

Manitoba Hydro Market Considerations for Planning

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Power Planning
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MISO Scope of Operations as of November 2009



Scope of Operations

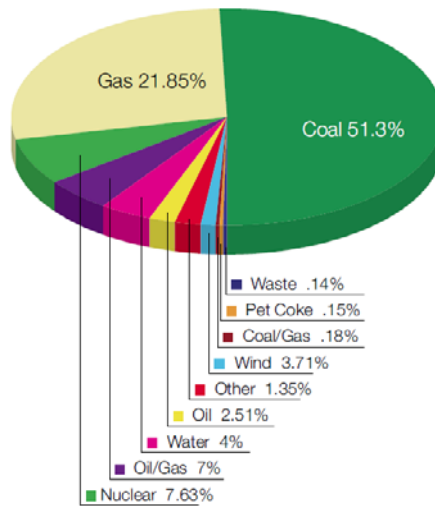
- Generation Capacity
138,556 MW (market)
- Historic Peak Load (set July 31st, 2006)
116,030 MW (market)
- 13 states
- One Canadian province
- 750,000 square miles



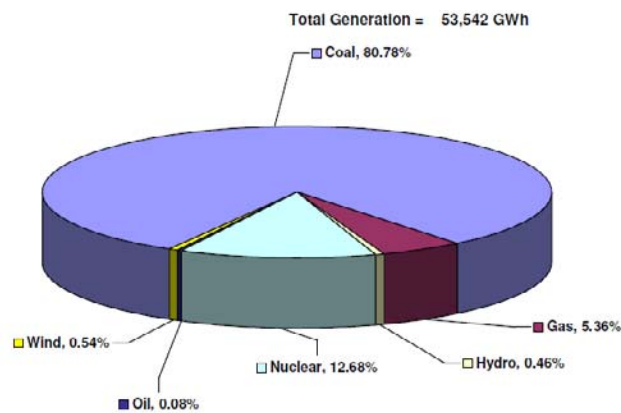
MISO Market Footprint

Manitoba Load and Generation are External to the MISO Market Footprint

Installed Generation Capacity in MISO as of November 2009

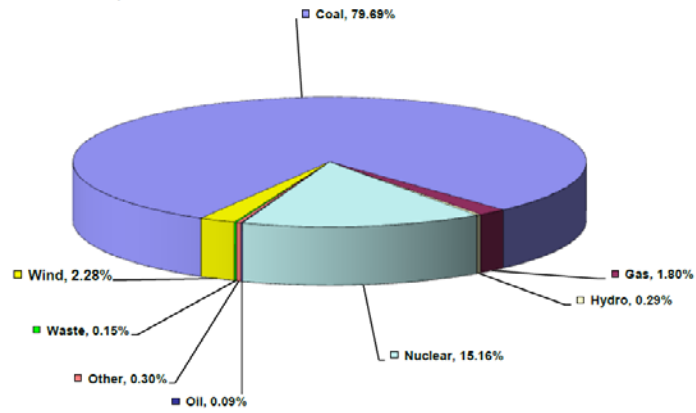


MISO Generation by Fuel Type - July 2008



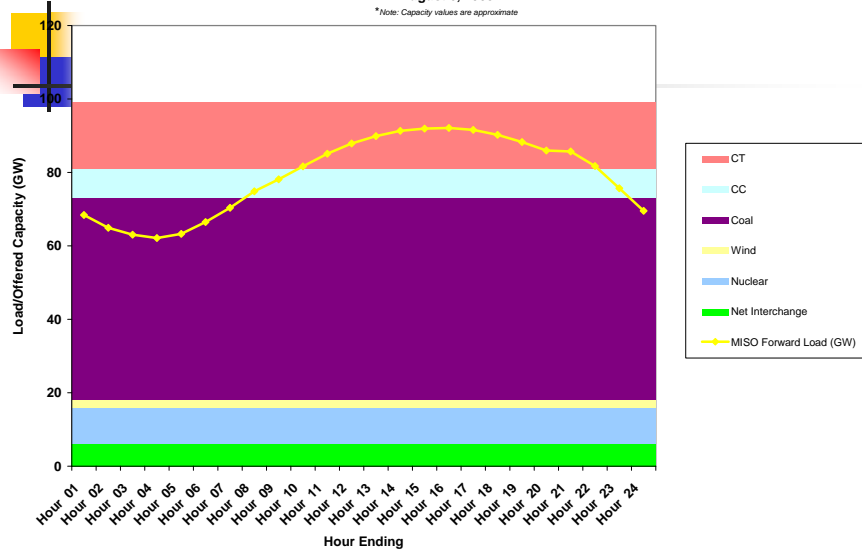
MISO Generation by Fuel Type- October 2009

