

Offshore Wind and CCUS Co- Location Forum - 6th Plenary Meeting

1st March 2023



Agenda

1. Introduction – recap on forum objectives and apologies
2. Matters arising - review actions and minutes from last meeting
3. Forum workstreams – opportunity to consider refocussing workstreams
4. Stakeholder engagement
5. Spatial Characterisation
6. MMV Seismic
7. OW/CCUS SimOps
8. Forum structure
9. Next plenary & workstream meeting dates

Forum Objectives

Identify the key challenges
and opportunities

Facilitate collaborative
working

Focus on solutions and
identify a clear set of
required actions

Identify innovative
solutions

Engage stakeholders

Matters arising

Matters Arising

Action	Owner	Status	Action	Owner	Status
Questionnaire to be sent to Developer event attendees suggesting similar events, meeting dates & to identify best future attendees.	The Crown Estate	Ongoing	Suggested dates for next plenary meeting Jan/Feb'23 to be agreed and invitation, agenda and pre-reading issued. Hybrid event combined with separate in-depth Workstream sessions.	OreC	Complete
Issue suitably redacted minutes and slides to Forum Members from all plenaries to date for publication on website.	Grayling	Complete	Consider forum and meeting structure (members, meeting frequencies etc.) and feedback views.	All	For discussion
Project Management proposal for Workstreams 7-10 to be circulated asap	The Crown Estate	For discussion	OW to host a trial to gather seismic data, BS, RP and NR to speak and develop plans offline	NSTA	To receive update

Forum workstreams

Test and Demonstration Projects

TCE approached academics to scope potential for Test and Demonstration Projects to assist with colocation

Both institutions are scoping timeframes, deliverables and parameters of the project



Stakeholder engagement

Developer questionnaire - key considerations

TCE / CES issuing
joint survey to
understand market
requirement for future
seabed
and carbon store
development

Opportunities and
challenges in meeting
industry's aims

Focus on number of
stores, capacity levels
and annual injection
rates developers
might seek to be in
place by 2035 and
by 2050

Spatial characterisation

Main report takeaways

- key implications

Larger and more geologically and geographically diverse set of stores needed

Considerably more carbon stores need to be appraised to enable CO2 storage targets to be met

Report will be published on The Crown Estate's website - timing to be decided

MMV seismic

Update on workstream

- NSTA to provide

OW/CCUS SimOps

Neccus report focus - decision needed

Recommendations on
coordination of both
types of development

Set out spatial
requirements both
sectors will need at
various times

Explanation on how
operational
requirements of both
sectors may be
accommodated

Forum structure

Forum structure

- for discussion

Lessons learnt from
Spatial
Characterisations and
MMV Seismic
workstreams

Focus on
commissioning
reports rather than
members producing

Additional
workstreams and
emerging areas of
interest - any
'elephants in the
room' we should
address

Next plenary & workstream meeting dates



North Sea
Transition
Authority

Co-Location Forum – NSTA studies

Ronnie Parr/ Nick Richardson/ Carlo Procaccini

1/3/23

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Studies overview

Phase 1: MMV (CCS measurement, monitoring, verification) report

External publication NSTA website Aug 22

Phase 2: Ocean bottom nodes
/ seismic detection/ windfarm noise

Previously presented to co-location forum
External publication awaiting Phase 3

Phase 3A Seismic “Field Trial” engagements

Ongoing: complete end Mar 23

Phase 3B: CO2 subsurface
from site characterisation to MMV

Follow-on technology portfolio review
Ongoing end Apr 23

Compressed Fluid(air) Energy Storage (CFES/CAES)

