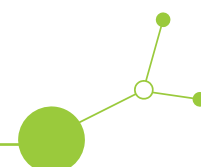




D.3.2.1 JETforCE Strategy - Preliminary Architecture



Final
06/2025





Table of Contents

INTRODUCTION	3
1. THE JUST TRANSITION IN THE JETFORCE AREA	4
1.1 Regulation and policies for Just Energy	4
1.1.1 The European Union framework	4
1.1.2 National and Regional policies	7
1.2 The JETforCE at work	16
1.3 Studies and Case histories from the JETforCE area.....	17
2. SUPPORTING JUSTICE IN THE ENERGY TRANSITION PROCESS.....	24
2.1 The bright and dark sides of the energy transition	24
2.2 Towards a JET: guiding principles and policy recommendations	27
2.3 Stakeholder Engagement and Digital Empowerment	29
2.4 Financing Just Energy Transition.....	30
2.5 The contributions from the Action Plans: work in progress.....	31



Introduction

The energy transition currently unfolding across the European Union is not only a technical and environmental imperative, but also a profound social and political challenge. At the heart of this transformation lies the principle of justice, which has gained increasing prominence as governments, institutions, and citizens confront the uneven distribution of the benefits and burdens associated with decarbonization. The notion of a Just Energy Transition (JET) reflects a multidimensional understanding of justice, encompassing distributive, procedural, and recognitional elements. As the EU intensifies its commitment to achieving climate neutrality by 2050, ensuring that this transition does not reproduce or amplify existing inequalities has become a central concern. Marginalized communities, economically peripheral regions, workers in carbon-intensive industries, and low-income households are particularly vulnerable to exclusion from the green transition if policies fail to account for their specific needs, capacities, and constraints.

This report represents the Preliminary Architecture of the JETforCE Strategy, a foundational effort to build a coherent and integrated framework for a just energy transition across Central Europe. Drawing on the European and national regulatory frameworks, and localized empirical evidence, the report offers a multidimensional exploration of justice in the energy transition. It begins with a comprehensive review of academic debates, mapping the evolution of the JET concept and its intersections with energy poverty, territorial equity, and socio-technical transformation. It then analyzes how European directives and national strategies – particularly in the nine Member States involved in the JETforCE project, are translated into regional and local actions. The report further highlights promising practices emerging from JETforCE partner territories, including Renewable Energy Communities, agrivoltaics, energy renovation projects, and digital tools for citizen engagement.

Importantly, this document should be read as a conceptual and strategic scaffold: a Preliminary Architecture that anticipates the forthcoming consolidation of the final JETforCE Strategy. Future iterations will incorporate detailed Local Action Plans and pilot projects, offering grounded insights from specific territories, and culminating in a conclusive chapter identifying context-sensitive policy solutions. These will aim not only to operationalize justice within energy transition pathways, but also to provide actionable guidance for public institutions and communities committed to ensuring that the decarbonization of Central Europe proceeds both effectively and equitably.

All results will be accompanied by documentary evidence proving the adoption of strategies, action plans, or solutions, or the conclusion of formal agreements for the continuation of cooperation.



1. The just transition in the JETforCE area

In this section, we explore how the nine territories involved in the JETforCE project operationalize the JET topic through regulatory basis, financial mechanisms, and policy instruments. The latter are given on the one hand by the EU's framework for JET, rooted in the European Climate Law, Renewable Energy Directives, and the Energy Efficiency Directive; on the other hand, by national and regional strategies, addressing in particular socio-economic challenges in coal-dependent and vulnerable areas.

The analysis highlights diverse approaches, giving attention to SMEs, marginalized groups, and regional disparities. Case studies across the partner territories illustrate innovative practices like Renewable Energy Communities (REC), agrivoltaics, energy renovations, and resilience projects.

A final reflection identifies convergences around fairness, inclusion, and territorial equity, not ignoring the persistence of challenges such as governance complexity, administrative barriers, and capacity gaps. Justice is seen as an operational principle, not as a rhetorical goal, and the importance of embedding participatory governance and place-based strategies into transition pathways is stressed.

1.1 Regulation and policies for Just Energy

1.1.1 The European Union framework

The EU has developed a comprehensive regulatory and policy framework to support JET, aimed to ensuring that the shift to sustainable energy systems is socially equitable, economically viable, and environmentally responsible. The foundation of this framework is embedded in key EU policies, legislative measures, and financial instruments designed to facilitate a fair transition, particularly for regions and communities historically dependent on fossil fuels.

The legal framework is based upon the European Climate Law (Regulation EU 2021/1119), formally adopted by the EU Council on 28th June 2021, which establishes the legal framework for achieving climate neutrality within the EU by 2050, enshrining into law the EU's commitment to reducing greenhouse gas (GHG) emissions and aligning EU policies with the goals of the Paris Agreement.

