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Where now for the UK energy system

- steady progress or another expensive diversion...?

Dr David Clarke
Chief Executive



Many different viewpoints...

Shared, robust evidence base is critical

Strategic

- 2050 decarbonisation targets
- Security of supply (diversity of fuel supply and power generation capacity margin)
- Consumer attitudes, needs and engagement

System

- = power + heat + transport + infrastructures
- Infrastructure base is aging and unfit for future purpose
- Optimisation and effective linkage cuts costs, increases security and can increase consumer engagement

Common Evidence base

Policy

- ‘Market decides’
- EMR delivery identifies direction
 - LCF capacity - Contracts for Difference, Capacity payments, Feed in Tariffs, etc
- Innovation support, Low Carbon Network fund, ...

Decisions and Actions

- in an uncertain world ...
- Focus on 6 priorities
- Recognise risks, mitigations and implications
- Prepare for the future - with technology, regulation, incentives



Building a shared evidence base...

ETI Firsts

Building the world's largest wind turbine blades
30% lighter with 5% more energy yield



Offshore Wind

Vehicle designs
for 34% fuel
efficiency
improvement
across UK HDV
fleet

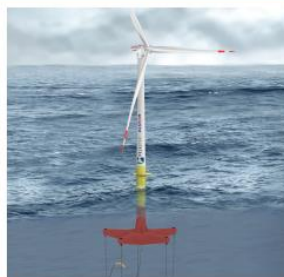


Transport



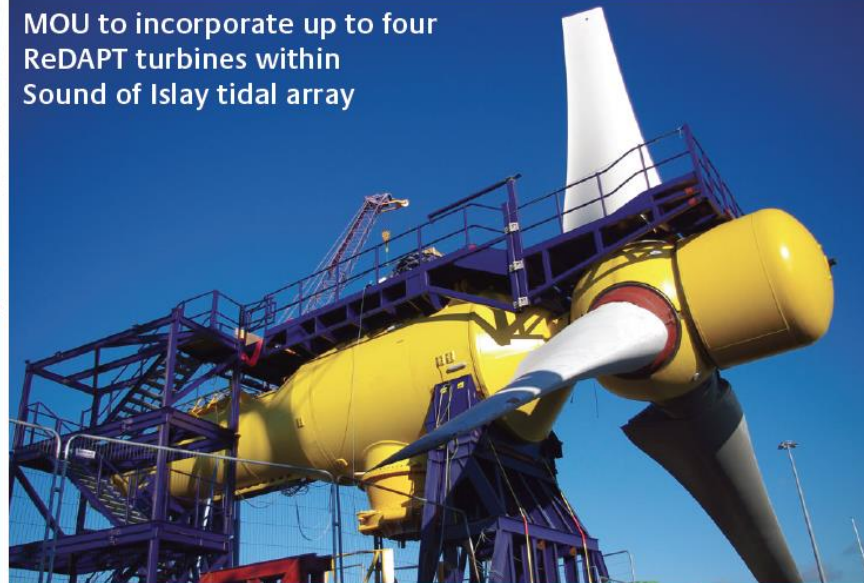
Bloenergy

Largest UK
investigation
into soil carbon
effects following
land use
transitions



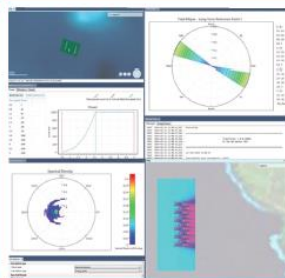
Offshore Wind

MOU to incorporate up to four
ReDAPT turbines within
Sound of Islay tidal array



Marine

Validated
software tools
predicting
energy yield of
tidal and wave
sites - in use on
current UK
projects



Marine

15% cost
reduction on
offshore wind
through floating
platform design





Building a shared evidence base...

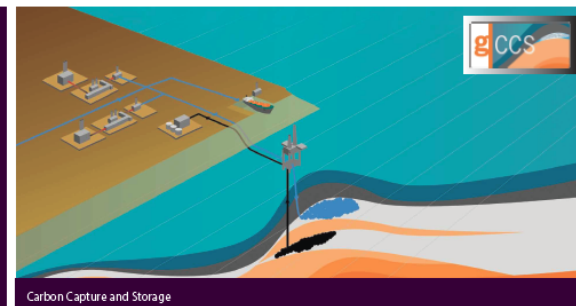
ETI Firsts

First fully cost
optimised UK
energy system
model to 2050



Strategy

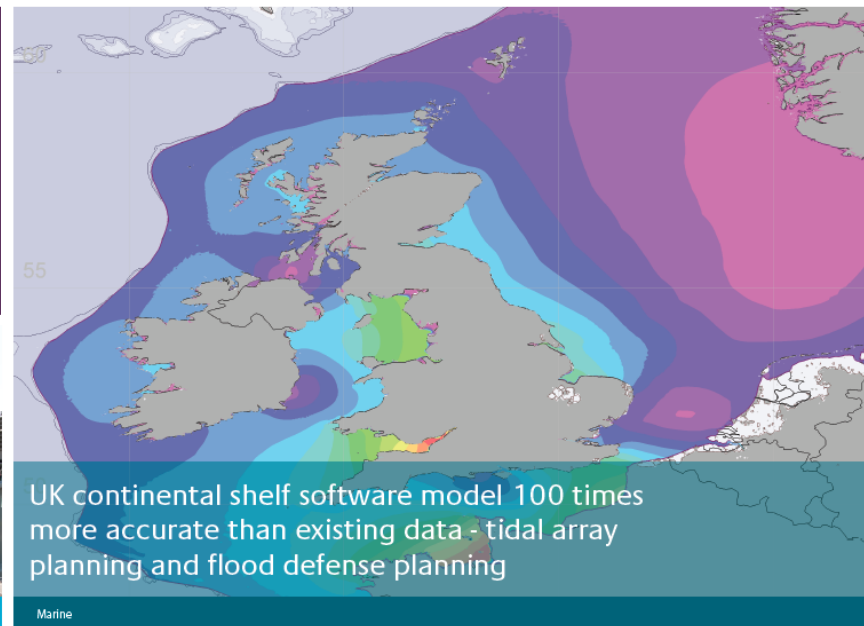
First whole chain
CCS system
modelling
software package -
launched and
in use



CO₂ Stored

Carbon Capture and Storage

First national
database created
for offshore CO₂
Storage



First UK commercial
CO₂ storage site
appraisal drilling
with National
Grid

First distribution
scale active
fault current
management





Strategic view - the UK energy challenge...

