Enabling Operational Flexibility Of Distribution Networks Using Residential Energy Storage & Demand

Publieke samenvatting / Public summary

Aanleiding

Over the past years, the penetration rates of renewable generation like wind and solar energy have been rapidly growing within distribution networks. In the future, the use of electric vehicles together with residential energy storage is expected to drastically increase. Currently, residential distribution grid infrastructure does not have adequate flexibility to cope up with relatively large increase in demand. In practice, the lack of flexibility creates a series of technical problems as follows: congestion management, frequency control, local under- or over voltage, peak load increase, transient stability and reliability problems. To solve these issues, at the residential distribution level, it is required to develop and build integrated sustainable modular system which employs advanced charging algorithms. TKI FLEXGRID is a multidisciplinary project that aims at enabling the flexibility of distribution networks through novel modular system for the efficient integration of storage (e.g., distributed residential energy storage systems (RESSs)) together with smart charging strategies for electric vehicles (EVs) and novel demand response (DR) programs.

Doelstelling

The primary goal of this project is to enable flexibility of residential distribution networks by developing and charging a novel modular sustainable system for integrated charging of

Projectinformatie / Project information

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Algemene informatie / General information

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Publicaties en materialen / Publications and attachments

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EVs+RESSs with DR schemes. The specific objectives are: - Investigate the pros and cons of various distributed RESS options - Design and develop a moular, integrated PV+RESS+EV+DR (PRED) system enabling novel integrated charging of EVs, RESSs, & DR schemes - Evaluate the flexibility offered by residential energy storage, electric vehicles and flexible loads in networks when using the above novel integrated system - Identify the most relevant and valuable electricity services provided by flexible components like distributed RESSs, EVs and DR. - Develop of new charging algorithms including vehicle-2-grid (V2G) schemes for the integrated EV+RESS and future programme for DR in the system. - Recommendations for innovative local electricity markets such as real-time, voltage/reactive power, and smart markets for distribution regions including distributed RESSs, and their indirect use in the project. - Quantify the benefit of integrated charging of RESSs, EVs, and DR in local electricity markets.

Korte omschrijving

WP1: Project management WP2: Integration of sustainable RESSs in distribution grids o Pros/Cons of RESSs & their best options o Develop novel charging schemes for RESSs o Recommendations for innovative local electricity markets WP3: Coordinated smart charging of EVs o Estimate the flexibility offered by EV o Develop novel charging & V2G schemes for EVs together with RESSs o Maximizing use of solar energy through smart charging of RESSs+EVs WP4: Flexible demand response programs o Develop flexible DR programs for residential users o Determine flexibility from new program for an individual PRED system WP5: Innovative power electronics designing integrated PRED hardware with lower conversion losses o Design & develop an integrated EV+RESS hardware o Implementing EV multiplexing enabling the sharing among multiple EVs o Experimental validation of PRED hardware with charging algorithms WP6: Evaluation of increased flexibility of the grid when using the integrated PRED system o Creation of PRED cases for end-use consumers in an area o Evaluation of theoretical research in WPs2-4

via simulations WP7: Dissemination & communication o Workshops and dissemination for Netbe

Resultaat

The project results in a new integrated modular PV+RESS+EV+DR system with advanced charging schemes and DR programmes to enable the flexibility of residential distribution grids in a synchronized manner. These include: - Building and developing new integrated modular PV+RESS+EV+DR hardware for end users (in WP5) - Evaluate the flexibility offered by residential energy storage, electric vehicles and flexible loads in distribution grid using theoretical research in WPs 2-4 through simulations (in WP6) - Development of new charging scheme for the integrated EV+RESS and future programme for DR that can capitalise on their flexibility, encourage their charging from renewables and delay distribution network upgrades - Experimental implementation and validation of the flexibility offered by RESS, EVs, and residential loads in WP6 through the use of the integrated hardware with the novel charging schemes - Recommendations for the best choice of RESS technologies as well as future local electricity markets that incentivises flexibility including distributed RESSs, DR & EVs.

De data in deze applicatie is afkomstig van de Rijksdienst voor Ondernemend Nederland (RVO) en wordt in samenwerking met de Topsector Energie ontsloten.
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