The IESO's Mandate

The IESO response to the article "Missing the Mark" was that it is "beyond the mandate of the IESO".

The Ontario Ministry of Energy has outlined its own objectives, explaining:

"As the province plans for Ontario's energy needs for the next 20 years, conservation will be the first resource considered."

The Ministry of Energy outline continues: ***"Conservation is a key part of our collective effort to lower greenhouse gas (GHG) emissions. It is also the province's most cost-effective energy resource, and it offers consumers a way to reduce their electricity bills. The least expensive type of energy is the energy we don't use."***

About half of Ontario's electricity is used for thermal applications such as cooling, heating and domestic hot water. ***Missing the Mark*** showed how that half of our electricity consumption could be eliminated by utilizing stored heat, and in doing so it would reduce both the capital and operating costs for electricity generation by many billions of dollars, it would radically reduce the related GHG emissions and the result would be much more sustainable systems for both electricity and for heating/cooling.

Thermal storage systems exactly meet the Ministry of Energy's primary objective. However, cutting the electricity demand in half could also cut the generation revenues in half, leaving organizations like the IESO in a position where they inherently have a conflict of interests – do they protect their revenues or do they support conservation? In this case they have made it very clear where their preference lies.

Thermal storage systems also have the potential to store electricity on a very large scale as outlined in Missing the Mark. Storing electricity makes it possible to shift demand from high-demand periods to low-demand periods, to utilize the hydro spring river runoff, to handle the intermittency of wind turbines, to facilitate the repurposing of hydro pond storage, to provide grid regulation, etc. Again, the IESO has a conflict of interests. Those measures would all make the existing generation systems substantially more productive, again reducing revenues at little cost. By linking the two forms of storage Ontario could eliminate its use of fossil fuels for both thermal and electrical applications, and could also retire its fleet of nuclear power reactors as well.

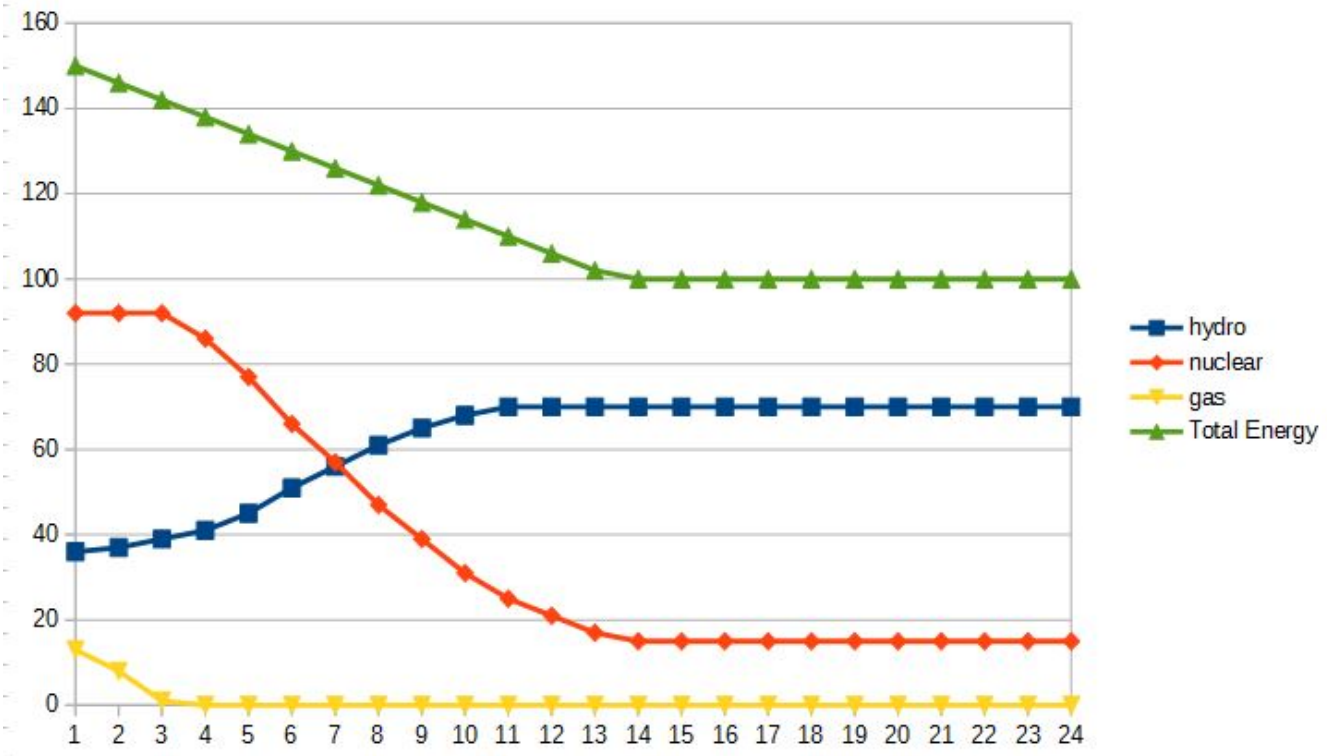
To understand the economic significance of these reductions we need to bear in mind that the cost of Ontario's electricity generation system is primarily determined by the power generation target, not the energy delivery objective. If we need 30,000 MW of power to handle the potential peak power load but we utilize storage to both reduce and shift that load then we might reduce the peak power demand to, say, 10,000 MW, reducing the capital and operating costs for the generation facilities in proportion. Since the required facilities already exist the net investment is reduced very nearly to zero. The cost of the storage capacity is mostly covered by building owners whose primary interest lies in storing the heat – the storage of electricity is a free side benefit.