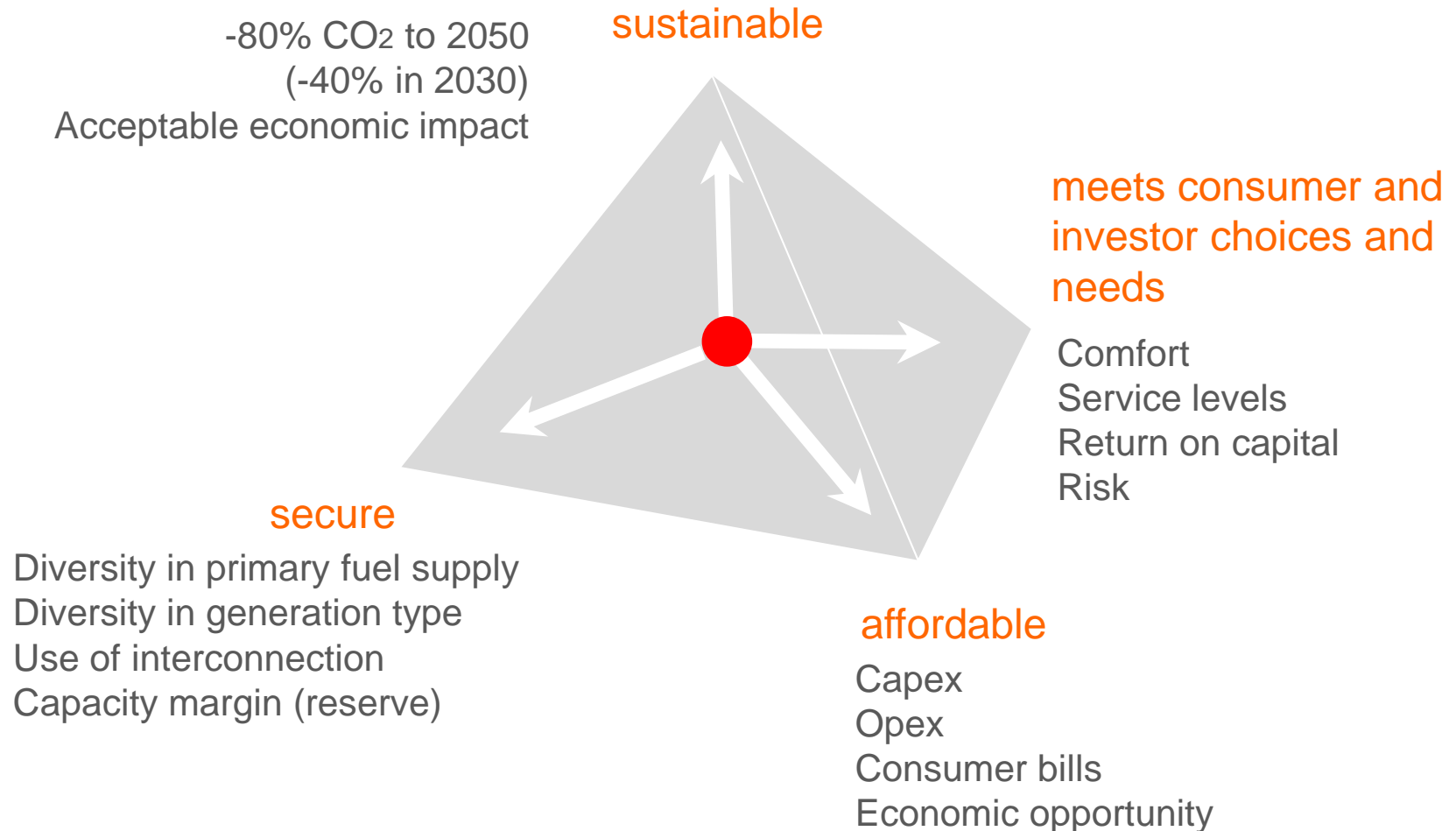
Demand will grow, assets are aging, prices are rising

- 62m people growing to 77m by 2050
- 24m cars growing to 40m by 2050
- 24m domestic dwellings 80% will still be in use in 2050
total dwellings 38m by 2050
- Final users spent £124bn on energy in 2010 9% of GDP
- 2.4m English households in fuel poverty average 'fuel poverty gap'
£438 and increasing
- ~90GW generation capacity in units from 2kW to 3.9GW
- 50% of power generation capacity in 20 powerplants
average age 30 years
- 3% of power generation capacity in PV in 590,000 installations
average age < 5 years
93% domestic <4kW



Trilemma or 'quadralemma'?

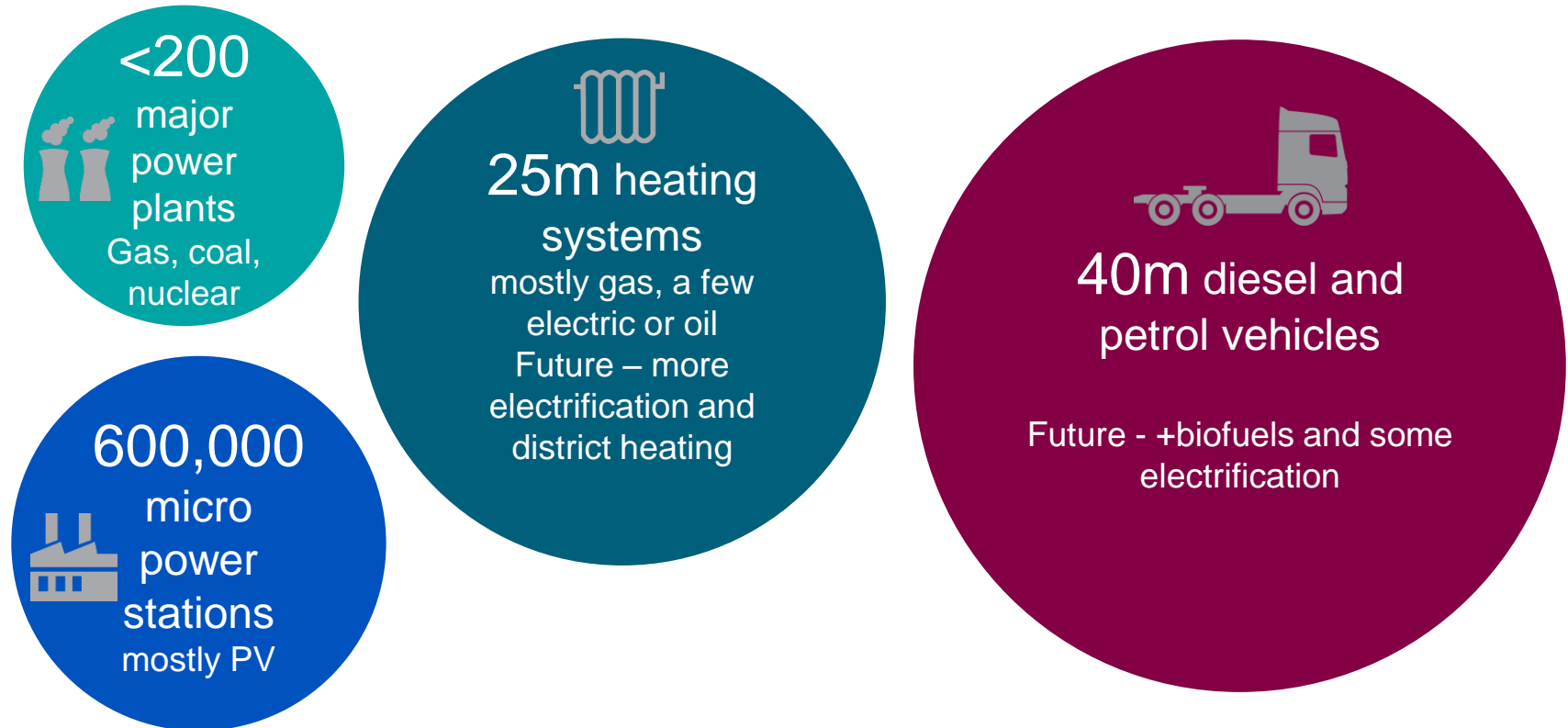
consumer and investor needs are changing, choice is increasing





