

September 2011

Wind power in Ireland and USA

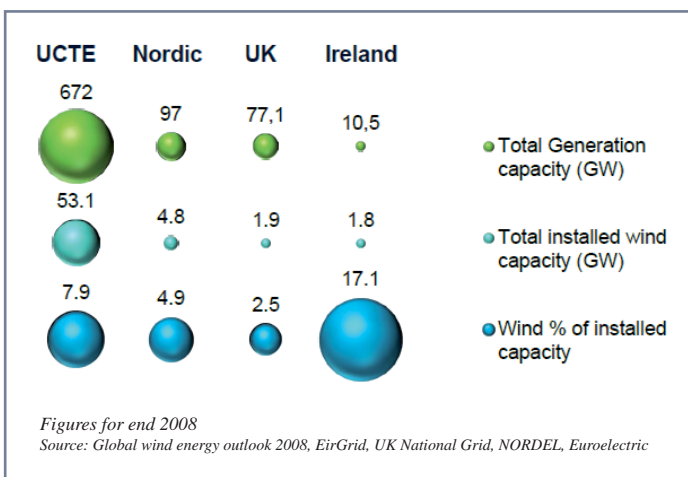
The “Joint Workshop NEPP and IEA (Wind Task 25)” was held at KTH, Stockholm on 4 April 2011. The main speakers were three experts from the IEA work group on design and operation of power systems with large amounts of wind power. The audience was representatives from the NEPP project and the Swedish industry.

The Irish power system is rather small, and with weak interconnections to Great Britain. Most of the balancing of wind power in the Irish system must be done in thermal generators. Nevertheless, the Irish system already has a large share of wind power, and the discussion is not whether the system can manage situations where wind power account for up to 50% of the instantaneous power, but what technical adaptations are necessary to manage shares between 50-80%.

As in the Nordic countries, the power systems in USA only have a small share of wind power so far (a few per cent of the annual electrical energy supply). In order to increase the share of wind power, it is considered vital not only to investigate how to provide the technical flexibility to manage the balancing, but also to study how the electricity market should be designed in order to make sure that the existing physical balancing capacity is available to the system.

Wind Power Dispatch in Ireland

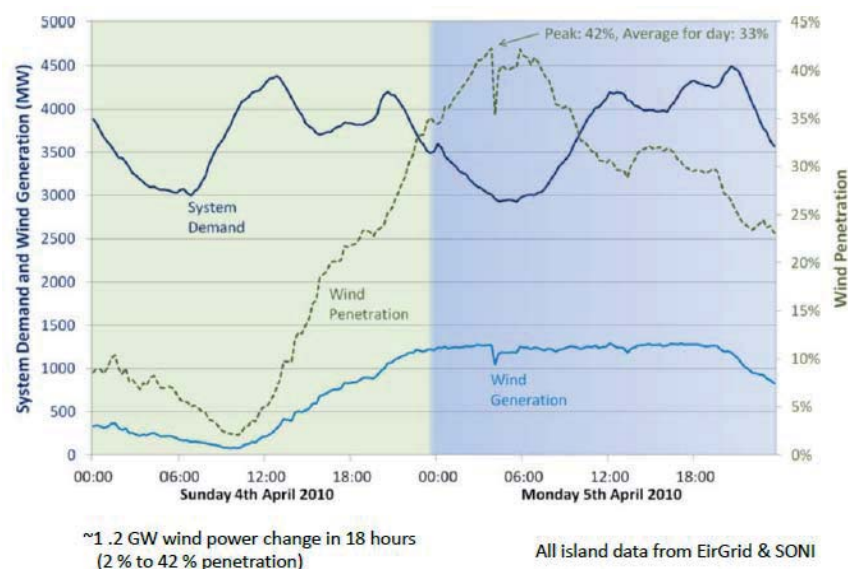
The power system in Ireland, including both the Republic of Ireland and Northern Ireland, is an interesting example of how power systems can manage large volumes of wind power. The Irish power system is comparatively isolated, because the interconnections to Great Britain are up to now weak. The power system is dominated by thermal power plants; hence, it does not have as good technical conditions to balance variable electricity generation as for example the Nordic power system with its large share of hydro power. Nevertheless, wind power in Ireland has been expanded rapidly in a short time—the installed capacity in the Republic of Ireland was less than 100 MW in 1997 and has increased to about 1400 MW in 2010. According to Professor Mark O’Malley from University



