JUMP
into Refrigerator Savings

Ga-Young Park
ENERGY STAR Appliances Product Manager
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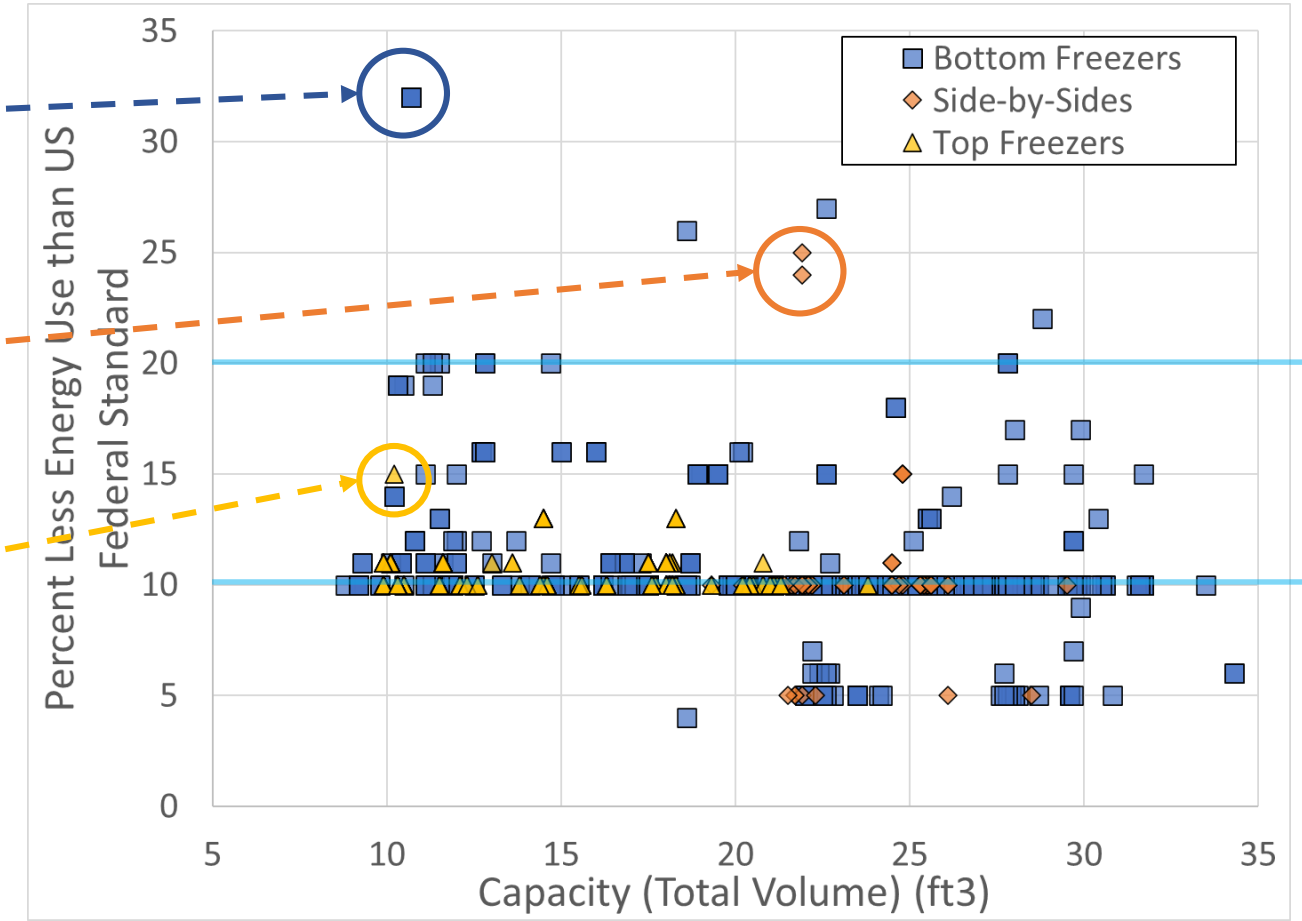
Refrigerator Market Current Status

- Best in class Bottom Freezer at 32%
- Best in class Side-by-Side at 25%
- Best in class Top Freezer is currently at 15%

