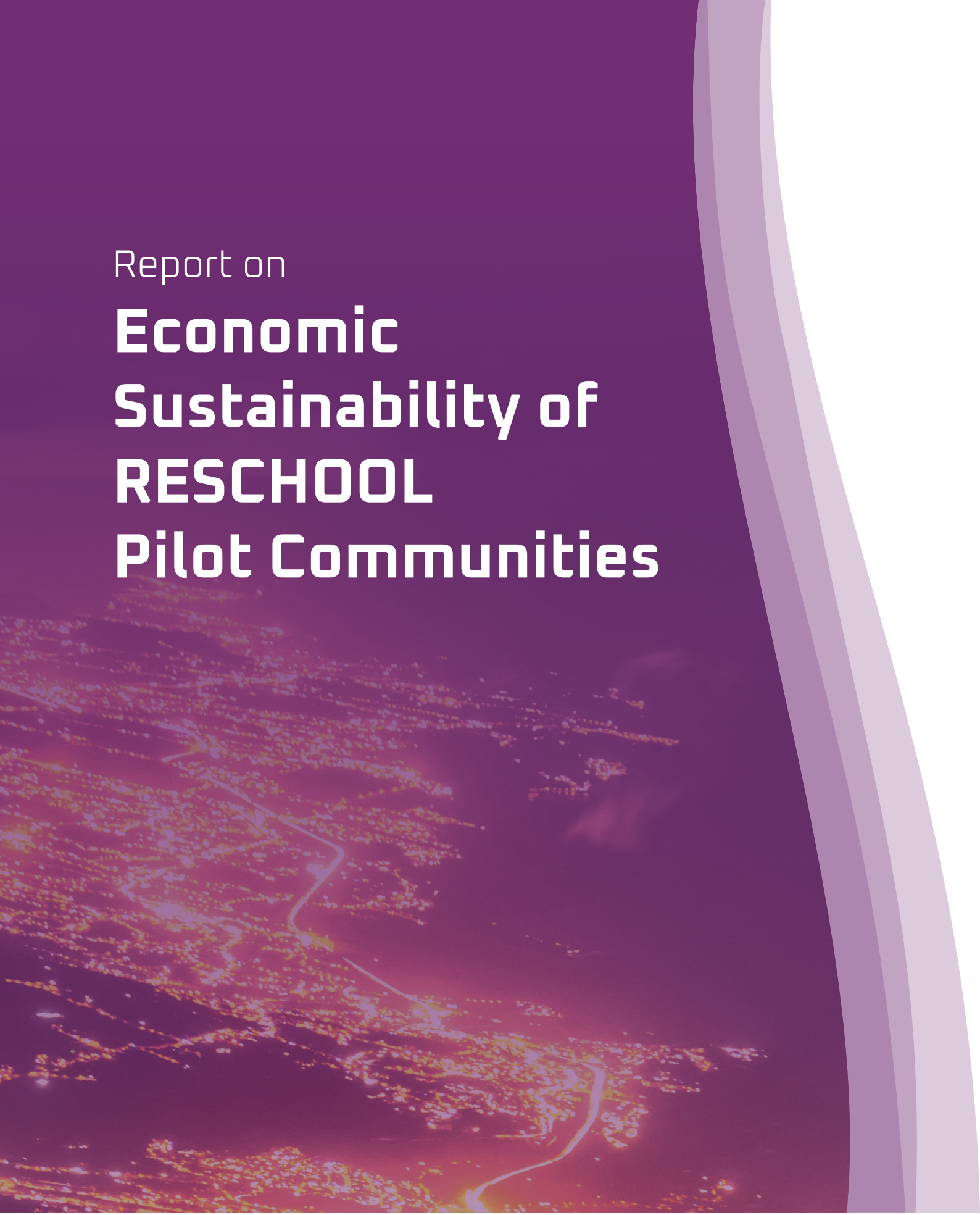
Report on

Economic Sustainability of RESCHOOL Pilot Communities



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Abbreviations

BRP	Balancing Responsible Parties
BSP	Balancing Service Providers
CAPEX	Capital Expenditures
CCS	Carbon Capture Storage
CCU	Carbon Capture Utilization
CEC	Citizen Energy Communities
CEP	Clean Energy Package
DER	Distributed Energy Resources
DSO	Distribution System Operator
ESCO	Energy Service Company
EU	European Union
EU-ETS	European Union Emission Trading Scheme
EV	Electric Vehicle
IDEA	Institute for Energy Diversification and Saving (Spanish: Instituto para la Diversificación y Ahorro de la Energía)
IEMD	Internal Electricity Market Directive
NRA	National Regulatory Authority
OPEX	Operating Expenses
P2P	Peer-to-Peer
PV	Photo-Voltaic
REC	Renewable Energy Communities
RED II/III	Revised / Recast Renewable Energy Directive
RES	Renewable Energy Sources
SCE	Subsidy Scheme for Cooperative Energy (Dutch: Subsidieregeling Coöperatieve Energieopwekking)
SME	Small and Medium-Sized Enterprises
TSO	Transmission System Operator
WP	Work Package

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In the transition to net-zero economies, there is no choice but to decarbonise the ways we produce and use energy.

INTRODUCTION 1

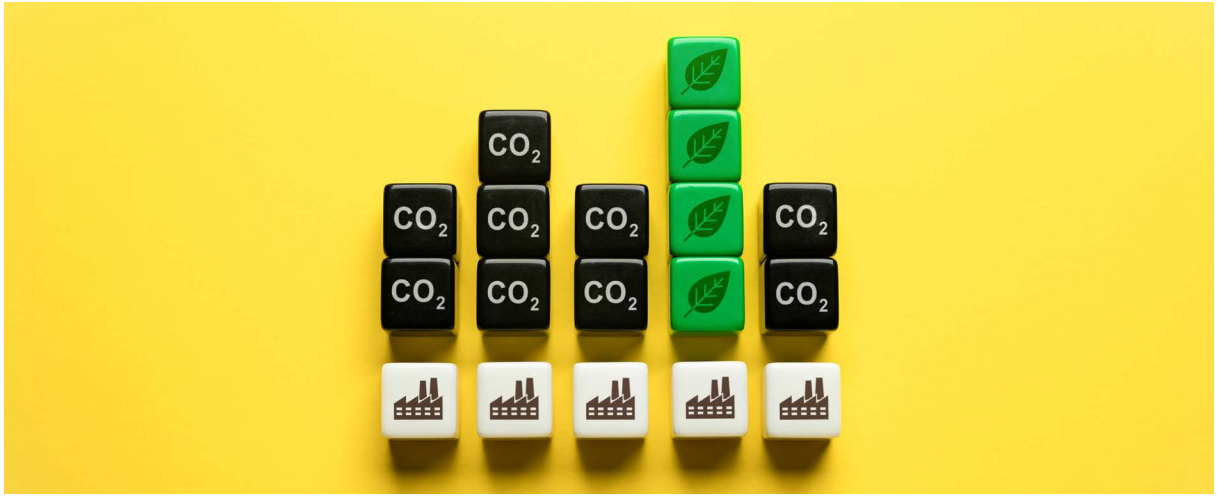
Reaching the EU's recently revised climate and energy targets in the 2030 and 2050 timeframe requires profound transformations of energy systems and markets, which ought to become decentralised and digitalised further and faster. This means, among others, deploying and integrating much higher RES shares, for instance by exploiting the widely untapped potential of individual and collective self-consumption of renewable energies, incl. through the many forms and shapes that community energy models can be built on. Growing in size and numbers, many more of such initiatives are emerging across Europe, with experts estimating that by 2050, half of all EU households (or: 113 million) could be producing renewable energy, while 64 million households could be doing so as members of energy communities[2].

Indeed, the value proposition is substantial, with community energy providing a large range of economic, environmental and social benefits: engage citizens and local businesses, who so far are mostly passive consumers of energy, in climate change mitigation and take ownership of the energy transition and the decarbonisation process, through the collective generation and consumption of green electricity (mostly, while also renewable fuel solutions are available). This reduces public and private expenditure on energy, which can alleviate risks of social unrest and energy poverty, and ease economic pressure on businesses and industry, particularly at local level; it increases resilience through shorter supply and value chains, as well as improved domestic labour markets and the advancement of skills that, in many EU regions, are urgently required for delivering on decarbonisation strategies; it strengthens democratic processes, social cohesion, and makes governance at local level more transparent, which in combination with collective ownership and inclusive organisational and legal structures can create trust and foster social acceptance of local renewable energy projects.

From a systems perspective, energy communities are key drivers for advancing decentralisation and digitalisation,

which on the one hand improve autonomy and energy security, and on the other hand provide requisite flexibility for balancing local supply and demand. Smart energy management, supported by storage, demand response, and other services provided to network operators, can reduce infrastructure costs and help avoid investments in conventional grid extension.

While the EU has addressed these opportunities and undertaken policy and legal reform under the EU Green Deal and the previous Clean Energy Package (adopted in 2018-19), transposition and implementation in Member States is lacking behind. Provisions that are meant to create fair, decentralised and smart energy systems that can integrate higher shares of renewable energy sources (RES) require national authorities to establish definitions and enabling frameworks for renewable as well as citizen energy communities, and to reform energy market designs and facilitate the creation of local energy markets and unlock flexibility potentials that could benefit energy communities, as well as the market entry of new actors such as aggregators. Regulatory evolution extends to changing roles and obligations for transmission and distribution system operators and the more recent EU rules[3] that allow energy sharing / trading among households, public authorities, and small and medium enterprises (SMEs) - and between members of energy communities.



