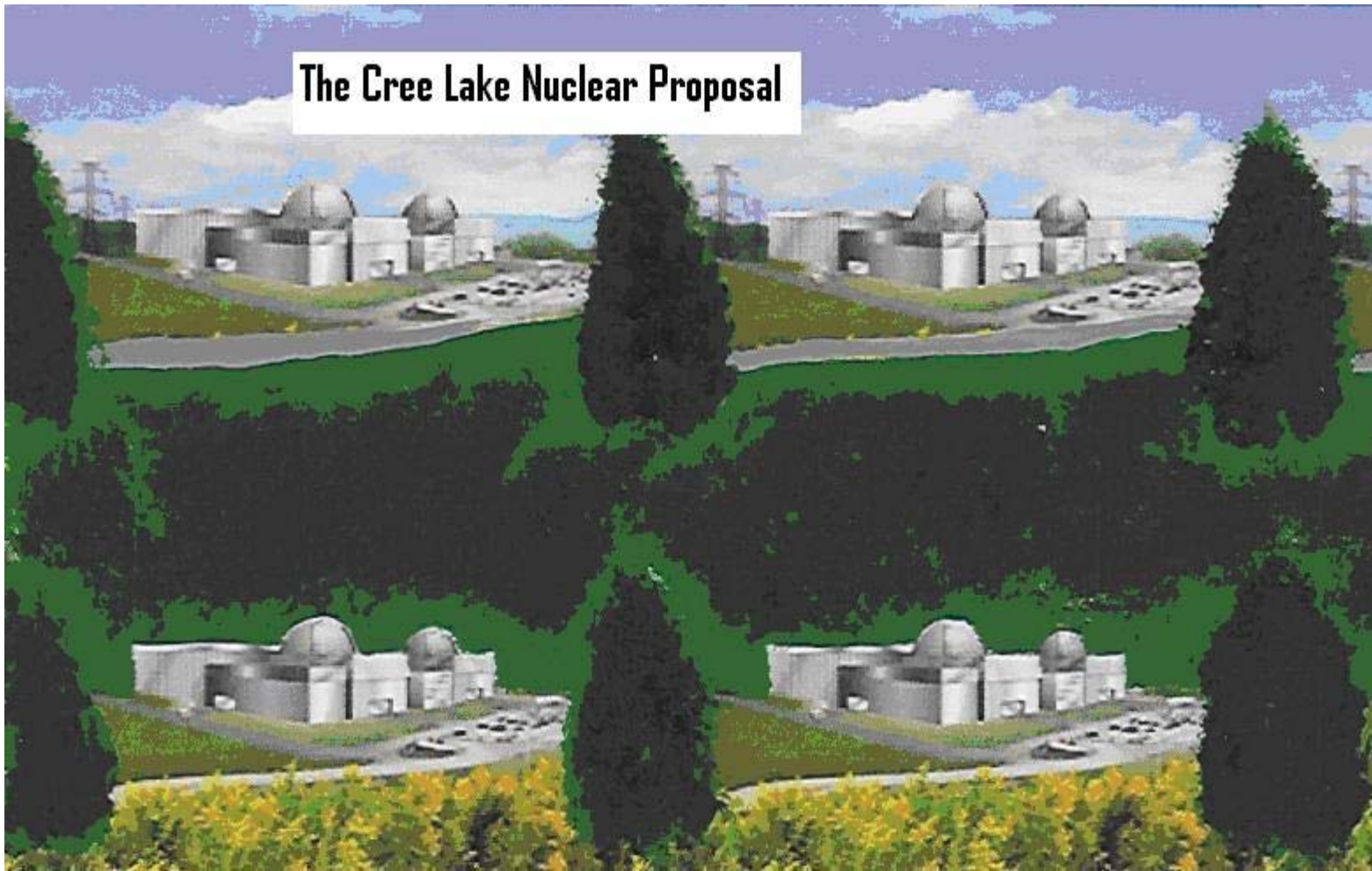


April 19th, 2005



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On Thursday, April 14, 2005 the federal government came down with their long awaited Kyoto plan, having now fixed a \$10 billion dollar price tag to some ambiguous structure for conformity. Much of that money will apparently be spent purchasing carbon credits. There is a conventional wisdom developing that says that the plan will go the way of the federal liberals, and accordingly there isn't much excitement with the public or the oil patch. It seems that expectations for results will remain low.

The ratification of the Kyoto accord by the government of Canada has sent jitters through the oilsands industry. It is extremely unlikely that this accord will be an effective protocol in achieving its stated ambitions, or whether there will be widespread adherence to the mandated CO₂ reductions. An unfortunate reality is that it would seem to be a mechanism whereby the government of Canada could levy a carbon tax that would affect Alberta oilsands producers disproportionately. Alberta produces 1/3 of the Canada's CO₂ emissions, most of that coming from oil sands exploitation. The mega projects undertaken at Ft. McMurray along with provincial refining capacity are expected to supply 1 million barrels/day in 2005 and 3 million barrels/day by 2015. Though CO₂ reduction is a desirable benefit exclusive of the Kyoto accord, it does make good business sense to embrace nuclear power for process energy as well. Every GJ of gas not used in steam production is one more available for sale.

The nuclear option is not new but it is an option that would cost less money than the federal government's \$10 billion figure for Kyoto conformity, and have an impact. It is an option that would create tens of thousands of jobs, grow the economy, the GDP and exports and at the same time result in radical reductions in the amount of CO₂ produced.

