



UTC Power

A United Technologies Company

4TH IPHE Workshop, Stationary Fuel Cells

PURECELL[®] COMBINED HEAT & POWER FUEL CELL SOLUTIONS

Surpassing the early adopter market

Tokyo, Japan
1 March 2011

United Technologies Corporation



Fortune 50 corporation

\$52.9B in annual sales in 2009



UTC Fire & Security



Pratt & Whitney



Carrier



Otis



Sikorsky



Hamilton Sundstrand



Research Center



UTC Power

~60% of sales are in building technologies

About Us



- Fuel cell technology leader since 1958
- ~ 600 employees
- 750+ Active U.S. patents, more than 300 additional U.S. patents pending
- Global leader in efficient, reliable, and sustainable fuel cell solutions

Stationary Fuel Cells



Transportation



Space & Defense



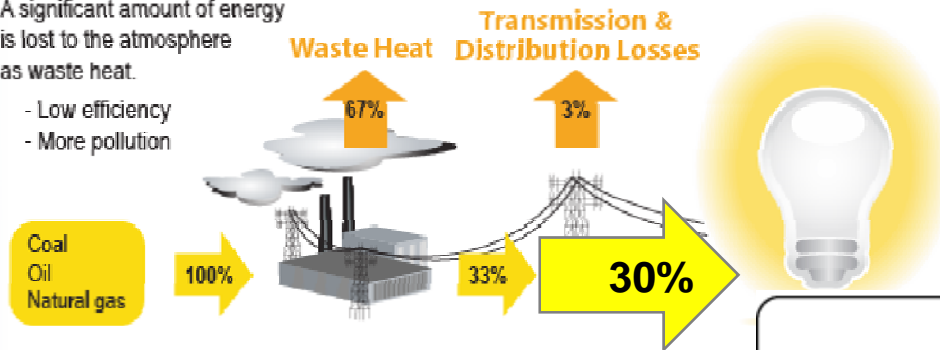
CHP Versus the Grid

Energy Efficiency Comparison to Utility Grid

Traditional Central Power Plant

A significant amount of energy is lost to the atmosphere as waste heat.

- Low efficiency
- More pollution



Source: Adapted from U.S. Combined Heat and Power Association.

CCHP

Combined Cooling Heating and Power

PureCell® Model 400 Solution

More waste heat is recovered and converted to usable energy.

- High efficiency
- Ultra-low emissions



Source: Adapted from U.S. Combined Heat and Power Association.

