

*A cross-border region where rivers
connect, not divide*



**SEPIaM-CC – Raising capacity of cross-border public institutions in
sustainable energy planning and management and climate change
mitigation**

(HUHR/1901/3.1.1/0048)

JOINT ANALYSIS OF GATHERED STRATEGIC DOCUMENTS
**(Joint state-of-art analysis of the present practices of sustainable
energy planning and management and climate change mitigation)**

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Project partners:



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1. Executive summary

In the last few years, sustainable energy planning and management and climate change mitigation have become key strategic goals that local, regional and even national governments are striving to achieve. Based on insights into existing practices in sustainable energy planning and management and climate change mitigation in Croatia and Hungary, project partners of the SEPlAM-CC project – Raising capacity of cross-border public institutions in sustainable energy planning and management and climate change mitigation (HUHR/1901/3.1.1/0048) concluded that more and more cities and municipalities, especially those whose administrative area is located along the HU-HR border, are investing in projects oriented towards increasement of energy efficiency and the use of renewable energy sources. This is evidenced by the fact that an increasing number of local governments in Medjmurje county are investing in energy refurbishment of buildings in their ownership, while Hungarian local governments along the Croatian border are known for exploiting the geothermal potential for heating buildings of different purposes (public, residential, commercial, etc.).

When we talk about the implementation of energy and climate related projects, it is important to point out that these are very high investment projects that should be harmonized with a large number of regulations at national and European level. All this leads to the conclusion that the successful implementation of such projects in addition to compliance with legislation is further based on securing sufficient funding sources through various financing mechanisms (EU funds, national ministries, commercial banks, alternative funding sources, etc.). Through this document project partners tend to address the importance of gaining knowledge on the existing legislation as well as the possibility of financing projects in the field of energy and climate change.

In the introductory part, the project partners emphasize the importance of energy and climate planning as well as key challenges in the development of strategic and planning documents aimed at increasing energy efficiency, the use of renewable energy sources and climate change mitigation in Croatia and Hungary. In addition, they investigated the potential funding mechanisms for such projects without which their implementation would not be possible nor successful.

Furthermore, the first chapter of the document deals with the analysis of legislation in the field of energy and climate change in Croatia and Hungary as well as with the impact of European legislation on the national regulations of the involved project partner countries. Analysis of the existing regulations as well as strategic and planning documents was conducted using publicly available sources as well as access to relevant scientific papers.

The second chapter includes an overview of potential financing mechanisms for energy and climate projects with examples of projects whose implementation has been funded by some of the available national and even European funding sources in Croatia and Hungary.

Following the results of the analysis of legislation as well as potential sources of funding energy and climate projects on both sides of the border, the project partners will identify some potential strategic objectives which should be set for next decades.

1. Sažetak

U posljednjih nekoliko godina održivo energetske planiranje i upravljanje te ublažavanje klimatskih promjena postaju ključni strateški ciljevi koje lokalne, regionalne pa i nacionalne vlade nastoje ostvariti. Uvidom u postojeće prakse u održivom energetske planiranju i upravljanju klimatskim promjenama u Hrvatskoj i Mađarskoj, projektni partneri projekta SEPlAM-CC – Povećanje kapaciteta prekograničnih javnih institucija u održivom energetske planiranju i ublažavanju klimatskih promjena (HUHR/1901/3.1.1/0048) su uvidjeli kako sve više gradova i općina, posebice onih čije je administrativno područje smješteno uz samu granicu ulaže u projekte povećanja energetske učinkovitosti i upotrebe obnovljivih izvora energije. Tome svjedoči i činjenica kako sve veći broj međimurskih gradova i općina ulaže u energetske obnovu zgrada u svojem vlasništvu, dok su mađarske jedinice lokalne samouprave uz samu granicu s Hrvatskom poznate po iskorištavanju geotermalnog potencijala podzemnih voda za grijanje zgrada svih namjena (javne, stambene, komercijalne, itd.).

Kada govorimo o implementaciji energetske i klimatske projekata, važno je istaknuti kako se ovdje radi o vrlo visokim investicijskim zahvatima koji prije same implementacije trebaju biti usuglašeni sa velikim brojem zakonodavnih regulativa i propisa na nacionalnoj i europskoj razini. Sve ovo dovodi do zaključka kako se uspješna implementacija ovakvih projekata uz usuglašenost sa zakonskom regulativom dodatno temelji i na osiguranju dostatnih financijskih sredstava kroz različite mehanizme financiranja (EU fondovi, nacionalna ministarstva, komercijalne banke, alternativni izvori financiranja, itd.). Upravo kroz ovaj dokument, projektni partneri su se osvrnuli na važnost poznavanja postojeće zakonodavne regulative kao i mogućnosti financiranja projekata u domeni energetike i klimatske promjena.

U uvodnom dijelu projektni partneri ističu važnost energetske i klimatske planiranja kao i ključne izazove u razvoju strateških i planskih dokumenata usmjerenih na povećanje energetske učinkovitosti, upotrebu obnovljivih izvora energije i ublažavanje klimatske promjena u Hrvatskoj i Mađarskoj. Uz to osvrću se i na potencijalne mehanizme financiranja takvih projekata bez kojih njihova realizacija ne bi bila moguća niti uspješna.

Nadalje, prvo poglavlje dokumenta bavi se analizom zakonodavnih regulativa u području energetike i klimatske promjena u Hrvatskoj i Mađarskoj kao i utjecajem europske zakonodavne regulative na nacionalne regulative uključenih zemalja projektnih partnera. Analiza postojeće regulative, te strateških i planskih dokumenata provedena je korištenjem javno dostupnih izvora te pristupom relevantnim znanstvenim radovima.

Drugo poglavlje obuhvaća pregled potencijalnih mehanizama financiranja energetske i klimatske projekata s primjerima projekata čija provedba je financirana nekim od dostupnih nacionalnih i europskih izvora financiranja u Hrvatskoj i Mađarskoj.

Nastavno na rezultate provedenih analiza zakonodavne regulative kao i potencijalnih izvora financiranja energetske i klimatske projekata s obje strane granice, u okviru dokumenta projektni partneri će identificirati potencijalne strateške ciljeve djelovanja u budućem razdoblju financiranja projekata sredstvima EU fondova iz nove financijske perspektive 2021. – 2027. i provedbe energetske i klimatske projekata.

1. Összefoglaló

Az elmúlt néhány évben a fenntartható energiatervezés és energiamenedzsment, a klímaváltozás csökkentése kiemelkedő stratégiai célokká nőttek ki magukat, melyeket a helyi, a regionális és a központi kormányzati szervek egyaránt törekednek figyelembe venni.

A fenntartható energiatervezés és a energiamenedzsment jelenlegi magyarországi és horvátországi gyakorlata alapján, egyre több város és település, különösen azok, amelyek közigazgatási területe a horvát-magyar határmentén helyezkednek el, az energiahatékonyság növelését és a megújuló energiaforrások felhasználását célzó projektekbe kezdenek bele. Erre a következtetésre jutottak a SEPlAM-CC (projekt szám: HUHR/1901/3.1.1/0048), "A határon átnyúló állami intézmények kapacitásnövelése a fenntartható energiatervezés és energiakezelés, valamint az éghajlatváltozás enyhítése terén" című projekt partnerei.

Ezt bizonyítja az a tény, hogy horvátországi Muraköz megyében egyre több önkormányzat fektet a saját tulajdonukban lévő épületek energetikai felújításába, míg a horvát-magyar határmenti magyar önkormányzatok pedig a geotermikus energiákat használja az különböző rendeltetésű épületek fűtésére (közcélu, lakossági, kereskedelmi stb.).

Amikor az energetikával és klímával kapcsolatos projektekről beszélünk, akkor figyelembe kell venni, hogy ezek magas beruházásköltségű projektet, melyeknek harmonizálniuk kell a nemzeti és az európai szabályozásokkal egyaránt. Mindez arra enged következtetni, hogy az ilyen jellegű projektek sikeres megvalósítása a jogszabályok betartásán túlmenően a különböző finanszírozási mechanizmusok (EU-források, nemzeti minisztériumok, kereskedelmi bankok, alternatív finanszírozási lehetőségek stb.) révén történő megfelelő források biztosításán alapul.

Ezen a dokumentumok mellett a projektpartnereknek fontos foglalkozniuk a jelenlegi jogszabályokkal kapcsolatos ismeretek megszerzésével, valamint az energia és az éghajlatváltozás területén megvalósuló projektek finanszírozásának lehetőségeivel egyaránt.

Jelen dokumentum bevezető részben a projektpartnerek kihangsúlyozzák az energia- és klímatervezés fontosságát, valamint az energiahatékonyság növelését, a megújuló energiaforrások felhasználását, a klímaváltozás mérséklését célzó stratégiai és tervezési dokumentumok kidolgozásának kulcsfontosságú kihívásait Horvátországban és Magyarországon. Ezenkívül megvizsgálták az ilyen projektek lehetséges finanszírozási mechanizmusait, amelyek nélkül nem lenne lehetséges a megvalósítás.

A dokumentum első fejezete a horvátországi és magyarországi energetikai és klímaváltozási jogszabályok elemzésével, valamint az európai jogszabályokkal, melyek a projektben résztvevő partnerországok nemzeti szabályozására gyakorolt hatásával foglalkozik. A hatályos szabályozások és a stratégiai és tervezési dokumentumok elemzése a nyilvánosan elérhető források, valamint a releváns szakirodalom felhasználásával történt.

A második fejezet áttekintést nyújt az energia- és klímaprojektek lehetséges finanszírozási mechanizmusairól, olyan példákkal karöltve, amelyek megvalósítását a Horvátországban és Magyarországon elérhető nemzeti, valamint európai finanszírozási források is finanszíroztak.

A jogszabályok elemzése, valamint a határ mindkét oldalán lehetséges energia- és klímaprojektek finanszírozási forrásai alapján a projektpartnerek azonosítanak néhány lehetséges stratégiai célt, amelyeket a következő évtizedekre kell kitűzni.

2. Introduction

Energy is one of the most important drivers of the economy and determines the intensity of socio-economic development of each country. It is linked to almost all economic sectors such as agriculture, industry, commerce, trade, transport, etc. which require the increasement of capacities of related institutions and cooperation between various agencies and organizations. When we talk about energy, it is important to include the issues related to energy security, fossil fuel consumption, socio-economic impacts and environmental pressures. These are all motivating factors that have brought energy policy, energy planning and energy management onto the public agenda over the last decades.

Energy planning as well as climate change accelerated by anthropogenic greenhouse gas emissions are two greatest challenges with whom humanity in the 21st century is facing. Although individual countries have not contributed equally to the development and maintenance of the problem and are not equally affected by adverse effects, in the Paris Agreement of global significance adopted in December 2015, members of the UN Framework Convention on Climate Change agreed that all countries following the principle of common but differentiated responsibilities and different capabilities and are equally involved in the fight against global climate change, given the different national circumstances. Article 4 (1) of the Paris Agreement states that the aim is to "ensure a balance between greenhouse gas emissions by sources and removals by sinks in the second half of this century on a fair basis, in the context of sustainable development and poverty eradication".

The energy sector can be affected by changing climate conditions through many ways, either for the better or for the worse. Although impacts on energy supply and demand are the most immediate, climate change can also affect various other aspects of the energy sector, such as energy transportation and infrastructure, or have indirect effects through other economic sectors. Due to all mentioned above, it is very important to integrate energy and climate management and planning policies with economic planning policies. Planners who work in local and regional government units have an important role to play in helping communities meet energy needs, reduce greenhouse gas emissions, and adapt to a changing climate. While most planners recognize the significance of these issues, they are still working on translating these imperatives into on-the-ground plans, actions, and regulations.

To ensure the successful implementation of such plans and actions, the establishment of an energy and climate planning and management process on all government levels of every country must be insured. To be successful, energy and climate planning and management process should be based on the knowledge on existing regulations and other relevant strategic and planning documents which are crucial in regulating energy and climate issues and on available financial possibilities in financing energy and climate related projects. Accordingly, the purpose of this document is to present and analyse the legislative framework of regulating energy and climate actions with energy and climate planning and management modes in Croatia and Hungary as well as available financial possibilities on financing energy and climate projects. Analysis of the existing regulations, strategic and planning documents and financial possibilities was conducted using publicly available sources as well as access to relevant scientific papers.

In the last few years, Croatian and Hungarian governments noticed the importance of energy and climate planning in order to achieve energy neutrality and reduce greenhouse gas emissions, so the relevant Croatian and Hungarian government bodies adapted the national legislation accordingly. It was also recognized that due to many internal and external political, economic, technical and technological influences it is very important to take them into

account in energy and climate planning and energy and climate policies development. Since the main objective of SEPlAM-CC – Raising capacity of cross-border public institutions in sustainable energy planning and management and climate change mitigation project is to raise capacity of cross-border public institutions in sustainable energy planning and management and climate change mitigation this document will also be used as educational material by local and regional government units during the development of strategic and planning documents, i.e., in development of sustainable energy and climate action plans and other relevant strategies and implementation programmes.

Today's climate change and existing energy challenges include the need to promote greater energy efficiency and use of renewable energy, reduce greenhouse gas emissions, and prepare for and adapt to a changing climate. To address these complex issues, local and regional planners must understand the scientific basis for taking action and utilize the most effective planning tools and techniques for the specific challenges they face. Taking action could help reduce reliance on non-renewable energy sources, help local communities better meet their energy needs, improve environmental quality, and generate other benefits such as improved health, quality of life, and increased investment in the local economy.

Due to all mentioned above, energy and climate policies in Croatia and Hungary are important basis for development and implementation of measures in order to achieve energy savings, reducing greenhouse gas emissions and dealing with the increasingly frequent consequences of climate change. At the regional and local level, it is necessary to involve the energy agencies and other relevant institutions in monitoring and revising the energy and action plans and other relevant documents, especially in cases where local authorities do not have the skills and resources, or where there is a lack of technical capacity to implement and adapt to new needs.

3. Regulations, strategic and planning documents regarding energy and climate with energy and climate planning and management modes

Energy and climate planning can be carried out at the national as well as at the regional and local levels. National planning covers longer time spans and considers more sectors and processes but cannot pay attention to the variations in socio-economic and ecological factors of a region which influence the success of any intervention. Accordingly, these are the most challenging tasks with whom local, regional and national governments are facing. Croatia and Hungary consider energy, climate and climate change to be critical factors in development so it is very important to set rules in order to regulate this fields. They also recognized the need to develop a national energy and climate policies (including strategies, programs and plans) and bring them to the regional and local level, where concrete measures will need to be implemented. It is important to know that the overall energy and climate policies need to adapt to dynamic changes in the energy sector and should include new entities and their needs.

Decentralization of energy generation, transmission and distribution, on one hand, and the opportunities for improvement of the efficiency of energy consumption, on the other hand, has nowadays changed radically the attitude towards energy and climate change. For this reason, an increasing number of people and institutions in Croatia and Hungary are paying special attention to energy and climate planning as a significant element of their energy policy, but also of the policy regarding climate change. Agreement between top-down planning and bottom-up planning is presently one of the most important tasks, whose implementation will ensure realism and efficiency of the efforts of national, regional and local authorities.

By joining the European Union (EU) Croatia and Hungary have made certain commitments in the field of energy planning and management and climate change mitigation and adaptation. Energy and climate change are two areas in which EU and Member States (MS) share competence which means that the EU and MS can develop and adopt legally binding regulations. Accordingly, in order to understand Croatian and Hungarian legislation in the field of energy and climate, it is necessary to look at and understand European regulations regarding energy and climate.

In the period from 2014 till 2018, the governments of Europe and representatives of the European Parliament adopted a comprehensive set of EU laws setting new, legally binding targets for climate and energy policy in Europe in a 2030 perspective which aim is to have a clean, affordable and reliable energy system in Europe. Accordingly, by 2030, the MS of the EU will:

- reduce their GHG emissions 55% compared to 1990 levels;
- increase the EE of their economies by 32.5%;
- increase the share of renewable energies in final energy consumption from roughly to 32% in 2030.

Furthermore, in 2018 the European Commission laid the analytical foundation for the development of an EU Long Term Strategy for climate and energy policy and a political vision for achieving a Net-zero economy by 2050. Simply put, these headline commitments for 2030, the expected goals for 2050 and the new legal framework mean that Europe is moving towards a clean energy transition based on an efficient use of energy and a

progressive decarbonization of the energy supply. Accordingly, all MS of the EU have started to adapt their existing national regulations in order to be in line with the European energy and climate targets.

3.1. European Union regulations, strategic and planning documents regarding energy and climate with energy and climate planning and management modes

The field of energy and climate at the EU level is regulated through appropriate treaties, regulations, directives, decisions, recommendations and opinions. The Treaty is a binding agreement between EU's MS. It sets out the EU's objectives, the rules for the EU institutions, the decision-making process and the relations between the EU and its MS. The objectives set out in the EU treaties are achieved through various legal acts, i.e., regulatory instruments. Some are binding and some are not. Some apply to all EU members, while some apply to only a few.

In the Figure 3.1 we can see the main EU regulatory instruments.

Regulations	Directives	Decisions	Recommendations	Opinions
<ul style="list-style-type: none"> • binding legislative act which must be applied entirety all across the EU 	<ul style="list-style-type: none"> • legislative act that sets out a goal that all EU countries must achieve • is up to the individual countries to devise their own laws on how to reach these goals 	<ul style="list-style-type: none"> • binding on those to whom it is addressed (e.g. an EU country or an individual company) and is directly applicable 	<ul style="list-style-type: none"> • is not binding so it allows the institutions to make their views known and to suggest a line of action without imposing any legal obligation on those to whom it is addressed 	<ul style="list-style-type: none"> • is an instrument that allows the institutions to make a statement in a non-binding fashion, in other words without imposing any legal obligation on those to whom it is addressed

Figure 3.1 EU regulatory instruments

In the legal framework of EU, regulations and directives are two main types of acts which harmonize the legal framework of MS. These two acts differ significantly in the degree to which they harmonize the internal rights of the MS: while regulations completely unify the law, i.e., they replace the existing internal norms with one, completely identical European norm, the directives leave room for different solutions in different MS. EU directive outlines certain rules which must be met, but each MS decides how to ensure compliance through national laws. Directives specify an exact date by which they must be implemented (or transposed) into national law. This is normally two years after their publication in the Official Journal, but can be longer for some other instruments. Regulations are binding legislative acts that have direct implications for all MS. They are applied in their entirety across the EU, meaning that they are directly applicable in every MS and can be immediately enforced through law like any piece of local legislation. Regulations are equally pertinent to every MS of the EU.

