Workshop Presentations
2008 California Building Energy Efficiency Standards
July 12, 2006

Part 1: Furnace Fan Watt Draw and Airflow in Cooling Mode

Part 2: Air Conditioner Airflow, Refrigerant Charge, and TXVs

Bruce Wilcox, P.E.
John Proctor, P.E., Proctor Engineering Group, Ltd.
Ken Nittler, P.E., Enercomp, Inc.
Rick Chitwood, Chitwood Energy Management

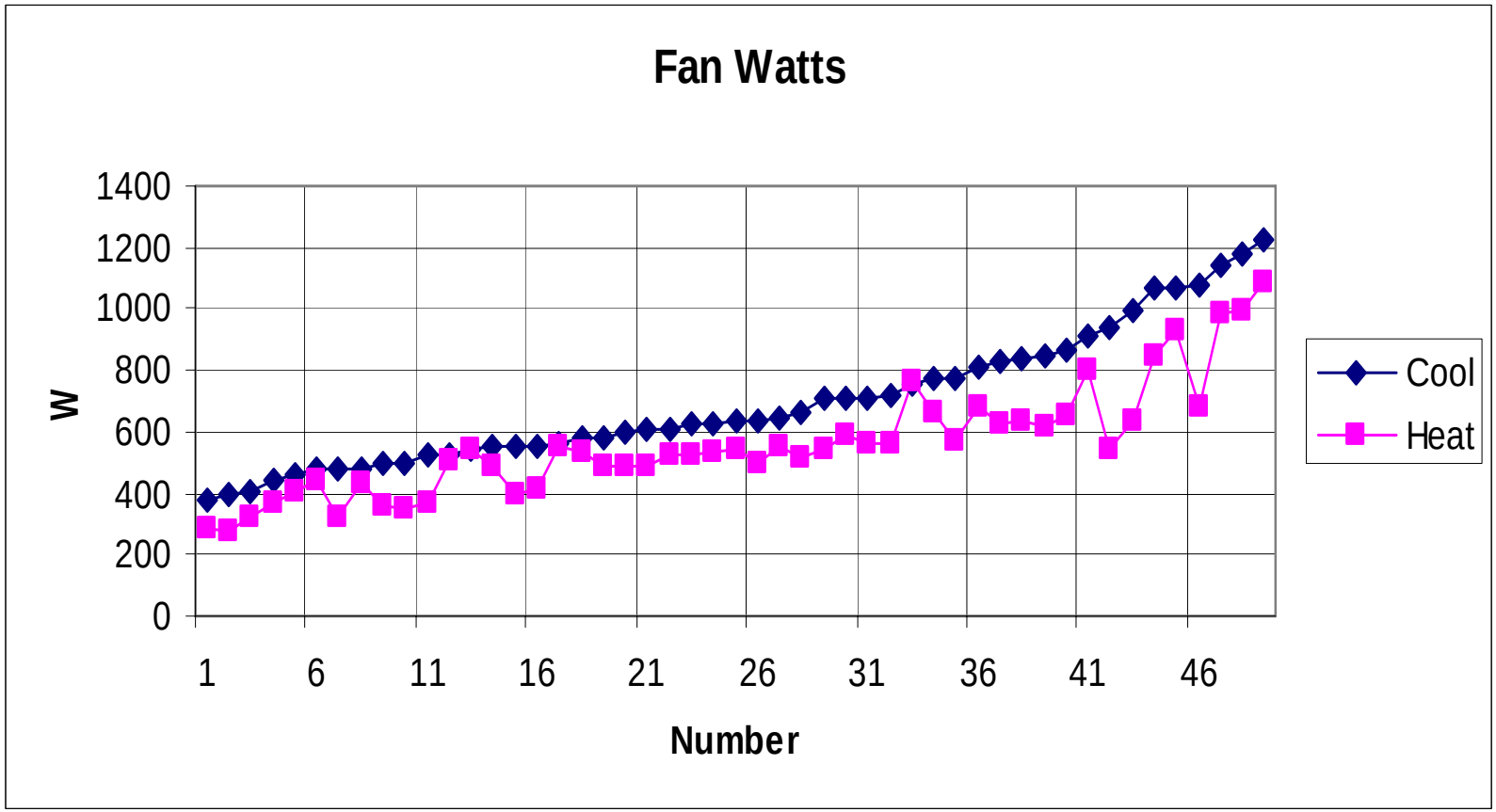
Part 1: Furnace Fan Watt Draw and Airflow in Cooling Mode and Watt Draw in Air Distribution Mode

- Investigation and Supporting Data
- Cost Effectiveness
- New Prescriptive Standard
- ACM Changes