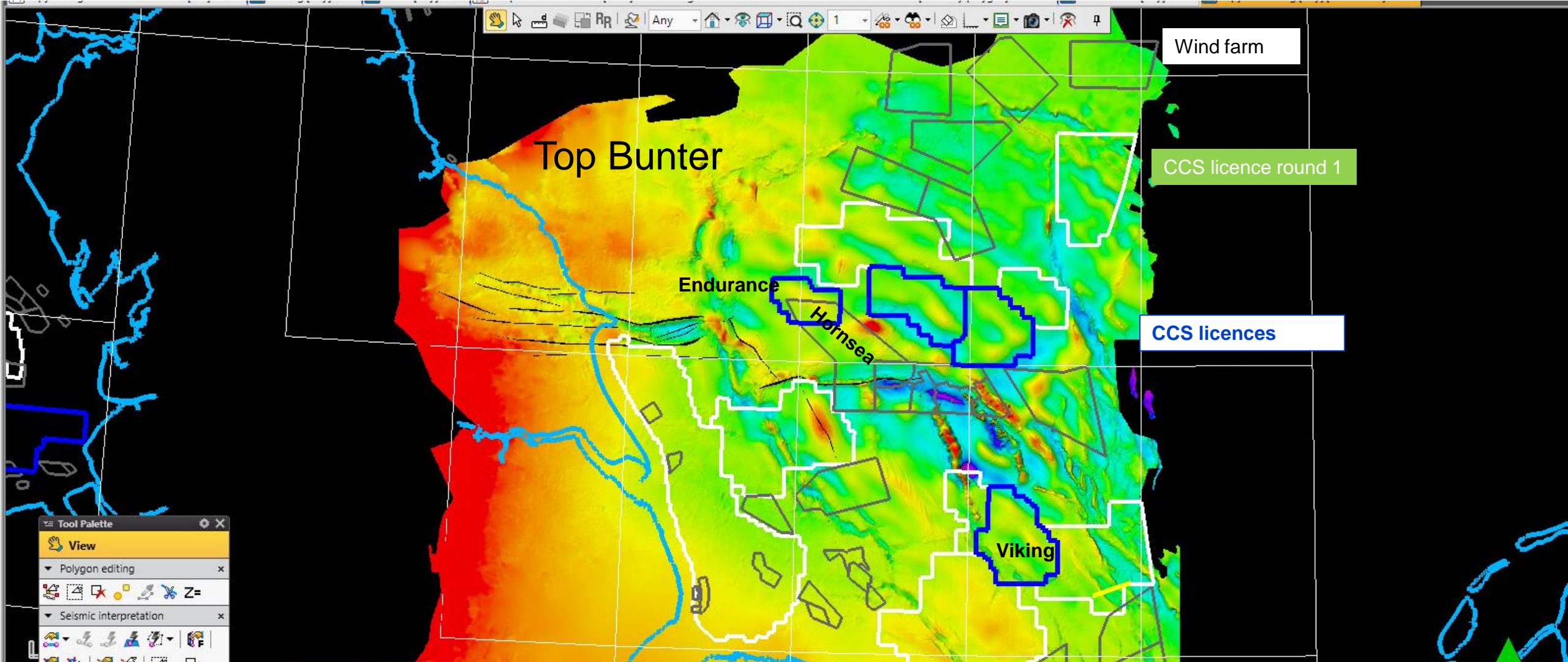
Ongoing: screening research end Mar 23

CO2 facilities: process, flow assurance and power. Key requirements to deliver injection systems.
Study ongoing, expected end Mar 23

Seismic Field Trial (Phase 3a) engagements

- Aim: Radically improved seismic imaging of CCS (Carbon Capture and store) complexes
- What?
 - Ideas for field trial in 2023 or more likely 2024
 - New seismic acquisition and/or seismic processing/imaging
- Where?
 - Focus on Southern North Sea (SNS)
 - Bunter or Leman reservoir stores
- Who?

