PVTECH **TECHTalk** Product Series **WEBINAR**

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Sungrow: Key benefits of DC coupling ESS solutions

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SUNGROW
Clean power for all

Key Topics

01 Sungrow Introduction
02 Market Challenges
03 DC Coupled System - Benefits
04 DC Coupled System - Solution
05 Working Scenarios

The World’s Most Bankable Inverter Brand

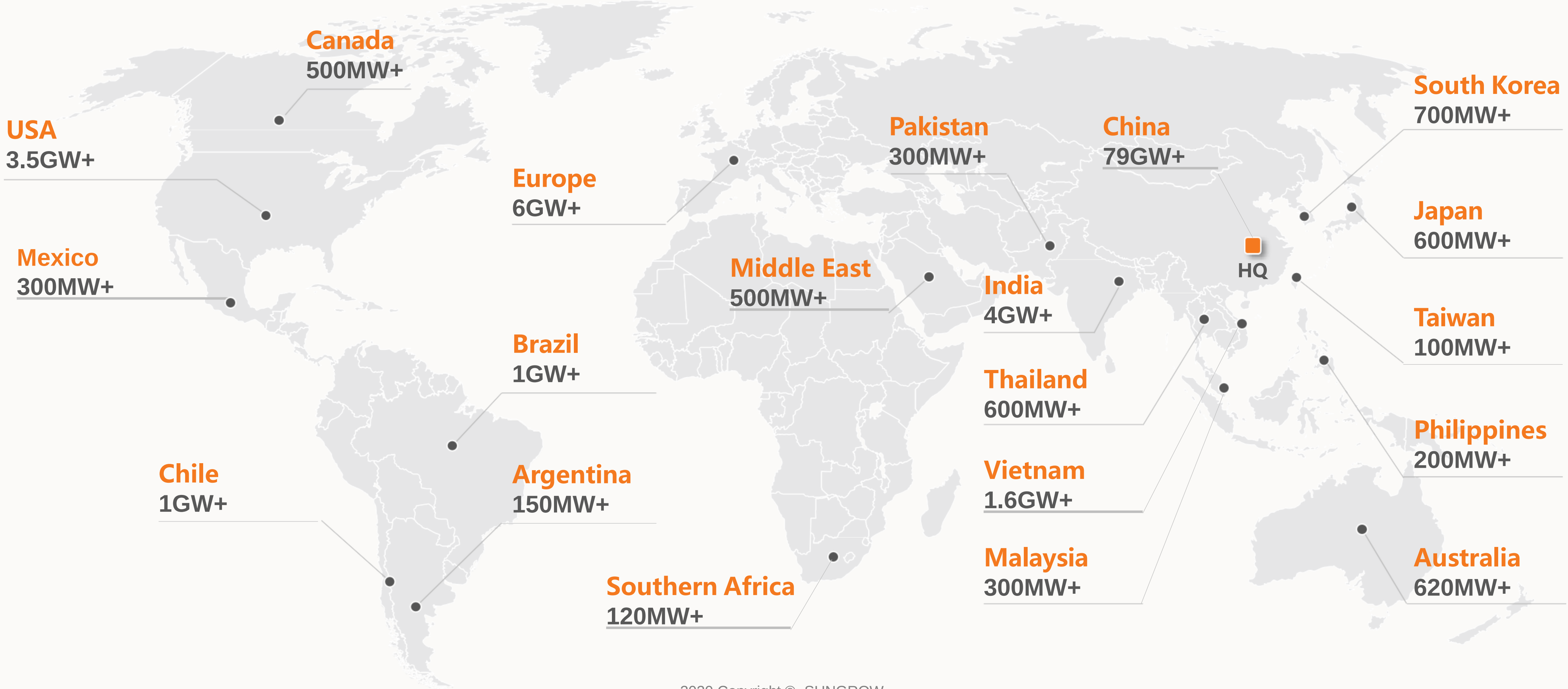
NO.1
supplier in financed projects

100%
bankable

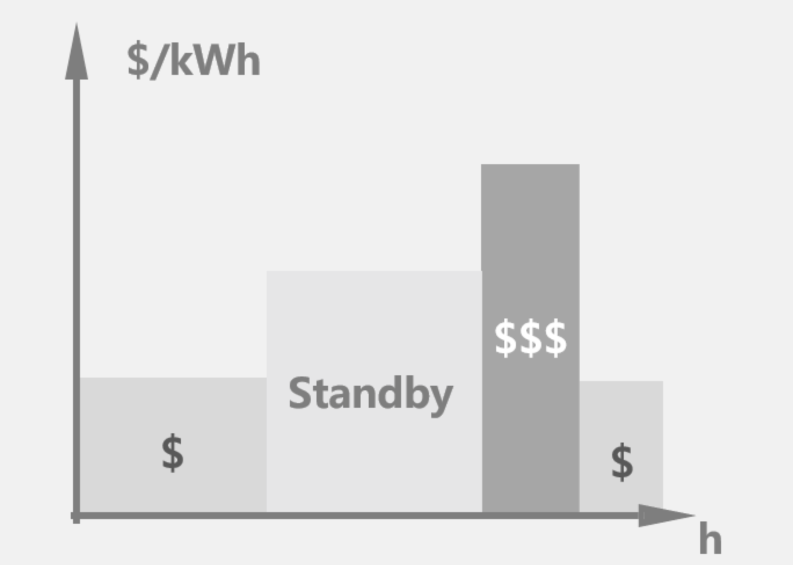
Source : BloombergNEF

Over 120GW of Inverter Equipment Installed Globally

- **60+** Countries/Regions
- **120GW+** Inverters installed



