



SPE DISTINGUISHED LECTURER SERIES

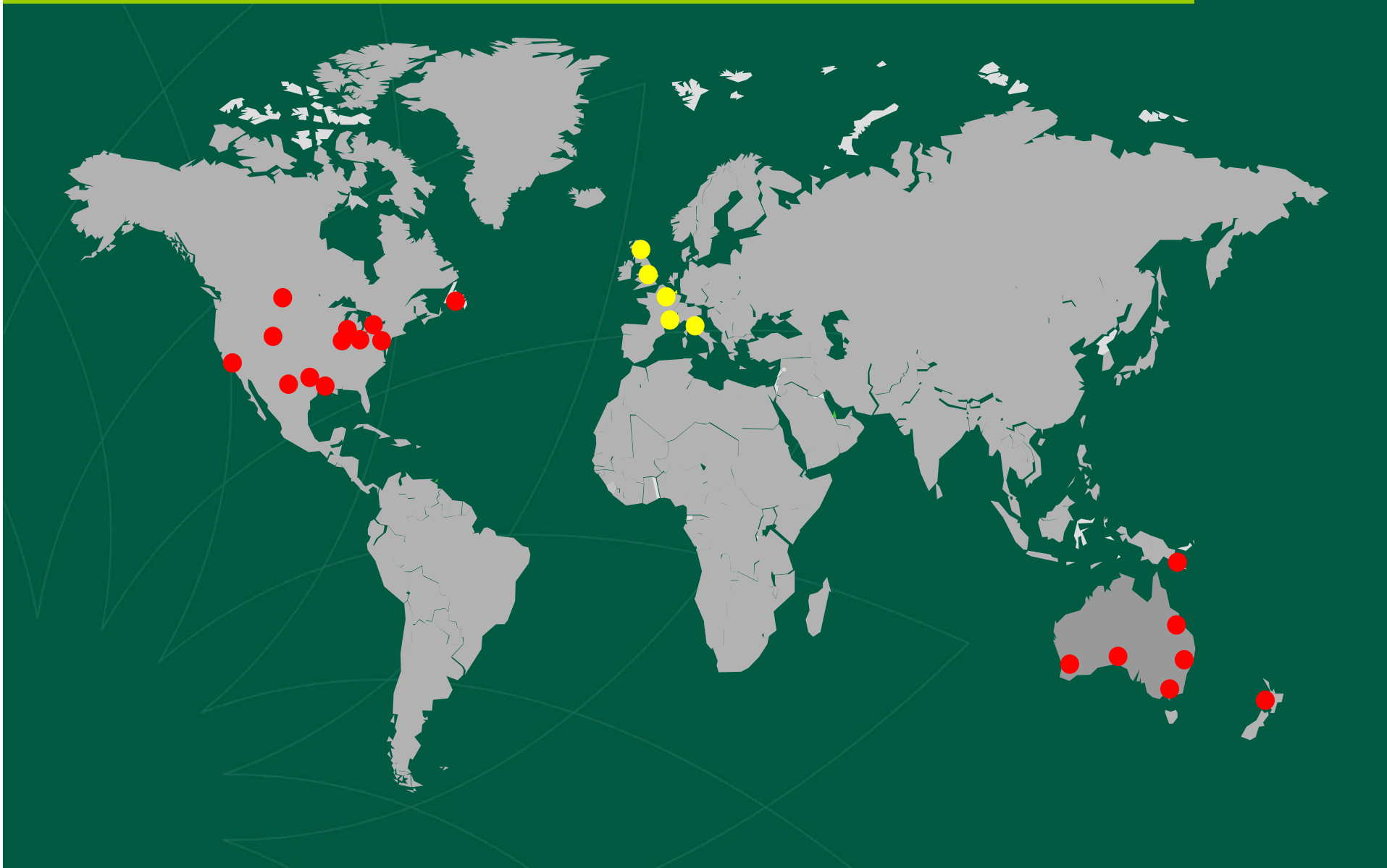
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My SPE Distinguished Lecture tour





SPE DISTINGUISHED LECTURE
**The End of Stranded Gas:
The Emergence of the Gas to Products Option**

Dr. Theo H Fleisch
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Houston, TX 77079

Outline

- Problem with gas: stranded or associated
- Gas monetization options
- The case for Gas To Products (GTP)
 - What is GTP and GTL?
 - Products and markets
 - Technologies
 - Global projects
 - Economic viability
 - BP's role in GTP
- The future of GTP

Gas resources: plentiful but...

