یەکێتی نەندازیارانی کوردستان
Kurdistan engineering union
اتحاد مهندسی کوردستان

Engineering project and research on:-

Power OPEX Saving Expert Project

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CDC Hybrid Solution

ur OPEX Saving Expert

Indexes :-

eferences :-

Huawei Technologies Co. LTD
Asiacell site & communication equipment’s

CDC Hybrid in Brief

lecoms operators seek the next billion subscribers over the next five s, their focus is shifting to developing markets from which, according yramid Research, 90% of new subscribers will come.

nding the network in these markets is a challenge; there is no ricity grid infrastructure or in some cases connection to an liable grid. For some wireless operators 70% of the trouble tickets ower related and often the only option is to send an engineer to site. n the power goes it takes time to resolve and valuable network nue is lost.

common option is to run a diesel generator 24/7 and live with the problems of l supply in remote areas, as well as theft and network downtime due to power ges. In addition, excessive generator wear and tear due to sub-optimal runtime s (e.g. a 17kVA generator powering a 2kW telecoms load) results in increased cing and decreased operating life – meaning that the generator needs to be ced frequently.

problems associated with blackouts or brownouts in a network with an liable grid present another set of challenges. The common approach is to use a ery bank with a fuel cell or a diesel generator for power back-up. However, wit anagement or control platform the performance is improved but not optimize erformance or equipment lifetime

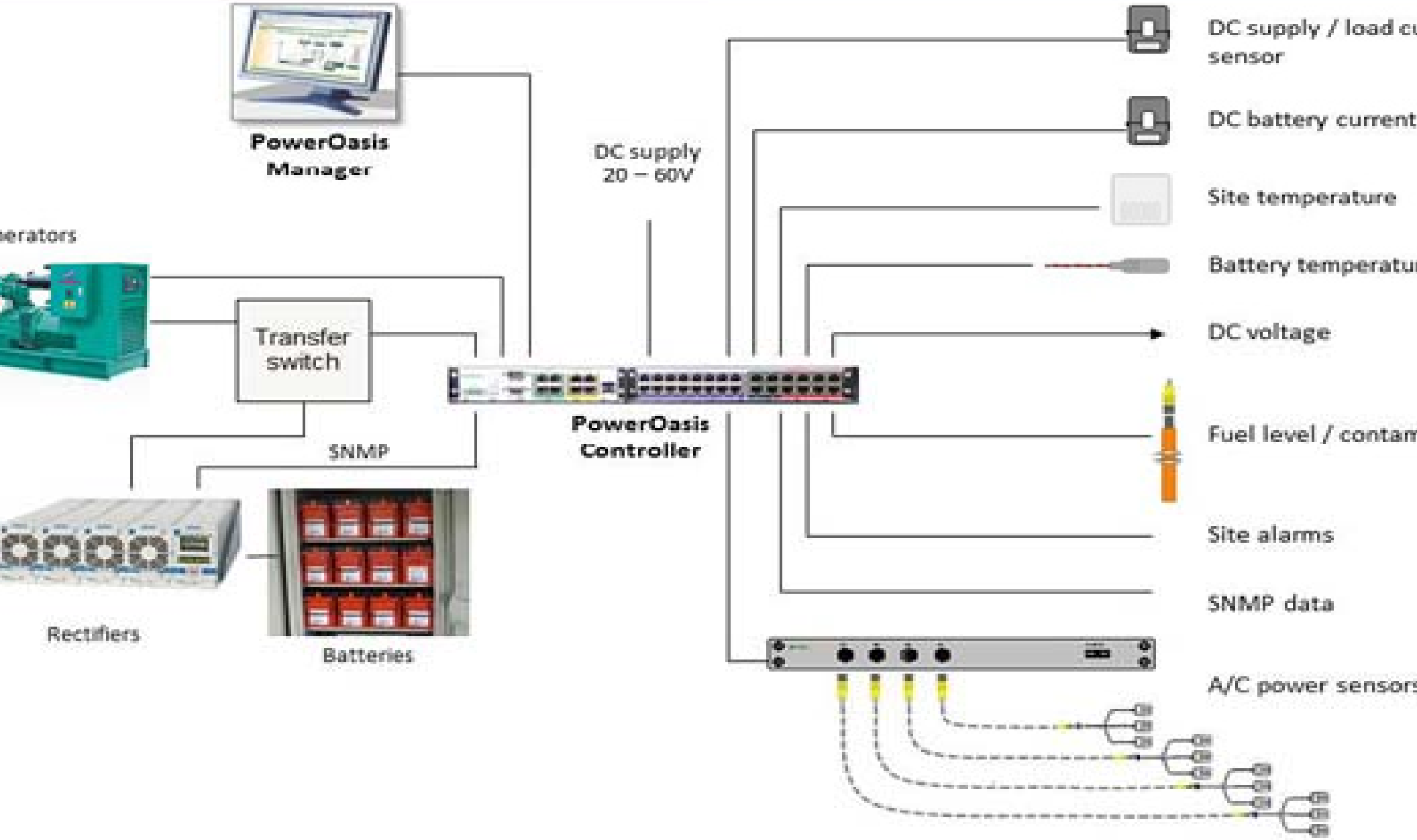
CDC Hybrid Power Systems Report Objectives

ybrid Power Solution is one that takes a power source, such as a diesel generat
ombines that with an energy storage system, such as a battery bank. The batte
meets the day-to-day site power load and when its state of charge reaches a
ured threshold, then the controller starts the generator and the site is powered
ator which also recharges the batteries. The generator is running under near 'f
conditions and therefore is in optimum efficiency mode.

ically, the generator will run for 4-6 hours to charge the battery bank under fu
s opposed to running 24 hours a day at 30% of its capacity just keeping the sit
ed – this results in up to 50% diesel saving. The overall result is reduced fuel c
r equipment service life and fewer refueling and maintenance site visits.

following diagram illustrates the key components of a Generator-Battery Hyb
r solution.

Diesel Hybrid



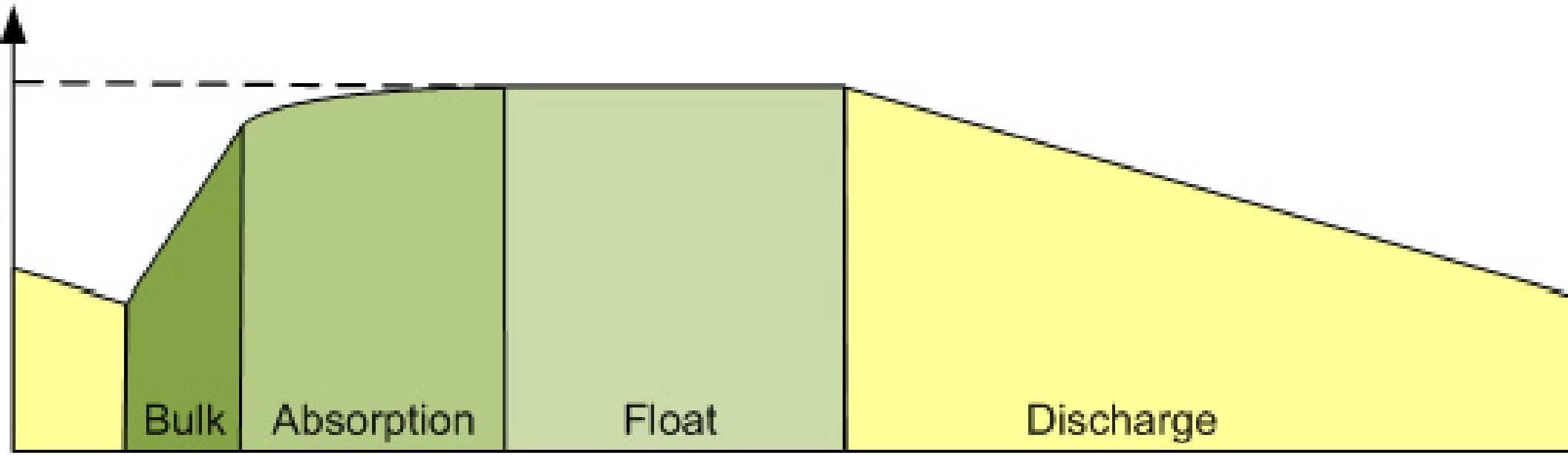
**PowerOasis Generator-Battery Hybrid Power solution measures all key senso
to optimize system performance. The data is stored locally and then uploaded
tral PowerOasis Manager in the networks operations Centre. The result is
ed fuel costs, longer equipment service life and fewer refueling and maintenanc
its.**

