OV2040REP

Oman Vision 2040: Renewable Energy Program

NEWSLETTER

Volume 2, Issue 1, March 2021

1. Project initiation

1.1. To consider the scope of the problem

Renewable energy utilization in Oman is a topic with growing interest by the Omani government and the private sector. The existing renewable energy resources, which can be used as an energy alternative and eco-friendly energy systems, needs further research, development, planning and awareness. This initiative presents a step in the direction toward renewable energy vision of Oman 2040 along with a detailed discussion with regards to sustainable energy, energy sources, technologies, building capacity, and strategic planning, all with relation to the vision.

1.2. Goal

This goal is to be in line with the aims of the Oman vision 2040, aim to reduce the dependency on non-renewables and effectively develop resources such as renewable energy to lower production cost and enhance competitive element in economic sectors. Also, develop the infrastructures and building the human capacity of Omanis to meet the vision 2040.

1.3. Objectives

- Conduct scientific research to investigate renewable and sustainable energy sources parameters, options, and improve its applications in Oman.
- Establish a massive collection of research committed to improving sustainable power sources incorporation in Oman power and energy systems for private and public sectors.
- Assist, through research, governmental and private associations to arrive at the top of the line innovative improvements in the field of renewable and sustainable energy sources and technologies.
- Initiate scientific and technical discussion between researchers and experts in the renewable energy field with younger Omani researchers.
- Increase Oman community awareness toward renewable energy.

1.4. Phases of the work

- Establish a database of resources that are useful to conduct research and development in Oman.
- Start local and international collaborations to brainstorm and carryout projects to fulfill the aims of the initiative.
- Plan for targeted efforts to achieve the main aims and goals of Oman’s vision 2040 with relation to the energy sector and to renewable energies in particular.
- Acquire funding for research projects centered around solutions for Oman’s energy situation.
- Carryout colloquiums and public talks to enrich the discussion around the topic of Oman’s vision 2040 in Renewable Energy.
- Update the work structure annually, according to the changes that occur in the energy and renewable energy industry.

Nano enhanced fluids and latent heat storage material for photovoltaic modules: A case study and parametric analysis

1.5. Conceptual framework

To generate technical reports and research data that will serve research and development in Oman. The focus of research should be in original research, case studies, technical reports and other mediums to aid fellow researchers in acquiring useful information and data for their own research studies. Moreover, collaborations will encourage and open the door to create local and international joint research and funding which will be helpful to boost research in Oman.

1.6. Community awareness campaign

- Increase the awareness of the public about renewable energy vision 2040 for Oman.
- Increase the awareness of the public about different types of renewable energy and how to be part of the new vision.
- Contribute to the development of local people by providing the needed energy which will help them socially, economically, culturally, and educationally.
- Raises the standard of living of the people living in rural areas, by providing them with energy solutions to get clean water, preserve their foods and enjoy a healthier life.
- Contribute to the current energy policy in Oman.
- Develop a team of researchers who are aware of the needs of the Omani energy and environment.

1.7 Family of Omani younger researchers

This family or group focus on the Omani younger researchers interested in renewable energy from different levels (i.e. undergraduate, fresh graduate and postgraduate). The group will work together as a family to collect and analyze related data, training and increase awareness, discuss, and collaborate toward the vision 2040. This group will prepare the new generation to participate positively when Oman is approaching 2040 based on education, knowledge, experience, and new ideas.

Note: to be part of this family, click “Follow” to this project in RG.

2. Communications | The communications are to be released on Volume 2, Issue 2 of the newsletter (next issue).

2.1. Founders meeting
2.2. Drafting first letter of communications
2.3. Approval of the project objectives and scope

3. Annual Report | The first annual report has been set to be released on the 30th of September 2021.

3.1. Publishing the first Oman2040 Annual report
3.2. Setting suitable venues to distribute the report
3.3. Preparing follow up of report for the Oman2040 newsletter

4. Seasonal Newsletter

4.1. Objectives and scope of the newsletter
4.2. Primary components
4.3. Newsletter management and logistics

5. Annual Address

5.1. Future plans and recommendations
5.2. Main findings and achievements of the first year
5.3. Video of the annual address

Solar energy in Oman: A way forward, part (I)
An Introduction
By: Dr Ali H. A. Al-Waeli