Objectives of this report

The RESCHOOL project helps apply the above-mentioned EU policy measures into the daily lives of citizens and other local actors in Athens, Amsterdam, Stockholm and around Girona, through social and technology innovation that improve energy behavior and increase engagement among citizens and younger generations (mostly through gamification and intergenerational learning), foster market and grid integration, energy and flexibility modelling and forecasting services, and optimized energy management. Yet just like many other renewable and citizen energy communities (as per RED II and IEMD[4]) that are being developed today in Europe, the RESCHOOL pilots are challenged by financial, legal and administrative barriers that prevent operating and expanding in economically more sustainable ways - which often makes them rely on public support that comes in various forms, such as EU and national grants, subsidies and other financing mechanisms. Therefore, this report is issued to improve the understanding on drivers and barriers that allow and disallow the economically sustainable operation and further development of the RESCHOOL pilots, with the objective to inform decision-makers and other stakeholders among industry, academia and civil society on (potential as well as available) revenue streams that energy communities can – or could – generate. It further aims to demonstrate that more political support and informed reform decisions are required from especially national and local authorities, in order to unlock the benefits as outlined here above.

Contribution of Partners[5]

This report is based on the input received from among the RESCHOOL pilots, which are as follows:

Girona Pilot:
KM0 Energy,
Diputació de Girona,
Bamboo Energy

Amsterdam Pilot:
Resourcefully,
Gemeente Amsterdam,
Open Remote

Stockholm Pilot:
ElectriCity,
Local Life

Athens Pilot:
Collective Energy,
Centre for Research and Technology Hellas (CERTH)

Additional involved partners are the Universities of Utrecht and of Girona as well as RISE, who, together with the RESCHOOL pilots, have contributed with expertise on overall trends and developments at national level, as well as on recent changes in regulation and the impact these have on the RESCHOOL pilots but also on the community energy across Spain, Sweden, Greece and the Netherlands. Further input was provided with regards to 1) progress (or the absence) of local energy markets, as well as entry barriers that allow mostly larger industrial consumers to participate; 2) tariff structures, net-metering schemes and feed-in compensation for surplus electricity; 3) national support schemes for both community energy and renewable energy projects; 4) additional barriers that stem from financial, legal and administrative requirements.

2 OVERALL TRENDS AND DEVELOPMENTS IN COMMUNITY ENERGY AT NATIONAL LEVEL

According to the European network of citizens' energy cooperatives (REScoop.eu), there are about 3500 energy cooperatives and communities in Europe, mostly spread across the North-West and the Alpine region of the continent. This includes the RESCHOOL countries Spain and the Netherlands, both of whom have a long-standing tradition of energy cooperatives, which have been created since the early 20th century and contributed to rural electrification and industrialisation in remote areas, on account of security and quality of supply. While Greece and Sweden have experienced a less important presence of energy cooperatives throughout the 20th century, numerous initiatives have been emerging in recent times, with around 1700 energy communities[6] that have been established in Greece between 2018 and 2023.

Whether the overall trend is positive and developments in community energy are advancing, much depends on the general political support provided by national (and regional and local) governments,

demanding national regulatory authorities (NRAs) to establish favourable framework conditions and market designs that foster the economic sustainability of energy communities; and make them thus become less dependent on public support. This has been done to differing degrees, when assessing changes that have been introduced to regulation in Sweden, Greece, Spain and the Netherlands. While Greece is among the pioneers to have formally transposed relevant EU provisions, Sweden does not have any specific policies or measures to promote energy communities or be included in renewable support schemes. Although Spain has introduced a series of royal decrees (the last one dating to 2019[7]) that promote individual and collective self-consumption, it has not established many of the elements that are legally required for constituting an enabling framework. In the Netherlands, the House of Representatives has approved in June 2024 new legislation (the Energy Act) that is meant to ensure legal recognition and a market role for energy communities. In this context, NRAs are also facing the question if and to what extent, when transposing the EU provisions, existing cooperatives can be treated as renewable or citizen energy communities (see also the introduction to chapter 3).

The Netherlands

Between Legal Reform and the Transformation of Long-Standing Cooperatives

Historically, the Netherlands looks back at a long-standing tradition and strong presence of energy cooperatives, amounting to a total of 714 entities in the Netherlands in 2023, involving 89% of the municipalities and 131.000 participants[8]. At the same time, there is significant growth potential in generation capacity for self-consumption and a positive outlook for the upcoming years, with the Dutch Climate Agreement setting out a non-binding policy objective of 50% local ownership of renewable energies on land until 2030. Activities of larger business cooperatives include joint investment in renewable energy projects, self-consumption of locally generated electricity from PV and wind that was organised according to postal code affiliation (where energy consumers receive an energy tax deduction for energy produced within a collective renewable energy project situated in their postal code area), as well as the optimization of consumption and production, energy services, the provision of flexibility to the grid and aggregation of available capacity to energy markets (min. 1 MW for participation required). Also, former regulation[9] allowed, between 2015-18, for smaller emerging actors such as energy communities to apply for exemptions and act in regulatory sandboxes, e.g. for undertaking energy sharing among fellow members of an energy community.

In parallel, the Dutch electricity grid is reaching its limits. With the increase in renewable energy projects and electrification initiatives (mainly in the mobility sector) but limited grid expansion, securing grid connections has become challenging. In return, this can be the driving force behind solutions for the integration of decentralised renewable sources, like demonstrated in the RESCHOOL pilot community in Amsterdam. Additionally, grid fees have seen significant hikes, and real-time congestion (above 3x80A connections) is on the rise. Since most decarbonisation technologies rely on electricity, reduced access and high grid costs are threatening the national energy transition. Acknowledging these challenges, the Dutch Government introduced its Grid Congestion Action Program in December 2022, outlining policy proposals for the medium term. These proposed changes will significantly impact various energy technologies. While some may face increased costs, they also present opportunities for new revenue streams and for forward-thinking participants to capitalise on the changing energy landscape. This includes initiatives such as the Amsterdam RESCHOOL pilot, which could benefit from new revenue streams, once there is a clear picture on its flexibility potential, through the development of remuneration schemes, for instance in form of lower network tariffication or offering congestion services, in direct interaction with the DSO.

Greece

Legal Complexity and Lacking Grid Capacity in a Thriving Community Context

Greece has seen significant energy community development throughout recent years, with close to 1700 energy communities that have been established between 2018 and 2023. Although Greece, in comparison to many other EU countries, made early progress in implementing EU rules on renewable and citizens energy communities, incl. through a law that was adopted in 2018[10] (even before the Clean Energy Package and its EU Directives had been approved) and had opened the door for corporates to take advantage and benefit from provisions that were meant to foster collective energy actions by stakeholders that include municipalities, citizens and other local actors. In the meantime, measures were taken to reduce such “high-jacking” by businesses and large industrial consumers who had been initiating up e.g. virtual net metering projects and self-consuming the electricity produced, taking over grid capacities that are scarce in the first place.

The more recent Law 5037/2023 transposed EU provisions for RECs and CECs, establishing elements of an enabling framework and introducing 2 new definitions, thereby increasing legal complexity and questioning the status of already existing communities (Greece has now 3 definitions in parallel). Yet, existing energy communities established under the 2018 law will not be affected by their transition to the new legal forms (incl. for the RESCHOOL pilot in Athens, where existing contracts and agreements are to be continued, regardless of the transition). Still pending is a series of ministerial decisions, incl. on measures that are likely to impact the economic sustainability of energy communities, such as energy sharing, support

schemes and virtual net-metering (to be replaced by net-billing).

Nationwide, the total installed capacity of energy community projects amounts to 1,178 MW, with a great majority of 1,164 MW being done in form of commercial projects – and only 14 MW in form of self-production projects. At the same time, requests for self-production initiatives are increasing substantially, with the submission of 377 new such projects during 2023, while 4 were submitted for commercial projects[11].

In general, one of the major barriers to energy community development is the saturation of the electricity distribution network, with 48% of pending projects having received a notification by the Hellenic Distribution Network Operator about unavailable grid capacity. In addition, there is a limit put by the DSO on all PV plants, at 70% of their capacity, reducing the overall feasibility and economic sustainability of small-scale projects for energy communities. This also impacts the RESCHOOL pilot in Athens: while finding a location with sufficient grid capacity and in compliance with proximity requirements was done without facing any major barriers, the 70% limitation restricts the pilot's PV production (using inverters), reducing the energy yield and the energy community's overall profitability.

Spain

Self-Consumption as Reference Regulation and the Need for Local Energy Markets

In Spain, energy cooperatives have a historical tradition, since local communities at the end of the 19th century started to collectively supply electricity to homes and enterprises, generated mainly by small hydro power plants. Much later, in the years after 2010, cooperatives were established that focused on electricity supply from mostly solar and wind, driven by environmental, social and economic aspects. Many of these recent cooperatives were initiated by citizens who jointly invest in mainly PV systems, supplying green electricity to its members, with the main purpose to reduce expenditure on energy or increase collective self-consumption. Today, there are sophisticated energy cooperatives who carry out activities that include supply and distribution system operation, and provide services (e.g. through external Energy Service Companies, or ESCOs) to advance smart grids, IT solutions, asset control in real-time, demand response, consumption profile optimisation, billing, energy efficiency services, as well as mobility services such as the provision and maintenance of e-vehicle charging points.

