Energy Savings Creates Profit, Reduces OpEx

— Green Mobile Strategy for Indian market

October 2011

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- Strategy for Indian market
- Reference Cases

Major Telcos' Green Strategy and Green Target

It's important responsibility & obligation of enterprises



王建宙
中国移动董事长

- To improve energy efficiency and cut carbon emission
- Implement green action in all divisions of CMCC
- **Power consumption per traffic in 2012 lower 20% than 2008**

Become green integrated information service provider



王晓初
CEO 中国电信

- "Green Action Programme " starts up now!
- Lower power consumption, save source, CO area and cost, waste recycle
- **Power consumption per traffic in 2012 lower 30% than 2009**

Promote low carbon economic development



常小兵
中国联通董事长

- Sharing of base infrastructure , improve equipment utilization
- Energy contract management
- **Power consumption per traffic in 2013 lower 40% than 2009**

A sustainable company in a sustainable society



René Obermann
CEO, DT

- Energy efficiency is a crucial factor for Telekom, not only in the planning of new networks but also in the optimization of existing ones
- Reduce our CO2 emissions 20% by 2020 compared to the base year 1995

Climate change is costing us



Ian Livingston
CEO, BT

- Harness the capability, diversity and innovation of our supply base, encouraging solutions with reduced environmental impact.
- Reduce our CO2 emissions 80% by 2020 compared to the base year 1996

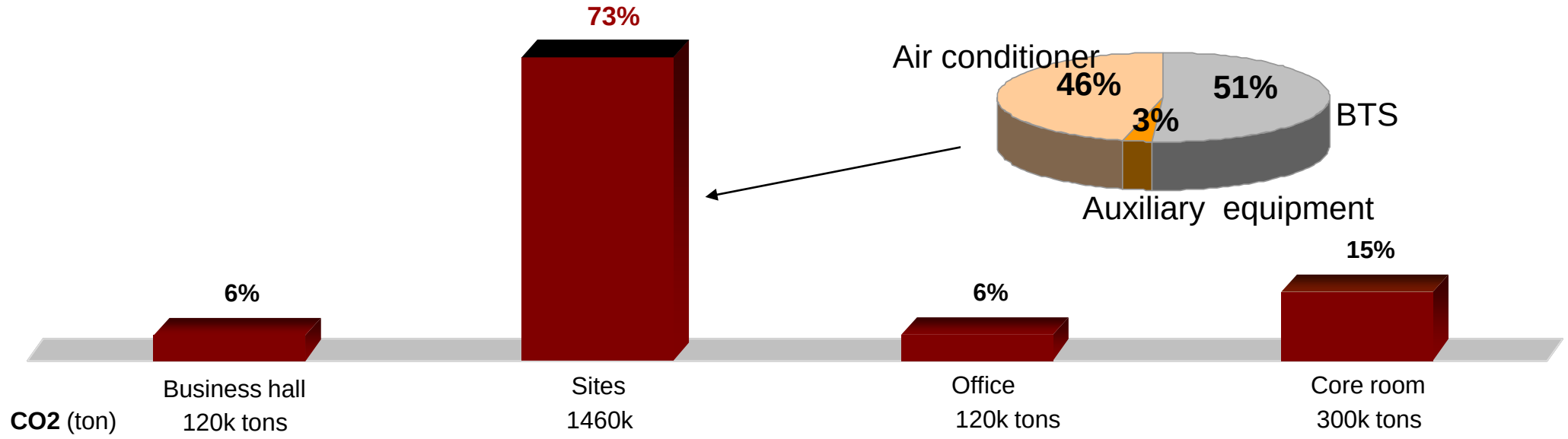
Low energy is key performance



Stefano Pileri
CTO, TI

- Implementation is linked to the reduction of energy consumption
- Develop energy saving plan for NGN2
- Reduce our CO2 emissions 60% by 2017 compared to the base year 2008

Site energy consumption is 70% of the total, and is the key factor for power saving

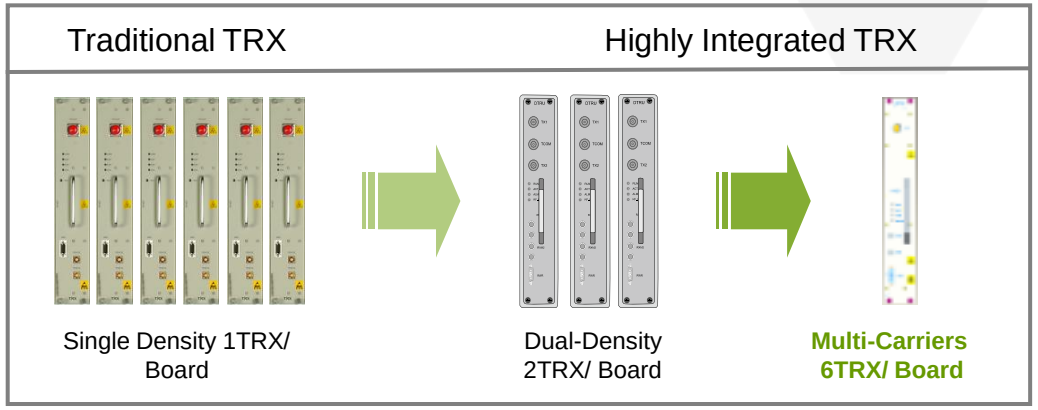


- **How to reduce BTS power consumption?**
  - ✓ High efficiency power amplifier
  - ✓ High density hardware module
  - ✓ New software techs (Carrier shift, slot shift)

- **How to reduce AC usage?**
  - ✓ HEX ,TEC ,direct Cooling
  - ✓ Battery cooling cabinet
  - ✓ Ground-Coupled Heat Pump Systems

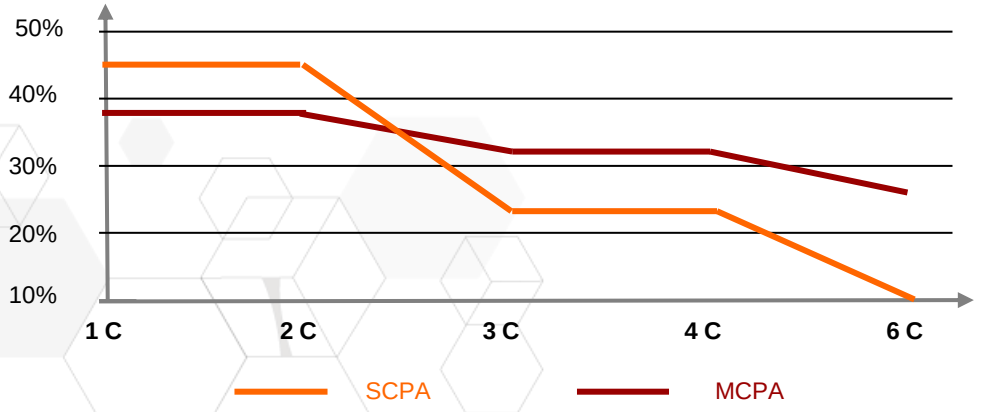
- **How to improve power supply system efficiency?**
  - ✓ High efficiency power system
  - ✓ Alternative energy
  - ✓ D.G. & battery hybrid power system

