Econ 366

Fall 2012

Electricity Supply

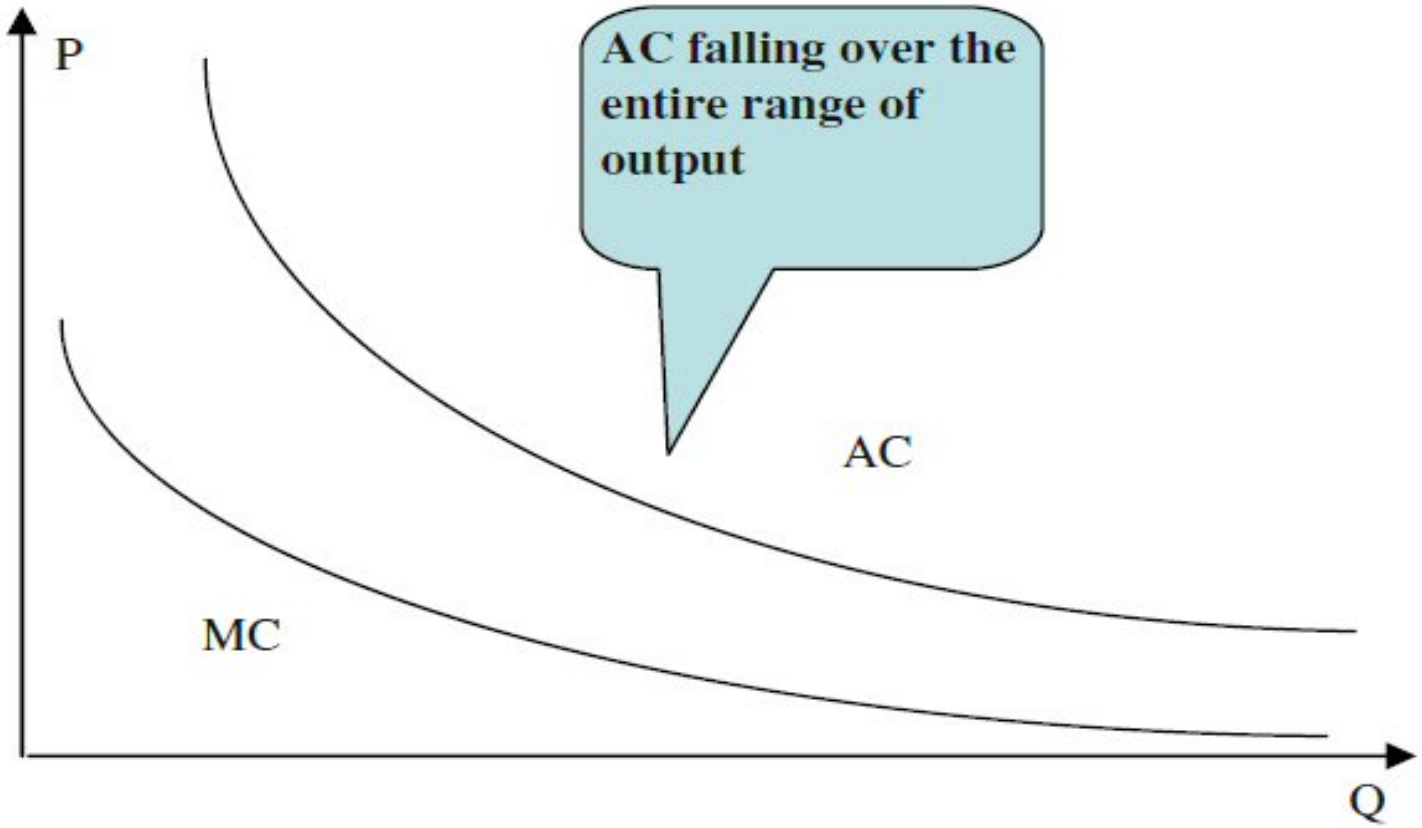
Basic Theory

Natural Monopoly

In some production processes, long-run average cost falls over a large range of output levels → economies of scale

Large fixed costs → Lower costs per unit from one large producer than from several small producers

Figure 12.9



Basic Theory

Before the advent of small scale natural gas plants and alternative ‘green’ generation, both generation and transmission were considered to be ‘natural monopolies’

In most jurisdictions, there would be a single supplier that was publicly owned or that acted as a ‘regulated monopoly’ (to limit the ability of the electric utility to exert market power) with rates set in a way that guaranteed a specific ‘rate of return’ on the utility’s investment

