



Solar schools project in Montenegro

Work in progress

Organisation of school system in Montenegro

- Centralized system under the jurisdiction of Ministry of Education, Science and Innovation.
- Funding is through Ministry.
- Each school director is working for benefit of its own school.
- Donations, funding from local business must be approved by the Ministry.

Pro and cons of current funding

- Centralized planning of investments
- Access to greater funds
- Prevention of misuse of funds
- Particular needs of particular schools are not addressed
- Lack of donations from local society and bussiness

Energy efficiency in public schools in Montenegro

- Up to now there were projects about screening energy efficiency of the school objects in Montenegro.
- Results of the projects lead to changing of the doors and windows on the object schools.
- Schools have steam heating systems but not air conditioning systems.
- Later years air conditioning systems are implemented but as a separate units with no centralisation or any smart energy efficiency solution

Why there is no solar schools up to now

- Problems with law and policy
- Lack of experienced and technical staff
- Constructing problems with objects
- Impossibility to sell or return to system excess of produced energy
- Expensive equipment and lack of funds

Old law VS new law

- Old law was strict that solar power plants must be on roof of object.
- Old law did not recognized small producers.
- Old law did not allowed small producer to be connected directly to grid at a measurement place.
- New law allows solar power plants to be built everywhere.
- New law allows public – private partnership
- New law recognizes small producers and connection directly to measurement place.

Now schools are solar?

- We have interviewed more than 15 principals of elementary and high schools.
- Solar energy is good! But..
- Principals are not familiar with details of new law.
- Schools do not have clear road map of how to achieve solar roof.
- Schools do not have technical knowledge or expertise.
- Procedure is very complicated and involves few different ministries with very weak intercommunication.

Any solar luck?

- There were few attempts of introducing solar energy and they were made through IPA Cross Border projects.
- Small scale projects with low power.
- No school implemented solar photovoltaic or solar heating plant.
- Two schools have conceptual designs of solar power plant on the school roof. But no further elaboration

Main problems now?

- Each school is for itself. Everything is depending on principal and school council.
- The oldest school in Montenegro has dynamic principal who tried to start project but object of school is historic heritage.
- Most of schools have flat roofs covered with gravel. No construction engineer would give permission to work without danger of leaking water.

Public – private partnership

- There was attempt to create public – private partnership to cover school parking.
- School is property of Ministry of Education, but parking is state property. Even school uses it there were problems.
- School did not get urban technical conditions.
- Estimated value of project was only for solar power plant but not for construction needed for mounting solar panels.
- Project was too expensive for school.

