Qtel Group
Energy Efficiency Strategy

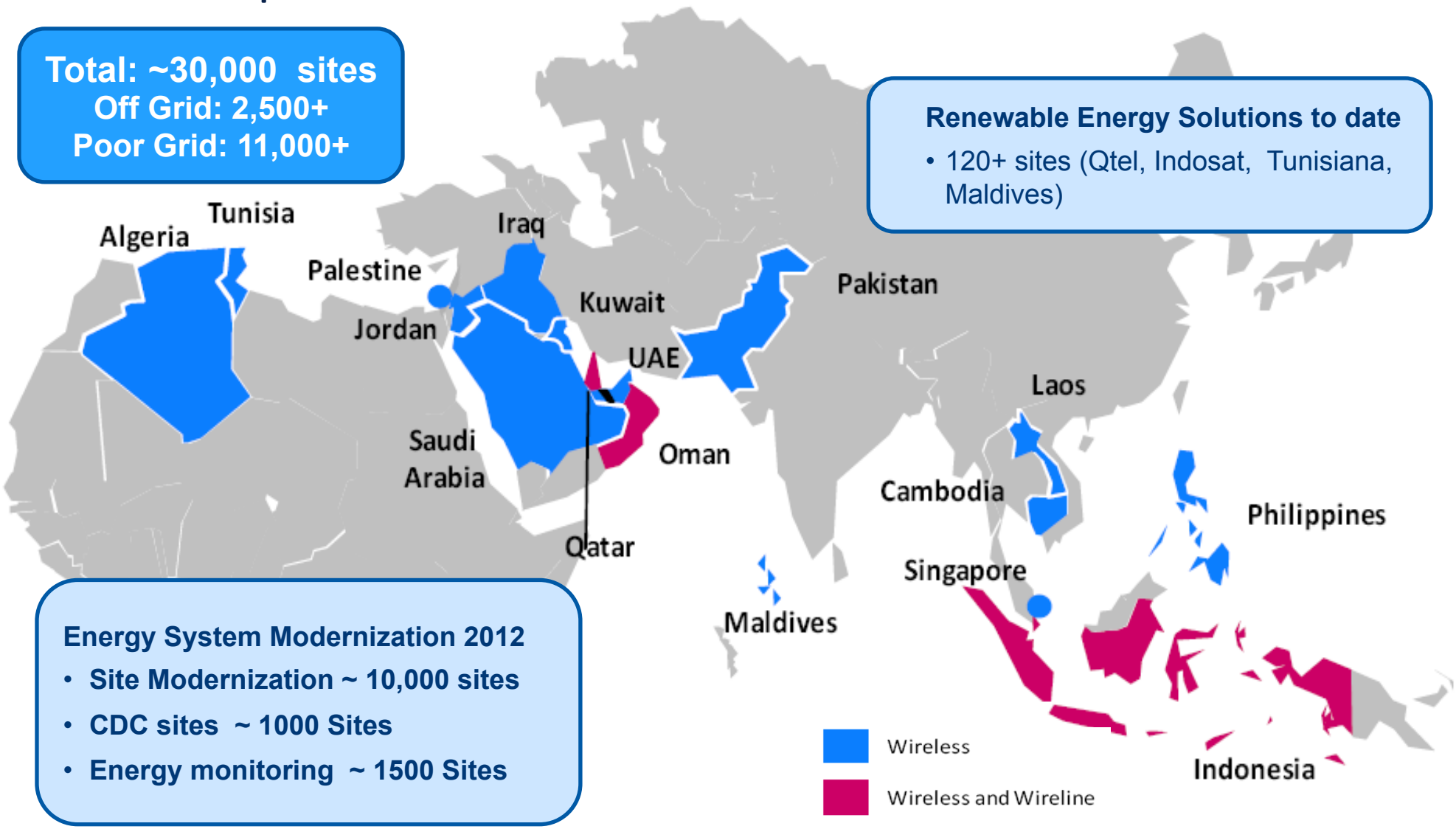
GSMA Green Power For Mobile
Doha, 18-19 April 2012