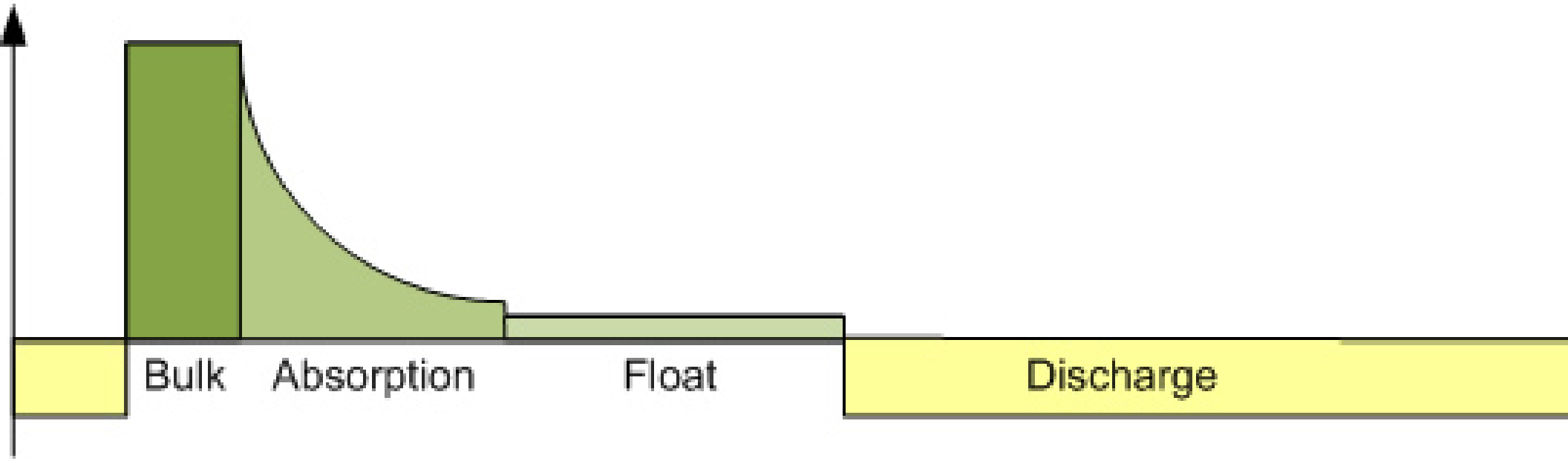
**purpose of CDC system to provide longer backup in case of grid source and
tors failure (manually or automatically), to reduce the OPEX of Power source
inimization of fuel consumption. By using Deep cycle batteries for longer
p,**

**se of lonely generator source available, during the fully charging of batteries
GS will be automatically shut off and on 60% DOD to will return to duty
atically. In this way DG OPEX (fuel consumption cost and operational with
tive maintenances) will be minimized.**

ery Profiling :-

**cycle batteries are used to store energy between generator runs and
le power to the telecoms loads. Battery life is dramatically influence
te of charge management, which must follow the manufacturer's
ng profile if battery life is to be maximized and warranties adhered
agrams below illustrate one of the many programmable battery
ng profiles implemented by PowerOasis Smart Hub Controller. Th
art shows the battery state of charge and the bottom chart shows t
ponding battery current.**


Bulk
Absorption
Float
Discharge


Bulk
Absorption
Float
Discharge

ing the bulk charge phase (also described as constant current or UI phase) battery charge acceptance is high and the power system is in current limit, er delivery to the battery during this phase is optimal and limited only by power source. In the bulk charge phase approximately 80 – 90% of battery rge can be returned.

absorption charge phase returns the battery to full state of charge, in this se the battery voltage has reached that of the power system and the charge ent reduces. This constant voltage stage of the cycle is less efficient in terms ower return but necessary to fully recharge a battery.
float charge is required for long term maintenance of batteries on standby ication, the charge voltage is reduced and battery current at low residual ls. The float charge is only required where commercial power is available for nded periods.

ry state of charge is monitored using highly accurate patent pending coulomb ting algorithms to avoid battery damage from undercharging or over-charging tate of charge, combined with high and low voltage disconnect thresholds, are by PowerOasis Smart Hub Controller to control rectifiers, which govern the r used to charge the batteries.

rOasis tests and certify the performance of each battery system and can fore recommend solutions based on the performance and cost criteria of the oms operator.PowerOasis has undertaken extensive testing with EnerSys and mmends its Eon battery for telecoms applications. EnerSys will provide a highe warranty when their batteries are controlled by a PowerOasis system. rOasis has undertaken extensive testing with SAFT and recommends its on Lithium-ion battery for long term telecom applications.

ine the thrust of a new program:

educe or eliminate noise of generators and emission Problem.
event/reduce power trespassing since the produced power is DC only
creasing network from 30% to100% (21hours autonomy plus 8 hours backup
crease installation contractor (the solution is plug and play)
quipped with Solar & Wind power to increase saving
mote Management for all equipment's
ompile a set of activities that may tap into existing Technology programs to in the gaps"
oordinate but not overlap with technology programs
mulate innovative thinking that leads to creative business ortunities
courage cross-programmatic interactions and benefits

nclusion

owerOasis we take a systematic approach to dramatically reduce power OPEX
ng solutions that optimize the Return on Investment (ROI) for the Telecoms
or. PowerOasis undertake a six-stage Services Model to identify those base sta
ith compelling power reduction opportunities.

: Hybrid power systems can offer solutions and value to Customers that indivi
logies cannot match (communications and network field). The approach is cen
viding a Total Cost of Ownership (TCO) model comparing new alternatives w
g (benchmarked) data. In addition, the approach enables the Telecoms Operat
e CAPEX investment with OPEX savings. In some cases, it is useful to deploy
ted solution to rapidly gain OPEX savings and then to re-invest these saving to
de the site to get additional OPEX saving.

brids offer market entry strategies for technologies that cannot currently pete with the lowest-cost traditional Options.

me renewable CDC Hybrid power systems are commercially available today a d be outsourced to our region for further study & instant utilization especially ural areas.

tiative with an emphasis on distributed applications that currently existing in llel to the main technology focus & Design.

r minimum coherence with the new technology focus, it could be a considerabl enge to study it within university courses for new engineering generation.

nergy Worldwide Applications .

