

CANDU OR CANDON'T: COMPETING VALUES BEHIND CANADA'S NUCLEAR SALES

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States often pursue contradictory policies internationally. On one level, states may seek to promote a good reputation for themselves by supporting international regimes. Yet, on another level, they may also seek to pursue narrower, self-interested policies for the benefit of their populations or domestic industry, thus calling into question the strength of their "internationalist" commitments. Canada has been an active participant in many international security and nonproliferation regimes. It has played a leading role in a variety of international peacekeeping operations; it provided innovative ideas (such as the "strengthened review" process) that led to the indefinite extension of the Treaty on the Non-Proliferation of Nuclear Weapons (NPT) in 1995; and it led the fight to create

an international treaty (the Ottawa Treaty) banning anti-personnel land mines in the fall of 1997. Despite these significant contributions to international security and nonproliferation efforts, however, Canada has also pursued narrower, self-interested policies in its export of proliferation-risky Canadian Deuterium Uranium (CANDU) reactors. It has also frequently stretched its own environmental laws to the limit in waiving restrictions on these exports to countries with questionable environmental safety records and capabilities.

This article examines the history of Canada's CANDU reactor sales (see Figure 1) and the clash between Canada's "internationalist" principles and its narrower domestic priorities. In doing so, the study makes the argument that the latter set of

domestic concerns has tended to dominate Canadian decisionmaking in sales of CANDU reactors, despite Canada's reputation as a champion of "internationalist" values. Consistent with this argument, the article also presents new evidence that Canadian policy may now be changing—to one less favorable to CANDU exports—but precisely for *domestic* reasons. That is, recent public revelations about hidden costs behind CANDU exports have made justifying reactor sales more and more difficult at home. At the same time, recent evidence of environmental problems and lowered economic efficiency in the operation of CANDU reactors in Canada have thrown the alleged benefits of CANDUs (compared to other reactors) into question in the eyes of foreign purchasers. Such concerns and

Figure 1: Canada's Nuclear Reactor Exports

COUNTRY	ORDERED	ON-LIN
India (CIRUS - research reactor)	1956	1960
India (RAPP I)	1963	1973
Pakistan (KANUPP)	1965	1972
India (RAPP II)	1966	1981
Taiwan (TRR - research reactor)	1969	1971
Argentina (Embalse)	1973	1984
South Korea (Wolsung I)	1973	1983
Romania (Cernavoda I)	1978	1996
Romania (Cernavoda II)	1982	Under Construction
South Korea (Wolsung II)	1990	1997
South Korea (Wolsung III)	1992	Under Construction
South Korea (Wolsung IV)	1992	Under Construction
China (Qinshan I)	1996	Under Construction
China (Qinshan II)	1996	Under Construction

their associated costs led Ontario Hydro to initiate the shutdown of over a third of its nuclear reactors in 1997. These points suggest that while Canada continues to remain motivated largely by domestic factors, its flirtation with nuclear exports may soon become a relic of the past.

Given these incipient changes, this article begins by reviewing the “internationalist” and domestic values that have competed in Canadian nuclear export policies. It then turns to a detailed analysis of the history of Canada’s nuclear exports, tracing

the main trends in Canadian policy as they evolved from the mid-1950s deal with India to the early 1990’s deal with South Korea. These cases show how—over time—narrow economic considerations came increasingly to the forefront of Canada’s nuclear decisionmaking. Finally, the study examines Canada’s most recent sale of two CANDUs to China in 1996 and how new economic issues are changing the politics of future Canadian exports.

“INTERNATIONALIST” VALUES VERSUS DOMESTIC PRIORITIES IN CANADIAN REACTOR SALES

Although differences clearly exist across the cases described below, fairly definitive trends can be traced in Canada’s nuclear export policy from 1956 to 1994. It is useful to consider while reviewing this history a series of linked questions: How did these priorities compare to one another, what priority was placed on “internationalist” versus domestic concerns, and how has the weight of any of these factors changed over

time? The following section outlines the “internationalist” and domestic concerns that relate to Canada’s export of CANDUs.

“Internationalist” Goals

Nuclear Nonproliferation Principles

The most obvious test of Canadian “internationalist” principles regarding CANDU exports is its commitment to nuclear nonproliferation. Over time, Ottawa has developed an official nuclear policy that purportedly is designed to: 1) promote the evolution of a more effective and comprehensive international nonproliferation regime; and 2) ensure that Canada’s nuclear exports did not contribute to nuclear weapons proliferation.² But how has it actually been implemented?

The fear of nuclear proliferation is exacerbated because of the CANDU’s unique heavy water technology. The CANDU’s on-line refuelling capability, its use of natural (rather than enriched) uranium, and its higher production of plutonium, mean that it is more susceptible to diversion for military uses than conventional light water reactors (LWRs). This concern with the CANDU’s technology was explicitly noted in a 1977 U.S. report, the Ford-Mitre nuclear policy review, which concluded that the CANDU “is more suitable for reliable weapons.”³

Since it began exporting reactors, Canada has noted several ways to minimize the proliferation risk posed by its export of CANDUs, but it has rarely implemented the necessary measures. It did eventually apply full-scope nuclear safeguards on all reactor exports. However, Canada adopted this policy only after it

learned a hard lesson, as a result of India’s 1974 nuclear test, that the failure to implement strict measures in this regard would greatly heighten the possibility of diversion. After 1976, Canada restricted exports of nuclear materials only to states “that ratify the NPT or otherwise accept international [full-scope] safeguards on their entire nuclear programs.”⁴

To further promote nonproliferation goals, Canada could have refrained from exporting to unstable, military-oriented, or repressive regimes that might be considered more likely to proliferate. As shown below, however, the political characteristics of client regimes did not figure prominently in Canada’s nuclear decisionmaking process. Canada also could have weighed its potential sales to take into account the likely effect of such exports on regional conflicts. The Canadian government’s 1982 *Nuclear Policy Review* laid out guidelines that acknowledged the importance of these considerations when it stated: “[a]part from specific safeguards requirements, Canada makes political and economic assessments of potential reactor customers and discourages sales to countries which may be subject to domestic or external instabilities or security threats.”⁵ Yet, as shown below, there is little evidence of rigorous application of these guidelines during the 1956 to 1994 period.

Nuclear Safety and Environmental Values

Canada’s commitment to the international goals of nuclear safety and environmental protection presumably should be an important influence on its export policies, considering its serious concern with these issues at home.⁶ The safety of

the reactors poses the biggest environmental threat. The most common potential reactor accident is a loss-of-coolant, but the more serious safety issue is the potential for a core meltdown. (The most infamous core meltdown occurred at Chernobyl, Ukraine in 1986, when hundreds of people were immediately killed, and thousands will likely die as a result of cancer, the contamination of the food chain, an increase in all types of infectious diseases, and increased radiation levels.⁷) Equally dangerous potential environmental concerns include: 1) the extent to which the public is exposed to the tritium radiation that is emitted from CANDUs; 2) the safe disposal of vast amounts of radioactive nuclear waste (which has a half-life of several hundred years); and 3) the decommissioning of old nuclear reactors.

