
THE
BEST
FRESHWATER
FISHERIES
IN NORTH AMERICA
Freshwater Fisheries
Society of BC

FFSBC Sustainable Energy Management Program

Our Plan to Achieve a 40% Reduction in Electrical Energy Consumption

BC hydro
powersmart

- BC Hydro provides electrical energy to most of BC.
- Energy conservation is a critical component of BC Hydro's plan to meet growing provincial electrical needs.
- BC Hydro is prepared to work with its clients to implement lasting energy reductions.
- BC Hydro Power Smart will provide technical and financial resources to assist its clients.

Why We're Keen on Energy Reduction

- Utility costs will continue to rise
- Reduce water consumption, operating and maintenance costs
- All monies saved can be redirected to other business needs
- Be environmentally responsible
- BC Hydro prepared to provide financial assistance and support.

- Sign us up!

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BC Hydro Power Smart's Industrial Energy Manager Program

- Signed Industrial Energy Manager Agreement with BC Hydro in 2009:
  - Fund 75% of Energy Manager salary (4 yrs)
  - Fund energy audits and special studies.
  - Support for training, materials & awareness.
  - Financial incentives for hard wired upgrades that save electrical energy.

CSI Savings Report

The goal of this **CUSTOMER SITE INVESTIGATION (CSI)** is to assist the facility staff in defining their electricity usage and to provide a preliminary list of electrical cost savings opportunities within their facility.

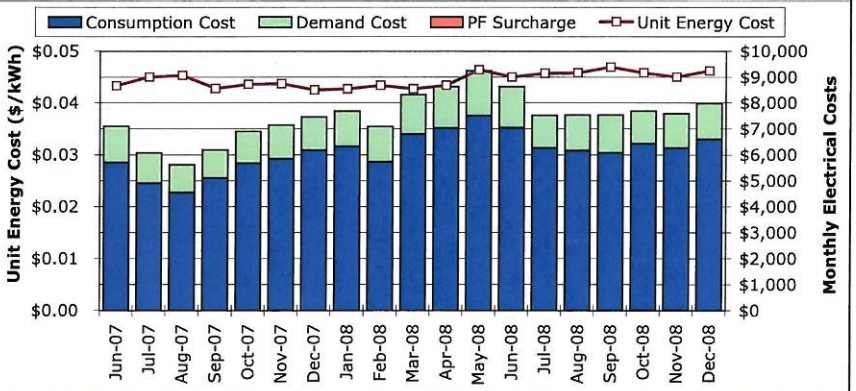
BC hydro powersmart

Company Name:	**FFSBC**	Facility Name:	**Kootenay Trout Hatchery**
Location:	Bull River, BC	BC Hydro KAM:	Rachelle Trent
Contact:	Ray Billings	Energy Use Model:	Compiled from walk-through audit
NAICS Code:	NAICS	Walkthrough date:	Tuesday, January 20, 2009
Industry Type:	Fish Hatchery	Completed by:	Empac Engineering

The principle process of this facility is to produce fish for distribution to the fishing rivers in BC. Located in Bull River BC, this facility constructed in the 1960's has dated processes and therefore has significant opportunities for energy efficiency improvements. The Kootenay Trout Hatchery has been successful in achieving significant energy savings acting on previous energy conservation studies carried out in 2001 and 1983.

Electrical Billing Summary

The facility is billed under B.C. Hydro's 1211 rate schedule for general service over 35 kW with trailing rates of $6.79 per kW and 3.32 cents per kWh. In addition, the customer receives discounts of 1.5% and $0.25 per kW of billing demand because the electricity is metered at a primary potential and the customer supplies transformation to a secondary potential. The data has been normalized from the number of days in the billing period to the number of days in the month.



Electricity Summary (not including taxes)			Operating Summary			
Average billing demand	**289** kW		Facility Load Factor	**81**	**max LF**	87
Yearly Consumption	**2.1** GWh per year		Operating Hours	**8,760**	hours/year	
Annual Electricity Cost	**$90,000**	per year	Production Hours	**8,760**	hours/year	
Demand Cost	**18** %		**Performance Summary**			
Consumption Cost	**82** %		Annual Production	**27,244**	Kg (Live Fish)/yr	
Other Cost	**0.0** %		Elec. Use Benchmark	**75.41**	kWh/Kg (Live Fish)	
Unit Electricity Cost	**4.4** cents per kWh		Elec. Cost Benchmark	**$3.30**	$elec/Kg (Live Fish)	

A baseline and trend of the plant's utilization index (kWh per unit of production) and the plant's energy cost index ($ electricity per unit of production) should be tracked on a monthly basis corresponding to the billing period. Variations in the energy utilization index can indicate opportunity for improvement.

