IGBC and LBNL Workshop, 13 Feb 2019, Bangalore

CleanMax SOLAR

CAPEX
RISK
HASSLE FREE

SOURCING OF RENEWABLE POWER & STORAGE SOLUTIONS

PRESENTATION BY
CLEAN MAX ENVIRO ENERGY SOLUTIONS PVT. LTD
www.cleanmaxsolar.com

Factors involved in Data Center energy management

1 **RELIABILITY**
Downtime of the system, Availability, Safety, etc.

2 **EFFICIENCY**
Power density, Space utilization, Power Usage Effectiveness

3 **ECONOMICS**
Capital cost/operational costs.

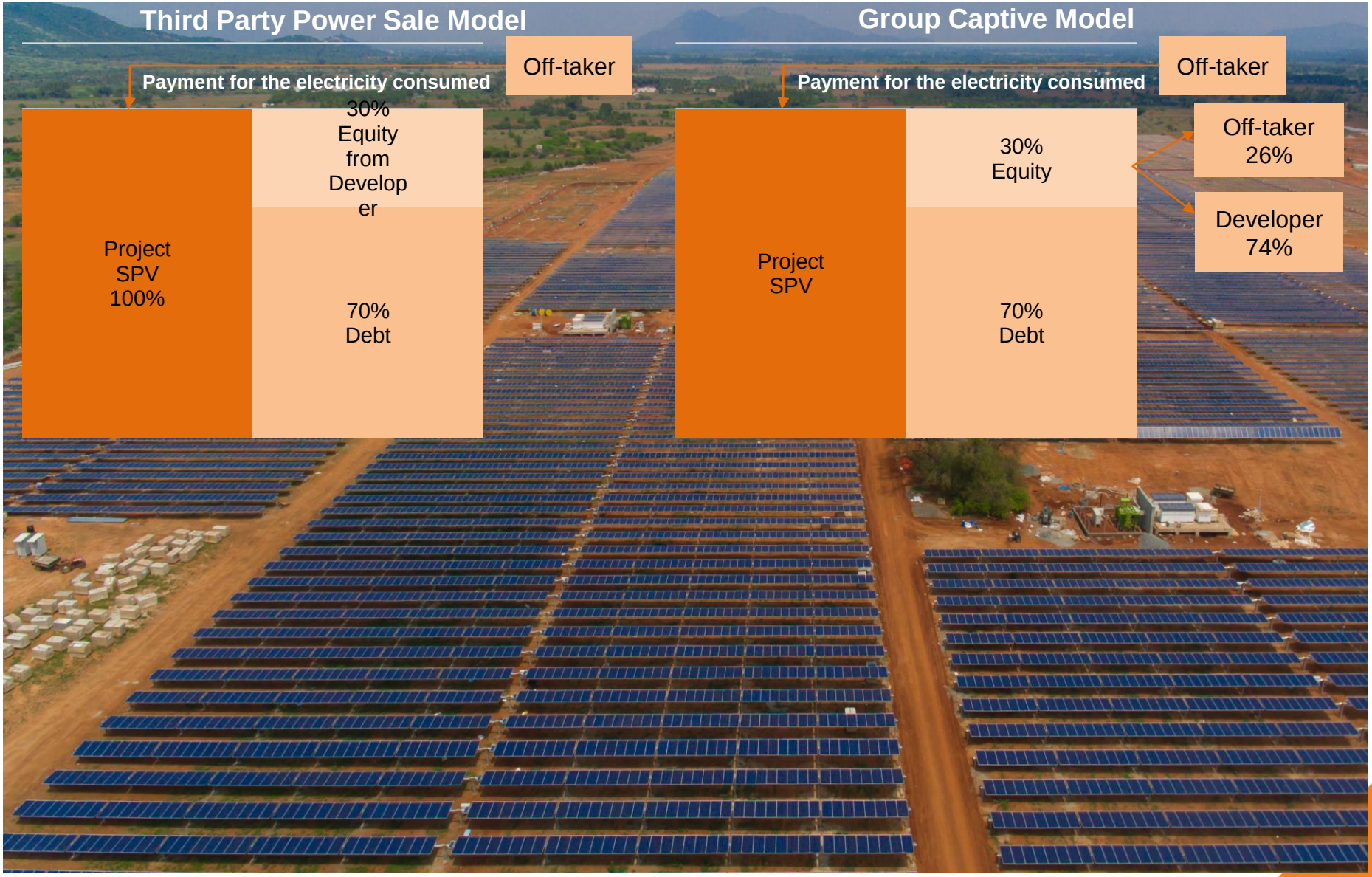
4 **ENVIRONMENTAL IMPACT**
Carbon footprint of the DC and ways of reduction

5 **MANAGEMENT BANDWIDTH**
Capital cost as well as the operational costs.