52,000+ sites with hybrid power solution

60,000+ Mini-shelter

700,000+ power system

80+ countries, **130+** operators

130+ service branches spread all over the world

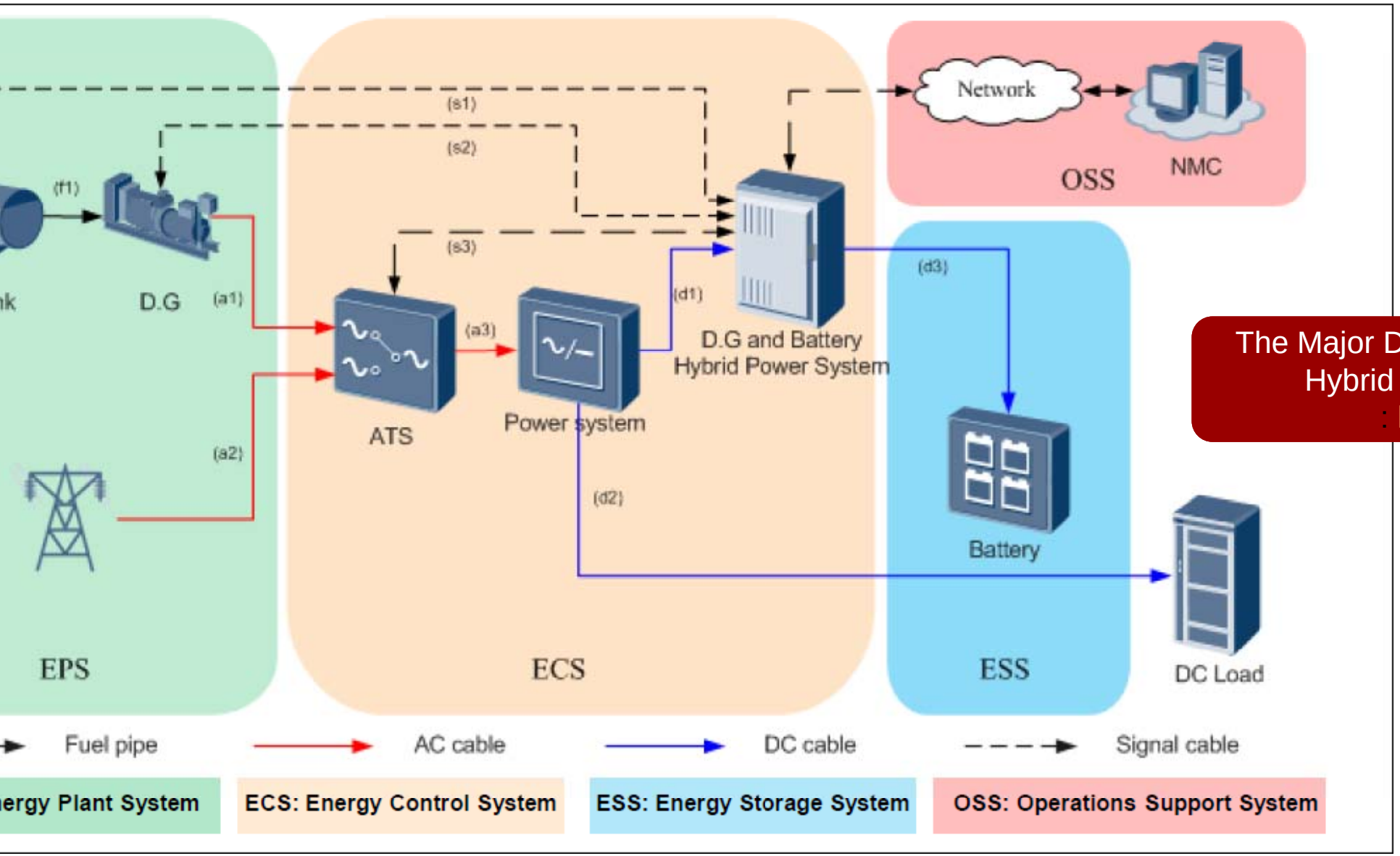
1100+ professional partners

7X24 hours service

Localized service close to customers

e T-Mobile Get more from life 中国移动通信 CHINA MOBILE China unicom中国联通 Telefónica MTN everywhere you go zain telenor bite etisalat Bharat San

DC Hybrid Power Solution



The Major Difference
Hybrid **VS** Tradi
: **Battery**

Special Designed ESS for Different Scenarios

CB Energy Storage System
Deep Cycle Battery

features:

g cycle life and high current harging performance

- Cycle life **: 2000 times @ 60% DOD, 25℃**
- Max. working temperature 35℃.

FCB Energy Storage System
Fast Charge Battery

Key features:

Higher current charging performance

- Maximum charging current up to **0.3C**
- Shorten **50%** charging time
- Cycle life : **1500 times @ 40% DOD, 25℃;**
- Fully recovered to **100%** capacity
- Battery efficiency more than 90%

ACB Energy Storage Syste
Advanced Cycle Battery

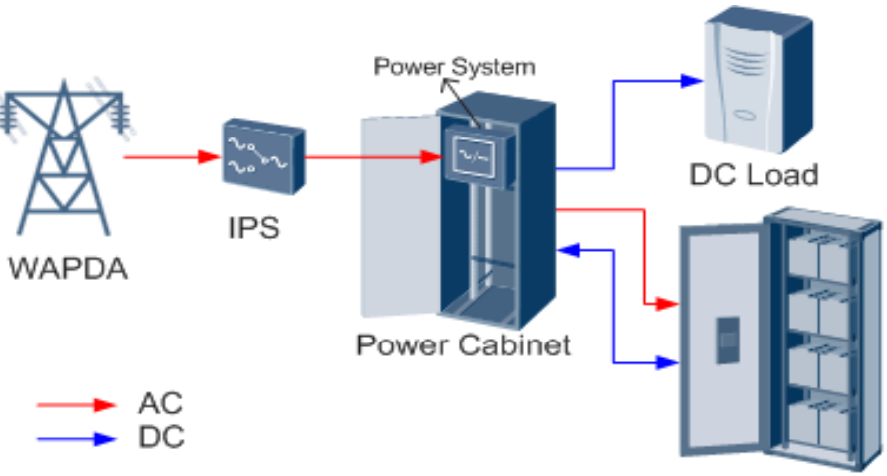
Key features:

Longer cycle life, High density & save space

- Cycle life : **3500 times @ 85% D 35℃;**
- High energy efficiency is more th **95%;**
- Save 1/2 weight & 1/3 volume

B Hybrid Solution for site

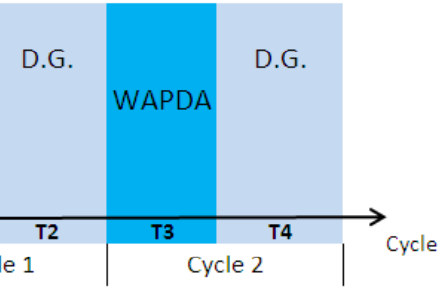
DA supply >=6 Hrs



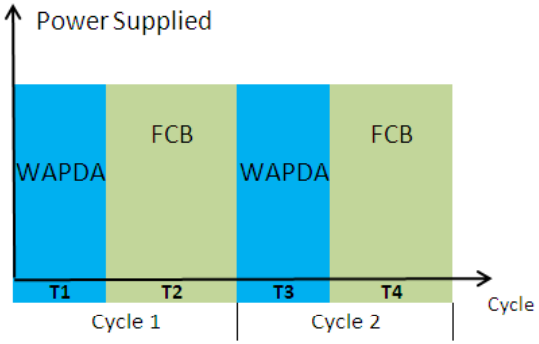
Advanced Cycle battery

is: WAPDA + D.G.

