i-RESEV NEWSLETTER

ISSUE No. 5 - December 2014

INTRODUCTION

i-RESEV PROJECT

This is the final Newsletter issue of the i-RESEV project entitled **"ICT-aided integration of Electric Vehicles into the Energy Systems with a high share of Renewable Energy Sources"**, and supported by the Croatian Science Foundation. The project started in January 2012 and ended in December 2014. The main information about the project can be found on the web site http://powerlab.fsb.hr/iresev and the previous newsletter issues posted therein.

CONTENT OF THIS NEWSLETTER ISSUE

This newsletter issue describes the main project activities since September 2014 when the 4th Issue was published. This includes an outline of main project results, and a related list of recent publications. The project news section is also given, as well as a popular section including information on upcoming events, web portals, and project calls.

PROJECT NEWS

3rd PROJECT WORKSHOP

The project team organised the third project workshop entitled **"Towards Integration of Electric Vehicles into the Energy Systems with a High Share of Renewable Energy Sources"**, which was held at the University of Zagreb-FMENA on January 15, 2015. The main aim of the workshop was to disseminate the project results with the emphasis on the final research year period to the domestic community involved or interested in electric vehicle and energy system R&D activities. The introductory overview of project results, given by the project leader, Prof. Deur, and the sub-coordinator of energy planning activities, Dr. Goran Krajačić, was followed by detailed presentations given by young researchers. Also, a round table on e-Mobility was held, including presentations by several entities from Croatian, Austrian and Slovenian companies and institutes (i.e. *Austrian Institute of Technology (AIT); ETREL, Slovenia; and HEP - OPSKRBA d.o.o.*). The workshop program can be found on the i-RESEV website (in Croatian only). The workshop participants were to be able to download all workshop presentations.

i-RESEV TEAM WON FIRST HORIZON 2020 PROJECT

From January 2015 the Universiy of Zagreb-FMENA participates in the three-year **Horizon 2020, 2014-LCE-14 project Bin2Grid** (*"Turning unexploited food waste into biomethane supplied through local filling stations network"*), The project consortium includes eight European partners, led by Zagreb Holding as the coordinator. The main focus of the project is sustainable management of bio wastes together with biomethane production and distribution through local filling stations for public transport. The i-RESEV team member Dipl. Ing. T. Pukšec and other colleagues from The FMENA's Department of Energy, Power Engineering and Environment will take an active role in project execution.

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Ph.D. STUDENT ANNUAL AWARD

Dipl. Ing. Mihael Cipek, the project team member, received the Award for young researchers in 2014 from the Society of University Teachers, Scholars and other Scientists in Zagreb for his paper entitled "A control-oriented simulation model of a power-split hybrid electric vehicle" and published in the journal *Applied Energy*, and related work through this project.


DRUŠTVO SVEUČILIŠNIH NASTAVNIKA I DRUGIH ZNANSTVENIKA U ZAGREBU

GODIŠNJA NAGRADA DRUŠTVA MLADIM ZNANSTVENICIMA I UMJETNICIMA

dodjeljuje se

MIHAELU CIPEKU

za znanstveni rad iz područja tehničkih znanosti
polje strojarstvo
koji je objavljen u akademskoj godini 2012/2013.

U Zagrebu, 18. ožujka 2014.

Predsjednik Povjerenstva za dodjelu godišnje nagrade Društva:
Prof. dr. sc. Mladen Franz

Predsjednik Društva:
Prof. emeritus dr. sc. Željko Horvatić

POPULAR LECTURE TO STUDENTS

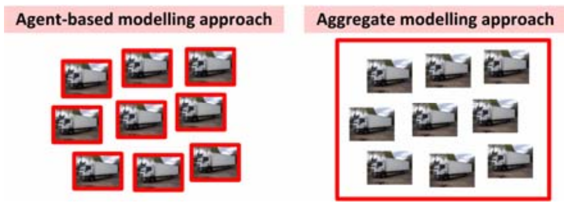
Mag. Ing. Branimir Škugor, the Ph.D. student on the project, gave a popular lecture on the topic of electric vehicle-grid inegration, on the forum of student organisation SUPEUS. The lecture was held at the University of Zagreb-FER in March 2014 and attended by around 250 students from Zagreb, Rijeka, Slavonski Brod and Split.

OVERVIEW OF RESEARCH RESULTS

This section gives an overview of recent project activities and results related to modelling and charging optimisation of electric vehicle fleets, agent-based transport modelling and energy planning. More detailed results are included in our publications listed in a separate section below.

AGENT-BASED MODELLING AND CHARGING OPTIMISATION OF ELECTRIC VEHICLE FLEET

There are two basic approaches of modelling an electric vehicle (EV) fleet: agent-based and aggregate modelling approaches. In an agent-based model, each EV within a fleet is modelled separately, while in an aggregate model whole EV fleet is represented by a single aggregate battery model. Agent-based EV fleet models are considered more accurate than aggregate ones since they incorporate constraints related to individual vehicles more effectively. Therefore, agent-based models can be used as benchmark for validation of aggregate ones. Aggregate modelling approach is elaborated in 4th Newsletter Issue, where two aggregate fleet models are presented, the basic one and the novel one. Here, the emphasis is on the agent-based modelling and corresponding charging optimization.



