

# 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.



## 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.



Implemented this 16th day  
of December, 2011.

  
Don Peterson, President

  
Ray Billings, Energy Manager





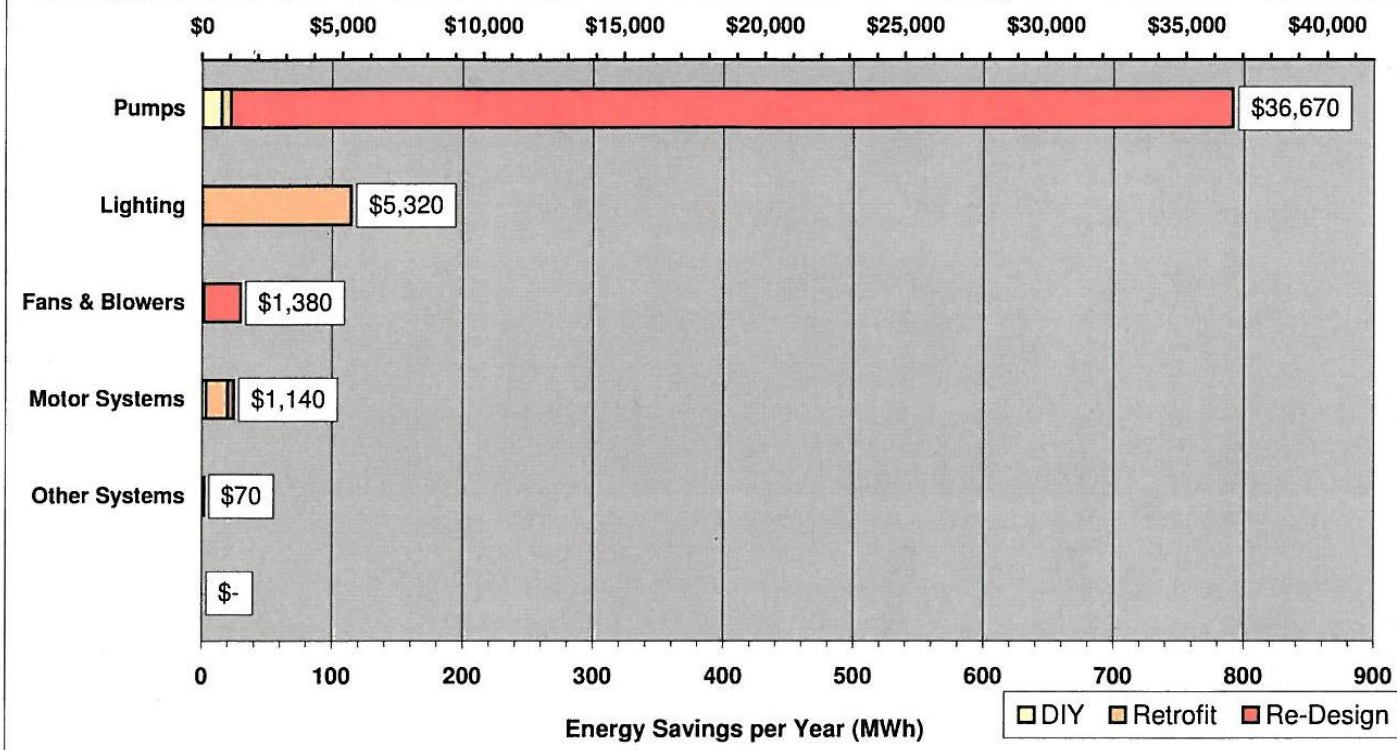
# Water Pumping – Best Energy Saving Opportunity

## 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.
- 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.



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[gofishbc.com](http://gofishbc.com)

