PROJECT RURES

D.T2.1.4 Pre-investment report of Solar “E-Tree” Pomurje region

September 2018

1. Introduction

Project index number and acronym	CE933 RURES
Responsible partner (PP name and number)	Local Energy Agency Pomurje (PP12)
Project website	http://www.interreg-central.eu/RURES
Investment location	Puconci 178, 9201 Puconci, Slovenia Location: parcel number 1988, cadastral municipality - Puconci
Delivery date	26.09.2018

2. General description of pilot idea

Please write a short overview and description of the pilot idea, activities, purpose and goals.

The Solar E-Tree will be installed at the property / land on address Puconci 80. Owner of the land is Municipality of Puconci. The exact location is near Primary school Puconci, Green Hall into direction to bus station, it is in the middle of settlement Puconci, near by in cca 400-700 meters of distance is also Memorial home of Štefan Küzmiča, building of Municipality Puconci, school playgrounds, church and park. The municipality of Puconci is one of the municipalities in the north-eastern Republic of Slovenia. The municipality of Puconci is part of the Pomurska statistical region. The Municipality measures 107.70 km^2. It ranks 61th among Slovenian municipalities by the surface. In the middle of 2016, the municipality had approximately 5.960 inhabitants (approximately 2.920 men and 3.040 women). According to the number of inhabitants, it ranks 86th among Slovene municipalities.

For the pilot investment itself in the location described above, it is planned to install *Solar Tree* with (4) four photovoltaic panels, this tree will support charging mobile phones and computers also it will have LED-lightning with strong capacities.

The second installation will be a *Solar bench* with its smart design will enable all people to charge their devices. In the middle of the bench the solar panels are installed that charge the energy of 4 USB ports. Anyone can relax on this bench, enjoy iand simultaneously charge their phone or tablet. Comfort and design meet sustainability.

And the third part will be *Smart bench with shadow*, it will provide shadow with (6) six photovoltaic solar panels installed with LED lightning, wireless mobile phone charger and six seating places for relaxing and at the same time charging e-devices. Its steel construction is very resistant, while all electro equipment is fitted inside the box.

First step in preparing of pilot investment was to hire external expert that made feasibility study for planned EE and RES measures. The feasibility study has been developed for the Solar E-Tree its installation in frequented public place, with all the features that it should have but in the end for this report and for realization of PI the design was slightly different but in terms of a different layout but

with all the same features. The second stage of the investment preparation was to hire external experts to develop technical documentation needed for smooth implementation of the pilot investment. This developed technical documentation is used to conduct public procurement for the stylized Solar E-Tree, with the complete installation of the E-tree with the associated bench seating, panels, sockets, LED lighting. It is also used to present technical data within this report. It serves as a best-practice for RES production, object of public facility (relax, charge E-devices).

Solar E-Tree shows use of RES for everybody and fits with surroundings. It confirms as eligibility of instalment also for municipal administration, which will acquire certain new knowledge, ability to compare between regions, new experiences in implementations of EEP. Solar E-Tree is the protection of the environment and ecological values symbolized facility, aims to raise awareness of the community on environmental sustainability. It is made from environment friendly materials, energy produced by solar cells.

3. Description of pilot investment

3.1. Technical analysis of the current state

Please describe current state in the area of planned pilot investment (current installed technology, usage regime, mode of use, etc.).

The location where the pilot investment is planned (Figure 1-2) is currently empty. The only thing that stands at the location is the bus station for the pupils of the Elementary school Puconci. The location is the property of the Municipality of Puconci (owner). The exact location is near Elementary school Puconci, Green Hall into direction to bus station, it is in the middle of settlement Puconci, near by in cca 400-700 meters of distance is also Memorial home of Štefan Küzmiča, building of Municipality Puconci, school playgrounds, church and small park.

Since Solar E-Tree is treated as a small building / object there is not mandatory to provide building permits, only location information is needed. Lea Pomurje completes the application for location information and submits it to the Municipality of Puconci. The municipality issues location information within 1-2 weeks.

