Nuclear Power in Alberta:

An Alternative Perspective

-Citizens Advocating the Use of Sustainable Energy (CAUSE) www.nuclearfreealberta.ca

April 6, 2009

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EXECUTIVE SUMMARY

In April 2008 the Alberta government appointed a panel to study the issues associated with generating nuclear power in the province. This was in response to a proposal from Bruce Power, a nuclear operator from Ontario, to build as many as four large nuclear reactors in Alberta. The panel was directed to consider specific topics and prepare a report.

This document provides an analysis of the nuclear issues examined by the provincial nuclear panel and provides an alternative perspective. The need for such a document is based on the conflict-of-interest present on the appointed panel and its subsequent inability to prepare the objective report that had been intended. For example, one nuclear panel member is on the board of Atomic Energy of Canada Limited (AECL), the federal crown corporation that desperately wants to build the proposed reactors.

Albertans should know that the provincial government has the authority to decide whether or not nuclear power is used to generate electricity in this province.

Alberta's future electrical demand

The Alberta Electrical Systems Operator (AESO) is projecting that Alberta could need almost twice as much electricity by 2028 as it does now—another 10,000 megawatts. This projected demand will likely be less given the economic downturn. The Pembina Institute's "Greening the Grid" shows that renewable energies and energy efficiency can easily meet Alberta's future electrical demand. There are proposals before the AESO for about 11,500 megawatts of new wind power projects. **There is no need for Alberta to embark on a nuclear future.**

Nuclear power generation technologies

The nuclear technologies being considered in Alberta, and in other parts of the world, are third generation reactors. **Not one of these third generation reactors is up-and-running anywhere in the world.** AECL has not even completed the design for its proposed 1200 megawatt nuclear reactor, the ACR-1000. Two third generation reactors designed by the French nuclear company AREVA are under construction, but both have run into problems with design, quality control and cost overruns. Even the Fraser Institute is concerned about the financial risk involved in building new nuclear technology for the first time.

Comparing nuclear to other generation

The Pembina Institute's "Greening the Grid" concludes that when nuclear energy is compared to renewable technologies such as wind and solar power, "the benefits of investing scarce resources in clean electricity capacity will offer higher long term returns than making future investments in coal and nuclear. A cleaner grid is not only a commendable goal, it is an achievable one." ("Greening the Grid", p. 73) Large nuclear power plants, like those proposed for Alberta, have the disadvantage of needing a large source of energy backup.

Renewable energies (supported by conservation and energy efficiency) can provide reliable power while offering the flexibility of meeting Alberta consumers' electrical needs.

Integration into electrical grid

The 4000 megawatt nuclear facility being proposed for the Peace River region will require a massive 500 kilovolt transmission line to be built. Building transmission lines in southern Alberta where the real need for new electrical generation exists will be less expensive and mean lower distribution costs for Alberta electricity consumers.

Canada and the world

Canada's CANDU reactors have a long history of design problems, decreasing reliability, cost overruns during construction, and expensive repair costs when in operation. Meanwhile, some European countries, including Germany, are phasing out nuclear power and turning to renewable energy as safer, more cost-effective, and less damaging to the environment. **More jobs can be created in renewable energies than in large power plants**

such as nuclear, as stated by the Canadian Labour Congress among others.

Risk and Benefit Analysis

- ✓ The cost of building nuclear continues to escalate, while renewable energies such as wind and solar become more affordable.
- ✓ **Nuclear is only possible if supported by billions of dollars of taxpayer's money**.
- ✓ Reliable sources including Moody's Investors show that the cost of building 4000 megawatts of nuclear power would be $37 billion dollars Canadian more than three times Bruce Power's cost estimate.
- ✓ Albertans will be assuming a high and unnecessary risk by introducing nuclear power into the province. **The safety of these first-of-their-kind reactors is untested.**
- ✓ The Nuclear Liability Act provides only a small fraction of the cost incurred from a major nuclear accident.
- ✓ When the entire nuclear cycle is considered, nuclear contributes more to global warming than alternatives such as wind power.
- ✓ Nuclear power will contaminate our environment through routine releases of radiation into the air, and high levels of tritium into our water.
- ✓ A recent health study in Germany has shown much higher rates of cancer in children living near nuclear reactors.
- ✓ Nuclear power is the most water-intensive way to produce electricity and will deplete Alberta's already dwindling water resource.
- ✓ Current storage of nuclear waste at reactor sites poses a terrorist threat.

Waste Management and Liability

The third generation reactors being proposed have the capacity to use reprocessed "spent fuel" from light water reactors such as those used in the United States. Transporting nuclear waste from the United States or other parts of Canada is a real risk.

If Alberta begins to generate electricity from nuclear, it will join other provinces in being considered for long term nuclear waste disposal. Alberta taxpayers may find themselves contributing towards the ballooning cost of storing this highly toxic waste for hundreds of thousands of years.

Social Issues

Do we want another Fort McMurray with all its social problems in Alberta? If nuclear goes ahead, the provincial government will need to contribute funds to address the demands on infrastructure and the decrease in revenue from tourism and agricultural production. One should expect Alberta taxpayers to have to pay for nuclear power in one way or another, including higher electrical costs.

Conclusion

In conclusion, nuclear power poses too high a risk economically, environmentally and to the health and safety of Albertans. Renewable energies and energy efficiency provide a more cost-effective option that can easily meet the province's future demand for electricity, in a more timely manner, creating more jobs, and avoiding the risky business of nuclear. When choosing a source of future electrical generation we need to put our support towards creating a green and innovative energy future for the province.

Recommendations

- ✓ The Alberta government should implement the recommendations in the Pembina Institute's "Greening the Grid", starting with the appointment of a panel or task force on renewable energies.
- ✓ The province should collaborate with the federal government to initiate a long overdue study on the health effects of nuclear.
- ✓ Finally, Alberta should establish a centre of excellence in the province to support further growth and expertise in renewable energies.

INTRODUCTION/BACKGROUND

Bruce Power, a nuclear operator from Ontario, is proposing to build and operate up to 4000 megawatts of nuclear power in the Peace River region. If successful, this would be unprecedented since all existing power plants in Canada are owned by provincial utilities. Bruce Power submitted an application to the Canadian Nuclear Safety Commission on March 13, 2008 but on January 6, 2009 it was withdrawn. Local opposition to the proposed Lac Cardinal location near Grimshaw was a factor in this withdrawal. On March 24th, 2009 Bruce Power identified a preferred location north of Peace River that the company refers to as the "Whitemud" site. Bruce Power has also launched an extensive public relations campaign in the Peace River region, that has included large sponsorships handed out to local groups in an attempt to buy public support. Clearly Bruce Power is still determined to convince Albertans that they should take a chance on the proposed untested, third generation nuclear reactors.

