Solar PV and Battery Storage Colocation Thought Leadership Series – Part 2

This ITPEnergised insights series examines the techno-economics of solar PV and battery storage colocation projects in the GB (Great Britain) market. The series is arranged with an introduction to battery storage first, then builds from this in the remainder of the series to discuss the key value drivers of additionally including solar PV with battery storage in colocation (*figures are illustrative*).

Part 2 – Introducing the Techno-Economics of Solar PV and Battery Storage Colocation Projects

For colocation we use the definition for this insight series where a solar PV farm is connected to the same main grid connection as battery storage. Wind farms will be considered in a later insight series. A single line diagram is shown below for a greenfield solar PV and battery storage colocation project that is DC coupled and a retrofit project with battery being added to an existing solar PV project which is AC coupled. Both schemes are shown with separate import-export metering.

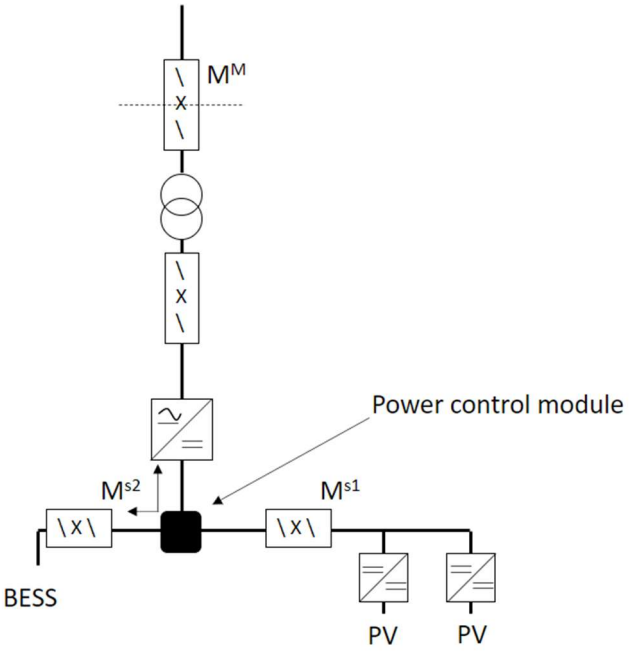

Figure 1 – Greenfield Colocated Solar PV and Battery Storage Single Line Diagram

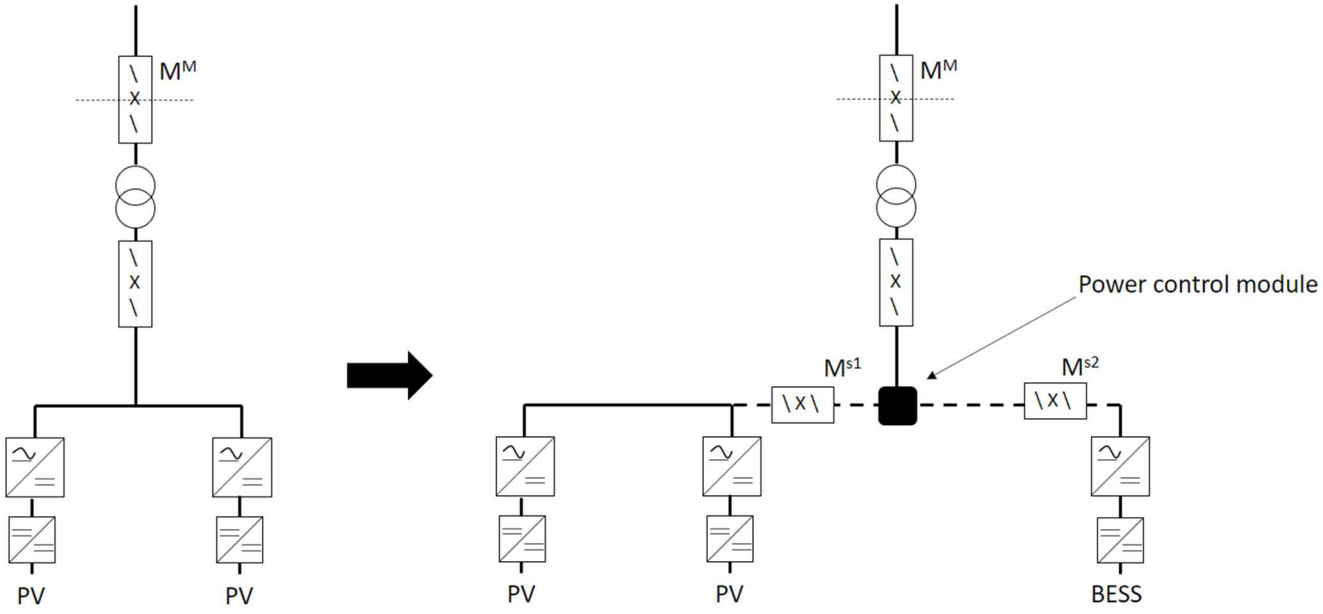

Figure 2 – Retrofit Colocated Solar PV and Battery Storage Single Line Diagram

Key:

Key	Description
Mm	Main meter
Ms1	Secondary meter for the solar PV
Ms2	Secondary meter for the battery

We then consider three cases of techno-economic study to drive a comparative analysis of NPV, IRR, investment capex and ratio of merchant to contracted revenues which is a proxy for risk appetite.
The three optimisation frameworks are shown in the diagram below.

