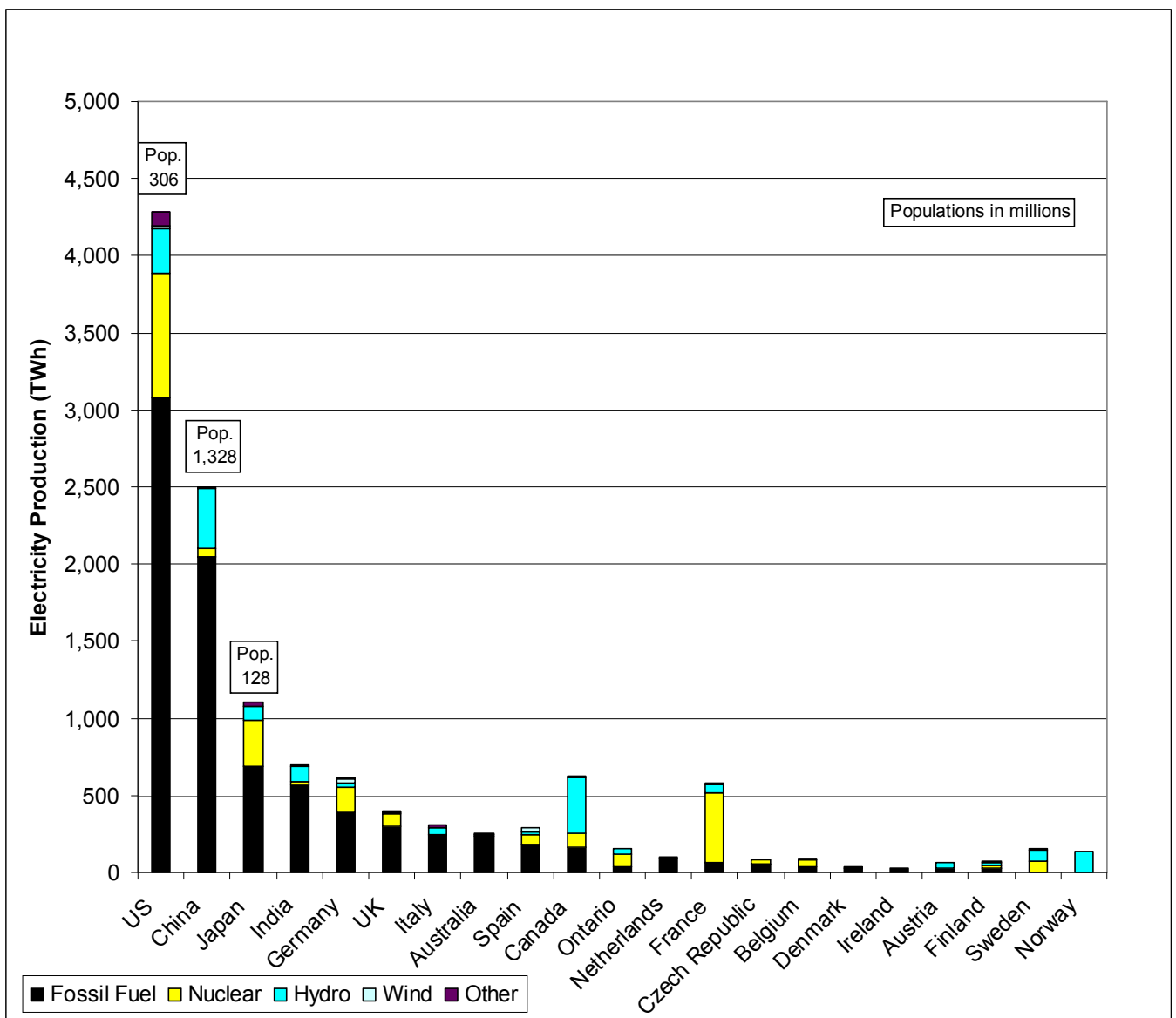


## Electricity Generation Carbon Footprints

Within the electricity sector, world-wide we do have a CO<sub>2</sub> emissions problem. Figure 1 shows the total electricity production for selected countries, divided into fossil fuel (largely coal) and other, and ranked by fossil fuel use. The problem does exist on an aggregate, global basis but is strongly skewed to a few countries. Ontario is shown for information purposes. The data on which this information is based is from the International Energy Agency and is for 2005, which provides the latest detailed comparable data by country. There will not be significant changes relative to the current situation, and robust conclusions can be drawn.

