Field and Laboratory Tests of a Smart Efficient Fan Controller® with Fault Detection Diagnostics (FDD) for Residential Cooling and Heating

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EEDAL'19 Presentation

November 7, 2019

Summary

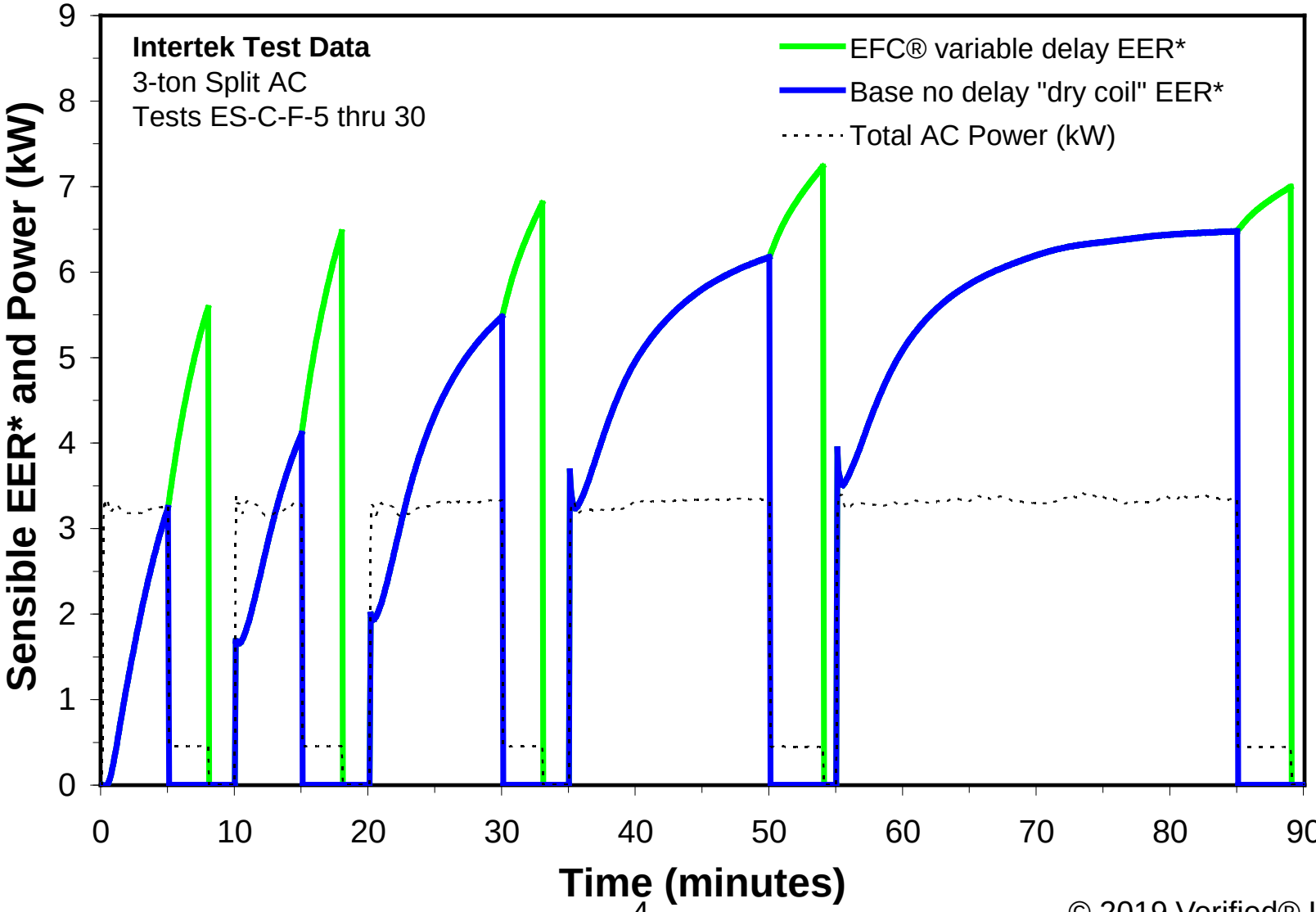
- HVAC systems in US are oversized and operate at Part Load Ratios (PLR) of 13% reducing efficiency
- Patented EFC® improves part load efficiency with variable fan-off delays, FDD, and reliable power for smart thermostats
- Smart EFC algorithms can be deployed on smart thermostats and fans to improve efficiency
- California Utilities offer incentives for EFC® and 135,000 units have been installed since 2012

Laboratory Tests

- Tests were performed at Intertek® ISO-certified laboratory used by manufacturers and USDOE to test HVAC equipment for US Efficiency Standards
- Cooling and heat pump efficiency tests were performed per ANSI/AHRI Standard 210/240 for Unitary Air-Conditioning and Air-Source Heat Pump Equipment and ANSI/ASHRAE Standard 37
- Gas furnace tests performed per ANSI Z21.47
- Hydronic efficiency tests were performed per AHRI Standard 840 for Unit Ventilators