Increasing evidence of climate change and increasing energy dependence underscore the EU's efforts to become a low-energy economy and to ensure that the energy consumed is safe, secure, competitive, locally produced and sustainable. In addition, European energy policy aims to:

- ensure the efficient operation of the energy market;
- ensure the security of supply of energy in the EU;
- promote energy efficiency and energy savings, as well as the development of new and renewable energy sources;
- promote the interconnection of energy networks to ensure solidarity between MS.

These aims, i.e., EU's policies on climate and energy are based on Articles 191 –194 of the Treaty on the Functioning of the European Union. Under Article 191, combating climate change is one of the objectives of the EU's environment policy, while under Article 194 the EU promotes energy efficiency and energy saving and the development of new and renewable forms of energy.

What is relevant for the future energy and climate energy policy is **“Fit for 55”** where EU has agreed on a more ambitious 2030 climate target and now aims to reduce greenhouse gas emissions by “at least 55” percent. The European Commission presented its package of proposals on 14 July 2021, unloading hundreds of pages on the public, which member states and the European Parliament will fight over in the coming months, if not years. The proposed changes will have a major impact on national policies across Europe and range from revising emissions trading and increasing renewables targets to introducing new CO₂ limits for cars and vans. Disputes seem inevitable as, in many cases, countries have vastly different interest and points of departure.

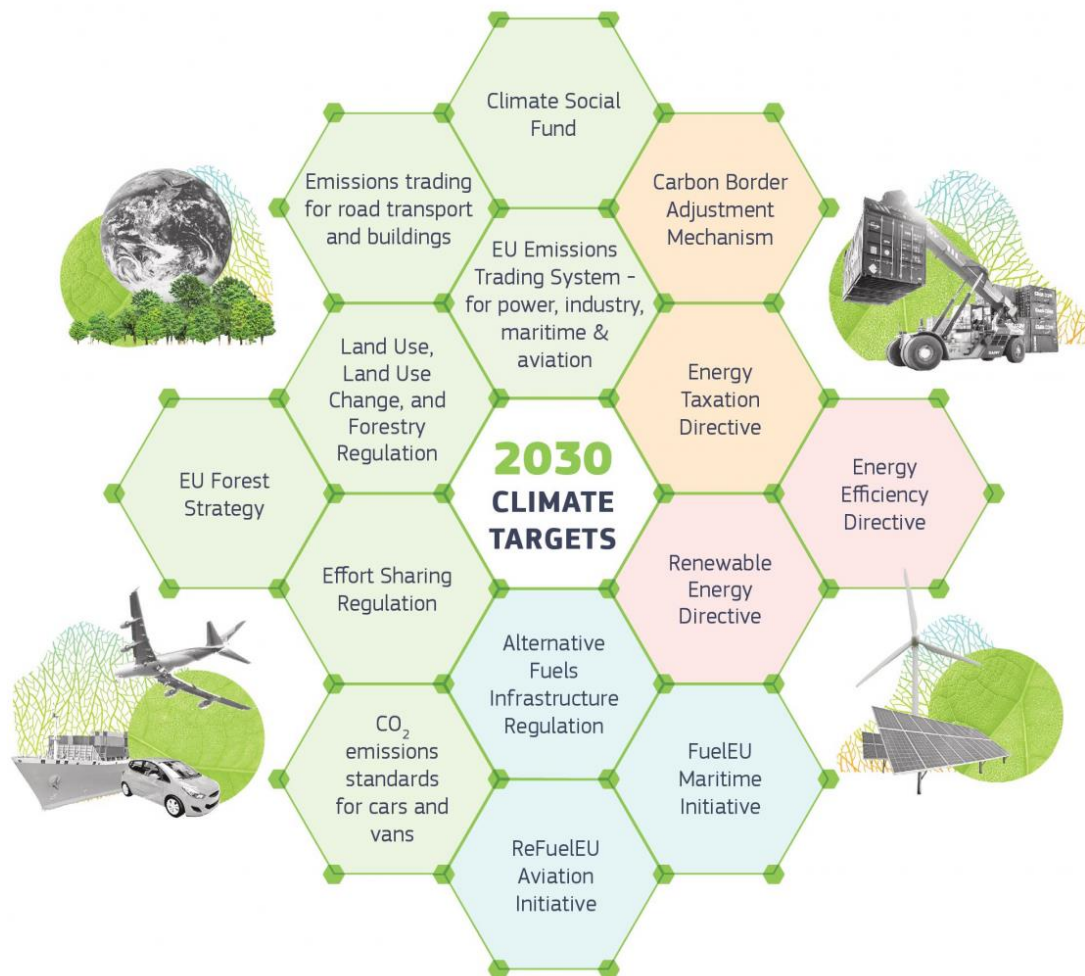


Figure 3.2 2030 climate targets

Source: European Union, 2021

3.1.1. General and other EU regulations

The starting point for the development of legislative framework for energy and climate planning and management in MS are aligned obligations with the European acquis in the process of accession to the EU, fulfilment of obligations within Energy Community Treaty and real needs of regulating relations in the energy sector which are in accordance with the requirements of energy policies at the European and national level.

By adopting new energy acts and regulations necessary for their implementation, energy legislative framework of MS is continuously harmonized with the requirements of European acquis. The main EU directives related to energy and climate actions are:

1. Directive (EU) 2019/692 of the European Parliament and of the Council of 17 April 2019 amending Directive 2009/73/EC **concerning common rules for the internal market in natural gas**;
2. Directive 2009/72/EC of the European Parliament and of the Council of 13 July 2009 **concerning common rules for the internal market in electricity** and repealing Directive 2003/54/EC;
3. Directive (EU) 2018/844 of the European Parliament and of the Council of 30 May 2018 amending Directive 2010/31/EU **on the energy performance of buildings** and Directive 2012/27/EU **on energy efficiency**;
4. Directive (EU) 2018/2001 of the European Parliament and of the Council of 11 December 2018 **on the promotion of the use of energy from renewable energy sources**;
5. Directive (EU) 2018/2002 of the European Parliament and of the Council of 11 December 2018 amending Directive 2012/27/EU **on energy efficiency**.

The main EU regulation which sets out the necessary legislative foundation for reliable, inclusive, cost-efficient, transparent and predictable governance of the Energy Union and Climate Action is **Regulation (EU) 2018/1999 of the European Parliament and of the Council of 11 December 2018 on the Governance of the Energy Union and Climate Action**. The Regulation 2018/1999 ensures the achievement of the 2030 and long-term objectives and targets of the EU in line with the 2015 Paris Agreement on climate change following the 21st Conference of the Parties to the United Nations Framework Convention on Climate Change (the 'Paris Agreement'), through complementary, coherent and ambitious efforts by the Union and its MS, while limiting administrative complexity. The Regulation (EU) 2018/1999 is a part of the **Clean Energy for all Europeans Package**, is the first attempt to introduce an integrated governance mechanism for the Energy Union. The governance mechanism needed to ensure an adequate response from MS toward reaching the targets and, indirectly, create a degree of accountability amid growing anti-EU sentiment.

While the non-binding nature of the targets at national level does leave energy and climate action vulnerable to the winds of national politics, the approach of the regulation offers an interesting counterpoint to the standard form of governance. The regulation, which is a compromise between EU intervention and preserving the autonomy of MS, opens a new path in the governance of EU energy and climate. In taking a more interactive, dialogue-based approach to governance, it has shifted the focus away from a more punitive view of EU governance toward positive enforcement. In a rapidly and continually evolving sector in which the priority is now firmly on decarbonisation and a complete overhaul of our energy system, this bottom-up approach to governance recognises that a true transformation of the system requires all hands on deck.

In the addition to before mentioned directives, in the international context, important documents and agreements regarding energy and climate developed in the past 20 years are also the **Energy Charter Treaty** and **Energy Community Treaty**, United Nations Framework Convention on Climate Change (UNFCCC), Kyoto Protocol and the Paris Agreement. **The United Nations Framework Convention on Climate Change** (UNFCCC) is an international environmental treaty addressing climate change, negotiated and signed by 154 states at the United Nations Conference on Environment and Development (UNCED), informally known as the Earth Summit, held in Rio de Janeiro from 3 to 14 June 1992. As of 2020, the UNFCCC has 197 signatory parties. **The Kyoto Protocol** is an international treaty which extends the 1992 United Nations Framework Convention on Climate Change (UNFCCC) that commits state parties to reduce GHG emissions, based on the scientific consensus that (part one) global warming is occurring and (part two) it is extremely likely that human-made GHG emissions have predominantly caused it. The Kyoto Protocol was adopted in Kyoto on 11 December 1997 and entered into force on 16 February 2005. The Protocol's first commitment period started in 2008 and ended in 2012. A second commitment period was agreed in 2012, known as the Doha Amendment to the Kyoto Protocol. As of October 2020, 147 states have accepted the Doha Amendment. It entered into the force on 31 December 2020, following its acceptances by 144 states. Negotiations were held in the framework of the yearly UNFCCC Climate Change Conferences on measures to be taken after the second commitment period ends in 2020. This resulted in adoption of the Paris Agreement in 2015, which is a separate instrument under the UNFCCC rather than an amendment of the Kyoto Protocol. **The Paris Agreement** sets out a global framework to avoid dangerous climate change by limiting global warming to well below 2°C and pursuing efforts to limit it to 1.5°C. It also aims to strengthen countries' ability to deal with the impacts of climate change and support them in their efforts. This is the first-ever universal, legally binding global climate change agreement, adopted at the Paris climate conference (COP21) in December 2015. It entered into force on 4th of November 2016. Implementation of the Paris Agreement is essential for the achievement of the **UN Sustainable Development Goals**, and provides a roadmap for climate actions that will reduce GHG emissions and build climate resilience. UN Sustainable Development goals include the following 17 Goals: No Poverty, Zero Hunger, Good Health and Well-being, Quality Education, Gender Equality, Clean Water and Sanitation, **Affordable and Clean Energy**, Decent Work and Economic Growth, Industry, Innovation and Infrastructure, Reduced Inequalities, **Sustainable Cities and Communities**, Responsible Consumption and Production, **Climate Action**, Life Below Water, Life on Land, Peace, Justice and Strong Institutions and Partnership. In order to provide policymakers with regular scientific assessments on climate change, its implications and potential future risks, as well as to put forward adaptation and mitigation options **the Intergovernmental Panel on Climate Change** was established. The Intergovernmental Panel on Climate Change (IPCC) is the United Nations body for assessing the science related to climate change.

It can be said that the Paris Agreement on Climate Change, the United Nations' Sustainable Development Goals and the Special Report of the Intergovernmental Panel on Climate Change (October 2018) all call for accelerated and decisive action to reduce GHG emissions and to create a low-carbon and climate-resilient economy. The EU has agreed ambitious targets for 2030 regarding GHG emission reductions, renewable energy and energy efficiency, and has approved rules on GHG emissions from land use as well as emissions targets for cars and vans. In 2018 EC published its strategic long-term vision for a prosperous, modern, competitive and climate-neutral economy by 2050.

Another important field of interest goes to energy transition. The EU has adopted a growing set of policy instruments to drive the energy transition – a process that is ongoing. The whole

policy set-up is currently under review in the framework of the **European Green Deal** launched by the European Commission in 2019 to make the EU fully sustainable and climate-neutral by 2050.

In 2021 EU adopted the **European Climate Law** which writes into law the goal set out in the European Green Deal for Europe's economy and society to become climate-neutral by 2050. The law also sets the intermediate target of reducing net greenhouse gas emissions by at least 55% by 2030, compared to 1990 levels. Climate neutrality by 2050 means achieving net zero greenhouse gas emissions for EU countries as a whole, mainly by cutting emissions, investing in green technologies and protecting the natural environment. The law aims to ensure that all EU policies contribute to this goal and that all sectors of the economy and society play their part. The European Climate Law was published in the Official Journal on 9 July 2021 and entered into force on 29 July 2021.

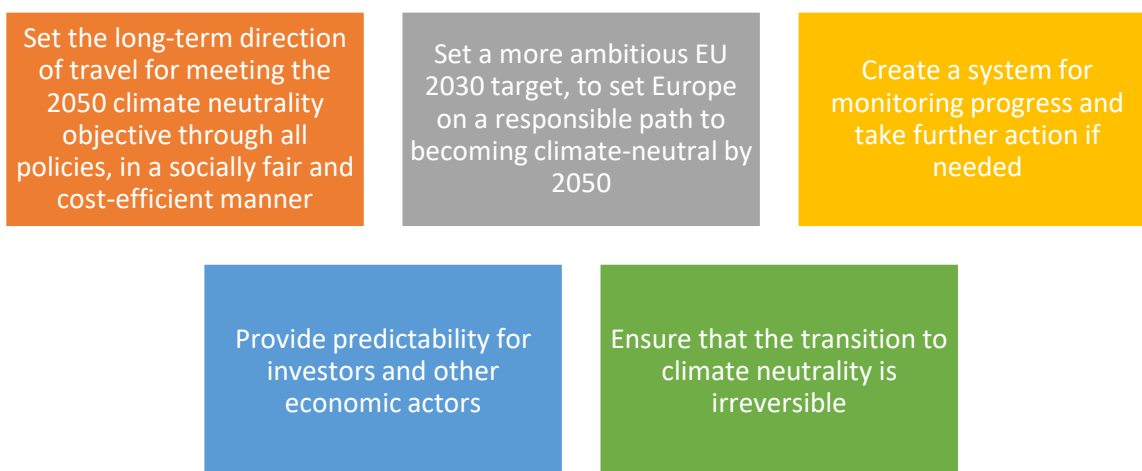


Figure 3.3 The objectives of European Climate Law

Source: https://ec.europa.eu/clima/eu-action/european-green-deal/european-climate-law_en

3.2. Hungarian regulations, strategic and planning documents regarding energy and climate with energy and climate planning and management modes

Basic measures related to climate change are interpreted both on the national and community level, providing tacit knowledge on the level of citizens and decision-makers, that results in action programs in individual circumstances and also in micro and macro communities.

Regarding the European and national targets, the reduction of CO₂ emission and other pollutants and the usage of potential and regionally specific renewable energy sources must be clearly measurable, while new regulatory frameworks shall be elaborated through incentive programs to increase energy efficiency.

In the energy sector, the role of governments is primary, as the governmental actors have control over legislation, standardization, environmental protection, economic governance, setting directions for development, taxation, and those assets that can influence energy production and utilisation. In the past 20-25 years, the Hungarian energy policy proclaimed its commitments upon energy management in national strategies in line with the EU energy policy targets.

The goal of the present period and the near future is that smaller communities (counties, districts, settlements) will intend to strive for their own planning system, regulation, action programs and their thematic implementation, thus recognizing the importance of planning and implementation on local and regional level.

3.2.1. General regulations, strategic and planning documents

The European Union formally ratified the Paris Climate Convention on the 5th of October 2016. In November 2018, the European Commission published the EU long-term strategy, which states that the EU must achieve carbon neutrality by 2050. In this context, greenhouse gas emissions should currently be reduced by 40% by 2030 comparing to the 1990 basis. Following its resolution of March 2019, the European Parliament called for a much more ambitious emission reduction target to achieve carbon neutrality by 2050. At the same time, the Hungarian government undertook and formulated the **National Energy Strategy 2030**, with an outlook to 2040. The Hungarian strategy was published in January 2020 and one of its most important objectives is the decarbonisation of energy production.

As the Hungarian National Energy Strategy emphasizes, climate change is one of the major challenges of our time. Moreover, a wide range of institutions and stakeholders – from the global to the local level – consider as a primary task to address these issues as the “Cambrian explosion” of climate change has become more complex, fragmented and decentralized.

Based on the above, the regulations and strategies elaborated by the Hungarian government should be examined along the following key governmental principle enshrined in the National Energy Strategy 2030:

"With the creation of the National Energy Strategy 2030, the Government aims to harmonize energy and climate policy with economic development and environmental sustainability, to determine acceptable energy demand and future directions of energy developments, and to develop a vision for Hungarian energy involving energy market participants."

In this regard, it must be mentioned that at the end of November 2016, the European Commission published the so-called “**Winter Energy Package**”, which, in addition to several new climate and energy policy proposals, called on Member States to develop a **National Energy and Climate Plan (NECP)**, using a common methodology and with a standardised content. According to the resolution of the European Commission, the national plans can rely on the existing climate and energy strategies and action plans of member states, if they are compatible with the EU 2030 climate and energy policy goals and the greenhouse gas emission reduction commitments arising from the Paris Agreement.

In this respect, during the preparation of the NECP, Hungary carried out extensive professional, civil and social consultations in order to implement the plan with the support of residents. Integrated design of the document involves decarbonisation, energy efficiency, energy security, internal energy market, research, innovation and competitiveness dimensions of the Energy Union.¹

Based on the NECP, as next step, the new National Energy Strategy and related action plans published in January 2020 outlined the future of the domestic climate and energy sector until 2030, with a view to 2040. The Energy Strategy promises a "clean, smart and affordable" energy supply, with the main objectives of focusing on consumers, strengthening

¹ Magyarország Nemzeti Energia és Klíma terve 2018

security of supply, climate-friendly transformation of the energy sector and exploiting the economic development potential of energy innovation. Regarding the forthcoming strategic targets, from 2020, the Hungarian government is intended to achieve strategic goals along four programs by focusing on consumers, strengthening the security of energy supply, transforming the energy sector in a climate-friendly way and supporting energy innovations. The implementation of the goals is supported by thematic programs through 40 sectoral projects.

