

Specifications for 200 kWh / 50 kW Vanadium Flow battery

1. Introduction:

BHEL is one of the leading engineering organisations in the world contributing to society in the diversified fields in design, engineering, manufacturing and erection & commissioning of power generation equipment, power transmission system, transportation and industrial automation.

BHEL is planning to develop 200 kWh/ 50 kW Vanadium Flow battery based Energy Storage System by sourcing Battery and BMS from the most suitable battery manufacturer for following Energy storage applications.

- 1) Output smoothening of SPV power output
- 2) Frequency regulation
- 3) Time shifting of energy generation and consumption
- 4) Peak load saving

Offers for Battery & BMS are solicited from reputed OEMs. . The OEM must provide relevant details of the battery and BMS for integration with BHEL developed power conditioning and SCADA system for above mentioned ESS functions.

Specification for Battery & BMS are as given below

2. Specifications for the Battery:

The offered Flow Battery system should be a self-contained device including all necessary control and regulation elements in order to operate as a battery under the specified environmental conditions. The offered Flow Battery system must necessarily include tanks for storage of electrolyte, fluid conduit(s), electrolyte transfer means (e.g. electric pump) for the flow of the electrolyte, heat exchangers in order regulate the electrolyte temperature, electrochemical cell(s) and electrical contacts (battery terminals). Additionally, the offered Flow Battery should contain all other components necessary for operation, for example, but not limited to, fluid valves, electrolyte filters, heat-exchangers, battery management system (e.g. pump controller), sensors (e.g. state-of-charge sensor) and matching battery management system for reliable functioning of the battery.

A. Data for evaluation:

S.No	Parameter	Rating	Remarks	Complied(Y/N)
1	Energy	200 kWh		
2	Nominal Power	50 kW	For 4 hours	
3	DC-DC Cycle Efficiency	Min 70 %		
4	Service Life	20 years		
5	No of cycles	>10000		
6	DOD allowed	0-100% (Should not be any impact on battery life)		
7	Response time	<75ms		
8	Self-discharge per day	< 0.02%		
9	Climatic operating conditions	0-50 degree centigrade with 90 % humidity		
10	Enclosure	Total system should be enclosed in a IP54 container		

In addition to the above, following parameters are to be furnished by the supplier to BHEL along with the offer for developing PCS, SCADA and other sub-systems which are not under scope of supplier.

B. Additional information:

1	Short circuit current at 100 % SOC
2	Nominal terminal Voltage
3	Lifetime Energy delivered during service life
4	(a) Configuration of the battery (b) Open circuit voltage of each cell (c) Max and Min cut-off voltages
5	Tables of data or graphs a) Maximum charge power as a function of charge level b) Maximum discharge power as a function of charge level c) Curves of capacity vs. time for various power setting d) Discharge capacity as a function of discharge power e) Charge energy as a function of charge power f) Discharge energy as a function of discharge power
6	Physical dimensions of the Container
7	Auxiliary Power Supply requirement
8	External Interfaces
9	Safety Precautions

3. Specifications for the Battery Management System (BMS):

Suitable battery management system (BMS) should be offered reliable functioning of the offered flow battery under normal and abnormal operation. The offered BMS must provide display, data logging, protection, diagnostic, and communication with SCADA or PCS etc. features for reliable operation of the battery.

The offered Control Hardware and Software for BMS should perform the above functions. Please provide response (Yes/No) to the following features of the offered BMS along with necessary technical details.

S.No	Operations of BMS	Yes/No
1	Protection and Control i. Thermal management ii. Operating between safe current and voltage limits iii. Shutdown / communication on detection of faults iv. Providing optimal charging patterns v. Control of Electrolyte Flow vi. Protection alarms/indications vii. Detection of Electrolyte Leakage	
2	Measure i. Report Real time SOC	
3	Monitoring i. Battery bank Current/Voltage monitoring	

	<ul style="list-style-type: none"> ii. Monitoring of system performance and health indicators iii. Monitor SOH 	
4	Data recording <ul style="list-style-type: none"> i. Event recording and storage features ii. Display of important parameters like voltage, current, SOC, health indicators etc. 	
5	Any other parameter which is not specified, but required for safe operation of battery	
6	Hardware and communication details	

4. General Conditions:

- i. The suppliers should have supplied / commissioned Vanadium Flow battery of rating at least 100 kWh with BMS in the last two years and should have been in operational for the last one year. Documentary evidence against the same shall be submitted along with the offer. Offers not meeting the above criteria will not be considered.
- ii. The battery and BMS should be erected and commissioned by the supplier at BHEL site, Hyderabad. As the PCS and other switch gear is under the scope of the BHEL, the prospective supplier should support BHEL in commissioning total ESS system. Supplier should complete erection and commissioning within 45 days of receipt of Intimation from BHEL.
- iii. The supplier should demonstrate the following features of ESS at its factory as a part of Factory Acceptance Test (FAT) before despatch of equipment. The vendor shall develop and submit a comprehensive FAT plan for battery and BMS to BHEL for its review and approval.
 - a) At least 4 no of full charging and discharging cycles for at least 50 % of rated energy and power level.
 - b) Operation of BMS with all features
 - c) Maintenance and replacement functions
 - d) Data logging and display of BMS
 - e) Testing of sensors, alarms and metering

Supplier should give minimum of 45 days notice to BHEL about readiness of system for testing. Travel and Hospitality for BHEL Inspectors will be to BHEL Account.
- iv. The warranty for Batteries & Battery Management System should be for at least 5 years from the date of commissioning. The prospective supplier shall submit Performance Bank Guarantee (PBG) for 10 % of the order value towards warranty for 5 years plus 2 months claim period.
- v. The prospective supplier shall submit offer for erection & commissioning charges separately along with the taxes applicable, which include erection, commissioning, performance tests at site, on-site training to operators etc.

- vi. The battery container should be self-sufficient with all safety and thermal management equipment for safer and proper operation of the battery. The supplier should mention these equipment details in his offer.

- vii. Vendor shall provide a list of mandatory spares for the offered system. The prices of these spares shall be quoted separately as optional which may be considered during evaluation of bid. It shall not be binding on BHEL to procure all of these mandatory spares.