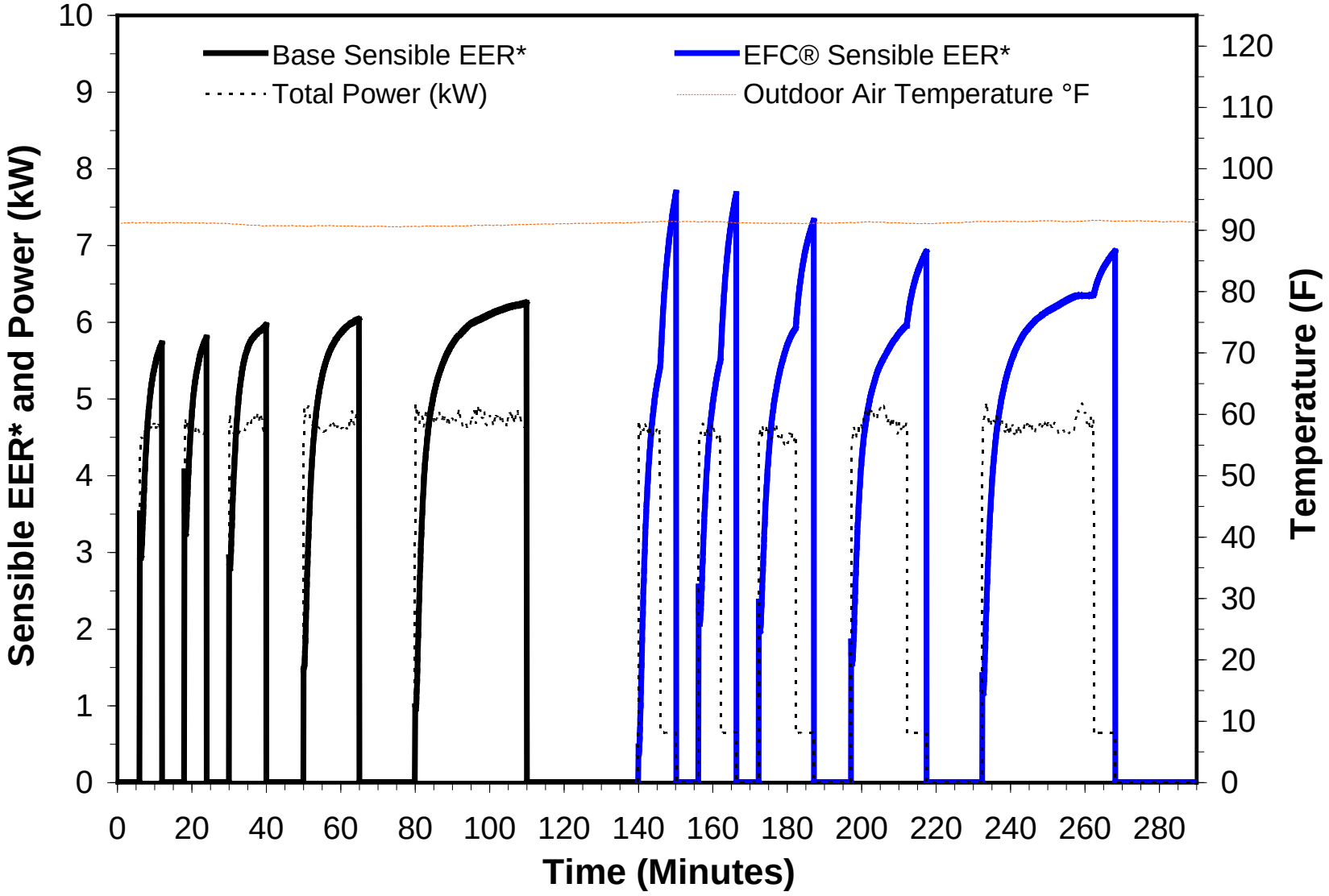
Intertek® Base and EFC® Cooling Tests

EFC® saves 6 to 30% due to low part load efficiency of base



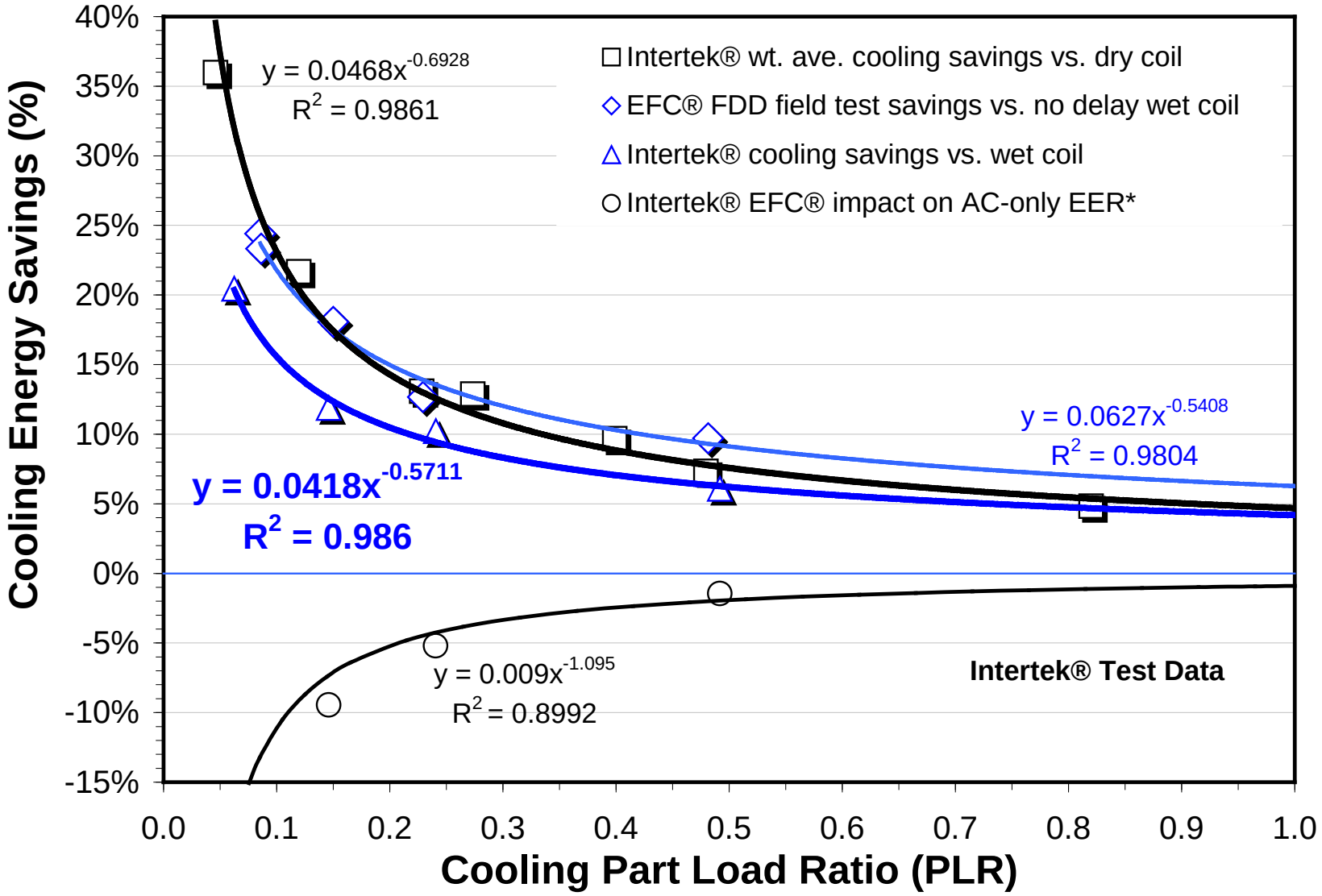
Base and EFC® Cooling Field Tests