System view - UK energy system today

Limited interactions – power / heat / transport



£100s bn of integrating systems

176,000 miles of gas pipe, 400,000 miles electrical feeds, 500,000 substations and transformers, 600,000 direct jobs in power sector alone (2% of UK workforce)

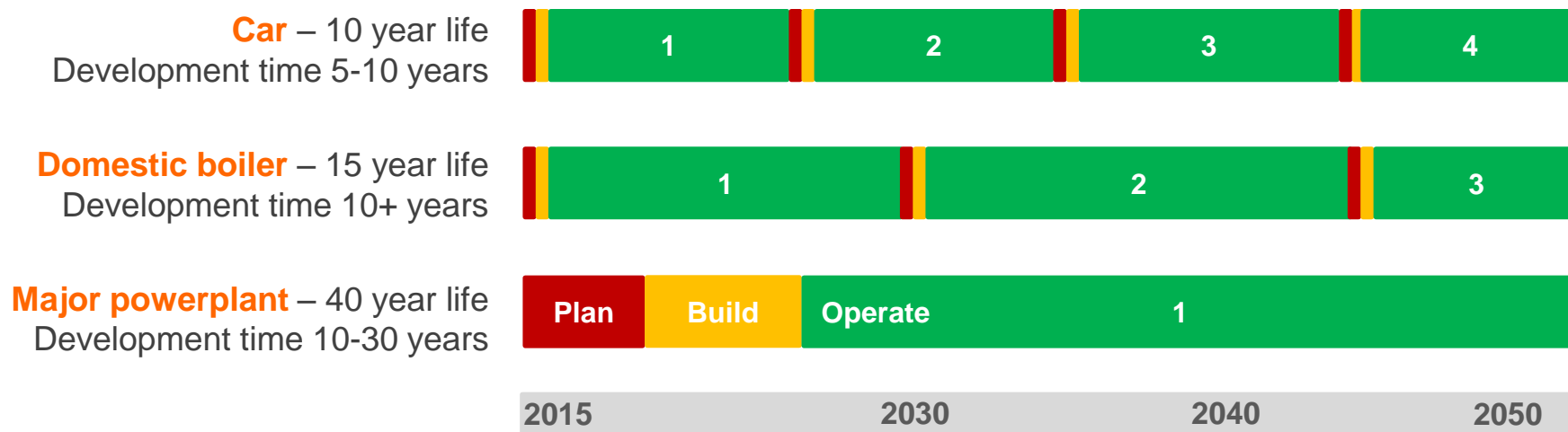


Renewal - slow and steady...

'fleet replacement' opportunities to 2050

Opportunities to introduce step-changes in technology or strategic direction are few

- Some largely HMG policy driven (eg large power, major transport links)
- Many more are consumer led decisions driven by comfort, affordability, supply regulations and standards (cars, heating, some distributed generation)



- Other major infrastructure – road, rail, power and gas transmission – similar to power assets, 40-100 year lives, planning phase can be 10-20+ years
 - Lead-time for step-change in vehicle and boiler performance often driven by introduction of new standards and regulations – may take 10 years



