# Testy Testing Makes for Better Transformation

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NORTHWEST ENERGY EFFICIENCY ALLIANCE

# Super Efficient Clothes Drying

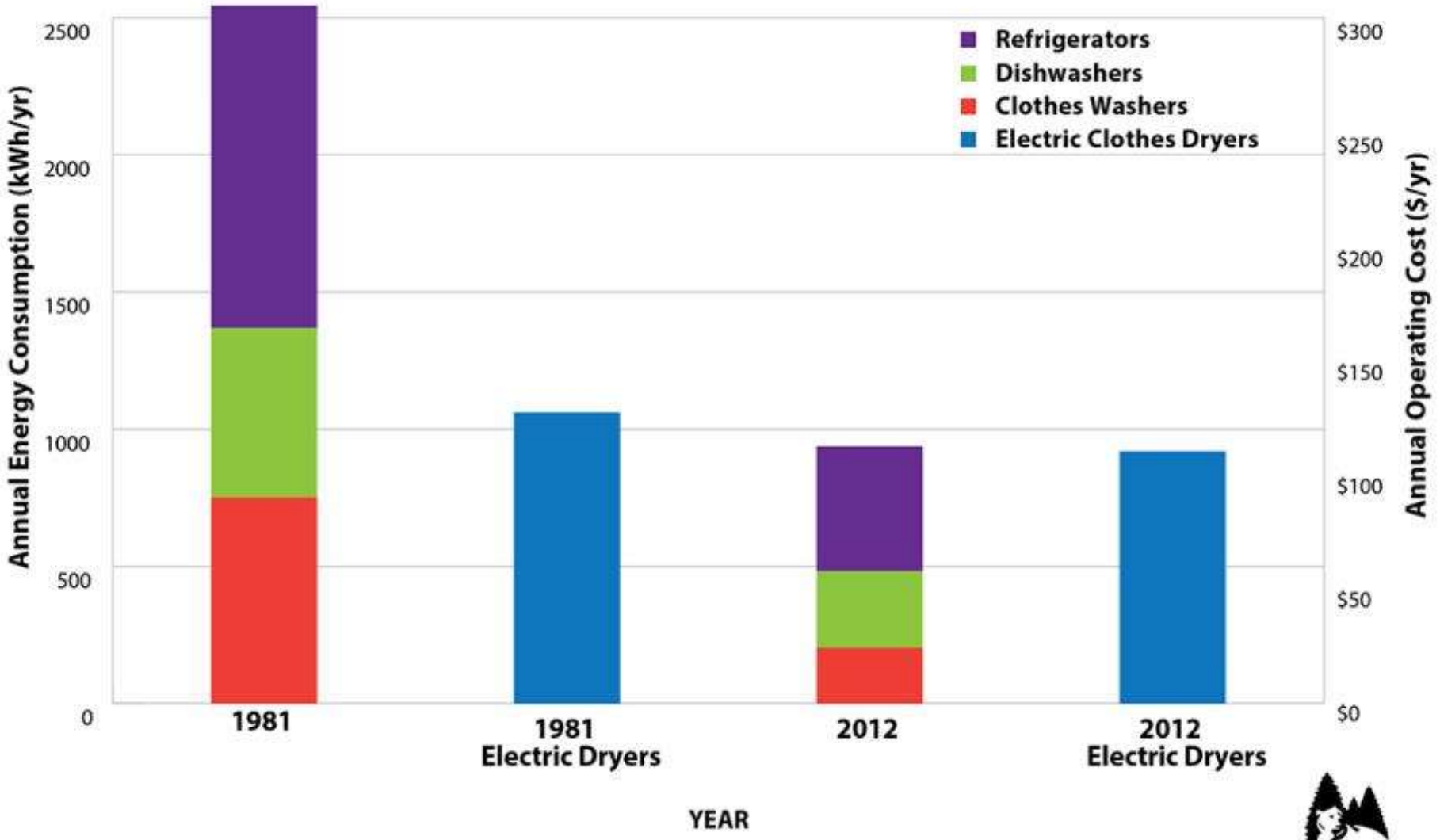
# Outline

- Background
- Field Data
- Supplemental Test
- Recent Lab Data
- Next Steps
  - Performance Baseline
  - Multi-Tiered Specification


"I thought you wanted a clothes dryer."

# Energy Use Comparison

**Figure 1. Annual energy consumption of electric clothes dryers vs. other major home appliances, 1981 and 2012**




*Source:* Data for refrigerators, dishwashers, and clothes washers from the Association of Home Appliance Manufacturers on new purchases. Data for dryers estimated from a collection of field studies conducted over the past four years by Ecova and others.

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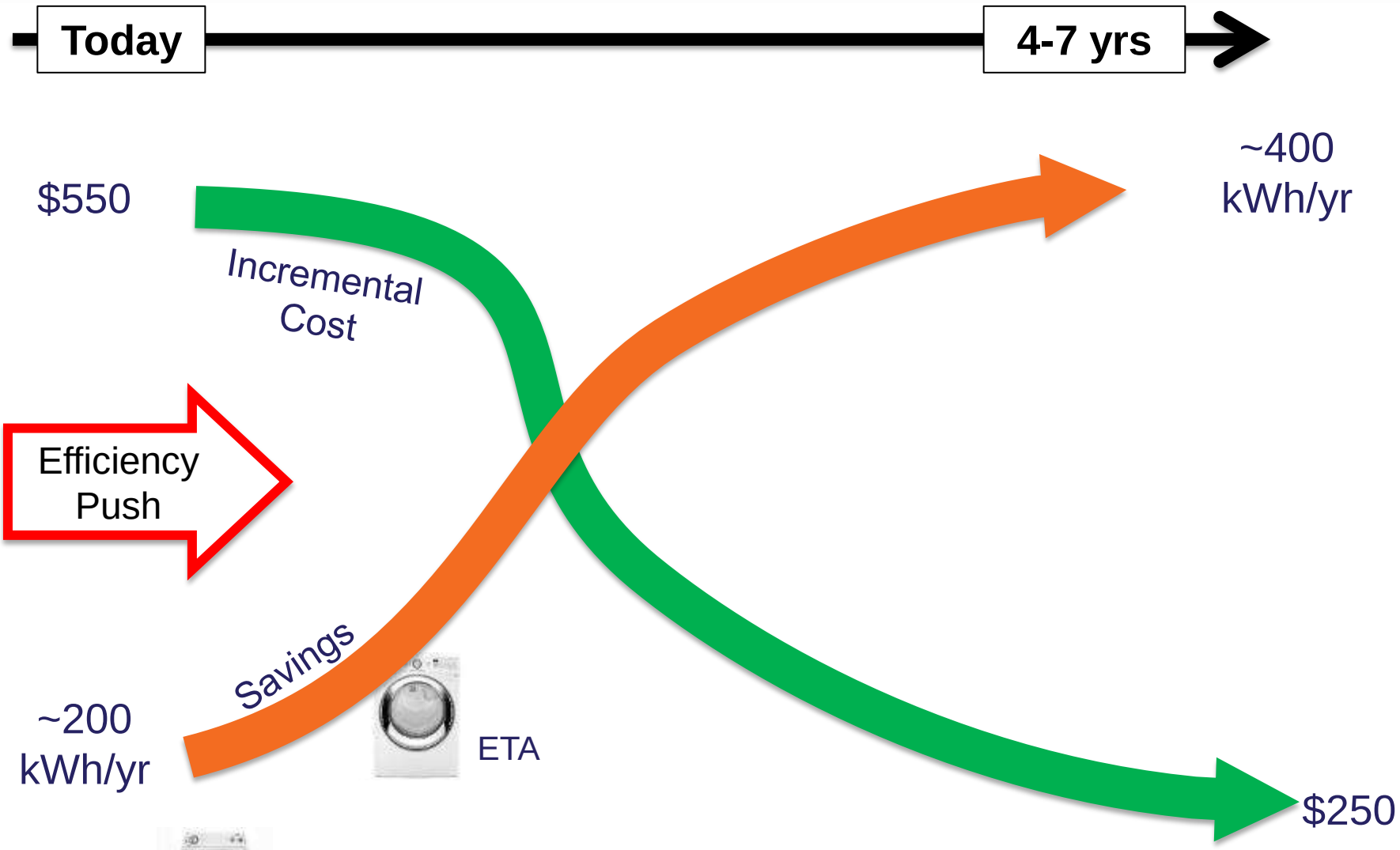
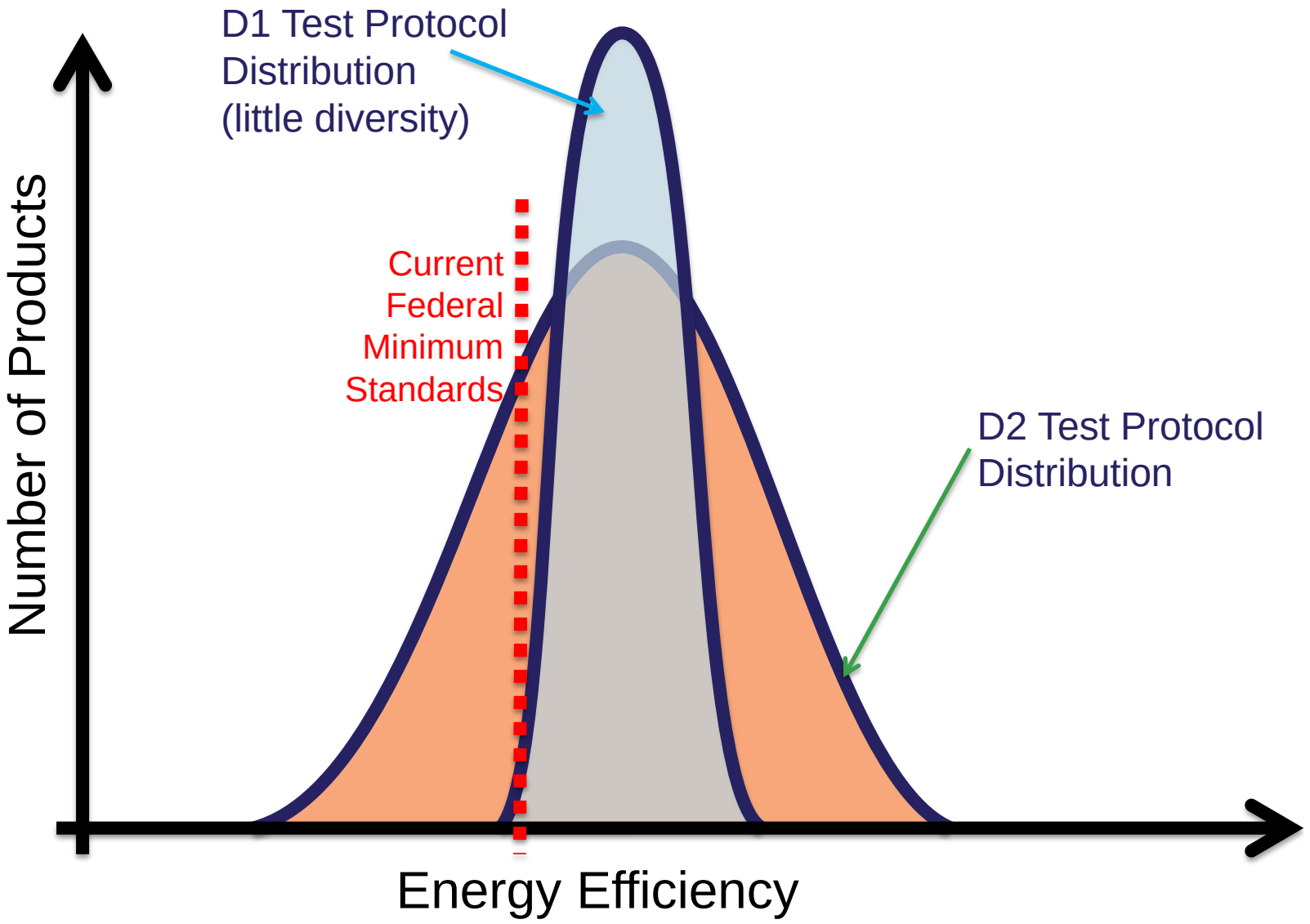
# Barriers