Market Challenges



Lack of Grid Capacity

- Increased connection cost
- Saturated grid
- **Expensive infrastructure upgrades**

Network Quality Issues

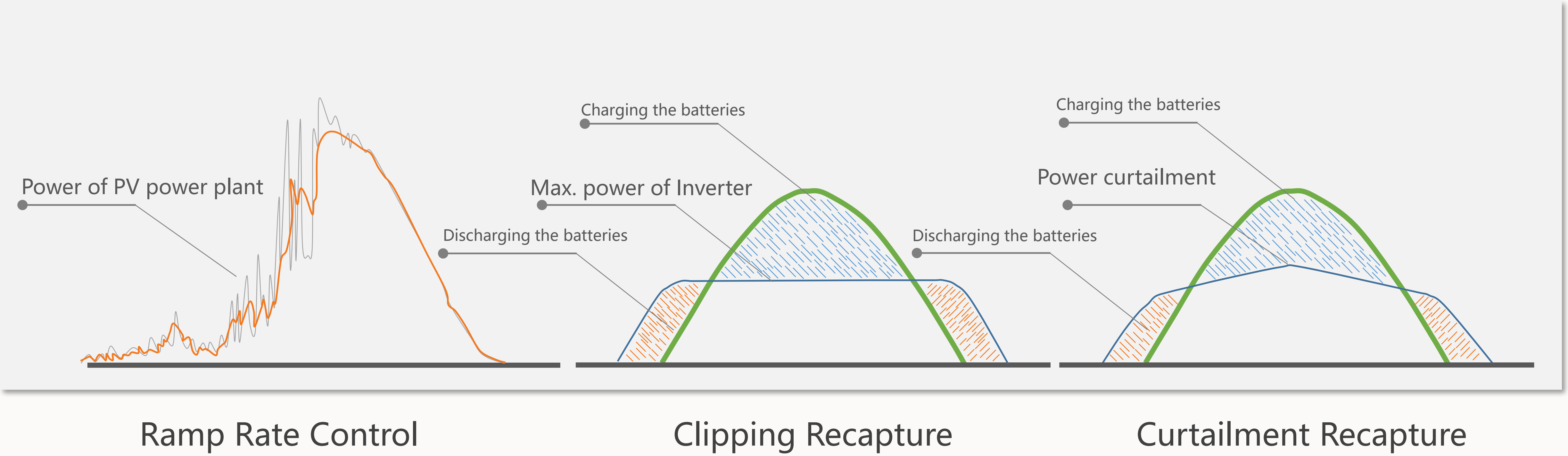
- **Frequency & Voltage fluctuation**
- Over Capacity
- Low Short Circuit Ratio

Subsidy Free Era

- Wanting to go beyond the Standard PV designs
- **Negative price during the day**
- Emerging revenue streams

Main Application Scenes of DC-Coupled

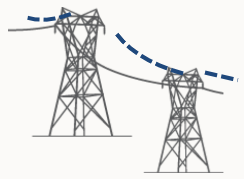
- Control the rate of PV power plant, reduce the grid impact
- Minimize the power clipping losses for high DC:AC ratio projects
- Plant curtailment, energy time shifting