CSI Savings Report

The goal of this **CUSTOMER SITE INVESTIGATION (CSI)** is to assist the facility staff in defining their electricity usage and to provide a preliminary list of electrical cost savings opportunities within their facility.

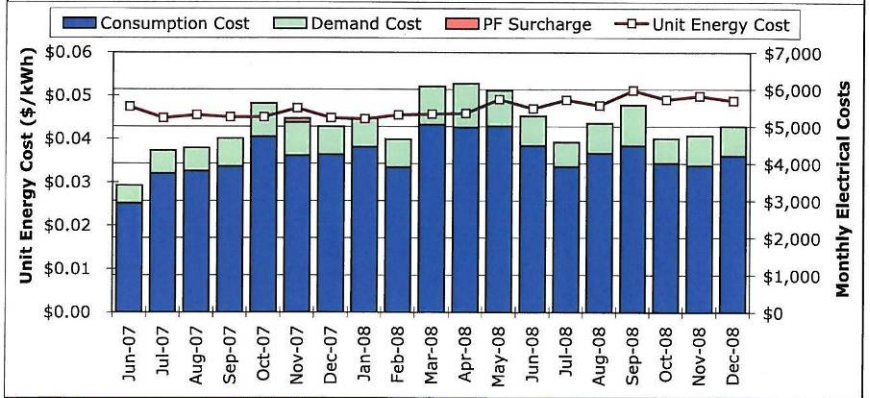
BC hydro powersmart

Company Name:	**FFSBC**	Facility Name:	**VI Trout Hatchery**
Location:	Duncan, BC	BC Hydro KAM:	KAM
Contact:	Ray Billings	Energy Use Model:	Compiled from walk-through audit
NAICS Code:	NAICS	Walkthrough date:	Tuesday, January 27, 2009
Industry Type:	Fish Hatchery	Completed by:	KS - Empac Engineering

the Vancouver Island trout hatchery raises trout for stocking of lakes on Vancouver Island. The facility was built in 1993. Power usage cycles as fish grow towards their release date, then drops back down.

Electrical Billing Summary

The facility is billed under B.C. Hydro's 1200 rate schedule for general service over 35 kW with trailing rates of $6.79 per kW if the demand is greater than 115 kW and $3.54 per kW if the monthly peak demand is less than 115 kW. The trailing energy consumption rate is 3.32 cents per kWh. The data has been normalized from the number of days in the billing period to the number of days in the month.

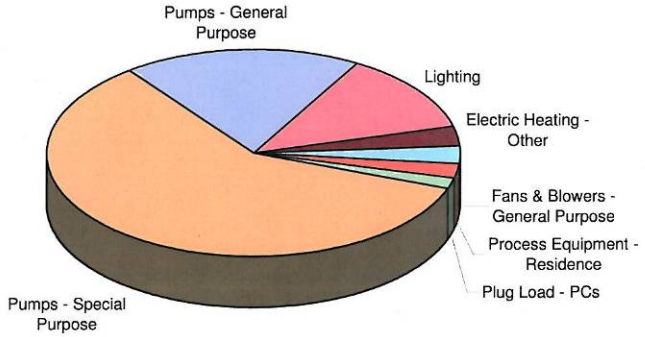


Electricity Summary (not including taxes)			Operating Summary			
Average billing demand	**202** kW		Facility Load Factor	**72**	**max LF**	81
Yearly Consumption	**1.3** GWh per year		Operating Hours	**8,760**	hours/year	
Annual Electricity Cost	**$59,000**	per year	Production Hours	**8,760**	hours/year	
Demand Cost	**16** %		**Performance Summary**			
Consumption Cost	**84** %		Annual Production	32,369	Kg Live Fish	
Other Cost	**0.1** %		Elec. Use Benchmark	40.16	kWh/Kg Fish	
Unit Electricity Cost	**4.6** cents per kWh		Elec. Cost Benchmark	$1.82	$elec/Kg Fish	

A baseline and trend of the plant's utilization index (kWh per unit of production) and the plant's energy cost index ($ electricity per unit of production) should be tracked on a monthly basis corresponding to the billing period. Variations in the energy utilization index can indicate opportunity for improvement.

Basic Electricity Cost Breakdown by Enduse

The electricity use summary and cost breakdown is shown by equipment type and given in the table and figure below. The load inventory was compiled through measured and typical estimates of motor loads and annual operating hours to derive a basic model of the facility's energy usage.