Scaling

Dual thermal/electricity storage systems (called exergy stores) can be employed on any scale ranging from a single building to covering the whole province. That makes it very easy to phase in the use of exergy stores at any desired rate, and with any desired end objective. Exergy stores can be built in a matter of days so there is no long gestation period like that encountered with nuclear power stations. However, the feasibility of building such stores depends on the Ontario government's willingness to follow its own policies. The generation monopoly can (and does) impose obstructions that make it difficult to build such systems, starting from blocking even the consideration of employing such stores, which is the point of this current discussion. The benefits of electricity storage are realized primarily by the cost reductions/generation efficiency gains of the generation facilities themselves so if the IESO et al choose to turn a blind eye to those gains then the benefits are lost.

An inappropriate tax

According to the IESO web site the Global Adjustment (which is the primary means of funding nuclear power) averages 9.97 cents/kWh and the cost of hydro power averages 1.58 cents/kWh, for a total average cost of 11.57 cents/kWh. In effect we are paying an 86.2% tax rate to subsidize the cost of nuclear power. In the process any generation supply that might compete with nuclear power is paying that tax to the nuclear generators (with some pet government exceptions). Ontario has no need of nuclear power. If we switched to using stored heat and electricity then the demand reductions and efficiency improvements would be sufficient to allow the reactors to be permanently shut down on the dates at which their CNSC permits expire – all of which are pending in the near future except for one of the Darlington reactors. The graph below illustrates how that would unfold.



The green line shows how the total electricity demand will fall as storage is implemented. The use of fossil fuels for generation will disappear within 3 years but it will take 15 years to displace the use of natural gas for heating applications. The wind turbine contribution is not shown but it was included in the figures, using a straight line projection for the future. There would be a solar PV contribution but it is not shown in this graph because it would be behind the meters. The numbers are based on the IESO data, with the reactor shutdown dates being determined by the CNSC permit expirations. Small adjustments were made in those dates to make the nuclear curve smoother. The Pickering stations are shown as being shut down according to the dates proposed to the OEB. The red line shows that there will be a residual need for some power that could be provided via imports from Quebec, including power for which negotiations are currently underway. Note that Quebec will have a very large surplus of power available once it too takes advantage of exergy storage.

Transportation

Over the coming two years new models of EV's will be introduced at the rate of nearly one per month. While it will take many years for the electricity demand for EV's to become a major factor the means of actually achieving the needed recharging capacity is an immediate problem, and it directly involves the IESO. The most efficient way of building recharging stations is to integrate them with distributed grid regulation systems that can be built into exergy storage systems. Integrated regulators are about two orders of magnitude less expensive than the IESO-preferred approach of using single purpose battery regulation and they are located at the load end of the supply chain, which is preferable to integrating them with the supply system (which implies high distribution costs and waste).

