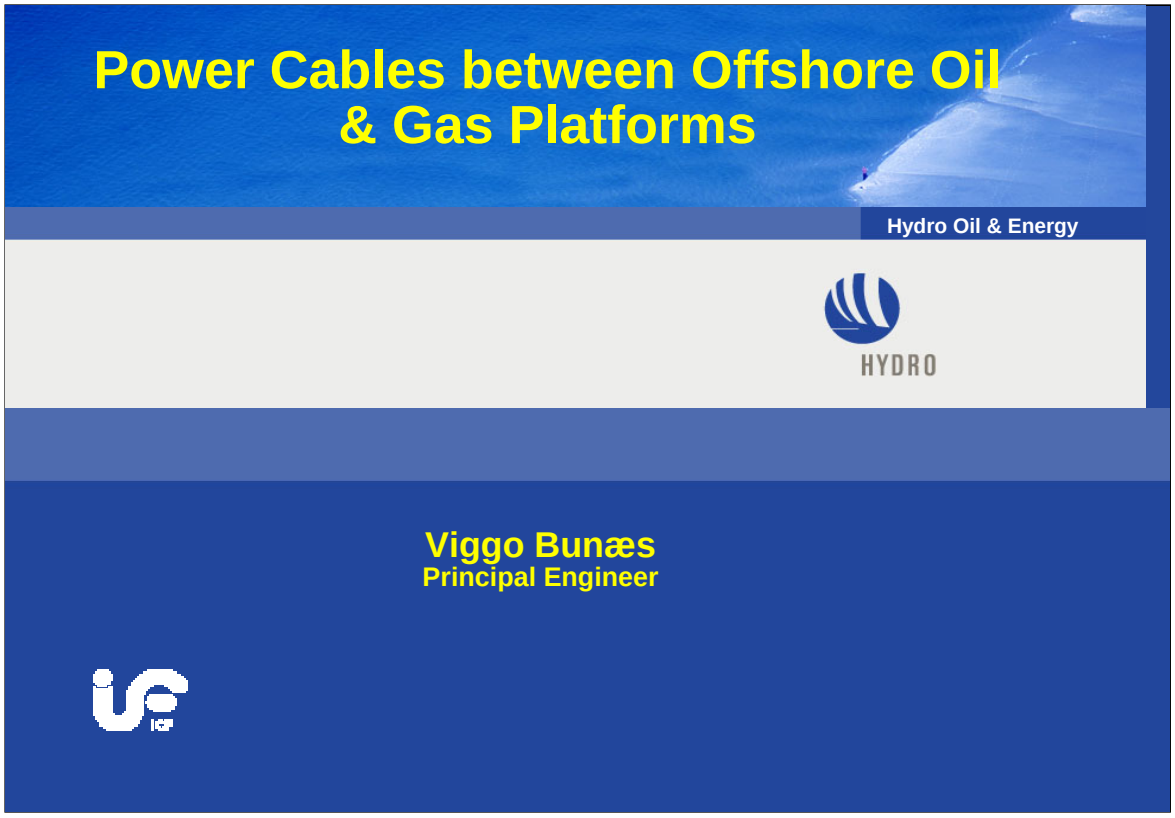


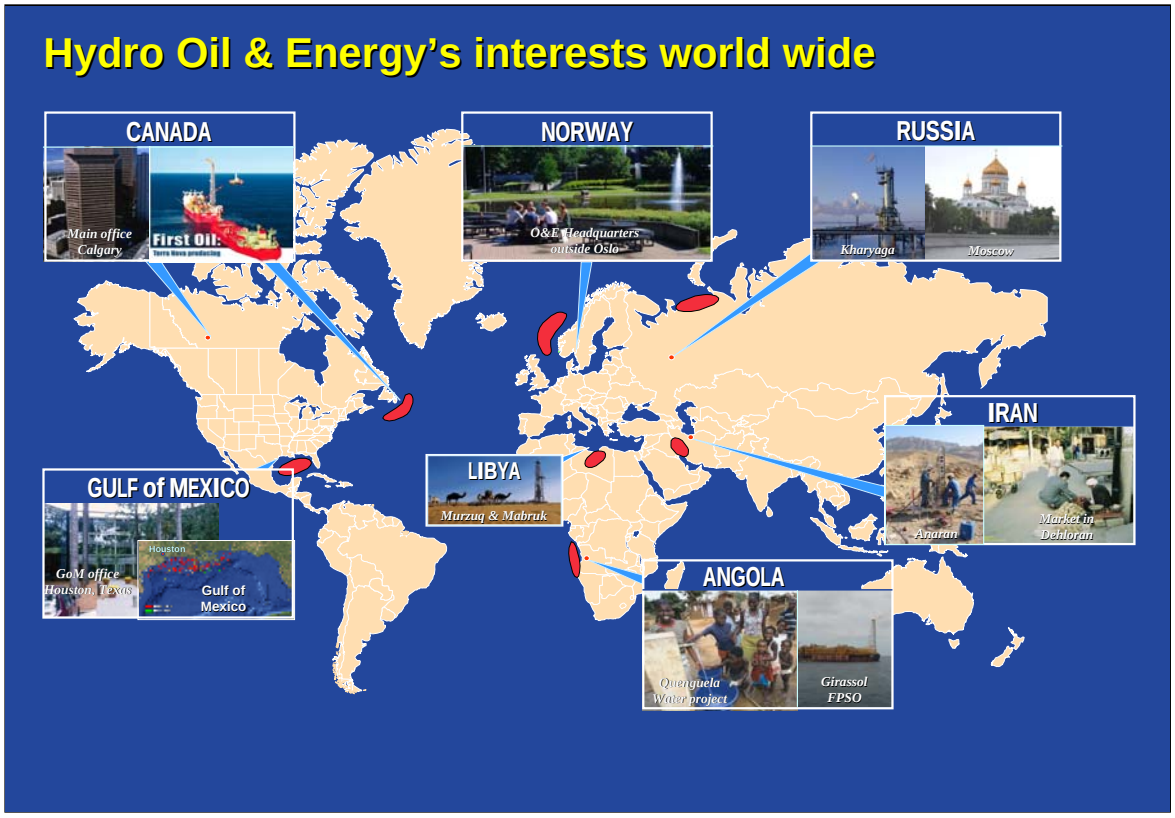
Good afternoon ladies and gentlemen.

First I like to give you some facts on my company Hydro Oil & Energy:

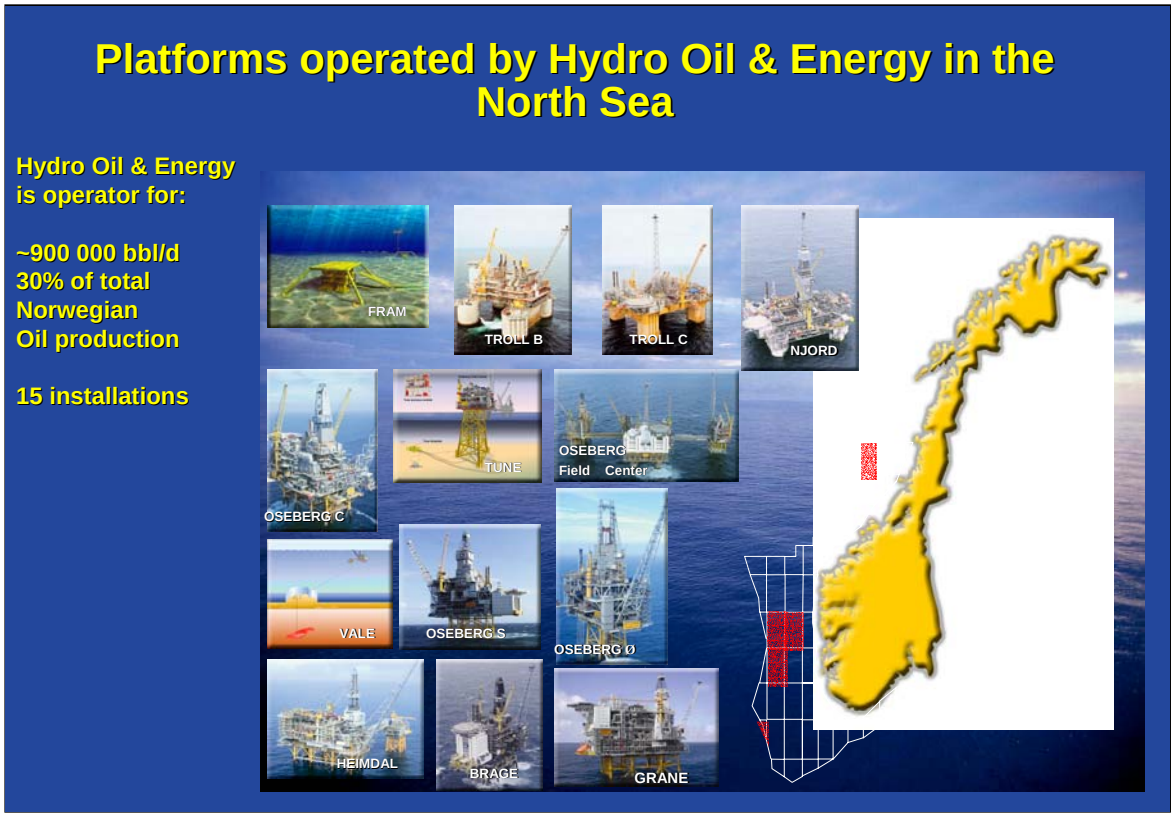
•One of the world's leading offshore oil companies
•Operator of 15 oil and gas installations
•Own production of oil in 2003 averaged 530,000 bbls of oil equiv. a day
•Oil production in Angola, Canada, Libya, Norway and Russia
•Interesting positions in Iran and the Gulf of Mexico

