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Résumé de l'article

Au cours des années soixante-dix, une crise mondiale de l'énergie fracasse le Canada. À la recherche de moyens de subvenir aux besoins énergétiques du pays, le gouvernement canadien encourage le développement d'une nouvelle technologie : le chauffage à l'énergie solaire. Les besoins économiques et politiques du gouvernement Trudeau et du Département de l'Énergie, des Mines et des Ressources, dominent l'industrie du chauffage solaire canadien de sa conception en 1978 jusqu'à sa disparition en 1983. La politique partisane n'est toutefois pas la seule source d'influence sur l'énergie solaire au Canada. Les technologies de simulation et de prédiction, ainsi que l'adhésion du gouvernement canadien à l'idéologie d'objectivité, ont aussi influencé l'histoire du chauffage à l'énergie solaire au Canada. Cette analyse du rôle de la simulation, de « l'objectivité », et du pouvoir politique dans l'essor et le déclin de l'industrie solaire vise à démontrer l'importance du gouvernement dans l'histoire canadienne de la technologie, et également à fournir une histoire de l'industrie de la technologie solaire canadienne.

Brief Periods of Sunshine: A History of the Canadian Government's Attempt to Build a Solar Heating Industry, 1974-1983

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Abstract: In the 1970s a worldwide energy crisis wracked Canada. Searching for ways to provide energy for Canada's future, the Canadian government encouraged the development of a new technology: solar heating. The political and economic needs of the Trudeau government and Department of Energy, Mines, and Resources dominated the Canadian solar heating industry from its inception in 1978 until its demise in 1983. Partisan politics, however, were not the only important influence on solar energy in Canada. Technologies of simulation and prediction, as well as the Canadian government's adherence to the ideology of objectivity, also shaped the history of solar heating in Canada. By analyzing the role of simulation, "objectivity," and political power in the rise and fall of the solar industry, this essay hopes to illuminate the importance of government in the Canadian history of technology and begin to provide a history of Canadian solar technology and industry.

Résumé : Au cours des années soixante-dix, une crise mondiale de l'énergie fracasse le Canada. À la recherche de moyens de subvenir aux besoins énergétiques du pays, le gouvernement canadien encourage le développement d'une nouvelle technologie : le chauffage à l'énergie solaire. Les besoins économiques et politiques du gouvernement Trudeau et du Département de l'Énergie, des Mines et des Ressources, dominent l'industrie du chauffage solaire canadien de sa conception en 1978 jusqu'à sa disparition en 1983. La politique partisane n'est toutefois pas la seule source d'influence sur l'énergie solaire au Canada. Les technologies de simulation et de prédiction, ainsi que l'adhésion du gouvernement canadien à l'idéologie d'objectivité, ont aussi influencé l'histoire du chauffage à l'énergie solaire au Canada. Cette analyse du rôle de la simulation, de « l'objectivité », et du pouvoir politique dans l'essor et le déclin de l'industrie solaire vise à démontrer l'importance du gouvernement dans l'histoire canadienne de la technologie, et également à fournir une histoire de l'industrie de la technologie solaire canadienne.

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From 1973 until the early 1980s an energy crisis wracked Canada, as inexpensive supplies of oil which had subsidized the post-war economic boom disappeared. In response, the Trudeau government radically changed Canada's energy policy and launched a dizzying array of energy initiatives, including the development a solar heating industry. Beginning in 1974 new programs massively increased funding for Canadian energy research and development and National energy plans released in 1976 and 1980 made self-reliance the cornerstone of Canadian energy policy. The Canadian nuclear industry readied itself for expansion, the Alberta tar sands entered full scale development, and a new source of energy, solar, received funds for the first time. Although solar energy had a history of substantial success, particularly solar heating technology in the southern United States, it was virtually unknown in Canada until the early 1970s, when a few entrepreneurial engineers and architects began experimenting with it. Despite its relative novelty, the Trudeau government would announce Purchase and Use of Solar Heating (PUSH), Program of Assistance to Solar Equipment Manufacturers (PASEM), as well as Research and Development in Solar Energy, which together promised to pour well over $125 million (in 1978 dollars) into solar-thermal research and to assist the development of a Canadian solar industry. In 1983, however, the Trudeau government abandoned the idea of a Canadian solar industry. Funding for solar research decreased to $1 million (in 1983 dollars) per year, and financial assistance for Canada's infant solar industry ended.

The rapid rise and fall of solar-thermal technology and the Canadian solar industry, raises a series of interesting questions. Most intriguing among them: why did the Canadian government quickly become such a strong supporter of solar-thermal energy, and why did it abandon the industry so abruptly? One might guess that the government's commitment was caused by technical breakthroughs in solar-thermal technology and that it was later put off by major failures. The technology, however, changed little during the 1970s and early 1980s. So what motivated the embrace and rejection of solar-thermal? This paper will argue that politics, and not the inherent strengths or weaknesses of the technology, dictated the fortunes of Canada's short-lived solar heating industry. Despite its seeming simplicity, this conclusion reveals a great deal about the fascinating ideas attached to solar energy during the 1970s, the Canadian government's understanding of science and technology, and the integral role supposedly objective forecasts and rationalist ideology played the Canadian governments' attempt to control and quickly develop a new technology.

Historians of science, economic historians, and those who study the state and policy, generally agree that the post-war world has been characterized by the growth of expert planning and "rational" or "objective" policy

making.[1] Statistics, or more precisely the appearance of mechanical objectivity numbers imparted, provided the foundation for the rise of the expert in the post-war period.[2] As Paul Edwards has noted, the new science of computing and simulation allowed the construction of a mechanical method of decision making which took advantage of the computer's capabilities, including statistical analysis and game theory, this greatly strengthened the influence of supposedly objective expertise as it seemed to remove the possibility of human error and bias from the process.[3] This development quickly transformed both military and civilian realities into "closed worlds" where computer simulations, cost benefit analysis, and rational choice theory shaped both government epistemologies and policies.[4]

The quest for expert decisions uninfluenced by politics or prejudices was deeply relevant to Canada in the 1970s. The decade saw two developments, the Trudeau government's commitment to "rationalizing" the Canadian government and its decision making practices and the advent of a completely unexpected energy crisis which forced Canadians to respond completely new problems. Together these events transformed the process of decision making within the Canadian government.[5] Adapting Edwards and Porter's observations to the Canadian context, and strengthening them with the work of Daniel Carpenter, a historian of state power, I will examine how the Department of Energy, Mines, and Resources (EMR) attempted to use computer models to both enable objective decision making about energy policy and increase the legitimacy of those decisions.[6] Beyond explaining the speedy rise and fall of the solar heating industry, this analysis will demonstrate how the Trudeau government's commitment to instrumental mathematical "rationality" influenced the development of solar heating technology in Canada.