The investment will be located on the land owned by Municipality of Puconci. According to Slovenian legislation is possible the execution, on the principle that one organization (LEA Pomurje) erect/builds E-Tree on somebody else`s (in this case Municipality of Puconci) property / land. But after the installation of investment and official opening from the mayor of the Municipality Puconci, the ownership right will be transferred to the municipality of Puconci, and therefore all the obligations of maintaining of the Pilot investment.

Purpose

By using solar energy, the Solar E-Tree will serve as a source of electricity for charging various electronic devices (computers, mobile phones) and for illuminating the surrounding environment. An integral part of the tree will also serve as a bench for rest.

Connection to communal infrastructure

The operation of the Solar E-Tree is completely autonomous and does not require connection to any communal infrastructure.

***Figure 1-2**: Location of Pilot investment – Solar E-Tree*

3.2. Presentation of implementation of planned pilot investment

Please specify technical solutions planned to be installed, goals, target groups and activities of planned investment.

Please describe procedures and working methods that will be used while implementing the pilot installation and additionally through the maintenance of the same.

In property / land of Municipality Puconci it is panned to install three (3) components:

1. **Solar E-Tree:**

It supports working of portable computers, mobile phones and LED lightning, solar panels have huge capacity and professionally equipped with the highest quality product Victron energy. It is also resistant to vandalism, has resistant steel structure and electrical equipment is installed inside the box.

Equipment:

- 4 photovoltaic modules SOLE 260 W BIPV
- 1 MPPT controller 70A Victron energy
- 1 converter 12V - 230V pure sinus Victron energy
- 1 gel battery 220Ah Victron energy
- LED lights 10W
- LED lighting controller
- Electronics for protection of electrical devices, overvoltage and short circuit
- Fuses, cables and other small equipment
- Dimensions:
  Bottom of the pillar: Length 170 mm x Width 170 mm x Height 6000 mm
  Table: Length 1400 mm x Width 1400 mm
  Branches: Length 2200 mm x Width 2200 mm

2. **Solar bench:**

Solar bench (smart bench) is made of galvanized steel, which makes the solar bench firmly and resistant to any vandalism and natural conditions (salt). On the middle part of the bench are solar panels that supply electricity with USB ports for charging mobile devices. Installation and construction is very quick and easy. It provides ready for use charging station on the bench for e-bike, e-roller, e-cycle 2x220 V (300W).

Equipment:

- 4 USB sockets for mobile phone or tablet
- 3 photovoltaic panels SOLE total power = 100 W
- 1 MPPT regulator 25 A Victron energy
- 1 GEL battery 60 Ah Victron energy
- LED lighting of the billboard (back of the bench)
- LED lighting controller
- Protectors, cables and other small equipment
- Dimensions: Length 2020 mm x Width 810 mm x Height 950 mm, weight 180 kg

3. Smart bench with shadow

The smart bench (with shadow) enables charging laptops, mobile phones and other e-devices and has LED lighting, as the solar panels have huge capacity and professional equipment from the reputed manufacturer Victron Energy. Solar bench is impossible to destroy or damage. Its steel construction is very resistant, while all electrical equipment is installed inside the box. USB charging cables and one wireless cord for charging a mobile phone will be included.

Equipment:

- 6 seats
- 6 photovoltaic panels Q CELLS SOLIBRO
- 1 MPPT regulator 70 A Victron energy
- 1 converters 600W 12 V - 230 V pure sinus Victron energy
- 1 GEL battery 120 Ah Victronenergy
- 2 LED light 5 W
- LED lighting controller
- Protectors, cables and other small equipment
- Dimensions: Length 1810 mm x Width 2230 mm x Height 2500 mm, weight 700 kg

Solar E-Tree is an environmental enterprise, an ecological sculpture that aims to promote awareness to sustainability within the community. The E-Tree is powered by solar panels that produce energy directly from the sun. It is an independent unit that produces green energy and provides a place of comfort and energy for a wide variety of services. With the Solar E-tree, we want to show the new innovative way of using RES to the target groups (schoolchildren, young people, families, visitors, inhabitants, tourists) and offer a space that combines leisure time by creating a common space.

