THE BEST FRESHWATER FISHERIES IN NORTH AMERICA

Freshwater Fisheries Society of BC
Utilizing Airlift Water Reuse Technology to Help Achieve Electrical Energy Savings in Fish Hatcheries

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Freshwater Fisheries Society of BC
Why We’re Keen on Energy Reduction

• Reduce operating and maintenance costs.
• All monies saved can be redirected to other business needs.
• Utility rates will continue to rise.
• Be environmentally responsible.
• Opportunity to upgrade our aging facilities.
• BC Hydro will provide significant financial assistance and support.
Water Pumping – Best Energy Saving Opportunity

Customer Site Investigation Report

Top 5 Electricity Cost Savings Opportunities

The top five electricity cost savings opportunities are given below. The opportunities are ranked by their preliminary cost savings estimate.

These energy savings estimates are preliminary and intended to evaluate and prioritize the savings opportunities for further investigation.

<table>
<thead>
<tr>
<th>System</th>
<th>DIY</th>
<th>Retrofit</th>
<th>Re-Design</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pumps</td>
<td>$0</td>
<td>$0</td>
<td>$36,670</td>
</tr>
<tr>
<td>Lighting</td>
<td></td>
<td>$5,320</td>
<td></td>
</tr>
<tr>
<td>Fans &amp; Blowers</td>
<td>$1,380</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Motor Systems</td>
<td>$1,140</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other Systems</td>
<td>$70</td>
<td></td>
<td></td>
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</tbody>
</table>

Energy Savings per Year (MWh)
Water Reuse vs. Recirculation

- **Recirculating Aquaculture Systems (RAS):**
  - achieve very large water reductions,
  - more complex systems results in significantly higher installation costs.

- **Water reuse systems:**
  - also achieve significant water reductions,
  - less than RAS,
  - simpler and less expensive to install.

- **FFSBC is shifting into lower cost water reuse systems.**
Airlift Technology

- Aerate water
- Strip carbon dioxide
- Lift water and allow to return as a high cleaning flow.
Air Blower System
Diffuser Arrangement
Raceway Airlift Layout

- Install airlift pumps onto baffles set about 3.5 metres apart.
- Connect pumps to energy efficient air blower system.
- Aerate water, strip carbon dioxide and increase cleaning flows.
Raceway Airlift
Raceway Airlift

Removable Baffle

New Hinged Baffle
Water Flows and Quality

• Before Airlift:
  – Outlet oxygen levels at 6.0 -> 7.0 ppm.
  – Inlet water flows about 1 litre/min/ kg fish.

• Once Airlift Installed:
  – Outlet oxygen levels at 8+ ppm.
  – Inlet water flows reduced by 75% at pH 7.0.
  – Inlet water flows reduced by 65% at pH 8.0.
    • NH₃ will limit water flow reductions in higher pH waters.
  – Carbon dioxide not a concern due to agitation.
Water and Energy Savings

- **August 2011:**
  - Avg daily flow – 15,000 lpm
  - Monthly kWh – 103,500

- **September 2011:**
  - Avg daily flow – 15,500 lpm
  - Monthly kWh – 94,500

- **August 2012:**
  - Avg daily flow - 7,700 lpm
    (monthly water savings – 326M litres)
  - Monthly kWh – 60,300
    - 43,200 kWh saved
    - $1840 saved

- **September 2012**
  - Avg daily flow – 8,400 lpm
    (monthly water savings – 307M litres)
  - Monthly kWh – 59,400
    - 35,100 kWh saved
    - $1495 saved
Water and Energy Savings

- Monthly water savings of 326,000,000 litres:
  - Saved water would fill 2,200 railway box cars in a train stretching 24 miles long!

- Then consider this benefit after several years of water reuse:
  - Very large water, energy and $$$ savings.
  - Reduced maintenance & repairs to wells, screens, pumps, motors, bearings, failures, etc.
  - Much less impact on water table & environment.
Raceway Airlift Costs

- 8 - 80’ raceways each with 6 airlift pumps & baffles.
- 12 - 55’ raceways each with 4 airlift pumps & baffles.
- 2 – 25 HP air blowers & air delivery system.
- Controls and alarms.
- Installation costs.

- TOTAL COST INSTALLED - $215,000
Raceway Airlift Costs

• $215,000 = 9 year simple payback.
• Reduced maintenance & repairs to wells, screens, pumps, motors, bearings, failures, etc. likely doubles our savings.

• Therefore simple payback about 4.5 years.
• Does not take into account ever increasing energy rates.
• Does not include ~60% cost sharing from our electrical utility.

• A good deal!
Circular Tank Airlift

• Shifting to fibreglass circular tanks in future hatchery upgrades:
  – either placed directly in ground,
  – or inside former raceways by removing portion of each 2nd raceway wall.

• 1 to 3 airlift pumps installed along inside perimeter of tanks.

• Connect to energy efficient air blower system.
Circular Tank Airlift
Circular Tank Airlift Considerations

• Circular tanks are excellent at self cleaning
  • no baffles required.

• Fewer airlift pumps required than with raceways:
  • 1 airlift pump on 16’ tank,
  • 2 airlift pumps on 20’ tank,
  • 3 airlift pumps on 26’ tank.

• $2,500 per airlift pump.

• Achieve up to 75% reduction in water flows and similar energy savings.
Pump Efficiencies & Upgrades

• Achieved huge water flow reductions once airlift was installed.

• Large energy savings also realized by installing Variable Frequency Drives (VFDs) in place of throttling valves.
  – 4 year simple payback.

• Further energy savings possible by reducing pump and motor size and improving its efficiency rating.
Energy Metering

- Installing electrical meters and energy management software.
- Will allow us to quickly access & act upon energy consumption information and trends.
Acknowledgements

• BC Hydro Powersmart- energy advice and funding support.
• Duaine Hardie, FFSBC Energy Projects Technician for hitting the ground running.
• Jim Bomford, FFSBC Airlift Design Wizard.
• All FFSBC staff for their continuing patience and willingness to try new things.
• FFSBC Board of Directors and Management – for a very free hand in allowing us to do this stuff!
QUESTIONS?
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