

Power Potential – a transformational project in a changing world

Fiona Woolf, CMS, London



The Trilemma of electricity market design

The “Trilemma”

Simultaneously juggling
three competing objectives:

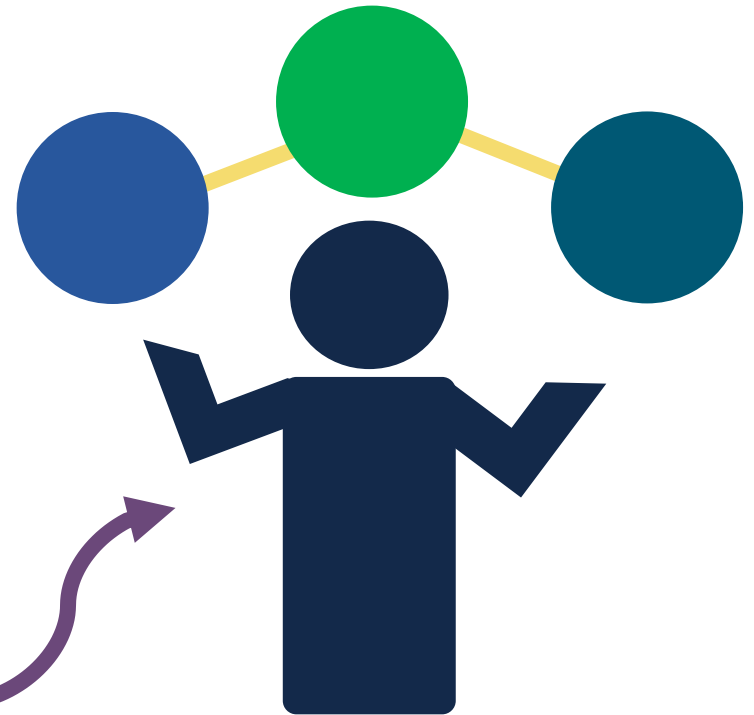
Reliability

Decarbonisation

Affordability

