Green Power Solutions

August 2013



Agenda

- Cascadiant & Inter-Active Group Introduction
- Overview of Green Power Solutions for Telecom Operators
- GSMA Energy Optimization Trial conducted with Warid Telecom
  - Trial results & Recommendations

Cascadiant Company Profile

- Company HQ in Singapore and founded in 2010. Cascadiant is a green energy solutions integrator (SI) and managed energy service provider with 51 employees and 5 regional offices (Australia, Indonesia, Vietnam, Pakistan and East Timor)
- Indonesia is Cascadiant's largest market and most staff based in Jakarta.
- Our corporate mission is to provide highly reliable end-to-end power and clean energy solutions by integrating the very latest in green technologies to reduce an operator's carbon footprint and immediately lower overall operating costs associated with energy
- Cascadiant integrates all elements of an energy solution into a turnkey, fully managed service, built around an in-house developed software platform and wrapped in a multi-year fixed priced Managed Energy Service (MES) contract.

Interactive Group Profile

- **Vision:** Be one of kind System Integrator in Pakistan, providing integration services with security as the core of all services.
- **Mission:** Providing system integration capabilities using state of the art technology and knowhow enclosing Application, Communication & Infrastructure.
- Interactive founded in 1984 in Pakistan at Karachi, its headquarters was established later in 1993.
- Interactive operating in four countries around the globe (Pakistan, UAE (Dubai), Saudi Arabia (Riyadh), Turkey (Istanbul).
- Deals in turnkey basis Data Centres Solutions, Telecommunication, Satellite Services, Infrastructure & Green Power Technology, Managed Services.

Cascadiant 21st Century Green Solutions





Green Fuel Cells

A direct replacement for diesel generators on sites requiring up to 5kW of back-up power. Converts methanol into clean, extremely reliable and cost effective DC electricity.



Advanced Cooling Systems

A direct replacement of AC comfort air conditioners. Advanced cooling operating in AC & DC modes with remote management. Shows power savings of more than 60%.

CASCADIANT energy

Network Operations Center

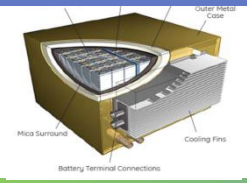
Cascadiant fully networks and integrates all solutions into an in-house developed 7/24 network operations center that monitors, manages and controls all aspects of a customer's power operations, field service, maintenance, spares management and re-fueling service.



Next Generation Batteries

A direct replacement for lead acid using lithium and sodium. Rapid recharge with very long cycle life. A 55°C operating range that eliminates the need for cooling and results in lower power consumption.





Cloud Site Monitoring and Control

Allows for full remote monitoring, control and management of all power and energy functions within a network. System reacts in real time to optimize performance and energy consumption.



ElectraGen™ ME Features

Next Generation Reformer Based Backup Power Fuel Cell System



Key Features

- Integrated fuel cell (PEM) + reformer system
- 225 liter tank (up to 48hrs autonomy @ 5kW)
- Weight < 300 kg (dry)
- 2 x 2.5 kW stack design (alternate usage, redundancy)
- Customer user interface keypad with LCD display for set-up and diagnostics (no PC required)
- Dry contacts (8) + SNMP interface

Run Time	Load
48 hours	5 kW
96 hours	2.5 kW
10 days	1 kW

Additional Benefits:

- Superior Performance - >99% reliability
- No fuel theft
- Stable fuel pricing (methanol)
- 24/7 monitoring
- No noise, no emissions – no community problems

