Knapton H2 Storage for H2P

Ofgem Strategic Innovation Fund Round 4 Discovery C3

Project number: 10167733

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Presenter: Katriona Edlmann

SIF Discovery

Knapton H2 Storage for H2P

The vision for Knapton: Rationale for the work

Informed by whole system modelling of H2P, the project has been designed to integrate with the wider East Coast Hydrogen (ECH) network.

The project is a hydrogen storage optioneering study focused on enabling Hydrogen-to-Power (H2P) at the Knapton Energy Hub.

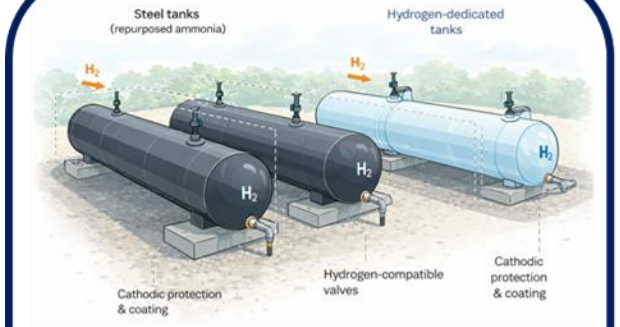
The study assesses a **range of geological and engineered hydrogen storage options** that could support H2P, integrated with:

- Local and regional **hydrogen production**
- Industrial and power-sector **hydrogen demand**
- **Water and wastewater resources**
- Future infrastructure associated with ECH

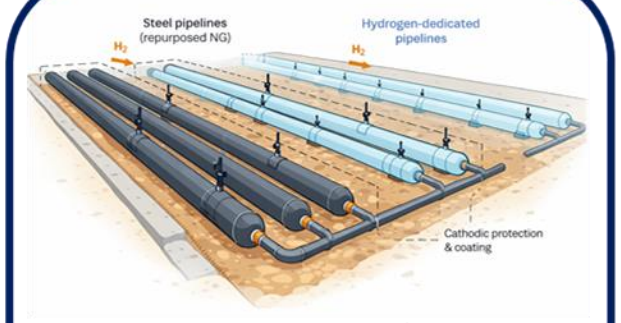
Understand how **different storage technologies**, appropriate to local geology and infrastructure, across a range of scales and deployment timelines, could contribute to system flexibility and resilience at Knapton and within the wider regional hydrogen system.

Knapton H2P: Storage Technology Options

Northern Gas Networks

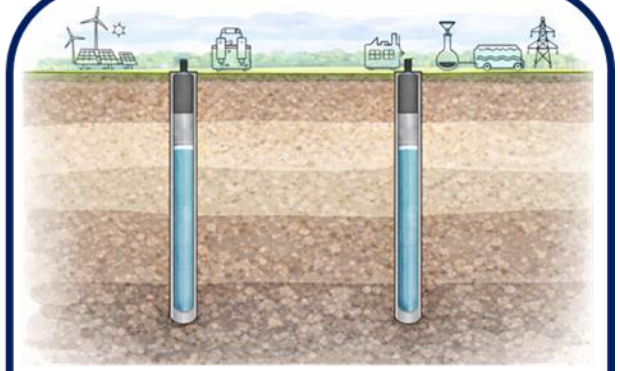


Surface tanks
kW to MW over hours

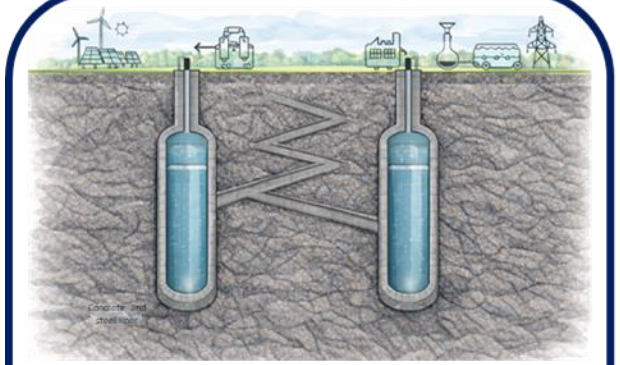


Dedicated pipelines
(new/repurposed)
kW to MW over hours

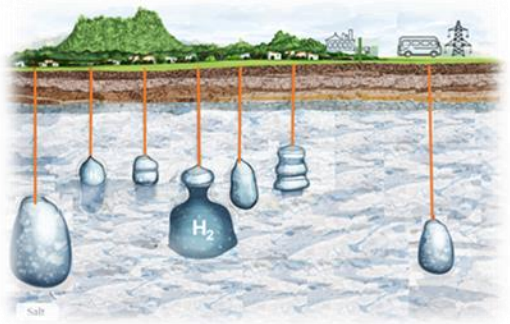
Subsurface Silos
MW to GW over hours



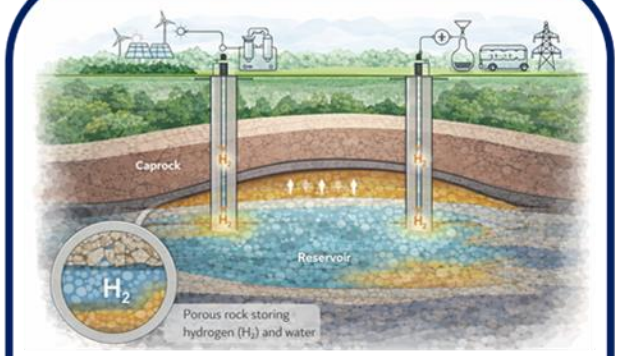
Lined Rock Shafts
MW to GW over weeks



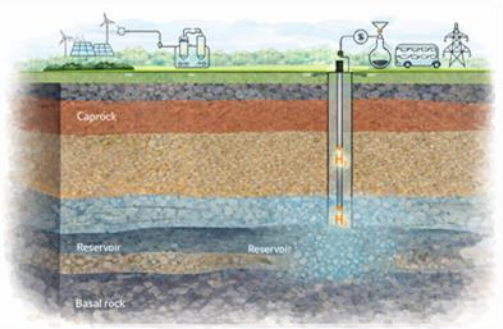
Lined Rock Caverns
MW to GW over weeks



Salt Caverns
GW days, weeks to months



Depleted Gas Fields
TW over months



Saline Aquifers
TW over months

Hydrogen Storage Optioneering

Discovery Phase optioneering used spatial screening and proximity analysis to compare storage options at a high level.