EFC® saves 10 to 24% due to low part load efficiency of base



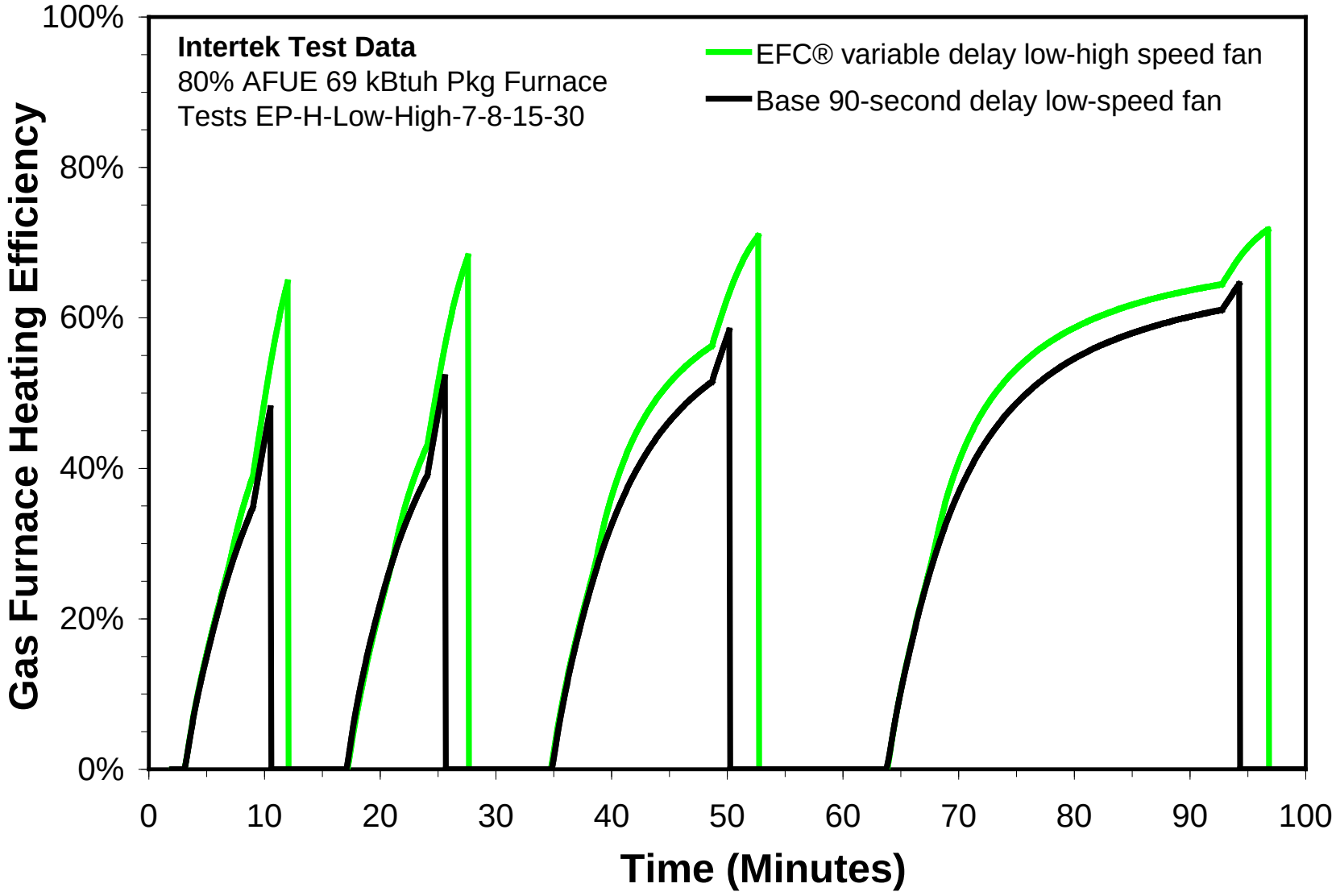
Intertek® EFC® Cooling Savings vs PLR

EFC® saves 10 to 15% on cooling for average Part Load Ratios



