(User-centric) UK Zero Carbon Energy Futures

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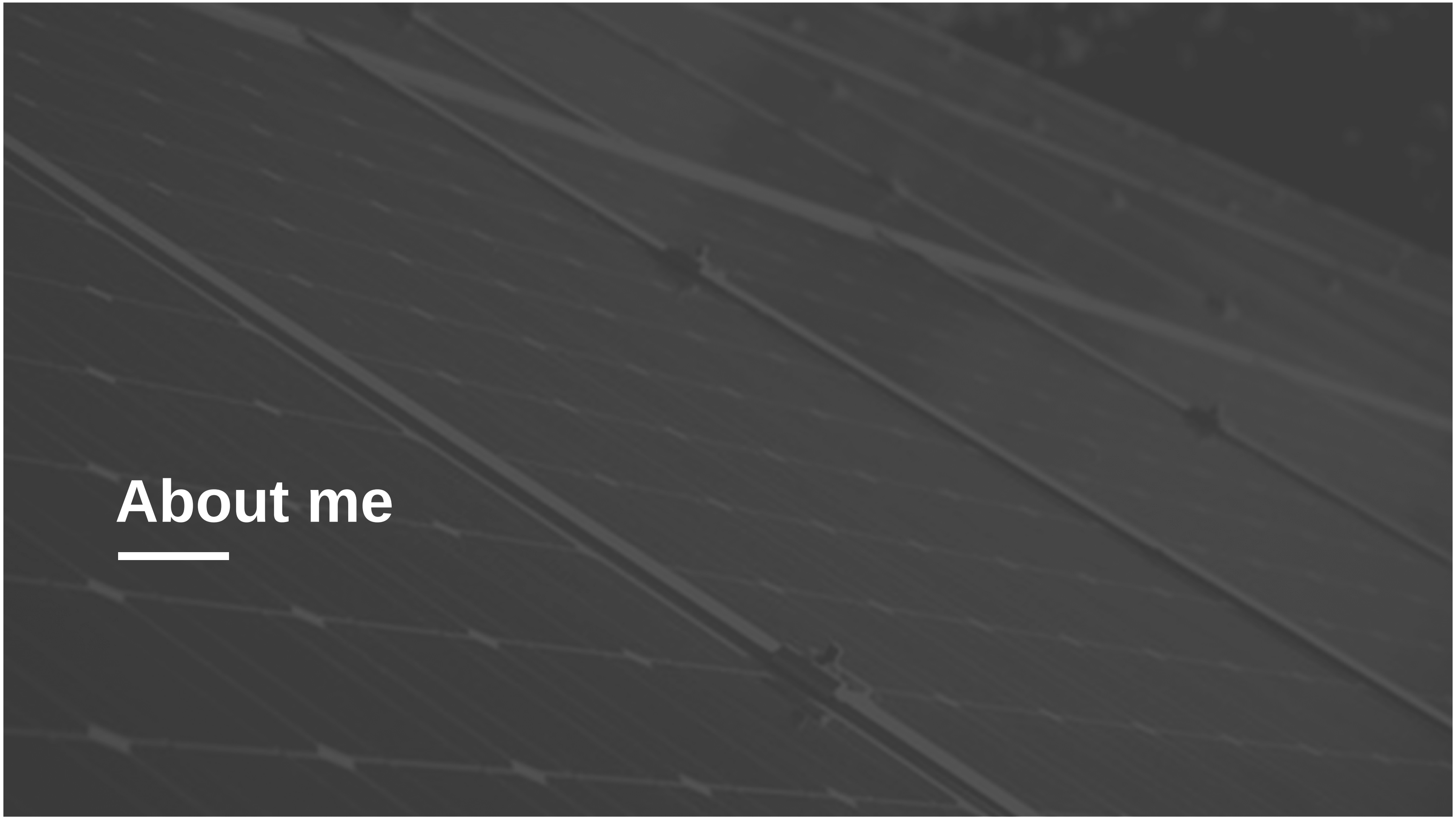
EnergyREV

