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Forging Local Energy Transition in the Most Carbon-Intensive European Region of the Western Balkans

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Abstract: To close an existing literature gap, we explore the conditions critical for the enactment of local energy transition and the shift to decarbonized renewable heating systems in the public sector of the most carbon-intensive European region of the Western Balkans. We select and then analyze the municipality of Priboj, which stands out among 150 municipalities in Serbia due to its effective promotion of local energy transition. The analysis provides a rich empirical illustration of a specific path that enables the local level to embark on a tailor-made energy transformation in an underdeveloped and path-dependent national policy framework. By linking a multi-level perspective of sustainability transitions to accounts of path dependency, we advance the understanding of the critical determinants and frameworks of local energy transition. Our analysis is enhanced with an investigation of the role of key actors and governance modes. A shared understanding of innovative solutions and existing local heating regime problems, and a shared vision of economically and environmentally viable opportunities based on available and unutilized local biomass, encouraged the local leaders to embark on a long and novel journey to decarbonize the local heating system. These observed factors coalesced with local political stability anchored in both the local- and national-level contexts. The effective coordination and cooperation across national- and local-level decision makers, financial institutions, and utilities was facilitated by a specific geographical and political context out of the reach of powerful gas network advocates. With these factors present, the synchronized entrepreneurial multi-level efforts served as the vehicles to develop and implement a shared vision of energy transition that became a learning platform for other regional actors.

Keywords: post-socialist energy transition; decarbonization; local energy transition; renewable heating; biomass; political stability; effective coordination; policy entrepreneurship

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1. Introduction

Smaller administrative units, such as local self-governments (LSGs), are pivotal actors in energy transition. With their multiple roles, they act as a decision maker with planning and regulating authority, a supplier/provider of energy, a consumer of energy, and an investor. They manage local infrastructure and play an exemplary role for their citizens and businesses [1–4]. An enabling supra-national and national policy framework is an important condition for the development of local energy transition initiatives. This has been observed in Western European countries [5]. However, cases of a strong local initiative and progress, although scarce, can also be found in EU countries with less favorable policy framework for local-level energy system transformation. Under some set of conditions, local levels can break through national-level policy barriers and initiate more advanced local energy transition [6–9]. What exactly these local-level conditions are and how they shape the energy transition outcome in a challenging context is the research puzzle we address in our analysis of the conditions critical for forging local energy transitions in the most carbon-intensive European region of the Western Balkans (WB).

For a long time, energy transition studies predominantly focused on the national, regional, and global determinants of energy transition. Their findings provided important guiding principles and instruments for energy transition governance, as well as decision and policy making [5,10–13]. The main assumption was that a well-designed strategic plan implemented with political support, policy instruments, and technical instruments would lead to change [11,12]. Soon, it became apparent that energy transition as a complex societal transformation would need to be complemented with flexible and decentralized governance and financing, and tailor-made innovative solutions. This puts the sub-national levels of government at the *transition core* [14–17]. As a result, local energy transition research agenda has advanced to capture how existing supra-national and national-level decisions and policies become localized and how they fit local energy contexts, while identifying the key drivers for or barriers to innovative local energy policy [1,2,7,9–12,16,18,19].

Despite its significance for energy transition in a post-socialist, carbon-intensive, and EU-accession setting, the WB region, including individual countries, remains understudied. The WB region is home to approximately 18 million people (Figure 1). The WB countries share a post-socialist policy setting and a limited tradition in innovative renewable energy policy initiatives that are needed to push energy transition through the EU-accession process [20]. A scarcity of local-level energy system transformations additionally limits the ability of the WB region to advance and tailor energy transition to its needs [7–9,17]. The ongoing climate crises [21] and the 2022 energy crisis resulting from the war in Ukraine makes the EU commit to even more vigorous results in energy savings, diversification of energy supplies, and roll-out of renewable energy to replace fossil fuels. The WB countries are expected to embrace these policy developments [22]. However, from an analysis of the process of energy transition in the WB region in the last fifteen years, it remains unclear how this can be done and whether the EU-accession process alone can adequately respond to these challenges. In this respect, studying local energy transition cases in a challenging context, such as the Western Balkans, is of ever-growing relevance.

A handful of publications on national-level conditions deal with the main barriers to advancing energy transition, such as low energy prices, high energy intensity, prioritization of energy security (based on domestic fossil fuel), inadequate utilization of renewable sources, policy incoherence, and lack of internal funding [8,20,23–29]. Accounts on local energy transition in this context are almost absent with a few exceptions [7,9]. The little knowledge calls for further in-depth research of single countries, local cases, and conditions for energy transition. We target this existing research gap to shed light on the critical conditions at a local level to tailor and steer policy responses in support of local energy transformation in an otherwise unfavourable policy context.

We use five indicators to compare the WB countries and single out a successful LSG case in Serbia. Serbia, as the largest country representing 39% of all population, 45% of the GDP, and 49% of total energy supply, has the highest comparative weight for energy transition in the WB region. It also stands out in total energy supply (TES) coal and TES biomass (Figure 1).

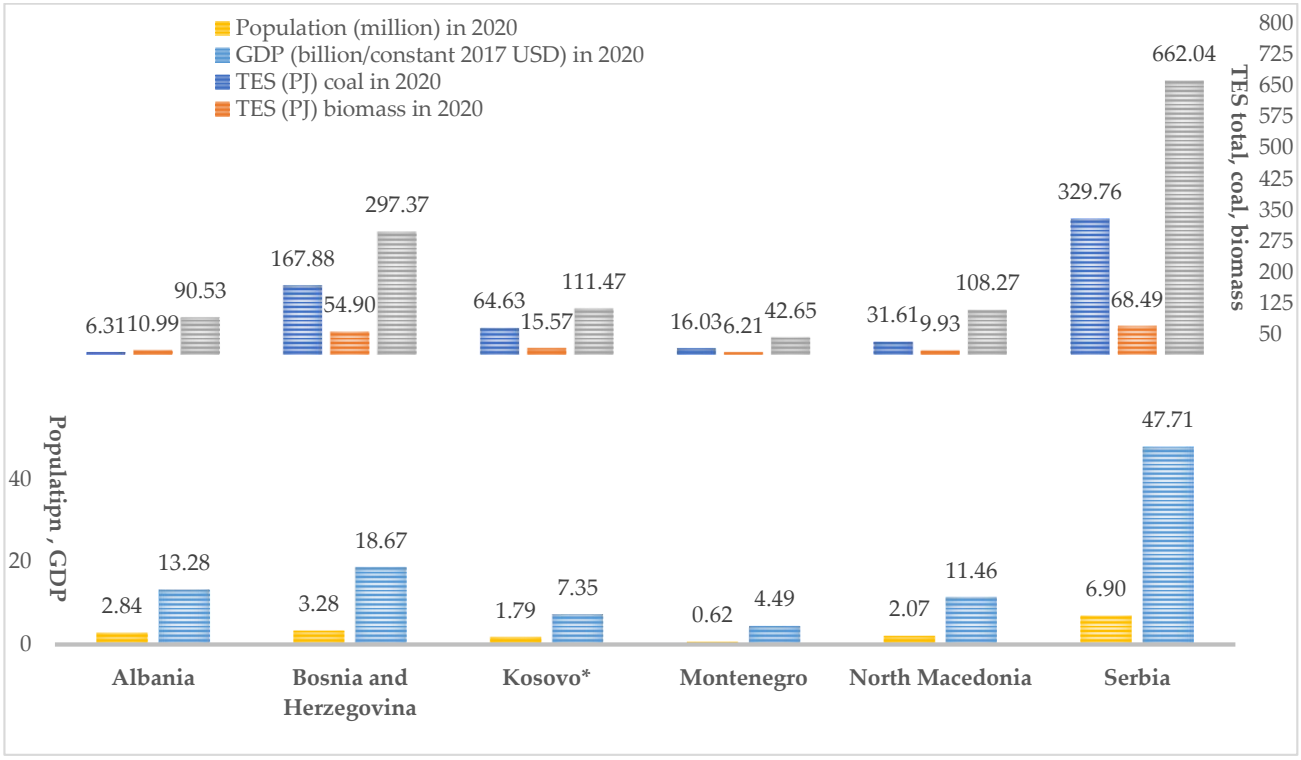

Figure 1. Comparison of WB countries on the main indicators that justify the decision to study Serbia and the context of the carbon-intensive, biomass-abundant framework [30,31].

We then turn to the local level and select a smaller administrative entity of local self-government—a municipality that is committed to the outcome we aim to explain *and that shares and consistently implements a vision of local energy transition with a nearly completed switch to a renewable heating system in the public sector.* According to the Law on Territorial Organisation of the Republic of Serbia, local self-governments are municipalities, 28 cities, and the city of Belgrade. In our research and selection, we exclude cities and the city of Belgrade and screen the remaining 150 local self-governments that have the status of municipality [32]. We perform field and internet-based research of the 150 municipalities using two indicators: an articulated decarbonization vision by 2030 and a nearly completed transition to renewable heat. We find that among the 150 municipalities in Serbia, only the municipality of Priboj satisfies these criteria. With its nearly completed transition to renewable heat and an articulated decarbonization vision dating to 2015, it stands out among the 150 municipalities in Serbia in its attempt to forge local decarbonization [32]. Given this background, we perform a within-case analysis of the municipality of Priboj to answer our research *question 'What conditions are critical to forge a local energy transition and shift to renewable heat in the most carbon intensive European region of Western Balkans?'* We use the case study approach as an overall methodological tool, while process tracing is used as a main within-case heuristic and analytical tool to detail and sequence the chronological stages of the case development. The analysis of the municipality of Priboj provides evidence of the process characteristics and drivers of the actual outcome.

By linking sustainability transitions to accounts of path dependency, we advance the understanding of energy transition frameworks and their application in a real-world context. We are aware of both the strengths and weaknesses in the application of sustainability transition frameworks. We exploit these strengths, such as the longitudinal, multi-dimensional, and multi-actor conceptualization of transitions, while paying attention to weaknesses that include an overemphasis of earlier work on technological niches, insufficient focus on the processes of change, and limited attention to issues related to agency, governance, power, and politics [33–43]. Although these weaknesses have been

gradually addressed in the literature [4,9,16,33,44–48] (for a detailed overview see [49]), we continue to tackle them in the analysis of our case with a particular focus on actors and governance. Our findings deepen the understanding of how local energy transitions unfold in a post-socialist, carbon-intensive, and EU-accession policy setting, where the energy policy environment constrains system change.

