

The NEW Power System: challenges and solutions

1st October 2018 – Duncan Botting – IEA DSM



The NEW Power System

Challenges and Solutions

Agenda

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2. Introduction to FPSA
3. Redefining the Power System
4. Radical change – needed now
5. How to make these changes happen
6. Conclusions and Recommendations

Appendix – Defining the whole energy system



1. Summary

Who We Are

The **FPSA** is an **independent expert group**, anticipating and **exploring system-wide energy challenges** and developing **objective solutions** to deliver the energy system transition while maintaining system resilience.

What we believe

Solutions must be **developed from a 'whole energy system' perspective** which includes customers and their service providers. This 'whole' system has technical, digital, commercial and societal dimensions, covering power, heat and transport.

Our findings

1. This new 'whole' system must provide **the functionality to allow customers easy access to the services they want** while maintaining the resilience they expect.
2. Today's **silos-based governance and change processes will be unable to deliver in this new world**. We have designed agile new processes, termed *Enabling Frameworks*, to accelerate change and achieve the efficient, holistic and timely delivery of new technical and commercial functions.

What we propose

1. A **new operating model** for governance of the **NEW 'whole' power system**, based on Enabling Frameworks and an Enablement Organisation, should be developed further.
2. A **pilot for this new operating model** should be implemented as soon as possible to gain experience, refine the design and add to the base of evidence.



2. Introduction to FPSA

The Future Power System
Architecture project

Introduction to FPSA

The story so far...

- FPSA's work is **independent and impartial**. It brings together **energy system specialists** and has consulted a **wide stakeholder base** to anticipate and explore system-wide challenges. It has developed objective solutions for **delivering the energy system transition** while maintaining system resilience.
- The FPSA programme was **initially commissioned by the Department of Energy & Climate Change (DECC)** and undertaken through a collaboration between the Institution of Engineering and Technology (IET) and the Energy Systems Catapult.
- The initial programme (FPSA1) **focused on identifying the new functionality** that the power system would need by 2030, to efficiently facilitate the energy transition. This work, which identified **35 new functions**, was published in 2016.
- The following programme (FPSA2) explored the implementation of this functionality, which revealed serious weaknesses in current change mechanisms. **New change mechanisms have been proposed** based on an *Enablement Organisation* and *Enabling Frameworks*. This work was published in 2017.

Introduction to FPSA

Our mission

- To help deliver the energy transition
- To promote the need for a **whole system perspective**, that includes physical, procedural, digital, societal and commercial aspects across the power, heat and transport systems
- To focus initially on the **GB power system** which is undergoing the most rapid change, ensuring that the highly relevant 'beyond the meter' environment is included
- To help identify **what** the key transition risks and opportunities are, particularly the technical ones
- FPSA is **not about detailed solutions**, rather it identifies **how the transition can be facilitated** in a responsive and inclusive way, through market and regulatory processes

