Econ 366

Fall 2012

Demand Management: Rationales and Methods

Growth in Energy Demand

- http://www.altalink.ca/news/news-releases.cfm?releasePage=02232012171918

"In the last 20 years, Alberta has welcomed more than one million new residents and our demand for electricity has doubled, yet the backbone of the transmission system remains largely the same."

Dealing with Growing Energy Demand: Options

- Encourage increases in supply: encourage exploration for conventional depletable resources (fossil fuels), R&D for renewables and non-conventional energy sources, building of electricity generation capacity
- Attempt to curb demand through a variety of means: prices / taxes (if demand is sufficiently elastic), encourage the replacement of energy-inefficient technologies with more efficient ones, smart metering, ...
- Note: supply-side management involves fewer agents than demand-side management (but supply is not always from domestic sources)

Dealing with Growing Energy Demand: Options

- Demand management techniques / policies have been undertaken by
  - Governments
  - Utilities (why would a firm that makes money by selling energy want to curb demand?)
  - Policies undertaken by utilities via smart meters and other programs usually referred to as DSM (demand-side management)

- Policies attempt to affect the amounts and/or timing of use (peak-load problems for electricity generation; congestion and pollution problems for transportation)

Demand Management history (very brief)

- 1973 oil price shock → programs aimed at encouraging people to shift away from oil and towards other (locally available) fuels for heating, etc.
- 1990s: environmental concerns start driving many energy-related programs; move towards deregulation in electricity markets leads (?) to lower prices (counter-productive for environmental concerns)

Policies to curb demand: Rationales

- Energy Importers:
  - Falling demand →
    - reduced reliance on imports
    - reduced exposure to risk from price fluctuations
    - improved supply security (to the extent that demand reductions allow local energy options to be used)

Policies to curb demand: Rationales

- Energy Conservation (reduce the amount of energy used) / Fuel Substitution (change the amount and mix of fuels used) to deal with environmental concerns:
  - Encourage the adoption of new technologies
    - information programs (Energy Star®), audits
    - Subsidization and buy-back programs that reduce the cost of switching technologies
  - Adjust the relative price of one type of fuel relative to another
    - Carbon tax or other targeted fuel taxes

Policies to Curb Demand: Rationales (and tools for load management)

- Load management (change the timing of demand, often in conjunction with reducing the size of demand) in order to reduce the need to expand generation capacity or in order to reduce traffic congestion:
  - Smart meters with time-of-day pricing → consumers shift use of appliances / equipment to lower priced periods
  - Smart meters with remote disconnect → utility company controls when some systems (ex., HVAC) are on
  - Appliance buy-backs (e.g., refrigerators) → reduce overall demand, and therefore also demand at peak periods
  - Regulations on when vehicles can be used (based on license plate numbers, for example)

DSM: Electricity*

- Electricity generation:
  - DSM may offer advantages over supply management since each 1 MWh drop in demand leads to a greater than 1 MWh fall in the need for generation (due to transmission and distribution losses)
  - DSM may reduce pressure to expand infrastructure (AUC transmission line hearings* ...) → reduced externalities associated with building up infrastructure (also applies to other energy sources: pipelines, for example)
  - http://www.energy.alberta.ca/Electricity/transmission.asp

*some of the problems / issues on following slides also apply to transportation 'peak load' (congestion, pollution) problems

Brief Digression: Alberta Transmission Line Project Hearings

- http://www.heartlandtransmission.ca/upload/file/EXECUTIVE%20SUMMARY.pdf
  1.1 Heartland Transmission Project

1. This is an Application to the Alberta Utilities Commission (AUC) pursuant to the Hydro and Electric Energy Act, R.S.A. 2000, c. H-16 for permits to construct and licences to operate the following three facility additions:

   a. A 500 kV AC double-circuit transmission line (1206L/1212L) connecting the 500 kV system on the south side of the City of Edmonton to the new Heartland 12S Substation (the 500 kV Line Project);

   b. A 240 kV/500 kV Heartland 12S Substation, located approximately 15 km north east of the City of Edmonton in the Gibbons – Redwater Region (the Heartland 12S Substation Project); and

   c. A 240 kV double-circuit transmission line (1054L/1061L) connecting the 240 kV system in the area to the new Heartland 12S Substation (the 240 kV Line Project).

