Saving Energy on Hydraulics and Refrigeration

Alaska Fisheries Development Foundation

University of Alaska Sea Grant Marine Advisory Program



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Alaska Longline Fishermen's Association



≻Efficiency

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➢Viscosity

➤Cleanliness

Note: Hydraulic demand energy use in some vessels is 55-57% of total fuel consumption.



El Rio: Belt Driven Engine Mounted Hydraulic Pump

Perform many tasks from anchor winches to gear hauling to powering generators and refrigeration.

Hydraulic power costs can be measured with instrumentation or calculated from pump pressure, displacement and flow rate.

Pump may be belt- or gear-driven by main or auxiliary engine, or by electric motor.

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Optimized systems efficiency about 98% at full load, 0% at no load. Most systems not optimized.

Noise and heat are wasted energy.

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Continuously running hydraulics when not doing work wastes energy.

Long runs, corners, constrictions in hydraulic lines, dirty oil (fluid), all reduce system efficiency.

What the Energy Audit Pilot Project Revealed

Many small fishing vessels have substantial hydraulic power cost; for some it was more than half all energy.
Many are configured so that pump runs continuously when engine is running.
A gillnetter was using 2 hp from main engine when hydraulics were in standby.
One troller used \$1200 worth of fuel in a season just to run pump when gurdies not engaged.*
A 50-footer spent \$2,000 per season on fuel to power hydraulics.*

*Dollar calculations based on the average of \$4/gallon for diesel fuel at the time of the pilot project.



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	Measured	
Activity	Fuel (GPH)	Change (GPH)
Trolling with hydraulics OFF	1.47	
Trolling with hydraulics ON	1.68	-0.22
Trolling, Running Gear w Hydraulics	1.74	-0.27

Hydraulic Systems: F/V Myriad

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	Name (eg. Ice troll, gillnet,	Propulsion Engine #1	
Operating Mode	family outing)	Hrs Transit	Hrs Fishing
1	Longline	125	160
2	Ice troll	70	150
3	Freeze troll	160	480
4	family	40	20
Total		395	810

Energy Analysis Tool Vessel Profile Page

Ave Hourly Hydraulic Loss Cost: \$1/hr *No Load Hydraulic Fuel Cost on All the Time (1,205 hrs): = \$1,205*

Only Engage Hydraulics When Needed for Useful Work

Energy Conservation Measures

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De-clutch hydraulics when not in use.

Track down and eliminate sources of heat and noise.

Ensure all line runs are straight as possible with no corners or constrictions.

Change fluid and filter regularly, and use lightest grade fluid recommended by equipment makers.

Install VFD controllers on electrically powered hydraulics.

Consider a small auxiliary engine to power hydraulics if used only intermittently.

Consider replacing hydraulics with more efficient electric drive where feasible.

VFD on Hydraulic Steering 70% reduction in Energy Usage

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Figure 22 MED Controlled Steering Cont



Refrigeration Systems

Compressor EfficiencyMaintenanceOperating Pressure

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F/V Born Again

On-Board Refrigeration Systems

Refrigerated seawater chilling and blast freezing can be run mechanically, electrically or hydraulically.

Some run off main engine but more commonly a diesel auxiliary powers the refrigeration.

Refrigeration is a major energy consumer. On some vessels it's more than half of all energy consumption.

Systems are most efficient under heavy load. RSW uses 1.6 hp/ton capacity, blast freezer 4.6 hp/ton of compressor rating.

The compressor is the biggest energy consumer in both chilling and freezing systems. Others are seawater pump for condenser and circulation pump (RSW) and fan (blast freezer).

A vessel's refrigeration energy consumption can be calculated. Refer to Energy Analysis Tool.

Refrigeration systems can be adjusted to maximize efficiency.

Maintenance vs. Technology Compressor Power on Reefer Containers

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Cumlative Energy - 24 hour



On-Board Refrigeration Systems

What the energy audit project reveals

Refrigeration related fuel costs can be as high as \$15,000 per season. Most vessels in the Alaska study have older technology compressors and pumps. Head pressure frequently is set higher than necessary, which wastes energy. Data analysis showed a trawler could save 23% or \$4200 in just 2,000 hours of operation by reducing compressor discharge (head pressure0 from 180 psi to 140.



On-Board Refrigeration Systems

Energy Conservation Measures

Thorough insulation of the fish hold is essential, including lines passing through. Ensure door seals are tight.

Reduce compressor head pressure to minimum needed to achieve correct chilling. Install VFD controls on compressor condenser, circulating pumps, and fans. When replacing compressors, fans and pumps, select premium efficiency models.

Questions?

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http://seagrant.uaf.edu/map/fisheries/fishing-vessel-energy-audit/

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