Hydrogen Fuel Cells From Demonstration to Commercialization

HTAC Meeting

November 3, 2011

Agenda

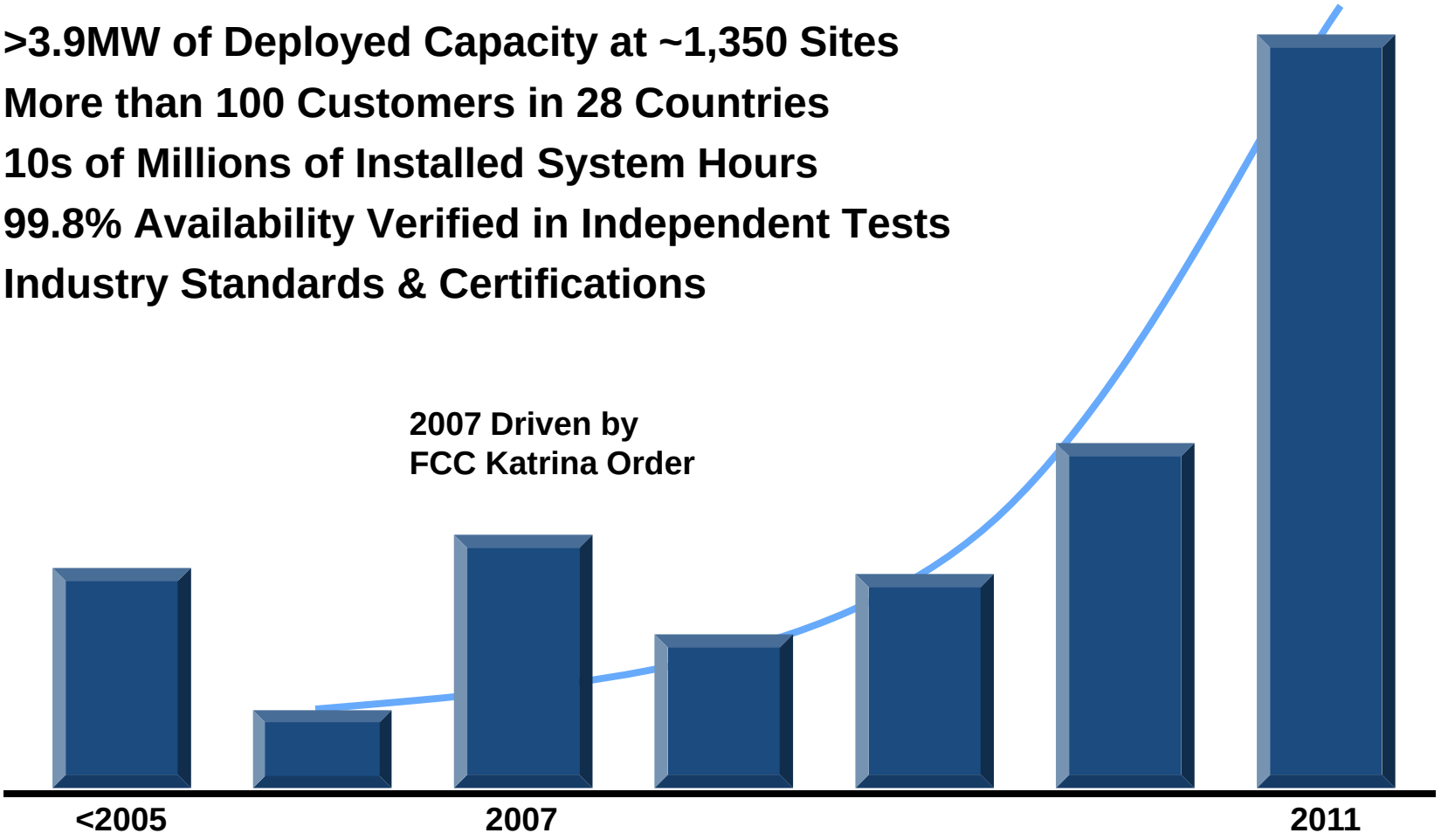
- Introduction
- Commercial Growth
- World View
- Hydrogen Solutions
- AT&T Case Study
- WSP Case Study
- Challenges
- Summary

ReliOn Overview

Markets	Backup, grid supplement, and off-grid power systems for critical communications infrastructure spanning telecom, transportation, government, utility, and OEM customers throughout the world. Nearly 4MW deployed product at more than 1,300 sites
Products	Purpose designed product portfolio of 175W to 2.5kW building blocks providing solutions up to 30kW for target markets. Broad range of hydrogen storage solutions supported by major industrial gas companies.
Team	~50 highly educated and trained staff. Direct marketing and selling augmented with key channel partners, integrators, and OEMs. Over 100 cumulative years telecommunications experience on Sr. Management team.
Technology	Fundamental technology company with strengths in materials science, electrochemistry, thermal management, and power electronics. Ongoing R&D programs with a broad and growing Intellectual Property portfolio.

