

# **COST OF POWER**

**for Jamestown  
Board of Public Utilities  
Electricity Supply Options**

**Proposed Coal-Fired Power Plant  
Is Most Expensive Option  
Even with Federal Subsidies**

**September 17, 2009**

**Prepared for Clean Energy for Jamestown under a grant from  
the Sierra Club Beyond Coal Campaign with Research by  
Lake Effect Energy**

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## Clean Energy for Jamestown

Clean Energy for Jamestown is a coalition of environmental organizations opposed to the construction of a new 50 MW coal-fired power plant in Jamestown, New York. The coalition believes that Jamestown ratepayer electric needs can be met through a combination of Jamestown's existing New York Power Authority hydropower allocation, energy efficiency, renewable energy, and occasional purchases off the regional electric grid as needed.

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## Sierra Club Beyond Coal Campaign

The Sierra Club's Beyond Coal Campaign is committed to (1) stopping the construction of dirty, new coal plants by educating investors and decision makers about the economic and environmental risks of investing in new coal, (2) retiring old plants that are the worst contributors to health-harming soot and smog pollution and replace them with clean energy solutions, and (3) working with communities to protect our mountains, lands and waters by keeping our vast coal reserves in the ground.

Contact: Beyond Coal Campaign, Sierra Club National Headquarters, 85 Second Street, San Francisco, CA 94105; 415-977-5500; [www.sierraclub.org/coal/](http://www.sierraclub.org/coal/).

## Lake Effect Energy

Lake Effect Energy, LLC, is a Buffalo, New York-based environmental consulting firm specializing in wind and renewable energy assessment and project development.

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# **COST OF POWER**

## **For Jamestown Board of Public Utilities**

### **Electricity Supply Options**

#### **Proposed Coal-Fired Power Plant Is Most Expensive Option Even with Federal Subsidies**

#### **Executive Summary**

This report examines electricity supply options available to the Jamestown Board of Public Utilities (JBPU) for meeting its ratepayers'<sup>1</sup> electric needs as it takes steps to close down its existing, aged coal-fired Samuel J. Carlson plant. Our analysis demonstrates that energy efficiency, wind energy, and buying off the regional electric grid are much less expensive options than constructing a new \$400 - 500 million 50 megawatt (MW) coal-fired power plant with carbon capture and storage (CCS) capability to meet the small increment of power required by JBPU ratepayers over and above what is already being provided by the New York Power Authority (NYPA). The cost of power to JBPU ratepayers for electricity from the proposed coal plant with CCS could be as high as \$0.250 per kilowatt-hour (kWh) – more than 10 times as costly as NYPA hydropower, 5 times more costly than meeting JBPU ratepayer electric needs with efficiency, 4 times more costly than purchasing electricity off the regional grid, and 3 times more costly than generating the needed power with wind turbines. (See Table A on page 12.)

The proposed power plant represents the most expensive supply option available and could result in losses to the JBPU of over \$20 million a year and an increase in ratepayer electric rates of 4 cents per kilowatt hour over electric rates that would result from use of the lower cost electricity supply options assessed in this report. If the proposed coal-fired power plant is built, JBPU ratepayers will experience an average annual electricity cost increase of \$1000.

The proposed new coal-fired power plant is not a prudent investment for ratepayers or an economically viable option. Contrary to claims made by proponents of this plant, it will not be an engine of economic revitalization and job creation for the area. This study demonstrates that the reverse is much more likely. The coal plant's construction, even if CCS is fully subsidized, could bankrupt the JBPU and devastate the already depressed local economy.

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<sup>1</sup> This report contrasts JBPU ratepayers with all of the JBPU's customers which include JBPU ratepayers (who are customers located within the JBPU service territory) and non-ratepayers (who are customers located outside of or external to the JBPU service territory). While the JBPU provides electricity to ratepayers and non-ratepayers alike, its sole statutory grant of authority is to supply power to its ratepayers. NYS General Municipal Law, Section 360(2).

## Background & Overview

The JBPU, a municipal utility, supplies the City of Jamestown and some surrounding communities with electricity and other municipal services. In 2008, the JBPU served 16,515 residential, 2,336 commercial, and 127 industrial electrical customers within its 23 square mile district as the local electrical transmission monopoly and as the generator of a small increment of its ratepayer electric load.

As a result of the 1957 Niagara Redevelopment Act, the JBPU is entitled to receive low cost hydroelectric power (i.e. \$0.022/kWh delivered) from the New York Power Authority (NYPA). The amount of low cost hydropower the JBPU can purchase from NYPA is based on this formula:  $72.28 \text{ KW} \times \text{load factor}$ .<sup>2</sup> In 2008, the JBPU received an annual average of 55.2 MW (or 55,200 KW) from NYPA.<sup>3</sup> This represented over 90.5 % of the electricity consumed by JBPU ratepayers that year. The remaining electricity required by JBPU ratepayers, an annual average of 5.8 MW (or 5,800 KW), was supplied by self-generation at the JBPU's Samuel J. Carlson Plant and occasional purchases off of the regional power grid. Because so much of the power sold by the JBPU to its ratepayers is NYPA low cost hydro-power as opposed to the much more costly JBPU self-generated power, JBPU ratepayers have enjoyed relatively low electric rates. For example, in 2008, average residential electric rates were \$0.0684/kWh which is much less than most New York residential customers were charged for electricity.