- No US product
- Lack of test protocol
- High initial cost
- Market awareness
- Existing dryers are high profit margin products for manufacturers
- Consumer barriers
  - Longer drying time (10-40 min)
  - Installation and Operational differences
  - Consumers might not operate them efficiently

# Dryer Market Transformation



# Test Protocol → Product → Standard



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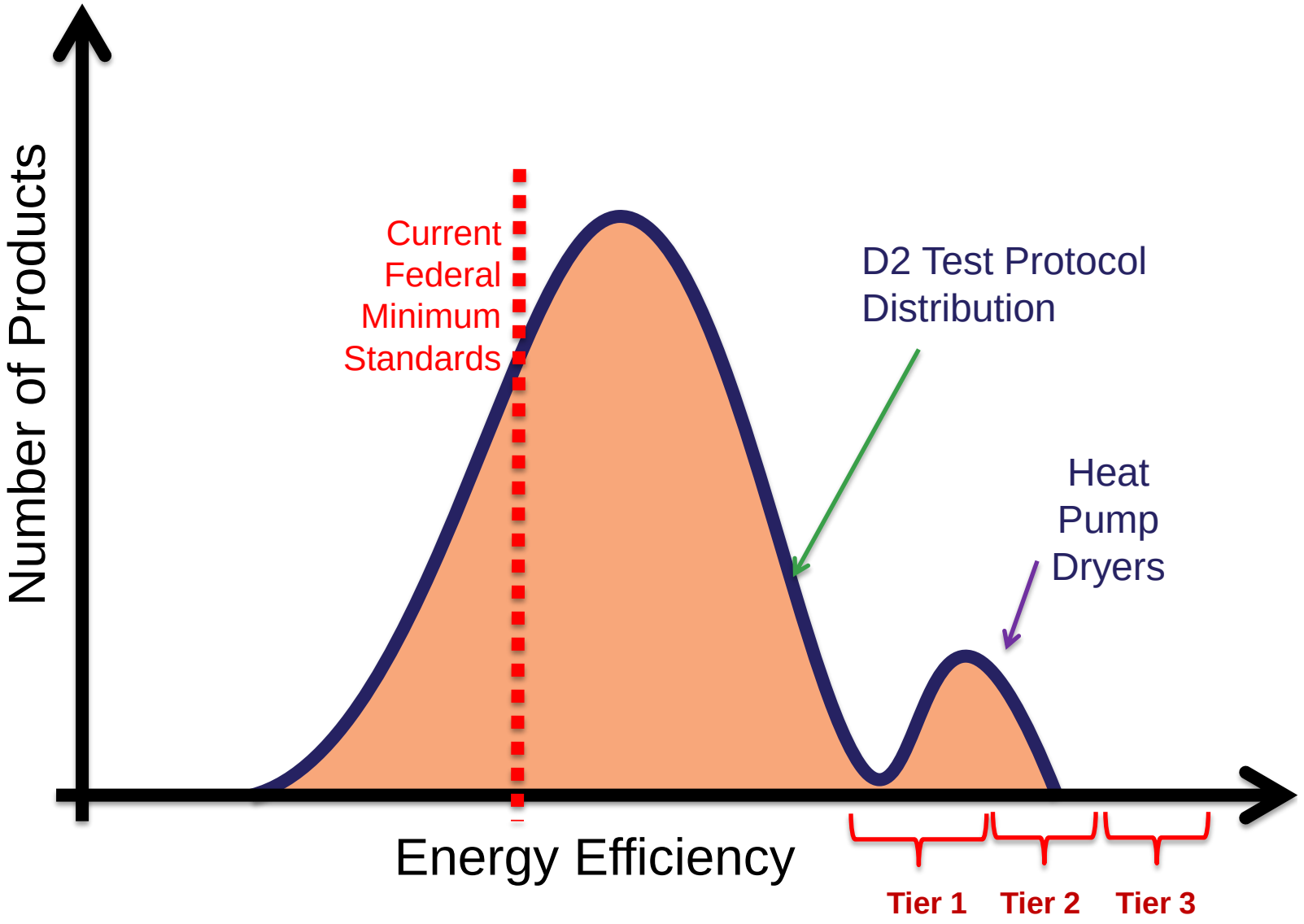

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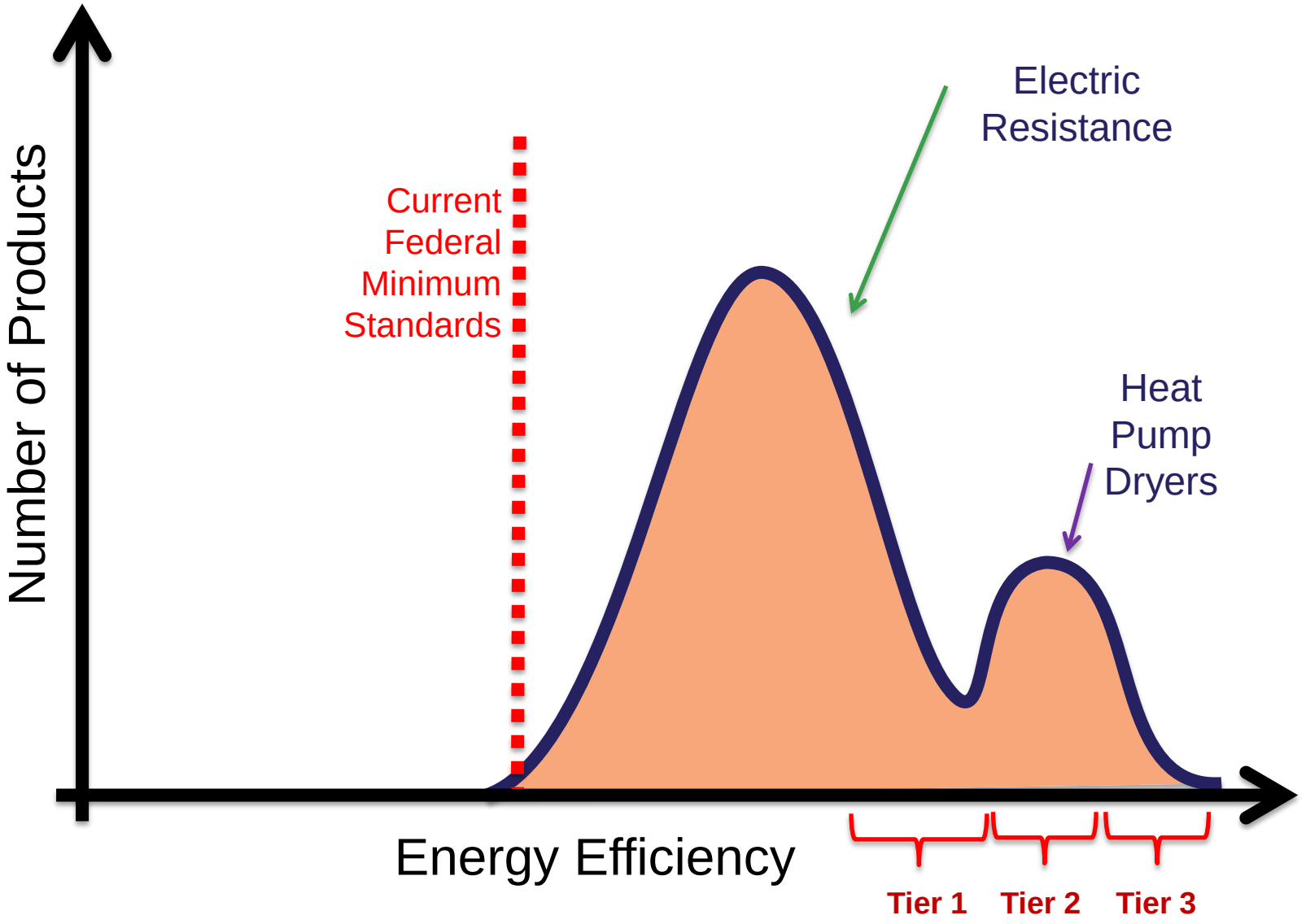