Human Rights

The issue of exporting nuclear reactors to human rights violators raises several unique questions. A reactor transaction requires a long-term relationship. In several cases described below, Canada was willing to attempt to forge close economic and political ties with states who abuse their own people. In fact, Canada’s representatives in international fora pointed out the human rights abuses of the very countries (i.e., Argentina and Romania) with which it was eagerly pursuing reactor export deals. Canada’s principal tool to prevent nuclear proliferation has been through its safeguards agreements, which require a certain level of trustworthiness between the parties. The history of CANDU exports has raised the question whether a regime that violates its own domestic social contract by subjecting its

citizens to human rights atrocities can be trusted to adhere to its international responsibilities? By helping a human rights violator, through the provision of greater energy resources produced by nuclear reactors, Ottawa may have been providing the regime with increased means of state repression. In this way, Canada may have actually increased the scale and scope of human rights abuses by exporting CANDUs to the offending state.

CANADA'S DOMESTIC PRIORITIES

Economics

As shown below, Canada hoped to achieve enormous economic benefits from CANDU exports. These benefits were to have included: positive shifts in Canada's balance of trade; the employment of over 30,000 Canadians, many in high-paying, advanced technology sectors; the development of a high-technology industry with possible spin-offs to other areas of Canadian industry; the use of the CANDU as a wedge to break into new markets; and the use of economies of scale to help subsidize the domestic nuclear market.⁸

In contrast to these benefits, it was perceived that there would be stark consequences if Canada were to fail to obtain sufficient CANDU exports. Initially, Canada would move back down the nuclear learning curve. If this sales drought continued, the result would be the collapse of the Canadian nuclear industry. This would likely result in higher energy costs, a less self-sufficient energy supply, a massive "brain-drain" of nuclear engineers and scientists, and the psychological blow of losing another high-tech industry.

Figure 2: Share of Nuclear Export Market as of August 1997*

COUNTRY	TOTAL #	PERCENTAGE
United States	43	69%
France	8	13%
Canada	7	11%
Germany	4	6%

*Compiled from data in International Atomic Energy Agency, *Reactors Connected to the Grid* (December 31, 1996). These figures do not include those reactors that are still being built. For example, Canada has sold an additional five reactors that are still in the construction phase.

The combination of the significant perceived economic benefits that accompany nuclear reactor exports and the huge costs of insufficient exports has resulted in intense competition among the world's nuclear supplier states. Canada's toughest competition comes from the United States (Westinghouse and General Electric), France (Framatome), and Germany (Siemens AG). Figure 2 indicates the number of reactors exported by and the market-share of each of these supplier countries.⁹ This competition is heightened by the fact that Canada is surrounded by the worldwide dominance of the LWR, while it has been trying to market a heavy water reactor (HWR).¹⁰

An issue related to Canada's economic goals is the extent of government subsidies for the nuclear industry. The Canadian government has heavily subsidized the Canadian nuclear industry.¹¹ There are two specific ways that CANDU exports have benefited from government subsidies. First, the federal government has supported the research and development efforts of Atomic Energy of Canada Limited (AECL) (see Figure 3). Second, it has provided grants and loans that have been used

to help finance specific CANDU exports (see Figure 4). This support demonstrates Canada's willingness to pursue perceived domestic economic gains despite conflicts with its internationalist goals. At the same time, the subsidies have created political and policy concerns within Canada. Canadians have begun to question what types of priorities their government has been promoting.

Figure 3: Federal Government R&D Subsidies to AECL*

(in 1997 C\$ millions)

1952-59	193.8
1960-69	453.3
1970-79	869.3
1980-89	1559.0
1990-97	1284.4
Total	4359.8

*Compiled from data in Atomic Energy of Canada Limited, *Annual Reports*, 1951-52 to 1996-97.

Canadian Foreign Policy

In addition to improving its economic situation, Canada has viewed reactor exports as a way to further its foreign policy goals by assisting the economic and political development of Third World states. Canada believed that the peaceful benefits of nuclear power should be at the

**Figure 4: Federal Financing of Nuclear Reactor Exports*
(in C\$ millions)**

COUNTRY	GRANTS	LOANS (CIDA/EDC)
India (CIRUS)	9.5	0
India (RAPP I-II)	0	33.5
Pakistan (KANUPP)	0	47.2
Taiwan (TRR)	0	0
Argentina (Embalse)	0	200
South Korea (Wolsung I)	0	560
Romania (Cernavoda I-II)	0	2178.3
South Korea (Wolsung II-IV)	0	0
China (Qinshan I-II)	0	1500

*The figures for India and Pakistan were compiled from data in Canada, Department of Energy, Mines and Resources, *Nuclear Policy Review, Background Papers* (Ottawa: EMR, 1981), p. 314. For Argentina, South Korea, and Romania the data are from Export Development Corporation, *Annual Reports 1974-1979*. Additional information on Romania was acquired from Canada, *News Release* No. 199, September 17, 1991. For China, the data are from Natural Resources Canada, *Speech* 96/116 (November 26, 1996).

disposal of all states. Therefore, Canada sought to use the transfer of nuclear technology as a way of aiding underdeveloped states, in particular its Commonwealth partners in India and Pakistan. J.G. Hadwen, a former senior official with the Ministry of External Affairs, articulated this view when he stated that:

[t]he basic argument was that Canada, during the war period, had developed considerable expertise in the generation of electricity by nuclear processes. We believed that Canadian technology was the most efficient of the nuclear technologies available. We thought of it as the safest of alternatives and as the one best suited to peaceful generation of electricity.¹²

A second major foreign policy goal—especially in the early cases—was anti-communism. Throughout the Cold War, a central pillar of Canadian foreign policy was prevent-

ing the spread of communism. It implemented this policy in many well-known ways: joining Western defense alliances like the North Atlantic Treaty Organization (NATO) and the North American Air Defense Command (NORAD), fighting the Korean War, and generally maintaining limited relations with both the Soviet bloc and communist China. With regard to international nuclear trade, Canada wanted to prevent countries from working with the Soviet Union on nuclear projects. A reactor sale meant a long-term partnership between supplier and recipient, and Canada did not want to see stronger economic relations emerge between the Soviet Union and other states, especially vulnerable Third World countries. Moreover, given the potential military application of nuclear power, there was the fear that reactor exports would be the first step in a military alliance between

the Soviet Union and the recipient state.

PAST EXPORTS

The following history of the policies influencing CANDU exports reveals the interplay between Canada’s internationalist principles and domestic concerns and shows that economic concerns clearly took precedence over nonproliferation, environmental, and other international goals.

Canada’s nuclear expertise flowed out of its work on the Manhattan project during World War II. Its decision to pursue a heavy-water, natural-uranium nuclear reactor was based on a desire to develop an independent system from the Americans and to avoid the costly construction of an enrichment facility. Canada’s first research reactor came on-stream in 1947. In 1952, with the conclusion of a feasibility study between AECL and Ontario Hydro, Canada had decided to concentrate its efforts on developing the CANDU. In conjunction with the decision to develop the CANDU domestically, it was also decided to pursue foreign sales. As the 1982 Nuclear Industry Review later explained, “Canada’s exports of nuclear equipment and technology represent both a natural extension of, and a support for, the domestic nuclear power programme.”¹³

How has the clash between Canada’s economic and political interests and its internationalist principles been played out in case of the export of CANDU nuclear reactors? This section will evaluate Canada’s past sales to India, Pakistan, Taiwan, Argentina, South Korea, and Romania. The history of Canada’s nuclear reactor export trade divides naturally

into three periods—1956 to 1974, 1974 to 1976, and 1977 to 1994—so the following section adheres to that structure.