Note	Rank	Enduse Description	Enduse Percent	Elec. Use (MWh/yr)	Elec. Cost ($/yr)
The largest enduse of Pumps - Special Purpose equipment accounts for 58% of the total electricity cost.	1	Pumps - Special Purpose	58.1%	1129	$52,000
	2	Pumps - General Purpose	18.3%	356	$16,000
	3	Lighting	12.3%	239	$11,000
	4	Electric Heating - Other	3.1%	60	$3,000
	5	Fans & Blowers - General Purpose	2.7%	53	$2,000
	6	Process Equipment - Residence	2.4%	46	$2,000
	7	Plug Load - PCs	1.5%	30	$1,000
	8	Fans & Blowers - Process Ventilation	1.0%	19	$1,000
	9	Refrigeration - Other	0.4%	8	
	10	Electric Heating - Tape Heating	0.1%	2	
		Combined Other	0.1%	1	

Note	Rank	Large Energy Using Equipment	Rated Power	Elec. Use (MWh/yr)	Elec. Cost ($/yr)
These Top 10 energy equipment items account for 73% of the total electricity cost.	1	Well Pump 1	75 HP	481	$21,100
	2	Well Pump 2	60 HP	358	$15,700
	3	Well Pump 3	60 HP	291	$12,700
	4	Sturgeon Supply Pump 1	15 HP	98	$4,300
	5	Domestic Pump 1	10 HP	65	$2,900
	6	Residence (based on BCH 22kWh/day)	0.92 kW	46	$2,000
	7	Unit Water Heater	3 kW	45	$2,000
	8	Air handler in Pond bldg	15 HP	44	$1,900
	9	Boiler Circ Pump #1	5 HP	33	$1,500
	10	PCs	0.5 kW	30	$1,300

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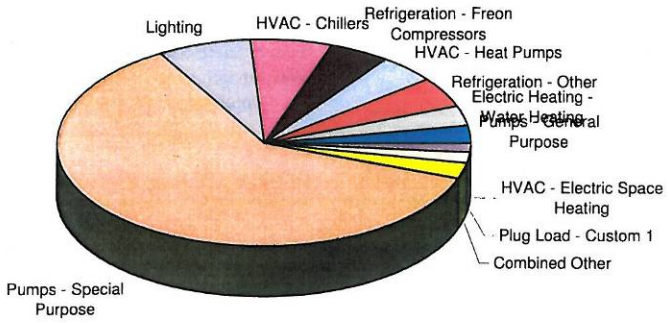


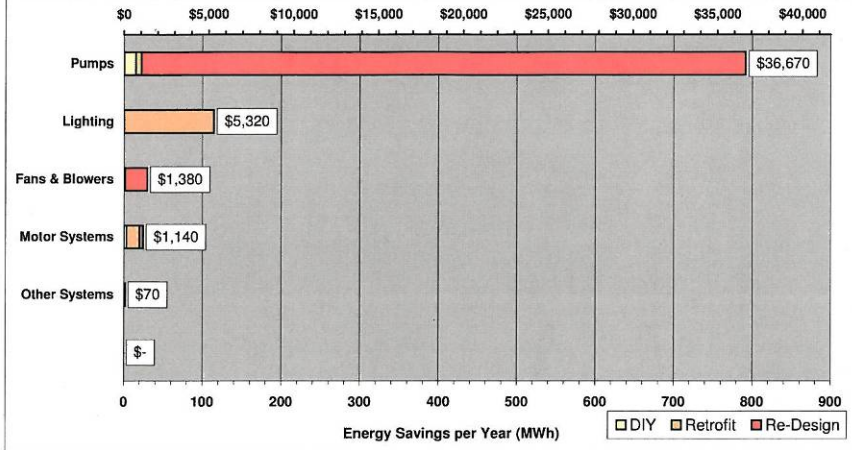
Note	Rank	Enduse Description	Enduse Percent	Elec. Use (MWh/yr)	Elec. Cost ($/yr)
The largest enduse of Pumps - Special Purpose equipment accounts for 61% of the total electricity cost.	1	Pumps - Special Purpose	61.2%	803	$47,000
	2	Lighting	7.2%	94	$6,000
	3	HVAC - Chillers	6.1%	81	$5,000
	4	Refrigeration - Freon Compressors	4.8%	63	$4,000
	5	HVAC - Heat Pumps	4.6%	60	$4,000
	6	Refrigeration - Other	4.5%	60	$4,000
	7	Electric Heating - Water Heating	3.0%	40	$2,000
	8	Pumps - General Purpose	2.8%	36	$2,000
	9	HVAC - Electric Space Heating	1.6%	21	$1,000
	10	Plug Load - Custom 1	1.4%	19	$1,000
		Combined Other	2.6%	34	$2,000