The quest to encourage and grow the Gulf Cooperation Council (GCC) countries' renewable energy industry continues with more investments and initiatives. I believe that the interest in renewable energy, and especially solar energy, is due to four main reasons, which are as follows:

Firstly, the availability of natural resources such as solar energy, or solar irradiation, in the region, and the diversity of renewable energy resources such as wind, geothermal, etc. Secondly, the price decline of solar energy technologies, particularly silicon solar cells which has dropped by around 89% since 2010. This drop has been attributed to economies of scale, which are yet to be realized, a reduction in the price of inverters and lithium batteries, and an increase in solar cell efficiency—moreover, the technological development in the field, which allows for integrating solar cells in various applications. Thirdly, the increase of international efforts to mitigate climate change through global agreements, such as the Paris treatment, and the continuous media coverage to spread awareness to the public. Fourthly, the fluctuation of oil prices, especially during the COVID19 pandemic, and the discovery of many health and environmental concerns related to fossil fuels over the past decades.

In recent year, we have witnessed a rise in investments in solar power plants, the implementation of solar energy in desalination plants, and solar cell manufacturing facilities. One of the essential characteristics of the solar cell is that it is a static device, which means there is no need for any mechanical movement to produce electrical energy. Thus, the cell does not emit any toxic gases and does not emit any noise, making it environmentally friendly and suitable for the consumer at the residential level, specifically, solar cell users on rooftops. Harnessing solar energy to produce electrical and thermal energies contributes to reducing carbon emissions and reducing greenhouse gases that pose a threat to the environment and are considered contributing factors in the rapid increase of global warming and climate change. In Oman, at the local level, harnessing solar energy contributes to reducing individual dependency on traditional sources of energy. Moreover, the consumer benefits by reducing the consumption of conventional sources of energy, electricity from the grid, and selling the excess generated energy from photovoltaic modules, thus reducing the electricity bill. Another benefit to the country and the working class are the jobs and job opportunities generated when investing in renewable energy.

In my view, there is more room for improvement in the solar energy market in the Sultanate of Oman, which I believe has a bright future for renewable energy investments. I also believe that there is more room to exploit many opportunities and harness environmental resources to serve the Omani society and economy and preserve the Omani environment. Oman's environment is characterized by the diversity of its biomes and the availability of large areas that allow for investing in various renewable energy generation plants such as solar energy, wind energy, geothermal energy, and others. As for renewable energy applications, I think that all state sectors can reap the benefit of their utilization, specifically the agricultural sector (agriculture and fisheries) and the electricity and water sectors.

Solar energy integration can lead to remarkable outcomes for Oman's industrial areas (such as the Sohar Industrial Zone) and major road lines (such as the Muscat Expressway). Although the solar energy market in the Sultanate, in my view, is in the starting phase, the road to solar energy integration can be accelerated with policy and encourage industrial and residential investment. There is an urgent need to develop methods of acquiring and producing renewable energy. Also, to reduce losses associated with the energy generation process (affected by climatic and geographic factors). For example, there is a need to discover and define the most appropriate ways to reduce the impact of dust on the output of the solar cell and use various modern technological methods such as passive and active cooling solutions to improve the energy yield from solar cells.

Comparison and evaluation of solar photovoltaic thermal system with hybrid collector: an experimental study

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Highlight:

- A PVT hybrid (oscillatory/direct flow) proposed and compared with Web, direct and oscillatory collectors.
- Using hybrid collector enhances electrical and thermal efficiencies of PVT.
- PVT with hybrid collector outperforms PVT's with direct, web and oscillatory collectors.
- Electrical efficiency of PVT systems outperform conventional PV module.

Brief:
In this study, evaluation, and comparison of a new designed PVT hybrid collector with three PVT systems and conventional PV in term of electrical and thermal performance is presented. The problem statement that drives this study is the nonhomogeneous distribution of heat on the PV module and in the collector, which produces a hot spot and reduce system efficiency. The proposed hybrid (oscillatory/ direct flow), Web, direct and oscillatory PVT collectors were designed and installed with a conventional PV in Oman. The outdoor experimental investigation was conducted at a mass flow rate of 0.020 kg/s. The proposed system improved the voltage and generated power by 28.5%, and 19.4%, respectively. Also, it was found that the hybrid PVT has 9.11%, 9.98%, and 15.28% higher efficiency than oscillatory, direct and web PVT's, respectively. From the other hand, the highest thermal efficiency was found to be 60.7% approached by the hybrid system while the highest is 53.3%, 37.0% and 18.7% for the oscillatory, direct and web collectors, respectively. Evaluation and comparison with literature result confirm that the proposed hybrid system provides a significant improvement and suitable for Oman and nearby countries with similar weather conditions.