The JBPU presently operates an old coal-burning facility with four boilers and a relatively new gas turbine, all of which are housed within the Carlson Power Plant complex. This plant generates power that is sold to ratepayers and non-ratepayers. Coal is the Carlson Plant's mainstay. Due to increases in natural gas prices (peaking in the summer of 2008), the electricity generated by the gas turbine is very expensive compared to regional electric market pricing, and the gas turbine is rarely used – despite its \$35 million initial cost in 2001-2002 and the on-going need for the JBPU to pay its debt service.<sup>4</sup>

In 2008, the JBPU sold an annual average of 10.1 MW of self-generated power from the Carlson plant to non-ratepayers. JBPU's cost to generate that power in 2008 by burning coal was \$0.085/kWh. In 2008, the average New York Independent System Operator (NYISO) West Zone price was \$0.059/kWh, which is a full \$0.025/kWh less than the JBPU's coal-fired power generation cost. There is no public information from which anyone can ascertain the timing of JBPU electric sales to the NYISO and thus compare NYISO hourly pricing to JBPU hourly generation costs. The large price differential

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<sup>2</sup> "Load factor" is defined as average electrical demand divided by peak electrical demand.

<sup>3</sup> The average 55.2 MW of NYPA power received by the JBPU in 2008 includes electricity from the JBPU's 72.28 MW allotment of NYPA power plus NYPA expansion power delivered by the JBPU to certain businesses within the JBPU territory. NYPA expansion power is industrial power from the Niagara Power Project that is reserved for Western New York businesses under New York State law.

<sup>4</sup> In 2008, the JBPU gas turbine's average output was less than 700 KW or less than 2% of its rated capacity of 43 MW (43,000 KW).

between the JBPU's average cost to generate electricity and the annual average NYISO West Zone price, however, raises the question of whether the JBPU may be selling its self-generated electricity at a loss or blended with the low-cost NYPA hydro-power in order to avoid showing losses from these "off-system" power sales to non-ratepayers. If the latter is the case, JBPU ratepayers are subsidizing sales to external customers (non-ratepayers), which is clearly contrary to the JBPU's statutory mandate *and* means the JBPU is in violation of its contract with NYPA because recipients of the low-cost NYPA hydro-power are not permitted to resell that power.

## Plans for a New Coal-Fired Power Plant

In 2004, the JBPU publicly announced that it intended to build a new coal-fired power plant to replace two of the four fifty-year old coal boilers and associated generating equipment in the Carlson Plant. Initial plans were to construct a new plant, which would use circulating fluidized bed (CFB) coal combustion technology,<sup>5</sup> which the JBPU called “clean coal” technology even though it would have very little effect in terms of reducing carbon dioxide emissions that contribute to global warming and climate change.

The JBPU Draft Environmental Impact Statement (DEIS) for this original proposal, released in 2006, stated that the capacity of this plant would be 43 MW. The DEIS as well as the JBPU’s 2007 Final Environmental Impact Statement and the 2003 and 2004 JBPU-commissioned Orbital Technical Solutions power supply option reports (Orbital reports) did not adequately evaluate alternative supply options, i.e. demand side management, energy conservation and efficiency, wind energy, biomass energy, buying off of the grid, etc. Also, none of the above documents revealed the estimated cost of power from the proposed power plant. Instead, the Orbital reports disguised this cost by only providing estimates of anticipated overall rates to ratepayers based on blending the anticipated high cost of power from the proposed power plant with low cost NYPA hydro-power -- using a formula which was not disclosed.

The initial design and construction cost estimate for this new coal-fired power plant was \$145 million. In April 2007, the JBPU commissioned a study from URS Corporation’s Washington Division to update these figures.<sup>6</sup> The URS report, dated September 9, 2008, updated and increased the cost of the proposed plant to \$159-177 million.<sup>7</sup> The URS Report was based on a CFB plant with a net capacity of 42.47 MW and a gross capacity of 50.10 MW. Even if coal prices stayed at the assumed low price of \$49.75/ton,<sup>8</sup> the URS Report demonstrated that the electricity from this plant would be expensive (\$0.140

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<sup>5</sup> CFB technology would permit the plant to co-fire coal with petroleum coke, tire-derived fuel, and woody biomass fuels – though the primary fuel would be coal. Pet coke is a refinery by-product. Tire-derived fuel is chipped tires. Woody biomass fuels could be wood waste from the wood processing and furniture industries or virgin wood fuels or urban wood waste.

<sup>6</sup> See resolution #070410, April 24, 2007, JBPU meeting minutes. This resolution, passed 9 to 0, authorized the JBPU management to hire the URS Washington Division to conduct this study for \$183,000, <http://www.jamestownbpu.com/about/board/min070424.pdf>

<sup>7</sup> The URS Washington Division report was entitled, *City of Jamestown Board of Public Utilities Clean Coal Project – Conceptual Design Review and Budgetary Cost Estimate*. The range of costs presented in the report was based on two different plant locations. The URS report stated that the cost of the proposed new coal plant would be approximately \$177 million if it were located in the original Carlson Plant site which would require the demolition and reconstruction of the adjacent JBPU operations center. The construction of the new plant in another location on the JBPU property could leave the operations center intact and thus lower coal plant construction costs to \$159 million.

