CONGREGATE

COMPLETED SET OF GENERAL SOLUTIONS FOR RENEWABLE ENERGY COOPERATIVES

BULGARIA - CZECH REPUBLIC - GREECE

NATIONAL CONTEXTS FOR ENERGY COMMUNITIES

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Disclaimer

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Abbreviation	Explanation
APES	Association of Energy Services Providers
BoD	Board of Directors
CEWR	Commission for Energy and water Regulation
CHP	Combined Heat and Power
CNG	Compressed Natural Gas
CZ	The Czech Republic/Czech
CZK	Czech koruna (1 EUR ≈ 26 CZK)
EBRD	European Bank for Reconstruction and Development
EnCom(s)	Energy Community (ies)
EE	Energy Efficiency
EPC	Energy Performance Certificate
ERO	Energy Regulatory Office
ESCO	Energy Service Companies
EU	European Union
EV	Electric Vehicle
GCR	General Commercial Registry of Greece
HECHP	High Efficiency Cogeneration of Heat and Power
HPP	Hydropower plant
INPEC	Integrated National Plan “Energy and Climate” of Bulgaria
IoT	Internet of Things
LA	Local Authorities in Greece
LDS	Local distribution system
LNG	Liquefied Natural Gas
NECP	National Energy and Climate Plan of Greece
NPEEMRB	National Programme for Energy Efficiency in Multifamily Residential Buildings of Bulgaria
NTUA	National Technical University of Athens
PHES	Pumped Heat Electrical Storage
PPP	Public-private partnership
PSPP	Pumped-storage power plant
PV	Photovoltaic power plant
RAE	Regulatory Authority for Energy of Greece
REA	Renewable Energy Act
RED II	The Renewable energy directive
REECL	Residential Energy Efficiency Credit Line
RES	Renewable energy sources
RPS	National Plan for Reconstruction and Sustainability of Bulgaria
RRF	Recovery and Resilience Mechanism
SMEs	Small and Medium-sized Enterprises
SVJ	Community of housing unit owners

Foreword

Without any uncertainty, the energy transition is right at our doorsteps, and while there would always be doubters, the ones that are at the forefront are already reaping the benefits from their proactive behaviour and willingness to invest in the future of new energy technologies. Right in its core, community energy, both as regards energy efficiency and production of energy from renewable sources, is the key to a decarbonised economy, and offers significant potential to mitigate climate change and adapt to its already evident manifestations. It is also the cornerstone of energy democracy, with a potential global outreach and unlimited capacity to involve each and every urban and rural community, independently of its social, economic, and cultural status. And it is so much more than windmills and solar panels – it is most of all about bringing people together and caring about future generations. In fact, there is hardly anything more appealing to our societies nowadays, facing yet another health, economic, and trust crisis with the COVID-19 pandemic, which is seemingly cutting through even the strongest social safety nets that we so desperately need to persevere and set our sights to the future again.

The CONGREGATE project, supported by the European Climate Initiative (EUKI) of the German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU), is combining two of the key playfields of the energy transition - the renovation of the multifamily apartment buildings and the initiation of energy communities with the active involvement of the municipalities. This combination, while requiring coordinated joint action by individual energy actors and strong support by the relevant public authorities at national level, has the potential to drive large parts of the population out of energy poverty risk and to ensure sustainable growth for local communities, allowing them to overcome the overspread dependence from energy suppliers and distributors operating on the volatile energy markets, and to create new economic opportunities for its members. With this goal in sight, the project will support the implementation of the building renovation policies and the functional deployment of energy cooperatives in 5 target countries in the region of Central and Southeast Europe – Bulgaria, Croatia, Czech Republic, Greece, and Romania, trying to exploit the synergies from sharing best practices and know-how directly at the level of the local governance.

The current report sets the foundation for the development of a common framework enabling the mass roll-out of energy cooperatives in the three countries which are particularly engaged in this area under the CONGREGATE project – Bulgaria, the Czech Republic and Greece. It starts with a review of the current state of play regarding the EU legislation and its implementation at national level, analysing the existing good practices, identifying gaps and obstacles, and setting expectations for immediate improvements in each of the countries. Then, the technological potential for renewable energy production is outlined in relation to the emerging practices of energy cooperatives, employing different organisational and legal forms and adapted to various economic targets and conditions.

The different levels of development of the community energy in the three countries, with Greece being a frontrunner in both legislation development and practical implementation, and Bulgaria and the Czech Republic still taking the first steps but having extended experience with the deployment of public support programmes and innovative financing mechanisms in the area of energy efficiency, provides an excellent basis for comparison and mutual exchange, which has the potential to support policy developments in each of the countries. This is very much reflected in the collection of best practice examples form the three countries, which are expected to be of particular interest to the involved local authorities. They also provide a logical transition to the next stages of CONGREGATE, where a coherent framework for mapping of community energy projects will be defined, under which the most promising ones will be selected for detailed techno-economic studies and future implementation.

1. NATIONAL LEGAL FRAMEWORKS AND POLICIES

1.1 Introduction – EU Framework

An Energy Community (EnCom) is an entity that implements a set of sustainable energy policy measures in the fields of Renewable Energy Sources (RES) along with Energy Efficiency (EE), with strong involvement of the local population in the planning and implementation processes. The measures can be implemented in various sectors (e.g.: transport, industry, buildings, agriculture, etc.) and the communities are organised to manage their own energy, optimising consumption, generating it with maximum efficiency and leveraging local resources available (solar energy, biomass, wind, …). The concept of EnComs encompasses two key aspects:

- The dimension relating to the management and exploitation of energy sources. The use of renewable energy is closely linked to the rational use of energy, as the objectives of sustainable energy development will only be completed if the two areas (renewable and rational energy) are exploited.
- The horizontal aspect of energy, which affects all dimensions of sustainable development:

Social dimension: An EnCom undertakes actions to support vulnerable consumers and tackle energy poverty, supporting citizens living below the poverty line even if they are not members of the EnCom.

Environmental dimension: EnComs aim at the conservation of natural resources, the reduction of greenhouse gas emissions and the improvement of EE.

Educational and informational dimension: EnComs promote awareness and education at local and regional levels on energy sustainability issues.

Economic dimension: EnComs aim at the support of small and medium-sized enterprises and the conservation of economic resources by using community assets (solar panels, wind turbines) to generate profits within the community[1].

Dimension of technological innovation: The energy activities of EnComs offer an innovation potential, essential to current energy practices and can overcome limits on citizen engagement and adoption of new technologies in the energy system.

Dimension of training and preparation: EnComs are entrusted with the task of training their members in order to be able to take on multiple roles, such as producer-consumer, supplier, co-owner etc.

Political dimension: The EnComs are mechanisms for strengthening the participatory role of local consumer societies and can be a living core in which its members are gradually transformed from passive receivers of climate change information to active

[1] **Source:** Energy communities: an overview of energy and social innovation (2020), JRC Science for Policy Report, page 21

citizens who are informed and understand relevant policies and are invited to design and implement solutions.

The EnComs can take various legal forms and business models, based on a variety of factors, such as:

- The national regulatory frameworks.
- The combination of activities to be carried out (production, supply, distribution, improvements in energy efficiency, ...).
- The renewable technologies to be used.
- The geographical location.
- The number of members that will consist the EnCom.
- The degree of involvement of the local population.
- The extension and use of the geographical territory consisting of regions, cities and municipalities, islands, rural areas, industrial areas, etc.

In European law there are multiple definitions of what can be considered as an EnCom. In the process of developing European legislation, the definitions for the EnComs have evolved, with the definition first appearing in European Union (EU) law in 2016. In fact, two different names are identified which in subsequent amendments converge:

- "Local energy community" or "citizens' energy community", which is found within the legislation on common rules for the internal electricity market.[2]
- "Renewable energy community", which is defined in the context of legislation on the promotion of the use of energy from renewable sources.[3]

Directive of the European Parliament and of the Council on common rules for the internal market in electricity (recast) COM/2016/0864[4], introduced the following definition:

"**Local Energy Community** is an association, a cooperative, a partnership, a non-profit organisation or other legal entity effectively controlled by local shareholders or members, generally value rather than profit-driven, involved in distributed generation and in performing activities of a distribution system operator, supplier or aggregator at local level, including across borders."

[2] **Source:** European Parliament and EU Council (2016): Proposal for a Directive of the European Parliament and of the Council on common rules for the internal market in electricity (recast) - COM/2016/0864, Article 2.7
[3] **Source:** European Parliament and EU Council (2016): Directive on the promotion of the use of energy from renewable sources (recast) - COM/2016/0382, Article 22
[4] **Source:** European Parliament and EU Council (2016): Proposal for a Directive of the European Parliament and of the Council on common rules for the internal market in electricity (recast) - COM/2016/0864, Article 2.7

This EnCom definition emphasises on the creation of value in social and environmental terms, beyond the economic benefit of community activity, and, in particular, seeks to enable greater participation of residential consumers in energy market decision-making.

In addition, Directive (EU) 2018/2001[5] of the European Parliament and of the Council of 11 December 2018 on the promotion of the use of energy from renewable sources in Article 2.16 introduces a broader definition:

A "renewable energy community" is defined as a legal entity:

- which, in accordance with the applicable national law, is based on open and voluntary participation, is autonomous, and is effectively controlled by shareholders or members that are located in the proximity of the renewable energy projects that are owned and developed by that legal entity.
- the shareholders or members of which are natural persons, Small and Medium-sized Enterprises (SMEs) or local authorities, including municipalities.
- the primary purpose of which is to provide environmental, economic, or social community benefits for its shareholders or members or for the local areas where it operates, rather than financial profits.

In addition, Directive (EU) 2018/2001[6] stipulates that:

- Member States shall ensure that final customers, in particular household customers, are entitled to participate in a renewable energy community while maintaining their rights or obligations as final customers, and without being subject to unjustified or discriminatory conditions or procedures that would prevent their participation in a renewable energy community, provided that for private undertakings, their participation does not constitute their primary commercial or professional activity.
- Member States shall ensure that renewable energy communities are entitled to:

i. produce, consume, store, and sell renewable energy, including through renewables power purchase agreements.
ii. share, within the renewable energy community, renewable energy that is produced by the production units owned by that renewable energy community, subject to the other requirements laid down in this Article and to maintaining the rights and obligations of the renewable energy community members as customers.

[5] **Source:** European Parliament and EU Council (2018): Directive 2018/2001 on the promotion of the use of energy from renewable sources, Article 2.16
[6] **Source:** European Parliament and EU Council (2018): Directive 2018/2001 on the promotion of the use of energy from renewable sources, Article 22

iii. access all suitable energy markets both directly or through aggregation in a non-discriminatory manner.

- Member States shall carry out an assessment of existing barriers and potential of development of renewable energy communities in their territories.
- Member States shall provide an enabling framework to promote and facilitate the development of renewable energy communities. That framework shall ensure, inter alia, that:

iv. unjustified regulatory and administrative barriers to renewable energy communities are removed.
v. renewable energy communities that supply energy or provide aggregation or other commercial energy services are subject to the provisions relevant for such activities.
vi. the relevant distribution system operator cooperates with renewable energy communities to facilitate energy transfers within renewable energy communities.
vii. renewable energy communities are subject to fair, proportionate, and transparent procedures, including registration and licensing procedures, and cost-reflective network charges, as well as relevant charges, levies and taxes, ensuring that they contribute, in an adequate, fair and balanced way, to the overall cost sharing of the system in line with a transparent cost-benefit analysis of distributed energy sources developed by the national competent authorities.
viii. renewable energy communities are not subject to discriminatory treatment with regard to their activities, rights and obligations as final customers, producers, suppliers, distribution system operators, or as other market participants.
ix. the participation in the renewable energy communities is accessible to all consumers, including those in low-income or vulnerable households.
x. tools to facilitate access to finance and information are available.
xi. regulatory and capacity-building support is provided to public authorities in enabling and setting up renewable energy communities, and in helping authorities to participate directly.
xii. rules to secure the equal and non-discriminatory treatment of consumers that participate in the renewable energy community are in place.

Given the nature of the EnComs, their development offers various socio-economic and environmental benefits:

- At environmental level: RES and EE include "clean technologies", i.e., technologies that generate heat and/or electricity or propel vehicles without the use of fossil fuels, offering safe, reliable, clean, local, and increasingly cost-effective

alternatives to our energy needs, thus helping to reduce polluting gas emissions and the negative impact of climate change.

- At socio-economic level:

i. Cost reduction and energy independence: EE measures reduce energy demand and demand for fossil fuels using RES, resulting in reduced energy dependence and energy supply costs for the community.
ii. Job creation: The development of local businesses is encouraged.
iii. Added value at local level, as the EnCom offers the possibility to promote investment and development in the community.
iv. Social regeneration and improvement of living conditions in rural and urban areas.
v. Social cohesion.

More specifically at social level, the development of EnComs can advance EE at the household level and alleviate energy poverty. Energy poverty is a particularly crucial social issue directly linked to the energy sector. In the current economic downturn, the phenomenon of energy poverty is becoming increasingly pronounced, especially in low- and middle-income households. Considering that there is no concrete definition of energy poverty at European level while there are only few Member States that have developed and launched a definition, this conclusion can be drawn from the indicator of the inability to guarantee necessary domestic energy services due to a combination of low income, high energy expenditure and poor energy efficiency of households[7]. The institution of EnComs can revitalise the local economy, by creating local jobs and reducing energy bills, and tackle energy poverty, by supporting vulnerable consumers, either through cheaper tariffs or free electricity provided by EnComs' RES. Workshops and educational campaigns organised by the EnComs are also an effective mean of guiding people on reducing their energy consumption and cutting back their bills

1.2 Bulgaria

Following the formal requirements of the Clean Energy for All Europeans package, the topic of energy communities appears in all current climate and energy strategic documents at national level, albeit with varying intensity. Unfortunately, however, none of these documents offers specific quantitative targets and investment commitments. The current analysis includes the Integrated National Plan "Energy and Climate" (INPEC), the Strategy for Sustainable Energy Development of the Republic of Bulgaria until 2030 with a horizon until 2050, the second preliminary version of the National Plan for Reconstruction and Sustainability (RPS), and a Long-Term National Strategy to support the renovation of the national building stock of residential and non-residential

[7] **Source:** The REScoop.eu (2020): Community Energy: A practical guide to reclaiming power, page 154

buildings by 2050, noting the main positions regarding the energy communities in each of them.

INPEC offers the most detailed information regarding policies and measures to support the establishment and functioning of energy communities, which will be implemented in the period up to 2030. Unfortunately, the intentions to implement such measures, which are directly in line with recent changes in the related European legislation are not backed by specific measurable targets in terms of the expected amount of energy produced and its contribution to the achievement of the national targets in the field of RES. Their role in the development of the internal energy market is set out in the general framework of the plan, which provides for "stimulating the creation of energy communities for the production and consumption of renewable energy and stimulating a more active role of consumers" (p. 19).

In the "decarbonisation" dimension, the commitment on the envisaged policies and measures is as follows: “In the period 2021-2030, the development of the electricity sector is consistent with the possibility of maximum integration of electricity produced by renewable energy in the electricity market, reporting on decentralised electricity production and providing consumers of electricity from renewable energy sources at the lowest possible price. A favourable framework has been created to encourage and facilitate the development of the consumption of own electricity from renewable energy sources and the establishment of renewable energy communities” (p. 110). As a specific measure, the creation of conditions for consumers of own electricity from renewable energy sources and renewable energy communities is set. It is claimed that the interest of Bulgarian consumers in the production of electricity from renewable energy for own consumption is weak, but in view of the introduction of a favourable framework for encouraging and facilitating the development of consumption of own electricity from renewable energy, legislative changes are envisaged, through which to optimise the current regulations and to better regulate the rights of this type of consumers. As a specific commitment, albeit without time frames, it is envisaged to provide the opportunity to operate in the energy system, to facilitate market integration, to regulate optimal administrative procedures in accordance with the specifics of the renewable energy communities. Again, without specific commitment, it is mentioned that in the period 2021-2030 opportunities will be sought to finance such projects and measures will be taken to ensure access to electricity consumption by renewable energy for low-income consumers or vulnerable households through the social assistance system. (p. 115)

The plan also draws attention to the contribution of local authorities to the creation of conditions for the consumption of energy from renewable sources by separate "renewable energy communities" at the local level, which is considered essential for the cost-effective development of renewable energy in the country (p. 114). In this regard, the contact points required by Directive (EU) 2018/2001 to assist investors (applicants) in the process of issuing permits by the relevant competent authorities are also considered: “Municipal authorities have obligations to issue part of the permits during construction of power plants for production of electricity from renewable energy

sources. Also, their role in terms of planning and expanding the use of energy from renewable sources in the municipality implies a greater commitment to the process of realization of investment intentions. In this regard, it is appropriate to designate municipalities as contact points" (p. 125). The problem of providing the necessary information and adequate training is also addressed, and again the relevant institutions and local authorities are called upon to conduct comprehensive initiatives on information campaigns, forums, awareness-raising programmes, and training of citizens on the benefits and opportunities for the use of energy from renewable sources. It is argued that "information will be provided in an efficient and easily accessible way", without, however, mentioning the specific mechanism and financial resources through which this process will be carried out.

Within INPEC, the most specific parts are the commitments regarding the implementation of the provisions of Directive 2019/943 on the electricity market, which also regulate the process of full liberalisation of the electricity market. Progressive deregulation of prices for household and small non-household consumers is planned, and the liberalisation process started in 2020 and will take 3 to 5 years. The derogation under Article 5 (6) of Directive 2019/943 will be a temporary measure until the full liberalisation of the retail electricity market. Policies and measures will focus on:

- Encouraging local energy communities to stimulate energy consumers to participate more actively and efficiently in the market and to allow for an easy transition of active customers to an open and fully liberalized electricity market.
- Granting the right to conclude a contract with a dynamic price of electricity and a contract for aggregation to optimise consumption in order to encourage energy consumers to participate more actively and efficiently in the market, as well as to allow easy transition for active customers to the open and fully liberalised electricity market.
- Creation of a platform for tools for comparing the offers of suppliers, which will support the active participation of consumers in the market, the choice of contracts for aggregation of services and transparency of relations in civil energy communities. The measure should cover at least household consumers and micro-enterprises with expected annual electricity consumption below 100,000 kWh (p. 169).

Renewable Energy Sources (RES) are also widely represented in the comments of stakeholders. They mainly concern the opportunities for RES to enter the liberalized energy market and the need for additional mechanisms for the development of RES in the urban environment, active consumers, and energy communities. Most of the statements received concern the need to remove administrative barriers to market entry for renewable energy sources and to stimulate the development of renewable energy sources in industrial areas and the urban environment, mainly for own consumption. This is related to recommendations for network modernisation and development of smart grids (p. 42).

Although the Strategy for Sustainable Energy Development of the Republic of Bulgaria until 2030 with a horizon until 2050 invariably follows the logic of INPEC, there are far fewer references to energy communities. With regard to the development of an integrated and competitive energy market, it is stated that “The development of electricity transmission and distribution networks and the introduction of smart monitoring systems will enable all household and non-household electricity customers to have access to electricity markets and to trade the electricity produced by themselves. Consumers will be able to use, store and sell the electricity produced by themselves, as well as to participate in all electricity markets, through consumption optimisation or energy efficiency schemes. These activities in the future will be facilitated by the introduction of the necessary legislation and regulatory conditions for the establishment of energy communities, through the construction of its own closed distribution networks and the introduction of new technologies for production and storage of electricity. By establishing themselves as active market participants, electricity consumers will also play a significant role in the process of sustainable energy development” (p. 36). As a national policy in the field of sustainable energy development for clean energy and decarbonisation of the economy, it is stated that in the period 2021-2030 the development of the electricity sector will be consistent with: (1) the possibility for maximum integration of electricity produced by renewable energy in the electricity market, (2) the possibilities for decentralised production of electricity, (3) providing electricity from renewable energy sources at an affordable and lowest possible price for all consumers, (4) promoting and facilitating the development of own electricity consumption from renewable energy and the creation of renewable energy communities. It is claimed that “Expansion of electricity production from renewable energy sources will be linked to the possibility for maximum integration of the produced electricity on the electricity market, as well as to consider the decentralised electricity production, incl. creating conditions for consumers of own electricity from renewable energy sources and renewable energy communities (p. 46). Unfortunately, in both areas there is again no specific quantitative target, although the relevant sections are entitled "Objectives and Policies".

