GreeSE Papers

Hellenic Observatory Discussion Papers
on Greece and Southeast Europe

Paper No. 181

A Greek Green Deal: building energy democracy and fighting energy poverty

Yannis Maniatis, Haris Doukas, Emmanuel Karagiannis

LSE THE LONDON SCHOOL OF ECONOMICS AND POLITICAL SCIENCE

February 2023

HELLENIC OBSERVATORY European Institute Research at LSE

HELLENIC OBSERVATORY
European Institute
Research at LSE

A Greek Green Deal: building energy democracy and fighting energy poverty

Yannis Maniatis, Haris Doukas and Emmanuel Karagiannis

GreeSE Paper No. 181

Hellenic Observatory Papers on Greece and Southeast Europe

LSE THE LONDON SCHOOL OF ECONOMICS AND POLITICAL SCIENCE

Contents

A Greek Green Deal: building energy democracy and fighting energy poverty

Yannis Maniatis,[1] Haris Doukas,[2] and Emmanuel Karagiannis[3]

ABSTRACT

While implementing the New Green Deal, the European Union is faced with major energy challenges and dilemmas. Energy poverty is an issue of critical importance affecting many Europeans. Since Greece has experienced a prolonged period of crises, the strengthening of energy democracy and the fight against energy poverty must be among the top national priorities. Collective energy actions can pave the way towards the uptake of renewable energy, enabling and incentivizing consumers to become prosumers. This study first outlines the main theoretical perspectives on the politics of energy and proposes a new approach to understand renewable energy. Then it describes the EU energy policy and the transition to a climate-neutral economy. It briefly explains the concept of energy communities before focusing on the case of Greece. The study examines the rise of the country's energy communities, including the Agrinio and Minoan communities. It also explains the measures taken in Greece during the last decade to tackle energy poverty by offering incentives for energy savings. Moreover, the study describes the national energy and climate plan by examining the case of Tilos. Finally, the study summarises the main findings and offer some policy recommendations.

Keywords

Greece, energy poverty, energy saving, prosumers, energy democracy, renewable energy.

Acknowledgements

We are especially grateful to the Hellenic Observatory for awarding us a grant to conduct research on Greek energy poverty and democracy. We would like to thank A.C. Laskaridis Charitable Foundation and Dr Vassili G. Apostolopoulos for their financial support. Moreover, we would like to acknowledge the valuable contributions and assistance of Lydia Kainourgiou, Evi Makri, Afroditi Manoli, Giannis Tarnaris, Ifigeneia Tsakalogianni, Petros Vachaviolos and Ioanna Voulgari who are students at the University of Piraeus' postgraduate programme on Climate Crisis and Information and Communication Technologies. Also, we would like to thank Michalis Michalopoulos for his assistance and contribution. Finally, we would like to thank the Hellenic Ministry of Environment and Energy for providing data about various programmes and schemes.

[1] Associate Professor at the University of Piraeus. He can be contacted at maniatis@unipi.gr
[2] Associate Professor at the National Technical University of Athens. He can be contacted at h_doukas@epu.ntua.gr
[3] Reader at King's College London. He can be contacted at manos.karagiannis@kcl.ac.uk

1. Introduction

The European Commission (2019) has set ambitious goals to mitigate climate change by reaching its climate targets in a fair and efficient, and balanced way. Hence, a new Green Deal has been drafted aiming at establishing policies for reducing net greenhouse gas emissions by at least 55% by 2030, compared to the 1990 levels (European Commission, 2019). The Clean Energy for all Europeans package, adopted in 2019, seeks to transform the EU into a resource-efficient and competitive economy, achieving zero net emissions by 2050, economic growth and inclusivity in the transition (European Commission, 2019). In this way, the National Energy and Climate Plans of EU countries are designed to meet the common energy and climate targets for 2030.

While the legislative framework is being formulated and individual national plans are being laid out, it still challenging for citizens to escape energy poverty (Lennon, Dunphy and Sanvicente, 2019). The empowerment of citizens could ensure that the envisioned transition is just and fair, leaving no one behind. Bottom-up solutions that include citizens and enhance energy democracy are needed to tackle important issues such as energy poverty. Yet, the technologies, policies, and plans (e.g., uptake of renewable energy sources) remain unknown concepts for non-experts. Thus, many citizens are not aware of the important role they can play in accelerating a fair energy transition.

The engagement of citizens in the energy sector regarding not only the consumption but also the production, can "democratise" the markets. According to the Climate Justice Alliance, "*energy democracy represents a shift from the corporate, centralized fossil fuel economy to one that is governed by communities, is designed on the principle of no harm to the environment, supports local economies, and contributes to the health and well-being for all peoples*" (Climate Justice Alliance, 2022). Under this prism, the concept of prosumers has emerged which describes a cycle of consumption, production, and distribution: electricity consumers produce some electricity from their own power plants, while using the existing distribution network to inject excess production. In this regard, collective energy actions can be used to empower citizens in the energy transition. Energy communities, as consumer-empowering and community-driven initiatives, can play a key role in fostering social innovation, securing public acceptance, and enabling citizens to reinvent their role as

consumers by placing them in the loop of the energy market.

The study largely relies on primary sources, including government documents, company reports, and several interviews with business leaders and energy experts in Greece. Most of the data has been supplied by the Hellenic Ministry of Environment and Energy; it is the first time that date about the "Exoikonomo" programme is being published. Most interviews were conducted face-to-face and were open-ended. Respondents were encouraged to share their thoughts. However, these interviews were not recorded because it was believed that this would help build trust between the interviewer and the interviewee. Although data from these interviews is too small, it offers some insight into the energy dynamics of Greece. The diversity of data sources could improve validity and reliability in research.

This study first outlines the main theoretical perspectives on the politics of energy and proposes a new approach to understand renewable energy. Then it describes the EU energy policy and the transition to a climate-neutral economy. It briefly explains the concept of energy communities before focusing on the case of Greece. The study examines the energy community of Agrinio and the Minoan energy community, which have prospered in recent years. Moreover, the study explains various innovative schemes and measures to fight energy poverty in country since 2010, including the Saving at Home programme. Moreover, the study describes the national energy and climate plan by examining the case of Tilos. Finally, the study summarises the main findings and offer some policy recommendations.

2. Theoretical Perspectives on the Politics of Energy

After the oil crises of 1973 and 1979, it became clear that energy could contribute significantly to the redistribution of power among states (Ebinger, 1982). In the post-War international system, the control of energy resources has become one of the most important indicators of state power (Noreng, 2002). Those countries that have energy self-sufficiency could improve their position in the international system. Small states, like Norway and Qatar, exercise disproportionate to their population size influence because of their energy wealth (Roberts, 2014). Although its core mission is to understand the international system, the discipline of International Relations has not studied in detail energy as a determinant of interstate

relations (Shaffer 2011, 18). Nevertheless, there are two main theoretical perspectives on the politics of energy: the realist and the liberal.

The theory of political realism, in all its versions, views energy largely as a national security issue (Klare 2008). The end of the Cold War has intensified competition among the USA, the EU, Russia, and China to control the energy resources of the Middle East, the Caspian Sea, and Africa. The consuming countries seek diversification of supply to enhance their energy security and not to fall victim of political or economic blackmail. Most realists have espoused the theory of peak oil, which claims that oil (and gas) will run out one day because it is a non-renewable source of energy (Tsatskin and Balaban, 2008). This means that conflicts over energy resources will increase significantly both regionally and globally.

On the other hand, liberal analysts do not associate energy with national security issues. Instead, this perspective favours the de-politicisation of energy and supports the liberalization of energy markets to achieve maximum benefit for the consumers (Goldthau and Martin, 2010). The liberal approach tends to be less hydrocarbon-centric because energy is a commodity, not a cause. Also, proponents of the liberal approach argue that the interdependence between producers and consumers is a positive development, as it creates a climate of cooperation and reciprocity (Shrivastava and Neha, 2007). Furthermore, some liberals view energy as a tool for resolving political conflicts. For instance, the process of European integration began in 1952 with the founding of the European Coal and Steel Community, which partly aimed at fostering energy cooperation between two former belligerents, West Germany, and France.

To sum up, the realist approach emphasizes diplomacy, national security, and geopolitics, while the liberal one focuses on the market forces of demand and supply. However, their rationalistic and deterministic frameworks of analysis tend to ignore new important developments such as growing environmental concerns and the emerging EU energy policy. In fact, both approaches are largely hydrocarbon-centric and does not account for the impact of Renewable Energy Resources (RES). The latter have revolutionised the energy sector, particularly electricity supply. Therefore, the study has utilised an integrated approach that considers new explanatory variables such environmental concerns, social justice, and anti-poverty.

3. Towards a Common Energy Policy

From the Commission's point of view, a common energy policy (CEP) would promote economic integration and would contribute much to the realization of the single European market. Furthermore, a CEP would also aim to enhance economic competitiveness and contribute to the achievement of the EU's broader policy goals regarding employment and environmental protection. In November 2000, a Commission Green Paper on Energy identified four main principles of a common energy policy (European Commission, 2000):

- Security of supply.
- Completion of the internal market.
- Environmental responsibility.
- Promoting renewable energy and demand management.

