SMA SOLAR TECHNOLOGY AG

SiCPCS, sick ROI

Silicon Carbide (SiC) PCS boosting BESS performance and resilience

Carsten Wendt SMA AG

Blackhillock - © Zenobē Energy Limited

ENERGY
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SMA Solar Technology AG
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Energy transition pioneer since 1981

> 160 GW
installed inverters

> 20 GW
installed battery inverters

> 1,600
patents & utility models

> 4,000
employees

> 20
countries (sales & service)

> Compliant
HQ and Production in EU

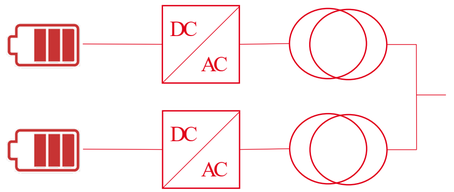
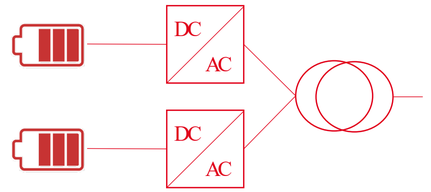
All figures as of end of 2024

INTRODUCING – BESS Tailored SiCMOSFETs

Medium Voltage Power Station with Sunny Central Storage UPS (SiCMOSFETs)

Stack topology	B6 Bridge with 1x2.0 kV SiC	Compliant Grid-forming
Temperature Derating	0% till 35°C $C_{ambient}$	Less PCS, more density
Derating in charging direction	0% (fully bidirectional)	Less PCS, more density
Efficiency (DC/AC)	99.2%	Less batteries, more throughput, less DoD
Thermal Reserve	significant	More inertia, more power cycles

Stack Topology – Apples and Oranges

	SMA Sunny Central Storage	Competitors
		
Topology	2-Level (B6)	3-Level (NPC)
DC-Bus per galvanic system	single	multi
Grid-forming during grid events (short-circuit, phase jump)	✓ Injects asymmetrical currents ✓ Improves grid voltage & frequency	↯ Only symmetrical currents ☐ No grid distortion improvement
Grid-forming Operation	✓ Robust and compliant	☐ Unstable and very difficult

SiC MOSFET: Added revenue / savings

Scenario		Same battery size - Less DoD • Same BESS size (200MWh) • Same revenue • 2xSavings for less charging • Less DoD/aging *			Less Battery Capacity • Less BESS CAPEX (0.2-1%) • Same revenue • 2xSavings for less charging • Same DoD			Same battery size - More Throughput • Same BESS size (200MWh) • More revenue • 1xSavings for less charging • Same DoD		
	Cycles/day	**1**	**1.5**	**2**	**1**	**1.5**	**2**	**1**	**1.5**	**2**
Δ Efficiency (one-way)	**0.20%**	£ 116,800	£ 175,200	£ 233,600	£ 164,800	£ 223,200	£ 281,600	£ 204,400	£ 306,600	£ 408,800
	0.40%	£ 233,600	£ 350,400	£ 467,200	£ 329,600	£ 446,400	£ 563,200	£ 408,800	£ 613,200	£ 817,600
	0.60%	£ 350,400	£ 525,600	£ 700,800	£ 494,400	£ 669,600	£ 844,800	£ 613,200	£ 919,800	£ 1,226,400
	0.80%	£ 467,200	£ 700,800	£ 934,400	£ 659,200	£ 892,800	£ 1,126,400	£ 817,600	£ 1,226,400	£ 1,635,200
	1.00%	£ 584,000	£ 876,000	£ 1,168,000	£ 824,000	£ 1,116,000	£ 1,408,000	£ 1,022,000	£ 1,533,000	£ 2,044,000

* Additional benefit for less aging not calculated (less augmentation, more capacity retention, improved life time projection)

Assumptions: 200MWh BESS; avg. buying price: £40/MWh; avg. selling price: £120/MWh; over 10 years

More resilience and more revenue potential

- **Thermal cycle for PCS ≠ battery charge cycle**
  - Various heating-cooling cycles of components accelerate aging
  - Most PCS in the market were designed with PV mission profile (1-2 thermal cycles per day)
  - SCS UP uses air outlet louvers which reduce cooldown