The National Recovery and Sustainability Plan confirms the political declaration on increasing the share of energy from renewable sources in gross final energy consumption. At the same time, it is noted that "the growing development of renewable sources and the associated volatility in electricity production require increased adaptability of the operational management of the electricity system to ensure the necessary flexibility, security and rapid action in its management." The Long-Term National Strategy for Supporting the Renovation of the National Building Stock from Residential and Non-Residential Buildings by 2050, where in addition to the need for legislative changes for the functioning of "energy communities / energy cooperatives", the need for initiatives to promote smart technologies and well-connected buildings and communities, as well as the acquisition of skills and education in the construction and energy efficiency sectors. Here, too, special hopes are placed on the concept of one-stop-shops and the creation of administrative and technical capacity in municipal administrations. In response to the identified need, the measure "Creation of regulatory conditions for inclusion of buildings in different ownership and management in

communities for renewable energy for own consumption" with a deadline of 2025 and responsible - Ministry of Energy.

1.3 Czech Republic

Community energy movement, supported by European legislation, now gives communities and individuals the right to produce, store, consume and sell their own energy. The Renewable Energy Directive (REDII) [8] contains a key set of enforceable rights that protect citizens when investing in renewables resources. These rights must also be guaranteed by individual governments and private market players. However, it is still necessary in the Czech Republic to transpose these rules properly into the national legislation.

A key point of the new legal framework for community energy is a national official definition of the renewable energy community. The Czech Government has to define the specific legal entities that can be considered as a renewable energy community. In the Czech Republic, the energy community will be defined in the amendment to the Energy Act, which has to be introduced and approved till June 2021. The Czech Ministry of Industry and Trade is developing the necessary amendment. Until now the substantive intent[9] of the new legislation has been published.

According to Substantive intent of the Energy Act document, the Ministry plans to introduce a uniform definition of "energy community", which will meet the requirements of the European law. The community should be a legal person based on the principle of voluntary membership, the main objective of which will not be profit-oriented. An association or cooperative thus appears to be the most appropriate legal form for an energy community.

According to the Ministry's proposal, it does not plan to assign a specific legal form to the community and leaves the choice to its members. However, the energy community cannot be, for example, a foundation or a fund, because they are not based on the membership principle.

Similarly, according to the Ministry, the energy community cannot be a community of housing unit owners, so called “SVJ”, because it cannot be left without losing the ownership of the unit - thus the condition of voluntary membership is missing.

Four main elements need to be emphasised:

1) Eligibility to participate. Regardless of the legal form chosen only individuals, local authorities (including municipalities) and Small and Medium-sized Enterprises may join the renewable energy community as members. The exclusion of large companies has to

[8] **Source:** European Parliament and the European Council (2018) RED II Directive
[9] **Source:** Czech Ministry of Industry and Trade (2020): Substantive intent of the Energy Act (in Czech)

ensure that they cannot unfairly benefit from specific rights or special treatment for communities.

2) Control and democratic decision-making. Renewable energy community must be controlled by members located near the RES projects operated by the community. It will be important to ensure that the delimitation is not too narrow; otherwise, it could constitute a high obstacle. Furthermore, such a community must be autonomous, i.e., no individual member (especially a company or a financial institution) can produce a disproportionate influence on decision-making.

3) Open and voluntary participation. The community must be open to all potential members on the basis of non-discriminatory criteria and the members must also be able to leave the community any time. This is to ensure that local citizens can easily join the community and are able to apply their decisions in the energy market, at the same time they can freely leave it.

4) Alternative purpose of the entity (not making profit). Primary purpose of the renewable energy community must be to provide environmental, economic, or social benefits for its members and/or the locations of their operation. Communities can get a financial return on investment; however, the community itself should not be profit-oriented.

Anyone can be a member of the civil energy community, while only natural persons, Small and Medium-sized Enterprises or local authorities, including municipalities, have opportunity to become the members of the renewable energy community.

According to the RED II Directive, it is up to the Member States to allow energy communities to operate a local distribution system (LDS). In its proposal, the Czech Ministry of Industry and Trade clearly states that it will use this opportunity. This is good news for energy communities, as the possibility of setting up your own LDS at the level of an apartment house or a municipality can mean significant savings in energy prices for the community.

The current energy system is unfortunately set up in such a way that it does not favour in any way the price of locally produced energy, for example, in a municipal power plant. For instance, as soon as the produced electricity is delivered to the distribution system, it is taken at the other end by the consumer at the same price, whether it is produced right behind the corner or at the other end of the country. The possibility of favouring consumption from the own electricity generation arises only if a municipality owns part of the distribution system and could set its own specific conditions.

The legislative intent also states that if the energy community is interested in carrying out any activity as a business, it must obtain an appropriate license from the CZ Energy Regulatory Office. This could potentially cause a problem for the development of energy communities.

According to the legislative proposal, the production of electricity with capacity over 10 kW for own consumption of a customer connected to the electricity system is also considered as a business activity (e.g., a solar power plant to meet the needs of a prefabricated “panel” house), as well as almost any production receiving financial state support, despite that they serve primarily to meet the needs of the energy communities themselves. It is therefore a certain administrative barrier, which may discourage energy communities from their establishment.

The Czech Ministry of Environment is also preparing rules for the distribution of financial means from the Modernization Fund. This is a total of CZK 120-150 billion (EUR 4.6-5.8 billion), which should be used to transform the energy sector. Some of these will be intended to support community energy. This is a one-off investment aid that can be also combined with the operating financial aid. It will be possible to receive support for the individual projects beginning from 2021. The detailed conditions for the provision of support and the administrative complexity of drawing on these funds for the energy communities are not yet known.

1.4 Greece

Complying to the official recognition of 'energy communities' as specific types of community energy initiatives in the recasts of the Renewable Energy Directive and of the Electricity Market Directive, Greece has already adopted measures and policies on community ownership. EnComs are recognised by Greek jurisdiction as tools of energy transition, through which social and solidarity economy in the energy sector is promoted, energy poverty is addressed, end-use energy efficiency at local and regional level is improved and energy sustainability is reinforced.

The National Plan for Energy and Climate (NECP)[10] foresees the active role of the EnCom in the country’s energy production mix. The National Energy and Climate Plan (NECP), published in December 2019, is the Greek government’s strategic plan for climate and energy issues at national level. Through this, policy priorities and measures are defined in a wide range of development and economic activities. It is the guideline for the development of corresponding strategies at local and regional level as it sets out the objectives to be achieved and measures to be implemented.

[10] **Source:** Ministry of Environment and Energy Greece (2019): National Energy and Climate Plan, page 81

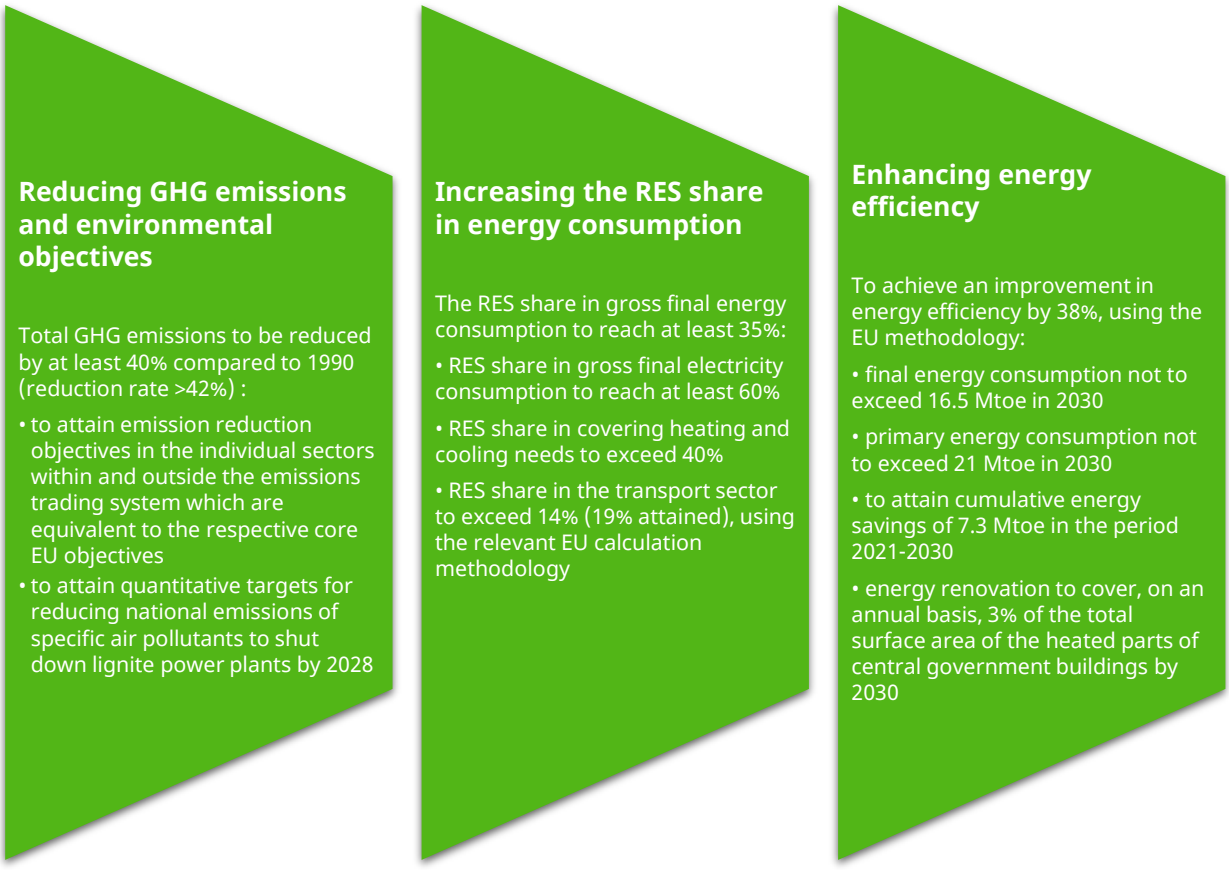

Figure 1 National energy and environmental objectives for the period 2021-2030 in the context of EU policies[11]

More specifically, NECP refers that "The contribution of energy net metering schemes, as well as the Energy Communities scheme is twofold, as they will contribute to the implementation of RES and energy saving technologies investments, as well as to the more active participation of the local community and the role of citizens in energy affairs. Achieving a minimum number of projects through these schemes is considered crucial to formulate and evaluate the required implementation framework. Within this context, the goal is to develop innovative energy net metering schemes, both in terms of energy production and consumption, thus supporting decentralized energy production and management. Quantitative goal is the installation and operation of new self-generating and energy net metering systems, mainly to cover own needs over 600 MW by the year 2030 (to total more than 1GW of installed capacity), as well as the activation of cumulative representation bodies with the potential participation of Energy Communities, as well as citizens in the energy markets."

[11] Ministry of Environment and Energy Greece (2019): National Energy and Climate Plan, page 25

1.4.1 Law 4513/2018 on Energy Communities and Other Provisions

In 2018, the Greek Parliament adopted the Law N4513/2018 which set the legal framework for the establishment of EnComs, aiming to the promotion of social economy, solidarity, innovation, sustainable energy, as well as enhancing EE in the final consumption of local communities. The initiative was designed as a tool to enable the development of new types of green economic activities at local level, aimed at increasing RES share, promoting EE, and reducing greenhouse gas emissions.

According to Government Gazette A 9/21.01.2018, an EnCom must carry out one of the following activities[12]:

- Production, self-consumption, storage or sale of thermal energy or electricity from hybrid stations, high-efficiency cogeneration plants (CHP) or RES stations located within the region where the EnCom is located or also within a border Region for EnComs based within the region of Attica.
- Raw materials management such as collection, treatment, transport, storage or disposal, for the production of thermal energy or electricity from biogas or biomass or bioliquids through the recovery of the biodegradable fraction of municipal waste.
- Supply of energy efficient appliances, energy products and installations in order to reduce energy consumption and the use of conventional fuels, as well as to improve energy efficiency.
- Supply of electric vehicles, hybrid or non-hybrid, and in general vehicles using alternative fuels.
- Distribution of electricity within the region where its head office is located.
- Supply of natural gas or electricity to final customers in accordance with Article 2 of Law 4001/2011 (A'179) within the region where its head office is located.
- Production, supply, and distribution of thermal energy within the region where its head office is located.
- Management of demand in order to reduce the end-use of electricity and represent consumers and producers in the electricity market.
- Grid development, operation and infrastructure management of alternative fuels, in accordance with Law 4439/2016(A'222) or management of sustainable transport means within the Region where the head office of the EnCom is located.
- Installation and operation of water desalination plants using RES within the Region where the head office of the EnCom is located.

[12] **Source:** Law 4513/2018 on Energy Communities and other Provisions– Government Gazette A 9/21.01.2018, Article 4

- Offer of energy services in accordance with Article 10 of D6/13280/7.6.2011 (B'1228).

Furthermore, according to Government Gazette A 9/21.01.2018, an EnCom may also carry out one of the following activities[13]:

- Attracting funds to make investments for the exploitation of CHP or RES or interventions to improve EE within the region where the EnCom is based.
- Elaboration of feasibility studies for the exploitation of CHP or RES or implementation of interventions to improve EE or provision of technical support to members in these energy sectors.
- Participation in or management of energy efficiency related projects financed from national or EU resources in accordance with the EnCom's objectives.
- Provision of consultants for the participation or management of its members in relative energy efficiency projects financed from EU or national resources in accordance with the EnCom's objectives.
- Awareness, information, and education at local and regional level on energy sustainability issues.
- Actions to support vulnerable consumers as well as to tackle the energy poverty of citizens living below the poverty line within the region in which the EnCom is located regardless of whether they are members or not. Examples include net metering or power supply, energy housing upgrade or other actions that reduce energy consumption of the said houses.

1.4.2 Decisions of Government Gazette A' 940/20.3.2020

The decisions in GG A' 940/20.3.2020[14] focus on the promotion of RES at lignite dependent regions aiming at the reinforcement of the energy transition. More specifically, these decisions are intended for the resolution of delays observed in the previous years in the licensing process of new power plants as well as for the upgrade of electricity networks in order to facilitate the connection of new power plants. At the same time, a number of EnCom regulations is included: Article 2 distinguishes the categories of power plants from RES, which will be classified into five groups, and on the basis of this categorisation, the applications of the project carriers will be examined, and the final connection offers will be granted. Within this framework, priority shall be given to EnComs as if they had been submitted one month before their actual date of submission. In EnComs, in which participate Local Authorities (LAs) and profits are not

[13] **Source:** Law 4513/2018 on Energy Communities and other Provisions– Government Gazette A 9/21.01.2018, Article 4
[14] **Source:** Decisions of Government Gazette A 940/ 20.3.2020

distributed or in which more than 60 members participate, they retain the priority of 4 months in the licensing process.

1.4.3 Law 4685/2020 (Government Gazette A' 92/7.5.2020)

Law 4685/2020 (Government Gazette A' 92/7.5.2020)[15], which came into force in May 2020, attempts to radically reform energy licensing and the regulatory framework, addressing administrative deficiencies in the regulations previously in force and providing a safe legal environment for prospective investors, particularly in the RES sector. The main innovations introduced by Law 4685/2020, which focuses on the reform of the RES licensing framework, are as follows:

- the RES production permit shall be replaced by a certificate issued digitally through an expedited procedure.
- the duration of environmental permits is extended from 10 to 15 years, while the deadlines for issuing environmental permits are greatly reduced.
- the various restrictions on land use are completely or partially abolished.
- new deadlines are set for various milestones in the authorisation process.

1.4.4 Law 4759/2020[16] (Government Gazette A' 245/9.12.2020)

The amendment regulates a number of critical energy issues for the support of the Special RES Account, for the EnComs, for the facilitation of future investments in lignite areas and for the reduction of energy costs for businesses. In particular, for projects whose applications are submitted after 01.01.2021, either by private individuals or by EnComs, the participation in a competitive procedure is required in order to enable an operational aid contract, with the exception of the participants of the programme 'Photovoltaics on roofs'. Furthermore, after 01.01.2022, no operating aid contract for photovoltaic plants will be signed without prior participation in a competitive tendering procedure, even if it concerns applications before 01.01.2021. For photovoltaic plants installed in the region of Western Macedonia, these deadlines are extended by one year. These provisions exclude EnComs in which first or second degree LAs participate or which have more than 60 members, of which at least 50 are natural persons.

[15] **Source:** Law 4685/2020 on Modernisation of environmental legislation, incorporation into Greek legislation of Directives 2018/844 and 2019/692 of the European Parliament and of the Council and other provisions - Government Gazette A 92/07.05.2020

[16] **Source:** Law 4759/2020 on Modernisation of Spatial and Urban Planning Legislation and other Provisions - Government Gazette A 245/09.12.2020

2. LEGAL STRUCTURES AND FINANCING FOR ENERGY COMMUNITIES – COOPERATIVES

2.1 Bulgaria

The current legislation, unfortunately, lacks provisions on the establishment and functioning of energy communities. However, as noted in the previous section, a number of strategic documents, including INPEC, encourage the entry of energy communities and their active participation in the energy market by prescribing legislative measures.

In general, the current legal framework applicable to renewable energy production sites does not limit the possibility for such projects to be set up by citizens. Energy that is not necessarily bought at regulated prices can be sold on the open market. In the free market, transactions are concluded between producers, energy traders and consumers. Energy for the free market is purchased from traders and end industrial consumers at freely negotiated prices or from the platforms of the Bulgarian Independent Energy Exchange. Customers are free to change their electricity supplier. At present, preferential prices for new sites for production of electricity from renewable energy sources are provided only to sites with a total installed capacity of up to 30 kW inclusive, which are planned to be built on roof and facade structures of buildings connected to the electricity grid and on real estate in urban areas.

Any producer of electricity from renewable energy sources may be connected to the grid even without free capacity, when, submitting a request for connection, he declares that he will not use a preferential price for the purchase of electricity but will sell on the open market and / or uses energy for its own needs. In these cases, requests are submitted for examination of the conditions and the manner of connection to the respective electricity network operator. Upon concluding a preliminary connection contract, the producer of electricity from renewable sources shall owe to the respective distribution company, which connects it, an advance payment in the amount of BGN 25,000 for each megawatt (MW) of installed capacity of the future energy site, when the installed capacity is up to 5 MW inclusive. The Accession Treaty regulates the payment of the remaining part of the connection price determined in it in the cases when this price is higher than the value of the advance payment. Producers of electricity from renewable sources, whose energy sites have a total installed capacity of over 30 kW, enter into an access contract with the distribution system operator under general conditions approved by the Commission for Energy and Water Regulation (CEWR) and announced on the website of the distribution network operator before concluding the contract for the purchase of electricity. Producers of electricity from renewable sources, whose energy sites have a total installed capacity of up to 30 kW inclusive, use the distribution networks to which they are connected, under general conditions approved by CEWR and published on the website of the distribution network operator. The purchase of energy at preferential prices does not apply to sites that have declared that they will not benefit from the preferences because they have exhausted the available capacity, and sites that produce energy for their own needs. However, in case the facilities producing for own

needs produce a quantity of electricity that is not used for own consumption, this quantity is purchased by the respective final supplier at a price determined by CEWR. For sale on the free market, energy producers should enter into a contract with a licensed electricity trader.

The national definition of a nearly zero-energy buildings requires that at least 55% of the energy required for heating, cooling, ventilation, and lighting be supplied by renewable energy sources on or near the building, which could be an incentive for local energy communities. Unfortunately, this definition has not yet been introduced into the actual design and construction practice through the relevant necessary amendments to the Energy Efficiency Act and the Spatial Development Act. The Renewable Energy Act (REA), for its part, considers the applicability of renewable energy sources in the construction of new or in reconstruction, major renovation, overhaul, or reconstruction of existing buildings. In these cases, at least 15 per cent of the total amount of heat and cooling energy required by the building must be produced from renewable sources by introducing:

(a) centralized heating using biomass or geothermal energy.
(b) individual biomass combustion plants with a conversion efficiency of at least 85 per cent for residential and commercial buildings and 70 per cent for industrial buildings.
(c) solar thermal installations.
(d) heat pumps and surface geothermal systems.

According to REA, local governments must take measures to ensure that new and refurbished buildings serve as a model for promoting the production and consumption of energy from renewable sources. REA also suggests how this can be achieved, namely "by complying with the standards for nearly zero-energy residential buildings or by ensuring the use of the roofs of such buildings or mixed-use buildings, including public services, by third parties for installations for the production of energy from renewable sources". Unfortunately, however, this is not a mandatory prescription of REA and there are no sanctions or control over its implementation.

2.2 Czech Republic

According to the substantive intent of the law, the energy community will not be limited to only one legal form of legal entity. The condition is that the primary purpose of the legal entity forming an energy community must not be to generate profit but to satisfy the environmental, economic, or social needs of its members.

Another necessary condition is openness and voluntary membership in the legal entity. In order to create an energy community, it will therefore be necessary to create a special legal entity in the form of, for example, an association or cooperative. A municipality can be a member or a partner in the given legal entity and set its membership in such a way that it has a decisive say.

If the energy community operates electricity generation with an installed capacity of more than 10 kW, which is highly likely in the case of a RES project, it will have to apply to the Energy Regulatory Office for a license to produce electricity. The substantive intent of the new energy act does not provide for any exception to this obligation for the communities.