Moreover, the Hampton Court Summit in London in October 2005 approved in principle the idea of a common energy policy. The 2006 Commission's Green Paper on a *European Strategy for Sustainable, Competitive and Secure Energy* (European Commission, 2006) recommended, among others, the following measures to enhance energy security:

- Building interconnections.
- Increasing the use of renewable energy sources
- Promoting carbon capture and geological storage
- Encouraging innovation.
- Energy partnerships with producers, transit countries and other international actors.
- Fostering dialogue with major energy producers/suppliers.

In January 2007, the Commission published *Energy for a Changing World: The New European Energy Policy* (Piebalgs, 2007) which described the parameters of a Common Energy Policy by setting the following goals:

- 20% reduction in EU emissions, as compared with 1990 levels, or 30 percent if other developed countries agree to take similar action by 2020.

- 20% increase in energy efficiency by 2020.
- 20% increase in the use of renewable energy by 2020.
- 10% increase in the use of biofuels in transport by 2020.
- Improvement of energy relations with EU's neighbours.
- The development of an African-EU energy partnership.
- The development of a European Strategic Energy Technology Plan to develop further technologies in the area of 4th generation nuclear power, renewables, carbon capture and clean coal.

In July 2009, the EU adopted Third Internal Market Energy Package consisting of five pieces of legislation relating to the internal energy market. It included Electricity Directive 2009/72/EC which aims at improving and integrating electricity market by fostering efficient, transparent, and non-discriminatory grid access. Thus, it covers the unbundling of transmission system operators and their activities as the centrepiece for the creation of "real incentives for companies to invest in new infrastructure, inter-connection capacity and new generation capacity", emphasis on the RSE (Directive 2009/73/EC; European Commission 2007, 6).

The Third Energy Package was supplemented by a Commission Communication titled '2020 Climate and Energy Package' that sets out three targets: a) 20% cut in greenhouse gas emissions (from 1990 levels), b) 20% of EU energy from renewables, and c) 20% improvement in energy efficiency (European Commission 2008). Therefore, the European electricity market is going green. In 2018, most of the EU's net electricity was generated by coal, oil, and natural gas (45.5%) and nuclear power (25.8%). The rest came from renewables, such as hydropower plants (13%), wind power (11.3%), and solar power (4.1%) (Eurostat, 2020).

Charting the course ahead, the 'European Green Deal' (2021) has come to dominate the front scene, capitalizing on the earlier goals, and boosting them further towards a climate neutral EU in 2050. While implementing the New Green Deal, the European Union is faced with major energy challenges and dilemmas. The EU's effort to promote renewable energy is linked to broader issues of poverty and democracy.

4. The Rise of Energy Communities

The *Energy Communities Repository* was launched by the European Commission in April 2022 with the objective to support local stakeholders willing to participate in or build energy communities. In particular, the repository will contain the most enabling and supporting frameworks, assessing different energy communities, and presenting the best practices to be used for local authorities, businesses, and citizens. Hence, special focus will be given to countries that are lacking such supportive mechanisms for energy initiatives. The Commission has also launched the Rural Energy Community Advisory Hub to focus on providing guidance and assistance to citizens, stakeholders, and local authorities in creating energy communities in rural areas.

The establishment of energy communities is a promising new way to tackle energy poverty and promote energy democracy. Since the transition to a renewable, green economy requires the cooperation of different stakeholders (i.e., governments, corporations), energy communities can provide the citizens with the opportunity to participate actively in the process of energy transition (Biresselioglu et al., 2020). Energy communities have also made significant progress as a concept, becoming a feature of the Clean Energy for all Europeans (CEP) package and more specifically of the Renewable Energy and Energy Market Directives (RED and ED respectively) (Caramizaru and Uihlein, 2020; Biresselioglu et al., 2020).

There are two types of energy communities defined in the legislation: Renewable Energy Communities (RECs) and Citizen Energy Communities (CECs) (Sokolowski et al, 2020). The two categories are related but distinct in terms of their applications and effects. Their governance depends on open and voluntary participation by citizens, local authorities and small (non-energy related) businesses (Caramizaru and Uihlein, 2020). However, there are also some crucial differences. First, unlike RECS which are bound to a specific location, CECs can be trans-local (Caramizaru and Uihlein, 2020). Moreover, CECs are active exclusively in the sector of electricity and can utilise any technology; RECs are involved only in renewable energy and can only utilise certain technology. In summary, energy communities might engage in several different activities such as production, distribution, and consumption of renewable energy and electricity sharing within the community, and even electro-mobility initiatives (Caramizaru and Uihlein, 2020).

In any case, innovative projects can face significant risks making them unappealing to usual financing mechanisms (Agrawal, Catalini, and Goldfarb, 2014). Community finance is defined as a practice of funding a project or venture by collecting small amounts of money from different sources. Crowdfunding is not limited to local contributions, but necessary funds can be raised for a project from anywhere in the world via the Internet. The way crowdfunding works is simple; the promoter presents their project on a relevant platform stating details such as how much it will cost, where it will be implemented and who it is aimed at and all that is left is to find investors who are willing and able to support this project with small amounts of money.

For instance, millions suffer from energy poverty in France. Enercoop has created a solidarity fund collecting small donations from the energy bills of consumers who are members of an energy cooperative. It is a cooperative that has more than 400 production sites, claiming that its "democratic model promotes transparency and cooperation among all stakeholders" (Enercoop, 2022). Its activities include the supply of renewable electricity and energy savings. The technologies included are solar, wind, hydraulic and biogas. The renewable generation (or capacity) is estimated at 249 GWh/year.

In Spain, there is a well-known project to replace community boilers and other energy efficiency measures in the centralized hot water production system of homeowners in Barcelona. The project achieved significant savings in the energy consumption of the centralized domestic hot water production system, as well as a fair distribution of the real consumption. A crowdlending campaign has already started for the realization of more energy efficiency proposals, including the replacement of old atmospheric gas boilers with new, more efficient watertight boilers; the replacement of old circulation pumps, new monitoring, and control system; and the installation of individual Accredited Certification Scheme (ACS) meters in each house. The campaign raised 49,600€ from 56 people ensuring lower energy consumption for involved households with significant savings on the energy bill and CO2 emissions reduced by 16 tons/year (Ecrow, 2022).

In the United Kingdom, Energy4All was established in 2002 with 27 independent renewable-energy cooperatives (Energy4All, 2022). The entity's organization type is that of a Private Limited Company and its network of activities among the communities include financial and management services. The Energy4All has raised funds through public shares and bond offers,

bringing the technical expertise to build projects. The initiative seeks to enhance new cooperatives in designing their projects, along with generating capital and solving different issues.

Finally, the Power Fund tool has been developed by the European Commission to enable the use of joint energy initiatives and innovative financing schemes (Powerpoor, 2020). The Power Fund tool serves as an online marketplace for collective energy actions and a one stop shop for information on optimally leveraging crowdfunding. It also displays current energy related crowdfunding campaigns. The Power Fund tool aims at empowering citizens to understand how collective energy actions work, but also enables them to find out how to set up one themselves. All the necessary steps from setting a business model to following the EU guidelines are covered on the platform. At the same time, the available energy communities across Europe are displayed so citizens can reach out and take part in them. Moreover, all the necessary steps in setting up a successful crowdfunding campaign are shared along with a list of existing energy related crowdfunding campaigns that individuals may wish to contribute to. The study now turns to energy communities in Greece, which have grown in recent years due to the significant production of renewable energy.

5. Energy Communities in Greece

The energy communities (EC) in Greece constitute a new model of self-generation, self-consumption of electricity and independence of the everyday electricity consumer through their advancement to producers. Since the publication of Law 4513 in January 2018, the ECs have entered the Greek energy market. Yet, the gaps in the legal framework and the delays of bureaucracy have caused obstacles to the institutional shielding of this new way of self-generation of electricity.[4]

According to recent surveys, there are more than 400 energy communities in the country; they have implemented more than 430 projects of 300 MW capacity (mainly photovoltaic installations).[5] Most of them are in Central Macedonia, while only few communities exist in

[4] Personal communication with Ms Georgia Polytanou, European relations expert, Athens, May 2022.
[5] Personal communication with Professor Harry Papapanagos, University of Macedonia, Thessaloniki, April 2022.

the islands other than Crete. The majority of energy communities (around 75%) have 10 – 20 members, mostly males (Greenpeace, 2020).

The founding Law 4513/2018 defines an EC as a civil cooperative "with the aim of promoting the social and solidarity economy and innovation in the energy sector, tackling energy poverty, promoting energy sustainability and innovation, the production, storage, self-consumption, distribution and supply of energy as well as improving energy efficiency in the final use at local and regional level". It should be noted that in the Greek legal order the term *'community'* instead of the common '*cooperative'* has been chosen; apparently as directly influenced by the European Directive 2018/2001 in which they are referred to as "*renewable energy communities*".