- SCS UP SiCMOSFETs operate at significantly lower component temperatures and thus allow various thermal cycles a day

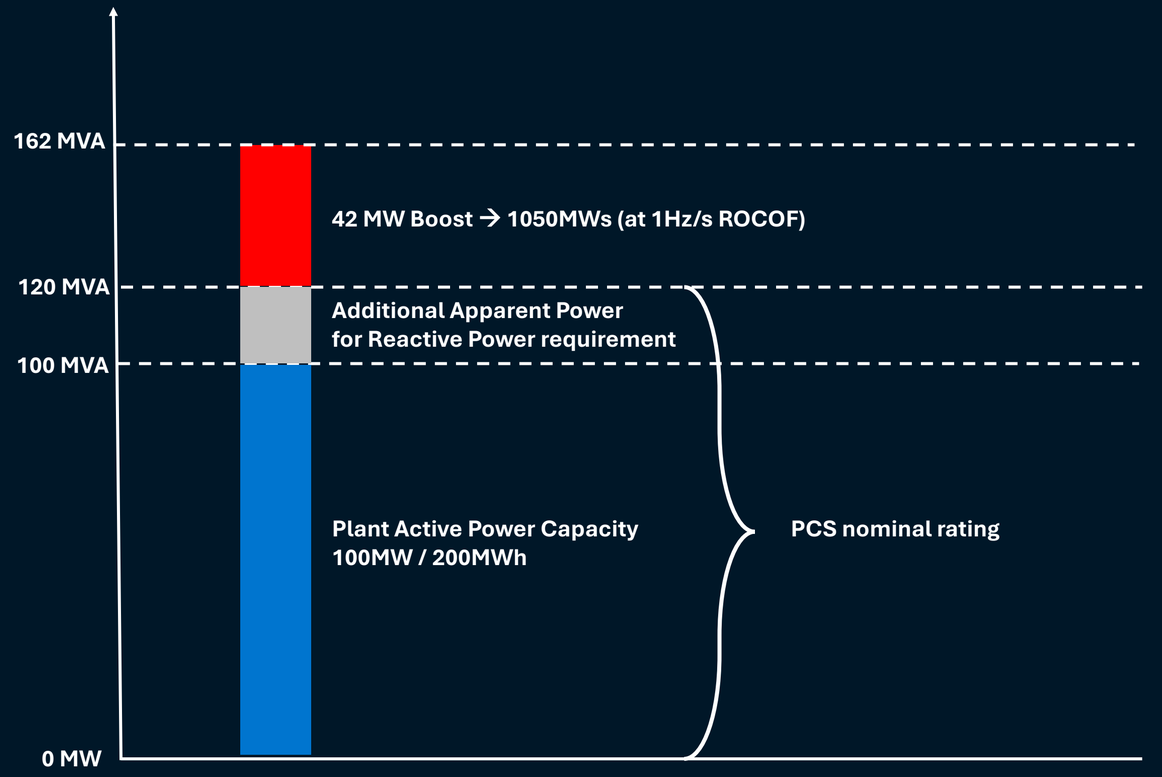
- This allows more aggressive BESS operating strategies and hence more revenue potential

- Further, it reduces the likelihood of failures, improves the availability and expands the operational life of the PCS