Hydro Oil & Energy has been the second largest producer of oil and gas in the Norwegian offshore sector since Norway's petroleum industry started in the 1970s.

We have steadily built up our experience and expertise to become one of today's leading offshore companies in the world. We also lead in the development of new technology and aspire to be the safest company operating and creating value in the Norwegian waters.



To day Hydro Oil & Energy has oil production in Angola, Canada, Libya, Russia and Norway as well as interesting positions in Iran and the Gulf of Mexico.



These are the main installations operated by Hydro Oil & Energy in the North Sea to day. Except for Heimdal Platform, all the other fields and platforms were developed and built by Hydro Oil & Energy.

Ownership in each platform (licence) could vary from platform to platform.

Oseberg Field Centre (Oseberg A, B and D) was the first Hydro operated oilfield. First oil was in December 1988.

Cables on an offshore platform

Typical quantity of cables on a medium sized offshore platform could be:

Fire resistant / Flame retardant :

Medium volt.	**95 – 300 mm²**	**: 2700 m**
Low volt.	**2,5 – 150 mm²**	**: 85000 m**
Instrument/Telecom		**: 95000 m**

Today offshore platforms only use power cables made with Cu-conductors Challenge to cablemakers?

Medium voltage means 5,5 – 11 – 13,8 kV

Weight is an important factor on offshore oil platforms. My personal opinion is that aluminium conductors are applicable to offshore platforms as well as to all other industrial plants and other similar onshore installations.

There are some offshore power supply and environmental aspects to be taken into account.

Hydro Oil & Energy continuously aim for better environment and less emission.

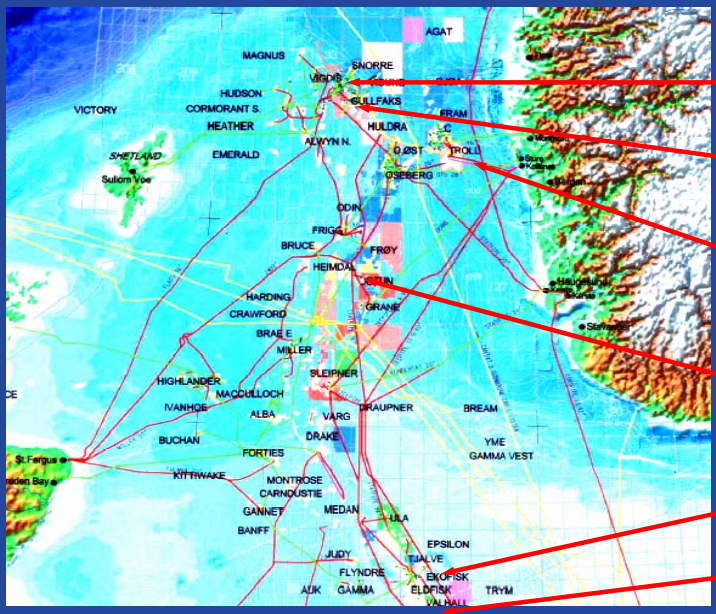
In the following I will concentrate on offshore power generating, supply and consumption on oil & gas platforms.