Enabling the transition

Making the
NEW power
system work

Making
change
happen



Technically fit for purpose

Deploying innovation at scale

Best value for customers

Adaptable to ongoing change

3. Redefining GB's Power System



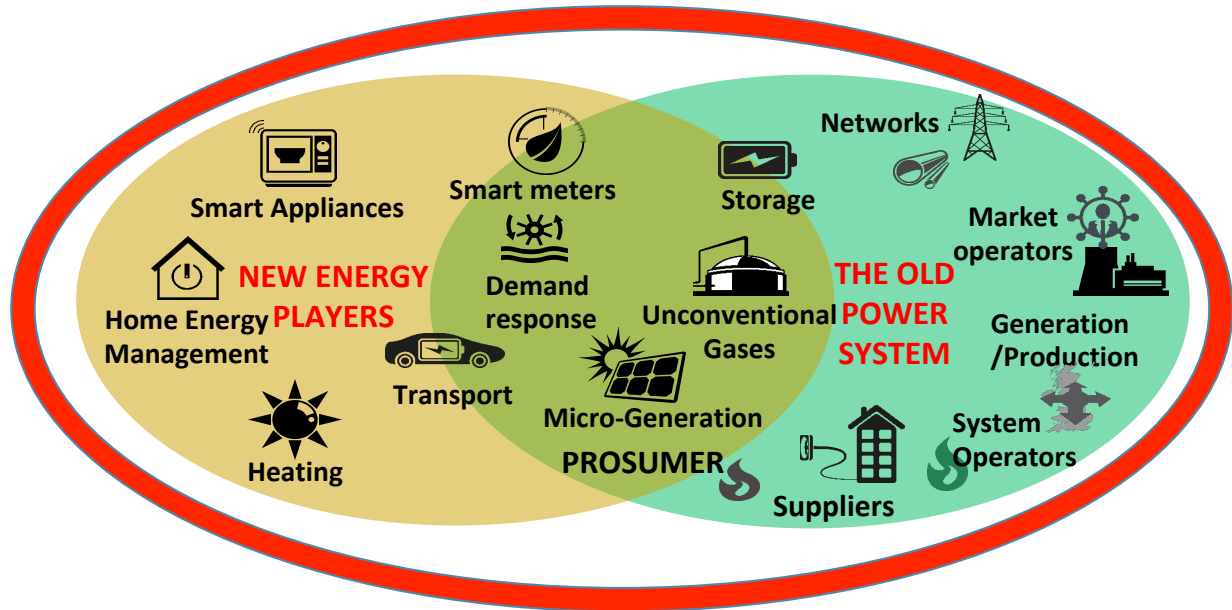
Redefining GB's Power System

The Old Power System

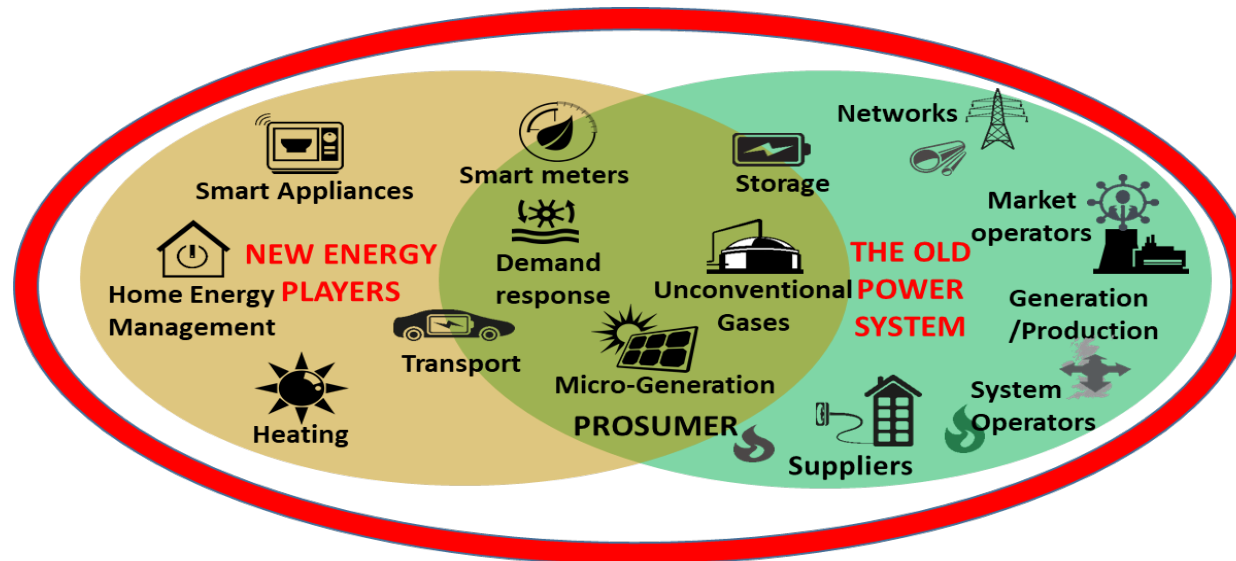
Predicable Players, Controlled
Actions, Old Assets

The New Power System

At the heart of the 'whole energy system'
New Complexities, Disparate Players, New Assets,
New Actions, Heat/transport interaction



Redefining GB's Power System



New Architecture

The NEW power system's architecture will have to recognise the new interfaces and procedures necessary to allow multi-party interactions. Its governance of change will need to be much more flexible and adaptive while maintaining the resilience of the system and security of service for all users

New Considerations

The power sector is being influenced by an increasing range of external social, technological, economic and political factors. It will need to encompass changes to physical energy flows, data flows and commercial value flows that to date have been governed by codes and regulations set in strictly defined silos