<sup>8</sup> U.S. coal pricing has been low and relatively stable until recently. For example, during the 2000 – 2007 period Northern Appalachian coal pricing stayed within the \$30-60/ton range. However, in October 2007 Northern Appalachian coal pricing began climbing and rose to over \$150/ton by June of that year, demonstrating that much higher prices and substantial price volatility was possible for coal. Due to the current global recession, North Appalachian coal prices have returned to the \$60/ton range. See: <http://www.eia.doe.gov/cneaf/coal/page/coalnews/coalmar.html>

– 0.150/kWh<sup>9</sup>) – presumably because of the plant’s small size and inability to take advantages of economies of scale. The proposed plant’s capacity cost of ~\$4 million/MW is exceedingly high.<sup>10</sup>

As previously explained, JBPU ratepayers require a small amount of power over and above their NYPA power allotment, i.e. an annual average of 5.8 MW. So even though the proposed coal-fired power plant was relatively small with a net output of 42.47 MW, it had over 7 times the capacity required to meet JBPU ratepayers’ needs – assuming that efficiency measures were not employed to lower that already small non-NYPA-provided ratepayer electric load.

While the JBPU often speaks about anticipated load growth as a rationale for a new power plant, over the past five years electricity consumption by JBPU residential and commercial ratepayers has been relatively constant while that of industrial customers has declined dramatically, leading critics of the proposed new power plant to conclude that the proposed power plant was either grossly oversized or not needed at all, and that its main purpose appeared to be to sell power to non-ratepayers. Project critics also have argued that building a new power plant primarily to serve non-ratepayers was not in the interest of JBPU ratepayers and would be illegal under New York State General Municipal Law.

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<sup>9</sup> The URS Report used proprietary EPRI software to calculate the cost of power from the new plant. URS concluded that if the plant operated at a 90% capacity factor, it could produce electricity for \$0.1399/kWh and \$0.1456/kWh for the \$159 million and \$177 million plant designs, respectively.

<sup>10</sup> In a 2007 analysis the U.S. Department of Energy’s National Energy Technology Lab estimated the average capital cost of proposed new coal-fired power plants in the United States to be \$1.56 million/MW; see: <http://cmnow.org/NETL%20New%20Coal%205.2007.pdf>

## Proposed Power Plant Becomes CCS Demonstration Project

In August of 2007, the JBPU announced that its new 43 – 50 MW coal-fired power plant would demonstrate carbon capture and storage (CCS) technology. This announcement followed criticism by local citizens and numerous regional, statewide, and national environmental organizations that the JBPU was ignoring the proposed coal-fired power plant’s impact on climate change.<sup>11</sup> The JBPU aligned itself with several CCS proponents and organized the Oxy-Coal Alliance. That Alliance – which apparently has recently been reorganized<sup>12</sup> -- consisted of the Jamestown Board of Public Utilities, Praxair, Inc., the Dresser-Rand Group, Inc., Ecology and Environment, Inc., AES Corporation, Foster Wheeler North America Corp., Battelle, and the State University of New York at Buffalo. All supported “oxy-coal” technology<sup>13</sup> which, according to Praxair, “involves the introduction of pure oxygen instead of air into the utility boiler, creating a highly concentrated stream of carbon dioxide which is more economical to capture than emissions from existing systems.”<sup>14</sup>

Proponents claim that oxy-coal technology can capture more than 90% of the carbon dioxide generated by a coal-fired power plant as well as facilitate reduced emissions of sulfur dioxide, nitrogen oxides, and mercury. However, carbon dioxide capture comes at a price. Oxy-coal adds significant design and construction costs and is expensive to operate because of the energy requirements associated with producing oxygen gas for coal combustion. In the proposed Praxair process, oxygen production consumes electricity as well as substantial amounts of natural gas.

The energy consumed by a power plant for its own operations is called its “parasitic load.” With CCS, the parasitic load increases dramatically. In addition to the energy requirements of producing oxygen gas for combustion, CCS also involves compressing and liquefying captured CO<sub>2</sub>, pumping it to burial sites, and injecting it into underground

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<sup>11</sup> As of August 2009, the following organizations have gone on record against the proposed Jamestown coal-fired power plant: Alliance for Clean Energy New York; American Lung Association in New York; Campus Climate Challenge, SUNY Fredonia; Catholic Care for Creation Committee of Buffalo; Citizens Campaign for the Environment; Clean Air Coalition of Western New York; Earthjustice; Environmental Advocates of New York; Global Warming Action Network, Syracuse; Great Lakes United; Jamestown Area Concerned Citizens; Natural Resources Defense Council (NRDC); New York Interfaith Power & Light; New York Public Interest Research Group (NYPIRG); Northeast Sustainable Energy Association; Pace Energy and Climate Center; Physicians for Social Responsibility (PSR), Washington, D.C.; Sierra Club, Atlantic Chapter; WNY Climate Action Coalition; WNY Sustainable Energy Association.

