UCG Syngas: Product Options and Technologies

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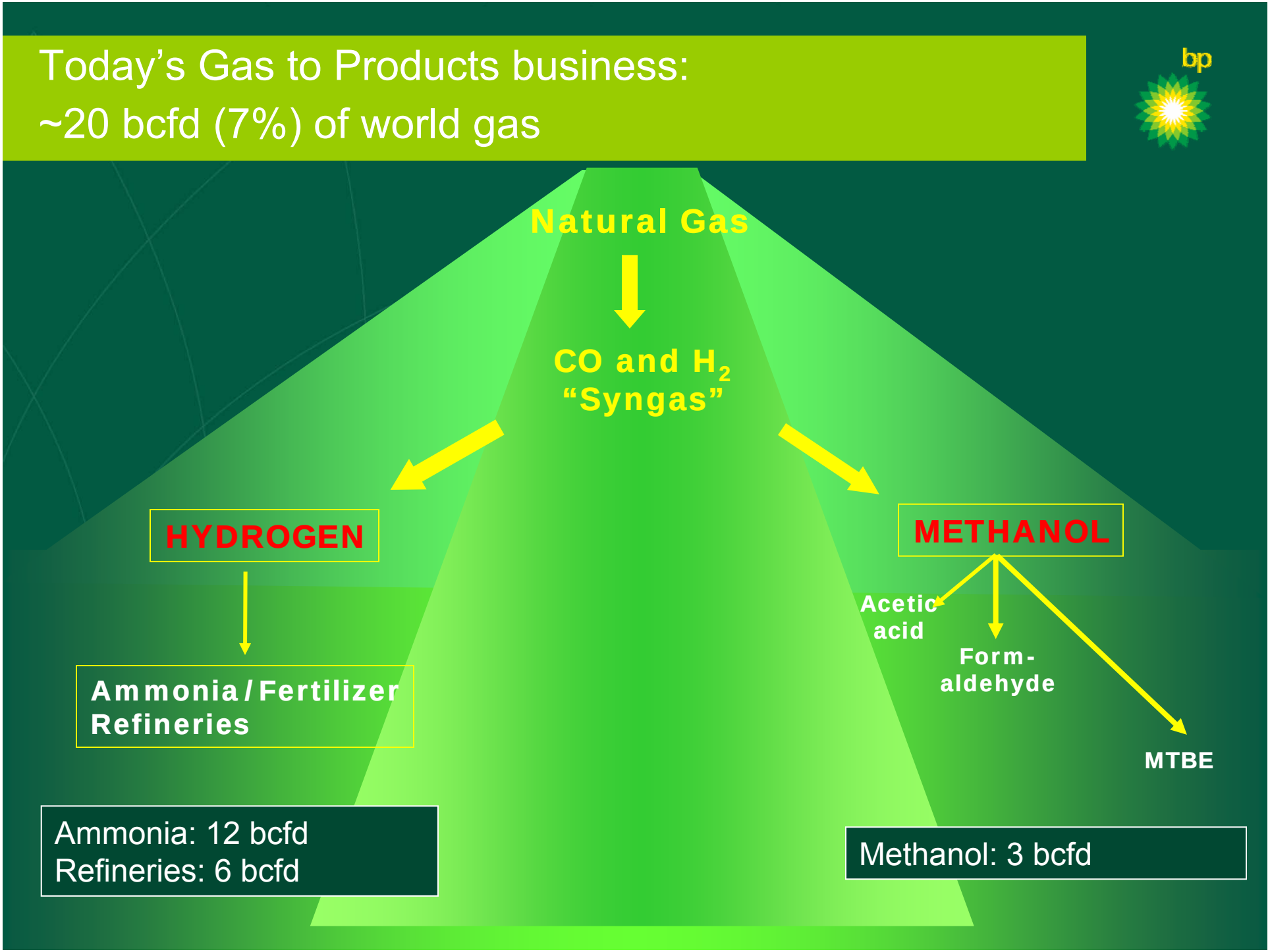
Some numbers and facts about BP