Although the federal government regulates the nuclear industry, the province has the legal authority to decide what form of energy will make up part of the mix. The Alberta government has the ability to reject nuclear power as an energy option. Bruce Power has said that "If the province rules against nuclear power, the company would not build a project in the province…."[1]

In April 2008 the Alberta conservative government appointed a so called "expert" nuclear panel to prepare a "balanced and objective" report. The government also identified various issues it saw as relevant to developing nuclear power. The panel was asked to prepare a report specifically dealing with the following issues:

- Alberta's projected future demand for electricity
- Nuclear Power Generation Technologies
- Comparison of nuclear power with other base load generation technologies
- Integration of nuclear power into the supply of electricity in Alberta
- Current and Future Nuclear Power Generation—Canada, World
- Risk and Benefit Assessment – Environment, Health and Safety, Cost
- Waste Management and Liability
- Social Issues and process to respond to social issues.

The panel was to have presented this report by the end of 2008. Public consultation has been promised once the report is released.

The Pembina Institute in their recent landmark paper on renewable energies, "Greening the Grid" has called for the Alberta government to give renewable energies the same kind of consideration as has been given to nuclear. They call on the provincial government to form a panel or task force on renewable energies. Such a body could look at the various issues around electrical generation from a broader perspective than just nuclear.

The following analysis explores the same issues that the nuclear panel has been asked to consider, providing a different perspective than the pro-nuclear position represented on the panel. While the authors of this alternative perspective are opposed to introducing nuclear power into the province, they are not associated with any organization that would benefit financially, or in any other way, if the proposed

[1] **"Site chosen for proposed nuclear power plant." Hanneke Brooymans and Darcy Henton, The Edmonton Journal , March 24, 2009.**

nuclear project were not to go ahead. This alternative perspective to nuclear in Alberta was prepared before the nuclear panel report was released. Unlike the nuclear panel report, this document does include recommendations.

NUCLEAR PANEL MEMBERS—OBJECTIVE?

Four members were appointed to this nuclear panel, with the chair being Harvie Andre, a businessman, chemical engineer, and former federal Conservative M.P. Andre's political allies, Stephen Harper and his government, fully support widespread development of nuclear power in Canada.

As chair, Andre was approached with an offer to arrange a meeting with the panel and Dr. Helen Caldicott, an internationally recognized physician and Nobel prize nominee. At the time, the Calgary Herald recognized that "It's important people such as Caldicott are heard. If the Alberta government is to develop a safe and responsible policy for nuclear energy, all sides of this contentious issue must be fully debated."[2] Andre refused to meet with Caldicott even though a risk and benefit assessment of health was one of the issues to be studied, and no medical professional sits on the panel.

Also lacking on the panel is anyone to bring another perspective to the issue, such as internationally renowned Dr. Gordon Edwards, who has the credentials and decades of experience to address the issues of nuclear power in Canada, particularly the risks, and the nuclear industry's troubled history. At the very least, someone of Dr. Edwards' caliber should have been brought in to speak to the panel.

Another panel member, Harrie Vredenburg, whether biased towards nuclear or not, has a number of connections that put him in a perceived conflict of interest. He has worked as a consultant for TransCanada Corp., a major shareholder of Bruce Power, and he is a Director of the TransCanada International Institute for Resource Industries and Sustainability Studies. Vredenburg is also a Director of the Van Horne Institute who in January 2009 sponsored AECL to speak to the Calgary Chamber of Commerce.

Panel member John Doucet is a professor of energy policy at the University of Alberta, School of Business.

The fourth member of the panel, John Luxat, has worked for the nuclear industry for 34 years. Luxat is also past president of the Canadian Nuclear Association, whose mandate is to promote nuclear. In October of 2008 Luxat was appointed to the board of Atomic Energy of Canada Ltd. (AECL), the crown corporation that desperately wants to sell the nuclear reactors to Bruce Power. Luxat should never have been appointed to what was, in the government's own assessment, intended to be an 'objective' panel. As a director of AECL, Luxat is in an unequivocal conflict of interest.

While Chairman Harvie Andre maintained that the panel would not "entertain requests from proponents or opponents of nuclear power", he had a proponent of nuclear development sitting right on the panel, and in a convenient position to advocate for nuclear.

No one was appointed to the panel from an environmental organization, such as the Pembina Institute, that could have brought some balance to the report. The very composition of the panel made it inevitable that we would be presented a very one-sided and biased view of

[2] Calgary Herald, October 8, 2008.

the nuclear issue. The nuclear panel report can in no way claim to be objective.

ALBERTA'S FUTURE ELECTRICAL DEMAND

In the latest projections of Alberta's electricity needs over the next 20 years, the Alberta Electrical System Operators (AES0) predicts that electrical consumption, as well as peak demand, will almost double by 2028. By this date, AESO estimates that electrical demand will increase by about 10,000 megawatts.

Although the AESO's report, "Future Demand and Energy Outlook (2008-2028), has taken the economic downturn into consideration, their minimal adjustment was made in November 2008. The freefall in the economy has continued since then, more drastically than was anticipated. With industrial use being "the largest sector in terms of load and energy consumption, comprising roughly 49 per cent of total AIL {Alberta Energy Load} energy use"[3], one would expect to see these projections decrease in the next AESO update.

As for new oil sands development, in the past the industry has been able through cogeneration to produce excess energy to feed into the grid.

The Pembina Institute's recent publication, "Greening the Grid" also recognizes that these AESO projections are high, but uses them to show that even at this inflated rate, renewable energies and energy efficiency can realistically provide 75% of Alberta's electrical energy generation in the next 20 years with wind and energy efficiency taking the lead. And with a more aggressive approach that involves government incentives, what Pembina calls the "Green Scenario", geothermal is added to the mix and we can even start phasing out coal. This recent Pembina report shows green energy can easily meet future electrical demand in Alberta without even taking into account the innovations that are likely to be developed in renewable energies in the near future.

The AESO assumes that future electrical generation will include nuclear as part of the mix, but doesn't see this happening until 2022. Based on the past history of nuclear, and the current experience with the few generation III reactors now under construction, in all likelihood it would take even longer. So nuclear, in addition to its environmental, health and economic costs, is incapable of providing the solution for the energy needs of Alberta over the next two decades, just because of the time it would take to bring it onto the grid.

NUCLEAR POWER TECHNOLOGIES

Although AECL likes to stress the similarities to previous CANDU reactors, this new generation III technology has key differences. The ACR-1000 nuclear reactor is a hybrid reactor with characteristics common to both pressurized heavy water and light water reactors. Unlike existing CANDU reactors, this new technology uses enriched uranium instead of natural uranium and light water instead of heavy water as a coolant.

In AECL's pre-application to the Nuclear Regulatory Commission in the United States, the ACR-700 reactor (the predecessor to and a smaller version of the ACR-1000 now being proposed) was described as being in the category of "those reactors that are significantly different from current generation light water reactors under construction or in operation." The licensing application in the United States was dropped after technical design problems

[3] "AESO's Future Demand and Energy Outlook (2008-2028)", p. 9.

were discovered that involved some safety features.