Firstly, we present the research design comprised of an operational framework that is embedded in a literature review. Next, we present a snapshot of our case study approach and data collection. Then, we present the findings that are merged with the discussion. We finish with the conclusions and make recommendations for future research.

2. Research Design

2.1. Operational Framework

We consider different strands of literature to address our research question—*What conditions are critical to forge a local energy transition and shift to renewable heat in the most carbon-intensive European region of Western Balkans*?—and explain the outcome, which is defined as a shared and consistently implemented vision of local energy transition with a nearly completed switch to renewable heating system.

Firstly, we use an influential framework of sustainability transitions, the multi-level perspective (MLP), that is widely employed for conceptualizing dynamic patterns that occur in socio-technical transitions. It views transitions as non-linear processes that result from the interplay of technological and structural developments on three analytical levels: niches, socio-technical regime, and exogenous socio-technical landscape [49–52]. The socio-technical regime is central to the MLP, covering not only technical and material elements but also social, political, institutional, and cognitive aspects [52]. It embeds a system's rules and interdependencies and represents a source of system stability and inertia that over time locks the society into the dominant technological solution. Consequently, a new system (such as an energy system) competes with the whole system of physical, social, and institutional features that have co-evolved with the dominant technology. The socio-technical regime can develop at different empirical levels, because *'what looks like a regime shift at one level may be viewed merely as an incremental change in inputs for a wider regime at another level'* [51] (p. 400). We analyze the regime at the level of a local energy heating system. The landscape is exogenous, with static and dynamic aspects of a different frequency, amplitude, speed, and scope. This landscape is compared to soil condition, forests, and climate, while its processes include long-term socioeconomic, cultural and political changes, and key events such as energy crises [51]. In our study, the landscape is presented at the intersection of a post-socialist, carbon-intensive, and EU-accession policy setting that provides a specific set of asymmetric impulses to stability and change. Niches developed in protected spaces (incubation rooms) are the loci for innovations but also the spaces to build social networks that support innovations, such as supply chains. The analytical focus here is on processes, such as learning, innovation, and multi-actor interactions. The MLP suggests that transitions occur when changes in the exogenous landscape and/or internal systemic failures create instability within the regime. This creates a window of opportunity for niche innovations that have been gaining momentum to transit from one socio-technical system to another [51,53]. As our case is embedded in a post-socialist, carbon-intensive context constraining to local-level energy system change, we consider the MLP as a way of exploring the circumstances under which the current local-level regime provides opportunities for change. We explore whether there are any critical points of alignment and synergies of policies or economic activities at the regime level, such as the alignment of environmental, economic, and landscape interests [9]. We investigate how technological niches, innovative business, or user practices stimulate change in the present regime.

Secondly, we consider a path dependency perspective that preserves socio-technical systems in their current development paths. Both the MLP and the path dependency concept strive to answer the core questions of transition research on how socio-technical

systems stay stable or change [49]. Persistent social challenges that are attributed to the path dependency of prevailing practices and structures constituting the regimes are addressed in sustainability transition research [44]. We use this dual approach as a strategy that offers a systematic mapping tool for understanding local energy transition in a post-socialist and carbon-intensive context [8,54,55]. Path dependency is conceptualized by singling out the historical barriers to transformation. As such, it is relevant for the post-socialist and carbon-intensive context that tends to reinforce existing paths. In this respect, we investigate the energy policy developments to determine the national-level approach to energy transition, identify the most striking path dependencies that cut across socio-technical landscape and regime, and assess how these path dependencies affect local-level energy transition. While theoretical knowledge of the path dependency mechanism is well developed, the question of how to overcome path dependency and break through the path remains largely unanswered [8,54]. Our case study is meant to answer this question.

Thirdly, following recent accounts on local energy transition, our explanatory primacy within these frameworks is given to the role of actors and local energy transition governance [2,9,16]. We draw on Fouquet's [56] observation that there is nothing inevitable about a clean energy transition as it depends on diverse forces and actors to create a new path, and path creation requires agency. This corresponds to the subsequent developments of the MLP framework and path dependency that emphasize the critical role of the actor concept [4,33,49,54,57–60]. In the MLP, agency is attributed to different actors at the niche, regime, and landscape levels [33,59], who have their own resources, capabilities, beliefs, strategies, and interests to enact transitions [49]. Apajalahti and Kungl [54] highlight that path breaking occurs when the core actors of a sector start to develop new business solutions, engage in explorative learning, and mobilize alternative resources that benefit the new sector. In path breaking, the core actors become aware of the lock-in situation, adopt a new perspective, and take measures that weaken the underlying self-reinforcing mechanisms of the dominant path. This suggests that breaking a path is intentional and strategic. Along these suggestions, we engage in a deeper analysis of agency and look closely into the role and interactions of non-state and state actors, including investors, civil society organisations, and local officials. We also explore the agency of entrepreneurs in this context [9,16,61]. A policy entrepreneur, besides power, relies on the influence of their innovative ideas, the logic of their arguments, and their ability to convince others to embrace their ideas. Policy entrepreneurs, including government officials and implementing bureaucrats, seek new ways of doing business and promote new ideas that go beyond the dominant social, political, or economic arrangements [61–65]. We look for policy entrepreneurs and analyze how they affect the process of energy system change in our case.

Fourthly, to address governance, we draw on Kooiman's definition that highlights its multi-actor nature and normative ambitions. Governance is defined as '*the totality of interactions, in which public as well as private actors participate, aimed at solving societal problems or creating societal opportunities, attending to the institutions as contexts for the governing interactions, and establishing a normative foundation for all those activities*' [66] (p. 4). In a broader sense, governance refers to processes of decision making, including the rules and institutions that shape behaviour and facilitate the achievement of outcomes [43,67]. The mode of governance can influence or guide regime change in many ways through the rules and norms that can either constrain or enable regime change. For example, innovative, flexible, horizontal, and participative forms of governance are considered critical for sustainability transitions [2]. This brings us back to the interaction between actors and processes as these modes of governance require the involvement of different non-state individuals or institutional regime actors; the coordination of resources; and the alignment of the actors' ambitions, ideas, and activities, and their inclusion in energy decisions [9,16,39,43]. By examining the nature and sequence of the decision-making process, financing, participation, and interactions of all key actors, we decode the governance mode and explore its relevance for the outcome.

2.2. Within-Case Analysis and Data

We use a case study approach for an in-depth exploration of intricate issues in their real-life settings, which provides firmer evidence of the factual accuracy of a given angle. As an empirically rich, context-specific method, it has an advantage in studying phenomena that require an intensive analysis of an individual unit with clear boundaries [68,69]. These features make it a method of choice in exploring the unique cases of local energy transition [9,16,70,71]. For the within-case analysis, we use process tracing as a central technique that informs how, why, and under what conditions one event leads to another. Process tracing contributes to both describing complex social phenomena and exploring and evaluating the underlying mechanisms and causal claims in complex policy arenas. These features have raised process tracing's salience as a research methodology, leading to its application across a range of fields, including policy science [72]. We support the methodological pluralist position that recognizes and understands that different variants of process tracing have strengths and weaknesses in different research situations. On the one hand, by disaggregating processes into their constituent parts, we better understand how they work, while on the other hand, this requires lowering the level of theoretical abstraction by providing a detailed theorization of the actors involved and the activities that provide the linkages in the process [73,74]. In the application of process tracing in our research, we follow Beach [73] who states that process tracing as a method has three core components: theorization about the underlying mechanism linking the critical conditions and the outcome, analysis of the observable empirical manifestations of the theorized mechanisms, and questions of case selection and generalization. As most process-tracing users, we engage in an iterative design that moves back and forth between the operational framework and the empirical data. We use process tracing both as a heuristic method and as a way of analyzing the evident manifestations of the factors embedded in the analytical framework, inferring that a set of factors work together to produce the outcome. Evident manifestations represent empirical fingerprints left by the operation of a underlying process/mechanism in a case or the fingerprints left by the activities of actors that are linkages in the process [73]. With this conceptualization, a factor is part of a set of factors '*that all add weight toward the outcome, such that each individual factor that is a part of underlying mechanism makes the outcome more likely*' [75] (p. 203). To make a mechanism-based claim, our analytical focus is on unpacking the process that has produced the outcome. We concur with Keast [72] and view the process as being in a productive account because it is more than the sum of its parts, and how it operates is very sensitive to context. As a consequence, our findings are limited as one cannot claim that just because something has been found to work in one case, it will work everywhere. We remain equally aware of another limitation: inferences about the underlying mechanism are made within the studied case. To generalize beyond the studied case, one must couple process-tracing case studies with comparative methods. However, in order to generalize the claims about the underlying mechanisms across cases, one must demonstrate that the studied case is contextually like other positive cases where the underlying mechanism may be present [73]. In our thorough ex-ante scanning of the outcome, our investigation of *'a shared and consistently implemented vision of local energy transition with a nearly completed switch to renewable heating system'* of the 150 local self-governments in Serbia found no similar outcome. We perform the thorough ex-ante scanning based on two indicators: an articulated decarbonization vision by 2030 and a nearly completed transition to renewable heat in the public sector. We perform this through field and internet-based research (websites of municipalities, strategic documents, and, in few cases, phone calls). We find that, among the 150 municipalities in Serbia, only the municipality of Priboj satisfies these criteria. The ex-ante scanning of the outcome strengthens our analytical and methodological approach, while providing recommendations for future research. Therefore, our contribution is related to the identification of the underlying mechanism that explains this unique outcome, that is, the almost complete decarbonization of the heating sector and a switch to renewable heat in a carbon-intensive, post-socialist, and EU-integration policy setting. Additionally, it is a valuable contribution

as one of the possible cases for future comparative research. Its relevance increases when considering that this type of research requires longstanding observations of different cases to acquire considerable case-specific knowledge and intensive field research, which is often not feasible within one research project.