- Gas Reserves (2005) = 6500TCF (185TCM); “under-explored”
- R/P ratio: ~70 years (versus oil at ~35)
- About 40% of gas (2500TCF) is stranded
 - (Russia, Qatar, Australia, Alaska, ...)
 - Solution: conversion of gas into transportable liquid
- Associated gas: re-injected or flared

Flaring of associated gas (in red; 15 bcfd?)



Remote and flared gas: an inexpensive feedstock

GTP Value creation:

Feedstock: \$0 to 1.50/MMBTU

Products: \$10/MMBTU

(diesel at \$50 oil or methanol at \$200/t)

GTP: Transportable, high value products

Greater netback to the feedstock

New markets for gas

Remote Gas Monetization Options

PIPELINE

LNG

GTL (FT, Fischer-Tropsch)

METHANOL

DME

CNG

GAS BY WIRE

HYDRATES

GAS BY BAG

PUSHING THE LIMITS (\$25B)

TECHNOLOGY OF CHOICE TODAY

BIRTH OF A NEW INDUSTRY

TRANSITION FROM CHEMICAL TO FUEL

“SYN-LPG”, ASIAN TIGER AWAKENS

A NICHE FOR SMALL & SHORT (EnerSea)

DC TRANSMISSION COST DECREASING

MOVING A LOT OF WATER

A VERY SMALL NICHE

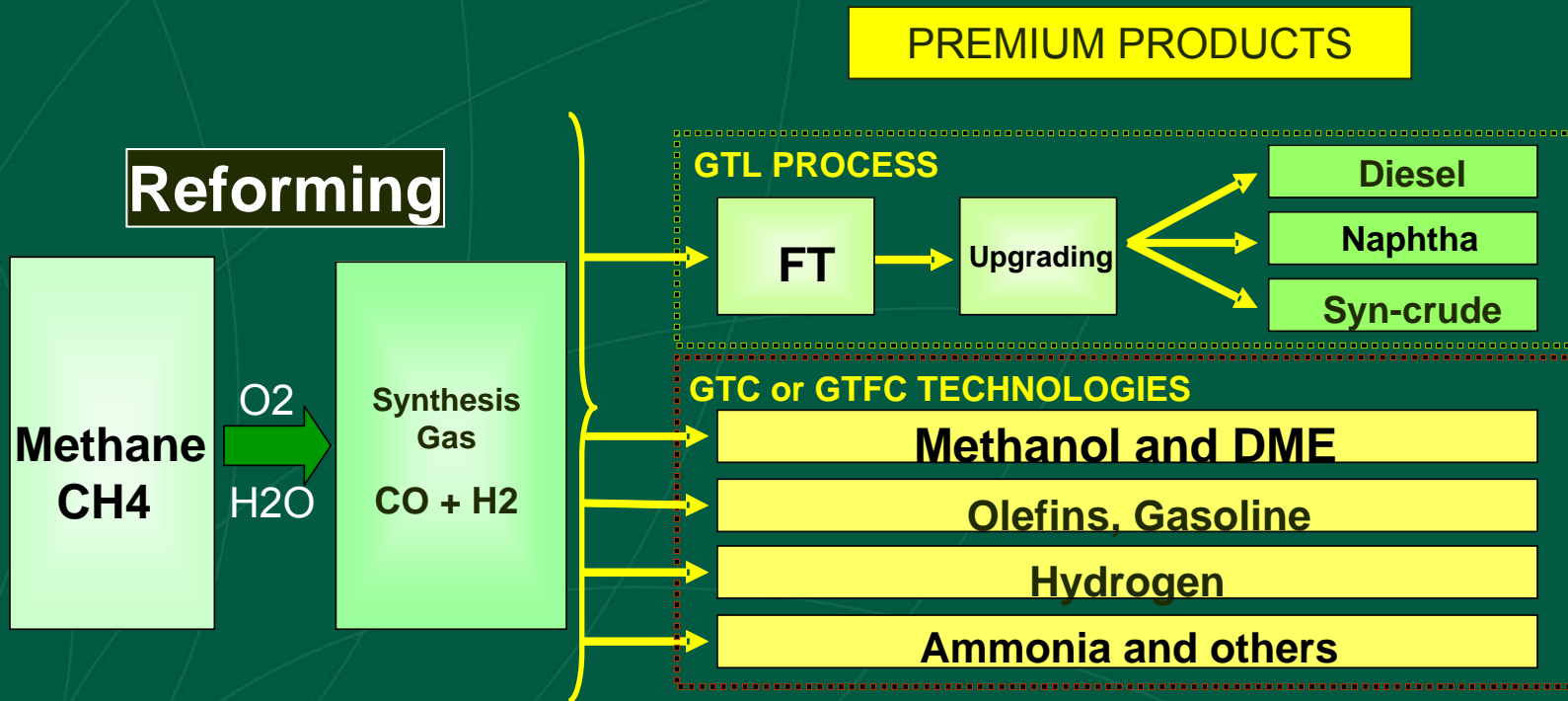
Gas by Bag



Outline

- Problem with gas: stranded or associated
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GTP: Inclusive term for all chemical gas conversion options (today: 20 bcf/d)

