

Federal Government Subsidies to Atomic Energy of Canada Limited

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January 11, 2006

This report calculates the Canadian government's total subsidies to Atomic Energy of Canada Limited (AECL) since its inception in 1952.

Because the subsidies have extended over more than five decades, it would be misleading to add the annual subsidies together without reflecting the time value of money. To be accurately summed or compared using consistently valued dollars, dollar amounts from different years must be adjusted by applying an annual "discount rate" or a "rate of return" to historic sums in order to calculate a present value. This report provides analysis applying three different discount rates to these sums but focuses on answering two logical questions:

- If all the money directed to AECL had been invested reasonably well, how much would it be worth today?
- How much of the federal government's total debt is attributable to AECL?

Appendix 1 presents annual subsidy tracking and Appendix 2 presents the present value calculations. A live version of the spreadsheets can be obtained by contacting the author.

In a 1996 study published in the journal "Policy Options", George Lerner, Dean of the Faculty of Management at the University of Lethbridge, dealt with the first of these questions. Lerner recommended that the present value of the subsidies directed to AECL be calculated by applying an inflation-adjusted or real rate of return of 7.5% per year.¹ Lerner's approach reflects the fact that federal subsidies to AECL have always been justified as an investment. He therefore applied a typical investment rate of return. Had the money spent on AECL been invested at an inflation-adjusted rate of return of 7.5%, the total value of the investment to the Canadian economy today would be \$194.6 billion. By this measure, the value forgone through subsidies to AECL is equivalent to 11.5% of the total value of all of the domestic firms traded on the TSX as of the end of 2005.

¹ "The Dismal Economics of Candu," George Lerner, Policy Options, April 1996. Compared to market indicators, Lerner's proposed real discount rate might be considered an underestimate. In the period from 1953 until 2005, the inflation adjusted return on investment for all of the stocks traded on the TSX has averaged approximately 7%. Since the TSX includes firms of all different risk levels, a speculative technology investment might be expected to perform much better than the average stock to justify the higher risk.

Assuming all subsidies to AECL came from borrowed money and not increased taxes, how much is AECL's portion of federal debt worth today? Calculated as a contribution to the federal government's total debt, total subsidies to AECL amount to \$74.9 billion. This figure reflects the actual dollars transferred, plus all compound interest paid, at actual federal government borrowing rates. By this measure, AECL is responsible for 12% of today's federal government debt.²

Taking only inflation into account, total subsidies to AECL amount to \$20.9 billion calculated in net present value in today's dollars. This total includes the actual dollars transferred, converted to today's dollars by applying an interest-free discount rate equal to the Consumer Price Index.

In addition to these subsidies, AECL has also amassed substantial contingent liabilities that may result in additional claims against taxpayers, although the scale and timing of any claims cannot be known now.

AECL's contingent liabilities include at least the following:

- The outstanding amount of a \$1.5 billion loan issued in 1997 by the Government of Canada to the Government of China supporting the purchase of two Candu reactors from AECL;
- The value of AECL's guarantees for refurbishment timing, refurbishment cost, and post-refurbishment production provided to NB Power in 2005 to support retubing of the Point Lepreau reactor (The scope of these guarantees has not been disclosed.);
- The value of AECL's guarantees for refurbishment timing, refurbishment cost, and post-refurbishment production provided to Bruce Power in 2005 to support retubing of the Bruce A nuclear generation station (The scope of these guarantees has not been disclosed.);
- The dispute currently in arbitration between AECL and MDS Nordion related to construction delays, cost overruns, and significant safety violations by AECL associated with the joint Maple reactor project at Chalk River; and
- Cost escalation beyond currently estimated costs for decommissioning and nuclear-waste liabilities at AECL's numerous contaminated sites.

Both of the parties that have governed Canada since 1952 have been nuclear spendthrifts. For every day Liberals have been in power since 1953, government subsidies to AECL have added, on average, \$4.313 million to the federal debt. AECL subsidies from Conservative governments have added \$2.554 million per day to the federal debt, on average. The majority of contingent liabilities amassed by AECL arose during periods of Liberal government.

² In 2004, the total debt was \$628.830 billion. ref: <http://www40.statcan.ca/101/cst01/govt03a.htm>

AECL's Legacy of Achievement

While many Canadians might support subsidies to a federal government program that brought prosperity and pride to Canada, the massive subsidies conferred upon AECL have produced the opposite results.

The jurisdictions in Canada most reliant on AECL's Candu technology -- Ontario and New Brunswick -- are the only major energy systems in Canada requiring government aid to remain solvent. Ontario and New Brunswick also have the fastest-growing power rates in Canada.