2.3 Greece

2.3.1 Legal Structures according to Law 4513/2018

As described in the previous section, Law framework 4513/2018 on the establishment and operation of EnComs enables citizens, local authorities, and small and medium-sized enterprises (both private and public) to set up urban cooperatives that operate exclusively in energy-related fields, at local and regional level. Eligible members of an EnCom may be:

- Persons of full legal capacity.
- Legal entities governed by private law.
- Legal entities governed by public law other than first- and second-degree local authorities.
- First-degree local authorities (LAs) of the same Region in which the EnCom or its companies are located. First-degree LAs consist exclusively of Municipalities and more specifically 332 Municipalities[17,18].
- Second-degree local authorities within the geographical limits of the Energy Community. Second-degree Las consist of Prefectural Administration Offices that are legal persons governed by public law. In Greece there are totally 13 Prefectural Administration Offices[15].

In addition, the Law defines two types of EnComs, **profit** and **non-profit**, which differ in terms of the composition of the members and their minimum number, as well as the potential of profits (surpluses) distribution, that applies only to members of the for-profit EnComs. The profit or non-profit characterisation of an EnCom cannot be altered during the lifetime of the Community.

Regarding non-profit EnComs, the surpluses are not distributed to the members, but remain as reserves for its purposes, by decision of the general assembly. At least ten percent (10%) of the surpluses of a non-profit EnCom are withheld for the formation of the regular reserve. Withholding is not mandatory when the amount of the reserve is at least equal to the amount of the cooperative capital of the Community.

[17] **Source:** Law 3852/2010 - Government Gazette A 87/ 07.06.2010
[18] **Source:** Law 4555/2018 – Government Gazette A 133/19.07.2018

Exception are the EnComs consisting of exclusively first or second-degree local authorities for EnComs based in an island municipality (with the population limit of 3.100) and under the presupposition of local authority participation (first or second degree), then part or total of the surpluses can be distributed to finance actions of common benefit of a local character related to the adequacy and supply of raw materials, fuel, and water after the withholding of the regular reserve.

The distribution of surpluses is allowed only in the case of profit EnComs, provided that there is a relevant provision in the articles of association and after the deduction of the regular reserve.

The minimum number of members of non-profit EnComs is:

- Five, if the members are legal entities governed by public law other than the local authorities or legal entities governed by private law or persons.
- Three, if the members are persons or legal entities governed by public or private law, at least two of whom are local authorities.
- Two, if the members are only first-degree local authorities of island areas with a population of less than three thousand hundred inhabitants according to the latest census.

Regarding the profit EnComs, the minimum number of members is fifteen (15) with the exception of small island municipalities where the number is reduced to ten (10). At least 51% of the members must have a relation with the place where the EnCom is located and in particular, the members- persons have to own full or small ownership or profit of the property situated within the Region of the establishment of the EnCom or have to be citizens of a municipality of that region.

Legal entities governed by public law and first or second-degree local authorities may participate in more than one EnCom as members by way of derogation from paragraph 3 of Article 2 of Law 1667/1986 (Civil cooperatives and other provisions).

The Law 4513/2018 recognising the value of energy democracy foresees that:

- Each member may hold, in addition to the compulsory shares, one or more optional cooperative shares.
- Each member, regardless of the number of cooperative capital (shares) it holds, participates in the general assembly with only one vote.
- No member may exceed 20% in the participation in the cooperative capital, with the exception of local authorities that can participate with a maximum of 40% and the local authorities of island areas with a population below 3,100 inhabitants. The maximum participation in these cases is set at 50%.
- The transfer of the cooperative share to a member or to a third party shall take place only with the consent of the Management Board. The decision of the

Management Board to transfer a cooperative share shall be registered in the Energy Community Register of the General Commercial Register.

The basic characteristics of the profit and non-profit Energy Communities in Greece are summarised in the following Tables[19].

Table 1 Basic characteristics of Non-profit and Profit Energy Communities in Greece according to Law 4513/2018

	Non-Profit Energy Communities	Profit Energy Communities
Members	▪ Persons of full legal capacity ▪ Legal entities of public or private Law ▪ First degree local authorities within the same Region ▪ Second degree local authorities within the same Region	▪ Persons of full legal capacity ▪ Legal entities of public or private Law ▪ First degree local authorities within the same Region ▪ Second degree local authorities within the same Region
Minimum No of members	Five (5). Especially for local authorities: ▪ Two (2), if the members are first degree local authorities of island areas with a population of less than 3,100 inhabitants, according to the latest census. ▪ Three (3) in case the members are only local authorities. ▪ Three (3) in case that two local authorities participate in synergy with a legal entity of public or private law or a natural person. However, the synergy of one (1) LA with a legal entity under public or private law and not with a person, or at least with a particularly large number of persons, is acceptable. ▪ In case of participation of one (1) LA, the total number of members must be five (5).	▪ Fifteen (15) members, with 50% plus one of them being persons. ▪ Ten (10) members in the case of EnComs based in an island municipality with a population of less than 3,100 inhabitants, with 50% plus one of them being persons.

[19] **Source:** Heinrich-Böll-Stiftung Greece (2019): Building Energy Communities: Energy in the hands of citizens. ISBN: 978-618-81299-9-3. Thessaloniki (2019)

	Legal entities under public law, local authorities of first and second degree can participate in more than one EnComs. Legal entities under private law and persons are excluded from this provision.	Legal entities under public law, local authorities of first and second degree can participate in more than one ECS. Legal entities under private law and persons are excluded from this provision.
Activity fields	▪ Mandatory: Production, distribution, RES supply, energy efficiency, supply chain (biomass, etc.), electrical vehicles, water desalination with RES, energy services. ▪ Additional: Information – sensitization – training activities, participation in co-funded programmes, etc.	▪ Mandatory: Production, distribution, RES supply, energy efficiency, supply chain (biomass, etc.), electrical vehicles, water desalination with RES, energy services. ▪ Additional: Information – sensitization – training activities, participation in co-funded programmes, etc.

2.3.2 Financing and Supporting an Energy Community

Law 4513/2018 foresees in Article 11 a number of supporting and financing measures regarding Energy Communities in Greece, such as:

- Eligibility for inclusion in the Development Law (Law 4399/2016) applied in proportion to its provisions of this Law on Social Cooperative Enterprises (SCE) of law 4430/2016, as well as in other National or European Union funded programmes and resources.
- Exemption from the tender procedures for projects up to 6 MW for wind farms and 1 MW for PV, until the 31st of December 2021. According to Article 160 of Law 4759/2020, from January 1, 2022, every E.C. should participate in competitive processes, i.e., compete with private investors in bids to ensure operational support of RES projects. Simply put, there will be absolutely no separation between EnComs (profit and non-profit) and private investors.
- Specification of special conditions such as preferential charges and longer usage regarding the use of the services of the Last Resort Aggregator Cumulative from RES and High Efficiency Cogeneration of Heat and Power (HECHP) stations of Energy Communities.
- Special terms in the Regulation of Electricity Generation Licenses for RES, HECHP stations and hybrid stations licensed by Energy Communities.
- Exemption from the obligation to pay the annual entitlement fee holding a power generation license for RES, HECHP and Hybrid stations.

- The applications submitted by the Energy Communities for granting a production license from the Regulatory Authority of Energy (RAE) for power stations from RES, HECHP and Hybrid Stations are given priority over other applications, by way of derogation from any other general or special provision.
- Applications for grid connection offer and approval of environmental terms concerning power plants from RES, HECHP and Hybrid Stations that will operate under the responsibility of Energy Communities are prioritised over other applications.
- Installation of Virtual Net Metering RES, HECHP and Hybrid Stations of a maximum installed power limit of 1MW, by Energy Communities to cover the energy needs of their members and vulnerable consumers or citizens living below the poverty line, within the Region in which the headquarters of EnCom is located.
- Reduction of the amount of the guarantee letter for RES, HECHP and Hybrid Stations, which belong to Energy Communities, by fifty percent (50%).
- Definition as a minimum cooperative capital for the issuance of an electricity supply license by RAE, an amount equal to 60,000 euros.
- Special terms for Energy Communities - operators of electric vehicle charging infrastructures.
- Ability to set reduced amounts of guarantees for the registration of Energy Communities in the registers of participants within the DAS Transactions Contract and management of electricity networks framework, considering criteria such as the population or the demand for electricity within the EnComs region.

According the 2019 Guidebook on the establishment of viable Energy Communities, published by the Heinrich Böll Stiftung Greece[20], potential means for the funding of an Energy Community in Greece include:

Table 2 Funding schemes of Energy Communities in Greece

Funding by members	Financing by the own members ensures financial flexibility, but also independence and autonomy of a EnCom. Although it is usually impossible for members to cover all the capital required for the initial investment, international experience indicates that an effort must be made for members to cover at least a percentage between 15% and 30%.
Revenue from business activities	For EnComs that are not at the start up stage but at an advanced stage, percentage of the income from the business activities can finance new projects, new services, and new products.

[20] **Source:** Heinrich-Böll-Stiftung Greece (2019): Building Energy Communities: Energy in the hands of citizens. Page 89, Table 13. ISBN: 978-618-81299-9-3. Thessaloniki (2019)

Loan	The most common way to access funds. Great attention must be given to the interest rate and the terms of the loan. EnComs can apply, in addition to conventional banks, to cooperative banks, credit unions and ethical banks. Some additional indicative factors that play a role in a credit institution's decision on a loan application: ▪ The extent of the responsibility of the members determined by the statute of each EnCom. ▪ The possibility or not of guarantee. The possibility of understanding the business model by the credit institution (mainly concerns the conventional banks).
Grants, Donations	They can be provided by individuals, companies, charities and other types of organisations. They may be targeted at the specific EnCom or the EnCom can receive a donation for its participation in a programme e.g., joining an institution's programme to combat energy poverty. Although these funds are not always easy to find, they are usually an ideal solution to cover the costs of the initial phase (Phase of Feasibility Analysis, initial idea analysis and planning) where it is very difficult for an external investor or supporter to provide funding due to the maturity of the project.
National and European Programmes and Financing Tools	An EnCom can receive financial support directly, from national programmes, e.g., competitiveness programmes, the development Law 4399/2016, NSRF programmes, programmes for strengthening the social economy, programmes for strengthening EnComs, agricultural aid programmes, programmes related to the production and saving of energy, etc. Also, from European programmes and aid from European funds, e.g., programmes for the environment, research and innovation, competitiveness, etc.
Cooperative Funds and Funds of Energy Cooperatives	They are funds created by cooperative companies and other EnComs in Greece and abroad. These funds have the advantage of providing competitive interest rates, have a very good understanding of the operation of the model and can at the same time provide know-how that will largely guarantee the viability of the project. Expertise can be related to organisational, commercial, and technical issues. In this case too, however, it is usually required to have a business plan and the project is at a satisfactory stage of maturation. That is, to have the required permits available, a sufficient number of members, studies, etc.
Institutional Investors	These are organisations that manage very large funds deriving from the funds of insurance companies, credit organizations, investment funds, pension funds, hedge funds, mutual funds, etc. They have the potential to offer satisfactory terms and many institutional investors have a positive drive towards RES investments. Usually, they do not finance small projects individually but collect, evaluate, and group potential investment projects before making any investments.

Hybrid Sources of Indirect Financing	Each EnCom, depending on its needs, can explore different ways of indirect financial support. One such example is the free provision of energy or other energy services to a landowner in exchange for the use of his land by EnCom. Another example is the cooperation with local authorities or other organisations, e.g., a development, under which it may be agreed to provide premises (e.g., offices for the headquarters or for training of members, etc.) or land in exchange for energy and energy services.
Entrepreneurship Competitions	Entrepreneurship competitions held in Greece and abroad can provide some amount (usually small) in the form of a prize, but at the same time they can bring EnCom in contact with mentors and investors. Participation is usually free, but it often takes a long time to write the idea and submit the proposal, as each competition has different procedures, priorities, and questions to which the contestants are asked to answer.
Fintech and Financial Innovation	The application of new technologies in the banking and financial sectors is a rapidly growing source of new ideas, products and services that can facilitate transactions, reduce EnComs' operating costs, and help raise capital. Other relevant tools are platforms that allow the promotion and financing of the idea, financial solutions through cryptocurrencies, digital applications for the sale and purchase of energy, etc. Crowdfunding is also an innovative funding method that can be explored.
Recovery and Resilience Mechanism	The Recovery and Resilience Mechanism (RRF) funds mainly 'green' actions in the EU Member States. It was agreed at the July 2020 European Council to facilitate the recovery of Member States with limited fiscal space to adopt recovery measures from the economic crisis caused by the COVID-19 pandemic. In Greece, there are about 17 billion euros of the RFF grants, as well as the possibility of access to loans up to 14 billion euros.

3. CURRENT STATUS

3.1 Bulgaria

3.1.1 Statistical data on existing energy communities – cooperatives

Although Bulgaria has great potential for the formation of such communities, no such energy project has been implemented on the territory of our country yet. The current legislation lacks provisions on the establishment and functioning of energy communities. Nevertheless, the Integrated Plan in the field of energy and climate of the Republic of Bulgaria 2021–2030 encourages the promotion of local energy communities and their active participation in the energy market by prescribing the adoption of legislative measures. The European Renewable Energy Directive (REDII) has yet to be transposed, and Bulgaria should do so by 30 June 2021, defining the rights of its citizens in the field of energy. There are high hopes that this act will give an initial impetus to such public-private projects and will stimulate the creation of energy communities in the country. However, at present, it is not possible to gather and assess statistical data, as Bulgaria is still far from cooperative forms of business in the energy sector. Knowing that communism destroyed the traditional Bulgarian cooperative, reducing it to an appendage of the then Central Planning, it can be predicted that now - based on the lost memory - the energy cooperatives will not be accepted easily and unambiguously. Especially among the poorer sections of the population, for whom they would have the most tangible benefits, suspicions of "another fraud" are expected.

The main barriers and challenges that cooperatives are facing are connected to access to projects and land, the unfavourable and unstable legal framework, the lack of knowledge about the business model of the cooperative, the need to professionalise start-up cooperatives. At the moment, in Bulgaria only the homeowners' associations are acting as energy communities with the goal to achieve substantial energy savings through participation in renovation programmes. There are a just handful of examples of motivated property owners who have established owner partnerships in private multifamily buildings and have implemented solar heating and electricity generating measures. As for public-private partnerships, the sectors are electricity generation, mostly by photovoltaic systems, generation of heating energy from biomass and joint projects related to the modernization of the public infrastructure.

This situation is also reflected by the composition of the support programmes for energy efficiency and renewable energy technologies. Currently, there is no public programme in Bulgaria funding specifically the energy communities. The National Programme for Energy Efficiency of Multifamily Residential Building is however aimed at renovating multifamily residential buildings through implementation of energy efficiency measures through establishing of homeowners' associations acting as energy communities. Certain opportunities for public-private partnerships are also available under the "Regions in Growth" Operational Programme, as Energy Efficiency and Renewable Energy Programme aiming at "Increasing energy efficiency and use of renewable energy

in municipal and state buildings and local heating systems", and the similar programme for energy efficiency in the peripheral cities and regions. The "Competitiveness" Operational Programme also provided support for energy efficiency and renewable sources measures for either SMEs or large industrial enterprises, without however setting targets for engaging in PPPs. Similar programmes are expected to be set up in the next financial framework, as well as under the Recovery and Resilience Mechanism, as the hope is that the design of the programmes will follow the stated policy goal for enabling and strengthening energy cooperatives.

Furthermore, there are some public-private partnerships (PPP) between municipalities and energy suppliers. We can look for example at one of the public kindergartens in the city of Pazardzhik (see below), or by "Energo-Pro", another energy supplier, who invested in the renovation of the street lighting of Dobrich municipality on one of the main boulevards in the city, and the whole street lighting system in Opaka municipality.

3.1.2 RES technologies adopted

Bulgaria is a small country, but with diverse topography, geographically location and climate, which favours the formation and the availability of significant stocks of RES. At present in Bulgaria the potential of solid biomass is most fully used, mainly as a fuel for heating in households and public buildings, as well as hydropower through hydropower plants. The production of electricity from wind and solar power plants is developing rapidly, as well as the use of solar energy to meet the needs for domestic hot water.

Although Bulgaria has suitable climatic conditions for the development of the renewable energy sector, there are some objective restrictions related to certain areas where facilities for the production of energy from renewable energy sources cannot be installed e.g., the territories that fall within the scope of "Natura 2000" - a network of protected areas covering around 34% of the country's territory.

In recent years, the consumption of energy from renewable energy has increased significantly, reaching in 2018 a share of 20.53%[21] in the gross final energy consumption in the country, which exceeds the mandatory national target for renewable energy in the National Action Plan - 16% by 2020.

3.1.2.1 Solar

In recent years, solar technology has greatly improved and has enjoyed high popularity and social acceptance, thanks to its modularity and adaptability. It is one of the cleanest and environmentally friendly ways of producing energy. Bulgaria has optimum climatic conditions: great solar activity March - October> 7 kWh / m2 per day and duration of solar lighting> 14 h / day, so the technological possibilities for the utilisation of solar power in this country cannot be neglected. Bulgaria is located at the upper border of the

[21] **Source:** According to SHARES tool 2018, Eurostat

so-called "solar belt" of the world. As a result of the total annual solar intensity in the capital of this Country, Sofia, is equivalent to the solar intensity of Madrid, Spain, and similar to those in Athens, Greece, and in Sicily, Italy.

Thus, the potential for solar energy is very high, mainly due to the favourable conditions of location, high efficiency, lower costs, and availability of various technical solutions. All of this makes the technology very attractive for small investors – individuals and energy communities.

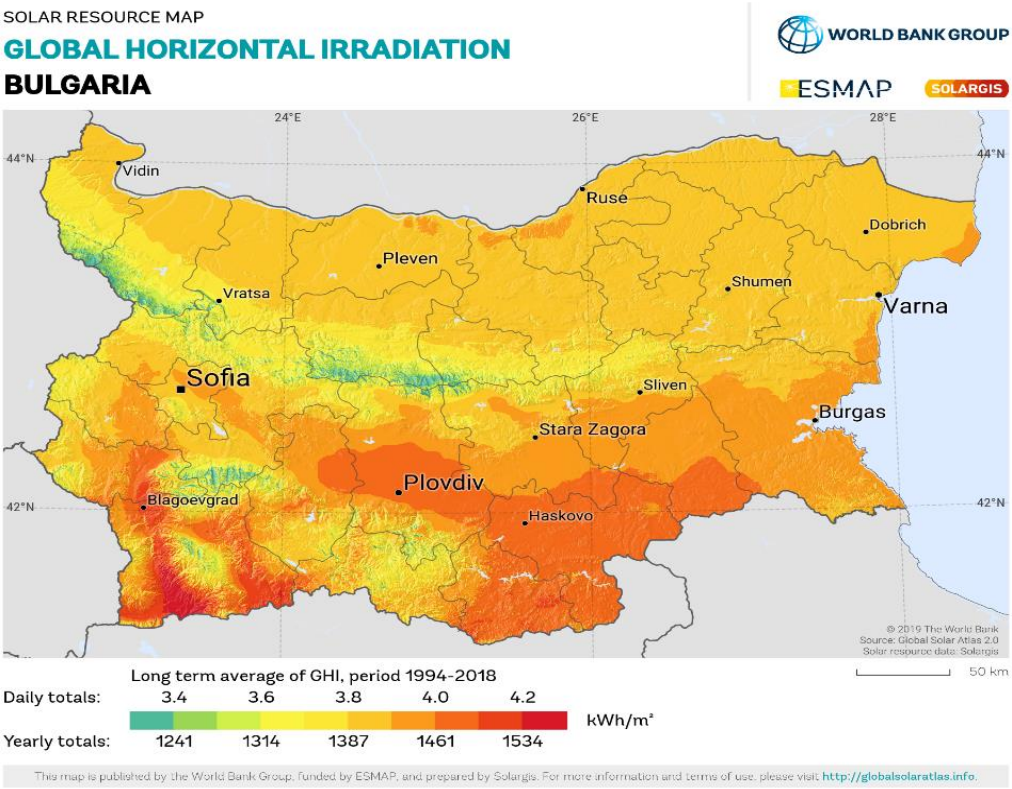

Figure 2 Solar Irradiation map of Bulgaria[22]

At present, the legal framework lags far behind the growing number of smaller decentralised energy market participants such as households and small businesses. However, there are some good examples of RES investments made by energy service companies such as “EVN Bulgaria”, “CEZ”, “ENERGO-PRO”. One of the examples is in the public kindergarten “Valentina Tereshkova” in the city of Pazardzhik where “EVN Bulgaria” installed a photovoltaic power plant, for production of electricity for own needs and generation of excess energy in the network with installed capacity: 29.76 kW and is worth BGN 44,777. It consists of 96 photovoltaic modules installed on the roof of the building. The estimated amount of electricity produced is 37,05 MWh per year. The

[22] **Source:** The World Bank, Global Solar Atlas 2.0, Solar resource data: Solargis

excess energy will be purchased by "EVN Bulgaria" according to a contract signed with the Municipality of Pazardzhik for a period of 20 years.

