

Overview of conventional hydrocarbon resources in the North Sea Basin – harmonization of assessments, cross-border play mapping and new concepts

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OUTLINE

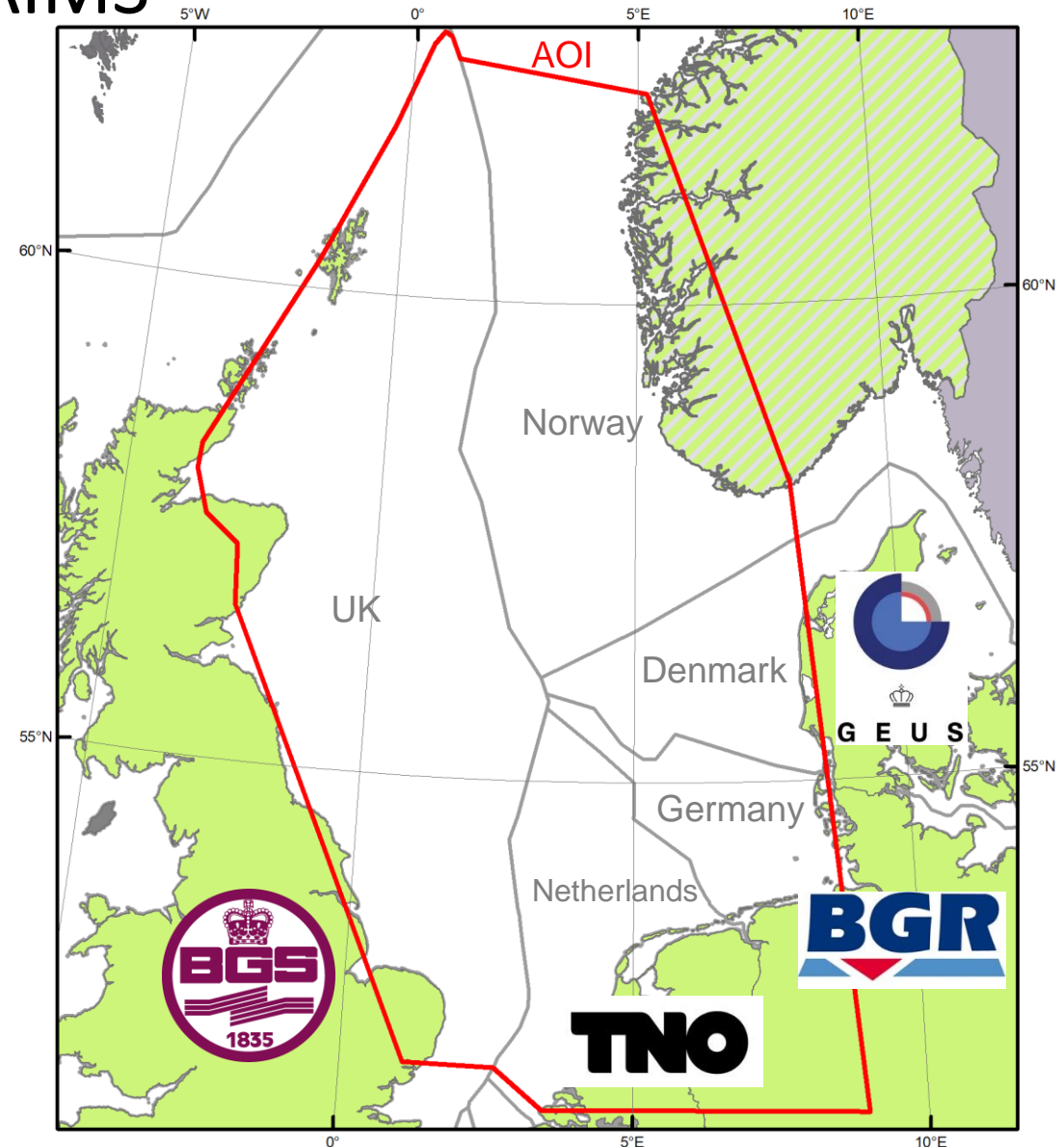
- Project aims
- Methodology
- Results
 - Survey
 - Data Themes
 - GIS project
 - What is unique about GARA H?
 - Next Steps and Questions

**Geological
Analysis and
Resource
Assessment of selected
Hydrocarbon systems**



COUNTRIES, AREA OF INTEREST AND AIMS

- Netherlands, Germany, UK, Denmark (and Norwegian data)
- Regional collation of hydrocarbon-related information and resource assessments for the North Sea
- Harmonisation of methods and resource assessment results
- Resolve cross-border issues in understanding petroleum geology
- Identify play concepts across North Sea and explore potential across borders
- Identify data gaps in geological understanding
- Collate information for alternative resources such as geothermal, CCS and wind energy



METHODOLOGY – SURVEYS for ALL COUNTRIES

CAPTURE:

- Summary of exploration history, main plays, current methods for resource assessments across borders
- Quantitative descriptions of reserves, resources, yet to find – all in same units
- Summary of play types across borders – reservoir, source, seal
- List of exploration wells for each country from 2000 – name, location, company, dates drilled and completed, target formation if possible.

3. Summary of Play Types

a) List the main play types in your country's North Sea based on: play type status (proven, conceptual etc); present (i.e. heavy oil, dry gas etc); main source(s) (including age and lithology); trap type (structural); geographic location (e.g. Viking Graben, Broad Four

See spread sheet tab: Norwegian NSea well activities

b) For your country, summarise which play types have been underexplored, and which are most promising for future exploration

Most successful: Cretaceous Chalk and Jurassic Sandstone
Most Promising: Late Triassic to Early Jurassic Sandstone

4. Exploration History

a) From the year 2003 (by end of drilling), list all publically available exploration data in the spreadsheet. Include details of: TD; Water Depth; etc.

b) Do you have further released well information relating to target lithology or reservoir; target play type; result (i.e. d etc). If so, is it possible to compile this information for the below what may be available and how long it would take to

All this is published on the NPD website.

Questionnaire - GARAH Conventional Resource Assessments

Introduction
This questionnaire is intended to assess the data availability in your country related to conventional oil and gas resources in the North Sea study area. The aim of the GARAH project is to assess cross-border resources, and our approach here is not only to compare existing reporting on resource assessment, but also to compare methodologies. Initially, we are interested in existing assessments of conventional resources and associated methodologies. We will then take a play-based approach to collate information on conventional petroleum systems across the North Sea, and compare exploration data to see if further insight can be made regarding particular plays and regions of exploration interest.

Note: All geographic data should be supplied in ED50 31 or ETRS89-LAEA format
Note: All references should be in Geological Society of London format

Name of your geological survey:
British Geological Survey

1. State-of-the-art of conventional hydrocarbons in the North Sea offshore.
For your country, Please provide a brief overview of the current situation with regards to oil and gas exploration and production, for example: current licensing activities; planned or recent exploration activities; relinquishments; production forecasts/numbers; government priorities and policy. List relevant overview publications.

