



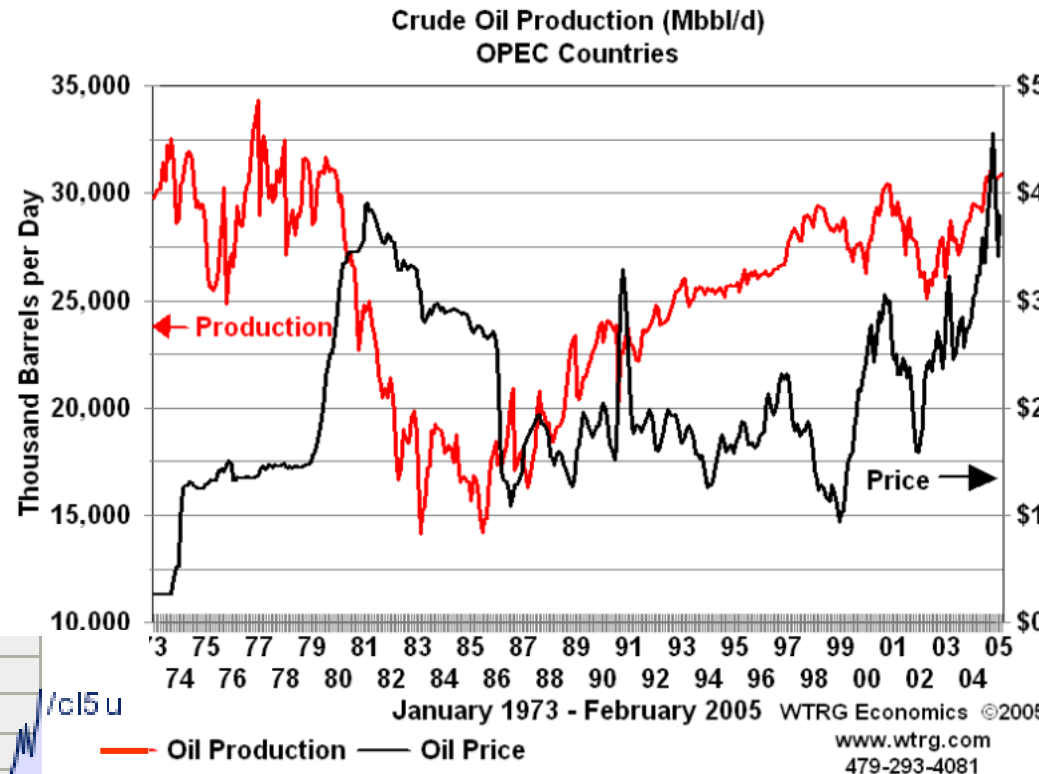
# **FFU seminar 2006**

## **Trender og muligheter for subsea teknologi internasjonalt**



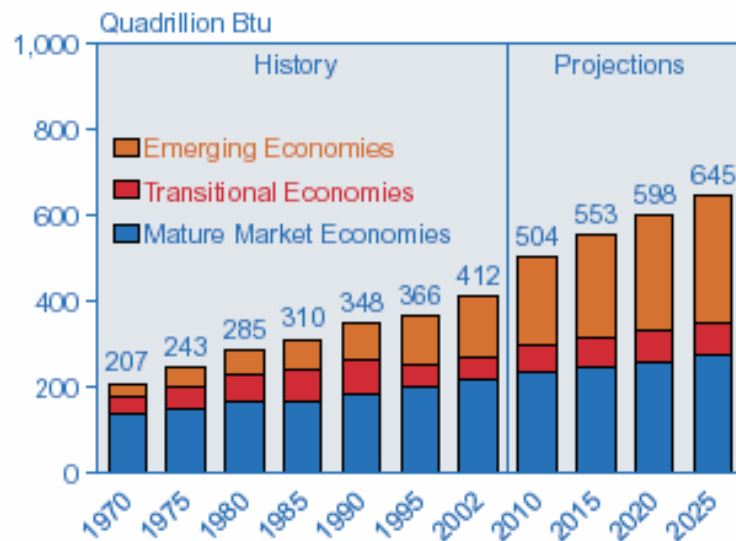
**Fredrik Witting**  
**Vetco Gray**

# Oil prices go up...



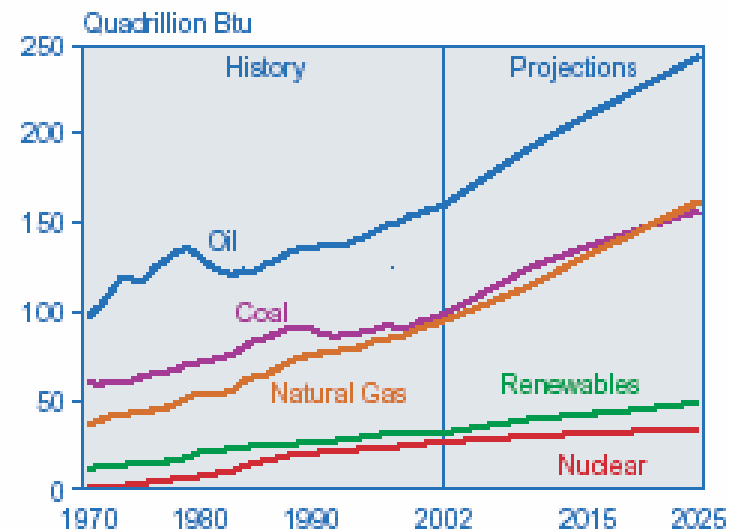
# ...and stay up..?

Figure 1. World Marketed Energy Consumption by Region, 1970-2025



Sources: History: Energy Information Administration (EIA), *International Energy Annual 2002*, DOE/EIA-0219(2002) (Washington, DC, March 2004), web site [www.eia.doe.gov/iea/](http://www.eia.doe.gov/iea/). Projections: EIA, *System for the Analysis of Global Energy Markets* (2005).

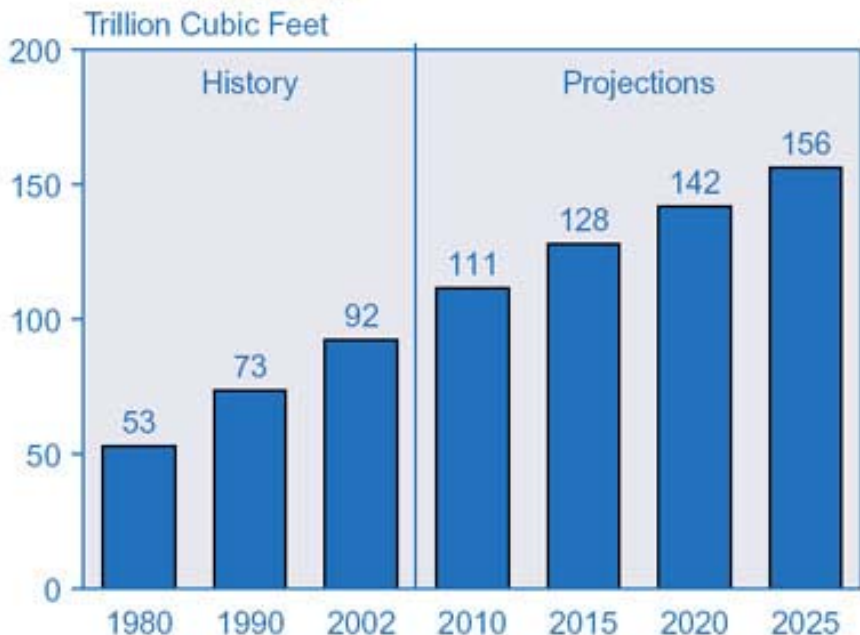
Figure 2. World Marketed Energy Use by Energy Type, 1970-2025



Sources: History: Energy Information Administration (EIA), *International Energy Annual 2002*, DOE/EIA-0219(2002) (Washington, DC, March 2004), web site [www.eia.doe.gov/iea/](http://www.eia.doe.gov/iea/). Projections: EIA, *System for the Analysis of Global Energy Markets* (2005).