We perform a detailed chronological tracing, sequencing of events (including the context), and case development over time. We carry out desk research using relevant academic literature and policy documents, but also grey literature, and perform comparisons, extensive field investigations, and indirect and direct case observations that include twelve open-ended interviews.

Firstly, we present the policy and factual framework in the Western Balkans and Serbia and in the municipality of Priboj since 2009. This includes the national energy policy framework that started with the energy reform driven by the EU-accession process and renewable heat policy landscape developments. We focus on its implementation, administrative procedures, and financial and legal aspects. This helps us identify the major landscape features and chart relevant path dependencies. Secondly, we focus on the local level through an analysis of the landscape regime and niche. We gain valuable insights by observing the case development in a number of public events and strategic meetings. We investigate the local political landscape in the municipality of Priboj since 2009 and its respective political positions regarding the energy sector, as well as its natural resource potential, the state of the environment and economy, local strategic documents relevant for energy transition, and the decision-making process that identifies the governance mode. We tackle the local political situation and priorities, and local socio-economic development challenges and opportunities (e.g., connected industries, tourism, reduction in energy bills to the benefit of local inhabitants and local economic players, reduction in air pollution, and combat against energy poverty). This research strategy provides evidence of the process characteristics, sufficient analysis of the change and temporal sequence, and identification of the key steps and drivers of the actual outcome as defined in our analytical framework [76–78]. Thirdly, the unique outcome of our case, e.g., nearly completed decarbonization of the heating sector and switch to renewable heat in a carbon-intensive, post-socialist, and EU-integration policy setting, implies a major change in the ways in which actors are involved. As an integral part of the technique, we trace the actions and explore the role of involved actors and the way the process is governed [9,70]. We learn about their multiple roles, levels of expertise, motivations, and modes of interaction. This approach opens the avenue to identify the relative contribution of conditions for the outcome and infer the underlying mechanism (Figure 2). This mechanism is according to Keast [72] at the core of the process tracing and represents a 'sequence of social events or process steps actioned by actors (people, organizations or other entities) that, under certain conditions (known or unknown), deliver a change or outcomes' [72] (p. 143).

Our case observation is divided into two major phases (Figure 3) The first one is indirect observation from 2009 to 2016 that informs our chronological ordering and identification of the key stages of the case development. The second one is direct observation that took place from 2017 to July 2022, culminating in 2020, 2021, and 2022. We draw on Beach (2017) and engage in multiple observations and corroboration across multiple sources to enable a strong confirmation of the evidence at the empirical level. Our choice is grounded in the following statement '*Often process tracers use interviews with participants who have a stake in the events being studied, and therefore have incentives to provide biased accounts. In this instance, found evidence in an interview would not enable strong confirmation because the source could not be trusted. The questions that should be asked here are common source critical questions. It is only through corroboration across multiple sources and types of evidence that evidence can be trusted*' [73] (p. 12). This evidence confirmation strategy represents a good practice in process-tracing methodology and, at the same time, strengthens our independent observation of the case development in a familiar local context. Additionally, a robust analytical perspective grounded in a state-of-the art literature review serves to navigate the research and interpretation of the findings while maintaining our impartiality.

To collect and corroborate the evidence, we observed many open-for-public fora where this case was presented. We engaged in three study visits (two separate visits in 2018 and one in 2021) and conducted face-to-face discussions, open-ended interviews, and eleven multi-stakeholder high-level discussion forums that dealt with energy transition, with participation from the representatives of the municipality of Priboj. In addition, we observed seven high-level strategic partnership meetings (based on the request/invitation and approval as observers, without intervening in decisions) in the period from 2019 to 2021 that facilitated our case's switch to renewable heat. Most recently, we directly observed the development of a green rural deal and a local development plan during 2020 and 2021. In addition, twelve open-ended interviews (two rounds of interviews with six actors) were conducted on a rolling basis in the period from April 2017 to July 2022 following the major breakthroughs in the case of Priboj. The interviewees are decision makers (mayor's office), a municipal energy manager, the directors of the new biomass-based local heating plant and local centre of social welfare, and renewable energy and biomass experts. Finally, eleven structured discussions on local energy transitions took place with the actors involved in the case of Priboj, including civil society and international organizations working on energy transition in Serbia. The evidence collected represents the core material for the identification of critical factors in local energy transition through the lenses outlined in the operational framework (Figure 3).

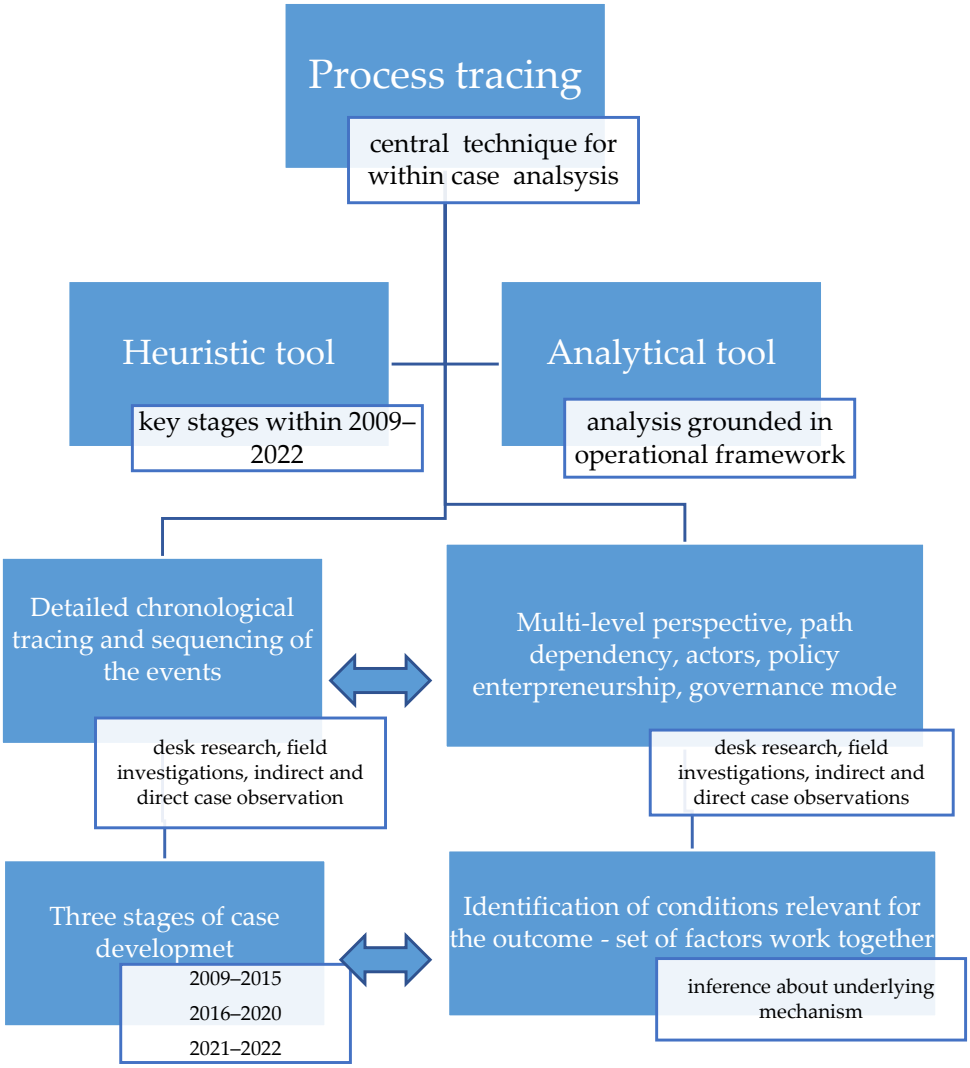

Figure 2. Within-case analysis used in the case study of the municipality of Priboj.

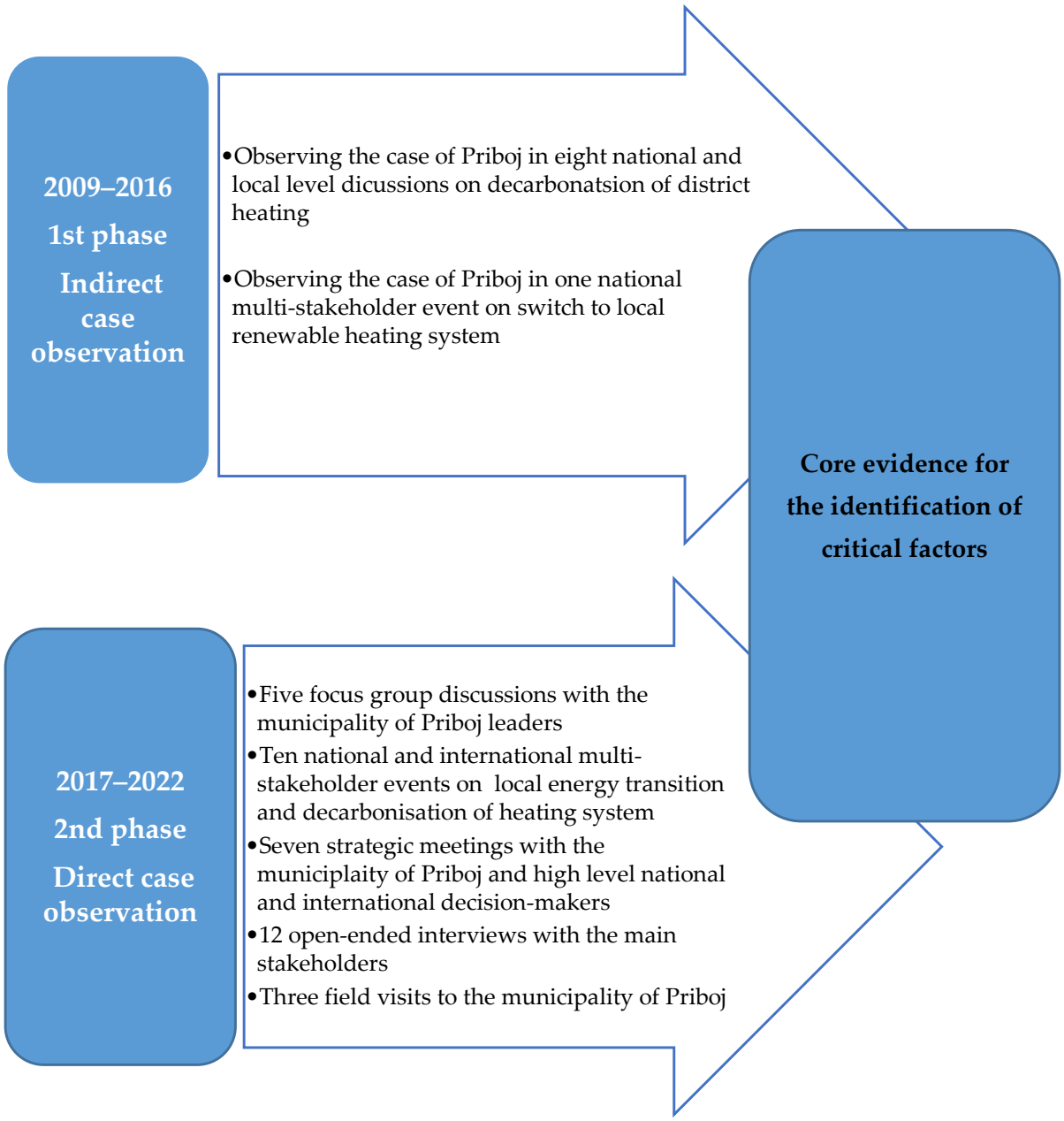

Figure 3. Two major stages of the case observation that provides the core evidence for the identification of critical factors in local energy transition through the lenses outlined in the operational framework.

