e-STORAGE
A subsidiary of Canadian Solar

Noise Mitigation in Battery Storage

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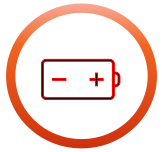
Key Figures*

2021
Founded
with
7 GWh
Deployed Energy Storage Projects
with
16 GWh
Contracted Energy Storage Projects
on
KEY MARKETS
Canada, US, LATAM, UK, EU, India, Australia
and

974
EMPLOYEES GLOBALLY

491 Manufacturing	80 R&D
93 Quality & EHS	132 Engineering
90 PM & LTSA	89 Sales & Support

Key Facts *



Best-in-Class BESS
5 MWh in 20 ft Container

20 GWH
Manufacturing Capacity

Bankable at 100+
Financial Institutions

Industry
Knowledge

Local Teams

Global Projects

Excellent Track
Record

BNEF Tier 1

Solar + Storage
Implementation

*Figures updated as of December 2024

The Challenge

- The UK is a condensed area compared to global site opportunities
- Battery storage sites are moving closer to towns and cities
- Proximity to residential & commercial areas requires enhanced planning conditions
- Noise becomes an issue
- A solution is needed to mitigate noise with minimal effect to overall CAPEX

Site Selection

Coalburn, Scotland

500MW / 1GWh

Sound - Basic Terminology

Sound Power Level (LWA) is the acoustic energy emitted by a source which produces a Sound Pressure Level (LPA) at some distance.

While the sound power level of a source is fixed, the sound pressure level depends upon the distance from the source. Both are measured in dB so can be easily confused.

The sound pressure level may be measured as a single overall value, we use the dBA (A weighted scale to match human hearing), to provide an indication of how loud the sound may appear to a listener.

A doubling of sound pressure level corresponds to an increase of +6 dB.

A 10 dB increase in the sound pressure level corresponds to a doubling of the perceived loudness of a sound.

What are the requirements?

Typical requirements as follows:

The requirement for planning consent is for the BESS plant not to increase noise compared to before construction.

Normally expressed as background noise level (or background noise + 5 dB(A) if lucky!

Measurement points are often defined as noise sensitive receptors which are typically houses surrounding the site.

The challenge is to meet the required noise level at night – because background noise level is lower.

As a manufacturer and systems integrator our challenge is to minimise the noise of the equipment by design.

A noise consultant will be involved to model the noise from the planned BESS and to ensure planning requirements will be met.

How do we meet the Noise requirements?

The approach is as follows:

1

Design, manufacture and select equipment to minimize noise

2

Design and advise on site layout to direct noise away from noise sensitive receptors