# Gas demand is also growing...

Figure 34. World Natural Gas Consumption, 1980-2025

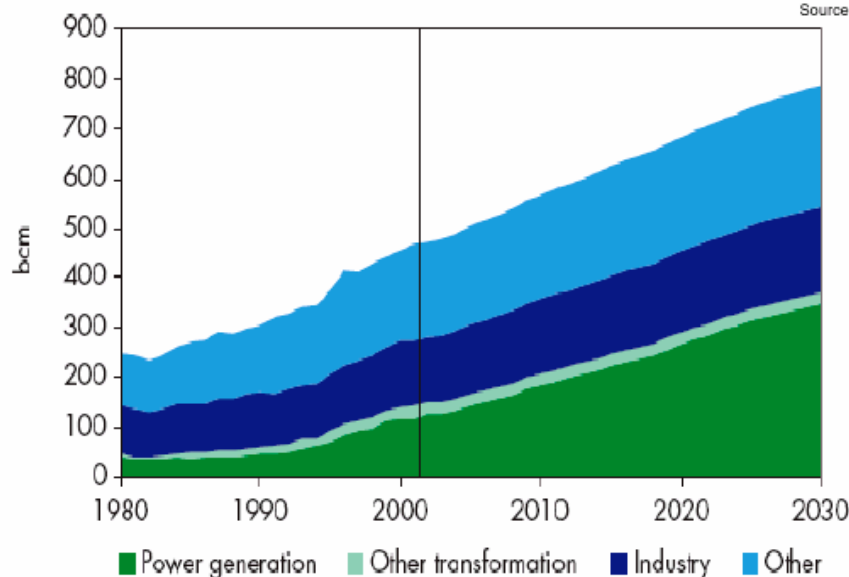


Sources: **History:** Energy Information Administration (EIA),

European\* Gas Demand Projections to 2030 (IEA)

\* Europe 2

Source: WE

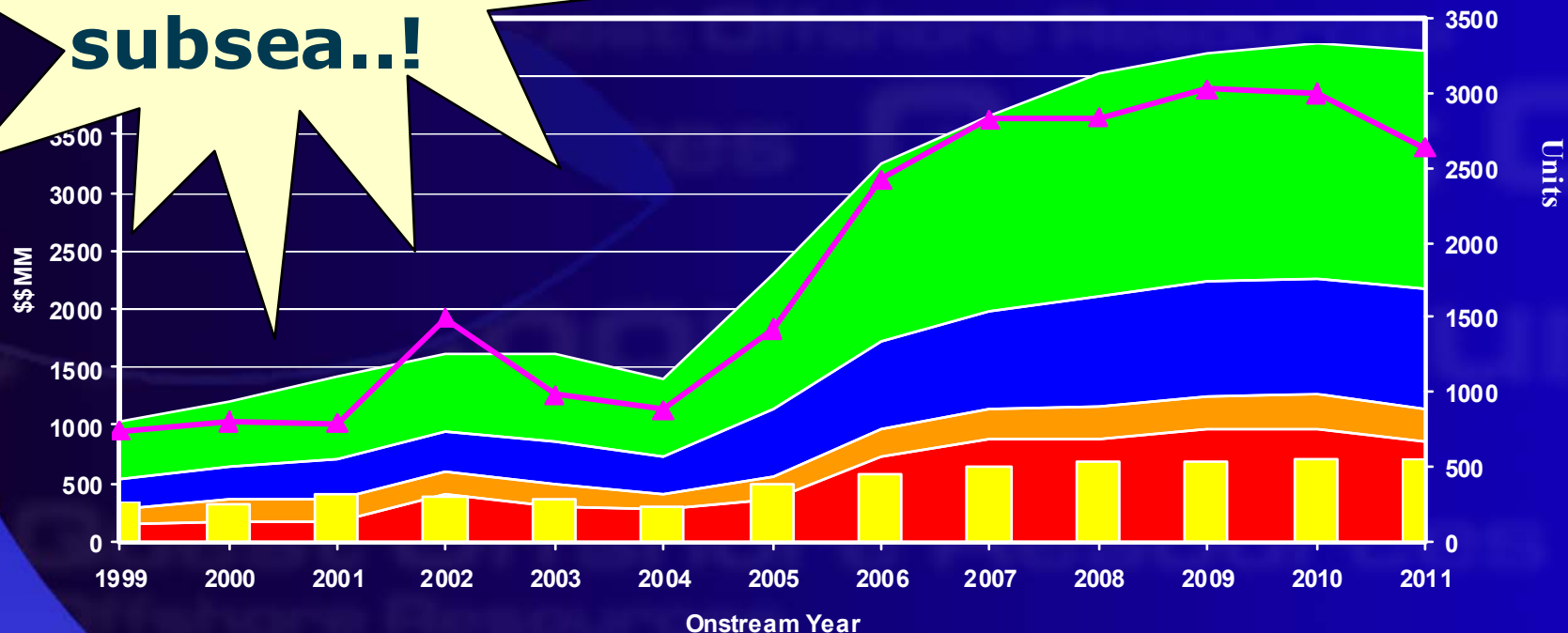


70% of incremental demand is for Power

# World Subsea Production Capex

*Forecast spending \$25.9bn*

**...and the  
growth is  
subsea..!**



subsea production umbilicals installed (\$MM)

subsea manifolds (\$MM)

tree control pkg (flying leads, jumper, MCS, HPU, UTA, J-Plate)(\$MM)

subsea trees & control pod: (chokes, sensor pkg.)(\$MM)