High Efficiency PA For Consumption Reduction

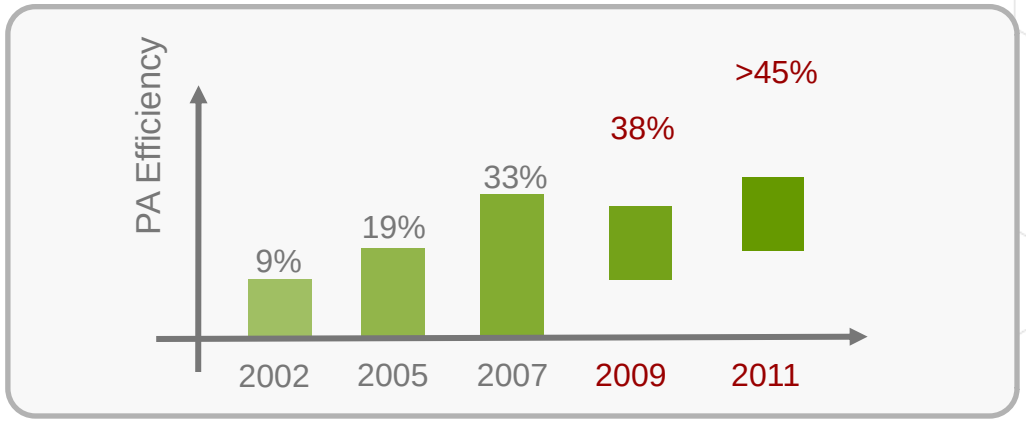




Power Efficiency Improvement (multi-carrier)