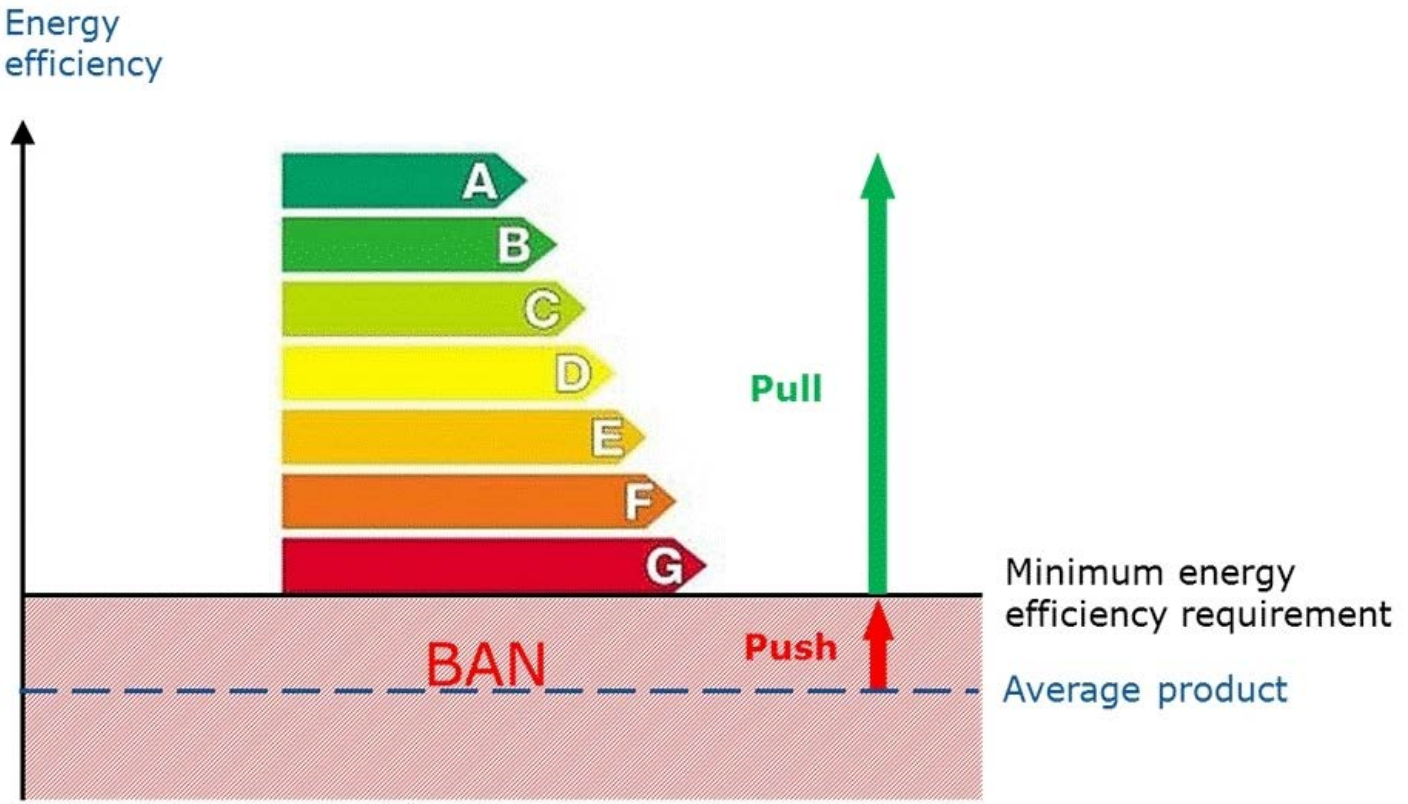


ESME: 20% > DOE for Bottom Mounts / Side-by-Side

ESME: 10% > DOE for Top Freezers
ENERGY STAR: 10% > DOE

Change is imminent in the EU

- New EU Refrigerator/Freezer Standard going into effect in 2 phases in 2021 and 2024
  - Resetting rating scale to A -G
  - Increasing EU min ~25-30%
    - ~30% more efficient than current DOE standard



https://ec.europa.eu/commission/presscorner/detail/en/qanda_19_5889

Manufacturers are working now to meet EU standards

In advance of the standards going into effect, many refrigerator/freezer models sold on the EU market now are much more efficient. Manufacturers are meeting the challenge through incorporating:

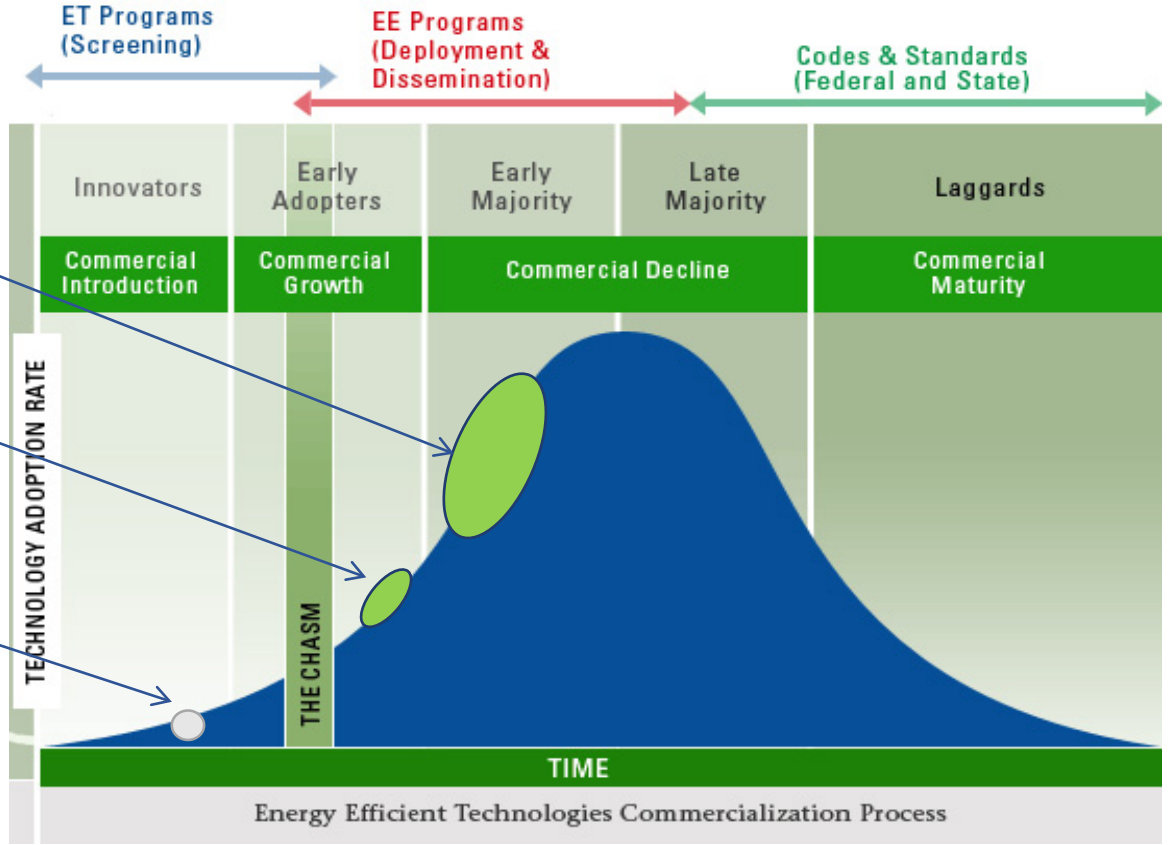
- Adaptive Compressor Systems
  - Efficiency savings ~25%
- Insulation improvements
  - Efficiency savings ~5-20%
- Low-GWP refrigerant
  - Efficiency savings ~5%
- Other

How can we “Push” and “Pull” the U.S. Refrigerator market?

ENERGY STAR

ENERGY STAR Most Efficient

Emerging Tech



2020 Emerging Technology Award: Advanced Adaptive Compressors for Residential Refrigeration

Emerging Technology Award (ETA)

- Raises the profile of innovative technologies that may significantly reduce GHG emissions once more widely adopted.

Award criteria for compressors includes:

- 30% below Federal Standard or equivalent
- Requires low-GWP refrigerant and foam
- Standard-size models (no built-ins)

ETA criteria extended to 2021!

ENERGY STAR® 2020 Emerging Technology Award Requirements: Advanced Adaptive Compressors[1]