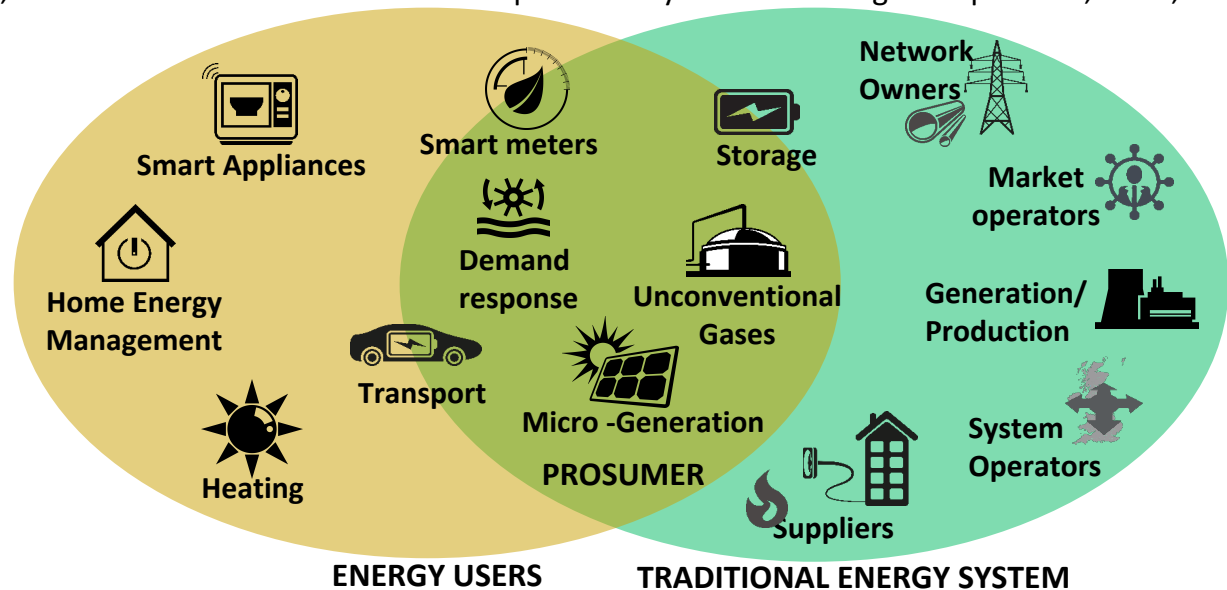
Defining the whole energy system

The '**whole energy system**' comprises the power, heat and transport systems, but excludes upstream oil & gas production. It includes:

- **Existing Energy System**, comprising existing electricity generators, gas shippers, network companies, gas and electricity suppliers, system operators, and other market companies
- **Energy users**, comprising domestic, commercial, and business electricity, gas and heat, electric/gas-powered vehicles, and consumer applications and devices (including smart devices) that are not engaging directly with the whole energy system.
- **Prosumers**, a world where customers, communities and businesses are empowered by new technologies to produce, store, and trade energy.

Whole energy system participants

The whole energy system is made up of a diverse range of organisations, each of whom has differing motivations and differing access to relationships, data and levers of control.



Redefining GB's power system

The FPSA's 7 Drivers of Change

- The FPSA's prior work explored the impacts of energy decarbonisation, decentralisation, digitalisation and democratisation.
- This identified **7 Drivers of Change** that demand a reshaping of GB's power system architecture to ensure effective migration from the Old to the New.
- These drivers will require rethinking of the physics, data flows, commercial arrangements and change governance models.
- It will require **increasingly close interaction with changes in other energy vectors**

Failure to address the drivers of change will risk the future delivery of secure, clean and affordable energy

Redefining GB's power system – new functionality

7 Drivers of Change

- Changing **generation mix**
- New entrants – **new customer services**
- Active management** of generation, networks, storage, demand
- New customer incentives** to promote energy efficiency
- Growing need to **co-ordinate across energy vectors**
- The need to **be more flexible** to better manage uncertainties
- Guaranteeing the ability to **recover from system emergencies**

8 Challenges

- Design new market frameworks
- Embrace all new technologies
- Establish new interfaces between players
- Deliver total system visibility
- Ensure new operator interventions
- Monitor/respond to new risks and opportunities
- Develop new markets – especially for communities
- Develop new 'black out' response capabilities

