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# The Value Opportunity for New Zealand's Lignite Deposits

NZ Minerals Conference 2005

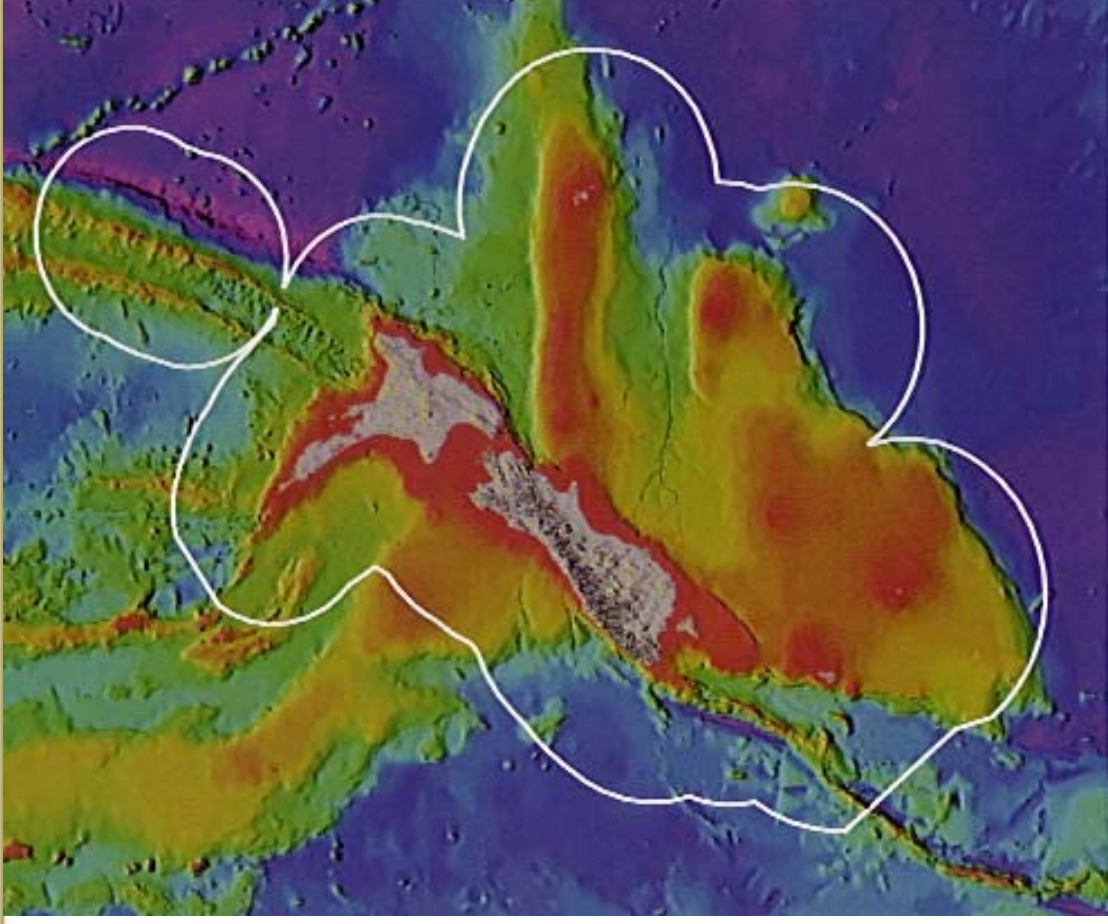
George Hooper  
*Centre for Advanced Engineering*

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All our energy sources ultimately derive from our primary resource base.

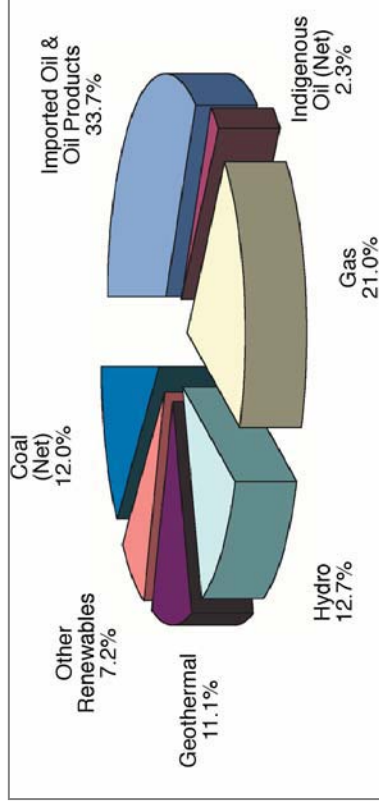
The question for today is:-

*“Should this country with a small population and a large resource-rich territory be a net consumer or a net supplier of energy commodities”?*

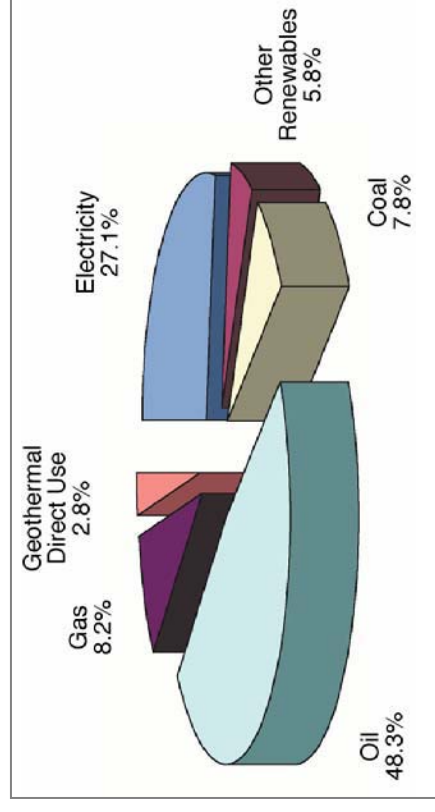


- **Primary energy supply is around 766PJ/y - dominated by our thermal fuels market**
- **As a country we are self sufficient in all energy forms apart from oil.**
  - most indigenous product is exported
  - 34% self sufficient in oil products
  - Shift towards distillate fuels to replace gas is further reducing self sufficiency
- **NZ consumer energy (514PJ/y) dominated by domestic transport - which accounts for about 212PJ/y.**
  - Transport demand projected to grow strongly at around 2%/y
  - Electricity consumption increasing at about 2% /y
  - Energy efficiency improvement targets remain ambitious.

