



# Battery Energy Storage in India

*Nov 13<sup>th</sup> , 2019*

# About AES

*Our Mission: Improving lives by accelerating a safer and greener energy future.*

- Fortune 500 Company, headquartered in Arlington, Virginia , USA
- AES is Fortune 200 Global Power Company
- AES provides affordable, sustainable energy to 15 countries through our diverse portfolio of distribution businesses as well as thermal and renewable generation facilities
- Having continued presence in India since 1992

**\$33B**

TOTAL ASSETS  
OWNED & MANAGED

**\$11B**

TOTAL 2018  
REVENUES

**32,000 MW**

GENERATION CAPACITY

**4,500 MW**

UNDER CONSTRUCTION



DELIVERING SAFE,  
RELIABLE & SUSTAINABLE  
**ENERGY TO  
MILLIONS OF  
PEOPLE**



**6**

**UTILITY  
COMPANIES**



**9,000**

**GLOBAL  
WORKFORCE**

# Why Battery Storage?

## TRANSFORMING NETWORK

Transmission & Distribution  
Enhancement

## TRANSFORMING GENERATION

Frequency Regulation

Capacity Peak Power

Generation Enhancement

## TRANSFORMING ENERGY USE

Black Start

Energy Arbitrage and DSM

Renewable (Solar and/or Wind with BESS) Integration

Micro-grids & Islands

8 primary energy storage applications available full spectrum of use cases



# AES' Battery Energy Storage Fleet

**570 MW**

In operation, construction  
or late stage development





# Experience in India



# Delhi BESS

*10 MW/10 MWh*



FLUENCE  
A TATA POWER AND AES COMPANY



# Delhi BESS Project

- India's first grid scale battery based energy storage project and largest in South Asia
- AES, Mitsubishi Corporation (MC) and Tata Power Delhi Distribution Limited (TDPPL) have deployed a 10 MW / 10 MWh Battery Energy Storage System at Rohini substation
- Technology supplied by Fluence, a joint venture of AES and Siemens
- Built in an area of 603 m<sup>2</sup> (6500 sq ft)



