Energy communities in StartSun countries

GUIDEBOOK v1

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ENERGY TRANSITION
StartSun

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About StartSun

https://interreg-baltic.eu/project/startsun/

The StartSun project is co-financed by Interreg Baltic Sea Region.

To advance in energy transition, the project StartSun establishes five energy communities of different types, and compiles start-up packages for authorities, enterprises and others, with guidance and steps to follow in building their own energy communities.

StartSun contributes to the growing body of projects that emphasize energy democracy, citizenship, and justice as essential elements of any transformation.

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Abbreviations

DERs	Distributed energy resources
DSO	Distribution system operator
EC / ECs	Energy community / Energy communities
EV / BEV	Electric vehicles, battery electric vehicles
PV	Photovoltaics
NECP	National energy and climate plan 2030

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1. Purpose of the guidebook

Solar photovoltaics (PV) have become affordable for many, reflecting the global shift towards renewable energy[1]. To harness the benefits from the solar revolution individually and collectively, it is important that we participate.

StartSun is a project dedicated to making solar energy communities (ECs) work in the Nordic and Baltic countries. ECs can be part of the building blocks of new energy systems that are increasingly electrified, digitalized, distributed, and decentralized.

An energy community is a group of people or organizations that collaborate to generate, consume, and manage energy locally.

According to the European Commission, ECs are citizen-driven energy actions that contribute to the clean energy transition, advancing energy efficiency within local communities[2]. Either defined as organizations or projects, ECs can take different forms and vary in terms of size, business model and geographic configuration.

This guidebook is the first publication from StartSun, introducing our approach to understanding collective initiatives and planning new EC projects in the four partnering countries: Estonia, Finland, Latvia, and Sweden. The guidebook draws on 10 case studies that highlight recent developments and best practices in each StartSun country, along with a few inspirational stories from other parts of the EU.

StartSun's mission is to facilitate the creation of solar ECs as start-ups.

We are learning by doing, and this guidebook was prepared in parallel to planning StartSun's energy community pilots, which are still in their early stages (Figure 1). Therefore, the guidebook reflects our StartSun journey through the literature, other projects, toolboxes, webinars, working groups, site visits, and interviews that have informed and supported our project team.

The StartSun Guidebook is structured into three parts. **First**, the introduction lays out our motivation and presents StartSun's current approach to ECs. We focus on open topics surrounding the EU's energy and climate policy. StartSun's vision remains grounded in practice, bridging the gap between ambitious goals and the challenges posed by limited commitment or resources. **Second**, we present the key findings from the case studies and StartSun country insights (Figure 2). It serves as a comparison, highlighting strengths and limitations. Finally, in the **third** part, we draw conclusions, referring to the local contexts and prospects in each StartSun country.

1 Since 2009, costs of solar PV have decreased by 90%: https://www.solarpowereurope.org/about/discover-solar

2 https://energy.ec.europa.eu/topics/markets-and-consumers/energy-consumers-and-prosumers/energy-communities_en

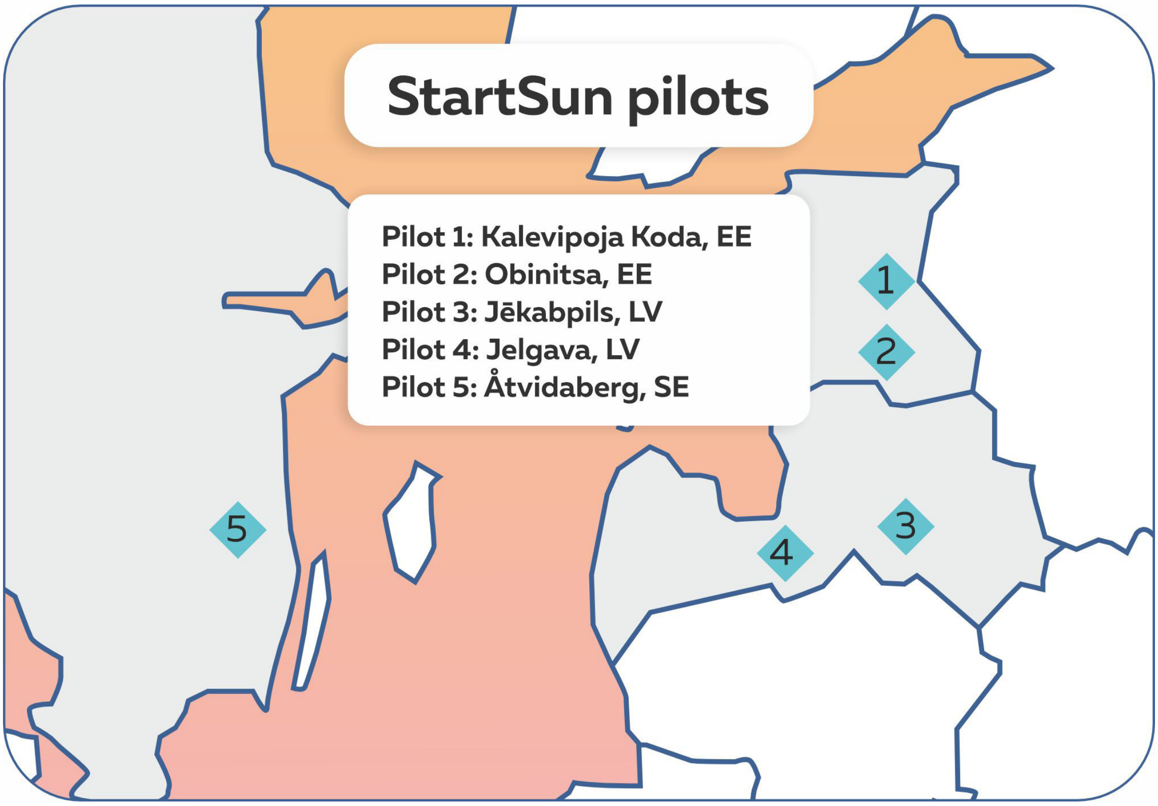

Figure 1. Locations of StartSun energy community pilots.

Pilot No.1	**Kalevipoja Koda, Estonia**	Two rooftop PV systems will be installed at the Kalevipoja Koda museum and cultural center, as well as the local store. In future, nearby apartment associations and the local energy company could join the EC.
Pilot No.2	**Obinitsa, Estonia**	A rooftop PV system will be installed at Seto Aiad's cold storage facility, owned by the local cooperative of berry producers. The EC was established in October 2024.
Pilot No.3	**Jēkabpils, Latvia**	Rooftop PV systems will be installed on two preschool buildings, and their excess electricity will be consumed at the city sports hall.
Pilot No.4	**Jelgava, Latvia**	Rooftop PV systems will be installed on the Pārlielupe primary school and the House of Culture. Battery storage will be added to the system.
Pilot No.5	**Åtvidaberg, Sweden**	A rooftop PV system will be installed on the municipality-owned business park building, with shares offered to the office tenants.

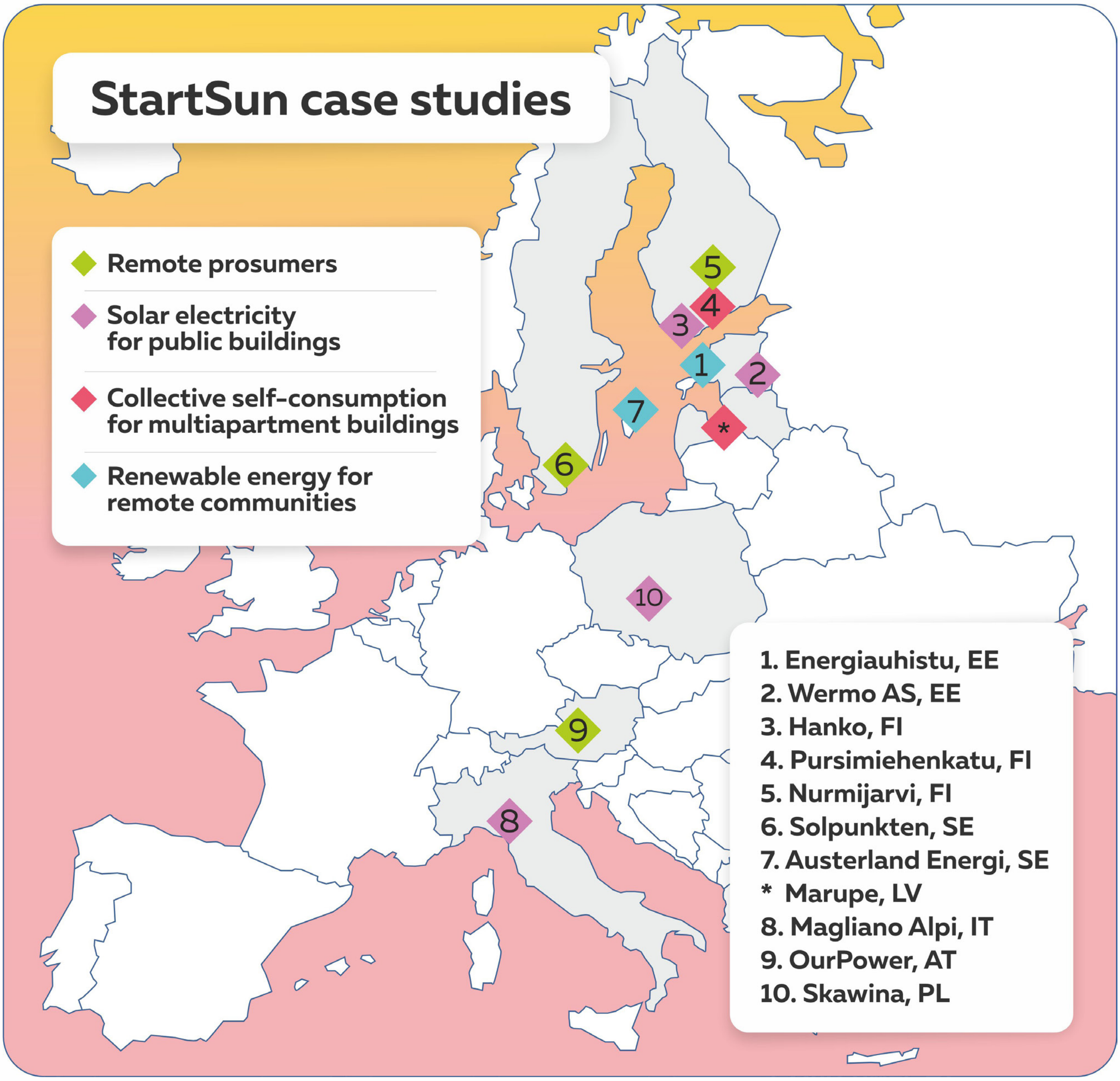

Figure 2. Types and locations of energy communities studied in StartSun.

2. Introduction

Energy is a fundamental aspect of the built environment, and access to energy services is a basic right that greatly influences our quality of life. "Using energy" may seem like a simple, everyday task embedded in our devices and surroundings. Yet understanding how energy systems and markets work can become complicated as soon as one seeks to initiate change.