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1. Theodore Porter, *Trust in Numbers: The Pursuit of Objectivity in Science and Public Life* (Princeton: Princeton University Press, 1995).
2. Lorraine Daston and Peter Galison, "The Image of Objectivity," *Representations* 40 (1992): 81-128.
3. Paul Edwards, *The Closed World: Computers and the Politics of Discourse in Cold War America* (Cambridge: MIT Press, 1997).
4. Philip Mirowiski, *Machine Dreams: Economics Becomes a Cyborg Science* (Cambridge: Cambridge University Press, 2002); Micheal Bernstein, *A Perilous Progress: Economists and Public Purpose in Twentieth-Century America* (Princeton: Princeton University of Press, 2001).
5. G. Bruce Doern, "The Cabinet and the Central Agencies," in *Public Policy in Canada: Organization, Process, and Management*, ed. G.B. Doern and Peter Aucion (Toronto: Macmillan Co. Canada, 1979), 27-61.
6. Daniel Carpenter, *The Forging of Bureaucratic Autonomy: Reputations, Networks, and Policy Innovation in Executive Agencies, 1862-1928* (Princeton: Princeton University Press, 2001).

Historians of Canadian science and technology have tended to focus on the influence of the Canadian environment or Canada's neo-colonial status on the development of Canadian science and technology.[7] This essay attempts to add a specifically political dimension to the Canadian discussion of science and technology by analyzing politics and ideology surrounding the rise and fall of Canadian solar heating industry. Studying the roles science and technology played within the Canadian Government, specifically the Department of Energy, Mines, and Resources, will improve our understanding of relationship between technological development and government politics in Canadian during the turbulent 1970s.

From 1968 until 1984 successive governments under the leadership of Pierre Elliott Trudeau dominated the Canadian political landscape. Motivated by critiques of Canada's neo-colonial economic position in the world, and by concerns over national unity, these complex and ambitions governments sought to strengthen Canada both economically and socially. Two major policy initiatives largely set the institutional context in which solar heating developed in Canada. The first policy initiative was the "rationalization" of the Canadian government.[8] This policy greatly expanded the role of planning and of expert advisors within the Canadian government. It also saw the institution of American management practices, including programming, planning and budgeting systems. As G. Bruce Doern argues, this policy initiative had its roots in the modernist ethos of the 1950s and 1960s which held that science, rational planning, and effective management could solve previously intractable social problems and create a "just society."[9] While the Canadian government was being "rationalized" in an effort to expand its abilities, the Trudeau government also launched a review of Canada's science policy in 1970, and between 1972 and 1974 published a three volume report, *A Science Policy for Canada*. These extensive reports inaugurated a new science policy for the country.[10] The report's principal conclusion was that the National Research

7. Douglas Francis, *The Technological Imperative in Canada: An Intellectual History* (Vancouver: UBC Press, 2009); Edward Jones-Imhotep, "Nature, Technology, and Nation," *The Journal of Canadian Studies* 38, 3 (2004): 5-36.

8. Lorna Marsden, "The Party and Parliament: Participatory Democracy in the Trudeau Years," in *Towards a Just Society: The Trudeau Years*, ed. Thomas Axworthy and Pierre Trudeau (New York: Viking, 1990), 262-281.

9. This belief was widely influential and characterized the "Great Society" programs of the Johnson Administration in the United States as well. See John Andrew, *Lyndon Johnson and the Great Society* (Chicago: Ivan R. Dee, 1998); Jim Coutts, "Expansion, Retrenchment and Protecting the Future: Social Policy in the Trudeau Years," in *Towards a Just Society*, 177-201; Doern, "The Cabinet and the Central Agencies," 40.

10. G. Bruce Doern, *Science and Politics in Canada* (Montreal and London: McGill-Queen's University Press, 1972).

Council (NRC), the government agency primarily responsible for directing the development of Canadian science, had not offered sufficient scientific assistance to Canadian industry, and, as a result, had damaged Canada's international competitiveness.[11] In response the Trudeau government stated it would concentrate on scientific assistance to Canadian industry "to provide new opportunities for manufacturing in Canada, and so extend market potential [of Canadian products and resources]."[12] This utilitarian view of science, and its focus on applied science and technology characterised the Trudeau government's approach to solar energy in the 1970s, eventually aiding the solar heating industry's rapid rise.

The first visible result of the Trudeau government's interest in solar energy came in 1974 with the formation of an Energy Task Force within the EMR, whose aim was to examine Canada's energy use and try to plan for an unstable future.[13] The Task Force consisted of a mix of environmentalists, bureaucrats, and scientists. Its primary role was to advise the department and the public on how to conserve energy.[14] The creation of new task forces, such as the Energy Task Force, marked a period of expansion within the EMR. Before the 1970s the department had been largely responsible for overseeing mining operations and had little policy making power. However, with the advent of the energy crisis the EMR became a full-fledged energy department with the expertise required to conduct energy forecasts and construct national policies. As John Eric Fossum has demonstrated, constructing a national energy policy quickly became contentious due to the conflicts over the control of resources encouraged by Canada's federalist structure.[15] Unfamiliar with setting policy, and facing immediate and politically charged criticism, the EMR needed to justify and legitimate its new-found autonomy and power. To do so the department employed an extensive array of scientific, economic, and political advisors.[16] This broadening of the EMR's responsibilities

11. Marcus Sharaput, "Policies of Culture Science and Technology in Canada," in *Policies: From Ideas to Implementation*, ed. Glen Toner, Leslie Pal, and Michael Prince (Montreal: McGill-Queens University Press, 2010), 142-176.
12. Senate, Special Committee on Science Policy, *A Science Policy for Canada: Report of the Senate Special Committee on Science Policy, Targets and Strategies for the Seventies*, vol. 2 (Ottawa: Information Canada, 1972), 566.
13. Library and Archives Canada (LAC), Department of Energy, Mines, and Resources (RG21), Central Registry Files, vol. 294, memo to members of the Energy, Mines, and Resources Policy Committee, Feb 20, 1974; LAC, RG21, Efficiency and Alternative Energy Branch, box 1, 5-78 DP, *The Implementation of Solar Heating*.
14. Energy Task Force, *Exploit Renewable Energy Resources: Solar Energy, R&D Program Outline* (Ottawa: Department of Energy, Mines and Resources, 1975).
15. John Eric Fossum, *Oil, the State, and Federalism: The Rise of Petro-Canada as Statist Impulse* (Toronto: University of Toronto Press, 1997).
16. Doern, "Cabinet and the Central Agencies," 40, 49.