Cascadiant Indonesia

Over 500 Fuel Cells deployed across Indonesia





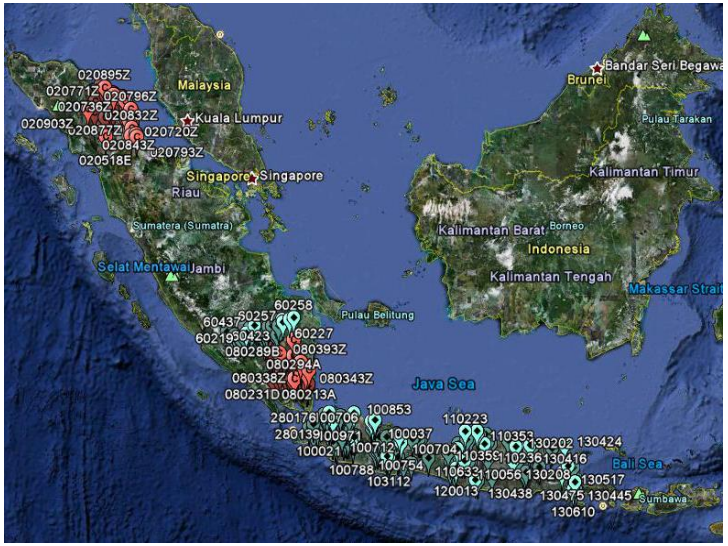




Indonesia Deployment Experience



Regional Service Centers and Warehouses



Deployments

Key Challenges Faced:

- Total absence of skilled technicians - Training of local sub cons - language/turnover/mindset
- Establishment of regional service centers and warehouses – trustworthy partners
- Logistics and trucking – reliable/cost effective/police road blocks/gangs
- Fuel investigation, sourcing, testing and quality control – methanol supply chain/water quality/reagent supply

Coolsure UTS-55W

Coolsure
Keeping Networks Cool

•Substantial Energy Savings (50% to 70% savings over existing/traditional cooling system)
• Improved availability (uninterruptible operation, allowing hybrid powering solutions, etc)
• Advanced controls (automatic redundant operation, remote monitoring, etc)
• Basically, lower total cost of ownership for Telecom Operators for BTS shelter sites