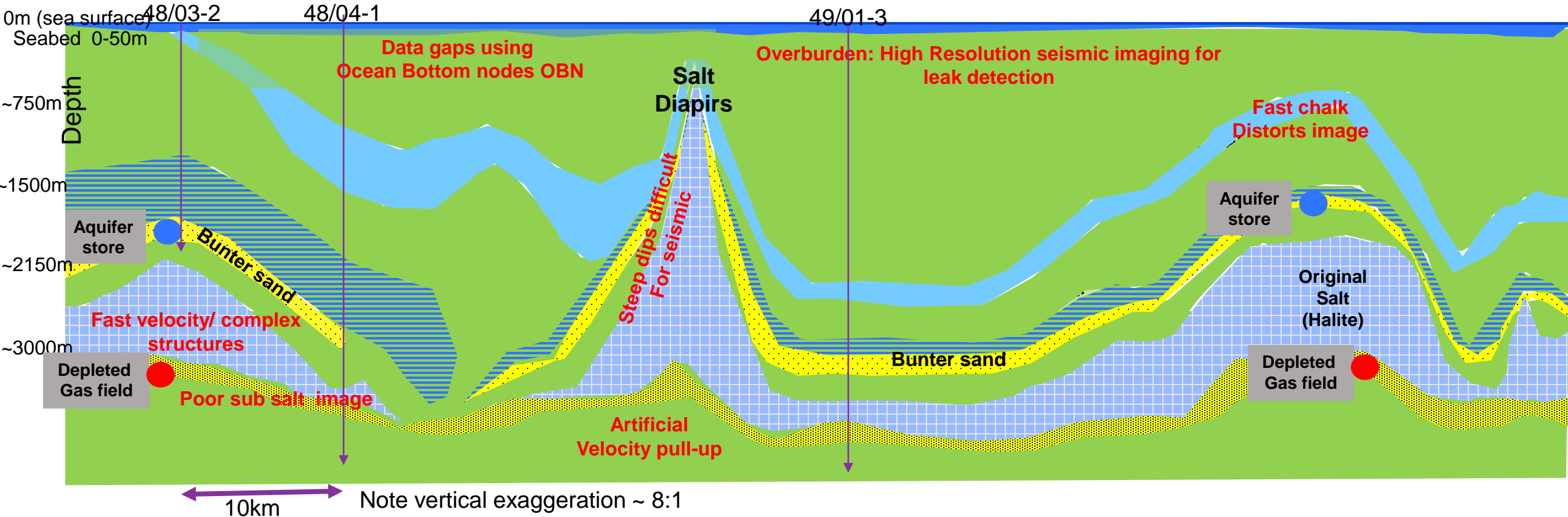
Ronnie Parr & Ian Barron (NSTA), Graham Lilley (Seismic acquisition consultant), Hemang Shah (seismic processing/ Imaging consultant)
- When?
 - Engagements close end march 2023



Large Basin, with 4 current CS licences (blue), large area offered in CS licence round 1 (white)
Significant number of windfarms in operation/development (grey).
Shallow water near coast & Dogger Bank

Indicative SNS seismic issues

Seismic Access: Shallow water, strong currents, increasing windfarms, fishing (lobster pots)
Multi-Vintage (mainly 1990s): mostly streamer, some ocean bottom cables