Criteria			Test Method/Required Documentation
Product Characteristics			
Energy Efficiency	Option 1	Outperform the measured Annual Energy Consumption for the Federal Minimum Standard by 30%[2]	Perform the 10 CFR 430, Subpart B Appendix A – Residential Refrigerators test method for refrigerators and refrigerator-freezers or perform the 10 CFR 430, Subpart B Appendix B – Residential Freezers test method for freezers
	Option 2	With the compressor in the adaptive mode[3], outperform the Annual Energy Consumption by 25% compared to when the compressor is in a fixed-speed mode	Perform the appropriate test procedure described in Option 1 comparing only the steady-state energy consumption[4] per Section 5.2.1 with all compartment temperature controls set at their median position midway between their warmest and coldest settings per Section 3.2.1 and average the results from the following three ambient temperature test conditions for Section 2.1.1: 60 °F, 75 °F, and 90 °F[5]
	Provide documentation of the model information and test results for the product being submitted for consideration		
	Energy measurements must be performed at an EPA-recognized accredited lab[6] or at manufacturer lab certified by an EPA-recognized Certification Body under the Data Acceptance Program		
Low-GWP Refrigerant & Foam	Contains refrigerant and foam with a Global Warming Potential (GWP) less than 15 and approved for use in the U.S. market		Listed as Acceptable by the U.S. EPA Significant New Alternatives Policy (SNAP) Program for refrigerants[7] and foams[8]. Product documentation listing the refrigerants and foams contained within the product.
Non-Built-In	The model shall not be a built-in model per the DOE product class definitions		10 CFR 430.2 Definitions
Total Volume	Total Volume[9] ≥ 7.75 (cu-ft)		10 CFR 430, Subpart B Appendix A or B, Section 5.3
Additional Product Requirements			
Warranty Minimum	One year parts and labor		Copy of warranty agreement
Certification	Must meet all applicable U.S. electrical safety requirements		Copy of case files
Commercial Status	This program recognizes only products available for sale in the U.S.		

ENERGY STAR 2020
Emerging Technology Award

Bridging "The Chasm" with JUMP

Immediate → Future

ENERGY STAR 2020
Emerging Technology Award

JUMP Initiative

Working with manufacturers and Utility sponsors to advance the refrigerator market in U.S.

Most Efficient 2020
www.energystar.gov

- Refrigerators/Freezers at least 30% more efficient than current federal standards
- Standard-sized residential units (i.e., volumes between 10-25 cu feet)
- Products that use isobutane refrigerant (R600a)
  - Acceptable EPA Significant New Alternatives Policy (SNAP) Program refrigerant substitute

EPA: Connecting Utilities with Manufacturers

- EPA is connecting with interested EEPs
  - Make them aware of potential technological advances
  - Work together to improve the value proposition for leadership companies interested in introducing next-gen models to the US market

- Target Fuel: Electric
- Target sector: Residential
- New to U.S. market—Low free-ridership concerns
- Potential market segments
  - Mass market (e.g., retail)
  - Multifamily
  - Income-qualified direct install

- EPA is connecting with Manufacturers who have or will have next-gen refrigerators/freezers
  - Learn how efficiencies of 30% above fed min are being achieved
  - Understand the conditions under which manufacturers would be willing to introduce products into US market
  - Understand timing of product being introduced into US Market

Current Status

- EPA released a letter in January 2020 to EEPS associating a target level of 30% better than federal standard with this effort

- Since 2019, EPA has held meetings with ~20 utilities to discuss the opportunity and understand what would help them move forward
  - Utilities represent over 15 million households
  - Broadened scope. Initial thoughts were to focus on mass procurement but realized EEPS' interests were more wide-ranging.

Next Steps

- Identify EEPS most ready to meet with manufacturers and discuss opportunities
  - Manufacturers need to understand:
    - Potential volume of refrigerators that could move through program(s)
    - Under which channels and utility programs refrigerators could partake (near-term/long-term?)
  - EEPS need to understand:
    - Brand/Product availability in the market
    - Incremental costs + Potential Savings that can be claimed

Next Steps (cont'd)

- Explore potential intersection with Diversity, Equity, and Inclusion work being done by EEPS
  - Understand what kinds of DEI campaigns or work manufacturers are doing. Is there any alignment with next-gen technology goals?
  - Learn what manufacturers can do to include more efficiency innovations and advancements in Top Freezer models
  - Understand how low-income programs across the country may be changing and how can they be leveraged to advance next-gen refrigerators

- Please connect with us

ENERGY STAR®
Products Partner Meeting
2020

JUMP
into Refrigerator Savings

EPA

JUMP Into Savings

Eric Olson

Senior Product Manager, NEEA

October 27, 2020

The Alliance

neea

Avista
Bonneville Power Administration
Cascade Natural Gas Corporation
P.U.D. Chelan County
Clark Public Utilities
EnergyTrust of Oregon
Idaho Power An IDACORP Company
NorthWestern Energy
NW Natural
Pacific Power
Portland General Electric
PSE Puget Sound Energy
Seattle City Light
Snohomish County PUD Public Utility District No. 1
Tacoma Power Tacoma Public Utilities

Why JUMP…

…For Utilities

- Energy savings
  - Refrigerators are a top consumer of energy
- Diminishing savings in other categories/products
- Experience with refrigerator programs
- Natural fit in multi-family programs

Image US Army Corps of Engineers

Why JUMP…

…For Energy Efficiency Advocates

- Technologies have advanced significantly in recent years
- Manufacturers are introducing more-efficient models outside of U.S.
- Pull demand forward to get more efficient products in the hands of more consumers quicker

Image LG Electronics

Why JUMP…

…For the Supply Chain

- Demonstrated demand from customers
- Manufactured by known and trusted brands
- Support from utilities with incentives
- Aligns with goals to sell more efficient products