2. Together, these three facility additions are referred to as the “Heartland Project”.

Brief Digression: Alberta Transmission Line Project Hearings

Useful links for more details on the hearing process / issues considered

- http://www.heartlandtransmission.ca/
- http://hvdc.atcoelectric.com/
- http://albertaelectricityfuture.com/alberta/?page_id=403
- http://www.auc.ab.ca/items-of-interest/western-alberta-transmission-line/Pages/default.aspx
- http://www.auc.ab.ca/items-of-interest/heartland-transmission-project/Pages/default.aspx#redacted%20hearing%20transcripts

Load Management

- attempt to alter the 'load shape', usually with a goal of reducing peak demand
  - →reduce the need to invest in generation and transmission capacity to ensure that peak demand can be met; (in the context of transportation, peak-load may refer to congestion)
  - → generation may be more efficient when closer to capacity, so may want to also increase off-peak demand (i.e., demand smoothing can reduce overall generation costs)
- Components
  - (1) Peak-clipping: reduce peak-time demand
    - (1) Restrict the use of equipment / vehicles at certain times of day
    - (2) Provide price signals (time-of-use pricing)

Load Management

- Components

(2) Valley-filling: Promote use at off-peak times

(1) Encourage charging /filling in off-peak periods (such charging electric cars overnight) * See news article link on next slide

(2) Provide price signals (time-of-use pricing)

(3) Load-shifting: Combination of (1) and (2)

(1) Encourage use of appliances (dishwashers, washing machines) at night instead of early evening

(2) Provide price signals (time-of-use pricing)

News Article from Oct. 4

http://www2.timesdispatch.com/business/2011/oct/04/tdbiz01-dominion-introduces-lower-rates-for-owners-ar-1356142/

Load Management

- Components

  (4) Energy Conservation (shift entire load downwards)

  (1) Encourage the purchase / installation of energy-efficient technologies

  (2) Encourage “eco-friendly” use of technologies: unplug when not in use; use cold water for laundry; use public transport; ....

Load Control Methods

- Direct
  - Utility disconnects end-user devices remotely (usually incentives offered)

    http://www.fpl.com/residential/energy_saving/programs/oncall.shtml
  - Interruptible loads (short-notice; price concessions)
  - load-shedding (supply cut off to a whole area)

Load Control Methods

- Indirect
  - Price signals (TOU pricing)
  - http://www.ontarioenergyboard.ca/OEB/Consumers/Electricity/Smart+Meters/FAQ+-+Time+of+Use+Prices
  - http://www.ontarioenergyboard.ca/OEB/Consumers/Electricity/Electricity+Prices (examples of time of use price rates)

Energy Efficiency Improvements / Energy Conservation

- Both governments and utilities undertake a variety of initiatives to encourage adoption of energy-efficiency technologies in order to conserve energy.
- Examples*
  - MEPS: Minimum Energy Performance Standards (introduced for home appliances in 1995; amended occasionally)
  - Energy Star® (starts in 2001, specifications change occasionally)
  - EnerGuide labelling program: estimated annual average unit energy consumption (UEC)

