# The impact of intermittency

A presentation to IEA GHG/ Imperial College

11 November 2009

# Agenda

1. About Pöyry
2. Introduction to study
3. Thoughts on an intermittent world

# Pöyry Plc – global consulting and engineering company

# Pöyry Energy Consulting


- Pöyry offices
- Pöyry Energy Consulting offices

**Over 250 energy market experts in 15 offices across Europe:**

| | | |
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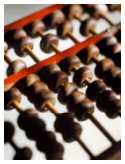
| – Copenhagen | – Düsseldorf | – Helsinki |
| – London | – Madrid | – Milan |
| – Moscow | – Oslo | – Oxford |
| – Paris | – Stockholm | – Stavanger |
| – Vienna | – Villach | – Zurich |

Strategy

Business Operation



Valuation & Financing

Sustainability

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# Study objectives

*'How could the impact of intermittent generation, required to meet targets for renewables and decarbonisation of generation, affect the wholesale energy markets in GB and Ireland?'*

**Specific areas of investigation**

- Market prices
- Plant operation
- New thermal generation
- Wind revenue
- Reserve and response
- Interconnection and transmission
- Market arrangements
- Security of supply

# Study summary

## Overview

- Almost £1m budget
- Nov 2008 – May 2009
- 5 Workstreams
- 4 Steering Group meetings
- 2 major presentations
- Final report

## Sophisticated computer modelling…

- 2.8 million wind records
- Each model run generates 50 million records, 840,000 prices and a 1.5GB database
- A total of 150GB of data generated from the study

## Study membership

**6 Founders**

- Centrica
- DONG
- EirGrid
- ESB/I
- National Grid
- RES

**10 Members**

- Bord na Mona
- Committee on Climate Change
- DECC
- Bord Gais
- RWE
- EDF Energy
- Premier Power
- Scottish Power
- CER/NIAUR
- Premier Power
- SWS Energy

- 4 government bodies
- 3 grid operators
- 4 established players/ incumbents
- 2 wind power operators
- 3 new entrants

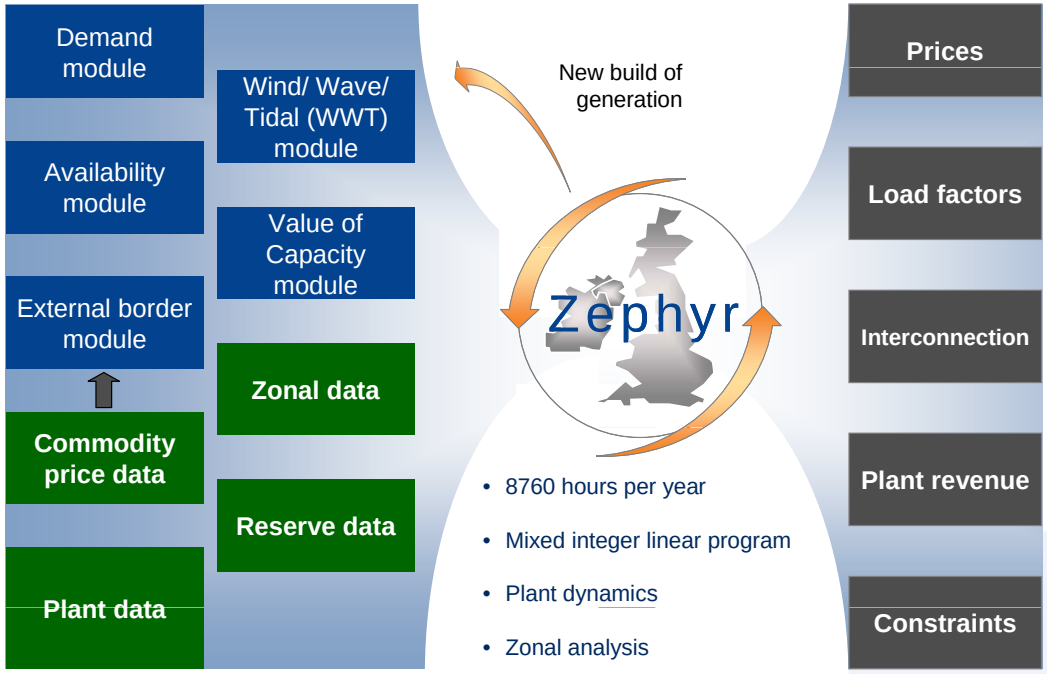
# Summary of modelling

Zephyr has been designed specifically to answer the key questions about how intermittency could affect the GB wholesale market