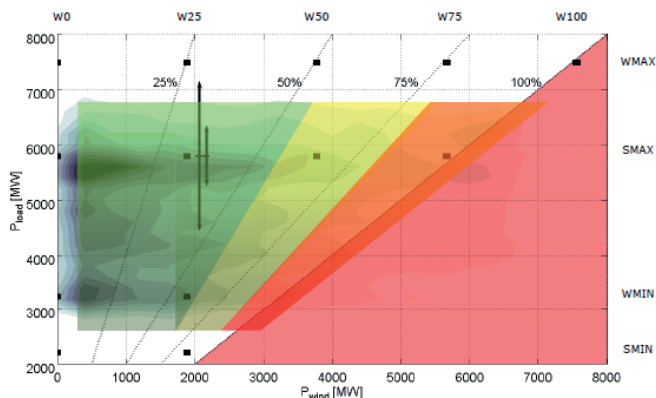
College Dublin, the Irish power system probably has the largest share of wind power in the world.

Already today, the Irish power system from time to time has to manage high wind power penetration. In 5 April 2010, wind power accounted for in average 33% of the system total demand, with a peak at 42% early in the morning.

The report “All Island TSO Facilitation of Renewables Studies” from the system operators in the Irish power system (EirGrid and SONI) has studied which dispatch cases the system can manage in year 2020. The judgment in the report is that there are no problems to manage up to 50% of the instantaneous power being generated by



wind power. However, if wind power accounts for about 50–80% of the power generation then the system will face increasingly critical technical issues, and to manage the upper part of this range major adaptations of the power system are necessary. According to the study, going beyond 80% wind power is not possible.



Wind power dispatch in USA

In USA there is neither a national power system nor a national electricity market. The power system is divided regionally with quite varying physical conditions and partly different market designs. The possibilities to accommodate large volumes of wind power are thus differing from region to region. In order to study issues concerning wind power integration, a large number of players in both USA and Canada have formed the Utility Wind Integration Group (UWIG) with a commission to critically analyse wind power technology. According to J. Charles Smith from UWIG, the current major challenges are congestion management, minimum load problems, wind power influence on pricing, the possibilities of wind power to supply ancillary services, and the concern about reliability of supply as wind pushes out other base load units. A number of studies have been carried out to investigate how these issues affect the dispatch of the power system.

The dispatch in three areas was presented at the seminar: Texas (ERCOT), New York (NYISO) and the Midwest (MISO). In New York, it is decided in the day-ahead market which units need to be committed in order to maintain appropriate security of supply. This so-called reliability unit commitment is based on forecasts of load and wind power generation. The real-time dispatch is carried out by the system operator, based on wind power forecasts for the next eight hours divided in 15 minutes intervals. Normally the

system operator will allow wind power plants to generate their maximum output, but if necessary the system operator can instruct wind power producers to curtail some generation. A similar system is used also in Texas. In the Midwest, a system will be introduced during 2011, where wind power is treated as conventional power plants. In this system, there is a penalty for differentiating more $\pm 8\%$ from accepted bids.

Research in USA concerning balancing of wind power

Michael Milligan from the National Renewable Energy Laboratory (NREL) in USA presented the background of on-going research about balancing wind power and other varying generation (for example photovoltaics). It was emphasised that the capability of the system to balance wind power is depending both on technical issues and of institutional factors.

The technical issues concern the need to make sure that there is sufficient flexibility in power plants as well as in the transmission system. Among the technical issues that are considered the most interesting in USA are alternatives for the generation mix (i.e., investment in fast response power plants as for example gas turbines, diesel generator sets and pumped hydro), the possibilities of wind power and photovoltaics to provide regulation, increased flexibility on the demand side, and the possibility to use electric vehicles for regulation.

The institutional factors are about creating a market design such that the physical flexibility really can be used. These questions have received increased attention and are considered very important for a large-scale expansion of wind power in USA. Among other things, it is studied whether there is a need to change the transmission protocols

and scheduling for transmission between different parts of USA. Another interesting issue is the need for new markets, for example fast energy markets (markets with shorter delay time from bid to delivery, which in practice means markets for regulation capability) and markets for ancillary services. It is also investigated which mix of different types of reserves (fast and slow, spinning and non-spinning, etc.) that is most efficient and how wind power forecasts can be utilised more efficiently.



For further information:
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