3.1.2.2 Wind

Wind energy production is attractive for several reasons - it is abundant, cheap, virtually inexhaustible source of energy, does not lead to pollution and climatic anomalies. In short, it has qualities that none of the traditional energy sources for electricity production can boast. Operating costs, or more precisely the lack of fuel, in energy production, make wind, as an energy source, particularly attractive to investors.

In Bulgaria there is also a potential for building wind farms in the coastal strip and in places over 1000 meters in altitude. Future development in suitable mountain areas and those at lower wind speeds depends on the application of new technical solutions. The operation of the turbine depends on the speed and turbulence of the wind, the height of the tower and the density of the air, so it is important to know the potential in the selected region of the country and the conditions under which it was obtained.

In general, the wind energy potential of Bulgaria is not great. It is estimated that an area of about 1,400 km2 has an average annual wind speed of over 6.5 m / s, which is in fact a threshold for the economic feasibility of a wind energy project. Therefore, the areas where it is most appropriate to develop such a project are only some areas in the mountainous areas and the northern coast (Figure 3).

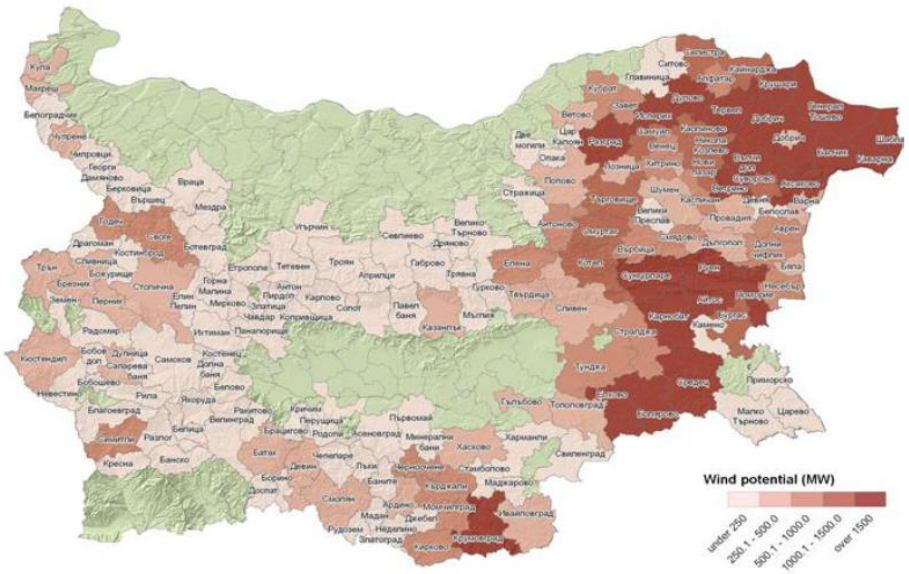

Figure 3 Wind potential on municipal level in Bulgaria[23]

[23] **Source:** EnviroGRIDS: https://www.slideshare.net/envirogrids-blacksee/d56-assessment-of-the-wind-and-solar-energy-potential-and-improved-policy-for-their-promotion

3.1.2.3 Hydropower

The cheapest electricity is obtained in hydropower plants, as they use the cheapest raw material. These plants are environmentally friendly, but their construction is expensive. The country has limited hydropower resources - only 26 billion kWh. However, in recent years, the construction of hydroelectric power plants in Bulgaria has undergone a rapid development. Renewable energy sources are a priority of the energy policy not only in Bulgaria but throughout the European Union as well. The production of energy utilising the power of the water brings undoubted benefits for the whole country, because it creates a gross domestic product that does not require import of resources, increases energy independence, etc. However, it is critical that the energy production of this type must comply with the environmental standards guaranteeing the environmental objectives set to save the life in, along and around the rivers.

The statistics show that there are currently about 247 hydroelectric power plants (see Figure 4) operating in Bulgaria, not counting the plants under the big dams, most of which are constructed more than 40 years ago. Another nearly 250 HPP investment plans are at a different stage of progress and have already received Water permits for use of a surface water body from the River Basin Directorates. Some of these are in the middle of construction, but most are in a stage of searching for finances.

Most hydropower plants are on running water, as they require less capital investment. HPPs on dam walls are few in number, but most of the capacity is concentrated in them. The most powerful are hydropower plants on the Arda River - "Ivaylovgrad", "Studen Kladenets", "Kardzhali" - with over 100 MW of power each. Varieties of HPPs are Pumped-storage power plants (PSPP). In them, the water from the lower water basin is pumped to the upper basin for reuse in the peak moments of electricity consumption. Such power plants are "Chaira", "Kalin-Karagyol", "Belmeken".

For 2015 the available data shows that 10.68%[24] of the electricity in the country is produced by HPPs. The leading place of hydropower in the overall energy mix of the country is due to the significant advantages of hydropower plants.

[24] **Source:** https://hidro-energia.org/wp-content/uploads/2017/10/doklad_2017.pdf

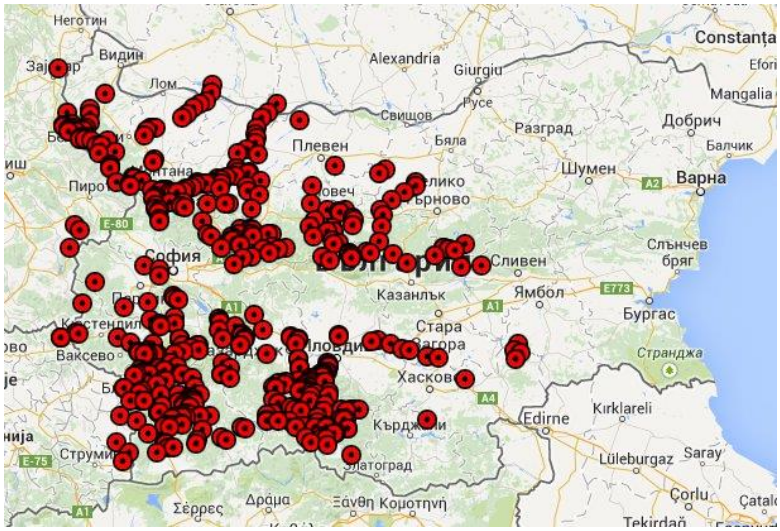

Figure 4 Map of existing and potential HPPs in Bulgaria[25]

3.1.2.4 Biomass

The potential of the biomass in Bulgaria is a question with present interest during the last ten years. In the EU pre-accession period, Bulgaria has undertaken different legislative and practical activities for the implementation of the obligations concerning the decisions of the UN and EU for the sustainable improvement of the common environmental condition. Biomass can be classified based on its origin. Thus, the following main categories of biomass are recognised: fuel wood, removal biomass, unutilised biomass, and energy cultures. Possible methods for converting biomass into energy include direct combustion with heat recovery, gasification or pyrolysis (which produces fuel gas) and rapid pyrolysis (which produces a liquid fuel product).

In the period 2017 - 2018 there is an increase in the installed capacity for the production of electricity from biomass (transition of existing power plants to conventional biomass fuels), which in 2018 reached 195 MW. Compared to 2017, the installed capacity of this type of power plants has increased almost 4 times.

One example of a project involving the use of biomass as a renewable energy source for heating has been implemented with funding from the European Regional Development Fund for the refurbishment of the community centre "Zemedelets - 1899" in the village of Kozarevets - a building with 111 years of history, has achieved its goal of becoming the most modern and affordable building of the cultural infrastructure of the municipality of Lyaskovets. The project included repair works on all the facades and roof, replacement of electrical and plumbing installations, the construction of a new ventilation system, the construction of an information centre, a hall for ethnographic exposition, a design of a reading room, a rehearsal hall, a conference hall, and repair of a theatre hall. The project also implemented a series of energy efficiency measures

[25] **Source:** https://dams.reki.bg/Dams/About

which included the installation of PVC windows, thermal insulation, construction of a local heating system operating with a renewable energy source - biomass, with additional separation of functional areas for heating according to the intensity of use. The biomass (residue from the sunflower processing) is provided by a nearby private industrial facility at no cost for the municipality.

3.1.2.5 Geothermal energy

Deep below the Earth's surface, a huge amount of heat, known as geothermal energy, is constantly being generated and accumulated. It is believed in the scientific community that this energy source has the potential to exist for billions of years with regular use of its thermal energy. For this reason, geothermal energy is considered as a renewable energy source. However, it does not have the periodic or random nature of occurrence, as in solar and wind energy. The most common method for utilisation of geothermal energy is aimed at mastering the places of natural release of geothermal energy in the form of thermal springs - hydrothermal sources.

Bulgaria is rich in low-potential geothermal deposits. There are over 840 studied localities with temperatures up to 103°C in about 140 sites (see Figure 5). A total of 136 hot mineral springs with different flow and temperature are registered in the country. A characteristic feature of our thermal waters is that they are weakly mineralised, with low flow rate (0.5 l / s - 478 l / s) and low temperature (from 20 ° C to 101.4 ° C).

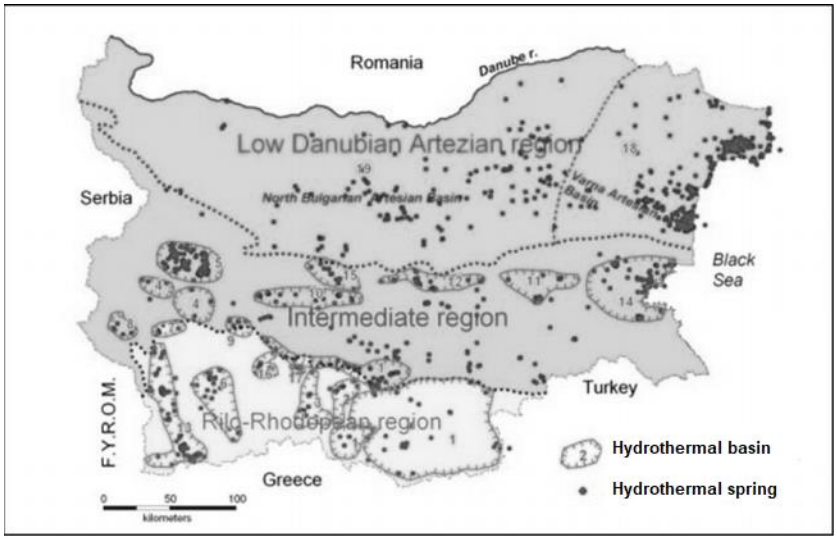

Figure 5 Location of hydrothermal resources on the territory of Bulgaria[26]

Bulgaria does not utilise well its own energy resources in the field of geothermal energy. The hydro-geothermal potential in the country, unfortunately, is currently used very little and inefficiently. There are about a hundred separate thermal aquifer systems at a depth between 500 and 3500 meters that have been studied in Bulgaria. Their total area is

[26] **Source:** https://inis.iaea.org/collection/NCLCollectionStore/_Public/47/017/47017674.pdf

about 50,000 square kilometres, and many of them are located in the northern plains' regions of the country. This is a serious prerequisite for the development of agricultural greenhouse products.

The total amount of water that can be used technologically in the country has a flow rate of 15-20 cubic meters per second. Currently, the flow rate of these sources used in the country is not more than 3 cubic meters per second. The heat received from all geothermal sources has a total capacity between 1500 and 2000 MW. This energy is applicable in local heating, air conditioning and domestic hot water systems.

3.2 Czech Republic

3.2.1 Statistical data on existing energy communities – cooperatives

Projects related to energy communities arise so far only as an exception in the Czech Republic. There are few cases of operating sites that could have fit some parameters of the energy communities, such as producing and consuming the energy locally, however, at the same time they are not energy communities per se. Therefore, summary data on operation of energy communities are unavailable in the country.

There are though some secondary or indirect sources. The Czech Energy Regulatory Office has a public database of all entities that have been granted a license for the production, distribution and sale of electricity, natural gas, and heat. These are, however, built on so called "purchasing areas" that do not correspond entirely with legal persons or energy producers. On top of these central data, only ad hoc enquiries can be obtained directly from the communities after they commence the operation.

3.2.2 RES technologies adopted

3.2.2.1 Electricity Generation

According to two separate studies, a study by the Behavio agency for the Association of Modern Energy and a study by Focus, Marketing & Social Research[27], solar and wind power are the sources of renewable energy that are mostly preferred for the application in the Czech Republic. Most respondents consider a municipal power plant to be the most favourable and efficient model of RES application.

Use of **solar** radiation to gain energy is the cleanest and environmentally friendly way of its production. However, an efficient solar system for heating and hot water generation has not been a cheap affair for a long time. The high price of materials in combination

[27] **Source:** https://hnutiduha.cz/sites/default/files/publikace/2020/06/vytahnute_uhli_focus_pro_hnuti_duha_energie_2020.pdf

with still relatively cheap energy makes the return on such solar systems still problematic even today.

At the same time, technical solutions for the use of solar energy to produce electricity are already available at a quite high level. The efficiency of the conversion of solar radiation into electricity makes it possible to obtain, with current solar systems, up to 110 kWh of electricity per year from one meter of active area.[28] With application in remote locations without connection to the power grid, photovoltaics is a technically and economically more advantageous solution compared to existing conventional sources. All of this makes the technology very attractive for small investors – individuals and energy communities. Besides, in power plants on buildings, it is often possible to consume the electricity produced immediately. It brings savings on electricity that the community would have to buy from the grid. If the consumption in the building is not high enough, the surplus can be sold to the network.

Electricity generation seems to be the most attractive sector for the energy communities, especially its generation with the use of solar energy. Availability of technical solutions for photovoltaic power plants, combined with economic benefits, is especially appreciated in this case. Yields in the sector are not low, as a rule, around 5 to 10%, which is higher than by most other technologies.[29] The main reason for this was until recently the guaranteed redemption price and the redemption period. Now, it is possible to receive support in the form of green bonuses for the local self-consumption. In case of a wind or biogas power plant with an output of several kilowatts (which could be used to supply a community with energy), it is quite a lot time- and resources consuming to adopt. Compared to this, putting several solar panels on the roof is more favourable both technically and financially.

Table 3 Photovoltaic plants in 2019 (Source: ERO)

	Total installed capacity [MWe]	Net electricity generation [MWh]
Photovoltaic plants (PV)	**2,061.4**	**2,265,464.1**
Up to 10 kW inclusive	94.7	97,385.1
Over 10 kW to 30 kW inclusive	148.5	146,973.7

[28] **Source:** https://biom.cz/upload/6e01d6d4c4835ec93cda508772f3bf6e/oze_ekonomika.pdf
[29] **Source:** https://biom.cz/upload/6e01d6d4c4835ec93cda508772f3bf6e/oze_ekonomika.pdf

Over 30 kW to 100 kW inclusive	55.9	54,595.5
Over 100 kW to 1 MW inclusive	455.7	496,363.9
Over 1 MW to 5 MW inclusive	980.5	1,103,004.6
Over 5 MW	326.2	367,141.3

As for the **wind energy**, earlier analyses[30] have shown that the production of electricity from wind sources for the needs of a small community or small enterprise that can be connected to the distribution network is unprofitable. Economically it is justifiable only in places without the possibility of connection to the grid, with an average annual wind speed of at least 4,5 - 5 m/s at a height of 10 m. Production of electricity by small wind farms for sale to distributors due to significantly higher specific costs is not efficient as well.

Besides, the number of localities in the Czech Republic is also limited by the conditions of nature protection, there is often frequent resistance from local residents or regional authorities, and it is necessary to comply with various technical and legal regulations. These facts complicate the adoption of this technology by small communities.

The most advantageous and a larger part of **hydropower** potential is already used in the Czech Republic. It can also be said that there is still some hydro potential awaiting to be used, but its technical parameters are already significantly less advantageous for implementation. These are locations with low gradients, in better case from 2 to 5 m and with extremely low gradients up to 2 m.

Locations with higher gradients will be very rarely available, mainly in water supply facilities, where, however, legislative, and ecological conditions will be more difficult for implementation.

[30] **Source:** https://www.cez.cz/edee/content/file/vzdelavani/obnovitelne_zdoje_energie_a_moznosti_jejich_vyuziti_pro_cr.pdf

5.10 Development of gross electricity generation from renewable energy sources 2019

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Total RES [MWh]	**5,886,915**	**7,247,504**	**8,055,026**	**9,243,382**	**9,176,705**	**9,423,838**	**9,397,625**	**9,621,166**	**9,405,351**	**10,024,602**
Small hydroelectric power stations up to 10 MW	1,238,819	1,017,878	1,026,254	1,236,978	1,011,674	1,001,797	1,053,100	1,062,479	873,649	1,023,025
Hydroelectric power stations over 10 MW	1,550,655	945,276	1,102,912	1,497,762	897,549	793,010	947,388	806,985	753,701	985,004
Wind power plants	335,493	397,003	415,817	480,519	476,544	572,612	496,957	591,038	609,330	700,014
Photovoltaic	615,702	2,182,018	2,148,624	2,032,654	2,122,869	2,263,846	2,131,455	2,193,368	2,339,677	2,285,904
Biogas	598,755	932,576	1,472,142	2,241,300	2,573,522	2,614,813	2,601,270	2,639,441	2,607,921	2,527,072
Biomass	1,511,911	1,682,563	1,802,591	1,670,327	2,007,212	2,091,119	2,068,893	2,213,616	2,120,862	2,398,734
BDMW	35,580	90,190	86,686	83,842	87,335	86,642	98,561	114,238	100,210	104,849

Data sources: previous yearly reports, ERÚ-E1 report form, OTE, a.s. since 2013)

National gross consumption [MWh]	70,961,700	70,516,541	70,453,278	70,177,356	69,622,096	71,014,254	72,418,279	73,818,342	73,940,764	73,931,040
Share of RES [%] *)	**8.30%**	**10.28%**	**11.43%**	**13.17%**	**13.18%**	**13.27%**	**12.98%**	**13.03%**	**12.72%**	**13.56%**

**) simple ratio of gross electricity generation from RES and total national gross electricity consumption*

Data sources: previous yearly reports, ERÚ-E1, ERÚ-E2 and ERÚ-E3 report forms, OTE, a.s.

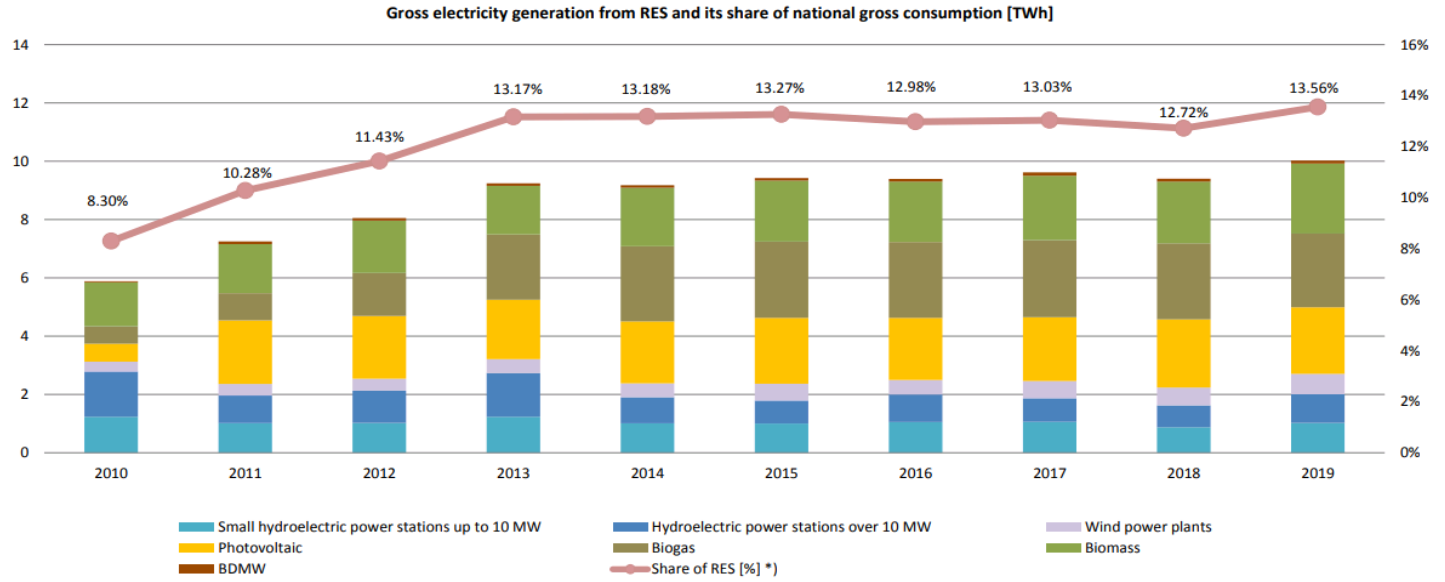

Figure 6 Development of gross electricity generation from renewable energy sources (Source: ERO)

3.2.2.2 Distribution - Supply

In the Czech Republic the ownership of the regional electrical grid is divided between three regional distributors - ČEZ Distribuce a.s., E.ON Distribuce a.s. and PRE Distribuce a.s., (Figure 7) which are business corporations, and operators of local distribution systems, i.e. private companies that own part of the network, for example in industrial areas or shopping centres. The existing legislation does not prevent the purchase or sale of part of the distribution system. However, it is a big question if the owner will be interested in disposing an asset that brings a rather high return, which is generated by the operation of the distribution system. It is definitely a high effort for a community to acquire an existing local distribution system, as well as to build a new system, owned by the community. Otherwise, it is not possible to use the benefits of local energy generation. Once electricity is sold to the owner of the grid, it is delivered to all the consumers at the same price.