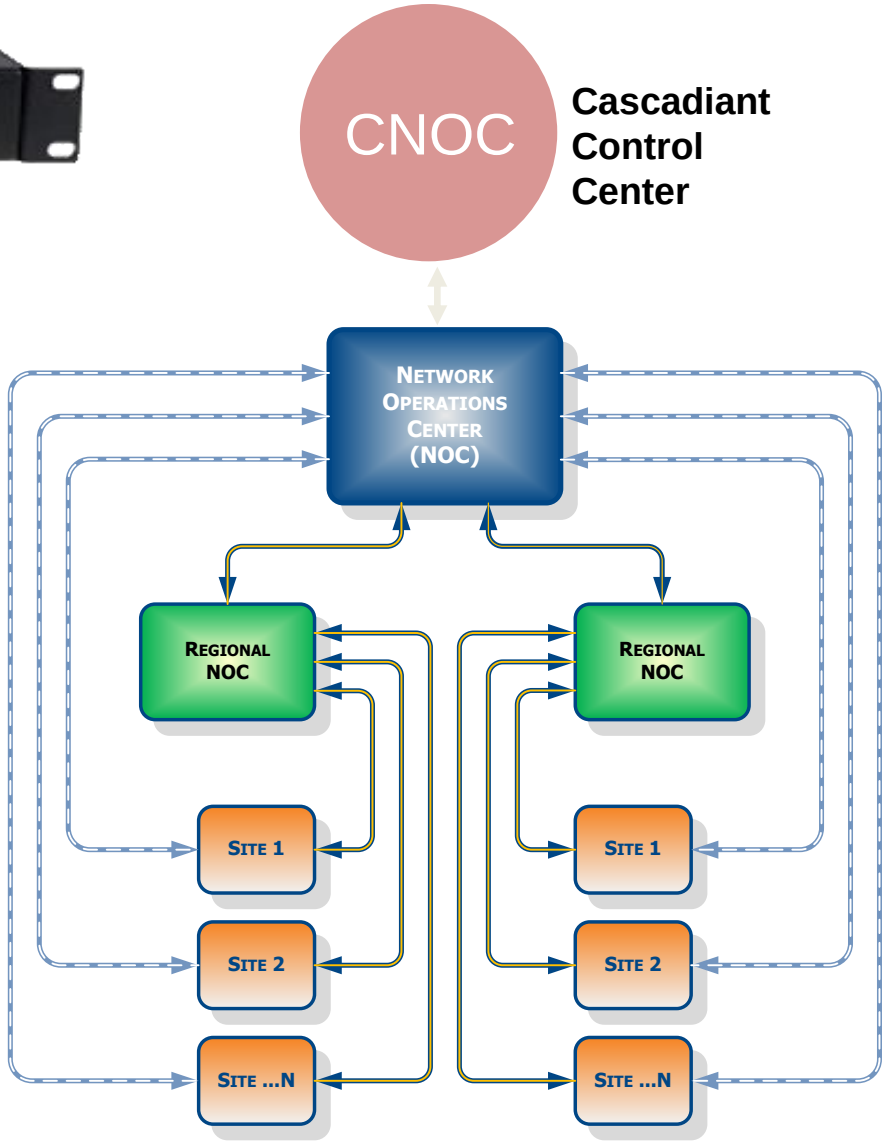


Site Monitoring System



IntelSite™

- Site Monitor
- Rapidly and easily customizable per specific customer requirements
- Base package provides full monitor of environmental, aircon, gen set, and battery functions
- Able to monitor and control off grid, poor grid and reliable grid applications
- Integrates and optimizes the monitoring and control of renewables such as wind and solar
- Single integrated dashboard across vendors and applications fully and easily customizable