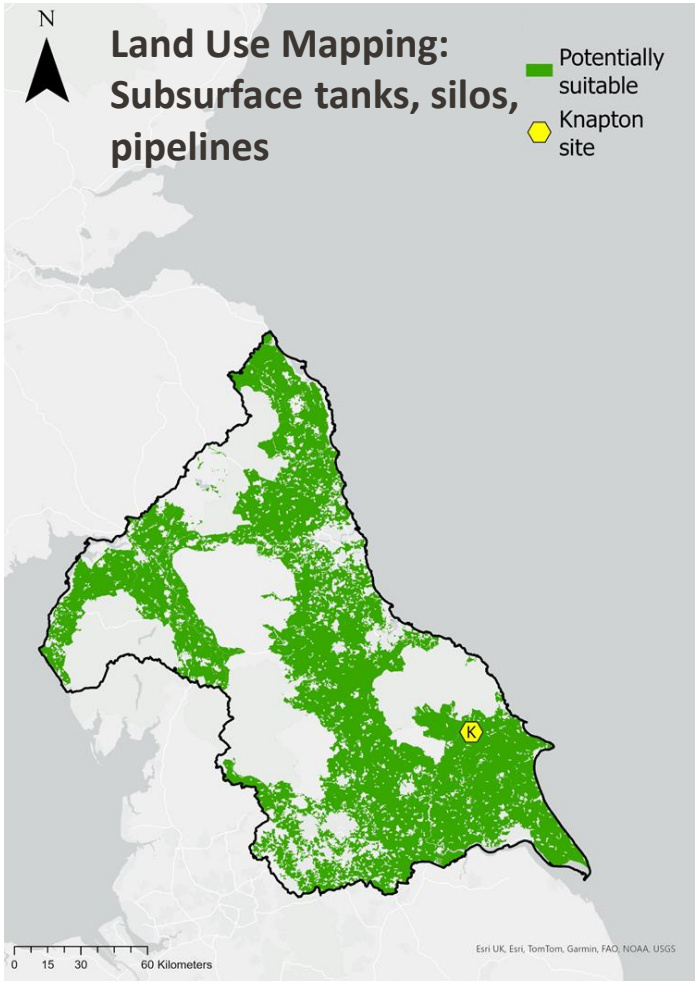
This approach:

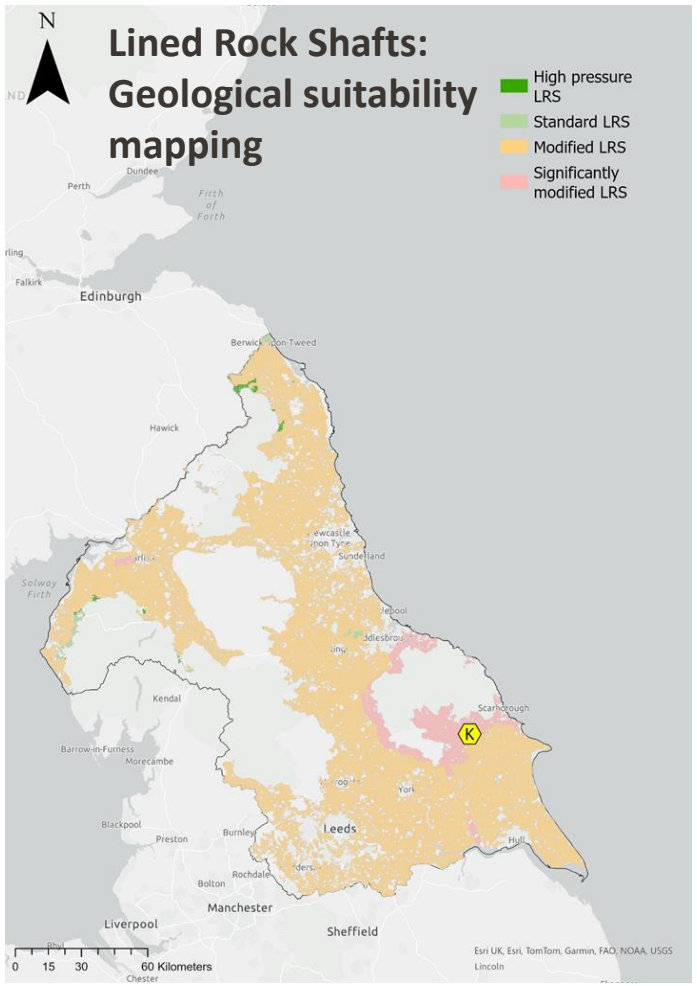
1. Identified where different hydrogen storage technologies could be hosted within regional geology and land use constraints (WP2).
2. Determined locations and scales of hydrogen production, demand, water, and energy infrastructure (WP3)
3. Applied first-order screening criteria to prioritise storage options most suitable for different use cases at Knapton H2P (WP3/4).

