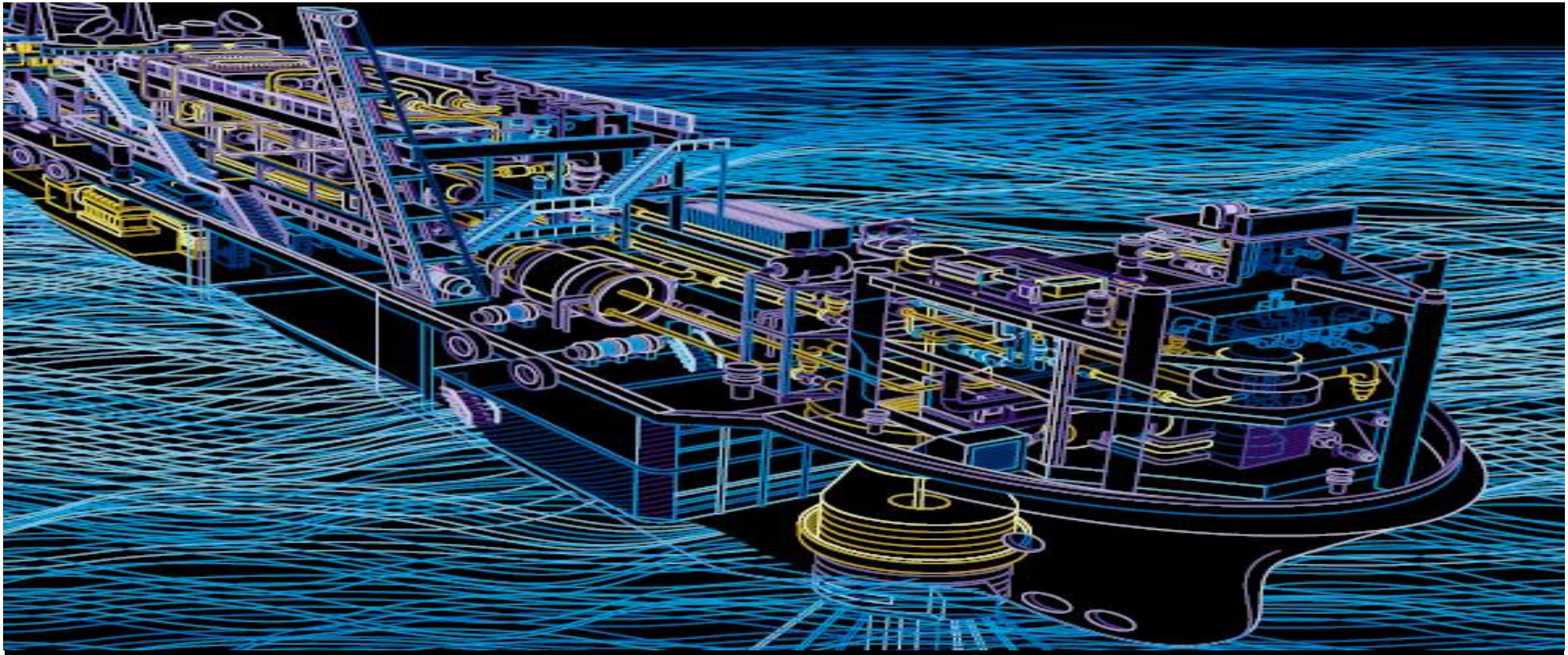


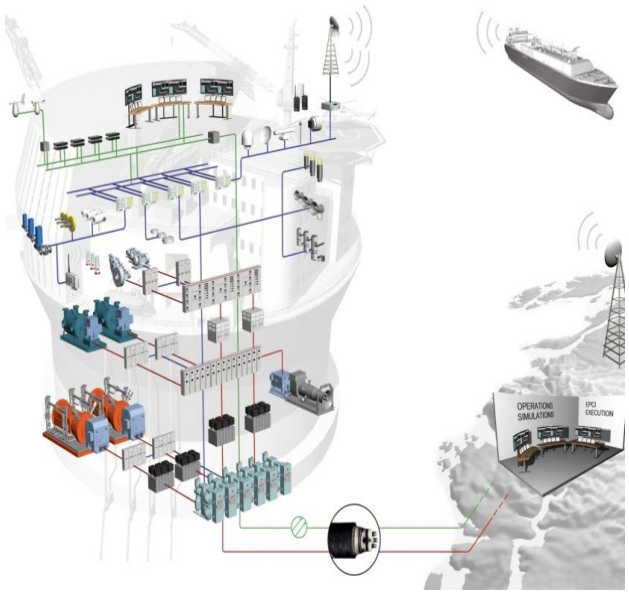
Stein Guldbrandsøy/Håvard Devold– April 8, 2016