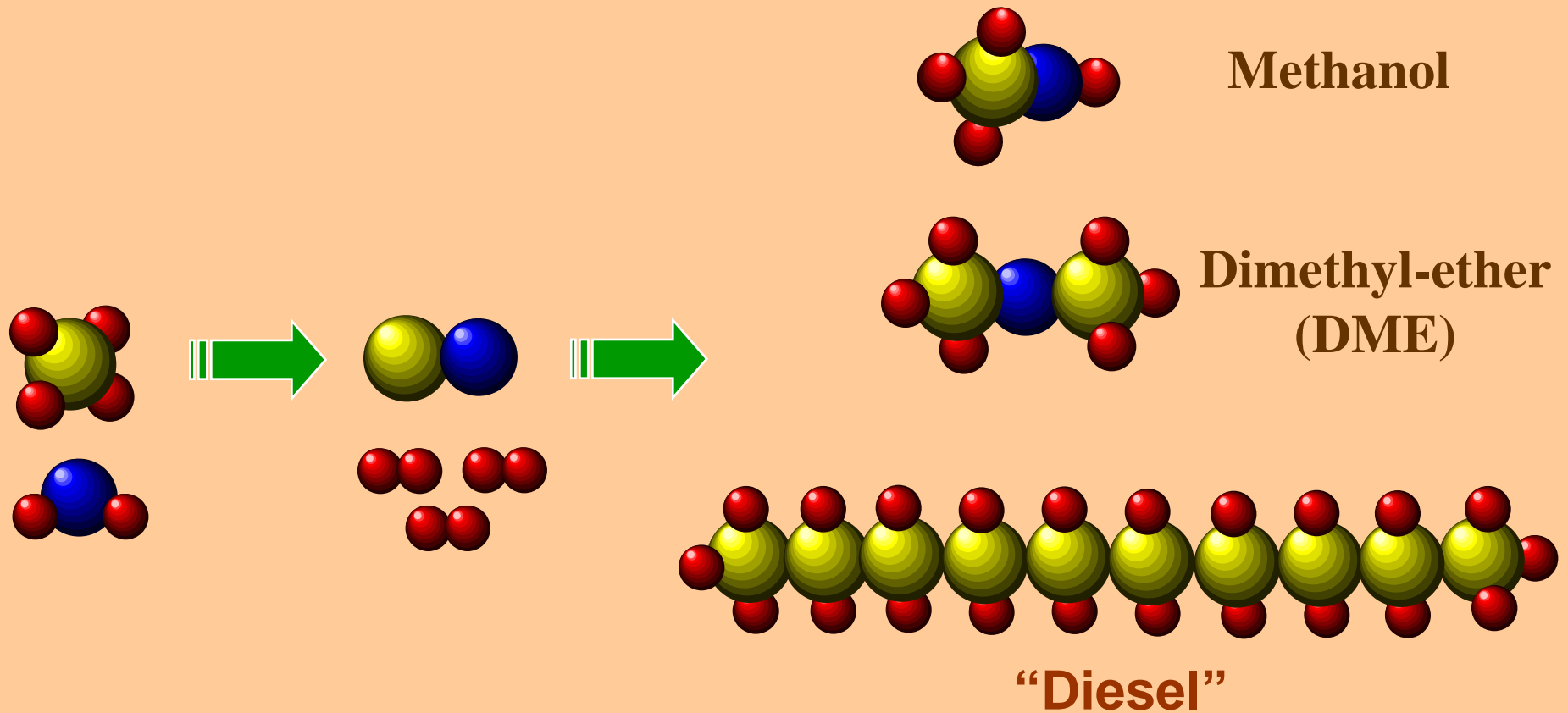


GTL: Gas to Liquids (FT- Fischer Tropsch)

GTC: Gas to Chemicals

GTFC: Gas to Fuels and Chemicals