Electric vehicle fleet modelling approaches

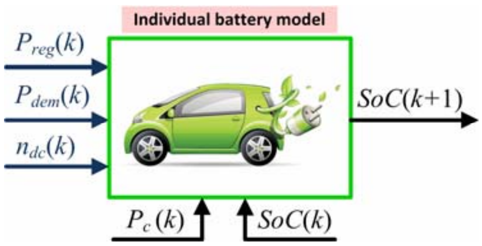


Illustration of individual vehicle model

Agent-based EV fleet model is defined by a state equation, which includes individual EV battery state-of-charge (SoC) dynamics, as well as by SoC- and charging power-related constraints. The individual battery model requires the following input time distributions: (i) power demand (P_{dem}), (ii) time share of parked (i.e. ready-to-charge) individual EVs within each time step ($0 \leq n_{dc} \leq 1$), and (iii) regenerative

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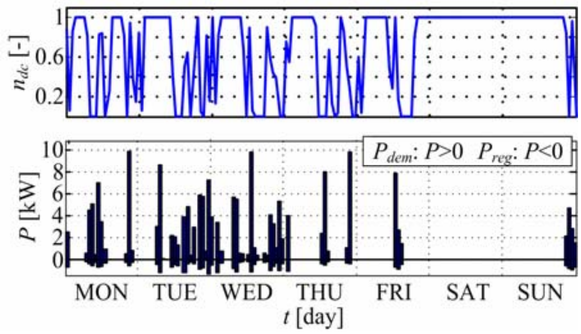
braking power (P_{reg}). The model also includes charging power as a single control variable, while the SoC is the only state variable.

Before conducting the EV fleet charging optimization, a battery model of each EV within a fleet should be parameterized. The following figure shows the required input time distributions derived from recorded data and simulations of a passenger extended range electric vehicle (EREV) model over recorded driving cycles (see 2nd Newsletter Issue for more details on EREV modelling and control, and analyses related to recorded driving cycles).

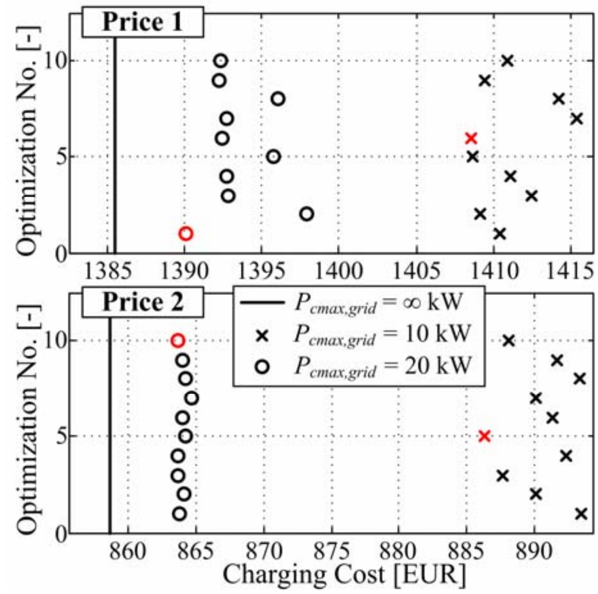


Example of input time distributions of individual battery model shown in a weekly time basis

As already noted, the agent-based EV fleet model is more accurate, but at the same time it is numerically rather inefficient when compared to an aggregate battery models. Consequently, it is not possible to use computationally demanded dynamic programming (DP) algorithm (that give globally optimal solution for general non-linear problem) for simultaneous charging optimization of all EVs within fleet. In that case, the execution time of charging optimization of the whole EV fleet would exponentially grow

$$N_{soc}^{Nv-1} \cdot N_{control}^{Nv-1} \cdot T_{optim,ind},$$

where N_{soc} and $N_{control}$ denote the number of SoC, and charging power discrete levels, respectively. N_v denotes the number of EVs within fleet, while $T_{optim,ind}$ stands for duration of individual EV charging optimization. This would become infeasible even for a few EVs within a fleet. In order to resolve this issue, DP-based charging optimization is performed successively for each EV, but this can give globally optimal results only in the case when there are no shared constraints between EVs. In the presence of shared constraint, e.g. maximum charging power which can be drawn from the grid, optimization results will depend on the charging optimization ordering list. The following figure shows charging cost for the case of two electricity price models and different values of grid power upper limit ($P_{cmax,grid}$). In the case when there is no grid power-related constraint (black line) minimum possible charging cost is obtained. In the presence of grid power-related constraint, different orders of successive optimization are performed, and the minimum charging results are considered as optimal (denoted by red).



Charging cost of EV fleet obtained for different charging optimization ordering lists

The aggregate power time profiles obtained by using aggregate battery model and DP-based optimization (see 4th Newsletter Issue for more details) is distributed over individual EVs by using a simple heuristic method. This is considered as a hierarchical charging concept which can be efficiently applied to real-time management of EV fleet charging and it is illustrated in the following figure.