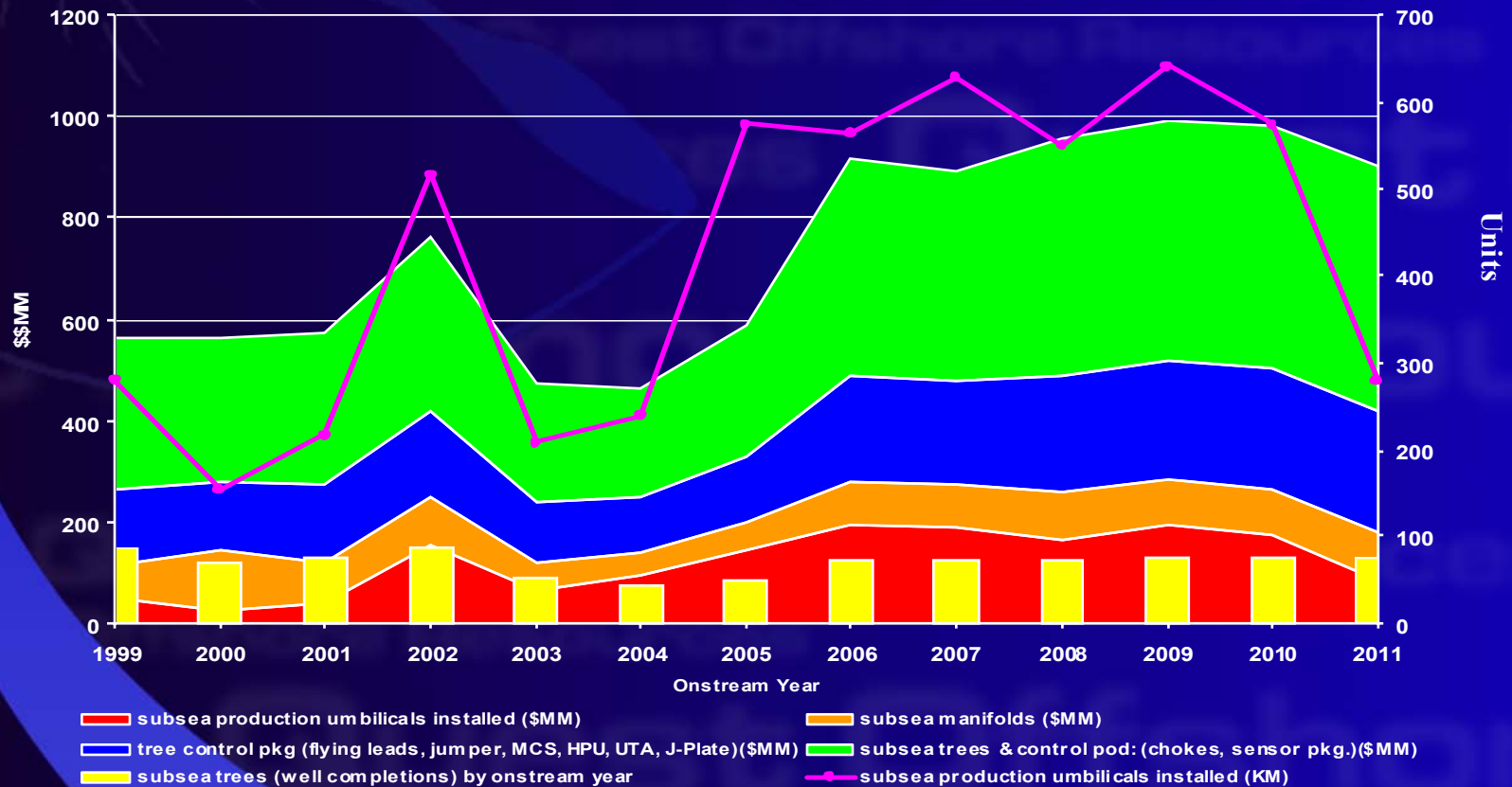
subsea trees (well completions) by onstream year

subsea production umbilicals installed (KM)