Summary of Existing Research

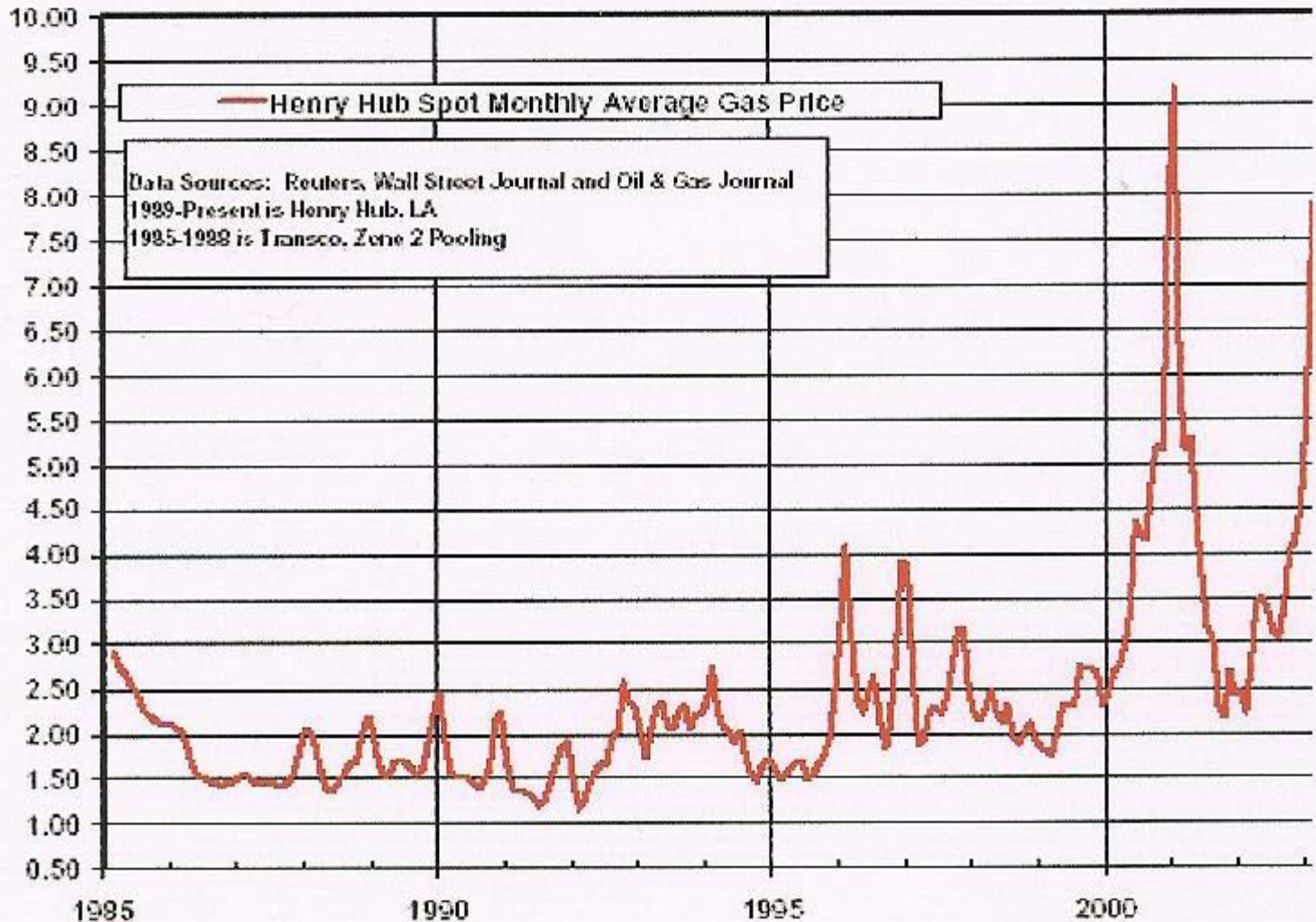
The idea of using nuclear power for oilsands process energy is not a new one. Most recently, in June of 2003 a paper on the subject was presented at the Canadian International Petroleum Conference in Calgary. This paper, by R.B. Dunbar and T.W. Sloan of the Canadian Energy Research Institute (CERI), compared the economics of conventional CH₄ fired SAGD methods with a modified ACR-700 (731 MW) CANDU reactor. The study concluded that nuclear steam generation was economically competitive with CH₄. Dunbar and Sloan used 2002 costs, or \$4.25 GJ for gas and \$30.68 kg for Uranium. In both cases these spot prices are roughly half of what they are now.

They modeled a central steam generation site to be located within the oilsands, where in-situ process steam was to be created more directly by the heat of nuclear fission, as opposed to producing electric power through generation and transmission. Though direct nuclear steam generation is more efficient and involves significantly less capital cost than power generation and transmission, the thermodynamic limitations of transporting steam over long distances were thought to be a major constraint, since nuclear reactors are anything but portable.

Dunbar and Sloan credited the work of Bock and Donnelly from their paper Fuel Alternatives for Oil Sands Development, presented in 1995 at the Canadian Nuclear Society Annual Meeting in Saskatoon, as well as the 1982 study by Bancroft entitled Nuclear Energy for Oil Sands, which was a feasibility study undertaken jointly by the AECL, Alberta Power LTD., Petrocanada and NOVA.

The comparative economic analysis of Dunbar and Sloan is used in the economic analysis of this presentation.

Henry Hub Spot Monthly Average Gas Prices (\$/MMBTU)



Source: Reuters, Wall Street Journal and Oil & Gas Journal

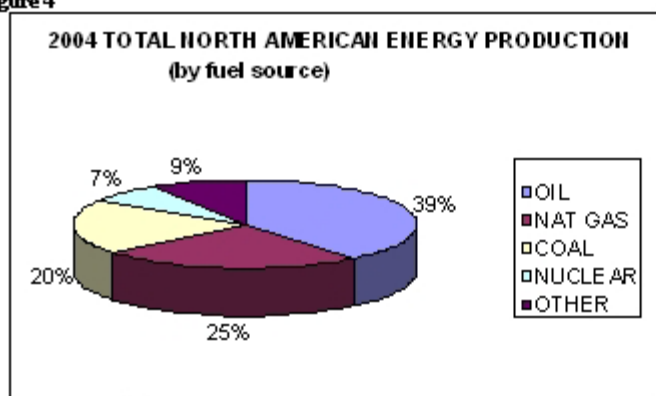
Process Energy Demands of Bitumen Production

There is no guarantee that at some point we will not experience a drop in continental demand for energy in any or all forms, but it is unlikely. The most probable case scenario is that demand will continue to grow. Synthetic crude production will continue to be a major Alberta export on an ever increasing basis, and demand from the Americans will remain healthy. With 250-300 billion barrels of presently recoverable oil and more multi-billion dollar production upgrades on the way, there is a potential for the costs of process energy to be reduced by replacing natural gas and coal-bed methane with nuclear generated electrical power.

