NDR NATIONAL DATA REPOSITORY 2019
Utrecht, The Netherlands

Country Report:

Denmark

GEUS

NDR 2019, 14-17 October 2019, Utrecht The Netherlands

NDR key parameters

Name of the NDR	Geological Survey of Denmark and Greenland (GEUS) & Danish Energy Agency (DEA)
Type of organisation	Govermental regulator
Operating since:	1891
Employees:	300
State participating agency:	Nordsøfonden
State Supervisor:	DEA

Type of data	
Onshore	Yes
Offshore	Yes
License information	Yes
Production information	Yes

Objectives

NDR in Denmark - DEA & GEUS

- The Danish Energy Agency (DEA) regulates and registers licences, drilling operations, well completions, production and injection
- Geological Survey of Denmark and Greenland (GEUS) is responsible for well logs and seismic data as well as other geophysical data and geological interpretations
- The DEA and GEUS share the same database system: SAMBA
- Since 1985 SAMBA has been developed by staff at GEUS and DEA

Challenges

• Political discussions ongoing to ban future petroleum exploration activities


DEBAT.

15

Leder.

Stå imod, Dan Jørgensen

Grøn omstilling skal ske med omtanke. At lukke for hanen i Nordsøen vil alene være symbolsk, så længe vi har brug for olien.

ANSV. CHEFREDAKTØR PETER ORRY


8 BØRSEN. VIRKSOMHEDER

Nordsøkæmpe ser muligheder i ny politisk betændt oliejagt

Politisk pres får ikke nordsøaktører til at slå bak på at søge efter nye fund i Danmark. Styrelse og minister er tavs om igangværende licensuddeling


10 Det går godt i København, og det smitter af på hele Danmark politiken.dk/7354868

Vismændene forudser, at lønnen vil stige mere end priserne til næste år

Den globalt set svækkede udsigt til vækst har indtil videre haft begrænset virkning på dansk økonomi, skriver de økonomiske vismænd i deres efterårsrapport. De spår, at lønmodtagere i gennemsnit får flere penge til forbrug i 2020.

Så meget har staten tjent på Nordsøen

Nordsøens olie: Regeringen er under øget pres for at stoppe jagten på nye oliefelter


8 PRIVAT ØKONOMI

64 Så mange procent af stigningen i atmosfærens CO_2 skyldes kul, olie og gas. Resten stammer fra afskovning.

110 Er antallet af pensionsselskaber globalt, der er gået helt ud af olie-, kul- og gasinvesteringer.

46 procent af danskerne mener, at deres pensionsselskab skal undlade at investere i kul, olie og gas. Men kun 17 procent er villige til at skifte pensionsselskab.

Oprør fra neden: Pensionskunder presser deres selskaber ud af olien

Læger, arkitekter, magistre og ingeniører er de sidste fire år gået i kødet på deres pensionsselskaber for at få dem til at frasælge aktier i fossil energi. Det er en del af en 'afinvesteringsbølge', som tager til i styrke.

Successes

- Danish Energy Agency (DEA)
  - New system to report production data in place from 2020

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A new format for submission of Production Data to the Danish Energy Agency

GEUS

Uffe Larsen

Background

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- **Standardization of Data Submission.**
  In connection with a new executive order regarding the submission of production data the format of the data files is in the process of being revised and standardized.
- **Historical Background.**
  For historical reasons many different formats have been in use by companies active in the Danish sector of the North Sea.
- All the present formats are flat ASCII files.

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PRODML Considerations

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PRODML is a standard developed by Energistics

https://www.energistics.org

The versions PRODML 1.2.2 and PRODML 2.0 have been considered.

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Some problems with PRODML version 1.2.2

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- **The executive order contains elements that cannot be found in the standard.**
  PRODML 1.2.2 does not describe waterSalinity (for well tests) or VesselName (in connection with cargo operations). It is possible, though, to extend the standard.
- **The standard has a complicated structure.**
  Often a considerable hierarchy has to be filled out to be able to deliver simple data.
- **Apparent lack of general company acceptance.**
  The companies were very critical when the use of PRODML was proposed on a hearing / consultation meeting in autumn 2013.

