

**UTC Power**

A United Technologies Company

## ***Onsite Power - at the Ritz***

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2006 ASME IGTI



**United  
Technologies**



**Research Center**

# Outline

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## **PureComfort™ System**

- What is the system?
- What technology makes it unique?
- Where is it in operation?

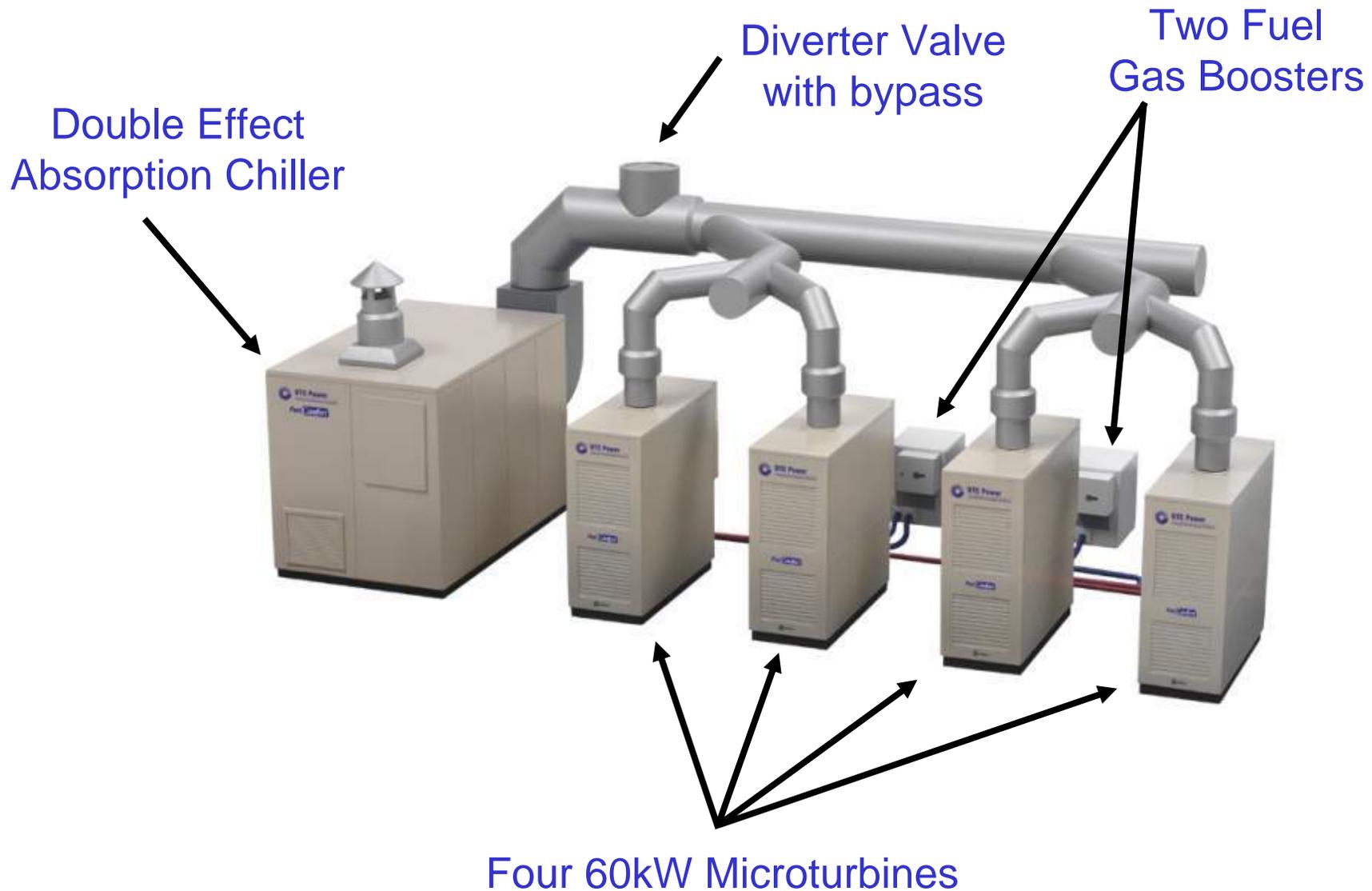
## **Ritz Carlton Hotel, San Francisco, CA**

- What is the application?
- What were installation challenges?
- How is it working?
- Is energy being saved?

## **Summary and Next Steps**

# PureComfort™ Solution is a Packaged CHP System

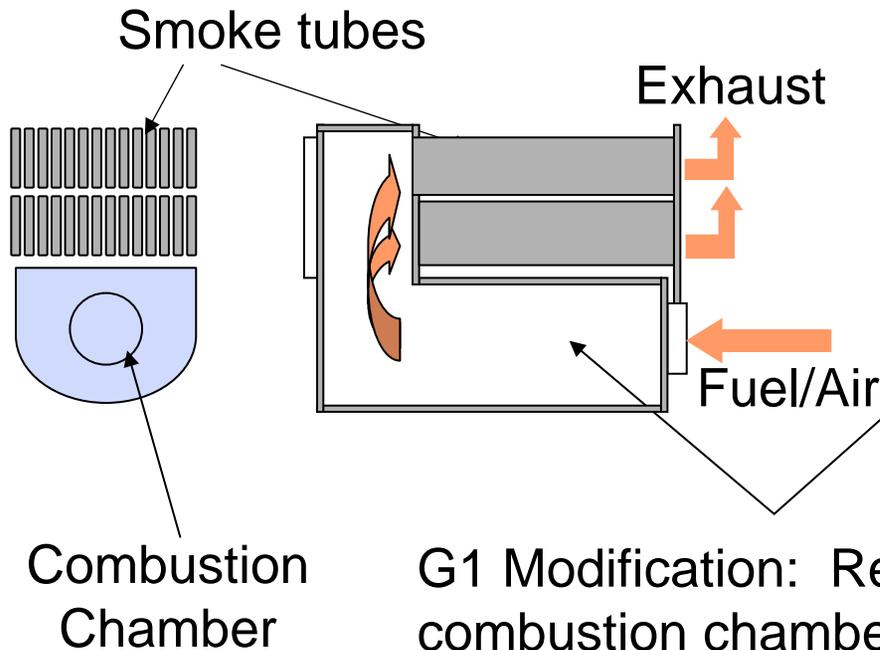
*Model 240M delivers 229 kW net power and 161 RT on ISO day → 91% CHP*