Every barrel of synthetic crude produced using SAGD bitumen extraction techniques requires 15% process energy. We have to cook the steam, and lots of it. Every GJ of gas used in bitumen production is one less we can supply to the market. For every million barrels of SAGD bitumen production 1,128,767 GJ of gas are required. This in turn produces 67,630 tonnes of CO₂.

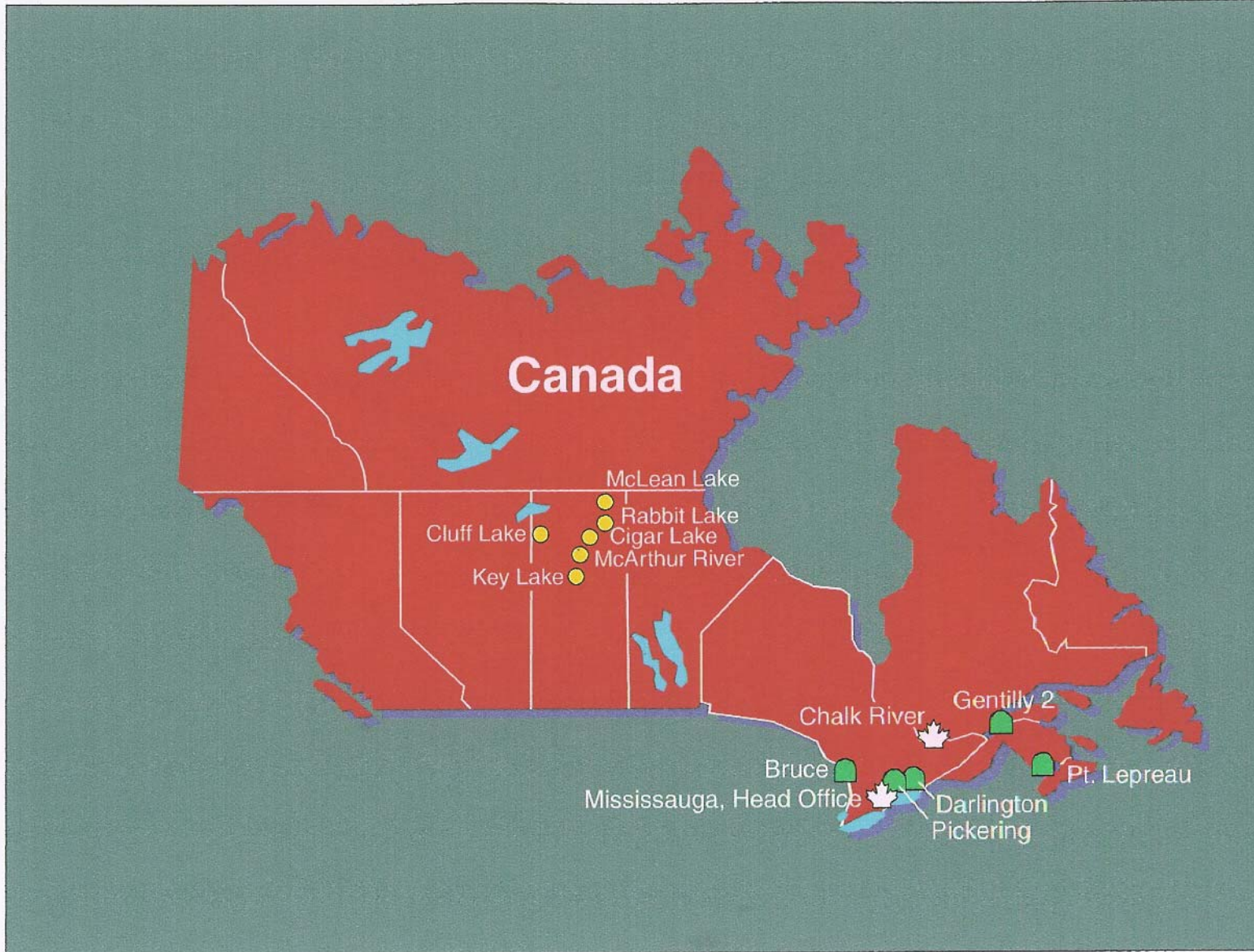
To a large extent, the profitability of SAGD extraction is contingent upon increases in gas prices being matched by corresponding increases in oil prices. Though there is to exact correspondence, this phenomenon is very much at play recently. There is a risk that demand for gas will outstrip demand for oil, thus eating away the margins of SAGD extraction. Gas has tremendous value, not only as an expanding fuel source, but also as an industrial feedstock and a primary component in fertilizer production. It could well be that gas is simply too valuable to be used as the fuel source for SAGD, to the extent that there is an alternative.