QTEL Group at a Glance

Total: ~30,000 sites
Off Grid: 2,500+
Poor Grid: 11,000+

Renewable Energy Solutions to date

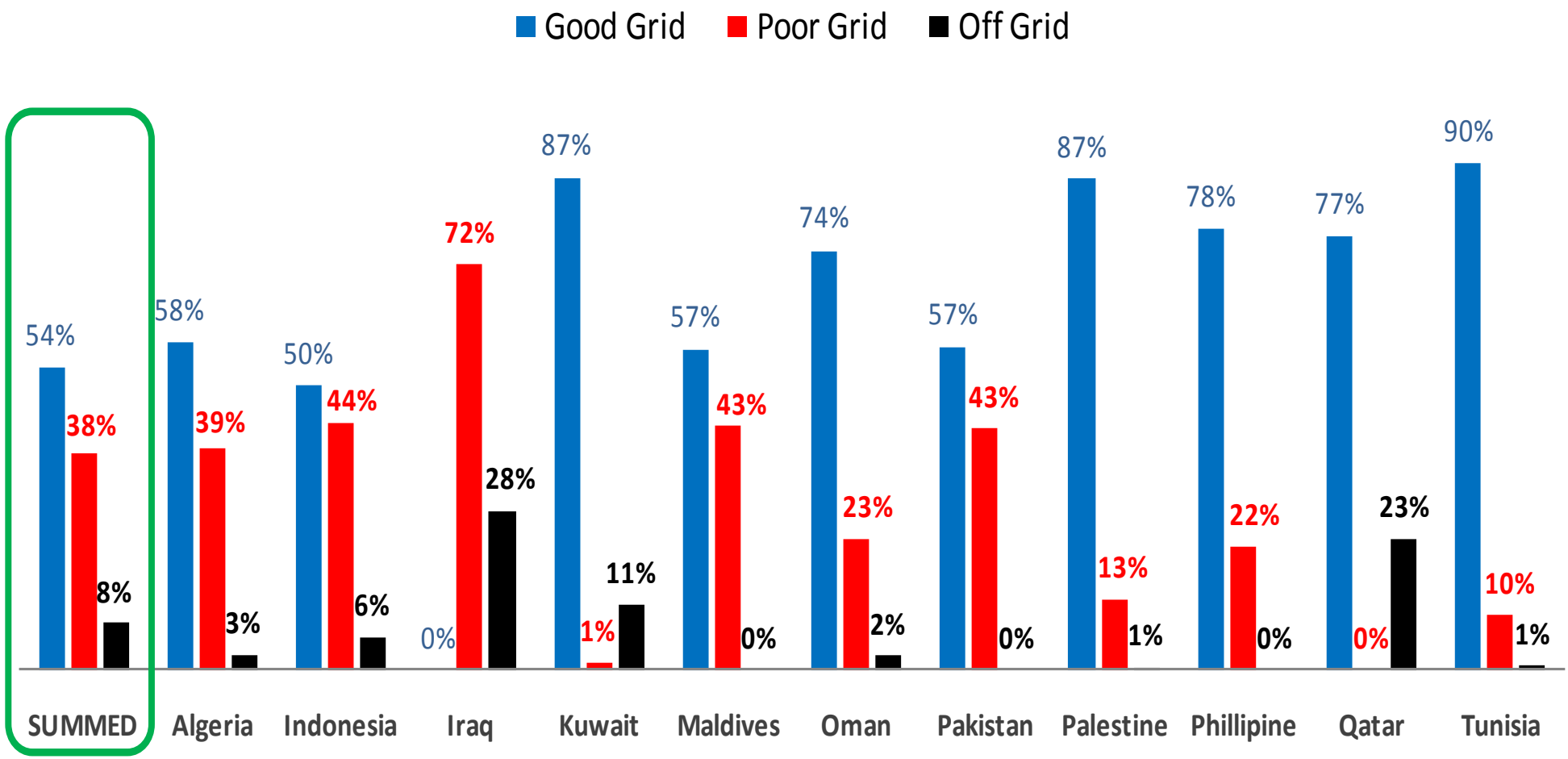
- 120+ sites (Qtel, Indosat, Tunisiana, Maldives)



Energy System Modernization 2012

- **Site Modernization ~ 10,000 sites**
- **CDC sites ~ 1000 Sites**
- **Energy monitoring ~ 1500 Sites**

