Influence of Missouri River on Power Plants and Commodity Crop Prices

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An evaluation of 100 years of daily inflow data from the Missouri River tributaries suggests that when summer releases from Gavins Point fall below minimum navigation levels of 28-30,000 cubic feet per second, some power plants experience losses in efficiency. During periods of low inflows from Missouri River tributaries, a relatively low sustained summer release of 21,000 cubic feet per second at Gavins Point will cause electric power losses that would have to be made up by purchasing from the grid or from peaking units at a significantly higher cost. Ultimately, these higher costs will be passed on to consumer in the form of higher utility bills.

Changes in local prices due to changes in Missouri River navigation, impact all production in the region, not just that which is transported via the river. Approximately 540 million bushels of corn, 160 million bushels of soybeans, 14 million bushels of sorghum and 12 million bushels of wheat produced within the economic reach of the Missouri River can be impacted by barge transportation in the Missouri river. Seasonality analysis suggests that prices along the Missouri River are closer to the St Louis price at times when the river is open.

The Impact of the Missouri River on Power Plants
Preliminary Summary Points – Full Report Forthcoming
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After reviewing 100 years of daily inflow data from the Missouri River tributaries, our analysis indicates that with average inflows, some power plants using the Missouri River for cooling water, experience efficiency losses when summer releases from Gavins Point fall below the 28,000 to 30,000 cubic feet per second required to support minimal navigation. A sustained summer release of 21,000 cubic feet per second from Gavins Point will cause significant de-ratings (de-rating is the term used to indicate when a plant must reduce its power generation from its normal capacity rating) in some power plants cooled by the Missouri River, especially when combined with low tributary inflows.

The electrical power lost from these de-ratings will have to be made up by purchases from the grid or from peaking units at a significantly higher cost. Ultimately, these higher costs will be passed on to consumers in the form of higher utility bills. Also, in the longer term, if low summer releases were sustained, power plants could be facing significant additional structural investments.

Background

- The Corps reports that the upper basin of the Missouri River, including the 6 reservoirs, entered its fifth year of drought.

- The Corps 2004 Annual Operating Plan was simulated as steady releases from Gavins Point of 28,000 cubic feet per second for May and June, and 30,000 cubic feet per second for July and August, provided 1200 acres of wildlife habitat is created for the endangered pallid sturgeon by July 1. If this habitat is not created, releases from Gavins Point would be reduced to 25,000 cubic feet per second by July 1.

- The summer 2003 court ruling restricted releases from Gavins Point to 21,000 cubic feet per second for a period of 3 days, resulting in a significant increase in river water temperatures. Legal action could result in similar flow restrictions in 2004, possibly for longer periods.

- These summary points are focused on the implications of summer river flows for power plants. The omission of other seasonal flows does not imply that the power plants are unaffected during these other seasons.

Power Plant Implications

- Power plant implications were derived by surveying power plants cooled by the Missouri River under confidentiality agreements. All companies operating plants cooled by the Missouri River were contacted and all companies with the exception of MidAmerican agreed to participate in this study. MidAmerican

operates the three plants in Iowa reported to use cooling water from the Missouri River. Therefore, the implications discussed in this report are not necessarily applicable to the Iowa power plants.

- Power plants using cooling water from the Missouri River are affected by the river level and the river water temperature.

- Each power plant has a unique set of critical river levels and thermal regulations regarding the temperature or heat energy of the water released back into the Missouri River. Therefore, **changes in the Missouri River flows or river water temperatures do not affect all plants uniformly**.

- River water temperatures also affect the efficiency with which a power plant operates. The higher the water temperature, the less efficient the plant becomes.

- In January - March 2004, FAPRI resurveyed for these critical levels under confidentiality agreements with the power companies excluding the MidAmerican plants. **In almost all cases, the survey found that the critical levels for river level/flow were significantly more restrictive than the levels established by the Corps.** In some situations, current thermal regulations were found to be binding.

- Most power plants using Missouri River water for cooling are base load units (they are relied upon to supply the base load of power to their customer base 24 hours per day, 7 days a week). These base load units produce power about 4 to 8 times cheaper than gas turbine peaking power generation units.

Water Intakes

- The river level must be high enough at the water intake to provide water volume sufficient for the intake pump to maintain sufficient suction.

- Power plants designed their water intakes assuming minimum navigation levels would be maintained. This puts power generation at risk when river flows fall below navigation levels. Minimum navigation approximately corresponds to a 28,000 cubic feet per second release from Gavins Point.

Thermal Regulations

- Power plants are regulated by thermal emission guidelines which specify the maximum BTU of heat or actual temperature of the water that can be released back into the river.

- During the normal process of renewing operating permits and with changing Missouri River conditions, thermal regulations were eased in the early 2000s.

