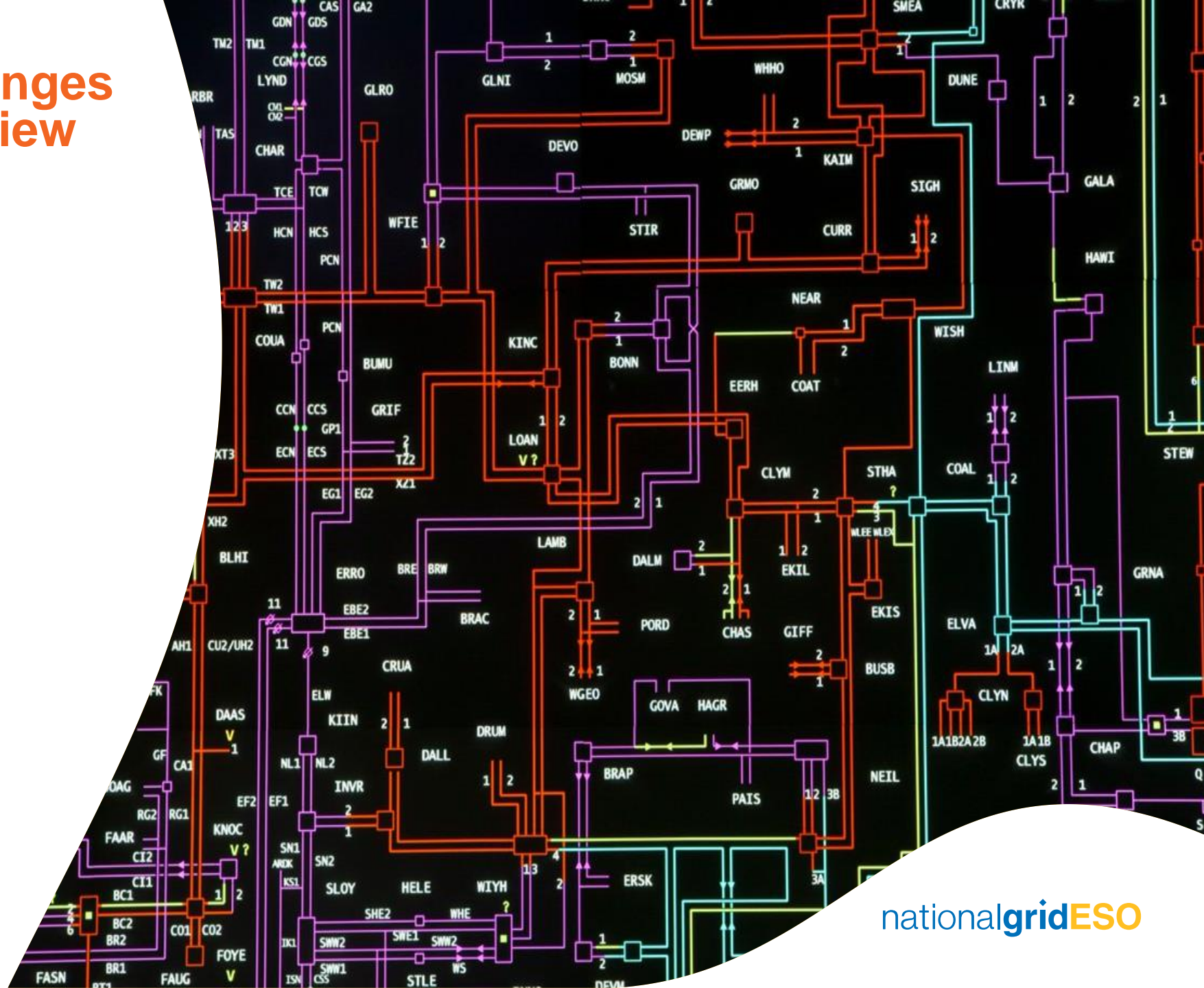


# Future Energy Challenges A System Operator View

Dr Cathy McClay

Head of Future Markets

National Grid ESO



# The energy landscape has been changing

2012

26GW



35GW



9.5GW



8GW



1.8GW



13GW

33GW

9GW

18.5GW

12.5GW

2017

# Drivers of change

**Decarbonisation**

**4 times**

Increase in all renewable capacity since 2010



**Decentralisation**

**3 times**

More distributed capacity connected than in 2010



**Digitalisation**

**12.3 mil**

Smart and advanced meters in homes & businesses in GB



# A Review of Summer 2018



**24 April**  
GB runs without coal for 76 hours



**6 May**  
Record solar output  
28.5% of gen



**27 June**  
Record peak solar output of 9.39GW



**13 July**  
GB passes 1000 hours without coal in 2018

# The future is uncertain

**Uncertain Demand**  
**3 to 11 million**

Electric Vehicles driving on our roads by 2030



**Uncertain Supply**  
**37 to 50 GW**

Of wind capacity generating on the system by 2030

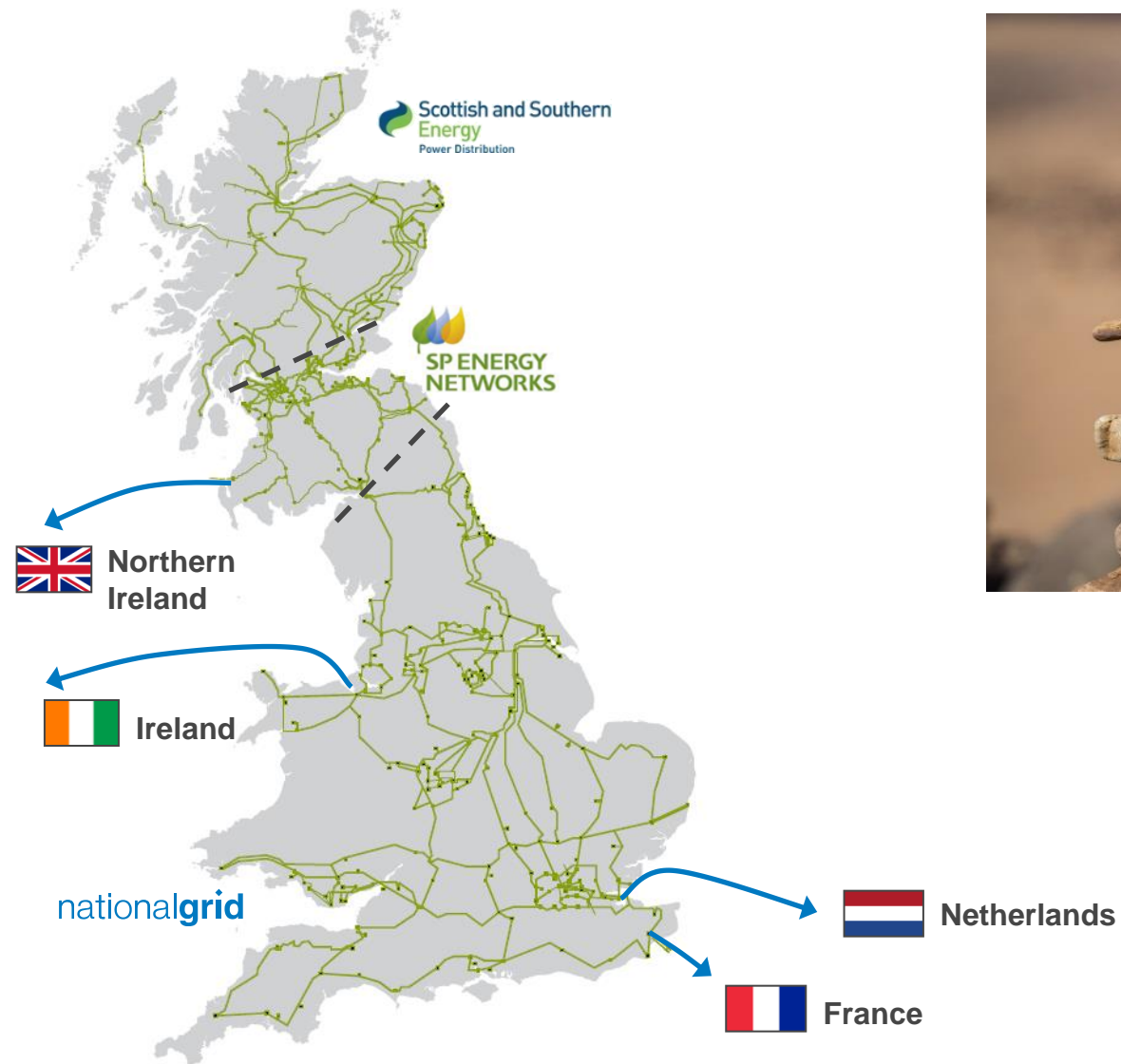


**Uncertain Markets**  
**10s to 1000s**

Of active energy suppliers across the country by 2030



# Role of System Operator



£1bn

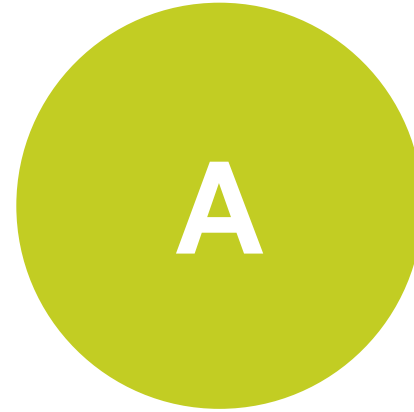