The amount of CO<sub>2</sub> emissions produced by the fossil fuel production is approximately 0.8 tons per MWh (about one ton per MWh for coal). In the case of the U.S., this represents about 2,500 million tons of CO<sub>2</sub> per year. For Germany to eliminate its nuclear plants, as planned, and replace the production with coal would release an increased 150 million tons of CO<sub>2</sub> per year.

**Figure 1 – Annual Electricity Production for Selected Countries**



## Electricity Generation Carbon Footprints

The combined fossil fuel consumption in the U.S, China, Japan and India represents almost 80 per cent of the total of all the countries selected (and more than 50 per cent of the world total), and China and India are growing. Note in particular that Canada and Ontario both obtain a substantial portion of electricity from non-fossil-fuel sources, as does France, Sweden and Norway. In Canada, this is largely due to hydro sources and in France, nuclear. Norway obtains almost all of its electricity from hydro, and Sweden is about half hydro and half nuclear.

Germany's generation means in percentage terms is fossil fuel 62%, nuclear 26%, hydro 5%, wind 5% and other 2%.

Wind power production for any country is barely visible. Wind power's much advertised rapid growth rate, is due to its very small base. Any amount of wind worth noting is in a few countries, the U.S., Germany, Spain, Denmark, China and India. In spite of any continuation of this growth rate, wind power will still be inconsequential in terms of its impact. Any significant continued growth would be accompanied by increased gas generation, which further defeats this strategy. As we will see for Ontario, there is only one way to achieve the goals of a sufficient and reliable electricity system that has the least impact on the environment, and it is not new renewables, especially industrial-scale wind.

What should be evident from looking at Figure 1 is that no renewable energy source can have other than a very insignificant impact. There is no hope of their coming close to the needed result, and this is not an "every little bit helps" situation. Because of the size and nature of the CO2 emissions issue, if we are to succeed in significant reductions, we need the maximum focus on approaches that will have the necessary effect. Wind power is already a huge distraction from the real problem and solutions.

Canada is already a world leader in the minimum use of fossil fuel for electricity production and will substantially improve on that by 2015 with the removal of Ontario's coal plants. Today, Canada obtains 26 per cent of its electricity from fossil fuels, and coincidentally, so does Ontario. Compare this to the use of fossil fuels by world leaders in wind power implementation as shown in Table 1.

**Table 1 – Fossil Fuel Use in Canada (and Ontario) Compared to Wind Power Leaders**

Use of Fossil Fuel in Electricity Generation	Canada and Ontario	U.S.	Germany	Denmark	Spain	China	India
Percent	26%	72%	62%	71%	63%	82%	82%

With the removal of its coal plants by 2015, fossil fuel use for electricity generation in Ontario will fall to 13 per cent. The associated reduction in CO2 emissions will be 79 per cent, which any other sector of the economy or any country would be hard pressed to match. Within Canada, and in particular in Ontario, attention must therefore focus most profitably on other sectors.

Figure 2 provides a closer look at a selection of countries at the same scale of, or smaller than, Canada in terms of electricity production. What is apparent is Canada's low relative use of fossil fuels compared to most, the Nordic countries being the major exceptions. As with Figure 1 population numbers have been provided for countries at about the same levels.