Italian – Norwegian Energy Dialogue
SOLUTIONS FOR THE FUTURE
Energy efficiency and emissions reductions

Energy efficiency and emissions reductions
Contents

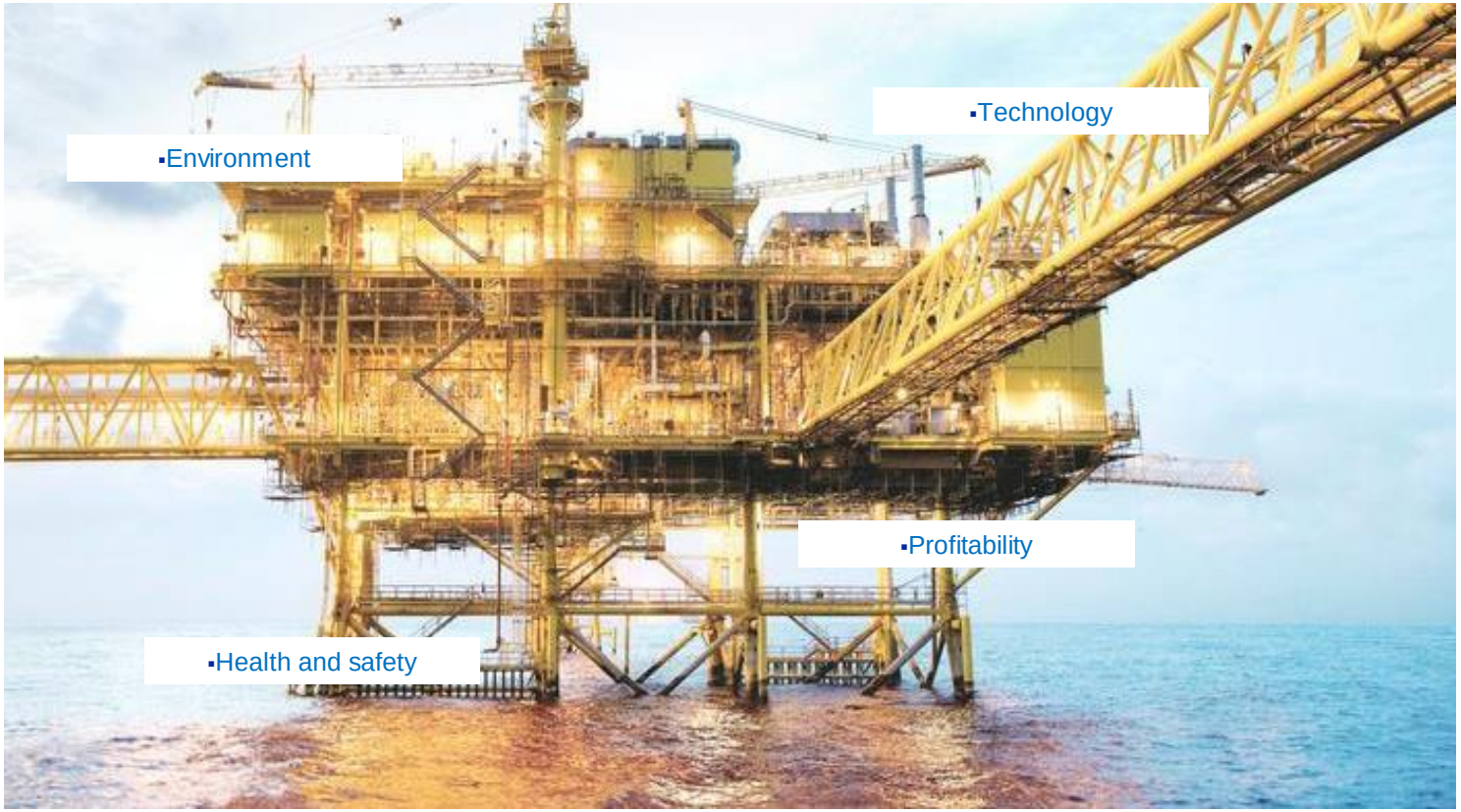
- Electrification
- Energy efficiency
- Integrated Operations, remote operation support