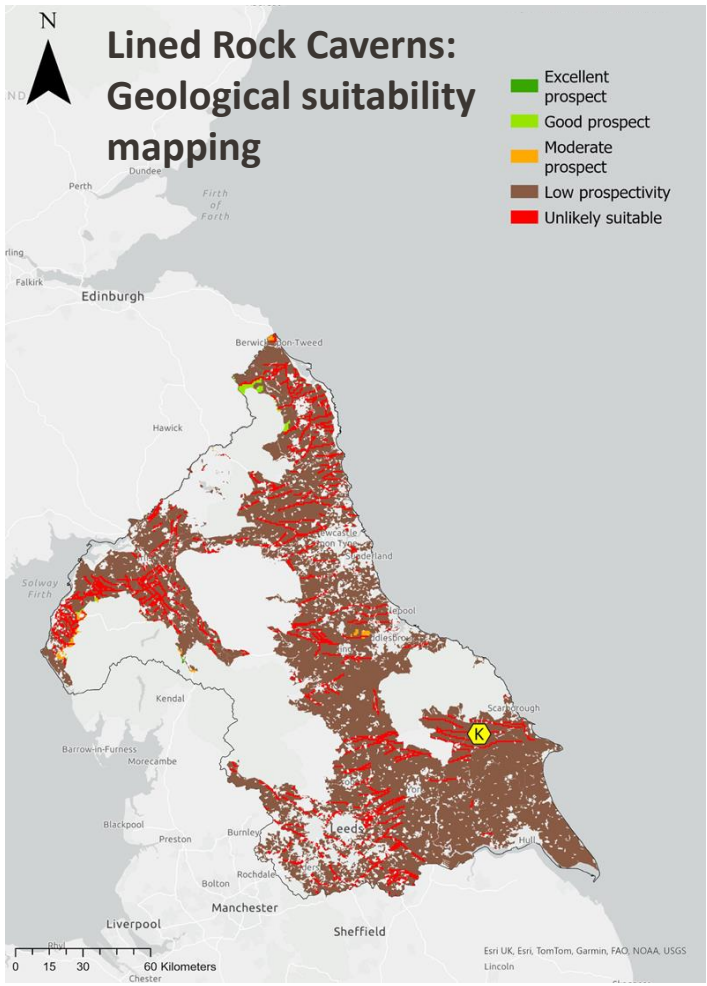
This approach enabled a consistent, location-specific screening of storage options, allowing those most relevant to Knapton H2P to be prioritised for potential progression to Alpha.

Near-surface & engineered storage options

- ✓ Significant scope near or onsite at Knapton to host surface task and subsurface silos
- ❖ Geology unsuitable for hosting lined rock shafts and lined rock caverns