35 Functions

**FPSA's
35
new
Functions**

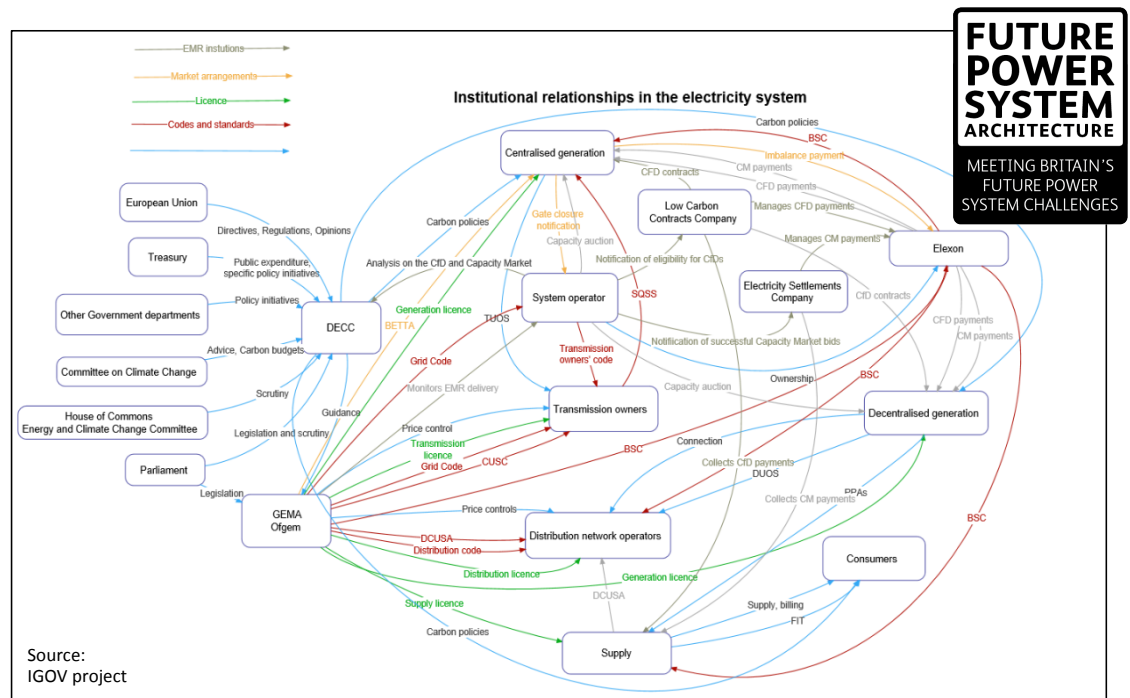
4. Radical change
– needed now



What needs to change?

To transition without risk to the system and be flexible enough to accommodate change, there needs to be a **much more agile, transformative and adaptive approach** to systems change.

It must address the complexity, interoperability and new business models in the “New System” architecture



Current governance must change – “New” models need to:

- Focus across the whole energy system, including ‘beyond the meter’
- Lead to agile, adaptive and efficient decision making
- Overcome silo boundaries and enable better co-ordination
- Reduce barriers to new entrants, new business models and innovation
- Seek optimal commercial outcomes, and competition
- Ensure technical solutions that are fit for purpose