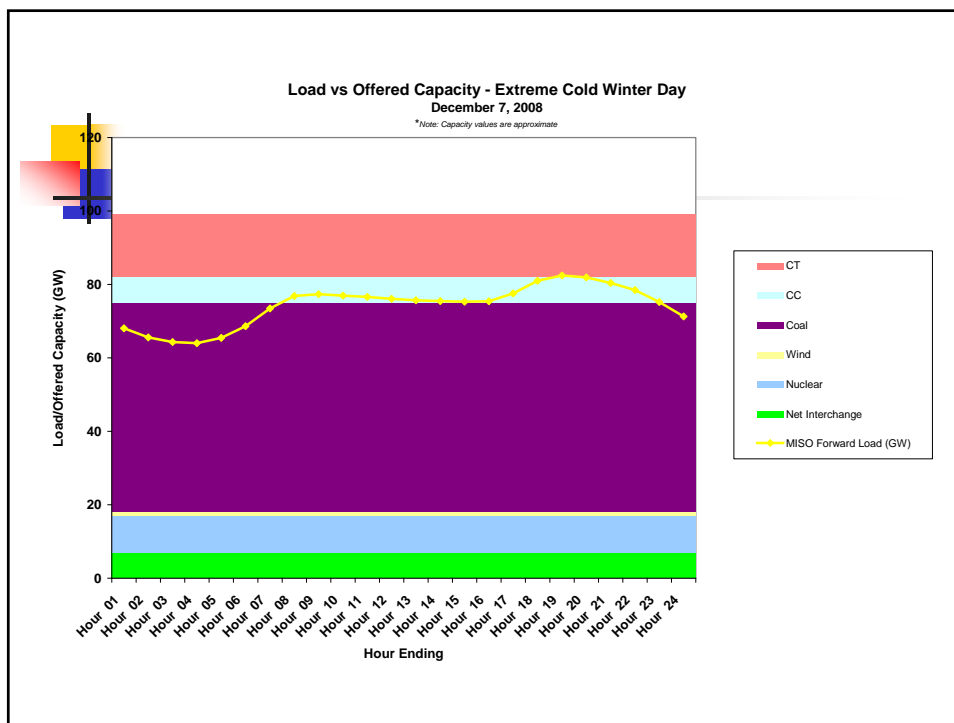
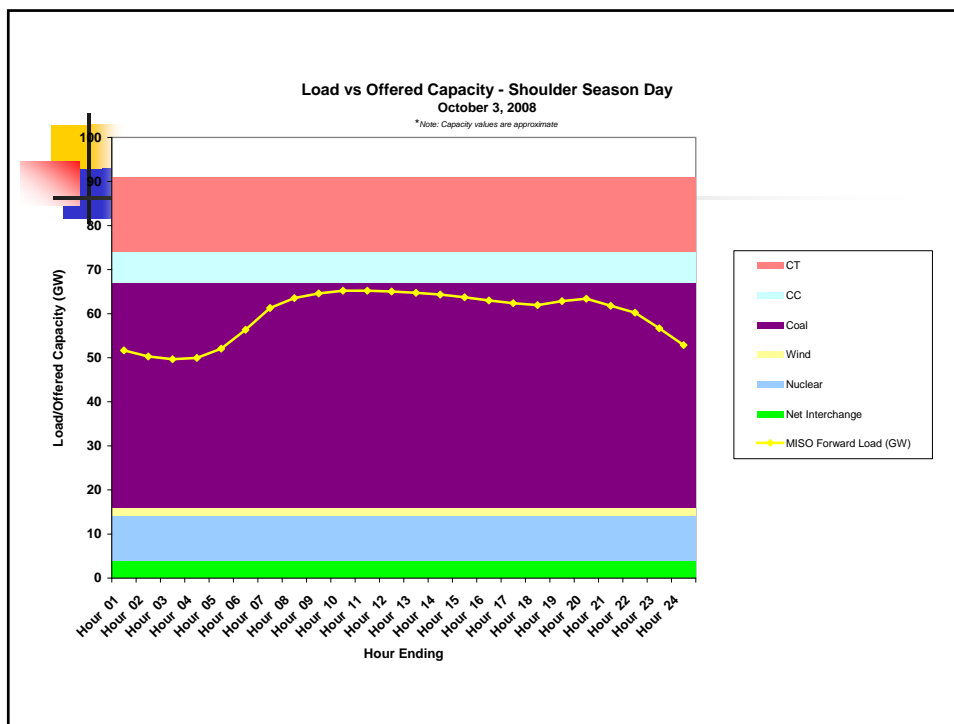
Total Generation = 48,013 GWh