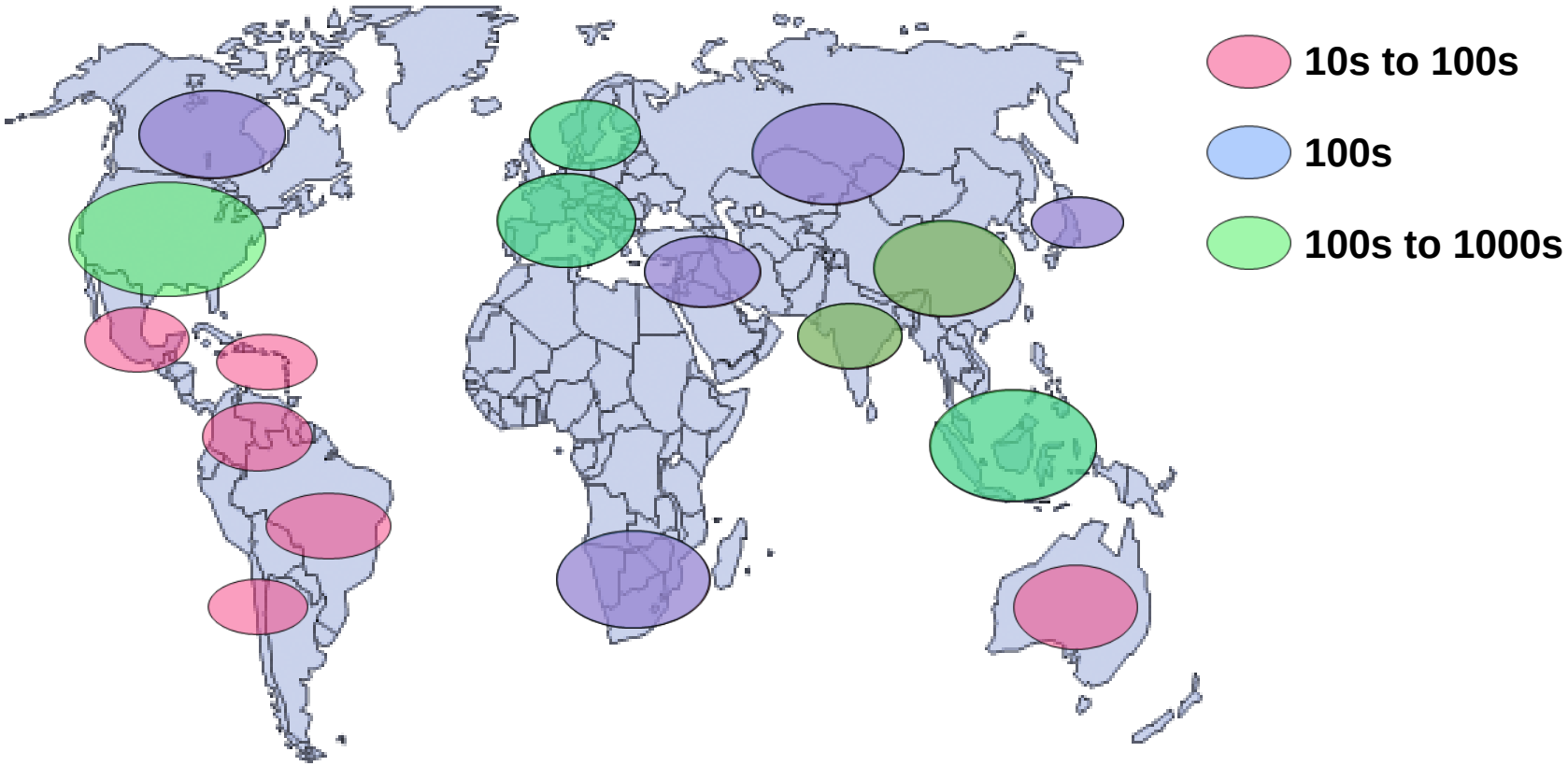
Commercial Performance

- >3.9MW of Deployed Capacity at ~1,350 Sites
- More than 100 Customers in 28 Countries
- 10s of Millions of Installed System Hours
- 99.8% Availability Verified in Independent Tests
- Industry Standards & Certifications