# Project Timeline

Project NTP

Completion of Building

Installation of Batteries

Commissioning of the Project

APR-18

MAY-18

JUN-18

JUL-18

AUG-18

SEP-18

OCT-18

NOV-18

DEC-18

JAN--19

FEB-19

MAR-19

Final Completion of the Project



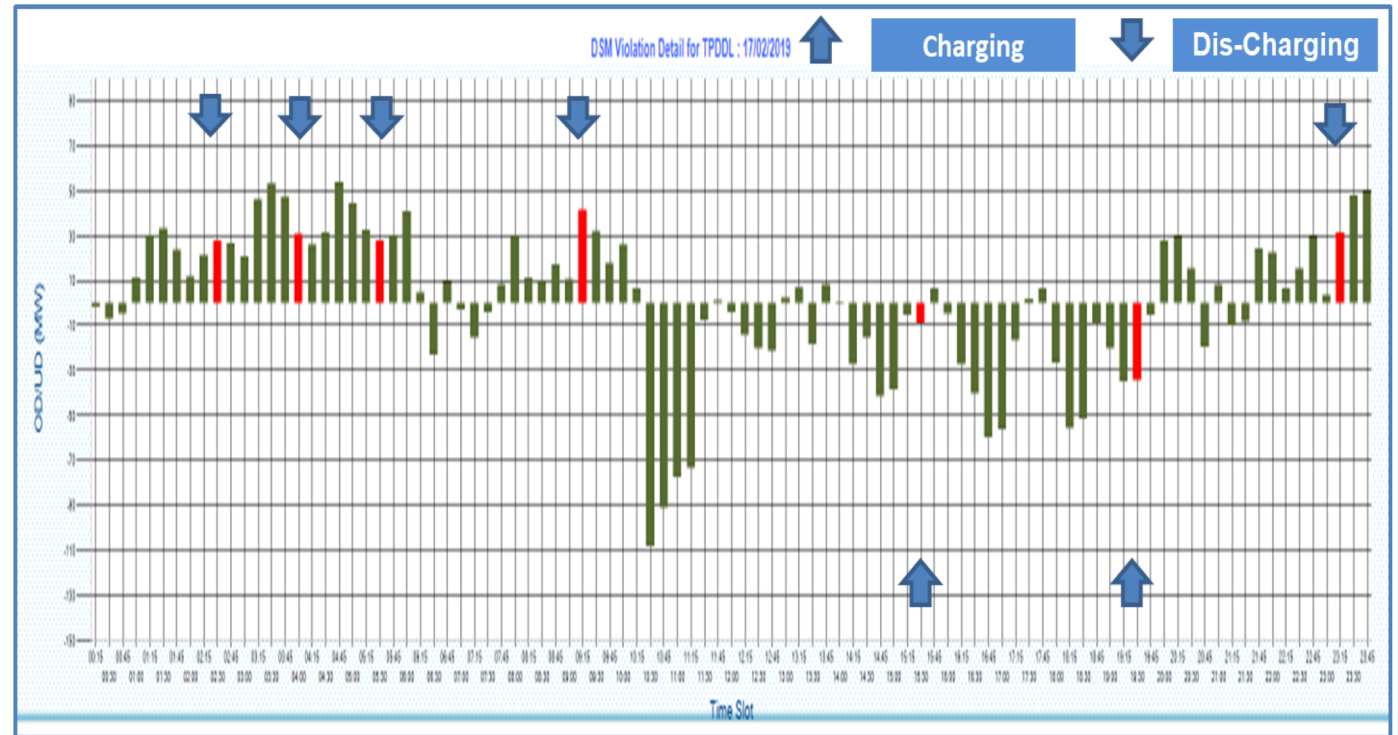
# Key Challenges faced by Tata Power - DDL

- Managing Sustained Deviation penalty
- Disposal of surplus power during off-peak hours
- Power Quality Management
- Peak Load Management and Capex deferral
- Frequency Management

# Key Challenges faced by Tata Power - DDL

## *Managing sustained deviation penalty*

- DSM sustained violation of TP-DDL for 17th Feb 2019 were seven which are highlighted in Red Bar which is 140% additional charges on DSM net charges for the day.
- Battery storage can give dynamic command of charge and discharge during sustained violation.

