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Cover image: AI-generated illustration of a renewable heating network created with OpenAI (2025).

Abstract

This policy paper proposes a strategic framework for achieving a socially just and climate-neutral heating transition in North Macedonia, with a particular focus on the coal-dependent region of Bitola. It argues that decarbonizing the heating sector is not merely a technical challenge, but a comprehensive societal transformation that requires institutional reform, active citizen participation, and local ownership. While the 2025 Energy Act establishes a new legal foundation by formally recognizing citizen energy communities, additional regulatory, financial, and administrative measures are essential for effective implementation. The framework identifies six priority areas: strengthening the legal and governance framework, fostering participation and democratic ownership, expanding financial support instruments, building technical and administrative capacity, modernizing infrastructure, and enabling targeted implementation in coal-dependent regions. Special emphasis is placed on integrating large-scale heat storage, developing flexible grid systems, and supporting cooperatives and community-led initiatives. Bitola is presented as a potential model region to demonstrate how a decentralized, inclusive heating system can advance national energy objectives while ensuring a just transition for vulnerable communities. Drawing on legislative analysis, expert insights, and international best practices, the paper offers concrete policy recommendations to guide North Macedonia toward a sustainable and resilient energy future.

Content

1. Background: Presentation of North Macedonia's climate and energy targets

North Macedonia, although not yet a member of the European Union, has taken decisive steps towards a climate-friendly future. With the aim of ending its dependence on fossil fuels, the country adopted an ambitious energy development strategy in 2020 for the period up to 2040. This comprises three scenarios for the planned energy transition:

- Reference scenario: transition from conventional energy sources based on current policy and the principle of optimal development at the lowest costs.
- Moderate transition scenario: gradual move away from conventional energy sources based on new policies and the principle of optimal development at least cost
- Green scenario: radical shift away from conventional energy sources based on new policy measures and the abolition of lignite. The Republic of North Macedonia has also adopted a national energy and climate plan for the period from 2021 to 2030, which sets out the path towards the 2030 targets.

The moderate and green scenarios both envisage a coal phase-out period of 2025-2027. This makes North Macedonia one of the pioneers of the energy transition in the Western Balkans.

Another important step was joining the "Powering Past Coal Alliance" in September 2021, in which the country committed to decommissioning all coal-fired power plants by 2027 at the latest.

The National Energy and Climate Plan (NECP), which was finally adopted in 2022, aims to increase the share of renewable energies in gross final consumption to 38 per cent by 2030 and gradually take central coal-fired power plants, including Oslomej and Bitola off the grid. In the NECP, no specific date is provided; however, based on the stated assumptions, the period in question is between 2025 and 2027. In the "Strategy for Energy Development of the Republic of North Macedonia until 2040" and the "Program for Implementation of the Energy Development Strategy 2021–2025", the period 2025–2027 is repeatedly mentioned as a possible timeframe for phasing out coal as an energy source at REK Bitola.

The National Climate and Energy Plan of North Macedonia builds on existing strategies and plans that provide a comprehensive overview of the current energy system and the state of play in the field of energy and climate policy.

The National Energy and Climate Plan of the Republic of North Macedonia is based on the five dimensions of the EU Energy Union: decarbonization (including the reduction of greenhouse gas emissions and the expansion of renewable energy), energy efficiency, security of supply, internal energy market and research, innovation and competitiveness.

To achieve these goals, North Macedonia has created regulatory incentives and harmonized its energy legislation with the EU acquis. The switch from feed-in tariffs to competitive auctions for renewable energy capacities has already attracted significant private investment in solar and wind energy. The state energy supplier ESM is driving forward the conversion of former coal sites into green energy projects. For example, the former Oslomej lignite mine is being converted into a solar photovoltaic park with a capacity of 120 MW - a project that is already partly in operation. This does not mean that the state plans to produce the same amount of energy that was previously generated by TPP Oslomej using the new photovoltaic plant with the same installed capacity. The strategy

states that the government plans to build a total of 1,400 MW of photovoltaic installations, of which 250 to 400 MW are rooftop installations, while the rest are in various areas across the country.

The Just Transition Roadmap adopted in 2023 considers the social and economic challenges of structural change. It emphasizes the need for retraining programs and the promotion of new industries in traditional coal regions such as Bitola. Nevertheless, key challenges need to be overcome. These include the provision of financial resources, the adaptation of regulatory frameworks and close cooperation between national and local authorities, investors and energy consumers.

The government under Prime Minister Hristijan Mickoski also announced new investments in the energy sector in 2024 (DE International DOOEL Skopje 2024). This is intended to accelerate the expansion of renewable energies - particularly solar and wind power - and further increase energy efficiency in households, industry and the public sector (DE International DOOEL Skopje 2024).

Thanks to strategic partnerships and international support, significant progress has already been made. In particular, the expansion of large solar parks is progressing rapidly. In addition, the legal framework for small producers and energy communities has been improved to further promote decentralized energy generation.

The coming years will be crucial to consistently realize the ambitious climate targets and shape a sustainable, secure and climate-friendly energy future for North Macedonia. In order to achieve the desired climate targets, the heating sector must also be decarbonized. In this project, a feasibility study was carried out to analyse how Bitola's district heating network can be supplied with renewable energy.

Table 1: Political goals vs. reality – comparison

Area	Political objective	Actual status (2025)
Renewable energies	45 % RE share by 2040; coal phase out by 2027	Continued dominant role of fossil fuels in the heating sector
Technology prioritization	Equal promotion of all renewable technologies	Focus on solar and wind - geothermal energy largely ignored
Administrative reform	Simplified authorization procedures, digital application systems	Procedures still analogue, lengthy, not very standardized
Geothermal expansion	Local energy independence, emissions reduction through deep heat	No targeted funding, unclear responsibilities, lack of planning instruments

Table 1 "Political goals vs. reality - comparison" illustrates the gap between the goals formulated in strategy papers, laws and government programs and the current implementation status in the field of renewable energies in North Macedonia. This discrepancy is neither unusual nor exclusively negative. On the contrary, it provides important indications for necessary political adjustments.

1.1. Significance of the conversion of the district heating network in Bitola

The conversion of the district heating network in Bitola plays a central role in the North Macedonian energy transition. The city is currently heavily dependent on coal, particularly the REK Bitola lignite-fired power plant - the largest source of air pollution and CO_2 emissions in North Macedonia, with a serious impact on the climate, air quality and the health of the population.

Switching to renewable heat sources such as solar thermal energy, biomass or heat pumps brings numerous benefits: greenhouse gas emissions are drastically reduced, air quality is improved, and economic opportunities are created by investing in clean energy technologies. In the long term, heating costs for consumers would also fall or remain stable. At the same time, this change will create new jobs in the renewable energy sector and mitigate the social consequences of the coal phase-out.

A decisive step in the decarbonization of Bitola's heating system would be the use of geothermal energy via heat pumps. This stable and reliable source of heat would significantly reduce dependence on fossil fuels. Compared to coal, geothermal energy incurs hardly any fuel costs, which would make heating prices more stable and less dependent on global energy price fluctuations. In addition, less dependence on imported fossil fuels improves national energy security.

The district heating supply in Bitola was already considered when the thermal power plant was built in the 1980s. The district heating network is currently under construction in line with the national climate and energy plans to modernize the city's energy supply. In addition to the ecological dimension, economic, financial, and social factors are decisive for its realization.

Switching to renewable energy would drastically reduce the city's dependence on coal, improve air quality, and promote public health. Private households, public institutions, and commercial enterprises in particular, which currently use inefficient individual heating systems based on electricity, firewood or oil, would benefit from a modern district heating system.

North Macedonia has set itself the goal of phasing out coal by 2027 (with its contribution to the Powering Past Coal Alliance) and significantly reducing greenhouse gas emissions. The conversion of Bitola's district heating network is an important part of this strategy and is in line with the EU's energy transition policy. As a result, funds from the EU's climate and energy programs could also be used to finance the transition.

The city of Bitola can serve as a model region for geothermal heat supply - provided that the regulatory, financial and administrative conditions are created now. If these structural gaps can be closed, Bitola could serve as a model for other municipalities in the country - and the Republic of North Macedonia could take a decisive step towards a climate-neutral heat supply.