Up to 3x More Efficient

Dual Mode

Backup power when the grid goes down

Load Following

Able to ramp up and down with facility demand



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Process Overview

1

Fuel Processor

Converts natural gas fuel to hydrogen

2

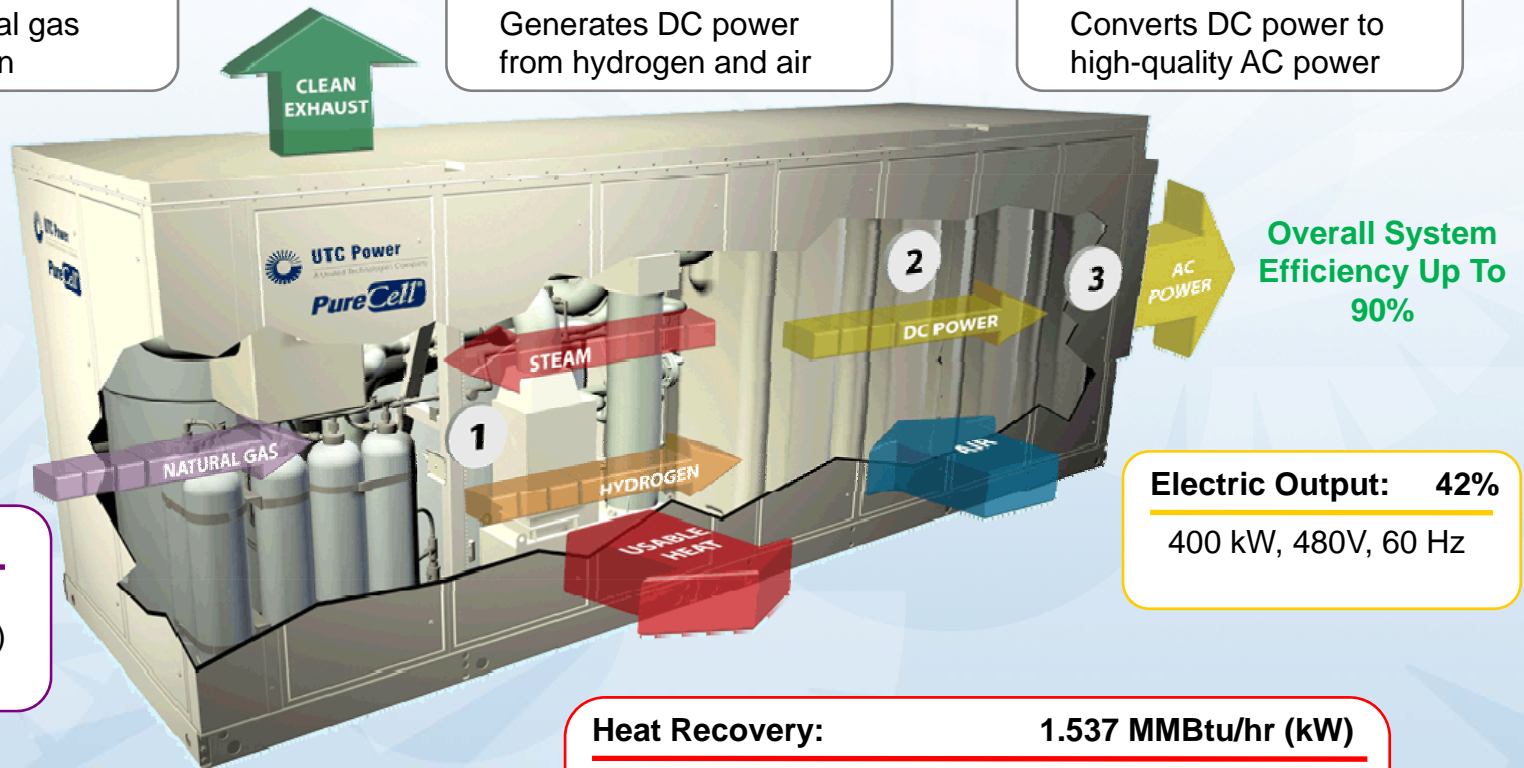
Fuel Cell Stack

Generates DC power from hydrogen and air

3

Power Conditioner

Converts DC power to high-quality AC power



Fuel Input (LHV):

Natural gas
3.2 MMBtu/hr (950 kW)

Electric Output: 42%

400 kW, 480V, 60 Hz

All Values are Beginning-of-Life (BOL)
Product Certified To FC-1 & CARB 2007

Heat Recovery:

1.537 MMBtu/hr (kW)

High-Grade up to 250°F (120°C)

