



Name:

Enrolment No:

UPES

End Semester Examination, December 2023

Course: E_Vehicles & Energy Storage

Program: BBA GES

Course Code: OGET 3008

Semester: V

Time : 03 hrs.

Max. Marks: 100

Instructions:

SECTION A

10Qx2M=20Marks (Answer All Question)

S. No.		Marks	CO
Q 1	Which of the following storage method has working like the cycle of a Gas turbine Power plant? A: SMES B: Flywheel C: Pumped Hydroelectric D: Compressed Air Energy Storage	2	CO1
Q 2	Which of the following battery parameters is important in determining the range in an Electric Vehicle? A: Specific Power B: Volumetric Energy density C: Gravimetric Energy density D: Cycle Life	2	CO1
Q 3	_____ can be defined as the amount of stored energy relative to the total energy storage capacity of the battery A: State of Charge B: Depth of Discharge C: Self discharge D: Specific Energy	2	CO1
Q 4	What is typically the value of specific energy density of Lithium-Ion batteries? A: 35 to 40 Wh/kg B: 150 to 200 Wh/kg C: 300 to 500 Wh/kg D: 10 to 20 Wh/kg	2	CO1
Q 5	Which of the following Energy storage technology has highest energy density? A: Lead acid battery B: Nickel metal hydride battery C: Lithium ion battery D: Vanadium redox flow battery	2	CO1
Q 6	_____ stores energy in the form of rotational kinetic energy. A: Pumped hydro storage system	2	CO1

	B: Compressed Air energy storage C: Flywheel D: SMES		
Q 7	When was the first electric car invented? A:1830 B:1985 C:1832 D:1945	2	CO1
Q 8	Electric Vehicles are generally powered by _____ A: Aluminum batteries B: Lead-acid batteries C: Sodium batteries D: Magnesium batteries	2	CO1
Q 9	Who invented the battery? A: Alessandro Volta B: Alexander Bell C: Alessandro Bell D: Tim Southee	2	CO1
Q 10	Full form of ICE is _____ A: Internal combustion engine B: Internet combustion engine C: Internally combined engine D: Internet combined engine	2	CO1
SECTION B 4Qx5M= 20 Marks			
Q 1	What is Grey Hydrogen, Black Hydrogen and Pink Hydrogen?	5	CO2
Q 2	Write 5 major performance indicators wrt Energy Storage.	5	CO2
Q 3	Why DISCOMs should integrate Energy storage as part of their business process?	5	CO2
Q 4	What challenges Dicoms will face for high penetration of E-Vehicles and how the challenges can be resolved?	5	CO2
SECTION-C 3Qx10M=30 Marks			
Q 1	Analyze the process of Power to Gas technology with proper schematic diagram.	10	CO3
Q 2	What steps Government of India have undertaken to promote E-Vehicle?	10	CO3
Q 3	Analyze various Charging technologies for Electric Vehicle.	10	CO3
SECTION-D 2Qx15M= 30 Marks			
	Aypa Power has secured a portfolio debt and tax equity financing package totalling US\$550 million for two battery energy storage system (BESS) projects in California and Texas.		CO4

	<p>Aypa, part of the world’s largest private equity firm Blackstone, secured the debt from First Citizens Bank & Trust Company, Nomura Securities International, Inc., National Bank of Canada and MUFG Bank, LTD. while U.S. Bancorp Impact Finance provided the tax equity investment.</p> <p>The money will go towards the Cald project, a 100MW/400MWh standalone system in urban Los Angeles, and the Borden County project, a 150MW/300MWh project in Texas. Both are currently under construction and set to enter commercial operation in 2024.</p> <p>The projects are likely to be those for which Aypa ordered BESS systems from the energy storage arm of Canadian Solar earlier this year: a 487MWh order for an unnamed California project in February and a 363MWh order for an unnamed project in Texas. The larger size is most likely because of the need to overbuild a project to account for energy losses from DC to AC conversion at the inverter.</p> <p>BESS projects in California are mostly 4-hour systems in order to get the maximum payment under the grid operator CAISO’s Resource Adequacy framework, the basis of the business case for grid-scale storage there. Aypa’s Cald project has secured an agreement under it with utility San Diego Gas & Electric (SDG&E).</p> <p>In Texas, BESS still mainly get revenues from the state’s large ancillary services market and so have not moved significantly past 1 or 2-hour duration yet. However, the ancillary service market is pegged to start to saturate next year while recent state-of-charge regulations from grid operator ERCOT mean virtually all new projects are at least 2-hour systems.</p> <p>Aypa has been owned by Blackstone since 2020, before which it was called NRSTOR C&I when it focused on the commercial and industrial (C&I) segment, though it has since pivoted to the utility-scale market. Alongside being active in the US’ two biggest markets for storage (California and Texas) this year it acquired BESS projects in Indiana.</p> <p>The size of the tax equity portion of the financing package was not disclosed but it represents the latest in a string of large tax equity investments into standalone storage seen in the past few months, including from developer-operators Spearmint Energy, Plus Power, SMT Energy and SUSI, Strata Clean Energy and Eolian (earlier in the year).</p>		
Q1	What are the financing tools that can used for financing any Energy storage projects?	15	CO4
Q 2	If this project was selected through a proper bidding process, then suggest through what 10 parameters L1 bidder will be selecte.	15	CO4