1.2. Objectives of the strategy paper

This strategy paper describes the necessary steps for the conversion of the district heating system in Bitola and the measures required for the successful modernization of this infrastructure. The aim is to provide policy makers at local and central level with clear guidance on how they can support

the transition to a sustainable heat supply through appropriate legal, political, and administrative measures.

The prerequisite for this is that the modernization of the entire district heating network in Bitola is given the highest political priority. To this end, decision-makers must be sensitized to the long-term economic, social, and environmental benefits of switching to renewable heat sources and the need to invest in modern technologies and systems.

The strategy paper also identifies existing regulatory barriers or gaps and makes recommendations for adjustments to facilitate the transition to a climate-friendly energy supply. These include setting specific targets and deadlines and creating suitable framework conditions.

The financial, regulatory, and technical challenges and possible solutions are discussed in detail in the following chapters.

2. Stakeholders in energy policy

North Macedonia's energy policy is characterized by a large number of actors at central, local and economic level.

The newly created Ministry of Energy and Mineral Resources plays a key role. It drew up strategies and legal requirements that form the basis for the development of programs based on renewable energies. Its tasks also include promoting cooperation with local authorities and private investors as well as enabling and supporting collaboration between local authorities and investors, particularly through the Investment Forum, Regional Forums, and its coordinating functions.

in order to encourage investment in energy transition. As an independent authority, the Regulatory Commission for Energy, Water and Municipal Waste Management (ERC) is responsible for authorizing market participants, monitoring legal regulations and setting grid charges and end customer tariffs. It contributes to market transparency, protects consumer interests and monitors technical efficiency and security of supply, particularly in the district heating sector. It is also involved in the integration of new market players and prevents monopolistic structures.

The state-owned energy company Elektrani na Severna Makedonija (ESM) plays a dominant role1, particularly in electricity generation. In addition to conventional electricity production, it also operates large parts of the existing heat generation plants. In addition, ESM is increasingly involved in the conversion of former coal-fired power plants to renewable technologies, as in the case of the Oslomej site.

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[1] The Annual Report of the Energy Regulatory Commission for 2024 states that AD ESM Skopje, a state-owned company, remains the largest producer of electricity in the Republic of North Macedonia in 2024, with a 58.31% share in total electricity production.

During these consultations, citizens can express their concerns, express support and provide feedback on the proposed projects. These debates are usually organized at the local government level and offer an opportunity for citizens to influence the decision-making process.

Before major renewable energy projects are built, an environmental impact assessment is required. This process involves the participation of local stakeholders, including citizens, in considering the project's effects on the environment.

Municipal councils, which are composed of elected local councillors, play a significant role in planning and approving renewable energy projects. These councils can vote on or reject projects based on decisions made by them.

The new Energy Act of 2025 recognizes energy cooperatives and citizen energy communities as independent market participants for the first time. These can jointly operate electricity and heat generation plants, store energy and market it directly. This gives citizens, companies and organizations the opportunity to actively participate in the energy transition - both through financial participation and by helping to shape decentralized projects.

International institutions also play an important role in the transformation process. The European Union, the European Bank for Reconstruction and Development (EBRD) and the World Bank provide funding, low-interest loans and technical support. Their programs aim to accelerate the expansion of renewable energies, reduce investment risks and support legal harmonization in the course of EU convergence.

Last but not least, private actors and technical experts also make a significant contribution. Planning offices, research institutions, technical service providers and specialized consulting firms support the implementation of complex infrastructure projects with studies, feasibility analyses and technical expertise. Financial institutions, on the other hand, assess the profitability of planned measures and provide capital to enable the realization of investment-intensive projects - for example in the field of deep geothermal energy or the modernization of district heating networks.

The following table provides an overview of the relevant players, their functions and their influence on the energy transition:

Table 2: Key actors, their roles and influence

Actor/stakeholder	Role	Power/influence
Government (Ministry of Economic Affairs and Labour, Ministry of Environment, Ministry of Energy, Mines and Mineral Resources)	Establishes the legal framework, creates incentives and monitors compliance	Establishes legal and political support, allocates public funds and enforces regulations.
Municipality (Municipality of Bitola)	Facilitates local implementation, issues permit and manages public infrastructure.	Facilitates local implementation, issues permit and manages public infrastructure.

Regulatory Commission for Energy and Water Supply	Monitors energy pricing (including thermal energy), grid Facilitates local implementation, issues permit and manages public infrastructure. connections and compliance with energy laws	Sets tariffs, regulates market conditions and ensures compliance with them
Private investors and property developers	Financing and development of renewable electricity and heat projects and installation of infrastructure	Provision of capital, coordination of project implementation and introduction of new technologies
District heating operators	Managing and distributing the heat supply to end users	Operating the infrastructure, setting heat prices and ensuring efficient distribution
Financial institutions (EBRD, World Bank, EU funds)	Provide loans, grants and funding for renewable energy projects	Offer financial support, assess the risks and influence the feasibility of projects
Research institutes and technical experts	Conduct resource assessments, feasibility studies and technology assessments.	Provide data, advise policy makers and recommend optimal (drilling) sites
Citizens and consumers	End users of district heating electricity and potential supporters of clean energy.	Reliable consumers and influencing policy through public support and adoption

2.1. Economic actors and their importance for the expansion of RE

The successful implementation of the energy transition in North Macedonia depends largely on the coordinated cooperation of various economic actors. The new Energy Act of 2025 clearly defines the roles and obligations of these groups for the first time, creating a reliable framework for cooperation, participation and market integration.

Landowners play a key role, as many renewable energy projects, particularly wind and solar parks and infrastructure measures, are built on private or agricultural land. Their consent is crucial for land utilisation, grid connection and project development. At the same time, new

sources of income arise for owners through lease agreements or participations in community energy projects[2].

Project developers act as a link between private owners, authorisation authorities and investors. They coordinate feasibility studies, environmental assessments, planning processes and tenders. The law obliges them to communicate transparently and to comply with technical, environmental and social standards, especially for projects of public interest [3]or of cross-border significance.

Grid operators, such as MEPSO for the transmission grid and the regional distribution grid operators, are responsible for the technical integration of new plants. The law stipulates transparency in grid connection procedures and clear deadlines for processing.

Energy supply companies, including the state-owned provider ESM, are key players in the modernisation of the energy infrastructure. They are investing in new technologies, digital control systems and flexible storage solutions. Their ability to implement innovations and enter into co operations is crucial for a future-proof energy supply.

Citizens are explicitly recognised as active market participants in the new law. They can not only purchase electricity, but also generate, store and market it themselves. For example, through photovoltaic systems on private roofs, as part of energy communities or in the form of investments in cooperatively organised projects. They also have a key role to play in energy saving and energy efficiency.

Farmers also have growing potential in the transformation process. Agricultural land offers ideal conditions for solar installations or wind power projects, while residues from animal

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[2] According to a study by TNC (The Nature Conservancy), even when excluding higher-protection areas (Important Bird/Plant Areas), the country has the potential to install up to 11 GW of photovoltaic (PV) capacity.
According to a study by the "Goce Delchev" University (Adjiski and Serafimovski, 2024), 11.6% of the country's surface area is classified as "highly suitable" for PV, which corresponds to a theoretical potential of 288 GWp.
If this is taken into account, along with the national Energy Development Strategy which foresees the installation of only 1.4 GWp, it becomes evident that the actual potential for PV deployment is significantly higher than current plans. This will likely influence landowners to become less willing to lease or sell their land without demanding higher prices.

[3] In the Republic of North Macedonia, the determination of public interest for projects is carried out through several legal mechanisms:
• By Special Law Adopted by the Parliament
When it comes to projects of public significance (e.g., infrastructure corridors, highways, gas pipelines), the Parliament adopts a special law that:
• Enables expropriation, and
• Appoints a strategic partner for implementation.
For example, such a law was adopted in 2021 for infrastructure corridors 8 and 10D.
• Law on Strategic Investments
This law defines that high-priority projects (e.g., over €50–100 million or projects spanning multiple municipalities) are considered of public interest through the status of a "Strategic Investment Project."
• Construction Law
This law states that national roads, railways, main gas pipelines, and other facilities of strategic national interest are considered constructions of public interest, as defined by law and urban planning projects.
• Law on Urban Planning
Under this law, public interest is defined within the scope of urban planning documents.

husbandry or crop cultivation can be used to produce biogas. The government is promoting these developments through targeted programmes, tax breaks and technical advice in order to tap into synergies between agriculture and the energy transition.

