

ENERGY STAR[®]

Commercial Refrigerators and Freezers

Draft 1 Version 3.0 Specification

**Stakeholder Meeting
Chicago, IL**

May 20, 2013

Call-in Information

- Audio provided via conference call in:

Call in:	+1-877-423-6338 (in the US, Canada)
	+1-571-281-2578 (outside the US, Canada)
Code:	132085

- Phone lines will remain open during the presentation to allow for open discussion
- Please keep phone lines on mute (*6) unless speaking

Agenda



- Introduction
- Draft 1 Proposed changes
 - Definitions
 - Scope
 - Testing and Reporting
 - Energy Consumption limits
- Timeline/Next Steps

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Introduction



- EPA thanks all stakeholders who have been participating in the qualification of models to ENERGY STAR as well as your active participation in development of the ENERGY STAR specification for Commercial Refrigerators and Freezers
- Stakeholder participation is critical to the specification development

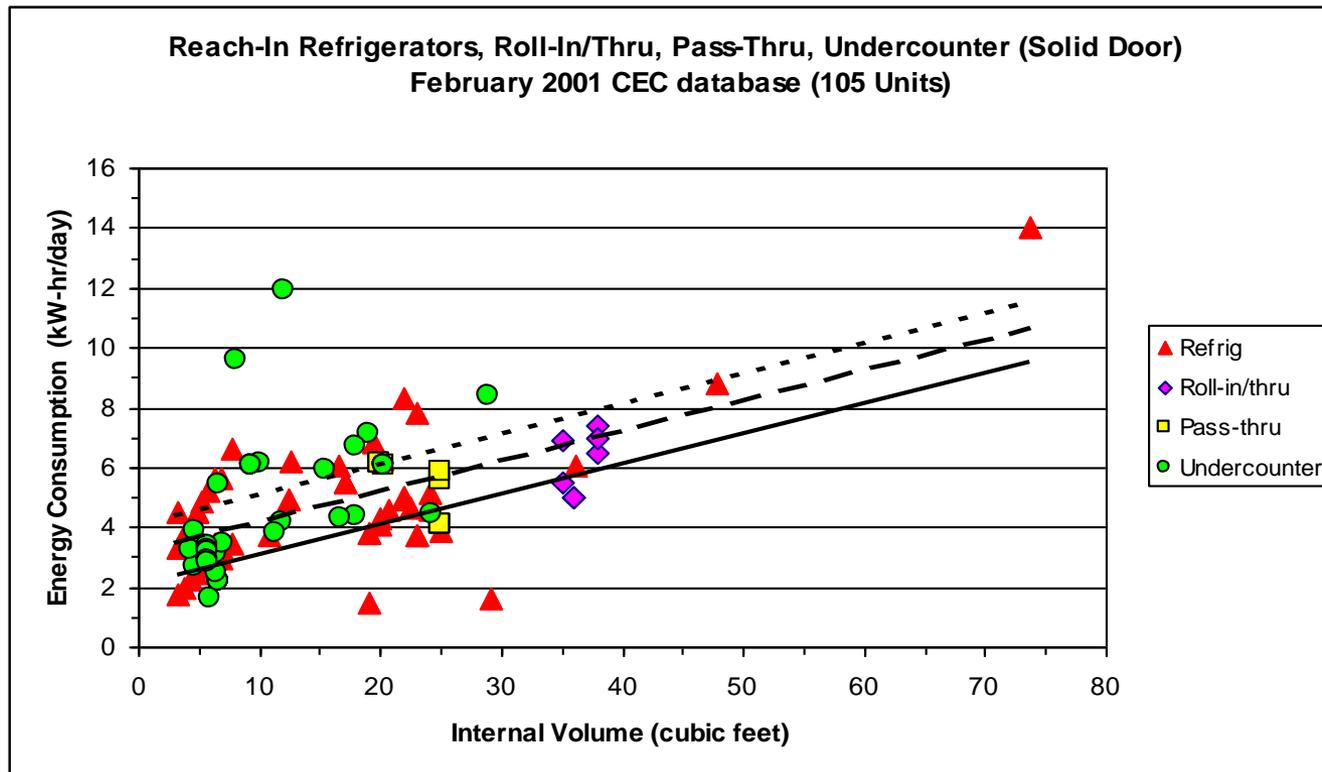
Purpose of the Revision

- ENERGY STAR market penetration is high
 - 2011 Unit Shipment report estimates at 65%
- ENERGY STAR qualified product data shows opportunity to provide further product differentiation and additional savings potential
 - Set new efficiency criteria such that approximately 25% meet the new levels.
- Set appropriate efficiency criteria to re-engage utility programs in providing incentives for energy efficient commercial refrigeration
- Align definitions and testing requirements with the current DOE federal standard

History of the Specification



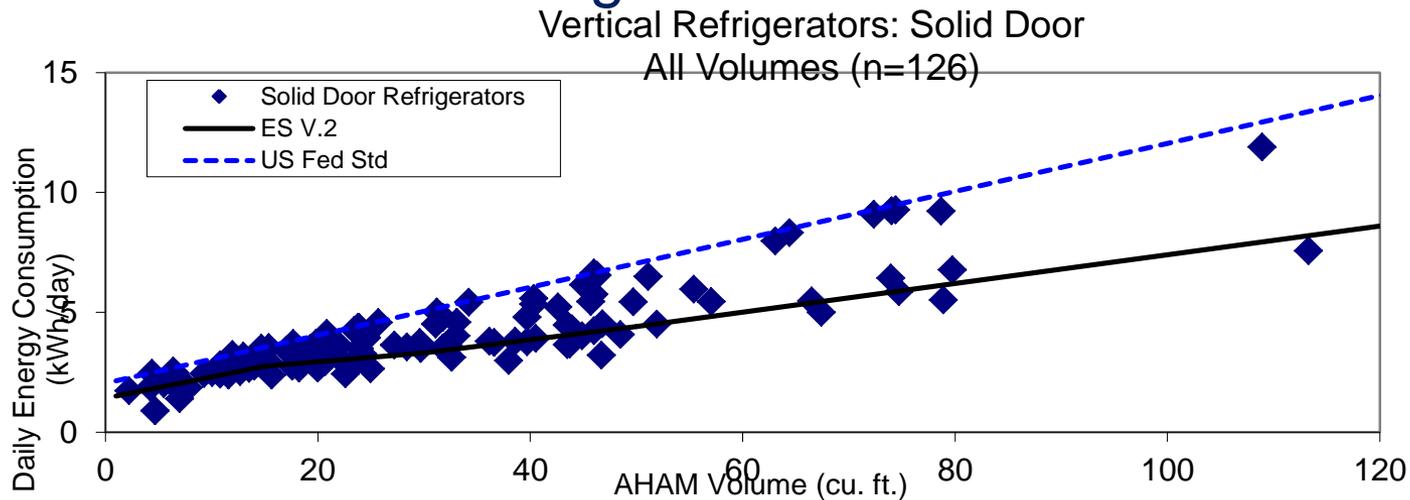
- Version 1.0
 - Went into effect September 1, 2001
 - Set levels for Refrigerators/Freezers/Refrigerator-Freezers/Ice Cream Freezers



History of the Specification, *cont.*



- Version 2.0
 - Added glass door to scope – effective April 1, 2009
 - V2 levels for solid doors went in effect January 1, 2010
 - Coincide with DOE regulation effective date
 - Excluded lab grade
 - 44 partners have currently over 1000 qualified models
 - 876 certified refrigerators and 279 freezers



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Changes Proposed in Draft 1 Version 3.0



- Definitions
- Scope
- Determining Refrigerated Volume
- Maximum Daily Energy Consumption (MDEC) requirements
- Test Method
- Reporting Requirements

Definitions



- Revised the following definitions to align with those in the 10 CFR §431.62:
 - Commercial Refrigerator, Freezer, and Refrigerator-Freezer
 - Commercial Hybrid Refrigerator, Freezer, and Refrigerator-Freezer
 - Horizontal Closed
 - Horizontal Open
 - Vertical Closed
 - Vertical Open

* From U.S. Department of Energy (DOE) Final Rule for Commercial Refrigeration Equipment (Federal Register, 77 FR 10292, 10318, February 21, 2012, Subpart C of 10 CFR Part 431)

Commercial Refrigerator, Freezer, and Refrigerator-Freezer



V2.1

- Commercial Food grade Refrigerator: : A refrigeration cabinet designed for storing food products at temperatures above 32 degrees Fahrenheit (F) but no greater than 40 degrees F and intended for commercial use. **For purposes of ENERGY STAR qualification, set-point temperatures must represent as shipped conditions.**
- Commercial Food-grade Freezer: : A refrigeration cabinet designed for storing food products at temperatures of 0 degrees F and intended for commercial use. **For purposes of ENERGY STAR qualification, set-point temperatures must represent as shipped conditions.**
- Refrigeration Cabinet: A refrigerator or freezer used for storing food products at specified temperatures, with the condensing unit and compressor built into the cabinet, and designed for use by commercial or institutional facilities, other than laboratory settings. These units may be vertical or chest configurations and may contain a worktop surface.

Draft 1 V3.0 *

- Refrigeration equipment that:
 - (a) is not a consumer product (as defined in §431.2 of part 430);
 - (b) is not designed and marketed exclusively for medical, scientific, or research purposes;
 - (c) operates at a chilled, frozen, combination chilled and frozen, or variable temperature;
 - (d) displays or stores merchandise and other perishable materials horizontally, semi-vertically, or vertically;
 - (e) has transparent or solid doors, sliding or hinged doors, a combination of hinged, sliding, transparent, or solid doors, or no doors;
 - (f) is designed for pull-down temperature applications or holding temperature applications; and
 - (g) is connected to a self-contained condensing unit or to a remote condensing unit

Commercial Hybrid Refrigerator, Freezer, and Refrigerator-Freezer



V2.1

- Not defined.

Draft 1 V3.0*

- A commercial refrigerator, freezer, or refrigerator-freezer that has two or more chilled and/or frozen compartments that are:
 - (a) in two or more different equipment families,
 - (b) contained in one cabinet, and
 - (c) solid as a single unit.

Horizontal Closed



V2.1

- Chest Configuration: An enclosed refrigeration cabinet to which access is gained only through a top - opening door.

Draft 1 V3.0*

- Equipment with hinged or sliding doors and a door angle greater than or equal to 45°.

Horizontal Open



V2.1

- Not specifically defined.

Draft 1 V3.0*

- Equipment without doors and an air-curtain angle greater than or equal to 80° from the vertical.

Vertical Closed



V2.1

- Not specifically defined.

Draft 1 V3.0*

- Equipment with hinged or sliding doors and a door angle less than 45° .

Vertical Open



V2.1

- Not specifically defined.

Draft 1 V3.0*

- Equipment without doors and an air-curtain angle greater than or equal to 0° and less than 10° from the vertical.

Horizontal Open



V2.1

- Not specifically defined.

Draft 1 V3.0*

- Equipment without doors and an air-curtain angle greater than or equal to 80° from the vertical.

Ice Cream Freezer



V2.1

- Not specifically defined.

Draft 1 V3.0*

- A Commercial freezer that is designed to operate at or below -5°F (-21°C) and that the manufacturer designs, markets, or intends for the storing, displaying, or dispensing of ice cream.

Door Angle



V2.1

- Not specifically defined.

Draft 1 V3.0*

- Door Angle:
 - For equipment with a flat door, the angle between a vertical line and the line formed by the plane of the door, when the equipment is viewed in cross-section; and
 - For equipment with curved doors, the angle formed between a vertical line and the straight line drawn by connecting the top and bottom points where the display area transparent joins the cabinet, when the equipment is viewed in cross-section.

Basic Model



V2.1

- Product Family: Variations of one model offered within a single product line with differences in aesthetics only. Individual models represented by a product family must be based on the same basic engineering design and have the same energy consumption. Examples of acceptable aesthetic differences include external finish, color, or door opening orientation (left-opening versus right -opening).

Draft 1 V3.0*

- Basic Model: All units of a given type of commercial refrigerator, freezer, or refrigerator-freezer (or class thereof) manufactured by one manufacturer that have the same primary energy source, which have electrical characteristics that are essentially identical, and which do not have any differing electrical, physical, or functional characteristics that affect energy consumption.

Definitions from V2.1 Retained



V2.1

- Solid Door: Less than 75% of the front surface area is glass.
- Glass Door: Greater than, or equal to, 75% of the front surface area is glass.

Draft 1 V3.0

- Solid Door: A door with less than 75% of the surface area is composed of a transparent material.
- Transparent Door: A door with greater than or equal to 75% of the surface area is composed of a transparent material.
- Solid Door Cabinet: A commercial refrigerator, freezer, or refrigerator-freezer in which all outer doors on all sides of the unit are solid doors. These doors may be sliding or hinged.
- Transparent Door Cabinet: A commercial refrigerator, freezer, or refrigerator-freezer in which all outer doors on at least one side of the unit are transparent doors. These doors may be sliding or hinged.

Definitions from V2.1 Retained



V2.1

- Mixed Solid/Glass Door Cabinet: A commercial food-grade refrigerator or freezer in which all outer doors on at least one side of the unit are a combination of solid and glass doors. A unit which has all glass doors on one side and a combination of solid and glass doors on another is considered a glass door cabinet.

Draft 1 V3.0

- Mixed Solid/Transparent Door Cabinet: A commercial refrigerator, freezer, or refrigerator-freezer in which all outer doors on at least one side of the unit are a combination of solid and transparent doors. A unit which has all transparent doors on one side and a combination of solid and transparent doors on another is considered a transparent door cabinet.

Definitions from V2.1 Not Included

- Worktop Surface: A solid working surface. The working surface may be a cutting board, a stainless steel work surface, or a stone slab. This surface cannot add to the total energy consumption of the unit.

