

The report is also a reminder that we should not jump to conclusions when presented with new or revised data before we examine it. In this case, jumping to conclusions would have been a mistake. China's GDP in US dollars has been revised downwards substantially, but its real output in Chinese Yuan remains unchanged.

Note

¹ The 2005 PPP estimates for China are based on prices from 11 administrative areas, which may or may not be representative of the rest of the country. The International Comparison Program argues that if there is a bias in the new estimates, it is likely not more than five percent (International Comparison Program, 2007).

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CANDU or no CANDU?

The future of nuclear power in Ontario

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THE government of Canada is currently considering the future of Atomic Energy of Canada Limited (AECL), a federal crown corporation based in Ontario.¹ In my assessment, privatization is indicated. But it may not be possible to save AECL's unique CANDU (CANada Deuterium Uranium) technology because that technology is based on the use of "heavy water," whereas AECL's major global competitors use "light-water" technology.² If AECL were sold to an existing nuclear reactor competitor, the buyer might not wish to continue developing the CANDU technology. What should the government do? The determining factor in the government's decision should be an honest assessment of Canada's best strategic positioning in the global nuclear industry.

Ontario's critical situation

TODAY, nuclear power plants meet over 50% of Ontario's electricity requirements (OPA, 2007). The government has begun a massive construction program aimed at refurbishment or replacement of almost all the existing nuclear capacity within the next 10 to 15 years (OPA, 2007). The proposed Ontario plan envisions coincident mega-projects.

The cost and reliability of the province's electricity supply hangs in the balance. Each nuclear mega-project must be completed on time and on budget—an outcome for which there is no Ontario precedent. Moreover, most of this

massive construction program must be accomplished without the backstop of Ontario's coal-fired stations—historically the province's back-up insurance for maintaining power system reliability when unexpected outages in nuclear generation capacity occur. This is because the province is planning to phase out coal capacity by 2014 (OPA, 2007).

The existing Ontario nuclear plants utilize CANDU technology. However a crucial decision for Ontario will be the choice of technology for any new nuclear plants. The province says AECL is the preferred supplier, consistent with the federal-provincial history of using Ontario's electricity sector to "nation/province build."

But AECL's Generation III+ Advanced CANDU Reactor design, the ACR 1000, is not complete and, once complete, has to be submitted to the Canadian Nuclear Safety Commission (CNSC) for licensing before construction could begin. Given an estimated 10-year timeline for commissioning a new plant, last year both Bruce Power and Ontario Power Generation (OPG), the two Ontario operating companies, initiated the regulatory process with respect to construction and operation of new nuclear generating units at the Bruce and Darlington sites, respectively (OPA, 2007).

The Ontario new-build market is likely to be significant, perhaps between 4,000 and 8,000 megawatts, or from 35% to 70% of Ontario's current nuclear generation capacity (OPA, 2007). While this amount is far more than any Ontario politician would dare even whisper, this

is likely what both OPG and Bruce Power will prefer. These same nuclear operating companies will also want all technology and first-of-a-kind construction risk to be borne by the reactor supplier if a new design is involved. This can be accomplished by negotiating a fixed-price contract.

Additionally, Bruce Power and OPG will want Ontario to remove transmission and market risk through a guarantee to buy the electricity production of the plants at a specified price. They will also want indemnity against project cancellation by a future government. Ontario has proven itself willing to do as much, and more, in a deal already signed with Bruce Power to refurbish the Bruce A nuclear station. Accident, waste disposal, and plant decommissioning risks in Ontario are already shared with governments.

The AECL meltdown

THE tight timeline of Ontario's electricity supply plan puts extreme pressure on the federal government to decide the future of AECL and its ACR 1000 quickly. In turn, AECL's problems are le-

gion. AECL exhibits all the pathologies of mixed for-profit and not-for-profit mandates, and inconsistent, political-cycle-driven funding.

The company needs huge new financial resources. According to the federal Auditor General (2007), AECL needs \$850 million over the next 10 years to refurbish its Chalk River Laboratories and, at last count, \$400 million to complete the ACR 1000 design. It also needs "significantly more" than \$150 million to fix its two, eight-years overdue, Maple reactors designed to fulfill contract obligations for medical radio-isotopes. This is in addition to new funding required for handling its existing stockpile of nuclear wastes (AGC, 2007).

AECL's corporate strategy shifted in 2005, introducing yet more uncertainty. The ACR 1000 design itself reflects a change of strategy to refocus on Canada after the company lost its best shot at entering the US market with a smaller scale ACR 700 (AGC, 2007). Worse still, AECL's technology reputation is surely damaged by the cost overruns and protracted delay of its Maple reactors. To top it off, the recent debacle involving

the CNSC, which saw the Minister of Natural Resources, the Hon. Gary Lunn, fire the CNSC Chairman, points to the conflict of interest inherent in the federal government being both the owner of AECL and its safety regulator.

Federal policy options

THE clear policy implication is to privatize AECL. Some aspects of AECL cannot be privatized, such as ownership of the existing nuclear wastes and funding of basic nuclear research. For all other aspects, it is crucial to define what is meant by privatization.

