WPC FEEDBACK:
DOWNSTREAM PERSPECTIVE

April 2012

Roelof Heezen
WPC: Forums with Downstream focus

- F12 - New Refinery Technologies to Meet Feedstock Flexibility, Transportation Fuel Demand and Quality
- F14 - Technology and Feedstock Changes in Petrochemistry
- F15 - Heavy Oil and Residue Upgrading
- F16 - Biofuels and Biomass: Feedstock Options Life Cycle Analysis
- F20 - Industry Responses to Climate Change
CHEMICALS PORTFOLIO + PERFORMANCE

- Base chemicals and derivatives portfolio
- Plant integration with refineries
- Growth potential through advantaged feedstock
- Product innovation

INTEGRATED CHEMICALS

EARNINGS
CCS Earnings - $ Bln

0 0.5 1 1.5
2005 2006 2007 2008 2009 2010 H1 2011

USGC BASE CHEMICALS SHIFT TO GAS FEEDS
Evolution of USGC industry cash margins + feedstock slate

- Advantaged Gas
- Ethane
- USGC Ethane margin

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# Heavy Oil and Residue Upgrading

## SHELL IN SITU PORTFOLIO

### PEACE RIVER
- Cold Production, Vertical Steam Drive and Cyclic Steam Stimulation
- Carmon Creek application 2010
- Potential for 80 kboe/d project
- Shell 100%

### AERA ENERGY
- Shell / Exxon LLC (Shell 51.8%)
- Production ~ 160 kboe/d
- Headquartered in Bakersfield CA
- Enhanced Oil Recovery with potential future use of SAGD

### COLD LAKE - ORION
- Steam Assisted Gravity Drainage (SAGD)
- Design capacity of 10 kboe/d
- Shell began operations in 2007
- Shell 100%

### GROSMONT
- Investigating In Situ Upgrading Process (IUP)
- 125,440 hectares in Athabasca oil sands region
- Shell 100%
Biofuels and Biomass: Feedstock Options Life Cycle Analysis

GASOLINE COMPARED TO ALTERNATIVE FUELS
WELL-TO-WHEEL CO₂ INTENSITIES

CONVENTIONAL GASOLINE BASELINE

CONVENTIONAL DIESEL BASELINE

Source: CONCAWE/JRC/EUCAR WM report (version 3)

* Biofuels numbers do not include possible indirect land use change effects
Industry Responses to Climate Change

QUEST - CARBON CAPTURE & STORAGE PROJECT

- Capture CO₂ at the Scotford Upgrader from 3 Hydrogen Units
- >1 mtpa CO₂ will be transported by pipeline and stored over 2 km underground
- Funding agreements signed with Government of Alberta and Government of Canada for C$865 million over the construction and 10 year operating life of the project
- Regulatory application submitted Dec 2010
- FID planned in 2012

QUEST PROJECT PROPOSED TIMELINE

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