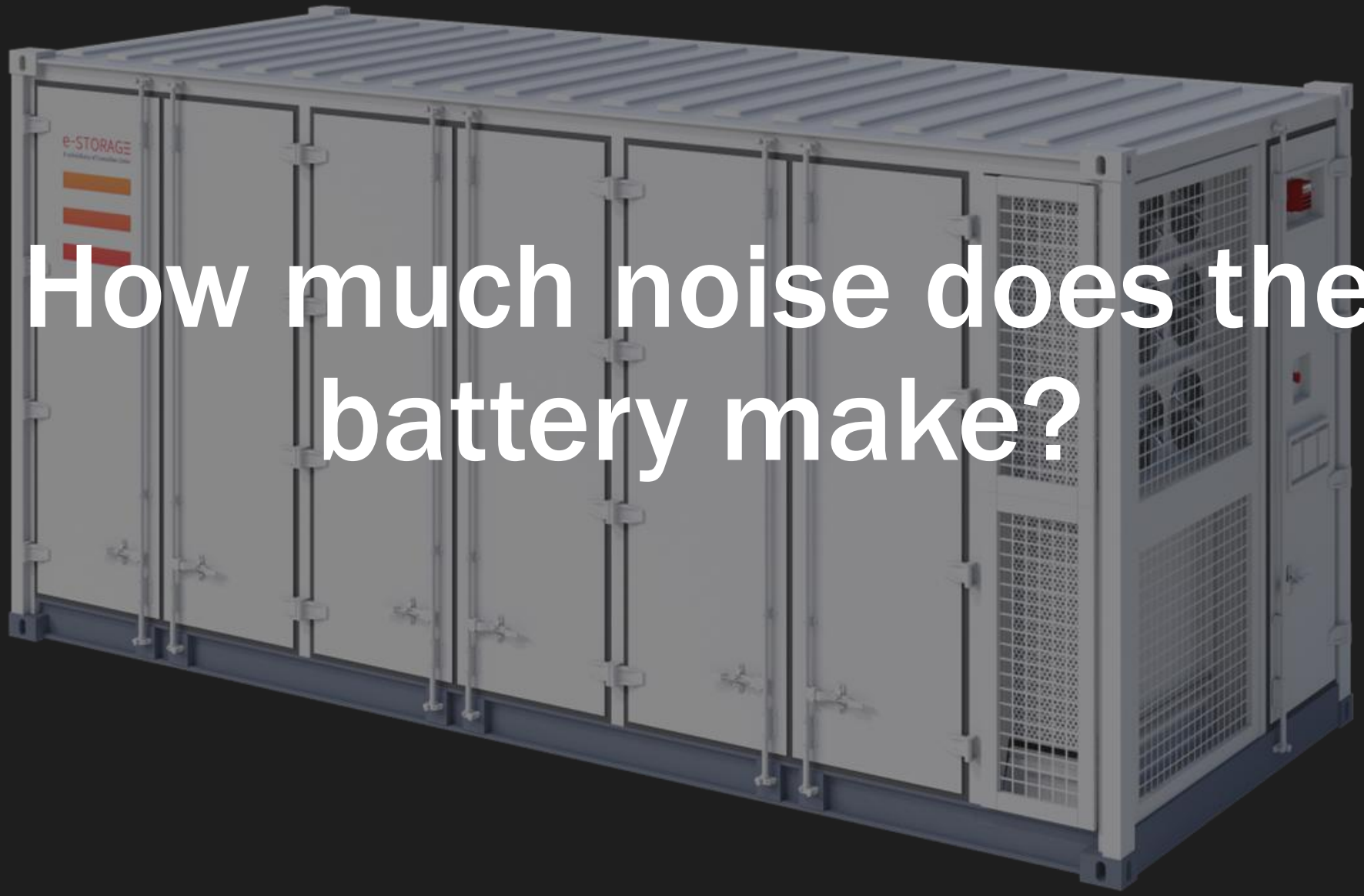
3

Noise consultant model site level noise considering noise sensitive receptors

4

Add mitigation if required to meet noise requirements

Equipment



How much noise does the battery make?

Look at the datasheet

Storage Block

ENERGY STORAGE SYSTEM
S-5016-2H-EU | S-5016-4H-EU
Capacity: 5.0 MWh

e-STORAGE, a subsidiary of **Canadian Solar**, is a world-class energy storage solution provider, specializing in storage system design, manufacturing, and integration of battery energy storage systems for utility-scale applications.

The company offers value-added system consulting and turnkey EPC services, in addition, we provide customers with our proprietary LFP battery solution SolBank.

Together, we are building a brighter, greener future for all.

Storage Block 3.0 Highlights

- **Cutting-Edge Technology**: Storage Block 3.0 features high-density LFP cells, an active balancing BMS, and an innovative liquid cooling TMS, ensuring optimal safety.
- **Compliance and Certifications**: Storage Block 3.0 adheres to all industry standards: IEC 62619, IEC 63056, IEC 62477-1, IEC 62933-5-2, IEC 61000-6-2, UL 9540A, NFPA 855, NFPA 69, UN38.3/UN3536, ensuring rigorous safety and performance criteria.