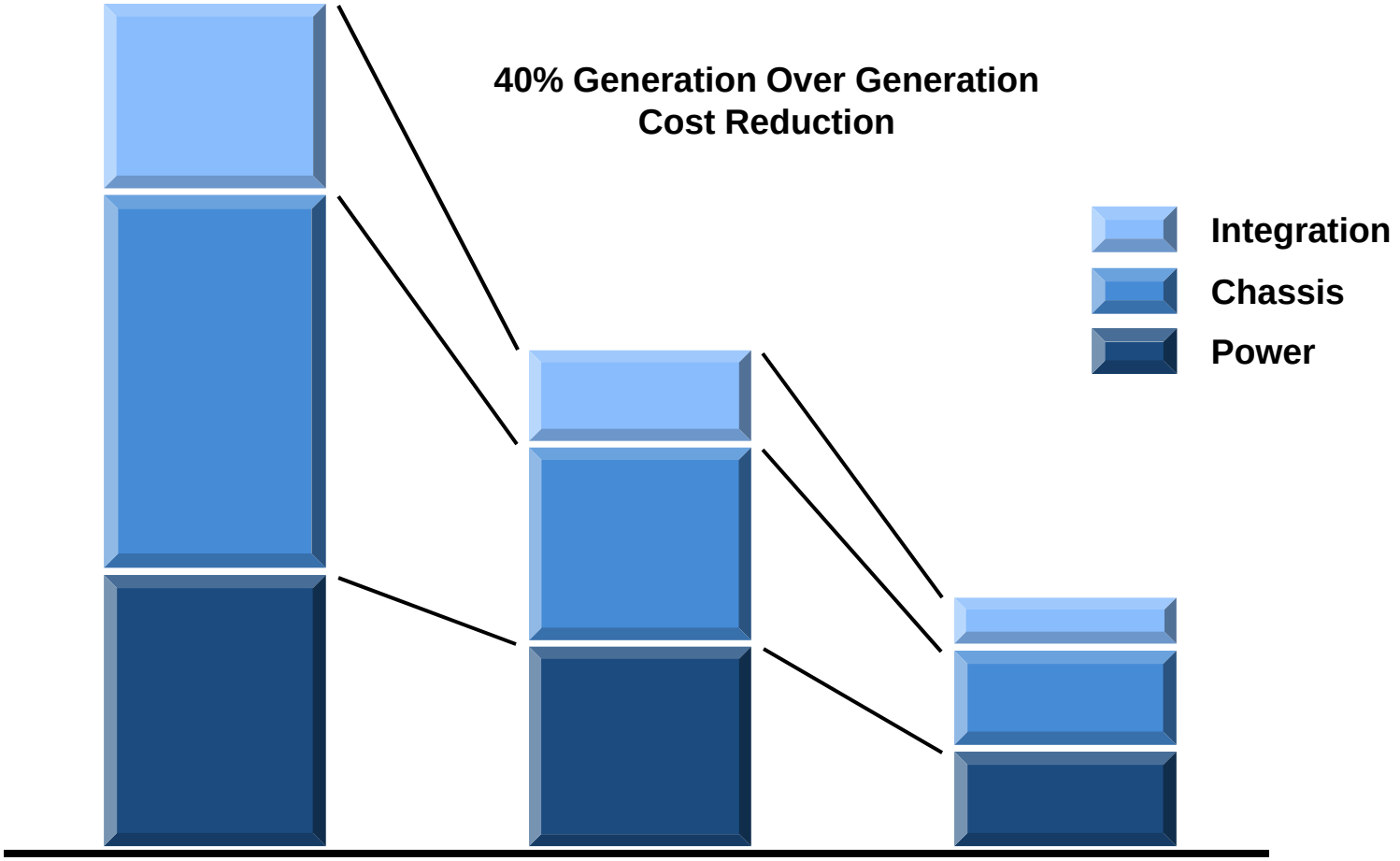
Commercial Systems Deployed – Kilowatts
57.7% CAGR from 2006-2011

World View of Fuel Cells in Telecom



- **Worldwide Adoption of Fuel Cells is Increasing**
  - **For backup power and as component of energy management**
- **Continue to Improve Overall Value Proposition**
- **Global Improvements Needed for Hydrogen Availability & Logistics**
- **Harmonize Codes & Standards with Other Fuels & Generators**

