***Is The Transition To Zero Carbon Power Economically Feasible? The Case Of A 70% Variable Renewables Power System***

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## Overview

## Ambitious national renewable electricity targets in Europe have resulted in countries without significant hydro resources, such as Denmark, Ireland and Spain, aiming to source over 70% of their annual electricity consumption from variable renewables by as early as 2030. A high share of wind and solar power in the electricity system introduces numerous technical and operational issues, as well as raising questions about the financial viability of generators in the current electricity market. The objective of this paper is to examine whether such high shares of renewable electricity are economically feasible, under the current electricity market design and technical constraints, and the policy implications.

## Methods

## We apply a scenario-based, system-scheduling approach, using the unit commitment model Backbone. System security and renewables curtailment under various renewable generation and electricity load profiles and scenarios are considered, as are market prices and net present values of different technology types in 2030.

## Results

## We find that high shares of variable renewable electricity in isolated systems such as Ireland could lead to curtailment of up to 15% but that additional interconnection, battery storage and dynamic load behaviour reduce this. Marginal prices fall to near zero in periods of high generation of renewable electricity. We estimate that this, combined with curtailment, may lead to insufficient revenues from the electricity price alone in existing electricity markets to cover the costs of generation for many renewable and conventional power plants.

## Conclusions

## The design of electricity markets needs to ensure additional revenue streams from capacity markets and tariffs designed for system services incentivise investment in system security and make future decarbonised electricity systems economically feasible.

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