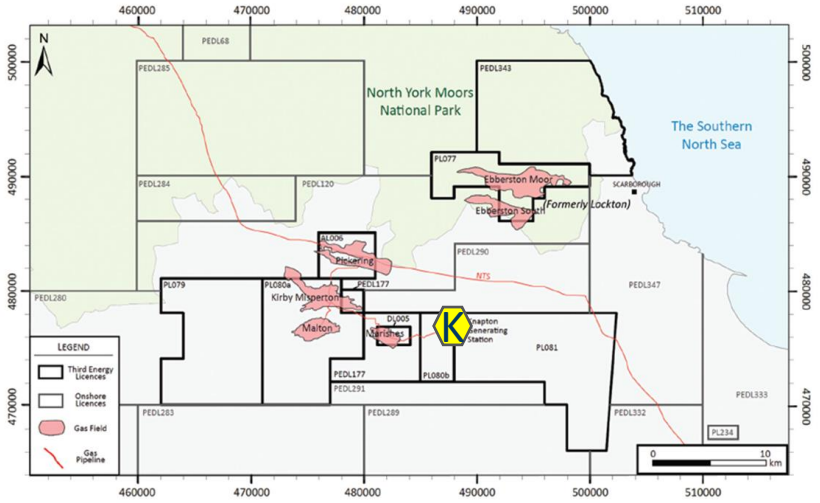


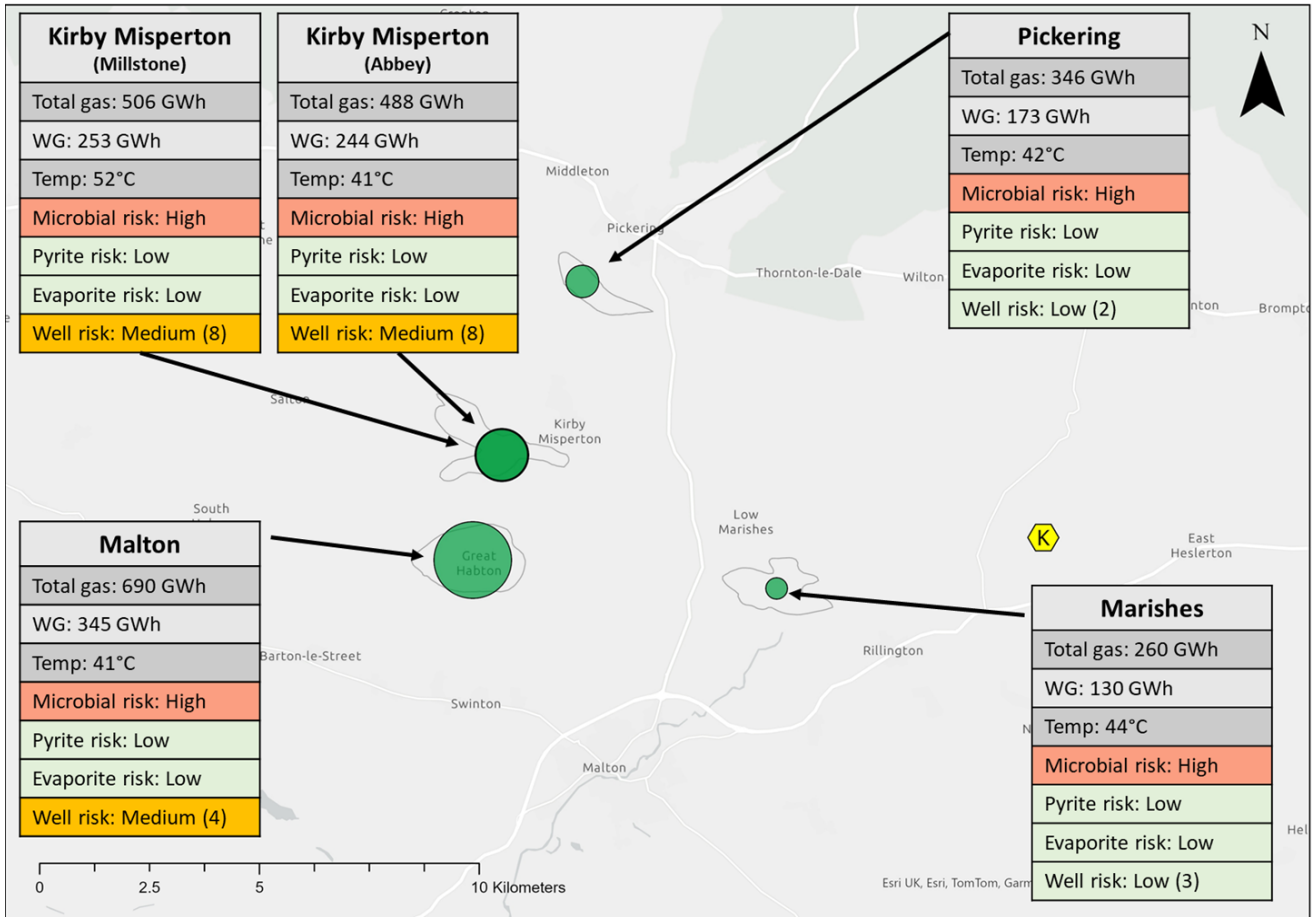




Geological storage: Depleted Gas Fields

✓ Suitable depleted gas fields in the Knapton region



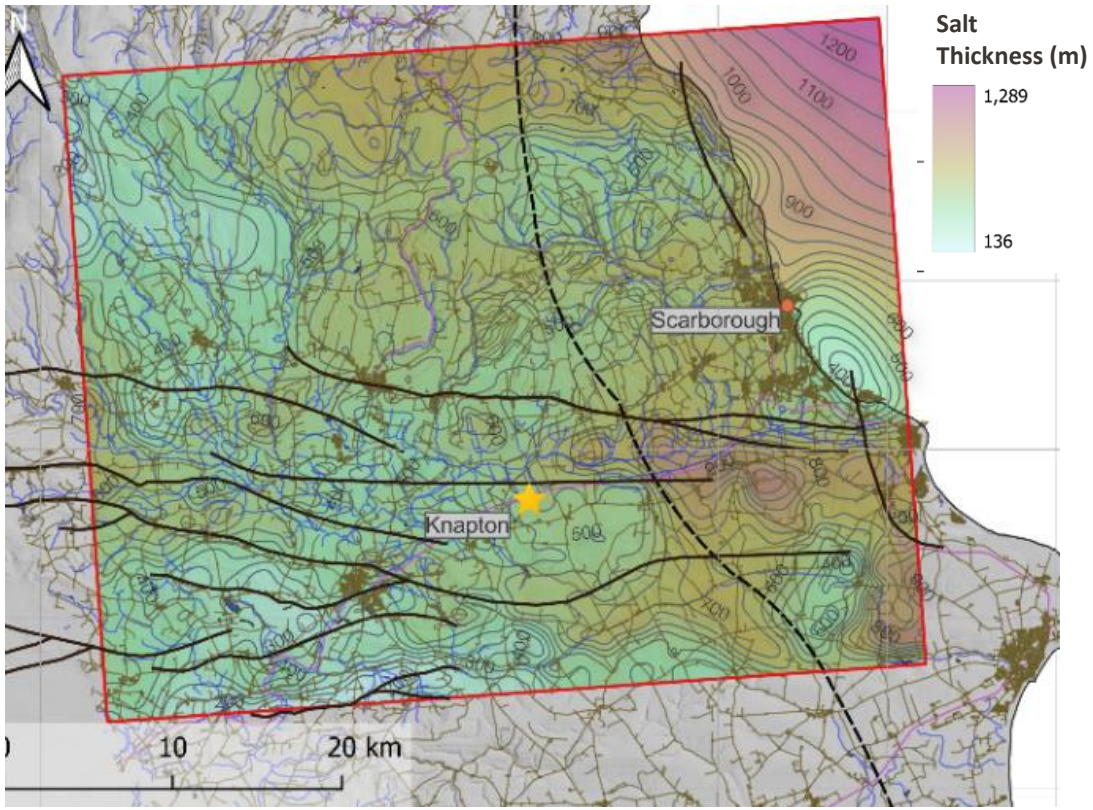