## Principles

- Detailed underlying wind data
  - Hourly data for 8 years for 36 sites
- History as basis
  - Wind, availability and demand
  - 8 historical simulations for each future year
- Zonal analysis
- Value of capacity
- System security standard

## Platform



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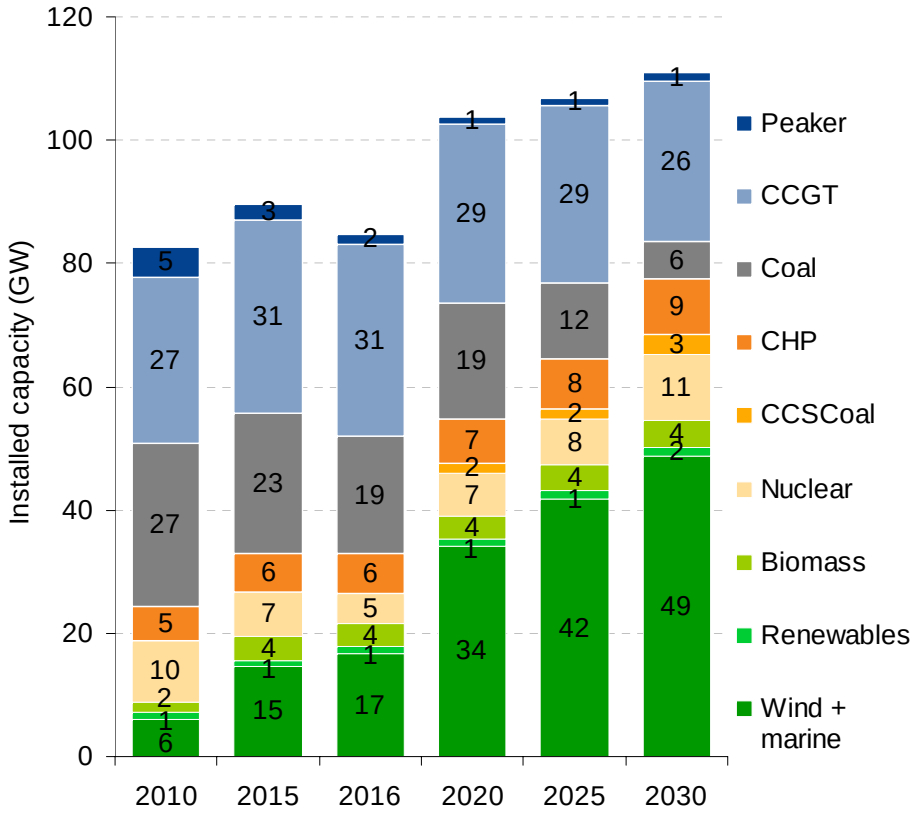
# Summary of ‘Core scenario’

The study was focused around a Core scenario. It does not represent a base case but instead provides a ‘stress-test’ with a high percentage of generation from renewables.

## Installed capacity assumptions in GB




## Fuel and demand assumptions

- Demand was assumed to grow at around 0.4% p.a.
- Oil price ~$70/bbl
- Coal price ~$70/tonne
- Carbon price ~€37/t$CO_2$
- New build of CCGT and coal is market determined
- New build of renewables, nuclear and coal CCS is ‘non-market determined’

# The study assumed wind generation build patterns across the UK and the ROI

Hourly historical wind speed data for each region was used to simulate wind generation