The overall aim of the strategy is to provide direction and policy support to domestic energy industry actors and stimulate sectoral action plans in order to create, coordinate and stimulate investment and RDI activity in line with national energy commitments. It also aims to contribute to low energy prices, job creation, environmental and climate protection, reducing dependence on energy imports and maintaining a high level of security of supply at all times. Some of the proposed action plans are worth mentioning: “Energy Industry Development and RDI Action Plan 2030” or the **Strategic Environmental Assessment (SEA)** framework. Moreover, the National Energy Strategy also requires the elaboration of an action plan on energy industry development, R&D and innovation. Taking this into account, the Energy Industry Development and RDI Action Plan concerns, among other things, the organizational and financial conditions for the training of professionals required for the energy market, the continuation of research and development and education at a high level, and the implementation of the results of domestic R&D initiatives.

Regarding the SEA framework, its ultimate goal is to compile an environmental assessment that makes feasible proposals for improving the environmental performance of the Action Plan and for promoting sustainable development in the framework of energy industry development and RDI. In order to prevent and mitigate the adverse effects, SEA formulated a total of 36 proposals and recommendations. Methodologically, in this matter, the National Environmental Council (NEC) issues a resolution on the completed action plans and the SEA Environmental Report. Among other things, the NEC states: “The structure and content of the SEA reflect professional work, but it also inevitably reflects the shortcomings of the basic document, which it seeks to fill in some places. As a particular advantage, it examines in detail the relationship and coherence (or possible lack thereof) with other national strategies and plans that could be linked to the action plans and also points out potential inconsistencies to be eliminated at a later stage.”²

In connection with the NECP, the Hungarian government has authorized the **Ministry of Innovation and Technology (ITM)** to develop appropriate policy programs and visions for issues that determine the future of the energy sector and other sectors affected by decarbonisation, thus setting national energy and climate change targets and domestic commitments, in particular on emission reductions, energy efficiency and the share of renewable energy, in order to meet the objectives of the Energy Union and to comply with the Paris Agreement.

ITM presented (2019, 2020) the main elements of the main projects of the NECP, emission reduction and climate adaptation, which include decarbonized and flexible electricity generation, greening of transport, support for energy-conscious and modern Hungarian homes, climate-conscious water management, or the implementation of climate protection programs in the municipality.

² http://www.env-in-cent.hu/hu/n/a_kormany_elfogadta_az_energetikai_iparfejlesztési_es_kfi_cselekvési_tervet_az_skvt_az_énvince nt_kft_keszítette-104

In addition to these types of actions, the manner of policy coordination is also an essential point. Related decisions can be based on the principle of self-government, where local initiatives dominate the whole process, including planning, funding and implementation. The situation is different when reference is made to public-private partnership projects and awareness-raising campaigns.

During the establishment of the NECP, Hungary took into account the current national plans, measures and policies. It is closely linked to the content and process of the new National Energy Strategy being prepared at the same time as the NECP.

On behalf of government involvement, the current government is constantly positioning the place of the topic.

From 15 January 2021, the State Secretariat for Energy and Climate Policy and the State Secretariat for the Construction Economy, Infrastructure Environment and Sustainability will continue to operate in a single organization within the Ministry of Innovation and Technology. As a reason for this, the Ministry indicated in a statement that the strategic and regulatory foundations of the Climate and Nature Action Plan were laid by the Ministry last year. The challenge for the next period is to implement the prepared and already launched programs in a coordinated manner in line with international commitments and obligations. In accordance with the tasks that require primarily EU conciliation experience, the related state secretariat will be headed by newly appointed Mr. Attila Steiner, the former State Secretary for European Union Affairs of the Ministry of Justice.

3.2.2. Other specific regulations

In order to satisfactorily interpret the completeness of the regulatory environment, in the following section an overview is given about the framework of construction regulation and qualification (quality assurance). What follows are excerpts from the current regulation as of early 2021.

Government Decree 666/2020. (XII. 28.) on the energy review

The regulation contains provisions about the obligation to register and record an energy audit, about the content requirements of an energy audit and the supervisory tasks of the audit process. Here is the full text of the decree:

Legislative changes after 2020:

1. **Decree Amendment of TNM Decree 7/2006** on the determination of the energy performance of buildings (V. 24.); and
2. **Amendment of Government Decree 176/2008** on the certification of the energy performance of buildings (VI. 30.)

A six-month postponement of the introduction of the nearly zero energy buildings provision has been included in the following regulation:

The amendment reads as follows: "By way of derogation from point (a) of 6/B. § A 6. § Section (2), if, on the basis of the architectural and technical documentation, the design of the building is not close to zero or below zero and the commissioning takes place after 31th of December 2020, 6. § Section (2) (a) shall apply in the case of putting into service after 30th of June 2021. "

3. Modification of Government Decree 176/2008 on the certification of the energy performance of buildings (VI. 30.)

This is a minor amendment, in which one or two terms have been changed (e.g. “use of renewable energy” has been replaced by “use of renewable energy and the aggregated energy characteristics as defined by the Order”, and “building services” has been replaced by “building technologies”).

4. Modification of Government Decree 122/2015 on the implementation of the Energy Efficiency Act. (V. 26.)

Here, some points have been amended or supplemented, including those on energy experts, energy audits and the liability regime. Several annexes have been modified also.

5. Modification of Government Decree 7/2006 on the determination of the energy performance of buildings (V. 24.)

The regulation has been amended and supplemented on several points. Among other things, a section has been added to the section on the share of renewable energy in Annex 6 stating that "In the event that the technical and economic conditions for meeting the minimum share of renewable energy in accordance with point 1 are not met, the minimum renewable energy requirement may be met by increased energy efficiency. The minimum expected level of increased energy efficiency shall be ensured in accordance with Table IV.2." According to this, the 25% renewable share should only be met if "the technical and economic conditions are present, as outlined by the expert opinion included in Annex 4".

The following point is added to Annex 6 to the Regulation: „4.3. The amount of renewable heat used to cool the building can be taken into account during the cooling operation, but not exceeding the period of between 15th of April to 15 October. In case of a heat pump, the heat removed from the building towards the outside air cannot be considered as a renewable energy source."

Annex 1 of the Decree has also been amended/supplemented with regard to "Room temperature control", "Assessment of building services systems" and "Building supervision".

It has also been supplemented with Annex 8, which contains new points on electromobility.

Construction legislation has also been amended. This modification is the most important in relation to increasing efficiency. Thus, we can assume this will result in the reduction of industrial emissions and the improvement of the energy performance of the building sector. These can be read as follows:

1. Government Decree 2033/2020. (XII. 29.) on the support for increasing the productivity and efficiency of the construction sector

"The Government

1. supports the increase of domestic construction productivity and the provision of financial means resulting in better economic processes in the construction sector;

2. calls on the Minister of Finance to ensure the provision of HUF 12,000,000,000 to support the technological modernization and increase of productivity of domestic construction enterprises in accordance with Act LXXI of 2019 on the Central Budget of Hungary 2020; as described in Annex 1 Chapter XVII. for the Ministry of Innovation and Technology, Section 20. „Appropriations managed by chapter”, Section 64. „Economic tasks”, legal group „5. Aid for technological modernization and efficiency improvement in the construction sector,,.

2. Government Decree 700/2020. (XII. 29.) on the amendment of certain government decrees on construction

It amended Decree 253/1997 on national urban planning and construction requirements (XII. 20.), the Government Decree 191/2009 on construction activities (IX. 15.), Government Decree 312/2012 on the procedures and inspections of the construction and construction supervision authorities, and on the services of the construction authorities (XI. 8.) and Decree 155/2016 on the simplified notification of the construction of a residential building (VI. 13.)

3.2.3. Strategic targets for the next decades

In order to achieve the reduction targets of the Paris Agreement – adopted by Hungary – the three main types of necessary climate change measures are adaptation, mitigation and awareness raising. The implementation of these measures can be very successful with a variety of planning tools such as adaptation strategies, mobility plans, greenhouse gas (GHG) reduction concepts, and municipal climate action plans. Strategies and activities can be extended to different sectors, such as energy, transport, water supply, waste management, etc.

In Hungary, climate-sensitive planning is quite rare at the level of villages or towns, and only larger cities have some kind of energy/climate action plans (SEAP – Sustainable Energy Action Plan, SECAP – Sustainable Energy and Climate Action Plan). These documents are largely public, but organizations such as the Covenant of Mayors, which have direct access to each municipality and are consciously disseminating the need to involve municipalities more actively in their work on climate change, are committed to ensuring accessibility.

One of their tasks is to support these activities of local governments: In the last 1-6 years, county-level climate planning was implemented, and municipalities had the opportunity to join this process. The majority of responding municipalities were aware of this county-level process, and many of them were actively involved. Unfortunately, the little ones haven't even heard of these initiatives. With regard to climate change or energy planning, it can be seen that only the larger municipalities treat this issue as their own task. The map visualizes the Hungarian municipalities having joined the initiative of the **Covenant of Mayors**.

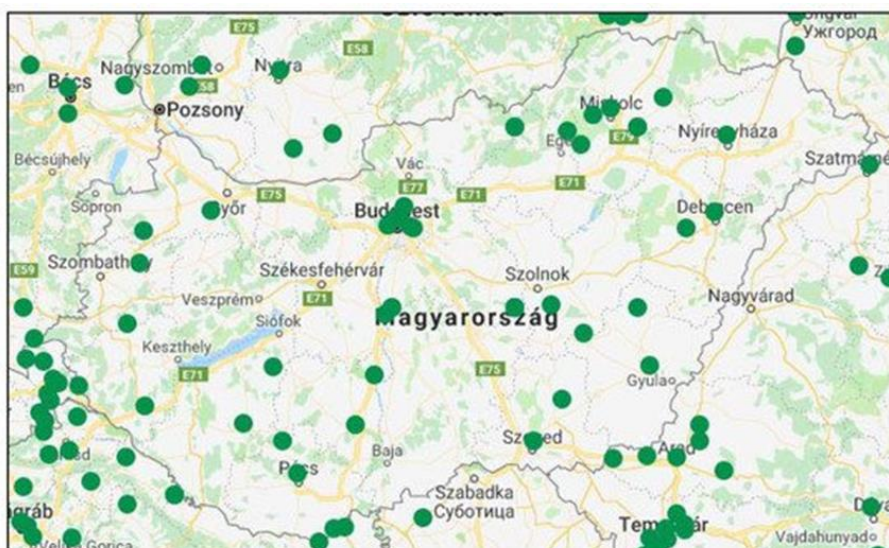


Figure 3.4 Membership of Hungarian municipalities in the Covenant of Mayors (2018)

Source: <https://www.covenantofmayors.eu>

The way to participate in climate change can be manifested in tangible projects and programs. One of the most popular projects is the energy-saving retrofitting of public buildings. This usually means replacing old windows with more efficient and up-to-date plastics insulating the exterior walls and roofs of buildings. Most municipalities have already implemented some projects in this field. The main benefit for them is to improve the energy efficiency of public buildings and decrease the municipal energy bill.

In order to achieve the energy efficiency objectives, the Hungarian legislation adopted **Act LVII/2015** on energy efficiency. The legal act not only imposes obligations on companies, but also encourages public institutions to operate more efficiently in an exemplary manner, albeit without the support of the necessary resources.

In this respect, in every five years, public institutions must prepare an energy saving action plan, which they must upload to the online interface operated by the National Energy Network by 31 March of the year of preparation, and after that an annual report on the fulfilment of the energy saving action plan to the same online interface. Moreover, they have to also report energy consumption data for the building, certify the building with an energy efficiency certification, the results of which must also be reported, updated within the energy audit.

From the point of view of public administration and public institutions, stakeholders have to adhere to the measures of the following dimensions of energy policy:

Decarbonization dimension

Greenhouse gas emissions and removals

The EU Climate and Energy Policy Framework, adopted by the European Council in October 2014, envisages a reduction in greenhouse gas emissions of at least 40% at EU level by 2030 compared to 1990. In connection with this, Hungary aims to reduce its greenhouse gas emissions by at least 40% by 2030 compared to 1990, i.e. gross emissions in 2030 should not exceed 56.19 million tCO₂eq.

Renewable energy

Hungary wants to achieve a share of renewable energy sources of at least 21% in gross final energy consumption by 2030.

The share of renewable energy in the heating and cooling sector, with additional measures, could approach 30% in 2030. There is great potential for the efficient utilization of biomass in both individual heating systems and district heating, as well as the possibilities of using thermal heat through heat pumps. The implementation of the Green District Heating Program and the placement of as many of the individually heated buildings as possible on a renewable basis will play a key role in replacing natural gas and increasing our use of renewable energy sources in the heat market.

In the field of transport, Hungary sets a renewable energy share of at least 14% by 2030. In order to achieve this goal, so-called food and feed crops the share of first-generation biofuels to almost 7%, while the so-called Hungary will increase the share of second-generation (or advanced) biofuels and biogas to 3.5% of final energy consumption in transport. The remaining part can be achieved through a significant increase in the use of electricity for transport.

Energy efficiency dimension

Our main energy efficiency goal is that the Hungarian final energy consumption in 2030 does not exceed the value of 2005 (785 PJ / 18750 ktoe). Naturally, reducing the amount of energy is a priority, but in case of economic growth, the energy consumption of neither industry nor transport can be limited, therefore after 2030 Hungary undertakes to increase only final carbon consumption from carbon-neutral energy sources after 2005.

Energy security dimension

The high share of imports in both the electricity market and the gas market is decisive in the Hungarian energy supply. High dependence on energy imports can pose serious security of supply and price risks. As Hungary sees security of supply as an element of its national sovereignty, one of the main tasks of the Hungarian Government is to strengthen energy independence. In reducing its dependence on energy imports and strengthening geopolitical independence, Hungary places emphasis on increasing energy efficiency.

Internal energy market dimension

The proper functioning of the internal energy market depends primarily on three main components: the degree of interconnectivity (interconnection) and the need to increase it; the level of market interconnections and its effect on reducing prices and price volatility; and the liquidity of the Budapest Power and Gas Exchange.

Hungary already significantly exceeds the EU target for electricity interconnection, but the target figure can also be increased above 60% on the basis of a policy vision, due to significant energy coordination reasons.

Research, innovation and competitiveness dimension

Hungary strives to ensure that the domestic energy industry and the RDI sector are able to serve national and EU energy and climate policy goals as much as possible. That is why the priority for the country is to increase innovation performance and to make the most of the economic development opportunities inherent in energy innovation and climate change. As part of the new energy innovation strategy, the Hungarian government is intended to encourage the use of innovative solutions.

To support the development of an energy innovation strategy in line with these criteria, the Energy Innovation Council (EIT) was established by Hungarian energy and industrial companies, universities, research institutes, professional organizations, the Hungarian Energy and Public Utilities Regulatory Authority (MEKH), the Ministry of Technology and Innovations and the representatives on the Paks Nuclear Power Plant. The Council identified options for action in the following areas:

1. Innovative system balance (Flexibility storage and demand management, distribution system active operation);
2. Encouraging the market introduction of innovative energy supply methods;
3. Energy efficiency innovation program;
4. Promoting the utilization of domestic natural gas assets;
5. "Smart regulation" to encourage distributors and service providers to innovate;
6. Traffic greening;

7. Encouraging the use of renewable energy sources;
8. Supporting nuclear innovation;
9. Encourage innovative seasonal electricity and heat storage solutions.
1. The strategy is the and document system description and availability

The implementation of the energy policy provisions are primarily influenced by the following official documents elaborated by the Hungarian government:

National Renewable Energy Action Plan

The most important strategic goal of the Hungarian renewable energy policy is to optimize the joint implementation of security of supply, competitiveness and sustainability as the primary goals of the national economy, taking into account the long-term aspects as well. There can be several interactions between these three goals, in many cases their implementation can be in conflict with each other, but they can also strengthen each other. For this reason, the measures formulated to achieve the objectives must place particular emphasis on synergies, the resolution of contradictions and the greatest possible coherence. For this aim, the action plan identifies five main areas of intervention:

- safe and stable energy supply;
- climate protection, environmental sustainability;
- agriculture and rural development;
- green economy;
- adaptation to EU commitments.

National Energy Strategy 2030

As the strategy highlights, the national energy policy of the future must be shaped partly by the responses to the most important domestic and global challenges, and partly by the EU energy policy aspirations, taking into account the Hungarian geopolitical specifics. The focus is on achieving a rationalized energy demand and energy supply (both in infrastructure and services) that simultaneously serves the growth of the domestic economy, ensures the availability of services and affordable prices for a wide range of consumers. The challenges related to the forthcoming change in the energy structure can be turned to the benefit of Hungary, but for this the government has to exploit the opportunities inherent in employment and economic growth in energy developments.

During the energy restructuring, the following points must be implemented:

- energy efficiency measures covering the entire supply and consumption chain;
- increasing the share of low-carbon electricity generation, based primarily on renewable energy sources;
- the spread of renewable and alternative heat production;
- increasing the share of low-carbon modes of transport.

By implementing these four points, significant progress can be made towards the creation of sustainable and secure energy systems, which can also make a significant contribution to increasing economic competitiveness.

3.3. Croatian regulations, strategic and planning documents regarding energy and climate with energy and climate planning and management modes

Croatian legislation system in the field of energy and climate is mainly based on the European energy and climate policy. While analysing the Croatian legal framework relating energy and climate it could be concluded that energy and climate policy of Croatia is focused on EU goals in terms of reducing GHG emissions, increasing the share of RES, EE, security and quality of supply and developing the EU internal energy market, as well as available resources, energy infrastructure and competitiveness.

Before joining the EU, Croatia needed to adopt various legislative mechanisms and policy frameworks necessary to align the country goals with EU environmental standards and climate change. The country has therefore taken multiple steps at international, national and regional levels to change laws and acts, sign treaties and implement conventions that support the global fight against climate change. Accordingly, Croatia pledged to cut 80–95% of greenhouse gas emissions by 2050 compared with a 1990 baseline .

Being the youngest member state of the EU, Croatia demonstrated a strong commitment to integrating climate change in its legal and policy frameworks by adopting and implementing relevant acts, strategic and planning documents and other relevant regulations. However, more needs to be done for Croatia to become a more climate-resilient country and enhance its preparedness and capacity to respond to the impacts of climate change at local, regional and national level. The first step to accomplish this would be to adopt The Low-carbon Development Strategy of the Republic of Croatia by 2030 with a view to 2050.

