

Laboratory Refrigerators: Energy Use and Efficiency Potential



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PART I



REFRIGERATOR AND FREEZER SURVEY



Purpose of Survey

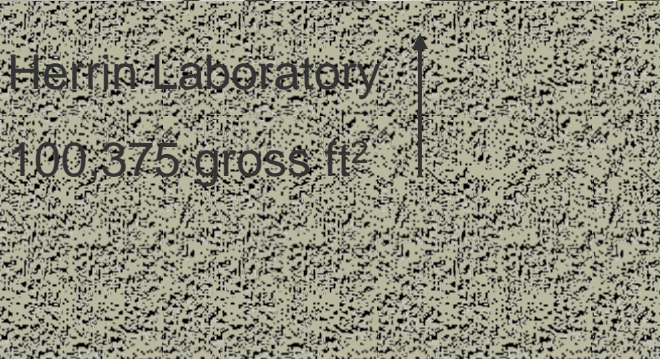
- Understand magnitude of energy consumed by refrigerators & freezers in two biology buildings at Stanford University
- Estimate energy and cost savings potential
- Recommend cost-effective efficiency improvements



Buildings Surveyed



Gilbert Biological Sciences
103,781 gross ft²



Herpin Laboratory
100,375 gross ft²



Survey Methodology

- Take inventory
 - Make, type, size, nameplate data, location
- Collect actual energy usage information
 - Nameplate data is not helpful; must obtain actual kW and run time
 - Used Line Logger to collect kWh and kW data; run time calculated



Xantrex Technologies/
Trace Engineering
Line Logger
Cost: ~ \$370*

* Source: <http://www.solarcellsales.com/products/LINELOGGER.cfm>

Survey Results

- The two biology buildings contain a total of 384 stand-alone refrigeration units
- There are 13 different types of refrigeration equipment (see pie chart)
- Estimated energy consumption = 251,000 kWh/year or \$35,000/year at 14 cents/kWh