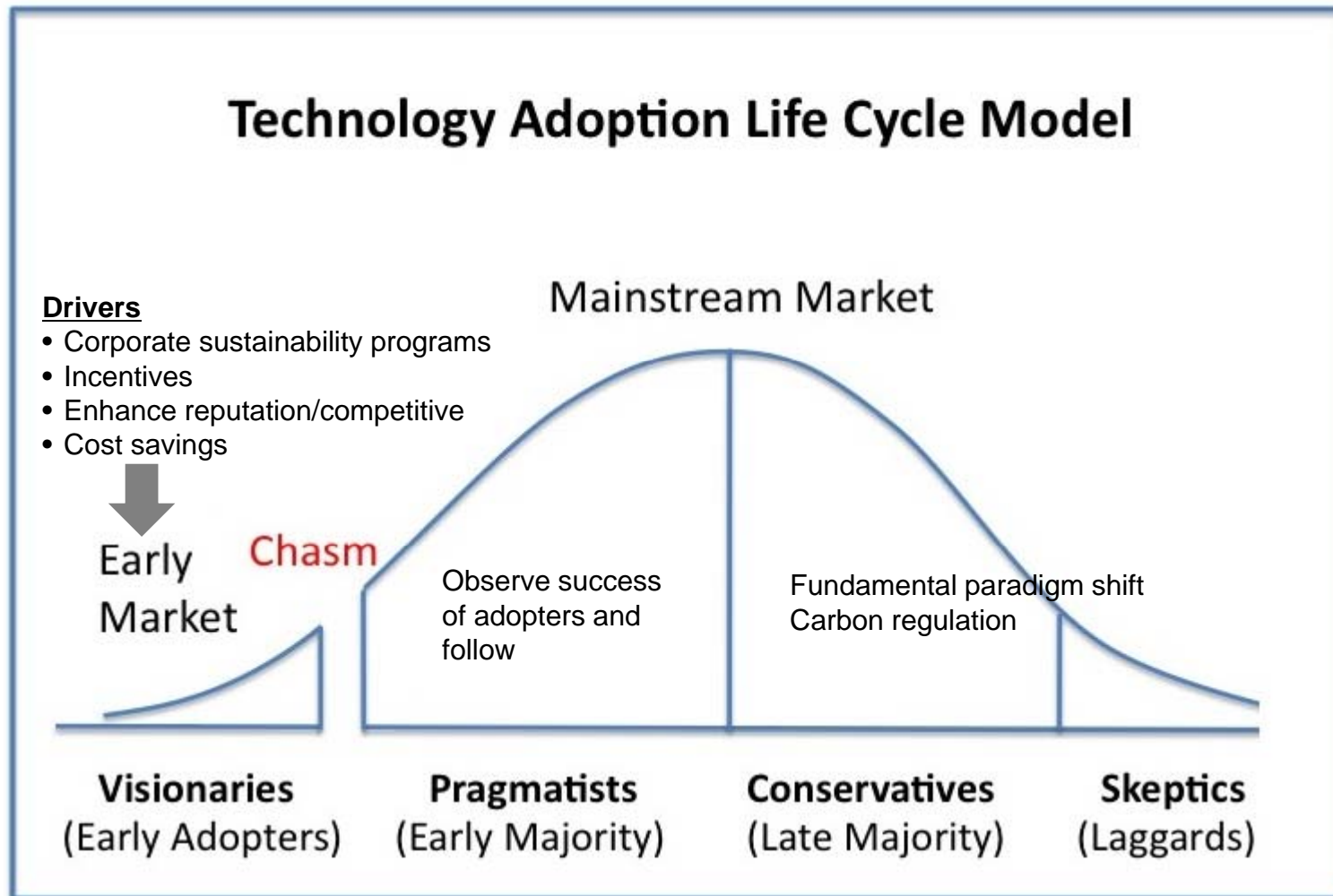
683,000 (200)

Low-Grade up to 140°F (60°C)

854,000 (250)



