

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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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.



FFSBC Sustainable Energy Management Mandate

Organizational Goals:

- To develop a company culture of energy awareness and conservation.
- To continuously improve our energy efficiency through employee awareness, teamwork, innovation and investment.
- To establish partnerships with energy suppliers and equipment manufacturers that supports our energy goals and initiatives.
- To be recognized as a leader in energy conservation amongst organizations in the fish culture and fisheries management fields.

Specific Goals:

- Establish corporate-wide energy reduction goals for each energy type.
- Establish division and office specific energy reduction goals for each energy type.

Specific Actions:

- Establish an "eFishent Energy Team" made of a cross-section of FFSBC employees to lead and implement our energy mandate in each office.
- Continuously monitor and evaluate all forms of energy use and progress towards energy reduction goals.
- Establish a communication plan to inform and educate employees about energy reduction initiatives and progress towards energy goals.
- Continuously investigate, develop and implement innovative energy reduction technologies and practices.
- Develop a long term capital investment plan to improve the energy performance of our facilities, equipment and fleet.
- Share financial energy savings with staff through the FFSBC Gainsharing Program.



Energy Policy

FFSBC is committed to sustainable energy management, energy conservation and greenhouse gas reduction as part of our company's vision of being "The Best Freshwater Fisheries in North America".

Implemented this 16th day
of December, 2011.

A handwritten signature in black ink, appearing to read "Don Peterson".

Don Peterson, President

A handwritten signature in black ink, appearing to read "Ray Billings".

Ray Billings, Energy Manager



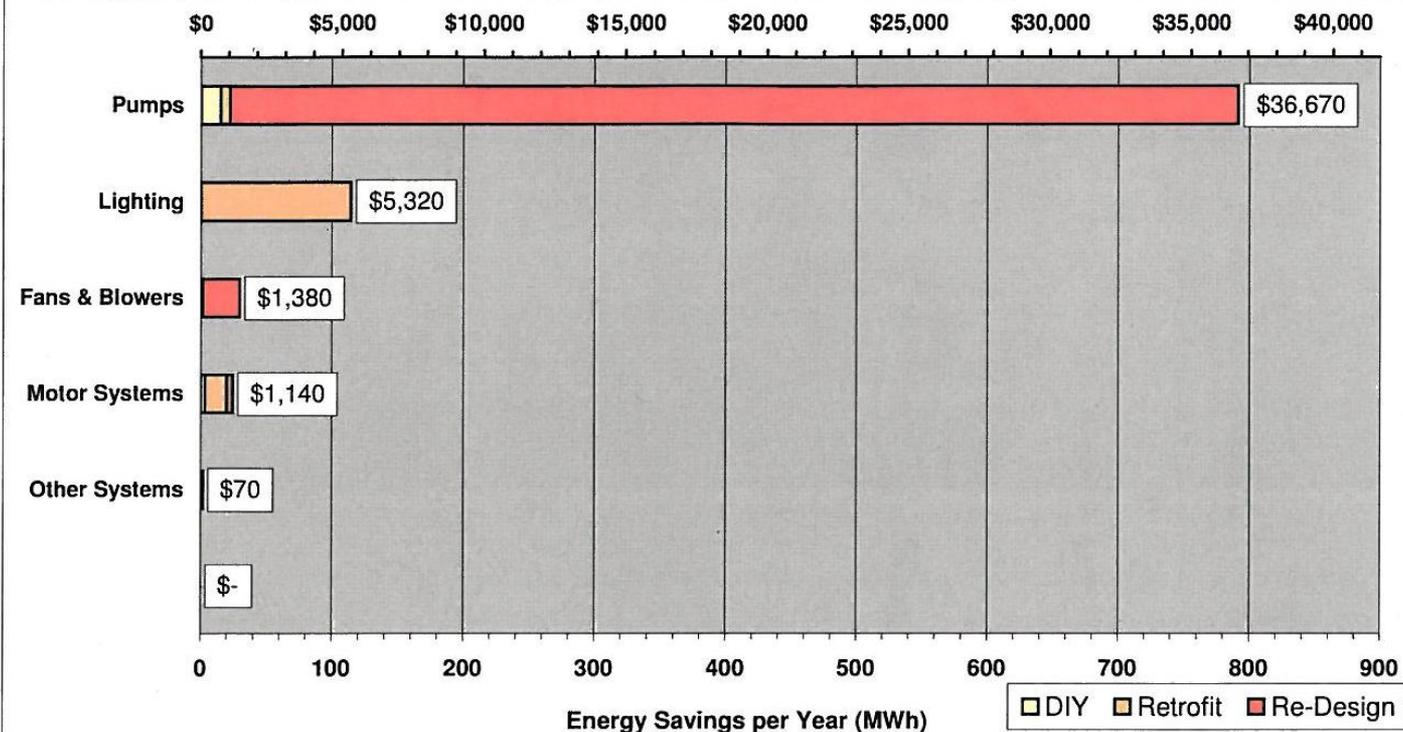
Water Pumping – Best Energy Saving Opportunity

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.