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Some problems with PRODML version 2.0

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Released 2016

- **Version 2.0 still misses some elements compared to the executive order.**
  For example version 2.0 does not have a element for “ownership to cargo” in connection with cargo operations. (The standard does, however, provide the possibility to add user defined elements)
- **The element <aggregates>, which is found in PRODML version 1.2.2. does not exists in version 2.0.**
  This means that a data compilation for a month cannot be delivered in one single file.
- **The standard is still regarded as complicated.**

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XML chosen for submision of Production Data

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- **XML is chosen.**
  A big advantage with XML is that the companies can validate the format by the means of an XSD at an early stage
- **Naming of elements and attributes.**
  Follows as far as possible the naming used in PRODML.
- **The XML is very simple with few hierarchies.**
  This results in good performance when data are imported and exported.
- **The XML can easily be compared to the description of data in the executive order**

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Data Flow

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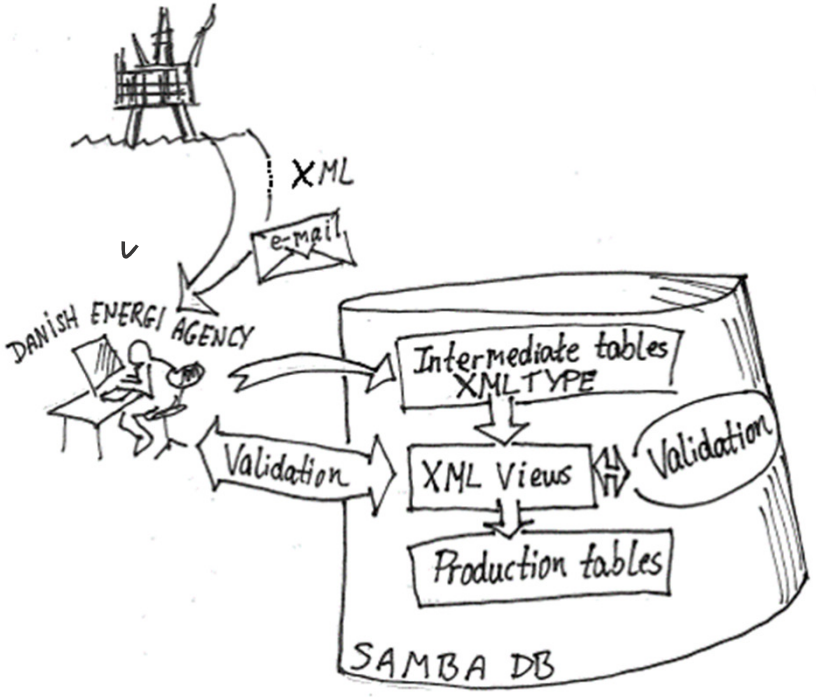
- **Security**.
  Connection to the database from the internet is not allowed. Database must be completely invisible from the webserver's point of view. This makes it tricky (but not impossible) to develop a fully automatic system where data are delivered through a web service.
- **Low submission frequency.**
  Only 3-4 companies submit and only once a month.
- **Submission via mail.**
- **Data upload and QC.**
  Danish Energy Agency uploads the files to the database, validates data and communicates with the companies.



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Data validation

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- **Validation.**
  An XML schema (xsd) validates data types (string elements, numerical elements, enumerations).
- **Control.**
  Constraints in the database control at upload time that wells, platforms etc., which is referred to in the XML document also exist in the database.
- **Enhancements.**
  The solution is flexible and can be extended with statistical tests.

- **New scheme in use from 2020.**

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An example of how an XML file can be created

The test was run on Oracle 12c

SEGMENT_NAME	PROD_DATE	GASQTY	GASMASS	GASLIFTQTY	BLACKOILQTY	WATQTY	THP	WHT	BHP	BHT	UPTIME
KARSTEN 1	15-06-2009	0	0	0	0	0	1957.38	50	17708.9	60	0
KARSTEN 1	16-06-2009	370.3828	442.6764	0	33.6819	215.2064	3248.7	50	17710	60	5.75
KARSTEN 1	17-06-2009	5501.37	6575.2492	0	500.2907	1131.1952	2024.7	50	17337.1	60	24
KARSTEN 1	18-06-2009	5629.8756	6728.834	0	511.9765	962.6236	2055.3	50	17150.1	60	17.58
KARSTEN 1	19-06-2009	1894.556	2264.3776	0	172.2896	368.6992	2181.78	50	17475.7	60	7.75
KARSTEN 1	20-06-2009	6621.0928	7913.5364	0	602.1169	1497.2356	2114.46	50	17022.5	60	24
KARSTEN 1	21-06-2009	4574.654	5467.6336	0	416.0156	927.2772	4032.06	50	17208.4	60	15.33
KARSTEN 1	22-06-2009	6220.5156	7434.7776	0	565.6896	1458.6232	2102.22	50	16874	60	24
KARSTEN 1	23-06-2009	6892.4192	8237.8272	0	626.7912	1656.5336	2108.34	50	16746.4	60	24
KARSTEN 1	24-06-2009	6564.2368	7845.5852	0	596.9467	1505.2948	2106.3	50	16678.2	60	24
KARSTEN 1	25-06-2009	7134.3884	8527.0384	0	648.7964	1473.0672	2101.2	50	16630.9	60	24
osv.....											