Technology Adoption

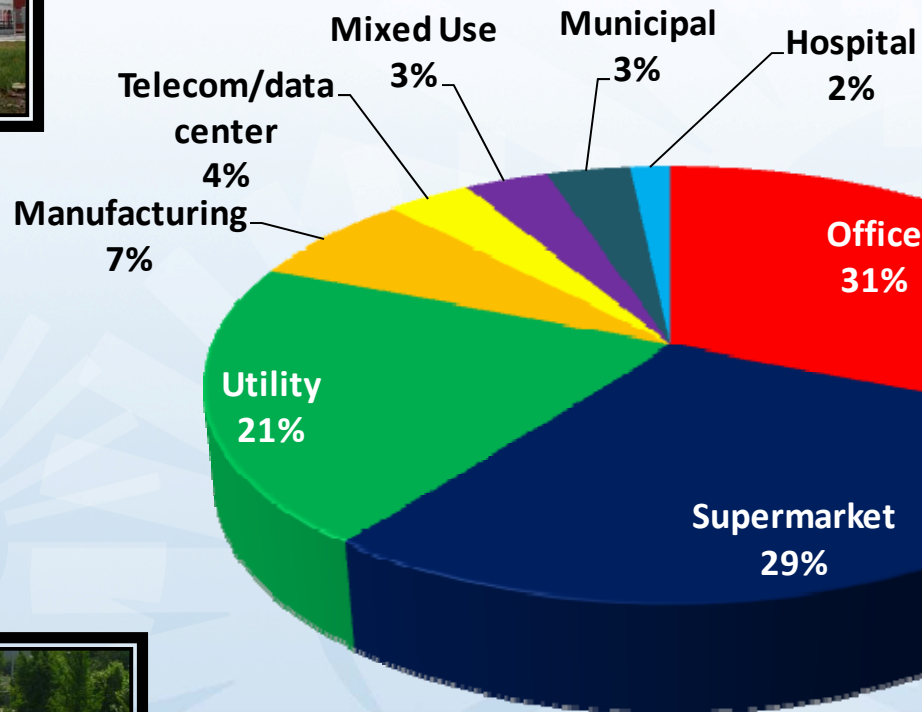


Key Challenges and Barriers

- Product cost
- Thermal utilization and integration
- Fluctuating incentives
- Other clean energy alternatives
- Sub-metering restrictions