Description of the work envisaged

1. ***Preparatory works**, including insurance of construction site with PVC fence, marking installation connections and marking of all routes, resettlement and insurance of utility lines (electricity, sewage, water).*
2. ***Geodetic works**, involving the slaughter of the boundary of land or interventions, slaughter of profiles of all facilities and records of construction.*
3. ***Ground works**, covering the mechanical and manual laying of the earth's layers, machine-made excavation of the foundations, supply and installation of gravel fractions, loading and removing excess soil. Supply of land for landscaping.*
4. ***Construction work**, involving earthworks (foundations, technological installations, grounding),*
5. ***Concrete and reinforced concrete work**, installation of concrete in un-reinforced and reinforced structures, concreting of the underlying concrete of the pavement, concreting of the base plate, supply and installation of reinforcement from concrete iron and reinforcing meshes, machining and manual installation of reinforcement, and cutting, laying and bonding.*
6. ***Prefabricated works**, covering the installation of a solar tree.*
7. ***Craftworks**,* involves the installation of electrical installations,

8. ***Implementation of landscaping***, *earthworks, paving, placing curbs, paving, planting shrubs and lawns arrangements.*

General maintenance instructions

It is anticipated that the period of use of the facility, with regular maintenance, will be at least 15 years. Regular maintenance of the facility means regular (monthly) cleaning, maintenance and regular servicing of all installed equipment and devices according to the manufacturer's instructions.

Preventive maintenance involves viewing the facility and performing works to prevent the loss of properties and functionality, and replacement and supplementation. All maintenance work must be carried out in such a way as to preserve the technical characteristics of the building, meet the requirements of the project, and to comply with the construction regulations according to which the facility is built.

Only the construction and other products that meet the prescribed requirements may be used in the maintenance of the building.

Building materials used in the maintenance of the building and other materials used must have properties that correspond to the properties of the originally built building materials.

The maintenance of the installed equipment is carried out according to the instructions of the manufacturer and the contractor.

Maintenance must not change the planned properties of the building. The essential requirements for the facility and other instructions that apply to the construction and maintenance of this facility must be considered.

3.3. Energy and emission analysis

Please include calculations to show reduction of energy consumption and the CO2 emission achieved by the pilot implementation. Please describe the results.

ENERGY PARAMETER: When installing Solar E-Tree is estimated that energy produced will be 1.870 kWh (1,87 MWh) annually. In 30 years, the Solar E-Tree will generate 56,1 MWh of pure and green electricity *(see Figure 3)*.

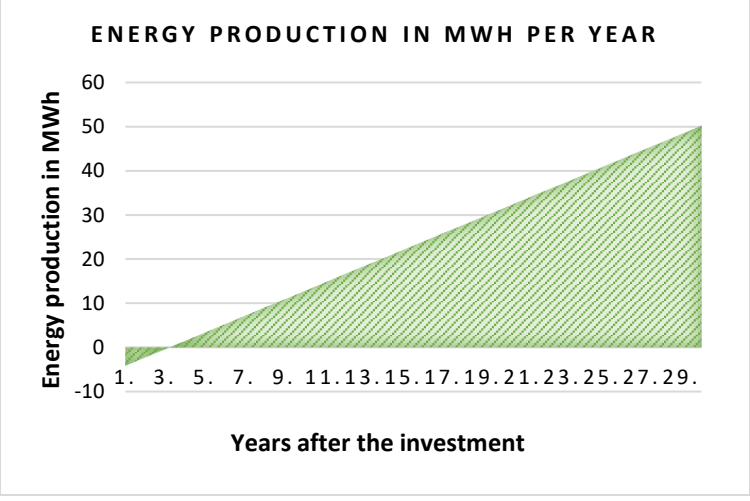

***Figure 3**: Energy production in MWh per year in 30 years (Life Cycle Assessment)*

ENVIRONMENTAL PARAMETER: At the annual level, with this energy production, we will save 1.041 kgCO2 (1,04 tCO2), compared to purchasing this energy. During the lifetime of 30 years, the Solar E-Tree will save 31,25 tCO_2 emissions *(see Figure 4)*.

