Microgrid development bosnia and herzegovina

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One way to increase reliability and quality of electrical power supply in advanced power generation networks is the integration of distributed production, energy storage and energy management on level of microgrids and distribution networks. Benefits of distributed production are reduction in transmission and distribution losses, improved utilization of energy sources, shorter construction time and possibility of production at all voltage levels.

Hybrid power systems (HPS) are designed for the generation and use of electrical power. They are independent of a large, centralized electricity grid and incorporate more than one type of power source. They may range in size from relatively large island grids of many megawatts to individual household power supplies on the order of one kilowatt. In general, a hybrid system might contain AC diesel generators, DC diesel generators, an AC distribution system, a DC distribution system, loads, renewable power sources (wind turbines, photovoltaic power sources, small hydro power plant), energy storage, power converters, rotary converters, coupled diesel systems, dump loads, load management options or a supervisory control system [1].

Analysis in [2] focuses on the comparative analysis between HPSs on a microgrid and the supply option over the transmission and distribution network. Autonomous HPSs are conceptualized by taking into account storage in the electric vehicles of guests and employees within the treated example of the winter tourist center. In this way, a possible future concept for a sustainable power supply is proposed, focusing on locally available RES utilization and capacity optimization, in accordance with real indicators at the site.

The distribution system energy system needs to evolve to facilitate such access to distributed generation based on renewable energy sources and to establish a communication system that will enable interaction with end users to gain data on the amount of energy required. The presence of distributed sources slowly transforms the distribution network from the passive network into active, resulting in some branches of the network changing the direction of power flows [8]. The active network requires new equipment and services, voltage control, system protection and calculation of power flows, which makes it harder for the job of the system dispatcher. But the main function of such a network is, of course, to equalize production and consumption of electricity in real time.

Bjelimi?i is community of villages located in the southeastern part of the municipality of Konjic. Konjic is located in northern Herzegovina and is mountainous, heavily wooded area. Bjelimi?i is wide, hilly area between the mountains Viso?ica, Treskavica and Crvnja, and is 1000 m above sea level. It has great potential for installing renewable energy resources on this area.

Figure 1 shows the georeferenced scheme of the medium voltage distribution network in analyzed area Bjelimi?i.

Georeferenced scheme of the area Bjelimi?i

Besides complete topology and georeferenced scheme, the materials used in this paper consist of real network parameters of components (transformers, lines, loads) in the feeder 10 kV La?anica, then load profiles of loads (mostly village houses) on TS 10(20)/0.4 kV Od?aci and TS 10(20)/0.4 kV Luka, in 15-min intervals for 1 year (2016) and wind potential and solar insolation measurement data from wind atlas and PVGIS.

According to load profile of this area, data for PV, wind and diesel generator will be taken from PVGIS, wind atlas and HOMER generators catalogue, respectively. After entering this into HOMER software, appropriate HPS configuration will be established, based on least-cost investment optimization.

The load following strategy is a dispatch strategy whereby whenever a generator operates, it produces only enough power to meet the primary load. Lower-priority objectives such as charging the storage bank or serving the deferrable load are left to the renewable power sources. The generator can still ramp up and sell power to the grid if it is economically advantageous [11] (Table 1).

The real network will be modeled in DIgSILENT PowerFactory software, but due to the limited number of buses that are allowed with used software license, the certain parts of network would be implemented as equivalent loads. For modeling microgrid in this software, data obtained from HOMER will be used. Two modes of operation will be analyzed, grid-connected and island mode. For both cases, two scenarios will be obtained, winter and summer scenarios. After this, power flow, voltage profiles, line and transformer loading, and total grid losses will be compared and analyzed.

Results section will be divided into two subsections, one for results from HOMER and another for results from DIgSILENT PowerFactory (Table 2).