1956-1974: Establishing Markets

Canada's principal consideration during this initial time period was to establish markets. India was Canada's first nuclear customer, purchasing a research reactor (CIRUS) in 1956, and two power reactors (RAPP I and II) in 1963 and 1966. There were many economic factors that facilitated these exports to India. First and foremost was Canada's desperation to break into the international nuclear market. At this point in time, Canada was seen as a junior partner to the United States and Britain in the development of nuclear energy; it needed a foreign sale to demonstrate the credibility of its technology and to establish it as an independent producer. Second, the consensus in the 1950s was that nuclear energy would become a substantial growth area. An initial sale could establish Canada as India's primary nuclear supplier and lead to repeat business. Third, and related to the previous point, was that a sale to India would allow Canada to make commercial inroads into South Asia. Fourth, because Canada's reactor technology was still relatively unproven and developing, it was hoped that India would become its testing ground.¹⁴

In addition to these economic factors, Canada had political incentives to conclude nuclear exports with India. India was a strategically important country in the context of the Cold War struggle with communism. Canadian officials rationalized that it was better if India acquired "nuclear expertise and facilities

through cooperation with countries like Canada than as a result of assistance from the Soviet Union."¹⁵ Moreover, it was felt that India could be trusted due to the special relationship that existed between the two British Commonwealth countries during the 1950s and 1960s. Canada and India enjoyed warm, cordial relations reinforced by personal friendship at the highest level. Some writers have even referred to this era as characterized by an Ottawa-New Delhi entente.¹⁶ Both Prime Minister Louis St. Laurent and External Affairs Minister Lester Pearson "attached the highest importance to Canadian-Indian relations, viewing India as a necessary bridge between what would now be called the First World of Western industrial democracies and the Third World of developing and impoverished states."¹⁷

Canada's economic and political arguments heavily outweighed any qualms that it might have had about nuclear proliferation. Canada's lack of concern was evidenced by the minimal safeguards that were placed on the reactors. The CIRUS agreement had only a simple clause stating that the reactor was for "peaceful purposes only." Although the RAPP I and II agreements contained more stringent safeguards than CIRUS, significant gaps still existed. In particular, India's refusal to sign the NPT meant that the safeguards contained in that treaty were not applied to its nuclear program. Canadian officials admitted that "[w]e knew that reactor was naked... [b]ut the commercial people kept saying that if we didn't give the Indians what they wanted, they'd get it elsewhere."¹⁸

In 1965, Canadian General Electric (CGE), in its only nuclear reactor export, sold Pakistan the

KANUPP reactor. The KANUPP transaction was motivated by several domestic economic and political concerns. First, Canada needed to sell its reactor to more than one country, and, therefore, the Pakistani sale was critical to the industry. Second, Ottawa hoped that the involvement of the privately owned CGE would increase domestic competition in Canada by giving credibility to a second supplier. Third, Pakistan was a Commonwealth partner, and Canada felt an obligation to aid members of the Commonwealth. Fourth, Canada had already exported reactors to India, and it was important to the government that Canada play a balanced role in the region. Fifth, Pakistan was a firm member of the western alliance, and played a strategic role in the containment of communism in Asia.¹⁹

As was the case with India, the only internationalist principle that was even addressed in the KANUPP deal was the threat of nuclear proliferation, and even then the results were inadequate in light of international concerns. Although Pakistan readily agreed to Canada's imposition of facility-specific nuclear safeguards on KANUPP, these agreements cannot be taken at face value due to other security issues. For example, there should have been concerns about the effect that selling nuclear technology to Pakistan would have on the stability of the Indian subcontinent. The Pakistani-Indian conflict, with wars in 1949 and 1965, had been a constant source of anxiety since the 1947 partition. For Canada to be involved in a nuclear relationship with both Pakistan and India required great delicacy, and it must be judged that Canada was quite possibly adding to the instability of the region by pro-

viding nuclear technology to both sides. Also, there should have been concerns about the trustworthiness of the Pakistani government. Pakistan was ruled by an autocratic military regime, and there were reasons for Canada to conclude that Pakistan wanted the reactor for military purposes. On one occasion, President Ali Bhutto even stated that “[i]f India builds the bomb, we will eat grass or leaves, even go hungry, but we will get one of our own.”²⁰

In 1969, Canada sold a research reactor to Taiwan. However, one year later, Canada terminated all nuclear cooperation with Taiwan when it decided to recognize mainland China. In both of these decisions, the role of Canada’s internationalist principles was minimal. On the issue of nuclear proliferation, there should have been concern about the possibility of Taiwan’s using Canadian nuclear technology to develop nuclear weapons to defend itself against China. China had a population advantage of almost a billion people, and since 1964, nuclear bombs. Moreover, as Gordon Edwards has argued, “[s]upplying Taiwan with the means to make nuclear weapons, and then joining in its international abandonment, might be said to invite the spread of the atomic bomb.”²¹

Canada’s initial decision to sell the reactor was swayed by economic interests, particularly Taiwan’s willingness to pay the entire cost of the reactor without Ottawa subsidizing it. The decision to terminate nuclear cooperation, however, was due to Canada’s 1970 decision to end its official recognition of Taiwan. As Robert Bothwell has written, it would have been “impossible to sell such a sensitive item as a nuclear

reactor to a government which no longer had any legitimacy in official Canadian eyes.”²²

When Canada sold CANDUs to Argentina (Embalse) and South Korea (Wolsung I) in 1973, its economic interests continued to be of paramount importance. In particular, AECL felt intense pressure to conclude foreign sales. According to AECL’s then-president, Lorne Gray, “we were getting pretty tired” of the search for exports and “were really concerned about the future of the Canadian nuclear power programme if we did not get something.”²³ This desperation outweighed any of Ottawa’s international principles.

Some minor concern was expressed over the need for Argentina and South Korea to sign the NPT, but the major source of public unease was the extent of Canadian government subsidies. In order to secure the deals, Ottawa provided Export Development Corporation (EDC) loans in the amount of Canadian dollars (C\$) 560 million for South Korea and C\$130 million for Argentina. However, each loan had a ceiling of 25 percent on any possible inflation, and, therefore, when Argentina suffered hyper inflation of 300 percent, the resulting loss to Canada was in the tens of millions. Canada ended up losing over C\$130 million on the Embalse project.²⁴ If this were not enough, AECL also resorted to bribery. As compensation for helping secure Wolsung I, a sales agent named Shaul Eisenberg was paid C\$18.5 million, but over C\$8 million of this amount was used to bribe high-level Korean nuclear officials.²⁵ AECL also spent C\$4 million on bribes to officials with the Argentine Nuclear Energy Commission (ANEC).²⁶ As *Maclean’s* maga-

zine so aptly pointed out, “[i]f we have to loan people money at subsidized interest rates to buy CANDU at prices below cost and then bribe them to do it, how great is the accomplishment?”²⁷

1974-1976: Strengthening Safeguards

Canada’s lack of concern with nuclear proliferation would come back to haunt it in 1974, when India used Canadian nuclear technology and fuel to explode a nuclear device. This event deeply traumatized Ottawa and led to two years of significantly strengthening Canada’s nuclear safeguards policy. This process culminated in 1976, when Canada announced that henceforth reactor sales would be restricted to states that had ratified the NPT or accepted full-scope safeguards on their nuclear programs.²⁸ In implementing this policy, Canada unilaterally terminated nuclear assistance to India and Pakistan, renegotiated nuclear safeguards agreements with South Korea and Argentina, and suspended uranium shipments to Japan and the European Community.

