Feasibility Study of 23 kW Photovoltaic Power Plant Connected to the Grid in Haftkol City

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Abstract – Renewable energies, in addition to being inexhaustible, are among the clean energies and do not pollute the environment. Among renewable energies, solar energy is of special importance due to its extent and scope of application. In this article, the feasibility of building a photovoltaic power plant connected to the grid has been studied at the desired location, which selects the appropriate capacity and angle for the optimal use of solar power by the plant and reduces costs. Networking is very useful. In this paper, the feasibility study of a photovoltaic power plant with a capacity of 23.76 kW in Haftkol city, considering equipment, modules, power, voltage, inverter, optimal use of area and high reliability, has been designed using software. Land with an area of 144 square meters with an efficiency of 84.65% and 88 photovoltaic panels is considered and also the annual injection capacity to the network is 42350 MW.

Keywords: Solar energy, Pvsyst, Photovoltaic system

1. Introduction

Solar energy is the largest source of energy in the world. This energy is clean, free and endless, and in most parts of Korea Land can be extracted. Limitation of fossil resources and the consequences of environmental and global climate change,

Provide good opportunities for solar energy to compete with fossil fuels, especially in countries with potential for radiation Has created, It can supply a large part of its energy needs from sunlight. Grid-connected photovoltaic systems, along with other scattered sources such as small power plants, inject electrical energy into the grid. Due to the high initial cost of building photo power plants. Proper and principled design of the main components of the power plant with regard to economic issues and reliability is essential. Bozondunda et al., [1] studied the effect of shadow is due to the existence of construction around tree, on the function of the folding system Placed and specified effects are limited by conditions. There is a shadow over the operation of the system. Pars Karki et al. (2012) have presented a comparative study of grid-dependent photovoltaic system in Gotmando Berlin using pvsyst software [2]. A 60kw system has been simulated by the authors with similar parameters in two cities and the amount of energy produced the analysis is also escaped by the arrays as well as the energy injected into the grid [3]. India declared in its solar mission a goal of producing 22GW of electricity from solar energy by 2022 [4]. Energy production capacity of solar is very little compared to other countries. Grid Connected photovoltaic system has been generated 30,000MW in India and ~973MW stand alone systems in January 2014 [5]. Estimated PV growth is to around 100 MW in 2022, till now about 592,000 solar street and home lighting systems and 7300 agricultural pumps have been running in the rural area [6]. India's solar mission is structured in three phase in 2010: the purpose is to achieve the target 1 GW of grid-connected solar by 2013, the second 4GW by 2017 and the final to reach 22GW of PV capacity for power generation by the year of 2022. India stands now over 1GW PV capacity all over country [7].

2. Implementation in PVsyst software

PVsyst is simulation software that was first of all designed in Geneva and helps in calculating the working and operations of PV system. This software helps in designing the configuration of the system and also enables to calculate the amount of energy generated. The output is based on the simulation of the sizing system which further depends mainly on geographical. site location of PV system. Results may include several simulation variables that can be displayed in monthly, daily or hourly values. The ''Loss Diagram'' predicts the weaknesses in the system design Simulation in PVSyst is carried out in following steps.

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Received: 2021.11.17 ; Accepted: 2022.01.19

2.1 Defining the project

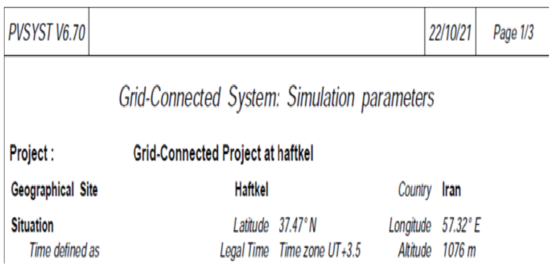
Different sites and meteo files are already present in the PVSyst. databases but one can create his own projects depending upon the location of the site and meteo files that are to be used.