- Existing building retrofit schedules
- Changing economy & operators building philosophy

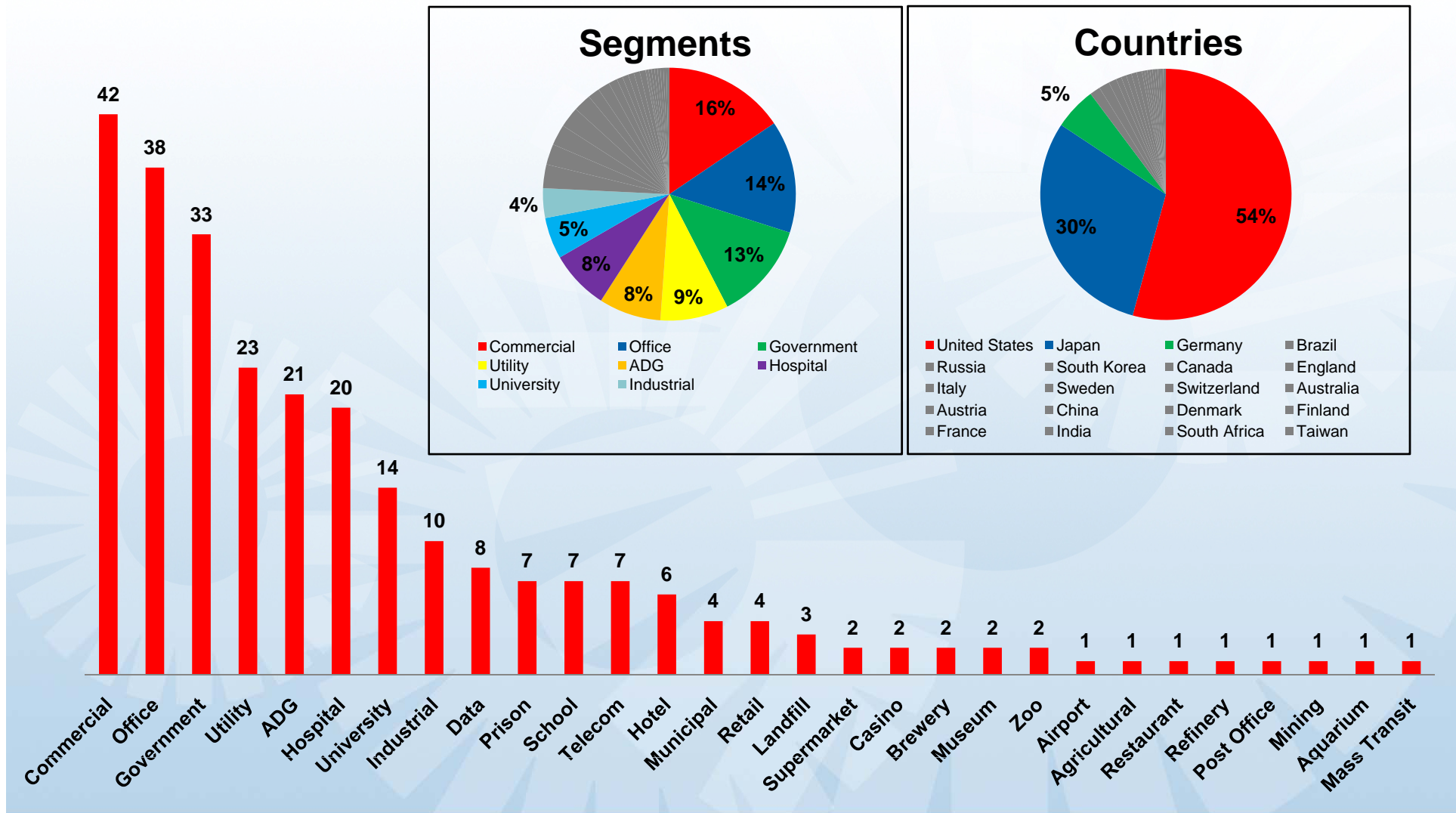
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Market Segments Addressed