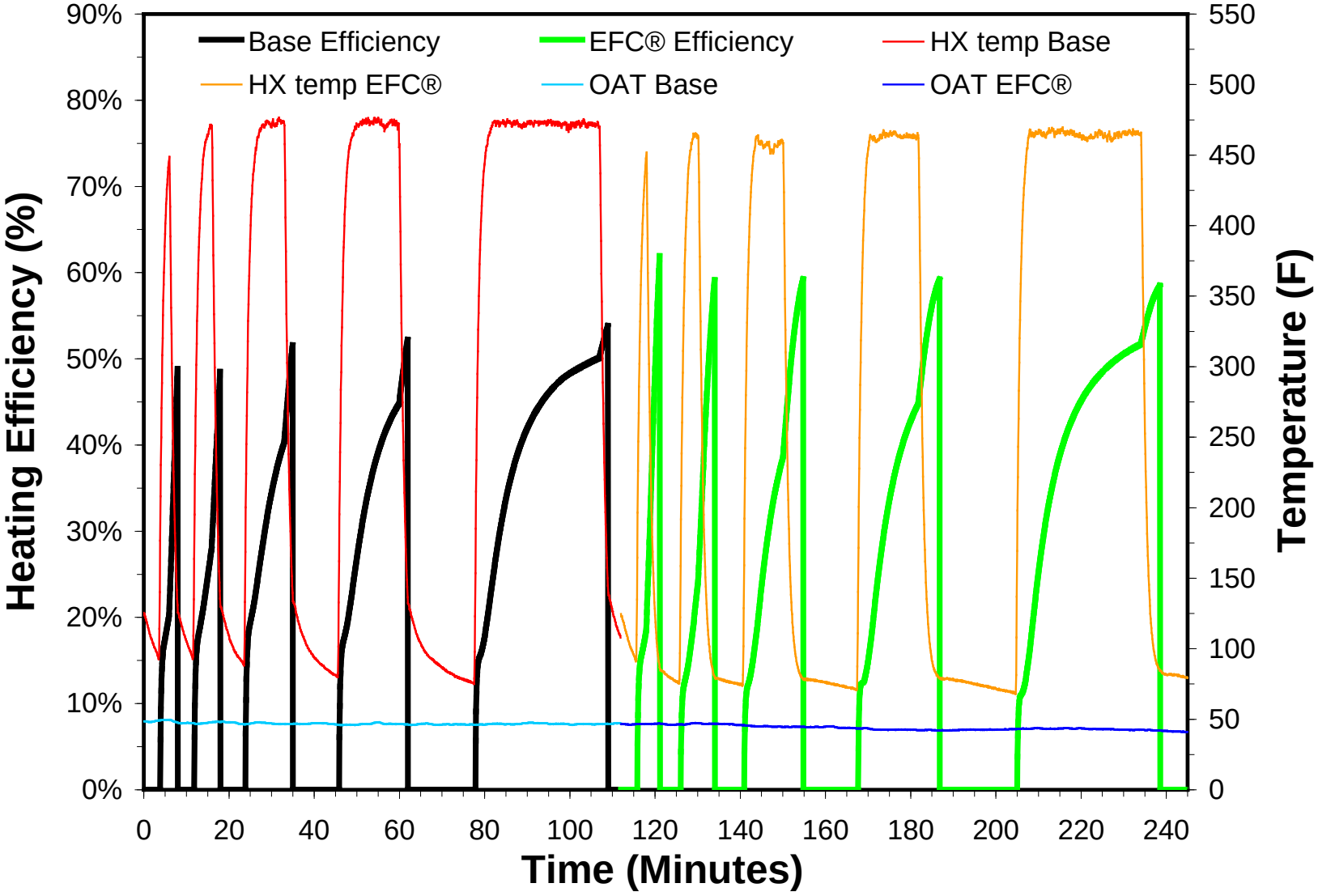
Intertek® Gas Furnace Heating Tests

EFC® saves 10 to 26% due to low part load efficiency of base



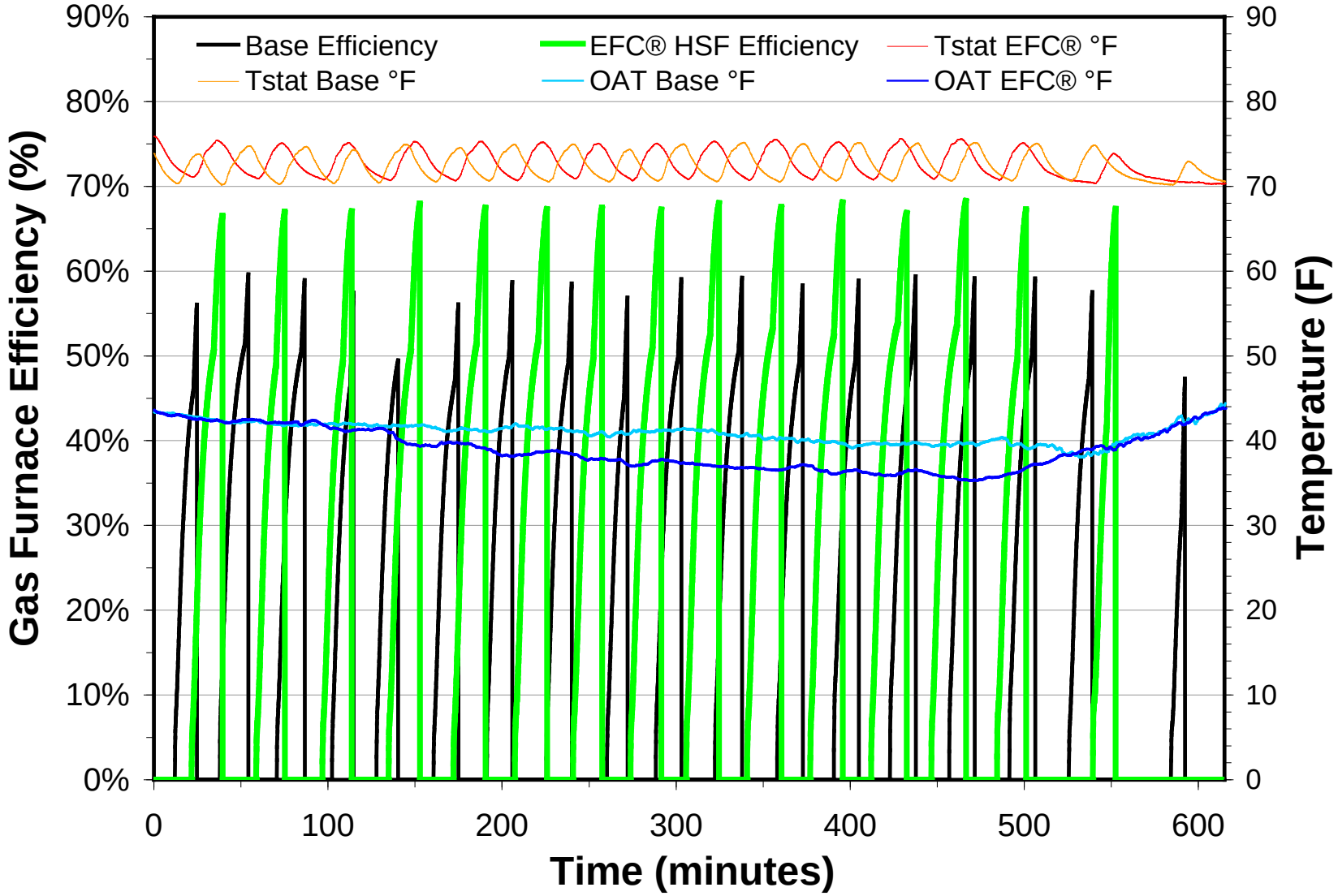