Envisioning and developing EC projects has gained recognition as **a model of civic participation and local action driving the energy transition**. Despite support from EU legislation and advocacy efforts, ECs still face barriers such as legal ambiguity, low public awareness, and limited funding.

As a practical concept, ECs represent diversity and uniqueness, which may not easily serve as blueprints for replication or scaling. ECs often involve a level of risk and experimentation that is less typical in local energy planning but is rather common for the sharing economy.

2.1. Impact

StartSun brings together organizations from four countries where the number of EC projects remains low, and regulations are still incomplete. While the absence of citizen-led collective initiatives was typical in countries that were part of the Soviet bloc in the 20th century, ECs are also scarce in Finland and Sweden, where enabling frameworks were similarly lagging[3].

In this section, we look at the impact or **ECs' potential to make a positive change** from three perspectives. **First**, we give a brief overview from a recent EU-wide survey about public attitudes towards energy policy. **Second**, we provide basic data about the share of renewable energy resources and related indicators in all StartSun countries. And **third**, we reflect how ECs support the aspirations of energy democracy more broadly.

As elements of today's power systems and participants of the electricity markets, ECs are situated in-between "big" and "small". In terms of activity and size, some countries, such as Spain, have thousands of members forming energy cooperatives, while others, like Latvia, had no formally established energy communities as of 2024. It remains difficult to assess the EU-wide and individual potential of ECs, particularly in terms of the scale and scope of the legal, economic, and technical changes their projects shall bring to the energy sector.

2.1.1. Public perception of energy communities

In 2024, Eurobarometer investigated Europeans' attitudes towards energy policies. Among actions taken to empower consumers, one of the questions was about ECs[4] . At least 1000 people in each Member State were asked if they had ever joined or considered joining a renewable EC. On average, 75% of Europeans answered no, 23% said yes, and 2% did not know. There were slight differences among the StartSun countries. Latvia had the lowest number of respondents not considering ECs as an option (72%), whereas Sweden had the highest (84%). In Sweden, there was also a higher share of people who were not familiar with

3 https://www.nordicenergy.org/publications/energy-communities/
4 https://europa.eu/eurobarometer/surveys/detail/3229

the EC concept (26%) (see Figure 3).

In Latvia, there were more people interested in the economic benefits of ECs (12%). Also, the respondents from Estonia (8%) and Finland (9%) recognized lower energy bills or financial advantages as a more significant motive. In Sweden, however, the motivation to be part of a clean energy project scored first (7%). Overall, having an EC for the sake of taking part in a local community building project was the least popular choice (see Figure 4).

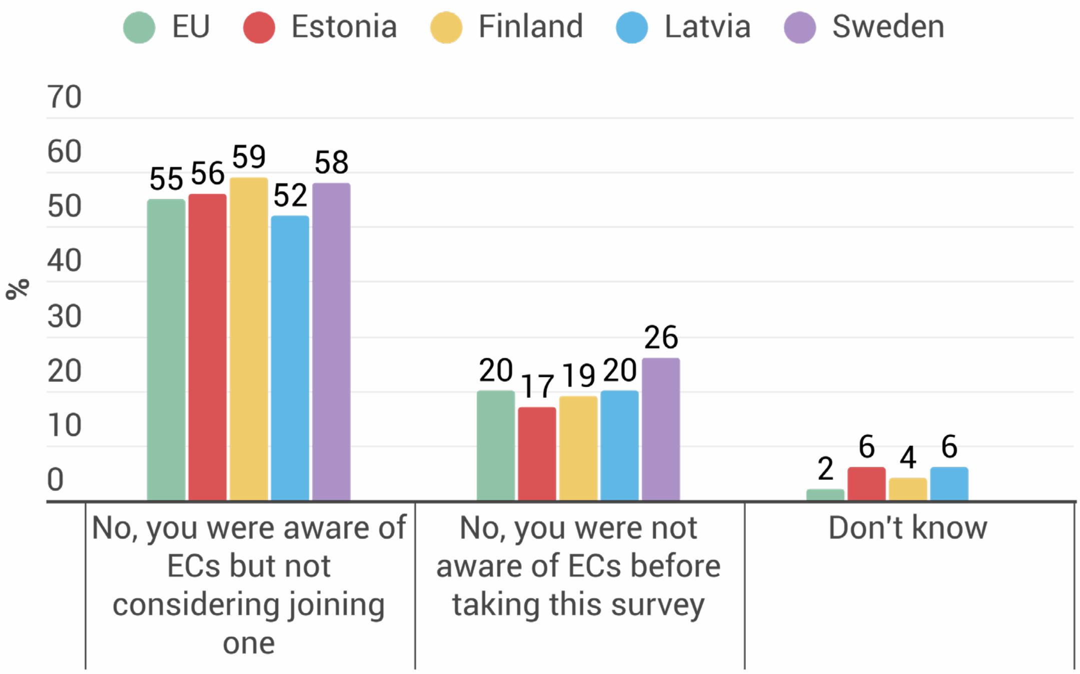

Figure 3. Have you ever joined or considered joining a renewable EC? Results for negative and neutral answers.

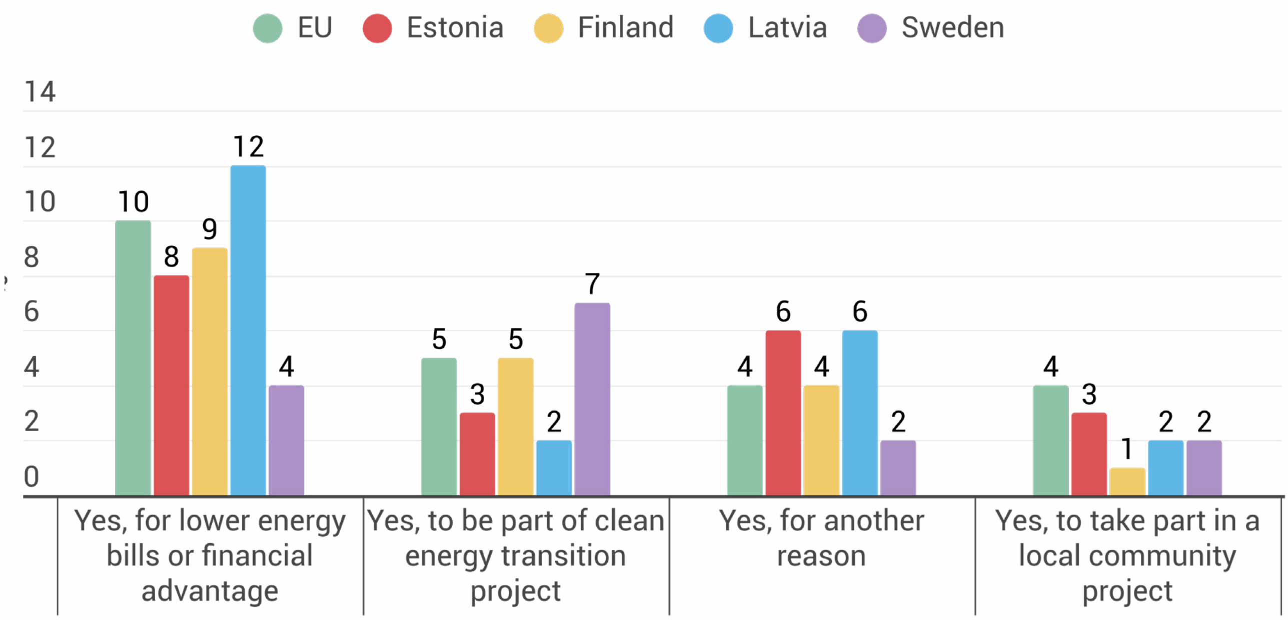

Figure 4. Have you ever joined or considered joining a renewable EC? Results for positive answers.

The survey indicates that both the readiness to launch EC projects and awareness of ECs' benefits are rather low among the population despite the overall positive image that ECs have. However, due to absence of enabling frameworks and little experience with EC projects in most countries, the share of population interested in ECs is significant: 23% in EU; 20% in Estonia; 19% in Finland; 22% in Latvia; 15% in Sweden.

2.1.2. Contribution to decarbonization

ECs, and the people or organizations who create them, need public support and broader social acceptance. ECs' contribution to reaching EU's climate and energy goals – foremost, the increase of the share of renewable energy – is a measurable and comparable impact. European EC advocacy groups stress that **quantified targets for ECs should be included in the National energy and climate plans** (NECP). Those could be set either as capacity targets for EC-managed renewable energy projects, reserved grid capacities for ECs, amount of public funding allocated for ECs and others.

Higher national ambition of decarbonization is a prerequisite for energy policies supportive of ECs. In the renewable electricity sector, Nordic and Baltic countries score well. Sweden has the highest share of renewable electricity in the final consumption (83%), also Finland and Latvia are above the EU average[5]. Estonia's electricity sector is the most carbon intensive due to domestic oil shale use. However, Estonia has achieved significant progress, integrating wind and solar in its electricity mix. For example, in 2022 more solar electricity was produced in Estonia than in Finland. Latvia was the last one to embark on the solar revolution[6] (see Figure 5).

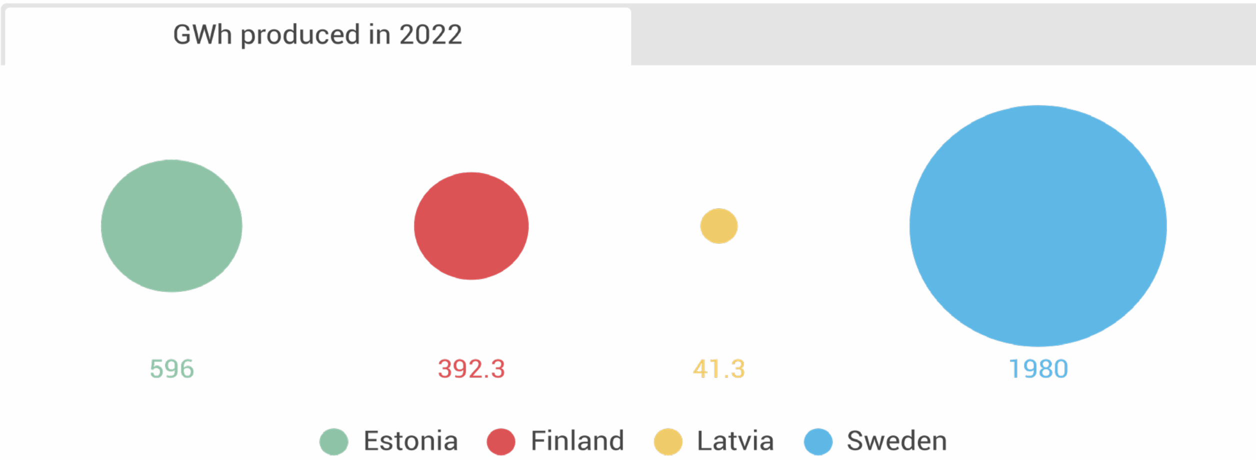

Figure 5. Solar electricity statistics in 2022. Source: Eurostat[7]

In recent years, small-scale solar added most to the share of solar electricity. For example, in 2022, 90% of solar capacity in Latvia was microgenerators; the proportion has changed since 2023, as larger solar plants get completed[8]. In 2024, there were about 23 thousand prosumers in Latvia, but this number in Sweden is 10 times higher – 250 thousand[9].