ABB offering
What we offer today



- Electrical
  - Complete single line
  - Drives & motors
  - Drilling, power quality
- Field instrumentation, all major
  - level, pressure, temperature, flow
- Automation, ICSS & PMS
  - PCS, ESD, PSD, F&G, PMS
  - IMS and Condition Monitoring
  - Lifecycle simulation
  - Control room design
- Telecom system integrator
  - Infrastructure
  - 20+ subsystems
- Integrated Operations/Digital Oilfield
- Packaging – E-house, power skids
- Electrification – Pfs
- Subsea power

Why electrification?
Electrification by power from shore



Why electrification?
Benefits

Gas turbines (typical)

- 1 unit in maintenance > 50% of time, cost ~18% of capex/yr.
- Unplanned shutdown ~ 6% of time
- Loss of capacity of 1-3 %
- 3- 12 on-stream days lost

Power from shore

- Higher availabilty 10 on- stream days
- Tighter control - Lower recirculation 1-3% losses
- Maintenance cost down 80%
- Higher efficiency 1.5 - 3 times

Why electrification?

Electrification helps to save ~1.3 mio. tonn CO_2 per year

A huge installed base of 30+ projects in Utilities, Oil & Gas & Windpower

Princess Amalie
120 MW
AC

Borwin 1
400 MW
HVDC

Dolwin
2 900 MW
HVDC

Valhall
80 MW
HVDC

Thornton Bank
325 MW
AC

Goliat
60MW
AC 100km

Troll 1 - 4
4 * 43 MW
HVDC
2 * 20 MW AC

Dolwin 1
800 MW
HVDC

Gjøa
40MW
AC, 100km

Total world > 100 projets from ABB and other suppliers

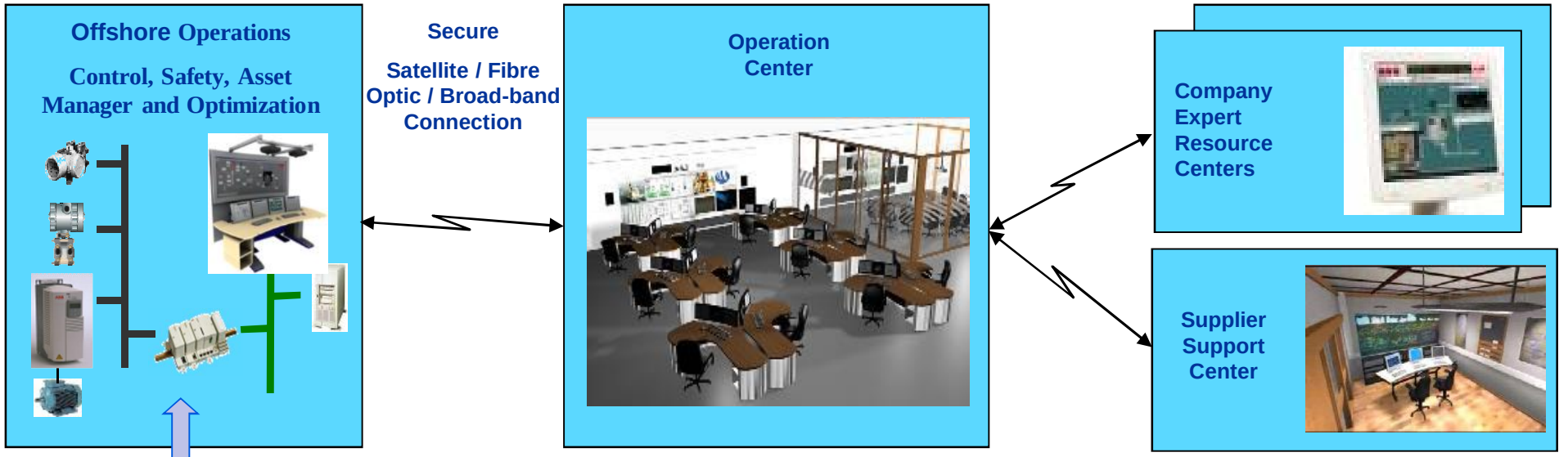
Field	CO2	NOX
Troll	230 000	230
Valhall	400 000	250
Gjøa	250 000	200
Goliat	90 000	88
Martin Linge	100 000	100
Troll 2	250 000	200
SUM:	**1 320 000**	**1069**