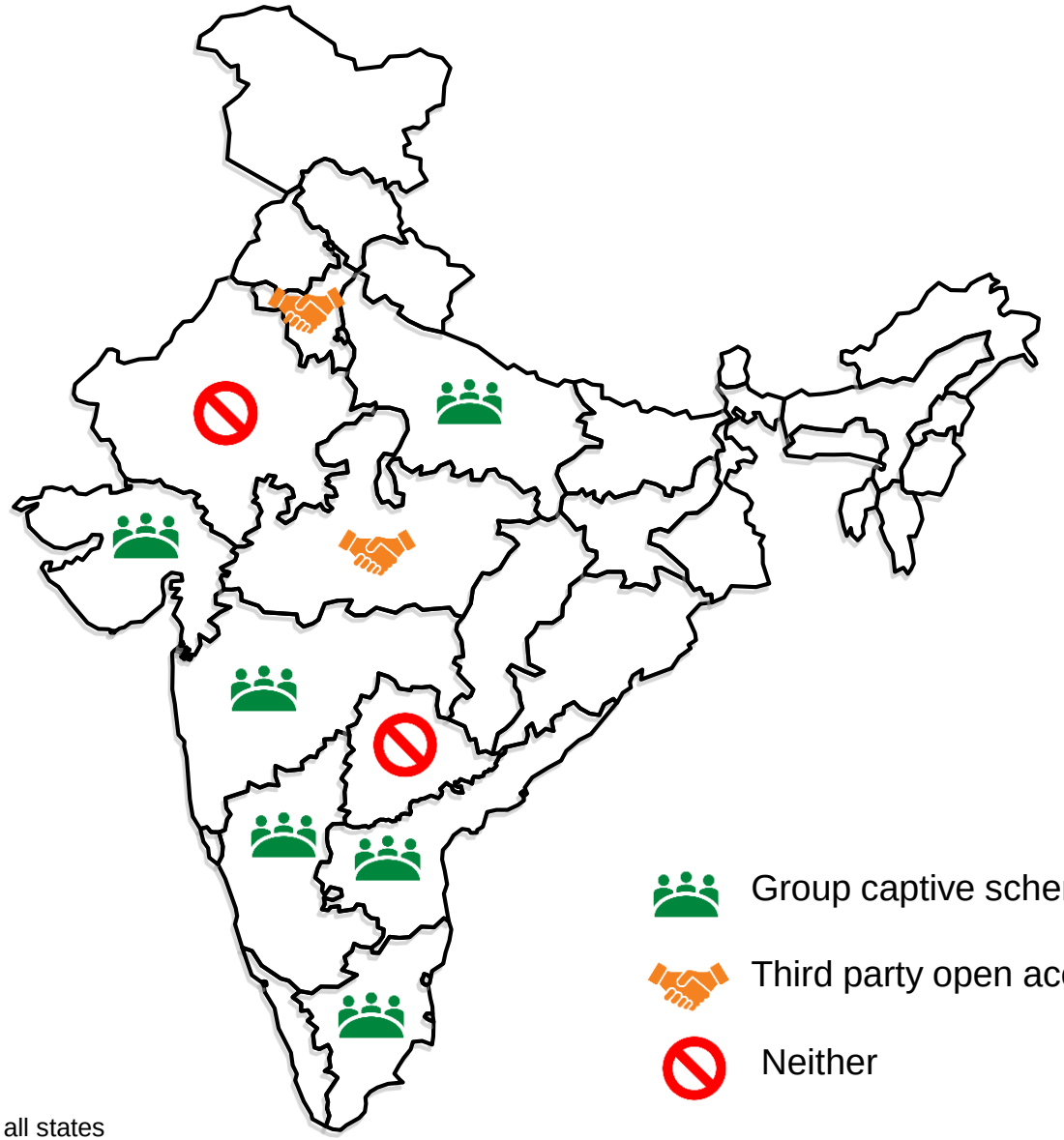
1 SOURCING OF POWER FROM OPEN ACCESS RENEWABLE PROJECTS

2 ONSITE ENERGY STORAGE SOLUTIONS – LI- ION BATTERIES

1 Sourcing of Power From Open Access Renewable Projects



States enabling third party open access and group captive schemes



Rooftop solar is viable in all states

New Trend: States have started to impose banking and drawal restrictions on open access supply