The ACR claims to have a "negative void coefficient". This means that if a loss of coolant accident happens, the power will decrease, rather than increase (Existing CANDUS have a positive void coefficient and require special safety features.) A negative void "reactivity" (nuclear reaction) is required for the ACR because it uses enriched rather than natural uranium. But AECL has not been able to show that this will be achieved. In fact, the U.S. Nuclear Regulatory Commission during pre-licensing of the ACR-700, a smaller version of the ACR-1000, predicted a positive void "reactivity" if coolant were lost, possibly jeopardizing the reactor's control and safety features.[4]

A similar, but not identical problem, for years delayed construction of the Maple reactors which have now been scrapped because AECL could not solve the design problems. Also a first-of-its-kind reactor, the Maple reactor was supposed to replace the aging NRU reactor at Chalk River. (This is not the first time that AECL has been unsuccessful in designing reactors. They could never get the Quebec nuclear reactor, the Gentilly-1, operating properly and it was finally mothballed.)

In 2007 the aging Chalk River nuclear facility was shut down by the Canadian Nuclear Safety Commission (CNSC) for safety violations. The federal government recklessly overturned the decision and then fired Linda Keen, the CNSC president at the time.

Another concern about the ACR-1000 nuclear reactor being proposed is that, like the CANDU 6, the design reduces costs by eliminating the vacuum building, an additional safety component in Ontario's Darlington and Pickering CANDU reactors. This water spray equipped building maintains a vacuum relative to the pressure in the reactor containment system. In the case of a loss-of-coolant accident, the vacuum building sucks up and condenses the high pressure steam, minimizing release of highly radioactive emissions during a nuclear accident. The vacuum building in the CANDU ACR-1000 is eliminated to reduce costs at the expense of safety.

Bruce Power is also considering the evolutionary pressurized reactors designed by the French nuclear company AREVA. This same company has recently been criticized by French regulators for a number of "serious infractions" in the construction of a nuclear reactor in northern France including cracks in its concrete base, an essential barrier for containing radiation. AREVA is also building a third generation reactor in Finland. This project has run into delays and cost overruns, so far totaling more than 2 billion dollars after only three years. The project has been plagued with technical difficulties and quality control issues.

Given the history of the nuclear industry, one can expect long delays, quality control issues, and cost overruns would emerge in any nuclear reactor that would be built in this province, particularly an untried technology. Even the Fraser Institute has concerns about potential

[4] http://www.nrc.gov/reading-rm/doc-collections/commission/secys/2004/secy2004-0126/2004-0126scy.html

taxpayer liability for AECL, particularly in building a first-of-its-kind nuclear reactor.[5]

COMPARING NUCLEAR

The nuclear panel was instructed to compare nuclear to other base load generation technologies. As can be seen in the following discussion, they should have been asked to make a much broader comparison between nuclear and other kinds of electrical generation, particularly the cleaner and sustainable options offered by renewable energies.

Just released in January 2009, Pembina Institute's "Greening the Grid" is a milestone document and can be instrumental in realizing Alberta's potential for a green energy future. The report shows how over the next 20 years it is possible to shift to green electrical generation using energy efficiency and renewable energies such as wind, biomass, hydro, and micropower by at least 75%. Pembina calls this the "Pale Green Scenario". With a more aggressive approach, the report says, we can achieve the "Green Scenario" where even more of our electricity needs are met by energy efficiency and renewable energies, we see geothermal introduced, and we start to phase out coal. Transitional energy resources such as cogeneration also play a role. Nuclear is not part of the recommended energy mix.

"Greening the Grid" concludes that "the benefits of investing scarce resources in clean electricity capacity will offer higher long term returns than making future investments in coal and nuclear. A cleaner grid is not only a commendable goal, it is an achievable one."[6] And when the full environmental costs and other liabilities are considered, it is clear that nuclear is just too costly an option.[7]

When it comes to renewable electricity sources the discussion almost certainly ends up with the argument that renewables cannot meet 'base load' requirements. In terms of generating "base load electricity" the Pembina report offers geothermal as a viable option down the road, and makes a particularly astute observation: "The considerable experience Albertans have in drilling for oil and gas should be easily transferable to geothermal electrical technologies…." [8] The report also describes the variability of wind and solar, often criticized, as actually beneficial in its ability to gear up or down to meet electrical demand unlike larger traditional power plants.

Renewable energy sources are also advantageous because they generally operate in smaller units. As a result, a failure, or downtime due to maintenance, is not as significant as having large nuclear power plants that contribute to a considerable share of the overall energy supply. Nuclear power would need to be backed by another large source of energy. In Ontario, this role has been filled by coal powered stations.

Wind power is the world's fastest growing and already the most inexpensive clean renewable electrical energy source. A recent study by scientists at Stanford University finds that linked wind farms can result in reliable power:[9]

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[5] "CANDU or no CANDU? The Future of Nuclear Power in Ontario", by Bryne Purchase, Fraser Forum, 03/08.

[6] Pembina Institute's "Greening the Grid", p. 73.

[7] Ibid , p. 26.

[8] Ibid, p. 40.

[9] **STANFORD UNIVERSITY STANFORD NEWS SERVICE** Stanford Report, December 5, 2007 **Study finds that linked wind farms can result in reliable power** BY LOUIS BERGERON AND STEPHANIE KENITZER

"The key is connecting wind farms throughout a given geographic area with transmission lines, thus combining the electric outputs of the farms into one powerful energy source... interconnecting wind farms with a transmission grid reduces the power swings caused by wind variability and makes a significant portion of it just as consistent a power source as a coal power plant."

The potential for wind will increase even further through development of storage technologies as well as the increased use of virtual power plants to predict and control peak load.

The contribution of solar energy (active and passive) in some countries (e.g. Germany) is growing very quickly. It is true that currently the production costs of solar photovoltaics is comparatively high and still needs to be subsidized, but with only a small fraction of the subsidies that the nuclear industry enjoys.

In the southern United States they are now building solar thermal plants. The head of Pinnacle West in Nevada who operates a solar thermal plant explains: "The key is that solar technology has advanced….At 280 megawatts, it's a critical size; it's a real power plant; it's meaningful; it's beyond the demonstration stage."[10] Renewable energy sources, especially solar energy, have incredible potential for development whereas the nuclear power technologies are basically at their end!

Last but not least, energy efficiency can play a significant role in reducing the amount of electricity we need. At a 2008 Council of Federation meeting in Quebec City, Alberta's premier agreed to increase energy efficiency by 20% by 2020.[11] The Pembina Institute has shown that in 20 years, efficiency can compensate for as much as 2530 megawatts of electrical demand.[12]

INTEGRATING NEW GENERATION

Development of new electrical generation, whether renewable energies or nuclear, will require an investment in new transmission lines so that the grid can efficiently distribute the electricity to the consumer. Currently the Alberta Electrical System Operators (AESO) 2008/09 business plan estimates that there will be a need for $5 billion dollars of new transmission development in the next 8 years.

