IPRO 319 – Feasibility Assessment of Sustainable Hydroelectric Facilities in Northeastern Illinois

That Dam IPRO
Certification
Permitting
Economics
Stakeholders
Bush Takes Steps to Ease Increase in Energy Prices
Experts: Natural Gas Economy Losing Steam
High gasoline prices here to stay:
US energy secretary
Energy chief: High gas prices could last 3 years
Governor Blagojevich Sends Sustainable Energy Plan to Illinois Commerce Commission
Illinois Sustainable Energy Plan

% Total Energy

Year

2006 2007 2008 2009 2010 2011 2012

Renewable Energy Non-Renewable Energy

- Renewable Energy
- Non-Renewable Energy
Illinois Sustainable Energy Plan

- Wind Power: 75%
- Solar thermal energy: 25%
- Photovoltaic cells and panels
- Crops and organic waste biomass
- Methane recovered from landfills
- Hydropower
Concerns with Hydropower

- Affects water quality
- Changes river flow
- Harms fish
- Prevents recreation
EPA Green Power Partnership Program

- Green-e renewable resources
  - Eligible Hydro: 30 MW or less, or certified by the Low-Impact Hydro Institute (LIHI)
- Renewable Energy Certificates (REC) “green tags”
Low-Impact Hydro Institute

- Certified hydropower facility criteria
  1. River flows
  2. Water quality
  3. Fish passage and protection
  4. Watershed protection
  5. Threatened and endangered species protection
  6. Cultural resource protection
  7. Recreation
  8. Facilities recommended for removal
Stakeholders
Environmental Groups and Objectives Identified

- Sierra Club, Valley of Fox Group, Fiends of the Fox River, Fox River Ecosystem-Partnership, Illinois Smallmouth Alliance, etc.

- Want dams removed or modified with fish passages and portages for recreation

- Fish friendly turbine, eliminates the need for a fish passage
Stakeholders Cont.

- Owner of Dams and Support Identified
  - State Owned – Geneva
    - Proposals submitted to various state departments for approval
  - City Owned - Stolp Island & Elgin
    - Both support the project if it is feasible
Stakeholders Cont.

- Utility Company Identified
  - ComEd powers Elgin and Aurora
  - No Power Purchase Agreement available at this time
- Geneva purchases its own power
  - Interested in hydroelectric power
State/Local Agencies

US Army Corp of Engineers, Chicago District
Illinois Department of Natural Resources
Illinois Environmental Protection Agency

Federal Agencies

Federal Energy Regulatory Commission
US Department of Interior
Timeline of Permit Process

6 Months
- Perform Environmental Analysis

6 Months
- Obtain Air, Water, Historical, or Other Permits

6 Months
- Obtain Zoning Permit

6 Months
- Obtain Construction Permit

12 Months
- Complete Site Development, Install DER Unit, Test DER Unit

2 Months
- Conduct Impact Studies
Economic Analysis Group

IDENTIFY THE GOAL

Determine if it is economically attractive to develop hydropower on the Fox river.
Strategy

- Filter out potential candidates, but how?
  - Eliminate dams recommended for removal
  - Examine head and flow data
  - Calculate potential output
  - Investigate possible turbines
  - Estimate total cost and benefit
  - Examine benefit/cost ratio
Head vs. Height

inclined semi-Kaplan siphon
Flow Duration Curve
Potential Power Output

\[ P = \frac{Q \cdot H}{11.8} \]
Which kind of turbine should be used?

- Axial
- Francis
- Pelton

**Diagram:**
- Minimum flow
- Maximum head
Siphon Turbine
<table>
<thead>
<tr>
<th>Site Fox River</th>
<th>Elgin</th>
<th>Geneva</th>
<th>Stolp Isl.</th>
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</thead>
<tbody>
<tr>
<td>Installed Capacity MW</td>
<td>0.405</td>
<td>0.99</td>
<td>1.06</td>
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<tr>
<td>Equipment</td>
<td>$2.1</td>
<td>$3.3</td>
<td>$4.1</td>
</tr>
<tr>
<td>Civil Work</td>
<td>$0.53</td>
<td>$0.8</td>
<td>$1.0</td>
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<tr>
<td>Total direct cost</td>
<td>$2.6</td>
<td>$4.1</td>
<td>$5.0</td>
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<tr>
<td>Contingencies</td>
<td>$0.4</td>
<td>$0.7</td>
<td>$0.8</td>
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<tr>
<td>Subtotal</td>
<td>$3.2</td>
<td>$5.1</td>
<td>$6.1</td>
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<tr>
<td>Grant from IL</td>
<td>$1</td>
<td>$1</td>
<td>$1</td>
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<tr>
<td>Total project cost</td>
<td>$2.2</td>
<td>$4.05</td>
<td>$5.2</td>
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<tr>
<td>Cost per kW (actual USD)</td>
<td>$4192</td>
<td>$4090</td>
<td>$4900</td>
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<tr>
<td>Plant Description</td>
<td>Capacity (KW)</td>
<td>Cost in M USD</td>
<td>Cost per KW *1000</td>
</tr>
<tr>
<td>-----------------------------------------------</td>
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<tr>
<td>North American Hydro feasibility Study for Elgin.</td>
<td>480KW</td>
<td>5.2</td>
<td>11</td>
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<tr>
<td>City of Peru Hydroelectric plant</td>
<td>8MW</td>
<td>14.7</td>
<td>1.8</td>
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<tr>
<td>Kankakee Hydroelectric plant</td>
<td>1.2MW</td>
<td>5.5</td>
<td>4.6</td>
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</tbody>
</table>
10 Year Analysis for Elgin

Interest rate=5.25%

Electricity sold for 8.3 cents/KWh
How can we profit then?
Where do we go from here?
We Would Like to Thank

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Prof. Paul Anderson
Prof. James Braband
Naila Madhi
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