Offshore oil and gas exploration in the UK sector of the North Sea has been ongoing since the 1960's. The oil and gas industry is regulated by the Oil and Gas Authority (OGA), part of the UK Government Department for Business, Energy, and Industrial Strategy (BEIS). The OGA regulates, promotes and influences the oil and gas industry in order to maximise economic recovery of oil and gas from the UK. The OGA published an updated exploration strategy in 2016, which is publically available here: https://www.ogaauthority.co.uk/media/2835/exploration_strategy_master.pdf
The OGA published an updated overview of their work in 2018: https://www.ogaauthority.co.uk/media/5063/oga_overview_sept.pdf

Oil and gas production from the UK North Sea peaked in 1999, and the OGA reports 42.3 billion barrels of oil equivalent (boe) total hydrocarbons produced since 1975 (last updated October 2018). Of this, 39 bn boe of hydrocarbons have been produced from the North Sea area - 92% of total production. The last compilation of OGA reporting, from 2018, calculated 1.63 million boe/day was produced in 2017, similar to the figure in 2016. Up to date production information can be found and queried here:

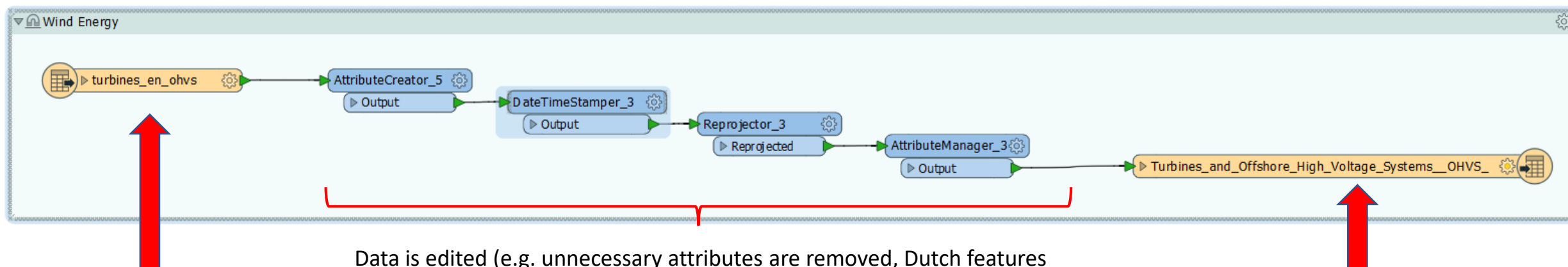
METHODOLOGY – DATA THEMES AND AVAILABILITY

- Identification of hydrocarbon themes: fields; infrastructure; facies maps; play maps; reservoir distribution; salt structure; temperature; permeability
- Resource assessment parameters: selected intervals; thickness etc.
- Other themes such as data relating to CCS; geothermal; marine environment
- Decision on feasibility for creating new data and maps e.g. areas of HPHT where not previously collated
- Understanding static versus dynamic data

me	Assessment	Layer NL	The Netherlands available at the moment	Denmark available at the moment	or static (e.g. shapefile) u
Wells	Conventional	Wells offshore	yes (shapefile)	Yes (Shapefile)	Yes
	Conventional	Hydrocarbon fields	yes (shapefile)	yes (shapefile)	Yes
Hydrocarbon fields	Conventional/Unconventional		No	Yes, but only for the Jurassic	No
Play maps			No	Partly (likely WMS, via https://www.emodnet-humanactivities.eu/view-data.php)	Yes
Facies maps	Renewables	Wind turbines	Yes (WFS)	Partly (likely WMS, via https://www.emodnet-humanactivities.eu/view-data.php)	Yes
		Location of licensed wind parks	Yes (WFS)	Partly (likely WMS, via https://www.emodnet-humanactivities.eu/view-data.php)	Yes
		Designated wind energy areas (Nationaal Waterplan)	Yes (WFS)	Partly (likely WMS, via https://portal.emodnet-bathymetry.eu/?menu=29)	Yes
Cables and Pipelines	Multiple use			Remark: at least for the Netherlands, the data on this website is not up to date	
		Pipelines North Sea area	Yes (WFS)	Partly (likely WMS, via https://portal.emodnet-bathymetry.eu/?menu=29)	Yes
		Electricity cables North Sea	Yes (WFS)	Partly (likely WMS, via https://portal.emodnet-bathymetry.eu/?menu=29)	Yes
		Telecom cables North Sea	Yes (WFS)	Partly (likely WMS, via https://portal.emodnet-bathymetry.eu/?menu=29)	Yes
		Service cables North Sea	Yes (WFS)	Partly (likely WMS, via https://portal.emodnet-bathymetry.eu/?menu=29)	Yes
		Preference routes for cables in the North Sea	Yes (WFS)	Partly (likely WMS, via https://portal.emodnet-bathymetry.eu/?menu=29)	Yes
		Search areas for sand mining covered by MER 2017-2018	Yes (WFS)	Partly (likely WMS, via https://portal.emodnet-bathymetry.eu/?menu=29)	Yes
Areas for sand and shells	Other	Area reserved for sand mining	Yes (WFS)	Partly (likely WMS, via https://portal.emodnet-bathymetry.eu/?menu=29)	Yes
		Test mining areas for sand	Yes (WFS)	Partly (likely WMS, via https://portal.emodnet-bathymetry.eu/?menu=29)	Yes
		Mining areas for sand	Yes (WFS)	Partly (likely WMS, via https://portal.emodnet-bathymetry.eu/?menu=29)	Yes
		Mining areas for shells	Yes (WFS)	Partly (likely WMS, via https://portal.emodnet-bathymetry.eu/?menu=29)	Yes
		Military areas	Yes (WFS) Remark: likely of minor importance	Partly (likely WMS, via https://portal.emodnet-bathymetry.eu/?menu=29)	Yes
Defence	Restricted areas	Military areas of interest	Yes (WFS)	Partly (likely WMS, via https://portal.emodnet-bathymetry.eu/?menu=29)	Yes
Nature 2000 protected areas	Restricted areas	Nature 2000 protected areas	yes (shapefile)	Yes (likely WMS, via https://portal.emodnet-bathymetry.eu/?menu=29)	Yes
Water depths	Other	Water depths			

METHODS – static vs. dynamic data processing

- Static data (e.g. shapefiles or raster files) – GIS data is produced but not updated automatically: Fine for geological data (e.g. facies maps, play maps).
- Dynamic data by using WFS (Web Feature Services) – GIS data is produced and updated regularly by the owner/sourceholder to provide the latest status: Preferably used for data showing policies and infrastructure (e.g. pipelines, windparks, production data from gasfields). Disadvantage; Dynamic data is not always available and every country has different source holders.
- Dynamic data is processed by using FME software (from Safe Software) (see image below for example). By using FME, dynamic data can be updated, harmonized and edited to be more comprehensible. Also static data can be harmonized/edited in FME (but not updated!).