Industry and commerce are also playing a growing role. In addition to the use of renewable energies for self-supply, they are involved in demand-side management programmes and long-term power purchase agreements (PPAs).

Financial institutions provide capital - in the form of loans, grants or guarantees - and examine the economic viability and risks of projects, thereby playing a key role in determining the feasibility of cost-intensive projects in particular, such as deep geothermal drilling or the expansion of heating infrastructure.

In recent years, a range of coordinated mechanisms have been established to further support clean energy investment. One of the most prominent is the Green Finance Facility (GFF), led by the European Bank for Reconstruction and Development (EBRD) in cooperation with UNDP and national authorities. By mid-2025, this initiative had mobilized €30 million in credit lines for local banks, resulting in over $15.8 million invested in 115 solar and energy efficiency projects. Targeted support measures included an additional €4 million for Sparkasse and €3.5 million for Komercijalna Banka, specifically designed to ease access to finance for SMEs and households.

On a larger scale, premium feed-in tariffs and transparent solar PV concessions have helped reduce market uncertainty and attract public-private partnerships, such as the Oslomej solar park. Major private investments like Alcazar Energy's $500 million wind project highlight how regulatory clarity and strong institutional frameworks can unlock transformative infrastructure development.

Seed funding from the Climate Investment Funds (CIF) has also had a significant impact. With $85 million in initial capital, it has catalysed an additional $591 million in co-financing from development banks and private investors.

All of these efforts are coordinated under the umbrella of the Just Energy Transition Investment Platform (JETIP), which brings together key stakeholders from the public and private sectors. Its governance structure includes several important components:

The Investment Forum serves as the main channel for private sector engagement. It brings together chambers of commerce, business associations and individual companies to identify investment opportunities and barriers. It supports the adoption of green technologies, facilitates public-private partnerships and offers businesses a voice in shaping regional development strategies.

The JETIP Steering Committee, co-chaired by the Ministry of Economy and the EBRD, aligns financial instruments with national priorities and JET objectives. It works to de-risk investments by clarifying eligibility criteria and promoting blended finance models, including capital expenditure grants, concessional loans and technical assistance.

The Technical Support Unit (TSU) supports project development by maintaining a central pipeline of eligible projects. It assists investors with project matching, provides information on financing instruments and helps reduce entry barriers through technical guidance.

The Ministry of Finance contributes by defining fiscal rules, allocating public funds for approved projects and ensuring investment-friendly regulation. Projects must pass transparent

evaluation and selection procedures before becoming eligible for public funding, providing reassurance to co-investors.

Regulatory and permitting processes are streamlined through cooperation between the ministries of energy, environment and transport. This includes support for grid integration, permit issuance and long-term policy predictability, all of which are critical for investor confidence.

At the regional level, Just Transition Forums bring together municipalities and local businesses to co-develop projects. This strengthens ownership, reduces opposition and improves project bankability.

Finally, the organization of annual investor roundtables and the availability of investment pipeline information ensure transparency and continuous engagement from economic actors.

Altogether, these mechanisms illustrate how a broad and well-coordinated ecosystem of economic actors is not only facilitating but actively shaping the energy transition in North Macedonia.

Table 3: Important economic actors and their role in the expansion of renewable energies

Actor	Role in the expansion of renewable energies	Importance for geothermal district heating
Landowners	Provide land for renewable energy plants (PV, wind, geothermal) and conclude lease or participation agreements	Provision of suitable sites for drilling and surface infrastructure
Project developers	Coordinate the planning, authorisation, financing and implementation of RE projects	Take over the technical and financial realisation of geothermal projects
Grid operator	Responsible for the connection, integration and control of decentralised renewable energy systems; compliance with grid standards	Integration of geothermal heating systems into existing district heating systems
Energy supplier	Sales of electricity and heat to end customers, tariff design, customer communication	Organisation of heat supply, billing and distribution
Citizens/households	Energy consumers, but also potential prosumers with their own PV or heating systems	Demand for renewable district heating strengthens economic efficiency
Citizen energy communities	Joint generation, utilisation and marketing of renewable energies by groups of citizens	Operation of community heat supply systems in residential areas
Farmers	Utilisation of agricultural land for PV or wind, utilisation of residual	Utilisation of agricultural land for PV or wind, utilisation of residual

	materials for biogas, participation in projects	materials for biogas, participation in projects
Industry and commerce	Utilisation of RE for self-supply, participation in demand side management and PPA models	Utilisation of geothermal heat in processes with low to medium temperature levels
Financial institutions	Granting of loans, subsidies, financing guarantees; risk assessment and project appraisal	Financing of deep drilling and infrastructure development

2.2. Regulatory Commission for Energy, Water and Waste Management (ERC)

The Regulatory Commission for Energy, Water and Waste Management (ERC) is the central regulatory authority for the North Macedonian energy market. It plays an independent role in the sustainable development of the energy system in North Macedonia. T

he institutional framework of the ERC stipulates that its management members items are appointed by parliament. An internal statute regulates the working methods, decision-making and organisational structure of the authority. The Commission prepares an annual activity report and submits it to the government and the public.

With the adoption of the Energy Act 101/2025, its competences were significantly strengthened and adapted to European requirements. As an independent, politically and financially autonomous institution, it ensures the stability and fairness of the market. Its tasks include the approval of new market participants, i.e. the issuing of licences for electricity, gas and heat suppliers, the monitoring of legal requirements, the control of grid operators, including the setting of grid charges and end customer tariffs. Particular attention is paid to the protection of consumer rights, especially those of socially disadvantaged groups.

In addition, the Commission issues technical regulations and market rules to facilitate the integration of renewable energies into the system. It ensures that prosumers, aggregators and citizen energy communities can participate in the market under fair conditions and sets binding standards for the cyber security of critical infrastructures.

The ERC is also the point of contact for resolving disputes between consumers and energy companies as well as between the market players themselves. At the same time, it monitors cross border trading activities and ensures that dominant market positions are not abused. In cooperation with neighbouring countries, the Commission is involved in the harmonisation of regional energy markets, particularly in electricity trading and capacity management. The introduction of digital market surveillance instruments is an important step forward. Smart metering systems, standardised billing procedures and transparent pricing models are intended to strengthen consumer protection and increase market transparency. The ERC also regularly assesses the economic viability and technical safety of new technologies such as storage and electromobility.

Another focus of the ERC's work is on the heating sector. Operators of district heating systems are now subject to stricter efficiency and inspection requirements in order to drive energy

savings and reduce emissions. However, pricing remains centrally regulated, which could be more decentralised and adapted to local conditions in the future.

Overall, the ERC ensures the functioning of the energy market, promotes investment in new technologies and protects the interests of consumers. Its independent role is crucial for the trust of market participants and the sustainable development of the energy system in North Macedonia.

Table 4: Core tasks of the Regulatory Commission for Energy, Water and Waste Management (ERC)

Area of responsibility	Responsibility for
Licensing	Authorisation for electricity, gas and heat suppliers and grid operators
Market supervision and regulation	Monitoring compliance with legal requirements, prevention of market dominating practices
Tariff design	Determination and review of grid charges and end customer tariffs
Technical market rules	Development of standards for feed-in, grid stability and integration of renewable energies
Prosumer and community participation	Promoting the participation of prosumers, aggregators and energy communities
Cybersecurity Dispute	Introduction of binding security standards for critical infrastructures Arbitration of conflicts between market players and consumers
Dispute resolution	Arbitration of conflicts between market players and consumers
Digital market monitoring	Introduction of smart meters, monitoring of transparency and pricing
International market integration	Cooperation with neighbouring countries in cross-border electricity trading Energy cooperatives
Heat efficiency and inspections	Monitoring energy efficiency in the district heating sector, introduction of inspection obligations

2.3. Citizen Energy Communities

In recent years, the legal framework for citizen participation in local electricity generation in North Macedonia has been significantly expanded. Two key instruments define this field: the Law on Cooperatives (Official Gazette No. 101/2023) and the Energy Law (Official Gazette No. 101/2025).