Nearly all of the upcoming EV models have short ranges, generally amounting to less than 300 km. For such vehicles to be attractive we will need to provide charging points that are even more densely distributed than gas stations. That will be a major challenge considering the small related demand for power. If it provides the charging points then Ontario could restore its car manufacturing industry and it could make a major reduction in GHG emissions from transportation, but that will require that the IESO play its part. Unfortunately, the IESO has been reluctant to do that, arguing that its role is to perpetuate the status quo for electricity supply.

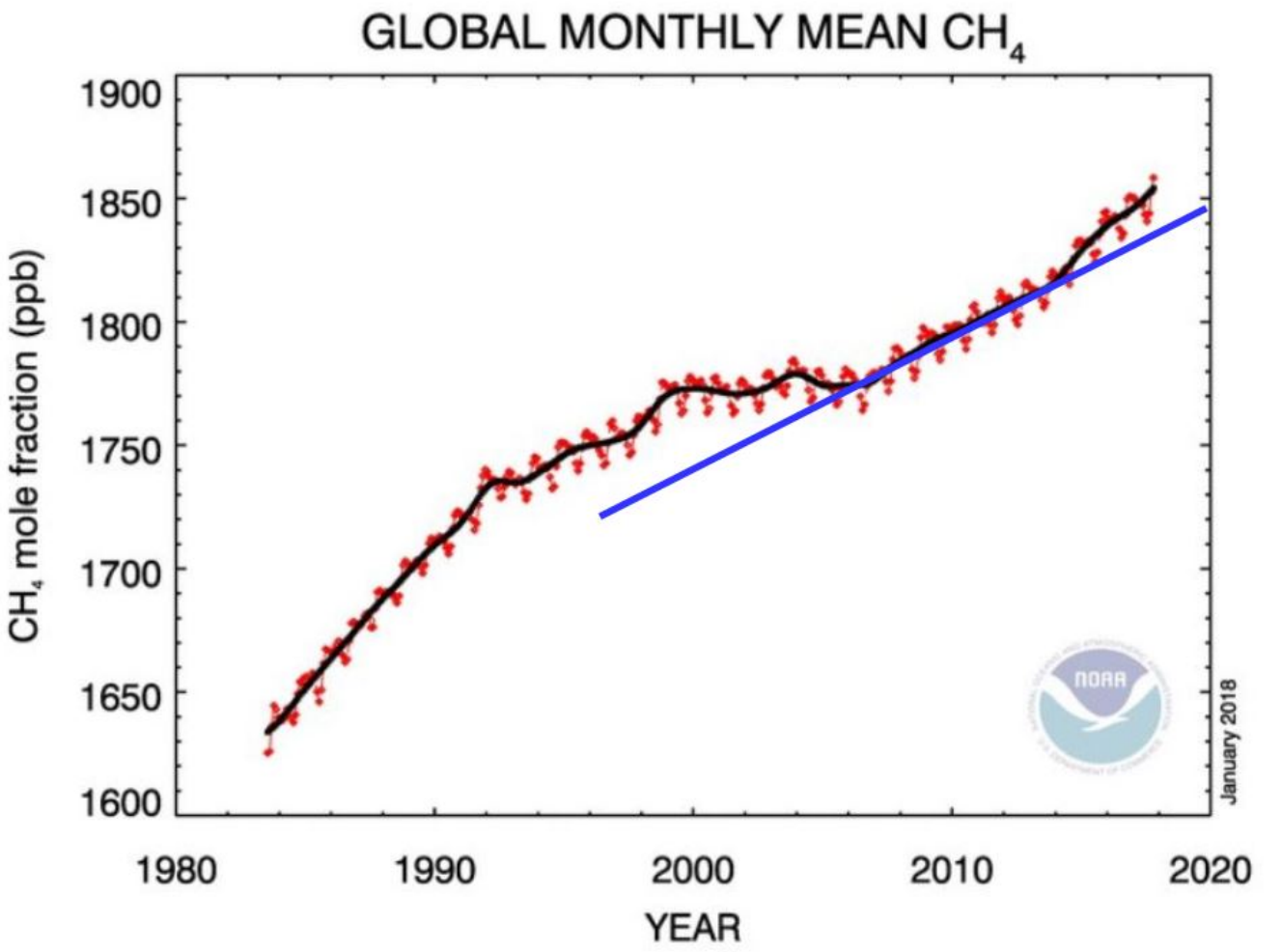
Why the IESO has no choice

If Ontario proceeds with its plans to refurbish its Darlington and Bruce reactors then it will almost certainly find that they will become stranded assets even before the refurbishments are completed. The problem lies with how we heat our homes. The overwhelming choice in Ontario is to use natural gas, most of which currently comes from the Marcellus fracked gas source. Two new pipelines (Rover and NEXUS) are currently under construction and they will soon bring our share of fracked gas to 100%. In the fracking process about half of the released gas is captured and the other half is released into the surrounding ground, which is about one million times more permeable than the shale from which the gas was extracted. Once the gas is mobile there are many mechanisms, such as porous rock layers, faults, water adsorption, failed drilling pipes, etc., that will enable the gas to eventually flow to the surface.

For the past decade Ontario's share of that underground bubble of uncaptured gas has been growing at the average rate of about 2000 megatonnes of GHG(eq.) per year, growing to about 3000 megatonnes per year as we complete the switchover to fracked gas. To date hardly any of that released gas has

reached the surface, thanks to the 2 km depth of Marcellus. However, it has now begun to reach the atmosphere. There have been many sub-surface, surface, aerial and satellite surveys that have confirmed that the methane content of the atmosphere is rising, and it has been established that the increases are due to fracking rather than from the generation of methane at the surface from organic processes. The two can be distinguished by measuring the ethane constituent, which is not produced by the surface processes.

NASA uses a satellite to measure the global methane. They have just released their most recent results (below):