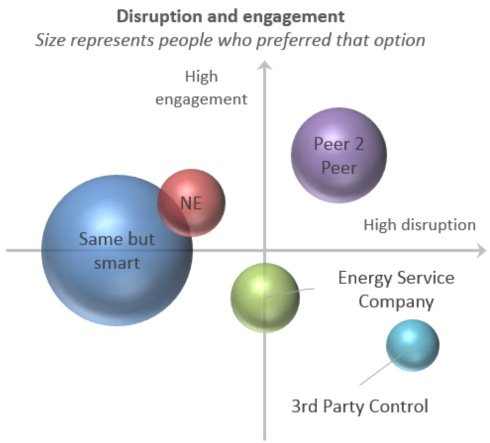
INDUSTRIAL STRATEGY

UK Research and Innovation


About me

Current research interests

Future energy business models



Utility 2050

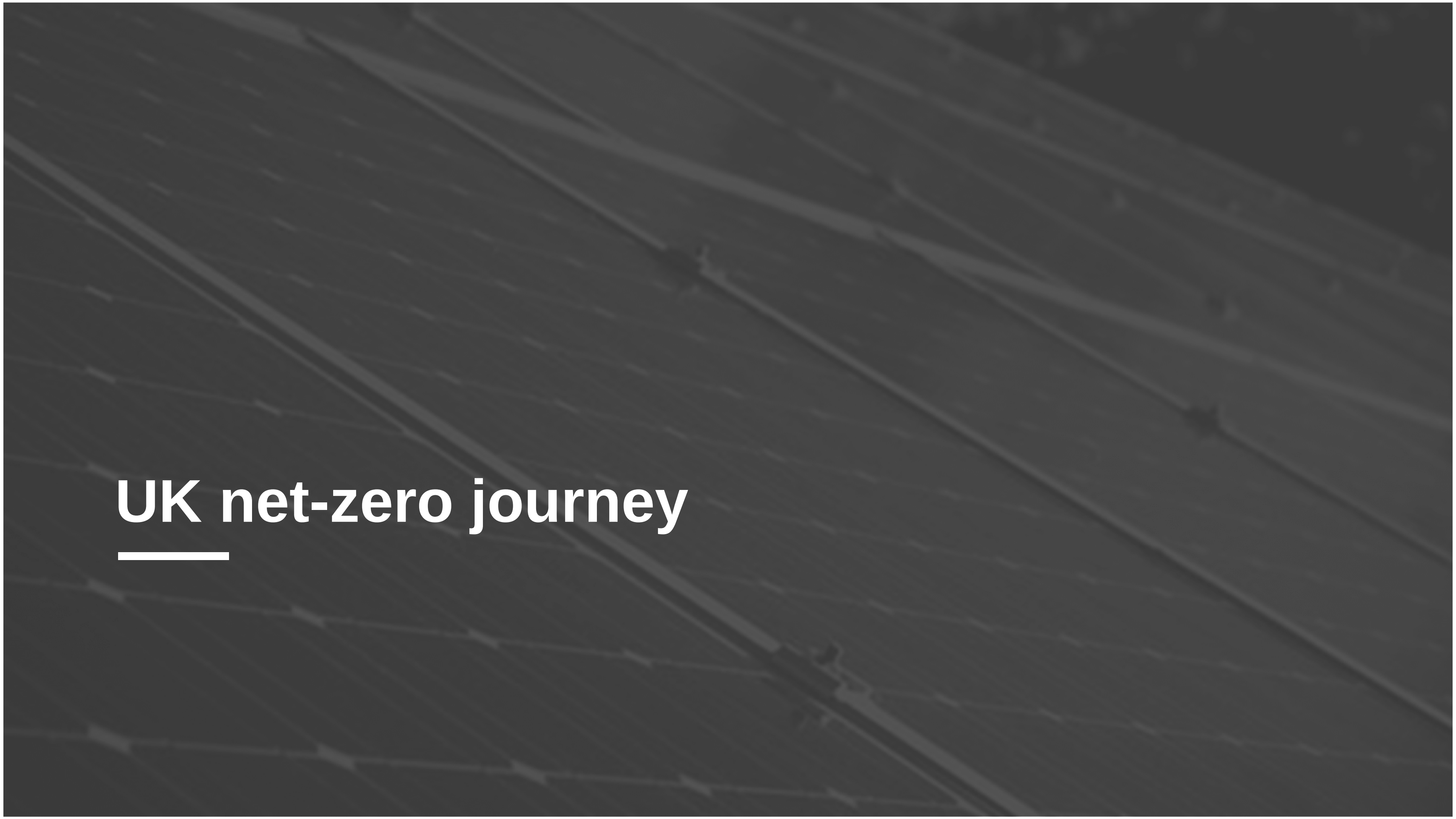
Energy policy and regulation

Redesigning Regulation

People and energy

Society led low-carbon transformation

Energy Revolution Research Consortium



UK net-zero journey

UK Climate Change Act

“It is the duty of the Secretary of State to ensure that the **net** UK carbon account for the year 2050 is **at least 100% lower** than the 1990 baseline.”