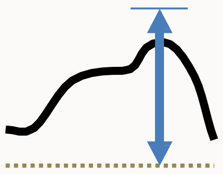
Main Grid Benefits of DC-Coupled

Utility Applications

Avoid Costly Updates

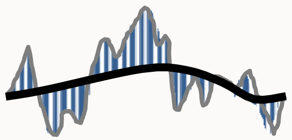


Resource Adequacy

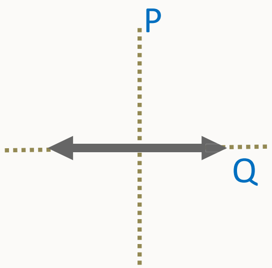


ISO/RTO Services

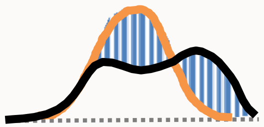
Frequency Regulation



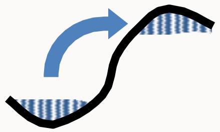
Voltage Support



Energy Shifting

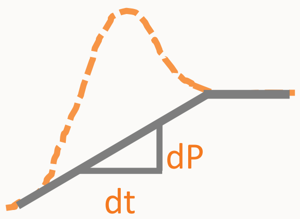


Energy Arbitrage

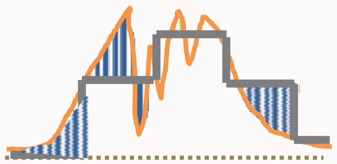


Plant Output Control

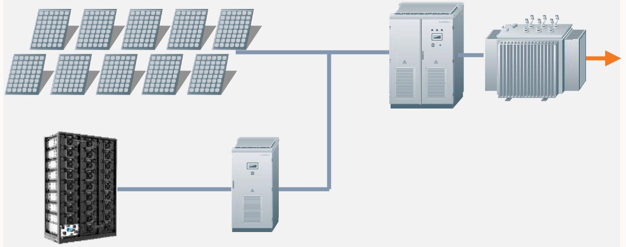
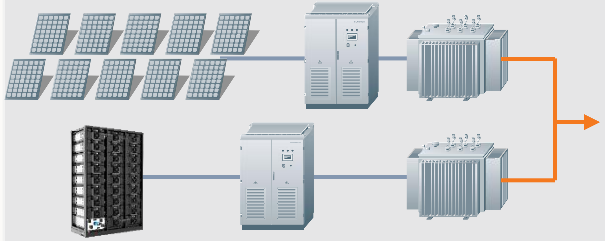
Ramp rate control