Server from sourceholder (in this case Dutch Rijkswaterstaat) is requested by using WFS

Data is edited (e.g. unnecessary attributes are removed, Dutch features are translated into English and metadata (data of last update) is added)

Updated server request is saved as feature class in geodatabase

METHODS – static vs. dynamic data processing

Metadata is added

AttributeCreator Parameters

Transformer Name:

> Advanced: Attribute Value Handling

Attributes To Create

New Attribute	Attribute Value
Link WFS	<input type="checkbox"/> https://geoservices.rijkswaterstaat.nl/apps/geoserver/windenergiegeb...
Source Holder	<input type="checkbox"/> Rijkswaterstaat
Website of origin	<input type="checkbox"/> https://data.overheid.nl/dataset/58341-windparken-noordzee--nederl...

Filter: Import ...

Help Defaults OK Cancel

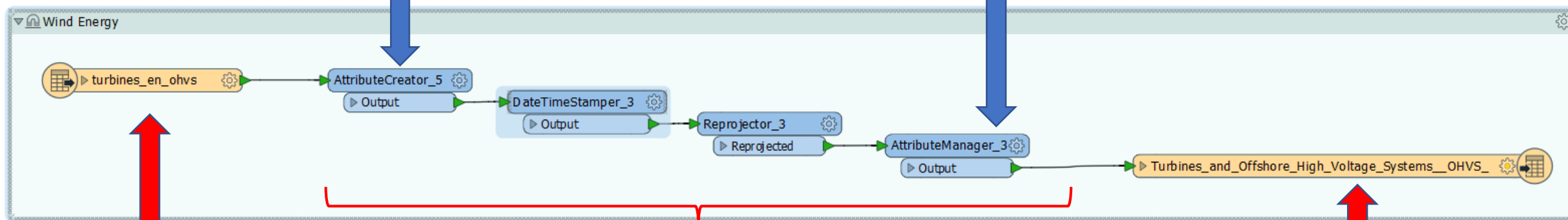
Attributes are removed/translated to make it more comprehensible

Attribute Actions

Input Attribute	Output Attribute	Attribute Value	Action
OPMERKING	TYPE		Rename
OPMERKING.xsi_nil			Remove
GEBIEDNR	AREA_NUMBER		Rename
GEBIEDNR.xsi_nil			Remove
TURBINE_NR	TURBINE_NUMBER		Rename
TURBINE_NR.xsi_nil			Remove
EIGENAAR	OWNER		Rename
EIGENAAR.xsi_nil			Remove
SHAPE	SHAPE		Do Nothing
SE_ANNO_CAD_DATA			Remove

Filter: Import ...

Help Defaults OK Cancel

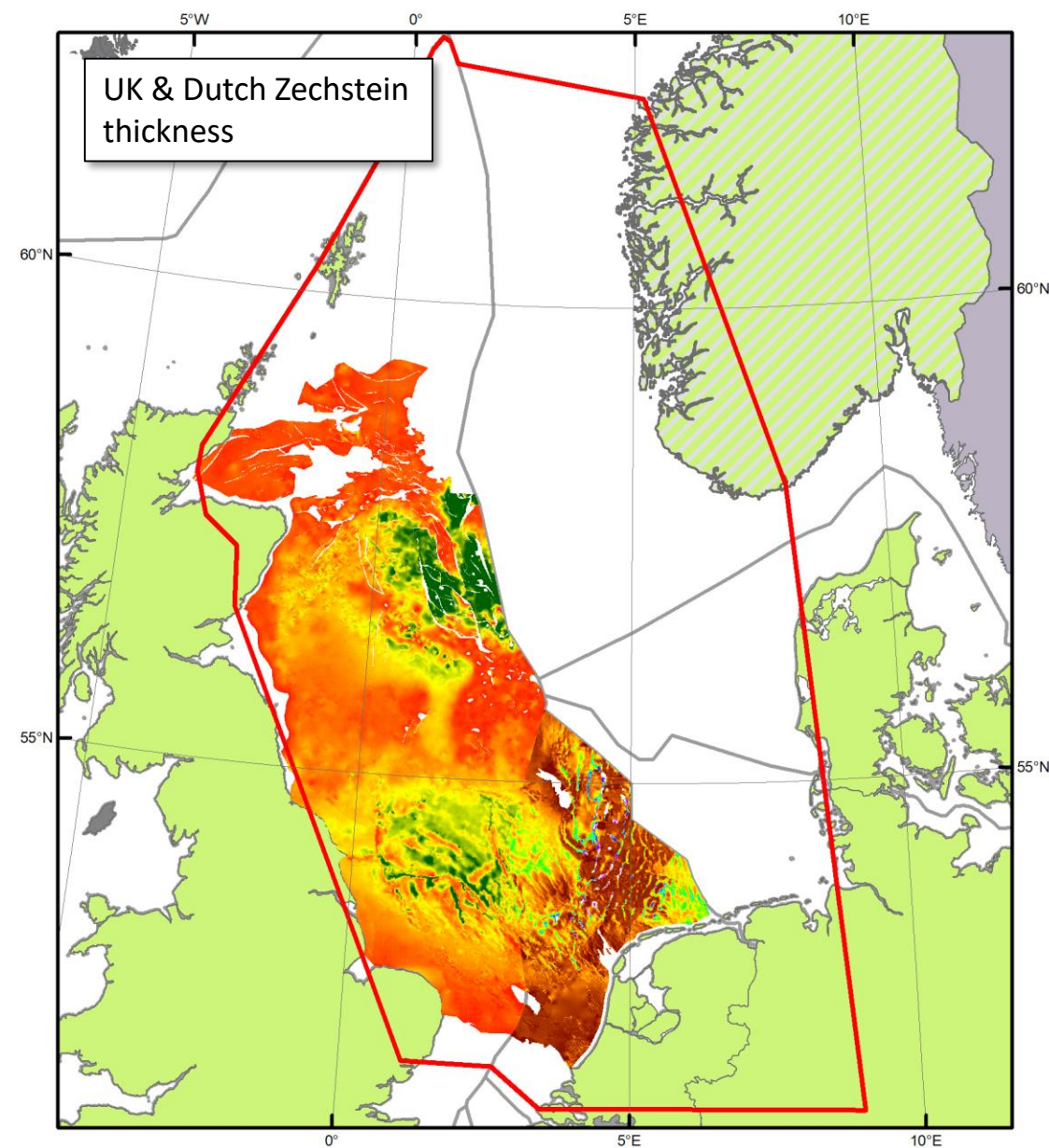
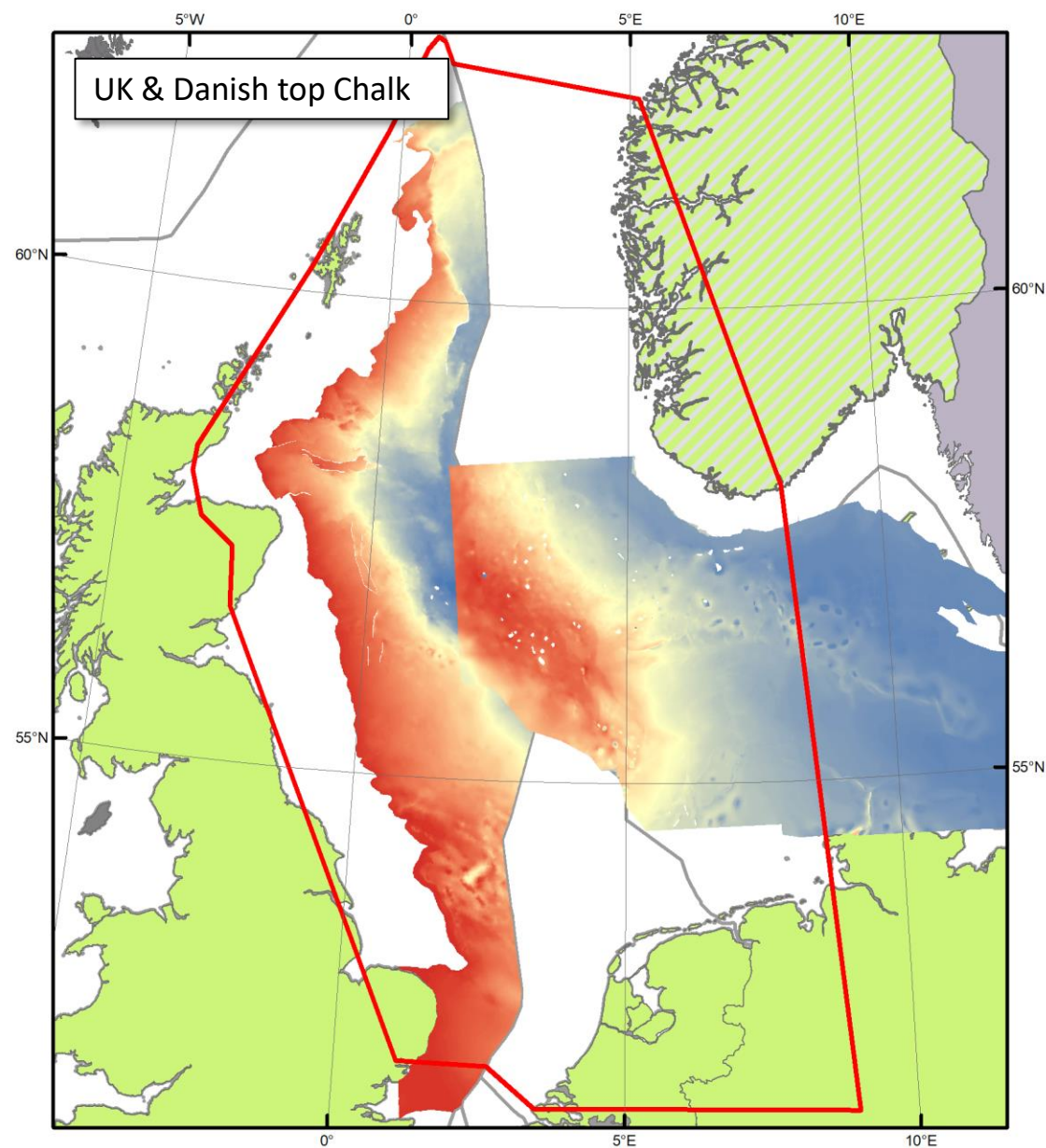