Climate Change Act 2008

Entwined policy & regulatory challenges

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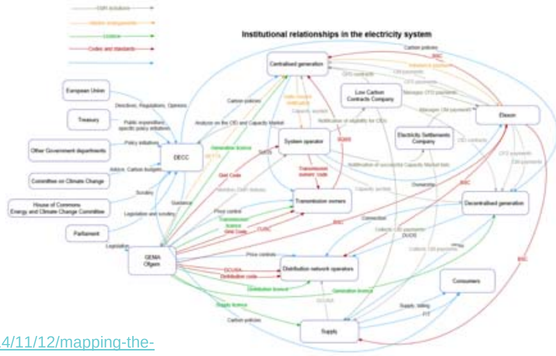
Objectives

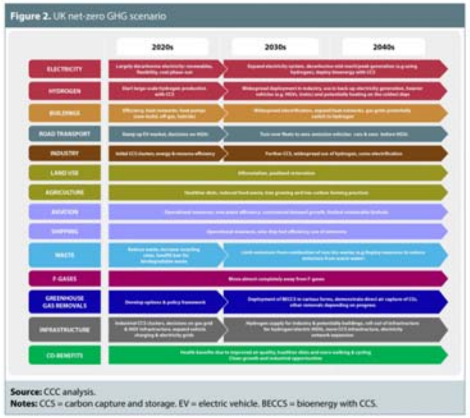
- Net zero
- Lowest (or reasonable) cost
- Security
- Competition
- Environment
- Equity & Fairness
- Better than today
- …

Complexity



Credit: Exeter Energy Policy Group - https://blogs.exeter.ac.uk/energy/2014/11/12/mapping-the-power-in-the-electricity-system/

Certainty



https://www.theccc.org.uk/wp-content/uploads/2019/05/Net-Zero-The-UKs-contribution-to-stopping-global-warming.pdf

Acceptability

extinction rebellion

Thirty years of action required to meet UK net zero target

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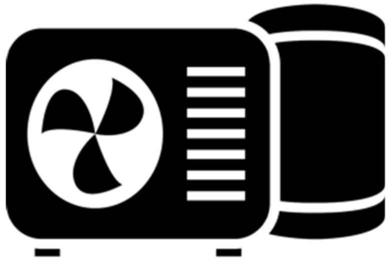


~3.6 (6.1*) GW/year
(300 x 12MW turbines/year)
(current 4GW/year)

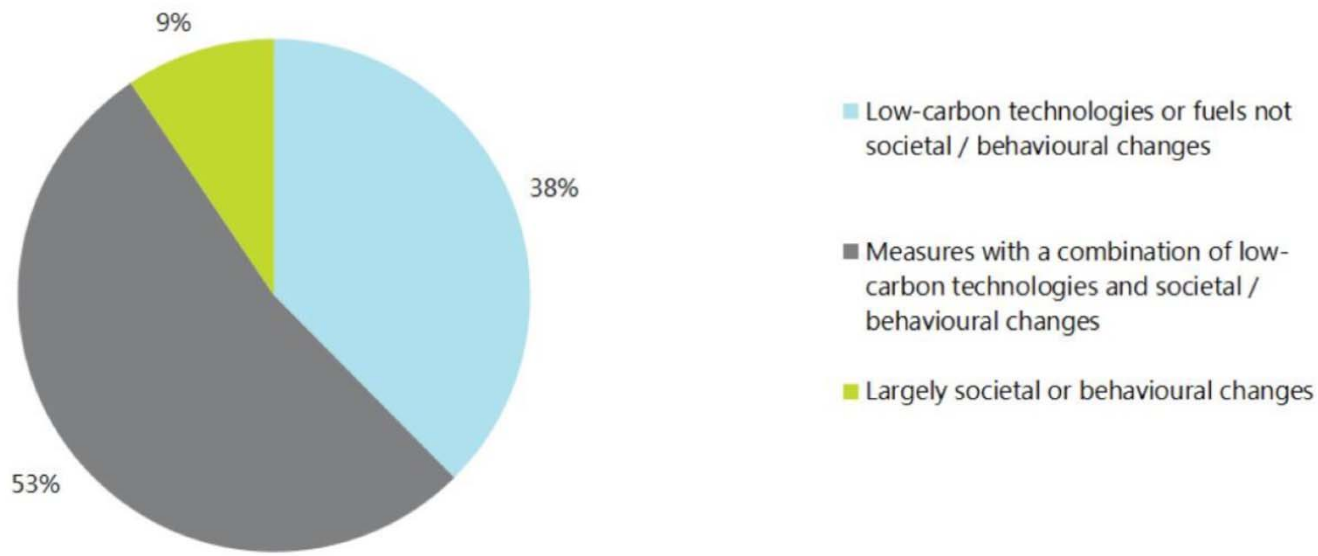
~1.2 million BEVs/year
(136 per hour)
(current 331 vehicles/hour)