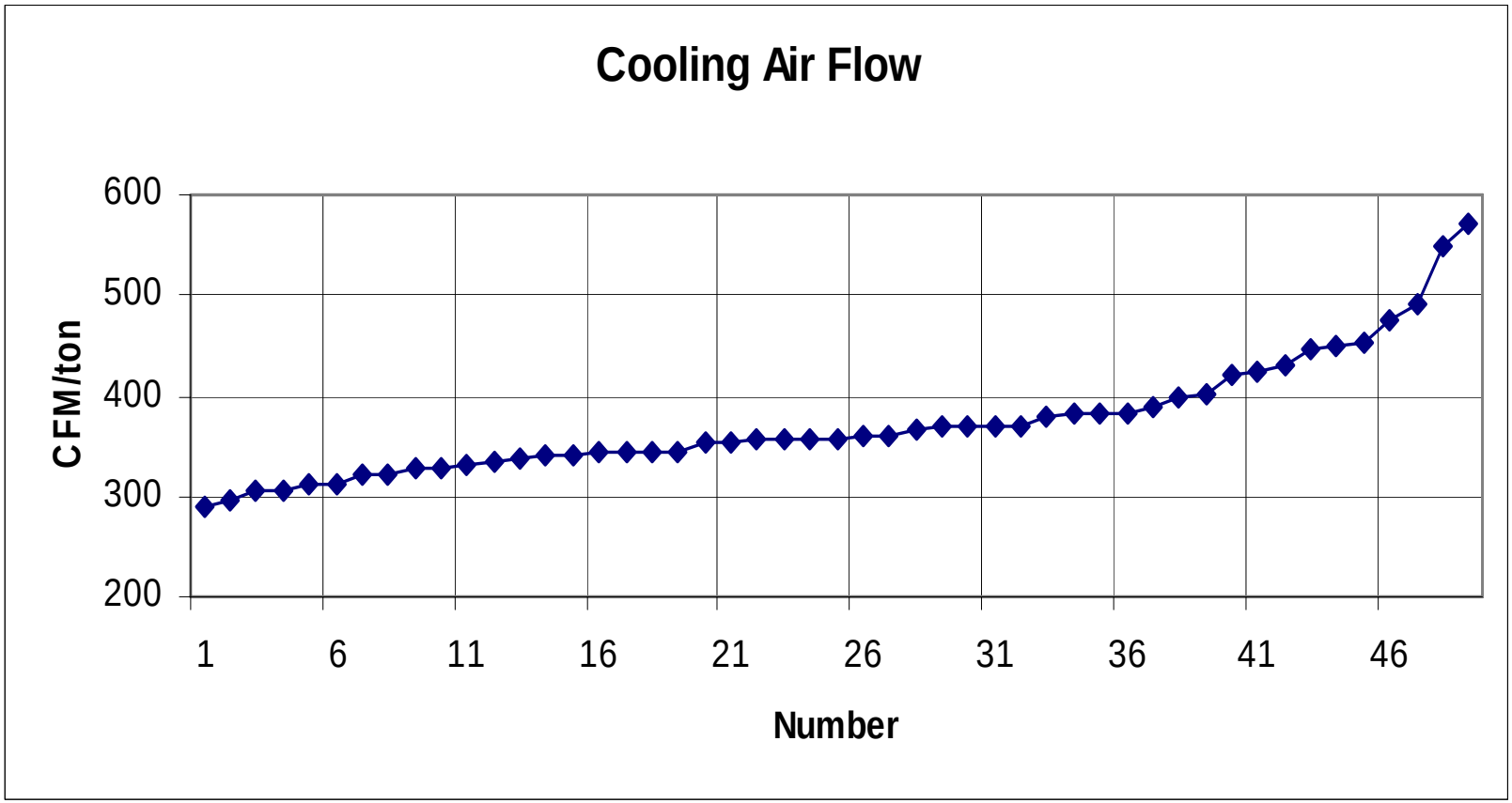
Field Survey

- 60 furnace systems in new homes
- 55 in production homes, 5 custom
- Measured air flow and fan watts by mode (heating and cooling)
  (zonal control)
- Measured static pressures by mode and component