Haryana

- Restrictions on banking during peak months and TOD peaks

Gujarat

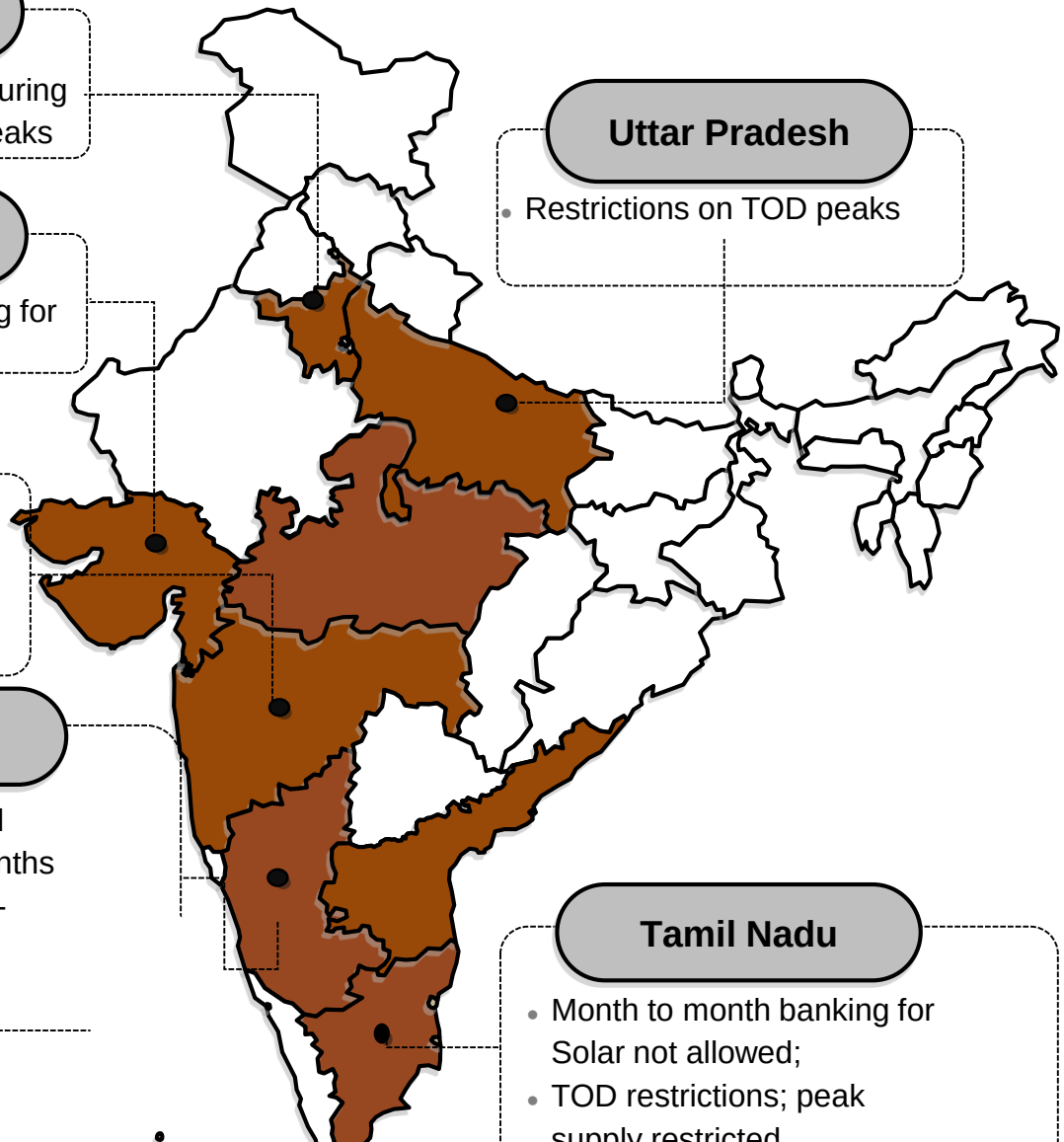
- Month to month banking for Solar not allowed;