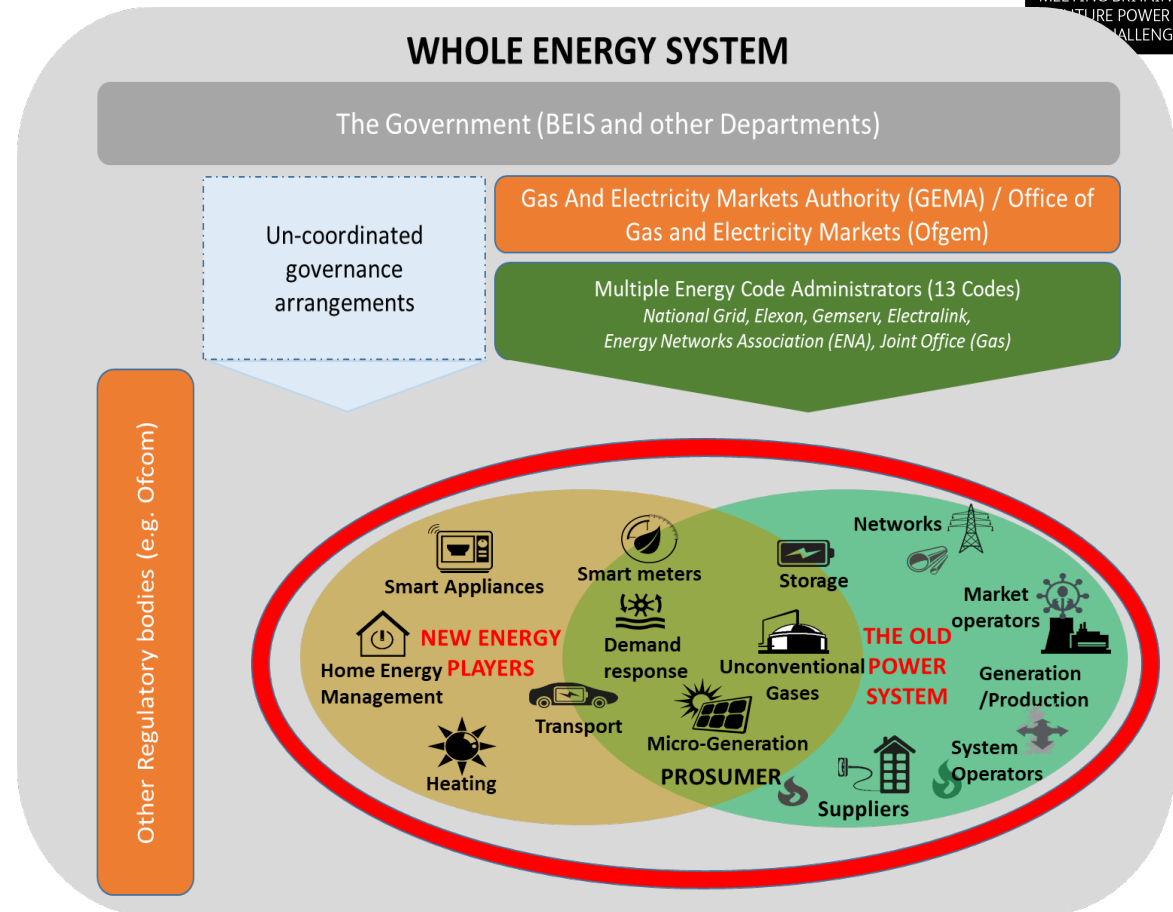
The Challenges to Transition – what needs to change?

Silo regulation and governance are placing a brake on change and potentially threatening the “New” system’s resilience

The “New” system will have to address additional complexity and interplay of the physical energy flows, data flows and commercial value flows from the smart phone App through to the power generator

A governance model is needed that embraces the ‘New’ Power System and reduces the drag from the “Old” Power System