5 Share of energy from renewable sources [nrg_ind_ren__custom_12995556]
6 https://www.pv-magazine.com/2024/06/29/solar-leading-baltic-states-to-energy-security/
7 Use of renewables for electricity - details [nrg_ind_ured__custom_12964925]
8 https://sadalestikls.lv/lv/elektroapgades-apskats Data from the DSO
9 https://svensksolenergi.se/minskat-stod-bromsar-elektrifieringen/

Table 1. Comparison of StartSun countries

	Estonia	Finland	Latvia	Sweden
# of energy communities, 2024	2+	100+	1+	100+
# of small-scale solar prosumers, 2024 [10]	20 000	30 000	23 000	250 000
# of DSOs with household customers [11]	2	77	1	170
GWh of solar in national electricity production, 2022 [12]	596	392.3	41.3	1 980
% of RES in the electricity mix, 2021 [13]	41	54	64	68
# of passenger BEVs 2023/2024 [14]	7 559	83 800	6 369	291 700
Average electricity prices for household customers, 2023 euro/kWh [15]	0.23	0.24	0.28	0.22
Rollout of smart meters accomplished	Yes	Yes	Yes	Yes
Population, million	1.3	5.6	1.9	10.5
Land area, km2	45 339	338 462	64 589	447 430

10 Estonia https://elektrilevi.ee/et/uudised/2023-aasta-tootmisrekordid-elektrilevi-vorgus Finland https://energiavirasto.fi/en/-/solar-power-production-capacity-rose-to-1-000-megawatts Latvia https://sadalestikls.lv/lv/elektroapgades-apskats Sweden https://svensksolenergi.se/minskat-stod-bromsar-elektrifieringen/

11 Europe https://cdn.eurelectric.org/media/5089/dso-facts-and-figures-11122020-compressed-2020-030-0721-01-e-h-6BF237D8.pdf Sweden https://www.ei.se/ei-in-english/electricity

12 Eurostat Use of renewables for electricity - details [nrg_ind_ured__custom_12964925]

13 https://energy.ec.europa.eu/publications/state-energy-union-report-2023-country-fiches_en

14 Estonia https://www.transpordiamet.ee/en Finland https://www.statista.com/statistics/1177464/number-of-electric-and-hybrid-passenger-cars-in-finland/ Latvia https://data.stat.gov.lv:443/sq/23239 Sweden https://www.statista.com/statistics/1483622/sweden-battery-electric-car-stock/

15 Eurostat Electricity prices for household consumers - bi-annual data (from 2007 onwards) [nrg_pc_204]

The benefit of ECs for the decarbonization of the power system does not equal the number of additionally installed MW. Development of solar ECs is strongly linked with broader electrification efforts in the heating and transportation sectors, such as integration of heat pumps and battery electric vehicles (BEVs). In countries where the share of renewables in the electricity sector is already high, EC projects can contribute to mitigating grid constraints and deferring investments in grid upgrades.

2.1.3. Democratization of the energy systems

Even if public awareness about ECs is still relatively low in Europe, the academic and professional attention has flourished in the last decade, now forming a rather solid knowledge base grounded in numerous studies, comparative analysis, models, guidelines, and recommendations [16].

A key driver of interest in ECs was the adoption of common EU-level legislation in the Clean Energy package. It has highlighted differences in ways how Member States transpose the EU framework and adapt the common definitions [17]. Again, there are countries where cooperative and community-led energy projects have existed prior to a unified legal definition (Denmark, Germany) as well as countries where the governance of power systems has not been suited to accommodate similar collective initiatives (most countries in Central and Eastern Europe). In Sweden, there are still no formal definitions of energy communities in legislation, but this obstacle has not prevented establishment of several wind cooperatives, ecovillages, and, more recently, urban development projects piloting ECs [18].

Following the decentralization of energy systems, domestic energy technologies and local ownership have become more widespread. European Commission notes that the intention of its electricity market design is to **"put the consumer at the center of the clean energy transition, enabling active participation, with a strong framework for consumer protection"**[19]. Despite the empowerment of the individual, ECs as collective action still face impeding factors such as distrust and limited access to resources or property.

From the rights perspective, REScoop argues that ECs are key for a democratic energy transition and the achieving favorable legal provisions have required intensive advocacy work and consultations on all levels of the government [20]. Since ECs' purpose is making energy more affordable and minimizing environmental pollution compared to former energy systems, it implies gradual reworking of rights and obligations, including **"institutionalization of new forms of participative governance"**[21].

Local governments and public bodies in general can be great partners when it comes to EC projects. ECs' umbrella organizations call it "a match made in heaven" [22]. Local governments are

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16 A rich collection of resources is maintained by the Energy Community Platform: https://energycommunity-platform.eu/resources/
17 https://www.rescoop.eu/policy#transposition-tracker
18 See the section about Sweden: https://www.nordicenergy.org/publications/energy-communities/
19 https://energy.ec.europa.eu/topics/markets-and-consumers/electricity-market-design_en
20 https://www.rescoop.eu/news-and-events/news/the-energy-transition-can-save-democracy
21 https://doi.org/10.1016/j.erss.2021.102482
22 https://energy-cities.eu/match-made-in-heaven-once-you-have-it-its-beautiful/

responsible for planning and possess resources to support EC projects. Municipalities also have buildings and infrastructures that provide public services. Moreover, municipalities can build bridges to make ECs more accessible for vulnerable households, as it is stipulated in the new design of EU's electricity market [23].

ECs are forward looking, envisioning what energy systems and their participants could become. ECs are also rooted in history and resonate with the environmental sensations and activism from the second half of the 20th century [24]. The rationales and value propositions for ECs have social and environmental undertones.

2.2. Technologies

The EU's customer-centric vision for its energy systems represents a significant technological shift. Placing customers at the center shifts the focus to the grid's edges - specifically, where end users' devices interact with operators' systems. Distributed energy resources (DERs) and decentralized energy markets demand advanced digital representations and automated management systems that enhance the observability and control of the many components within electricity grids.

In this section we address two technological aspects of ECs. **First**, the more successful EC projects are, the more they offer synergies to other parties, having specialized roles in the electricity markets. Thus, the technological "how-to" of ECs largely depends on cooperation and shared experience. **Second**, we also look at how ECs meet the challenges of grid development.

2.2.1. Cooperation and expertise

The interaction between ECs and various service providers is close, and the boundaries between ownership and governance will blur even further with energy sharing [25]. ECs' relative independence from external electricity supply is increasingly replaced by reliance on DERs, behind-the-meter devices, maintenance services, and software providers— the tools necessary for ECs to operate [26].

All ECs reflect **a sense of self-sufficiency and grassroots initiative**, meaning that at least some of their members, advisors, or leaders must contribute either professionally or voluntarily to the technical setup and operation of EC projects. The need for expertise is recognized as one of the barriers to broader engagement - it's rarely possible to procure or subscribe to a ready-made, all-in-one EC solution.

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23 https://energy.ec.europa.eu/topics/markets-and-consumers/electricity-market-design_en
24 Film "We the Power" https://www.youtube.com/watch?v=75A9WGxoUn8
25 See "Energy sharing for communities" 2024 developed for the Energy Communities Repository https://circabc.europa.eu/ui/group/8f5f9424-a7ef-4dbf-b914-1af1d12ff5d2/library/f221ba07-6103-43ad-bbba-df71c-2de2c57/details
26 See "Digital Tools for Energy Communities" 2024 developed for the Energy Communities Repository https://circabc.europa.eu/ui/group/8f5f9424-a7ef-4dbf-b914-1af1d12ff5d2/library/4d412a68-46aa-42d0-9ed2-49e0b6a51005/details

REScoop also believe that growth is beneficial for energy communities: "**The bigger the initiatives get, the more professional they become** – because they can have employees and do not need to be run only by volunteers"[27].

The relationships between ECs and traditional participants in the electricity markets - retailers, DSOs, and transmission system operators - can be complicated. While DSOs are generally supportive of active customers and ECs when improving demand-side management, they are often hesitant to implement changes in their data management systems or technical regulations that would directly benefit energy sharing and EC projects. The divide between "big" and "small" players tends to disproportionately affect the interests of ECs.

The technologies that are available for or created by EC projects should produce positive social effects, including more connectedness, freedoms, and affordances in our everyday interactions with energy systems and neighbors. Necessarily, **ECs have a lot of common with sufficiency policies**, interrogating how a good life is possible for many without crossing the planetary resource boundaries. Energy sufficiency can be improved by designing more compact and compatible living spaces which requires seamless coordination of technical components and peoples' use patterns.

2.2.2. Grid constraints and smart grids

One of the biggest policy questions regarding ECs is **how they impact the overall system costs and efficiency of the power grids**. There are arguments based on improved grid resilience, local energy markets and the future needs of flexibility services [28]. However, there are reserved and cautious views too - the general principle is that ECs should neither be exempt from system costs, nor face discrimination in the form of additional financial burdens. The system operators may see the surge of active customers and EC projects as additional challenges due to increasing costs of grid modernization, especially when serving a large population of sparsely located customers. The grid tariffs are a significant cost component for energy communities and reduced fees for EC operating within some geographic boundaries would benefit energy sharing.

DSOs provide the core infrastructure for planning, monitoring and controlling the bi-directional flows of electricity in the public grids, as smart meters and data management systems are prerequisites for energy sharing and billing. Hence, **ECs and DSOs have a particularly good match in different smart grid projects that aim to enhance the observability of the grid**, considering events on different levels of the electricity system. However, the structure of distribution system is different in StartSun countries – Latvia and Estonia have one or two large DSOs, while the number of DSOs is much larger for Finland and Sweden.

In fact, ECs are often subject to grid constraints and many projects have commenced in response to the grid problems and aspiration to fix it. The regulation for ECs roles and obligations for using the public grids or building their own varies among countries, for example EC are not entitled to manage parts of public grids autonomously but are allowed to build

27 https://www.rescoop.eu/news-and-events/news/the-energy-transition-can-save-democracy
28 https://www.iea-isgan.org/energy-communities-impact-on-grids-energy-community-embedment-increasing-grid-flexibility-and-flourishing-electricity-markets/

out direct lines or inner grids within real estate. Since innovation in the energy sector often stumbles against normative barriers, EC projects are very suitable for testing regulative sandboxes.

ECs can provide services to other parties, including the system operators. In principle, also ECs can participate in flexibility markets and offer ancillary services. Demand side management can improve the economic performance of the ECs. Usually, it also requires energy storage options - batteries, EVs, thermal storage, and other means of systems integration. In each case, **customized data exchange is needed for most EC projects** – and it is different than the traditional retailer-customer model of the electricity market. The data is usually accessed via the national energy platforms – for example, the Finnish TSO Fingrid has implemented an EC module in its DataHub that is referred to as best practice for other system operators in the region[29].

