

Readers Respond

The Real Nuclear Numbers

In Spring 2006 edition of *Engenuity*, engineer Nancy Black's letter about "Another Perspective on Nuclear" offered her views on nuclear energy.

She is correct in saying that statements about nuclear energy not producing greenhouse gases (GHGs) are simplistic. However, after all the GHGs released in the mining of uranium, fuel processing, construction, decommissioning and nuclear waste management are taken into account, and divided by the very large quantity of electrical energy produced, this GHG emission factor is much lower than solar PV which she claims to be "green".

For more than 10 years now, I have seen various estimates of the total GHG emissions for different electricity production systems expressed in grams of CO₂ equivalent per kilowatt hour (kWh) of electricity produced.

This is known as **Full Energy Chain** (FENCH) analysis and is described in IAEA Bulletin Vol.42 No.2: "Assessing the Difference". This six-page document was published in 2000 and is available at www.iaea.org/Publications/index.html or by e-mailing me (ncraik@nbnet.nb.ca).

The document includes the chart entitled "Range of Total Greenhouse Gas Emissions from Electricity Production Chains" which I have summarized below. The data depends on the date of the technology and other factors. On average, wind produces twice as many GHGs as solar and 10 times as much GHGs as nuclear.

	Total GHG per kW/hr			
Nuclear	from	2.5	to	5.7
Wind	from	2.5	to	13.1
Biomass	from	6.4	to	16.6
Hydro	from	4.4	to	64.6
Solar PV	from	8.2	to	76.4
Natural Gas	from	108	to	188
Oil	from	150	to	240
Coal	from	210	to	350

NOTES:

Nuclear: here are GHGs attributable to nuclear power from the fossil fuels used in the mining, refining and transportation of uranium and in nuclear plant construction and decommissioning. The Point Lepreau CANDU reactor is at the low end because the fuel is not enriched.

Wind: GHGs are calculated based on the energy required in manufacturing and construction. It is questionable how many GHGs would really be saved because back-up power is required. When Point Lepreau is providing this back-up, there are no significant savings in GHGs from wind power. When the Mactaquac Hydroelectric Dam has surplus water during the spring, no GHGs are saved by wind power.

Solar: CO₂ is released when silicate is converted to silicon for the PV cells. Also, this chemical process requires heat.

Ms. Black also expressed frustration about the cost of management of nuclear waste.

I can understand this feeling because the recent 451-page report by the Nuclear Waste Management Organization (NWMO) does not express such costs in a way to which electricity consumers can relate.

During the last NWMO New Brunswick Open House Dialogue meeting in Saint John on June 23 and 24, I recommended that the huge estimates (over \$6 billion) for final management of nuclear waste management be expressed in terms of cents per kWh of nuclear electricity generated. This was not done. Maybe it was considered too simplistic.

However, the NWMO final study (November 2005 "Choosing The Way Forward" chapter 11, pp 250-263) describes the projected future costs of long-term nuclear waste management. The most costly option is estimated as \$6.2 billion of which 5.22% is allocated to NB Power. Nancy Black referenced the website www.nwmo.ca as containing this information.

Here is my simple calculation of what this would cost electricity consumers.

By the year 2004, Point Lepreau had operated for 21 years at an average capacity factor of 83% with a net output of 635MW which approximately equals 100 billion kWh (or units of electricity). So the cost per unit of electricity required to cover long-term management of the nuclear waste is only about 0.3 cents per kWh on the cost of electricity from Lepreau.

Ms. Black also seems to have been misled into thinking that the Federal Government, rather than electricity consumers, would be somehow responsible for such costs.

In fact, the NWMO was set up by the Federal Government to ensure that the nuclear utilities (Ontario, Hydro Quebec, NB Power) and Atomic Energy Council Ltd. (AECL) were accumulating sufficient funds for the long-term management of the nuclear waste that these four organizations have created.

On page 262 of the NWMO final study, it is stated that NB Power-Nuclear has funds of \$87 million plus \$28 million (total \$115 million already set aside for this purpose.)

Ms. Black also mentions the cost of waste issues from uranium mine tailings. It should be noted that 80 percent of the uranium mined and processed in Canada is exported so that the GHGs emitted during these first stages are born by Canada and the benefits of GHG free electrical power generation are credited to other countries.

Neil G. Craik , P. Eng.
Nuclear Generation Consultant
Fredericton, NB

And the

2006 Award Goes To... Et le prix est décerné à...



You Decide! / Vous décidez!

If you know a professional engineer or geoscientist who has made an outstanding contribution to their profession and the people of New Brunswick, they may be eligible to receive an APEGNB Award at the 2007 Annual Meeting in Saint John.

Si vous connaissez une personne qui exerce la profession d'ingénieur ou de géoscientifique et qui a contribué de façon remarquable à sa profession ou à la vie des gens du Nouveau-Brunswick, celle-ci pourrait mériter un des prix ou des distinctions de l'AIGNB qui seront décernés à l'assemblée annuelle 2007 de Saint John.

In order to recognize their efforts and accomplishments, the APEGNB Awards Committee needs to hear from you—the nominator. So call the Association for the easy-to-complete nomination kit and let us know who your choice is for the:

Afin de souligner le travail et les succès de nos collègues professionnels, le comité des prix et distinctions de l'AIGNB veut connaître vos suggestions, auteur de mises en candidature. Donc, communiquez avec l'Association pour une trousse de mise en candidature et pour nous signifier votre choix de candidats et candidates dignes des prix et distinctions suivantes :

- C.C. Kirby Award / *Prix C.-C.-Kirby*
- L.W. Bailey Award / *Prix L.-W.-Bailey*
- Citizenship Award / *Prix du mérite civique*
- Corporate Award of Excellence
Prix d'excellence à l'entreprise
- Individual Award for Technical Excellence
Prix d'excellence technique
- Honorary Membership / *Membre honoraire*

Deadline to receive nominations
La date limite de mise en candidature

**September 15, 2006
15 septembre 2006**

Call / Appelez au **506-458-8083**
e-mail / Courriel **info@apegnb.com**
visit / Consultez le site **www.apegnb.com**

to receive your nomination kit including
award descriptions, criteria and forms.
*pour obtenir votre trousse de mise en
candidature comprenant la description des
prix et distinctions, les critères et les formulaires.*

NEW FOR 2006 / NOUVELLES DISTINCTIONS EN 2006

- Outstanding Educator Award / *Prix d'excellence en éducation*
- Outstanding Student Award / *Prix d'excellence dans les études*
- Service to the Profession Award / *Prix pour contribution à la profession*
- Support of Women in Engineering Award / *Prix de soutien aux femmes ingénieures*
- Young Professional Achievement Award / *Prix hommage à un jeune professionnel*