

# Meeting Residential Customer Needs for Space Conditioning

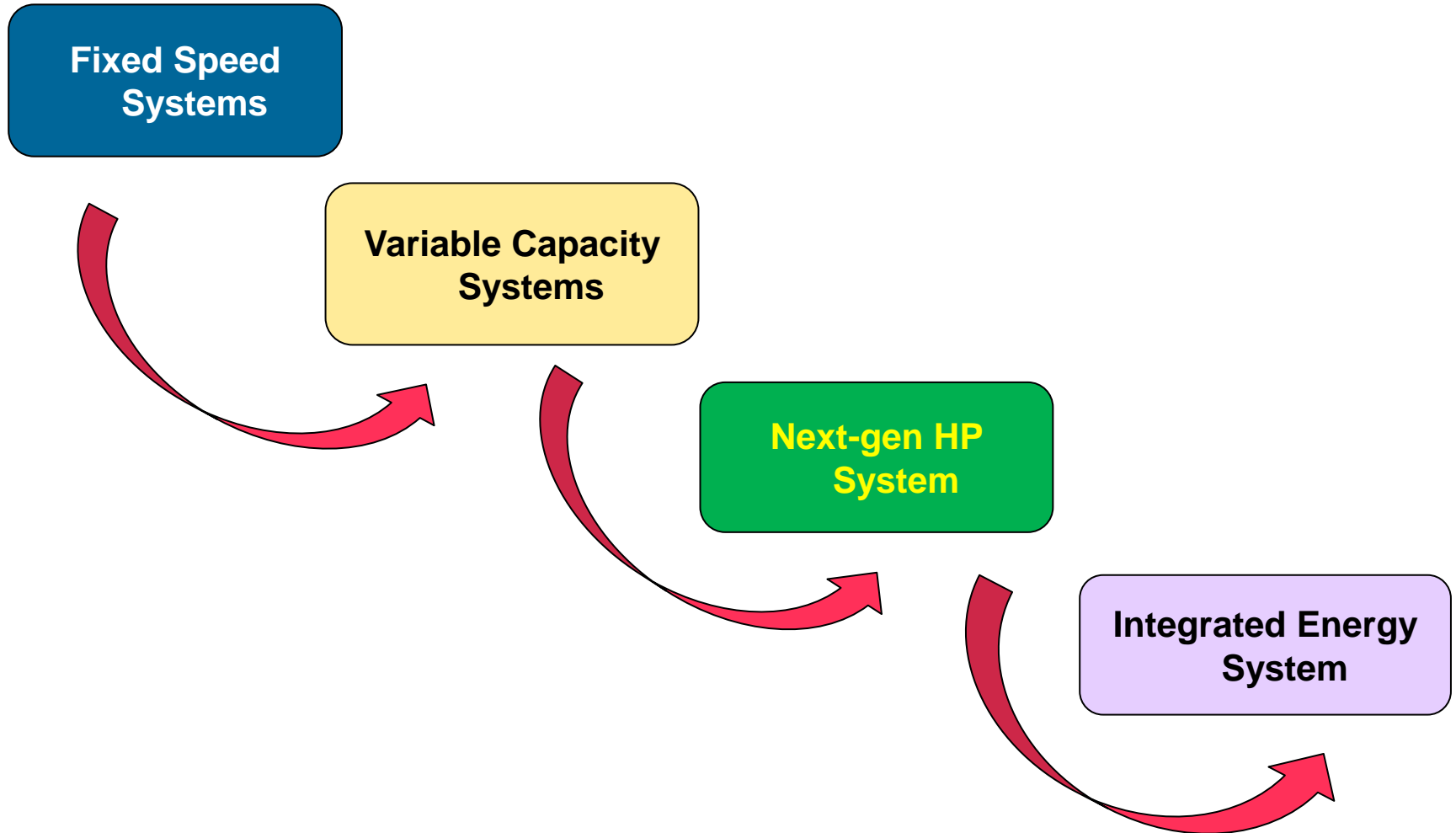
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Program Manager