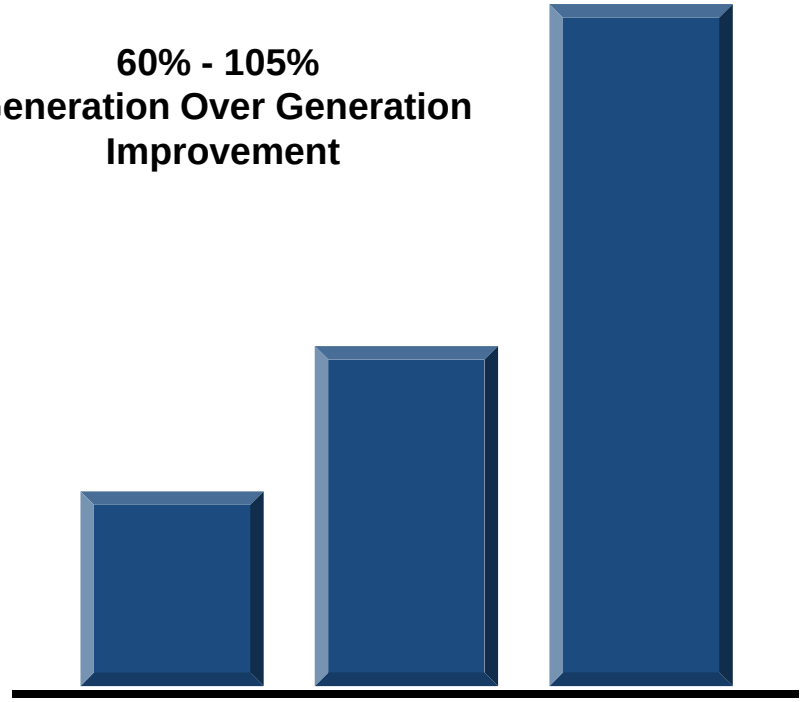
Generational Cost Reduction



Typical 4kW Configuration in Outdoor Enclosure w/ Hydrogen Storage

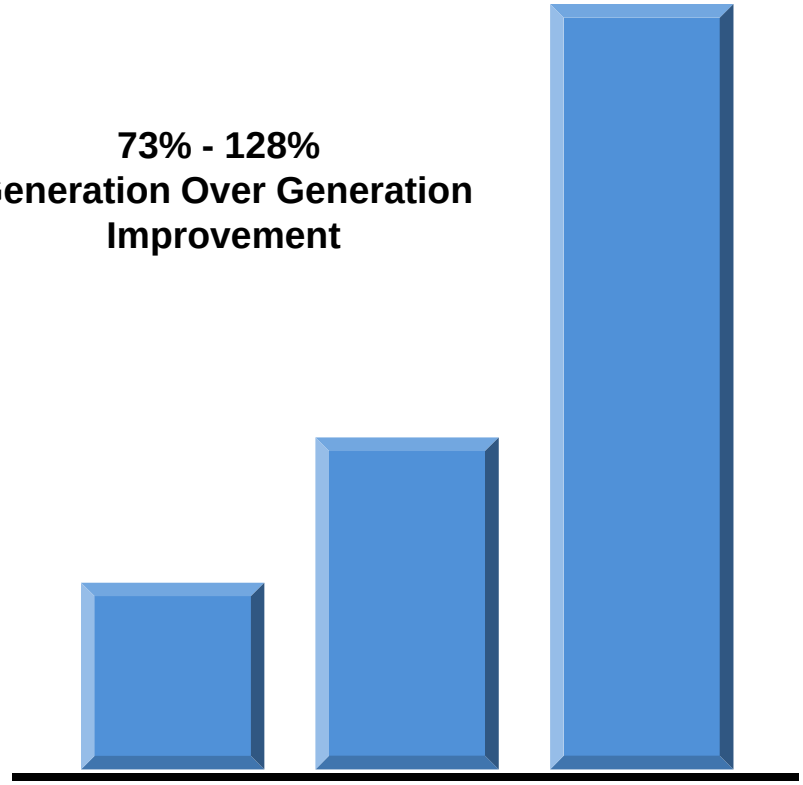
Generational Density Improvement

60% - 105%
Generation Over Generation Improvement



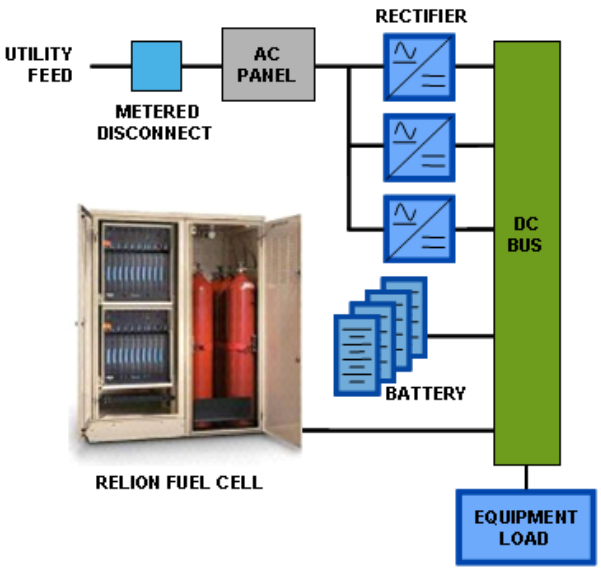
Specific Power of Fuel Cell System

73% - 128%
Generation Over Generation Improvement



Specific Power of 6’ Tall Fuel Cell Enclosure

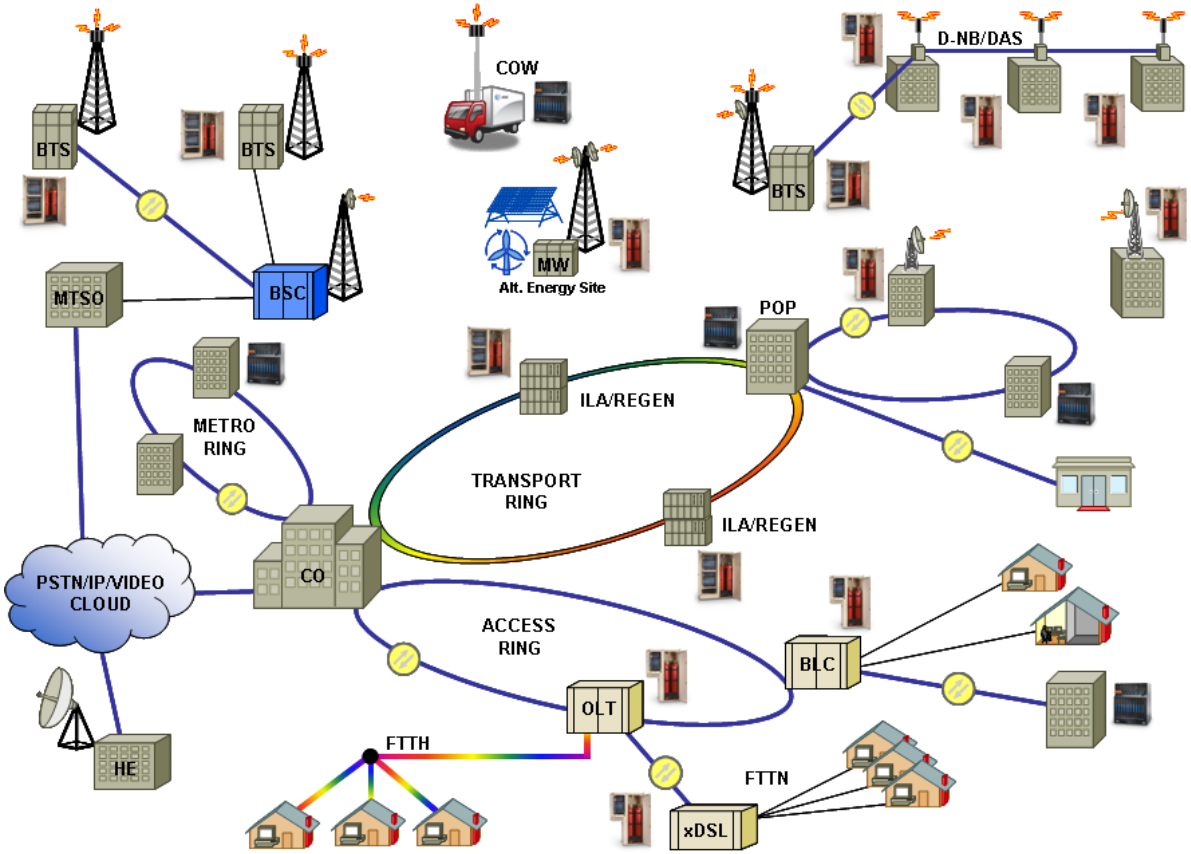