AESO documents repeatedly refer to the need to have the transmission lines in place so that we can encourage investment in new power plants, such as nuclear. What is not clear is how much of this planned $5 billion dollar expenditure on new transmission lines is directly related to the proposal to produce 4000 megawatts of nuclear power in the Peace River region. Some comparison of the transmission costs for nuclear and renewable energies such as wind is needed, since in Alberta the distribution costs of electricity are eventually paid for by the consumer in the form of higher electrical bills.

The Stanford University study explains that: "Another benefit of connecting multiple wind farms is reducing the total distance that all the power has to travel from the multiple points of origin to the destination point. Interconnecting

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http://news-service.stanford.edu/news/2007/december5/windfarm-120507.html

[10] The New York Times, Business, March 6, 2008.

[11] Pembina Institute's "Greening the Grid", p. 31.

[12] Ibid.

multiple wind farms to a common point and then connecting that point to a far-away city reduces the cost of transmission."[13]

The Pembina report, "Greening the Grid" recommends we look at "siting generation in a decentralized manner close to demand". Line losses are also minimized when generation capacity is closest to end users.

Does it not make more sense to build new generation where the need exists in the south, rather than developing more electrical generation in northern Alberta where there is already more electricity being generated than the region needs?

Here is what Enmax has to say about the current plan to build more transmission lines from Calgary to Edmonton: "large transmission lines may not be the best choice. Alberta consumers deserve a comprehensive public evaluation of all viable options to meet their need for reliable power…". Enmax is looking at smaller sources of electrical generation such as solar and wind as viable options that will cost considerably less in terms of the new transmission required.

The flexibility of renewable energies would make it easier to meet the needs of Alberta electrical consumers while keeping the electrical rates lower than larger more centralized electrical generation such as nuclear power.

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[13] **STANFORD UNIVERSITY, STANFORD NEWS SERVICE** Stanford Report, December 5, 2007 **Study finds that linked wind farms can result in reliable power** BY LOUIS BERGERON AND STEPHANIE KENITZER

http://newsservice.stanford.edu/news/2007/december5/windfarm-120507.html

NUCLEAR IN CANADA

Atomic Energy of Canada (AECL) is the federal crown corporation whose nuclear reactors have a poor track record in Eastern Canada. The corporation is a key contender in the bid to build nuclear reactors in Alberta.

Bruce Power is the company that wants to own and operate the proposed nuclear complex in Alberta. Currently, Bruce Power leases an eight reactor nuclear facility located near Port Elgin on the shores of Lake Huron. At no time since 1995, have all eight reactors been operational at any one time, with shutdowns needed to correct technical problems and related safety concerns. Bruce's nuclear reactors, like other CANDU reactors, have a history of huge cost overruns during construction, unreliable performance over time, and safety issues during operation, particularly related to corrosion of the reactors' pressure tubes and feeder pipes.

Nuclear reactors regularly release tritium into the air and the water. Tritium is a radioactive form of hydrogen that causes cancer. The amount of radioactive tritium that Canada allows in drinking water is 7000 becquerels, almost 10 times more than what is allowed in the United States, almost 500 times the California limit, and 70 times that set by the European Union. The higher limits in Canada are needed because existing CANDU reactors use heavy water as a moderator and a coolant producing significantly more tritium than light water reactors. (The new ACR-1000 reactors will have similar problems although only the moderator will use heavy water.) Water wells had to be closed in Ontario because of spills of radioactive tritium into the Great Lakes. Recently large amounts of radioactive tritium have leaked from the aging Chalk river reactors into the Ottawa river, contaminating the capital city's drinking water.

There hasn't been a nuclear power reactor ordered in Canada, nor anywhere in North America, since 1978. Reactors have been sold in Asia and Eastern Europe where the nuclear experience is more limited. In many instances, large government loans, and even bribes, have been needed to make the sale.

The world's first nuclear accident was in Canada in 1952 at the NRX nuclear reactor at Chalk River. There have been at least two cases of catastrophic pressure tube ruptures in Ontario reactors, with one happening in March 1986 at one of the Bruce Power's nuclear reactors. As a result, billions of dollars have had to be spent for "refurbishment", essentially removing the damaged tubes and replacing them with new ones. Canadian CANDUs have run into these exorbitant repair costs after less than 20 years, not even half the reactor's expected life. The Ontario government permanently shut down two units at Pickering rather than spend the 1.6 billion dollars needed to repair them. Some of Bruce Power's reactors are currently being refurbished, and as expected, are over budget and behind schedule.

Although the Ontario government plans to continue to produce 50% of its electricity from nuclear, by replacing a couple of the aging reactors at Darlington, Ontario has no intent of increasing its generation from nuclear power. In response to Bruce Power's announcement that they want to build some new nuclear reactors in Nanticoke in southwestern Ontario, the provincial energy and infrastructure Minister, George Smitherman stated that: "It does not have government support in any form…."[14]

[14] CBC News, November 1, 2oo8.

http://www.cbc.ca/money/story/2008/10/31/nuclear-ontario.html

NUCLEAR ELSEWHERE IN THE WORLD

Looking to Europe, Germany serves as an example of a country that has phased out nuclear power and has made great progress in adopting renewable energies. In just four years, Germany installed solar panels on 100,000 roofs. The country now produces more than 20,000 megawatts of electricity from renewable energies, with annual revenue of $240 million, and employing some 250,000 people.

Germany expects that by 2020 the renewable sector will provide more jobs than the auto industry. [15] The Canadian Labour Congress concurs that the potential for jobs in renewables and energy efficiency is greater than nuclear.[16]

Finland is now regretting its decision to venture into nuclear. As previously mentioned, AREVA, the French nuclear company, is neither on time nor on budget in building a third generation reactor in Olkiluoto. Design problems and quality control are both issues.

Even France, often touted as a country where nuclear has been successful, is now running into trouble. The cost overruns on the Olkiluoto reactor have reached over $2 billion. With a similar problem in constructing a first-of-its-kind reactor in France, Areva "has plunged into a deep financial crisis led by a devastating

[15] "The Wind at his back" . Chris Turner. Globe and Mail, August 2, 2008. http://www.hermannscheer.de/en/index.php?option=com_content&task=view&id=212&Itemid=13

[16] Canadian Labour Congress, http://canadianlabour.ca/en/Green_Job_Creation.

shortage of cash.[17] French taxpayers are on the hook for at least $13 billion dollars.

Even Japan's nuclear program has been set back by the rising costs from the earthquake last year that badly damaged seven reactors at Kashiwazaki. Meanwhile in January 2009 Spain was producing 35% of its energy from renewable energies, particularly wind.

In the United States there have been serious design problems with the AP1000, a new reactor being developed by Westinghouse. As a result, legal action has been taken in South Carolina to recover some pre-construction costs.[18] There have been calls on the U.S. Nuclear Regulatory Commission to facilitate construction of new nuclear reactors by fast tracking the licensing process. In Canada new regulations have been designed for the same purpose. But premature licensing of untried nuclear reactors will only increase the chance of problems arising during operation and jeopardize the public's safety.