# Waste-Heat-Driven Double Effect Absorption Chiller

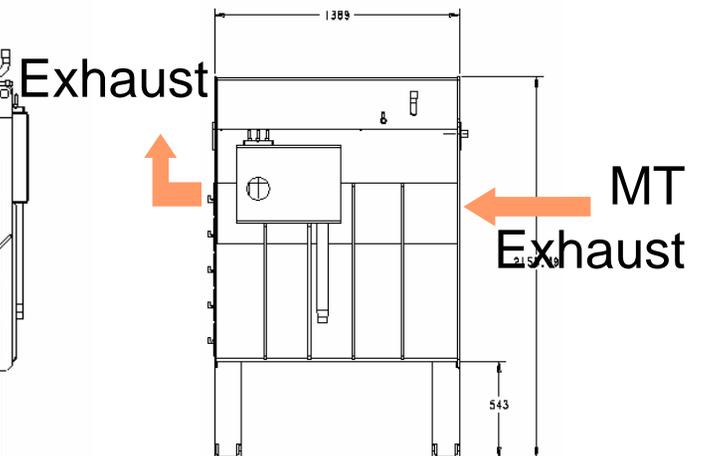
*Replace direct-fired chiller combustor with additional heat transfer area*

## Commercial Direct-Fired Double Effect



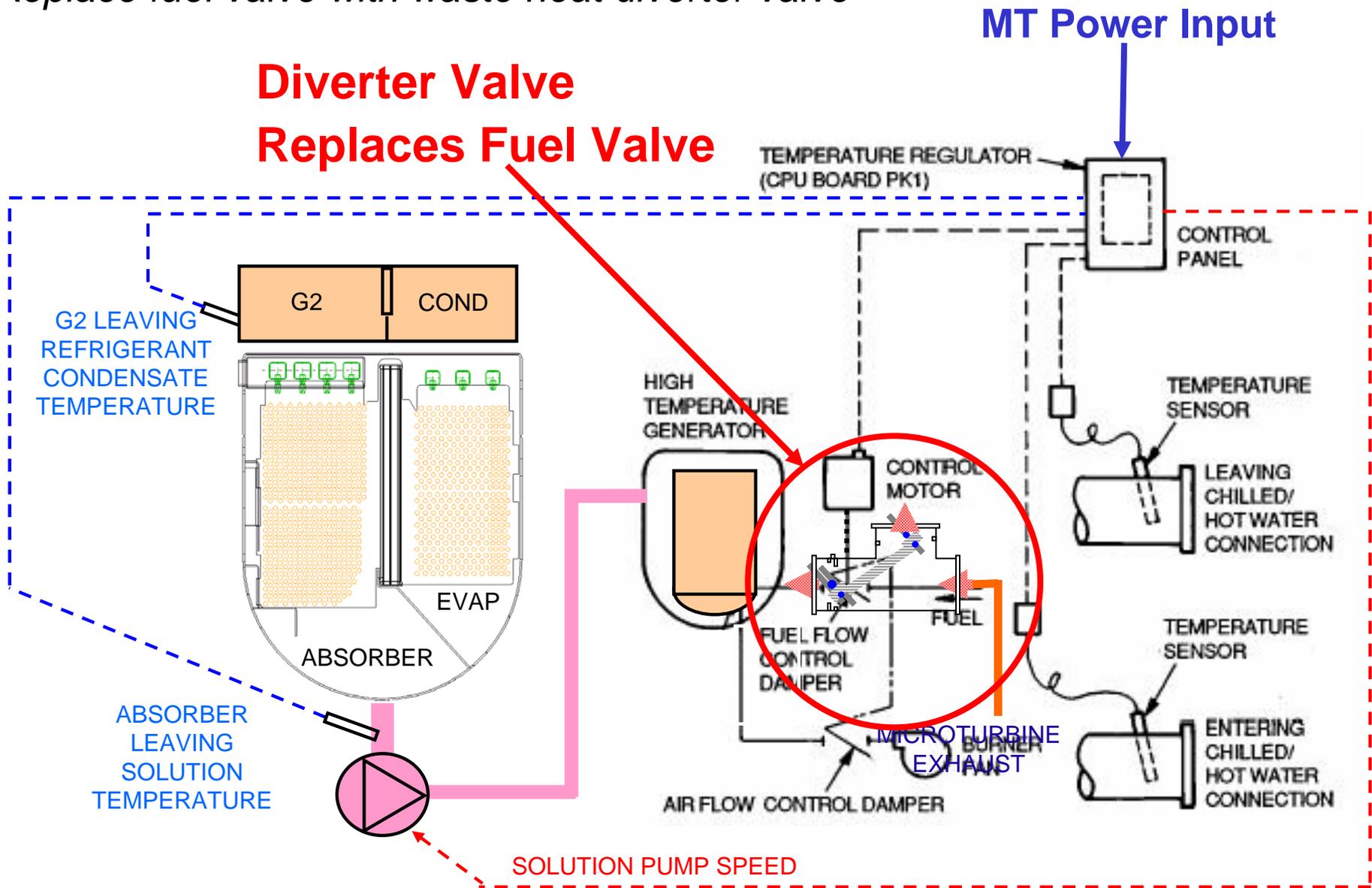
G1 Modification: Replace combustion chamber with additional smoke tubes

## Waste-Heat-Driven Double Effect



# Waste Heat Chiller Control

*Replace fuel valve with waste heat diverter valve*



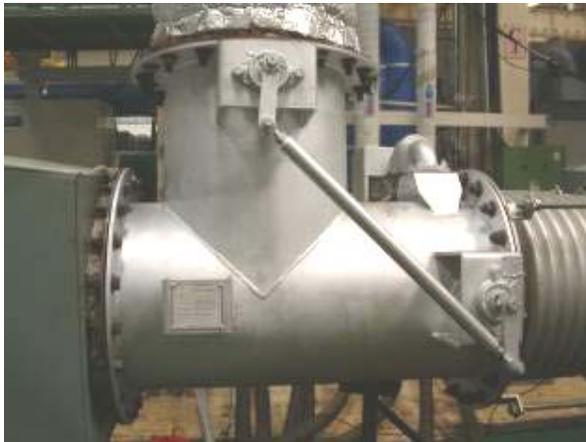
# Waste Heat Diverter Valve

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*Valve design and qualification ensures a reliable system*

