

# Solving the technological challenges of operating in the arctic

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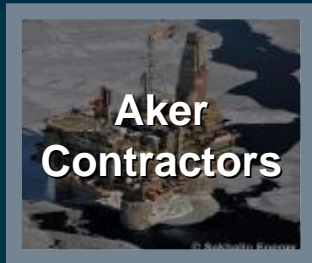
VP Innovation and IPR, Aker Engineering and Technology  
at **Barents Sea Conference 2011**, Hammerfest, Norway



# Aker Solutions 2011: Focused on oil & gas

## Positioned for growth

### Aker Contractors



**EPC**  
company

Spin-off and list<sup>1</sup>



**Engine-  
ering  
solutions**



**Product  
solutions**



**Field life  
solutions**

**Engineering and  
technology** company in the  
oil and gas industry

### P&C



**Process &  
Construction**

**E&C**  
company  
Sold to Jacobs<sup>2</sup>

<sup>1</sup> Separation to be concluded in second half 2011

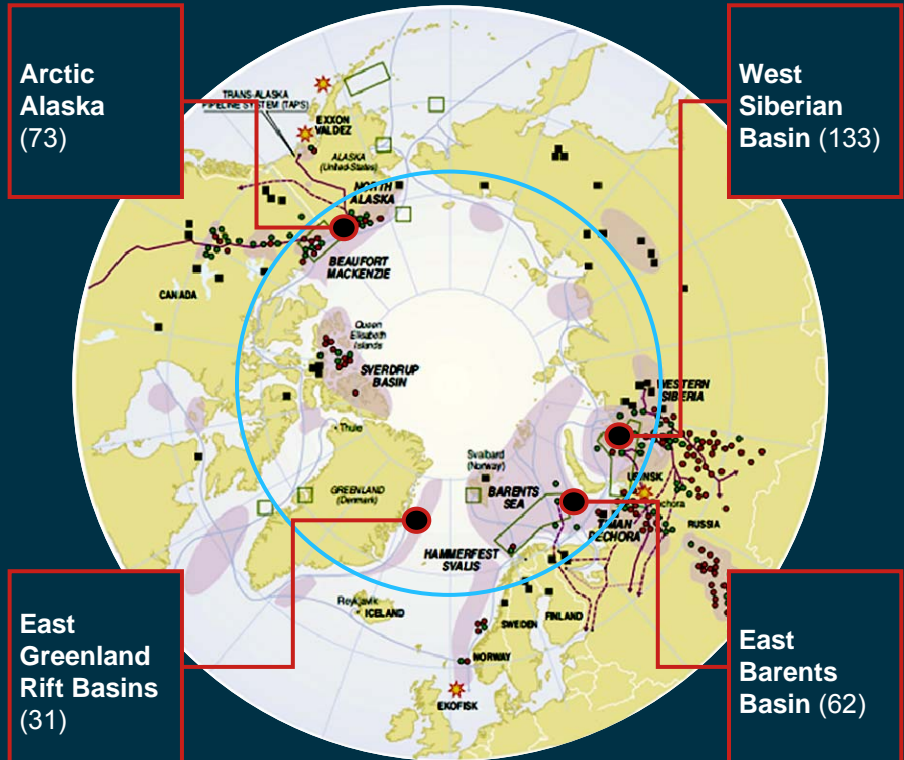
<sup>2</sup> Transaction concluded on 1 February 2011

# The challenges are highly complex

- **Political challenges**
  - Conflicting territorial claims
  - Perceived risk
  - Political motivations
  - Indigenous peoples
- **Environmental challenges**
  - Rich wildlife
  - Sensitive environment
  - Uncertain effects of pollution / spills
- **Technical challenges**
  - Seasonal pack ice and ice bergs
  - Remote areas with no / low infrastructure
  - Extreme cold
  - HSE / zero emissions