2.2 Creating a system variant

Calculation version of the project created in step 1 is created by the user. Module orientation, system configuration and loss parameters are to be defined by the user.

2.3 Simulation and Results

Simulation generates different graphs and reports for the PV system. The user can analyze the results in the program, export them to a different program or save the results for further evaluation. Meteorological information extracted from the software is shown in figure 1.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Grid-Connected System: Simulation parameters

Project :	Grid-Connected Project at haftkel		
Geographical Site	Haftkel	Country	Iran
Situation	Latitude 37.47° N	Longitude	57.32° E
Time defined as	Legal Time Time zone UT+3.5	Altitude	1076 m

Fig.1 Meteorological information of the project

Figure 2 shows the designed system, which includes solar cells, inverters, and so on.

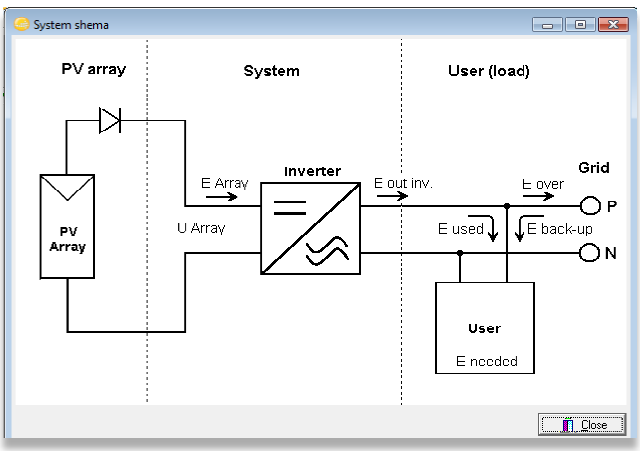
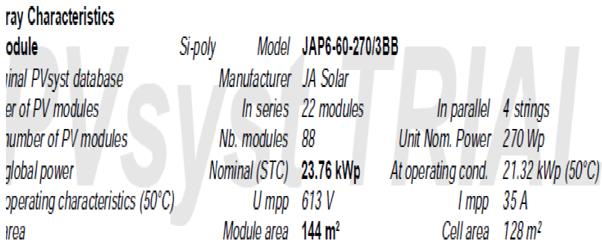


Fig.2 schematic of the system

Specifications of the desired standard module extracted from the software pvsyst:

Figure 3 shows the type of photovoltaic cell and the number, capacity and country of manufacture.


ray Characteristics

odule	Si-poly	Model	JAP6-60-270/3BB		
inal PVsyst database		Manufacturer	JA Solar		
er of PV modules		In series	22 modules	In parallel	4 strings
umber of PV modules		Nb. modules	88	Unit Nom. Power	270 Wp
global power		Nominal (STC)	23.76 kWp	At operating cond.	21.32 kWp (50°C)
operating characteristics (50°C)		U mpp	613 V	I mpp	35 A
rea		Module area	144 m²	Cell area	128 m²

Fig. 3 pv array models

As shown in the figure 3, in this paper, the angle of the photovoltaic panels for the city of Haftkol, a fixed angle of 34 degrees to the south, causes the annual radiation from the sun to increase 7 times compared to the horizontal radiation, and in this case the maximum The amount of radiation may be absorbed and the amount of radiation angle with this optimal angle selection will reach 2101 kWh per square meter.

