

## **Hydroelectric Subsection of the Energy Task Force**

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### **Hydroelectric Workgroup Proposal**

Consider the installation of a 600-megawatt Susitna Hydroelectric project that would supply the electrical needs of the Railbelt. Construction of multiple transmission lines to Fairbanks and Anchorage would also be required for the reliable “firm” delivery of the Susitna energy.

Delivery of electrical power from Susitna to rural Alaska would likely not be economic, but Susitna energy could augment or power the production of Fischer-Tropsch liquid fuels for delivery to rural Alaska that would be used in existing infrastructure.

In the long-term, a 20 to 50-year timeframe, once the technology is commercially available, electricity from Susitna could be used to power electrolyzers for the creation of hydrogen. Hydrogen would be delivered locally for use in home fuel cells for heat and electric cogeneration and car fuel cells for transportation. This is idealistic; zero-emission renewable energy used in a technology that only produces energy and distilled water.

### **Discussion**

Hydroelectric power has been an important source of electrical power throughout the World for decades. Regions have developed and grown from the construction of hydro projects, many of which were constructed with Federal governmental support.

Hydroelectric projects typically have very high initial capital costs to construct the original dams and generators. The operations and maintenance costs that typically are predictable with increases linked to inflation. The predictability of the very stable hydroelectric costs, over 100-year plus project lives, has coined the phrase “flat power”.

In the 1930’s through the 1950’s, when most of the large federal projects were built, the National Environmental Policy Act (NEPA) was not in existence. The goal of these projects was to provide jobs, abundant and cheap power to regions for economic growth. After the passage of NEPA, the rules governing the evaluation of projects and their effects on the environment were developed and clarified into the current day, Environmental Impact Statement (EIS).

All the legacy combustion turbines in the Railbelt are over thirty years old, and will need to be replaced within the next ten years. The cost of replacing these aging electric generators is approximated to be in the range of \$1.5 billion to \$2.5 billion. The general approach to the aging generation situation will be the replacement of the combustion turbines with new more efficient combustion turbines or with low cost fuel options such as coal power plants. Financially, once the new turbines have been installed and the investment has been made the turbines are expected to be operated and emit some level of pollutants and carbon dioxide for their economic life of about thirty years. Fuel

switching or changing to hydroelectric is a only viable option before commitment to the construction of the replacement turbines. Environmentally, the carbon-based power plants will emit varying amounts of oxides of sulfur, oxides of nitrogen, particulate matter and carbon dioxide. Hydroelectric generation will provide a renewable alternative to combustion technology that will emit near zero emission. Hydroelectric emissions are considered near zero rather than zero due to recent discussions of methane released from submerged biomass due decomposition from the creation of the lake behind the dam. There is little data on this topic in northern regions but it is suspected that the potential release of the quantity of methane released would have much less impact as a green house gas than the carbon dioxide release from even the most efficient combustion turbine using natural gas as a fuel. In addition, logging and clearing the area to be inundated prior to filling the reservoir can greatly reduce the quantities of methane released after the reservoir is completed.

### **Cost of hydroelectric Construction and Operation**

The capital cost of a 600,000-kilowatt Susitna project was estimated at \$5,000/kilowatt for a hydroelectric capital cost of \$3,000,000,000. The electrical transmission lines for inclusion were 20 miles and 300 miles if line at a cost of \$1,000,000 and \$1,500,000., respectively, for a total transmission line cost of \$470,000.

The State of Alaska provided a September 13, 2005 memo on an update of the cost estimate for the Susitna project, from the 1984 Update Study adjusted to 2005, at a cost of \$10.5 billion. The reason for this 3 fold increase in price are not known, but needs to be examined and evaluated. The scope of this project is not known and needs to be verified to ensure the proper cost estimate. The full 1,600-kilowatt project was referenced in the FERC application but in the later stages of the project there were discussions of a reduced scope Susitna Project. More research needs to be conducted on the project scope. A former Alaska Power Authority employee involved in the project estimated the Watana dam to be 4/5 of the project costs.

Operation and maintenance cost were estimated at \$0.008/kWh, based on a DOE Large Hydro report.

### **Recommendations for next steps:**

Analysis should be done on the appropriate sizing of the dam to power both the mid-term and long-term energy of the Railbelt.

The hydrological design should be reviewed once the sizing has been completed.

System security should also be analyzed to ensure power supplies in the Railbelt would continue following any common mode failure or natural disaster. Peaking units could be maintained at each load center to ensure continuity of energy supply if the hydroelectric was unavailable. The existing aging generators may provide many years of emergency power at a realistic price. Delivery of the electric energy of high-voltage transmission lines can be secured through multiple transmission lines, which are separated by distance to reduce one cause removing multiple lines from service.

The timing of permitting and licensing should be reviewed to identify the effect of re-filing the existing FERC license for Susitna, or modifying the dam design, which may require additional environmental field studies.