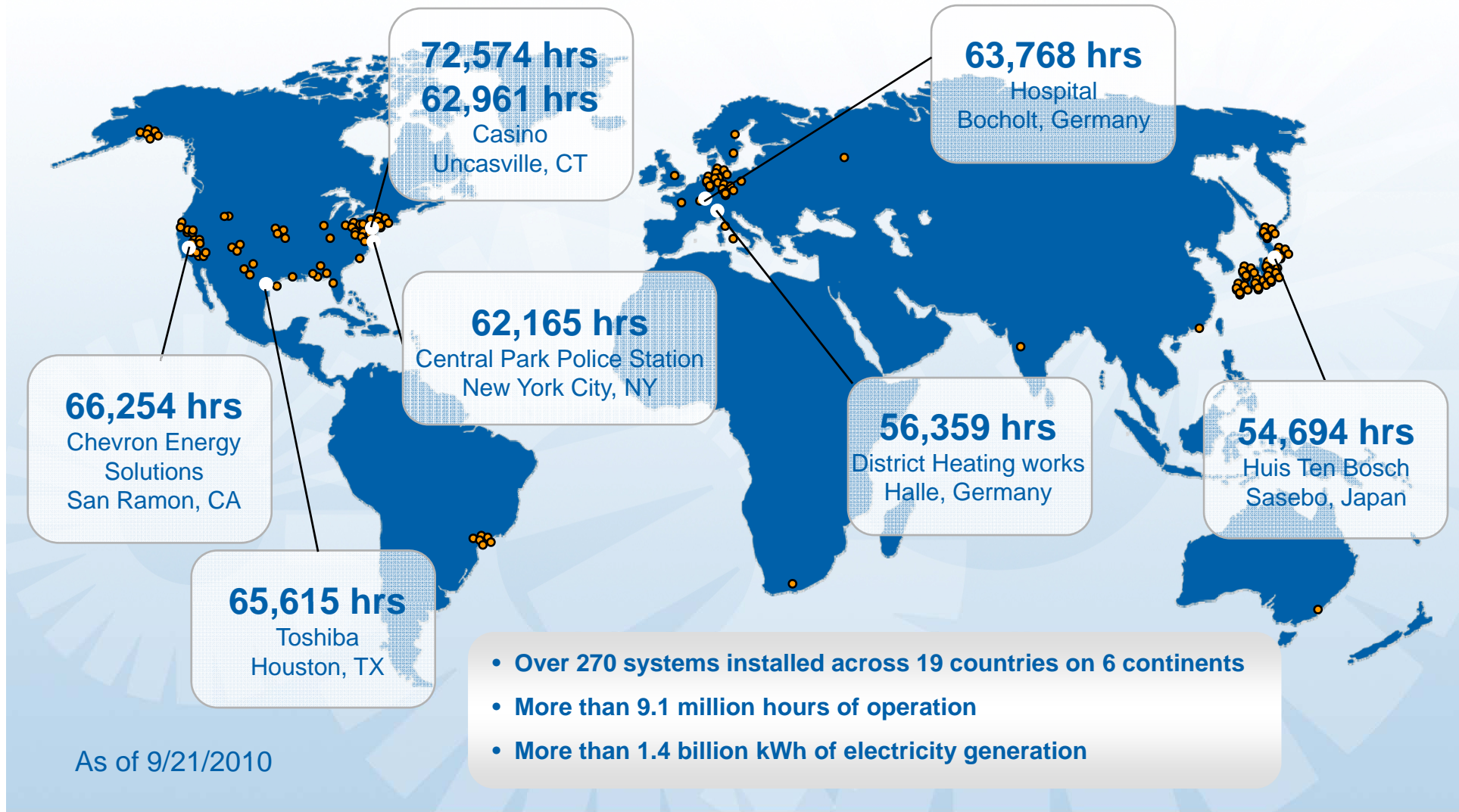
PureCell® Model 200 Solution

Market Segmentation Since 1991



PureCell® Model 200 Solution

Units Exceeding 40,000 Hour Fuel Cell Stack Design Life



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Supermarket Segment – Price Chopper (Albany, NY)



- Commissioned March 2010
- Meets ~85% of store's energy needs
- Energy security for perishable items
- Reduces store's carbon footprint by 71 metric tons
- Saves over 4 million gallons of water each year



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Supermarket Segment – Albertson's (San Diego, CA)



- Commissioned September 2010
- Energy security for perishable items
- Reduces store's carbon footprint by 478 metric tons per year
- Saves millions of gallons of water each year