Members of ECs can be citizens and legal entities, as well as regional and local authorities, while the purpose of each EC can be profitable (i.e., economic benefits through the sale of the electricity produced) or not (self-consumption). The ECs could engage in actions to help vulnerable consumers or even support those living below the poverty line within the area of responsibility. Also, the ECs can undertake social policy initiatives such as the provision or offsetting of energy, energy upgrade of residences or generally actions that reduce the energy consumption of buildings.[6]

A key point of the law 4513/2018, lies on the element of locality for shaping synergies on energy projects to address local needs and to take advantage of the local renewable energy sources, returning the benefits to the community's members[7]. There is the obligation that 50% +1 of the members of an energy community to be related to the place where the project's base will be registered. According to insularity, specific arrangements and privileges are implemented in cases of very small islands with population less than 3,100 people to deal with issues like the high cost per kWh. The Law introduces technological tools, such as energy offsetting, virtual or not, aiming to protect vulnerable consumers. The Law also includes incentives for projects of up to 6 MW for wind power plants and of up to 1 MW for solar (PVs)

[6] Personal communication with Ms Georgia Polytanou.
[7] Personal communication with an official from the Hellenic Ministry of Environment and Energy, name withheld at his request, Athens, March 2022.

to be excluded from bidding procedures, as well as other exemptions regarding for instance the payment of an annual fee covering the right to hold a power generation license.[8]

While Greece has many energy communities, two of them have attracted attention for their innovative approach and creative thinking: the Agrinio energy community in Western Greece and the Minoan energy community in the island of Crete.

5.1. The Agrinio Energy Community

The Agricultural Cooperative of Agrinio (ACA) has been one of the most successful examples of cooperatives engaging in energy production. Its main goal is to support the participation of local population in activities developed not only in the sector of agriculture, but also in the sector of energy production. The ACA has been established since 1930 and members (mostly males) are usually tobacco and olive oil producers from the provinces of Trichonis, Xiromero and Valtou. Over the years, it has been active in projects across the country, counting almost 300 people as permanent or temporary personnel in total. In addition, the cooperative has developed several subsidiary companies such as Arogin (Consulting services), AgroGenesis (Consulting, Assessments, Licensing support services), Amfigal (Process & Packaging Unit for milk production) as well as Cognitera (providing digital solutions). In recent years, the ACA has been active in projects producing renewable energy in Western Greece. Hence, the cooperative operates 17 energy communities, including 10 wind farms with 168 MW capacity and 7 solar farms with 126 MW capacity (ACA, 2022).

5.2. The Minoan Energy Community

This is the first energy community established in Crete with more than 200 members, including municipalities, small businesses, and individual citizens (Minoan Energy, 2022). It is located in the small town of Arkalochori which was hit by an earthquake in 2021. The Minoan energy community (MEC) has commissioned a photovoltaic plant with a capacity of 405-kilowatt peak (kWp) and plans to invest in new projects locally. More importantly, the MEC plans to cover the energy needs of low-income households which have suffered from the earthquake and other natural disasters. In the words of one member, “the community is all

[8] Ibid.

about solidarity and good will because we cannot always rely on outside support".[9] As a result, it received the European Sustainable Energy Award for local energy action in September 2022.

The two communities are different in size and orientation. The ACA has a long history and a diverse portfolio of different assets. The MEC was established in 2019 and still is largely under development, but it has gained attention due to its social activities. Yet, both communities have been innovative and creating in planning and delivering services. They have promoted energy democracy in Western Greece and Crete, but the problem of energy poverty remains unsolved.

6. The Energy Poverty of Households

According to recent surveys of the Hellenic Statistical Service, the risk of poverty, income inequalities and material deprivation have increased compared to 2019 (Hellenic Statistical Service, 2021). More specifically:

A. The number of citizens at risk of poverty (€5,251/year for a single-person household and €11,028 for a household with two adults and two children) increased by 0.9% and reached 2,971,200 people, or the 28.3% of the population. The rate at risk of poverty and social exclusion was steadily decreasing during the period 2012 - 2019.

B. The income of the richest 20% of the population in 2020 increased by 0.6% (compared to 2019) and became 5.8 times greater than the income of the poorest 20% of the population. The ratio of incomes was decreasing from 2016 to 2019.

C. 13.9% of Greeks suffer severe material and social deprivation (deprived of 7 out of 13 essential goods and services).

A recent IMF study (2022) explains how high energy prices hit vulnerable European households harder and increase economic inequalities. Greece ranks 5th among European countries with the highest increase in the cost of living of the poorest households. More than 10% of the cost of living will rise this year for the 20% of Greek households with the lowest

[9] Personal communication with a member of the Minoan energy community, name withheld at his request, Arkalochori, August 2022.

incomes, the biggest increase after Estonia (25%), Britain (15%), the Netherlands and Czech Republic (13%). For the 20% of the richest Greek households, the cost of living is estimated to increase by almost 8%, which means that the energy crisis is intensifying inequalities and redistribution of income at the expense of the poorest in the country. The IMF study (2022) recommends that European governments withdraw horizontal aid and focus only on targeted support for the weakest. It estimates that for each European country the average cost of fully covering the losses for the poorest would be 0.4% of GDP, compared to the 1.5% of GDP that horizontal state aid costs. The study also found that 90% of electricity price increases are due to natural gas price increases. This is particularly worrying for Greece which largely depends on gas imports for its electricity production.

In Greece, energy poverty was defined for the first time in Article 2 of Law 4001/11 as the state in which consumers are in great difficulty due to their low income to cover the expenses for their reasonable needs for their supply of electricity or natural gas. Within the framework of the law, financially weak residential customers affected by energy poverty are classified as vulnerable customers. However, energy poverty is a multifaced complex social phenomenon. Identifying energy poor people so far has been based on whether they meet certain criteria and indicators and not by examining whether the conditions in a broad-brush definition are met. Therefore, some households that suffer energy poverty episodes are hard to identify and help. Since 2010, certain initiatives and policies are in place to deal with the problem of energy poverty, including the Social Residential Tariff, Saving at Home ("Exoikonomo"), the Solidarity Services Tariff, the Smog subsidy, and the special fee of RES stations.

6.1. Social Residential Tariff

The Social Residential Tariff (SRT) was established in 2010 for the protection of vulnerable residential groups of electricity consumers through the Public Power Corporation (PPC). In accordance with a Decision of the Ministry of Environment, Energy and Climate Change[10], specific conditions were set for the inclusion in a more favorable system of electricity consumption pricing, for certain categories of consumers. Inclusion criteria can be categorized as: a) income, b) marital and professional status (number of children, unemployment status) c) health status of the persons concerned (persons with disabilities or

[10] Ministerial Decision 16027/6 August 2010 (Government Gazette B' 1403/06.09.2010) as amended and in force.

protectors of people with disabilities, people in mechanical support) and d) energy consumption levels per category of beneficiary.

The inclusion of the SRT is for a whole year, namely for all bills issued in that year and for the total of the quarterly consumption up to the corresponding consumption limits provided for each category of beneficiary. It should be noted that with the last substantial amendment of the SRT, the categories and the criteria of beneficiaries were modified, while the Special Tariff for Large Families, who can now be included only in the SRT, was abolished.[11] Furthermore, an approved application for the Social Solidarity Income (which constitutes of income support based on specific social criteria, such as family composition, income and residence criteria) is needed, in order to be included in SRT.

Since the beginning of the implementation of the measure in 2012, the number of eligible households who joined the SRT, was constantly increasing, reaching 693,487 beneficiaries in 2017. In later years, there was a decrease, possibly due to the change in criteria, reaching 436,505 beneficiaries in 2022 (See Table 1).

According to the data available for the year 2022, there were 436,505 SRT beneficiaries. Almost half of them are households of the Region of Attica (130,608 beneficiaries) and the Region of Central Macedonia (96,233 beneficiaries), which makes sense as these regions represent approximately 50% of the total Greek population (See Table 2). Accordingly, while the average beneficiaries in terms of population in Greece amounts to 10.9% of the population, in Western Greece the percentage amounts to 16.5%, in Central Macedonia to 14% and in Thessaly to 13.5%. On the other hand, in the South Aegean region, the beneficiaries amount to only 5.9% of the population, in the Ionian Islands to 7% and in Crete to 7.3% of the population (See Table 3).

Table 4 presents the 10 Municipalities with the highest and the 10 with the lowest concentration of SRT beneficiaries by population. Regarding the cases of the lowest concentrations, there are mainly areas either with very little population (islands) or to areas with high income (Philothei – Psychiko districts in Athens). The highest concentrations of SRT beneficiaries can be found throughout the country, but mainly in agricultural areas.

[11] A new Ministerial Decision repealed the decision of the Committee on Prices and Incomes (No. 2153/3.4.96) which established the special Tariff for large families (article 5) (Government Gazette B' 242/01.02.2018).

6.2. Saving at Home ("Exoikonomo")

One of the most successful measures at the level of national energy policy is the pioneering programme of upgrading the energy efficiency of homes called "*Saving at Home*". It was first introduced in 2010, with the establishment of the relevant Fund as a separate financing unit for the completion of the country's energy system through energy savings in the residential building sector. Eligible houses for the programme were only those which had been constructed without the application of thermal insulation standards and were located in areas with a specific zone price (while taking account of income criteria of the house owners).

The total amount of applications for the period 2016-2020 for the various phases of Saving at Home programme reached at total of 54,403 properties (See Table 5). The programme's funds were allocated according to the distribution of the population. Most of the beneficiaries lived in the province of Attica (Athens), Central Macedonia (Thessaloniki), with the island regions occupying the last places (see Table 6). Most of the properties first were detached houses and apartments but blocks of flats were also included at a later stage.