Basic support for the construction and organization of the energy sector in Croatia consists of legal acts and other appropriate regulations. They determine the principles of energy policy, prescribe the conditions for performing energy activities and adopt rules relating to the operation and regulation of the energy sector, energy planning, construction, operation, maintenance and supervision of energy facilities, taking into account energy efficiency, use of renewable energy sources and environmental protection. Overall energy policy framework in Croatia is determined by the signed international agreements and political determination to join the EU on 1 July 2013.

Following the EU regulations on energy and climate, the Croatian government published multiple regulations on overall energy and climate planning. These regulations are crucial for a long-term change and improvement of energy sector, the economy and the overall ecology of the country.

When we talk about Croatian regulations regarding energy, we can divide them in three groups: general regulations, strategic and planning documents and other specific regulations. Each group of regulations are presented and analysed in the following chapters.

3.3.1. General regulations, strategic and planning documents

Legal framework for energy sector in Croatia is defined through the package of energy acts. The main act which regulates energy issues, i.e., energy sector in Croatia is **Energy Act** (OG 120/12, 14/14, 102/15, 68/18). This Act, as a general act for the field of energy, regulates issues and relations that are of common interest for all energy activities or that are related to several forms of energy. The Energy Act regulates measures for secure and reliable energy supply and its efficient production and use, it determines energy policy and

energy planning process, performance of energy activities on the market or as public services and basic issues of energy performance activities. Another important act is **Energy Activity Regulation Act** (OG 120/12, 68/18) which regulates the establishment and implementation of the system for the regulation of energy activities, the procedure for establishing the energy regulatory body – i.e., Croatian Energy Regulatory Agency (CERA) as an independent legal entity with public powers to regulate energy activities and its rights and obligations and other matters of importance for the regulation of energy activities.

Issues related to gas, electricity, oil and petroleum products, thermal energy, energy efficiency, renewable energy sources and high-effective cogeneration are regulated by special acts. In the following figure we can see all Acts defined in accordance with the Energy Act.

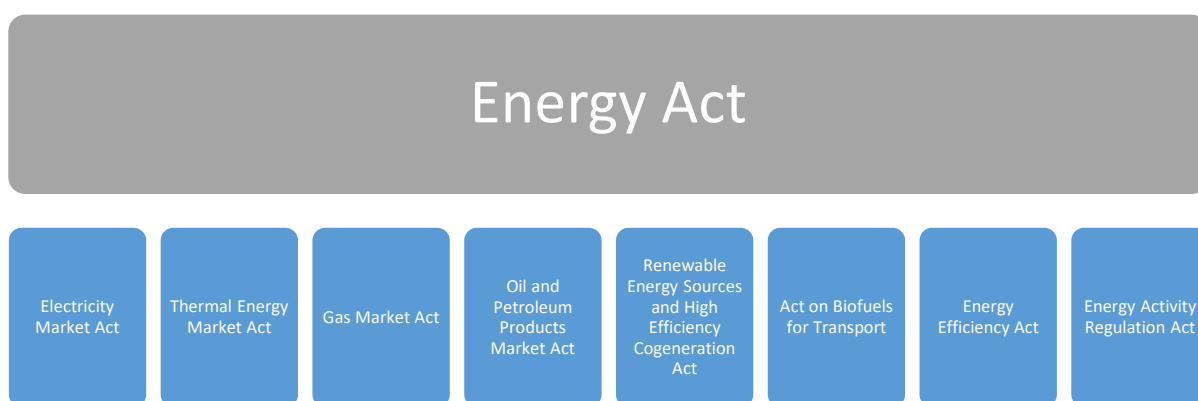


Figure 3.5 Croatian energy related acts

From Croatian acts listed above the most important acts which should be further elaborated are Renewable Energy Sources and High Efficiency Cogeneration Act and Energy Efficiency Act. **Renewable Energy Sources and High Efficiency Cogeneration Act** (OG 100/15, 123/16, 131/17, 111/18) regulates the planning and encouragement of production and consumption of electricity produced in production facilities that use renewable energy sources (RES) and high-efficiency cogeneration (HEC), determines incentive measures for electricity production using RES and HEC and regulates the implementation of incentives for electricity production from RES and HEC. Furthermore, it regulates issues of construction of facilities for production of electricity from RES and HEC on state land, regulates keeping the register of RES and HEC, project holders and privileged producers of electricity from RES and HEC, regulates the issue of international cooperation in the field of RES and regulates other issues of importance for the use of RES and HEC. **Energy Efficiency Act** (OG 127/14, 116/18, 25/20, 32/21, 41/21) regulates the area of energy efficiency (EE), adoption of plans for EE improvement at the local, regional and national level and their implementation, EE measures, EE obligations, obligations of the energy regulator, transmission system operator, distribution system operator and energy market operators in connection with the transport and distribution of energy. It also defines obligations of energy distributors and energy water suppliers in providing energy services and obligations regarding determination of energy savings and consumer rights in the application of EE measures. The main purpose of this act is to achieve the goals of sustainable energy development, to reduce the negative environmental impacts from the energy sector, improve energy security, meet the needs of energy consumers and meet the international obligations of Croatia in the field of reducing GHG emissions by stimulating EE measures in all areas of energy consumption.

One act which is also important for energy and climate legislation is **Building Act** (OG 153/13, 20/17, 39/19, 125/19) which was enacted by Croatian Government in 2013 and

regulates the designing, construction, use and maintenance of construction works and the enforcement of administrative and any other procedures relating thereto for the purpose of ensuring protection and planning of space in accordance with the regulations governing physical planning and providing the essential requirements for construction works and other requirements prescribed for construction works under this Act and regulations adopted on the basis thereof as well as under special regulations. With the aim of implementing special provisions of mentioned acts, certain bylaws are enacted. These bylaws, i.e., secondary legislations include regulations, ordinances, decisions and rules.

In accordance with the provisions defined in acts and other bylaws, each country is obliged to adopt appropriate planning and strategic documents in order to define their key development potentials, basic principles and criteria for determining goals and priorities in considering long-term transformation towards sustainable development. Unlike general regulations, which are more focused on the harmonization with European directives into national legislation, strategies and plans are implementing documents that define the methods of energy planning and management with defined deadlines and holders of individual activities for longer time periods. First fundamental strategic document is the **Sustainable Development Strategy of the Republic of Croatia** (OG 30/09) which was adopted by the Croatian Parliament in February 2009 for the period until 2019. This document serves as a key strategic document from which it will be possible to identify the key development potentials of Croatia, the choice of direction and path towards the realization of a long-term development vision. The Sustainable Development Strategy makes reference to several key areas important for this document:

- environment and natural resources;
- promoting sustainable production and consumption;
- ensuring energy independence and increasing energy efficiency.

In order to adopt the existing challenges in sustainable development, use all potentials and coordinate the efforts of all public policies, Croatia needs to have a clear vision of its future development and define the goals it wants to achieve by 2030. In addition, as a member of EU it has generous European funds at its disposal which will be an important leverage in achieving these goals. However, this requires a clear framework and quality multi-annual planning, so that the benefits of EU membership can be better exploited. Accordingly, in 2018, the Croatian Government began drafting the **National Development Strategy until 2030** as an umbrella document and a comprehensive strategic planning document which directs the long-term development of society and the economy in all important issues for Croatia. The document is based on Croatia's competitive economic potential and on identified development challenges at the regional, national, European and global levels. The National Development Strategy defines the vision of the future development of Croatia, taking into account the expected global trends. The main goal is to accelerate the economic recovery in order to raise living standards and create conditions for better living conditions for all Croatian citizens.

Due to the constant development of the energy sector, the Republic of Croatia had to develop and adopt a Strategy for the energy development of the Republic of Croatia (OG 130/09). The first Strategy for the energy development of the Republic of Croatia was developed in 2009 for the period until 2020. The second Strategy for the energy development of the Republic of Croatia until 2030 with an outlook to 2050 (OG 25/20) (Energy development strategy) was enacted in March 2020. The key objectives of the Energy development strategy are:

- ensuring sustainable energy production in Croatia over the next 10 years, with projections until 2050;
- reducing import dependence,
- and strengthening the security of energy supply through the development of strategic infrastructure.

The main purpose of Energy development strategy is to ensure energy independence, a safe and sustainable supply, as well as the development and competitiveness of the energy system, in the context of accomplishing the vision of a common energy-climate policy in Croatia and at the EU level. The implementation of Energy development strategy will enable a transition to low-carbon energy through two types of activity – increasing EE and utilizing RES as much as possible.

Speaking about increasing EE in the context of lowering overall energy consumption in the next 10 years, as well as in the period until 2050, CO₂ emissions are expected to be reduced by about 36%. These objectives will require significant investment in renewable energy production as well as in the EE of buildings. Energy development strategy is based on growing, flexible and sustainable energy production, development of new infrastructure and alternative energy supply routes, and greater EE, the purpose being the accomplishment of the EU's climate neutrality by 2050. In the following figure we can see the main goals of energy development in Croatia which are also stated in Energy development strategy.

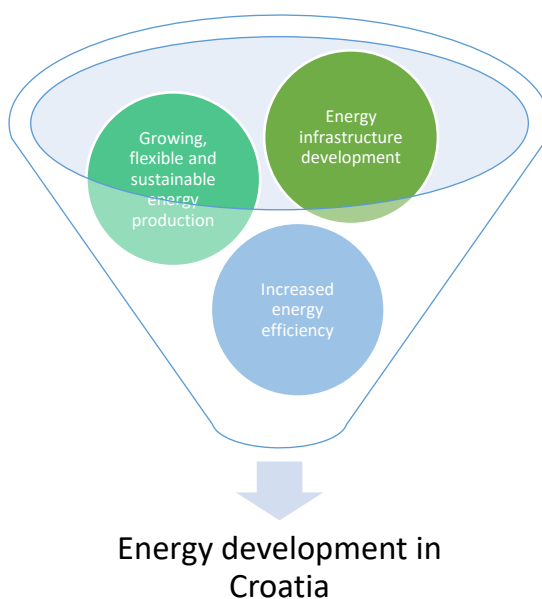


Figure 3.6 The main goals of energy development in Croatia

Based on the Energy development strategy, the Government of the Republic of Croatia adopts the Energy Development Strategy Implementation Program, which determines measures, activities and dynamics of energy policy implementation, the manner of cooperation with local and regional government units in energy sector development planning and cooperation with energy institutions, and with other international organizations.

In order to develop and implement the Energy development strategy, it was necessary to develop the Strategic study of the impact of the Energy development strategy on the environment and **Analysis and Foundations for the Preparation of the Energy Development Strategy of the Republic of Croatia – Green Book**. The Green Book includes the analytical foundations for the preparation of the strategy and was developed in 2019 by Energy Institute Hrvoje Požar. In line with the final version of the Green Book, the

Climate Change Adaptation Strategy in the Republic of Croatia for the period to 2040 with a view to 2070 - White Book was also prepared. The White Book represents an executive summary of the current state and analytical outcomes for selected development scenarios in line with the results of the Green Book.

According to Energy Efficiency Act Republic of Croatia had the obligation to develop **National Energy Efficiency Action Plan (NEEAP)**. NEEAP is a planning document adopted for a three-year period and determines the implementation of the national policy for improving EE. So far Croatia developed four NEEAPs, where the Fourth NEEAP is currently in force. The Fourth National Energy Efficiency Action Plan for the period until the end of 2019 was adopted at the 140th session of the Government of the Republic of Croatia on 30 January 2019 and it was in force until end of 2020.

Since energy planning and management must be carried out at all levels in Croatia (including regional and local level) local and regional government units are required to adopt certain strategic and planning documents related to energy management, energy efficiency and encouraging the use of renewable energy sources in order to achieve the national energy goals. In accordance with the Energy Efficiency Act, regional government units adopt three-year action plans in their administrative area. **Energy efficiency three-year action plans** are more systematic presentation of EE measures prepared in accordance with the Energy development strategy of the Republic of Croatia, the fourth NEEAP, the Energy Efficiency Act and other relevant regulations.

The main purpose of development the three-year Energy Efficiency Action Plan is to determine guidelines for the implementation of energy efficiency improvement policy through the realization of energy savings and respecting the energy needs of the region and the principles of sustainability and environmental protection. Energy Efficiency Action Plan contains an overview and assessment of the situation and needs in energy consumption, long-term goals including the indicative energy saving target of the county, EE measures and sources of funding for their implementation, calculation of planned energy savings, monitoring and implementation of the plan and the method of financing the plan.

Local and regional government units as key drivers of sustainable development at the local and regional level are also, according to Energy Act obligated in their development documents to plan the needs and manner of energy supply and harmonize such documents with the Energy Development Strategy and Action Plan for the Implementation of the Energy Development Strategy. These development documents referred to development strategies of regional government units and implementation programs of local and regional government units and other relevant planning documents.

Implementation programs of local and regional government units are a short-term strategic planning documents related to the multi-annual budget adopted by the mayor, chief or prefect which describe priority measures and activities for implementing goals from related, hierarchically higher strategic planning documents of national importance and of importance for local and regional government units. Development strategy of regional government unit is a basic strategic planning document in which development goals and priorities for the county are determined in order to strengthen its development potentials, with special emphasis on the role of large cities and cities of county headquarters in encouraging development and the development of less developed areas. Among other defined priorities within those documents, environmental and nature protection, energy management, the use of renewable energy sources and the promotion of energy efficiency stands out. Achievement of these priorities will contribute to the main goals of the new EU strategy for growth and development Europe 2020. One of the basic priorities defined in the Europe 2020 strategy relates to

sustainable development through resource efficiency and a "greener" and more competitive economy. The Europe 2020 strategy encourages the building of competitive society based on a low-carbon economy, environmental protection, prevention of biodiversity loss and the introduction of efficient "smart" electricity grids.

Local government units according to Energy Efficiency Act can develop Energy Efficiency Action Plans but by now only small number of local government units in Croatia developed Energy Efficiency Action Plan. By developing this document, local government units define their curs of action in order to increase energy efficiency in their administrative area.

Due to the need for significant investments in RES and HEC, it is important to mention the following two documents: National Action Plan for Renewable Energy Sources until 2020 and National potential for cogeneration in Croatia.

Energy security and climate change prevention largely depend on considerable improvements in building energy efficiency. The key strategic document for the energy efficiency dimension in building sector is the **Long-term Strategy for Mobilising Investment in the Renovation of the National Building Stock of the Republic of Croatia by 2050** (Long-term renovation strategy), which promotes the need to invest in the building stock and based on established economically-energy-optimal model of building renovation, identifies effective measures for long-term mobilisation of cost-effective integrated renovation of the national building stock by 2050 on grounds of the established economical and energy-optimal building renovation model. The Long-term renovation strategy was enacted in 2014 and revised in 2017 and 2020. The Long-term renovation strategy aligns the renovation objectives and activities in the construction sector, with trends of accelerated abandonment of the existing building stock of poorer properties and gradual growth in new construction. The current energy renovation rate of 0.7% per year will gradually rise to 3% over the 2021 – 2030 period, with a 10-year average rate of 1.6% . An important element of the Long-term renovation strategy is the introduction of additional measurable indicators of energy renovation of buildings, which will strengthen the process of conversion of the stock into nearly zero-energy buildings, i.e., climate neutral. To achieve the goals set by the Long-term renovation strategy, the existing measures primarily include the implementation of national energy renovation programs for different types of buildings. Energy renovation programs for buildings will be adopted in accordance with the Building Act by 30 June 2021, and they will precisely determine the necessary financial resources for co-financing. More information on the renovation programs will be given in the next subchapter.

Due to the need to increase the number of nearly zero-energy buildings in Croatia (obligation to Directive 2010/31/EU on the energy performance of buildings/Directive (EU) 2018/844 on the energy performance of buildings), Ministry of Construction and Physical Planning (later Ministry of Physical Planning, Construction and State Assets) defined the Plan for increasing the number of nearly zero-energy buildings (nZEB) up to year 2020. This plan contains review of existing targets for increasing EE in buildings, review of available funding models, policies and measures to promote nZEB buildings.

One another relevant planning document refers to **Social Action Plan on understanding the social aspects of the Energy Community** (Social Action Plan). The Social Action Plans were intended to serve as a roadmap to develop and implement necessary measures to deal with social consequences in a socially responsible manner. The whole idea of developing this document came from the Treaty on Establishing the Energy Community which defines social stability alongside economic development as one of the primary interests for MS for which the access to stable and continuous energy supply is essential. Chapter IV of the Treaty on Establishing the Energy Community (Articles 31 – 33) further promotes the social

aspects of the energy acquis in the context of provision of energy to citizens and its affordability. During the implementation of the Treaty on Establishing the Energy Community, i.e., the social consequences of its implementation, a **Memorandum of Understanding on Social Issues of the energy community** was adopted. He became the starting point for development of Social Action Plan on understanding the social aspects of the Energy Community. Croatia developed this document in 2013. which main goals are:

- improving the living and working conditions of workers in the energy sector, anticipating and resolving the negative impacts that the restructuring of the sector will have on them: protection of workers' rights, improvement of working conditions and protection at work, equal opportunities for men and women, education, rewarding improvements in energy efficiency at work and similar activities;
- encouraging social dialogue that will ensure the development of the energy sector in line with social needs, both on the production side (domestic producers, supply routes, renewable energy sources) and on the consumption side (EE, fiscal and tax policy), consumer information and education play a key role. The energy sector must provide a reliable, high-quality, available and affordable service. Special attention must be paid to the design of measures to protect the most economically vulnerable social categories.

As it was said, the energy planning should be implemented on all country levels including local level. One very important initiative which deals with energy planning in EU on local level is initiative called Covenant of Mayors. The Covenant of Mayors was launched in 2008 in Europe with the ambition to gather local governments voluntarily committed to achieving and exceeding the EU climate and energy targets. When officially joining the Covenant of Mayors, signatories commit to developing a Sustainable Energy Action Plans (SEAP) within two years. Many Croatian local governments joint the initiative and developed SEAP. SEAP is a key document that shows how the Covenant signatory will reach its commitment by 2020. It uses the results of the Baseline Emission Inventory to identify the best fields of action and opportunities for reaching the local authority's CO₂ reduction target. It defines concrete reduction measures, together with time frames and assigned responsibilities, which translate the long-term strategy into action. In 2014, the EC launched the Mayors Adapt initiative. Based on the same principles as the Covenant of Mayors, this sister initiative was focusing on adaptation to climate change. Mayors Adapt invited local governments to demonstrate leadership in adaptation, and was supporting them in the development and implementation of local adaptation strategies. In 2015 these two initiatives officially merged into new initiative The Covenant of Mayors for Climate & Energy. The signatories of the new initiative commit to developing a Sustainable Energy and Climate Action Plans (SECAP). Since this document include the climate and climate change aspects, it will be further elaborated in the fifth chapter.