2.3. Finance and funding

Electricity is a commodity, which means that its exchange value is monetary, and it is measured in euro/kWh. The term electricity market somewhat encloses the whole system complemented with economic transactions that are guided by laws, rules, regulations and partially affected by human behaviors.

The EU and its Member States have agreed on EC definitions that juxtapose profit making to social and environmental purposes. Simultaneously, ECs may not be discriminated against or bear additional costs compared to other market actors. In general, ECs imply also sharing all costs. The value propositions for ECs often center on providing direct benefits to its members and reinvesting the income in community development[30]. Managing the internal relations, e.g. billing the EC members, remains a challenging aspect for most projects.

Recently, the LifeLOOP project presented an overview of EC business models, including (i) collective investment in renewable energy generation; (ii) ECs for collective self-consumption; (iii) ECs as renewable energy supplier; and (iv) ECs as service providers[31]. As shown by the StartSun case studies in the next chapter, the **collective investment and self-consumption aspects are characteristic to all ECs**, while the roles of energy suppliers and service providers usually belong to the professional companies who have either founded and joined the ECs or have contractual relations with ECs.

There are different options for financing EC projects and access to finance is the main prerequisite for new initiatives. Sccale203050 project discerns various financing models such as equity financing (shares), loans, crowd investment, grants (public support schemes) and municipal support[32]. Grants tend to be the most favored form for EC piloting, while shares and other forms of collective investment have proved successful in ECs initiated by utility

29 https://www.fingrid.fi/en/news/news/2023/datahub-ready-for-the-next-steps/
30 https://doi.org/10.1016/j.rser.2021.111013
31 https://energy-cities.eu/wp-content/uploads/2024/07/D-3.1-Report-on-selected-business-models-for-development-of-community-energy-projects.pdf
32 https://energycommunityplatform.eu/resources/financing-guide-for-energy-communities/

companies or cooperatives[33].

Public authorities and local governments can contribute to EC development not only by investing in their projects or allocating public resources but also by procuring services from ECs[34]. In this way they **strengthen the role of ECs as equal market participants**. Applying EC models for financing renewable energy projects should become more common. The revised Renewable energy directive also puts forward new provisions for ECs participating in large-scale projects, including offshore wind[35]. Furthermore, public authorities should work out eligibility criteria for prioritizing among different EC projects and grants applications for EU funding and national programs[36].

33 https://www.sciencedirect.com/science/article/pii/S2214629624002172
34 https://energycommunityplatform.eu/resources/procurement-guide/
35 https://energy.ec.europa.eu/topics/renewable-energy/renewable-energy-directive-targets-and-rules/renewable-energy-directive_en
36 https://www.rescoop.eu/toolbox/following-the-frontrunners-a-public-financing-guide-for-managing-authorities

3. Case studies and country insights

In the first half of 2024, the StartSun team worked on 10 case studies, exploring different examples of EC initiatives in the project countries. To compensate for the lack of studies in countries with little EC experience, the Latvian partners added three stories about inspiring projects in other parts of Europe (Austria, Italy, Poland) and used the materials about Latvia's first EC pilot prepared by other Interreg projects. StartSun's case studies do not offer a comprehensive mapping of EC initiatives in Sweden, Latvia, Finland, or Estonia. Rather, it is **a selection that investigates the goals and design of various projects with our forthcoming StartSun pilots in mind**. Each EC and its business model add to our perspective on the national and regional contexts they operate in.

EU's Renewable energy directive stipulates that each Member State should perform a comprehensive assessment of barriers and opportunities for EC projects. In Finland, the report was published in 2023[37]. In Sweden, the EC report was published in September 2024[38]. Estonia's and Latvia's national assessments are forthcoming or prepared as supplements to annotate the new regulation.

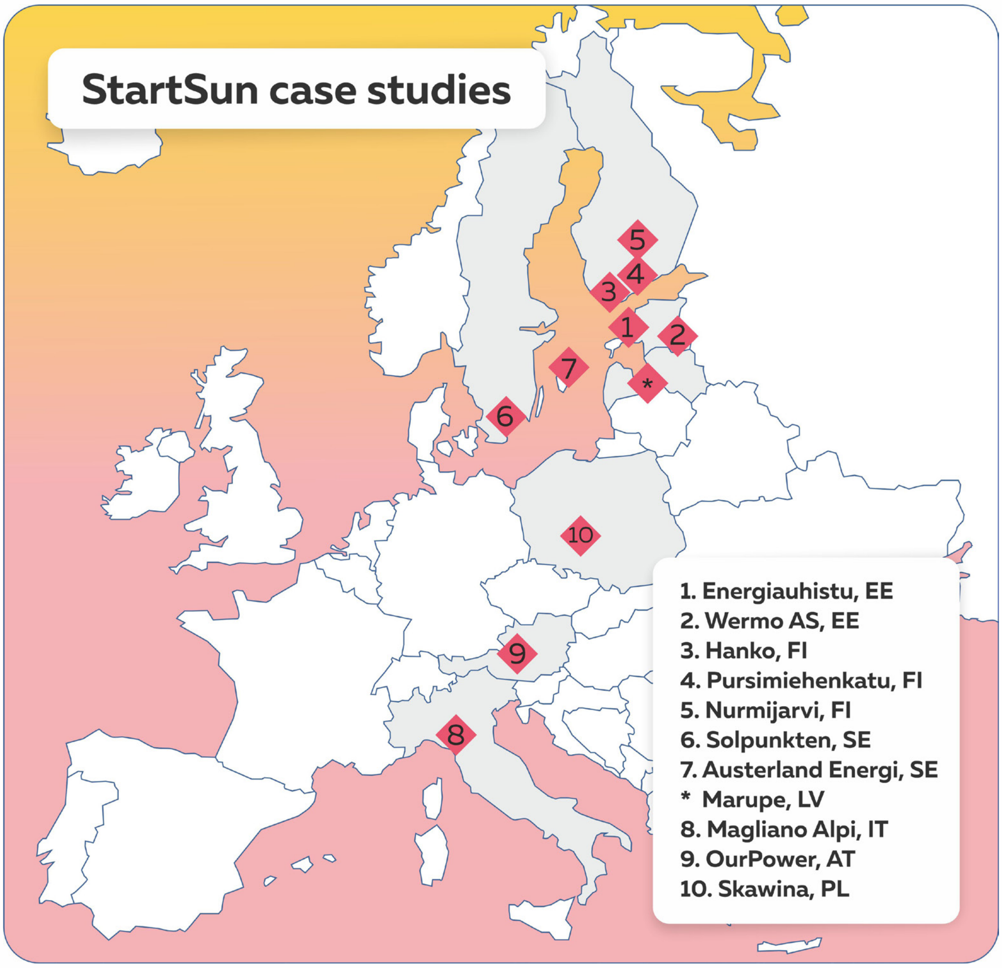

Figure 6. The location of StartSun case studies.

37 https://tem.fi/en/energy-communities
38 https://www.energimyndigheten.se/nyhetsarkiv/2024/energigemenskaper-behover-battre-och-tydligare-forutsattningar/

The full-length case studies are published on StartSun's website. To structure the content in a similar way for all cases, we had prepared a 10-section template with suggested titles and indicative questions. The sections included: **context, legal framework, technical setup, energy efficiency, governance, business models, digital tools, social inclusion, barriers and diagrams**. The national StartSun teams worked independently and based their reports on interviews, site visits, and desk research. This work took place in parallel with planning phase of the StartSun pilots in Estonia, Latvia, and Sweden.

3.1. Types of solar energy communities

Diversity in modes of operation, membership and value propositions is typical for ECs across Europe. We grouped our case studies in **four types:**

(1) remote prosumers
(2) solar electricity for public buildings
(3) collective self-consumption for multiapartment buildings
(4) renewable energy for remote communities.

3.1.1. Remote prosumers

Active customers[39] and prosumers[40] are terms that can be used interchangeably to refer to the end users who either produce electricity in their own premises or partake in the electricity market in some other way that influences not only demand but also supply.

We named this type after a solar electricity project in Lithuania that was considered a Baltic citizen energy innovation: "In 2019, Lithuania became the first country in Europe to introduce a digital platform that enables the buying or renting of parts of a remote solar park, making it the first such platform in the world to operate on a national scale."[41] Or, as civic organizations put it: "With a new 'remote prosumers' a new wave of household use of solar electricity has come to Lithuania."[42] Interestingly, this type of solar wave did not reach Lithuania's neighbor Latvia.

"Remote" or "virtual'' implies a connected distance between different functions and parties. It has become a key characteristic of how electricity markets evolve in response to distributed generation[43]. In the move towards more flexible, customized, and customer-centric electricity markets, energy companies are key actors. They offer new services to their clients and adapt business models to potential active customers / prosumers. The electricity is produced in solar parks at one location and injected in the distribution or transmissions grid (depending on the installation size), but there are no physical changes in the grid connections at the end customers objects.

39 Article 15 in https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32019L0944
40 https://www.eea.europa.eu/publications/energy-prosumers-and-cities
41 https://sciendo.com/fr/article/10.2478/rtuect-2024-0025
42 https://caneurope.org/achievements/prosumers-program/
43 https://energy.ec.europa.eu/topics/markets-and-consumers/electricity-market-design_en

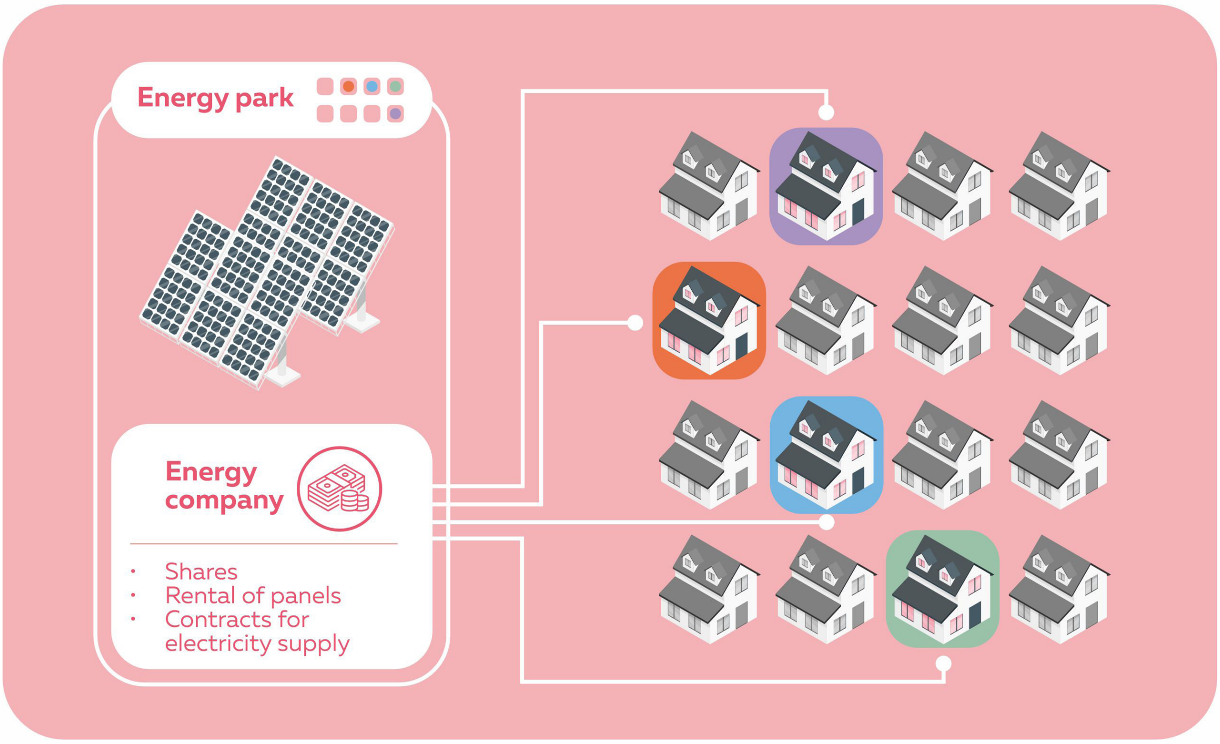

Figure 7. A scheme of solar parks for remote prosumers.