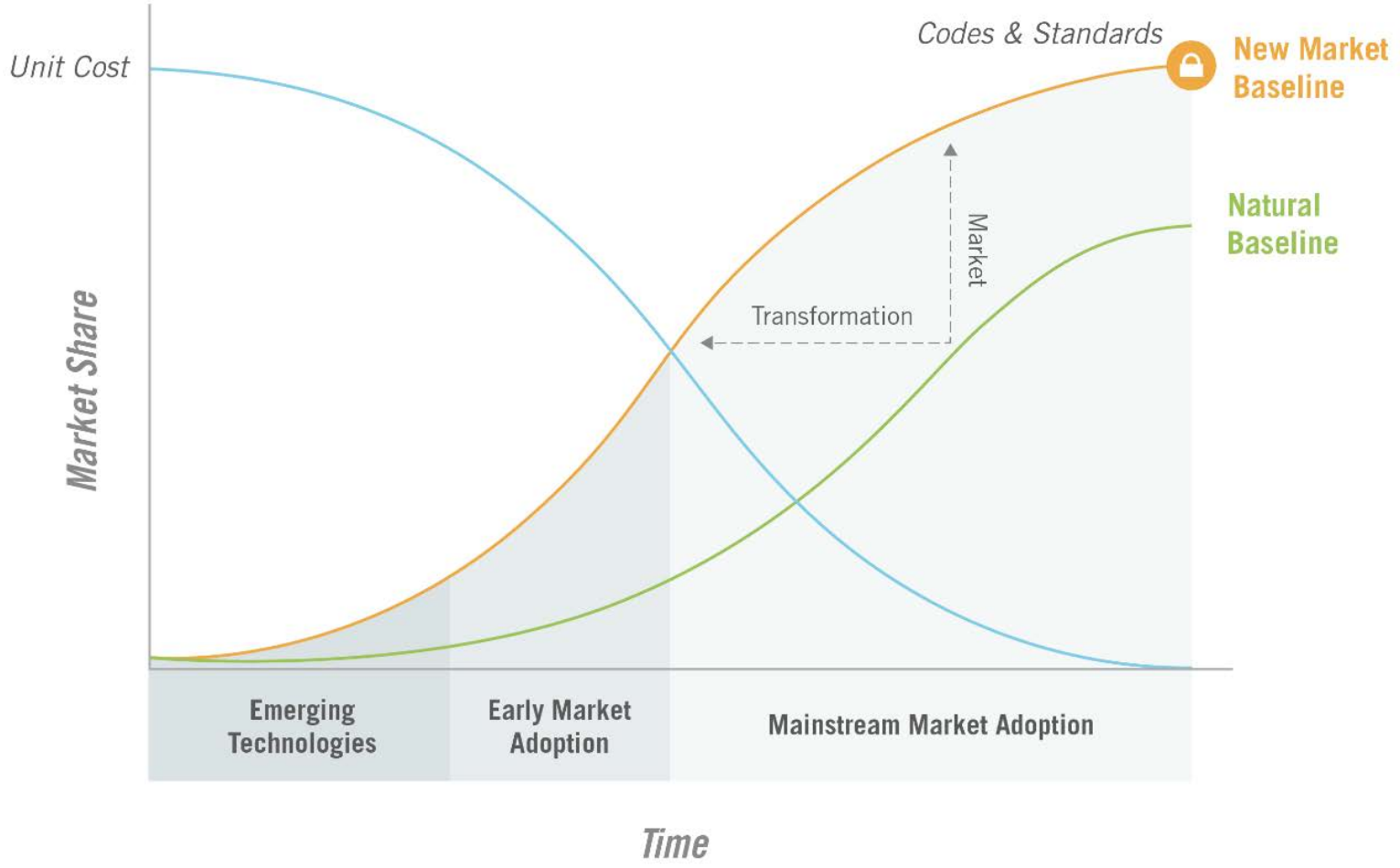
Why JUMP…

…for Manufacturers

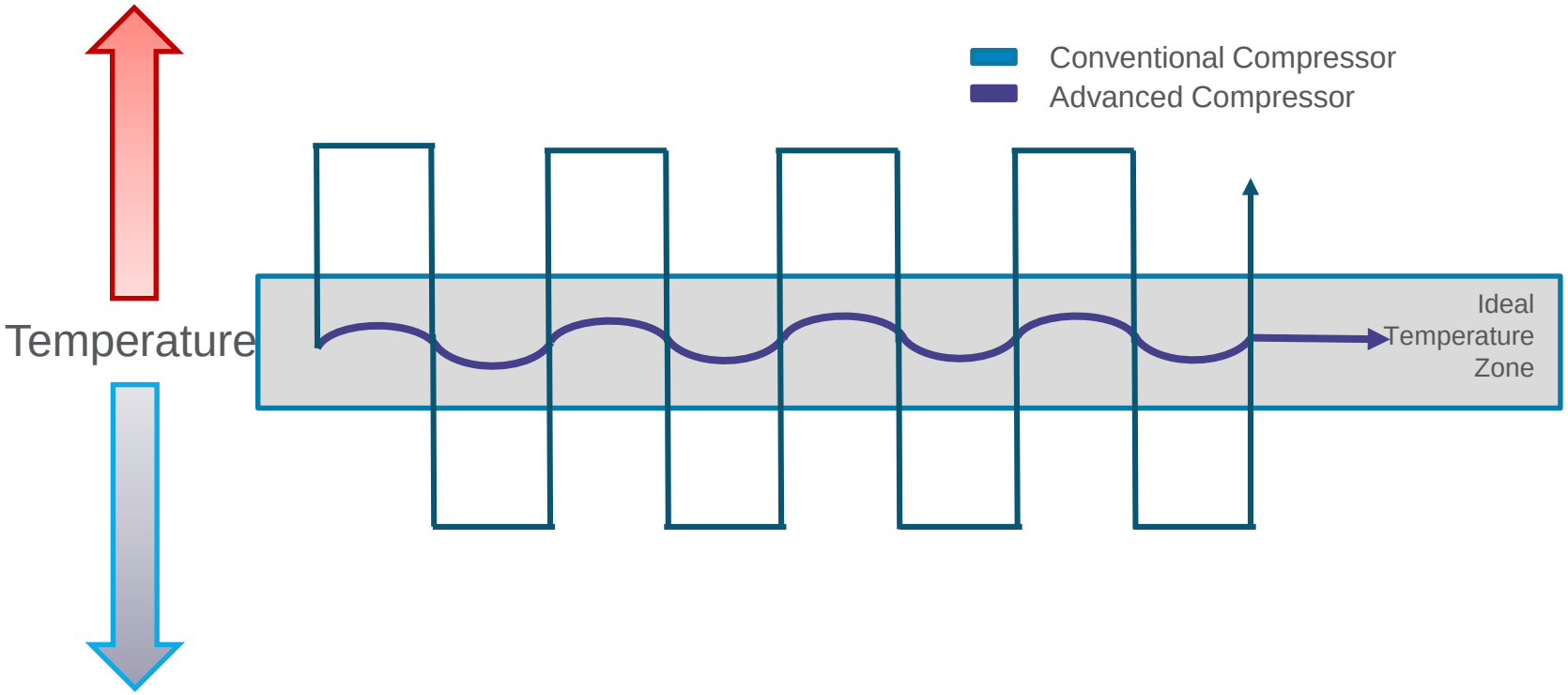
- Support from utilities and EE advocates
- Pull-through demand from retailers and end-users
- Leverages existing technologies used globally

Image GE Appliances

Market Transformation



Why the Focus On Inverter Technology?



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Non-Built-In		The model shall not be a built-in model per the DOE product class definitions	10 CFR 430.2 Definitions
Total Volume		Total Volume[9] ≥ 7.75 (cu-ft)	10 CFR 430, Subpart B Appendix A or B, Section 5.3
Additional Product Requirements			
Warranty Minimum		One year parts and labor	Copy of warranty agreement
Certification		Must meet all applicable U.S. electrical safety requirements	Copy of case files
Commercial Status		This program recognizes only products available for sale in the U.S.	

[1] Intended for residential refrigeration products that pair advanced compressors with sensor-driven control systems capable of capacity modulation.
[2] In meeting the Option 1 criteria, the model must have a variable speed compressor with control systems capable of capacity modulation.
[3] The refrigerator shall be shipped with the compressor in the adaptive mode.
[4] For example, in Section 5.2.1.3, the steady-state energy consumption is equal to 1440*E1/T1*K.
[5] The three temperatures are intended to demonstrate the advanced efficiency through a three-point performance curve.
[6] ENERGY STAR Partner Resources Third Party Certification Webpage
[7] List of acceptable and unacceptable refrigerants in residential refrigerator-freezers https://www.epa.gov/snap/substitutes-household-refrigerators-and-freezers#self
[8] List of acceptable and unacceptable foams in residential refrigerator-freezers https://www.epa.gov/snap/substitutes-rigid-polyurethane-appliance
[9] Total Volume = Fresh Food Compartment Volume + Freezer Compartment Volume; in cubic feet.