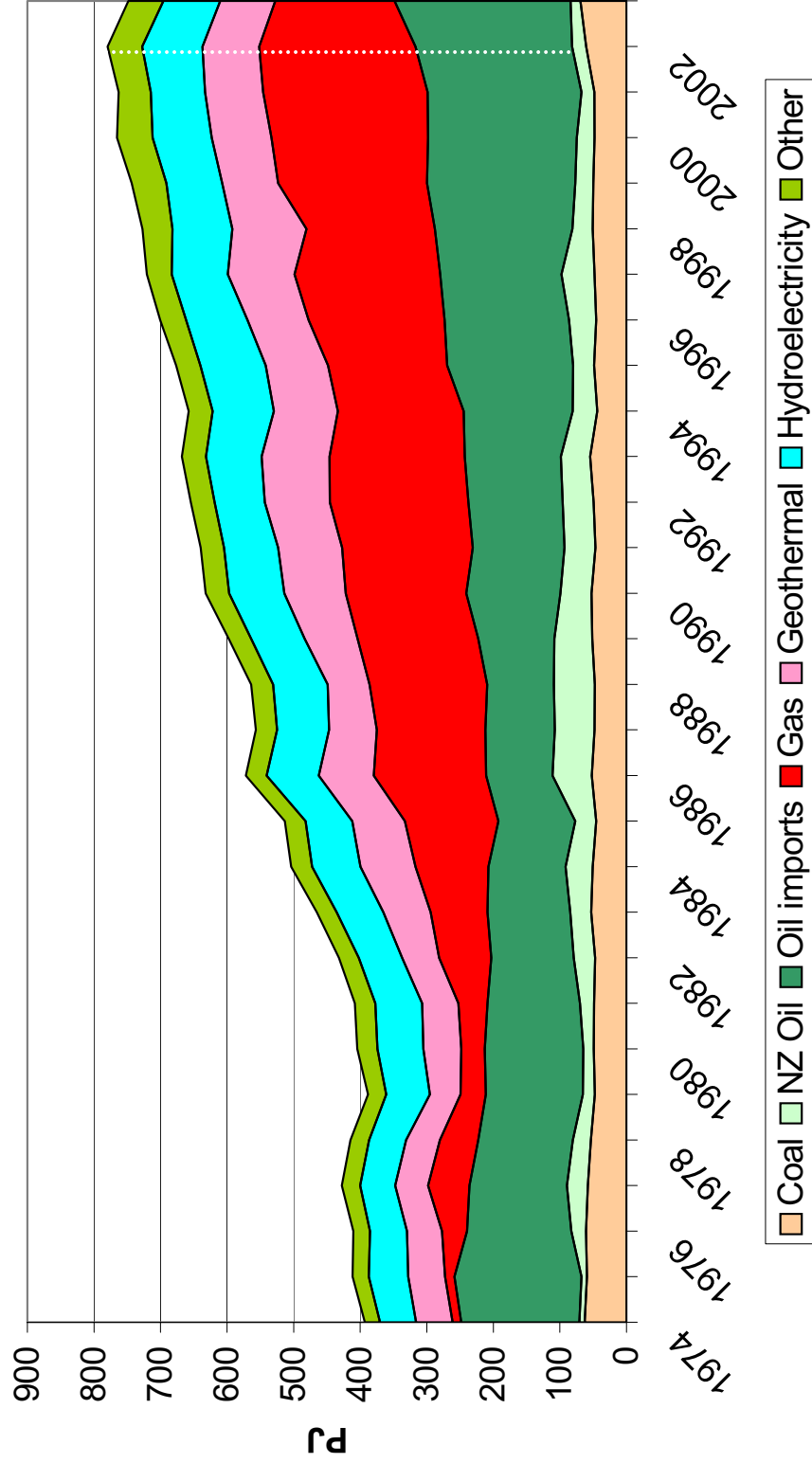
**Figure 1: Primary energy supply**



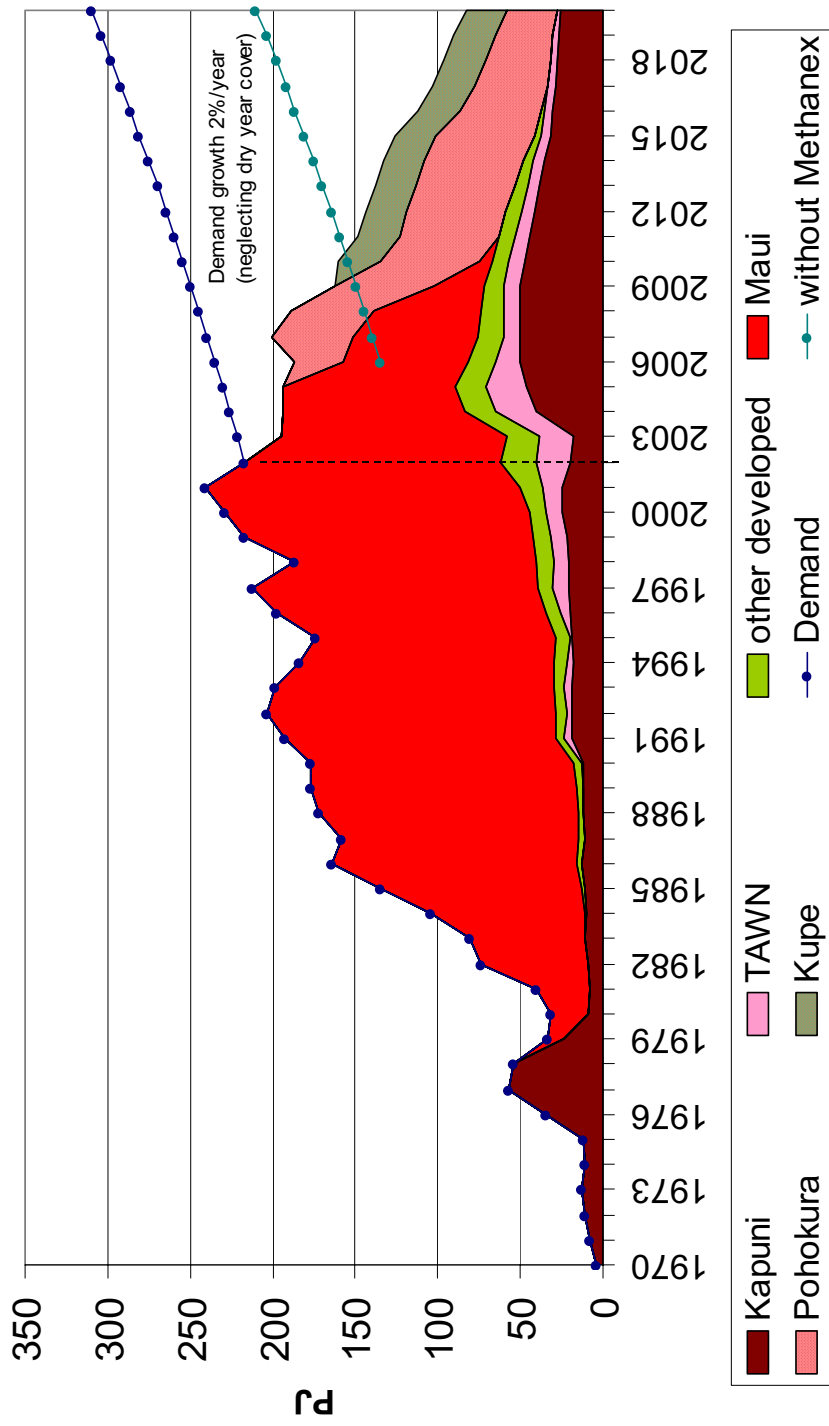
**Figure 2: Total consumer energy by fuel**