Telecom Power Solutions



- Simple Parallel Bus Connection
- Backup for Grid & Rectifiers

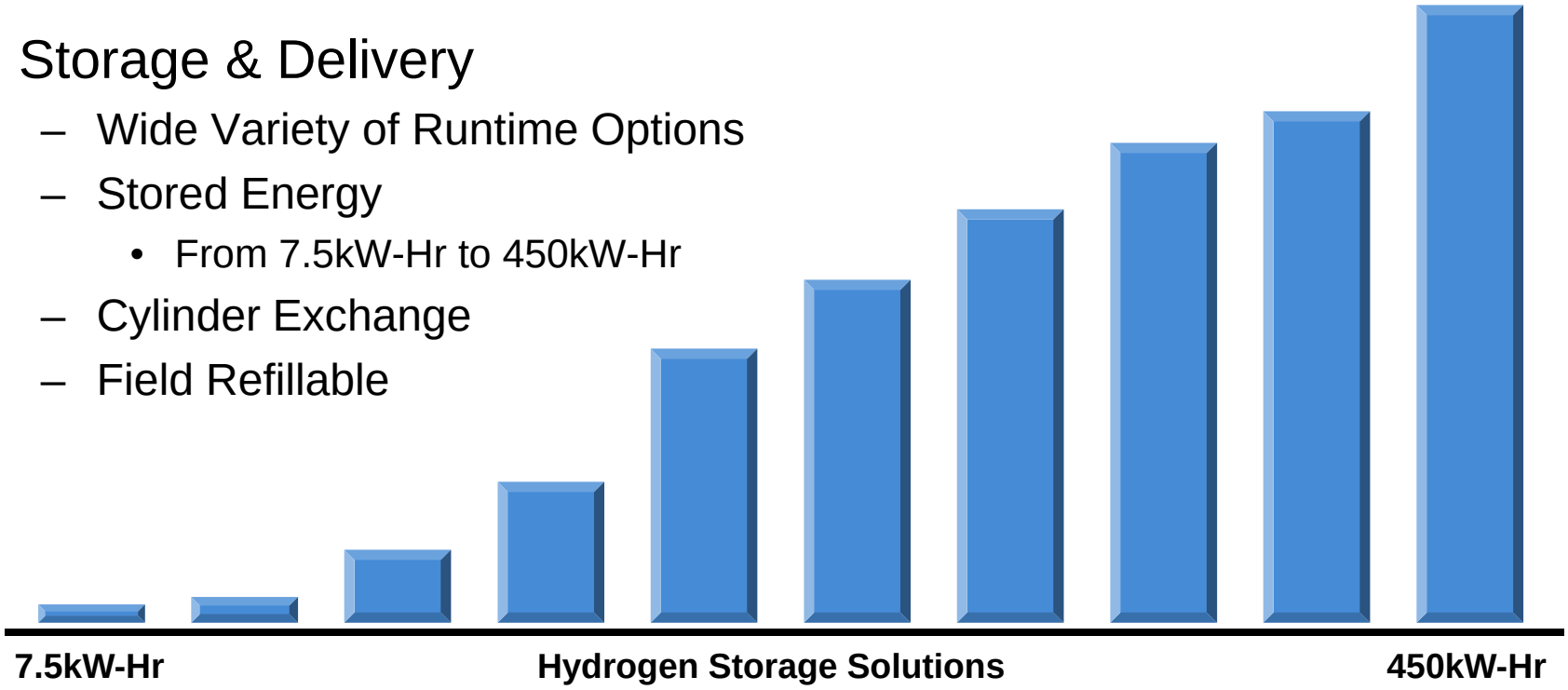
ReliOn E-2500

- Urban/Remote/Rooftop/Portable
- Backup/Grid Support/Hybrid

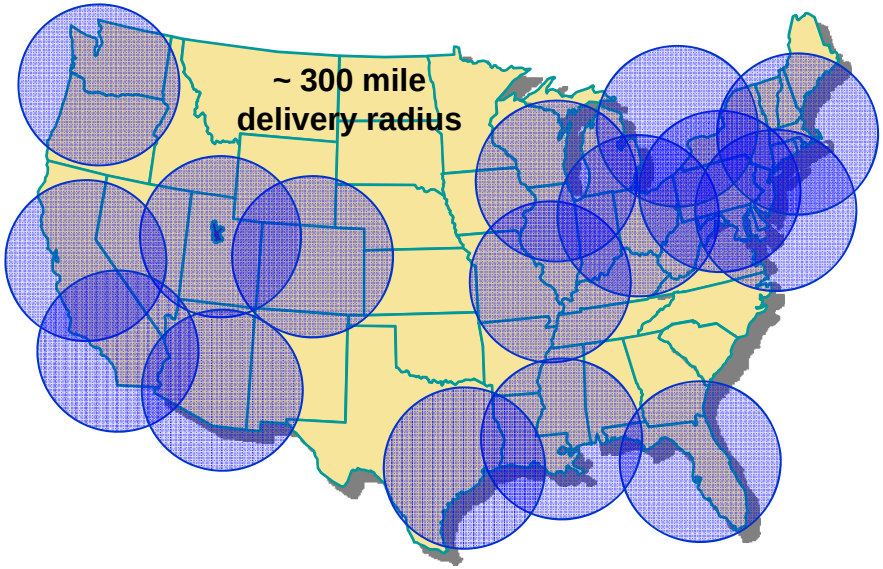


Hydrogen Solutions

- Storage & Delivery
  - Wide Variety of Runtime Options
  - Stored Energy
    - From 7.5kW-Hr to 450kW-Hr
  - Cylinder Exchange
  - Field Refillable



Bulk Hydrogen Refueling



16 cylinder specs

- **52”L x 56”D x 72”H**