## **Diverter Valve Throttles Hot Exhaust**

- ◆ Diverter valve designed for this application
- ◆ Design for fail-safe operation
- ◆ Valve position commanded by chiller controller
- ◆ Valve qualified by component and system qualification tests



# PureComfort™ System Family

*Capacities for range of commercial buildings*

**Model 240M**



**91% CHP efficiency**

**Model 300M**



**91% CHP efficiency**

**Model 360M**



**86% CHP efficiency**

**One Double Effect Absorption Chiller/Heater**

# Installed PureComfort™ Systems

*Broad range of market segments*



Mount Kisco, NY  
240M



Mississauga, Ontario  
240M

Ronald Reagan



Simi Valley, CA  
3 @ 300M



THE RITZ-CARLTON®

San Francisco, CA  
240M



Providence, RI  
240M + Trigen



**WAL★MART**

Aurora, CO  
360M + Trigen

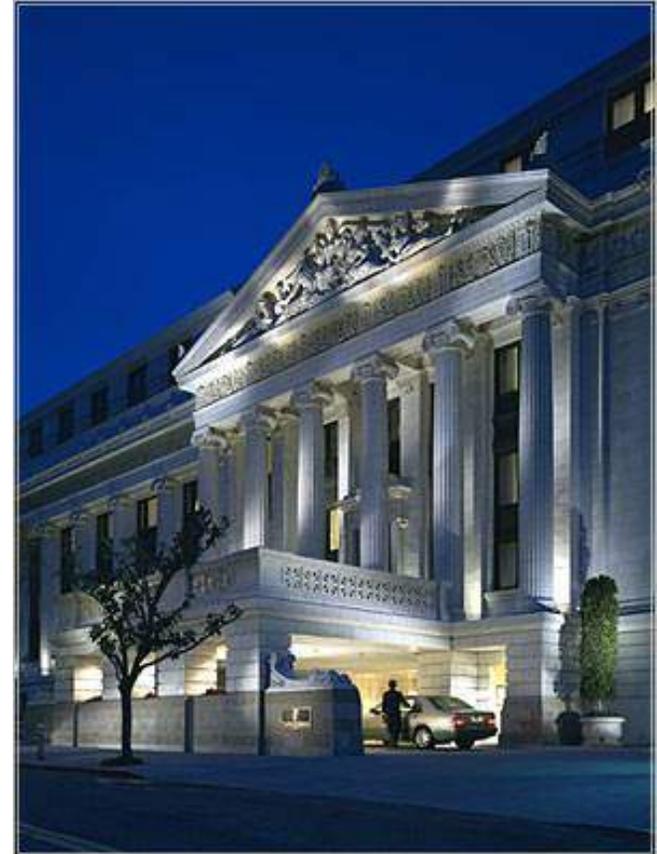


# Ritz Carlton Hotel, San Francisco

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*Mobil:* ★ ★ ★ ★ ★      *AAA:* ◆ ◆ ◆ ◆ ◆

- **336 room full-service luxury hotel located in heart of San Francisco**
- **Electrical and cooling profiles consistent with 240 kW, 120 RT CHP system**
- **Network connection to maximize grid reliability**
- **Retrofit onto 4<sup>th</sup> floor**

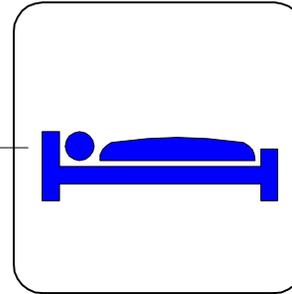
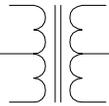


# Ritz Electrical Service is a Network, Not Radial, Feed

*Reliable, redundant supplies add interconnection complexity*

## Radial Supply

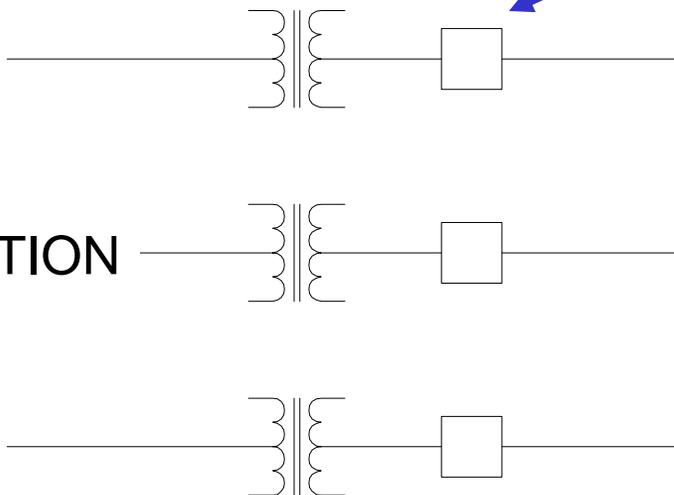
UTILITY  
DISTRIBUTION  
SYSTEM



HOTEL

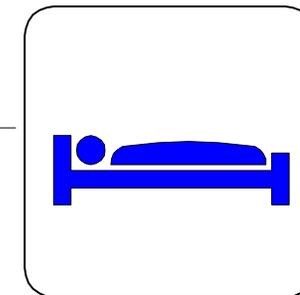
## Network Supply

UTILITY  
DISTRIBUTION  
SYSTEM



## Network Protectors

- On each utility source
- Customer side of transformer
- Breaker and Reverse Current Protection Relay



