The Future Of Energy: 
An Urgent Need To Connect The Right Dots

MIT Enterprise Forum Of Texas 
January 22, 2003 
Houston, Texas 
Presented By: 
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The History Of Modern Energy

“Study the past…to define the future”
Confucius, 551 BC
20th Century Saw The Creation/Widespread Use Of Modern Energy

• Ancient energy is created by burning charcoal, agricultural waste and animal dung.
  – Usage dates back for thousands of years.
  – All three are toxic, inefficient, harmful to society and human health.
  – 2 billion people still use ancient energy.

• This is environmental Public Energy Number One.
For A Century, King Coal Ruled The Modern Energy World

- Coal helped spur the industrial revolution
- It anchored/fueled the British Empire’s Peak Power
- Few thought coal would ever be replaced
- Colonel Drake’s oil discovery was deemed a tiny by-product
- The internal combustion engine opened the door to the Age of Oil
The Real Age Of Oil Began In 1901: Spindletop

- Spindletop was the world’s first giant oilfield
- It propelled oil to a lead role in modern energy
- It made Texas the world’s primary oil producer
- It made Houston the world’s energy capital
What A Difference Three Years Made
1900 To 1903

1900

1901

1903
Oil Became 20th Century’s Biggest Growth Industry

- Many thought oil was running out after World War I
- “Permanent Glut” followed East Texas discovery in 1930’s
- TRRC became an “OPEC” and kept oil alive
- 30 years ago, $3 oil was deemed to “hurt the economy” and considered “way too expensive”
- Two oil shocks were an energy wake-up call (Energy’s World War I)
- Two decades of low prices led to widespread oil/energy complacency
For years, most natural gas was flared as waste product
Even in 1960s, natural gas was “given away”
Two bitter winters (1977/78) led to terrible natural gas policy mistakes (banning use as scarce resource)
Falling demand stymied serious analysis for further supply gains
1990s finally saw gas become America’s premier energy resource:
  - 2001 production : 9.5 million boe/day (same as 1970 U.S. oil)
  - All future electricity needs to come from North American natural gas
Just as gas became fully appreciated, it peaked!
Global Natural Gas Picture
Even More Confusing

• World’s two largest natural gas producers and consumers – Russia and U.S.

• A tale of two energy states:
  – U.S. is a gas importer (our supply not enough).
  – Russian is a gas exporter (so far).

• In both countries, current production in serious decline.

• World’s number 3 and 4 producers (Canada and U.K.) are also in decline.

• LNG had promising start in 1967-1975 but “petered out” until 2001.

• Most “stranded gas” has never seen a drill bit.
Coal Still Wears An Energy Crown

• Despite its unpopularity, coal is still a dominant energy source.
• But it is dirty.
• And extremely energy inefficient (transforming coal into useable energy takes a lot of energy).
• Coal’s greatest asset: abundancy.
Nuclear Became Only “New Energy” Native To The 20th Century

• In a Century of technological miracles, energy had only one new primary source: The Atom
• Its creation took decades – its commercialization took several decades
• Late 1960s – Commercial use of nuclear power came of age
• March 1979: Three Mile Island closed nuclear energy door
• Chernobyl was nuclear’s “nail in the coffin”
• Ohio’s problems, Tokyo electric cracks merely add to nuclear woes
Energy History Profoundly Impacted By Environmental Concerns

- January 1969 (34 years ago) Santa Barbara had an oil spill
- This created the Environmental Movement
- Since then, oil exploration and production spills have been very few
- Natural gas does not spill
- But Environmental Movement shut down most frontier drilling areas
- So, Maritime Energy Transportation and tanker spills rose exponentially
- Environmental war on modern energy took a savage toll on energy’s sustainability
Alternate Energy Is Primarily Non-Renewable

- Hydro is biggest source.
- Most dam sites now gone.
- Dams are not perpetual - they silt up.
- Geothermal is also probably not renewable.
Did Anyone Fully Appreciate Energy Role As 20th Century Ended?

• Modern energy fueled all 20th Century miracles
• With the exception of a handful of years, modern energy was affordable and reliable
• But, its foes grew and its users wanted it to fall in price
• And, energy was deemed to be “irrelevant” in the New Economy
• Why are so many great things taken for granted and not appreciated until they are gone?
U.S. Oil: Gracefully Slipping Into The Sunset

• Penwell was a thriving area during the oilfield-boom days; now, it is literally a junkyard of old oilfield equipment.