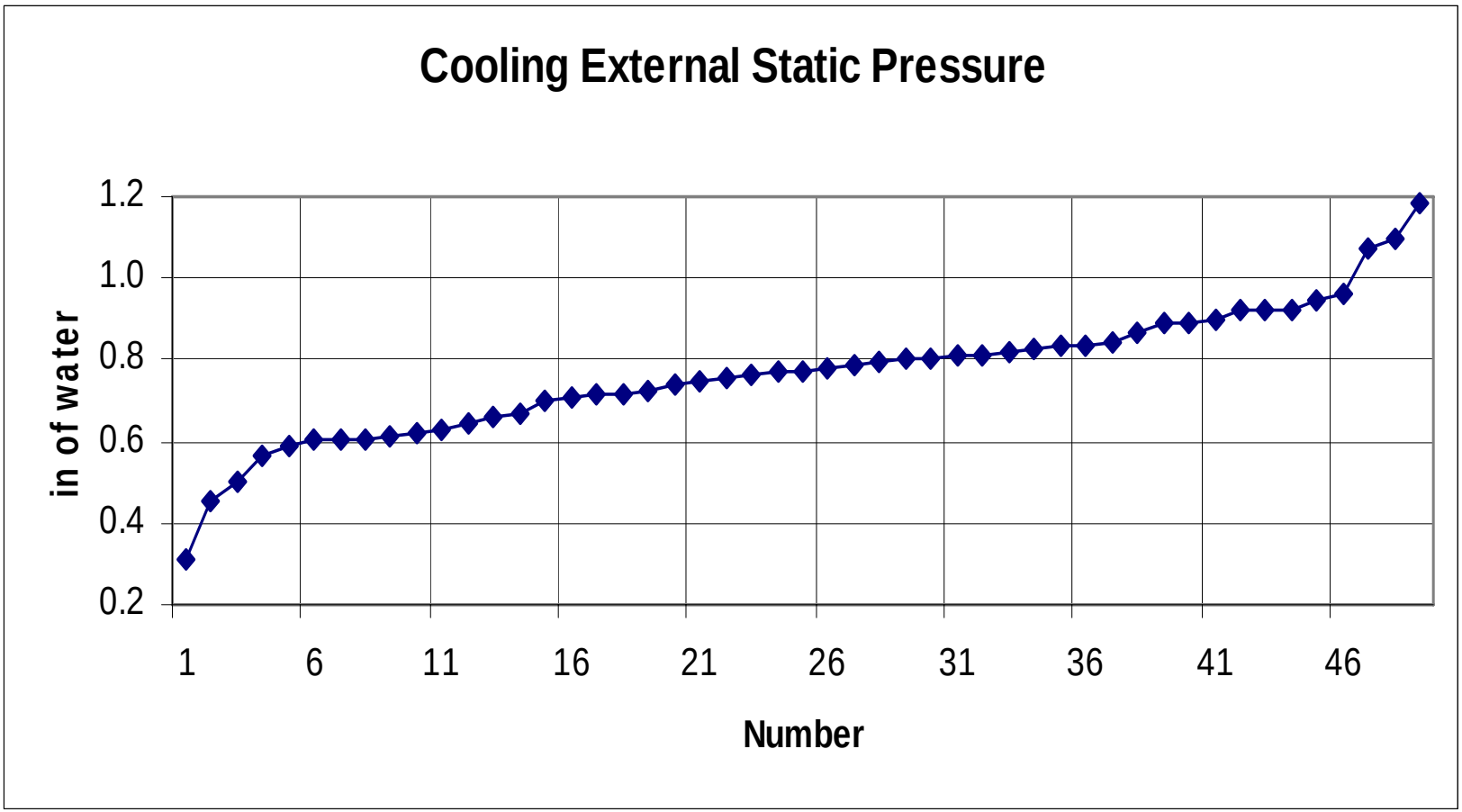
Median Cooling Fan Watts = 632



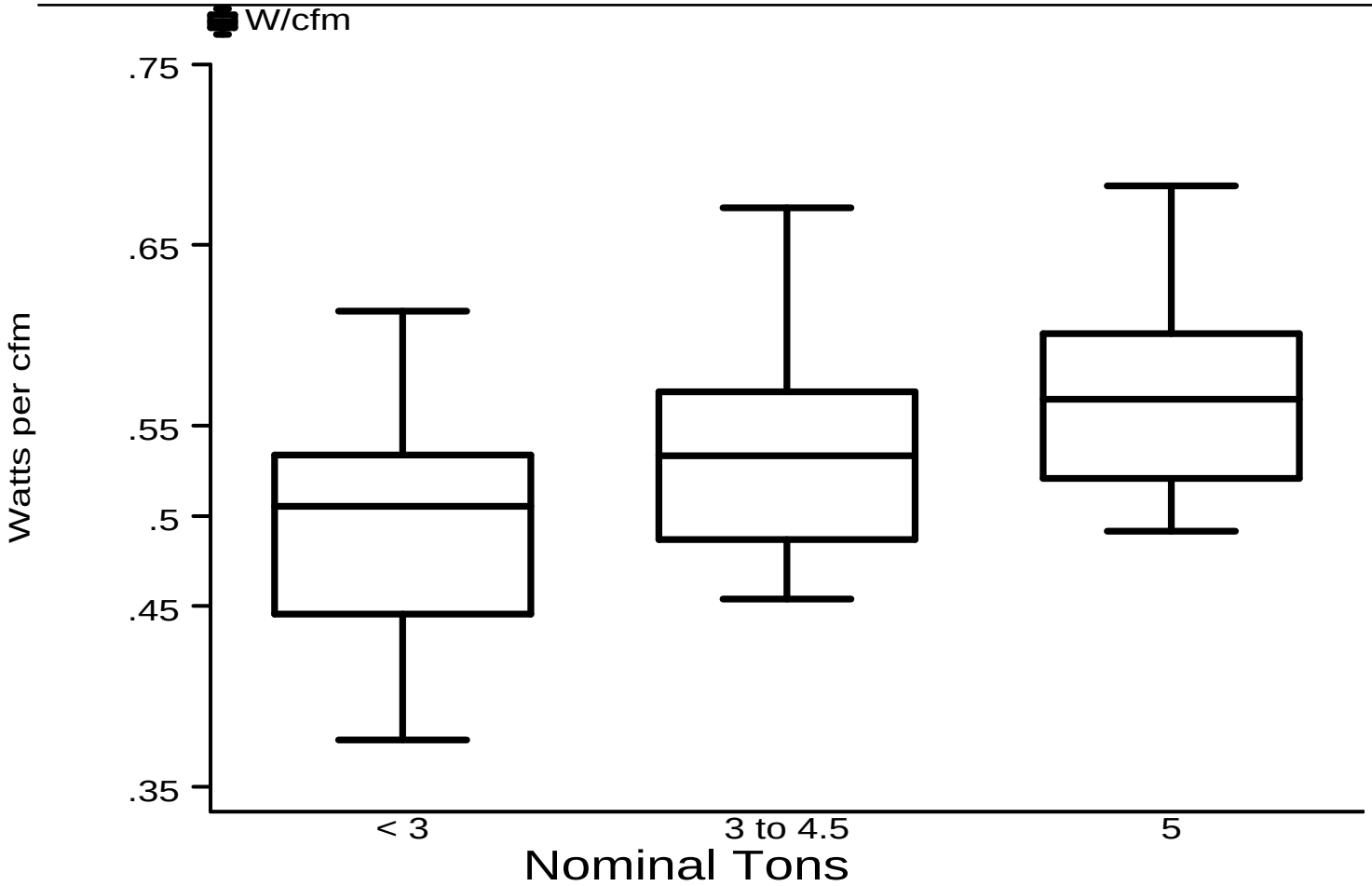
Median Cooling Airflow = 358 CFM/ton



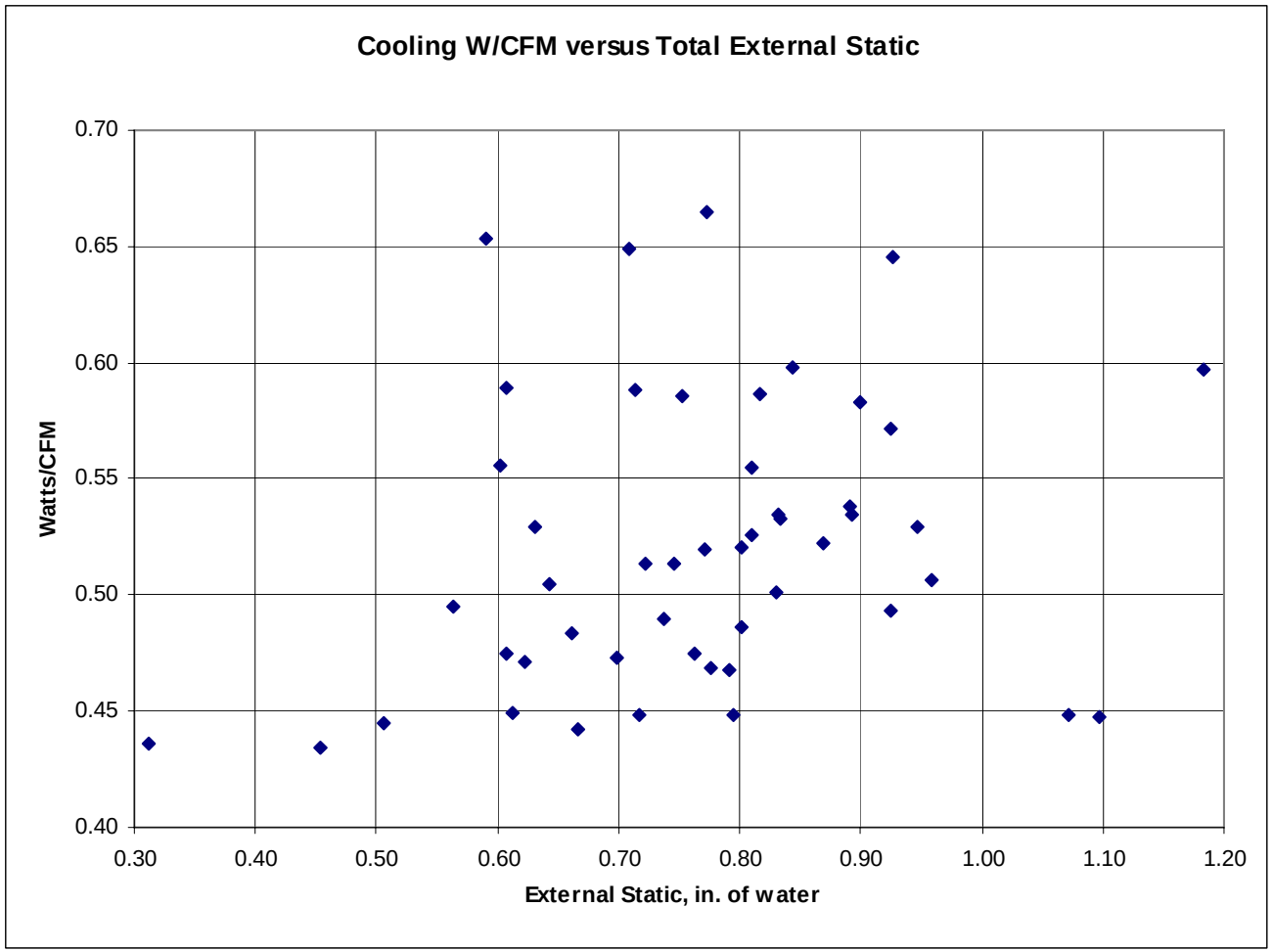