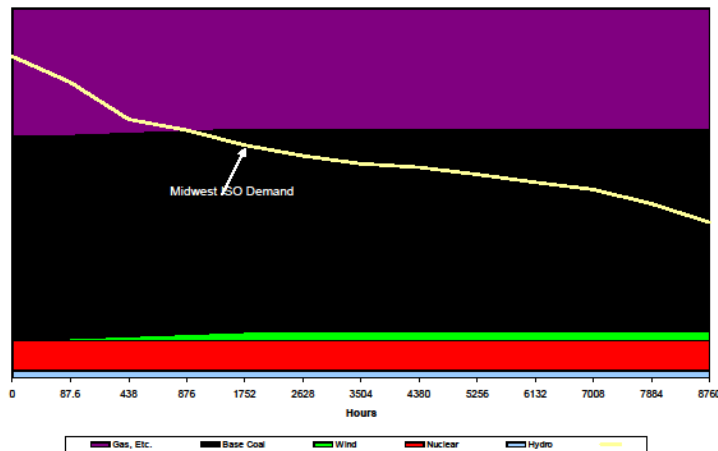
Load vs Offered Capacity - Hot Summer Day August 6, 2008

*Note: Capacity values are approximate





MISO Load Duration Curve superimposed
on a Representative Generation Stack



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Components of Electricity Market Prices

- *Electricity Price* = Capacity Charge plus Variable Production Cost for Energy
- *Capacity Charge* (also called fixed or capital) costs represents fixed costs to have a plant available for generation, *but not producing any energy*
- *Variable Production Cost* - Cost of producing the energy and is the market clearing price in a power market. In a thermal system, this is largely fuel (gas or coal) cost, and in the future will include the cost of carbon.



Determining the Market Clearing Price

- Generators electronically offer the potential output of their units into the market based on their variable cost of producing power
- The market operator uses security constrained economic dispatch to stack all the offers from lowest to highest, and selects the offers (or dispatches the generators) as required to meet the current load, while respecting any system limits such as transmission line capacities
- Each generator which runs gets paid the market clearing price for that hour, which is the variable (or marginal) cost of the most expensive unit operating during that hour