Dealing with Natural Monopolies

- Public Ownership
  - Municipal ownership → profits can be used to fund other public projects and / or keep taxes lower than would have otherwise been possible
- Private Ownership
  - Public Utility Commissions (such as the AUB) regulate the utility in exchange for monopoly rights in the jurisdiction
  - Rate-of-return regulations evolved, whereby utility's prices are set so as to guarantee a 'fair' rate of return on investment in generation capacity and transmission infrastructure
  - Alberta (pre-restructuring): regional franchise monopolies with Cost-of-Service regulation → regulated price that covered costs of production and allowed for a 'reasonable' rate of return

Averch Johnson Effect

- Palgrave Dictionary: “The Averch–Johnson effect is produced when fair rate of return regulation encourages a firm to invest more than is consistent with the minimization of its costs. This can happen when the allowed rate of return exceeds the cost of capital, since the difference between the two represents pure profit.”
- http://www.dictionaryofeconomics.com/article?id=pde2008_A000186

Averch Johnson Effect

- Can be illustrated in a simple isocost / isoquant framework
- Regulator sets a profit limit as a percentage return on capital (one of the inputs) → utility can increase total profits by increasing the size of its capital stock → it is as if the cost of purchasing capital has fallen (as some of the costs will be offset by a guaranteed return)

Electricity Supply in Alberta

Generation Market:

- Deregulated
- Facilities must be approved by the AUC to ensure that they comply with safety, environmental and design standards
- New plants built privately; subject to financial risk
- Old plants (formerly regulated assets): auction of PPAs → (i) buyers obtained financial rights for energy produced by these plants; (ii) original investors received guaranteed returns; (iii) customers received proceeds beyond those needed to provide for (ii)
- All generating units (old and new) now 'compete' for right to sell energy through Power Pool auctions

For more details see:

http://www.auc.ab.ca/market-oversight/albertas-energy-market/Pages/default.aspx#energymarket

Electricity Supply in Alberta

Basic Statistics (as of August 2012):

Generation capacity: 14098 MW (about 30% is co-gen*)

Coal Plants:	6239 MW
Natural Gas Plants:	5504 MW
Hydro:	900 MW
Wind:	972 MW
Biomass:	409 MW
Waste Heat:	62 MW
Fuel Oil:	12 MW

Plus Interconnections with BC (750 MW) and Sask (150 MW)

*simultaneous generation of electricity and steam/heat for industrial process

For a list of additions to capacity and decommissions since 1998 see:

http://www.energy.alberta.ca/Electricity/682.asp

Wholesale (Merit Order) Auctions → hourly pool prices

See AESO fact sheet:
http://www.aeso.ca/files/fastfacts_det_market_5_may06.pdf (has auction diagram)