In 2015, Spain introduced a regulatory framework for collective self-consumption on a building/neighborhood level that allows for using the electricity distribution network, without being charged for network tariffs (yet taxes and other charges apply). Yet, the regulation was revised in 2019[12] and builds today's reference framework, with the purpose to increase self-consumption, allowing for surplus compensation at low-voltage level (up to 100 kW), where customers who feed into the gird are directly remunerated by retailers. Above 100 kW, the injected surplus electricity does not generate benefits from the compensation scheme, but from being sold directly to the electricity market and distributed according to the energy price at any given time. To do so, producers need to get certified.

In consequence of this favorable regulatory environment, according to the Spanish Photovoltaic Union (UNEF), in 2023 there has been 1,706 MW of new installed solar power in self-consumption facilities, making Spain reach at the end of 2023 almost 7000 MW in total – which is roughly equivalent to the capacity of the country's 7 nuclear power plants. In the residential sector, 372 MW solar capacity had been added, distributed among roughly 85.000 installations. At the same time, and with legal reform pending, no enabling frameworks have been developed for renewable and citizen energy communities, nor for the establishment of local energy markets that would allow for generating new revenue streams for energy communities. While Royal Decree 23/2020 introduced a definition for renewable energy communities, in form of merely a copy-paste from the EU Directive, without any further specifications of the governance principles, rights, duties, and possible market activities. As a result, most existing energy communities rely on the above-mentioned framework for collective self-consumption (excludes technologies, such as wind or small-hydro), as well as grants provided through funding programs such as CE-Implementa[13].

In general, stakeholders interested in developing community energy initiatives suffer from considerable regulatory uncertainty. As of today in Spain, there are no operating energy communities that comply with the legal framework adopted by the EU in 2018-19 as part of the Clean Energy Package. In Q2 of 2023, the Spanish government launched a public consultation on draft regulation that would legally establish energy communities (both RECs and CECs) but up to date, the adoption of the Royal Decree is still pending.

Sweden

Pioneer Communities in a Non-Enabling Framework

Among the Nordic countries and behind Denmark, Sweden had the second largest estimated electricity generation for self-consumption in 2017: namely 722 GW, according to estimates by Sweco and Oslo Economics. Electricity generation for self-consumption is defined by small scale generation plants, and in this context, the share between solar PV, small scale wind and small-scale hydro is equally distributed. However, in recent years following global trends, distributed solar PV is extensively growing and increasing the share of electricity production for potential self-consumption in Sweden.

For larger systems, the installed capacity for renewable electricity generation from wind and in recent years also solar PV parks, has significantly increased since the early 2000s. In addition, with an historical large share of hydropower and from the 1970s and onwards and nuclear power, electricity generation in Sweden is almost emission-free. In addition, larger Swedish cities have wide district heating networks which are mostly running on biofuels and excess energy from industry - which is among the main reasons why citizens and local stakeholders might have been less interested to initiate the development of energy communities in the past. Yet due to increased electrification and investments in the production of renewable steel and fossil-free concrete and an investment in the battery industry, experts expect a shortage of electricity, with Sweden's need for fossil-free electricity to increase from 140 TWh to approx. 380 TWh by 2045[14]. In conjunction, the infrastructure development needs to address that larger transmission capacity is required, to transport electricity to the more populated South of the country, as most of the renewable energy is being produced in the Northern parts. A larger transmission capacity is needed. Electricity companies have therefore been aiming to encourage energy consumers to locally produce renewable electricity to meet the increased demand.

Electricity prices in Sweden have historically been very low, until before COVID-19 and Russia's invasion of Ukraine. After prices spiked especially during some of winter months, they have in the meantime come back down and are closer to pre-crisis levels. Still, price volatility as well as price differences between the North and South of the country are still well-above, spurring private investments in the residential sector into energy efficiency measures, solar installations, batteries and the purchase of EVs. Both the pandemic and the war have increased awareness for resilience and availability, and probably also added on the willingness to contribute on an individual and local basis.

The Swedish regulatory authority (Energy Market Inspectorate, or Energimarknadinspektionen) was mandated to analyse necessary measures and issue recommendations to transpose EU rules for energy communities and energy sharing. Yet no enabling framework on renewable and citizen energy communities has not been adopted at this time – despite this absence of overall political and legal support, higher costs for energy, for both electricity and heating, has increased the incentives for building active and innovative energy communities – such as in Hammarby Sjöstad, the RESCHOOL pilot in Stockholm. Experts estimate there to be significant growth potential for distributed electricity production that can be used for self-consumption, and in result, for energy community development.

3 ENERGY MARKET DESIGN: RESCHOOL PILOTS AND (THE LACK OF) ECONOMIC SUSTAINABILITY

In general, the regulatory environments in which the RESCHOOL pilots operate – in Spain, Sweden, Greece and the Netherlands - are disallowing the generation of revenue streams that establishes energy communities as market actors who are enabled to maintain and grow, independent from public financial support. While the deadline for transposing EU provisions on renewable as well as citizens energy communities into national law has passed since 2021, legal experts agree that most Member States – incl. those covered under RESCHOOL - have not sufficiently done so, neither in completeness nor conformity. Many elements and criteria have not been adequately reflected in the countries' legal decrees, with critical voices pointing to the fact that entire text parts of the EU Directives have been copy-paste. Nevertheless, authorities across Europe's capitals and regions are contributing to initiate community energy development on their territories.

Regulatory transposition challenges stem from several factors: the diverse reality and tradition of community energy initiatives in Europe, as well as the wide scope of EU definitions that make energy communities touch upon several areas of regulation, in particular on consumer protection and infrastructure rules, including supplier and network connection arrangements. Certain aspects of energy communities, such as ownership of simple generation assets or direct services to the local community (e.g. advice on energy efficiency or initiatives to help reducing energy poverty) are largely unproblematic, from a regulatory perspective. Others, like energy sharing within energy communities, defy the classical supplier-customer relationship and pose complex legal questions around supplier obligations, contracts, data protection and communication etc. Depending on which EU and national regulation applies, energy communities may act as supplier or service provider (e.g. of aggregation and balancing services) or, if allowed by the relevant Member States, as grid operator. These activities fall under the competence of energy market regulation and go beyond enabling energy community frameworks - for instance, energy communities operating distribution networks would have to comply with all regulatory requirements that apply to DSOs. Consequently, national regulatory authorities pay particular attention when introducing new business and organisational models and service provisions that imply increasing complexity for the consumer. The same diligence applies to questions that relate to new market roles, the complexity of network tariff design, as well as data protection and cyber-security requirements.

Such regulatory challenges and the progress made by national authorities are intrinsically entwined, and do not exclusively depend on political preferences of elected officials and vested interests of incumbent industries.

Establishing new actors in markets and systems that were designed to generate and transport energy largely made from fossil fuels (and later: nuclear) since more than 100 years is a fundamental challenge. Connecting more higher RES shares, which is a prerequisite for the effective transition to net-zero, requires profound transformation - therefore, regulators are tasked to revise energy market designs and optimise roles and responsibilities for all actors that are needed to deliver on the EU's upgraded climate ambition, as adopted under the Green Deal. This results in Member States having to transpose and agree on complex and extensive provisions, such as on new rights for active customers and new market entrants (such as aggregators and energy communities) and changing roles and obligations for transmission and distribution system operators that are tasked to develop flexible and smart infrastructures. It encompasses stronger rules that amongst others apply for the energy performance of buildings, for the accelerated and simplified permitting procedures for renewables, under the emissions trading schemes that is meant to cover buildings and transport from 2027 on, as well as for the uptake of hydrogen produced from additional renewable capacity. Each of such regulatory intervention is likely to impact the business and operational environments of energy communities.

In the context of this report and energy communities that seek to improve economic sustainability, the establishment of local flexibility markets could generate revenue streams, by reducing consumption or increasing the feed-in of electricity and sell that ability as a flexibility service. In principle, sellers of flexibility can be both electricity producers and consumers, or assets such as batteries that can act in both directions.

Aggregatrs can connect flexible resources from several different actors and provide a combined offer to the marketplace, where even small resources like home batteries, heat pumps and EV-charging can in theory participate. Buyers of flexibility are mainly regional and local network operators who do not have sufficient capacity in their girds at times of saturation. The marketplace itself is digital where offer and demand bids are matched against each other. The following chapter describes the current state of play with regard to evolving national regulation in the Netherlands, Sweden, Greece and Spain, as well as existing initiatives and barriers and drivers that are related to network tariff designs, taxation, and compensation schemes for surplus electricity.

The Netherlands – Legal Reform, Dynamic Tariffs, Net-Metering, Flexibility Market Platforms

The new Energy Act and the regulatory treatment of energy cooperatives

On 4 June 2024, the House of Representatives adopted the new Energy Act with a broad parliamentary majority, which is since awaiting final approval by the Senate. The bill is meant to become the 'legal foundation of the energy transition' and replace the currently still applying Gas Act and Electricity Act of 1998. Designed to modernize and harmonize energy markets and systems in the Netherlands, the new Act also would transpose provisions from recent EU Directives and Regulations into Dutch legislation, such as the revised Renewable Energy Directive, the Energy Market Design reform, and the Decarbonised Gas Package. In general, the objective is to change the energy market organization and deliver transparent and market-based prices, and implement measures that would empower and better protect residential as well as industrial consumers - by facilitating supplier-switching, improving data provision, and guaranteeing security of supply and the protection of vulnerable groups. Regarding energy systems, there would be more options for a flexible use of the power grid, with a revised framework for roles and responsibilities that are undertaken by transmission as well as distribution system operators, incl. the broader application of congestion management and the expansion of 'cable pooling[15]' options.

