

Energy Institute Hrvoje Požar (EIHP) from Croatia (technical leader) together with Croatian city of Ludbreg is looking for the partners for application on Horizon 2020 Call **SMART AND SUSTAINABLE CITIES, SCC-1-2016-2017:Smart Cities and Communities lighthouse projects**. You can contact us on kperic@eihp.hr (M.sc. Kristina Perić, e.e.)

Energy Institute Hrvoje Požar (<http://www.eihp.hr/?lang=en>) is non-profit scientific institution financed on a per-project basis through the execution of project development contracts won following international and national competitive biddings. It has a 21 year long tradition in:

1. Strategic planning in the energy sector
2. Development of electric-power, gas, petroleum and heating systems
3. Market, legal framework and restructuring of the energy sector
4. Energy efficiency
5. Renewable energy sources, environmental and climate protection
6. Energy audits and certification of buildings
7. Energy balances and statistics
8. In-service training and promotional activities.

We offer collaboration and we would like to apply on Horizon 2020 Call **SCC-1-2016-2017:Smart Cities and Communities lighthouse projects** together with strong willingness of city of Ludbreg. We offer that city of Ludbreg in Croatia to **be a lighthouse city** of Southeast Europe and the rest of that region.

Basic advantage of city of Ludbreg is that the city could become a **living laboratory** and on one place could be tested the **adjustment of citizens all social, educational and economical status**, without exception, **to the applied energy efficiency projects of smart cities** and their willingness to participate and give their own contribution to the success of planned project activities regarding behavior change.

Some features of City of Ludbreg are:

- o **Continental climate** with diversities in energy needs and two energy networks (el. energy and natural gas)
- o Cca. 1/1000 ratio no. of citizens in Ludbreg towards no. of Croatia
- o **Developed industry** tradition and production, especially in new technologies which could be also **included in the project application** (smart lighting, e-bicycle, components for e-charging stations, e-cars, transformer stations,...), developed **services and tourism** (cultural and religious monuments)
- o Located on **main traffic route** between Central and SE Europe
- o The resulting solutions could be **re-implementable in Croatia and beyond**.

City of Ludbreg is member of Covenant of Mayors and by the end of 2014. has finalized its SEAP. It has 3.594 inhabitants, and a total of 8.458 in the entire municipality. Basic geographical information of his location are: Alt. 157 m, Lat. 46° 14' 58", Long. 16° 37' 21". The city belongs to the area with

moderately warm rainy climate characterized by warm summers (mean temperature of the warmest month doesn't exceed 22°C).

Activities of lighthouse smart city planning

This should be the lighthouse pilot project with the aim of mobilizing local authorities in development of funding scheme for enforcement and implementation of sustainable energy projects and development of energy independent "green city" through activities and projects in the buildings, freight and passenger transport services, public lighting system and implementation of smart grid based on action plan and national/EU directives and experiences, related to:

- Cost reduction and consumption of all forms of energy;
- Energy sustainability and reduction to environmental impact with the increase of quality of living for citizens;
- Increasing the use of all forms of renewable and alternative solutions/platforms in buildings;
- Solutions/platforms for development of city regions or areas self-sufficient in energy,
- Local energy development and partnership to generate new investment cycles, new technologies and financing platforms.

All these activities will be implemented in a city of Ludbreg in northwest part of Croatia with all his energy demand diversity. Relevant state bodies and institutions as well as energy distributors and potential investors will be involved in project development and implementation.

Obtained results will use for reimplementation of developed platform and solutions for application of sustainable energy projects in other cities or regions of Croatia, Europe and neighboring countries.

The main activities of lighthouse smart city planned in City of Ludberg are:

- assessment of existing energy need and energy consumption
- sustainable refurbishment of the buildings (energy efficiency, use of RES), smart control and monitoring (ICT applications)
- smart mobility (eco vehicles, ICT application, infomobility, dynamic traffic control systems, optimal e-charging integration)
- smart platform (smart grid, demand response, innovative tariff system development, energy storage)
- innovative business plan (green funds/credits, subsidies, own capital, ...)
- CO₂ reduction, strengthening of local capacities, increase of citizen's quality of living,
- performance monitoring (comparison of initial state with achieved state regarding energy consumption and energy efficiency).

Data collection and assessment of the existing building stock, public transport and public lighting and the existing energy requirements

Detailed assessment of building stock is needed in order to get additional information necessary to establish sound model of energy refurbishment of existing building. Available information on building stock accessible through energy performance certificates databases are largely based towards public and new buildings, while existing residential buildings need to be more detailed revised and certificated and make refurbishment.

Without quality energy baseline of public lighting system and appropriate analyzed data – there's no possibility to have appropriate results of its renovation.

Good baseline of mobility pattern and congestions could lead to development and implementation of optimal smart solutions in transportation.

This project activities are important for determination of economic potential, energy consumption, energy and mobility pattern of citizens in assumed city area needed for further planning of smart city project activities and potential of savings. Economy, energy and mobility baseline are also important for comparison to results achieved after implementation of proposed project activities, to better show the realization outcome with the aim of selection the optimal technical solutions and financial platforms.

Refurbishment of buildings

Savings have to be reached through refurbishment with some share (5- 10 %) to three general categories of buildings:

- a) buildings retrofit to energy rating A+ (generally comparable to international passive house standard)
- b) buildings retrofit to CO₂ neutral level
- c) building retrofit to zero energy level.

