



# NATIONAL REPORT ON SOCIAL ACCEPTANCE AND IMPLEMENTATION RISKS OF THE CROATIA'S REVISED NATIONAL ENERGY AND CLIMATE PLAN



University of Zagreb  
Faculty of Mechanical  
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## **Authors:**

Tomislav Pukšec

Ana Kodba

Luka Simić

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# 1. SUMMARY OF THE NATIONAL REPORT

National report on social acceptance and implementation risks of the Croatia's revised national energy and climate plan assesses the revised Integrated National Energy and Climate Plan through an integrated analytical framework combining quality analysis, energy and climate security risk assessment and evaluation of social preferences and public acceptance. The objective of the report is evaluating whether the revised NECP provides a credible, socially acceptable, and resilient pathway toward achieving national and EU climate and energy objectives.

## Energy and climate security risks

Croatia's overall energy and climate security has remained relatively stable over the past decade, with a slight downward trend in risk levels. However, this gradual improvement has been interrupted by energy crisis in early 2020s, most noticeable through affordability dimension.

- ❖ Geopolitical risk has shown a declining trend primarily due to reduced reliance on petroleum imports and the diversification of natural gas supply routes where LNG terminal played a major role. These measures have strengthened short-term supply security and positioned Croatia as a regional gas hub. However, long-term geopolitical exposure remains, since Croatia continues to rely on imported fossil fuels, leaving the potential system risk to global price volatility and external market disruptions.
- ❖ Affordability risk is the most volatile and politically sensitive dimension, with a sharp increase during the recent energy crisis. High energy import combined with rising CO<sub>2</sub> costs significantly increased pressure on households and businesses. Prompt Government actions successfully mitigated short-term affordability impacts, keeping household energy prices among the lowest in the EU during the crisis. However, these measures did not address structural vulnerabilities. Low energy efficiency of the residential building stock and dependence on fossil fuels in heating and transport sectors remain key drivers for long-term affordability risks.
- ❖ Reliability risk has substantially decreased, reflecting increased electricity capacity diversity, higher shares of RES, and improved grid infrastructure. However, growing shares of variable renewables increase the importance of system flexibility and need for energy storages, which, if not addressed properly creates new reliability challenges.
- ❖ Sustainability risk has shown a constant downward trend, driven mainly by increased renewable electricity generation and reduced energy and emission intensity. However, progress is slower in transport and heating sectors. Persistent fossil fuel dependence in these sectors suggest to long-term risks in emissions reduction, affordability, and alignment with EU climate targets.

## Social acceptance and public preferences

Public acknowledgement of energy transition and climate changes in Croatia is generally high, with strong support in renewable energy deployment. The survey results shows that most citizens in Croatia feel responsible to some amount and are prepared to act towards lowering climate changes.

- ❖ Social acceptance is primarily shaped by affordability concerns. Household energy bills represent the main reference for evaluating energy and climate policies. Rising electricity and heating costs are perceived as the most immediate and tangible impacts of the transition.
- ❖ DCE results indicate clear preferences for progressive and broadly shared cost distribution, where costs and benefits are spread across society rather than concentrated on narrowly defined groups. Policies framed as collective national projects receive significantly higher support than narrowly targeted measures.
- ❖ Citizens are willing to accept higher costs if policies result with visible benefits, such as increased efficiency of households, cleaner air and reduced energy import dependence. This suggests that social acceptance depends on fairness, transparency, and credible implementation.
- ❖ Institutional trust remains a key constraint, with low confidence in national and local institutions that their activities are beneficial in reducing climate change impacts.

## Strengths and shortcomings of Croatia's revised NECP

The revised NECP is evidently aligned with EU climate and energy objectives in its strategic orientation, particularly in renewable electricity expansion and short-term energy security. Renewable electricity targets are ambitious, building on strong hydropower and rapid growth of wind and solar capacities. Energy security measures are well developed in the gas sector, especially focusing on LNG terminal, with clearly defined infrastructure investments and regional integration objectives.

The revised NECP's implementation pathways lack detail and clarity, with many measures missing clear timelines, financing structures, and responsibilities. Analytical transparency is limited, particularly with modelling assumptions and infrastructure planning. Sectoral imbalance persists, with slow decarbonisation in transport, heating, and building compared to power sector. Building renovation targets lack operational clarity and falls behind set EU objectives.

## Key policy recommendations

Based on the integrated assessment the national report identifies a set of policy recommendations aimed at strengthening the credibility and effectiveness of Croatia's energy policies, which focus on improving implementation capacity and aligning policy ambition with social and economic realities. The summarised recommendations are:

1. Strengthen governance and implementation capacity by increasing transparency and consultation with related stakeholders, particularly involving local and regional authorities.
2. Improve analytical modelling and transparency of scenarios by clearly referencing modelling assumptions and methodologies. Establish clear connection between targets, measures, and projected outcomes.
3. Include social preferences into core NECP measures, ensuring that affordability and fairness impacts are addressed at the design stage, ensuring long-term social acceptance.
4. Shift from natural gas supply routes diversification to energy source diversification, particularly by integrating renewable energy sources across all sectors, specially heating and transport to structurally reduce energy import dependence. Integrate system flexibility technologies and energy storages in order to ensure system stability and resilience.
5. Raise ambition in energy efficiency and building renovation, particularly for energy-poor households, to permanently reduce energy demand and exposure to price volatility,
6. Accelerate decarbonisation in transport and heating, through clearer timelines, stronger regulatory instruments, and targeted financial support, addressing sectors that currently lag behind NECP objectives.

## 2. INTRODUCTION

The European Union climate policy framework has evolved rapidly in recent years, with the European Green Deal, the “Fit for 55” package, and REPowerEU initiative. The expectations regarding emissions reductions, renewable energy deployment, energy efficiency, and reductions in fossil fuel dependence has been a primary focus of the legislative framework. At the same time, the energy crisis following Russian invasion of Ukraine had a drastic impact on perceptions of energy security and affordability, highlighting geopolitical vulnerability across Europe. These developments have reshaped the policy environment in which national governments design and implement energy and climate strategies. National Energy and Climate Plans constitute the central strategic instruments through which EU Member States define their pathways toward climate neutrality and sustainable economic development. NECPs role is to be an integrated policy framework through which countries align their national objectives with EU wide climate and energy targets, based on realistic, coherent, and implementable pathways for achieving them. Therefore, the quality of NECP design and the feasibility of implementation are as important as the level of ambition reflected in set targets.

For Croatia, the revision of the Integrated National Energy and Climate Plan for the period 2021–2030 takes place under demanding structural conditions. Lower household incomes, an energy inefficient building stock, and continued fossil fuel dependence in transport and heating impact the feasibility and social implications of the energy transition. Energy affordability plays a central role in public perception, with policies assessed through their impact on household budgets and fairness. In this context, the revised NECP represents a key document to translate long-term climate objectives to a credible and socially acceptable policy framework.

National report on social acceptance and implementation risks of the Croatia’s revised national energy and climate plan examines the revised Croatian NECP and evaluate its targets and measures through an integrated approach. The report consists of three complementary perspectives. In the first part, the internal coherence, transparency and governance of the revised NECP have been analysed. The focus was on quality of data, modelling, stakeholder engagement, and the construction of policy measures. In the second part, Croatia’s exposure to energy and climate security risks has been evaluated using an Energy and Climate Security Risk Index method, identifying key vulnerabilities related to geopolitical dependence, affordability, reliability, and sustainability. In the third part, based on results of conducted survey and a discrete choice experiment, social preferences and public acceptance of energy transition policies have been assessed, with main goal to understand how households perceive costs, benefits, and policy design choices. By integrating these perspectives, the report assesses whether the revised NECP adequately addresses Croatia’s structural challenges and whether it provides a credible basis for long-term implementation.

### 3. QUALITY OF THE CROATIAN REVISED NATIONAL ENERGY AND CLIMATE PLAN

National Energy and Climate Plans (NECPs) are the main strategic instruments through which EU Member States plan and report their energy and climate policies. Following the revision process and completion of Croatia’s revised Integrated National Energy and Climate Plan for the period 2021–2030, which was submitted to European Commission on 27 of March 2025, this chapter evaluates the revised NECP against key quality criteria using a specially designed methodology within the EUKI project with purpose to identify deficiencies in national policies and strategies, thus providing the basis for strengthening the NECP. The revised NECP provides an overview of national energy and climate change targets and total of 104 policies and measures across five EU dimensions for successful achievement of set objectives. *Table 1* presents the most important measurable targets for each of five dimensions, compared to set EU values for the Republic of Croatia.

*Table 1 Comparative table of national targets and corresponding EU targets for the 5 NECP dimensions*

Dimension	EU target / objective	National target / objective
<b>Decarbonisation</b>	/	-62 % GHG emissions in ETS sector
	-16.7% GHG reduction in non-ETS sector	-16.7% GHG emissions in non-ETS sector
	-593 kt CO <sub>2</sub> eq. GHG removal in LULUCF sector	Not clearly defined. Not reaching its target based on projections.
	44 % share of renewable energy in gross final consumption	42.5 % share of renewable energy in gross final consumption
<b>Energy efficiency</b>	5,9 Mtoe of final energy consumption	5.88 Mtoe of final energy consumption
	6,8 Mtoe of primary energy consumption	8.05 Mtoe of primary energy consumption
<b>Energy security</b>	/	7824 MW of electricity production capacity (of which 2268 MW wind power and 2382 MW solar power)
<b>Internal energy market</b>	15 % interconnectivity	Already exceeding set target
<b>research, innovation and competitiveness</b>	/	3 % of GDP investments in science and technology

The assessment of the revised NECP was based on both comprehensive desk research and expert-based consultation to evaluate the quality and alignment with European Commission requirements of the document. Desk research was used to analyse the content of the revised NECP, transparency and inclusiveness of revision process and its consistency with EU governance criteria. The expert-based consultation provided assessments, allowing for a more detailed examination of assumptions, measures, and implementation aspects.

### **3.1. Data, Modelling, and Science**

To ensure the reliability of data, in the development of the Revised National Energy and Climate Plan for the period 2021-2030 the latest available data were used. Most of the data is taken from the official EU databases, for which references are clearly provided throughout the document. This reliance on EU data sources contributes to transparency and reliability of the NECP. It is important to note that no information from scientific papers or other scientific sources was incorporated during the revision process. The absence of references to scientific studies or academic modelling exercises limits the depth of defined measures and scenarios. The lack of scientific engagement indicates that the revised NECP relies on baseline assessments and did not foresee innovative approaches to energy management and modelling.

The revised NECP largely builds on existing national strategies and plans relevant to energy and climate protection. However, many of these strategies are outdated when compared to the ambitions and assumptions of the revised NECP. This creates a lack of coherence between NECP and other strategies, presenting a challenge that needs to be dealt with. The alignment of all national planning documents is crucial to ensure effective policy implementation and avoid conflicting objectives. Although revisions of other relevant strategies are mentioned as planned, no concrete timeline or procedural clarity is provided, which raises concerns about how and when coherence across the policy framework will be achieved. Additionally, the research has revealed that there is a formal connection between the revised NECP and local and regional energy action plans, but the alignment of measures and targets remains limited. Local and regional authorities have a significant role in implementing many NECP measures and misalignment between national projections and local plans can reduce policy effectiveness and complicate monitoring and reporting.

From a modelling perspective, the revised NECP presents two different scenarios: first with existing measures (WEM) and second with additional measures (WAM). These scenarios allow comparison between current policy trajectories and more ambitious perspectives. They include a variety of projections, which some are developed based on reliable sources, while others are calculated. Detailed information about the methods and modelling framework for these calculations is missing. This absence of transparency in the methodology can pose a challenge in interpreting results, as well as understanding

the reliability and sensitivity of defined outcomes. Regarding the implementation, a significant number of measures outlined in the revised NECP lack concrete elaboration of their financing structures, and in some cases do not include estimated budget requirements at all. Where budget estimates are provided, information on the calculation methods is generally missing.

### **3.2. Stakeholder Engagement**

The Croatian authorities undertook stakeholder engagement activities during the preparation of the Revised National Energy and Climate Plan. A cooperation between ministry and regional agency was carried out due to one of LIFE projects funded by the EU. Until the adoption of the revised NECP, the project resulted with 3 multi-level dialogue workshops followed by 7 sectoral workshops, each dedicated to different sectors affected by NECP. The workshops' results are published and publicly available. From a procedural perspective, this framework suggested an intention to ensure inclusiveness and transparency. It has allowed participation of a diverse group of actors, including public institutions, energy companies, civil society organisations, academia, and individual citizens. However, a closer examination reveals important limitations in how inclusiveness and transparency was realised and how conflicts among stakeholders were managed.

The draft of revised NECP was published on the Ministry website by the end of first half of 2023 and delivered to European Commission on time. The document was followed by a formal channel throughout which interested stakeholders could provide their feedback which aligns with minimum transparency standards. The process itself was not publicly nor clearly communicated with the broad public, where clarity was missing on how decisions were made and how different measures were defined into final document. Due to technical complexity, limited access of data and short consultation timelines, smaller civil society organisations, local communities, and citizens affected by specific infrastructure projects often made it difficult for stakeholders to understand whether the process adequately reflected the diversity of social, environmental, and regional interests affected by the NECP.

The research has shown that local and regional self-government units and other local authorities were not involved in the revision process and generally had very limited knowledge of the NECP document itself. Additionally, employees of private companies in the energy sector are generally unfamiliar with NECP or does not give much on its importance. Those stakeholders who were invested in the revision process revealed conflicts in terms of economic, environmental, and social priorities. Tensions were raised around issues such as the pace of renewable energy deployment, the role of natural gas as a transitional fuel, land-use conflicts and the distributional impacts of energy transition policies. While these conflicts could be expected and even constructive element of participatory policymaking, the revision process provided limited evidence of

structured conflict resolution. Conflicting perspectives were often expressed in parallel through public consultation, that was open by the end of 2024 with a month frame, missing the opportunity for a constructive discussion and negotiation. In addition, the official report on public consultation, including acceptances or rejections of proposals, was not publicly published. The final version of revised NECP was submitted to the EC by the end of first quarter of 2025.