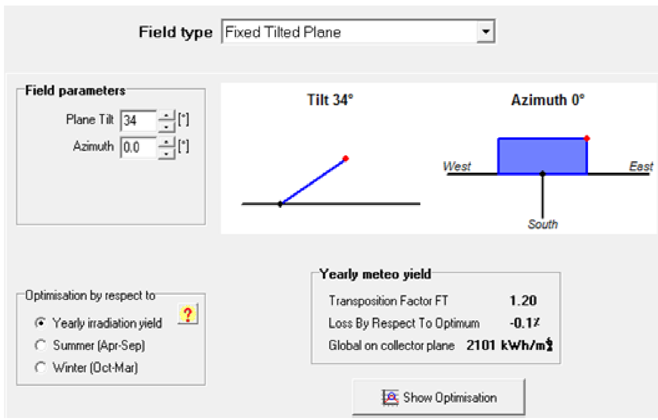


Fig.4 Angular position of photovoltaic panels: Angular position

In order for the electricity generated by photovoltaic solar panels to be suitable for injection into the power grid, solar inverters are used. KW You can use different models of inverters. In this article, a German inverter with the following specifications has been used.

Inverter	Model	Sunny Tripower 20000TL-30		
Original PVsyst database	Manufacturer	SMA		
Characteristics	Operating Voltage	320-800 V	Unit Nom. Power	20.0 kWac
Inverter pack	Nb. of inverters	2 * MPPT 50 %	Total Power	20 kWac
			Pnom ratio	1.19

Fig.5 Inverter specifications

Main simulation data is shown in figure 6.

Main simulation results				
System Production	Produced Energy	41.45 MWh/year	Specific prod.	1745 kWh/kWp/year
	Performance Ratio PR	84.69 %		

Fig.6 simulation data

In the figure 7, the two groups of losses per energy produced by photovoltaic modules at the inverter output in the system are the average losses during a month, which in the warmer months of the year due to ambient heat and more sunlight, these losses will increase. Is equal to 23.76 kWh.

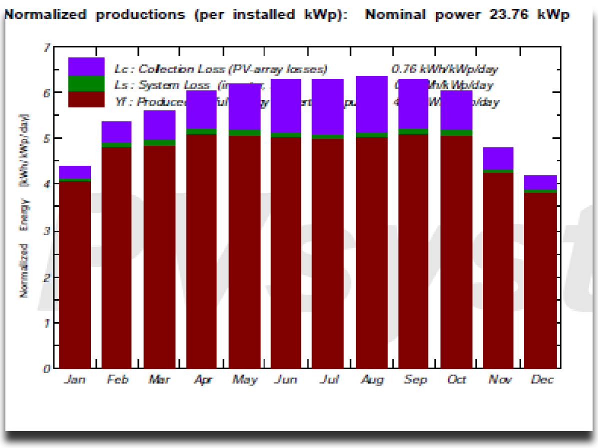


Fig.7 Monthly diagram of equipment energy losses

Figure 8 shows the multiplier of the annual performance of the power plant. In this article, the annual efficiency of the power plant is about 84.69% and in general is between 84 to 90%, which is divided by the amount of energy produced injected into the network to the amount of energy received from modules. Photovoltaic is obtained.

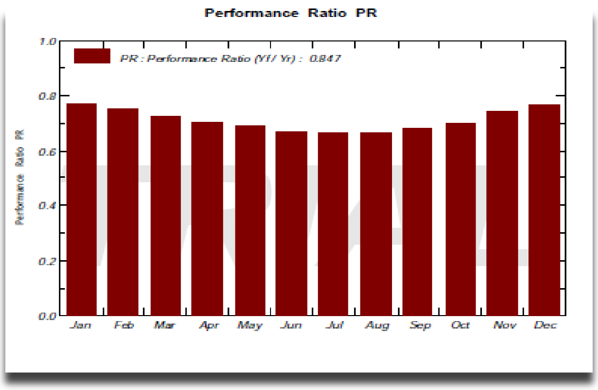


Fig.8 Graph of power plant power generation in different months of the year

Shading loss chart and daily input/output diagram are shown in figure 9 and 10, respectively.