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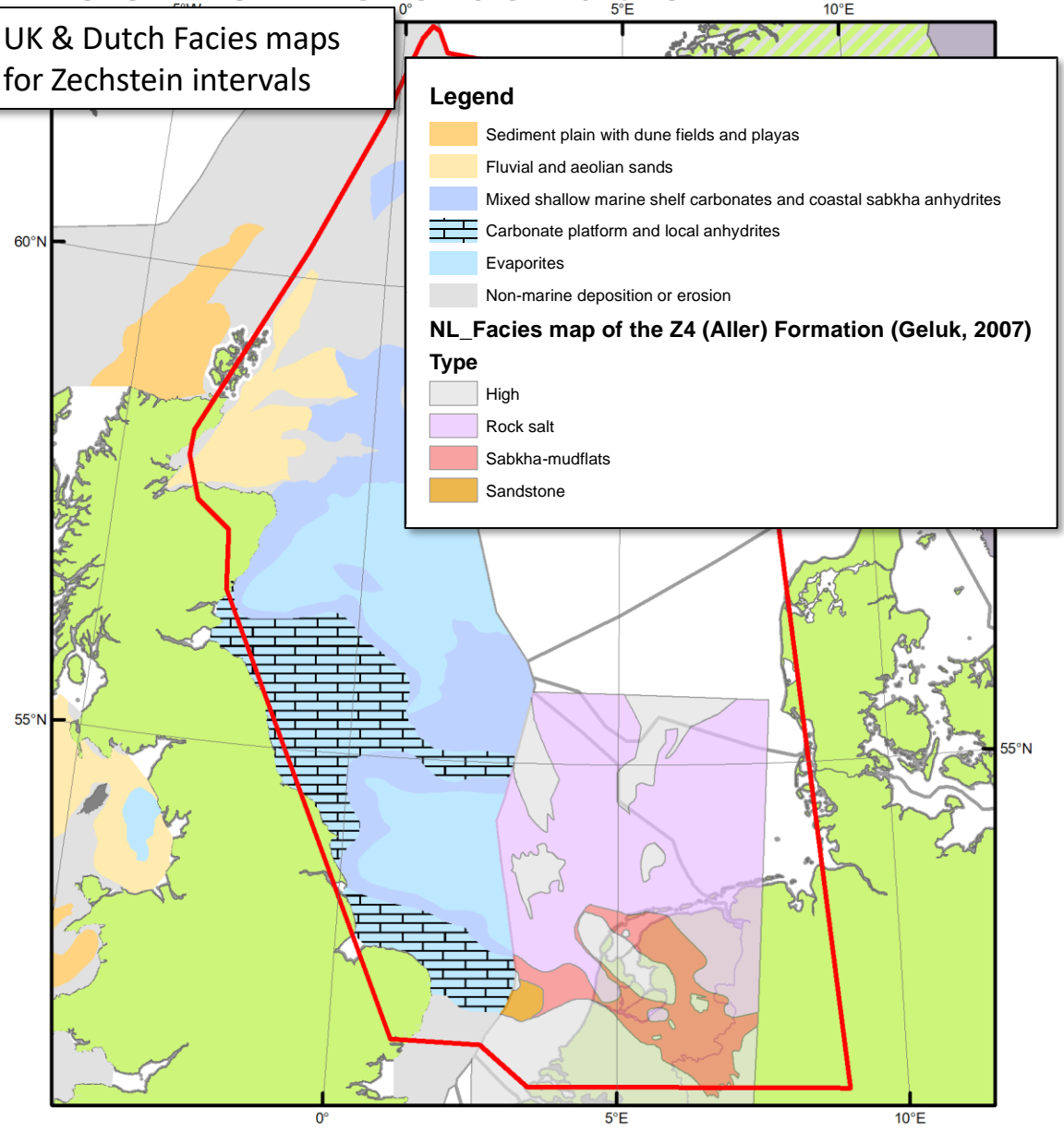
Updated server request is saved as feature class in geodatabase