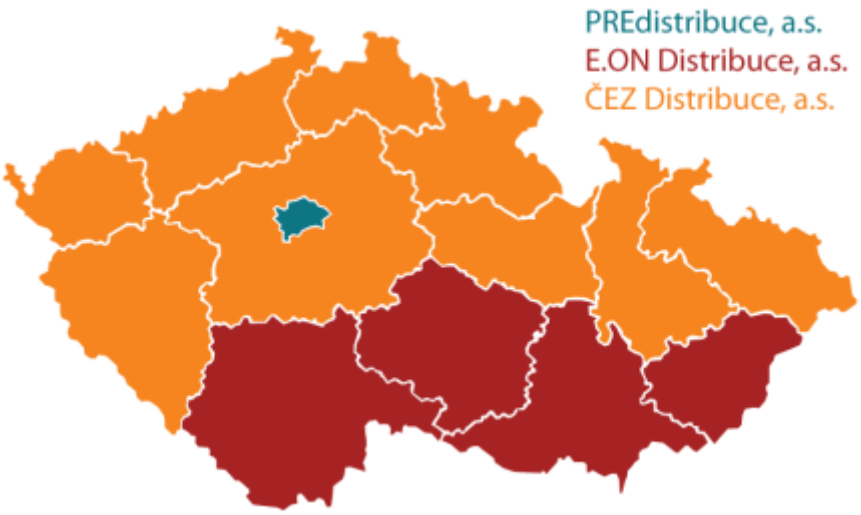

Figure 7 Distribution grid owners in the Czech Republic (Source: tzb-info.cz)

3.2.2.3 Energy Saving Services

The Czech Republic has a very developed market for projects implemented by using the Energy Performance Contracting (EPC) method. Energy saving measures are implemented by Energy Service Companies (ESCOs), which are part of the Association of Energy Service Providers (APES) of the Czech Republic.

3.2.2.4 Heat

Biomass and biogas technology can be adopted by a community for the heat generation. Due to rising fuel prices, biomass is often used as a solution for modernisation of heating facilities - the input fuel, in case it is available from local sources, is usually cheap, which should lead to a substantial reduction in operating costs. It is important to choose the right type of the biomass. It is therefore desirable to carry out a high-quality feasibility study which, among other things, will determine the potential of the available biomass species at the point of consumption. In smaller municipalities with loosely build-up areas of family houses, the construction of a central heat source would be uneconomical due to the need for a long heat distribution network. Besides, biomass can be burned well in individual boilers or stoves. The decision to adopt the technology has to be analysed well on the individual basis.

In case of intention to build a new biogas plant, it is useful to thoroughly determine the potential of available biomass. The use of biogas technology makes good sense if the plant will dispose food waste or residues from slaughterhouses or other biological wastes. Possibility to dispose bio-waste sorted from municipal waste also looks advantageous, both environmentally and economically - payments for disposing can be then an income of the community. For many current biogas plants, the decisive factor is the sale of electricity generated from renewable source due to the guarantee of the purchase price. Project preparation, permitting procedure and the actual construction

of a biogas plant, however, takes several years, which creates certain barrios for the adoption of technology.

3.2.2.5 Energy Storage

The development of electricity storage facilities in the Czech Republic has great potential. Battery and other energy storage contribute to the stabilisation of the distribution network in the case of the connection of a significant amount of renewable energy sources with uneven energy production.

3.2.2.6 Transport & Mobility

Electromobility will also be a growth sector in the coming years, again mainly due to investment support for the acquisition of new vehicles with alternative propulsion. Another impetus for the development of electromobility will be the gradually expanding network of fast charging stations throughout the country, for the establishment of which the ČEZ Group and E.ON have received investment support from European programmes.

3.3 Greece

3.3.1 Statistical Data on existing energy communities – cooperatives

The EnComs began to multiply in Greece after the enactment of Law 4513/18. In the following two years after the enactment, the number of EnComs followed an upward trend, involving thousands of citizens in the logic of "self-organisation" and "self-production" of electricity utilising RES.

Recently, Greenpeace, Electra Energy Cooperative and NTUA SmartRue conducted a research about the existing EnComs in Greece and more specifically, they designed an online dynamic map in which the name, title, registration, date, activity status, and address details, i.e., region, and postal code, of each EnCom are presented.

3.3.1.1 General Characteristics

According to the information extracted from the GCR business registry, the research[31] showed that there are currently 409 EnComs in the country. However, for the 26 EnComs out of 409 no information relating their location was found and they are not included on the map.

[31] **Source:** Greenpeace Greece, Electra Energy Cooperative, NTUA SmartRue (2020): Mapping of Energy Communities in Greece, pages 8-9. Reference No HP1AB-00256. Athens (2020), https://www.greenpeace.org/static/planet4-greece-stateless/184045bd-mapping_of_energy_communities_v1.2.pdf

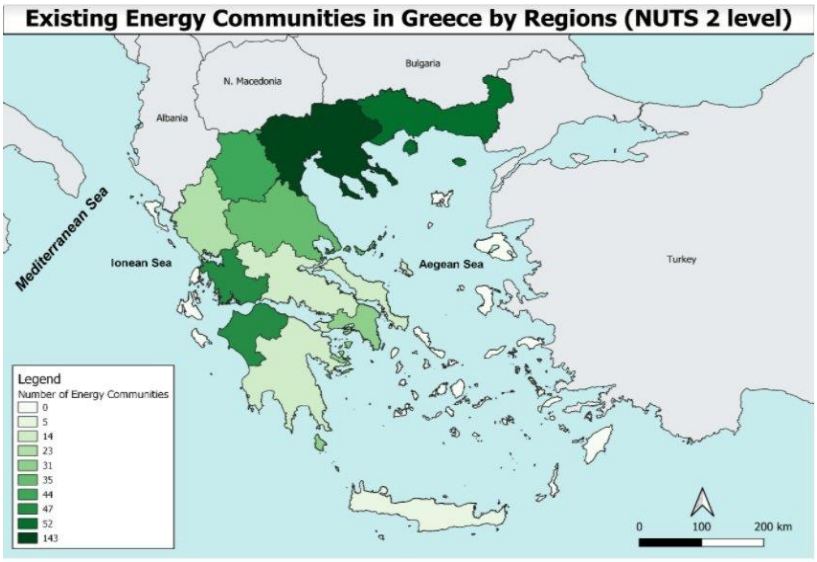

Figure 8 Existing EnComs in Greece by Regions[32]

Based on the geographical distribution, it is apparent that EnComs are developed predominantly in the mainland. Given that Law 4513/2018, gave significant importance to island Greece, considering that the EnComs will enhance the energy self-sufficiency and security of the island regions and municipalities in Greece, it is perceived that the EnComs do not develop on the island but on the mainland.

Moreover, there is greater concentration in large urban centres and in rural areas, which, most of them, are concentrated in the north than in the south parts of the country. Specifically, as the map presents, the region where most EnComs are stationed is Central Macedonia, with 143 EnComs, whereas the region with the least EnComs is Crete (5 active EnComs).

[32] **Source:** Greenpeace Greece, Electra Energy Cooperative, NTUA SmartRue (2020): Mapping of Energy Communities in Greece, pages 10. Reference No HP1AB-00256. Athens (2020), https://www.greenpeace.org/static/planet4-greece-stateless/184045bd-mapping_of_energy_communities_v1.2.pdf

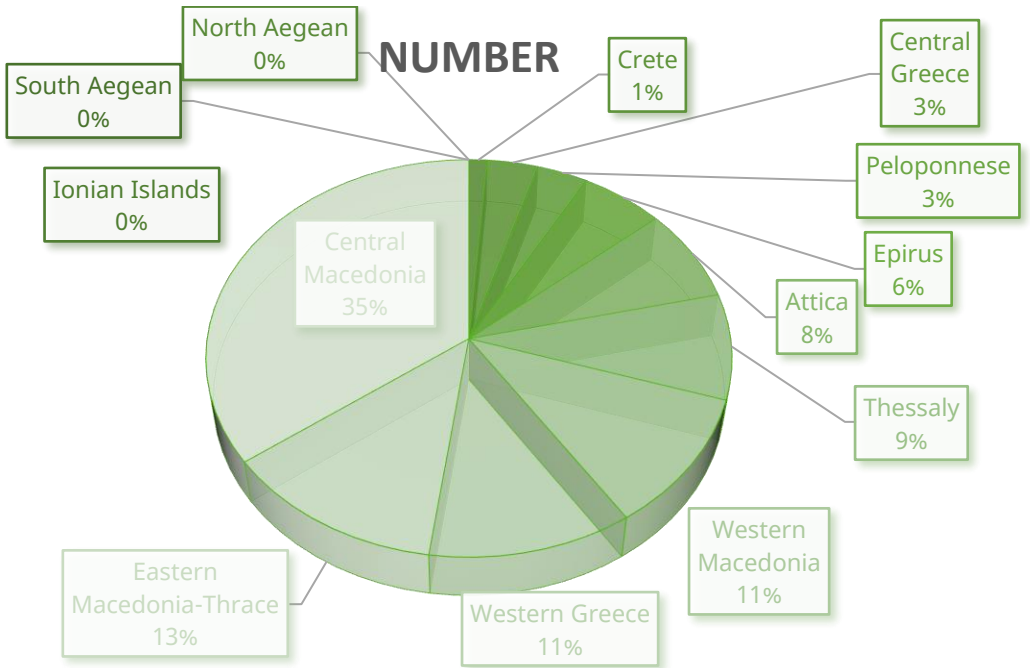

Figure 9 Regional distribution of EnComs in Greece

3.3.1.2 Registration Period, Cooperative Capital, Gender Balance and Leadership

By classifying EnComs by the date of registry, it appears that most EnComs were registered in the second semester of 2019. Although the Law 4513/18 was first introduced in January of 2018, the research suggested that only 6% of them were established in 2018. Besides, for 29 EnComs out of a total of 409, the registration date was not accessible[33].

[33] **Source:** Greenpeace Greece, Electra Energy Cooperative, NTUA SmartRue (2020): Mapping of Energy Communities in Greece, pages 10-11. Reference No HP1AB-00256. Athens (2020), https://www.greenpeace.org/static/planet4-greece-stateless/184045bd-mapping_of_energy_communities_v1.2.pdf

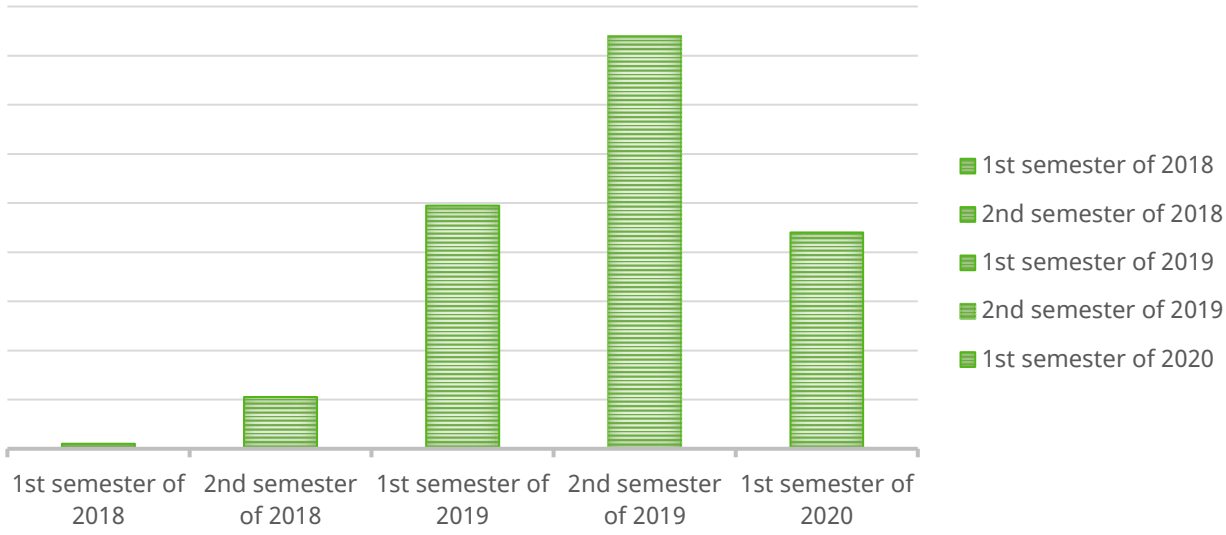

Figure 10 Registered EnComs per chronological period.

On the subject of the cooperative capital, most EnComs invested less than 10.000€, 35% of them invested a capital of 10.000-100.000€ and 4% of them over 100.000€[34].

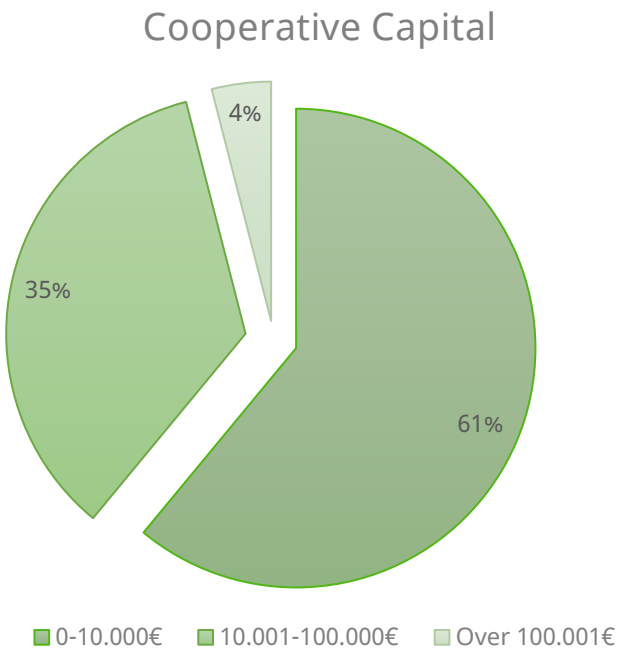

Figure 11 Cooperative capital

[34] **Source:** Greenpeace Greece, Electra Energy Cooperative, NTUA SmartRue (2020): Mapping of Energy Communities in Greece, pages 12-13. Reference No HP1AB-00256. Athens (2020), https://www.greenpeace.org/static/planet4-greece-stateless/184045bd-mapping_of_energy_communities_v1.2.pdf

Regarding the presence of women in the Board of Directors (BoD) of the EnComs, it was uncovered that there is scarcity of female representation, based on the information collected from 329 EnComs out of 409 in total[35].

More specifically, as shown in Figure12, most of the EnComs do not occupy a female member, as 93% of EnComs have less than 2 women participating in the BoD. Additionally, just 1% of the total EnCom have 4 or 5 women in their BoD.

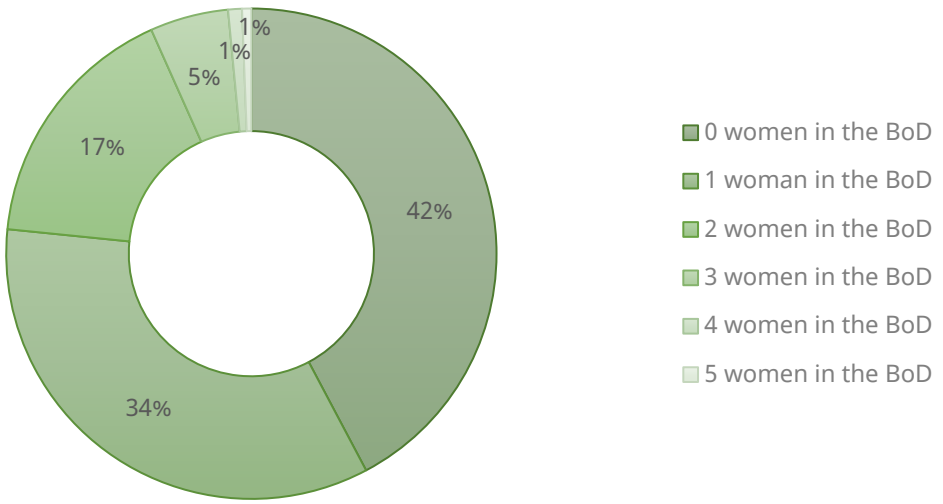

Figure 12 Number of women in BoD

[35] **Source:** Greenpeace Greece, Electra Energy Cooperative, NTUA SmartRue (2020): Mapping of Energy Communities in Greece, pages 13-14. Reference No HP1AB-00256. Athens (2020)
https://www.greenpeace.org/static/planet4-greece-stateless/184045bd-mapping_of_energy_communities_v1.2.pdf

3.3.2 RES technologies adopted

Greece has considerable RES potential, which can make a significant contribution to the environmentally compatible restructuring of the country's energy system. This potential consists mainly of solar, wind and geothermal energy, hydroelectric energy on land (hydraulic energy) coupled by the sea (wave-tidal energy), and biomass. Consequently, the fact that the available energy saving potential in the domestic sector, in the transport sector, etc. should not be overlooked. According to the Monthly Bulletin of the Special Res & HECHP Account for November 2020 from the Renewable Energy Sources Operator & Guarantees of Origin (DAPEEP SA)[36], the installed capacity of each RES and their annual generation is continuously increasing, as it is presented below.

Table 4 Installed Capacity (MW) & Energy Generation (GWh) in 2020

Month	Wind		PV		PV on Roofs		Hydroelectric Plants		Biofuels-Biogas		Hybrid/ RES		HECHP & Distributed HECHP		Total	
	MW	GWh	MW	GWh	MW	GWh	MW	GWh	MW	GWh	MW	GWh	MW	GWh	MW	GWh
January	3.621,50	786,10	2.437,90	225,40	375,20	32,60	241,30	51,70	89,40	32,40	2,95	1,02	233,40	106,00	7.001,70	1.235,20
February	3.700,70	805,60	2.452,40	259,10	375,30	24,50	232,90	46,90	89,90	33,60	2,95	0,30	237,40	92,10	7.091,50	1.262,00
March	3.832,60	819,30	2.465,70	307,50	375,30	25,50	232,90	66,20	89,90	38,40	2,95	0,46	237,40	94,80	7.236,80	1.352,10
April	3.832,60	773,30	2.484,20	337,10	375,30	31,40	233,50	76,90	89,90	35,80	2,95	0,35	237,40	88,40	7.255,80	1.343,30
May	3.875,60	557,70	2.511,80	399,70	375,10	44,20	233,50	50,10	89,90	36,10	2,95	0,10	237,40	89,20	7.326,10	1.177,20
June	3.897,87	534,71	2.528,37	412,94	375,30	42,09	242,17	37,09	89,89	32,95	2,95	0,08	237,37	81,09	7.373,92	1.140,95
July	3.934,65	828,68	2.558,21	444,54	375,34	49,51	243,33	33,23	95,91	31,88	2,95	0,13	234,65	83,35	7.445,04	1.471,32
August	3.993,45	642,20	2.620,09	427,74	375,34	57,67	243,33	31,45	95,91	34,43	2,95	0,18	234,65	82,45	7.565,72	1.276,12
September	4.018,25	1.001,39	2.669,53	366,55	375,34	60,57	243,33	28,39	95,91	36,14	2,95	0,13	234,65	87,83	7.639,95	1.581,01
October	4.036,25	611,75	2.739,01	329,82	375,34	47,59	243,33	33,63	96,41	36,36	2,95	0,11	234,65	96,65	7.727,94	1.155,91
November	4.064,25	996,58	2.832,18	227,85	375,34	42,08	243,33	22,33	96,41	39,89	2,95	0,20	234,65	103,24	7.849,10	1.432,18
Total	**4.064,00**	**8.357,00**	**2.832,00**	**3.738,00**	**375,00**	**458,00**	**243,00**	**478,00**	96,00	388,00	2,95	3,05	235,00	1.005,00	7.849,00	14.427,00

[36] **Source:** Monthly Bulletin of the Special Res & HECHP Account for November 2020, The Renewable Energy Sources Operator & Guarantees of Origin (DAPEEP SA), page 11, https://www.dapeep.gr/wp-content/uploads/ELAPE/2020/07_NOV_2020_DELTIO_ELAPE_v1.0_01.02.2021_d.pdf?_t=1612280977

More specifically, as is shown at Figure 13, wind power accounts for more than half of the installed capacity of RES. Additionally, a more than a third of the capacity is generated from PV systems, excluding PV on roofs. The latter constitute 5% of the total figure.