One route to meeting - 80% CO₂ for the UK

Power now, heat next, transport last – cost optimal

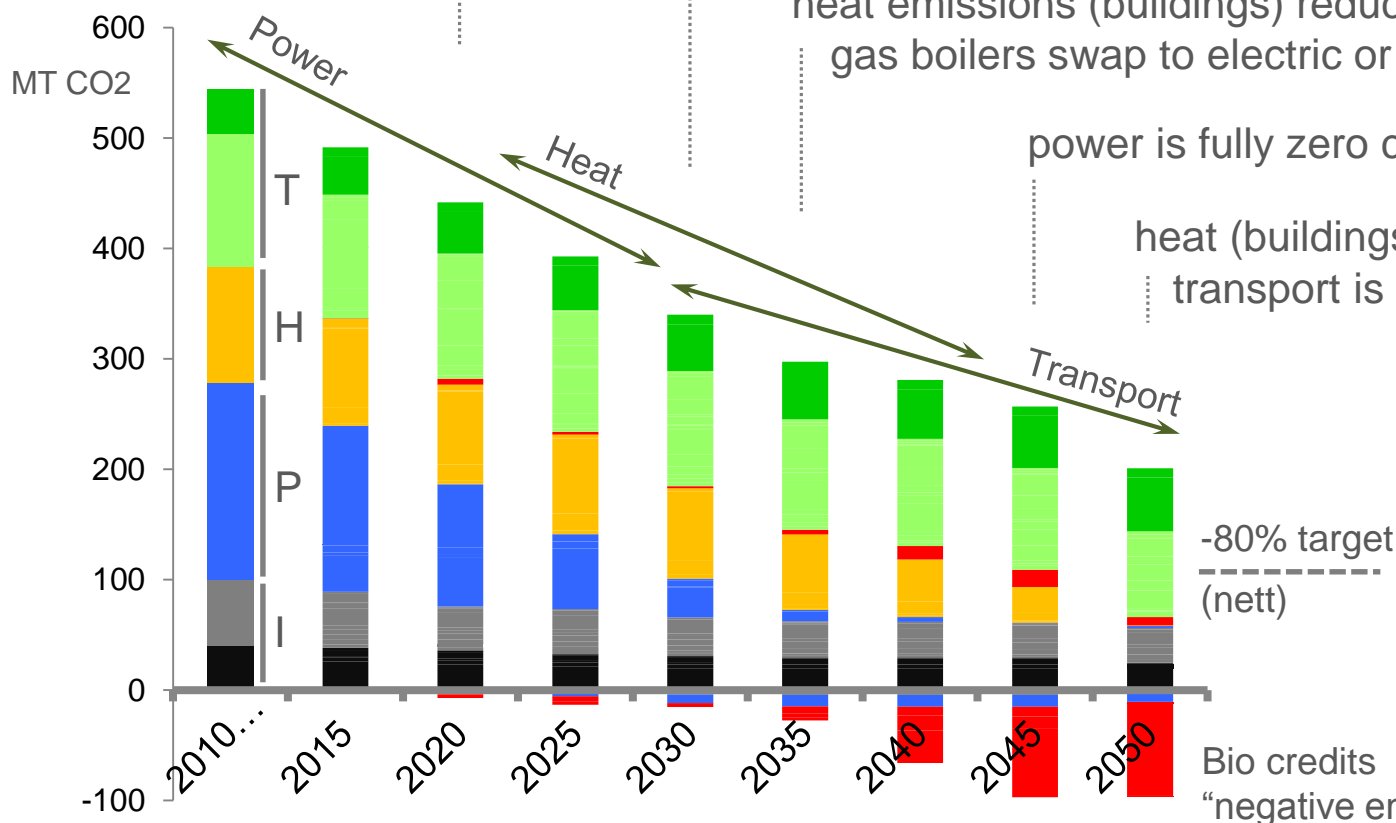
CCS and bioenergy demos operating

negative emissions through bioenergy + CCS

heat emissions (buildings) reducing as domestic
gas boilers swap to electric or district heating

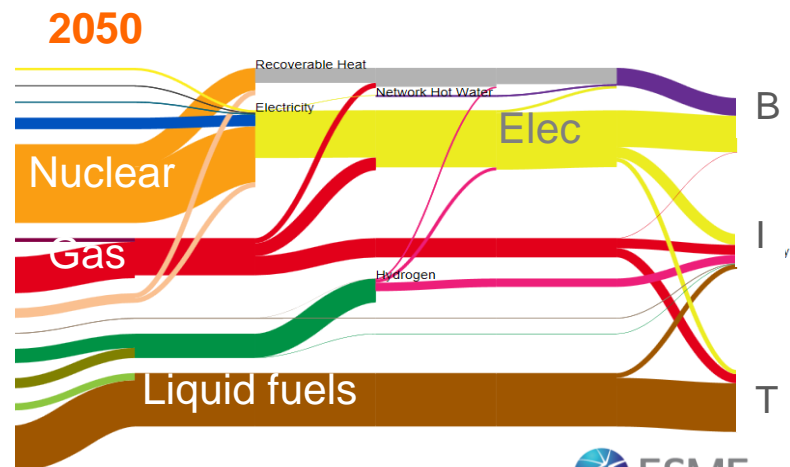
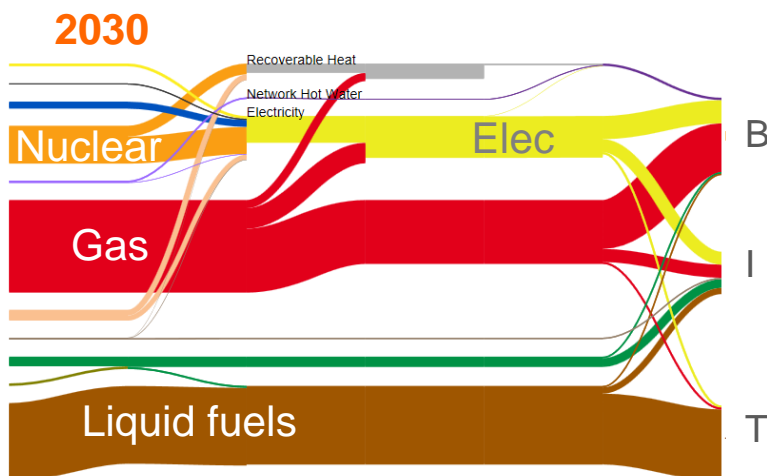
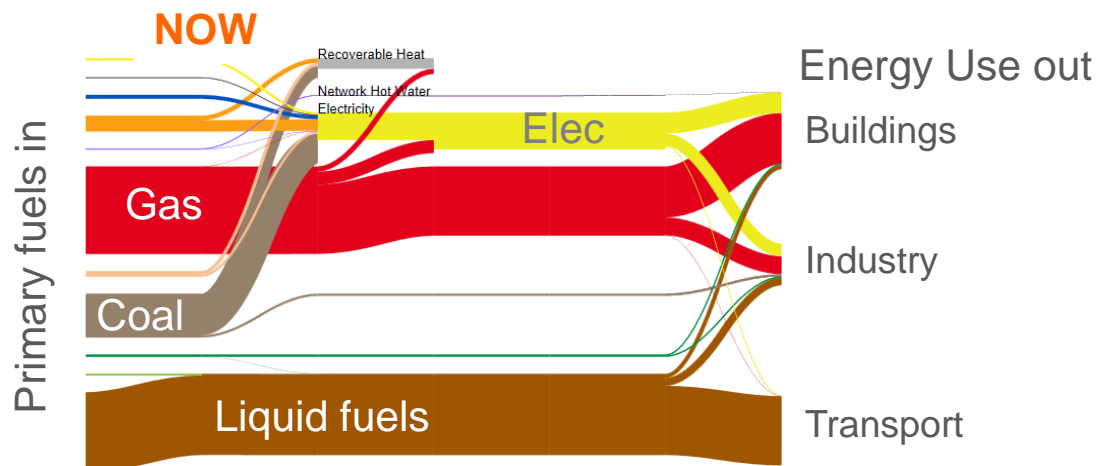
power is fully zero carbon

heat (buildings) zero carbon,
transport is largest CO₂ emitter





system change starts slow then accelerates
as new capability is taken up by market