Theory:
In this study, different PVT systems were designed, evaluated, and compared with a conventional PV to find the best solar energy option for Oman and GCC countries. However, one of the PVT systems is proposed (hybrid collector) in this study, which opens the door for hybrid collectors to be investigated. The systems were all tested under the same weather conditions, for the city of Sohar. The electrical and thermal performances were investigated. Figure 1 shows research activities sequences in this study. Also, Figure 2 shows the experimental setup.

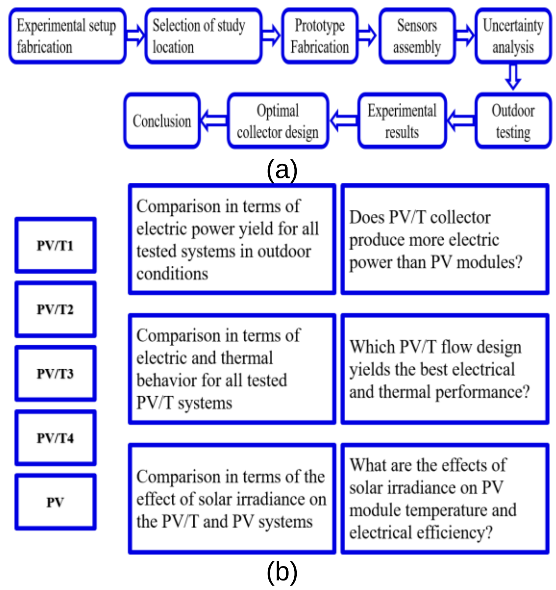

Fig. 1. Research methodology flowchart (a) research activities, (b) research justifications.

Fig. 2. PVT experimental setup.

Achievements:

The present study aims to design, investigate, and evaluate four PVT systems with different collectors (oscillatory, direct, web, hybrid oscillatory/direct) under desert weather conditions. However, the proposed hybrid oscillatory/direct was designed, evaluated, and compared with other PVT and conventional systems. The growth of solar energy usage and applications in Oman and other Gulf Cooperation Council (GCC) countries motivate the current research. However, the electrical (current, voltage, power, efficiency) and thermal (inlet, outlet, cell temperatures, efficiency) were investigated in outdoor conditions. Solar irradiance and ambient temperature effect were studied, and a comparison of PVT systems and PV were considered. The study was comparing the investigated systems with other systems in literature.

The experiments and investigation were conducted in Sohar, Oman. The electrical and thermal performance was measured and discussed for each PVT. A 0.020 kg/s mass flow rate was used. It is found that the highest voltage and power achieved was by the proposed hybrid system which are ±18 V and 64.6 W compared with ±14 V and 54.1 W of the conventional PV, respectively. In all experiments the hybrid system shows the highest values in term of voltage, power and efficiency. The electrical, and thermal system efficiencies for the proposed model are 12.7%, and 60.7% compared with 11.94% and 53.3%, 11.13% and 37.0% and 11.16% and 18.7% for the oscillatory, direct and Web collectors, respectively. It is found that hybrid PVT has 9.11%, 9.98%, and 15.28% higher efficiency than oscillatory, direct and web, respectively. The efficiency difference appears to be significant and approximately, 0.80%, 0.87%, and 1.27% with respect to oscillatory, direct and web, respectively. The temperatures range is approximately 40.26 - 65.85 ^{o}C, 37.45 – 62.69 ^{o}C, 35.93 – 58.42 ^{o}C, 35.26 – 49.31 ^{o}C, and 33.98 – 45.21 ^{o}C for hybrid, oscillatory, direct and web, respectively. Using the proposed hybrid PVT system reduced the temperature by around 20 ^{o}C compared with conventional PV. It is found that the investigated PVT systems efficiencies are consistent with other systems. However, the thermal efficiency is higher compared with electrical efficiency and this is a trend in PVT systems.