Supplied



To be: WAPDA + ACB



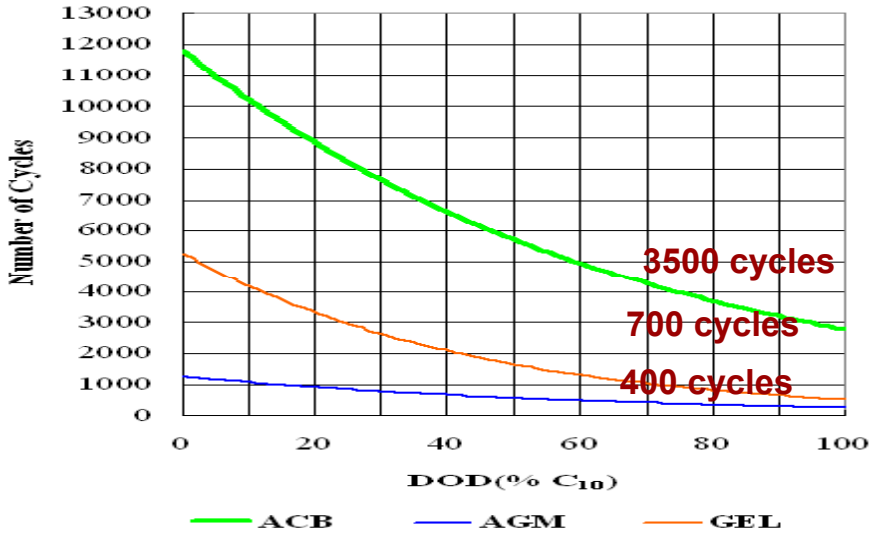
Benefits:

- Maximize utilization of WAPDA, Only use WAPDA

ACB,AGM Battery used for Backup;

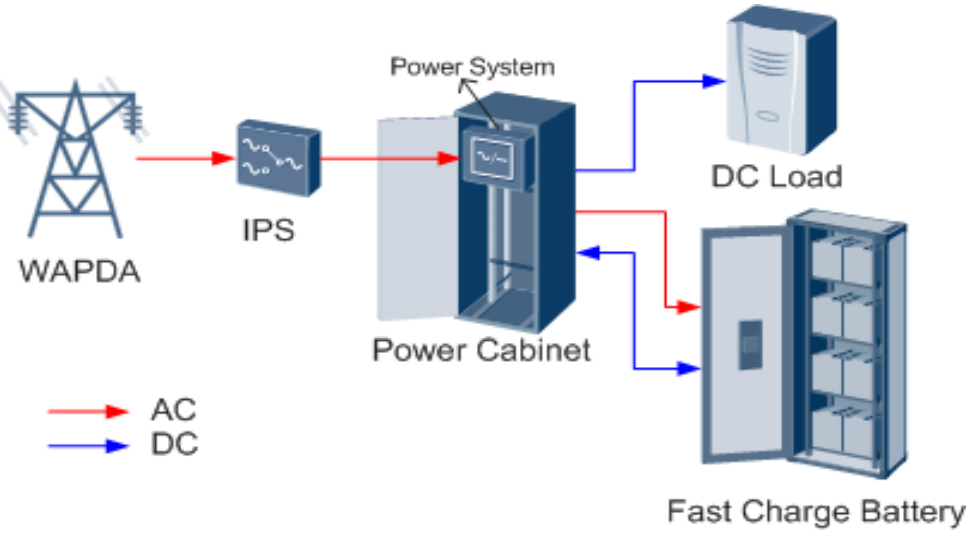
- Remove D.G. and Zero Fuel & Maintenance cost;

Cycle life of AGM/GEL/ACB 35℃:



Hybrid Solution for city site

DA supply >=12 Hrs



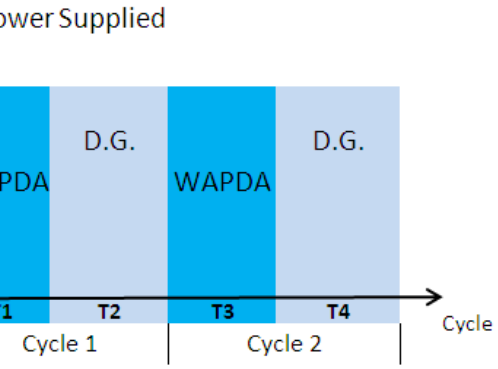
Benefits:

- **Maximize utilization of WAPDA, Only use WAPDA ar**
- **Accept 0.3C fast charge, Battery charging time savin**

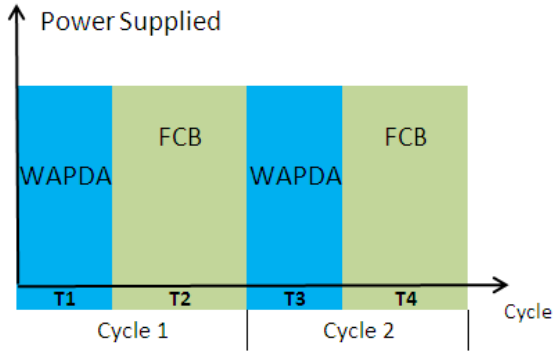
increase charging current;

- **Remove D.G. and Zero Fuel & Maintenance cost;**

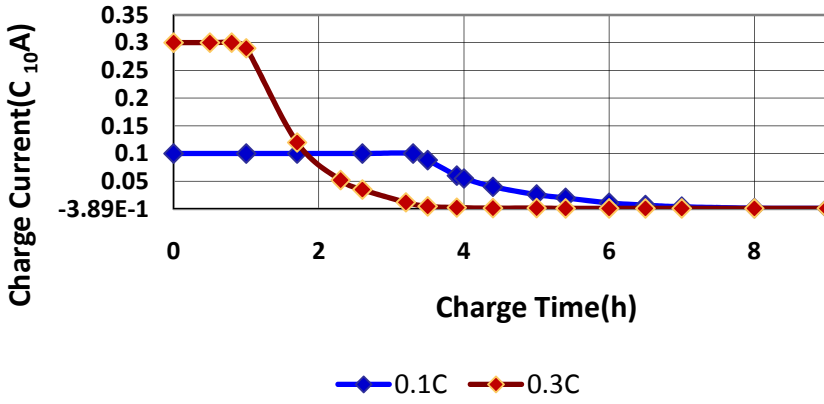
As is: WAPDA + D.G.