## Installed capacity by region: 2020


GB Capacity: 32.7GW

SEM Capacity: 6.1GW

## Installed capacity by region: 2030

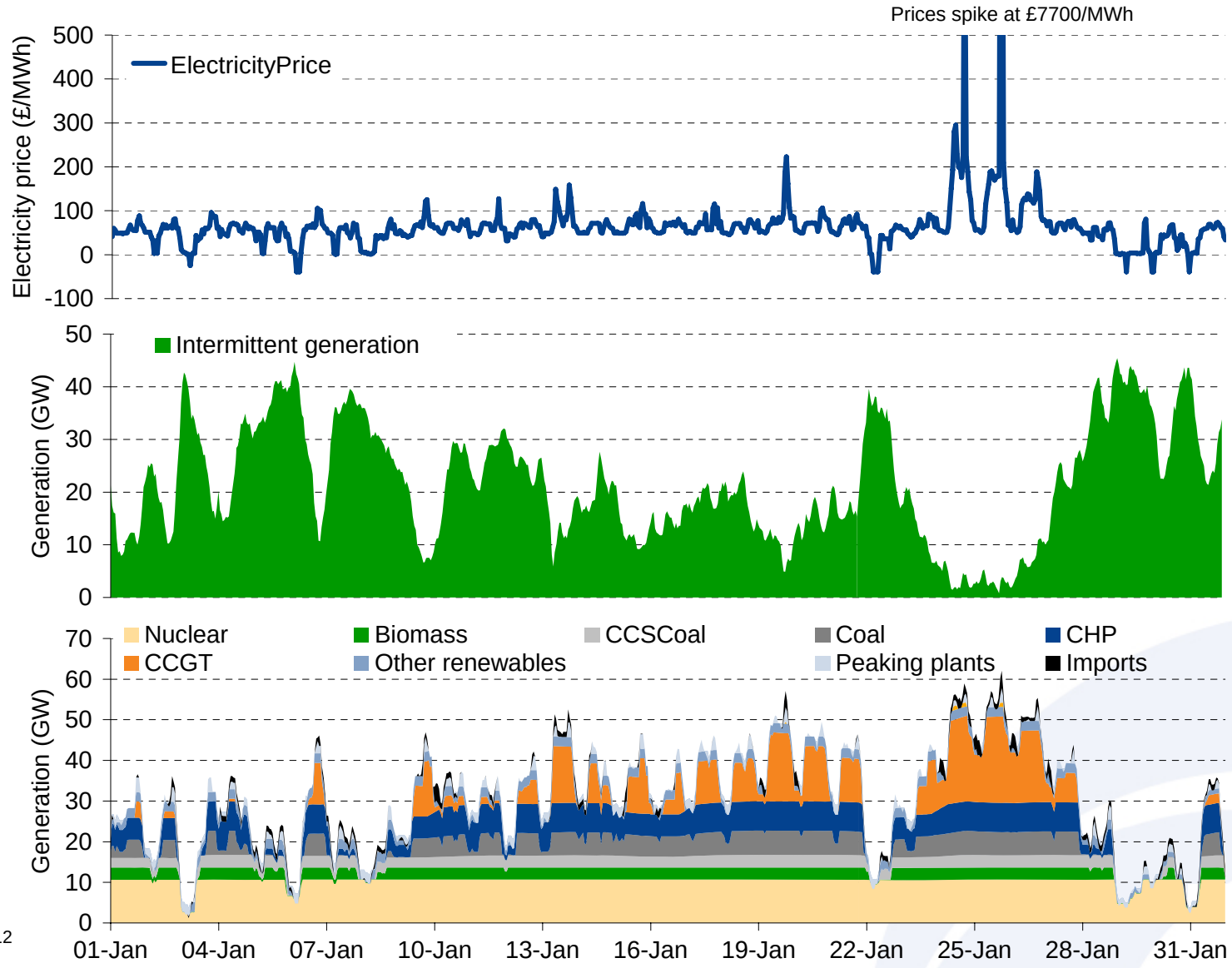

GB Capacity: 43.1GW

SEM Capacity: 7.9GW

Installed capacity (MW):

# January 2030 (based on 2000 data)

The model allows highly detailed simulations of future years based on historical weather data. The example below shows January 2030 based on actual wind data from 2000