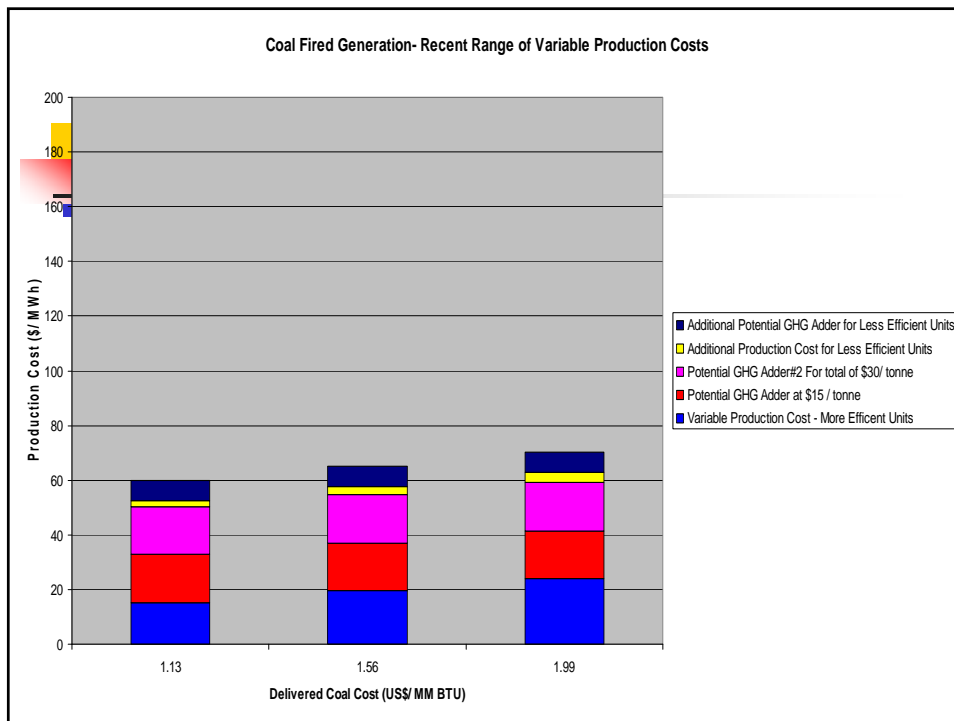


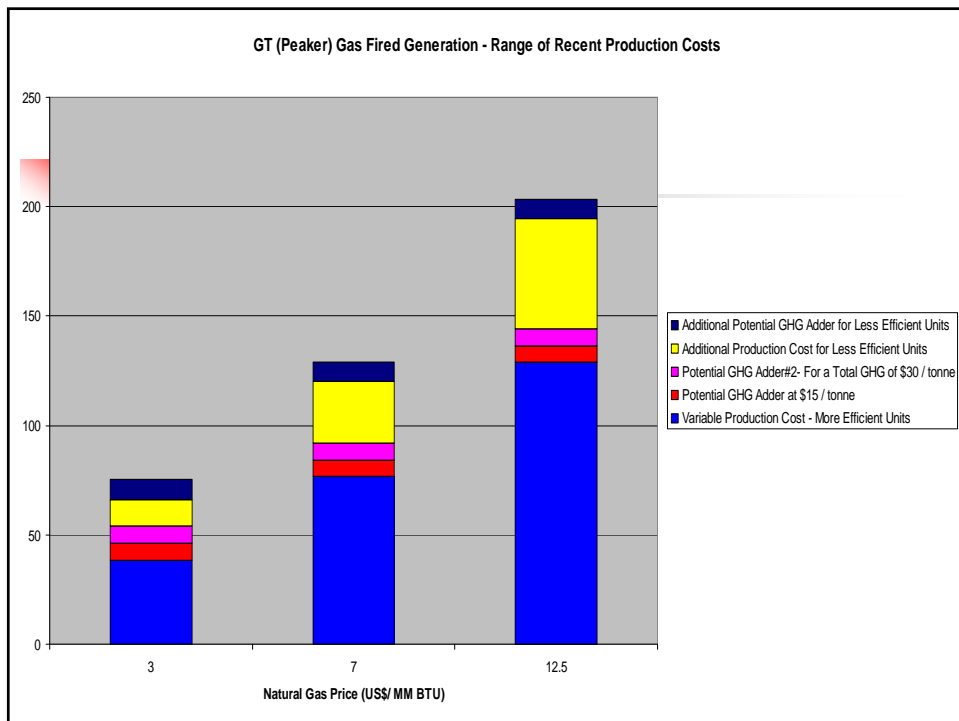
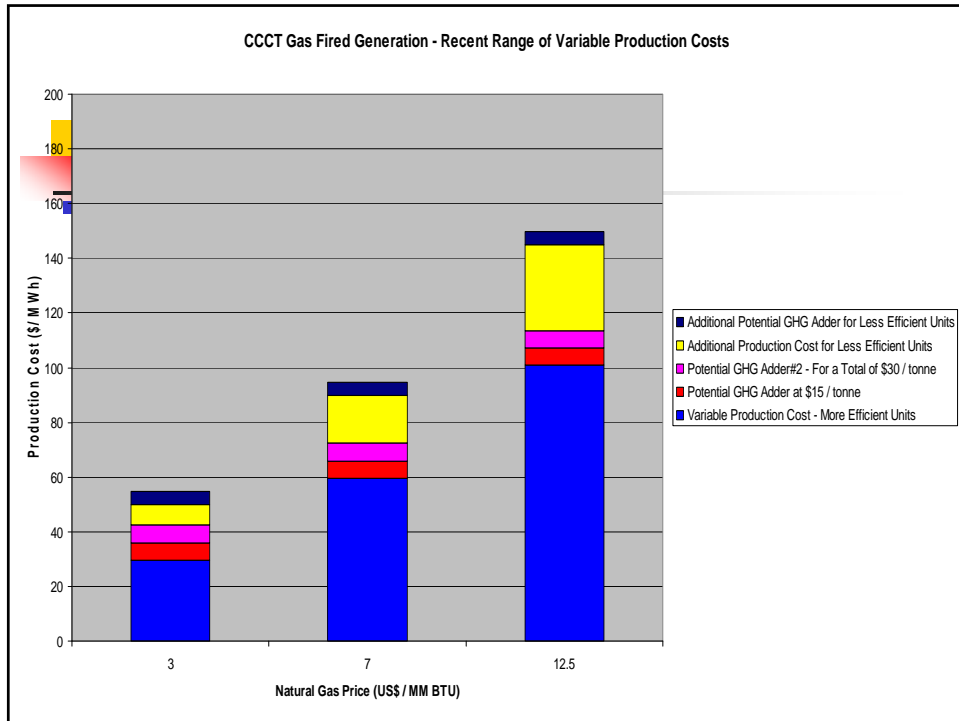
Market Dispatch versus Long Term Resource Planning Decisions