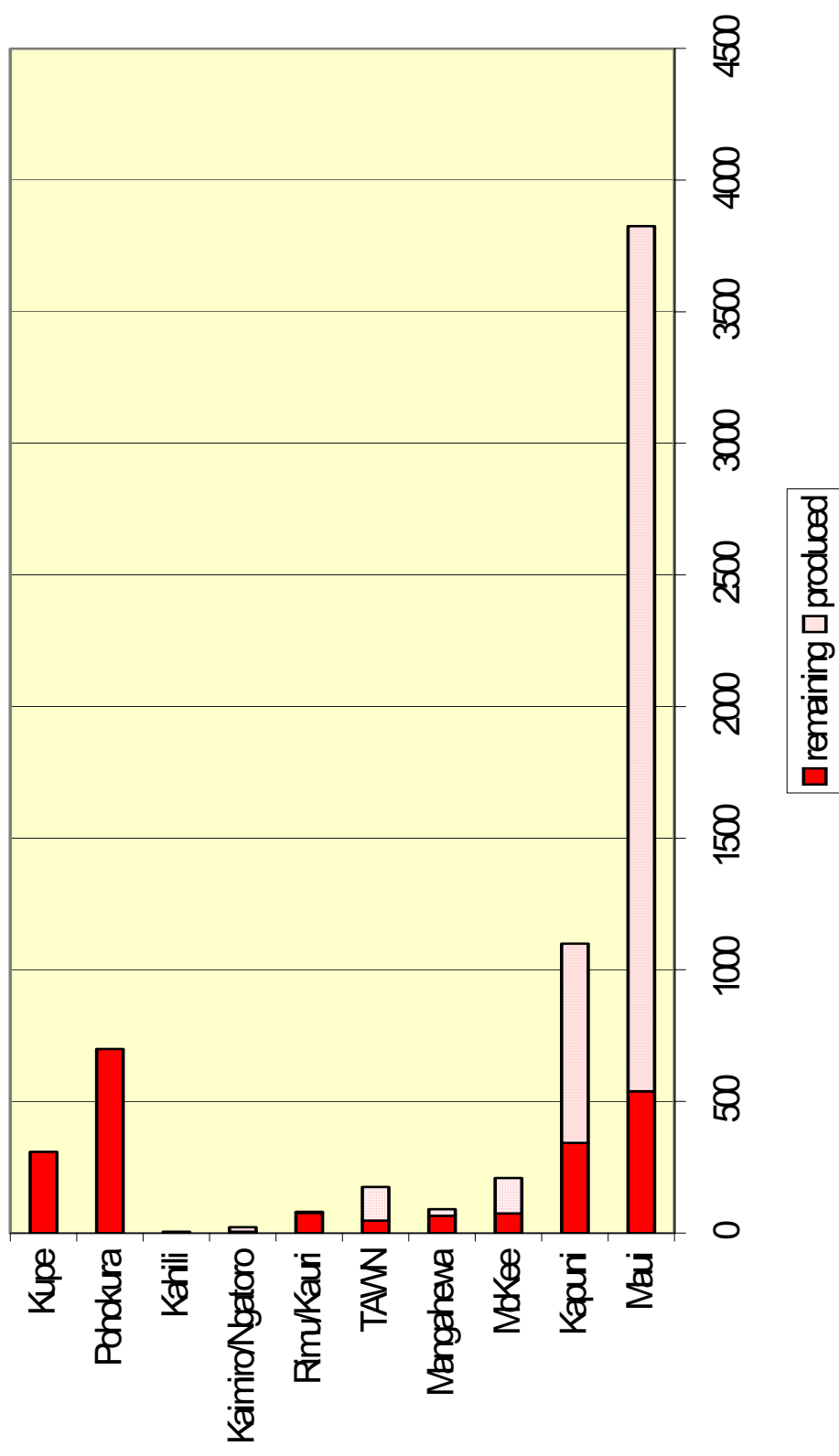
## New Zealand Primary Energy Supply



## New Zealand gas market



### New Zealand gas reserves



## Primary energy supply:

- Gas reserves are not being replaced at their rate of consumption due to inadequate levels of exploration investment
- Past failure to secure sufficient gas reserves to maintain at least partial methanol production makes the gas market vulnerable to price volatility
- NZ exploration opportunities are skewed towards the high-risk, high-capital end of global opportunities
- If additional new gas reserves are not developed soon coal or distillates are the only realistic fossil fuel alternatives
- In the absence of forward supply planning, NZ will become reliant on imported fuels

- Despite strong fundamentals, exploration investment too low to sustain gas requirements
- Coal resources ample but requires both mine developments and new investment in modern generating plant
- Long-term potential for gas and gas hydrate in remote offshore situations
- In the absence of gas discovery NZ will need to supplement a dwindling indigenous supply with imported fuels
  - Coal
  - Distillate
  - LNG?