# North Sea

## Subsea Production Capex

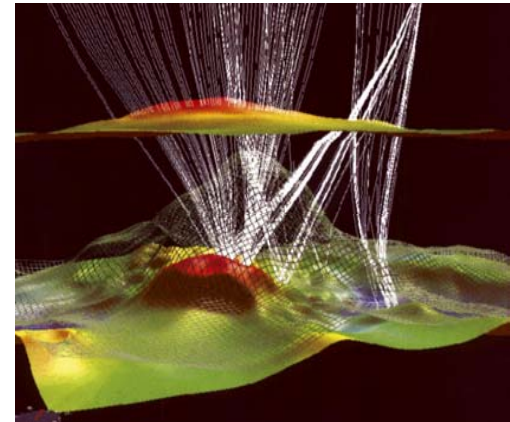
*Forecast spending \$6.2bn*



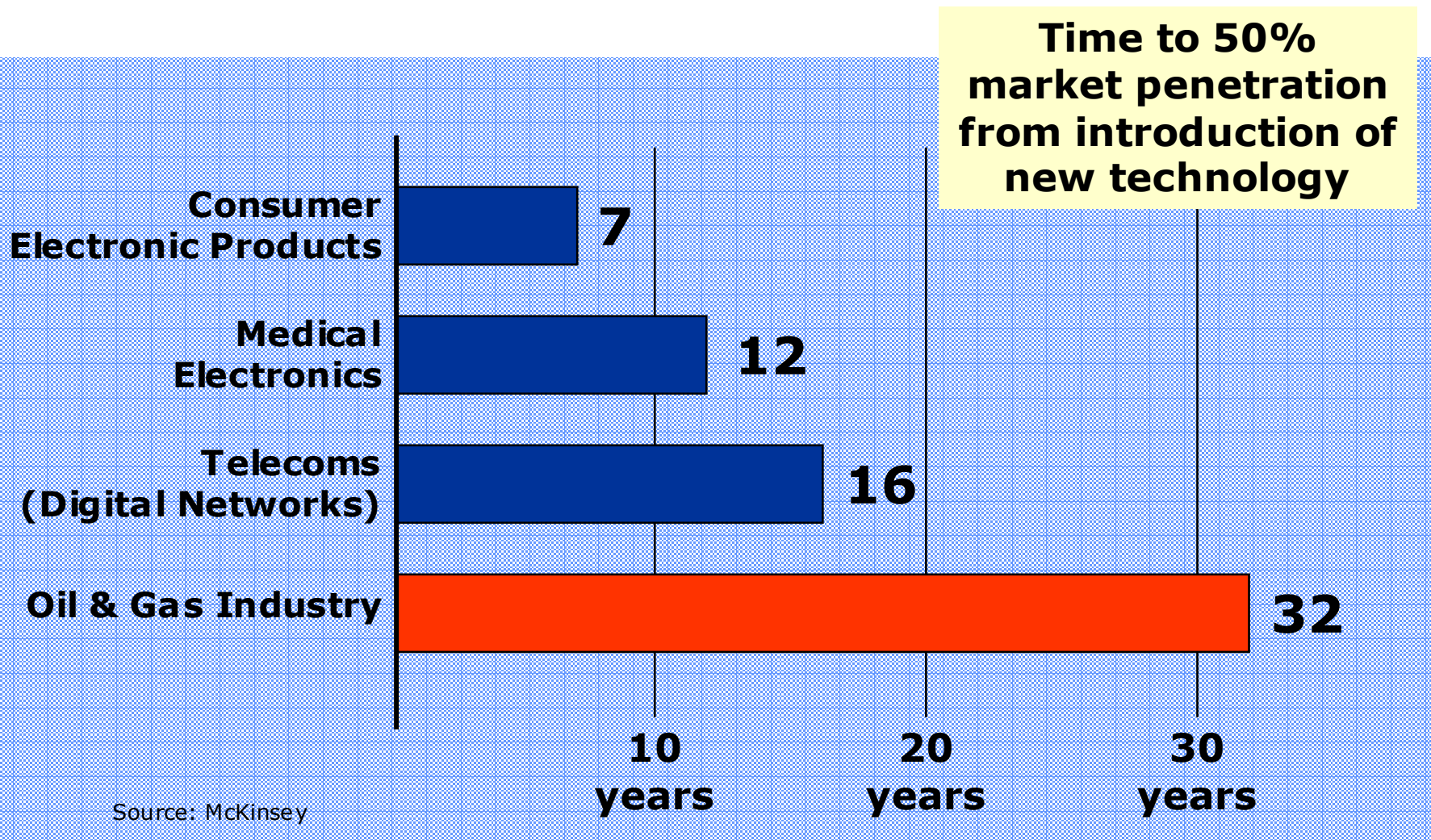


# ...but the easy pickings are gone..

- ✓ **Most 'easy' fields have already been developed**
- ✓ **Many new fields are located in harsher environments, remoter locations or deeper water, and/or are associated with production challenges, such as low temperatures (hydrate risk) or heavy oils**
- ✓ **Many mature fields have falling production, with increasing water cuts**
- ✓ **Record-high oil and gas prices create a rapidly increasing market demand for E&P development resources, far outpacing industry capacity**
- ✓ **To meet these challenges, new technology will be required on a massive scale...and high prices is a powerful incentive**



# Oil & Gas industry conservatism





# ..so where are the gaps and needs..?

## ✓ Deepwater:

- Thermal insulation systems
- Artificial lift systems (boosting, riser base separation..)
- Riser systems

## ✓ Remote locations (e.g. Arctic region):

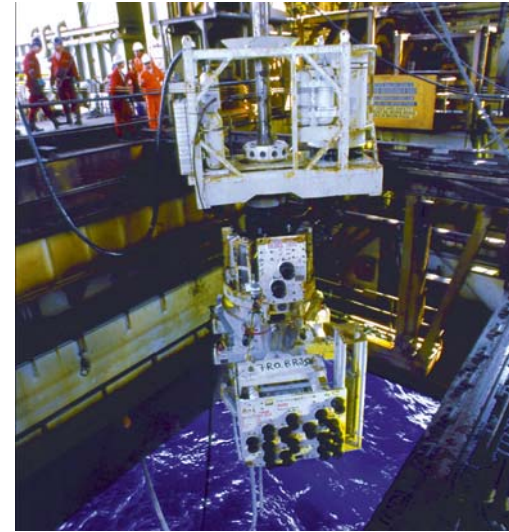
- Long step-out Subsea-To-Beach
- Subsea gas compression, power distribution
- Environment
- Ice and cold water

## ✓ Mature fields:

- Increased Oil Recovery
- Reservoir modelling, 4D seismic
- Well intervention
- Subsea boosting, separation, compression