### **3.3. Targets and Measures across the Five NECP Dimensions**

#### **Decarbonisation**

The Republic of Croatia shares the same view as Europe towards decarbonisation, and in accordance with “Fit for 55” initiative, it has defined several national targets and appropriate measures in the revised National Energy and Climate Plan. By implementing proposed measures, the revised NECP estimates greenhouse gas emissions reduction up to 40.3% by 2030, compared to 1990 levels. Under the *Effort Sharing Regulation (ESR)*, determined national target for reducing greenhouse gas emissions for the Republic of Croatia is -16,7 % for non-ETS sector. The revised NECP estimates the same amount. In the ETS sector greenhouse gas emissions reduction would be between 40.7% and 60% compared to 2005 levels, depending on the amount of successfully implemented measures. The net removal target for Croatia in 2023 amounts to -5.527 ktCO<sub>2</sub> equivalent based on the revised NECP.

Regarding carbon capture and storage, the revised NECP brings measures through which will be assessed the geological CO<sub>2</sub> storage capacity. The CCS technology is seen as a solution to certain industrial branches, in which reduction of GHG emissions remains challenging. By end of 2026, a pilot project should be implemented to enable development and commercialisation of CO<sub>2</sub> capture and storage. In 2028 a second large-scale industrial project has been planned that will include capture, liquefaction and permanent storage of CO<sub>2</sub> in Mediterranean.

The revised LULUCF Regulation sets an Overall EU-wide target of 310 million tonnes of equivalent CO<sub>2</sub> net removals in the LULUCF sector in 2030. The revised NECP acknowledges that under the scenario with existing measures (WEM) Croatia cannot achieve the LULUCF Regulation objectives for 2026–2030 and that defining additional measures requires further analysis. The WEM scenario shows that LULUCF removals in 2030 are at around -4,247 kt CO<sub>2</sub>eq implying that the WEM pathway is not ambitious enough to fulfil national target. However, the revised NECP introduces a measure whose purpose is to build the scenario with additional measures (WAM) capable of meeting the -5.527 ktCO<sub>2</sub>eq target by 2030. The WAM scenario will highly depend on upcoming Forest Management Plan 2026 - 2035.

The Republic of Croatia sets a contribution of 42.5% share of renewable energy in gross final energy consumption by 2030. This target aligns with European Commission’s target for whole EU, but according to the formula set out in Annex II of the *Regulation (EU) 2018/1999 on the Governance Regulation of the Energy Union and Climate Action* target for the Republic of Croatia should amount to 44% share of renewable energy in the final energy consumption. Croatia has seen substantial advancements towards renewable energy, mainly driven by EU directives and national policies aimed at reducing fossil fuel dependency and enhancing sustainability. In the last ten years, Croatian RES share in final energy consumption has been constantly above EU average, around 30%, which can be seen on Figure 1.

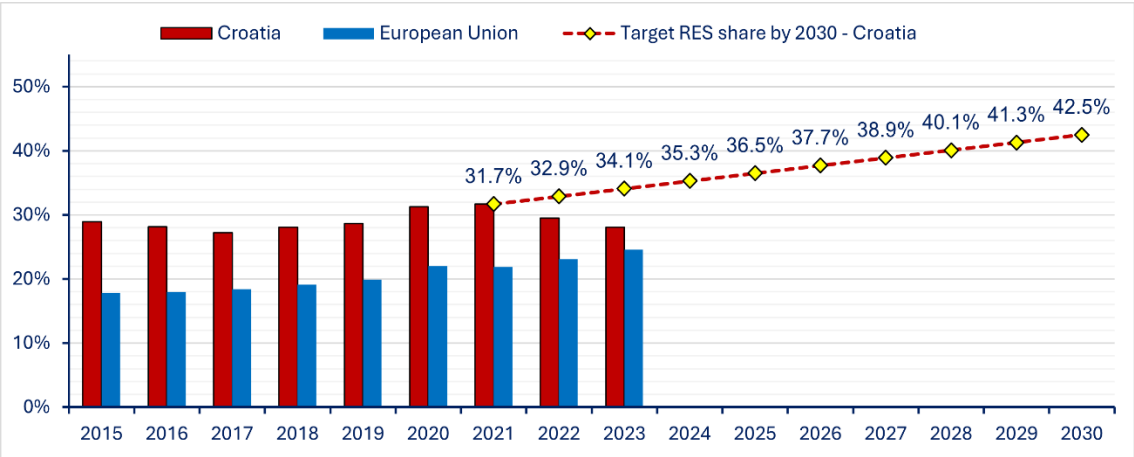


Figure 1 Comparison of Croatian RES share in final energy consumption to EU average with indicative trajectory to 2030 target

In 2021 the highest share of 31.7% could be noticed, on which a promising trajectory was assumed to achieve NECP target of 42.5% by 2030. However, in 2023 a total share of RES in final energy consumption was 28%, which shows a slight deviation of initial plan.

Looking at the energy sectors individually, the highest growth is expected in renewable electricity generation, with target of 76.7% by 2030. Figure 1 illustrates the realised growing trend of RES share in final energy consumption in electricity sector, followed by indicative trajectory of future values based on NECP scenario with additional measures (WAM). This reflects Croatia’s continued reliance on hydropower, followed by accelerated investments in deployment of wind and solar energy.

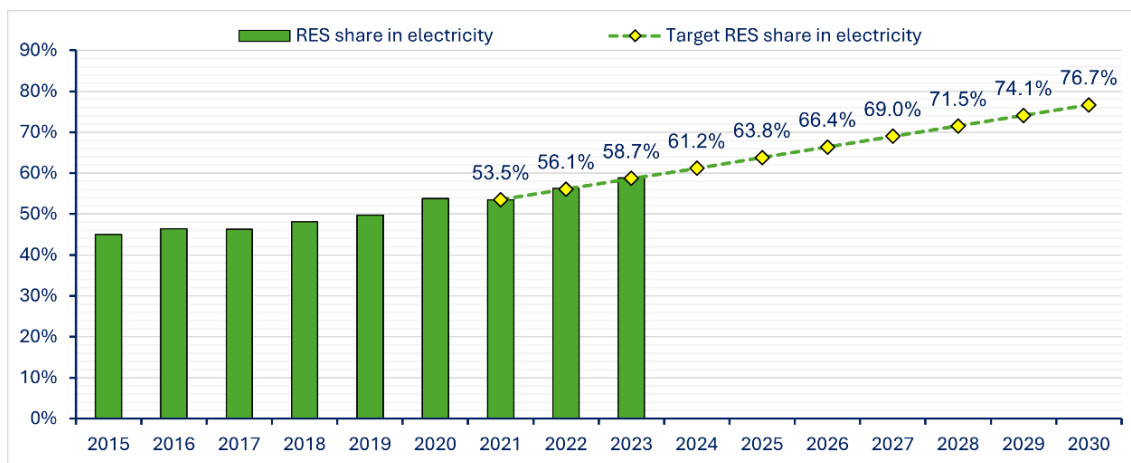


Figure 2 RES share in the final consumption of electricity with NECP indicative trajectory until 2030

For heating and cooling sector, the set target for RES share in final energy consumption amounts to 47.1% by 2030. The target set under the Renewable Energy Directive states that all member states should increase the share of RES for heating and cooling by 1,3 % per year, or 1,1 % per year if waste heat is not used. In accordance with current situation in the Republic of Croatia, and defined targets, the Republic of Croatia will not meet Directive’s requirements. The projected RES trajectory shown on Figure 2 indicates a constant growth, driven primarily by integration of heat pumps and the gradual decarbonisation of district heating systems.

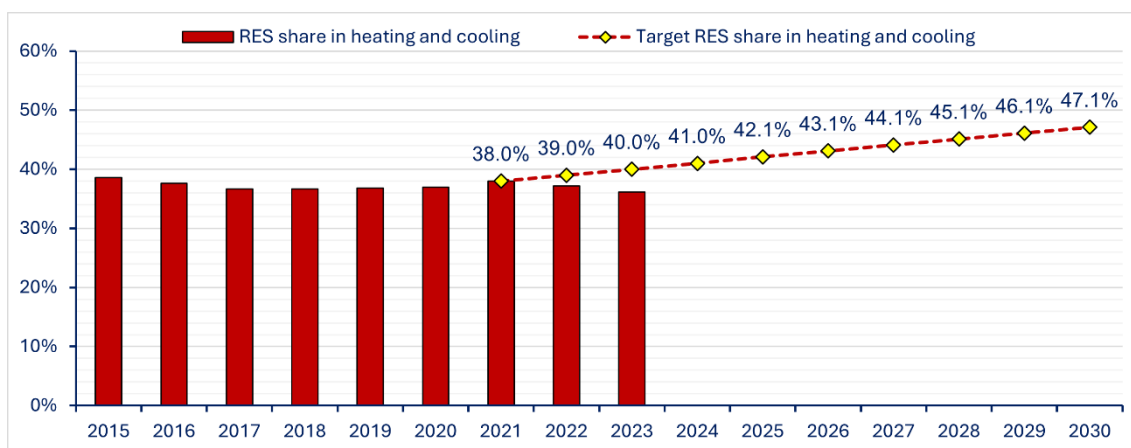


Figure 3 RES share in the final consumption for heating and cooling with NECP indicative trajectory until 2030

Regarding district heating systems, Croatian systems can be considered effective now, according to terms presented in Energy Efficiency Directive. The use of RES in district heating systems has been identified as a key measure. However, the projected increase of RES in district heating systems indicates that the share will drastically rise from 0.1% to 20.9% in the following 5 years, raising concerns that this plan might be too ambitious and unrealistic, especially with existing investment and regulatory barriers.

To achieve set goal of 24.6% RES in final energy consumption in transport sector Croatia plans to introduce new regulatory instruments, such as standards and taxes which will promote vehicles with lower emissions. Additionally, Croatia plans to invest significant amount into developing infrastructure for alternative fuels in road transport. Subsidizing of alternative fuel vehicles is also planned. With this, the revised NECP predicts that share of electric and plug-in hybrid vehicles in vehicle sales reaches 10% in 2030. Detailed information is missing, but it will be presented through *Program for encouraging the construction of infrastructure for alternative fuels in the Republic of Croatia*. Besides road transport, Croatian revised NECP brings measures for railway, naval and air transport, but these measures lack clear implementation path. The indicative trajectory of RES share in transport final energy consumption is show on Figure 3.

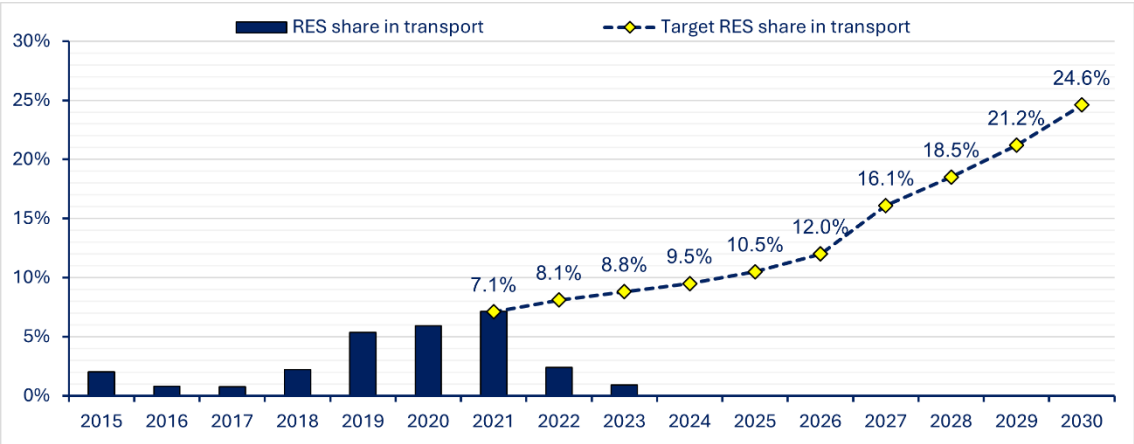


Figure 4 RES share in the final consumption of transport with NECP indicative trajectory until 2030

Transport remains the most challenging sector for RES integration, with progress heavily dependent on regulatory measures and financial incentives which can be observed from realised RES shares in previous period.

The NECP outlines a set of measures to directly support RES integration, including regulatory reforms and spatial planning activities. Overall, indicative RES share trajectories presented in the revised NECP shows a clear shift towards decarbonisation of Croatian energy system. However, the linkage between individual measures and the projected RES trajectories is not clearly defined. Although, the positive trend in RES increase in electricity generation is clear, a slower and decreasing path in heating and cooling, as well as transport sector, raises questions about feasibility of achieving the overall RES target of 42.5% without stronger intersectoral integration and clearer implementation strategies.

## Energy efficiency

In the energy efficiency dimension the revised NECP sets targets of 5.88 Mtoe of final energy consumption and 8.05 Mtoe of primary energy consumption by year 2030. Compared to first version of NECP in 2020 and draft version of revised NECP from 2023, these targets are more ambitious, but still not ambitious enough to achieve indicated targets from EU legislation. According to the formula set out in Annex I of the Directive (EU) 2023/1791 on energy efficiency and amending Regulation (EU) 2023/955, to achieve Union's energy efficiency goal of -11,7 %, Croatia must achieve 5,9 Mtoe of final energy consumption and 6,8 Mtoe of primary energy consumption by year 2030. According to NECP's developed scenario, the increase of energy efficiency will be achieved in all segments of the energy chain, from production, distribution to final consumption. The electricity will be used wherever possible and economically feasible.

Croatia has set a Long-term strategy for renovation of national building stock until 2050. According to this strategy, Croatia plans from 2021 to 2030 renovate buildings with an average annual renovation rate of 2%, rising to 3,5 % until 2040, and to 4 % by 2050. These long-term targets are mentioned in revised NECP, but they are lacking detailed explanation and information on their implementation monitoring. Croatian National Energy Efficiency Portal is lacking credibility since there is no clear information on a pathway for achieving set targets. The envisaged renovation measures cover all building categories, including single - family houses, multi-apartment and public sector buildings. Quantitative values delivered within said measures are estimated and lacking detailed information about the implementation process on how to achieve them. All renovations measures are directly connected to individual energy renovation programmes that are developed separately from NECP. These measures strive to achieve near zero energy building standard, but they are missing information about low carbon technologies which are planned for implementation.