Grid Highlights



Interesting Highlights

- **Grid Tariffs**: Tariffs vary from **<1cent/kwh** (Kuwait) to **>$1/kwh** (Maldives)
- **Fuel Cost**: Delivered fuel costs in some locations **>$2/litre** due to**;**
  - Transportation (Maldives by boat)
  - Security supplement (Iraq)
- **Temperatures:** Summer temperatures in Gulf countries are regularly above 50^{o}C with Kuwait and Basra region being above 55^{o}C
- **Renewable Energy Regulations:** There are no renewable energy regulations in any of the Group's operating Countries.
- **Group Green Power Statement:** The Qtel Group is only a young Group and is still developing our Green Power and Carbon Emissions corporate objectives.
- **Current Focus**: Current Group focus is;
  - Reduce site loads
  - Identify and implement most energy efficient solutions

Group Energy Objectives

NETWORK MODERNIZATION

POOR GRID SOLUTIONS

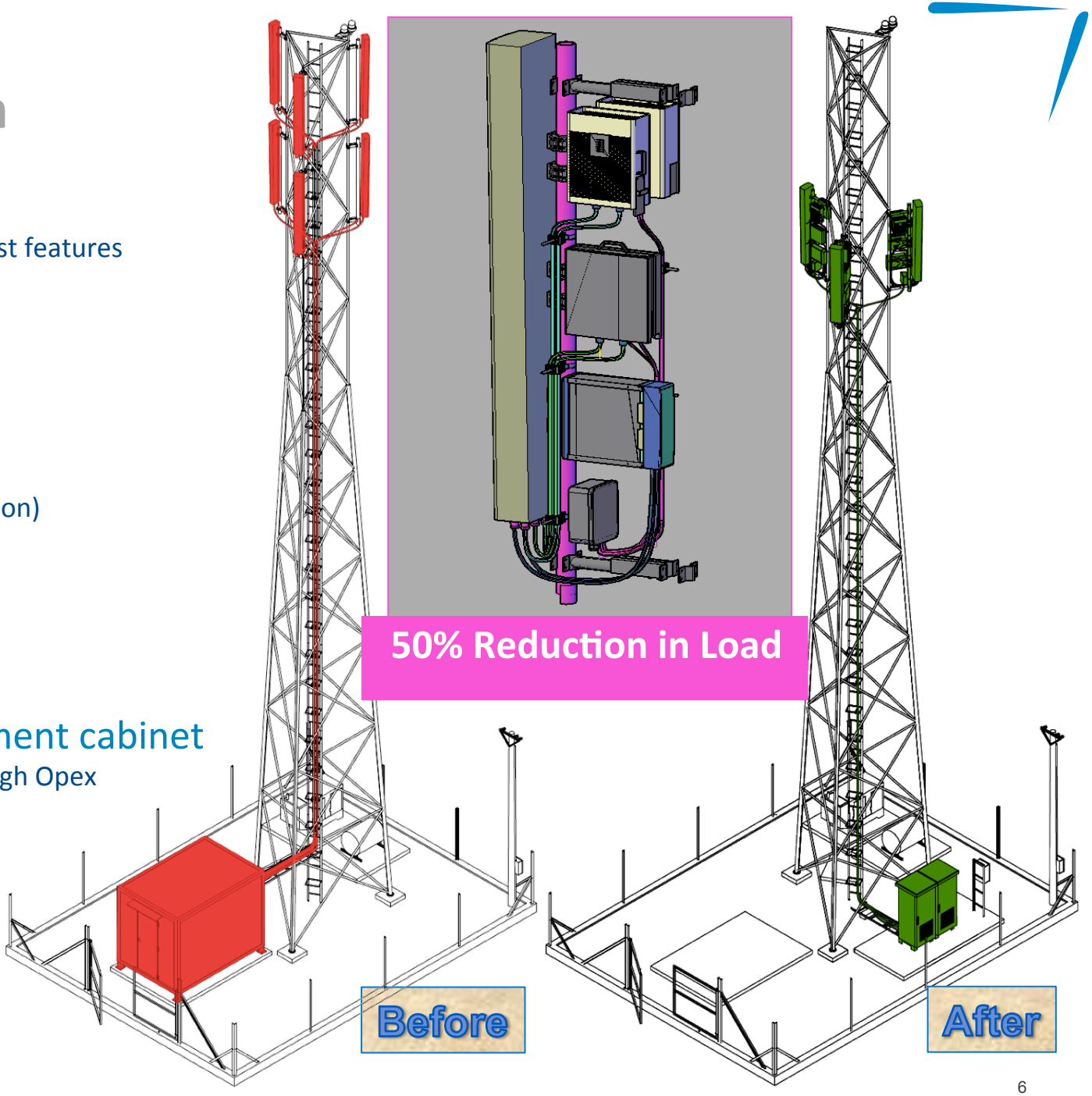
OFF GRID SOLUTIONS

DATA CENTRE CONSOLIDATION

ENERGY BENCHMARKING

Site Modernization

- Modern RAN
  - Latest generation equipment – latest features
  - Reduced power consumption
  - Smaller equipment footprint
- RRU at the antennas
  - Enhanced RF performance
  - Technology change flexibility
  - Reduced PIM (Passive Intermodulation)
- Multiband antennas
  - Reduce tower load
  - Technology change flexibility
- External power and equipment cabinet
  - Abandon shelters with associated high Opex
  - Reduce overall site footprint
- Site Layout
  - Smaller site footprint
  - No feeders – reduced tower loading



Existing Shelter