Rather, the electricity consumption at customers' locations and their shares in solar parks are linked via accounting, proportional to their investment and contracts with the energy companies.

In two StartSun case studies about **Solpunkten**[44] (Sweden) and **Nurmijärvi**[45] (Finland), the solar parks are managed by municipal energy companies. Thus, the community model is designed and implemented by a professional utility business. The end users may be situated at larger distances from the production facilities and receive electricity via the local distribution system. The main benefit of renting solar panels in a community PV park is the reduction of the total electricity costs in the regular bills.

The projects add a sense of collective investment to renewable energy projects in one's municipality. In Solpunkten, the solar park has been also created as a place with additional environmental values (sustainable land-use, exploring potential benefits of sheep grazing). The companies from Solpunkten and Nurmijärvi have further development plans, including battery systems and new solar parks.

These two case studies from StartSun countries illustrate how municipal energy companies develop new services, incorporating principles of collective investment and community development. According to a recent study, solar parks that are jointly owned by municipal energy companies and local citizens are typical in Sweden[46].

44 https://interreg-baltic.eu/project-posts/startsun/case-study-6-solpunkten-kristianstad-sweden/
45 https://interreg-baltic.eu/project-posts/startsun/case-study-5-nurmijarvi-finland/
46 https://doi.org/10.1016/j.erss.2024.103626

However, the energy cooperative **OurPower**[47] (Austria) shows how renewable electricity can be also purchased via a more decentralized model based on peer-to-peer trading. In this setting, the central role of the energy company is substituted by an online market platform to facilitate transactions among multiple producers and end customers. The feasibility of energy cooperatives depends on national regulation, smart metering infrastructure, distribution system tariffs, and digital platforms.

3.1.2. Solar electricity for public buildings

Public bodies, especially municipalities, are increasingly recognized as key players in the local energy transition and formation of new ECs. Participation of local governments can take several forms, for example, provision of renewable energy for different public buildings or offering public land or roof spaces for other ECs. Public buildings have distinct patterns of usage, the electricity consumption may match well with the active hours of sunlight. Importantly, public buildings often have professional staff and energy management systems that are good preconditions for new energy projects. Despite technical readiness, different rules of decision-making and procurement may limit the scope of community initiatives that are applicable to public bodies.

Figure 8. A scheme of solar PV on public buildings I.

In **Hanko**[48] (Finland), economic cooperation is enacted via power purchase agreements and long-term leases of solar PV from the energy companies. The project rests on innovative contracts, including public authorities and other end users procuring energy services for their

47 https://interreg-baltic.eu/project-posts/startsun/case-study-8-ourpower-austria/
48 https://interreg-baltic.eu/project-posts/startsun/case-study-3-hanko/

buildings.

The rooftop solar PV system at the furniture factory **Wermo AS**[49] (Estonia) is an instance of cooperative renewable energy projects. Wermo's employees have invested in the solar PV that provides electricity for the factory's daily operation. The enterprise pays for the locally produced electricity that generates additional income to the employees proportional to their shares.

Figure 9. A scheme of solar PV on public buildings II.

The energy cooperative in **Skawina**[50] (Poland) is another example of public institutions (municipality, library, museum) jointly investing in rooftop solar PV to cover their energy needs and benefit from a dedicated net metering scheme.

Also, **Magliano Alpi**[51] (Italy) brings together public and private community members. The solar PV system, however, is installed on the roof of the town hall. Energy communities encompass technical and social innovations in the energy sector, and this project has been supported by research institutions to test and develop tools for energy sharing and demand side management.

49 https://interreg-baltic.eu/project-posts/startsun/case-study-2-wermo-as/
50 https://interreg-baltic.eu/project-posts/startsun/case-study-10-skawina-poland/
51 https://interreg-baltic.eu/project-posts/startsun/case-study-9-magliano-alpi-italy/

3.1.3. Collective self-consumption for multiapartment buildings

Rooftop solar on multiapartment buildings is the most popular setting for urban energy communities and it could be scaled up significantly. Usually, integration of renewable energy technologies is coupled with housing renovation. Solar PV on the roofs and facades of the buildings cover part of the local energy demand, including electricity for domestic appliances, heating and charging of e-vehicles. The legal frameworks and technical setups of energy sharing within the buildings work differently in each country. Regulative developments will follow due to changes in the EU's Electricity market design and energy performance requirements for buildings.

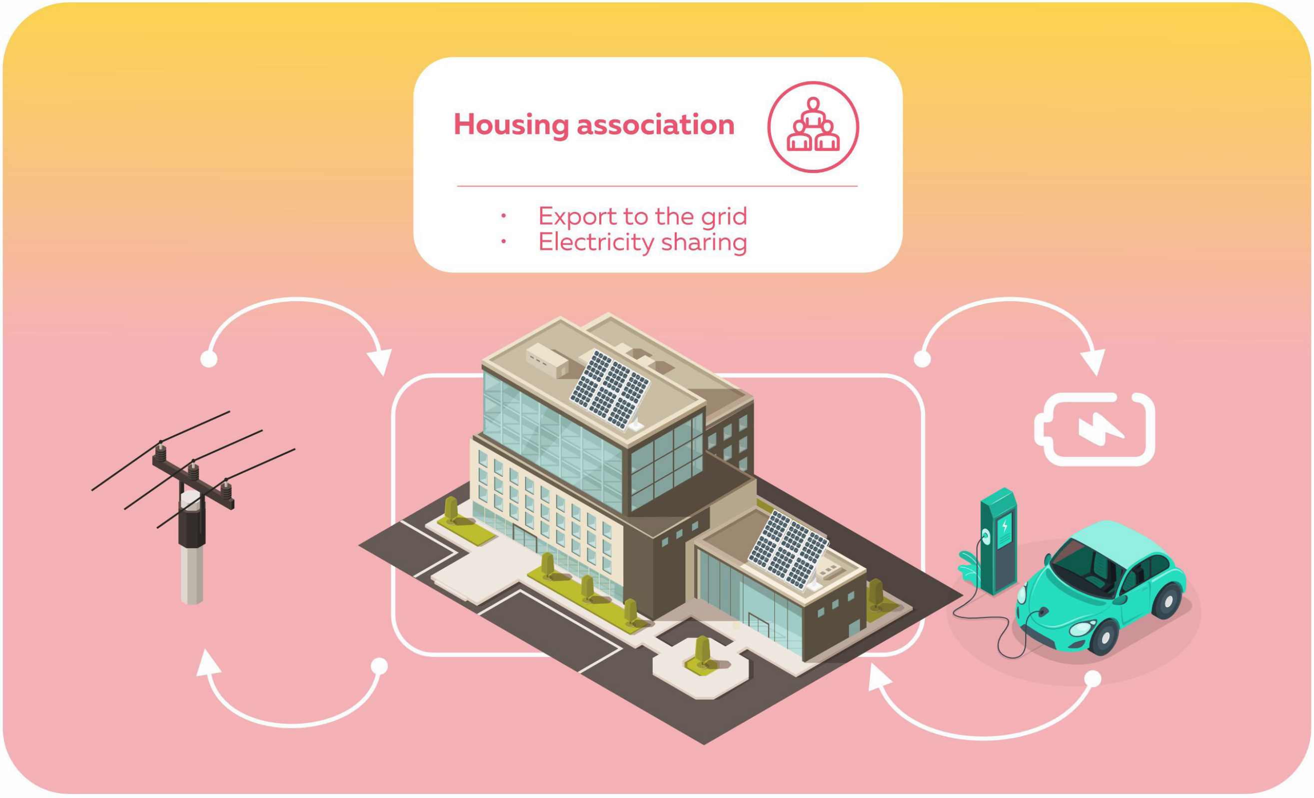

Figure 10. A scheme of rooftop solar for multiapartment buildings.

The case study about **Pursimiehenkatu 21**[52] (Finland) shows that installing rooftop solar on historical buildings is a feasible solution regardless that such buildings have strict permitting and design rules due to heritage protection.

If energy sharing takes place within one real estate object or address, it can be classified as collective self-consumption without requiring establishment of a new legal entity representing the community. When legal or technical barriers for collective self-consumption prevail, rooftop solar PV can be utilised to cover the energy consumption of common premises (elevators, lightning, pumps), excluding individual consumption in the apartments. The demo project in **Mārupe**[53] (Latvia) consisted of two such apartment buildings that deploy solar panels for

52 https://interreg-baltic.eu/project-posts/startsun/case-study-4-pursimiehenkatu/
53 https://www.interregeurope.eu/good-practices/first-energy-communities-in-latvia-small-scale-demonstration-projects-at-marupe-municipality

common premises and solar collectors for water heating.

3.1.4. Renewable energy for remote communities

Energy services and infrastructures are closely tied with other economic activities and local development. Rural energy communities differ from their urban counterparts in terms of the spatial distribution of the end consumers, facilities, and resource pooling. To invest in solar energy generation and benefit from local cooperation in rural areas, new entities can be founded, for example, cooperatives or economic associations such as **Austerland Energi**[54] (Sweden).

