to explain mundane, but powerful, concerns, such as rising prices, he constructed a story about the promise of renewable energy technology. As he defended his analysis and began speaking with both government ministers and political leaders, his ability to shift between abstract calculations and the potential real world consequences proved invaluable.

Lovins’ rethinking of energy policy made it an important aspect of environmental advocacy and part of a new approach to development. Connecting with and supporting the SCC’s conserver society, he helped to outline an influential conception of sustainable development. In fact, Lovins’ approach to energy policy and his “soft path” is still popular today. His arguments for a technologically driven escape from climate change (no longer scarcity and authoritarian technology) continue to define North American discussions of renewable energy through their reformulation as natural capitalism and his Rocky Mountain Institute.\(^{855}\)

This optimistic story of green progress, foundational to contemporary sustainable development and deeply influential in the 1970s, could not have existed without Lovins’ abstractions and calculations. By borrowing Herman Kahn’s “intuitive science” and

\(^{854}\) Lovins and Price, *Non-Nuclear Futures*, 176.

rubbing the hypothetical up against the real, Lovins reframed energy policy and made it into a central means of saving the world. In this way, his rationalistic abstractions, calculations, and intuitive leaps of futurology shaped environmental thought and framed early attempts to undertake sustainable development. In Canada, the network of energy experts, advisors, and environmentalists Lovins worked with convinced the EMR to invest hundreds of millions in an experiment with the primary technical fix of the soft energy path: solar energy. The following chapter will examine how the mobilization of models and political networks made this pioneering program of sustainable development possible, and how the fragilities of this technocratic method of exercising power framed Canada’s embrace of solar energy in the late 1970s.

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Chapter 6:
Models, Networks, and Optimism: Renewable Energy in the Late 1970s

On July 4, 1978, Alastair Gillespie, the Minister of Energy, Mines, and Resources (EMR), announced a five-year, $380 million subsidy program for solar energy and biomass. When other research spending and joint federal provincial funding were included, Gillespie estimated total outlays would reach roughly $600 million (in 1978 dollars). He further suggested that renewables programs might generate ten percent of Canadians’ energy and promised they would create as much as 39,000 “man years of work” and lead to the development of a solar heating industry with annual sales of between $400 and $800 million by 1990. Minister Gillespie’s statement, promising the equivalent of $1.96 billion (when adjusted for inflation) for renewables, remains one of the largest financial pledges ever made to developing renewable energy in Canada. The government’s ambitious commitment to solar technology becomes even more intriguing when one realizes that since Canadians had only begun to experiment with solar energy in the 1970s, the EMR relied on simulations of solar technology rather than direct experience when proposing hundreds of millions of dollars in funding.

This chapter expands my earlier analysis of technical knowledge and its political power by examining how the Office of Energy Conservation (OEC) and its allies used modeling and forecasting to transform solar heating from an obscure technology into the centerpiece of Canadian sustainable development. I argue that the practice of simulation, in the form of the influential WATSUN computer model, framed the Trudeau government’s funding of renewable energy by acting as both a method of analysis and a tool of political debate. Privileged by the scientistic ideology of the Trudeau

858 Pritchard, “Federal Plan to Encourage use of Solar and Waste Energy”.
859 Inflation adjustments were made according to the Bank of Canada inflation calculator. http://www.bankofcanada.ca/rates/related/inflation-calculator/
government and necessitated by the long-term nature of energy policy, simulations had a significant role in the federal government’s efforts to construct a national energy policy in the early 1970s and remained central throughout the decade as the government attempted to plan its way out of the energy crisis. Thus, the story of Canada’s commitment to solar heating is one of political manipulation and the use and misuse of technical knowledge by government advisors anxious to change policy.

I am not the first to examine the important place of modeling in Canadian energy politics. Previous scholars, however, have understood its significance as part of the state’s efforts to obscure political decisions behind claims to objectivity. To expose this appeal as a façade, scholars have focused on the simplicity and the inaccuracy of these models. The failings they have pointed to were very real. In Canada, for example, natural gas forecasts went from predicting surplus, to scarcity, to surplus again in the 1970s. This analysis has also highlighted how “fact based” policy heightens the power of some at the expense of others, a very important point that lies at the foundation of my examination of how OEC shaped energy policy. In emphasizing the state’s ability to control knowledge, however, these scholars overlook how the production of knowledge and the employment of expertise by the state expanded policy debates and limited or redirected state power. When bureaucrats and politicians use metrics to assist policymaking, they alter relationships of authority, since the use of expertise to legitimate their actions pushes them to abide by the practices of expert communities. This shifting of authority can transform models from tools of obfuscation into a means of starting or


broadening political debate or internal discussion of policy among government departments and, in some cases, it can justify novel or experimental policies.

As I argued in the previous chapter, environmentalists used models to draw on the scientific and political legacy of the Cold War to challenge central ideas of American and Canadian political ideology, namely the possibility of endless growth. The particular form of abstract and formalist rationality that emerged from Cold War efforts to contain and direct human irrationality provided the foundation of both the Trudeau government’s efforts to systematize policy and environmentalists’ assertion that continual exponential growth in resource use was impossible. 866 This technically mediated approach resulted in a technologically optimistic form of criticism. Environmentalists and government advisors, from Amory Lovins to the Science Council of Canada, asserted that the Trudeau government’s energy policy was flawed, but rather than calling for radical changes, they suggested a technical fix designed to replace the most flawed technologies (nuclear and fossil fuels) and gradually transform Canadians’ society and economy into a conserver society. This shared approach rested on two foundations: first, the belief that experts could plan and manage social and economic transformations, and second, the ability of new technologies to achieve these adjustments without causing substantial political change and without rejecting continued economic growth. Guided by their belief in the simulations that analyzed the future and enabled long-term planning and excited by the endless energy renewables seemed poised to provide, these environmentalists and government advisors attempted to take the first steps towards the conserver society through programs of national economic growth and energy independence.

Sustainable development, however, did not emerge solely from simulations and technological optimism. Departmental politics, namely network building and the assertion of bureaucratic autonomy, played an instrumental role in making it into policy. 867 The OEC had begun assert its understanding of Canada’s energy future through


its use of energy analysis and economics soon after its founding in 1973.868 Beyond working to establish its claims to expert authority, the OEC helped the Science Council and the Campbell government on PEI to examine renewables and illustrate their promise in the mid-1970s. Continuing to build broader support for conservation and renewables, the OEC also worked closely with the group of scientists and engineers who formed the Solar Energy Society of Canada in 1975, and it began to study solar technology intensively. With this network of experts and political allies, the OEC established itself as the leading authority on renewables, particularly solar, and shaped the federal government’s understanding of renewable energy. In short, sustainable development became policy because the OEC erected a coalition behind solar technology, manipulated the Trudeau government’s scientism to establish a reputation for expertise on renewables, and pushed solar into the EMR’s plans for energy development in 1978.869

Unfortunately for the development of solar technology, the optimistic forecasts of the technology’s development that OEC relied upon to win support for its solar programs proved inaccurate. In the early 1980s, solar technology disappointed. It failed to meet the expectations created by energy experts’ forecasts of the technology’s future development. Just as significantly, the networks within the EMR crumbled as staff changed and the department’s policy focus shifted back to oil. This collapse in the government’s support for solar illustrates the fragility of expert authority within politics by showing its ultimate reliance on both a political culture that values science and the support of specific government departments. In politics, the methods of analysis and the goals of the state matter as much as the facts themselves.

This chapter’s examination of the Trudeau government’s solar energy program and the central role modeling played in its creation proceeds in four sections. The first expands upon my earlier analysis of the Trudeau government’s efforts to convert policymaking into a process of calculation by analyzing how the government employed models to construct a policy response to the energy crisis and how the OEC, along with a network of environmentalists and energy advisors, used these plans to their advantage.

The chapter then turns to a detailed examination of WATSUN, the most important model used by the EMR to analyze the prospects of solar technology. This model framed solar energy and its future by projecting its development and its potential contributions to Canadian energy policy. Reflecting the technological optimism of the EMR, WATSUN’s particular interpretation of the technology displaced competing analyses of solar heating and provided the metrics through which the government analyzed the performance of solar technology and projected its success. The third section examines how the OEC used WATSUN’s simulation of solar technology’s development to take advantage of the EMR’s emphasis on modeling and planning to insert solar into government efforts to achieve energy self-sufficiency. The final section examines the crumbling of support for renewables in the early 1980s and the government’s decision not to renew the funding for the programs after their first five years of operation. I argue that this decision underlines the fragility of experts’ authority in the face of political changes and failures to deliver on overly optimistic promises.

**The Energy Crisis and the Need for “Self-Reliance”**

Conservation had no initial place in the Trudeau government’s attempt to address the energy crisis. As I discussed in chapter one, its first response to the rising prices, announced on December 5th 1973, focused on shielding Canada from these fluctuations by increasing domestic oil production.870 This brief policy statement, which called for the expansion of oil production and subsidized prices, guided federal policy throughout 1974 and much of 1975 as the federal and provincial governments and oil companies jockeyed to gain control over oil and gas development, and all three ignored the OEC’s calls for energy conservation.871 In fall of 1975, this view of energy conservation started to change.

Trudeau and the Liberals had been re-elected to a majority government in late 1974, but a year later rising energy prices and increasing inflation began to threaten the

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government’s plans for national economic development. In response, Parliament passed wage and price controls in an attempt to gain control of inflation. This legislation put the Liberals into a particularly awkward position as they had harshly criticized the Progressive Conservatives in the recent election campaign for proposing such controls. Cabinet memos from this period show a government anxious to respond publicly to Canada’s economic problems and to disprove accusations by provincial governments and opposition parties that “Canada [had] no national energy policy.” To protect its commitments to directly improving Canadians’ lives and to burnish its image as an active government capable of dealing with the energy crisis, cabinet called on the EMR to construct a coherent energy policy which could guide “aggressive government policies directed at increasing supplies, reducing demands, and ...encouraging inter-energy substitutions.”

