

Econ 366

Fall 2012

Other Fossil Fuels
(Coal and Natural Gas)

Natural Gas

- Where available, offers a 'cleaner' alternative relative to coal (~70% less) and oil (~30% less)
- Also, being a gas, riskier in terms of the possibility of accidents
- Prices have been impacted by development of fracking technologies (can be analyzed at a basic level as a 'discovery' of new "economic" reserves or as a new 'backstop' given the large supplies)
- In Alberta, low natural gas prices have an implication for electricity prices (via the merit order auctions) and for the "economics" of CSS

Natural Gas

- Markets are more localized compared to oil
(Note: lack of availability of ng in Atlantic Canada until very recently)
- Although often found in conjunction with oil, can be found in a wide variety of geological circumstances
- Transportation usually via pipelines (natural monopoly)
 - High pressure pipelines for transmission network
 - Low pressure pipelines for distribution to end-users
- Disruptions in transmission are costly → as with electricity, transmission and distribution needs to be coordinated via a system operator
- Transmission systems better developed in industrialized countries
- If pipelines cross international borders, potential for conflict increases

Shale Gas / Fracking

- Hydraulic Fracturing: water and chemicals forced underground at high pressure → release of natural gas
- Has reduced the demand for LNG in some regions
- Impact on water supplies? Seismic activity?

Shale Gas Development: Risks

- Fracturing fluids contain chemical additives
- “flowback fluid” returns to surface and can be recycled, treated or stored → potential for water contamination if mismanaged
- Gases can escape during process (NO_x and VOCs → ozone; GHGs; other air pollutants)
- Accidents can happen (well blow-outs)
- Contamination from drill cuttings could leach into groundwater supplies

Shale Gas Development and Property Values: Differences Across Drinking Water Sources Muehlenbachs, Spiller and Timmins (2012 Working Paper)

- **Abstract:**

“While shale gas development can result in rapid local economic development, negative externalities associated with the process may adversely affect the prices of nearby homes. We utilize a triple-difference estimator and exploit the public water service area boundary in Washington County, Pennsylvania to identify the housing capitalization of groundwater risk, differentiating it from other externalities, lease payments to homeowners, and local economic development. We find that proximity to wells increases housing values, though risks to groundwater fully offset those gains. By itself, groundwater risk reduces property values by up to 24 percent.”

- <http://www.nber.org/papers/w18390>

LNG

- Can reduce the need for pipelines if gas is first liquefied:
 - *Liquefaction*: ng is liquefied by cooling to -162°C (which greatly reduces the volume: 1/600); requires substantial investment in liquefaction plants
 - *Transportation* (and storage) in specialized containers on specially designed tankers (~ 25 to 40% of supply costs for LNG)
 - *Re-gasification*: Converted back to gas for injection into pipeline for delivery to final users (~ 15% of LNG supply costs)

Coal

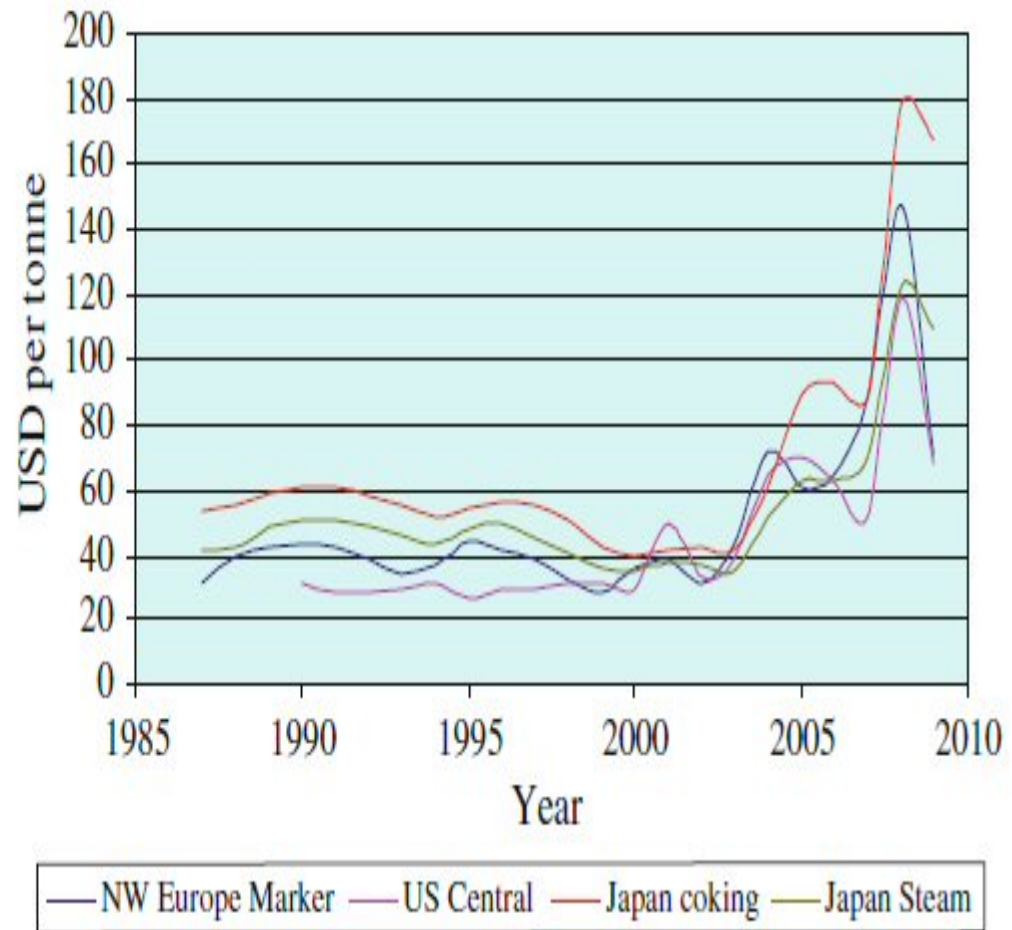
- Abundant but not as 'clean' as other fossil fuels
- Largest producer: China (almost $\frac{1}{2}$ of world production; doubling of output since 2000)
- Coal production declining in some regions (Germany, Poland)
- Mix of 'types' varies across regions
- Given its weight, usually used close to source (in electricity generation, for example; also used in steel production (coking coal))

Coal Markets

- Relatively small proportion of coal is traded (less than 15%)
- Markets tend to be regional given the transportation costs
 - Atlantic market (western European importers)
 - Pacific market (Asian importers)
- Even importers don't necessarily buy coal in the 'marketplace'
 - <http://www.cbc.ca/news/canada/calgary/story/2011/10/31/grande-cache-coal-takeover.html>

Coal Prices by Region / Type

Fig. 16.7 Coal price development. *Data source* BP Statistical Review of World Energy 2010



General Developments in the Coal Industry

- In spite of global warming concerns, coal continues to be a major source of primary energy supply
- Shift of coal production and use from west to east
- More (very) large firms (international market dominated by 4 majors), but many small-scale producers in some countries

Coal and New Technologies

- Integrated Gasification Combined Cycle electricity generation plants offer reduced emissions but higher generation costs
- Carbon capture and storage (CCS) technologies may increase the attractiveness of coal in many markets
- Pilot projects in Alberta → learning-by-doing → decrease the cost of implementing CCS?
(currently 'eats up' about $\frac{1}{2}$ of the energy that would otherwise be generated to operate the CCS system)