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The Incentive to Invest in Thermal Plants in the Presence of Wind Generation

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Investment in thermal plants is critical for the reliability of electricity systems, especially in countries facing a large renewal of their electricity generation portfolios. As the share of intermittent renewables – and especially wind – increases, thermal plant flexibility is at a premium.

The analysis of electricity systems around the world suggests that the returns to thermal plants will decrease with large amounts of wind (see Traber and Kemfert, 2011 for Germany). Garcia *et al.* (2012) use a stylised theoretical model to show that designing renewable energy incentives without affecting investment in conventional generation is challenging.

To determine how power plants' expected profits change as wind generation capacity increases, we compare the revenue and cost streams of three types of thermal generation plants: a coal plant, a combined cycle gas turbine plant (CCGT) and an open cycle gas turbine plant (OCGT). We simulate cost and revenue streams in the Irish Single Electricity Market (SEM) for two scenarios: one with the average amount of wind installed on the system in 2011 (1889MW) and the other with 3000MW of installed wind capacity.

Our results show that current market rules might favour less flexible plants, creating more difficulties in balancing the market in the future. In the presence of increasing wind, the profits of baseload plants decrease for two reasons. First of all, more wind decreases the shadow price and therefore on average decreases the profits of baseload plants at times of generation. Second, increased penetration of intermittent sources of electricity increases the number of times a generator starts up to follow the variable wind load. There are technical constraints that must be met, in addition to constraints to ensure reliability of the system. These tend to favour less flexible plants, since they reduce the number of times these plants turn on or off with respect to more flexible plants. When

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3000MW of wind capacity are installed on the system, a natural gas CCGT plant loses about 3.5% in profits with respect to a scenario with 1889MW of wind. A less flexible coal plant loses only 2.2 per cent.

This suggests that under certain market rules, the incentive might be to invest in less flexible plants with more wind, a result that would make the electricity system more difficult and costly to balance in the long run.

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