HOTEL

# Protection Requirements for DG on Network

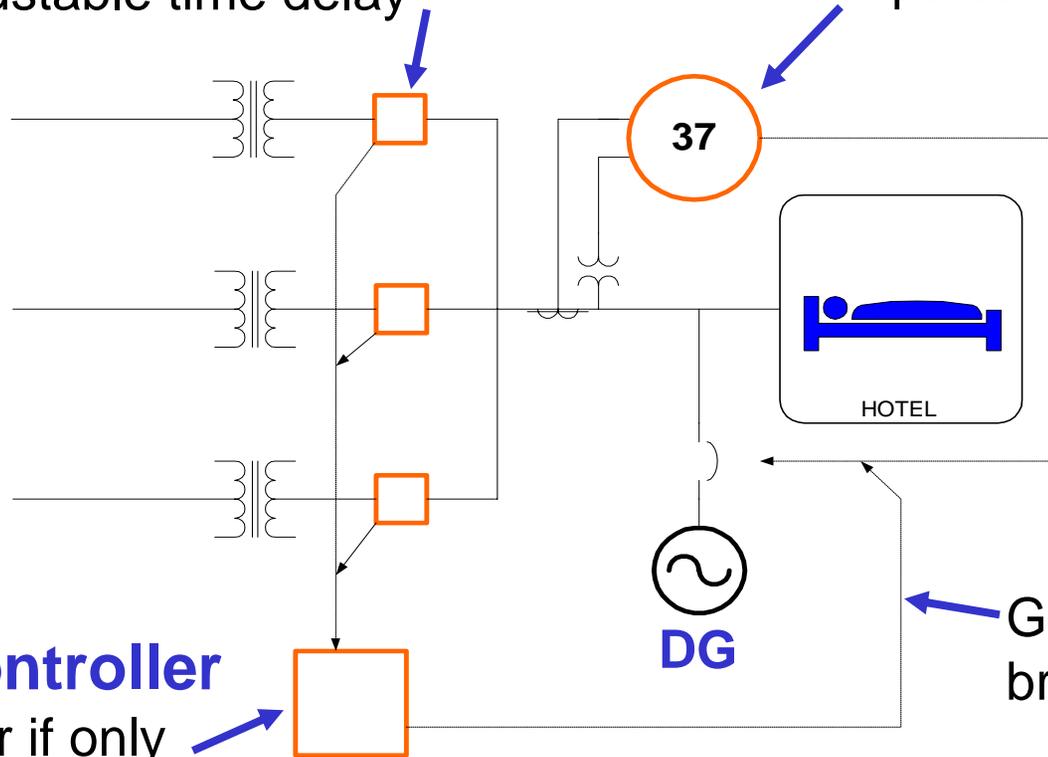
*Extra equipment owned and maintained by utility*

## Upgraded Network Protector

Includes electronic relay with  
Adjustable time delay

## Under Power Relay

Trips before network protector



## GE C-30 Controller

Trips generator if only  
one network protector  
is closed

Generator circuit  
breaker trip signal

# Urban Rigging

*Dense population and Nob Hill slopes presented challenges*



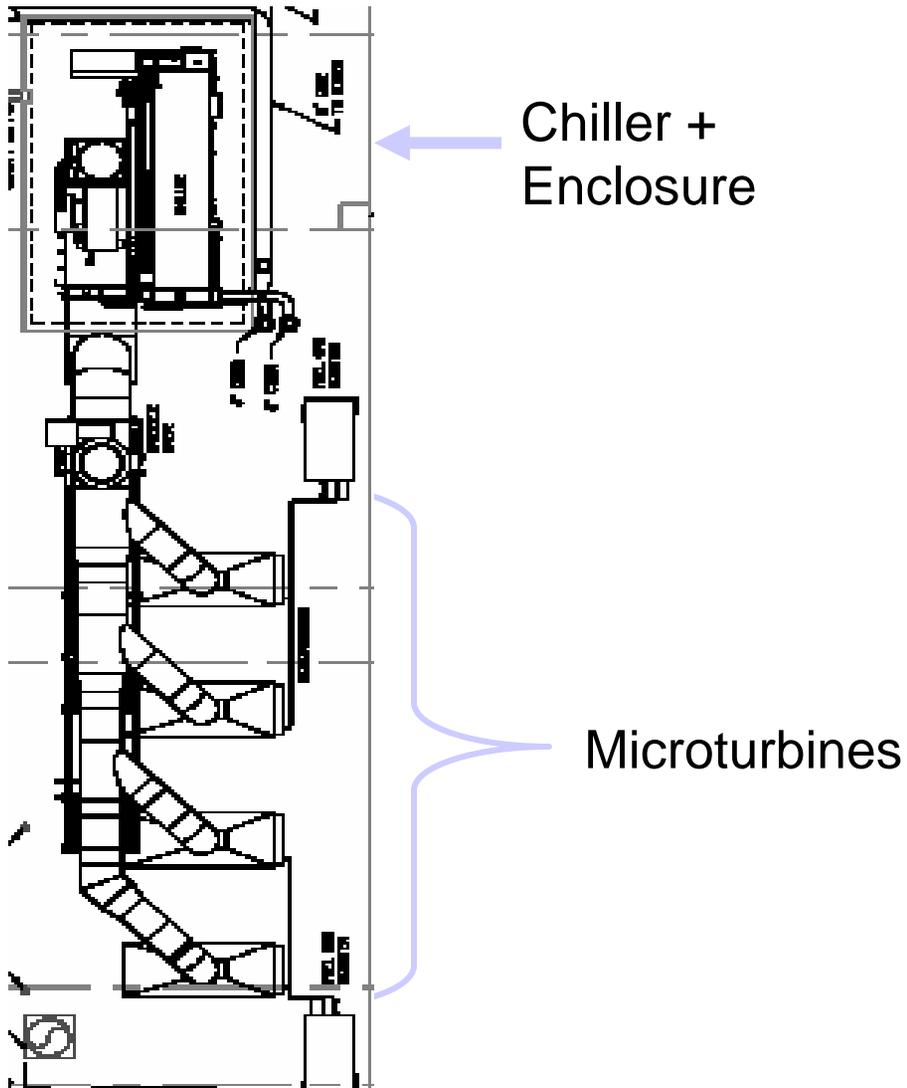
## Retrofit/space limitations prevented installation of a skid configuration

- Microturbine, FGB easily lifted
- Chiller lift (at 19,731 lb) was challenge
  - But accomplished!



