Master Thesis Vacancy

Research related to the contribution of batteries towards emission reduction at solar carparks for electric vehicle charging

Period: Around 9 months, starting date negotiable (mid-2022)

Research group and supervision: You will be supervised by researcher, Rishabh Ghotge, Future Energy Systems group, Process and Energy, 3mE department, TU Delft under Prof. Ad van Wijk. You will also work closely with senior project leader, Karin Maatje, Province of Flevoland, Lelystad and other parties within the PowerParking consortium. For the duration of your thesis, you will be hired as an intern by the Province of Flevoland with a corresponding stipend.

Project details

The PowerParking project has recently constructed a solar powered parking lot for the charging of electric vehicles at the Gemeentehuis (Municipality building), Dronten. It consists of solar arrays in the parking lot, controlled charging of electric vehicles and battery storage.

A similar concept will be rolled out at the parking lot at MAC^{3}Park (without the stationary battery), with future scale-up in the Dutch province of Flevoland. The project at Dronten has monitoring data being collected at site, based on which we can understand at a deeper level how the system operates in response to the charging needs of users and energy prices in the market.

Background

The success of projects involving clean energy is increasingly being measured by the emissions reduced through their implementation rather than the number of units of energy they produce [1]. The

emissions released as a result of clean electricity projects (such as a solar project) are generally estimated by

1) counting the units of electricity which is substituted through production at the plant
2) Assigning a value of carbon intensity to each unit of electricity
3) Calculating the effects of the proposed plant on operation and construction of other plants (existing and future).

This methodology is quite clear and well established [2]. However, for projects involving (multiple) innovative elements such as storage and demand response, the calculation of emissions becomes far more complicated. As an example, batteries can enable the use of energy which might otherwise have been curtailed due to limited grid capacity. Similarly, plug in electric vehicles can be controlled to charge using solar electricity, which then substitutes electricity from the public grid. Time shifting of demand can lead to lower emissions without changing the net units of electricity consumed.

Assignment

You will need to

- understand the systems built at the Gemeentehuis Dronten and MAC^{3}Park, how they operate and what data is collected.
- Apply a recently developed methodology [3] for the calculation of offsetted emissions per year by the project based on both inputs from the project (typically meter data) and external data (such as carbon intensity).
- Identify the error margins in the carbon estimations made based on the accuracy and completeness of measured data and the assumptions made in the calculation steps.
- Make an estimation of the offsetted emissons in the Dronten and Mac3Park projects analysis and compare them over the duration of data availability and project lifetime.
- Draw project specific and broader conclusions on the contribution of batteries towards carbon offsetting.
- Identify the limitations of the applied methodology in terms of scope, accuracy, wider applicability and decisions-usefulness, and make concrete recommendations for improvements.

You will be expected to step out of the University to independently find/ measure data to support your work.

Profile

- Background in Sustainable Energy Technology, or similar.
- Knowledge of or prior experience with energy system modelling.
- Enthusiastic and aware about subjects like the use of solar energy in the built environment, energy storage, electric vehicles and charging infrastructure, vehicle-to-grid concepts, impacts of electric vehicles on the electric grid, etc.
- Ability to work independently, communicate well and learn quickly on the job.
- Working knowledge of Dutch will be an asset but is not a requirement for this project.
- Previous knowledge of Python for data analysis will be an asset since a lot of the datastreams use Python. Knowledge of MATLAB (or other languages) or quick learning curve with Python would also be useful.

Response

To apply for this thesis position, please send an email to both Karin.Maatje@flevoland.nl and r.ghotge@tudelft.nl including your CV.

References

[1] Ministerie van Economische Zaken en Klimaat, "Kabinet stelt met SDE++ €5 miljard beschikbaar voor CO_2-reductie - Nieuwsbericht - Rijksoverheid.nl," Feb. 17, 2020. https://www.rijksoverheid.nl/actueel/nieuws/2020/02/17/kabinet-stelt-met-sde-%E2%82%AC5-miljard-beschikbaar-voor-co%E2%82%82-reductie (accessed Jul. 27, 2020).

[2] UNFCCC, "Tool to calculate the emission factor for an electricity system," 2018. Accessed: Jul. 27, 2020. [Online]. Available: https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-07-v7.0.pdf

[3] K. Tegtmeier, "Offset Carbon Emission Accounting Methodology and Application to Solar Carport," Delft University of Technology, Delft, the Netherlands, 2021. Accessed: Oct. 11, 2021. [Online]. Available: https://repository.tudelft.nl/islandora/object/uuid%3Ae022316c-8172-47be-bd5c-57f1a98e8606