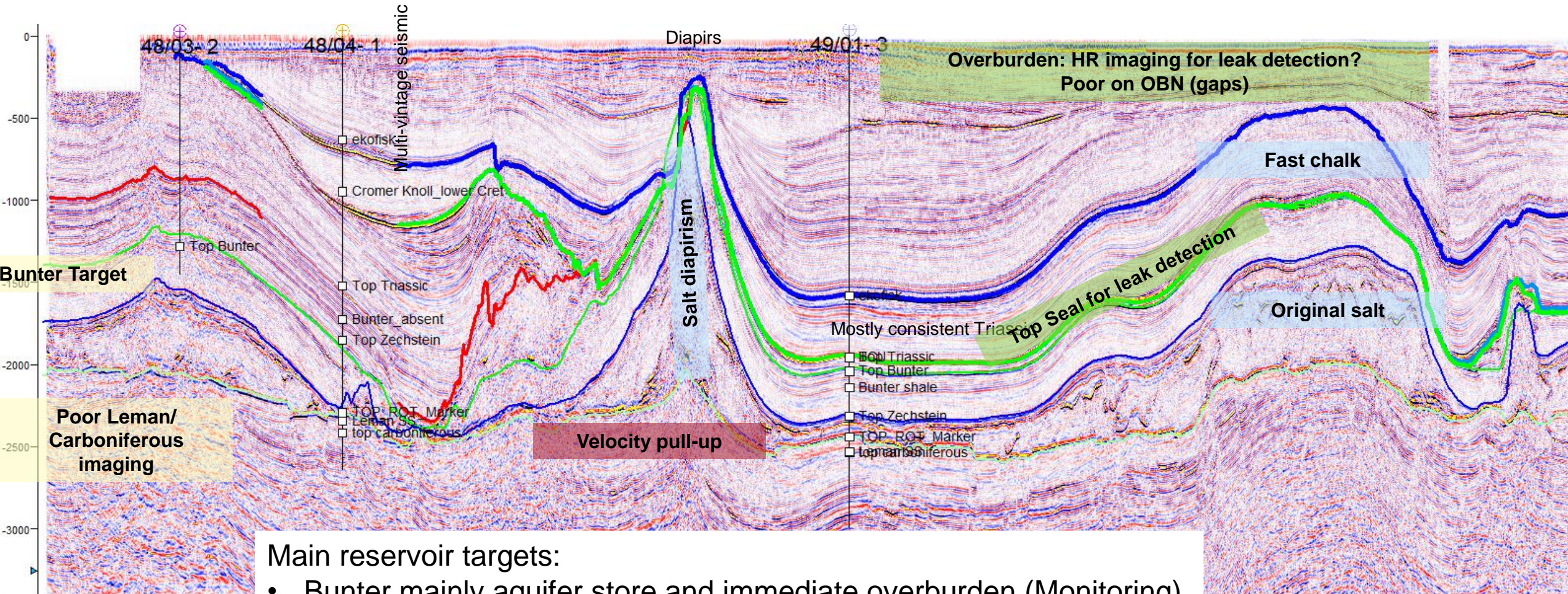


Main CCS reservoir targets:

- Bunter mostly aquifer stores and immediate monitoring of overburden
- Leman/Carboniferous: main depleted gas field stores

Real seismic issues

Seismic Access: Shallow water: strong currents, windfarms, fishing (lobster pots),...
Multi-Vintage, mainly 1990s streamer



- Main reservoir targets:
- Bunter mainly aquifer store and immediate overburden (Monitoring)
 - Lemans/Carboniferous: main depleted gas field stores

10km \longleftrightarrow Note vertical exaggeration ~ 8:1

Phase 3B Monitoring (MMV) technology screening project

Aim: Project ongoing to understand monitoring technology availability, applications and deployment sweet spots

What?

- Investigating integration of non-seismic methods with “traditional” 4D
- Also assessing applicability of different technologies to saline aquifers and depleted fields

How?

- Utilising information provided by current CS licensees, technology providers, and other Regulators

Who? Ian Barron (NSTA)

When? Ongoing end Apr 23

Compressed Fluid Energy Storage (CFES)

- Why?
 - Wind oversupply (curtailment cost) and undersupply (Gas-fired power substitutes)
 - CAES Bulk / Mechanical energy storage
- Which Screening studies?
 - Regional distribution of suitable geological stores
 - Indicative volumes/ rates (Reservoir engineering)
 - Facilities scope (Facilities engineering)
- Who?

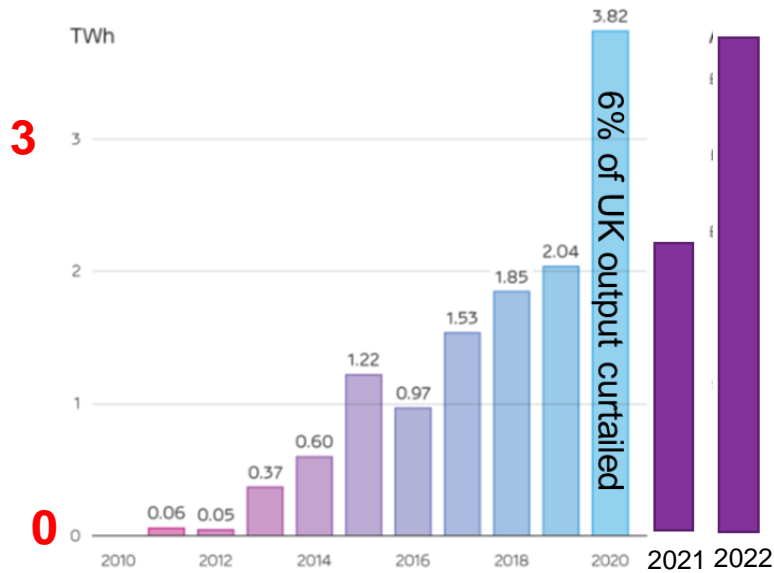
Matt Neal (NSTA secondee), Ronnie Parr (NSTA), TRACS, Crondall Energy (previously recipient of BEIS grant on CAES)
- When?