Canada suffered a definite commercial price for its new stand on nuclear proliferation. Immediate economic losses from cancelled exports included: C\$12 million worth of heavy water sales, a C\$6 million turbo generator destined for India, a C\$3.5 million fuel fabrication plant to Pakistan, over C\$1 million in spare parts, the freezing of C\$6.7 million in additional loans for the RAPP program, and the immediate repayment of a further C\$8 million in loans already extended.²⁹ Future economic benefits were also lost: additional supplies of heavy water and spare parts for India’s indig-

enous reactor; the possibility of being the supplier for Pakistan's proposed second reactor; a possible sale of a CANDU to Japan in the late 1970s; the threat that the nuclear projects in South Korea and Argentina would be cancelled; and the loss to a West German firm of a 1979 contract to build a second reactor in Argentina. Finally, there was concern that Canada's ability to export future nuclear reactors would suffer because of the damage done to its reliability as a supplier. As Canada's 1982 *Nuclear Policy Review* recognized:

The long lead times needed to cultivate the market, prepare bids, negotiate contracts, obtain regulatory approval, and build and commission plants require long-term economic and political commitments to nuclear co-operation. Even after they are in service, the reactors will involve the two countries in a continuing relationship to ensure safe and efficient operation. Perceptions of the strength and stability of the vendor government's commitment to the project are essential components of the decision to purchase a nuclear reactor.³⁰

The actions taken by Ottawa between 1974 and 1976 show the growing importance of Canada's international nonproliferation principles. Prior to India's 1974 test, Canada's domestic economic and political objectives were clearly predominant in the decisionmaking process for CANDU exports. However, as a result of the Indian explosion, Canada's concern with preventing nuclear proliferation began to act as a major constraint on exporting CANDUs, even to the detriment of its economic and political interests.

1977-1994: Argentina, Romania, and South Korea

Argentina

This section highlights Canada's efforts to export the CANDU to three countries in the years 1977 to 1994: Argentina, Romania, and South Korea. The first case—Canada's failure to win the 1979 Atucha II contract in Argentina—illustrates the detrimental effects of Ottawa's earlier actions based almost exclusively on domestic policies.³¹ It also provides insights into the clash between Canada's economic and political interests and its internationalist principles. The most important international concern that emerged in the context of the Atucha II project was Argentina's deplorable human rights record. Following its 1976 coup, the Argentine military junta cracked down on left-wing groups using methods such as arrests, torture, killings, and, perhaps the most insidious method, "disappearances."³² Bob Carty, a spokesman for the lobby group "No CANDU for Argentina," asserted that, "Canada is selling a potential weapon of mass destruction to a regime that represses, tortures, and murders its own citizens."³³ Moreover, in her first United Nations address, Canada's External Affairs Minister, Flora MacDonald, singled out Argentina as a human rights abuser.³⁴ In spite of its expressed concern about the principle of human rights, Canada pursued a policy of furthering its economic interests. AECL President Lorne Gray admitted that while AECL "did not like Argentina...it happened to be the only game in town."³⁵

The decision whether to try to sell a second CANDU to Argentina had divided Prime Minister Joe Clark's

cabinet between "those who wanted to put the reactor on the next plane and never ask for payment, and those who didn't want to sell it at all, even if they paid us in advance, in gold."³⁶ However, the fact that Canada decided to pursue the sale shows that, in the final analysis, economic interests took precedence over the substantial inconsistencies with Canada's internationalist principles that accompanied the Atucha II project.

Romania

The second case—Canada's rocky nuclear relationship with Romania—involved two distinct decisions during a 13-year period. The first occurred in 1978 and 1982, when Canada sold two CANDUs as part of Romania's Cernavoda reactor complex. While Canada had obvious economic incentives to sell the CANDUs, its political interests sealed the Cernavoda deal.³⁷ In particular, the Ministry of External Affairs officials believed that nuclear co-operation could help to reduce East-West tensions, and, paradoxically, would encourage Romania's emergence as an independent communist country.³⁸

The second decision occurred in 1991, when Canada decided to further assist the new, non-communist, Romanian government by providing technical assistance and hundreds of millions of dollars in additional funds to complete Cernavoda's construction. This decision was heavily influenced by Canada's economic interests.³⁹ First, the level of Canadian content in the reactors would be substantially increased from the 1978 agreements. Second, AECL would operate the reactor for the first 18 months. Third, much of the money that Canada would supply to

finish Cernavoda would be used to purchase Canadian goods and services and would be paid back with interest.

Canada also had an important political interest that favored further nuclear cooperation with Romania. It was expected that the Cernavoda reactors would supply over 30 percent of the Romanian's electricity needs. Romania was desperate for electricity, and if the project were not finished soon it could push a country already close to the edge into a state of collapse. In short, the economic conditions in Romania could act as a catalyst for a return to an authoritarian dictatorship. Allowing the Romanians to "freeze in the dark" would only add to that potential.

There were reasons to believe, notwithstanding Romania's ratification of the NPT, that the original Cernavoda sale in 1978 might be a proliferation threat. In particular, there was the matter of transferring sensitive nuclear technology to an Eastern bloc country. In deciding to construct nuclear reactors, why would Romania chose to ignore the technology available from its Soviet ally? In other words, might Romania and the Soviet Union have ulterior motives? Ottawa decided to discount the risk of proliferation for two reasons: there were written guarantees from Romania; and Canada was confident that the Soviet Union would act as a constraint on Romania. As then-Minister for External Affairs Don Jamieson, pointed out, "Romania is clearly within the Soviet orbit" and therefore "it is not very likely" that "there would be any development of nuclear weapons in a country such as Romania."⁴⁰

In 1991, the threat of nuclear pro-

liferation, rather than acting as a brake, facilitated Canada's decision to further assist the Romanians. Ottawa believed that the threat of nuclear proliferation would have increased more if Canada had withdrawn its support from Cernavoda. Romania would have been left with the blueprints for Canadian nuclear technology at a time when the former Soviet Union was in no position to ensure that Romania would use its nuclear power only for peaceful purposes. By placing Canadian officials in charge (which would occur only if Canada pledged additional funds), the Canadian government would be in a position to assume the role played in the past by the Soviet Union. Department of External Affairs officials have since asserted that "the current regime has taken on all obligations of the former regime and has informed on discrepancies of the past."⁴¹

