

Barriers to implementing solar energy systems in buildings: The resident's perspective in Malaysia

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Plan to increase use of renewable energy

- Eleventh Malaysia Plan (2016-2020) and Energy Act along with the Feed-in Tariff (FiT) are efforts to increase the use of renewable energy resources (Oh, 2018).
- The plan is targeted towards reducing 45% of the greenhouse gas emissions and its dependency on non-renewable resources by 2030.
- Rising demand of electricity in residential areas due to the increase in household incomes, rapid electrification, and technology development (Hossain et al., 2014).



<https://www.solarpanelmalaysia.com/>



Energy in residential areas in Malaysia

- Residential users account for almost 7.5 million of total energy consumers (Abdullah et al., 2019).
- Energy in residential areas is still mostly produced by burning non-renewable resources (Chong et al., 2015).
- About 2% of electricity in residential buildings is produced with solar energy because these are still underdeveloped (Muhammad-Sukki et al., 2011).
- An increase in the use of solar energy in this sector may reduce carbon emissions by 20%, while eliminating the use of fossil fuels (Basri et al., 2015).



<https://climatekids.nasa.gov/fossil-fuels-next/>

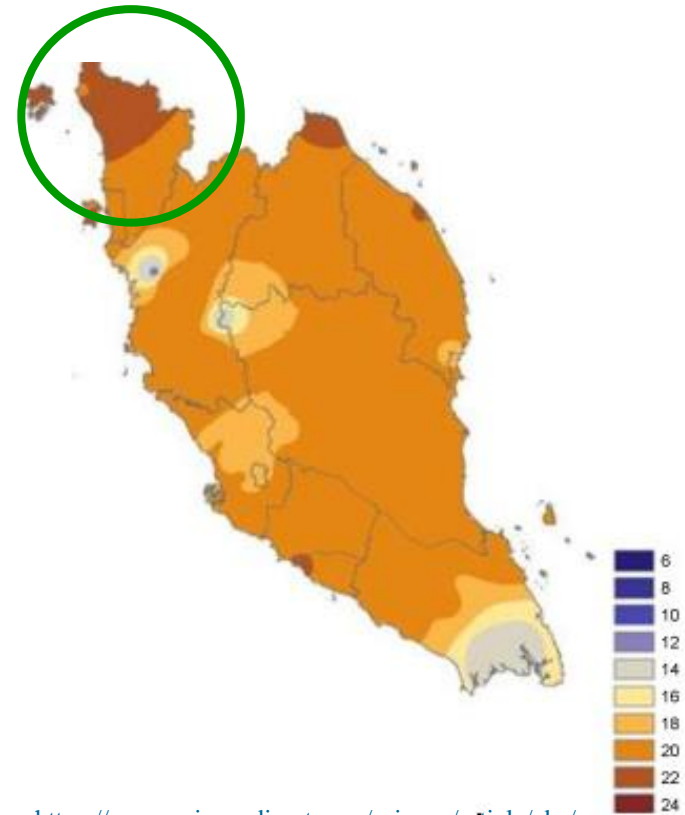


Objectives and contribution

- The Malaysian government has been promoting the use of renewable sources.

Why it has not been successful in residential areas, despite a wide interest from the sector?

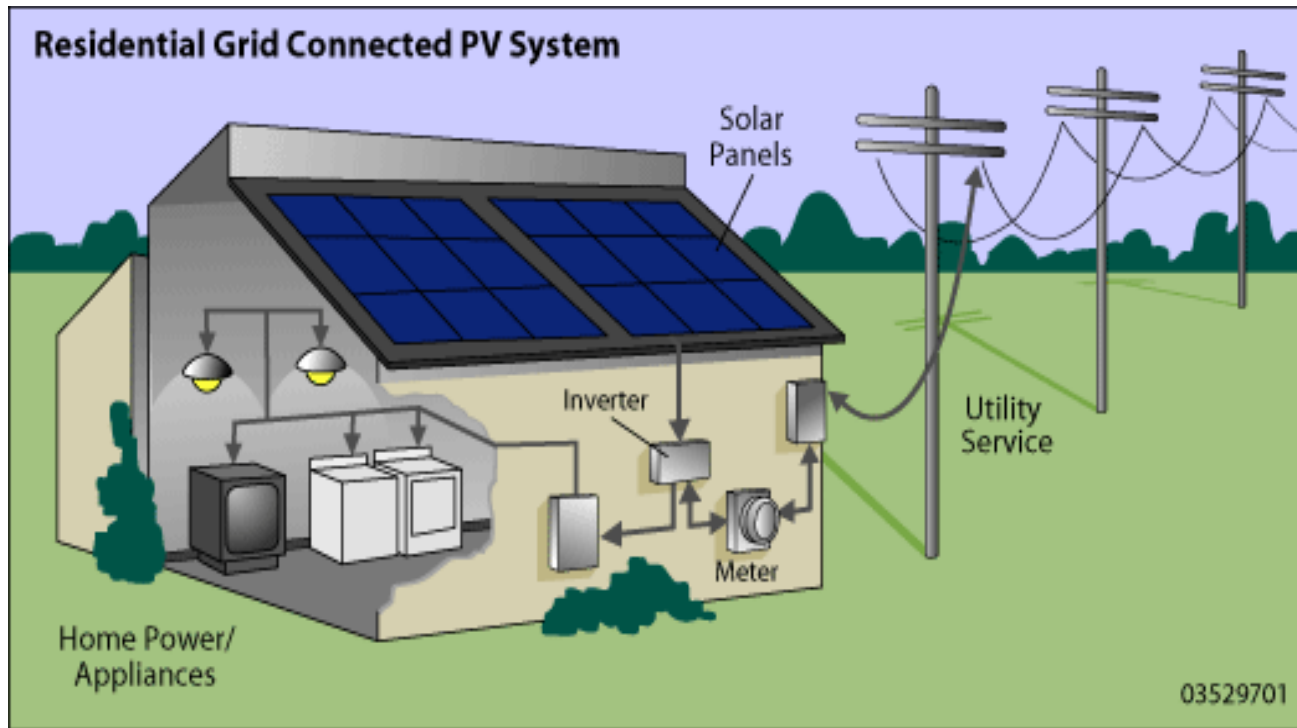
- To gather users' perspectives from the Northern region of Malaysia since it is of interest to determine what is stopping them from adopting solar energy.
- To understand the underlying reasons that prevent the use of solar energy by ranking the importance of factors.