Besides building measures, the energy efficiency for other sectors remains uneven. Regarding transport sector, which is significant contributor to final energy consumption, NECP brings measures related to vehicle efficiency but without quantified targets. In heating and cooling sector, one measure addresses the efficiency of district heating systems in general matter, with low ambition and limited pathway.

Improvements in power transmission systems and distribution grids has also been highlighted as important segment for increasing energy efficiency and enabling large scale RES integration in Croatia. Building on already implemented measures, the revised NECP includes measures aimed at further reduction of technical losses, by modernisation and digitalisation, as well as integration of smart grids and advanced system management. As a result, the contribution of transmission and distribution efficiency improvements is estimated at 24.4 ktoe energy savings, leading to 32.6 ktCO<sub>2</sub>eq in analysed period.

## Energy security

Croatian energy security landscape has been drastically changing over the past decade, influenced by combination of geopolitical crisis, European legislative frameworks, and national strategic initiatives. Although, Croatia has been successfully exploiting its renewable potential its energy system has been historically characterized by heavy reliance on fossil fuels, imported from other countries which can be seen on Figure 5.

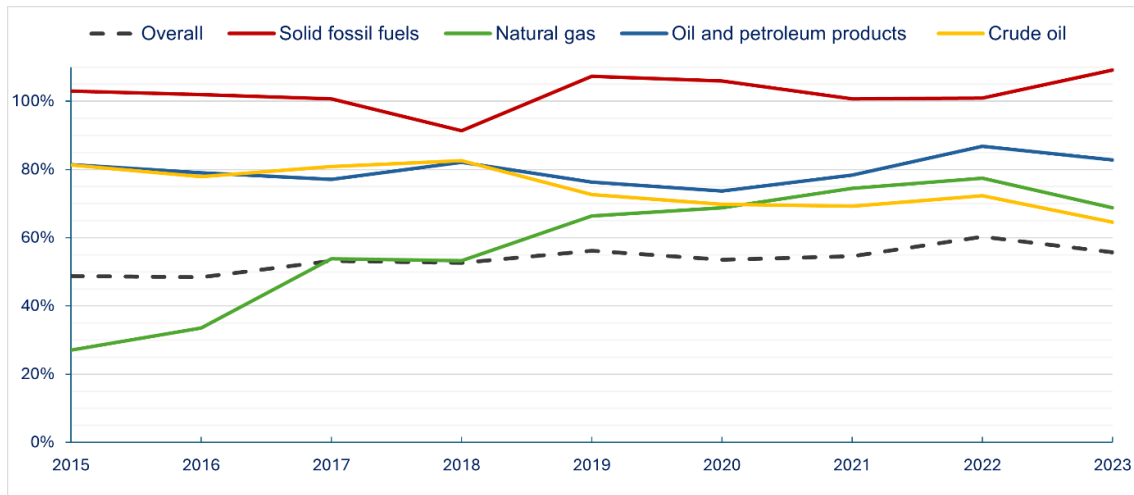


Figure 5. Croatia energy import dependency from 2015 to 2023

Overall Croatian import dependency has been varying from 50% to 60% without noticeable reduction. In 2023 Croatia imported 68.75% of its natural gas, 64.61% of its crude oil, 82.83% of oil and petroleum products and over 100% of its solid fossil fuels. Compared to European Union, overall energy imports of Croatia were slightly lower than EU average which is illustrated on Figure 6.

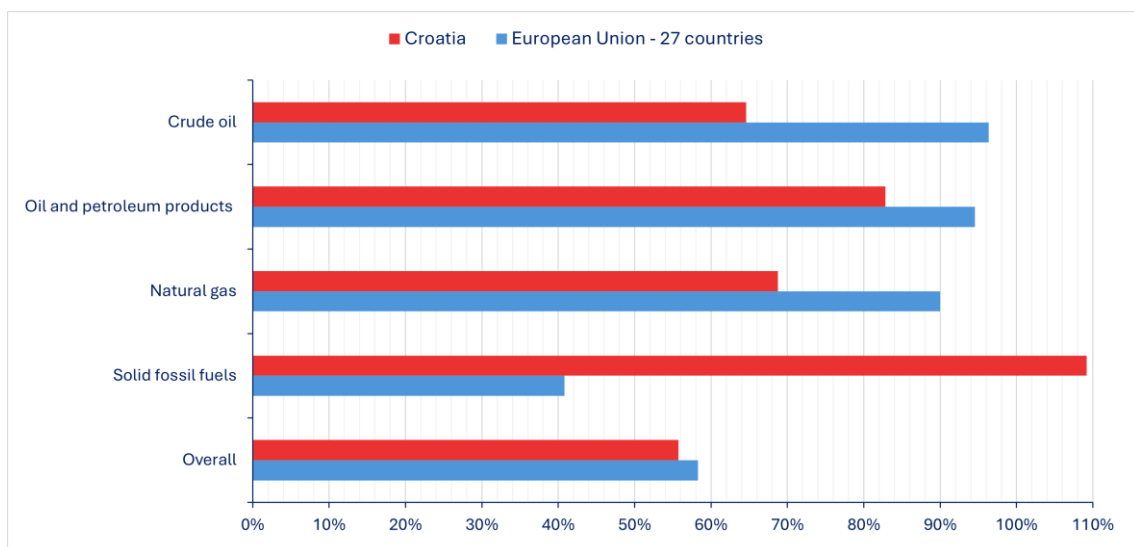


Figure 6 Comparison of Croatian energy imports to EU average in 2023

To achieve safe and quality supply of all energy sources, Croatia has set comprehensive targets for energy security dimension. The revised NECP sets focus on reducing import dependence risk, combined with system flexibility measures. However, the measures remain uneven, without detailed implementation pathways.

To improve Croatian energy system resilience, the NECP sets target of increasing the share of own production in final consumption of oil and natural gas from 23% in 2022 to 30% in 2030. Furthermore, for LNG and gas infrastructure the revised NECP brings detailed measures and substantial investments. In the late 2025, the terminal capacity was successfully expanded to 6.1 billion cubic meters from initial 2.6 billion m<sup>3</sup>/year. Previously in the same year the construction of the transport gas pipeline Zlobin - Bosiljevo was also finished. The two projects were estimated in revised NECP to have a combined investment of 180 million euros. To increase export capacity, further pipeline constructions towards neighbouring countries, Slovenia and Hungary, are envisaged in the next period. It is also planned to build Southern gas interconnections with Bosnia and Herzegovina and Rest of the Ionian-Adriatic gas pipeline. Total investments are estimated at 730 million euros. All pipelines will be able to transport hydrogen when production sources and market conditions for hydrogen consumption are developed. Furthermore, exploring new reserves and thus increasing hydrocarbon production from domestic sources is also one of the goals of increasing domestic oil and gas supply. The revised NECP states that new pipelines will be able to transport hydrogen when production sources and market conditions will be developed. However, there is no credible demand and supply outlook for hydrogen to justify “hydrogen ready” infrastructure choices.

With stable rise of variable RES shares in energy mix, Croatia plans activities to increase the flexibility of the system. Planned measure will modernise, digitalize, and expand the electricity system. It will develop advanced network system and bring high level of automation of management systems. One of targets is also to improve electricity storage infrastructure by construction of battery tanks with total power of 250 MW. However, the document does not clearly explain how storage and flexibility needs were defined.

Republic of Croatia is co-owner of nuclear power plant Krško with the Republic of Slovenia. Each country receives 50 % of produced electricity. The revised NECP states that the operating life of the plant has been extended to 2043, with ongoing negotiation of extending it beyond 2043. It is also mentioned that Croatia will consider nuclear alternatives including small modular reactors. Further information on nuclear deployment pathway in Croatian energy mix is missing.

Overall, measures in the energy security dimension connect the RES transition to operational needs and provides quantified storage targets. Regarding gas infrastructure investments are justified with limited transparency on long-term demand trajectories and with “hydrogen-ready” claims that are not backed by a robust hydrogen market assessment.

## Internal Market integration

Transmission system of the Republic of Croatia already exceeds the EU targets for a desired level of interconnection of at least 15% by 2030 and therefore further increases in cross-border capacity by 2030 are not foreseen in revised NECP.

In the gas sector, the NECP places strong emphasis on continued development and modernisation of gas infrastructure. Defined measures include the expansion of gas storage capacity by construction of an underground gas storage facility of 60 million cubic metres at the hydrocarbon exploitation field. Further development of the gas transmission system is planned in line with the ten-year network development plan. The NECP also states that the gas transmission system will be developed to enable the future transport of up to 100% hydrogen. However, this target is only briefly described and lacks analytical background. The revised NECP does not assess in detail future hydrogen production, especially from renewables, and demand, integrated with cost competitiveness and infrastructure adaptation needs. As a result, there is lack of clarity on how gas infrastructure investments align with long-term decarbonisation and hydrogen market.

Regarding electricity market functioning, the revised NECP expects to continue with market connectivity activities. Besides continued regional market coupling, proposed measures include the implementation of 15-minute products on the intraday and day-ahead markets. The revision of the regulatory framework is also foreseen, aiming to enable the active participation of grid users on electricity market.

The mitigation of energy poverty remains a significant weakness of the revised NECP. The revised NECP acknowledges that Croatia still lacks an official definition of energy poverty, which prevents systematic monitoring of energy poor households. However, after the submission of the revised NECP, an energy poverty definition has been defined in national energy efficiency law. The revised NECP refers to the Program to Combat Energy Poverty which would enable to assess and define energy poor households, set objectives and develop monitoring method of the success of program implementation.

## Research, Innovation & Competitiveness

Looking at the research, innovation and competitiveness dimension, it is evident that this dimension is the least processed compared to the rest. Croatia sets the overall target to achieve EU average of investment 3 % of GDP in science and technology by 2030.

The package of measures covers four thematic priority areas linked to low carbon economy and low carbon technologies, that are part of Smart Specialization Strategy. Unfortunately, these measures remain conceptual and uneven from implementation perspective. Most of the proposed measures are organizational nature just with intentions rather than operational activities. Additionally, the measures are lacking defined funding needs, raising concern about their proper implementation.

The proposed measure for setting up a KPI monitoring system has a relatively late implementation period, leading to time limitations for the setting up the system. Furthermore, the monitoring system is designed to track new R&I projects but focusing more on quantity of initiatives and activities rather than impact and outcomes of realising projects.

Strengthening this dimension would require clearer prioritisation on what technologies and value chains should Croatia commit their investments and further elaboration on KPIs monitoring system that track outcomes and their impacts on emissions, energy system and industrial uptake.

### **3.4. Just Transition**

The concept of a just transition is increasingly recognised at EU level as an integral component of energy and climate policy framework, aiming to ensure that the costs and benefits of the transition are distributed fairly across society and regions. In the revised NECP, Croatia formally acknowledges the social dimension of the energy transition and refers to just transition principles in the context of social inclusion, resolving energy poverty, and creation of new workforce. However, the elaboration of just transition is insufficiently developed.

From a socio-economic perspective, the NECP points out that the energy transition will have different impacts across sectors and population groups, such as intensive industries, transport sector, and households with low incomes. The references to social instruments such as the Social Climate Plan and the use of EU funding mechanisms to mitigate negative impacts are included in the document. However, the revised NECP does not provide a systematic assessment of employment impacts, such as labour market changes, including both new green job and job losses linked to the decline of fossil fuel-based activities. Following that, the revised NECP does not sufficiently differentiate between regions with specific socio-economic and energy profiles. Croatia has significant regional disparities, where most impactful are between coastal and continental regions. The coastal part of Croatia has shown a much better perspective for RES technologies deployment, especially wind and solar. On the other hand, the continental part has been energy more intensive annually. This mismatch would potentially lead to transition risks due to dependence on different economic activities and available regional labour capacity. In the revised NECP the role of regional and local authorities has been pointed out, coupled with the establishment of regional energy and climate agencies. However, it does not clearly identify priority regions for just transition support or define measures to region-specific challenges. The results of this is that the spatial dimension of just transition is weakly integrated into the revised NECP.

The treatment of affected groups is similarly limited. Vulnerable households, including those at risk of energy poverty, are acknowledged, but measures addressing energy

poverty are shifted to other national strategic plans, such as the Programme to Combat Energy Poverty. Moreover, other potentially affected groups are not systematically analysed. The NECP does not clearly explain how these groups will be supported during the transition or how social impacts will be monitored over time. The revised NECP includes measures for building renovation and clean mobility that indirectly contribute to a just transition, there is limited integration between decarbonisation objectives and social policy instruments and no clear KPIs are provided to track impacts or social outcomes. This weakens reliability and reduces the ability to adjust policies and measures if negative social effects emerge during implementation.

Overall, the revised NECP shows awareness of just transition principles but lacks concrete plan to put them in operation in qualitative and measurable manner. The lack of a comprehensive socio-economic impact assessment, insufficient regional differentiation and limited focus on affected groups reduce the effectiveness of the Plan in ensuring a fair and inclusive energy transition.

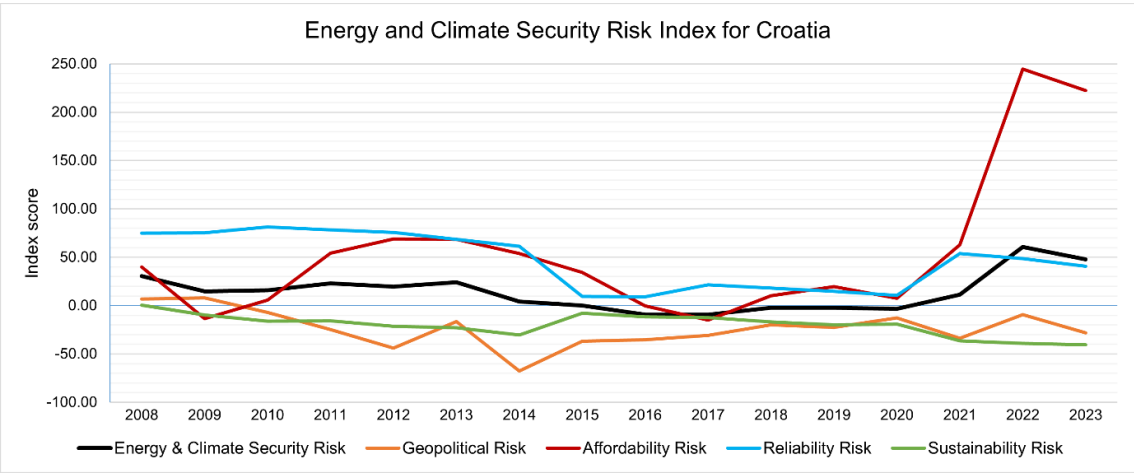
### 4. ENERGY AND CLIMATE SECURITY RISKS

Energy and Climate Security Risk Index (ECSRI), developed by Center for the Study of Democracy (CSD), is data-driven method to objectively analyse national energy and climate security. The index calculation is based on 4 different dimensions with total 20 indicators, illustrating the vulnerabilities in energy security and climate sustainability for selected country. The summary of ECSRI is shown in Table 2 below.