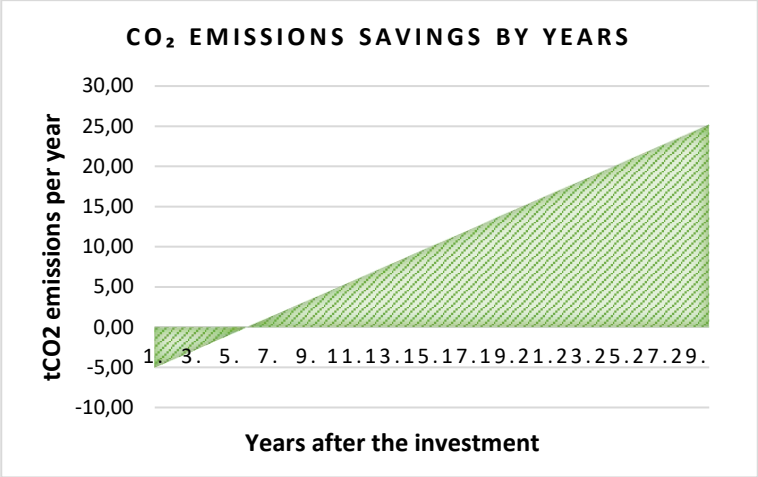

***Figure 4**: CO_2 emissions savings by years (Life Cycle Assessment)*

ECONOMIC PARAMETER: The investment is reimbursed after 26 ½ years. After this time, if the generated energy starts to transmit to the network, revenue would be generated *(see Figure 5)*.

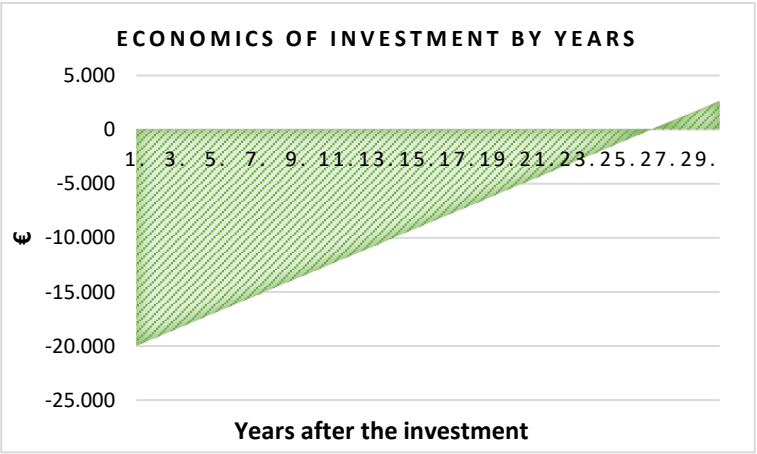

***Figure 5**: Economics of investment by years (Life Cycle Assessment)*

All parameters calculation of the planned pilot investment – Solar E-Tree was done for a 30 years lifetime of the Solar E-Tree, taking into account the national coefficients and the current national situation in the field of solar energy.

3.4. Social analysis of pilot investment

Please specify users and potential users, describe impact of the planned installed pilot and benefits for relevant fields (society, environment, economy), stakeholders and RURES project.

While the location of a pilot investment is in the surrounding of the school, more precisely at the bus station, the beneficiaries are pupils (especially from Monday to Friday). The school also runs a project

(ECO school as a way of life) in which pupils learn about the efficient use of natural resources. Potential users are also visitors of the playground and outdoor fitness park at Primary School Puconci. There is also a park, church and Štefan Küzmič Memorial House, which are places to which visitors go past pilot investment, for which the location will be interesting for short stopovers, rest and socializing. The target groups are families, residents, tourists.