- | | |
|---|---|
| <ul style="list-style-type: none">■ Market Dispatch:<ul style="list-style-type: none">■ Very short term horizon■ Capacity costs are sunk and are not considered■ Capital costs of existing generation not in energy price and recovered via other rate base mechanisms■ Thermal generators offer into market at variable cost of production■ Variable production cost normally sets a floor on the market price | <ul style="list-style-type: none">■ Long Term Resource Planning Decisions:<ul style="list-style-type: none">■ Capacity costs are not yet incurred and are considered along with variable production costs■ Consideration of expected capacity factor of plant:<ul style="list-style-type: none">■ Low capacity factor requirements often select a gas peaker with high operating but low capital costs■ High capacity factor requirements often selected a baseload coal plant (before CO2 consideration) |
|---|---|

Typical Variable Production Costs from Existing Generation

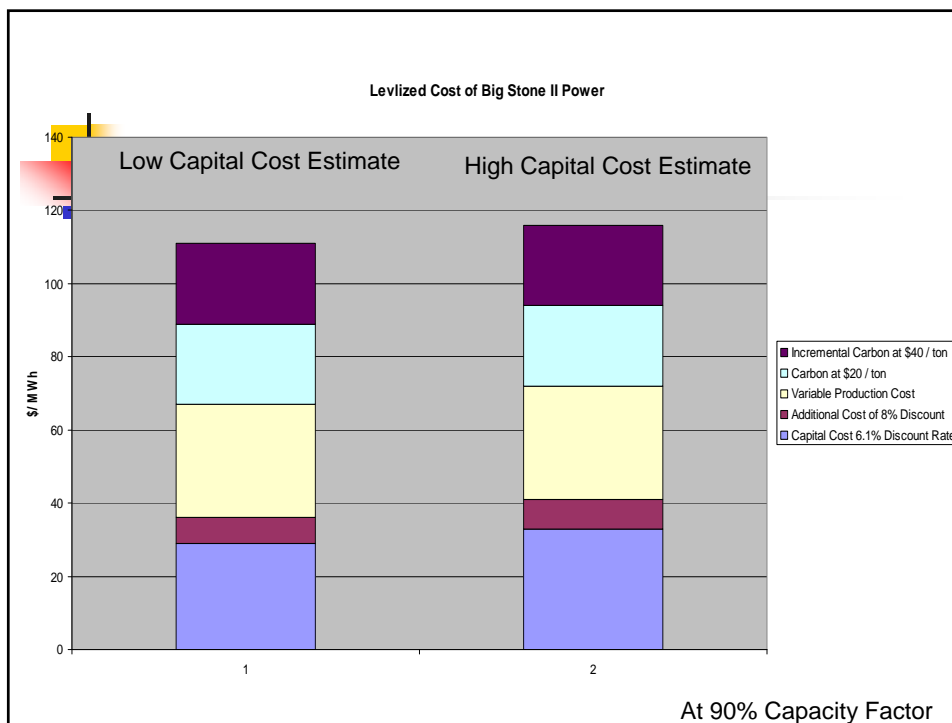
Plant Characteristics	Coal Plant	Combined Cycle Gas Turbine	Simple Cycle Gas Turbine
Typical Coal Heat Rate range	10,000 - 12,000 Btu/KWh		
Typical Combined Cycle Heat Rate range		7,500 - 10,000 Btu/KWh	
Typical Combustion Turbine Heat Rate range			9,000 - 13,500 Btu/KWh
Approximate Non-Fuel O&M (\$/MWh)	\$4.00	\$7.00	\$10.00
Typical Emissions Rates (Tons CO ₂ /MWh)	1.17 - 1.41	0.43 - 0.59	0.52 - 0.82



