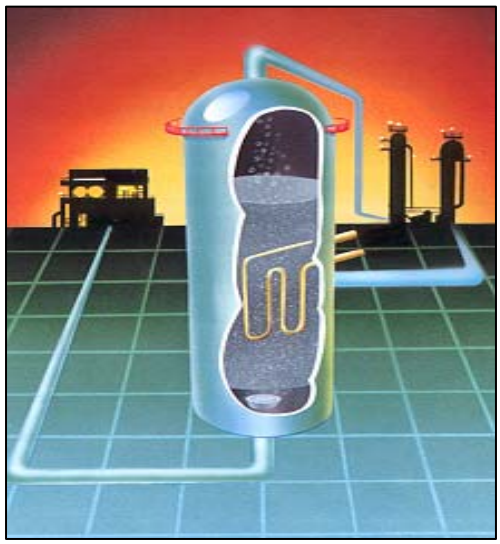
WESTERN GOVERNORS ASSOCIATION

JUNE 14, 2005 ENERGY POLICY RESOLUTION 05-06

ANGTL RESPONDS WITH THE IGFCC PROPOSAL



APPENDIX VI – CTL/BTL LIQUID RESERVES

THE WORLD HAS STRANDED GAS FOR F-T DEVELOPMENT

WHAT CAN AMERICA DO TO DEVELOP F-T IN THE U.S.?

LIQUID RESERVES FROM COAL AND BIO-MASS IN THE U.S.

Beginning in the late 1990's virtually all F-T developers have focused on flared gas and large gas reservoirs across the world as feed stock for gas based F-T plants, the "G" in GTL's. With the exception of Alaska's stranded North Slope gas reserves, the U.S. has no giant stranded gas field waiting for a GTL program to develop it. Until someone develops a technology to extract the vast reserves of hydrates locked in our frozen north or in deep offshore pools, coal and bio-mass are the only carbon based materials available to supply large scale U.S. based, domestic F-T plants. Having the resources is one thing; being able to convert them into an economic transportation fuel is another.

COAL – THE U.S. SAUDI SIZED NATURAL RESOURCE

It is estimated that the U.S. has over 250 billion tons of recoverable coal reserves. Using a typical conversion ratio of two barrels of F-T from one ton of coal, the **U.S. has approximately 500 billion barrels of F-T fuels** or almost 50% of known world's oil reserves. CTL in the U.S. can have a significant impact on imported crude oil if we want it to.

Certainly from a military fuel supply point of view, a U.S. CTL program should be attractive.

As an example, Alaska has a "small" coal field in the Cook Inlet 40 miles south west of Anchorage called Beluga, see Figure 9. This west Cook Inlet Beluga area coal field has approximately 1.4 billion tons of proven recoverable sub-bituminous coal or the equivalent of 2.1 billion barrels of liquids. Using Sasol's F-T thermal conversion efficiency of 65%, that means that 35% of the thermal energy in the coal, if captured, can be converted into the same BTU energy content as 6.5 TCF of natural gas. A 2.1 billion barrel oil field is the second largest oil field in the U.S. behind Prudhoe Bay and 6.5 TCF is the largest gas field ever found in the Cook Inlet and 20% of the proven gas reserves on the North Slope. Multiply this across the U.S. and you can quickly see how coal can fill the gap between U.S. oil production and product