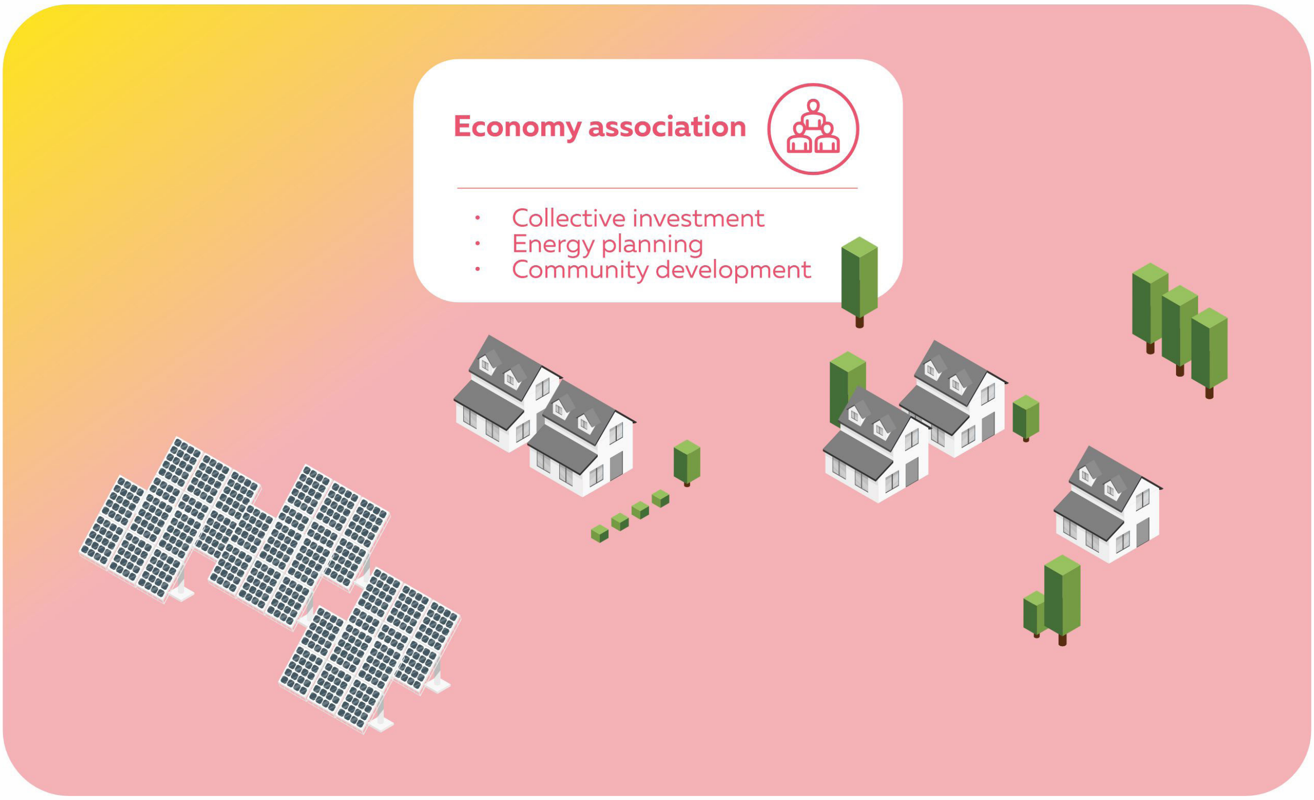

Figure 11. A scheme of remote energy community I.

Another rationale of the energy community projects may be enabling local energy generation and dealing with constraints of the local distribution systems, especially in island communities. Often, grid capacity problems are evident in more remote (rural) locations where grid upgrades are more costly. When excess electricity produced by the solar PV systems cannot be exported due to the grid's capacity limits, it must be either consumed or stored locally. Alternatively, electricity can be shared with other consumers via direct lines or individual microgrids; however, such projects may require larger investments and complex solutions.

In the case of **Energiaühistu**[55] (Estonia), solar PV panels are installed on the roof of a single office building – there is one connection point to the distribution system, one end customer but several users of the building. This building is purchasing electricity for a fixed price from

54 https://interreg-baltic.eu/project-posts/startsun/case-study-7-austerland-energi-sweden/
55 https://interreg-baltic.eu/project-posts/startsun/case-study-1-energiauhistu-at-kardla-2/

the members of the Estonian energy community organization that funded this rooftop installation.

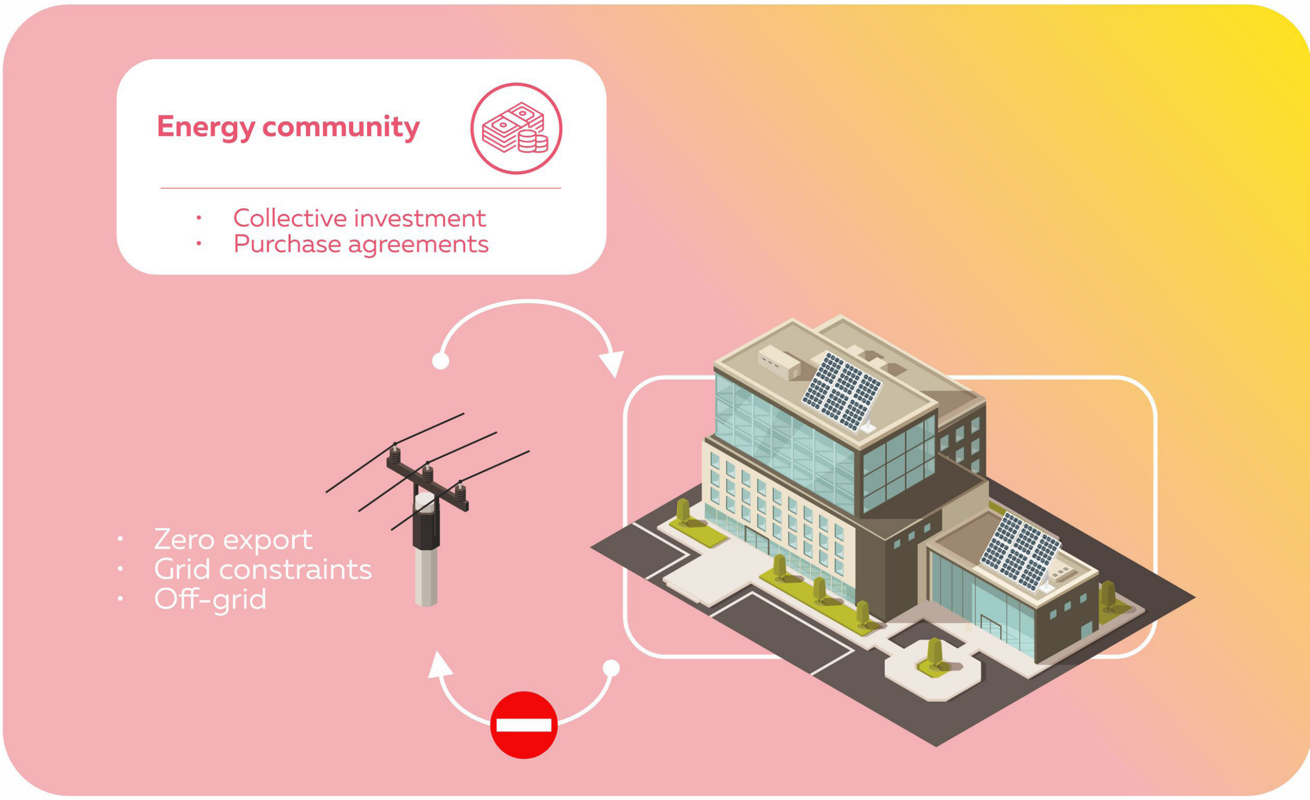

Figure 12. A scheme of remote energy community II.

3.2. Estonia

3.2.1. Overview of policy and legislation

In Estonia, the legal definitions "energy community" and "renewable energy community" were established in 2022 with amendments to the Electricity Market Act and the Energy Sector Organization Act. Proximity criteria apply for the renewable ECs. Prior to this, "energy associations" and "energy cooperatives" were used for referring to energy provision in multi-apartment housing associations or local ownership of public renewable energy generation units. The laws permit various legal forms of ECs, including non-profit and for-profit organization; however, not all forms would be suitable in case local authorities or other public entities plan to form ECs[56].

ECs also feature in International Energy Agency's recommendations for development of Estonia's energy policy[57]: "Increase electricity system flexibility through policy and market regulations supportive of smart grids, energy storage, demand-side response, and other

56 See the country policy fiches prepared for the EU's Energy Community Repository https://circabc.europa.eu/ui/group/8f5f9424-a7ef-4dbf-b914-1af1d12ff5d2/library/2d6720f5-b474-4c3c-90fc-a900fe605e9d?p=1&n=10&sort=modified_DESC
57 p.39 in https://www.iea.org/reports/estonia-2023

distributed resources, energy service companies, energy communities and non-wire alternatives, leveraging Estonia's high level of digitalisation."

Foresight Centre, the think tank at the Estonian Parliament, conducted a study about active customers and energy cooperative, concluding that the right form or the best model should be identified over time, creating more space for exploration and learning in regulation and project design[58].

According to REScoop, the EC definitions are not operational without a broader enabling framework[59]. More concreteness about the government's policies, including expected financial support measures, can be found in Estonia's updated Development plan for the energy sector. The gaps in regulation currently prevent electricity sharing among several properties.

3.2.2. Energiaühistu at Kärdla

Case study #1
Prepared by Nele Ivask, Tartu Energy Agency
Full story:
https://interreg-baltic.eu/project-posts/startsun/case-study-1-energiauhistu-at-kardla-2/

Photo by Energiauhistu

Energiaühistu, an umbrella organization for ECs in Estonia, was founded in 2021 in Tallinn. Their first project at Kärdla, Hiiumaa, was initiated through a crowdfunding campaign in September 2022, collecting funds from 29 investors (35% of EC members). In 2024, Energiaühistu joined the REScoop association of the European energy cooperatives.

Energiaühistu is a for-profit entity with 90 members from diverse professional backgrounds. 20 council members plus one board member manage Energiaühistu's day-to-day operations. Energiaühistu collaborates with local communities, public sector entities, and commercial developers to raise awareness about renewable energy technologies, investments and seek opportunities for new community projects.

For Kärdla project in Hiiumaa Island, a rooftop solar PV system of 13 kW is installed on a private

58 https://arenguseire.ee/en/news/the-best-model-for-supporting-estonian-energy-cooperatives-is-yet-to-be-found/
59 https://www.rescoop.eu/policy/transposition-tracker/rec-cec-definitions/estonia-rec-cec-definitions

office building. The project was completed in 2023. The office building is the sole consumer of locally produced electricity. Its manager pays a fixed price for the solar electricity produced to the members of Energiaühistu.

Due to the local grid constraints, the system operates in a zero-export mode and the surplus electricity cannot be injected in the distribution system. This is a particularly important example (albeit a very small one) in a situation where the distribution grid capacity has been fully limited in many regions in Estonia, and adding additional capacity requires huge investments that small communities cannot finance.

Find out more: https://energiayhistu.ee/

3.2.3. Wermo AS

Case study #2
Prepared by Nele Ivask, Tartu Energy Agency
Full story:
https://interreg-baltic.eu/project-posts/startsun/case-study-2-wermo-as/

Photo by Wemo AS

The EC of Wermo AS was founded in 2022 in Võru, Estonia. The owners of Wermo AS furniture factory decided to install a solar PV system on the roof of the production building to cover the factory's electricity consumption. The owners of Wermo AS invited factory employees to participate and invest in the solar park. Its legal form is a private company (OÜ) and the members who have decided to join are and can be only the employees of Wermo furniture factory.