~600k installations/year
(68 per hour)
(current 182 boilers/hour)

*including CCS and electricity storage

Technology can't do everything

Role of societal and behavioural changes

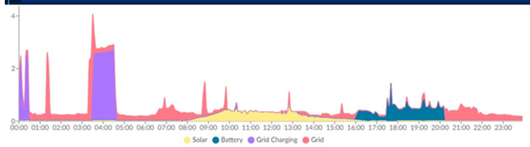


Source: CCC analysis

Opportunity for consumer-centric business models

Implications for end-users…

15th February 2020	16th February 2020
Period	**Price (inc. VAT)**
00:00 - 00:30	1.58 p/kWh
00:30 - 01:00	1.58 p/kWh
01:00 - 01:30	1.97 p/kWh
01:30 - 02:00	0.63 p/kWh
02:00 - 02:30	-1.68 p/kWh
02:30 - 03:00	-2.10 p/kWh
03:00 - 03:30	-2.10 p/kWh
03:30 - 04:00	-3.19 p/kWh
04:00 - 04:30	-2.94 p/kWh
04:30 - 05:00	-2.94 p/kWh
05:00 - 05:30	-2.31 p/kWh
05:30 - 06:00	-2.10 p/kWh



Time of use pricing

New kit

Upfront costs

Massive opportunity for future UK utilities

Plant efficiency
£75 – 1809 m

Service provision
£5 – 9 bn

Local LC generation
£42 – 4600 m

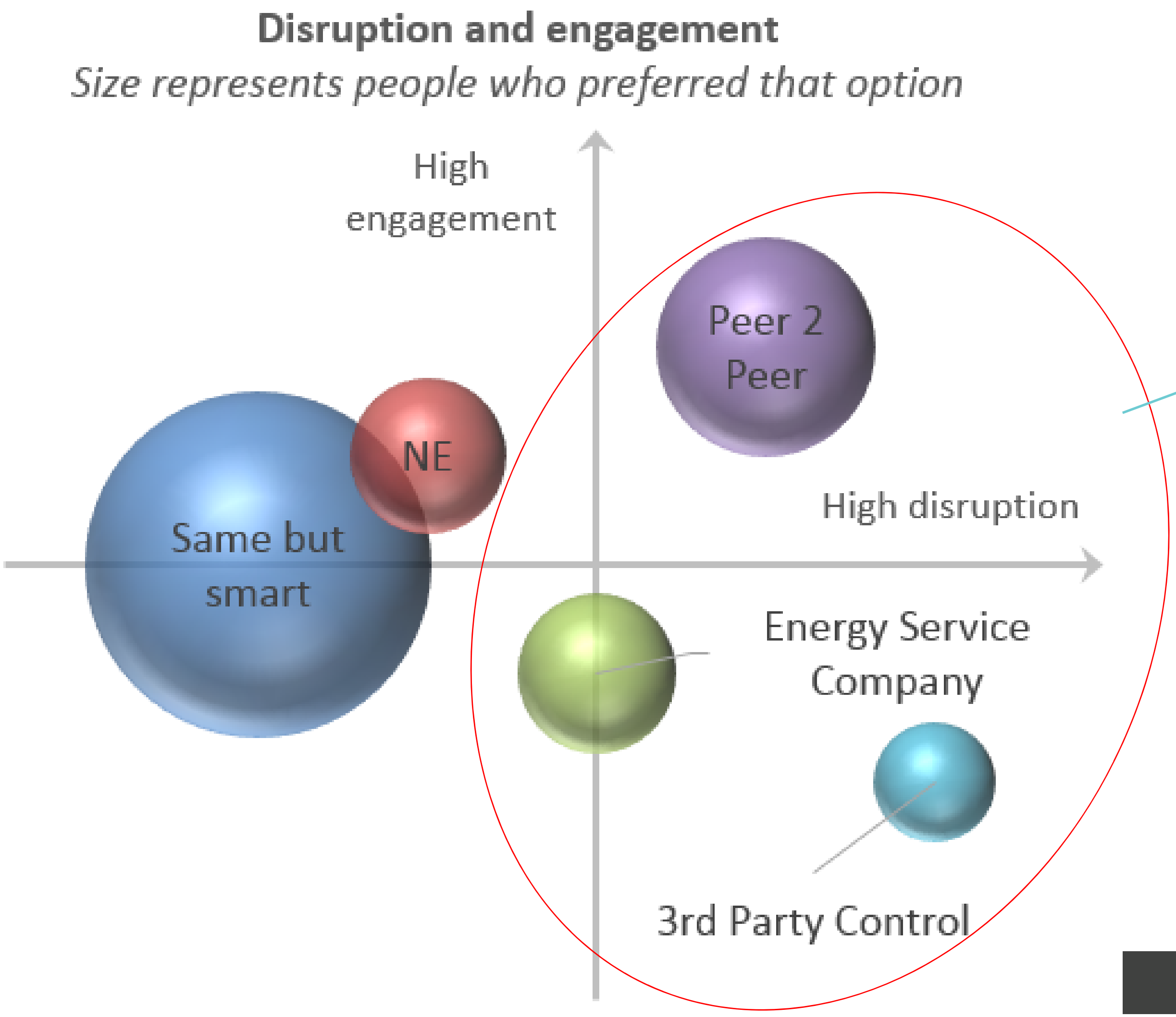
Large LC generation
£0.61 – 8 bn

Flexibility optimisation
£400 – 2000 m

CCS
£-0.14 – 1669 m

Up to £21bn of new value is available to electricity utilities per year by 2050

Wegner, M.-S., Hall, S., Hardy, J., Workman, M., 2017. Valuing energy futures; a comparative analysis of value pools across UK energy system scenarios. Appl. Energy 206, 815–828. doi:10.1016/j.apenergy.2017.08.200