presented opportunities for new ideas and new people.[17] Staffed with new and often well-qualified bureaucrats and motivated by the belief that innovative solutions should be tried, the EMR's Energy Task Force added a novel form of energy to Canada's future: solar.[18]

Although solar heating had a long and successful history in the southern United States, it was virtually unknown in Canada during the early 1970s.[19] Anxious to gauge the utility of this possible source of energy, the EMR began funding research into solar through the NRC. After briefly surveying solar-energy technology the NRC concluded that solar-thermal technology was the most fully developed and had the greatest ability to a contribution to Canada's energy future.[20] As a result, most of the resources it allotted to solar energy research focused on solar heating. The EMR, through the NRC, immediately began funding the development of a computer simulation program, named WATSUN, at the University of Waterloo. The program was designed to predict the amount of energy that solar thermal could provide Canada in the next twenty years.[21] The development of the WATSUN simulation would prove integral to how solar energy developed in Canada.

The WATSUN simulation program used meteorological data collected by Environment Canada, and mathematical models of various solar heating systems, to calculate the performance of heating systems, measured in terms of solar energy delivered by the system and the life-cycle cost of the

17. Michael Prince, "Policy-Advisory Groups in Government Departments," in *Public Policy in Canada: Organization, Process, and Management*, ed. G.B. Doern and Peter Aucion (Toronto: Macmillan Co. Canada, 1979), 275-300.
18. LAC, RG21, Central Registry Files, vol. 294, Minutes, Energy, Mines, and Resources, Deputy Minister's Policy Committee, Fifth Meeting, April 8, 1974.
19. Ken Butti and John Perlin, *A Golden Thread: 2500 Years of Solar Architecture and Technology* (Palo Alto: Cheshire Books, 1980); Adam Rome, *The Bulldozer in the Country Side: Suburban Sprawl and the Rise of American Environmentalism* (New York: Cambridge University Press, 2001). Eric Hoffman of Surrey British Columbia installed the first recorded Canadian solar heating system in 1970. See, Eric Hoffman, "Solar Energy Utilization in British Columbia," in *Applications of Solar Energy*, ed. Peter Catania (Regina: Canadian Plains Research Center, 1976), 106-107.
20. Task Force on Solar Energy Research and Development, *Exploit Renewable Energy Resources: Solar Energy, R&D Program Outline* (Ottawa: Energy, Mines, and Resources, 1975); LAC, RG21, Central Registry Files, vol. 294, memo to members of the Energy, Mines, and Resources Policy Committee, Feb 20, 1974; LAC, RG21, Efficiency and Alternative Energy Branch, box 1, *Canadian Renewable Energy Prospects*; LAC, RG21, Efficiency and Alternative Energy Branch, box 1, 12-77 DP, June 15, 1977, *Solar Heating*.
21. K.G.T. Hollands and J.F. Orgill, *WATSUN: A Solar Heating and Economic Evaluation Program* (Ottawa: NRC Division of Building Research, 1976); K.G.T Hollands and J.F. Orgill, *Technical and Economic Feasibility of Solar Energy Heating in Canada, Yearly Report* (Ottawa: NRC Division of Building Research, 1976); K.G.T. Hollands and J.F. Orgill, *Potential for Solar Heating in Canada* (Ottawa: NRC Division of Building Research, 1977), 1.

energy delivered.[22] The results were then applied to various building types, such as single-unit dwellings, multi-unit apartments, and commercial buildings in major cities across Canada, including Vancouver, Calgary, and Ottawa. The goal was to estimate where solar heating would be most competitive and which systems and building types were compatible. While not uniformly positive, the results of these simulations stated that liquid based heating systems outperformed other systems and would be cost competitive with conventional heating systems in most of Canada by 1980.[23]

On the surface the computerized calculations seemed to give very logical and objective results. The privileging of machines "objective" results has a long history as machines played a central role in the emergence of the ideal of mechanical objectivity within the sciences.[24] The apparent mathematical and mechanical objectivity provided by the computer running WATSUN obscured a number of important assumptions imbedded within the simulation. Life-cycle costing, for instance, compared the costs of oil and a solar heating system over a twenty-year period. Adopted to balance the lower initial cost of oil heating with the lower operating costs of solar heating, this method of measurement seemed quite reasonable.[25] However, it assumed that a solar panel could be exposed to the humid heat of Canadian summers and the freezing cold Canadian winters for twenty years without losing any operating efficiency. Despite such questionable assumptions the Department of Energy, Mines and Resources accepted the results of the WATSUN program and even had them simplified to ease their use by solar developers across the country.[26]

Beyond establishing the utility of solar energy in a general sense, the seemingly objective simulations of the WATSUN program performed a task of specific importance to the EMR in the mid 1970s. The program gave members of the EMR a method of examining and discussing solar heating technology and its possible future information that the Department was desperately in need of due to the unknown performance of solar heating in Canada. Further, since the EMR had little expertise in solar energy technology before the 1970s, this would prove invaluable to the EMR's later efforts to define and direct the development of solar energy. WATSUN, therefore, helped the EMR establish its vision of a Canadian solar heating industry and contain other advocates of solar energy, advoca-

22. Hollands and Orgill, *WATSUN: A Solar Heating and Economic Evaluation Program*, 4-5; Hollands and Orgill, *Potential for Solar Heating in Canada*, 7-8.
23. Hollands and Orgill, *Potential for Solar Heating in Canada*, 5.
24. Daston and Galison, "Image of Objectivity," 119-120.
25. Hollands and Orgill, *Potential for Solar Heating in Canada*, 10.
26. K.G.T. Hollands and J.F. Orgill, *Continuation Study of the Potential for Solar Heating in Canada* (Ottawa: NRC Division of Building Research, 1977).

tes who often had a good deal of expertise in solar energy and very different views about how and why Canadian solar energy should be developed.

In the early 1970s the international Appropriate Technology movement had taken shape and sought to use small scale technologies, including solar power, to make western society more democratic and environmentally sustainable.[27] Although the movement was centered in the United States, its belief that appropriate technologies could cause social change was felt in Canada.[28] For instance, Eric Hoffman, one of the very first users of solar heating in Canada, saw his solar panels as a way of asserting his personal and political independence.[29] Others, such as environmentalists of Energy Probe, saw reliance on locally produced solar energy as the first step away from large-scale energy technologies and the powerful centralized governments, which they believed encouraged polluting mega-projects.[30] Anxious to use solar energy to buttress the reputation of the Trudeau government and its energy policies, the EMR used WATSUN to redefine solar energy as an apolitical technology that could provide Canadians with much needed energy without radically changing Canadian society. This conflict would continue throughout the early 1970s as the Trudeau governments and the EMR struggled against the radical politics and libertarian ideals attached to solar energy by the Appropriate Technology movement and environmental groups.