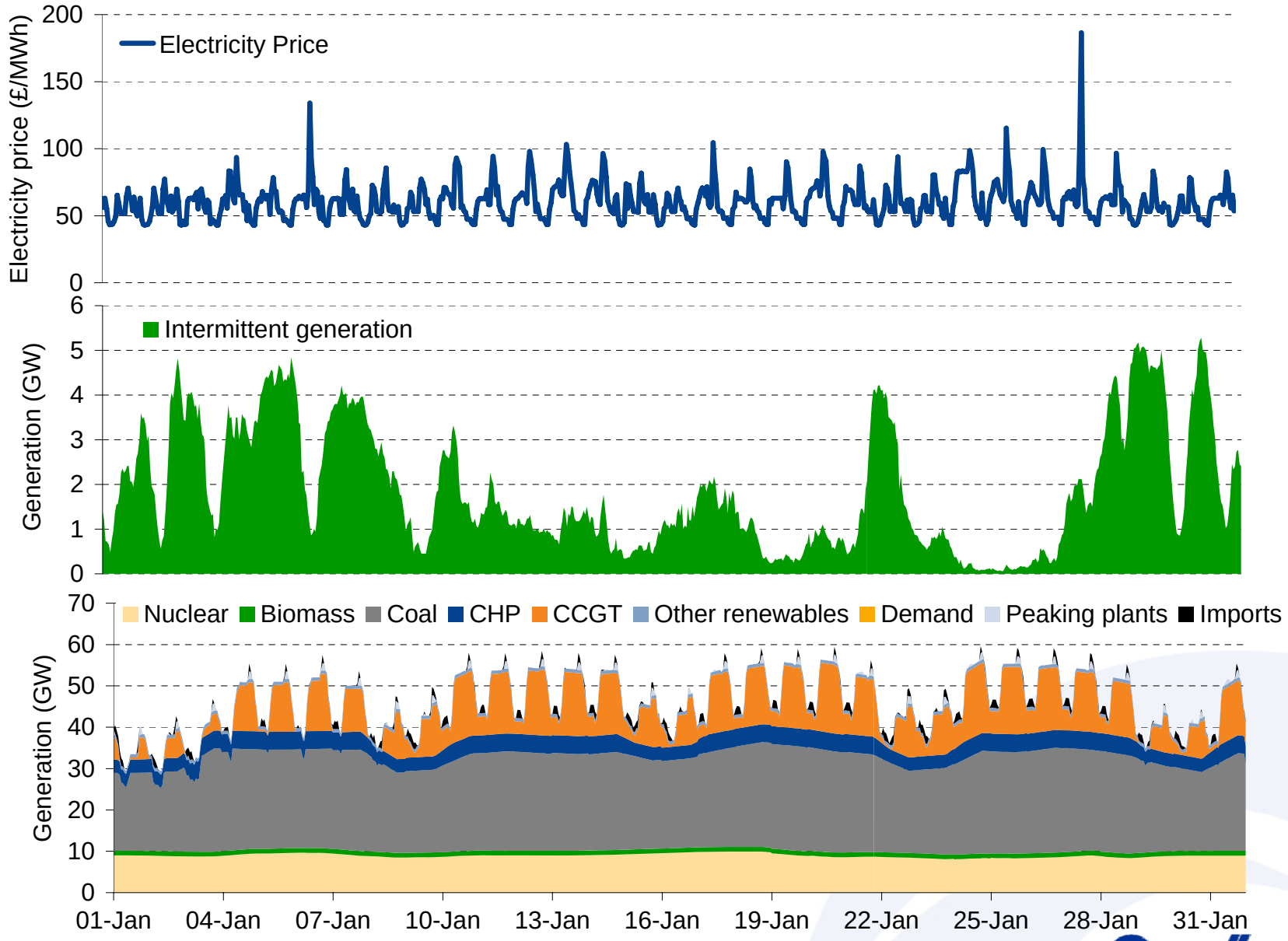



Prices may become highly volatile, and driven increasingly by wind generation

Wind generation is very variable, leading to periods of very high generation, and periods of very low generation

Thermal plant will have to operate in a different manner, with lower load factors and higher risk