The influence of human rights in Canada's nuclear cooperation with Romania was insignificant despite the fact that Canadian officials knew about Romania's disgraceful human rights record during Ceausescu's reign. Moreover, even as Ottawa was debating further nuclear co-operation, External Affairs Minister Joe Clark was acknowledging that there were still "widespread and systematic human rights violations in Romania."⁴² There was even extensive evidence that forced labor had been used at the Cernavoda site.⁴³ AECL tried to justify this practice by referring to the workers as military conscripts, even contending that Cernavoda was considered a "preferred posting," and better than a "gulag."⁴⁴ Ottawa has claimed that Romania's human rights violations were simply a reflection of the former Ceausescu communist re-

gime. Nevertheless, Romania, of all the former Warsaw Pact members, lags farthest behind on the path to democracy, and its Hungarian and Gypsy minorities remain subject to state-sponsored persecution.⁴⁵

International environmental principles were virtually non-existent during the original CANDU transaction, but during the 1991 decision over renewed nuclear assistance, they acted as a facilitating factor. If Canada left the reactors half-built, Romania might attempt to finish them on its own with substandard work, thereby creating environmental risks. By continuing with the project, Canada could help ensure that Cernavoda reactors remained safe. Indeed, once the renewed commitment was made "the Canadian technical advisory team on-site strictly supervised completion of repair work to piping welding: which had previously been done by the Romanians, evidence of the safety advantages stemming from Canada's continuing cooperation."⁴⁶ During this period, Canada used the international principles of nonproliferation and environmental protection as justifications for exports, if it considered them at all.

In the years immediately following the signing of the original Cernavoda contracts, the extent to which the Canadian government had subsidized the project became an issue.⁴⁷ Cernavoda benefited from EDC loans totalling over C\$1.8 billion in 1978 and 1979. When Romania was forced into massive financial restructuring in the early 1980s because of its high foreign debt, Ottawa suspended all EDC loans, but, unfortunately, over C\$320 million had already been disbursed. In addition, the Ceausescu

government insisted that Canadian suppliers of CANDU components buy Romanian products equal in value to what they sold in Romania. Finally, there was a question of the amount of content actually produced by Canada. In order to clinch the deal, AECL had sold its nuclear technology, allowing the Romanians to act as their own contractors. This resulted in many of the non-nuclear components, and all of the administrative responsibilities, being handled by non-Canadian firms.

The government subsidies issue reappeared during the negotiations in the early 1990s, when the opposition in the House of Commons asserted that Canada would be “throwing good money after bad in helping to complete the CANDU reactor project in Romania.”⁴⁸ Nevertheless, Canada decided in September 1991 to assist Romania by supplying them with an additional C\$315 million EDC loan to complete Cernavoda I and II.⁴⁹ Thus, Canada’s decisions about CANDU exports to Romania were motivated more by domestic policy issues than internationalist principles. To the extent Canada considered the principles that it raised in international fora, it used them as justification for the exports.

South Korea

The third case during this time period was South Korea. In the 1990s, South Korea emerged as the most important CANDU customer with the purchase of Wolsung II in 1990 and Wolsung III to IV in 1992. Wolsung II to IV provided a litany of commercial benefits to Canada, but these benefits, as important as they may have been, were outweighed by the fact that it was likely that Wolsung II to IV, the first

CANDU exports in a decade, saved the Canadian nuclear industry. In 1990, Ottawa unveiled a seven-year plan of increased funding for nuclear research and development (R & D) that would pump an additional C\$66 million into the nuclear industry, but this decision was based on the assumption that the Wolsung II sale was imminent.⁵⁰ If Canada had lost the sale, it could very well have been the end not only of Canada’s reactor export program, but also of all government support for the domestic nuclear industry.

As a consequence of this very real fear for the future of the Canadian nuclear industry, the relevant internationalist principles were downplayed by Ottawa. However, these issues were not insignificant and should have been explored. South Korea had a strong security incentive to acquire nuclear weapons because it remains technically at war with North Korea. Nonetheless, at the time of the Wolsung II to IV sales in 1990 and 1992, there were strong reasons to believe that South Korea would maintain its non-proliferation policy. Seoul and Pyongyang even signed a 1991 joint declaration on the denuclearization of the Korean Peninsula. Unfortunately, this progress eroded in 1993, when North Korea decided to opt out of the NPT and prevent International Atomic Energy Agency (IAEA) inspections of its nuclear reactors. This crisis has been resolved, at least for the time being. Heavy U.S. diplomatic pressure resulted in the Agreed Framework in October 1994 under which North Korea agreed to freeze its nuclear program and eventually to comply with its IAEA safeguards obligations in return for the provision by an international consortium (the Korean Peninsula Energy De-

velopment Organization) of two LWRs to meet its electric energy needs.⁵¹ But the difficulties of implementing the agreement—including serious financial obstacles—suggests that North Korea may yet resume its weapons program and thereby provide Seoul with a future “justification” to pursue a nuclear option.

There has also been the issue of South Korea’s human rights record. Until 1992, South Korea was run by a series of military dictators who were not adverse to violating human rights in order to maintain civic order. In fact, during the 1970s, Amnesty International, the United Nations, and Canada all cited South Korea as a major human rights violator.⁵² In 1990, in the midst of the contract signing for Wolsung II, over 1,500 people were imprisoned under the National Security Law for their political activities.⁵³ South Korea has elected a new president, but its democracy remains fragile for a variety of reasons, not the least of which is the level of economic uncertainty due to its 1997 stock market crash.

The extent of Canadian government subsidies has also been raised as a concern with the Wolsung projects. Although Wolsung I benefited from a large EDC loan, the sales in 1990 and 1992 were free of concessionary financing. The bigger concern, however, is the fact that the corruption associated with Wolsung I did not end in the 1970s, but has continued through the 1990s with Wolsung II to IV. In 1994, a bribery scandal involving the Korean Electric Power Corporation (KEPCO) and AECL’s Korean agency, Samchang Corporation, resulted in several senior officials from both companies being incarcerated.⁵⁴

STAYING THE COURSE IN CHINA

In November 1994, as the centerpiece of the Team Canada trade mission to China, Canadian Prime Minister Jean Chrétien and Chinese Premier Li Peng signed a Nuclear Cooperation Agreement. Two years later, contracts were formally signed for the construction of two CANDUs at Qinshan. Does this most recent CANDU sale fit the historical pattern of Canada's neglect of its internationalist principles in favor of its economic and political interests?

Strong economic interests worked towards ensuring the successful CANDU export. Canadian officials frequently cited the immediate economic benefits of the Qinshan project, such as additional jobs, but a more important factor was Canada's need to penetrate the huge Chinese market.⁵⁵ With over a billion people and a dramatically accelerating growth rate, China is the last, great, untapped market. Foreign Minister André Ouellet stated in 1994 that a central pillar of Canada's China policy was "to build an economic partnership with China that will create jobs and prosperity in Canada and will also benefit the people of China."⁵⁶

The issue of whether Canada contributed to nuclear proliferation with the Qinshan reactors is complicated by the fact that there are two types of nuclear proliferation: horizontal proliferation, defined as increasing the number of the NPT-recognized nuclear weapons states beyond the five existing ones⁵⁷; and vertical proliferation, which concerns the addition of new nuclear weapon systems to the arsenals of the nuclear weapon states. Since China is a NPT-recognized nuclear weapon state,