Getting to 30%

- Current DOE test requirements need improvement
  - Originated decades ago
  - Only measure performance at one ambient temperature
- Testing standards outside the U.S. test at multiple temperatures
- More robust testing of load-processing

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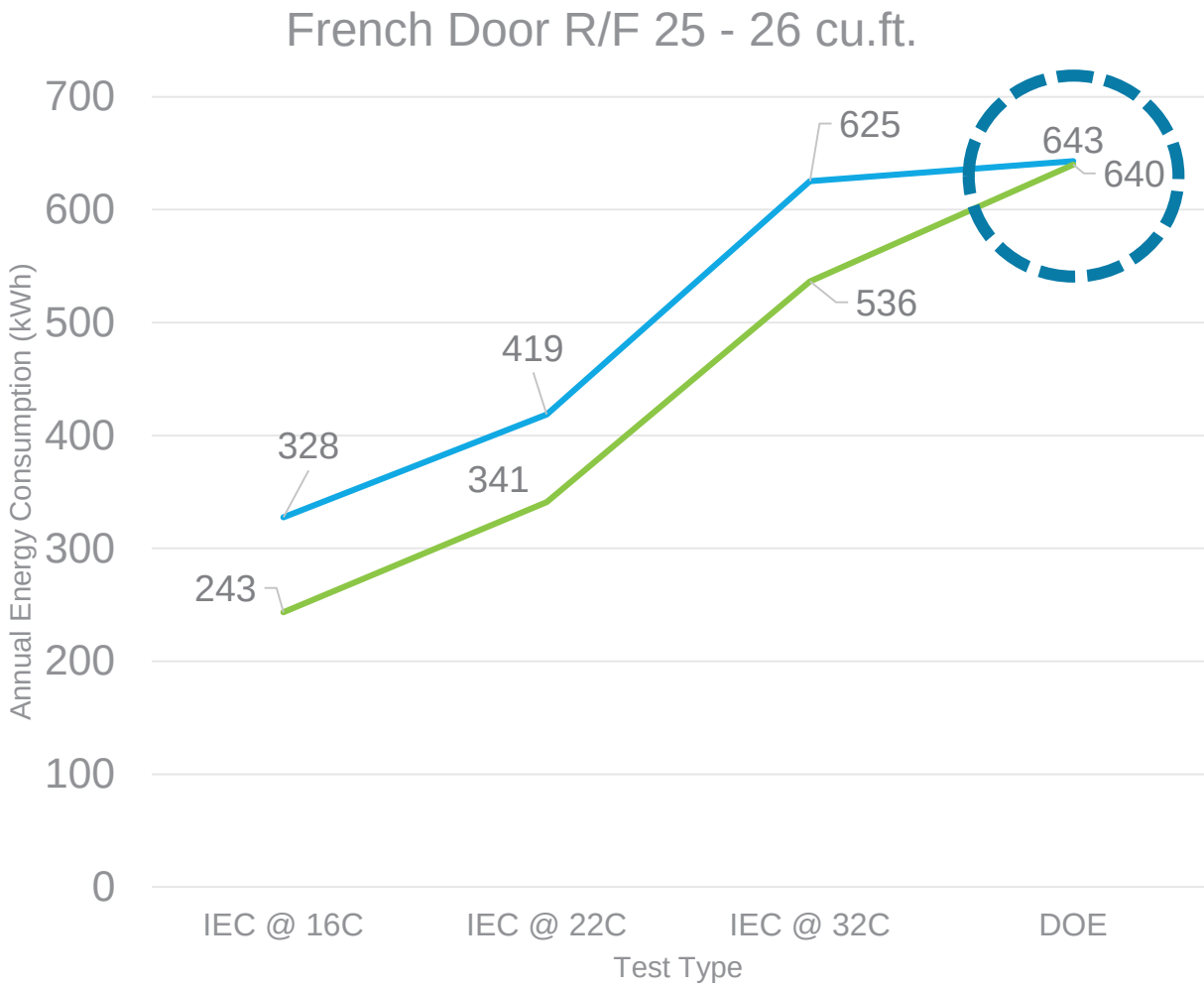
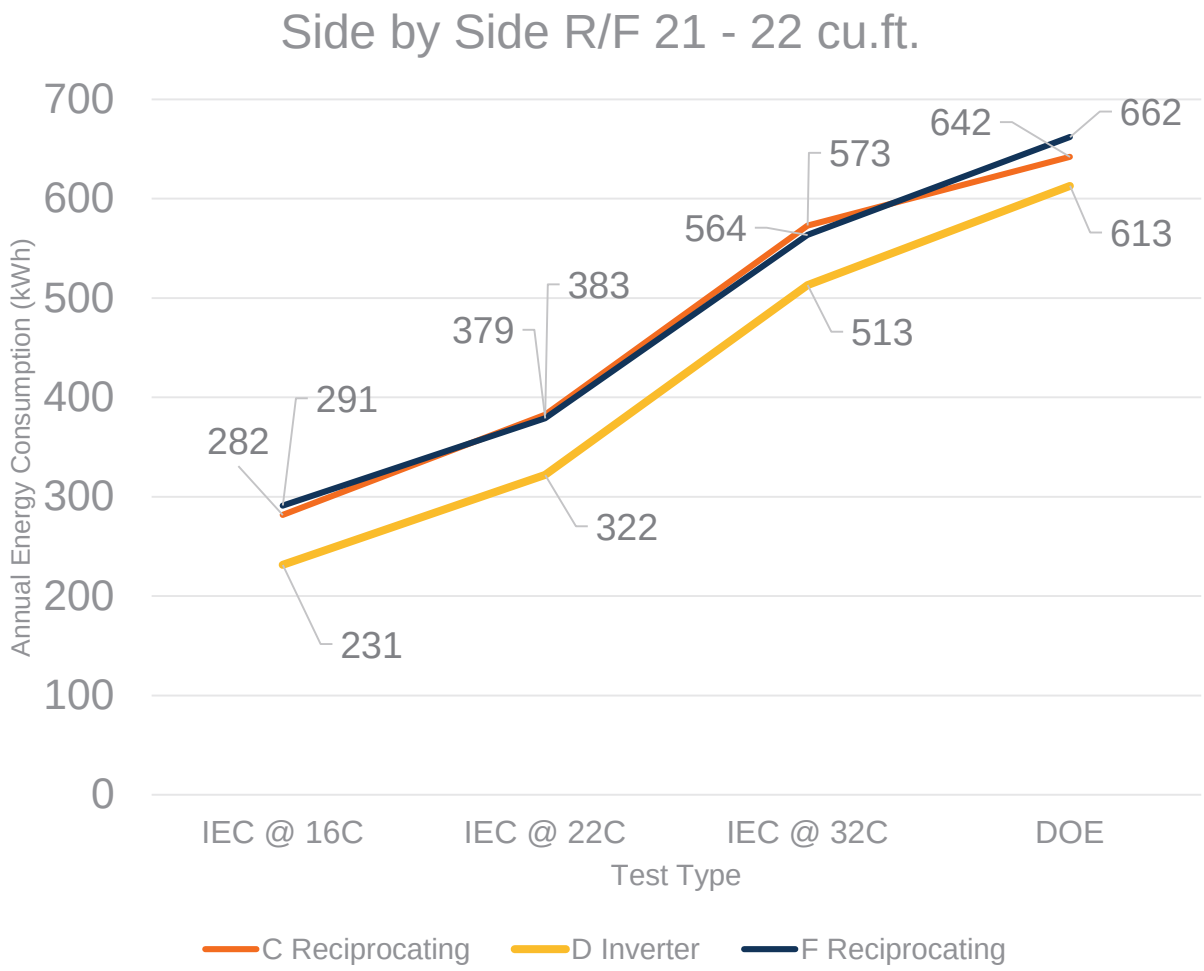
What's the Testing Difference?