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Scope



- Same between V2.1 and V3.0:
 - Reach in, roll in, pass through
 - Merchandisers
 - Undercounter
 - Milk coolers
 - Bar coolers
 - Glass frosters
 - Beer dispensing
 - Bunker freezers
- Excluded:
 - Drawer
 - Prep tables
 - Deli cases
 - Open air units
 - Display cases
 - Hybrid refrigerator/freezers
 - Ice cream freezers
 - Laboratory grade
 - Residential

Ice Cream Freezers

- Efficiency requirements set for Ice Cream Freezers in V1.0
- Specific requirements for Ice Cream Freezers was dropped in Draft 1 V2.0
 - Revised integrated average product temperature for ice cream freezers to be consistent with Federal regulations (-15°F)
 - limited data and interest for separate category for self-contained commercial ice cream freezers
 - If units met the definition and operated at the integrated average product testing temperature for commercial food-grade freezer cabinets ($0^{\circ}\text{F} \pm 2^{\circ}\text{F}$), then eligible to qualify for ENERGY STAR.

Prep Tables



- ASTM F2143-04: Standard Test Method for Performance of Refrigerated Buffet and Preparation Tables
- California Energy Commission (CEC) data available (prep tables only)
 - 255 individually listed models
 - 6 manufacturers
 - 8 brands

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Determining Refrigerated Volume



- V2.1 – referenced the AHAM HRF 1-2004 to determine interior volume
- V3.0 D1 – references the DOE test method 10 CFR §431.64 to determine refrigerated volume
 - which references the AHAM HRF–1–2004, “Energy, Performance and Capacity of Household Refrigerators, Refrigerator-Freezers and Freezers,” (Incorporated by reference, see § 431.63) section 3.21, “Volume,” sections 4.1 through 4.3, “Method for Computing Total Refrigerated Volume and Total Shelf Area of Household Refrigerators and Household Wine Chillers,” and sections 5.1 through 5.3, “Method for Computing Total Refrigerated Volume and Total Shelf Area of Household Freezers.”

Alternative Refrigerants



- Launching V3.0, EPA asked about the prevalence and energy impacts associated with natural refrigerants with commercial refrigeration equipment
- Responses noted:
 - current limited supply of units in the U.S. market but potentially greater percentage in near future
 - Requiring alternative components and redesigns to address alternative refrigeration systems for safety and efficiency - adding to the cost of the equipment
- Diverse opinions on relative impact on units energy performance



Alternative Refrigerants, *cont.*

- At this time, EPA does not see a need to create a separate classification or allowance
- For V3.0, EPA is proposing to continue to maintain separate levels for commercial refrigerators and freezers based solely on:
 - configuration,
 - application,
 - size, and
 - door type.
- Does not include refrigerant type as a differentiating factor

Significant Digits and Rounding



- All calculations shall be carried out with directly measured (**unrounded**) values. Final ratings for daily energy consumption should be **rounded to 0.01 kWh increments** in accordance with the DOE test procedure provisions.
- Directly measured or calculated values that are submitted for reporting on the ENERGY STAR website shall be calculated in accordance with the requirements for determining certified ratings for DOE.

- Test method to be used to determine ENERGY STAR qualification:
 - 10 CFR Part 431 Subpart C,
 - 10 CFR Part 431.64 and
 - 10 CFR Part 431.66(d)
 - Only relevant for horizontal and vertical closed refrigerator and freezers.
- Integrated average temperatures for testing
 - No longer listed but now references DOE test condition requirements

Integrated Average Temperatures



Category	Test procedure prior to January 1, 2016	Test procedure on or after January 1, 2016	Integrated average temperatures
(i) Refrigerator with Solid Door(s)	ARI Standard 1200-2006	AHRI Standard 1200 (I-P)-2010	38 °F (±2 °F).
(ii) Refrigerator with Transparent Door(s)	ARI Standard 1200-2006	AHRI Standard 1200 (I-P)-2010	38 °F (±2 °F).
(iii) Freezer with Solid Door(s)	ARI Standard 1200-2006	AHRI Standard 1200 (I-P)-2010	0 °F (±2 °F).
(iv) Freezer with Transparent Door(s)	ARI Standard 1200-2006	AHRI Standard 1200 (I-P)-2010	0 °F (±2 °F).

Additional Test Conditions



- Removed the additional test conditions from the ENERGY STAR specification (4.E and 4.E)
 - Requiring manual controlled standard accessories to be in the “On” positing during testing
 - Power management not impacting integrated average temperature
- For ENERGY STAR, all eligible commercial refrigerators and freezers with standard accessories and power management devices shall undergo testing as specified in § 431.64.

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Guiding Principles Reaffirmed



1. Significant energy savings can be realized on a national basis.
2. Product performance can be maintained or enhanced with increased energy efficiency.
3. Purchasers recover their investment in increased energy efficiency within a reasonable period of time.
4. Energy-efficiency can be achieved through multiple technologies.
5. Product energy consumption and performance can be measured and verified with testing.
6. Labeling would effectively differentiate products and be visible for purchasers.

Data Set and Methodology

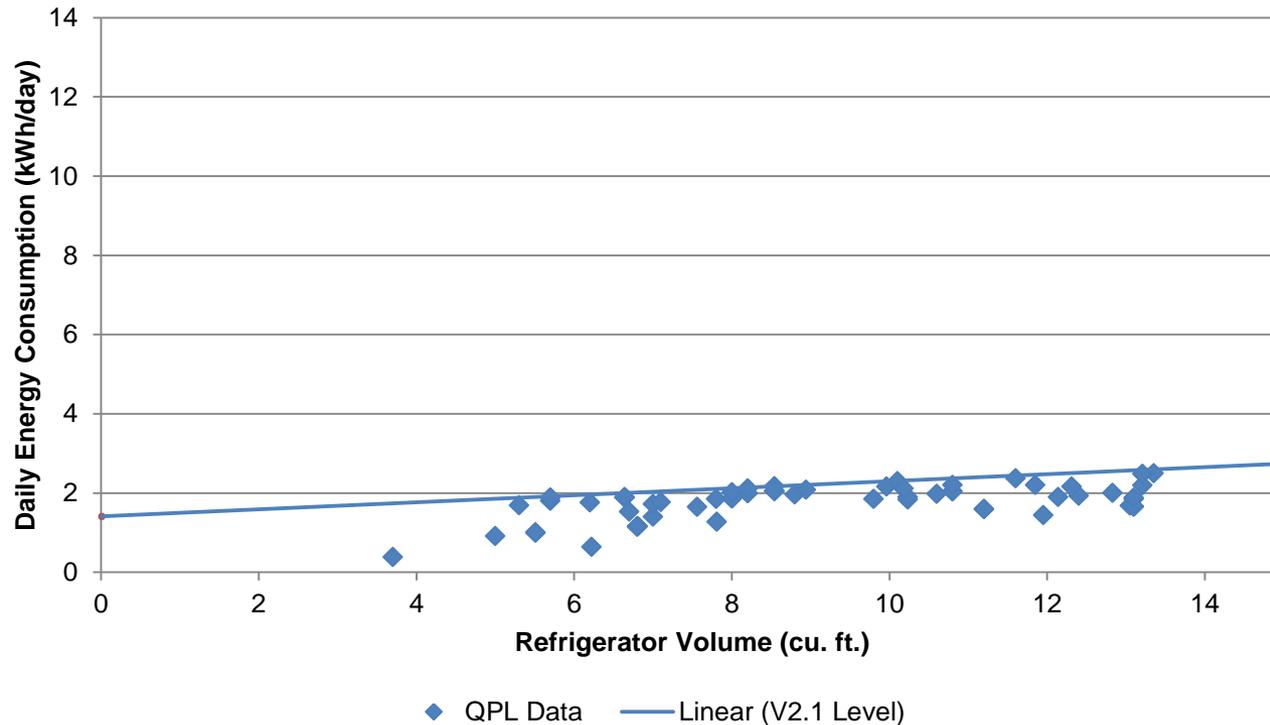


- Data set combines non-ENERGY STAR model data listed in the CEC database with models on the ENERGY STAR qualified product listing (QPL)
 - 894 unique models from ENERGY STAR QPL
 - 541 unique models from CEC directory (date added: 2007 – 2013 models)
 - 1,435 total unique models in the data set
- Data set is skewed by multiple models representing the same design/MDEC values

Data Set and Methodology, cont.



- Extracted the QPL data for each subcategory.
- Removed any duplicate models (e.g., models that met the same “basic family” definition with the same brand name and identical refrigerated volume and DEC).



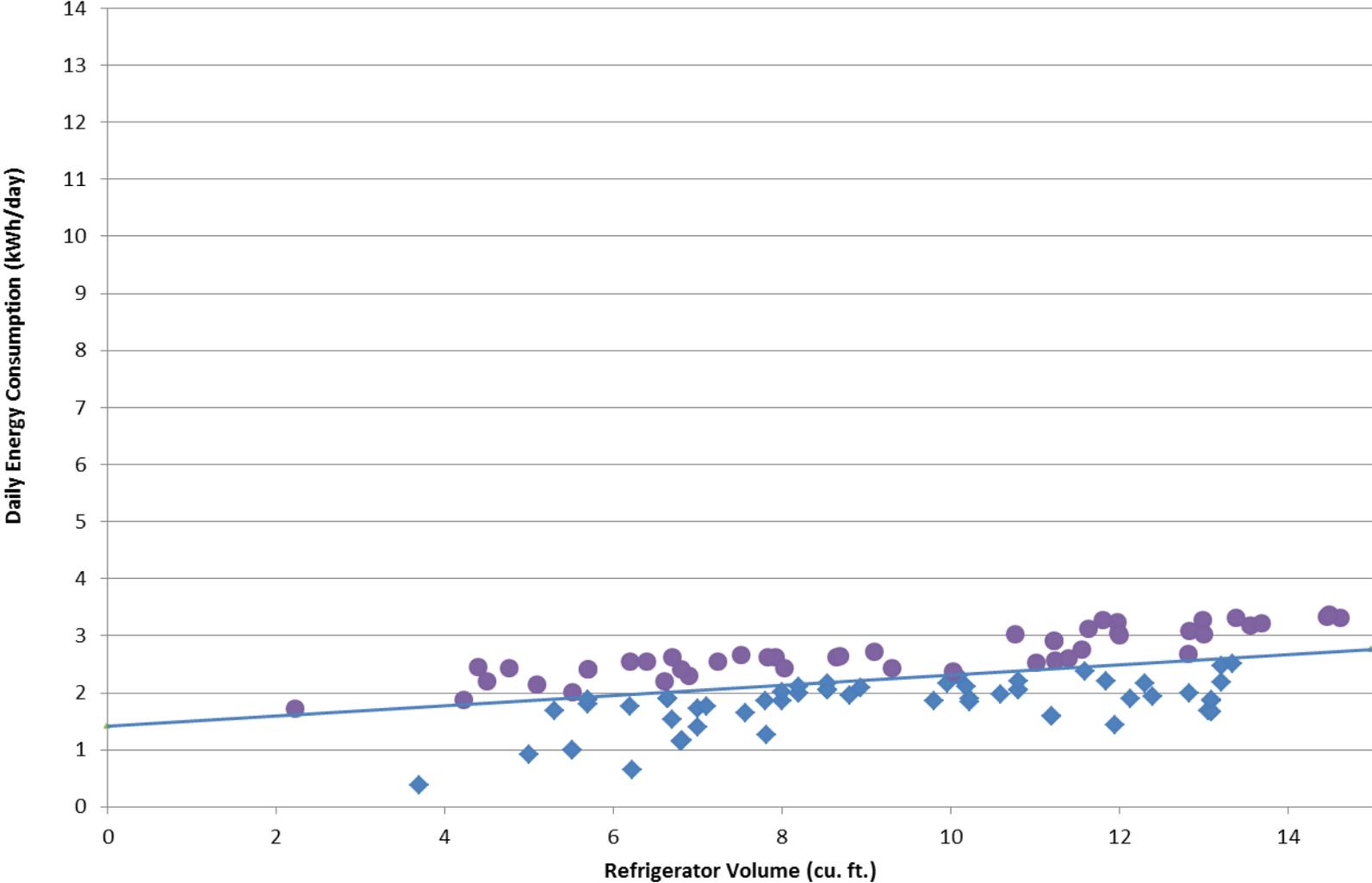
Data Set and Methodology, *cont.*



Criteria for adding CEC data:

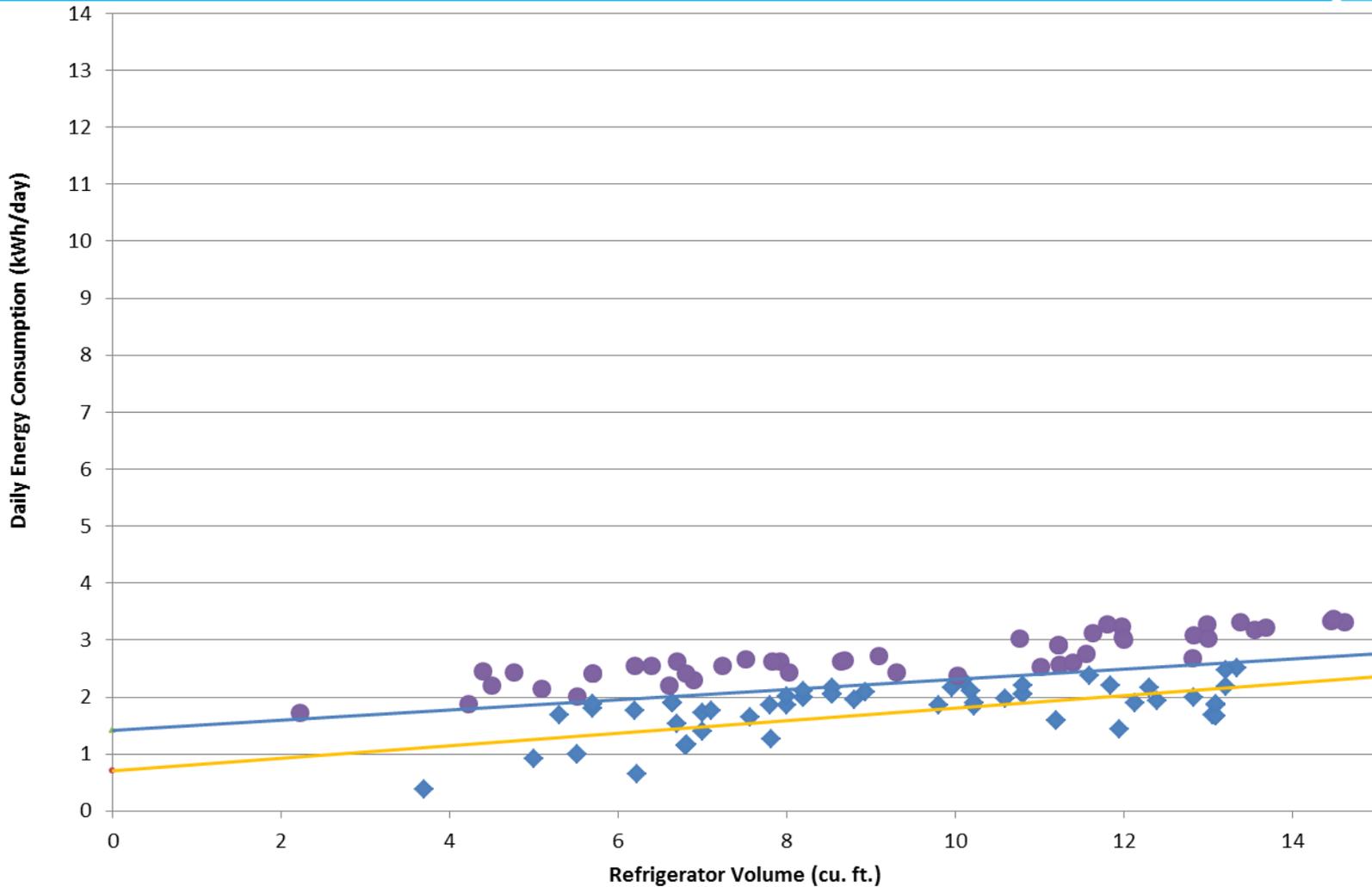
- The CEC data must meet the ENERGY STAR Draft 1 V3.0 scope.
- In an effort to avoid duplicate data points, no CEC models shall meet the V2.1 levels.
- The models shall not have been added to the CEC database prior to 2007.
- Any unique models that were added after 2007 and prior to 2010, but do not meet the current DOE minimum levels were removed.

Determining Proposed Levels (Example)



◆ QPL Data ● CEC Data — Linear (V2.1 Level)

Determining Proposed Levels (Example), *cont.*



◆ QPL Data ● CEC Data — Linear (V2.1 Level) — Linear (Draft 1 V3.0 Level)

Draft 1 Proposed Max Daily Energy limit



Table 1: ENERGY STAR Requirements for Commercial Refrigerators, Freezers, and Refrigerator-Freezers

Product Volume (in cubic feet)	Refrigerator	Freezer
Vertical Closed		
<i>Solid Door Cabinets</i>	<i>VCS. SC. M</i>	<i>VCS.SC.L</i>
$0 < V < 15$	$0.11V+0.70$	$0.25V+1.20$
$15 \leq V < 30$	$0.05V+1.35$	$0.29V+0.45$
$30 \leq V < 50$	$0.04V+1.64$	$0.12V+6.10$
$50 \leq V$	$0.02V+2.95$	$0.18V+3.20$
<i>Transparent Door Cabinets</i>	<i>VCT.SC.M</i>	<i>VCT.SC.L</i>
$0 < V < 15$	$0.10V+1.07$	$0.61V+0.89$
$15 \leq V < 30$	$0.13V+0.80$	$0.30V+5.50$
$30 \leq V < 50$	$0.04V+3.80$	$0.60V-4.20$
$50 \leq V$	$0.05V+3.75$	$0.30V+11.00$
Horizontal Closed		
<i>Solid or Transparent Door Cabinets</i>	<i>HCT.SC.M, HCS.SC.M</i>	<i>HCT.SC.L, HCS.SC.L</i>
Any volume	$0.06V+0.60$	$0.10V+0.20$

Qualification Rates on Proposed Levels



Refrigerators

- Vertical Closed Solid:
 - 0 – 15 cu ft – 22 %
 - 15 – 30 cu ft – 24 %
 - 30 – 50 cu ft – 21 %
 - +50 cu ft – 20 %
- Vertical Closed Transparent:
 - 0 – 15 cu ft – 24 %
 - 15 – 30 cu ft – 25 %
 - 30 – 50 cu ft – 24 %
 - +50 cu ft – 23 %
- Horizontal Closed – 23 %

Freezers

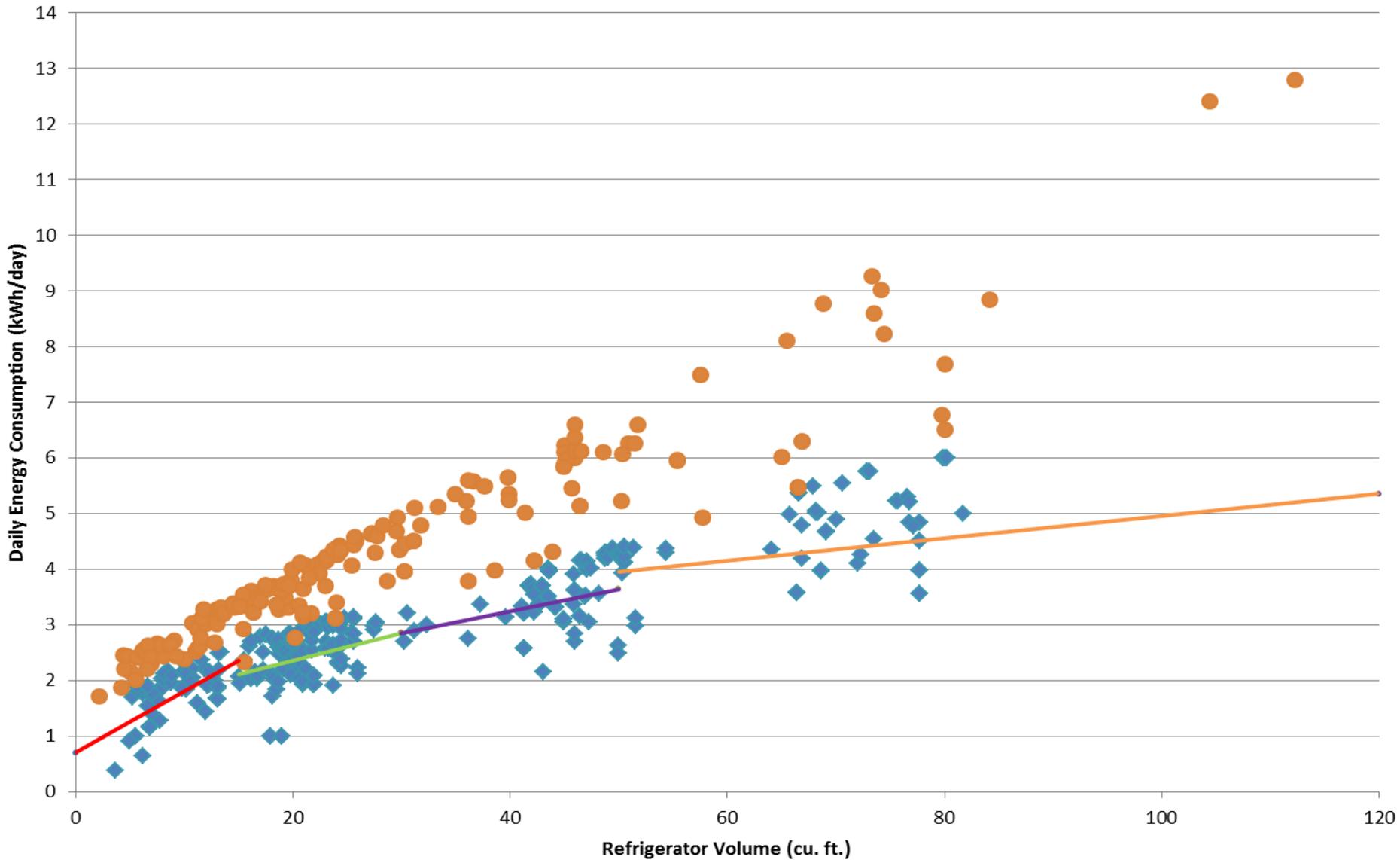
- Vertical Closed Solid:
 - 0 – 15 cu ft – 20 %
 - 15 – 30 cu ft – 25 %
 - 30 – 50 cu ft – 21 %
 - +50 cu ft – 23 %
- Vertical Closed Transparent:
 - 0 – 15 cu ft – 0 %
 - 15 – 30 cu ft – 26 %
 - 30 – 50 cu ft – 25 %
 - +50 cu ft – 27 %
- Horizontal Closed – 22 %
- No change proposed in V3

Comparison of Standard and Specification



	Calculated Daily Energy Consumption Limits (kW-hr/day)		
	DOE Standard	ENERGY STAR V2.1	ENERGY STAR V3.0 Proposed
Refrigerator – Solid Door (25 cu ft volume)	4.54	3.125	2.61
Refrigerator – Transparent Door (25 cu ft volume)	6.34	4.55	4.05
Freezer – Solid Door (25 cu ft volume)	11.38	9.0	8.11
Freezer – Transparent Door (25 cu ft volume)	22.85	17.325	13.25

Refrigerator Levels, Vertical, Solid Door

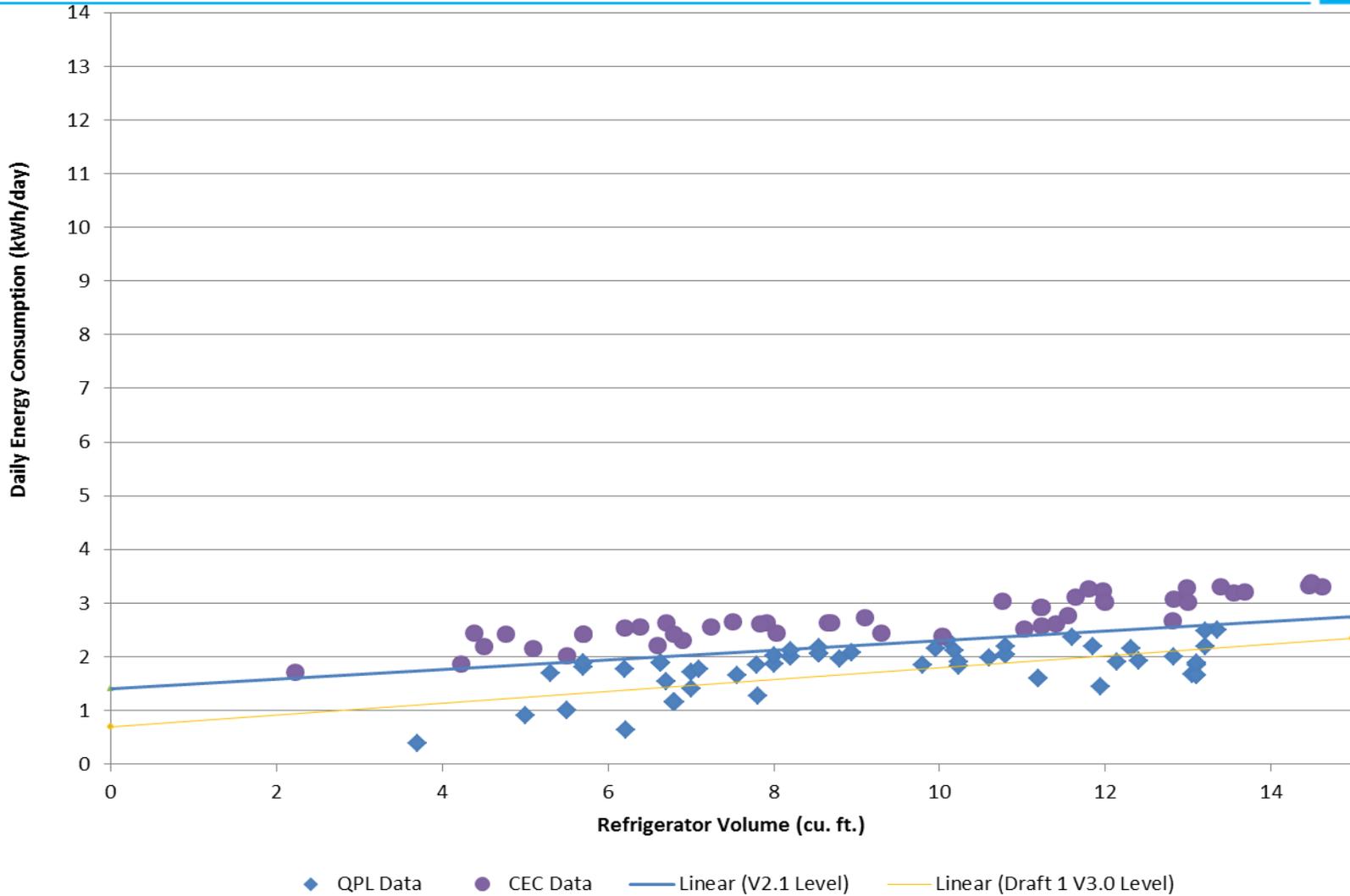


◆ QPL Data ● CEC Data — Linear (0<V<15 Level) — Linear (15<V<30 Level) — Linear (30<V<50 Level) — Linear (50< Level)