Until recently the dominant trend has been the increase due to fugitive emissions coming from the production pipelines (blue line). However, the graph is now departing from that trend because some of the underground bubble is at last reaching the surface. That trend will rapidly accelerate until it reaches a balance at about 3000 megatonnes per year (for Ontario). That gas was actually released years ago and there is nothing we can do to stop it. Even if we abruptly stopped using natural gas altogether the amounts reaching the atmosphere will continue to expand dramatically. The best we can hope for is to stop the gas production ASAP and hope that our kids will forgive us for our stupidity.

To put the number in perspective all of Canada's GHG emissions from all sources put together add up to 700 megatonnes per year. The 2050 objective is to reduce that by 80%, or to something like 140 megatonnes. If the Paris Climate Change objective were to be honoured then the emissions would need

to be reduced to well under 140 MT. Obviously such objectives cannot possibly be met by Ontario because for many years we have been releasing thousands of megatonnes of GHG for the methane contribution alone, and that gas is now beginning to reach the atmosphere. Both the provincial and federal governments grossly misrepresent the “national inventory” GHG figures (which do not include upstream methane) as if they were a measurement of the GHG related to our use of natural gas. So long as none of the released gas had reached the surface an “out of sight, out of mind” mentality has ruled government planning. Now our governments must address the issue. Every year of delay will contribute an extra 3000 MT, none of which will be helped by government agencies that point to one another as the source of the problem.

If we stop using natural gas for heating then the only practical alternative is to use thermal storage of local energy to heat our homes. The energy source might be solar energy, stored solar energy drawn from the ground, or heat extracted from the air. Actually, storage makes it possible for heat extracted from the buildings during the summer to provide a large part of the winter heating. Neither nuclear power nor superinsulation provide economically viable alternatives for large scale use so we will need to use some mix of the local thermal energy sources. The direct consequences will be that the demand for electricity will fall and the generation efficiencies will rise, leaving us with derelict power reactors and a bill for 26 billion dollars.

These are issues that the IESO needs to deal with right now. To fail to do so would impose huge economic and environmental penalties on Ontario residents. The IESO has asked for our advice – now it needs to consider that advice, not dismiss it on the questionable grounds that it does not fit into their mandate.

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