Figure 4



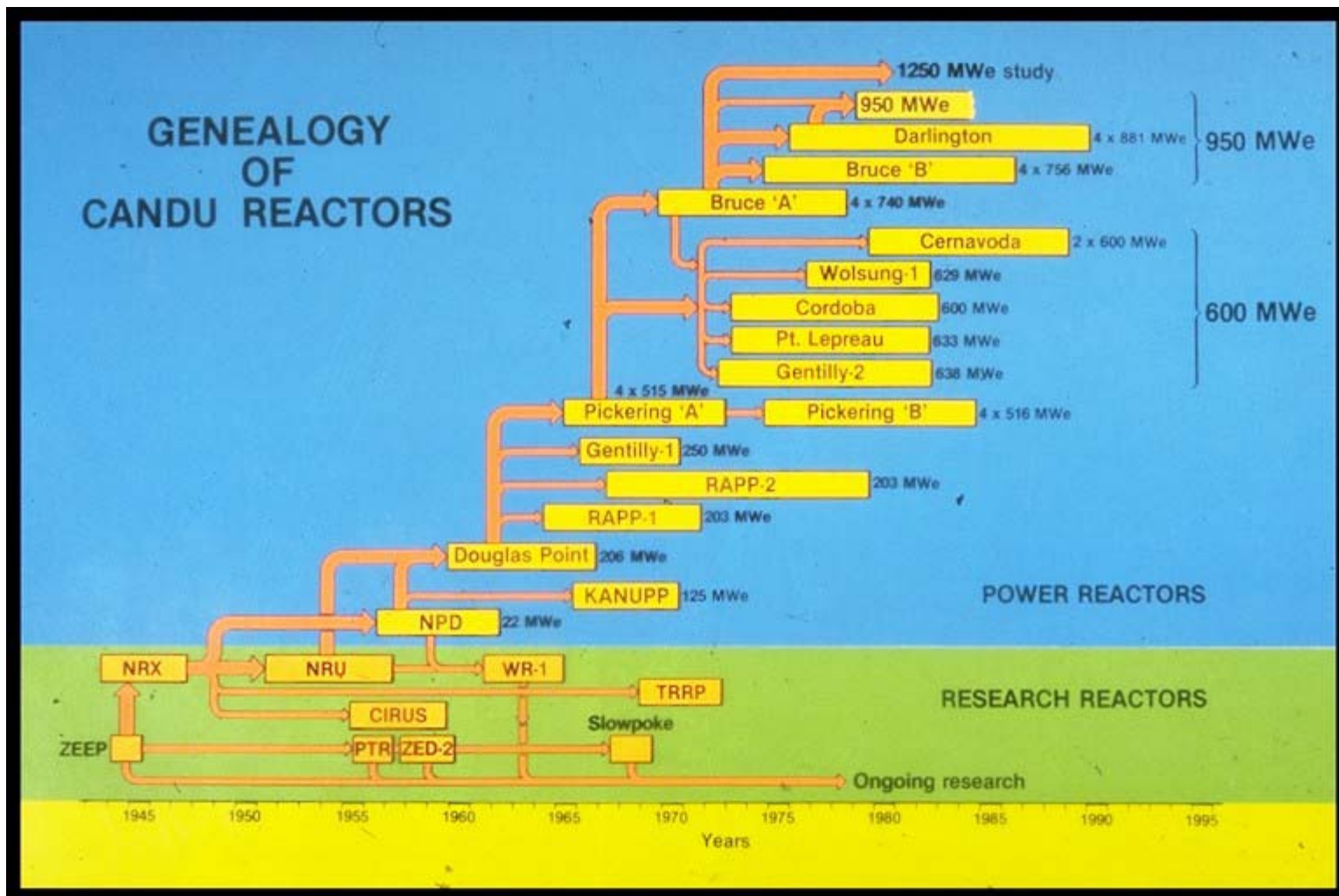
Phoenix Research Inc.

The Canadian Nuclear Industry



<http://canteach.candu.org>

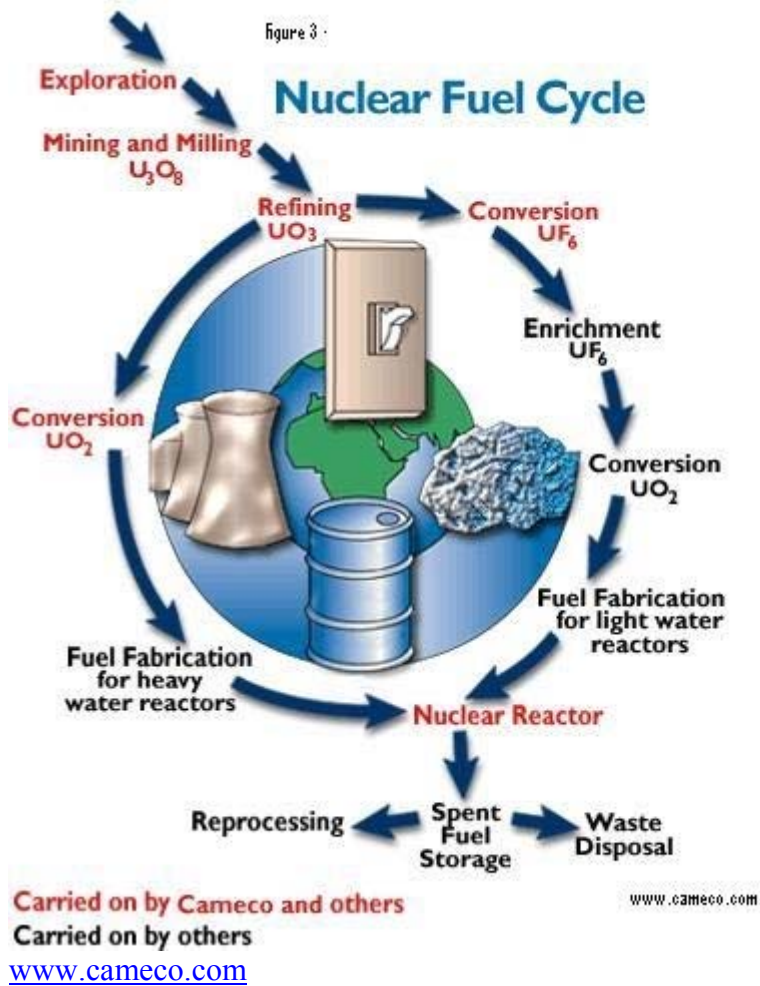
As you can see from this graphic there is a large uranium mining industry in Northern Saskatchewan, which supplies fuel to a large power industry in the east. This Canadian nuclear industry is divided into design, uranium production, and power production camps, with Saskatchewan supplying uranium oxide to the east and the rest of the world, through the mining operations of AREVA-Cogema and Cameco Corp. This uranium fuels CANDU plants operated by crown corporations in Ontario, Quebec and New Brunswick which are or have been net exporters of electrical power to the US. Saskatchewan is the world's largest uranium exporter.



<http://canteach.candu.org>

In terms of design, Canada is a world leader through the 53 year old crown corporation AECL. The development of their CANDU reactor ranks as one of the greatest Canadian engineering achievements of all time. The AECL and CANDU technology have an impeccable safety and reliability record, based on decades of operational validation and more than a half century of research. This technology and these reactors have been exported to Pakistan, Argentina, Romania, South Korea, India and China.