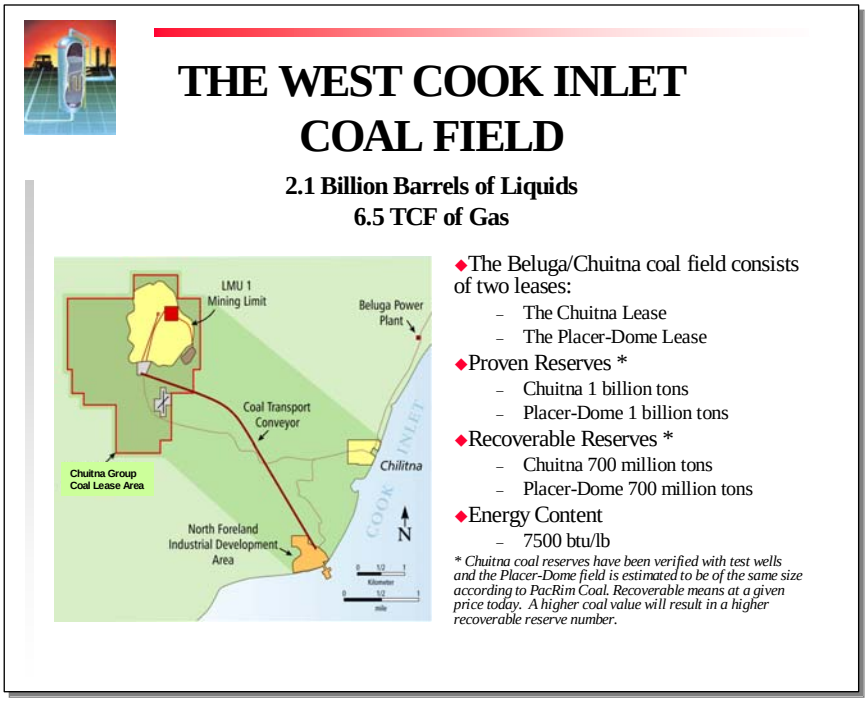


Figure 9

demand. We will touch on ways the federal government can help make CTL and BTL economically attractive in the U.S. later in this paper.

F-T Fuels Economics for the World and the U.S.

There is no question that F-T technology works with over 250,000 barrels per day of F-T plants operating in the world today and another 500,000 barrels per day under construction or in the final design phase. It is a **PROVEN** concept.

There is no question that F-T transport fuels are compatible with the existing motor fuels market and infrastructure with over 40 billion gallons sold to date throughout the world. It's **COMMERCIALY** proven.

No new refinery (crude oil or alternative fuel) built in the U.S. can recover its capital cost (CAPEX) if it has to sell its "new cleaner fuels" at the same price as "conventional fuels".

NEW REFINERIES, whether or not they are crude oil or GTL based, they will need an economic boost or incentive to compete in the U.S. This is not the case in Europe or Asia where F-T diesel sells for a premium over even low sulfur diesel.

The question is then, "CAN F-T FUELS BE ECONOMIC"? If the measure of economics is price at a U.S. fuel pump, the answer is generally no. However, as the price of crude oil continues to rise at some point the cost of manufacture of F-T fuels will equal that of crude based transportation fuels. Environmental issues, reducing a nation's dependence on imported crude oil are two factors that will favorably affect the economics of F-T fuels across the world.

There are generally three economic drivers that impact the real cost of U.S. transportation fuels outside of the basic cost of crude oil feed stock. They are:

- Strategic, the need to maintain a military presence in the Middle East to insure the free flow of oil to the world. We refer to this as a *Security Premium*.
- Short fall in US Refining Capacity (fuel availability). We refer to this as a *Refining Capacity Penalty*.
- Environmental - Lower Emissions + CAFÉ Levels (Clean Cities Programs - lower GHG emissions & better fuel mileage). We refer to this as the *Engine Emission and Efficiency Costs*.

The problem in the US is that many factors are at play that effect over all economics of fuel at the pump. There are the hidden costs of our national energy policy that are not apparent at the fuel pump but do cost us as tax paying citizens – the *Security Premium*. There are costs we see at the fuel pump each driving season that as individuals we have no control over – the *Refining Capacity Penalty*. New alternative fuel refineries (F-T) plants cost tremendous amounts to build as they are more like chemical plants instead of crude oil refineries. If new environmental laws require crude oil refineries to make fuels as clean as F-T, then F-T plants could be competitive. If the U.S. charged a premium for importing oil or gave credits for refineries that reduced U.S. dependence on imported crude, F-T plants could be competitive. If the U.S. charged a tax for importing gasoline and diesel, refineries would be built in the U.S. making new F-T refineries competitive.

As individuals there is little we can do to control our fuel costs except buy more fuel efficient vehicles - *Engine Emission and Efficiency Costs*. However, there are two areas where the Federal Government can help promote new alternative fuel refineries in the U.S.

