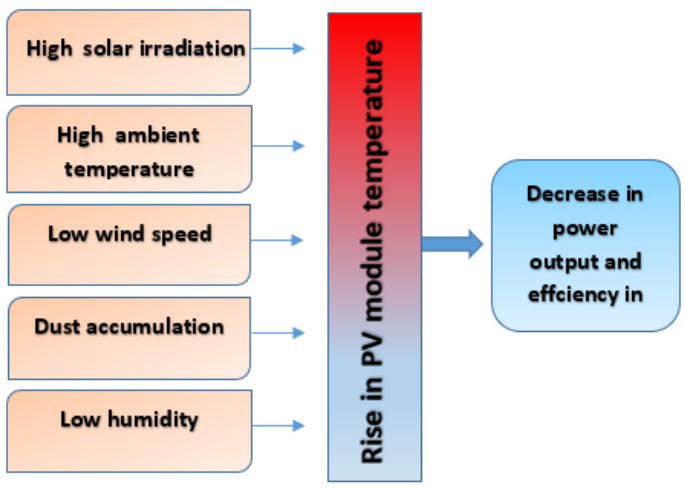
PV COOLS: CLOSE LOOP WATER COOLING SYSTEM FOR PV MODULE

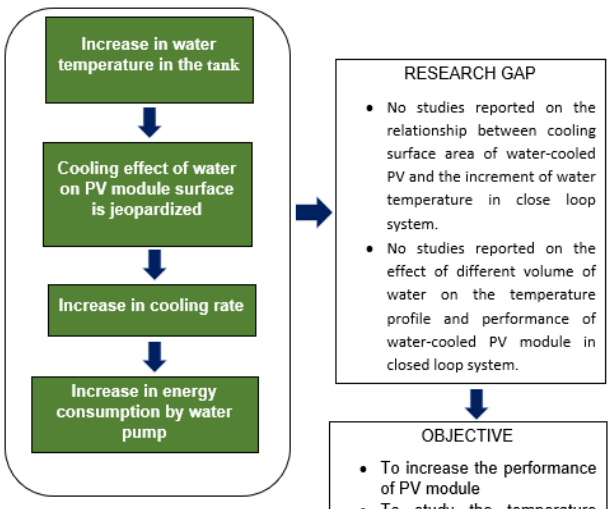
INVENTOR: PROF.MADYA DR.FIRDAUS BIN BASRAWI
FACULTY: COLLEGE OF ENGINEERING
UNIVERSITY: UNIVERSITI MALAYSIA PAHANG
EMAIL: puganesachandran@gmail.com
CO-INVENTORS: PUGANESA CHANDRAN

Background study



- Significant drop in performance due to extreme rise in solar cells temperature.
- Dust deposition on the module surface inhibits the incoming solar irradiation from reaching the solar cell.

Limitions in current water cooling system



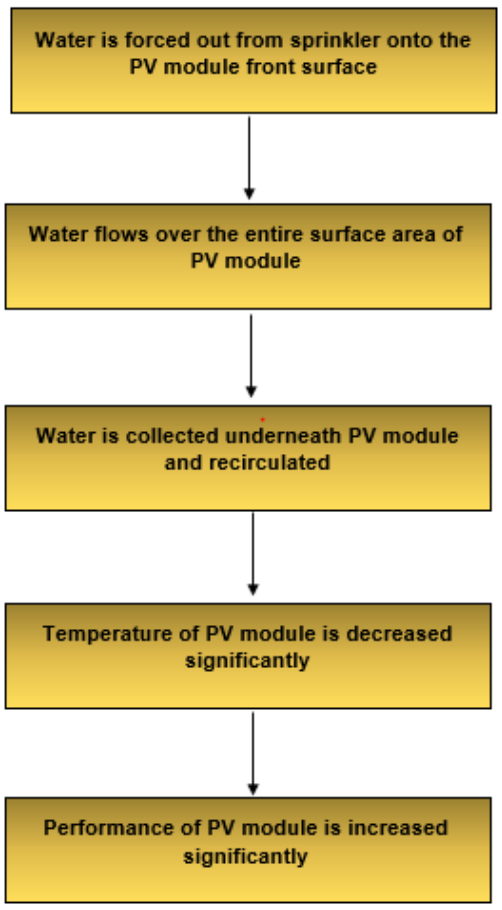
RESEARCH GAP

- No studies reported on the relationship between cooling surface area of water-cooled PV and the increment of water temperature in close loop system.
- No studies reported on the effect of different volume of water on the temperature profile and performance of water-cooled PV module in closed loop system.