Capacity Firming



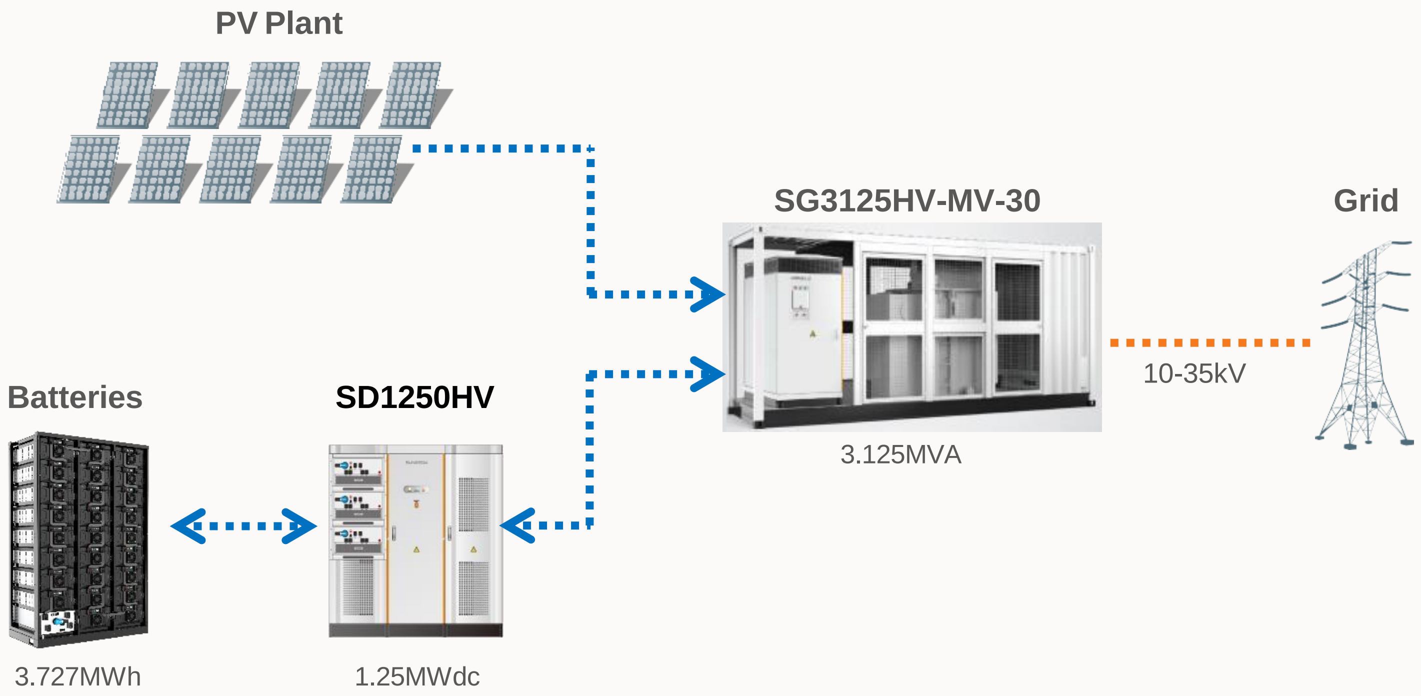
DC vs. AC Coupling

Solutions	Higher DC/AC ratio	Round Trip efficiency	Maximise POI capacity	Reduce cost
 DC-coupled	Oversizing without loss of energy	Round trip efficiency is 3% to 5% better	the DC/DC can match the PV Inverter for capacity	Common MV for PV and ESS
 AC-coupled	Yield clipping and losses	More AC losses and lower system efficiency	Either increase grid capacity or reduced combination of PV and ESS	Separate PV and ESS MV switchgear

Plant Overview

Key Features

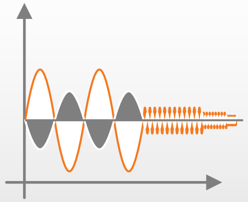
- Bi-Directional Inverter charging and discharging from the grid
- No standalone PV/BESS combiner box required
- Parallel up-to 3x DC/DC converters
- Allows for 1:1 PV/BESS ratio
- Each DC/DC contains up to 10x 125kW DC/DC converters
- Stops the battery short circuit current at rack level
- Futureproof (Add DC/DC + ESS in the future)



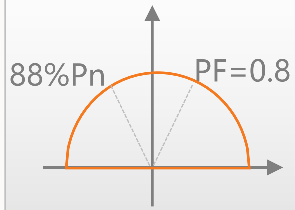
PV Inverter - Functionality

SG3125HV-30

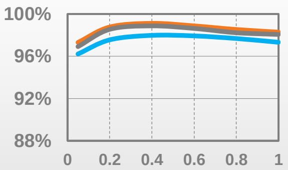
Response time <30ms



HVRT/LVRT

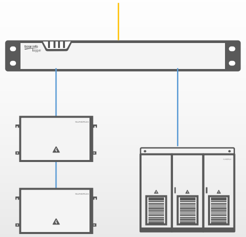


More reactive capacity

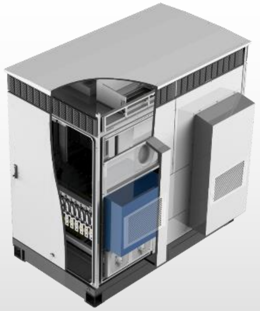


Max. efficiency 99%

Higher DC/AC ratio



Integrated SCU



No derating up to 50℃

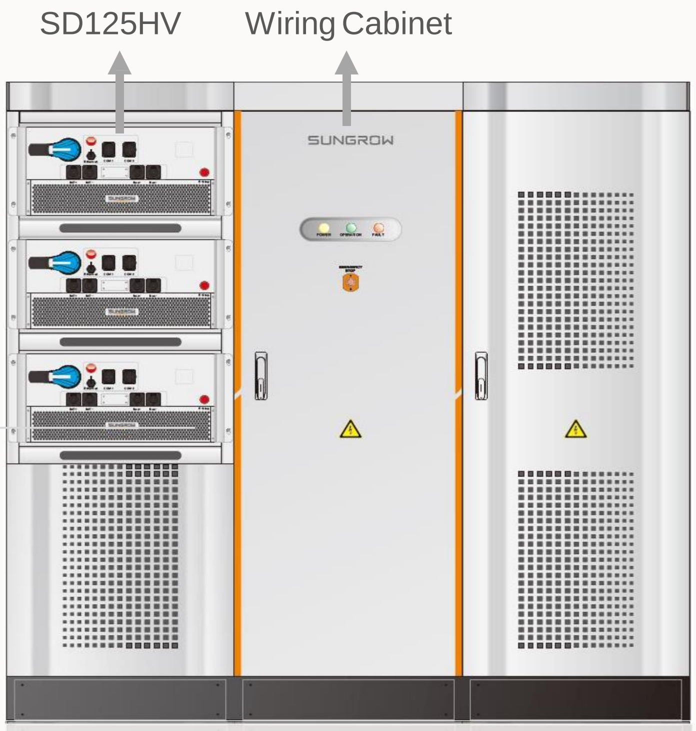
DC/DC Converter - Benefits

SD125HV

- Bi-directional boost converter
- 0~1500Vdc, compatible with different battery voltages
- MPPT function integrated
- Peak Efficiency 99%