It should be noted that there is a strong correlation between the regions with severe weather conditions during winter and the average primary energy savings (See Table 6). The highest average primary energy savings (kWh/m^2) achieved in Western Macedonia amounts to 331.59 (kWh/m2), while the lowest average primary energy savings (kWh/m2) achieved in Attica, South Aegean and Crete (167.4 and 181.8). The total primary energy savings amount to 2.03 TWh per year, while the total electricity consumption range between 51.5 to 61.13 TWh between 2011-2020 according to the International Energy Agency (IEA, 2022). The achieved savings were bigger at the detached houses since they were usually built before the block of flats which follow higher standards. As a result, detached houses exhibit worse energy efficiency compering to relatively newer buildings. It should be also noted that Exoikonomo has significantly contributed to the reduction of CO_2 emissions that amount to 630,000 tonnes annually.[12]

As already mentioned, the purpose of the programme is to fund energy upgrade interventions. There is a combination of criteria that need to be met for a participant to become eligible to participate at the programme. The first criterion taken into consideration

[12] Data provided by Yannis Maniatis.

is the energy efficiency of the property. As the efficiency deteriorates the changes to become eligible increases. The second key criterion depends on the financial status of participant. As the total income reduces the changes of the participant to become eligible increases, the same also applies for the total funds allocated by the programme the lower the financial comfort of the participant the higher the funds he/she receives by the programme. As an example, during the first cycle of the programme the total funding could reach up to 85% of the total budget, and the rest of the capital was acquired by interest free bank loans.

The highlight of the programme was the announcement of Exoikonomo 2021, partially funded by the Recovery and Resilience Fund (RRF), with the ambitious goal of energy upgrading of 105,000 houses by 2025. The new Exoikonomo subsidizes with additional resources the de-lignification process in Western Macedonia, while supporting areas affected by extreme weather events. The programme encourages the installation of smart energy management systems in different regions.

6.3. Solidarity Services Tariff

Since 2013, in the field of social policy, the existing about 3,000 public law entities of social security character, religious - charitable institutions, local municipality institutions, as well as specially certified bodies of private law of non-profit character (orphanages, nursing homes) that provide social care and solidarity services (social groceries, clinics, and soup kitchens), have a special discount of 70% for their electricity consumption, according to the "Solidarity Services Tariff".[13]

6.4. Smog Subsidy

In case of detection of high levels of smog (the type of air pollution that occurs with a high concentration of pollutants, such as particulate matter - soot, sulfur dioxide, carbon monoxide in combination with relatively low temperature and high humidity), announcements are issued at central and regional level to establish short-term measures to reduce particulate matter (PM10) emissions.[14] Among those, a recommendation to avoid or even completely cease the use of combustion sources (fireplaces, solid fuel, and biomass

[13] See Ministerial Decision 23824/23 December 2013 (Government Gazette 3274 B/23-12-2013).
[14] For the short-term action plans see Joint Ministerial Decision 70601/2013 (Government Gazette B'3272/23-12-13)

heaters) is included. In these cases, zero energy consumption charge is provided for the beneficiaries of the SRT, as far as its competitive part is concerned, for the double number of days of implementation of the short-term measures, while the corresponding charge for other consumers is equal to 30% of the respective household tariff, for a number of days equal to the days of implementation of the measures.[15]

6.5. Special Fee of RES stations

All electricity from Renewable Energy Systems (RES), mainly wind parks and hydro-power stations is assigned a special fee of 3%, except for electricity producers from RES in buildings or from photovoltaic systems (with the exception of those who receive Operating Aid) and self-producers. This fee is allocated by 1/3 to the electricity suppliers of residential consumers of the municipalities within which each RES installation is located, in order to be finally attributed as a reduction in the citizens' electricity bill, while the remaining amount is attributed by 80% to the respective Municipality and by 20% to the Municipality(-ies), from the territory of which the station's connection line to the System or the Network passes[16]. In the context of the proliferation of RES projects in Greece in recent years, it may be useful to increase this percentage from 3% to 5-6%, with part of it attributed to the most vulnerable members of local communities, after checking if the prerequisites that make up the concept of energy poverty per category, taking into amount locality criteria, are met. The average total estimated collected amount of the last years is about €20.000.000 per year, for the 300 villages with wind park installations, where 35.000 families live. Therefore, it is estimated that this fee is equal to 70-80% of the total electricity bills (before energy crisis) for the whole year for the above mentioned 35.000 families living in mountainous villages.

According to a study by ELETAEN (2021), the contribution of RES (wind and photovoltaic) resulted in a reduction of €46/MWh on average, while only for the month of December this reduction amounted to €81/MWh. Furthermore, according to the same study, it was calculated that thanks to wind and photovoltaics, this reduction saved €2.5 billion in the wholesale market. In addition, the now characterized as "super profits" obtained by RES on

[15] See 23823/23 December 2013 Ministerial Decision and the 238/3 January 2014 Joint Ministerial Decision.
[16] See Article 25 of Law 3468/2006 (Government Gazette A' 129/27.06.2006) as amended and in force, in combination with the Joint Ministerial Decision 48653/1597/19 (Government Gazette 2172 B/7-6-2019).

the energy exchange are one of the sources of revenue that will be utilized by the Energy Transition Fund in order to subsidize consumers' energy bills.

7. The “Hidden” Energy Poverty

In 2021, the Institute of Small and Medium Enterprises of the General Confederation of Professional Craft Merchants of Greece has offered data on energy poverty of the Small and Medium Enterprises (SMEs) (Table 7). The research shows that the smaller a business is, the greater its inability to pay its energy bills. While, based on the different geographical region, there are no big differences. Annual turnover, on the other hand, plays a key role. Thus, we observe that of all businesses with revenues almost up to 50,000 euros, 1 in 5 have unpaid bills (Vatikiotis, 2021). As the turnover increases, the percentage of businesses that owe steadily decreases to reach businesses with revenues of more than 300,000 euros, with the result that only 1 in 20 owes (Vatikiotis, 2021). The same trend is confirmed by the distribution of unpaid bills based on the number of employees. The largest percentage of unpaid bills (18.9%) is observed in companies that do not employ staff. This percentage is constantly decreasing as we look at companies with a larger number of employees, to reach companies with more than 5 staff having arrears at 7.2% of the companies (Vatikiotis, 2021).

According to the same study, total of 42% of professionals, answered that in previous years he left unpaid electricity bills for a small or a long period of time. In addition to that, the 69% of the buildings do not have insulation, 74% do not have a white roof, 68% of the buildings do not have frames of new technology with energy efficiency, 68% do not have awnings, 95% of the buildings do not have a bioclimatic design and 89 % of the buildings do not have other energy saving systems. There is no self-production of electricity in any building, even though a non-negligible, percentage of around 37% considers that self-production of electricity would be a solution to cover its energy needs. Nevertheless, 89% answered that the building they are housed in has economy lamps and 53% that it has economy automation. Overall, the Greek government has been less effective in tackling the energy poverty challenge facing SMEs. The current energy crisis has worsened the conditions for Greek businesses, although there is no available date yet.

Since the late 1970's, there are more than 400 local Land Improvement Organizations (LIOs), with more than 300.000 farmers as members in Greece. The main scope of the LIOs is the economic, tax and technical organization of all the procedures for farming irrigation in the 400 villages. In 2014, the parliament enacted a specific legislation to give priority to the electricity grid, if a LIO has installed a PV or wind infrastructure. At the same time, there was a provision for subsidizing up to 60% the investment through the European Structural Funds to promote the use of green power in agricultural use. Unfortunately, due to various reasons, this subsidizing has not been implemented and the 400 LIOs have more than doubled their debt to Public Power Corporation (PPC) during the period 2014 – 2021 (See Table 8).

8. The Greek National Energy and Climate Plan

The Greek National Energy and Climate Plan sets the ambitious target of reducing energy poverty by 50% by 2025 and by 75% by 2030 with 2016 as the reference year. The National Energy and Climate Plan is to be revised in 2022 or 2023 for several reasons: to increase building efficiency under the European Green Deal; to meet EU's ambitious climate and energy targets; to include unforeseen developments; and to incorporate new challenges from the energy crisis that followed the Covid-19 pandemic and the Russian invasion of Ukraine.

Moreover, the National Action Plan to Combat Energy Poverty has attempted to target energy poverty through three dimensions: information – education of affected consumers and energy saving professionals; consumer protection; and development perspective – improvement of energy efficiency and enhancement of RES.[17] In each individual dimension, action measures are laid down, among which are the improvement of the SRT for the supply of electricity to energy-vulnerable families, the "*energy card*", which will enable a certain amount of energy products to be consumed by affected households in exceptional times of crisis, as well as a package of regulatory protection measures.[18] The third dimension seeks to link energy poverty with energy production, while proposed measures include the energy upgrading and installation of RES systems in the buildings of affected households to save

[17] See Government Gazette 4447/B/28.09.2021
[18] Personal communication with Mr Alexandros Nikos, Climate crisis expert, Athens, February 2022.

energy and promote self-consumption, as well as the preparation of economic and regulatory reforms to support and expand ECs.

