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# Building the UK CCS sector by 2030 Scenarios and Actions

Den Gammer for UKCCSRC

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# What is the ETI?

- The Energy Technologies Institute (ETI) is a public-private partnership between global industries and UK Government

## Delivering...

- Targeted development, demonstration and de-risking of new technologies for affordable and secure energy
- Shared risk

## ETI members



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# ETI Portfolio



## Nine Technology Programme Areas

Delivering...

New knowledge

Technology development

Technology demonstration

Reduced risk



## Scenarios - giving target ranges for CCS

- No explicit government target for the “mix” of clean power producers, but
  - Policy and obligation to reduce GHG emissions by 80% by 2050, from 1990 levels.
  - Acceptance of CCC conclusion that power sector decarbonises first (cost)
  - Gas Generation Strategy decarbonisation - 100g CO<sub>2</sub>/kWh by 2030 needs CCS
  - DECC published projections in range 1GW – 13GW scenarios by 2030, 5GW CCS in most recent case.
  - CCC 4<sup>th</sup> carbon budget – 10GW CCS by 2030.

### ETI Scenarios Work (2015)

Balancing a “lowest cost “ pathway solution (higher demand for CCS) with a later start, normal individual project schedules and reasonable risk taking, focuses on

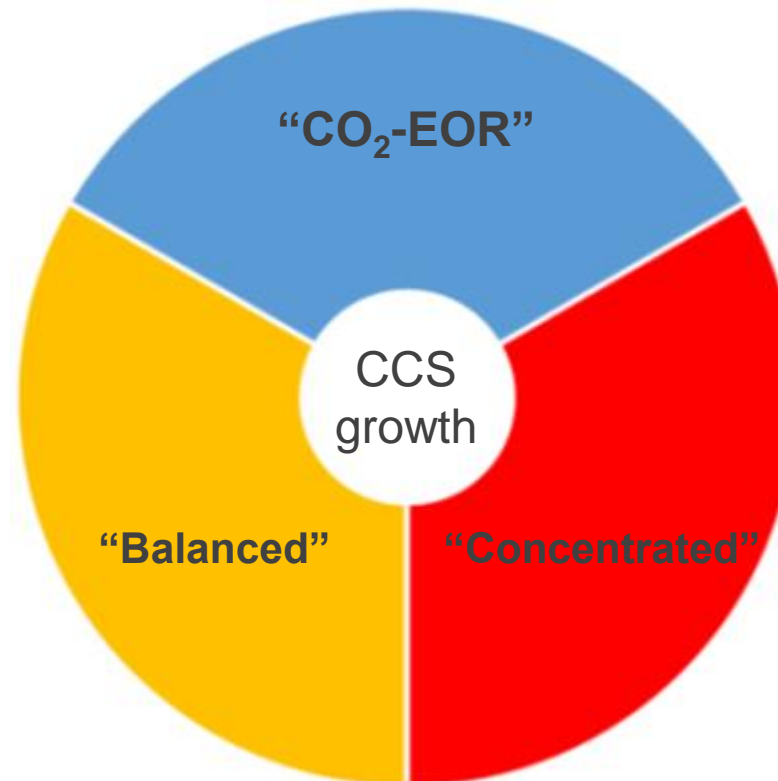
- 10 GW CCS by 2030 (nominally 50 MT/a)



## Three main roll – out scenarios based on policy backdrop

- High CO<sub>2</sub>-EOR policy support (e.g. tax incentives)
- CO<sub>2</sub> has a value due to the CO<sub>2</sub>-EOR projects

- Push “on all fronts” to win support from diverse stakeholders.
- A variety of regional source clusters
- Multiple fuel sources and capture technologies



- Geographic concentration around the two competition projects Dominant role for SNS storage and gas CCS