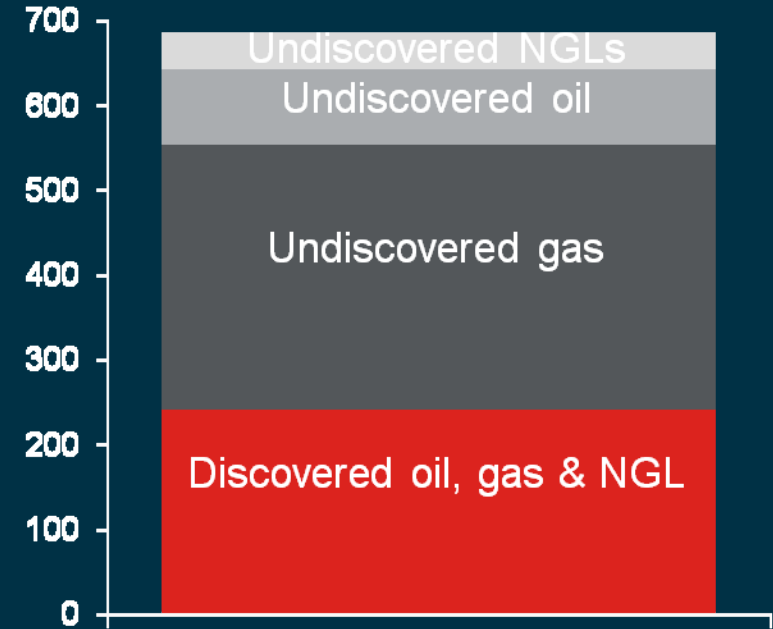


# The arctic reserves are substantial



## Estimated reserves

(billion barrels of oil equivalent)