While the WATSUN program at the University of Waterloo Research Institute worked to predict the future of solar heating, the NRC also funded direct research programs, among them the Meadowvale solar home (also known as the Mississauga House).[31] Built during 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.[32] The Meadowvale home's solar heating system consisted of six

27. David Dickson, *Alternative Technology and the Politics of Technological Change* (Glasgow: Fontana, 1974).

28. Andrew Kirk, *Counterculture Green: The Whole Earth Catolog and American Environmentalism* (Lawrence: University Press of Kansas, 2007); Alan MacEachern, *The Institute of Man and Resources: An Environmental Fable* (Charlottetown: Island Studies Press, 2003).

29. Eric Hoffman, "Solar Energy Utilization in British Columbia", in *Applications of Solar Energy*, ed.Peter Catania (Regina: Canadian Plains Research Center, 1976).

30. Energy Probe, *The Renewable Energy Hand Book* (Toronto: Energy Probe, 1976); Christopher Conway, *Energy Planning in a Conserver Society: Implementation Strategies* (Toronto: Energy Probe, 1979); Lawrence Solomon, *Energy Shock: After the Oil Runs Out* (Toronto: Doubleday Canada, 1980).

31. Lorriman, Doug, "Meadowvale Solar Experiment Performance Report," SESCI Conference Proceedings, Edmonton, Alberta, August 22-24, 1977.

32. See B.E. Sibbitt and H. Jung, *Performance of the Meadowvale Solar System* (Ottawa: Division of Building Research, National Research Council, 1981).

components: a connected series of solar collectors totalling 64.4 m², two 18,000L built in concrete hot water storage tanks, a domestic hot water preheating tank, a forced air heating system, a heat pump, and electric water pumps.[33] The complexities of this system meant that it required constant fine-tuning and close monitoring to ensure all of its components worked efficiently, but the system did work. It was particularly effective at heating hot water. However, due to problems with system design, corrosion of the collectors, and high losses from heat storage, it provided only forty-one percent of the Meadowvale home's heat.[34] This was a significant disappointment for the system's designers, who designed the system to supply at least sixty percent of the home's heat.

As these less-than-inspiring results came out between 1976 and 1978, they did not garner extensive interest within the NRC or the EMR.[35] Instead the simulations produced by the WATSUN system, which emerged at the same time, grabbed the EMR's attention. Based on the WATSUN program's simulations, the influential government report on solar energy, *Potential for Solar Heating in Canada*, argued that solar energy could make substantial contribution to Canada's energy needs by the early 1980s.[36] This report had three significant impacts: first, it drew considerably more positive conclusions than what could have been drawn from the qualified successes of the Meadowvale solar home and other direct applications of solar heating undertaken by non-government groups.[37] Secondly, it justified the development of solar energy using the discourse of "rationalistic" planning expertise that the Trudeau government had been trying to develop. Finally, it strengthened the department's control over solar heating technology because the EMR could use the computer program's predictions to direct the discussion of solar energy without seeming overly biased. As Theodore Porter notes, "a decision made by the numbers has at least the appearance of being fair and impartial" and in this instance WATSUN and the EMR had all the important numbers.[38]

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33. Lorriman, 1-2.
34. Sibbitt and Jung, 12.
35. None of the government policy papers I was able to examine mentioned or cited the Meadowvale Solar Home. The work of WATSUN, however, was citied. LAC, Peoples Commission Fonds (MG28), file 11, Energy Mines and Recourses, *Renewable Energy Resources: A Guide to the Literature*, 1977; LAC, RG21, Efficiency and Alternative Energy Branch, box 1, *Canadian Renewable Energy Prospects*; LAC, RG21, Efficiency and Alternative Energy Branch, box 1, *The Cost Effectiveness of Residential Solar Heating*.
36. Hollands and Orgill, *Potential for Solar Heating in Canada*, 3.
37. See for example R.W. Besant, R.S. Dumont and G. Schoenau, "The Saskatchewan Conservation House-Some Preliminary Performance Results," SESCI Conference Proceedings, Winnipeg, Manitoba, August 20-24, 1978.
38. Porter, *Trust in Numbers*, 8.

The differing receptions WATSUN's predictions and the Meadowvale study received had their genesis both in the Trudeau government's wider policies and in the particular events of 1976, making it a pivotal year in the history of Canadian solar technology and the solar heating industry. The year 1976 saw a new minister and new policies, both favourably inclined towards renewable energy, at the EMR. That year also saw the announcement of an energy policy that favoured energy self-reliance and Canadian control of energy resources. Finally, 1976 saw the emergence of a strong public lobby for solar energy comprised mainly of the Solar Energy Society of Canada and environmental and Appropriate Technology groups. Together these developments deeply influenced how solar heating developed in Canada and made it a "technology for the future" in the minds of its supporters.

Alistair Gillespie, who replaced Donald MacDonald as minister of EMR in the fall of 1975, helped to usher in a series of new energy policies built around new federal energy strategy announced in 1976.[39] Gillespie seems to have been personally interested in renewable energy and alternative energy policies, and carried on correspondence with soft technology and sustainable energy activist Amory Lovins throughout his tenure at EMR. Lovins had been made famous by his article arguing for a soft energy approach to the future, which appeared in the prestigious journal *Foreign Affairs* in 1976.[40] It is hard to say how seriously Gillespie took Lovins' ideas, but the fact that he tried to introduce Lovins' policies into a meeting of the International Energy Agency's in 1976 suggests that he thought they had some utility.[41] Gillespie also caused a minor stir within EMR by taking seriously both Lovins' recommendations, and those of the Office of Energy Conservation. The recommendations of both emphasized the dangers and high expenses of atomic energy scandalizing the Atomic Energy Control Board (AECB) and Atomic Energy of Canada Limited (AECL), the crown corporation in charge of developing and selling CANDU reactors. The AECB and the AECL had viewed nuclear energy as the only possible source of Canada's future energy and did not take kindly to the possibility that renewable energy might also become a viable source of energy in a post-petroleum world.[42] This conflict, however minor, is important to note

39. Energy, Mines, and Resources, *An Energy Strategy for Canada: Policies for Self-Reliance* (Ottawa: Ministry of Energy, Mines, and Resources, 1976).
40. Amory Lovins, "Energy Strategy: The Road not Taken," *Foreign Affairs* 55, 1 (1976): 65-96.
41. LAC, Alistair Gillespie Fonds (R1526), vol.165, file 107, Armory Lovins.
42. LAC, R1526, vol. 165, file 107, Armory Lovins.

because the AECL received the majority of funds allocated to energy research by EMR and was a powerful interest within the Canadian government. As a result, a slight decrease in the AECL's influence within the EMR accelerated the trend towards new approaches to energy policy and technologies that had begun with the establishment of the Energy Task Force in 1974.