# Air Blower System





# Diffuser Arrangement



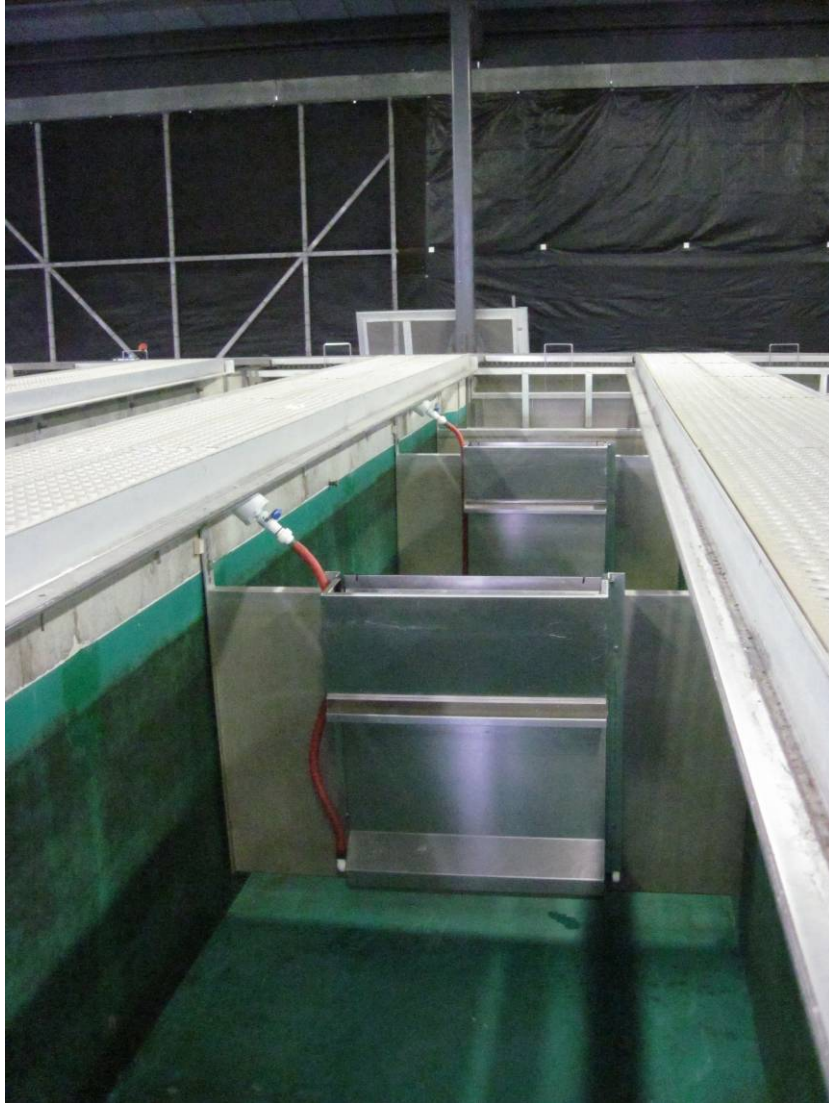


# Raceway Airlift Layout



- 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.
    - $\text{NH}_3$  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!



