Transportation Energy: Supply, Demand and the Future

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The problem

• Transportation in nearly 100% dependant on petroleum as a source of energy.
• Global supply and demand trends will have a profound impact on the ability to use our transportation system and on economic activity.
• Alternatives are slow in development and implementation. Short term impacts are likely to be extreme and massively disruptive.
• The ability to finance future transportation programs will be severely impacted.
Demand

- Worldwide demand for petroleum is growing, particularly as related to economic trends in China, India, Eastern Europe and other developing areas.
  - China oil demand +104% by 2030, India +91%, Africa +105%, Central and South America +98 to 112%, US, Europe +22 to 34% (Exxon)

- Transportation energy demand in the U.S. has increased because of the greater use of less fuel efficient vehicles. – a transportation finance bonus
Figure 1. United States Petroleum Production and Consumption, 1970–2015

Source: See Table 1.1 and 23. Projections are from the Energy Information Administration, Annual Energy Outlook 2004, January 2004.
2000-2050 Energy Model

- 50% population increase (.8%)
- 1.1% intensity decline
- 300% GDP increase (2.5%)
- Assumption: Hubbert Curve for oil & gas

Outcome

- 172% total energy demand increase (2%)
- 42% hydrocarbon production decline

World Conventional Oil Production & Discoveries

The Growing Gap
Supply

- Different predictions of the total global supply of petroleum and related products.
- Some believe we may have reached the global peak of production. (peak oil)
- Rates of discovery have slowed, there may be few places left to find petroleum
- Major oil companies have reduced estimates of reserves and reduced investment in finding new sources
- As easy sources are used up, the cost, risk and energy inputs for other sources will increase.
Campbell's prediction "the end of cheap oil"
Sources of supply

- Remaining sources require more energy input and are more difficult to process than in the past
- Many producing countries have moved past their peak production and are in a period of decline and are becoming net importers. (Oman, Indonesia, China, UK, Iran?)
- Exceptions are in the middle east (Saudi Arabia, Iraq, Kuwait, Abu Daubi)
- No matter when we reach the peak, most of the world, including the U.S. will be highly dependant on sources from a few foreign locations.
- Who gets the money?
Time to Depletion Midpoint
source: http://www.hubbertpeak.com/summary.htm

Census Bureau: When it comes to the question of carpooling
To work 74% of TUCSONANS prefer to drive alone.
Where does the Money go?
(Emirates Palace Hotel and Conference Center, Abu Daubi)

Some Quotes

• "Simply put, the era of easy access to energy is over. In part, this is because we are experiencing the convergence of geological difficulty with geopolitical instability... [W]e are seeing the beginnings of a bidding war for Mideast supplies between East and West." David J. O'Reilly Chairman and CEO, ChevronTexaco

• "The supply side is limited, We are reaching the limits of the planet very soon" Dr. Ali Samsam Bakhtiari, Senior Planner, National Iranian Oil Company

• “By some estimates, there will be an average of two-percent annual growth in global oil demand over the years ahead, along with, conservatively, a three-percent natural decline in production from existing reserves. That means by 2010 we will need on the order of an additional 50 million barrels a day.” Vice President Cheney
The Future??

Prices

• We are operating on a very thin, thin edge to balance supply and demand.
• The current system is not sustainable
• The result will be a series of major oil price shocks with rapidly increasing prices with a high potential for conflict over remaining resources.
• Short term effects are likely to be very sever with few options. “over a barrel”
• Highly visible prices
• Prices will rise and fall, but are likely to generally continue upwards.
Crude Oil Price Trends:
Source: http://www.eia.doe.gov/emeu/cabs/chron.html
Reasons for Rising Gas Prices

- The Blackout
- The Broken Arizona Pipeline
- No ANWR Drilling
- The Cold Winter
- SUVs
- The Sun Rise

So, what’ll it be? That European vacation or a tank of gas?!
The Future

• No easy long term solution, a combination of thousands of actions
  – Price increases
  – Conservation
  – Alternative Fuels
  – New sources
  – Economic impacts

Can Conservation Solve the Problem?

• More efficient vehicles, price pressures and general conservation can delay the problem, but are not enough.
• “You can only turn off the lights once”
• Price increases will force more conservation
• More conservation of fuels means less revenue for transportation purposes.
More oil wells! More refineries! More pipelines! Where's the incentive for conservation?!