*Table 2 Energy and Climate Security Risk Index dimensions and indicators*

Energy and Climate Security Index			
Geopolitical Risk	Affordability Risk	Reliability Risk	Sustainability Risk
Security of petroleum imports	Oil & natural gas import expenditures per GDP	Electricity capacity margins	Energy intensity
	Energy expenditures per GDP	Electricity capacity diversity	Emissions intensity
Security of natural gas imports	CO <sub>2</sub> costs	Gas stocks	Electricity non-CO <sub>2</sub> generation share
Security of raw materials and RES imports	Retail natural gas prices – Households	Gas infrastructure reliability	Waste per capita
	Retail electricity prices – Households	Household energy efficiency	Circular material use rate
	Retail electricity prices – non-Households		Material footprint

The ESCRI incorporates data from 2008 to 2023. Figure 7 represents the calculated Energy and Climate Security Index for Croatia, with 4 core dimensions from which is the ESCRI derived from.

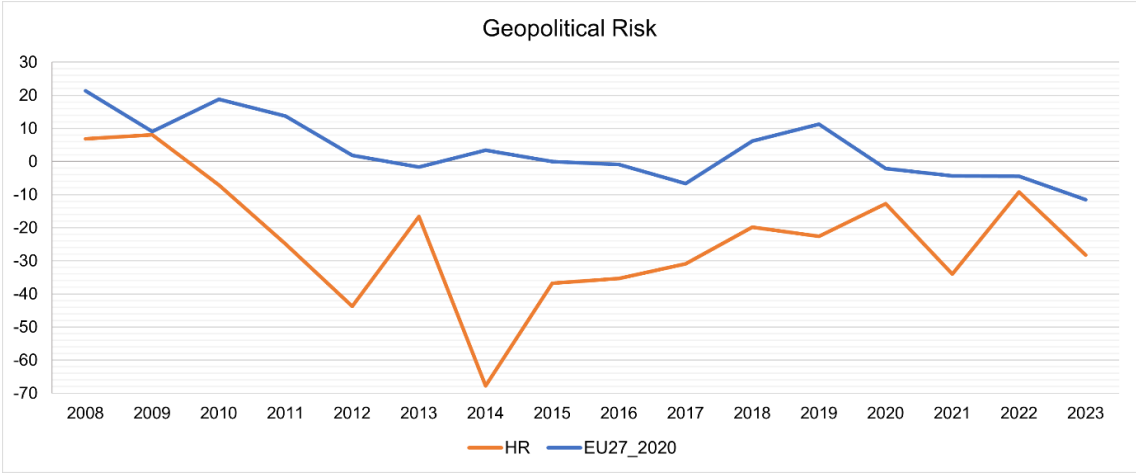


*Figure 7 Energy and Climate Security Index for Croatia 2008 – 2023*

Croatia’s overall Energy and Climate Security Risk Index has followed a mixed trajectory. The risk index had a slow decrease through the mid-2010s but rose again by the early 2020s. This rise was mostly due to high rise in affordability dimension, which is also most fluctuating dimensions, in period when Russian invasion on Ukraine started. Reliability dimension shows general decrease over the analysed period, indicating increase in energy efficiency and diversity, which was also disrupted in 2021. Geopolitical Risk remained moderate for Croatia thanks to diversified supply sources and improved import security. Sustainability dimension is showing the lowest risk values as Croatia lowered its carbon intensity and constantly expanded integration of renewables. Each out of four risks will be detailed describe in following part.

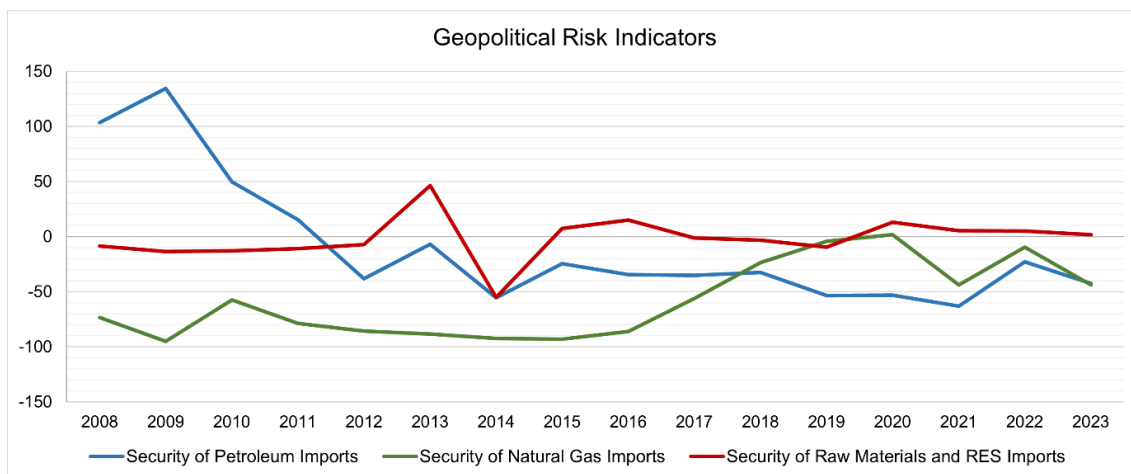
**4.1. Geopolitical risk**

National energy security highly depends on national energy imports and developments in global energy markets, as well as level of democracy and political stability of importing countries. This influence is reflected throughout ESCRI geopolitical dimension. The Geopolitical Risk of Croatia indicates significant improvements when compared to the broader EU average trend from 2008 to 2023. Initially, both Croatia and the EU had relatively similar levels of geopolitical risk. However, since 2010, Croatia's geopolitical risk has significantly decreased, diverging notably from the EU27 more constant trajectory. The comparison of Croatian geopolitical risk to EU average values can be seen on Figure 8.



*Figure 8. Geopolitical Risk for Croatia compared to EU27\_2020*

Croatian positive trajectory in geopolitical risk reduction can be explained through analysis of three main indicators: security of petroleum imports, security of natural gas imports, and security of raw materials and RES imports. The annual changes of these three indicators are presented on Figure 9.



*Figure 9 Geopolitical Risk Indicators for Croatia 2008 – 2023*

Despite domestic production contributing to overall supply to some amount, Croatia continuously relies on imports to meet total demand, leaving the energy system sensitive to disruptions in international markets and transit routes. In 2014 Croatia's security risk indicator started to increase due to natural gas imports. This increase was mainly caused by higher overall consumption of natural gas, which demanded a drastic increase in import volumes, which could be seen on Figure 5. During this period main importing country was Russia. Before the energy crisis caused by Russian invasion, the Republic of Croatia maintained a moderately dependent energy relationship with Russia, particularly in the supply of natural gas and crude oil. Croatia were not heavily reliant as other Central and Eastern European countries, but it has still imported around 60 to 70% of its natural gas from Russia through pipeline routes that traversed Hungary and Ukraine. Russian oil company Lukoil also held a significant presence in the Croatian petroleum retail market. A pivotal factor was the opening of the Krk LNG terminal in 2021, which notably enhanced Croatia's energy independence by allowing access to a broader global market for liquefied natural gas, thus diversifying the supply routes and sources. However, natural gas remains a fuel with significant geopolitical exposure due to its price sensitivity and the global competition for LNG cargoes. Security of petroleum imports shows a drastic drop from 2009 to 2012, followed by steady and constant decrease. The declining indicator for Croatia corresponds to reduced need for petroleum imports, thankfully to increased efficiency in transport and industry, alongside electrification of end-use sectors and increased usage of biofuels.

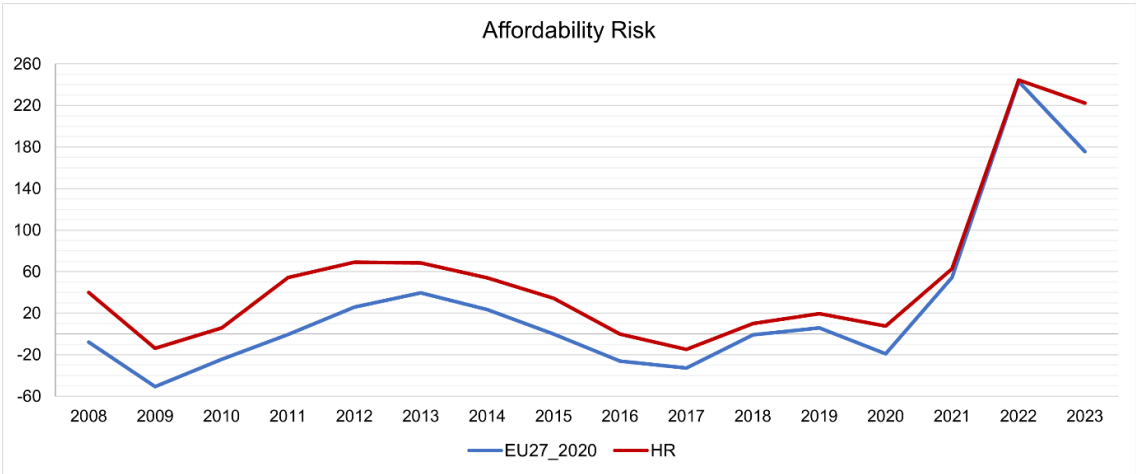
Croatian effort to reduce the dependence on fossil fuels consequently leads toward integration into raw materials value chains, which reflects broader EU policy shifts but also introduces new dependencies. The Security of Raw Materials and RES Imports indicator presents a relatively stable trend with slight fluctuations, except for a notable spike in 2013 and drop in 2014, which was later stabilized. Even though the import concentration index of Croatia is comparatively low, meaning a diversified supply chain, the origin countries include both EU and non-EU producers, some with challenging

governance environments. This is showing that as fossil fuel imports decrease, raw material imports climb. The EU Critical Raw Materials Act acknowledges this pattern and limits over-reliance on any single non-EU supplier, meaning that not over 65 % of materials should come from single supplier, with aim to promote domestic and circular sourcing. Croatia remains fully aligned with these EU measures, and its low concentration score suggests progress. However, the country’s clean-tech manufacturing sector is still growing, with limited domestic extraction or processing capacity for battery, solar, and grid equipment.

Overall, Croatia’s performance in reducing geopolitical risk from 2008 to 2023 reflects effective policy interventions, especially in diversifying its natural gas import routes and reducing dependence on petroleum supplies.

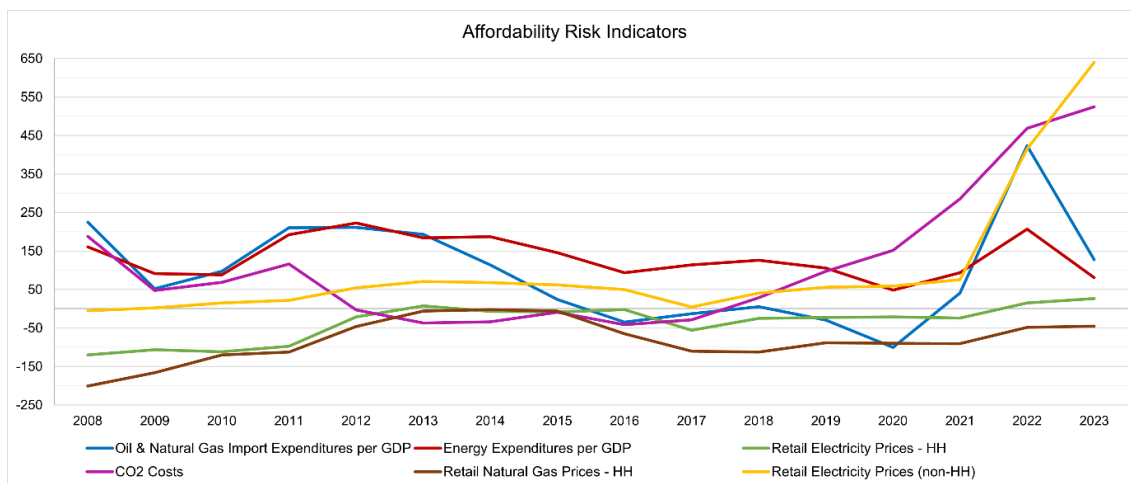
**4.2. Affordability risk**

Affordability Dimension investigate the impact of energy and carbon prices volatility on national economic stability, as well as ability of end consumers to afford their energy consumption. These indicators show a direct correlation with energy poverty trends on national level. Moreover, energy costs are influenced by different costs of energy sources, as well as energy efficiency and overall consumption trends, reflecting the importance of energy sources diversification and energy management. Affordability risk for Croatia in general follows the overall trajectory of EU average, with slightly higher values, as shown in Figure 10.



*Figure 10 Affordability Risk for Croatia compared to EU27\_2020*

Croatian affordability risk experiences a dynamical trajectory from 2008 until around 2020, constantly following EU average. However, a sharp spike occurred in early 2020s, driven by the global energy crisis caused by pandemic and the geopolitical impacts of Russian invasion of Ukraine. Indicators for Croatian affordability risk are illustrated on Figure 11.