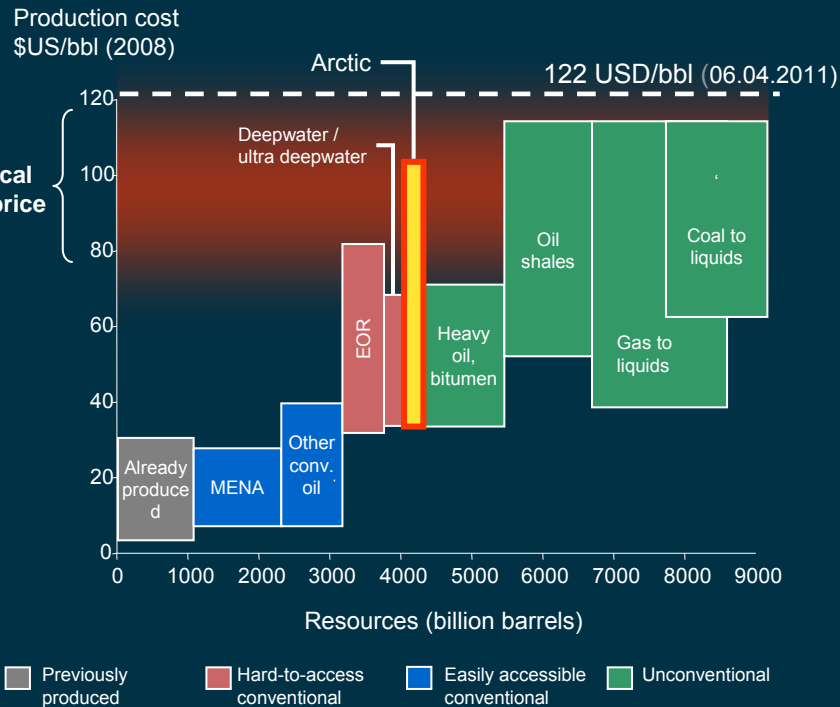
**USGS estimated arctic reserves**

Source: United Nations Environment Program, United States Geological Survey

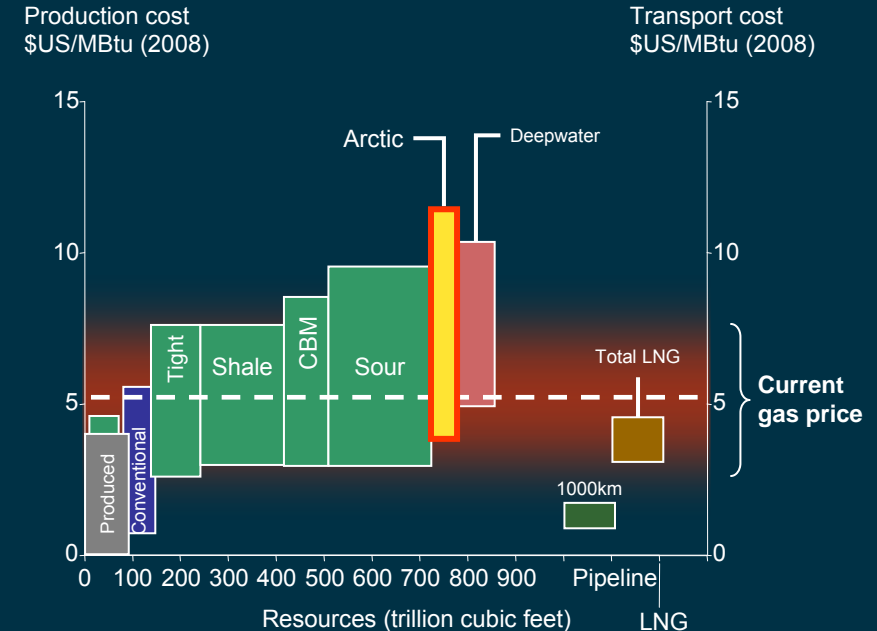
Barents Sea Conference 2011

# Development is commercial with today's technology

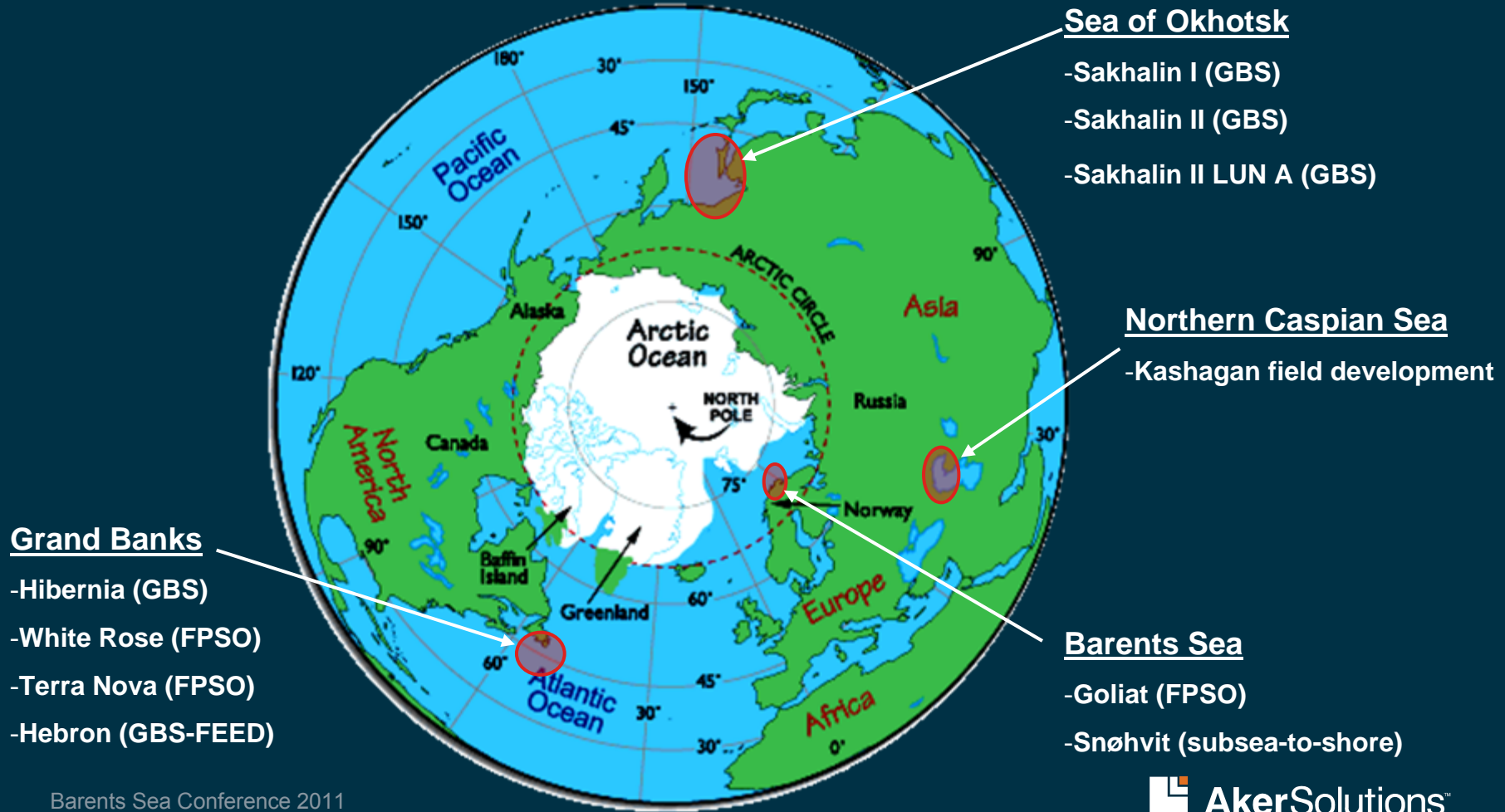
## Oil



## Gas



# Existing arctic offshore developments



# Proven arctic technology



White Rose



Terra Nova



Goliat

### Winterized topside:

- Heat tracing
- Enclosing critical areas
- Dropped ice protection



Snøhvit - Melkøya

### Subsea to shore:

- Subsea compression



Ormen Lange

### FPSO:

- Deep water
- Storage capability
- Drift ice management
- Quick disconnect

### GBS:

- Shallow water
- Storage capability
- Resistance to ice

Hiberina



Sakhalin I



Sakhalin II



Sakhalin II LUNA



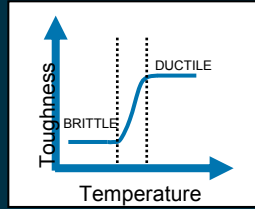
Kashagan



Hebron (FEED)