RISK AND BENEFIT ANALYSIS

Cost - The Pembina Institute's "Greening the Grid" rejects nuclear for a number of reasons not least of which is cost. While construction costs for large power plants continue to increase, "the long term trend shows prices for most renewable technologies going down."[19] Neither are renewable energies subject to the fluctuations in fuel price of other sources of electricity such as nuclear.

The nuclear industry is in the business of acquiring government subsidies. Without hefty funding from governments around the world, nuclear power generation simply would not exist. Canada is no exception. **The annual federal subsidy to Atomic Energy of Canada Limited (AECL), the crown corporation that designs and builds nuclear reactors, has averaged about $350 million dollars a year from 1952 to 2002.** In 2008, 400 million dollars of the federal budget went to AECL, and in 2009 another $351 million. $135 million of this was added to the hundreds of millions already spent in developing the ACR-1000, one of the first-of-its-kind nuclear reactors being proposed for Alberta. AECL admits more funding will be needed to complete the basic ACR design.

Another costly AECL design failure is the Maple reactor at Chalk River. Two of these new medical isotope reactors were built and then scrapped because AECL couldn't get them to work. Not only did this boondoggle cost the Canadian taxpayers $600 million dollars, but MDS Nordion (AECL having signed a contract to build the new reactors and provide a supply of isotopes) is suing the federal government for 1.6 billion dollars! Decommissioning the Maple reactors is estimated to cost another $80 million.

The Canadian taxpayers are also on the hook for hundreds of millions of dollars as a result of delays in nuclear refurbishment of CANDU reactors in Eastern Canada. A $100 million supplementary allotment was given to AECL in the 2009 federal budget to cover overruns in the repairs to Point LePreau and Bruce Power reactors. The escalating and exorbitant price of replacing the faulty CANDU pressure tubes and feeder pipes has led to a decision to permanently mothball two reactors at Pickering.

Bruce Power prices the four proposed reactors they want to build in the Peace River region

[17] "France's nuke power poster child has a money melt-down", Harvey Wasserman. Freepress, March 19, 2009.

[18] "Revelations of nuclear design flaws spur legal action over Duke cost estimates." Institute for Southern Studies, July 28, 2008.

[19] Ibid., p. 25.

variously at $10 to $12 billion or up to $2965/kw Canadian ($2410/kW U.S). There are a number of credible organizations that estimate the overall cost of a new third generation nuclear reactor to be as high as $8000 US per kilowatt. Moody's Investors Services' estimate is $7.5 billion U.S. to produce 1000 megawatts of electricity from just one new third generation reactor, or $30 billion U.S. ($37 billion Canadian) for 4000 megawatts, more than three times as much as Bruce Power's estimate. This shortfall of at least 25 billion dollars is more than the entire amount of the Canadian 2009-10 federal stimulus package! Meanwhile, **AECL and its partners, Team CANDU, have already approached the Harper government asking them to cover any cost overruns.** Even the Fraser Institute is concerned about the potential liability to Canadian taxpayers.[20]

Private banks won't invest in nuclear. No wonder given the history of nuclear construction with billions of dollars in cost overruns. That's why sales of CANDU reactors overseas have had to involve hefty federal government loans, with generous terms, such as the 1.5 billion that went to China for the purchase of a CANDU without approval of the legislature.

One of the most comprehensive evaluations of the economics of nuclear power in comparison with alternative paths is given in the "**The Nuclear Illusion**" (2008)[21] by Amory B. Lovins and Imran Sheikh. This study concludes that : "The economic evidence ... confirms that new nuclear power plants are unfinanceable in the private capital market because of their excessive costs and financial risks and the high uncertainty of both. During the nuclear revival now allegedly underway, no new nuclear project on earth has been financed by private risk capital, chosen by an open decision process, nor bid into the world's innumerable power markets and auctions."[22]

And what about the cost to Albertans? Well first of all, we are federal taxpayers as well, so without a doubt we will continue to pay dearly for nuclear power. Then there is the real risk that we will need to contribute to the cost of nuclear waste management and decommissioning, or top up the cost of disaster relief if there is a nuclear accident, and certainly pay higher electrical distribution costs. Or like Ontario's electricity users, consumers in Alberta may need to pay a surcharge for the inevitable problems that can be expected with nuclear, particularly given the fact that we are dealing with first-of-its-kind technology.

Other costs related to nuclear development are increased medical costs, a higher rate of inflation, and a rise in local property taxes. And what about additional infrastructure costs to the local government? Calgary can attest to the fact that these costs can be higher than the new property tax revenue generated from an increase in population.

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[20] Fraser Institute Forum, March 2008, "Candu or no Candu?"

[21] **Ambio Nov 08 preprint, dr 18, 27 May 2008, DRAFT subject to further peer review/editing**

The Nuclear Illusion

AMORY B. LOVINS AND IMRAN SHEIKH

http://www.rmi.org/images/PDFs/Energy/E08-01_AmbioNucIllusion.pdf (last accessed March 13, 2009)

[22] **The Nuclear Illusion**

ibid

Most important of all is the cost of lost opportunity. Introducing 4000 megawatts of nuclear power with its inflexible electrical generation into Alberta's electrical system will hinder development of renewable energies such as wind and solar. Albertans will miss out on the economic and environmental benefits of a green energy future.

Nuclear Liability- Canada's current Nuclear Liability Act, passed in 1974, limits the liability of a nuclear power plant owner to $75 million. The government is finally in the process of revising this act. The new Nuclear Liability and Compensation Act, if passed, will increase the nuclear liability limit to $650 million. If a nuclear accident or terrorist attack were to happen in Alberta, whether at a cooling pool or at the reactor itself, this compensation from insurance would still only cover a small fraction of the cost associated with the devastating loss of property and human lives. The federal government, i.e. every Canadian taxpayer, would pay additional compensation as it sees fit. The provincial government, having made the decision to develop nuclear power, will also be under pressure to provide financial compensation.

Meanwhile, individuals cannot purchase their own insurance to protect themselves from a nuclear accident, since insurance companies routinely exempt damages due to nuclear contamination from homeowners' and renters' policies. The question then arises as to **why, if nuclear installations are so safe, are private insurers unwilling to provide coverage?** And why, with this kind of potential liability, would Alberta want to give the green light to nuclear?

Safety – The concerns about safety around third generation reactors and the poor safety record of existing CANDUs have already been expressed. The real safety issue around nuclear is that a severe nuclear accident would be so catastrophic, causing illness and death and rendering areas uninhabitable for generations.

The 1978 Report of the Ontario Royal Commission on Electric Power Planning, "A Race Against Time", concurred with Dr. Gordon Edwards and Ralph Torrie's estimate of the probability of a complete meltdown in a CANDU reactor being 1 in 10,000 per reactor per year. Based on these numbers, **given a 100 CANDU type nuclear reactors operating for a period of 40 years, the chance of a core meltdown during this time could be as high as 4 in 10.** If the plan for a nuclear renaissance goes ahead, the risk across the world will only become greater.