All of the CANDU's built this decade have been built in Asia. There are presently 438 nuclear reactors in operation around the world, of which 32 are CANDU's. The distinct feature of the CANDU is heavy water moderation, which gives the reactor the advantage of using naturally occurring uranium fuel, with little or no enrichment. Additionally, advanced CANDU Reactors (ACR) utilize on-power refueling, eliminating scheduled shut-downs and productivity interruptions.



In 1973 Canada laid claim to the world's largest nuclear power complex, when the last reactor of the first four units at Pickering Ontario went active. Pickering A & B now comprises 8 – 515 MW reactors or more than 4 GW of power. In addition to billions of dollars in productivity, Pickering went on to demonstrate the safety and reliability of the CANDU, as well as to establish the AECL as a world leader. Given the increase in continental energy demands, now is the time to build on this valuable Canadian expertise after decades of exporting it.



Magellan Geographix – www.maps.com

The Proposed Project

The proposed project is the construction of a multi-gigawatt CANDU nuclear generating station near Cree Lake, Saskatchewan, west of Key Lake, Saskatchewan and 275 km east of Ft. McMurray, Alberta. This remote location is on the eastern edge of the Athabaska basin 550 km north of Saskatoon, Saskatchewan and 850 km north of the Montana border. The project should be scaleable, commencing with the Phase 1 construction of two 1-GW ACR-CANDU 9 series reactor complexes (4-units), with suitable turbine capacity and 700kV – DC transmission lines to Fort McMurray, Alberta. The transmission right of way would run south of Clearwater Provincial Park. Scaleable, in this context implies that further reactors and generating capacity should be added over time as revenues will accommodate, the demand will justify, and transmission infrastructure will allow.

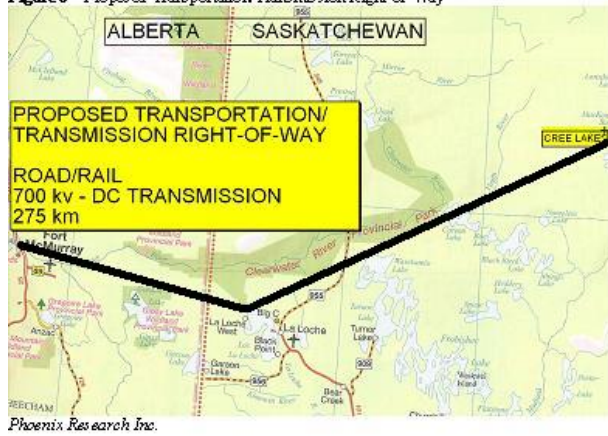
Why Cree Lake? This is an excellent question of course. Why 275 km from Ft. McMurray as opposed to something closer? One very important consideration in the development of a nuclear reactor is the question of what to do with the spent fuel. Indeed, this is a major concern for nuclear generators everywhere. The real cost of nuclear power includes not only uranium and enrichment costs, but the cost of disposing of spent fuel as well. In the case of this proposed project, the answer is deep and permanent geologic disposal.

AECL has long studied the deep geological disposal of spent fuel, and established its effectiveness at their Waste Technology Business Unit (WTBU) research facility located near Pinawa, Manitoba. The geologic conditions near the proposed plant site are known to be among the safest anywhere for deep and permanent disposal. Given the environmental concerns, spatial concerns, and security concerns related to spent nuclear fuel storage and disposal, there is great economy in a safe and permanent solution. High and low grade nuclear waste could be permanently disposed of at or near the same place they were originally mined as uranium ore, and this could be accomplished using existing research and design. With the technical expertise of AECL, the world's safest disposal repository could be developed. The environmental risks related to the transport and storage of high-level nuclear waste would also be minimized.

Geologically speaking, Cree Lake is incredibly stable. Located on the Athabaskan Group of Precambrian rock, the sub-Athabaska basement comprises Achaean gneissic granitoid rock, which is incredibly stable. This would be the least likely reactor complex anywhere to be damaged by an earthquake, or affected by volcanism, or any natural weather phenomena. Additionally, the plant site would be surrounded by the world's largest reserves of uranium oxide. 70-km to the southeast is the Key Lake Mine, site of the largest high-grade uranium milling facility in the world, operated by Cameco. 80-km east is the Macarthur River mine, the world's largest, high-grade uranium deposit. 95-km to the North West is the Cigar Lake deposit, the world's largest undeveloped high-grade uranium deposit.

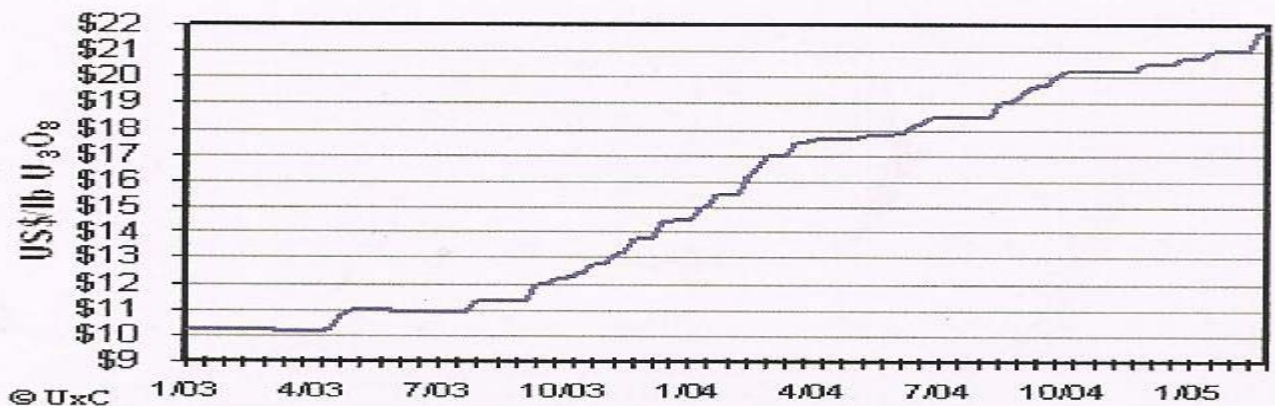
Cree Lake is the only place where, within a fixed geographic area the size of Lake Athabaska, a facility could be developed that would integrate the functions of uranium mining, milling, fuel fabrication, nuclear power production and transmission as well as safe and permanent disposal of spent fuel. At this location there is an unlimited potential, given the transmission capacity to deliver the power.