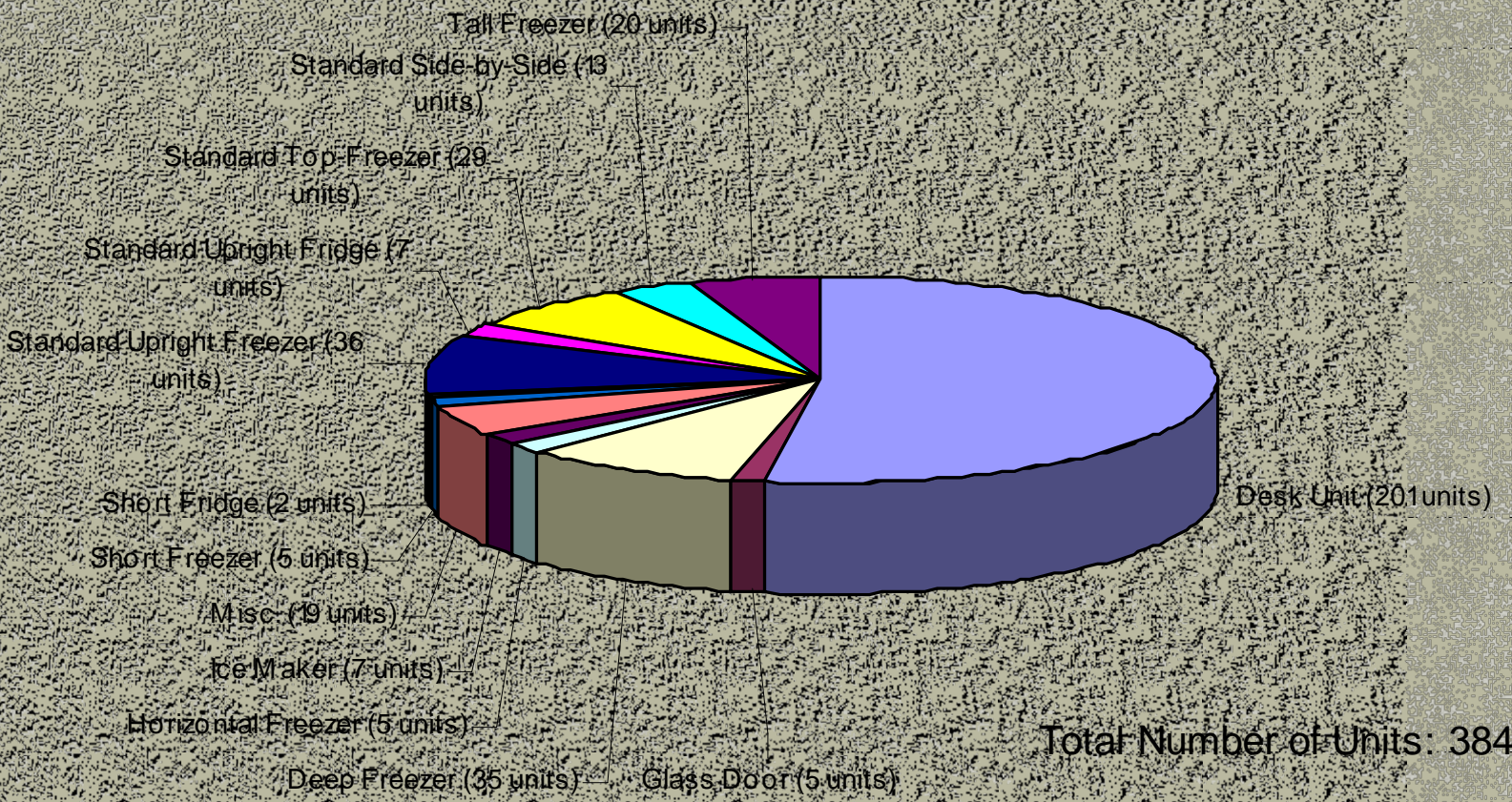


Hallway lined with refrigerators & freezers

* Walk-in refrigerated rooms (aka "cold boxes") were not included in the survey.



Refrigeration Types and Distribution



Total Number of Units: 384

Focus on Desk Units

- The greatest number of refrigerators were “desk units”
 - 4 to 6 cubic feet (fit under counter)
 - easy access from researcher’s desk or work station
 - a “residential” appliance
- *Marvel* the most common brand (see pie chart)
- Small difference between least and most efficient models, but good potential savings due to quantity