<sup>12</sup> On August 10, 2009, Praxair, Inc. – the Jamestown BPU’s primary partner and Oxy Coal Alliance organizer -- announced to the Board of Public Utilities in Holland, Michigan, that it had re-prioritized its oxy-coal project commitments and that conducting a CCS demonstration project at the Holland, MI, site was now its number one priority instead of the proposed project in Jamestown. See: “BPU is Alternative Site,” Jamestown Post Journal, August 13, 2009 and “Shift in Jamestown ‘Clean Coal’ Plans Decried, Lauded – Jamestown Proposal Loses Top Priority,” Buffalo News, August 14, 2009..

<sup>13</sup> Sometimes called “oxy-fuel” technology -- though oxy-fuel refers to a range of technologies associated with burning combustible fuels in pure oxygen.

<sup>14</sup> There are three general strategies for capturing carbon dioxide generated by coal-fired power plants. In addition to oxy-coal, there are pre-combustion and post-combustion carbon capture technologies. The former typically use gasification technology to gasify the coal and remove CO<sub>2</sub> before combustion while the latter typically use solvent technology to chemically remove CO<sub>2</sub> from the plant’s exhaust stream.

geologic repositories, which may be over one mile deep. All of these functions consume energy<sup>15</sup> and add cost, as does the monitoring of the CO<sub>2</sub> from source to underground disposal site (the latter in perpetuity). Managing risk and covering the liability associated with this process also represent costs to the operator of a CCS facility.

On June 10, 2008, New York Governor David Paterson announced his support for the project and offered to provide the JBPU Oxy-Coal Alliance with \$6 million for two stages of “Front End Engineering Design” through the Empire State Development Corporation (ESDC). This funding was tied to various stipulations memorialized in a memorandum of understanding (MOU) signed on June 9, 2008, by Praxair and ESDC. The MOU stated that funding was based on the agreement that CCS would be permanent and that the JBPU plant would minimally capture and sequester ~55% of overall carbon dioxide emissions.<sup>16</sup> This performance standard, based on the carbon dioxide emissions of a combined cycle natural gas-fired power plant, is consistent with regulations being developed by the New York State Department of Environmental Conservation but is much more lenient than the 90% CCS performance standard that the U.S. Department of Energy (U.S. DOE) initially required for federally funded Clean Coal Power Initiative projects.<sup>17</sup>

In January 2009, the JBPU Oxy-Coal Alliance announced it had submitted an application for Clean Coal Power Initiative – Round 3 funding. The exact amount of this request is not known because the application -- submitted by Praxair -- was not made public, but the amount is believed to be in the range of \$100-300 million. This application was apparently rejected in July by the U.S. DOE for reasons pertaining to the disappointing geological testing conducted by the JBPU and the questionable economics of the Jamestown project, causing Praxair to announce in August that it was reducing its role in the Jamestown project and prioritizing its commitment to a similar project in Holland, Michigan.<sup>18</sup> The JBPU then met an extended application deadline of August 24<sup>th</sup>, reapplying for Clean Coal Power Initiative – Round 3 funding apparently with a new, undisclosed primary partner.<sup>19</sup>

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<sup>15</sup> The electric parasitic load of the JBPU’s proposed oxy-coal CCS plant would be approximately 40%. This number is derived by dividing the anticipated electrical output of the proposed new plant with CCS, i.e. 30 MW, from its gross output, i.e. 50 MW. If oxy-coal’s natural gas consumption is also factored in, the plant’s parasitic load climbs even higher. In contrast, the parasitic load of the JBPU’s original proposal (without CCS) was 15% based on the anticipated 42.27 MW net output of that design.

<sup>16</sup> The June 9, 2008, MOU established other terms which would have to be met as a condition of receiving ESDC funding. For example, the second segment of Front End Engineering Design or “FEED 2” money would be provided only if the Oxy-Coal Alliance developed a plan to hold JBPU ratepayers harmless against the additional costs associated with CCS and that the JBPU create an effective energy efficiency program for its ratepayers. On February 27, 2009, ESDC and Praxair signed a contract based on the MOU for \$3.5 million in FEED 1 funding. FEED 2 funding is pending.

<sup>17</sup> The U.S. Department of Energy recently modified the CCS performance requirements of Clean Coal Power Initiative projects as per the American Recovery and Reinvestment Act of 2009. Eligible projects now must operate at 50 percent carbon capture efficiency and make progress toward a target CO<sub>2</sub> capture efficiency of 90 percent.

<sup>18</sup> See references provided in footnote 12.

<sup>19</sup> See “A Calculated Long Shot,” Jamestown Post Journal, August 22, 2009 and “Council Backs project – City promises \$145 Million for OxyCoal Plant,” Jamestown Post Journal, August 25, 2009.

The total cost of the proposed new coal-fired power plant is estimated to be between \$400 million and \$500 million, according to recent articles the Buffalo News<sup>20</sup> and Business First of Buffalo<sup>21</sup> newspapers. Of that amount, apparently \$159 – 177 million is for the proposed coal plant minus CCS, called the Base Plant hereafter in this report.