3. Research Findings and Discussion

We commence with the presentation of the main energy policy features of the WB region. We chart the landscape conditions in Serbia, including the elements of a post-socialist, carbon-intensive, and EU-accession energy and biomass policy setting that is burdened with path dependencies that stabilize the existing regime.

3.1. Is There Energy Transition in the WB Region?

The WB region is at an early stage of the EU accession-driven energy transition. The slow and patchy transposition of the energy and environmental acquis has recently reached satisfactory levels [79]. However, the energy policies of the WB countries remain burdened by path dependencies related to a carbon-intensive context, implementation deficiencies, and a lack of path-breaking support for renewable energy innovations in both the electricity

and heating sectors. This creates an array of challenges for national- and local-level energy system transformation.

Nearly twenty years down the transposition and implementation road, carbon and energy intensity remain high, with a limited ambition of the WB countries to reverse this trend (Figure 4). The WB countries share a post-socialist policy setting and a limited tradition in innovative renewable energy policy initiatives that is needed to push energy transition through the EU-accession process. Until 1991, all the countries, except Albania, were part of a unified energy system based on domestic lignite and large hydro. The energy infrastructure, inherited from the Socialist Federal Republic of Yugoslavia, is now outdated, with some being up for closure and others needing reconstruction and major improvements in production and distribution efficiency [20,80]. The EU has long been contributing to the energy transition in the WB region. Current EU candidate countries from the WB include Albania, North Macedonia, Montenegro, and Serbia, while Bosnia and Herzegovina and Kosovo* are potential candidates. In 2005, the WB countries were among the signatories of the Energy Community Treaty that mandates the transposition of the EU energy acquis communautaire. It includes a legislation that covers environment and market competition, with the aim of creating an integrated pan-European energy market and attracting investments [81]. This has resulted in a higher integration of the WB region with the EU energy markets, although policies are still greatly fragmented across the energy markets, and it is necessary to overcome many barriers to boost investments [20].

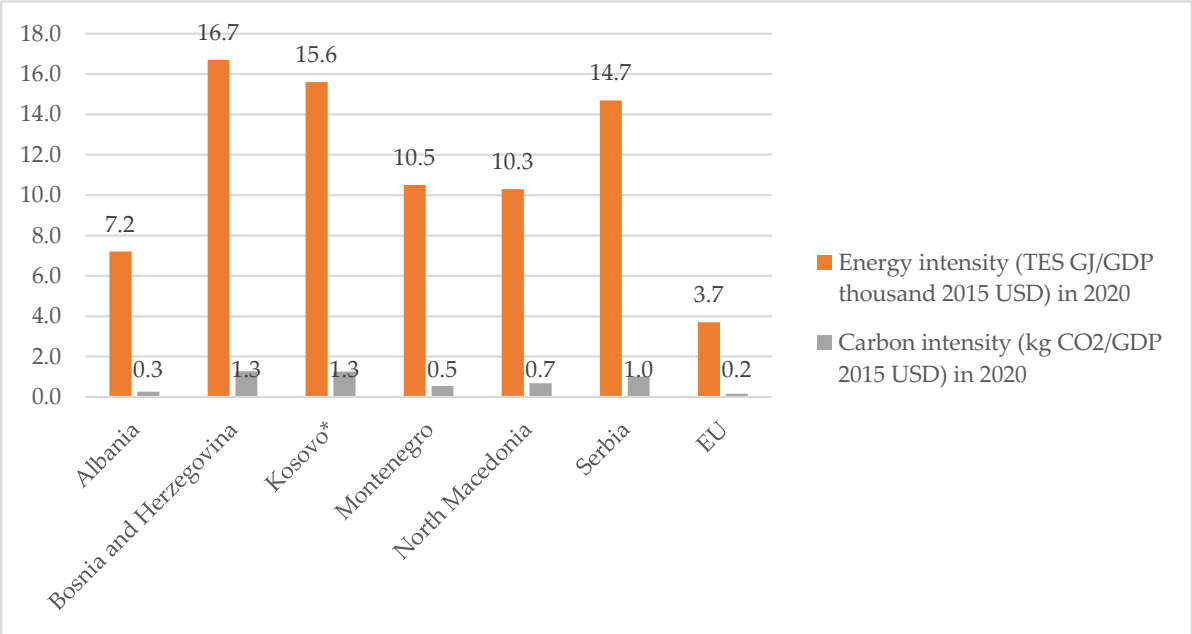

Figure 4. Energy and carbon intensity of the WB region and the EU [30].

Firstly, the main emitter of greenhouse gasses in the WB countries is the energy sector, where the implementation of reductions in emissions from large combustion plants within the framework of the Energy Community Treaty has been very poor. By the end of 2020, five out of six contracting parties failed to comply with their long-standing commitments [82]. The WB region continues with the large production of lignite that is predominantly used for electricity generation in an outdated coal-fired plant fleet. Its lignite-based electricity production, standing at 47,564 GWh [83], represents nearly two-thirds of the entire electricity production, while lignite electricity production of the entire EU is 241,259 GWh [84].

Secondly, the WB countries used creative data manoeuvring to bring renewable energy share close to the 2020 target without a major policy change or innovation in this sector [8,82]. For example, if we take the share of renewable energy in the final energy consumption as one of the indicators and compare the WB countries, we notice that a major

portion of the increase in renewable energy shares among the WB countries is the result of creative data management and not innovative renewable energy policy making. The policy framework is set by the 2009 Renewable Energy Directive, and each WB country had a mandatory 2020 target that was determined using the same methodology. Four WB countries corrected their data on biomass consumption in the energy balances for the years in the run-up to 2020, without correcting the balances that served to establish the baseline for the renewable energy target [82]. This is with the exception of North Macedonia that revised its biomass share for energy balance downward, reducing its baseline and subsequently its 2020 target, and Albania that has nearly 100% of RES share coming from hydro energy. Serbia was the last country in the region to use this manoeuvre in its official statistics. To illustrate, the primary production of energy from wood fuels recorded in the energy balance increased by 36.9% (roughly for more than one million tons of wood) in only one year's time from 2019 to 2020 [85,86].

Thirdly, the WB countries suffer from the highest levels of air pollution in Europe. Energy production and consumption is the major source of local air pollution in the WB region. Air pollution is particularly alarming during the heating season. One of the reasons for this situation is the failure to transpose stringent EU standards for heating devices and the widespread energy poverty that additionally hampers the energy transition outlook, particularly at the local and individual levels [87]. The dominant cause is traditional use of biomass that is mainly used in the form of fuel wood for individual heating (in more than 2,800,000 households) in technologically outdated and inefficient stoves [88]. According to the European Environmental Agency, citizens of the WB region are at higher risk of dying from the consequences of air pollution than any other European citizens [89]. The environmental consequences of energy sector activities in the WB region spill over its boarders and affect the quality of life of citizens in the EU as well due to geographical proximity [90].

Finally, the evident lack of adequate policy responses to the EU's carbon adjustment border mechanism (CBAM) from the WB countries could additionally jeopardize their competitiveness and energy transition outlook. The EU is the main trading partner of the WB region. In 2021, almost 60% of all imported goods came from the EU, while 81.2% were exported to the EU in 2021 (Figure 5), excluding inter-regional trade. This puts the issues of the CBAM and carbon leakage risks high on the agenda of harmonized regulation and implementation of climate and energy policy standards for both the EU and the WB region [91].

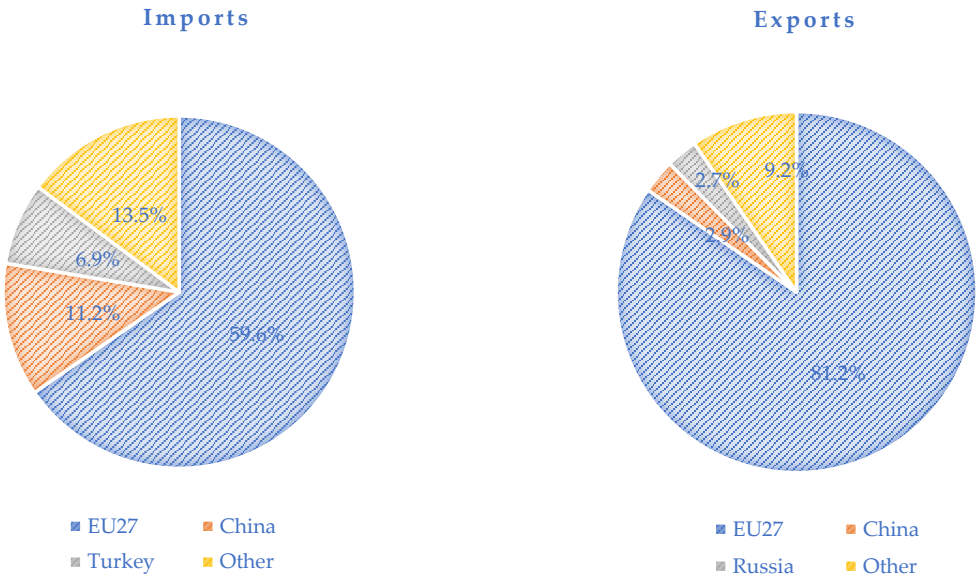

Figure 5. Share of goods, imports to the WB, and exports from the WB (excluding inter-regional trade) by trading partner in 2021 [92].

