Micro-hydroelectric project
“Early travelers described the Rio Grande as a mile wide and an inch deep, too thick to drink and too thin to plow.”
Location of EBID

- Single purpose project 1905
- Paid out 1972
- Federal facilities transfer 1996
- Surface water delivery to 90,640 acres
- 600 mile canal and drain system
Elevation Differentials of Gravity Flow Structures

Total drop of 430 ft
Site Location Drop 8
Upstream of Drum Structure 10/2008

- Elevation drop of 8 feet.
- Flow rate of 300 cubic feet per sec (CFS).
- Ample room for power house.
- Preservation of Historical Structure 1920
Construction of Site

Upstream Drain

Start water level

8 ft

End water level

12/2008

Downstream Drain

End water level

8 ft

Start water level

12/2008
Construction of Site

Finished structures 3/2009
Old and the New
Arial view of site 7/2009
Design, Labor, and Construction Costs of Power House

- Design by EBID & NMSU
- Design and labor by EBID $10,000

<table>
<thead>
<tr>
<th>Component</th>
<th>Material Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power House</td>
<td>$15,000</td>
</tr>
<tr>
<td>Drain Pipe</td>
<td>$5,000</td>
</tr>
<tr>
<td><strong>Total Material Cost</strong></td>
<td><strong>$20,000</strong></td>
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</tbody>
</table>
# Turbine Cost per 50kW

<table>
<thead>
<tr>
<th>Hydraulic Device</th>
<th>Minimum Cost</th>
<th>Maximum Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manufactured turbine</td>
<td>$120,000</td>
<td>$450,000</td>
</tr>
<tr>
<td>Manufactured high flow pump as turbine</td>
<td>$50,500</td>
<td>$200,000</td>
</tr>
<tr>
<td>EBID fabrication design</td>
<td>$15,000</td>
<td>$35,000</td>
</tr>
</tbody>
</table>
Turbine 1

- 36” paddle wheel
- 8 blades
- 2” shaft

3/2009
Turbine 1
Installed with 24” Manifold  3/2009
Turbine 2

Layout  5/2009

Turbine 1 and 2  5/2009
Turbine 3

- Axial flow
- 15” three blade propeller
- 1.5” shaft

8/2009
Turbine 3

24” to 16”  8/2009

Hatch removed  (click to play)
Turbine 3/2 propellers

- 2 propellers
- Increase torque
- Increase power

9/2009
Turbine 3 videos

Turbine in operation (click to play)
Turbine 4 Current Version

- Axial flow
- 24" throughout system
- 23” five blade fixed pitch Kaplan style
- All fabricated at EBID
- Chain and sprocket drive
- Future installment of double propeller

10/2009
Turbine 4 Updated Version

24" System with two propellers and stator blades
## Cost of Turbine 4

<table>
<thead>
<tr>
<th>Component</th>
<th>Material Cost</th>
<th>Labor</th>
<th>Design</th>
</tr>
</thead>
<tbody>
<tr>
<td>Turbine 4</td>
<td>$1,700</td>
<td>$4,000/EBID</td>
<td>EBID &amp; NMSU</td>
</tr>
<tr>
<td>Total Cost</td>
<td>$5,700</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Results

Power Generated

<table>
<thead>
<tr>
<th>Turbine</th>
<th>Power (kW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Turbine 1</td>
<td>0.3</td>
</tr>
<tr>
<td>Turbine 2</td>
<td>0.6</td>
</tr>
<tr>
<td>Turbine 3 w/ 2 props</td>
<td>1.5</td>
</tr>
<tr>
<td>Turbine 4</td>
<td>6.2 kW</td>
</tr>
</tbody>
</table>
Projections

Potential Power in District

- **Total Power (kW)**
  - 1000 kW
  - 1600 kW
  - 2000 kW

- **Power per unit (kW)**
  - 1.5 kW
  - 5 kW
  - 10 kW

- **Potential Power in District**
  - 1.5 MW

- **Sites**
  - 50 Sites
  - 100 Sites
  - 150 Sites
Power Production & Use within EBID – Drip & Sprinkler Irrigation
Power Production & Use within EBID – Drip & Sprinkler Irrigation
Prohibitive FERC Requirements

- Production of power requires either a license or exemption from the Federal Energy Regulatory Commission (FERC).
- Other irrigation districts have advised EBID that the cost of pursuing an exemption or license for a power project costs over $100,000 and takes years. Other states have also reported cost and time problems with the process for low head power.
- No inexpensive or streamlined process exists to allow low-head power generation under existing law.
- Without a statutory change to the FERC process, low head power will never be cost effective enough to be considered by any water provider.
Summary

- A low cost turbine without a formal FERC exemption is cost prohibitive.
- Utilizing water flow for renewable energy production does not consume or disrupt water delivery services.
- System produces renewable energy from existing irrigation canals with potentially thousands of applications throughout the West.
- By allowing irrigation districts to install and manage such systems, the districts potentially adds an additional revenue source to maintain existing irrigation district infrastructure.
- The off-river system has no or minimal environmental effects on temperature and aquatic life.
- The off-river system is completely compatible with the historical nature of irrigation facilities.
2/16/10 Site Visit – Senator Bingaman & BOR Commissioner Connor
Questions

From left, Gary Esslinger, Henry Magallanez, Ross Irwin, and Matt Haines,