Key Features

Enhanced Energy Density
- Utilizes 314 Ah battery cells and compact integration, increases single container energy density up to 45%
- Reduces land cost by up to 35% in a 100MWh project

Safety
- IP67-rated pack design
- Up to 20% faster detection of abnormal and automatic protection
- Advanced pack thermal isolation, electrical redundancy protection, and multi-level fire protection, effectively minimize potential issues

Intelligent Control
- Liquid cooling cuts auxiliary consumption up to 30%
- Active balance and string-level management, guarantee high efficiency and availability

Compatibility & Installation
- Supports various PCS topologies
- Turn-key integration and stationery certification, reduce project schedule risks by up to 40%
- Plug-and-play setup for streamlined commissioning

Storage Block 3.0
System Parameter

e-STORAGE
A subsidiary of Canadian Solar

General	
Product Model	CSI-SolBank-S-5016-2h-EU
	CSI-SolBank-S-5016-4h-EU
Battery Chemistry	Lithium Iron Phosphate (LFP)
Pack Configuration	1P104S (104 Cells)
Rack Configuration	1P416S (4 Packs)
System Configuration	12P416S (12 Racks)
Nominal DC Voltage	1331.2 V
Operation DC Voltage Range	1164.8 V ~ 1497.6 V

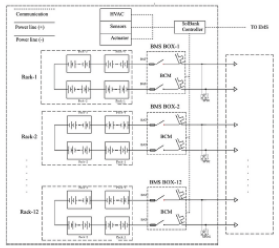
Performance		
Rated DC Power	2350 kW	1200 kW
Initial Storage Capacity	4700 kWh	4800 kWh
Charging/Discharging Mode	0.5 P / 0.5 P	0.25 P / 0.25 P
Duration @Rated Power	2hrs	4hrs
Round Trip Efficiency (RTE)	93%	94%
Max. Short Circuit Current	10 kA*12	10 kA*12

Aux Systems	
Auxiliary Power Interface	AC480 V / 60 Hz, 3P5W
Thermal Management System	Smart liquid cooling/heating for battery system
Aux Load (Standby/Peak)	1.5 kVA / 50 kVA
	1.5 kVA / 22 kVA
Operating Temperature (Ambient)	-30 °C to 55 °C (derating from 45°C to 55°C)
Relative Humidity	≤95% (non-condensing)
Altitude	< 2000 m (derating from 2000 m to 4000 m)
External Communication Interface	Ethernet connection, Modbus TCP/IP protocol

Safety	
Fire Detection and Alarm	Fire alarm panel, heat and smoke detection, alarm bell and strobe
Explosion Prevention	Combustible gas detector with active ventilation
Uninterrupted Power Reserve	Container level UPS for 2-hr control system backup; dedicated fire safety UPS for 24-hr fire alarm backup
Fire Suppression Options	Aerosol-based suppression system, dry pipe sprinkler system
Emergency Stop/Automatic Shut-off	Local and Remote

Mechanical	
Enclosure	20ft. high-cube container
Dimensions (L*W*H)	6058*2438*2896 mm (238.50*95.98*114.02 in)
Weight (Battery Included)	38,200 kg (84,217 lbs)
Enclosure Ingress Rating	IP55 / NEMA 3R
Painting/Coating	RAL9003 / C4 Coating
Seismic Parameter	Zone 4
Noise @1m distance	≤ 75 dB @1m distance