Technical options for application of buildings retrofit measures have to be analyzed, creating the sustainable retrofit plans for both public and residential buildings, identifying categories of buildings for which different retrofit strategies will be applied.

Investments are addressing whole building refurbishment of building envelope, heating and cooling systems, lighting and auxiliary systems of the building. Average energy rating of existing buildings according to Croatian rating system is E with specific useful heating energy need between 150 and 200 kWh/m², and goals set out by project is that all buildings reach A+ energy rating . There is a possibility of retrofit measures combination which might reach CO₂ neutral standard or nZEN standards with higher heating energy demand, but most likely is that additional requirements set by CO₂ neutral or ZEN design cannot be met without reaching A+ energy rating of heating energy demand.

Electricity produced by RES integrated in buildings will be fed into the grid, but smart grid component of the project is going to be used to further investigate into the ratio of on-site RES energy use and energy delivered to the grid.

Energy efficient public lighting

Public lighting represents the most affordable EE measures for each local authority. New technologies, ecological boundaries as well as developing status – push each local authority (LA) to renovation of public lighting system.

Proposed energy efficiency measures and investments in public lighting system should include

- definition of present Public lighting system status (energy baseline, economy, ecology benchmarking), and definition of future activities
- substitution old, inefficient and un-ecological public lighting system with the new EE system
- appropriate standardization of the public lighting system- new plan of maintaining
- installation of the smart lighting control (dimming, maintenance alert, ...)

- Definition of more efficient monitoring and bookkeeping system regarding more transparent and more efficient work
- Definition of financing platforms appropriate for targeted investments.

Nominated activities should save 30-50% of energy (based on 2010. Public lighting energy baseline) depending of proposed action Estimation is that after whole renovation, all activities could reduce over 50 t CO₂.

Clean urban transport

Traffic and whole mobility sector is responsible for 1/3 of all energy consumption (based on fossil fuels). New technology platforms, organizational ideas and green policies leading us to new era of e-mobility (eco/electro – mobility), which could be based 100% on RES.

The main planned activities are connected to the monitoring of fuel consumption in the public transport for development of preventive maintenance program and renewal of transport fleet. Monitoring of citizen mobility pattern that can be used for development of intelligent public traffic control and application of ICT-based integrated system able to interact between driver, vehicle and transport and energy infrastructures, taking advantage of the information provided from these sources in order to optimize trip planning trip and routing. This project will give clear view of future platforms of zero-emission transportation and/or reduced specific consumption with next steps:

- energy efficiency in public transport (e-bus, e-taxi, etc.),
- e-mobility platform (e-cars, e-bikes),
- ECO Drive trainings and raising awareness about EE in local transport,
- ECO Drive trainings for all public representatives,
- energy certificate for public and utility fleet vehicles,
- new logistic solutions, promotion and use of e-bikes and e-scooters for delivery of goods and freight,
- intelligent control and organization of public traffic (infomobility, GPS system)
- intelligent parking control
- optimal installation and use of grid of e – charging stations.

Smart platform

Development of smart grid with the use of smart meters and ICT solutions can increase quality and reliability of the grid, decrease energy consumption and increase consumer awareness on a way of using energy and appliances concerning energy efficiency. In smart grid each element can be active component of energy system (household, vehicle, power plant). The main characteristics of smart grid which are expected to apply and develop are:

- self-healing grid – reduction of total losses, reduction of losses of load
- automation of the network - easy integration of RES
- active base of information – two way direction (information of lower tariff scheme)
- optimization of consumption and productions – demand response, innovative tariff system development, energy storage (V2G)
- optimization of energy prices and selection of energy sources
- real time measurement of energy consumption and billing.

Smart platform can be used for development of energy management information system of the city with the use of GIS data, IT application solutions and data security application.

Financing structure

Analysis of current investment scheme, identification of investments sources in the first phases of the project and development of an investments framework, procedure design and investments criteria in the second phase of the project (after elaboration of proposed actions) on which this project could be based upon is conducted in.

Development of new financing platforms for smart city development and implementation.

Outcome of the project

Project activities will result with many of innovations and regarding technical or economic solutions for financing and procurement procedures. All of them could be replicated to other public authorities in Croatia, Europe or region. Proposed project activities and solution will contribute to development of:

- project for retrofit buildings to achieve A+ energy rating,
- project for retrofit buildings to CO2 neutral standard,
- project for retrofit buildings to nZEN standard,
- new public lighting system – EE power LED,
- e- mobility platform – e-car, e-charging station,
- new financing and procurement platforms
- municipality as a power producer and supplier
- municipality as a regulator and motivator.

The project should result in increased competitiveness and transparency of the local community or region in the preparation, implementation and operation of energy efficient projects and smart city development. Dissemination and reuse of developed projects and funding platforms in other cities or regions.

Until now, Ludbreg has made:

- energy certificates for all public buildings
- participate in project Covenant CapaCITY (Capacity building of local governments to advance Local Climate and Energy Action – from planning to action to monitoring)
- finalized SEAP
- refurbishment of couple public building (kindergarten to B energy rating, refurbishment with the use of EE standards)
- EE public lighting
- using e-car by City authorities
- refurbishment of residential units by funding of Fund for Environmental Protection and Energy Efficiency of Croatia
- installation of small facilities for use of renewable energy resources.