The main power supply sources on offshore oil & gas platforms today are turbine generator sets on each platform.

Cables between platforms have been considered, but so far only a few installations have been carried out.

Since the first Hydro Oil & Energy's offshore installation, Oseberg Field Centre, we have been working with studies and models for cables and grid connections between platforms in the North Sea. The most suitable platform for this today is Grane – Heimdal.

North Sea map – Main oil & gas installations
Selected cables



Snorre cable
L= 12km

Gullfaks cables
L= 7km
L= 4km

Troll A cables
2xDC L= 65km

Heimdal cable
L= 47km
(not yet installed)

Ekofisk cable
L= 3,3km

Valhall cable
2x L= 7km

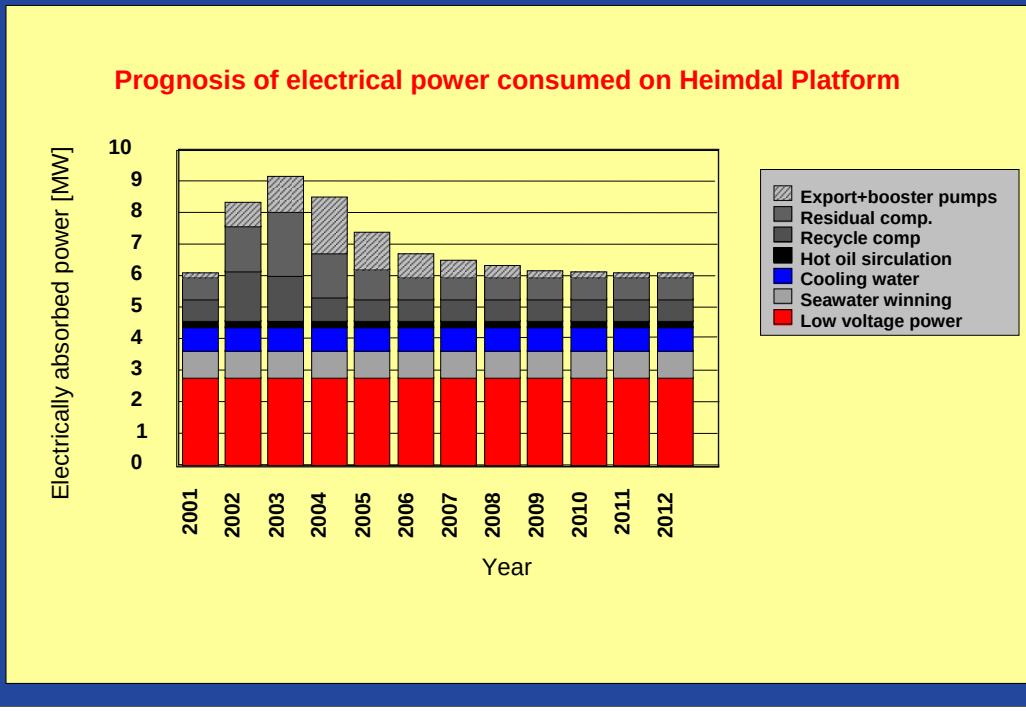
I tried to list all the power cables I could find between platforms as well as shore and platforms in the North Sea. Here they are:

CABLE	LENGTH	CROSS-SECTION	VOLTAGE LEVEL
Snorre A – Snorre B	12 km	3 x 240 mm²	36/33 kV
Gullfaks A – Gullfaks C	7 km	3 x 185 mm²	45/ 36 kV
Gullfaks A – Gullfaks D	4 km	3 x 300 mm²	13,8 kV
Troll from shore	65 km	2 x 300 mm²	47 kV
		HVDC light	
Grane – Heimdal (prelim)	47 km	3 x 185 mm²	36/32 kV
Ekofisk internal	3,3 km		
Valhall internal	2 x 7 km		

Heimdal Platform in the North Sea

With regards to power supply upgrades Hydro Oil & Energy has fair-sized challenges on Heimdal Platform in the North Sea. Just in these days we are working with a project having the goal to improve the environmental situation on Heimdal Platform.

