



Laboratory Grade Refrigerators and Freezers Framework Discussion

ENERGY STAR[®] Labeled Products Program

September 22, 2010

Activities To Date



- Test method for lab grade developed in 2009
 - EPA and stakeholders developed a supplement to ASHRAE Standard 72-2005
- EPA issued call for data in December 2009
 - Three manufacturers tested products and submitted data to EPA
- Data Analysis and Framework Document released September 7, 2010
 - Stakeholder meeting on September 22 to discuss results and interpretations

Goals for Today's Discussion



- Present analysis of test data received to date
- Discuss questions of interpretation raised by the data
- Discuss upcoming testing and verification changes to the ENERGY STAR program
- Request additional test data
 - **Specification development process will not move forward without more data**

Goals for Today's Discussion (cont.)



- Discuss any other issues raised by the Data Analysis and Framework Document
- Comment period open until September 30, 2010.

Issues for comment will be highlighted in boxes such as this.

- Slides will be made available online after the webinar.

Product Definitions



- Laboratory Grade Refrigerator
 - A refrigerated cabinet used for storing non-volatile reagents and biological specimens at temperatures between 23 and 53.6 °F (-5 and 12 °C) . . .
- Laboratory Grade Freezer
 - A refrigerated cabinet used for storing volatile reagents and biological specimens at temperatures between -40 and 50 °F (-40 and 10 °C) . . .
- Combination Laboratory Grade Refrigerator/Freezer
 - A product composed of two or more refrigerated cabinets, one of which meets the definition of Laboratory Grade Refrigerator and another that meets the definition of Laboratory Grade Freezer.

Product Definitions (cont.)



- Equipment types not analyzed:
 - Portable Laboratory Refrigerator/Freezer
 - Explosion-Proof Refrigerator/Freezer
 - Ultra-Low Temperature Laboratory Freezer
 - Walk-in Laboratory Grade Refrigerator

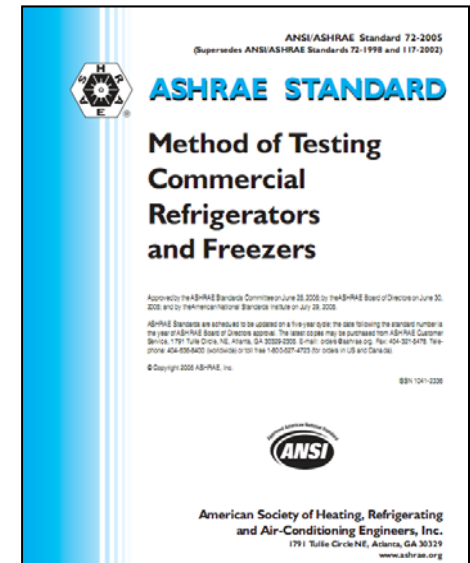
EPA seeks comment on:

- Whether the definitions correctly describe the major distinctions between equipment types

Performance Metrics



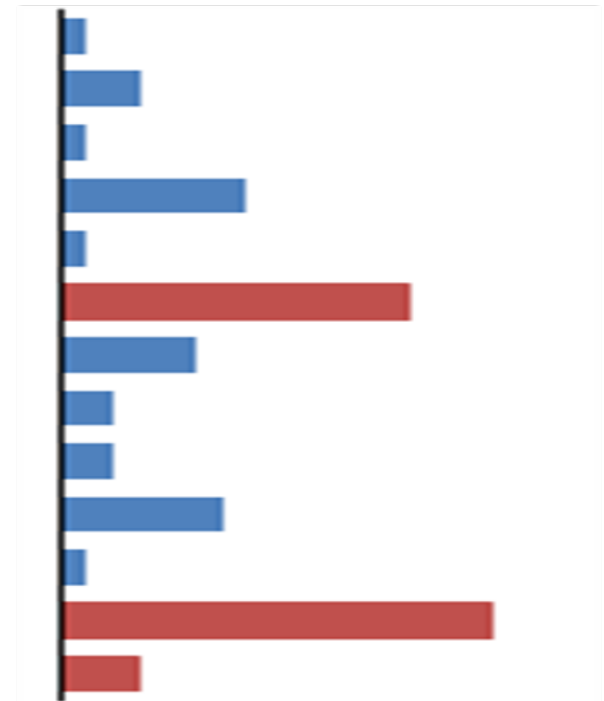
- Per ASHRAE Standard 72-2005 with ENERGY STAR Lab Grade Supplement
- 24-hour Energy Consumption (kWh/day)
 - Includes door openings
 - Refrigerators: for 15 seconds, every 20 minutes, over 8 hours
 - Freezers: for 15 seconds, every hour, over 8 hours
 - Includes defrost cycles (if automatic/continuous)
- Temperature Uniformity
 - Two samples, 3 hours each: during defrost and steady state
 - Min., max., and standard deviation of temperature during tests



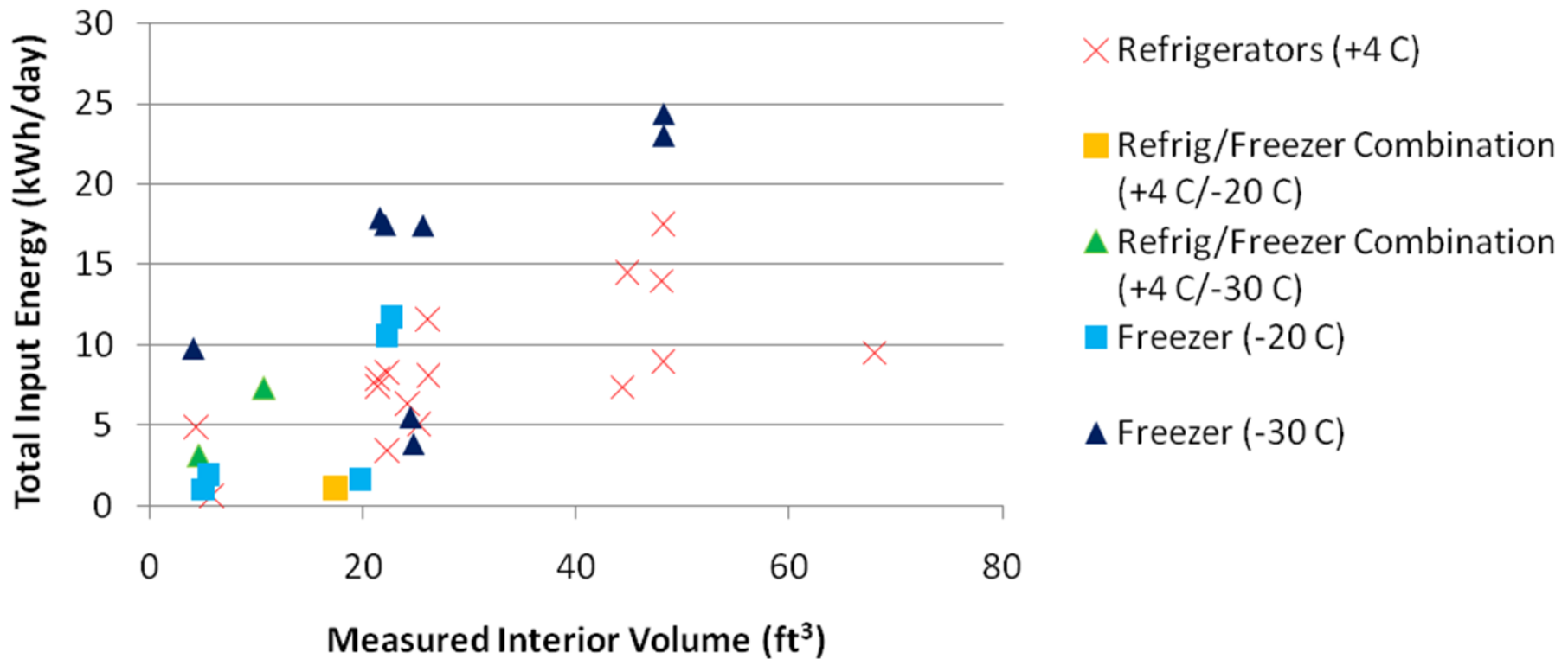
Overview of Data Analyzed



Equipment Type	Nominal Temp.	Door Type	Defrost Strategy	Total
Freezer	-20° C (-4° F)	Solid	Automatic	1
			Manual	3
			Continuous	1
	-30° C (-22° F)	Solid	Automatic	7
			Manual	1
Freezer Total				13
Refrigerator	+4° C (+39° F)	Glass	Automatic	5
			Manual	2
			Continuous	2
		Solid	Automatic	6
			Manual	1
Refrigerator Total				16
Refrigerator /Freezer Combination				3
Grand Total				32



Overview of Data Analyzed (cont.)