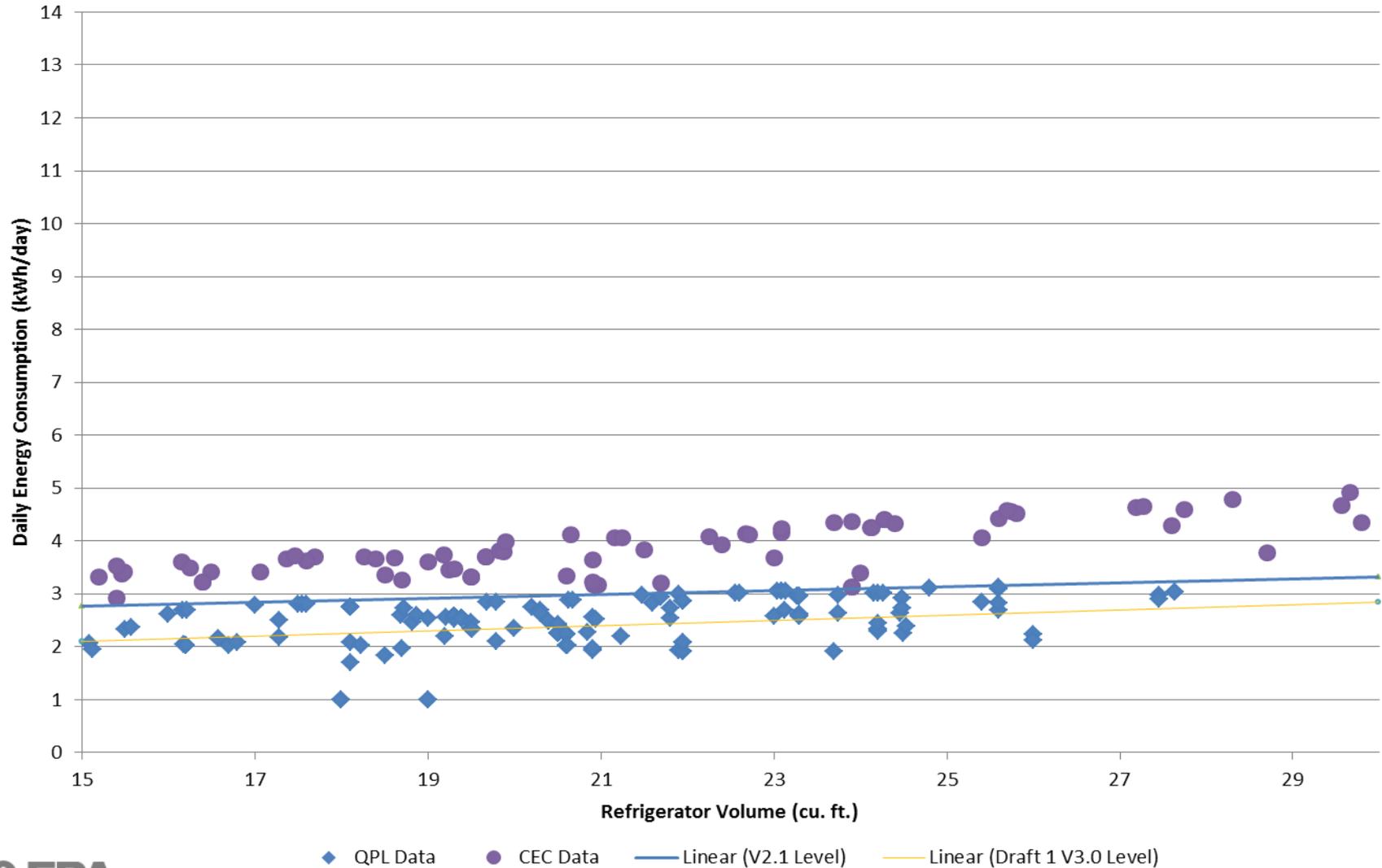
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Number of Manufacturers Meeting Draft 1 V3.0 Levels: 13 of 17

Refrigerators, Solid Door, $0 < V < 15$ cf



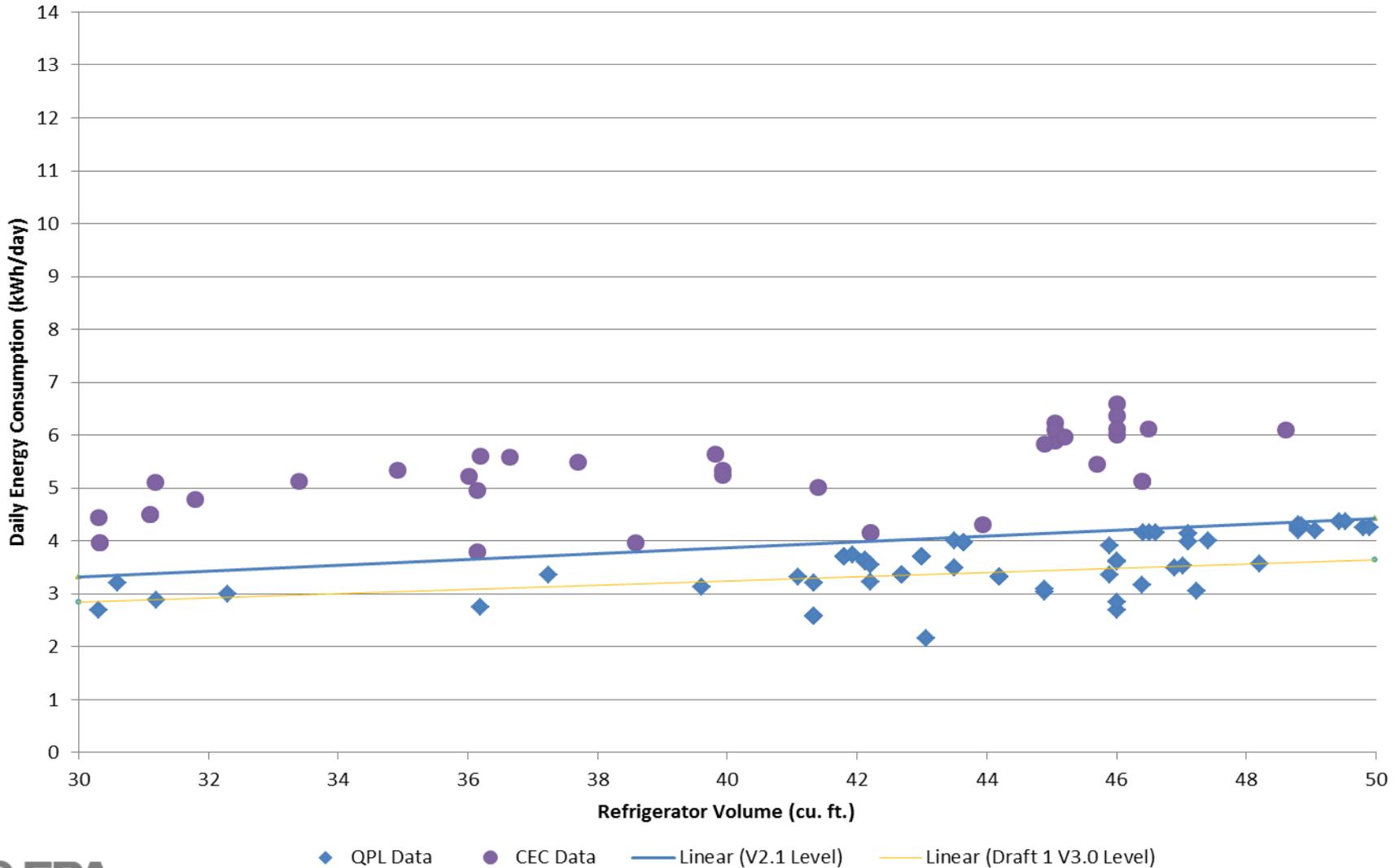
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Number of Manufacturers Meeting Draft 1 V3.0 Levels: 20 of 30

Refrigerators, Solid Door, $15 \leq V < 30$ cf

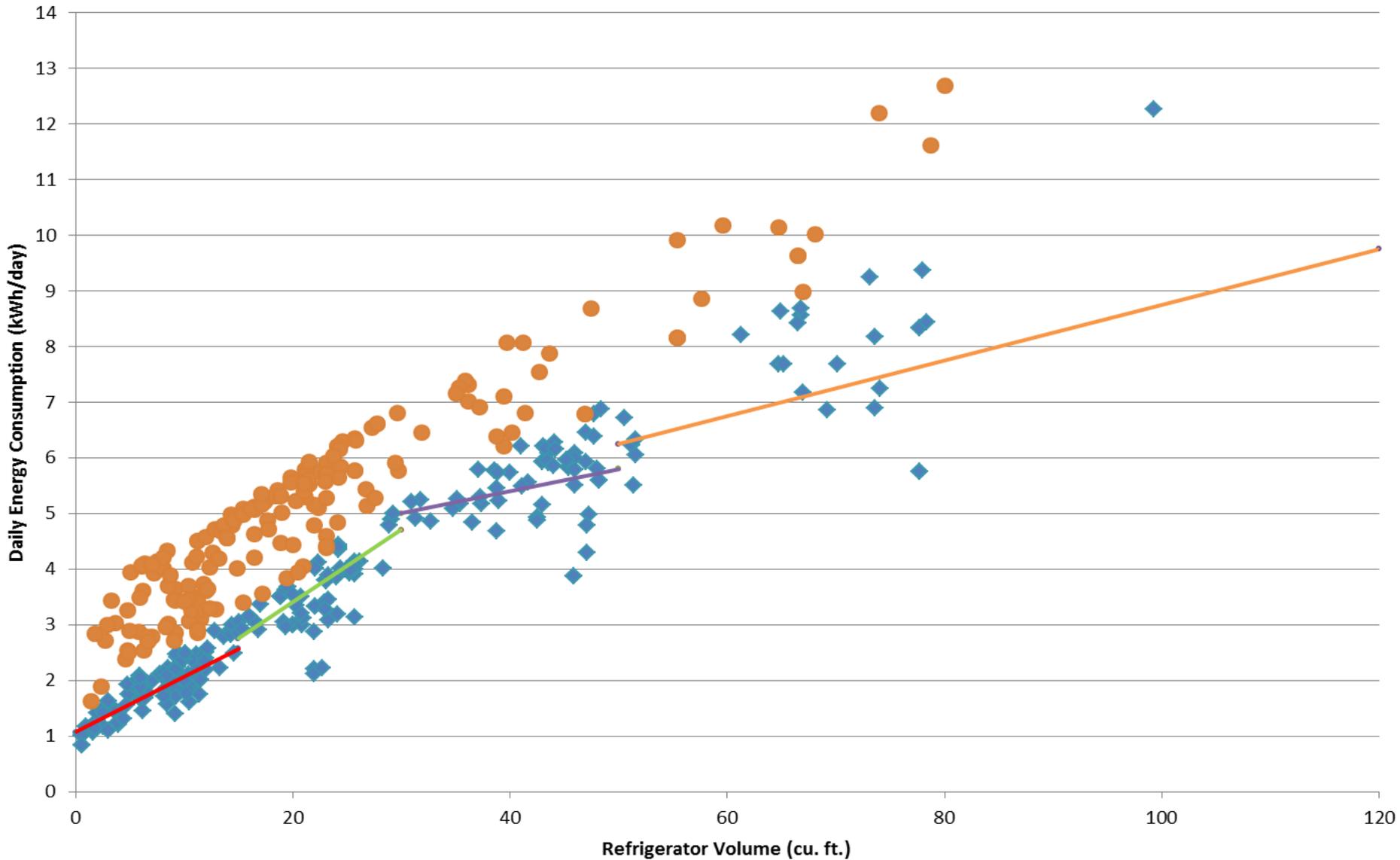


Number of Models Meeting Draft 1 V3.0 Levels: 27
Number of Manufacturers Meeting Draft 1 V3.0 Levels: 17 of 29