- **14.4 kg / 5,961scf / 216kWhr @ 2,150psi**
- **19.4 kg / 8,031scf / 291kWhr @ 3,000psi**
- **Approx. weight 6,200 lbs**

AT&T Mobility

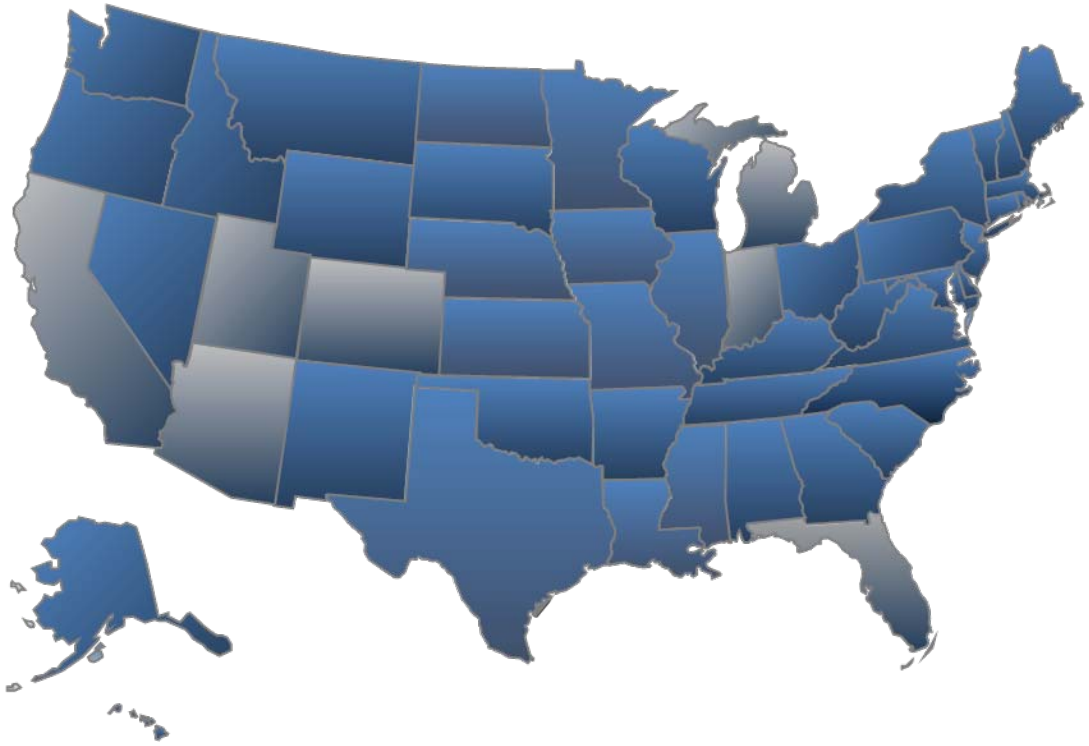
- Affirms corporate commitment to environmental sustainability
- Department of Energy Market Transformation Program enabling 180 new sites with 72 hours runtime added to installed base of ~125 fuel cells
- Clustering of sites in several regions allowed development of bulk hydrogen refueling model