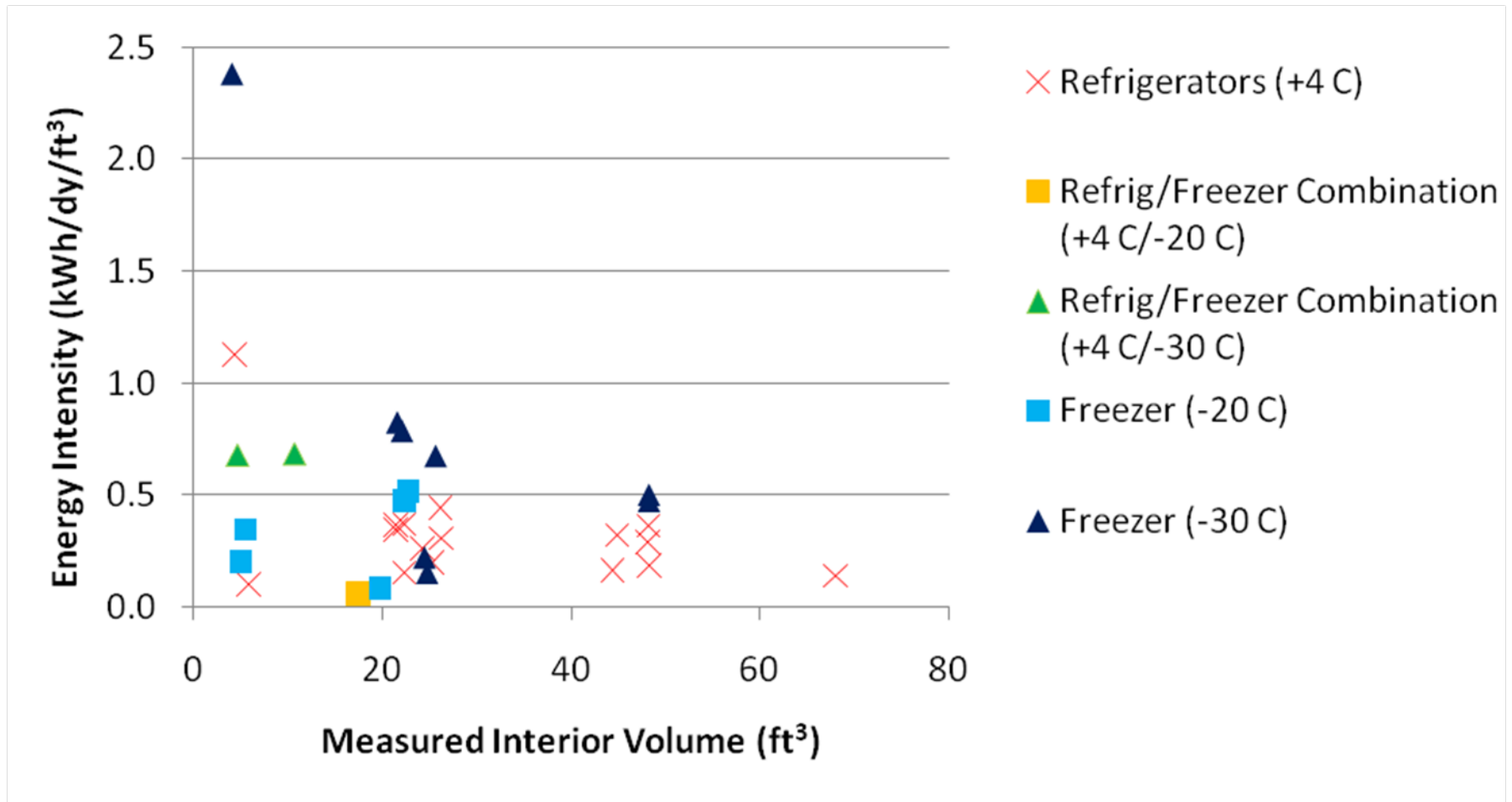
EPA seeks comment on:

- Whether the range of volumes is representative of the majority of the laboratory grade market

Overview of Data Analyzed (cont.)



Normalizing energy consumption by volume: **Energy Intensity**

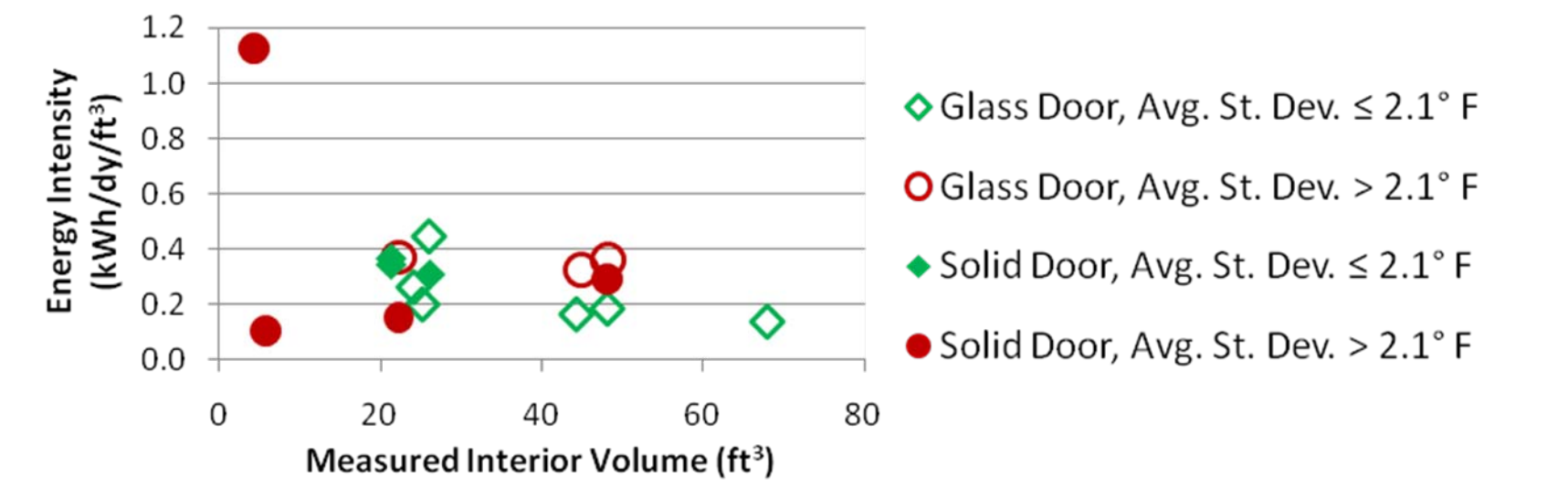
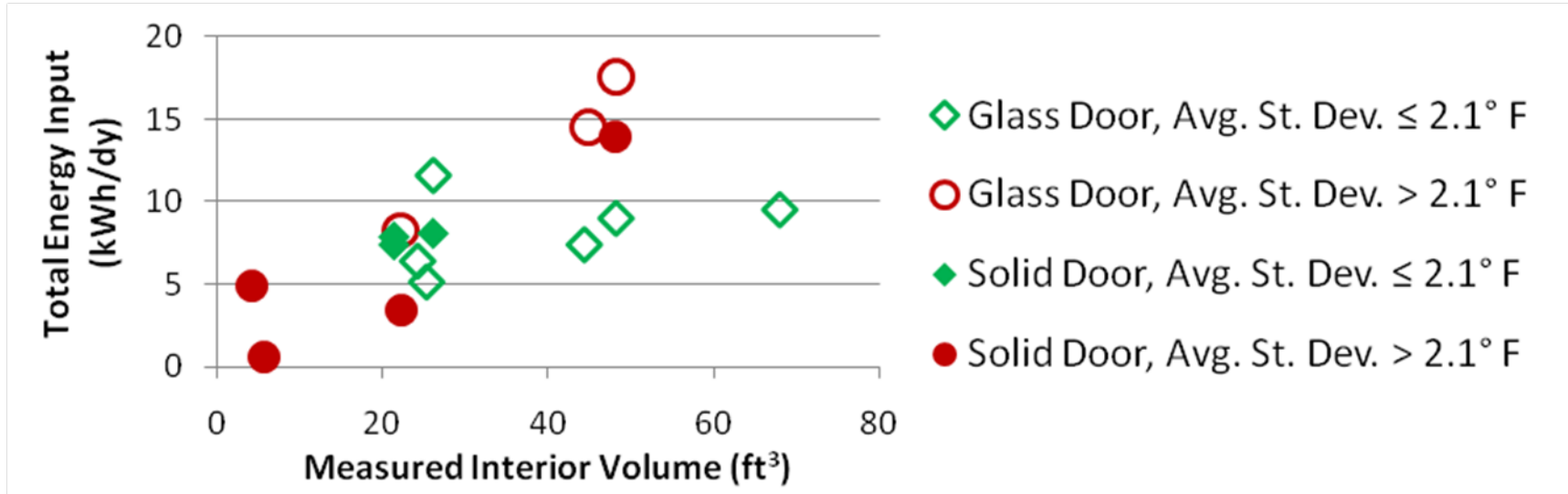