Geological storage: Salts and Saline Aquifers

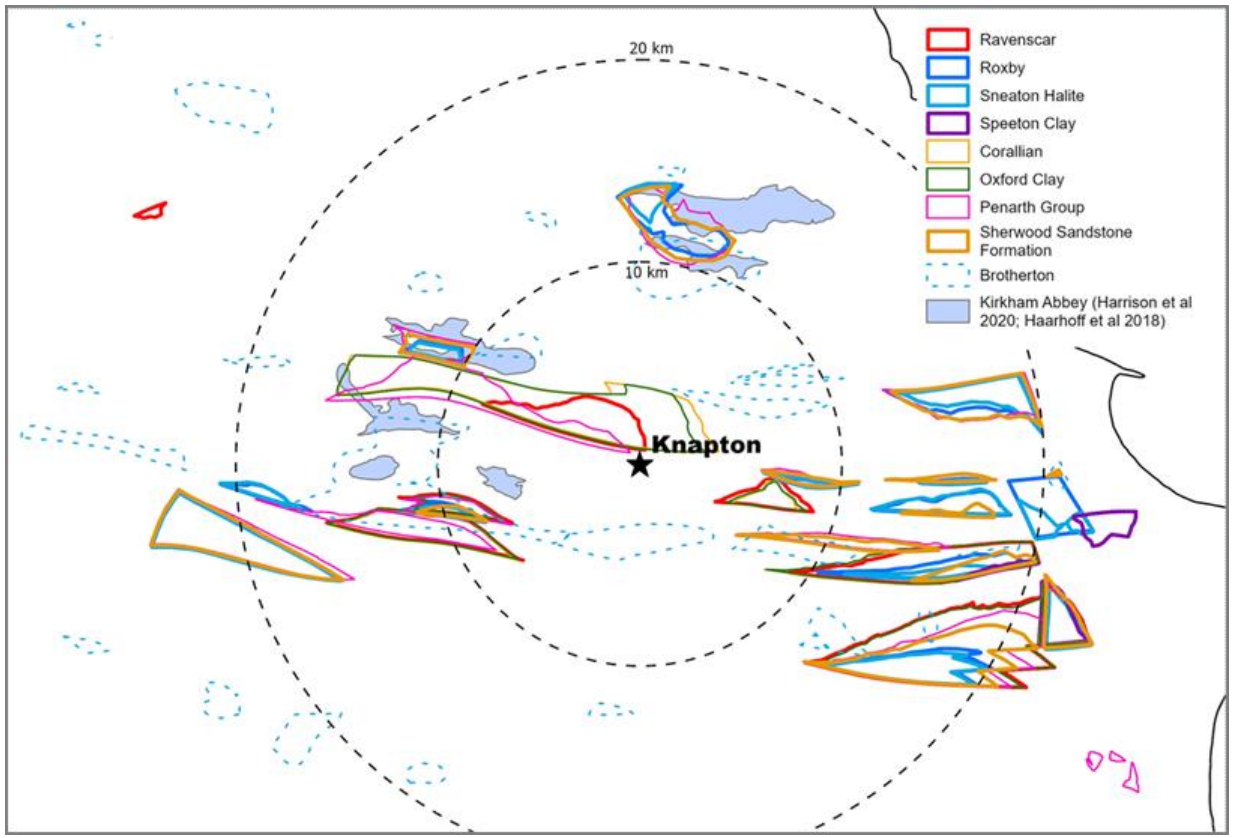
Northern Gas Networks

- Salt formations and saline aquifers are present but subject to significant data gaps and uncertainty