SD1250HV

- Modular design, support up to 10x125kW modules in parallel
- Battery inputs can be independent or in parallel
- High protection degree (NEMA 4X, C5)
- High power density, lower footprint



Scenario 1

PV Export + Battery Charging

[Standard Working Mode]

Assumptions

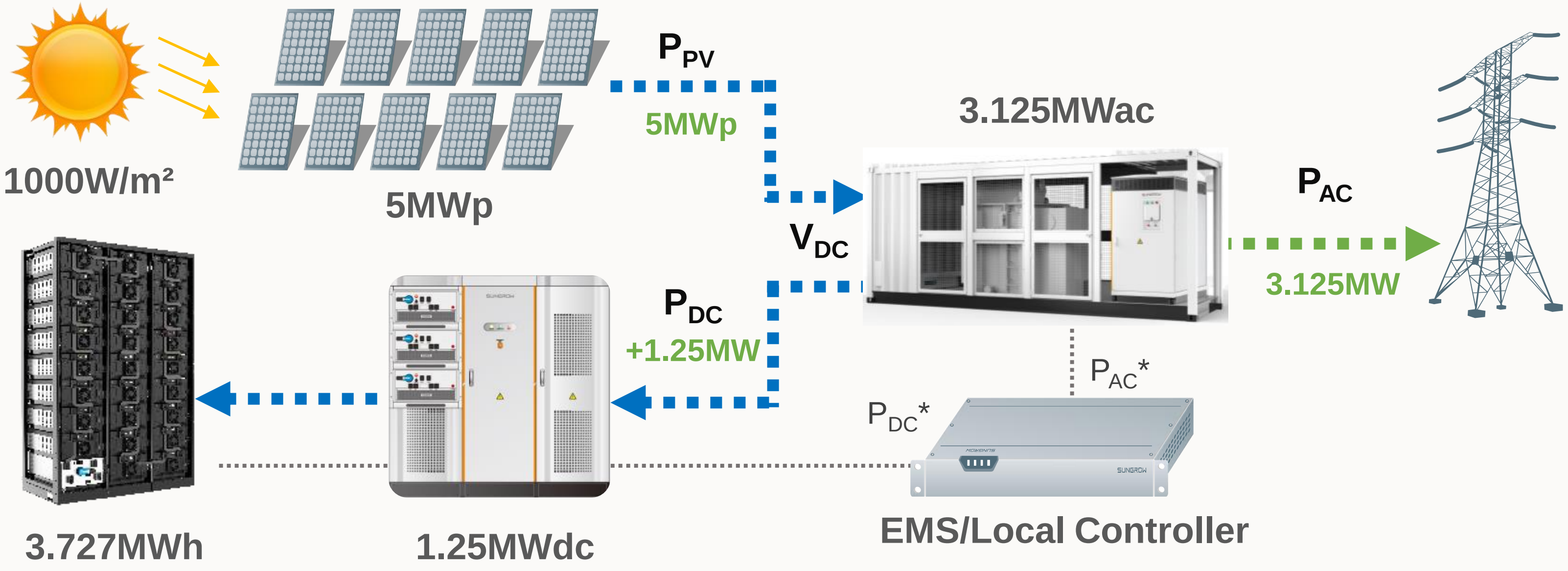
- The inverter track MPPT
- EMS/Controller communicate with inverter and DC/DC. The EMS/controller dispatch the output.