Maharashtra

- Restrictions on banking during peak months and TOD peaks

Karnataka

- Changed banking period from 12 months to 6 months
- Power generated in non-peak periods cannot be supplied in peak periods



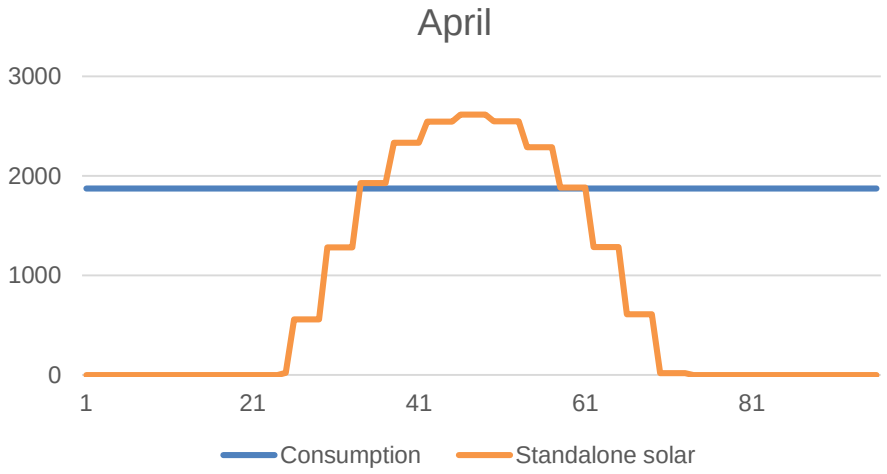
Uttar Pradesh

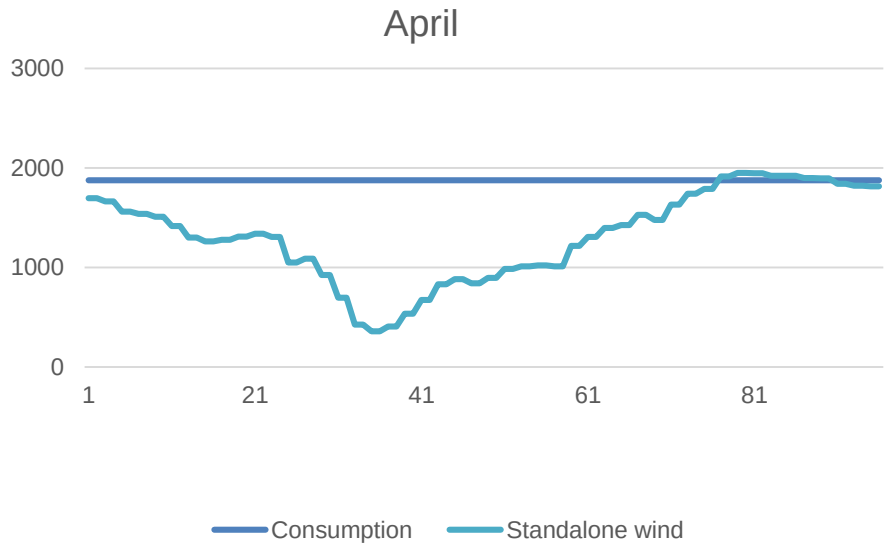
- Restrictions on TOD peaks

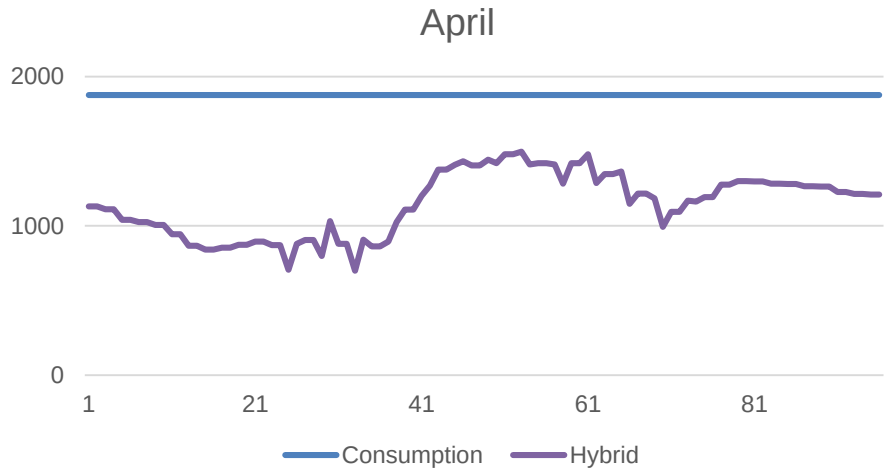
Tamil Nadu

- Month to month banking for Solar not allowed;
- TOD restrictions; peak supply restricted

