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Description of the funded research project

2nd Call for H.F.R.I. Research Projects to Support Post-Doctoral Researchers

Title of the research project:
Smart ELectric Vehicles Integration in electric energy Systems (ELVIS)

Principal Investigator:
Stylianos Vagropoulos, Assist. Professor, University of Thessaly

Reader-friendly title:
ELVIS

Scientific Area:
Environment and Energy

Institution and Country:
University of Thessaly, Greece

Φορέας Υποδοχής:
University of Thessaly

Collaborating Institutions:

1. **Engie Hellas S.A.**
2. **ASEM Island Mobility Services**
3. **Inetum Realdolmen**
4. **Core Research Center – University Catholique de Louvain**
5. **Municipality of Thermi**

Stylianos Vagropoulos
Assist. Professor, U.Th.,
Dept. of Energy Systems
Modeling and optimization

Stratos Keranidis
Post-doc Researcher
Network experimentation & prototype implementation

Christos Roumkos
Ph.D Candidate
Electricity market modeling and design

Budget:
188.784,00 €

Duration:
27 μήνες

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Research Project Synopsis

The massive, uncontrolled charging of numerous electric vehicles from the grid will create problems in the proper and reliable operation of the electricity networks (indicatively: overloading of power lines and transformers, extreme voltage fluctuations, increased energy losses).

A very promising solution is the application of controlled and coordinated charging of electric vehicles, also known as smart charging. During smart charging, the charging time and rate of an electric vehicle is controlled.

The development of an integrated smart charging solution meets significant technical challenges and requires the cooperation of numerous stakeholders (e.g., electric vehicle users, charging point operators, e-mobility service providers, market operator, system and network operators, electricity suppliers, electric vehicle aggregator).

The Electric Vehicle Aggregator (EV Aggregator) is a new entity that can take over the central management of the smart charging of numerous electric vehicles and interact with the various stakeholders in an optimal way.

The object of ELVIS is the development of a prototype integrated tool for the management of smart charging by an EV Aggregator in order to provide cost-effective charging to electric vehicle users, while providing ancillary services to the system and network operators.

Project originality

The prototype integrated tool that will be created within ELVIS brings together a set of innovations:

- ✓ **Advanced mathematical models for optimal bidding strategy in EU-based electricity markets**
- ✓ **Remote and coordinated control of numerous electric vehicle chargers with emphasis on interoperability (OCPP)**
- ✓ **Mathematical models for estimating and predicting charging energy needs and evaluation with real-world data provided from the collaborating institutions**

- ✓ **Viability assessment of various business models utilizing smart charging**
- ✓ **Development of charging point operator interfaces and mobile applications for electric vehicle users that participate in smart charging programs**
- ✓ **Dynamic pricing for electric vehicle users supported by “smart" contracts**
- ✓ **Real implementation of the overall system in commercial chargers that will be installed at one collaborating institution**
- ✓ **Smart and green charging (power by renewables)**

Expected results & Research Project Impact

- **Development of a prototype integrated tool for smart charging management by an EV Aggregator in order to provide cost-efficient charging to electric vehicles users, while providing ancillary services to the system and network operators.**
- **Contribution to the sustainable integration of electric vehicles in electric power systems, enhancing the reliable operation of the electricity grid and promoting e-mobility.**
- **Contribution to the reduction of fossil fuel consumption and greenhouse gas emissions through optimal electric vehicles charging from wind and photovoltaic energy.**
- **Support of the key priority of Greece and the EU for a cleaner and more sustainable future.**

The importance of this funding

H.F.R.I. funding is an excellent tool for supporting young researchers, since it provides the necessary resources to high-quality research staff to be employed in Greek research institutions by conducting pioneering research. It also provides the resources for the equipment needed for the research activities. Finally, it gives free-space to young researchers to organize their research independently, to choose their research team and to fund their overall needs. This flexibility maximizes efficiency in research production and gives unique opportunities for researchers to move forward in new, high-quality research outcomes.

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