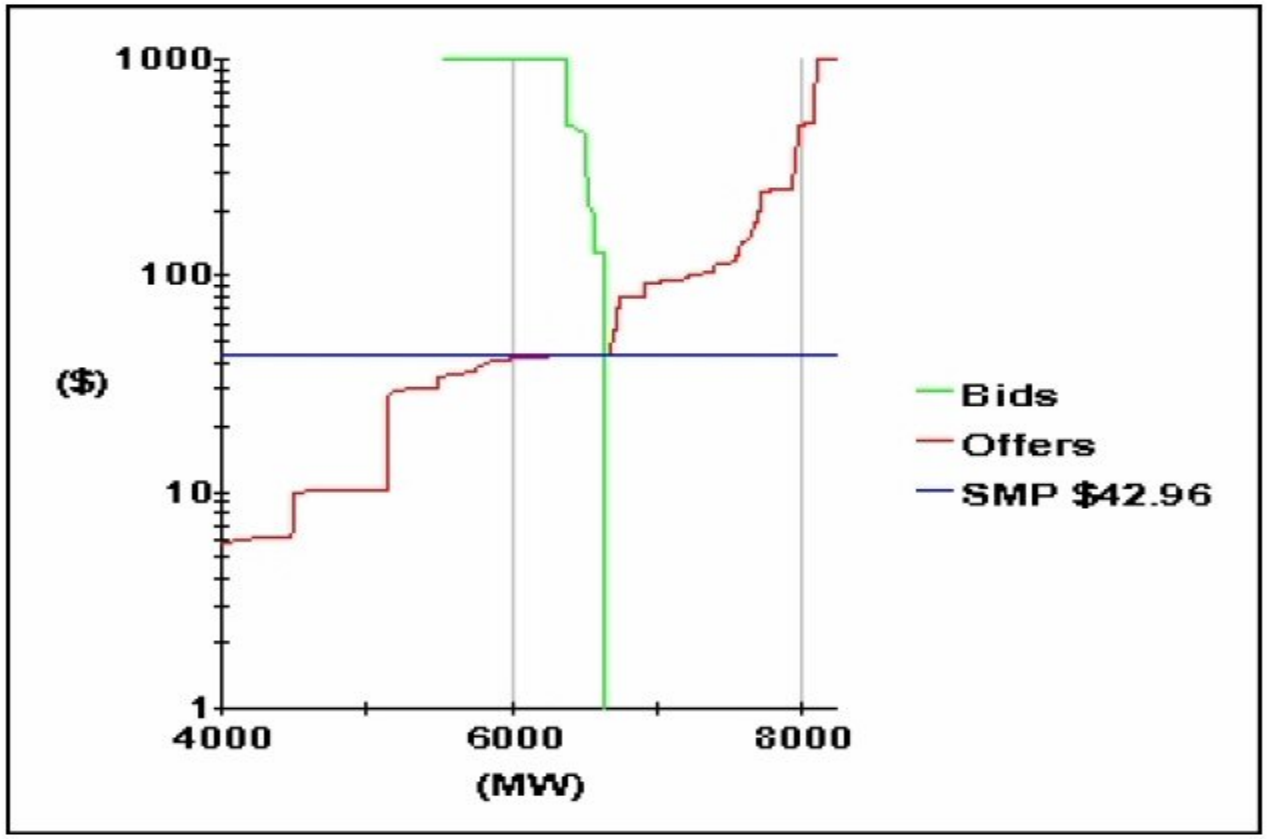
All bids have a price and quantity (= maximum capacity for a supplier) component:

Supply Side (all generators need AUC approval)
Baseload plants (usually large coal plants) will tend to put in low price bids

Peaking plants (natural gas, wind, etc. with higher variable costs and lower shutdown costs) will tend to put in higher price bids

Demand Side:
Generally consists of retailers / marketers (who service end-users) can make bids 'not to purchase' if prices rises to a specified level; otherwise, they have a default standing bid to purchase at any price

Merit Order Auction (AESO)



Pool Prices

- Prices can be seen at: http://ets.aeso.ca/ (divide by 1000 for KwH prices)
- "Wholesale prices are affected by many factors that relate to the supply and demand for electricity. These factors include:
  - Generation outages
  - Maintenance down times
  - Weather/temperature
  - Provincial growth
  - New generation coming on stream
  - Water levels in dams
  - Wind
  - Price of fuel (coal and natural gas) used as generation inputs
  - Time of day, and time of the year electricity is to be used. " http://ucahelps.alberta.ca/electricity-market.aspx

Electricity Supply in Alberta

Micro-generators:

http://www.energy.alberta.ca/Electricity/2396.asp

http://www.aeso.ca/downloads/Micro-generation_Fact_Sheet_020311.pdf

Small-scale 'environmentally friendly' producers (such as solar, hydro, wind, biomass, micro-cogen, fuel cells)

Local 'wire service' provider pays for interconnection and two-way meter upgrade

Retailer* manages billing (credits) and administration costs. Micro-generator can select to be paid for contributions to the grid at the auction price or retail price

* Micro-generators do not participate in AESO auctions.

Transmission / Distribution: Wires

- “Wires” are still a regulated monopoly in Alberta (natural monopoly conditions)
  - Transmission: suppliers to load centers
  - Distribution: serves individual customers
- Each region has a WSP (Wire Service Provider)
  - Edmonton and Ponoka: EPCOR Dist’n Inc
  - Calgary, Red Deer, Cardston, Fort Macleod, Crowsnest Pass: ENMAX Power Corp
  - Lethbridge: City of Lethbridge
  - Northern and east central AB: ATCO Electric
  - Other regions: FortisAlberta

Wires

- Transmission grid:
  - owned by public for-profit companies
  - Planning and operation by AESO (Alberta Electric System Operator)
    - Regulated by AUC
  - Regulated under a cost of service model:
    - Customers are charged for the costs of running the system (including the costs of hearings, etc.) plus a ‘reasonable’ rate of return
- Distribution systems: generally owned and operated by municipal governments or municipally owned public utilities; also regulated