Most power plants expect that the thermal regulations will return to the original more restrictive levels when their permits expire over the next two to four years once the Corps makes a final decision on river flow management.

- With more restrictive thermal regulations, power plants are even more sensitive to Missouri River flows and incur greater de-ratings during low flow periods.

- The thermal regulations are primarily relevant in the summer months (June – September) when ambient water temperatures are normally higher.

- Missouri River water temperatures are affected by ambient air temperature, river flow rate, and tributary inflows. River water temperature is most affected by ambient air temperature. However, river flow rates also affect river temperature. Generally, during the summer months, if the Missouri River flow rate falls, the water temperature rises.

Power Plant Efficiency

- Power plant efficiency is affected by the river water temperature and by the level of the river.

- When river water temperatures rise, the efficiency of the power plants operations is reduced.

- The level of river affects how much energy must be used to pump the cooling water. When the river level falls, more energy must be used to pump the water reducing the efficiency of the plant.

- The level of the river also affects trash and sediment buildup at the plant's intakes. When low flows are experienced additional trash and sediment build up in the condensers further reducing plant efficiency.

Power Plant De-ratings

- When de-rating occurs at a power plant using Missouri River water for cooling, the power must be supplied by purchasing power off the grid, turning on more expensive peaking units or building new capacity. Power supplied on the grid is made up of excess capacity from other base load plants or peaking units.

- Some power plants can partially de-rate their power production before they completely shut down while others are either on or off. The cost of a power de-rating is measured as the cost of buying power off the grid minus the fuel costs saved by not using the base load plant.

- With average tributary inflows, most power plants have some cost impacts from de-ratings or modifying intakes when releases from Gavins Point are at least 25,000 cubic feet per second over the summer months from June through September.

- With average tributary inflows, some power plants experience a decline in power plant efficiency when releases from Gavins Point fall below the 28,000 – 30,000 cubic feet per second that supports minimum navigation over the summer. This loss in efficiency represents a de-rating from the plant's normal summer capacity.

- With average tributary inflows, when releases from Gavins Point are dropped to 21,000 cubic feet per second over the summer months, some power companies begin to de-rate or shutdown their plants due to water intake problems and/or to maintain compliance with thermal regulations.

- After reviewing 100 years of daily inflow data from the Missouri River tributaries, our analysis indicates that a relatively low sustained summer release of 21,000 cubic feet per second from Gavins Point will cause significant de-ratings or shutdowns in some power plants cooled by the Missouri River, specially when combined with low inflows.

Power Transmission

- Assuming that power was available to purchase on the grid, power transmission lines still could limit how much power can be transferred from one part of a reliability region to another or among reliability regions.

Consumer Effects

- De-ratings and/or adjustments by power plants for lower river flows translate into higher power generation costs that will be passed through to consumers.

- The base load power plants using the Missouri River for cooling water are among the cheapest sources of electricity. All other viable alternatives are more expensive. De-ratings or shut downs in these plants will increase utility costs to consumers.

- In the extreme situation of rolling blackouts or blackouts, the spillover impacts on the community's economic growth and population health are significant.

Potential Impacts of the Missouri River on Cash Crop Returns
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- Changes in cash price basis (local cash price relative to nearby futures markets) due to changes in Missouri River navigation impact all crop production in the region, not just that which is transported via the river. Within the economic reach of the Missouri River, 537 million bushels of corn are produced as well as 161 million bushels of soybeans, 13.6 million bushels of sorghum and 11.5 million bushels of wheat.

- Reaches of the Missouri River above Kansas City, Missouri and below Sioux City, Iowa represent the majority of crop production affected by the Missouri River and the areas where the economics of river navigation is more negatively affected by changes in the navigation service level then downstream where additional inflows from tributaries are available. The change in navigation service level from full to minimum service reduces each barge's capacity by 16.7%. Moreover, low flows reduce the number of barges per tow by reducing the length and width of groupings of tows that can pass through the restricted channel. The resulting changes in per barge volume and barges per tow increase the marginal cost of barge transportation substantially. In addition, uncertainty with regard to river maintenance on the upper reaches also negatively impacts the economics of river navigation.

- An analysis of daily market prices over the twelve year period 1991 through 2003 indicate that seasonal cash crop prices along the Missouri River are closer to the St. Louis, Missouri cash price at times when the river is open.

Change in Local Cash Price Differentials to Saint Louis, Missouri
December-February compared to April-October

	Corn	Soybeans
	Dollars per Bushel	
Boonville, MO	-$0.06	-$0.05
Kansas City, MO	-$0.04	-$0.12
Nebraska City, NE	-$0.06	-$0.08
Omaha, NE	-$0.06	-$0.06
Sioux City, IA	-$0.07	-$0.09