Effect on open access supplies due to such restrictions: lower mix of renewables







CONCLUSION:

- Standalone wind and solar systems might not be the right fit for consumers with round the clock load.
- Generation from wind solar hybrid farm almost mirrors the round the clock requirement of manufacturing facilities (representative figures based on data of one such facility)

Wind solar hybrid (WSH) is being encouraged by several state governments

MAY - 2018
MINISTRY OF NEW AND RENEWABLE ENERGY

NATIONAL WIND SOLAR HYBRID POLICY

JUNE - 2018
GUJARAT GOVERNMENT

WIND SOLAR HYBRID POWER POLICY
50% waiver on W&T charges, CSS, ED for 10 years for both third party OA & Captive plants

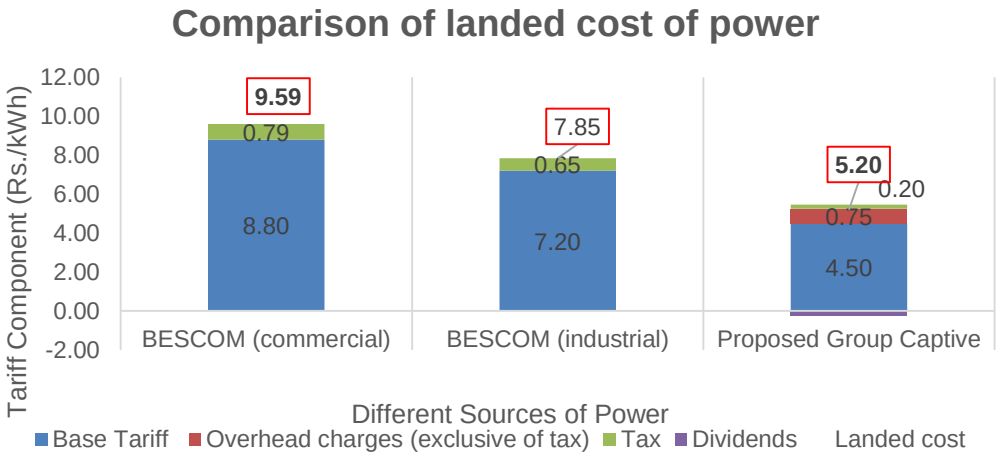
JAN - 2019
ANDHRA PRADESH GOVERNMENT

WIND SOLAR HYBRID POWER POLICY
50% waiver on W&T charges, CSS, ED for 10 years for both third party OA & Captive plants

KARNATAKA GOVERNMENT

Draft will be released in 2019. Currently, discussion with industry experts including CleanMax is ongoing

Wind solar hybrid (WSH) can increase savings by up to 45% and CO2 offset of 0.9 kg per unit per year



Based on the comparison between Hybrid and BESCOM tariff, consumer will accrue a per unit savings of approximately Rs. 2.65 (industrial) and Rs. 4.39 (commercial) respectively

Case Study:

DC capacity: 100 racks
Power density: 7 kW/rack
PUE: 2
Constant Power load: 1.4 MW
Yearly power consumption: ~12.5 million
Assuming Hybrid penetration: 80%, i.e. 10 million
Per unit savings= Rs. 2.65 (industrial) & Rs. 4.39 (commercial)
Annual savings= Rs. 26.5 million (industrial) & Rs. 43.9 (commercial)
Carbon footprint reduction: 9500 tonnes of CO2 offset in a year

WSH is better than standalone systems due to flatter generation pattern, lower tariffs and lower risk exposure to regulatory changes

1

Hybrid plant has a consistent generation pattern as compared to standalone systems

- Solar radiation is higher during the day and typically wind blows higher during the night/early morning
- In India, solar and wind also complement each other seasonally- wind is higher in monsoons, when solar radiation is lower
- Hence, reduces risk of restrictions imposed by regulatory regime on supply/demand matching. Ex. Currently in Karnataka, power generated in peak time of day bands can only be supplied during peak slots
- Typically WSH can replace 78-80% of energy requirements vs. 50-60% by standalone solar/wind
- some representative graphs of generation pattern