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# Heat Pump Technology Evolution

## *Next Generation of Advanced Variable Capacity HPs*



# The Next Generation Heat Pump

## *History*

### Next-gen HP System

- EPRI Technology Innovation Project
  - Development of “Next-Gen ASHP Specification”
    - Level 1 & Level 2
  - Prototype development and testing of Level 1 systems
  - RFP issued for construction of a Level 2 system—outstanding
- Transition to large-scale deployment of systems
  - Evaluate various use-cases

# The Next Generation Heat Pump

## *EPRI Technology Innovation Breakthrough Project*

Advanced Heat Pump Technology that enables features that alter how space conditioning will be done

- **New options for customers**
  - Heating in cold climates
  - Extreme efficiency
  - Flexible connectivity
  - Comfortable supply air temperature
- **New options for utilities**
  - Enhanced demand response
  - Open protocol connectivity
  - Electric heating option



# The Next Generation Heat Pump

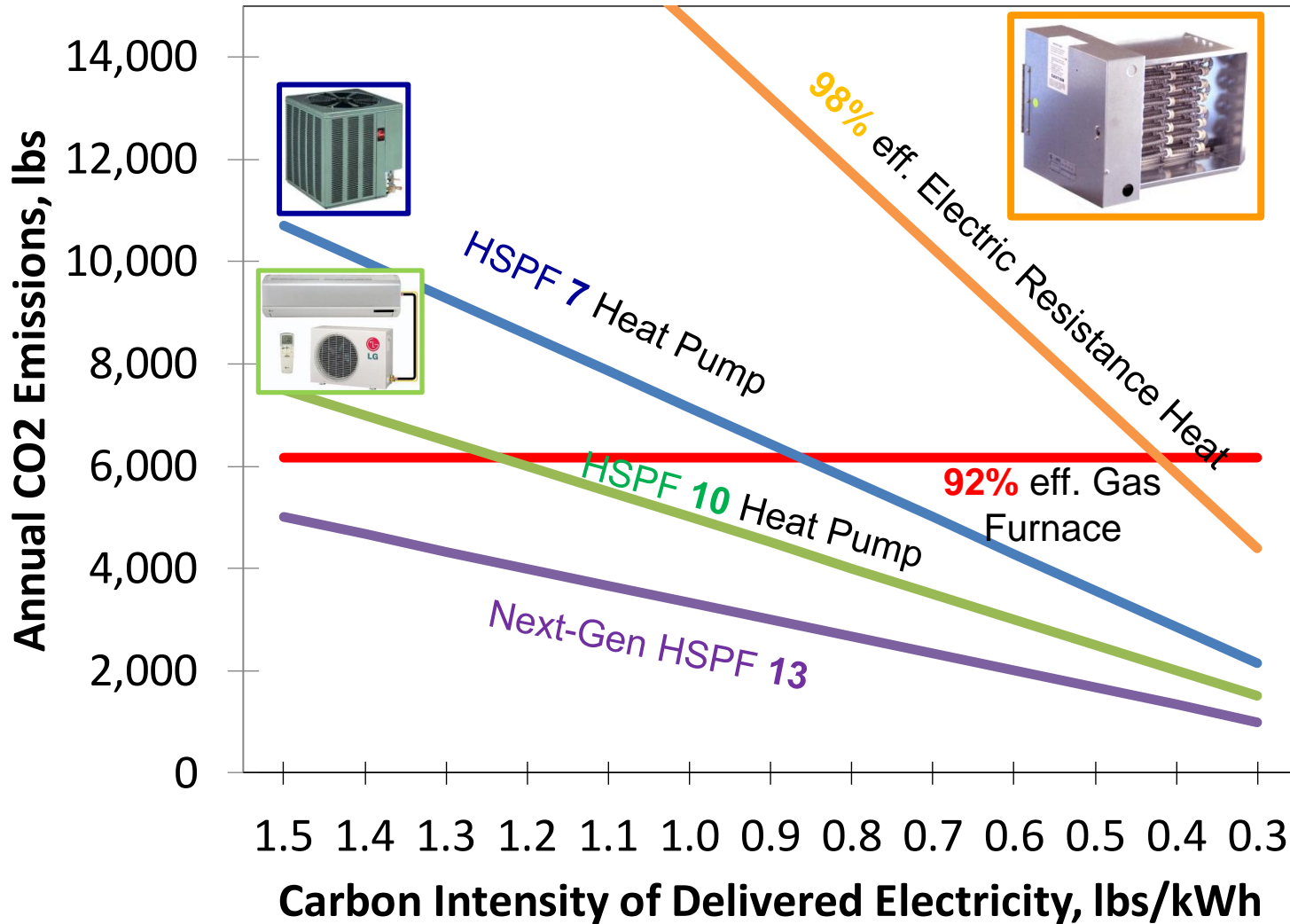
## *Example use cases*

### Next-gen HP System

- Heating in cold climates
  - Flexibility of sizing
- Elimination/reduction of electric 2<sup>nd</sup> stage heat
- Advanced demand response
  - more curtailment/less discomfort
  - Variability in curtailment
- Customer-side demand management
  - Growing customer demand rates
- Service enhancement
- Facilitating carbon reduction