Government officials of all of AECL's foreign reactor customers have at one time expressed intentions of using their nuclear technology for weapons purposes. So far, two Candu customers -- India and Pakistan -- have actually tested nuclear weapons.

Nor have these subsidies created a business with a promising future export market. AECL has been spending a large amount of funds since 1989 to develop a new reactor design to compete for new orders. At present, AECL has no modern reactor design completed and any new design appears to be at least five years from receiving a safety certification. Meanwhile other reactor vendors have new designs ready. For example, as of the end of 2005, the U.S. Nuclear Regulatory Commission had certified two new reactor designs that are being actively supported by manufacturer/vendors: a boiling water reactor from GE/Toshiba/Hitachi and a pressurized water design developed by Westinghouse. In 2005, AECL's efforts to secure the funding from the Chinese and U.S. governments to update the Candu reactor design collapsed. Only the Canadian government is currently funding this effort.

Comments on Data Sources:

The principal data source for the annual appropriations from 1953 until 2002 was Dave Martin's study "Canadian Nuclear Subsidies: Fifty Years of Futile Funding" published by the Campaign for Nuclear Phaseout in 2003.³ Martin's work draws upon previous work he authored or co-authored with David Argue and also on reports by Ernst & Young⁴ and former Canadian nuclear industry bureaucrat Robert Morrison⁵.

Following Martin's approach, federal subsidies to the heavy water industry are included even though some elements of industry were not directly owned by AECL at the time they were initiated. The Glace Bay heavy water plant was originally a joint project of a Nova Scotia crown corporation called Industrial Estates Limited and a private company called Deuterium Canada. Port Hawkesbury was initiated by Canadian General Electric. In both cases however, AECL was the intended market for the heavy water. The federal

³ Reference: <http://www.cnp.ca/resources/nuc-subsidies-at-50-ex-sum.html>.

⁴ "The Economic Effects of the Canadian Nuclear Industry." Ernst&Young, 1993.

⁵ "Nuclear Energy Policy in Canada 1942 to 1997." Robert Morrison, 1998. Published by Carleton Research Unit on Innovation Science and Environment.

government bailed out those failed projects with a decision taken in April 1980 and reported here in the entry for 1981.

This report makes one change to Martin's tracking of annual appropriations for the period 1952 until 2002. Martin's 1997 entry of \$1.5 billion for the Government of Canada loan to Government of China supporting sale of two Candu reactors is eliminated, because it is scheduled to be repaid, albeit at below-market interest rates. Instead, as noted above, the risk of non-payment is reflected in the contingent liabilities AECL has amassed.

One of Martin's tracking decisions – adopted in this report – should be highlighted for reconsideration in future studies of this type. Martin notes that in 1988, the Canadian government transferred Nordion International Inc. (formerly the AECL division known as the Radiochemical Company) to the crown corporation Canada Development Investment Corporation (CDIC) for eventual privatization. In 1991, CDIC sold Nordion to MDS Health Group Ltd. for \$165 million, and it was reported that AECL received \$150.5 million from CDIC, and that this, “together with interest earned thereon between the dates of receipt and disbursement, has been distributed to the Shareholder by way of dividends.”⁶ E&Y and Morrison noted a \$152.5 million dividend paid to the government in 1992 by AECL funded from the proceeds of the Nordion sale. However, the sale resulted in lengthy litigation initiated by MDS/Nordion, with AECL, CDIC and the Attorney General of Canada named as defendants. An out-of-court settlement was announced in July 1996, involving a payment of \$5 million by the government, an interest-free loan of \$100 million from the government to MDS/Nordion, and an additional payment of \$12.5 million to MDS/Nordion by AECL. However, details, including the total project cost, loan terms, long-term liability for waste management and decommissioning, and other potential terms of the settlement have not been disclosed. Martin rejected crediting AECL for \$152.5 million returned to the government in 1992 on the grounds that this sum is unlikely to offset overall liabilities associated with the sale. When the arbitration between MDS and AECL, discussed above, is concluded, it may be appropriate to reconsider the treatment of related amounts starting in 1992.

The appropriations for 2003-2005 inclusive are taken from AECL's annual reports.

Government funds that come to AECL through other federal government agencies, such as grants from Canadian International Development Agency, are not recognized in this report as federal subsidies. Future studies of this kind might reconsider this approach.

