AN INTRODUCTION TO
SHELL LNG FOR TRANSPORT

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DEFINITIONS AND CAUTIONARY NOTE

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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NATURAL GAS OPPORTUNITY
9 BILLION people, 75% living in cities
(2 BILLION more than today)

2 BILLION vehicles
(800 MILLION at the moment)

Many MILLIONS of people will rise out of energy poverty; with higher living standards energy use rises

Energy demand could DOUBLE from its level in 2000… while CO₂ emissions must be HALF today’s to avoid serious climate change

Twice as efficient, using HALF the energy to produce each dollar of wealth

Renewables could supply up to 30% of the world’s energy

Projections are based on the Shell Scenario Estimates – a planning tool used by Shell to explore alternative views of the future by considering long-term trends in economics, energy supply and demand, geopolitical shifts and social change, as well as the motivating factors that drive change.
ROBUST LONGER TERM FUNDAMENTALS

Energy demand outlook in million boe/d

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**THE CASE FOR GAS**

**ABUNDANT**
- Gas resources can supply >230 years of current global gas production
- LNG supplies could meet one-fifth of global gas needs by 2020

**ACCEPTABLE**
- Replacing coal with gas for electricity generation is the cheapest and fastest way to meet CO₂ reduction targets
- Gas fired power plants emit around 50% less CO₂ than coal fired plants.

**AFFORDABLE**
Gas as a source for power generation is a lower cost alternative.

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Source: IEA World Energy Outlook, WoodMackenzie, Shell Interpretation

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**AFFORDABLE**

<table>
<thead>
<tr>
<th>Technology</th>
<th>Total Cost</th>
<th>Capital Cost</th>
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<td>Wind Offshore (75 km)</td>
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<td>250</td>
</tr>
<tr>
<td>CCGT</td>
<td>100</td>
<td>50</td>
</tr>
</tbody>
</table>

- **CCGT**: Combined Cycle Gas Turbine
- Total Cost = Capital + Fuel + Operating
- Source: DECC (Mott MacDonald) June 2010
- This is a European example
LNG AS A TRANSPORT FUEL
INTEGRATED VALUE CHAIN

Gas production
Small scale liquefaction
Storage tank + loading facilities
Retail (CRT) site
Road transport
Mining
Rail
Inland barge
Coastal marine
Deep sea marine
Bunker vessel
LNG carrier

Road transport

Mining
NO SINGLE SOLUTION FOR OIL BASED TRANSPORT

THERE IS NO “SILVER BULLET”

LNG IS ONE OPTION IN AN EVOLVING FUEL MIX

AVAILABLE ACCEPTABLE AFFORDABLE

MOSAIC OF FUEL OPTIONS

BIOFUELS

CONVENTIONAL FUEL

GTL

LNG

H2 MOBILITY E-MOBILITY
3

Drivers and Challenges
LNG AS A TRANSPORT FUEL

**DRIVERS**

**SUPPLY**
Abundant global gas resources

**ENVIRONMENT**
Lower emissions NOx, SOx and particulate matter**

**COST COMPETITIVE**
Lower cost alternative*

**CHALLENGES**

**INFRASTRUCTURE**
Increasing infrastructure development in conjunction with demand

**ENGINE TECHNOLOGY**
Varied OEM solutions available

**REGULATORY**
Requires framework that facilitates infrastructure and market development

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* Versus Marine Gasoil
** Versus heavy fuel oil
Shell LNG fuel can help reduce well-to-wake GHG emissions by up to 20%, compared to High Sulphur Fuel Oil.

- Virtually zero SOx emissions
- Virtually zero Particulate matter
- Reduced NOx depending on tier 1/2/3 engine

**REGULATION OF SOx EMISSIONS**

![Graph showing SOx emissions regulation](image)
SECA BECOMES ECA: NOX EMISSION LIMITS

Current Global Nitrogen Oxides (NOx) Limitations

- Tier II: 20% reduction of Tier I limit for new ships built after 1 January 2011

SECA becomes Emission Control Area as of 1 January 2016

- SOx limit of 0.1% fuel sulphur (implemented 1 January 2015)
- NOx Tier III limit of 80% reduction of Tier 1 for ships built after 1 January 2016

Source: IMO
SHELL VALUE PROPOSITION
LNG IS AT THE HEART OF OUR BUSINESS

SHELL GLNG SUPPLY PORTFOLIO

- Nigeria LNG
- Qatar LNG
- Oman LNG
- Brunei LNG
- Malaysia LNG
- Sakhalin LNG
- Prelude LNG
- Gorgon
- Pluto (Woodside)
- North West Shelf
- Wheatstone LNG

NEW INNOVATIONS

- Floating Liquefaction
- Greenstream Barge
- Harvey Gulf
- LNG bunker vessel

SHELL LNG LEADERSHIP

Year end equity liquefaction capacity in mtpa

- Shell
- XOM
- CYX
- TOT
- BG
- BP

- 2013
- 2017
- Repsol acquisition (2014+)
LNG CAN OFFER A COMPELLING VALUE PROPOSITION

1. Cost competitive fuel
2. Cleaner burning fuel
   Can contribute to lower local exhaust emissions and global greenhouse gas emissions
3. Proven and reliable LNG engine technology availability
4. LNG Availability, Safe and reliable supply chain
MGO is regarded as the base case fuel, HFO + Scrubber and LNG are the compliance alternatives. LNG will provide a payback to the MGO base case and can be competitive with the HFO + Scrubber option.

LNG pricing will be oil linked, de-risking the customers exposure to other commodities.

As with oil products, every step in the supply chain will cause a cost increase. This means that the closer to hub (e.g. Rotterdam) product is delivered, the lower will be the LNG fuel cost.
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SHELL INITIATIVES
Shell’s 100% subsidiary, Gasnor, is a market leader in Norway, distributing 140,000 tons per year of LNG to Norway and Scandinavia.

- 10 year of operational experience Serving Marine and Industrial customers by Road and Ship delivery
- Three production plants for LNG and distributes LNG by two ships and 22 tanker lorries
- Gasnor has performed > 70,000 LNG transfers
Shell has announced investment into a break bulk jetty at the GATE (Gas Access To Europe) terminal.

To serve marine customers in the port of Rotterdam, Shell intends to charter a LNG bunker vessel facilitate ship to ship transfer operations, and also deliver LNG to secondary distribution terminals outside the port area.

In addition, LNG will be loaded onto trucks and delivered to road customers.
The new vessel will be built by STX Offshore & Shipbuilding. It will be based at the port of Rotterdam in the Netherlands, and will load from the new LNG break bulk terminal and jetty to be constructed by the Gas Access to Europe (Gate) terminal. It will also be sea-going and, therefore, able to bunker customers at other locations.
DEVELOPING A GLOBAL MARINE BUNKER SUPPLY NETWORK

Around-the-World Route

KEY
- Existing ECA
- Possible future ECA
- Development Areas

Transatlantic
Transpacific
Asia-Europe
SUMMARY

- Collaborative relationships between ship owners, charterers, ports, and fuel suppliers
- Developing global infrastructure hubs on the back of supporting demand
- Ensuring harmonized industry standards