The thermal efficiency affected by many parameters such as the absorber type, fluid used, mass flow rate, weather data, cooling method, etc. However, the proposed system approved its productivity in Oman weather and countries with similar weather conditions. Also, use of nanoparticles to improve the working fluid is expected to lead to a high thermal conduction, efficiencies, and power production. We recommend for future work to conduct indoor investigation to get more information about system behaviours in term of optimal conditions by looking into the system parameters separately such as solar irradiance, temperature, mass flow rate, etc.

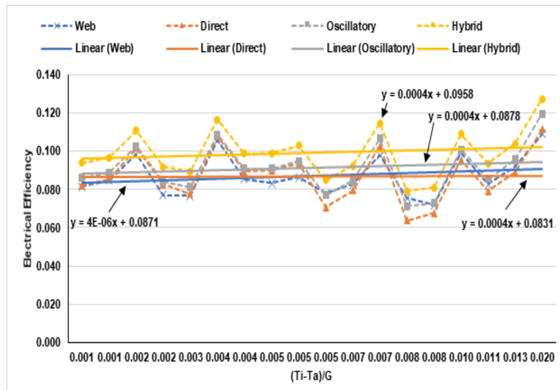

Fig. 3. Investigated system efficiency in term of (T_i-T_a)/G.

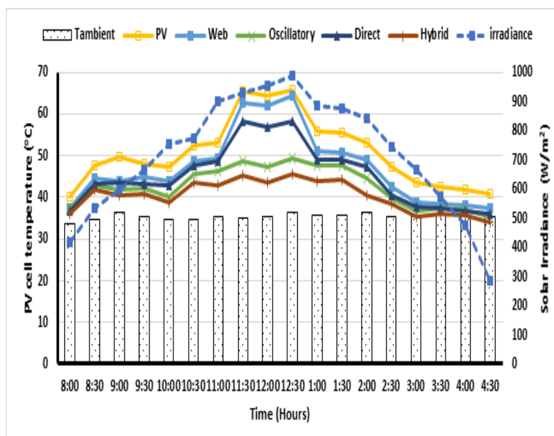

Fig. 4. PVT systems outlet water temperature.

Investigation of a nanofluid-based photovoltaic thermal system using Single-Wall Carbon Nanotubes: an experimental study

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Highlight:

- SWCNT nanoparticles mixed with water and ethylene glycol as a heat transfer fluid.
- The performance of a nanofluid-based PVT system in Oman was evaluated.
- The nanofluid-based PVT produces 11.7% more electric power than a conventional PV.
- At peak irradiance, the PVT cell temperature is lower than the PV's by 18-20 °C.

Brief:

The temperature of photovoltaic cell is reduced by heat transfer fluids (HTF) in cooling channels, which are attached to the back of photovoltaic module in hybrid thermal photovoltaic system (PVT). Recently, nanofluids have been implemented as HTF's in PVT systems. Various types of nanofluids have been synthesized, prepared and tested, however, not a specific type in particular. In this paper, experiments were carried out using Single-walled carbon nanotubes (SWCNTs) nanofluids. The proposed nanofluid consisted of a primary fluid that is water with a volume ratio of 75.0% and glycol Ethylene with a volume ratio of 25% and a surfactant, Cetyltrimethylammonium Bromide (CTAB), in an amount of 0.5 ml. Single-walled carbon nanotubes (SWCNTs) were added in four weight ratios of 0.1%, 0.5%, 1.0%, and 2.0%. The samples were examined and compared based on their thermophysical properties, and from these properties, a volume fraction of 0.5% SWCNT was chosen to form the nanofluid. In this study the performance characteristics of the PVT were investigated. The results of the study showed that the proposed nanofluid caused an increase in the electrical power generated by 11.7% while the electrical efficiency of PVT was increased up to 25.2% compared to the PV system. It is found that the cell temperature reduced by 18% on average for a whole day operation. The studied PVT system produced an impressive overall efficiency of 71% compared to the PV system, which generated no more than 11%. SWCNTs have shown superior results in improving the performance of the studied PVT system compared to other types of nanofluids used in PVT systems in the literature.