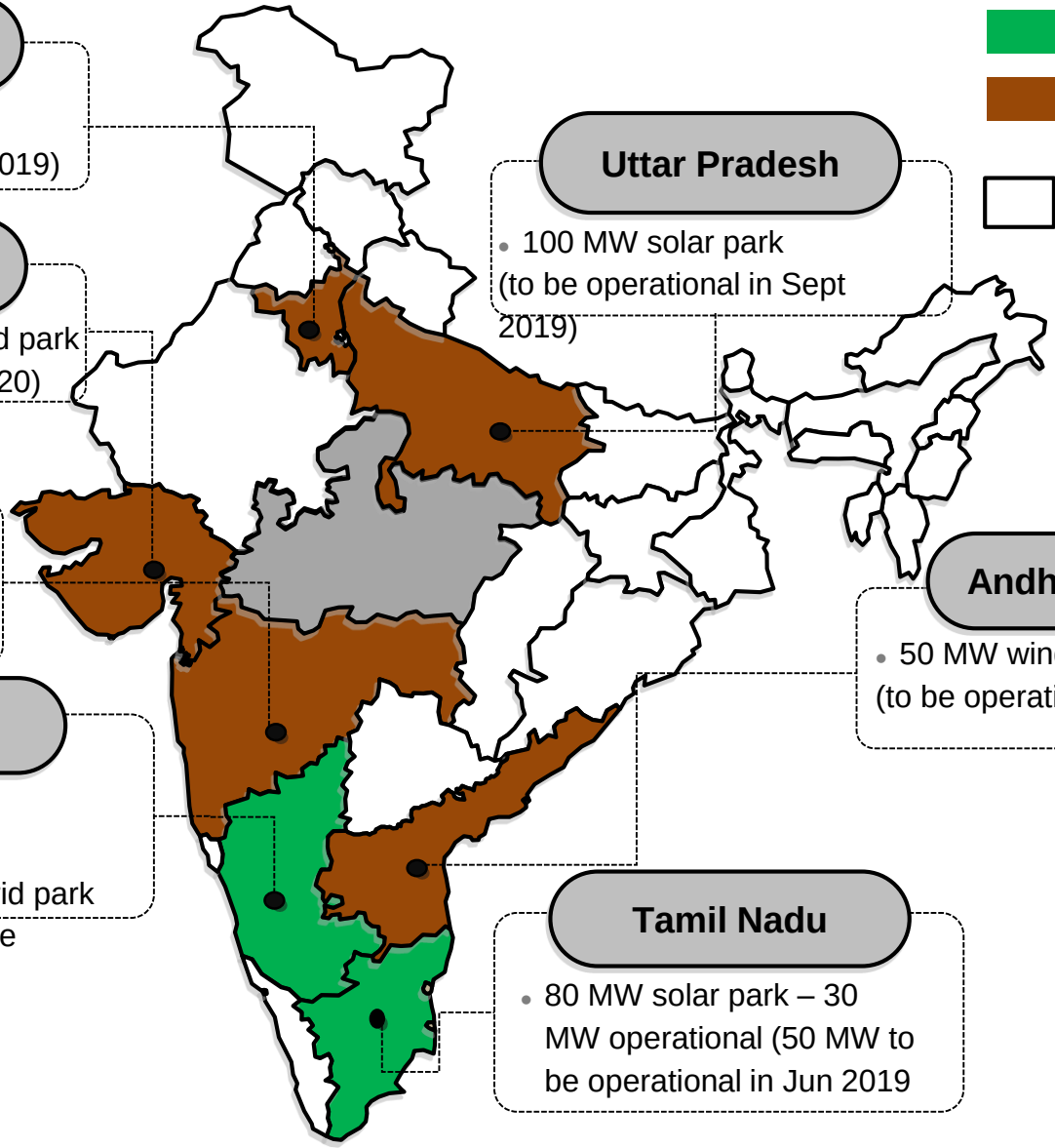
2

Lower landed cost in WSH due to more efficient transmission system and higher PLF

- WSH plants use common transmission infrastructure for wind and solar and hence costs are lower resulting in a lower farm gate tariff
- Since we use a lower transmission capacity, transmission charges and losses are lower; lowering landed delivery cost. ~ 15 paise. difference
- Higher PLF of WSH plants translate to lower per unit cost as compared to other standalone wind/solar systems
- Some state governments are also coming out with policies which will further encourage hybrid plants and exemption on charges may be applicable

