

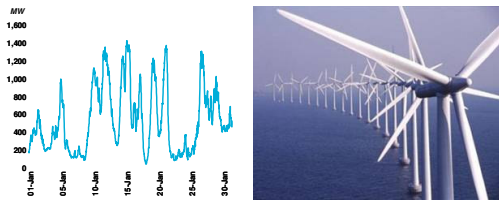
# System Balancing



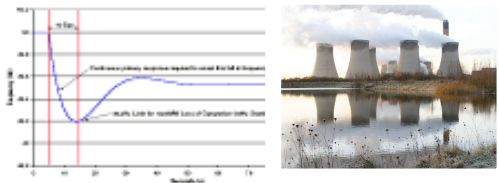
**Craig Dyke**  
**Strategy Development Manager**

# Balancing supply and demand

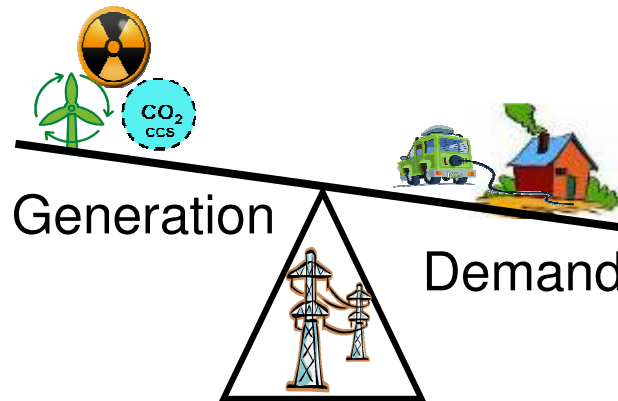
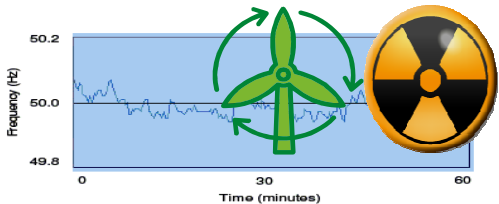
## Variable generation



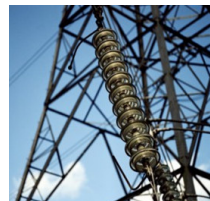
## Large generation



## Inflexible generation



## Smarter transmission



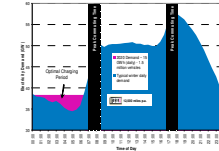
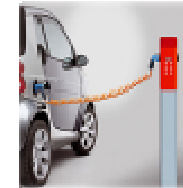
Smart zones  
HVDC  
Series compensation  
WAM