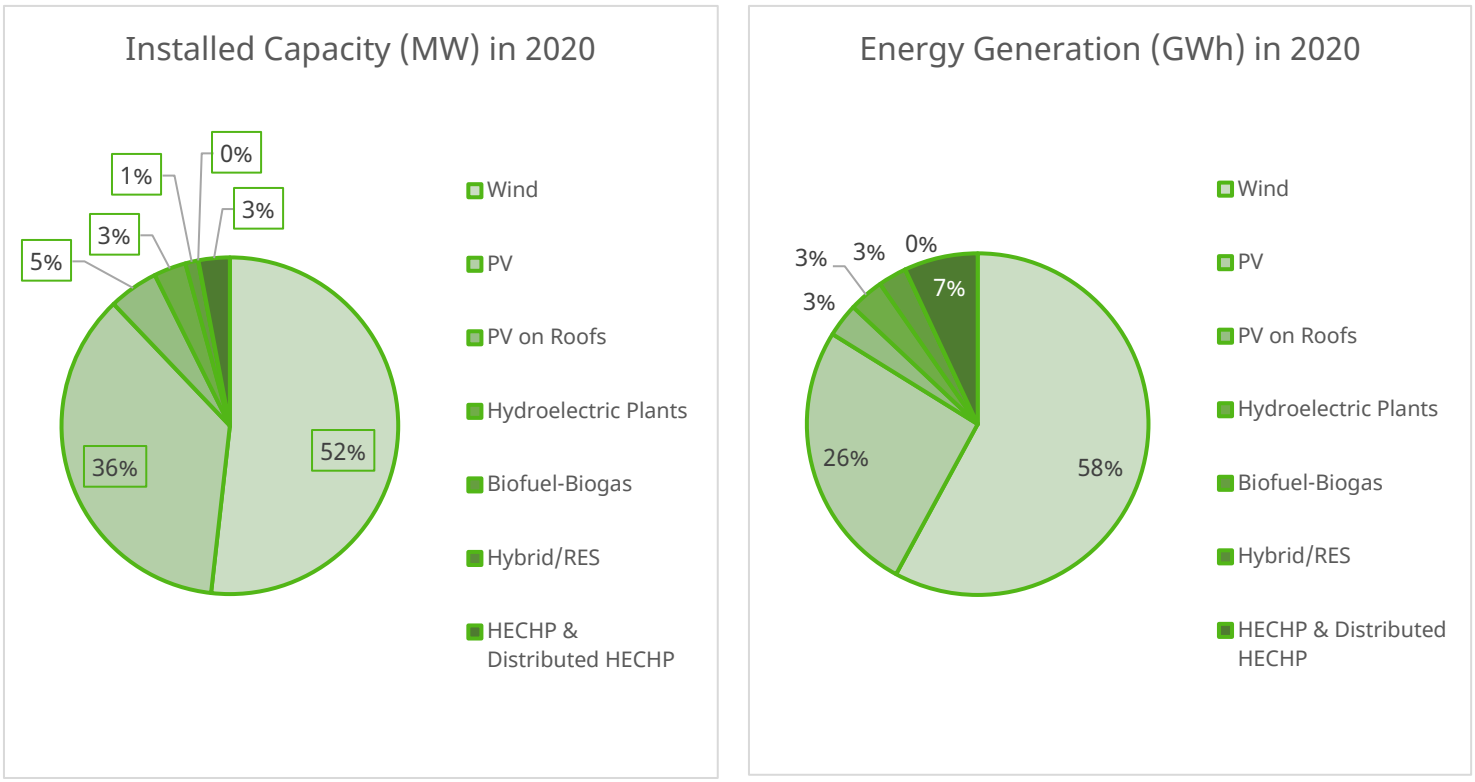

Figure 13 Percentage Share of Installed Capacity (MW) & Energy Generation (GWh) in 2020

The development of local energy projects can be facilitated through the co-operation of the local academic community, through the engagement of local professionals and via the incorporation of economic knowledge into the local planning process. The collaboration promotes the development of these projects more feasibly and efficiently, while considering the local demands and energy resource constraints. Furthermore, the knowledge obtained from the activities in the planning process can also be used to develop further local co-operation or co-production, with the involvement of local communities.

3.3.2.1 Solar

Solar technology has a considerable adaptability to all kinds of environments, thanks to its modularity. It has remarkable flexibility on urban and architectural designs and integrations, is undemanding to install and requires effortless maintenance. In addition, it presents an important reduction of all its costs, has been the touchstone of regular net-metring development first and self-consumption in recent years as well as it enjoys outstanding popularity and social acceptance.

In Greece, the amount of solar energy in its present state is equivalent to about 36% of the total RES production, according to the Monthly Bulletin of the Special Res & HECHP Account for November 2020 from the Renewable Energy Sources Operator & Guarantees of Origin (DAPEEP SA)[37]. This is not a negligible percentage considering that this proportion is going to increase in the coming years.

Furthermore, the potential for solar energy is very high, mainly due to the favourable conditions of this location (high solar irradiation and temperature), the high amount of sunshine (greater than 6 hours per day) and the country's proximity to the Mediterranean Sea.

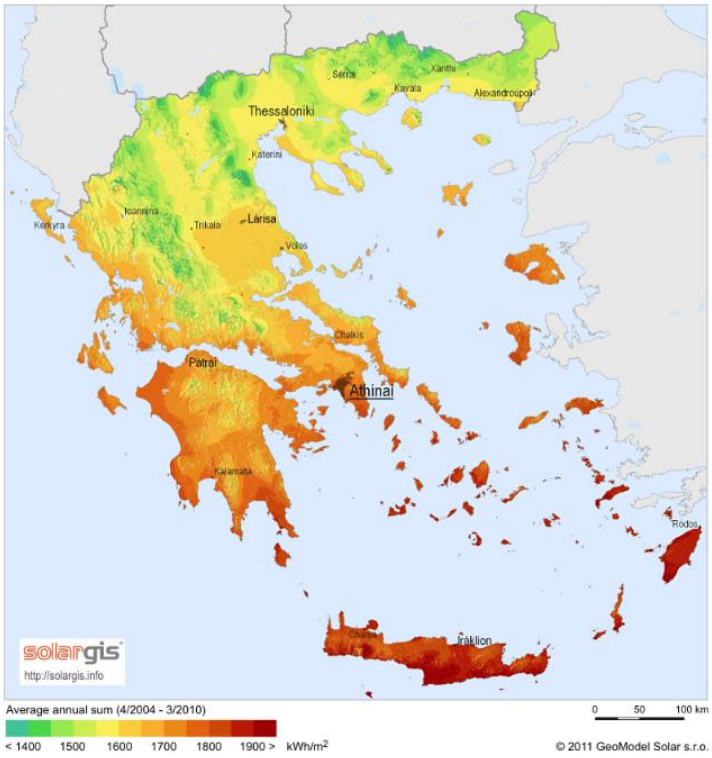

Figure 14 Solar irradiation map of Greece

Therefore, the exploitation of solar energy can be a viable choice of energy production, especially in areas with very high solar potential (e.g., Crete, Peloponnese, Aegean islands). As a matter of fact, the share of RES' generation in the total electricity generation of the 29-autonomous non-interconnected islands was 16,77% in 2019[38], a percentage which shows great prospects for growth.

[37] **Source:** Monthly Bulletin of the Special Res & HECHP Account for November 2020, The Renewable Energy Sources Operator & Guarantees of Origin (DAPEEP SA), page 11, https://www.dapeep.gr/wp-content/uploads/ELAPE/2020/07_NOV_2020_DELTIO_ELAPE_v1.0_01.02.2021_d.pdf?_t=1612280977

[38] **Source:** Regulatory Authority for Energy (RAE), Athens, June 2020, page 78, http://www.rae.gr/site/file/system/docs/ActionReports/2020;jsessionid=0ac113f330d9e52749283a3948d5b25c946f89c9c1b3.e34Lah0LbNqMe34MaNyKch8Lb3r0n6jAmljGr5XDqQLvpAe

In general, solar systems are integrated into a wide range of applications and are the most preferrable technologies among EnComs. The Prometheus Energy Community, for instance, which is located in a remote area of the Epirus region, is currently designing its first 500kWp PV plant, with the aim of production and sale of clean energy for the support of disabled people and vulnerable groups[39].

3.3.2.2 Wind

Wind energy is one of the most preferable options of energy forms as it is an abundant "fuel" that generates electricity. An average wind park can produce a significant amount of energy, more than solar panels for example. An average onshore wind turbine can produce more than 6 million kWh in a year – supply 1.500 households with electricity.

In Greece, the exploitable wind potential is estimated to represent 13.6% of the total electricity needs of the country. More specifically, according to the Hellenic Scientific Association of Wind Energy ("ELETAEN"), during the second half of 2020 wind power reached 4.114MW and generally in 2020, 200 new wind turbines with a total output capacity of 517.5 MW were connected to the network. This is an increase of 14.4% compared to the end of 2019. At regional level, Central Greece remains at the top of wind farms as it hosts 1678 MW (41%), followed by the Peloponnese with 619 MW (15%) and Eastern Macedonia - Thrace where 485 MW (12%) are located. The distribution of wind capacity per region is presented in Figure 15.

[39] **Source:** Greenpeace Greece, Electra Energy Cooperative, NTUA SmartRue (2020): Mapping of Energy Communities in Greece, pages 43. Reference No HP1AB-00256. Athens (2020), https://www.greenpeace.org/static/planet4-greece-stateless/184045bd-mapping_of_energy_communities_v1.2.pdf

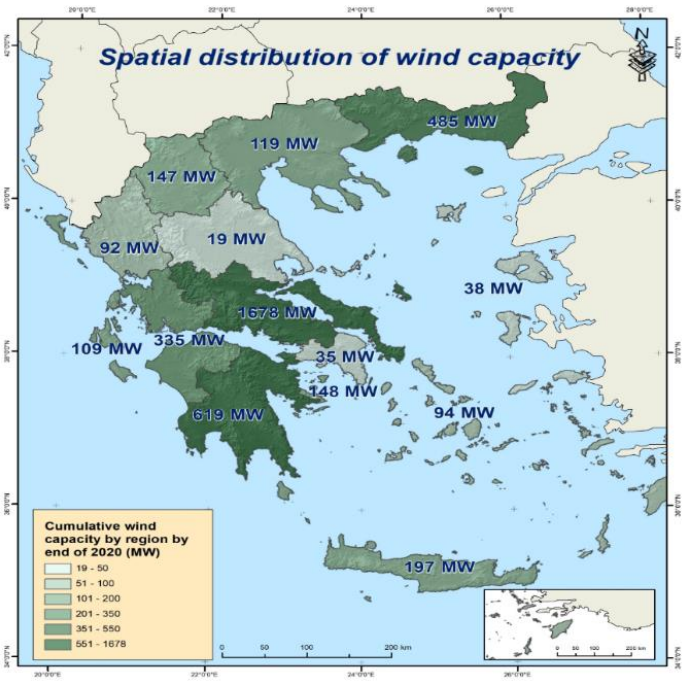

Figure 15 Spatial Distribution of wind capacity

Examples of application of wind farms exist in many islands of Greece such as the wind farm "Manolati - Xerolimba" in Cephalonia as well as the wind farm "Agia Dynati" and the wind farm "Imerovigli" on the same island. With the operation of the three wind farms, the Region of Kefallinia supplies the electricity network of the country with a total of 75.6 MW of electricity whereas the island's requirements of electricity in the peak period (August) reach up to 50MW. The correspondence between the power that Cephalonia offers to the grid and the power it consumes is extremely encouraging for the spread of wind energy in many more islands. Consequently, EnComs located in islands are oriented around wind projects: for instance, Minoan Energy Community, based in the island of Crete, is currently planning and working on the development of a wide range of projects among whom are wind parks[40].

3.3.2.3 Hydro

Hydroelectric energy, also called hydroelectric power or hydroelectricity, is a form of energy that harnesses the power of water in motion—such as water flowing over a waterfall—to generate electricity[41]. It is one of the oldest forms of energy, as in Greece, over two thousand years ago, flowing water was utilised to turn the wheel of their mill to ground wheat into flour.

[40] **Source:** Minoan Energy Community, https://minoanenergy.com

[41] **Source:** National Geographic: Hydroelectric Energy, https://www.nationalgeographic.org/encyclopedia/hydroelectric-energy/.

In Greece, hydro power is exploited either via dams or via diversion facilities. This type of plant is unique because it does not use a dam. Instead, it uses a series of canals to channel flowing river water toward the generator-powering turbines.

Another type of plant which is being adopted as very promising technology is the pumped-storage facility. Pumped hydroelectric energy storage (PHES), is a type of hydroelectric energy storage used by electric power systems for load balancing. The method stores energy in the form of gravitational potential energy of water, pumped from a lower elevation reservoir to a higher elevation. Low-cost surplus off-peak electric power is typically used to run the pumps. During periods of high electrical demand, the stored water is released through turbines to produce electric power. Pumped-storage hydroelectricity allows energy from intermittent sources (such as solar, wind) along with other renewables, to be reserved for periods of higher demand.

At the island of Sifnos, the "Energy and Development Cooperative of Sifnos S.A." intends to implement a hybrid power station, consisting of a wind farm and a reversible hydropower plant. It will be able to meet all the energy needs of Sifnos, utilising only RES. The facilities will be based on the protection of the environment and the tourist product of the island, which is expected to increase.

In Greece, energy storage is present in the form of pumped-storage stations. At the moment there are two hydroelectric power stations with reverse pumping capability, the pumping hydroelectric station of Sfikia, with an installed capacity of 315 MW and the pumping hydroelectric station of Thesaurus with an installed capacity of 384 MW. The specific pumping stations pump water to their upper reservoir during the hours when the energy value is low, for its usage at a later time.

3.3.2.4 Biomass-Biogas

Biomass is any material created by living organisms (livestock waste, food industry waste, wood along with other forest products) that can be used as fuel for energy production (pellets). According to Government Gazette 1450/2013 "biomass" is any of the following[42]:

- products consisting of any plant material, derived from agriculture or forestry, which can be used as fuel to recover its energy content.
- the following wastes:
  i. plant or forestry crop waste,
  ii. plant waste from the food industry, if the heat released is recovered,
  iii. fibrous plant waste from the production of virgin pulp and the production of pulp paper, provided that this waste is co-incinerated at the production site and the heat released is recovered,

[42] **Source:** Decisions of Government Gazette B 1450/ 14.06.2013, Article 3.

iv. cork waste, and
v. wood waste other than wood waste which might contain halogenated organic compounds or heavy metals as a result of treatment with wood preservatives or coatings, and which includes in particular wood waste from construction and demolition.

Greece shows remarkable prospects for the development of standard centralised biogas plants. The available biomass potential can be used to produce energy (heat and/or electricity) directly through combustion, or indirectly after conversion through appropriate processes (e.g., cracking, gasification, anaerobic digestion, etc.) into gases, liquids and / or solid fuels. In particular, it can be used to meet energy needs (heating, cooling, electricity, etc.) and to produce liquid biofuels (bioethanol, biodiesel, etc.). As a RES, it falls under the provisions of the Law on the Sale of Electricity, and the sale of surplus heat can generate additional revenue. In addition, the production of solid organic waste can be considered a source of income if this waste by separation and evaporation is properly modified and sold as a solid and liquid fertiliser.

At the Region of Thessaly, the "Energy Cooperative Company of Karditsa" produces 1.100 tn of high-quality wood pellets for heating usage, taking advantage of the residual forest biomass derived from wood processing industries and at pilot level they also process a percentage of the urban plant biomass for the production of industrial pellets.

3.3.2.5 Geothermal energy

Geothermal energy is the thermal energy generated and stored within the earth. Geothermal power is cost-effective, reliable, sustainable, and environmentally friendly, but has historically been limited to areas near tectonic plate boundaries. Recent technological advances have dramatically expanded the range and size of viable resources, especially for applications such as home heating, opening a potential for widespread exploitation. Utilisation of this energy is achieved by applying the heat pump combination, coupled to a borehole.

Due to suitable geological conditions, Greece has significant geothermal fields of all three enthalpy categories (high, medium, and low enthalpy). In particular, in areas such as the volcanic islands of the Aegean (Milos, Nisyros, Santorini, Lesvos, etc.) as well as many areas of Macedonia and Thrace, the exploitation of geothermal energy can be an extremely efficient option.

4. CASE STUDIES

4.1 Bulgaria

4.1.1 NPEEMRB – National Programme for Energy Efficiency of Multifamily residential Buildings

The National Programme for Energy Efficiency of Multifamily Residential Buildings is aimed at the renovation of multifamily residential buildings (NPEEMRB). The main goal of the Programme is to ensure better living conditions for citizens in multi-family residential buildings, thermal comfort, and higher quality of living environment through the implementation of EE measures. The programme is Alternative Measure 2 of the scheme for EE obligations, determined according to the requirements of Art. 7 of Directive 2012/27 / EU. All 265 municipalities in Bulgaria are eligible to participate in the Programme, and activities are carried out within 143 municipalities. Grants of up to 100% can be received by associations of owners registered under the Condominium Management Act in the eligible buildings, in this case acting as energy communities.

For the purposes of the programme, it is necessary to register a homeowners' association for the whole building. The owners' association is recognised by the law as a legal entity but acting only with the purpose of absorption of funds from the European Union and/or from the state or municipal budget, grants, and subsidies and/or use of own funds for the purpose of repair and renovation of multi-family residential buildings. A management board is elected, and it then acts on behalf of all owners in the building. The agreement for establishment of an association should clearly state the subject of activity of the association. The registered owners' association declares their interest to the municipality through Application for Interest and financial assistance for participation in the programme on the basis of 67% agreement among homeowners. Under the programme, only entire buildings can be renovated.

Municipalities accept documents for application, evaluation, approval, provision of financing and monitoring of the implementation of energy efficiency measures in buildings. Each municipality is responsible for the implementation of the entire process of renovation of residential buildings on its territory and for the selection of contractors under the Public Procurement Act for the implementation of individual activities on the buildings.

After receiving the Application for Interest and financial assistance, the municipality checks the submitted documents and evaluates their completeness. In case of missing documents, the municipality requires the owners' association to provide them. In the evaluation process, each candidate receives a positive or negative evaluation. Additional information and/or documents may be required to rectify gaps.

The owners' associations whose applications have been approved are invited by the municipality to sign a model contract. The contract contains the conditions for providing financial assistance and defines the rights and obligations of the parties. After

concluding the contract between the municipality and the owners' association, the municipality, on behalf of the owners' association, concludes a contract for targeted financing with the Bulgarian Development Bank and with the district governor.

The conclusion of a contract between the owners' association and the municipality is a prerequisite and grounds for the municipality to assign the performance of an inspection to establish the technical characteristics related to the requirements under the Spatial Development Act to an external contractor, who is selected by the municipality.

While it is arguable if the participation in a financing programme with a 100% grant component is a form of energy community, it must be noted that this approach overcomes the unwillingness of separate homeowners in a single building to enter into any form of a joint legal entity. This benefit, if managed properly, can become the first step of a transition towards more sustainable financial mechanisms for building renovation, including projects for joint energy generation and consumption in the form of energy cooperative.

4.1.2 Public Private Partnerships – EVN Bulgaria

Public-private partnerships (PPPs) can play a leading role in the implementation of infrastructure projects and energy efficiency projects. The need to develop public infrastructure, as an engine for economic development and limited budgetary resources for its construction and maintenance, can provide for the creation and dissemination of this form of cooperation between public authorities and the private sector. The following main characteristics and advantages of the public-private partnership can be listed:

- Long-term contract between a public and private partner for the provision of services of public interest.
- The private partner in all stages of project implementation - design, construction, financing, maintenance and / or operation of the site.
- The public body determines the goals, determines the requirements for quality and quantity and controls the implementation.
- The private partner does fully finance most of the project implementation.
- Fair distribution of risks between the partners on the basis of who can deal with them better.
- A public sector payment mechanism is linked to the implementation.
- Improving the management of the site and improving the quality of services.
- Better value of the invested funds.