Reporting expected end March 2023



Wind Oversupply: Expensive & rapidly growing Curtailment cost

Past Curtailment

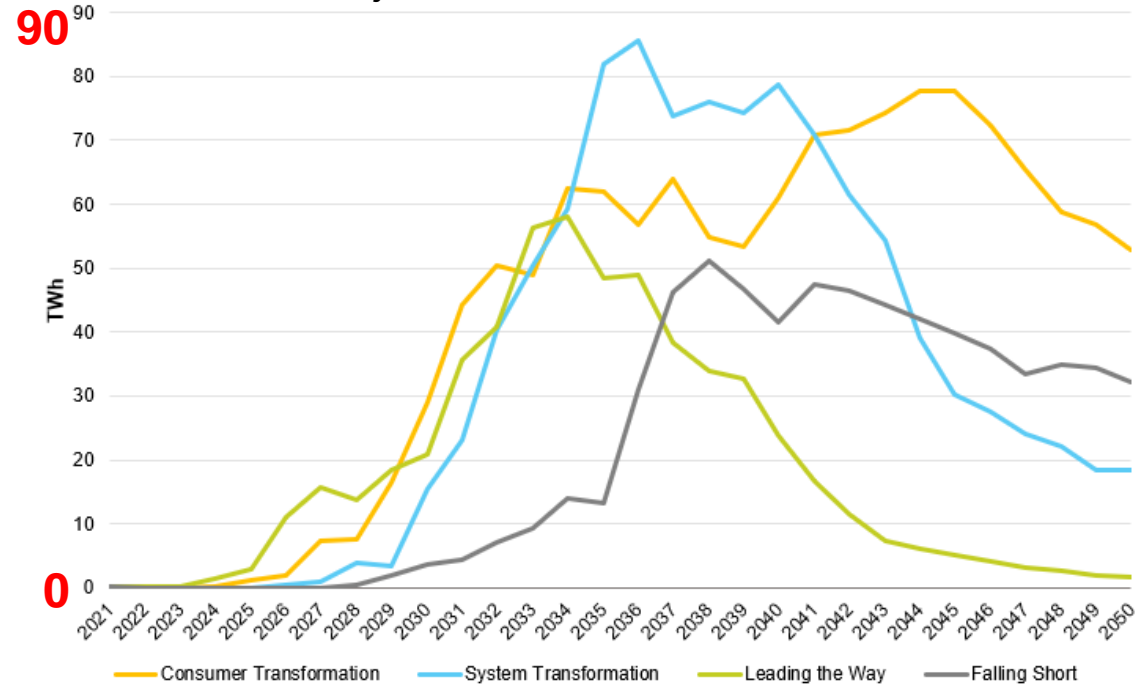


[Record wind output and curtailment | Q4 2020 Quarterly Report | Electric Insights](#)

[UK risks losing £4bn worth of cheap energy that could power millions of homes \(msn.com\)](#)

[National Grid spends £4bn to prevent blackouts after surge in wind and solar \(msn.com\)](#)