The Energy Law of 2025 introduces the concept of Citizen Energy Communities (CECs) as a comprehensive and legally defined form of energy-related cooperation. CECs are recognised as market actors with specific rights and responsibilities under the energy regulatory framework. They may take the form of cooperatives, associations or other legal entities, and can participate in electricity production, grid operation, storage, supply, aggregation and energy services provision.

As such, energy cooperatives represent a possible organisational form within the broader legal category of Citizen Energy Communities. All energy-related activities of cooperatives are governed by the Energy Law, and cooperatives wishing to engage in electricity production or supply must meet the conditions laid out in Article 183 of the Energy Law.

The Cooperatives Act defines a cooperative as a voluntary association of at least five natural or legal persons for the realisation of common economic, social or ecological interests. In addition to agricultural, housing and craft co-operatives, energy co-operatives are also expressly provided for. These can be active in the field of electricity or heat production, distribution or use and can be organised on a municipal or private sector basis. The law also regulates the registration, internal structures and dissolution of such organisations.

The Ordinance on Renewable Energies specifies the conditions under which small, decentralised generation systems may be operated. It differentiates between households, homeowners' associations, small companies and public institutions. These may operate photovoltaic or small wind power systems for their own supply and feed surplus electricity into the grid if certain conditions are met: The installed capacity must not exceed 6 kW for households and 40 kW for public institutions, the system must be installed on a building owned or leased by the owner, parallel supply by an energy supplier is excluded and the technical connection conditions must be complied with[4]. The technical connection conditions and grid rules must be complied with.

The new Energy Act of 2025 also recognises citizen energy communities as an independent legal form. These can be made up of private individuals, municipalities or small and medium-sized enterprises and primarily pursue joint ecological, social or economic goals. They may generate, store, sell and aggregate electricity and invest in charging infrastructure or energy efficiency projects. They are given easier access to subsidies, tax relief and grid connections.

Overall, North Macedonia has created an important basis with this legislation to systematically enable citizen participation, decentralised energy transition and community energy projects. The combination of civil society self-organisation (via cooperatives) and legally protected market integration (via the Energy Act) provides a viable basis for a participatory, sustainable energy strategy.

Table 5: Comparison of prosumer/citizen energy community and energy cooperatives

Criterion	Prosumers	Energy Cooperatives	Citizen Energy Communities (CECs)

[4] A prosumer (consumer–producer) has the right to deliver surplus electricity into the distribution grid only if they are supplied by a regular supplier with whom they have a valid contract, and not under last-resort supply. According to the Rulebook on Renewable Energy Sources (2024), this restriction is introduced to ensure technical and legal alignment between contractual parties, since last-resort supply is intended as a temporary, emergency measure in cases where the consumer is left without an active supply contract — for example, due to supplier bankruptcy or non-compliance with market rules.
The Energy Law (Article 9) stipulates that last-resort supply may not last longer than 90 days, after which the consumer must resume supply through a standard contract with a supplier. Only within such a contractual relationship does the prosumer gain the right to inject surplus electricity produced from photovoltaics into the grid and to benefit from compensation mechanisms or financial returns.

Legal Basis	Defined in the Energy Law as active customers	Regulated under the Law on Cooperatives	Defined in the Energy Law (Art. 183); may be established under the Law on Associations and Foundations or Cooperatives
Legal Form	Individual (natural persons or legal entities)	Cooperative with joint ownership and democratic control	Legal entity with open and voluntary membership
Ownership Structure	Individual ownership	Joint ownership among members	Shared ownership among natural persons, municipalities, and/or companies
Main Activities	Generation and self-consumption of electricity (mainly solar PV)	Varies depending on type (e.g., energy cooperatives focus on renewable generation, supply, or services)	Generation, supply, distribution, aggregation, storage, energy efficiency, EV charging, etc.
Market Role	Mainly self-consumption and limited surplus feed-in	Project development, energy service provision, community benefits	Broader scope including full participation in electricity markets and closed distribution systems
Grid Access	Standard access for households or businesses	Depending on cooperative agreements and grid capacity	Can operate own closed distribution network or access public grid under fair and transparent terms
Profit Orientation	Typically, non-commercial/self-sufficiency	Economic participation with possible surplus distribution	Primary goal is social, environmental, or local economic benefit rather than profit
Governance	Individual decision-making	Democratic: one member, one vote	Democratic and transparent governance; must publish rules on membership, decision-making, and profit use
Permitting & Regulation	Subject to simplified rules for small-scale systems	May require permits depending on size and scope of activity	Subject to licensing and regulatory requirements; may be granted operator status
Key Advantage	Simple entry, low threshold	Local value creation, democratic control	Broad range of activities, legal backing, access to support schemes and regulatory privileges
Barriers/Challenges	Upfront investment cost, limited support programs	Limited access to finance and market opportunities	Complexity of setup, licensing burden, need for coordination among multiple actors
Examples	Rooftop PV installations by households or SMEs	Local energy cooperatives developing small-scale RE projects	Community-driven multi-actor projects with grid operation or aggregated energy services

3. Excursus How is the energy price made up?

Pricing in the energy sector in North Macedonia is regulated in detail in Energy Law 101/2025 and in several regulations issued by the regulatory authority (ERC). The aim is to ensure fair, transparent and cost-covering energy prices. Both in the electricity and gas sector as well as in the heat supply sector.

In the electricity and gas market, Article 54 and 61 of the Energy Law (Official Gazette of the Republic of North Macedonia" No. 101/2025) defines the ERC as the body responsible for setting and monitoring prices in regulated areas. The Commission issues binding methodologies and regulations on the basis of which network charges and retail tariff prices[5] are calculated for regulated suppliers. These methods are based on principles such as objectivity [6], cost recovery, transparency and non-discrimination. At the same time, the pricing considers long-term investment requirements, consumption management measures and the costs of decentralised energy generation.

In the area of heat supply, the relevant requirements are contained in Articles 237 to 246 of the Act. These include the granting of licences to producers, distributors and suppliers of thermal energy, the obligation to draw up technical network rules and to ensure a continuous, secure and quality but assured supply to end consumers. The operators of district heating systems - regardless of whether they are public, private or organised in partnership models - must fulfil grid connection conditions, operating requirements and information obligations, which are reviewed and approved by the ERC.

For the operational implementation of these legal provisions, the regulatory authority has adopted the regulations on pricing for thermal energy and ancillary services (Official Gazette no. 225/2023 and no. 153/2024). Among other things, it defines how the regulated thermal energy price is determined, which procurement costs are taken into account, how average prices are calculated over certain periods and how the end customer tariff is made up of supply, distribution and operating costs. It also contains provisions on the procedure for the submission and review of price applications by licensed companies and on the maximum turnover limits permitted in the regulated area.

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[5] The term "retail tariffs" refers to both electricity and natural gas, but only within the regulated segment of the market—that is, where consumers are supplied by the so-called universal supplier or last-resort supplier, and not through the liberalized market.
Retail tariffs include:

- Tariffs for households and small consumers who have not chosen a supplier on the free market.
- Tariffs for last-resort supply (in cases where the user is left without a supplier).
- Tariffs related to natural gas supply, if a regulated supplier exists.

In these cases, the Energy Regulatory Commission (ERC) has both the right and the obligation to approve the pricing methodology and tariff levels, in accordance with the principles set out in the law.

[6] The principle of objectivity, in the context of the ERC's methodologies, means that:
Prices are not determined arbitrarily, but according to standardized economic and technical criteria.
All costs that are real, justified, and supported by documentation may be considered.
Favouritism toward certain entities is not permitted – i.e., all regulated suppliers are treated equally under the same rules.
The ERC uses explicit formulas, parameters, and input data (such as allowed rate of return, depreciation, operational costs, etc.) that must be based on real market and regulatory indicators.

The regulation therefore affects the entire heat supply chain: from generation to distribution and delivery to the end consumer. By applying standardised methods, deadlines and reporting obligations, the ERC not only ensures planning certainty for suppliers, but also transparency and fairness for consumers. In addition to economic and social aspects, price regulation also takes into account environmental policy objectives as well as requirements for security of supply and technological development.

