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# Disrupting the UK Energy System: Causes, Impacts and Policy Implications

Mark Winskel, University of Edinburgh
Jim Watson, UKERC Director, UCL,
and many others

LCNI Conference, Glasgow, 31st October 2019

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# Disrupting the UK Energy System

## RWE and Eon find fortunes diverge

Hiving off 'dirty' gas and coal-fired power stations seems to have been a mistake

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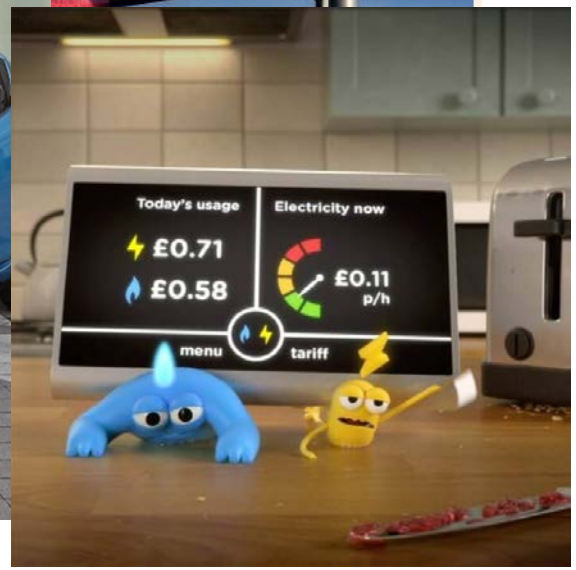
**Subsidy-free offshore wind? Energy auction to drive down costs for new wind farms**



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# Disrupting the UK Energy System


Press release

## PM Theresa May: we will end UK contribution to climate change by 2050

Legislation laid today puts the UK on the path to become the first major economy to set net zero emissions target in law.

Published 12 June 20
From: Prime Ministe
Rt Hon Theresa May

Donald Trump

## Donald Trump tells Prince Charles US has 'clean climate'

**President blames other countries for environmental crisis, in long talk with prince**

Matthew Weaver *and* Kate Lyons

Wed 5 Jun 2019
09.02 BST

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# Disrupting the UK Energy System

Our report addresses three main questions:

- What are the potential sources of disruption to the UK energy system?
- Which sectors and actors might face particularly disruptive change?
- How should decision-makers respond to ensure that the low carbon transition is implemented successfully?

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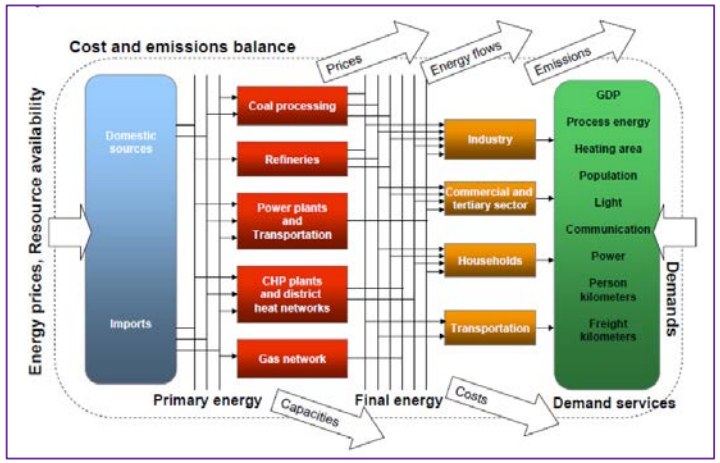
# Disrupting the UK Energy System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# Expert survey: approach

- In a **Disruption-based transition**, policies, technologies, business models and behaviours provoke a fundamental remaking of the UK energy system.
- Existing organisations and infrastructures can't respond sufficiently and are largely displaced.
- Wide-ranging technical and institutional decentralisation of the system
- Citizens become more actively involved

- In a **Continuity-based transition**, system change is pursued mainly by adapting and repurposing existing organisations and infrastructures.
- New technologies, business models and behaviours are extensions and adaptions of existing ones to meet policy objectives.
- Scale economies remain important; national strategy and regulation dominate.
- Lack of active public participation