## Active distribution networks



Smart(er) grids & meters, energy storage

## Active demand



Time of use tariffs

## Distributed generation



## The four classes of balancing tool

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Flexible Thermal Plant

Storage

Demand Side Response

Interconnectors

2010

2020

2030

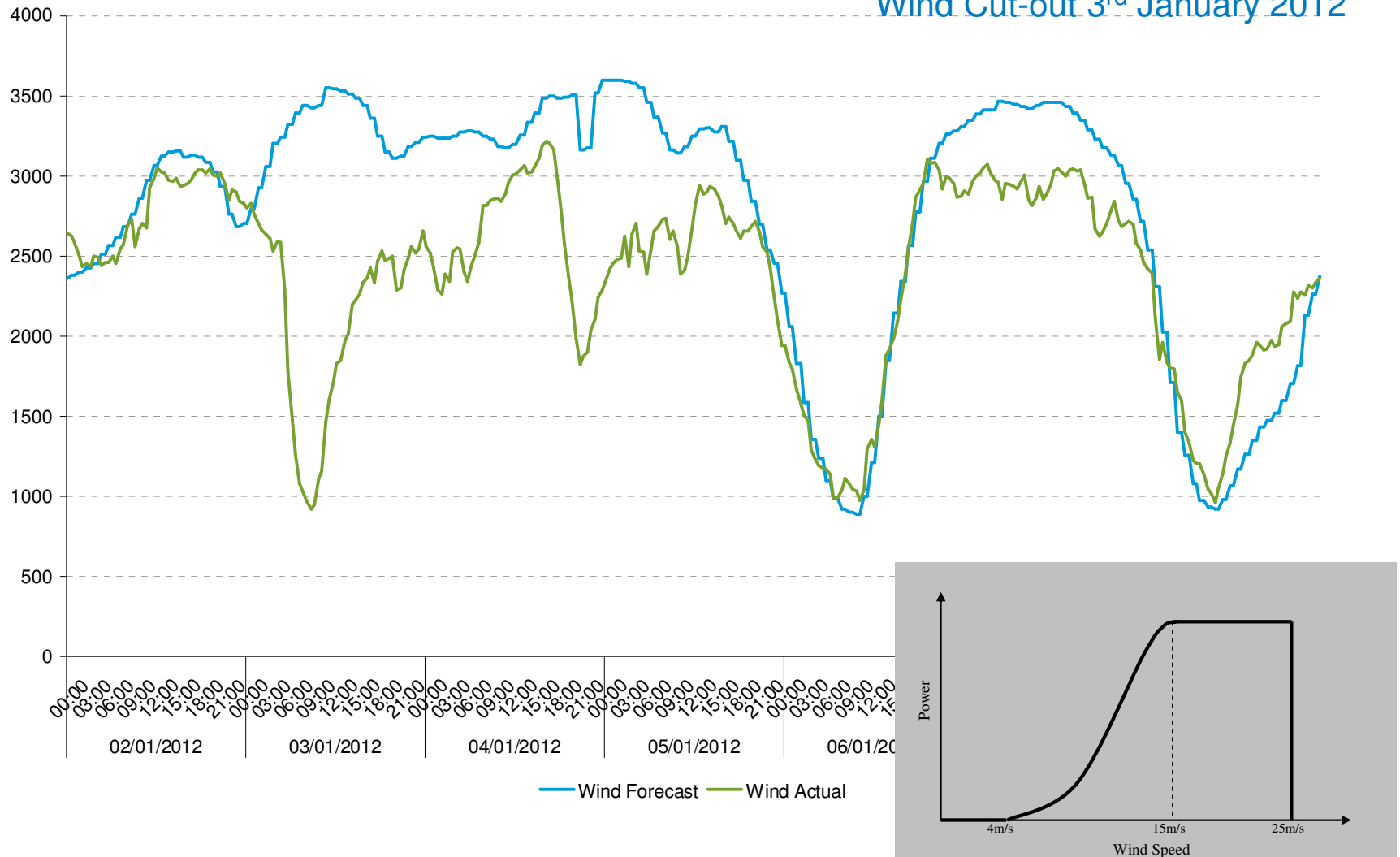
2040

2050

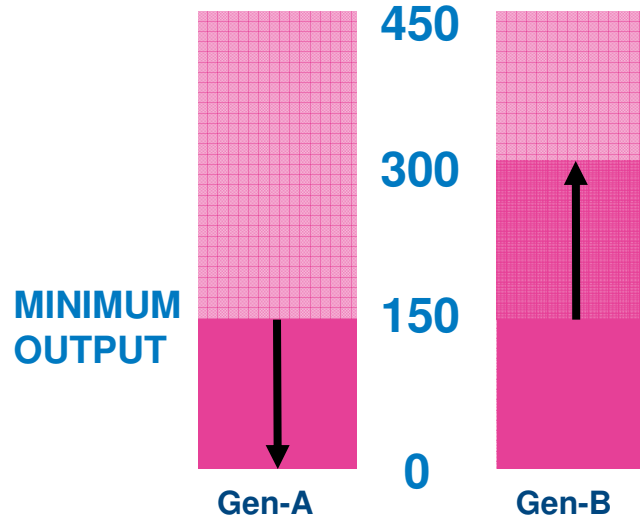
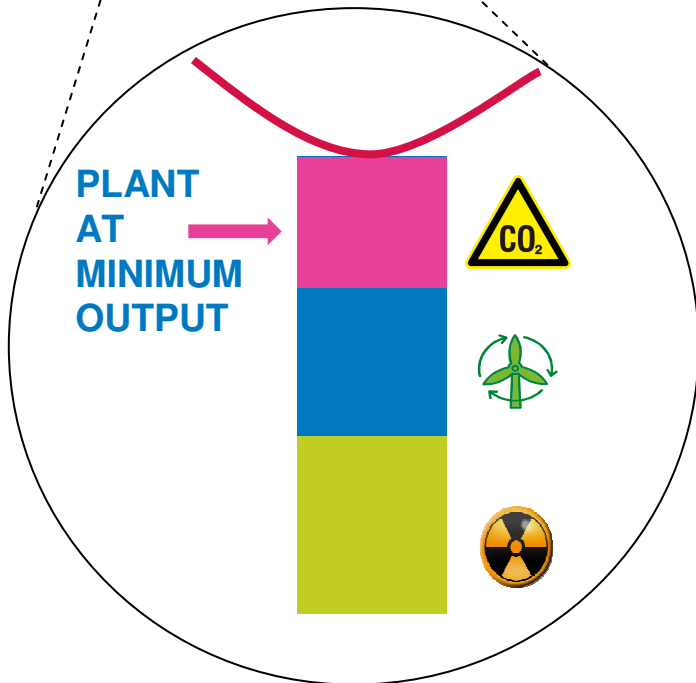
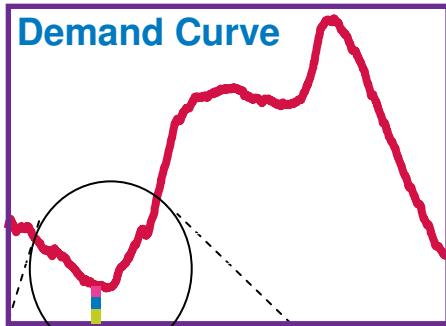


