# *DEMAND RESPONSE AND CURTAILMENT IN AN ISOLATED SYSTEM WITH UP TO 80% VARIABLE RENEWABLES*

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## Overview

National renewable electricity targets are being urgently revised upwards to tackle greenhouse gas emissions. As a result, relatively isolated systems reliant on variable renewables, such as wind and solar power, are soon facing into technical and financial issues which have yet to be fully resolved. The objective of this paper is to investigate the impact of flexible demand on curtailment, operational security, and the economic implications for electricity generators and consumers. The island of Ireland is used as a pertinent case study, where the latest 2030 target aims for up to 80% of electricity consumed on the island to be provided by renewable sources, predominantly wind power.

## Methods

The system scheduling and investment optimisation model, Backbone, is used to assess the impact of different flexible load types on curtailment levels in the Irish power system. The model is run at hourly intervals for the year 2030. Transport and heat loads are broken down between industrial, commercial and residential categories, each with their own demand profiles and demand response characteristics. Scenario analysis is undertaken to consider the additive impact of introducing synchronous condensers, medium-duration battery storage, and various flexible loads, compared to a base scenario in 2030.

## Results

Preliminary results indicate that with more wind and solar installed capacity, up to 75% renewable electricity post-curtailment is achieved in the base case. This gradually increases with higher levels of storage and flexibility options. Flexible loads reduce periods of strain on the system negating the need for high-cost conventional plant and reducing instances of very high prices. Curtailment of wind power is reduced as loads shift to absorb near-zero prices. Demand response also offers an important source of contingency reserves, particularly variable in isolated systems to ensure the system is equipped to deal with sudden changes in demand or supply.

## Conclusions

A flexible share of residential and commercial demand at any point in time provides important additive benefits to system security and reduces curtailment, which enables more wind and solar generated electricity to reach consumers. This has implications for the value of demand response, and a need for appropriate incentivisation measures, to assist in ensuring affordable energy for consumers and the economic viability of generating units in systems with a very high share of variable renewables.

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