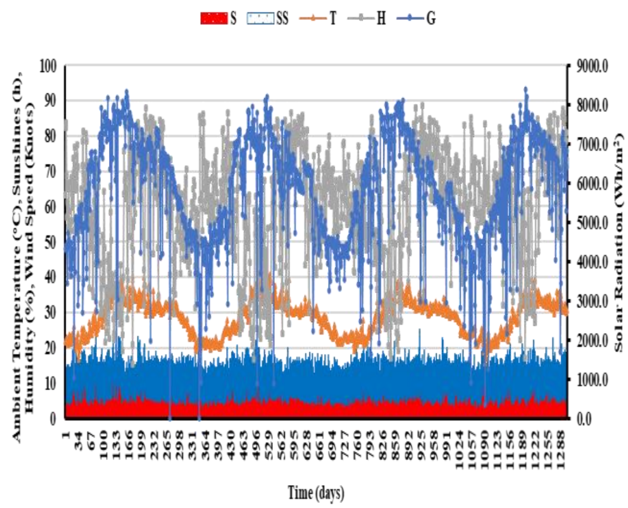

Fig. 1. Weather data for Sohar city from 1 January 2017 till 25 August 2020. In the figure, G denotes 'irradiance', H denotes 'Relative humidity', T denotes 'Ambient temperature', S denotes 'wind speed' and SS denotes 'Sunshine hours'.

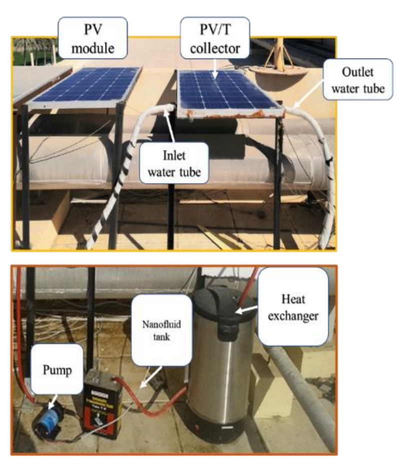

Fig. 2. PV and PVT experimental setup.

Theory:

This study aims to investigate the real-time performance and behavior of SWCNT nanofluid-based PVT systems which are installed in the outdoor environment of Oman. The nanofluids were used as coolants flowing within copper pipes that were attached to the back of monocrystalline PV cells, installed on the rooftop of the Faculty of Engineering building in Sohar University, Oman. There is a clear lack of studies concerning the use of nanofluids, particularly SWCNTs-nanofluids, as HTF for PVT systems in Oman. Moreover, to the best of our knowledge there are no investigations of an EG-water mixture with SWCNT nanoparticles in direct-flow PVT research. The outcomes of this study are useful to understand the behavior of nanofluid-based PVT's in Oman, in particular, and the system's behavior in hot and humid environments, in general. The main questions that this study intends to answer are (i) what the energy performance of PVT system is utilizing SWCNT nanofluids in Oman, (ii) what are the thermophysical properties of a water-ethylene glycol mixture, with ratio of 75% to 25%, respectively, that is mixed with SWCNT's and CTAB surfactant, (iii) what is the overall PVT efficiency in real-time in hot and humid conditions. The system in question, have been designed, fabricated, installed and tested. Henceforth, the main contributions of the study are: (i) proposing and testing a nanofluid with hybrid base fluid mixed with SWCNT type nanoparticles and surfactant, (ii) evaluating the PVT performance in real-time. There is massive similar research conducted in this area. However, what distinguishes this study is that it tested a cooling fluid with SWCNT experimentally in one of the world's harshest climates in terms of the very high solar radiation intensity, ambient air temperature, and relative humidity. This study's results give an essential answer about the nanofluid most suitable for use in the climatic conditions of the Sultanate of Oman and the neighbouring countries with similar conditions.

Achievements:

The best PVT performance was selected for the evaluation from a day that is characterized as 'clear sky'. The following points summarize the main findings of this study:

1. The addition of SWCNT in different proportions to the base fluid changes the fluid's viscosity, density, thermal conductivity and stability. Comparing different volume fraction from 0.1% to 2% shows that 0.5% is the optimum volume fraction of SWCNT in Water-EG (75:25) base fluid.
2. The experimental results showed a significant improvement in reducing the temperature of the PV cell by an average of 19% for a full-day operation.
3. The use of the studied nanofluid caused an increase in electrical efficiency by 25.2% compared to the PV system.
4. The overall efficiency of the studied PVT system increased up to 71.0% compared to the PV system.