*Figure 11 Affordability Risk Indicators for Croatia 2008 – 2023*

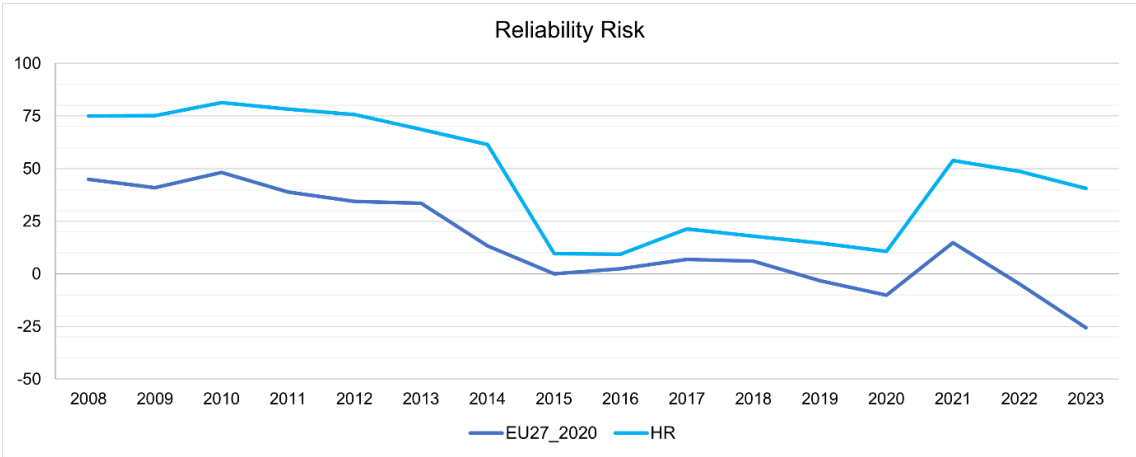
Both oil and natural gas import expenditures per GDP and energy expenditures per GDP indicators shows the similar trend as other EU members states, reflecting comparable fossil fuel supply chains. However, energy expenditures per GDP indicator shows one of highest values out of all EU countries, showing a major burden of high energy costs relative to the size of Croatian economy and representing limits to its growth. These indicators declined slightly from 2013 onward, supported by lower global oil prices and increased renewable energy integration, until they rose again sharply in 2021 and 2022 as consequence of energy crisis.

The Retail Natural Gas Prices for Households and Retail Electricity Prices for Households indicators shows a slow rise but still contributed to the upward pressure of affordability risk for Croatia, reflecting delayed but real impacts of supply disruptions, inflation, and shifting tax burdens. Electricity prices for Croatian households experienced constant rise from 16 cents per kWh in 2008 to 20 cents per kWh in 2020. Natural gas prices for Croatian household were lowest in 2008 and amounted to 4 cents per kWh, peaking in 2014 at 7.5 cents per kWh and falling to 6 cents per kWh in 2020. During the energy crisis after 2020, natural gas and electricity prices for Croatian households haven't experienced major changes, thanks to Croatian Government aggressive package of measures worth more than 1 billion euros that was envisaged for subsidizing the price of electricity and gas for households and the economy sector. The price of electricity for households, non-profit sectors and small businesses remained frozen until September 2022 and natural gas until March 2023. In addition, a reduced VAT rate to 5% was introduced on natural gas. These measures have ensured the lowest electricity and natural gas prices in the EU, except in Hungary. Although, the impact of price increases was amortised, consumers continue to pay more than before and Croatia, like the rest of the EU. Indicator of retail electricity prices for non-household consumers showed a significant upward trajectory in 2022–2023, becoming one of the primary drivers of the affordability risk spike. This increase is consistent with broader European trends, as industrial and commercial consumers faced challenges in energy markets and had less

protection from government price interventions than households. The CO2 cost indicator which began rising sharply after 2020 due to the increasing price of carbon allowances under the EU Emissions Trading System, illustrates how this cost had an impact on electricity and heating prices, especially in systems still reliant on fossil fuels. Although Croatia is not among the highest emitters, it was not immune to this effect due to its partial reliance on gas and oil for electricity and heat generation.

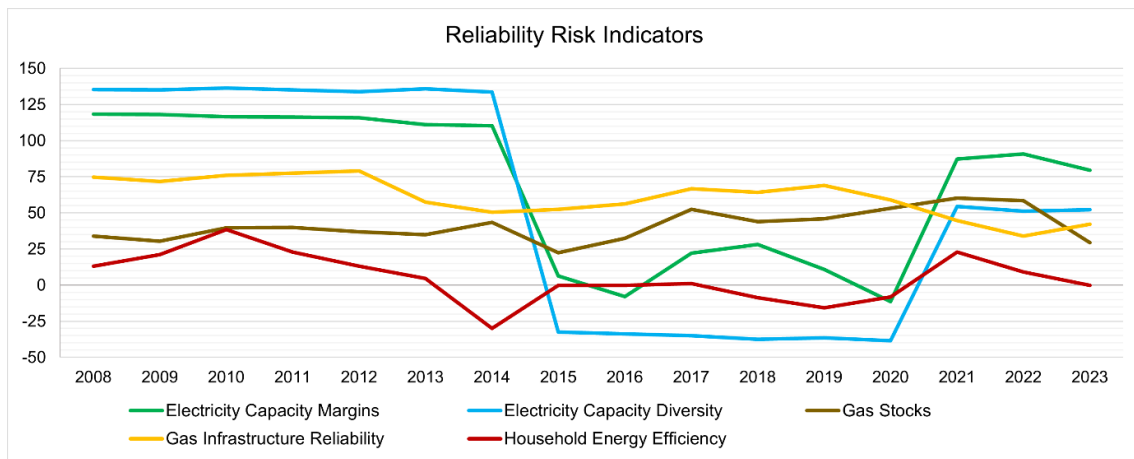
**4.3. Reliability risk**

The reliability dimension refers to the capacity national energy system to meet its continuous demand, as well as ability to respond to unexpected supply disruptions and peak load conditions. It specially focuses on electricity and natural gas systems. Additionally, reliability dimension also covers household energy efficiency, since disruption in household demands are in direct connection with energy performance of households. The Reliability Risk performance for Croatia from 2008 to 2023 is shown in Figure 12 and compared to EU average for the same period.



*Figure 12 Reliability Risk for Croatia compared to EU27\_2020*

The Reliability Risk for Croatia indicates a complex and evolving trajectory. Initially, Croatia experienced substantially higher reliability risks compared to the EU average, reflecting vulnerabilities connected to infrastructure capacity and lower energy efficiency. In 2014 Croatia demonstrated a significant reduction in reliability risks, decreasing the value nearly to EU average. This significant improvement is primarily attributable to substantial progress in electricity infrastructure, including substantial increases in electricity capacity diversity and improved electricity capacity margins. Breaking down to each the individual indicator that influence reliability risk provides a clearer explanation of the reliability risk. Each indicator performance is shown on Figure 13.



*Figure 13 Reliability Risk Indicators for Croatia 2008 – 2023*

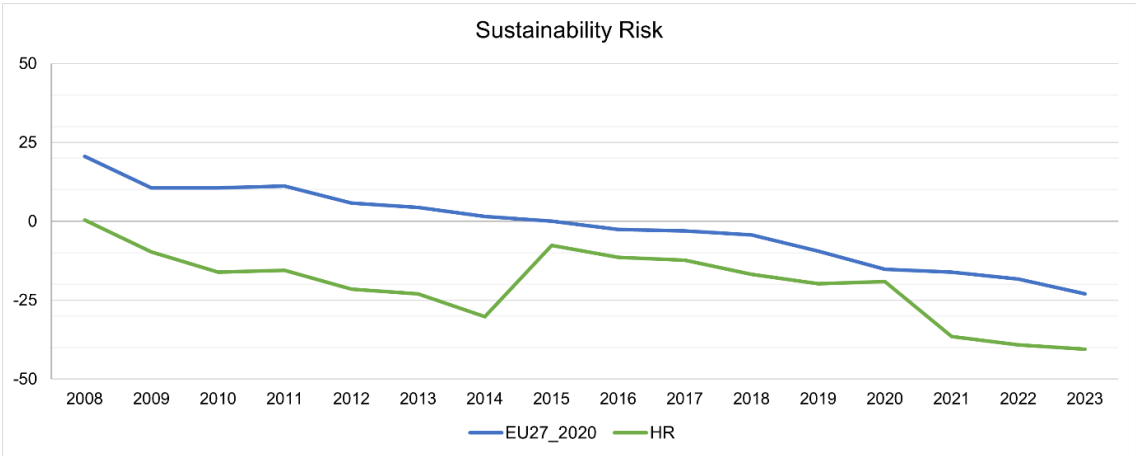
Two most influential indicators refer to national electricity system and are illustrating Croatia’s performance over analysed period in securing the electricity to meet the usual demands, as well as diversifying the electricity supply. Electricity capacity margins indicator in first few analysed years shows notably high values from around 118 to 110. A remarkable drop occurs in 2015 when indicator value drops to around 6, followed by fluctuations between values of 30 and -12. Simultaneously electricity capacity diversity indicator shows the similar performance. Before 2015, indicator shows almost constant values around 135, with extreme drop to -32 in 2015. Both risk indicators experience a significant raise in early 2020s when energy crisis occurred. Remarkable risk reduction between 2014 and 2015 is result of Croatian substantial efforts in diversifying its electricity generation sources. This reflects high investments in renewable energy projects, particularly wind and solar, which reduced dependency on singular sources of electricity and enhanced overall system resilience. Additionally, Croatia successfully increased available electricity generation reserves by integrating additional renewable generation capacity into the national grid, coupled with strengthened cross-border interconnections and grid infrastructure upgrades, which reduced the risk of supply disruptions.

Gas infrastructure reliability and gas stock indicators shows relatively constant trends with slight fluctuations throughout the period, implying that there were no significant changes in Croatian natural gas sector to drastically reduce natural gas reliability risk, and that Croatia has a stable management of gas reserves. However, there was a visible decrease in gas infrastructure reliability indicator in 2020s, aligning closely with the start of the LNG terminal on Krk island in 2021, and its effect on Croatian dependence on the natural gas imports. Household energy efficiency indicator also progressively improved, with fluctuations between the years. The steady reduction of this indicator’s risk highlights targeted policy measures such as subsidies for building insulation, renovation programs, and energy-saving initiatives at the household level. Nevertheless, progress has been gradual, suggesting the presence of ongoing challenges, particularly in deeper

renovation uptake and public engagement. Overall, Croatian reliability risk demonstrates substantial improvement from initially high vulnerability levels, especially in national electricity system but reveals new challenges, mainly caused by energy crisis in early 2020s.

**4.4. Sustainability risk**

The sustainability dimension refers to climate and environmental factors that influence national economy and national alignment with EU energy and climate objectives. Sustainability risk indicators include energy and CO2 emissions intensity, illustrating national dependence on fossil fuels and their constant demand for imports, as well as its impact on climate changes. Moreover, the share of non-CO2 technologies indicator in electricity generation mix reflects the national reliance on renewables and how they increase national independence on fossil fuel imports. Waste per capita, material footprint, and circular material use rate indicators reflects national dependence on raw materials imports and quality of its waste management. The sustainability Risk for Croatia in analysed period shows consistent improvement and that Croatia is operating more efficiently in sustainability terms, compared to EU average. The comparison is illustrated on Figure 14.



*Figure 14 Sustainability Risk for Croatia compared to EU27\_2020*

Over time, Croatia demonstrated notable reductions in sustainability risk. This positive trend reflects Croatia’s steady progress in reducing carbon intensity and constant raise in renewable technologies, especially for electricity production. The notable raise in sustainability risk occurred during 2014, mainly caused by increase capacities of electricity production from fossil fuels, thus reducing share of non-CO2 technologies in electricity generation.

Figure 15 presents sustainability risk indicators, and their trajectories in analysed period. The constant reduction in the sustainability risk has been driven primarily by the constant reduction in carbon and energy intensity. These indicators reflect continuous integration of new renewable energy technologies into Croatian energy systems, as well as increase

in energy efficiency. One additional factor for energy intensity indicator is that Croatian economy hasn't been highly industry-oriented but mainly puts its efforts in labour and service sectors. Decreasing indicators reflects that the lower usage of total energy in Croatian economy, and that used energy is coming from more efficient and sustainable sources, thus reducing environmental impact and exposure to energy price volatility.

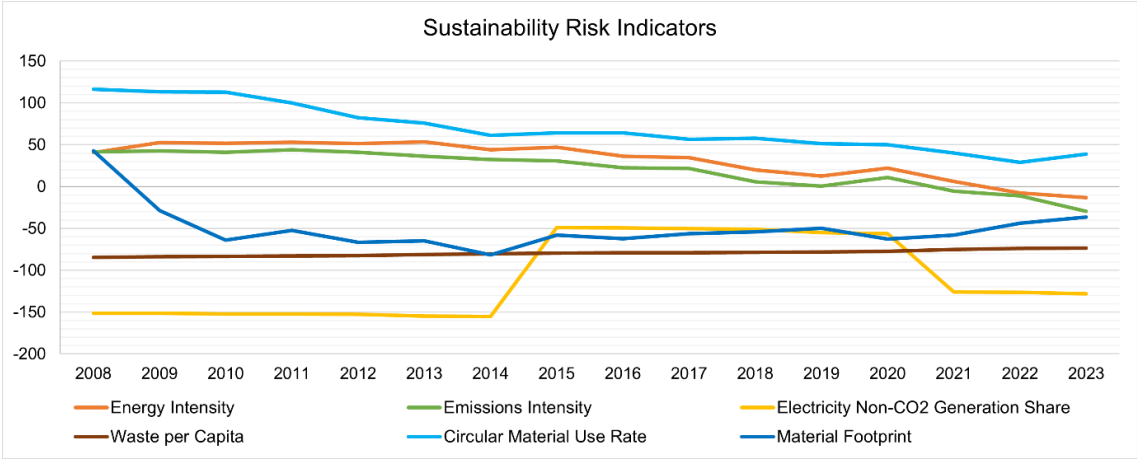


Figure 15 Sustainability Risk Indicators for Croatia 2008 – 2023

Significant jump of electricity non-CO2 generation share indicator in 2014, followed by higher values until 2020, was main reason for raise of Sustainability Risk in the same period. This was mainly consequence of increased reliance on fossil fuels where Croatia raised electricity production capacities on combustible fuels by 250 MW, additionally followed by bad hydrological conditions limiting hydropower electricity generation and policy-related uncertainties involving coal. By 2020 Croatia has decommissioned around 550 MW of electricity production capacity running on fossil fuels, leading to drop in electricity non-CO2 generation share indicator, as it can be seen on Figure 12.