Median External Static Pressure = 0.8 IWC



Cooling W/CFM is related to AC size



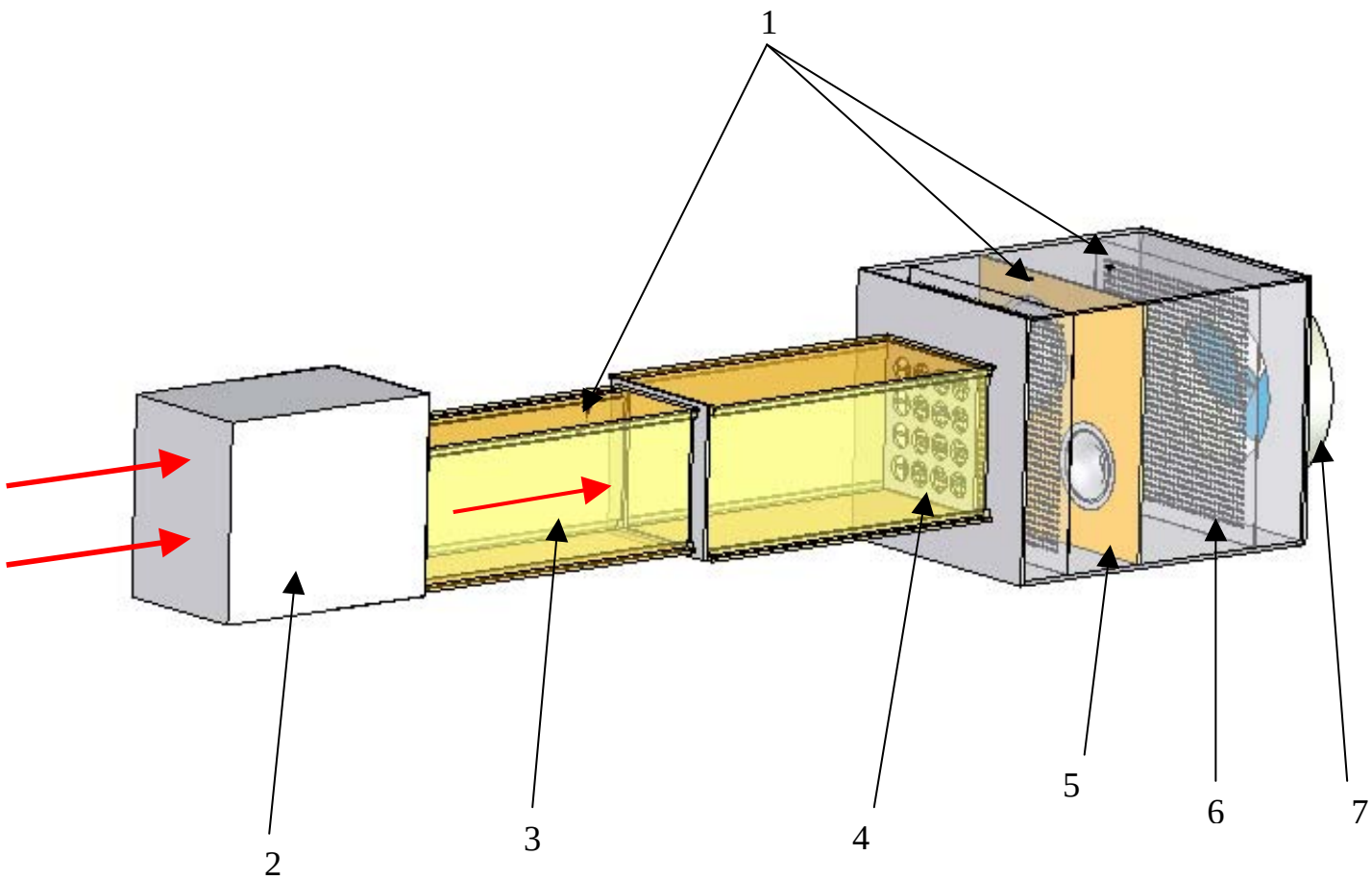
External Static Pressure Alone is Not a Sufficient Predictor of Watts/CFM