Salt Formations



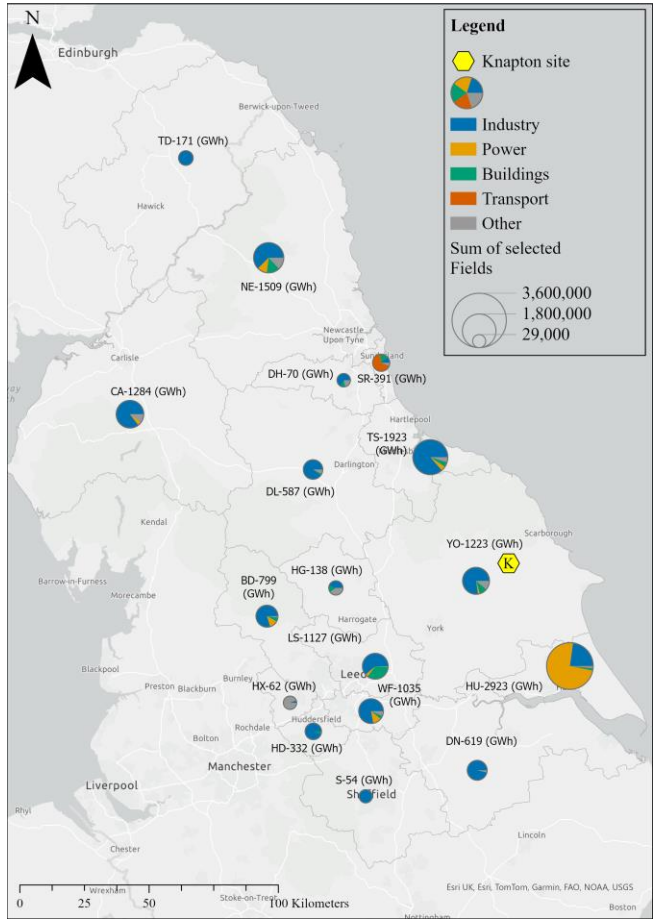
Saline Aquifers



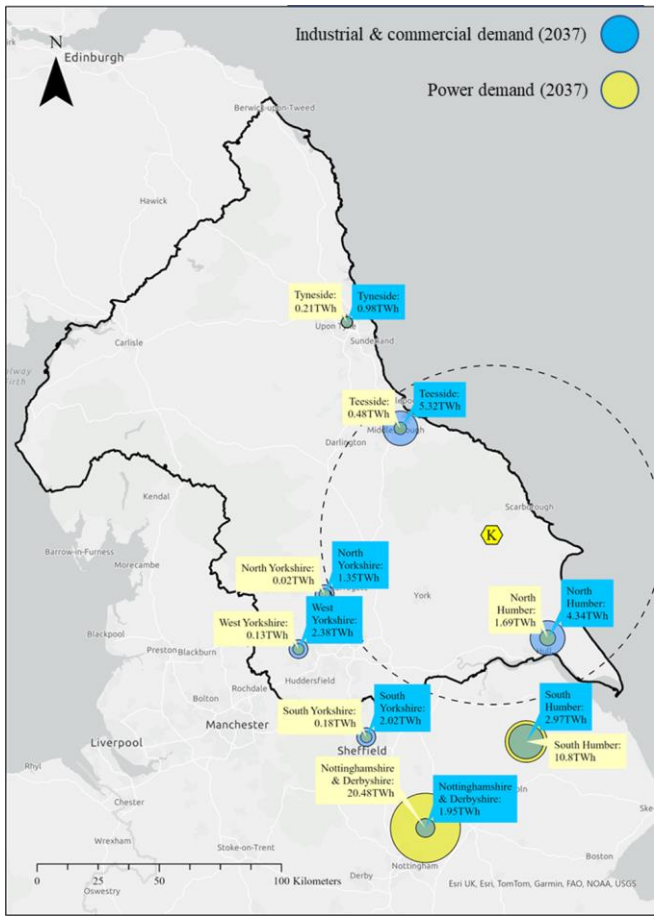
Hydrogen Demand and Production

- ✓ ~11 TWh/year of hydrogen demand projected within ~60 km of Knapton by 2037, dominated by industry and power
- ✓ 7 HAR green hydrogen projects within 60 km with ~300 MW initial / ~530 MW peak electrolytic capacity by late-2020s –proximity to blue hydrogen clusters at Teesside (H2NorthEast) and Humber (H2H Saltend)

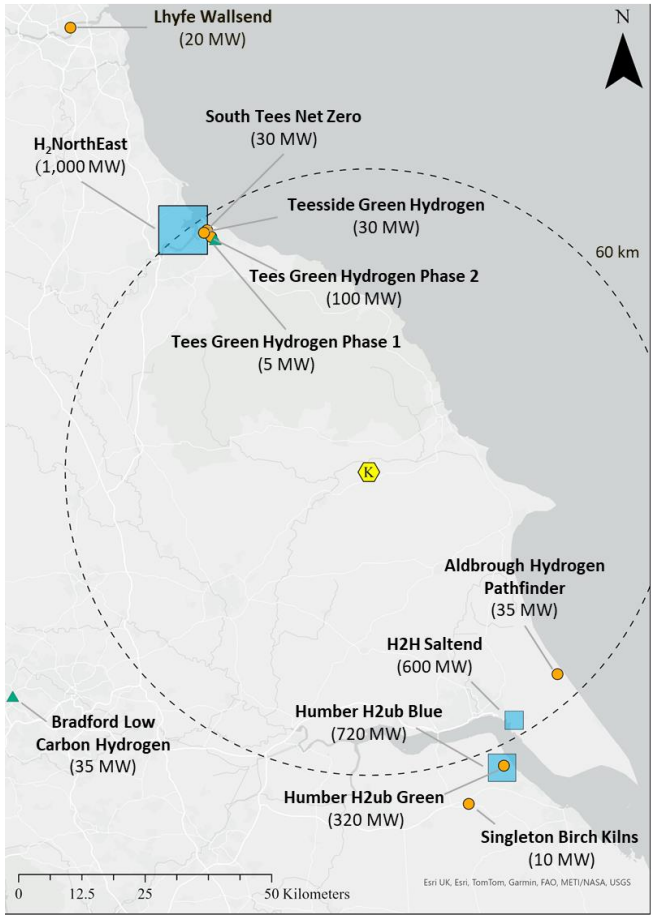
Gas Demand by sector



Anticipated H2 demand (ECH)