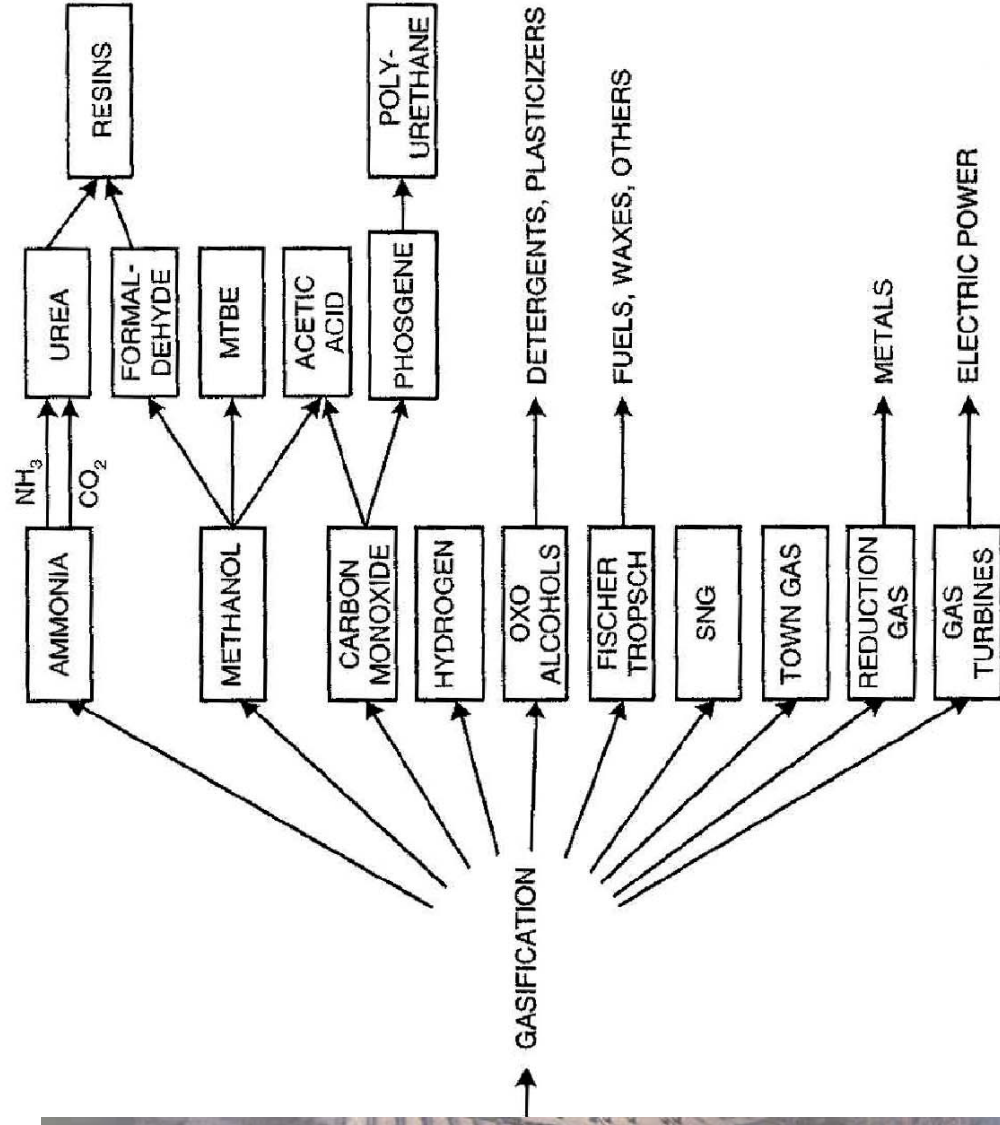


## *New Zealand is at a crossroad*

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- We are an energy-rich country, yet unless we change our thinking we are facing a shock as severe as the oil crises of the 1970s
- The critical constraint facing New Zealand is not electricity but immediate tactical action to manage the transition from dependence on Maui gas to a preferred energy future
- If we get the strategy wrong, New Zealand will revert to being dependent on global; oil markets; limiting our options; raising costs and stunting economic growth