Overall the Plan aims at tackling energy poverty through the improvement of the energy efficiency of homes and the change of the energy model with which the vulnerability of those affected is perpetuated through the support of RES and participation in ECs. Regarding energy efficiency, one challenge is to guarantee the required development funding and its fair sharing among affected persons according to the local conditions. Another challenge is the further amendment of the regulatory framework towards a more decisive and just shift to sustainable energy managed by consumers themselves. Both challenges share two common factors: the qualitative identification of the factors and characteristics that make up an energy poor household – which depends on the interpretation of energy poverty itself in the Greek legal order – and the quantitative analysis of the affected households regarding their number and spatial distribution in the Greek territory. Based on the results of those two analyses, it is crucial to provide specific and *locally oriented* incentives for the implementation of planned policy measures. The transformation of Tilos into a green-only island could serve as an example of energy autonomy.

9. Tilos as an Example of Energy Autonomy

Tilos is the first island has been energy independent and fully autonomous, not only in the country but also in the broader region of the Mediterranean Sea. The island has managed to become autonomous due to a privately developed innovative technology system, the S4S system – which stands for “Storage for Sustainability, Smart Grid, Solutions and Security”.

The S4S system is designed to initiate the combination of renewable energy production and energy storage, while strengthening energy security with novel technologic solutions. More specifically, the system can facilitate the optimized use of energy regarding production and demand; this, it offers more energy efficiency.[19] This hybrid energy system has utilised various energy sources, including wind and solar power, while adjusting the energy production, storage and use to the real-time meteorological and technical operation data. As a result,

[19] Personal communication with Ms Eleni Kanellou, Sustainability expert, Athens, March 2022.

charging and storage have taken place in a way that allow the power supply run to the electricity system without any interruptions and at the lowest cost possible, maximizing at the end the energy efficiency of the whole system.[20]

Currently, the project includes 800kW of wind power, 160kW of solar power and 2,8 MWh in storage capacity through batteries (Tilos energy community, 2022). In addition, the project has generated more than 3,000 MWh saving over 3,000 tons of carbon dioxide – what could have been absorbed by a forest as big as more than 50,000 trees (Tilos energy community, 2022). Further, the savings mentioned above can be financially estimated at 39,000 euros cost, which makes the project's contribution to the efforts in order to tackle climate crisis and mitigate its consequences, even more significant. At the same time, the development and success of the project has been calculated to have reduced the fuel cost for electricity generation by almost 510,000 euros (Tilos energy community, 2022). On top of that, regarding the occasion of grid losses, the hybrid system along with the energy infrastructure existing on the island has been capable of completely covering the energy needs of the area's residents and also providing energy excess for exports towards neighboring island such as Nisyros and Kos.

In summary, the project has brought many benefits to the community, the local economy, and the environment: the utilisation of different renewable energy sources; the protection of the island's bio-diversity and ecosystem; the creation of jobs; and the promotion of eco-tourism.[21] This hybrid system has played an important role on reducing the use of hydrocarbons for the domestic energy production and thus the CO2 emissions. Following the successful implementation of the Tilos project, other Greek islands have started to apply the same model and practice; Leros, Anafi, Donousa and Fournoi will become the next green islands. By increasing the share of RES and reducing the energy costs, these islands are becoming less dependent on oil and oil-related products. With the help of new technologies (e.g., smart meters), the Greek island can achieve complete energy autonomy. Hence, local consumers could enjoy both financial and environmental benefits.

[20] Personal communication with Mr Konstantinos Koasidis, Energy expert, Athens, March 2022.
[21] Personal communication with a representative from Eunich Energy Group, name withheld at his request, Athens, May 2022.

10. Conclusion

The multifaceted social phenomenon of energy poverty currently affects millions of people across the European Union, including Greece. The recent energy crisis has rendered important that the just energy transition is accelerated, moving away from fossil fuels and towards the installation and uptake of renewable energy sources. Collective energy actions can pave the way towards the uptake of renewable energy, supporting citizens and enhancing energy democracy. At the same time, the lack of funding can be a problem when setting up collective energy actions. Combining collective energy actions with innovative financing schemes can be part of tackling energy poverty by providing citizens with all the necessary information and tools so that they can become from educated consumers prosumers.

In Greece the notion of energy communities is rather new, and the legislative framework is now being formulated. Until now, some policies have been in place trying to support energy poor citizens mostly in the form of subsidies based on economic criteria. This approach leaves many people facing energy poverty episodes without any support and does not provide long term solution to the problem rather than a temporary relief. Several challenges need to be addressed with regards to energy communities in Greece. Nevertheless, the community-led initiatives are on the right track towards enhancing energy democracy putting citizens at the heart of the energy transition making them from consumers to prosumers. Indeed, the country stands at a crossroads, domestically and internationally. It has enormous a RES potential that can fulfil its own energy needs. Thus, RES can contribute to the economy by reducing costs, creating numerous jobs, and further promoting energy democracy. Greece can also substantially participate in the EU transformation, serving as its main "energy ambassador" to the region of the Eastern Mediterranean.

However, it is fair to say that energy democracy is still in embryonic stage in Greece. Most citizens and entities are not aware of the new opportunities to influence decisions in the field of energy. Therefore, the following measures could be taken to further energy democracy at the municipal level:

- Organising public events to meet and engage with citizens on energy poverty and energy democracy issues.
- Providing energy training and education for front line advisers.

- Supporting women empowerment and gender equality through energy democracy.
- Offering more financial incentives and innovative financing schemes for the establishment of ECs which can highlight the positive contribution of green energy in local economies.
- Amending Greek legislation regarding LIOs to allow the combination of different kind of activities (agriculture + energy) so they can produce all or a significant portion of the energy needed for different purposes.
- Subsiding energy efficiency, such as installation of solar panels and thermal insulation.

Bibliography

Agrawal, Ajay, Christian Catalini, Avi Goldfarb, "Some Simple Economics of Crowdfunding", Innovation Policy and the Economy, vol. 14, 2014, 63-97.

Biresselioglu, Mehmet Efe et. al. "Individuals, Collectives, and Energy Transition: Analysing the Motivators and Barriers of European Decarbonisation", *Energy Research & Social Science*, vol. 20, 2020, 417-429

Climate Justice Alliance, "What is Energy Democracy?", 2022, https://climatejusticealliance.org/workgroup/energy-democracy/

Ebinger Charles K., *The Critical Link: Energy and National Security in the 1980s* (Cambridge, MA: Ballinger Publishing Co. 1982)

Ecrow, "Project Description", 2022, https://www.ecrowdinvest.com/detalles/comunidad-propietarios-barcelona#description

ELETAEN, "RES Penetration and Electricity Market Prices in Greece", 2021, https://eletaen.gr/en/study-res-penetration-and-electricity-market-greece/

Enercoop, "Why Enercoop?", 2022, https://www.enercoop.fr/notre-projet

Energy4All, "Annual Report 2021", 2022, https://energy4all.co.uk/wp-content/uploads/2022/06/Annual-Report-supplement-2021.pdf

EurObserv'ER, "Solar Thermal and Concentrated Solar Power Barometer 2021", 2021, https://www.eurobserv-er.org/solar-thermal-and-concentrated-solar-power-barometer-2021/

European Commission, "Towards a European Strategy for the Security of Energy Supply", Green Paper, Brussels, 2000, https://op.europa.eu/en/publication-detail/-/publication/0ef8d03f-7c54-41b6-ab89-6b93e61fd37c/language-en

European Commission, "European Strategy for Sustainable, Competitive and Secure Energy", Green Paper, Brussels, 2006, https://europa.eu/documents/comm/green_papers/pdf/com2006_105_en.pdf

European Commission, "An Energy Policy for Europe", 2007,

https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52007DC0001&from=en

European Commission, “2020 by 2020: Europe’s Climate Change Opportunity”, 2008, https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A52008DC0030

European Commission, “Electricity Interconnection: North-South Electricity Interconnections in Central Eastern and Southeastern Europe”, 2018,

https://ec.europa.eu/energy/sites/ener/files/documents/pci_3_10_1_en_2017.pdf

European Commission, “The European Green Deal”, December 2019, https://eur-lex.europa.eu/resource.html?uri=cellar:b828d165-1c22-11ea-8c1f-01aa75ed71a1.0002.02/DOC_1&format=PDF

European Commission, “EuroAsia EU Status”, 2021, https://euroasia-interconnector.com/at-glance/the-big-picture/euroasia-eu-status/

European Commission, “A European Green Deal: Striving to be the First Climate-Neutral Continent”, 12 April 2021, https://ec.europa.eu/info/strategy/priorities-2019-2024/european-green-deal_en

Eurostat, *Energy, Transport and Environment Statistics* (Luxembourg: Publications Office of the European Union, 2020

Goldthau, Andreas and Jan Martin, *Global Energy Governance: The New Rules of the Game* (Washington, DC: Brookings Institute Press, 2010)

Greenpeace, “Ενεργειακές Κοινότητες στην Ελλάδα” [Energy Communities in Greece], 8 December 2020, https://www.greenpeace.org/greece/issues/klima/15472/oi-energeiakes-koinothtes-stin-ellada/

Hellenic Statistical Service, “Risk of Poverty”, Press Release, 23 September 2021, https://www.statistics.gr/documents/20181/92456ff4-ca92-fd4d-df49-81c297c978e7

IEA, “Greece – Energy Profile”, US Department of Energy, 2022, https://www.iea.org/countries/greece