# The Next Generation Heat Pump

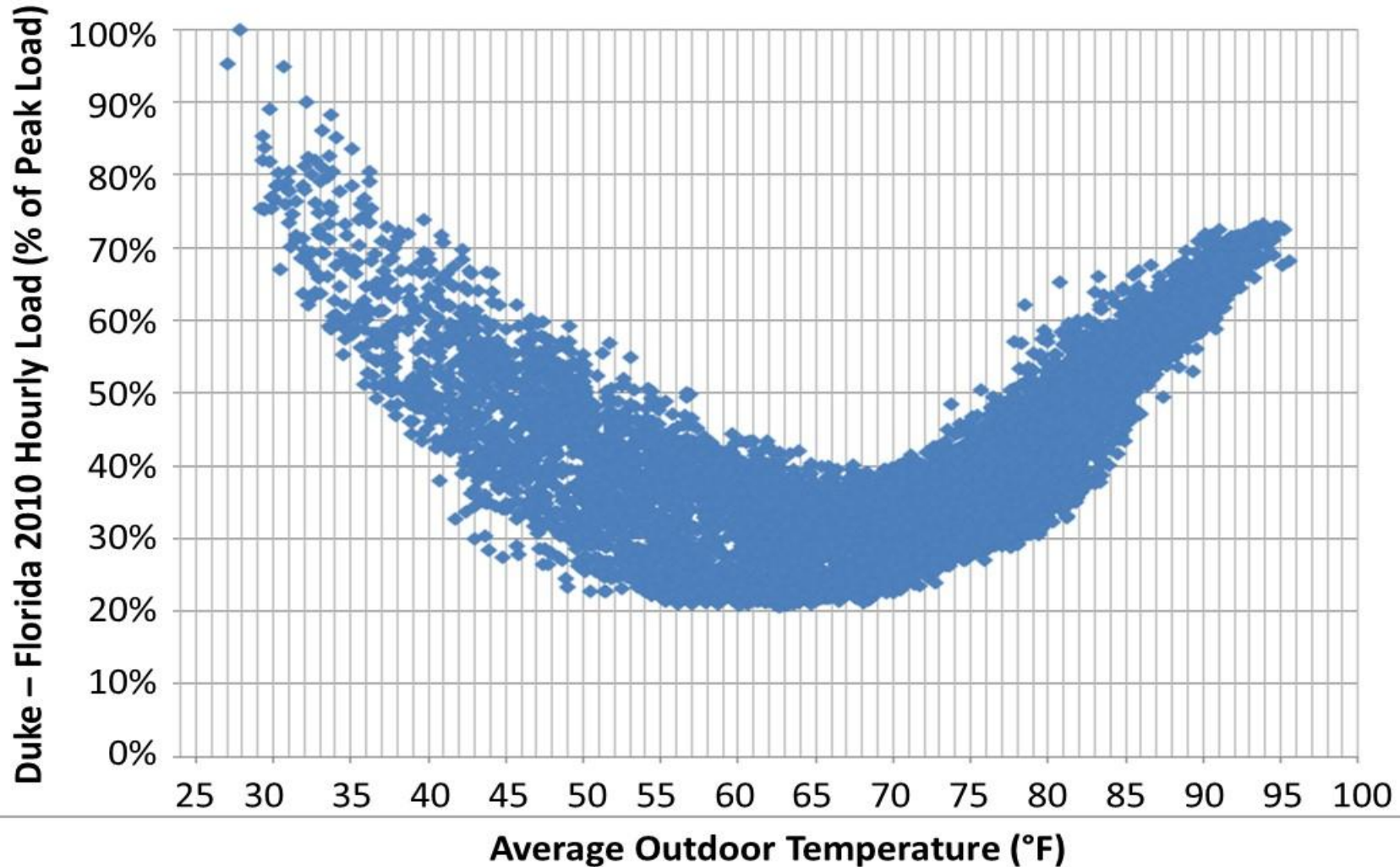
## Potential for Carbon Reduction



# The Next Generation Heat Pump

