Energokopiena Kalniena, Gulbenes novads

Kopsavilkums / Summary

Latviešu valodā

Kalnienas energokopienā apvienotas vairākas ēkas Gulbenes novadā — dzīvojamās mājas, veikals, bibliotēka un tautas nams — ar kopējo elektroenerģijas patēriņu ap 32,4 MWh/gadā. Patēriņa profils ir vienmērīgs visa gada garumā ar izteiktu slodzi dienas gaišajā laikā, kas ir labvēlīgi saules PV pašpatēriņam.

Modelējot saules PV īpatnējo ražību 910 kWh/kWp, tika secināts, ka 10 kWp sistēma saražo ap 9 MWh/gadā, nodrošinot ap 20 % no kopējā patēriņa bez akumulācijas. Šāds risinājums nodrošina atmaksāšanos aptuveni 7 gados, IRR 13 % un kopējā naudas plūsma kļūst pozitīva 10. gadā. Palielinot jaudu līdz 15–20 kWp, tīklā nodotās enerģijas īpatsvars pieaug, un atmaksāšanās periods kļūst ļoti atkarīgs no pārpalikuma realizācijas elektroenerģijas cenas.

Akumulācijas ieviešana ļautu sasniegt gandrīz 100 % pašpatēriņu, tomēr pašreizējos apstākļos tas vēl ir ar salīdzinoši garu atmaksāšanās laiku. Ar atbalstu akumulācijas ieviešana varētu samazināt atmaksas laiku līdz aptuveni 7 gadiem.

Ieteicamā ieviešanas secība:

- Uzstādīt 10 kWp PV sistēmu bez akumulācijas, maksimizējot pašpatēriņu un noslēdzot labvēlīgu līgumu pārpalikuma nodošanai tīklā.
- Sagatavot sistēmu nākotnes paplašināšanai, paredzot bateriju (20–40 kWh) un PV jaudas palielināšanu līdz 15 kWp, ja mainās tarifi vai tiek nodrošināts atbalsts.
- Ja, plānojot slēgt elektroenerģijas kopīgošanas līgumu, neizdodas vienoties par elektroenerģijas pārdošanas cenu, ieteicams izvērtēt iespēju katram lietotājam uzstādīt atsevišķu PV sistēmu, nodrošinot individuālu uzskaiti un norēķinus ar tirgotāju.

Tehniskie ieteikumi:

- Paneļus izvietot uz neēnotiem jumtiem, pārbaudot nesošo konstrukciju nestspēju un zibensaizsardzību.
- Jumta platības: ap 50 m² (10 kWp) un 100 m² (20 kWp).

Slodžu pārnese uz dienas stundām (siltumsūkņi, EV uzlāde) var palielināt pašpatēriņu par 5 - 10%. Jānovērtē kabeļu šķērsgriezumi un pieslēguma jauda, lai izvairītos no dārgiem pārbūves darbiem. Šāda pakāpeniska

pieeja samazina sākotnējo risku, nodrošina pozitīvus finanšu rādītājus jau pirmajā posmā un saglabā elastību reaģēt uz tirgus un regulatīvo izmaiņu signāliem.

English

The Kalniena Energy Community unites several buildings in Kalniena, including residential houses, a local shop, library and cultural centre, with a total annual electricity consumption of around 32.4 MWh. The purpose of the techno-economic feasibility study (TEP) was to evaluate technical and financial options for increasing local renewable electricity generation, improving self-consumption and reducing dependence on fossil fuels and volatile market prices. The analysis shows that Kalniena's electricity demand is relatively stable throughout the year and concentrated during daylight hours, which makes it particularly suitable for solar photovoltaic (PV) generation and the gradual electrification of heating.

The study included detailed data collection on electricity use, load profiling of all buildings, assessment of roof surfaces and shading, evaluation of heating demand and fuel-switching potential, and an economic analysis of different system configurations. Three system sizes were modelled: a base 10 kWp PV system without battery, a larger 15 kWp version, and two hybrid systems combining PV with battery storage (10 kWp + 27 kWh and 15 kWp + 40.5 kWh). The calculations were based on a specific PV yield of 910 kWh/kWp and current market assumptions, using an avoided electricity price of 130 EUR/MWh, a 5 % discount rate and a 20-year lifetime.

The results show that a 10 kWp PV system would generate approximately 9 MWh per year, covering about 20 % of the total annual consumption without the need for storage. Under these conditions the system achieves a simple payback period of about seven years, an internal rate of return of 13 %, and a positive cumulative cash flow in year 10. At higher capacities (15 - 20 kWp) the proportion of surplus electricity exported to the grid increases, and the profitability becomes highly sensitive to the electricity sale price agreed between energy-community members. When the export tariff varies between 0.04 and 0.08 EUR/kWh, the payback period extends considerably.

The addition of batteries could increase self-consumption to 98–100 % and reduce evening purchases from the grid. However, with current equipment prices and tariff structures, the financial performance remains weak: the net present value is negative (from –1.3 to –7 thousand EUR) and the payback period exceeds 15 years. The situation would change significantly if a grant of 40–50 % of investment costs became available, reducing the payback time to roughly seven years and improving the project's overall attractiveness.

From a technical perspective, PV panels should be installed on roofs after verifying their structural load capacity and ensuring adequate lightning protection. A 10 kWp installation requires about 50 m² of roof space,

while a 20 kWp system would need roughly 100 m². The use of load-shifting measures—for example, operating heat pumps or charging electric vehicles during daylight hours could further increase the share of self-consumed electricity by 5 to 10 percentage points. Where security of supply is important, the inverter should be capable of operating in islanding mode with continuous output of approximately 10 kW for critical loads. Grid-connection points and cable cross-sections should also be checked to avoid costly future upgrades.

The recommended implementation pathway is gradual. **In the first stage, the community should install a 10 kWp PV system without batteries, optimising on-site consumption** and establishing a transparent internal accounting and settlement mechanism for shared electricity. **In parallel, the system should be designed to allow for later integration of modular battery storage (20–40 kWh) and potential expansion up to 15 kWp when market conditions or support schemes improve.** In a subsequent stage, the community can integrate heat pumps for space heating and domestic hot-water preparation, linking renewable generation with demand-side management to reduce the use of natural gas.

During the TEP, several preparatory activities were completed: data collection and analysis of hourly and daily consumption profiles, development of financial models comparing capital costs, operational savings and possible grant scenarios, and initial consultations with electricity retailers regarding internal billing and energy-sharing options. Technical recommendations were prepared for safe PV installation, load-management optimisation and electrical-connection upgrades.

Overall, the Kalniena project demonstrates a scalable and replicable model for rural Latvia. It shows how local communities can jointly produce and use renewable electricity, improve energy security and manage costs through cooperative investment, transparent governance and gradual expansion of low-carbon technologies.