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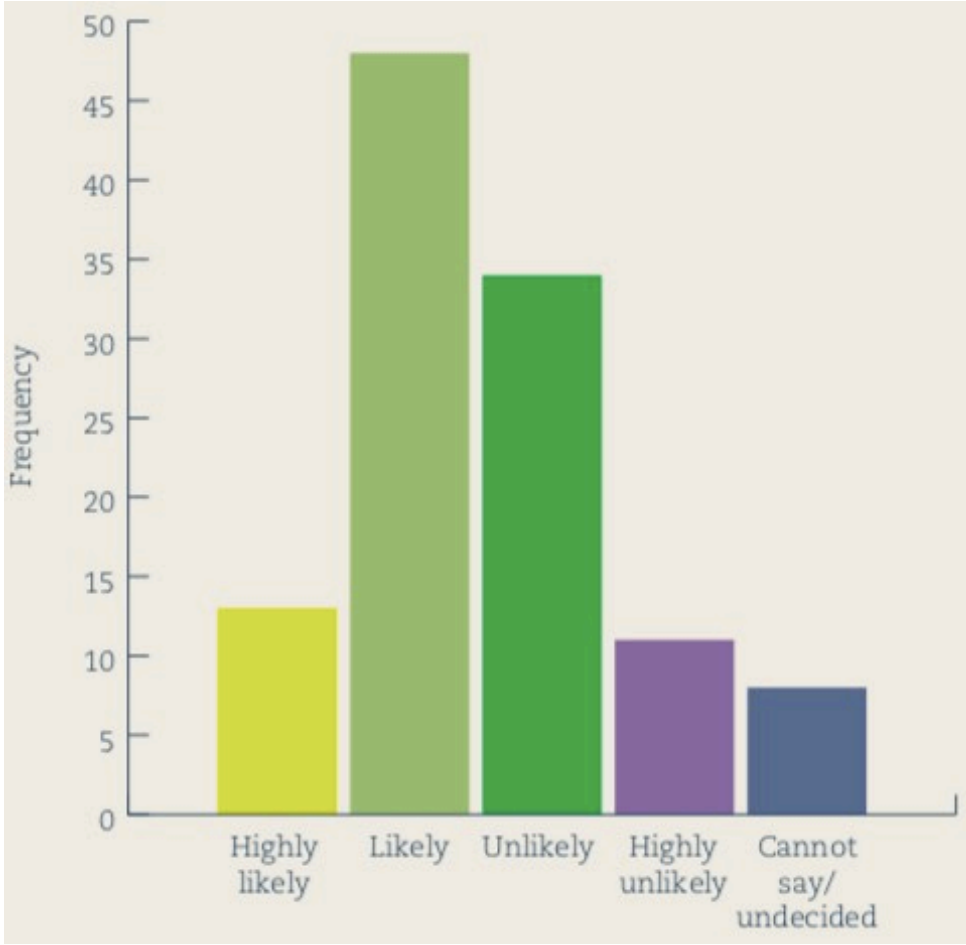
# Expert survey: some results

Likelihood that the UK's energy system transition will be continuity-based




*"I think the energy system will go through significant change but that incumbents will be part of that change"*

**Director of a public-private partnership**

*"All industries that deliver at low cost have high degrees of standardisation and economies of scale."*

**Independent consultant**

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# Expert survey: some results

Likelihood that the UK's energy system transition will be highly disruptive


*"New organisations will emerge without the baggage of legacy practice and will find it easy to become profitable doing what the incumbents are not structured to do."*

**Professor of engineering**

*"The scale of financing needed to fully decarbonise the system is beyond the balance sheet of the traditional incumbents."*