Around 50% of domestic consumers

In review: Nature Energy

Inertia and barriers to innovation

Innovation in UK energy suppliers

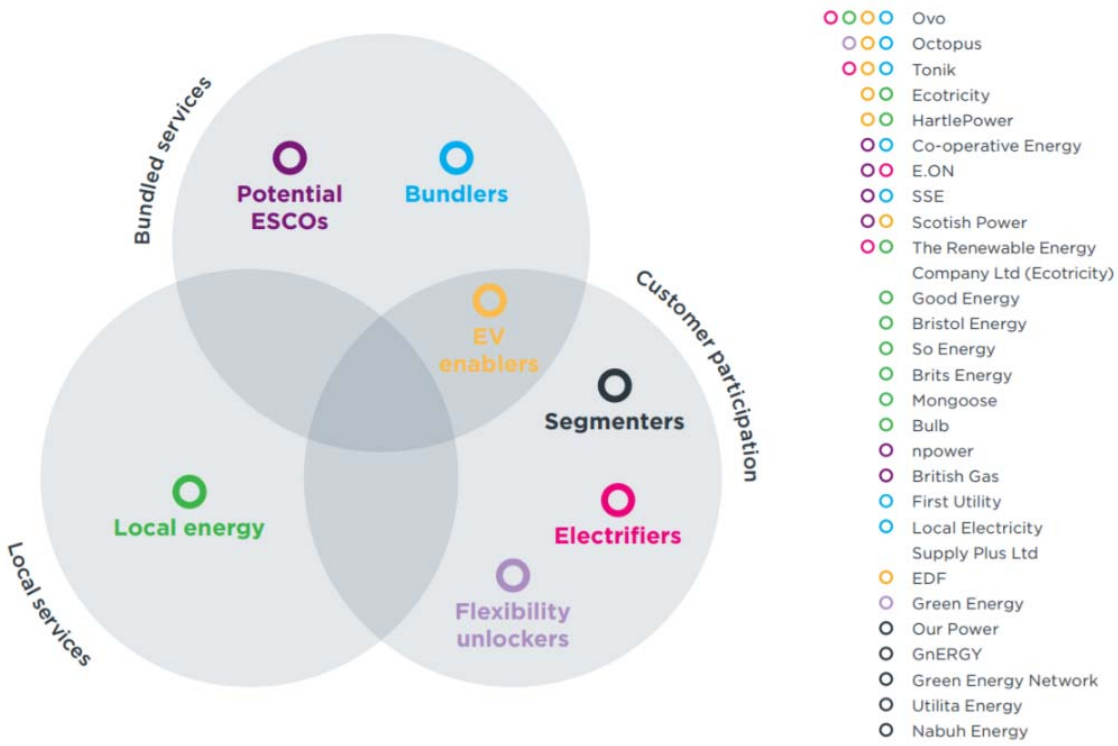
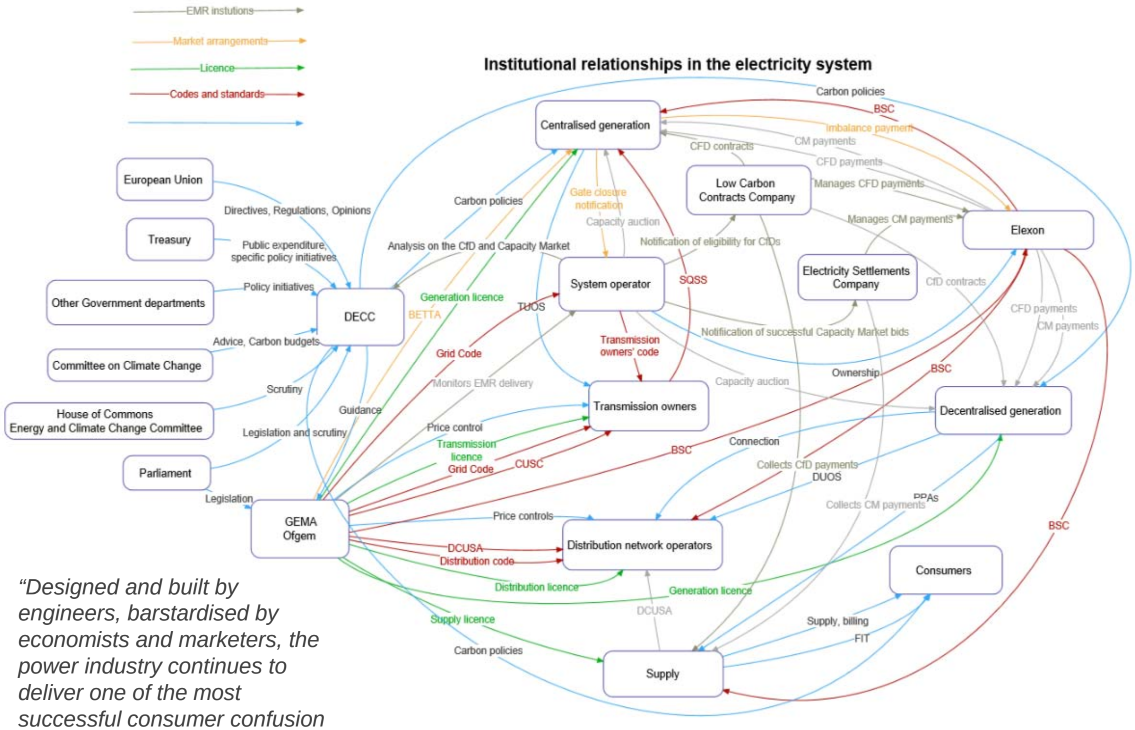