Another government document, the 1980 Select Committee on Ontario Hydro Affairs report entitled "The Safety of Ontario's Nuclear Reactors" says that : "The worst possible accident….could involve the spread of radioactive poisons over large areas, killing thousands immediately, killing others through increasing susceptibility to cancer, risking genetic defects that could affect future generations…"

Proponents of nuclear power like to present the **Three Mile Island accident** as a success of the reactor's safety features. The question is why did the reactor's safety features allow the accident to happen in the first place?

Indeed the accident resulted from a chain of many technical and human errors leading eventually to the meltdown of a large part of the reactor core. Through this meltdown huge amounts of radioactivity were released. Although the containment structure prevented much of that radioactivity from escaping, still significant amounts of radioactivity did contaminate the environment or were released intentionally to relieve the reactor pressure.

Proponents of nuclear power also tend to belittle the **Chernobyl disaster** greatly, usually quoting from publications of UN agencies which are generally bound by the International Atomic Energy Agency, (IAEA), an organization that promotes the use of nuclear power. In contrast to more critical publications, for instance, the UN agencies underestimate fatalities of the Chernobyl disaster sometimes in many orders of magnitude and generally do not consider the catastrophic impacts on health, social life, and the economy.

Quite a different picture emerges from another international perspective on the long term consequences of the Chernobyl disaster.[23]

- ✓ "The nuclear disaster at Chernobyl effectively deprived the country of 22 per cent of its agricultural land and 21 per cent of its forests. The official Chernobyl Committee in Minsk, which is responsible for dealing with the consequences of the disaster, estimates the total damage for the Republic at USD 235 billion... Chernobyl-related costs accounted for 22.3 per cent of the country's national budget in 1991, and in 1996 it was still 10.9 per cent. Currently the republic is investing about 6 per cent of its budget in the official Chernobyl programme…"

- ✓ "... of the 800,000 'liquidators' (soldiers deployed to clean up the reactor compound) ..., 25,000 ... have since died (according to official reports from the three former Soviet states affected)."

- ✓ "(According 'TORCH' (The Other Report on Chernobyl) ...about 30,000 to 60,000 excess cancer deaths are predicted, 7 to 15 times greater than IAEA/WHO's published estimate of 4,000."

- ✓ "(The Chernobyl disaster resulted in) ... the evacuation and resettlement of 350,400 people ..."

The **Canadian Nuclear Safety Commission (CNSC)** is supposed to serve as Canada's nuclear watchdog. Previously known as the Atomic Control Board of Canada, there have always been concerns about the close relation between the country's nuclear watchdog and the nuclear industry. The organization has in the past seemed more concerned with accommodating AECL than ensuring the safety of the Canadian public.

Confidence in the CNSC was shaken further when the president of the CNSC, Linda Keen, head of a supposedly independent arms-length agency, was fired by Prime Minister Harper for trying to do her job. Ms Keen shut down the NRU reactor at Chalk River for safety violations, and the federal government recklessly overturned the decision. As the Fraser Institute explains, this "points to the conflict of interest inherent in the federal government being both the owner of AECL and its safety regulator."[24]

[23] **chernobyl.info**

The international communications platform on the longterm consequences of the Chernobyl disaster

http://www.chernobyl.info/index.php?userhash=38236668&navID=1&lID=2 (last accessed September 16, 2008)

[24] "CANDU or no CANDU? The Future of Nuclear Power in Ontario", by Bryne Purchase, Fraser Forum, 03/08, p. 26.

Health- Nuclear reactors regularly give off radioactive emissions during normal operation. The best known international studies, based in part on survivors of Hiroshima, are the Biological Effects of Ionizing Radiation (BEIR) reports, part of an ongoing series of publications from the National Academies concerning the effects of ionizing radiation on health. The most recent of these reports, **the BEIR VII, has reconfirmed the previous knowledge that there is no safe level of exposure to radiation—that even very low doses can cause cancer.** The report also shows that risks from low dose radiation are equal or greater than previously thought. BEIR VII concludes:

- "There is no safe level or threshold of ionizing radiation exposure.
- Even exposure to background radiation causes some cancers. Additional exposures cause additional risks.
- Radiation causes other health effects such as heart disease and stroke, and further study is needed to predict the doses that result in these non-cancer health effects.
- It is possible that children born to parents that have been exposed to radiation could be affected by those exposures."[25]

A recent German health study of residents living near nuclear reactors examined 1,592 cases resulting from all childhood cancer diagnosed and reported to the German Childhood Cancer Registry between 1980 and 2003. All the children were under the age of five at the time of the diagnosis and lived in pre-defined regions near16 nuclear power plants.

The study was commissioned by the Federal Office for Radiation Protection and funded by the Federal Ministry of the Environment, Nature Conservation and Nuclear Safety of Germany. It was conducted by the Institute for Medical Biostatistics, Epidemiology and Informatics of the University of Mainz in October 2007.

The study concludes that between 1980 and 2003 the risk of children under five years old who lived within 5 km of one of 16 German nuclear power plants being diagnosed with cancer was about 60% higher than expected, while the risk of childhood leukaemia increased by more than 100%.

Environment - A nuclear reactor uses nearly 50% more water than a natural gas power plant. Bruce Power's plan for up to four large reactors will require so much water that the intent now is to use cooling towers and a cooling pond since Bruce Power admits the Peace River does not contain enough water as would be needed in a "once through" cooling system: "the quantity of water required to be drawn from available sources is too large for local water sources." The water for the cooling towers and pond will be piped in from the Peace River and the amount needed will be substantial. In one year, the proposed 4000 megawatts of nuclear power would require **40 times the amount of water used by all residents of Calgary.**

Of this huge amount of water required, Bruce Power indicates that the water consumed (lost to evaporation) would be 520,000 cubic metres per day which would mean 190 billion litres of water per year. This is nearly twice as much as the 104 billion litres used by all proposed and existing upgraders northeast of Edmonton! The impact of nuclear on Alberta's dwindling water

[25] Sierra Club of Canada: http://www.sierraclub.ca/national/postings/radiation-levels.html

supply is enough of a reason to look to other sources for our electrical generation.

Neither is nuclear power the answer to global warming. Nuclear power requires significant effort to cope with the back end side of the whole nuclear cycle (decommissioning of the nuclear power plants, waste fuel management over extremely long time periods). As well, the whole nuclear cycle requires considerable groundwork at the front end side (mining and milling of the uranium ore, processing and production of the nuclear fuel, construction of the nuclear power plants). All these steps of the nuclear cycle process large amounts of material and energy (including the construction and eventual dismantling of the facilities) translate into a significant amount of CO_2 emissions.

