A little discussion about Energy

Lectures 25 & 26

Load video: [http://nyti.ms/1H09wdS](http://nyti.ms/1H09wdS)
Current Reserves

- Undiscovered but economically viable reserves
- Known but economically unviable reserves

Fracking is financially viable only at higher prices.

Oil rigs sit idle because of low prices.

Environmental costs may be seen as prohibitive (ANWR).

Geologic Uncertainty

- Reserves we haven’t even started to look for yet
- Reserves we haven’t even started to look for yet
- Reserves that will never be viable

Economic viability

- Known but economically unviable reserves
- Undiscovered but economically viable reserves
- Undiscovered but economically viable reserves
- Reserves that will never be viable
What about Peak Oil

M. King Hubbert (1903 to 1989)

The Hubbert Curve: The U.S.

The Hubbert Curve: Global

Team exercise:

- In the Hubbert model, there must be a supply curve, a relationship between price and quantity.
- What do you think the supply curve for oil that is implicitly assumed in the Hubbert model?
  - (hint: does price appear at all?)

- There is a growing consensus among those who follow such things, that the new high of world oil production (87.9 million barrels a day) reached last July is likely to go down in history as the all-time peak.

- “Global production of oil from conventional sources is likely to peak and decline permanently during the next decade, according to the most thoughtful analyses.”

- “As new oil fields are not being formed and as the number is ultimately finite, the time will come sooner or later when the supply is exhausted. The bonanza days of oil discovery [for the US], for the most part, belong to history.”

- “If the public some day in the near future awakens to the fact that we have become a bankrupt nation as far as oil is concerned. ….”

- There is a growing consensus among those who follow such things, that the new high of world oil production (87.9 million barrels a day) reached last July is likely to go down in history as the all-time peak.

- “Global production of oil from conventional sources is likely to peak and decline permanently during the next decade, according to the most thoughtful analyses.” (Scientific American, March 1998)

- “As new oil fields are not being formed and as the number is ultimately finite, the time will come sooner or later when the supply is exhausted. The bonanza days of oil discovery [for the US], for the most part, belong to history.” The director of reserves for the Petroleum Administration for War (1943)

- “If the public some day in the near future awakens to the fact that we have become a bankrupt nation as far as oil is concerned. ….”
  Larry Doherty (1924) from Daniel Yergin, The Prize (p. 222)
So how do you explain oops.

What does the supply and demand for fuel look like?

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**Total US Gasoline Consumption**

**Gasoline Consumption per capita and price per gallon**

**Prices* & Quantities of US Gasoline Consumption (1959 – 2015)**

**Total Consumption vs. price**

* In real (inflation adjusted) 2005 dollars per gallon
Per-capita Consumption vs. price

Team Discussion

- Do you believe the U.S. consumption of gasoline will go up or down in the next five years?

So what really determines the price of gasoline?

Short-run & Long-run MC & MWTP

- **Short-run**: weeks – months
- **Long-run**: a year or more

- **MC/S curve**: Shows how much the cost of production goes up as the quantity produced per day increases.
- **MWTP/D curve**: How much does the people would be willing to pay for increases in the quantity of oil. ⇒ If the price falls a little, by how much will the quantity consumed increase.

Team Exercise

Short-run & long-run

- In the very short run (days),
  - What is one thing firms could do to increase their supply of oil?
  - What is one thing consumers could do to decrease their consumption of gasoline?
- In the long run (years)
  - What is one thing firms could do to increase their supply of oil?
  - What is one thing consumers could do to decrease their consumption of gasoline?
- Is it easier to make significant adjustments in the short-run or the long-run?
- Draw 4 graphs:
  - short-run demand & long-run demand
  - short-run supply & long-run supply

Two Big Questions

- Will the price of gasoline in five years be greater or less than it is today?
- When will we run out of oil?
Energy Part II: Electricity

Key Electricity Concepts
1) Base load vs. Peak load
- **Base load**
  - at low cost, can keep coming hour after hour.
  - Usually cannot be changed quickly.
  - Examples: Nuclear, Coal
- **Peak load**
  - Can easily be changed over time to accommodate fluctuating demand
  - Example: Natural gas

Key Electricity Concepts
2) Dispatchable vs. non-dispatchable
- **Dispatchable**: the quantity of energy produced can be controlled.
  - Example: natural gas
- **Non-dispatchable**: the quantity of electricity is controlled by external forces
  - Example: wind

Key Electricity Concepts
3) Excess Demand
- For most products, if the quantity demanded exceeds the quantity supplied, the price goes up.
- For electricity, if the quantity demanded exceeds the quantity supplied, the grid **shuts down**.
- The quantity supplied must **always** exceed the quantity demanded.

Electricity in the U.S.

Market Fundamentals: Coal & Gas Prices
Renewable Energy Questions

Do you feel like the solar energy industry knowledge in Nevada will support a renewable energy sector that won't place non-renewable in the state - with you many a ton of money.

Will it become economically possible to use renewable resources such as solar panels in homes or wind turbines on farms.

Is solar energy a main source to live in the future?

Is it practical to replace oil for a cleaner energy source for society?

Renewable Electricity Sources in the U.S.

U.S. average levelized costs (2012 $/MWh) for plants entering service in 2019

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Levelized Cost of Electricity

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1. **What is the estimated cost per MWh for existing conventional coal?**
2. **How low will the capital cost per MWh of solar have to fall to be competitive with existing coal?**

## Team Exercise

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1. **Why is battery storage technology such a game-changer?**

## Wind Potential

Source: [http://www.windpoweringamerica.gov/wind_maps.asp](http://www.windpoweringamerica.gov/wind_maps.asp)

## Transmission Issues

Source: [http://www.aep.com/about/transmission/docs/transmission-facts.pdf](http://www.aep.com/about/transmission/docs/transmission-facts.pdf)

## Transmission Losses

Source: [http://www.aep.com/about/transmission/docs/transmission-losses.pdf](http://www.aep.com/about/transmission/docs/transmission-losses.pdf)
Transmission Losses

Solar Potential

The price of one watt of solar energy 1977-2015

Renewable Energy Questions
The challenges of renewables

- “Net metering is a billing mechanism that credits solar energy system owners for the electricity they add to the grid.”
  (www.seia.org/policy/distributed-solar/net-metering)

- http://nyti.ms/1H09wdS

Externalities and Solar Electricity Team Exercise

- What is one negative externality that solar electricity eliminates?
- What is one negative externality that solar electricity creates?
- Given the above, do you think net metering at full price is economically efficient? Yes or no

If your team was king for a day...

- If you were allowed to make one energy policy change that would lead to a more socially efficient outcome, what would it be and why?

What about biofuels?

- What policies exist in the U.S. to incentivize the production of biofuels?
- Do these policies make sense?