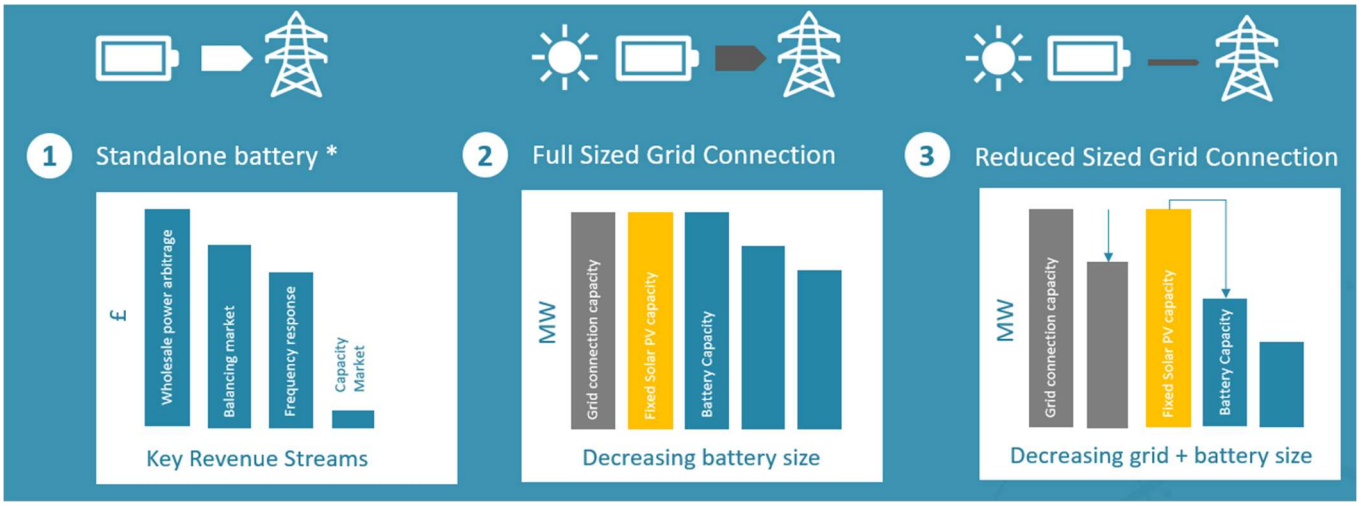

Figure 3 – Three techno-economic optimisation frameworks

Case 1 concerns a standalone battery storage project and the associated revenue streams that can be back tested to the market.
Case 2 considers a full-sized grid connection adequate to export the full capacity of the solar PV farm with varying levels of battery capacity at a fixed duration to derive the optimum economics and compare the techno-economics of a standalone solar PV before to the colocated project after.
Case 3 is used to drive better techno-economic-capex-risk outcomes, where we over plant the solar PV farm and make it larger than the grid connection itself in capacity terms. This reduces grid connection capex whilst improving grid connection load factor with smaller grid connection schemes having the potential for more accelerated times to connect enabling faster positive cash flow for a project. Again, we compare the techno-economics of a standalone solar PV before to the colocated project after.

Our methodology is proprietary but as we discover more information through our due diligence or technical development process with our grid, renewable technical services, and environmental planning teams we continue to optimise the techno-economics. This then gets reflected into the technical design whilst still ensuring the configuration fits within the planning regime and grid connection parameters.

A summary of an illustrative case for the three techno-economic frameworks is shown in the table below, assuming the same solar PV capacity and that the solar PV and battery project use the same discount rate. Please note results can vary from project to project.

Illustrative Economic Ranking			
KPI	Full size grid connection	Reduced size grid connection	Standalone battery
NPV	1st	2nd	3rd
IRR	2nd	3rd	1st
Lowest Capex	3rd	1st	2nd
Lowest Merchant Risk	2nd	1st	3rd

Table 1 – Illustrative Economic Ranking of Three Techno-economic Optimisation Frameworks

In our remaining insight articles, we will examine some of the key drivers of colocation economics, including the impact of wholesale price volatility, location within GB and finally a summary of the key drivers of colocation project value. To find out how we can help you optimise the size your colocation project and to provide accompanying due diligence services please contact peter.lo@itpenergised.com.