Storage Block 3.0
Circuit Diagram



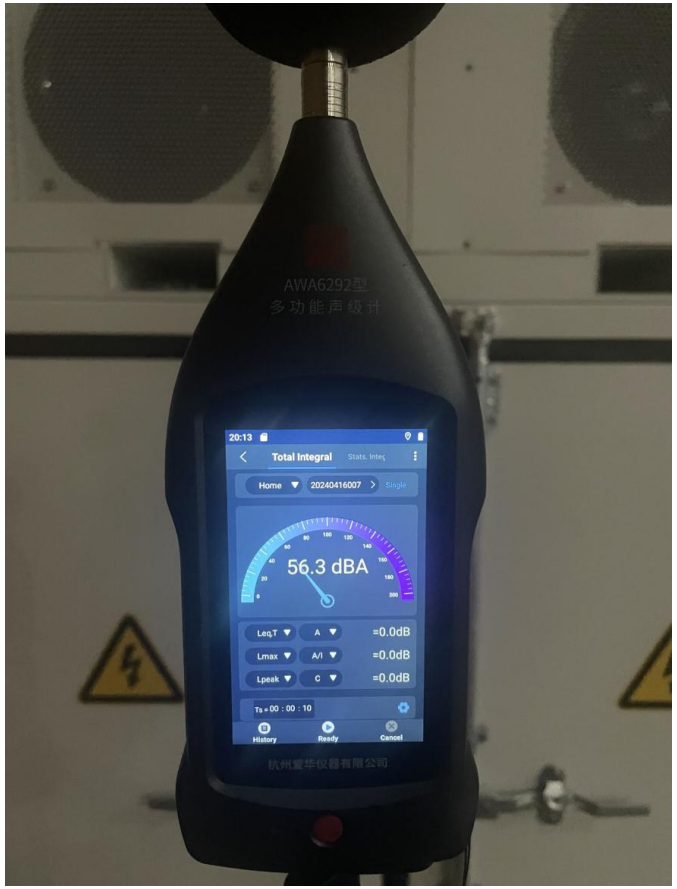
Notes
1. The unit is rated at 1164.8V~1497.6V for optimized product performance, the maximum voltage range for the battery system is 1060.8V~1497.6V
2. Rated DC Power is measured at the product DC terminal, the Rated DC Power and Initial Storage Capacity is limited to the use of two Storage Block 3.0 units connected in parallel
3. Initial Storage Capacity is the usable product capacity at FAT, contact e-STORAGE for capacity at COD per project schedule
4. DC RTE is measured during capacity test at Rated DC Power, refer to the product warranty document for the complete procedure

Due to ongoing innovation, improvements, and product enhancements, the technical specifications in this document are subject to change and are not guaranteed.
Canadian Solar reserves the right to update or change its products or this technical data without prior notice and customers should not rely upon these or any technical specifications which are not made part of a definitive binding agreement.

Storage Block 3.0 Datasheet. Version 1 2/10/2023

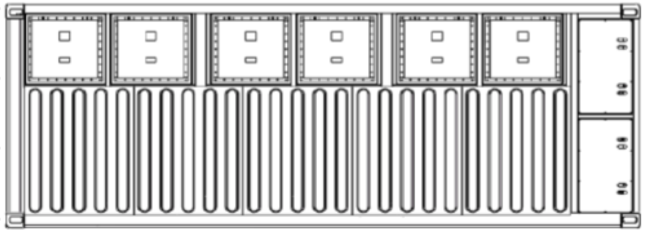
Noise @1m distance	≤ 75 dB @1m distance

SPL determined by measurement



100% fan speed

												1m	2m	3m	4m	5m	6m	7m	8m	9m	10m	15m	30m	50m
10m										55.5														
2m				55.8				60.9																
1m		56.7		60.2		56.1		56.7		65.3		71.1	69.8											
	55.1	53.8																						
												77.6	74.6	70.8	71.1	67.6	66.7	64.1	64.5	62.1	61.6	59.1	55.8	54.2
	53.4	53.6																						
1m		53.9		54.0		58.3		60.2		65.3		70.7	70.9											
2m				55.9				57.9																
10m										54.8														



What about the PCS?

e-Storage MV-Skid-5160 solution

SKID solution 5.16MVA/5.16MW:

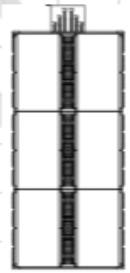
- CSI inverters 215kVA x 24
- Tier 1 MV Switchgear
- Tier 1 MV transformer 15,20,30,33kV

Benefits:

- 3L Optimization for E-Storage BESS solutions
- Safe and eco-friendly
- Ultra-low noise (<65dB)
- Substantial BOP cost savings.
- High availability.