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<sup>20</sup> “Hopes Rise for Coal Plant in Jamestown,” Dave Robinson, March 15, 2009, Buffalo News and “Power Costs Cloud Outlook for Coal Plant,” Dave Robinson, July 5, 2009, Buffalo News. Both articles reference a \$400 million overall project cost.

<sup>21</sup>“Energy to Burn: Jamestown Coal Plant Polarizes City Leaders, Environmentalists,” Dave Bertola, Business First of Buffalo, June 12 - 18, 2009. Article states that Jamestown Mayor Sam Teresi “estimates it could cost more than \$500 million – if it gets built.” The JBPU has not released any public documents, analyses, or reports on the overall cost of its proposed CCS project.

## Cost of Power for JBPU Electricity Supply Options

The JBPU has not released electricity production cost (\$/kWh) figures for its proposed coal-fired power plant with CCS. When recently asked about the cost of power from the plant, JBPU General Manager David Leathers told Buffalo News reporter David Robinson: “It’s a difficult thing to pin down, but it doesn’t mean we’re recklessly pursuing a project that doesn’t make sense.”<sup>22</sup> Robinson further quoted Leathers as saying, “If the cost of electricity is expensive, then the project is not going to go forward.”

The JBPU has, however, provided cost of power figures for the Base Plant in the URS Report, and those figures are used here.<sup>23</sup> The projected cost of power for the CCS-equipped coal plant can be estimated by extrapolating from the cost of power figures from the Base Plant.

Table A presents cost of power (\$/kWh) estimates for various options readily available to the JBPU to meet its relatively small non-NYPA-provided ratepayer load once the aged coal-fired equipment in the Carlson plant is retired. The narratives following the chart explains the sources of these estimates.

Table A

### Electrical Production Cost Comparison for JBPU Supply Options

Electricity Source	Cost \$/kWh	Comments
<b>Low Cost NYPA</b>	\$0.022 (delivered)	In 2008, an average of 55.2 MW was purchased by the JBPU. Up to 72.28 MW is available, depending on load factor
<b>Energy Efficiency</b>	\$0.030	Based on the national experience for efficiency programs which provide incentives to ratepayers
<b>NYISO Grid</b>	\$0.06	Off-the-grid purchase of electricity from the New York Independent System Operator (NYISO) system; average less than \$0.060/kWh in 2007 and 2008
<b>Biomass</b>	\$0.070 to \$0.090	Based on national averages as explained below

<sup>22</sup> “Power Costs Cloud Outlook for Coal Plant,” Dave Robinson, July 5, 2009, Buffalo News.

<sup>23</sup> The URS Report is described in more detail at pages 3-4 of this analysis.

<b>Wind Energy</b>	\$0.080 to \$0.093	Based on various assumptions described below
<b>Natural Gas</b>	\$0.110 to \$0.160	Using existing gas turbine; wide variation in cost due to volatile natural gas pricing and expected CO <sub>2</sub> regulation
<b>Coal (Base Plant)</b>	\$0.140 to \$0.190	Proposed new coal facility; wide variation in cost due to fluctuating coal prices
<b>Coal with CCS</b>	\$0.220 to \$0.270	Additional design, construction and operating costs add significantly to power cost; see discussion below

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## Low Cost NYPA Hydro

The JBPU has regarded the low cost electricity it receives from NYPA as a fixed quantity, though, as previously explained, the amount of low cost hydro-power that the JBPU is eligible to receive annually from NYPA is a function of the following calculation: 72.28 MW x the JBPU's load factor -- where the load factor is JBPU's average electrical demand divided by its peak electrical demand. As previously stated, in 2008, NYPA provided an average 55.8 MW of power to the JBPU, which met 90.5 % of the electric needs of JBPU ratepayers. The JBPU could receive additional low cost power from NYPA if it reduced its peak demand or otherwise flattened its load profile.<sup>24</sup> This could be accomplished by a variety of strategies including energy conservation and efficiency during peak demand periods and demand-limiting strategies and "smart grid" devices that could be activated to turn off electricity-consuming equipment when peak power periods were approached. The JBPU could also utilize pumped hydroelectric storage to reduce peak demand and flatten its load profile – thus accessing more low cost NYPA hydropower.<sup>25</sup>

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<sup>24</sup> A flatter electric load profile is one where there is a reduced difference between average load and peak load, producing a flatter demand curve when hourly demand is plotted against time.

<sup>25</sup> Pumped hydroelectric storage involves pumping water to a reservoir located at a higher elevation during times of low demand and then releasing that water and generating power with it during times of high demand. While there are energy losses in this process, they would be of small cost consequence if this strategy were used to access more \$0.020/kilowatt-hour NYPA hydropower.