Conditions

Irradiance = 1000W/m²

P_{AC}^{*} = 3.125MWac

SoC < 100%



Scenario 2

No PV Export - Battery Charging From The Grid

[Standard Working Mode]

Assumptions

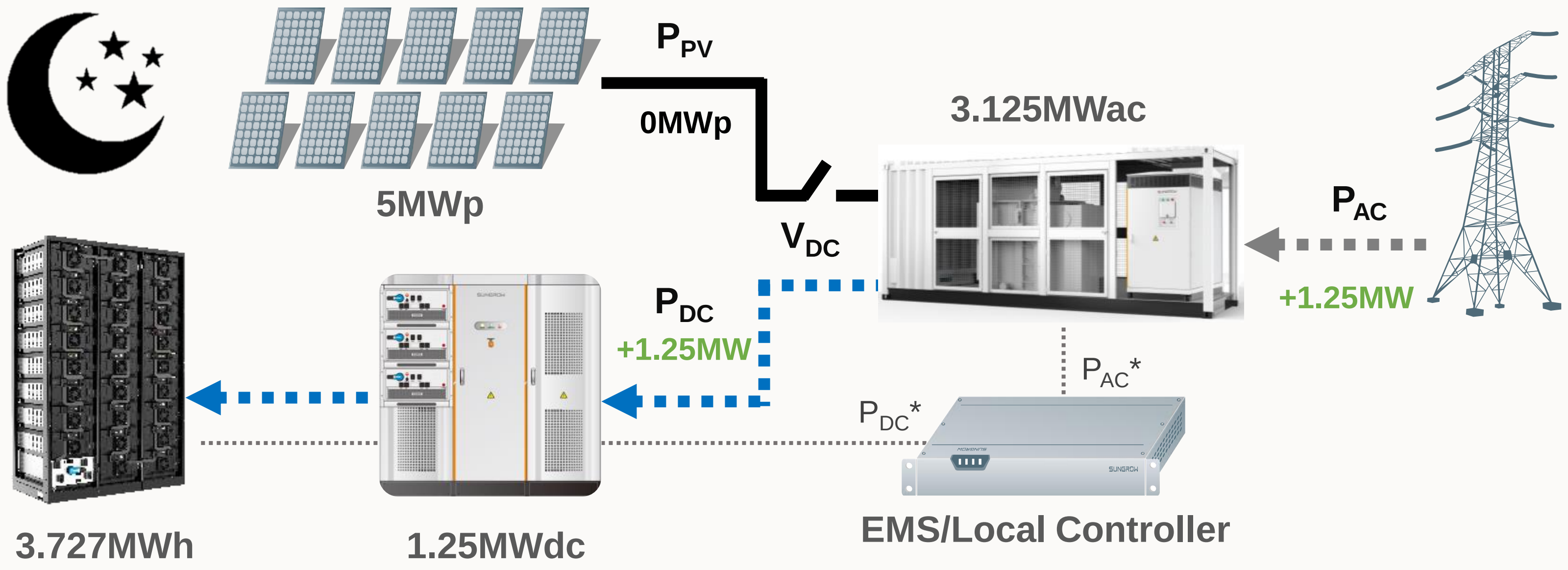
- No losses
- Irradiance is proportional to I_{PV}
- P_{DC}* and P_{AC}* are EMS control values

Conditions

Irradiance = 0W/m²

P_{AC}* = 1.25MWac

SoC > Lower Limit



Scenario 3

Minimal PV Export + Priority Battery Charging

[Non Standard Working Mode]

Assumptions

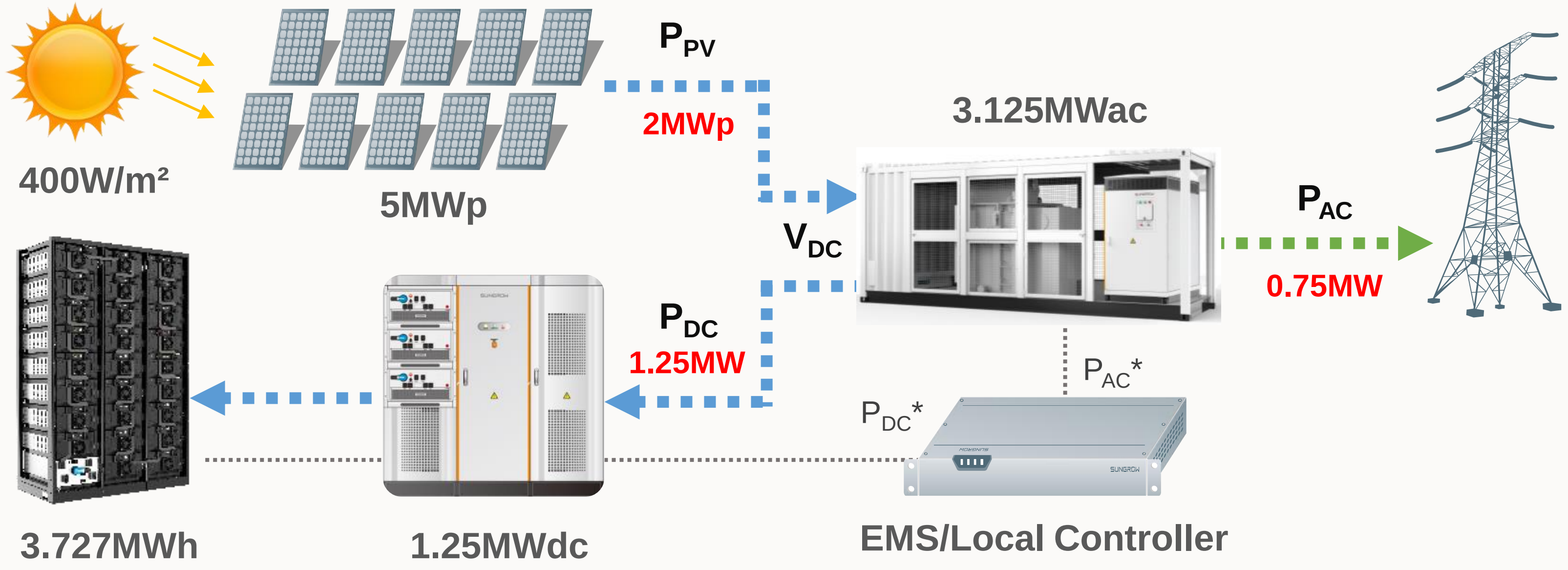
- The inverter track MPPT
- EMS/Controller communicate with inverter and DC/DC. The EMS/controller dispatch the output.