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.
- FFSSBC 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

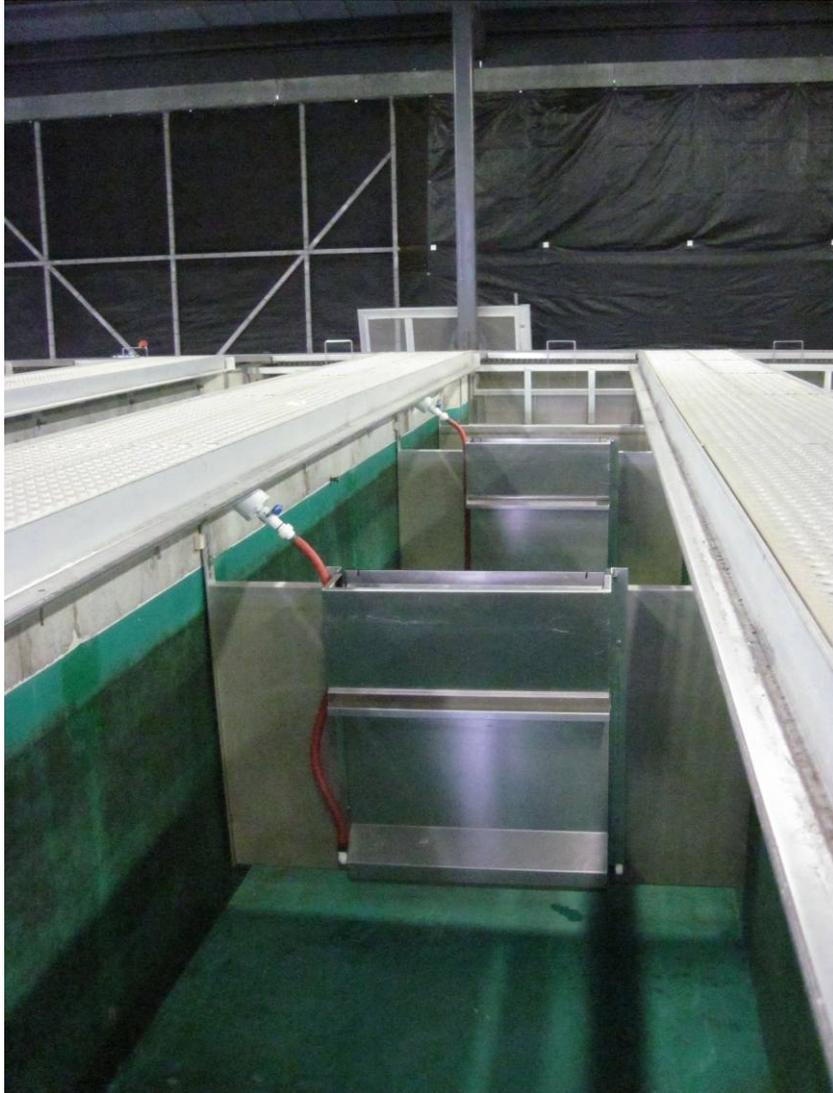


Raceway Airlift Layout



- 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
 - August 2012:
 - Avg daily flow - 7,700 lpm
(monthly water savings – 326M litres)
 - Monthly kWh – 60,300
 - 43,200 kWh saved
 - \$1840 saved
-
- September 2011:
 - Avg daily flow - 15,500 lpm
 - Monthly kWh – 94,500
 - 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!