Figure 6 – Proposed Transportation/Transmission Right-of-Way



It was said earlier in this presentation that the profitability of SAGD extraction is contingent upon increases in gas prices being matched by corresponding increases in oil prices. This of course is true as it applies to uranium prices as well. There appears to have been a more linear climb in these prices as you can see, however, this steady incline is more likely resultant of constricted supply coupled with only moderate increases in demand. The pressure from oil prices has been good for the uranium business. You can see that uranium prices have doubled over the last two years, a smaller increase than that of oil and gas, with much less volatility.

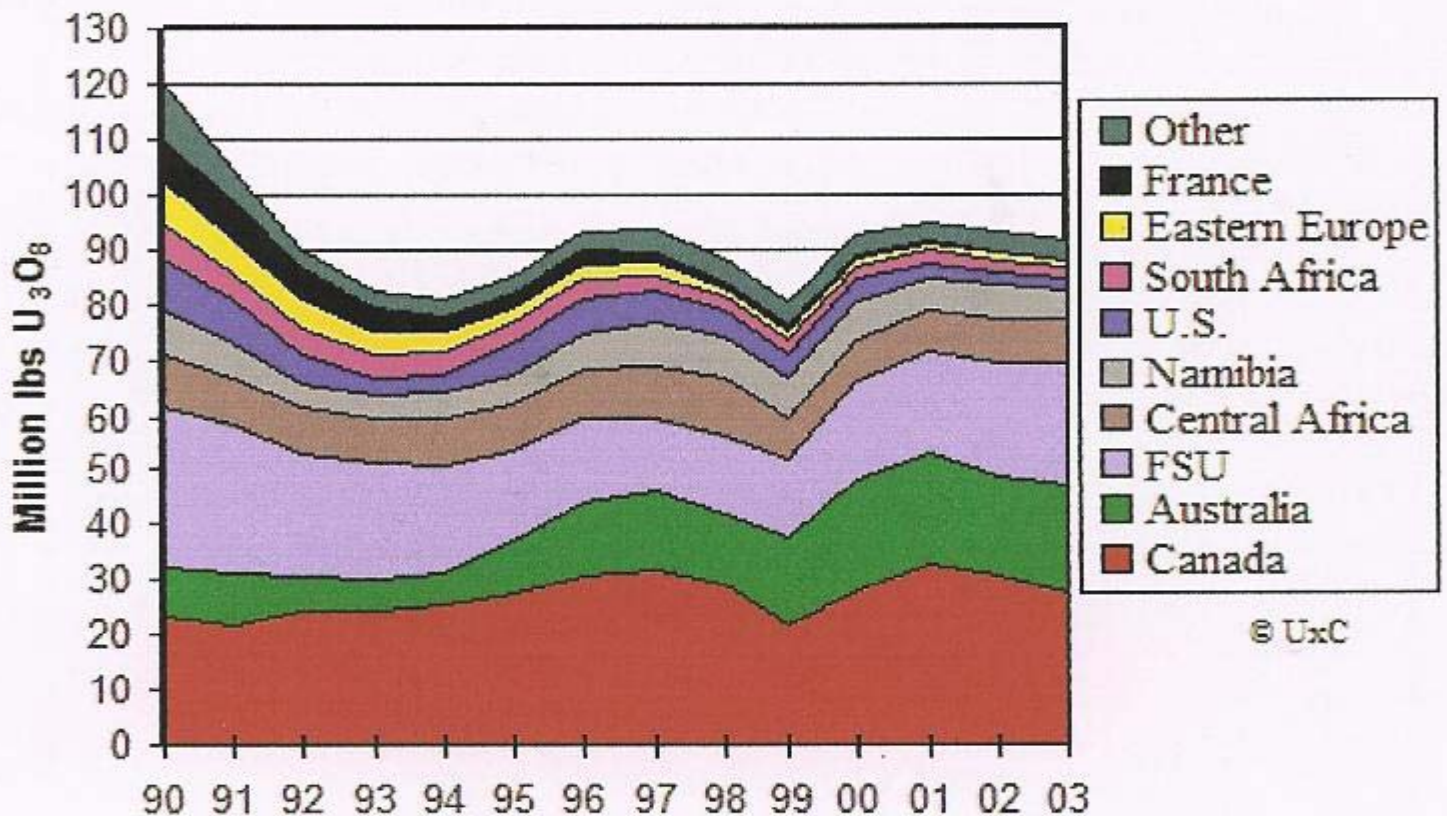
Ux U₃O₈ Prices



Worldwide uranium production over the last 15 years has fallen some 20%, though Canadian production had remained consistent. Why is this the case? Obviously global energy demands have not diminished, so what is going on?

Though nuclear reactors supply less than 8% of the North American energy market, that share of the electrical power market has risen from 11% to 20% over the last 25-years. This is important considering that no new nuclear plants have been licensed or built in Canada or the US since the Three Mile Island fiasco 25 years ago. The added production is the result of plant efficiencies, and operation near capacity of existing plants.

Uranium Production by Region, 1990-2003



Updated: 10/22/04
Frequency: Annually

It is very troubling that there is an absolute lack of discussion about this type of project. Notwithstanding the contribution of CERI and others, there has been little in the way of proposals. The approach taken in this presentation is to propose that such development should proceed, on a colossal scale, on a timely basis, including where it should proceed and why.

The new millennium has brought with it a new realm of security concerns. This is especially true with regard to the nuclear power industry, for it has become a serious concern that a reactor site would become a terrorist target. The events of September 11, 2001 introduced the plausibility that nuclear facilities could be attacked in a similar way. The public safety risks associated with nuclear reactors are the major reason that more reactors are not presently being developed to meet our escalating power demands. It is also the reason why no nuclear generating stations have been built anywhere in North America since 1979.