**Senior economist at a large NGO**

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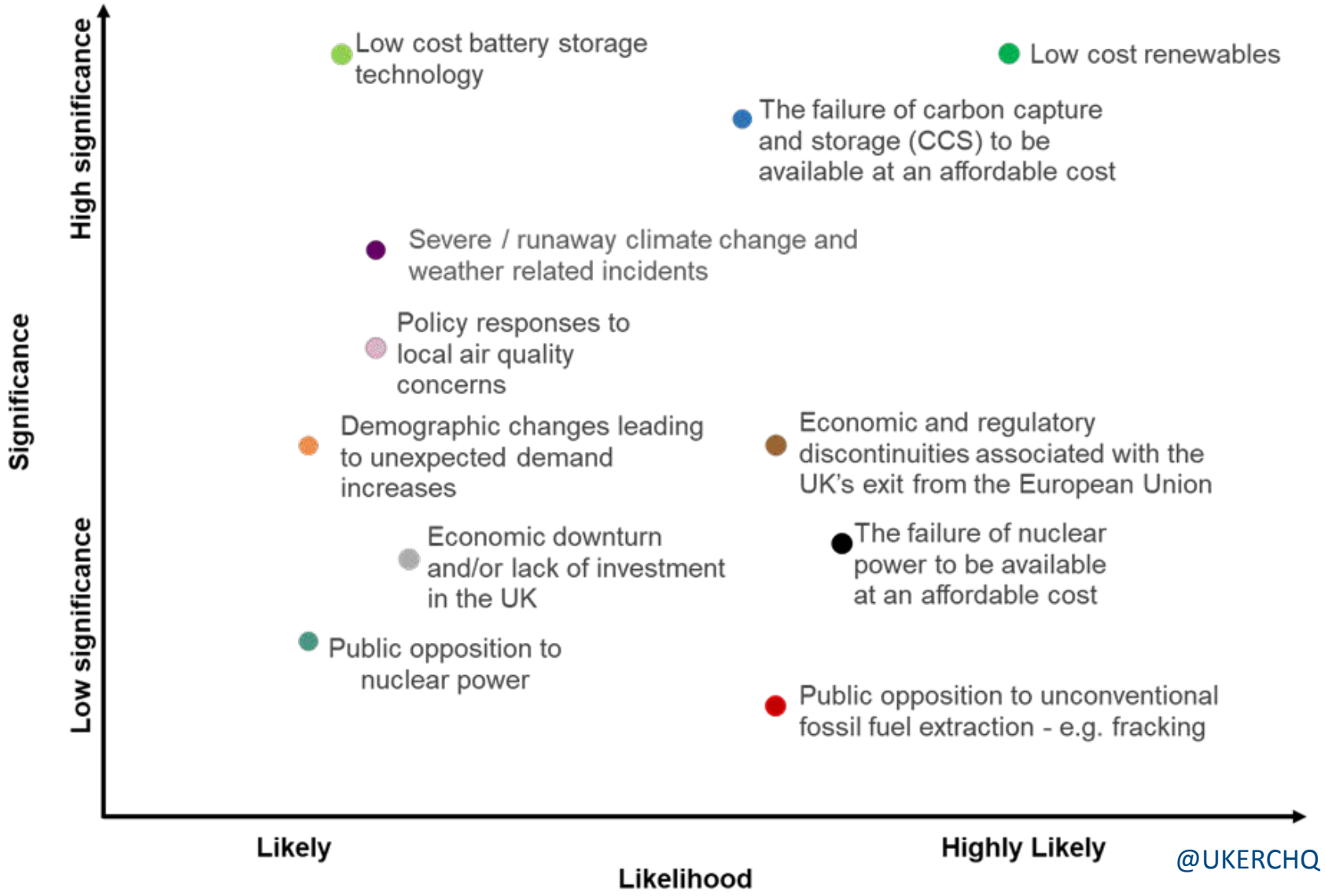
# Expert survey: some results

