

# **Impacts of intermittent renewables on electricity generation system operation**

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**Abstract—** All power generation technologies leave their particular imprint on the power system that they belong to. Wind and solar power have only recently reached significant levels of penetration in some countries, but they are expected to grow much during the next few decades, and contribute substantially to meeting future electricity demand, see e.g. European Commission (2011). Wind, photovoltaic (PV) solar and concentrated solar power (CSP) with no storage have non-controllable variability, partial unpredictability and locational dependency. These attributes make an analysis of their impacts on electricity generation system operation and design particularly interesting. This paper reviews how a strong presence of intermittent renewable generation will change how future power systems are planned, operated and controlled. The change is already noticeable in countries that currently have a large penetration of wind and solar production. The mix of generation technologies, and potentially market rules, will have to adapt to accommodate this presence. Regulatory adjustments might be needed to attract investment in "well adapted" technologies. This paper identifies open issues that deserve further analysis from a technical, economic and regulatory perspective.

**Index Terms—** Wind power, Intermittency

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