Security initiatives surrounding existing North American reactor sites have made them less vulnerable, but no amount of vigilance can guarantee that terrorists won't attempt to attack a reactor site. It is extremely improbable that the most remote reactor site in the world would be considered a practical terrorist target, given the logistical challenges to access and the absence of a target population. In addition to the fact that the CANDU is the world's safest nuclear reactor, the Cree Lake project would be the world's most secure reactor site.

Of course there are other reasons why Cree Lake is the ideal location for such a project. There is a strong potential for a vertically integrated nuclear power industry with the uranium producers invested. Cameco is a world powerhouse in uranium production, and could be a valuable partner in a development of this scale. The AECL has the design and engineering expertise, along with the experience to expedite the project. The process energy market is already in place.

From a public safety perspective there is no question that a remote plant location is preferable, as is the case of this development. As a remote and isolated location, Cree Lake would be a preferred place to develop what would ideally become the world's largest nuclear power complex. With a regional population of less than 400 persons within a 200km radius, many of them employees of the various uranium mining operations, this regional population density is among the lowest found anywhere in the world. No other nuclear plant would have such an extensive natural buffer, and accordingly no other nuclear reactor complex anywhere would be as safe.

This project would require an abundant supply of clean freshwater, which is amply available at this location.

Economics (Canadian Dollars)

Nuclear power stations and long-distance transmission are expensive proposals with large, up front capital costs. A project of this size (about as large as the Pickering complex in its capacity) is a mega project in every respect. For analysis purposes this presentation has used the NYMX spot gas price on April 11, 2005 as well as the U_x spot uranium price for the same day.

In the 2002 CERI analysis there was a rough equivalence in the steam generation cost for SAGD using gas in the first instance, and a nuclear facility in the alternative. At the time of this analysis, the spot price used for gas was \$4.25/GJ and the price of uranium was \$30.80/kg.

Updating this analysis using the 2002 CERI estimates, it is necessary to adjust for changes in gas and uranium prices, as well as adding 20% for inflation through 2005. A conversion factor of US\$1 = CAN\$0.80 was used.

Per 1000 MW_e produced, using a gas price of \$8.73 GJ and a U₃O₈ price of \$62.25 CAN/kg.

Method of Generation	Capital \$ Millions - CAN\$	Operating \$ Millions - CAN\$ <u>Annual</u>	Fuel \$ Millions - CAN\$ <u>Annual</u>	Bitumens (Million-Barrels) <u>Annual</u>
Gas	380	14	718	73
Nuclear	2298	50	200	73

Of course this analysis is incomplete with regard to transmission. Whereas the gas fired generation method reflects the cost at the point of steam generation, the electrical power must be transmitted through high voltage lines over the 275 km distance. This in turn would involve at least one substation, as well as I²R losses. For purposes of this analysis, we have budgeted \$1 million/km, or \$275 million for this transmission infrastructure using 700kV – DC transmission. The design life of the plant in both alternatives is set to 40 years. Using an interest or ROI rate of 6% compounded annually, the total annual cost for comparative purposes is estimated.

$A = P(A/P, i\%, n)$ for the capital recovery factor: $i(1+i)^n / (1+i)^n - 1$

For the gas project (per GW_e):

$P = \$380 \text{ Million}$ $i = 6\%$ $n=40 \text{ years}$

$A = \$380,000,000(0.0665) = \$25.3 \text{ Million per year} + \text{operating costs} + \text{fuel}$

Total Cost = \$25.3 Million + \$14 Million + \$718 Million = **\$760 Million**

For the nuclear Project (per GW_e):

$P = \$2298 \text{ Million} + \$275 \text{ Million} = \$2573 \text{ Million}$ $i=6\%$ $n=40 \text{ Years}$

$A = \$2,573,000,000 (0.0665) = \$171 \text{ Million per year} + \text{operating costs} + \text{fuel}$

Total Cost = \$171 Million + \$50 Million + \$200 Million = **\$421 Million**

Obviously, gas fired generation is more sensitive to gas prices and nuclear generation is more sensitive to the interest rate. Clearly, the gas fired system is not competitive using the aforementioned spot price, and this analysis does not factor in any Kyoto compliance costs for the thousands of tonnes of CO₂ that would be produced daily. Though some would consider the spot prices or the interest/ROI rate utilized as impractical, it is difficult to know what these will be, and certainly beyond the scope of

this presentation. This analysis also does not consider the capital costs of re-fitting existing steam generators from gas fired to electrical. There is also no consideration for the value of carbon credits that such an installation would earn.

Safety

It is distressing for someone who believes in the potential for nuclear development to accept the fact that there has been no nuclear power plants built in North America since the Three Mile Island incident in 1979. Anti-nuclear activism is an easy sell, and the incident at Chernobyl didn't help the industry either. Quietly though, and without incident, we continue to generate many GW of nuclear power from the Great Lakes complexes at Pickering, Bruce and Darlington safely and economically, right in the heart of the most densely populated region of the nation.

The CANDU has never had a radiation breach in its history anywhere, and this is not luck at play. It is the superior design of the reactor, the highly advanced if not redundant safety systems and containment structures, and the tried and tested vigilance of the AECL that all factor in to the public safety equation.

There have been enormous strides made in the control and operation of these reactors with the advent of information technology, and indeed it is now possible to employ redundant safety systems that diminish the potential for human error to the point of elimination. I mention human error because it was the primary reason for both of the infamous accidents I have mentioned. Add to these advances the inherent benefit of locating the reactor in a remote and unpopulated area and what you end up with in the safest reactor complex anywhere. No other complex anywhere in the world has the luxury of a 200 km population buffer. It is truly something that is uniquely Canadian, and it goes a long way with the public in terms of the perception of safety, in addition to the actual benefit. The best nuclear power stations are those that are invisible to the public.

In the most probable case scenario, a meltdown is not a likely type of accident. Far more likely would be a radioactive contamination resultant of an accident involving the storage and transportation of the spent fuel. Indeed, most of the world's nuclear power plants have no solution to the permanent disposal of spent fuel and they are compelled to utilize temporary solutions to storage. The Cree Lake proposal would have the benefit of safe and permanent disposal. Pursuant to this, an integrated facility such as this one has great potential for complete automation of refueling and disposal. Spent fuel would be permanently stored in Uranium capsules, 1000's of metres deep in stable granite for the millennia.