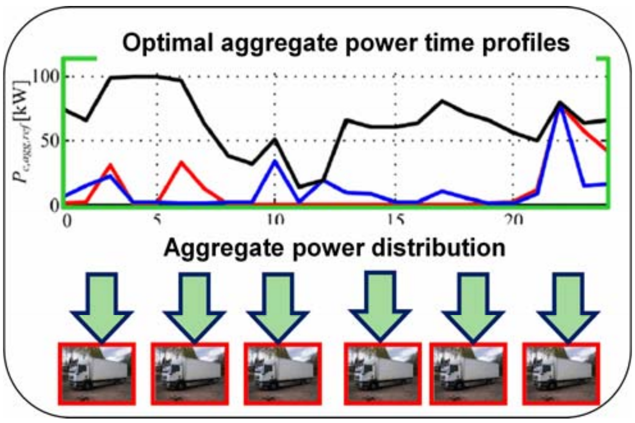


Illustration of EV fleet hierarchical charging concept

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ICT-aided integration of Electric Vehicles into the Energy Systems with a high share of Renewable Energy Sources

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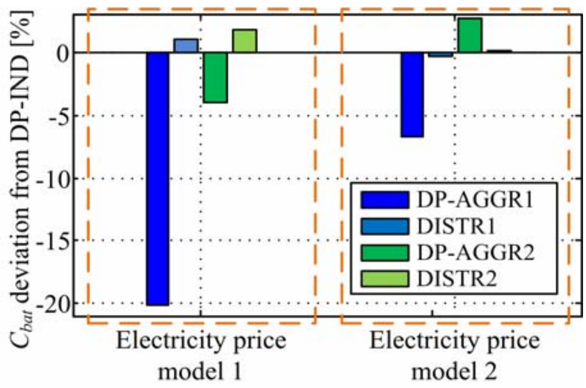
The following figure shows validation of the aggregate battery models (DP-AGGR1 for the basic model, and DP-AGGR2 for the novel model) and the corresponding heuristic distribution methods (DISTR1 and DISTR2, respectively) against results obtained by agent-based EV fleet model and successive DP optimization (denoted as DP-IND for the case of $P_{cmax,grid}$ = 20 kW). It can be seen that the charging costs of basic aggregate battery model (DP-AGGR1) deviate significantly from DP-IND as opposed to the charging cost of novel aggregate battery model (-20% vs. -4% and -7% vs. +3%), thus indicating the accuracy of the novel model. However, this deviation is reduced for both models when heuristic charging distribution is applied. This indicates possibility of using both aggregate models in hierarchical charging, while in energy planning-related studies novel aggregate battery model should be used due to the improved accuracy.

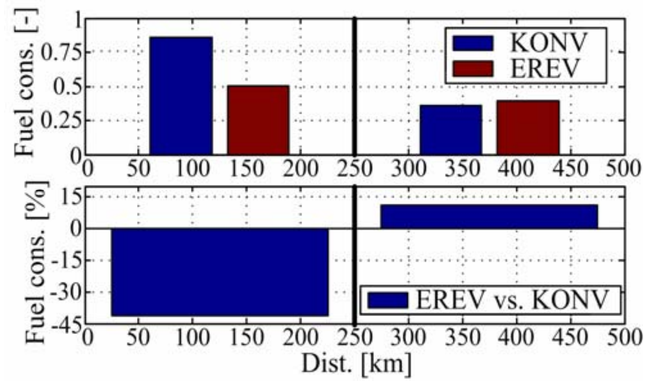


Charging cost of EV fleet obtained by different methods and compared to DP-IND results

A CASE STUDY OF ELECTRIFICATION OF DELIVERY VEHICLE FLEET

The case study relates to replacement of existing conventional vehicle fleet with a hypothetic one based on EVs and introduction of renewable energy sources (RES). It is conducted for the case of an isolated energy system of a distribution centre of a leading regional retail company Konzum, d.d. The case study is based on a novel aggregate battery-based EV fleet model and the corresponding DP-based optimization method. The required EV fleet model input-time distributions are determined by using GPS experimental data of the delivery vehicle fleet, which were being continuously recorded for ten fleet representative delivery vehicles over a three month period. The transport demand time-distributions are based on a simulation of a series configuration of an Extended Range Electric Vehicle (EREV) over the recorded driving cycles, where the EREV is designed to have comparable output-torque and power characteristics as the existing diesel engine-propelled vehicle.

The following figure shows normalized total fuel consumption obtained by simulations of EREV and conventional vehicle models over two groups of driving cycles. Reduction of the total fuel consumption for the considered fleet of 10 delivery trucks, as well as CO2 emission reduction, is around 40% when compared to the conventional vehicle fleet for the case of driving cycles up to 250 km. In the case of solely those cycles longer than 250 km, EREV vehicles can result in 10% larger total fuel consumption than conventional vehicles, because of lower efficiency of multiple energy conversion chain characteristic for the considered series powertrain configuration. Consequently, at the current stage of battery development (including its cost and weight), it is reasonable to electrify only vehicles that cover shorter driving cycles (e.g. urban and suburban cycles). The longer distance covering can be viable only for multiple, preferably fast charging locations, e.g. in sales centres and public stations.



Normalized and relative fuel consumption over two groups of driving cycles (<250km, >250km)

The DP-based charging optimizations are conducted by using novel aggregate model for different effective areas of solar panels installed. Two-tariff electricity price model characteristic for Croatian energy market is used in optimizations.

The following figure shows the EREV fleet total charging cost for different effective areas of solar panels installed. It can be seen that in the case of full potential of solar panels installation, the charging cost for the EREV fleet of 10 vehicles can be reduced by more than 40% when compared to the case when there is no energy production from solar panels. This can be extended to 60% if maximum charging power of individual EREV is increased (red line).