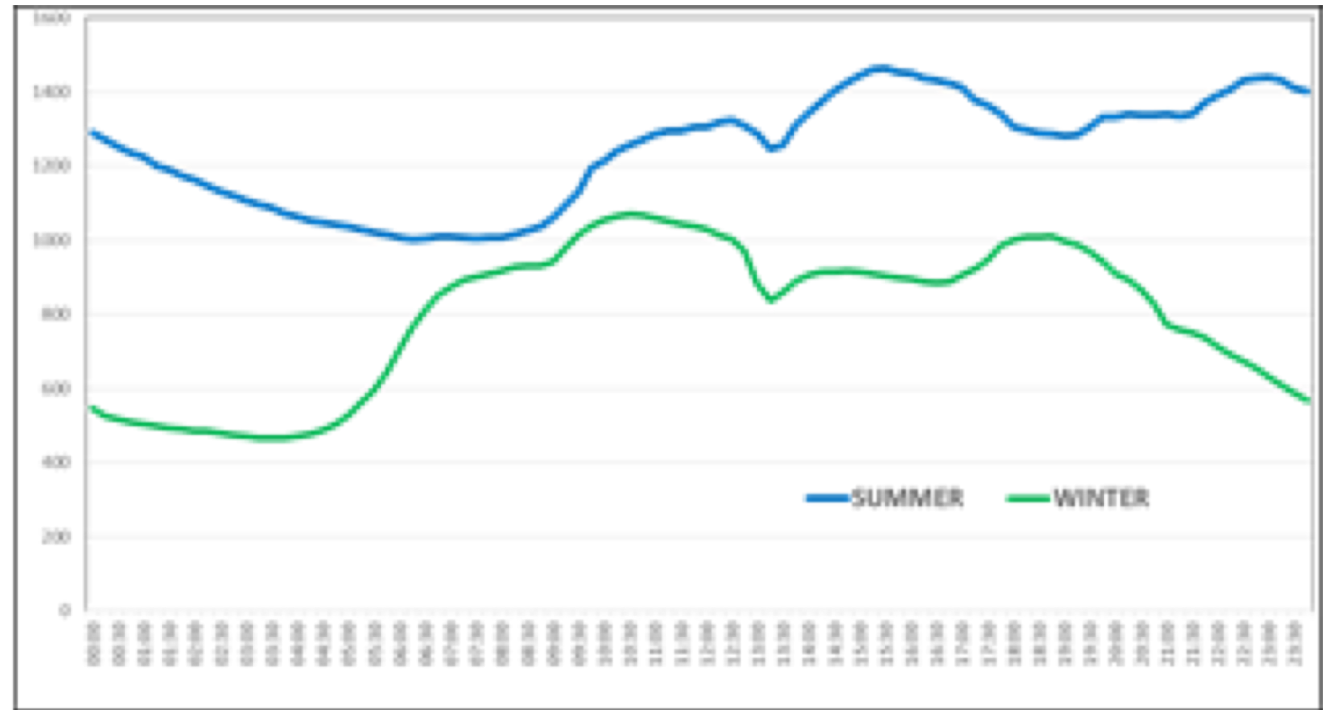




# Key Challenges faced by Tata Power - DDL

## *Disposal of surplus power during off-peak hours*

- Long term power purchase agreement are on RTC basis and this results in huge surplus during off-peak hours.
- The disposal of surplus power during off-peak hours is major bottleneck issue for DISCOMs. Power exchange rates are also low during off-peak hours so selling the power through exchange won't give benefit.