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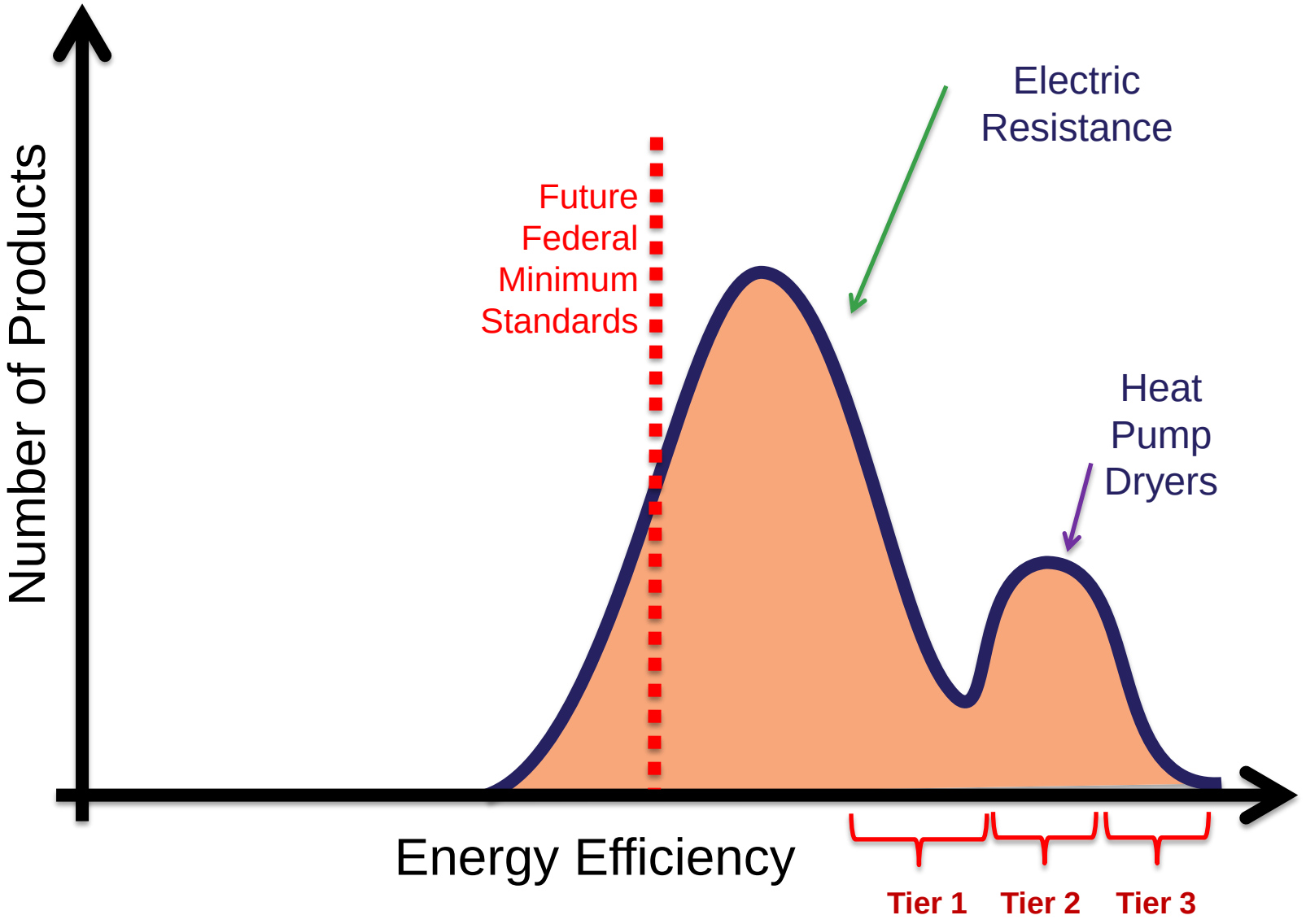
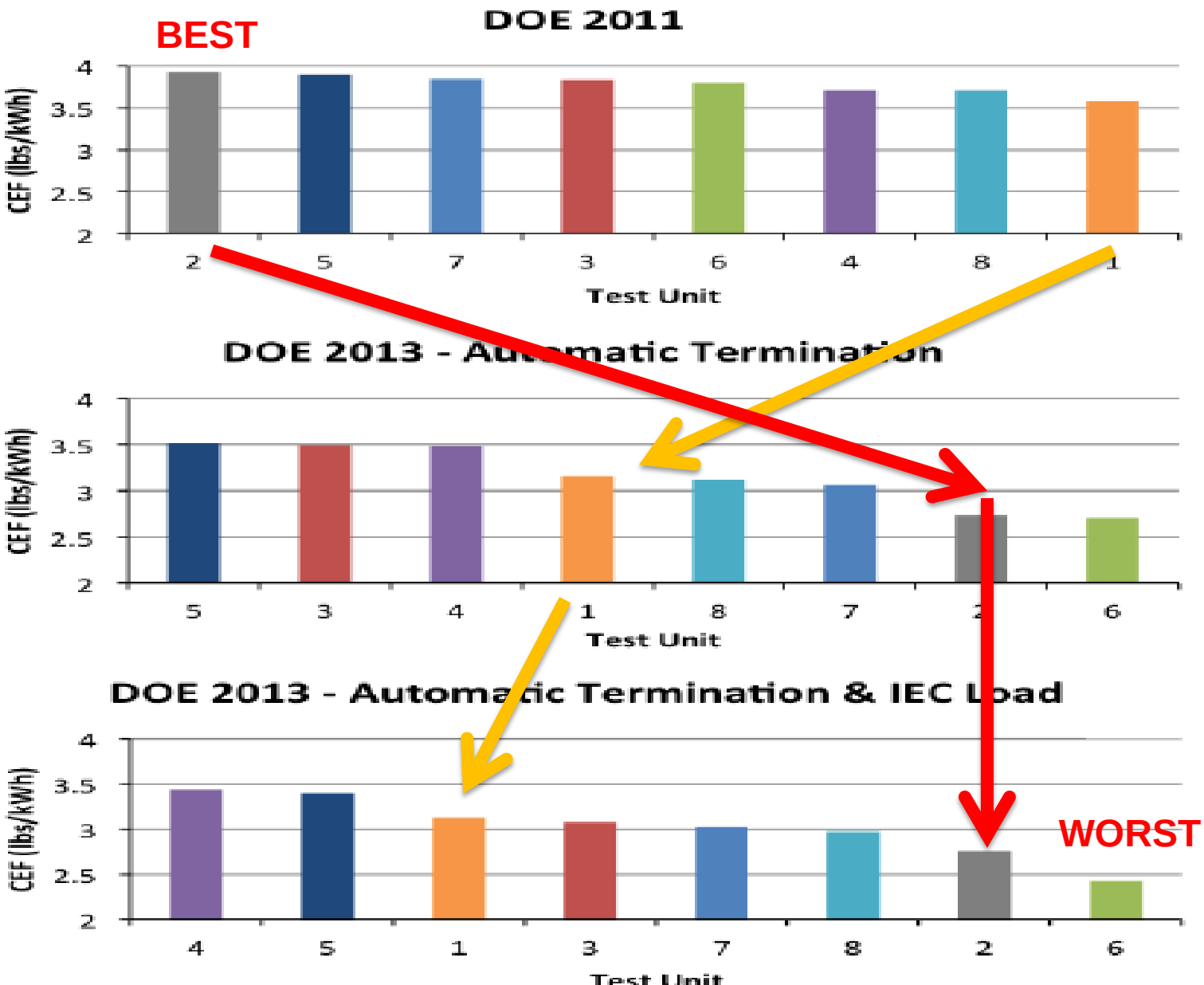


# Testing - Impacts Relative Ranking

**DOE 2011 ~"D1"**

**DOE 2013 ~"D2"**

**"Real World"**



# Laundry Field Study 2012

# Laundry Field Study

## Residential Building Stock Assessment

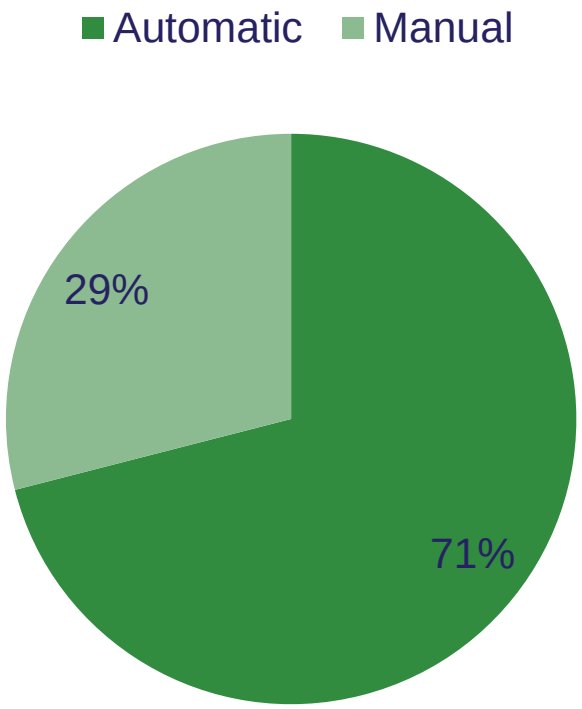
- Approximately 1,850 homes

## Laundry Supplemental Study

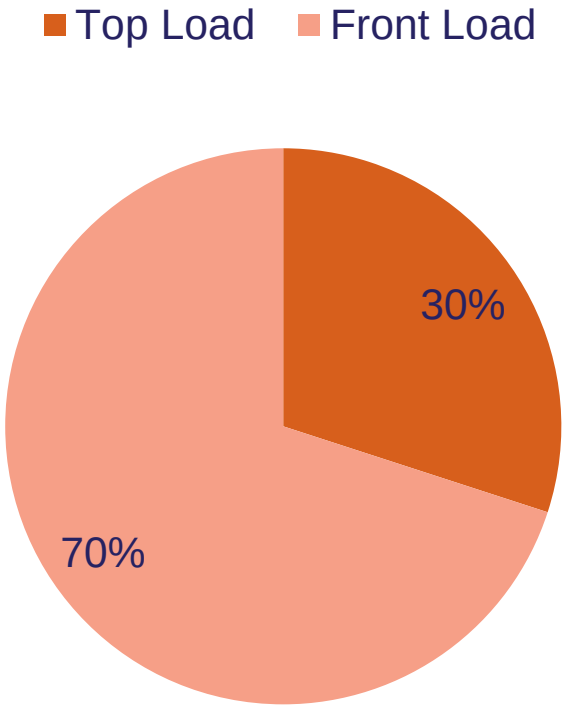
- Final report due July
- 50 sites – 1 month
- Statistically significant sample
- 2005 and newer models
- 3 weight measurements
- kWh monitoring of both washer and dryer
- Participants paid to provide load and setting  details