<https://www.sciencedirect.com/science/article/abs/pii/S1364032111004138/>



Solar energy power



Solar photovoltaic systems

<https://www.solarnrj.my/residential-solar.html>

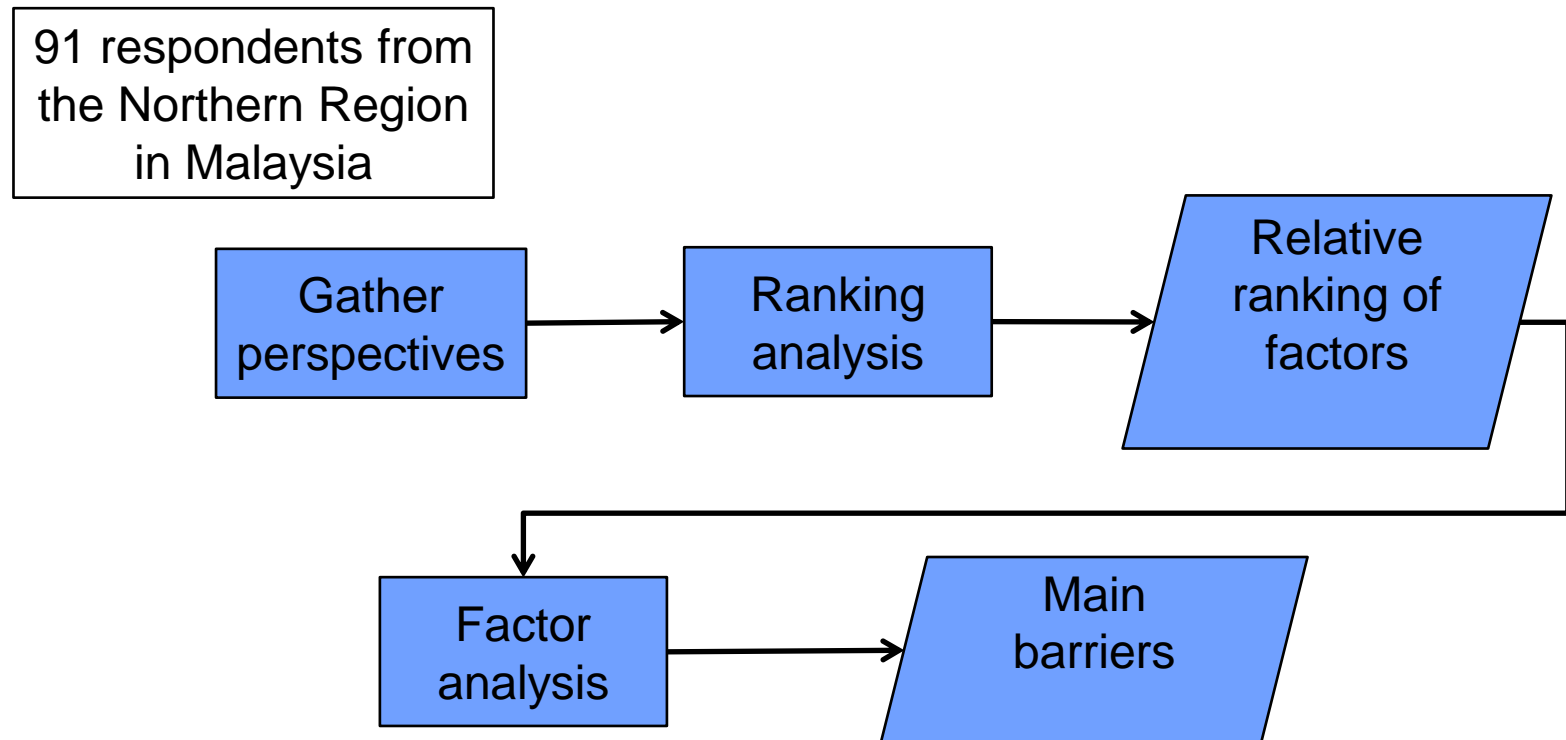


Barriers to implementing solar energy

- The initial **installation costs** and sophisticated technology are believed to prevent residents from installing PV systems.
- About 80% of the respondents agreed they would be interested in installing one if the government would fund half the cost (Mekhilef et al., 2011).
- Residents have **limited knowledge and awareness** of solar PV systems and the government programmes, including the advantages and long-term investment (Muhammad-Sukki et al. 2011; Gadenne et al. 2011).
- Lack of **suppliers to install and maintain** solar PV systems (Kamaruzzaman et al., 2012).



Methodology



Resident's perspectives

No.	Barriers	Mean	Std. dev.
B1	High initial purchase cost	3.88	1.078
B2	High maintenance cost	3.78	1.137
B3	Lack of solar panel providers	3.76	1.337
B4	Lack of experienced technicians for maintenance and support	3.66	1.112
B5	Lack of knowledge of financial support	3.58	1.241
B6	Lack of awareness of feed-in-tariff	3.45	1.277
B7	Lack of knowledge on alternative sources of electricity generation	3.42	1.038
B8	Lack of government incentive programmes	3.24	1.378



Resident's perspectives

No.	Barriers	Mean	Std. dev.
B9	Lack of regulations	3.21	1.245
B10	User conservatism and skepticism	3.12	1.194
B11	Uncertainty of installation cost	2.93	1.291
B12	Dependence on traditional electricity generation systems	2.51	1.171
B13	Reluctance to innovation	2.31	0.980
B14	Lack of awareness of solar energy for electricity	2.25	1.125
B15	Lack of awareness of environmental impact of fossil fuels	2.18	1.065
B16	Lack of knowledge on electricity generation systems	2.16	1.026
B17	Lack of awareness of solar panels	1.95	1.113



Resident's perspectives- Key barriers

No.	Barriers	Mean	Std. dev.
B1	High initial purchase cost	3.88	1.078
B2	High maintenance cost	3.78	1.137
B3	Lack of solar panel providers	3.76	1.337
B4	Lack of experienced technicians for maintenance and support	3.66	1.112
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Barriers to implementing solar energy

No.	Barriers	Factor 1	Factor 2
B10	User conservatism and skepticism	0.862	-
B4	Lack of experienced technicians for maintenance and support	0.855	-
B8	Lack of government incentive programmes	0.855	-
B6	Lack of awareness of feed-in-tariff	0.847	-
B3	Lack of solar panel providers	0.793	-