The Energy Regulatory Commission uses these instruments to ensure that prices are comprehensible, socially balanced and economically viable - taking into account environmental goals, security of supply and investment incentives. By introducing binding methods and deadlines, the regulatory framework also improves predictability for suppliers and creates legal certainty for consumers.

Table 6: The final energy price in North Macedonia: components and analysis

Component	Description	Impact on renewable energies and geothermal heating
Generation costs	Costs for fuel, operation, maintenance, investments and depreciation in generation	Renewable energies have lower operating costs; high initial investment for geothermal energy
Grid and distribution fees	Charges for utilisation, operation and expansion of the electricity and heat distribution grid	New renewable energy projects can cause additional grid connection costs[7]
System services	Costs for grid stability, system reserve, voltage maintenance, etc., regulated by ERC	Geothermal energy can reduce system costs through base load capability; wind and PV increase the need for flexibility and, in some cases, reserve capacity
CO_2 costs	Taxation or certificates for CO_2 emissions from fossil fuels	Improves competitiveness of emission-free technologies such as solar, wind and geothermal energy
Subsidies and funding	State premiums, investment grants, feed-in tariffs, net metering regulations	Solar and wind projects benefit more; geothermal energy has so far received less direct funding
Taxes and levies	Value added tax, local energy levies, excise duties	Reduction of taxes on RE possible; high fossil fuel taxation indirectly promotes geothermal systems
Regulatory requirements	Requirements of the Energy Regulatory Commission (ERC) - tariff systems, licences, price controls	Simplification of procedures can promote RE projects; uncertainty regarding price caps inhibits investment

[7] When there are new investments, connection from the plant to the substation is on the energy producers. Still, regarding utilisation, operation, and expansion of the electricity and heat distribution grid, the grid operator bears those costs.

4. Need for action and recommendations

The successful conversion of the district heating system in Bitola and other cities in North Macedonia to geothermal and other renewable heat sources requires a determined, strategically coordinated and multidimensional approach. While the legal basis has been created with the Energy Law 101/2025 and accompanying regulations, there has so far been a lack of consistent operational implementation, particularly at local and cross-sectoral level.

A key obstacle is the lack of a national heat transition strategy that is open to all technologies and formulates clear goals, funding paths and technical standards. Although the Energy Efficiency Act mentions certain technologies, including heat pumps and CHP, there is a lack of

- binding specifications for the gradual decarbonisation of existing heating networks,
- targeted financial support instruments for capital-intensive projects (e.g. boreholes, solar collector arrays, storage facilities),
- a regulatory environment that ensures the feed-in of renewable heat, third-party access to heating networks and economic viability guarantees

A national heating strategy should address six central fields of action:

1. Legal and regulatory reforms

2. Financing and investment incentives

3. Institutional coordination and decentralisation

4. Technical and administrative capacity development

5. National political consensus for a long-term strategy

6. Infrastructure and market development

4.1. Legal and regulatory reforms

The Energy Efficiency Act (Official Gazette no. 32/2020 ff.) forms the legal basis for the building sector. It obliges building owners to carry out an energy analysis for new buildings and extensive renovations. The aim is to promote the use of highly efficient alternative systems such as heat pumps, combined heat and power generation or decentralised renewable solutions. This is supplemented by the building regulations (Official Gazette no. 94/2013 ff.), which stipulate minimum insulation standards, limits for primary energy consumption and the use of solar thermal systems in public buildings. The Building Act in turn regulates, among other things, the obligation to connect to the gas infrastructure in cities and stipulates the calculation of energy requirements in the authorisation process. Despite this progress, building law remains fragmented across technologies and heating systems. Important transformation instruments such as neighbourhood heating, large heat pumps or municipal storage solutions are barely covered by law.

Lack of definition of renewable heating technologies

The Energy Act 101/2025 has comprehensively modernised the energy market but remains imprecise in the area of renewable heat. There is no clear definition of which technologies fall under the term "renewable heat". While photovoltaics and wind power are clearly regulated by law, geothermal energy, solar thermal energy, large heat pumps and biomass remain under-regulated.

This gap makes eligibility for subsidies, planning security and market access more difficult.
Solution: A clear legal classification of renewable heating technologies is needed - supplemented by standardised criteria for eligibility, technical requirements and approval obligations.

Geothermal energy and heat pumps: insufficient legal anchoring
These regulatory gaps are particularly evident in the area of geothermal district heating. Although the Energy Act specifies responsibilities and minimum standards, it only deals with key aspects - such as drilling authorisations, environmental impact assessments or minimum technical requirements - in passing. There are also no specific regulations for neighbourhood-based heat pump systems that use environmental heat. In order to trigger investments, sector-specific legal provisions are needed, either as a sub-law or as a clear section within the Energy Act.
Solution: A separate sub-law or a precise section in the Energy Act should provide technical, legal and subsidy policy safeguards for geothermal and environmentally based heating solutions.

Standardised regulation of grid connection to district heating
To date, district heating networks have been largely focussed on fossil sources. The regulatory framework offers neither clear rules for the connection of renewable heat generators nor for the distribution of grid costs or access for private providers.
Solution: The introduction of a statutory feed-in priority for renewable heat sources, comparable to the electricity sector, would strengthen decentralised generation and create fair competitive conditions. Uniform standards for grid connection fees and transfer points are also necessary.

Economic efficiency and subsidies remain insufficiently regulated
Price caps in the regulated heating sector prevent cost-covering business models, particularly for capital-intensive technologies such as geothermal energy. There is no maximum limit for the connection fee to the district heating network. In accordance with the legal framework, operators prepare network rules for the distribution of thermal energy, which include a methodology for calculating the connection fee[8]. At the same time, there is a lack of targeted funding programmes for renewable heat, while international financing instruments are mostly focused on electricity sector projects.
Solution: Regional pricing leeway, bonus models for renewable heat, technology-neutral tenders and a national heat transition fund could improve investment security. Storage solutions and cross system projects should be explicitly eligible for funding.

Further strengthen the position of energy cooperatives
The Energy Act 2025 recognises energy cooperatives as stakeholders. However, their involvement in funding programmes and heat planning has not yet been specifically regulated. Cooperative law also does not provide a sufficient basis for their economic viability.
Solution: Clear regulations are needed on formation, tax status, eligibility for subsidies and integration into municipal planning processes. Harmonisation between energy, cooperative and tax law is required. This should be flanked by a citizens' energy strategy. In other words, a roadmap for creating as many energy cooperatives as possible.

Simplify and digitalise approval law - strengthen the participation of civil society
Approval procedures for renewable heating systems are complex, lengthy and mostly analogue. Responsibilities are not clearly allocated, which penalises smaller players in particular. Solution: A

[8] The Energy Regulatory Commission approves the network rules for the transmission and distribution of the respective type of energy, adopted by the relevant system operators. These rules include the methodologies for calculating connection fees.

digital one-stop-shop procedure with standardised requirements and fixed deadlines would increase transparency and efficiency. Participation rights for environmental organisations and citizens' initiatives should be secured by law in order to increase local acceptance. Lack of expansion targets and storage integration to date, there are neither binding expansion targets for renewable heat nor legal requirements for the integration of storage technologies into municipal heating plans.
Solution: The definition of sector-specific target paths and the mandatory integration of storage systems into regional heating plans would promote planning security and system stability.

Citizen Energy Communities can not directly engage in thermal energy systems.
Under the current Energy Law, Citizen Energy Communities (CECs) are primarily focused on electricity. However, through energy efficiency services and other energy-related services, they can indirectly engage in thermal energy systems—particularly in cases involving innovative, decentralized, and low-emission solutions.
Solution: To clarify and expand this possibility, further regulatory elaboration and/or amendments to the Energy Law and the Energy Efficiency Law are needed.

The regulatory framework provides a solid basis for electricity and energy efficiency, but the cross sectoral heating transition remains inadequately regulated. Targeted further development of the Energy Act, clear technological definitions and coherent funding mechanisms are required in order to create planning security, mobilise investment and legally secure the heating transition.

4.2. Financing and investment incentives

The transformation of the heat supply in North Macedonia towards renewable energies is technically possible but often fails in practice due to inadequate financing conditions.