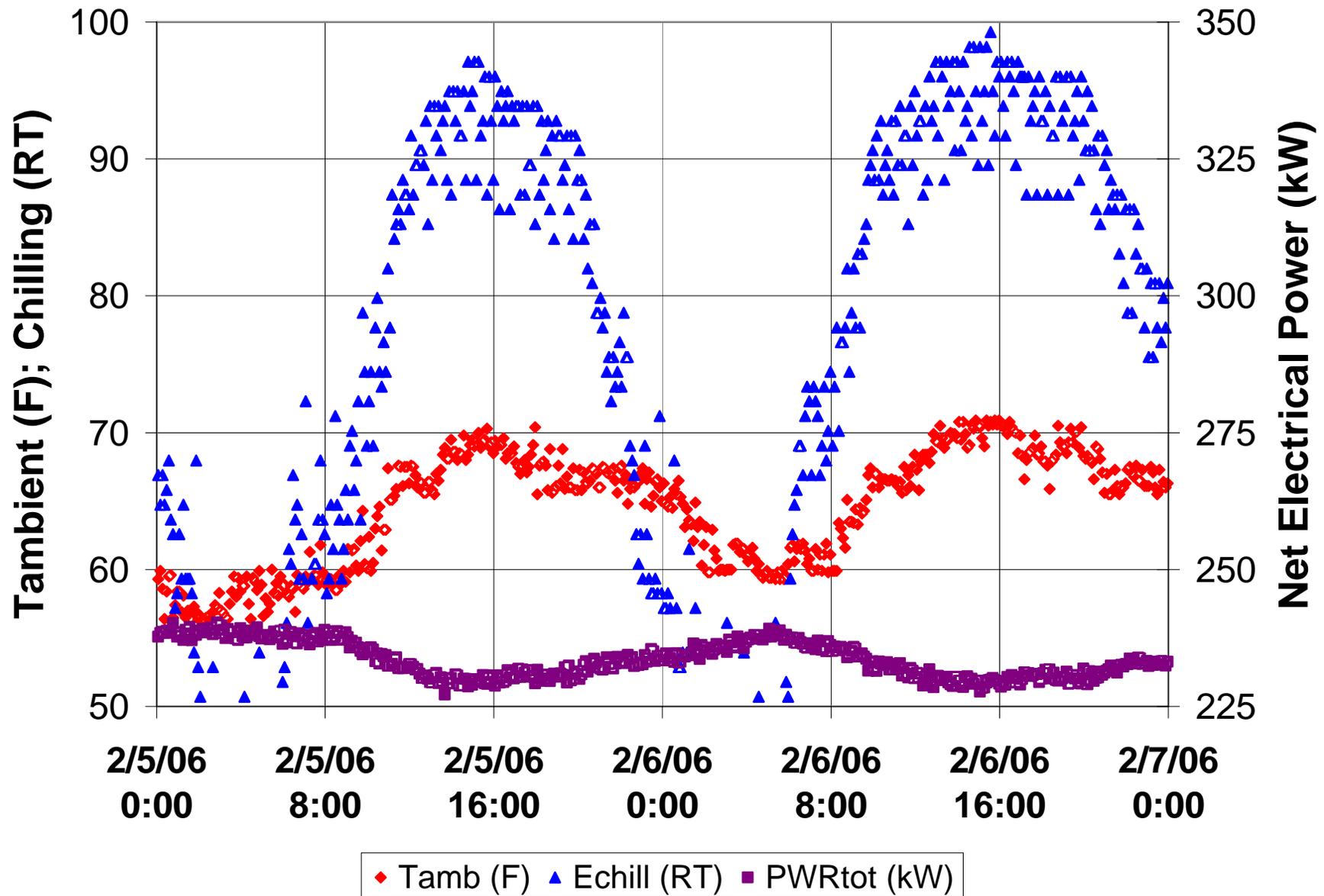
# PureComfort™ System on Ritz Carlton Rooftop

*Nearby outdoor courtyard demand quiet operation*



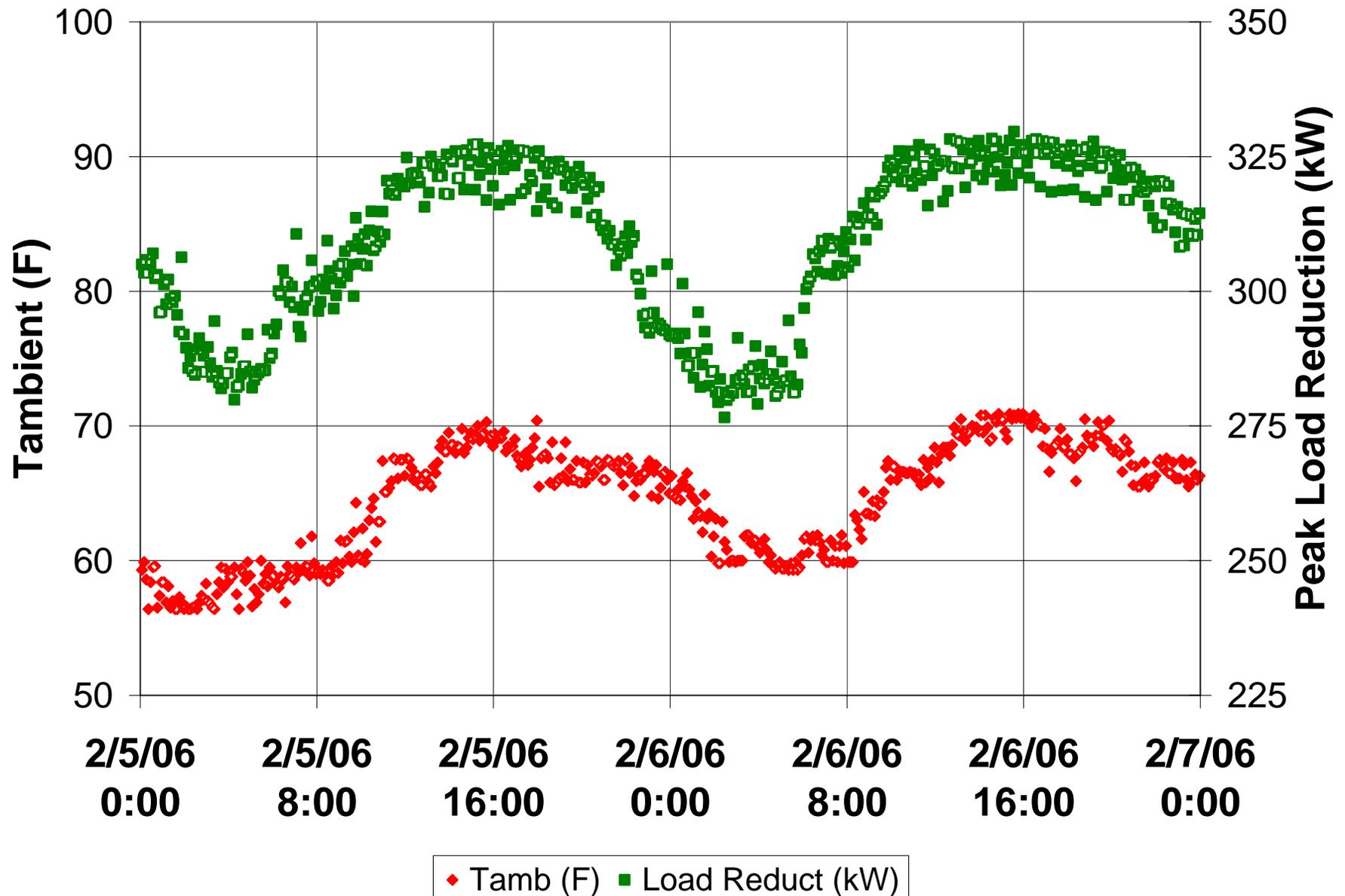
# CHP System Electrical and Thermal Outputs in February