An example of such a PPP is a project in the city of Pazardzhik where "EVN Bulgaria" and the municipality partnered for a project which included the installation of a photovoltaic power plant on the roof of the public kindergarten "Valentina Tereshkova". This plant allows the kindergarten to produce at least 50% of all the energy they consume annually i.e., their electricity costs are greatly reduced and in case of an excess of produced

energy “EVN Bulgaria” has an obligation to buy it so this will have an additional positive effect for the kindergarten. The photovoltaic power plant is for production of electricity for own needs and generation of excess energy in the network with installed capacity of 29,76 kW and a total cost of BGN 44,777. It consists of 96 photovoltaic modules installed on the roof of the building. The estimated amount of electricity produced is 37,05 MWh per year. The excess energy will be purchased by “EVN Bulgaria” according to a contract signed with the Municipality of Pazardzhik for a period of 20 years. There are also other examples of such partnership, mostly stirred by the initiative of big electricity distributors.

4.1.3 Staccato – Sustainable technologies and combined approaches on municipal level

Since 2008 Oborishte district with the aid of Dutch partners launched the Staccato project, envisaging renovation of residential buildings in Sofia with a subsidy from the European Union (6th Framework Programme). The subsidy for the renovation operations in Sofia is provided in the amount of EUR 630,000. The STACCATO pilot project envisaged energy-efficient renovation of residential buildings with the use of innovative technologies and renewable energy sources. Renovation of the buildings includes installation of thermal insulation systems and replacement of windows, modernisation of the distribution of thermal energy and application of solar energy for the provision of domestic hot water.

In the implementation of the individual activities, a number of approaches and good practices developed by other European projects were used. The system for quality assurance in the renovation of residential buildings was adopted in order to increase energy efficiency, developed under the SQUARE project and the approaches to organising green public procurement under the BUY SMART + project.

In order to apply for funding from the Staccato project property owners had to establish homeowners’ association for the whole building. The owners’ associations created for the purposes of the project can be regarded as energy cooperatives because of the energy production from RES and the shared energy usage among property owners. One of the renovated buildings through the Staccato project is located at 75 Cherkovna Street. It deserves special attention with its innovative financial model for providing financing for energy saving measures on the facade with higher indicators than the normatively required for the country, in order to achieve the criteria for its inclusion in "Staccato", in which several sources successfully participated: rents from a base station of a mobile operator; loan for thermal insulation on the facade; a loan from the Kozloduy Fund for the implementation of energy saving measures (EBRD financing scheme REECL), which provides 30% of the necessary funds for energy efficiency measures. Thus, homeowners did not have to contribute with personal funds.

The building at 75 Cherkovna Street has 26 solar collectors, which have been made in Bulgaria, with a total area of about 52,50 m2. The quality requirements in combination with the competitive price were leading in the selection of contractors under the Staccato project. Thus, only certified equipment suppliers worked on the project, and the

solar panels installed on the pilot buildings had a 5-year warranty. Energy efficient windows have been installed, the front door and the interior of the common areas have also been renovated. Residents of the building already use water heated by solar energy.

The results from the monitoring of the thermal energy readings indicate a continuous reduction of the energy consumption compared to the base line year of 2008, with achieved around 50% energy savings for the building. The established owners' association and the good partnership between it and the Dutch partners involved in the implementation of the project were extremely beneficial for its success.

4.2 Czech Republic

The cases of energy communities in the Czech Republic presented in the following case studies show integrated approach to RES as a part of Positive Energy District concept projects. The phenomenon is only taking off in the Czech Republic and thus all the projects are currently in their initial phases of commissioning feasibility studies. Even more features they share. They are mostly part of an ambitious local decarbonisation and modernisation strategy and they are implemented in existing built-up areas. Just one project is a new development. High level of automation is envisioned wherever possible and practicable, such as control and regulation of heating and lighting. Finally, additional non-energy related and non-economic objectives are sought, mostly social innovations and beneficial spill overs to adjacent neighbourhoods.

4.2.1 The capital city of Prague

One example of energy community in Czechia is the energy project launched by **the capital city of Prague** despite of the lack of new legislation - the Community for Renewable Energy Sources. It promises a lower dependence on energy supplies from coal-fired power plants and a reduction in greenhouse gas emissions, which Prague produces now.

The basis of the community will be municipal buildings, on which the city installs photovoltaic panels. A special legal entity will be created, which will be wholly owned by the capital city of Prague. The community will purchase electricity from suppliers and reduce electricity costs at the installed facilities. Whoever joins the community will also be entitled to a centralised purchase of electricity, which will be more favourable in such a large entity as the capital city of Prague.

The community will be open to Small and Medium-sized Enterprises and to citizens. For example, the city wants to allow citizens to buy smaller shares in power plants installed in municipal buildings. Thus, even those who cannot install photovoltaics on their own roofs will be able to participate in energy production.

4.2.2 The municipality of Litoměřice

Another local experience is **the municipality of Litoměřice**, which is supporting the development of community renewable energy sources within the international project

SCORE, supported by the Horizon 2020. In the project, the installation of photovoltaic power plants (PV) is being prepared on three selected buildings in the municipality, one of these is an apartment house. It also includes a pilot verification of community funding for PV plants in the form of crowdfunding.

4.2.3 "Clean Energy" in Karviná city

The city of Karviná, a coal mining municipality located in Silesian Ostrava industrial agglomeration, actively explores number of innovative energy projects. Among them is the feasibility study of the Positive Energy District (PED), a concept of an urban area that more than covers its energy consumption by own renewable production and achieve high indoor environment quality at the same time. University Centre of Energy Efficient Buildings of the Czech Technical University (UCEEB) has been commissioned for this. The effort aims to identify suitable area where the PED concept can be implemented. First outcomes are expected in mid-2021.

PED energy saving and indoor environment quality improving measures will span existing housing with positive effects spilling over to neighbouring quarter. The area includes both residential and commercial spaces. Although the city hall of the initiative, many additional stakeholders take part such as energy distributors, developers, and transportation companies. The project is part of the wider effort to achieve energy efficient municipality.

4.2.4 PED Kladno

Analogous feasibility study is being carried out by urbanists form UCEEB in Kladno city in the Central Bohemia. Here, exploiting existing heating system is one of the considered options along with other synergies such as link to the public transportation system. One of the cutting-edge features of the PED preparation in Kladno is the use of airborne thermo-imaging. The mapping was done early in 2020 and is now available in an interactive online map application[43] shown in the Figure 16.

4.2.5 Židlochovice new development

Líchy neighbourhood in the Židlochovice municipality near Brno aspires to create an exemplary modern development, smart and sustainable. The development will combine the latest smart and sustainable technologies along with social innovations supporting local community. Currently, a multi discipline team headed by Židlochovice mayor projects the new neighbourhood. Currently, a feasibility study is being prepared that should recommend the technical solutions. Variant urban plan will be ensured and the first constructions works are scheduled for 2022 with the completion planned for 2023.

[43] **Source:** https://kladno.gepro.cz

Regarding technologies, smart elements are envisioned wherever applicable. Thus, outdoor lighting systems will be highly automated, limiting light pollution among other functions. Parking lots will be managed with real time flexibility. The authors of the newly developed neighbourhood, when it is completed, want their project to become an exemplary case for other Czech and European designs. The project design has been awarded by Deutsche Bundesstiftung Umwelt.

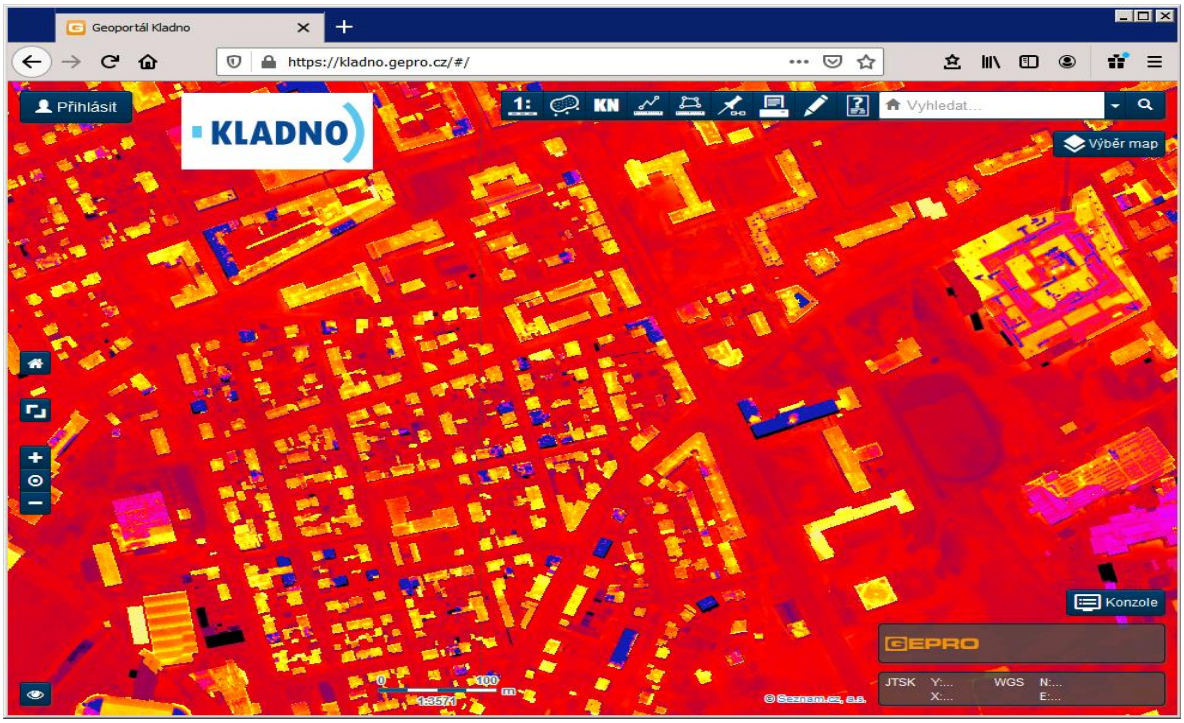

Figure 16 Kladno thermal map

4.3 Greece

The objectives of the National Energy and Climate Plan (NECP) concern the achievement of specific national targets regarding the reduction of greenhouse gas emissions, the greater participation of RES in domestic energy consumption as well as the achievement of energy preservation in final energy consumption, the strengthening of security of energy supply, the enhancement of the competitiveness of the Greek economy, protecting consumers while expanding their role in the energy system, shaping and operating a competitive domestic energy market, increasing domestic added value in the energy sector and establishing new jobs.

Despite the fact that the participation of EnComs in RES projects is currently confined in Greece, it is intelligible that they have obtained a decisive role in the fulfilment of NECP's objectives. Part of the cases of EnComs are examined and presented below.

4.3.1 Peloponnisos Energy Community of Limited Responsibility (Pel.E.C.P.E)

On February 2018, the establishment of an EnCom under the name "Peloponnisos Energy Community of Limited Responsibility"[44] was approved at the meeting of the Regional Council of Peloponnese with its base in the city of Tripoli. Members of the EnCom are:

- The Municipality of Megalopolis with 10% share.
- The Regional Development Fund of Peloponnese with 25% share.
- The Region of Peloponnese with 40% share.
- The "Peloponnisos S.A. - Development Agency of Local Authorities" with 25% share.

The EnCom aims at the data recording, monitoring, and evaluation of the buildings' energy consumption of all its members via the installation and operation of digital electronic energy metres.

One of the obstacles that the EnCom is called upon to confront in the first place is the provision of power supply[45] without outrages or blackouts. There are remote areas at the Peloponnese that are either mountainous or coastal, which, due to the obsolete network experience many power cuts. Thus, the EnCom's goal is to support areas of frequent power cuts via the exploitation of alternative energy sources. Another initiative that the EnCom will undertake in the following programming period, is the promotion of electromobility. The EnCom is participating in a European programme in which the region of Peloponnese will supply a certain number of electric cars, and possibly chargers.

4.3.2 Energy Cooperative Company of Karditsa ("ESEK SynPE")

The EnCom of Karditsa[46] has a history of approximately 10 years. It initiated as an energy cooperative in 2010 and in 2018 it began the operation of a biofuel production plant. In 2019, it became an EnCom and currently has more than 400 members, including all the municipalities of the prefecture of Karditsa. This plant is EnCom's first step in contributing to the energy transition: The plant produces 1.100 tn of high-quality wood pellets for heating usage, taking advantage of the residual forest biomass derived from wood processing industries and at pilot level they also process a percentage of the urban

[44] **Source:** The Municipality of Megalopolis will participate in the proposed Regional Energy Community of Peloponnese, February 2018, kalimera-arkadia.gr, https://www.kalimera-arkadia.gr/megalopoli/item/81218-stin-ypo-systasi-perifereiaki-energeiaki-koinotita-peloponnisou-tha-symmetexei-o-dimos-megalopolis.html

[45] **Source:** Peloponnese Energy Community": Focus on the Use of RES and the Support of Vulnerable Social Groups», July 2018, ENERGIA.gr, https://www.energia.gr/article/144675/peloponnhsos-energeiakh-koinothta-sto-epikentro-h-hrhsh-ape-kai-h-sthrixh-ton-eyaloton-koinonikon-omadon

[46] **Source:** Presentation of ESEK's Representative Vassilis Filippou on Virtual Workshop "Energy Communities Talk about Energy Communities", Energy Democracy Dialogues, INZEB, https://inzeb.org/wrap-up-energy-communities-discuss-about-energy-communities-workshop/

plant biomass of the municipalities for the production of industrial pellets. Concurrently, it participates in European projects for the development of biomass plants (Horizon BECoop[47]) and has already submitted to the Hellenic Electric Distribution Network Operator S.A. (HEDNO S.A.) application for the construction of a 1MW photovoltaic park.

4.3.3 Sifnos Energy Cooperative (SES)

The "Energy and Development Cooperative of Sifnos S.A." or Sifnos Energy Cooperative (SES) is an Urban Cooperative, which combines two basic elements: it is a company operating under social and democratic standards and objectives provided from both by Greek law and by its statutes.

The project that SES intends to implement is a hybrid power station, consisting of a wind farm and a reversible hydropower plant. It will be able to meet all the energy needs of Sifnos, utilising only RES. The initiative will be based on the protection of the environment and the tourist product of the island, which is expected to increase.

The project (hybrid station) consists of[48]:

- a small wind farm of 5 wind turbines
- an artificial lake of 1.000.000 + cubic metres, dug in a rocky area, near the sea, at an altitude of 330 metres.
- a hydropower station with 4 hydro turbines
- a pumping station of 12 pumps.

The electricity generated by the wind turbines will be given in parallel to the grid and pumps that will raise sea water, filling the artificial lake. The hydroelectric project will operate permanently, providing stability to the grid. If the production of electricity from the wind farm is not sufficient to provide to the grid safely, the hydropower station will produce the remaining energy. Even in case of apnoea at several days of the year, the hydropower station will be able to supply electricity without problems to the island.

The investment, based on a study carried out by the EnCom, has proven to be profitable since its first year of operation and will continue to be as energy requirements are assured. So far, the members exceed the number of 100 and it is feasible for persons with full legal capacity or legal entities governed by public law - other than first and second degree LAs - to participate.

[47] **Source:** The Energy Community of Karditsa Participates in the European BECoop Project", December 2020, Karditsanews.gr, https://www.karditsanews.gr/η-ενεργειακή-κοινότητα-καρδίτσας-εσε/

[48] **Source:** Energy autonomy of Sifnos, https://www.sifnosislandcoop.gr/energyautonomy/index.html

4.3.4 Minoan Energy Community

Based in the island of Crete, Minoan EnCom[49] was founded in October 2019 with the participation of 38 members. Within a year of operation, the EnCom has managed to build a wide base of members, exceeding the number of 200, including farmers, citizens of urban areas, local cooperatives, three municipalities and the Regional authority of Crete. Four working groups have been formed in order to support the development of the cooperative in its early stages. The four groups are in charge of the following tasks: Technical, Administrative, Promotion & Communication, Educational. Minoan EnCom is currently planning and working on the development of a wide range of projects including:

- the production, storage, self-consumption or sale of power or thermal energy from RES stations, CHP or hybrid stations located within the region of Crete, the base of the EnCom,
- raw materials management, such as collection, transport, treatment, storage, or disposal for the production of electrical or thermal energy from biomass or bioliquids or biogas or through the energy recovery of biodegradable municipal waste,
- the supply of energy products, appliances, and installations to members, with the intention of reducing energy consumption and the use of conventional fuels, as well as improving EE,
- the supply of electric vehicles to members, either hybrid or not, and vehicles using alternative fuels in general,
- power distribution within the region of Crete,
- the supply of electricity or natural gas to final customers, according to article 2 of Law 4001/2011 (A 179),
- the production, distribution, and supply of thermal energy within the region of Crete,
- the management of end-use electricity demand and the representation of producers and consumers in the electricity market,
- the grid development, the management and operation of alternative fuel infrastructures, in accordance with Law 4439/2016 (A 222) or the management of sustainable means of transport within the region of Crete,
- the provision of energy services, in accordance with Article 10 of Ministerial Decision D6 / 13280 / 7.6.2011 (B 1228).

[49] **Source:** Minoan Energy Community, https://minoanenergy.com

4.3.5 Energy Community of Fourni – Korseon

The first EnCom in the Aegean was established in the municipality of Fourni[50] [51]. The island of Fourni is currently supplied with power through an undersea pipeline from the island of Samos and therefore, the EnCom's purpose is the autonomous energy operation of the island with the use of RES. The EnCom consists of the municipality of Fourni Korseon, a fairly large number of the residents and the company EUNICE LABORATORIES S.A., subsidiary of the Greek energy group EUNICE ENERGY GROUP. The EnCom took the form of an urban cooperative according to the provisions of Law 4513/2018 aiming to combat energy poverty. The members are both energy producers and consumers (prosumers) and it is possible for all companies and citizens with a residence or registered base in Fourni to participate as members.

4.3.6 Energy Community of Vlasti

The EnCom of Vlasti[52] was established in 2018 with the participation of 33 members, among whom were the Municipality of Eordaia and seven local companies. The EnCom is self-financing, and it is open to persons or legal entities and LAs, who maintain a proven relation with Western Macedonia and are not currently members in other EnComs. To become a member the participation fee is 1.500€ per share. The EnCom aims at the promotion of solidarity economy and energy democracy at the lignite areas, via the implementation of RES projects during the national energy transition plan from lignite production to clean forms of energy.

4.3.7 Trikkeon Energy Community

The Municipality of Trikala decided to utilise green energy through renewable energy sources. According to the municipal council, the "Energy Community Trikkeon-I "[53] is an urban cooperative of exclusive purpose which aims to conserve resources and produce green energy. More specifically, initially the purpose of the EnCom Trikkeon was the energy generation through PV, placing some installations on the roofs of schools, for production and self-consumption. However, the next step is to install small biogas plants in villages where there is livestock and to ensure the energy autonomy of local communities by the instalment of small hydroelectric plants, exploiting the numerous tributaries.

The Energy Community of Trikala is non-profit and does not distribute surpluses to its members. Among the first members of the EnCom were the Municipality of Trikala and the Municipal Water Supply and Sewerage Company of Trikala ("DEYAT"), with initial

[50] **Source:** Energy Communities", Eunice Energy Group, https://eunice-group.com/gr/projects/energy-communities/
[51] "The Municipality of Fourni founded the first Energy Community of island Greece, September 2018, ECOPRESS.gr, https://ecopress.gr/o-dimos-fournon-idryse-tin-proti-energ/
[52] **Source:** The Energy Community of Vlasti is activated, August 2019, e-ptolemeos.gr, https://e-ptolemeos.gr/energopoieitai-i-energeiaki-koinotita-vlastis/
[53] **Source:** The Municipality of Trikala enters the energy sector, March 2018, Municipality of Trikala, https://trikalacity.gr/o-dimos-trikkeon-iserchete-ston-tomea-tis-energias/

participation capital of 10.000€, which consisted of five cooperative shares of 2.000€ value each.

4.3.8 Energy Community Good Energy

The "Good Energy EnCom"[54] [55] has been established with the participation of 21 members on 28/03/2019[56]. It is based in Attica and its goal is oriented at the operation of PV systems for the production and storage of electricity. The members of Good Energy believe that L. 4513/2018 has given significant financial incentives and priorities in the licencing for RES investments by EnComs and that the operation of the projects and the sale of the energy will boost the annual income of the members. They also consider that the whole activity of EnCom, from the stage of its establishment to the stage of connection with the network will have a positive outcome on the wider community. During the construction phase there will be available temporary jobs for local contractors, engineers, and workers, but also permanent jobs in the long term. The EnCom has implemented a 1 MW Photovoltaic power station in the area of Lamia, Central Greece and will soon create a network of 8 solar farms around the Region of Attica that will provide 7.8 MW of clean energy to its members.