3.2. Inconsistent Path Dependent Energy Transition in Serbia

In this section, we present the findings related to the landscape conditions relevant for the national and local energy system transformations, especially the renewable heat and chart path dependencies embedded at the landscape level. Landscape conditions in Serbia resemble those of the rest of the WB region. The renewable energy policy developments are anchored in the Directive 2009/28/EC from 2009 [93]. Since 2009, the renewable energy policy change came in three major waves, firstly in 2013 when the National Renewable Action Plan was adopted, then in 2016 when the policy implementation was made possible, and most recently in 2021 when the market-based policy support schemes and the concept of prosumers were introduced [8,94]. However, all along the way, there have been strong indicators of a mismatch between good transposition level, evolution of the policy, and the real change it aims to produce [8]. The energy policy in Serbia still revolves around lignite, traditional use of biomass, and centrally steered large-scale renewable energy sources (wind and hydro), which reinforces existing path dependencies related to the strategic direction, governance mode, and technological solutions. The development of energy transition continues to be burdened by a strategic and political focus on fossil fuels (including imported gas) and a lack of vision for innovative approaches to both district and residential heating by utilizing locally available biomass [95].

Firstly, the structure of the energy supply mix remains relatively unchanged over the last ten years. Serbia's lignite production is very large and continues to dominate the energy supply mix by approximately 50% of the total supply. For example, Germany and Poland are the only EU countries with a larger lignite production than Serbia in absolute terms [96,97]. Modern renewables are almost negligible in the supply mix, with large hydro and fuel wood contributing to the RES share in terms of supply and final energy consumption (Figure 6).

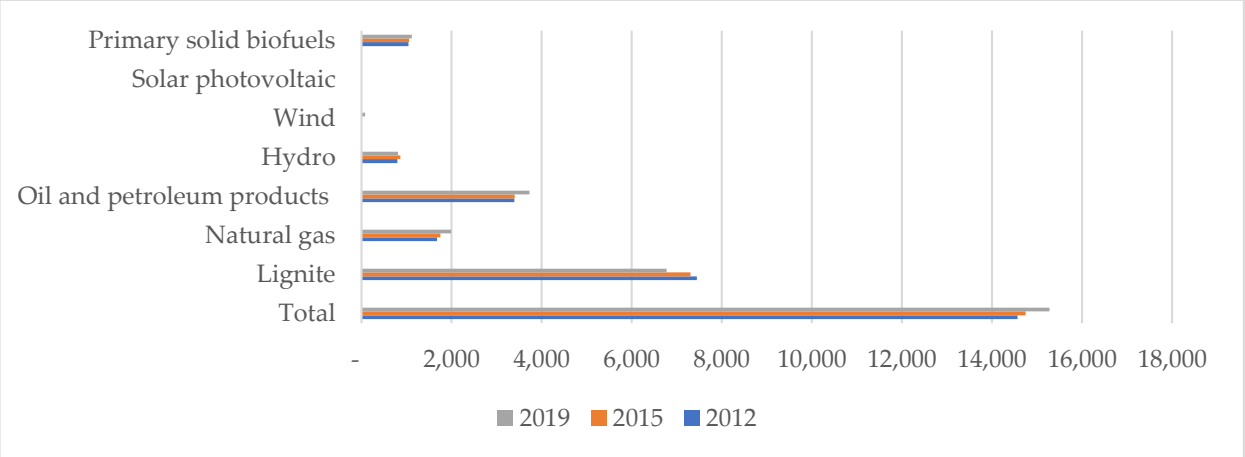

Figure 6. Serbian energy supply in 2012, 2015, and 2019 in thousands of tonnes of oil equivalent: total supply and major fuels [98].

Secondly, there is a gap in the potential, level, and quality of utilization of locally available renewable energy sources, such as wind, sun, and biomass (Figure 6). Biomass, with more than 12 million tons per year of wood waste, represents the most striking example. We will elaborate more upon it as it is the most important renewable energy source for our study of local heating system transformation [99]. For example, Serbia has the largest amount of biomass in total energy supply among the WB countries (Figure 1). Of all the renewable energy sources in Serbia, biomass has the biggest potential. In the total potential of renewable energy, biomass constitutes 61% and is dominated by wood and agricultural biomasses. While the level of wood use (forest) biomass potential is relatively high (66.7%), the agricultural biomass potential reaches only about 2% [95]. However, twelve years since the development of the first policy document in this field, the highest

percentage of biomass is still predominantly used in a traditional way—in the form of fuel wood used in technologically outdated stoves in households—that also critically pollutes the air. A total of 87% of final energy consumption of wood energy takes place in households. Serbia has the biggest estimated number of technologically outdated and inefficient solid-fuel individual heaters used as the main heating device: 1,144,428 pieces, or 40% of all solid-fuel individual heaters in the WB region. So far, little has been done to tap this huge potential in the residential sector, and policy makers remain blind to this challenge and opportunity. Ad hoc replacement schemes have been piloted in 2021 with no strategic policy developments. For example, the National Program for Air Quality was only adopted at the end of 2022 after a delay of seven years. This is despite the fact that Serbia is home to a local stove manufacturer that produces stoves that are compliant with stringent EU standards [100]. This suggests an inability to design sustainable and innovative renewable policies, particularly in the heating sector, even when such a solution has a clear win-win potential [87,101]. Furthermore, this way of using wood can have detrimental consequences on forests and biodiversity if the wood is not sourced from sustainably managed forests.

Thirdly, biomass policy developments are marked by an absence of coordination and lack a strategic vision regarding switching to efficient and renewable heating systems, overburdened as they are with implementation deficiencies. The first policy document that aimed to promote renewable heat and biomass use that would correspond to its potential and the EU directives in Serbia was adopted in 2010, followed by the National Renewable Energy Action Plan (NREAP) that set the targets for biomass use in 2020 and envisaged new support schemes [102,103]. Such a scheme, with a program for the development of the biomass market, made EUR 102 million available to promote the use of biomass in selected district heating plants in Serbia that fall under the jurisdiction of LSGs [104,105]. This window of opportunity, however, got stuck in an unprepared and inadequate political, policy, administrative, market, and technological framework. The progress has been slow and marginal. The general situation has not fundamentally changed in the last ten years, as the implementation of the first phase of the program started only in 2018. The funds were secured from the KfW loan in the amount of EUR 20 million and from donations in the total amount of EUR 7 million. It was envisaged that ten municipalities would participate in the program, with five of them participating in the first phase including the municipality of Priboj [106]. To capture the very limited progress in this policy area and to illustrate how the municipality of Priboj stands out in this context, we present the targets set in the NREAP against the data from 2020. The targets, which were set relatively low to begin with, have not been reached for biomass usage despite an abundance of resources and financial allocations (Table 1).

Table 1. Targets for additional biomass use in 2020 [101,106,107].

Type of Renewable Energy Source	Target for 2020 (ktoe)	2020 Energy Balance
Biomass—CHP plant heating	49	0
Biomass—CHP plant electricity	55	0
Biomass district heating	25	2.17
Biogas (manure)—CHP plant heating (energy transformation input from biogas for both heat and electricity)	10	22
Biogas (manure)—CHP plant electricity (energy transformation input from biogas for both heat and electricity)	19	22
Biomass in individual households (such data cannot be verified from the energy balance)	50	N/A

In 2020, only 0.4% of all heat produced in district heating systems was produced using biomass [108]. The prospect for increased financing and national-level attention remains uncertain. This is revealed in the latest national policy document that lists project opportunities for investments in energy in Serbia. Potential for investments in biomass thermal energy is estimated at EUR 0.006 billion out of the total EUR 36.11 billion, while biomass electricity has not been recognized as an area worthwhile of financing. Additionally, district heating in Serbia is predominantly fuelled by natural gas that Serbia imports from the Russian Federation, which embeds a risk related to the security of heat supply, while co-generation facilities are mainly related to biogas-fired, combined heat and power generation facilities [109]. In 2021, there are only four operational biomass plants out of the 59 district heating installations in Serbia [110]. Priboj plant is the largest plant that uses biomass, which is connected to the district heating systems in Serbia.

Against this backdrop, we present the findings and discussion related to the municipality of Priboj as an example of local energy transition in a post-socialist, carbon-intensive, and challenging EU-accession policy setting that is forging local decarbonization through an almost completed transition to renewable heat.

3.3. Key Stages of the Case Development

3.3.1. The Years 2009–2015: The Window of Opportunity in the Landscape and Regime Strengthen Path-Breaking Strategic Intentions

The energy transition ideas in Priboj can be traced back to 2009 [111,112]. At the time, local leadership started considering the opportunities to reverse a steep economic decline in the municipality, which otherwise has a rich natural (forests), agricultural, and tourist potential [113]. The current mayor came into power in 2008 as a member of a party that, at the time, was in opposition in Serbia. The details of the discussions in the first phase of the case observation (Figure 3) suggest that, from the beginning, he positioned himself as a young leader who would strive to stimulate the economic development based on local potential [114].

In this period, the local energy transition debate was shaped by the major renewable energy policy developments at the EU level, firstly by the adoption of the Renewable Energy Directive with its binding targets for 2020 (Directive 2009/28/EC), its transposition in Serbia, and finally the first national policy document—the Action Plan for Biomass in Serbia [93,102]. One important factor that did not constrain the opportunity for local energy system regime change was the absence of a gas network in Priboj (being too far and in a geographically isolated terrain surrounded by mountains), as this has been a prominent strategic direction in the national-level heating sector. In the rest of Serbia, this strategic direction ignored (and still does) the potentials of locally available biomass that could be used as a clean and renewable energy source, given the primacy of foreign gas that Serbia has been importing exclusively from Russia, thereby exacerbating the risk of energy security [115]. As noted in the discussions in the first phase of the case observation (Figure 3) the national policy arena remained populated with international development actors ready to facilitate projects related to new economic opportunities. The local interests converged with these developments, opening a window of opportunity that local decision makers in Priboj sought to exploit [116,117]. As this window of opportunity was not burdened with the artificial and politically motivated penetration of a gas network, the LSG led by the forward-looking mayor engaged in numerous strategic processes that were supported by international actors as a frontrunner. For example, in 2009, Priboj was one of three municipalities in Serbia that participated in the first study that examined the potentials and possibilities for the commercial use of woody biomass to produce energy and boost economic development [118]. As a result, a novel concept for local economic development that embraced energy transition ideas and usage of local wood biomass for heating was put forward for the municipality of Priboj [112,113,117].