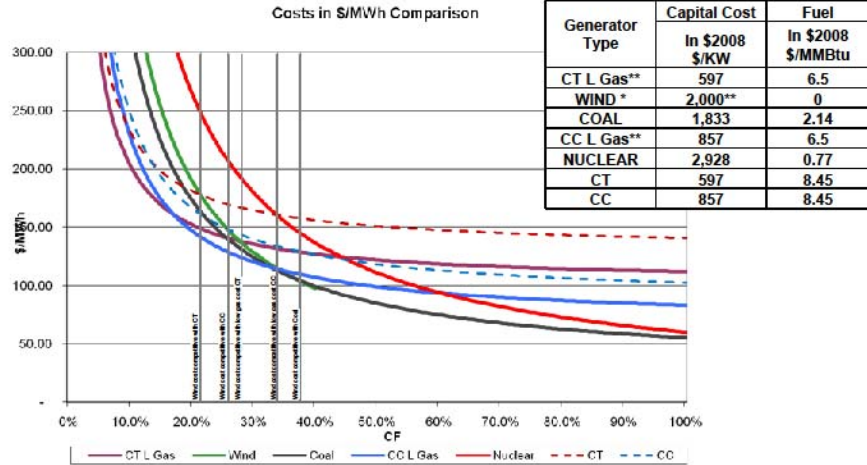


Costs of Power from a New Coal Plant- Big Stone II

- Approved Coal Plant in South Dakota cancelled in Nov 2009 due to uncertainty in the future of carbon regulation
- A Report released in October 2008 looked at carbon, construction and fuel prices for the Big Stone II development



Cost of Generation



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*Wind cost does not include Production Tax Credit; does include cost of associated CTs

** All values from MTEP 2009 analysis (Jan 2008) except: wind capital cost, and L gas price scenarios

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2007 Cost Data; No carbon costs included; Nuclear capital costs significantly understated

Existing MISO Generation fleet is aging and replacement is required

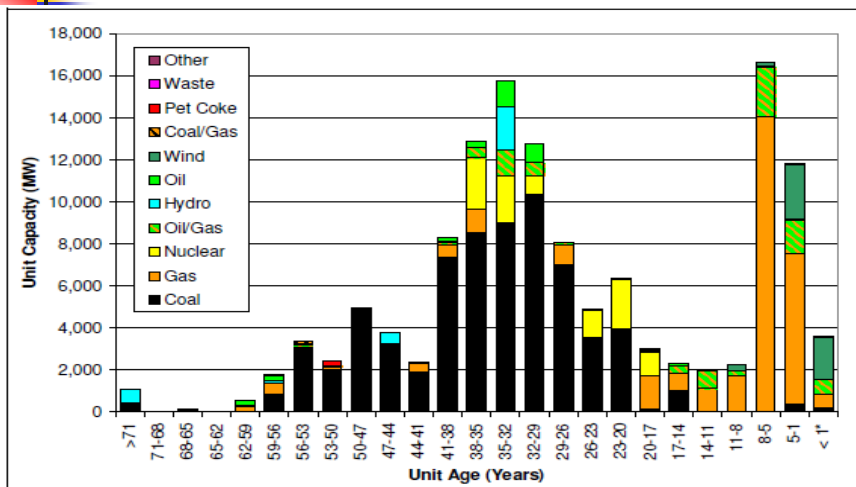


Figure 5.2-10: Age of Generation Fleet by Fuel Type

Source MISO MTEP 09 Report – Dated Dec 2009 page 86