Base and EFC® Gas Furnace Field Tests

EFC® saves 10 to 32% due to low part load efficiency of base



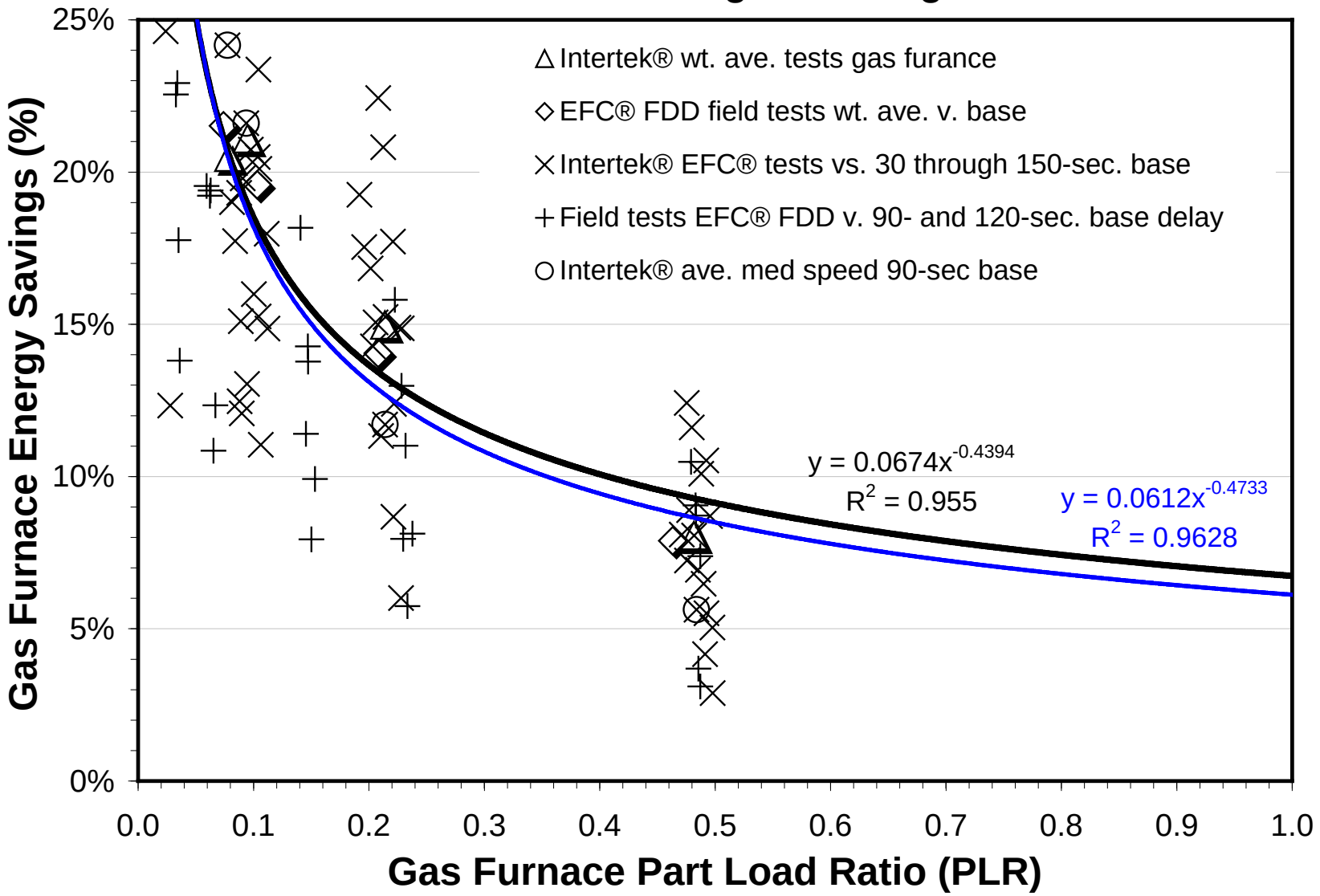
Base and EFC® Gas Furnace Field Tests