Penwell, Texas “Oiltfield Cemetery”, about 10 miles west of Odessa, Texas

Old US Highway 80 is the road in the foreground, and the building left-center was once a cafe. The building to the left of the cafe was once a service station and garage.
Some Of The World’s Newest Energy Systems Now Aging

- Multibillion dollar energy projects:
  - Alaskan Pipeline: 1972 - 1978
  - Siberian Pipeline: 1975 - 1982
  - Giant North Sea Fields: Early 1970s
    [Brent, Forties, Ekofisk, Statfjord]
  - Mexico’s Cantarell Field: 1975 - 1977
  - Russia’s Samotlar Field: 1967 - 1968
  - Alaska’s Prudhoe Bay: 1967 - 1968
  - Colombia’s Cusiana/Cupiagua Fields: 1989

None are new anymore. All are aging, deteriorating and in decline.
Global Oil And Gas Infrastructure Is Old

- Oil and gas system: delivers 115 to 120 million barrels per day
- North American oil and gas pipeline system: built 40 to 60 years ago
- U.S. tank farm system: 50 to 60 years old
- Global tanker fleet: significant percentage 20 to 30 years old
- Offshore/Land drilling fleet: 90% is over 20 years old
- Employee base: graying and retiring
- No one has ever estimated:
  - How to rebuild or refurbish infrastructure
  - How much will this cost?
  - Whether is could even be done
What Was Once “Energy Safety” Moved To “Just In Time” Supply

Source: DOE, IEA and Goldman Sachs Research.
Energy In 2003
Energy’s Value To The World Has Never Been So Immense

- Energy use now exceeds 200 million barrels of oil equivalent each day
- Energy is the world’s largest industry
- Modern energy creates the ability to supply world with:
  - Water
  - Food
  - Health
  - Modern living standards
- Energy is truly the world’s equivalent of oxygen to the human body!
## Relative Size Of Key Industries

<table>
<thead>
<tr>
<th>Industry</th>
<th>Annual Spending (Billions)</th>
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<tbody>
<tr>
<td>Energy Used</td>
<td>$ 3,000</td>
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<tr>
<td>Defense Spending</td>
<td>720</td>
</tr>
<tr>
<td>Agricultural &quot;Value Added&quot;</td>
<td>1,575</td>
</tr>
<tr>
<td>International Tourism Receipts</td>
<td>476</td>
</tr>
</tbody>
</table>
Despite Growth, Energy Demand Is Still In Its Infancy

- Growth in total demand has been astonishing, but…..
  - 12% of the world uses 54% of all energy
  - 33% of the world still has no access to modern energy
  - The other 45% use 1/4 of the energy consumed by remaining 12% (“us”)

- Energy use by the remaining 12% varies from a little to a lot
  - U.S.: 65 bbls energy per person
  - Japan: 32 bbls energy per person
  - U.K.: 30 bbls energy per person
  - Germany: 32 bbls energy per person
Why U.S. Uses So Much Energy

- Size of the U.S. created massive use of automobiles.
- Lack of mass transit further fueled energy growth.
- Traffic congestion is biggest “gas guzzler.”
- Size of U.S. houses (footprint and ceiling height) creates big use of energy.
- Our affluence: U.S. 31% of global GDP
  U.S. 17% of world energy use.
- We are actually an efficient user of energy.
- SUVs are a minor contributor to this complex puzzle.
World Demographics: Far More People Than "Things"

Is this gap permanent or about to change?

- 6 Billion People
- 1 Billion TV Sets
- 600 Million Cars
- 480 Million Mobile Phones
- 350 Million Computers
Houston’s Role As Energy Capital In 2003

- Houston is still unrivaled Global Energy Capital
- City’s prominence in:
  - Upstream E&P
  - Oil Services/Petroleum Equipment
  - Engineering/Design
  - Downstream Activity
- But the capital is only focused on oil and gas
- Fortunately, there is no “capital” for all other energy sources
- This vacuum unlikely to be permanent (some city will fill this gap)
- Since U.S. oil and gas production is in steep decline, oil and gas capital city is not automatically guaranteed
The Future Of Energy

Today:
January 22
IEA’s Long-term Energy Forecast
September 2002 Was First “Peek” At 2030 Global Energy Needs

- World Energy Outlook 2002 has already become OECD’s “Best Seller”
- Forecasts show global energy use growing:

<table>
<thead>
<tr>
<th></th>
<th>2000</th>
<th>2010 (Million BOE/Day)</th>
<th>2020</th>
<th>2030</th>
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<tbody>
<tr>
<td>Total Energy</td>
<td>196</td>
<td>278</td>
<td>281</td>
<td>326</td>
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- Adding 130 Million BOE/Day is 22% more energy than the world used in 1971!
Through 2030, Fossil Fuels Still Dominate