EMR Minister Alastair Gillespie and his department quickly put together An Energy Strategy for Canada: Policies for Self-Reliance and released it to the public in the spring of 1976. This detailed policy document explained the government’s past policies, outlined Canada’s energy prospects for the next fifteen years, and announced a comprehensive new energy strategy for the country. Built around energy forecasts that showed globally declining stocks of oil and rising national demands for energy, the plan made self-reliance the centerpiece of Trudeau’s new plan. This goal helped renewables gain a position in policy discussion by offering a possible means of achieving something close to energy self-reliance as the “end of oil” loomed. The report even took a page from the OEC and argued that Canada needed to start conserving energy. An Energy Strategy for Canada, however, still focused primarily upon the importance of expanding Canadian supplies of oil and gas in an effort to meet most of Canada’s energy needs with domestic oil production while exporting enough fossil fuels to offset the costs of any

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876 Energy Debate briefing for Trudeau, November 1973, Trudeau Fonds, LAC.
necessary imports. Thus, the report continued the earlier effort to shield Canadians from international price instability, while creating an opening for renewable energy and conservation as part of a broader effort to achieve self-reliance.

By calling upon the EMR to plan Canada’s energy future and encourage conservation without undermining economic growth, Trudeau’s cabinet created an opportunity for environmentalists, the Science Council of Canada, the OEC, and others critical of the government’s past energy policies to suggest alternatives. This network of expert energy critics had been growing since David Brooks and OEC first began to call for conservation in the early 1970s. With the emergence of the Campbell government’s alternative development program and the SCC’s conserver society in the mid 1970s, a consensus emerged among these groups that renewable energy provided the best answer to Canada’s looming energy problems. PEI’s Energy Days, for example, brought together leading conservation and renewable energy experts from inside the federal government and among the environmental movement to convince observers, including provincial MLAs, that renewables had a place in Canada’s future. In the same year, Peter Middleton, the energy advisor who helped negotiate funding for the Institute of Man and Resources, provided the EMR with its first analysis of renewables, which promised solar space and water heating “will prove to be technically and economically viable” before 1990. Perhaps even more importantly, Amory Lovins pushed solar energy and sustainable development into energy debates across the western world in the mid 1970s and provided their advocates with a methodology and rhetorical style perfectly suited to

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880 Lynne Douglas and Martha Pratt, eds. Energy Days: Proceedings of an Open Seminar of the Legislative Assembly of Prince Edward Island, Charlottetown, 1976, PEI Collection, UPEISC; Letter from Alex Campbell to Alistair Gillespie, May 17, 1976, Background Information, Series 3, Subseries 4, IMR Fonds, PEIPARO.
the Trudeau government’s political culture of “rational management.”  

As I argued in chapter one, the government’s technocratic style of policymaking framed Canadian politics, particularly energy policy. An Energy Strategy for Canada: Policies for Self-Reliance, for example, devoted an entire chapter exclusively to energy scenarios. Analyzing the future of oil, the EMR made specific projections suggesting that “net imports of oil could increase continuously over the next fifteen years, amounting to almost 0.5 million bbls/day in 1980, 1.2 million bbls/day in 1985 and just under 2 million bbls/day in 1990.” Similar quantitative estimates and simulations appeared throughout the report as it sought to define Canada’s energy future through simulation and begin constructing a response that fit its understanding of how the energy crisis would play out over the coming decades.

While the government’s use of technical knowledge did narrow debate and helped the Trudeau government frame policy around expertise, it also opened a space within which those groups that possessed this knowledge could challenge its assertions. This framing of analysis created a reciprocal relationship between scientists and experts and government when the EMR drew on their advice in its attempts to plan Canada’s energy development around the best available estimates of what that future would be and which approaches might succeed. Taking advantage of the EMR’s reliance on models and forecasting to examine the future and assert its ability to plan development, the OEC and the network of renewables experts employed the same methods to point out problems in government policy and suggest solutions better suited to achieve energy self-reliance.

883 My argument draws upon Theda Skocpol’s analysis of how the state shapes political culture as its ideology and policy creates feedbacks which enhance the power of specific groups and approaches within political debates and Daniel Carpenter’s argument that by drawing on reputational and political networks bureaucrats are able create a degree of autonomy and shape policy. See Skocpol, “Bringing the State Back in: Strategies of Analysis in Current Research,” in Bringing the State Back In, eds. Peter Evans, Dietrich Rueschemeyer, and Theda Skocpol (Cambridge: Cambridge University Press, 1985) and Carpenter, The Forging of Bureaucratic Autonomy: Reputations, Networks, and Policy Innovation in Executive Agencies, 1862-1928 (Princeton: Princeton University Press, 2001).
884 EMR, An Energy Strategy for Canada, 76.
Energy advisors who favored renewables were well aware of the possibilities offered by working within the ideological context of the Trudeau government to establish the potential of renewables and conservation. Since its creation in 1973, the OEC had made acquiring the technical expertise to participate policy discussions its top priority by adopting energy analysis and emphasizing the economic utility of conservation. The OEC’s growing ability to participate in the technocratic discourse that characterized Canadian policy making of the period meant that the Trudeau government itself provided the foundation for alternative approaches to Canada’s energy future. Together the network of renewable energy advocates and the Trudeau government’s own political discourse provided the OEC with intellectual support to draw on and a political means to pursue its efforts to make renewables part of Canadian policy.

Two events in late 1975 and 1976 foreshadowed the OEC’s expanded role in energy policy and helped to make its influence possible. In 1976, the OEC relabeled itself the Conservation and Renewable Energy Resources Branch (Renewables Branch). While

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Figure 17: Domestic Demand and Availability Forecasts for Oil, 1970 to 1990. Note that everything after 1975 is a scenario constructed by EMR analysts.


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the EMR records do not divulge the precise reason for the new name, its occurrence just as a consensus began to emerge that renewable energy would be important to Canada’s future strongly suggests that the former OEC had managed to expand its responsibilities beyond conservation and had gained support for this expanded mission within the EMR. This change corresponded with another important event in 1975, which added the Solar Energy Society of Canada (SESCI), a new and very significant node, to the network of renewable energy experts and advocates. The work of this group of scientists and engineers promised a means to probe the novel technology and investigate solar’s potential as an energy source. In the 1970s, SESC became the leading Canadian authority on unfamiliar renewable energy technologies. In fact, an SESC member constructed the first solar heated home in 1971, and his house remained one of only a handful in operation in Canada when the society formed in 1975. This scientific expertise and its connections to the NRC and the wider circle of energy experts perfectly equipped the SESC to take an active part in the Trudeau government’s discussion of energy.

While the SESC worked to provide accurate analysis of solar and other renewables, it was the theoretical potential of these technologies rather than their more pedestrian present that motivated this group of scientists and engineers. This optimistic view of the technology pervaded its meetings and conferences as well. It is worth noting that Amory Lovins spoke about his “soft path” at SESC conferences using an optimistic rhetoric of progress through innovation. Emphasizing the potential of solar, the SESC joined its voice to the solar advocates championing a vision of solar energy’s successful development and its rapid deployment in a world of declining oil reserves and growing demands for environmentally benign energy. As sociologists J. Jasper Deuten and Arie Rip argue, such a combination of technically founded assertion and rhetoric can deeply

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887 E.W. Hoffman, “Four Years Operation of a Solar House,” (paper presented at The Potential of Solar Energy for Canada organized by the Solar Energy Society of Canada in cooperation with the National Research Council of Canada and the Central Mortgage and Housing Corporation, Ottawa, Canada, June 2-3, 1975). It is important to note that solar heating technology had seen widespread use in the southern United States. This success, however, should not be interpreted to mean the technology could be easily adapted to Canada since the climate and availability of sunshine in the two areas differ significantly. See Adam Rome, The Bulldozer in the Countryside: Suburban Sprawl and the Rise of American Environmentalism (Cambridge: Cambridge University Press, 2001).

affect the development of new technologies by shaping expectations, guiding research, and enrolling financial and political support.\textsuperscript{889} In the case of the SESCI, this belief that technological innovation could solve the energy crisis gave the group a policy goal – rapid renewable energy development – and connected them to an existing network of intellectual and political support.

Emerging as the Trudeau government searched for ways to address the energy crisis while maintaining its active promotion of economic growth, and well suited to the scientistic political culture of the mid 1970s, the SESCI generated significant interest. Leading bureaucrats and advisors from Environment Canada, the EMR, the Ministry of State for Science and Technology (MOSST), and the SCC attended the new group’s inaugural conference in Ottawa. C. M. Drury, the Minister of MOSST, even provided the conference’s opening comments. Focusing on the looming energy crisis identified by all “thinking Canadians,” he stated:

We do not, however, need to be very shrewd to realize that our present overwhelming reliance on oil and gas must come to an end within the next two decades and that by that time we must have established alternative energy sources. …[the federal government] shall certainly welcome any contribution that your society can make in bringing together experts in the field in developing a consensus among professionals and education of the general public. This last is the most important facet of the problem. It may well be that in future years governments will face greater problems in trying to obtain public acceptance of necessary changes in living style than in achieving the necessary technology.\textsuperscript{890}

After thus emphasizing the SESCI’s potential to provide the government with expert advice, he went on to tell those present that a recent Cabinet decision had identified renewables as one area of interest for the federal government and would provide a small amount of funding for these technologies.\textsuperscript{891} The combination of the SESCI’s growing influence and the tireless work of the Renewables Branch would transform this tiny

\textsuperscript{889} Deuten and Rip, “The Narrative Shaping of a Protect Creation Process,” 82.  
\textsuperscript{890} Remarks by the Honorable C.M. Drury, Minister of State for Science and Technology, “Energy Research and Development for Canada” (presented at The Potential of Solar Energy for Canada organized by the Solar Energy Society of Canada in cooperation with the National Research Council of Canada and the Central Mortgage and Housing Corporation, Ottawa, Canada, June 2-3, 1975).  
\textsuperscript{891} Memo to Cabinet, March 10, 1975, Research and Development for Canada,” Vol. 296, File EMR Policy Committee General, EMR Files, LAC; C.M. Drury “Energy Research and Development for Canada,” Vol. 9 files from Feb. 15, 1975 to March 24, 1975, File EMR Policy Committee, EMR Files, LAC.
commitment into a full-blown program of sustainable development.