Relevant in the context of RESCHOOL and this report is the legal recognition of new market actors, such as active customers, energy communities, and aggregators. This would give energy communities a distinct position and role in the energy market, alongside suppliers, producers and grid operators. Citizens who are members of the same energy community would be enabled to share self-generated energy among each other, while the new regulation also strengthens democratic governance, through the requirement to establish equal voting rights that need to be reflected in the legal entity's statutes. In addition, the new Energy Act fosters a new legal basis for a 50% local ownership of renewable energy installations, entitling municipal and provincial authorities to lay down rules that require renewable project developers to demonstrate the efforts that will be made for achieving such target levels. As such, the legal reform measures aiming to foster community energy development in the Netherlands could help the RESCHOOL pilot in Amsterdam to remunerate flexibility, as there currently is no price incentive for load-shifting, to reduce grid congestion.

When transposing the EU provisions into Dutch regulation, national regulatory authorities are facing the question if and to what extent the many existing energy cooperatives can be treated as renewable or citizens energy communities, from a regulatory perspective.

While energy cooperatives adhere to the primary purpose to provide social, economic and environmental benefits, rather than financial profits, there are several important features, which many of today's cooperative models do not comply with, not being "effectively controlled by shareholders or members that are located in the proximity of the renewable energy projects" (as per Renewable Energy Directive). In general, the regulatory treatment of energy cooperatives will determine the ambition of Dutch authorities to establish enabling frameworks and amend existing provisions, as done now in the adoption process of the new Energy Act. Incentivising existing cooperatives to evolve and qualify as renewable or citizen energy communities can facilitate the further uptake of community energy, including in countries like the Netherlands, where many citizens already have access to collective energy actions.

Flexibility market platforms – big and small, we need them all

In the Netherlands, there are several initiatives with the objective to establish flexibility market platforms, to incentivize flexibility procurement as a cost-effective solution to network capacity constraints, granting DSOs the possibility of selecting the most efficient mix of expenses (CAPEX and OPEX), as well as through TSO–DSO coordination. Yet as of today, mostly larger business and industrial accounts dispose of the resources and expertise that are required to meet participation criteria and become licensed to be active on energy markets directly. Yet from the perspective of small consumers and producers, such as energy communities, the energy market is not transactive, they are exposed to mostly flat and sometimes dynamic prices and have no interaction with transactive mechanisms such as the wholesale market. With the current 'supplier-centric model', it is in general not possible for smaller actors to become involved directly, or via a third party other than their energy supplier.

For instance, the Grid Operators

Platform for Congestion Solutions (GOPACS) platform was established by the Dutch TSO (TenneT) and the country's six DSOs as a software platform aimed at mitigating capacity shortages and solving congestion in the electricity infrastructure at any voltage level, with the purpose to attract more flexibility providers to the market. GOPACS is designed as a separate platform that interacts with one or more intra-day market platforms, such as ETPA (Energy Trade Platform Amsterdam) as well as EPEX Localflex, which is a marketplace for trading energy resources allowing participants to offer and purchase flexibility services in real-time. Although every market actor with the ability to influence electricity consumption or generation is in theory eligible to participate, GOPACS requires obtaining a license as congestion management service provider from the TSO or DSO, for aggregating capacities smaller than 1 MW, which can limit the participation of independent actors and the aggregation of residential production and consumption.

Another initiative is the Equigy data platform that facilitates flexibility at low-voltage level so that also residential customers, through an aggregator, can participate in balancing services. As such, Equigy is a European crowd balancing platform that allows for data exchange to enable aggregators to participate with smaller flexibility devices, such as home batteries, heat pumps and electric vehicles, in electricity balancing markets. While not directly interacting with the platform, consumers can, indirectly via aggregators, make use of distributed energy resources (DERs) and benefit from flexibility markets.

On the other hand, pilots and research initiatives are demonstrating the potential of increasing the economic sustainability at community level: the GridFlex Heeten project tested how to match local demand, supply and energy storage in a local energy market, with the objective to alleviate congestion by persuading the 47 participating households to shift behavior to less congested moments - through two different network tariffs that were based on actual network congestion, in combination with a sea-salt battery. The real-life demonstration showed that peaks could be lowered by up to 36%, while also achieving economic benefits through savings for the participants.

In another project, Local4Local, several energy cooperatives cooperate with citizens, companies, local governments to offer a fair, stable price for electricity and heat that is based on cost, non-profit and transparency to its members (who are local residents). When renewables are being consumed at the time it is generated, a stable price can be secured. At other times, the price still depends on the wholesale market. This mechanism incentivizes users to consume as much as possible when it is generated, thereby supporting the system and reducing pressure on the grid. Local4Local's main purpose is the intention among energy cooperatives to fundamentally improve market failures, experienced mainly in form of the increasing difference between the cost of the sustainable energy that cooperatives produce locally, and the price that members pay to energy suppliers for their purchase. Using the trading platform ENTRNCE for interacting with the wholesale market, the Local4Local model is foreseen to be applied, by the end of 2025, within seven pilot energy communities, providing affordable energy to at least 20,000 participating citizens, local governments and companies, by sharing the energy community's own renewable heat and electricity with each other.

With the new Energy Act and the transposition of EU rules[16] on the introduction of new roles in the electricity system (e.g. aggregators, energy communities, active prosumers) and on the preference of market-based solutions for activities that include supply, balancing, redispatch, transport capacity and congestion management, national regulation is expected to include more transactive mechanisms in the Dutch energy market and system – which will also provide market-based incentives for investments into flexibility sources such as flexible generation, interconnection, demand response or energy storage . which in return enable also smaller consumers and producers to participate in energy markets.

Static network tariffs, and net-metering

Grid connections are usually based on peak demand from (or peak supply to) the grid. With today's saturation of the Dutch electricity distribution networks, solutions to ease system pressure include peak shaving, storage, aggregation, flexibility etc. At the same time, the current regulatory framework on network tariffs offers limited opportunities in terms of flexibility provision: one of the main reasons is the lack of locational signals, given the uniform capacity-based tariff for residential consumers that was introduced in 2009.

Changing to more dynamic network tariff is considered to increase complexity in comparison to the current (static) structure, increasing administrative and technical requirements in a more complex regulatory environment. Therefore, regulators are hesitant to reform the capacity-based tariff, although actors such as energy communities could use dynamic tariffs as instrument for responding to network constraints and unlock demand-side flexibility, and shift loads from high-priced periods to when electricity is cheaper, adding value to flexibility and incentivizing investments in battery storage for instance.

The current net metering rules prescribe that every kWh that residential producers and small businesses feed into the grid is worth as much as they pay for a kWh consumed from the grid, with the annual electricity bill amounting for the resulting balance. Yet the compensation is reduced when prosumers start producing more electricity than they consume, hence limiting the economic incentives e.g. for energy communities to invest and install more renewable generation capacity than is needed for meeting

their own demand. Now, with increasing numbers of producers (such as energy communities) revenues for incumbent energy suppliers (as well as tax revenues for the state) are decreasing, and the low voltage grid is becoming under stress at certain times of the day and in certain places. The Netherlands' new government, in office since July 2024, is planning to phase out net metering by 2027. When still in pace, there is little economic incentives to go beyond self-consumption and undertake new activities, such as installing battery storage systems.

Greece – Flexibility and Energy Management Bottlenecks

Enabling framework elements – self-consumption and virtual net metering

With the recent Law 5037/2023, Greece has transposed the EU provisions for renewable energy as well as citizen energy communities (RECs and CECs), establishing several elements of an enabling framework, whereas a series of ministerial decisions on activities that are expected to increase the energy communities' economic sustainability is still pending (such as energy sharing etc., see chapter 2.2).

Legally, RECs can now engage in generation, consumption, storage and sales of energy from renewable sources. Also, each REC is entitled share renewable energies among the community, which is being generated by RE plants (and/or made available through storage facilities) that are in the REC's ownership. RECs can benefit from undertaking virtual net metering, which can be done over longer periods of time and is exclusively available to energy communities, agricultural enterprises and public entities, building the foundation of many initiatives' business models and profitability. Virtual net metering is also being carried out by the Greek RESCHOOL pilot COEN, who thereby obtains reductions on the electricity bills for its members. COEN members have collectively invested in PV installations, with each member contributing according to their energy consumption profile, and with the investment transferred into cooperative shares. Then, a file with a matrix of the members' meters' IDs, together with the sharing coefficients, are provided to the DSO, who then signs the energy sharing contract. The DSO, based on the coefficients, provides the retailer with the netted energy that is billed. The energy sharing contract with the DSO can be updated whenever the energy communities is requesting so. This business model does not involve monetary transactions, since the excess energy is not compensated, yet the reduction in electricity bills can be significant, as the cost of electricity represents around 60% of the total electricity bill (the rest are grid tariffs and taxes). Moreover, members are not affected by changes in the cost of electricity. In parallel, COEN is exploring whether to expand self-consumption through a virtual net billing scheme (the new law 5037/2023 replaces virtual net metering by virtual net billing, applicable to new energy community projects but not existing ones), as well as new business models that could include energy sharing and the provision of flexibility.

Furthermore, RECs can engage in activities that include the production of energy from biomass (or biogas or biomethane), from the operation of water desalination units using renewable energy sources, from the provision of energy services, from aggregation, as well as from the operation of electric vehicle charging infrastructure. On the other hands, CECs are, who can be active within one or more regions while RECs are locally bound), entitled to carry out the following activities: generations, self-consumption, sales and supply of renewable electricity, storage, distribution, aggregation, provision of flexibility and balancing, as well as providing energy efficiency services, electric vehicle charging and other energy services.