Annual Curtailment (TWh) Projected Curtailment scenarios

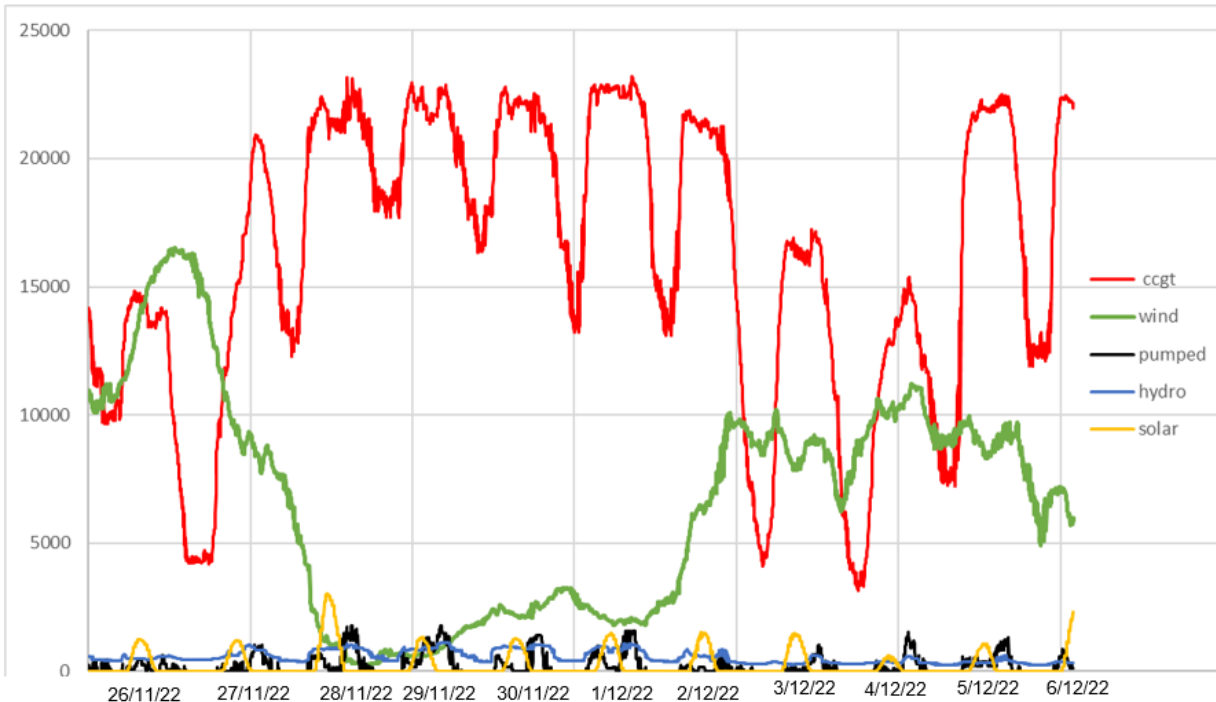


National grid Future Energy Scenarios 2022 Data Workbook

Major and rapidly growing problem of oversupply curtailment charges \$\$\$\$M

Wind Undersupply:

2022 real data
When the wind does not blow –



Long spells where high pressure dominates across the whole of the UK

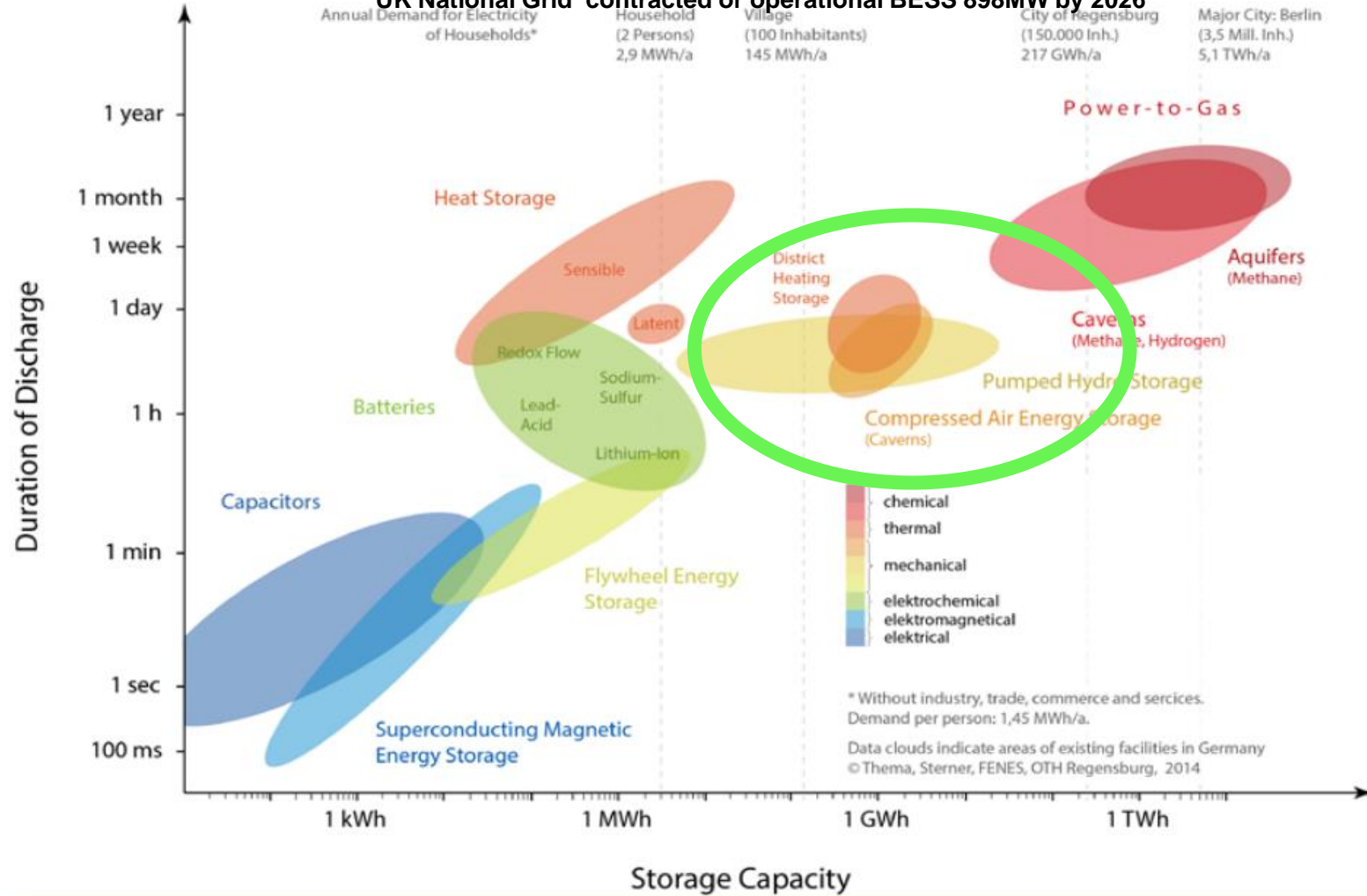
- There is effectively no wind turbine generation
- Gas-fired turbine generation steps in
- Other renewables are minor players (e.g. solar and pumped storage hydro)

Not shown: ~ Consistent delivery from Nuclear (Av. 4200MW) & Biomass (Av 1900MW)
Source: Gridwatch

Storage options



BESS (battery energy storage)
 California Battery Farms Moss Landing 400MW for 4 hours, Tesla megapack 182MW
 UK National Grid contracted or operational BESS 898MW by 2026



Pump storage is the ideal solution:
 Britain has 4 existing pump storage. In Scotland (Cruachan 440MW/ 8.8GWh & Foyers 300MW/ 6.3GWh) & Planned Balmacaan (600MW), Coire Glas (800MW) & expansion to Cruachan II (600MW)

Very few other opportunities which have the right geography : Mountainous area with upper reservoir (shown) and large discharge loch