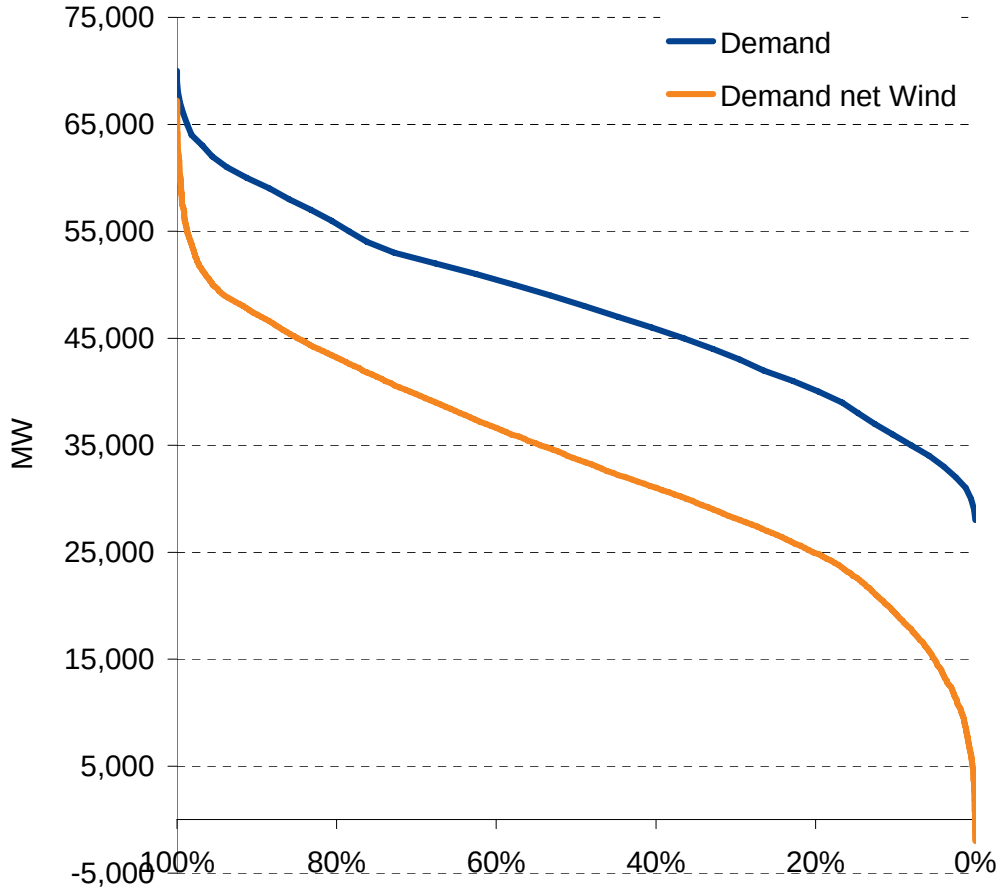
# GB – January 2010 (based on year 2000)



# Understanding the ‘demand net wind’

## Operating space for thermal plant will decrease

### Demand and demand net wind duration curve for GB in 2030

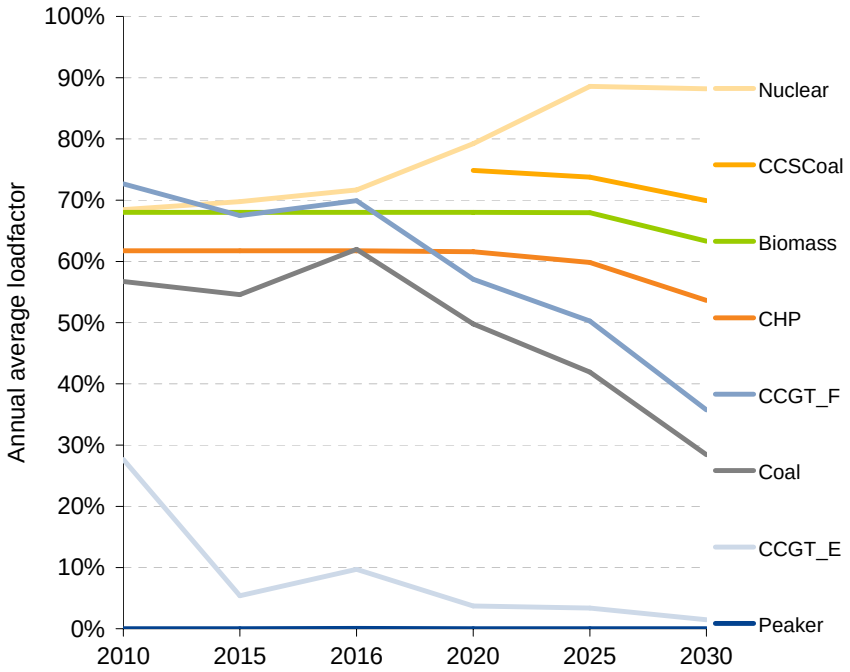



- At present, there is a continuous requirement of around 30GW
- In the core scenario demand net wind varies between 0-65GW
- Less need for base load generation