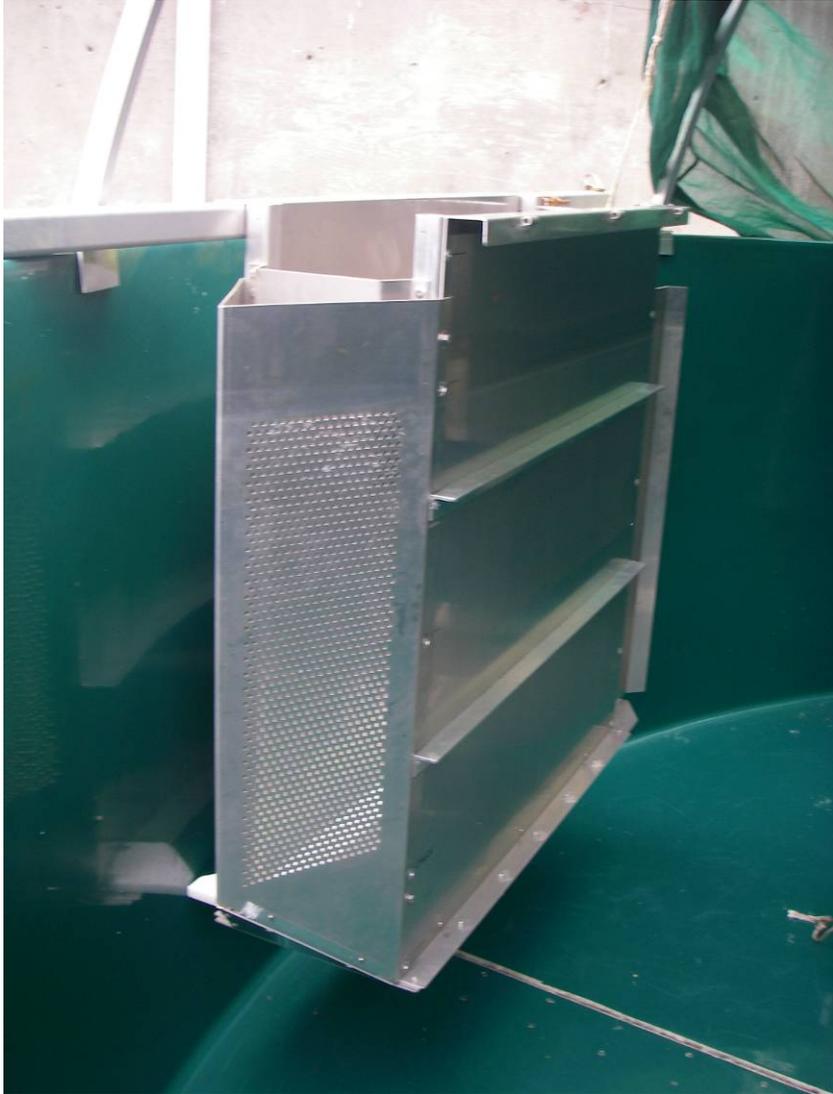


Circular Tank Airlift

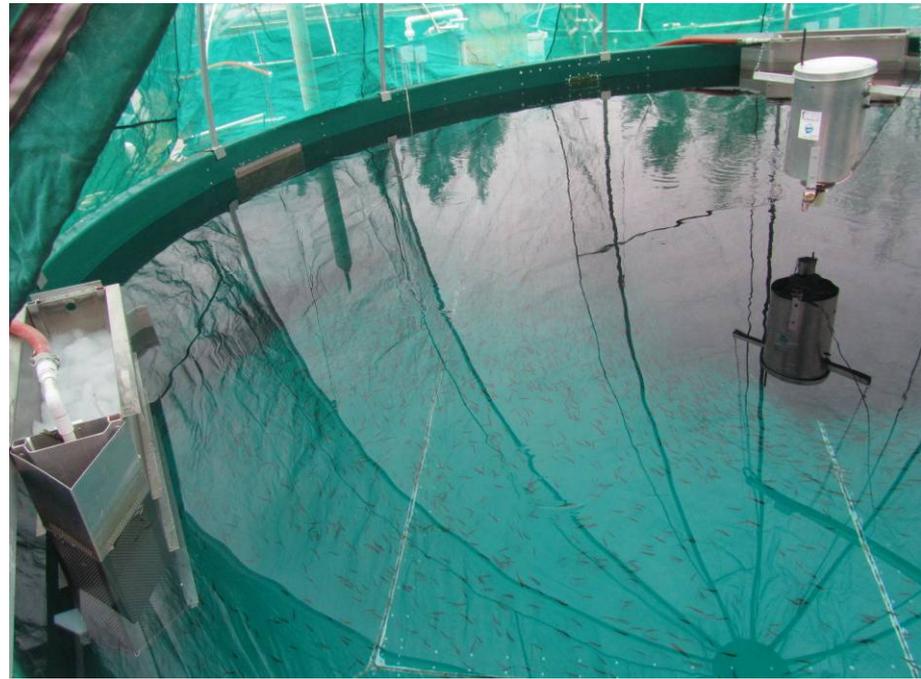
- Shifting to fibreglass circular tanks in future hatchery upgrades:
 - either placed directly in ground,
 - or inside former raceways by removing portion of each 2nd raceway wall.
- 1 to 3 airlift pumps installed along inside perimeter of tanks.
- Connect to energy efficient air blower system.