CANDU exports will have no effect on horizontal proliferation. However, the Qinshan project may have an effect on vertical proliferation if China complements Canadian nuclear technology with its indigenous technology to expand its weapons arsenal. Moreover, China's nuclear policy—including its record of cooperation with such countries as Algeria, Iran, and Pakistan—is greatly at odds with Canada's. However, it is unrealistic to assume that CANDU exports, or the lack thereof, would alter that policy. Finally, Foreign Affairs officials are "fully confident that our nuclear trade with China will be for peaceful purposes only" because of the IAEA inspections provided for in the nuclear safeguards agreement.⁵⁸

China is a well-known human rights abuser, with its most infamous atrocity the Tiananmen Square massacre occurring in June 1989. China's human rights record has led to calls for Canada to cut all economic ties with the country; certainly this would preclude providing it with nuclear materials.⁵⁹ However, Canada's current position is that international trade, such as CANDU exports, can be used as a mechanism to improve China's human rights record. Canadian Secretary of State for Asia-Pacific Raymond Chan noted in a speech that "trade is also a powerful tool. It encourages cooperation, and co-operation leads to understanding and appreciation, with which we can better manage concerns such as human rights development."⁶⁰

The episode of the environmental impact study for the Qinshan project in China illustrates the negligible role that international environmental principles have had on

CANDU exports. The Canadian Environmental Assessment Act states that before any federal project can be authorized it must undergo a comprehensive environmental impact assessment. For foreign projects, additional studies are required to ensure that Canadian environmental standards will be met. However, in the case of Qinshan, Ottawa decided, less than a month before the formal signing of the contracts, to waive these environmental requirements. This decision was met by opposition from anti-nuclear groups. The Sierra Club, arguing "that the government has violated its own laws," launched a court challenge against the Chrétien government.⁶¹ It was further revealed that the Liberals had ignored their own consultants' report recommending that public hearings be held in Canada due to a dearth of scientific data and a lack of cooperation from the Chinese authorities. Not only did Ottawa ignore this advice, but it tried to bury the consultants' report and pretend that it never existed. Only through an Access to Information request by Energy Probe, an environmental lobby group, did the truth come out.⁶² International Trade Minister Art Eggleton responded that "it was never our intention that the act would apply to projects carried out in other countries."⁶³ However, a more likely reason, as revealed in briefing notes prepared for the Cabinet by the Department of Foreign Affairs, was the belief that requiring environmental assessments would put Canada at a great disadvantage compared to other nuclear suppliers.⁶⁴

An additional controversial aspect of the Qinshan project was the extent of Ottawa's subsidization. National Resources Minister Ann

McLellan claimed that the sale “could not be subsidized by Canada, but would have to proceed on the basis of fair market costs.”⁶⁵ However, EDC eventually provided a C\$1.5 billion loan. In addition, the loan was not on EDC’s own books, but placed on its “Canada Account,” which is carried by Foreign Affairs. Canada Account loans are used in cases where the loan is extremely large and/or there is an extreme risk to the project. Moreover, there is no political risk insurance—covering currency fluctuations, expropriation, breach of contract, war, and civil disturbance—on the loan.⁶⁶ Even *The Globe and Mail*, which had previously been a cheerleader for the CANDU, was outraged by the Qinshan deal. High-profile columnist Terence Corcoran blasted the deal as “a high-order abomination, a dishonest flouting of Canadian principles and possibly Canadian laws, carried out behind a screen of deceptive information.”⁶⁷

THE FUTURE OF CANDU EXPORTS

What effect will Canada’s internationalist principles have on future CANDU exports? The historical record, including the 1996 sale to China, shows that Canada’s economic and political interests have tended to strongly outweigh its internationalist principles. In certain respects, this situation will continue. First, the effect of nonproliferation principles on CANDU exports reached its peak in the period immediately following India’s 1974 nuclear test.⁶⁸ Second, there is little indication that human rights will play a greater role in CANDU exports than they have in the past. For example, AECL is currently wooing states that have repressed, and com-

mitted human rights atrocities against, their minority groups: Indonesia and Turkey.⁶⁹ Nevertheless, Canada’s international environmental principle, when combined with domestic concerns about government subsidies and the diminishing importance of CANDU’s economic benefits, will likely spell the end of CANDU exports.

When this reversal of Canadian policy is analyzed, its origins will likely be traced to August 12, 1997. That was the day when Ontario Hydro, the largest domestic CANDU customer, announced that it had temporarily shut down seven of its 19 reactors. This decision was based on an internal report that was scathing in its assessment of the safety culture that existed in Ontario’s nuclear plants.⁷⁰ This report stated that Ontario Hydro’s safety standards were only “minimally acceptable.” “Minimally acceptable” is the lowest grade that can be given to a reactor before a utility’s nuclear license is revoked. The report blamed Ontario Hydro’s problems on “a lack of authoritative and accountable managerial leadership.” For example, the nuclear plants were portrayed as being manned by poorly trained workers with a blatant disregard for safety. It documented numerous instances of unqualified radiation safety technicians, unauthorized ad hoc modifications to the CANDU design, unsafe storage of dangerous chemicals, and alcohol and drugs in the workplace.⁷¹ The report stated that while Ontario Hydro did an excellent job in the “design and construction phase,” it failed in the second stage of “operating and maintaining” its nuclear reactors. Ontario Hydro’s report will force decisionmakers to focus on the questions of environmental conse-

quences and government subsidies when considering CANDU exports.

Environment

Potential foreign customers may now have doubts about the CANDU’s safety and reliability. AECL’s competitors will also undoubtedly attempt to capitalize on Ontario Hydro’s decision to shut down a third of its reactors telling potential customers: “Canadians are shutting down their own CANDUs because they are unsafe. Why should you buy one from them?” AECL recognizes that Ontario Hydro’s announcement will significantly compromise its ability to secure future exports. Following the announcement, Gary Kugler, AECL vice-president of commercial operations, understated that “it’s certainly not great advertising for us.”⁷² AECL has launched a public relations campaign, at home and abroad, to seek to minimize the damage caused by the disaster in its CANDU showroom. Its first strategy was articulated by Kugler when he stated that “if our international partners do show concern, they can look at the Ontario Hydro report which shows that it was a management problem which caused the problems.” Kugler emphasized that AECL would concentrate on the fact “that the CANDU technology is basically sound.”⁷³ However, the limitations of this strategy were pointed out by Gordon Edwards, the president of the Canadian Coalition for Nuclear Responsibility, when he replied that “here you have people [at Ontario Hydro] who are the best-placed in the world to understand and maintain the CANDU and they can barely do it. How do we expect these other countries to be able to run these plants safely.”⁷⁴

Figure 5: Lifetime Reactor Efficiency (as of 1991)*

COUNTRY	# OF REACTORS	LOAD FACTOR %
Canada	19	74.9
Germany	21	72.2
Japan	56	67.6
France	40	62.7
United States	109	60.0
United Kingdom	29	49.5

*Data for the Soviet Union were unavailable. Compiled from data in Nuclear Engineering International, *World Nuclear Industry Handbook 1992* (Surrey, U.K.: Reed Business Publishing Group, 1991), pp. 18-20.

There will also be increased public opposition to any attempt to export the CANDU. The anti-nuclear movement has gained immense credibility since it was proven correct about the problems at Ontario's nuclear sites.⁷⁵ The expansion of the Canadian nuclear industry is at an end, and even its maintenance is in doubt. For example, Ontario Hydro has estimated that it will cost the utility between C\$5 billion and C\$8 billion in upgrades and replacement energy costs for it to adhere to the internal report's recommendations. If nuclear energy has been proven to be unsafe for Canadians, how can it justify exporting it to other, primarily Third World, states? What politician would like to be as closely linked to future CANDU exports as "Team Canada" was towards the sale to China?

