

# Final pilot action report

## Port of Zadar

PP11, deliverable no. D.4.2.9

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## Pilot action no. 1: Solar System

### 1. Ex-ante situation

Zadar plays an important role as a transport center of Croatia, where the northern continental transport routes meet the Adriatic Sea and connect to the sea routes. Port of Zadar is located in one of the Zadar County – in the very center of the Croatian side of the Adriatic coast and the City of Zadar is an economic, administrative and cultural center of the county and fifth largest city in Croatia. In recent years, traffic of passengers have been steadily increasing (except during the COVID-19 pandemic crisis) and it shows tendency for further growth.

One of the main goals of the Port of Zadar Authority is to ensure the safety of ships entering Zadar waters, taking care of the shore and port facilities and finally supporting the protection of the coast and marine environment. Energy efficiency, sustainability and environmental protection issues are tackled in several documents, policies and strategies implemented within the Port of Zadar Authority with the final goal of making the New Port of Gazešnica a **green port**.

In 2020 in Croatia, the specific CO<sub>2</sub> emission factor per total electricity consumption was 0.124 kg/kWh and specific CO<sub>2</sub> emission factor per total electricity production in Croatia **0.166** kg/kWh. Emission factor per total electricity consumption considers electricity imports in Croatia (as Croatia is significant net importer) and is a more adequate factor for emissions calculation.

Port Authority Zadar have 1.529kW connection and yearly consumption is **1,145.571 kWh** and until now, there has been no use of renewable sources of electricity in the port. However, part of Croatian electricity is coming from renewable sources.

In Croatia, the most used renewable energy sources are wind farms. According to OIEH data, in 2022, 3,435 GWh (gigawatt hours) were produced from renewable energy sources in Croatia, which is **18.41** percent of the total 18,416 GWh produced.

Solar power plants produced only 79 GWh and participated with 0.43 percent in the total structure of available energy. Biomass and biogas plants together produced 971 GWh of electricity.

Total wind power plant generation in Croatia in 2022 was 2263.1 GWh. Maximum hourly output was 860.65 MWh and it was realized on 9.4.2022 at 22 h, while minimum output was 0 MWh on 23.7.2022 at 9 h. Hourly production higher than 300 MWh occurred in 3232 hours. Average hourly wind power plant generation in the last 12 months was 258.37 MWh.

To conclude, overall GHG emissions from electricity consumption in the Port of Zadar is approx. **142 tons** per year.

## 2. Pilot action description

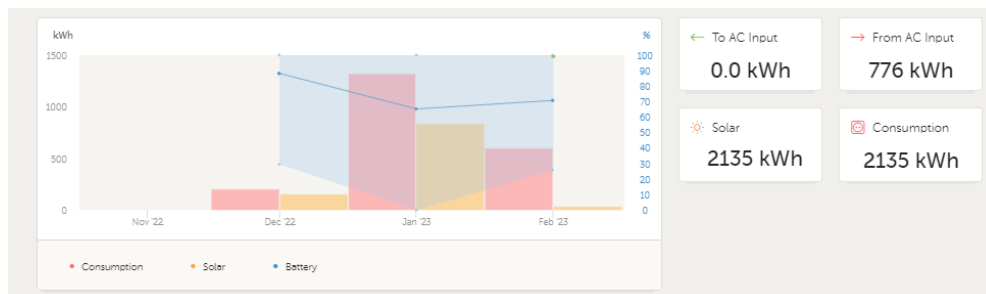
Port of Zadar Authority decided to create a project – Solar power plant, battery system and charging station for electric vehicles. The project included installation of a canopy with integrated photovoltaic panels in the area of the Port of Gaženica.

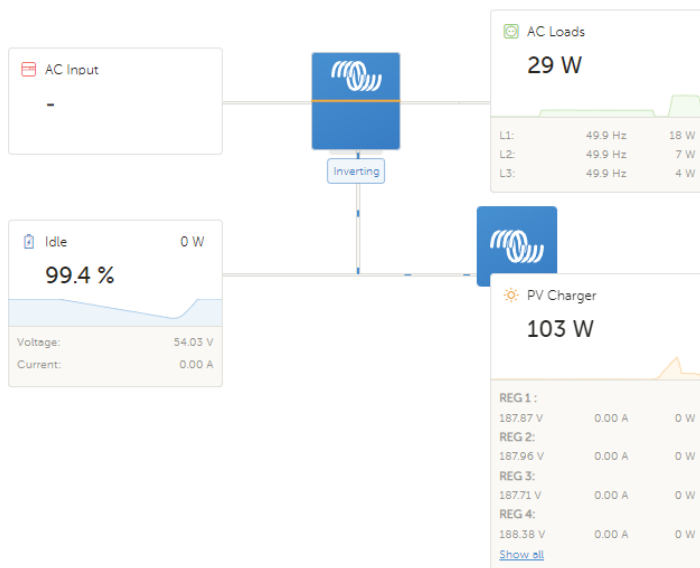
The public procurement procedure began with the procedure of prior consultation with interested economic entities on March 9, 2022. By May 2, all bids were submitted, while on May 16, the decision on the selection of the contractor was made. The contract was concluded on June 14, 2022. The works started in July and all activities were completed by December 22, 2022.

56kW of photovoltaic modules (128 pieces) were installed, monocrystalline, Half-Silent, nominal power 445 Wp with battery system with a total capacity of 30 kWh.

From 1.11.2022. until 1.03.2023. that is, in a total of 120 winter days, the power plant produced **2135 kWh**, which is an average of **17.5 kWh per day**.