Some simple conversion chemistry

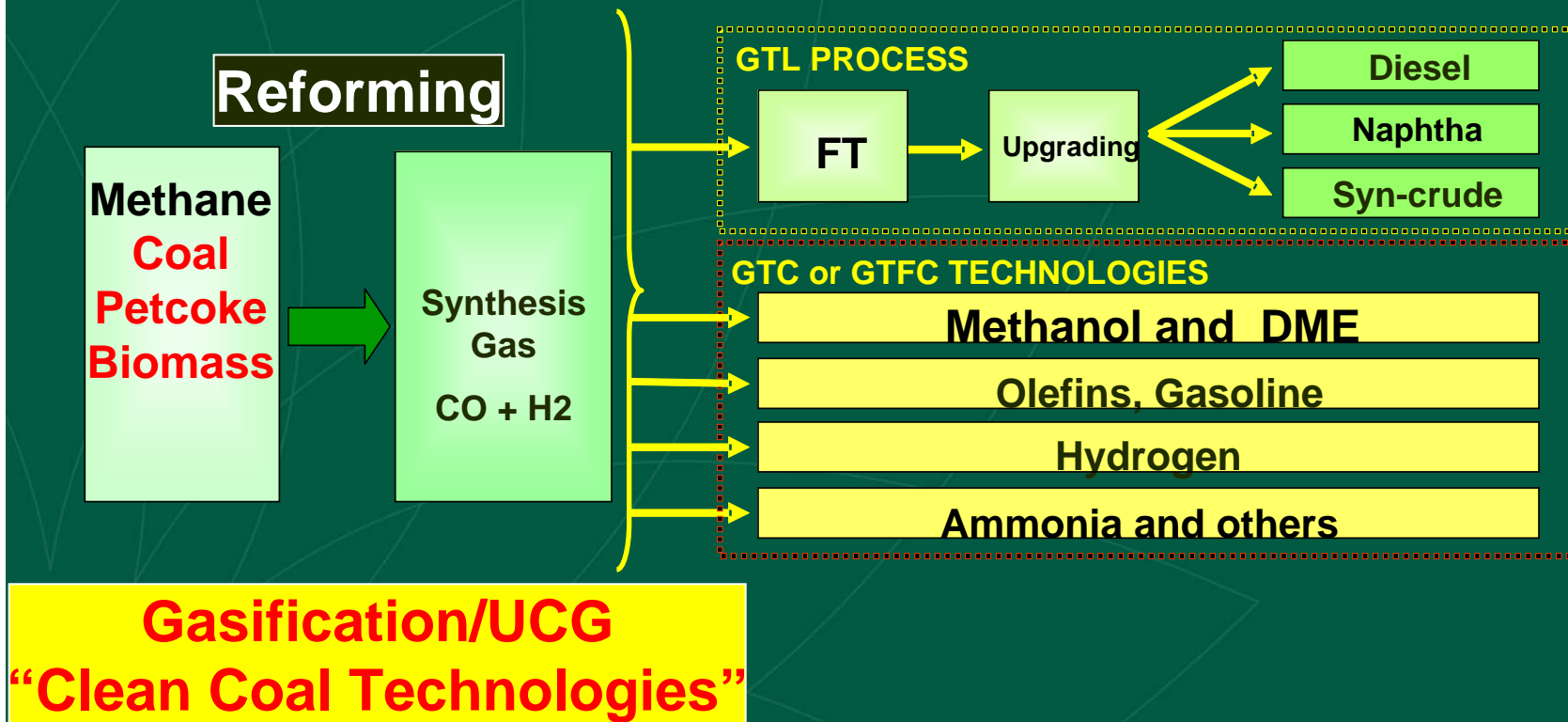


● Hydrogen

● Carbon

● Oxygen

Industry moves from GTP to "XTP"