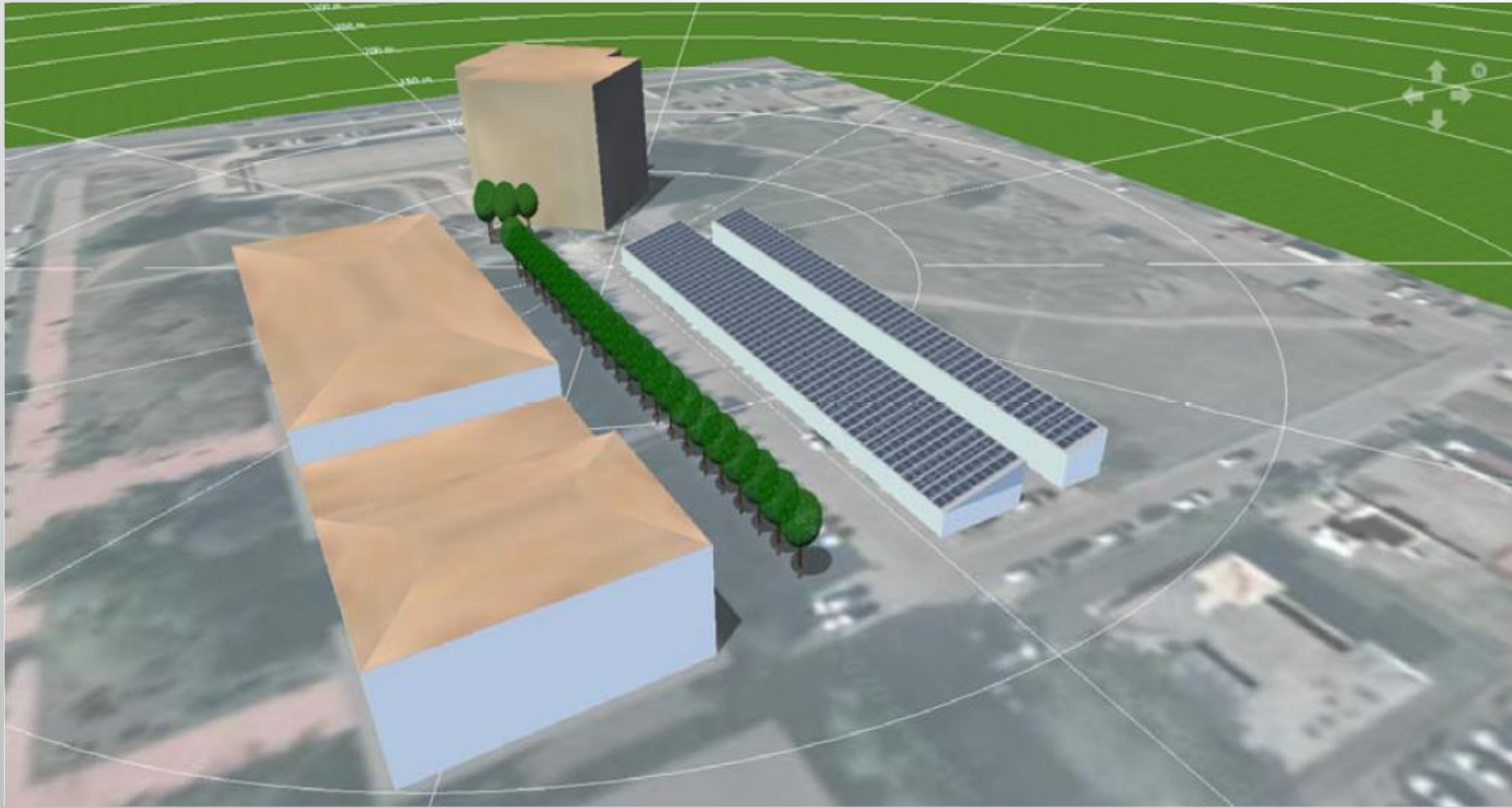
Yearly consumption



High price: 372934 kWh
(68%)

Low price: 170617 kWh
(32%)