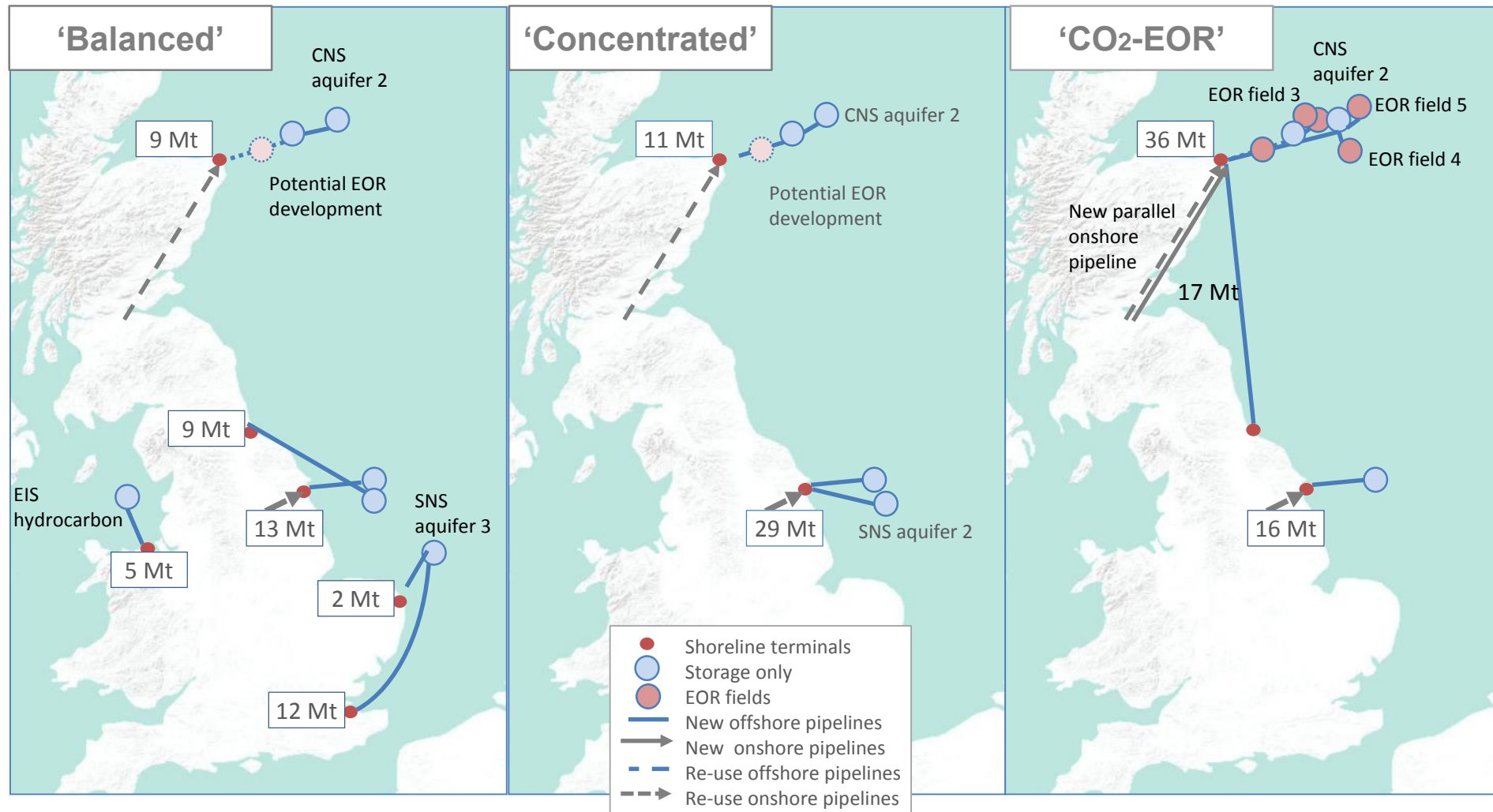


# Potential 2030 scenarios for the UK

## 'Balanced'

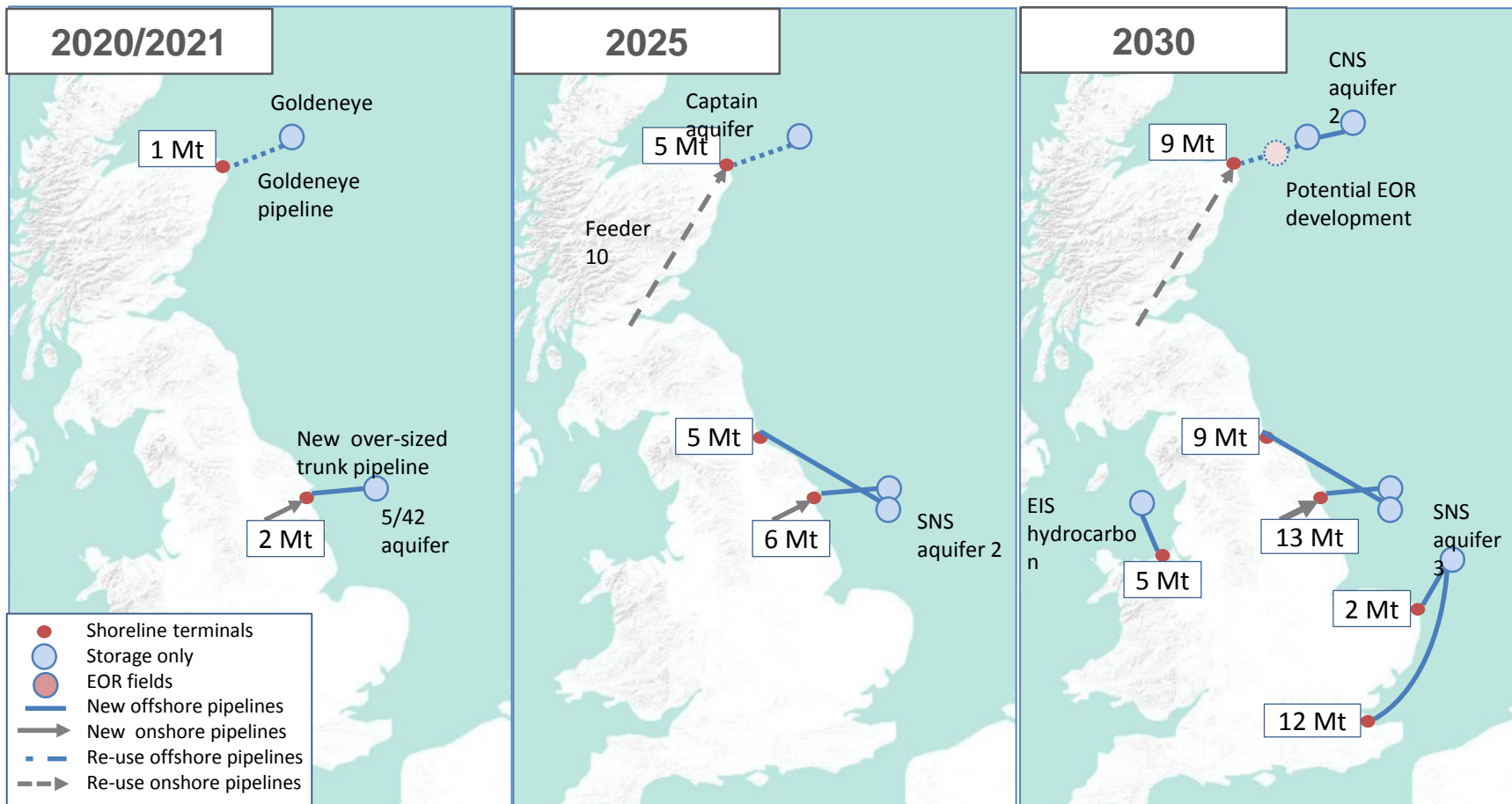
## 'Concentrated'

## 'CO<sub>2</sub>-EOR'





# Balanced Scenario to 2030



Equivalent ESME power carbon intensity ( covering all mitigation activities)

2010 – 450 gms/kWh

2020 – 330 gms/kWh

2030 - 75 gms/kWh



## Key conclusions on Scenario Work

- 10 GW equivalent scale CCS sector by 2030 is **feasible and affordable** by a range of different paths, based on co-ordinated cluster / hub development
- **Timely implementation of both CCS Commercialisation Programme projects**
- Strike prices at or below **£100 / MWh achievable by 2025** with further potential for cost reduction by 2030
  - Efficient use of stores and transport infrastructure developed under the commercialisation programme is key
- This outcome can be delivered by creating a **supportive policy environment with early action** on critical issues to bring forward timely investment





## Technology readiness vs UK readiness

Capture	Status	Current UK CCS Project
Coal - PC	Proven for power/chems	No
Coal - IGCC	Proven for chems	Yes
Coal - Oxy	Pilot – (Multiple)	Yes
Gas - PC	Proven for EOR/chems	Yes
Refinery, Cement, Steel	Pilots	No
Nat Gas	Proven	No
NH3, H2	Proven for chems	No

Storage	Status	Current UK CCS Projects
Open Aquifer	Proven	No
Structured Aquifer	Proven	Yes
Dep. Oilfield - EOR	Proven	No
Dep. Gas/Condensate field	Pilot	Yes

