

DEVELOPMENT OF GAS TURBINES IN MECHANICAL DRIVE APPLICATIONS

Koninklijk Instituut Van Ingenieurs Afdeling Olie- en Gastechnologie

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Reserves: Our use of the term "reserves" in this presentation means SEC proved oil and gas reserves.

Resources: Our use of the term "resources" in this presentation includes quantities of oil and gas not yet classified as SEC proved oil and gas reserves. Resources are consistent with the Society of Petroleum Engineers 2P and 2C definitions.

Organic: Our use of the term Organic includes SEC proved oil and gas reserves excluding changes resulting from acquisitions, divestments and year-average pricing impact.

Resources plays: our use of the term 'resources plays' refers to tight, shale and coal bed methane oil and gas acreage.

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may affect future results are contained in Royal Dutch Shell's 20-F for the year endea

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Safety Natural Gas Market LNG

LNG Gas Turbine Parts Improvement Program

ABUNDANT: HUGE GLOBAL GAS RESOURCES

GAS RESOURCES ARE PLENTIFUL, GROWING AND GEOGRAPHICALLY DIVERSE



- Conventional and unconventional recoverable gas resources can supply >230 years of current global gas production
- Unconventional gas is transforming the global gas market

GLOBAL ENERGY OUTLOOK

DEMAND GROWTH 1980 - 2050

Energy demand outlook in million boe/d



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WHAT IS LNG?

LNG: Liquefied Natural Gas

WORLD LNG PRODUCTION IN 2012 = 236 mtpa



PRODUCTION

 Natural Gas production and separation from oil and water (when present)



LIQUEFACTION

- Natural Gas cooled to liquid state at -162°C at atmospheric pressure.
- Volume reduced
 600 fold



SHIPPING

 LNG transported over long distances in purpose built carriers



REGASIFICATION

 LNG returned to gas state and injected into the transport pipeline network for distribution and sales

COST EFFECTIVE ALTERNATIVE TO PIPELINE FOR DISTANCE > ~3000 KM

LNG process

Nearly pure methane (CH₄) at ~1 atm. and ~ -160°C Enable transport large volumes of energy: 600x volume shrinkage upon liquefaction



GOAL ZERO = NO HARM + NO LEAKS



SHELL'S CONTRIBUTION TO THE LNG INNOVATION JOURNEY



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VALUE GAP CLOSURE



Benchmarking