The EMR agreed with Minister Drury’s positive assessment of the SESCI. Energy Minister Gillespie praised the society and the research of its members, and he sent official EMR representatives to its conferences. The EMR, particularly the Renewables Branch, also drew actively on the group for advice and enabled the organization financially. With this support, the SESCI successfully sought permission to brief cabinet directly on energy issues rather than rely on its work to flow through regular ministerial channels, an important achievement given the “focus group” organization of the Trudeau Cabinet that attempted to debate policy options to reach the most rational policy solution. While it is difficult to say exactly how much the group gained from this access to cabinet, its ability to put itself in this privileged position underlines both the Canadian government’s desire for expert advice on the “complexities of the energy situation” and the elevated status accorded to scientific and technical experts by the highest levels of the Trudeau government.

The SESCI’s cabinet briefings may have had mixed results, but its close relationship with the Renewables Branch played an instrumental role in pushing solar onto the federal agenda. The research of the SESCI’s members became the central source of information the federal government relied upon to judge the future of renewable energy technologies in Canada. Two mechanical engineers at the University of Waterloo Research Institute, K.G.T Hollands and J.F. Orgill, enjoyed a singularly far-reaching influence on energy policy when the Renewables Branch used WATSUN, a computer program they constructed, to model the future of solar heating in Canada. Built for the National Research Council, this model’s simulations of the future came to define expectations for solar heating technology within the Renewables Branch and, through it, Canadian energy development.

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895 Remarks by the Honorable C.M. Drury, Minister of State for Science and Technology.
The WATSUN Model and Solar Energy in Canada

The WATSUN model contributed to the Canadian discussion of solar energy in two ways. First, it provided the Canadian government, primarily the Renewables Branch and the NRC, with means of analyzing the state of solar technology and its possible economic and energy contributions to Canada. This ability to measure potential and theoretically plan the development of a new technology enabled solar to become a part of government energy plans. Second, WATSUN implicitly recreated the vision of renewable energy and its future promise held by energy experts from Lovins to the SCC. By building this vision into a model, Hollands and Orgill gave it a physical existence that provided an understanding of the future for solar advocates in the government to rally around and attempt to make into policy. Just as importantly, these two aspects of the model allowed it to overshadow other analyses of solar that suggested solar technology might not have as bright a future. As a result, WATSUN and the vision of solar technology it represented came to frame experts’ discussion of solar and, through them, the Trudeau government’s approach to the technology.

Orgill and Hollands constructed WATSUN in 1976 at the University of Waterloo Research Institute. It had substantial success immediately, and it remained in use, albeit in a reconfigured and expanded form, into the 1990s. The NRC funded the creation of WATSUN as part of its examination of solar technology and made it a central part of government research on the new technology. WATSUN had two closely connected functions: to simulate the performance of typical solar heating technologies and to calculate and project their economic performance. To paraphrase Orgill and Hollands, the model was designed to enable the EMR, NRC, and other government agencies to make an informed decision about the future of solar heating and construct a policy that reflected solar technologies' potential value in Canada’s economic and energy future.

In a manner similar to the EMR’s simulation of Canadian energy development discussed in chapter one, WATSUN attempted to understand Canadian energy

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development through highly abstract analysis. To contribute to the NRC’s efforts to quantify the typical behavior of solar heating systems and begin setting standards for the technologies’ performance necessary to predicting its development, Orgill and Hollands developed a set of algorithms to calculate the hourly efficiency of solar collectors and their thermal circulation systems. Along with its ability to examine theoretically every aspect of solar technology, WATSUN could act as “a detailed analytical model” or, when accuracy had less importance and computer power was limited, it could perform as “one of two relatively simple models, based on certain measures and ‘efficiency parameters’ obtained from actual efficiency measurements.” A third option allowed users of the model to input values and parameters for simulation. These options provided WATSUN with the flexibility to present a seemingly complete picture of how solar technology would perform in Canada.

To complete its simulation of how solar technology would behave, WATSUN drew on insolation and meteorological data, standardized information about buildings in Canada, and available information about solar collectors. Together this information created “four parameters which completely describe the type of system under study.” In an effort to examine the technology as comprehensively as possible, Hollands and Orgill added significant detail and variability to the model. For instance, WATSUN calculated the hourly values of solar radiation in population centers chosen to represent accurately a cross section of national insolation and the real world solar “fuel” users could expect anywhere in Canada. It also analyzed various typical configurations of solar collector, heat storage technology, and heat circulation method in an effort to allow the model to examine the solar heating system as a whole and accurately assess which configuration would function the most effectively.

The data Orgill and Hollands drew on to examine solar heating and its future came primarily from government sources. The EMR, Environment Canada, and Statistics

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900 Orgill and Hollands, WATSUN, 4.
901 Orgill and Hollands, WATSUN, 9.
902 Orgill and Hollands, WATSUN, 9.
903 Orgill and Hollands, Potential for Solar Heating in Canada, 42.
904 Orgill and Hollands, Potential for Solar Heating in Canada, 41.
905 Orgill and Hollands, WATSUN, 17-28.
Canada provided the economic and meteorological information they used to estimate solar radiation and the all-important future costs of oil, as well as the potential economic benefits of developing solar technology. Information about solar heating systems was less easily obtainable, and Orgill and Hollands relied upon a mixture of data available from professional journals (often from the United States or Australia, where the technology had a longer history) and experimental results provided by their own research and that of the NRC. Although somewhat patchy, this combination of academic and government data represented a reasonable, if not excellent, standard and gave the model scientific and technical rigor comparable to the EMR’s policy analysis.

Along with its projection of solar technology’s typical function, WATSUN simulated Canada’s and solar technology’s economic future. These economic projections

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906 Orgill and Hollands, *WATSUN*, 3.
907 Orgill and Hollands, *WATSUN*, 53.
played a central role in its analysis since the model had been built to make it possible to plan the development of solar technology.\textsuperscript{908} To understand solar’s present and future opportunities, WATSUN compared solar heating with conventional (oil, gas, or electric) heating systems to determine which technology provided the best economic value. Oil, the most widely used fuel and the focus of the EMR’s interest in inter-fuel substitution, served as the main competitor for solar. Orgill and Hollands, however, could not simply compare the cost of a solar heating system with that of an oil heating system since the structure of investment in these systems was entirely different. Solar systems required considerably more initial investment whereas oil systems had greater continual costs since fuel had to be purchased while sunshine was free. Furthermore, projects of future scarcity suggested the price of oil would rise and alter dramatically the economic competitiveness of these two technologies. As Orgill and Hollands put it with disarming directness:

\begin{quote}
To evaluate whether a solar heating system is cost-effective, it is necessary to know how fuel costs will alter in the future. It is also necessary to know the anticipated life of the solar system. Since an investment is also involved, it is necessary to know the current rate of interest on money.\textsuperscript{909}
\end{quote}

In short, to calculate the commercial success of solar they had to arrive at some understanding of the future cost of oil, Canada’s future interest rate, and the durability of a technology currently under development. Accurately simulating all these variables may seem a Sisyphean task. Nonetheless, Canadian energy analysts had been undertaking similar calculations in an attempt to plan oil and gas development since the early 1970s, and while they had achieved few successes, the combination of long lead times and the Trudeau government’s desire to plan meant that such estimates remained the core of energy policy.

Orgill and Hollands turned to simplification and abstraction to determine the future, settling on life cycle cost as the most useful metric to compare solar with conventional heating and to determine its long-term value. Defining life cycle cost as “the total money which must be set aside in the first year of operation so as to cover initial costs and all the operating costs over the life of the system,” the engineers set about

\textsuperscript{908} Orgill and Hollands, \textit{WATSUN}, 1.
\textsuperscript{909} Hollands and Orgill, \textit{Potential for Solar Heating in Canada}, 29.
developing algorithms to estimate these costs. The formula for Present Worth Factor (PWF) formed the foundation of their calculations by defining mathematically the relationship between interest rates and maintenance costs, years of operation, auxiliary fuel costs, and initial price.\textsuperscript{910} It enabled WATSUN to estimate the life-cycle cost for a solar heating system and, with a minor tweak to the calculation for fuel, the life cycle costs of conventional heating systems. The model could then compare solar with alternate energy systems by simply calculating their lifecycle costs. Whichever had the smaller number represented the most cost effective technology.\textsuperscript{911} Within the context of Canadian energy policy in the 1970s, the model became an extremely powerful tool able to project the technologies’ effectiveness and thus allow them to be understood and added to policy scenarios being used to plan for Canada’s energy development in the 1980s, 1990s and beyond. In effect, being able to simulate the technology gave solar heating an existence in the world of policy even if it lacked a substantial presence on Canadians’ rooftops.

WATSUN’s algorithm had a second important result. It made the commercial competitiveness of solar technology a function of its technological development and the cost of oil (or gas or electricity) over the period of time it defined as a “life cycle.” This assumption had the effect of making the consensus among advocates of renewables that the technology had a bright concrete and inserting it into the very foundations of analysis. Reflecting The SCC’s, Amory Lovins’, the Campbell government’s, and the OEC/Renewables Branch’s confidence that the technology would work and, more importantly, rapidly improve, Orgill and Hollands settled on twenty years as their baseline “life cycle” after they surveyed the existing literature on solar heating technology. Underlining their view, the two engineers even asserted that the “rate of development in solar technology in 20 to 25 years’ time” would be so fast that solar systems would remain functional, but be ready for replacement by better technology.\textsuperscript{912}

Orgill and Hollands’ faith in the rapid development of solar technology also shaped their baseline cost figures, the foundation of its economic competitiveness. In their view, because solar technology had yet to be widely manufactured or experimented

\textsuperscript{910} For price: P = a[(a^n-1)/(a-1)]x; For the PWF for the auxiliary energy (assumed to be oil): PWF = P/x = a(a^n-1)/a-1; For the PWF of inflation of auxiliary energy: PWF = Σ\textsubscript{m=1} [\textprod\textsubscript{j=1}(1+f/j/100)] /1 = i/100)^n.

\textsuperscript{911} Hollands and Orgill, Potential for Solar Heating in Canada, 29-30.