Landscape changes and system shocks: most likely issues



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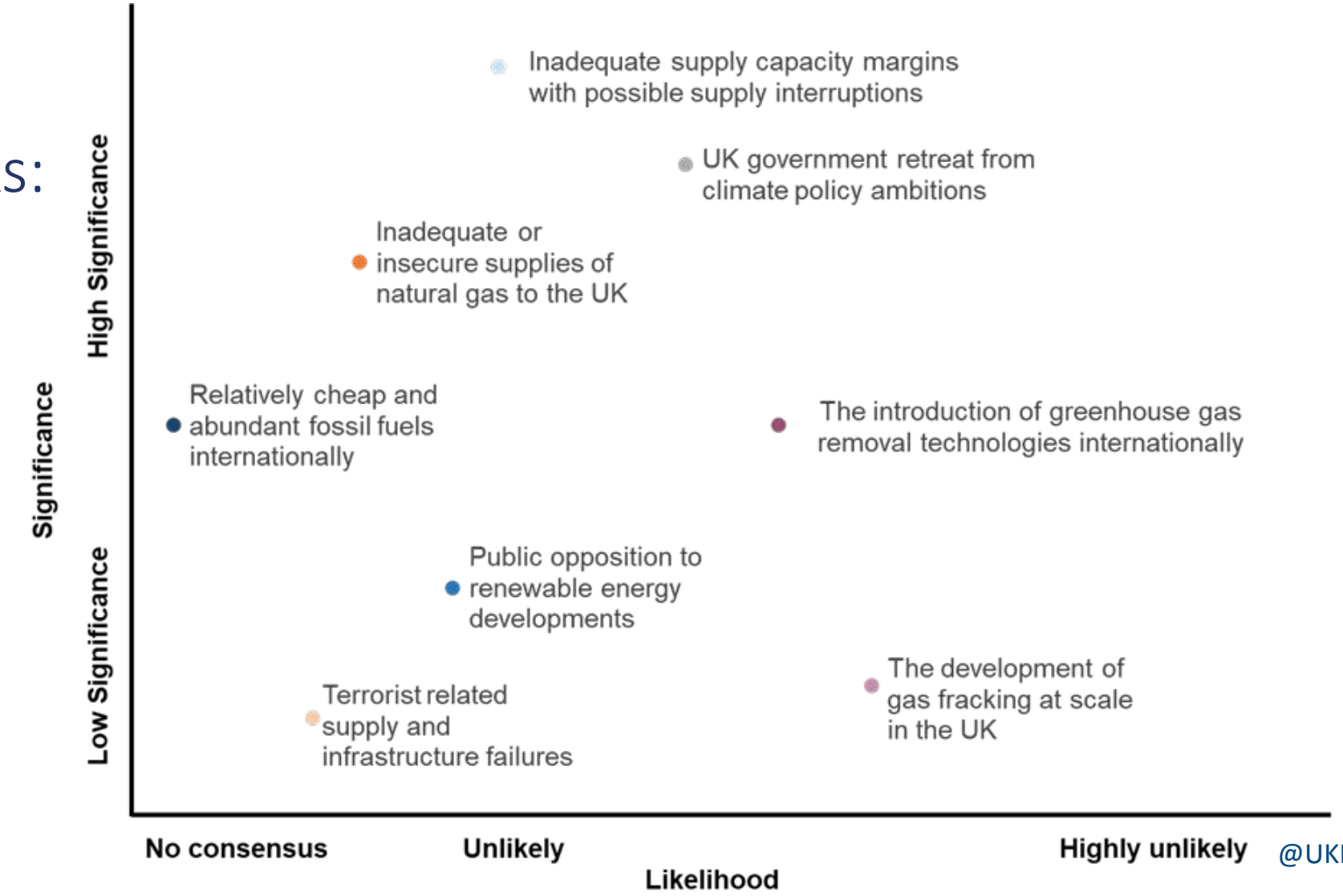
# Expert survey: some results

Landscape changes and system shocks: least likely issues



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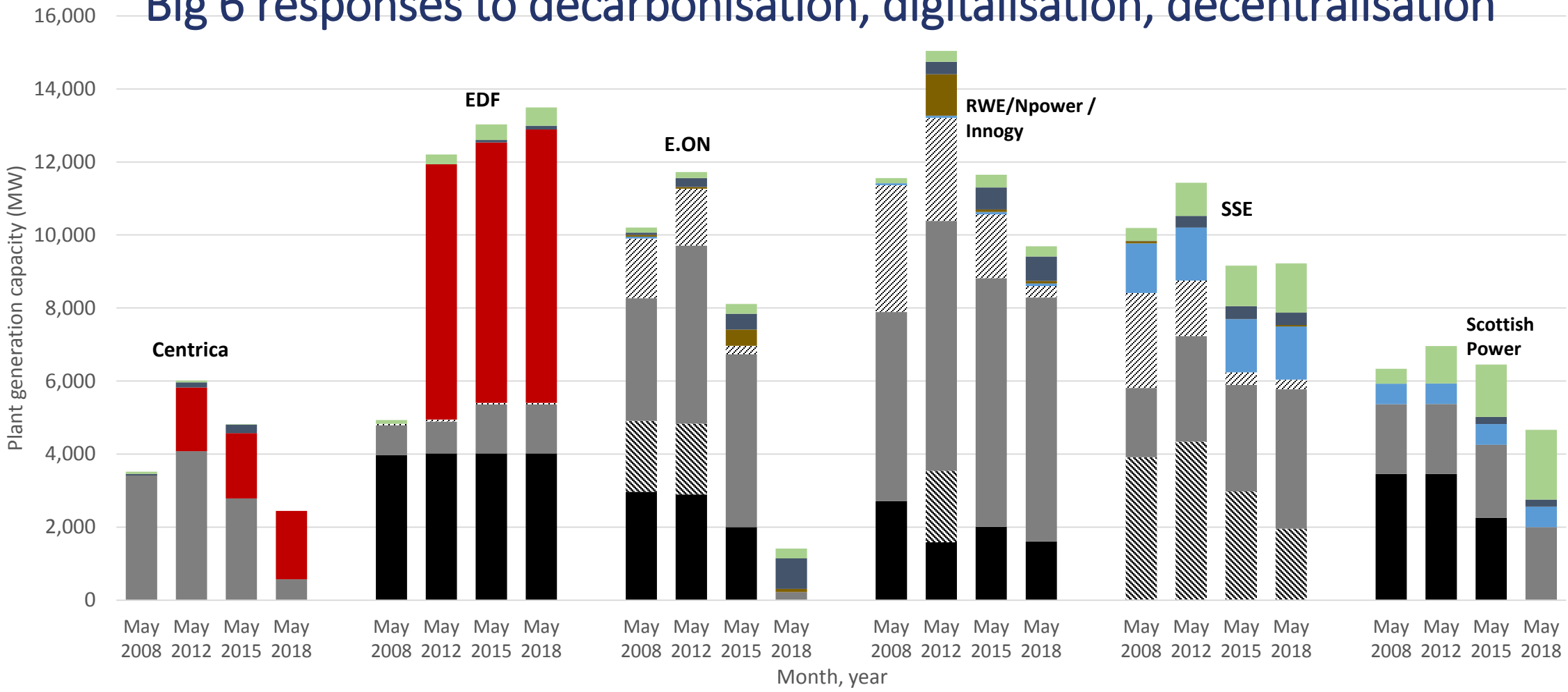
# Power sector disruption