Conditions

Irradiance = 400W/m²

P_{AC}* = 0.75MWac

SoC < 100%



Scenario 4

No PV Export + Battery Recharging Priority

[Non Standard Working Mode]

Assumptions

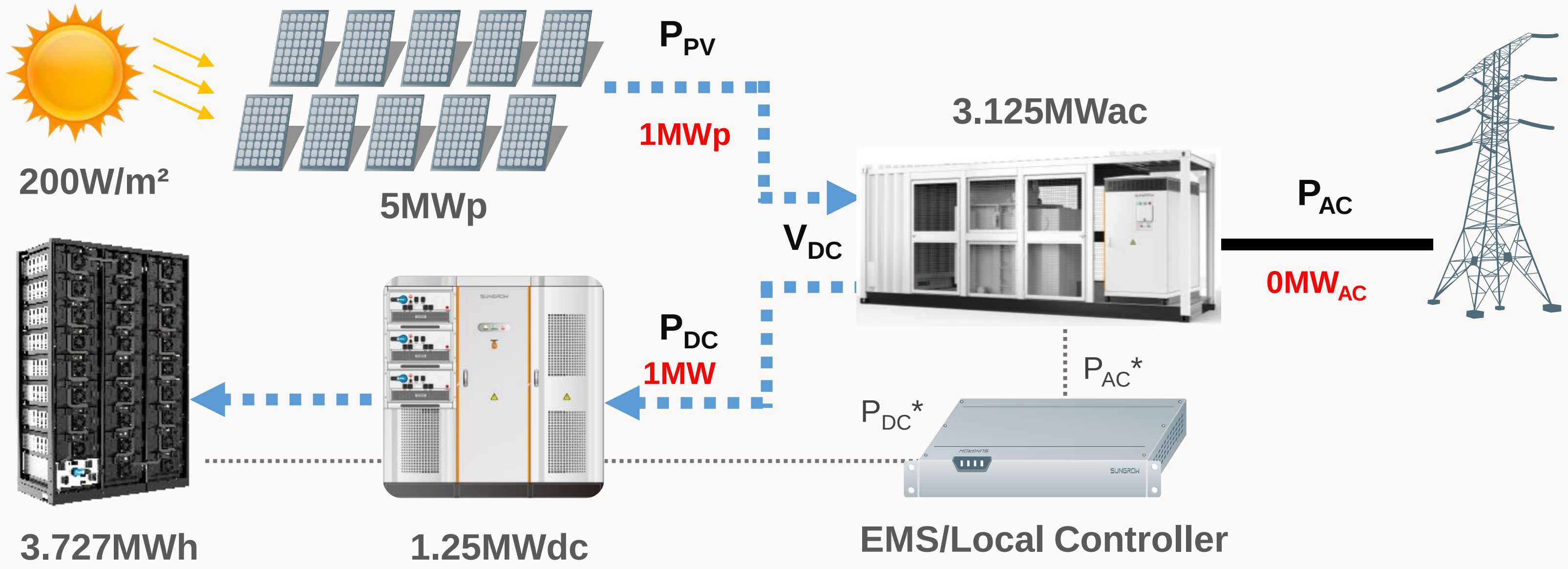
- No losses
- Irradiance is proportional to I_{PV}
- P_{DC}* and P_{AC}* are EMS control values