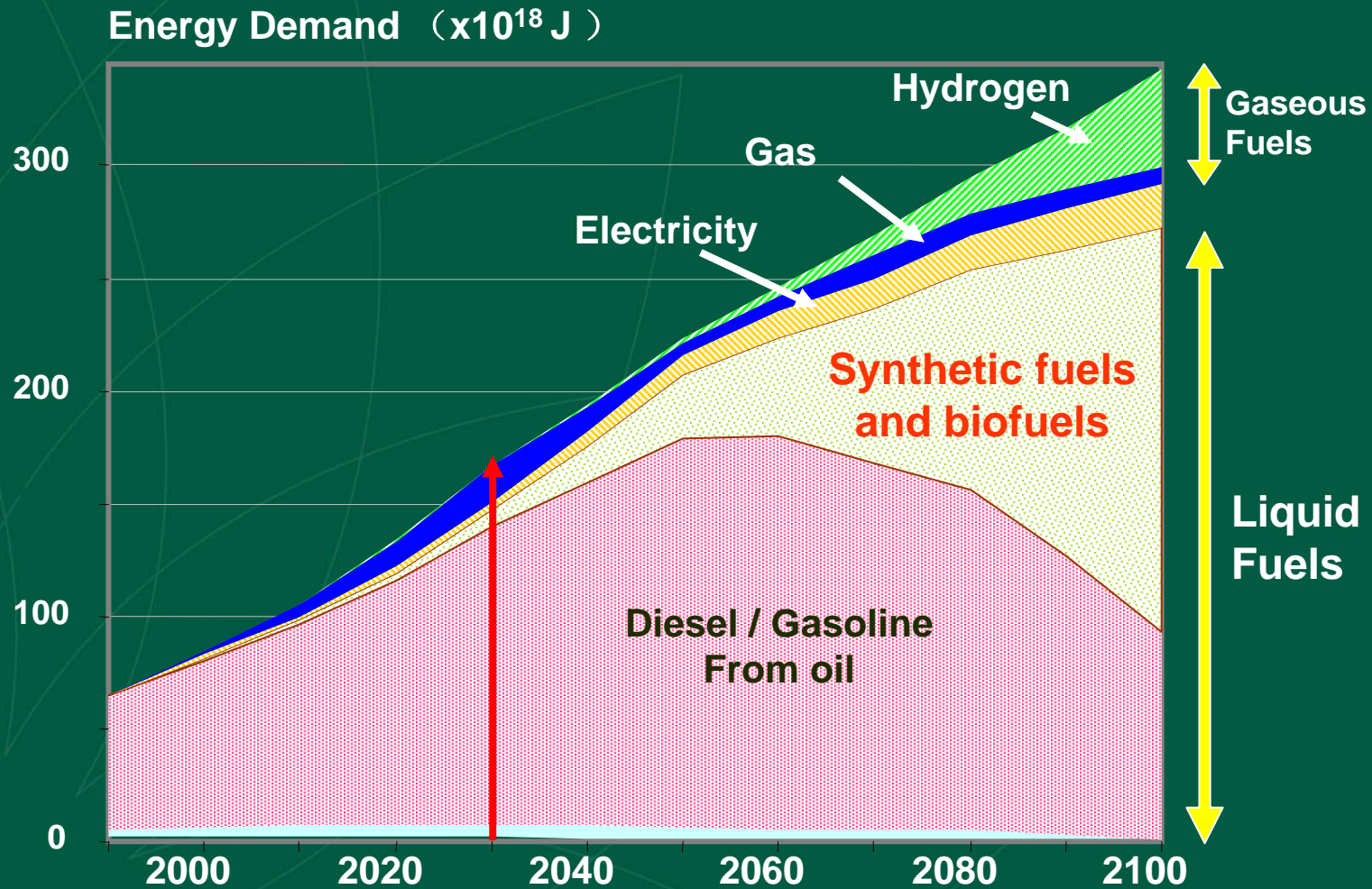
GTP offers large markets for gas

Target Products	Product market size MMTPA
<i>Comparison: LNG</i>	<i>150 (actual size)</i>
Synthetic "crude"	3800
GTL-FT Diesel	1100
Methanol, chemical	34
Methanol as/to gasoline	900
Methanol to DME (LPG)	215
Methanol to Olefins	140
Power (methanol, hydrogen)	Very large
Ammonia	130

2030: Some likely transportation fuel scenarios

- Transportation will remain the domain of liquid hydrocarbons, but oil dominance will decline
 - emergence of synthetic fuels (e.g. GTL, CTL, biofuels)
 - preferred marketing through blends (~5 to 30%)
 - improved performance, lower emissions
 - hydrogen is a very long term option, if it's there at all
- Demand side reduction has enormous potential
 - PNGV: 80 mpg hybrids
 - dieselization

Automotive fuel demand scenario to 2100

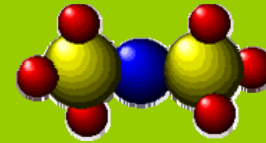


Source: IEA

The dangers of technical prediction

- **Nuclear-powered vacuum cleaners will probably be a reality in 10 years** - Alex Lewyt, president of vacuum cleaner company Lewyt Corp., 1955
- **There is no reason anyone would want a computer in their home** - Ken Olson, president of Digital Equipment Corp. 1977