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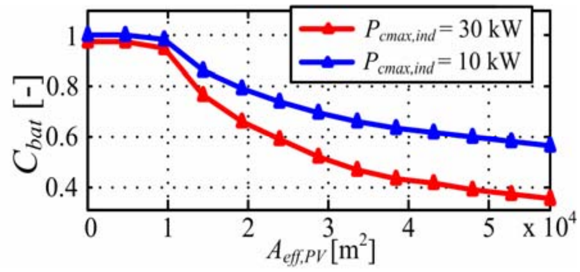
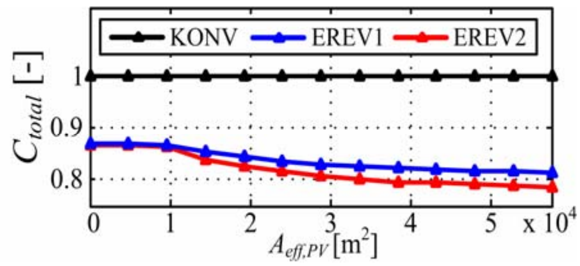


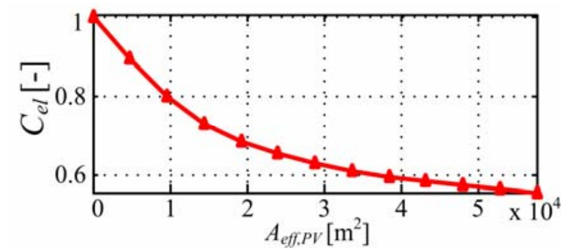
Normalized total charging cost of EREV fleet vs. different solar panel area installed ($A_{eff,PV}$)

The EREV fleet total operational cost shown in the next figure (EREV: $P_{cmax,ind}$ = 10 kW, EREV2: $P_{cmax,ind}$ = 30 kW), which includes the fuel- and electric energy-related costs, is reduced by 13% with respect to the total operational cost of the conventional fleet, while this reduction is further improved to 20% for a full potential of solar panels installed.



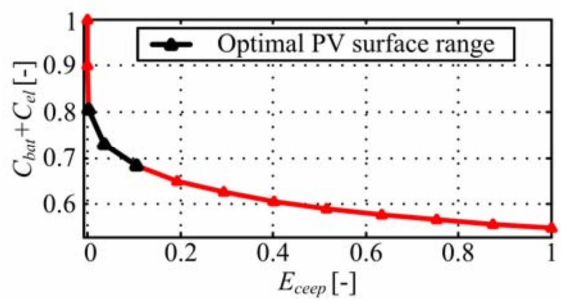
Normalized total cost (including fuel and electric energy) of EREV and KONV fleet vs. different solar panel area installed ($A_{eff,PV}$)

The following figure shows normalized electric energy cost of other appliances within the distribution centre, where the cost reduction can reach 45% in the case of a full potential of solar panels installed.



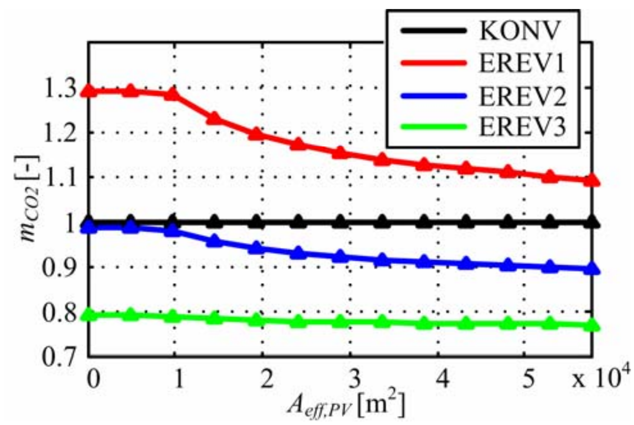
Normalized total cost of electric energy used by other appliances vs. different solar panel area installed ($A_{eff,PV}$)

Based on the conducted results, the recommendations for the optimal effective area of installed solar panels can be given. The estimation is based on criterion of maximizing the total electric energy cost reduction, while minimizing the excess energy production from the solar panels. The analysis point out that for the particular fleet of 10 vehicles the optimal solar panel area should be in the range from approximately 15% to 30% of the maximum available solar panel area (see the following figure). Installing the full potential of solar panels would, therefore, be reasonable only in the case of higher penetration of electric vehicles.



Normalized total electric energy cost (C_{bat} + C_{el}) vs. normalized excess energy production from solar panels (E_{ceep})

Finally, the below figure comparatively shows CO2 emissions caused by diesel fuel consumption and production of electric energy used for EREV charging. Different production sources of electric energy are assumed: (i) coal fired power plants, (ii) natural gas power plants, and (iii) nuclear energy and renewable sources. In the case (i), EREV fleet generates 10-30% more CO2 than the conventional fleet (EREV1). This unfavourable CO2 excess is somewhat decreased in the case of higher maximum charging power of individual EREVs. In the case (ii), the CO2 emissions are reduced by up to 10% (EREV2), while in the case (iii), the CO2 reduction reaches 20% (EREV3). This would be further improved if only short driving cycles are covered with EREVs. Apart from CO2 emissions, the benefit would then be even higher in terms of reduction of air pollutants and noise pollution, which are particularly harmful in urban and suburban regions.



