TOWARDS SMART ZERO CO_2 CITIES ACROSS EUROPE

VITORIA-GASTEIZ ✣ TARTU ✣ SONDERBORG

Deliverable 4.14: PV installations in use

WP4, Task 4.5

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Abbreviations and Acronyms

Abbreviation/Acronym	Description
SmartEnCity	Towards Smart Zero CO2 Cities across Europe
SEC	SmartEnCity
WP	Work package
TAR	Tartu City Government
PV	Photovoltaics
RES	Renewable energy source

Table 1: Abbreviations and Acronyms

0 Publishable Summary

According to the estimation of the International Panel on Climate Change (IPCC), human activity has raised the average temperature of the climate by 1 °C compared to the time before the industrial revolution. It is highly likely that in 2023–2052, there will be another 1.5 °C increase in global temperature as a result of human activity. Climate warming has a negative effect on the health and livelihood of people, availability of fresh water, food security, the economy, and biodiversity.

One of the greatest values of Tartu City is its clean, human-friendly, and natural living environment. Human-induced climate change is one of the greatest hazards to the living environment and current living arrangement of Tartu. Mitigating climate change and decreasing the consequences of the environmental impact caused by humans is one of the most important activities for preserving Tartu's values and retaining the current living environment.

In April 2021, the Tartu city council adopted the Tartu energy and climate plan "Tartu energia 2030". According to the plan, the city of Tartu wants to achieve climate neutrality by 2050 at the latest. Recently, the city of Tartu joined the European Commission's mission "100 European climate-neutral cities by 2030". Tartu must achieve its goals much faster than planned so far.

Currently, about 70% of electricity in Estonia is generated from the oil shale, making the national energy mix one of the most carbon intensive in the EU.

According to the emissions inventory, electricity consumption accounts for the largest part of the city's carbon emissions. The climate plan stipulates several activities to reduce the environmental impact of electricity consumption, but the main ones are the on-site production of electricity from renewable sources and also the on-site consumption of this electricity.

In the administrative area of the Tartu city government, there are a significant number of different buildings (schools, kindergartens, administrative buildings, sports facilities, etc.), which are suitable for the production of electricity from solar energy and are also consumers of this energy.

As part of the project, solar parks for the production of electricity were established as pilot projects on 4 buildings in the administrative area of the city of Tartu. The total installed capacity of the solar parks is 202 kW.

Expected annual saving of CO2 emissions thanks to the PV installations is in total 213 tons.

