Palestine energy storage for grid stability

Others handled the REs from various points of respect, motives, and challenges [25, 26], strategies and policies [27,28,29], achievements and barriers [30], creating HRESs [31], locating and mapping [5, 32], experiences [33, 34], evaluating and modelling [35,36,37], estimating and assessing [6, 38,39,40,41], utilization [42], and experiences and lessons learning from neighbouring countries [43,44,45,46].

The key future of this paper is highlighting the individual REs potentials (electrical and thermal solar, wind, and biomass energy) in Jenin Governorate, making this study the most comprehensive in this field. In this context, the present study has the following contributions:

Jenin city is located on the northernmost of the WB (Fig. 1) at coordinates 32? 27? 40? N, 35? 18? 00? E and has an area of about 37,342 dunams (37.3 km2). The population in Jenin is counted as 314,866 according to the Palestinian Central Bureau of Statistics in Ramallah for the year census 2021 [47].

Construction of the electric power plant in JG was started in 2016, and is expected to be completed in 2025, with a total capacity of 450 MW, and for $620,000,000. The Jenin power plant is expected to meet about 50% of the total electricity consumption in Palestine [48].

Although all previous studies unanimously agreed on the availability of solar energy in all parts of the Palestinian territories, including the JG, the unstable political situation in the region is considered a deterrent to investment in the Palestinian energy market. Despite all this, some small projects have been completed in the field of solar energy, and there are plans to establish more of them as the only way out of the energy crisis in the Governorate. Table 1 presents an inventory of solar projects in Jenin Governorate up to the year 2020 [29].

The approach followed in this research is demonstrated in the flowchart depicted in Fig. 3. The approach begins with importing data that include: meteorological, energetic, and economic data. The energetic and economic key figures of the solar and wind energy potential have been determined via SAM software [49]. Then, the data have been processed by the HOMER software, to optimize the design and size of HRES. The main constraints that hold during the simulation process are

The proposed isolated (HRES) should be providing a sustained supply of energy independently. As it is the unique source for fulfilling the load requirement of the Governorate, therefore, the power supply reliability operational constraint (PSROC) was expressed as [44]

The uncertainty in solar radiation resources is in part related to the instruments about 2.76% [50], in part to the translation of measured global horizontal irradiance to plane-of-array irradiance (POA) [51] about 6% [52], and the last part is the effective irradiance, which represents the irradiance converted to electrical current

within the module. It differs from POA due to several mechanisms: optical losses; and losses due to shading and soiling which is about 4% [53].