Today’s governance is siloed and does not coordinate across the whole system



5. Making change happen

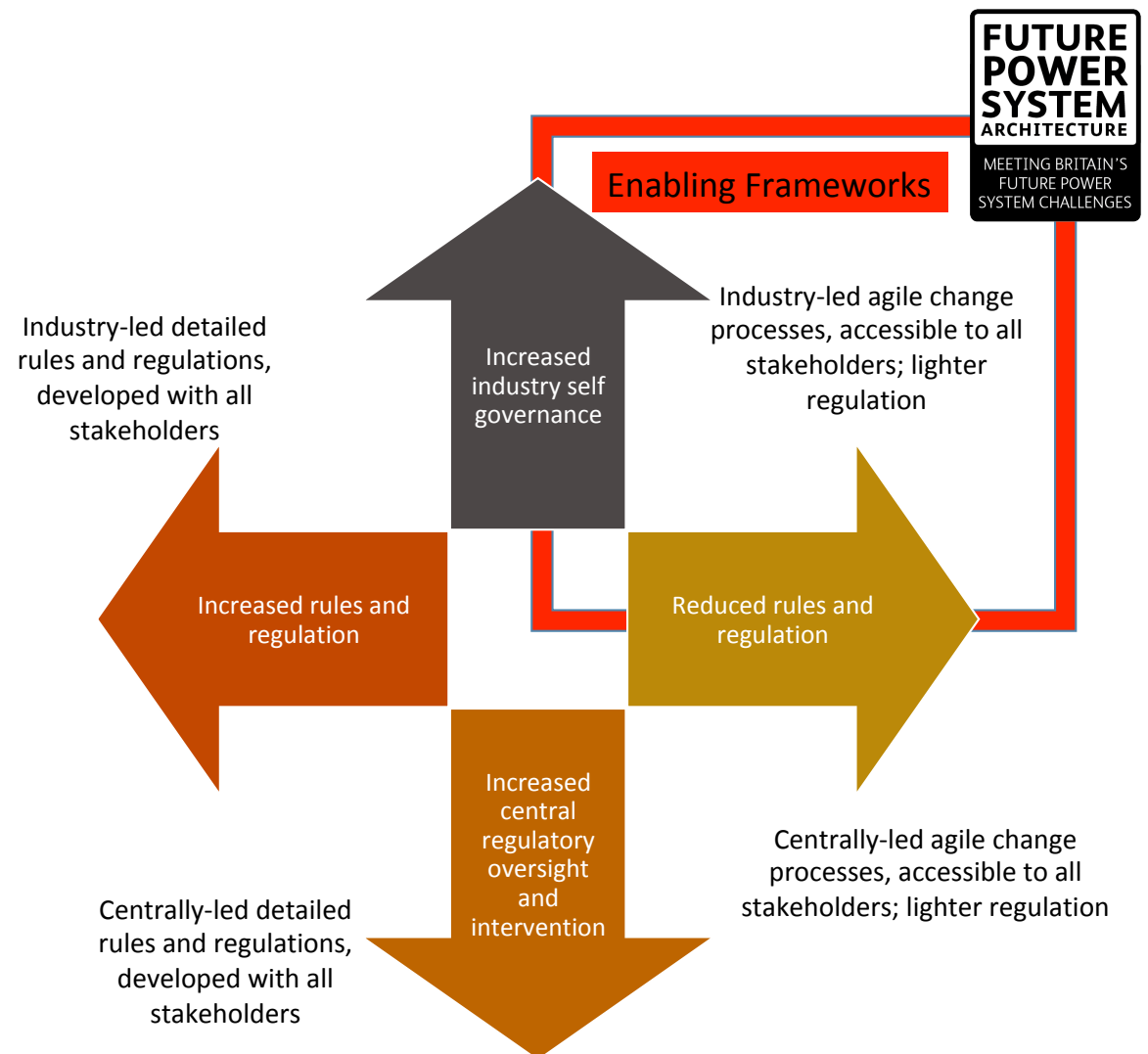


Identifying the options

FPSA is proposing a new governance operating model; **Enabling Frameworks** facilitated by an **Enablement Organisation**.

This model;

- Takes a whole system approach
- Harmonises decision making across all parts of the system
- Is Flexible and Adaptive
- Recognises the links between technical and commercial issues
- Allows change to be driven by user needs
- Engages with a wider stakeholder base
- Improves the quality and speed of change/ decision making



A new operating model – the key elements

Enablement Organisation

- An *Enablement Organisation* (EO) coordinates stakeholder interests, facilitates entry of new parties, and considers and agrees when new functionality is required. It provides strategic input to *Enabling Frameworks* (EFs)
- The EO has key wider roles such as horizon scanning and knowledge retention to support on-going sector change; these are not part of today's governance.