Note	Rank	Large Energy Using Equipment	Rated Power	Elec. Use (MWh/yr)	Elec. Cost ($/yr)
These Top 10 energy equipment items account for 83% of the total electricity cost.	1	P103 - Well Pump #3	100 HP	316	$14,600
	2	P101 - Well Pump #1	100 HP	243	$11,300
	3	P102 - Well Pump #2	100 HP	243	$11,300
	4	C301 Chiller	75 kW	81	$3,700
	5	Freezer Comp #1	26 kW	31	$1,500
	6	Freezer Comp #2	26 kW	31	$1,500
	7	HPU1	18.2 kW	30	$1,400
	8	HPU2	18.2 kW	30	$1,400
	9	Freezer Evap #1	22 kW	27	$1,200
	10	Freezer Evap #2	22 kW	27	$1,200

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.



		Estimated Electricity Cost Savings		
		Percent	$/year	MWh/yr
Top 5 Electricity Conservation Measures		**41.3%**	**$37,170**	**803.01**
1	Pumps - Special Purpose - Reduce overall pump system requirements	27.9%	$25,100	542.11
2	Pumps - Special Purpose - Reduce or control pump speed	6.1%	$5,490	118.59
3	Lighting - Convert T12 Fluorescent to T8 Fluorescent lighting	3.6%	$3,250	70.25
4	Pumps - Special Purpose - Match pump size to load	2.3%	$2,090	45.18
5	Fans & Blowers - General Purpose - Reduce overall fan system requirements	1.4%	$1,240	26.88

Top 5 Energy Action Details - Recommendation for Energy Study ☑

1	Typical savings for eliminating by-pass loops and other unnecessary flows, and equalizing flows over production cycles.	☑
2	Typical savings for replacing throttling valves with speed controls to meet variable loads or trim impeller for fixed loads.	☑
3	Savings estimate to convert all old T12 fluorescent lamps to new electronic T8 fluorescent lights.	☑
4	Typical savings for reducing pump size to better fit load and/or installing parallel systems for highly variable loads.	☑
5	Typical savings for reducing friction and system effect through better inlet and outlet fan design.	☑

Recommendations of the Auditor

Process redesign could replace 2 Well Pumps (135 HP) with a Re-Use pump (~20HP). VFDs installed on well pumps could replace throttle valves. A T12 to T8 lamp replacement could be considered but it has been identified that changes in lighting can affect the fish health. A micro hydro resource is available and has the potential for a NET metering installation. Investigate heat-recovery/geothermal/solar water heating (currently heating is propane). Install metering scheme - providing power use by activity and prove savings (this will support the BCH EMA Nov08). The peak kW demand shown in this study is high-the 4 well pumps do not run simultaneously. ('Special Purpose - Pumps' has been used for Well Pumps.)

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.

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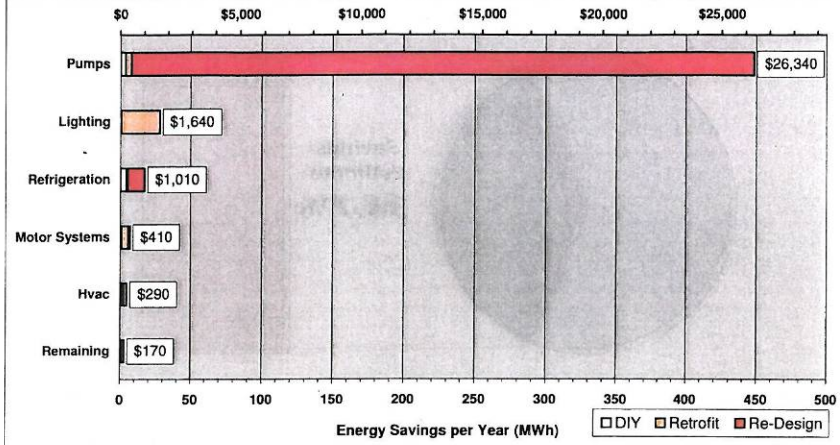