-80% CO₂ costs 1-2% of GDP

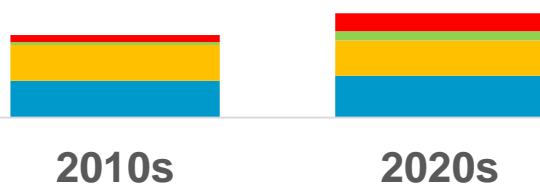
using considered system planning and consistent leadership

Abatement capex

Incremental
£bn/10yr
period
vs system
renewal
without
CO₂
reduction

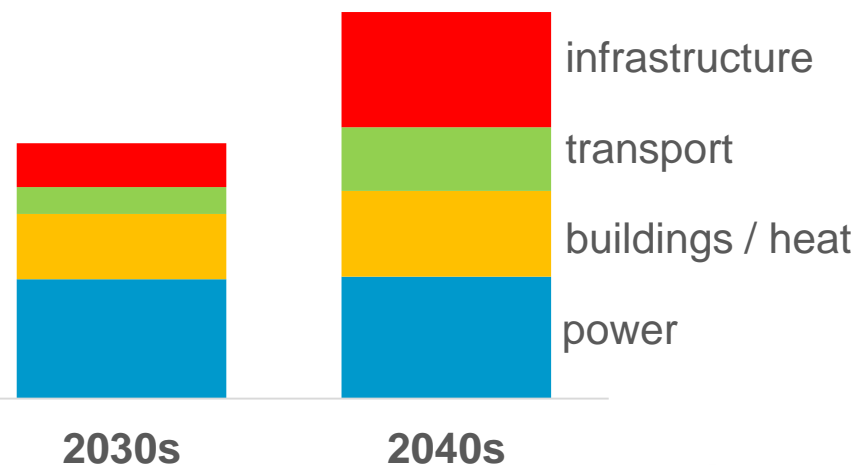
~£100bn over 20 years

- Deployment of existing approaches
- Testing and commercialisation of new approaches
- Strategic investment decisions for 2030 onwards
- **'Preparedness' phase**



~£500bn over 20 years

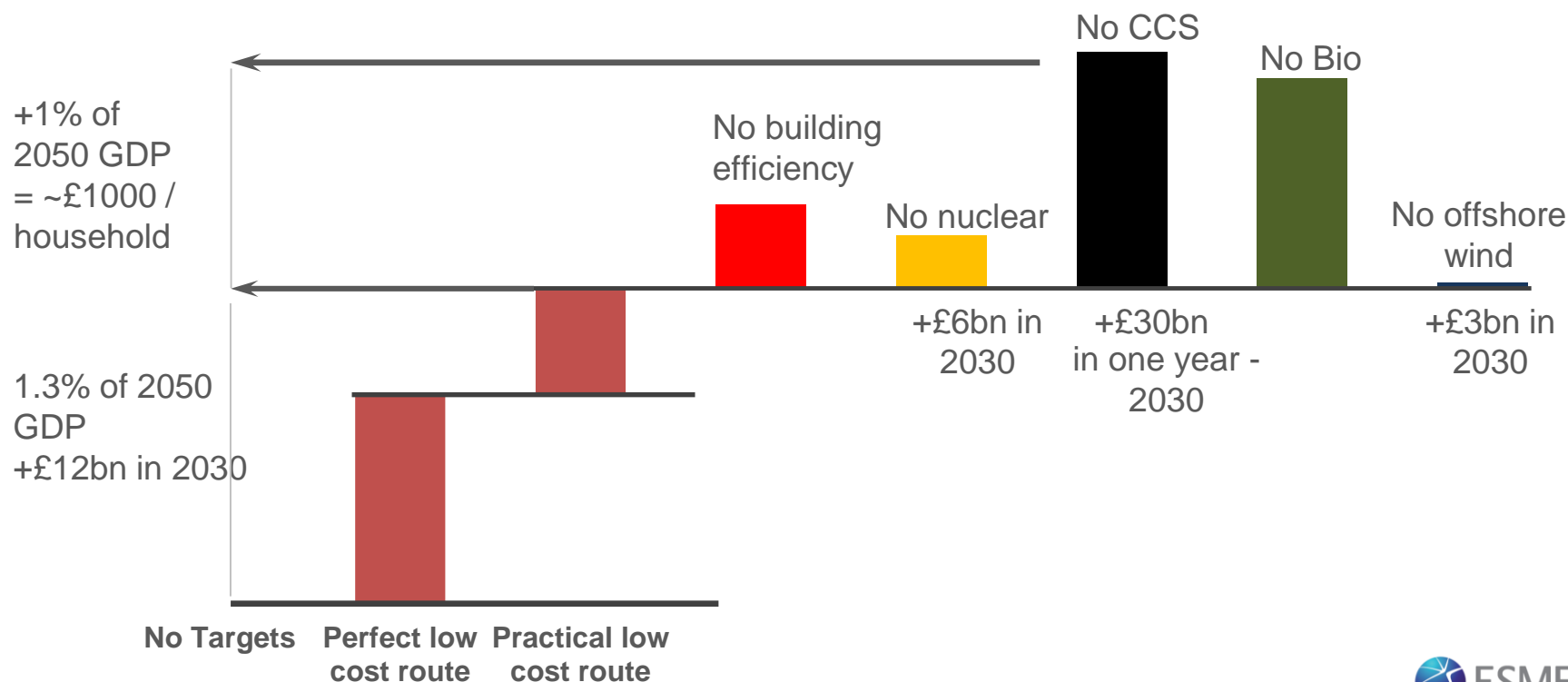
- Building retro fits
- Vehicle fuelling infrastructure
- New major powerplants
- Pipes and wires
- **Widescale roll-out phase**





Poor system optimisation doubles the cost of a 2050 UK low carbon energy system

Additional cost of delivering -80% CO₂ energy system





UK deployment priorities

for a 'lowest cost', secure and sustainable future system

Carbon Capture and
Storage

Bioenergy
(including with CCS)

New Nuclear

Renewables

Efficiency
Buildings and Transport

- Selected to deliver optimal :
Affordability + Security + Sustainability
- Enables continued use of global resource of fossil fuels
- Supports long-term sustainable delivery against rising demand
- Uses known - but currently underdeveloped – solutions
- CCS and bioenergy emerge as the two potentially most valuable technology options in delivering a low carbon future
- Ability (or failure) to deploy these two technologies has material impact on costs and the national energy system architecture



Recent policy view on enabling transition

works in a “steady as she goes” world...