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Process

Pyrolysis

*Gasification*

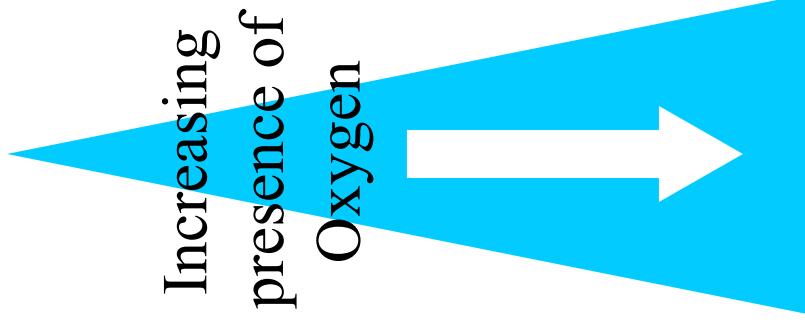
Combustion

Products

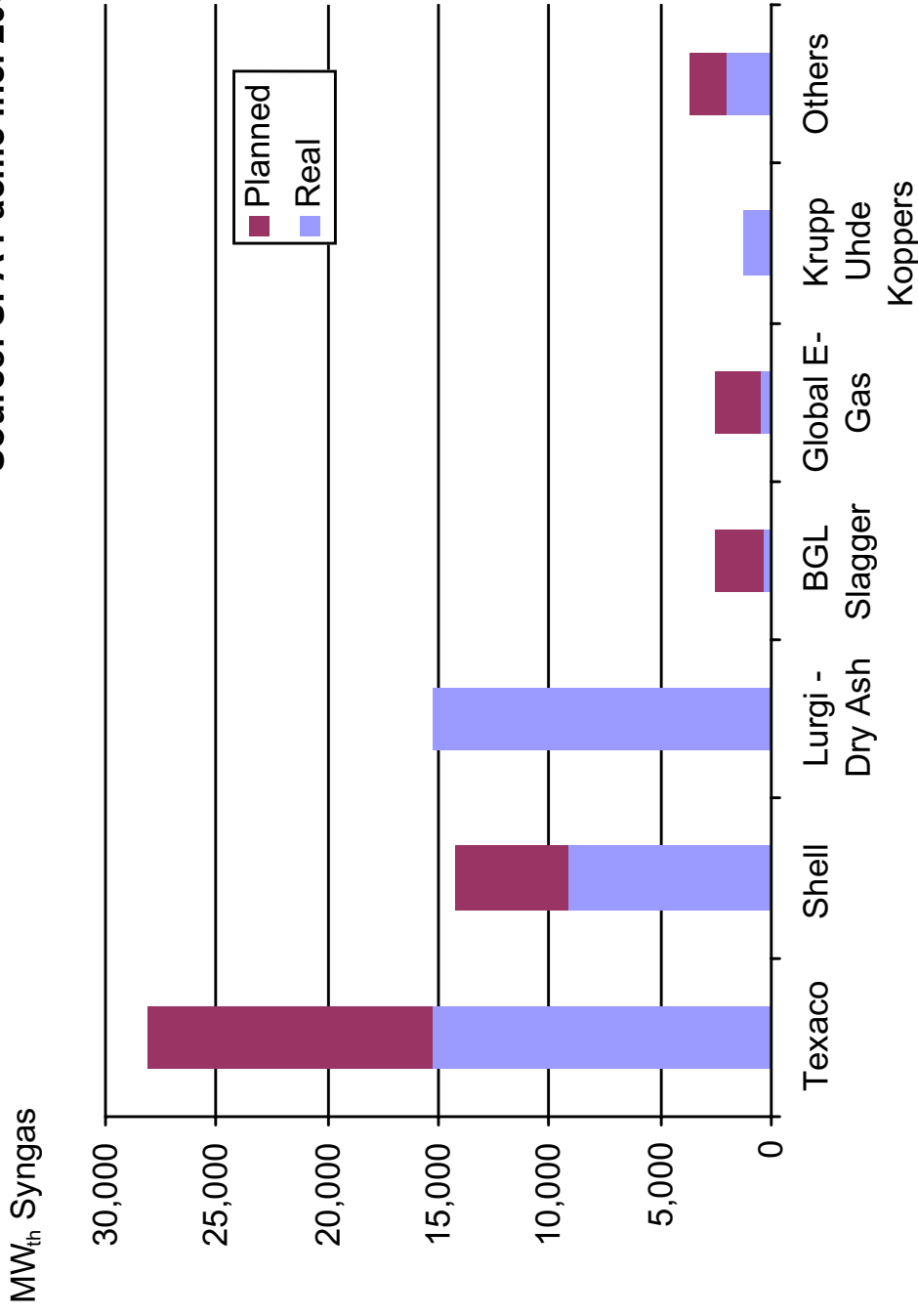
CH<sub>4</sub> and other  
Hydrocarbons

H<sub>2</sub> and CO with  
some CO<sub>2</sub>

CO<sub>2</sub> and H<sub>2</sub>O  
with some CO



Source: SFA Pacific Inc. 2005