IMF, Surging Energy Prices in Europe in the Aftermath of the War: How to Support the Vulnerable and Speed up the Transition Away from Fossil Fuels”, IMF Working papers, July

2022, https://www.imf.org/en/Publications/WP/Issues/2022/07/28/Surging-Energy-Prices-in-Europe-in-the-Aftermath-of-the-War-How-to-Support-the-Vulnerable-521457

Kacper Szulecki and Indra Overland, “Energy Democracy as a Process, an Outcome and a Goal: A Conceptual Review”, *Energy Research & Social Science*, vol. 69, 2020

Klare, Michael T., *Rising Powers, Shrinking Planet: The New Geopolitics of Energy* (New York: Henry Holt and Company, 2008)

Kurrer, Christian, “Environmental Policy: General principles and Basic Framework”, 2020, European Parliament, https://www.europarl.europa.eu/factsheets/en/sheet/71/environment-policy-general-principles-and-basic-framework

Lennon, Breffni, Niall P. Dunphy and Estibaliz Sanvicente, “Community Acceptability and the Energy Transition: a Citizens’ Perspective”, *Energy, Sustainability and Society*, vol. 9, no. 35, 2019

Noreng, Oystein, *Crude Power: Politics and the Oil Market* (London: I.B. Tauris, 2002)

Piebalgs, Andris, “Energy for a Changing World: The New European Energy Policy”, Speech at the EPP seminar “Europe's Energy Challenges”, Brussels, 7 February 2007

Powerpoor, “Empowering Energy Poor Citizens through Joint Energy Initiatives”, 2022, https://powerpoor.eu/

Roberts, David, *Qatar: Securing the Global Ambitions of a City-State* (London: Hurst Publishers, 2014)

Shaffer, Brenda, *Energy Politics* (Philadelphia: University of Pennsylvania Press, 2011)

Shrivastava, Leena and Neha Misra, “Promoting Regional Energy Co-operation in South Asia”, *Energy Policy*, vol. 35, no. 6, 2007, pp. 3360-3368.

Sokołowski, Jakub, Piotr Lewandowski, Aneta Kiełczewska & Stefan Bouzarovski, “A Multidimensional Index to Measure Energy Poverty: the Polish Case”, *Energy Sources*, *Part B: Economics, Planning, and Policy*, vol. 15, no. 2, 2020, 92-112.

Solariseheat, “Energising Europe With Solar Heat”, 2022, https://solariseheat.eu/

The Agricultural Cooperative of Agrinio (ACA), “New Energy Projects”, 2022, http://www.e-ea.gr/απε/νέα-ενεργειακά-έργα/

Tsatskin, Alexander and Oded Balaban, “Peak Oil in the Light of Oil Formation Theories”, *Energy Policy*, vol. 36, no. 6, 2008, pp. 1826-1828.

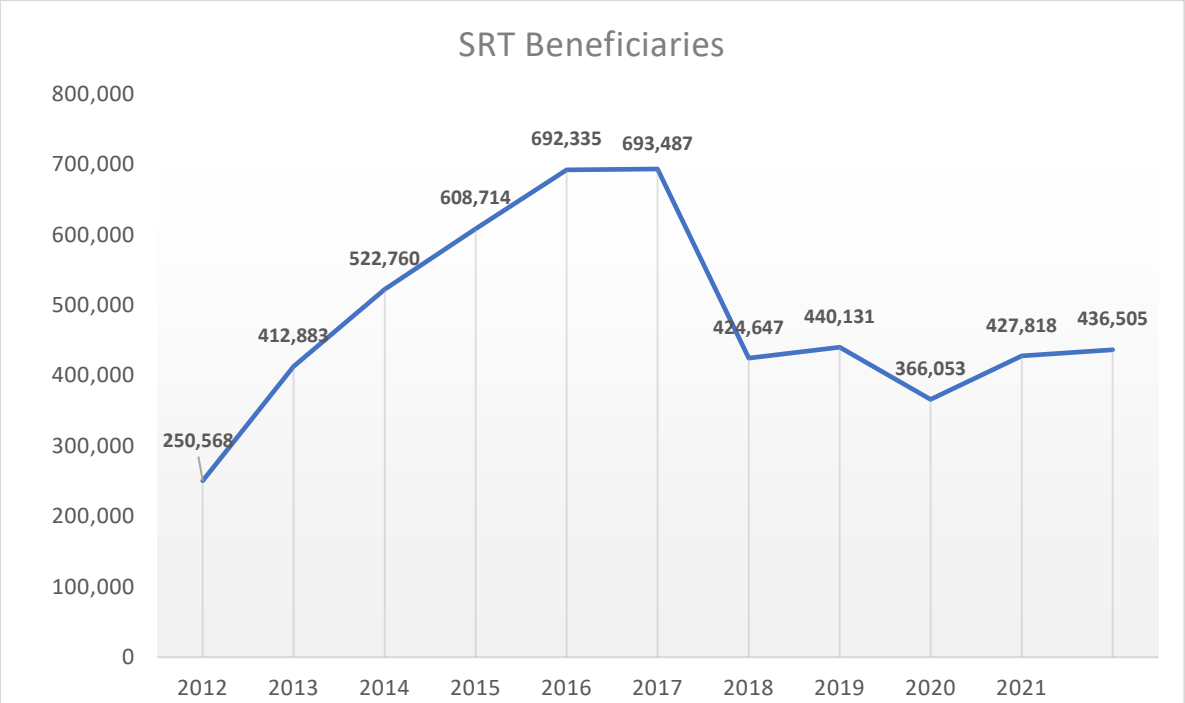
Uihlein A., Caramizaru A., “Energy Communities: An Overview of Energy and Social Innovation”, Ch. 2: Concept and definitions for energy communities, Joint Research Centre (JRC), European Commission, 2020,

United Nations, “Sustainable Development Goals: 17 Goals to Transform Our World”, 2015, https://www.un.org/sustainabledevelopment/?

Vatikiotis, Leonidas, “Energy Poverty in Small and Medium Enterprises in Greece”, Working Paper 22, IME GSEVEE, February 2021

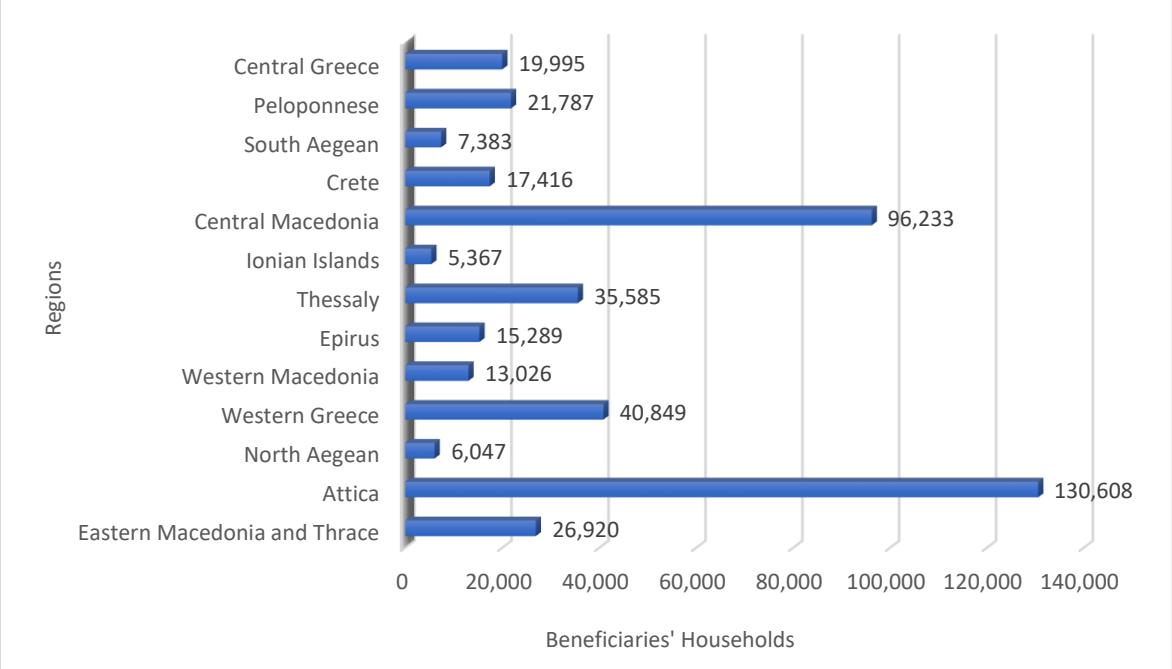
Appendix

Table 1 Evolution of the number of Social Residential Tariff (SRT) beneficiaries' households