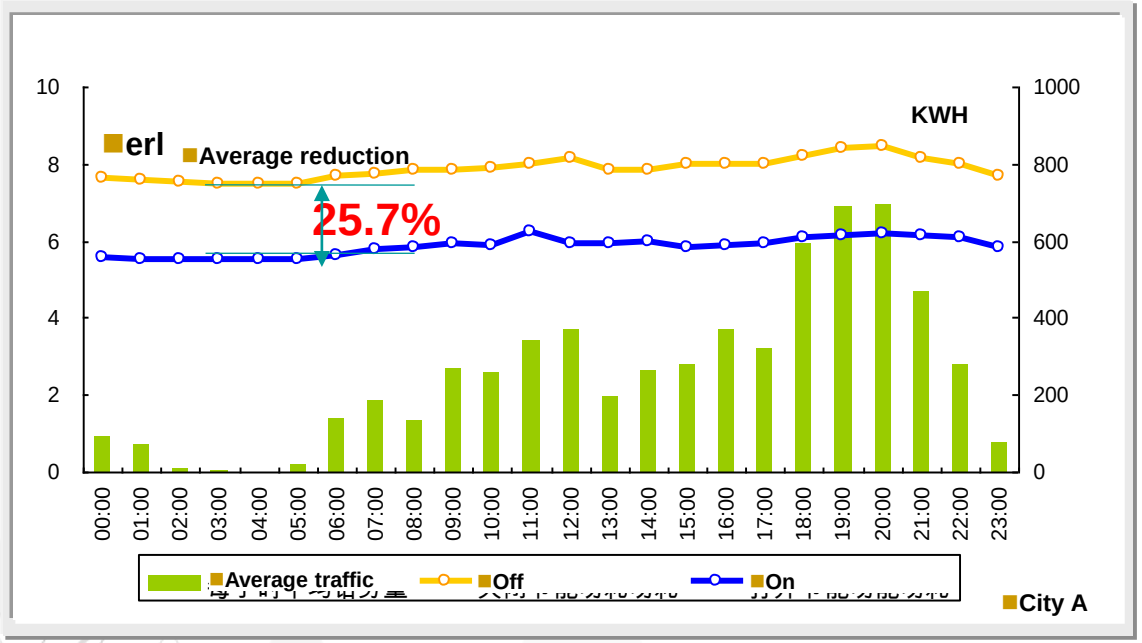


PA Technology Roadmap

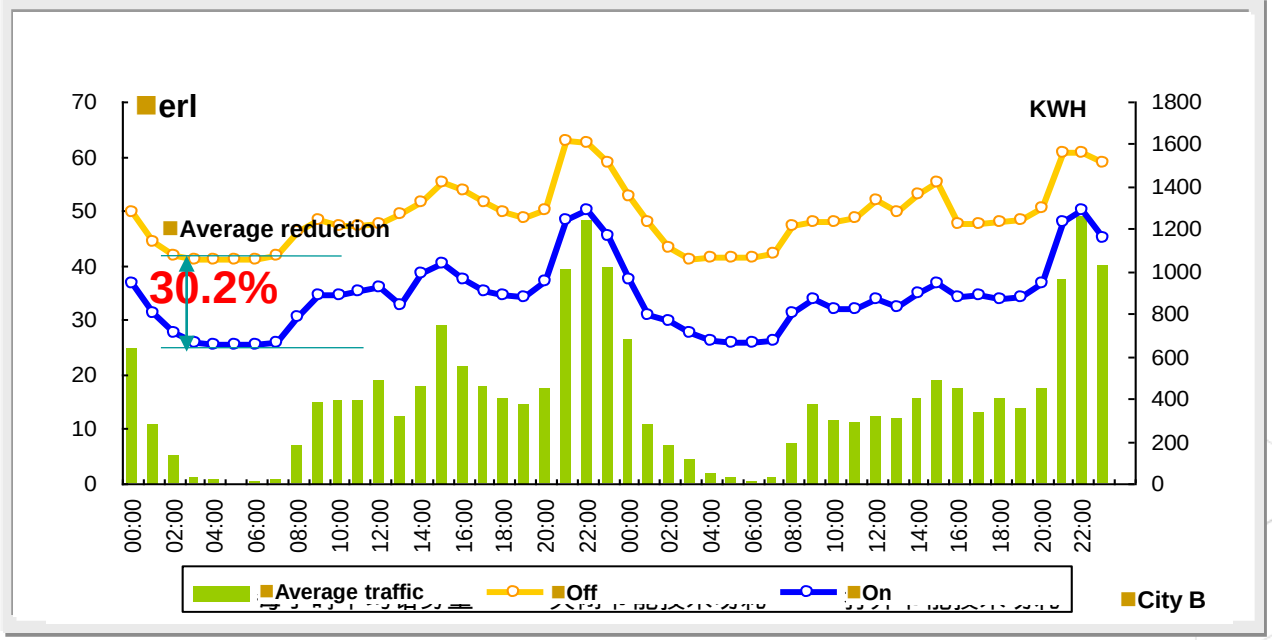


Intelligent Shutdown Strategy

Power saving of S2/2/2 in 24 hours



Power saving of S434 in 48 hours



Power saving balances SW cost

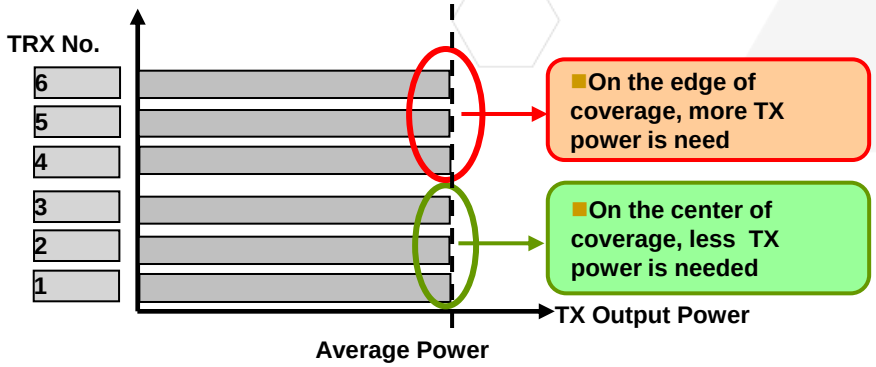
- Large BTS type, more power saving
- 36.9% of power saving especially in 0:00~7:00

Test conditions

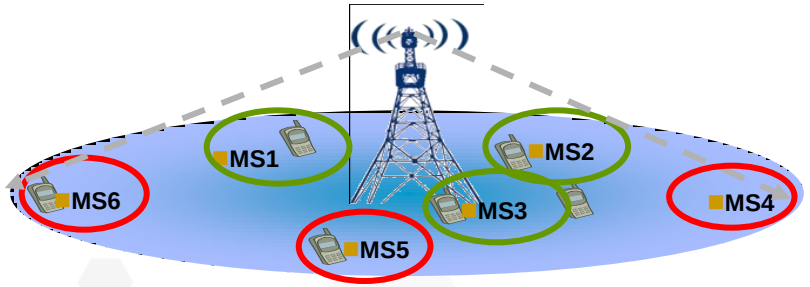
- **Software:**
  - TRX shutdown on TS Level
  - TRX intelligent shutdown
  - Preferentially allocating channels on BCCH carrier
- **Hardware:**
  - **BTS3900 and BTS3012 in downtown**
  - **900M, 1800M**

MCPA: 8%~20% Improvement

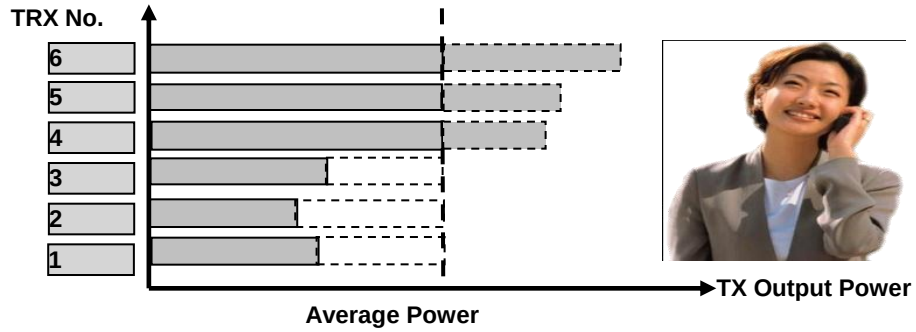
Normal mode



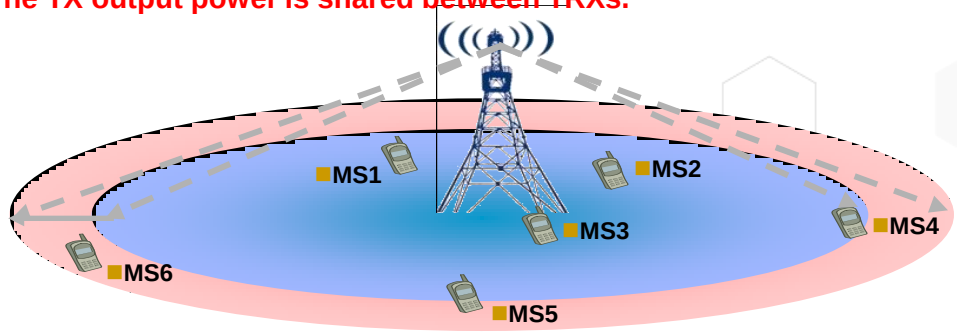
- Average Power per TRX = Total power/6
- The TX output power is independent between TRXs.



Power sharing mode



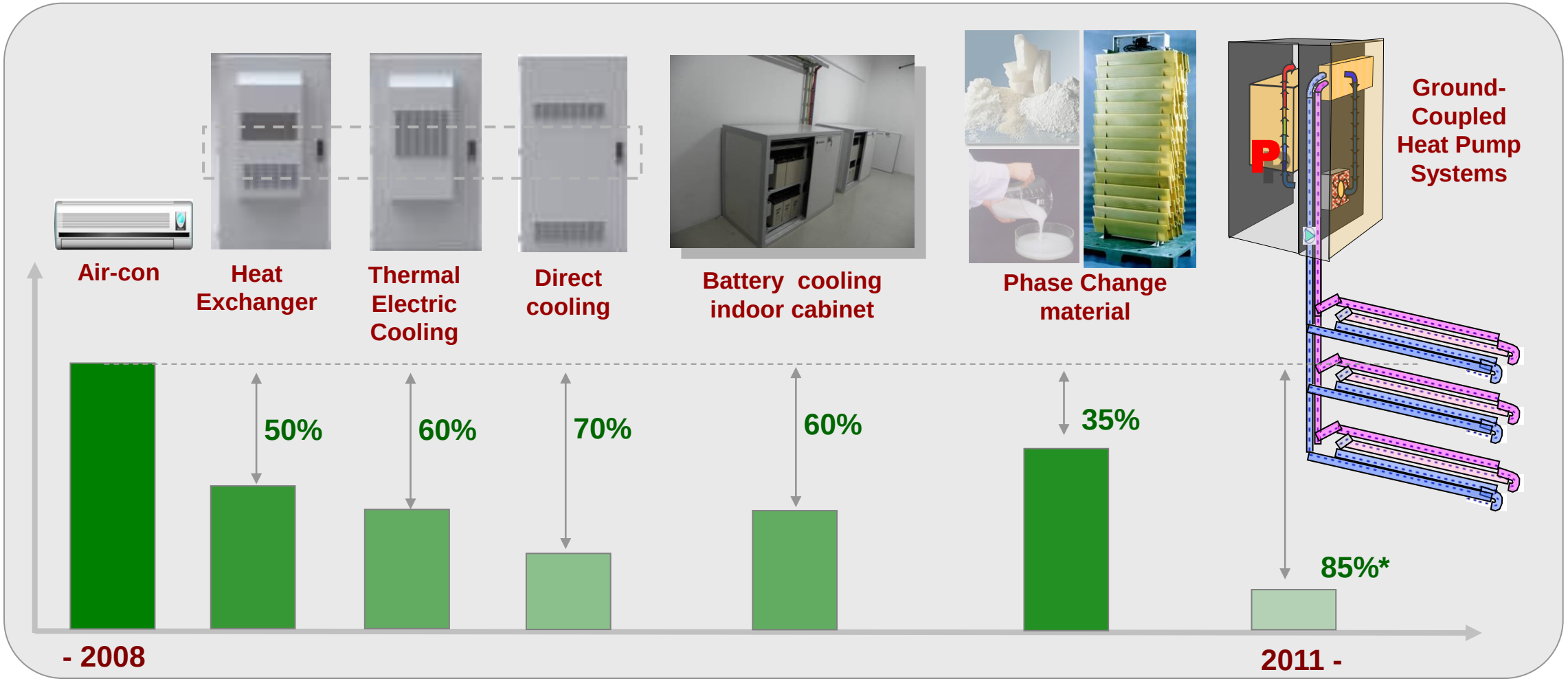
- The TX output power is shared between TRXs.