Positioning of the parking

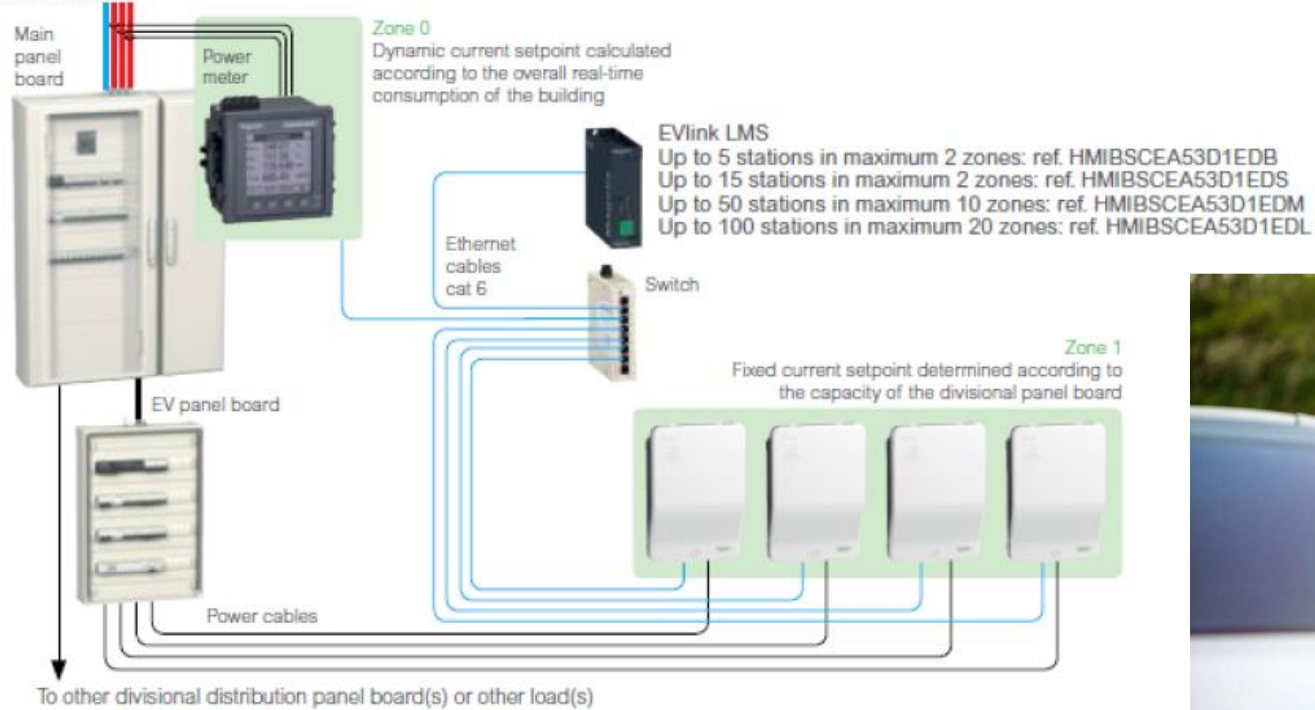


Monocrystal panels half cell technology, power of 320 Wp, dimensions 1,675x0,992x0,035 m