Government Subsidies

Will AECL be able to maintain its high level of government subsidies now that its biggest domestic customer apparently has given up on the technology? Prior to Ontario Hydro's decision, it was assumed that R & D subsidies would con-

tinue. As a consequence of Ontario Hydro's decision, it is now likely that R & D support for AECL will be terminated. How can Ottawa justify further subsidization of an industry, even a high-tech one, which is being downgraded in Canada? Given the federal government's budgetary restrictions, it will be difficult for it to maintain AECL's current C\$160 million funding without the existence of a domestic market or a viable export market. Moreover, it is doubtful that AECL will be able to maintain a high level of nuclear R & D without vast government support. This will erode its ability to innovate nuclear technology and will make it that much harder for AECL to compete with General Electric, Westinghouse, Framatome, and Siemens. In short, the withdrawal of Ottawa's annual multi-million dollar subsidies will eventually mean the end of an independent nuclear industry in Canada.

Economics

While the two principal political interests associated with past CANDU sales—political development and anti-communism—have

lost their importance, it would be unwise to assume that other foreign policy goals will not emerge to take their place. There will also be some type of political interest that will facilitate, or constrain, CANDU exports. However, what has changed, likely forever, is the importance of Canada's economic arguments.

One of the major selling points, as presented by AECL and its patrons in Ottawa, has been the safety and reliability of the CANDU. For example, former Energy Minister Anne McLellan bragged that "[t]he CANDU 6 reactor is acknowledged to be among the safest and best performing designs in the world."⁷⁶ However, as CANDUs have aged, there has been a stark decrease in their efficiency rating.⁷⁷ As recently as 1991, the CANDU was the most efficient reactor model in the world (see Figure 5). In addition, Canada had the most efficient reactor in the world at Pt. Lepreau, New Brunswick, and three of the top seven.⁷⁸ However, by 1996 the CANDU had become the most inefficient reactor design outside the former Soviet Union (see Figure 6).

An additional weakening of Canada's economic arguments can be seen by the diminishing amount of Canadian content contained in CANDU exports. Canadian content has been reduced in three interrelated ways. First, as AECL sells additional CANDUs to its established customers, the level of Canadian content is reduced. For example, only about 25 percent of Wolsungs II to IV will be Canadian.⁷⁹ Second, AECL has been forced to link nuclear technology transfers with CANDU exports, further limiting Canadian contributions. Third, KEPCO will be a junior partner with

Figure 6: 1996 Reactor Efficiency*

MODEL	LOAD FACTOR %
Boiling Water Reactors	78.9
Pressurized Water Reactors	77.1
Advanced Gas Cooled Reactors	76.0
Pressurized Heavy Water Reactors (CANDU)	61.5

*Data for Russian-style reactors are unavailable. Compiled from data in Richard Knox, "1996 load factors analyzed by NSSS vendors," *Nuclear Engineering International* (July 1997), pp. 39-40.

AECL in China, and if a sale goes through, in Indonesia. The reason for the partnership is to take advantage of KEPCO's substantial CANDU experience and as an added enticement to sell more reactors to South Korea, but the net effect is a further reduction in the level of Canadian content.

Finally, there has been a shift in the view that CANDU exports have been an economic benefit to Canada. For example, in 1987, George Lerner wrote a monograph for the Economic Council of Canada where he argued that although each CANDU sale had lost money, Canada had still received a modest benefit from its investment in the CANDU.⁸⁰ However, as a result of the steadily decreasing efficiency rate of the CANDU and the future costs of decommissioning old reactors, Lerner, less than a decade later, dramatically reversed his position and argued that "the federal expenditure on CANDU has been a financial disaster."⁸¹

CONCLUSION

The historical record clearly shows that Canada's professed internationalist principles played only a

limited role in CANDU exports. The only principle that really played a constraining role was nonproliferation, and that only emerged following the 1974 Indian nuclear explosion. The issues of human rights, the environment, and government subsidies were virtually absent from the decisionmaking process. In short, CANDU exports were strongly facilitated by Canada's domestic economic and political policies.

Due principally, but not solely, to Ontario Hydro's decision to shut down seven of its CANDUs because they compromised public safety, the future of CANDU exports is in great jeopardy. Ontario Hydro's actions have highlighted, if not created, the importance of the environmental principles and government subsidies as constraining influences on CANDU exports. More importantly though, Ontario Hydro's decision has sapped the credibility of AECL and its supporters in Ottawa by exposing the weaknesses in Canada's economic arguments for CANDU exports. This is the most important reason behind the likely shift in Canada's nuclear export policy; the case for the economic benefits of

CANDU exports is no longer a convincing one. In short, the decision to phase out the CANDU export program, like the decisions to pursue it, will be based on domestic policies rather than international principles.

¹ An earlier version of this article was first presented at the "Ethics, Human Rights, and Canadian International Security Policy" Workshop, York University's Centre for International and Security Studies, North York, Ontario, Canada, November, 21-22, 1997.

² Canada, Department of Energy, Mines, and Resources (EMR), *Nuclear Industry Review, Problems and Prospects 1981-2000* (Ottawa: EMR, 1982), p. 29.

³ Quoted in Gordon Edwards, "Canada's Nuclear Industry and the Myth of the Peaceful Atom," in Ernie Regehr and Simon Rosenblum, eds., *Canada and the Nuclear Arms Race* (Toronto: Lorimer, 1983), p. 166. Also see David H. Martin, *The CANDU Syndrome: Canada's Bid to Export Nuclear Reactors to Turkey* (Ottawa: Campaign for Nuclear Phaseout, 1997), p. 36.

⁴ Canada, Parliament, House of Commons, *Debates* (December 22, 1976), p. 2255.

⁵ EMR, *Nuclear Policy Review, Background Papers* (Ottawa: EMR, 1981), p. 275.

⁶ There is a large literature, much of it emotionally pro or con, on the environmental consequences of nuclear energy. This section relies on the more balanced approaches presented in Essam E. El-Hinnawi, ed., *Nuclear Energy and the Environment* (Oxford: Pergamon, 1980) and Lynne C. Myers, *Nuclear Power Systems: Their Safety* (Ottawa: Library of Parliament, Science and Technology Division, 1991).

⁷ "Ukraine Tallies Sharp Rise in Illnesses Near Chernobyl," *The New York Times* (International Edition), April 23, 1998, p. A5.

⁸ These economic arguments were best articulated in a series of studies completed in the late 1970s and early 1980s. For example, Leonard & Partners Ltd., *Economic Impact of Nuclear Energy Industry in Canada* (Toronto: Leonard & Partners Ltd, 1978); EMR, *Nuclear Policy Review: Background Papers*; and EMR, *Problems and Prospects*.

⁹ Russia, which used to be one of the largest exporters, is no longer a serious competitor to Canada because it has lost its primary export market in Eastern Europe.