Although Gillespie's interest in renewable energy undoubtedly helped solar heating become part of Canada's energy policy, another development in 1976 had a much bigger influence. The EMR announced its new energy plan and issued *An Energy Strategy for Canada: Policies for Self-Reliance*. This policy document contained the first official mention of solar energy as a possible source of energy for Canadians. Its importance, however, lay not in its brief mention of solar energy, but rather in its commitment to energy self-reliance and the Canadian control of energy resources.[43] After the announcement of this policy, solar-heating technology quickly gained momentum within the EMR. Solar energy had the potential to produce energy locally, and since it was a relatively new technology, no established industries or interests controlled the technology. This raised the possibility that it could be the foundation of a new Canadian industry.[44] In fact, the EMR believed that a solar heating industry would create a substantial number of jobs.[45] The possibility of industrial growth and energy independence meshed perfectly with the Trudeau government's concerns about Canada's neo-colonial relationship with the United States.[46]

Events outside the government's control also added considerable impetus to its growing interest in solar energy during the mid 1970s. The most important of these were the Canadian Energy Control Board and the EMR's drastic reduction in their estimates of Canada's petroleum reserves.[47] Some of these revised estimates were so drastic that they raised the possibility that Canada could run out of oil by the middle of the twenty-

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43. See, Energy, Mines, and Resources, *An Energy Strategy for Canada*, 5, 123; LAC, R1526, vol. 256, file 240, Energy Strategy for Self-Reliance, 1976.
44. LAC, RG21, Efficiency and Alternative Energy Branch, box 1, *Canadian Renewable Energy Prospects*; LAC, RG21, Efficiency and Alternative Energy Branch, box 1, 12-77 DP, June 15, 1977, *Solar Heating*.
45. LAC, RG21, Efficiency and Alternative Energy Branch, box 1, *Employment Resulting from Federal Solar Purchase Program: Progress Report on Middleton Contract*.
46. Joel Bell, "Canadian Industrial Policy in a Changing World," in *Towards a Just Society: The Trudeau Years*, 78-106.
47. Energy Policy Sector, *An Energy Strategy for Canada*; John Bridger Robinson, "Pendulum Policy, Natural Gas Forecasts and Canadian Energy Policy, 1969-1981," *Candian Journal of Political Science* 16, 2 (1983): 299-319.

first century and would face shortages by the late 1990s.[48] Such estimates stood in sharp contrast to late 1960s and early 1970s predictions that Canada would have oil to spare for well over a century.[49] Faced with an entirely new energy situation and without other sources of information, the government had little choice but to accept these new estimates. As a result of these contractions in Canada's projected oil and gas reserves, the search for alternatives to petroleum became an urgent necessity.

As the availability of oil became a national concern, Canadian scientists, engineers, and solar activists joined together to form the Solar Energy Society of Canada (SESCI) to encourage the use and development of all forms of solar energy. Although the society was formed in 1974, it broke onto the public stage in 1976 with a well attended conference it co-hosted with the American section of the International Solar Energy Society. This conference attracted experts on solar energy and solar technology from all over the world, and caught the Canadian government's attention.[50] Gillespie, who sent members of the EMR to the conference, was impressed and began to correspond with the SESCI further increasing the currency of solar energy in Canada.[51] In total the conference presented a very hopeful and positive view of solar. It argued that solar could be a contributor to Canadian and American energy needs within the next decade, as long as the technology continued to improve and energy prices continued to rise.[52] In the view of the SESCI some technologies, such as solar hot water heating, were particularly promising and nearly ready for commercialization. In general, the SESCI and its members embraced and strengthened the positive view of solar energy emerging within the EMR. True to its membership of scientists and engineers, the SESCI added a

48. LAC, RG21, Tombs Fonds, Energy Policy References, vol. 3, 1974, William James Brown, "Energy Allocation: A Canadian Experience"; LAC, RG21, Tombs Fonds, vol.4, file Energy Policy References, 1975, Life Expectancy of Canada's Oil Resources.

49. LAC, RG21, Tombs Fonds, Energy Policy References, vol. 3, 1974, "Oil and Gas in Canada: A Short Briefing."

50. Solar Energy Society of Canada, "Opening Statements," Sharing the Sun Solar Technologies in the Seventies: Joint Conference, American Section, International Solar Energy Society and Solar Energy Society of Canada, Winnipeg, Manitoba, August 15-20, 1976; George Löf, "Message of the Technical Chair," paper presented at Sharing the Sun Solar Technologies in the Seventies, Winnipeg, Manitoba, August 15-20, 1976.

51. LAC, R1526, vol. 259, file Solar Energy Society of Canada.

52. George Löf, "Heating of Buildings with Solar Energy," paper presented at Sharing the Sun Solar Technologies in the Seventies, Winnipeg, Manitoba, August 15-20, 1976; K.W. Böer, "Payback of Solar Systems," paper presented at Sharing the Sun Solar Technologies in the Seventies, Winnipeg, Manitoba, August 15-20, 1976; Ali Shams and Rudy Fichtenbaum, "The Feasibility of Solar House Heating: A Study in Applied Economics," paper presented at Sharing the Sun Solar Technologies in the Seventies, Winnipeg, Manitoba, August 15-20, 1976; R.M.R. Higgin, "Solar Heating for Buildings in Ontario," paper presented at Sharing the Sun, Solar Technologies in the Seventies, Winnipeg, Manitoba, August 15-20, 1976.

twist of its own to the Canadian understanding of solar energy. Building on the view that solar energy would play a significant role in Canada's energy future, it saw solar heating as an emerging technological field where Canada had the opportunity to become a world leader, but only if it began a major research initiative in the near future. To the SESCI solar energy not only had the potential to solve Canada's energy problems, its development could make Canada a scientific and technological leader.