- BP is the 2nd largest oil company and 7th largest company in the world
- Market capitalisation of $219 billion (Feb 2005)
- 103,000 employees worldwide
- Presence in over 100 countries and 6 continents
- Production: 1.93 million barrels daily (oil)
  8.63 bcf daily (natural gas)
- 6.6 million barrels total daily refined product sales
- 29,200 service stations
- Serving 13 million customers daily, more than McDonalds

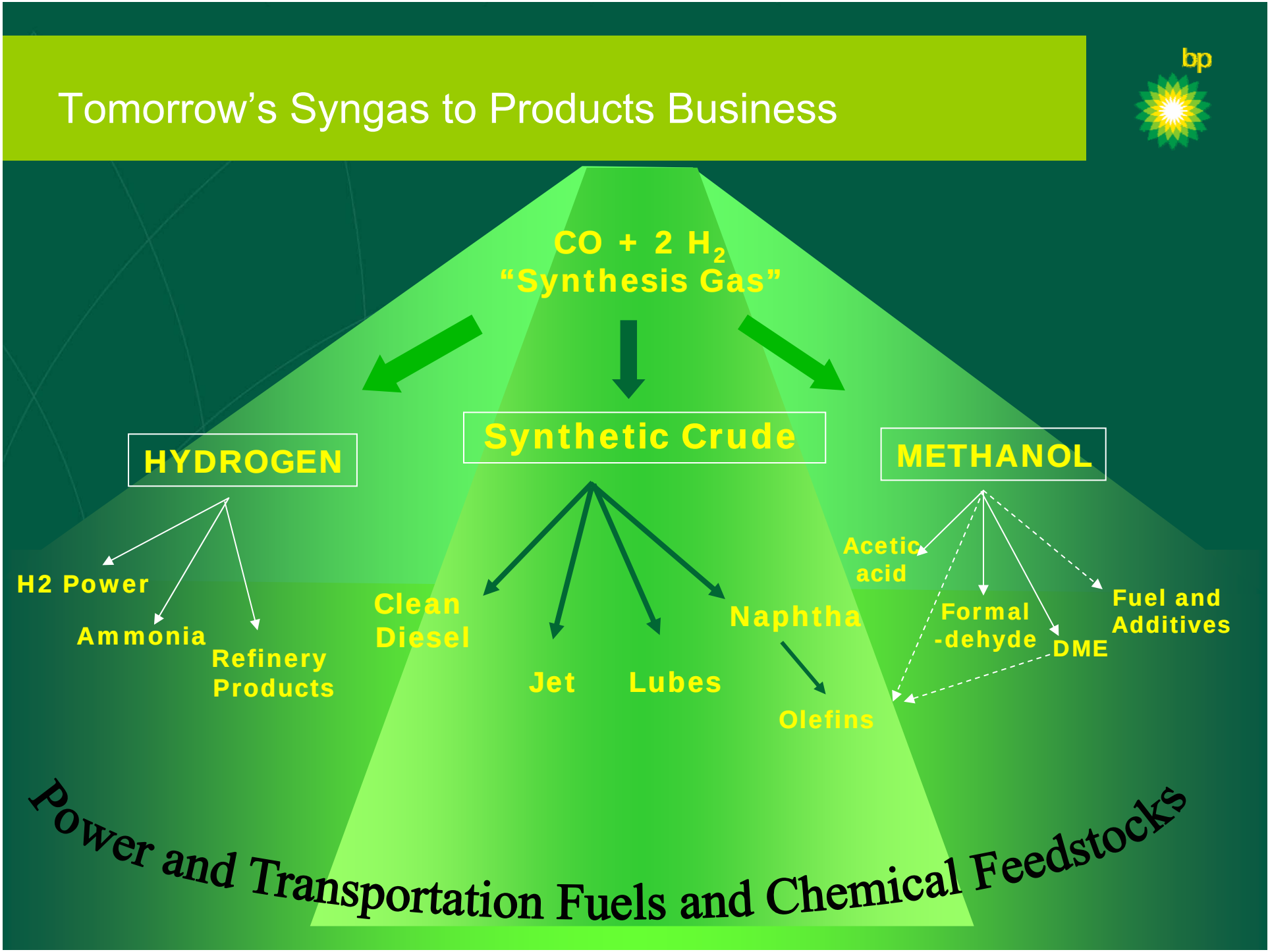
GTP Experience from Heritage Companies

- BP
  - GTL-FT, Compact reformer
  - Numerous direct conversion schemes
  - Autothermal cracking (ATC)
- Amoco
  - Focus on oxygenates (methanol derivatives); DMC, DMM
  - Inventors of DME (dimethylether, synthetic LPG)
  - Breakthrough technologies (OTM syngas)
- Arco
  - GTL-FT partnership with Syntroleum
  - Cherrypoint demonstration plant (70bpd); now at Catoosa
- Summary
  - Total spend: >$400MM over about 15 years