RESULTS – GIS collation

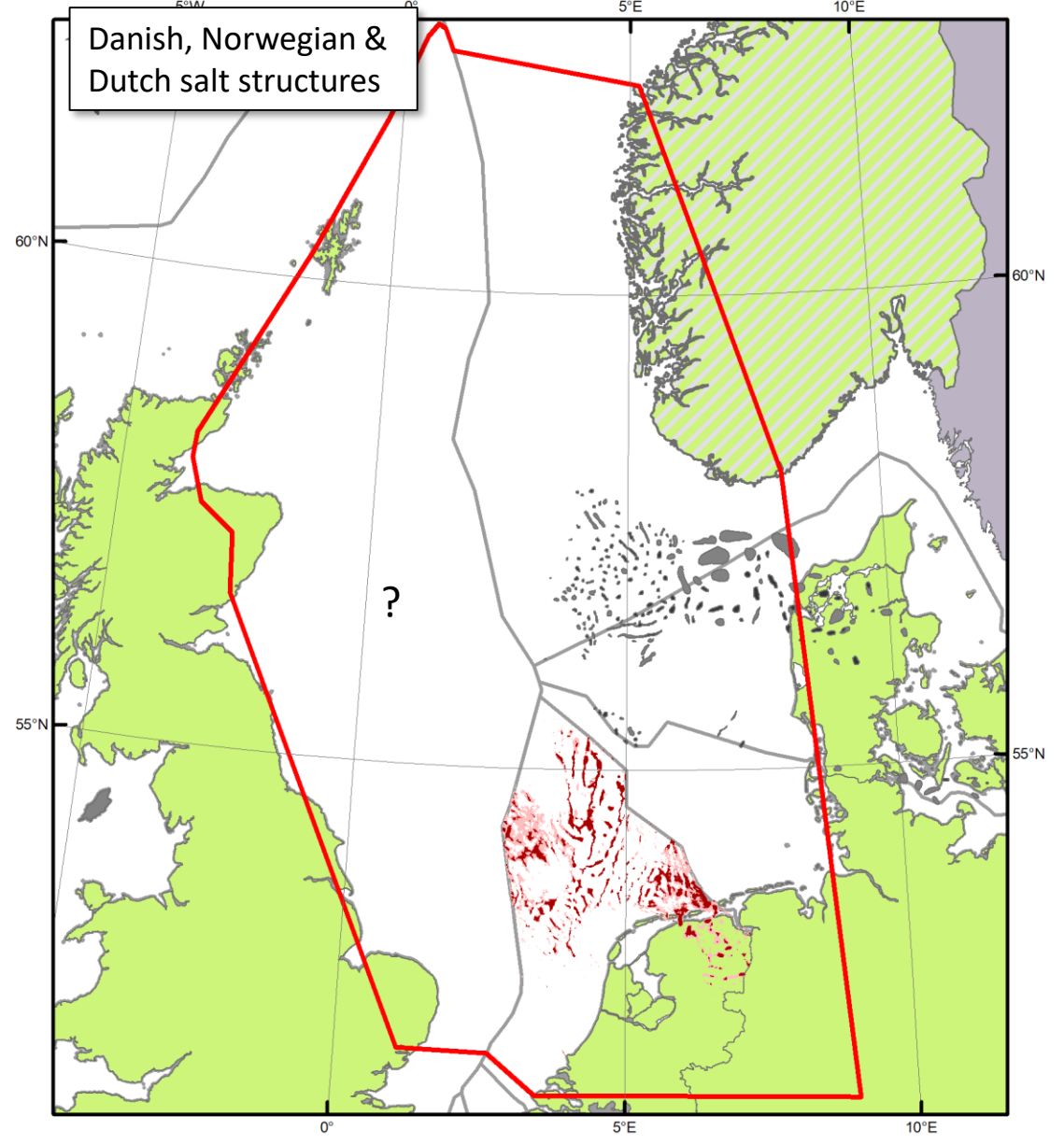


RESULTS – GIS collation

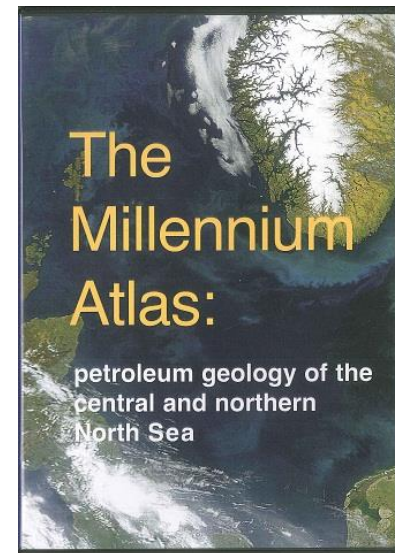
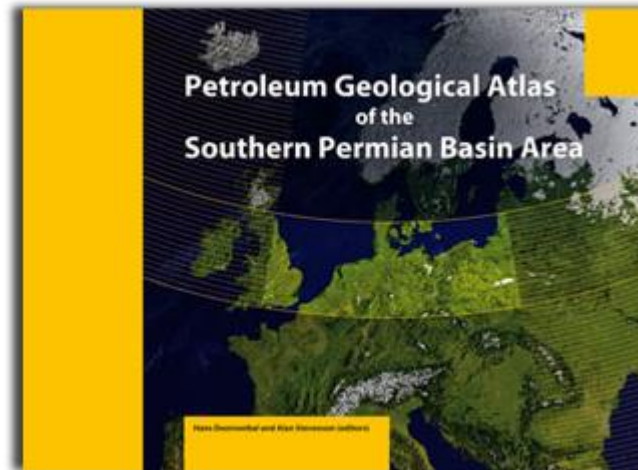
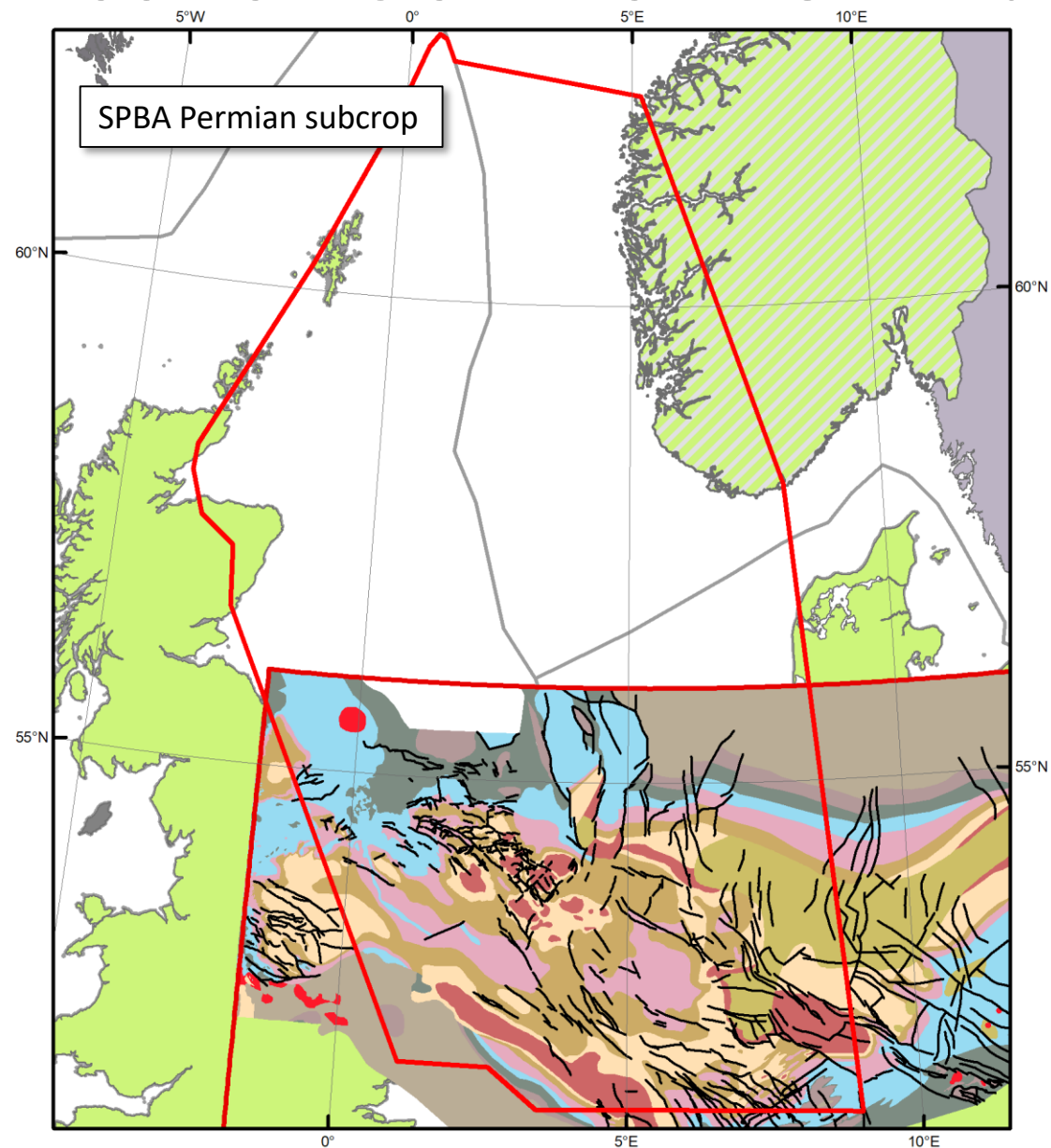
UK & Dutch Facies maps
for Zechstein intervals



