

The balancing stress-test

To avoid power outages, electricity demand needs to balance with electricity supply at all times. This is a tricky task as both demand and some forms of supply fluctuate throughout any day, over a week and between the seasons.

For comparison, today's average electricity consumption in the Republic of Ireland is 3 GW and in pathways with high levels of electrification of the system in 2050 average electricity consumption reaches up to 9 GW. The output from 9 GW of onshore wind, the maximum level assumed in the 2050 Calculator, could vary between 0 GW and 9 GW.

Significant additional interconnection, demand shifting and storage requirements would be needed. For example, the existing interconnectors between Ireland and England total 0.8 GW and the Turlough Hill pumped storage facility has a capacity of 300 MW. The scale of balancing systems required may involve the construction of about 2 GW of additional interconnection from Ireland to Europe and new storage systems able to absorb a further 5 GW.

The 2050 Calculator includes a 5-day 'stress-test' which models the impact of a period of cold temperatures and low winds, in order to understand the scope of the balancing challenges

during such adverse weather conditions. It is assumed that over a 5-day period the Irish temperature drops to below zero which increases heating demand (to a degree that depends on buildings' insulation levels). It is also assumed that the output of both onshore and offshore wind drops to 5% of installed capacity, and solar generation levels are below 80% of average output. Each 2050 pathway which is selected by a user generates a different electricity balancing challenge, and the 5-day stress-test indicates how much of the total capacity of the electricity network is used.

If the chosen pathway exceeds 100% of that capacity then the Calculator contains 2 further options:

1. The user can increase the level of storage, demand shifting and interconnection.
2. The Calculator computes the capacity of backup generation required to cover the electricity shortfall, assumed to be unabated gas-fired power stations.

Interaction with other choices

The renewable technologies chosen (in particular onshore wind, offshore wind and wave power), the degree to which heating is electrified, and the number of electric cars chosen under the transport option determine what the requirement for back-up generation is and how much demand shifting is possible.

Figure 39: The stress-test assumes that there could be a complete drop in wind during 5 cold winter days. The graph to below shows the total output of all wind capacity in Ireland (including Northern Ireland) in 2015, with a five day lull in wind visible during the second week of June. Data are provided every 15 minutes by eirgrid.com.