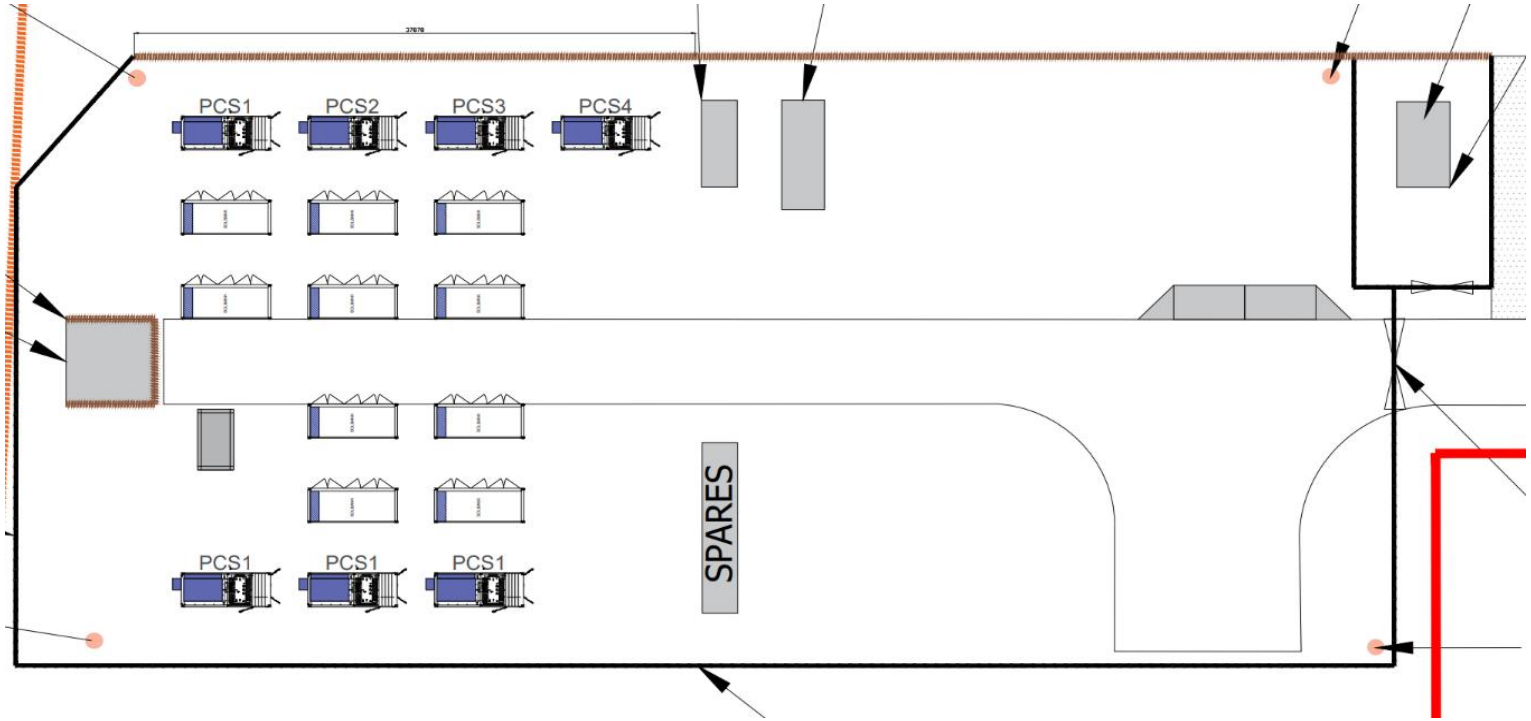
PCS String Skid – 100% fan speed

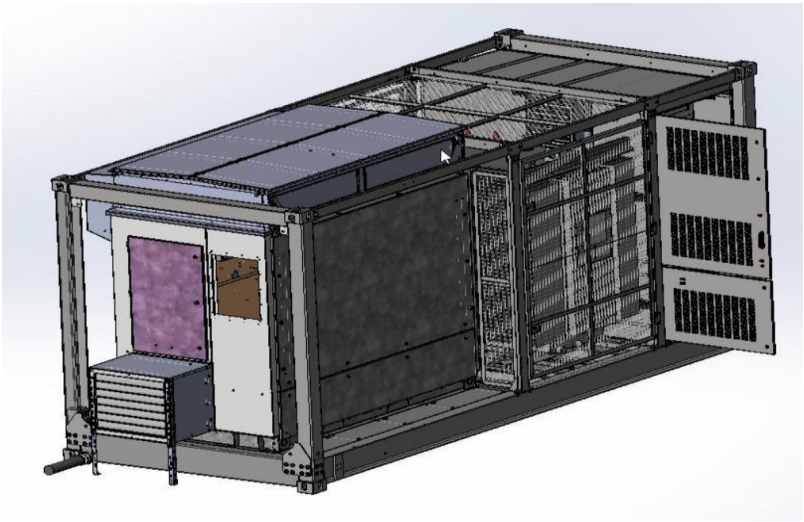
7m	10m	9m	8m	7m	6m	5m	4m	3m	2m	1m					1m	2m	3m	4m	5m	6m	7m	8m	9m	10m
6m																								
5m						50.6					50.6			50.1					50.6					
4m							51.7				51.7			51.7				52.0						
3m								53.0			53.2			53.1			53.5							
2m									56.3		55.8			54.6		54.0								
1m										56.1	57.3	56.8	57.4	56.9	56.6									
	50.5	50.5	50.7	51.0	51.4	53.5	54.1	54.7	56.2	58.2					58.3	56.4	55.2	53.9	53.6	51.2	51.2	50.0	49.5	48.8
										58.6					60.1									
	50.4	50.3	49.4	50.6	51.3	52.3	54.4	55.3	57.4	59.9					60.8	57.5	55.7	54.6	54.1	52.3	51.2	50.5	49.9	49.5
	50.1	49.2	49.7	51.1	51.7	53.0	54.0	55.1	57.2	60.1					60.3	57.6	55.6	54.5	54.4	51.9	51.3	50.9	49.5	49.2
										59.8					59.6									
	50.5	48.9	48.9	49.9	51.9	51.5	53.5	53.0	56.0	58.1					58.2	56.2	54.8	54.1	53.5	51.5	50.7	49.4	48.8	49.2
1m										56.3	57.3	56.6	57.8	57.2	56.7									
2m									54.8		55.8			54.6		54.2								