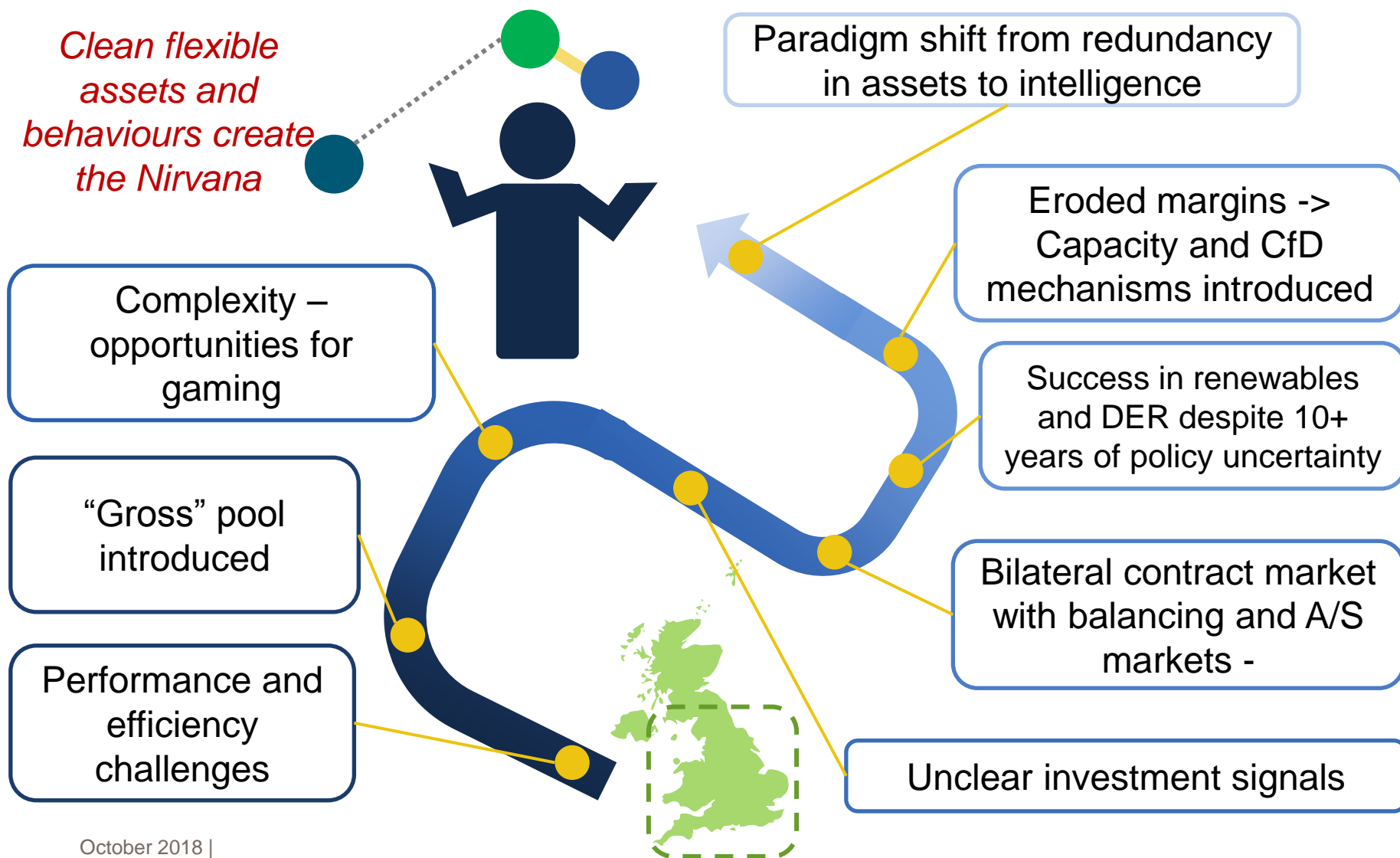
The Journey

Achieving the “Nirvana” of market objectives



Trade off v keeping all balls in the air

The long and winding road to Nirvana in England & Wales



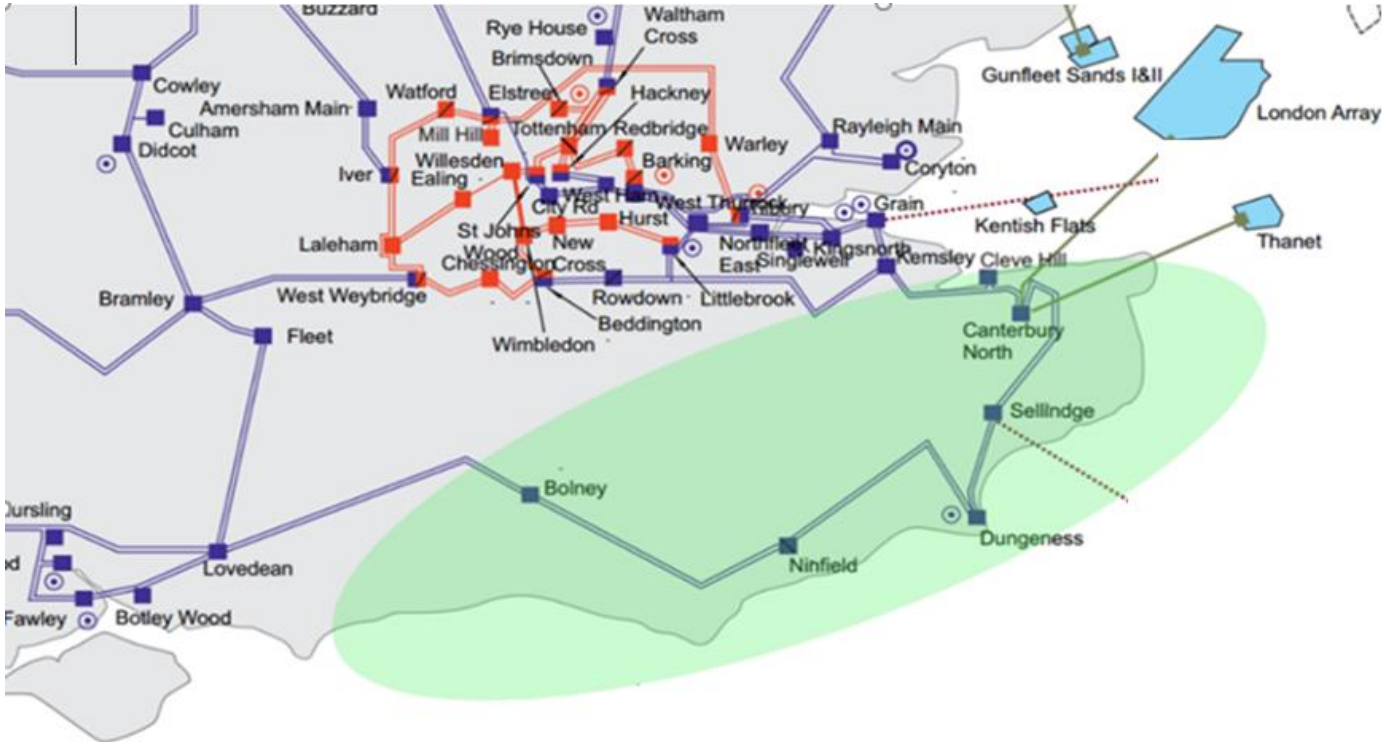
Global Transmission Expansion – Recipes for Success (2002)