## Big 6 responses to decarbonisation, digitalisation, decentralisation



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# Key trends: Decarbonisation

- SSE and Scottish Power: large scale renewables
- Centrica: radical scale down of electricity generation portfolio, pursuing decarbonisation through services that reduce energy demand
- EDF: key Big 6 supporter of nuclear power (position of parent company in France), but also coal
- E.ON: portfolio dominated by several large and medium sized wind farms (divestment from Uniper)
- RWE: high aspirations but unclear commitment

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# Key trends: Decentralisation

- Centrica: strategy shift to decentralised model in 2015
- EDF, RWE, SSE and Scottish Power: geared towards a more traditional centralised power system
- E.ON: initially invested ambitiously in decentralised energy services activities; but then dissolved them in 2013

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# Key trends: Digitalisation

- Centrica & RWE: repositioning retail strategies towards smart technologies and energy management
- SSE: set up SSE Enterprise to engage with customers in new ways
- E.ON: Home Energy Services business was sold in 2013
- EDF & Scottish Power: expressed an interest in 2011 but actual level of commitment unclear

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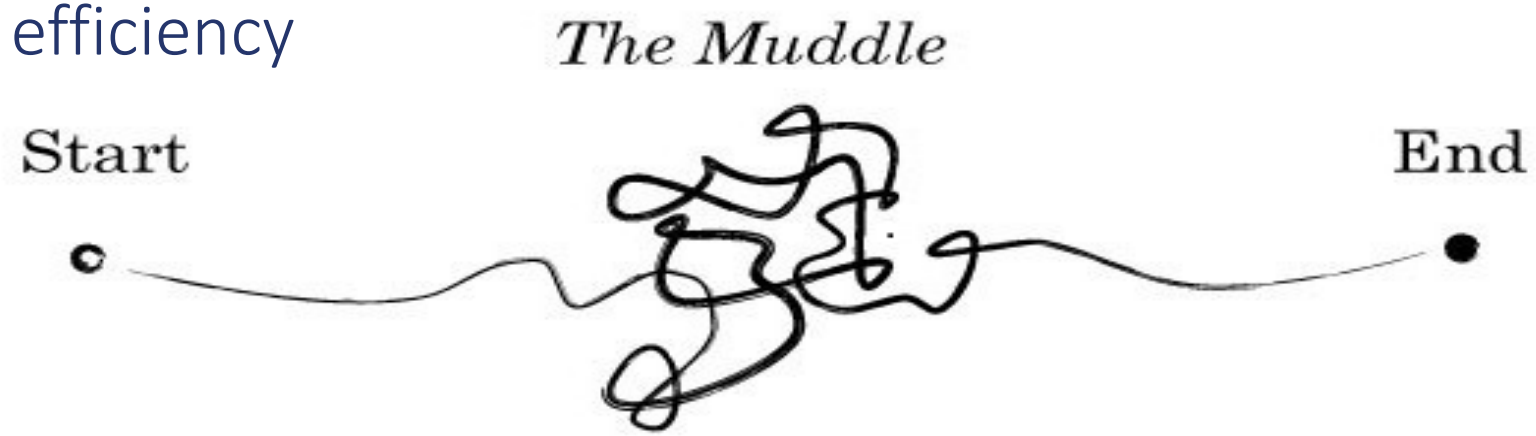
# Disruption ahead for heating:
## Perceptions of senior policy makers