Danish, Norwegian &
Dutch salt structures

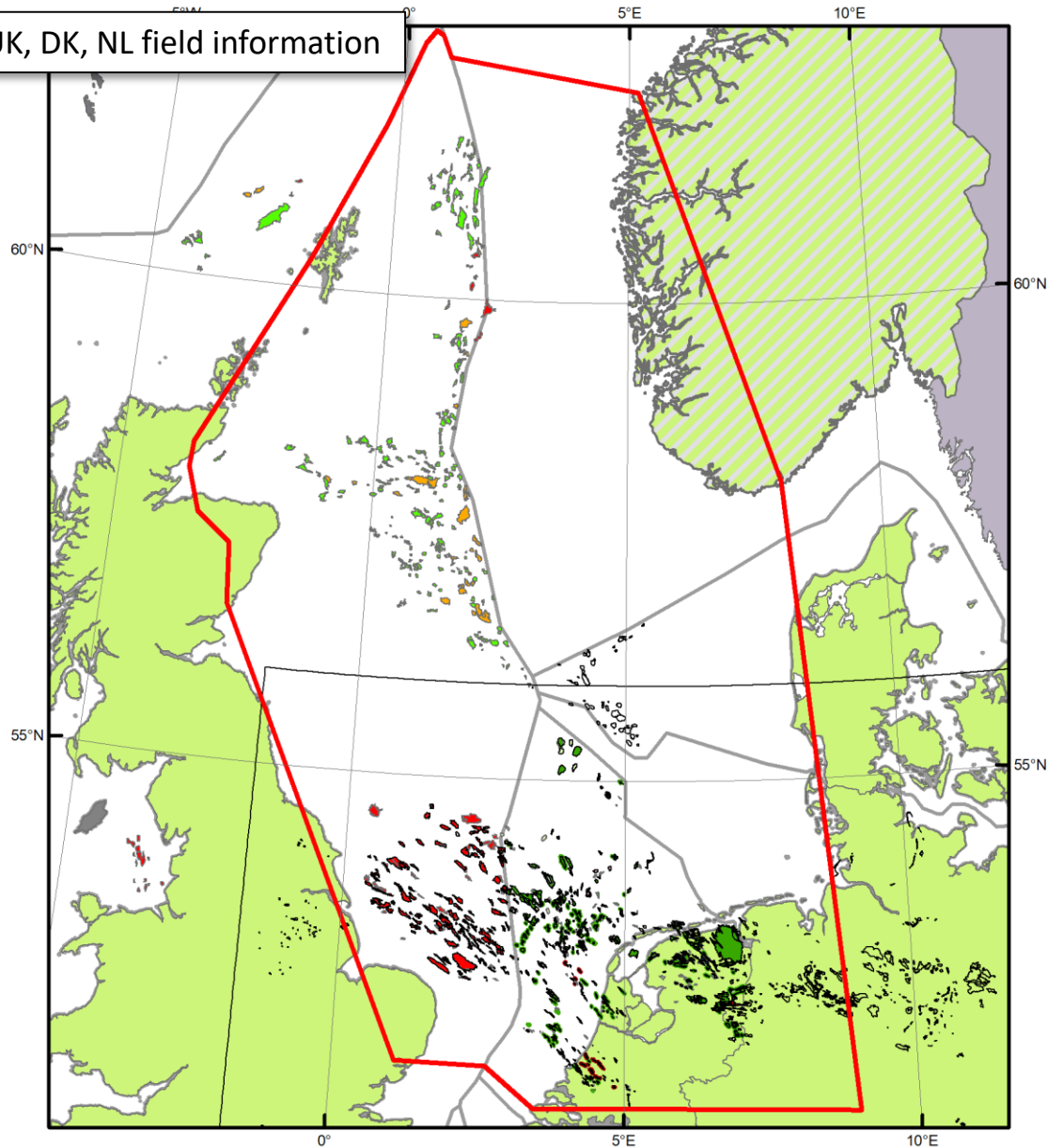


RESULTS – GIS – PAST WORK – avoid duplication



CURRENT RESULTS – GIS collation – new work

UK, DK, NL field information



Hydrocarbon Field Information UK, NL, DK

SPBA_fields

Denmark

Hydrocarbon fields

Type

Gas field out of production

Gas field in production

Undeveloped gas field

Subsurface gas storage

Temporarily abandoned gas field

Oil field out of production

Oil field in production

Undeveloped oil field

COND

GAS

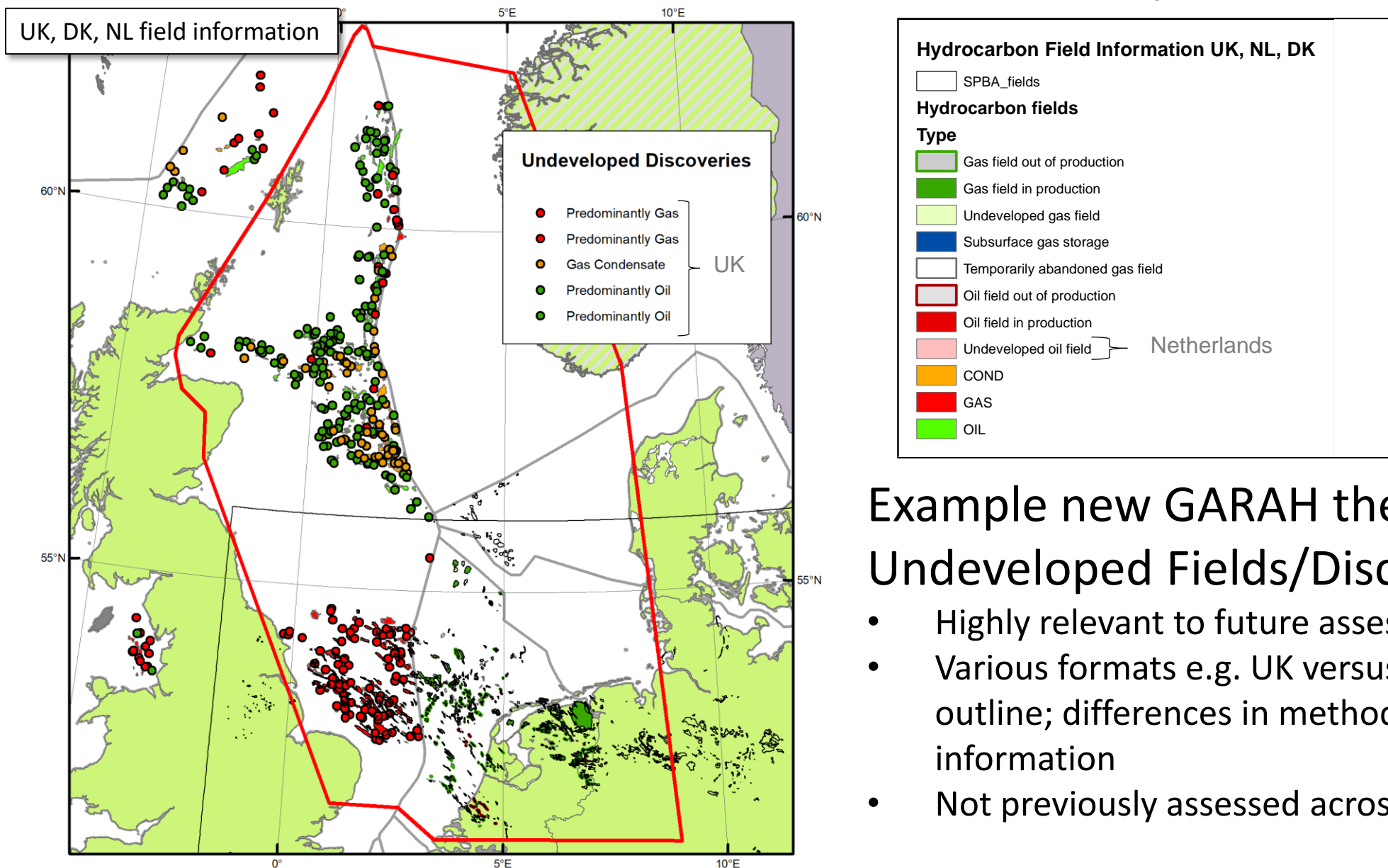
OIL

Netherlands

UK

- Various levels of detail e.g. Dutch information captures production status; UK does not include gas storage
- Different definitions depending on country
- **What is relevant to the future?**