## Electricity Generation Carbon Footprints

Figure 2 – Closer Look at Countries Comparable to Canada

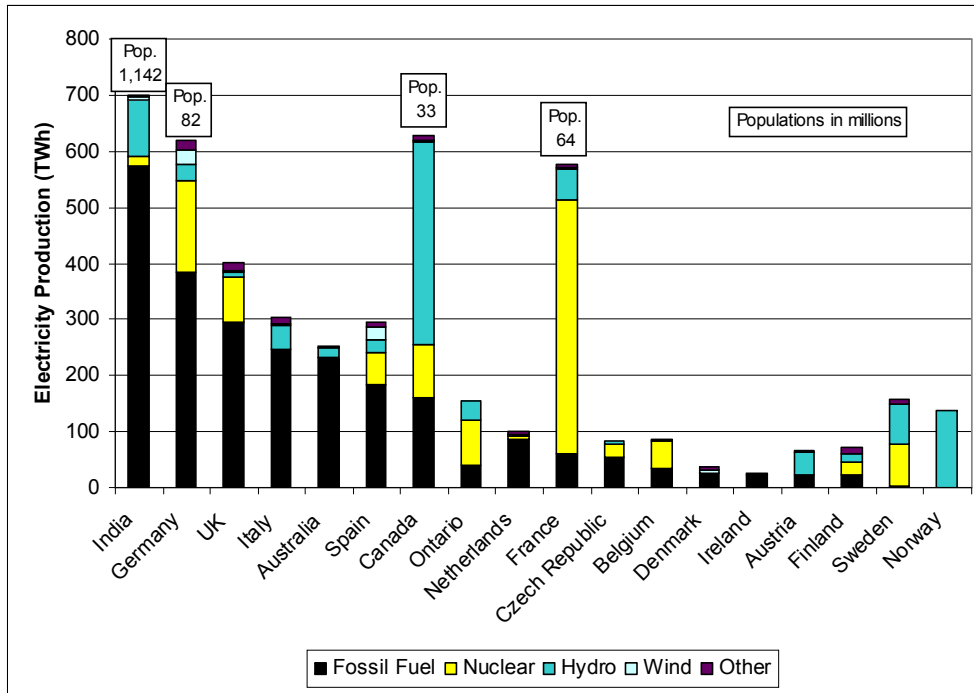
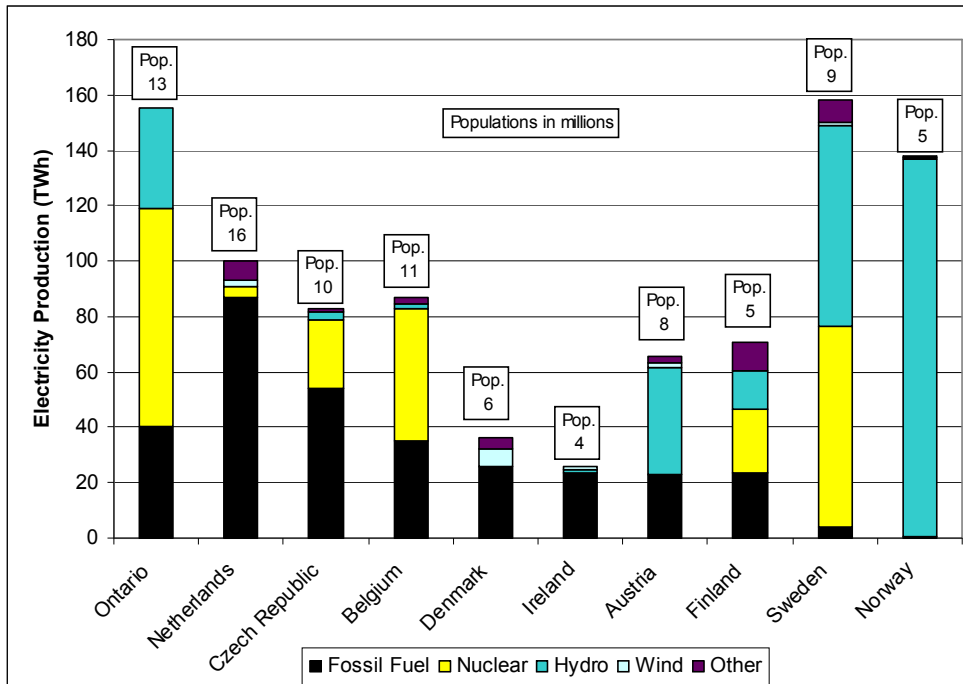


Figure 3 gives an even closer look at countries at about the same level of electricity production as Ontario. Note that the contribution of wind in Denmark now just starts to show.

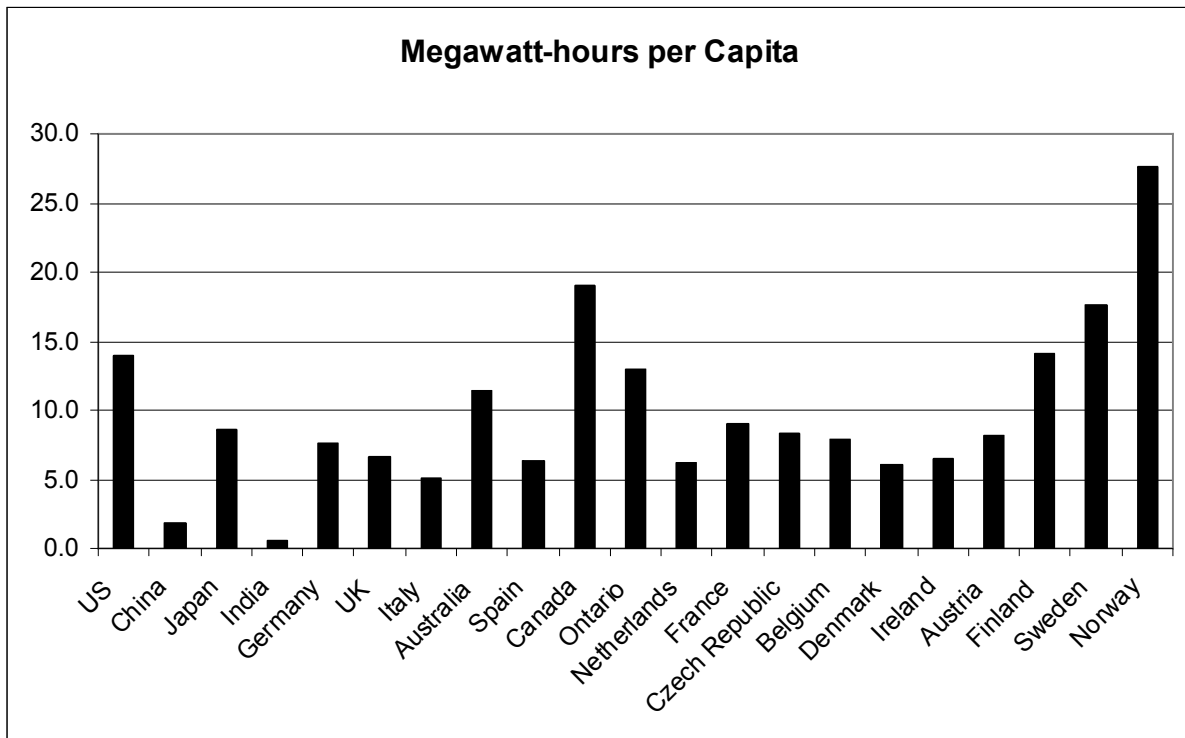
Figure 3 – Closer Look at Countries Comparable to Ontario