Privatization should imply more than simply private ownership. Privatizing AECL should also transfer risk from the government to the new owners. Specifically, the transaction should relieve Canadian taxpayers of the future technology development risk, first-of-a-kind construction risk, and any risks related to domestic and international marketing of the technology, including any regulatory and political risk.

The federal government's strategic position seems clear. There are really four possible buyers: Areva (a combined French/German company), Westinghouse (a US-based Japanese-owned company), General Electric Nuclear (which has US and Japanese ownership), or a consortium of Canadian companies (possibly more than one group).

The great advantage of the three large nuclear technology companies is that the technology development, construction, marketing, and licensing risk could automatically be transferred to them. Each is a major corporation with a successful track record in nuclear plant design and construction, and is supported by government policy that provides it with tax or other advantages in its own key home market—Areva in France and Westinghouse and GE Nuclear in the United States and Japan. They are also supported in export markets.

What is Candu technology?

CANDU (CANada Deuterium Uranium) was a joint project of Atomic Energy of Canada Ltd. and Ontario Hydro, the predecessors of Ontario Power Generation.

The CANDU is a unique design using natural uranium as fuel and heavy water as a moderator. A nuclear reaction is created when uranium atoms split. This fission creates heat, which heats the fluid in the heat transport system. This, in turn, heats ordinary water, which turns into steam that is used to turn the turbine generator to make electricity.

Heavy water (deuterium), which is about 10% heavier than regular water, is used as a heat transport fluid and a moderator. The purpose of a heavy water moderator is to control the nuclear chain reaction which results from splitting uranium atoms.

The ACR 1000 is a 1,200 MWe class nuclear power plant which is capable of generating enough power to meet the daily needs of up to two million people. The ACR 1000 was designed to prevent or mitigate severe accidents, which means that there are multiple technological and operational safety measures, including two passive, independent shutdown systems.

Sources: Bruce Power; AECL (2007).

The potential political disadvantage of selling AECL to one of these three large companies is that they are unlikely to want to continue the CANDU technology and supply chain development, or the licensing and marketing of the ACR 1000. Splintering their focus from their own preferred light water reactor technologies is not likely to make business sense.

By contrast, the presumed political advantage of a Canadian consortium is that it could be packaged as a Canadian/Ontario “champion” that would continue to develop and market the ACR 1000. But could this be a privatization in terms of risk transfer from the federal government? For three business lines—CANDU-related laboratory services, radio-isotopes, and the refurbishment of existing CANDU reactors—the answer is probably yes because market risks are reasonable. A privatized AECL is highly likely to win any refurbishment contracts for existing CANDU reactors at home and abroad, along with continuing related lab services. And if the Maple reactors will work, there already exists a 40-year contract and a dominant share of the global market for radio-isotopes.

CANDU or no CANDU?

THE bigger problem is with the ACR 1000, where the issue is not necessarily the technology or its design specification costs, but rather an enormous marketing barrier. The attractiveness of new nuclear plants as a commercial proposition depends on multiple replication. That, in turn, depends on the size of the home market and access to foreign markets.

The Canadian market is not big enough, notwithstanding a possibly sizeable Ontario market. Of course, one could imagine 15 new ACRs dedicated to producing hydrogen to fuel Canada’s transportation sector, but not any time in the next 20 years. And the very “prov-

ince building” logic that argues for the ACR implies its possible limitations beyond Ontario. Would other provinces be willing to invest in the ACR before their own alternative “province building” power opportunities? Perhaps, but not likely without federal incentives.

Even so, limited foreign marketability is likely why any truly privatized Canadian company would ultimately fail. Nuclear power reactor marketing is inextricably linked to government policy and a government’s chosen corporate champion. Even a better Canadian technology would likely not be decisive outside Canada.

In addition, large foreign markets that are not effectively foreclosed as “home turf” by a national champion will be extremely competitive. The Russians and Koreans are future contestants in this competition as well. China has indicated a preference for light water technology, and India is being wooed by the United States, probably having broader geo-political objectives in mind. Would the government of Canada be prepared to buy the way of its privately-owned Canadian champion into these markets as well? Perhaps, but would a future government also underwrite the development of a newer, updated Canadian design in order to remain competitive?

Strategic positioning for the future

It would be a mistake simply to equate the future of the nuclear industry in Canada with the future of the ACR design. Canada is already secure in the international market for the mining and processing of nuclear fuel. In the power reactor market, it may be that the Canadian nuclear industry could be far stronger in the camp of one of the “big three” global competitors. Indeed, Canada might enjoy some negotiating leverage, given the value of AECL’s personnel and patents, the potential market addi-

tion, and the strategic foothold in North America that Canada represents.

Whatever course of action is decided, the transaction should be open to review by the Auditor General to determine the degree of risk transfer, the probability of any future liability to taxpayers, and the logic in terms of strengthening Canada’s competitiveness in the global nuclear industry.

Notes

1 A press release from the office of the Minister of Natural Resources for Canada (2007) states that “it is time to consider whether the existing structure of AECL is appropriate in a changing marketplace.”

2 Heavy water is used as a moderator and heat transporter in the CANDU design. Light water reactors use normal water.

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