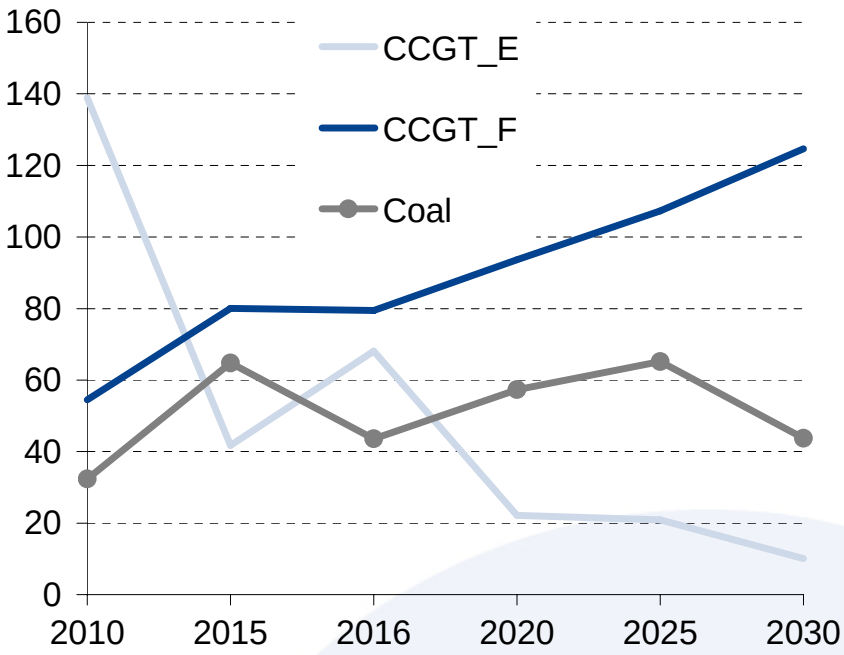
# Plant operation profiles will change radically

## Not only will thermal plant load factors be squeezed by intermittent and baseload generation, but operating regimes will change