The appropriations reported for 2006 reflect amounts budgeted for AECL in both the government's Estimates and Supplementary Estimates⁷ as well as an additional distribution of \$2.319 billion to AECL.

Amounts associated with unrepaid Canadian government loans made in the 1970s to assist reactor sales to Argentina and Korea are not included.

⁶ AECL “Annual Report 1991-1992,” p. 12.

⁷ Reference:<http://www.tbs-sct.gc.ca/est-pre/20052006/005_E.PDF p. 238>.

Comments on Methodology:

The method for determining the proper interest rate to apply for calculating the contribution of annual appropriations to the federal debt starts with the long term government borrowing rate in place in March of the year of the respective appropriation.⁸ The rate used is drawn from a consistent Bank of Canada data set showing the borrowing rate for long term government debt issued in each month extending over the entire time period of AECL's subsidies. The duration of borrowing to fund AECL is assumed to be 15 years.⁹ At the conclusion of each 15-year period, AECL's maturing debt is rolled over into another 15-year bond, at then-current rates.

The index used for inflation adjustment is the Consumer Price Index reported by the Bank of Canada.

Subsidy responsibility is allocated to each governing party by assigning the entire annual amount to the party in power in March of the respective fiscal year, except for one case. For the Conservative government in 1980 – the only short-lived term of office for one party since 1953 – the report prorates the annual appropriations between the two parties in power during that year.

Conclusion

Subsidies to AECL are a significant drain on the national resources of Canada. Canadian taxpayers have no prospect for recovering their investment in AECL.

In addition to national-scale financial losses, AECL has created a large inventory of radioactive waste. There appear to be no current prospects for reactor exports. Historic reactor exports from Canada have contributed to international peace and security concerns.

The main domestic spinoff of AECL's activities has been CANDU reactor programs in Quebec, New Brunswick, and especially Ontario. These programs have effectively driven their owners in New Brunswick and Ontario into insolvency, raised electricity rates, and incurred tens of billions of dollars of additional cleanup liabilities. Taking into account their associated debts, waste liabilities, running costs, and value of their output, the overall value of each of the power reactors in Canada is a large net loss.

Nuclear technology research in Canada should be drastically slashed. Modest taxpayer subsidies might be considered to meet a completely revised set of priorities. Canada should be working to manage legacy nuclear wastes, rather than creating more. Safety-enhancing programs associated with existing reactors and other nuclear operations should

⁸ Reference: http://www.bankofcanada.ca/pdf/annual_page19_page20_page21.pdf.

⁹ The data set used explicitly identifies the term of the quoted bonds as 15 years but only for the period from 1936-1948.

be maintained but should be funded by reactor operators. In place of power reactor subsidies, Canada should instead consider modest support for theoretical science, medical applications, and scientific support for international nuclear technology control programs.

Appendix 1: Federal Government Subsidies to AECL (\$Millions, Dollars of the Year)

Fiscal Year End	<R&D>	REACTORS					HEAVY WATER					FINANCIAL			Nominal Total
	R&D	Prototype Reactor Funding	Pickering Pay-back	CANDU 3	Slowpoke	Reactor Decomm- ission'g	Loans Forgiven	HWP Loans Payment	HWP Support	LaPrade Maintenance	HWP Closures	Dividends/ Guarantees/ Investments	Additional Subsidies	Subsidiaries Divested	
1953	21.4											44.7			66.1
1954	19.6														19.6
1955	29.5														29.5
1956	30.3														30.3
1957	30.5	0.5													31
1958	23.8	0.8													24.6
1959	26.6	2.1													28.7
1960	24.7	5.8													30.5
1961	26.5	11.7													38.2
1962	29.1	4.8													33.9
1963	37.1														37.1
1964	44.9														44.9
1965	45.2														45.2
1966	52.7														52.7
1967	58														58
1968	66.5														66.5
1969	68.6														68.6
1970	69														69
1971	68.9														68.9
1972	77														77
1973	78.2														78.2
1974	87.9														87.9
1975	85.9														85.9
1976	93.6														93.6
1977	96.8	85.5							13.3						195.6
1978	101.7	275.4	0						26.8						403.9
1979	110.3	8.9	0												119.2
1980	114.7	8.8	0												123.5
1981	123.1	10.2	0				816.9	9.3	65	8.6					1033
1982	145.7	11.4	0					9.3	112.9	4.5					283.8
1983	169.9	12.7	0					11.3	118.3	3.1					315.3
1984	184.5	12.4	0					12.3	124.7	2.5					336.4
1985	192.4	11.1			2.6			12.3	104.6	2.5					325.5
1986	172.7				3.9	18.3		13.3	29.2	2.3	35.4				275.1
1987	176.8				4.9	11.9		3.3		1.9	18.8				217.6
1988	143.3				10.4	20.3		3.3		0.5	2.6				180.4
1989	135.9			44.4	11.1	10.3		4.5							206.2
1990	141.5			29.2	12.2	12		1.6						9.1	205.6
1991	154.3					11.4		1.8							167.5
1992	162.1					11.9		1.9							175.9
1993	167.3					10.9		2.1							180.3
1994	161.5					9.8		2.3							173.6
1995	169.5					10.5									180
1996	164.3					10.3									174.6
1997	167.4										0	19.9			187.3
1998	132.2											20.6			152.8
1999	102.4											8			110.4
2000	105.7											32.1			137.8
2001	108.9					13									121.9
2002	136.3					17						60			213.3
2003	106.6					31									137.6
2004	103					30						46			179
2005	99					29						35			163
2006	98.8					2319						60			2478