## Energy Efficiency

Because reducing energy demand eliminates the need for additional energy production or generation, energy efficiency can be considered an energy supply option. The national experience with ratepayer electricity efficiency programs is that it costs on average approximately \$0.030 to save a kilowatt-hour of electricity.<sup>26</sup>

The JBPU's relatively low electric rates would have the effect of discouraging energy conservation and efficiency by reducing the dollar savings associated with energy conservation measures (and making paybacks longer). This, as well as the high proportion of rental properties in Jamestown, suggests that accomplishing electrical energy efficiency in Jamestown might be more difficult and expensive than the national average. However, because the JBPU had no energy efficiency programs for its ratepayers between 1991 and 2007, its ratepayers undoubtedly have an abundance of cost-effective opportunities for energy conservation and efficiency improvement now and in the future. At the insistence of the NYS Public Service Commission, the JBPU recently began a ratepayer efficiency program. Recently, NYPA has also demonstrated an interest in seeing a serious electric ratepayer energy efficiency program in Jamestown. If aggressively pursued, energy efficiency could probably eliminate all or most of the JBPU's non-NYPA-provided ratepayer electric load.

## NYISO Grid Purchase Option

The New York Independent System Operator runs the statewide and regional electric grid, scheduling power generation and transmission to meet demand. The average cost of NYISO power in the Western Zone was \$0.053/kWh in 2007 and \$0.059/kWh in 2008. Thus far in 2009 NYISO pricing has been in the \$0.020 - \$0.030 /kWh range. Peak summer hourly rates can exceed \$0.25/kWh for a few hours at a time. The cost of NYISO power varies each hour – and is lowest during low demand off-peak hours and highest during high demand on-peak hours. While economic recovery will tend to boost NYISO power costs, other factors will have the opposite effect. Aggressive statewide energy efficiency programs, such as New York State's energy efficiency portfolio standard and 45 by 15 clean energy program,<sup>27</sup> should have the effect of keeping statewide electric demand in check or on a downward trajectory – thus maintaining relatively low NYISO Western Zone pricing in the years ahead.

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<sup>26</sup> See the Alliance to Save Energy's "Reducing the Cost of Addressing Climate Change Through Energy Efficiency," <http://ase.org/content/article/detail/5426>, and "Five Years In: An Examination of the First Half-Decade of Public Benefits Energy Efficiency Policies," <http://www.aceee.org/pubs/U041.htm>.

<sup>27</sup> For information about New York's energy efficiency portfolio standard and Governor Paterson's 45 by 15 program which seeks to provide 45% of New York's electricity from renewable energy sources and efficiency by 2015, see: [http://www.dps.state.ny.us/Case\\_07-M-0548.htm](http://www.dps.state.ny.us/Case_07-M-0548.htm) and [http://www.state.ny.us/governor/press/factsheet\\_0107092.html](http://www.state.ny.us/governor/press/factsheet_0107092.html)

## **Biomass Energy**

Jamestown has a district heating loop that uses thermal energy now produced by the coal-fired boilers/generators or the natural gas-fired boiler/generator in the Carlson Plant. Jamestown's plan to retire the Carlson plant should include an alternative means of providing heat to this loop. Increased reliance on natural gas-using existing equipment is one possibility. A small 6 – 10 MW biomass cogeneration unit is another.<sup>28</sup>

The JBPU has already conducted biomass fuel supply analyses. A JBPU-financed report conducted by the Antares Group identifies enough available wood manufacturing residue biomass fuel – sawdust, wood chips, and wood scrap -- within a 100 mile radius of Jamestown to continuously supply 10.75 MW of electrical generation (with complete redundancy).<sup>29</sup> This fuel would qualify as sustainable biomass because it is waste material which might otherwise be land-filled.

The Natural Resources Defense Council states that the national average cost of biomass-generated electricity is \$0.070-0.090/kWh.<sup>30</sup>

## **Wind Energy**

The \$0.080 - \$0.093/kWh range for the cost of power for wind energy provided in Table A was derived from calculations for three wind energy options using average wind resource estimates obtained from the NYS Wind Map, manufacturer power curves for Vestas V82 turbines, existing federal wind subsidies, and average bond interest rates currently paid by the JBPU as follows:

1. Install wind turbines within the 23 square mile JBPU zone. Assume an average of a 6 m/s average hub height wind speed. Estimated cost to JBPU is \$0.080/kWh.
2. Install JBPU-owned turbines outside of the JBPU district in locations with a better wind resource than exists in the JBPU area, but with the added cost of transmitting the power over transmission lines owned by National Grid. Assumes hub height wind speed of 7 m/s. Estimated cost is \$0.057/kWh + \$0.023 = \$0.08/kWh delivered to JBPU.
3. Purchase electricity from a commercial wind farm or set of farms in Western New York – several currently are operating and many others are planned. Estimated cost is \$0.070/kWh + \$0.023 = \$0.093/kWh delivered to the JBPU.

## **Natural Gas-Fired Generation**

Natural gas pricing is subject to significant fluctuations. Within the last year, for example, Henry Hub and NYMEX commodity prices of natural gas have ranged from

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<sup>28</sup> For a description and explanation of various biomass combustion and generation technologies, see [http://www.eere.energy.gov/de/biomass\\_power.html](http://www.eere.energy.gov/de/biomass_power.html)

<sup>29</sup> See June 18, 2007 study, "Phase II Biomass Fuel Supply Analysis," by the Antares Group.