Power consumption example



Power consumption on offshore platforms can vary from 6-7 MW to 40-50 MW dependent on size and type of the platform .

This is a typical power consumption on a platform of Heimdal size. Base load low voltage power (red colour) covers for light, heating, kitchen, heat tracing emergency systems (battery converters) and most small consumers below 3 kW.

In addition we have emergency generators and battery power (UPS) for critical situations, when main power fails.

Why do we upgrade Power Supply systems ?

In the Heimdal case, reduction of emission is the main objective for evaluation of new power supply.

Today Heimdal has enough power from old generators, but with very low efficiency in proportion to pollution

New power supply on Heimdal will only be environmental investments - and no other profit than reduced "green" taxes…..

Other objectives making power supply evaluation interesting on "old" platforms could be :

- **Increase/decrease of power demand on the platform**
- **Low utilization factor of generator capacity**
- **Change of operating conditions and equipment start-up**
- **Security of supply – back-up need**
- **Reduce maintenance cost**

In order to achieve these objectives, Hydro Oil & Energy has to

- follow-up research and development of new technique with regards to more effective and "clean" turbine generators.

- evaluate alternative solutions to reduce emission, such as:

•"Combined cycle" generators (waste heat recovery)

•Power supply from shore grids

•Power system operation between several platforms

•Power import from neighbouring platforms.

The main challenges on rebuilding / upgrading of existing oil and gas platforms are:

Environmental challenges

Technical challenges

Business challenges

Maritime challenges.

Environmental challenges on Heimdal

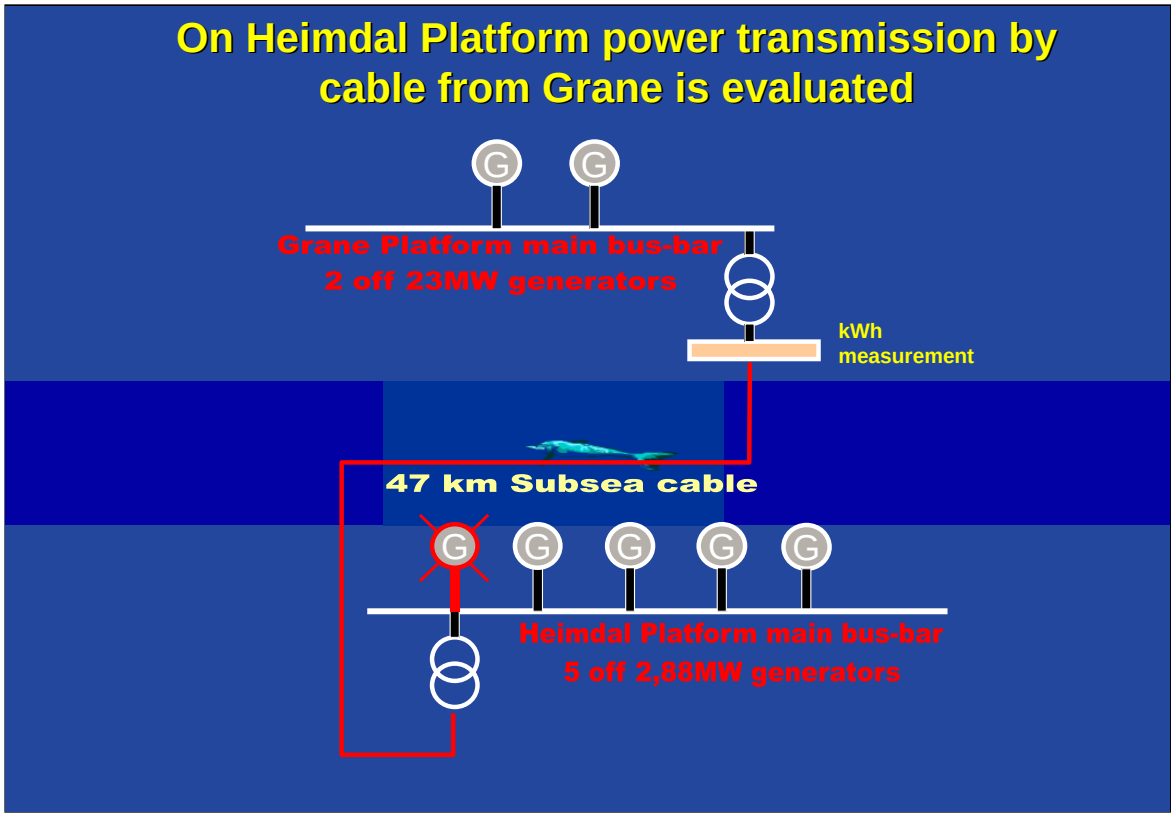
An important environmental challenge for Hydro Oil & Energy today is reducing emission from Heimdal Platform.