- Uncertainty seen to be limiting decision making.
  - “Standoff”, “false binary”, “woeful state”
- Lobbying has increased policy makers’ support for hydrogen
- Despite the perceived uncertainty, still clear wins:
  - New build homes
  - Off-gas grid homes
  - Energy efficiency



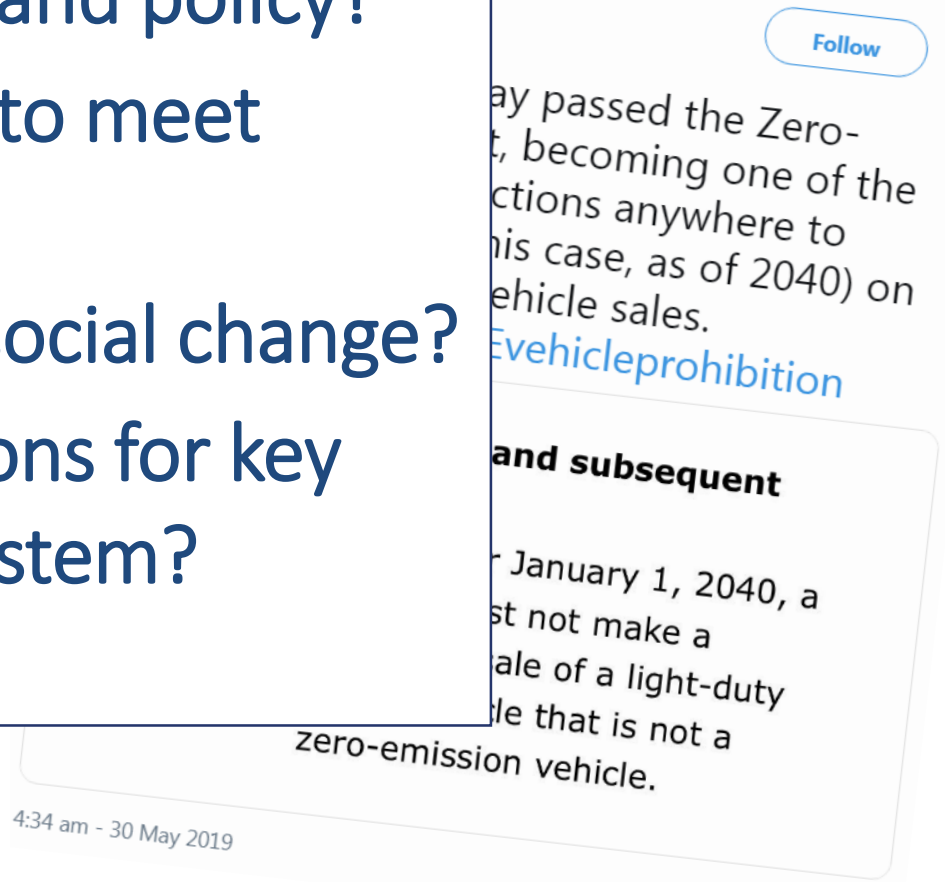
# Why is this important?