# Equipment Type

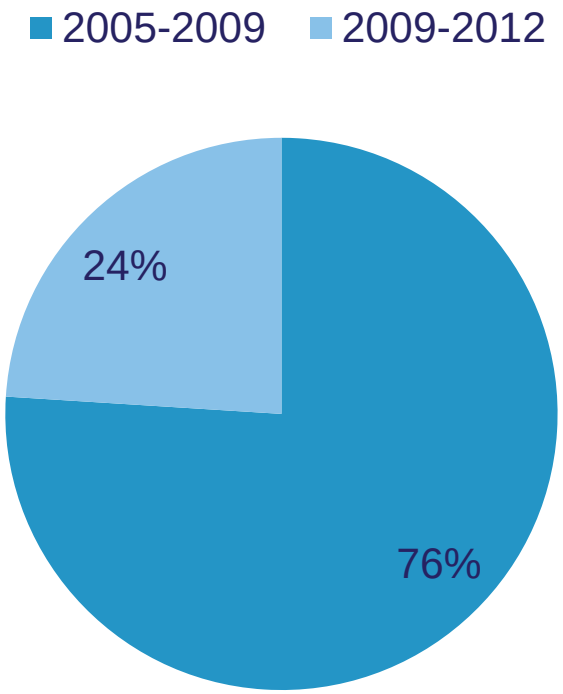
## Termination



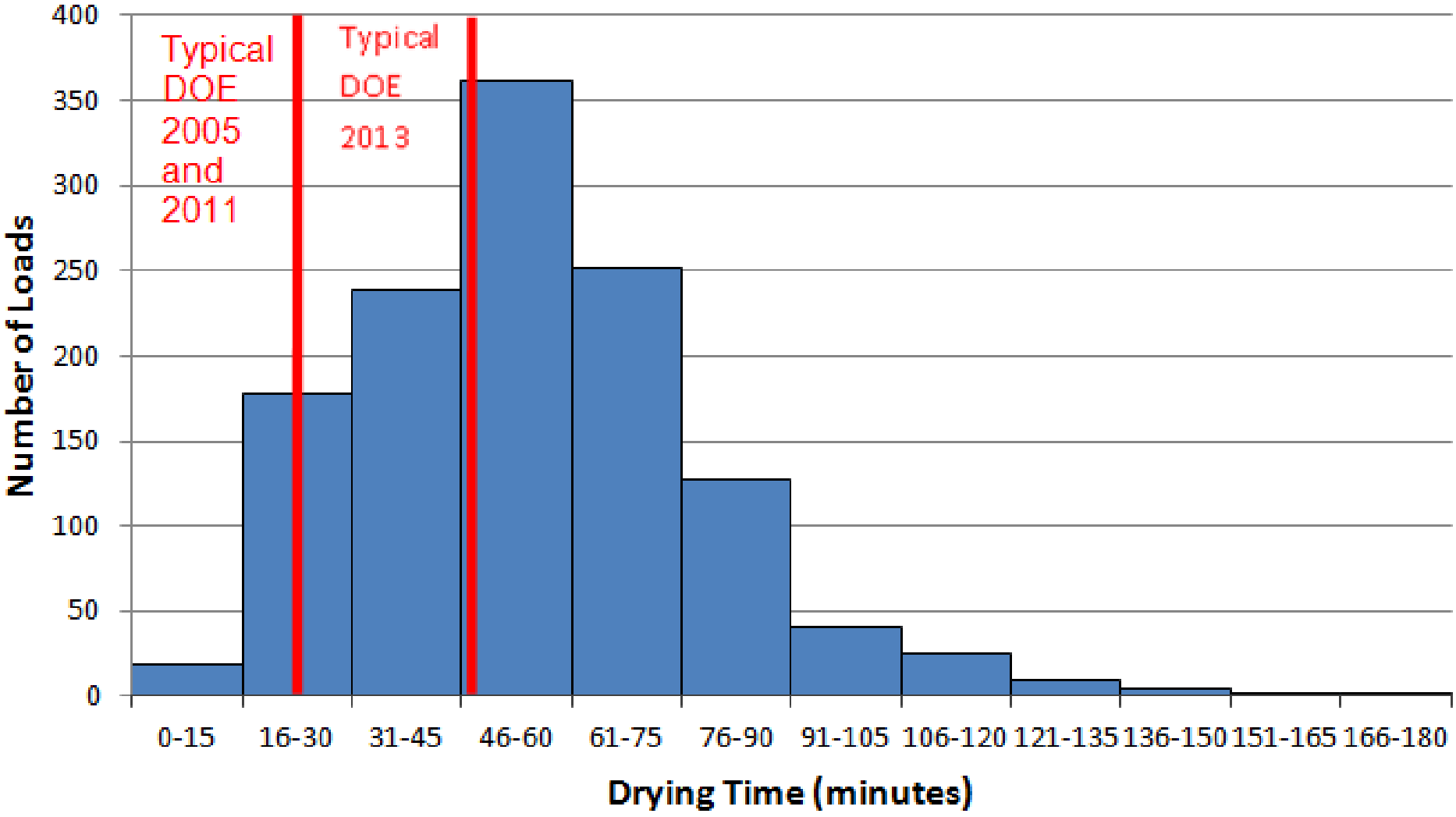

## Paired Washer Type



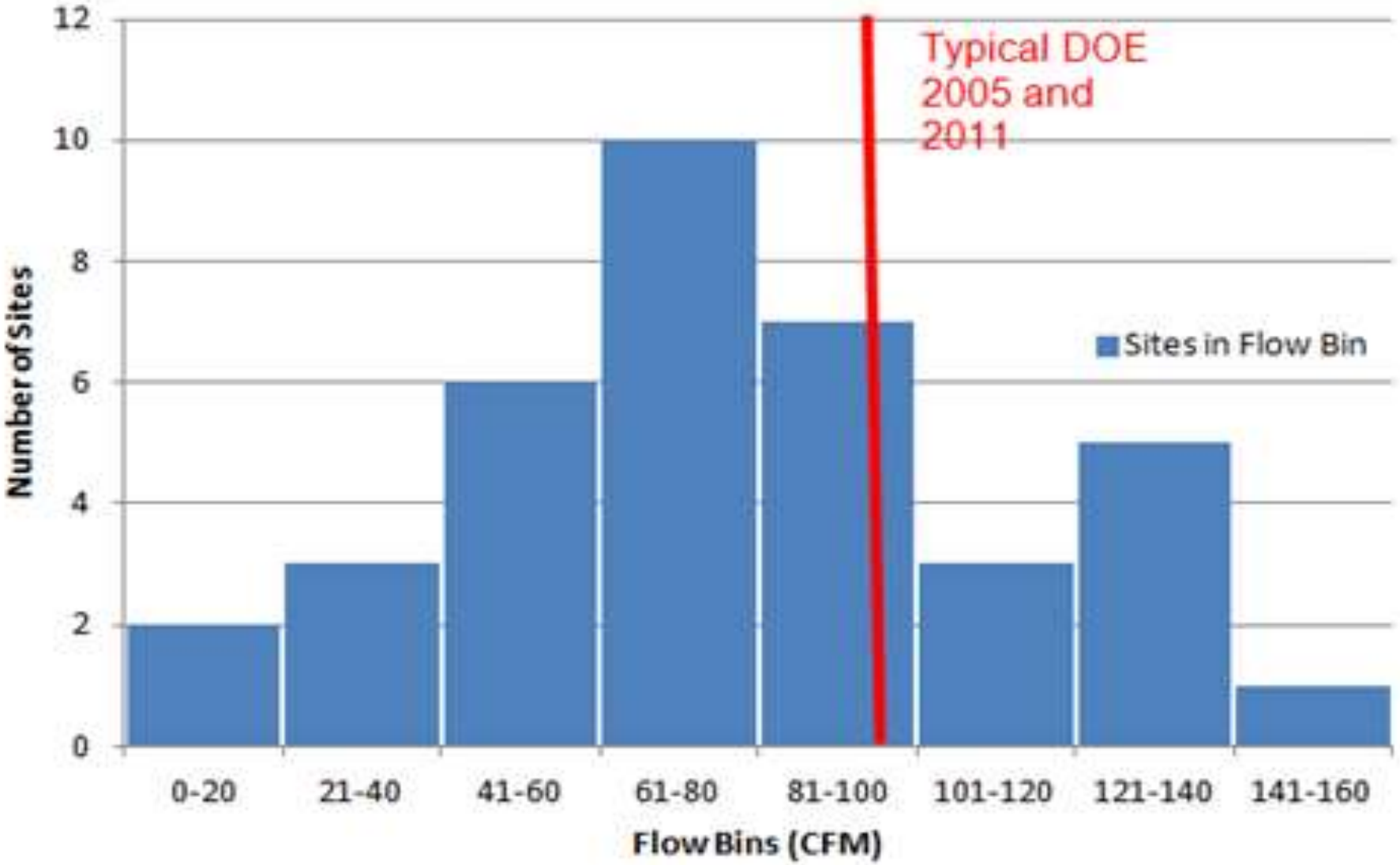

## Year Manufactured



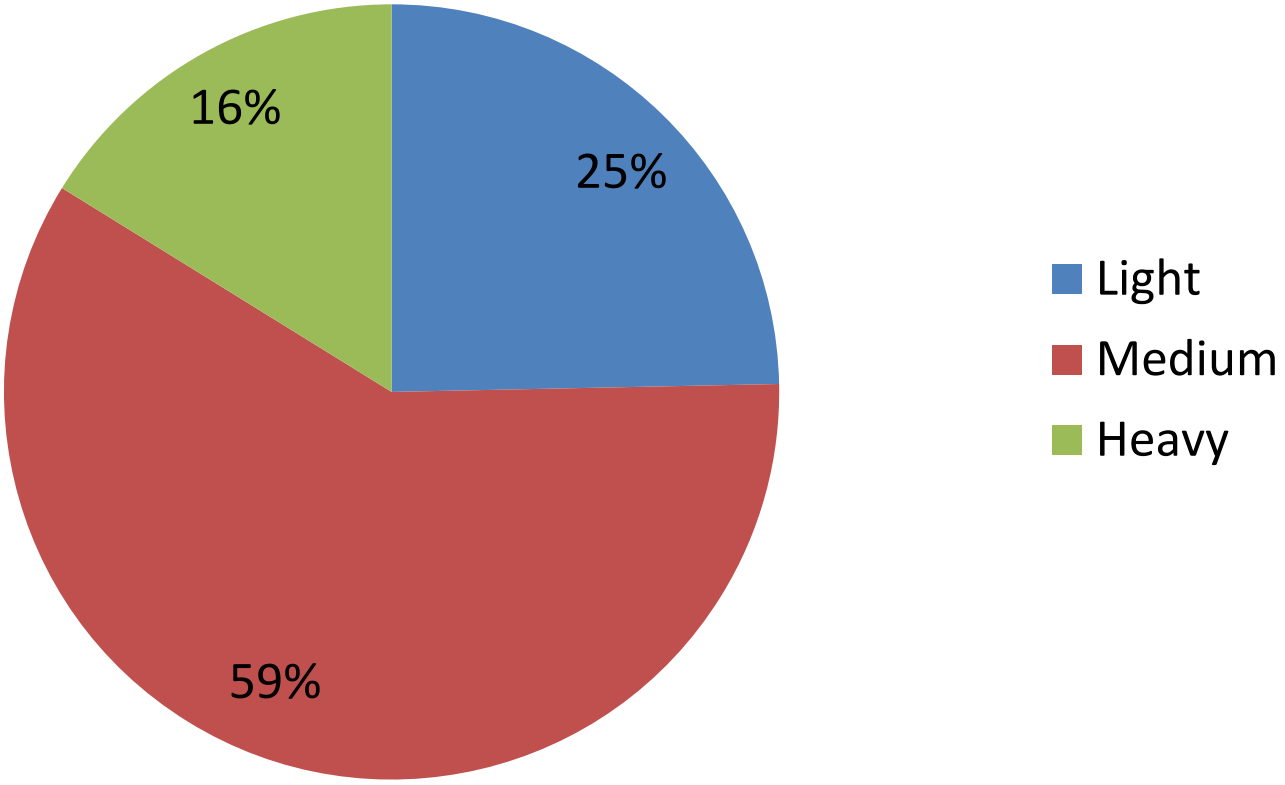
# Drying Time


Typical DOE 2005 and 2011
Typical DOE 2013
Number of Loads
400
350
300
250
200
150
100
50
0
0-15
16-30
31-45
46-60
61-75
76-90
91-105
106-120
121-135
136-150
151-165
166-180
Drying Time (minutes)