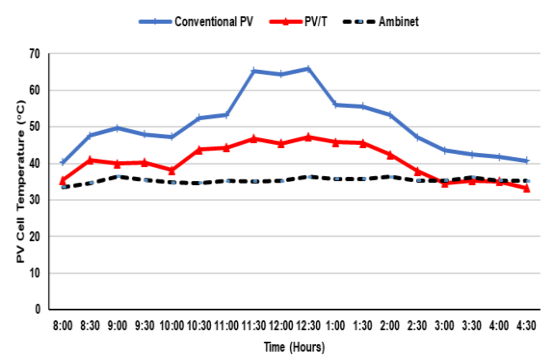

Fig. 3. PV and PVT systems surfaces temperature variation with time.

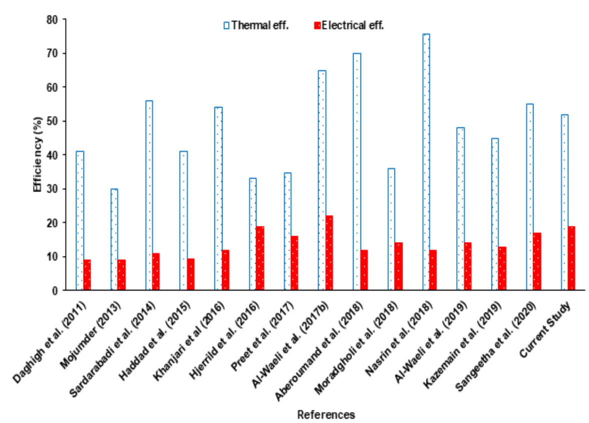

Fig. 4. Comparison between PVT thermal and electrical efficiencies of the current study and several articles in literature.

Nano enhanced fluids and latent heat storage material for photovoltaic modules: A case study and parametric analysis

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Highlight:

- A PVT with silicon carbide (SiC) nanofluid and Phase change material enhanced with SiC nanoparticles is tested in Bangi, Malaysia.
- An electrical and thermal evaluation of the PVT performance is made.
- The variation in the PV's electrical efficiency corresponding to the nanofluid's mass flowrate and PV cell temperature is showcased.

Brief:

Thermal stress causes reduction in the open circuit voltage of Photovoltaic (PV) modules which results in a reduction in overall power generation. Photovoltaic thermal (PVT) collectors have been used to mitigate this issue by providing both cooling of the cell temperature and yielding thermal energy in the same space. However, the implementation of PVT systems in the industry is still lacking and requires further innovative solutions to achieve higher electrical and thermal efficiencies. In this paper, a case study experimental and parametric analysis of a PVT system with nano-Phase Change Material (PCM) and nanofluid, as the heat transfer fluid, is presented. The system was tested in Bangi, Malaysia and the findings have been compared with previous studies in the literature. The findings of the evaluation shows an average and peak overall PVT efficiencies of 61.6% and 77.8%, respectively. Moreover, the electrical efficiency of the PV and PVT averaged at 9.9% and 13.1%, respectively. The main reason for the drop in the PV module was its average cell temperature which was around 45.6 °C, while the PVT's average cell temperature reached 39.2 °C. Finally, the average thermal efficiency of the PVT was around 48.5% when the mass flowrate was 0.175 kg/s. Figure 1 showcases a drawing of the system conceptual design, while figure 2 shows the PVT collector's schematic drawing.

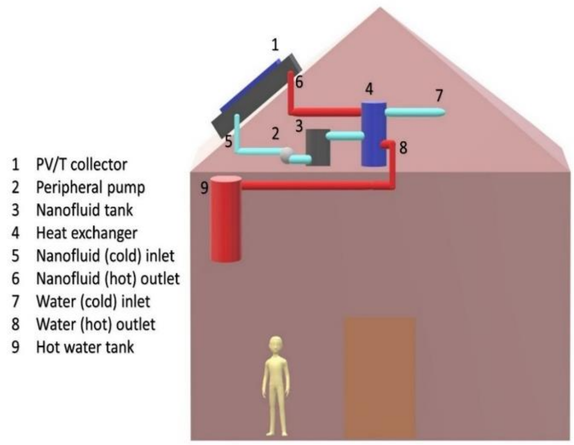

Fig. 1. Schematic diagram of the PVT system

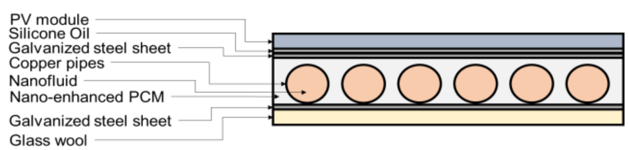

Fig. 2. Cross-section schematic of the photovoltaic with nano-PCM and nanofluid cooling channels