The Solar E-tree also represents a good example of energy self-sufficiency and the reduction of energy dependency, and at the same time reducing CO2 emissions. Stakeholders will have the opportunity to see the benefits arising from the implementation of energy efficiency measures and will be stimulated to pass a similar measure on their environment. It can be an urban or rural area. The solar tree works well on city squares, parks, tourist destinations (lakes, beaches), recreation centers, for street lighting, parking spaces, etc. Potential investors will have the opportunity to see and also use the Solar E-Tree on-site and see opportunities in their possible spatial planning plans.

Solar E-Tree aims to promote the trend of implementation of energy efficiency and renewable energy, trend that is just beginning to develop in Pomurje region. Solar E-Tree represents dynamic concept, aesthetically acceptable in the city or any other environment that provides free solar energy, resulting in financial savings and reduced negative impact on environment. Uniqueness of the project lies in the benefit that is provided to the community as well as to manufacturers of solar panels.

3.5. Building and technical legal requirements

Please specify and describe all of the legal requirements regarding potential building and technical permits.

Investor (Local Energy Agency Pomurje) hired an external expert who developed technical documentation needed for implementation of the pilot investment. The required technical documentation consists of:

e.g. for Slovenian pilot investment:

1. *Location information (Slovenian language)*
2. *PID (projekt izvedenih del) for Solar Tree (type project) – consisting of:*
   - *Construction plan (No. G-59/18)*
   - *Plan for electrical installations and electrical equipment (No. E-59/18)*
3. *Safety plan – the installation of a Solar tree in Puconci*
4. *Minutes of the review and examination of working equipment*

Since Solar E-Tree is treated as a small building / object there is not mandatory to provide building permits, only location information is needed. Lea Pomurje completes the application for location information and submits it to the Municipality of Puconci. The municipality issues location information within 1-2 weeks.

4. Timeframe of investment

Start date (dd.mm.yyyy.)	10.8.2018
End date (dd.mm.yyyy.)	8.10.2018

5. Financial analysis of the pilot investment

Please define the cost of the pilot investment, potential revenues, describe financing method as well as the possibilities of financing similar projects in your region and country. Here you can use the deliverables from WP1 for each specific pilot investment as well as the calculations from point 3.3.

According to the last approved Application form of the RURES project, total value of this investment is 20.000,00 EUR. This value consists of the following two components:

- Solar E-Tree: Costs 18.500,00 EUR (the costs can`t be more break down as the tree, bench and other features are part of one Solar E-Tree concept);
  - This includes purchase of solar cells, bench for visitors, LED lightning system, charging point and sensors for "Solar E-tree".

- Additional works for 1.500,00 EUR (Fixing the tree on the ground with the concrete (installation).
  - This includes technical work (hours) of finalizing work and extraction for tree and bench and electro installation work.

When performing a public procurement, we are obliged to abide by the rules of public procurement. For each order above EUR 5.000,00, appropriate proof of market demand has to be provided (Instructions for reporting eligible expenditures for Slovenian beneficiaries in the period 2014-2020).

Financing of this investment will be as follows:

- 85% of the investment will be financed through the ERDF i.e Interrreg Central Europe programme – 17.000,00 EUR
- 15% is financed by the investor i.e. Local Energy Agency Pomurje - 3.000,00 EUR.

No revenues are expected to arise from this investment.

Possible financing instruments that support the implementation of investments in energy efficiency:

- Budgetary funds of the municipality, which from the budget spend / plan the share of funds for the purpose of measures of efficient use of energy and renewable energy sources.

- Eco Fund, Slovenian Environmental Public Fund; Eco Fund is a specialized public financial institution for the promotion of environmental protection in the Republic of Slovenia. Eco Fund grants favorable loans to municipalities, other legal entities, entrepreneurs and private individuals and citizens, as well as irreversible financial incentives for various measures of efficient use of energy and the use of renewable energy sources since 2008.