Today's Gas to Products business:
~20 bcfd (7%) of world gas



Tomorrow's Syngas to Products Business



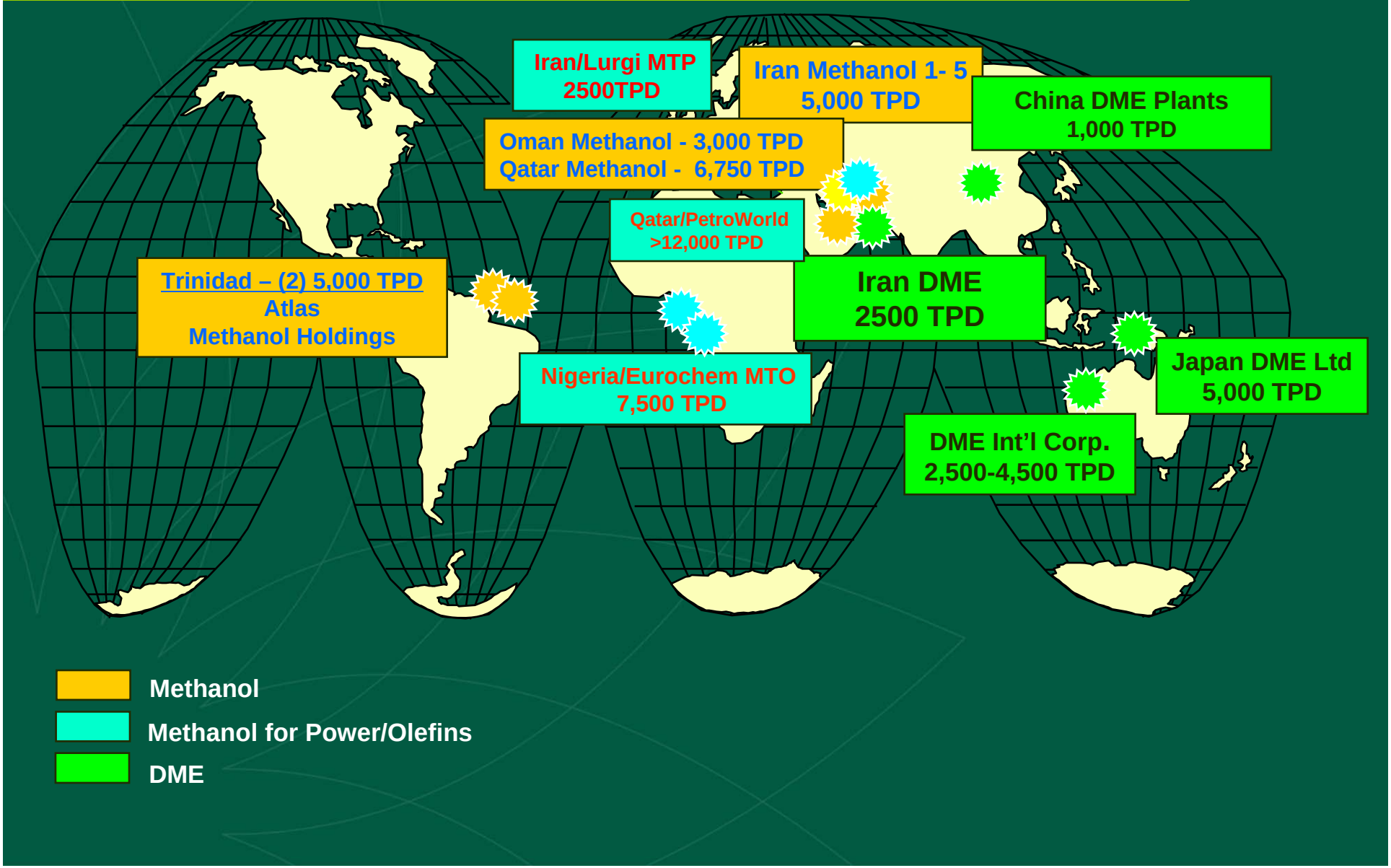
Syngas to Products offers large markets

Target Products	Market size, MMTPA
Benchmark: LNG	***140 (actual)***
Diesel	**1100**
Crude Oil	**3800**
Methanol, chemical	**34**
Methanol to/as gasoline	**900**
Methanol to DME (LPG)	**215**
Methanol to Olefins	**140**
DME (power, diesel)	**200**
Ammonia	**130**

Comparison GTL and MeOH

	GTL-FT	MeOH
Technology availability	Issue but improving	Global choice
Process steps	3	2
Efficiencies Thermal/carbon	60/77	70/85
Fuel markets	Conventional Large	New Large?!

Some Large Methanol/MTO/DME plants (built, proposed)



Atlas Methanol Plant (5000tpd = 15,000bpd GTL)