*Baseload Electrical; Chilling responds to time-of-day demand*



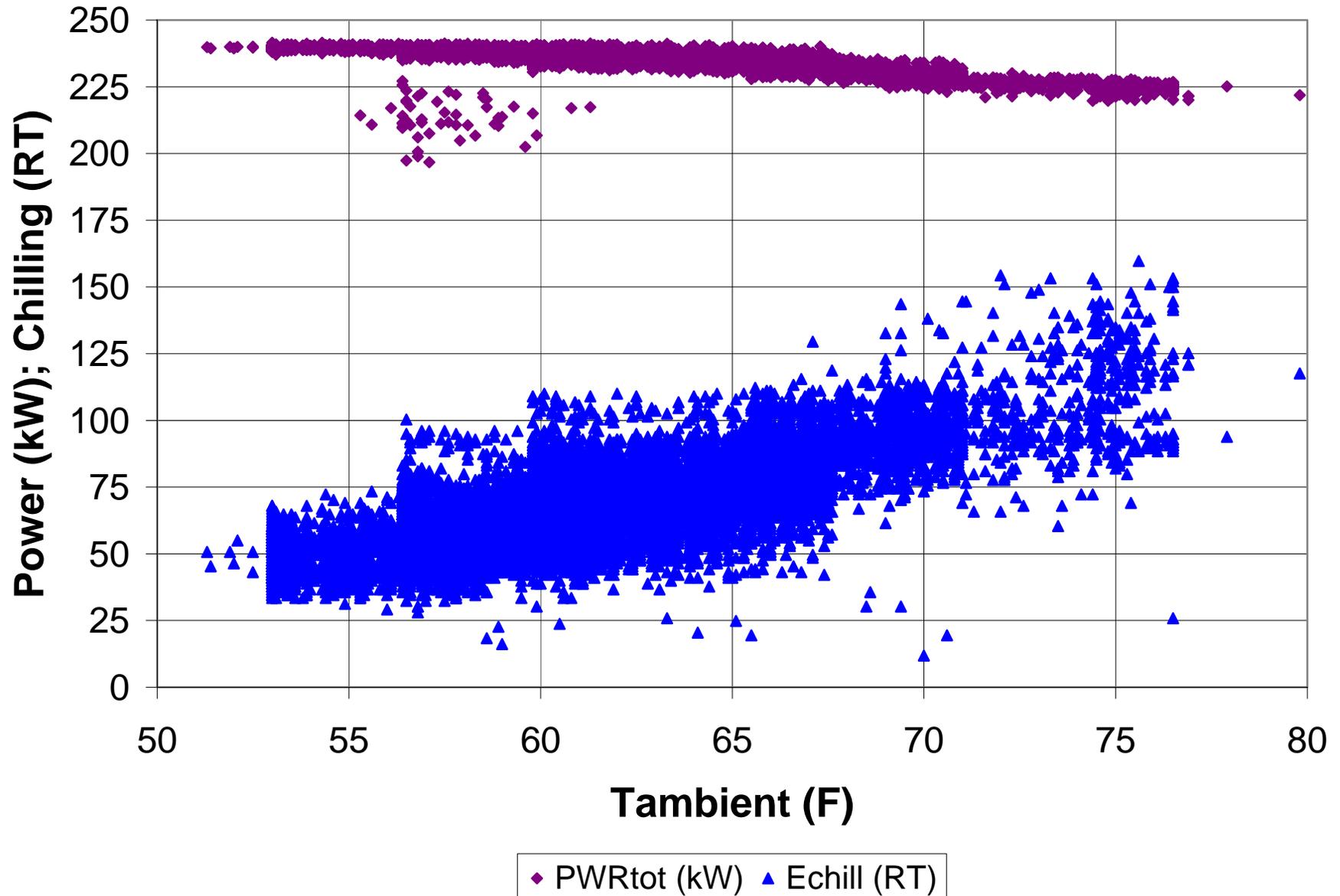
# Peak Load Reduction From CHP Electrical and Avoided VCC