Key Performance Indicators

- Diesel Fuel Level
- GenSet Power Output (amps, volts)
- GenSet Run Hours

- Shelter Temperature
- Shelter Humidity
- Door Open/Close
- Outdoor temp/humidity

- Battery Temperature
- Battery Voltage
- Battery Current

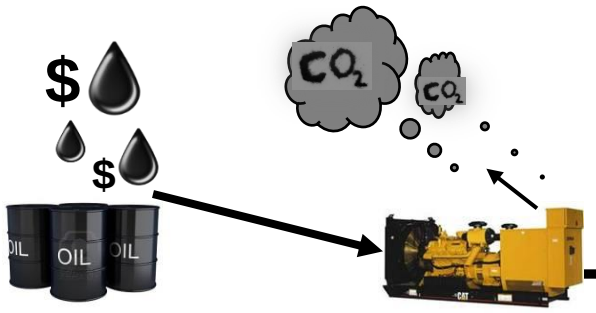
- Air Conditioner current draw and Set Points
- Free Air Cooling Control

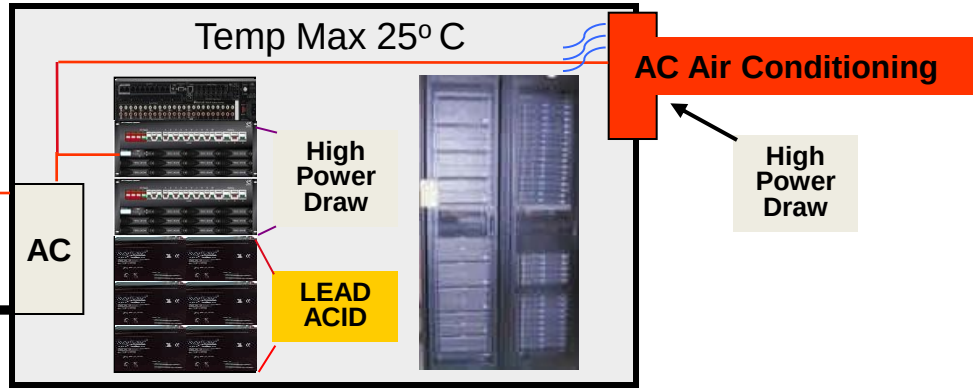
- Rectifier Voltage
- Rectifier Amperage
- Grid Voltage (3 phases) & Current
- DC loads