Other, very different views of solar energy's potential also became widely publicized in 1976. In that year a group of countercultural ecologists in PEI called the New Alchemists and associated with the Appropriate Technology movement significantly raised public awareness about solar energy with a series of experimental solar structures. The centerpiece of their work was a novel structure called an Ark which combined a living space with a greenhouse and a fish farm.[53] Groups like the New Alchemists saw solar energy as a method of achieving self-reliance, but in a very different sense than the Federal government. In their view self-reliance was the cornerstone of a sustainable and decentralized libertarian society in which powerful central governments would no longer be necessary and humanity could live in sync with the environment.[54] This belief made solar energy central to the Appropriate Technology movement, a North American social movement which attacked large-scale technology and bureaucracy, and wanted to (re)establish a republican society in the Jeffersonian mould.[55] Energy Probe, a far less utopian group, did not view solar energy in such libertarian terms. However, its members did think of it as a viable alternative to large scale energy technologies, and encouraged Canadians to see solar energy as a way of creating a society in which conservation and slower, more equitable, economic growth would become the norm.[56]

Thus from 1976 onwards solar energy became integral to the politics and future visions of Canada held by the EMR, SESCI, and environmental and Appropriate Technology groups. Their visions of Canada, however, diverged: solar heating technology could be an engine of Canadian economic growth, scientific and technological advancement, energy and environmental conservation, or even radial social change. This many-sided embrace of solar technology lent solar energy a complex politics and caused some confusion over actual goals of adopting solar energy.

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53. MacEachern, *The Institute of Man and Resources*, 49.
54. John Todd, "A Modest Proposal," *The New Alchemy Bulletin* 2 (1971): 1-7.
55. Jordan Kleiman, *The Appropriate Technology Movement in American Politics* (PhD diss., University of Rochester, 2000).
56. Energy Probe, *The Renewable Energy Handbook*, 2; Conway, *Energy Planning in a Conserver Society: Implementation Strategies*, 1-3.

Concerned that a struggle over the politics of solar energy could delay or disrupt development, the Trudeau government and the EMR took advantage of their unparalleled resources, their ability to co-opt elements of competing visions of solar technology, and their seemingly objective predictions of the future of solar energy, to exert control over both the public and technical discourse around solar energy. As a result, their view of solar as a solution to future energy problems and a method for creating new science-and-technology-based industries silenced rival visions and became the conventional understanding of solar heating by 1978. This control also mitigated the confusion and conflicts over social impacts which normally surround the introduction of a new technology and a new industry, and allowed the immediate introduction of solar heating into Canada's energy plans.[57] The resulting set of policies would attempt to create a Canadian solar-heating industry in the late 1970s.

A series of EMR and NRC studies published in 1977-78 reflected this consensus, calling for a substantial commitment of resources to solar energy.[58] Reflecting the government's hopes for energy self-sufficiency and economic development, these reports also argued that the manufacture and installation of solar heating systems could become a multimillion-dollar industry by the early 1990s. Finally, reports ambitiously projected that solar could provide up to five percent of Canada's energy needs, if heavy investments led to quick and successful technological developments. Both were remarkable predictions considering that solar energy was unknown in Canada at the beginning of the 1970s.

As noted above, these laudatory studies tended to overlook the problems brought to light by direct experiments, such as the Meadowvale solar home, and portrayed solar heating as a largely problem-free technology. Two drawbacks inherent in the Meadowvale solar home's experimental nature limited its influence on policy making. First, it did not offer the government a way of gaining control over the construction of solar technology.[59] Second, its focus on evaluating the function of specific technologies made generalizing from its results difficult. As an examination of the conferences the SESCI held demonstrate, provincial and non-state engineers could, and did, carry out similar experimental

57. Trevor Pinch and Webie Bijker, "The Social Construction of Facts and Artefacts: Or How the Sociology of Science and the Sociology of Technology Might Benefit Each Other," *Social Studies of Science* 12, 3 (1984): 399-441.

58. LAC, RG21, Efficiency and Alternative Energy Branch, box 1, *Canadian Renewable Energy Prospects*; LAC, RG21, Efficiency and Alternative Energy Branch, box 1, 12-77 DP, June 15, 1977, *Solar Heating*; LAC, RG21, Efficiency and Alternative Energy Branch, box 1, *The Cost Effectiveness of Residential Solar Heating*.

59. Trevor Pinch and Webie Bijker, "The Social Construction of Facts and Artefacts," 399-441.

projects which might or might not agree with the results of federal projects.[60] If the federal government was going to invest millions in solar energy and sell the technology as a partial solution to the politically sensitive energy crisis, it wanted to be able to establish the narrative and to avoid the political acrimony that accompanied federal ventures into oil and gas development.[61] Unlike the Meadowvale solar home, the WATSUN simulation program required expertise and technology uncommon in the 1970s, making it difficult for non-federal engineers or policy makers to challenge its conclusions. As a result, the program and its predictions allowed the EMR to dominate discussion and ignore potential problems or alternate visions in a way that real world experiments never could. Further, the computer simulation gave the appearance of near-total knowledge and mechanically controlled objectivity, as its calculations were aggregated to provide sets of average possible outcomes from which generalizations were possible, and from which policy decisions could easily be made.[62] The WATSUN program's influence lay in its ability to construct a complete and ostensibly accurate narrative about solar energy and how it would develop in Canada, thus shaping the government's decisions around its description of the future.

Since the WATSUN simulations were not tied to any specific reality and could not be easily duplicated by other groups they became quite durable. Even being partially contradicted by the results of the project at Meadowvale did not undermine them. For instance, the 1977 WATSUN report, *Potential for Solar Heating in Canada*, based its simulations and predictions on models of solar heating systems which included short-term and annual-term heat storage.[63] These heat storage systems were analogous to those used in the Meadowvale solar home. Systems which had been shown to lose heat far faster than any of the engineers involved in the pilot project predicted.[64] Hollands and Orgill seem have been unaware of these problems with heat storage, a surprising oversight for experts on solar heating, and boldly stated that annual storage systems could "supply 100% of the yearly heating demand."[65] However, such discrepancy between simulation and reality were overlooked. To contain

60. V.M. Ireton, "Domestic Water Preheating Using Solar Energy," paper presented at Annual SESCI Conference, Penticton, B.C., August 20-24, 1978; R.K. Romak and P.P. von Hatten, "Sensible Heat Storage for Solar Energy Applications," paper presented at Annual SESCI Conference, Penticton, B.C., August 20-24, 1978.
61. Fossum, *Oil, the State, and Federalism*, 35.
62. Hollands and Orgill, *Potential for Solar Heating in Canada*, 1-5. See Edwards, *Closed World* for a discussion of how computer simulations can define discourse.
63. Hollands and Orgill, *Potential for Solar Heating in Canada*, 20-26.
64. Sibbitt and Jung, *Performance of the Meadowvale Solar System*, 11-12.
65. Hollands and Orgill, *Potential for Solar Heating in Canada*, 25.

such inconsistencies the WATSUN programmers had clearly stated in their report that their simulation had imperfections and was unable to perfectly depict reality. With its limitations noted, but downplayed, and its authority intact the computer simulation went on to forecast possible futures for solar-thermal energy in Canada.