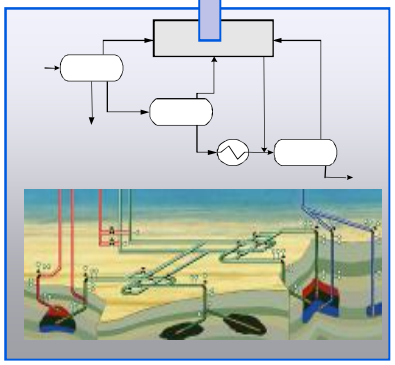
Energy efficiency
Less fuel consumption, lower emissions

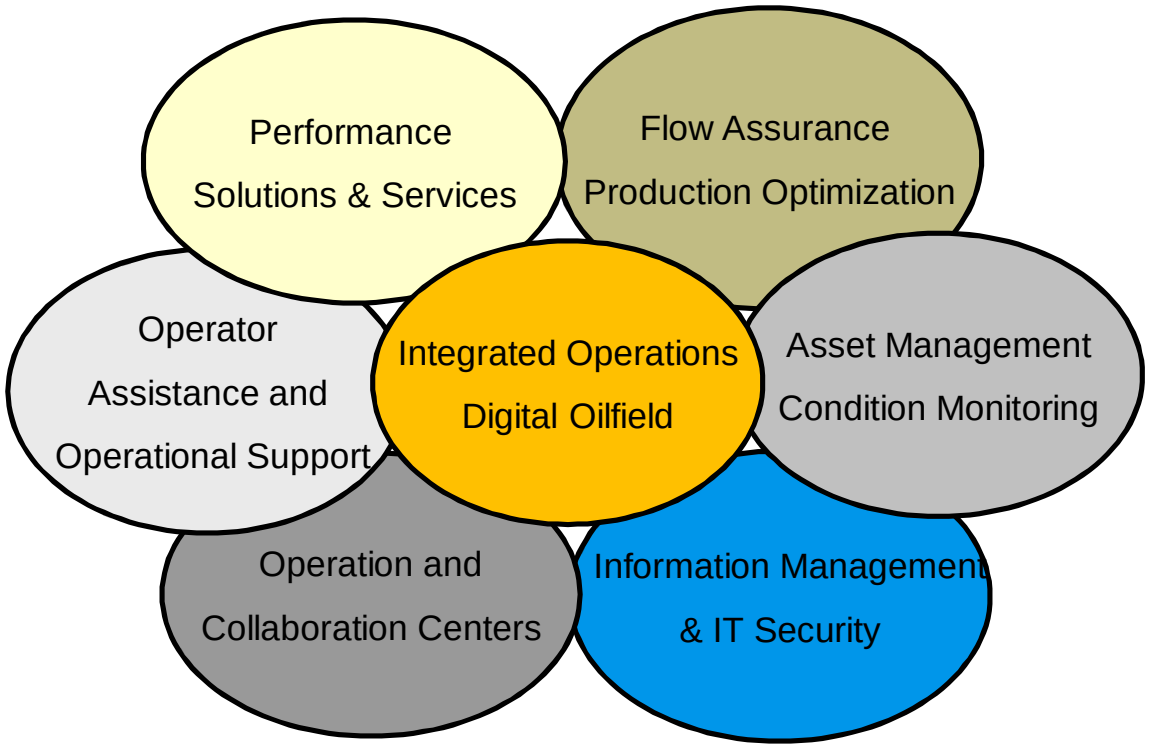
- **“The Toaster”**
  - Runs continuously 06:00-10:00, 2 kW
  - Air conditioned area, so 3 kW to cool down again
  - 50% efficiency => (2+3)/0,5 * 4 h = **40 kWh** thermal
  - Conventional: Two loafs/2 min each 5 min @1kW gives (1+1,5)*(2/5)/0,5 *4 = **4 kWh** thermal