Axess - Main Screen v6.3.3006
MDLH1028
10.30.196.183
MDLH1654
User: None
Axess
Door UnLock
Door Lock
Dial RAS Connection
OFF
OFF
OFF
OFF
OFF
OFF
OFF
OFF
OFF
OFF
OFF
OFF
OFF
OFF
No
N
N
Door Open
0 - No
RAS DialUp Connected
1 - Connected
Device Timeout
0 - Normal
Battery Bus DC Volts
53.125V
BTS1 DC Volts
27.4V
BTS2 DC Volts
27.2V
Fuel Level
2.485%
Battery Bus DC Current
0A
BTS1 DC Current
1A
BTS2 DC Current
1A
Fuel Temp
28.24C
Indoor Temp
26C
Outdoor Temp
27C
Outdoor Humidity
46%
Outdoor Dew Point
14C
DC Power System Temp
20C
BTS1 Temp
22C
BTS2 Temp
23C
Transmission Temp
21C
Online
Mute
Setup
Logs
Help
About
Logon
DVI
SRCA
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Statmon
TECHNOLOGIES
1 2 3 4 5 6 7 8
1 2 3 4 5 6 7 8

19th Century Solutions to 21st Century Problems

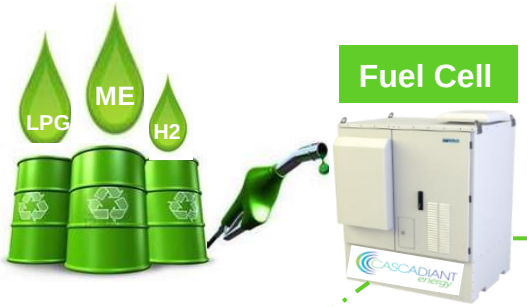
AC Power Grid





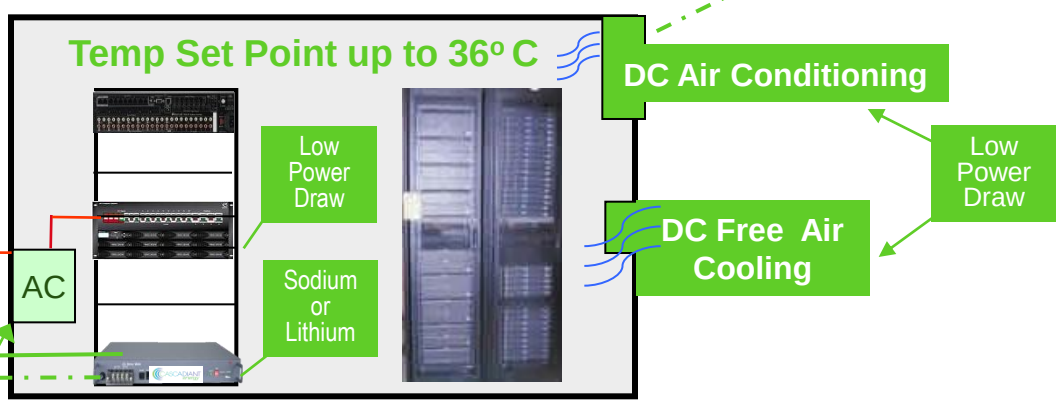
BACK-UP POWER GREEN TRANSFORMATION

AC Power Grid





Remote Monitoring and Control





Remote Monitoring and Control

50% decrease in distribution panel

Market Landscape Snapshot

COMPETITION

- Entrenched and well understood technologies and relationships
  - Diesel Generators and Lead Acid Batteries have been in use for over 100 years
  - Operators have few in-house power experts making change difficult and risky
  - Grey and black market ecosystems generate a significant headwind
- Customer Perception
  - Alternatives not economically or functionally viable
  - All alternative energy carries a significant “Green Tax”
  - Technology, pricing and subsidies constantly evolving creating uncertainty