Refrigerators, Solid Door, $30 \leq V < 50$ cf



Refrigerator Levels, Vertical, Transparent Door

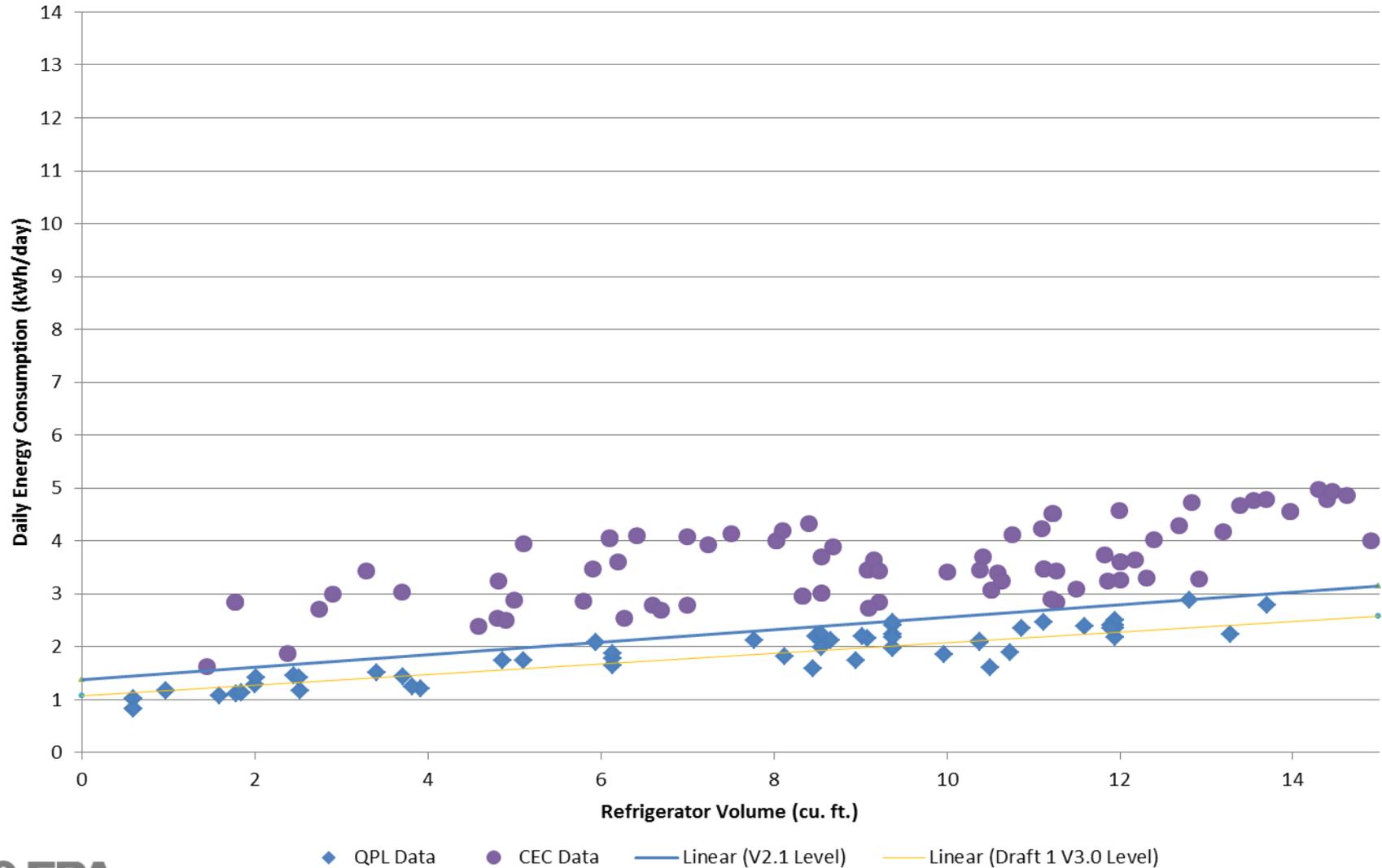


◆ QPL Data ● CEC Data — Linear (0<V<15 Level) — Linear (15<V<30 Level) — Linear (30<V<50 Level) — Linear (50< Level)



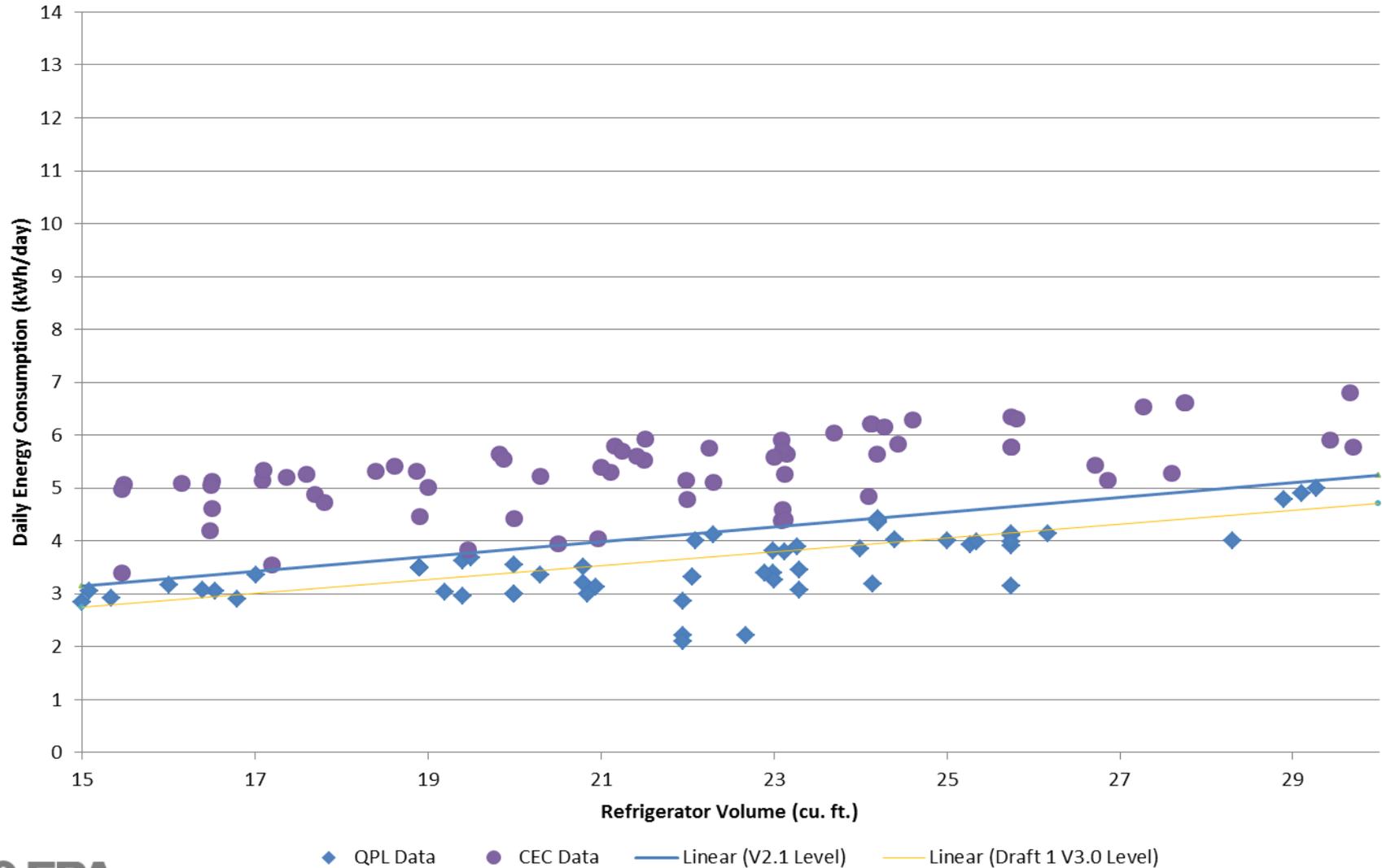
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Refrigerators, Transparent Door, $0 < V < 15$ cf



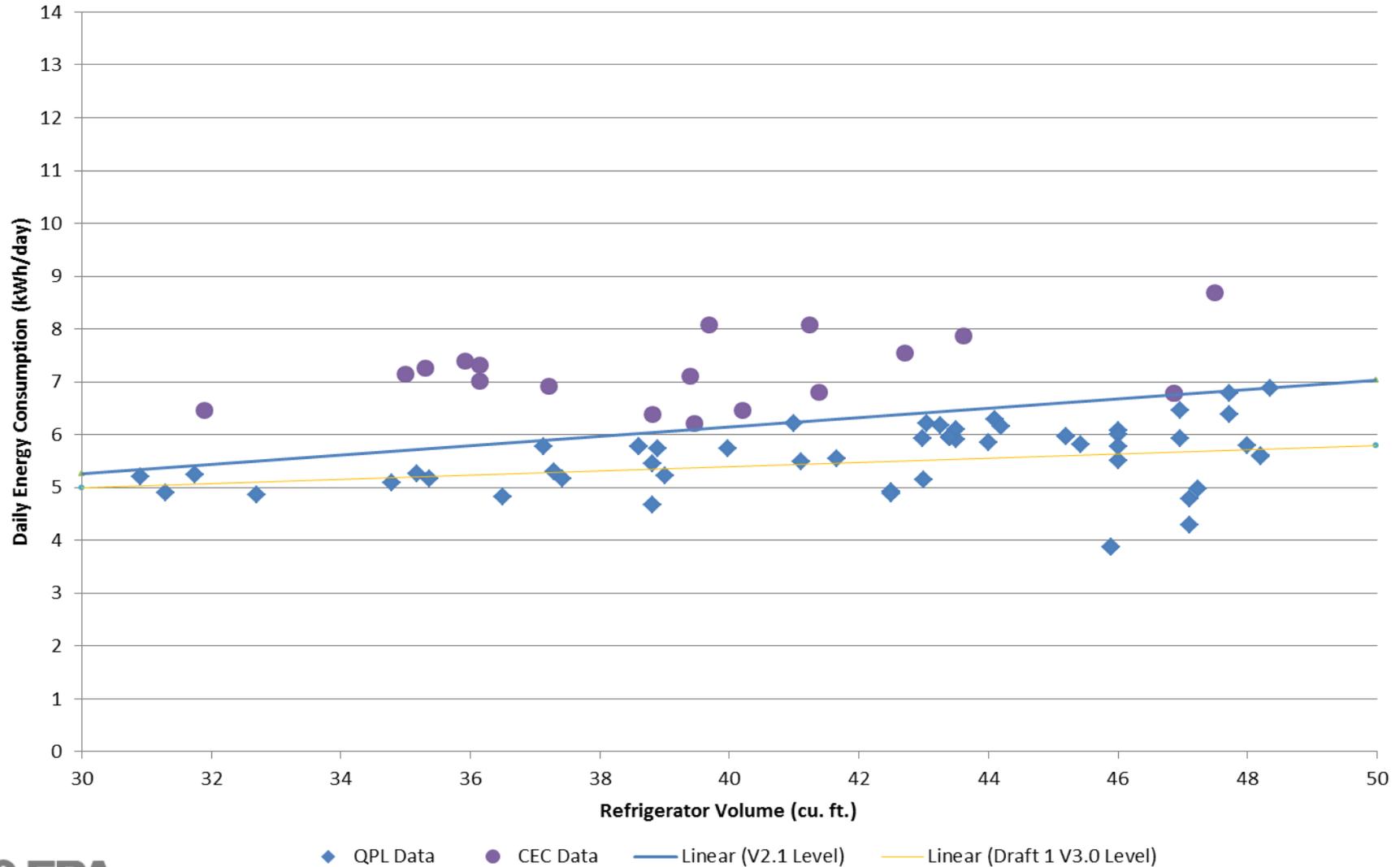
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Refrigerators, Transparent Door, $15 \leq V < 30$ cf



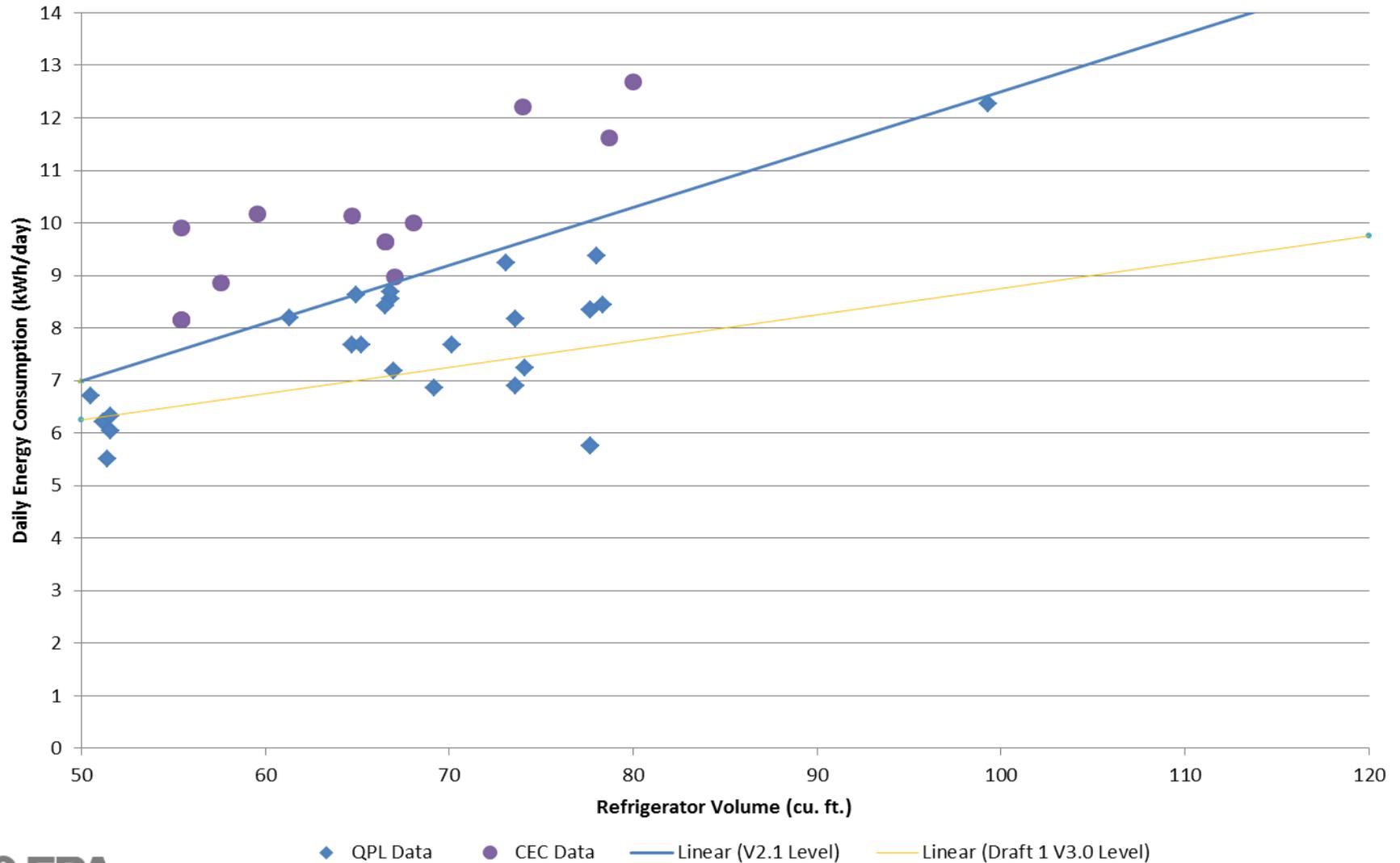
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Refrigerators, Transparent Door, $30 \leq V < 50$ cf