Strategic

The National Defense Council Foundation has performed a very detailed study of the "Cost of Imported Oil" including other factors such as loss of jobs showing that as consumers we pay a *Security Premium* approaching $2.00/gallon. Years ago the government estimated this number to be 50¢/gallon. We currently use approximately 12 million barrels per day of gasoline and diesel in the U.S., using the lower figure of 50¢/gallon this *Security Premium* cost is approaching $92 billion per year - *$368 billion at $2/gallon.*

Short fall in US Refining Capacity

The U.S. currently has a 3 million barrel per day refining capacity shortfall. This means that each driving season U.S. refineries cannot make enough gasoline and diesel to supply motor fuels demand. They raise the price at the fuel pump to cause "economic conservation". It is estimated that the lack of U.S. refining capacity, costs the US consumer ~ 25¢/gallon for 3 months or about $11 billion per year - *Refining Capacity Penalty*.

Crude oil refiners have no incentive to eliminate this refining capacity short fall as they would lose this annual windfall, plus they will claim there is no way to recover the capital cost of the new refinery if they are selling motor fuels at the same price as other refiners. Most refiners will tell you it is cheaper to import gasoline than to build new refineries in the U.S. In addition because Europe has a higher CAFÉ standard and cleaner diesel, most European refiners are struggling to meet diesel demands but are awash in gasoline, which they export to the U.S. A refining short fall in the U.S. provides a home for their excess gasoline supplies in Europe.

It is estimated that if the U.S. was to institute CAFÉ standards similar to Europe, the American consumer through better mileage would save over 1.4 million barrels per day of gasoline; resulting in a fuel savings of over $35 billion dollars each year. Like in Europe, diesel would become the preferred transport fuel because diesel engines are more efficient and generally diesel vehicles get 25% to 30% better mileage than similar gasoline powered vehicles.

By instituting a tax credit or energy credit to build new refineries the federal government can reduce the refining capacity short fall, eventually reducing the annual price fly-up seen at the pump each driving season. Who benefits? The American consumer, with lower fuel pump prices and more efficient, higher-mileage vehicles. Who looses? The traditional crude oil refiner.

The Table below illustrates the price needed for products from a new refinery above today's fuel prices to recover the capital cost of the refinery. As we can see even a crude oil refinery will need a higher price for its gasoline and diesel if it is to recover its capital investment. Smaller-size coal and bio-mass F-T plants will need an even higher price. However, their gasoline and diesel F-T fuel is of much better quality. Environmental rules affecting crude-based fuels can add more costs to a crude oil refinery closing the gap. As the price of crude oil continues to rise and the price of coal and bio-mass (F-T plant feed stocks) remains stable, BTL and CTL plants will become more competitive.

Estimated Costs of New Refining Capacity
(plants built in the U.S.)

Refinery Type ↓	Estimate By	Plant size bbl/d	Cost / Installed Barrel	* Refinery CAPEX at 100,000 bbl/d	¢/gal to recover CAPEX
Crude oil**	Oil Majors	100,000	$28,000	$2.8 billion	29¢
Gas to liquids	Sasol	33,000	$22,000	$2.2 billion	23¢
Coal to liquids	Sasol	50,000	$60,000	$6.0 billion	63¢
Bio-Mass to liquids	Choren	6,500	$85,000	$8.5 billion	89¢

•Cost of refinery estimate at capacity shown but adjusted to 100,000 bbl/d for comparison only

**** Assumes that the Crude Oil Refinery will be producing ultra clean transportation fuels**

Conversely, crude oil prices can drop, making BTL and CTL less competitive. This has been the traditional way oil producing nations have stopped alternative fuel programs in the past. Whether world demand for crude has outstripped the ability of oil producers to produce excess crude is the big question today.

A recent quote regarding the Sasol CTL plants built in South Africa said "*Sasol's Secunda CTL Plant: Costly To Build, But Now It's A Cash Cow"*. Once the capital costs of U.S. built F-T plant are recovered, American BTL and CTL plants can be competitive well below today's price of crude oil.