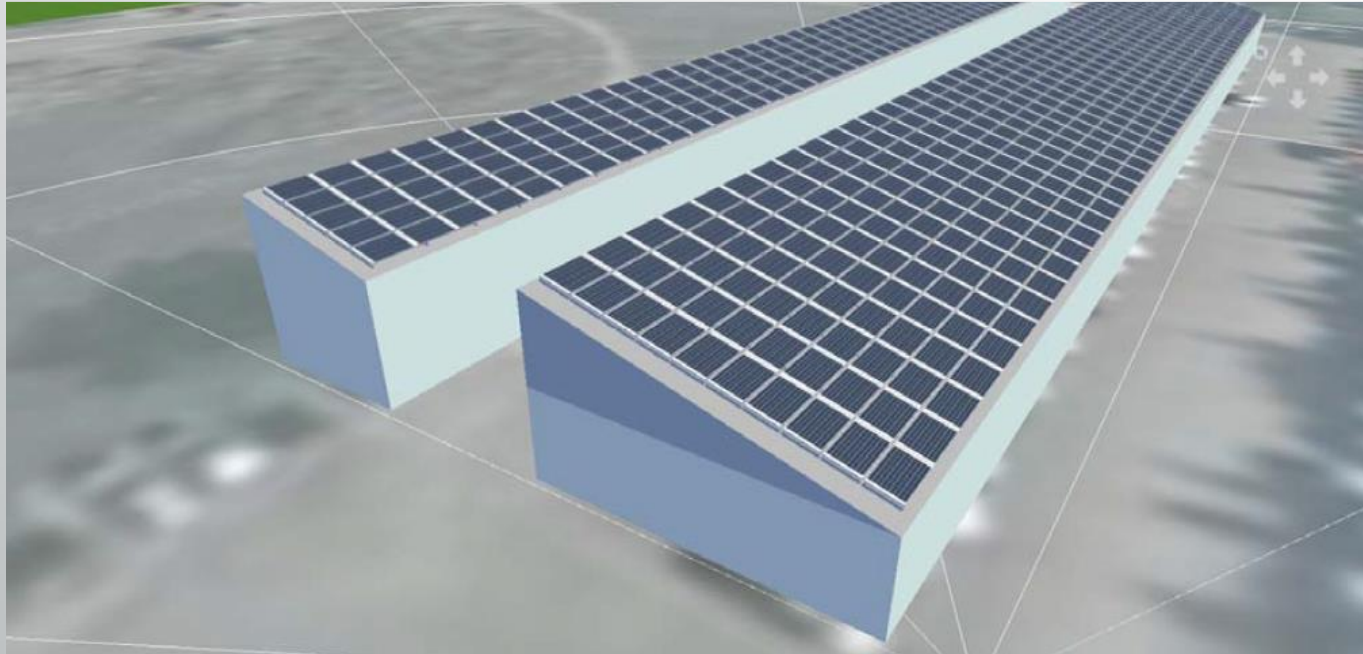
Power management for EV chargers

> Dynamic load management from a dynamic current setpoint

Multi zone⁽¹⁾



Simulation



Period: 21 years
Average insolation 1637 kWh/m²
Average temperature 15.9 C
Panel power 320Wp, orientation south 180 degrees, elevation 15 degrees
720 panels, 5 inverters
Degradation of modules: 85% after 20 years
Yearly production: 345 272 kWh

Cashflow table

	Year 1	Year 2	Year 3	Year 4	Year 5
Investments	-207.360,00 €	0,00 €	0,00 €	0,00 €	0,00 €
Feed-in / Export Tariff	29.391,58 €	28.825,65 €	27.762,39 €	26.736,79 €	25.747,54 €
Annual Cash Flow	-177.968,42 €	28.825,65 €	27.762,39 €	26.736,79 €	25.747,54 €
Accrued Cash Flow (Cash Balance)	-177.968,42 €	-149.142,78 €	-121.380,39 €	-94.643,60 €	-68.896,06 €

	Year 6	Year 7	Year 8	Year 9	Year 10
Investments	0,00 €	0,00 €	0,00 €	0,00 €	0,00 €
Feed-in / Export Tariff	24.793,41 €	23.873,17 €	22.985,65 €	22.129,74 €	21.304,32 €
Annual Cash Flow	24.793,41 €	23.873,17 €	22.985,65 €	22.129,74 €	21.304,32 €
Accrued Cash Flow (Cash Balance)	-44.102,65 €	-20.229,49 €	2.756,17 €	24.885,90 €	46.190,22 €

	Year 11	Year 12	Year 13	Year 14	Year 15
Investments	0,00 €	0,00 €	0,00 €	0,00 €	0,00 €
Feed-in / Export Tariff	20.508,36 €	19.740,82 €	19.000,73 €	18.287,13 €	17.599,11 €
Annual Cash Flow	20.508,36 €	19.740,82 €	19.000,73 €	18.287,13 €	17.599,11 €
Accrued Cash Flow (Cash Balance)	66.698,58 €	86.439,40 €	105.440,13 €	123.727,26 €	141.326,36 €

	Year 16	Year 17	Year 18	Year 19	Year 20
Investments	0,00 €	0,00 €	0,00 €	0,00 €	0,00 €
Feed-in / Export Tariff	16.935,77 €	16.296,26 €	15.679,74 €	15.085,43 €	14.512,54 €
Annual Cash Flow	16.935,77 €	16.296,26 €	15.679,74 €	15.085,43 €	14.512,54 €
Accrued Cash Flow (Cash Balance)	158.262,13 €	174.558,39 €	190.238,13 €	205.323,56 €	219.836,10 €

	Year 21
Investments	0,00 €
Feed-in / Export Tariff	21.022,87 €
Annual Cash Flow	21.022,87 €
Accrued Cash Flow (Cash Balance)	240.858,97 €

State energy company and Ministry

- 26.02.2024 Ministry of Education, Science and Innovation has held meeting with representatives of state Electricity company.
- State Electricity company has project of giving solar panels to households and then household is paying back equipment with monthly bill and sell energy to state Electric company.
- Same model of cooperation was topic of the meeting.
- State Electricity company has founded new company called Solar building that is dedicated to building of solar capacity in private households and public companies (companies owned or founded by state or municipalities)

Solar building

- Solar building company has capacity to conduct whole project.
- They have civil engineers who conduct research of objects structure and possibility to work on roofs.
- They have electrical engineers that cover electrical installation and connection to public power grid.
- They have mounters.
- And they have **MONEY!**

How expensive is solar?

- State Solar building company have all needed equipment for implementation of solar power plants on roofs or elsewhere.
- Solar building is capable of actually crediting institutions interested in building solar power plants.
- Solar building is working under state Energy company and has monopoly over infrastructure and has no law or legislative setbacks.
- At the moment Solar building is the best solution for schools.



Thank You!!!