SQL that generates XML

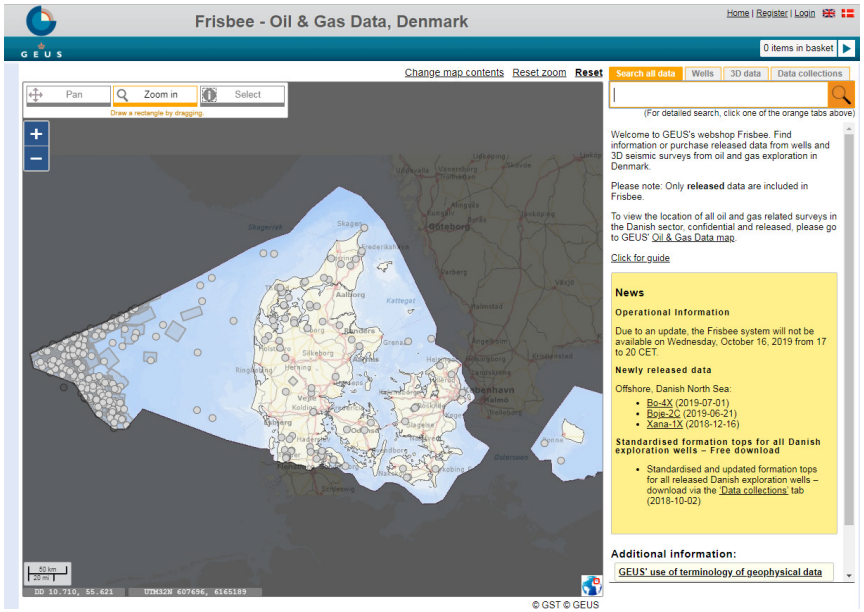

```
WITH h AS
  (SELECT
       XMLELEMENT("Month",'2009-06') as mon,
       XMLELEMENT("Company",'ABCDE A/S') as com,
       XMLELEMENT("Created", TO_CHAR(SYSDATE,'YYYY-MM-DD"T"HH24:MI:SS"Z"')) as cre,
       XMLELEMENT("Contact",
          XMLELEMENT("Name",'Ole Hansen'),
          XMLELEMENT("PhoneNo",'+45 65 65 65 65'),
          XMLELEMENT("email",'oh@abcde.com')
          ) as cont
  FROM DUAL),
  wp AS
  (SELECT
    XMLELEMENT("ProductionWell", XMLELEMENT("Name", a.segment_name), XMLAgg(
        XMLELEMENT("Period",
         XMLELEMENT ("Date", TO_CHAR(a.prod_date,'YYYY-MM-DD')),
         XMLELEMENT ("GasProductionVolume",XMLAttributes('Nm3' as "oum" ), a.gasqty),
         XMLELEMENT ("GasProductionMass",XMLAttributes('kg' as "oum" ), a.gasmass),
         XMLELEMENT ("LiftGas",XMLAttributes('Nm3' as "oum" ), a.Gasliftqty),
         XMLELEMENT ("OilProduction",XMLAttributes('Sm3' as "oum" ), a.blackoilqty),
         XMLELEMENT ("WaterProduction",XMLAttributes('Sm3' as "oum" ), a.watqty),
         XMLELEMENT ("WellHeadPressure",XMLAttributes('kPa' as "oum" ), a.thp),
         XMLELEMENT ("WellHeadTemperature",XMLAttributes('degC' as "oum" ), null),
         XMLELEMENT ("BottomHolePressure",XMLAttributes('kPa' as "oum" ), a.bhp),
         XMLELEMENT ("BottomHoleTemperature",XMLAttributes('degC' as "oum" ), null),
         XMLELEMENT ("UpTime", a.uptime)
         ) ORDER BY prod_date)) as productw
  from well_prod_example a
  where  to_char(a.prod_date,'YYYY-MM') = '2009-06'
  group by segment_name
)
SELECT
  XMLRoot(
     XMLELEMENT("Report",
                  XMLAttributes('http://www.ens.dk/de' AS "xmlns",
                        'http://www.w3.org/2001/XMLSchema-instance' AS "xmlns:xsi",
                        'http://www.ens.dk/dea deareport2019.xsd' AS "xsi:schemaLocation"),
                   XMLConcat( h.mon, h.com, h.cre, h.cont, wp.productw)),
  VERSION '1.0" encoding="UTF-8')
  AS "XML exampel"
FROM h, wp;
```