The municipality of Priboj is located in an area that is exceptionally rich in natural resources. With a forest cover percentage of 55%, Priboj is a top-ranking municipality in

Serbia, way above the national average of around 29% [119]. Even though huge quantities of harvested raw wood materials are processed in this municipality, the level of secondary processing was low and dominated by the sawmill industry. Historically, fuelwood was the only form of biomass energy use. In that period, this municipality exclusively used fossil fuels (heavy fuel oil and coal) for municipal heating [118]. The first research commissioned in Serbia, in which Priboj participated with two other municipalities, provided hard evidence of favorable but unused landscape conditions. As highlighted in one of the discussions, in their search for new opportunities for economic development, local leadership decided to exploit the link between local energy system change and locally available biomass and economic development [113]. The idea was that forest wood residues in Priboj would be used for the heating of primary schools, municipal buildings, and kindergartens in the centre of Priboj, as well as boiler rooms in Priboj spas, instead of coal and heavy oil. The choice of using woody biomass was thought to contribute to the economic development, local employment, reduced costs of operation, and improved heating services to customers, with prominent environmental and social benefits (reduction in CO_2 emissions, reduced air-pollution, decreased energy poverty, improved public health, and reduced health costs) [118]. During the interviews, it was repeatedly emphasized that these features made it suitable for the successful promotion of declared local political goals and for solving chronic problems in the local district heating system [120,121]. Additionally, the stability of this regime at the national level started weakening. During that period, the district heating sector in Serbia was characterized by inefficiency, deteriorating assets, low asset utilization rates, high levels of air pollution, and poor-quality heating service provided to its customers. The high cost of operating district heating systems was related to the high cost of heating fuel, particularly heavy fuel oil, which Priboj also used [120,122]. However, existing political and national strategic direction that favored natural gas, along with a weak institutional and investment framework, provided little opportunity for the municipalities to raise the required finances and implement innovative projects [120,122]. However, as revealed during the interviews, this did not discourage the local leaders in Priboj, who continued searching for opportunities to promote what they believed to be an economic opportunity [121,123]. In these circumstances, choosing and implementing the new local energy system trajectory had to involve innovation, not only technical but also institutional, economic, and social innovation, in addition to significant political support and, above all, proactive and coordinated entrepreneurial effort of local leaders.

As evidenced throughout the first phase of the case observation (Figure 3), and the discussions and interviews [113,117,121,123–129] in 2008, the political landscape in the municipality of Priboj exhibited a high level of political stability and support, a shared understanding, and a united approach to vital issues, particularly related to local energy system change, the initiation of energy transition, and the vision of economic development. In 2012, the same mayor retook local office, but, at this time, his party came into power at the national level as well. This strengthened the position of the local leader vis à vis the extensive network of power and access to high-level decision makers. In the same year, Priboj adopted the Sustainable Development Strategy, with the participation of many local stakeholders, and was supported by an external expert organization. There was a high level of consensus of local participants about development priorities, including those based on natural resources. The mayor put forward sustainable development as one of these priorities and positioned himself as a leader who favors decision making that puts the interests of local people above the party interests [114]. Local leaders, regardless of their political positions, showed a united approach to vital issues, particularly the need to overturn the economic decline and bring scarce investments to their municipality. The promotion of a biomass-based local heating system was embedded in the vision of economic development [130]. The newly appointed President of Municipal Assembly (later on, the deputy mayor) who came from the political opposition shared this approach with the mayor. They joined forces to pursue common local interests and bring scarce investments to their municipality. However, they set off on a long journey as the switch to a local

biomass-based heating system and the creation of a bioenergy market had never been successfully attempted in Serbia. The local financial resources were insufficient, and the national energy system was locked into fossil fuels. Nevertheless, local leadership was determined to promote technological, financial, and governance novelties [131,132]. In the past, the municipality of Priboj had a strong industrial sector, and many technically literate people ended up working in the public sector. One of them was the President of Municipal Assembly. This built trust among the local actors in regard to the new technology.

The next opportunity that the local leaders seized was the participation of the municipality of Priboj in another program commissioned by international development actors, which aimed at promoting biomass use for district heating in Serbia. During this process, local decision makers and utility managers discussed suitable technology, institutional and legal set up of the future utility, and general directions for district heating system development, including efficiency improvements in distribution and delivery of heat [113,120]. Local biomass potential was assessed at a level that was seven times higher than the optimized needs of the district heating system of Priboj [122]. That was the moment when the hard evidence and advocacy for financing entered the national mainstream. Their business case was convincing and ready for promotion at the national level as a novel way of making local heating system change based on locally available sources. During the discussion, it was emphasized that the supply of biomass to district heating system could provide a stable long-term revenue stream, which would support the financing of forest rehabilitation activities and provide long-term biomass supply at a stable price [117]. This could be coupled with economic development and job creation benefits, as forest rehabilitation, biomass harvesting, and transport activities are mostly performed locally [122]. The two local leaders (the mayor and the President of the Municipal Assembly) and local utility managers started advocating at all existing national and international forums for a fuel switch of local heating system to be piloted in their municipality, as a first step in the establishment of the innovative business model described above. They continued searching for opportunities to pursue their vision to switch to renewable energy heating through dynamic networking, interaction, and frequent visits to the nation's capital to meet with national and international decision makers [133]. The final decision of local leadership to abandon fossil fuels and change the local energy heating system to a system based on biomass was taken in 2014. Ever since then, the local leaders actively promoted their new vision, searching for the support to implement it. For example, this common local vision, the first of this kind in Serbia, was presented by the President of Municipal Assembly at a National Parliament public hearing on the possibilities of the use of biomass for energy purposes to international and civil society actors [134]. This kind of presentation was also the first one in Serbia. During the Parliamentary hearing, the President of Municipal Assembly highlighted the reasons why the switch to a local renewable energy heating system is needed. He listed the local heating regime weaknesses as follows:

- The poor socio-economic situation that resulted in low collection rates in the oil-based district heating system in the municipality, even though the prices were lowest in Serbia among the systems that used the same fuel.
- The need to overhaul the heat production facilities and distribution system that were old and outdated.
- The high level of CO_2 and SO_2 emissions and air pollution generated by the local heating system [134].

As revealed by the multiple-stakeholder events and as observed at the seven strategic meetings [133–149], this vision also identified weaknesses that many other municipalities shared and served as an inspiration to others, especially considering that the municipality of Priboj belongs to the group of least developed municipalities in Serbia [150]. The proactive engagement of the local leaders continued. For example, the President of Municipal Assembly started chairing the first regional working group for biomass (2015), which within seven years, became the leading regional working body for the energy efficiency program [151]. By the end of this stage, the local leaders were widely recognized as front

runners in their efforts to seek opportunities for the transition of their local energy system, promoting the new technology and business model based on local renewable resources. They were well placed to start using available funds from the newly established national institution for public investment management [152], as, even to this date, many LSGs across Serbia fail to win these funds due to insufficient quality of proposed projects and lack of implementation capacities [124,133].

3.3.2. The Years 2016–2020: Local Actors Launched and Promoted New Niches and Governed the Regime Change

The start of this period was marked by the strengthened political leadership at the LSG level. The previous President of Local Assembly was already recognized as a devoted leader with needed expertise and appointed to the position of deputy mayor. He even joined the ruling party, stating that this move brought greater opportunities to promote the vision on local energy system change. His role was critical in '*making the switch to renewable heat happen*' [121,124]. The promotion of local niches started right away. We find that no national strategic initiative, financial plan, decision, or implementation activity had been made in the biomass-based heating sector without the local leaders of the municipality of Priboj during this period [121,123–127,135–141,143–149,153]. The municipality embarked on its implementation of the vision, supporting the first niche change that included an array of stakeholders, such as international financial institutions and civil society organizations [144–148]. In the absence of national-level funding, the municipality allocated its own funds (EUR 120,000) to replace a coal-based local heating plant with one using wood pellets (0.9 MW) to heat four public buildings, including a municipal building, in 2016 [124]. This marked the launch of the new niche and materialized the first step toward the breaking of the fossil fuel path. Additionally, the municipality of Priboj successfully fundraised EUR 220,000 to tackle the long-standing problem with rundown public lighting that was often the subject of political fights. The full reconstruction of public lighting with more energy-efficient LED bulbs, announced in 2016 [154], was finalized in 2020, halving the LSG's annual costs of electricity and maintenance [128,155].

During the second stage of the case observation (Figure 3) it was found that the LSG continued strengthening its strategic, institutional, and implementation capacities to undertake local energy system change, the first one in Serbia. It successfully managed the administrative burden through the timely preparation of local implementation legislation and technical documentation. This was synchronized with numerous interactions to secure funds and to implement blended financial arrangements from national and international actors, as revealed during the first field visit [156] and during several multi-stakeholder events and strategic meetings [133,135,136,143]. In 2018, the municipality adopted the Program for Biomass Use for Energy Purposes, a policy document that aimed to support the implementation of the vision set in 2014 [157]. It established an energy management system and appointed an energy manager [158]. It adopted the Program for Energy Efficiency and joined the EU Covenant of Mayors [156]. In this period, the municipality of Priboj was frequently visited by many high officials, including the Director of Public Investment Office who, at the time of our second field visit, stated that '*the success achieved by the municipality of Priboj in the field of using renewable energy sources in the heating system of public buildings goes beyond local importance and that the forward looking thinking, pioneering and efficient approach of local leaders of Priboj provided an example worth promoting at the national level as a successful case of local energy system change with many positive outcomes including contribution to the city budget, public health and sustainable development of the local economy*' [159].