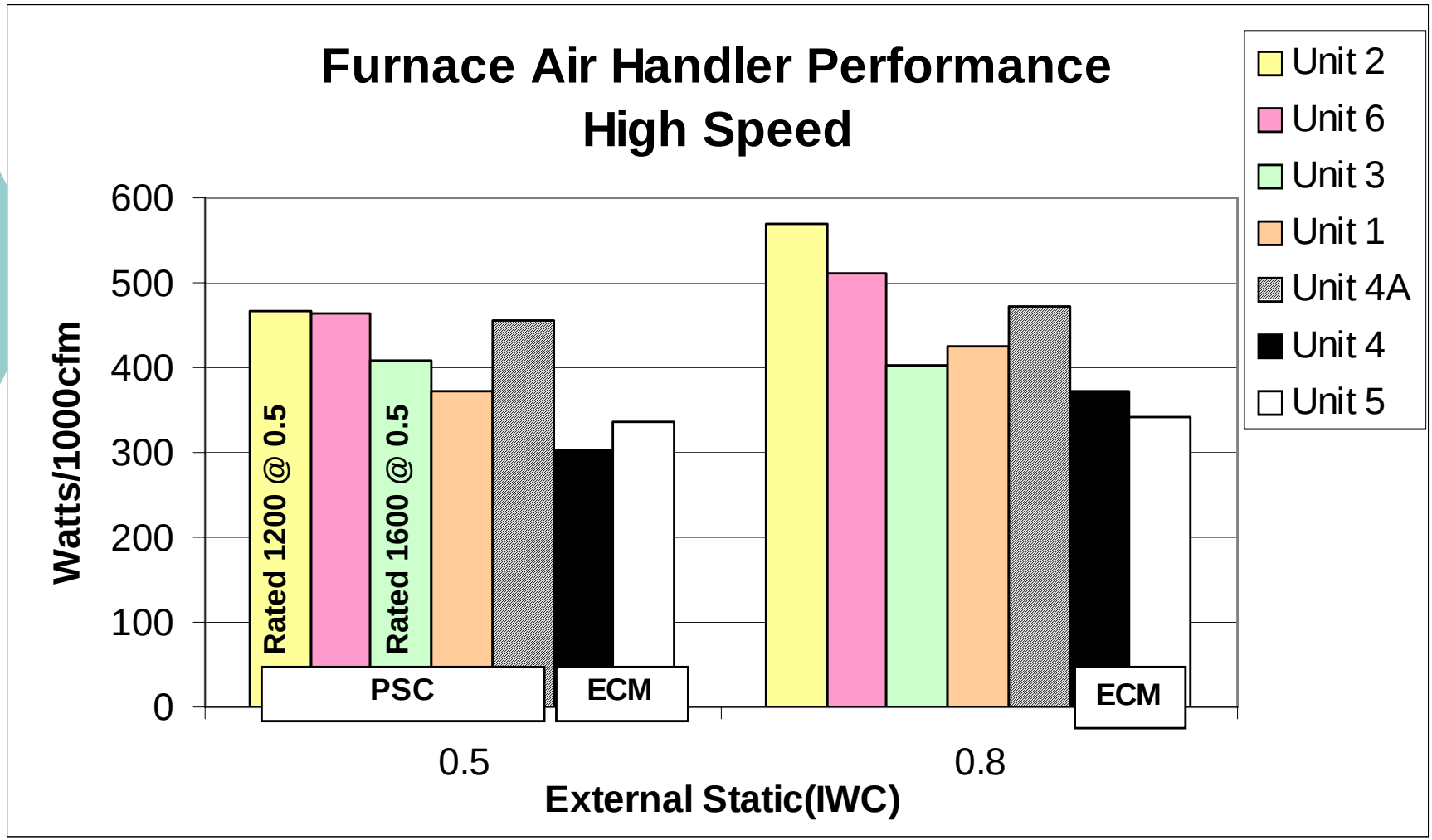


Lab Tests

- 6 furnaces, representative of survey results
- 3 ton and 4 ton airflows
- Permanent Split Capacitor and Electrically Commutated Moters
- Measured flow and watt draw over a range of external static pressures