		Estimated Electricity Cost Savings		
		Percent	$/year	MWh/yr
Top 5 Electricity Conservation Measures		**35.5%**	**$27,310**	**464.78**
1	Pumps - Special Purpose - Reduce overall pump system requirements	30.6%	$23,580	401.40
2	Pumps - Special Purpose - Reduce or control pump speed	2.0%	$1,560	26.49
3	Lighting - Convert T12 Fluorescent to T8 Fluorescent lighting	1.6%	$1,230	20.87
4	Pumps - Special Purpose - Match pump size to load	0.6%	$470	8.03
5	Lighting - Convert Incandescent to CFL Lighting	0.6%	$470	7.99

Top 5 Energy Action Details - Recommendation for Energy Study ☑

1	Typical savings for eliminating by-pass loops and other unnecessary flows, and equalizing flows over production cycles.	☑
2	Typical savings for replacing throttling valves with speed controls to meet variable loads or trim impeller for fixed loads.	☑
3	Auditor preferred response. Lock the ECM (to the left) to disable the auto-fill that paricular Recommendation.	☑
4	Typical savings for reducing pump size to better fit load and/or installing parallel systems for highly variable loads.	☑
5	Another locked ECM.	☐

Recommendations of the Auditor

See atached document.

Key Finding of Energy Audits

- Water pumping accounts for 60 – 70% of electrical energy consumption.

- Reducing water pumping is single best opportunity to lower energy costs.

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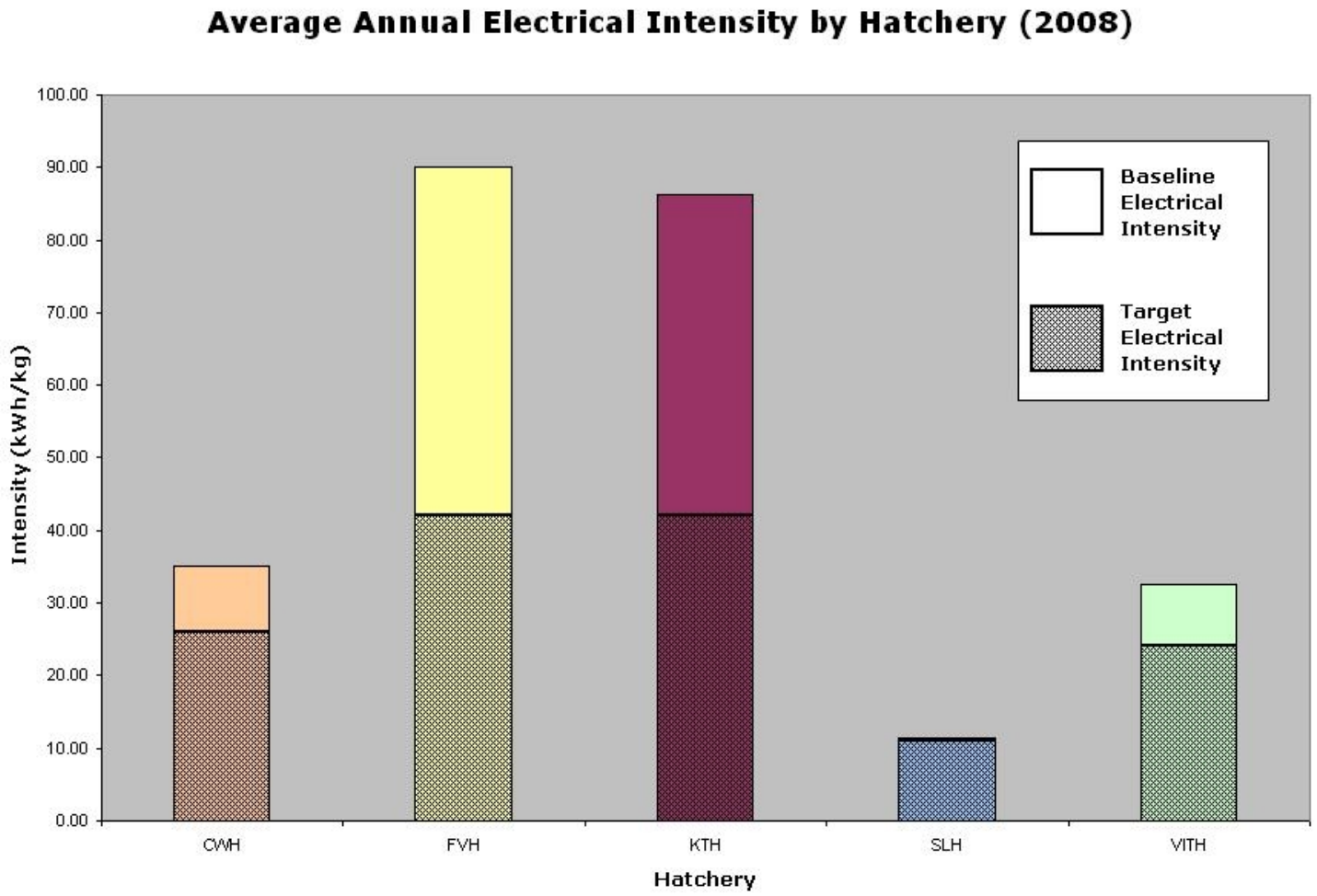
Electrical Intensity (KWh/kg)