# Targets of System Operator



**50 Hz**  
**+/-0.5 Hz**



**+/-10% of**  
**nominal**



**No thermal**  
**overloads**



**Within limits to**  
**prevent**  
**disconnection of**  
**embedded gen**

# Impact on the transmission system

More generation connected to distribution system

Move from small number of large generators to smaller sources

Uncertainty on system increased

Dynamics of system changed

Requirement for more flexibility on the system

Changed understanding of security of supply

Sources of flexibility have changed

**Our old models and rules of thumb for managing the system are no longer valid  
Need improved modelling and analysis of the system for safe and economic management**



# Key Areas of Interest Include

Forecasting  
Demand

Modelling System  
Dynamics

Designing new  
balancing  
services

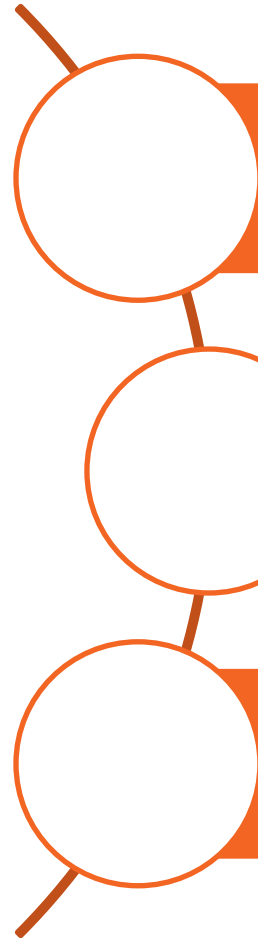
Tenders/Auctions  
for balancing  
services

System dispatch  
and control

Market design

Decision Making  
under uncertainty

# Summary

- 
- 1 The electricity system is changing rapidly and this change will continue
  - 2 The ESO needs improved modelling and analysis to manage the system economically and efficiently
  - 3 There are a large number of diverse and interesting problems to solve but progress to date has been promising