# Emerging arctic technologies

JIP – Arctic Materials



**Winterized topside:**

- Material technology
- Explosion proof enclosing
- Zero emission
- Gas / LNG processing

**Moored floater in ice:**

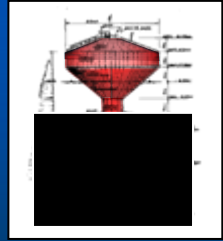
- Resistance to sea ice
- Resistance to ice berg
- Floating LNG

**GBS:**

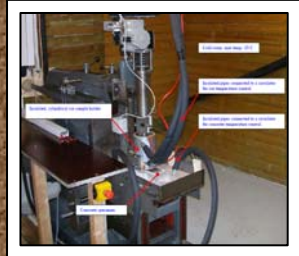
- Improved ice abrasion
- LNG

**Very long distance subsea to shore:**

- Power distribution
- Subsea compression
- Flow assurance



JIP – Mesoscale ice test on Spitzbergen

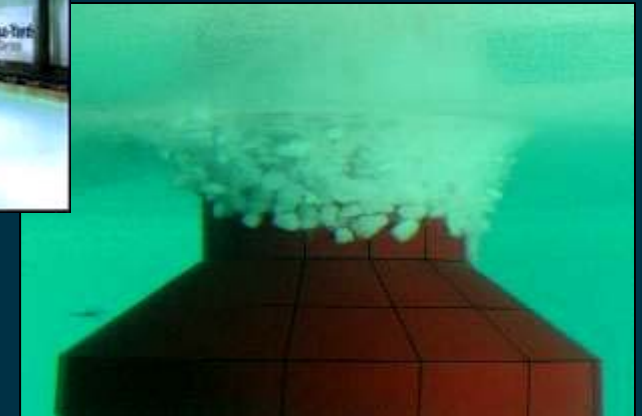


JIP – COIN



Compact subsea compression

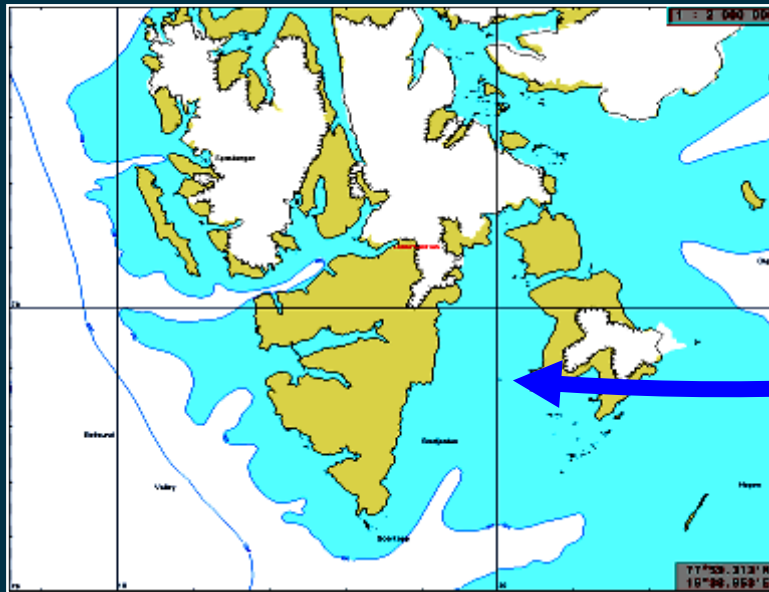
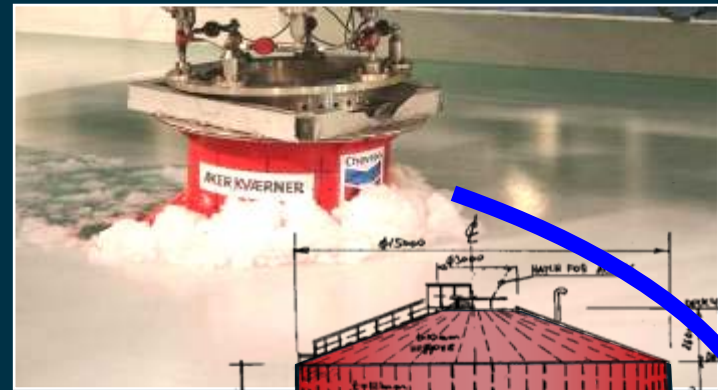
# Aker Arctic; our arctic R&D facility