Water Reuse vs. Recirculation

- Recirculating Aquaculture Systems (RAS)
  - very large water reductions
  - expensive to install.
- Water reuse systems
  - also achieve significant water reductions
  - less than RAS
  - less expensive to install.
- FFSBC is shifting into lower cost water reuse systems.

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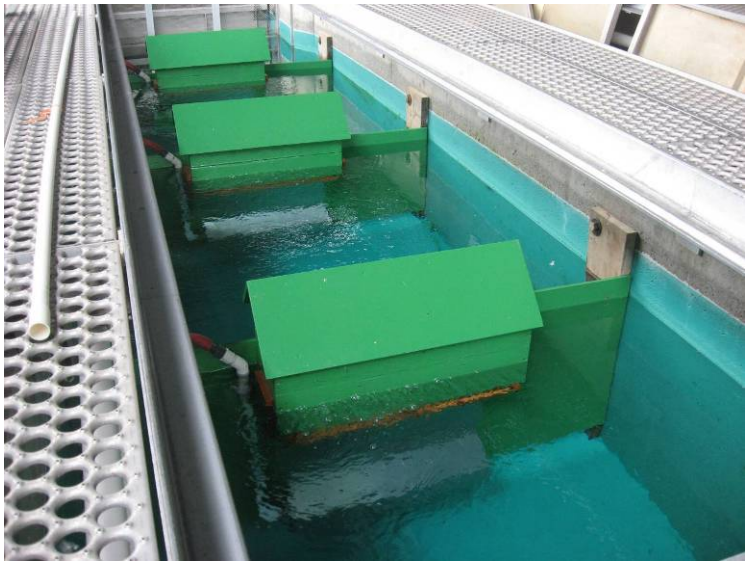
Airlift Technology

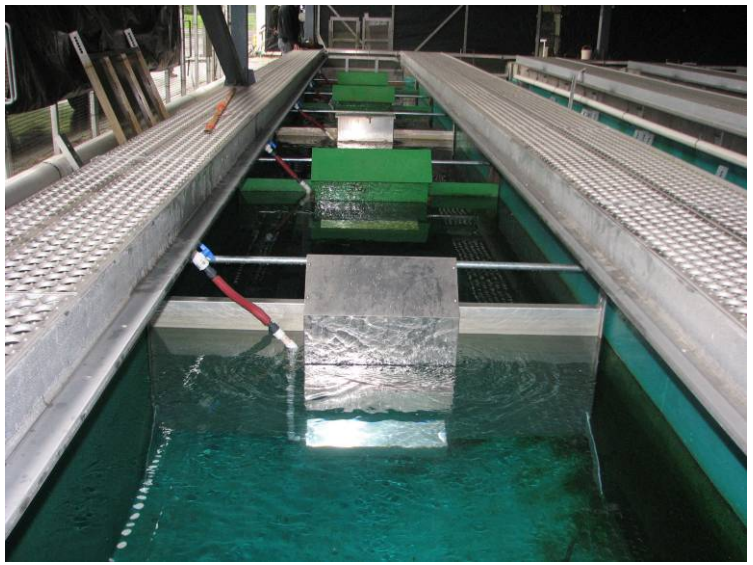
- Aerate water
- Strip carbon dioxide
- Lift water and allow to return as a high cleaning flow.