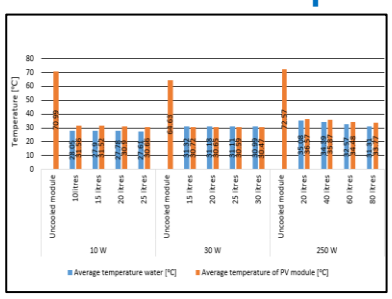
OBJECTIVE

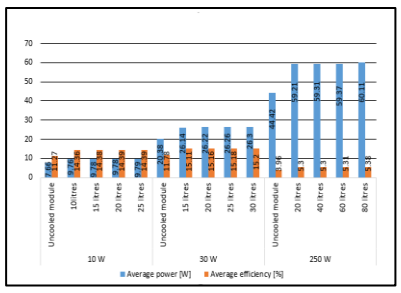
- To increase the performance of PV module
- To study the temperature profile and performance of water-cooled PV module under different water volume in closed loop water cooling system

State of the Art/ Methods



Graphical results





Findings

- Temperature of cooled module decreased significantly in the range of 53.54-56.81%,52.46-52.85%,59.60-53.47% for 10 W,30 W and 250 W of water cooled module respectively at different water volume.
- Performance of cooled module increased in the range between 27.42-27.68 %,28.27-29.05% and 33.39-35.32% for 10 W,30 W and 250 W of water cooled module respectively

Cost analysis

Material	Quantity	Price (RM)
Pipe	3 meters	4.00
Pipe fittings	6	2.50
AC water pump (10 W)	1	30
Sprinklers	10	5
Water	80 liters	0.074
Sprinkler mounting	1	5

Economic analysis

Electricity sold by 250 W uncooled PV module (RM) = Total power generated for 30 minutes in kWh (uncooled module) × Feed in tariff (RM/kWh)

- For uncooled module

Electricity sold by 250 W uncooled PV module (RM) = 0.02 × 0.5413 = 0.01

- For cooled module

Electricity sold by 250 W cooled PV module (RM) = 0.03 × 0.5413 = 0.02 (1)

Electrical cost consumed by ac water pump for 30 minutes (RM) = Power consumed in kWh × electricity tariff at peak hours(RM/kWh) = 0.06 × 0.218= 0.01 (2)

Net potential saving for a single PV module = eqn. 1.- eqn. 2 = 0.01 (Higher the power generated, higher the electrical sold, hence payback period could be decreased)

Novelty & Benefits

- No external energy or external devices such heat exchanger required to the cool the water in close loop system,instead increasing the volume of water in water tank can maintain the temperature of water at acceptable range as well as the cooling capacity of water
- More electrical energy is generated in the water cooled PV module
- Reduces the temperature of the module instantly

Applicability

Publications

- Basrawi, Firdaus, Yeong C. Leon, Thamir K. Ibrahim, Mohd Hazwan Yusof, A. A. Razak, Shaharin Anuar Sulaiman, and Takanobu Yamada. 2018. “Experimental Analysis on the Effect of Area of Surface Cooling for a Water-Cooled Photovoltaic.” *MATEC Web of Conferences* 225: 1–6. https://doi.org/10.1051/matecconf/201822501011.
- Basrawi, M. F., M. N.A.F. Anuar, T. K. Ibrahim, and A. A. Razak. 2020. “Experimental Analysis on the Effect of Cooling Surface Area and Flow Rate for Water Cooled Photovoltaic Module.” *IOP Conference Series: Materials Science and Engineering* 863 (1). https://doi.org/10.1088/1757-899X/863/1/012043.

Acknowledgement

This research is supported by universiti Malaysia Pahang internal grant of RDU 190381