Financing programmes for renewable heat are lacking
While increasingly functioning funding mechanisms have been established for electricity from photovoltaics and wind power, there is a lack of comparable instruments in the heating sector. Projects for the use of solar thermal energy, large heat pumps, biomass or geothermal energy often require high initial investments, the economic risk of which can hardly be borne by municipal or co operative sponsors.
Solution: A national funding programme for renewable heat that is open to all technologies should provide targeted support for initial investments in solar thermal energy, heat pumps, biomass heating plants and municipal geothermal projects. In addition, a national heating fund can enable the financing of feasibility studies, storage integration and system design - especially for municipalities with limited resources.

Financing threshold for municipal and citizen-led projects
To date, national funding programmes have primarily addressed large energy companies or private investors. Local initiatives often fail due to the financing threshold, as municipalities have neither their own funding nor access to low-interest loans. In particular, this hinders the development of municipal heating plans, the creation of operator models or the establishment of local heating networks. This gap not only jeopardises the expansion of renewable heat sources, but also the goal of a socially balanced heating transition.
Solution: Local authorities should be given direct access to subsidies and low-interest loans.

Special grant programmes for heat planning and project development as well as advisory services for applications can help to lower the barriers to entry.

Lack of risk-sharing instruments
Projects such as geothermal exploration drilling or large-scale solar thermal plants are associated with considerable financial risks. Without subsidies, loan guarantees or tax relief, such projects remain economically unviable for smaller players.
Solution: A state-backed guarantee system - such as loans with risk assumption or exploration subsidies - can create planning security. Tax depreciation models for climate-neutral heating technologies are an additional incentive.

Limited access to international funding sources
Numerous international funds (e.g. Green Climate Fund, EBRD, IPA III) offer financing opportunities in principle but are often difficult to access for small cities and municipal initiatives.
Solution: A national clearinghouse or advisory centre for international funding sources can help to make available funds accessible in a targeted manner. It should support municipalities and cooperatives with applications, project design and implementation.

Lack of economic incentives in ongoing operations
Even if investments are made, ongoing operating costs remain a challenge. Without feed-in tariffs or other forms of economic recognition, there is little incentive to provide renewable heat on a permanent basis.
Solution: Feed-in premiums for renewable heat, tax benefits for grid investments and clear rules for depreciation and cost reimbursement can significantly improve the investment climate.

Weak financing options for energy cooperatives
Despite their social relevance, energy cooperatives have so far received little consideration in funding instruments. They lack start-up capital, planning security and access to the grid.
Solution: Start-up grants, standardised feed-in contracts, simplified access to funding programmes and legally secured grid integration can strengthen cooperatives as stakeholders and improve their economic capacity to act.

Little innovation funding in the heating sector
The development of new, systemic solutions - such as the combination of solar thermal energy, heat pumps and seasonal storage - is hardly supported by research funding or real-world laboratories.
Solution: Targeted innovation funding with pilot projects, research collaborations and regional competence centres can accelerate technical development, market maturity and the recruitment of skilled workers.

A stable investment environment is created not only through financial support, but also through institutional reliability (see section 4.1). Investors need transparent and long-term rules for heat prices, subsidy commitments and award processes.

4.3. Institutional coordination and decentralization

The implementation of renewable heating systems in North Macedonia is hampered by a number of institutional barriers. Despite the Energy Law 101/2025, there is still a lack of clarity regarding responsibilities, authorisation processes and planning procedures - particularly for complex

technologies such as geothermal district heating, large-scale solar thermal systems or large heat pumps.

Fragmented responsibilities hinder expansion
A central problem is the inadequate demarcation between the ministries at national level, the regulatory authority ERC and the municipal administrations. There are no clear authorisation paths for many technologies. This results in overlaps, contradictory requirements and lengthy procedures. The interfaces with planning law, building regulations and environmental impact assessments are also not systematically harmonised - especially in the case of hybrid projects with cross-sectoral components.
Solution: Responsibilities must be clearly defined and legally secured. Standardised procedures and coordination mechanisms at all administrative levels create reliability and predictability.

Lack of procedural standards and digitalisation
Approval procedures for heating systems are still largely analogue and decentralised. They differ from municipality to municipality, are not standardised in terms of time and often lack transparency. This makes it difficult for smaller project sponsors in particular to realise complex projects.
Solution: The introduction of a digital one-stop-shop portal for renewable heating projects is urgently needed. Standardised application forms, fixed deadlines and centralised project monitoring could simplify and speed up processes.

Low grid flexibility and lack of storage integration
The existing district heating network is designed for centralised, fossil-fuelled generation. There is a lack of flexibility for decentralised feed-in, storage integration or load shifting. Technical standards for coupling different heat sources are not established.
Solution: Network planning must be more strongly orientated towards flexible systems and seasonal storage solutions. Municipal heating plans should be obliged to take storage capacities and different source types into account.

Lack of strategic control at national level
Although sectoral strategies exist, there is a lack of a coordinated implementation mechanism. There is a lack of strategic coordination between the levels, particularly in cross-sectoral projects involving solar thermal energy, geothermal energy and heat pumps.
Solution: The establishment of a national coordination body with representatives from ministries, the ERC, municipal umbrella organisations, energy cooperatives and the private sector is necessary. This body should be responsible for pilot projects, technical guidelines and cross sectoral standards.

Expand public participation
Social acceptance remains a key factor. So far, public participation has often only been formalised. Transparent procedures and early information are lacking. Local stakeholders are crucial to the success of a project.
Solution: Publicly accessible project platforms, regular consultations and targeted information campaigns can create trust. The possibility of financial participation - e.g. via cooperatives - should be systematically strengthened.

Utilising international cooperation
North Macedonia can benefit from international partnerships through knowledge transfer, model projects or access to EU funding programmes. So far, however, there has been a lack of systematic

integration of these resources into national planning processes.
Solution: The targeted integration of European and multilateral support programmes into national strategies can promote innovation and open up additional funding opportunities.

The heating transition in North Macedonia needs a new institutional balance: between state control, municipal implementation and private investment. Clearly defined responsibilities, digital processes and coordinated governance structures at all levels are the prerequisite for removing planning obstacles, building trust and enabling local value creation. Overall, there is a need for a better balance between state control, local authority competence and private willingness to invest. Only if all levels work together effectively can planning obstacles be overcome, investments mobilised, and sustainable local value creation realised.

4.4. Technical and administrative capacity development

Initiate comprehensive skills development
Despite growing requirements for system integration, funding applications and operational management, many administrations, companies and institutions lack the necessary knowledge and skills. Training programmes for technical, legal and economic aspects of the heating transition have hardly been available to date.
Solution: A national training and advisory programme should specifically address all levels of stakeholders, from municipal energy planners to project developers and investors. The content should convey technical standards, authorisation procedures, business models and funding mechanisms in a practical way.

Involving science and research
Science and research have so far played a subordinate role in the North Macedonian heat transition. Universities, universities of applied sciences and research institutes could be key partners in the development and testing of innovative technologies, for example for seasonal storage, emission-free district heating networks or digital control and monitoring solutions.
Solution: Research institutions should be specifically involved in projects - e.g. through real-world laboratories, pilot plants or innovation partnerships with industry and local authorities. The establishment of regional innovation clusters could also promote practical solutions, for example in the areas of waste heat utilisation, hybrid supply or storage technologies.

Creating reliable framework conditions for private investment
Private companies are indispensable players in the planning, construction and operation of renewable heating systems. However, in many places there is a lack of clear tendering conditions, stable funding frameworks and transparent authorisation processes. This discourages investors and inhibits innovation. Capital-intensive projects in particular, such as geothermal heating networks or long-term storage systems, require long-term security.
Solution: Reliable political framework conditions are needed - in particular open-technology tenders, standardised contract models and coordinated funding programmes. The public sector and private providers should work together at an early stage to design these instruments.

Structural weaknesses in the planning and installation sector
The switch to complex heating systems also poses challenges for the energy market itself. Planning offices, installation companies and technical service providers often do not have the expertise to design or implement systemic solutions such as the combination of solar thermal energy, large

heat pumps and storage tanks. There is also a lack of practical planning guidelines and standardised tender documents.
Solution: The establishment of a national training and competence network - e.g. with the involvement of chambers, professional associations and training institutions - can help to disseminate expertise. In addition, reference projects, planning aids and open-source tools should be made publicly available.