Raceway Airlift Trials

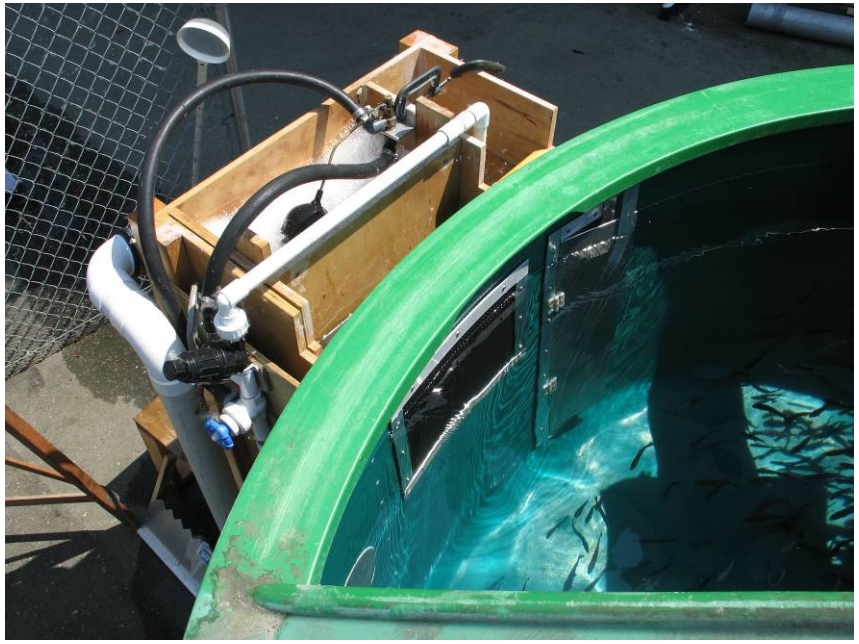


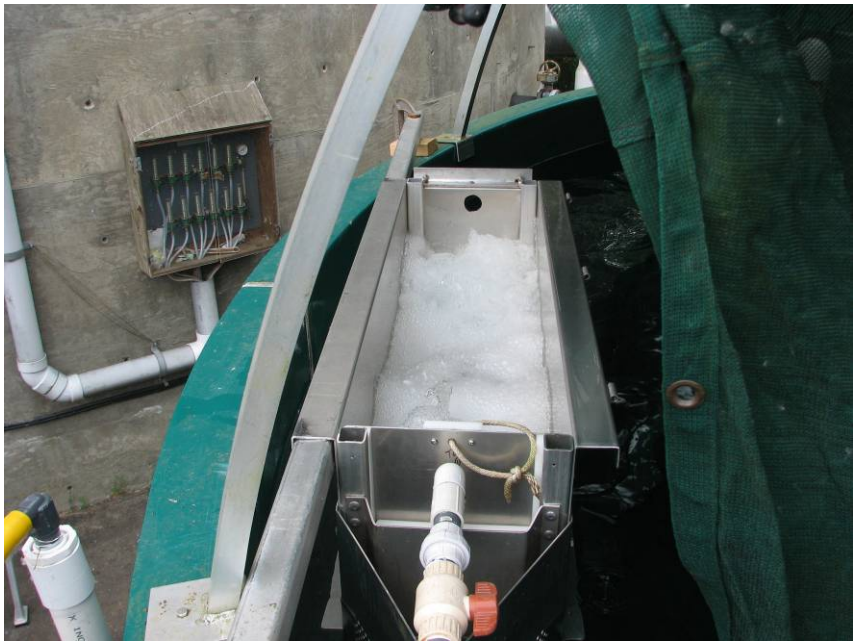
Raceway Airlift Plan

- Install several airlift pumps attached to baffles along length of each raceway.
- Connect to energy efficient air blower pump.
- Aerate water along raceway length and increase cleaning flows.