"Out of gas?"
So what?
We don't need more fuel.
Will just preserve our way of life here."
The Future

• Can Technology and Alternative Fuels solve the problems?
  – Possibly, in the long run, but it will take a long lead time to happen
    • Technology development - 6-15 years
    • Infrastructure deployment -10-15 years
    • Market penetration occurs along with above
    • Fleet turnover – 12 years
    • Total 20-40 years for full effect to be felt

Alternative Fuels

• An ideal fuel has
  – high energy content per unit of volume – (vehicle range),
  – is easily converted to useful transport energy,
  – is easily transported,
  – doesn't take more energy to produce than it returns as a useful fuel (positive EROEI),
  – has low emissions and
  – has an existing infrastructure
• (Gasoline or Diesel fuel)
Alternatives

- Natural gas
- Liquid Petroleum gas (LPG/Propane)
- Compressed or liquid natural gas
- Methanol
- Ethanol
- Electricity
- Hydrogen
- Bio-diesel

Alternative fuels

- Most require substantial energy to produce.
  - Hydrogen from natural gas or electricity
  - Methanol, ethanol need fuel, fertilizer and heat from fossil fuels
  - Electricity as a source to convert fuels, generally uses coal, natural gas or nuclear fuels
More about alternatives

- U.S. Department of Energy provides comparisons of fuel alternative and their characteristics:
  - source, intensity, physical state, environmental factors, security impacts, availability, infrastructure, safety

- See:
### Energy UWM-CUTS

#### Maintenance Issues

<table>
<thead>
<tr>
<th>Issues</th>
<th>Description</th>
<th>Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy leaks and waste</td>
<td>Energy leaks and waste can be reduced by improving maintenance and operational practices.</td>
<td>Improve maintenance schedules and increase awareness among staff.</td>
</tr>
</tbody>
</table>

#### Fuel Availability

<table>
<thead>
<tr>
<th>Fuel Type</th>
<th>Availability</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diesel</td>
<td>Available at all filling stations.</td>
<td>UWM-CUTS, local vendors</td>
</tr>
</tbody>
</table>

#### APV Facility Status Location

<table>
<thead>
<tr>
<th>Location</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>UWM-CUTS</td>
<td>Functional</td>
</tr>
</tbody>
</table>

### Energy UWM-CUTS

#### Current Status

- Maintenance issues have been effectively addressed through regular inspections and timely repairs.
- Fuel availability is consistent across all locations.

#### Future Plans

- Continuously monitor and improve maintenance practices to reduce energy waste.
- Explore alternative fuel sources for future projects.

#### Energy UWM-CUTS

- Rigorous maintenance practices ensure the efficient operation of vehicles.
- Fuel management systems are in place to optimize fuel usage.

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*Note: All data and statistics are based on internal reports and validated by UWM-CUTS Energy Management.*
Contingency Planning for the near term

- Conservation is not enough and there is not adequate time to develop and deploy alternatives
- “If it could happen, it will happen”. So, what strategies should be used when it does happen?
- Prepare for the worst, hope for the best
- Must plan for the crisis in advance because there is no time to plan for it when it does actually happen.
- Goal: To increase the ability to respond to an energy shortfall through an adjustment of demand without causing severe problems for households, or the economy.

Question of Allocation & Conservation

Who gets the scarce resources and how is that decision made?

- Who is vulnerable to price swings and availability issues?
- What essentials do these groups need?
- At what stage are these essentials provided?
- Prioritize policies based on effectiveness (work trips, short trips, long trips, etc.)
- Implement contingency plan
Conclusions

• The current system is not sustainable
• Energy issues will dominate the future of transportation and the economy
• Failure to act early will lead to more severe consequences
• Contingency planning is essential
• Transportation finance will be radically affected by future energy factors
• To do project planning or development without a thorough knowledge of future energy situations is a waste of time
• Become knowledgeable about the issue

Web sites

• Millions of web sites on Google or Yahoo
• http://www.hubbertpeak.com/index.asp
• www.eia.doe.gov
• http://www.eia.doe.gov/oiaf/ieo/index.html
• http://www.eere.energy.gov/afdc/
• http://www.oilanalytics.org/netentop.html
• http://tonto.eia.doe.gov/FTPROOT/features/longterm.pdf#search='oil%20supply'
• http://www.peakoil.net/
• http://www.drydipstick.com/