<sup>30</sup> "Wind, Solar, and Biomass Today," Natural Resources Defense Council, <http://www.nrdc.org/air/energy/renewables/biomass.asp>

\$3/MBtu to \$13/MBtu.<sup>31</sup> The delivered cost of natural gas is a function of the commodity price plus a delivery charge of approximately \$1.30 per MBtu. Natural gas prices are now low with the economy in recession but were very high before the recession occurred. At a delivered cost of \$10/MBtu, natural gas electrical production cost is approximately \$0.092/kWh. Stable and potentially lower natural gas prices are possible through the purchase of long term natural gas futures or long-term purchase agreements with natural gas suppliers.

## **JBPU Coal-Fired Power Plant I (Base Plant)**

The cost of power for the Base Plant (i.e. the CFB coal plant without CCS) consists of the cost of building and financing the project plus fixed and variable operating and maintenance (O&M) costs – including the labor, coal, limestone, ash removal, and other materials and services the plant needs to produce power. It does not, however, include any costs associated with carbon capture and storage, i.e. designing and constructing the CCS systems or operating them. These additional CCS costs are included in the next supply option discussed.

The cost of power for the Base Plant shown in Table A is based on estimates provided in the previously cited September 9, 2008 URS Washington Division report. The URS Report projected a \$0.139/kWh and \$0.146/kWh cost of power depending on where the plant was built. This analysis increases the range of electricity production costs for the Base Plant to \$0.190/kWh in order to allow for the possibility of more expensive coal. The URS Report estimates are based on an assumed coal cost of \$49.75/ton yet in 2008 U.S. coal prices rose to over \$150/ton. For every \$50 increase in the price of a ton of coal, the cost to generate a kilowatt-hour of electricity rises by 2 cents. The upper range \$0.190/kWh cost figure is based on a price of \$150/ton for coal.<sup>32</sup>

The URS Report also assumes that the proposed coal-fired power plant will operate at an average of 90% of full capacity year round. While this assumption is the norm for thermal generating plant economic analyses, it presents a challenge to the JBPU's coal plant proposal. Our analysis suggests that the proposed power plant is oversized and can only be operated at 90% capacity if most of the plant's output is sold to non-ratepayers. Given the high cost of generating this power, these "off system" sales to non-ratepayers would probably have to be heavily subsidized by JBPU ratepayers in order to make the power cost-competitive on the grid. These subsidies would have the effect of driving ratepayer costs per kilowatt-hour even higher. Alternately, if the plant were run at a low capacity factor in order to match actual ratepayer load (i.e. at an average output much lower than 90%), the plant's debt service and fixed costs would be distributed over far fewer kilowatt-hours – again driving the cost per kilowatt-hour higher for JBPU ratepayers. Thus, the \$0.140 – 0.190/kWh range shown on the chart may significantly under-estimate the ultimate cost of power to ratepayers from the Base Plant. This

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<sup>31</sup> For natural gas commodity pricing, see: <http://tonto.eia.doe.gov/oog/info/ngw/ngupdate.asp>

<sup>32</sup> For the price of coal from different domestic sources, see: <http://www.eia.doe.gov/cneaf/coal/page/coalnews/coalmar.html>

financial risk is further discussed and quantified in the “Additional Analysis” section below.

## **JBPU Coal-Fired Power Plant II (Base Plant + CCS)**

This supply option includes the full coal-fired power plant with CCS as proposed. Carbon capture and storage involves additional design and construction costs over and above those associated with the Base Plant and additional operating costs – specifically in the form of extra electricity and natural gas consumption. That the amount of electricity consumed in oxygen production and carbon dioxide compression and transportation is significant can be seen by the anticipated de-rating of the net output of the proposed power plant with CCS – from 42.47 MW to approximately 30 MW.<sup>33</sup> All other things being equal, this 12.27 MW or 29% loss of net output compared to the Base Plant plus the cost of natural gas used in oxygen production could raise the cost of power from the plant by 40% or more.<sup>34</sup> Thus, our estimate of the cost of power with CCS is \$0.080/kWh higher than power from just the Base Plant. This figure is conservative because it does not include additional costs associated with natural gas consumption by the oxygen generation process or the significant additional costs of compressing and liquefying captured CO<sub>2</sub>, pumping it to burial sites and injecting it into these sites. We have found no published data estimating how high these costs might be, but note that they must be significant.

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<sup>33</sup> 30 MW figure is quoted in “Energy to Burn,” Business First of Buffalo, June 12-18, 2009.

<sup>34</sup>  $42.27 \text{ MW} / 30 \text{ MW} = 1.409$ , not counting additional costs for natural gas consumed by the oxygen generation process. We estimate natural gas consumption to be 110 MBtu/hr when the plant is operating at full capacity. Depending on the price of natural gas, this additional parasitic load could add additional millions of dollars in annual ratepayer costs.

## **Additional Analysis and Concluding Remarks**

This analysis demonstrates there are a variety of ways to meet the JBPU's relatively small average 5.8 MW non-NYPA-provided ratepayer electric load, and that unfortunately and paradoxically the JBPU has selected an option which will produce much more expensive electricity for its ratepayers. This is the case even if federal grants and subsidies are received to cover the additional costs associated with modifying or upgrading the Base Plant to accommodate and operate CCS.