Impact of Product Characteristics on Performance

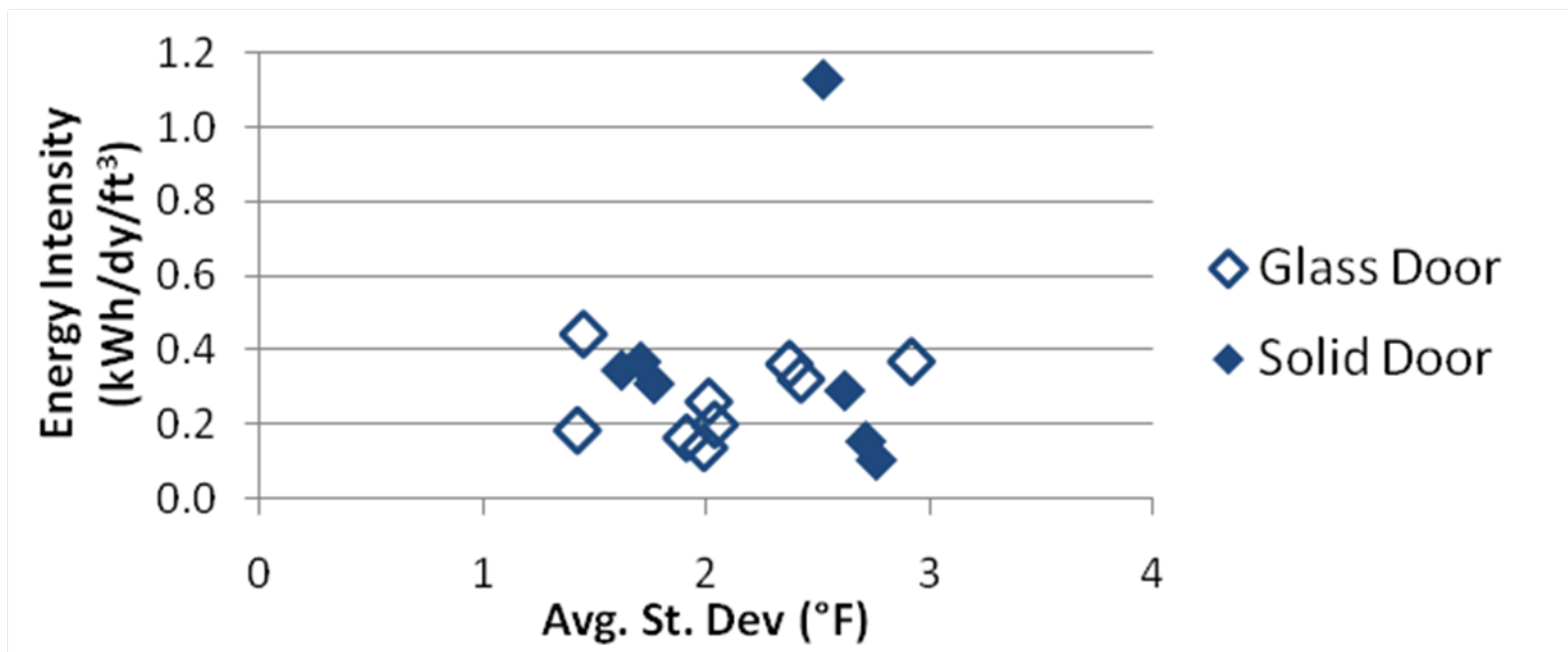


- Previous slides show some differentiation in performance between products
- EPA analyzed the impacts of three characteristics related to product utility:
 1. Door type:
 - **glass** or **solid**
 - only concerns refrigerators
 2. Defrosting strategy
 3. Intended application

Door Type (Refrigerator)



Door Type (Refrigerator, cont.)



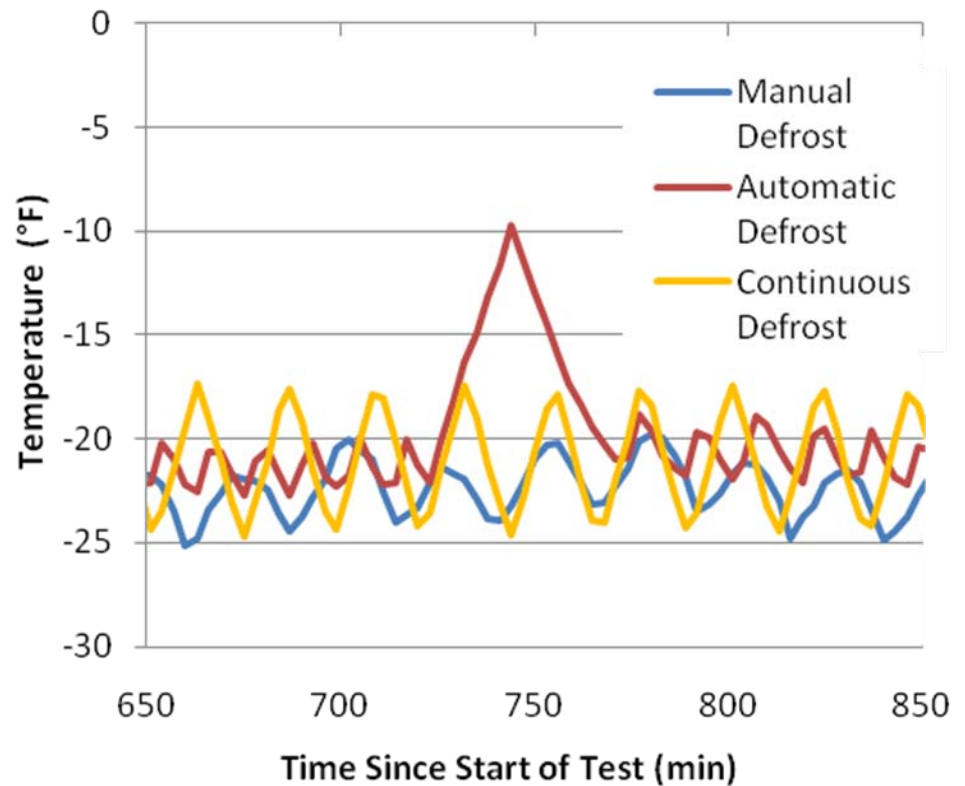
EPA seeks comment on:

- The representativeness of the above data
- Any design features that may explain the lesser impact of door type on performance in lab grade equipment