B7	Lack of knowledge on alternative sources of electricity generation	0.783	-
B1	High initial purchase cost	-	0.819
B5	Lack of knowledge of financial support	-	0.807
B9	Lack of regulations	-	0.805
B2	High maintenance cost	-	0.802



Lack of government incentives and technology

- It consists of six critical barriers focusing on the lack of:
 - Knowledge on incentives provided by the government
 - Support to install and maintain solar panels.
- This factor accounts for 75.5% of the total variance explained.
- Lack of experienced suppliers of solar panels as well as technicians for support and maintenance clearly reflects that residential users do not have information about where to acquire panels and how to maintain them.



Cost and financial support

- It consists of four critical barriers focusing on the:
 - Initial cost of installation and maintenance costs
 - Lack of financial support
- These factors account for 19.5% of the total variance explained among all critical factors.
- Service providers of the FiT do not last for 5 to 10 years, thus residents have to find a new provider and make a new contract if the service is terminated.
- Payment rate for the FiT decreases annually by 8% because more people install solar panels (supply increases) so the government reduces incentives.



Concluding remarks

- Identify barriers by focusing on the perspective of residents, who are the key decision makers regarding the adoption of solar PV systems.
- The results indicate that the most dominant of the five factors pertains to regulations and policies.
- About 90% of the residents in Northern Malaysia support innovation and are aware of the environmental impacts of conventional electricity systems.
- As Malaysia is moving towards sustainable development, an increase in renewable energy use with a whole life cycle perspective needs to start with policies at the local and national level.



Concluding remarks

- Policies need to communicate objectives clearly while accompanying that with cost incentives and financial support.
- This added value, critical in lean thinking can help users, suppliers and the government to achieving efficient performance.
- The majority of households have on average 3 to 6 inhabitants so this could be considered for determining the size and capacity of panels.
- Confirmatory factor analysis and gathering perspectives of the views of residents in other states in Malaysia and a bigger sample should be considered in future research.



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