

### **MORE FROM LESS**

# FRIGYES LESTAK

GENERAL MANAGER CO2 SHELL FUTURE FUELS & CO2

Technical University Budapest 10 April 2008

## AGENDA

- Setting the Global Context
- Regulations
- Abatement Options
- Shell Technical Response
- Summary

# **THREE HARD TRUTHS...**



The global demand for energy is growing, both in the developed and developing world.



Supplies of "easy oil" cannot keep up with the growth in energy demand.



More energy means more  $CO_2$  emitted at a time when climate change looms as a critical global issue.



## THE 1<sup>ST</sup> HARD TRUTH: ACCELERATING ENERGY DEMAND



- From 900 million to 2 billion vehicles (ex 2-wheelers)
- Almost doubling of the global electricity demand



# THE 2<sup>ND</sup> HARD TRUTH: THE TIME OF "EASY OIL" IS OVER



The growth rate of supplies of easy oil will struggle to keep up with growing demand

• Just when energy demand is surging, many oil provinces are going into decline



### THE CHALLENGE – TWICE THE ENERGY WITH HALF THE CO2



\* Shell estimates

### **THE GREENHOUSE EFFECT - AN UNSTABLE HISTORY**

#### **HISTORIC DATA**

- 600,000 years of data from ice cores
- Strong correlation between CO2 concentration and temperature
- The earth has operated in a band of 180ppm -300ppm throughout evolution of mankind

#### **CURRENT DATA**

• Current CO<sub>2</sub> concentration is 380ppm



Source: http://www.grida.no/climate/vital/02.htm

### LIVING WITHIN A STRICT CARBON BUDGET

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### **Climate change impact**



### Social impact (2°C in 2050)

10 million people impacted by hunger
35 million people impacted by coastal flooding
250 million people impacted by malaria
2,500 million people impacted by water shortages



#### Economic impact

Acting now to mitigate change will cost 1% global GDP Acting later to adapt will cost 5–20% global GDP



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### **RECENT REGULATORY DEVELOPMENTS (2007-2008)** EU Directive proposals, US Energy Act, China goes LCFS





## EUROPEAN UNION Legislative Framework Regulating CO<sub>2</sub>



- Proposal under Discussion at European Parliament and Council
- Expected to be adopted in June 2009



### PROPOSED EMISSION TRADING SCHEME DIRECTIVE

- EU wide cap
- 21 % reduction by 2020 (2005 base-year)
- Auctioning in power sector
- Auctioning in refining : 20% (2013) 100% (2020)

#### PROPOSED CCS DIRECTIVE

- CCS in EU ETS
- No free allocation to CCS



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## **US CO2 ABATEMENT CURVE**





# The world energy flows – efficiency potential



Approximate calculations based on data from IEA, plus energy balances of non-OECD countries 2002–2003

Units EJ



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## The energy challenge

"Meeting the world's growing energy needs in an environmentally responsible manner is a tremendous challenge. Technology is essential to answering that challenge"



Jeroen van der Veer Chief Executive, Royal Dutch Shell plc



### **COMMITTED TO CO2 MANAGEMENT**

#### **A VOLUNTARY COMMITMENT**

We set an aggressive, voluntary CO2 emissions target – to reduce emissions from Shell operations in 2010 to at least 5% lower than the 1990 level, even while we grow our business

In 2005, our emissions fell to 105 million tonnes CO2 equivalent – 15% below the 1990 level of 123 million tonnes

This has been accomplished by reduced flaring and increased efficiency in our operations

#### SHELL GREENHOUSE GAS EMISSIONS



Million tonnes CO<sub>2</sub> equivalent

### SHELL ENERGY EFFICIENCY PROGRAMMES GLOBALLY





### **RESULTS FROM SHELL ENERGY EFFICIENCY PROGRAMMES**

Manufacturing location	Energy use reduction, %	Realised savings (1), million USD/year
Refinery A, Europe	6.5	1.5
Refinery B, Americas	5.0	20
Refinery C, Asia	2.0	13
Petrochemical plant A, Europe	3.5	5
Petrochemical plant B, Americas	3.5	20
Minerals processing plant, Americas	5.0	1.9
Specialty chemicals plant, Americas	9.0	1.17

(1) The approximate validated annualised total value at end of each programme. This is the aggregate of all completed projects. The figure also includes non-energy benefits where applicable.