# Moored floater in ice

## Meso-scale Ice test on Spitsbergen

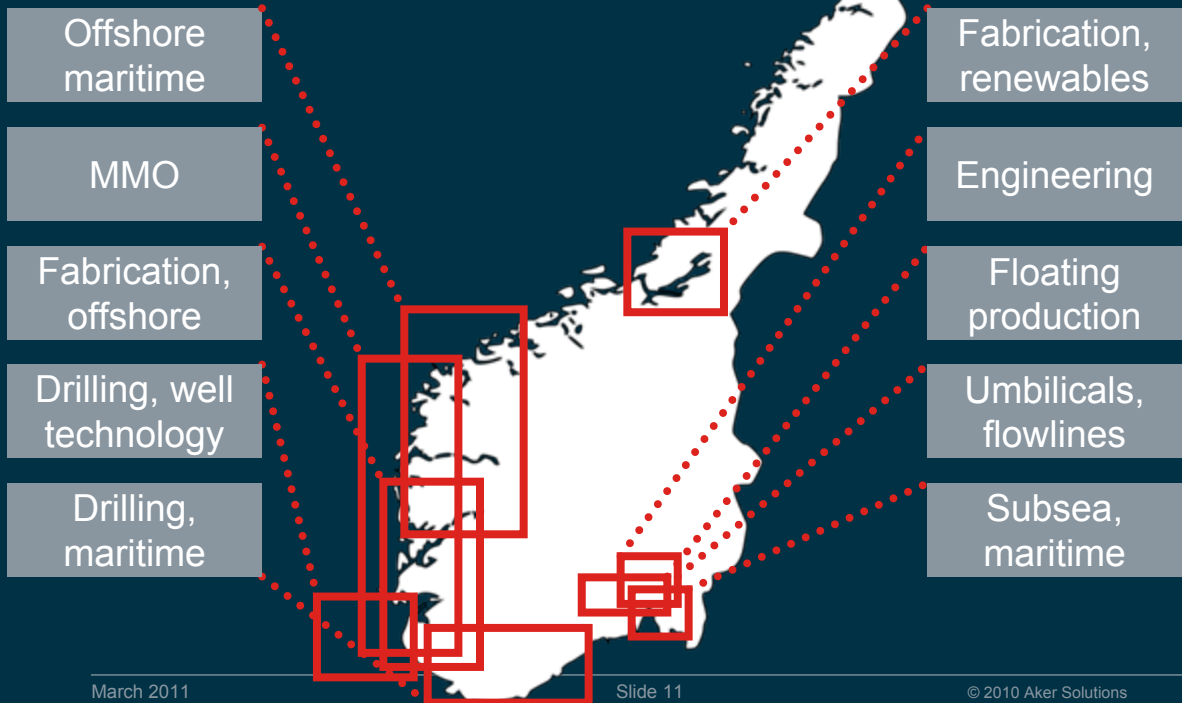
- JIP Proposal to install large scale buoy for measuring ice loads (Invited: BP, Chevron, ConocoPhillips, ExxonMobil, Shell, Statoil)
- To bridge the gap between analysis / model test and real conditions



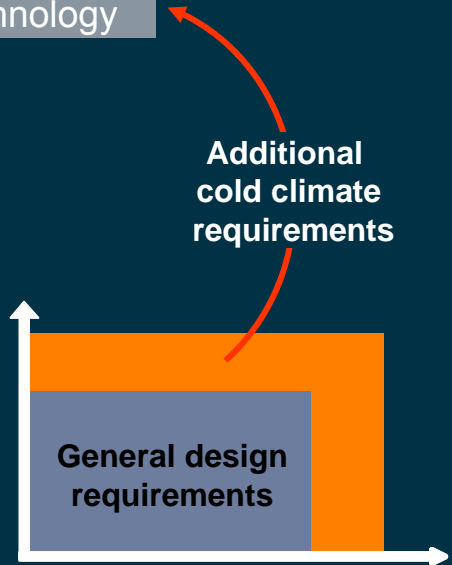
# Concluding remarks

## New arctic offshore cluster?

### Existing Norwegian offshore clusters



Arctic technology



# Thank you for your attention



Vision for the Yamal gas field; a concrete GBS LNG factory in the polar winter night.

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