

EVALUATING RENEWABLE ENERGY TARGETS IN LOCAL AREAS WITH AN ENERGY SYSTEM MODEL – CASE STUDY OF ISKANDAR MALAYSIA

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Overview

This study presents the development and application of a model for designing renewable energy system in local areas. The main purpose of the model is to evaluate the feasibility of renewable energy (RE) targets in local areas that are formulated as part of low carbon development plans. The model combines data on local features and spatial distribution of renewable resources in an optimization formulation. Low carbon development plans in local areas require practical information on the deployment of renewable technologies. This study introduces the case of Iskandar development region in Malaysia, where an ambitious plan to implement low carbon actions across several sectors has been ongoing.

Methods

The least-cost energy system is modelled as the mix of renewable energy resources and technologies and the location of electricity supply sites and allocation of biomass resources. The formulation is a location-allocation problem based on mixed integer programming (MIP). The model developed is able to evaluate a large number of alternative locations for location of renewable technologies using gridded data. The system is evaluated in terms of cost of electricity generated, and potential for CO₂ emissions reduction in the target area.

Results

The application of the model shows that over 5% of electricity demand can be supplied from a renewable energy system combining solar photovoltaic panels, onshore wind power and biomass from forests. Most of the supply may come from PV panels installed in buildings in cities. Unit cost of electricity generated are above 16 cents/kWh, and would involve large investment for the installation of the technologies. A detailed description of the biomass resource will be considered in further analysis. Main sources of biomass in the target area are wastes from palm oil industry, such as empty fruit bunch (EFB) and palm kernel shells (PKS). These resources are an alternative for energy supply and income generation inside palm oil factories as well as in the region in general.

Conclusions

The local energy model for renewable energy system applied to the case of Iskandar Malaysia shows that combined utilization of solar PV, onshore wind power and forest biomass can contribute to up to 6% of electricity supply in the region. Implementation of RE targets with larger share of renewable energy supply must consider additional renewable resources, such as municipal and industrial waste, and technological improvements that secure higher efficiency of the renewable energy system.

References

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