- Greater Savings
- Greater renewable penetration
- Lower risk exposure

CleanMax has projects in all major states where wheeling of renewable energy is viable



Haryana

- 200 MW solar park (to be operational in Sept 2019)

Gujarat

- 100 MW Wind-solar hybrid park (to be operational in Jan 2020)

Maharashtra

- 100 MW solar park (to be operational in Jan 2020)

Karnataka

- 310 MW solar park (operational)
- 121 MW wind-solar hybrid park (to be operational in June 2019)

Uttar Pradesh

- 100 MW solar park (to be operational in Sept 2019)

Andhra Pradesh

- 50 MW wind-solar hybrid park (to be operational in Jan 2020)

Tamil Nadu

- 80 MW solar park – 30 MW operational (50 MW to be operational in Jun 2019

Existing Solar Farms

Upcoming Solar Farms

States where renewable energy wheeling is not viable

2 Lithium Ion Energy Storage Solution (ESS) – Preferred mode of backup for Data Centres

- India is witnessing a **transition to Lithium ion Batteries (LiB)**. **Over 5 MWh of capacity** is operational since 2017 for the Data Centre operators in the country, with repeat orders.

- Data Centres are finding multiple values drivers for the transitioning to LiB - **Space (freed), Safety, Lifetime costs, and in being environment friendly**.

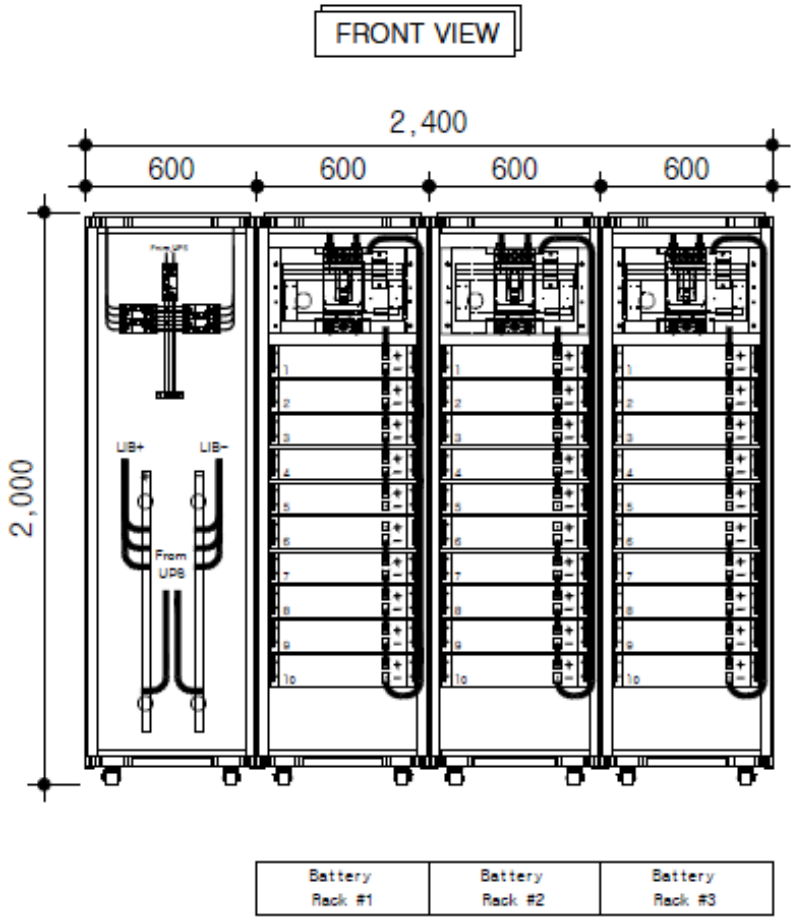
- **CleanMax** can help Data Centre operators avoid investment costs and technology risks by **designing, investing, installing and maintaining Lithium Ion batteries** on behalf of data centre operators