Defrost Strategy



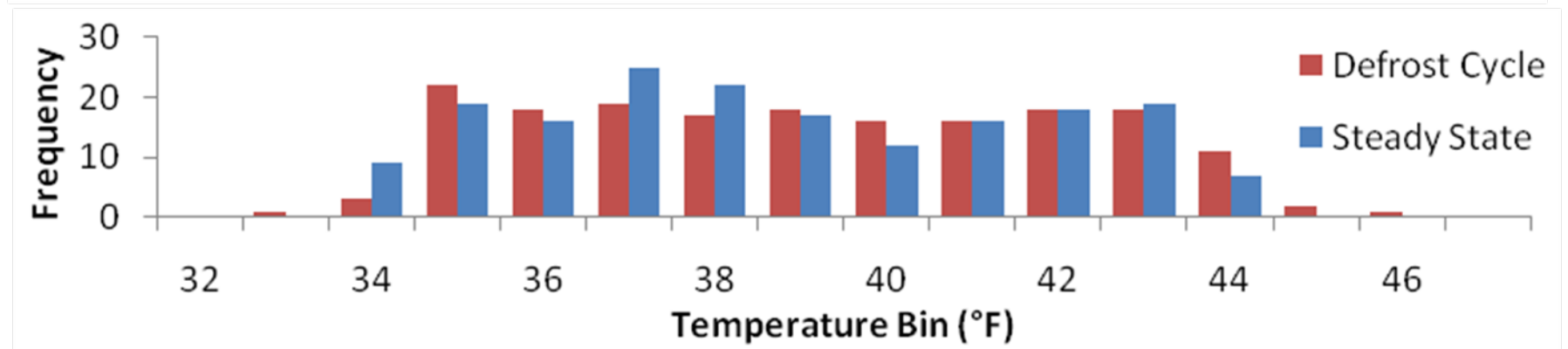
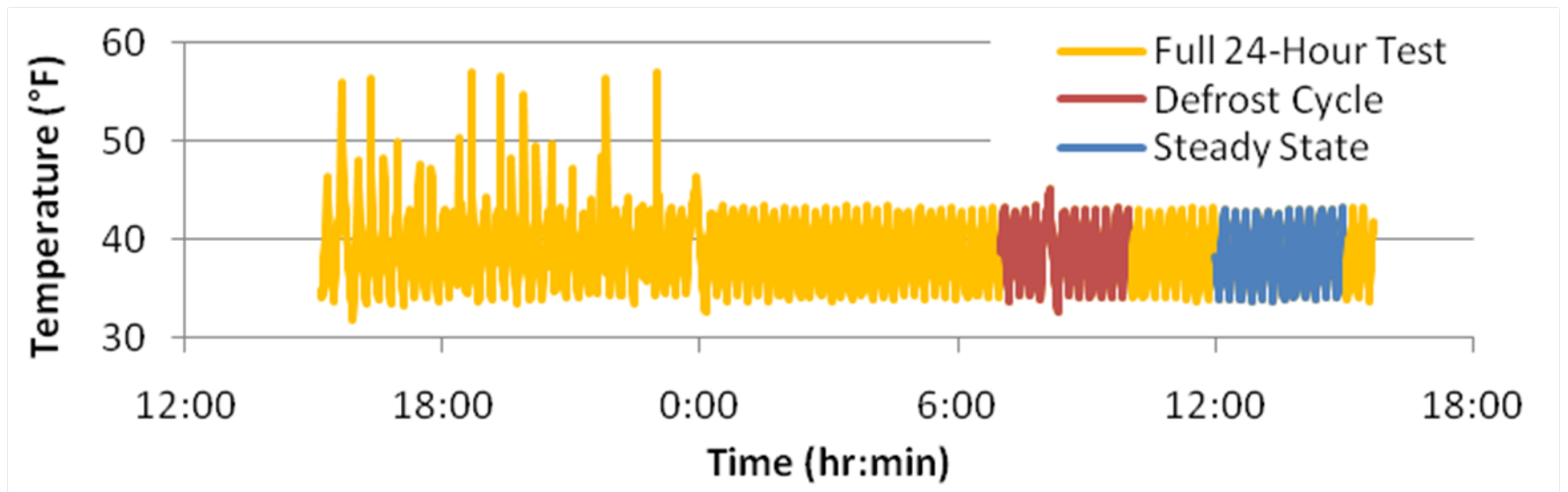
- EPA received data on equipment with three defrost strategies:
 1. Manual
 2. Automatic
 3. Continuous



Defrost Strategy (cont.)



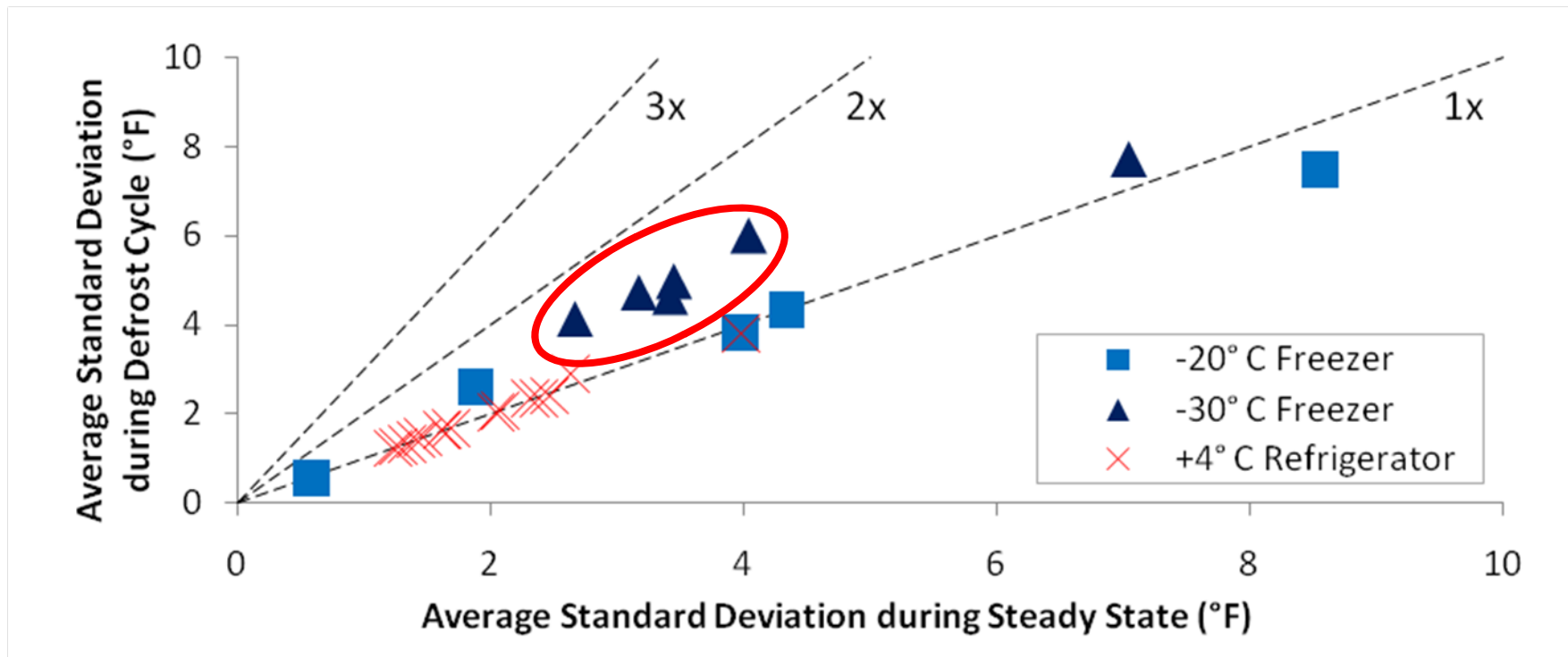
Impact of defrosting on temperature inside refrigeration cabinet:



Defrost Strategy (cont.)