Outdoor Cabinet

- Total functionality of equipment shelter can be transferred to a single cabinet
- **There is a difficulty in convincing people this can be achieved!**



DC Aircon + FAN
55° C Ambient

FAN + TEC Cooler
45° C Ambient

DC/AC Aircon + TEC

AC Aircon + AC Aircon

Qtel Group

Outdoor Cabinet Design Considerations – Few Examples

- DC Load Calculation + Battery & PLD Calculation
- Cabinet Structure Material Selection – **Steel Rusts!**
- Heat Load Calculation Considerations
- Active + Passive Cooling Calculation & Selection Factors
- Noise Emission Calculation – **can be worse than diesel generator**

- **Fan/Filter operation**
  - ✓ Should have 2x Fan (300 CFM each of Axial or Centrifugal)
  - ✓ Should use G4/F5/F6 filter
  - ✓ Air Inlet should be at least 300mm above floor level
  - ✓ Max Noise emission (SPL) 65dBA @ 1 meter @ rated cooling capacity

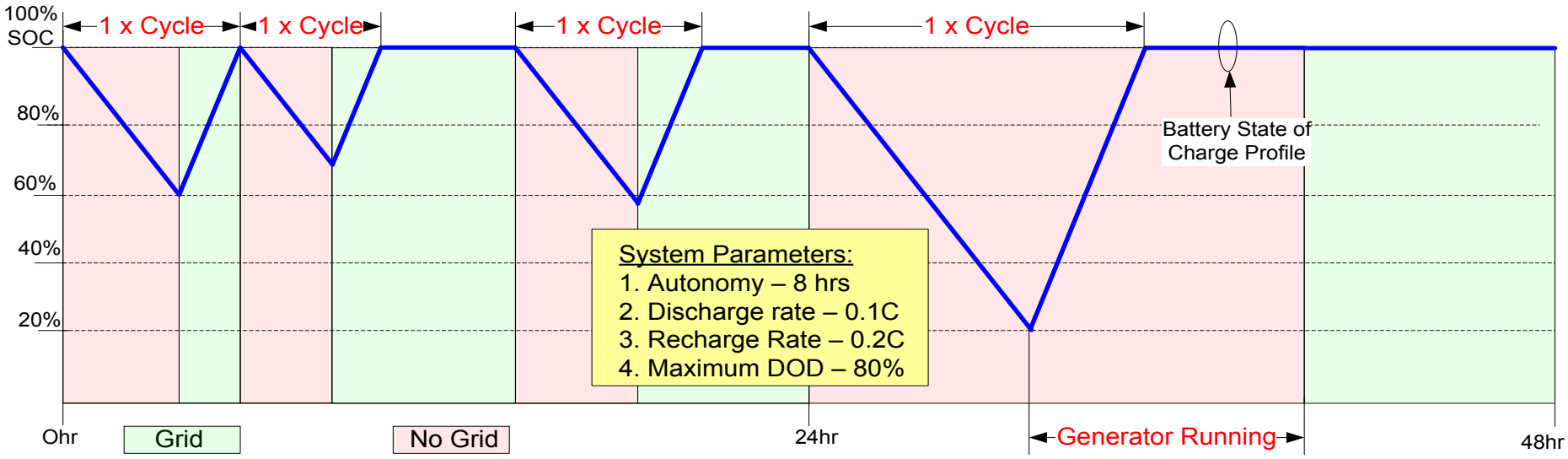
- **Should design with Hybrid Cooling**
  - ✓ DC Aircon + Fan/Filter (250W/K) for 1000W Heat Load
  - ✓ DC Aircon + Integrated Hex (No Commercial Product yet!)
- **TEC cooling**
  - ✓ Min 40mm Insulation
  - ✓ Hydrogen ventilation arrangement should be installed

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Poor Grid Sites

- Poor grid sites represent the most difficult of sites to minimize TCO.
- Poor grid sites can lead to **revenue loss** if grid is lost for long periods
- Simplest solution is to run generator when grid is down but this can lead to **very high Opex.**
- A CDC arrangement can reduce TCO but the challenge is in how to dimension it.