AT&T / DOE Program Summary

- Market Drivers
  - Longer run-time, expanded range of power solutions, improved economics
- DOE Market Transition Program
  - Enable significant volume of fuel cell sites to be manufactured and deployed
  - Improve CAPEX and OPEX model
  - Trigger development of bulk storage and delivery infrastructure
  - Validate the field refill or “bumping” of hydrogen storage
  - Construction engaged throughout 2010 & 2011
- Provide viable alternate backup power solution for carriers

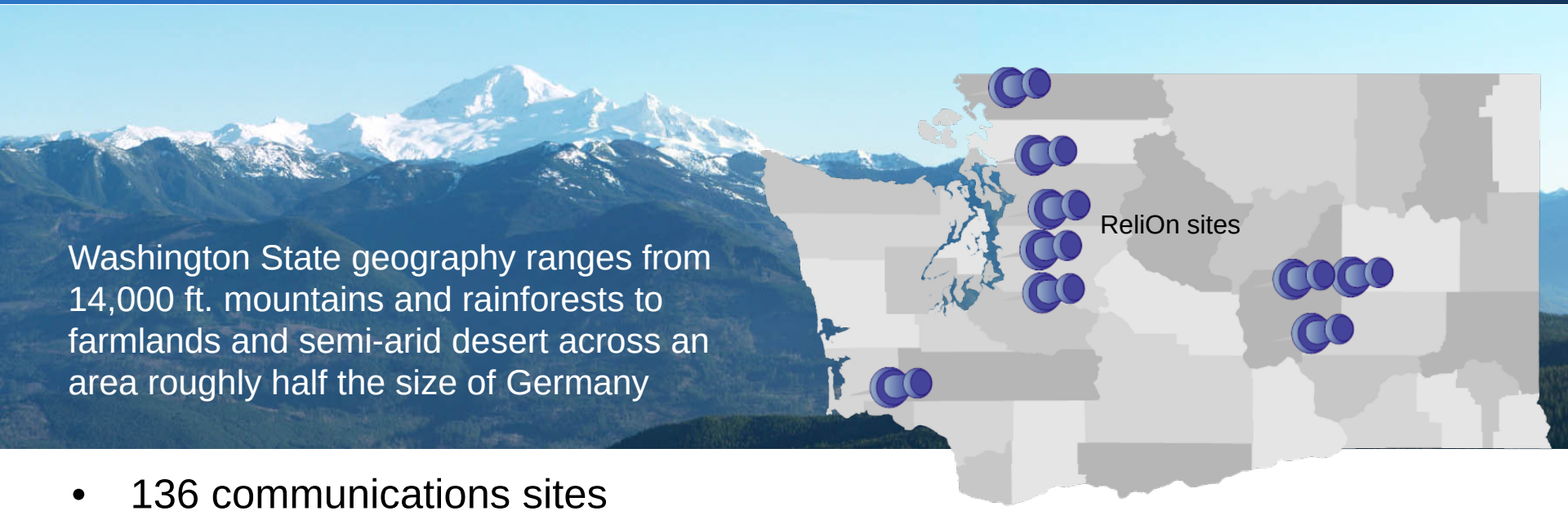
Typical Site Development Process

- Site Selection – 7 States – 180 Sites
  - Power levels: 2-6kW per site
  - Refueling access: varies by site
  - Site acquisition feasibility: some easier than others
- Equipment Installation
- Equipment Operation



AT&T Typical Sites

Washington State Patrol



- 136 communications sites
- 8 regional dispatch centers
- VHF conventional wideband analog transitioning to P25 operation
- Predominately microwave backhaul
  - 600 channel analog looped systems
  - DS3 Point to Point digital microwave
  - OC3 ATM ringed digital microwave
- Primary service provider for state, federal, tribal, and local public safety agencies

Why Fuel Cell Technology?

- A typical site has 3 lines of defense for power:
  - Commercial grid power
  - Backup generator
  - Station batteries
- An emerging need was to replace large end-of-life battery stacks for digital microwave.