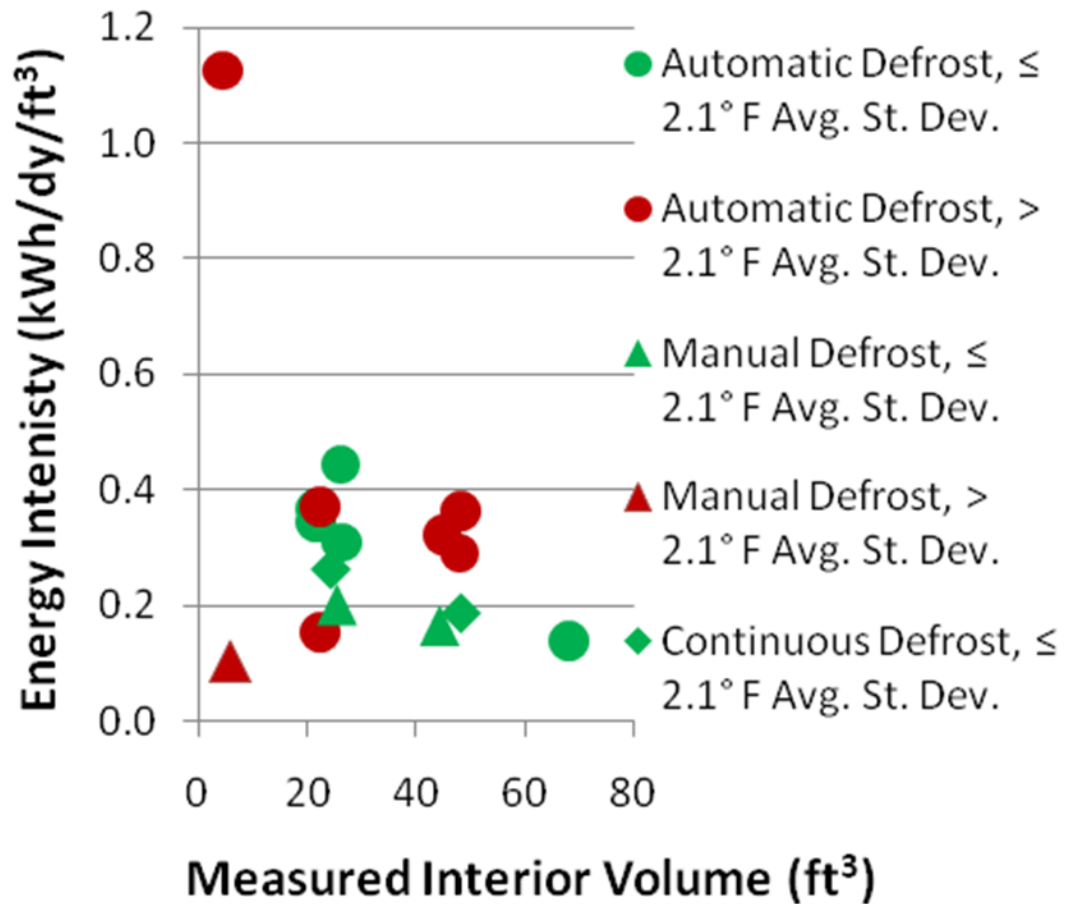
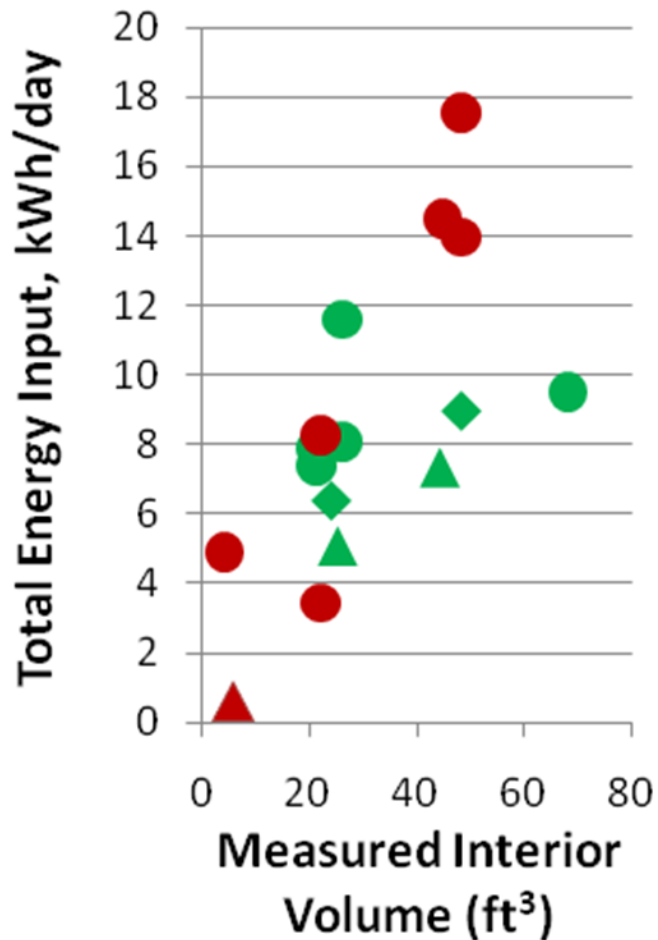
Standard deviation during defrost versus steady state



EPA seeks comment on:

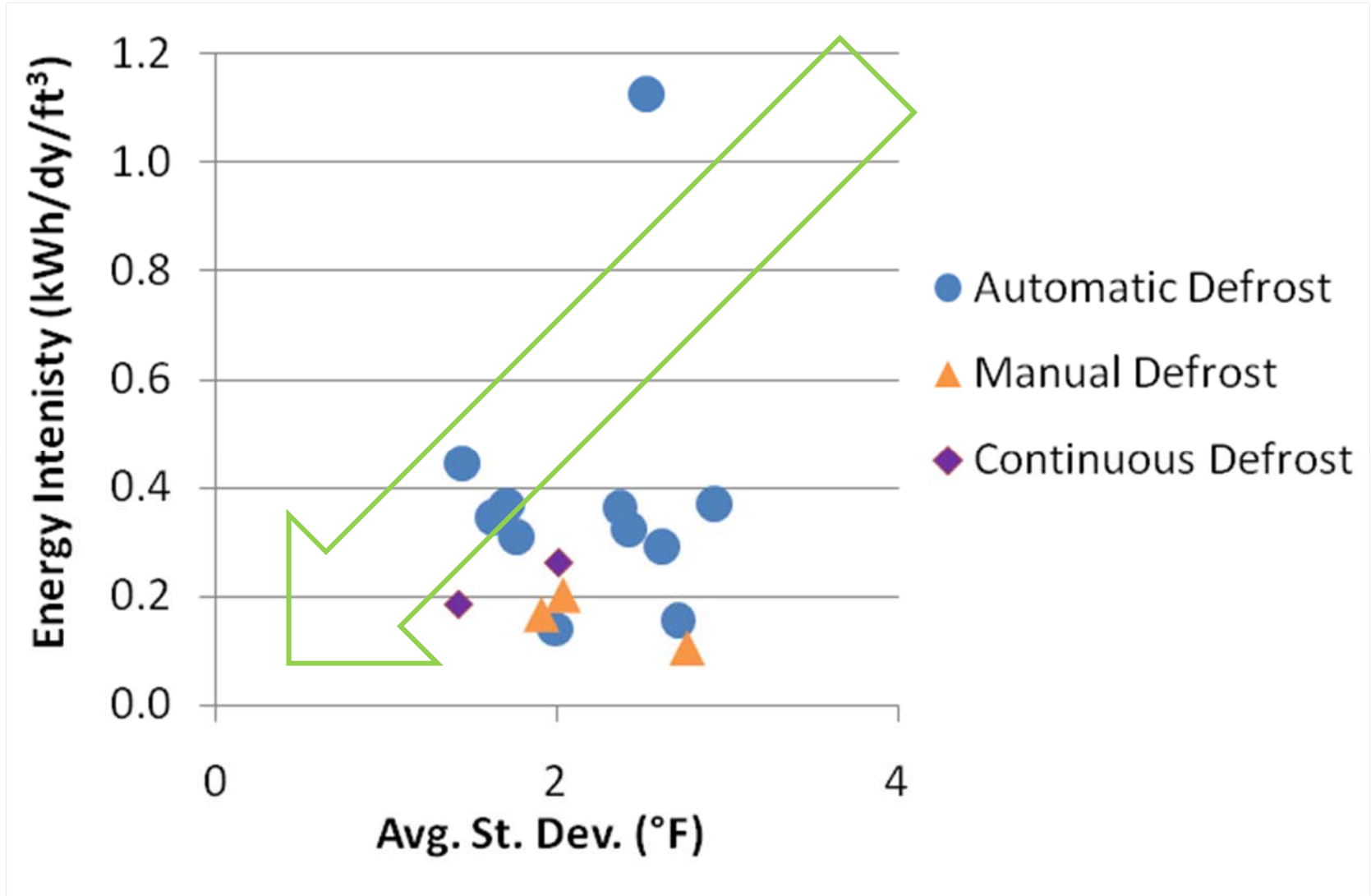
- The apparent lack of temperature variation during the defrost cycle.
- Whether average standard deviation correctly represents uniformity.