## ✓ Rig shortage:

- Tree-On-Wire installation
- Surface BOP
- Light Well Intervention

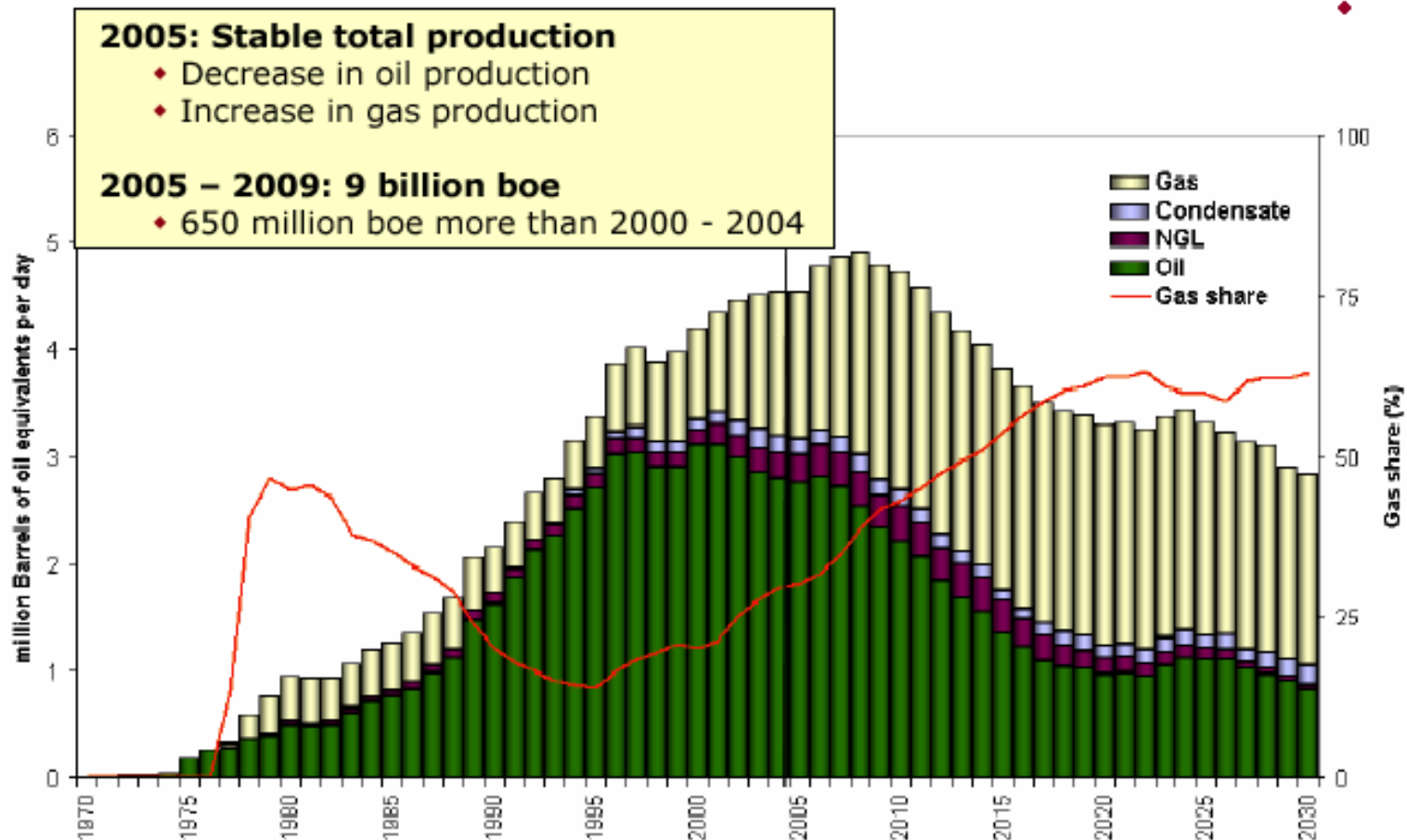


# The technology frontiers...

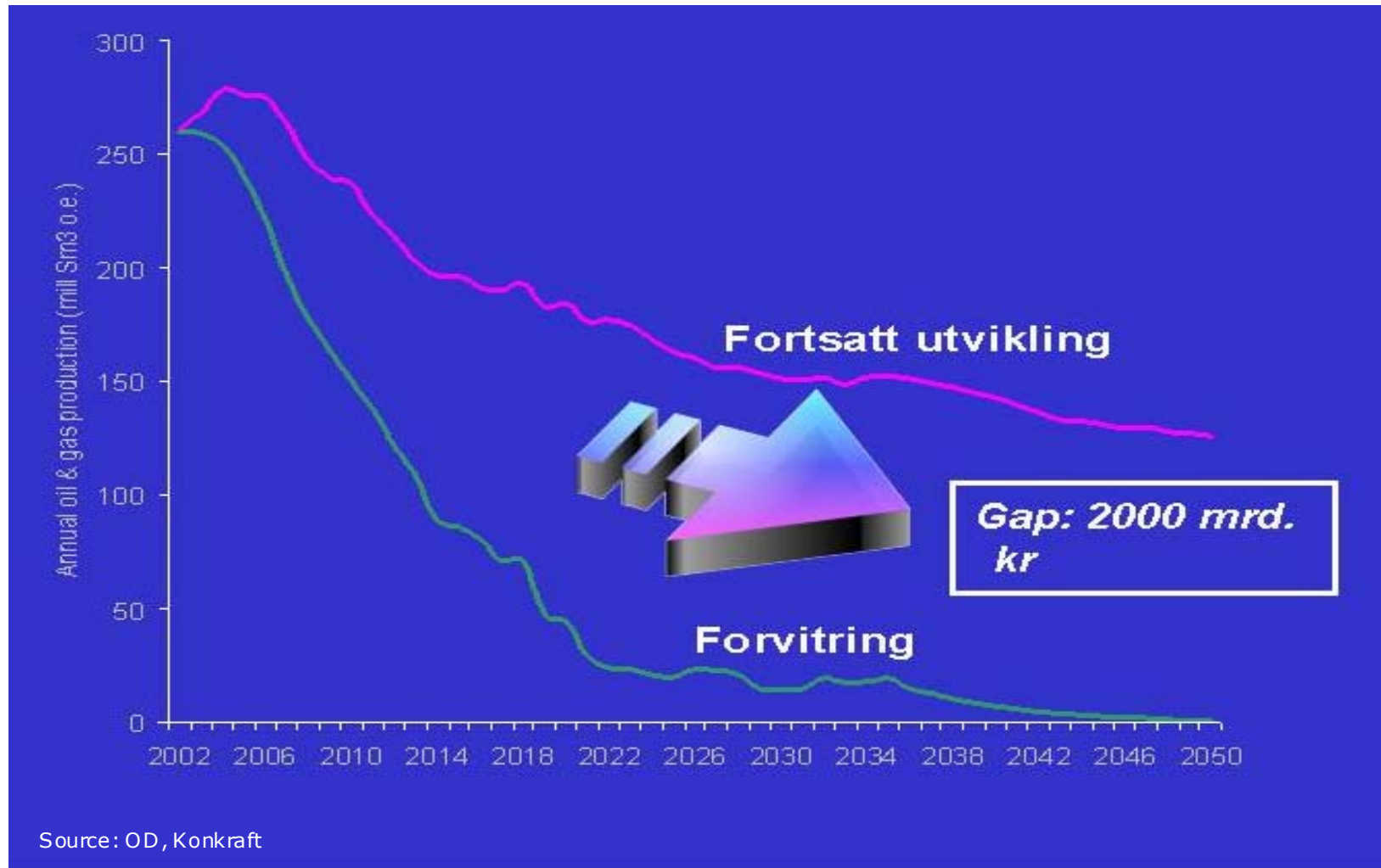


# Mature provinces shift from Oil to Gas

## Total Norwegian petroleum production 1970 - 2030



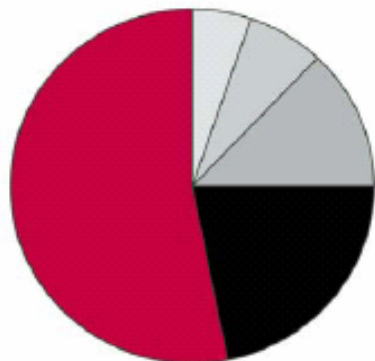
# New subsea technology will be vital...



# Intelligent Wells - Benefits

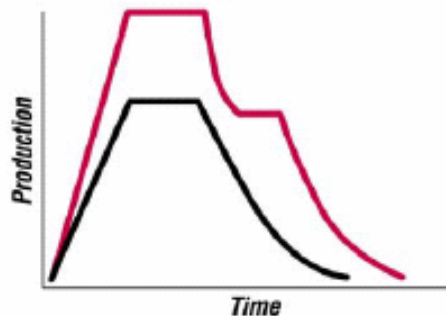
## Fact 1: Intelligent Wells Add Value

The Intelligent Well Value Hierarchy



- Increased Ultimate Recovery
- Reduced Surface Facilities
- Reduced Well Costs
- Accelerated Production
- Reduced Well Intervention Costs