17.9% normalized EFC® savings 33.7F ΔT vs base 31.5°F ΔT



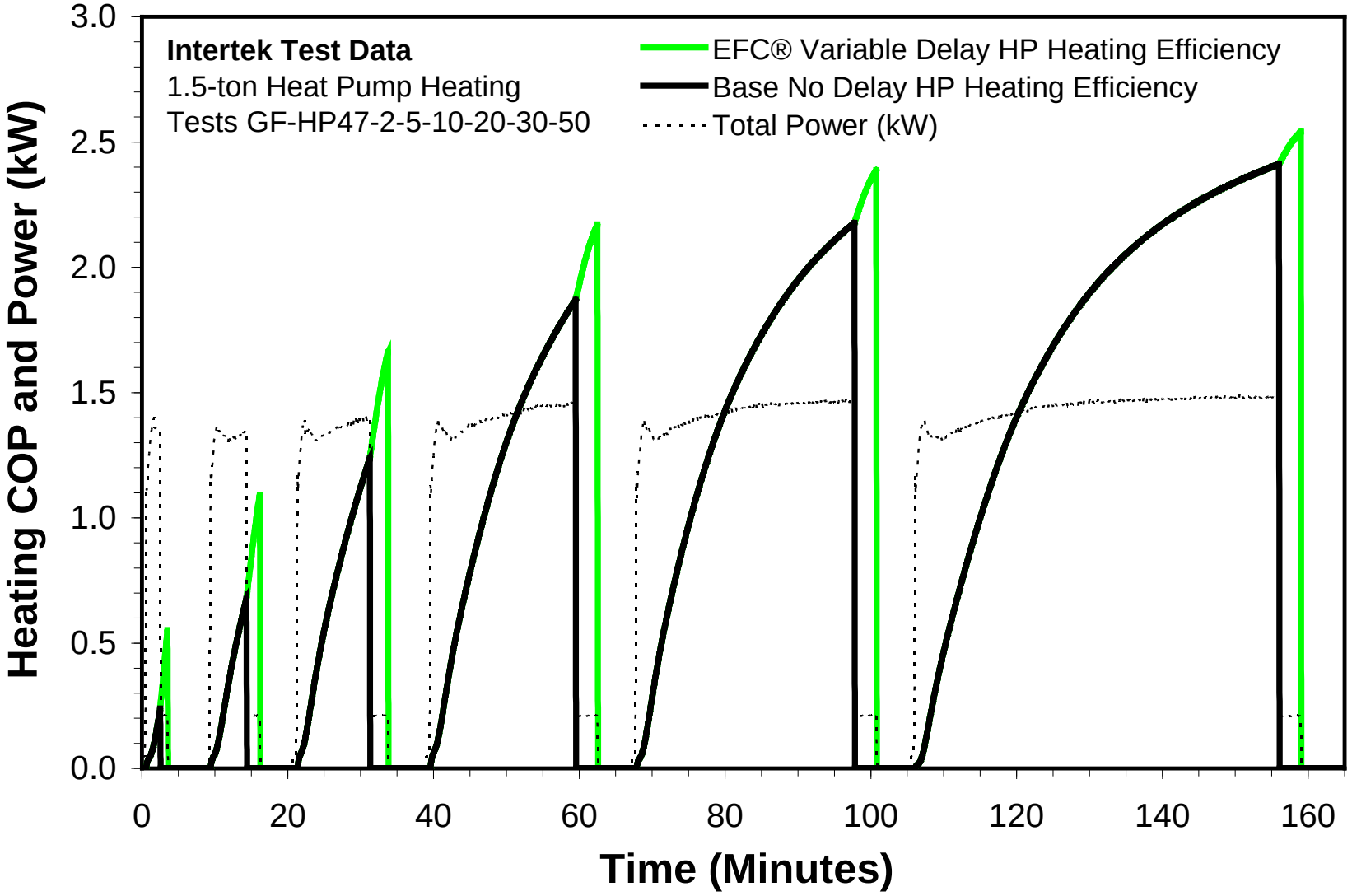
Intertek® EFC® Furnace Savings vs PLR

EFC® saves 10 to 20% on heating for average Part Load Ratios



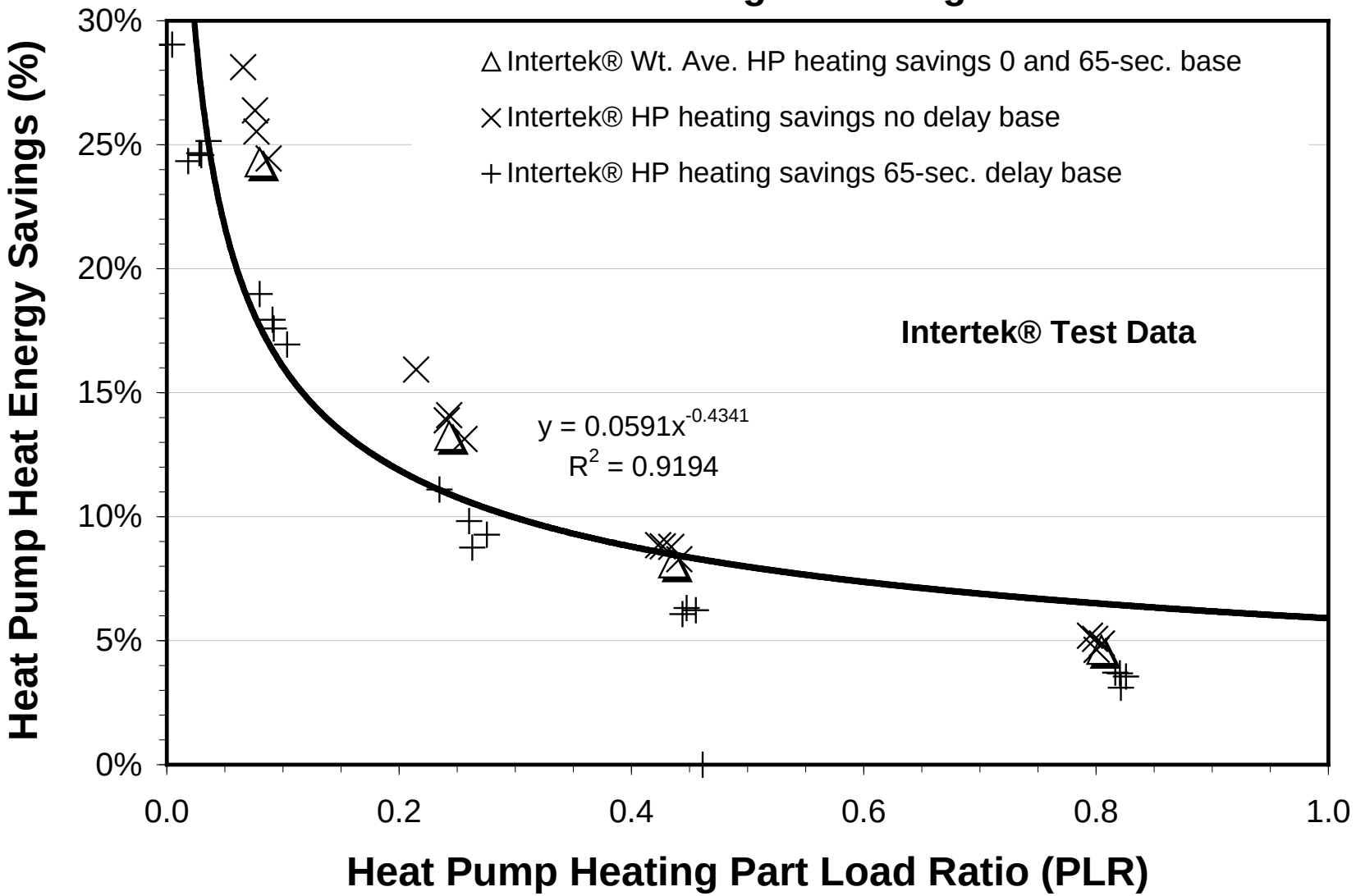