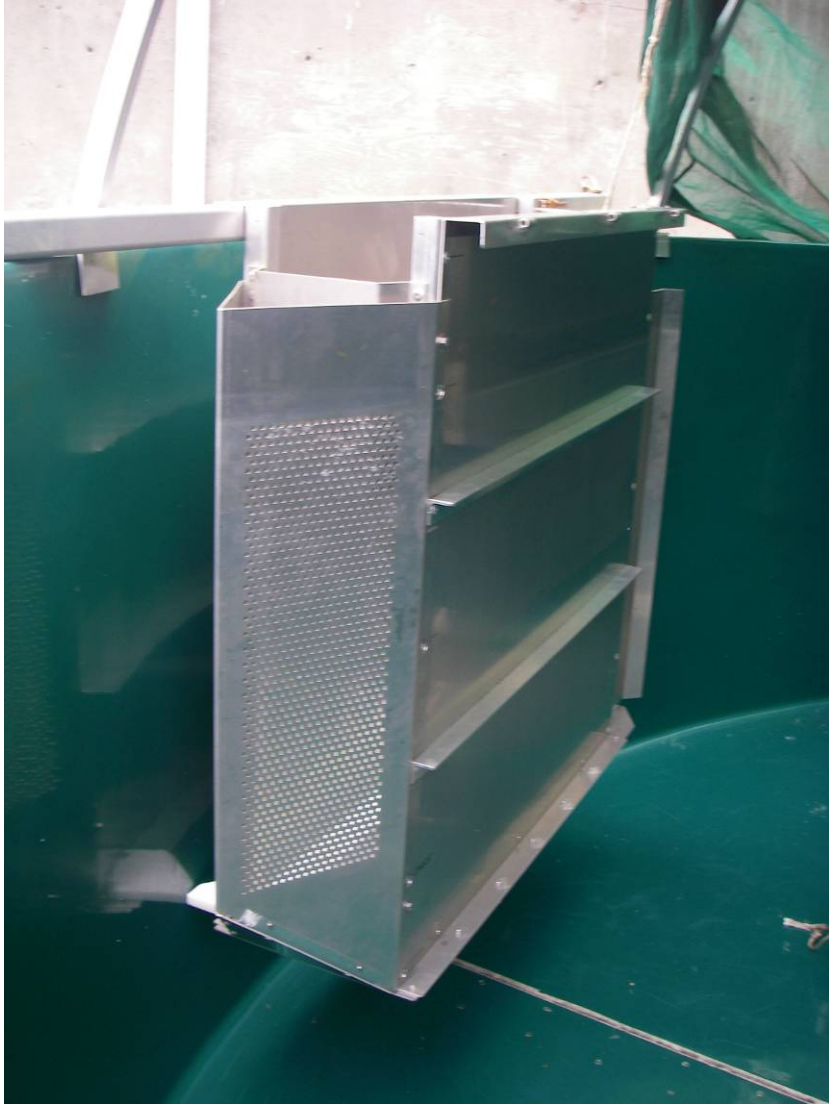
# Circular Tank Airlift

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

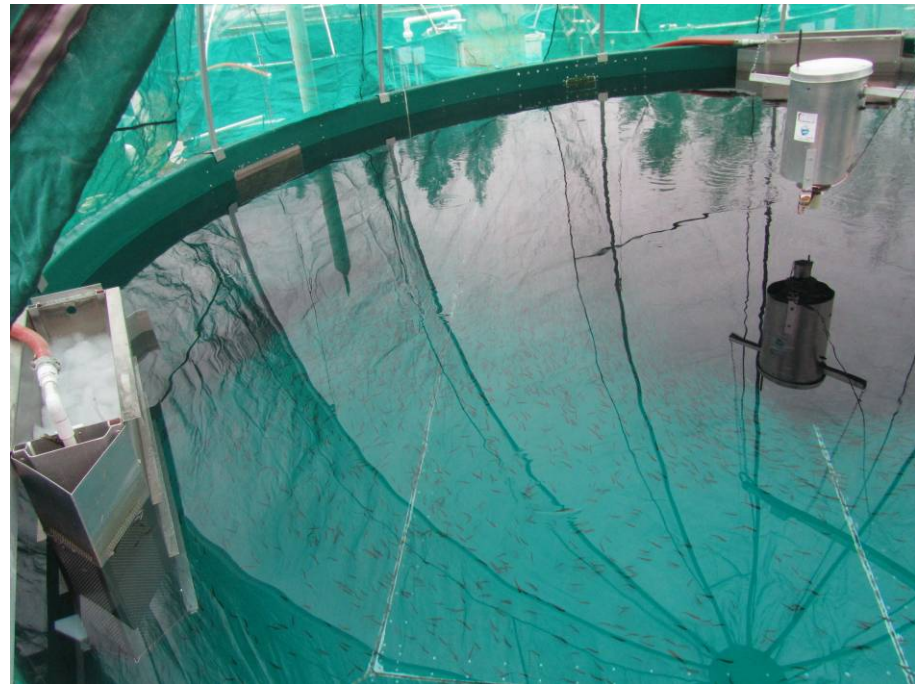




# Circular Tank Airlift



# 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.