It would take far more than some problematic discrepancies to call into question expert authority and the predictive power of computer models. Much like other departments in Canadian and American governments who employed forecasting and cost benefit analysis, the department of EMR's policymaking ability relied on the use of models and expert theories about the future costs and demands of energy.[66] If the department seriously questioned simulations, which did not have obvious flaws, it risked undermining its ability to make decisions, and damaging the expertise which underlay its bureaucratic power.[67] Questioning the analysis presented in *Potential for Solar Heating in Canada* could have also thrown the department out of step with the Trudeau governments' policies of encouraging expert planning and cost-benefit analysis. In the mid 1970s the government searched for solutions to an unexpected crisis, making new technologies and approaches both necessary and ideologically favoured. In this context, solar-thermal technology, as defined by WATSUN, became a part of the solution to this crisis. More importantly, it fit perfectly with the vision of Canada's energy future held by those with the power to help solar heating succeed.

In order to ensure support for its energy program, including the development of solar heating, the EMR formed the National Advisory Council on Conservation and Renewable Energy in 1978. The council ostensibly helped to organize energy policy, however, in reality it functioned as part of the EMR's efforts to gain control over definition and development of solar-thermal technology. The Purchase and Use of Solar Heating (PUSH) and Program of Assistance to Solar Equipment Manufacturers (PASEM) programs announced in the same year received a good deal of the council's attention. The advisory council, as well as expanding the EMR's pool of expertise in solar technology, enabled the department to directly solicit the advice of members of the environmental movement, the SECSI, the private solar industry, and other government departments which dealt with solar energy.[68] Among those who served on the council were David Brooks and David Wood. Brooks is perhaps

66. Porter, *Trust in Numbers*, 186-187.
67. Carpenter, *The Forging of Bureaucratic Autonomy*, 362.
68. LAC, R1526, vol. 236, file 220, National Advisory Committee on Conservation and Renewable Energy.

the best example of a councillor who saw solar heating as part of a wider program of social change. While serving on the council he wrote a series of articles calling for Canada to become a zero-energy growth society.[69] However, his radical views were moderated by more conservative members of the council. Wood, the president of Solartec Ltd and an industry spokesman, was one such moderating presence. Wood's recommendations mirrored the wider government policy of energy self-sufficiency and economic growth. He strongly supported the commercial-lization of solar-thermal technology and saw federal funding and technical assistance for the industry as instrumental to its success.[70] Since the general outlines of Canadian policy had been decided before 1978 the National Advisory Council on Conservation and Renewable Energy did not play an important role in deciding how solar development programs should be implemented. Instead of providing advice, the council built consensus around the EMR's approach to solar development among supporters of solar energy by containing and moderating views which conflicted with the EMR's.

The PUSH and PASEM programs began in 1978. Through them the Canadian federal government set out to build a solar industry capable of designing, manufacturing, and installing solar heating systems.[71] The two programs, along with a smaller research program, allocated close to $130 million in funds to the development of a solar industry over a five year period. The PUSH program, by far the larger of the two, had a rough beginning. It lacked a clear mandate and responsibility for carrying out a program that was shared between the EMR, the NRC, and Public Works Canada.[72] This resulted in confusion and delays as departments sorted out who was responsible for approving projects and how funds would be managed.[73] It took until early 1979 before any funds actually made their way to members of the solar industry. The program also required that all solar companies conduct extensive and time consuming feasibility studies, a task which the often newly formed manufacturing companies had difficulty carrying out. This further exacerbated the slow start caused by

69. David Brooks, "Choosing an Energy Future for Canada," in *Energy Policy: The Global Challenge*, ed. Peter Nemetz (Toronto: Butterworth & Co., 1979), 69-79.
70. LAC, R1526, vol. 236, file 220, NACCRE.
71. LAC, RG21, Efficiency and Alternative Energy Branch, box 1, 5-78 DP, *The Implementation of Solar Heating*.
72. LAC, RG21, Efficiency and Alternatve Energy Branch, box 4, file 478, *Program Review Energy Research and Research and Development 1978/80*.
73. LAC, Romeo Leblanc Fonds (Minister of Public Works), vol. 4, Public Works Canada: Solar Energy Program, *Policy and Administration Directive for Solar Industry Development Contracts for PUSH Program*, June 1982.

administrative confusion in the program.[74] As a result of these problems, by 1982 the program had only spent $35 million of its allocated $125 million on solar projects. The program received mixed responses from the budding solar industry. Companies were angered by initial delays and the cumbersome review process, but pleased with the lucrative contracts the program provided.[75] The research community was also less-than-impressed, noting that the PUSH projects were often not properly monitored to ascertain which solar thermal systems functioned well, or even if the systems functioned as their manufacturers promised they would. The PASEM program had somewhat more success. By 1980 it had provided about $3 million in onetime research grants to leading Canadian firms to develop new solar heating systems.[76] Smaller companies unable to develop, manufacture, *and* install solar heating systems viewed the grants as unfair. However, their protests were muted, since PASEM only ran for a short time in order to provide seed funds for companies unused to developing their own products, and it was quietly phased out once the PUSH funds started flowing.

When the PUSH program came under review towards the end of its first five years in operation, the problems with both the management of the program and the difficulties it faced with the technology all came to light. In response, industry spokesmen pointed out the funds promised through PUSH had been delayed and less than half the funds spent.[77] This resulted, they argued, in the industry's inability to focus on decreasing the cost of solar heating systems. The industry also pointed out that the Canadian solar industry had achieved surprising success internationally, bringing in roughly $3 million in sales in 1982.[78] Unfortunately, it was markedly less successful domestically. Most damningly, solar heating remained uncompetitive with conventional energy in heating applications, and the industry remained almost completely reliant on government contracts. This was all a far cry from the seemingly objective predictions of WATSUN, which had

74. Hicking-Partners Inc., *Solar Policy Review: Task 1 Review of Government Solar Programs* (Ottawa: Energy Mines and Resources, 1982), 41-42; LAC, RG21, Efficiency and Alternative Energy Branch, box 4, *Program Review of Energy Research and Development 1979/80*.

75. Canadian Solar Industries Association, Inc., *Solar Report*, no.14, January 1983, 1-3.

76. Minister of Energy, Mines, and Resources, *The National Energy Program* (Ottawa: Department of Energy Mines, and Resources, 1980), 65-66.