- So what are the “toasters” in your process ?
  - Pumps
  - Compressors
  - Process Instabilities (all variations drain energy)
  - Heat loss
  - Maintenances issues (wear, friction, scaling…)
- Typical power consumption
  - 10-100 MW offshore field ,
  - 250 MW new 7.5 MTPA LNG Plant,
  - 300 MW for large compressor stations

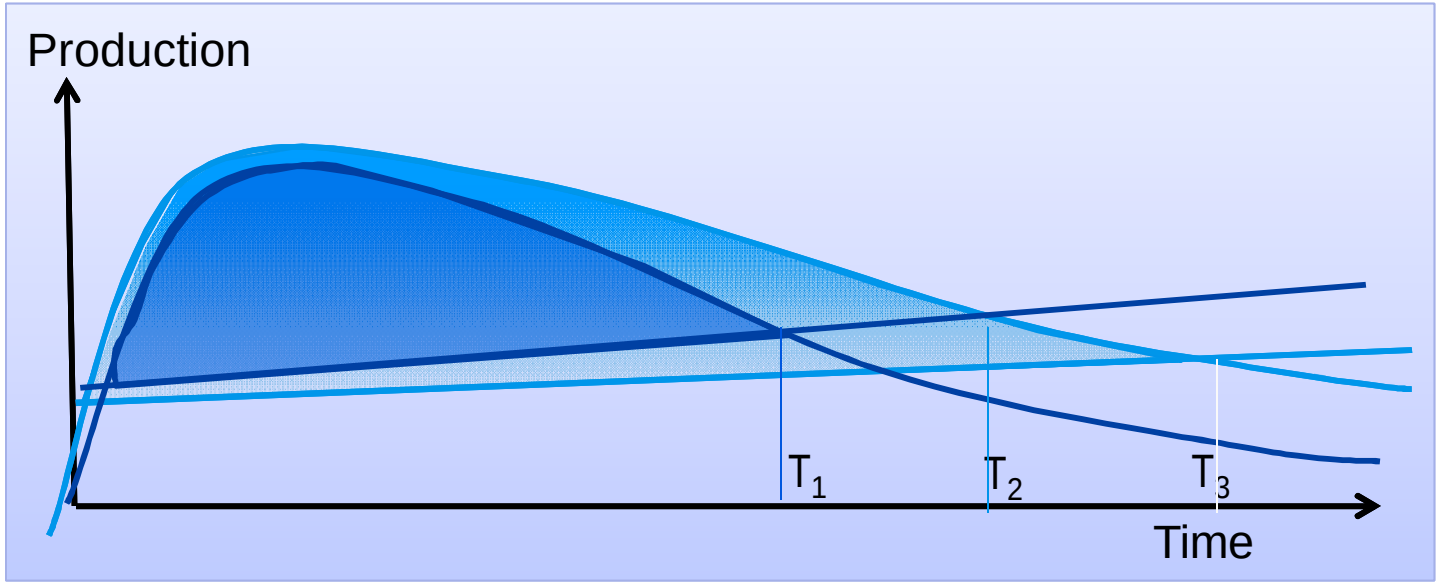
Digital Oilfield Structure







Digital oilfield: value potential



- Increased production (3-5%)
- Reduced production losses (20-40%)
- Reduced operation and maintenance costs (15-30%)

Source: NPD IO Potential Study for NCS

Summary
Electrification is profitable and environmentally sound.

- Electrification and power from shore:
  - Eliminates:
    - Emissions
    - Heavy maintenance
  - Improves
    - Availability
    - Improves the local environment.
  - Generally a profitable investment
- Energy efficiency
  - Identify the «toaster» – And optimize accordingly
- Integrated Operations, remote operation support
  - Increased production (3-5%)
  - Reduced production losses (20-40%)
  - Reduced operation and maintenance costs (15-30%

Power and productivity
for a better world™