*Example use case—Reduction of Electric Resistance*

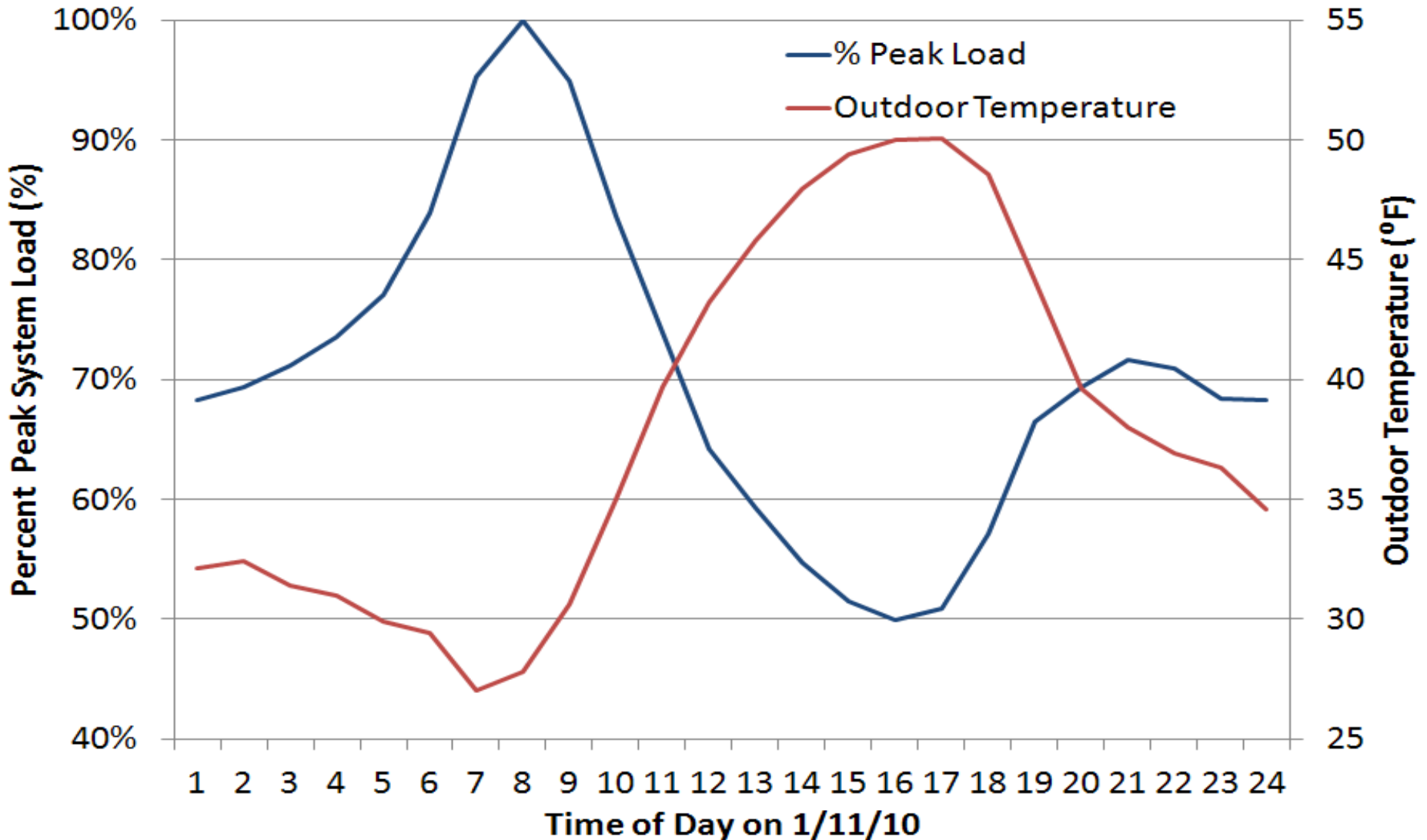
## Central Florida Electrical System Peak Load