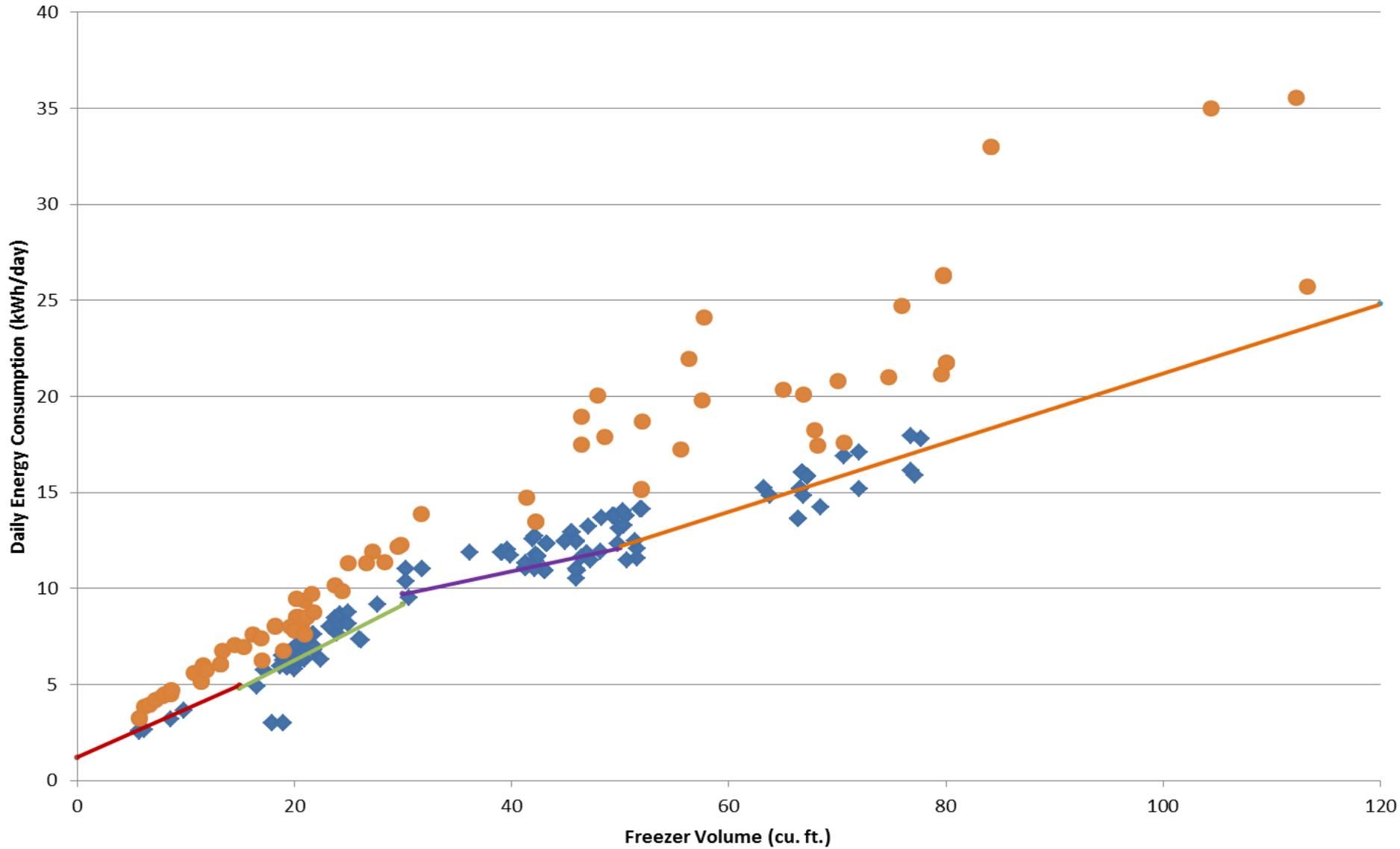


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Number of Manufacturers Meeting Draft 1 V3.0 Levels: 7 of 10

Refrigerators, Transparent Door, 50 cf ≤ V



Freezer Levels, Vertical, Solid Door

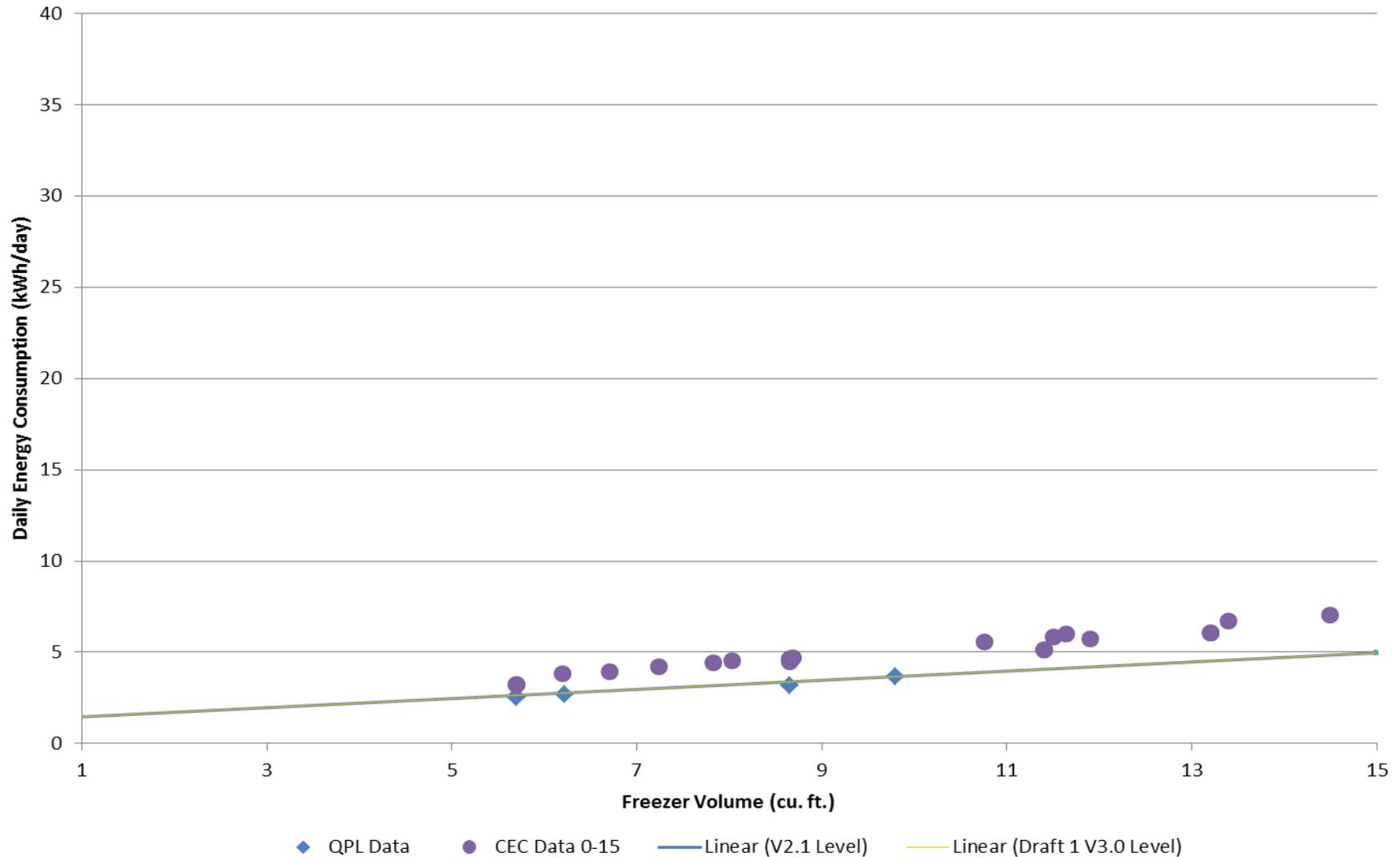


◆ QPL Data ● CEC Data — Linear (0<V<15 Level) — Linear (15≤V<30 Level) — Linear (30≤V<50 Level) — Linear (50≤V Level)



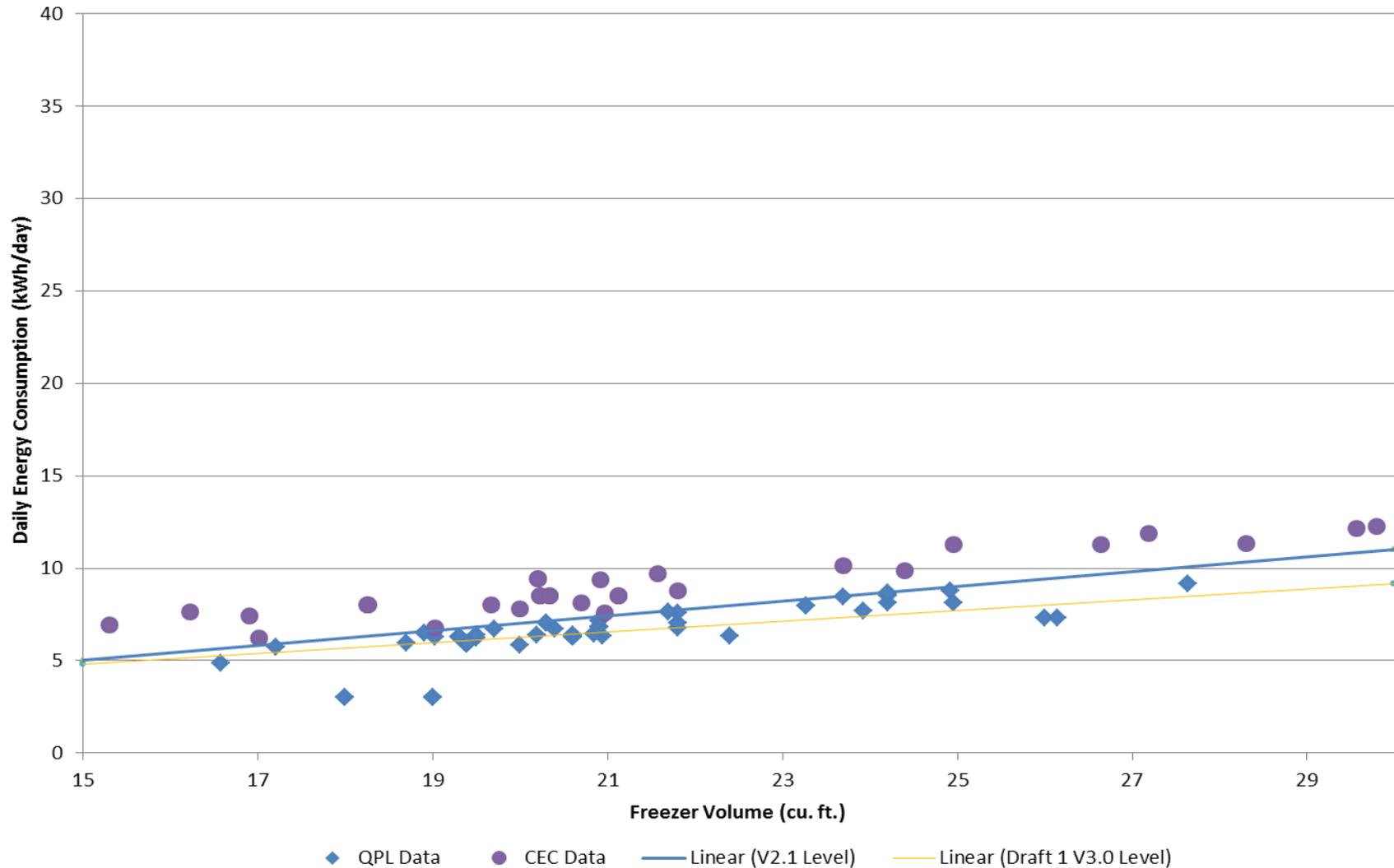
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Number of Manufacturers Meeting Draft 1 V3.0 Levels: 3 of 3