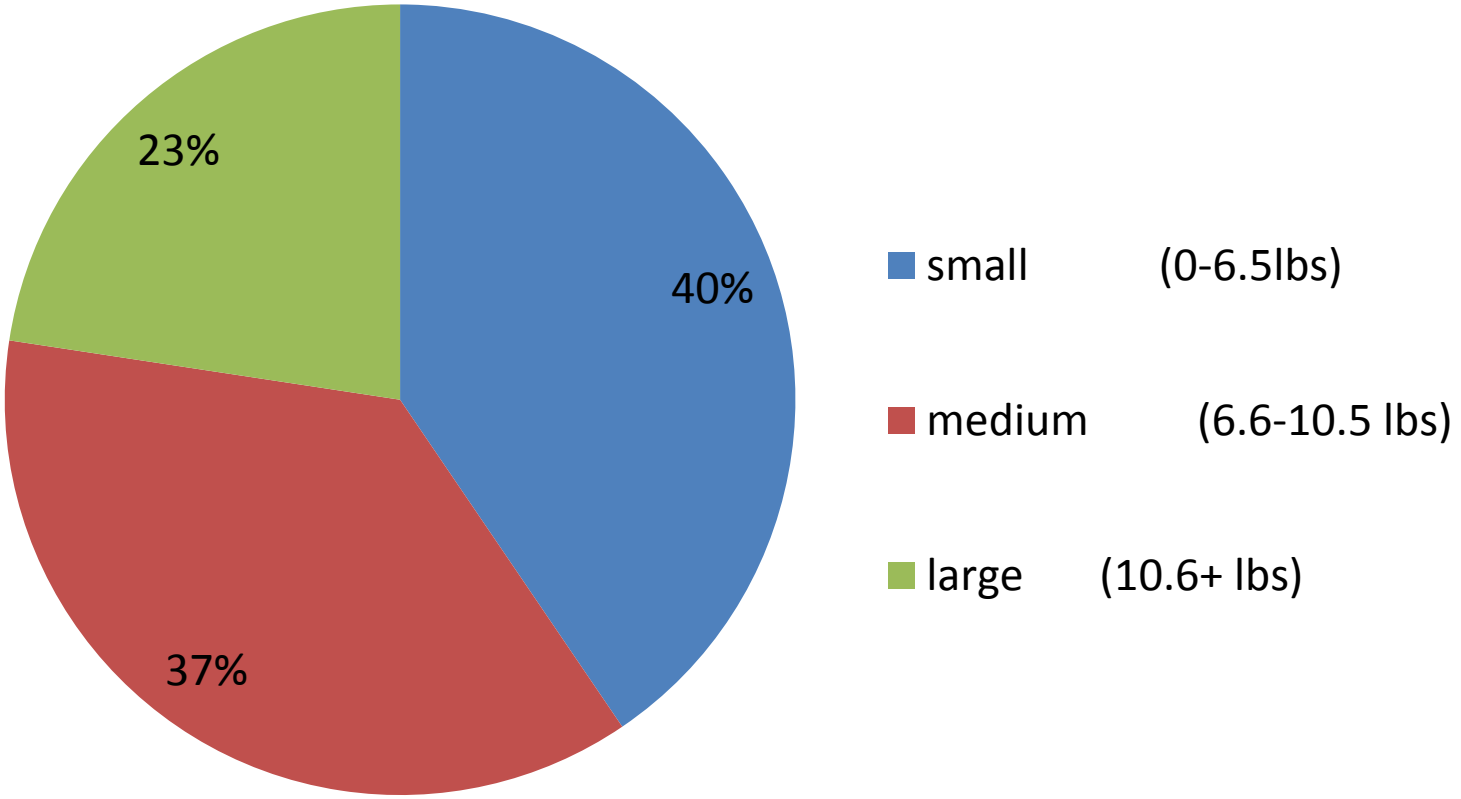
# Air Flow Rate



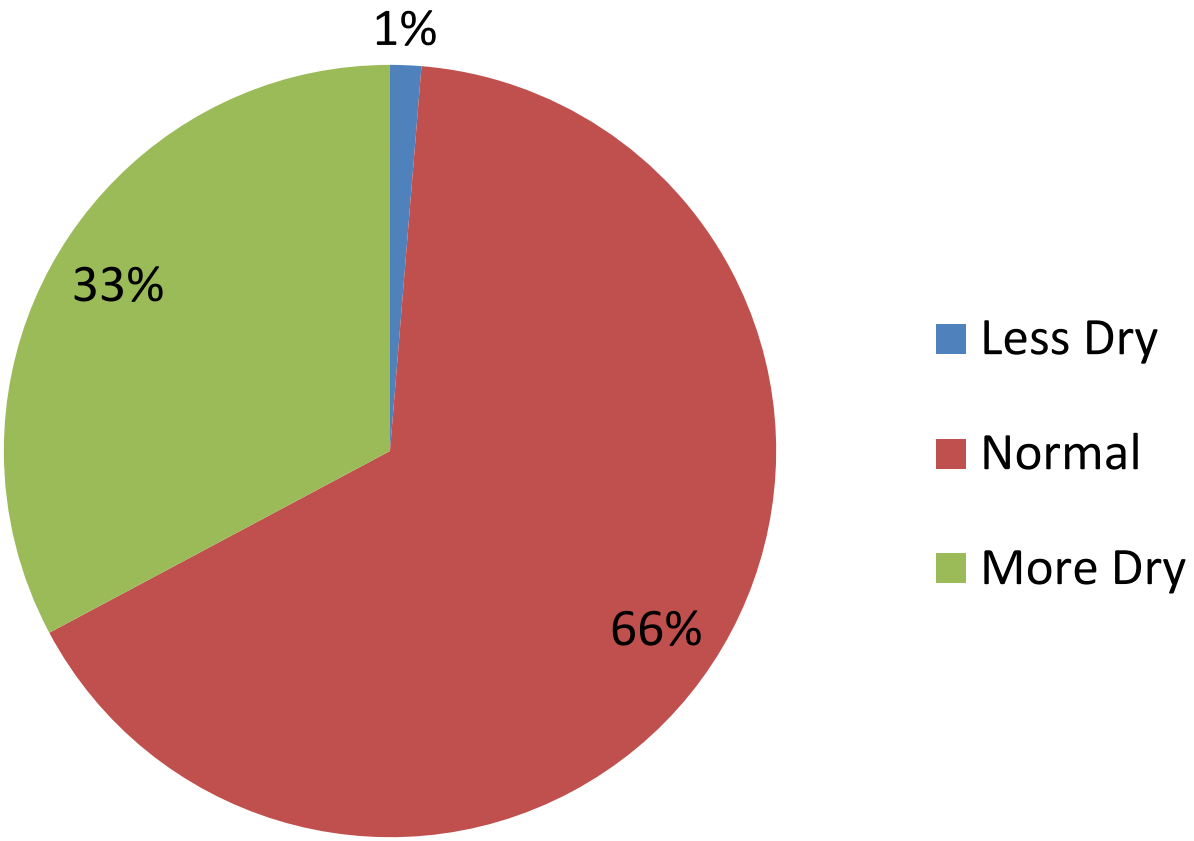
# Dryer Clothing Setting



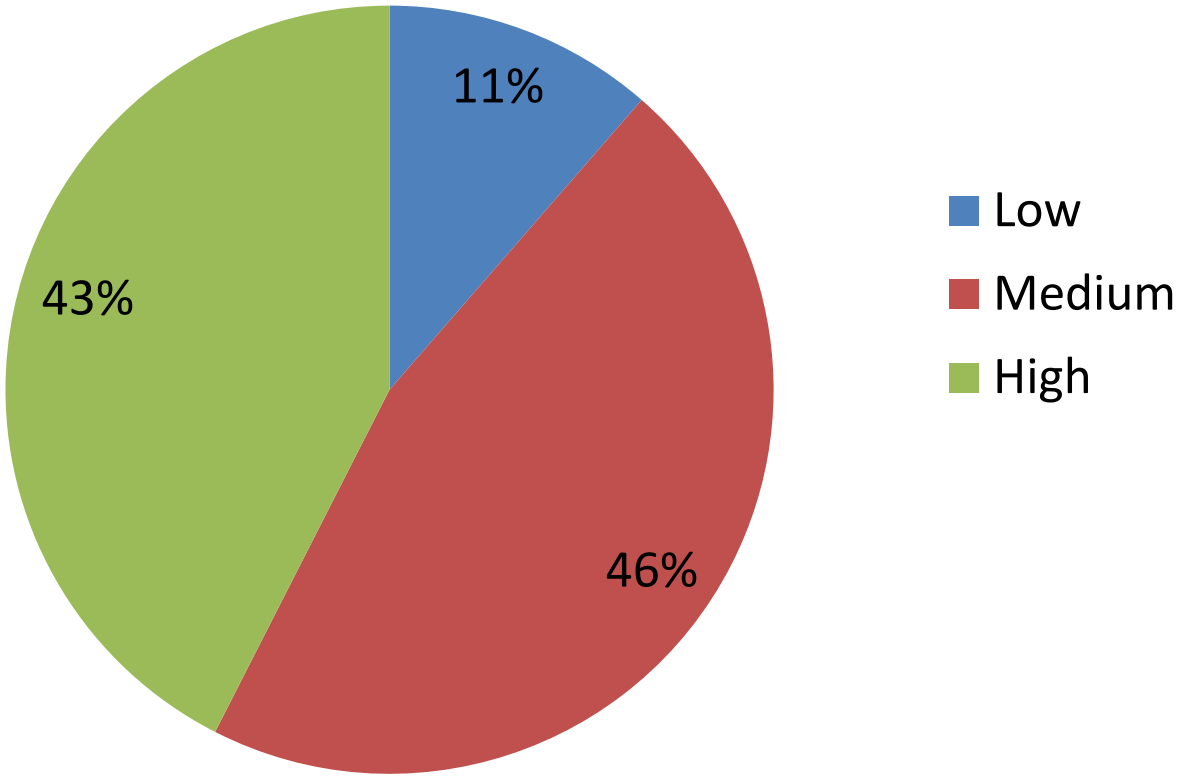
# Load Weight



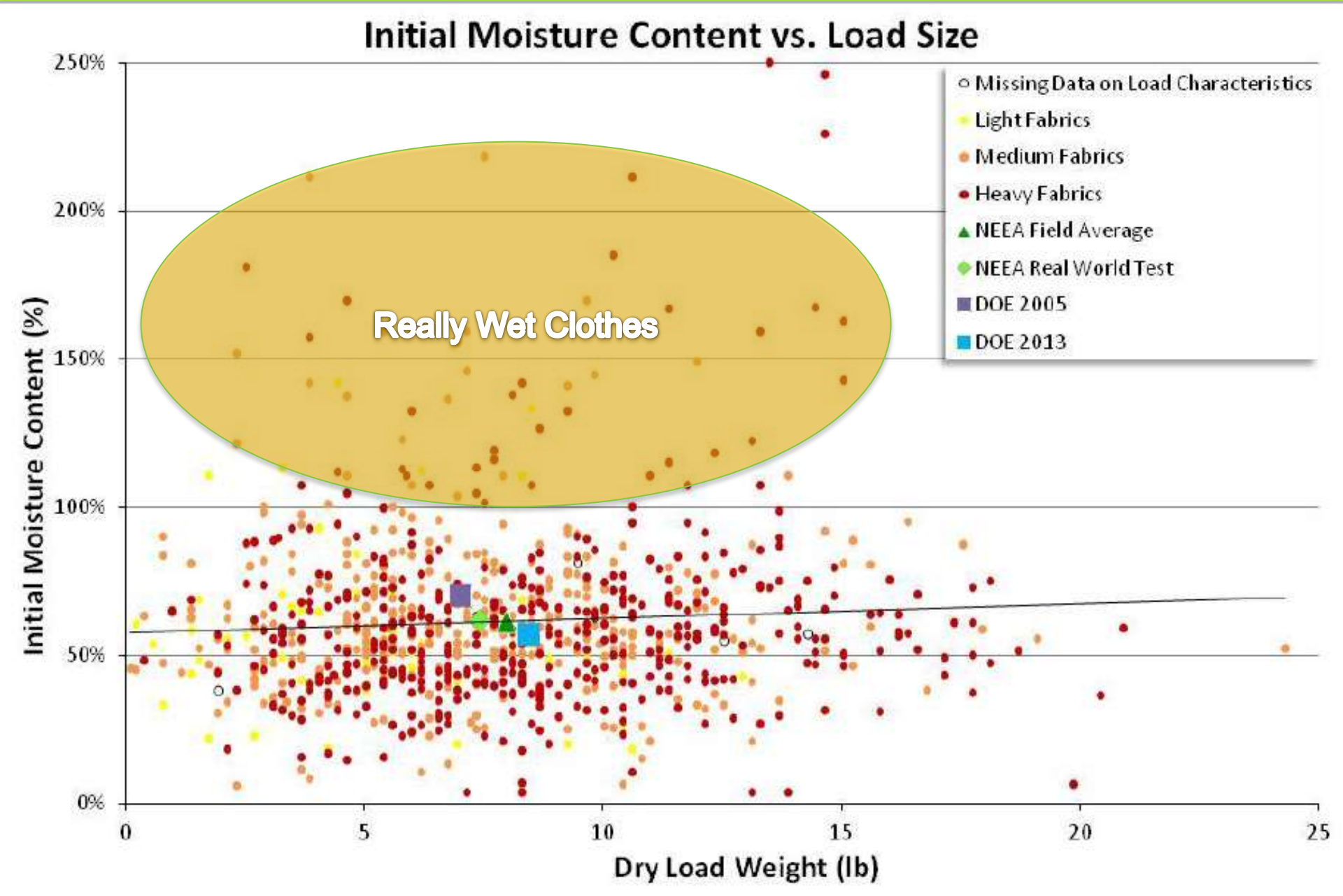
# Dryness Setting



# Dryer Temperature Setting



# NEEA Field Data Showed Huge Diversity

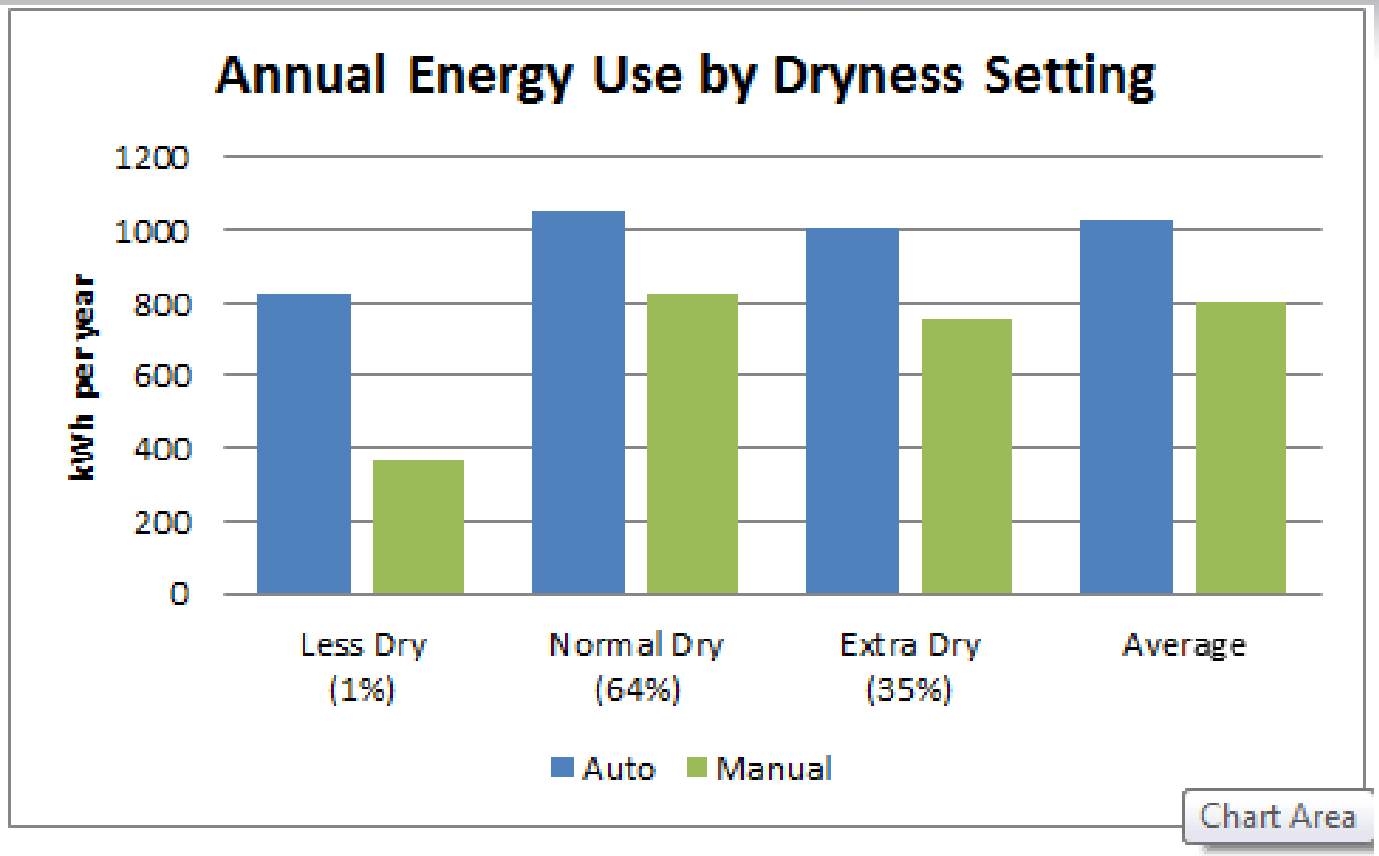


# Field Testing vs. Test Conditions

| | | Temperature Setting | | | | |
|---|---|---|---|---|---|---|
| | | Low | Medium | High | Total | Avg. Wt (lbs) |
| Load Weight | 0-6.5 lbs | 6.6% | 17.4% | 16.5% | 40.5% | 4.3 |
| | 6.6-10.5 lbs | 3.0% | 20.8% | 13.1% | 36.9% | 8.5 |