Intertek® Base and EFC® Heat Pump Tests

EFC® saves 5 to 31% due to low part load efficiency of base



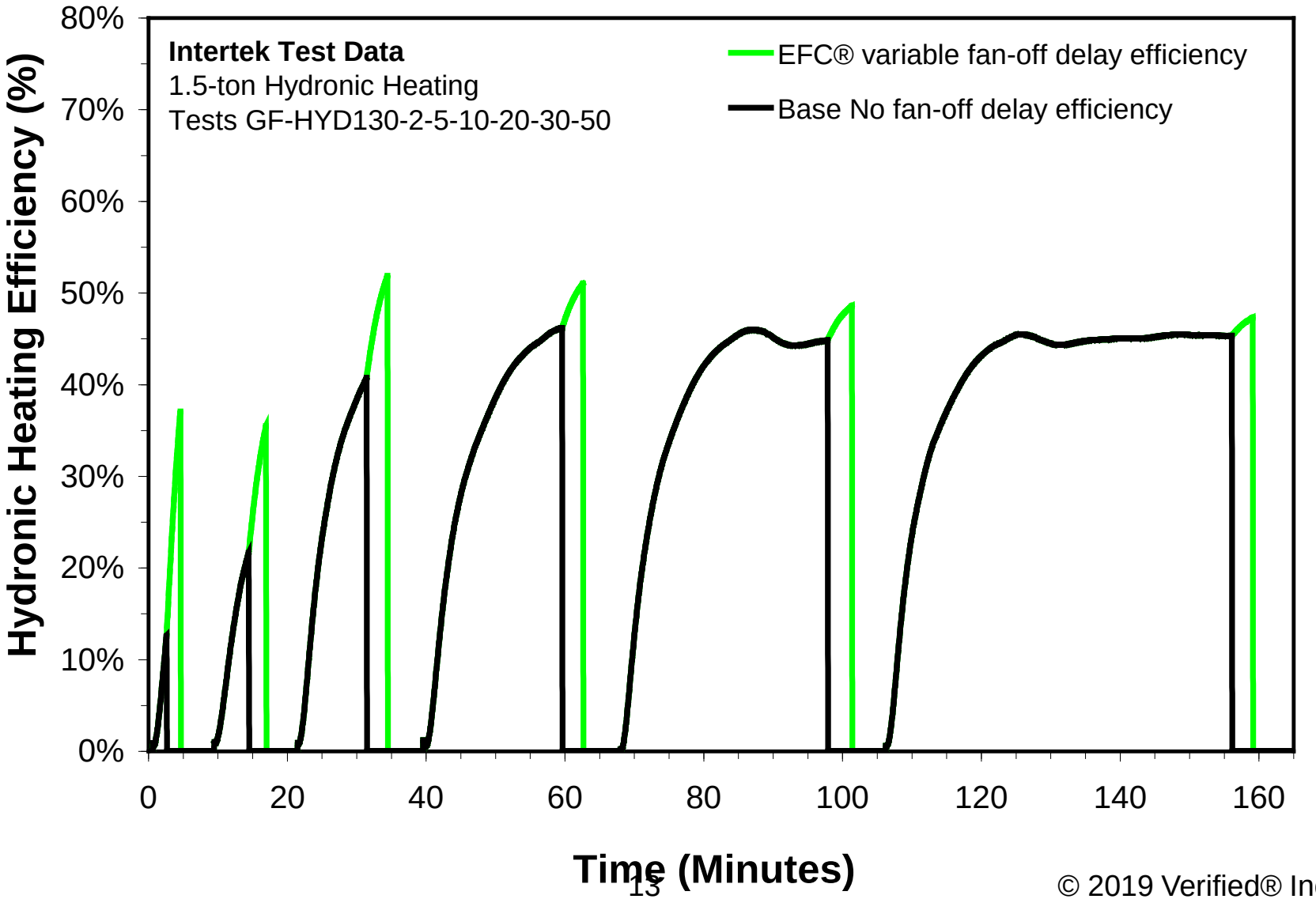
Intertek® EFC® HP Heating Savings vs PLR