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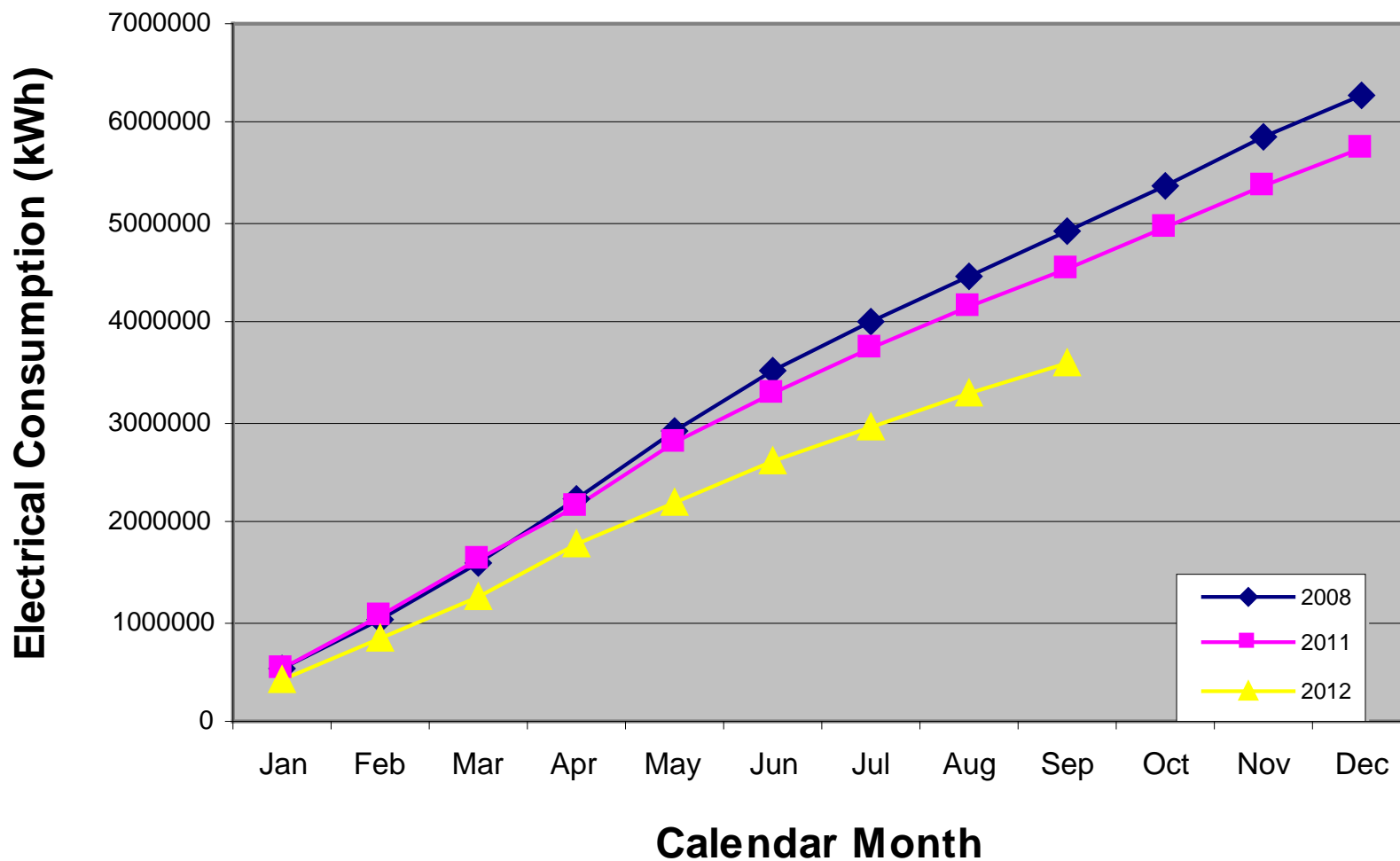
# Energy Metering

- 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, 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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