¹⁰ There are also countries—Russia, Britain, Japan, and India—which may not compete in the export market, but do have flourishing domestic nuclear industries. This greatly restricts the size

of the potential nuclear market because no country with an indigenous nuclear industry will import reactors. Another factor that further shrinks the nuclear market is that most Third World countries do not possess the necessary technological infrastructure to justify the acquisition of nuclear power. This means that the actual nuclear market is quite small, and consists mainly of the newly industrialized countries in the Third World, such as South Korea, Indonesia, Egypt, and Turkey. For further information on the economic dimensions of the international nuclear trade see: William Walker and Mans Lonnroth, *Nuclear Power Struggles: Industrial Competition and Proliferation Control* (London: George Allen & Unwin, 1983) and William C. Potter, ed., *International Nuclear Trade and Nonproliferation: The Challenge of the Emerging Suppliers* (Lexington, MA: Lexington, 1990).

¹¹ See, David Martin and David Argue, *Nuclear Sunset: The Economic Costs of the Canadian Nuclear Industry* (Ottawa: Campaign for Nuclear Phaseout, 1996).

¹² J.G. Hadwen, "A Foreign Service Officer and Canada's Nuclear Policies" in David Reece, ed., *Special Trust and Confidence: Envoy Essays in Canadian Diplomacy* (Ottawa: Carleton University Press, 1996), p. 160.

¹³ EMR, *Nuclear Policy Review: Background Papers*, p. 259. For further information on Canada's development of its nuclear industry see: Robert Bothwell, *Nucleus: The History of Atomic Energy of Canada Limited* (Toronto: University of Toronto Press, 1988); Wilfrid Eggleston, *Canada's Nuclear Story* (Toronto: Clarke, Irwin, 1965); Ron Finch, *Exporting Danger: A History of the Canadian Nuclear Energy Export Programme* (Montreal: Black Rose Books, 1986), pp. 1-30; and EMR, *Nuclear Policy Review: Background Papers*, pp. 262-264.

¹⁴ For more information on Canada's reasoning behind the CIRUS transaction see: Iris Lonergan, "Canada and India: The Negotiations for the Supply of the N.R.X. 1955-56," *bout de papier* 8 (Spring 1991), pp. 12-15; Gordon H.E. Sims, *A History of the Atomic Energy Control Board* (Hull, Quebec: Minister of Supply and Services Canada, 1981), pp. 190-196; and Bothwell, *Nucleus*, pp. 350-358.

¹⁵ Lonergan, "the negotiations for the supply of the NRX," p. 15.

¹⁶ See: M.J. Rajan, "The Indo-Canadian Entente," *International Journal* (Autumn 1962), pp. 358-384 and Escott Reid, *Envoy to Nehru* (Toronto: Oxford University Press, 1981).

¹⁷ Robert Bothwell, *Eldorado: Canada's Natural Uranium Company* (Toronto: University of Toronto Press, 1984), p. 404.

¹⁸ Quoted in Peter Pringle and James Spigelman, *The Nuclear Barons* (New York: Holt, 1981), p. 377.

¹⁹ For more information on the KANUPP transaction see: Bothwell, *Nucleus*, pp. 382-391; Robert W. Morrison and Edward F. Wonder, *Canada's Nuclear Export Policy* (Ottawa: The Norman Paterson School of International Relations, 1978), pp. 17-18; and Finch, *Exporting Danger*, pp. 41-

46, 80.

²⁰ *Ibid.*, p. 338.

²¹ Edwards, "Canada's Nuclear Industry and the Myth of the Peaceful Atom," p. 136.

²² Bothwell, *Nucleus*, p. 425.

²³ Quoted in Morrison and Wonder, *Canada's Nuclear Export Policy*, p. 20.

²⁴ EMR, *Nuclear Policy Review: Background Papers*, p. 313.

²⁵ "Payments to Agents by AECL," *International Canada* 7 (November 1976), p. 268.

²⁶ Finch, *Exporting Danger*, p. 54.

²⁷ James Fleming, "The deal that never was," *Maclean's*, October 15, 1979, p. 45.

²⁸ Canada, Parliament, House of Commons, *Debates* (December 22, 1976), p. 2255; also, Canadian Department of Foreign Affairs and International Trade website (<http://www.dfait-maeci.gc.ca/~eicb/notices/ser72-e.htm>).

²⁹ Gary Clyde Hufbauer and Jeffrey J. Schott, *Economic Sanctions Reconsidered: History and Current Policy* (Washington, D.C.: Institute for International Economics, 1985), pp. 499-503.

³⁰ EMR, *Nuclear Policy Review: Background Papers*, p. 269.

³¹ Duane Bratt, "Is Business Booming? Canada's Nuclear Reactor Export Policy," *International Journal* 53 (Summer 1996), p. 497.

³² See: T.A. Keenleyside and Patricia Taylor, "The Impact of Human Rights Violations on the Conduct of Canadian Bilateral Relations: A Contemporary Dilemma," *Behind the Headlines* 42 (November 1984).

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³⁴ Canada, Secretary of State for External Affairs Flora MacDonald, "An Examination of Conscience at the United Nations," *Statements and Speeches*, September 25, 1979.

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³⁷ Bratt, "Is Business Booming?" pp. 495-496.

³⁸ Canada, Department of External Affairs official (name withheld by request), Ottawa, telephone conversation with author, June 6, 1992.

³⁹ These arguments were obtained from information provided in Government of Canada, *News Release No. 199* (September 17, 1991) and Canada, Department of Energy, Mines, and Resources official (name withheld by request), Ottawa, telephone conversation with author, June 14, 1992.

⁴⁰ Quoted in Morrison and Wonder, *Canada's Nuclear Export Policy*, p. 83.

⁴¹ Canada, Department of External Affairs official (name withheld by request), Ottawa, telephone conversation with author, June 6, 1992.

⁴² Canada, Secretary of State for External Affairs Joe Clark, Ottawa, letter to the author, January 15, 1990.

⁴³ See, Dave Todd, "Forced Labour used in Romanian CANDU," *Toronto Star*, December 30, 1989, pp. A1, A20; Dave Todd, "Conscripts built CANDU reactor: Government never protested to Romanians," *Toronto Star*, December 30, 1989, p. A20; and Paul Watson, "Life Harsh for 14,000 CANDU workers," *Toronto Star*, January 3, 1990, pp. A1, A17.

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⁴⁵ Geoffrey York, "Romanian palace cast in new light," *The Globe and Mail*, May 4, 1996, p. A14.

⁴⁶ Atomic Energy of Canada Limited, *Annual Report 1990-91*, p. 11.

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⁴⁹ Government of Canada, *News Release No. 199* (September 17, 1991).

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⁵⁵ Natural Resources Canada, *Speech* 96/116 (November 26, 1996).

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⁵⁷ It is widely believed that India, Israel, and Pakistan—among others—also have a nuclear weapons capability, however these "threshold" nuclear weapons states are not recognized by the NPT.

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- ⁷⁶ Natural Resources Canada, *Speech 96/116* (November 26, 1996).
- ⁷⁷ Nuclear reactor efficiency is measured through the capacity load factor, which is the reactor's actual electricity production divided by what the reactor would produce if it always operated at its design rating.
- ⁷⁸ Nuclear Engineering International, *World Nuclear Industry Handbook 1992* (Surrey, U.K.: Reed Business Publishing Group, 1992), pp. 18-20.
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