- **8%~20% Power improvement**

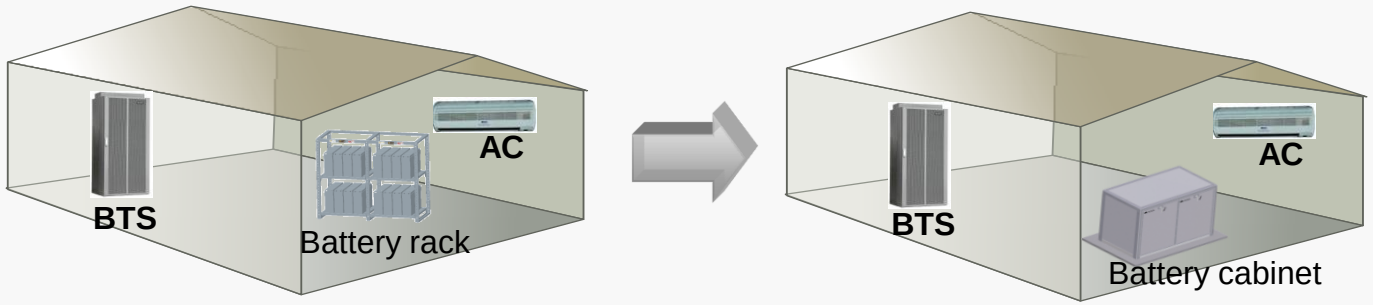
TRXs	Static Cabinet-Top Power	Dynamic Cabinet-Top Power	Increased Power	Increased Coverage Radius	Increased Coverage Area
3	27W/44.3dBm	31W/44.9dBm	**0.6dB**	**4%**	**8%**
4	20W/43dBm	27W/44.3dBm	**1.3dB**	**9%**	**18%**

Series Cooling Solution for Different Scenarios



Individual Climate Control Saves Cooling Energy by more Than 50%

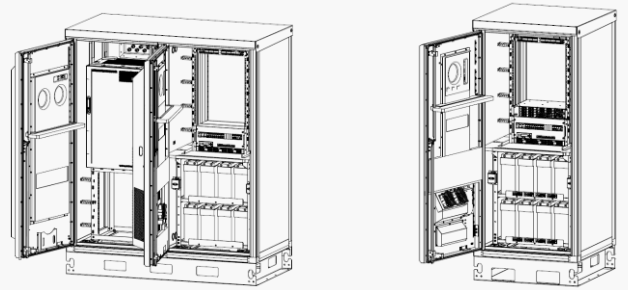
Indoor constant- temperature battery cabinet for indoor temperature rising



Shelter temperature 25℃

Shelter temperature 35℃

Mini-shelter for outdoor individual cooling



2 units for Macro BTS

1 units for DBS

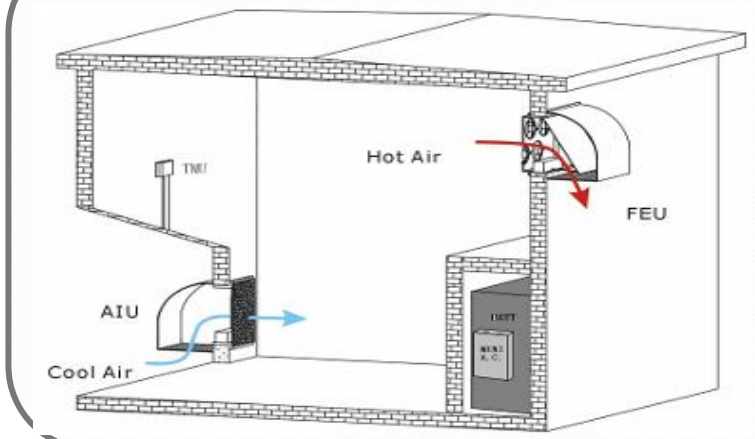
- Strict demand of Battery's working temperature is the pain of shelter cooling energy consumption
- Providing individual cooling system for battery, guarantee battery working temperature at 25℃
- Indoor solution: rising A/C start-temperature from 25℃ to 35℃, reducing A/C usage time
- Outdoor solution: individual cooling for equipment, battery, and other auxiliary equipment

Individual climate control saves more than **3～4 MWh** electricity per year for a 1000w BTS site

Improvement of Ventilation Of Existing Site Room

Temperature:
5~25℃

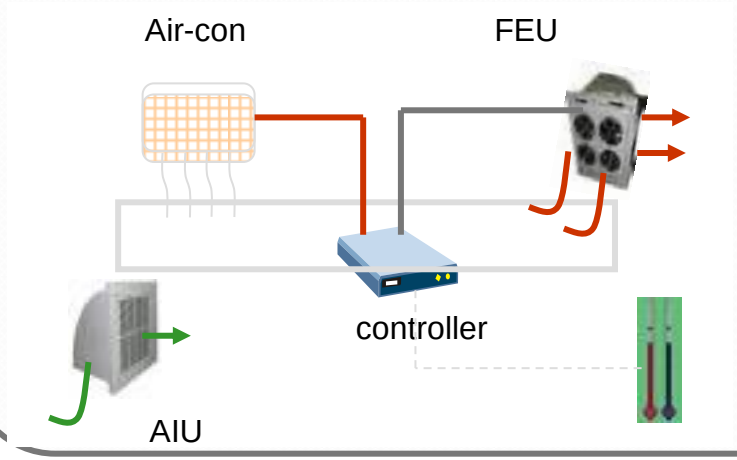
Direct cooling



- **Advantage:**
  - **●No air conditioner**
  - **●Up to 80%~90% power saving**
- **Application scenario:**
  - **●Good air quality**
  - **●Temperature: 5~25℃**