Defrost Strategy (+4 °C Refrigerators)

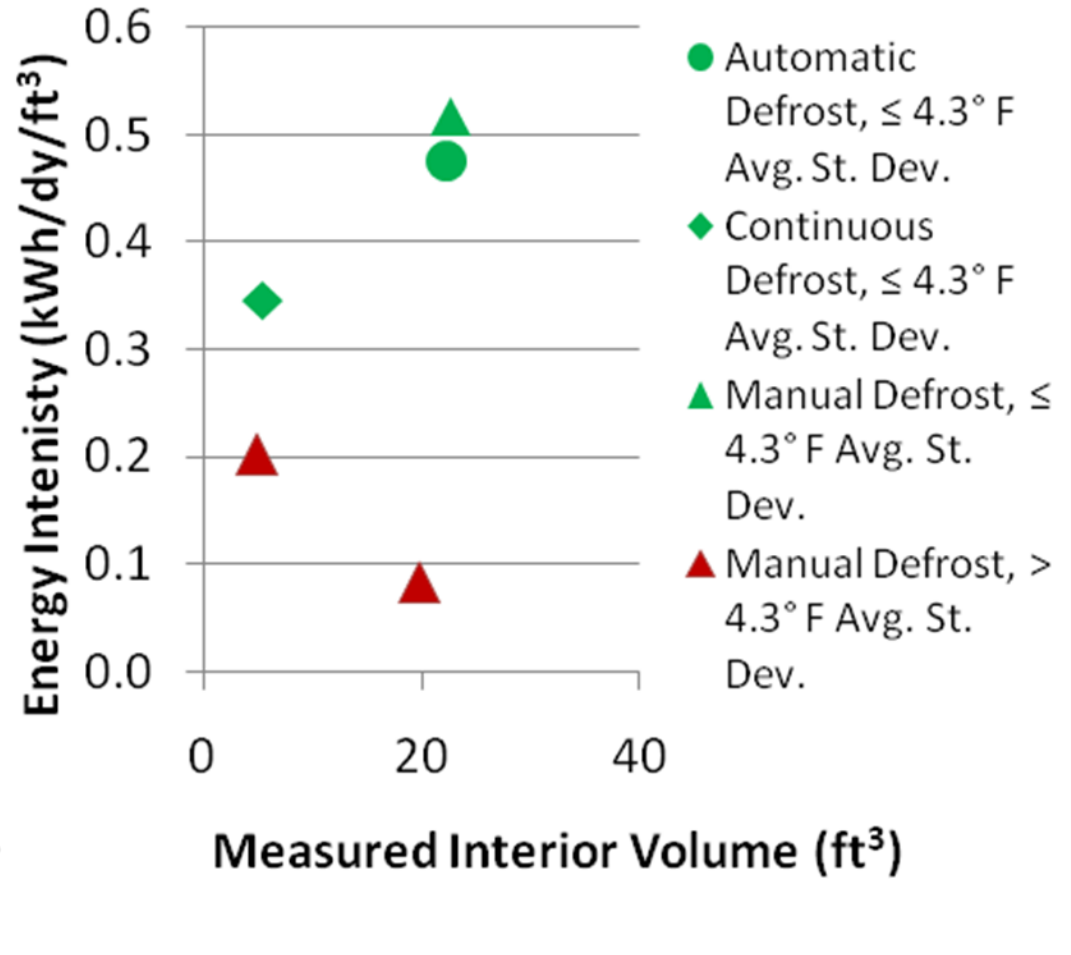
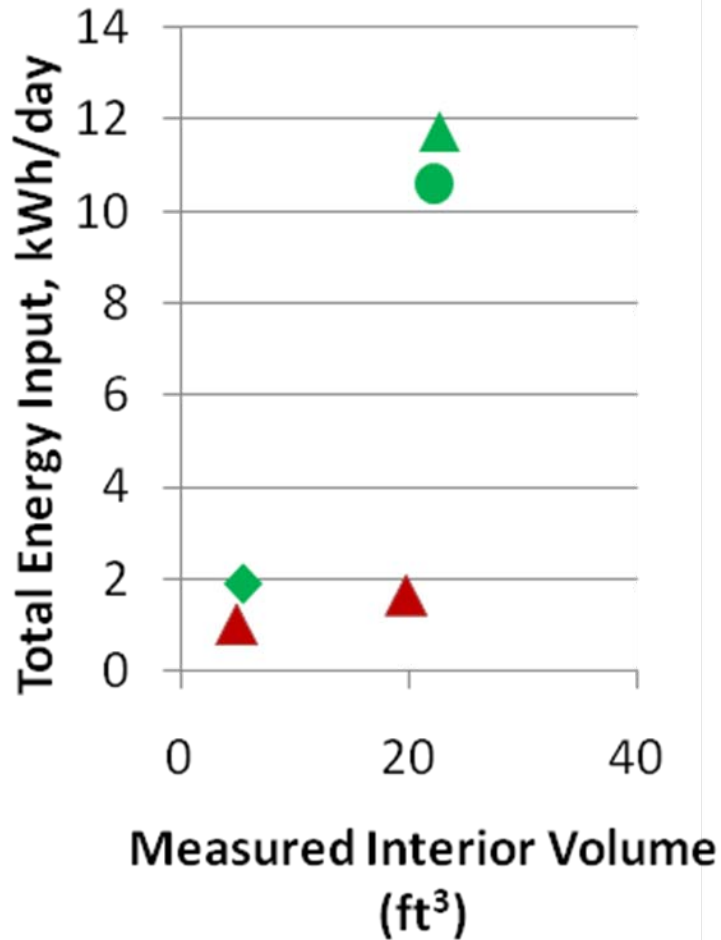


Defrost Strategy

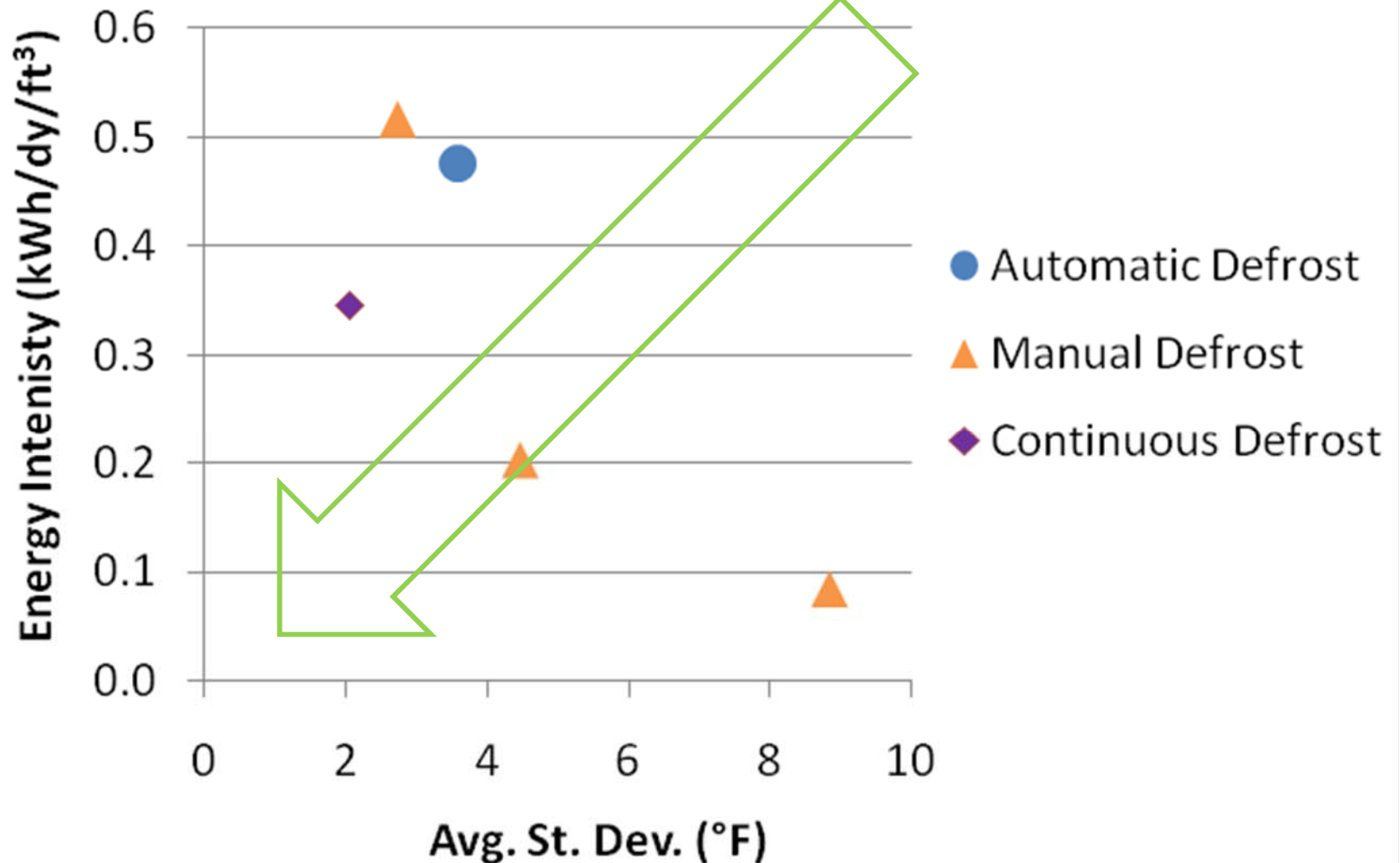
(+4 °C Refrigerators, cont.)