Normalized CO2 emissions (m_{CO2}) vs different solar panel area installed ($A_{eff,PV}$)

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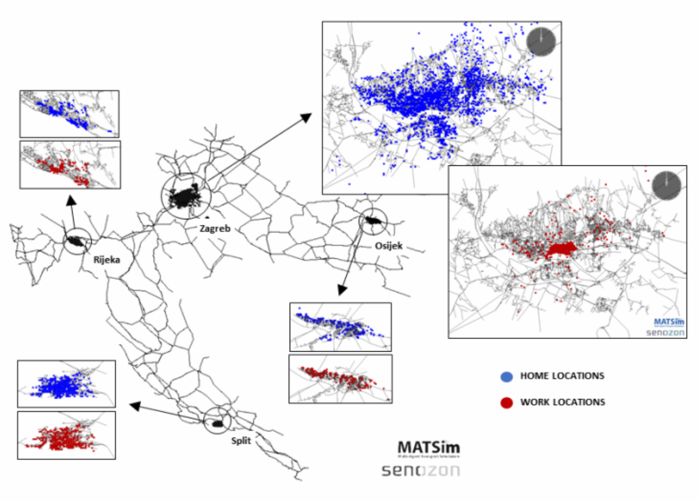
AGENT BASED MODELLING OF DEMAND OF PERSONAL ROAD VEHICLES

The transportation sector is one of the major energy consumers, i.e. a large portion of the energy demand is linked to road transport and personal vehicles. Because of significant boost in efficiency, a modal switch from conventional internal combustion engines (ICE) to electric vehicles (EVs) has the potential to greatly reduce the overall energy demand of the transport sector. Our previous work has shown that a transition to EVs in a combination with a modal split from air and road to rail transport can reduce the energy consumption in Croatia by 99 PJ, which is approximately 59%, by the year 2050 when compared to the business as usual scenario.

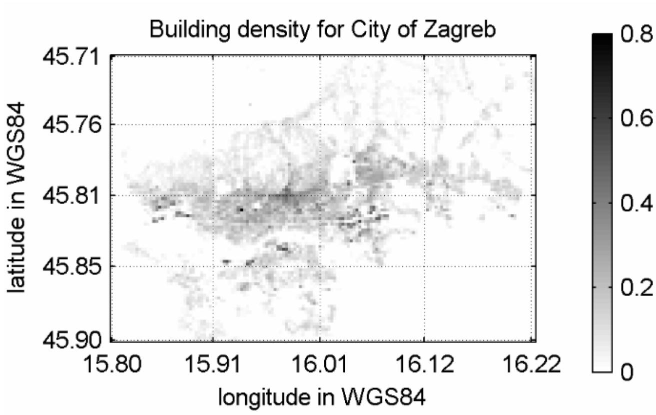
The goal of this investigation has been to model the hourly distribution of the energy consumption of EVs and use the calculated electricity load curves to test their impact on the Croatian energy system. The hourly demand for the transport sector has been calculated using the agent-based modelling tool MATSim on a simplified geographic layout. The impact that EVs have on the energy system has been modelled using the EnergyPLAN advanced energy system analyses tool.

In order to find the population and activity plan inputs for the four biggest Croatian cities, the spatial distribution of home and work locations were estimated based on the socio-demographic data, available as aggregated values at the municipality level, building density per area and the official addresses of registered companies. Since the municipalities are too big to provide a sufficiently fine resolution of home and work locations, they are further divided into 200 x 200 m rectangular cells. At this resolution, the home and work locations can be found and overlaid over the road network, as presented in the first figure bellow for the case study of Croatia.

An activity plan for each agent should provide the coordinates of each activity and their time series during the day. Activities are different for the work day or weekend. In this work, the only activities are home and work. Home location for each agent is found among the available cells taking into account the probability of the building density. An example for the city of Zagreb is given in the second figure bellow.

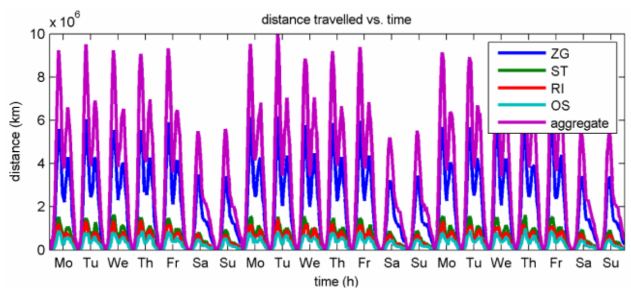


Network of Croatia's main roads coupled with the detailed road network in the four biggest cities overlaid with the facilities presenting agent's home and work activity locations



Distribution of building densities in Zagreb city; each square is a cell with dimensions 200 x 200 m

Results obtained from MATSim are time series of kilometres that the modelled vehicle fleet travels for each day of the week for each of the four cities taken into consideration, as shown the plot below. With this distributions, the distribution of the time the vehicles are parked can also be easily obtained.



Output from MATSim: time series of kilometres driven for three weeks

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The time series of travelled distance is strongly following the time series of prescribed activities. The city of Zagreb is the most dominant in the aggregated value.