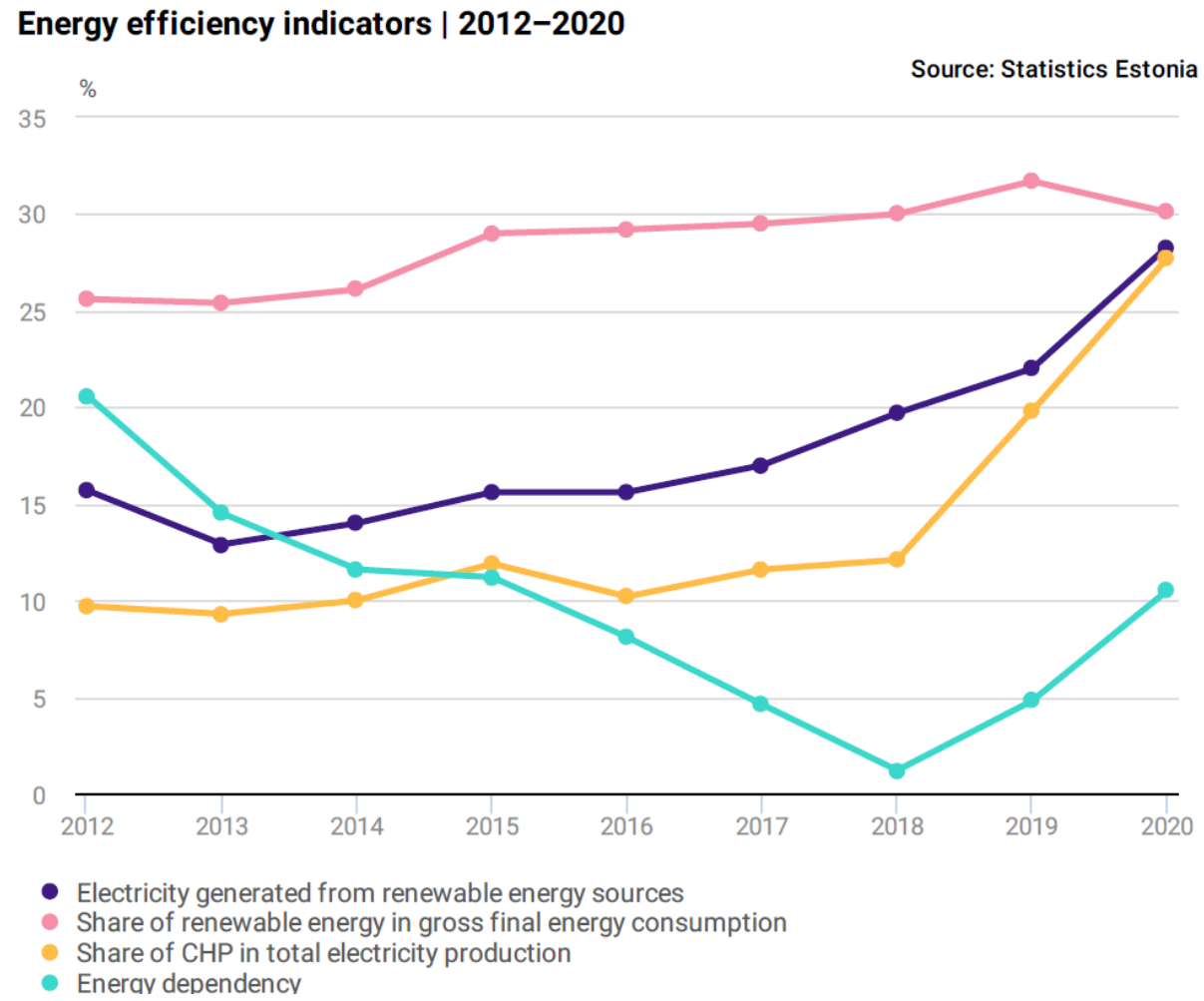

Figure 1: Electricity production in Estonia

1 Introduction

Tartu, with its population of 100,000 is the second largest city in Estonia. Lying 185 kilometers south of Tallinn, Tartu is also the centre of South-Estonia. Tartu is known as a green, innovative and environment-friendly city. The slogan of Tartu is "The City of Good Thoughts". Tartu is a city of education and well known for the University of Tartu founded in 1632.

Figure 2: Location of Tartu City

The aim of the Tartus climate policy is to achieve a climate neutrality by 2030. Tartu joined recently with EU Mission “100 Climate-neutral Cities by 2030”. In terms of energy production, Tartu has set a clear target for local energy production and consumption. An important role is also seen here for energy communities and local microgrids.

1.1 Purpose and target group

The purpose of this deliverable is to document the details and processes made by TAR related to implement PV- stations at public buildings within the SmarEnCity project. The details include a description of the technical details process and also first results and lessons learned so far.

Target group include other partners of SEC project but also target groups interested in implementation of solar energy production.

1.2 Contributions of partners

The following Table 2 depicts the main contributions from participant partners in the development of this deliverable.

Participant short name	Contributions
TAR	Overall & general content

Table 2: Contribution of partners

1.3 Relation to other activities in the project

The following Table 3 depicts the main relationship of this deliverable to other activities (or deliverables) developed within the SmartEnCity project and that should be considered along with this document for further understanding of its contents.

