

Wind Turbines will Provide the Energy Needed in the Future, and Create a Lot of Jobs



Papers in this Journal were selected from the first EPE Seminar on Wind Energy that took place in Delft on 27 and 28 March this year... Enjoy the reading. Now the call for papers for the 2nd EPE Wind Energy Chapter Seminar in Stockholm on 23 and 24 April 2009 is out, deadline for the synopsis is 14 November 2008.

Energy is the most important resource for mankind. About 100 years ago, before we started to use cheap oil, our standard of living was low, we were poor. Within about 200 years we will consume the oil nature needed about 100 million years to create. The need for energy will increase, especially in Asia. The oil pumped and made available will decrease. In the years to come, the gap between supply and demand

will increase. One day the oil discovered will be less than the amount we consume.

Producing electricity emits various amounts of CO₂ depending on the used fuel (basic life cycle inventory): 1 MWh electricity emits 884 kg CO₂ if produced from gas, 997 kg CO₂ if produced from hard coal, 810 kg CO₂ if produced from oil, 105 kg CO₂ from 3 kW rooftop photovoltaic (monocrystalline silicon), 48 kg CO₂ from wind turbines, 13 kg CO₂ from nuclear power plants, 3 kg CO₂ from hydropower (run or storage).¹

Reaching the Kyoto targets is asking for a strong reduction of those emissions.

80 % of the primary energy consumption in the world is based on fossil fuel. Wind energy provides less than 1 %. Wind energy and other renewable energy sources last forever and there is but very little CO₂ emission.

As concerned engineers we are in a position to provide the technologies for renewable energies. Since wind energy is the most promising and available almost all over the world, it is the preferred type of renewable energy. The power generated from a wind turbine increases as the cube of the wind speed, 10 % increase in the wind speed results in 30 % more generated power. So the use of areas with good wind conditions is looked for and the trend is now to go offshore.

Usually, there are long distances from the areas with the best wind conditions to the load centers. To allow for the most efficient transmission, STATCOM or other FACTS installations will be used. Those functions are provided by power electronic converters and appropriate control.

Speed of rotation is usually controlled. Wind turbines rotate slowly, if the rated power is 3 MW the nominal speed may be 16 rpm, at lower wind speeds the rotation speed is reduced to improve the efficiency and reduce the noise. To provide speed for an industrial generator a gear of 100:1 is needed. Industry standards with gear today are either DFIG (double fed induction generator) with 1 MW power electronics converter, or a standard induction generator with a full power (3 MW) converter. Some manufacturers are able to do without gear. As a rule of thumb, the size of an electric machine is related to the torque, and power is torque multiplied with speed. When the speed is low we need a huge torque, and a full power converter. There are a lot of challenges in designing the generators, converters and the controllers.

Students see the future of renewable energy. There are a lot of research challenges and projects. Smart professors see the teaching and research opportunities.

Read the papers in this Journal and we see you in Stockholm next April!

Tore Undeland, chair of the EPE Chapter of Wind Energy

¹ From: Frischknecht, R., Dones, R., Bollens, U., Bosshart, S., Ciot, M., Ciseri, L., Doka, G., Hirschler, R., Martin, A., Grabner, U.,: Eco-inventories of Energy Systems, Swiss Federal office of Energy, Bern, Switzerland (1996). (in German)