Very thorough studies show that when the full nuclear cycle is taken into consideration, nuclear power is indeed not CO_2 free, with estimates ranging from 60 to 122 g CO_2/kWh for nuclear compared to only 11 to 37 g CO_2/kWh for wind power [26] [27]

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[26] **Oxford Research Group**

SECURE ENERGY?

[27] **CIVIL NUCLEAR POWER, SECURITY AND GLOBAL WARMING**

Edited by Frank Barnaby and James Kemp

BRIEFING PAPER MARCH 2007

http://www.oxfordresearchgroup.org.uk/publications/briefing_papers/pdf/secureenergy.pdf

Based on these estimates, the nuclear reactors being proposed for Alberta would contribute around three million tonnes of CO2e in one year *or about 180 million tonnes over the reactors' lifetime.* Dwindling uranium ore grades in the near future will demand ever increasing effort for the extraction of the uranium and contribute even further to global warming.

WASTE MANAGEMENT AND LIABILITY

Overview- If the province chooses to support nuclear, as part of Alberta's energy mix, it will be taking on some financial risks associated with nuclear waste. Based on the precedence set by Ontario, and the probability of the cost being higher than anticipated, it is not unlikely that Alberta will end up having to pay its share for the development and management of long term waste storage.

If Alberta introduces nuclear into the province, the nuclear waste will be initially stored at the reactor site. Alberta may even become the site of long term waste disposal. Third generation reactors also have the option to use spent fuel. Transportation into Alberta of highly radioactive waste from the United States and elsewhere is an additional risk. The participation of Canada in the Global Nuclear Energy Partnership (GNEP) will have repercussions for any province producing nuclear energy. Finally, along with the financial risks will be a threat to Alberta's environment and to the health of present and future generations from exposure to highly toxic products that remain radioactive for hundreds of thousands of years.

Long term storage of nuclear waste - In accordance with the Canadian Nuclear Waste Act, the Nuclear Waste Management Organization (NWMO) has been formed to oversee the development of a centralized long term storage facility for nuclear waste (what is

called Adaptive Phased Management- APM) with a trust fund set up to cover the costs. Currently the estimated cost of this waste storage facility is 24 billion dollars. The trust is funded by Ontario Power Generation, Hydro-Quebec, New Brunswick Power and AECL. Bruce Power does not contribute to the fund because it leases the nuclear power stations it operates in Ontario from the provincial government and is not considered owner of the waste. It is unprecedented to have a private operator own nuclear reactors in Canada. If Bruce Power is successful in its bid in Alberta and elsewhere, it will now have to join the other "waste owners" in contributing to the management of the waste. In Ontario, the provincial government has set a precedence by committing to cover any shortfall in the funding needed to store the waste. The choice in the future could very well be to have Bruce Power go bankrupt, and leave the nuclear mess for the province to clean up, or subsidize the cost of waste management with provincial dollars. The NWMO's cost estimates also assume the long-term management project will be completed on budget and on time. Given the complexity and long timelines associated with the project, this is unlikely. (NWMO estimated that it will take more than 300 years before the waste storage is fully implemented.[28])

Nor is it certain that the NWMO can actually design a long term waste depository that works. The challenges are to find a safe geological site, which must not change over long periods of time, further evaluate corrosive effects on materials, estimate risks, determine costs, and assign accountability and liability far into the future. An even greater challenge is to find a community that will commit to taking the waste.

Aside from the technical development of a depository for long term storage of high level nuclear waste, a site in Canada will need to host the storage facility. By becoming part of the nuclear fuel cycle, Alberta will be one of the sites under consideration. Although the current plan is that taking on storage of the nations' nuclear waste will be "voluntary", this may change if no community agrees to store waste that remains radioactive for hundreds of thousands of years.

One can look at the United States to gage the difficulties of establishing a long term waste disposal site. According to President Obama, "After spending billions of dollars on the Yucca Mountain Project, there are still significant questions about whether nuclear waste can be safely stored there."[29] The project has been stalled by geological issues and growing public opposition. According to the Nevada Nuclear Projects Agency Director Bob Loux: "The pitfalls of entombing 77,000 tons of highly radioactive waste and spent fuel in a porous, volcanic rock ridge flanked by earthquake faults can't be fixed."[30] The United States continues to have a nuclear waste problem and Canada may become the solution.

GNEP and reprocessing of spent fuel - Reprocessing and reusing the spent fuel has long been a goal of the nuclear industry. In December of 2007, Canada joined the **Global Nuclear Energy Partnership** (GNEP). At the

[28] http://www.nwmo.ca/adx/aspx/adxGetMedia.aspx?DocID=1487,20,1,Documents&MediaID=2703&Filename=NWMO_Final_Study_Nov_2005_E.pdf

Nuclear Waste Management Organization, "Choosing the Way Forward: The Future Management Of Canada's Used Nuclear Fuel", page 24ff, Table 1-1.

[29] Review-Journal, May 2007.

[30] Las Vegas Review-Journal, Dec. 20, 2008.

time it was suggested that as a price of joining this international nuclear alliance, uranium-producing countries such as Canada must agree to accept and dispose of nuclear waste from any countries to which they sell the uranium for reactor fuel. It is no coincidence that the ACR-1000 being proposed for Alberta has been designed with the option to use spent fuel from light water reactors, such as those used in the United States.

The GNEP has plans to build the world's largest reprocessing facility capable of handling 2000 to 3000 tons of reactor fuel a year. The public relations arm of this organization has started to use the term "recycling" instead of "reprocessing". This is completely misleading because the technical process involved in the separation of the used fuel produces only a very small percentage of fissile uranium and plutonium (a few grams per kilogram of spent fuel). Mostly what is produced are various types of highly radioactive waste which hardly can be called recycling.

Due to the enormous risks involved in reprocessing, risks of magnitudes higher than the dangers posed by nuclear power plants themselves, only very few countries have dared to engage in reprocessing. The main method of reprocessing involves cutting up and dissolving the entire spent fuel rods in hot acid (nitric acid). This frees all the most dangerous substances which were before at least relative safely encapsulated within the fuel claddings.

At the end of the reprocessing activities the nuclear waste problem would not be solved. The Union of Concerned Scientists explains that **after reprocessing "the total volume of nuclear waste increases by a factor of twenty or more, and includes plutonium-contaminated waste."**

In 1977 the U.S. indefinitely suspended the (commercial) reprocessing and extraction of plutonium because of fear of nuclear weapons proliferation. Up to now Canada has never reprocessed spent nuclear fuel.

Originally nuclear reprocessing plants were built in connection with nuclear power plants exclusively for the purpose of producing plutonium for nuclear weapons. The extraction of plutonium-239 (and "unburned" uranium) out of spent nuclear fuel is a vast threat to the environment. By separating plutonium from the spent fuel, reprocessing makes it easier for terrorists to obtain the material they need to develop nuclear weapons.