- Transport sector now largest – and increasing – carbon emitting sector
- Transport
- Need for '
- 'Disruptio
- Bans on sa
- Lifestyle c

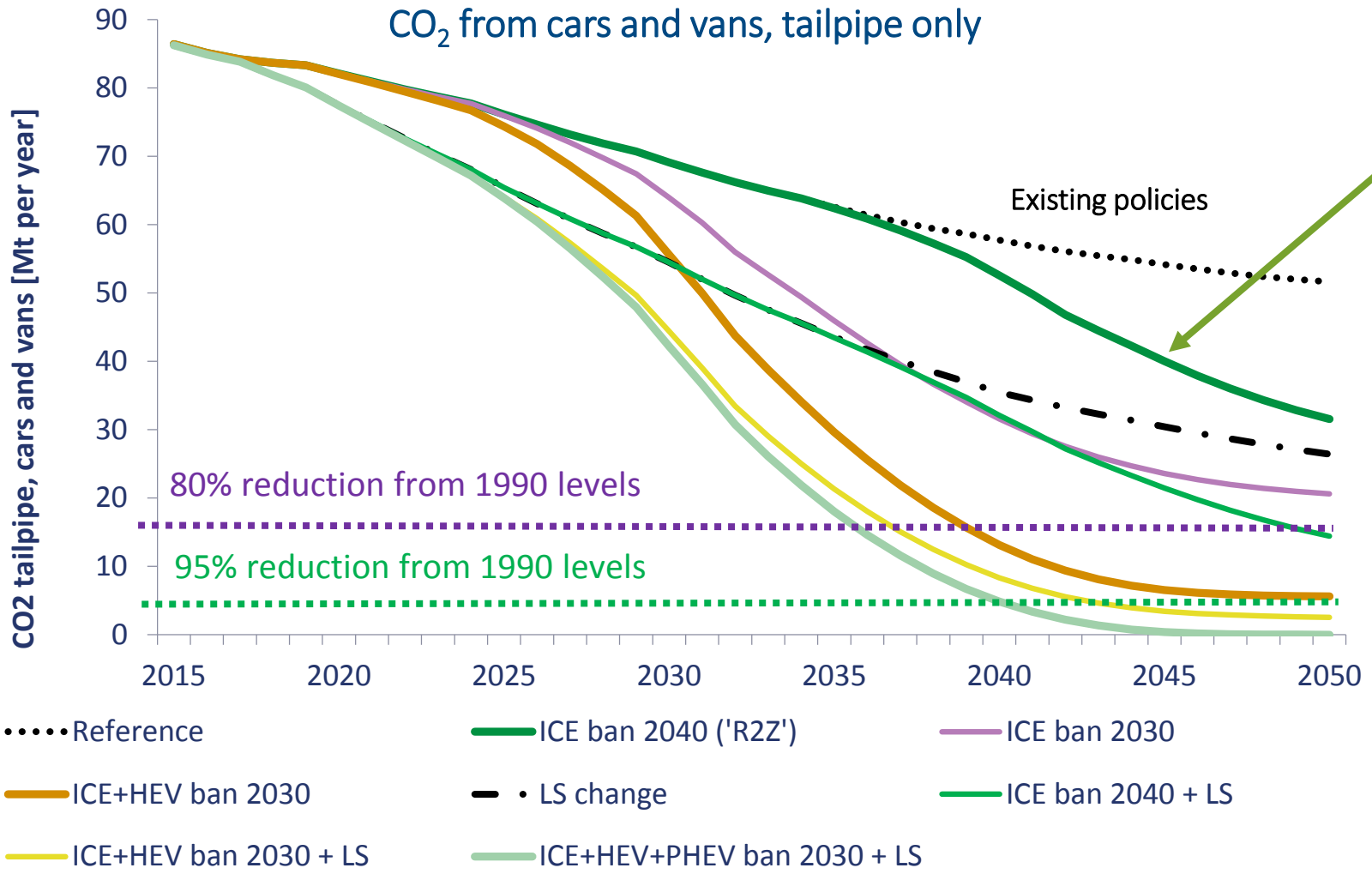
- What are the impacts if we were more ambitious than existing strategy and policy?
- How much disruption is needed to meet climate and air quality goals?
- What is the role of lifestyle and social change?
- What are the potential implications for key actors in the transport energy system?

ions


- energy generation
- land use
- cities
- industry



# Impacts and implications




'Road to Zero' ban **too little too late** – does **not** fit with our emissions targets

Still a lot of diesels on road in 2050

ULEV targets of R2Z only met when banning hybrids (HEV)

Lifestyle change brings earlier gains – 'no delay' due to fleet turnover

Largest and earliest savings in 2030 ban of non-plugin vehicles combined with more sustainable travel patterns

Source: Brand and Anable (2019) 'Disruption' and 'continuity' in transport energy systems: the case of the ban on new conventional fossil fuel vehicles, paper presented at ECEEE 2019, 3-8 June, France. Based on new analysis for UKERC, taking approach of Brand *et al.* (2017) Modeling the uptake of plug-in vehicles; and Brand *et al.* (2018) Lifestyle, efficiency and limits: modelling transport energy and emissions using a socio-technical approach.