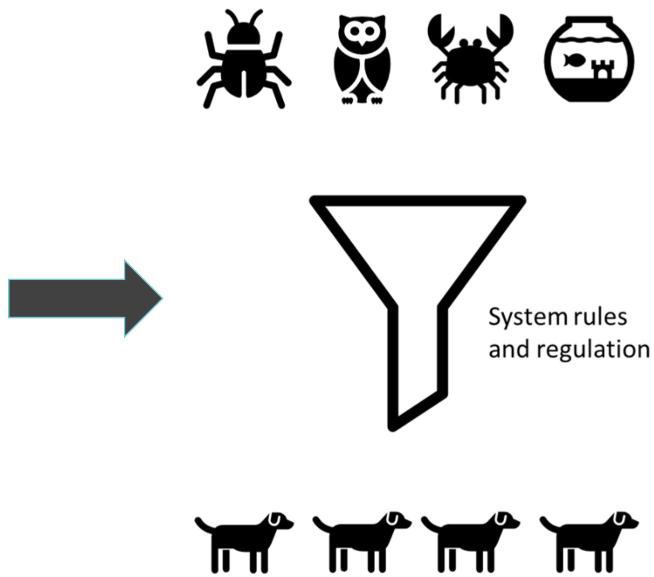
Figure 8: Emerging domestic electricity supplier value propositions compared to broad NTBM themes

- **Lot's going on, particularly on local energy, electric vehicles, 'smart' electric homes and bundling products**
- **However, little innovation in the core traditional utility business model (selling units of electricity and gas)**

Credit: IGov - http://projects.exeter.ac.uk/igov/wp-content/uploads/2019/01/IGov-BM-Analysis-report.pdf

Energy policy & regulation





"Designed and built by engineers, barstardised by economists and marketers, the power industry continues to deliver one of the most successful consumer confusion programmes of all time" Ari Sargent

Credit: Exeter Energy Policy Group - https://blogs.exeter.ac.uk/energy/2014/11/12/mapping-the-power-in-the-electricity-system/

Who is playing in the sandbox?

P2P trials
- EDF
- British gas / Verve
- Empowered

ESCo
- Green Energy Networks, SmartKlub and SIG

Innovative tariffs
- Ovo energy (electric heating)

Prosumer marketplac e
- BP (homes sell excess electricity to a marketplace)

Decentralisation of regulation?

The centre cannot always hold

‘Energy decentralisation’ means many things to many people. Among the confusion of definitions and practices that may be characterised as decentralisation, three broad causal narratives are commonly (implicitly or explicitly) invoked. These narratives imply that the process of decentralisation:

i) will result in appropriate changes to rules and institutions
ii) will be more democratic
iii) is directly and causally linked to energy system decarbonisation

https://www.sciencedirect.com/science/article/pii/S1364032119307075

Future governance?

- Gov sets objectives
- ETC 'sorts out politics' of energy transformation -> gives direction
- Whole systems operator (IISO) delivers
- Economic regulator ensures efficient network spend
- Data body ensures quality and access + protection
- Market monitor
- DSPs create local markets…

http://projects.exeter.ac.uk/igov/wp-content/uploads/2019/09/IGov-Getting-energy-governance-right-Sept2019.pdf