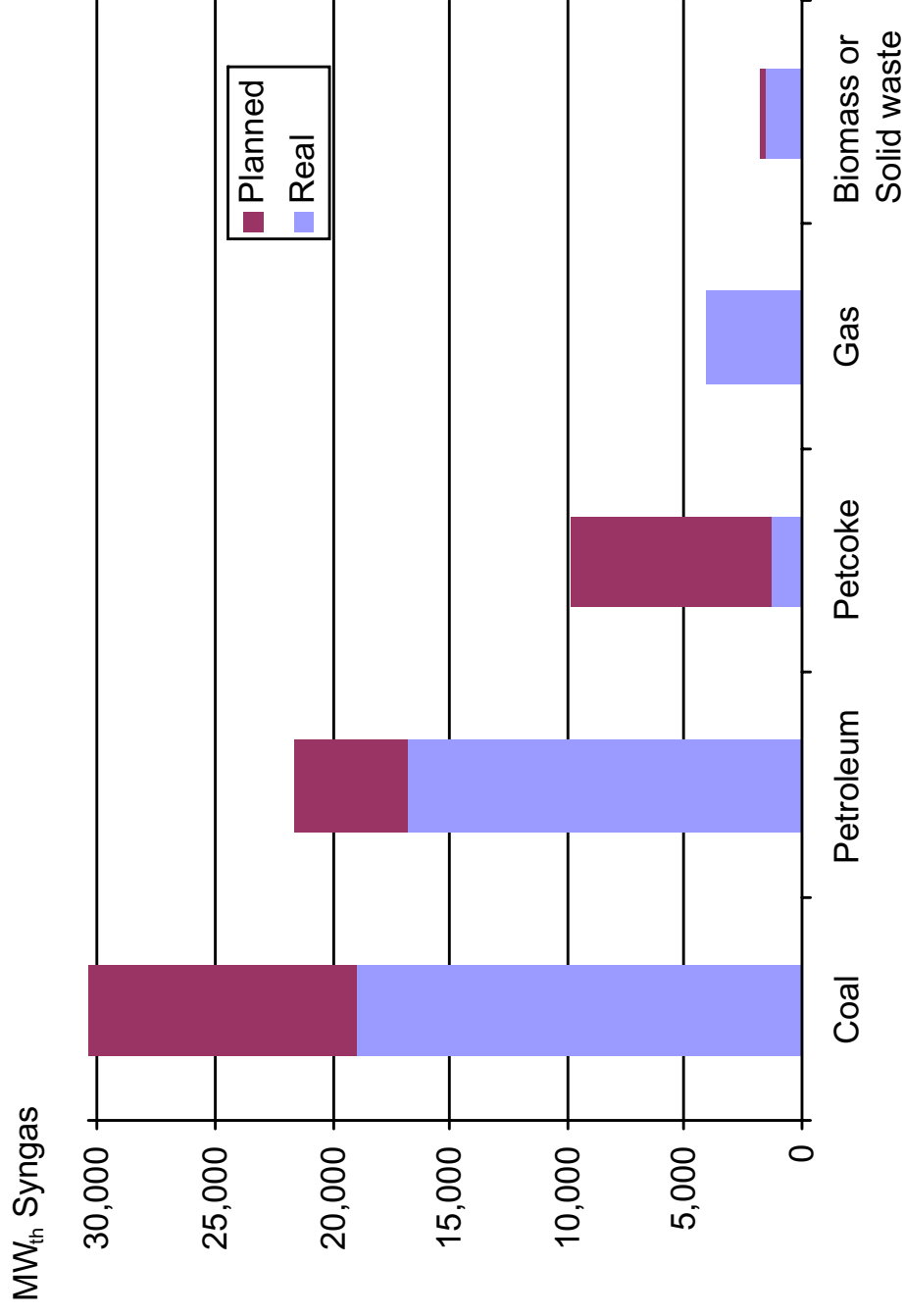




# Gasification by Feedstock....

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Source: SFA Pacific Inc. 2005



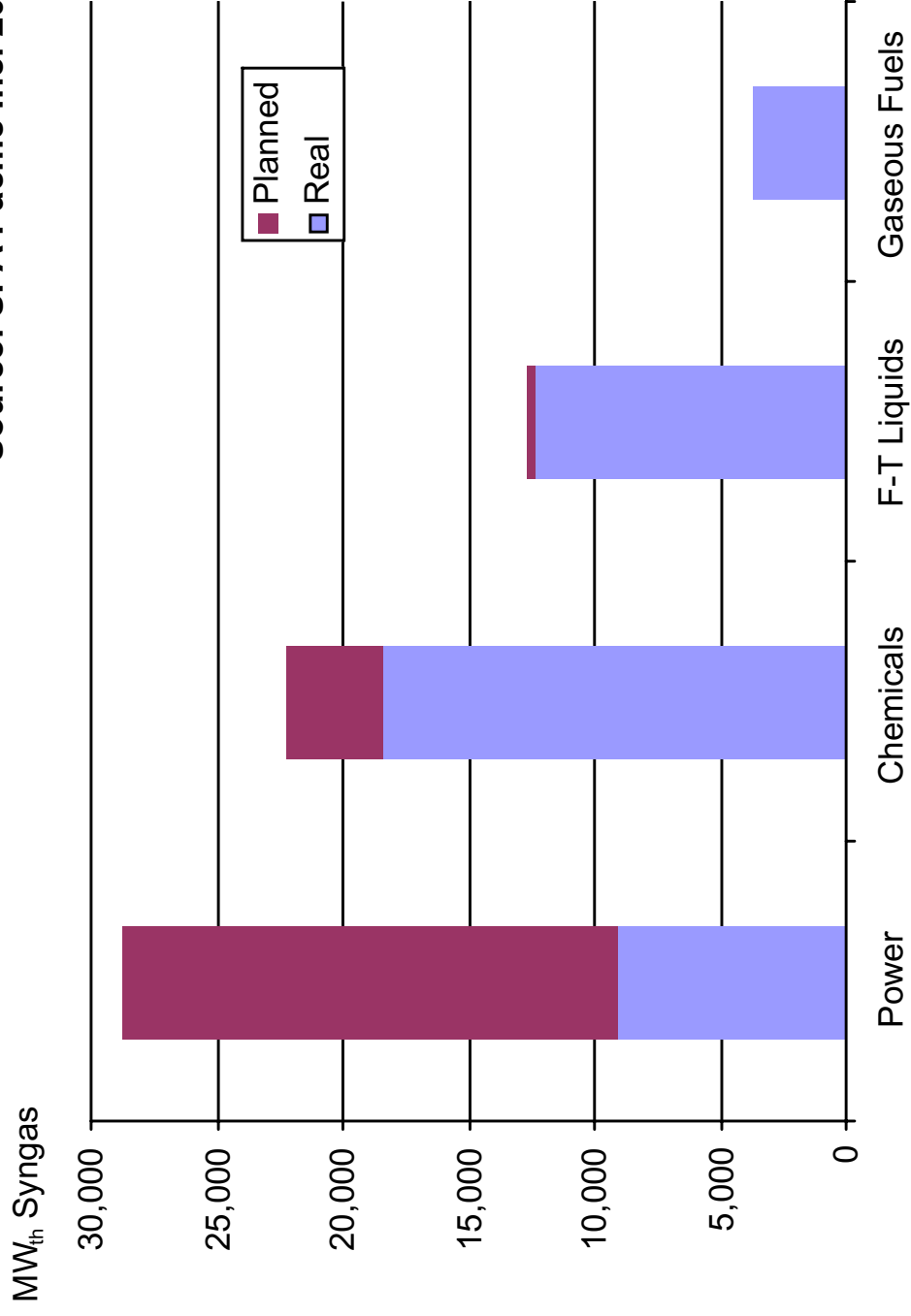
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# Gasification by Application...

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Source: SFA Pacific Inc. 2005



