ENERGY STORAGE TECHNOLOGY IN MICROGRIDS

TEHNOLOGIA DE STOCARE A ENERGIEI ÎN MICROREŢELE

Teodora MINDRA[1], Oana CHENARU[2], Gheorghe Florea[3], Radu DOBRESCU[4]

Abstract: *Microgrids can incorporate different renewable energy technologies, in this case helping to increase the quality of the environment and the achievement of carbon footprint indicators by companies that contribute to the development of sustainable economies. An important benefit is the possibility of use of stored energy, integrated with several green resources, compensating the limitations of their individual use and storing a fairly large quantity that can be used or sold to electricity market at the opportune time.*

Keywords: microgrid, battery energy storage, balance of system

Abstract: *Microrețelele pot încorpora diferite tehnologii de energie regenerabilă, contribuind în acest caz la creșterea calității mediului și la realizarea indicatorilor scăderii amprentei de carbon, de către companiile care le folosesc și la dezvoltarea economiilor durabile. Un beneficiu important este posibilitatea de utilizare a energiei stocate, compensând limitările utilizării lor individuale și stocarea unei cantități destul de mari care poate fi utilizată sau vândută la momentul oportun către piața de energie electrică.*

Keywords: microreţea, stocarea energiei în baterie, echilibrarea cu sistemul

1. Introduction

The energy industry is closely linked to changes in society and nature (such as climate change), given the intensification of energy production, mainly through the extraction, transformation and combustion of fossil fuels, but also to energy consumption in industry, households, transport, etc.), which represents 79% of the greenhouse gas emissions in the European Union, this

[1] Eng. at Societatea de Inginerie Sisteme SIS SA, teodora.mindra@sis.ro
[2] Head of Research, Development & Software Implementation Department at Societatea de Inginerie Sisteme SIS SA, oana.chenaru@sis.ro
[3] CEO at Societatea de Inginerie Sisteme SIS SA, gelu.florea@sis.ro
[4] Prof.PhD.Eng. at Polytechnic University of Bucharest, Faculty of Computer Science, radu.dobrescu@aii.pub.ro

being the main problem related to the energy field. Thus, estimated that an economy is booming, when energy consumption in all sectors is growing. [1]

In order to meet the above-mentioned EU climate change and energy policy targets by 2030, a major transformation of our electricity infrastructure will be needed. Strengthening and modernizing existing primary networks is important for integrating an increasing amount of renewable energy production, improving network security, developing the internal energy market and achieving energy efficiency. To achieve these goals, it is not only necessary to build new lines and stations, but it is essential to use the global electricity system more intelligently by integrating information and communication technologies (ICT). Sustainable use of energy requires the use of renewable energy sources wherever possible, in order to conserve fossil fuel resources and limit environmental pollution. As a current approach is to promote energy efficiency measures and the use of renewable energy sources, it is important to know the resources currently available and how to use them to meet energy needs.

A microgrid is a group of energy sources located close to consumers so that an interconnected unitary system is formed. Depending on the type of power source (AC/DC), they are connected to either the AC bus or the DC bus. Microgrids can operate connected to the network or can be independent of it, being able to operate, for a limited period, disconnected from the public network (islanded mode). The main benefit associated with the implementation of a microgrid is given by the increase of energy independence of the unit it serves (medical center, office building, data center, production space, etc.), allowing power from multiple sources, both renewable and fuel-based fossils, independent of the national network. Year 2021 is expected to be another record year for microgrid energy storage. However, with technological innovation accelerating to the market, renewable asset owners must carefully choose safe and reliable systems to protect their investment in energy storage, energy management, monitoring and control.

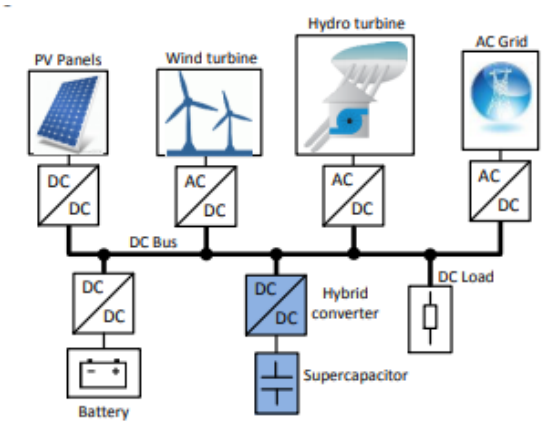

Figure 1 - Block structure of a microgrid network [2]

A primary level of operation can only be achieved by making electrical connections for the interconnection of generating elements and consumers, a classic example being the use of a gas generator to take over the load in case of a voltage drop. However, the benefits can be significantly improved by using a control system to intelligently manage and optimize generation and storage resources, which will automatically make choices that offer economic benefits and energy stability. Such a national solution is provided by SIS S.A. and Monsson office, through Innovation Norway financing. [3]

The microgrid, through the function of storage and management of batteries, can balance between these resources so as to achieve a reduction in costs and even additional revenue if the energy generated is in excess. The user thus becomes a prosumer, an active player on the energy market, having the opportunity to decide how much, when and at what cost to produce, storage, consume or store this resource. Depending on the user's consumption curve, the importance of consumers, the price of electricity, the price of gas and the weather forecast, the use of energy sources can be optimized to make optimal decisions. However, users of microgrid and energy storage systems may see substantially higher prices for their projects, depending on a number of factors.