Atlas Methanol, Point Lisas Industrial Park, Trinidad

UCG Syngas offers Substantial Product Optionalities

UCG → Syngas Clean-up → Products

Products:
- Fuels
- Chemicals
- Electricity
- CO_2 for EOR/Storage

Major Markets


27%


13%

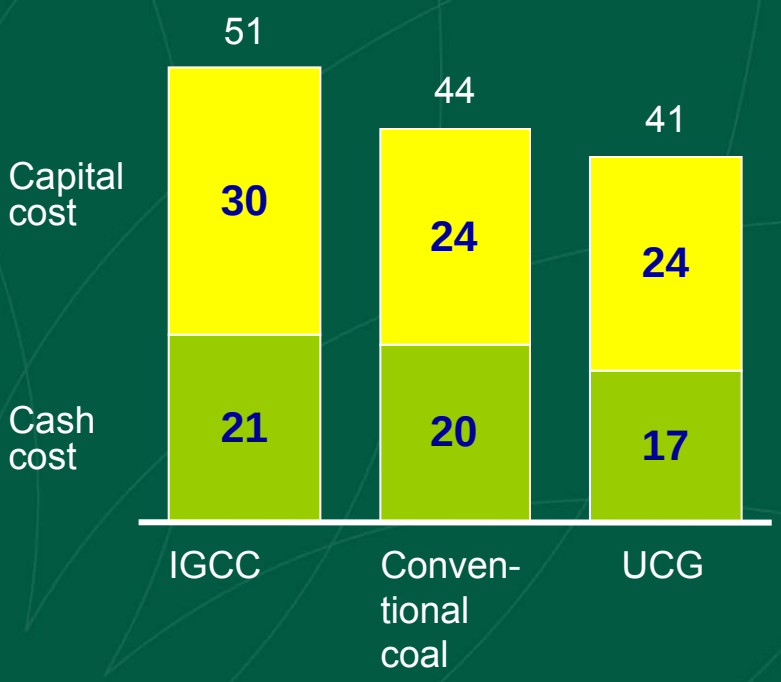

10%

Market size

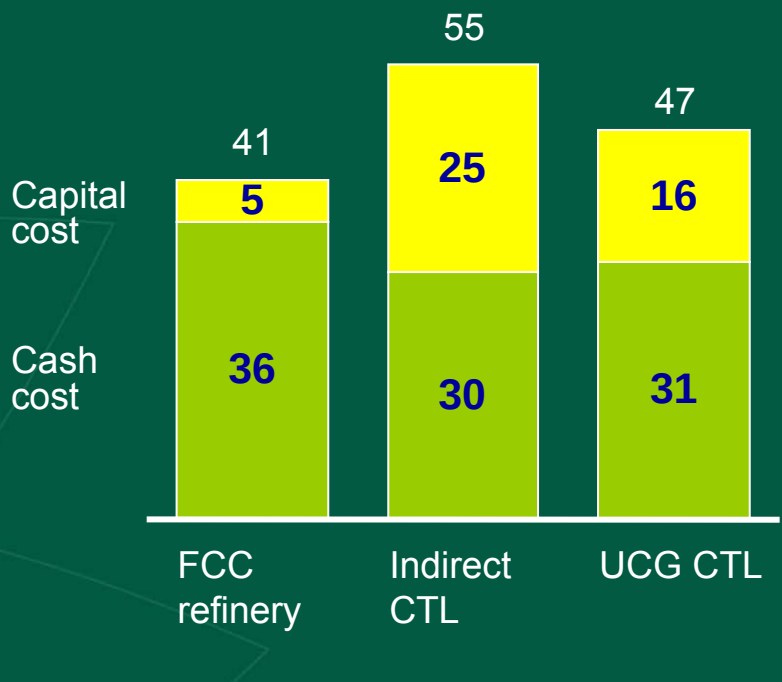
- Globally well over 600 billion tons of coal suitable for UCG production