### Load factor by plant type – GB




### Starts per year



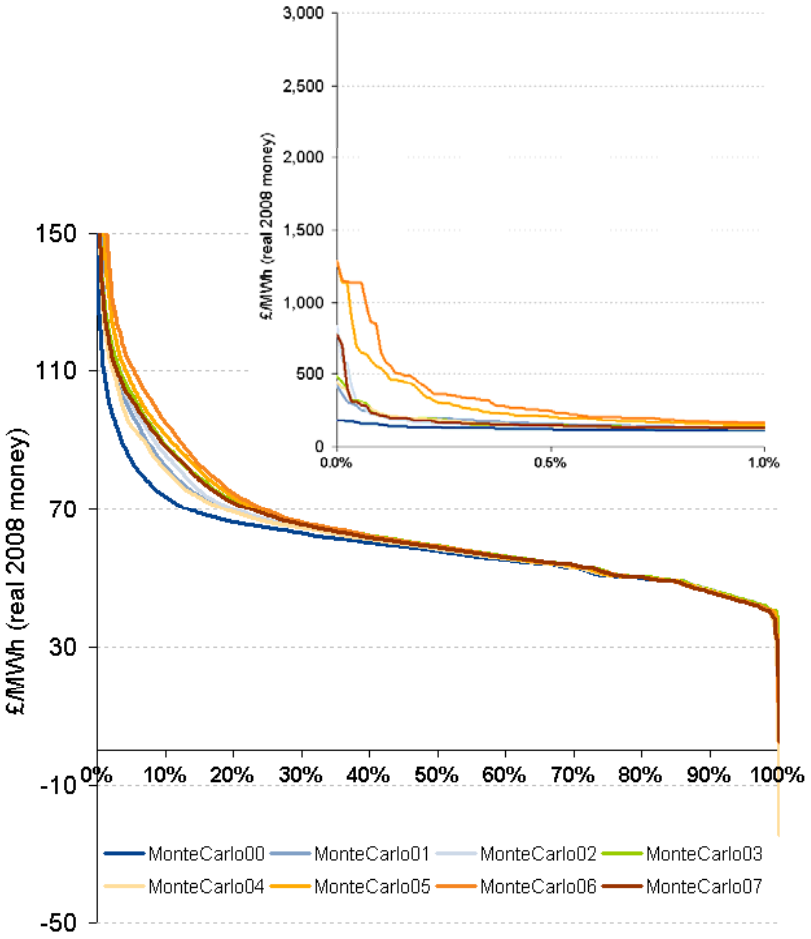



Data from Core scenario

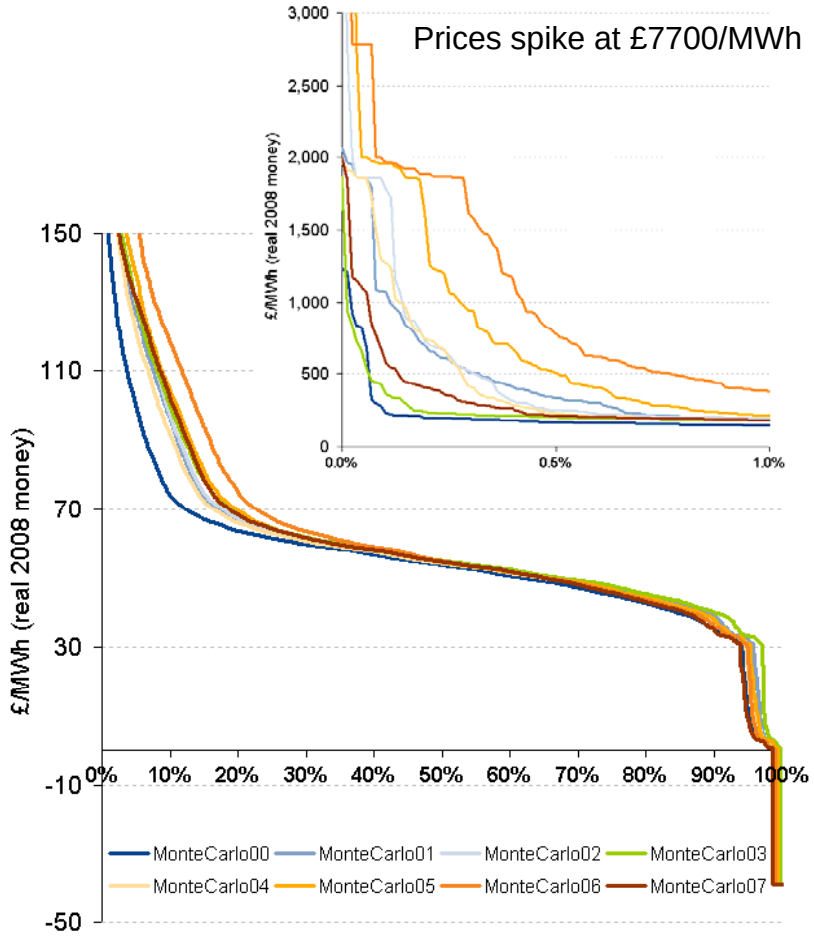
# Sensitivity of prices year on year

If security of supply is maintained, prices will become very peaky – with prices over £7000/MWh and less than zero by 2030