Appendix 2: AECL Subsidies Net Present Value

Fiscal Year End	Nominal Total (\$Millions)	CPI Index	\$2005 Equivalent Total (\$Millions)	2005 opportunity value as per Lermer	long term government bond rate (%)	Contribution to federal debt in 2005 (\$Millions)	Liberal govern't (years)	Conservative government (years)	LIB \$ RESPON'SY \$2005	CONS \$ RESPON'Y \$2005	LIB \$ RESPON'SY debt	CONS \$ RESPON'Y debt
1953	66.1	7.6310	504.4	21678.2	3.68	2374.8	1.00	0.00	504.4	0.0	2374.8	0.0
1954	19.6	7.5858	148.7	5944.1	3.11	755.7	1.00	0.00	148.7	0.0	755.7	0.0
1955	29.5	7.6310	225.1	8372.0	3.02	1048.8	1.00	0.00	225.1	0.0	1048.8	0.0
1956	30.3	7.4104	224.5	7767.8	3.41	655.5	1.00	0.00	224.5	0.0	655.5	0.0
1957	31.0	7.2429	224.5	7225.7	4.00	689.2	0.49	0.51	224.5	0.0	689.2	0.0
1958	24.6	7.1222	175.2	5245.0	3.99	602.6	0.00	1.00	0.0	175.2	0.0	602.6
1959	28.7	7.0440	202.2	5629.8	4.84	890.0	0.00	1.00	0.0	202.2	0.0	890.0
1960	30.5	6.9674	212.5	5504.9	5.31	1060.6	0.00	1.00	0.0	212.5	0.0	1060.6
1961	38.2	6.8556	261.9	6310.8	5.18	1171.1	0.00	1.00	0.0	261.9	0.0	1171.1
1962	33.9	6.7474	228.7	5127.4	4.86	779.1	0.00	1.00	0.0	228.7	0.0	779.1
1963	37.1	6.6082	245.2	5112.3	5.09	755.9	0.60	0.40	0.0	245.2	0.0	755.9
1964	44.9	6.5076	292.2	5667.8	5.25	954.6	1.00	0.00	292.2	0.0	954.6	0.0
1965	45.2	6.3781	288.3	5202.0	5.06	1449.0	1.00	0.00	288.3	0.0	1449.0	0.0
1966	52.7	6.1340	323.3	5426.1	5.58	1577.5	1.00	0.00	323.3	0.0	1577.5	0.0
1967	58.0	5.8807	341.1	5325.7	5.48	1815.3	1.00	0.00	341.1	0.0	1815.3	0.0
1968	66.5	5.6726	377.2	5479.2	6.91	1389.4	1.00	0.00	377.2	0.0	1389.4	0.0
1969	68.6	5.4093	371.1	5013.8	7.22	1670.8	1.00	0.00	371.1	0.0	1670.8	0.0
1970	69.0	5.2541	362.5	4556.6	7.93	1570.0	1.00	0.00	362.5	0.0	1570.0	0.0
1971	68.9	5.0873	350.5	4098.2	6.76	901.4	1.00	0.00	350.5	0.0	901.4	0.0
1972	77.0	4.8561	373.9	4066.8	7.24	950.5	1.00	0.00	373.9	0.0	950.5	0.0
1973	78.2	4.4825	350.5	3546.5	7.30	1065.3	1.00	0.00	350.5	0.0	1065.3	0.0
1974	87.9	4.0442	355.5	3345.7	8.19	1341.5	1.00	0.00	355.5	0.0	1341.5	0.0
1975	85.9	3.6524	313.7	2746.8	8.47	1374.7	1.00	0.00	313.7	0.0	1374.7	0.0
1976	93.6	3.4370	321.7	2620.0	9.39	1345.2	1.00	0.00	321.7	0.0	1345.2	0.0
1977	195.6	3.1733	620.7	4702.4	8.83	2206.1	1.00	0.00	620.7	0.0	2206.1	0.0