The JBPU's commitment to this highly expensive option raises issues of ratepayer cost and fairness. It also poses financial risks because the project assumes, without any supportive evidence, that the majority of the proposed coal plant's output can be sold on the open market without incurring losses. This assumption seems highly dubious. More likely, attempts to sell the plant's very expensive power will result in large losses to the JBPU. These losses will have to be covered by ratepayers, the City of Jamestown, or state taxpayers in the form of large annual bailouts.

Ironically, all of this expense and risk would buy a dirty supply option. Assuming the new coal plant operated with 55% CCS, as envisioned by Governor Paterson and pending DEC greenhouse gas emissions regulations, it would still spew 190,000 tons of carbon dioxide into the atmosphere each year—equal to the emissions of 35,000 cars and trucks. All the other options evaluated in this report are much cleaner, with efficiency and wind power having zero emissions.

The cost of power differential between the new coal plant and the cheaper, cleaner options outlined in this report is striking. If we optimistically assume that federal grants and subsidies are secured for all CCS costs including annual operating costs, then JBPU ratepayers will still face enormously burdensome costs based on the cost of power from the Base Plant only: the ratepayers' own cost of power from the Base Plant and the subsidy necessary to make the majority of this Base Plant power cost-competitive for sale to non-ratepayers. The annual amount of each of these costs can be reliably estimated using currently available data. The following calculation compares that cost of power to ratepayers with the cost of relying on a mixture of efficiency, wind, and grid purchases to meet their electric power needs:

- Cost of coal-fired electricity from the Base Plant = \$0.140 – 0.190/kWh
- Cost of efficiency, wind, and buying off the grid = \$0.030, \$0.090 and \$0.060/kWh, respectively, or an average \$0.060/kWh
- Cost difference between Base Plant power and meeting JBPU ratepayer electric needs via equal parts efficiency, wind and buying off the grid is \$0.080/kWh
- The additional, non-NYPA power required by JBPU ratepayers is 5.8 MW or 5,800KW

- $5,800 \text{ KW} \times 8760 \text{ hrs/yr}^{35} \times \$0.080/\text{kWh} = \$4.1 \text{ million/year}$

Thus, the difference in the cost of power between the Base Plant and a mixture of efficiency, wind, and grid purchases would impose a \$4.1 million a year additional cost on ratepayers. But, these are not the only additional costs ratepayers will bear. As noted above, ratepayers will also bear the additional costs associated with the anticipated losses the JBPU will suffer when selling excess generation from the proposed power plant on the open market to non-ratepayers through the NYISO. The next calculation estimates those losses:

- The output of the 50 MW plant with CCS will be 30 MW
- At a 90% capacity factor, the average output of the plant would be 27 MW
- Given that ratepayers only require, at most, 5.8 MW (or 5,800 KW), then 21.2 MW (or 21,800 KW) will have to be sold on the open market (or the plant would have to operate even less economically at below 90% capacity)
- Assume that the price difference between the cost of power from the proposed coal plant (not counting CCS costs) and NYISO Western Zone grid power is the existing differential of \$0.100/kWh
- $21,200 \text{ KW} \times 8760 \times \$0.100/\text{kWh} = \$18.6 \text{ million/year}$

Thus, extra costs to ratepayers associated with meeting the 5.8 MW non-NYPA-supplied ratepayer load with the new coal plant (Base Plant only) compared to meeting that load with a mixture of energy efficiency, wind energy, and grid purchases is estimated to be \$22.7 million/year (\$4.1 million + \$18.6 million). This amounts to over \$1,000/year in extra costs *per JBPU ratepayer*.

Another way of measuring these \$22.7 million/year costs is to calculate how much they would increase the cost of all kilowatt-hours purchased by JBPU ratepayers compared to meeting that 5.6 MW load with a mixture of efficiency, wind, and grid purchases. The next calculation estimates that rate increase.

- As per the JBPU 2008 annual report, JBPU ratepayers consume 535,000,000 kilowatt-hours annually (this consists of 91% from the New York Power Authority and 9% from self-generation or grid purchases)
- $\$22.7 \text{ million}/535,000,000 \text{ kWh} = \$0.042/\text{kWh}$

In other words, as a result of incurring the extra costs associated with building this unneeded power plant, *every kilowatt hour of electricity purchased by JBPU ratepayers* would be over \$0.040 more expensive than it would be if the 5.8 MW non-NYPA-supplied ratepayer load was met by a mixture of efficiency, wind, and grid purchases. Also, note that all of the above calculations assume that *all costs of carbon capture and storage* – including life-of-the-plant CCS operating costs, CCS design and construction costs, and CCS risk and liability management costs – are paid for by the federal or state

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<sup>35</sup> Technically, there were 8,784 hours in 2008 because it was a leap year. Our calculations will use the more standard 8,760 hrs/yr.

government or the private industry partners in the venture. This latter assumption is generous in the extreme and probably unrealistic – so the ratepayer burden most certainly will be significantly greater than estimated here.

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This analysis shows that the JBPU's proposed new coal plant is not a prudent investment for ratepayers or an economically viable option. Not only is it the most expensive and environmentally dirty option, it also poses the most economic risk to the JBPU, its ratepayers, the City of Jamestown, the local economy, and even New York State taxpayers who could be called upon to financially rescue Jamestown from this ill-conceived project.