### **EFFICIENCY IMPROVEMENTS**

#### **CO<sub>2</sub> SAVINGS**



Delivered savings of 0.8 million tonnes of  $CO_2$  per year

That's the equivalent of 160,000 hot air balloons filled with  $CO_2!$ 

#### **FUEL SAVINGS**

Or



Delivered savings of 0.3 million tonnes of fuel per year

That's the equivalent of 12,000 road tankers filled with fuel oil, extending in a convoy for 180 km



### **LEADING IN CURRENT & FUTURE BIOFUELS**

#### Food crops **Bio-esters** Diesel Sunflower Oilseed rape CHOREN Soya Diesel + Conversion biomass Residues 2nd generation to liquids **IOGEN** Mogas + Enzymatic hydrolysis, Residues 2nd generation cellulose to ethanol Wheat Maize Sugar cane Food crops Ethanol Mogas

### Technologies for tomorrow



### **ENERGY AND CO2 HUB - ROTTERDAM**



# **CO<sub>2</sub> Capture Systems**



Focus for the presentation: Post Combustion and H2 Manufacturing



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# Mechanisms to drive unit CCS costs down



# ZeroGen: smarter, cleaner power

### Energy & CCS Demonstration Project, Australia, A World's 1st



# Shell capabilities in gas injection (1) Denver Unit CO<sub>2</sub> EOR project

### • Largest CO<sub>2</sub> project in the world

- More than 400 MMscf/d sustained  $CO_2$  injection in >100 patterns
- Over 200 MMscf/d gas processing/recycling on site
- Surveillance and management of CO<sub>2</sub> EOR in various areas
- Was developed by Shell
- Integrated Source & Transport







### LOWER COST CCS - TEST CENTRE MONGSTAD

•TCM's purpose is to develop knowledge and test solutions that will reduce costs as well as technical and economic risks associated with a large-scale carbon capture plant.

•TCM achieves these goals through cooperation with leading vendors of capture technologies and through construction/operation of demonstration plants

•The Test Centre at Mongstad is planned as a joint venture between the Norwegian State and a few key European oil and energy companies

•The project is at its <u>preliminary stage</u> of development and final investment decision is expected in 2008

### **INFLUENCING THE USE OF FUELS**

#### **CONSUMER BEHAVIOUR**



 Shell Sets the new Guinness World Record for Fuel Economy – circled the globe covering 28,970kms, across 25 countries, in 70 days, achieving 22km/l

#### THE NEXT GENERATION OF ENGINEERS



- Shell Eco Marathon 3000 participants from 250 teams from around the world push the boundaries of sustainability mobility
- Current record is 3880km/litre.



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### CONCLUSIONS

- Fossil fuels will be needed for much of this century.
- We accept that CO<sub>2</sub> emissions must be managed.
- We need investment certainty for our long life assets.
- Many new zero-CO<sub>2</sub> energy technologies are far from commercial and will need further support.
- Voluntary action will not deliver the changes needed.
- A policy framework will be needed to help reduce CO<sub>2</sub> emissions.



# THE 3<sup>RD</sup> HARD TRUTH: CO<sub>2</sub> EMISSIONS FOR VARIOUS CASES



Unless we take quick action, the concentration of greenhouse gasses could surpass levels that scientists consider still manageable.

## **Abatement Options in Refining**



Efficiency	: attractive but limited in volume
Regulations	: point beyond efficiency
CČS	: large volume, high cost