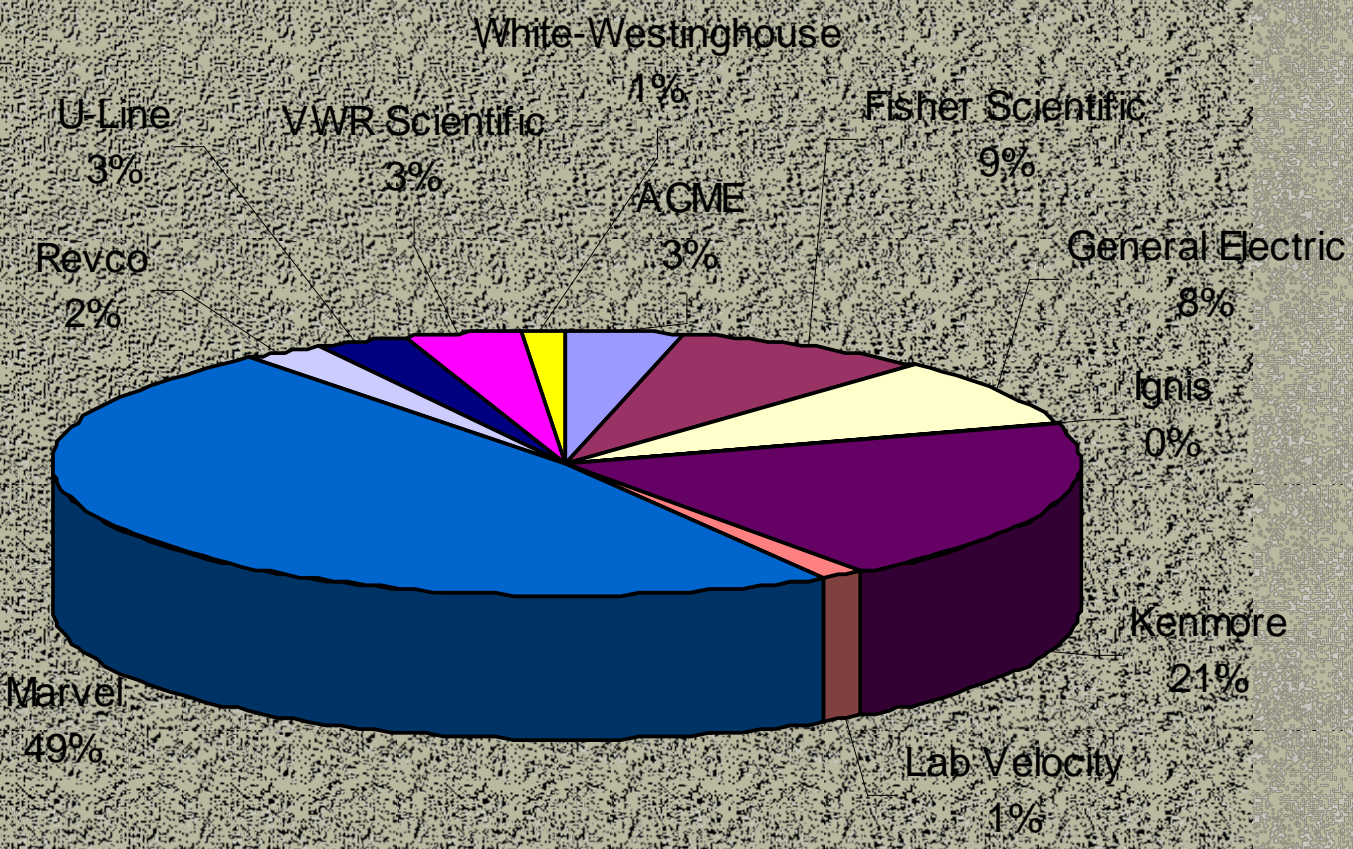


Marvel 61RF
refrigerator/freezer*

* Source = <http://www.us-appliance.com/61marref.html>



Desk Units by Make





Savings Potential

- We were able to collect actual energy use information for 5 types of equipment, estimated the remainder
- Savings estimates based on replacing each type of equipment with the most energy-efficient model in its class*
 - Energy savings = 55,000 kWh per year
 - Cost savings = \$7,700 per year (at 14 cents/kWh)
 - Emissions avoided = 39 tons CO₂ per year

* Per Association of Home Appliance Manufacturers (AHAM), Directory of Certified Refrigerators and Freezers, February 2002

PART II



IMPLEMENTING SURVEY RECOMMENDATIONS

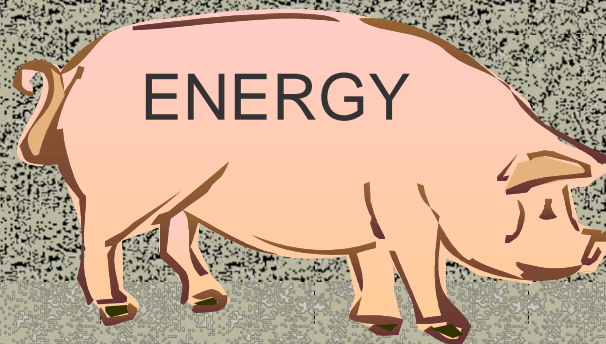


Survey recommendations

- Replace all units in the “worst” lab
- Create a financial incentive for “early retirement” of inefficient refrigerators and freezers throughout campus
- Develop better procurement policies and practices