- **Drill for oil? You mean drill into the ground to try and find oil? You're crazy.** - Drillers who Edwin L. Drake tried to enlist in 1859
- **Radio has no future. Heavier-than-air flying machines are impossible. X-rays will prove to be a hoax** - William Thomson, Lord Kelvin, 1899

About DME



- Easily made from methanol
- Physical properties: like LPG
- Clean bill of health
- Multi-purpose fuel
 - LPG extender (commercial)
 - Ultimate Diesel fuel (fleet demos)
 - Power production (CCGT)
 - Other: olefins, hydrogen, gasoline
- International DME Association (IDA)
- www.aboutdme.org



Methanol/DME in China

2020: 60/30

Year	Thousands MT/yr
2004	40
2005	155
2006	275
2007	935
2008	1555
2009	4155
2010	8355

Shandong Jiutai Chemical industry
1 million T/y - 2009
Xinao Group
400,000 T/y - under construction
Mengda Group
1 million T/y - under planning
Luthianhua Group
200,000 T/y - under planning
China Nat. Coal/Sinopec
3,000,000 T/y - 2010
Yigao Chemical Co
20,000 T/yr - Aug 2006 wet commiss.

Shanxi Lanhua Sci-Tech
100,000 T/y - under construction, 2007 (Jincheng)
Lanhu Group
1,000,000 T/Y - under planning