Waste per capita indicator remains consistently stable throughout analysed period, indicating minimal improvement in waste management efficiency, that was reciprocal to the national immigrations. Even though, the indicator shows one of lowest values compared to other EU countries. The circular material use rate indicator reflects the proportion of materials recovered and recycled back into the economy. Indicator's downwards trajectory shows that that Croatia had very low circular material usage in the initial period, but it was improving significantly afterward. From 2008 to 2023 the circular material use rate in Croatia improved from 1.38 % to 6.2 % but remained one of the lowest in EU. Material footprint indicator shows a significant downwards trend in first two years but onward remains relatively stable with a slight fluctuation trend. this indicates moderate improvement in resource efficiency, reflecting efforts to reduce raw material usage and increase recycling of materials.

## 4.5. Key risk drivers and vulnerabilities

The ECSRI assessment identifies structural risk drivers that continue to shape Croatian energy and climate security perspective. These risks are not isolated but span across multiple ECSRI dimensions influencing geopolitical exposure, affordability, reliability, and sustainability.

### **Continued reliance on natural gas and absence of a clear phase-out pathway**

Natural gas remains a central component of Croatia's energy system, accounting for approximately 25.9% of total primary energy supply in 2023, or around 2.29 Mtoe. Although total gas consumption has remained relatively stable over the past two decades, domestic production has declined significantly since 2010, leaving Croatia increasingly dependent on imports. Currently, only about 30% of gas demand is met through domestic production. Continuous investments in natural gas infrastructure on national level and small to no phase-out indicators from an ECSRI perspective sustain exposure to geopolitical risk, price volatility, and carbon cost pressures.

### **Low energy efficiency of the residential building stock**

Energy efficiency in the household sector represents a second major risk driver, strongly linked to energy affordability and reliability. More than 60% of Croatia's building stock is over 50 years old and was constructed without modern energy efficiency standards. Poor thermal insulation and inefficient heating systems result in high energy demand, particularly among vulnerable households. Rising energy prices in recent years have amplified these structural weaknesses. In 2023, 6.2% of households were unable to adequately heat their homes, while 19.3% of the population was at risk of poverty. Elderly single-person households are mostly exposed. Although short-term price regulation has limited immediate impacts, the underlying efficiency gap continues to drive long-term affordability risk and constrains demand-side flexibility in times of system stress.

### **Slow pace of decarbonisation in transport and buildings**

Despite strong progress in renewable electricity generation, Croatia's overall decarbonisation process remains uneven. Transport sector accounts around 35% of final energy consumption, while renewable penetration in the sector remains very low and with uncertain growth. Similarly, the heating and cooling sector, responsible for a large share of household and service sector energy use, continues to rely heavily on fossil fuels, particularly in district heating systems. Building renovation rates remain below 1% annually, significantly under the needed level. As a result, emissions reductions in non-ETS sectors are progressing more slowly than required, increasing sustainability risk and limiting resilience to rising carbon prices and climate-related disruptions.

## **Growing dependence on imported raw materials for clean energy technologies**

The existing transition from fossil fuels has reduced Croatia's exposure to hydrocarbon imports to some point but has simultaneously increased reliance on imported raw materials used in renewable energy technologies, grids, and energy storage. While Croatia's import concentration index remains relatively low, supply chains include both EU and non-EU producers, some of which are associated with governance and geopolitical risks. Limited domestic capacity for the extraction, processing, or manufacturing of clean energy equipment means that Croatia remains exposed to external shocks in critical raw material markets. This dependency represents an emerging sustainability and geopolitical risk that will become more visible as deployment of renewable technologies accelerates.

### **4.6. Role of NECP in addressing national risks**

Regarding geopolitical risk, the updated National Energy and Climate Plan introduce several measures aimed at supply diversification, increased use of renewables and improving energy efficiency. In particular, the further development and expansion of LNG infrastructure and capacity will further reduce supplier concentration risk while at the same time enhance short-term supply security. Leading measure was the expansion of the LNG terminal on the island of Krk from initial capacity of 2.6 billion m<sup>3</sup> of gas per year to 6.1 billion m<sup>3</sup> annually. With these measures, Croatia aims to position itself as an energy bridge between Central Europe and the Adriatic, ensuring reliable access to gas to countries that do not have their own terminal or stable sources of supply. Additional set of measures foresee expansion of renewable generation contributing to reduction of long-term dependence on imported fossil fuels with set target of 42.5 % of total energy generation from RES by 2030, with 76,7 % renewable electricity generation. Over time, this contributes to reduced exposure to external shocks and increased energy autonomy. However, continued reliance on natural gas indicates that NECP weigh to mitigate geopolitical risks rather than try to fully eliminate them during the transition period. The NECP also highlights persistent gaps in transport decarbonisation, where current trajectories are insufficient to meet 2030 objectives without accelerated action.

The NECP includes a combination of short-term social protection measures and longer-term structural interventions to address affordability risks. Emergency price regulation and subsidies have effectively shielded households from extreme price volatility. In parallel, the NECP foresees the development of a dedicated Programme for Energy Poverty Mitigation, which aims to define indicators, improve targeting of vulnerable households, and integrate energy efficiency improvements. Measures supporting building renovation, insulation, and the deployment of efficient heating systems directly address the mitigation of energy poverty. However, the pace of implementation remains a key challenge, as current renovation rates fall short of NECP targets.

## 5. SOCIAL PREFERENCES AND PUBLIC ACCEPTANCE

In Croatia, the energy transition is not only a technical component of decarbonisation agenda, but it also includes social and governance challenges. Households are directly affected through changes in energy prices, heating and cooling systems, transport costs, and the perceived distribution of costs and benefits. This is relevant for efficient NECP implementation since a significant amount of policy measures and instruments (subsidy schemes, building renovation programmes, regulatory frameworks, grid-related investments, etc.) rely on household uptake and require a social acceptance and political stability over multiple years.

The period during which Croatia was required to update and communicate its energy transition and climate policy priorities was aligned with an intensive electoral cycle (parliamentary and European elections in 2024 and presidential elections spanning late 2024 to early 2025). In such periods, public sensitivity to energy prices and affordability tends to increase, which can influence the broader policy environment in which climate and energy transition policy measures are discussed. From an implementation perspective, this context highlights a general challenge rather than a country-specific deviation: while NECP ambitions are aligned with EU-level objectives, the sequencing and pace of policy measures may be affected by the need to ensure social feasibility and whether public see the transition as credible, fair and beneficial to society. This does not directly imply a weakening of policy commitments but rather reflects the practical constraints under which long-term transition measures are introduced.

### 5.1. Methodology and sample

The analysis of social preferences and public acceptance in Croatia is based on a combination of a structured survey and a Discrete Choice Experiment (DCE) designed by Institute for Structural Research – IBS, Poland. This mixed-method approach allows for a comprehensive assessment of both general opinions and concerns toward climate and energy issues and more precise evaluations of how citizens value specific policy design features when confronted with different policy solutions.

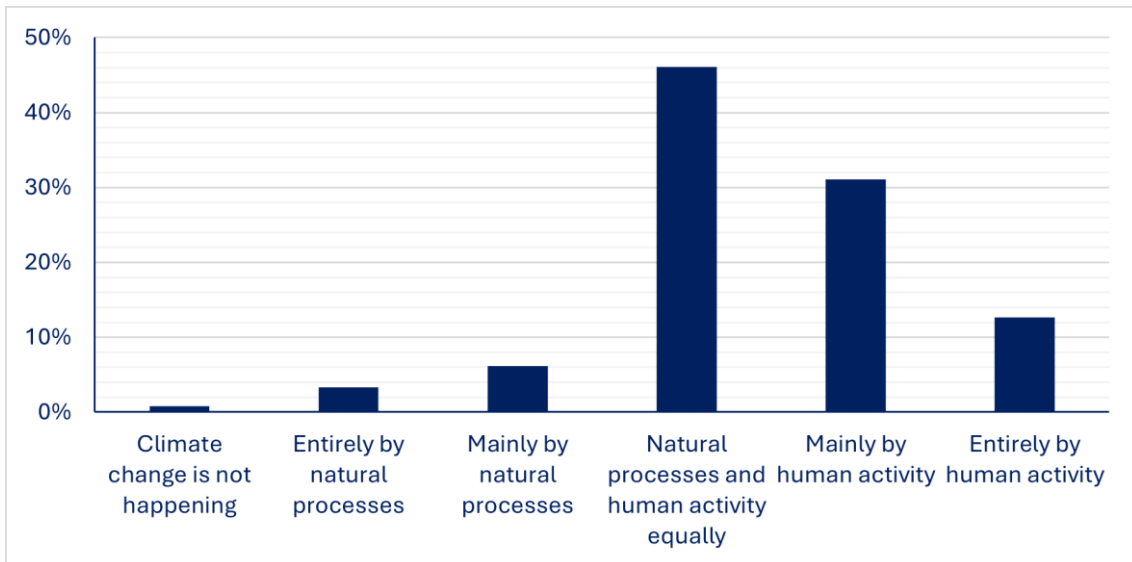
In Croatia, the survey was conducted on a sample of 760 respondents. Respondents had participated through online panel. To ensure the respondent diversity, the chosen representatives differ in age, gender, area of residence and level of education. The questionnaire consisted of a series of standardised questions designed to capture levels of concern, attitudes, and perceptions related to climate change, energy costs, and policy responsibility. Most questions were formatted in a way of asking respondents to indicate degrees of concern or agreement and disagreement with specific statements. This design makes it possible to measure not only the direction of opinions but also their intensity. The survey provides the broader social context in which policy preferences can be formed. It highlights which issues are most important to households, how

respondents perceive climate change and responsibility for addressing it and how they assess the role of both national government and public institutions, as well as the European Union. Survey results for Croatia indicate a public opinion marked by broad recognition of climate changes with different views on individual responsibility as well as institutional action and needed response.

The Discrete Choice Experiment complements the survey by placing respondents in hypothetical situations where they must choose between alternative climate and energy policy packages. Each package is defined by a set of attributes representing key policy dimensions: climate change impacts, energy import dependence, cost allocation and benefit distribution. By observing repeated choices across different combinations of attributes, the DCE makes it possible to examine the relative importance of individual policy features. The results of the DCE are expressed in terms of Willingness to Pay (WTP) indicator. This indicator shows the relative monetary value that respondents assign to changes in specific policy attributes. WTP shows how much financial benefits or costs monthly, respondents are considering adequate to a given change in policy framework. WTP values should not be interpreted as literal amounts that individuals would pay, but rather as indicators of the strength and direction of preferences. Positive WTP values indicate that respondents, on average, value a given policy feature and are ready to renounce some income so that policy is realised, while negative values suggest reluctance to the given policy feature or a need for compensation to accept such measure.

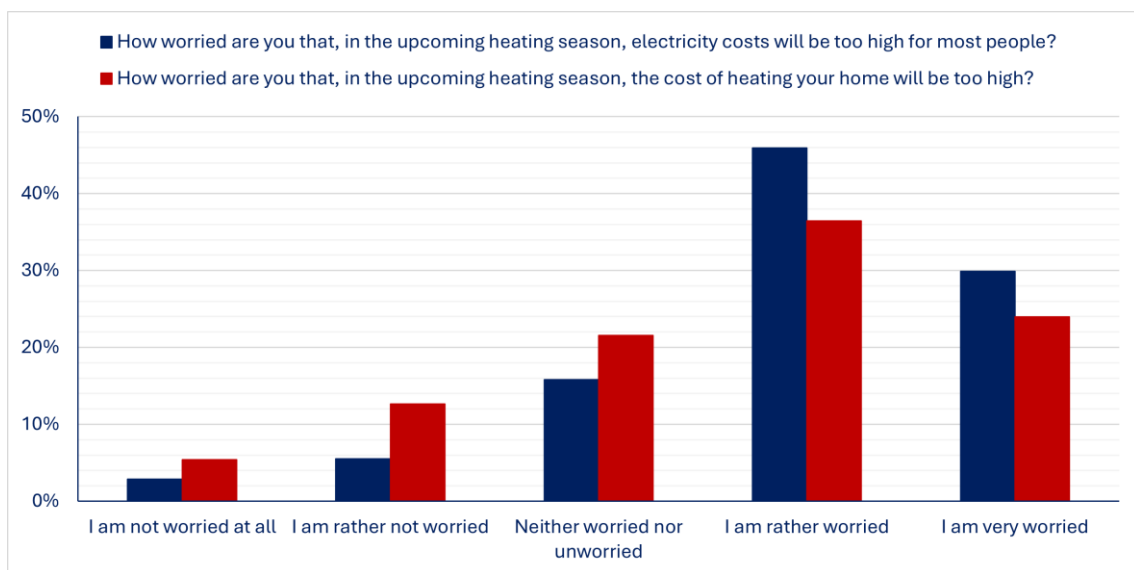
## **5.2. Survey results**

Regarding climate change, the results show broad acceptance of its reality and human influence which can be seen on Figure 16. A large majority of respondents believe that climate change is caused either entirely or partly by human activity, while only a small minority attribute it exclusively to natural processes or deny its existence. This finding indicates that in Croatia scepticism about climate change itself is marginal and does not present a major barrier to the energy transition and legitimacy of climate policies. At the same time, the perceived personal responsibility for addressing climate change is more moderate. While a segment of 29% respondents reports a strong sense of individual responsibility, a comparable share of 26% expresses none to low responsibility, and most respondents, 45% of them, place themselves in the middle of the scale. This gap between awareness and personal engagement suggests that recognition of the climate problem does not automatically translate into a readiness to bear personal costs or to take individual action without supportive policy frameworks. Moreover, 71% of respondents feel the need to take actions personally to mitigate climate changes, whether other citizens take similar actions or don't. 20% indicate a neutral opinion on this matter, while 9% agree that they don't need to act if others don't too.