# The Next Generation Heat Pump

*Example use case—Reduction of Electric Resistance*

Percent System Peak Load and Outdoor Temperature vs. Hour  
January 11, 2010

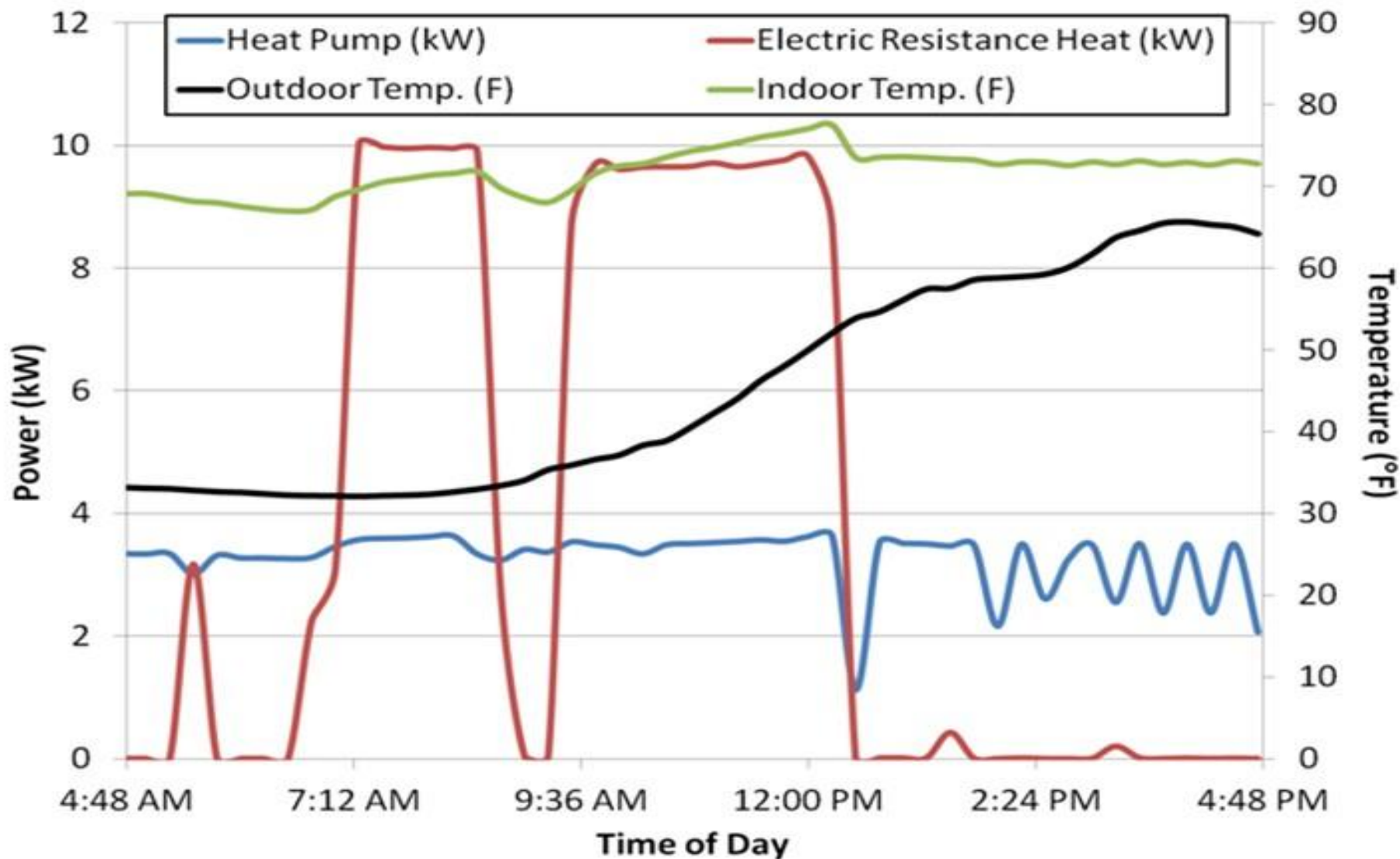




# The Next Generation Heat Pump

*Example use case—Reduction of Electric Resistance*

## Example Residential Heat Pump Profile in Central Florida



# The Next Generation Heat Pump

## *Example use case—Reduction of Electric Resistance*

### Oversized Field Site Data: Backup Electric Heat Usage

Outdoor Temperature Range (°F)	Baseline Equipment	Variable Capacity Equipment	
	Winter 2010	Winter 2013 (Factory Settings)	Winter 2014 (Lockout)
30 – 35	71%	20%	11%
35 – 40	40%	30%	4%
40 – 45	29%	18%	1%

\*All backup heat usage in Winter 2014 occurred in defrost operation