“Worst” Lab Replacement Project

- An Emeritus Professor's lab was identified as the “worst” in terms of the number of old, very inefficient units
- The University can buy all new units for his lab and still achieve a simple payback period of 3.2 years; 4.2 years including the cost of disposal for the old units.
- Funding for this project (\$5,500) approved for FY04





Refrigerator Rebate Program Design

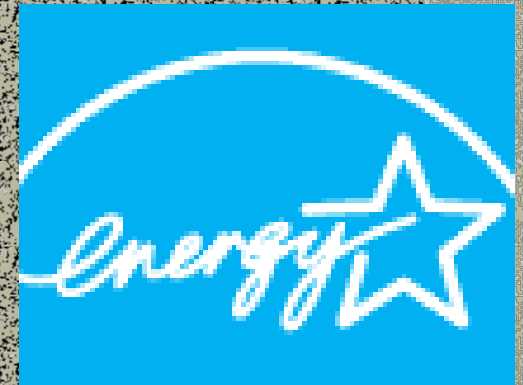
- Stanford's Energy Retrofit Program (ERP) requires a simple payback period of 5 years or less
- Rebate of \$200 per unit will cover disposal cost for old unit plus provide an incentive for "early retirement"
- First-come, first-served until \$10,400 rebate budget is depleted

Scenario	Simple payback period @ \$200/unit
Worst-case (only most efficient units replaced)	5.1 years
Best-case (only least efficient units replaced)	2.7 years
Average (a mix of units replaced)	3.4 years



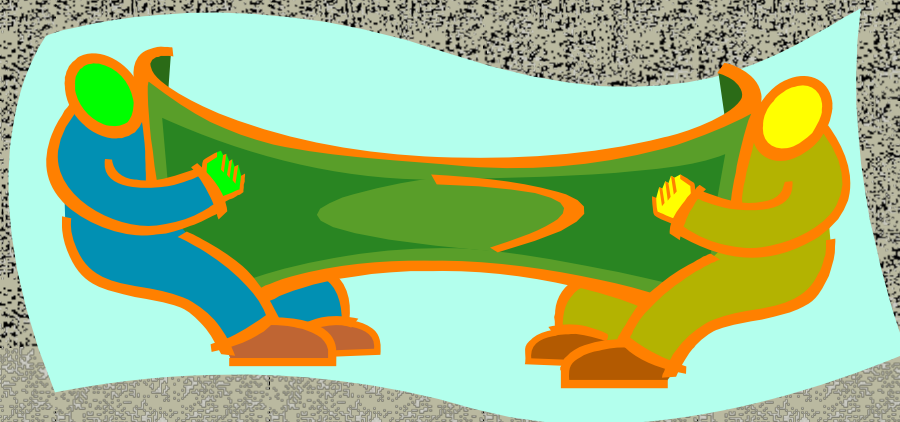
Rebate Program Requirements

- Applies to refrigerators, freezers, or refrigerator/freezers
- Both old and new units must have been/be installed in a building served with Stanford Utilities electricity
- New unit must be Energy Star® qualified
- Applicants must provide proof of purchase and proper disposal of old unit



Ideas for Procurement

- Add Energy Star® qualified yes/no or energy performance data to product detail for on-line catalog purchasing
- Add Energy Star qualification or energy performance to list of criteria for Procurement-assisted purchasing (units >\$5,000)
- Develop preferred product lists for common types/sizes and negotiate volume prices with vendors



Next Steps

- Launch rebate program in January 2004
- Complete "worst" lab replacement project by August 2004
- Work with Procurement to develop better policies and practices
- Find a safe way to measure energy used by freezers with 220-Volt power supply
- Talk with Principle Investigators about mysterious "miscellaneous" refrigeration units, their purpose, possible replacements





Acknowledgements

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