*Reduction maximizes during heat of the day*



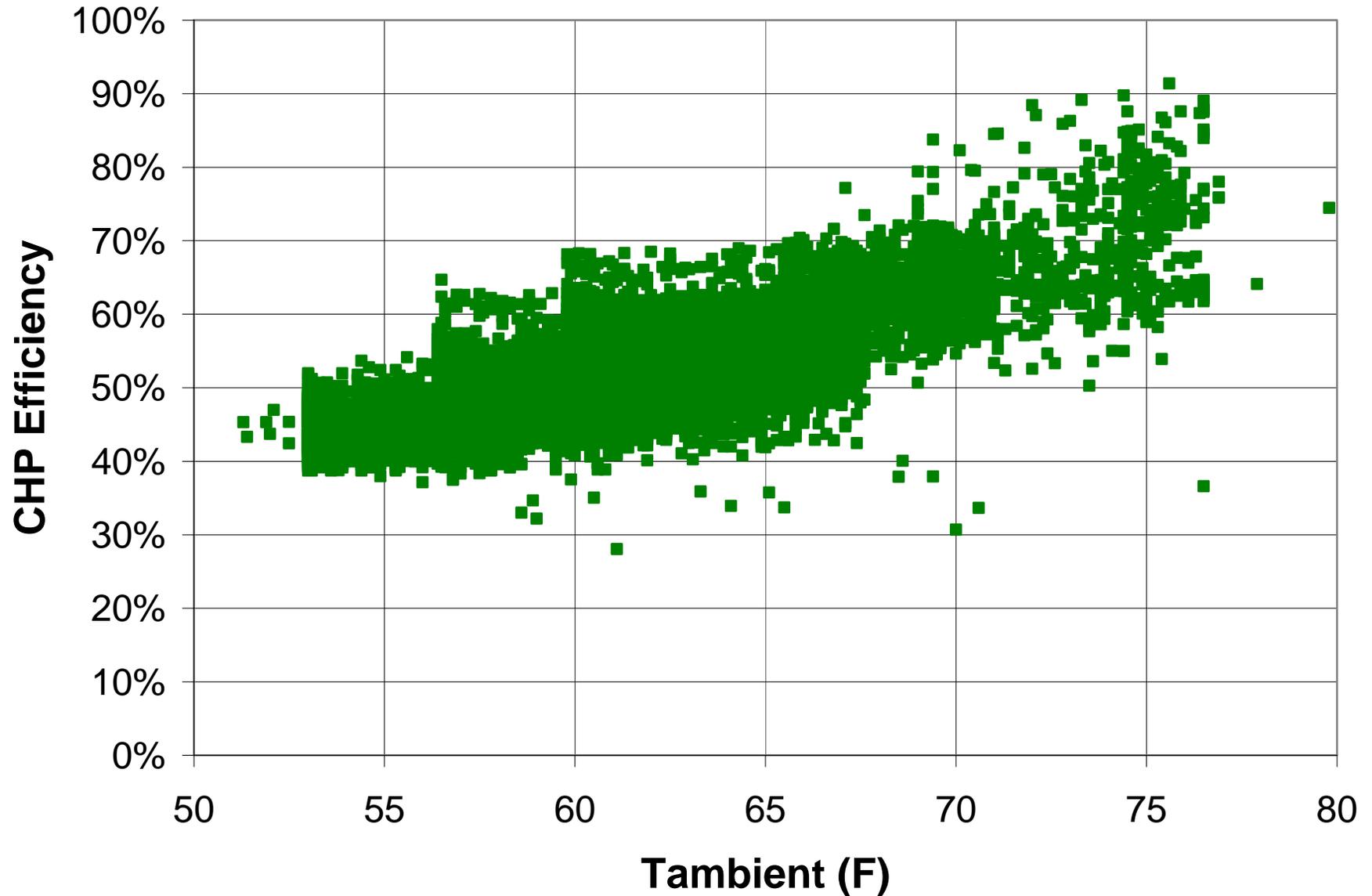
# CHP System Response to Ambient Temperature (Jan-Mar)

*Chilling output increases to meet demand*



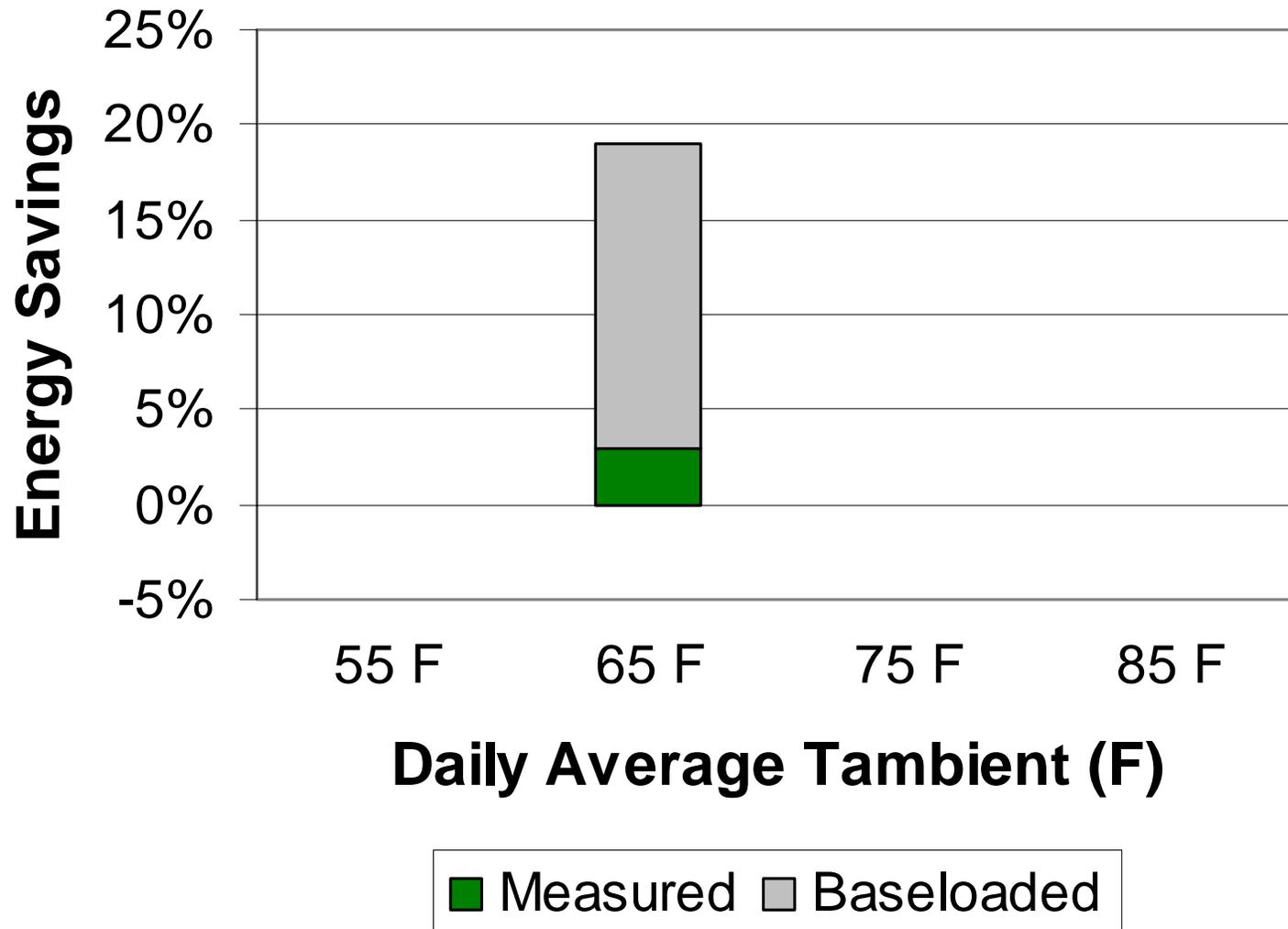
# CHP Efficiency Increases With Ambient Temperature