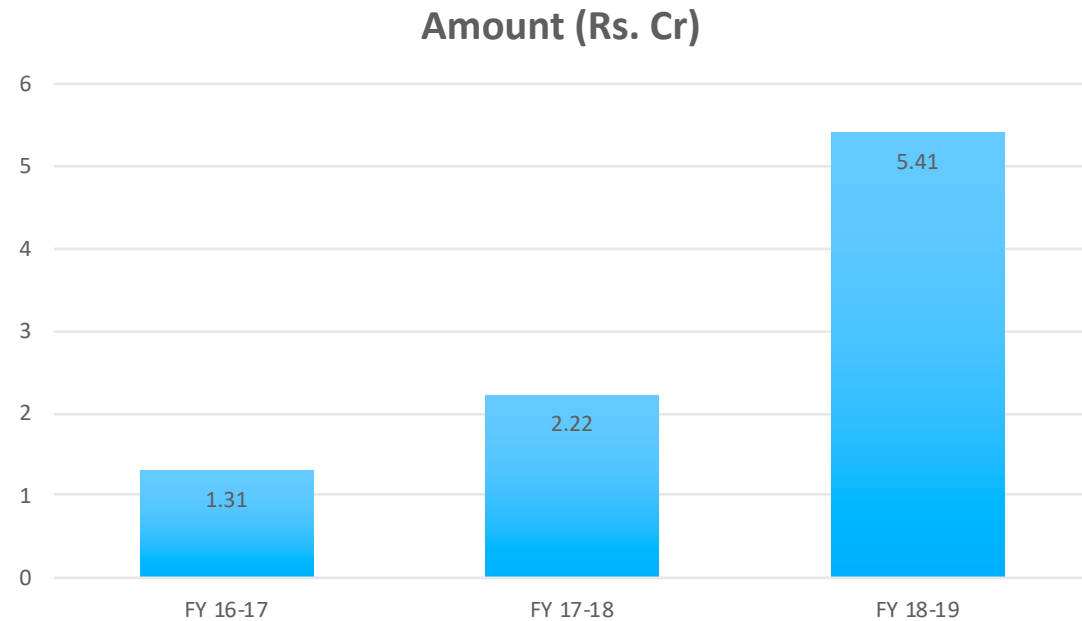


**1500MW Gap in Demand between Summer and Winter**

# Key Challenges faced by Tata Power - DDL

## *Power Quality Management*

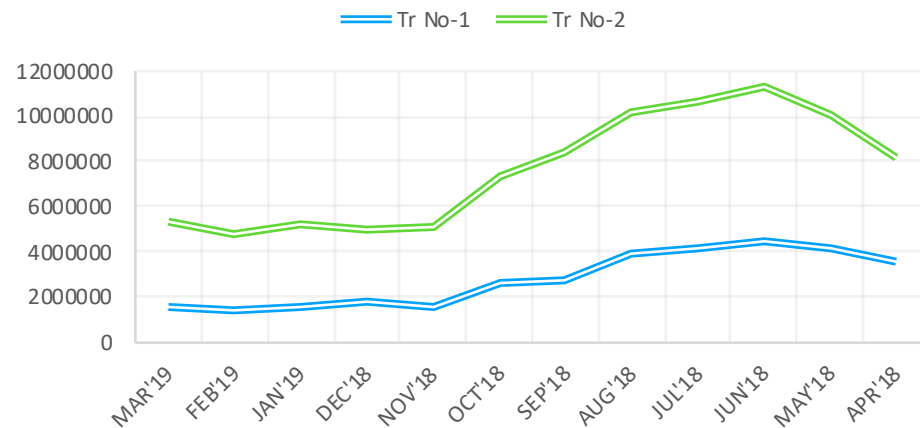
- Every year reactive power injection goes on increasing in TPDDL system due to which penalty also increase
- Battery storage can give dynamic command to absorb or inject reactive power as per need