*Figure 16 opinion on causes of climate change*

The survey results are characterised by strong affordability concerns. When asked about the upcoming heating season, a clear majority of respondents report being worried about the cost of heating their homes. Three out of four respondents indicate that they are “rather worried” or “very worried”, while only a relatively small share, 12 % of respondents have no concern about heating expenses. In addition, respondents’ answers about electricity prices present similar concerns, with approximately three quarters of respondents expressing worry about rising electricity costs. Taken together, these results are shown on Figure 17, and they clearly indicate that public expectations of high energy expenses are widespread. Energy affordability therefore can be described as a major component through which households assess climate and energy policy measures.



*Figure 17 Distribution of public concern about energy affordability in heating season*

Concerns about air quality during the heating season are also substantial, though less dominant than cost-related worries. Figure 18 indicates that six out of ten respondents express concern fully or to some amount about worsening air quality in their neighbourhoods, while roughly one fifth report no concern and a sizeable share remain neutral. This indicates an awareness of pollution and smog issues but also suggests that air quality is perceived as a secondary concern compared to direct financial pressures related to energy use.

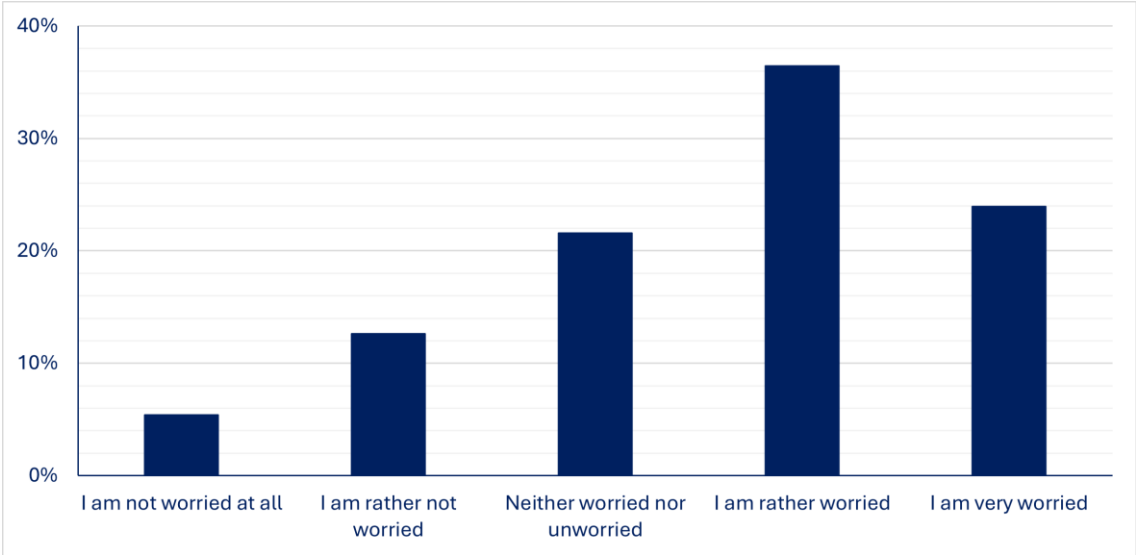


Figure 18 Public concern on air quality in their neighbourhoods

All respondents were asked to propose their preferred national energy mix, by defining shares of main energy sources for electricity and heat production in Croatia. Figure 19 illustrates mean values for 3 main energy sources, where renewable energy dominates with 62.35%, followed by nuclear energy and fossil fuels. Standard deviation for renewable energy amounts 23.75%, showing that even those respondents who favour renewable energy the least, still consider renewables as dominant source in energy mix.

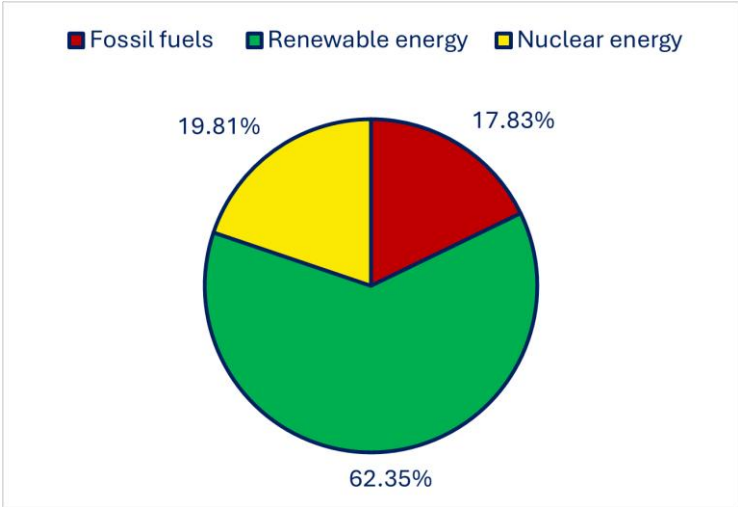
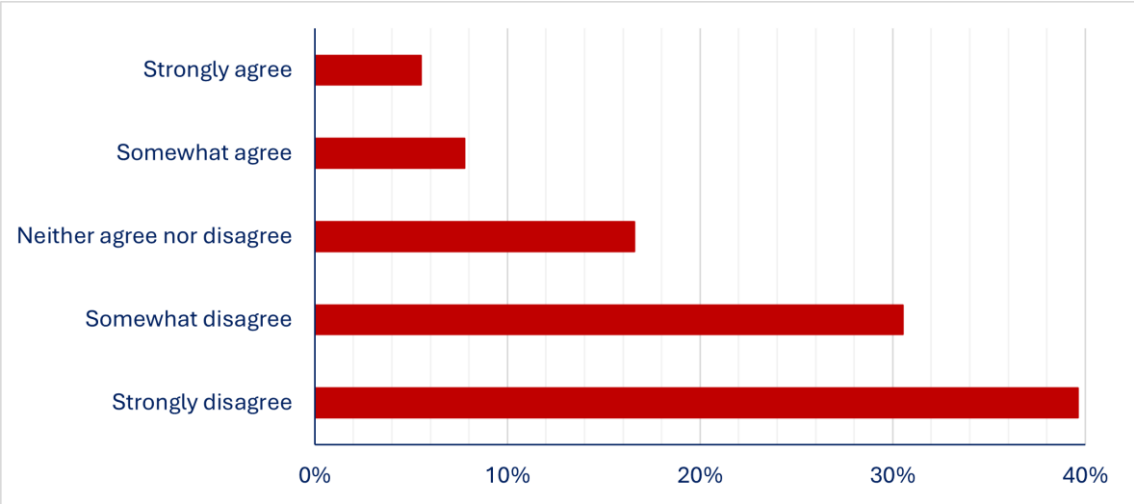


Figure 19 Respondents preferred national energy mix for electricity and heat production

The survey further explores respondents' opinion toward collective action from national level which is illustrated on Figure 20. Most respondents disagree with the idea that there is no need to act if others do not act, indicating a generally proactive orientation. However, the significant number of neutral responses reveals uncertainty about the effectiveness of national action in the absence of broader international cooperation. This shows the public view on importance of coordinated action and policy leadership on international level.



*Figure 20 Respondents view on country responsibility to fight climate change*

Respondents' assessments of different institutional involvement and effort in achieving renewable energy transition reveal different expectations and can be seen on Figure 21. At least 40% of respondents agree that all institutions have no or too little involvement in gradually replacing fossil fuels with environmentally friendly energy sources, while this value rise to 65% when, observing specifically local and regional authorities, as well as National government. Around 20% of respondents see their activities as sufficient, while 10% think they are too involved. Private companies, as well as energy firms follow similar pattern, with majority perceiving their insufficient involvement. At the same time, opinions regarding the role of the European Union are more proactive, with substantial shares of respondents considering EU involvement either sufficient or excessive.

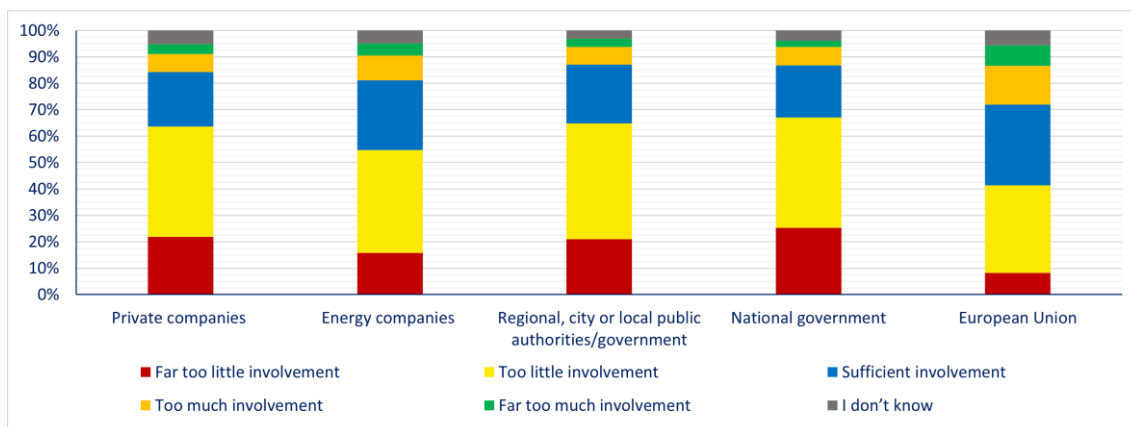


Figure 21 Respondents' assessment on institutional involvement in energy transition

### 5.3. Discrete choice experiment results

#### Impact of climate changes

The DCE results show that Croatian respondents assign a clear and statistically significant positive value to policy scenarios that reduce climate change impacts, compared to scenarios characterised by severe climate consequences. The estimated willingness to pay for moving from significant to minimal climate change impacts is around 39 EUR per month, indicating that respondents are prepared to accept noticeable monthly costs to achieve better climate outcomes, reduce air pollution and improve health and infrastructure resilience. This finding confirms that climate risk reduction is an important driver of policy support in Croatia.

#### Energy security and imports

Croatian respondents also value scenarios in which dependence on imported fossil fuels is reduced compared to a situation of no change. The estimated willingness to pay for a reduction in imports of gas, oil, and coal is slightly higher compared to climate change impacts and is approximately 41 EUR per month. This aligns with survey results where respondents' main concerns are potential high costs of electricity and heat for the households. However, the estimate is not statistically significant, indicating that while preferences point in a positive direction, support for reduced import dependence is expressed with greater uncertainty than support for improved climate impacts.

#### Cost allocation and benefit distribution

The DCE results reveal particularly clear patterns about the distribution of costs associated with climate and energy policies in Croatia. When the cost burden is shifted away from an equal contribution from all households toward higher-income groups, both estimated willingness-to-pay values are positive. The estimated WTP amounts to around 21 EUR per month when additional costs are assigned to the top 10% of income earners,

and to approximately 47 EUR per month when the burden is distributed across the top 30% of income earners. These results suggest that respondents in Croatia prefer progressive financing schemes in which higher-income households contribute a larger share of the costs. The difference between the two scenarios highlights that moderate progressivity is clearly more acceptable than highly concentrated sharing of costs. The 30 % scenario is also statistically significant, indicating stronger and more robust support for this design.

When energy and climate policy benefits are restricted exclusively to the poorest 10% of households, the estimated WTP is clearly negative and amounts around –68 EUR per month. This indicates a general reluctance to support policies with specifically targeted benefits, which may be perceived as socially excluding or as failing to present the transition as a collective project.

Following up, when benefits are directed to a broader group of the poorest 30% of households, the estimated WTP value becomes positive but small, around 7 EUR per month. This suggests a modest preference for moderately targeted benefit schemes, in which a larger low-income group benefits more than others, rather than only the very poorest segment.

#### **5.4. Alignment of social acceptance with NECP framework**

Taken together, the survey results suggest that social acceptance risks are not driven by opposition to the goals of the transition, but how are costs and benefits structured and sequenced over time. Climate and energy policies in Croatia are evaluated primarily through the lenses of affordability, fairness, and credibility of implementation. While climate change is widely recognised as a serious issue, public support for specific measures depends strongly on whether policies are perceived as protecting households from excessive costs and delivering widely shared benefits. Several implications for policy design and communication that are relevant for NECP implementation can be summarised as follows:

- 1.** Climate and energy policies are most likely to gain general and stronger acceptance when they are framed as instruments of risk reduction with clear relevance to meaningful benefits for households, rather than solely as contributions to long-term climate targets. Moreover, energy transition measures are more likely to be accepted when they are framed as multi-purpose measures. Integrating energy security and efficiency, cost stability, deployment of renewables and health improvements will lead to bigger social acceptance and stability.
- 2.** The findings also underline the importance of moderate progressivity in cost-sharing arrangements. While progressive cost distribution is generally supported, acceptance depends on whether contributions are perceived as proportionate and broadly shared among higher-income households. Policies that implicitly assign

responsibility to a very small segment of society risk undermining support, indicating that they should be communicated as collective efforts with differentiated contributions.

**3.** The visibility and accessibility of energy policy benefits should be widely spread. Targeted support for vulnerable households should be provided, but it gains broader acceptance when policy packages deliver benefits to a wider range of citizens. General outcomes, such as cleaner air, stable energy bills, improved housing quality or better infrastructure, are more favourable and frame the transition as a national project.

**4.** Results highlight the importance of a credible implementation on both national and local levels. Respondents clearly distinguish the role of different institutions, and public confidence increases when responsibilities are clearly assigned and implementation capacity is visible. Strengthening the role of institutions and local implementation channels can therefore enhance trust and reduce acceptance risks.

## 6. INTEGRATED ASSESSMENT OF NATIONAL ENERGY AND CLIMATE PLAN

Based on preceding chapters, an integrated assessment of revised National Energy and Climate Plan for the Republic of Croatia is presented in the following section. The integrated assessment combines the analysis of the internal quality and coherence of the revised NECP, evaluation of Croatia exposure to energy and climate security risks and resulting social preferences and public acceptance of energy transition policies. The integrated assessment serves two main purposes. Firstly, it evaluates whether the revised NECP adequately addresses the structural vulnerabilities and risk drivers identified in the ECSRI analysis and how well does it strengthen the Croatian alignment with EU energy security and climate objectives. Secondly, it examines whether the revised NECP policy orientation and energy planning logic are compatible with public preferences which are critical for long term policy credibility and implementation success.