As transposed from the EU Directives (mostly copy-paste, like several other provisions), RECs and CECs should be treated in a proportionate, non-discriminatory manner in terms of their activities, rights and obligations as end-customers, producers, suppliers, DSOs or market participants engaged in aggregation. Also, RECs should have access to all energy markets, both directly and through aggregation, in a non-discriminatory manner.

Flexibility markets for larger industrial and commercial actors

Yet as of today, the primary activities contributing to the economic sustainability of energy communities in Greece are self-consumption and participation in virtual net-metering. Flexibility markets are still in early stages, although the first independent aggregator[17] started operating in 2022 a demand response platform that monitors, connects and manages distributed industrial and commercial energy assets on balancing markets in Greece. Established in cooperation with the TSO, the platform allows mostly larger consumers to pool flexibility and create revenue streams, who are combining benefits from offering demand-side flexibility with virtual net metering and self-consumption. Aggregated data suggests that the capacity of Greece's demand-side flexibility could reach 3.2 GW by 2025[18].

On the other hand, such flexibility options are currently not yet

being used by smaller actors, such as energy communities. Flexibility bottlenecks include the technical inability to simultaneously match consumer-specific electricity demand with an increasingly complex national electricity generation profile, with significantly more renewable capacity connected to the girds. This is a major technical challenge at system level, which at the same time implies major economic and regulatory challenges. In parallel, (even large) consumers require significant upgrades to integrate flexibility measures, such as energy storage systems or demand response technologies, to overcome inflexible electricity consumption. At household level, the lack of equipment (hardware and IT systems) to electronically measure, monitor and control electricity and primary energy consumption prevents the needed data collection and exchange. For instance, this would mean to replace Greece's 7 million+ conventional electricity meters with smart meters, and the deployment of energy management systems. The economic burden of such upgrades, coupled with regulatory uncertainty, prevent making use of flexible solutions at larger scale, and by smaller residential and business actors as well.

Flexibility could be leveraged through regulatory reform and incentives that support energy efficiency maximization and/or consumption minimization schemes, the installation of RE systems with storage for self-consumption (e.g. PVs with batteries), as well as power purchase agreements with RE producers.

Furthermore, incentive schemes could incorporate flexibility criteria into eligibility requirements and reward market actors (such as energy communities) for the provision of flexible capacity, or for responding to grid needs in real-time.

Also, reform of network tariff design structures could help incentivize flexibility, e.g. through dynamic pricing mechanisms that reflect the real-time value of flexibility in the grid. Tariff designs could be structured to incentivize load shifting or demand response actions during peak periods, thereby encouraging consumers to adjust their consumption patterns to align with grid needs. Today in Greece, electricity consumers pay regulated, fixed rates for the use of electricity networks, depending on the consumption category, on a €/ MWh and / or a €/MW basis.

Spain – Participation in Energy Markets vs. Current Surplus Compensation Schemes

A framework for collective self-consumption – but not for energy communities

As mentioned under chapter 2.3, Spain's reference framework for self-consumption is building the foundation of the economic model that is applied to most of the energy communities that are being established across the country. Designed to increase self-consumption at building/neighborhood level and using the electricity distribution network without being charged for network tariffs (yet taxes and other charges apply), the 2019[19] regulation allows for surplus compensation at low-voltage level (up to 100 kW), where customers who feed surplus electricity that is not consumed can be fed into the distribution grid - and get remunerated directly by their retailer, in form of a discount on their bill. The level of compensation is offered by the retailer over the period of one year and follows the wholesale market price.

Below 100 kW, the level of savings depends on the kWh fed into the grid, and the compensation price applied. The so-called compensation limit prevents prosumers to be financially compensated for more kWh than they withdraw from the grid. Above 100 kW, the injected surplus electricity does not have to generate benefits from the compensation scheme but can be sold directly to the electricity market, for the energy price at any given time. Doing so can be financially more beneficial (incl. for energy communities), as no limit to the level of remuneration is applied. Yet for selling directly on the market, producers need to get certified, which is a process that requires registering PV installation in the self-consumption registry ("registro de autoconsumo") and the RIPRE (registry of electricity generating installations, or "registro de instalaciones productoras de energia electrica") in the respective autonomous communities (such as Catalonia). The installations above 100kW require more documentation to be submitted than the registration of installations below 100kW.

The regulation limits self-consumption to have the production and consumption done within the same substation, and through a participation radius which has been recently expanded from 500 m to 2000 m through Royal Decree Law no 18/2022. However, this expansion applies only to self-consumption projects using PV tech-

nology and if located on buildings, industrial sites and built environments that have a different purpose of use (such as parking lots).

It is important to keep in mind that Spain's self-consumption scheme is applicable within energy communities.

Yet, it can be done individually and collectively (coordinated by a "self-consumption manager", or "gestor de autoconsumo"), without any specific entity which is legally established and entitled to undertake other activities. Also, the benefits stemming from collective self-consumption are split among individual households (through a redistribution coefficient) but are not meant to create revenues or discounts for energy communities as an entity. Nevertheless, Spain has seen a boom in (mostly) solar installations that are being used for self-consumption (see chapter 2.3). The RESCHOOL pilots in the 4 surrounding municipalities of Girona operate under the collective self-consumption model, with the local government of each municipality having invested in PV installations mounted on a public building, and sharing the electricity generated among its inhabitants. The RESCHOOL project is designed to maximize the economical sustainability of this model, which have been widely confirmed to be the most suitable for creating financial energy community benefits (mostly because it is the model fostered by current regulation), but considering their evolution towards legal entities (e.g. cooperatives, associations or limited responsibility) and the possibility to enlarge them by aggregation (e.g. the four Catalan RESCHOOL pilot sites operating as one single entity). Moreover, different options are being analysed, incl. the possibility of implementing dynamic or fixed distribution coefficients or adapting the consumption of the participants to increase the self-consumption ratio and offering flexibility services (i.e. congestion avoidance, voltage control or peak reduction) to the DSOs through local flexibility markets.

Research and demonstration platforms to prepare local flexibility markets

It has been widely acknowledged that Spain has not sufficiently transposed EU rules on renewable and citizens energy communities, as required by the 2018-19 Clean Energy Package (CEP, see chapter 2.3). In parallel, despite various initiatives to develop local flexibility markets in Spain, there are currently no such markets in operation. Spanish authorities are in the process of transposing provisions of mainly the Internal Energy Market Directive[20], requiring Member States to i.a. provide the appropriate legal framework for DSOs to acquire flexibility services from suppliers of distributed generation, demand response or energy storage through a market mechanism. It also stipulates that DSOs, subject to the approval of the competent regulatory authority, must define the specifications for the flexibility services to be obtained and, if applicable, the standardized products for this market. These specifications must guarantee all market participants' effective and non-discriminatory participation, including those that offer energy from renewable sources, demand response services, managers of energy storage facilities, and aggregators. Hence actors such as energy communities can, as of today, not benefit from acting on local markets. This also affects the implementation of activities that the RESCHOOL pilots surrounding Girona had planned to undertake, in term of offering new energy services that value flexibility and storage at community level, through the aggregation of operable assets at sizeable scale - and thus becomes tradable on markets / by aggregators. Nevertheless, the 4 Girona RESCHOOL pilots are pursuing to explore the full potential of an energy community to provide flexibility and test different scenarios for creating benefits through the participation in such local markets and analyse the operational requirements (i.e. metering granularity, forecasting horizon and accuracy, activation times, capacity, etc.) to participate as an effective flexibility provider.

The Institute for Energy Diversification and Saving (IDAE) and the nominated electricity market operator, OMIE, have conducted initiatives to advance the integration of renewable energy renewable resource through local flexibility markets, including through the IREMEL project, which was designed to foster the "Integration of Energy Resources through Local Electricity Markets". IREMEL has developed a pilot of local flexibility markets to provide a solution to the flexibility needs of the DSOs, as well as a simulation tool that allows to verify different aspects of the operation model of local electricity markets, through the analysis of the technical, economic and behavioral aspects of the participants. When congestion occurred in the distribution network, local flexibility markets would be activated. These have a zonal scope, and their objective is to help DSOs react sufficiently in advance to network limitations and could provide prices incentive for decentralised energy resources (DERs) to participate in the local markets. In this context, OMIE has developed two demonstration platforms: the long-term platform allows for the negotiation of flexibility products with an advance notice of weeks or months, organized in periodic auctions that remunerate for available capacity of the DERs to modify their production or consumption depending on the requirements of the DSO, and for activation (in case the DSO does request the DER to modify its production or consumption). On the other hand, the short-term platform allows for the negotiation of products with near real-time flexibility, when such products are needed on the same or next day. These markets are organized into auctions (at the request of the DSO to provide flexibility) and continuous markets (which allow energy transactions for the current

day between the DERs of an area, but are not promoted by the DSO).

Despite the progress made in research and demonstration sites to improve the understanding of the functioning of local flexibility markets, the needs among involved actors and the products that should be offered, there is no local markets, as of today, where actors such as energy communities can act on.

Many stakeholders hope for regulatory evolution, regarding new provisions and enabling frameworks for energy communities, flexibility, aggregation, as well as DSOs and other relevant energy system and market actors.

Sweden – Taxation and Network Tariff Structure as Main Barrier to Energy Sharing and P2P-Trading

No definition, no framework – but energy sharing and microgrids

As outlined under 1.4, there is currently no legal definition nor other framework elements for energy communities in Swedish law, which in return reduces options to design provide specific support measures. Also, different legal forms come are attached to different rights and responsibilities, increasing the lack of clarity for local actors such as housing associations, cooperatives, small businesses, and residential consumers. In March 2024, the Swedish Energy Agency[21] was mandated by the government to analyse how to improve incentives (only non-financial/ not related to taxes) for energy communities in Sweden, as part of Sweden's transition to a sustainable and robust energy system. This includes assessing framework conditions for the establishment and operation for renewable as well as citizen energy communities and, if necessary, proposing further efforts to promote such communities. The government is expecting to receive the Agency report in early September 2024.