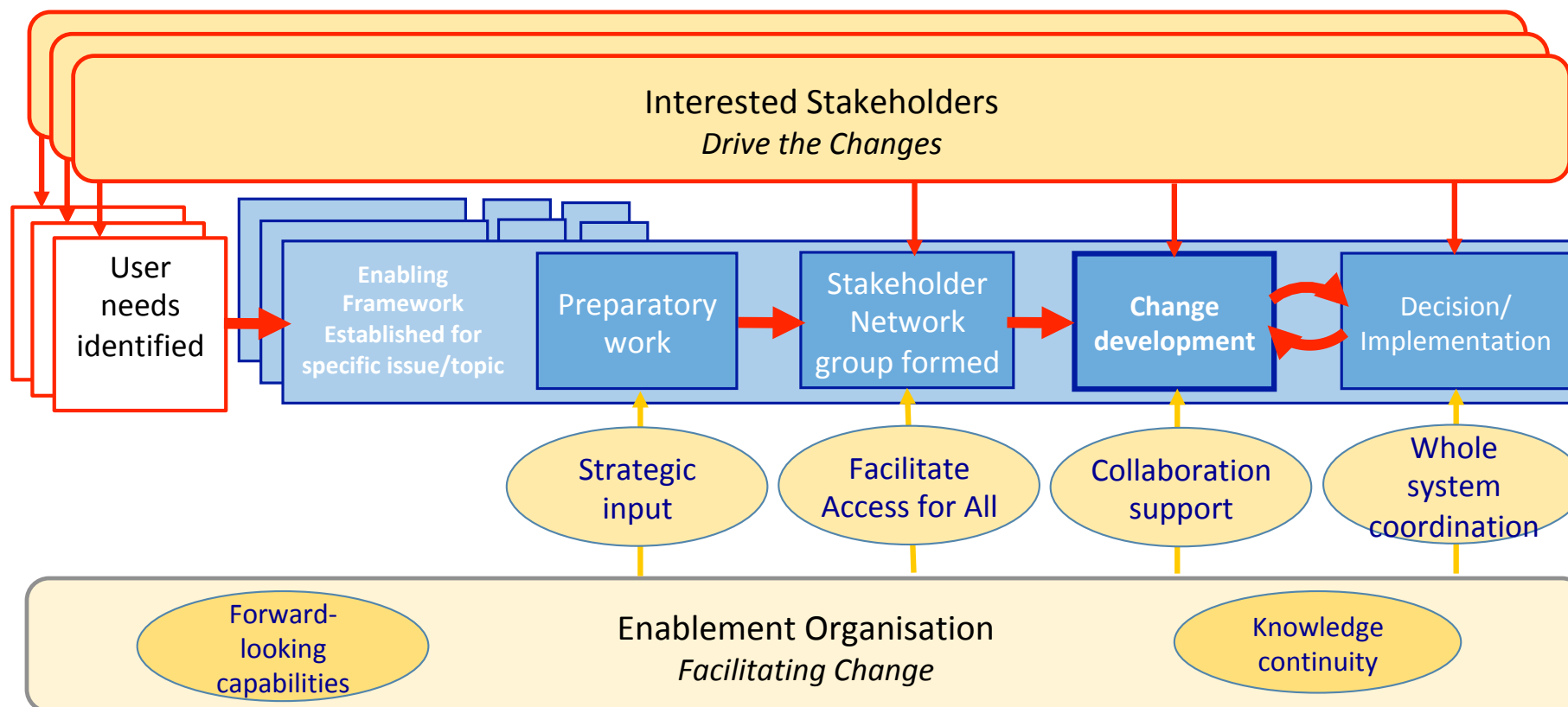
Enabling Frameworks

- An EF is essentially a facilitated stakeholder group established to govern an area of system functionality – e.g. the smart charging of EVs
- EFs require change to be driven by user needs and allow all aspects of a change proposal to be managed by one team of stakeholders

The Process

Agile processes (proven in other sectors) allow wide participation in framing what changes are needed - technical, commercial and data-related – and deliver change in less time

A new operating model – how it works



Each **EF** covers all aspects of the change: technical, commercial, digital etc.

Each **EF** operates on a continuous basis where changes are fed back into future thinking