*CHP efficiency > 85% expected on SF summer day*



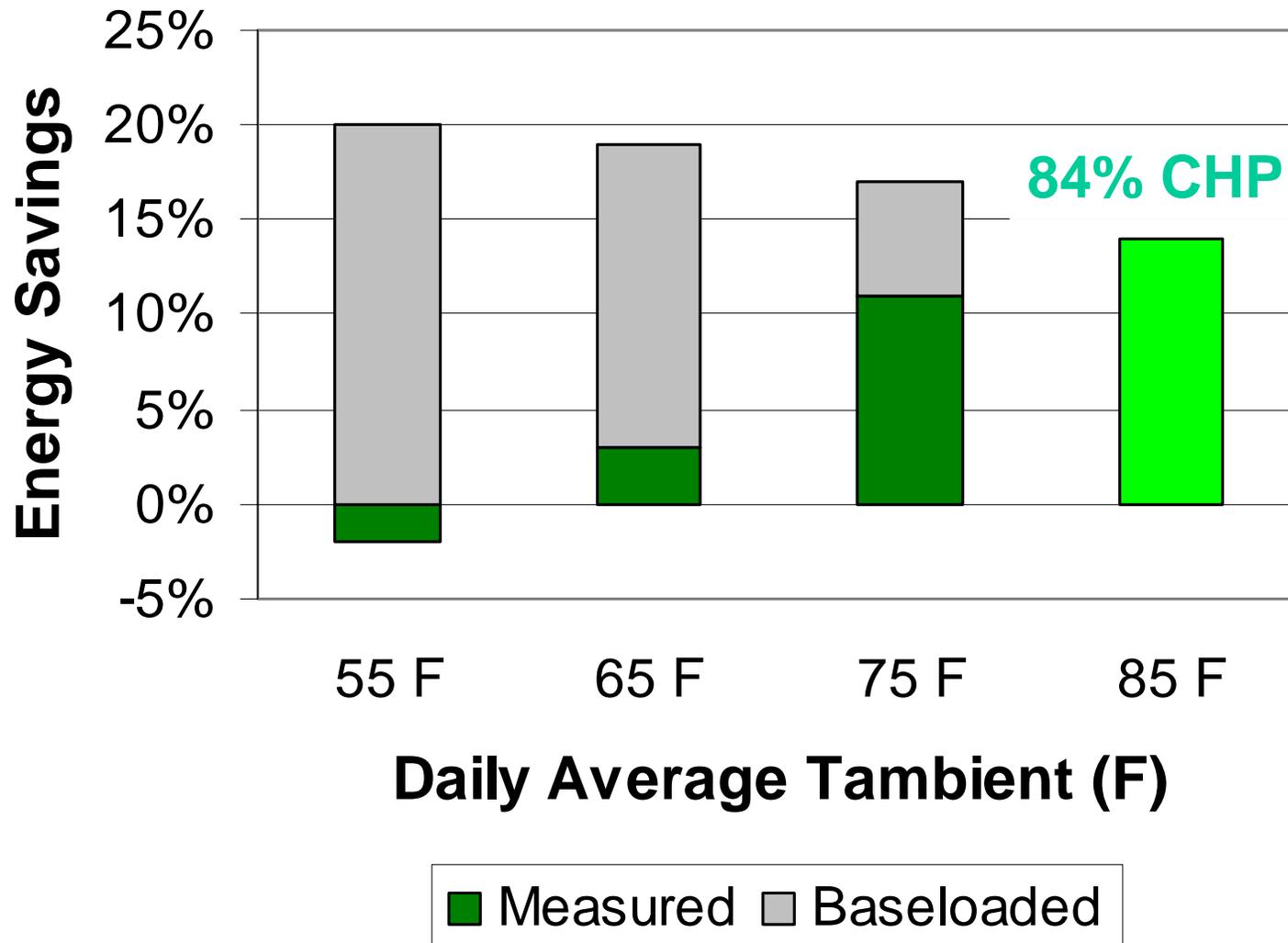
# Energy Saved in San Francisco on February Day

*Piece-wise integration of electrical and chilling over 24 hours*



# Energy Saved Over Much of Winter Months (Jan – Mar)

*~ 14% energy saving projected for SF summer day*



# Emissions Reductions Also

*Arises from high efficiency and advanced combustor technology*

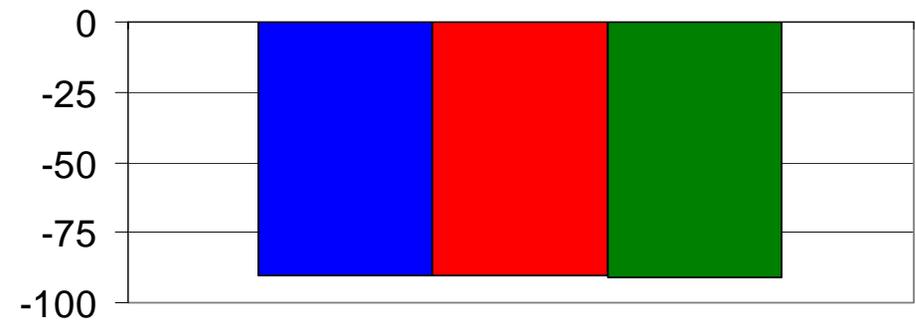
## CO<sub>2</sub> Production (%)



■ 55 ■ 65 ■ 75

Tambient (F)

## NO<sub>x</sub> Production (%)



■ 55 ■ 65 ■ 75

Tambient (F)

# Summary and Next Steps

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## CHP Systems do save energy

- and reduce Peak Loads
- and reduce emissions of Green House Gas and NO<sub>x</sub>

## Benefits always maximize when electrical and thermal demands match system capacity

- Winter demand at Ritz under-utilizes the chiller
- Simultaneous heating and cooling chiller is in final UTC development
  - Meet both thermal demands
  - Wide turndown of both heated or chilled water output
  - Increased yearly CHP efficiency and energy savings

**UTRC/UTC Power are always seeking reliable, sustainable, efficient CHP products that customers want.**



Research Center