CASCADIANT INDUSTRY POSITON

- World’s Largest Fuel Cell Network
  - 800 fuel cells currently under management is largest commercial deployment
- Vendor and Technology Agnostic
  - Managing hydrogen and methanol fuel cells from several vendors
  - Pilot projects with both A123 lithium ion and GE sodium based batteries
  - Only vendor providing full end to end multi-year service contracts
- First Mover Advantage
  - Only energy SI with 7/24 NOC for full monitoring and control
  - Only energy SI offering contractual commitments to industry’s leading SLA
  - Only energy SI with Managed Energy Service (MES) contract model
  - Only energy SI with Managed Battery Service (MBS) contract model

Cascadiant Green Power Activities in Pakistan

1. Coolsure Technology Trials with 2 Pakistan Telcos

2. 2 Fuel Cell Trials on-going today with 2 Pakistan Telcos
   - Lahore
   - Islamabad

3. Countrywide Energy Efficiency Project
   - 10 sites
   - Indoor/Outdoor/Poor Grid/Off-Grid
   - Fuel Cell
   - Coolsure Air Conditioning
   - Deep Discharge Battery

Fuel Cell Trial Performance – Interim Results

Trial Start: June 7, 2013

- Period: 7th June to 7th August
- Duration of Trial: 61 days
- Longest autonomous runtime event: 217:33 hrs
- Reliability: 100%
- MTTR to site: No Faults
- Total energy produced: 771.02 kWh
- Total hours of runtime: 569:45 hours
- Total number of cycles: 239 cycles

Warid Telecom GSMA Energy Efficiency Trial

Trial delivered free of charge by Cascadiant Energy

Trial Objectives

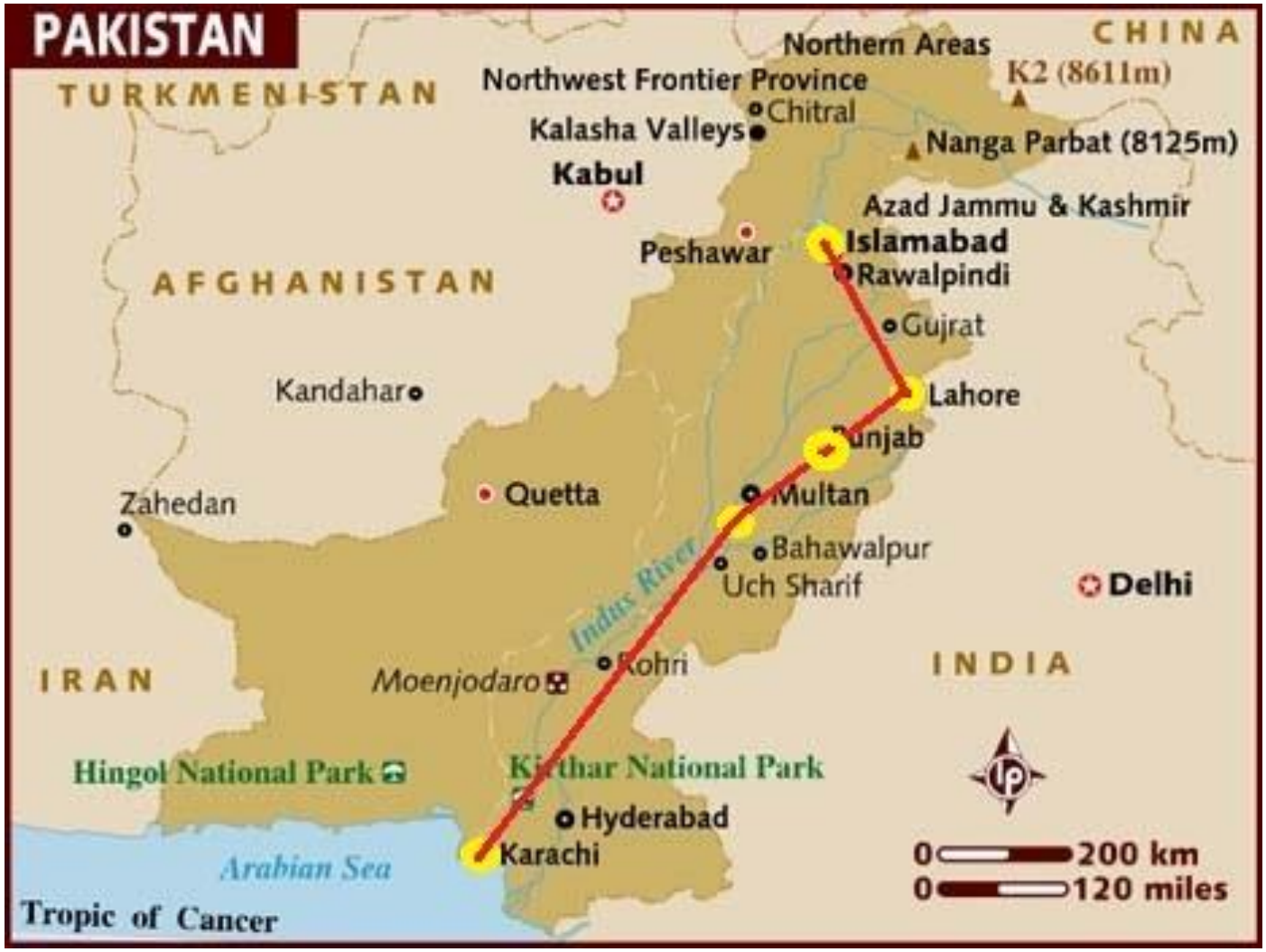
"The primary objective is to assess in more detail the opportunities to improve Warid's GSMA MEE Benchmarking performance in terms of energy efficiency, and to identify what actions Warid could take to improve energy performance to better the average and also to be best in class."