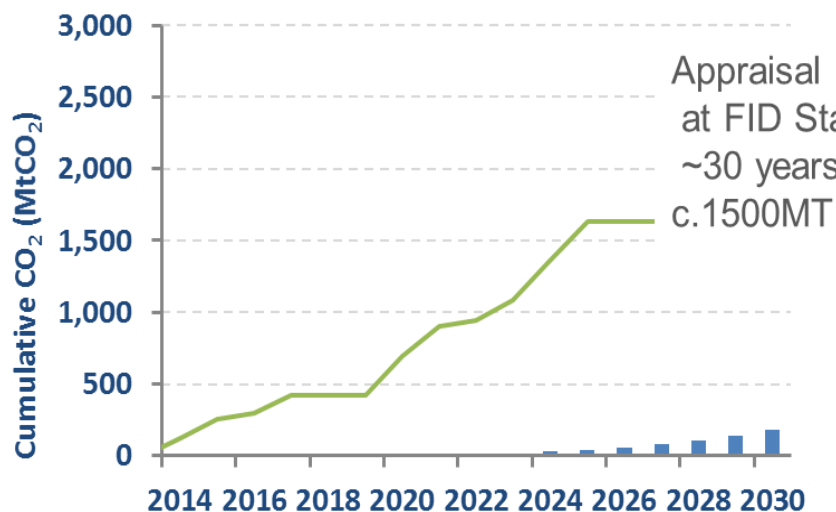


## Phase 1 competition and “10GW CCS / 50 MT/a”

Project	Store MT p90/p50 (CO <sub>2</sub> Stored)	Phase 1 Injection MT/a	Power GW	Pipeline MT/a
Peterhead	37/40	1	0.38	10
White Rose	200/500	2	0.44 gross	17

Note 1. The White Rose store has an economic injectivity of around 10MT/a in CO<sub>2</sub>Stored

Note 2. The Competition will not de-risk all of the White Rose store capacity



- Phase 1: Impactful investment in main trunk lines, but only a start to appraisal effort



# Action on preparedness – Transport and Storage

Address shortage of appraised storage

- Long lead time of 9 years, non-trivial cost £50M
- Reward uncertain
- Step –out projects from Phase 1 projects desirable to reuse infrastructure and lower risk
- Need for scale to lower costs



Strategic UK CCS Storage Appraisal Project



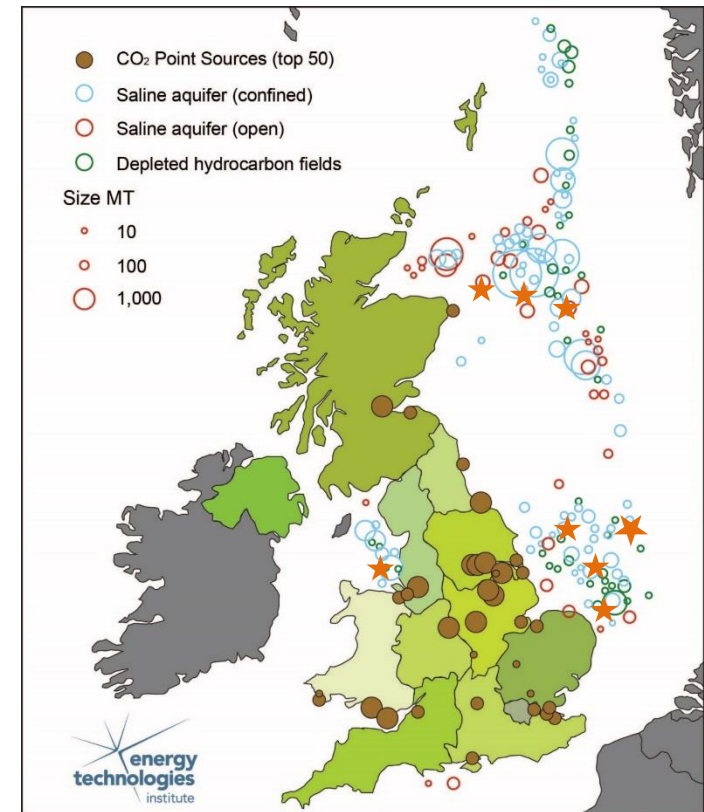
Department of Energy & Climate Change



Pale Blue Dot.