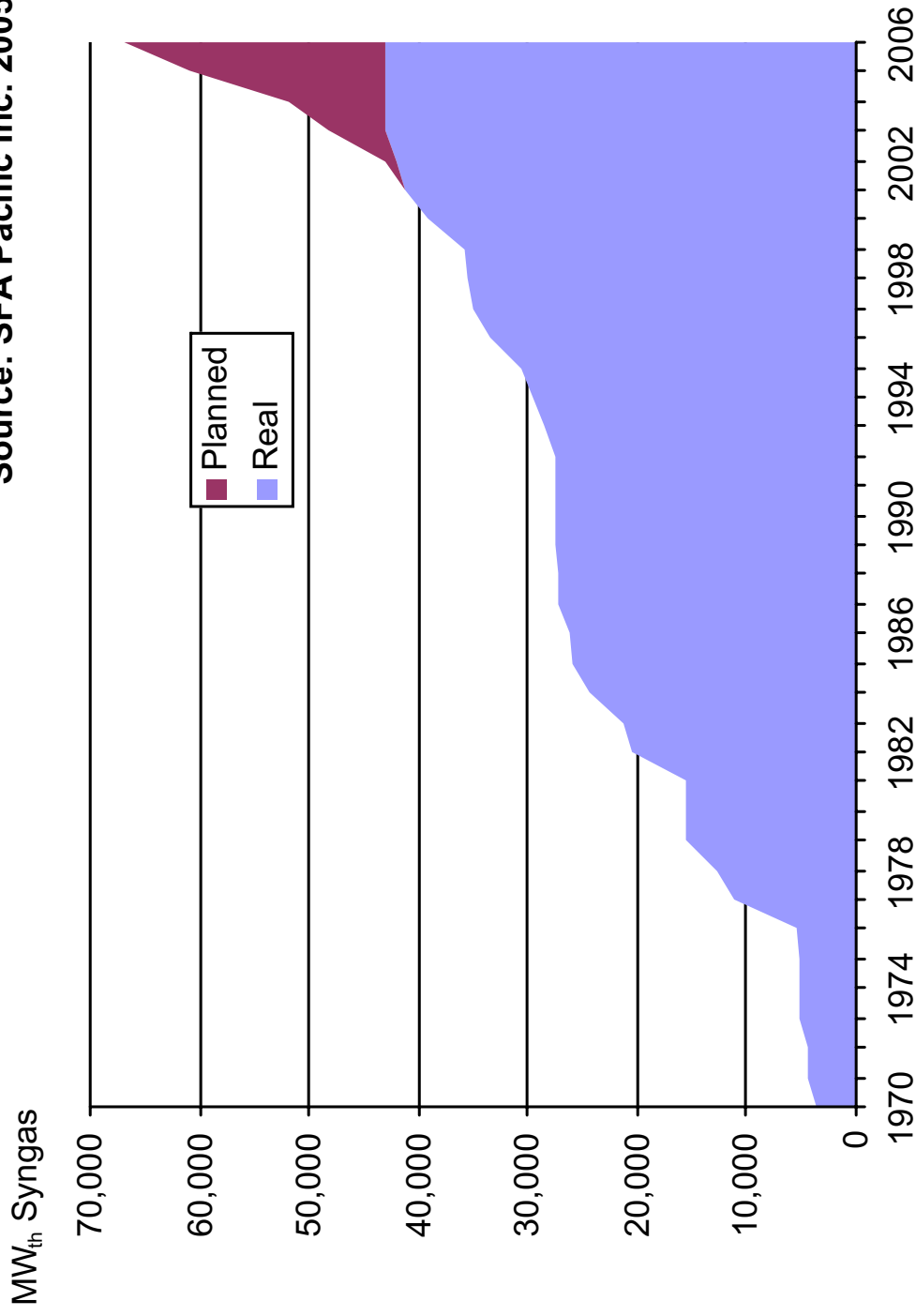
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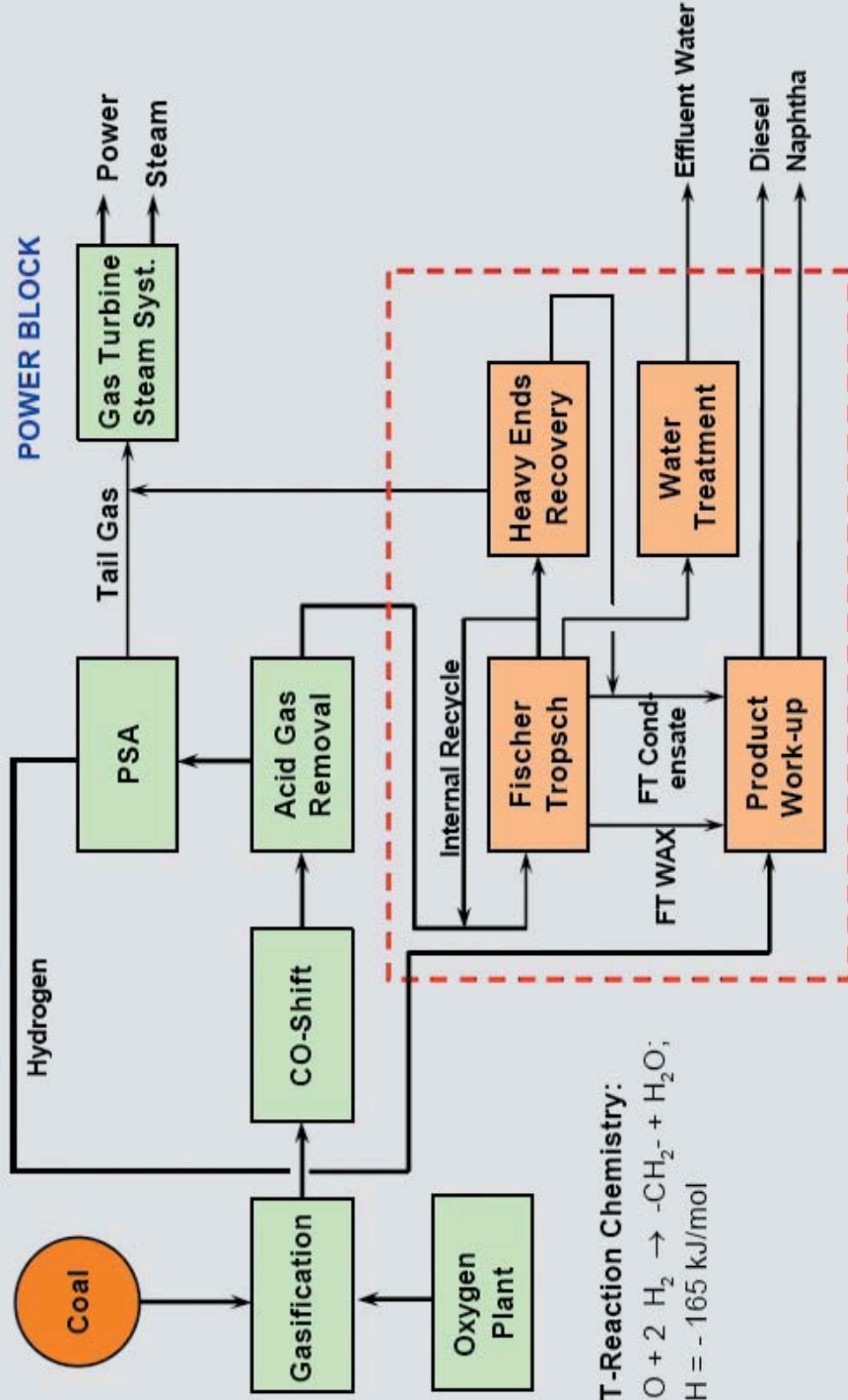
# Global Gasification Capacity...