To be: WAPDA + FCB

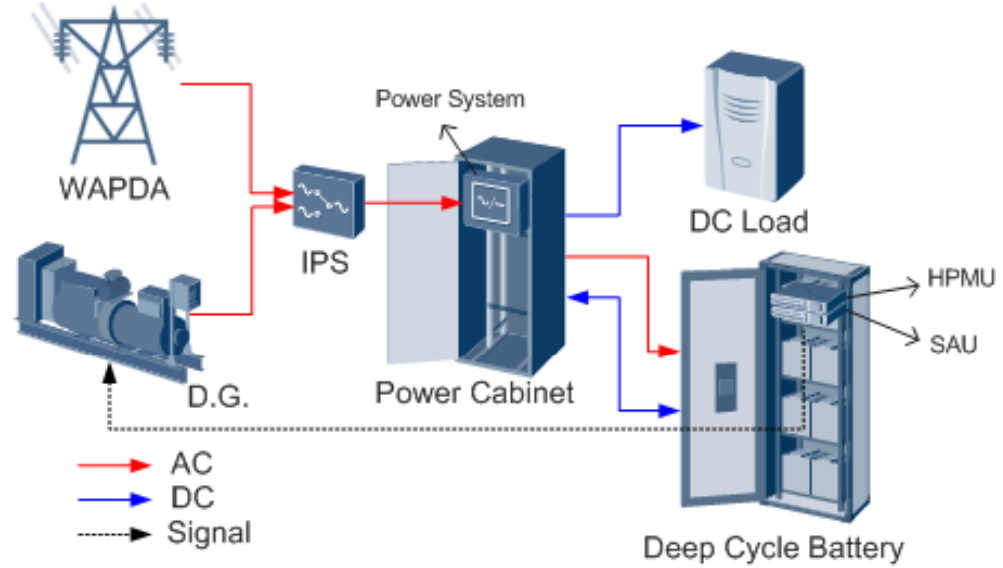


Charge time vs. different current

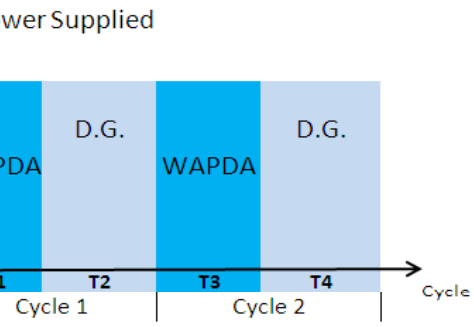


B Hybrid Solution for Suburban and Ruel site

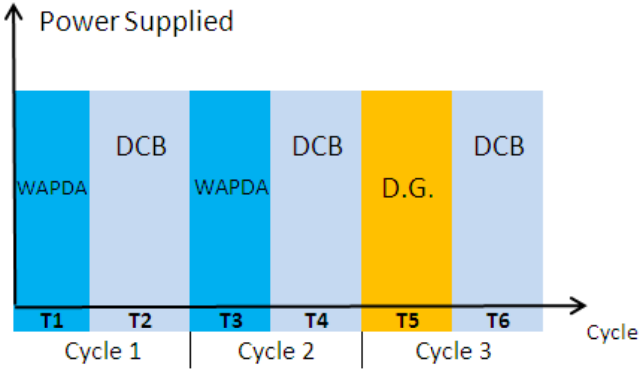
DA supply < 12 Hrs



s: WAPDA + D.G.

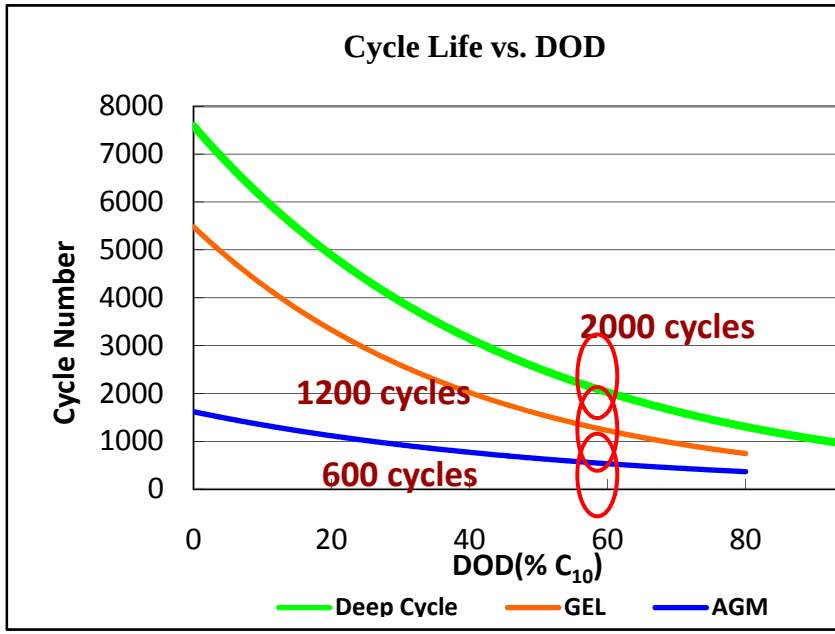


To be: WAPDA + DCB +D.G.



Benefits:

- Life Cycle can achieve **2000 times** @ 60% DOD
- DCB 2000 Cycles VS. AGM 400Cycles.
- Intelligent Battery Charging Management；Prolong battery by **40%.**



Dual Power Solution-ECS

tures:

pecial designed DC power system

- Support high battery charge current, which can reach up to 0.3C
- AC input source automatic adaption technology, which can adjust and imit the charge current base on the capacity of AC input to avoid suddenly shut down the AC input source (Grid/D.G.)
- Battery big current charge soft start technology and charge current automatic adjustment technology less battery temperature raise

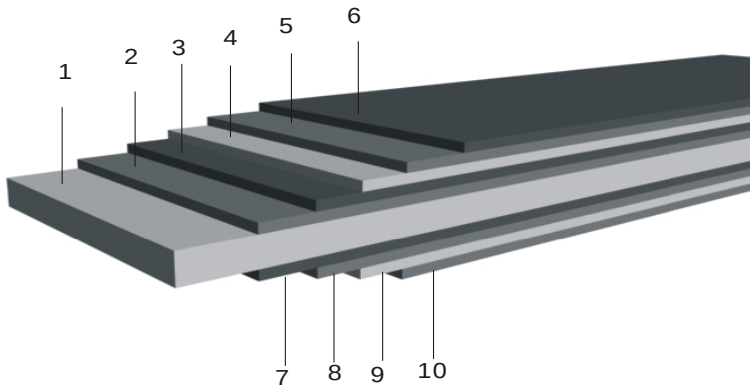
emote monitoring method by GPRS \ IP and in-band

13U standard 19inch spare space offered

Items		Parameter
Capacity	Full Load current	200A/50A
	Rated Voltage	Input：AC220V/380V
		176Vac ~ 290Vac , 100% out
		90Vac ~ 175Vac , degraded
		Rated Output：53.5V DC
Ambient	Temperature	-20℃～＋50℃
ACDB	AC input	63A/3P*1 (MCCB)
	SPD	Class B
DCDB	Battery connection	160A*2 (Fuse)
	LLVD	63A´4(Fuses)
		32A∗2 +16A∗2 (MCCB, can
	BLVD	63A∗2 (Fuses)
		32A∗2+10A∗2 (MCCB)
	SPD	10kA/15kA
Communications		Dry contact，RS232/485
Size/Weight		765∗700∗1550mm(W∗D∗H)
		≤150kg (Without Battery)
Cooling mode		Free cooling, Heat exchange

Dual Power Solution-DC Air-Conditioner Battery Cabinet

DC air-conditioner battery cabinet



Base aterial teel)	**2、Zinc coating**	**3、 Surface treatment film**	**4、Prime painting**	**5、 Surface painting**
otection n	**7、Zinc coating**	**8、Surface treatment film**	**9、Prime painting**	**10、Back painting**

- Multiple films which can isolate the sun radi
- Cabinet support battery installation 400/650 bank or 200AH*2bank
- High efficiency cooling system, suitable for h temperature scenario using

Items	Parameter
Cooling unit	DC air-conditioner
Rating supply voltage	DC 48V
Cooling capacity	1000W
Rated input power	300w
Working ambient temperature	-15～ +55 deg
Dimension (L*D*H)	905*1085*2155 (mm)
Weight	250kg
Panel board	Sandwich panel
Shelter structure	Assembled

ontent

- CDC Hybrid Solution Introduction
- Hybrid Trial Site Test Report
- Case Study
- Hybrid Solution Design for Asiacell

erview of Hybrid Power Trial Site

	Original	Hybrid
BTS	BTS3012AE	BTS3012AE
DC average consumption	1600W	1600W
Battery Cabinet	IBBS (TEC)	Mini-shelter (Air-con)
Battery Capacity / Type	2*150Ah / AGM	2*420Ah / DCB
Rectifier	90A	90A

erview of Hybrid Power Trial Site

	Original	Hybrid
BTS	BTS3900A	BTS3900A
DC average consumption	1300W	1300W
Battery Cabinet	IBBS (TEC)	Mini-shelter (Air-con)
Battery Capacity / Type	2*150Ah / AGM	1*600Ah / DCB
Rectifier	90A	90A

Method of Test Operation

Suly--CHWAR BAKH SITE
BTS3900A

Duration	Status	Target
2011-06-10	Installation Finished	Test Temperature , Alarm and Operating
2011-07-07—2011-07-17	Main Power OFF (By Manual)	Test Battery Performance
2011-07-18—Present	Main Power ON	Test Actual Performance & Reliability