As it could be seen in the previous chapters, the EU has a significant influence on Croatia's energy planning and management policies which are mainly concentrated on energy security. However, due to rapid climate change, energy goals must now be achieved with minimum GHG emissions. Accordingly, Croatia adopted new regulations, strategies and other planning documents regarding climate with climate planning and management modes.

The main obligations for Croatia regarding climate came from international climate change policy which include Paris Agreement, UN Sustainable Development Goals and The Intergovernmental Panel on Climate Change. Croatia, as a signatory of Paris Agreement prepares and submits periodic reports on implementation of actions in mitigation and adaptation to climate change. The last Seventh National Report of the Republic of Croatia

under the United Nations Framework Convention on Climate Change was submitted to the Secretariat of the Convention on 1 October 2018.

Until 2020 the Ministry of Environmental Protection and Energy was in charge of energy and climate issues, but after the reorganization of ministries in Croatia, these issues came under the authority of Ministry of Economy and Sustainable Development (MESD). MESD now acts also as energy and climate policy coordinator and works intensively to promote EE, RES usage and climate change adaptation policy in Croatia. MESD is the central government authority in charge of administrative and expert environmental protection activities relating to climate protection. It also carries the responsibility for the overall national policy of environmental protection, climate change, reporting on the implementation of policies, measures and GHG emission projections.

The general regulations regulating climate issues include acts, regulations, ordinances and decisions. They are in the function of fulfilling the internationally undertaken commitments of the Republic of Croatia within the framework of the UNFCCC and the EU acquis, and are the starting point for the long-term development of the low-carbon emission economy.

The main Acts regulating climate issues in Croatia are: Air Protection Act (OG 130/11, 47/14, 61/17, 127/19), Climate Change and Protection of the Ozone Layer Act (OG 127/19), Environmental Protection Act (OG 80/13, 153/13, 78/15, 12/18, 118/18), Nature Protection Act (OG 80/13, 15/18, 14/19, 127/19), Act on Ratification of the Kyoto Protocol to the United Nations Framework Convention on Climate Change (OG 05/07).

It can be said that climate policies in the Republic of Croatia are most often linked to certain climate and energy planning segments, and there is a lack of cross-sectoral and integrative climate-energy development planning. Croatia has been a country with an active policy when it comes to international commitments. Preceding the Paris Agreement, the country fulfilled its obligations under the Kyoto Protocol. This consisted of lowering GHG emissions by 5% over the period 2008–2012 when compared with the 1990 benchmark.

Two main strategies for regulating climate are **Low carbon development strategy of the Republic of Croatia by 2030 with a view to 2050** and **Climate change adaptation strategy in the Republic of Croatia for the period to 2040 with a view to 2070** with five-years action plans for their implementation. The Republic of Croatia started to prepare The Low-carbon Development Strategy of the Republic of Croatia by 2030 with a view to 2050 (Low-carbon development strategy) in 2012 by developing a Framework for a low-carbon strategy. The draft version of the new Low-carbon development strategy was proposed in June 2017 and enacted in June 2021. The Low-carbon development strategy is a multi-sectorial development strategy and a base for defining the actions in emission reduction by sectors in line with European strategic guidelines and UNFCCC commitments. Low-carbon development strategy provides a transition towards a low-carbon and competitive economy whose growth is based on sustainable development. The general objectives of the Low-carbon development strategy are:

- achieve sustainable development based on knowledge and a competitive economy with low carbon and resource efficiency;
- increasing security of energy supply, sustainability of energy supply, increasing energy availability and reducing energy dependence;
- solidarity by fulfilling the obligations of the Republic of Croatia under international agreements, and within the policy of the EU as part of our historical responsibility and contribution to global goals;

- reduction of air pollution and health effects.

The strategy opens up opportunities to encourage: investment cycle, growth of industrial production, the development of new business, competitiveness of the economy and creating jobs with a sustainable perspective. In order to fulfil Low-carbon development strategy goals, Croatia proposed Action plan for the implementation of the Low Carbon Development Strategy of the Republic of Croatia. The plan includes 97 measures (intersectoral measures: energy sector, industry, agriculture, waste management, etc.) and after its enactment it will be in force for five years period (2021.-2025). The plan provides: detailed description of measures, holders of all activities, structure and sources of financing of the measures, expected results, frame for implementation and completion of a certain measures; institutional framework for the implementation of the Low-carbon strategy, indicators of the implementation of the Low-carbon Strategy and sources of funding for Low-carbon strategy measures.

In 2015, Croatia proposed and in April 2020 enacted Climate Change Adaptation Strategy in the Republic of Croatia for the period to 2040 with a view to 2070 (Adaptation strategy). The drafting of the Adaptation strategy was preceded by the creation of the Green Book, based on technical documents related to:

- climate modelling that resulted in climate projections for the Republic of Croatia to 2040 and 2070;
- analysis of climate change impacts and vulnerability to projected climate change;
- defining the initial program of measures that will be applicable in the process of adaptation to climate change;
- analysis of cost effectiveness of the measures;
- an assessment of the need to strengthen capacity to adapt to climate change.

The purpose of the Green Book was to encourage debate on all the important issues for adapting to climate change and launching a debate at the national level. After consultation with key stakeholders, this document has been developed, in which the conclusions of public debates have been incorporated. The Adaptation strategy was adopted in April 2020 and it is a fundamental and crucial document which establishes a framework for implementing all climate change adaptation measures at the national level in Croatia.

In the addition to mentioned above, at the European Council on the Governance of the EU which was held on 26th November 2015 it was concluded that the energy and climate governance system should be based on the principles of integration of strategic planning and reporting on the implementation of climate and energy policy and on coordination between actors responsible for climate and energy policy, at EU, regional and national level. Accordingly, every MS has to developed integrated national energy and climate plan for a ten-year period. Croatia developed the first Integrated National Energy and Climate Plan for the Republic of Croatia for the period 2021-2030 (Energy and climate plan) in 2019. Energy and climate plan is based on existing national strategies and plans and provides an overview of the current energy system and the energy and climate policy. It also provides an overview of the national targets for each of the five key dimensions of the EU and the appropriate policies and measures to achieve those targets. In the Energy and climate plan, particular attention is paid to the targets to be achieved by 2030, which include the reduction in GHG emissions, energy from renewable sources, EE and electricity interconnection.

As it was already stated many times, the energy and climate planning process should be implemented also on local level since by engaging the local and regional level and taking

stock of the situation, knowledge and expertise developed on the ground, is essential to ensure that MS reach their objectives. When we talk about local level climate planning it is important to mention Sustainable Energy and Climate Action Plans (SECAP) which plays a key role in adaptation to climate change at local level. SECAP is the key document that shows how signatories of Covenant of Mayors on Climate and Energy will reach its commitments by 2030 and defines concrete measures for both climate mitigation and adaptation, with timeframes and assigned responsibilities, translating the long-term strategy into action. A large number of Croatian local government units joined the initiative Covenant of Mayors for Climate and Energy and developed SECAPs for their administrative area. The development of SECAPs contributes to the energy transition which has long become a reality all over the world. The energy transition has become a global phenomenon affecting energy supply structures and the way citizens and companies can contribute to rapid decarbonization. The power sector is leading the way through the transition as solar and wind power increasingly replace coal, natural gas, and nuclear energy as the world's main energy sources.

3.3.2. Other specific regulations

Other specific regulations include methodologies, programmes, technical regulations and ministry notes.

Energy security and the prevention of climate changes largely depend on considerable improvement of the EE of buildings sector. The key regulation for building sector with the Building Act is **Technical regulation on rational use of energy and thermal protection in buildings** (OG 128/15, 70/18, 73/18, 86/18, 102/20). This regulation prescribes technical requirements regarding the rational use of energy and thermal protection of the construction part of the building, technical heating systems, ventilation, cooling, air conditioning, hot water preparation and lighting that need to be fulfilled during the design and construction of new buildings and during reconstruction, design and major reconstruction of existing buildings. It sets requirements on the consumption of thermal energy for heating in residential and non-residential buildings, requirements related to airtightness of buildings, the maximum allowed transmission heat loss coefficient of building elements, etc. In order to clarify the provisions of the Technical regulation regarding nZEB standard, Ministry of Physical Planning, Construction and State Assets made a Note on the application of the provisions for the design of near-zero energy buildings.

In order to increase EE in the building sector several renovation programmes were developed. The objectives of this programmes are to determine and analyse energy consumption and EE in the existing Croatian residential and non-residential building fund, to identify the potential and the possibility of reducing energy consumption in existing buildings, to develop measures to promote energy efficiency improvements in existing buildings and to evaluate their performance. Building retrofit (renovation) programmes were adopted for different types of buildings and they are implemented accordingly: **energy renovation program of family houses for the period 2014 – 2020 with a detailed plan for the period from 2014 to 2016; energy renovation program of multi-residential buildings for the period 2014 - 2020 with a detailed plan for the period from 2014 to 2016; energy renovation program of non-residential commercial buildings for the period 2016 – 2020; and energy renovation program of public buildings for the period 2016 – 2020.**

In addition to these programs, the Program to encourage the construction of new and renovation of existing buildings to almost zero energy standards was also developed. This

program was developed in 2018 with the aim of encouraging the renovation and construction of nZEB buildings. Ministry of Construction and Physical Planning (later Ministry of Physical Planning, Construction and State Assets) based on **Ordinance on energy audits and energy certification of buildings** (OG 88/17, 72/20, 01/21) enacted the Methodology of performance of energy audits of buildings on 4 September 2017 which was applied from 30 September 2017. This methodology defines the concept and implementation steps of the energy audit, the way of collecting the necessary input data, the way of conducting the analysis and the budget. It also prescribes the layout and contents of the final report on the energy inspection of the building.

In addition to the Methodology of performance of energy audits of buildings, several other relevant methodologies were enacted. Some methodologies determine the amount of tariff items for supply, distribution, transmission, production, transport, storage, reception and dispatch of various energy sources (electricity, natural gas, thermal energy, etc.), prices and connection fees for different energy sources. When we talk about tariff items, prices and connection fees for different energy sources it is necessary to mention the most important institution in charge of regulating energy activities in Croatia – Croatian Energy Regulatory Agency (CERA). CERA is an autonomous, independent and non-profit public institution which regulates energy activities in the Republic of Croatia. CERA's obligations, authorities and responsibilities are based on the Act on the Regulation of Energy Activities, the Energy Act and other acts regulating specific energy activities. For the purposes of arranging the internal organization and representation, work and operations, supervisory bodies, establishment and scope of work of advisory and professional bodies, powers and methods of decision-making, general acts, confidentiality of data, publicity of work and other issues of importance for the CERA the Statute of Croatian Energy Regulatory Agency was passed.

Other regulations which should be mentioned are the guidelines. Guidelines aren't actually legal documents but they are usually developed in order to provide specific instructions. For climate field the most relevant guidelines are Guidelines for the inclusion of climate change and biodiversity in environmental impact assessments and Guidelines for project managers: How to increase the resilience of vulnerable investments to climate change.

The need for climate change action and biodiversity loss is recognized throughout Europe and around the world. In order to make progress in combating and adapting to climate change and to stop biodiversity loss and ecosystem degradation, it is necessary to fully integrate these issues into EU-wide plans, programs and projects. Accordingly, the main goal of Guidelines for the inclusion of climate change and biodiversity in environmental impact assessments is to help MS improve the way in which climate change and biodiversity are included in environmental impact assessments (EIAs) and carried out across the EU.

The main objective of the Guidelines for project managers: How to increase the resilience of vulnerable investments to climate change is to assist project managers and infrastructure development project developers in integrating existing climate variability and future climate change into their projects, infrastructure development and tangible assets. The purpose of the guidelines is to help project developers identify steps they can take to strengthen the resilience of investment projects to climate variability and climate change. The guidelines contain information on how to integrate climate change resilience issues into known project life cycle assessment methods used by project developers. These two guidelines are documents developed by European Commission who strongly recommends the application of these guidelines in projects and environment impact assessments developed in EU and beyond. The guidelines fall in the context of climate change policy development identified by

the Commission with a view to integrating climate change resilience into a range of policy and instrumental areas for financing infrastructure development and tangible assets.

3.3.3. Strategic targets for the next decades

Climate change is a serious environmental, security and socio-political challenge. Its impact is already visible at national, regional and local level throughout Europe and beyond. Tackling this challenge requires urgent action, with the engagement of local governments and communities needed. To address climate vulnerability effectively, Croatia must improve coordination among the different actors, beginning with stronger climate change discussion among its ministries. Climate change needs to extend beyond the framework of environmental legislation and become an active element in aiding understanding of the causal relationships within the Croatian socio-economic context.

Finally, it can be concluded that the most effective actions are those who combine holistic, integrated and long-term approach, addressing both climate change mitigation and adaptation, based on citizen, stakeholders and local governments involvement. The climate actions on local government level means addressing different sectors, from buildings to waste, but also involving the industry and business sectors. Local governments, together with other actors, play an essential role in this regard: creating a vision for the community, developing relevant strategies, implementing effective policies and rolling out actions. They lead citizens, act in an exemplary manner, and improve energy use in services.

The development of future Croatian energy and climate policy should be focused on achieving sustainable development based on knowledge and a competitive economy with low carbon and resource efficiency, increasing security of energy supply, sustainability of energy supply, increasing energy availability and reducing energy dependence. It should be focused in ensuring solidarity by fulfilling the obligations of the Republic of Croatia under international agreements, within the policy of the EU, as part of our historical responsibility and contribution to global goals and reduction of air pollution and health effects. As regards to energy and climate planning it is crucial to achieve it at all levels, from local, regional and national in order to achieve ambitious EU energy and climate targets. Energy and climate planning and management are the most challenging tasks with whom local and regional governments are facing nowadays. Although the national legal framework stipulates that local and regional government units adopt certain planning documents in which they define their energy and climate policy, it is important that they are aware of the importance of energy and climate planning in order to achieve national goals in terms of reducing GHG emissions. It is important not only to invest in the implementation of EE, RES and climate change mitigation measures defined in these documents, but also to get involved in additional initiatives such as the Covenant of Mayors for Climate and Energy to further contribute to the ambitious energy and climate goals and thus increase the quality of life and standard of the citizens in their administrative area.

In order to provide support to local government units in launching and implementing energy and climate related projects in their administrative area, national authorities should make sure their cities and municipalities have the right human resources, legal competences, technical expertise and financial leverage to usher in new forms of governance models in the energy system. By setting a high level target for local energy ownership of renewable energy capacity, they will ensure that the corresponding framework is put in place. National Energy and Climate Plans in the future should provide the perfect opportunity to plan future energy

scenarios with due consideration of all local movements, i.e., energy and climate related projects and in cooperation with them.

Also, national authorities should develop relevant professional handbooks and guidelines which local governments can use to develop robust climate and energy programs that incorporate complementary energy and climate strategies. For example, local governments can combine efforts to improve energy efficiency in local government operations with energy-efficient product procurement, combined heat and power, on-site renewable energy generation and green power procurement to help achieve additional economic, environmental, and social benefits. Local governments can also reduce their own transportation-related energy use and GHG emissions by implementing transportation control measures.

Accordingly, the following should or already is ensured for the following decades:

- the 2021-2027 EU budget period, significant amounts are available for the implementation of climate projects. In order to use it effectively, it is necessary to strengthen the absorption capacity of local governments in the region;
- it would be important to prepare a municipal climate strategy or SECAP for as many municipalities in the region as possible;
- local governments need to learn about and use alternative financial sources to implement their energy or climate-related projects;
- the involvement of adequate professional support for the development of their projects should be ensured to local governments.

4. Financial possibilities and their results in cross-border area

We are witnessing that energy consumption and climate change significantly impacts cities and regions requiring local and regional authorities to take action and invest in quality energy planning and mitigation and adaptation measures. Nevertheless, local and regional authorities face various obstacles in accessing and using public and private climate financing mechanisms. To address the challenges of climate change over the coming decades, significant additional resources will need to be made available for energy and climate action.

For local and regional governments, who are often central to both climate mitigation efforts and adapting to climate impacts, climate finance is crucial as it can kick-start investments in mitigation and adaptation measures and leverage additional private investments. For this purpose it is important to investigate and analyse available financial possibilities (including innovative and alternative mechanisms) in financing energy and climate related projects.

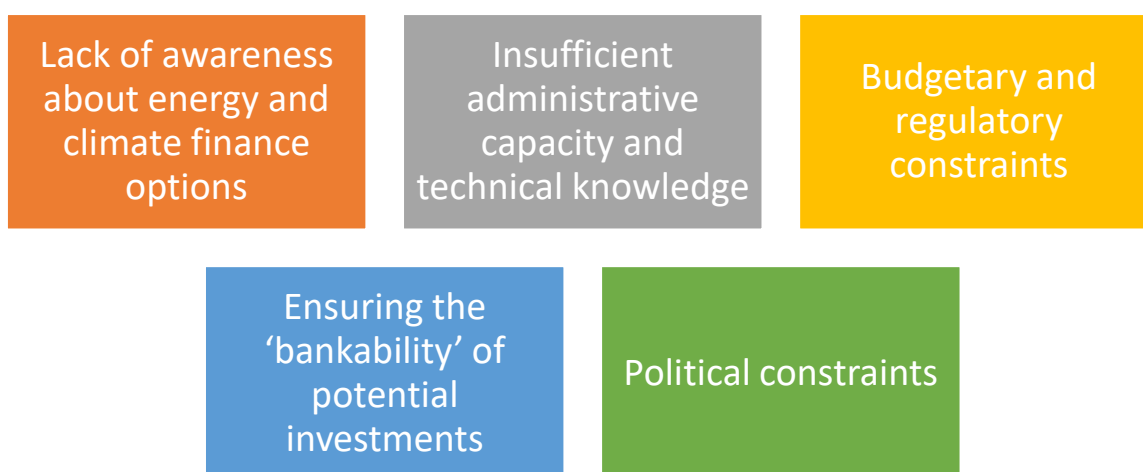


Figure 4.1 Main obstacles in using energy and climate financial options

Energy and climate finance helps countries reduce greenhouse gas emissions such as by funding renewable power like wind or solar. It also helps communities adapt to climate change impacts. Introducing climate resilient seeds, for instance, means farmers, despite droughts and other extreme weather, keep producing food and earning income.