On the other hand, recent regulatory changes enable Swedish consumers to share energy in apartment buildings, although to a limited extent. In this way, collective self-consumption can be done within the same building and with one grid connection. And although there are tax exemptions for prosumers who dispose of their own solar installations, there is little economic incentive to engage in local energy sharing or Peer2Peer trading, with energy taxation and network tariff designs that are not encouraging citizens to invest into local renewable production. The price difference consumers pay for energy on the market is not significant, except when being the owner of their solar installations. Regulatory improvement could in particular stem from tax reduction when sharing renewable energy within the energy community, or when selling surplus electricity to the market / grids.

In Sweden, energy communities are allowed to own and operate microgrids without having to obtain the permission from the system operator.

This is done to facilitate physical sharing connecting nearby buildings via new lines, which often run in parallel to the public electricity network, or that the network and connection arrangements for an apartment building with rooftop solar are reorganised so it qualifies as self-consumers and can benefit from the above-mentioned energy tax exemptions that apply to prosumers. In addition, it is possible to carry out virtual sharing, through the public network. What will be tested in the Swedish pilot is virtual sharing between apartment buildings. Yet unlike for self-consumers, there are no incentives or exemptions for virtual sharing models, making it unprofitable in most cases. Also, the distribution system operators are free to decide whether to accept the sharing to take place over their network. In close collaboration with the distribution system operator, the Swedish pilot has formulated a strategy for virtual sharing that is expected to be included in the Energy Agency's report that will be submitted to the government in September. The expectation is that this input will enhance awareness among decision-makers on economic viability of energy communities and virtual energy sharing in Sweden.

Flexibility markets at national and local level

Today, there are two types of flexibility markets in Sweden: one at national level that is run by the TSO, as well as local flexibility markets which are mostly test beds and still in less mature stages. Svenska Kraftnät, the TSO in Sweden and responsible for power system reliability and grid balancing, has created its own market for procuring different types of ancillary services from participants on the electricity market. Plans to establish from 1 May 2024 onwards the new market role of the independent Balancing Service Providers (BSP) and split it from the Balancing Responsible Parties (BRP), have been delayed[22], due to Svenska Kraftnät's IT capacities as well as requirements in upcoming regulation on the role of aggregators and a compensation model for flexibility. To act as independent BSP increases the opportunity for more actors to make use of flexibility and offer services to the

grids, without being a BRP themselves and financially responsible for ensuring that the same amount of electricity is fed into the electricity system as is withdrawn. It is foreseen that BSPs, with approved pre-qualified units or groups and in agreement with BRPs, will offer services in form of Fast Frequency Reserve (FCR) and automatic as well as manual Frequency Restoration Reserve (aFRR and mFRR). As such, market entry barriers, especially for smaller actors, include minimum bid size requirements, the maximum allowed reaction time of the flexibility source (notification time), the required duration of delivery, the minimum period during which a participant must guarantee flexibility (product resolution), and when and how often the market opens (tender period).

Experts estimate that revenues generated on the TSO-run market might start to decrease in approximately 5 to 6 years, when markets are expected to become more mature and reduce volatility, with the entry of many new actors, mostly larger business and industry accounts, increasing the offer to volumes that could satisfy system and market needs.

As much more variable renewable generation assets is being connected to the grid[23], the need for flexible assets that can provide ancillary services will increase on all voltage levels. Hence the development of local flexibility markets is likely to become more significant and contribute to the future economic profitability of actors such as energy communities. Still in early stages, economic barriers nowadays include, in addition to low remuneration, high technical costs for smart meters, communication and control technologies, and automation, while technological barriers extend to a lack of standardization in prevalent procedures and in data collection from assets (such as heat pumps, EVs, RE generation), that could be onboarded for aggregation and flexibility provision, and deficiencies in the information and communication infrastructure[24]. Throughout recent years, several local flexibility markets have been tested and evaluated in Skåne, Uppsala, Stockholm, Jämtland-Västernorrland and on Gotland. During the winter season of 2023-24, flexibility markets were run in Gothenburg-Mölndal (Effekthandel Väst), Stockholm (SthlmFlex) and in Scania, with the overall results demonstrating there to be a sound potential to increase capacity and enable the connection of more customers. At the same time, expertise and awareness among most actors involved need to be improved, as well as the understanding of processes and incentives. The platforms used must become more reliable and meet the same standards as Svenska Kraftnät's market for ancillary services, requiring the development of processes for pre-qualification, verification, certification and follow-up.

As for the RESCHOOL pilot in Stockholm, the economic potential for the energy community and its members to participate in the local flexibility market, SthlmFlex, is being explored. SthlmFlex is still in its early stages, and a significant barrier to the energy community's participation is the lack of substantial economic incentives.

The exploitation of flexibility potentials – DSO framework and network tariffs

One major barrier lies within the current regulatory framework for DSOs, which is not incentivising to buy flexibility services for improved network operation. Instead, the revenue regulation mostly rewards investments in conventional network expansion, rather than smart (and potentially the most efficient) solutions. On the consumer side, to increase the use of local flexibility, the structure of networks tariffs needs to be revised as well: there is high potential to shift the consumption of households and local enterprises through tariffs that at any given time reflect what it costs to use the electricity grid, based on its current load. Following recent regulatory changes that require DSOs to offer tariffs based on peak load from 2027 onwards, such offers have started being available to customers - although in some cases there are only 2 tariffs available (peak and off-peak). More granular and dynamic pricing would send better signals to consumers and facilitate aggregation and optimization through smart control, incl. for energy communities in Sweden. The current tariffs structure that is applied is not suited for efficiently managing real time grids needs at different voltage levels, as they incentivize reducing overall power demand - but not at specific times, when there is high renewable production and pressure on the grid load.

Also, there are around 160 local electricity network companies in Sweden, many of which have different tariff structures, makes it difficult to effectively aggregate, control and optimize the use of flexible resources and increase profitability for the resource owner while providing support to the electricity network. Standardised tariff structures that ensure equal conditions throughout the country would help reduce complexity and foster the development of efficient flexibility markets.

In general, resistance to reforming network design structures – e.g. to incentivize active participation in energy markets – also originates from protecting the principle of fairness.

Sweden is, in large parts, scarcely populated, with costs being distributed among all those connected to electricity (and gas and district heating) networks, regardless of how long the lines and pipes are. This is to prevent putting higher infrastructures costs to consumers who are connected in remote areas. If customers such as energy communities would benefit from dynamic tariffs and react to price signals, they would potentially contribute less to the overall system costs in Sweden anymore.

4 RES AND REC PROJECT DEVELOPMENT: TOWARDS INDEPENDENCE FROM FINANCIAL SUPPORT MECHANISMS

Research for developing this report as well as stakeholder and RESCHOOL partner consultations with experts who are knowledgeable on the national context in Greece, the Netherlands, Sweden and Spain indicate that existing RECs and CECs stand in contrast to the many energy cooperatives that are economically viable, and are currently being established and operated by means of financial support schemes, ranging from national and regional programs to EU funding mechanisms and industry initiatives. Depending on national priority, this chapter describes, if available, specific programs that are designed to foster energy community and cooperative development, as well as general RES support that can benefit related initiatives. The analysis of regulatory framework conditions (see chapter 3) and the state of progress among the RESCHOOL pilot communities in Amsterdam, Athens, Stockholm and the surroundings of Girona demonstrate why it is fundamental to develop business models and energy market designs further and strengthen the economic sustainability of energy communities - translating the significant interest among citizens and local stakeholders into practice.

The Netherlands – Subsidy for Cooperative Energy Supply and the SDE++ Scheme

Since April 2021, the Cooperative Energy Generation Subsidy Scheme (Subsidieregeling Coöperatieve Energieopwekking, or SCE) supports energy cooperatives and housing and homeowners' associations in generating renewable energy, establishing a fixed electricity price floor that is guaranteed over the guaranteed period of up to 15 years, meant to facilitate local residents and small businesses to participate in a collective initiative. Through the SCE, beneficiaries receive a subsidy per kWh produced, which is composed of a basic amount that is set initially, as well as a variable that reflects the market value of the energy produced in the given year - €0,124 kWh as a basic amount for small-scale installations in the current budgeting period that runs from 2 April to 1 November 2024, with a total volume estimated at 100 Mio EUR. The subsidy per kWh received is calculated based on the capacity of the production installation and the maximum number of full load hours applicable to that category of production installation – which include 3 categories of solar PV (small and large connection, ranging from 15 to 100 kWp, as well as 500 kWp to 6 MWp), 3 categories of onshore wind (small and large connections, ranging from 15 to 100 kW, 15 to 1 MW, 1 MW to 6 MW), as well as 2 categories of hydropower (small and large connection with 15 to 100 kW, and 100 to 150 kW)[25].

Designed to support new renewable projects by energy cooperatives and homeowners' associations, the SCE provides investment and revenue certainty and a profitable operation of the installation over its lifetime, stimulating local initiatives that not only contribute to national and regional climate and energy targets, but involve citizens as self-consumers in the transition to net-zero. The SCE subsidy is paid directly to the energy cooperative or homeowners' association, who then redistributes it among its members, allowing citizens who do not have roof space of their own to participate in collective solar projects.