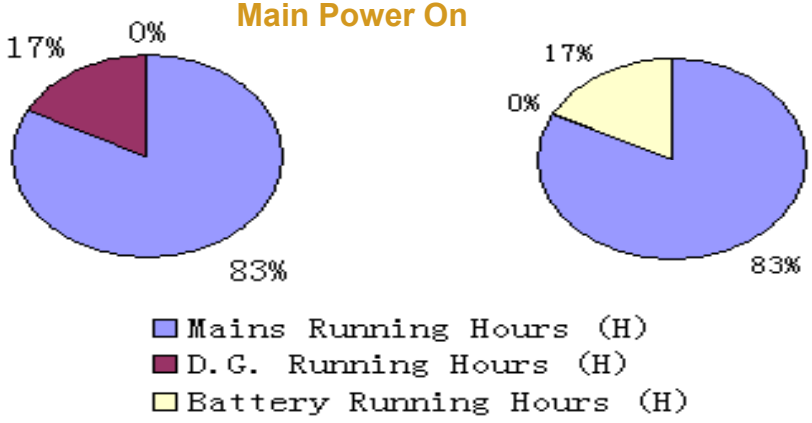
cell-BTS3900A R BAKH SITE	Mains Running Hours	D.G. Running Hours	Battery Running Hours	Battery Total Charge Times	Battery Total Discharge Times	Fuel Cons Overall (L
0707～0717 Main Power OFF	0	118	170.6	19	20	27
0719～0803 Main Power ON	329	0	55	16	15	0

- Average Charge time: 6.16 H
- Average Discharge time: 8.53 H
- Average Cycle time per day : 1.7 (Life Time ≥3 Years)
- Fuel Consumption per Hour : 2.31 L

Hybrid Solution Test Result

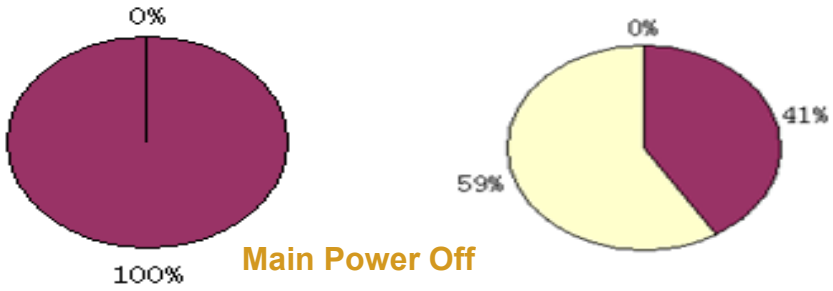
al (Before)	Average
Power Outage Hours	4.08
unning Hours	4.08
y Running Hours	0

Main Power On



Huawei Hybrid (After)
Daily Main Power Outage Hours
Daily D.G Running Hours
Daily Battery Running Hours

al (Before)	Average
Power Outage Hours	24
unning Hours	24
y Running Hours	0



Main Power Off

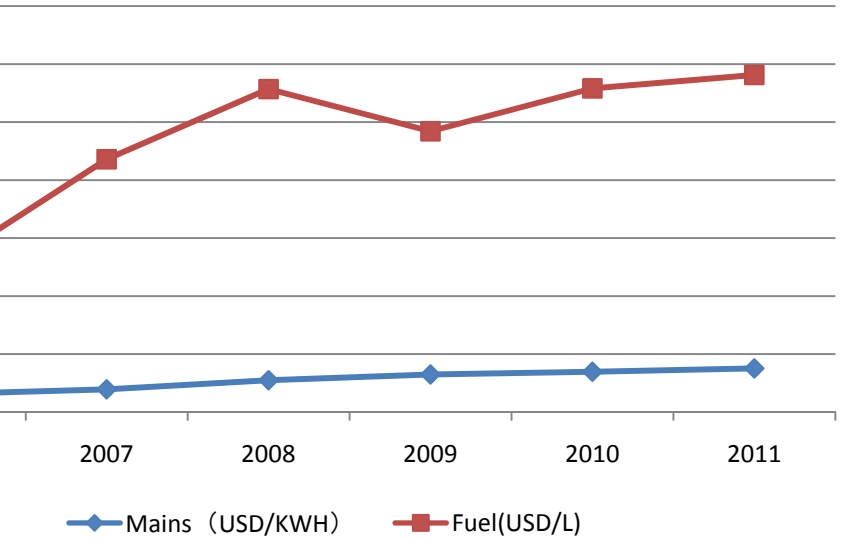
Huawei Hybrid (After)
Daily Main Power Outage Hours
Daily D.G Running Hours
Daily Battery Running Hours

- D.G. Doesn't Need To Work In Kurdistan Area
  "0" CO2 "0" Generator Maintenance "0" Fuel & Refueling

- D.G. Running Time Reduced 59% When No Main Power Available
  59% Running time reduced "1+1" Diesel Generator reduced to "1+0"

llenge :Consumption Cause High OPEX

of Mains and fuel in Pakistan (USD)



Mains Outage in Pakistan (hours / day)

Province	Punjab		Sindh		Baluchistan		N
	town	village	town	village	town	village	town
Mains outage (hours/ day)	5.4	8.4	5.8	8.6	5.9	8.4	5.9

INFORMATION FORM WAPI

Average energy consumption cost per site of entire network (USD/year)

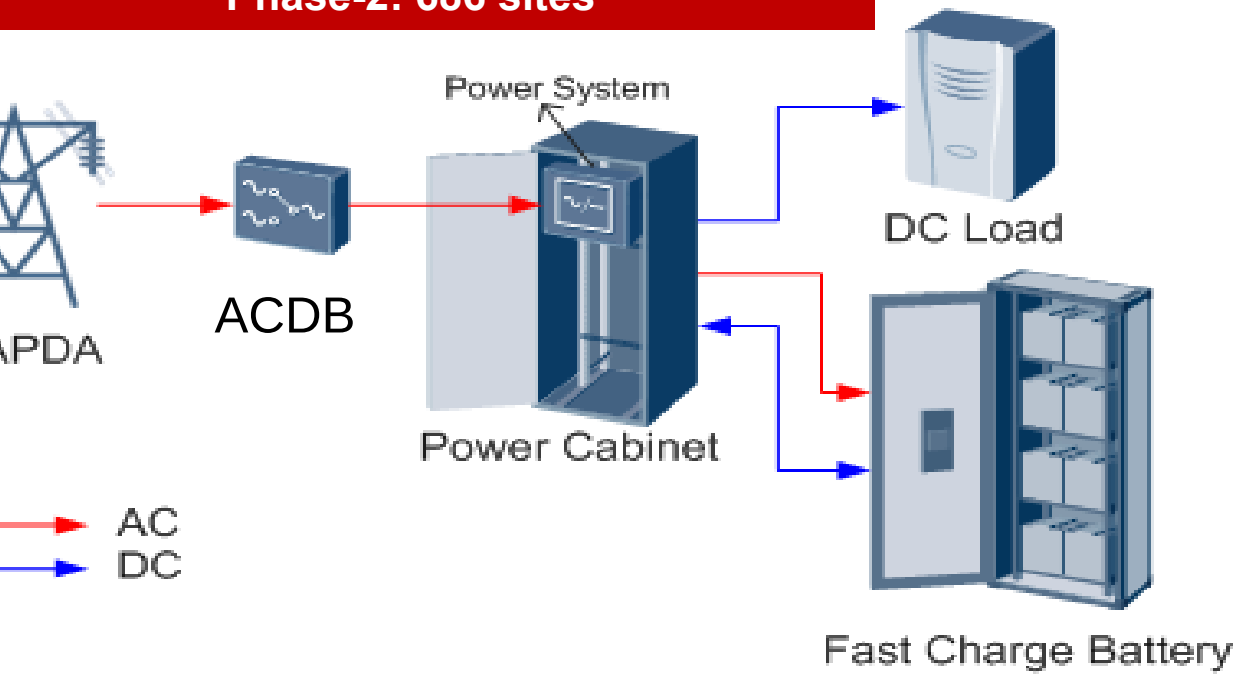
Operator	Mobilink	Telenor	Ufone	Cmpak	Warid
Mains supply	5,833	3,805	3,623	3,707	3,849
Diesel oil	8,750	5,707	5,434	5,561	8,398
Total	14,583	9,512	9,057	9,268	12,247