*From 1.11.2022-1.3.2023 historical data from PV*

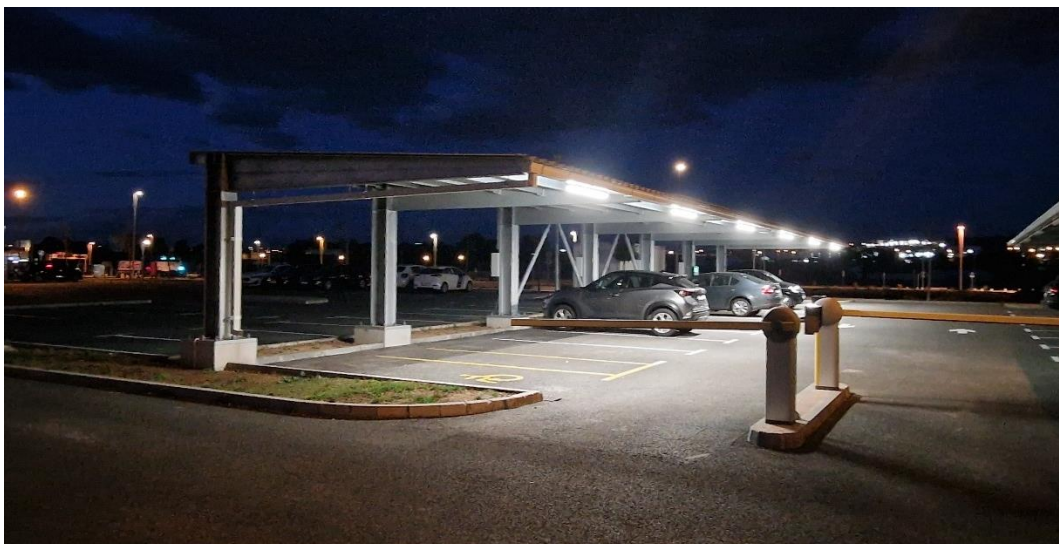




Present situation 13.3.2023 12:15

The electricity produced from the photo panels is used to charge the electric vehicle of the Zadar Port Authority as well as for external lighting in front of the terminal building.

The battery assembly has a capacity of 30 Kw, and the time required to charge it is approx. 1 hour. Depending on the period of the day, charging may take longer. Additionally, the average charging of an electric vehicle with a 21Kw battery with the system in question takes approximately 3 hours.





## Pilot action no. 2: Electric Vehicle

### 1. Ex-ante situation

The port of Zadar Authority has a fleet of vehicles for its use. All vehicles are with internal combustion engines and as such are considered as harmful for environment.

### 2. Pilot action description

Port of Zadar Authority wish to reduce GHG emissions and as such, the purchase of electric vehicle was part of pilot action project.

With regard to the estimated monetary value of the procurement, a simple procurement procedure was initiated. The request for initiation of procurement and the Invitation to submit bids were launched on September 22, 2021, and the bids were sent to three addresses. Two valid offers were received and the financially more favourable option was chosen. The review and evaluation of the offer was carried out on September 29, 2021, while the vehicle arrived in October 2021.

The chosen vehicle is Renault Twingo Electric, with technical specifications as follow:

Fuel: electricity  
Vehicle power: 82 PS  
Standard for environmental protection: NC  
Standard NEDC=0/WLTP=1 – 1  
Homologation: WLTP  
Engine type: R80  
Maximum speed: 135 km/h  
Gearbox: automatic with reduction gear  
Transmission type: Rear wheel drive  
Autonomy: 185 km  
Length: 362 cm  
Width: 165 cm  
Height: 154 cm  
Trunk volume: 174/240 l





The vehicle is used for the local transportation needs of the Zadar Port Authority. It replaced the Peugeot 207 1.6HDI vehicle. The vehicle in question was sold or written off and PZA no longer have any information about it, but it is known that it produced between 120-130g of CO<sub>2</sub>/km. The old vehicle travelled between 5.000-10.000 km annually.

That means that the old vehicle produced between 600 and 1300 kg of CO<sub>2</sub> per year.

The new vehicle so far has travelled approx. 2.500 km, however, with the construction of the filling station 4 months ago, usage has increased sharply and it is expected that the vehicle in question will have a similar annual mileage as the replaced vehicle. As such, the annual GHG reduction can be considered between 600 and 1300 kg.

### 3. Conclusions

The electricity produced by PV was used to charge the electric vehicle and to light the parking in front of the terminal building.

Thanks to the vehicle usage, Port of Zadar Authority have **reduced GHG emissions by 300 kg so far** and will continue to do so. Since vehicle is now charged exclusively from charger powered by solar panels, it could be said that vehicle footprint is 0 as energy used is renewable and clean. That means **GHG reduction between 600 and 1300 kg per year**.

| Source       | Expected PP production and vehicle usage | GHG reduction/year |
|--------------|--|--------------------|
| Power plant  | approx.. 8000 kwh/year                   | 992 kg             |
| Electric car | approx.. 7500km/year                     | 950 kg             |

Also, further electrification of the fleet is planned - this time with larger batteries and for the purpose of longer journeys and eventually with inclusion of plug-in hybrids to facilitate greener longer travels when electricity is not an option. The activity in question is planned together with increasing the capacity of batteries and photo panels on the canopy.



So far, solar plants have produced **2135 kWh** of electricity which is energy equivalent to 643 liters of gasoline or 760 kg of coal and reduction of **354 kg of CO<sub>2</sub>**.

The whole of Zadar City community has benefited from this pilot action as reduction of GHG emissions means healthier environment for all citizens.