# The Next Generation Heat Pump

## Example use case—Coldest Day of VCHP Data Collection

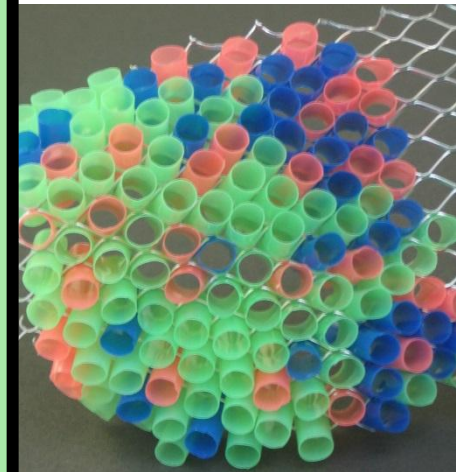
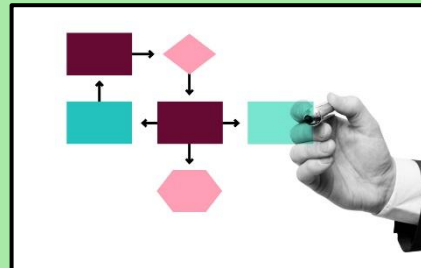
- Coldest Day of VCHP Data Collection (1/24/16)
- Minimum Temperature: 39°F Clearwater, 26°F Ocala

### Comparison of Two Similar Days for Baseline and VCHP

Site	System	Daily Outdoor Temperature (F)			HVAC Peak (kW)	HVAC Energy (kWh)
		Maximum	Average	Minimum		
Ocala	Baseline (1/13/10)	60	43	26	11.2	48.4
	VCHP (1/24/16)	55	40	26	5.4	28.6
Clearwater	Baseline (1/5/10)	51	45	39	5.0	31.4
	VCHP (1/24/16)	53	46	39	3.4	16.4

# Future...

- Establishing Next-gen HP Systems with Manufacturers
- Detailed Use Case Specification
- Test Protocol Development
- Laboratory Evaluation at EPRI
- Field Deployment
- Data Collection
- Data Analysis
- Program Implementation





# Together...Shaping the Future of Electricity