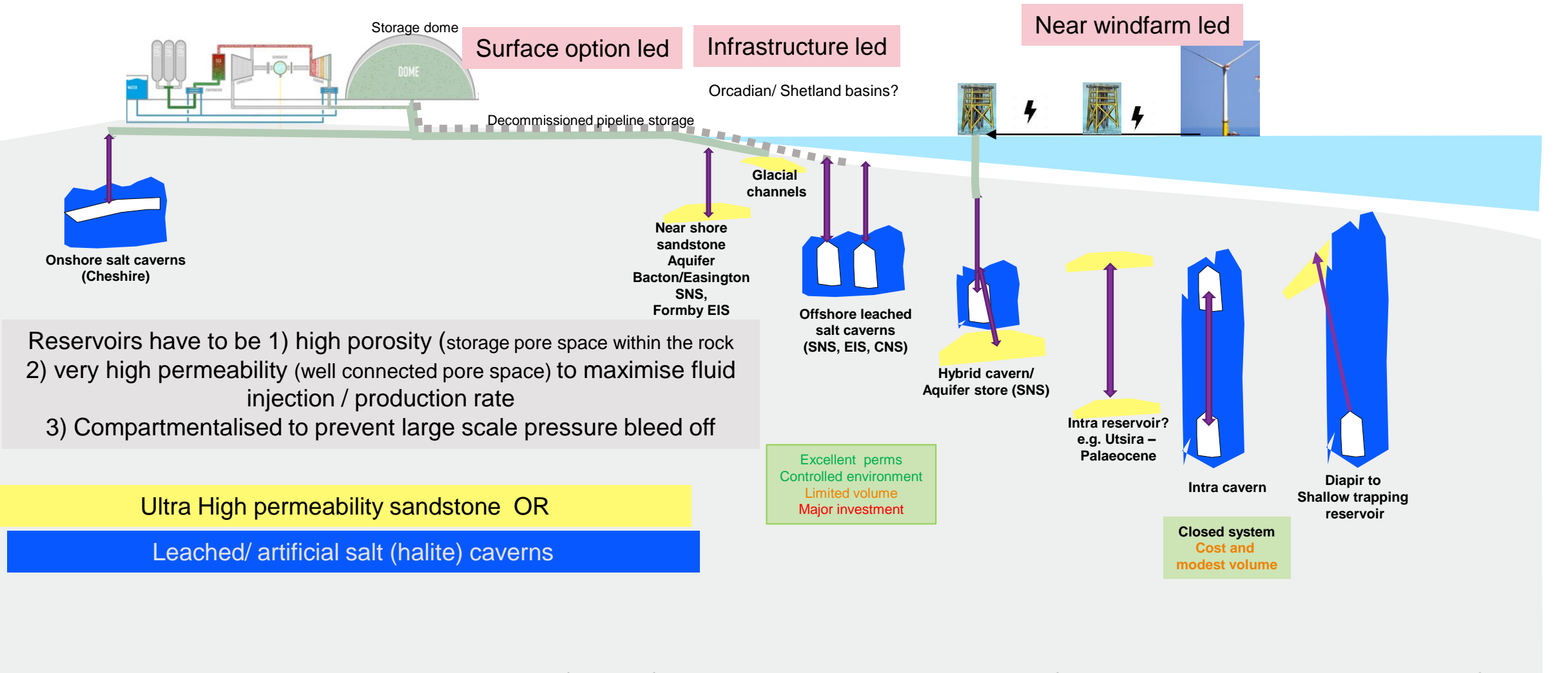
Source: Sterner, Stadler, 2014

Prof. Dr. Sterner, OTH.R, P. 9

Issues summarised by [Guy Martin's Great British Power Trip | All 4 \(channel4.com\)](https://www.channel4.com/programmes/guy-martin-s-great-british-power-trip)

Major mechanical Storage needed to provide capacity for UK long duration under-supply

Schematic of Mechanical UK Storage options



Reservoirs have to be 1) high porosity (storage pore space within the rock)
 2) very high permeability (well connected pore space) to maximise fluid injection / production rate
 3) Compartmentalised to prevent large scale pressure bleed off

Ultra High permeability sandstone OR
 Leached/ artificial salt (halite) caverns

Protected entities, such as groundwater reservoirs, flora and fauna, and ultimately humans, have to be safeguarded when utilizing the geological subsurface, which may put restrictions on the implementation of certain types of subsurface use

Some of these scenarios involve the presence of existing hydrocarbons which must involve closed systems and inert compressed fluids