## 2020



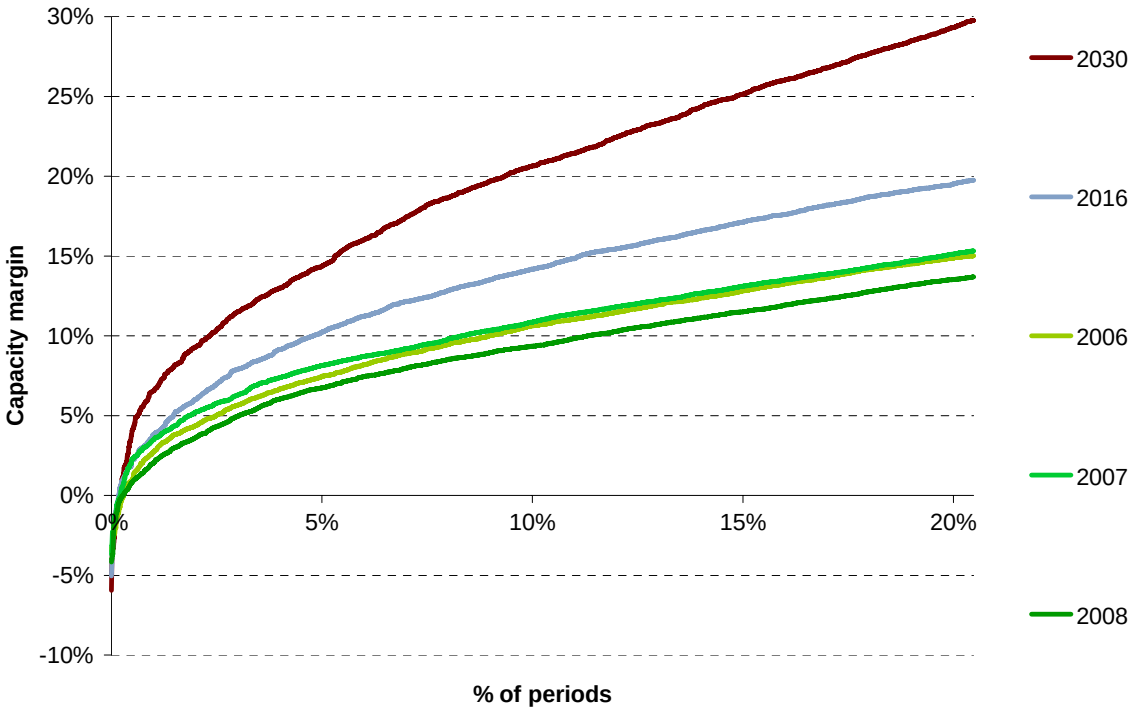

## 2030



# GB faces an investment conundrum

## Earning the returns below will become increasingly difficult, as the scarcity value has to be captured in a smaller number of hours

### Capacity margins in GB




- LCPD and (possibly) the IED will retire old mid-merit and peaking generation
- With a continuation of BETTA, the capture of capacity revenue will become more difficult
- Differences in outcomes between a BETTA and SEM market are stark



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# Summary

- A high wind world will look very different to currently

- The thermal system will flex in response to the wind
- Extremes will become more important
- Spiky prices
- Uncertainty and risk
- Changing operating patterns
- Investment conundrum in GB

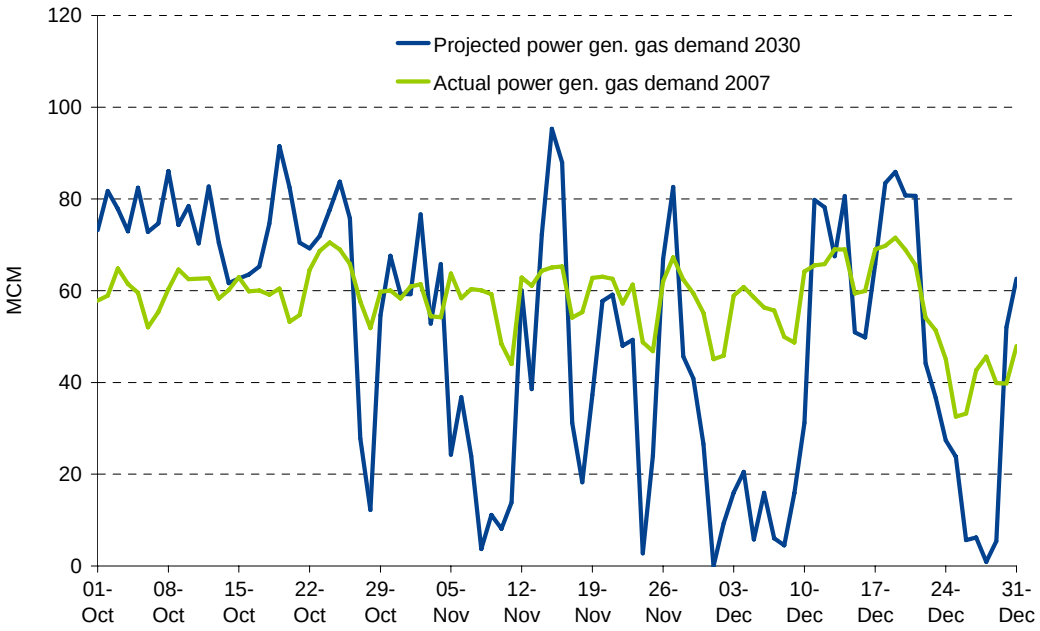
- Is CCS well suited to this environment?

- Potential effect on gas network?

# Gas intermittency project

A multi-client gas intermittency project began in September, investigating the implications on the gas network

## Daily gas demand




## Areas of investigation

- Market and investment
- Value of storage and flexibility
- System operation
- Regulation

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