Public finance provided through governments (and by taxpayers) is essential to finance action where private finance is not yet available or that would not normally attract private finance. Public finance is often used for investments that contribute to a public good, such as by reinforcing the banks of a river so it does not flood neighbouring communities. Sometimes, public finance encourages private finance from businesses by “nudging” firms to enter and create markets for new products, like building supplies made of recycled materials.

Private finance also has an important role. In addition to investments in projects vital to the new green economy, such as renewable power plants or electric cars, private finance needs to be aligned with climate goals. This means that an investor such as a pension fund would choose, for instance, to purchase stock in companies producing clean renewable energy instead of carbon-intensive fossil fuels.

4.1. General EU framework

European funds are allocated as part of the seven-year financial period 2021 – 2027. The envelope of the EU budget is the largest so far and amounts to 1,824.3 billion EUR.

Funds to be made available for MS in the financial period 2021-2027 are awarded from two sources. One is common and is called the Multiannual Financial Framework (MFF) which is programmed for a seven-year period, while the other source is a novelty that has proved necessary due to the crisis caused by the coronavirus. That source is the Next Generation EU (NGEU).

Multiannual Financial Framework (MFF)

The MFF is a long-term EU budget that sets limits on spending for the EU as a whole and for different areas of activity for a period of seven years.

It is an investment budget that pools Member States' resources to fund activities that Member States can more effectively co-finance. The EU budget is never in deficit, debt is never created and only is spent as much as is collected. The EU budget finances a wide range of activities in the interest of all EU citizens; for example, in the fields of energy, transport, information and communication technologies, climate change and research, etc.

The budget is divided into "headings" that correspond to the priorities and areas of action of the EU. MFF 2021-2027 consists of 7 budget headings covering a total of 17 policy areas.

European Union Recovery Instrument, Next Generation EU (NGEU)

As part of the recovery plan, the European Commission published on 27 and 28 May 2020 a series of documents which, in addition to the MFF for the period 2021-2027 include a new instrument: the European Union's Recovery Instrument (so-called Next Generation EU - NGEU / EU next generation) to recover from the economic and social damage caused by the outbreak of the COVID-19 pandemic, and to upgrade the budget and future MFF.

The value of NGEU is 750 billion EUR (in 2018 prices), but the distribution includes 390 billion EUR in grants (more precisely 384.4 billion EUR in grants and 5.6 billion EUR in guarantees) and 360 billion EUR in loans.

The funds will be repaid through future EU budgets by 31 December 2058 at the latest. The annual amounts to repay the principal of the debt may not exceed 7.5% of the amount of 390 billion EUR (total debt). Payments of interest expenses will be made by December 31, 2026.

In line with one of the European Union's top priorities, at least 30% of total MFF and NGEU expenditure will support climate targets, with a focus on reducing greenhouse gas emissions by 55% by 2030. From 2024, 7.5% of spending will focus on biodiversity targets, and from 2026 the percentage will increase to 10%.

Greater focus will also be on gender equality and gender mainstreaming when spending budget funds and the European Commission will develop a methodology for measuring relevant costs to be tested at program level under the MFF 2021-2027.

4.2. Hungary

In Hungary, as the first EU member ratifying the Paris Agreement, energy efficiency measures have been playing a central role in the development policy and they still are the horizontal cornerstones of the present structural policy framework. In this perspective, the most significant impact was provided by the EU-funded national operative programs, namely the Territorial Development OP (TOP) and the Environmental Protection and Energy Efficiency OP (KEHOP). These OPs offered non-refundable financial schemes with 100% intensity (mainly in form of pre-financing) both for public and private (residential) stakeholders. As such, EU-funded development instruments ensured the most competitive options for energy efficiency-related investments (instead of bank loans or ESCO solutions), therefore public stakeholders (mainly municipalities, public institutions) could take advantage from these OP schemes.

As a consequence, considering the attractiveness of the EU-funded instruments, the Hungarian government is engaged to keep the significance and increase the scope of the financial options to propel new green investment also in the 2021-2027 EU budget period, thus supporting the realisation of the Green Deal development targets. In this regard, we give a general outline of the previous and forthcoming non-refundable instruments to get a detailed picture upon the energy efficiency investment options of the Hungarian public stakeholders.

4.2.1. Non-refundable instruments

Regarding the non-refundable policy instruments, as it was mentioned above, the Territorial Development OP (TOP) and the Environmental Protection and Energy Efficiency OP (KEHOP) offered investment solutions for public stakeholders. The central institutions were able to call on support from KEHOP, the local governments (municipalities) from the TOP. The subsidy rate was 100% in all cases.

TOP instruments

The strategic goal of the Territorial Development OP (TOP) is to encourage the transition to a low-carbon economy by joining global efforts. Although much of the root cause of climate change is concentrated in urban areas, reducing CO₂ emissions and achieving resource efficiency is a challenge in all Hungarian municipalities, so urban-rural cooperation can also play a major role in achieving the objectives. For this aim, the following calls were outlined within the TOP framework:

1. Energy-efficient modernization of municipal buildings

Call code: TOP-3.2.1-15

Total fund: 203 million EUR

The overall aim of this measure is to promote a more efficient energy utilisation and more rational energy management in the local government institutions, within which the following are presented as sub-goals:

- Renovation and development of 100% municipally owned buildings and infrastructures in order to reduce greenhouse gas (GHG) emissions from fossil fuels;

- To boost increased usage of domestic renewable energy sources, as it lags behind the EU average, however Hungarian potential in this area is outstanding in several aspects. Therefore, an additional goal within the framework of the supported projects is to make renewable energy sources more accessible, to encourage and promote their broad utilisation.

Supported actions of the call:

- Energy-efficient investments of municipally owned buildings by modernizing their external insulation structures;
- Upgrading, replacement of fossil fuel-based heat generation equipment and / or upgrading of related heating systems;
- Installation and connection of solar collectors to a heat transfer system;
- Development of a photovoltaic system for a small household-sized power plant to meet its own electricity demand;
- Installation and connection of heat pump systems to a heat transfer system;
- Establishing a connection to a local community heating plant or a waste heat recovery system powered by fossil or mixed (both fossil and renewable) or purely renewable energy sources;
- Elaboration of municipal SECAPs.

2. Implementation of local government-controlled energy supply for the exploitation of renewable energy sources in line with local conditions, within the framework of complex development programs

Call code number: TOP-3.2.2-15

Total fund: 45 million EUR

Small-scale, complex regional energy programs aimed at exploiting the region's energy potential, especially renewable energy sources from within, and the implementation of autonomous energy supply at the individual and community level are of paramount importance both for mitigating the effects of climate change and for energy dependence in urban areas. All of these systems utilize local raw materials as renewable energy sources, thus providing an environmentally friendly, independent and long-term sustainable (primarily heat, but even electricity) energy supply.

The aim of this call is therefore to support complex projects of regional and local significance, but on a smaller scale, requiring municipal and inter-municipal coordination, for the production and local usage of energy from renewable energy sources to meet their own (public) energy needs.

Supported actions:

- Satisfying own (public) heating, cooling, electricity needs with biomass-based renewable energy;
- Satisfying own (public) heating, cooling and electricity needs with geothermal energy;
- Establishment of solar power plants to meet their own (public) electricity demand.

KEHOP instruments

In Hungary, about 40% of energy consumption takes place in private and public buildings. If the insulation can be improved and the utilisation of renewable energy sources can be boosted, we can create energy security for next generations. For this aim, the Environment and Energy Efficiency OP supported the following initiatives for central institutions during the previous budget period:

1. Tender developments in building energy for budgetary bodies

Call code number: KEHOP-5.2.10.

Total fund: 50,2 million EUR

The main objective of this call was to encourage the implementation of energy efficiency investments of central institutions and to promote the spread of decentralized, environmentally friendly renewable energy systems in line with the domestic and EU strategies. The need to increase energy efficiency and save energy can be explained by the statistical fact, that domestic energy demand per unit of GDP is more than three times higher in terms of currency parity and about one and a half times higher in purchasing power parity in Hungary than in developed EU Member States. Consequently, this scheme contributed to the implementation of energy saving investments to improve the energy efficiency of buildings and increase the use of renewable energy.

Supported actions:

- Improvement of the thermal technical properties of public buildings.
- Use of solar panels for grid or autonomous (non-grid connected) electricity generation. exclusively for the supply of electricity of the building block involved in the development.
- Use of solar collectors to partially or completely meet the domestic hot water demand.

2. Development of photovoltaic systems for central budget bodies

Call number: KEHOP 5.2.11.

Total fund: 123,4 million EUR

Within the 2012-2020 budget period, the Hungarian government set the goal of supporting the transition to a low-carbon economy in all sectors, supported by projects to partially or completely replace existing electricity needs with photovoltaic renewable energy related to central government buildings. The Government intended to achieve this goal in cooperation with central budgetary bodies under the conditions set out in this call.

The main objective of this call, in line with the domestic and EU strategy, was to encourage the deployment of decentralized, photovoltaic systems using environmentally friendly renewable energy connected to buildings, thus supporting the full or partial replacement of existing fossil electricity by central government.

In the framework of the co-operation, the Government undertook:

- the projects awarded with a non-refundable grant of between HUF 100 million and HUF 250 million, up to the amount of the available resources announced in the stages.

- a grant advance of up to 100% of the eligible costs of projects that meet the conditions of the call.

Supported actions:

- Development of grid-connected solar system(s) with a connection capacity of less than 50 kVA (small household-sized power plant) in order to partially or completely directly satisfy own electricity demand.
- Development of a grid-connected solar system with a connection capacity of 50-500 kVA in order to partially or completely directly satisfy one's own electricity demand.

3. Priority building energy developments of public buildings

Call number: KEHOP-5.2.2.

Total fund: 440,8 million HUF

Within this call, the Hungarian government was engaged to make further steps in order to implement energy efficiency investments in public buildings owned or managed by public sector organizations or public sector organizations with a background institution. Therefore, the government has set itself the goal of supporting the transition to a low-carbon economy in all sectors to be achieved in cooperation with the budgetary authorities under the conditions set out in this call.

In the framework of the co-operation, the Government undertakes to:

- provide non-refundable grants to projects that meet the conditions of the call, up to the available resources;
- provide a grant advance (pre-payment) for supported projects.

Activities to improve energy efficiency:

- Improving the thermal performance of buildings on part or all of the building, buildings or group of buildings involved in the renovation.
- Modernization of heating, cooling, ventilation and domestic hot water systems of institutions.
- Use of solar collectors to partially or completely meet the domestic hot water demand and / or to assist heating.
- Biomass, including agricultural by - products, horticultural by - products, energy crops, forestry main and by - products, wood and other industrial wastes and by - products or their mixed use for heating and / or heating assistance.
- Use of a heat pump for basic heating and / or domestic hot water production and / or heating assistance.
- Utilization of geothermal energy for heating or heating assistance and / or domestic hot water production.
- Use of solar panels for grid or autonomous (non-grid connected) electricity generation, exclusively for the supply of electricity to the building involved in the development.

Beside the outgoing EU-funded financial schemes, it is also important to examine the forthcoming financial possibilities that will be available for municipalities and public entities

with the 2021-2027 budgetary period. In this regard, even if we still don't know the exact financial structure of the operative programs, the incumbent Hungarian government is expected to launch the following development schemes to further boost on the energy efficiency and climate protection measures:

TOP Plus – “Promoting energy efficiency and reducing greenhouse gas emissions” priority

Within the framework of the next territorial development operative scheme, called TOP Plus, climate-friendliness and energy saving play also a strategic role as energy efficiency – like one aspect of economic competitiveness – became a more significant element of the Hungarian (mainly rural) development policy. Therefore, TOP Plus will support the following actions the “energy efficiency and greenhouse gas reduction” priority axis:

- Investments in energy modernization and energy saving of municipally owned buildings, including thermal insulation and door/window replacement, modernization of heating, cooling and domestic hot water systems, improvement of lighting systems for buildings, the development of smart grids and smart metering systems, the implementation of a green wall and a green roof as a green infrastructure solution.
- Meeting local heating, cooling and electricity demand, encouraging decentralized renewable energy production at individual and community level, in accordance with local conditions, for own or non-own use, to replace the consumption of energy communities, in particular solar, using biomass, geothermal, heat pump-based systems.
- Other activities related to the utilization of geothermal energy, which help to reduce greenhouse gas emissions, the complex utilization of the accompanying gases and methane for energy and environmental purposes.
- Preparation of the Sustainable Energy and Climate Action Plan (SECAP) and projects based on the Sustainable Energy Action Programs (SEAP) of the Municipalities completed in the previous period, implementation of the programs through energy efficiency activities, increased use of renewable energy sources and energy awareness activities.
- Interventions can be linked to awareness-raising, dissemination and education activities to present activities to increase energy and climate awareness, increase energy efficiency and the use of renewable energy, and develop green infrastructure.

KEHOP Plus – Supporting energy efficiency measures

In parallel with the territorial development operative support scheme, the outgoing KEHOP (Environment and Energy Efficiency OP) will be renewed as well entitled as KEHOP Plus to foster the energy efficiency developments and the utilisation of renewable energy sources in public institutions, as it was provided in the previous budgetary period.

In order to ensure an efficient assistance for the “fair energy transformation”, KEHOP Plus puts a meaningful emphasize on the modernization of the existing domestic building stock. despite the former energy investments, especially residential buildings still have great potential for energy efficiency, but without support, the modernization will not shift towards deep renovations. In the field of energy efficiency improvements in buildings, green

infrastructure solutions (green wall, green roof) have so far been completely untapped, although these solutions can mean significant energy savings (also in heating and increasingly important cooling) with a relatively small investment. The deep renovation of central government buildings, social, health and educational institutions, as well as church, civic and non-profit organizations serving public services and SMEs for energy efficiency should also be encouraged by KEHOP Plus.

Additionally, one of the most important innovation of KEHOP Plus, that must be mentioned here, is that the new OP structure and funding scheme will involve ESCO companies as well, which is a totally new modification of the conditionalities. As a result, ESCO companies will receive - in order to increase their liquidity - non-refundable or refundable subsidies from KEHOP Plus for the investments necessary for the fulfilment of their obligations to final consumers and investments to be made within the ESCO scheme. The obligors can use the support primarily for the investments of the final consumers, i.e. for the energy investment at the final beneficiaries, so that the development can be realized on the level of the final consumer. Thus, the grants can better encourage the implementation of building energy investments within the obligation scheme and avoid an increase in the beneficiary's overhead costs. As these schemes can only be introduced gradually, traditional forms of support used in the period 2014-2020 can also be used. Energy efficiency developments of general interest are also conceivable, which do not specifically target building energy, but can achieve significant energy savings and a qualitative leap with them. Supporting consumer awareness can also contribute to the effectiveness and success of the system.

Thus, in particular, the following can be accounted for:

- Energy efficiency investments and measures in the catalogue used for the energy efficiency obligation scheme.
- Specific measures with demonstrable energy efficiency gains.
- Modernization of building cladding (insulation, replacement of doors and windows).
- Developments for building services (heating, cooling and domestic hot water production systems, modernization of equipment), lighting modernization, etc.
- Installation of small-scale power plants utilizing renewable energy sources related to building energy renovation and generating electricity from them.
- Activities related to the introduction and operation of the energy efficiency obligation scheme.
- Establishment of a green roof, green wall, giving preference to extensive solutions requiring minimal maintenance. Transformation and reinforcement of a building structure, waterproofing in order to make the green roof feasible, design of a green wall support structure, establishment of a planting medium, planting.
- Awareness raising related to the design of green roofs, green walls, information on technical conditions, energy efficiency effects, etc.
- Soft investments, research and development-innovation up to a few percent of the basic investment.

According to the governmental intentions, KEHOP Plus intervention will cover the modernization of district heating, cooling systems and the construction of new district heating systems, with the exception of placing energy production on a renewable basis. New district heating systems will be installed primarily where renewable-based ones are provided operation and high heat demand density. Supporting this type of new investment will

simultaneously create new energy communities and increase geothermal energy use. At the level of consumers using district heating services, support for the installation of cost-sharing equipment also aims to promote energy efficiency.

4.2.2. Refundable and combined instruments

Within the actual Hungarian policy conditions, there is no meaningful option for the utilisation of refundable or combined instruments. Public stakeholders can choose among the following solutions:

- Applying for the above-mentioned non-refundable EU grants with 100% contribution intensity rate for covering the costs of their energy efficiency investments which is financially the most advantageous option for municipalities and public organisations. This is why banking institutions are not deeply involved in lending for public partners, as their offers are not as competitive comparing to EU funding.
- Technically, Hungarian municipalities and public stakeholders can take out for loans to finance their energy saving investments, but beside the previously mentioned challenges, municipalities must to adhere to many regulations and restrictions. They can legally utilise loans with a limit of one calendar year, longer debt periods need governmental authorisation requiring bureaucratic constraints, thus banking loans are not a suitable and flexible tool for municipal funding.

4.2.3. Innovative instruments

As we could see from KEHOP Plus, ESCO companies have a great importance in energy efficiency measures. Moreover, they can be considered as providers of innovative financial instruments for energy investments, therefore their participation shall be regarded as an alternative and beneficial solution for municipal stakeholders.

Energy Service Company, as defined in Directive 2006/32 / EC, as follows: “An ESCO (Energy Service Company) is a natural or legal person that provides energy and / or energy efficiency services to user facilities. participating in its management risk. The consideration for the service must be (in part or in full) the energy efficiency intervention, based on a system of performance criteria laid down in advance in the Energy Saving Contract (ESC).