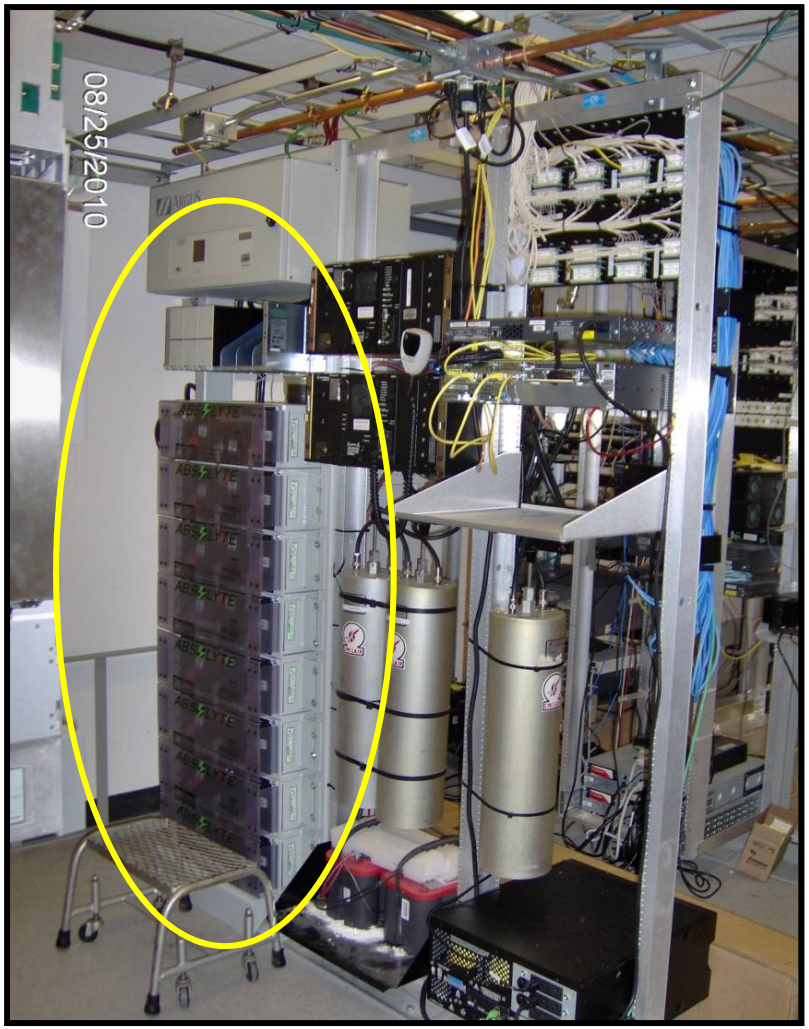
Benefits

- More cost effective
- Low maintenance
- Green in multiple ways
- Reliable
- Scalable
- Saves equipment room space

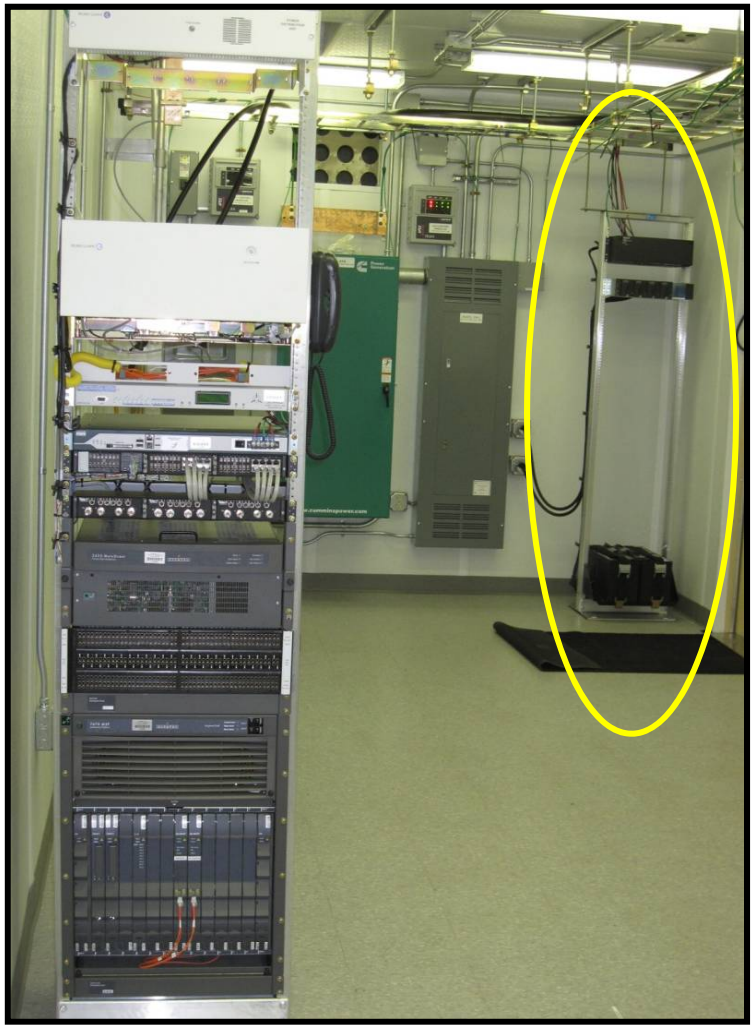
Lessons Learned

- Low maintenance, not no maintenance
- Not the right solution for all sites
- Educate your agency and stakeholders
- The technology is still evolving

Battery Reduction



Typical Station Battery Stack



Station Battery Stack with Fuel Cell

WSP Typical Sites

Challenges

- Hydrogen as Fuel
  - Distribution
  - Cost
  - Regulations
    - Zoning and Local jurisdiction approvals
- Incumbent Solutions
  - Mechanical Generators
  - Battery solutions
- Alternatives
  - New Battery Technology
- Momentum
  - Fuel Cells market penetration
- National & Local Policy

Summary

- Commercialization is Now
- Adoption Increasing
  - Value proposition has improved
  - Field performance has been positive
- Hydrogen Solutions Are More Available
  - Refillable storage
- Not a 100% Solution
  - Recognition that Fuel Cells are not a panacea
  - Very good solution for:
    - Backup power to hundreds of hours of runtime
    - Grid supplement with reasonable duty cycles
    - Hybrid with other power sources and storage systems


Reli On
Thank You
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