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# Governance approaches for disruption and continuity

- Transport (China)
- Heat (The Netherlands)
- Electricity (Australia, UK)
- Energy efficiency (Japan)

- Market- based
- Mission oriented
- Adaptive governance

*'the ability to recover or adjust to change through learning and flexibility so as to maintain or improve into a desirable state'*

- The importance of networks
- Policy as hypothesis
- Coordination infrastructure

- Perspectives of D&C - technologies, actors, sectors and scale.

| Country | Policy formulation/intention | Adaptive feedback mechanism present | Outcomes |
|---|---|---|---|
| **Japan**<br>**Energy efficiency** | Mission oriented;<br>Aimed at mix of creating disruption and continuity | Energy conservation covered all technologies, actors, sectors and scales;<br><br>adaptive nature of initial policy allowed for change with minimum disruptive influence | - Energy efficiency already embedded in Japanese industry/behaviour<br>- no increase needed in generation capacity following unexpected disruption (Fukushima); increase in fossil fuel emissions<br>- reduction in demand and new policies for RE to reduce future emissions . |
| **UK**<br>**Capacity market** | Mission oriented;<br><br>aimed at maintaining continuity during period of rapid change | lack of adaptability insofar as market interventionist policy allowed excessive influence from incumbent players | - Disruption as unexpected increase in diesel generation and no CCGT;<br><br>- exclusion of new/smaller market players led to legal challenge. |
| **China**<br>**EV Policy** | Mission oriented;<br><br>Aimed at mix of purposive disruption and continuity | decentralisation of EV policy to meet local requirements;<br><br>Coordination of infrastructure at regional level;<br><br>continuous feedback through a bottom-up process to shape future plans. | - Adaptability of governance able to meet intended continuation and disruption elements;<br><br>- unexpected disruption (falling technology costs) was able to be absorbed into policy intentions; |
| **Australia**<br>**Distributed Energy Resources (DER)** | Market-led;<br>Intended disruption | no anticipatory policy in place for coordination;<br><br>policy reactions too slow to capture new value streams | - Unexpected disruptions (falling DER costs, blackouts) caused unexpected rapid uptake of DER;<br>- further disruptions across dimensions |
| **The Netherlands**<br>**Heat Policy** | Initially market led, then mission oriented;<br><br>Initially continuity then intended disruption | Original policy had limited adaptive mechanisms;<br>disruption (earthquakes) caused change to policy paradigm to allow for more inclusivity of decision making and local area needs | - initially gradual reduction in heat use; Emergent disruption of earthquakes in Groningen;<br>- Change in policy paradigm to more mission oriented/adaptive governance |

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# Governance lessons

In order to counteract the negative effects of disruption, what the results of the case studies suggest is that:

- creating a long-term vision;
- where appropriate, including a local dimension in policies to allow for local needs;
- planning and coordinating policy across systems and scales; and
- allowing policy to be an iterative process

can reduce the adverse effects of system disruptions by creating flexibility – adaptive governance – for energy system transformation.

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# Conclusions and recommendations

What are the potential sources of disruption to the UK energy system?

- Despite some disruption so far, divergent views about what lies ahead
- Some further disruption is inevitable, especially to meet net zero target: extent, nature and impacts are very uncertain
- Significant gap between what stakeholders *expect* to happen in future, and what they think is *necessary* to meet targets
- Although falling costs of some technologies have shored up the political consensus for ambitious targets, this could be undermined by wider political disruptions

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# Conclusions and recommendations

Which sectors and actors might face particularly disruptive change?

- Some actors are likely to be more affected by disruption than others, e.g. by a shift to electric vehicles
- Impacts on incumbents are likely to vary: contrasts between electricity, heating and construction
- Some evidence of adaptation to change by incumbents in the electricity sector

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# Conclusions and recommendations

How should decision-makers respond to ensure that the low carbon transition is implemented successfully?

- Some deliberate disruption by government will be needed
- Decision makers are likely to require a wider range of models and methods to understand disruptive change
- International experience suggests need for an adaptive approach to energy policy (e.g. to deal with unintended consequences)

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# Thanks

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