

Dear Kent and Matt,

Thank you for an informative Energy Star webinar today. It was really great that you put the data in energy intensity units per ft³. That made it REALLY clear.

I agree that ability to pull down a heavy product load is not an important first criteria. Most additions to lab refrigeration is small in thermal mass. Those regularly adding large mass need to get something else.

FRAMEWORK DOCUMENT RESPONSE:

Q1: Table 1. Needs to have columns that address sample types, entered by industry, health care, and general researchers.

Explosion proof items may be only superficially different than other models, or maybe not. They do not a priori need exclusion, and manufacturers need to be encouraged to make [Energy Star](#) explosion proof equipment. More importantly, explosion proof equipment is rarely required in higher education. Some campus codes only require a researcher have access to an [explosion proof](#) refrigerator, for example, thus saving about \$500-1,000 on the purchase. A great example of where features selection is more important than Energy Star differences with-in a class of appliance.

Defrost type is another example. For residential freezers, virtually all manual defrost freezers use 25% less energy than auto defrost freezers, so all manual defrost freezers should be energy star, no? This could be true for research grade freezers.

Q2: -30 °C freezers seem to be a relatively new niche in cold storage. What justifies this class? Again, DNA can be stored at -20—30 for months, while proteins need colder temperatures. A storage guide is needed—maybe CDC, NIH and EPA could team up on sample storage guidelines for sample integrity and energy efficiency. It would be helpful for the manufacturers to give broad brush estimates of market share, or go to HHMI, University of California and another University and comb their purchasing records.

Q3: I would think combo frig freezers would be relatively rare in research freezers made from scratch. That is an impression from working in labs, and most of the combos with research labels on them look like retrofit and relabeled residential units.

Q4: You [have](#) data from the under counter, standard stand-up, and doublewide models, which looks representative.

Q5 & 6: I don't know how most biochemists shop for temperature stability. I can check that out.

Temperature excursions: Can thermal mass be used to protect both precious samples and reduce the sensitivity of alarmed thermocouples? Assume a standard box with some thermal mass, say 10 x 20 cm that drops onto gel packs built into the shelves. This is a design x regulatory issue that needs a shepherd.

Q7 Q9: It's fascinating that uniformity and glass doors apparently did not impact energy consumption. If so, use that information to lump them. At every opportunity this process needs to lump classes because there are so many splitting characteristics.

While it may not be reasonable to lump differently-defrosting freezers, I think refrigerator designers need to figure out condensation control without wasting a lot of heat, and they should be lumped together. That way if someone really wants auto defrost they will chose it over Energy Star. It's also important to have comparisons of different freezers across defrosting types.

Q12: for archival appliances, door openings would be insignificant and energy cost of glass could relatively go up.

Q13: I'm surprised as well.

Q14: I wrote with a Sharpie on the side of the freezer when it was defrosted. A year later I checked back and did it again. Ten bonus points for manufacturers that provide a sharpie zone on the side of their manual defrost fridges. There needs to be space for 20 lines, and if users write with blue or red sharpie, the initial writing will be faded in time to start again.

Q15 & 16: Popular thinking among biochemists stipulates that proteins need very stable temps, DNA not so much. A lot of folklore and anecdote out here.

Q17: ask the mfrs.

Q18: I might be able to get some before and after defrosting measurements of energy consumption. Uniformity and stability would be harder for me.

Q19: It looks like relatively low impact.

Q20: When does a high precision refrigerator become an incubator?

Q21: neither of those examples would impact energy draw.

Q22: See Q1

Table 3. Milestones.

The lack of data is not surprising and will likely come in at a trickle for the next two years and beyond, given that it will need to be done a second time by a certified lab, and even more expensive then. The process needs to be simplified and made cheaper if you want more data. I would like to know Joe's concerns about poor quality data: what are the red flags? Am I generating that data? Would I care with "field measurements"?

Beyond Energy Star: user education, name plate data.

By the end of 2012 I hope the University of California and partner universities will only buy lab equipment that has overnight energy consumption stamped on the name plate at two settings, (e.g. -70, -80, or -20 and -30) or speeds. It only needs to be relatively accurate. ($\pm 10-20\%$). That will be adequate to sort the hogs from the antelopes. Stability and uniformity will be driven by user needs, and they don't impact energy consumption according to these measurements.

Table 0.5 (not included) needs to compare residential, commercial food, and research grade refrigerators for stability, uniformity, cost and energy efficiency. Maybe a nice SubZero would last for 20 years, be ES rated, and cost half the price, or a General Electric, or a Maytag....at one sixth the price. These decisions are made ad hoc. Cold storage space is often allocated by the grad student, not their sample requirements, so ultra low freezers become the default. The cost of a \$10,000 freezer is relatively cheap for a successful scientist—just another line item on the federal grant lottery application. Storage time is important. Some freezers are not opened for months as they are crypts of archived samples, and samples will degrade over longer temperatures. Dry storage in powder form or freeze dried is stable with no energy input at all, and getting researchers to use those methods for archiving is best of all. Clinical applications: blood, serum, drugs, are very critical. See thermal mass suggestions above as a low-tech way to insure uniformity.

The data we list on Labs21 Wiki is complementary to Energy Star, and while uncertified, it would be fabulous to get more data on this site as well. It may also be more accessible to researchers, the thousands of decentralized purchasers and users we are trying to reach.

Ultra low freezers are very important on the UC Davis campus, using nearly 1 million dollars in electricity annually (>800 freezers; 20 kWh/d; 12 c/kWh). Getting preliminary data from manufacturers public can be very valuable. Please give my email address to Joe from Sanyo.

Make intended research use and optimal energy consumption VERY APPARENT on the outside of the box. Incentivize this, so you don't get really simple mistakes like someone using an incubator at 40 degrees F (a cold, white metal box) as a refrigerator (another cold, white box that uses 1/3 the electricity). Or.... Filling a small room full of eight room temperature incubators using a kW each and driving the set point of the AHU down ten degrees.

Sample storage guide (scientist and manufacturer generated) would be complemented by a buyer's guide for refrigeration and freezing (Energy star and manufacturer generated). I have a graduate student volunteering to do a literature search, and would love to hire one to do a real guide. That would cost about \$10-20 k, and we have the scientists, the library, and business students interested in technology management and a whole 'nother concentration in biotechnology that would be very complementary.

We are developing a "Sustainable features" grid for lab appliances and purchasing specifications, (attached) that goes beyond Energy Star into user education, embedded resources, compatible components, durability, field repairability, etc.

Natural Refrigerants: CO₂, alkanes, nh₃, the new DuPont refrigerant. What is the long range plan when HCFC's are phased out by 2020? Can we incentivize the mfrs to switch ahead of schedule?

That's enough for now!

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