THE HIDDEN COSTS OF ONTARIO RENEWABLE ELECTRICITY GENERATION

Ontario residents can be forgiven if they fail to understand the public debate during the current (2014) provincial election about the costs of different types of electricity generation and why these have caused electricity rates for consumers to rise so much over the past ten years. The complexity of the system makes it difficult to explain the costs associated with one source of supply, namely the renewable energy generation (industrial wind turbines and solar power generators). In this note, I will nonetheless try to explain in layperson’s terms why these costs are significant.

Electricity supply in Ontario takes place within the framework of the policy and legislative framework established by the Ontario government, an important part of which is the Green Energy and Economy Act of 2009 (GEA). Historically, the goal of Ontario electricity policy was to keep electricity rates for consumers as low as possible consistent with the goal of maintaining adequate and reliable supply. Within the current framework, however, that is no longer the goal. The GEA seeks to stimulate investment in renewable energy projects (such as wind, solar, hydro, biomass and biogas) and to increase energy conservation. To do this, it:

* Changed the review process for renewable energy projects to reduce environmental assessment and hasten approvals
* Created a Feed-in-Tariff that the Independent Electricity Systems Operator (IESO) must pay, guaranteeing the specific rates for energy generated from renewable sources (typically, the rates are fixed for the full term of the twenty year contracts, with inflation escalators)
* Established the right to connect to the electricity grid for renewable energy projects and gave renewable energy source preferential access over other sources of generation
* Implemented a “smart” grid to support the development of renewable energy projects
* Eliminated local approval requirements that local governments previously could impose on renewable energy projects

The guaranteed rates paid under the FIT system are not negotiated based upon the actual costs of production. In fact, the actual costs of production are largely unknown. The guaranteed rates for onshore wind turbines was initially set at 13.5 cents per kilowatt hour (kWh) and subsequently lowered to 11.5 cents per kWh. The guaranteed rate for solar rooftop equipment was initially set at 80.1 cents per kWh and subsequently lowered to 39.6 cents per kWh.

Scott Luft is an electricity data expert who accesses information from IESO’s website and publishes them on his web site “Cold Air”. Recently, he published an analysis of the actual amounts paid by IESO in 2013 for different types of electricity supply. The following table is my slightly simplified version of Mr. Luft’s analysis.

IESO POWER PURCHASES IN 2013

Generation TWh Paid for Production Total Paid Cost Total Cost

($million) (with (per kWh) (per kWh)

capacity)

Nuclear 90.7 $5375 $5375 5.9 5.9

Hydro 35.2 $1375 $1375 3.9 3.9

Nat. gas 17.4 $1217 $2152 7.0 12.4

Wind 5.2 $701 $701 13.5 13.5

Solar 1.3 $631 $631 48.5 48.5

Coal 3.1 $106 $414 3.4 13.4

Imports 4.9 $144 $144 2.9 2.9

What this table shows is that nuclear energy supplies the largest part of Ontario’s electricity needs at an average cost in 2013 of 5.9 cents per kWh, followed by hydroelectric energy at an average cost of 3.9 cents per kWh. In 2013, IESO payments to wind generators cost $701 million, or 13.5 cents per kWh, while payments to solar generators cost an extraordinary $631 million for 1.3 TWH, or 48.5 cents per kWh. Wind and solar energy combined provided 6.5 TWh, 4% of total supply, but IESO paid $1.331 billion, or 12 % of costs.

The numbers for natural gas and coal-fired generation are of interest because of the difference between the amount paid for actual production and that paid to generators to maintain capacity in place. Maintaining capacity in place is necessary to back up the wind and solar generators, a point on which I will expand later in this note. Based on actual production, the price paid for natural gas-fired generation was 7.0 cents per kWh, but it was 12.4 cents per kWh if the cost of unused capacity is taken into account. Similarly, the cost of electricity from coal-fired generation was 3.4 cents per kWh, but the cost rises to 13.4 cents when one considers the significant amount of coal generation left idle.

Another interesting point is that the lowest cost source of electricity supply was the power Ontario imported from other jurisdictions like Quebec and Manitoba. That cost only 2.9 cents per kWh.

These are the direct costs paid by IESO, but they do not include all the costs on the energy system. Not all generation sources are alike in terms of their effects on the system. By virtue of being connected to the same physical grid and delivering into the same market, they exert impacts on each other as well as on the total load available to satisfy demand at any given time. This is largely due to the fact that, generally, electricity cannot be stored like other energy sources; with some minor exceptions, the amount of electricity available at any time has to match demand. Renewable electricity sources like wind and solar are intermittent. That is, they only produce electricity when the wind blows or the sun shines, respectively, not when people need it. Other sources of generation such as nuclear, coal, hydro and natural gas, can produce reliably all the time and, within limits, they can vary their production to meet changes in demand. In the electrical energy industry’s parlance, these generation sources are “dispatchable”.

As a result, renewable electricity sources have large and costly indirect and infrastructure effects.

* The cost of keeping available the primary plants (usually either natural gas or coal) that must balance wind and solar energy’s variations;
* The higher fuel consumption (per unit of output) that wind and solar generation impose on the back-up plants;
* The cost of additional long-distance transmission that wind and solar plants require; and
* The losses that come with it.

A recent report for the Organization for Economic Cooperation and Development and the Nuclear Energy Agency attempted to quantify the “grid-level systems cost” for generation technologies in a number of countries. These were not theoretical projections, but estimates based on the actual cost experience of several European jurisdictions that have invested heavily in renewable energy technologies.

The results showed that system costs for the dispatchable technologies are relatively modest and usually below three cents per kWh. They are considerably higher for renewable technologies. In fact, system-wide costs for renewables can reach up to USD 40 cents per kWh for onshore wind and up to USD 80 cents per kWh for solar, with costs rising as the share of renewables in the electricity supply system rises.

Using Germany as an example, the study found that, at renewables’ shares up to 10% of total generation, the system costs for onshore wind and solar technologies were as follows in U.S. cents per kWh:

Onshore Wind Solar

Back-up costs 2.4 9.2

Balancing costs 7.6 7.6

Grid connection 6.8 9.2

Grid extension 2.8 5.3

Total costs 19.6 31.4

This is a clear indication that new generation sources with no ability to replace “dispatchable technologies” cost considerably more than any of the more traditional energy sources.

Using utilities’ traditional levelized unit cost accounting, the impact of adding fixed-price renewables is to drive up the levelized cost of increasingly less utilized dispatchable generation sources. In Europe, this has lead to countries adding renewables capacity now being characterized by escalating total system capacity, escalating consumer rates, and escalating accusations that it is the dispatchable energy sources that are driving the rate hikes.

Further, jurisdictions have to build far more renewable energy capacity to attain the same level of generation. In Ontario, IESO anticipates that only 13.5% of wind turbine capacity will be produced during peak summer demand periods. This means that a system can only replace 13.5 megawatts (MW) of dispatchable capacity for each 100 MW of industrial wind capacity added.

The fact that Ontario has a significant surplus of generating capacity at present makes the situation even worse. During 2013, the output of nuclear, hydro-electric and contracted non-utility generators (industrial companies that produce electricity as a by-product of their manufacturing process) exceeded Ontario electricity demand about 29% of the time. When wind and solar generators did produce, they either forced the curtailment of natural gas plants, the “steaming off” of nuclear power plants, cutbacks in hydro production or the dumping of electricity at a loss in export markets. The loss on export sales in 2013 was about $1 billion.

Unless the feed-in-tariff system is ended, Ontario will continue to contract for the most expensive possible sources of electricity generation. It is time to call a halt to this program.