Temperature: -
40~55 ℃

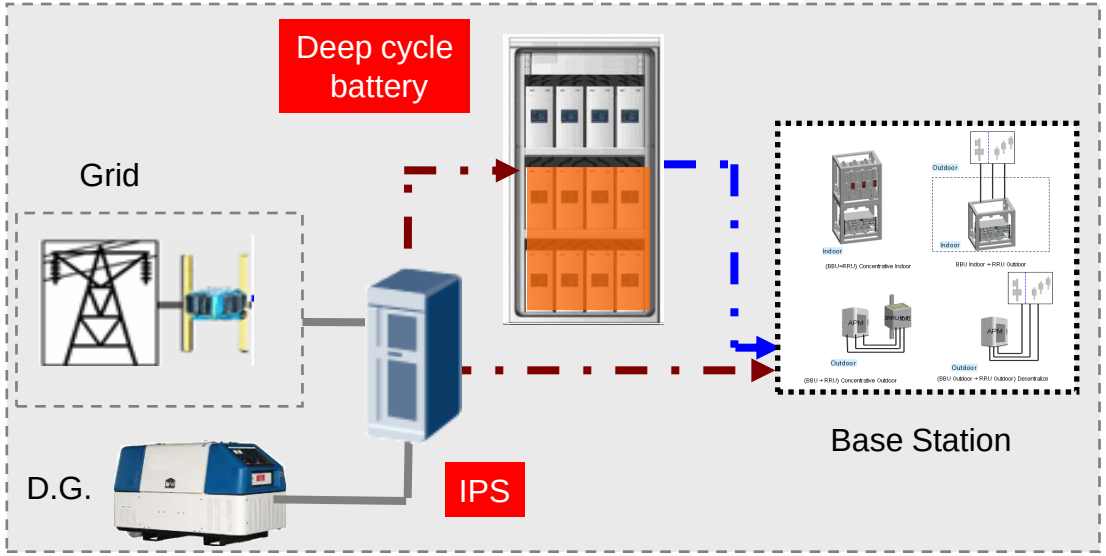
Intelligent ventilation



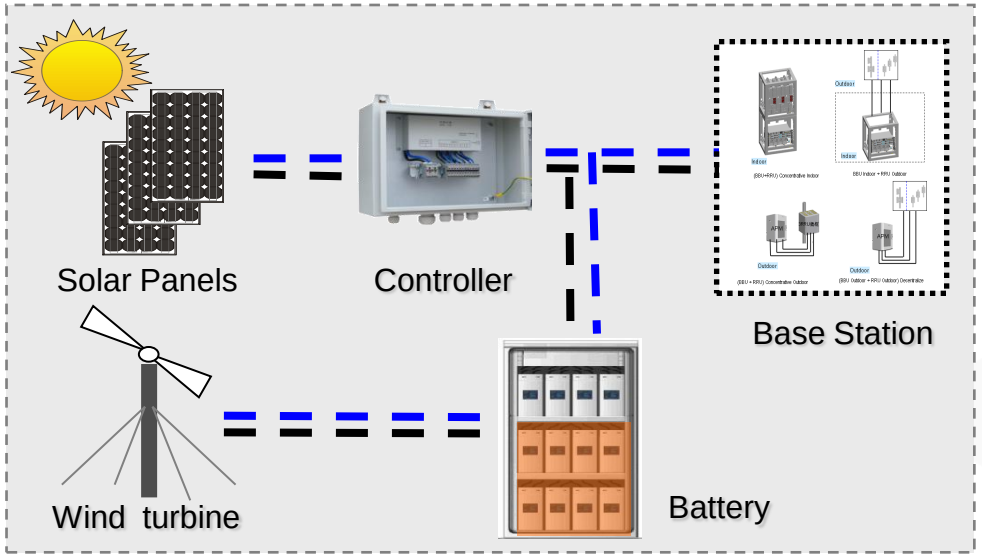
- **Advantage:**
  - **●Reduce air conditioner working time**
  - **●60%+ power saving**
- **Application scenario:**
  - **●Good air quality**
  - **●Temperature:-40~55 ℃**