Furnace Lab Experimental Apparatus

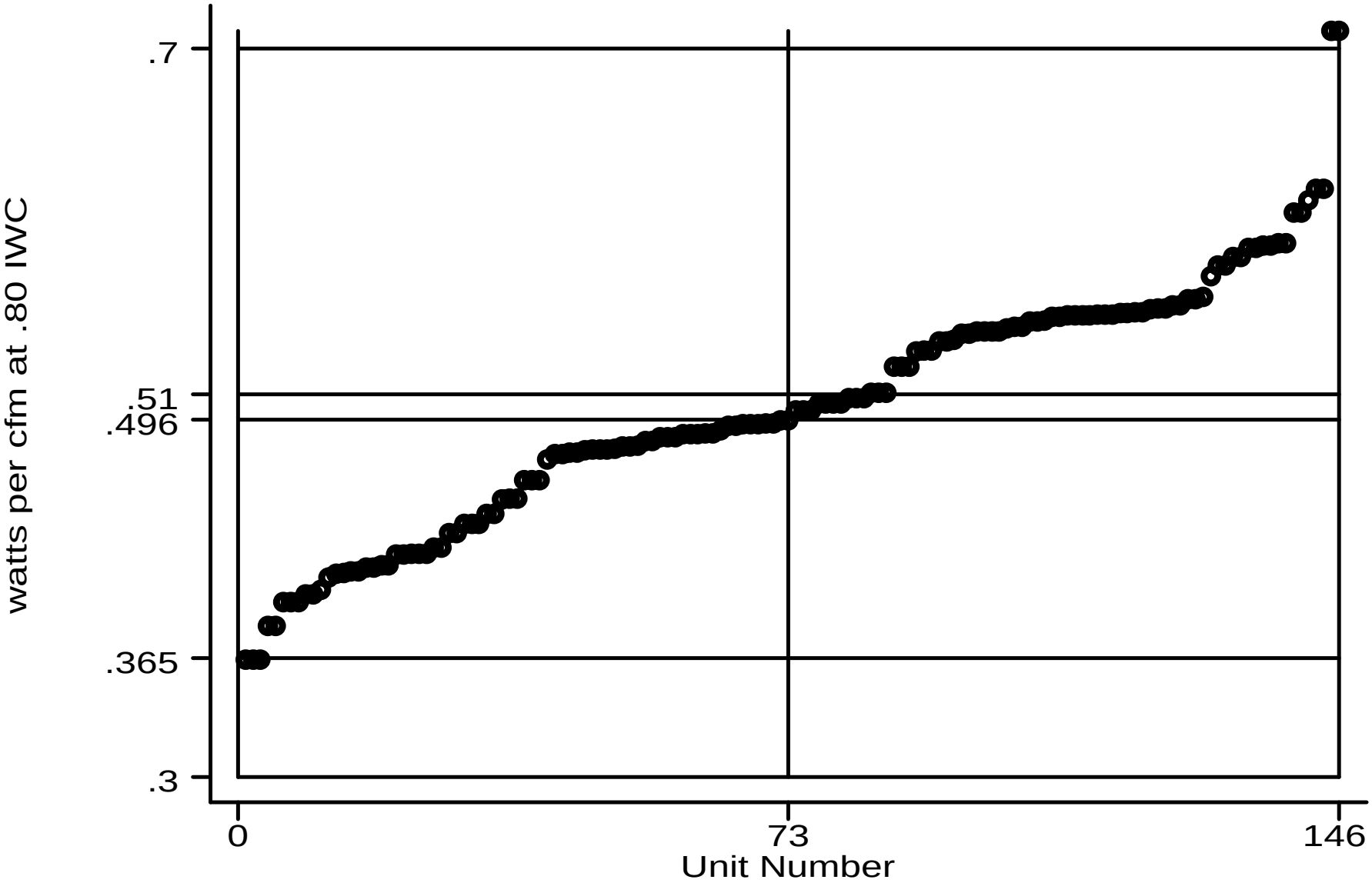



Furnace Air Handler Performance
High Speed
Watts/1000cfm
600
500
400
300
200
100
0
Rated 1200 @ 0.5
Rated 1600 @ 0.5
PSC
ECM
ECM
0.5
0.8
External Static(IWC)
Unit 2
Unit 6
Unit 3
Unit 1
Unit 4A
Unit 4
Unit 5