Freezers, Solid Door, 0 < V < 15 cf



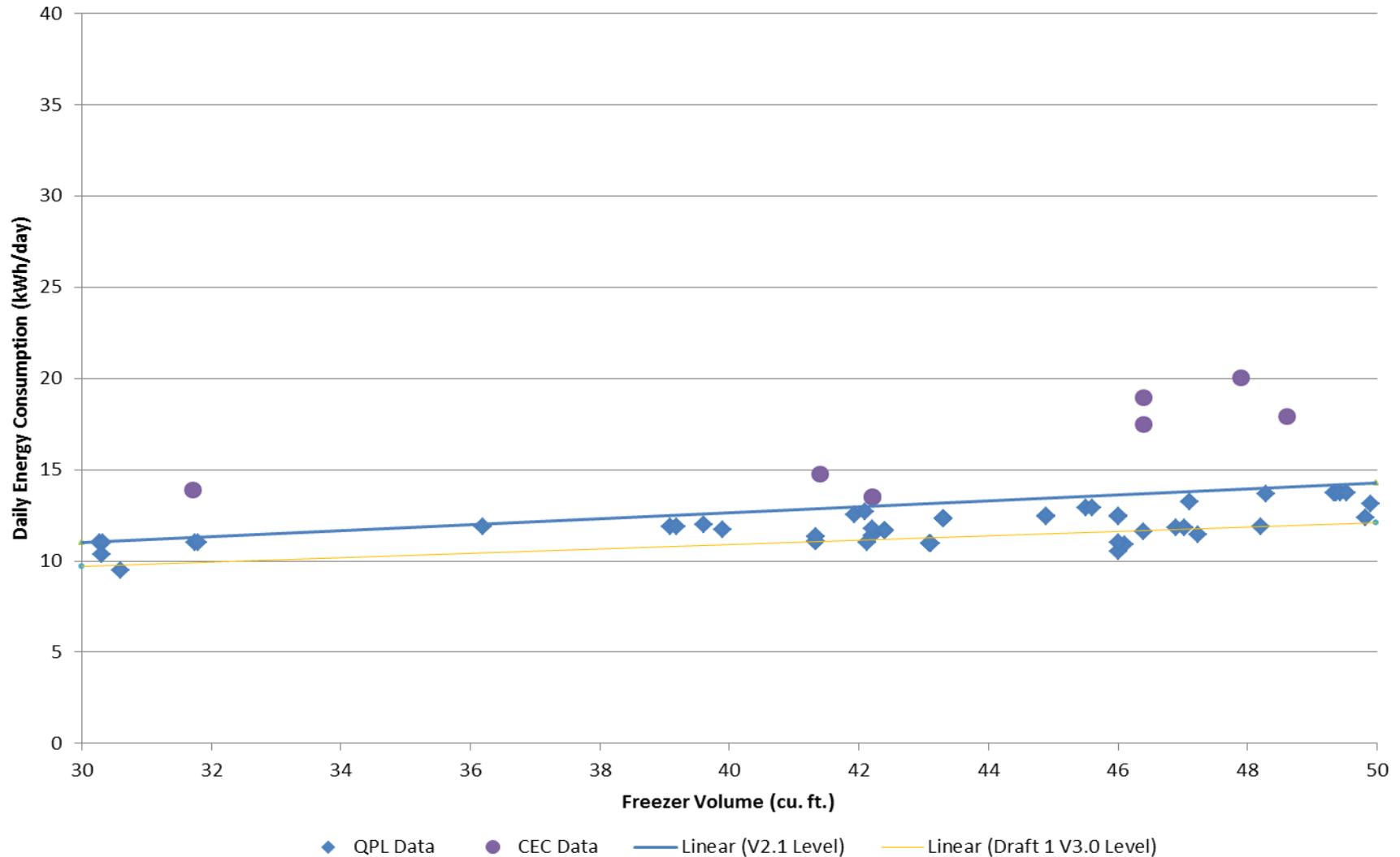
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Freezers, Solid Door, $15 \leq V < 30$ cf



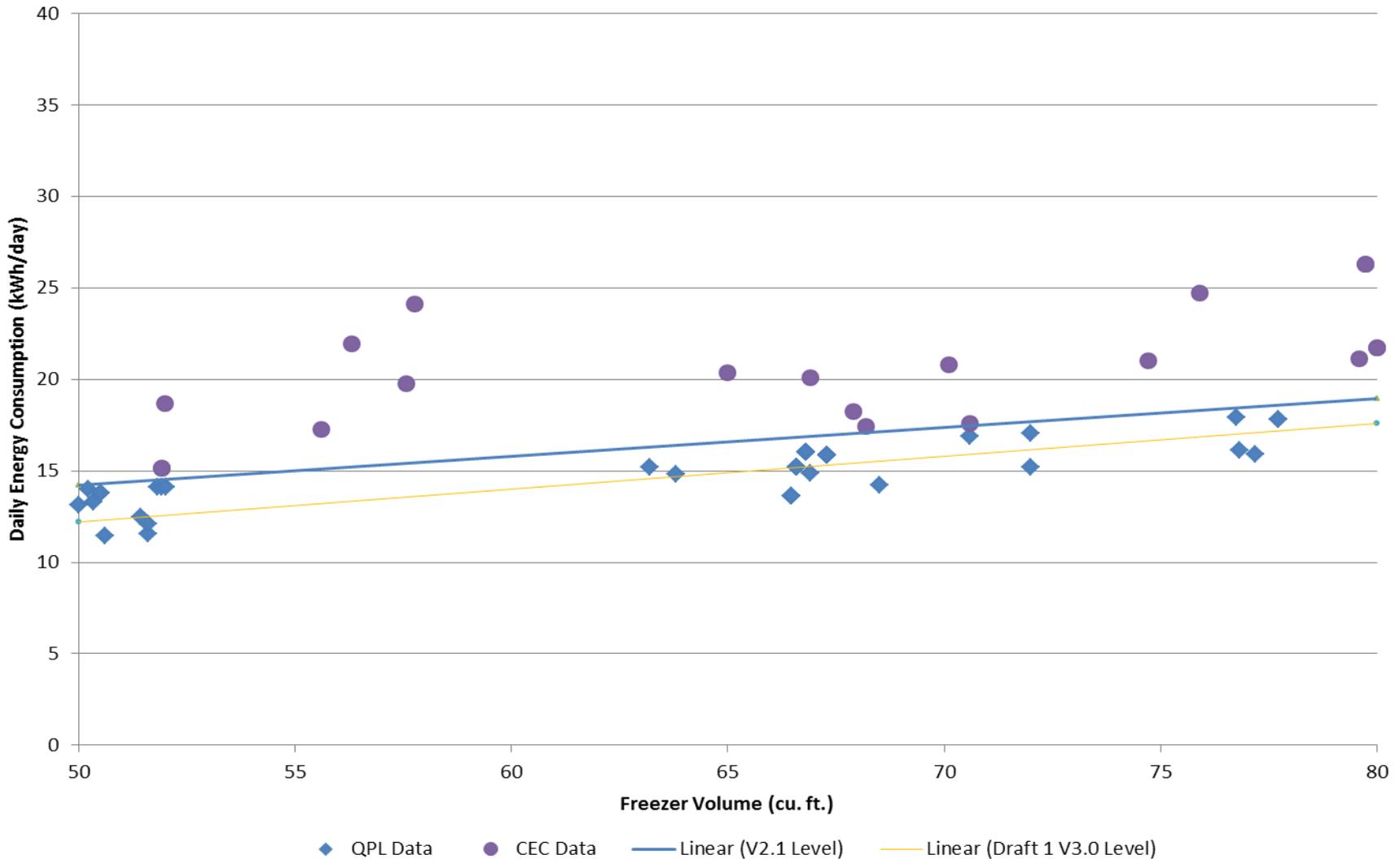
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Freezers, Solid Door, $30 \leq V < 50$ cf

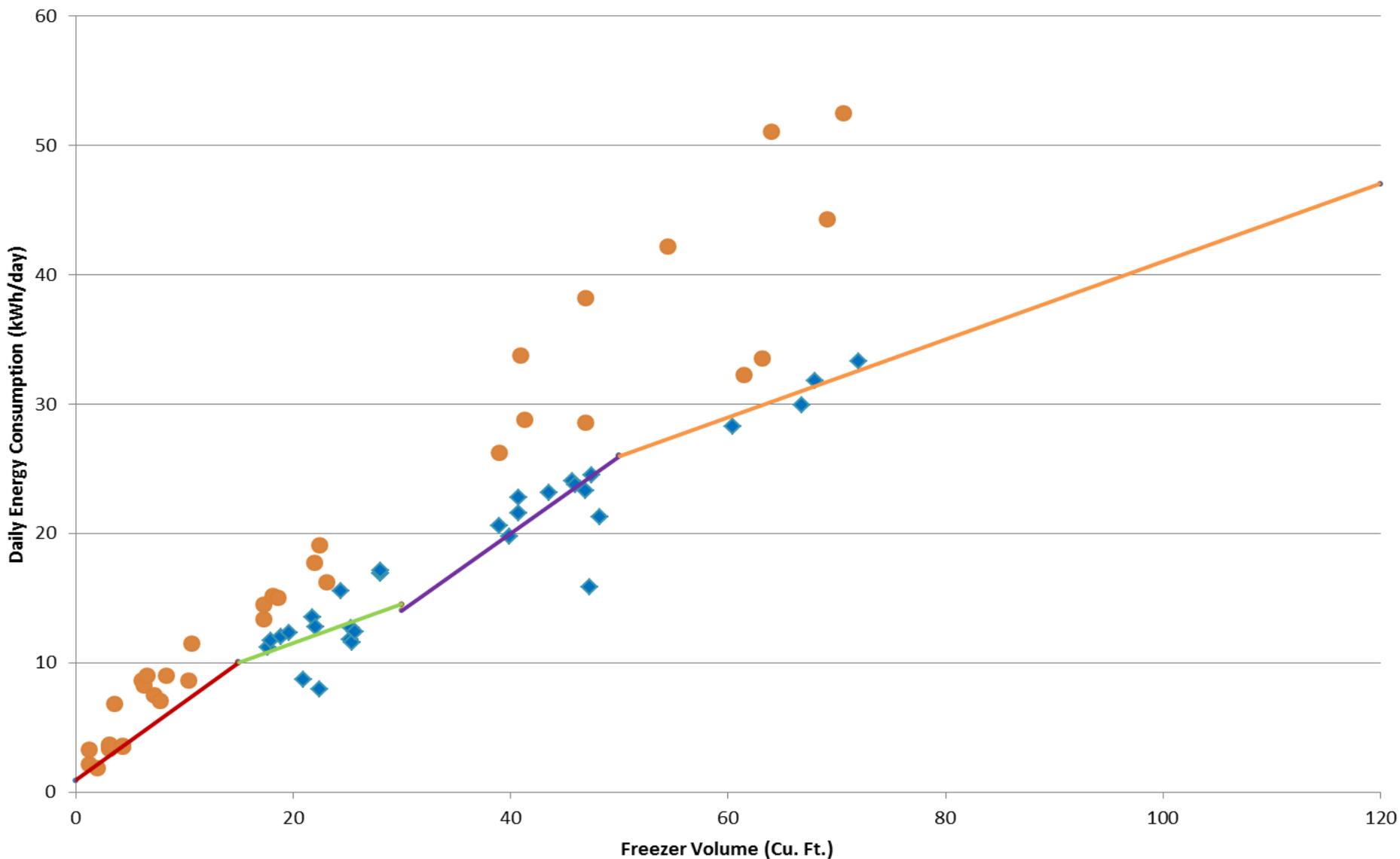


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Number of Manufacturers Meeting Draft 1 V3.0 Levels: 9 of 19

Freezers, Solid Door, 50 cf ≤ V



Freezer Levels, Vertical, Transparent Door

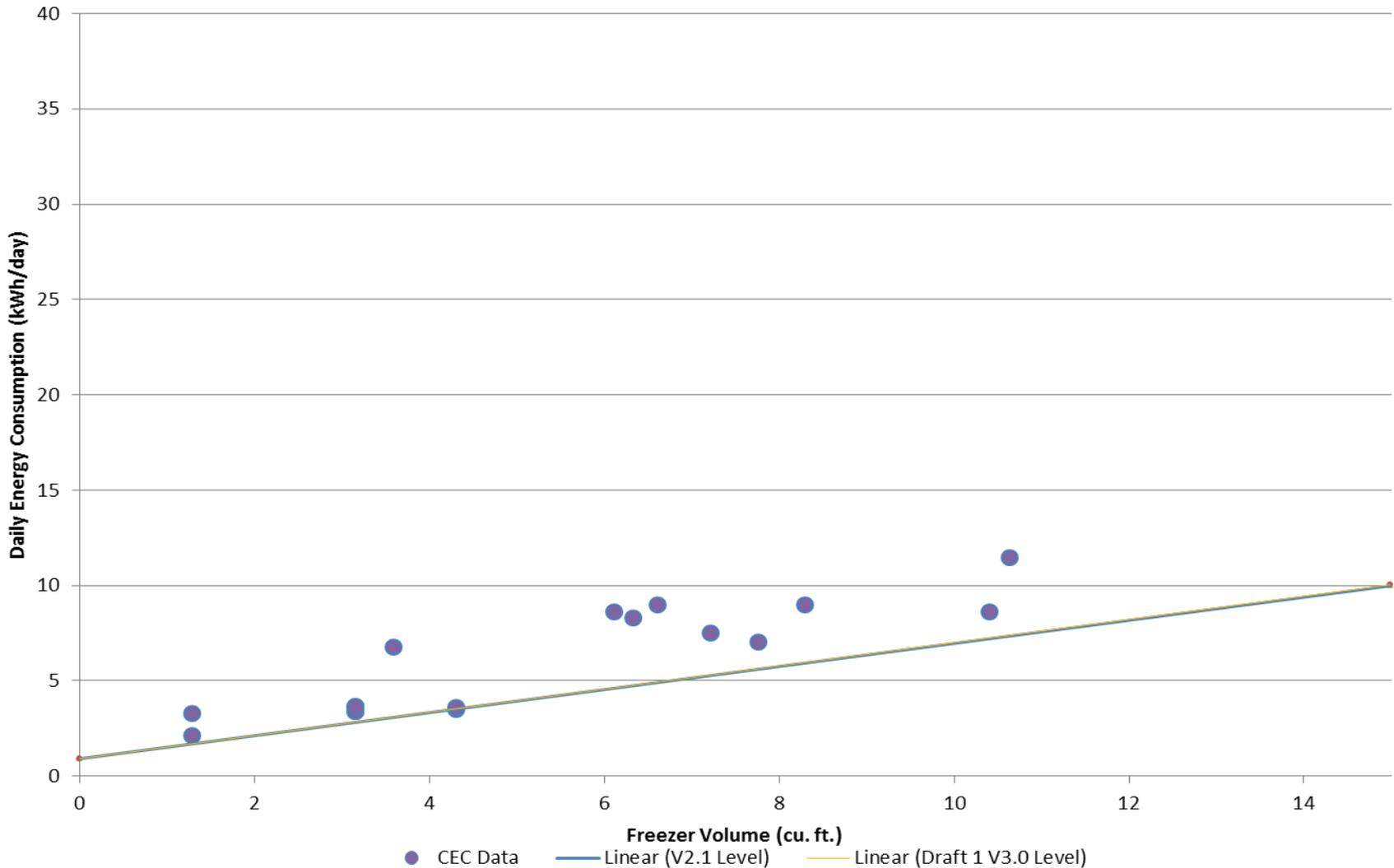


◆ QPL Data ● CEC Data — Linear (0 < V < 15 Level) — Linear (15 ≤ V < 30 Level) — Linear (30 ≤ V < 50 Level) — Linear (50 ≤ V Level)