The size of the PV park is 450 kW and it is connected to one consumer only. Surplus electricity not consumed by Wermo AS is redirected to the grid. Wermo furniture factory purchases electricity from its own EC and the income is divided among the members according to the size of their share. The smallest possible part is 1% of the investment volume of the solar park.

Wermo AS EC represents an excellent example of good cooperation between the employer and employees which (in addition to the cooperative experience itself) leads to environmentally sustainable actions and mutual benefits. Find out more: https://wermo.ee/factory/

3.2.4. Success factors and challenges in Estonia

Success factors

- ★ The forerunner Energiaühistu has a broader ambition to mentor other organisations and facilitate the establishment of many EC projects.
- ★ Estonian housing associations are the process owners of housing renovation, and they could promote energy sharing and rooftop solar on multiapartment buildings.
- ★ Interest in digitalisation of the energy sector and flexibility services among Estonia's energy companies and start-ups could spark new EC projects.
- ★ Estonian environmental organisations advocate for citizen-led energy projects and energy democracy, contributing to more favorable legal frameworks and public support.
- ★ There is a dedicated roundtable to discuss EC topics – a platform bringing together stakeholders from all levels and fields.

Challenges

- 🌓 The legal framework for energy sharing is still incomplete.
- 🌓 Direct lines are currently the only option for energy sharing; the costs of infrastructure are high.
- 🌓 Lack of public funding.
- 🌓 Competition with energy companies for grid connections and other system benefits.

3.3. Finland

3.3.1. Overview of policy and legislation

Finland's updated NECP2030 highlights advancing ECs among existing policy measures to strengthen the internal energy market. The introduction of EC definitions and basic provisions in the Finnish legislation took place in 2021[60].

ECs in Finland are overseen by national grid operator Fingrid and its subsidiary DataHub[61]. According to registers at DataHub, there are about 100 ECs in Finland. However, the study commissioned by Nordic Energy Research concluded that as "legal entities and practical realities, energy communities are in their infancy in Finland"[62].

The development of the legal and technical framework for ECs was based on the recommendations from the Smart Grid Working Group who published their last report in 2023[63]. There are three types of ECs defined in the regulation:

(1) Single-property ECs
(2) Cross-property ECs
(3) Distributed / dispersed ECs

60 See Finland's country fiche developed for the Energy Community Repository https://circabc.europa.eu/ui/group/8f5f9424-a7ef-4dbf-b914-1af1d12ff5d2/library/2d6720f5-b474-4c3c-90fc-a900fe605e9d?p=1&n=10&sort=modified_DESC
61 https://www.fingrid.fi/en/news/news/2023/datahub-ready-for-the-next-steps/
62 https://pub.norden.org/nordicenergyresearch2023-03/finland.html
63 https://tem.fi/en/energy-communities

In practice, only the single-property and cross-property ECs have been implemented via net-metering within the boundaries of one or several property objects having a single grid connection point. The single-property model is well suited for multiapartment buildings with rooftop PV.

The cross-property type indicates that production and consumption of renewable energy can take place in adjacent properties as could be the case for a ground-mounted solar park. Usually, the solar PV system should be connected to the points of consumption via direct lines.

The third type – dispersed / distributed ECs – has not been implemented yet. It is a more complex model allowing for geographically disconnected members to form ECs, using the public distribution system. The Finnish NECP envisions this type of ECs is a suitable measure for achieving renewable energy goals, but simultaneously recognizes the lack of proper guidance and need for additional improvements in the legislation regarding the taxes and requirements for build out of new electricity grids:

"Decentralised energy communities can better serve consumers' opportunities to participate actively in the electricity market through the netting of electricity within the balance period. The Working Group also judged that information on energy communities, such as information on different types of communities, the establishment of an energy community and operating practices, should be improved."[64]

3.3.2. Hanko

Case study #3
Prepared by Evilina Lutfi, Green Net Finland
Full story:
https://interreg-baltic.eu/project-posts/startsun/case-study-3-hanko/

The project began in 2018 with 12 solar power plants installed on the rooftops of various public properties, totaling about 700 kW. This initiative was part of a joint procurement with the Finnish Environmental Institute SYKE and the municipality. Hanko's solar power plants are financed through a 12-year leasing agreement (power purchase agreement), after which the panels will become the city's property. The city benefits from annual savings estimated at €63,000 after the repayment period. The energy produced is used directly by the properties, covering up to 20% of their electricity consumption.

Forus Oy offers the power purchase agreement, and the regional electricity distribution company Caruna Ltd. was also involved in the project. Performance data for the solar PV systems is available online, providing transparency and monitoring capabilities for the city's solar power plants. The electricity produced on the rooftops is used in the same buildings.

64 See p.122 in Finland's updated NECP2030 https://commission.europa.eu/publications/finland-final-updated-necp-2021-2030-submitted-2024_en

According to Denis Strandel, the Mayor of Hanko[65]: "At best, the power plants produce 20 percent of the site's total electricity consumption. In most cases, it is difficult to reach figures better than this. For example, schools are problematic, because they use the most electricity in the winter, and solar panels produce the most energy in the summer when consumption in schools is the lowest".

3.3.3. Pursimiehenkatu 21

Case study #4
Prepared by Evilina Lutfi, Green Net Finland
Full story:
https://interreg-baltic.eu/project-posts/startsun/case-study-4-pursimiehenkatu/

Photo by Asunto Oy Pursimiehenkatu 21

The historical protected building on Pursimiehenkatu 21 in Punavuori, Helsinki, was transformed into an energy-efficient property with a solar power plant. The building on Pursimiehenkatu 21 dates to 1869, with additions made in 1897. In 2022, 25 kW black solar panels were installed on the building's tin roof. The installation was facilitated by Solarvoima Oy, it was inspired by a solar electricity webinar.

The project operated under Finland's Land Use and Building Act, which simplified the permit process for solar installations on protected buildings. The energy community operates as a limited liability housing company (asunto-osakeyhtiö). The refund calculation model allows excess solar electricity to be distributed to the apartments, reducing their electricity bills.

Membership includes share owners of the housing company; technical maintenance is ensured by hosting companies. The solar installation costs approximately €30,000. It generated significant electricity savings due to high market prices.

Solar panels in apartment buildings are routine, which are quickly processed as requests for advice. The main impediment for rooftop solar is shading.

65 https://caruna.fi/ajankohtaista/hanko-suunnannayttaja-kuntien-aurinkosahkon-kaytossa-paneelit-tuottavat-parhaimmillaan

3.3.4. Nurmijärvi

Case study #5
Prepared by Evilina Lutfi, Green Net Finland
Full story:
https://interreg-baltic.eu/project-posts/startsun/case-study-5-nurmijarvi-finland/

The Nurmijärvi solar power project consists of several facilities managed by Helen Ltd., including Helen's Nurmijärvi solar farm, and additional parks are planned by Fortum and the Yrjö and Hanna Foundation. In future, the project will integrate energy storage facilities and renovate the distribution grid.

The EC brings together the municipality-owned energy company Helen Ltd. and individuals who have energy sales contracts with Helen Ltd. and rent solar panels. Nurmijärvi promotes significant investments in energy infrastructure, including a 40 MW electricity storage facility and additional solar parks.

Smart meter replacements started in 2024 to comply with the new regulations for 15-minute consumption measurements. The project was funded through public and private investments. The energy company charges a fixed fee for renting solar panels, with production credits applied to electricity bills.

More information: https://www.helen.fi/en/solar-panels/solar-power-plants/nurmijarvi-solar-farm

3.3.5. Success factors and challenges in Finland

Success factors

- ★ Cooperation in the renewable energy sector, interest in ECs role for innovation among system operators, energy companies, research organisations and NGOs.
- ★ Fingrid has customized the energy DataHub for EC needs.
- ★ EC projects are recognized politically as part of urban climate action (Hinko Network).
- ★ Investment plans in energy storage and grid upgrades.
- ★ Flexible building regulations for installing solar PV.

Challenges

- 🌓 Little experience with EC projects.
- 🌓 Lack of economic incentives compared to other alternatives available for active customers.
- 🌓 Incomplete regulation for distributed EC projects.

3.4. Latvia

3.4.1. Overview of policy and legislation

Like other countries, Latvia's first step towards a creating a legal framework for energy communities and energy sharing was introducing the definitions of the basic terms in the Law on Energy and the Electricity Market Law. The amendments were adopted at the Latvian Parliament in summer of 2022 and came into force in 2023. The legal provisions for active customers and future energy communities were promoted in the light of energy crises that had given another impulse for installing solar panels and planning for energy independence[66]. The very concepts, however, were already familiar from several EU-funded projects[67], work of advocacy groups and academic studies.

On a practical level, laws must be supplemented with regulation (by-laws) because the operation of energy communities requires detailed legal instructions. Despite the general support from the policymakers, the preparation and adoption of the regulation was put off several times. On the one hand, the reason was the high number of other urgent energy matters that the responsible ministry managed. On the other hand, the completion of energy community regulation required some important decisions about the overall electricity market design that largely depends on other stakeholders, especially the DSO and the retailers. Before launching the new provisions for energy sharing, the framework for transitioning from net metering to the net settlement (billing) system was accomplished.

The draft regulation for energy communities is available from spring 2024, and it should be adopted in the final form until the end of the year. It puts forward an electricity sharing model that is centered on contracts with the electricity retailers; thus, it resembles a net settlement system with several customers. The DSO will grant timely access to the smart meter data via the national energy data platform. The business models and inter-member relations will be specified in the EC's statues or additional agreements.

Latvia's updated NECP2030[68] confirms that the regulation will be finalized in due time, but it skips a more detailed description of support measures, including public funding. Some grants programmes have been promised from the Cohesion programme, Modernisation fund, or the ETS climate action funding.

66 https://www.sciencedirect.com/science/article/abs/pii/S0360544224021443
67 For example, https://come-res.eu/ and Co2mmunity (https://www.zalabriviba.lv/wp-content/uploads/eng-recommendations-co2mmunity-1704.pdf)
68 See the latest version of the NECPs at https://commission.europa.eu/publications/latvia-final-updated-necp-2021-2030-submitted-2024_en

3.4.2. Mārupe

Full story:
https://www.interregeurope.eu/good-practices/first-energy-communities-in-latvia-small-scale-demonstration-projects-at-marupe-municipality

Photo by Co2mmunity

Latvia's first EC demo project was made in 2020, installing rooftop solar PV (and solar collectors) on two apartment buildings of the suburban town Mārupe. Despite its simple design, Mārupe pilot has been recognized as good practice in many studies and projects:

"In collaboration with the Riga Region Planning Authority and the buildings' homeowner associations, the Mārupe municipality facilitated the installation of PV panels on 2 apartment buildings. 85% of the investment in each of the pilot projects was funded by the EU project "Energize Co2mmunity" and the remaining 15% was paid through national financing. The owner of the installed solar equipment, Riga Planning Region, lends the equipment to the Municipality of Mārupe, which in turn makes it available to be used by the homeowners' associations. After this tripartite agreement ends, the PV installations will become the property of the homeowners' associations. Residents of the buildings benefit through rebates on their energy bills."[69]

"The demonstration project plays a significant social and community-building role and has become a success story in Latvia. Profit, direct economic advantage, or intervention in market processes are of lesser importance," writes Ilgvars Francis, the project manager at Riga Planning Region[70].