\textsuperscript{912} Hollands and Orgill, Potential for Solar Heating in Canada, 41.
with, the price of solar heating systems would decrease by 25% over the next ten years due to technological improvements and by a further 30% when efficiencies of scale decreased the cost of manufacturing solar technology. In their view, this development would result in a drop in cost by roughly 7% a year over a decade, which they noted equaled the projected rate of inflation for the next ten years. Consequently, the price of solar would remain steady while everything else got more expensive. In short, the technology would not only work, but it would improve quickly enough that new models would completely replace old ones in less than their functional lifetime.

Figure 19: WATSUN Calculation of Cost Competitiveness. WATSUN’s comparison of solar and oil heating costs in 1980. Solar is cost effective if interest rates are 9% and cost competitive if interest rates are at 11.5%. The oil price scenarios refer to the EMR’s 1976 forecasts of Canada’s energy future.


The beliefs embedded within WATSUN led its calculations to project the bright future for solar technology that its advocates predicted. However, it is important to

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913 Hollands and Orgill, Potential for Solar Heating in Canada, 70.
recognize that WATSUN’s analysis did not simply rest on the wishful thinking of Orgill and Hollands. Its understanding of Canada’s energy future drew directly from the rising costs of oil, gas, and electricity that the EMR had painstakingly projected in its 1976 report. Oil, in particular, faced a daunting future. According to EMR analysts, Canada would become increasingly reliant on imported oil beyond the 1980s, due to the lag time needed to bring new oil to market and increasing energy use, which would force Canadians to pay the international price of oil that they believed would continue to rise as supplies decreased. Drawing on the EMR’s calculations, Orgill and Hollands broke down the cost of oil over the next twenty years into three periods in which prices increased by 23%, 10% and 12% respectively. Using these values as its baseline cost for the future price of oil, WATSUN estimated that “solar heating (using liquid based systems with short term energy storage) was cost effective in 1976 for some scenarios of future oil and electricity prices,” and its competitiveness would improve in the future as oil prices increased and solar technology progressed. Together the rising costs of oil, which EMR analysts viewed as inevitable, and the assumed rapid development of the technology led Orgill and Hollands to conclude that some uses of solar heating were immediately competitive, and eventually commercial success and substantial energy production would follow.

Orgill’s and Hollands’ model not only seemed to present evidence of solar technology’s cost effectiveness, but it produced a concrete representation of solar advocates’ view of the technology. WATSUN also provided those advocates within the EMR with a powerful political tool capable of inserting solar into plans for Canada’s energy future by exploiting the Trudeau government’s emphasis on technical knowledge and forecasting in its energy policy. This combination of analysis and belief, assisted by the EMR’s search for new sources of energy, would make solar a viable part of Canadian energy policy by carrying arguments for renewables into the EMR and presenting them in a manner privileged by the department. To do this, however, WATSUN and its view of solar energy needed to displace other analyses that did not support its optimistic vision of the technology.

WATSUN was not the only source of information about solar technology. While Orgill and Hollands developed WATSUN, another group of engineers working for the NRC under the leadership of Doug Lorriman carried out a more hands-on experiment with solar heating by building the Meadowvale solar home (also known as the Mississauga House). Completed in late 1975 as both a demonstration of solar heating technology and as an active research project, the Meadowvale solar home exemplified the NRC’s efforts to develop Canadian expertise in solar heating as quickly as possible.\footnote{See Sibbett, B. E. and H. Jung, \textit{Performance of the Meadowvale Solar System} (Ottawa: Division of Building Research, National Research Council, 1981).} Its solar heating system consisted of six components: a connected series of solar collectors totaling 64.4 m², two 18,000L built in concrete hot water storage tanks, a domestic hot water preheating tank, a forced air heat circulation system, a heat pump, and electric water pumps.\footnote{Doug Lorriman, \textit{“Meadowvale Solar Experiment Performance Report”} (paper presented at SESC\textI{I Conference Proceedings, Edmonton, Alberta, August 22-24, 1977); Doug Lorriman, \textit{National Research Council Solar Technical Series 1: An Assessment of Problems Experienced with the Operation of Solar Systems in Canada and the Northern United States}, Ottawa: WORDS Associate, 1978; J.M. Bell and D. Lorriman, \textit{"Off-Peak Electrical Backup Experience in the Meadowvale Solar Experiment” (paper presented at the Fourth Annual Conference of the Solar Energy Society of Canada, August 20-24, 1978); Sibbitt, B.E., H. Jung and D. Lorriman, \textit{"Performance of the Meadowvale Solar Home}” (paper presented at the Fourth Annual Conference of the Solar Energy Society of Canada, August 20-24, 1978).} Although it sounds somewhat complex, the Meadowvale solar system was actually analogous to the liquid based system with short-term thermal storage that WATSUN calculated to be the most cost efficient.\footnote{Sibbitt and Jung, \textit{"Performance of the Meadowvale Solar System,”} 12.}

Over the next three years Lorriman, who would go on to be a leading member of the SESC\textI{I,} presented a series of disappointing reports about the Meadowvale solar home which directly contradicted WATSUN’s analysis.\footnote{D. Lorriman, \textit{“Meadowvale Solar Experiment Performance Report,”} 1-2.} The central problem was that solar heating only managed to produce 41 percent of the house’s heat, far less than the sixty to seventy percent Lorriman and his team designed the system to produce.\footnote{Orgill and Hollands, \textit{WATSUN}, 25-26.} This result did not directly contradict the WATSUN model’s analysis since it assumed some solar would only provide fifty to seventy-five percent of the heat. However, if such an extensive system could not even manage to produce half of a home’s heat, more would have to come from expensive oil, thereby undermining the economic benefits of solar. Furthermore, Meadowvale’s disappointing results challenged other aspects of WATSUN

and the wider consensus of renewable energy experts, particularly the technology’s durability and the potential of thermal storage.

Lorriman and his team concluded that the complexity of the Meadowvale home was central to the project’s unimpressive results. In a manner similar to the PEI Ark, the complexity of the parts of the heating system caused problems to cascade when malfunctions occurred, which required constant fine-tuning and close monitoring far beyond what Lorriman expected. Condensation on the insides of the solar collectors, for example, resulted in continual trips to the roof and eventually corrosion of the temperature sensor and collector plate that in turn caused the system’s controls to malfunction and continually pump water, which threw off the system’s circulation of heat. Problems with the hot water storage tanks’ insulation similarly led to the continual loss of the heat the system did collect. Worryingly for those who argued that solar collectors were a technology ready for immediate use, Meadowvale’s collectors performed well below the manufacturer’s specifications even without the circulation system’s problems.

Figure 20: The Meadowvale Solar Home in the Winter of 1977.


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These less-than-inspiring results failed to garner extensive interest within the EMR. In fact, despite being a government study with direct relevance to the development of solar technology, Meadowvale was never mentioned in the EMR’s discussion of solar heating.\footnote{None of the government policy papers I was able to examine mentioned or cited the Meadowvale Solar Home. “Renewable Energy Resources: A Guide to the Literature,” MG28, File 11, 1977, People’s Commission Fonds, LAC; “Canadian Renewable Energy Prospects,” Efficiency and Alternative Energy Branch, Box 1, EMR Fonds, LAC; “The Cost Effectiveness of Residential Solar Heating,” Efficiency and Alternative Energy Branch, Box 1, EMR Fonds, LAC; Energy, Mines, and Resources, “Energy Issues,” Efficiency and Alternative Energy Branch, Renewable Energy Division, Box 1, EMR Fonds, LAC.} Instead, government planning documents often cited the works of Orgill and Hollands, Amory Lovins, Peter Middleton, and the SCC, and treated them as the leading sources of information on solar heating, particularly its potential contributions to the Canadian economy. As I noted in the previous chapter, the Renewables Branch, and through it the EMR, relied on this literature and even adopted Lovins’ vocabulary of “soft” and “hard” to describe energy technologies.\footnote{H. Swain, R. Overend, T.A. Ledwell and J.G. Hollins, “Canadian Renewable Energy Prospects,” n.d. Energy Sector, Efficiency and Alternative Energy Branch, Renewable Energy Division, Box 1, File SOL Originals, EMR Fonds, LAC.} This abstract, model based consensus around solar technology that developed among these energy experts in the mid 1970s limited the influence of Meadowvale, which fit neither the model’s established expectations nor the expanding vision of sustainable development.

Meadowvale seems to have had little impact among solar experts who pushed for the adoption of renewables. Lorriman, for example, remained a staunch advocate of renewables and continued to call for the development of solar technology. The relatively narrow focus of the study, which included only one solar heating system, provided one reason to deemphasize its results. Meadowvale represented only one data point, albeit an important one. Against this result, Peter Middleton and other government advisors had provided extensive studies of solar heating that drew on both successes in the United States as well as a variety of experts’ predictions that solar thermal technology would succeed.\footnote{Middleton, Canada’s Renewable Energy Resources, 59.} More famously, Lovins’ books and articles overflowed with citations detailing working solar heating systems down to the size of their thermal storage units.\footnote{Amory Lovins, Soft Energy Paths: Towards a Durable Peace (London: Harper-Colophon Books, 1977), 127.} The existing consensus, along with the technocratic assertions of coming success, pushed Meadowvale and other early projects with problems to the margins as lemons or as minor
setbacks in solar technology’s predicted progress.

The emphasis on the future manifested itself in a different, but no less important, way that also limited the impact of Meadowvale. Due to the government’s focus on planning, the EMR, particularly the Renewables Branch, had far less interest in the present state of solar technology than in its future. As the Renewables Branch put it in a discussion paper analyzing the possibility of a solar energy program in early 1978:

The performance and cost-effectiveness of new technologies usually improve as they mature; solar heating is not likely to be an exception to this rule. …the dilemma, of course, is that the technology will not mature without a market and the market will not develop without a mature technology. A stimulus is required to get us off this dilemma if solar heating is to realize its potential in the next few decades.\textsuperscript{928}

In short, the Renewables Branch suggested solar heating would, if given the right opportunity, rapidly develop and become a commercially successful technology. This optimistic belief in technology and planning underwrote both the political ideology of the Trudeau government and the efforts of solar advocates from the Campbell government to the SCC. In effect, WATSUN’s simulations had more utility for the government since they gave it the ability to plan development and since experts who advised it and worked to shape energy policy remained convinced of solar’s potential. In this context, little opportunity existed for Meadowvale’s results to moderate expectations for solar or change policy. In short, solar technology became part of policy because of a shared technocratic approach to the energy crisis and economic development, along with the construction of a network of experts who dominated the discussion of renewable energy.