The resulting XML


```
<?xml version="1.0" encoding="UTF-8"?>
<Report xmlns="http://www.ens.dk/de" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
        xsi:schemaLocation="http://www.ens.dk/dea deareport2019.xsd">
        <Month>2009-06</Month>
        <Company>ABCDE A/S</Company>
        <Created>2019-05-27T13:38:01Z</Created>
        <Contact>
                <Name>Ole Hansen</Name>
                <PhoneNo>+45 65 65 65 65</PhoneNo>
                <email>oh@abcde.com</email>
        </Contact>
        <ProductionWell>
                <Name>NA-3</Name>
                <Period>
                        <Date>2009-06-01</Date>
                        <GasProductionVolume oum="Nm3">7712.14
                        </GasProductionVolume>
                        <GasProductionMass oum="kg">9217.57</GasProductionMass>
                        <LiftGas oum="Nm3">0</LiftGas>
                        <OilProduction oum="Sm3"></OilProduction>
                        <WaterProduction oum="Sm3">1107.7</WaterProduction>
                        <WellHeadPressure oum="kPa">2114</WellHeadPressure>
                        <WellHeadTemperature oum="degC"></WellHeadTemperature>
                        <BottomHolePressure oum="kPa">15150</BottomHolePressure>
                        <BottomHoleTemperature oum="degC"></BottomHoleTemperature>
                        <UpTime>24</UpTime>
                </Period>
                <Period>
                        <Date>2009-06-02</Date>
                        <GasProductionVolume oum="Nm3">6730.96
                        </GasProductionVolume>
                        <GasProductionMass oum="kg">8044.85</GasProductionMass>
                        <LiftGas oum="Nm3">0</LiftGas>
                        <OilProduction oum="Sm3"></OilProduction>
                        <WaterProduction oum="Sm3">1226.29</WaterProduction>
                        <WellHeadPressure oum="kPa">2170</WellHeadPressure>
                        <WellHeadTemperature oum="degC"></WellHeadTemperature>
                        <BottomHolePressure oum="kPa">15150</BottomHolePressure>
                        <BottomHoleTemperature oum="degC"></BottomHoleTemperature>
                        <UpTime>24</UpTime>
                </Period>
                <Period>
                        <Date>2009-06-03</Date>
                        <GasProductionVolume oum="Nm3">6626.29
                        </GasProductionVolume>
Osv…
```

Successes

- Geological Survey of Denmark and Greenland (GEUS)
  - More free download of data available from GEUS' web shop Frisbee



https://frisbee.geus.dk

Successes

- Download of Well Data Summary Sheets .csv files – all released Danish wells

WELL DATA (DEEP WELLS) - DANISH

(Show Greenland Wells)

Well index

Download | Show on map

Sector	Location	Well	Additional segments
Danish	Offshore	A-1X	
Danish	Offshore	A-2X	
Danish	Offshore	A-10P	A-10, A-10A, A-10B, A-10C
Danish	Offshore	ADDA-1	
Danish	Offshore	ADDA-2	
Danish	Offshore	ADDA-3	
Danish	Offshore	ADDA-4	ADDA-4A, ADDA-4I
Danish	Offshore	ALMA-1X	
Danish	Offshore	ALMA-2X	
Danish	Offshore	AMALIE-1	AMALIE-1A
Danish	Offshore	ANNE-3	ANNE-3A
Danish	Offshore	AUGUSTA-1	AUGUSTA-1A

- casing.csv
- chronostratigraphy.csv
- cores.csv
- cuttings.csv
- digital logs.csv
- lithostratigraphy.csv
- reports.csv
- scanned logs.csv
- sidewall cores.csv
- technical and administrative data.csv
- well tests.csv