Last parliament :

- Supported a strategy that incentivised particular elements
- Established Electricity Market Reform mechanisms to enable implementation
 - Contracts for Difference
 - Capacity paymentsplus ...
 - FITs / RHI
 - Capital grants
 - Innovation support
- Left the market to propose implementation routes
- Accepted limited strategic planning for system connectivity between power, heat and transport
- Recognised need to directly fund key demonstrations ahead of market support eg; CCS commercialisation projects (£1bn)

Carbon Capture and
Storage

Renewables

New Nuclear

Efficiency

Bioenergy



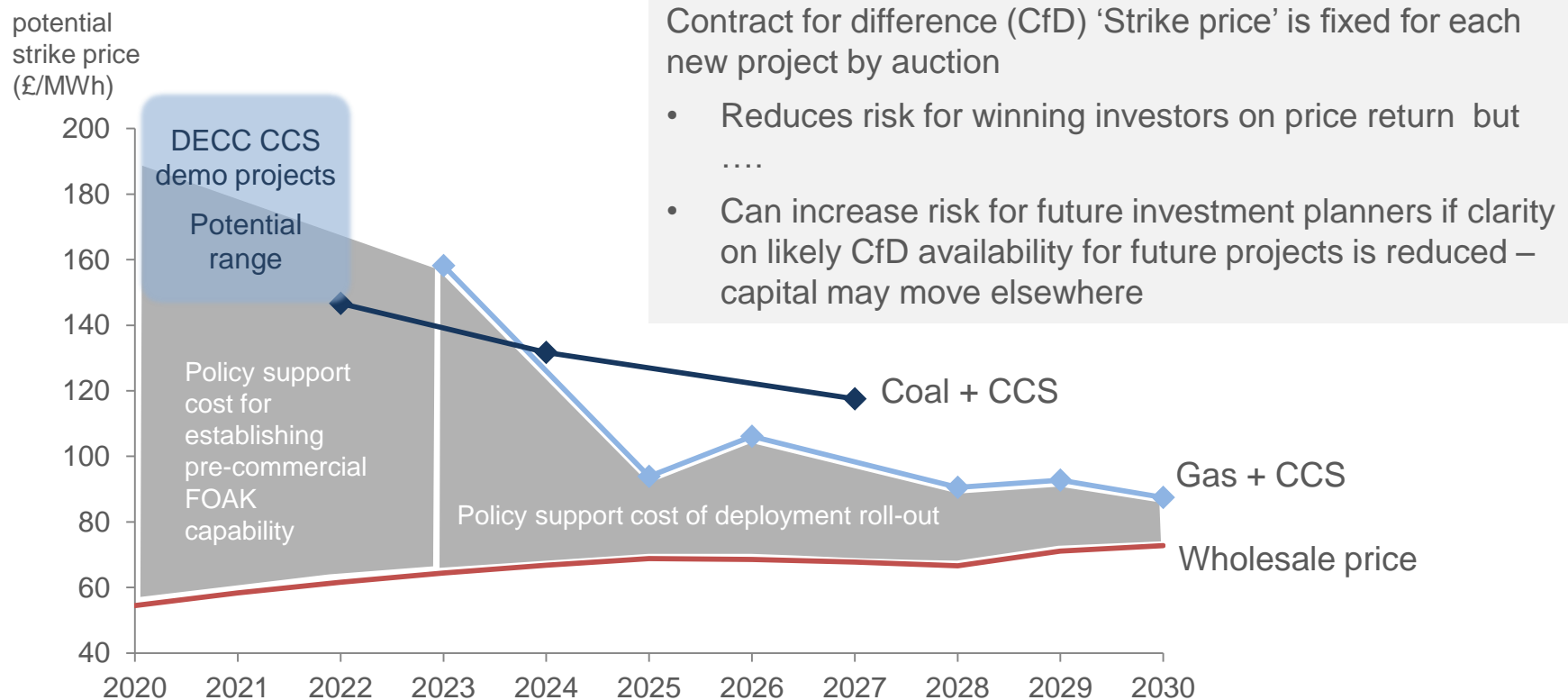
But the world is uncertain not 'steady'...

- Fossil energy prices
 - Sustained low prices increase the gap to low carbon energy prices in absence of carbon tax
- Commodity prices
- HMG budget capacity
 - Levy Control Framework (LCF) in particular
- Consumer attitudes and needs
 - Individuals
 - Communities
- Disruptive technologies
 - PV prices
 - Cheap electricity storage ?
- Impact of new standards and regulations
- ...



LCF CfD risks – eg; CCS development

'positive discrimination' towards targeted pre-commercial projects is critical



Approach caps risk to government of policy support costs

Competitive allocation should focus industry on delivering low risk projects and drive energy costs down

but

Increases importance of 'positive discrimination' towards targeted pre-commercial projects eg; CCS demos, new nuclear to establish initial technology feasibility and commercialisation pathway