D.G. & Battery Hybrid and Wind & Solar Power Solution Strategy

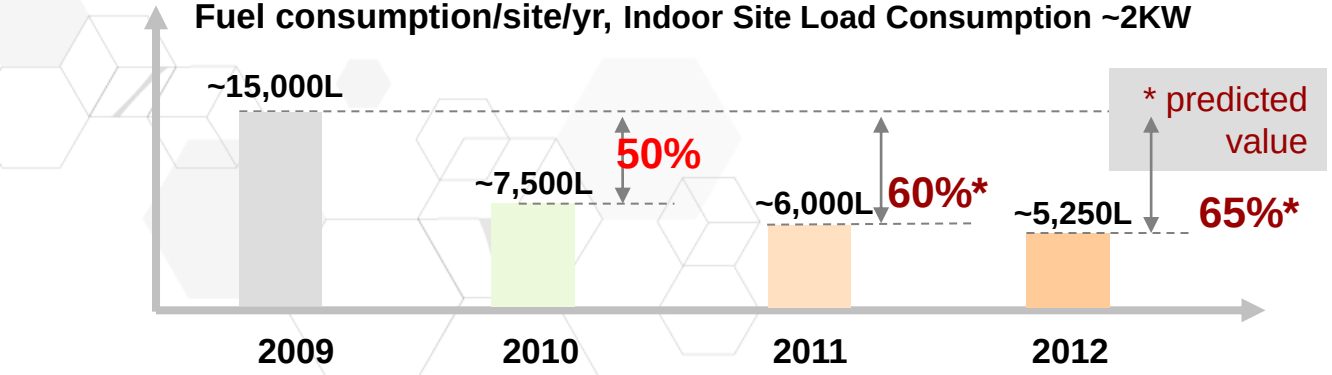
D.G. & Battery Hybrid Solution



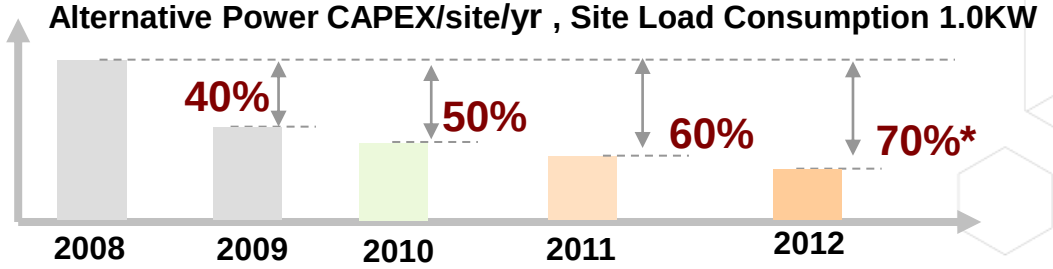
Wind & Solar Power Solution



Fuel consumption/site/yr, Indoor Site Load Consumption ~2KW

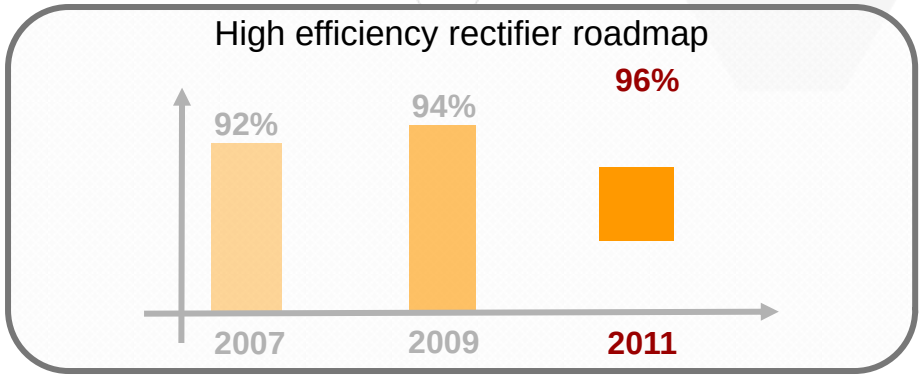


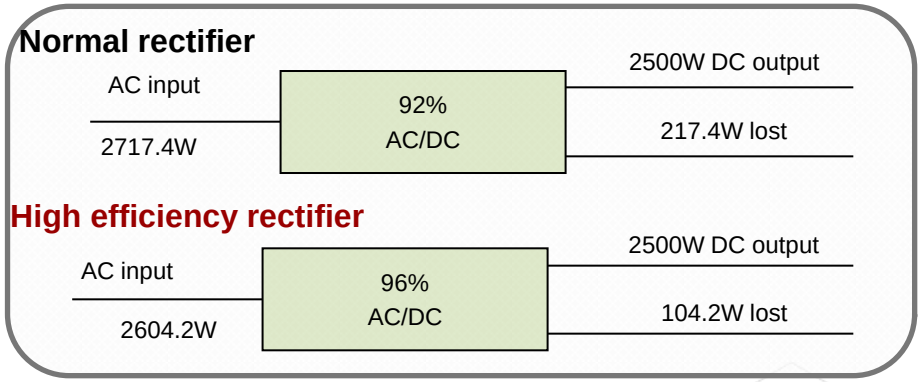
Alternative Power CAPEX/site/yr , Site Load Consumption 1.0KW



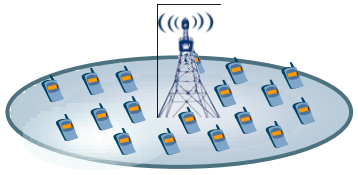
Compared with1+1 D.G. solution, Solar power solution can save fuel over 18.4 kL per year for a 1.0KW site

96% Efficiency Rectifier Module & Dynamic Energy Savings



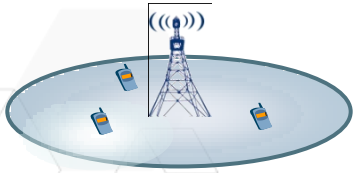


high traffic period

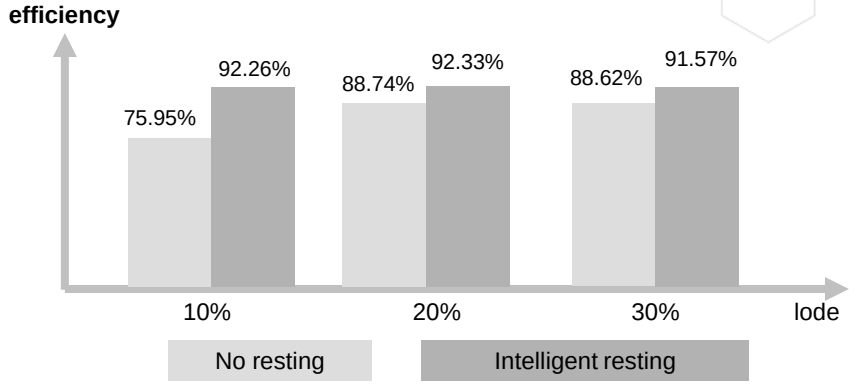




Intelligent shut down in low traffic period







- High efficiency saves 5% energy, it can save **992 kWh** electricity per year for a 2500W site
- Intelligent resting saves up to 17% energy

PowerCube: Best Power Solution for Off-grid or Unstable-grid Site

Huawei PowerCube:

An innovation solution
for indoor & outdoor site in off-grid
or unstable-grid area.



Benefits for customer:

- **60% Fuel Consumption Reduction**
- **1000 Hours D.G. Maintenance Period**
- **Anti-theft design**
- **Advanced Energy Scheduling Strategy**
- **Flexible Network Management**



Energy Plant System | **Energy Control Cabinet** | **Energy Storage Cabinet**

Main Parameters	
D.G. Power	10 kW
Fuel Tank Volume	1000 L
Dimensions (H x W x D)	1800 mm x 2150 mm x 780 mm

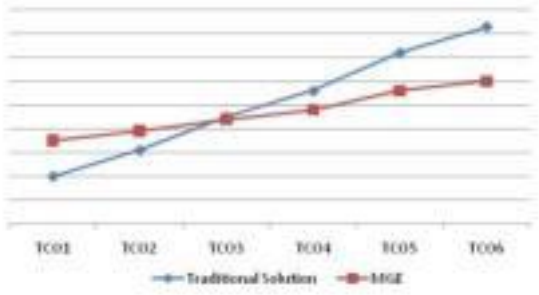
ROI: 1-3Years

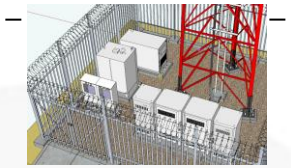
Scenario	Requirement	Solution
Off-grid areas	Low power consumption (≤800W)	Solar solution 1.200A on/off & MPPT 2.50A on/off or PWM
	Medium/high power consumption (≥800W)	D.G.-battery solution 1.Split design 2.Integrated design (Power Cube)
Unstable-grid areas		