WELL DATA SUMMARY SHEETS

ADDA-1

Contents

- Technical and Administrative Data
- Casing
- Lithostratigraphy (Groups)
- Chronostratigraphy (Periods)
- Lithologic column
- Samples
  - Cores
  - Cuttings
  - Sidewall Cores
- Logs
  - Scanned
  - Digital
- Well Tests
- Well Reports
- Scanned Core Photos

Technical and administrative data

Location	Offshore
Longitude	04°52'09,4 " E
Latitude	55°48'36,5 " N
UTM Zone	31
UTM Easting (x)	617,151.8 (m)
UTM Northing (y)	6,186,666.0 (m)
Well block no.	5504/8-1

Successes

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- Standardised formation tops for all Danish exploration wells
  Free download

Lower Cretaceous (Cromer Knoll Group):
Ltihostratigraphic units follow the nomenclature of Jensen *et al.* (1986):
Jensen, T.F., Holm, L, Frandsen, N. & Michelsen, O. 1986: Jurassic – Lower Cretaceous lithostratigraphic nomenclature for the Danish Central Trough. Danmarks Geologiske Undersøgelse DGU Serie A **12,** 68 pp.

Jurassic:
Ltihostratigraphic units follow the nomenclature of Michelsen *et al*. (2003):
Michelsen, O., Nielsen, L.H., Johannessen, P.N., Andsbjerg, J. & Surlyk, F. 2003: Jurassic lithostratigraphy and stratigraphic development onshore and offshore Denmark. Geological Survey of Denmark and Greenland Bulletin **1**, 147–216.
The publication is available at:
http://www.eng.geus.dk/media/12561/nr1_p145-216.pdf

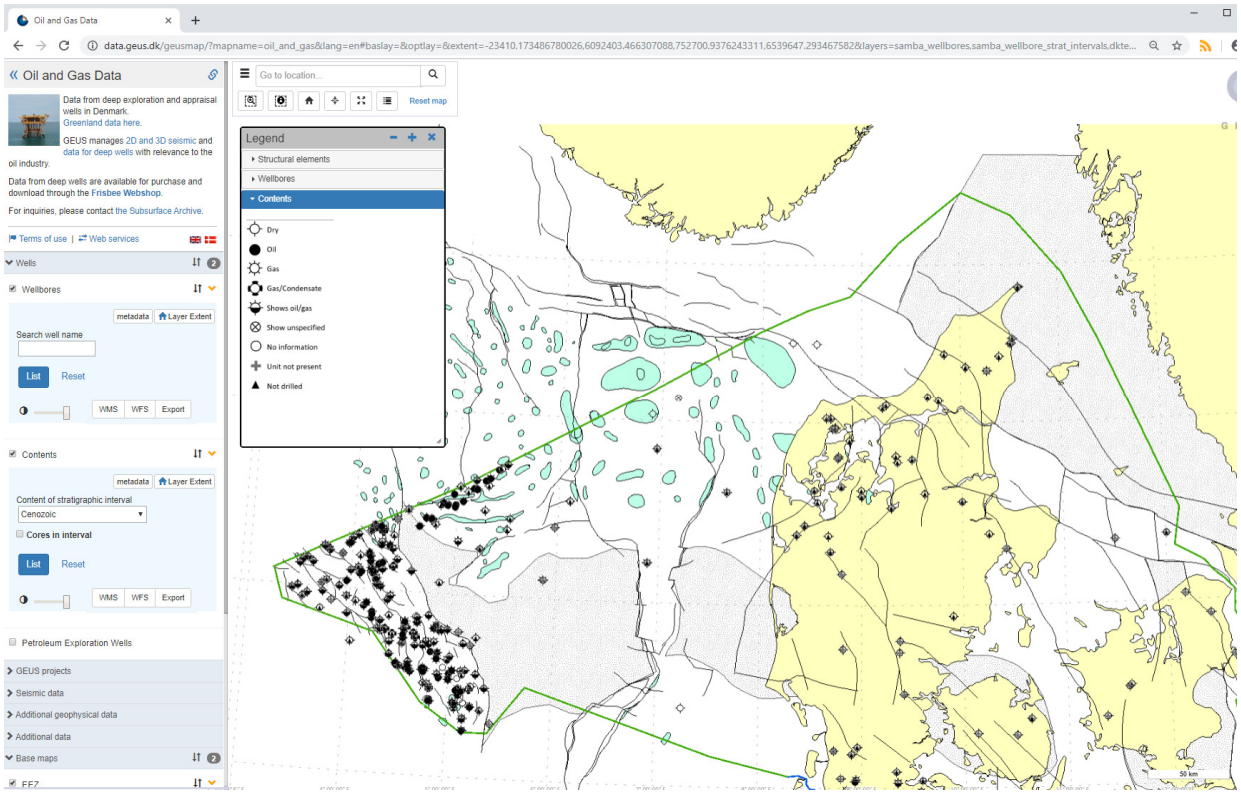
Triassic:
The Danish lithostratigraphy at formation and member level follows the schemes of Michelsen & Clausen (2002, Fig. 4), except in the onshore wells where the Vinding and Oddesund Formations (their Keuper Formation) have previously been recognised. In a few wells, the lower part of the Fjerritslev Formation interfingers with the Gassum Formation (marked with superscript 3).
Michelsen, O. & Clausen, O.R. 2002: Detailed stratigraphic subdivision and regional correlation of the southern Danish Triassic succession. Marine and Petroleum Geology **19,** 563–587 (REF_2 in DK_Formations_tops table).