1978	403.9	2.8939	1168.8	8237.3	9.17	3907.7	1.00	0.00	1168.8	0.0	3907.7	0.0
1979	119.2	2.6708	318.4	2087.1	9.91	1176.4	0.44	0.56	318.4	0.0	1176.4	0.0
1980	123.5	2.4098	297.6	1814.9	13.45	1888.1	0.81	0.19	242.2	55.4	1536.4	351.8
1981	1033.1	2.1402	2211.0	12543.0	13.48	13695.4	1.00	0.00	2211.0	0.0	13695.4	0.0
1982	283.8	1.9366	549.6	2900.3	15.06	3990.0	1.00	0.00	549.6	0.0	3990.0	0.0
1983	315.3	1.8340	578.3	2838.6	11.70	2417.9	1.00	0.00	578.3	0.0	2417.9	0.0
1984	336.4	1.7707	595.7	2720.1	13.06	2879.6	0.73	0.27	595.7	0.0	2879.6	0.0
1985	325.5	1.7025	554.2	2354.0	11.93	2357.5	0.00	1.00	0.0	554.2	0.0	2357.5
1986	275.1	1.6310	448.7	1773.0	9.54	1349.1	0.00	1.00	0.0	448.7	0.0	1349.1
1987	217.6	1.5615	339.8	1249.0	8.98	941.4	0.00	1.00	0.0	339.8	0.0	941.4
1988	180.4	1.5012	270.8	926.0	10.13	854.1	0.00	1.00	0.0	270.8	0.0	854.1
1989	206.2	1.4260	294.0	935.3	10.49	966.2	0.00	1.00	0.0	294.0	0.0	966.2
1990	205.6	1.3697	281.6	833.3	10.91	971.8	0.00	1.00	0.0	281.6	0.0	971.8
1991	167.5	1.2936	216.7	596.4	9.88	626.4	0.00	1.00	0.0	216.7	0.0	626.4
1992	175.9	1.2794	225.0	576.2	9.28	557.6	0.00	1.00	0.0	225.0	0.0	557.6
1993	180.3	1.2569	226.6	539.8	8.27	467.8	0.16	0.84	0.0	226.6	0.0	467.8
1994	173.6	1.2556	218.0	482.9	8.25	415.2	1.00	0.00	218.0	0.0	415.2	0.0
1995	180.0	1.2280	221.0	455.6	8.70	414.5	1.00	0.00	221.0	0.0	414.5	0.0
1996	174.6	1.2106	211.4	405.2	7.94	347.3	1.00	0.00	211.4	0.0	347.3	0.0
1997	187.3	1.1881	222.5	396.9	6.97	321.1	1.00	0.00	222.5	0.0	321.1	0.0
1998	152.8	1.1783	180.0	298.7	5.54	222.9	1.00	0.00	180.0	0.0	222.9	0.0
1999	110.4	1.1539	127.4	196.6	5.23	149.9	1.00	0.00	127.4	0.0	149.9	0.0
2000	137.8	1.1255	155.1	222.7	5.96	184.1	1.00	0.00	155.1	0.0	184.1	0.0
2001	121.9	1.0948	133.5	178.2	5.74	152.4	1.00	0.00	133.5	0.0	152.4	0.0
2002	213.3	1.0674	227.7	282.8	6.00	254.0	1.00	0.00	227.7	0.0	254.0	0.0
2003	137.6	1.0465	144.0	166.4	5.52	153.2	1.00	0.00	144.0	0.0	153.2	0.0
2004	179.0	1.0272	183.9	197.7	4.94	187.8	1.00	0.00	183.9	0.0	187.8	0.0
2005	163.0	1.0000	163.0	163.0		163.0	1.00	0.00	163.0	0.0	163.0	0.0
2006	2477.8	1.0000	2477.8	2477.8		2477.8	1.00	0.00	2477.8	0.0	2477.8	0.0
Total			20,937.3	194,564.3		74,884.7	38.2	15.8	16,698.7	4,238.6	60,181.7	14,703.0
Daily Average (millions):									\$1.197	\$0.736	\$4.313	\$2.554