Deliverable Number	Contributions
D4.1	This deliverable provides the overall description of the current state of the lighthouse city area and will provide a comparison in future after demo actions have been implemented
D4.11	This deliverable connects all demo actions into ICT platform. Data will be easily used for evaluation and replication purposes
D4.13	This deliverable summarizes all demo actions in the Tartu Lighthouse project.
D7.8	This deliverable provides the overall description of the KPI's and therefore the measurements to be implemented in PV installations

Table 3: Relation to other activities in the project

2 Objectives and expected Impact

According to the estimation of the International Panel on Climate Change (IPCC), human activity has raised the average temperature of the climate by 1 °C compared to the time before the industrial revolution. It is highly likely that in 2023–2052, there will be another 1.5 °C increase in global temperature as a result of human activity. Climate warming has a negative effect on the health and livelihood of people, availability of fresh water, food security, the economy, and biodiversity. One of the greatest values of Tartu City is its clean, human-friendly, and natural living environment. Human-induced climate change is one of the greatest hazards to the living environment and current living arrangement of Tartu. Mitigating climate change and decreasing the consequences of the environmental impact caused by humans is one of the most important activities for preserving Tartu's values and retaining the current living environment.

Emission of greenhouse gas has increased by 31% over the past decade in Tartu. The increase in emissions is mainly the result of power consumption by the private and public sector. Considering the increase in energy consumption and carbon emission in the city over the past decade, achieving carbon neutrality is a great challenge that requires meaningful impact from all parties for achieving the common goals.

Achieving the goals of Tartu Energy 2030 depends on three main courses of action:

• Energy efficiency

• Wider use of renewable energy

• Climate change adaptation

The municipal sector of Tartu acts as a role model by using renewable energy sources and simultaneously reducing its energy consumption.

Figure 3: Solar panels at cooling station in Tartu

2.1 Objective

The main objective of this deliverable is to implement a sustainable renewable energy production and usage in public buildings. The further goal is to achieve zero carbon urban environment.

2.2 Expected Impact

The expected impact of deliverable is multiple. Main impact is a reduction of CO^2 emissions from the power consumption. But there are several side impacts, which are significant in terms of city environment and sustainability – cleaner city environment, better health of citizens, energy independence etc.

The reduction of CO^2 emissions in energy production and consumption is the main expected impact. The estimated annual reduction of CO^2 emissions will be 213 tons.

Methodology

The Department of City Property has mapped 19 buildings that could be fitted with solar panels. An expert assessment has also been carried out to determine the possible capacity of a solar panels to be installed on each of these buildings, considering the roof area of the buildings and their position relative to the weather charts.

From the mapped buildings, 4 buildings were selected to build solar parks with a total capacity of 210 kW and in which there would be constant electricity consumption (including during the summer months, when electricity production is at its maximum). Tartu Vocational School buildings Põllu tn. 11, Kopli tn 1, as well as the kindergarten building Kummeli tn 5 and Tartu Nature House building Lille tn. 10 were selected.

A public procurement was organized for the construction of solar parks, the contract was signed with the company that made the most favorable offer. Construction work started in the early spring of 2022 and the work was completed in June 2022.the

The solar panel installation activities will be followed by a 12-month monitoring period starting from June 2022.

3 Overall Approach

Ambition of TAR in SEC project is to turn hrustsovkas into ‘smartovkas’ with accompanying innovative solutions in public transport, integrated infratructures and monitoring. The aim of the investments is to create a high-quality carbon-neutral living environment that inspires the community to make environmentally aware decisions and change their patterns of behaviour.

The installation of PV-parks in public buildings in Tartu is innovative, as there was no PV-parks installed on public buildings before.

The installation of PV-parks in Tartu is aligned with cities current strategy to decrease the negative impact of electricity production and consumption in the city.

On-site production of electricity from renewable sources and local consumption of this energy strongly contribute to the design of a sustainable and sustainable energy system. In addition to energy savings and a direct positive environmental impact, on-site electricity production and its on-site consumption have a whole range of different indirect positive effects: saving resources in the transmission of electricity (transmission lines, energy loss), reduced maintenance costs, etc.

Smart bike sharing ICT solutions, linked to the city’s open information platform (CIOP) developed in the frame of SmartEnCity project, will yield additional benefits for diverse stakeholders: public, private (business opportunities) and ultimately citizens. Data collected from Smart bike share system will be made through CIOP available for third parties for research purposes and for creating new business solutions/models. New arising business opportunities will increase a novelty of the system.