Boost Capability for Inertia

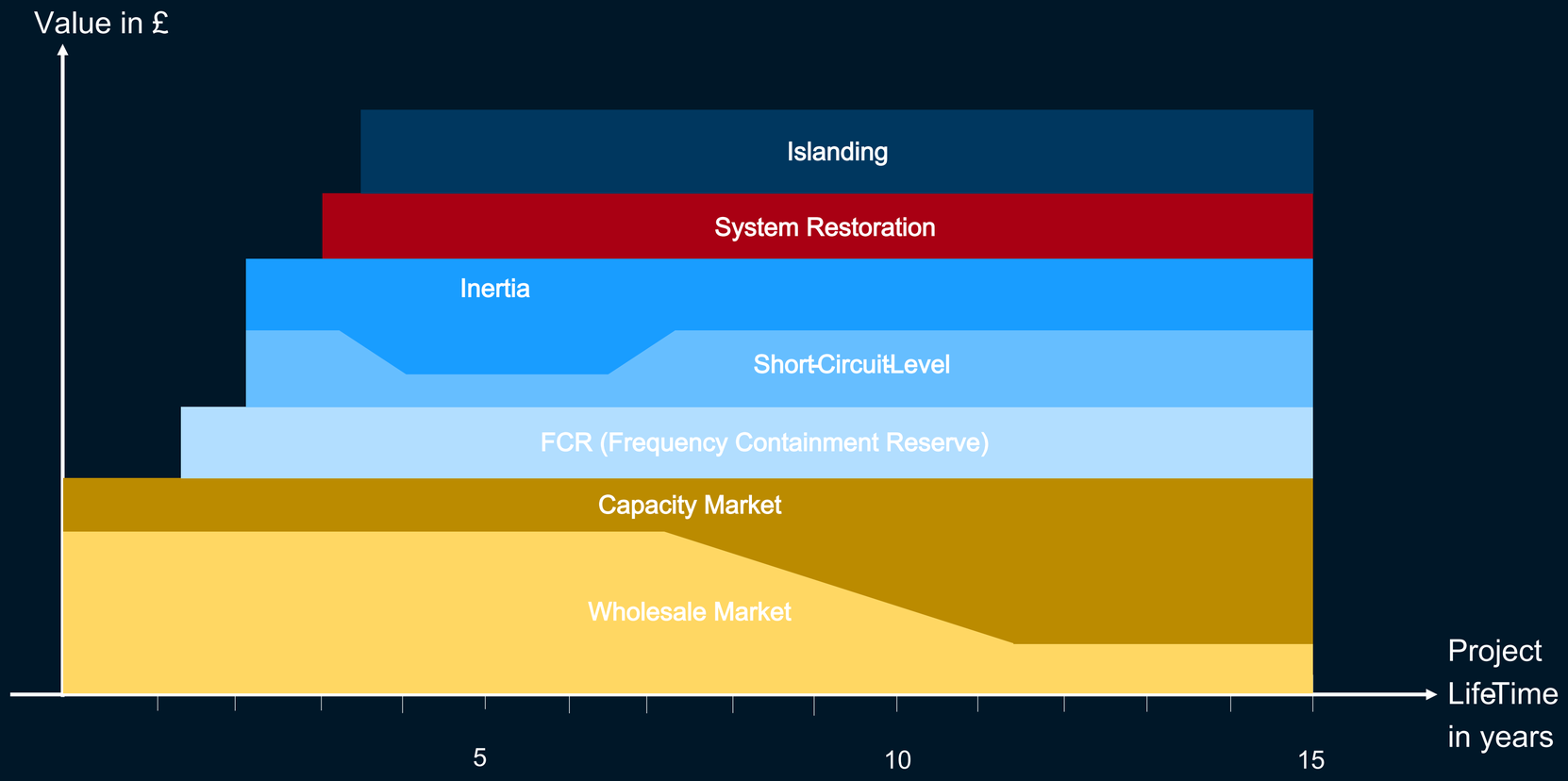
- +35% Boost capability over 5sec
- 100MW / 200MWh plant can provide 1050MWs Inertia on top
- At £2000 / MWs p.a.: 1050MWs Inertia are worth

£ 2,100,000 p.a.



*Assumptions: Inertia price: £2000 / (MWs x a);

Future-Proof now – Enable later



- Add use cases when they become attractive
- Ensure “stack-ability” of inertia
- Buy right PCS today
- SMA Power Plant Manager ensuring use case stacking, plant grid compliance and plant level inertia

- BESS Tailored Power Stack
- SiCPCS, sick ROI

MVPS with SCS UP-B (SiCMOSFETs)

Stack topology	B6 Bridge with 1x2.0 kV SiC	Compliant Grid-forming
Temperature Derating	0% till 35°C $C_{ambient}$	CAPEX Savings
Derating in charging direction	0% (fully bidirectional)	CAPEX Savings
Efficiency (DC/AC)	99.2%	CAPEX/OPEX Savings & More Revenue
Thermal Reserve	significant	More Revenue (inertia, power cycles)

Also ask us about the other important improvements like noise emissions or harmonic profiles

Thank you!
Questions?

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