Heimdal was first put into operation by Elf in 1985. In 1998 Hydro Oil & energy took over operator liability with the purpose to develop the platform to be a new gas centre in the North Sea.

5 off ”dual fuel” 2,88 MW turbine generators have run continuous since then. Power efficiency now is as low as 12 - 13%. New turbine generators to day operate with more than 40%. For ”Combined cycle” machines often above 50% !!!

Studies have been made for the last 4 – 5 years to make better conditions on the platform.

A cable connections with neighbouring platforms could be a solution – and in the following I will concentrate on this…….



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A few years ago on Oseberg A we installed a new steam driven generator to utilize wasted heat from three conventional built dual fuel generators.

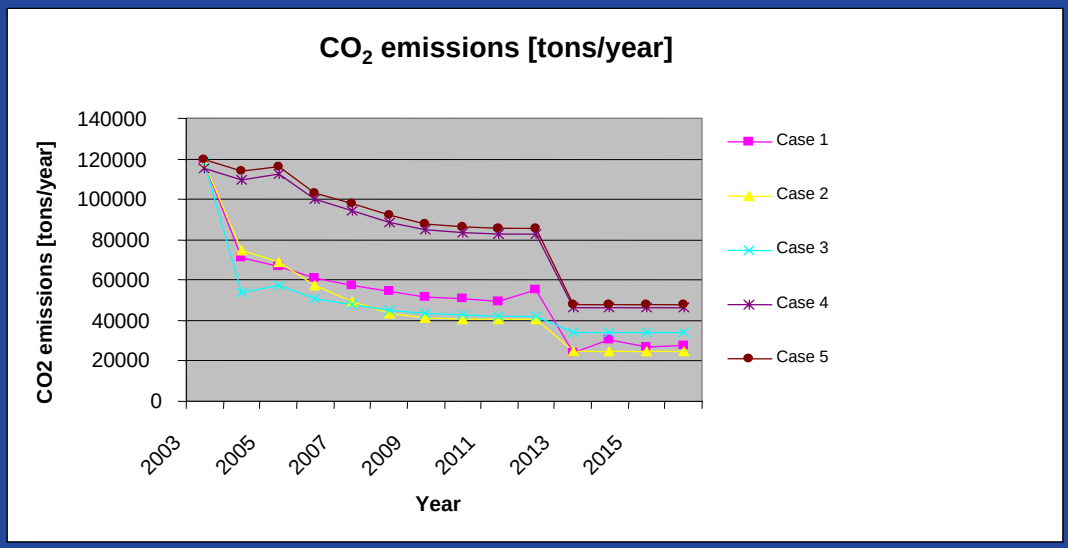
What you see here is our project groups proposal on an environmental cleaning up around Heimdal. Very soon our licence partners on Heimdal are expected to give their point of view on this figure!

Environmental challeges CO_2

Emission CO_2

Example: Illustration with different power supply sources.