| | 10.6-25 lbs | 3.0% | 12.9% | 6.7% | 22.6% | 13.1 |
| Total | | 12.60% | 51.10% | 46.10% | | |

*Load weight represents the net weight of the dry load going into the washer

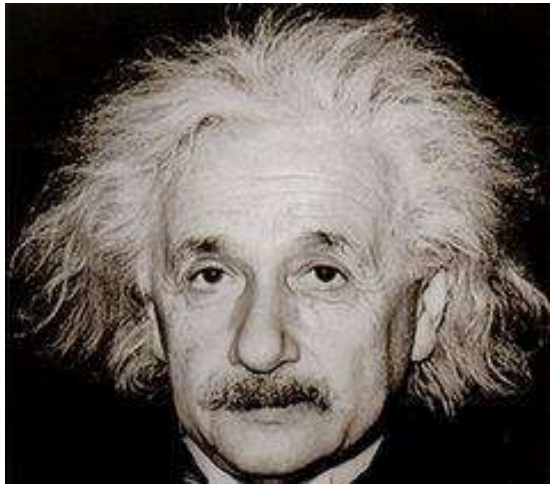
# Annual Energy Use




**Annual kWh by Dryness Setting**

| | All Loads | | | Simple Loads | | |
|---|---|---|---|---|---|---|
| Setting | Auto | Manual | Delta | Auto | Manual | Delta |
| Less Dry | 825 | 367 | 458 | 825 | 573 | 252 |
| Normal Dry | 1054 | 825 | 229 | 916 | 825 | 92 |
| Extra Dry | 1008 | 756 | 252 | 1008 | 710 | 298 |
| Average | 1031 | 802 | 229 | 939 | 825 | 115 |