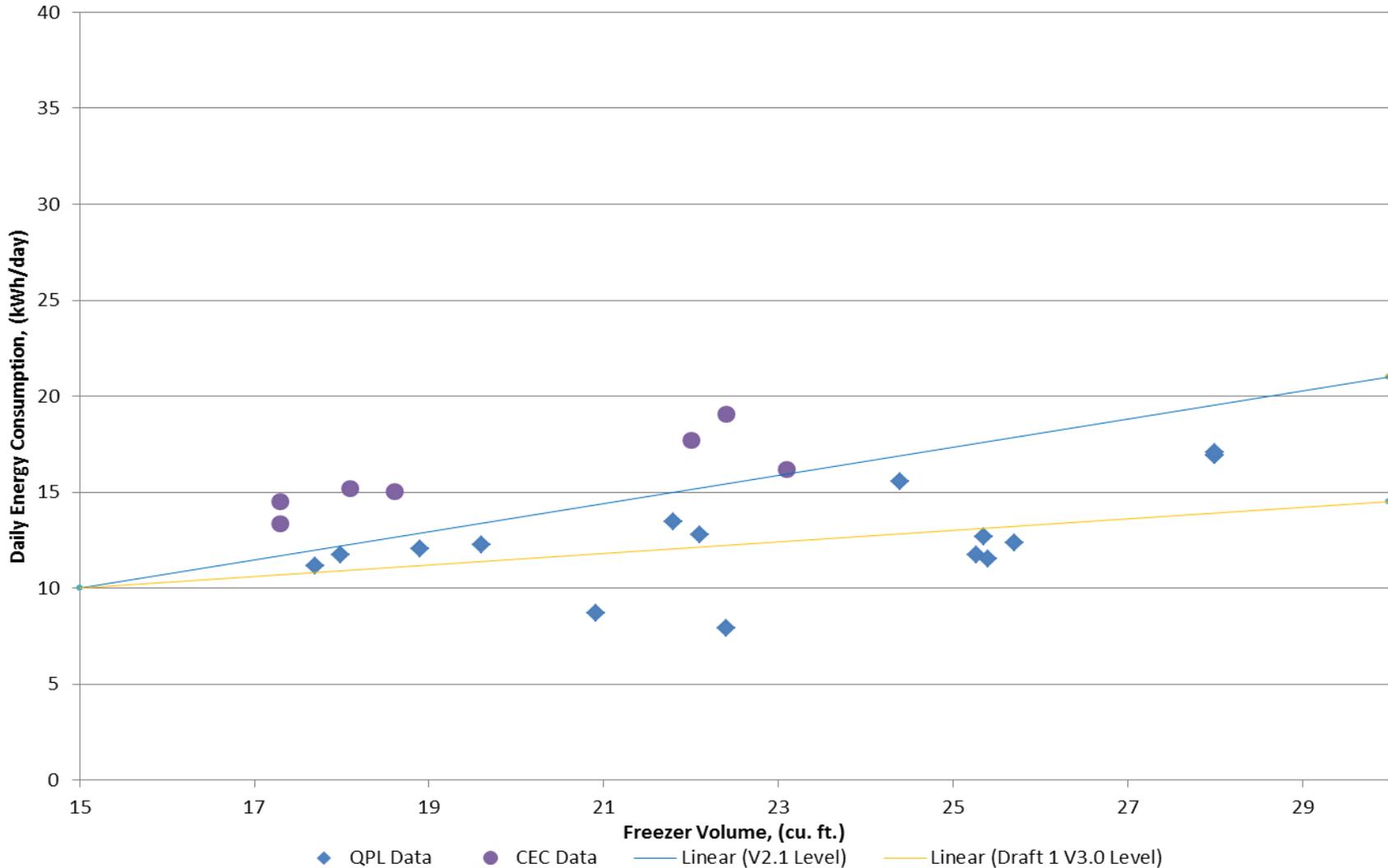
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Number of Manufacturers Meeting Draft 1 V3.0 Levels: 0 of 0

Freezers, Transparent Door, $0 < V < 15$ cf



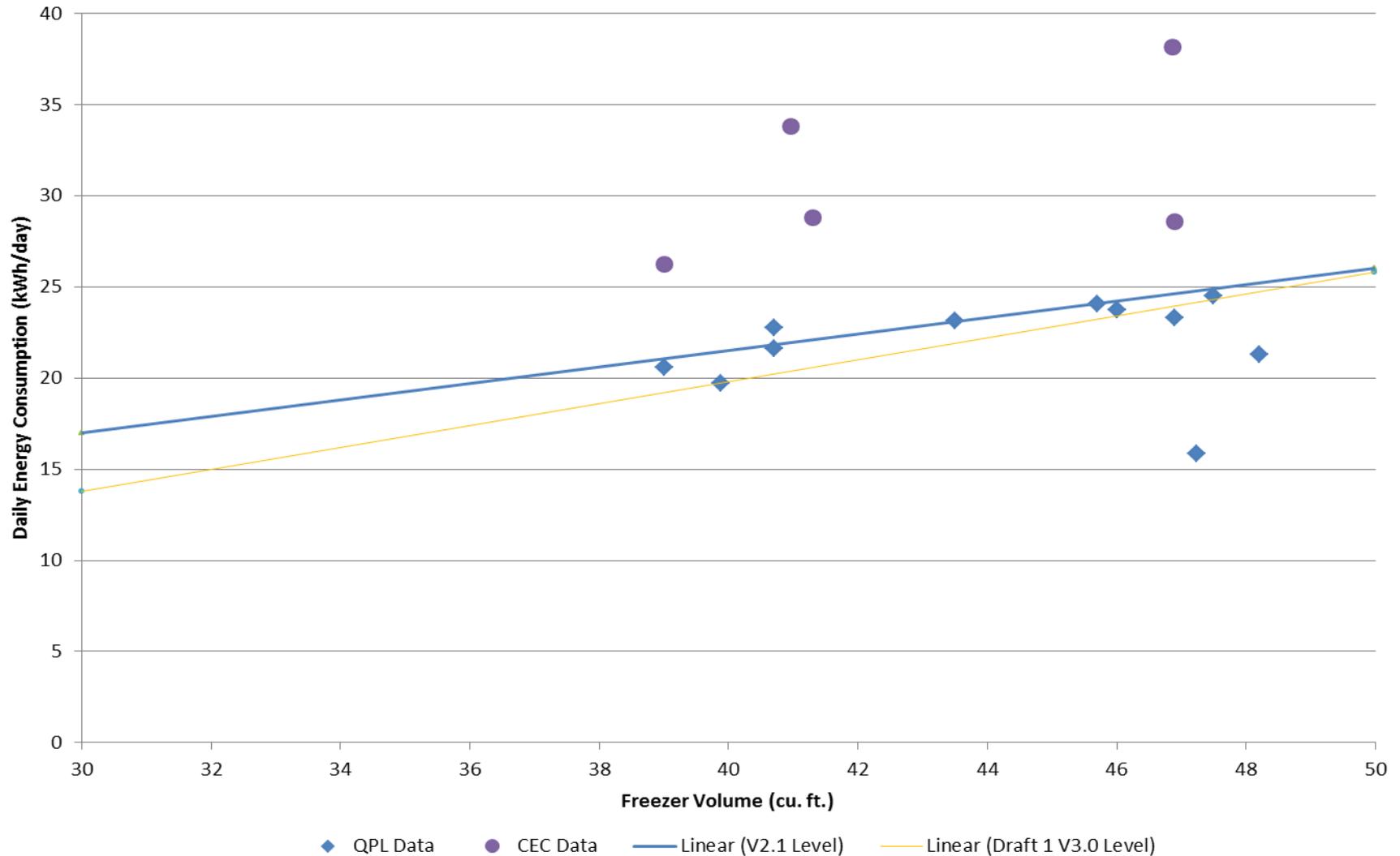
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Number of Manufacturers Meeting Draft 1 V3.0 Levels: 3 of 10

Freezers, Transparent Door, $15 \leq V < 30$



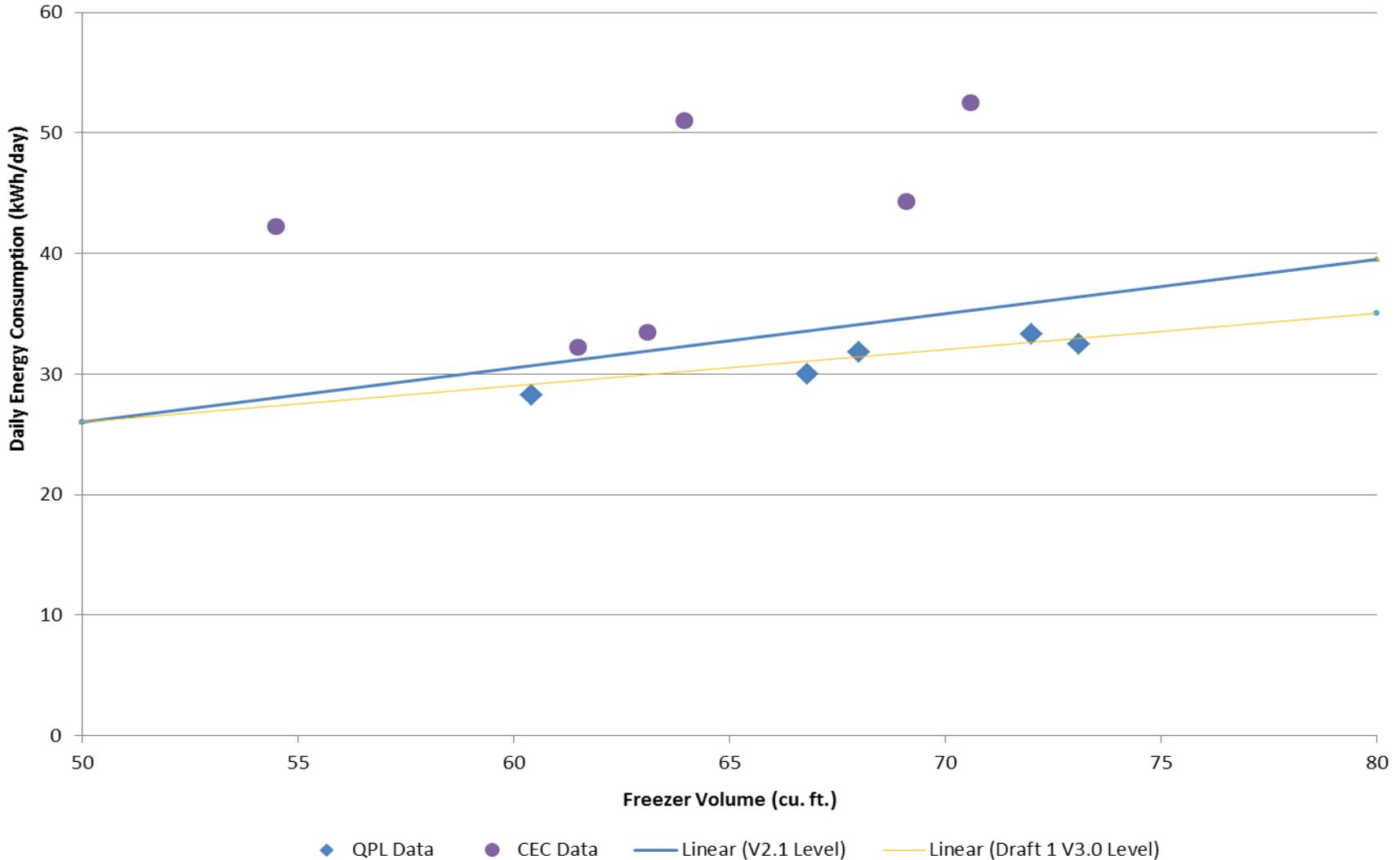
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Number of Manufacturers Meeting Draft 1 V3.0 Levels: 4 of 7

Freezers, Transparent Door, $30 \leq V < 50$ cf



Number of Models Meeting Draft 1 V3.0 Levels: 3
Number of Manufacturers Meeting Draft 1 V3.0 Levels: 2 of 3

Freezers, Transparent Door, V ≤ 50 cf



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Timeline/Next Steps

- Launch – October 2012
 - Webinar November 15, 2012
- Draft 1 May, 6 2013
 - Stakeholder Meeting – May 20, 2013
 - **Comments on Draft 1 due to EPA – May 28, 2013**
- Draft 2 – July 2013
 - Comments on Draft 1 due to EPA – August 2013
- Draft 3 – September 2013 – if needed
- Final Draft – October 2013 – subject to change
- Final – December 2013 – subject to change
- Effective –September 2014 – subject to change

Contact Information



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Thank you for participating!

This presentation as well as all material related to the specification development process is located at

www.energystar.gov/revisedspecs