3m								52.4			53.3			53.4			52.2							
4m							51.5				51.5			52.2				51.4						
5m						50.1					50.5			51.3					51.2					
6m																								
7m																								



Direct the noise away from the houses

Project site with houses to the East





UK project example: Initially failed to meet noise requirements

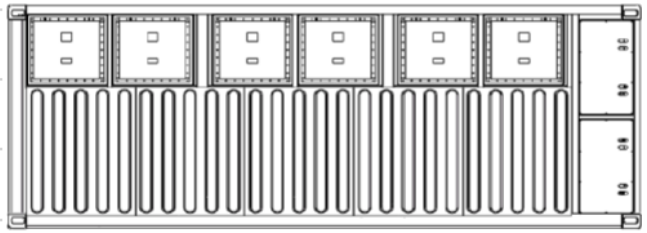
Our solution: through intelligent layout redesign, the noise is pointed away from the adjacent houses (noise receptors)

Operational Control

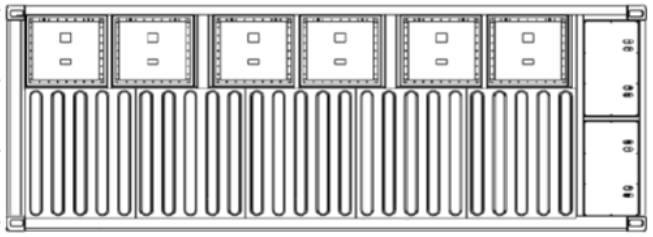
Turn down the noise

SolBank - 80% fan speed

										1m	2m	3m	4m	5m	6m	7m	8m	9m	10m	15m	30m	50m
10m									55.2													
2m				55.1				55.2														
1m		54.7		55.1		53.8		54.2	59.9	64.5	64.0											
	53.4	54.1																				
										71.7	68.1	64.7	63.3	61.7	60.9	60.1	59.2	57.8	57.2	55.6	54.1	53.6
	53.4	53.7																				
1m		53.4		53.0		54.7		55.7	60.8	64.9	63.8											
2m				52.7				53.9														
10m									54.0													