# When the wind blows too much

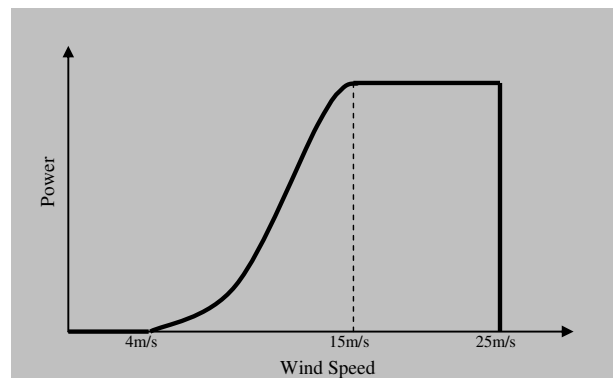
Wind Cut-out 3<sup>rd</sup> January 2012



# Wind - helping with balancing?



- Gen-A 150MW bid down (off)
- Gen-B 150MW offer up
- 150MW footroom released
- **Cost = 150MW Bid + 150MW Offer + Response Fee**



- Wind blowing – it will run
- Footroom opportunity
- High frequency response on wind
- **Cost = Response Fee**

## Expanding the balancing tools

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Flexible Thermal Plant

Storage

Demand Side Response

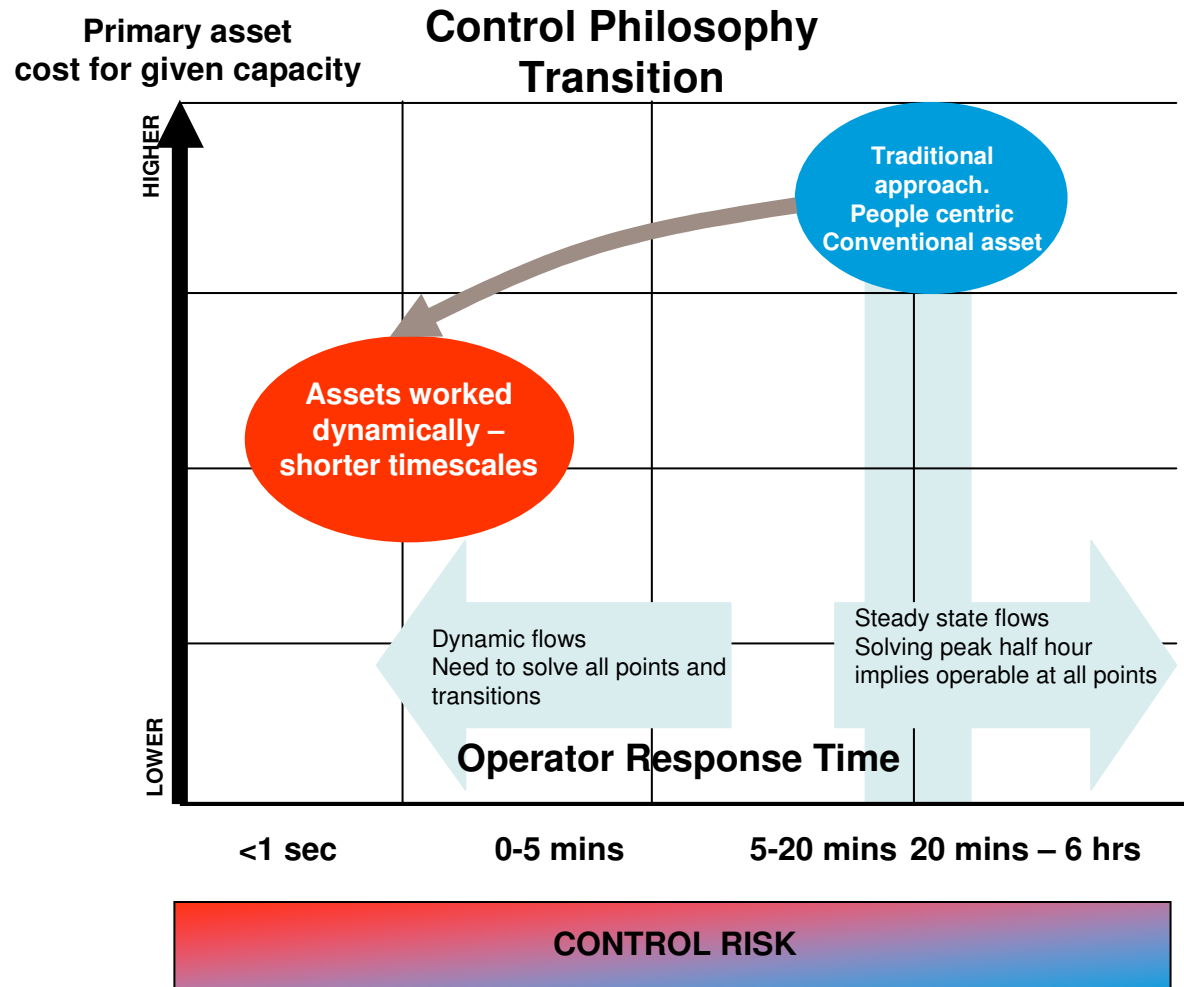
Interconnectors

Variable Generation

Inflexible Generation

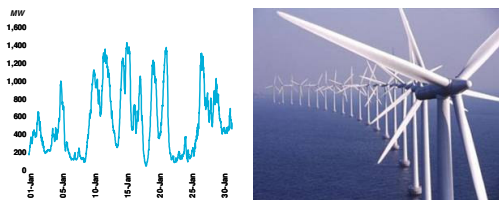