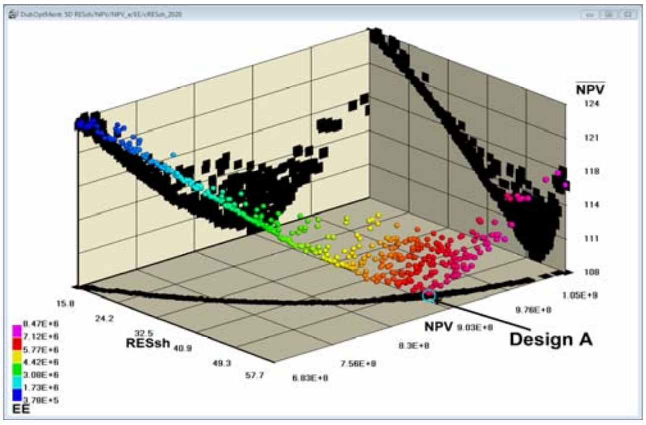
Agent based modelling can be a strong tool for modelling of the hourly distribution of energy demand of the transport sector. The quality of the results is highly dependent on the quality of the input data.

The obtained hourly energy demand curves for the Croatian road transport sector has been used in the EnergyPLAN tool to analyse the impact of introducing electric vehicles in the Croatian energy system and the potential for the increase of the penetration of wind power and PV. The results have shown that the electrification of the urban road transport sector can help reduce the fuel consumption by 12.3% and CO_2 emissions by 14.6% for the case of no renewables and a 50% share of electric vehicles. These numbers are greater when higher penetrations of renewables are taken into account.

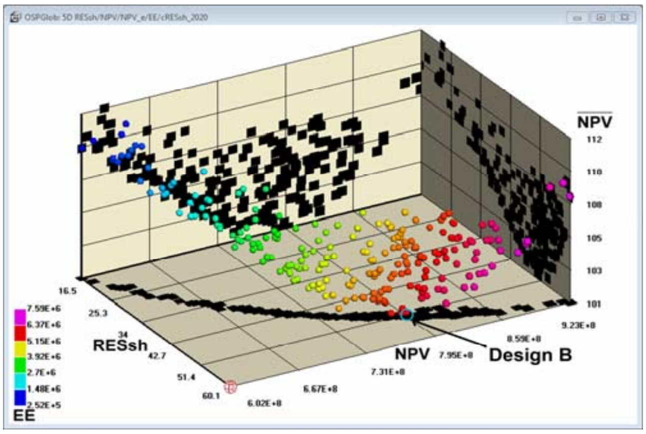
NEW OPTIMIZATION METHODS FOR LONG-TERM ENERGY PLANNING INCLUDING ELECTRIC VEHICLE BATTERY STORAGE

Energy planning in H2RES model has been upgraded with introduction of robust optimization algorithms, firstly through DeMak (OCTOPUS Designer) software, and later with integration into H2RES software itself. Multi-objective long-term optimization of an energy system with high share of renewables has been tested on a case-study of Dubrovnik region, simulating 20 years of operation. EV fleet is considered as additional energy demand for the system, and as power storage. Both presented approaches to energy system planning contain two levels. At the first level multi-objective optimization algorithm determines the overall installed capacity for the 20-year period in question, while the second level determines the best approach to regulating the system. Two problem solution types were used to solve the second level. Problem solution 1 uses merit-order operation of the energy system, in which electric energy demand is covered by power plants with predetermined priority for each hour. Problem solution 2 divides the second level problem on 24-hour periods in which regulation variables are determined by optimization algorithm, with objective of minimizing the operating costs of the system. Choice of a 24-hour period for the extent of each of optimization problems is governed by the behaviour of the EV drivers, and is mostly determined by their day-based obligations. The same applies for the electric energy demand.

The resulting Pareto fronts of both solution type are given in the sequel, where the used objectives are on three coordinate axes: maximization of share of energy from renewables (*RESsh*, including wind, solar without hydro power), minimization of economic parameter Net Present Value (*NPV*) and minimization of *NPV* divided by total energy consumption.($\overline{NPV}$). The difference between minimal $\overline{NPV}$ designs of Problem solution 1 (Design A) and Problem solution 2 (Design B) is ~7 EUR/MWh. Also, installed power of the hydro power plant, which is the only non-RES power plant in the case study, is 113 MW for design A, while 89.3 MW for design B.



Pareto front of Problem solution 1.



Pareto front of Problem solution 2.

The reason why design B outperforms design A is illustrated in the following figures, showing 24 hours of the 3634th day, which turns out to be the critical day in the entire scenario period. Figures show how each of two designs satisfies demand (red line). In both figures the produced energy is exactly the same as demand, while in problem solution 2, EV battery storage has enough capacity to produce energy in a period between hours 87233-87240 to cover difference between demand and

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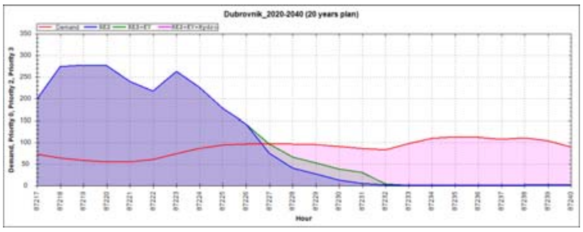
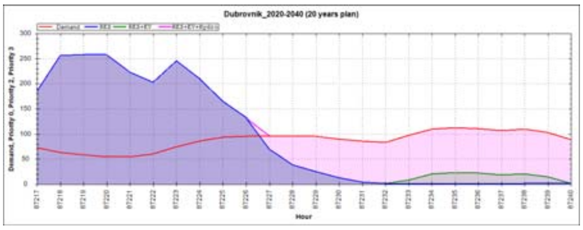
hydro power plant. The significance is critical because the period between the hours has negligible electricity production from RES (blue line/shade area), so that the total produced energy (magenta line/shade area) can only come from EV storage (green line) and hydro power. The difficulty of Design A is that it starts to empty storage too early, while Design B empties the storage exactly in the hours where it is needed the most to cover part of the daily peak electricity demand. This is the reason why all designs determined by the Problem solution 2 need smaller installation nominal hydro power capacity.