Information form Operator Budget(2010)； Operator Annual Report (2009) ; Huawei Analysis (20

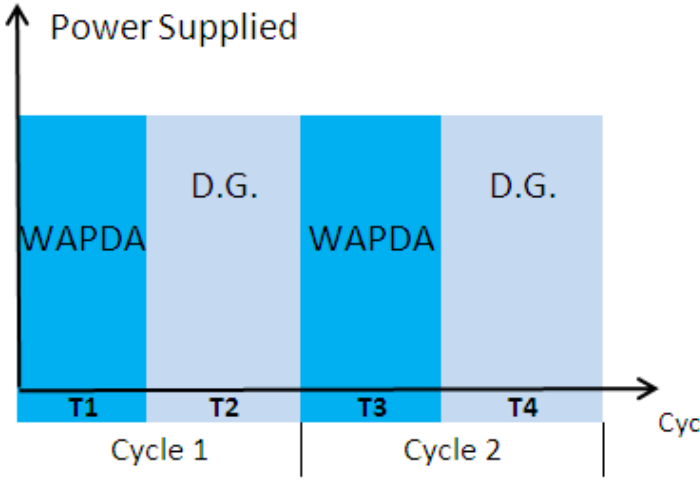
gy consumption accounts for more than 60% in OPEX which is main challenge to operat

CB solution-Urban Area

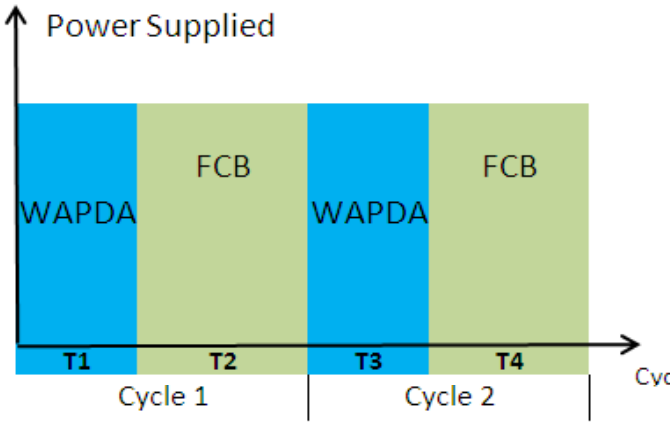
Phase-1: 130 sites
Phase-2: 686 sites



Traditional solution: Mains + D.G.



Propositional solution: Mains + FCB



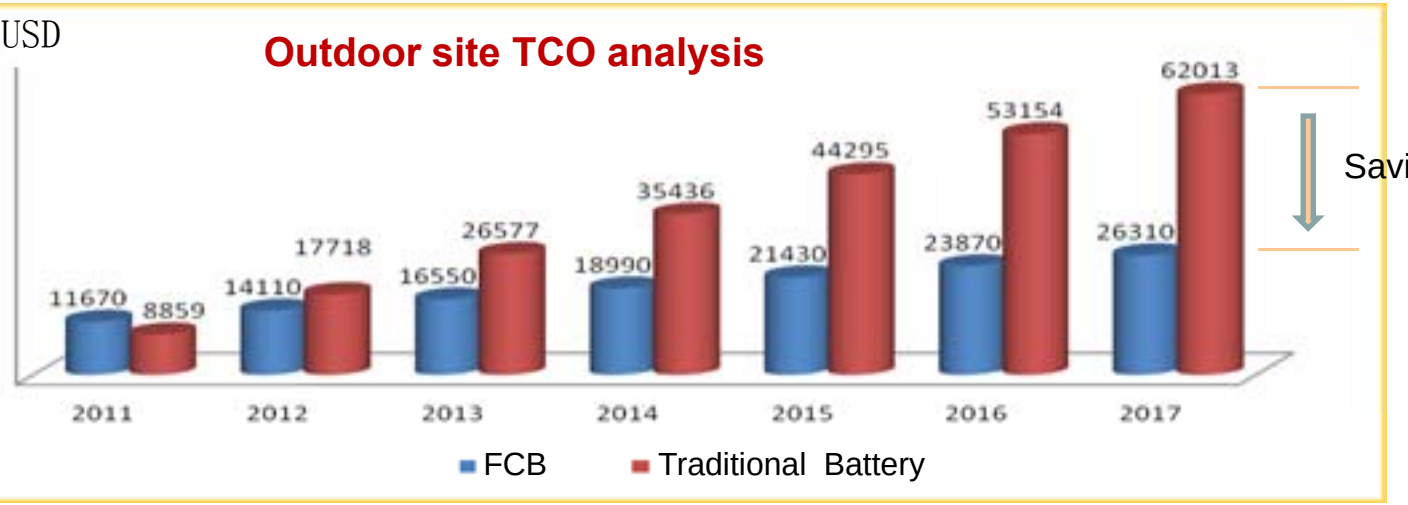
Benefit

move D.G., maximizing the use of Mains through the FCB

arging time shorten to 1/3, ensure battery life and site stability

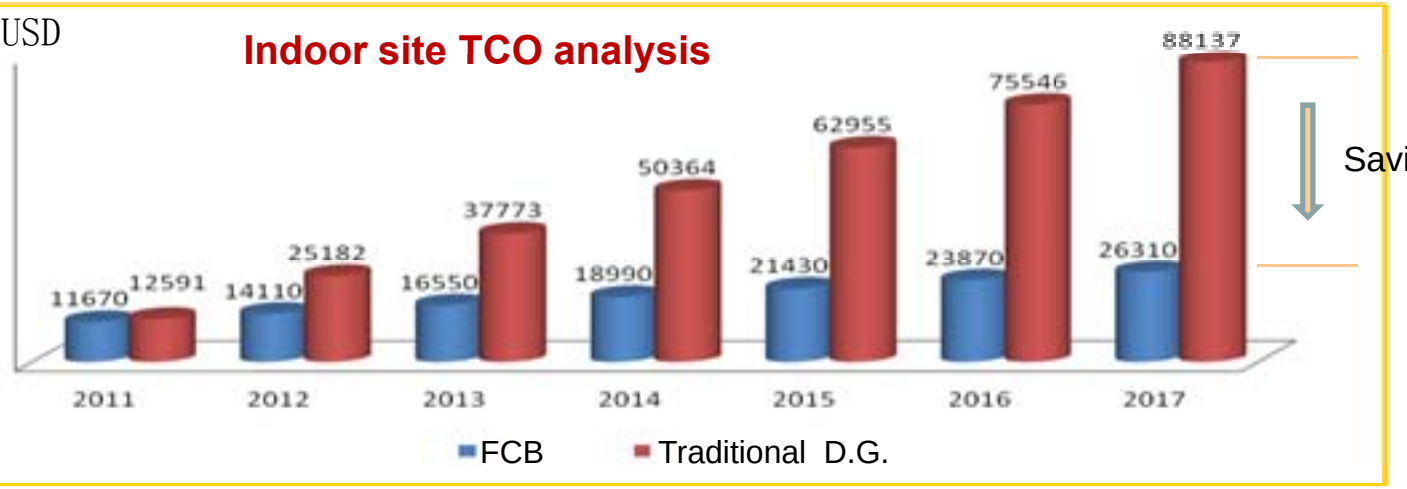
urn on investment time is less than 2 years

CB : Reduce TCO Greatly



Saving

- Rebuild outdoor sites, a payback within 17 months
- Single site annual save 5100USD 2500 outdoor sites rebuild with FCB, The average annual total sa more than 12 million USD.