Hydrogen production



Blue hydrogen plant

HAR 2 project

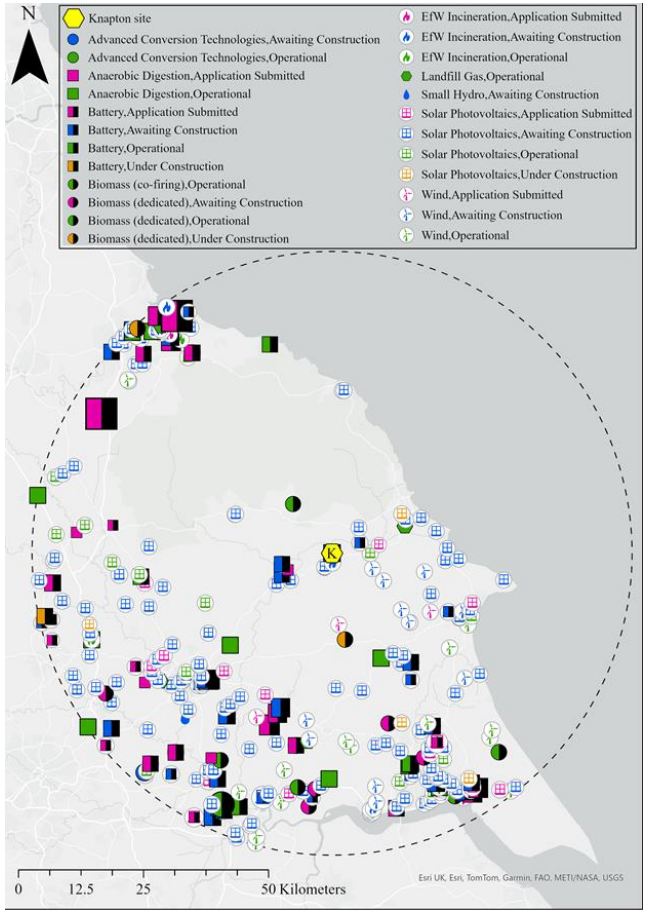
HAR 1 project

we are the network

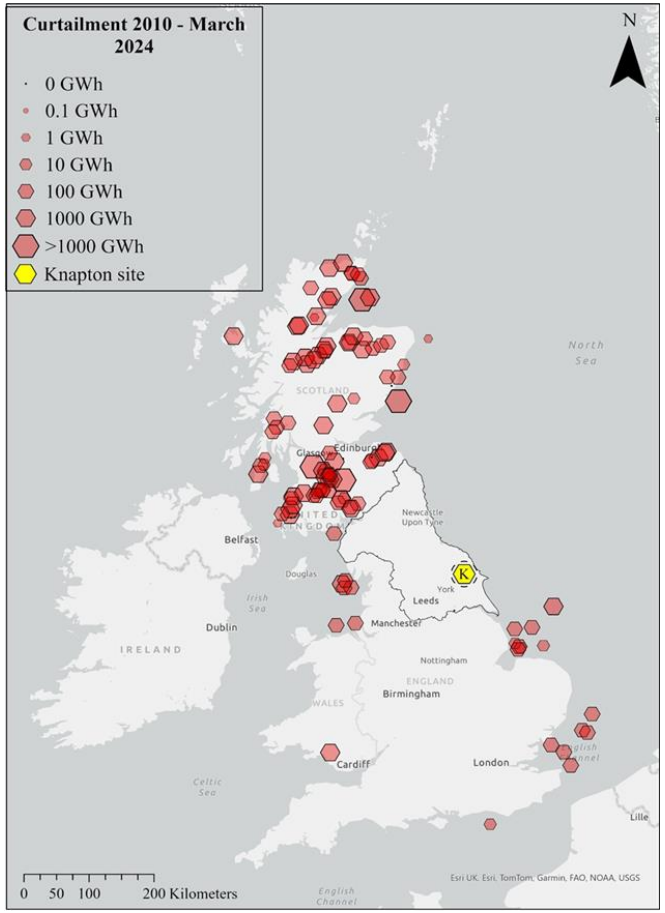
Regional Renewable Energy

- ✓ Renewable Energy Planning Database (REPD) mapping shows strong growth in planned renewables across the NGN region and around Knapton
- ✓ Variable generation is outpacing network flexibility, leading to curtailment and under-utilised assets – need large scale storage

Existing and planned renewables



Curtailment

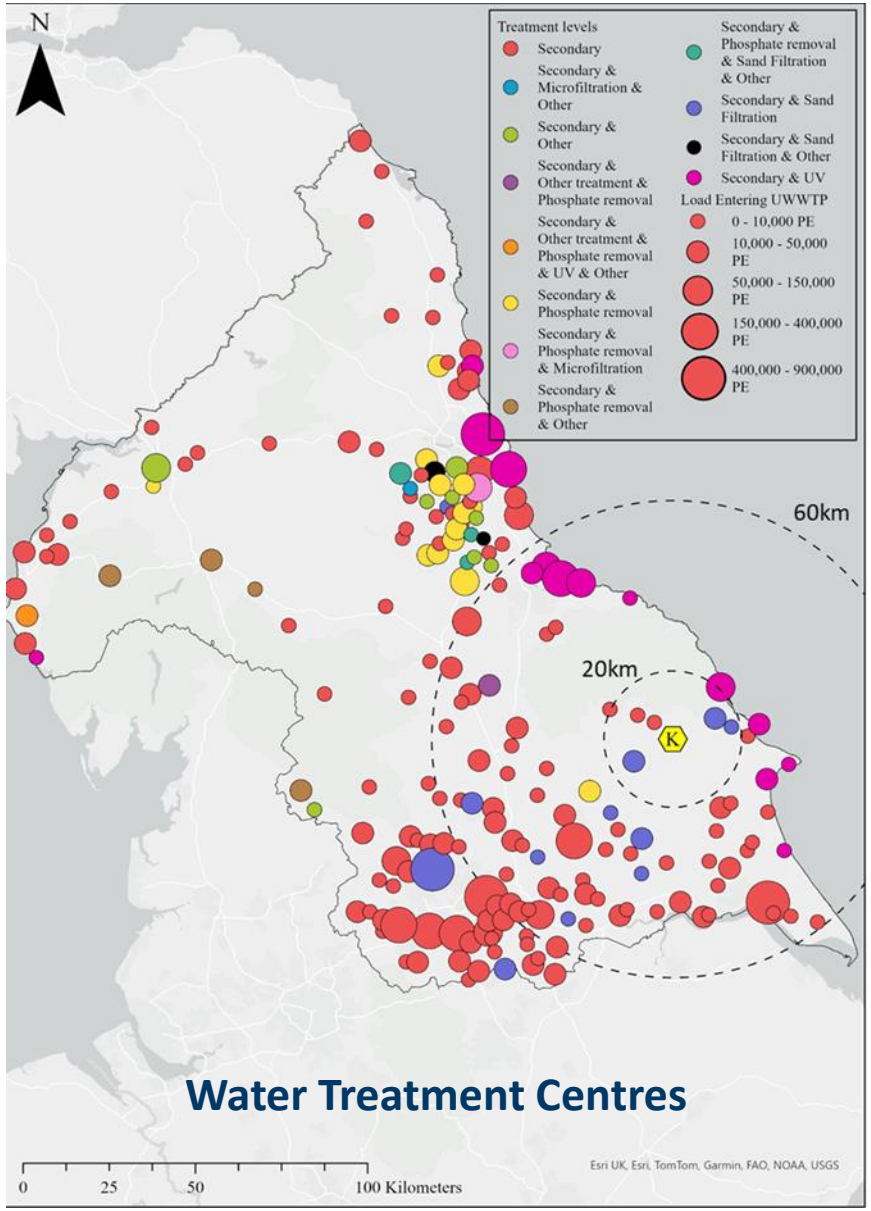


- ❑ Lower onshore curtailment in England due to a historical focus on solar not wind.
- ❑ Offshore wind close to London = large demand centre still shows significant curtailment