Incidents and accidents in nuclear reprocessing plants are many. One of the most notorious of these reprocessing facilities is **the Sellafield nuclear complex in Britain.** This reprocessing plant **"has the highest concentration of radioactivity on the planet……and discharge(s) some eight million litres of nuclear waste into the sea each day."**[31]

When Canada joined the GNEP, it opened the way to become the solution for the accumulating nuclear waste all over the world. The GNEP statement of principle clearly lays out the objective of international cooperation in taking back spent fuel produced in other countries and possibly even reprocessing it.

Transportation-Whether the highly radioactive waste is being transported to a centralized repository in Canada, or being carried to a reprocessing plant, "Moving deadly shipments of nuclear cargo around the country would

[31] Greenpeace, U.K. http://www.greenpeace.org.uk/nuclear/sellafield-nuclear-reprocessing-facility

create tens of thousands of viable targets for terrorists." And the result of a terrorist attack would be "thousands of cancer deaths and …billions of dollars to cleanup."[32]

Risks of short term waste storage - An interim shallow underground facility is also being considered. Meanwhile here in Canada, as in other nuclear producing countries, the nuclear waste fuel continues to fill up cooling pools at the site of existing nuclear reactors. After 7 to 10 years the waste fuel can be moved temporarily to dry storage. Meanwhile this highly radioactive and dangerous waste sitting in the cooling pools is vulnerable to terrorist attacks. And as long as a nuclear reactor continues to operate, it continues to produce new waste fuel to go into the pools. "As the 2005 National Academy of Sciences concluded, terrorist attack on spent fuel pools could lead to the release of large quantities of radioactive materials into the environment…"[33]

Meanwhile as cooling pools at reactors across the world run out of space, the nuclear operators are crowding the spent fuel together, increasing the risk of an accident. In May 2008 the Union of Concerned Scientists expressed concern: "…that **storing more spent fuel in a wet pool would have the potential to make an accident or terrorist attack that disrupts a pool's cooling system more devastating. A large radiation release resulting from a wet pool fire could result in thousands of cancer deaths and hundreds of billions of dollars in decontamination costs and economic damage…."**[34]

SOCIAL ISSUES

Employment- One of the main arguments presented by proponents of nuclear energy is job creation. Communities considering hosting a nuclear reactor would be well-advised to have a look at what kind of employment opportunities are available in the area of sustainable energies. Germany can serve as an international model as their "wind industry created 8000 jobs in 2007 alone. **One recent study suggests that the renewable sector could provide more work than the auto industry (currently the nation's {Germany's} biggest employer) by 2020."** [35]

The Pembina Institute's recently released report, "Greening the Grid" found that an investment of a million dollar will create 36.3 jobs in the energy efficiency sector and 12.2 jobs in the renewable energy sector, compared to only 7.3 jobs if the same amount were invested in conventional energy.

The Canadian Labour Congress, a group that surely knows about jobs, estimates that "it takes 100 workers in a nuclear plant or 116 workers in a coal-fired plant to generate 1,000 gigawatt-hours of electricity per year. Yet, 248 would be employed in a solar thermal facility or 542 in a wind farm to generate the same amount of electricity." [36]

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[32] Nuclear Information and Resource Service.

[33] PSR Security Program, June 2006, "Dealing with Spent Nuclear Waste", page 2.

[34] Union of Concerned Scientists, May 2008.

[35] Chris Turner, The Globe and Mail, August 4, 2008.

[36] Canadian Labour Congress. http://action.clcctc.ca/en/Green_Job_Creation

And are there really the job creation opportunities that Bruce Power claims? The economic impact on local workers and businesses depends on how much of the labor, materials and services for the proposed nuclear project are imported from outside the region. This local participation is by no means a given, and the economic benefits to the region may be much less than predicted. The new reactor is of a modular construction. In all likelihood, the manufacturing will take place in Ontario where the expertise resides.

Also to be considered is the loss of jobs in tourism and agriculture if nuclear reactors were to be built. The area will no longer be attractive as a recreational site. Who will want to buy the food produced in the vicinity of a nuclear reactor when radioactive emissions are given off regularly, and tritium contaminates the water?

Community Impact – There will be other negative impacts on the Peace River region if the proposed nuclear development goes ahead. As the Golder Report,commissioned by Bruce Power, recognizes "a large project can represent a large shock to particularly small economies such as that of the region, which in turn can strain limited human resources, cause changes in prices, and make economic impacts difficult to predict." Valid points and these impacts should be explored further before any commitments are made. Does the province want another Fort McMurray with all its problems of rapid growth, lack of affordable housing, inadequate infrastructure such as highways, and other social issues that come with unhealthy rapid growth?

CONCLUSION

The proposal by Bruce Power, a nuclear operator from Eastern Canada, to bring nuclear to Alberta, starting with four large first-of-their kind nuclear reactors in the Peace River region, presents an unacceptable and unnecessary risk to Albertans. The project would bring a host of technical problems with huge cost overruns. Further down the road there would be waste management and decommissioning issues.

For Albertans this would most certainly mean an increased tax burden and higher electrical costs. This has already been demonstrated in parts of Canada where nuclear power already exists. Canadian taxpayers have paid billions to subsidize this dying industry.

The social impact on the community, the environment, and our health make the proposed nuclear development completely untenable.

Water is a key issue, with an exorbitant amount required to operate the reactors. In addition, water contamination would occur through the release of tritium during normal operations. Neither is nuclear the answer to global warming when the entire nuclear cycle is considered. Moreover, renewable energies with support through conservation and energy efficiency can meet Alberta's future electrical demands more cost-effectively and without nuclear's assault on our environment and our health.

We only need to look to Eastern Canada to learn about the problems that have plagued the nuclear industry. The cost overruns and design and technical problems being experienced by the few generation III reactors now under construction should serve as a further caution.

Alberta should look to world leaders in renewable energies, such as Germany, to find the solutions to future electrical generation. Or even closer to home, the Pembina Institute has paved the way forward with "Greening the Grid." The smart investment today is in leading edge technologies such as wind and solar. Nuclear has already proven over and over again

to be a bad investment that can only stay alive through billions in government subsidies.

RECOMMENDATIONS

This alternative response to nuclear in Alberta recommends the provincial government takes the following actions:

1. As recommended by the Pembina Institute's January 2009 report, "Greening the Grid":

    - "assemble a task force or expert panel to examine the best ways of promoting renewable electricity analogous to those that have already been assembled to look at nuclear energy…."
    - "develop a comprehensive energy efficiency and conservation strategy leading to a suite of regulations, education and outreach, collaborations with industry, and economic instruments."
    - Carry out "A Renewable Energy Assessment for Alberta (REAA) …to provide detailed information for public and private decision-makers about the quantity and quality of the Province's renewable resources."
    - Invest public money in renewable energy in the order of "a quarter billion" dollars.
    - Spend funds collected under the Climate Change and Emissions Management Fund on promotion of and research in renewable energies.

2. Initiate discussions with the federal government to carry out a study of cancer cases and other illnesses in people living near nuclear reactors similar to the recent health study published in Germany.

3. Establish a centre of excellence to provide the technical expertise and training needed to support local growth in renewable energies.