RISE FINAL REPORT

Name: Sarah Henton

Project Title: Replacement of Aging Refrigeration Equipment with Modern Efficient Environmentally Friendly Equipment

Amount Awarded: $176.00

Amount Expended: $175.84

Department: AIL (Advanced Instrumentation Laboratory)

College/School: College of Natural Science and Mathematics

Phone: 907 687 7591

Email: shenton@alaska.edu

Date: May 29th 2011

What did the funding accomplish and how were students involved?

The RISE funding awarded was used to purchase an Envi Kit 3-Phase. This piece of equipment allows the user to measure the energy consumption of electrical equipment. The PI and AIL used the Envi Kit 3-Phase to compare the electrical usage of various water chillers in use on AIL equipment. The PI proposes to replace aging and inefficient chillers with more modern, energy efficient models. In addition to reduced energy consumption (and as such reduced cost), the new chillers contain coolants that are less environmentally corrosive. The PI on this project is a graduate student in the Department of Geology and Geophysics who has been involved in all stages of the project.

The Envi Kit 3-Phase has been used to estimate power consumption on 3 AIL chillers:

SX50 EPMA Chiller (model: Coolwell SE-112W)
Axios XRF Chiller (model: Haskris R250)
Panalytical MRD XRD Chiller (model: Haskris R100)

The Haskris R100 chiller currently in use with the XRD is the modern and efficient equipment that AIL proposes to install on all AIL equipment. Our results suggest that the Haskris R100 is significantly more efficient that the old chilling equipment and that the replacement of the old chillers with this newer model would save over $800 per year per replaced chiller in energy costs (based on current electric costs).

The Coolwell chiller connected to the SX50 EPMA runs continuously 24 hours per day, 365 days per year. It consumes a steady 29.8 kW-h (kilo Watt hours) per day. At current energy costs of $0.14 per kW-h (the rate used by the UAF powerplant in their recharge calculations) this translates into approximately $1522.75 of energy use per year. The US EPA estimates that the burning of 1 metric ton of coal produces 2460 kW-h of electricity and that 6.895 x10^-4 metric tonnes of CO$_2$ are released into the atmosphere per kW-h of energy produced. Based on these figures the SX50 EPMA chiller requires the burning of 4.4 metric tonnes of coal per year. This is equivalent to the release of 7.5 metric tonnes of CO$_2$ into the atmosphere per year.
The Haskris R250 chiller on the Axios XRF, adjusts its work in response to demand from the XRF. Depending on usage, the chiller uses between 30 and 40 kW-h per day. This results in energy costs between $1593 to $2044 per year. The Axios XRF chiller requires the burning of approximately 4.5 to 5.9 metric tonnes of coal per year. This is approximately equivalent to the release of 7.6 to 10.1 metric tonnes of CO$_2$ into the atmosphere per year.

The Haskris R100 chiller on the XRD adjusts its work in response to demand from the XRD. When the XRD is running at full power the chiller uses approximately 14 kW-h per day. This results in energy costs of $715.4 per year. The XRD chiller requires the burning of approximately 2.1 metric tonnes of coal per year. This is approximately equivalent to the release of 3.5 metric tonnes of CO$_2$ into the atmosphere per year.

While the different machines have varying energy requirements, the SX50 EPMA, Axios XRF, and XRD have roughly peak comparable chilling needs. Results from the Envi Kit 3-Phase suggest that the replacement of old inefficient chillers would significantly reduce energy consumption at AIL. The replacement of the SX50 EMPA chiller alone would result in a saving of approximately $807.35 per year. It would also save approximately 2.3 metric tonnes of coal and stop the release of approximately 4 metric tonnes of CO2 into the atmosphere. We have consulted with the manufacturer of the SX50 and they have indicated that indeed an R100 would be a suitable replacement. We have not investigated the replacement of the R250 on the Axios XRF in detail.

A new Haskris R100 chiller costs approximately $6500 (including shipping). At current electric rates, the cost of replacement of the Coolwell chiller would be recouped in approximately 8 years.

The RISE funding provided in this grant has allowed the PI and AIL to assess the efficiency of various chiller models. This data will allow for a further application for funding to replace the aging and inefficient chillers with new equipment. The Envi Kit 3-Phase purchased with this grant has been passed on to the UAF Office of Sustainability to allow other university departments to benefit from its use.

Comments and Issues:

The Envi Kit 3-Phase is relatively easy to set up, however recording and saving the data is non-trivial and requires the user to locate and download software and/or sign up for an internet based service (or perhaps purchase a separate ancillary microcomputer-based recording device). Locating and setting up the correct software was not straightforward. The PI chose to record data using the Google Powermeter internet based service. A number of other options were tested unsuccessfully. Google Powermeter has limited functionality, especially with regards to the visual display of data. The Envi Kit has been given to the UAF Sustainability Office for use by others.
Itemized Budget – Be sure to list each item purchased.

<table>
<thead>
<tr>
<th>Budget Detail</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Personnel</td>
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<tr>
<td>Contractual Services (Training)</td>
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<tr>
<td>Supplies</td>
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</tr>
<tr>
<td>Equipment (Hardware and software)</td>
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</tr>
<tr>
<td>TOTAL</td>
<td>$175.84</td>
</tr>
</tbody>
</table>

Suggestions you might have as to how we can improve the process:

Images: Please submit several high images of the projects and include descriptive information including photographer.

Notes: Images of the Envi Kit 3-Phase are taken from the manufacturers website. The AIL unit was given to the UAF Office of Sustainability before this report was written and before photographs could be taken.

Image One: Envi Kit 3-Phase Control Box

http://www.ecomonesaving.com/acatalog/ENVI_R_Household_Energy_Meter.html
Image Two: Envi Kit 3-Phase Sensors


Image Three: Example output from Google Powermeter (taken from AIL account)