Circular Tank Airlift



Circular Tank Airlift



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.



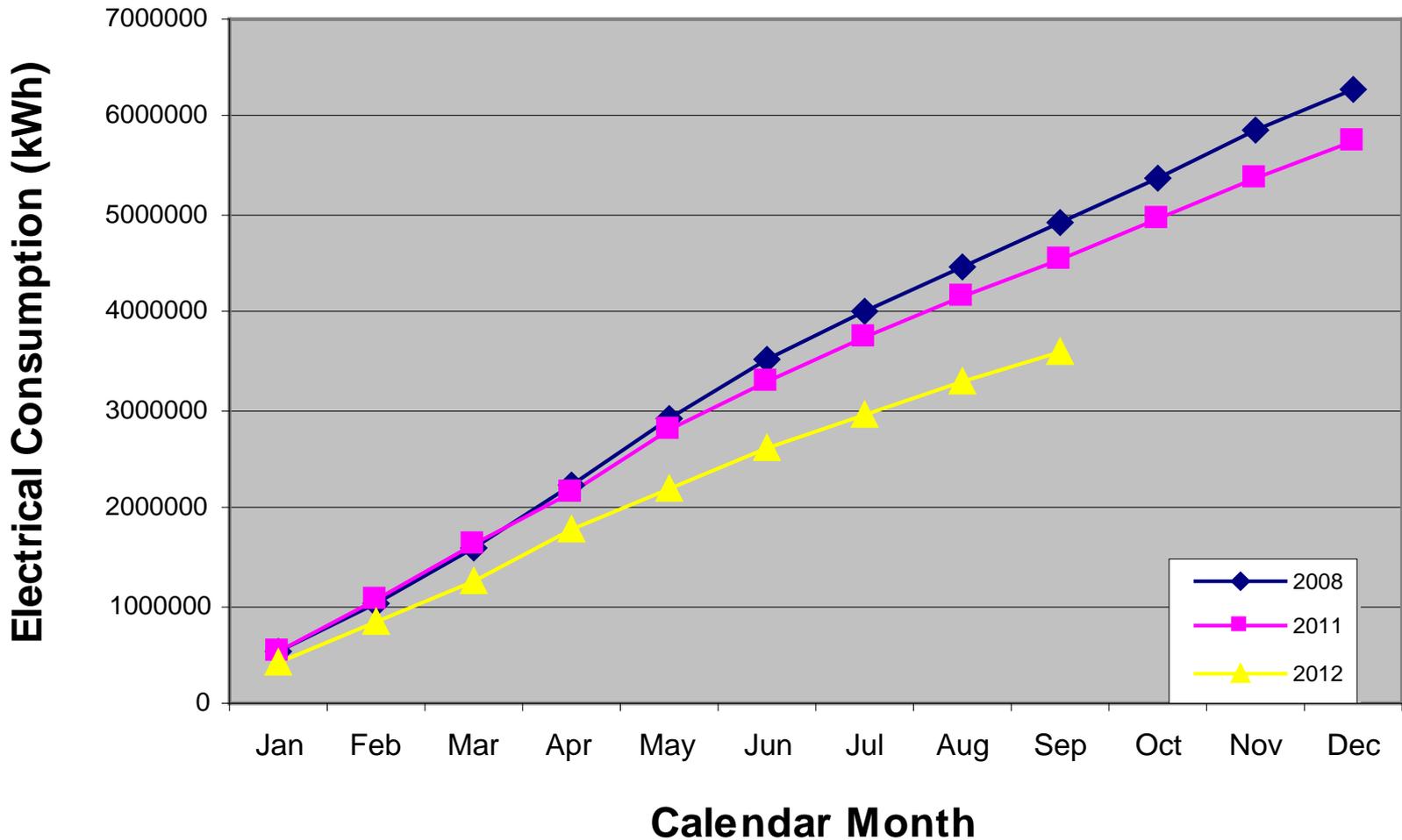
Energy Metering

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



FFSBC Cumulative Electrical Consumption

All Hatcheries and Sites



Acknowledgements

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



QUESTIONS?



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