The battery energy storage systems allow the microgrid to maximize the amount of renewable energy it uses by compensating sudden variations in the power output of photovoltaic panels and wind turbines. The system will

provide ultra-fast response spinning reserves to help maintain grid stability and reduce the need for diesel generator sets to be idle for this purpose.

2. Related work

It is essential to follow globally the evolution of microgrid and the storage trend in smart grid systems. If the entire systems of microgrids (hardware and software) cannot properly and optimally manage charging and discharging at the right amount and the right time, then the chosen storage system may thin the value stack and reduce project profitability.

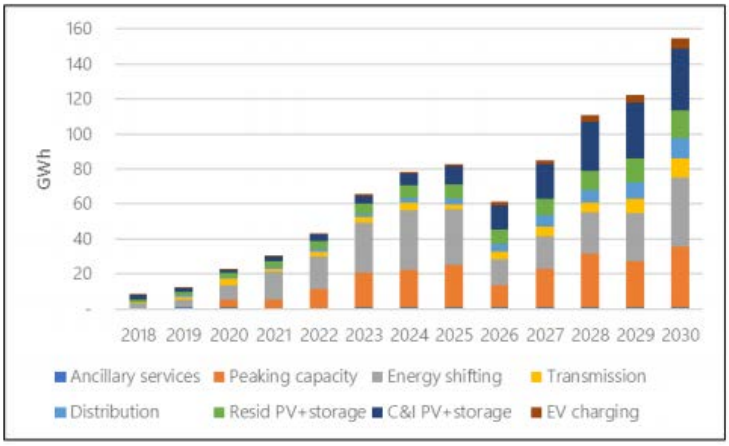

Figure 2 - Global projected grid-related annual deployments by application (2015–2030) Source: Bloomberg New Energy Finance, "2019 Long-Term Energy Storage Outlook," BloombergNEF, New York, 2019. Available: https://about.bnef.com/blog/energy-storage-investments-boom-battery-costs-halve-next-decade/

The world needs sustainable batteries to help meet the EU 2050 climate goals, particularly in transport and in the integration of renewable energy. The European Commission wants to improve the sustainability of batteries – and rightly so. The rapid growth of battery demand puts pressure on raw material resources. The legislation aims to ensure that buyers can identify and select batteries with the lowest carbon footprint. This will depend on real-world data on carbon dioxide emissions in each step of the procurement and processing of raw materials and the manufacture of all battery components and their assembly into finished products.

Such as global energy storage implementations through technology of 2018, reaches nearly 173 GW of energy storage [4]. In 2021, the first two options are lithium nickel manganese cobalt and lithium iron phosphate.

In the paper [5] is presented the interest in the form of an integrated renewable energy system model based on simulation was developed using MATLAB / Simulink. The battery is connected to the microgrid through a bidirectional converter that must allow charging and discharging to match supply to demand. The entire system works as a DC microgrid, composed of solar photovoltaic and wind energy such as renewable generators, lithium-ion batteries and inductive charging.

The operating modes of microgrid battery integration, in [6] is represented by a suitable switching sequence are detailed and a control scheme is also suggested. The complete simulation analysis performed guides component selection and drive design. It also introduces a key comparison between the proposed converter and the main single-phase bidirectional DC/AC converter.

3. Application for microgrid storage, design and implementation

In addition, the use of energy storage is an opportunity to improve the overall performance of the system, especially when considering primary energy sources with stochastic characteristics (such as wind energy and solar energy), energy storage becomes important because it can compensate for power fluctuations flowing. The conversion, conversion and storage of various forms of energy can be done in a unit called the energy center.

For example, the lowest price for lithium-ion batteries is generally available either for a major supply contract or for very large-scale deployments of 500 megawatt-hours and more. In addition to battery charging, the total cost of a fully integrated battery energy storage system will also include thermal management systems, battery management systems, and energy conversion systems, as well as fire suppression, SCADA and control technology. A case study developed by SIS Team in cooperation with Monsson Group demonstrate the advantages of using Battery storage for band delivery

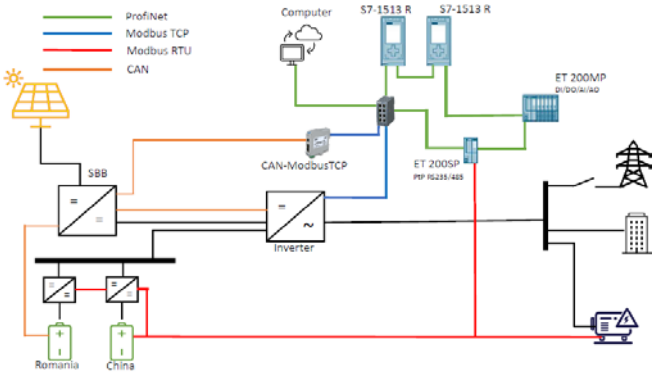

Figure 3 - SIS's control architecture

Two of the most promising strategies for optimization of microgrid functionality and performances was developed and tested; Peak Shaving and Time Shifting

4. Conclusions

With the adoption of utility-scale rechargeable power, consumer electronics, solar and wind energy projects, and stationary energy storage projects, the global demand for battery products is growing.

Energy storage will play a key role in promoting the global transition to a clean energy economy, but in the final analysis, there is no shortage or quality substitution.

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