Gas and Process Division

Smart and Clean

Capital Markets Day 2006

Dré Schmitz, President Gas and Process Division

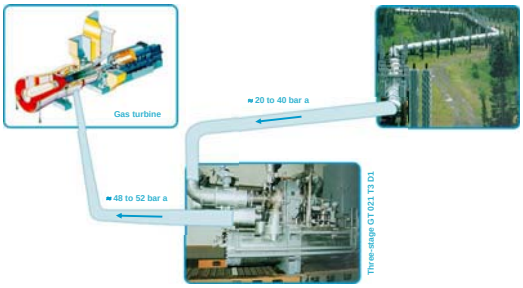
Atlas Copco

Smart & Clean

Natural Gas

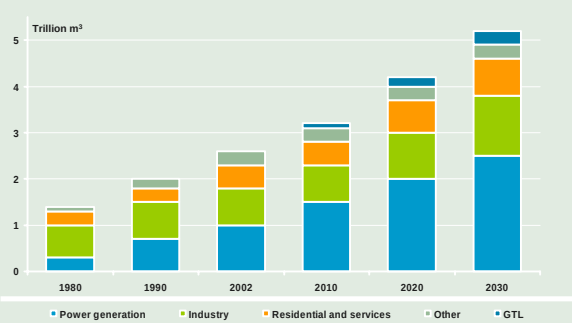
Driver for Smart and Clean

…is the growing demand for energy driven gas power station



Application fuel gas to the main gas turbine

Increase in Primary Gas Demand



Source: IEA World Energy Outlook 2004

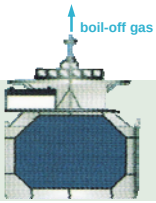
Distribution of Natural Gas

Pipeline

LNG carriers

CNG carriers feasibility study short distance

LNG – Liquified Natural Gas



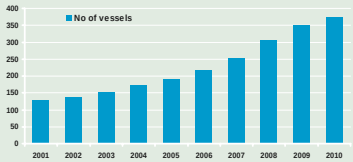
Liquid form at atmospheric pressure and temperature –161 °C

Reducing volume by a factor of 610

World LNG Potential

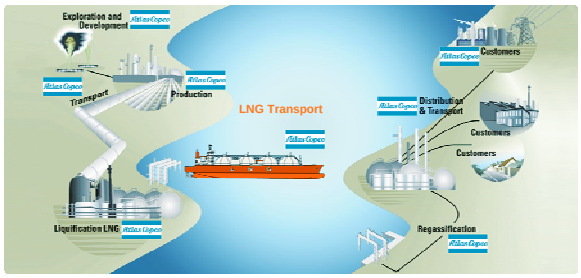
- The 12 countries that currently export LNG have approximately 28 percent of world natural gas reserves.
- Three countries with 33 percent of the world's reserves are currently building their first liquefaction facilities.
- At least seven additional countries, with 19 % of the world's reserves, are potential LNG exporters.

LNG fleet on the rise



The LNG Value Chain

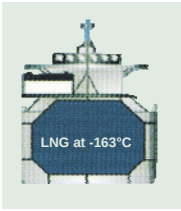
= APPLICATIONS FOR COMPRESSORS

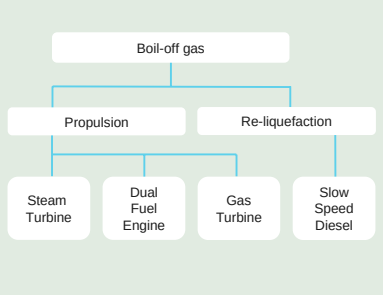


Exploration & Development	Production	Transport	Liquification LNG	Transport	Regassi-fication	Distribution & transport	Marketing & Sell

Boil-off gas

0.10 ~ 0.15% per day





NUMBER OF COMPRESSORS	4	4	4-6 (*)	6

(*) feasibility study

Trend

- Traditional steam turbine powered LNG of 135 - 145 tm3 is virtually a thing of the past
- The majority of new ships currently being specified are
  - 210-217 tm3 with low speed diesel and on board reliquefaction
  - 150-180 tm3 with dual fuel diesel electric propulsion
- Forecast 2006 - 2011
  - Steam 19 vessels (14%) ➡ 76 compressors
  - Dual fuel 69 vessels (50%) ➡ 276 compressors
  - Reliquefaction 51 vessels (36%) ➡ 306 compressors