Theory: Many studies discussing photovoltaic thermal (PVT) systems showcase the extensiveness of solutions which are proposed by scientists to mitigate the issues of power related to Photovoltaic (PV) modules. Moreover, the studies considered different types of crystalline-based PV modules, heat transfer fluids, cooling methods, and testing environments. However, most experimental work is done on PVT collectors with small capacity (e.g., Photovoltaic modules rated less than 100 Wp), these systems/modules are rarely used in real investments. The parametric analysis and case study in this study is performed on a 120 Wp PV module of Polycrystalline type, mostly used in the market, and hence, more amount of Phase Change Material (PCM) and nanofluid is produced and implemented in the collector. Moreover, most studies on this topic present data from one day, best data, however, it is also important to show the variation of the collector performance over multiple days. In addition, the current-voltage (I-V) curve characteristics of the tested PV modules are commonly neglected when integrating nanofluid and nano enhanced PCM, in this study those characteristics are determined. The continuation of assessing heat transfer material and processes to improve the performance of PVT systems is necessary for the technology to be cost-effective and sustainable. Further investigations and replication studies must be carried out for novel PVT systems to verify their effectiveness and justify the replacement of PV modules and solar thermal collectors in certain scenarios. Among the novel solutions to be considered is the PVT system utilizing nano-PCM for thermal regulation and heat storage, and nanofluids as working fluids for heat extraction. Henceforth, the objectives of this study are to (i) analyse the electrical parameters such as current, voltage and photovoltaic output power through determining the current, voltage (I-V) and power curves in addition to cell temperature and electrical efficiency, (ii) compare the performance of the cooled system with a conventional PV module of the same size and type and under the same outdoor conditions and (iii) evaluate the yield of the PVT collector with nanofluid and nano-PCM across multiple days, by providing more outdoor experimental data, to showcase the performance variability.

Achievements:

Implementing a nano-PCM and nanofluid based PVT system can lead to electrical and thermal efficiency enhancement in PVT systems. In this study, Silicon Carbide (SiC) nanoparticles were used to form a SiC-water nanofluid with a volume fraction of 3% and SiC-Paraffin nano-PCM with a volume fraction of 0.1%. Small quantities of Cetrimonium bromide (CTAB) were added as the surfactant. Various tests were carried on the system to examine the variation of its performance under the tropical climate conditions of Bangi-Malaysia. According to the findings of this study, the following conclusions are made:

- The maximum power produced is achieved by the PVT (85.2 W) and it is 26 W higher than that of conventional PV (59.2 W). On average, the power of the PVT was observed to be 15 W higher than that of the PV.
- Comparing the nano-PCM and nanofluid based PVT with the PV form an electrical exergy point of view, shows a significant gap that is attributed to hotspots. The surface temperature of the PVT can be as low as 38 °C when the mass flowrate of the nanofluid is 0.075 kg/s and at 700 W/m^2.
- The average merit functions of the PV and PVT for the 1-day real-time recordings are 1 and 1.5, respectively.
- Increasing the nanofluid's mass flowrate from 0.0833 kg/s to 0.175 kg/s at an irradiance of 500 W/m^2 caused a decrease in the surface temperature of the PVT from around 45 °C to 34 °C.
- Increasing the mass flowrate from 0.0833 kg/s to 0.175 kg/s at an irradiance of 500 W/m^2 led to an increase in the PVT's electrical efficiency by 7.3%.

Although this study showcases the performance of the nano-PCM and nanofluid based PVT in the tropical climate of Malaysia, it is important to also study the system in other climates and biomes such as high temperature low humidity and low temperature environments. Moreover, the use of different flow channels and types of nanoparticles and nano-PCM are recommended for future research. Moreover, to consider hybrid PCM and nanofluids for enhancing the heat transfer features of the system.