- 2030 energy use by source:
  - Coal usage: 24% 26%
  - Oil usage: 38% 39%
  - Natural gas usage: 28% 23%

- All other sources = 11%
  - Nuclear: 5%
  - Hydro: 2%
  - All others: 4%

Current Mix
The IEA’s Forecast Is Actually Conservative

• Even these staggering numbers are based on assumption that “everything” slows down
  – Population growth
  – GDP per capita
  – Energy intensity of global economies

• No scientific support for these conservative assumptions
Why The IEA’s Numbers Might Be Low

- Population growth might not slow down.
- China might begin to prosper.
- Cold winters could return.
- Two billion people might demand modern energy.
World Population: There Is Still Growth Ahead

![Population Graph](image)
The Slowdown Did Not Happen In The 20th Century

World Population
(In Billions)

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<td>1.5</td>
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<td>2.5</td>
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<td>3.7</td>
<td>4.5</td>
<td>5.3</td>
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We added as many people in the past 20 years as existed in 1890!

Why Population Grew
(Change In Life Span)

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<td>42</td>
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<td>Mexico</td>
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<td>U.S.</td>
<td>72</td>
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<td>Italy</td>
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<td>Japan</td>
<td>76</td>
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Source: The Illustrated 20th Century.
Narrowing Rich/Poor Gap Creates Massive Energy Needs

- If 2 billion people without energy had current consumption of:
  - China: 37 MMBOE/Day additional demand
  - Japan: 174 MMBOE/Day additional demand
  - U.S.: 350 MMBOE/Day additional demand
How Solid Is Our Energy Future?

“Only certain future energy fact: 
*Energy demand cannot exceed supply*”
(Simmons “Energy Axiom # One”)
Taking Off Rose-Colored Glasses Reveals Chinks In Energy Supply Armor

- **Oil:** Many basins have peaked
  Key supply sources very old
  New finds are small

- **Natural Gas:** 55 – 60% of current supply is in decline

- **Coal:** Abundant, but dirty and inefficient

- **Nuclear:** Highly unpopular and “old”

- **Hydro:** Most sites are gone/silting is real problem
Oil And Gas Depletion Creates Remarkable Treadmill

- All oil and gas fields finally peak (and “roll-over”)
- Upon peaking, declines begin
- New oilfield technology created extremely high rates of decline (15 to 50% a year)
- Lack of data made depletion an “enigma wrapped in a mystery”
A Realistic Oil Supply Model

15-Year Demand Growth
Excluding FSU = 2.1%
(Global Including FSU = 1.4%)

<table>
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<tr>
<th>Year</th>
<th>Demand Growth</th>
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<tr>
<td>2005</td>
<td>81.7</td>
</tr>
<tr>
<td>2010</td>
<td>90.7</td>
</tr>
<tr>
<td>2015</td>
<td>100.6</td>
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</table>

Demand Growth: 2.1%
Annual Decline Rate: 10%
81 Million Bbls In 13 Years
Creating A Reliable Energy Future Is World’s Biggest Challenge

• Getting to 2010 will cost over $5 trillion
  – Adding 82 million BOE/day of new energy
  – Keeping current base “intact”
  – Rebuilding most of current infrastructure

• Some of these additions defy effort and capital

• But, without added energy, everything comes to a halt
Can Houston Live Up To Its “Energy Capital” Role?

• If World faces a genuine Energy Crisis, Houston must play leading role in solution

• Fossil fuels must become bridge to new energy future

• This energy bridge needs to last 15 to 30 years

• Energy technology will be taxed to limit

• Growth in energy experts “rigs” and “power” could exceed any prior global effort
Houston Must Evolve Into “Total Energy” Capital

• Oil and gas, alone, are not the future of energy
• Clean energy can become Houston’s gift to the world
• Houston’s energy engineers can become the industry’s greatest “next generation”
• If we fail in this effort, the unforeseen risks are extremely high
Energy Needs A “Wake-Up” Call

- Could an energy “9/11” wake-up occur?
- Would a crisis jump-start Energy’s Future?
- How a wake-up call could occur:
  - Low OECD oil stocks/Venezuela shut-down serious
  - Tanker spare capacity is gone
  - Depletion was real
  - U.S./Canada gas supply peaked
- The alarm could be about to ring!
Oil has become more and more necessary to everyone. At first it was used for medicine, for lamps, and for lubrication. Now, if the supply of oil were cut off, our manner of living would change completely until something to take its place was found.

By Maud and Miska Petersham, ©1935.
Investment Bankers to the Energy Industry