4.3.9 Zagorin Energy Community

The "Zagorin"[57] [58] EnCom is based in Zagora, Magnesia and was established as a non-profit cooperative on 18/3/2019, comprised by 5 legal entities. "Zagorin" aims to install PV systems to cover the energy of its members and to provide the necessary energy for the packaging and refrigeration facilities of the Agricultural Cooperative of Zagora Pelion - Zagorin and the brewery of the Women's Agritourism Cooperative of Zagora. The expected result is the reduction of the operating expenses of the Cooperative, thus the increase of the income of its members as they will have to cover fewer operating expenses.

The medium-term goals are to cover all the energy needs of the Agricultural Cooperatives' headquarters and gas stations located in the Central Vegetable Markets of Athens and Thessaloniki, as well as to meet the needs of households in which the EnCom aims to invest in the long run. Moreover, there are further considerations for the use of electromobility and the operation of electric vehicle charging stations. The

[54] **Source:** Participation of Good Energy Representative Nektarios Tzortzoglou on Virtual Workshop "Energy Communities Talk about Energy Communities", Energy Democracy Dialogues, INZEB, https://inzeb.org/wrap-up-energy-communities-discuss-about-energy-communities-workshop/

[55] **Source:** GOOD ENERGY E.C., Genervest, https://genervest.org/campaign/good-energy-ec/

[56] **Source:** ENERGY COMMUNITY GOOD ENERGY LIMITED LIABILITY, https://www.businessregistry.gr/publicity/show/149718201000

[57] **Source:** Agricultural Cooperative of Zagora Pelion – ZAGORIN, https://zagorin.gr/zagorin-quot-megalonontas-ananeonetai-quot/

[58] **Source:** Synergy for energy from century-old Agricultural Cooperative of Zagora Pelion, July 2019, Ypaithros.gr, https://www.ypaithros.gr/ekdoseis/synergeia-energeia-apo-aionobio-agrotiko-synetairismo-zagoras-piliou/

working needs of Zagorin are covered by the employees of the Agricultural Association of Zagora.

4.3.10 Energy Community of Alexandroupoli-Samothrace

The "Energy Community of Alexandroupoli-Samothrace"[59] has been established in 2018 and is based in Alexandroupoli, Thrace. In the EnCom, the Municipalities of Samothrace and Alexandroupoli together with the Port Authority of Alexandroupoli and the Diocese of Alexandroupoli areParticipating. The EnCom plans on the creation of a photovoltaic park with a power of 1MW and more specifically:

- the 40% of it will be exploited by the municipality of Alexandroupoli,
- the 20% will be exploited by the municipality of Samothrace,
- the 20% by the Diocese of Alexandroupoli and
- the rest 20% will be exploited by the Port Authority of Alexandroupoli.

The main purpose of the EnCom is to generate energy and save money through the net metering process, while the citizens will benefit from less municipal taxes. In a secondary phase there will be initiatives to support the most vulnerable households and the municipality of Alexandroupoli will participate in another EnCom exploiting geothermal power generation[60].

[59] **Source:** The First Energy Communities in Alexandroupoli-Samothrace and Peloponnese Region", January 2019, energia.gr, https://www.energia.gr/article/123915/oi-protes-energeiakes-koinothtes-se-alexandroypolhsamothrakh-kai-perifereia-peloponnhsoy

[60] **Source:** Alexandroupoli is a pioneer in the energy sector, January 2019, energypress.gr, https://energypress.gr/news/protoporos-i-alexandroypoli-ston-energeiako-tomea

5. THE WAY FORWARD

It is more than evident that the widespread development of energy communities across Europe verifies their significant role in the European energy landscape. This is recognised by the European Community institutional framework: the EU Strategy for Energy Union and the Clean Energy Package, in particular the Renewable Energy – Recast to 2030 Directive[61] (REDII), recognises that energy community projects have multiple additional social, economic, and environmental benefits compared to the RES projects of other market players.

So, at a time when Europe is shaping its new development strategy, the European Green Agreement, and putting climate neutrality at the heart of its policies, even in the post-Corona era, energy communities are coming to complete the toolkit for energy transition. A transition from the most unprofitable fossil fuels to renewable energy sources.

5.1 Bulgaria

The renovation of the building stock is the area with most experience generated in regard to community energy initiatives. Given that 97% of the housing stock in Bulgaria is privately owned, there is a huge potential for multiplication of such renovation projects in combination with common solutions for production and shared use of renewable energy. Most of the residential buildings need urgent rehabilitation. They can be improved to provide better comfort to residents, reduce consumption and energy bills, while increasing the market value of housing. There are several projects that can be regarded as pilot projects and these are setting a good example that would encourage other owners of multi-family residential buildings to undertake such activities in their buildings. These successful experiences should be actively promoted, due to the wide application that they can have with such a large share of private housing in Bulgaria and because of the undoubted impact that such projects can have on reducing energy consumption and environmental protection.

However, it is necessary and still largely problematic to attract all owners in a single building to participate in such projects and to organize in a legal entity. Currently the Bulgarian legislation only recognises owners' associations as legal entities and does not mention energy cooperatives. However, the new RES Directive specifically addresses the removal of all barriers to decentralized generation, use and sale of electricity produced from RES in the grid. In addition, new rules and regulations are created for the functioning of the so-called small energy cooperatives - local associations of electricity producers that can exchange the energy they produce in real time and use it at different prices at different times of the day or during different seasons. This gives the market

[61] **Source:** Renewable Energy Directive 2018/2001/EU

flexibility and also creates huge opportunities for the strong IT sector to ensure this shared use of electricity.

5.2 Czech Republic

Concept of the energy communities (EnComs) has not been embraced in the Czech Republic yet. It can be concluded that the ground is prepared for EnComs but several obstacles need to be removed before the EnComs start to develop around the country. Most importantly, the legal definition is yet to be approved. Furthermore, the electricity distribution sector does not welcome divesting the infrastructure to small players. There are, however, numerous project designs waiting for the rules' finalisation, that would establish EnComs. Among them, local authorities are expected to play a key role in democratising energy and development of energy communities.

The new RED II directive could completely change the position of local authorities, if they (the municipalities) can make the most of the new regulations and help them to accelerate the transformation of energy sector. Municipalities acquire the legal background to be able to support new business models in the field of community management and ownership of renewable energy. In addition, they have the right to participate as one of the stakeholders in renewable energy communities.

A good practice for municipalities is to organise specialised workshops and information campaigns in the preparatory phase of projects to reach the local community, landowners, and other key stakeholders.

For the municipalities, the creation of an energy community brings greater control over local energy production. At the same time, this approach strengthens the influence of local governments on the formation of energy policy and gives the advantage of direct involvement of the population in energy transformation and climate protection. Thanks to the creation of the community, the municipality becomes more energy self-sufficient, economically stronger, and more environmentally friendly.

5.3 Greece

For Greece, which has long been the third largest lignite-producing country in the EU and is committed to forward-looking de-lignification, essentially by 2023, energy communities can be a factor in helping the transition to be truly fair and for the benefit of citizens.

The current legislative framework provides several possibilities in this direction. At national level, energy communities are clearly included in the proposed policy measures for the promotion of RES in the National Energy and Climate Planning (NECP), setting as an ambitious quantitative goal the installation and operation of new self-generating and energy net metering systems, mainly to cover own needs, over 600 MW (to total more than 1GW of installed capacity) by Energy Communities by the year 2030. The main legislative tool, Law 4513/2018 though, considered a flexible and promotional

framework for their establishment and operation, nevertheless it has been proven that it has not foreseen deviations and wrong implementations.

Thus, so far EnComs do not seem to have been sufficiently utilised, with non-profit EnComs facing obstacles to their development, which seriously undermine the effectiveness of the institution. The main deviation or even miss of the effort was the prevalence of privately funded profit Energy Communities that possess both know-how (technical, legislative-licensing, and financial) and the required funds. The institution of EnComs was exploited by them in order to take advantage of the prioritisation benefits that the existing Law provides over other applications, in a grid that is due to become oversaturated. As a result, many of the energy communities that have so far registered are covert private initiatives, thus demining authentic initiatives from local communities.

For the confrontation of the aforementioned phenomenon, the Ministry of Environment and Energy reacted rather unsuccessfully. Instead of a series of simple, self-evident, and targeted measures to separate the authentic EnComs from the covered private initiatives, the Ministry decided to remove the incentives for all cases without exception. According to Article 160 of Law 4759/2020, from January 1, 2022, every EnCom should participate in competitive processes, i.e., compete with private investors in bids to ensure operational support of RES projects. Simply put, there will be absolutely no separation between EnComs and private investors. Understandably, this development is not only not in line with the provisions of the Community RES Directive (REDII), which the Greek Government should have incorporated into national law by 31 June 2021, and in fact it removes any substantial incentive to create an energy community from 2022 onwards. Despite various interesting and promising efforts, the promotion, support and ultimately development so far of non-profit EnComs schemes involving local communities is unsatisfactory.

A recent report prepared by the European Federation of Energy Communities REScoop.eu, Greenpeace, WWF Hellas, and Electra Energy organisation, outlines the barriers in the development of the Energy Communities' institution in Greece[62], as follows:

- Expensive and complicated administrative procedures continue to apply, despite the requirement for directives to introduce simplified procedures for energy communities' RES projects. In addition, the legal framework for energy communities is complex and fragmented into many different laws and ministerial decisions, which exacerbates the complexity of the process of developing RES projects by energy communities and can be a deterrent to their establishment and citizen participation to them.

[62] **Source:** REScoop.eu, Greenpeace, WWF Hellas, and Electra Energy: DEVELOPMENT OF ENERGY COMMUNITIES IN GREECE: CHALLENGES AND SUGGESTIONS. Problem recording, analysis of the European institutional framework and submission of proposals to remove obstacles and promote the development of Energy Communities in Greece. February 2021.

- Especially with regard to virtual net metering schemes, their development is extremely limited to non-existent:

i. Regarding small and more flexible schemes, the "heavy" scheme of civil cooperatives proves to be non-functional. The establishment of an energy community requires, among other things, registration procedures in both commercial registry and tax office, bookkeeping and VAT refund, payment of stamps for the share capital, declaration and (compulsory) maintenance of headquarters, payment of rent, etc.

ii. With regard to the larger schemes, although the model of energy communities is a suitable vehicle, the aforementioned problems that generally concern the EnComs (e.g., access to finance, information, etc.) have not allowed the development of even larger collective net metering schemes.

- No tools have been made available to energy communities to facilitate access to finance and information as required by Article 22 (4) (g) of the RES Directive. Access to finance for energy communities is quite problematic as banks require, in addition to a certain percentage of investor participation with their own funds, significant personal guarantees, which make it difficult to implement even small photovoltaic stations for net metering. The lack of a package of financial support measures is particularly evident in the cases of non-profit EnComs and of collective net metering schemes.
- Article 22 (3) of the RES Directive states that each State has an obligation to carry out an assessment of the barriers and potentials for the development of renewable energy communities in their territory, in order to identify any obstacles and difficulties encountered by energy communities and to be considered when formulating a favorable legislative framework. However, Greece has not made such an assessment yet.
- The introduction of competitive procedures for RES projects in which all EnComs companies are obliged to compete with large private investors does not comply with Article 22 (7) of the RES Directive, according to which Member States must consider the specificities of renewable energy communities in the design of RES support systems to enable them to compete on an equal footing with other market participants. The development of RES projects by energy communities is associated with additional social, economic, and environmental benefits compared to RES projects developed by other market participants, which are not considered in the tender procedures.

This does not mean that there are no significant examples of authentic energy communities in rural areas, as well as in urban and island areas. These energy communities, despite the many challenges, have managed to develop important projects, mobilise a large part of the local community (there are EU Communities with

more than 2.000 members, including local authorities, local businesses, and citizens), raise funds and best practices, thus highlighting the great dynamics of the model. These energy communities are a small and encouraging example of the enormous benefits that Greece could enjoy by protecting and strengthening the institution of EnComs.

According to WWF Hellas[63], an investment programme through which all the Municipalities of the country create EnComs, could create up to 10.000, direct and indirect, new jobs (equivalent full-time jobs) throughout the country. The proposal concerns a national investment plan in which all the Municipalities of the country participate, 332 in total, for the installation of RES of power of 4 MW on average per Municipality (estimated 2 MW for smaller Municipalities and 6 MW for larger). Specifically, it is proposed to install about 1.3 GW in total until 2024 only by EnComs in which local authorities participate. This can be implemented either by legislation for the mandatory implementation of this proposal, or by creating a targeted financial tool that will finance these actions, a minimum percentage, e.g., 20%. It is emphasised that the National Plan for Energy and Climate (ESEK) provides for the development of additional self-generation and energy communities of 600 MW by 2030.

For the confrontation of the afore mentioned misfunctions and in order to pave the way for the creation of financial programmes for Energy Communities, the Ministry of Environment and Energy is proceeding with the harmonisation with the EU law and the rules of state reinforcements. At the same time, it examines other improvements, such as: a) the extension of the exemption from the competitive procedures after 1.1.2022 for EnComs in which local authorities or a large number of members participate and, b) the adoption of the plan prepared by the Centre of Renewable Energy Sources for the development of EnComs with the participation of Municipalities, in the context of confronting energy poverty in local communities.

6. CONCLUSION

Although it is evident that the national priorities and the dynamics regarding the development of community energy initiatives are vastly different, it can be argued that the initial steps and ongoing practices in the three target countries, prompted by both the local energy needs and the common EU legislation, have demonstrated the potential for deploying local energy cooperatives as a crucial mechanism to enable sustainable and inclusive energy transition. The leading example of Greece clearly showcases the opportunities related to the implementation of energy communities at the local level; however, it has also exemplified potential setbacks and dangers resulting from the raising interest of corporate investors on this emerging market. On the other hand, community energy in the other here countries – Bulgaria and the Czech Republic, is still very much associated with national support programmes, in the first case, and isolated

[63] **Source:** Ibid 18

initiatives from the local authorities in the second, as individual users are mainly regarded as beneficiaries of the new services rather than their initiators.

In any case, the (expected) fast development of the legal framework and the widespread practical application of renewable energy technologies substantiate the vast potential for immediate market interventions. They should however be carefully guided with regards to inclusiveness and providing equal access of individual prosumers, thus bolstering energy democracy, and mitigating the risk of energy poverty, which is unfortunately quite overspread in the target countries. To this end, the involvement of the local authorities could be of utmost significance, as they continue to be in position not only to provide economic incentives and support, but also to generate trust and effectively oppose excessive commercialisation of the concept. On the other hand, the municipalities themselves would also experience manifold benefits not limited to fair energy prices, but reaching as far as improving the urban environment, attracting new businesses, creating attractive employment opportunities, and stimulating economic growth. Hands-on support for the initiation of such processes at the local level represents the immediate next target of the CONGREGATE project, as besides further development of the analytical framework, exemplary feasibility studies for specific community energy projects will be conducted and promoted for future practical implementation.

7. APPLIED SOURCES OF INFORMATION

7.1 Bulgaria

- Scientific paper. "Analysis and synthesis of a hybrid geothermal power plant", Ana Borissova, Dimityr Popov, 2015, https://inis.iaea.org/collection/NCLCollectionStore/_Public/47/017/47017674.pdf
- Renewable energy directive (RED II), Official Journal of the European Union, 2018, https://eur-lex.europa.eu/legal-content/CS/TXT/?uri=CELEX:32018L2001
- Energy Strategy of the Republic of Bulgaria till 2020 for Reliable, Efficient And Cleaner Energy, https://www.me.government.bg/files/useruploads/files/epsp/23_energy_strategy2020%D0%95ng.pdf
- Report. "Renewable Energy Statistics and Challenges", Stoyanka Mastikova (in Bulgarian) https://www.nsi.bg/spisaniestatistika/page/en/details.php?article_id=213
- Report. „Legal analysis of the renewable energy communities and the opportunities for their development in Bulgaria", Raya Maneva (in Bulgarian), https://www.greenpeace.org/static/planet4-bulgaria-stateless/f7322930-praven-analiz-energiini-obshtonsti-2020.pdf
- Strategy for Sustainable Energy Development of the Republic of Bulgaria until 2030 with a Horizon Until 2050 (in Bulgarian), https://webcache.googleusercontent.com/search?q=cache:MhnS-ts-yvoJ:https://www.cms-lawnow.com/-/media/lawnow/pdfs/mawe/2030.pdf%3Frev%3D130f07e4-10dd-4dd6-89a7-8e6e01569bbe%26la%3Den%26hash%3DF1AC800C85FB122042192B2F31CF5A2CA08DE22F+&cd=9&hl=en&ct=clnk&gl=bg#32

7.2 Czech Republic

- Renewable energy sources and possibilities of their application in the Czech Republic (In Czech), ČEZ, a. s., Prague, 2007, https://www.cez.cz/edee/content/file/vzdelavani/obnovitelne_zdoje_energie_a_moznosti_jejich_vyuziti_pro_cr.pdf
- Renewable Energy. Economy and possibilities of support (In Czech), Ministry of the Environment, 2009, https://biom.cz/upload/6e01d6d4c4835ec93cda508772f3bf6e/oze_ekonomika.pdf
- Renewable energy directive (RED II), Official Journal of the European Union, 2018, https://eur-lex.europa.eu/legal-content/CS/TXT/?uri=CELEX:32018L2001
- Conceptual intent of the Energy Act (In Czech), Ministry of Industry and Trade, 2020, https://apps.odok.cz/veklep-detail?pid=KORNBQLGLK0X
- Report. Active energy consumers in selected European countries (In Czech),

https://www.modernienergetika.cz/aktuality/energeticky-aktivni-spotrebitele-ve-vybranych-evropskych-zemich/

- New European legislation will help to develop renewables, says the lawyer (In Czech), Greenpeace, 2019, https://www.greenpeace.org/czech/clanek/2423/nova-evropska-legislativa-pomuze-rozvoji-obnovitelnych-zdroju-rika-pravnik/
- How to use potential. Renewable energy community. Friends of the Earth Europe asbl, Hnutí Duha, Greenpeace ČR, 2018 http://foeeurope.org/sites/default/files/climate_justice/2019/cestina_-jak_vyuzit_potencial_0.pdf

7.3 Greece

- Decisions of Government Gazette B 1450/ 14.06.2013
- European Parliament and EU Council (2016): Proposal for a Directive of the European Parliament and of the Council on common rules for the internal market in electricity (recast) - COM/2016/0864
- Institute of Zero Energy Buildings-INZEB (2017): ENERGY POVERTY IN GREECE 2.0
- European Parliament and EU Council (2018): Directive 2018/2001 on the promotion of the use of energy from renewable sources
- Law 4513/2018 on Energy Communities and other Provisions– Government Gazette A 9/21.01.2018
- Ministry of Environment and Energy Greece (2019): National Energy and Climate Plan
- European Parliament and EU Council (2019): Directive (EU) 2019/944 of the European Parliament and of the Council of 5 June 2019 on common rules for the internal market for electricity and amending Directive 2012/27/EU
- Energy Communities Europe (2019): Information Package - Establishment of an Energy Community (in Greek)
- Decisions of Government Gazette A 940/ 20.3.2020
- Law 4685/2020 on Modernisation of environmental legislation, incorporation into Greek legislation of Directives 2018/844 and 2019/692 of the European Parliament and of the Council and other provisions - Government Gazette A 92/07.05.2020
- Law 4759/2020 on Modernisation of Spatial and Urban Planning Legislation and other Provisions - Government Gazette A 245/09.12.2020
- Heinrich-Böll-Stiftung Thessaloniki Greece (2020): Building Energy Communities: Energy in the hands of citizens
- The European Commission's science and knowledge service (2020): Energy communities: an overview of energy and social innovation
- The European Commission's science and knowledge service (2020): Social innovations for the energy transition
- The REScoop.eu (2020): Community Energy: A practical guide to reclaiming power

- Greenpeace Greece, Electra Energy Cooperative, NTUA SmartRue (2020): Mapping of Energy Communities in Greece
- The REScoop.eu (2021): Flexibility services for energy cooperatives
- REScoop.eu, Greenpeace, WWF Hellas and Electra Energy (2021): Development of Energy Communities in Greece. Challenges and Proposals. Problem recording, analysis of the European institutional framework and submission of proposals to remove obstacles and promote the development of Energy Communities in Greece (in Greek).

Table 5 Sources

Heinrich-Böll-Stiftung	https://gr.boell.org/en
REScoop.eu	https://www.rescoop.eu/
The European Commission's science and knowledge service	https://ec.europa.eu/jrc/en
Greenpeace Greece	https://www.greenpeace.org/greece/
Electra Energy	http://electraenergy.coop/
The European Climate Initiative (EUKI)	https://www.euki.de/
INZEB	https://inzeb.org/
Energy Communities Europe	https://enercommunities.eu/
Hellenic Wind Energy Association	https://eletaen.gr/en/home-eletaen/
Ecopower	https://www.ecopower.be/
FLEXCoop	http://www.flexcoop.eu/
WWF EU	https://www.wwf.eu/
COMPILE	https://www.compile-project.eu/
Biostruction (Energy Engineering)	https://www.biostruction.com/el/