**Model, Network, and Energy Policy**

In early 1977, the Renewables Branch began to use WATSUN to examine solar technology and through this analysis shaped the government’s understanding of solar.

\textsuperscript{928} Energy, Mines, and Resources, “Discussion paper 5-78: Implementation of Solar Heating,” Efficiency and Alternative Energy Branch, Renewable Energy Division, Box 1, EMR Files, LAC. Specific authorship is difficult to determine because the Department of Energy, Mines, and Resources records are fragmentary and rarely track internal correspondence within the department, and the designations and staffing of “offices” and “branches” changed regularly in the 1970s. As a result I have relied heavily on the few individuals I have been able to place with the few papers that include authors and on the source designated in the archival record (i.e. Efficiency and Alternative Energy Branch) to determine the authorship and intention of specific policy documents.
WATSUN enhanced the Renewables Branch’s analysis in three important ways. First, its calculations formed the basis of the Branch’s projections of solar development, which provided a quantifiable and seemingly objective basis for its work. Second, the Renewables Branch adopted its method of analyzing solar technology – life cycle cost – to compare energy technologies and their future economic competitiveness. Third, echoing the views of other energy experts, the Renewables Branch adopted WATSUN’s assertion that solar technology would improve rapidly and its improvement could be quantified and projected, which allowed it to use the model to outline the best methods to develop the technology. Using Orgill’s and Hollands’ model to frame its work, the Renewables Branch demonstrated how solar energy could be a part of Canadian energy “self-reliance” and began to advocate specific government policies, most importantly a substantial investment in solar technology and a broader effort to make the technology an engine of both energy security and economic growth.

The Renewables Branch’s push for new policy began with the “Discussion Paper 12-77: Solar Heating” circulated within the EMR in June 1977. Using WATSUN’s analysis to provide a technical foundation, the Renewables Branch argued Canada should heavily fund solar technology to create a new industry. DP 12-77 adopted life cycle costing as the primary measure of economic competitiveness and future success. In its first paragraph, it asserted that “projections of life-cycle costs make solar and water heating an attractive alternative.” To support this bold statement, the report assured its readers that these projections took into account solar technology, regional variations in solar radiation and climate, and conventional heating technology, and that the analysis drew upon “a range of reasonable estimates of the future costs of money, conventional fuels, and solar systems.” Going further, it noted that improvements in the technology “can be expected to enhance the attractiveness of solar systems,” which made success almost assured. Relying on these “reasonable estimates,” the Renewables Branch concluded by saying that the solar technology would be “directly supportive of the broad

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objective of energy self-reliance outlined in *An Energy Strategy for Canada*.

Using WATSUN’s analytical framework and employing its quantitative estimates of success, the report went on to make a series of policy recommendations. It asserted that WATSUN and many other studies had shown that the government had no cause to worry about technical or economic problems; rather the biggest challenge facing solar was the need to speed the rate of commercialization and adoption so that simple inertia and unfamiliarity did not impede the development of this piece of the solution to Canada’s energy problems. To speed adoption, the report suggested a federal program focused on purchasing solar heating systems for government buildings as a means to start commercialization. In keeping with WATSUN’s analysis, this market would allow manufacturers to improve the technology and decrease costs through economies of scale. This approach, according to DP 12-77, would also familiarize Canadians with the technology and further expand the market for solar heating.

The Renewables Branch also relied on the same calculations which WATSUN used to discuss solar heating and its prospects. In “Technical Note No.3: The Cost-Effectiveness of Residential Solar Heating Systems,” Don Strange, who along with Harry Swain led the Renewables Branch, used Orgill and Hollands’ research to examine the relative costs of heating a residence with solar. To provide the EMR with an estimate of the economic competitiveness of solar, Strange used the PWF algorithms to arrive at the conclusion that over its twenty year life a solar heating system would save $8,102 (in constant 1977 dollars) when compared to an oil heater. This calculation rendered solar economically beneficial and thus commercially viable. Echoing WATSUN’s technologically mediated focus on the future, Strange asserted:

The reinforcing combination of escalating fuel prices and declining solar system costs (through mass production and technological development) is likely to significantly improve the cost-effectiveness of solar heating. Under the above oil price scenario, a similar solar system installed in 5 years would generate cumulative

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931 EMR, “DP 12-77: Solar Heating.” Unlike many EMR reports, DP 12-77 cites its sources, and for both of the above assertions it cited Hollands’ *Potential for Solar Heating in Canada.*


933 EMR, “DP 12-77: Solar Heating.”

savings amounting to $9,196.

Solar technology’s future, according to this government advisor and his use of a popular and carefully designed forecasting model, would get brighter and brighter.

By asserting the utility of solar on the basis of the WATSUN model, the Renewables Branch gained leverage within policy discussions at the EMR. Energy policy under the Trudeau government privileged technical knowledge, and when the government sought a plan to address the energy crisis, modeling and forecasting became instrumental. When the EMR started to put the goal of “energy self-reliance” into practice in 1977 and memos professing the need for new sources of energy “based on the belief that our energy gap is growing” began to land on the Minister’s desk, seemingly objective evidence of solar’s future success provided the Renewables Branch with an opportunity to finally put renewables on the policy agenda.935

In the discussions of how to achieve “energy self-reliance” that consumed the EMR after 1976, WATSUN presented the perfect method of inserting solar into department debates. In fact, the Renewables Branch’s use of WATSUN marked the endpoint of the group’s efforts to expand its influence that David Brooks had begun years before as it mobilized economics and energy analysis to support its calls for conservation. The WATSUN model enabled these bureaucrats to uphold their position of expertise and provide what seemed to be scientifically grounded advice on the development of a new technology. Thus, by employing the models that some scholars have argued are the tools of obfuscation by the powerful, this small group within the EMR managed to gain a degree of autonomy and reshaped Canadian energy policy.936

The Renewables Branch’s ability to shape policy as well as the authority of WATSUN’s projections manipulated the hyper rationalism of the Trudeau government in a second, no less important way. The Trudeau government’s desire to manage policy rationally and sublimate political debate to fact-based analysis led it to emphasize seemingly objective analysis and the advice of experts. In the instance of renewable technology this quite reasonable emphasis on expert knowledge had significant consequences. Most notably, it meant a relatively small group of people dominated

936 Robinson and Hooker, “Future Imperfect.”
discussion of renewables and their potential to supply Canadians with energy and jobs. As I noted above, the experts whom the Renewables Branch relied upon for analysis of solar and its prospects included the SCC, Lovins, Middleton, and SESCI. While these scientists, engineers, and analysts took their investigations of renewables very seriously and critically examined solar and other technologies, a consensus of a sort existed within this network that solar provided one of the best options for long-term environmental sustainability, national growth, and energy self-sufficiency. Furthermore, this consensus rested on a sense of technological optimism and a belief in the importance of extensive planning that this network of experts shared with the Trudeau government.

The Renewables Branch’s briefing paper on “Canadian Renewable Energy Prospects,” written by Harry Swain along with other members of the Renewables Branch in 1978, provides perhaps the most complete summation of this network of experts’ view of solar and its influence within the EMR.\footnote{I have been unable to ascertain if Swain was a member of the SESCI, but he did publish an article in the SESCI’s journal. See H. Swain, “Solar Electric Conversion,” \textit{SOL} 7 (1977): 4-10.} The report began with a bland statement that “the outlook is disturbing” for conventional energy even within a country with as extensive reserves as Canada.\footnote{Swain, Overend, Ledwell, and Hollins, “Canadian Renewable Energy Prospects.”} With Canada’s bleak future of reliance on expensive imported oil established, the report moved on to renewables. Echoing the SCC’s introduction of solar years before, Swain et al. introduced their readers at EMR to its potential by noting that “7000 TW [is] intercepted by the disc of the earth” while humanity only uses 7.5 TW.\footnote{Swain, Overend, Ledwell, and Hollins, “Canadian Renewable Energy Prospects.”} From that inspiring beginning, the report went on to state that solar heating technology presented Canada with the greatest potential benefits on a life cycle cost basis.\footnote{Swain, Overend, Ledwell, and Hollins, “Canadian Renewable Energy Prospects.”} Drawing on WATSUN’s analysis and the broader optimism that surrounded the technology, it asserted that “as manufacturers and installers gain experience and as improved designs come onto the market, the real price of solar heating systems can be expected to decline.”\footnote{Swain, Overend, Ledwell, and Hollins, “Canadian Renewable Energy Prospects.”} To support this point it forecast a series of scenarios of solar development that resulted in between $20 million and $80 million in

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\footnote{Swain, Overend, Ledwell, and Hollins, “Canadian Renewable Energy Prospects.”}
industry revenues by the year 2000. In a reflection of the consensus surrounding solar’s bright future, the report also recognized, and to a degree embraced, the wider goals of renewable energy advocates by noting that while a society completely supported by “soft technologies” was a distant prospect, energy scarcity and changing views of consumption “may indicate that a conserver society is not so limited.” Swain et al. concluded their government report by reaffirming the belief that if a “sound technological base” could be established a “large market will develop in a decade or two.”

As the Renewables Branch embraced this optimistic view of solar technology’s prospects and convinced the EMR of its accuracy, other arguments based on this consensus began to have a significant effect on policy. Most strikingly, the expectation that solar would succeed quickly led to concerns that Canadian industry might miss this opportunity. Restating the SCC’s view of solar as a means of asserting “technological sovereignty,” the EMR began a series of internal discussions of the possibility that Canadians could lose out on this new and potentially lucrative industry. Well aware of the Trudeau government’s desire for economic development and the appeal of the SCC’s calls for national technologies, the Renewables Branch warned that “if Canadian manufacturers have not been able to establish themselves within [five years], the opportunity of creating this new billion-dollar-a-year manufacturing industry will have passed by.”