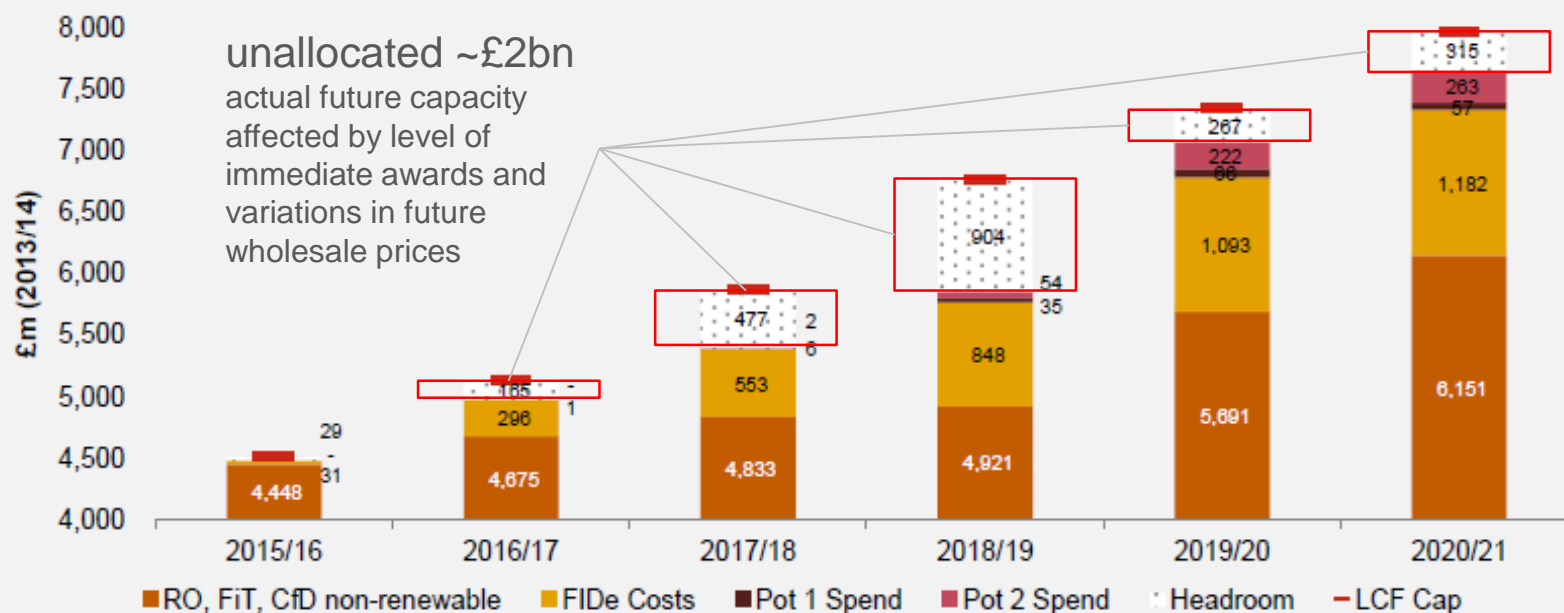


LCF CfD headroom to 2021 is limited

£2bn available in next 6 years but £35bn already allocated

Unallocated headroom
~£2bn to 2020/21 = 4 offshore wind projects
or
2 CCS projects
or
...a few of 'something else'

Figure 7: Forecast LCF spend by support mechanism (£m)¹⁶

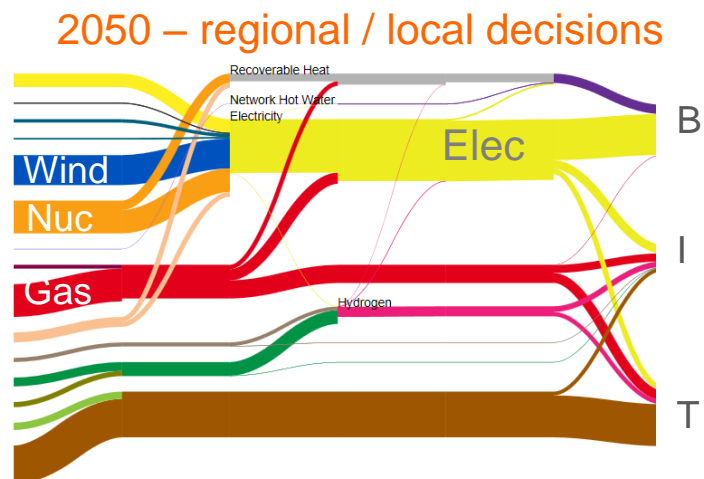
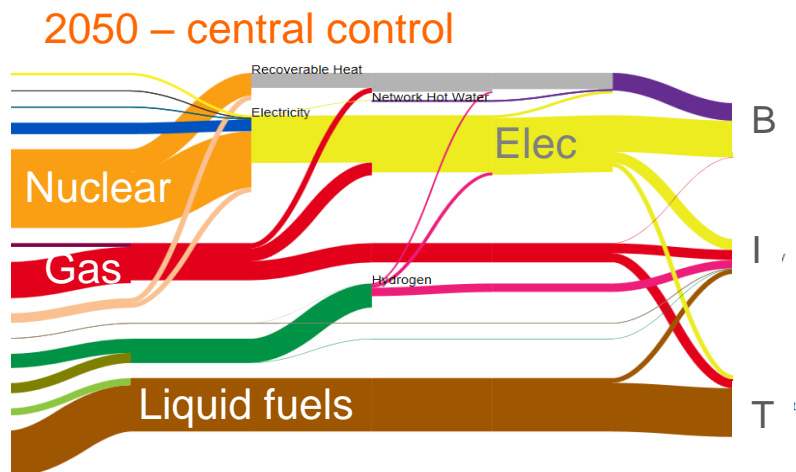
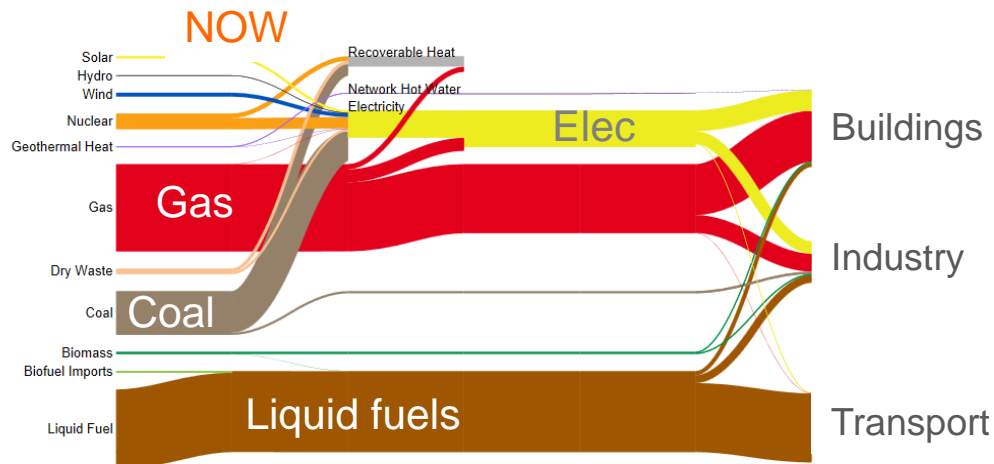


pwc report – 'State of the renewable industry' May 2015



Central control or locally driven?

local decisions often based on different criteria to central control





ETI scenarios – Clockwork, Patchwork

central control vs locally based decisions



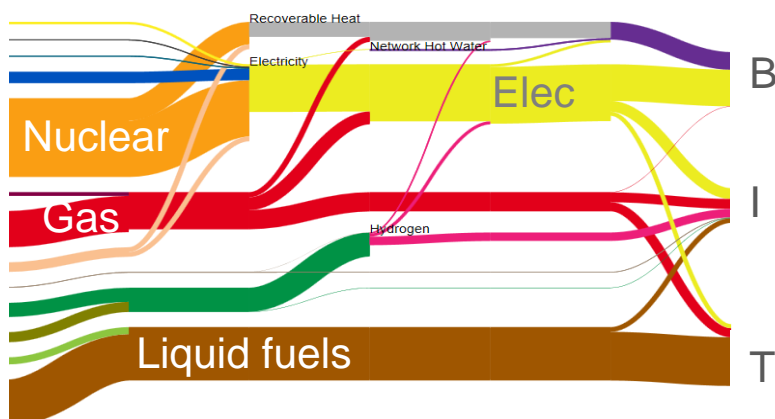
25% increase in
abatement cost to
2030 (+£33bn)