- Deregulation of the power supply system called into question the best use scarce transmission capacity and how to create incentives for transmission expansion – successful use of the recipes was limited
- In 2002, distribution systems still regarded as infrastructure for one-way flows to consumers – distributed energy resources (DERs) were not regarded as an ingredient
- Chapter 3 looked into the store cupboard and regulatory incentive schemes to get more out of the system to minimise investment. The National Grid's response to the transmission services scheme (TSS) was the most successful in reducing the cost of congestion, balancing and certain ancillary services at that time – network, not market solution
- Some ancillary services were supplied through consumer response, but little thought has been given to searching further in the store cupboard for smaller scale resources
- Over a decade later, the academics began to write about it

Power Potential Unwrapped

- The Power Potential project is a world first trial in using distributed energy resources in distribution networks to provide dynamic voltage control to the transmission system – a combined technical, commercial and business solution
- Technical – it provides active power support for constraint management and system balancing
- Commercial – it creates a new regional reactive power market from DERs
- Business – involves the transition from a DNO to DSO business model
- A whole-system approach can be beneficial for everyone from network operators to generators to end consumers – proof of concept trial
- On the path to cleaner, smarter flexibility

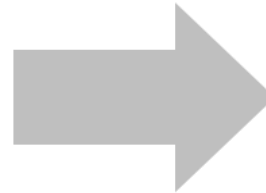
Area of focus



— 275 kV
— 400 kV

Using what is in the store cupboard

The Pantry of Design *Ingredients*



Each market should judiciously form design ingredients into a recipe based on their unique circumstances...



versus

The Bookshelf of Design *Cookbooks*



...rather than mix incompatible design ingredients from different recipes



Demonstrating approach & establishing its commercial viability

The principles are:

1. Market efficiency

- i. Level of stimulus to DER – promote participation
- ii. Efficient allocation of budget & in line with project budget

Examples:

- Reward the DER that is most effective
- Pay a fair price that reflects the need for investment to provide the service
- Avoid placing participants in an unfairly beneficial position going forwards

2. Operational

- i. Maintain system security by not utilising trial volume to secure system
- ii. Trials to follow operational profile requirements (natural system behaviour) for reactive power

3. Continuous review of applicability to business as usual – to provide projections for future use

4. **Market testing, fairness and accessibility are key to establishing viability**