SolBank - 60% fan speed

									1m	2m	3m	4m	5m	6m	7m	8m	9m	10m	15m	30m	50m
10m								53.5													
2m				54.0			53.4														
1m		52.7		53.3		53.0	53.3	55.5	57.1	56.3											
	51.9	52.1							63.8	59.5	57.6	56.1	55.5	55.4	55.1	54.9	54.7	54.5	54.4	53.6	54.0
	52.2	52.3																			
1m		51.9		52.9		53.2	53.3	54.9	57.6	56.1											
2m				52.1			53.3														
10m								52.2													

Fan Speed / Ambient Temperature – SolBank 3

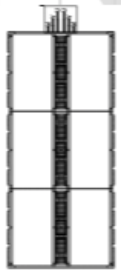
NR mode	Ambient Temperature deg C	P rate of SolBank 3	Noise dB(A)	Equivalence
III (80% fan speed)	35	0.5 (full power)	67.0	UK max daytime temperature
I (60% fan speed)	25	0.5 (full power)	59.5	UK max night-time temperature

PCS String Skid – 80% fan speed

7m	10m	9m	8m	7m	6m	5m	4m	3m	2m	1m					1m	2m	3m	4m	5m	6m	7m	8m	9m	10m
6m																								
5m						47.1					46.7			46.8					46.2					
4m							47.5				47.2			47.0				47.5						
3m								49.7			49.7			50.6			50.6							
2m									50.7		52.0			51.2		50.9								
1m										53.3	54.6	54.0	54.1	54.3	53.8									
	46.8	47.1	47.5	48.0	48.9	49.5	50.1	51.5	52.3	55.0					55.0	53.9	52.4	49.7	49.1	47.9	46.7	47.4	45.6	44.7
										55.3					56.4									
	45.6	46.4	45.8	46.4	48.0	48.5	49.7	51.5	53.5	56.6					56.8	54.8	53.0	50.7	49.3	49.5	47.1	47.0	45.8	45.0
	44.5	45.9	46.2	46.2	47.5	48.5	49.7	51.8	53.8	56.9					57.0	54.8	52.4	50.7	49.5	49.5	47.1	47.0	45.6	44.5
										56.4					56.1									
	43.6	45.5	45.3	45.9	47.6	47.2	48.8	50.7	52.4	54.5					54.7	53.3	51.3	49.7	48.8	48.4	47.1	45.5	45.9	43.6
1m										52.4	53.8	53.6	54.3	53.3	52.3									
2m									50.6		51.4			50.9		50.4								
3m								49.4			49.5			49.7			49.1							
4m							47.9				47.6			47.8				47.2						
5m						47.1					47.0			47.0					46.4					
6m																								
7m																								

PCS String Skid – 60% fan speed

7m	10m	9m	8m	7m	6m	5m	4m	3m	2m	1m					1m	2m	3m	4m	5m	6m	7m	8m	9m	10m
6m																								
5m						45.8					46.4			44.5					42.8					
4m							42.6				42.2			42.1				41.6						
3m								44.7			43.8			43.2			45.5							
2m									44.8		46.7			46.2		47.1								
1m										47.2	48.7	48.0	48.2	48.2	46.7									
	47.1	44.7	46.2	47.0	47.1	47.4	46.4	46.8	46.8	48.4					48.3	47.2	45.2	43.8	42.3	44.7	44.5	44.7	43.8	42.8
										48.5					48.5									
	44.5	42.8	45.5	44.5	45.3	44.3	43.6	44.8	46.7	48.7					50.3	47.8	46.5	46.1	44.0	46.8	45.5	43.8	44.0	44.0
	43.4	42.6	44.3	43.0	45.0	44.7	43.6	45.0	47.0	49.1					49.9	47.6	46.4	45.5	43.4	45.3	46.2	45.2	43.2	42.8
										48.7					49.4									
	42.9	42.8	42.8	42.5	43.4	44.5	42.7	44.0	45.6	47.4					47.6	45.8	44.3	42.8	42.3	45.0	47.1	45.2	44.0	43.4
1m										46.5	47.5	46.8	48.2	46.7	45.9									
2m									45.2		45.5			46.4		43.4								
3m								44.7			43.2			44.8			44.7							
4m							42.5				42.5			43.2				41.5						
5m						46.2					41.2			42.2					41.3					
6m																								
7m																								