# Results Are Conclusive  Smart = Good

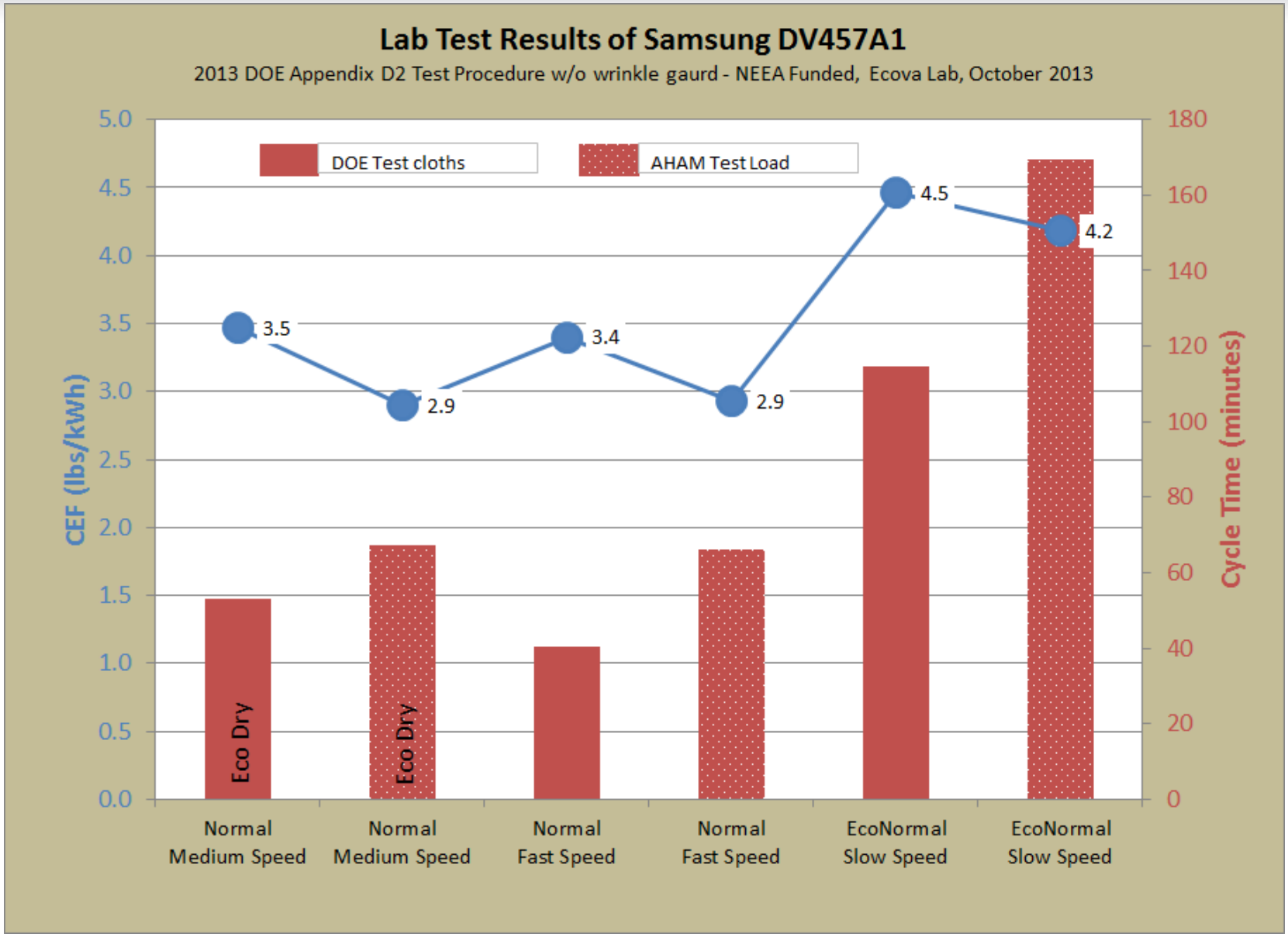



802 kWh/yr

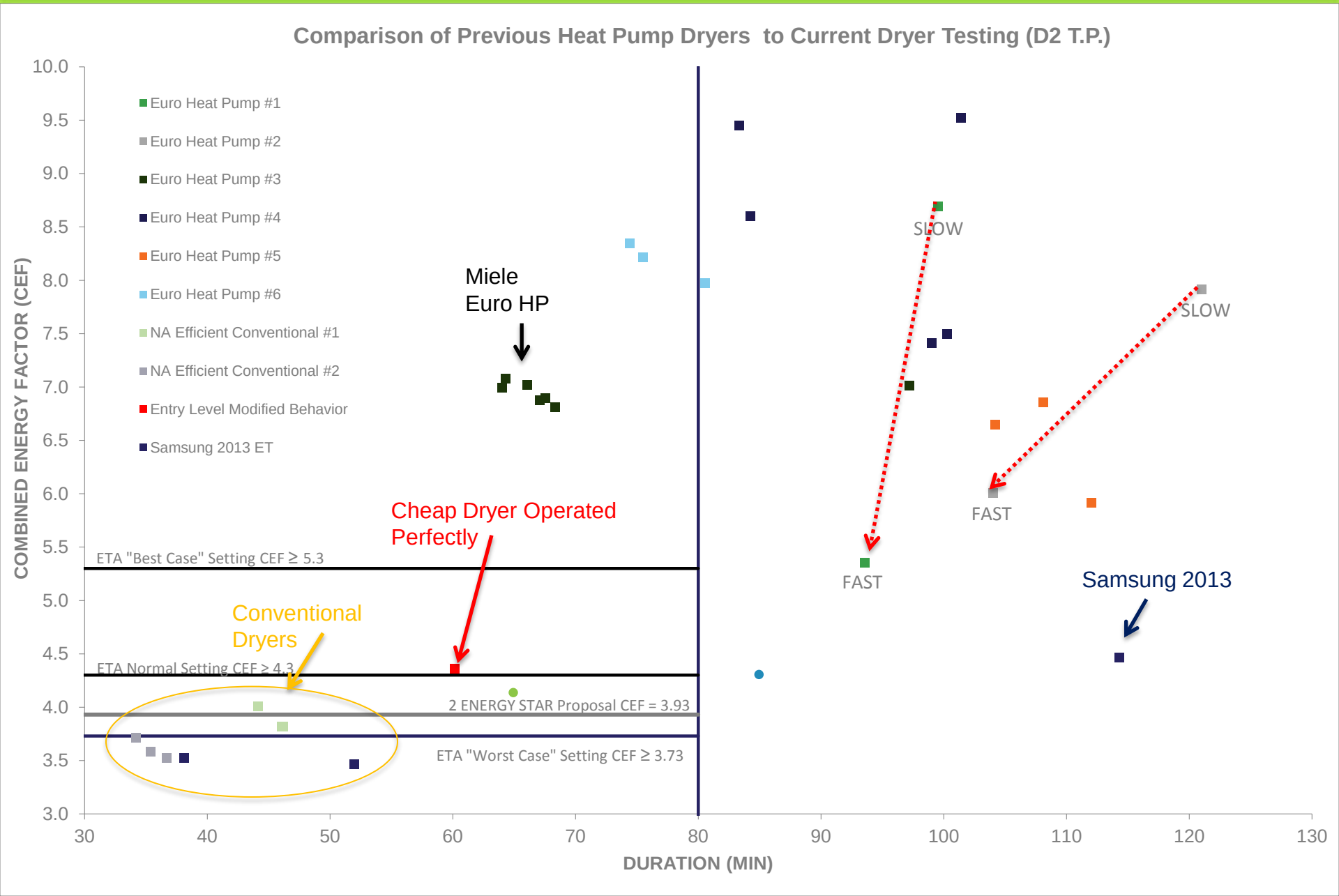

? kWh/yr

# LAB Data

# Samsung DV457A1 Lab Testing



# Lab Data - D2 Test Procedure



# NEEA & PG&E's "Supplemental Test"

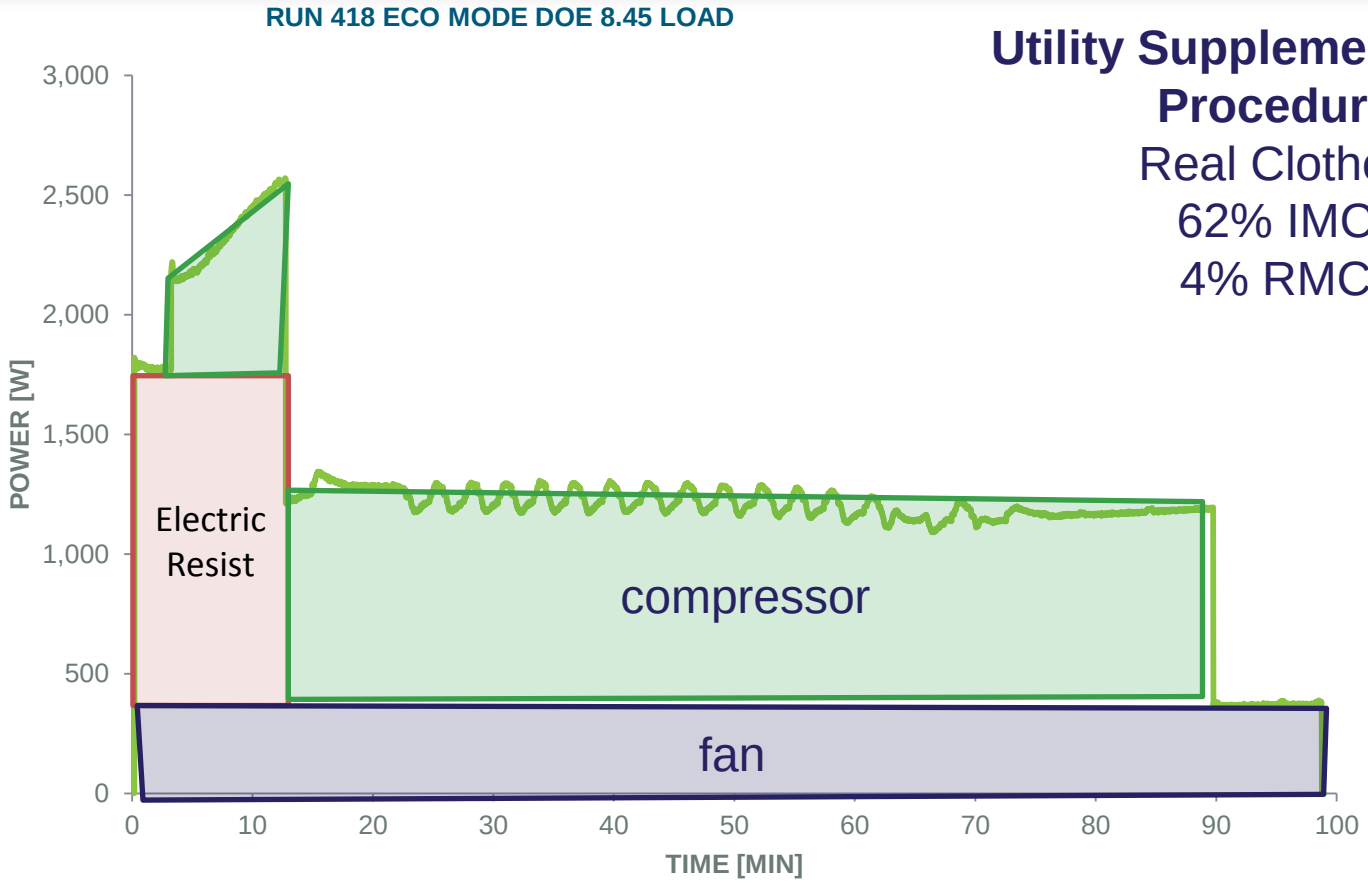
Concept: Combine D2 test results with additional tests runs using real clothing in multiple operational modes.

Benefit

- Increased accuracy of relative ranking
- Correlation to field results
- Eliminates optimization for just one test condition with non-realistic clothing type

# Small Realistic load = 4.3 lbs

# 2014 HP Dryer Lab Test Results




**Utility Supplemental Test Procedure**

Real Clothes

62% IMC

4% RMC

# Early Lab Results Comparison

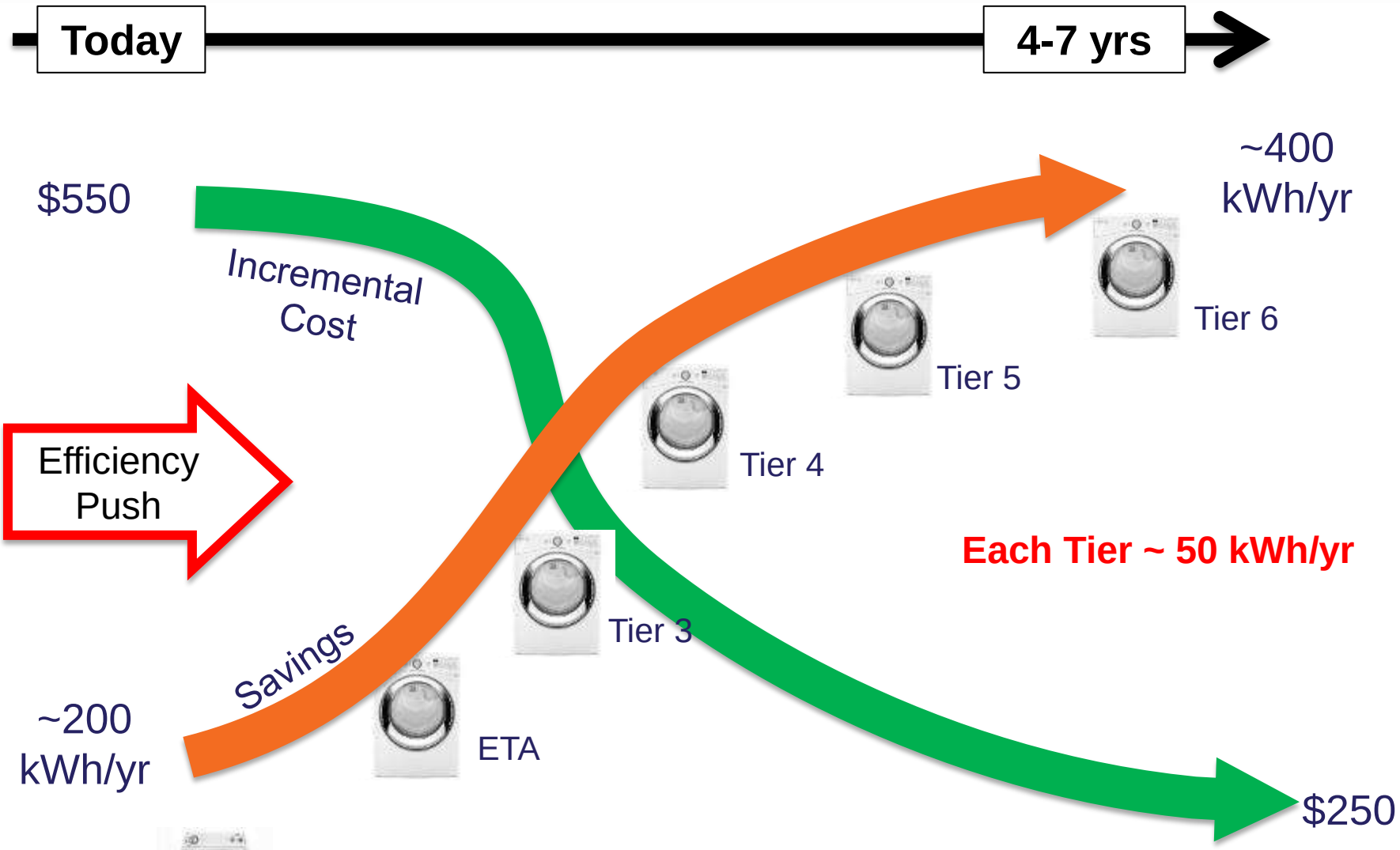
| Normal Cycle<br>Normal Temp<br>Normal Dryness | Combined Energy Factor (lbs/kWh) | | | Drying Time (minutes) | | |
|---|---|---|---|---|---|---|
| | DOE | Real Clothing | % change | DOE | Real Clothing | % change |
| Good HP | 6.9 | 4.6 | -34% | 67 | 93 | 38% |
| Conventional Electric Resist | 3.6 | 2.6 | -28% | 35 | 63 | 76% |
| Hornet | NDA | | -19% | NDA | | 15% |
| Condor | | | -31% | | | 57% |

## Rank Order Changed with Real Clothes



Hornet and Condor Products are pre-algorithm finalization

# Multi-Tiered Specification



# Questions

## Questions?

Verification that Americans can’t use European Dryers

# Questions & Comments

Filling the Energy Efficiency Pipeline

Accelerating Market Adoption

Delivering Regional Advantage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