Storage behavior, Design A.



Storage behavior, Design B

PUBLICATIONS

The above and related research results have been recently published in the below journal and conference papers. Previously published papers are referenced in the previous newsletter issues, as well as on the project web site.

Journals:

1. Pukšec, T., Mathiesen, B.V., Novosel, T., Duić, N., "Assessing the impact of energy saving measures on the future energy demand and related GHG (greenhouse gas) emission reduction of Croatia", Energy, Vol. 76, pp. 198-209, 2014.
2. Cerovac, T., Ćosić, B., Pukšec, T., Duić, N., "Wind energy integration into future energy systems based on conventional plants – The case study of Croatia", Applied Energy, Vol. 135, pp. 643-655, 2014.
3. Deur, J., Škugor, B., Cipek, M., "Integration of electric vehicles into energy and transport systems", Automatika - Journal for Control, Measurement, Electronics, Computing and Communications, 2014. (in review)
4. Novosel, T., Perković, L., Ban, M., Keko, H., Pukšec, T., Krajačić, G., Duić, N., "Agent based modelling and energy planning – Utilization of MATSim for transport energy demand modelling" (in review)

Conferences:

5. Novosel, T., Perković, L., Ban, M., Keko, H., Pukšec, T., Krajačić, G., Duić, N., "Hourly transport energy demand modelling – Impact of EVs on the Croatian electricity grid" 1st SEE SDEWES Conference, Ohrid, Macedonia, 2014
6. Novosel, T., Perković, L., Ban, M., Pukšec, T., Krajačić, G., Duić, N., "Utilization of agent based modelling for energy planning – Transport energy demand modelling" 21th Forum organized by the Croatian Energy Association, Zagreb, Croatia, 2014
7. Gašparović, G., Prebeg, P., Krajačić, G., Duić, N. "Multi-objective long-term optimization of energy systems with high share of renewable energy resources", 1st SEE SDEWES Conference, Ohrid, Macedonia, 2014.
8. Škugor, B., Deur, J., "Dynamic Programming-based Optimization of Electric Vehicle Fleet Charging", International Electric Vehicle Conference (IEVC), Florence, Italy, 2014.
9. Cipek, M., Škugor, B., Deur, J., "Comparative Analysis of Conventional and Electric Delivery Vehicles Based on Realistic Driving Cycles", European Electric Vehicle Congress (EEVC), Brussels, 2014.
10. Škugor, B., Deur, J., "A Novel Model of Electric Vehicle Fleet Aggregate Battery for Energy Planning Studies", 9th Conference on Sustainable Development of Energy, Water and Environment Systems (SDEWES), Venice-Istanbul, 2014. (in review for a journal publication)
11. Škugor, B., Deur, J., "Dynamic Programming-based Optimisation of Charging an Electric Vehicle Fleet System Represented by an Aggregate Battery Model", 9th Conference on Sustainable Development of Energy, Water and Environment Systems (SDEWES), Venice-Istanbul, 2014. (in review for a journal publication)

ONGOING EU PROJECTS

The below EU projects deal with various aspects of EV-grid integration.

1. FastInCharge, Innovative Fast Inductive Charging solution for electric vehicles, Coordinator: David Mignan
2. COSIVU, Compact, Smart and Reliable Drive Unit for Fully Electric Vehicles, Coordinator: Dag Andersson
3. MOBINCITY, Smart Mobility in Smart City, Coordinator: Zsolt Krémer

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4. COTEVOS, Concepts, Capacities and Methods for Testing EV systems and their interOperability within the Smartgrids, Coordinator: Eduardo Zabala
5. PRO-E-BIKE, Promoting-Electric-Bike-Delivery, Coordinator: Matko Perović
6. BATTERIES2020, Towards Competitive European Batteries, Coordinator: IK4-IKERLAN
7. Green eMotion, Developing the European Framework for Electromobility, Coordinator: Heike Barlag
8. ZeEUS, Zero Emission Urban Bus System, Coordinator: Stephanie Leonard
9. FREVUE, Freight Electric Vehicles in Urban Europe, Coordinator: Matthew Noon
10. eCo-FEV, Efficient Cooperative infrastructure for Fully Electric Vehicles, Coordinator: Dr. Massimiliano Lenardi
11. Mobility2.0, http://www.mobility2.eu, Coordinator: Andras Kovacs
12. CACTUS, Models and Methods for the Evaluation and the Optimal Application of Battery Charging and Switching Technologies for Electric Busses, Coordinator: Sebastian Naumann
13. Clean FleetS, Purchasing Clean Public Vehicles, Coordinator: Simon Clement

UPCOMING EVENTS, WEB PORTALS AND PROJECT CALLS

2015 SDEWES CONFERENCES

The 10th Conference on Sustainable Development of Energy, Water and Environment Systems – SDEWES Conference, to be held in Dubrovnik in 2015, is dedicated to improvement and dissemination of knowledge on methods, policies and technologies for increasing the sustainability of development by de-coupling growth from natural resources and replacing them with knowledge based economy, taking into account its economic, environmental and social pillars, as well as methods for assessing and measuring sustainability of development, regarding energy, transport, water, environment and food production systems and their many combinations. Sustainability being also a perfect field for interdisciplinary and multi-cultural evaluation of complex system, the SDEWES Conference has at the beginning of the 21st century become a significant venue for researchers in those areas to meet, and originate, discuss, share, and disseminate new ideas.