### 6.1. The revised National Energy and Climate Plan ambitions in mitigating energy and climate security risks

#### Geopolitical risk: diversification of supply routes and energy sources

Croatia has significantly reduced its geopolitical risk since 2010, mainly due to diversification of natural gas supply routes and reduced reliance on petroleum imports. The revised NECP builds directly on this trajectory by placing strong emphasis on diversification of supply routes, infrastructure expansion, and regional integration. Measures related to the expansion of the LNG terminal and the development of additional gas pipelines, both at the national and regional level, clearly contribute to geopolitical risk mitigation. These investments increase the resilience of national energy system and strengthen regional export capacity, positioning Croatia as main regional gas hub. The revised NECPs also highlights targets to increase domestic gas and oil production, which would lead to reduced import needs and further mitigate external supply disruptions, especially in the period after 2022 geopolitical context.

However, while gas production and infrastructure investments reduce geopolitical exposure, they also risk reinforcing long-term dependence on fossil fuels. The revised NECP refers to “hydrogen ready” infrastructure as a justification for continued gas investments, yet it does not provide a clear assessment of future hydrogen market development. This creates uncertainty regarding the long-term compatibility of these investments with energy and climate objectives.

The revised NECP should provide stronger emphasis on diversification of energy sources, particularly through more accelerated deployment and integration of renewable energy.

Expanding domestic renewable electricity and heat production lowers structural dependence on imported fuels and stabilises energy supply, leading to reduced impact of external geopolitical contexts. While the NECP includes ambitious targets for renewable electricity generation, deeper integration of renewables across all sectors would strengthen energy independence. A more balanced approach that combines diversification of supply routes with diversification of energy sources would therefore enhance long-term energy security and improve alignment with EU energy and climate objectives.

### **Affordability risk: structural vulnerability and long-term exposure of energy prices**

Affordability risk has been shown as the most volatile and politically sensitive dimension in the conducted analysis. Energy crisis in early 2020s led to a sharp increase in affordability risk, driven by high energy import expenditures relative to GDP, especially fossil fuels, and rising carbon pricing.

Government intervention through price regulation and subsidies successfully mitigated the immediate impact of rising energy prices on households. This measure has been proven effective and socially stabilising in short-term risk management perspective. However, price regulation and subsidies do not address the structural drivers of affordability risk. Low energy efficiency of the residential building stock, especially among energy poor households, and continued reliance on fossil fuels in heating and transport sectors, remains key vulnerabilities. These structural factors are not resolved through such measures and should instead be addressed through long-term interventions. The revised NECP recognise this issue and emphasise on structural improvements. Building renovation programmes, system and individual energy efficiency improvement measures and the gradual decarbonisation of end-use sectors have the potential to reduce energy demand, limit exposure to price volatility and lower affordability risks over time.

In addition, rising CO<sub>2</sub> costs under the EU Emissions Trading System increasingly influence electricity and heating prices, particularly in systems with residual fossil fuel use. Continued exposure to carbon pricing reinforces the importance of accelerating the transition toward RES and improving energy efficiency, which would structurally lower affordability risks over time.

### **Reliability risk: electricity System Progress and Emerging Challenges**

The analysis has showed that Croatia has significantly reduced its reliability risk over the past reflecting improvements in electricity capacity margins and diversification of generation sources. This positive trajectory is closely linked to increased deployment of renewable electricity, grid upgrades, and improved system management. The revised

NECP largely builds on these developments and brings measures to continue this positive pathway.

The revised NECP puts a strong focus on expanding renewable electricity generation, in combination with measures aimed at modernising and digitalising transmission and distribution networks. Measures also include investments in smart grids and cross-border market integration. All this directly leads to maintaining reliability in an electricity system and supports reduction of supply disruption risks.

At the same time, the integration of high shares of wind and solar in electricity generation increases the importance of system flexibility. The revised NECP recognises this challenge and includes measures related to energy storage development and improved operational flexibility. However, the limited transparency on flexibility and storage needs modelling as well as on how planned capacities correspond to future demand, generation and peak loads creates uncertainty regarding the sufficiency and timing of proposed measures.

### **Sustainability risk: Strong direction with uneven sectoral progress**

The revised NECP sets targets for increasing renewable electricity generation and greenhouse gas emissions reductions, thus supporting the downward trend in sustainability risk. However, the uneven sectoral progress constrains further reduction of sustainability risk. Decarbonisation in transport and heating remain limited. These sectors continue to rely heavily on fossil fuels and represent a substantial share of final energy consumption and GHG emissions. The revised NECP acknowledges these challenges and provides indicative trajectories but does not yet provide sufficiently detailed or accelerated strategy to achieve deep decarbonisation across all end-use sectors.

In the buildings sector, slow renovation rates and continued dependence on fossil-based heating systems reduce the potential sustainability gains from renewable electricity expansion. Similarly, in the transport sector, low penetration of electric vehicles limits emissions reductions despite policy intentions. From a sustainability risk perspective, this uneven progress increases long-term exposure to carbon pricing and climate-related impacts.

The transition toward RES technologies introduces new material use and resource dependency. Croatia currently exhibits relatively low material footprint and diversified import structures. However increasing deployment of renewable energy, storages, and grid infrastructure will raise demand for critical raw materials. The revised NECP only marginally addresses these emerging risks and does not yet fully integrate circular economy principles into its decarbonisation strategy.

## **6.2. Social perspective on the revised National Energy and Climate Plan**

### **Social acceptance as an implementation condition**

Findings from previous chapter have showed and demonstrated that social acceptance risks in Croatia are not driven by opposition to climate change mitigation or renewable energy. Instead, public support is mainly defined by affordability concerns and social fairness regarding distribution of energy and climate costs and benefits. Citizens tend to assess energy transition measures pragmatically, based on their direct economic and social impacts and the visibility of tangible improvements for households.

While the revised NECP formally acknowledges social dimensions such as energy poverty and just transition, the assessment shows that these aspects are often treated superficial and are not fully integrated into core policy measures. From an implementation perspective, measures requiring individual participation or behavioural change, such as building renovation measures, electrification of transport, or infrastructure development, are particularly sensitive to perceptions of fairness and credibility. Strengthening the just transition dimension would require clearer identification of vulnerable regions and groups, quantified employment and social impact assessments, and closer integration between climate measures and social policy instruments. Without these elements, there is a risk that the benefits of the energy transition will not be evenly distributed, thus potentially undermining public support and long-term policy credibility.

### **Alignment with public support for renewable energy and energy security**

Survey results indicate strong public support for renewable energy deployment and reduced dependence on imported fossil fuels. These preferences are broadly aligned with the revised NECP strategic perspective toward expanding energy generation from RES and strengthening energy security. Renewable energy expansion is perceived not only as a climate measure but also as a tool for reducing end-user costs and bring benefits to households. However, public support is conditional on visible benefits and credible implementation. The revised NECP has limited clarity on timelines and implementation of measures which lead to risks of weakening public confidence, particularly at regional and local levels where project impacts are most tangible.

### **Affordability, cost distribution and policy design**

Affordability concerns dominate public perceptions of the energy transition. Household energy bills represent the main driver on how citizens evaluate energy transition and policies. The DCE results show clear preferences for progressive cost-sharing policies in which costs and benefits are broadly distributed among all households, regardless of their income. Narrowly targeted benefit schemes receive limited support, suggesting that

citizens prefer to see the transition framed as a collective project, rather than support measures for targeted group.

The revised NECP partially reflects these preferences through its emphasis on protecting vulnerable households and addressing energy poverty. Furthermore, the revised NECP brings several measures for building renovation programmes, aimed at improving households' energy efficiency, and therefore reducing energy bills. However, these measures are delegated to separate strategic documents, and the NECP itself lacks explicit mechanisms linking climate measures to their expected impacts and cost distribution outcomes. This weakens the NECP's ability to effectively respond to dominant public concerns.

### **Institutional trust and governance capacity**

Survey results reveal low confidence in national and local institutions' engagement in the energy transition, while perceptions of EU involvement are more positive. This gap highlights the importance of governance quality for social acceptance.

The assessment has showed that stakeholder engagement during the NECP revision process was procedurally adequate but substantively limited, particularly regarding local authorities. This limited involvement of local actors reduces trust and complicates implementation. Trust in climate and energy policy depends not only on the ambition of targets but also on confidence that policies are developed fairly, transparently, and with meaningful public input. The limited visibility of how stakeholder input affected the final NECP risks reinforcing public perceptions that participation is symbolic and used only to fulfil minimum stakeholder engagement criteria. In Croatia, historical scepticism toward large infrastructure projects and governmental actions amplifies these trust concerns. Strengthening institutional accountability and local implementation capacity emerges as a key condition for aligning NECP ambitions with societal expectations.



## 7. CONCLUSION AND RECOMMENDATIONS

Over the last two decades, Croatia has made significant progress in improving its energy and climate security, by reducing geopolitical and sustainability risks through increased deployment of RES technologies, strategic diversification of energy supply, especially with LNG terminal, and energy efficiency improvements in both public and industry sector. These developments have strengthened Croatian energy system resilience and moved Croatia towards set energy and climate targets. However, significant challenges remain, particularly in managing energy affordability, revitalising the residential building stock, and accelerating decarbonisation in the transport and heating sectors.

The integrated assessment of the revised National Energy and Climate Plan for the Republic of Croatia indicates that the Plan is broadly aligned with EU climate and energy objectives in its strategic direction, but faces notable limitations in implementation depth, social acceptance, and long-term risk reduction. While the NECP effectively addresses short-term security and stability concerns, it lacks ambition and thoroughness in facing the structural drivers of affordability risks and uneven sectoral progress. In addition, findings on social preferences and public acceptance reveal that support for the energy transition in Croatia is strongly conditioned by affordability, fairness, and institutional credibility. Social considerations, including energy poverty and just transition are formally acknowledged in the revised NECP but remain insufficiently integrated in the design of core policy measures.

Based on identified gaps and vulnerabilities in previous chapters, a set of recommendations is derived with aim to strengthen the revised NECP as an operational and socially preferred instrument capable of delivering an affordable and sustainable energy transition, while ensuring broad public acceptance and alignment with EU climate, energy security, and just transition objectives.

### **Improving the governance and implementation capacity**

Effective implementation of the National Energy and Climate Plan, besides the ambition of its targets, highly relies on the strength of governance structures and institutional capacity across all levels of government. Strengthening governance is therefore essential for translating NECP objectives into concrete outcomes and maintaining long-term public trust.

Stakeholder engagement should move beyond procedural consultation toward more active participation. Although the NECP revision process met formal consultation requirements, the involvement of local and regional authorities and other key implementation actors remained limited. Earlier and more meaningful engagement would improve policy relevance and feasibility, particularly for measures that are locally

oriented. Greater transparency regarding how stakeholder input influences final decisions would further enhance trust and legitimacy.

Monitoring and accountability mechanisms should also be strengthened. Establishing clear and measurable key performance indicators linked to NECP objectives, combined with regular public reporting on progress and challenges, would support adaptive governance and ensure timely policy adjustments.

### **Enhancing social acceptance and just transition outcomes**

The findings of this report show that public support for the energy transition in Croatia is strongly influenced by affordability concerns, perceptions of fairness, and trust in institutions. Social aspects should be embedded directly into climate and energy policy design, rather than treated as compensatory instruments. Measures should explicitly account for social impacts and distributional effects. Integrating affordability and fairness considerations into revised NECP measures at the design stage would improve policy coherence and reduce the need for reactive corrective measures during implementation.

Regarding cost-sharing mechanisms, they should be aligned with public preferences identified in the social acceptance analysis. This means that financing initiatives that have moderate progressivity, in which costs and benefits are broadly distributed across society, are more likely to gain and sustain public support than narrowly targeted financial schemes. Energy transition should be presented as a collective national project, with visible and widely shared benefits.

Strengthening just transition governance is equally important. The revised NECP should include more detailed systematic socio-economic impact assessments, to identify employment effects and labour market changes, as well as impacts on vulnerable groups. Priority regions and population groups requiring targeted support should be clearly identified, and tailored measures developed to address their specific challenges.

Besides technical KPI monitoring, the revised NECP should also have a monitoring framework for social KPIs, to track social outcomes that could influence policy adjustments. This would ensure that the energy transition progresses in a fair, inclusive, and socially acceptable manner.

### **Strengthening the construction and transparency of policy measures**

The National Energy and Climate Plan should be built on clear and credible foundations from which concrete and transparent measures are constructed. Strengthening these elements is essential for improving policy coherence and increasing confidence in the feasibility of the Plan.

The analytical basis of the revised NECP measures should be strengthened through clearer documentation of modelling assumptions and scenario methodologies. Greater transparency in these areas would improve the interpretability of results and reduce uncertainty regarding the robustness of planned measures.

Improved alignment between the revised NECP and other national strategic documents is also critical. Revisions of related policy documents in energy and climate related areas should be accelerated to ensure consistency with NECP targets and timelines. Additionally, establishing a clear coordination between national and local planning documents would further reduce implementation gaps and support more coherent delivery of energy and climate objectives across governance levels.

### **Reducing structural energy and climate security risks while raising NECP ambition**

Reducing structural energy and climate security risks in Croatia requires strengthening the ambition and internal consistency of the measures defined in the revised NECP. The integrated assessment shows that the identified vulnerabilities are mainly rooted in the insufficient pace of implementation and the lack of detailed and clearly developed implementation pathways for key measures.

The diversification of fossil fuel supply routes, primarily natural gas, has improved short-term security, long-term resilience depends on reducing import dependence altogether. This requires rebalancing infrastructure investments toward higher diversification of energy sources through faster deployment of renewables across electricity, transport, heating and cooling sectors. Therefore, RES and energy storage technologies, smart grids and demand response flexibility should be prioritised. Continued investment in “hydrogen-ready” gas infrastructure should be carefully analysed against realistic demand and cost projections.

Additionally, raising ambition in energy efficiency and building renovation targets is essential for both affordability and sustainability. Emergency price regulation and subsidies have successfully mitigated impacts of energy crisis in 2022, but structural vulnerabilities remain. Accelerated renovation of the residential building stock and integration of RES in household sector would permanently reduce energy demand, leading to limited exposure to price volatility and CO<sub>2</sub> costs. These actions would strengthen social acceptance, since their result would be easily visible to citizens.



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