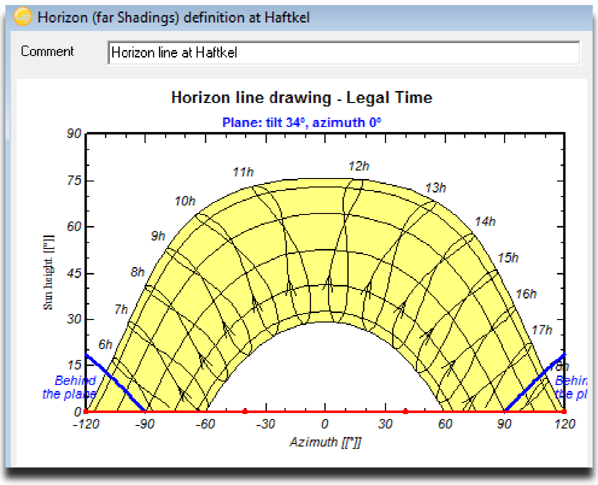


Fig. 9 Shading loss chart

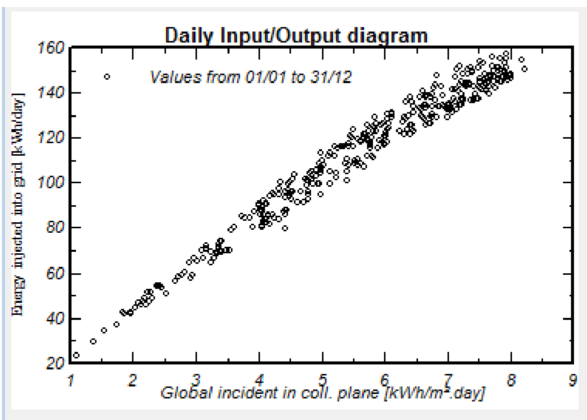


Fig.10 Graph of injection and power generation to the network

Figure 11 shows the losses of the whole system from the time of receiving solar energy to the time of injecting all the energy into the network in a period of one year. The head of photovoltaic panels has been 47460 kWh in the power plant complex, which is injected into the grid with a system loss of 42350 kWh.

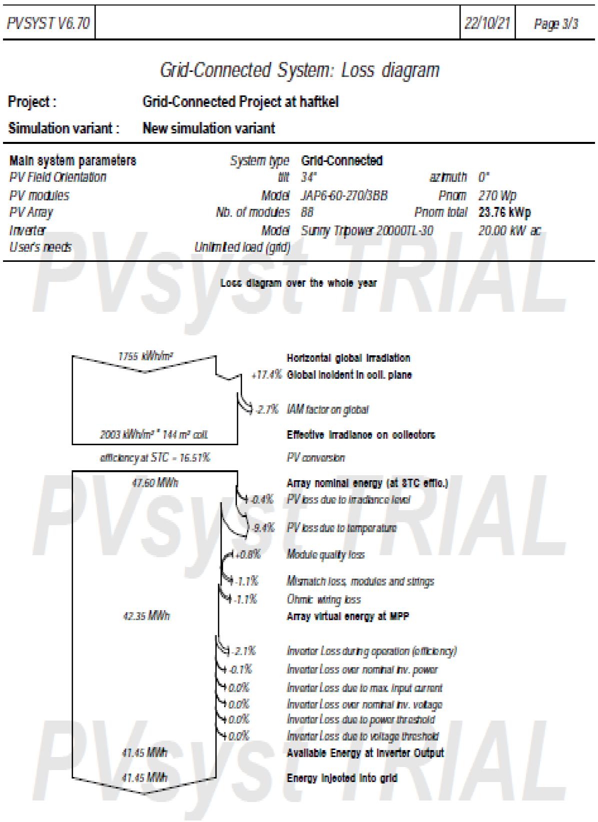


Fig. 11 General schematic of power plant system losses

3. Conclusion

In this paper, the feasibility study of a photovoltaic power plant with a capacity of 23.76 kW in Haftkol city, considering equipment, modules, power, voltage, inverter, optimal use of area and high reliability, has been designed. efficiency of the designed power plant is 84.65% for using 88 photovoltaic panels and also the annual injection capacity to the network is 42350 MW.

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