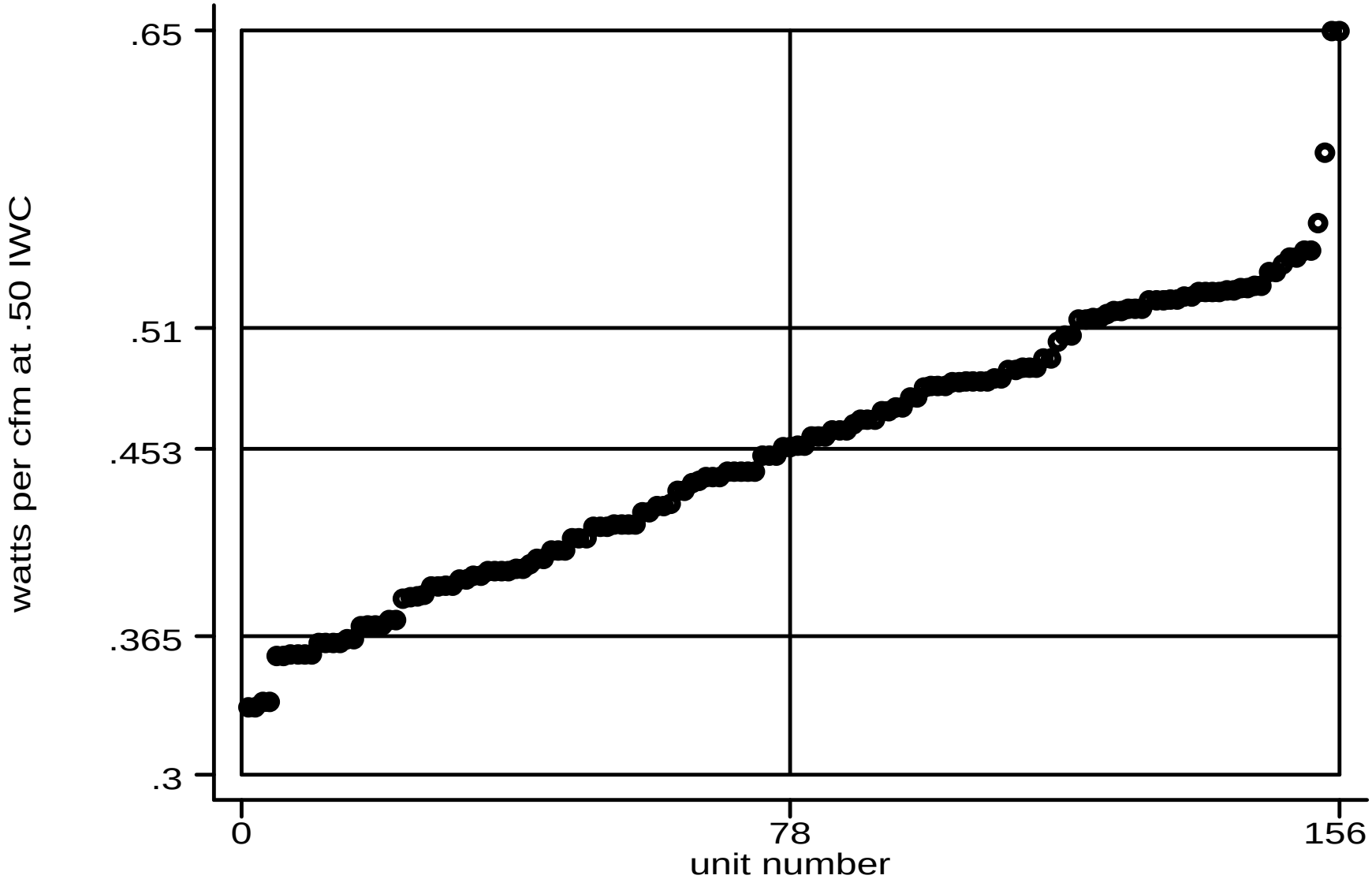
Manufacturers' Data

- Compiled by LBNL
- Data from Manufacturers' website or directly
- 841 model number and blower speed combinations that had blower power information

Permanent Split Capacitor Watts / CFM at High Speed and 0.8 IWC



Permanent Split Capacitor Watts / CFM at High Speed and 0.5 IWC



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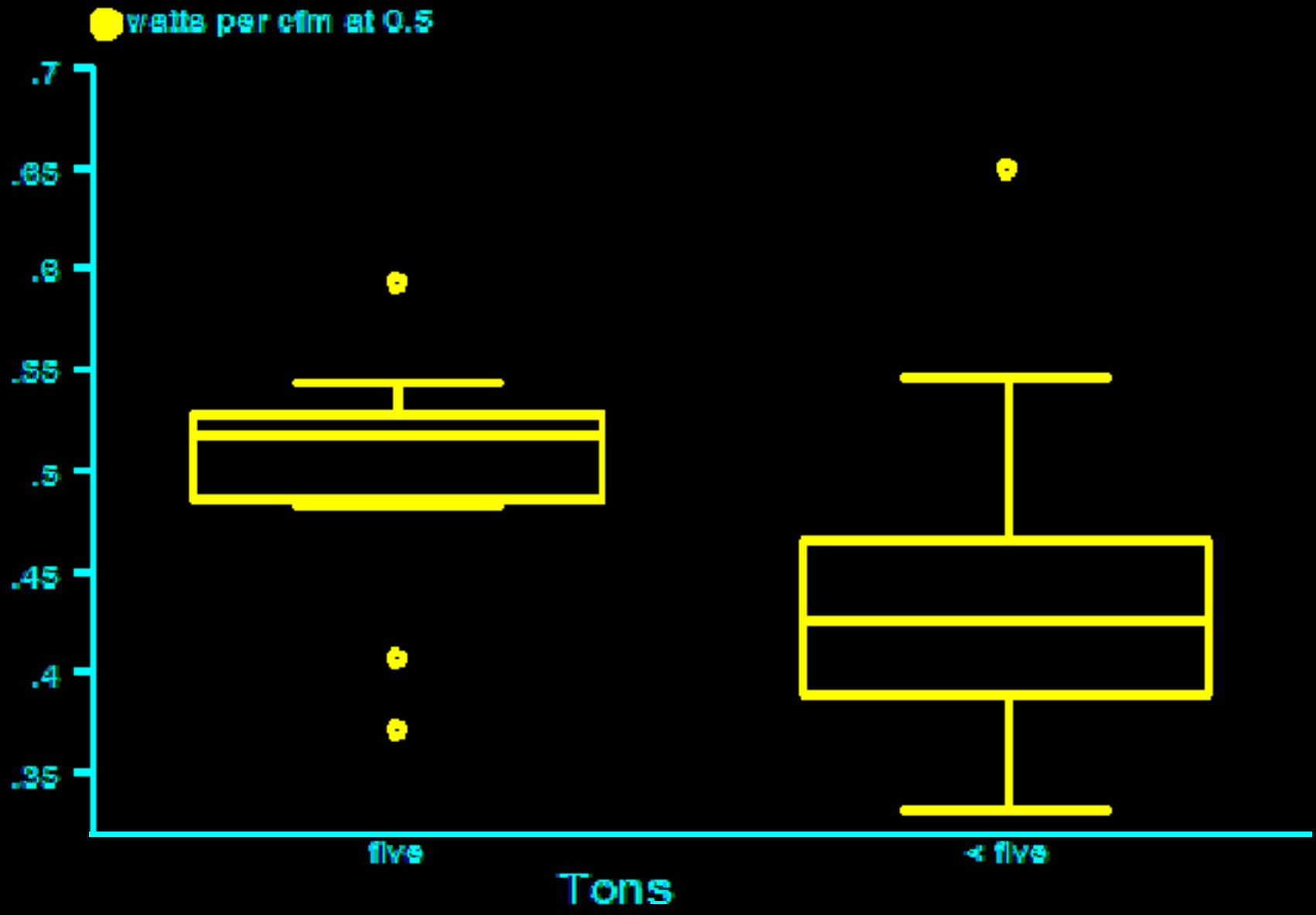


Reducing External Static

- Component level external static reductions for average surveyed system to achieve 0.5 IWC total external static

Component	Survey Median	Target
Supply Duct	0.18	0.18
Cooling Coil	0.27	0.20
Return Duct	0.15	0.05
Filter	0.15	0.07
Total	0.75	0.50

Cost of Reducing External Static

- Cost increase for average system surveyed (3.5 ton) to achieve 0.5 IWC external static

	Modification	Cost increase		
Component	Strategy	Labor	Material	Total
Supply Duct	No Change			
Cooling Coil	5 ton coil		40.00	40
Return Duct	Increase diameter	11.76	20.75	32
Filter	25% Larger area		15.00	15
Overhead and profit	30%			37
Total				123

Fan Watt Life Cycle Cost

- 100 Watt/1000 CFM reduction saves $172 PV in Climate Zone 12
- Cost delta for improved ducts is $123