# Key Challenges faced by Tata Power - DDL

## *Peak Load Management and Capex Deferral*

TRANSFORMER LOAD CURVE



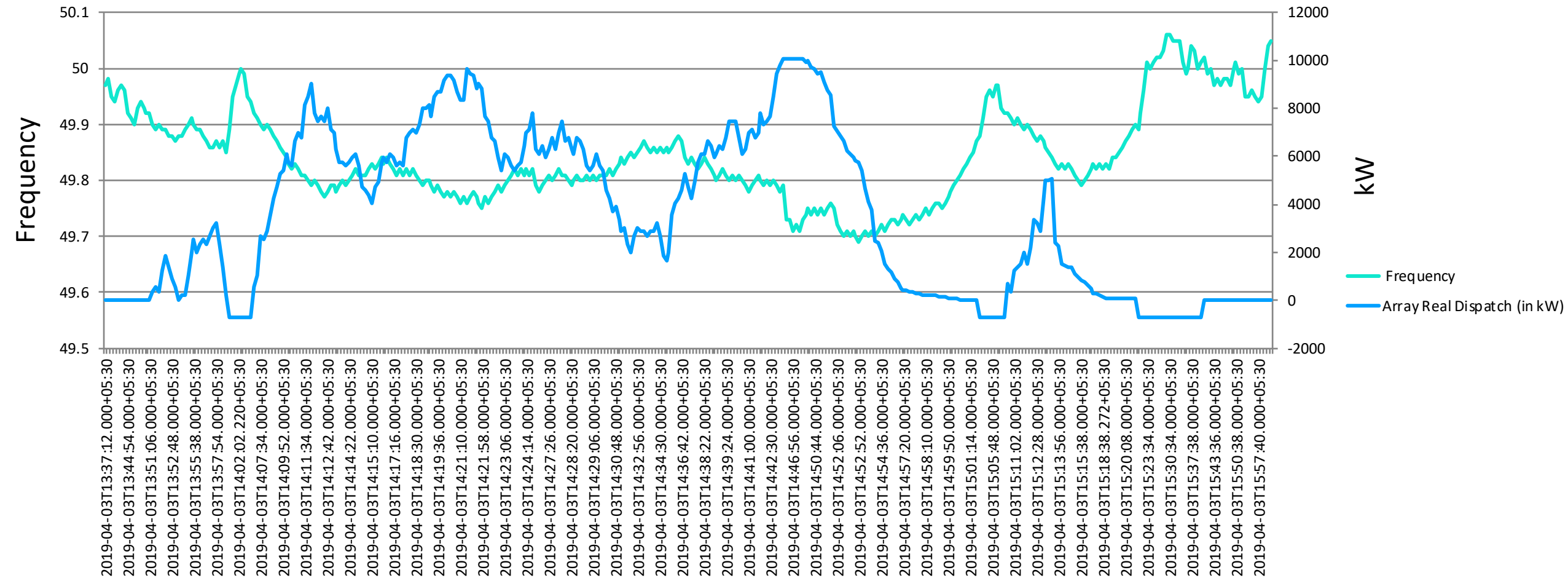
RG-24 Grid Substation

Date	Time	11 KV I/C NO-1	11 KV I/C NO-2	Total
		20 MVA(1040A)	20 MVA(1040A)	
		Avg Current	Avg Current	
10.07.2018	04:00:00	571.474	730.934	1302.408
10.07.2018	04:15:00	568.823	731.729	1300.552
10.07.2018	04:30:00	563.244	741.368	1304.612

- Managing the peak demand is a key challenges for any power distribution utility BESS can support short duration overload management at power transformer level and reduce transmission line congestion



# April 03, 2019 Northern Grid





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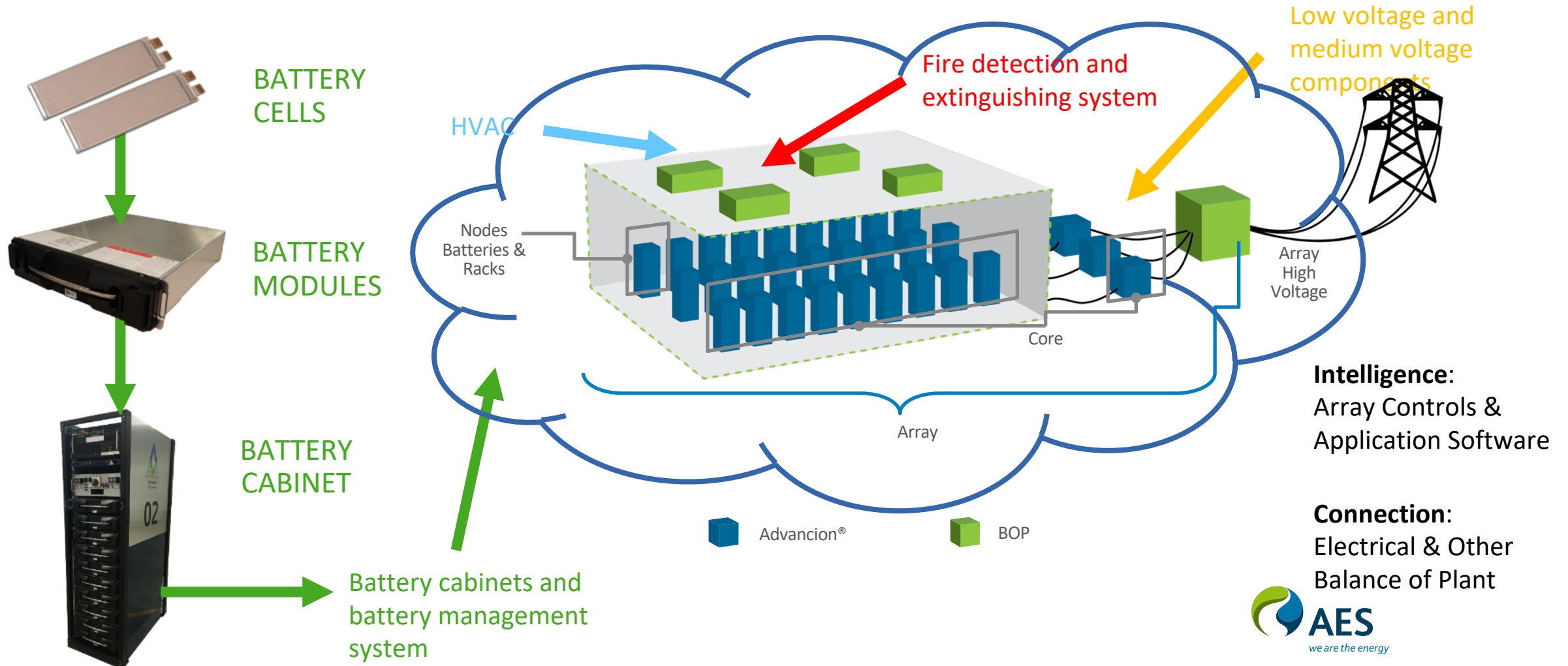
# Appendix