Permian:
The lithostratigraphy at group and formation level follows the schemes shown in Glennie *et al.* (2003, Fig. 8.1):
Glennie, K., Higham, J. & Stemmerik, L. 2003: Permian. In: Evans, D. *et al.* (eds) The Millennium Atlas: petroleum geology of the central and northern North Sea, 91–103. London: The Geological Society of London.
Well tops from Stemmerik *et al.* (2000) have been included in the DK_Formation_tops table (REF_1).
Stemmerik, L., Ineson, J.R. & Mitchell, J.G. 2000: Stratigraphy of the Rotliegend Group in the Danish part of the Northern Permian Basin, North Sea. Journal of the Geological Society, London **157**, 1127–1136.

SEGMENT_NAME	LITHO_NAME	TOP_DEPTH_M	TOP_SOURCE	BOTTOM_DEPTH_M	BOTTOM_SOURCE
A-2X	Farsund Formation	2251,0	GEUS	2472,4	GEUS
A-2X	Lola Formation	2472,4	GEUS	3022,1	GEUS
A-2X	Middle Graben Formation	3022,1	GEUS	3038,7	GEUS
A-2X	Bryne Formation	3038,7	GEUS	3064,0	GEUS
A-2X	**Triassic units**	3064,0	GEUS	3396,1	GEUS
ADDA-1	**Nordland Group**	72,2	GEUS	1208,0	GEUS
ADDA-1	**Quaternary deposits**	72,2	GEUS	481,6	GEUS
ADDA-1	**Hordaland Group**	1208,0	GEUS	2067,0	GEUS
ADDA-1	Lark Formation	1208,3	GEUS	1910,0	GEUS
ADDA-1	Horda Formation	1910,0	GEUS	2067,0	GEUS
ADDA-1	**Rogaland Group**	2067,0	GEUS	2091,1	GEUS
ADDA-1	Balder Formation	2067,0	GEUS	2065,0	GEUS
ADDA-1	Sele Formation	2065,0	GEUS	2077,0	GEUS
ADDA-1	Lista Formation	2077,0	GEUS	2085,0	GEUS
ADDA-1	Våle Formation	2085,0	GEUS	2091,1	GEUS
ADDA-1	**Chalk Group**	2091,1	GEUS	2289,2	GEUS
ADDA-1	Ekofisk Formation	2091,1	GEUS	2143,4	GEUS
ADDA-1	Tor Formation	2143,4	GEUS	2148,7	GEUS
ADDA-1	Hod Formation	2148,7	GEUS	2236,6	GEUS
ADDA-1	Herring Formation	2236,6	GEUS	2260,9	GEUS
ADDA-1	Hidra Formation	2260,9	GEUS	2289,2	GEUS
ADDA-1	**Cromer Knoll Group**	2289,2	GEUS	2556,4	GEUS
ADDA-1	Rødby Formation	2289,2	GEUS	2294,6	GEUS
ADDA-1	Sola Formation	2294,6	GEUS	2327,1	GEUS
ADDA-1	Tuxen Formation	2327,1	GEUS	2346,6	GEUS
ADDA-1	Valhall Formation	2346,6	GEUS	2556,4	GEUS
ADDA-1	Leek Member	2531,8	GEUS	2556,4	GEUS
ADDA-1	**Central Graben Group**	2556,4	GEUS	3049,5	GEUS
ADDA-1	Farsund Formation	2556,4	GEUS	3049,5	GEUS
ADDA-1	Bo Member	2584,8	GEUS	2653,6	GEUS