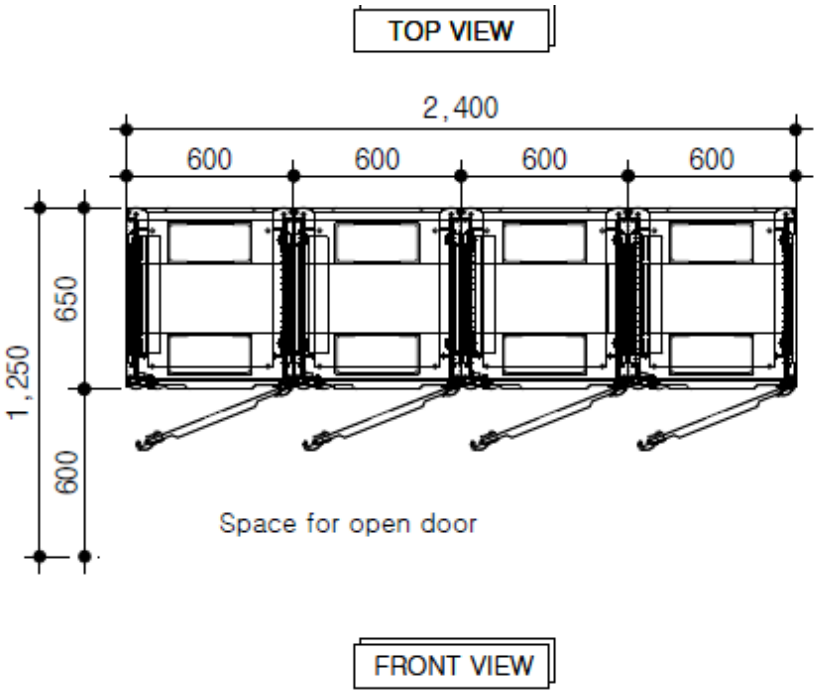
- Data Centres shall be charged based on availability/uptime of the **LiB**

Li Ion technology provides superior performance, occupies lesser space, is safer, and offers lower lifetime costs..

Parameter	Lead Acid Technologies	Li-Ion Technology
Warranted Life	3 – 5 Years	Earlier of 10 Years or 3,000 – 3,500 (100% Depth of Discharge)
Warranted Cycles	200 – 400 (100% Depth of Discharge)	
Space Requirement (Energy Density)	High space requirement due to low energy density (30 – 50 Wh / kG)	Low space requirement due to high energy density (150 – 180 Wh / kG)
Charging Speed	Normal	3 - 4x faster than conventional Lead Acid Technologies
Operating Efficiency	Low (45-65%) Lower efficiency at higher 'C' rate	High (90-95%)
Self Discharge	High (35% /Year)	Low (<6%/year)
Investment	Low (US$ 100 - 120 / kWh)	High (US$ 500 – 550 / kWh)
Emissions	Ventilation required	NA
Safety	Narrow operating temperature	In-built BMS, Wider operating temperature

Estimated 45-60% reduction in space required for deployment of Lithium ion batteries vs. Lead Acid equivalent..





Sample battery solution layout for a 250 kW x 15 m energy storage solution using Lithium ion based technologies

Higher EHS compliance (in LiB) due to absence of prohibited substances per RoHS standards..

No Prohibited Substances of RoHS certificate

This is to certify that [redacted] does not add mercury (Hg), lead (Pb), cadmium (Cd), hexavalent chromium compounds,polybrominated biphenyls(PBBs) and polybrominated diphenyl ethers(PBDEs) As raw materials in the manufacturing processes of below model, RoHS2002/95/EC &2011/65/EU Directive.

Sample RoHS certificate from a LiB manufacturer

Recycling scale will follow deployment pattern

Data centres can optimize their operations and reduce cost by switching to open access & Li-ion batteries without any capex

- Various restrictions have been imposed by state governments on drawal and banking of open access power, with indications of even stricter impositions. Such restrictions will reduce the % of renewables in the energy mix.

- To counter, facilities with round the clock consumption should switch to wind-solar hybrid systems, which are more reliable (in terms of regulatory benefits, round the clock generation), efficient (higher PLF, optimized transmission), cost efficient (~45% savings with no capex) and sustainable.

- The transition to Lithium Ion Batteries (LiB) is very real and customers find immense value in the space saved by LiB. CleanMax can support data center operators with zero investment solutions that mitigate technology and operation risks associated with LiB

THANK YOU!

For questions and queries, please contact:

Ramakrishnan Subramanian
Email: Ramakrishnan.s@cleanmaxsolar.com
Mobile: +91 91760 08261

Pranjal Paul
Email: Pranjal.paul@cleanmaxsolar.com
Mobile: +91 9962717594

Generation from WSH mirrors the round the clock requirement of manufacturing facilities (representative figures based on data of one such facility)