- For some models, performance appears the same with the DOE testing
- Testing at multiple ambient temperatures reveals performance difference



What's the Testing Difference?

- Side-by-Side models demonstrate inverter-compressor efficiency at all ambient temperatures
- An inverter-compressor will typically perform better
  - Cruise control vs. manual throttle
- Demonstrates the importance of total system design
  - Controls
  - Insulation
  - Sensors
  - Direct area cooling



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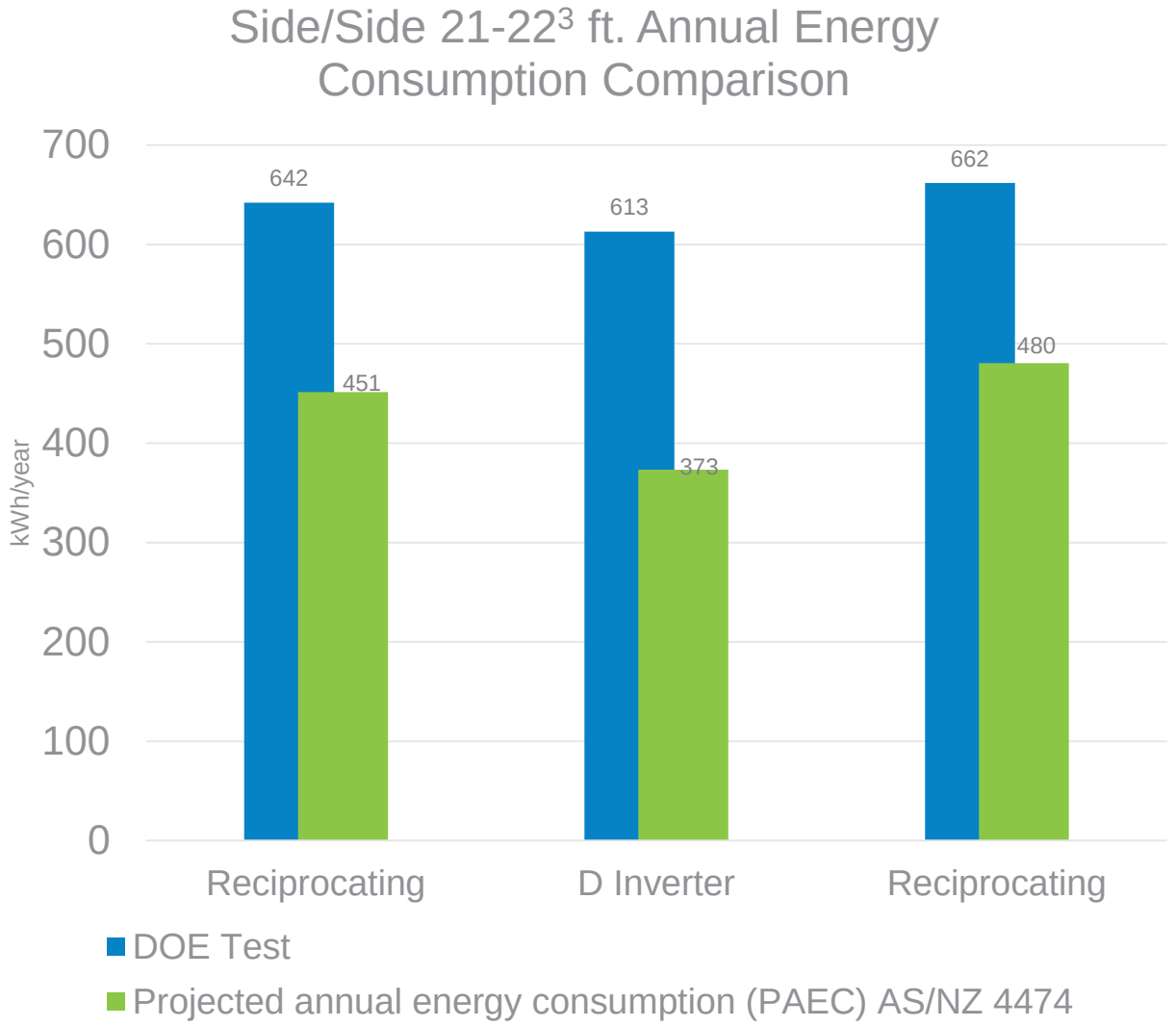
What's the testing difference?

- The DOE test doesn't fully represent the benefit of more efficient technologies
- Multiple ambient temperatures recognizes lower energy consumption*
- This chart demonstrates why it is important for manufacturers to continue to get test procedure waivers



* Calculated per AS/NZ 4474-2018

ENERGY STAR Emerging Tech Results*

Model	D	F
Type	Side by Side with Through the Door Ice	Side by Side with through the Door Ice
Compressor Type	Inverter Driven	Reciprocating
16C	231	291
32C	512	564
22C	322	379
Estimated ETA Method 2	355	411
Energy Savings vs. Competitor	13.6%	