Task 4.5 / PV installations in use

With the support of the project, solar plants were installed on 4 buildings in the administrative area of the city of Tartu:

Kopli str. 1 – 55 kW

Põllu str. 11 – 110 kW

Kummeli str. 5 – 25 kW

Lille str. 10 – 12 kW

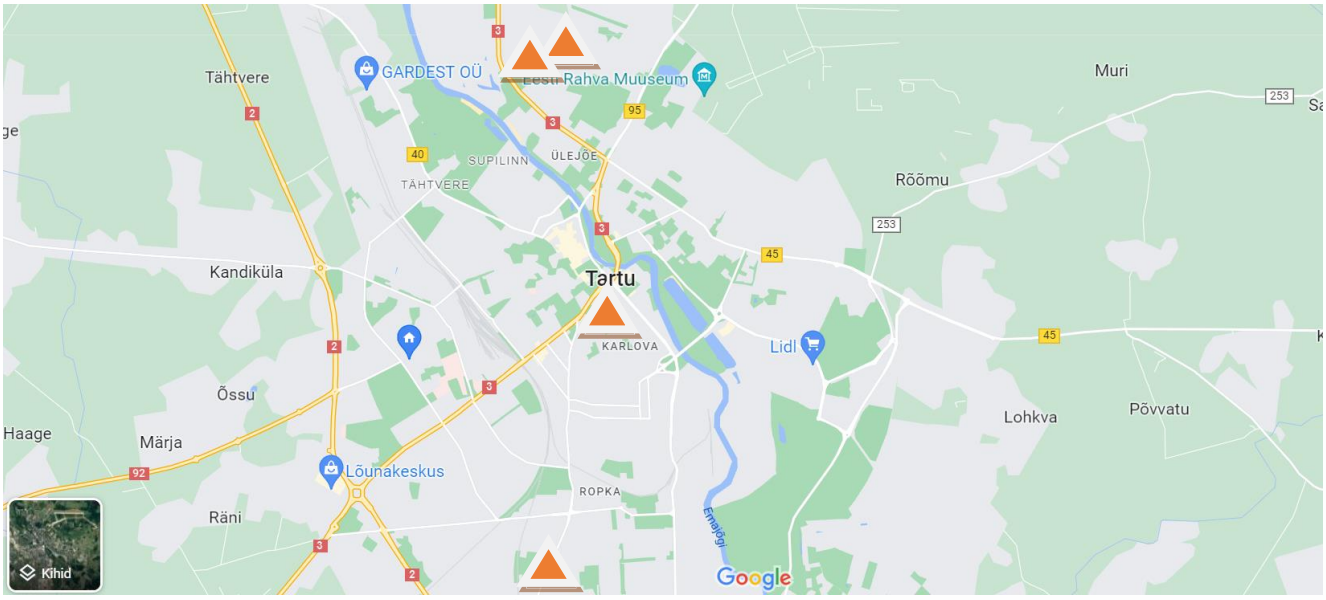

Figure 4: Locations of PV-parks in the City (▲)

The total capacity of PV-parks is 202 kW. Installation works started in March 2022 and finished in June 2022. The total capacity of PV-parks is slightly lower then initially planned (initially was planned 210 kW) due to the load-bearing capacity limitations of the roofs of the selected buildings.

It was decided to add the installation of solar panels as a new activity to the project activities in May 2021, when the project changes were approved. The activities were financed from the remaining amounts from the renovation of the buildings. The positive thing is that more CO2 emissions can be saved by building solar plants than would have been saved by renovations.

Initially, the construction work was planned to be finished in July 2021, but due to the processing of the documentation of amendment to the project, the execution of the work was postponed to 2022. By the time the report is submitted, all 4 PV-plants have been completed and are producing electricity.

Figure 5: PV-park at Kopli str. 1

Figure 6: PV-park at Põllu str. 11

Figure 7: PV-park at Kummeli str. 5

Figure 8: PV-park at Lille str. 10

Monitoring

Deliverable “PV installations in use” will be monitored from 01.06.2022 – 31.05.2023. Monitoring will be carried out with help of smart city platform (Cumulocity) developed within the project by company Telia Eesti AS and dedicated environment FusionSolar.