This fear of missing an industrial boom emerged from American solar initiatives in 1977. In that year President Jimmy Carter reorganized American energy policy and, along with meeting solar advocates, such as Amory Lovins, implemented tax subsidies for solar heating and publicly committed his government to the rapid development of solar technology in a speech marking the opening of the Solar Energy Research

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945 EMR, “DP 5-78: Implementation of Solar Heating.” I discussed the Science Council’s advocacy of a nationalist industrial policy in chapter three.
While these commitments added credibility to the view that a very large market for solar technology would emerge quickly, they also raised the possibility that American multinationals might establish themselves and aggressively enter the Canadian market. This combination of national fear and technological optimism directly shaped policy as the EMR openly designed its eventual program around direct purchase rather than tax incentives because that allowed funds to be channeled to Canadian companies. As Gillespie put it in his announcement of the solar programs, “we see no reason why equipment for solar heating can’t be designed and manufactured in Canada by Canadian firms.” It is also worth noting that Gillespie’s speech began with an imagined statement of thanks from future generations for looking ahead and planning effectively as well as an almost verbatim restatement of the Renewables Branch’s warning that Canadians had to create a solar industry in five years or lose their chance.

As a result of this combination of fear, optimism, and technocratic management, the minister of the EMR announced one of the largest support programs for renewable energy in Canadian history on July 4, 1978. Speaking to the press in Toronto, Gillespie stated that the government would spend $380 million, $600 million if joint provincial and industrial spending was included, on solar and biomass between 1979 and 1984. This five-year subsidy program, he claimed, would create a solar industry able to generate between $400 and $800 million in annual revenue by 1990 and provide more than 30,000 jobs for Canadians. It would also double the amount of energy produced by renewables in Canada and enable solar and biomass to contribute a full ten percent of Canada’s energy by the year 2000.

The solar programs announced in the summer of 1978 consisted of Purchase and Use of Solar Heating (PUSH), Program of Assistance to Solar Energy Manufacturers
(PASEM), and Low Energy Building Design Awards (LEBDA). Together they promised about $130 million over five years.\textsuperscript{950} This funding also coincided with significant increases to the NRC’s and EMR’s research and development budget for solar energy. Finally, the federal government promised to expand its provincial partnership agreements, based on the Canada – PEI Agreement on Renewable Energy Development, discussed in chapter two, in an effort to encourage other provinces to follow PEI’s lead in developing renewables and conserving energy.\textsuperscript{951}

The solar programs Gillespie described grew directly from the Renewables Branch’s discussion papers. The main programs – PUSH and PASEM – employed the two-part approach to developing the technology the Renewables Branch had suggested based on WATSUN’s analysis.\textsuperscript{952} The majority of funding - $125 million – for solar heating would be used by PUSH to create a market for the technology by purchasing Canadian-made heating systems for federal buildings. This procurement of solar systems allowed the government to assume any risks associated with the emerging technology while also ensuring that Canadian companies benefited from funding.\textsuperscript{953} The approach enacted the consensus view of renewable energy experts into policy, namely the idea that solar heating technology would develop rapidly if the government created a market. Reflecting this technologically optimistic view, PASEM and LEBDA offered a series of grants of between $10,000 and $350,000 intended to support companies’ efforts to improve solar technologies and design more energy efficient buildings.\textsuperscript{954}

The federal plan continued to make news on July 5th, when EMR official Harry Swain provided more details to reporters about the funding program. His description of the federal initiative connected it to Lovins’ and the SCC’s earlier arguments for solar as he emphasized the relative simplicity of solar heating technology and the advantages it derived from this straightforwardness, as well as its direct production of heat where users needed it.\textsuperscript{955} Swain also assured his audience that the technology was ready for

\textsuperscript{950} Government to Support Strong Canadian Solar Effort, Internal Fact Sheet, Vol. 311, File Renewable Energy Resources, 1977-78, Gillespie Fonds, LAC.
\textsuperscript{951} Memo to the Minister, Re: Cabinet Meeting June 1 – Renewables and Conservation, Vol. 311, File Renewable Energy Resources, 1977-78, Gillespie Fonds, LAC.
\textsuperscript{953} Pritchard, “Federal Plan to Encourage Use of Solar and Waste Energy.”
\textsuperscript{954} Pritchard, “Federal Plan to Encourage Use of Solar and Waste Energy.”
commercialization and could develop into an important part of Canada’s energy future.

The Renewables Branch manipulated the Trudeau government’s political culture with the support of the intellectual and political network of energy experts and WATSUN’s projections of technological and economic development. The Branch used this combination of technological optimism and claims to expert authority to enhance its position within the government and to make solar technology part of Canadian energy policy. Models acted as tools of the politically weak and enabled Canadian bureaucrats to manipulate government ideology to pursue their own policy goals. The formerly marginal Renewables Branch and its allies turned a relatively unknown technology into the centerpiece of a very ambitious program of development. This political ability, coupled with the Trudeau government’s desire for national development and the belief in the potential of technological solutions to address the energy crisis and create Canadian economic independence made the outlook of renewables seem dazzling. However, the authority upon which the political power rested – technical expertise – would prove fragile when the models failed and government priorities began to shift.

The Disappointing Results of the Solar Heating Program

The bright future of renewables in Canada began to fade almost immediately after the announcement of federal funding. PUSH, the flagship program, ran into a combination of disorganization, bureaucratic infighting, and technological problems. With the final rush to announce solar and other renewable energy funding, the EMR and other branches of government spent little time planning the implementation of PUSH or other programs, and they were left with a byzantine organizational structure. The large number of departments involved in the program caused the most grievous problems. PUSH, for example, had been awarded $125 million over a five-year period, but, deciding on projects and overseeing them involved the EMR, the NRC, and Public Works Canada. The EMR had primary responsibility for planning and managing energy programs, but since this project developed technology, the NRC monitored the solar systems which Public Works installed on federal buildings. Adding to the confusion, the Treasury Board oversaw the funds. Ever jealous of its financial prerogatives and insistent

upon the necessity of budgetary accountability, the Treasury Board decided to disburse money on a project-by-project basis. This decision made every request for funds a slow, multi-department process as each department had to sign off on every project the EMR attempted to guide through approvals and actually provide with funding.

Unsurprisingly, this diffuse organization and complex oversight machinery resulted in confusion and delays, as departments bickered over the approval of individual projects and attempted to keep track of how and where funds were spent. In fact, Public Works Canada eventually set up an office dedicated specifically to overseeing the complex process of managing the program. As a result of this initial confusion and the cumbersome funding process, it was 1979 before funds actually made their way to the members of the solar industry, and even by 1982 the PUSH program had only managed to spend $35 million of its allocated $125 million.

Frustrated by this confusion, particularly after the fanfare of the original announcement and the scale of the government’s projections, the tiny Canadian solar industry began to grumble about PUSH, PASEM and LEBDA. The initial delays angered solar companies, which were often small start-ups reliant on government funds, and the cumbersome grant review process slowed and complicated their ability to plan projects. Since the programs provided lucrative contracts, the new business enterprises stopped short of attacking them. The requirement that all solar companies conduct extensive and time-consuming feasibility studies, a task that most of newly formed manufacturing companies had difficulty carrying out, created another point of contention.

In sharp contrast, the NRC complained that PUSH projects did not always entail effective enough monitoring to ascertain which solar thermal systems functioned well, or even if the systems functioned as their manufacturers promised they would. As solar technology remained a novelty in Canada, the research community saw the program

primarily as a means to gather much needed data about the technology. Finally, PUSH had extensive problems with solar heating technology itself. New and sometimes less than professional companies often produced low quality products that required expensive repairs and forced Public Works to continually revisit installations. Such problems increased costs and hampered the EMR’s ability to plan its purchasing because it continually had to review which companies could provide acceptable solar systems.

Disappointed by these problems, the failure of the technology to improve rapidly, and the program’s minimal contribution to energy production or oil substitution, EMR and cabinet began to have doubts about solar heating technology. By July 1982, cabinet decided to give the program one more year of funding (the original program would have provided funds until 1984), but ordered the EMR and Public Works Canada to launch a thorough review. The resulting assessment reached cabinet in the spring of 1983. It suggested four possible responses. In the first option, the government would pay out its current contracts and then completely end funding for solar energy in Canada. The second option was to wrap up the PUSH program, but continue to fund Canadian solar research at a minimal level with the hope of maintaining a leadership position among developers of solar heating technology. A third option, the solar industry’s preferred approach, was to continue and accelerate government financing. Under this scenario, funding would increase to $175 million for a further five years to give the solar industry and the involved government departments an opportunity to build on their experiences with the PUSH program. A fourth option also continued the government subsidies, but at a low level.

The review fractured support for the solar programs. Public Works Canada, which had supervised the installation and maintenance of solar systems, supported the fourth option and the continuation of the program. The department identified with the solar industry and saw itself as engaged in an important mission of industrial development,

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which deserved more time to see if the industry could become commercially viable.\textsuperscript{966} In contrast, the EMR regarded PUSH and the other solar programs as failures and recommended phasing them out during the 1983 fiscal year while continuing to fund NRC research on solar at a reduced level. As Jean Chrétien, then serving as the Minister of the EMR, stated, the government had decided to fund solar on the belief that it would eventually supply roughly five percent of Canadian energy at a cost comparable to conventional energy, but “to date, active solar energy has not proven to be economically attractive relative to conventional energy sources.”\textsuperscript{967} Since the EMR had been tasked with evaluating the development of solar and other renewables and was the senior department, its assessment carried the day.\textsuperscript{968}

The EMR’s decision seems harsh given the disorganization of the programs and their short time span. The Renewables Branch, however, had initially recommended heavy funding for solar technology based on specific, quantifiable metrics. The WATSUN model, which had defined the future of solar development five years earlier, expected a decline in the price of solar technology by 7% per year as the technology attained wider usage and improved.\textsuperscript{969} The Renewables Branch championed this assessment and the rest of the EMR pursued solar development primarily on this basis.