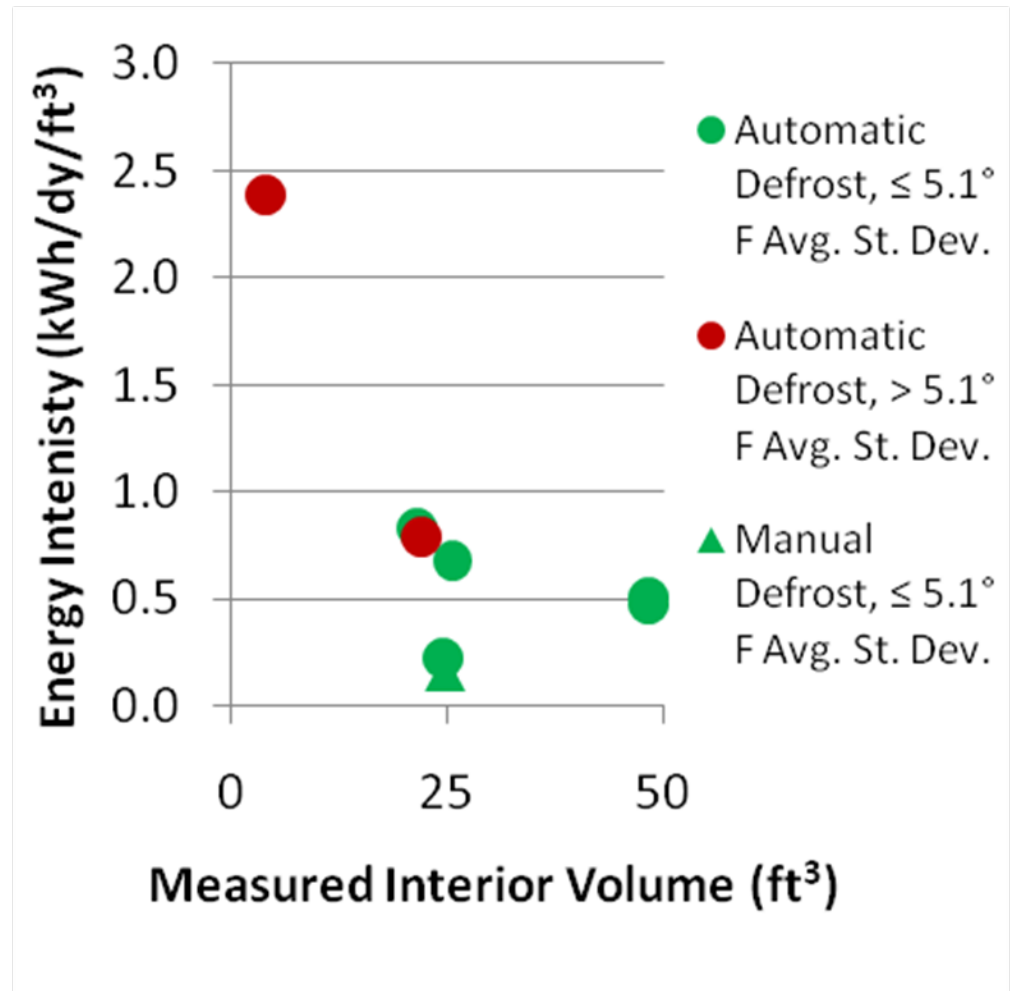
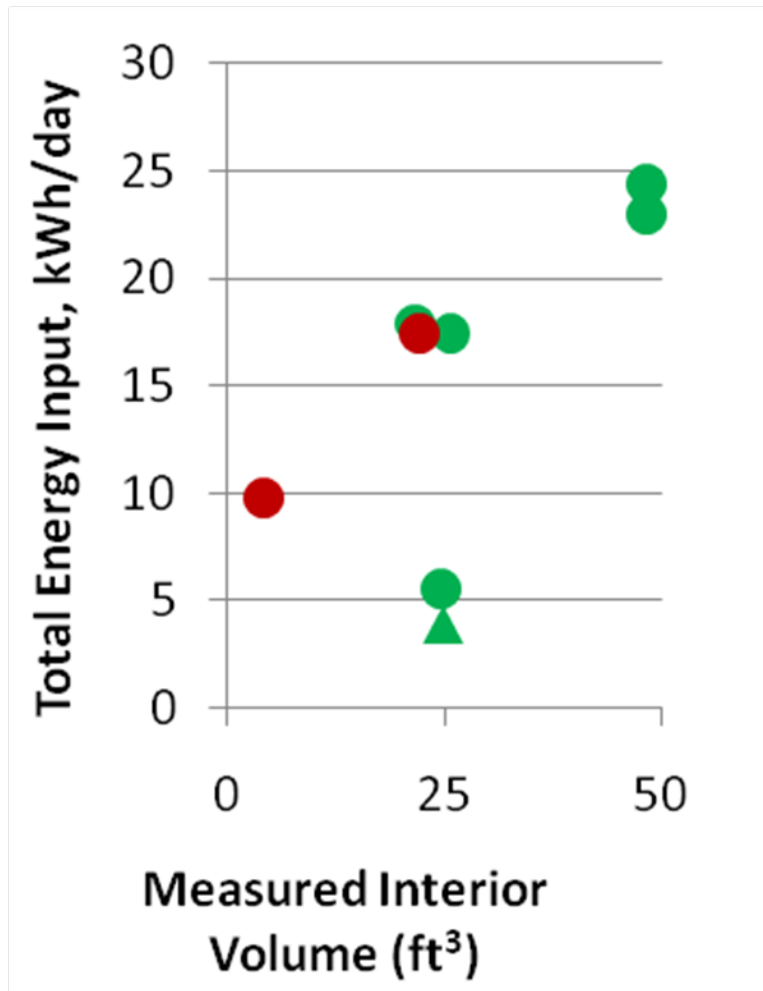
Defrost Strategy (-20 °C Freezers)



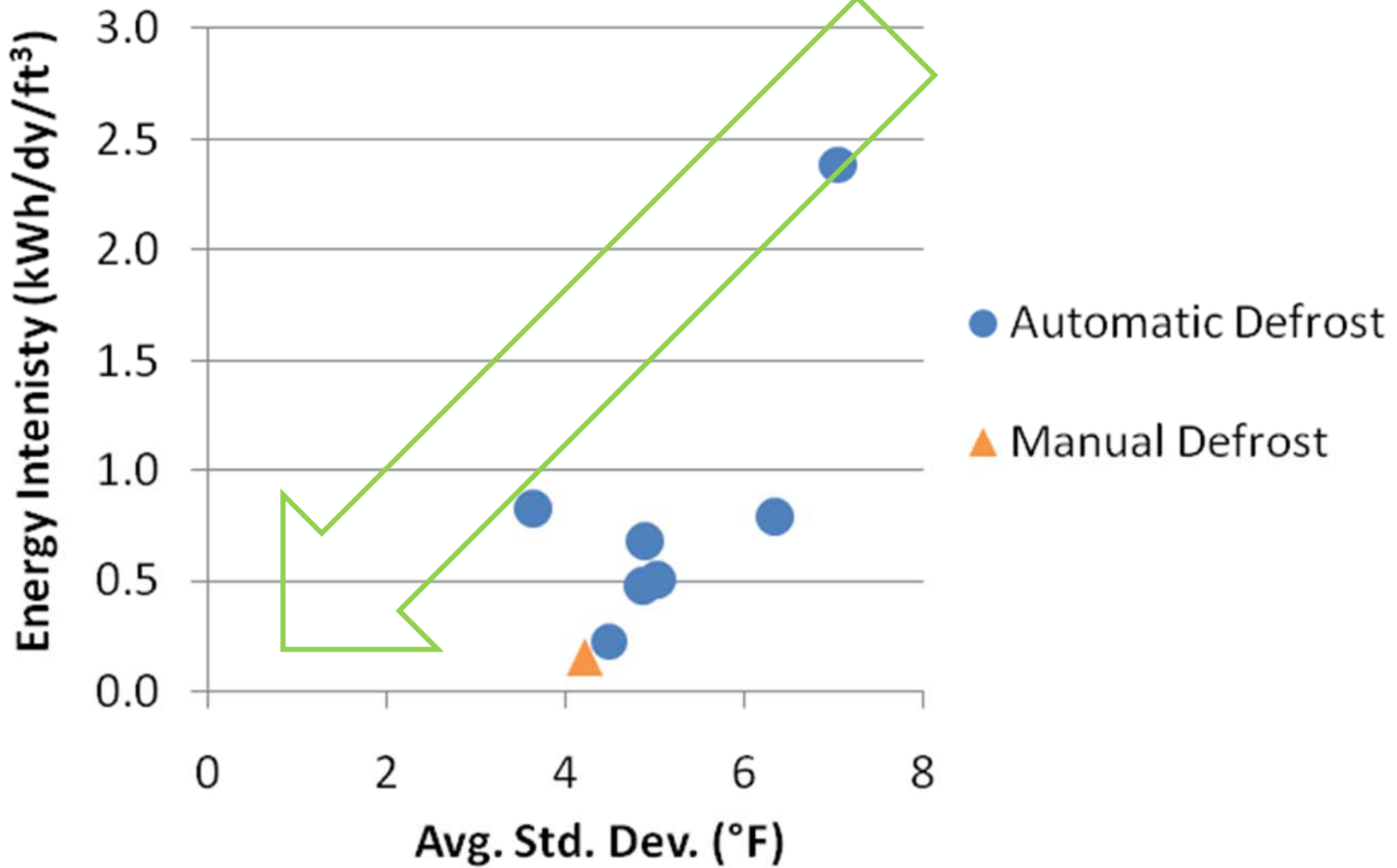
Defrost Strategy (-20 °C Freezers, cont.)