Lack of municipal control capacities
According to the law, local authorities are key players in heat planning. In practice, however, there is often a lack of qualified personnel, technical expertise and financial resources. Smaller towns in particular, such as Bitola, have hardly any opportunities to develop their own strategies, provide advisory services or coordinate investments. There are hardly any advisory structures for municipalities, such as NGOs or energy agencies.
Solution: Municipalities should be given binding responsibilities for heat planning - including direct access to funding, independent project responsibility and local participation models, e.g. via cooperatives or municipal utilities. An important starting point is the introduction of municipal heating project coordinators. These could act as an interface between ministries, project developers and local stakeholders, support approval processes, moderate conflicts and facilitate access to advice and funding.

Bitola as a real-life laboratory
To date, there has been a lack of transferable best-practice projects that can serve as a reference for other cities. Without tried and tested role models, many stakeholders remain hesitant.
Solution: Bitola should be developed as a real-life laboratory for a systemic, Europe-compatible heat transition. With its existing district heating network, diverse generation potential and high emissions reduction potential, the city offers ideal conditions. Experiences from Bitola could be transferred to other cities - such as Skopje, Kumanovo or Prilep - and thus accelerate the national heat transition process. The heat transition in North Macedonia is not just a question of technology, but also of skills. Technical and administrative capacities must be systematically built up - across all levels. Only with targeted education and support structures, embedded research and a reliable investment environment can the market ramp-up of renewable heat succeed.

4.5. National political consensus for a long-term strategy

Lack of a strategic framework and cross-party consensus
The transformation of the heating sector in North Macedonia has so far proceeded without a coordinated long-term political strategy. Although sectoral goals, laws and programmes exist, there is no binding, cross-party framework with clear priorities, timelines and responsibilities. This uncertainty makes it difficult for local authorities, private investors and citizens' initiatives to plan and sustainably implement projects. There is also a lack of an overarching political signal that makes the heating transition understandable as a task for society as a whole.
Solution: A national heating transition roadmap with binding expansion targets, technology priorities and financing mechanisms should be adopted by a consensus of all relevant political players. Only a cross-party commitment will create the trust that requires long-term investment and social support.

Shaping the energy transition as a social and democratic process
The transformation of the heating sector is not just a technical or economic challenge, but also a

social and political process. In the past, the energy transition in North Macedonia was primarily organised top-down, without the systematic involvement of local stakeholders or the general public. This has led to uncertainty, acceptance problems and conflicts during implementation, especially for projects with a local environmental impact or high visibility. In many municipalities, there is a lack of legally enshrined opportunities for citizens to have their say and transparent procedures for early information and consultation. Civil society players such as environmental organisations, energy cooperatives or social initiatives have also hardly been structurally integrated into decision-making processes to date. (See point "Expanding public participation" in 4.3)
Solution: The heating transition must be organised as a process for society as a whole, in which the population is not only informed but also actively involved. Citizens should be involved in municipal heating planning, infrastructure decisions and energy projects at an early stage and in a binding manner - for example through public hearings, participation procedures or the participation rights of interest groups. At the same time, new formats of co-determination should be promoted, for example through participation in energy cooperatives or citizen-financed local heating projects. At national level, the involvement of civil society organisations should be secured by law and institutionally supported at local level - for example through funding programmes for participation formats, transparency obligations in approval procedures or advisory services for citizen participation. This will create a democratically legitimised, socially just and sustainable heating transition.

Mitigating social hardship - ensuring social acceptance
The reorganisation of the energy infrastructure particularly affects regions with a high dependency on fossil fuel structures - such as coal mining, outdated district heating supply or emissions intensive industry. Without social policy support, there is a risk of job losses, structural disruption and social polarisation.
Solution: Retraining and qualification programmes, the conversion of industrial infrastructure and regional structural support are key building blocks for a just transition. Funding instruments must not only be technology-orientated but also have a socially equalising effect. The heating transition must not create social imbalances but must be seen as an opportunity for regional development.

Promoting the cultural anchoring of the heating transition
Social support for the energy transition also depends on how strongly it is anchored in everyday knowledge, education and public communication. A lack of information, scepticism towards new technologies or a lack of understanding of interrelationships hinder change.
Solution: Systematic educational programmes are needed - from schools and public information campaigns to energy advice for households. The heating transition must not only be technically feasible but also culturally compatible. It should be communicated as a shared task for the future that strengthens quality of life, security and social participation.

The heating transition in North Macedonia is not a purely technical reform, but a social, cultural and democratic transformation process. Only a broad political consensus that extends beyond legislative periods can create the conditions for commitment, participation and justice. A just heating transition is not the goal of one party - it is a project for society as a whole.

4.6. Infrastructure

Insufficient technical basis for a renewable heat supplies
The existing infrastructure in North Macedonia is only partially geared towards a decentralised, renewable heat supply. District heating networks were primarily designed for large fossil-fuelled plants and are not technically prepared for the feed-in from various renewable sources. There is a lack of standardised technical standards for network pressure, temperature control, feed-in points and return flow management (see Chapter 4.1). This makes the integration of solar thermal energy, geothermal energy, waste heat or large heat pumps considerably more difficult.
Solution: A national technical standard catalogue for heating networks should be developed and enshrined in law. This must include requirements for hybrid feed-in, grid compatibility and monitoring as well as regulations on grid connection and feed-in rights. At the same time, grid operators should be obliged to develop and gradually implement transformation plans for their systems.

Considering large-scale heat storage as a central component of heating grids
The expansion of renewable heat sources requires a temporal decoupling between generation and utilisation. However, there are currently hardly any efficient storage solutions, neither at neighbourhood level nor on an industrial scale. Without storage, there is a risk of peak loads, inefficiencies and unnecessary fossil backup systems.
Solution: Large-scale seasonal heat storage systems (e.g. underground or aquifer storage systems) should be specifically promoted and considered as an integral part of new heating projects. Funding programmes should explicitly support the combination of storage technology with solar thermal energy or large heat pumps. In addition, the development of standardised design and approval guidelines for storage projects is necessary. A more flexible design of heat networks is also needed to allow for the integration of third-party renewable heat producers. This includes technical provisions for connecting solar thermal fields, industrial waste heat, or decentralized storage units. Clear access rules and standard contracts for external producers can accelerate innovation and market entry, particularly for community-led or cooperative heating initiatives.

Lack of digitalisation and network intelligence
A large part of the existing heating infrastructure is operated in analogue mode and is not equipped with modern sensor technology or digital control. This means that demand-led control or real-time monitoring is not possible. There are also no interfaces to power grids or building technology.
Solution: The digitalisation of heating networks should be supported by a targeted funding programme for monitoring and control technology. Network operators should be obliged to introduce smart grid-capable systems in the medium term. In addition, expertise needs to be developed in the areas of data management, remote control and AI-supported operational management.

Sector coupling hardly utilised to date
The potential for coupling electricity, heat and possibly gas has not yet been fully utilised. Power to-heat applications, waste heat utilisation or flexible heat pump applications could help to make sensible use of fluctuating electricity surpluses and ensure that the heating transition is economically viable. However, a lack of interfaces, regulatory hurdles and a lack of project practice are slowing down development.
Solution: The regulatory basis for sector coupling should be created or adapted - for example through defined feed-in priorities for power-to-heat plants or grid fee exemptions for flexible

electricity utilisation in the heating sector. At the same time, pilot projects for sector coupling - e.g. with wind power and heat storage systems - should be financially supported and scientifically monitored.

4.7. Proposal for a transformation pathway to 100 % renewables

The complete transition of North Macedonia to an energy system based entirely on renewable sources is a feasible but ambitious task.

The analyses to date clearly show that legal clarity, reliable investment conditions, coordinated institutional responsibility and active community involvement are the cornerstones of a successful heat transition. It is now crucial to translate these prerequisites into a coherent transformation path that does justice to the national framework conditions as well as local resources and international obligations.

A phased approach appears to make sense in order to gradually create planning and investment security.