- Using the power route and assuming 200 years to extract all reserves, yields annual revenues of **$410bn**
- Main markets relative to global reserves: **US** (27%), **China** (13%) and **India** (10%)

Preliminary Economics of UCG Appear Attractive

Power economics
(@ $1.5/mmBtu of coal)
$/MWh



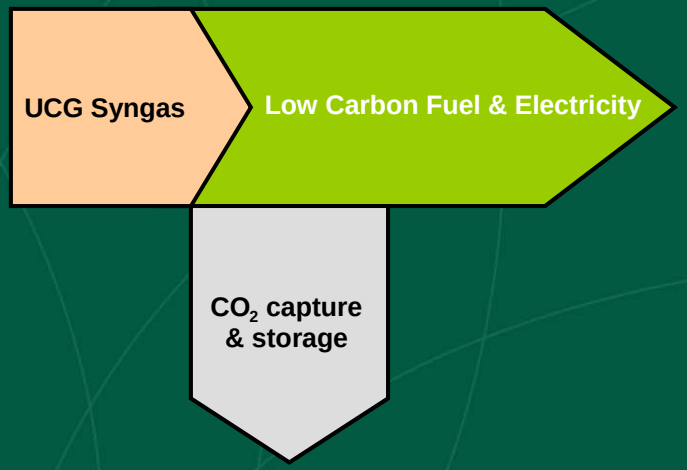
Transportation liquids economics
(@ $40/bbl crude)
$/barrel of gasoline/diesel