In addition to SCE, the Dutch government is providing support to the energy transition using resources that are mainly stemming from the auctioning of emission allowances under European Union Emission Trading Scheme (EU-ETS). Namely, these include the Subsidy Demonstration Energy Innovation (DEI+), which supports pilot or demonstration projects with a focus on circular economy, energy efficiency, energy system flexibility, renewable energies, Carbon Capture Utilization and Carbon Capture Storage (CCU and CCS), local infrastructure, as well as any other measure that reduce CO2 emissions in the built environment. These further include the Simulation of sustainable energy production and climate transition (SDE++), which targets renewable energy projects (electricity, gas, heat) or the implementation of CO2 reduction technologies (CO2 storage/low-CO2 production). Applications are ranked based on the amount of financial support per avoided CO2 ton, with a duration of 12 or 15 years. Similar to SCE, the SDE++ is subsidizes the difference between the market value of energy and the cost of renewable energy production. Another subsidy program is the recently issued €28.1 billion Climate Package for reducing CO2 emissions, directing support mainly towards onshore and offshore green hydrogen production, storage, and a pipeline network in the North Sea.

In general, the Dutch subsidy scheme (in particular SDE++) have proven successful and are driving decarbonisation efforts forward. Today, the Netherlands are global leaders in PV ownership, with 3,5 solar panels per capita. However, by the end of 2023 only 17% of the country's final energy consumed is generated by renewable sources[26] - which means there is great potential for further development. Furthermore, grid congestions are threating further growth, which is why unlocking flexibility is a key challenge. With a substantial growth in projects as well as high numbers of applications, the government's support schemes play an important role, boosting installed capacity and bridging the financing gap for citizen initiatives and the industry. Also, the Netherlands receive €506 million from the EU budget for the period 2021-2027 for its 4 European Regional Development programs. Only the Development Program for the Western includes energy communities as specific target group, while the program for the Northern Region has a small subsidy for energy communities for legal expertise. Whereas the program for the Eastern region doesn't mention energy communities at all, it doesn't exclude them as potential beneficiaries. The program for the Southern Region does mention energy communities but hasn't provided any funding to this purpose as of yet.

Greece – Fixed Tariffs and the National Recovery and Resilience Plan

Under Greece's Enterprise Agreement for the Development Framework 2021-27 (NSRF 2021-27), which is supported by the EU's Structural and Investment Funds, the government has allocated €42 million to support locally operated energy communities operating via net metering or virtual net metering. Municipalities and citizen groups that plan to develop their own energy community projects were able to apply until March 2024, with the selected projects to be operational by December 2029 at the latest. The projects must use renewable sources to cover electricity needs of municipal buildings such as hospitals, schools etc., while also supplying vulnerable households who are exposed to energy poverty. The funds will cover up to 80% of the costs of energy community projects, with a minimum installed capacity of 0.3 MW[27], helping to foster energy community development in five Greek regional prefectures, including Western Macedonia and Crete – but by now, not in the Attica region, where the Greek RESCHOOL pilot is located.

Furthermore, Greece's National Recovery and Resilience Plan, with a total budget of 1.5 billion EUR, explicitly mentions energy efficiency measures and household-level RES installations, as well as energy communities. Yet from the total budget of 6,194 million EUR dedicated to the Green Transition pillar, "only" 100 million EUR[28] are allocated to a targeted sub-budget, under which support can be provided to energy communities - which are operated by municipalities and allow sharing of green electricity with energy poor households.

According to previous laws[29], a specific public support scheme allows for energy community with a municipality as member, or an energy community with at least 60 members (50 of whom must be natural persons), to get a fixed tariff of 0.63 euros/MWh over 20 years (when selling the electricity produced), without having to take part in competitive procedures. This support does not represent any permanent regulatory entitlement but is approved by ministerial decisions on a case-by-case basis and in coordination with the network operators, who are consulted on available grid capacity.

Most of the funding programs are designed to incentivize municipalities to develop energy communities, while in practice, there are many initiatives which are being implemented without the participation of municipalities. In general, there is a lack of support schemes directed at citizen-led energy communities, with the available schemes not being claimed by many of the projects that are currently being established in Greece. On the other hand, the virtual net metering scheme, since recently replaced by virtual net billing, is a support scheme that many energy communities in Greece are taking advantage of. At the same time, the most recent law[30] that transposed the EU provisions into Greek legislation states that RECs can be covered by the law on social cooperative enterprises, as a distinct form of cooperative organization, as well as in other Greek or EU programs, in compliance with the state aid rules. Such programs can be issued for the installation of different renewable energy and storage technologies, incl. within RECs who apply virtual net metering.

Further support to foster economic sustainability comes in form of exemptions and reduced fees – as producers of renewable energy, RECs do not have to submit certificates that guarantee the origin of the electricity generated, nor do they pay any application fee for getting certified by the Waste, Energy and Water Regulatory Authority. In addition, RECs are exempted from or pay reduced fees with regard to administrative procedures and grid connection and installation. Yet this applies mainly to larger projects who are active on energy markets.

Spain – CE Implementa and REPowerEU

Spain's Recovery and Resilience Plan (RRP) explicitly – and substantially - addresses energy communities through central government funding that is channeled to regional authorities ("comunidades autónomas") for providing support to the establishment of energy communities. Also, Spain's regions have set individual objectives for the development of energy communities, to be implemented by means of financial support frameworks for community initiatives and self-consumption schemes, in form of grants, subsidies and tax exemptions. Approval of the support depends on fulfilling specific requirements that are issued by the respective regional authorities, in terms of governance, citizen involvement, social benefits, geographical coverage etc. In case of Catalonia, local energy community projects are eligible to receiving support under the SOLARCOOP program which is issued by the Catalan government and targeting the establishment of associations and cooperatives with the purpose to produce, distribute and consumer renewable energies and improve energy efficiency. Furthermore, support is also available at province level, such as the "Del Pla a l'Acció" program issued by the local government of Girona, which is enabling the creation of energy communities, incl. the ones that are being established under the RESCHOOL pilot.

In numbers, the RRP earmarks €100 million that are available in form of grants and technical assistance, split into 4 categories: 1) funding for organisations and initiatives who promote the concept and benefits of RECs and provide advice to incipient RECs; 2) CE-Aprende: funding to initiatives with the objective to raise awareness and advertise recently established communities among citizens and local stakeholders who could be interested in membership / partnership. 3) CE-Implementa (€40 million), contribution of up to 60% of the cost of REC projects that have been legally established, awarded in competitive bidding procedures as well technologies that cover RES incl. geothermal, energy efficiency and savings, citizen-led renovation, and e-moblity, as well as aspects such as innovation, social inclusion, gender equality, improved employment; 4) CE-Planifica: funding for planning and establishment of the REC, incl. for budget items such as feasibility studies, contract models, technical and legal assistance, legal assistance[31].

Provided in form of grants, access to the funding made available under Spain's RRP is challenged by regulatory uncertainty, with definitions and financing criteria to be determined through the still ongoing transposition of EU provisions. It is also unclear if and to what extent Spain's many and longstanding energy cooperatives can be eligible for funding. As for the RESCHOOL pilot communities in the 4 municipalities surrounding Girona, support was provided to the municipalities to make use of collective self-consumption models that benefit inhabitants, who would be then incentivized to legal energy communities entities.

In parallel, Spain's REPowerEU, with a total volume of 8 billion EUR of which 60% are foreseen to be applied in form of subsidies, provides strong support to self-consumption and energy communities, incl. through accelerated and simplified permit granting procedures for RES generation, as well as consumer protection reform measures that are meant to reduce energy costs for citizens, in form of funds for investments directed to renewable self-consumption, energy communities, storage, and energy infrastructures (incl. investments that complement the support provided by the RRP). In addition, investments 4 are foreseen in energy infrastructures, to expand and upgrade electricity networks that allow the integration of higher RES shares and the deployment of collective decarbonisation projects (such as energy communities).

While there is support for local ownership and while non-price criteria have been developed for tenders of solar and wind projects, RECs have not been formally integrated into Spain's RES support schemes. Nevertheless, tenders conducted in 2021 and 2022 earmarked auction capacity for 'citizen-led distributed solar PV projects' (300 MW and 150 MW). Criteria that applied include an installed capacity equal to or less than 5 MW and the obligation to connect to the distribution network at a voltage level that is equal to or less than 45 kV[32]. Also, local and participatory ownership or financing of the installations must be ensured, as well as proximity of generation assets to where the electricity is consumed. The legal entity must be a cooperative, with at least 10 members residing within a radius of 30km from the generation assets, or the local authorities, or a private undertaking with at least 25% of its equity owned by a natural persons or entities.

Overall, the public support provided to RES and specifically RECs in Spain / Catalonia has resulted in the implementation of numerous energy community initiatives. Having established the framework for collective self-consumption) that allows for an economically viable operation, has empowered citizens to engage in such initiatives, in combination with substantive support programs at national, regional and local level. For that reason, Spanish and local enterprises have increased knowledge and awareness on community energy and are expanding the offer of energy solutions, also leading to the creation of new jobs offers. The RESCHOOL pilots around Girona are a good example of how support programs have helped afford and install public PVs and share the electricity produced among residents.