Trial Plan

Approach

- Select 10 sites that represent majority of Warid network
  - Indoor
  - Outdoor
  - Poor grid (4-8hrs of load shedding per day)
  - Very bad grid (>8hrs of load shedding per day)
  - Off-grid – Prime Power
- Monitor sites for 3 weeks
  - Deploy Axess site monitoring solution
  - Collect data on WAPDA supply/outages, energy consumption of site, diesel fuel usage, environmental factors (temp, humidity), etc
- Upgrade select sites
  - Replace diesel genset with ElectraGen ME fuel cell
  - Replace traditional air conditioning system with Coolsure air conditioning system including DC operation
  - Replace VRLAs with GE Deep cycle battery
- Continue to monitor sites for additional 3 weeks
  - Methanol fuel consumption
  - Additional efficiency benefit of Coolsure with DC operation
  - Fuel savings with deep cycle battery

Trial Sites (10)



Trial Site (1 of 10) - Islamabad



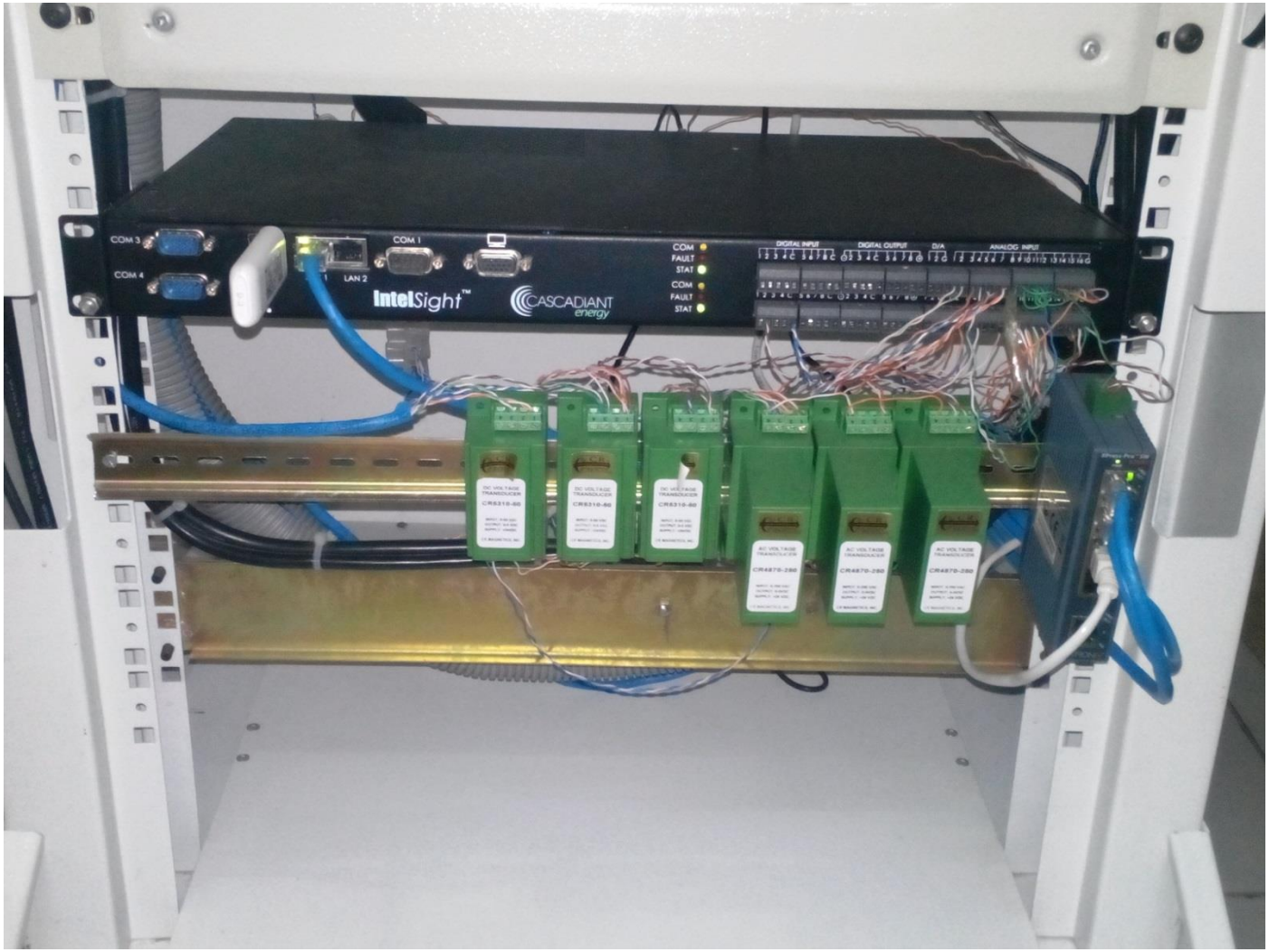
Trial Site (1 of 10) - Islamabad



Trial Site (1 of 10) - Islamabad



Trial Site (1 of 10) - Islamabad



Trial Site (1 of 10) - Islamabad



Fuel Cell Trial Site - Lahore





Trial Results and Recommendations

Recommendation 1 – Upgrade Indoor Site Air Conditioning

Accelerated replacement of all air conditioning systems at approximately indoor sites. This action will have the following benefits:

- Energy efficiency: up to 60% savings in energy consumption of air conditioning leading to approximately 20% - 25% total site savings. Even greater savings will be realized through improved temperature set point management.
- Environmental: Significant improvement in CO_2, NOx, and CO emissions is realized in two ways: reduced site loads and DC operation which reduces diesel genset runtime