Fan Speed / Ambient Temperature – PCS String Skid

NR mode	Ambient Temperature deg C	P rate of SolBank 3	Noise dB(A)	Equivalence
III (80% fan speed)	35	0.5 (full power)	57.0	UK max daytime temperature
I (60% fan speed)	25	0.5 (full power)	50.0	UK max night-time temperature

Summary

Site Selection

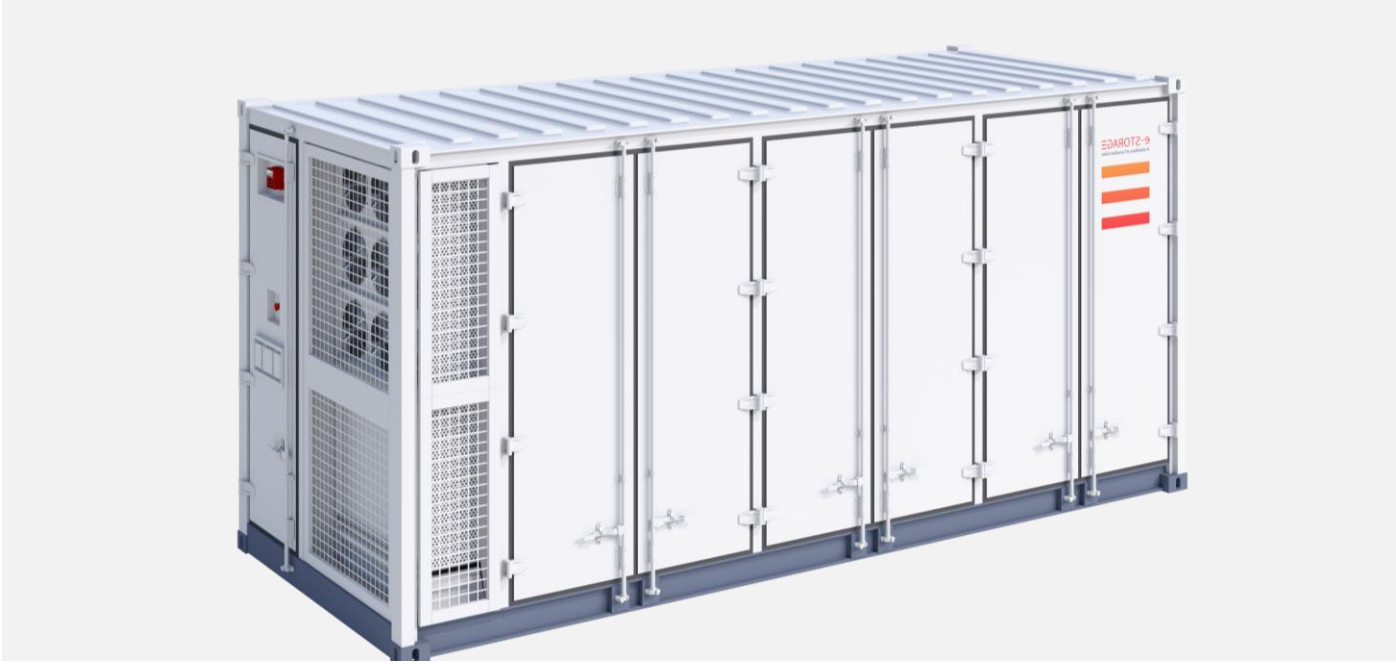
Select site considering background noise and location of noise sensitive receptors

Equipment

Chose equipment with low noise and utilize intelligent design and layout

Operational Control

Turn down the noise according to temperature to meet noise requirements



Richard A. Batty – Technical Manager

Please visit us at Stand 02 to book a Noise Design Workshop