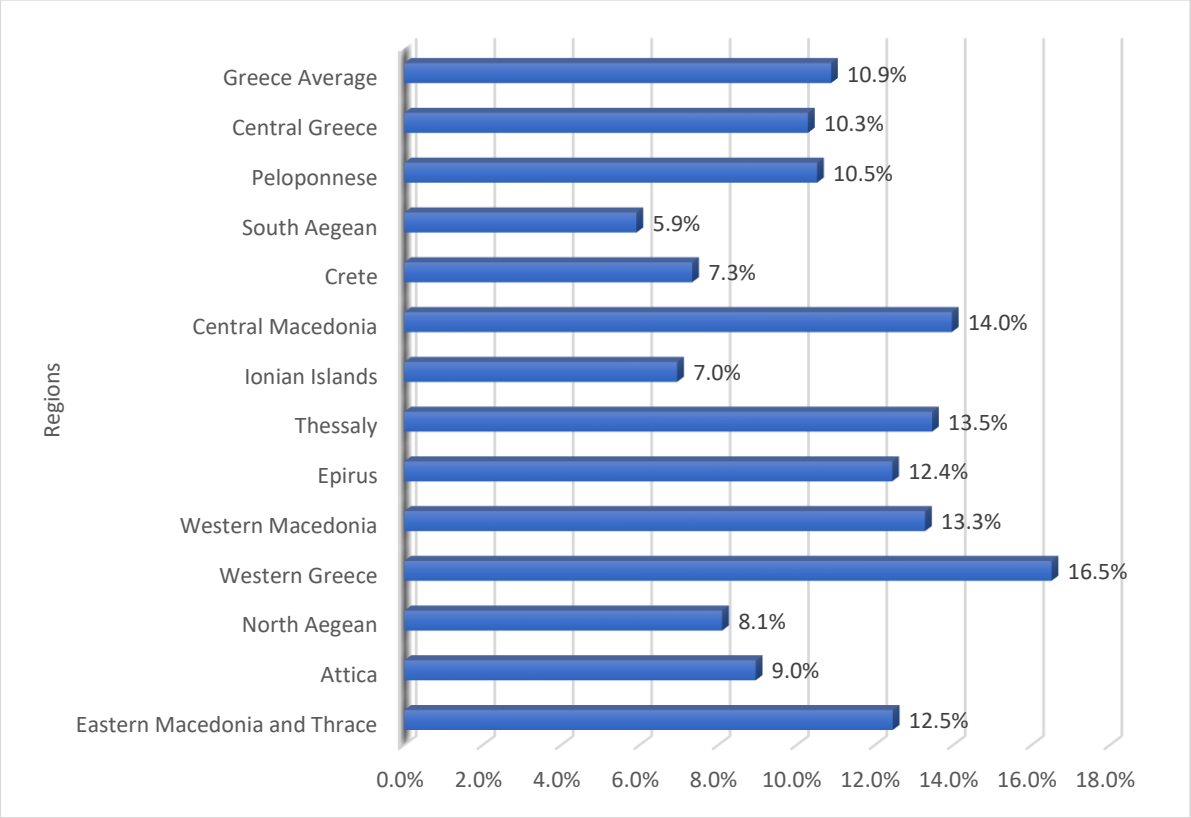
Source: The Hellenic Ministry of Environment and Energy, authors' manipulation

Table 2 SRT Beneficiaries' Households per Region



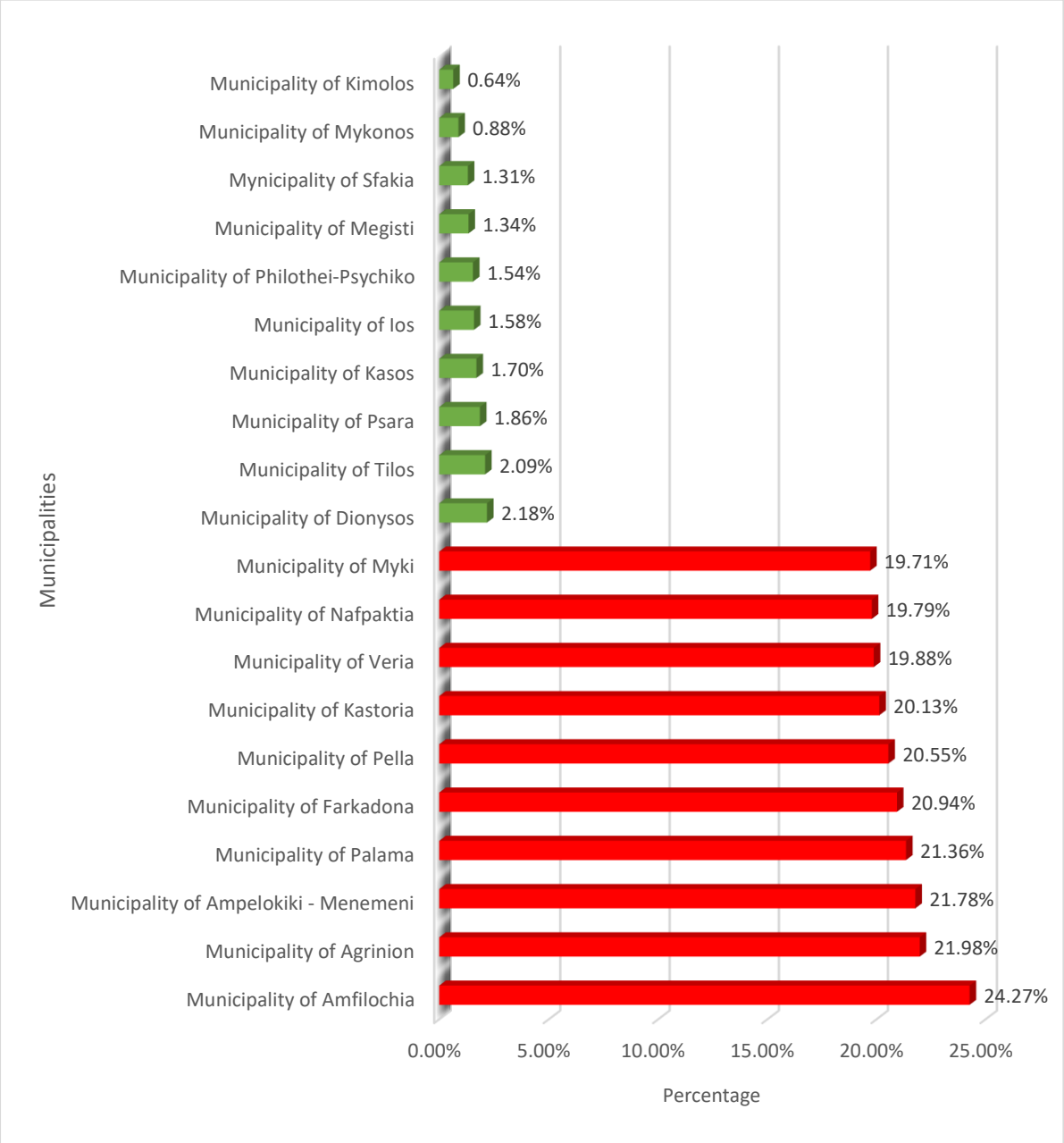
Source: The Hellenic Ministry of Environment and Energy, authors' manipulation

Table 3 SRT Beneficiaries per Region (Citizens)



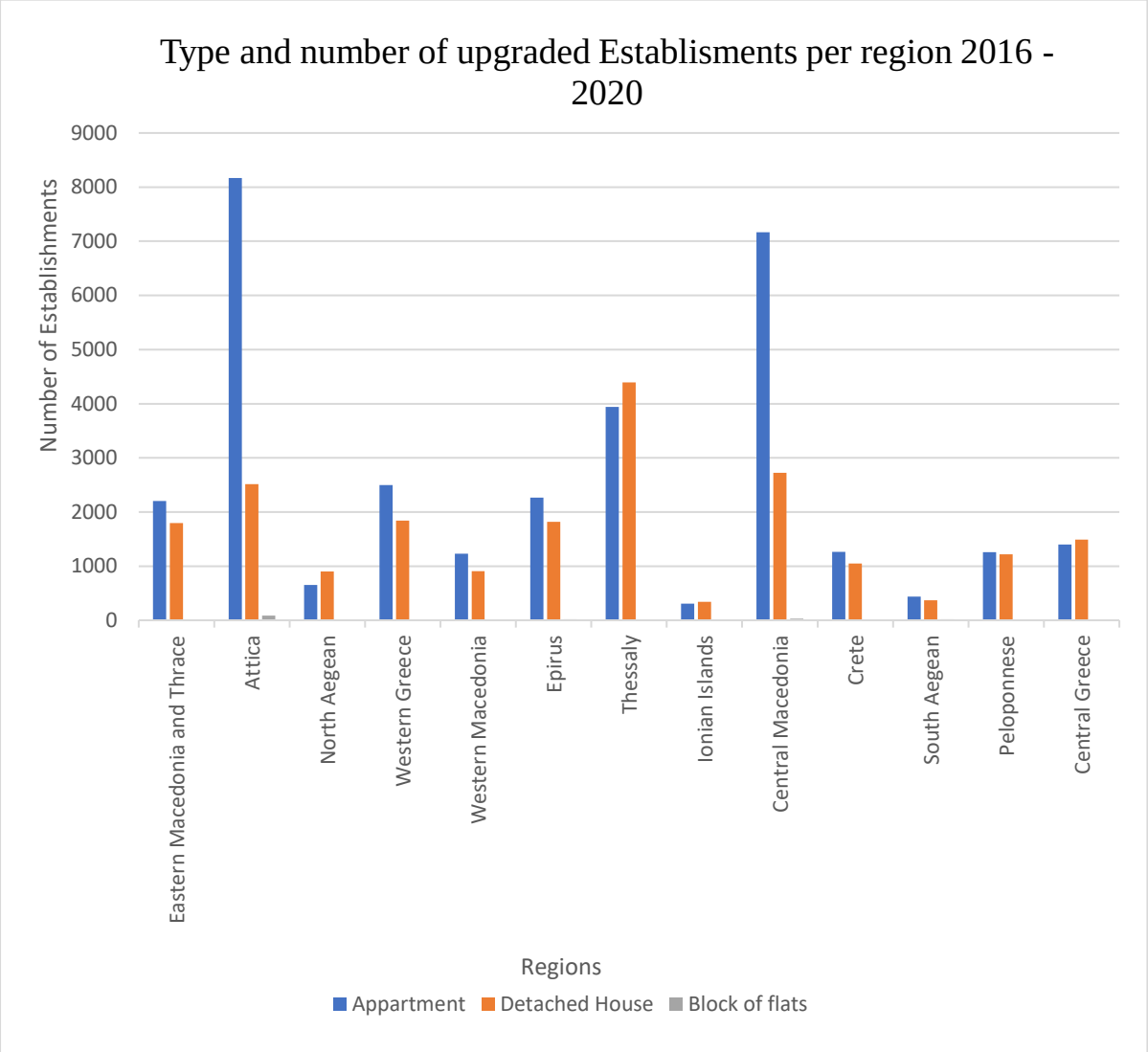
Source: The Hellenic Ministry of Environment and Energy, authors' manipulation