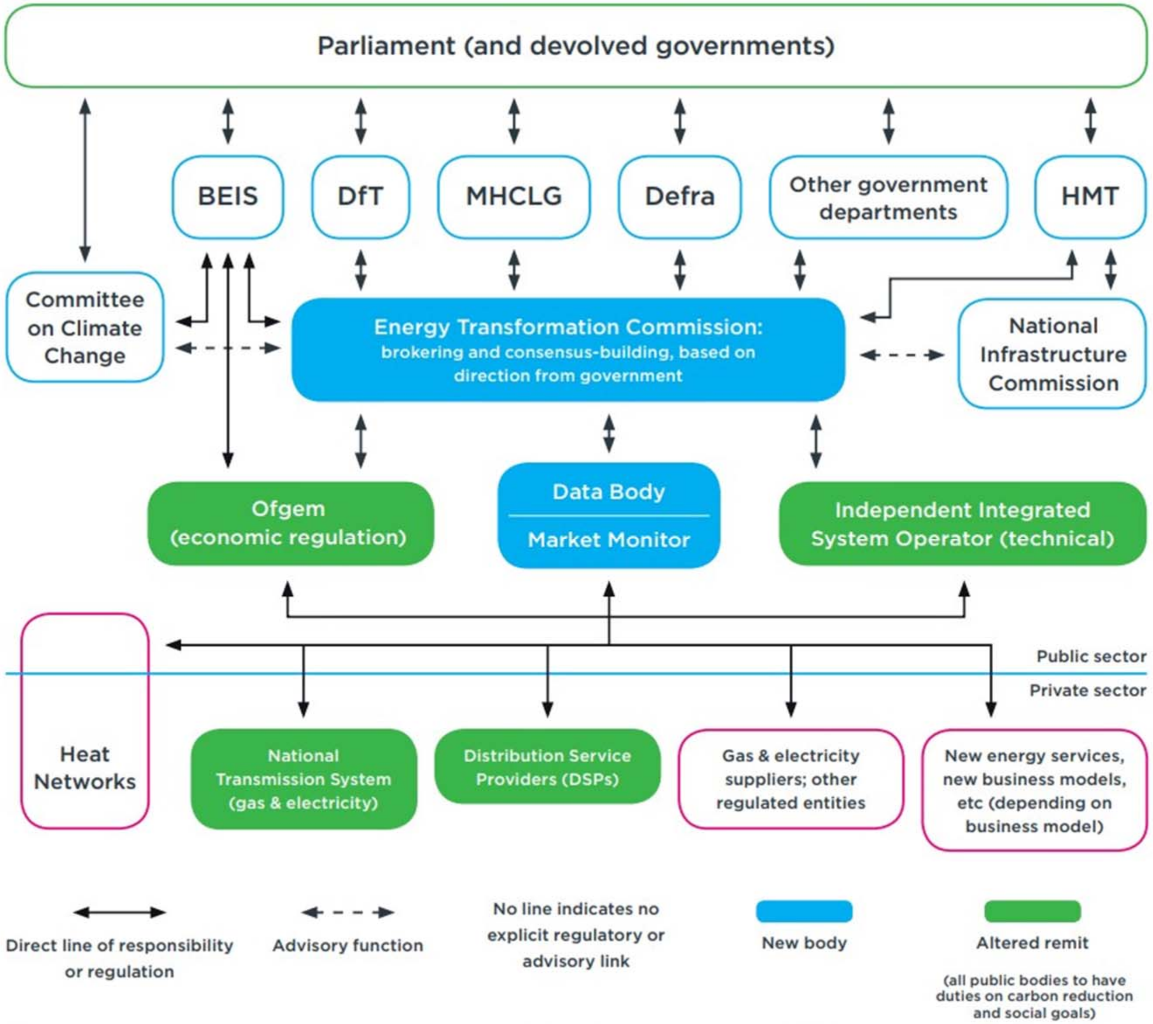
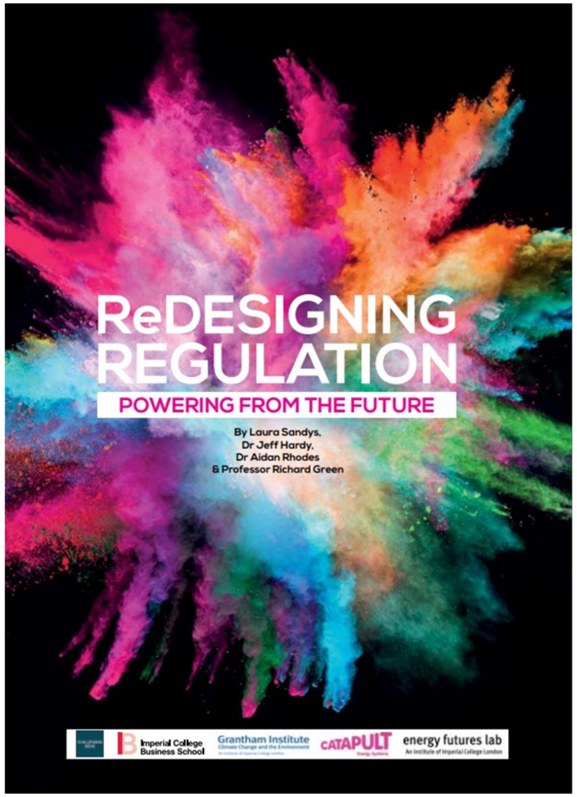


Figure 3: GB energy governance: proposed new institutions and responsibilities

Objectives for prosumers?

- Net zero
- Lowest or reasonable or any cost
- Security of what?
- Role of competition
- Neutral, worse or better for environment
- Equitable, fair, just?
- Better than today
- …what else?

Reshape and redesign regulation?



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