In 2019, the expansion and the promotion of the local niche continued. The existing heating plant was replaced with wood chip-based heating of 1.8 MW that provided heating for an additional five public buildings. The funds (EUR 1.07 million) were secured from the national budget with the technical support from the German Development Agency. At the opening, the mayor announced that there would be one more final step that the LSG needed to take to break out of the use of expensive and polluting fossil fuels—to build an 8 MW

biomass heating plant (Figure 7). The local leadership secured an investment worth EUR six million through a trilateral agreement between the German development bank KfW, the Serbian Ministry of Mining and Energy, and the Ministry of Finance [160]. Although this endeavour is not novel in other contexts, we argue that it ought to be interpreted within the existing national context as an innovative technology that rests on new user practices and business models involving a multi-actor entrepreneurial local action, which complies with Geels's definition of a niche [50,52]. Additionally, during our direct observation of the case (Figure 3), it became obvious that the local leaders of the LSG, particularly the deputy mayor, played a crucial role in the outcome. In a politically stable and favorable environment, the local leaders actively searched even beyond Serbia for best practices, engaging in the learning of opportunities and funding for new ideas, and investing their free time to promote the need for a niche change [143–147]. This included study visits, networking, fundraising, and advocacy and learning activities [123–125,127]. The local leaders (mayor, deputy mayor, and energy manager) continued to share their vision and experience in switching from polluting and expensive fossil fuels to biomass with other municipalities. They frequently participated in public discussions at all major national, regional, and local events [135–141]. The LSG kept investing its own funds, but it also won and implemented public financing for energy efficiency improvements projects through the national public investment office. Two of the five heated buildings were refurbished, and their energy efficiency was significantly improved through EUR four million in works financed through this channel [161]. At the end of this period, the municipality of Priboj have established itself as a national pioneer in the use and establishment of new clean technology and sustainable use of biomass in its local energy system [123,140,141,149,162].

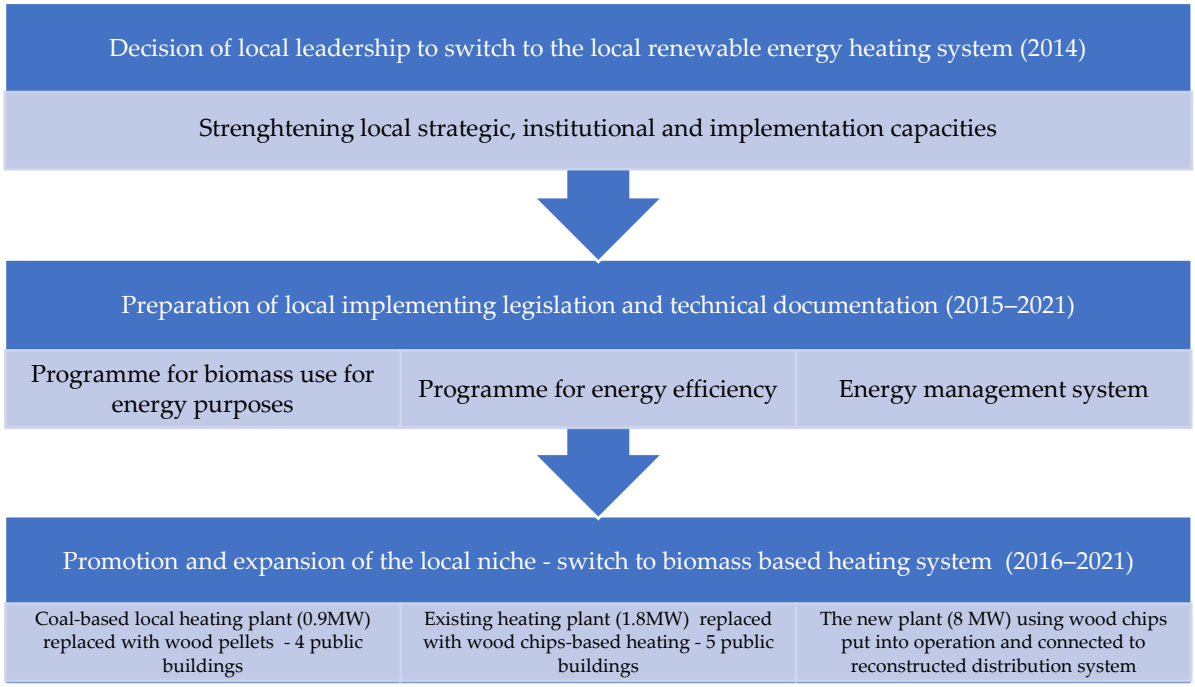

Figure 7. Implementation stages of local leadership decision that was set in 2014 to switch to a renewable energy heating system.

3.3.3. The Years 2021–2022: Local Renewable Heating Regime Broke the Path, Stimulating Other Innovative Local Policy Initiatives

In 2021–2022, the municipal leadership managed to fully transition away from the fossil fuel-based district heating system (Figure 8). In 2021, the new plant (8 MW) using wood chips as its primary fuel was connected to the completely reconstructed distribution system and put into operation, with opening by the Minister of Energy as the most prominent na-

tional example [163,164]. Priboj is the first municipality to complete the project. Out of the ten that were originally included at the start of the program in 2018, six LSGs already pulled out after two years [106]. Through the gradual deployment of technological niches, the LSG broke out of the fossil fuel path and switched to a renewable heating system (Figure 9). As the core actors became aware of the lock-in situation, they adopted a new perspective and took measures that weakened the underlying self-reinforcing mechanisms of the dominant path. This suggests that the path breaking was intentional and strategic [54,56].

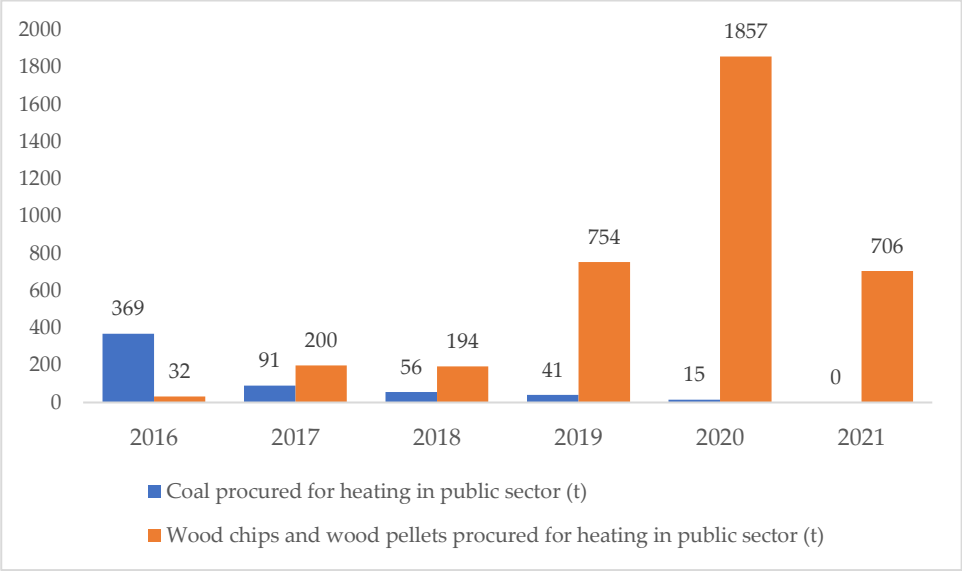

Figure 8. Procurement of selected fuels for the heating of public buildings in the municipality of Priboj [162].

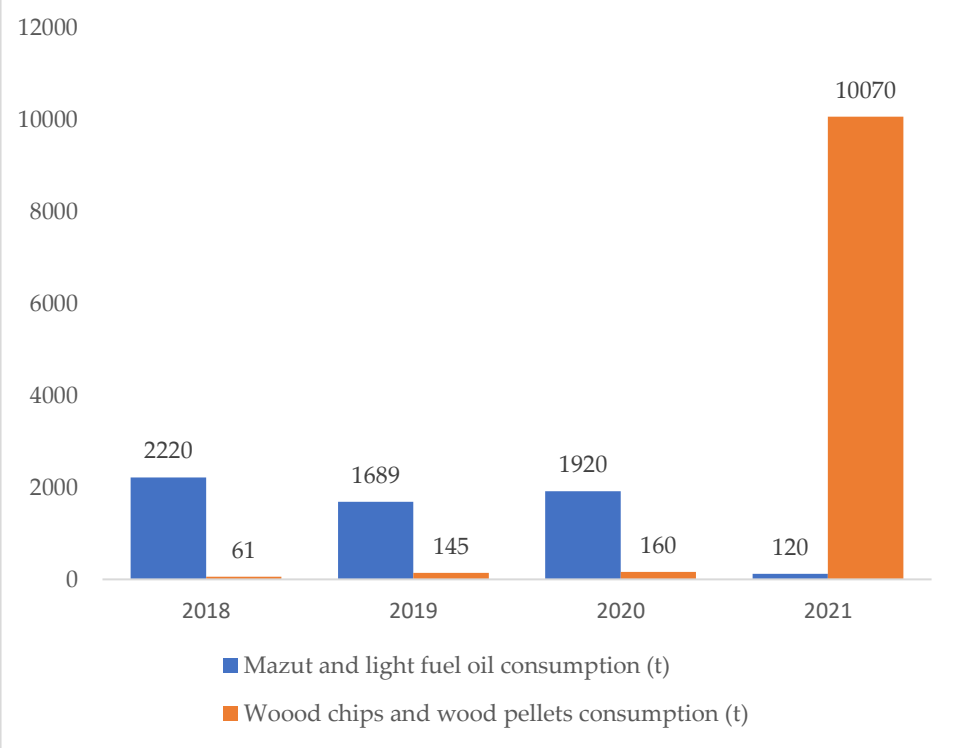

Figure 9. Consumption of selected fuels in the district heating system in Priboj [108,165–167].