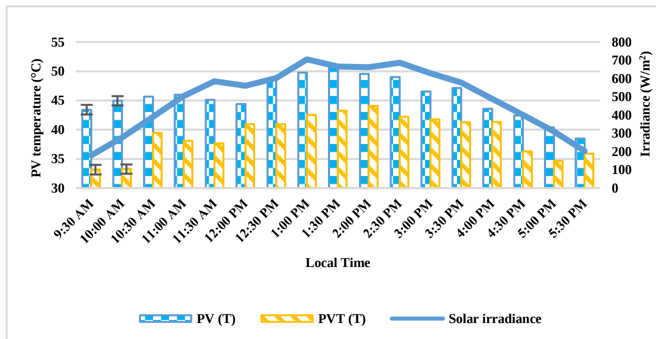

Fig. 3. Variation of the average cell temperature measurements of the tested systems, PV and PVT, in real-time from 9:30 AM to 5:30 PM, in addition to the solar irradiance curve

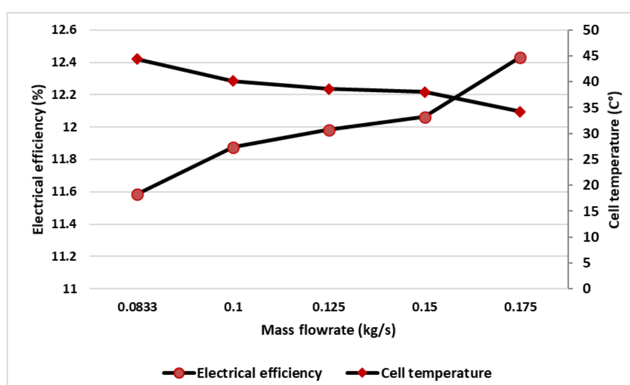

Fig. 4. Electrical energy efficiency of the PVT and cell temperature corresponding to mass flowrate at a solar irradiance of 500 W/m^2

News, updates, and announcements:

- Announcement #1: The communications are to be released on Volume 2, Issue 2 of the newsletter (next issue).
- Announcement #2: The first annual report has been set to be released on the 30th of September 2021.
- Announcement #3: Dr Ali H. A. Al-Waeli has been selected as a guest editor for a research topic with Frontiers in Energy Research (Q2, Scopus-indexed, and WoS-indexed). The title of the research topic is "Photovoltaic Thermal (PVT) Collectors: Advances in Design and Implementation". For those working in PVT research and are interested in participating in this topic, submit your abstract on the topic page. You can find the link in the home page of Dr. Ali's website (https://www.dralialwaeli.org/). The co-guest editors in this topic are: Prof. Dr. K. Sopian, Dr Hussein A. Kazem, Prof. Miqdam T. Chaichan, and Dr Hasila Jarimi. The submission Deadline have been extended. 17 June 2021 (Manuscript).
- Announcement #4: A web page section has been dedicated to this initiative (**OV2040REP**). Our readers and fellow scientists can know more about the goals and outcomes of this initiative through the following link: https://www.dralialwaeli.org/oman-2040-rep

References:

[1] Kazem, Hussein. A., Miqdam T. Chaichan, Ali H. A. Al-Waeli, & K. Sopian. "Comparison and evaluation of solar photovoltaic thermal system with hybrid collector: An experimental study." Thermal Science and Engineering Progress, 22 (2021): 100845.

[2] Kazem, Hussein A., Miqdam T. Chaichan, Ali H. A. Al-Waeli, and Kamaruzzaman Sopian. "Investigation of a nanofluid-based photovoltaic thermal system using single-wall carbon nanotubes: An experimental study." International Journal of Energy Research (2021).

[3] Sopian, Kamaruzzaman, Ali H. A. Al-Waeli, and Kazem, Hussein. A. "Nano enhanced fluids and latent heat storage material for photovoltaic modules: A case study and parametric analysis." International Journal of Energy Research.

All **OV2040REP** members are kindly invited to submit articles for publication in future **OV2040REP** newsletters. Articles can be on a range of topics surrounding the word of renewable energy technologies. With more than 30 members, the **OV2040REP** newsletter provides a great opportunity to publicise new ideas, technologies or products – all free of charge!
Articles should be no more than 400-500 words and one or two photographs would be very much appreciated. Submissions should be emailed to ali9alwaeli@gmail.com (**OV2040REP** coordinator). Furthermore, please contact **OV2040REP** coordinator regarding any conferences, seminars or symposiums relating to topics of renewable energy technologies that you wish to be advertised in the newsletter.
Once again, thank you for your continued support to **OV2040REP**.