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Effect of Temperature on PV Performance Based on Experimental Study

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Abstract- Solar energy is clearly available and very large in Iraq, which is clean energy, friendly to the environment and can be used to produce clean electricity in a country that has been suffering for decades from a lack of electricity supplies in addition to a large pollution in the environment. In this study, the effect of weather conditions, especially solar radiation, and the temperature of the photovoltaic unit, as well as the air temperature on the photovoltaic cell outputs installed at the University of Technology, east of Baghdad, were evaluated. The results proved that the high intensity of solar radiation helps increase the electricity generated, but at the same time it causes a high increase in the temperature of the PV unit, which causes a decrease in its productivity. High ambient air temperature limits the process of cooling the solar panel and, as a result, the performance decreases. The study concluded that the use of photovoltaic/thermal PV systems (PVT) solves the dilemma of low performance of photovoltaics due to the high intensity of solar radiation and the temperature of the air that characterizes the Iraqi city of Baghdad.

Keywords: *PV Module, Climatic Conditions, Radiation Intensity, Baghdad-Iraq*

I. INTRODUCTION

The environment forms everything that surrounds us from living creatures and non-living materials that have a direct impact on human life. They are water, air, rocks, and soil, in addition to living organisms, and all of this system comes together to enable a person to live on earth comfortably [1]. The environment is not only for humans, but humans are the most influential people in the environment. When we consider the pollution problems that our planet suffers from, we realize that the influence of humans is not always positive [2]. Among the most important environmental problems that the planet suffers from today are the following:

Air pollution: The World Health Organization (2016) report indicates that (92%) of the world's population lives in places with polluted air, and that every year three million deaths occur due to air pollution [3]. Air pollution is mainly caused by smoke from burning fossil fuels to produce electrical energy or in melting furnaces, as it is burned in cars, ships, planes, etc. [4, 5]. The burning of this fuel results in sulfur oxides, volatile organic compounds, radon, and other pollutants whose concentrations cause great health risks to humans, animals, and plants [6, 7].

Water pollution: means pollution of streams, rivers and oceans resulting from acid rain, oil spills, sewage, and runoff in urban areas [8].

Global warming: greenhouse gases lead to global warming, which raises the temperatures of the Earth's surface and oceans, which in turn leads to melting of the polar ice cap, sea level rise, and the resulting heavy snowfall, floods, and desertification also [9]. NASA reports indicate that the Antarctic ice sheet is declining by 13% per decade, and that sea level has increased by 7 inches during the past hundred years [10].

Climate change: the proliferation of factories and the burning of fossil fuels lead to the production of gases that increase the temperature of the atmosphere, lead to global warming, changing weather conditions, accompanied by melting of polar ice, the occurrence of floods, the spread of new diseases, and change in seasons [11].

Soil problems: including soil degradation as a result of many factors, including: agricultural processes, overgrazing, logging, and deforestation. Soil degradation leads to the phenomenon of desertification, and other problems that it suffers from are: soil, salinization of soils, and soil contamination with heavy metals, and pesticides pests and waste [12].

Pollution of drinking water: One of the environmental problems that raises fears for many people is pollution of fresh water intended for domestic needs, including drinking water, and fresh water can be polluted in rivers, lakes, and even reservoirs with micro-organisms, disinfectants, organic and inorganic compounds, and radioactive elements [13].

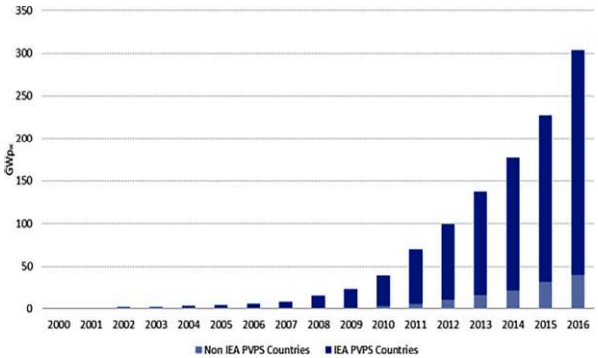

Fig. 1: The evolution of PV panels installations (GWPDC) between 2000 and 2016 as per the annual reports of the International Energy Agency in 2016 [34].

The researchers and the decision makers agreed that the best treatment for the above environmental problems is by heading towards renewable energies such as solar energy, wind energy, etc. These energies are environmentally friendly, do not emit harmful pollutants and do not increase global warming [14]. Among the most important renewable energies is solar energy, which can be considered the origin of all energies. This energy has been used since thousands of years for pre-heating, material heating and treatment. Today, this energy has many applications that can be used as a thermal energy, which can be used to ventilate and heat spaces using the Trombe Walls [15-19]. It can also be used to heat a saline water basin and to take advantage of the heat stored in many applications [20-22]. The thermal energy in the sun's rays is the fuel of solar air heaters, and it has proven its efficiency and capabilities in many different locations and is now practically applied in many countries [23-25]. It is also possible to produce electrical energy from the heat of solar radiation using concentrated solar