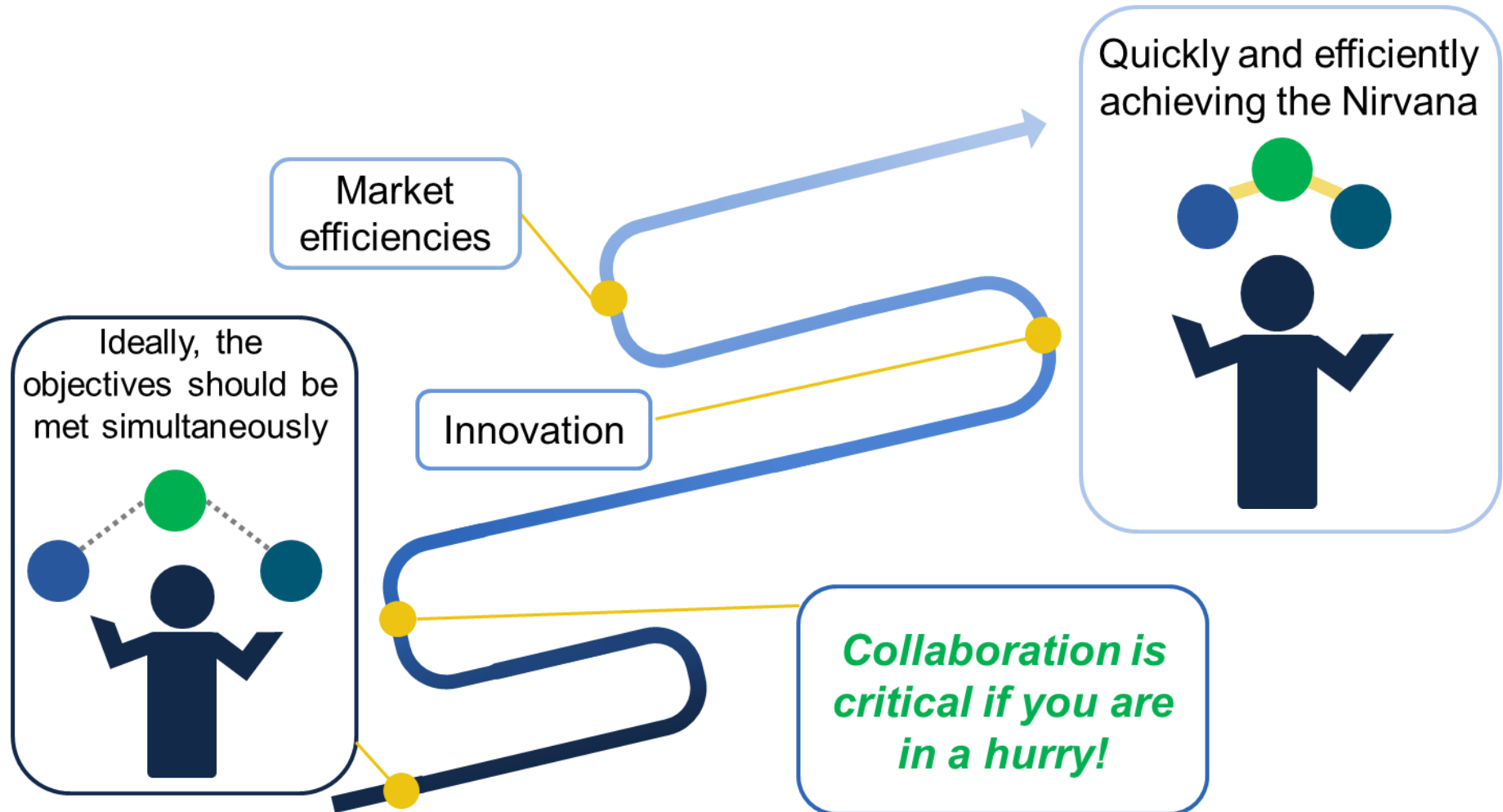
Lessons learned so far & observations

- Collaboration between two network companies with different functions and backgrounds requires effort
- Each network is different
- Innovation has to be tempered with keeping the lights on
- Exploring the individual needs of potential participants is key
- Issues such as cyber security, confidentiality and access to data are hidden complexity
- Network reinforcement may be deferred rather than avoided , but options are kept open
- Financial viability coupled with market transparency are key to feasibility and sustainability
- Trialing the market based solution does not automatically guarantee success or its application to other aspects of the electricity supply chain **but it is worth doing for the learning**

The Potential is Powerful

- Change is a constant in all aspects of electricity markets
- The learning will be useful for a wide range of purposes
- The concept could have application to many aspects of the supply chain
- It will create market opportunities for renewables (stacking) as well as DERs and consumers
- It should help to incentivise the smarter investment
- A new paradigm for flexibility (and focus) is likely to emerge which will be more sustainable
- The T and D network operators could develop their roles and achieve more efficiencies towards an improved “whole system outcome”
- We can learn more about aggregators – key to unlocking small DER and customer flexibility
- Consumers could become more responsive without a massive behaviour change through smart meters and appliances
- Everyone gets the benefit of the learning – the key to effective collaboration

The road ahead





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