The benefits of this new operating model

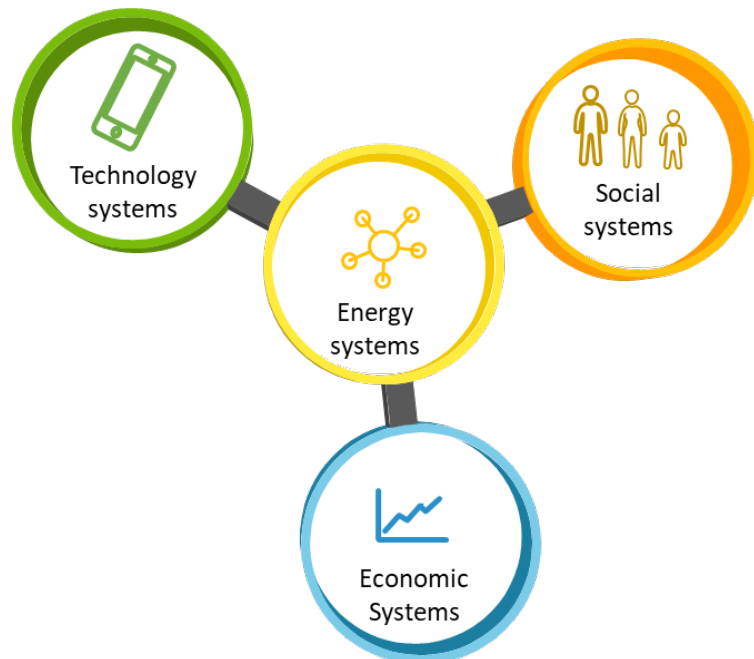
- ✓ Change to be driven by the needs of all affected stakeholders
- ✓ Stakeholders own the change process and the decisions
- ✓ The model incorporates whole-systems thinking so that decisions across the sector are coherent. This is assured by the Enablement Organisation
- ✓ *Agile techniques* make the process more inclusive, coherent and faster
- ✓ More radical innovations and business models involving new parties are given much greater opportunity to succeed

6. Conclusions and recommendations



Conclusions

How do we enable energy systems to adapt quickly?



A customer focus

- We must ensure that **energy services to customers are easy to access**, providing new functionality that more closely links customers to the services they want while **maintaining the resilience they expect**

Redefining the energy system

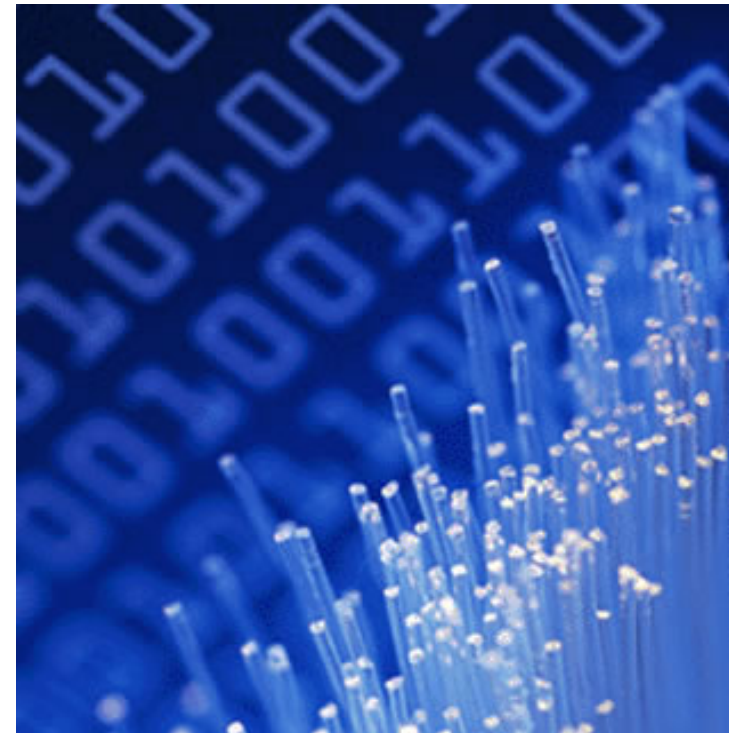
- We must redefine our concept of the '**whole energy system**' to include customers and their service providers, existing and new
- We must **recognise the breadth of the NEW energy system**: technical, digital, commercial and societal; integrating power, heat and transport

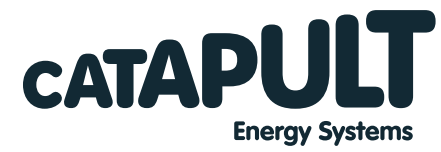
Governance and change

- Our current, siloed governance and change processes will be **unable to deliver effectively** in this new world
- A **new governance and change model is needed** that can deliver the integrated functionality needed by both customers and energy businesses

Recommendations

1. A **more agile operating model for governance** of the New power system should be developed
2. This new governance model should be accessible, flexible and fit for purpose so that increasingly dynamic change can be coordinated effectively
3. **Enabling Frameworks** should form the basis of this model, with the creation of an **Enablement Organisation** being a priority; use cases may be helpful to assist development
4. A **pilot of this new operating model** should be implemented as soon as possible on the power system to gain experience and add to evidence





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