STERLING & WILSON SELECTING SUITABLE STORAGE PV + BESS

Vikas Bansal Global Head, Business Development Solar EPC and Energy Storage



RANKED WORLD'S #1 SOLAR EPC COMPANY

Outside China by IHS Markit

S&W Group Overview







Commissioned > 9.4 GW Power Projects

3.05 GWp Solar PV*, 1.8 GW Co-Generation & 4.6 GW Diesel Generator



Strong Presence

in ME, Africa, South Asia, SE Asia, Europe, USA, Australia and Latin America





Largest Corporate

House providing Electrical Solutions in India



Leading

MEP contracting Company

In India

* - As on 31st March, 2018

** - As per EPC and O&M provider tracker - Q1 2018 by IHS Markit

SOLAR AND ESS: USE CASES



24x7 Power Reliable	Economical	Fast Response	Intermittent Support	5000 plus cycles	25 year Plant Life
---------------------	------------	---------------	----------------------	------------------	--------------------



Renewable Integration

- Frequency Regulation
- Voltage Regulation
- Peak Shifting
- Ramp Rate Management
- Renewable Firming
- Power Quality



Dispatch on Demand

- Improving Generation efficiency
- Defined Power output
- No Intermittency
- Fast Response time
- Load Matching
- Cover lead-in times
- Base Load generation
- Merit order dispatch

SOLAR AND ESS: USE CASES





Source: Bloomberg New Energy Finance

sterlingandwilson.com

POLICY SUPPORT

WIDE ACCEPTANCE OF PV + STORAGE ACROSS THE GLOBE

Nevada USA South Korea FERC Order 841 creates a clear RPS obligation: 40 % by 2030 Modified RPS to drive installation of Energy legal framework for storage Storage Energy storage delivered unit will count double resources to operate in all electric for the purposes of meeting the RPS Energy storage installed with Renewable Energy н. markets requirement to get higher REC multiplier Australia Japan Mauritius Five minute settlement rule change is 'Zero Energy House' (ZEH) subsidy Allocation of USD 30.9 m for 18 MW installation of . expected to boast ESS market as well available for behind the meter storage BESS in support of 185 MW of RE policy encourages near term build in Bids for 4 MW of BESS were invited in 2017 н. the residential sector Remaining expected in next 2 years



ACTUAL IMPLEMENTATION OF PV + STORAGE IS HAPPENING

.

\$110/MWh Solar + Storage PPA in Hawaii

- To meet morning and evening peak & ramp hours
- AES Distributed Energy's 28MWp PV & 20MW/100MWh storage project

- Tucson Electric's solar + storage PPA for less than 4.5 ¢/kWh
- 20 Years PPA for 100 MW & 30 MW/120 MWh energy storage facility
- Exact prices are confidential, but a release pegged the PPA for solar portion of the project at below \$0.03/kWh

\$0.35/kWh Solar + Storage Chitose Power Plant

- LS Group and KEPCO built 28 MW solar PV & 13.7 MW ESS
- 20 year PPA

sterlingandwilson.com

CHOOSING THE RIGHT ESS



The application can be categorizes via two criteria: duration of discharge and frequency of discharge.



SOLAR + BESS INSTALLATIONS & COST TRENDS STERLING & WILSON

Annual co-located energy storage with utility-scale PV installations & projection



Cost Reduction Drivers

- Technology improvements
- Economies of scale.
- Fierce OEM competition

Despite rapidly rising lithium and cobalt prices, average battery pack prices continued to fall. The volume-weighted average battery price in 2017 was \$209/kWh, a 24% year-on-year fall.

PV + BESS vs CSP + MOLTEN SALT



PV + BESS

- Lower LCOE (For Storage of up-to 16 hour)
- Simple and Modular Technology
- Fast Deployment time
- Works on Diffused Radiation as well
- Higher R&D, steeper Cost reduction Curve
- Low life, Limited cycles
- Lesser System Efficiency
- Cant act as Base Load





- Longer Life , up-to 25 Years
- Higher System Efficiency
- Coupled with Gas, act as Base Load



- Not Suitable for Small Scale of 20-80 MW
- Works only at High DNI Sites
- Higher LCOE
- Non-modularity

OFF-GRID CAPTIVE HYBRID POWER PROJECTS

5 MWp (3 PROJECTS) SOLAR - DG BATTERY - HYBRID PROJECT

NIGERIA



Scope of Work

Turnkey EPC Upgrading Distribution Network Provision for Street Light O&M for 10 years



Q4 2018

STERLING & WILSON

H Modules

Customer

Rural Electrification Agency

Confidential

Confidential

Inverters

sterlingandwilson.com 61



Thank You

You can reach us at

www.sterlingandwilson.com solarinternational@sterlingwilson.com

sterlingandwilson.com