Prescriptive Standard

- Cooling Mode in CTZ 10-15
- Central forced air system fans shall simultaneously demonstrate, in every zonal control mode, a flow greater than 350 CFM/ton of nominal cooling capacity and a watt draw less than:
  - .5 W/CFM <5 nominal tons
  - .55 W/CFM 5 nominal tons)

Prescriptive Standard

- Air Distribution Mode in all Zones
- Central forced air system fans in Air Distribution Mode, a watt draw less than :
  - .5 W/CFM <5 nominal tons
  - .55 W/CFM 5 nominal tons)

ACM Modeling for Air Distribution Systems

- Air Distribution Schedule is 33% on every hour.
- Ventilation air inlets if not controlled
  - add ELA to proposed SLA
  - add return leak with vent CFM

Part 2: Air Conditioner Airflow, Refrigerant Charge, and TXVs

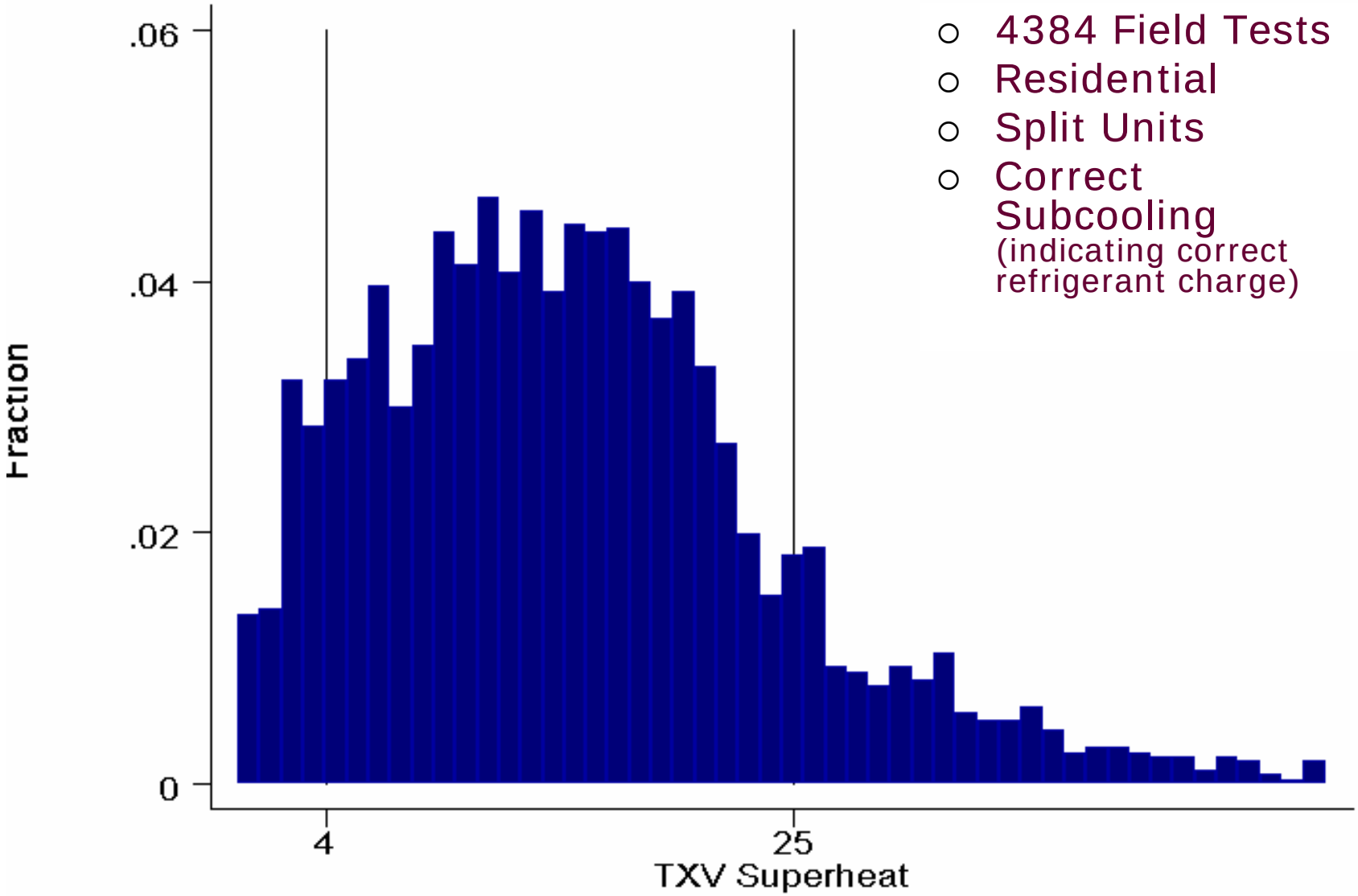
- Field Experience and Data
- Changes to Prescriptive Standard
- “Housekeeping” Changes

Field Reports

- Reports from HERS Raters and Evaluators
- Poor Installation Quality of TXVs Prevent Proper Operation

Data Analysis on TXVs

Superheat Distribution Indicates a Problem



- 4384 Field Tests
- Residential
- Split Units
- Correct Subcooling
  (indicating correct refrigerant charge)

Changes to Prescriptive Standard for AC Charge

- Eliminate TXV credit
- Always verify charge
- Verify TXV performance
- Set Adequate Airflow Credit at 350 CFM per ton

Appendix RD – Procedures for Determining Refrigerant Charge for Split System Space Cooling Systems

1. Remove TXV exemption
2. Add subcooling test method for TXVs and EXVs
3. Add metering device operation check for TXVs and EXVs
   a) superheat must be within manufacturer's specified range if available
   b) superheat must be between +4°F and +25°F if manufacturer's specification is not available

Housekeeping

- Clarify ***minimum*** airflow for refrigerant testing
  - Temperature split cannot be used for any purpose other than establishing minimum airflow for refrigerant testing
- Temperature Split Table clarification
- Inspectors' (HERS Raters) tolerance for temperature split, subcooling, and superheat changed to 1°F greater than installers