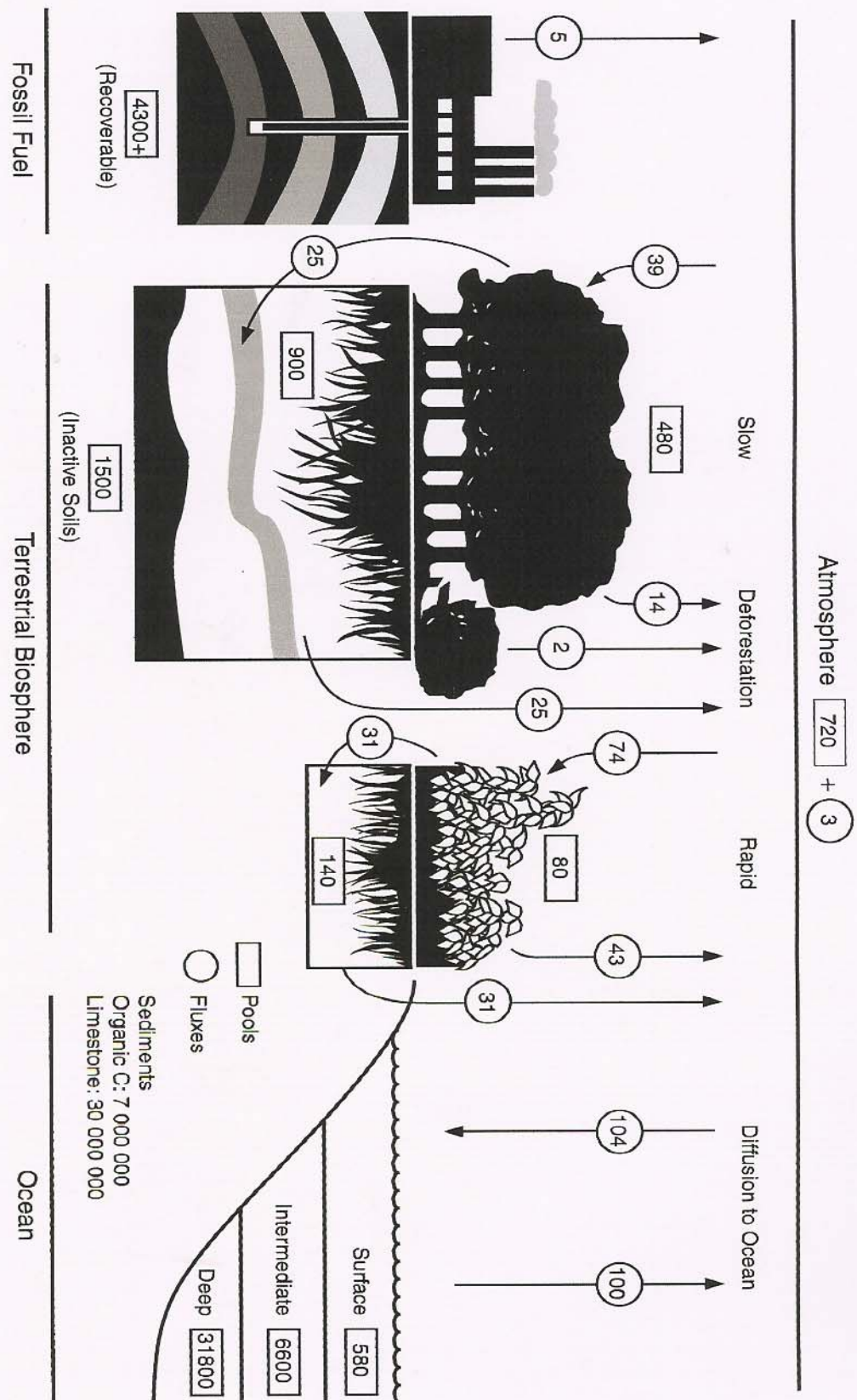


FIGURE 2 GLOBAL CARBON CYCLE POOLS AND FLUXES BILLIONS OF TONS AND BILLIONS OF TONS / YEAR

Environmental Considerations

The benefits of this proposal in terms of CO₂ reduction have previously been mentioned. As is universally the case, any power installation has its environmental footprint. It is already the case that there is a significant uranium mining operation in this geographic area, some of it open pit. Though the techniques for environmental efficiency have improved dramatically over decades of exploitation, open pit uranium mining will always alter the natural landscape.

The uranium mining is an existing industry, and its impact on the regional environment is well understood. It is an unfortunate truth that in the early days of the industry there was little attention paid to minimizing the environmental impact, and the area around Uranium City further north is indeed one of Canada's most contaminated sites. One should not judge this proposal according to what went on there 40-years ago. Like most mining operations in this country, the uranium industry has cleaned up its act.

What would ideally become the world's largest nuclear complex at Cree Lake would be the most environmentally efficient large power plant ever built. Not only would it eliminate millions of tons of CO₂ production, but permanent deep geologic disposal of spent fuel within the area's stable granite eliminates the only inefficiency of nuclear power generation. Low level wastes would be returned underground into existing mines for permanent disposal. This would be a closed loop, zero effluent, zero emission operation.

It is clear that we must judge the environmental impact of a project in the macroscopic sense. The Kyoto Accord mandates reductions in CO₂ at a time when global population grows exponentially. Given extensive CO₂ emissions from fertilizer production, in addition to the half-tonne or so exhaled by 6-billion people annually, this does not leave much room for expansion of conventional fossil fuel fired power generation. There is no master plan to deal with an energy demand that could increase 40% in the next twenty years. The probability that the Kyoto Accord will ever achieve its desired impact (*6% below 1990 levels*) is negligible in any time frame, let alone by 2012.

The environmental audit of the power generation industry reveals the trade-off between very small and concentrated amounts of spent fissile material, in the case of nuclear power, as opposed to very large and widely dispersed amounts of greenhouse gas, or other more noxious emissions. If you accept the premise that nuclear power is safe the way it is done in Canada, there is no question that it is a lot easier on the environment.

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