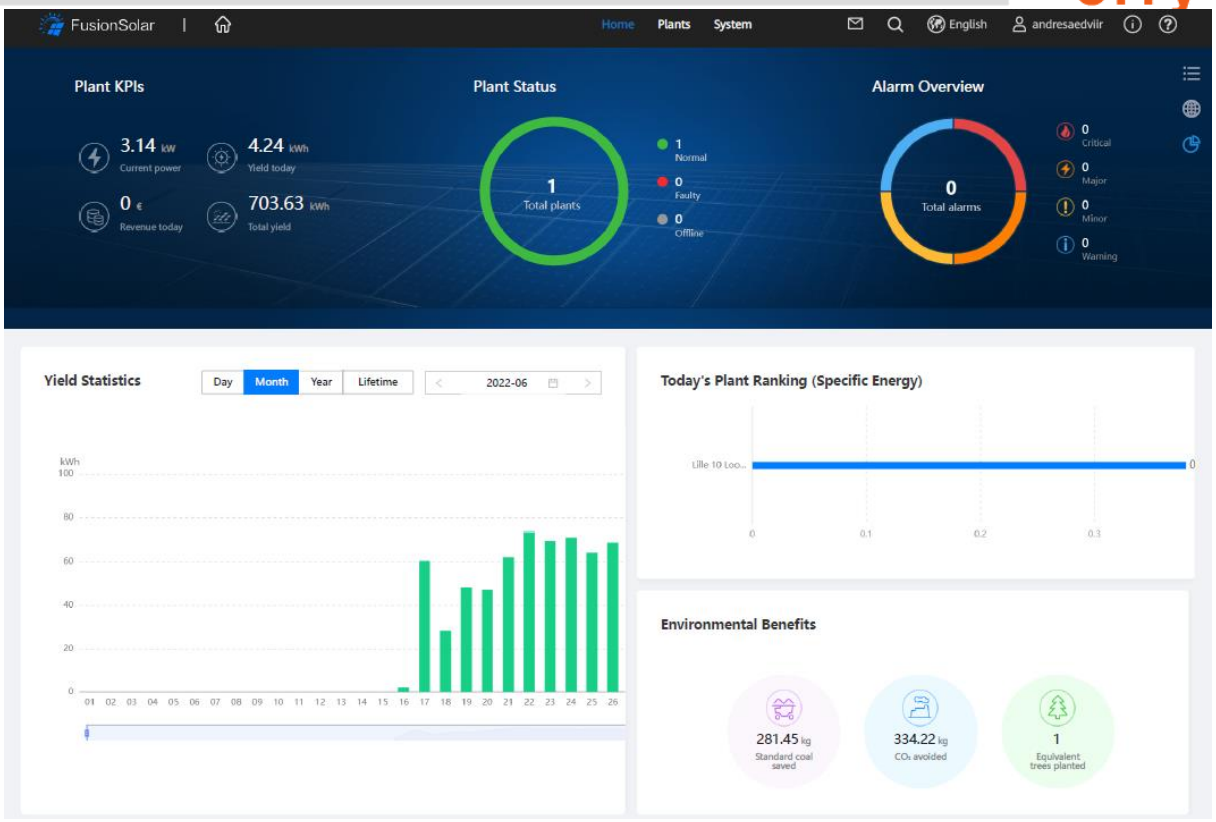

Figure 9: Monitoring environment FusionSolar (Lille str 10 – Tartu Nature House)

4 Lessons Learned

Building of solar power plants is a relatively simple in terms of construction. The complexity here lies in the availability of free capacity in the power substations, so that, if necessary, the selling of the surplus of produced electricity to the grid are ensured and also in ensuring the supply of materials.

The construction of the solar plants considered in this report fell into a very difficult period, when the prices of various materials (especially metals and fuels) rose rapidly all over the world and global logistics problems appeared.

Despite various hindering circumstances, the solar plants still managed to be completed within the given budget with some time delay and thus fulfill the project's objectives.

In the case of this project, the success was ensured by the professionalism of the contracting authority in conducting procurements and the involvement of competent technical consultants. Thoroughly prepared technical documentation and building mapping made it possible to keep the cost of the construction works within the desired budget and achieve the desired result within optimal timeframe.