Defrost Strategy (- 30 °C Freezers)



Defrost Strategy (-30 °C Freezers, cont.)



Defrost Strategy Summary

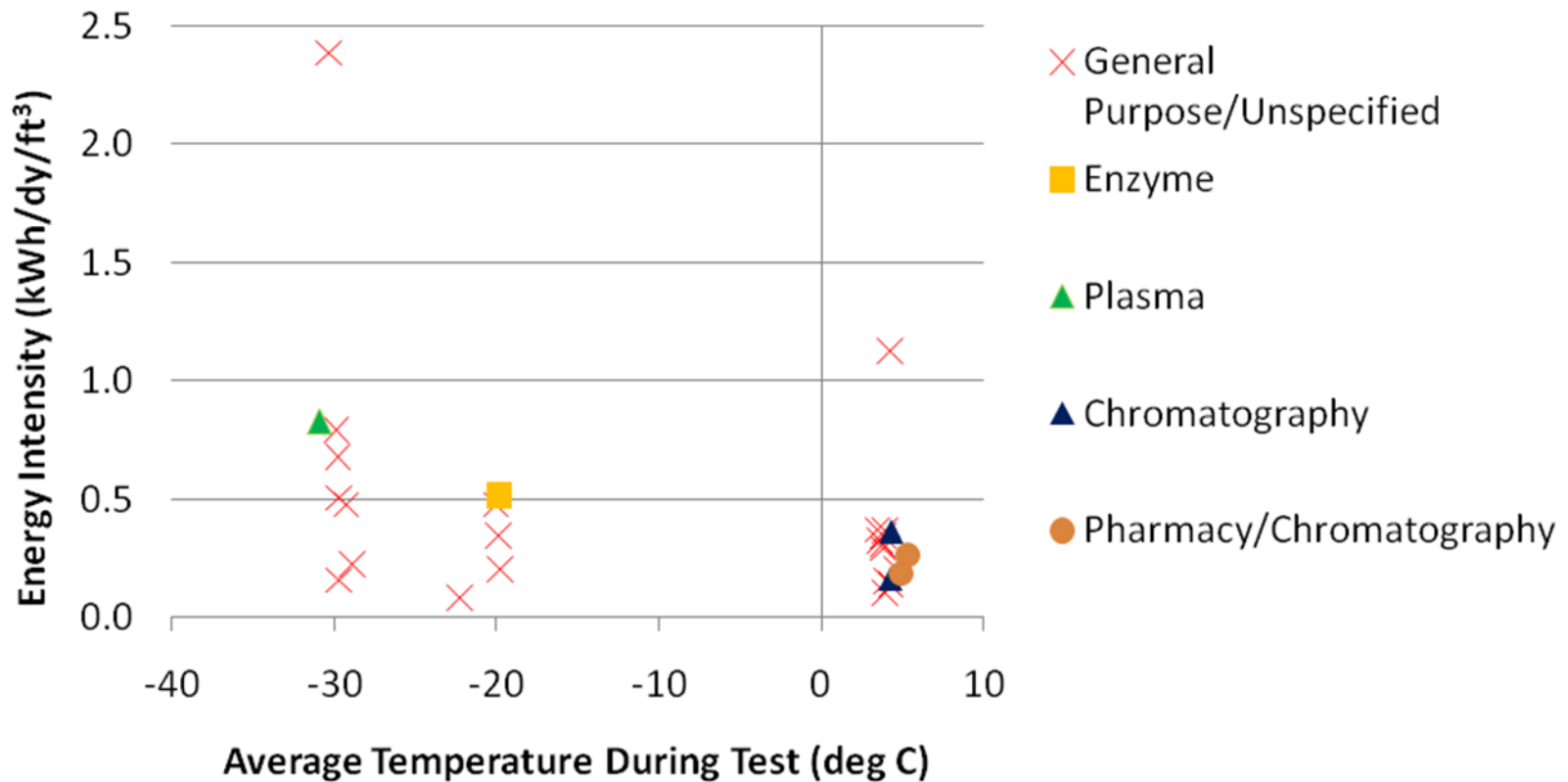


- Potential relationship between defrost type and **energy consumption/energy intensity** for:
 - Refrigerators (+4 °C)
 - Freezers (-30 °C)
- Potential relationship between defrost type and **stability**
 - Freezers (-30 °C)
- Small sample size

EPA seeks comment on:

- Whether the above relationships are true in general

Application



EPA seeks comment on:

- Impacts of application-specific design options on performance
- Any other applications that should be evaluated

Impact of Product Characteristics on Performance (Summary)



- EPA analyzed the impacts of three characteristics:
 1. **Door type:** no apparent impact on performance
 2. **Defrosting strategy:** some impact on energy consumption and temperature stability
 3. **Intended application:** some impact on energy consumption

EPA seeks comment on:

- The impacts of the above characteristics on performance
- Any other characteristics that should be considered

Product Classification under Consideration



- Based on data submitted to date, EPA is considering this scheme for classification of lab grade equipment
 - Energy consumption of combination units could be apportioned based on volume of each cabinet

Equipment Type	Defrost Strategy
Refrigerators at +4° C (39° F)	Automatic
	Manual or Continuous
Freezers at -20° C (-4° F)	Automatic
	Manual or Continuous
Freezers at -30° C (-22° F)	Automatic
	Manual or Continuous

EPA seeks comment on:

- The classification framework under consideration

Request for Additional Test Data



- Only three manufacturers submitted data to date
 - Additional results needed to move forward specification development process
- EPA seeks additional tests **through Nov. 2010**
 - Tests should be conducted on a variety of products in accordance with the ENERGY STAR lab grade supplement

Request for Additional Test Data (cont.)



- Temperature Uniformity
 - Previously collecting average of the standard deviations of each thermocouple
 - Would like to request temperature samples to investigate alternate methods of quantifying temperature uniformity.

EPA seeks comment on:

- The relative importance of the magnitude versus duration of temperature deviations.

Proposed Schedule



Comments on Framework Document due to EPA	September 30, 2010
Additional product testing and data analysis	September–November 2010
EPA decision whether to develop specification	December 2010
Potential Draft 1 specification released for comment	January 2011 (Potential)
Potential stakeholder meeting to discuss Draft 1	February 2011 (Potential)

Enhanced Testing and Verification



- For the past year, EPA has been working on enhancements to the testing and verification aspects of the ENERGY STAR program
 - Third-party certification of test results
 - Use of recognized laboratories
 - Annual submission of unit shipment data
- Additional info:
www.energystar.gov/testingandverification

Contact Information



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