Table 4 Highest and lowest concentration of SRT population by municipality



Source: The Hellenic Ministry of Environment and Energy, authors' manipulation

Table 5 Type and number of upgraded establishments per region 2016-2020



Source: The Hellenic Ministry of Environment and Energy, authors' manipulation

Table 6 Distribution of “Exoikonomo” applications by region and energy savings

Regions	Heated Area (m^2)	Percentage	Primary Energy Savings (GWh/a)	Primary Energy Savings (KWh/m^2)	Apartments	Detached Houses	Block of flats	Total Establishments
Eastern Macedonia and Thrace	404,608	7%	168.6	282.5	2,206	1,797	15	4,018
Attica	1,031,095	19%	298.2	167.4	8,170	2,513	88	10,771
North Aegean	161,862	3%	56.8	216.0	652	900	5	1,557
Western Greece	443,915	8%	141.9	195.0	2,500	1,843	12	4,355
Western Macedonia	223,417	4%	113.7	331.6	1,230	908	8	2,146
Epirus	401,891	7%	149.3	234.4	2,265	1,818	20	4,103
Thessaly	860,321	16%	354.3	279.9	3,938	4,393	8	8,339
Ionian Islands	66,872	1%	21.7	202.2	306	344	5	655
Central Macedonia	954,234	18%	406.7	278.6	7,168	2,723	30	9,921
Crete	245,947	5%	70.2	181.8	1,261	1,051	13	2,325
South Aegean	85,467	2%	24.0	181.1	438	371	16	825
Peloponnese	266,356	5%	106.5	234.2	1,256	1,221	15	2,492
Central Greece	298,952	5%	122.2	250.5	1,399	1,491	6	2,896
Greece Total	5,444,937	100%	2,034	237.7	32,789	21,373	241	54,403

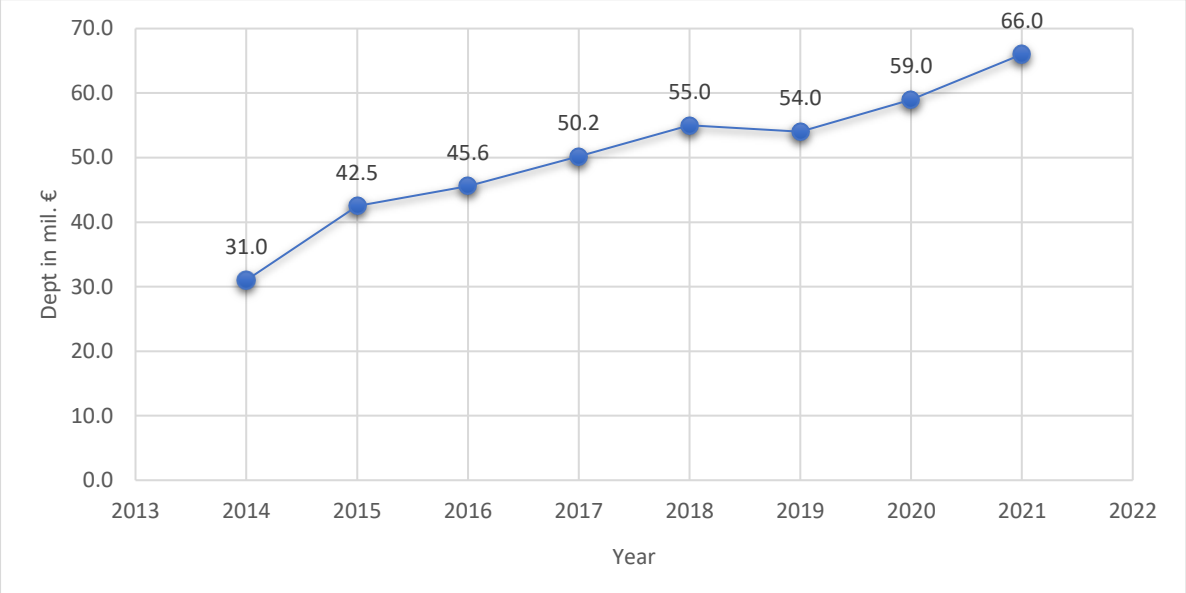
Source: The Hellenic Ministry of Environment and Energy¸ authors’ manipulation

Table 7 The Energy Poverty of Small and Medium Enterprises

Overdue debts on energy bills											
	Sector			Years of operation				Annual turnover			
	Trade	Clothing processing	Services	max 5	5-10	10-15	15+	50.000	50.000-100.000	100.000-300.000	300.000+
YES	14,7	12,8	17,3	10	17,1	22,1	14,8	21,9	17,5	12,2	5,4
NO	85,3	87,2	82,1	90	82,9	77,9	84,9	78,1	82,5	87,8	94,6
DK	0	0	0,6	0	0	0	0,3	0	0	0	0
		Region					Total employees				
		Attica	Aegean, Crete	North Greece	Central Greece	Without employees	1	2-3	4-5	>5	
	YES	16,1	16,8	14,2	14,3	18,9	18,2	17,3	10,3	7,2	
	NO	83,2	83,2	85,8	85,7	81,1	81,8	82,7	88,5	92,1	
	DK	0,7	0	0	0	0	0	0	1,1	0,7	
Source ΙΜΕ ΓΣΕΒΕΕ, Εξαμηνιαίο δελτίο οικονομικού κλίματος μικρομεσαίων επιχειρήσεων, Αύγουστος 2019											

Source: The Institute of Small and Medium Enterprises

Table 8 Land Improvement Organisations' Debt



Source: The Hellenic Ministry of Environment and Energy, authors' manipulation

Previous Papers in this Series

180. Gikas Hardouvelis and Dimitri Vayanos, The Greek Economic Crisis and the Banks, January 2023

179. Marilena Paraskeva, The Covid-19 Anti-vaccination Movement in Cyprus: an investigation of its discourses (AMID), December 2022

178. Antonis Pastellopoulos, Cypriotism as a Political Ideology: critical contributions and conceptual limitations, December 2022

177. Angelos Angelopoulos, George Economides, George Liontos, Apostolis Philippopoulos, Stelios Sakkas, Public Redistributive Policies in General Equilibrium: an application to Greece, November 2022

176. Dimitris Katsikas, Crisis, Clientelism and Institutional Resilience: reflections on a public sector reform under the MoUs, October 2022

175. Petros Kosmas, Antonis Theocharous, Elias Ioakimoglou, Petros Giannoulis, Leonidas Vatikiotis, Maria Panagopoulou, Lamprianos Lamprianou, Hristo Andreev and Aggeliki Vatikioti, Mapping and Measuring the Phenomenon of Precariousness in Cyprus: challenges and implications, September 2022

174. Nasia Hadjigeorgiou, The Invisible Impact of Frozen Conflicts: A case study of foreign domestic workers in Cyprus, August 2022

173. Dimitrios Karamanis, Defence partnerships, military expenditure, investment, and economic growth: an analysis in PESCO countries, July 2022

172. Cyrille Lenoël, Corrado Macchiarelli, Garry Young, Greece 2010-18: What could we have done differently?, June 2022

171. Ilias Livanos and Evi Tzika, Precarious employment in Greece: Economic crisis, labour market flexibilisation, and vulnerable workers, May 2022

170. Theodoros Rakopoulos, On Divisionism and Cypriotism: the civic languages of the Cyprus Problem, April 2022

169. Ritsa Panagiotou and Nikolaos Tzifakis, Deciphering the Greek Economic Diplomacy towards the Western Balkans: actors, processes, challenges, March 2022

168. Diomidis Spinellis, Athanasia Pouloudi, George Xirogiannis, Evmorfia Makantasi, Intelligent modeling of e-Government initiatives in Greece, February 2022

167. Lamprini Rori, Vasiliki Georgiadou and Costas Roumanias, Political violence in Greece through the PVGR database: evidence from the far right and the far left, January 2022