CURRENT RESULTS – GIS collation – Undeveloped fields

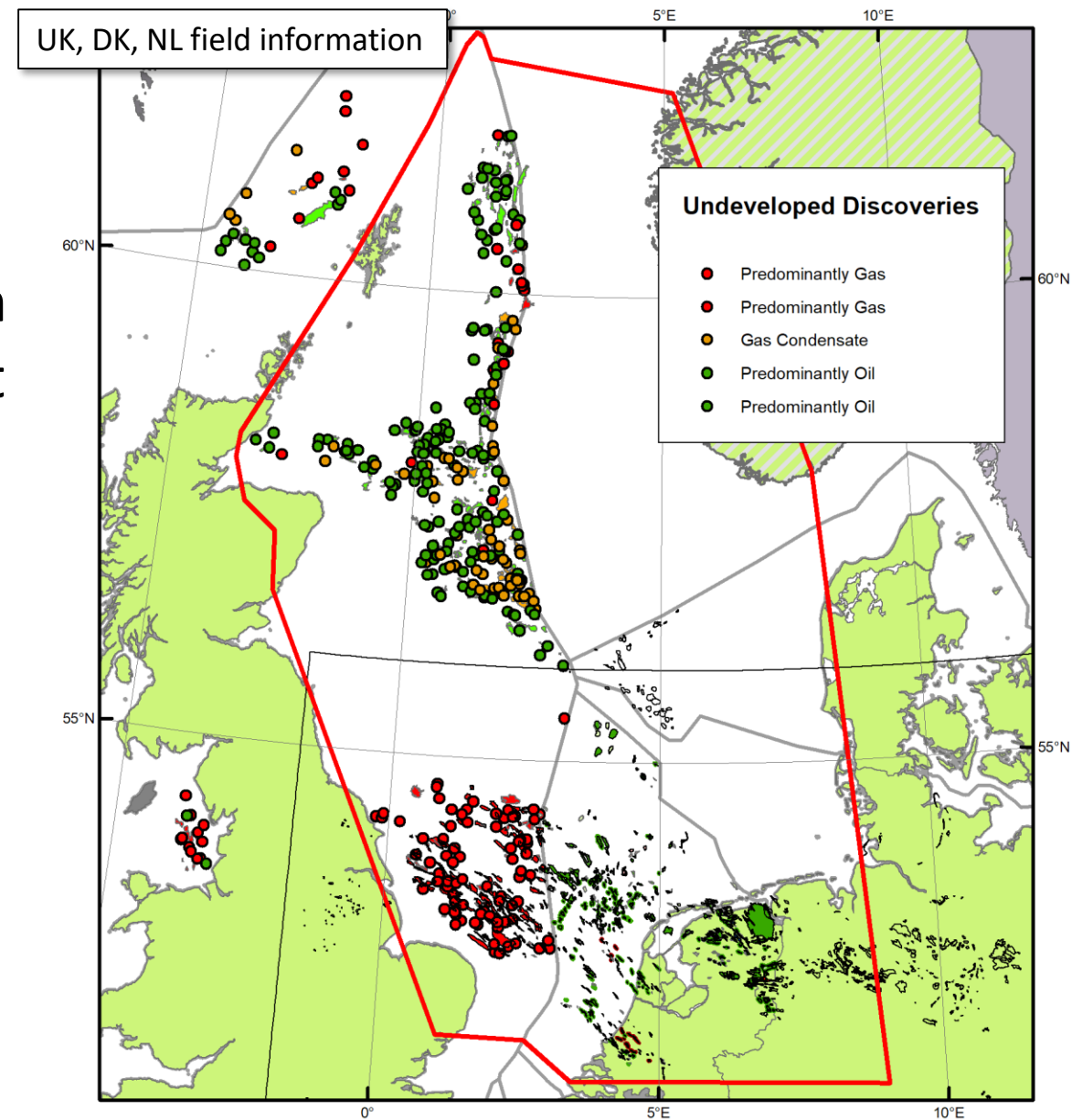


Example new GARAH theme: Undeveloped Fields/Discoveries

- Highly relevant to future assessment for mature basin
- Various formats e.g. UK versus NL – point versus outline; differences in methodology; ‘hidden’ information
- Not previously assessed across borders

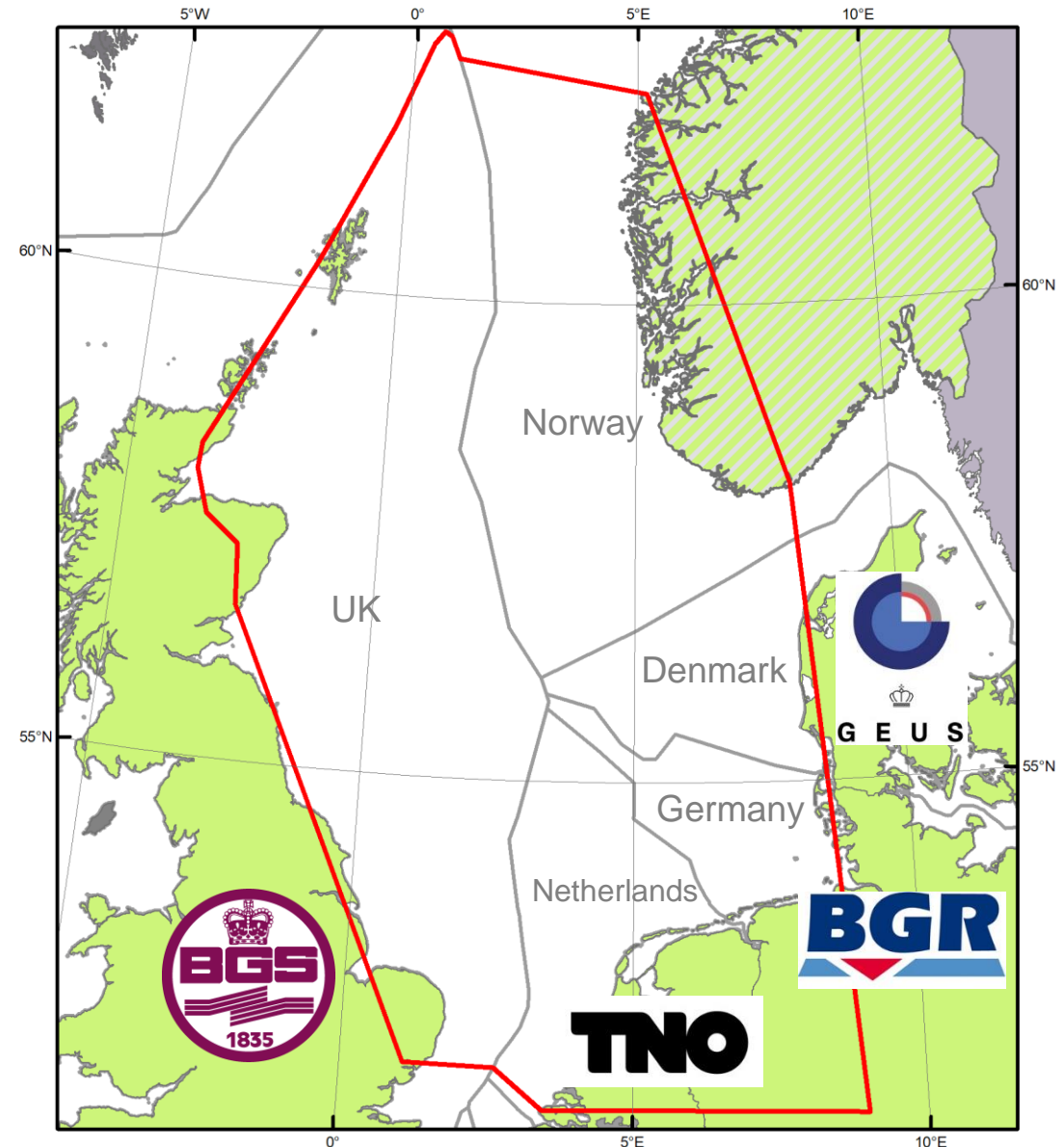
WHAT MAKES GARAH UNIQUE?

- Avoid point duplicating past work (i.e. SPBA, MA, NAGTEC)
- Influence of government policy and carbon commitments – mature basin environment
- Focus on cross-border play analysis and resource assessment rather than just ‘joining up maps’. What is left in the N. Sea?
- Focus on alternatives to traditional oil and gas; what do we need for cross-border assessment of CCS/geothermal/energy storage? What/where are the main data gaps?



NEXT STEPS/COLLABORATION

- Refinement of themes
- Harmonisation of data and metadata
- Identification of data gaps
- Resource assessment (of what?)
- Work with geoERA – what about offshore structure?
- Dynamic versus static outputs?



THANK YOU!

QUESTIONS

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