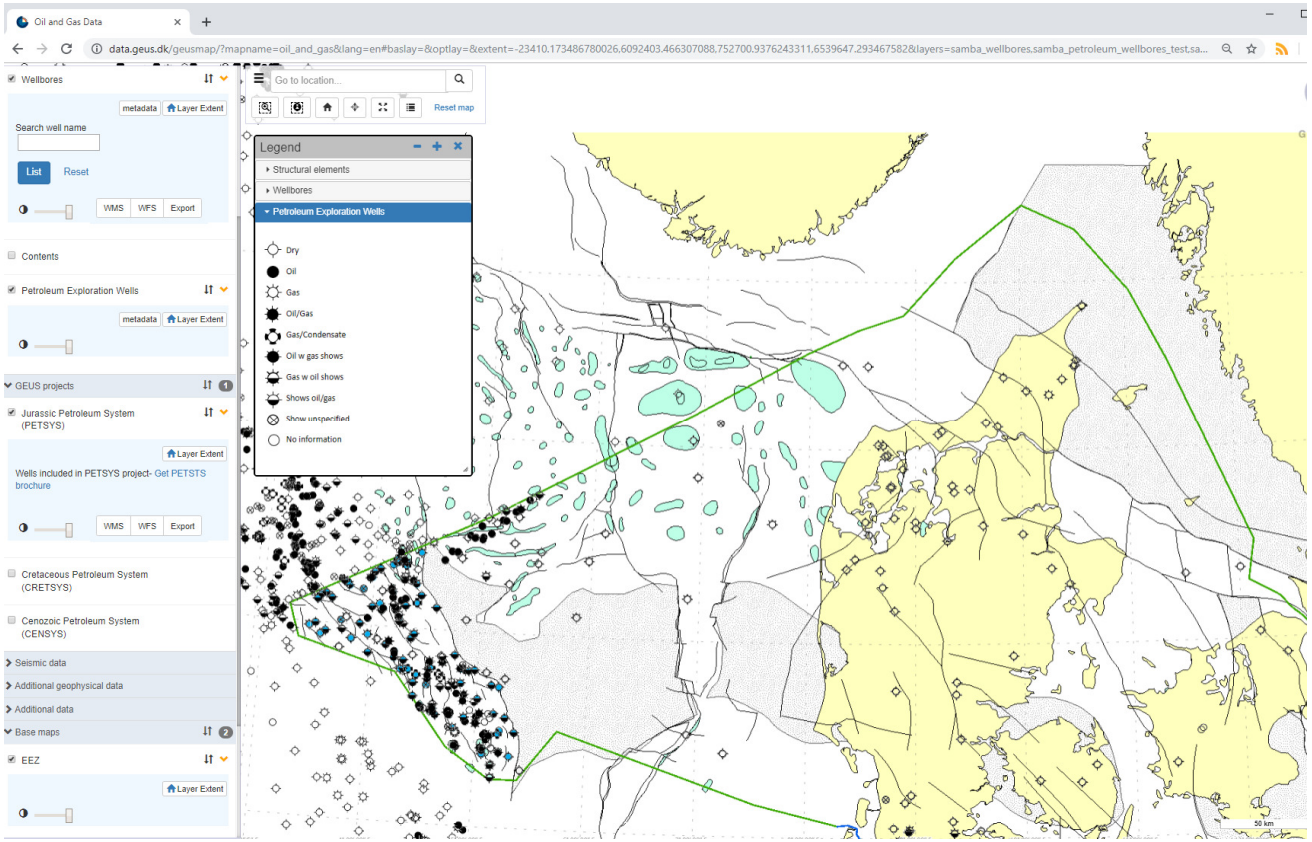
Successes

- Enhanced
  Oil & Gas Data Portal with extended search facilites.
- Stratigraphic level in well
- Core availability in stratigraphic level



Successes

- Wells included in special study projects
- Other North Sea exploration wells



Future Plans

- GEUS Archive
  - Scanning of Seismic displays
  - QC of 2D seismic data to include data in Frisbee web shop
  - Scan and process all released Survey publications for free download
- Open access to all subsurface data provided government funds