Regional Water Demands: Utilising Wastewater

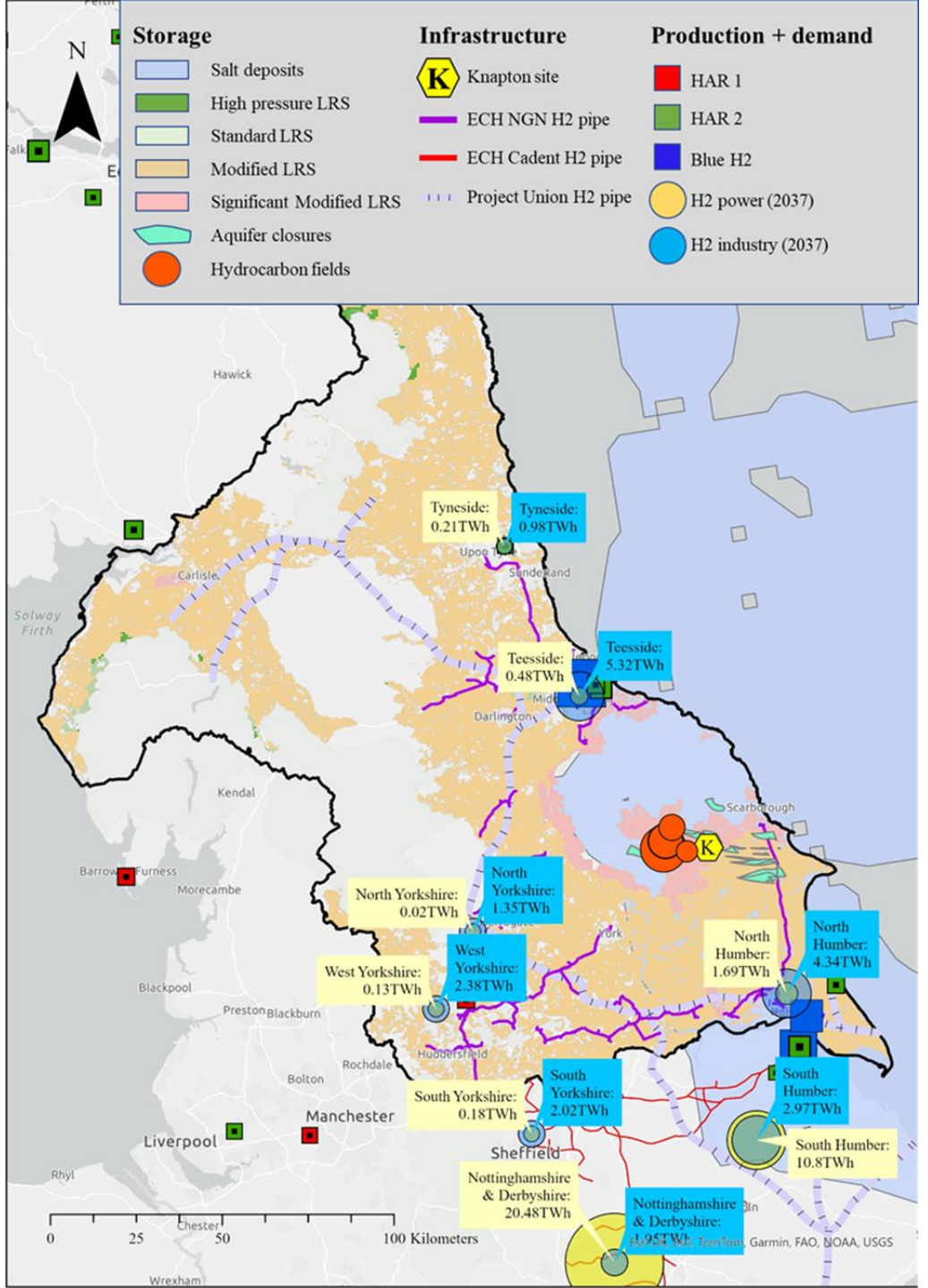
- Large-scale electrolytic hydrogen production creates significant water demand (~10-20L/kg H_2), competing with potable supplies.
- England already faces up to 5 billion litres/day water shortfall without intervention.
- Treated wastewater offers a viable alternative feedstock, supporting circular economy principles.

✓ Substantial wastewater availability locally and regionally around Knapton in urban wastewater treatment plans (UWWTPs)



Integration

- ✓ Knapton sits centrally on the East Coast Hydrogen corridor, linking Teesside, Humber and inland demand
- ✓ Hydrogen-to-Power (H_2P) is the anchor use case, providing flexible, dispatchable low-carbon power
- ✓ Geological storage in the Vale of Pickering offers TWh-scale, long-duration capacity
- ✓ Surface and near-surface engineered storage (tanks, silos, pipeline) provides fast-cycling, short-to-medium duration balancing
- ✓ Integrated storage enables hydrogen production, transport and power to operate as one coordinated system



Next Steps: February 2026 SIF Alpha application

Northern Gas Networks

WP1 Project management

WP2 Surface and near-surface storage

- Surface tanks and silos on brownfield site, engineering design plan
- Repurpose disused pipeline + linepack feasibility study
- Plan A for Knapton

WP3 Deep geological storage

- Depleted Gas field (Malton) characterisation and risk assessment (Geochemical, microbial, reservoir modelling, well integrity risk)
- Barriers to implementation and roadmap
- Plan B for Knapton, increasing TRL level for porous rock storage.

WP4 Permitting

- Engagement with EA on storage options
- Pre planning application to EA on preferred storage option

WP5 Business model

- Production onsite vs tube trailer
- Storage options
- Full business model viability on H2P

WP6 Communication and stakeholder

- Engagement with local community and with key stakeholders
- Dissemination event(s)

Key goal: Storage technology TRL development

we are the network

Thank you

For further information / copies of the project technical reports please email Jarred Knott Jknott@northerngas.co.uk

SIF Discovery

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ofgem

UKRI Innovate UK

Northern Gas Networks

centrica energy storage+

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