EFC® saves 5 to 36% on HP heating for average Part Load Ratios



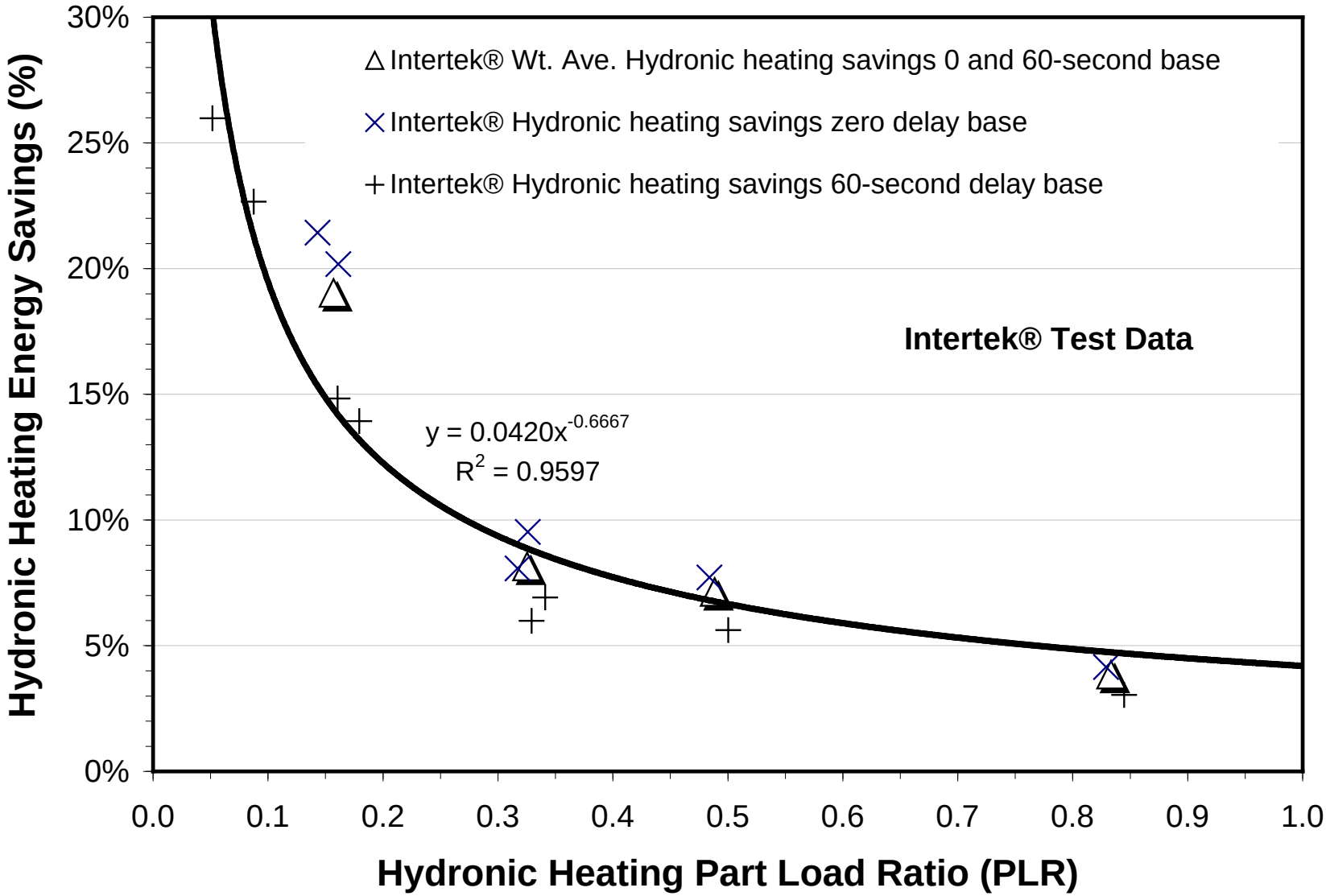
Intertek® Base and EFC® Hydronic Tests

EFC® saves 3 to 32% due to low part load efficiency of base



Intertek® EFC® Hydronic Savings vs PLR

EFC® saves 4 to 34% on hydronic heat for average Part Load Ratios



California HVAC Market Share Estimate

Building Type	AC with Gas Furnace Heat	Heat Pump	AC with Hydronic Heat	AC with Electric Heat
Multi-Family	49%	40%	9%	2%
Single family	88%	9%	-	3%
Mobile Home	89%	10%	-	1%

Conclusions

- EFC® average cooling savings are 11.3 ± 2.7%
- EFC® average gas furnace, heat pump and hydronic heating savings are 14.4 ± 1.6%
- Potential EFC® savings in US are 0.96 quads (1 EJ) based on 8.2 quads (8.6 EJ) for HVAC end uses
- Smart EFC® improves HVAC part load efficiency
- New transient test procedures are required for codes and standards to capture EFC® savings

Thank you!

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