# What is Battery Energy Storage?

*Modular, scalable arrays of proven technologies integrated at utility and industrial scale*







# Screen shot of HMI (human machine interface)

Advancion® HMI - Tata Delhi

Tue Jun 04 2019 10:37:45 Sign Out

MDU Primary Frequency Control (POSOCO) Status

Array	-705.8 kW	-4.7 kvar	-10020.6 kW	10020.6 kW	47.9 %	ARC (Collective)	Status
Core 01	-175.54 kW	-1.68 kvar	-2495.0 kW	2495.0 kW	47.4 %	ARC (Collective)	Status
Core 02	-174.23 kW	-8.69 kvar	-2454.0 kW	2454.0 kW	34.4 %	ARC (Collective)	Status
Core 03	-175.52 kW	0.81 kvar	-2535.8 kW	2535.8 kW	54.8 %	ARC (Collective)	Status
Core 04	-177.08 kW	2.84 kvar	-2535.8 kW	2535.8 kW	54.8 %	ARC (Collective)	Status

Events Log

Advancion® HMI - Tata Delhi

Tue Jun 04 2019 10:38:33 Sign Out

MDU Primary Frequency Control (POSOCO) Status

Application:

Primary Frequency Control (POSOCO)

Scheduler:

Off

Nominal System Frequency (Hz) :

50.0

Service Charge Limit (kW) :

-10148.0

Service Discharge Limit (kW) :

10148.0

Real Ramp Rate (kW/min) :

0.0

Show Details

Advancion® HMI - Tata Delhi

Tue Jun 04 2019 10:39:37 Sign Out

MDU Primary Frequency Control (POSOCO) Status

Array	-702.8 kW	19.3 kvar	-10020.6 kW	10020.6 kW	48.1 %	ARC (Collective)	Status
Core 01	-172.81 kW	5.17 kvar	-2495.0 kW	2495.0 kW	47.8 %	ARC (Collective)	Status
Core 02	-178.8 kW	-3.9 kvar	-2454.0 kW	2454.0 kW	34.8 %	ARC (Collective)	Status
Core 03	-172.45 kW	8.09 kvar	-2535.8 kW	2535.8 kW	55.0 %	ARC (Collective)	Status
Core 04	-174.59 kW	9.13 kvar	-2535.8 kW	2535.8 kW	55.0 %	ARC (Collective)	Status

Service Mode:

ARC Manual Idle Disconnect

Current Status: ARC (Collective)

Show Details

Overall:

Breaker Status

Overall Status

Capacity Diminished

Contact Fluorescence Service Team

Heartbeat Status

Heartbeat Status

Trim Loop Status

Warning Present

E-Stop Status

Hi SOC Status

Ground Fault Detected Status

Lo SOC Status

Core 04 Nodes

01

02

03

04

05

06

07

08

09

10

11

12

13

14

15

16

17

18

19

20

21

22

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Events Log