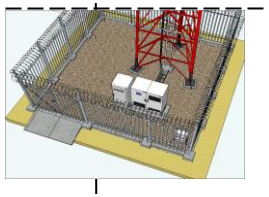
‘4S’ Carrier-Class Hybrid Power Solution: PowerCube

Saving TCO

- Fuel Saving: 60%
- Maintenance reduced : 70%
- TCO saving: 40%~50%

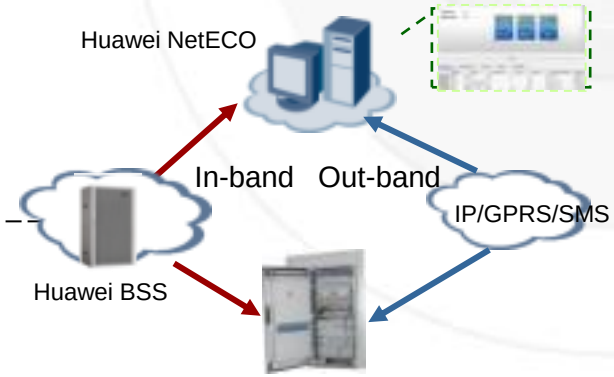






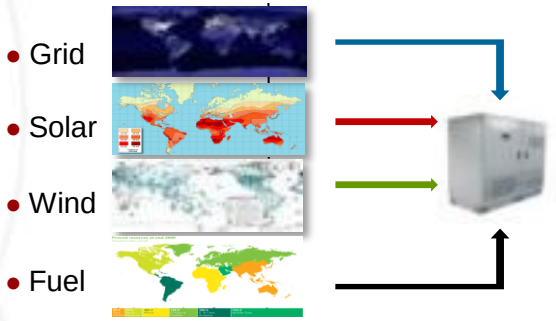
Smart management

- Single OSS
- Interaction with BTS
- Support Site sharing
- Safety management



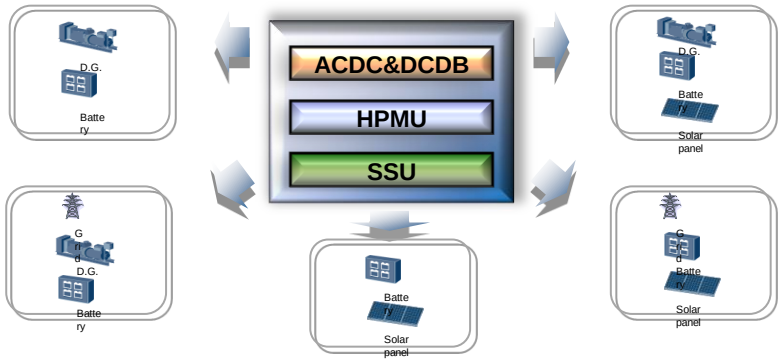
Single Platform

- Single Controller
- Uninterrupted Power



Scalable for Future Expansion

- Smooth Evolution by Modular Design
- Easy Capacity expansion by modular design



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- **Strategy for Indian market**
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Energy Solution Strategy for Indian market



Good Grid

Bad Grid

Off Grid



Indoor Power



Outdoor Power



Embedded Power



Grid + FCB



Grid + Solar



D.G. + Battery



Solar + Wind



Solar

Telecom Power

Hybrid Power

Alternative Power Supply Strategy For Different Scenarios

Solar power solution



- Application scenario：
  - Site load =130 W
  - Sun availability hours > 4Hours/Day
- ROI = 1.61 Years
- Reference: Vodacom SA

Solar-wind hybrid power solution



- Application scenario：
  - DBS3900, S4/2/2, Site load=520W
  - Sun availability hours> 4Hours/Day
  - Annul Avg. wind speed > 4 m/s
- ROI < 2.5 Years
- Reference: CMCC

Solar-D.G. hybrid power solution



- Application scenario：
  - BTS3012 S2/4/4 (GSM 900), S4/4/4 (GSM 1800), site load < 1.15KW
  - Sun availability hours > 4Hours/Day
- ROI < 2.69 Years
- Reference: Vodacom SA

Solar-Wind-D.G. hybrid power solution



- Application scenario：
  - BTS 3012, site load=1.65KW
  - Sun availability hours/day > 5.6Hours/Day
  - Annul Avg. wind speed > 6.7 m/s
- ROI < 3Years
- Reference: Safaricom Kenya

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Energy Worldwide Applications, Partners and Services (Ref. Huawei)

12,000+ sites with hybrid power solution

20,000+ Mini-shelter

700,000+ power system

80+ countries, **130+** operators

130+ service branches spread all over the world

1100+ professional partners

7X24 hours service

Localized service close to customers



Green Energy Solutions Make VIOM More Profitable

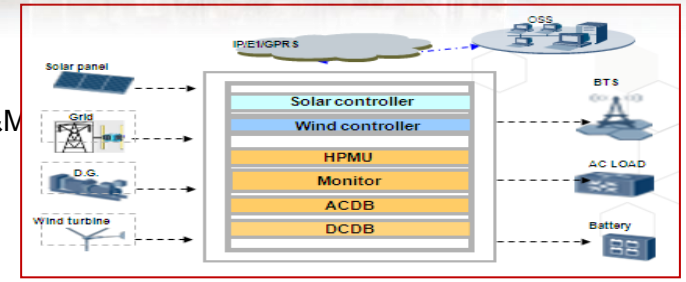
VIOM Challenges:

- D.G. power solution high OPEX and high CO2 emission
- The majority of rural sites are off-grid and unstable grid in emerging market.
- Maintenance of the rural sites is difficult because of location and terrain condition.
- Network is expending to rural areas where the ARPU is low.

viom NETWORKS one of the biggest Tower operator in India, operating >40,000 Towers



VIOM adopts Huawei Green Energy Solution:

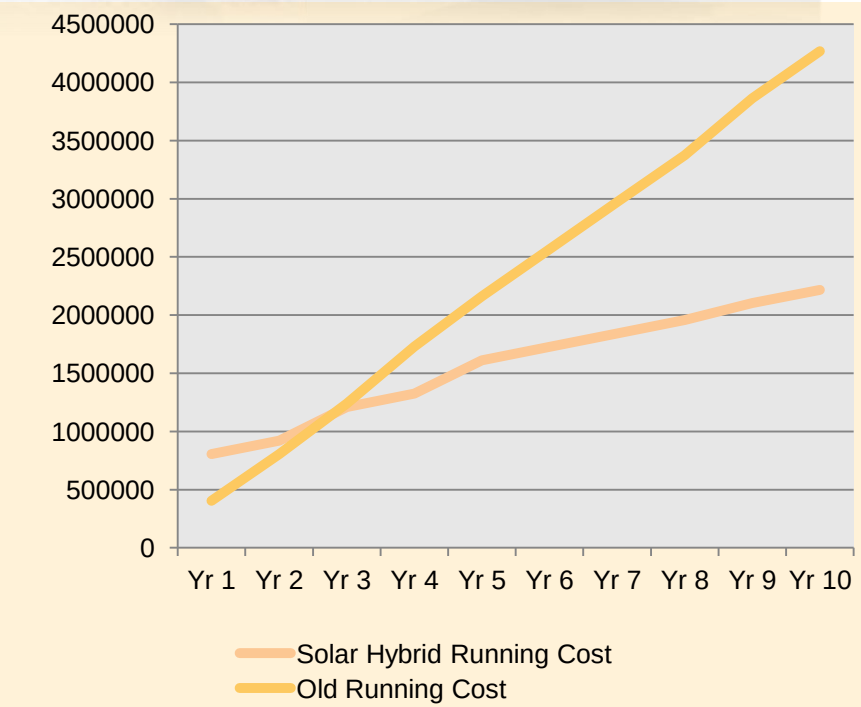


Solar power solution:

- Carrier Class solar power solution with smooth evolution and unified O&M
- MPPT controller saves PV modules up to 30% and prolong battery life.
- Intelligent battery management strategy for various scenarios.

Solar, D.G. and battery hybrid power solution:

- D.G. and Battery supplies power to BTS alternatively.
- Good Solar availability Power BTS and charge battery
- D.G. runs to power BTS and charge battery, keeps the loading rate at 20%-60%.



VIOM Benefits:

- Solar solution, saving 6400 USD per site/year, TCO reach balance at the 3rd year compared with D.G. solution.
- Solar solution, Saving 60900 USD per site/year in 10 years. Zero CO2 emission and maintenance.
- D.G. and battery hybrid solution, saving OPEX by 70%. Reduced the site visiting and lessen CO2 emission.

Diesel Hybrid: Helps MTN Group Energy Efficiency Doubled

MTN Group Challenges:

- 18 countries sites with bad grid.
- More than 30% of the total sites are off-grid in these countries.
- Dual D.G. solution was used on the sites of poor power.
- High fuel consumption and maintenance OPEX on the D.G.s.

MTN adopt Huawei D.G+Bat. Hybrid Power:

- D.G. and battery power the site alternatively.
- D.G. runs for powering BTS and charging battery.
- Hybrid controller checks the battery DOD to switch on/off D.G.
- The Deep Cycle Battery performs up to 3500 times cycles.

Benefits:50%+ Saving on OPEX:

- Improve the D.G efficiency from 10% to 25%
- Reduced running time of D.G.60~70%
- Huge reductions on fuel costs - saving more than 50% fuel;
- Reduced site visit and refueling
- Decreased servicing schedules

Sample site data for off-grid site

Site Name	D.G Running hrs/day	Bat. Running hrs/day	D.G Running percent	Bat. Running percent	Fuel saving
MTN Uganda	7.7 hrs	16.3 hrs	32%	68%	**54.60%**
MTN Zambia	7.2 hrs	16.8 hrs	30%	70%	**54.30%**
MTN Nigeria	7.1 hrs	16.9 hrs	30%	70%	**59.00%**
MTN Ghana	7.8 hrs	16.2 hrs	32%	68%	**64.20%**











Solar Hybrid: Widely Used By VDF

VDF Challenges:

- D.G. power solution high OPEX and high CO2 emission
- The majority of rural sites are off-grid and unstable grid in emerging market.
- Maintenance of the rural sites is difficult because of location and terrain condition.
- Network is expending to rural areas where the ARPU is low.

Vodafone: 1 of the biggest mobile operators globally, serving 200+ million subs


Site Visit


Turkey



Joint Team


South Africa


Ghana

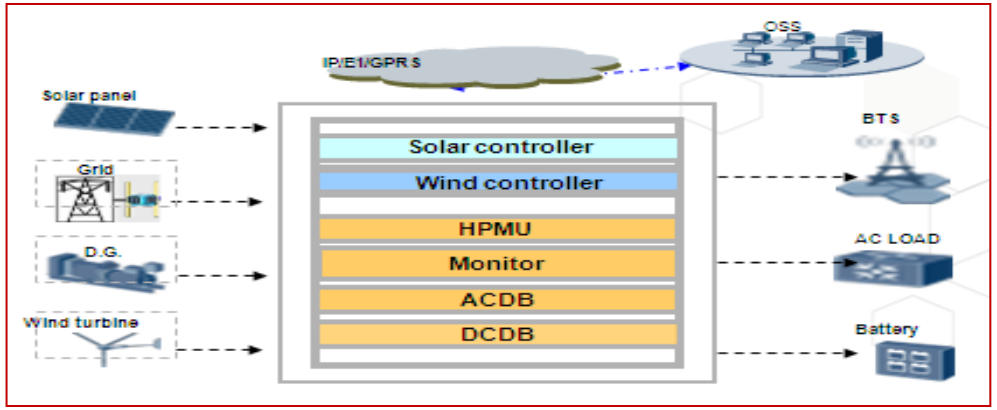
VDF adopt Huawei Green Energy Solution:

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- Intelligent battery management strategy for various scenarios.

D.G. and battery hybrid power solution:

- D.G. and Battery supplies power to BTS alternatively.
- The Deep Cycle Battery performs up to 3500 charging cycles.
- D.G. runs to power BTS and charge battery, keeps the loading rate at 20%-60%.



VDF Benefits:

- Turkey: Solar solution, saving 24,000 USD per year, TCO reach balance at the 4th year compared with D.G. solution.
- South Africa: Solar solution, Saving 102,000 USD in 5 years. Zero CO2 emission and maintenance.
- Congo: D.G. and battery hybrid solution, saving OPEX by 70%. Reduced the site visiting and lessen CO2 emission.

Rural Application For Vodafone



Site configuration	
BTS	BTS 3900E & WIFI
TRX	O2 /coverage 7km
Power consumption	140w
PV panels	8PCS*165W
Battery	400AH/3days

Dieted BTS + Solar Power
= “0” CO_2 emission ≈ **102 k$ saving** for 5 years

Green Mobile Award (Huawei and Grameenphone)



'Green Mobile Award' at the GSMA Mobile Awards 2009

Green Power For Mobile



One solar site of "Building a Greener Mobile Network“ project

'Grameenphone is very committed towards the 'Green' revolution in everything it has been doing over the last few years. This award is only indicative of the role that a mobile company can play in the development of low carbon economies, industries and lifestyles.'

—— from Mr. Frode Stoldal, CTO, GP

Thank you

www.huawei.com