Saving

- Rebuild indoor site, a payback pe 11 months
- Single site annual save 8832USD outdoor sites rebuild with FCB, Th annual total savings more than 4.5 USD

PEX Analysis

REA	SCALE	INDOOR SITES	OUTDOOR SITES	INDOOR SITES Proportion	status	OPEX Reduce(U
JK	241	25	216	10%	conformed	1,343,200
n area	1150	494	656	43%	planning	7,610,600
le area	2550	892	1658	35%	planning	16,133,30
h area	1620	615	1005	38%	planning	10,425,75
otal	5561	1521	3040	33%	planning	35,512,85

AJK has completed distributed base station rebuild + removed D.G., the D.G.number from 241 down to 17

After the whole network rebuilding , the annual OPEX savings will reach 35.51 million U.S. dollars.

eature and Benefit – Solution Introduce

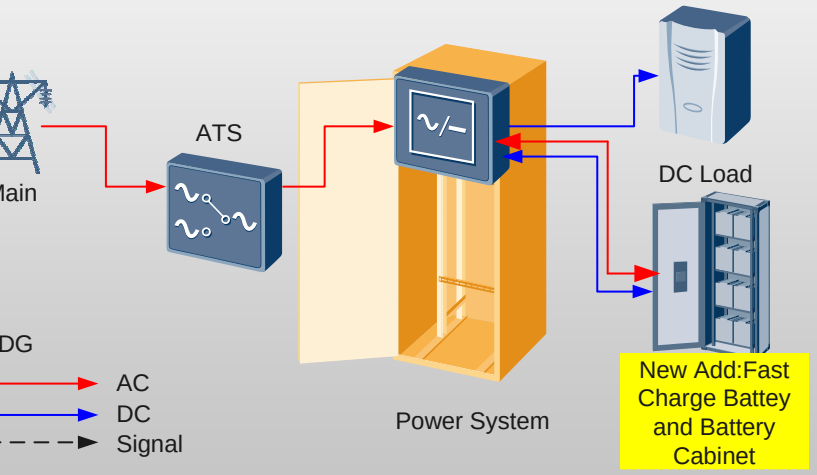
Scenario: Grid outage 6h/Day & 6h/Time

BTS : Huawei BTS3900 1200W

Hybrid equipment:

• FCB 650AH

• DC Air-conditioner Battery Cabinet



Scenario: Grid outage 12h/Day & 6h/Time

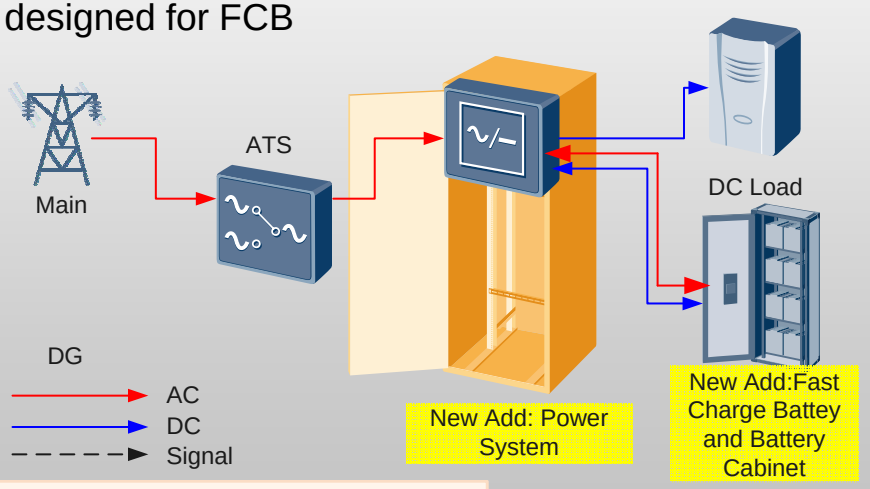
BTS : Huawei BTS3900 1200W

Hybrid equipment:

• FCB 650AH

• DC Air-conditioner Battery Cabinet

•TP48200A Rectifier system which is special designed for FCB



• Remove the D.G, “0”Fuel consumption and D.G maintenance

•The battery can supply 8.32 hours @ 40% DOD and total 20.8 hours @ 100% DOD to guarantee the safety of site power

• High efficiency cooling system to prolong battery life

• Both Support Indoor and Outdoor Modification

awei Optimized Solution Design For North-- FCB

Trial Site Solution -- DCB

D.G.

(Main Power Outage ≤6H)
Deep cycle battery (DCB 650AH)
Battery cabinet (Mini-shelter AC Air-con)
SAU

D.G.

(Main Power Outage 6~12H)
Deep cycle battery (DCB 650AH)
Battery cabinet (Mini-shelter AC Air-con)
SAU
HPMU

Grid

Grid

Optimizes Solution – FCB (Dual Power)

(Main Power Outage ≤6H)
Deep cycle battery (FCB 600AH)
Battery cabinet (Mini-shelter DC Air-con)

(Main Power Outage 6~12H)
Deep cycle battery (FCB 600AH)
Battery cabinet (Mini-shelter DC Air-con)
Power Rectifier (TP48200A)

bling: DC Air-con Cabinet more energy saving than AC Air-con

tery : FCB Battery more suitable and less Capex than DCB for Good Main power situation

: . Under Main Power + FCB Battery Dual Power Solution , D.G can be moved

ntrol : SAU can be saved according to no D.G on site

nitor: NetEco software and HPMU unit are optional items

uawei Hybrid Solution Design For South--DCB

Traditional Solution -- 1+1 D.G

D.G.

D.G.

(Main Power Outage ≥18H)
Battery (AGM 200AH)
Battery cabinet (IBBS TEC)
Power Rectifier (90A)

Hybrid Solution – DCB with only 1+ 0 D.G

Grid

D.G.

(Main Power Outage 6~12H
Deep cycle battery (DCB 600AH)
Battery cabinet (Mini-shelter DC Air
Power Rectifier (TP48200A)
SAU

oling: DC Air-con Cabinet more suitable for Battery lifetime

tery : DCB Battery support more frequent Charge & Discharge and also longer backup time than AGM for Poor Main power situation

: . Under Existing 1+1 D.G Solution , One D.G can be removed

ntrol : SAU can be saved according to no D.G on site

nitor: NetEco software and HPMU unit are optional items

oposed Hybrid Solution

D.G 1+0 (Main Power Outage ≤6H)	Quantity	Price (USD)
eep cycle battery (FCB 650AH)	1	6600
ttery cabinet (Mini-shelter DC Air-n)	1	3600
tal Price		**10200**
.G 1+0 (Main Power Outage 6~12H)	Quantity	Price (USD)
eep cycle battery (FCB 650AH)	1	6600
ttery cabinet (Mini-shelter DC Air-n)	1	3600
wer Rectifier (TP48200A)	1	5000
tal Price		**15200**

D.G 1+1 (No Main Power Available)	Quantity	Price (USD)
eep cycle battery (DCB 600AH)	1	10000
ttery cabinet (Mini-shelter DC Air-n)	1	3600
wer Rectifier (TP48200A)	1	5000
AU (Single Analysis Unit)		2400
tal Price		**21000**