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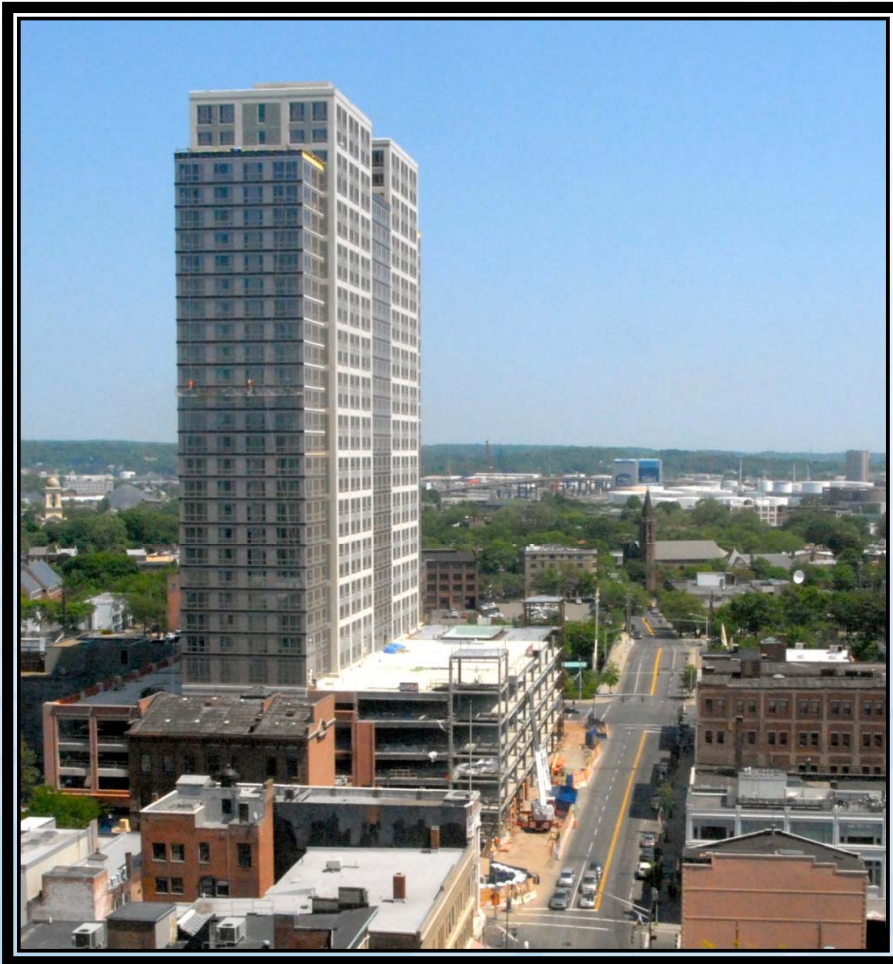
Manufacturing/Bottling - Coca-Cola Refreshments USA (Elmsford, NY)



- Installed October 2010
- Meets 35% of facility's energy and heat requirements
- Reduces facility's carbon footprint by 2,635 metric tons annually when compared to non-base load utility powerplants
- Saves millions of gallons of water each year

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Mixed Use Segment – 360 State Street (New Haven, CT)



- Commissioning: August 2010
- Large scale mixed-use residential
- 700,000 square feet, 500 units
- Will satisfy nearly 100% of building's electrical need
- Will provide thermal energy for space heating, DHW and swimming pool



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Utility Segment – GS Power / Samsung (Anyang, South Korea)



- One of the largest fuel cell installations in the world
- 4.8 MW installation (12 units)
- Will satisfy 5% of Anyang's power needs
- 40,000 MW hours total power output expected
- High grade heat feeds district heating loop
- Low grade heat supplied to natural gas let-down station

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Office Segment - World Trade Center (New York City, NY)