HORIZON 2020 CALLS

The most interesting Horizon 2020 calls in the fields related to the i-RESEV project are grouped in the transport, energy and ICT domains, where the corresponding 2014-2015 Programmes can be found on the following links:

http://ec.europa.eu/research/participants/data/ref/h2020/wp/2014_2015/main/h2020-wp1415-transport_en.pdf

http://ec.europa.eu/research/participants/data/ref/h2020/wp/2014_2015/main/h2020-wp1415-energy_en.pdf

http://ec.europa.eu/research/participants/data/ref/h2020/wp/2014_2015/main/h2020-wp1415-leit-ict_en.pdf

The calls, which the i-RESEV team is particularly interested in, are from the Green Vehicles (GV) section:

- **GV.8-2015. Electric vehicles' enhanced performance and integration into the transport system and the grid**
- **GV.6-2015. Powertrain control for heavy-duty vehicles with optimised emission**

as well as from the Smart City and Community (SCC) section, in particular:

- **SCC.1-2015. Smart Cities and Communities solutions integrating energy, transport, ICT sectors through lighthouse (large scale demonstration - first of the kind) projects**

CONFERENCES

The following forthcoming conferences are closely related to the topic of i-RESEV project.

- The 6th Innovative Smart Grid Technologies Conference (ISGT 2015), 17-20 February, 2015, Washington, DC, USA

  http://ieee-isgt.org/

- Society of Automotive Engineers' International World congress (SAE 2015), 21-23 April, 2015, Detroit, Michigan, USA

  http://www.sae.org/congress/

- The 28th International Electric Vehicle Symposium and Exhibition EVS28, 3 – 6 June, 2015, KINTEX, Goyang, Korea

  http://www.evs28.org

- The 2015 IEEE Transportation Electrification Conference & Expo (ITEC 2015), 14-17 June, 2015, Metro Detroit, Michigan, USA

  http://itec-conf.com/

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- The 2015 IEEE Intelligent Vehicles Symposium (IV 2015), 28 June – 1 July, 2015, COEX, Seoul, Korea

  http://www.iv2015.org/

- The 18th International Conference on Intelligent Transportation Systems (IEEE ITSC 2015), 1-4 September, 2015, Canary Islands, Spain

  http://www.ieee.org/conferences_events/conferences/conferencedetails/index.html?Conf_ID=30712

- The 17th European Conference on Power Electronics and Applications (EPE' 2015), 8-10 September, 2015, Geneva, Switzerland

  http://event-epe2015.web.cern.ch/

- The 10th Conference on Sustainable Development of Energy, Water and Environment Systems (SDEWES 2015), September, 2015, Dubrovnik, Croatia

  http://www.dubrovnik2015.sdewes.org/

- Vehicle Power and Propulsion Conference (VPPC 2015), 19-22 October, 2015, Montréal (QC), Canada

  http://www.vppc2015.org/

- The European Utility Week, 3-5 November, 2015, Vienna, Austria

  http://www.european-utility-week.com/

- European Electric Vehicle Congress (EEVC 2015), December, 2015, Brussels, Belgium

  http://www.eevc.eu

WEB PORTALS

There are a number of web portals, magazines and libraries that deal with electrified road transport and its integration into energy systems:

- Society of Automotive Engineers (SAE)'s International Global Technology Library – Electric Vehicle

  http://saegtl.org/ev/

- Vehicle Electrification (SAE)'s Magazine

  http://magazine.sae.org/digevsae/

- Information and Communication Technologies for the Fully Electric Vehicle

  http://www.ict4fev.eu/public/

- The IEEE Transportation Electrification Initiative

  http://electricvehicle.ieee.org/

- ELTIS The Urban Mobility Portal

  http://www.eltis.org/

ORGANISATIONS AND ASSOCIATIONS

These are some of major, mostly European organisations and associations dealing with e-mobility:

- AVERE - The European Association for Battery, Hybrid and Fuel Cell Electric Vehicles

  http://www.avere.org

- POLIS - The European Cities and Regions Networking for Innovative Transport Solutions

  http://www.polis-online.org/

- ACEA - European Automobile Manufacturer's Association

  http://www.acea.be/

- EUROBAT - Association of European Automotive and Industrial Battery Manufacturers

  http://www.eurobat.org/

- UITP - Advancing Public Transport

  http://www.uitp.org/

- ERAPA - Association of Automotive R&D Organisations

  http://www.earpa.eu/earpa/home

- EGVI - The European Green Vehicles Initiative

  http://www.egvi.eu

- EURELECTRIC - Electricity for Europe

  http://www.eurelectric.org/

DISCLAIMER

The opinions, findings, conclusions and/or recommendations included in this newsletter are of sole responsibility of the project team, and they do not necessarily reflect standpoints of the Croatian Science Foundation.

i-RESEV

ICT-aided integration of Electric Vehicles into the Energy Systems with a high share of Renewable Energy Sources

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