Trial Results and Recommendations

Recommendation 2 – Gradual replacement of diesel gensets with fuel cells

- Trial results highlighted the drawbacks of relying on diesel generators for backup power: high failure rate (3-15%), highly polluting, noisy, unpredictable operating expense due to varying fuel prices, and subject to theft of fuel.
- Fuel cells are far more reliable (>99%), more efficient, clean, quiet, and reliant on a fuel source, methanol, that has much more stable pricing than diesel fuel. Although fuel cells have a higher capital cost, 5 year total cost of ownership can achieve cost parity with that of a diesel genset

Trial Results and Recommendations

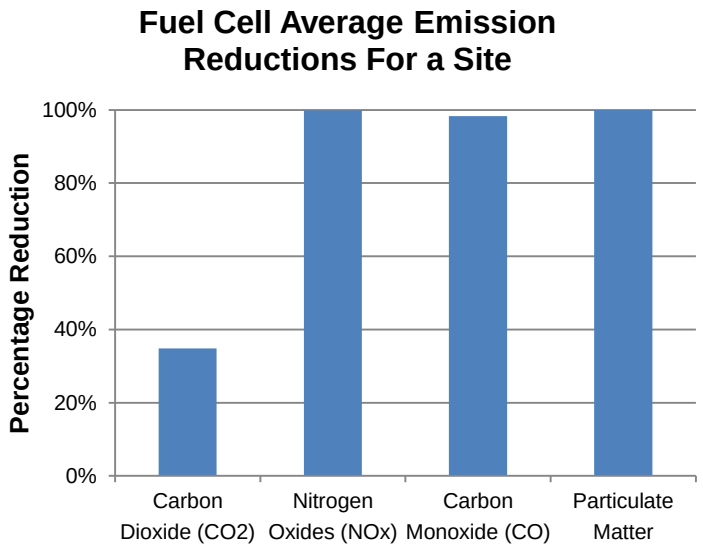
Recommendation 3 – Upgrade traditional lead acid batteries with advanced battery systems

- Trial measurements showed that the majority of outages of commercial power were highly regular in frequency and duration. Therefore, reducing diesel genset runtimes by deploying advanced fast charge, deep discharge batteries is highly recommended. Data analysis showed that 2 hours of battery backup could reduce diesel genset runtimes by 74% which will save on fuel and maintenance costs as well as benefit the environment.

Environment – Fuel Cell

In this scenario we have applied the fuel cell emissions savings to the average indoor site. The figure below represents the total emissions from the average site including CP power

Emission Reductions Per Week	CP & Diesel Genset	CP & Fuel Cell	Total Reduction	
	kg/wk	kg/wk	kg/wk	%
Carbon Dioxide (CO2)	692	451	241	35%
Nitrogen Oxides (NOx)	2.07	0.00	2.07	100%
Carbon Monoxide (CO)	2.21	0.04	2.18	98%
Particulate Matter	0.18	0.00	0.18	100%



Environment – Deep Discharge Battery

We compare the emissions of the baseline measurement of an off-grid site utilizing a genset/battery hybrid CDC scenario where the genset is running on average 14.67 hours per day to that of using a fast charge battery and reducing the diesel genset run time substantially to only 3.5 hours per day. This reduced total emissions by 63%.

Emission Reductions Per Weeks	Baseline	DG & Fast Charge Battery	Total Reduction	
	kg/wk	kg/wk	kg/wk	%
Carbon Dioxide (CO2)	890	329	561	63%
Nitrogen Oxides (NOx)	3.10	1.14	1.95	63%
Carbon Monoxide (CO)	3.30	1.22	2.08	63%
Particulate Matter	0.33	0.12	0.21	63%

Q/A

- How difficult is the deployment of Fuel Cell? How durability is Fuel Cell? How to maintain it?
- What is your company product to provide the solution for telecom market? (especially for Pakistan & Afghanistan market)
- How to tackle supply chain issue for fuel cell?
- What is benefit for mobile operator in Pakistan & Afghanistan?


CASCADIANT
energy