Shandong Jiutai Chemical Industry
30,000 T/yr - 2003
100,000 T/yr - 2005

Shenhua Ningxia Coal Industry Group
210,000 T/y - 2007
To 830,000 T/y - 2008

Yankuang Group
200,000 T/y - 2009

Luthianhua Group Inc, Sichuan
10,000 T/y - 2003
110,000 T/y - 2006

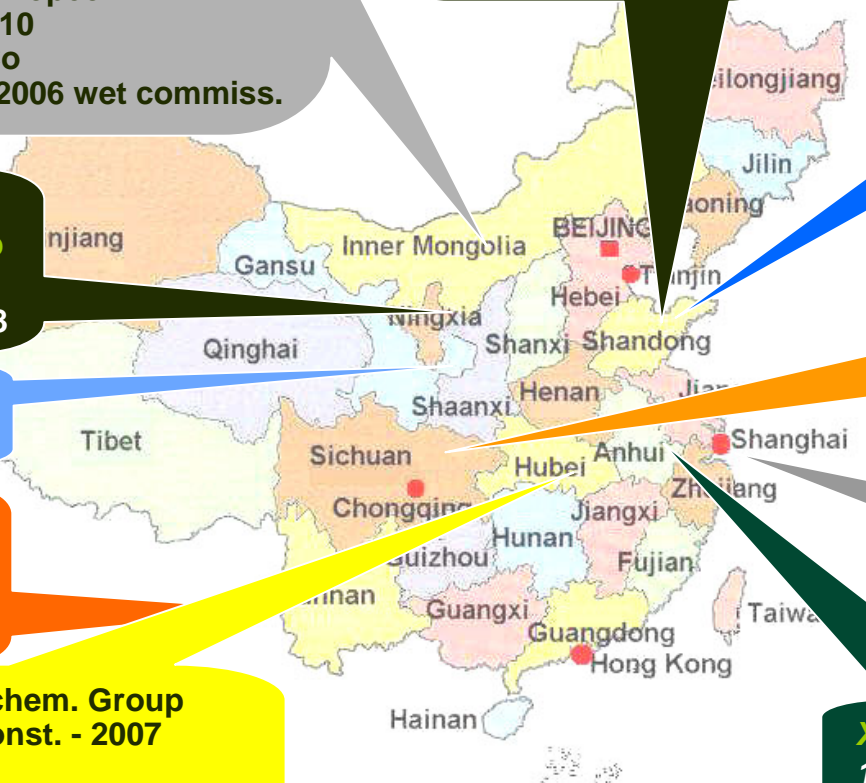
Yuannan Jiehua Chem. Group
150,000 T/y - 2007
Under construction

Shanghai Coking/Huayi Company
5000 T/y - Apr. 2006

Hubei Zhongjie Petrochem. Group
100,000 T/y - under const. - 2007

Xinao Group
10,000 T/y - Jan. 2006

Hubei Biocause Pharmaceutical
100,000 T/y - under planning - 2007



Walter Flowers Clean Energy Achievement Award

Dr. Theo H Fleisch

Dr. Yotaro Ohno

Outstanding Achievement Award

For the Advancement of

DME

as a new and clean

Multi-feedstock & Multipurpose

Fuel

Paris, September 2006



Role of GTP in host countries

- **Gas resource holder increasingly value GTP**
 - GTP: Requirement for gas access and country entry
 - Algeria: Tinrhert GTL bid
 - Qatar: “GTL Capital of the World”
 - Trinidad: “GTP Capital of the World”
 - No more flaring policies
- **Key advantages**
 - Diversity of products and markets
 - Country industrialization (investments, jobs)
 - Acceleration of gas monetization
 - New “unconstrained” markets for gas

GTL: large unconstrained markets

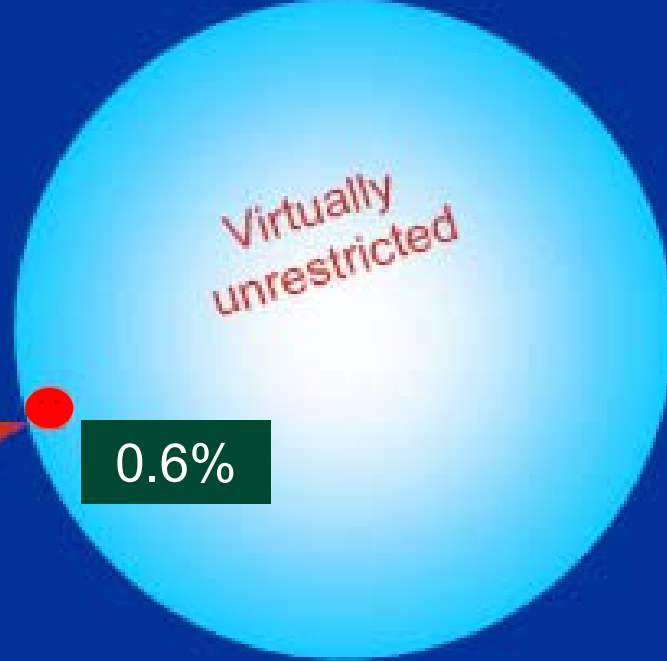
LNG
150 mln tpa



8%

15 tcf gas
over project life

GTL product slate
2,000 mln tpa



0.6%

GTL (and some other GTP) markets are virtually unconstrained

GTP is an excellent complement to LNG