Sweden - Tax Credit and Renewable Support Schemes that are unfit for Energy Communities

In Sweden, there is no specific public support available to energy communities, not at national level nor through the Recovery and Resilience Plan and REPowerEU. In parallel, taxation rules are not favorable to the economic sustainability to most Swedish energy communities (incl. the RESCHOOL pilot in Stockholm), with only micro-producers and installations below 43,5 kW to benefit from tax reduction (0,6 SEK/ 0,052 EUR per sold kWh, up to 30.000 kWh per year), and with an income tax exemption for surplus electricity sold to the grids up to 40.000 SEK / ~ 3.500 EUR. Also, all installations up to 500 kW are exempt from energy tax – yet both maximum values, 43,5 kW and 500 kW, apply cumulatively and thereby disadvantage energy communities which surpass such limits making combined use of solar, batteries and e-mobility charging infrastructure[33]. In this context, climate and energy stakeholders are addressing concerns about the tax burden that Swedish authorities have put on producers of renewable electricity, above the beforementioned thresholds. This is disincentivising energy communities, who could, if taxation was improved, act as suppliers and generate income e.g. through the provision of surplus electricity to customers outside of the community.

For private households who wish to engage in self-consumption, tax credit schemes foster the purchase and instalment of certain green technologies such as rooftop solar (20% tax credit on final investment cost, for grid-connected solar systems), EV-chargers (20% tax credit on final investment cost), and batteries (50% tax credit on final investment cost, for storage systems for self-generated electricity, allowing to be used mainly for self-consumption, and in addition for providing services to the gird via an aggregator or price arbitrage). The total tax credit is capped 50.000 SEK / ~ 4.300 EUR per year and per person, but is only applicable if a person pays a certain amount in annual taxes. Yet it is possible to divide the tax credit among several people living in the same property where the asset is installed.

As for the Stockholm RESCHOOL pilot, ElectriCITY as an organisation is not eligible to benefit from the above-described support schemes. Yet individual residents who own their apartment in Hammarby Sjöstad and housing associations have received support when investing in PVs and EV chargers. If the electricity produced by the PVs is used not only for the property's common areas but also for the households, residents in the housing association pay lower electricity bills.

Regarding support schemes for RES, the single largest and most significant mechanism in Sweden is a quota system in terms of quota obligations and a certificate trading system. The Electricity Certificates Act obliges energy suppliers to prove that a certain quota of the electricity supplied by them was generated from renewable energy sources - yet since 2022, no more new installations are able to register. Energy suppliers shall provide this evidence by presenting tradable certificates allocated to the producers of electricity from renewable sources. In particular for smaller installation such as most residential solar systems, it would no longer have been profitable to register and trade certificates, both due to low price levels and high annual fees. In parallel, the Swedish government has issued Climate Leap, which is an investment program for local and regional initiatives to reduce GHG emissions. Beneficiaries are both private and public entities, notably including municipalities, organisations[34] and enterprises - but not individuals. Supported actions include concrete climate action in areas such as transport, industry, agriculture and energy[35], with the financial support to reinforce complement an existing scheme, and with the implementation of the investment to be completed by 31 December 2025.

5 CONCLUSIONS AND OUTLOOK ON RESCHOOL DELIVERABLE 5.3 ON EVOLVING FRAMEWORKS FOR THE MARKET AND SYSTEM INTEGRATION OF ENERGY COMMUNITIES

In conclusion, much needs to be done for improving the economic sustainability of energy communities across Europe. In Sweden, the Netherlands, Greece and Spain, authorities and other involved stakeholders must develop framework conditions that enhance collective energy initiatives to thrive, becoming active on functioning markets that reward flexibility and demand response, and reduce dependencies from public support schemes. Still today, many energy communities – incl. the RESCHOOL pilots in Athens, Amsterdam, Stockholm and surrounding Girona – need to build financial viability on support that comes in form of grants and subsidies, virtual net metering, fixed rates, self-consumption models, or tax reductions. Yet the absence of remuneration for the provision of flexibility, which can help reduce pressure on electricity networks and integrate higher RES shares, and local energy markets that in many places are still in early stages and operate as demonstration or pilot sites do not allow for increased self-sufficiency. At the same time, Greece, Spain and the Netherlands have advanced, to some extent, the transposition of EU provisions, establishing legal definitions and elements of enabling frameworks for renewable as well as citizen energy communities into national legislation. Nevertheless, none of the 4 countries covered under RESCHOOL has established full compliance with EU Directives and Regulations, with Sweden not fulfilling many of the EU requirements at all. Focus will now put on national and local authorities and the transposition and implementation of the revised market design reform that has entered into force in July 2024, i.a. granting citizens and businesses the right to share energy and request flexible grid connection agreements. At the same time, countries like Spain and the Netherlands have issued vast support programs, for renewable energy development in general, as well as for the establishment and operation of energy communities. Yet in reality, the financial support that should be in theory available, is not accessed or channelled to the many nascent initiatives which are in need to foster their economic viability – or else could expand in size and engage in new activities.

It needs to be underlined again – without improvements in energy market designs and frameworks that are truly enabling, citizens in Sweden, Spain, Greece and the Netherlands will not be reaping the large range of economic, environmental and social benefits that community energy offers. The definition of flexibility products that can be traded in these markets is an essential part to identify the requirements for technical infrastructures of energy communities who aim to operate their energy assets (i.e. PVs, loads, batteries, etc.) in a coordinated and aggregated way to provide these services.

From climate change mitigation and decarbonisation through renewables to consumer engagement and ownership of the energy transition, from collective generation and consumption of green electricity to reduced cost of energy and lesser risks of social unrest and energy poverty, from economic benefits for local businesses and industry to resilience through shorter supply and value chains to improved domestic labour markets and the advancement of skills that, from more inclusive democratic processes and social cohesion to more transparent governance models to collective ownership, from organisational and legal structures that create trust and foster social acceptance of renewable energy projects to energy systems that become decarbonized, decentralised and digitalised, from higher autonomy and energy security to the provision of flexibility for balancing local supply and demand, from smarter energy management to demand response and other services that reduce infrastructure costs and help avoid investments in conventional grid extension – there is a long list of convincing arguments for decision-makers and climate stakeholder groups for taking the process forward and implement energy communities, such as the RESCHOOL pilots. As such, energy community development can make, in many ways, major contributions to the transformation of systems and related infrastructures that have been based for 250 years on the use of coal, oil and gas.

To this purpose and based on the findings of this report, RESCHOOL partners are now going to analyse in more detail, in the continuation of this work stream and from a regulatory perspective, roles and responsibilities that energy communities are meant (or disallowed) to fulfil, in the process of being established and interacting on energy markets. The next deliverable (D5.3) will report on the progress made on establishing regulatory frameworks that facilitate the market and system integration of energy communities in Sweden, Spain, Greece and the Netherlands. This includes the further development of (local) flexibility markets, the use of storage and the interaction with e-mobility, network tariff reforms, data management and interoperability, and changing roles and responsibilities of new market actors (especially aggregators) as well as system operators (in particular DSOs). Enhanced through the RESCHOOL dissemination and outreach efforts, the results will improve the understanding among policy-makers and support informed decisions in legal reform processes. From the EU perspective, RESCHOOL helps understand and overcome implementation challenges that stem from recently adopted EU Directives and Regulations, feeding into the guidance and technical support that is provided by the European Commission and related agencies to Member States.

Footnotes

2 REScoop.eu
3 Amending Directive EU/2024/1711
4 Recast Renewable Energy Directive (2018/2001/EU) (RED II), Integrated Electricity Market Directive (2019/944/EU) (IEMD)
5 Please see the full list and further information on RESCHOOL partners at www.reschool-project.eu/about-us/#partners
6 Greek Ministry of Environment and Energy
7 Royal Decree-Law 244/2019
8 Lokale Energie Monitor 2023
9 the "Electricity Acts Experiments Scheme"
10 Law 4513/2018
11 The Green Tank
12 Royal Decree 244/2019
13 Funding program to support energy communities, issued under Spain's Recovery and Resilience Plan
14 KTH Royal Institute of Technology
15 Cable pooling offer a solution to insufficient connection capacity, by 'pooling' multiple generation capacity on one single grid connection. For instance, this is feasible in situations where a solar park is installed close to an existing wind park that has a grid connection. Cable pooling can also be applied on an industrial location with an existing connection capacity, which can accommodate a wind/solar park.
16 See chapter 3.1.1
17 named Sympower
18 Energy Market Report 2023, International Energy Agency
19 Royal Decree 244/2019
20 which was part of the Clean Energy Package: Directive EU2019/944/EU
21 The Swedish Energy Agency (Energimyndigheten) is the government agency responsible for promoting energy-efficient measures and investments in renewable energy technologies. In parallel, EI supervises the compliance of energy market actors with laws and regulations at national and EU level.
22 Svenska kraftnät announced to provide upates on the state of play in Autumn 2024.
23 Sweden's Solar Association (Svensk Solenergi) estimates 30 TWh solar in 2030, compared to 3 TWh in 2023, while the Wind Association (Svensk Vindenergi) estimates a doubling of electricity produced from onshore wind by 2029 to 76 TWh (from 34,5 TWh in 2023), not even taking into account offshore wind that has another approx 10 TWh of approved sites in the project pipeline.
24 The Swedish regulator, the Energy Markets Inspectorate, has therefore proposed investment support for retrofitting smart control on older equipment.
25 Rijksdienst voor Ondernemend Nederland (Netherlands Enterprise Agency)
26 https://www.pbl.nl/publicaties/klimaat-en-energieverkenning-2023
27 PV Magazine International
28 REScoop.eu financial tracker, Greece
29 Law 4579/2020 and Law 4414/2016
30 Law 5037/2023
31 REScoop.eu financtial tracker, Spain
32 Union Espanola Fotovoltaica
33 RES Legal
34 incl. energy communities that are a registered organisation, e.g. housing association or similar.
35 Investments in assets for electricity production (incl. solar) are specifically excluded under the Climate Leap support scheme.

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