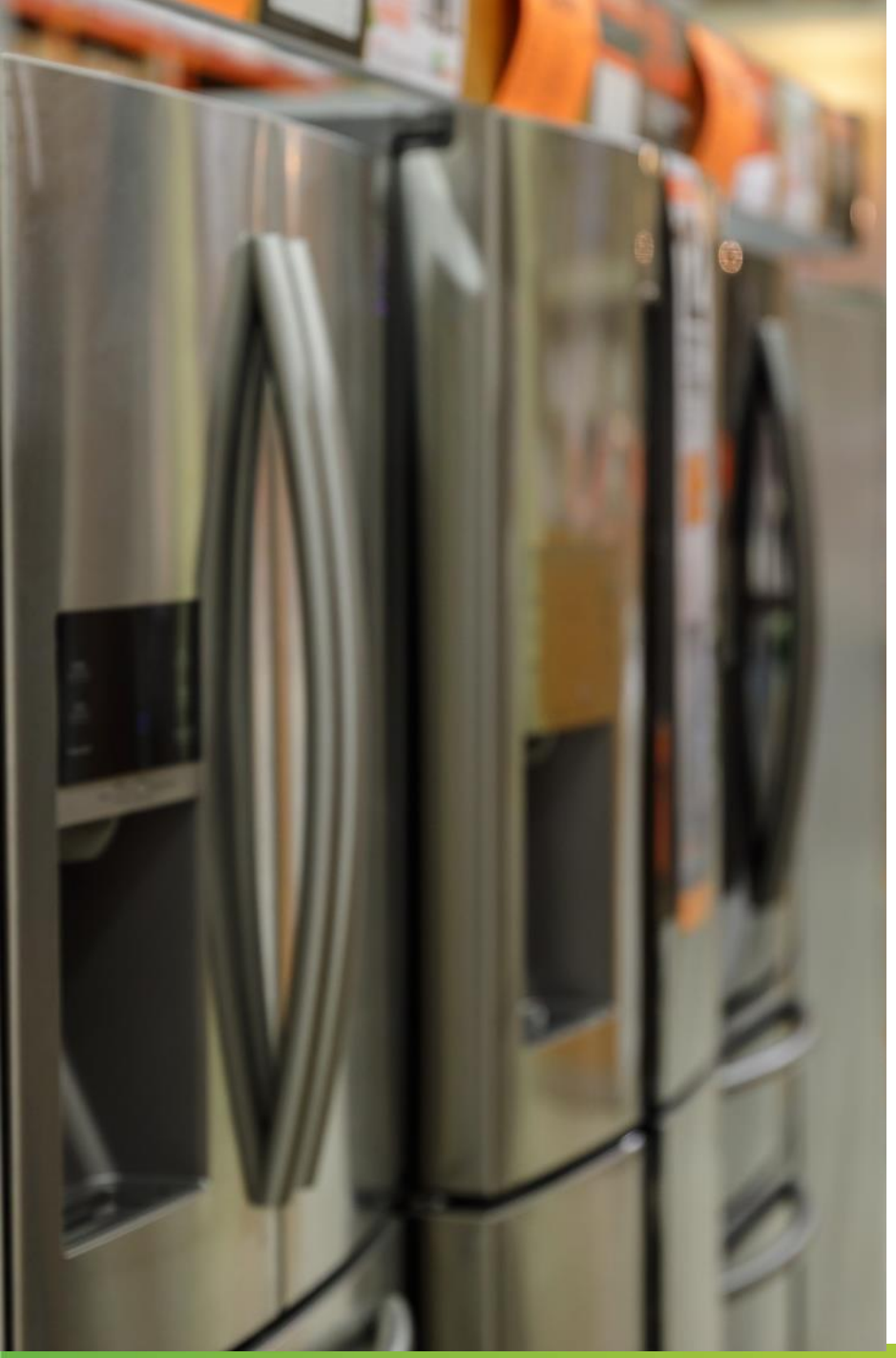
- Using ETA Method 2: Previous generation inverter compressor demonstrates its efficiency
- Near-future state with improved compressor and controls

* NEEA's testing was completed at 72°F (22° C), not 75° F (24° C) as an additional temperature range with the IEC method. The above table is for illustrative purposes only.

What is Currently Available?

- Models from two manufacturers
  - Samsung
  - Beko/Blomberg
  - 12 base models*
  - More manufacturers are planning to participate

QPL available at, https://www.energystar.gov/sites/default/files/asset/document/2020%20ETA%20QPL_Advanced%20Adaptive%20Compressors_0.pdf



How do JUMP and ETA Relate?