Poor Grid Sites – Some Solutions

Grid Classification

- **Class I**: Average AC mains failure time **per month: <10hours**
- **Class II**: Average AC mains failure time **per week: <10hours**
- **Class III:** Average AC mains failure time **per day: 2~8hours**
- **Class IV:** Average AC mains failure time **per day: >8hours**

Group Recommendation:

- **Class I + Class 2**:

- Install Standby batteries only
- Site may need generator based upon site importance

- **Class 3 + Class 4**:

- Sites require generator or alternative predictable energy source
- Change from standby batteries to PSOC resistant batteries
- Change configuration to CDC

Poor Grid Sites – Some Solutions

- If grid is very bad – no alternative but to install some additional energy source

- Generator is still favored solution but fuel cells on rooftops is gaining more popularity. Noise issues.

- If no backup – install larger banks of PSOC resistant batteries. Don't go too big as rate of charge becomes an issue.

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CDC Considerations

- The use of CDC is influenced by many factors.
- Most important observation is that it becomes **less** cost effective compared to 24 x 7 generators as load **increases**

- Typical Asia Cell Situation

Load (kw)	3 Year TCO		5 Year TCO	
	Genset 24 x 7	CDC	Genset 24 x 7	CDC
1	$ 75,300	$ 43,600	$ 118,800	$ 60,200
2	$ 76,700	$ 57,200	$ 120,200	$ 82,600
3	$ 79,400	$ 73,900	$ 124,600	$ 109,200
4	$ 80,000	$ 90,600	$ 124,800	$ 135,800
5	$ 88,200	$ 111,400	$ 137,200	$ 166,300
6	$ 93,800	$ 125,100	$ 146,600	$ 189,900
7	$ 103,700	$ 138,900	$ 161,800	$ 213,500
8	$ 110,300	$ 152,600	$ 172,700	$ 237,100
9	$ 120,200	$ 166,300	$ 187,500	$ 260,700
10	$ 129,300	$ 180,100	$ 201,470	$ 285,300

CDC effective operating range

Modernized Sites

AsiaCell operating range
for off grid site with guard

Solar Considerations

- Solar sites either solar only or hybrid solar are **less cost effective** for **short** TCO periods (3 -5 years).
- Previously solar sites were more attractive as TCO periods of 7 -10 years were used.
- Solar solutions are difficult to retrofit due to site layout and space constraints.
- In most circumstances, hybrid solar solutions are **less cost effective** than CDC so these solutions would only be effective for around 3KW and below
- Solar only, is only effective for loads less than 500W and only for remote sites where generator costs are high.
- There is a high risk of theft of solar panels at remote sites

Conclusion

Solar has a niche but there are a wide variety of site types and circumstances where it is not effective

Indonesia - Menaga







Indonesia - Mambi







Indonesia – Ketenong Jaya







Indonesia - Pagardin









Maldives

Hybrid Site: Solar + Grid







Qatar

Standalone Solar Site





Tunisia





Stand alone
Solar Site



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Data Centre Efficiencies

Some Observations

- Data Center Power Consumption is a significant part of the Groups power expenditure.
- Data Centers are generally very inefficient
- One question must be answered though

WHAT IS A DATA CENTRE?

- Network equipment
- IT equipment
- Hosting

Different Tier Requirements

Group Initiatives

- Reduce Tier Level requirements for network equipment to Tier 2 by pooling resources over 2 or 3 Core sites
- Consolidate IT requirements across the Group down to a small number of locations – currently 47 locations
- Introduce modular pay as you grow installation + cooling philosophy

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GSMA Energy Benchmarking

- The Qtel Group is an active participant in the GSMA's Energy Benchmarking Program
- This is benchmarking the Group against 88 mature operators

Findings and Advantages?

- Simply by gathering the required data stimulates the engineer to think more deeply about the solutions and efficiencies.
- When results are published and compared there is keen competition to strive for better results



Presented by;
Brian Theaker
Director Transport + CME
Qtel Group
btheaker@qtel.com.qa