*See: http://oee.nrcan.gc.ca/publications/statistics/cama10/pdf/cama10.pdf

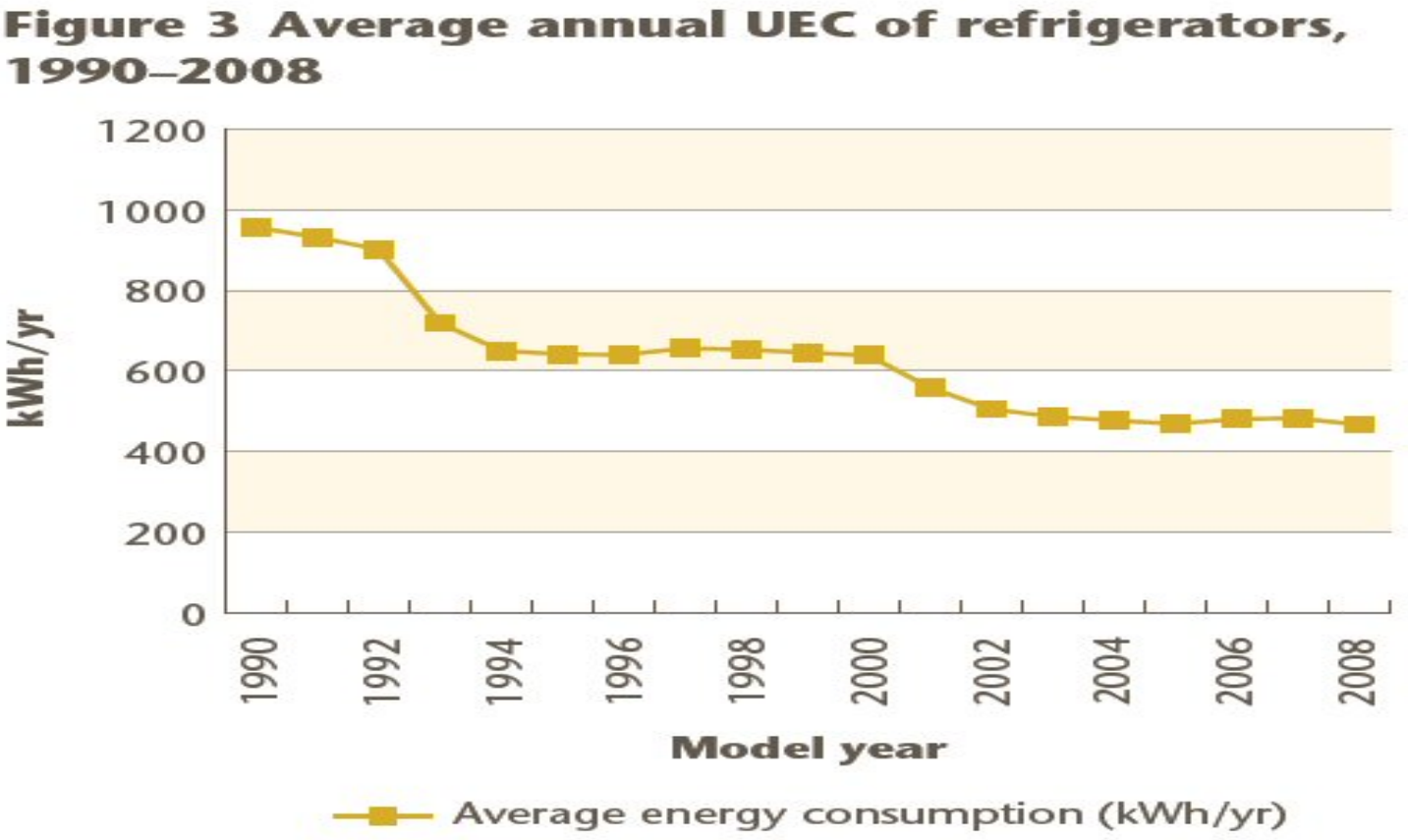
Energy Efficiency Improvements / Energy Conservation

- Examples continued
  - Audit / subsidy programs such as EcoEnergy Retrofit
  - Appliance buy-backs / Cash-for-clunkers
  - EnerGuide labelling program: estimated annual average unit energy consumption (UEC)

*See: http://oee.nrcan.gc.ca/publications/statistics/cama10/pdf/cama10.pdf

Energy Efficiency Improvement Example

http://oee.nrcan.gc.ca/publications/statistics/cama10/pdf/cama10.pdf



Other Opportunities for Energy Savings

- Things that go blip in the night

http://www.oecd-ilibrary.org/energy/things-that-go-blip-in-the-night_9789264192751-en

- Lighting
- Space heating / cooling .... Equipment and thermal envelope
- Transportation: alternative modes, fuel efficient vehicles