More info: https://www.marupe.lv/lv/viedie-risinajumi/projekts-co2mmunity

69 https://come-res.eu/fileadmin/user_upload/Resources/Factsheets_policybriefs/COME-RES-factsheet-2-ENG.pdf

70 https://www.interregeurope.eu/good-practices/first-energy-communities-in-latvia-small-scale-demonstration-projects-at-marupe-municipality

3.4.3. Success factors and challenges in Latvia

Success factors

- ★ Awareness and interest in EC projects among different stakeholders.
- ★ Good level of digitalization in the electricity sector.
- ★ EU funding programmes planned, synergies with housing renovation.

Challenges

- Delay in adopting the EC regulations, not a priority for the government.
- Slow progress in housing renovation, high costs and lack of cooperative ties among apartment owners.
- Little economic incentives for EC projects, dependence on grants-based models.

3.5. Sweden

3.5.1. Overview of policy and legislation

Sweden has been criticized for having no legal definition of ECs. However, the legal absence has not prohibited existence of different EC projects and local initiatives[71]. The interest in EC's normative and technical conditions has motivated several pilots and innovation projects with environmental and social goals[72]. Collaboration among researchers and other stakeholders have helped establish an umbrella organization for ECs in Sweden[73].

The Swedish Energy Market Inspectorate (Ei), responsible for implementing the EU's clean energy package, recommended in 2020 that energy communities be organized as economic associations within local geographic areas, necessitating no legal changes.

The primary legislation governing energy communities is the Swedish "Economic Associations Act" (2018:672), which provides a structured and cooperative approach for organizing and managing such entities. This legal structure allows for the formation of economic associations where members can jointly own and manage renewable energy projects, ensuring democratic governance and shared benefits among participants.

Sweden's updated NECP does not propose specific measures for energy communities; however, it lists several initiatives for promoting solar energy, including one-stop-shop and simplified permitting.

Following discussions with the government and other stakeholders, the Swedish Energy Agency commissioned a report about the present conditions and necessary policy improvement for ECs. The report that was published in September 2024 came up with five universal proposals[74]:

(1) Provide clear legal definitions for ECs to avoid ambiguity

71 https://energicentrum.gotland.se/manadens-ord-energigemenskap/
72 https://www.ri.se/sv/berattelser/energigemenskaper-gor-det-mojligt-att-dela-el-med-varandra
73 https://www.sverigesenergigemenskaper.se/
74 https://www.energimyndigheten.se/nyhetsarkiv/2024/energigemenskaper-behover-battre-och-tydligare-forutsattningar/

(2) Adapt the grid tariff structure to facilitate virtual energy sharing
(3) Provide more guidance about the recommended types of energy sharing
(4) Invest and support creation of new ECs
(5) Support and grant access to comprehensive information about ECs

The near-term future of ECs will depend on the speed and originality of policy implementation, requiring cooperation among the regulator, civic sector and the energy market participants.

3.5.2. Solpunkten

Case study #6
Prepared by Sara Spjuth, County Administrative Board of Östergötland
Full story:
https://interreg-baltic.eu/project-posts/startsun/case-study-6-solpunkten-kristianstad-sweden/

Photo by C4Energi

Solpunkten was established in 2020 by the local energy company C4 Energi, owned by the municipality. The solar PV park is located on 8 hectares of marshland in Kristianstad and leverages high sunlight availability on land unsuitable for agriculture or housing. The 4 MW park features 9,200 PV panels, each with a capacity of 435 watts, and battery storage is planned. In future, sheep may be allowed to graze to reduce shrub shading.

Legally, Solpunkten is an economic association, allowing broad participation by selling shares to individuals and businesses. C4 Energi owns two-thirds of the park and administers the association. The idea of the shares in the solar park is that they will cover part of the individuals' or company's own consumption of electricity but at the same time be sufficient for as many people as possible who want to be part of the energy transition. Therefore, C4 Energi decided on the distribution limit of a maximum of 60% of electricity consumption per shareholder.

Solpunkten was fully subscribed on August 25th, 2022. However, a shareholder can resell his or her share or sell it back to the association. Shareholders receive deductions on their electricity bills based on solar production. The initial investment is expected to pay off in 8-10 years. C4 Energi fosters local engagement through study visits and collaborations, promoting renewable energy awareness and community involvement. More information: https://www.c4energi.se/privat/solceller/solcellsandelar-solpunkten/

3.5.3. Austerland Energi

Case study #7
Prepared by Johanna Liljenfeldt & Heracles Polatidis, Uppsala University
Full story:
https://interreg-baltic.eu/project-posts/startsun/case-study-7-austerland-energi-sweden/

Austerland Energi is a community energy initiative from Gotland, run by residents, companies, and organizations. Started in 2018 and formally organized in 2023, it serves the Östergarnslandet area, consisting of five rural parishes with around 3700 households. The initiative is engaged in sustainable energy practices.

In 2023, Austerland Energi established Austerland Energi Ekonomisk Förening, an EC termed "energigemenskap." Opting for an economic association over a limited company, they aimed for an inclusive and democratic structure. Historically, Swedish local energy initiatives have used various legal formats such as tenant-owned apartment associations, non-profit organizations, and sole trader companies, with economic associations being most common. While no public entities are involved, the initiative collaborates closely with local public energy advisors.

Austerland Energi is developing a 15 MW solar park in a low-productive agricultural area, with plans to connect 13 MW initially. The park will use one connection point to the electricity grid, with approval for up to 2.6 MW. Future technologies under consideration include wind turbines, hydrogen production, and smart grids.

The economic association is governed by annual general meetings where members vote on activities and elect a board. Membership requires an electricity supply contract with the local provider GEAB, a membership fee, and an investment in the solar park. Members can transfer or exit their shares under specified conditions.

The solar park is funded by member investments, with nearly 200 individuals and organizations pledging over 9 million SEK. Electricity will be sold to GEAB, with profits distributed to cover administrative and operational costs, and dividends paid to members through their electricity bills.

More information: https://austerlandenergi.se/

3.5.4. Success factors and challenges in Sweden

Success factors
- Tradition of cooperative culture, economic associations – a feasible model.
- Central role of municipal energy companies in launching collectively funded solar PV projects.
- Landscape ecological approaches to PV siting.
- Complex urban development and energy planning projects that incorporate energy sharing.
- ECs as part of urban innovation and climate action.

★ A well-developed concept for how to organize a rural EC, cocreated in Austerland on the island of Gotland.

Challenges

- Legal uncertainties regarding the definition of ECs and viable options for energy sharing.
- High resource demand in the initial phase of the project.
- Lack of coordination and support from the energy sector.

4. Conclusions

Energy resources, systems, and services play a vital role in all communities. It is challenging to envision how ECs will fit into the larger picture of today's and tomorrow's energy systems in the Baltic Sea region. Will they remain individual nodes, created as alternatives to the conventional systems, or shall ECs become the model for how energy systems should be developed in general? StartSun's case studies showed that operational ECs are rather scarce in our region, however, there is evidence that principles of sharing economy are integrated in new energy services and real estate development.

4.1. Regulation

"The way energy communities are implemented into law and are technically and organisationally arranged is closely related to the way future energy systems are imagined"

Envall & Rohacher, 2024[75]

Today, EC projects face a lack of adequate regulation, which poses a barrier to making a greater impact. However, the diversity of Europe's ECs also presents an obstacle to establishing clear rules. One cannot prescribe and arrange what one cannot envision. In recent years, policymakers in the energy sector have faced significant challenges, with little time to take a step back and address foundational issues. What we have learned from ECs in the Baltics and Nordics is that now is the right time to write their enabling conditions and options into the law. Yet, it will not happen by itself.

Estonia needs a cost-effective solution for electricity sharing. That would allow the next ECs to act beyond the boundaries of one property or connection point.

Finland has electricity sharing enabled for multiapartment buildings and adjacent properties, however, the geographically dispersed model for ECs has not been implemented in practice yet.

Once **Latvia** adopts its first regulation, it should be tested if it supports innovative projects. ECs and electricity sharing are currently proposed as extensions of the net settlement system where the electricity retailers have the managing role.

Sweden is in the process of preparing on its national EC definitions. The main open questions resonate with the same topics as in other countries: should energy sharing via the public grid be incentivized and what tax regimes suit ECs.

Despite regulative inconsistencies, ECs are on the way to overcome the legal barriers and settle to stay among the participant of evolved electricity markets. Having a status "undefined" regarding some aspects is not necessarily a drawback, given the effort it takes to move the legal apparatus. There are opportunities to arrange things right via contracts and circumvent hurdles by technologies.

75 https://doi.org/10.1177/25148486231188263

4.2. Technical setup

Along with solar PV, EC projects increasingly plan to employ other technologies for managing the flows of electricity in response to variable generation, electricity prices and use patterns.

StartSun case studies from **Finland** and **Sweden** showed that municipal energy companies are key actors in engaging local population when it comes to investing in small scale solar energy. The energy companies and their partners are the ones who oversee and make the technical systems more accessible via monitoring, also in case of shared ownership.

Estonia's two EC cases are focused on SMEs and office buildings, thus matching the PV generation with local needs and demand profiles. In that sense, the ECs coevolve along building automation and energy management systems.

Latvia's environment for ECs is a work in progress. Connecting the dots between big and small often depends on the information systems, and thus the DSO and the retailers have a decisive role in speeding up Latvia's moderate success with EC pilots.

As collective initiatives ECs in some way involve "acting on behalf of others" and for that one needs "modern" technologies that connect people, save human labor, ensure privacy and seamless coordination of things, including solar panels, EVs, batteries, behind-the-meter devices, smarter buildings, bills and contracts.

4.3. Business models

ECs' modes of operation are usually not profit-seeking, and their economic value propositions are tied to social and environmental factors. At the same time, lower prices, savings or additional income serve as key motives for joining an EC.

The collective nature of EC manifests in various ways. In **Latvia**, the perception of EC business models is grants-based. The government's intention is to support EC projects with participation of local authorities providing some public services and having an obligation to redistribute part of the EC's benefits to socially vulnerable inhabitants. Other economic incentives, including reduced grid tariffs, are currently not proposed.

In **Sweden**, however, municipal companies apply EC concepts to their role of electricity retailers and renewable energy developers. Several other EC cases from Sweden show the promise of EC in the real estate development and urban transformation.

Finland's EC cases present a variety of approaches in the housing and public sector, including municipalities contracting energy companies and other service providers to equip their buildings with solar and other distributed energy resources.

And finally, **Estonia** demonstrates that ECs are about entrepreneurship that add a sense of cooperation to modern manufacture and office life. One also expects EC concepts to be enlivened for the housing renovation.