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Source: SFA Pacific Inc. 2005



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FT-Reaction Chemistry:



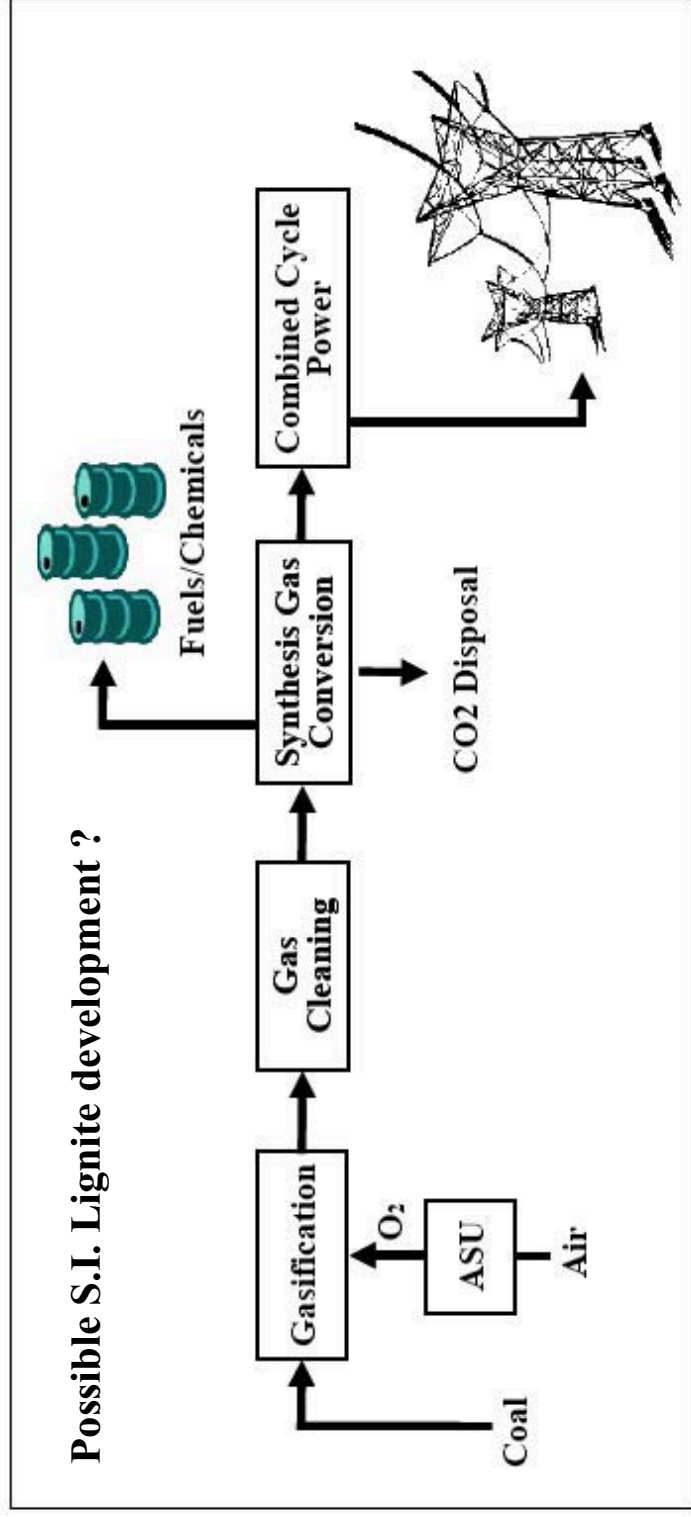
$$\Delta H = -165 \text{ kJ/mol}$$

Uhde

## **FT-Liquids Industry now emerging:**

- **Five FT Liquids plants in operation, both NG and coal**
- **Environmental pressures leading to an increased demand for ultra-low sulphur fuel oils**
- **Market price of crude now above where GTL diesel is competitive to refinery diesel**
- **Next plant on stream, Qatar Petroleum 34,000 bbl/day**

**Possible S.I. Lignite development ?**



## Attributes for a New Zealand facility?

- Resource risk low
- Coal quality indicates good conversion potential
- Gasification route superior in environmental performance
- Co-production offers swing capacity to mitigate dry year hydro risk
- Optimum process configuration?



# Estimated prices for an IGCC facility

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Capacity MW	Capital cost US\$/kW including provision for CO <sub>2</sub> separation	
	IGCC	Supercritical
250	1365	1920
400	1260	1728
800	1155	1584

Capacity MW	Electricity price NZc/kWh		Gas price NZ\$/GJ			
	IGCC	Supercritical				
250	5.83	6.28	8.01	8.46	8.10	8.73
400	5.42	5.87	7.25	7.70	7.52	8.15
800	5.00	5.45	6.69	7.14	6.95	7.57

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# Estimates for a New Zealand LNG Project ...

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Cost component	Conventional land-based		Regasification vessel	
LNG FoB			US\$3.30	
Shipping			US\$0.33	
Storage/regasification tariff @ 12.5% IRR		US\$1.15		US\$0.80
Total		US\$4.78		US\$4.43
		NZ\$8.70		NZ\$8.05

US\$/GJ

NZ\$ @ 0.55

*LNG price components comparing conventional land-based and regasification options.*

## The Lignite resources of the South Island offer an important strategic opportunity:

- Lignite resource amongst the most competitive of their type
- NZ needs to examine other supply options beyond just the generation of electricity
- Gasification combined with IGCC generation offers significant strategic flexibility
- IGCC has a much lower life cycle cost than conventional generation modes when CO<sub>2</sub> capture included
- Not a utility solution, experience lies in the chemical/oil industries.