A decrease in price, let alone significant annual reductions, had manifestly not happened by 1982 when the EMR and cabinet launched a review of Canada’s solar programs.\textsuperscript{970} Without this expected decline in the cost of solar, the technology could not compete on a life cycle cost basis with oil even as oil prices continued to increase. By the very metrics that advocates of solar within the EMR had used to understand the development of solar and recommend government funding in 1977, the technology had failed. The EMR Minister’s memo to cabinet put it bluntly: “[Solar] will continue to be uneconomical for space heating applications for the foreseeable future, unless major breakthroughs are made. …while solar energy continues to be extremely popular in terms

\textsuperscript{966} Memo to Minister’s Office, From Executive Secretary, Re: Canadian Solar Industry Association, March 30, 1983.
\textsuperscript{969} Hollands and Orgill, \textit{Potential for Solar Heating in Canada}, 70.
\textsuperscript{970} Memo to Cabinet, From Minister of EMR, Re: Solar Policy Review, March 14, 1983.
of public opinion, few consumers have been willing to pay the premiums over conventional energy required to install solar systems.”

In short, solar had not lived up to the optimistic projections that had generated government interest in the technology, and without the ability to contribute to Canada’s future energy security or create new Canadian industries, the EMR saw no reason to fund the technology.

Changes within the EMR also hastened the abandonment of this once promising technological fix. In 1979, the Trudeau government briefly lost power to Joe Clark’s Conservatives, before returning with a majority in 1980. According to historians, the brush with disaster made the revived Trudeau government more politically aggressive in its efforts to transform Canada in its image. Political scientists G. Bruce Doern and Glen Toner suggest that this resurrection substantially sharpened energy politics by convincing the Liberals that a national energy policy was necessary to stop the balkanization caused by oil revenues dividing the country into haves and have nots.

Two results followed: the appointment of Marc Lalonde, one of Trudeau’s most trusted lieutenants, as energy Minister, and the infamous National Energy Program.

The NEP took the explicitly political stance that having “[accepted] its national responsibility in the energy area, the government of Canada has therefore decided that it must act now, and that it must act in a manner that fully recognizes the special circumstances surrounding energy.” The EMR interpreted these “special circumstances” to mean the necessity of ensuring security of supply, Canadian participation, and equitable pricing for all Canadians. To this end, the NEP unilaterally imposed a new pricing regime for oil. Justifying its aggressive assertion on the simple basis that the federal government represented the national interest, the Trudeau government effectively declared war on the producing provinces in an effort to end the years of bickering surrounding oil development.

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Lalonde and the NEP generated such acrimony among the oil producing provinces and industry that the federal government began to soften its approach in 1982, and replaced Lalonde with Jean Chrétien, already a talented fixer. This rapid series of policy and personnel changes in the early 1980s had significance beyond their impact on the larger picture of Canadian politics and energy policy. The departure of Alistair Gillespie in 1979 when the Conservatives briefly replaced the Liberals changed the EMR in subtle, but important ways. Advocates of renewables lost a supporter with real power who had been willing to go against the interests of the Canadian nuclear industry and to suggest that EMR policy analysts read Amory Lovins’ works. Gillespie also had a close relationship with Premier Campbell and had personally supported PEI’s alternative development programs. He had similarly instructed the EMR to work with the SESCI. The loss of Gillespie coupled with the inaccuracies of WATSUN’s analysis and the failure of solar to meet expectations severely damaged the network of energy experts and environmentalists who had championed renewables. While their ideas received one final airing with the government’s publication of 2025: Soft Energy Futures for Canada in 1983, the network and the Renewables Branch lost their ability to shape energy policy.

Beyond its failure to meet projected benchmarks and the crumbling of political and intellectual networks, changing global circumstances also dampened enthusiasm for solar. By 1983, the context in which the government evaluated renewable energy and its subsidy program had changed. Oil prices had begun to fall, which undermined claims of future economic competitiveness that the disappointments of the PUSH program had already made quite shaky. American shifts in energy policy during the early 1980s also conspired against renewables. Ronald Reagan’s administration repudiated Jimmy Carter’s commitments to making solar energy a substantial contributor to America’s energy supplies almost immediately. At a stroke, this decision removed a primary motivation of the federal programs, namely to develop the technology before the

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*Years, ed. Thomas Axworthy and Pierre Elliott Trudeau (Markham, ON: Viking Press, 1990).*


Americans did and to take advantage of a growing American market for solar energy.\footnote{Memo to Cabinet, From Minister of EMR, Re: Solar Policy Review, March 14, 1983.}

**Conclusion**

The Canadian government’s brief, but substantial, commitment to solar and other renewables emerged from a combination of computer models, departmental politics, and a wider culture of technological optimism shared by environmentalists, energy experts, and government bureaucrats. At its foundation this vision rested on the Cold War rationality that countercultural environmentalists, such as Lovins, government advisors at the SCC, and the Trudeau government all adhered to. Lovins, for instance, attacked “ad-hoc” approaches to policy and called for an emphasis on the long-term. When the Trudeau government, which similarly emphasized the efficacy of extensive planning, called upon EMR to develop a plan capable of managing the energy crisis, it underwrote a significant point of ideological agreement between government policy and the assertions of renewable energy advocates, namely that an event as complex as the energy crisis could be managed with the right application of knowledge.

This shared understanding of how to deal with the looming “end of oil” provided the foundation upon which the network of energy experts that had developed since the early 1970s built its policy program. Working within the Trudeau government’s ideological framework, these energy experts provided a technical fix: renewable energy. As the previous chapters discussed, in its advocates’ view, solar would do more than simply provide energy, it would also help create a more democratic and sustainable society. For the EMR and the Trudeau government, however, solar energy presented only a means of working toward the government’s long-term goal of “energy self-reliance.”\footnote{See Amory Lovins, *Soft Energy Paths: Towards a Durable Peace* (London: Harper-Colophon Books, 1977) and E. F. Schumacher, *Small is Beautiful: Economics as if People Mattered* (New York: Harper and Row, 1973).} Despite these different views of the technology, this network embraced the role of technocrat to become government advisors and provide the information in an effort to advocate the development of solar energy in whatever way possible. The optimistic consensus among these experts that solar provided one of the best solutions to the energy crisis and could provide economic, social, and environmental benefits, including the new industries the federal government desired, gave this group the ability to dominate
discussions of renewable energy and its prospects.

The capability to define how technology was understood had significant consequences for the government’s view of solar. While the groups that researched solar energy and provided the government with information, such as the SESCI, in no way stopped the presentation of results that contradicted the optimistic vision of solar, such findings, garnered little attention and swayed few, if any, who studied solar. The disappointing results of NRC’s Meadowvale study, for example, were presented to the SESCI, but did not moderate hopes for solar. Even the study’s lead engineer, Doug Lorriman, remained convinced that the technology would overcome the problems his study found and succeed.

When combined with the EMR’s privileging of modeling and forecasting as a means to analyze the future and make informed policy, WATSUN superseded studies such as Meadowvale, which neither provided projections necessary for planning purposes nor fit within the optimistic consensus of solar’s bright future. Seen from this perspective, technological optimism founded in the longer history of Cold War rationality played an instrumental role in Canada’s funding of solar technology as well as in the broader popularity of sustainable development. Rather than rejecting economic growth and embracing an environmental worldview, this program of sustainability signified the continued influence of what historian Nils Gilman has identified as the central component of modernization theory, namely “progress through the application of human will and instrumental reason,” and it supported the Trudeau government’s efforts to encourage national economic growth.980

Using WATSUN to guide analysis and lend scientific authority to its attempts to change energy policy, the Renewables Branch extended this consensus view of solar energy and made it the foundation of policy. By working within the bounds of the Trudeau government’s approach to policy, the Renewables Branch was able to frame the policies it favored in a way that they would be accepted. To ensure its suggestions had authority, the Branch acquired and asserted the technical knowledge privileged in the EMR to both define and justify its arguments that Canadian energy policy should include,

even focus on, renewable energy and conservation. In the hands of Harry Swain and Don Strange, the WATSUN computer model became a means for this small department to make itself heard in departmental discussions and to show in extensive detail how solar technology could help Canada achieve energy self-sufficiency. Rather than strengthening the views of those with power by obscuring decisions behind a veil of instrumental reason, WATSUN allowed the politically marginal to assert a degree of autonomy and implement their policy goals. For the Renewables Branch and the wider network of environmentalists and renewables advocates, technical knowledge offered an important political tool able to shape policy when used effectively.

The authority the Trudeau government’s scientism conferred upon the Renewables Branch, the technocrats of the Science Council, as well as technically sophisticated environmentalists enabled all of these groups to participate in the discussion of energy strategy and push sustainable development into Canadian policy. The reliance of this authority on the political culture of the state rendered it quite fragile, however. In the instance of solar technology, the Trudeau government’s shift to a more narrow policy focus on oil with the NEP and changes in the EMR undermined the political power of the technology’s primary advocate, the Renewables Branch. This collapse underlines the politically contingent nature of technical knowledge within the Trudeau government and the brittle character of experts’ authority more generally. The power of experts to use models and facts to change policy relies upon the government’s recognition of their knowledge and its privileging of that form of understanding over other viewpoints. In short, the attitude of the state matters as much if not more than the validity of the information. Assuming that better facts or more facts will reshape policy is to misunderstand the political power of expertise within the context of the modern state.
Conclusion

The Renewables Branch, with the help of environmentalists, scientists, and government advisors, made solar energy and sustainable development part of Canadian energy policy. Although impressive, this achievement proved both partial and temporary. When solar technology could not start a burgeoning industry or contribute to Canadian energy production in the short term, the government quickly abandoned it. Perhaps more importantly, even when the Trudeau government supported solar energy and sustainable development in the late 1970s, it shrank from scaling back its investments in oil and other non-renewable fuels or jettisoning its commitment to expanding economic development. Rather, solar became a means to continue growth in a world of limits.

For those convinced the world faced imminent environmental dangers, and who believed themselves armed with solutions that could address the world’s problems, the government’s partial response was profoundly frustrating. Andrew Wells, the director of Prince Edward Island’s Institute of Man and Resources (IMR), voiced this dissatisfaction before federal ministers and provincial officials gathered at the “Conserver Society: The Technical Challenge” conference in Halifax in 1978.扬 Lambasting the government’s slow adoption of renewable energy and its hesitant shift towards a conserver society, Wells declared:

The rising prestige of “rational” science has led to a serious eroding of traditional values, and the inability of society to provide goals that will enlist the deepest loyalties and commitments of its citizens…. Our institutions have become counterproductive – producing less health, less transportation, less learning, less justice – while consuming more energy, dollars and time. …Freeways use so much land that places are father apart and require more freeways to get to. Air conditioning makes our cities hotter, necessitating more air conditioning。

Concluding his critique, Wells argued that “within the present institutional framework and given the predominate perception held in the country, there is very little likelihood of renewable energy systems ever attaining the prominence, opportunity, and degree of

support needed to fulfill [its] technological promise.”\footnote{Wells, “Institutional Factors of Renewable Energy.”} Asking a question made familiar by contemporary climate change debates – “must we wait for the catastrophe” – Wells summed up the frustration he and other advocates of environmental sustainability felt.