System features:

- Everything is focused in one hand (investment, financing, construction, maintenance).
- Long-term commitment, up to 10-15 years.
- It is typically used in Hungary in the following areas:
 - Heating upgrade;
 - Industrial and district heating modernization;
 - Modernization of public lighting;
 - Indoor lighting upgrade.

The ESCO investment can be realized in several variants, the following constructions can be considered as funds:

- **Third party financing:** The ESCO, as a third party, provides an external financing for the investment, but does not provide operating and maintenance service, so their fee is not charged to the construction.
- **Long-term lease / operating lease:** In this case, the service is an upgrade and the lease of the refurbished system.
- **ESCO:** Technical and financial service related to full modernization, where the ESCO undertakes project identification, technical design and licensing, turnkey construction, operation and maintenance, invoicing and the organization of the financing of activities.
- **Forfeiture / Factoring:** Supplier of long-term receivables from the bank purchase at a factored present value, where the discount bank undertakes to financial risks associated with the claim.

Advantages of the investment implemented by the ESCO:

- **Development without indebtedness:** The investment is made from energy savings service, so it does not increase the indebtedness of the municipality.
- **Simplification of public procurement frameworks:** Planning, investment, financing, significantly simplifies public procurement through the integration of operations procedure.
- **Economies of scale:** ESCOs are significant through their portfolio they are able to obtain discounts from suppliers and banks.
- **VAT funding bridging:** The ESCO is able to VAT on the investment to eliminate burdens, while postponing the payment of VAT charges through operation.

4.2.4. Overview of refurbished public buildings with good practice examples

If we would like to give two examples for successful energy efficiency developments, as best practices, we can choose among many regional projects, as energy efficiency, mainly insulation and renewable energy projects were implemented in high numbers by public institutions in Zala county.

1. Energy modernization of municipal buildings in Nagykanizsa

One of the most interesting projects with a greater financial volume is the **TOP**-funded municipal project of Nagykanizsa, where a meaningful part of the municipal building stock is still waiting for renovation on a certain scale. This project, entitled “*TOP-6.5.1-19-NA1-2020-00001 - Energy modernization of municipal buildings in Nagykanizsa*” has a total value of 3,7 million EUR (with 100% funding intensity) and involves 12 intervention sites as smaller and bigger municipal facilities where energy renovation will be done in 2021-2022. Within the project, the following public buildings (mainly educational institutions) will become more energy efficient:

1. Batthyány Lajos High School
2. United Social Institution of Nagykanizsa

3. Hevesi Sándor Cultural Center
4. István Halis City Library
5. Nagykanizsa Central Kindergarten - Rózsa Kindergarten
6. Nagykanizsa Central Kindergarten - Hevesi Kindergarten
7. Nagykanizsa Central Kindergarten – Attila Kindergarten
8. Nagykanizsa Central Kindergarten - Garden City Kindergarten
9. Nagykanizsa Central Kindergarten - Seven Colored-Flower Kindergarten
10. Nagykanizsa United Nursery - Bóbita Nursery
11. Nagykanizsa United Nursery - Fairytale Nursery
12. Nagykanizsa United Nursery - Sunflower Nursery

By developing the public buildings of the City of Nagykanizsa for energy purposes, it intends to promote the growth of energy efficiency and the use of renewable energy sources, on the one hand to achieve the transition to a low-carbon economy and on the other hand as a demonstration tool for local residents. Besides, within the framework of the project, the transformation of the Municipal Sustainable Energy Action Plan (SEAP) of Nagykanizsa will be also elaborated further into a more comprehensive Sustainable Energy and Climate Action Plan (**SECAP**). Moreover, for the buildings involved in the development, project-based accessibility, including communication accessibility, is also planned, except for implementation sites that include only solar development parts.

Expected results in terms of energy saving:

- **GHG emission reduction:** 452,852 t/y;
- **Reduction in energy consumption:** 5.087,376 GJ/y;
- **Newly established RES capacity:** 257,856 kW;
- **Energy from RES:** 786.264 GJ/y.

The biggest and most significant part of this comprehensive project is the insular and technological modernisation of the **Batthyány Lajos High School** which is on of the leading educational organisation in the region. Within this project part, the following development activities will be implemented:

- **Thermal insulation:** 14 cm Graphite EPS facade thermal insulation, 20 cm EPS flat roof thermal insulation, 26 cm rock wool suspended ceiling thermal insulation;
- **Replacement of doors and windows:** installation of heat-insulated doors and windows with 3 layers of glazing;
- **Heating modernization:** Installation of condensing gas boiler, Installation of thermostatic valve heads;
- **Lighting upgrade:** Installation of LED light sources;
- **GHG emission reduction:** 139,05 t/y;
- **Reduction in energy consumption:** 2.478,42 GJ/y.



Figure 4.2 Expected façade of the Batthyány Lajos High School

2. Geothermal energy supply in the Municipality of Lenti

In 2016, the Municipality of Lenti submitted a project proposal with the framework of **TOP** in order to secure a financial background for the establishment of a **geothermal power plant** (with 1 production well and 1 re-injection well) providing heating for 10 local municipal institutions. The conceptual background of this initiative is that in Lenti, there is a significant thermal asset below the surface within the administrative area of the town, which is well mapped by former oil mining activities. Actually, thermal water is only used for heating in the local thermal bath (Lenti Spa), that can be identified as a good practice for the utilisation of RES instead of natural gas, thus inspiring the elaboration of the project concept.

After the positive evaluation, Municipality of Lenti received **2.840,00 EUR** for the implementation of the envisaged developments.

Technical details:

- Transfer of the thermal water from the production thermal well extracted from a base depth of 1,480 m (wellhead temperature 69 °C, water volume 32-35 m³/h) to the heating center with the help of installed booster pumps.
- "Connecting" potential heat consumers directly (without creating a secondary circuit) to a simple two-pipe thermal transmission line network.
- Feeding through thermal heat exchangers installed in the boiler rooms of ten municipal institutions.
- Automatic operation of the system with a dispatcher central computer and telemechanical remote monitoring.
- Placement of thermal water in a return well with a planned base depth of 1,450 m.
- 8344 GJ produced renewable energy / year, 1860 kW power, 520 t / year CO₂ emission reduction.

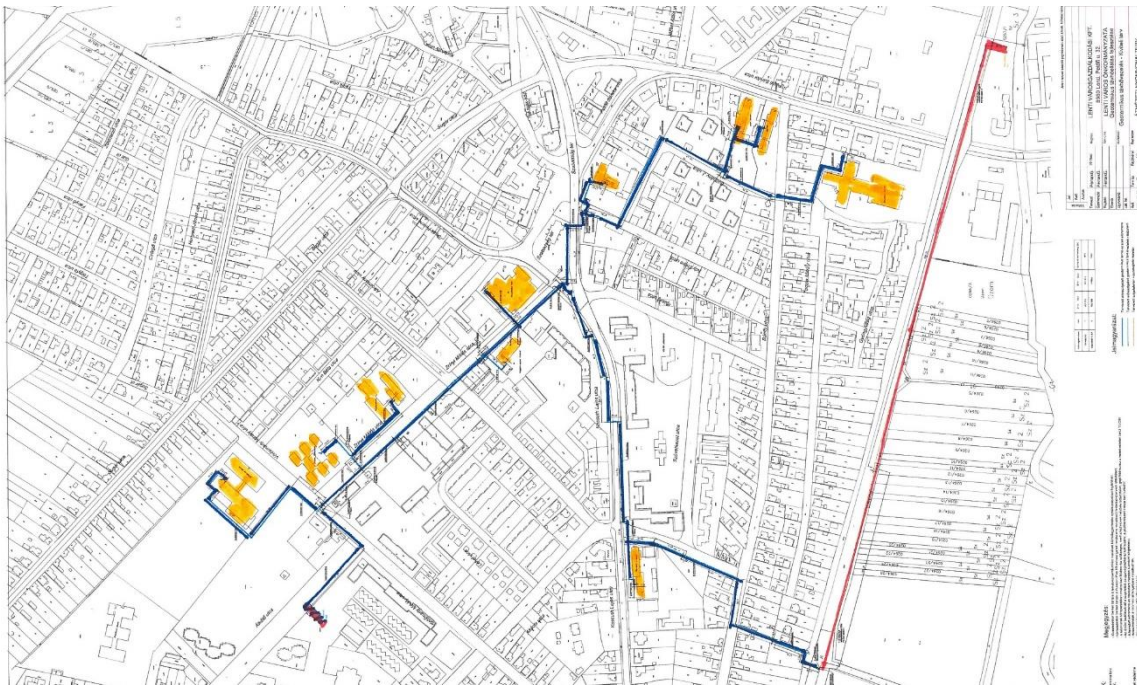


Figure 4.3 Construction map of the pipelines and the location of municipal institutions

Regarding the achievements, project implementation has so far realised the following results:

- Both wells (extraction and re-injection) are completed, operational, and the thermal water has been tested.
- Both wells, mechanical engineering and control technology are constructed by the end of May 2021.
- Wiring system and the related optical cable have been completed, subsequent landscaping work is underway.
- The mechanical installations of the 10 institutions have been completed.
- Control technology is being commissioned.
- The entire system will be handed over by July 15, 2021, and trial operation will begin.
- Operational documentation is currently being prepared.

After the finalisation of the ongoing developments, the further steps are considered to be made within next project activities to enlarge the scope of local RES utilisation:

- Involvement of other institutions with existing capacity beyond the project maintenance period - Spa and hotel.
- Providing solutions for the connection of residential real estate and tourist facilities - 2 new wells and piping system vs 1 deep-drilled thermal well (heat pump principle)
- Solar network development for electricity replacement.

4.3. Croatia

As the youngest member of the European Union, Croatia has more than 24 billion EUR available for the financial period 2021-2027 through the EU long-term budget. Croatia has 13,8 billion EUR available through the Multiannual Financial Framework, and additional 10,6 billion EUR in the Next Generation EU.

In Croatia, projects aimed at increasing energy efficiency, using renewable energy sources, as well as energy renovation are mostly financed from the European Regional Development Fund and Cohesion Fund implemented through the Operational Program Competitiveness and Cohesion. Other than EU funds, national funds provided by Croatian Environmental Protection and Energy Efficiency Fund are also available for private and public sectors in regards to energy efficiency implementation. Loans provided by the Croatian bank for reconstruction and development are aimed at energy efficiency and renewable energy resources projects, and the ESCO model presents a new model to reduce energy costs and maintenance by installing new more efficient equipment and optimizing energy systems.

4.3.1. Non-refundable instruments

Operational Program Competitiveness and Cohesion

The Croatian Ministry of Regional Development and European Union Funds, as the Coordinating Body in charge of organizing and coordinating the process of preparation of programming documents for the financial period of the European Union 2021-2027, submitted at the end of June 2021 to the European Commission the first drafts of the Partnership Agreement for the Operational Program Competitiveness and Cohesion (OPCC) 2021-2027 and the Integrated Territorial Program 2021-2027, totalling € 6.7 billion from the European Regional Development Fund, Cohesion Fund and Just Transition Fund.³

The draft program documents in question were prepared in accordance with the directive of the European Commission and aim to implement 5 policy objectives:

1. Smart,
2. Green,
3. Connected,
4. Solidarity
5. Europe closer to its citizens,

of which the minimum percentage of allocation of funds for Smart Europe is 25% and 30% for Green Europe, in accordance with the regulation of the European Commission.

The allocations for the OPCC are arranged by six priorities:⁴

1. Strengthening the economy by investing in research and innovation, supporting business competitiveness, digitalisation and developing skills for smart specialization – 1,17 billion EUR;
2. Strengthening digital connectivity – 0,16 billion EUR;

³ <https://razvoj.gov.hr/vijesti/europskoj-komisiji-poslani-prvi-nacrti-sporazuma-o-partnerstvu-opkk-2021-2027-i-itp-2021-2027/4632>

⁴ <https://razvoj.gov.hr/UserDocsImages/slike/Vijesti/2021/Srpanj/NKO%20i%20Sabor//Prezentacija.%20VFO%202021.-2027..pdf>

3. **Promoting energy efficiency and renewable energy sources, adaptation to climate change, risk prevention, environmental protection and resource sustainability** – 1,62 billion EUR - examples of projects proposed under funding operations include: energy and comprehensive renovation of public sector buildings; Investment in RES for end users (microsolars, heat pumps, etc. for citizens and institutions); investment in geothermal energy; investment in the development of the hydrogen economy;
4. Developing of sustainable intermodal urban mobility, as part of the transition to a low-carbon economy – 0,2 billion EUR;
5. Developing of sustainable, smart and safe mobility – 1,03 billion EUR;
6. Strengthening the health system, promoting social inclusion, education and lifelong learning – 0,57 billion EUR;

Overall allocation for the OPCC 2021 – 2027 for Croatia is 4,75 billion EUR.

Some of public calls issued through OPCC in the previous programming period (2014-2020) were:

1. **Increasing energy efficiency and the use of renewable energy sources in manufacturing industries** - intended for micro, small, medium and large entrepreneurs (2 calls)

Purpose of the call was to support the implementation of energy efficiency measures and / or measures for the use of renewable energy sources that will lead to a reduction of consumption of delivered energy of at least 20% in relation to the reference delivered energy, i.e. in relation to consumption of delivered energy.

The subject of the call is to support the realization of energy savings by increasing energy efficiency in manufacturing industries, enabling equal quantities of products using less energy supplied and reducing the share of conventional (fossil) fuels in total energy consumption by introducing renewable energy (RES).

Co-financing for the first call was around 60% to 80% and for the second call was around 50% to 60%.

Total allocation for the first call was 15,4 million EUR for 89 projects and for the second call was 44,2 million EUR for approximately 78 projects (28 projects were chosen, another 50 are expected to be announced).

2. **Increasing energy efficiency and the use of renewable energy sources in the service sector (tourism, trade)** - intended for micro, small, medium and large entrepreneurs

Purpose of the call was to support the reduction of energy consumption in companies registered for tourism and / or trade, through the implementation of energy efficiency measures (measures) and / or activities (measures) for the use of renewable energy sources that bring energy consumption to the cost of the company of at least 20% in relation to the reference delivered energy, i.e. in relation to the consumption of delivered energy before the implementation of measures.

The subject of the call is to support the realization of energy savings by increasing energy efficiency in the private service sector, enabling equal amounts of results (services) by using

less energy and/or reducing the share of conventional (fossil) fuels in total energy consumption by introducing renewable energy systems. energy.

Co-financing for this call was around 60% to 80%, depending on the company size and planned measures.

Total allocation was 29 million EUR for 74 projects.

3. Energy renovation and use of renewable energy sources in public sector buildings

Purpose of the Call was to support the implementation of energy renovation measures in public sector buildings that will result in a reduction of heating / cooling energy consumption (QH, nd) at an annual level (kWh/year) of at least 50% compared to annual heating / cooling energy consumption before implementation of these measures and the use of renewable energy sources.

The call was intended to support the implementation of energy renewal measures and the use of renewable energy sources in public sector buildings in which state and state administration bodies, local or regional self-government units, public institutions, religious communities and associations perform social activities, which will result in reduced energy consumption for heating / cooling with a specially integrated approach.

Co-financing for this call was approximately 60%.

Total allocation for the call was 156,08, million EUR, for 550 projects.

4. Energy renovation of buildings and the use of renewable energy sources in public institutions that perform activity of education

The purpose of the call was to implement measures of energy renovation and the use of renewable energy sources in public sector buildings in which public institutions perform education activities that will result in a reduction of energy consumption for heating / cooling through an integrated approach.

Co-financing for this call was approximately 60%, depending on the index of development the projects was implemented.

Total allocation for this call was 46,38 million EUR, for 216 projects.

5. Energy renovation of residential buildings

The purpose of the call was to implement energy renovation measures and use renewable energy sources in multi-dwelling buildings that will result in a reduction in heating/cooling energy consumption through an integrated approach.

Co-financing for this call was approximately 60%.

Total allocation for the call was 74,7 million EUR for 584 projects.

Recovery and Resilience Facility

The Recovery and Resilience Facility (the Facility) makes €723.8 billion (in current prices) in loans (€385.8 billion) and grants (€338 billion) available to support reforms and investments undertaken by Member States. The aim is to mitigate the economic and social impact of the coronavirus pandemic and make European economies and societies more sustainable,

resilient and better prepared for the challenges and opportunities of the green and digital transitions. The Recovery and Resilience Facility is the centrepiece of NextGenerationEU, a temporary recovery instrument that allows the Commission to raise funds to help repair the immediate economic and social damage brought about by the coronavirus pandemic. The Facility is also closely aligned with the Commission's priorities ensuring a sustainable and inclusive recovery that promotes the green and digital transitions. To benefit from the support of the Facility, Member States have to submit their recovery and resilience plans to the European Commission. Each plan sets out the reforms and investments to be implemented by end of 2026.⁵

The European Commission has given a positive assessment to Croatia's recovery and resilience plan, which will be financed by €6.3 billion in grants. The financing provided by the Recovery and Resilience Facility – at the heart of NextGenerationEU – will support the implementation by 2026 of crucial investment and reform measures put forward by Croatia to emerge stronger from the COVID-19 pandemic. Croatia's plan forms part of an unprecedented coordinated EU response to the COVID-19 crisis, to address common European challenges by embracing the green and digital transitions, to strengthen economic and social resilience and the cohesion of the Single Market. In particular, Croatia's plan will accelerate the green transition notably in energy and transport, enhance digitalisation of the public and private sectors, improve the business environment, strengthen labour, social and education policies and increase the efficiency of the public administration and of the justice system.

The plan is constructed of five components and one initiative:⁶

1. Economy;
2. Public administration, judiciary and state property;
3. Education, science and research;
4. Labour market and social protection;
5. Health care;
6. Initiative: Renovation of buildings.

The Croatian Recovery Plan is expected to start implementing at the end of 2021, after being approved by the Council of the European Union on the basis of a proposal from the European Commission.

By the end of 2021, Croatia can already expect the payment of around 6.1 billion HRK, which is an advance of 13% of the total amount of grants provided under the Plan.

Modernisation fund

The Modernisation Fund⁷ is a dedicated funding programme to support 10 lower-income EU Member States in their transition to climate neutrality by helping to modernise their energy systems and improve energy efficiency.