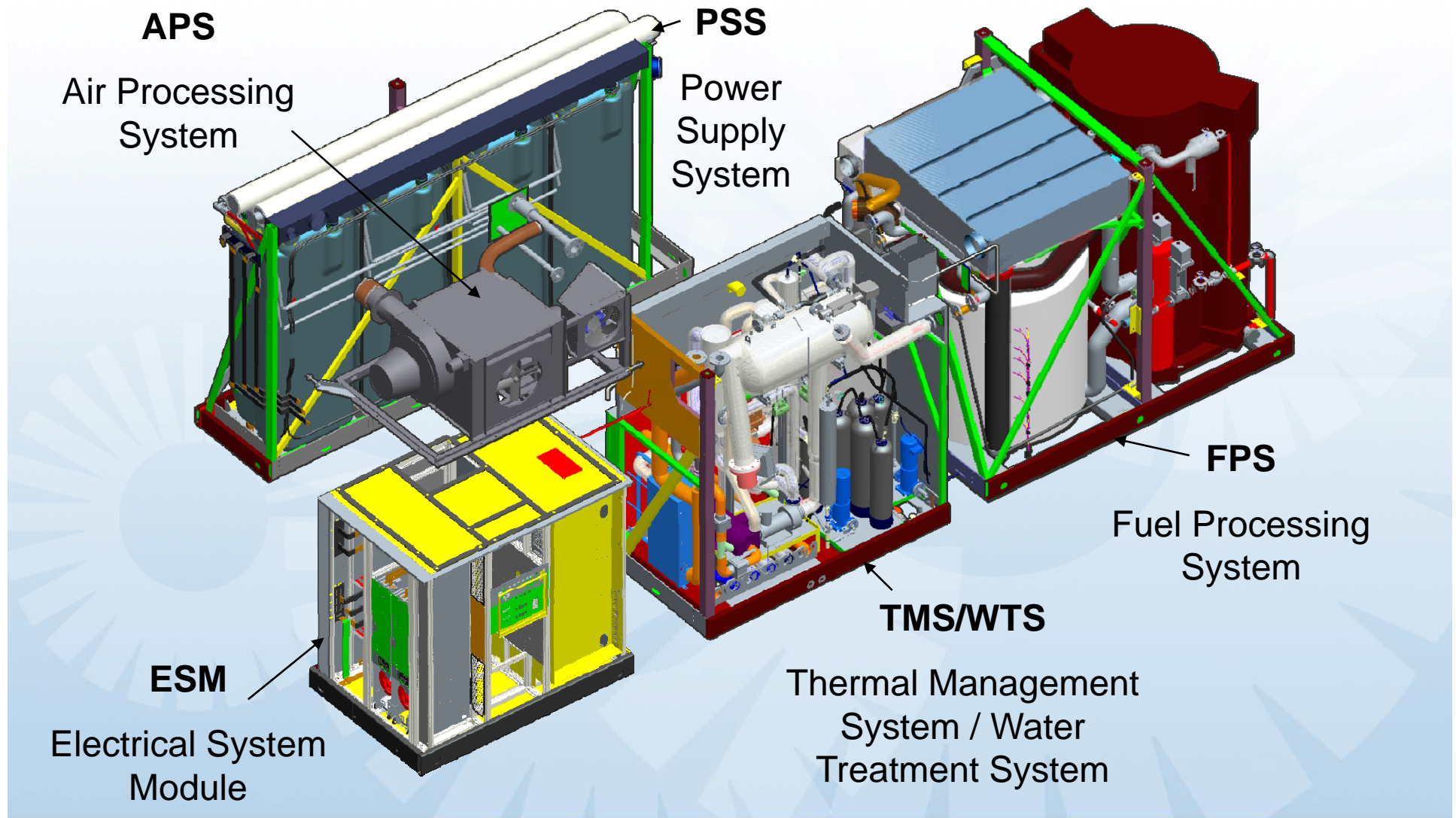
- World Trade Center, New York City
- 12 UTC Power 400 kW fuel cells (4.8 megawatt)
- 3 power plants per tower, initial 9 delivered in 2010
- Grid connected operation only
- Space heating offset
- Providing heat to one centralized single effect absorption chiller per tower for office cooling



Cost Reduction

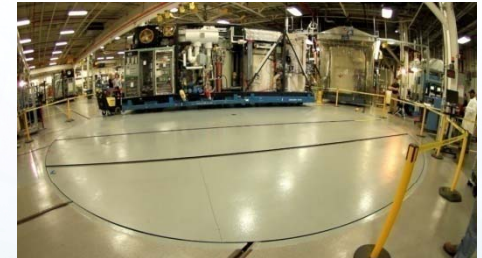
- 45% product cost reduction 2009 to 2011 (target)
- 30% installation cost reduction 2010 to 2011 (target)
- 53% reduction in test time over 2010
- Significant manufacturing plant upgrade in 2010

Assembly



Manufacturing Upgrades

- Manufacturing plant modernization completed
 - Automated cell stack assembly/robotics
 - New cell stack test stands in place
 - Rail/turntable assembly line to rapidly move powerplants – eliminating cranes
 - New final test stands for completed power plant



Summary

- Successful Model 400 product launch in 2009
- Gaining traction in key markets
- Cost reduction efforts show strong results
- Product line expansion decisions to be made

Almost across the chasm

THANK YOU !

www.utcpower.com