Accelerate Production and Increase Recovery

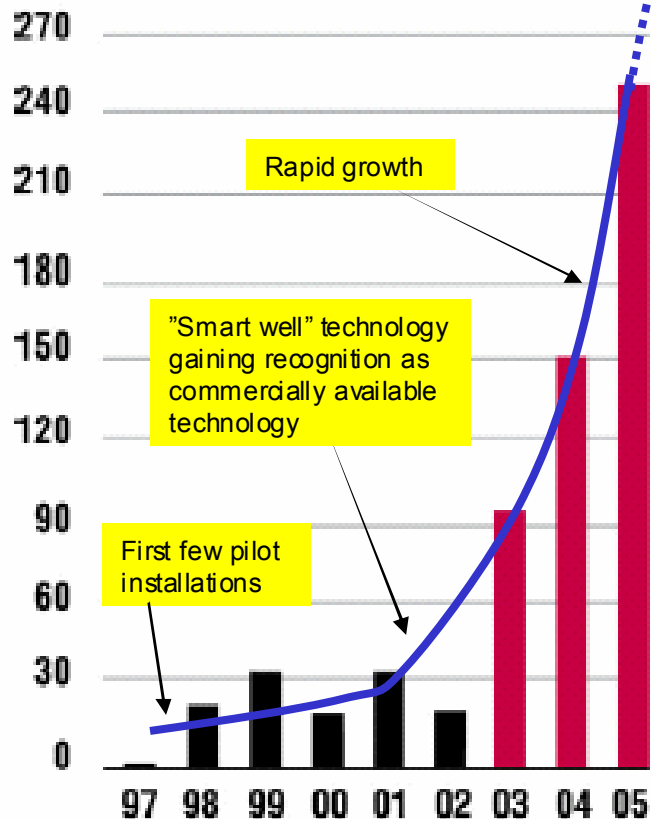


- Intelligent Completion
- Conventional Completion

**\$ 300 – 500 million of added annual value**  
**25 – 35 % improved well life cycle value**

# Exponential growth

Intelligent Well Installations

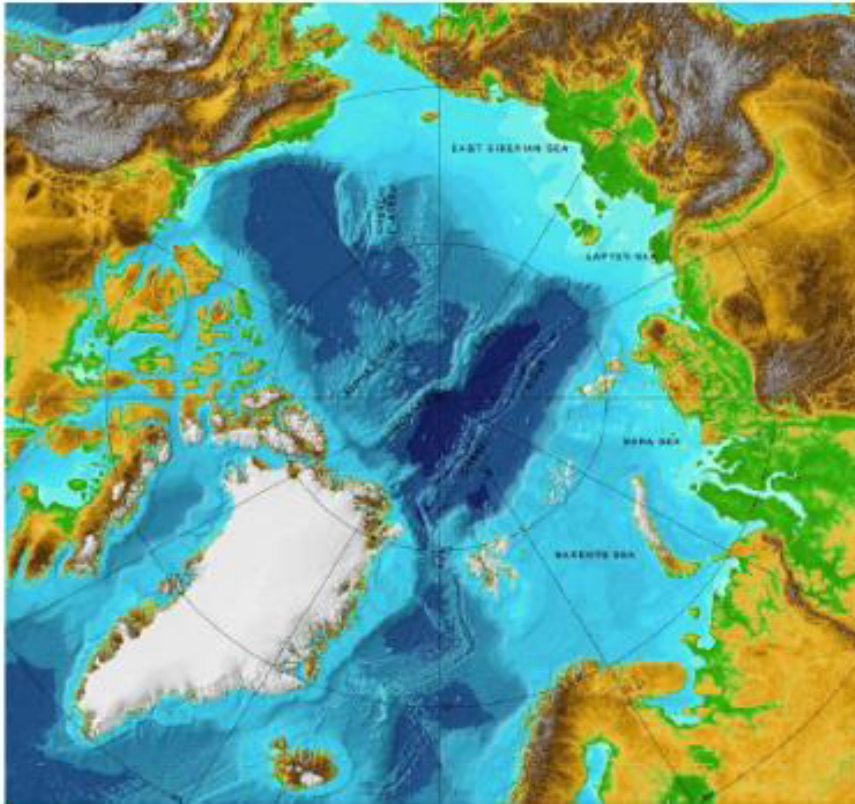


- ✓ Intelligent completion systems have been accepted as commercially available technology, at acceptable technical risk
- ✓ Rapid increase in number of installations – technology development followed closely by all major Operators
- ✓ Applications both for greenfield and brownfield developments
- ✓ Trend is that Operators specify intelligent features up front, or at least specify preparedness for future retrofit of new Intelligent Well technology
- ✓ Level of “Intelligence” to increase in new projects – features such as IWIS compatibility, MWR etc. are quickly becoming standard industry requirements

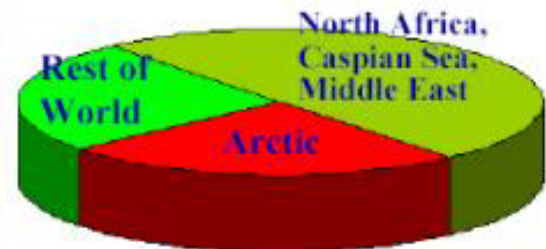


# Long Step-Out Subsea-to-Beach

## The Arctic potential



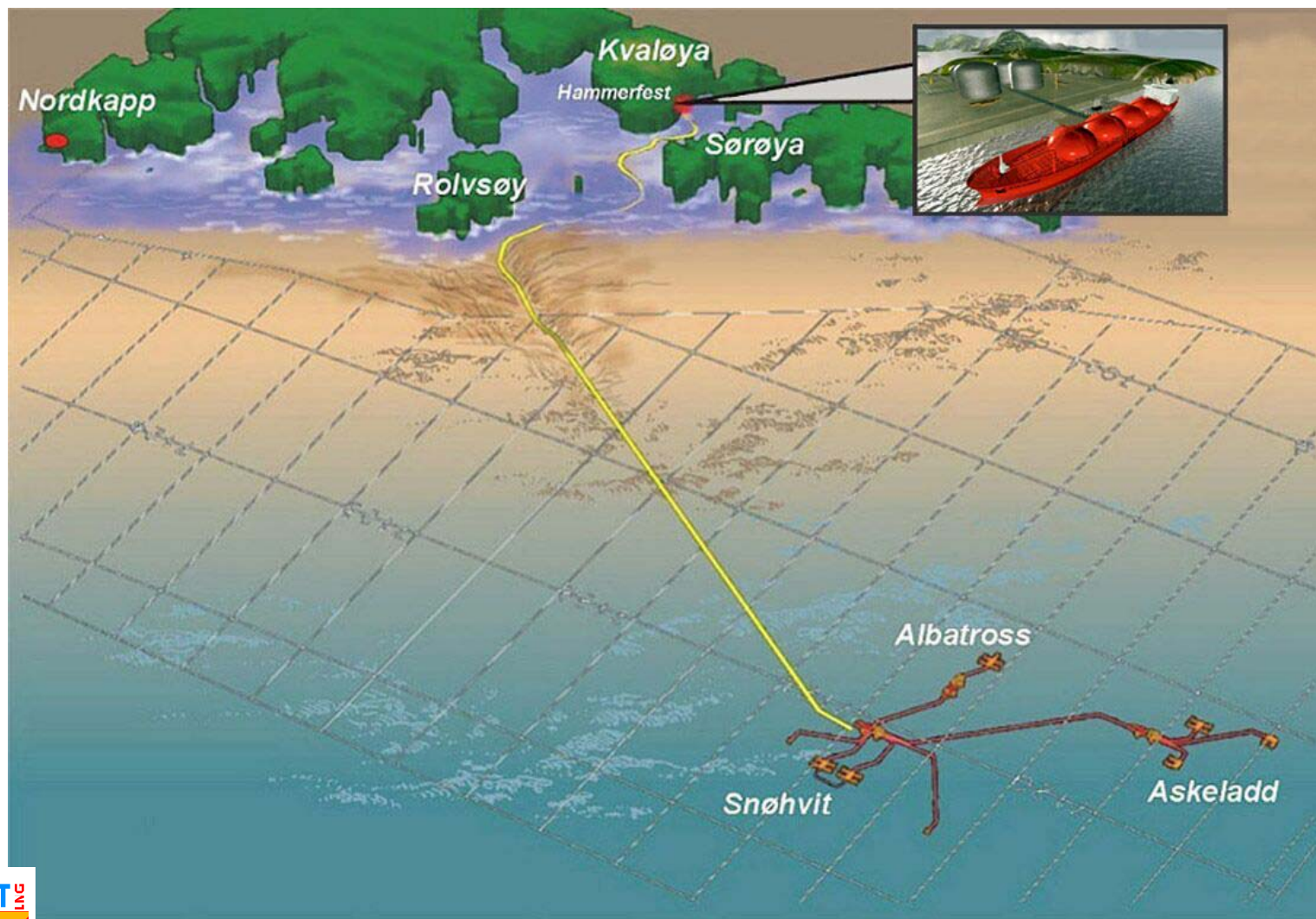
25% of the worlds  
undiscovered resources