However, the achievement is facing new barriers that are located beyond the reach of the local level. While local resource availability in the form of residual wood is documented, the development of resource management that includes physical access to the resource in the mountainous region, a robust supply chain, and appropriate contractual arrangements for residual wood is at an early stage of development and, as such, remains a challenge. This challenge may influence further developments in this field, as it needs to be resolved at a higher level than the LSG and should include an innovation of the business model related to supply [121]. To achieve sustainability in supply, besides the use of wood residues from regular cuttings, the transformation of coppice forests into high forests and the reconstruction of degraded forests into productive stands is a required next step. Cuttings from these processes would become a marketable good used as supplies to the energy markets, ensuring additional financing for sustainable forest management. Such a concept should lead to a long-term increase in biomass available for use, as sustainable harvesting from these lands should be possible at 10 to 15 years after transformation [122]. As observed during the third field visit [163] following the opening of the plant, the municipal leadership continued its broad engagement in many other processes to further promote energy transition and pilot new niches. In a number of strategic processes, the local officials kept an open and flexible governance approach to all the stakeholders to achieve their broader vision of energy transition, including civil society organizations and foreign partners. In this way, the municipality of Priboj developed a local development plan (ahead of the national one) as part of the international project on green rural deal [168], and it is in the process of drafting a sustainable energy and climate action plan with a civil society organization [163].

Most recently the LSG has intensified the support of its residents in improving energy efficiency and utilizing renewable energy in their homes, while tackling energy poverty at the same time. In 2021, 76 households received partial grant support from the national and local governments to replace their inefficient heating systems, and this program was continued in 2022 [139–142]. Additionally, it piloted the first ever replacement of inefficient stoves by local space heaters that satisfy the requirements of the EU Ecodesign Directive in socially vulnerable households in Serbia. Through cooperation with the leading national producer of wood stoves, which deployed its first ecodesign-certified individual wood heater, it subsidized the beneficiaries of a local social care center by 100% [128,153]. This opened not only a new innovative technological niche but also a social one that had never been piloted before, even though such an initiative is central to just energy transition and reduction in widespread energy poverty in Serbia [142]. This is the first national example in which social care measures were effectively combined with energy efficiency and stringent environmental standards, including improved use of locally available renewable energy resources. Although small in scope, this initiative was an important milestone at both the local and the national levels because this particular Directive and the relevant ecodesign standards are neither mandatory nor transposed in the Serbian legislation (the Commission Delegated Regulation (EU) 2015/1186 of 24 April 2015 supplementing the Directive 2010/30/EU of the European Parliament and of the Council with regard to the energy labeling of local space heaters OJ L 193, 21.7.2015, and the Commission Regulation (EU) 2015/1188 of 28 April 2015 implementing the Directive 2009/125/EC of the European Parliament and of the Council with regard to the ecodesign requirements for local space heaters OJ L 193, 21.7.2015). In this case as well, the municipality of Priboj served as a role model for other LSGs. This is illustrated by the transfer of this model to the City of Užice [169]. This infers not only sufficient energy management and governance capacities at the local level, but it also demonstrates the focus on innovative solutions in both technology and policy through a pioneering approach based on the coordinated entrepreneurial efforts of local leadership from whom others can learn.

The summary of the three-tier set of critical conditions found in the case of the municipality of Priboj depicts the underlying mechanism linked to the outcome (presented in Figure 10).

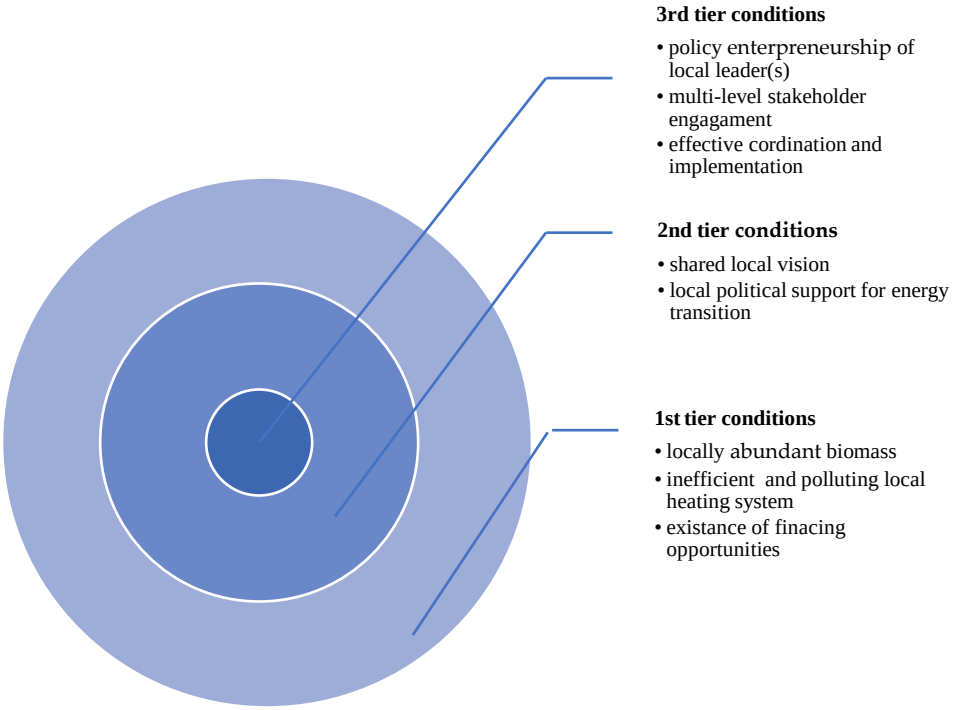

Figure 10. Summary of the sets of critical conditions for the outcome found in the case of the municipality of Priboj.

4. Conclusions

This study advances the understanding of how local energy transitions unfolds in a post-socialist, carbon-intensive, and EU-accession policy setting, where the energy policy environment constrains system change. Our case selection targets an existing gap in the literature to uncover the critical conditions for local energy transformation in the region of Western Balkans, the most carbon-intensive European region. We performed quantitative and qualitative comparative research and found that the municipality of Priboj, with an almost completed transition to renewable heat in the public sector, stands out among the 150 municipalities in Serbia in its attempt to forge local decarbonization. In contrast to the dynamics at the national level, the municipality of Priboj demonstrated ambitious and continuous local-level efforts toward energy transition that were administratively and financially consistently managed. These long-standing coordinated entrepreneurial efforts resulted in the decarbonization of the local heating regime in 2021. Our thorough comparison of all local self-governments in Serbia found no similar outcome and served to strengthen our analytical and methodological approach.

To address the research question—what conditions are critical to forge a local energy transition and shift to renewable heat in the most carbon-intensive European region of Western Balkans?—we link sustainability transitions to accounts of path dependency. We use this dual approach as a strategy that offers a systematic mapping tool for understanding local energy transition in a post-socialist and carbon-intensive context. We use a multi-level perspective of sustainability transitions to explore the circumstances under which the current local-level regime provides opportunities for change and accounts of path dependency to advance the understanding of the critical determinants and frameworks of energy transition, including their application in a real-world context. The explanatory primacy within these frameworks is given to the role of actors and local energy transition governance. We identify a set of critical conditions that have produced the outcome, which is defined as a shared and consistently implemented vision of local energy transition with a nearly completed switch to renewable heating system in the most carbon-intensive European region of the Western Balkans (Figure 10). We uncover and present the way in which the underlying mechanism has worked in this case.

Firstly, we find that the most prominent initiators shared a common interest in economic renewal, which was motivated by a new political leadership, available and unutilized local biomass, and environmental benefits of local energy transition. This coincided with the developments at the national level, where the energy transition debate was shaped by the major renewable energy policy developments at the EU level. In this period, the national policy arena remained populated with numerous international development actors ready to facilitate projects related to new economic opportunities that aligned with the energy transition policy requirements. The local interests converged with these developments, opening a window of opportunity that local decision makers in Priboj sought to exploit. Although other local self-governments in Serbia also demonstrated the first-tier critical conditions (Figure 10), which include locally abundant biomass, inefficient and polluting local heating system, and existence of financing opportunities, only the municipality of Priboj, led by a forward-looking mayor and the President of Municipal Assembly (who later became the deputy mayor and had the technical knowledge) presented a shared local decarbonization vision and engaged in numerous strategic processes, which were supported by international actors, as a frontrunner.

Secondly, a shared understanding of the solutions to existing local heating regime problems and a shared vision of economically viable opportunities pushed the local actors to embark on a long journey to decarbonize the local heating system, despite an undeveloped national policy framework. This combined with local political stability anchored at the national-level politics and synchronized entrepreneurial multi-level action and governance to produce the outcome. Effective coordination across national- and local-level decision makers, financial institutions, and utilities facilitated the implementation of a shared vision of energy transition. Through gradual deployment and promotion of technological niches, the municipality of Priboj broke out of the fossil fuel dependency path and switched to renewable heating system.

Finally, we are aware that our inferences about the critical conditions and the underlying mechanism are made within the studied case. For generalization beyond this example, process-tracing case studies need to be coupled with more comprehensive comparative methods. As there is a lack of cases that could be compared with the municipality of Priboj, our contribution is primarily related to providing an explanation of its unique outcome, which is a nearly completed decarbonization of the heating sector and a switch to renewable heat in a carbon-intensive, post-socialist, and EU-integration policy setting. The relevance is significant, considering that this type of research requires longstanding observations of different cases to acquire extensive case-specific knowledge and intensive field research that is often not feasible within one research project. Additionally, it is a valuable contribution to the number of possible cases and the selection of the necessary and sufficient conditions for future comparative research that should take these findings further and support a more complex comparative field research projects of selected cases. Future research that employs a comparative theory-testing research design could consider the three-tier set of critical conditions found in this case to identify the necessary and sufficient conditions across a number of cases. This would refine the operational framework and contribute to the generalization of findings. The theoretical focus could be on the role of actors and mode of governance in empirically understudied regions, which are relevant for the success of the EU energy transition ambitions, especially in the middle of current energy crises.

Supplementary Materials: The following supporting information can be downloaded at https://www.mdpi.com/article/10.3390/en16042077/s1, Table S1 Data on energy consumption of public lightning system in LSGs in Serbia. Source: Information system for energy management of the Republic of Serbia, 2022, https://www.sem.mre.gov.rs (accessed on 30 January 2023) and Table S2 List of interviewees, strategic meetings, events, and study visits related to direct observation of the case development; Spreadsheets_figures.

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