## Electricity Generation Carbon Footprints

What is the real problem? In Canada, and the U.S., we do not have a supply problem. We have a wasteful demand problem. Figure 4, showing the annual electricity use per person (MWh per capita) for the selected countries, illustrates this. By this measure, Canada and the U.S. are heavy users of electricity compared to most other countries. The Nordic countries provide interesting exceptions, possibly because of an abundance of hydro and high use of biomass in Finland.

Figure 4 – Electricity Use per Person in the Selected Countries



Canada uses two and one-half times the electricity per person as Germany, over two times as France and over three times as Denmark. I suggest that this means we have substantial need and scope to conserve. Conservation of 60 per cent would put us at the same level of electricity use as Germany, which could hardly be described as a hardship situation.

Now, for those who want to eliminate Ontario's dependence on nuclear plants, they must face up to substantial conservation efforts to reduce electricity consumption by about 70 per cent. We could offset this somewhat by importing large amounts of hydro-produced electricity from Quebec, and possibly Manitoba. Obviously, this would have to be accomplished over a period of time, and would not all realistically be achieved within the 20 year planning horizon of the OPA. As a result, the OPA has to provide substantial generation capabilities in the interim.

Having said all this, we should not forget that in Canada and Ontario we have substantially greater opportunities to reduce CO2 emissions in other sectors of the economy, but electricity seems to have hijacked too much of our attention. Some provinces do have challenges in electricity generation, especially Alberta, which relies almost exclusively on fossil fuels, but overall, our electricity sector is in relatively good shape.

The U.S., China, Japan and India have a different problem because of their starting points. In the U.S., conservation clearly has a role to play, and this is one area Obama should focus on. This is hardly applicable to China or India. For these four countries, as well as many others, such as Germany, the UK, Italy, Spain and Australia, viable options are fast-tracking clean-coal and carbon sequestration technology development and implementation, and maximizing the use

## Electricity Generation Carbon Footprints

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of nuclear fission. Along with conservation, these technologies are necessary today to bridge to future electricity generation and distribution means that have more desirable characteristics, but which are not available for the next 30-50 years, or more. Future possibilities include major advances in solar, a distributed hydrogen economy, nuclear fusion, more effective carbon sequestration, and smart grids. We cannot, and should not, try to pick the winners today, but should be investing heavily in research and development, to make effective use of the time that the current electricity generation “bridges” will buy us.

This may not be a totally satisfactory approach for many people, but it is the only one we have. New renewables have no part to play outside of political “window dressing”. The recently announced EU climate change pact with its heavy reliance on new renewables, particularly wind power, and carbon trading schemes is ill-conceived and ineffectual. It will not survive the realities that must be faced by 2020. Already, Germany is a major factor in the ineffectiveness of this pact through its current practices and the exceptions it has insisted on.

In summary, in the electricity sector, Canada and the rest of the world have to conserve as much as possible and use current technologies that minimize CO2 emissions to bridge to not-yet-available future generation and transmission means. As well, all countries must be more aggressive in other sectors of their economies, for example transportation, agriculture and land use, energy-efficient buildings and industrial processes.

*(Last updated December 18, 2008)*