Source: USGS, Statoil

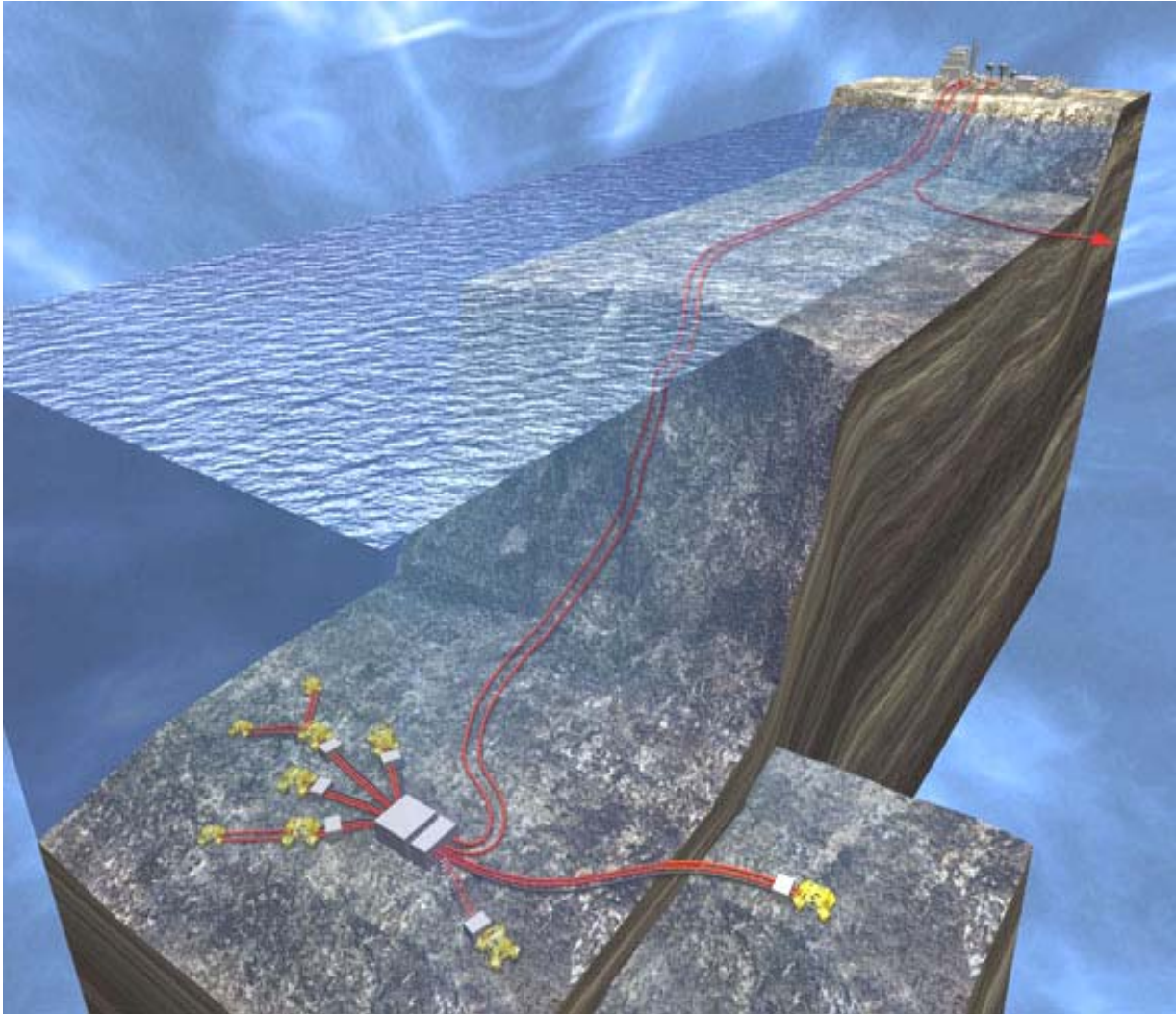


# Snøhvit

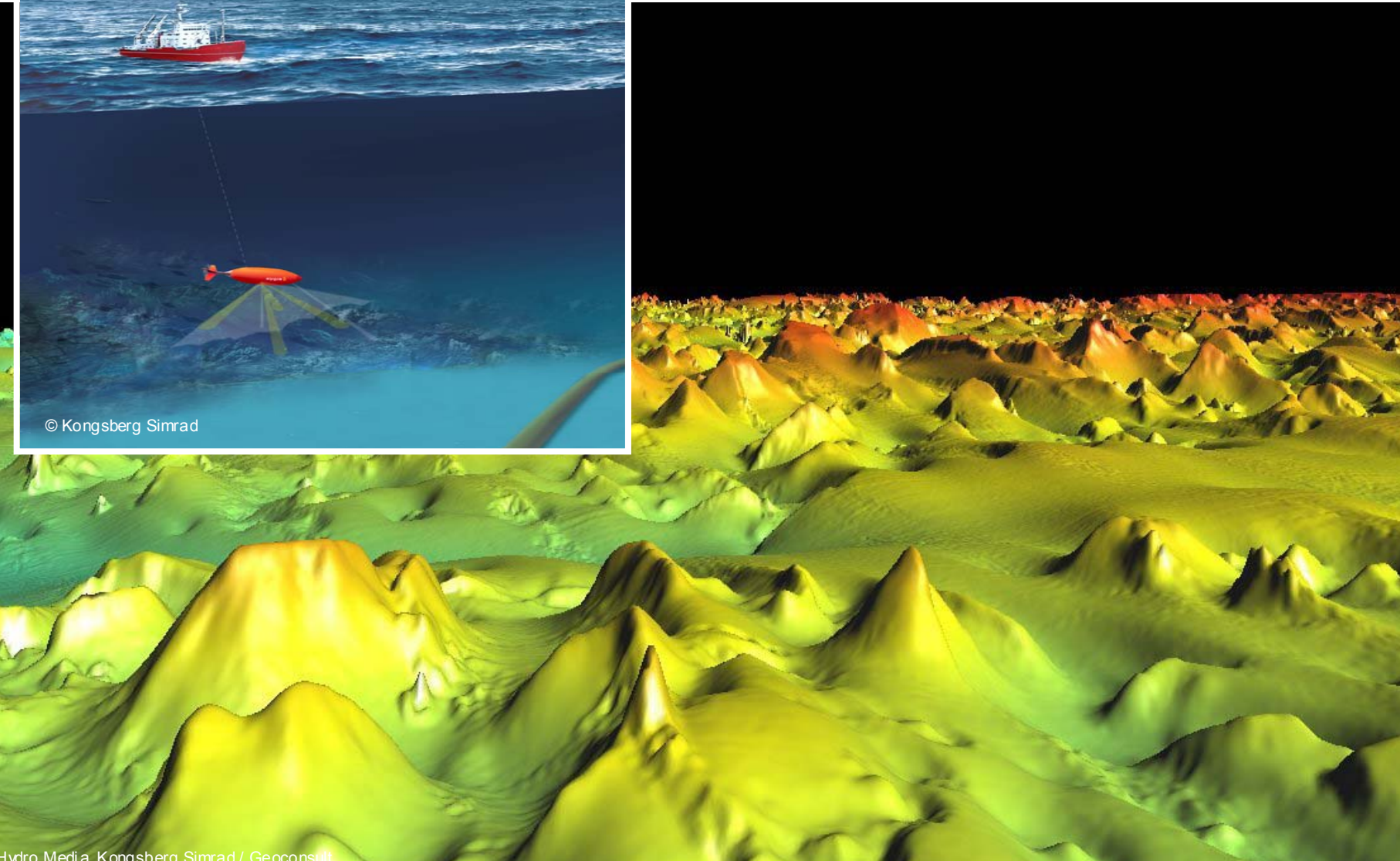
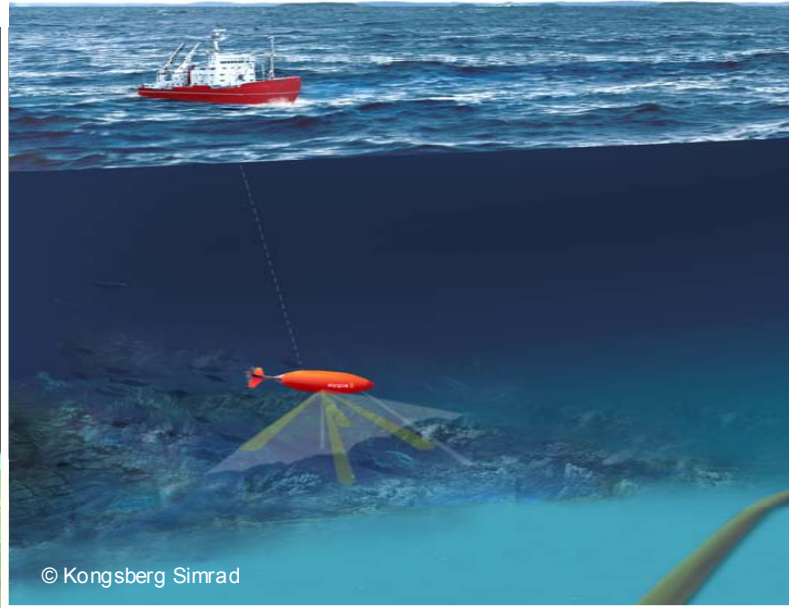