- SID Bank; Financing of infrastructure and energy projects; They provide municipalities with long-term financing of investments in local public infrastructure and local energy efficiency measures and residential care for vulnerable groups of the population.

- Borzen; the Slovenian electricity market operator, whose primary objective is to provide a transparent and reliable functioning electricity market, as well as the provider of the State Support Scheme for Renewable Energy Sources and Combined Heat and Power (CHP).

- Other possibilities are also European Union programmes such as Horizon 2020 and territorial cooperation programmes (cross-border cooperation, transnational coperation, inter-regional programmes). Also, there is one more instrument that can be used for financing of such investments and those are EEA and Norway Grants 2014-2021. EEA and Norway funds finance programs focusing on renewable energies, energy security and energy efficiency in line with the objectives of the energy union and the Europe 2020 goals of a 20% reduction in greenhouse gas emissions, 20% of renewable energy and an increase of 20% in energy efficiency.

6. SWOT analysis

Strenghts	Weaknessess
- The production of electricity from photovoltaic systems is environmentally friendly. - Exploiting solar energy does not pollute the environment. - Production and consumption are in the same place. - Photovoltaics enables the supply of electricity to remote areas and remote devices. - People in poor country would have access to electricity. - Land reguirement is very less.	- High investment costs. - May cause hazrds to the birds and incects. - Hazards to eyesight from solar reflectors.
Oportunities	**Threats**
- Example of good practice to local and regional authorities both in rural and urban area. - An example to citizens how energy refurbishment results not only in energy and financial savings but also in better quality of space usage – encouragement for action.	- Risks associated with bird nests under your solar panels. - Trees sitting close solar system (solar tree) can result in a variety of problems, such as unwanted leaf debris falling under the solar array. - Poor availibility of contactors.

7. Transferability of pilot investment

Please describe ways to implement described kind of investment in similar areas/objects. You can link this description to point 3.4.

Experience through implementation and use of the project not only has positive affect on technological development, but also focuses on transfer of knowledge and experience on wider environment. It is important to understand cultural and historical aspects, or characteristics of society, in order to some certain effects could become evident in concrete application of renewable energy.

Local institutions together with media can support design and implementation of new approaches to the technology through activities as local experiments, festivals, exhibitions and various information events. Constraints that we daily encounter can be solved if community works and acts as a collective, because only with active participation, support of different innovations and will to progress, small improvements can be achieved that will in future represent essential and irreplaceable aspect in the development of society.

Here defined pilot solution can in this context or in a different design be transferred to any public location in rural or urban areas. Implementation of this type of projects that promote the use of renewable energy at the local level is extremely important for the further development of any area.

Every case of transferring a pilot investment is an example for itself, as it depends mainly on where we want to place the tree and for the purpose of using it. The technical properties of the E-Tree are also adapted to this.

8. Conclusion and further suggestions

Please write a conclusion based on all of the previously described elements of the pilot investment, and also any suggestions you feel necessary.

With this project, »Solar E-tree«, we see an opportunity and at the same time a good example of the use of renewable energy sources (RES), as well as the presentation of a different-based exploitation of solar energy.
Suggestions for an ideal location for the implementation of the »Solar E-Tree« project can be both urban and rural areas, dynamic, where there is a constant concentration of people. Taking into account the principles of operation and design of a »Solar E-Tree«, people will be interested in how a similar model can be transferred in a wider environment. The significance of the project is not only local. Depending on the social acceptance and success of the project, it can be expanded at the regional level.

Project will have wide range of positive impacts (raising awareness of energy efficiency and renewable energy sources for the users and general public, creation of community space, produced electricity on renewable energy source with no CO_2 emissions).

9. Appendices – project documentation related to pilot investment and all necessary permits in national language

Please enclose a list of all relevant project documentation that had to be produced before the beginning of the pilot investment as well as all permits that were necessary to obtain.

e.g. for Slovenian pilot investment:

1. *Location information (Slovenian language)*
2. *PID (projekt izvedenih del) for Solar Tree (type project) – consisting of:*
   - *Construction plan (No. G-59/18)*
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