Impact of Brine Production on Aquifer Storage Call



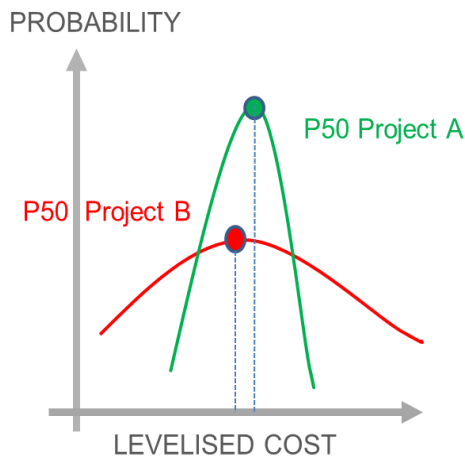
Appraised stores total <1Gte (CO2Stored 78Gtes)



# Action on Preparedness - Capture

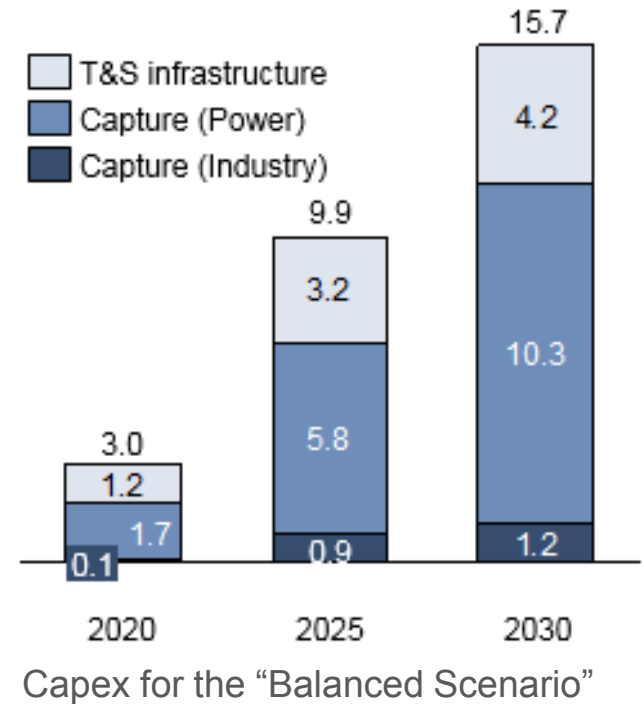
Address shortage of follow-up projects

- Awaiting outcome of DECC commercialisation project
- Uncertainty on incentives
- Cost reduction in capture plant is required
- But costing in the risk of new technology across the chain may favour lock-in



➔ ETI Thermal Power Project

Cumulative CAPEX (£billion – undiscounted)





# Policy

- Governance for infrastructure sharing:
- Strategy for capture readiness:
- Financial incentives for industrial CCS:
- Management of load factor risk for CCS power projects:
- Risk management and governance for EOR:
- Reflecting strategic value in CfD allocation decisions:



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# Summary of scenarios

Scenario	Costs	Strike prices	Benefits / issues
<p><b>Concentrated</b></p> <p>Concentrated around first 2 projects; dominant role for gas CCS with SNS storage.</p>	<p>£13.4 bn CfD cost to 2030</p> <p>£2.2 bn per annum in 2030</p> <p>£22 bn capex spend</p>	<p>Early Phase 2 projects &lt; £100/MWh by 2025</p> <p>&lt; £90/MWh in 2030</p>	<p>Fast cost reduction, but limited optionality or deferred costs to 2030s.</p>
<p><b>EOR-led</b></p> <p>Wood report-style push; market pull for CO<sub>2</sub> for EOR supported by e.g. tax incentives.</p>	<p>£12.2 bn CfD cost to 2030</p> <p>£2.0 bn pa in 2030</p> <p>£27 bn capex</p>	<p>Both coal and gas plants &lt; £100/MWh by late 2020's</p> <p>Assumes £20/t CO<sub>2</sub> price to EOR</p>	<p>North Sea jobs &amp; revenues</p> <p>Oil &amp; gas production cuts net costs to society.</p> <p>Oil price risk exposure</p>
<p><b>Balanced</b></p> <p>Multiple regional fuels and capture technologies.</p>	<p>£16.7 bn CfD cost to 2030,</p> <p>£3.2 bn per annum in 2030</p> <p>£31 bn capex</p>	<p>New gas-fired plants &lt; £100 in 2030 as 3rd gen of plants developed</p>	<p>Greater optionality for 2030s roll out</p> <p>Store &amp; technology diversity = risk reduction</p>