# Ormen Lange



# Ormen Lange: Seabed mapping with AUV





# Further out...



# Multiphase Flow

## Gas Tie-backs:

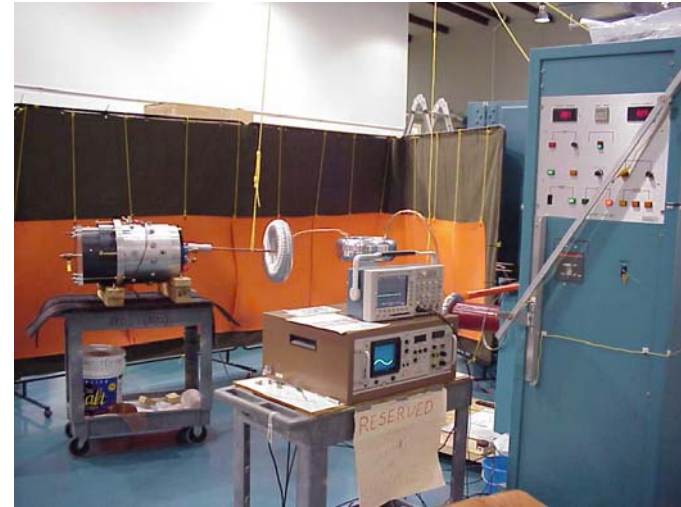
- Longer pipeline length gives higher pressure drop
  - Quicker off plateau; loss of production
- Increased pipeline diameter no solution to pressure loss problem
  - Minimum sweep (gas) velocity required to avoid slugs is 1,5 to 2,5 m/s
  - This corresponds to a pressure drop of 0,4 to 0,9 bar/km (DeepStar "rule of thumb")
- Subsea Wet Gas compression possible means to boost pressure
  - Ormen Lange and Mikkil reference cases
  - Challenging technology qualification
  - High power requirements
  - System for 120 km step-out will be qualified in year 2000?





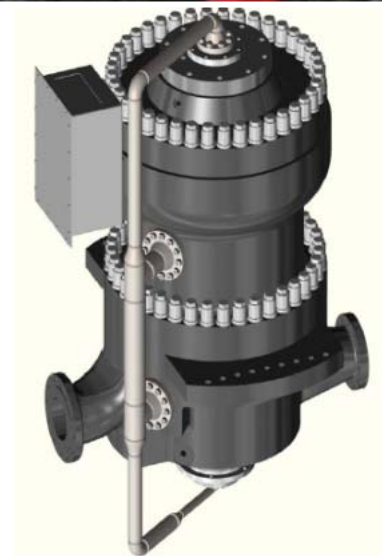
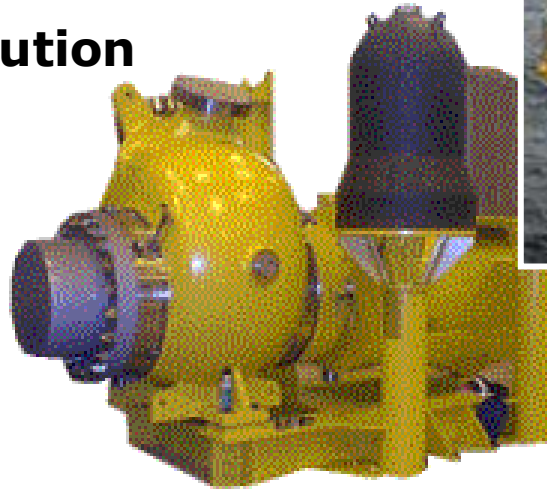
# MECON™ Mark II – 24kV / 36kV

- Testing of Vetco wet mateable 36kV MECON High Voltage connector



# The industry response

- ✓ **Multiphase pumping**
- ✓ **Subsea wet gas compression**
- ✓ **High voltage power distribution**
- ✓ **Reservoir modelling**
- ✓ **Light well intervention**
- ✓ **Subsea separation**
- ✓ **Framo, AKS, FMC, Kongsberg Simrad, Vetco and many other Norwegian suppliers at front edge of technology development**
- ✓ **Norwegian operators (Statoil, Hydro..) with challenging developments, strong technology focus and with world leading record of technology implementation**





# Summary and Conclusions

FFU seminar 2006:

# Et hav av

# muligheter

IB-senteret, Statoil. Forus, Stavanger.  
Torsdag 2. februar 2006