Innovation

# Control philosophy change

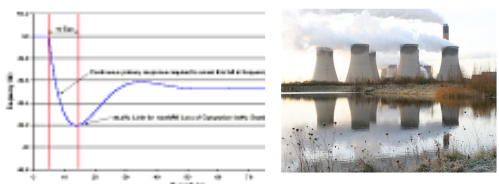


# Balancing supply and demand

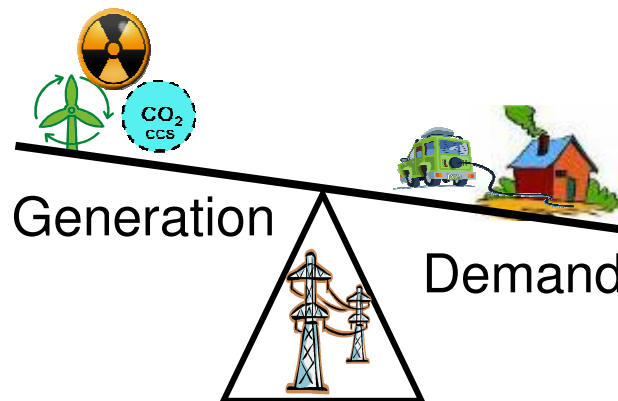
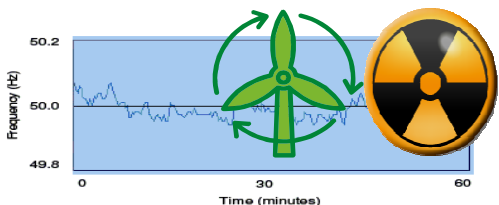
## Variable generation



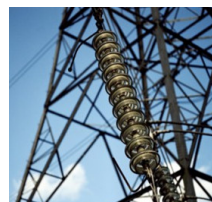
## Large generation



## Inflexible generation



## Smarter transmission



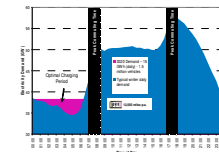
Smart zones  
HVDC  
Series compensation  
WAM

## Active distribution networks



Smart(er) grids & meters, energy storage

## Active demand



Time of use tariffs

## Distributed generation





# At the heart of the energy transformation...

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