Wells’ dissatisfaction with the slow response to the on-rushing catastrophe of energy scarcity and environmental collapse was palpable and quite understandable in the circumstances. Yet in his disappointment, Wells overlooked his reliance upon the power of the state and the quantitative, technocratic knowledge he cited as a cause of the world’s destruction. These forms of knowledge had helped him and the Campbell government of PEI launch the IMR. Furthermore, his analysis endorsed the core of the Trudeau government’s embrace of quantitative and formalist analysis when he argued Canadian society and government should respond to scientists’ and forecasters’ warnings by reorganizing the country to make it more efficient, humane, and sustainable regardless of the economic costs or the breadth of political support.

Wells’ dissatisfaction with the status quo and his reliance on the technical, abstract knowledge produced and privileged by the modern state underlines the tensions that ran through Canadian environmental politics in the 1970s. His criticism highlights a tension that remains central today, namely the question of whether environmental needs can be reconciled with growth or if it is necessary to abandon economic expansion altogether for sustainability to be more than an empty phrase. The environmental groups and government advisors this dissertation has examined thought accommodation was possible and pursued a strategy of technologically optimistic compromise with substantial success. But the question remains whether their approach benefited the cause of environmental sustainability or simply obscured the need for more fundamental change.

National politics enmeshes environmentalism, and state discourse circumscribes its actions, while government actors shape its ideas. In the 1960s and 1970s, “Cold War rationality” and the culmination of the postwar construction of the welfare state created a specific intellectual and political context that enhanced the power of environmentalists able to employ technical knowledge.\footnote{Paul Erickson, Judy Klein, Lorraine Daston, Rebecca Lemov, Thomas Sturn, and Michael Gordin, \textit{How Reason Almost Lost its Mind: The Strange Career of Cold War Rationality} (Chicago: University of Chicago University Press, 2013).} For example, the Club of Rome used the work of
a leading Cold War scientist, Jay Forrester, to introduce North Americans to the idea of environmental limits. In Canada, shared beliefs about the power of scientific rationality created a reciprocal relationship between environmentalists and the Trudeau government.985

Without the Trudeau government’s privileging of technical knowledge and long-term planning or its commitments to development in Atlantic Canada, it is difficult to believe the IMR, where Wells worked, would have received support. Similarly, Trudeau’s focus on rational management led to the creation of the Science Council of Canada. The elite scientists of the SCC played a central role in developing the very concept of sustainability and helped environmentalists adopt and popularize it. Even the conference at which Wells attacked “rational science” and “institutions” bears the unmistakable marks of the political culture of the Trudeau era. Arranged by the Ministry of State for Science and Technology, a body organized to provide the government with scientific advice, the conference emerged directly from the federal government’s technocratic efforts to encourage regional development and employed the Science Council’s conserver society concept to direct its actions.986 In short, the state and its rationalist ideology played an instrumental role in environmentalism, particularly the emergence of sustainable development.

Rationalist discourse and Cold War science even shaped some of the most iconic projects of countercultural environmentalists in the 1970s. The New Alchemists, who worked with Wells to launch sustainable development on PEI, used John Todd’s and Bill McLarney’s scientific credentials to lend credibility to their visioneering and successfully gathered a diverse cast of supporters, including countercultural environmentalists, charitable institutions, and governments. Without this support, including the hundreds of thousands of dollars provided by the Canadian government, Todd’s “biotechnic” research could not have happened and the famous space age Ark would never have existed.987

Amory Lovins shared the New Alchemists’ intimate relationships with the

Canadian and American governments and their reliance on Cold War science. His “soft path,” which still defines a leading effort to achieve sustainable development through capitalism, grew from the futurology that Herman Kahn had used to plan thermonuclear warfare.\footnote{Ghamari-Tabrizi, \textit{The Worlds of Herman Kahn: The Intuitive Science of Thermonuclear War} (Cambridge, MA: Harvard University Press, 2005). For a description of Lovins’ attempt to achieve sustainability through technological development and the free market, see Paul Hawken, Hunter Lovins, and Amory Lovins, \textit{Natural Capitalism: Creating the Next Industrial Revolution} (Boston: Little, Brown, and Co, 1999).} Using future studies, Lovins outlined the dangers of continuing the status quo and provided a rough blueprint for a social transformation through renewable energy and small-scale technology. Rather than being libertarians suspicious of the state or hostile to science and technology, countercultural environmentalists embraced the role of the technocrat and used their authority to help outline Canada’s first experiments with sustainable development. The government of PEI, the IMR, the Science Council, and the federal government all contributed to and borrowed from these technocratic environmentalists in the 1970s.

This influence, however, worked both ways. The desires of the state and the underlying assumptions of this rationalist ideology shaped their work by forcing them to act within the shared intellectual and political discourse. This reciprocal moulding of environmentalism, Canadian politics, and development and energy policy framed the country’s engagement with sustainable development above all else. The SCC’s desire for national economic and technological development, which it shared with the Trudeau government, generated interest in sustainability and indelibly connected the emergence of this fundamental environmental goal with national politics, economic development, and Cold War science. On PEI, the promise that renewable energy could underwrite provincial growth superseded its environmental benefits. Starting in 1974, the Campbell government, with which Wells remained closely associated, adopted renewables and sustainability to continue the modernization and economic development efforts begun by the Comprehensive Development Plan and adapt its encouragement of economic growth to a limited world. Thus, as Wells rightly pointed out, the institutions that supported them also constrained their actions and limited their impact. The underlying goals and ideology of federal and provincial governments shaped what advisors and environmentalists could propose, how their suggestions became policy, and the goals renewable energy.
technology was used to realize.

Even the ability to shape policy within the confines of the government’s broader goals could be quite fragile. When government priorities changed or the internal influence of groups and the policies they favored shifted, the network of environmentalists and advisors could find their expertise of little use. Government support for solar energy, for instance, dissolved in part because of changing priorities within Canadian energy policy. The fragility of expert authority and its reliance on state structure and political culture challenged a central, albeit implicit, assumption behind Wells’ speech and the actions of the environmentalists this dissertation has examined, namely, that scientific knowledge and expert analysis of the future could and should be the foundation of policy. Even with the Trudeau government’s attempts to make policy more objective and rely on science, the government’s evaluation of research mattered as much as the validity of the facts themselves. Policy, in short, remained stubbornly political.

The Trudeau government placed great weight on scientific and technical knowledge in the 1970s, but such analysis did not so much set policy as present a starting point for discussion. Rather than simply providing facts to policymakers or using their research as a political tool, environmentalists and government advisors interested in sustainability and renewables constructed networks of political and intellectual support and carefully worked to manipulate the government’s goals to their advantage. John Todd, Amory Lovins, and Andy Wells knew each other and worked together. The Science Council supported these individuals and the groups they represented, and in turn worked closely with the Renewables Branch, its first director David Brooks, and to a lesser extent the Advanced Concepts Center of Environment Canada. These relationships helped to spread understanding of how groups could manipulate government policy and to generate necessary financial support, and, as a result, they played an instrumental role in Canada’s experimentation with sustainability.

In both the Campbell government’s and the Trudeau government’s embrace of renewable energy, the development of this network of environmentalists, scientists, and government advisors enabled experimentation with new technologies. Together, the group not only presented seemingly objective research to validate new policies, it
dominated discussion of renewable technologies, such as solar, and defined the prospects of sustainable development programs in Canada. The ability of this web of associates to shape policy debates and even frame the prospects of developing technology, gave its supporters in government credibility and allowed them to frame policy. The Solar Energy Society of Canada and the Science Council, for example, shaped the Renewables Branch’s advocacy of solar energy and enabled its presentation of the novel technology as a near perfect solution to the EMR’s efforts to increase Canada’s energy security while also encouraging economic growth. This result suggests that building networks and reputations, the foundation of politics in modern bureaucratic states according to Daniel Carpenter, mattered as much as objective fact.  

The influence of a shared technical discourse, which brought together this diverse network for a brief period in the 1970s, underlines a point Wells made in his speech at the “Conserver Society: The Technical Challenge.” For all their successes, these experts lacked the power to change structures of the Canadian state, the economy, and society. By pursuing the seemingly easier technical fixes, championed from their position as elite experts, and appealing to governments’ desire for continued economic growth, this network of environmentalists and advisors achieved substantial success. However, this approach also limited their impact and rendered their accomplishments vulnerable to political changes. On PEI, for example, when Premier Campbell retired and the Liberals lost the 1979 election, the Conservatives sidelined Wells and the IMR, which ended the province’s experimentation with renewable energy.

The approach had a second, perhaps more significant, problem. It made sustainable development and renewable energy hostages to their ability to maintain or even expand economic growth. These technologically optimistic environmentalists and government advisors from the New Alchemists to the Science Council decided that if development were based on solar energy it would provide enough environmental benefits to offset the continuation of the consumer society. Furthermore, they believed new technologies might eventually lead to a conserver society. By making this compromise, they implicitly suggested that capitalism was sustainable, at least in the short term. Their

990 Wells, “Institutional Factors of Renewable Energy.”
assertion that economic growth could continue indefinitely in a closed system even while they built terrestrial space capsules to recycle their biological wastes underlines the central incongruity of this proposition. However, since these terrestrial space capsules owed their existence to promises of development, the intellectual concession had undeniable benefits. Beyond its logical incongruence, this compromise left sustainable development programs dependent on their ability to contribute economically, regardless of their environmental impacts. As advocates of solar energy found, competing on economic grounds with non-renewable resources could be a difficult task and left them vulnerable to the charge that renewables could not provide comparable economic benefits, a charge that helped end Canada’s support for solar technology.
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