77. Canadian Solar Industries Association, Memo to the Minister of Energy, Mines, and Resources, February 23, 1983; LAC, Romeo Leblanc Fonds (Minister of Public Works), vol. 4, Public Works Canada: Solar Energy Program, solar energy review files.

78. LAC, Romeo Leblanc Fonds (Minister of Public Works), vol. 4, Public Works Canada: Solar Energy Program, Jean Chrétien, Memo to Cabinet, *Solar Policy Review*, March 14, 1983.

stated that solar heating would be competitive by 1980. Consequently the EMR's ambitious plan to meet close to five percent of Canada's energy needs with solar by 1990 seemed completely unrealistic and PUSH became, at least in terms of its promised results, a failure.[79]

In response to this disappointment the government review 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 the PUSH program. Under this scenario funding would be increased to $175 million for a further five years, and the solar industry, as well as the involved government departments, would have an opportunity to build on their experiences with the PUSH program. The review, however, recommended a fourth option. This response also continued the PUSH program, but at a lower level of funding than the solar industry recommended.[80] Under pressure to cut spending and facing mounting criticism of its National Energy Policy for Conservatives and the Alberta government (exports had been decreased to ensure Canadian supplies), the Trudeau Government ignored the review report's warnings that substantially cutting funding would cause a major contraction in the solar industry and chose the second option.[81] It continued to fund PUSH contracts which were underway and sustained support for solar research and development, but cut all other assistance to the Canadian solar industry. Since PUSH had made the government the largest purchaser of solar heating systems in the country, the disappearance of this support hit the industry hard, and without any momentum or effective networks of support it fell apart in the 1980s.[82] Although some research continued under the NRC, the termination of industry support programs marked the end of Canada's large scale development of solar thermal technology.

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79. LAC, Romeo Leblanc Fonds, vol. 4, Public Works Canada: Solar Energy Program, *Solar Policy Review*.
80. Ibidem.
81. G.C. Watkins and M.A. Walker, *Reaction: The National Energy Program* (Vancouver: The Fraser Institute, 1981), 11, 84; LAC, Romeo Leblanc Fonds, vol. 4, Public Works Canada: Solar Energy Program, solar energy review files.
82. LAC, Romeo Leblanc Fonds, vol. 4, Public Works Canada: Solar Energy Program, *Solar Policy Review*; Thomas Hughes, "The Evolution of Large Technological Systems," in *The Social Construction of Technological Systems: New Directions in the Sociology and History of Technology*, ed. Trevor Pinch, Wiebe Bijker, and Thomas Hughes (Cambridge: MIT Press, 1987), 51-82.

From these events it is tempting to conclude that the Canadian government's development of solar heating was simply too hasty and it rushed a technology into commercial use before the technology had been fully developed. Or one might also be tempted to conclude that solar energy could simply not compete with conventional energy once the price of oil stabilised in the mid 1980s. However, such conclusions overlook the significant forces behind the decision to commercialize solar thermal technology in first place. The Trudeau governments, the EMR, Canadian engineers and scientists, and environmental groups all hoped to use solar energy to reconstruct Canadian society in important ways. Since solar thermal technology was a relatively novel technology with considerable potential, it seemed to promise many things to different groups of Canadians, leading to widespread, albeit cacophonous, support for the technology. The EMR and Trudeau governments' allocation of resources for research and development, their co-option or containment of leading supporters of solar energy, and the shaping of solar energy discourse, made possible by the simulations of WATSUN, allowed them to dominate the development of solar energy. True to their interests the Canadian understanding of solar-thermal technology supported the governments' economic and policy goals and strengthened the EMR's decision making power. This vision of solar energy ensured that it would be supported by the Trudeau governments and the EMR, but it also made that support contingent on the ability of solar-thermal technology and the solar heating industry to fulfil their needs and buttress their power. While its promise could support the Trudeau government's plans for economic growth and the EMR's need for future energy sources and policy making successes, solar-thermal was hailed as a "technology of the future." When solar heating technology proved unable to live up to "objective" predictions of its economic and energy potential, it quickly lost support within the Trudeau government and the EMR. Its speedy rise and fall is a testament to both the benefits and dangers that "closed world" decision making and political expediency can hold for the development of technology.

In the development of the Canadian solar industry, government policy and politics played the most important role, not global economics or the natural environment. The trials of solar heating in Canada demonstrate a need to shift the focus of Canadian historians of technology from environmental, economic, and social influences to the influence of the government.[83] The history of solar energy in Canada is both a history of a technology, and of the application of specific government decision

83. Jones-Imhotep, "Nature, Technology, and Nation," 29; Francis, *The Technological Imperative in Canada*, 276.

making processes. In the 1970s, solar heating seemed to offer the Trudeau government a method of achieving their goals for greater economic growth and energy independence, giving the new technology a great deal of value within the government. Just as importantly, solar energy presented the Department of Energy, Mines, and Resources with an opportunity to expand its policy making power, meet energy conservation goals, and strengthen support for its energy policies among Canadians concerned about the environment. In an effort to ensure that solar heating could meet these goals, the Trudeau government and the EMR took control of the Canadian discourse about solar heating, supplanting the usual social discourse which has more commonly defined technologies and directed their development.[84] This meant that solar heating technology did not develop a network of support of a large degree of momentum outside of the Canadian government, leaving it reliant on that support.[85] The Trudeau governments' efforts to rationalize the Canadian government and institute systems of objective decision making further strengthened its influence on the development of solar-thermal technology.[86] Faced with a new and politically contentious situation, an energy crisis, the government increased their reliance on objective methods of decision making in an effort to gain control over novelty and to depoliticize their response to the crisis. This emphasis on rational action and the desire to make objective decisions legitimated the forecasts of expert planners and computer simulations making programs quite influential among government policy makers.[87] As a result, solar heating technology was defined by what were believed to be rational and objective simulations, rather than the physical technologies and its users and developers. This made real world applications of solar heating quite vulnerable since the technology had to conform to idealized simulations to be judged a success. Unsurprisingly, this task proved to be too much for the developing technology and the infant industry. The influential, but largely closed world of governmental needs and desires shaped Canadian solar-thermal technology and the solar heating industry. Therefore the rise and fall of solar heating should be understood not as a technical failure, but as an example of the importance of government policy and rationalist ideology to Canadian technology in the late twentieth century.

84. Trevor Pinch and Webie Bijker, "The Social Construction of Facts and Artefacts," 421-423.
85. Hughes, "The Development of Large Technological Systems," 81.
86. Doern, "The Cabinet and the Central Agencies," 29.
87. Porter, *Trust in Numbers*, 74.