In the short term (2025-2028), the regulatory foundation should be laid by

- the simplification of authorisation procedures
- the introduction of technology-neutral funding programmes for geothermal district heating, large heat pumps and solar thermal energy
- the legal protection of decentralised energy generation (including cooperatives)
- and the establishment of municipal project structures with clear responsibilities.

Implementation must take effect in **the medium term (2028-2035):**

- gradually replace existing district heating systems with renewable heating systems,
- expand smart heat and electricity grids,
- establish binding quotas for renewable heat and
- promote the local production of key infrastructure - such as heat storage, control systems or heat pump technology - in a targeted manner.
- Citizen energy and cooperative models can become key implementation players in this phase.

In the long term (2035-2040+), the aim should be to switch completely to renewable energies in the heating sector:

- Implement cross-sector storage solutions,
- achieve smart coupling between electricity, heat and mobility
- completely abolish fossil fuel subsidies,
- full harmonisation with the European legal framework for energy, market transparency and security of supply will be both a prerequisite and a result of this transformation process.

The ability to adapt and learn remains essential for success. Systematic monitoring - via progress reports, regional evaluations, technology scouting and benchmarking with neighbouring countries - should be established as politically binding. Energy law itself must also be regularly reviewed and

further developed in order to be able to react to changing framework conditions, technological developments or social requirements.

5. Conclusion

The energy transition in North Macedonia is much more than a technology-driven modernisation project. It represents a far-reaching social transformation that requires new forms of participation, responsibility and justice. The success of this transformation depends not only on technical solutions or economic investments, but also on the ability to involve different social groups, create social acceptance and organise political processes transparently. A fair energy economy can only be created if citizens are involved not only as consumers but also as active co-creators, for example through energy cooperatives, municipal projects or local participation formats.

A concrete package of measures is needed for Bitola in order to realise the existing potential:

1. **create legal clarity**

   The Energy Act must be supplemented with precise regulations for renewable heat - with standardised approval procedures, minimum technical requirements and defined responsibilities for geothermal energy, large heat pumps, solar thermal energy and cross-sector system integration. Energy cooperatives and municipal operator forms must also be clearly regulated and integrated into funding and market access without discrimination.

2. **secure funding and create incentives**
   A national heat transition fund should specifically promote investments in feasibility studies, drilling, storage technology, grid modernisation and integrated system concepts. This can be supplemented by feed-in premiums for renewable heat, tax relief, risk protection and targeted EU funding (e.g. EBRD, Green Climate Fund, Just Transition Mechanism). Transparent and project orientated access to funds is important - especially for municipalities and community energy projects.
3. **strengthen municipal capacities**
   Bitola needs legal certainty and financial resources for strategic heat planning, operator decisions and municipal project development. The city should be empowered to implement its own heat transition projects - alone or in partnership with municipal utilities, cooperatives or private developers. A municipal department for renewable energy infrastructure would be an effective institutional lever.
4. **establish coordinated project management**
   An interdepartmental task force at national level - involving ministries, the Energy Agency, the Regulatory Commission and research - can coordinate standardisation processes, remove obstacles and develop guidelines. At municipal level, a permanent multi-stakeholder working group is recommended for Bitola, which strategically supports pilot projects and organises them in a participatory manner.
5. **Realise, evaluate and communicate pilot projects**
   The first concrete measures - such as a heat pump system with seasonal storage or a hybrid geothermal-solar thermal system - should be implemented with a high public profile, scientifically monitored and documented as a blueprint. Training for administrative staff,

systematic monitoring and active public relations work are just as important as transparent communication of costs, benefits and progress.

Many of these challenges, from high investment costs and a lack of authorisation standards to municipal bottlenecks, are described in detail in sections 4.1-4.5. The focus is now on the question of whether these obstacles can be overcome through political action. These problems can only be solved if the regulatory framework is further developed in a targeted manner - with clear responsibilities, funding programmes that are open to technology and a stable investment environment. The development of technical expertise and personnel capacities in local authorities, planning offices and installation companies must also be part of this reform agenda. To support this, a national roadmap for the heating transition aligned with EU climate goals and instruments such as the Just Transition Mechanism should be developed. This would offer planning security and facilitate access to international funding.

The heating transition will only succeed if it is understood as a joint project that enables broad participation - not as a technocratic project, but as a socially just transformation with local roots. The coming years are crucial.

Cities like Bitola will show whether North Macedonia can make the transition to a renewable, fair and economically viable heating system. The political course set in the next legislative period - whether in legislation, subsidy policy or municipal practice - will play a decisive role in determining whether potential becomes concrete progress. Now is the time for decisive action. If Bitola succeeds in becoming a visible beacon of the heat transition, this can not only accelerate the transformation in its own country but also send a signal to the entire Western Balkans.

Table 7: In summary

Chapter	Problem	Solution
4.1 Legal & regulatory reforms	Unclear definition of renewable heat technologies	Include a legal definition of renewable heat in the Energy Act.
	Geothermal energy and heat pumps insufficiently enshrined in law	Create separate regulations for geothermal district heating and large heat pumps.
	Lack of standardised regulation for grid connection	Develop standardised specifications for connection, feed-in and access.
	Lack of economic viability and funding	Introduce support programmes, feed-in priority and flexible pricing.
	Weak position of energy cooperatives	Reform co-operative law and secure access to subsidies and let them engage in thermal energy systems Develop a citizens' energy strategy.
	Lack of expansion targets and storage integration	Establish sector-specific target paths and the mandatory integration of storage facilities in regional heating plans.

4.2 Financing and investment incentives	Financing programs for renewable heat are lacking	Establish a technology-open funding programme for renewable heat.
	Financing threshold for municipal and citizen-led projects	Establish a heat fund for planning, studies and system design.
	Lack of instruments for risk sharing	Create guaranteed loans and tax relief for renewable energy projects.
	Limited access to international funding sources	Create guaranteed loans and tax relief for renewable energy projects.
	Citizen energy without financial support	Start-up grants, grid access and feed-in contracts for cooperatives.
	Lack of economic incentives in ongoing operations	Feed-in premiums for renewable heat, tax benefits for grid investments and clear rules for depreciation and cost reimbursement.
	Low level of innovation support in the heating sector	Create long-term rules for prices, tenders and funding.
4.3 Institutional coordination and decentralisation	Fragmented responsibilities hinder expansion	Clarify responsibilities.
	Lack of procedural standards and digitalisation	Introduce one-stop shop procedure, establish digital authorisation portal and deadline regulations
	Weak municipal control capacities	Appoint project coordinators, establish training and counselling.
	Lack of grid flexibility and storage integration	Promote storage technologies, adapt grid technology
	Lack of strategic control at national level	Establish a national coordination body with representatives from ministries, the ERC, municipal umbrella organisations, energy cooperatives and the private sector.
	Expandable participation of the population	Publicly accessible project platforms, regular consultations and targeted information campaigns Strengthen opportunities for financial participation.
	Lack of integration of international cooperation	Targeted integration of European and multilateral support programmes into national strategies.
4.4 Technical and administrative capacity development	Lack of expertise among authorities and project organisers	Create training and advisory services for all levels.
	Science and research barely integrated	Set up real-world laboratories and innovation clusters.

	Planning and installation expertise weak	Provide national training programmes and planning aids.
	Structural weaknesses in the planning and installation sector	Provide project responsibility, personnel and funding for municipalities.
	Lack of municipal control capacities	Municipalities should be given binding responsibilities for heat planning.
	Lack of real-world laboratory	Bitola as a real laboratory.
4.5 National political consensus for a long-term strategy	Lack of strategic framework and cross-party consensus	National heating transition roadmap with binding expansion targets, technology priorities and financing mechanisms.
	Lack of social participation	Promote citizen energy, co-determination and social justice.
	Mitigate social hardship - ensure social acceptance	Anchoring public participation in law, strengthening transparency obligations.
	Promote cultural anchoring of the heat transition	Educational programmes/information campaigns (energy advice).
4.6 Infrastructure	Outdated district heating infrastructure	Promotion of grid renewal and integration of RE sources.
	Lack of large-scale heat storage systems and digitalisation	Funding for storage, digital control and coupling systems.
	Sector coupling not regulated or implemented	Enable investment and regulation for power-to-heat and storage.

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