JUMP

ETA

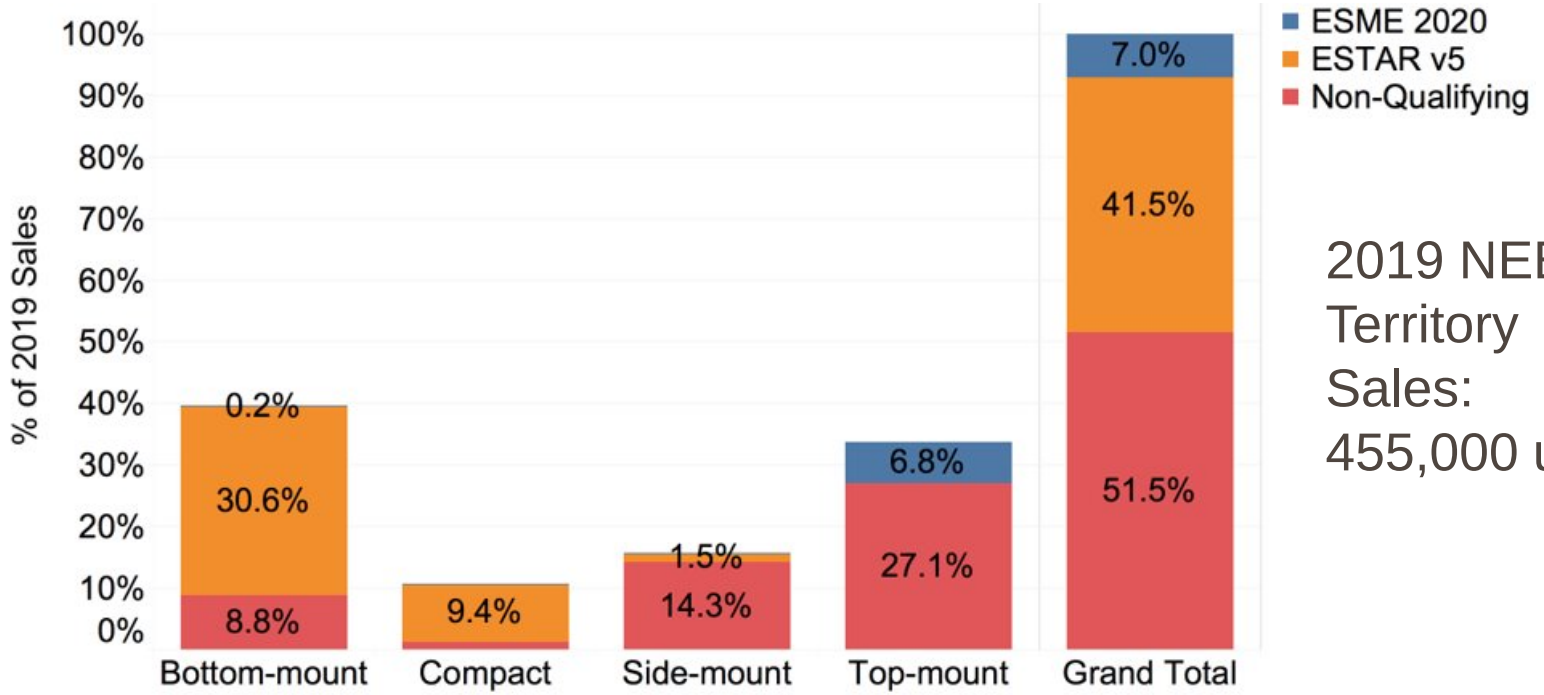
Increased Availability & Adoption

Market Transformation

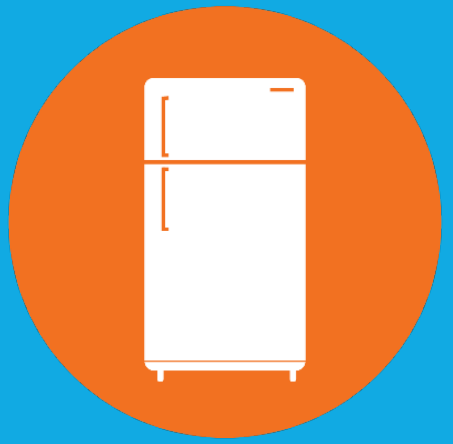
Energy Savings Potential

Market Penetration by Configuration

NEEA Territory 2019 Sales



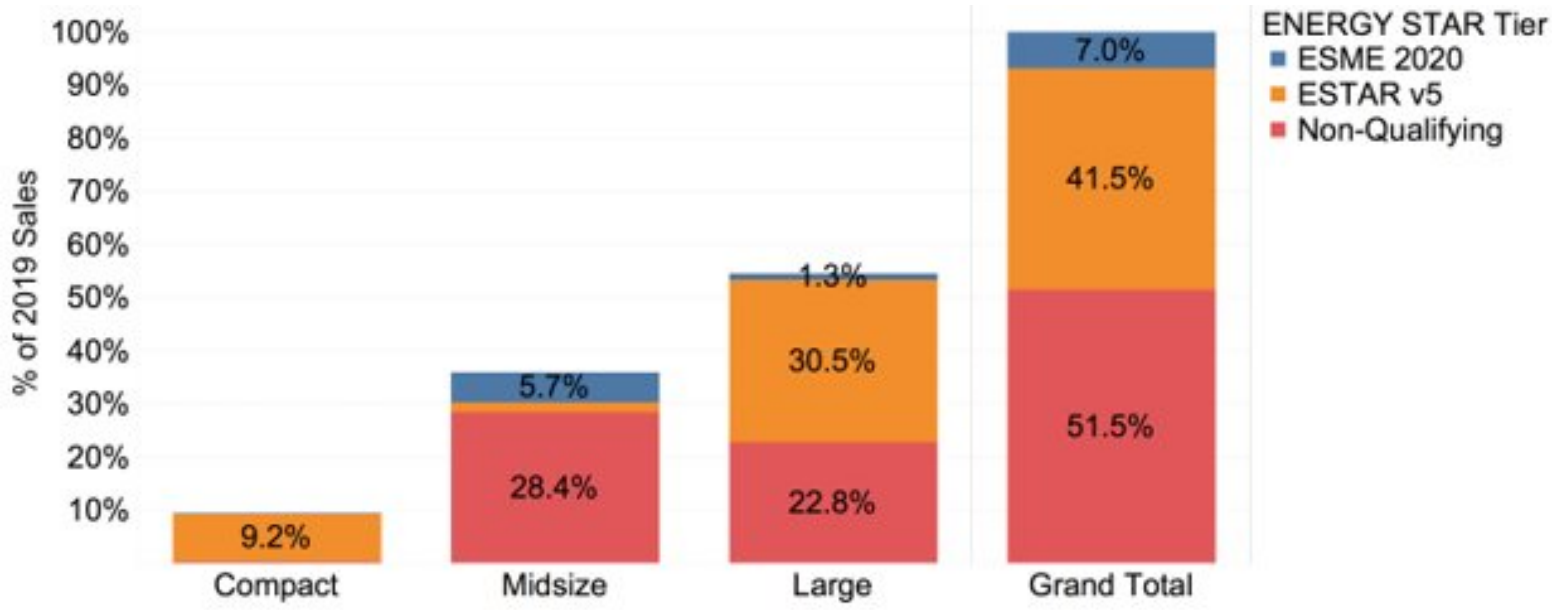
2019 NEEA Territory Sales: 455,000 units



ENERGY STAR v5 has significant market penetration

Retail Sales by Refrigerator Size

Midsize units (7.75^3 ft. – 25^3 ft.) have the highest ESME market penetration



ESME market penetration for midsize units is around **16%**

Energy Savings Forecast

	Annual GWh	5% Shift	10% Shift	15% Shift	20% Shift
		Savings in Annual MWh			
Year 1	0.17	0.4	0.9	1.3	1.8
Year 5	0.17	2.2	4.4	6.5	8.7
Year 10	0.17	4.6	9.2	13.7	18.3

Moving this much of the market

Nets this much savings over 10 years

Consumer Savings

	Annual GWh's	5% Shift	10% Shift	15% Shift	20% Shift
Year 1	0.17	$461,000	$922,000	$1,380,000	$1,840,000
Year 5	0.17	$2,300,000	$4,590,000	$6,900,000	$9,200,000
Year 10	0.17	$4,800,000	$9,600,000	$14,400,000	$19,200,000

- Shifting 5% of the market will save Northwest consumers $4.8 million over 10 years[1]

- Shifting 20% of the market will save consumers $19.2 million over 10 years

[1]Assumes consumer electric rates of $0.12 per kWh

National Savings Potential

- If all refrigerators sold in the United States were 30% more efficient than Federal standards:
  - Energy cost savings would grow to nearly $21 billion each year
  - 27 billion pounds of annual CO_2 emissions avoided

How do we move forward?

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What does success look like?

- Utilities can claim JUMP refrigerator energy savings
- Addition of multiple manufacturers to Emerging Tech Program
- Retailers and wholesalers stocking units
- Buy-in from multiple utilities to support more-efficient refrigerators
  - Mid-stream incentives through ENERGY STAR Retail Products Program (ESRPP)
  - Multi-family housing programs
  - Low-Income programs
  - Others

In Closing

- If you're interested in NEEA's research please contact me
- For more information on Market Transformation, NEEA's mission, and market intervention success stories, visit neea.org
- We will now open the floor to questions.

Eric Olson

Senior Product Manager, NEEA

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