UCG has high potential in power and is feasible in liquids at price >$40/bbl

UCG Syngas for Carbon Free Hydrogen Power

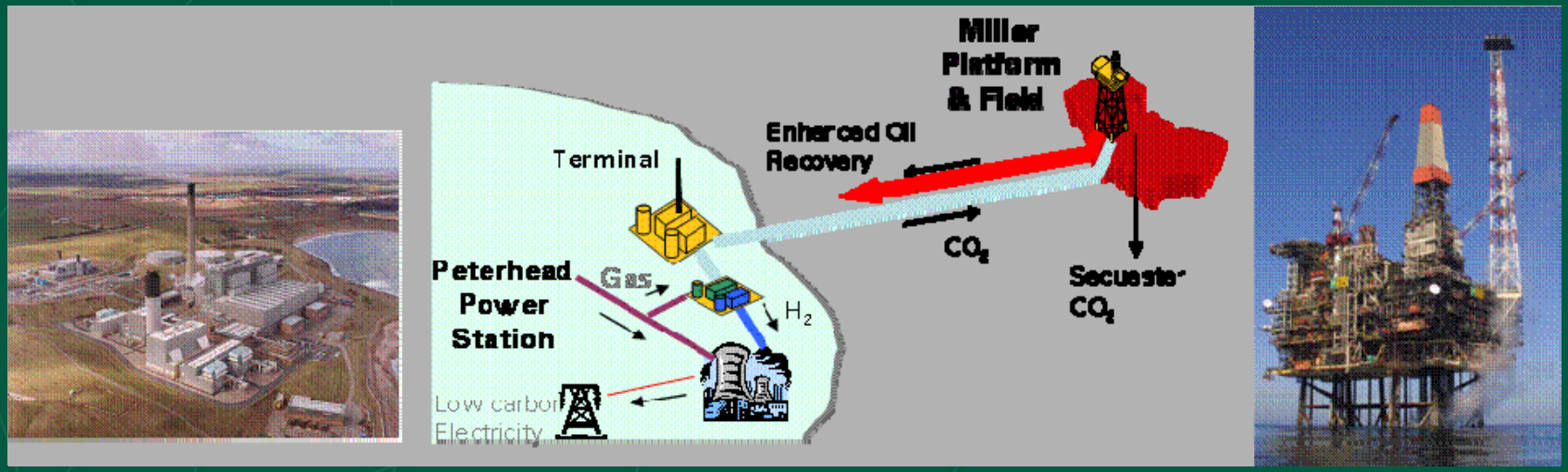
Concept



Offer

1. A material scale business opportunity
2. A substantial new climate change solution
3. A sustainable alternative to access coal

BP Scotland H2 Power Project (DF 1)



Climate Change Milestones

- 480MW of clean electricity
- Capture and store 1.8 million tons of carbon dioxide a year, equivalent of removing 500,000 cars from the road
- Provides more electricity than UK's entire wind farm capacity combined

Project Milestones

- Largest CO2 EOR project in North Sea
- 1st CO2 pipeline in the North Sea
- 1st CO2 storage in an offshore oil field
- World's largest hydrogen-fired power generation facility
- World's largest Auto Thermal Reformer

BP Gas to Products Organisation

- Extensive GTP experience from heritage companies - BP, Amoco and Arco
- Global team of ~ 60 providing full-range of technology, commercial and project support services
- Strong relationship with Davy Process Technology (UK) on GTL
- Extensive in-house R&D programme :
  - advanced fixed bed FT technology;
  - innovative slurry phase FT technology;
  - new technologies to convert gas to transportation fuels and petrochemicals
- External R&D programmes :
  - Caltech and Berkeley Universities in USA
  - Chinese Academy of Sciences
  - improved and breakthrough GTP technologies

BP Fischer Tropsch Technology : Fixed Bed

Nikiski Demonstration Plant, Alaska

- Capacity 300 barrels per day (3 mmscfd gas feedstock)
- Started production 2002 – over 1 million manhours of safe operation
- Proprietary BP catalyst (cobalt-based)
- Well established multi-tubular reactor – multiple manufacturers and >50 million tonnes per year of applications worldwide
- FT technology developed in BP since 1981; in partnership with Davy Process Technology since 1996

Summary

- Syngas to Products technologies provide MULTIPLE options to monetize UCG
  - LARGE new markets
  - Mature technologies and proof of technologies
  - Product values tied to crude oil (diesel, LPG, etc)
- UCG has the potential to offer an economic route to syngas production – but only if technology is proven at scale and site development costs are contained
- UCG is relevant to India and can contribute to the nation's energy security
- Carbon management is critical to sustained UCG implementation