LNG Equipment from Atlas Copco

	SHIP'S PROPULSION SYSTEM	STEAM TURBINE	DUAL-FUEL ENGINE	GAS TURBINE	DIESEL & DIESEL ELECTRIC
COM-PRESSORS	L/D compressor, single-stage	✓			
	L/D compressor, two-stage		✓		
	L/D compressor, multi-stage		✓	✓	
	H/D compressor, single-stage	✓	✓	✓	✓
RELIQUE-FACTION COM-PRESSORS & EXPANDERS	Nitrogen compressor				✓
	Nitrogen booster expander				✓
	Nitrogen compander				✓
	BOG compressor, two-stage				✓
HEATERS & VAPORIZERS	L/D gas heaters	✓	✓	✓	
	L/D forcing vaporizer	✓	✓	✓	
	Mist separator		✓	✓	
	L/D combined vaporizer / gas heater		✓	✓	
	H/D gas heaters	✓	✓	✓	✓
	LNG vaporizer	✓	✓	✓	✓
	BO/WU heater	✓	✓	✓	

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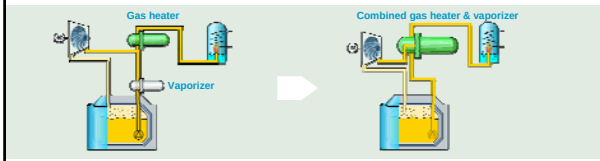
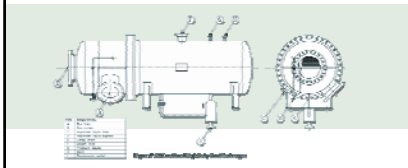
Combined gas heater / vaporizer

New Technology





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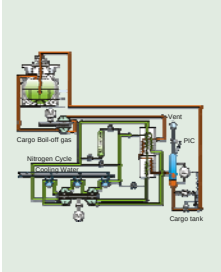
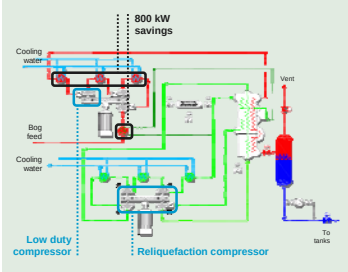
LNG – Reliquefaction

First generation	Second generation





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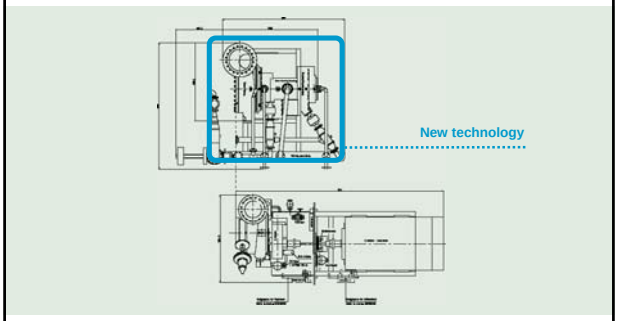
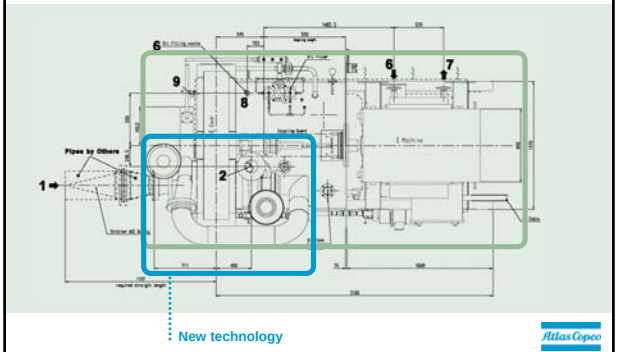
Size Comparison – HD Compressor



Size Comparison – LD – BOG 2 Stage



High Speed Direct Drive Compressor

New Technology

play movie

continue

Advantages:

- Weight and space reduction
- Efficiency improvement
- No gear box required
- No lube oil system required
- Life cycle cost reduced

Example for Energy Recovery

Not for LNG

Zandvliet – GT098 L4K1 + 2x ETI 450 NS

Process conditions GT098 L4K1

- Medium: Air
- Inlet pressure: 0.97 bar A
- Discharge pressure: 10.75 bar A
- Flow: 102.232 m^3/hr
- Shaft power: 12,310 kW

Process conditions Twin ETI 450 NS

- Medium: N_2
- Inlet pressure: 8.00 bar A
- Discharge pressure: 1.35 bar A
- Flow: 41,000 Nm^3/hr each
- Shaft power: 2,232 kW

Energy savings

Gas and Process Division

Summary

- LNG demand is growing 8% per year
- The growth is driven by gas power stations
- We have developed the products together with our customers
- Technology can also be used for other applications
- The technology used contributes to a better environment and energy savings

We are committed to your superior productivity through interaction and innovation.