The beneficiary Member States are Bulgaria, Croatia, Czechia, Estonia, Hungary, Latvia, Lithuania, Poland, Romania and Slovakia.

⁵ https://ec.europa.eu/info/business-economy-euro/recovery-coronavirus/recovery-and-resilience-facility_en

⁶ <https://planoporavka.gov.hr/o-planu/9>

⁷ https://ec.europa.eu/clima/eu-action/funding-climate-action/modernisation-fund_en

The Modernisation Fund will support investments in:

- Generation and use of energy from renewable sources;
- Energy efficiency;
- Energy storage;
- Modernisation of energy networks, including district heating, pipelines and grids;
- Just transition in carbon-dependent regions: redeployment, re-skilling and upskilling of workers, education, job-seeking initiatives and start-ups.

The Modernisation Fund is recognised in the European Green Deal Investment Plan as one of the key funding instruments contributing to the objectives of the European Green Deal.

The Modernisation Fund is funded from

- revenues from the auctioning of 2% of the total allowances for 2021-30 under the EU Emissions Trading System (EU ETS);
- additional allowances transferred to the Modernisation Fund by beneficiary Member States – 5 opted to do so (Croatia, Czechia, Lithuania, Romania and Slovakia).

The Modernisation Fund will contribute to the significant investment needs of the 10 lower-income Member States to modernise their energy systems. The Modernisation Fund will:

- Help the beneficiary Member States **meet the 2030 climate and energy targets** and play an active role in EU transition to climate neutrality;
- Increase **energy security** in the beneficiary Member States by supporting increased interconnections and modernisation of energy networks;
- Enhance the financing of **renewable energy sources**;
- Help make the economies and the energy sectors of the beneficiary Member States greener and cleaner;
- Promote exchange of **best practices** among the beneficiary Member States.

At the end of October 2020, Croatian Ministry of the Economy and Sustainable Development, in cooperation with the Croatian Chamber of Commerce, conducted a survey on the readiness of projects for financing from the Modernization Fund. On that basis, Croatia submitted on 30 November 2020 an overview of investments for which an investment proposal will be submitted in the next two calendar years to the European Investment Bank and the Investment Committee. Selection criteria, in addition to fitting into priority axes and investing in projects with significant effects on the transition to a climate-neutral economy, were project readiness for implementation, projects encouraging investment in the development of modern energy networks, energy-intensive industries projects, obligated plant projects greenhouse gas emissions trading due to which they have increased production costs and are not able to incorporate them into the price of the final product, and preference is given to projects that are able to encourage new investments.⁸

Some of the next steps for Croatia in regards to the Modernisation fund are:⁹

- to publish the State Aid Program for priority investments and for non-priority investments in the industrial and energy sector;

⁸ <https://mingor.gov.hr/vijesti/prijava-projekata-za-sufinanciranje-iz-sredstava-modernizacijskog-fonda/7515>

⁹ <https://mingor.gov.hr/UserDocImages/slike/Vijesti/2021/Modernizacijski%20fond%20-%20Prezentacija.pdf>

- to deliver a non-binding investment review European Investment Bank and the Investment Committee (by November 30, 2021);
- to adopt the Regulation on financing mechanisms within the system greenhouse gas emissions trading.

Croatian share in the Modernisation fund is 3,14% for 2021-2030.

Environmental Protection and Energy Efficiency Fund

The Croatian Environmental Protection and Energy Efficiency Fund (Fund) is established for the purpose of securing additional resources for the financing of projects, programmes and similar activities in the field of conservation, sustainable use, protection and improvement of the environment. Under the provisions of the Energy Act, the Fund is established for participating with its resources in the financing of the national energy programmes, with a view to achieving energy efficiency and use of renewable energy sources. Under the provisions of the Act on the Environmental Protection and Energy Efficiency Fund, the Fund is established for the purpose of financing of the preparation, implementation and development of programmes and projects and similar activities in the field of conservation, sustainable use, protection and improvement of the environment, and in the field of energy efficiency and use of renewable energy sources.¹⁰

In the last few years, the Environmental Protection and Energy Efficiency Fund issued public calls for private households, local and regional self-government units, small and medium enterprises and non-governmental organization. The co-financing rate ranged from 40 to 80 percent, depending where the implementing project is located (for example, the percentage is higher for projects implemented on islands and hilly mountainous areas). Some of those public calls are listed below:

- Public call for co-financing the use of energy efficiency and renewable energy sources in industrial systems, craft manufactories and family farms;
- Public call for co-financing of projects for the implementation of the concept of "Smart Cities";
- Public call for direct co-financing of the promotion of integrated and intelligent transport at the local and regional level;
- Public call for co-financing the use of renewable energy sources (photovoltaic systems) in tourism to natural persons - citizens - registered renters and family farms;
- Public call for direct co-financing of the purchase of energy efficient vehicles on alternative fuels for urban transport (municipal regular transport);
- Public call for co-financing the use of renewable energy sources for the production of heat or heat and cooling energy in households, for own consumption;
- Public call for co-financing the use of renewable energy sources in public buildings;
- Public call for co-financing the use of renewable energy sources for electricity production in households for own consumption;
- Public call for co-financing the energy renovation of family houses.

¹⁰ <https://www.fzoeu.hr/en/about-us/10>

4.3.2. Refundable and combined instruments

The Croatian Bank for reconstruction and Development (HBOR) is Croatia's promotional and development bank. Special attention is paid to establishing and maintaining successful relations with international financial institutions, development banks, export credit agencies and commercial banks. Interlinking internationally with financial institutions globally HBOR are able to timely exchange best practices in the development finance and export finance as well as EU, OECD and other institutions influential to the functionality of the finance sector. At the core of product and services provided are numerous loan programs, export credit insurance products (ECA activities) and export guarantees. HBOR maintains a wide network of correspondent and current account relations and can offer customary instruments of foreign exchange transactions to its clients. Having this in mind, HBOR has a vast know how in both domestic development financing as well as Trade Finance products.¹¹

Some of the sector HBOR supports are:

Private Sector Investment

Aimed at private sector business entities - companies, crafts businesses, sole traders, family farms, cooperatives and institutions.

Purpose of loans are investments in fixed assets (tangible and intangible assets) for the purpose of business modernisation, introduction of new technologies, increase in capacities, investments in research and development and introduction of new products or services, promotion of environmental protection, energy efficiency and renewable energy resources projects, tourist capacities and facilities as well as promotion of new employment.

There are two types of implementations for this loan; the first is in cooperation with commercial banks (via commercial banks or through risk-sharing model); the second is direct lending to borrowers (except family farms that are not within the VAT system and associations).

Generally, the minimum loan amount is HRK 200,000.00. The maximum loan amount is not limited and depends on the specific features and creditworthiness of the borrower, purpose and structure of investment as well as available HBOR's sources of finance. Financing through loan can be up to 75% of the estimated investment value.

Interests rate range from 1,5% to 3%, with a repayment period up to 14 years, with up to 3-year grace period included, depending on the purpose and structure of investment.

EU Projects

This loan is aimed at private and public sector business entities (units of local or regional government and entities owned or majority-owned by them and/or owned or majority-owned by the Republic of Croatia) that meet the requirements of the tender for grants under which they submit their applications, including the terms and conditions relating to the planned investment:

- European Structural and Investment Funds (ESI Funds) or
- EU Agricultural and Fisheries Funds (funds of the Common Agricultural and Fisheries Policy, or the funds of the European Agricultural Fund for Rural Development and/or

¹¹ <https://www.hbor.hr/en/international-cooperation/>

the European Agricultural Guarantee Fund and/or the European Agricultural and Fisheries Fund).

In accordance with the tendering procedure for grants under which the borrower has submitted application including: eligible expenses – project expenses to be financed from the grant proceeds; ineligible expenses – exclusively expenses of the project for which application has been submitted under the tendering procedure that cannot be financed from the grant proceeds (fixed assets and working capital up to 30% of the contracted loan amount).

There are two types of implementations for this loan, like with the previously mentioned loan: in cooperation with commercial banks (via commercial banks or through risk-sharing model); direct lending to borrowers (except family farms that are not within the VAT system and associations).

The minimum loan amount is generally HRK 200,000.00, and the maximum loan amount depends on the specific features and creditworthiness of the borrower, purpose and structure of investment as well as available HBOR's sources of finance.

The following can be financed through this loan:

- Private sector entities: up to 75% of the estimated investment value, whereby HBOR can accept as the borrower's own funds up to 70% of the amount that the borrower will obtain through a grant (if the loan is approved via commercial bank, the commercial bank will determine the borrower's own funds);
- Public sector entities: up to 100% of the estimated investment value.

Interests rate range from 1,5% to 1,7%, with a repayment period up to 15 years, with up to 3-year grace period included, depending on the purpose and structure of investment.

4.3.3. Innovative instruments

ESCO stands for Energy Service Company and is a model of services in the energy market. The ESCO model represents energy solutions and is recognised worldwide as a name for a company that plans, implements and finances projects in the field of energy efficiency. The goal of each project is to reduce energy costs and maintenance by installing new more efficient equipment and optimizing energy systems, thus ensuring the return on investment through savings over a period of several years, which can amount to more than 50%, depending on user type and project.

During the repayment of the investment for energy efficiency, the user pays the same amount for energy costs as before the implementation of the project, which is divided into the actual (reduced) cost for energy and the cost for repayment of the investment. After the investment is repaid, the ESCO company leaves the project and hands everything over to the user. Each project is designed separately and it is possible to expand the project by including new energy efficiency measures with an appropriate division of investment. In this way, it is possible to modernize the equipment without investment risk, since the risk of savings can be taken by the ESCO company. In addition, after the investment is repaid, the project beneficiary realizes positive cash flows in the repayment period and long-term savings. During all phases of the project according to the ESCO model, the user cooperates with only one company on the principle of all in one place, and not with several different entities, which greatly reduces the cost of energy efficiency projects and the risk of investing in them. Also, the ESCO project includes all energy systems at a particular location, which allows for an optimal choice of measures with a favourable ratio of investment and savings.

4.3.4. Overview of refurbished public buildings with good practice examples

In the last few years, 18 public buildings in Medjmurje County were refurbished with European Union funds, through the Operational Program Competitiveness and Cohesion 2014-2020.

The following buildings were refurbished in Medjmurje County and are therefore more energy efficient:

1. Workshop of Construction and Technical schools Čakovec
2. Primary school Donji Kraljevec
3. Student dorm of Construction school Čakovec
4. Primary school Selnica
5. Economic and trade school Čakovec and school sport hall
6. Primary school Šenkovec
7. Primary school Podturen
8. Primary school Vratišinec
9. Primary school Macinec
10. Primary school Donja Dubrava and school sport hall
11. Primary school Hodošan and school sport hall
12. Primary school Goričan
13. Primary school Draškovec
14. Construction school Čakovec
15. Retirement home Čakovec

Below are some examples of energy renovation projects and use of renewable energy sources in Medjmurje County.

1. Energy renovation of the building and school sport hall of the Primary School Hodošan

The energy renovation project was funded through public call 4c1.4 for energy renovation and the use of renewable energy sources in public sector buildings.

Total value of the project amounted to HRK 5,073,734.41, while the amount of eligible costs of the energy renovation project amounted to HRK 4,982,940.66, which, in addition to energy renovation works, included the development of the main energy renovation project, expert construction supervision, energy certificate after renovation, advertising and visibility costs and project management services.

From EU funds (Operational Program Competitiveness and Cohesion 2014-2020, Priority Axis 4 Promotion of Energy Efficiency and Renewable Energy Sources) the applicant was awarded a grant in the amount of HRK 2,994,140.00, which represents 60.09% of the total eligible project costs.

The Ministry of Regional Development and EU funds was requested to provide additional funding for eligible project costs in the amount of HRK 1,193,280.40, which were co-financed 23.52% of the total value of the energy renovation project.

Total amount of co-financing by the project holder amounted to HRK 795,520.26, ie 15.96% of the total eligible project costs.

Works on energy renovation of the building include the following measures:

CONSTRUCTION MEASURES

In order to improve energy efficiency, the following works were performed on the reconstruction of the outer shell:

- Reconstruction of the outer walls of the exterior walls (thermal insulation of 14 cm of mineral wool);
- Reconstruction of the roof above the heated space - connecting corridor and sports hall (thermal insulation of 16 cm of mineral wool);
- Reconstruction of ceilings towards the unheated attic - school building (thermal insulation of 20 cm of mineral wool);
- Dismantling of the existing exterior carpentry and assembly (installation) of the new exterior carpentry.

HORIZONTAL MEASURES

With this project, an inclined lifting platform was constructed on the main internal staircase with parking sideways along the staircase wall on the ground floor (180 °).

MECHANICAL MEASURES

Instead of the existing gas hot water boilers, with power $2 \times 147 \text{ kW} = 294 \text{ kW}$, a new gas condensing boiler with a capacity of 100 kW and air/water heat pumps with a capacity of 38 kW were installed, with the heat pump primarily operating at outdoor temperatures higher than 8 °C, while the gas condensing boiler operates at outdoor temperatures below 8 °C.

Also, other equipment in the boiler rooms was replaced: installation of highly efficient circulation pumps, valves for hydraulic balancing of heating circuits, installation of an automatic control system guided by external conditions.

ELECTRICAL INSTALLATIONS AND LIGHTING

With this project, the complete general lighting on the building was replaced with new LED lamps.

A system of automatic data collection from metering devices for electricity, heat, gas and water consumption and automatic data transfer to the central ISGE system has been implemented.

The works from the main project reduce the annual required thermal energy for heating the building for actual climate data by 121,539.13 kWh/a, or 54.81%. The annual required thermal energy for heating the building was $Q_{\text{Hnd}} = 221,752.34 \text{ kWh/a}$, and after the performed works it is reduced to $Q_{\text{Hnd}} = 100,213.21 \text{ kWh/a}$.

According to the calculation of the annual required thermal energy after the implementation of energy renovation, the school building moves from energy class D to energy class B while the building of the sports school hall moves from energy class D to energy class C.



Figure 4.4 Primary School and school sport hall Hodošan after energy renovation

Source: <https://www.menea.hr/medimurska-zupanija-osnovnoj-skoli-hodosan-pruzila-bolje-uvjete-u-obrazovanju/>

Another example of use of renewable energy sources and increasing energy efficiency in Medjimurje County is shown next.

The administrative building in the complex of the former barracks in Čakovec (Medjimurje Energy Agency Ltd. is located) is an example of good energy efficient building practice.

The administrative building has:

- solar collectors for domestic hot water heating,
- a system for smart metering of energy consumption,
- replaced lighting fixtures with highly efficient LED lighting,
- equipped kitchens with highly efficient kitchen appliances (A +++).

On the digital panel there's a possibility of getting an insight into the complete functioning of the system. Graphical consumption of electricity, water and gas at the current, daily, monthly and annual levels is shown. Water measurement is performed by sending a pulse every 10 litres of water, while gas measurement is read for every 0.1 m³. By pressing the interactive points in the display itself, detailed information on the role of each component from the system is obtained.

The investment was 33.000,00 EUR, with 85% co-financed via EU funds and the rest of the 15% was financed in parts from Ministry of Regional Development and EU funds and own funds.

The Pilot investment was implemented through project RURES - promote the sustainable use of renewable resources and energy efficiency in rural regions.

The project RURES was funded through the transregional cooperation program Interreg Central Europe and its goal explore the potential of renewable energy sources and energy efficiency in rural regions since they have great potential to achieve energy autonomy.



Figure 4.5 Solar collectors for domestic hot water heating on the administrative building

Source: <https://www.redea.hr/upravna-zgrada-kompleksa-bivse-vojarne-u-cakovcu-postala-primjer-energetski-visoko-ucinkovite-zgrade/>

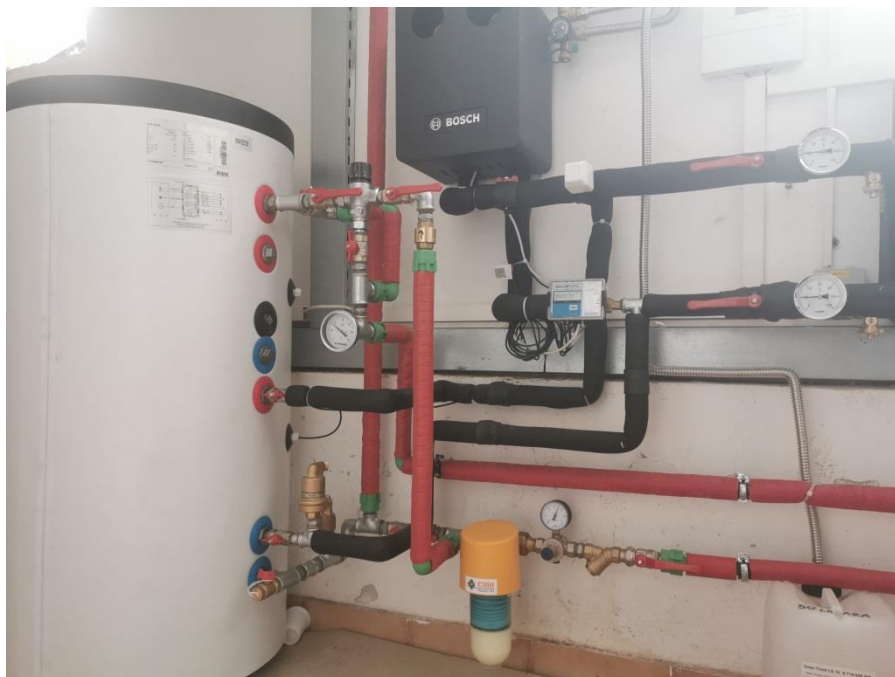


Figure 4.6 Hot water tank, calorimeter in the administrative building

Source: <https://www.redea.hr/upravna-zgrada-kompleksa-bivse-vojarne-u-cakovcu-postala-primjer-energetski-visoko-ucinkovite-zgrade/>



Figure 4.7 System for smart metering of energy consumption in the administrative building

Source: <https://www.redea.hr/postavljen-digitalno-vizualni-info-panel-o-energetskoj-potrosnji-dostupan-svim-gradanima/>

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