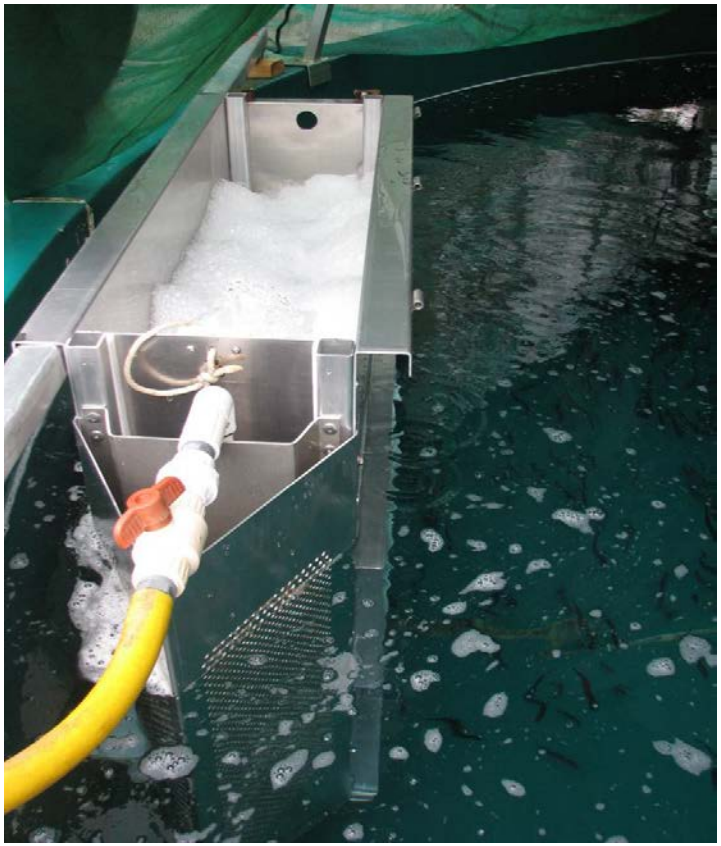
Circular Tank Airlift Trials





Circular Airlift Plan

- Install 1 or 2 airlift pumps inside each circular.
- Connect to energy efficient air blower pump.
- Pump air to bottom of airlift pump, aerate water and increase cleaning flows.



Future Pond Water Use

- Coastal hatcheries with lower pH water:
  - Shift from 100% to 25% makeup water.
  - 400% reduction in inlet water flows.
- BC Interior hatcheries with higher pH water:
  - Shift from 100% to 40% makeup.
  - 250% reduction in inlet water flows.
  - Rise in total ammonia nitrogen limits greater savings.
- End result is a very large reduction in water and electrical energy.

Energy Reduction Goals

Hatchery	Present Electrical Consumption (MWh)	Future Consumption May 2013	% Reduction
Vancouver Island	1,378	977	29
Clearwater	699	669	4
Fraser Valley	1,802	724	60
Kootenay	2,128	693	67
Summerland	177	177	0
FFSBC Overall	6,184	3,240	48

Financial Savings

- 2,944 MWh annual electrical saving:
  - @ $0.07/KWh = $206,000/yr
  - @ $0.08/KWh = $236,000/yr
  - @ $0.10/KWh = $294,000/yr

** BC electrical rates rise each year.

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Other Benefits of Airlift

- Less wear and tear on pumping equipment.
- Less well redevelopment costs and uncertainty.
- Less maintenance time.
- Reduced aquifer withdrawls.
- Operate all ponds at full capacity.

Capital Upgrade Plan

- Presently installing airlift technology at 2 hatcheries.
- Install airlift technology at remaining 3 hatcheries in 2012.

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BC Hydro Power Smart Incentives

- Clearwater airlift project
  - Project cost - $203,000
  - BC Hydro contribution $80,205
  - Simple payback period* - 6.1 years
- Vancouver Island airlift project
  - Project cost - $218,000
  - BC Hydro contribution $106,366
  - Simple payback period* - 5 .5 years

* Simple payback does not consider rising energy rates, future maintenance savings, labour, etc.

Other Planned Energy Projects

- Pump efficiency studies in all hatcheries:
  - Reduce pump/motor size.
  - Replace with premium efficiency motors .
  - Install variable frequency drives (VFDs).
  - Decommission unnecessary wells.

- Lighting upgrades.
- Building & process water heating/chilling.

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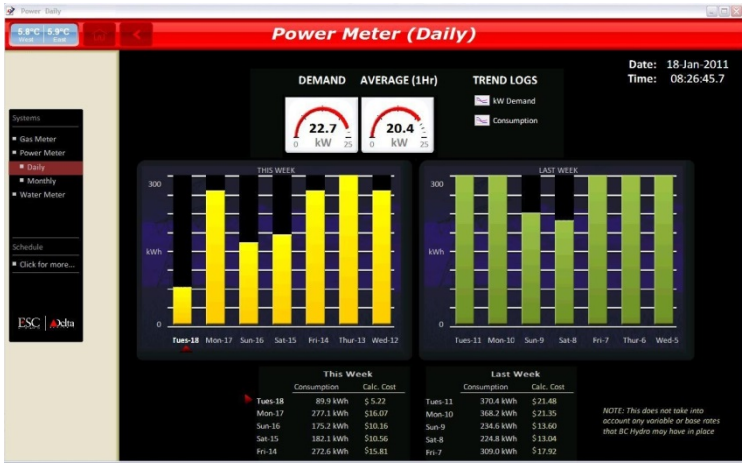
Energy Metering



- You can’t manage well what you don’t measure.
- Install meters and energy management software.
- Quickly access & act upon metered information.

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Staff Awareness

- Developed Energy Mandate and 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".*
- Formed energy team (eFishent Energy).
- Implemented gainsharing program
  - energy savings financially shared with staff.

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QUESTIONS?

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