Conditions

Irradiance = 200W/m²

P_{AC}* = 0 Mwac

SoC < 100%



Scenario 5

Combined PV Export + Battery Discharging

[Non Standard Working Mode]

Assumptions

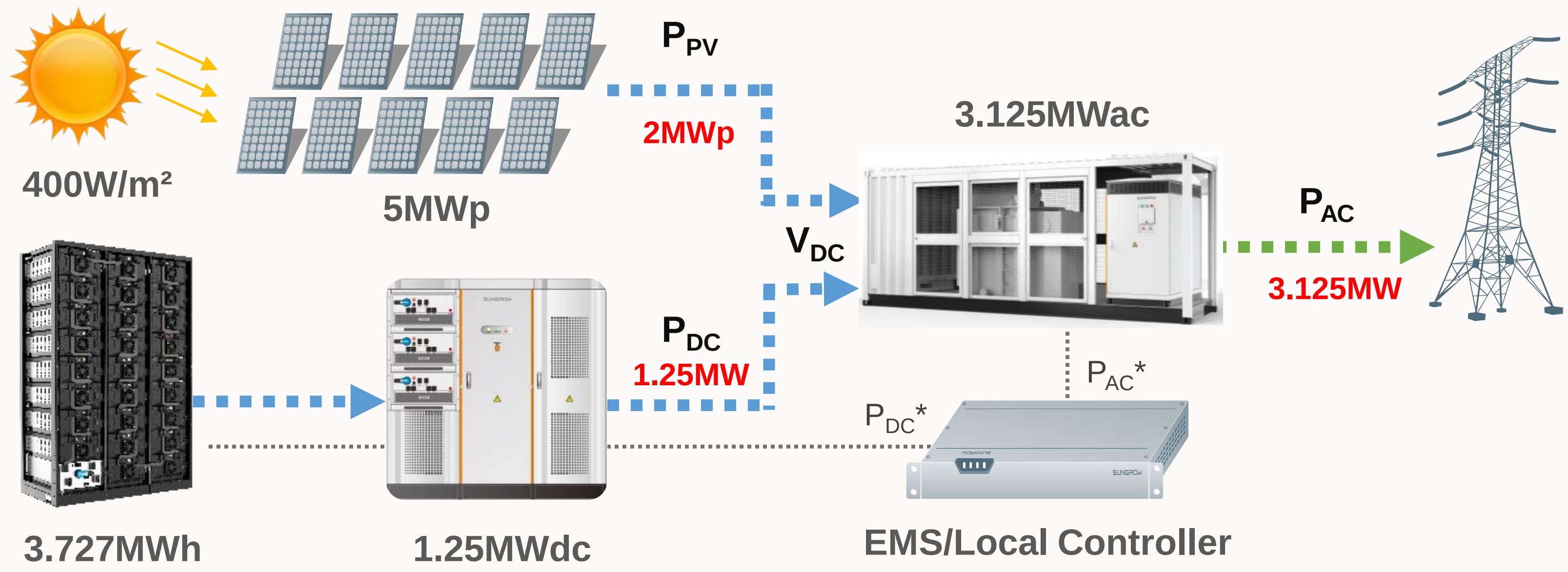
- No losses
- Irradiance is proportional to I_{PV}
- P_{DC}* and P_{AC}* are EMS control values

Conditions

Irradiance = 400W/m²

P_{AC}^* = 3.125 Mwac

SoC < 100%



Summary

Lack of Grid Capacity
- Increased connection cost
- Saturated grid
- Expensive infrastructure upgrades

Network Quality Issues
- Frequency & Voltage fluctuation
- Over Capacity
- Low Short Circuit Ratio

Subsidy Free Era
- Wanting to go beyond the Standard PV designs
- Negative price during the day
- Emerging revenue streams

SG3125HV-MV-30 Plus SD1250HV

- Enhanced Grid support functionality – Reducing the need for grid reinforcement works
- Exporting both PV and ESS - Maximizing the Grid Connection Agreement

- Ramp rate control and Capacity Firming
- De-risking energy loss during plant curtailment – Utilization of Storage

- Overall efficiency of the solution is increased – Compared to a traditional AC co-located system
- Global reduction on plant cost - Making DC/DC solution more viable
- Export energy at peak revenue earning times – Maximizing the site potential

THANK YOU