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Ontology-First data model design for cross-domain analyses in the context of electric vehicle charging infrastructure data

Eugenio Salvador Arellano Ruiz[1] [https://orcid.org/0000-0003-2508-3976] Fabia Miorelli[1] [https://orcid.org/0000-0001-5095-5401] Niklas Wulff[1] [https://orcid.org/0000-0002-4659-6984] Carsten Hoyer-Klick[1] [https://orcid.org/0000-0002-7273-9176] Patrick Jochem[1] [https://orcid.org/0000-0002-7486-4958]

[1]German Aerospace Center (DLR), Institute of Networked Energy Systems, Department of Energy Systems Analysis, Stuttgart, Germany

Abstract: A presentation with lessons learned during the development of data models for the evaluation of electric vehicle charging infrastructure across the fields of energy systems analysis and transport research.

Keywords: Energy systems analysis, FAIR, Research workflows, Charging infrastructure

In energy systems research and other interdisciplinary fields, research data models are traditionally constrained to the projects, publications, experiments and/or analyses behind them. These models are characterized by being knowledge representations of the practitioners in their respective fields of expertise. These representations are not always interoperable across disciplines because they may consist of incompatible axioms. Ontologies like the Open Energy Ontology(OEO) [1] are designed to ease the process of interoperability across domains in energy systems research. However, researchers without technical expertise in data infrastructure are unable to utilize them effectively in their workflows. In this presentation, using open electric vehicle charging infrastructure data, we show real-world examples on how ontologies like the OEO can be used to drive the data management of projects and experiments in an interdisciplinary context.

The format of the contribution is a 15 to 20 minute presentation detailing three stages of a work still in progress. First the development of the initial data model to apply the FAIR principles [2] to the charging infrastructure data of the German Federal Network Agency (BNetzA) [3], this is done using tools from the Open Energy Family like their metadata format [4] which in place borrows specifications from frictionless [5]. The second part is a technical proposal for documenting provenance of data derived from clean and structured datasets using code and querying languages. And the third is a demonstration of the interoperability and extension of the model from part 1 by reproducing existing research utilizing a completely different dataset. Across the three topics we will emphasize how the FAIR principles to reduce the burden on research reproducibility. It will be also be explained how these workflows can be integrated with existing infrastructure, in our case the Open Energy Platform (OEP) [6].

In our conclusions we emphasize on how to fulfil the FAIR principles across the data lifecycle within a specific project or experiment. We propose that an effective implementation of the FAIR principles in cross-domain energy research can be done by aiming at self-consistency and data normalisation within individual projects. This should be done without implementing every aspect of interoperability such as ontology development, which should be delegated to their respective working groups.

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