Upper curve old generators

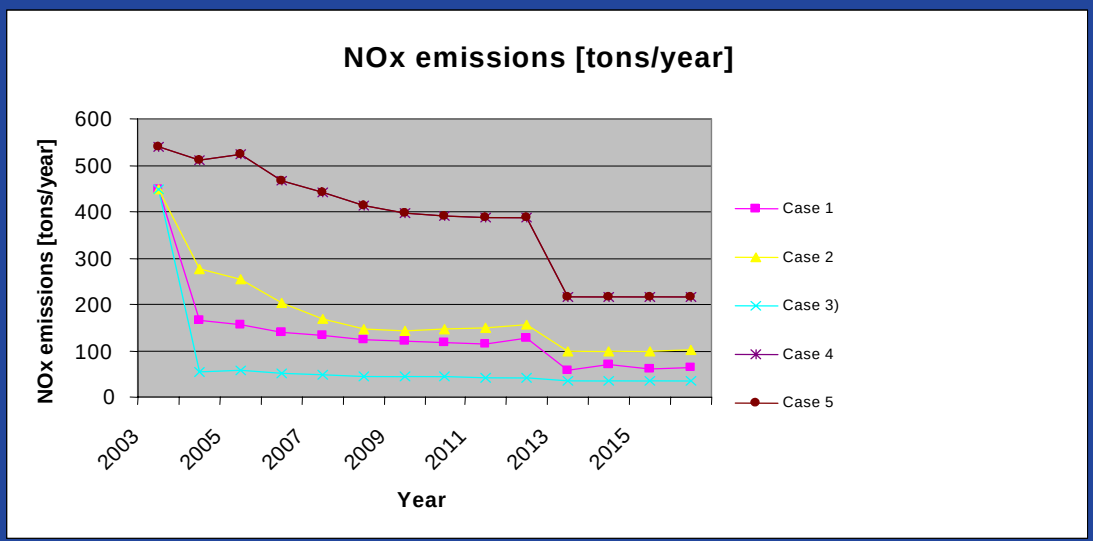


Environmental challeges NO_X

Emission No_x

Example: Illustration with different supply sources.

Upper curve old generators



Technical challenges

- Distance between platforms
  - AC is limited by distance and voltage level
  - DC needs heavy equipment onboard (converters etc.)
- Weight : Structural strength, centre of gravity, balance
- Construction work without affecting production and operation
- One platform could be a floating vessel – the other fixed
  - Swivel transmission
  - Dynamic cable tie-in
- Coordinated grid and generator run
  - Relay coordination
  - Different control systems
  - Dynamics (cyclic variation)
  - Different frequencies (60 / 50 Hz)

Marine challenges

- Lay-out and pull-in of sub-sea cable
  - Manoeuvre of boat close to platform
  - Other sub-sea installations (templates, pipelines, other cables etc.
- Floor conditions / ocean depths
  - Hilly floor, mud, etc.
- Weather conditions for maritime operations
  - A few short and hectic weeks in summer
- Lay vessel available
  - Limited access
- Environmental regards
  - Protection zones
  - Fisheries

Business challenges

- **Different operating companies on the respective platforms**
  - Tie-ins from external wells with various ownership
- **Different engineering and databases out of date**
  - Numbering and code systems
  - Mechanical completion (MC) / Commissioning systems
- **Different :**
  - Construction yards
  - Assembling sites
  - Vendors
  - Building countries (standards/legal provisions etc.)
- **Documentation availability / reliability**
  - Old files / Missing files / Hidden files
  - Bad quality ”As built”

Cost and cost distribution in percentages

Equipment, including cables, and marine operations represent main cost

Approximately cost split on 47 km sub-sea cable between Heimdal and Grane :

Management	4%
Engineering	10%
Equipment (including cables)	35%
Bulk materials	3%
Onshore / Atshore Construction	2%
Offshore Installations	8%
Marine Operations	33%
Logistics	3%
Project Completion & Commissioning	2%

(NOTE ! Studies and other prequalification work not included)

Advantages and disadvantages when electric grids are connected between two or more platforms

ADVANTAGES :

- More effective utilization of generators and grid
- Less emission
- Less need for emergency power on each platform

DISADVANTAGES:

- Receiving platform can be a low priority consumer (1st shut-down when problems on supplying platform)
- Operational difficulties on one platform can be carried forward to other platforms
- Energy taxes and price policy can be difficult discussion topics
- Vulnerability with regards to power control systems

A "free" J-tube for pull-in of sub-sea cable is very welcome!

J-tube not in use

…. and finally …there could be other solutions, or …? Thank you!