Clockwork

Well coordinated, long-term investments
National planning

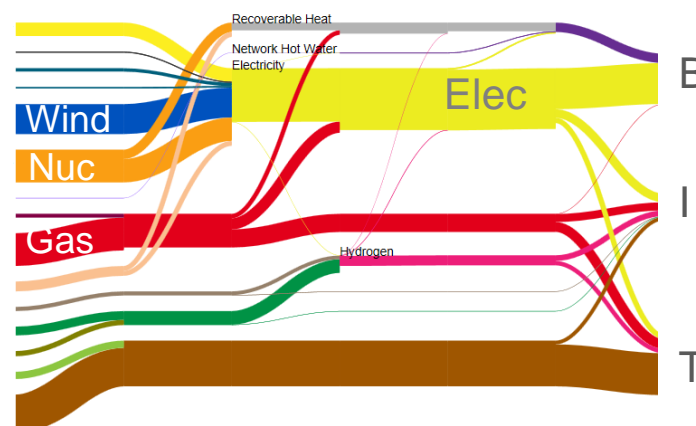
2050



Patchwork

Regional and community decisions
Larger number of (generally) smaller capital projects

2050





Less coordination increases capex need



Clockwork

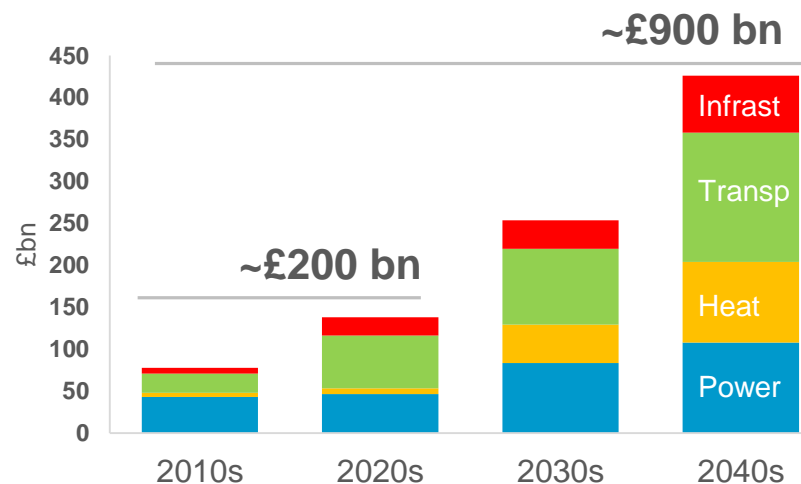
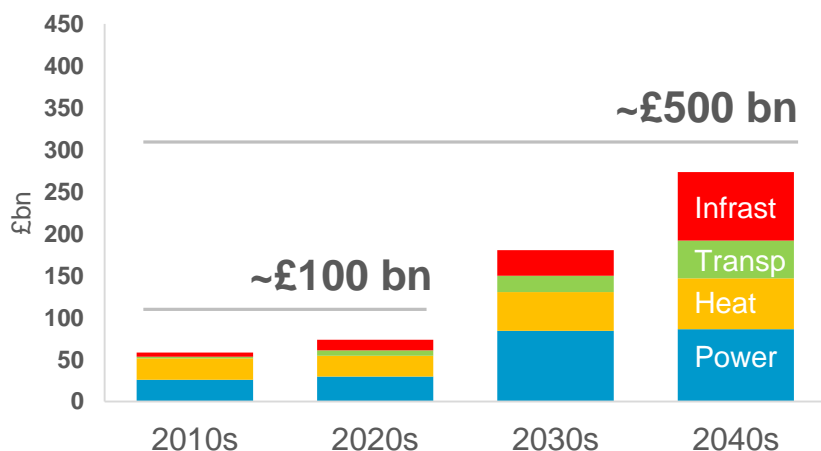
Well coordinated, long-term investments
National planning

100% increase in
system capex cost
to 2030



Patchwork

Regional and community decisions
Larger number of (generally) smaller capital projects





Where now for the UK energy system

- steady progress or another expensive diversion...?



Steady progress - actions...

Stay focused on delivering the 6 priority areas

Carbon Capture and Storage

Renewables
(particularly offshore wind)

New Nuclear

Efficiency
(buildings and transport)

Bioenergy
(for heat and power)

Recognise progressing CCS is key to mitigating potential system cost increases

1 key incentivisation route – EMR with use of CfDs in particular

But with insufficient budget capacity

Beyond initial proving of the 6 priorities and roll-out of a few deployments

Make early commitment to increase LCF headroom

within this parliament, enabling future commercial roll-out of CCS, renewables, nuclear and bioenergy

Sustain incentives for pre-commercial testing of favoured new approaches to delivering the 6, ('preparedness') starting with

Make early 2016 commitment to support both CCS commercialisation projects with CfDs



Mitigations against an expensive diversion ?

Risks

Weak central strategy and leadership

Insufficient headroom in LCF

Risks diminished with a majority government and retention of departmental structures?

Disruptive technology entry

Impacts

Developers move to lowest capex, shortest return projects – unabated gas?

Pre-commercial projects go on-hold

Essentially mothballs CCS and new nuclear roll-out

Low carbon transition cost escalates

Economic growth slows?

Wide scale take-up of cheap PV?

Mitigation Actions

Signal commitment to increasing LCF headroom

Consider and prepare future regulatory structures

Recognise criticality of consumer engagement and understand drivers on choices

Keep watch and maintain a 'real-time' system design and analysis capability



Reality – some major projects plus increasing number of small diversions...?

Reality - somewhere in the middle?
£150bn capex to 2030

Clockwork – steady progress
lowest cost
greatest economic benefits ...



Patchwork – fast decisions at regional level, diverse solutions
adapt for shocks and diversions



25% increase in abatement cost to 2030 (+£33bn)
100% increase in system capex cost to 2030 (+£100bn)

Do 2 things?

Maintain direction - focus on the 6 priorities
Uplift LCF capacity ahead of next CfD round



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