The regulation addresses several key challenges related to climate change, a fundamental threat to the environment, human health, and economic stability. The EU recognizes the need to decouple economic growth from fossil fuel consumption and mitigate the risks associated with climate change, such as heatwaves, wildfires, floods, food security threats, and rising sea levels. Furthermore, ensuring a just and socially balanced transition to a climate-neutral economy is a critical concern, as vulnerable communities and economic sectors could be disproportionately affected by decarbonization policies.

The European Climate Law's central goal is to achieve net-zero greenhouse gas emissions by 2050, ensuring that emissions produced within the EU are balanced by removals, including carbon sinks such as



forests and technological solutions like Carbon Capture and Storage (CCS). Additionally, the regulation establishes an intermediate target for 2030, requiring a 55% reduction in net GHG emissions compared to 1990 levels. It also commits the EU to a 2040 climate target, to be proposed based on the outcomes of global stock takes under the Paris Agreement.

Regulation EU 2021/1119 outlines tools and mechanisms to meet the prospected objectives. It reinforces the EU Emissions Trading System (EU ETS) as the primary market-based mechanism to drive emission reductions cost-effectively. The regulation also mandates sectoral roadmaps for industries to transition toward climate neutrality, ensures scientific oversight through the European Scientific Advisory Board on Climate Change, and requires national governments to adopt and implement adaptation strategies to strengthen resilience against climate change impacts. Moreover, the regulation introduces a carbon border adjustment mechanism to prevent carbon leakage by imposing tariffs on imports from countries with weaker environmental standards.

Additionally, the law mandates regular assessments and reporting by both the EC and Member States to ensure progress, asking additionally to the last ones to integrate climate targets into their national energy and climate plans and long-term strategies.

The final result of this framework include a fundamental transformation of the European economy towards sustainability and resilience, with enhanced energy efficiency, renewable energy deployment, and carbon sequestration capabilities. The regulation aims to position the EU as a global leader in climate action, encouraging other nations to increase their commitments under the Paris Agreement. The transition to climate neutrality is anticipated to drive innovation, create high-quality jobs, and improve overall societal well-being while ensuring economic competitiveness and fairness across Member States.

Less general, but equally relevant regulations are given by the Renewable Energy Directives (Directive EC 28/2009; RED II, Directive EU 2001/2018, and RED III, Directive (EU) 2413/2023), and the Energy Efficiency Directive (Directive EU 1791/2023), which establish legally binding targets for renewable energy adoption and energy savings.

The Renewable Energy Directives address critical challenges such as climate change, energy security, and energy independence in the wake of new geopolitical instability, which exposed the EU's reliance on fossil fuels. The directive acknowledges that the energy sector is responsible for over 75% of the EU's greenhouse gas emissions, making a shift to renewables essential.

RED III establishes binding renewable energy targets across sectors, increasing the EU's overall renewable energy target to 42.5% by 2030, with an additional aspirational goal of 45%. It also imposes sector-specific targets, including a 49% renewable share in buildings, accelerated decarbonization of industry, and higher quotas for renewable fuels in transport. The directive reinforces the principle of energy efficiency first, advocating for the prioritization of cost-effective and environmentally sustainable energy use.

To meet these goals, the directive enhances permitting procedures by simplifying and accelerating approval processes for renewable energy projects, introducing renewables acceleration areas where



projects will receive streamlined approvals. It also promotes grid modernization to accommodate increased renewable capacity and prioritizes electrification in industry and transport. Financial incentives and support mechanisms, such as power purchase agreements and investment in innovative renewable technologies, are also introduced.

Expected results include increased renewable energy deployment, reduced fossil fuel dependency, and strengthened energy security. By fostering innovation, industrial transformation, and public-private partnerships, RED III aims to position the EU as a global leader in clean energy while ensuring a just and equitable transition for all sectors and communities.

The Energy Efficiency Directive (EU1791/203) strengthens the EU's commitment to reducing energy consumption as part of the European Green Deal and the Fit for 55 package. The directive addresses climate change, energy security, and economic resilience by promoting efficiency measures across all sectors. It acknowledges that the energy sector is a major contributor to greenhouse gas emissions and that improving energy efficiency is key to achieving climate neutrality by 2050.

To tackle these challenges, the directive sets binding energy efficiency targets, requiring a 11.7% reduction in energy consumption by 2030 compared to projected levels. Public bodies must cut their final energy consumption by at least 1.9% annually, and at least 3% of public buildings must be renovated yearly to meet nearly zero-energy or zero-emission standards. The directive also promotes energy audits, digitalization, and efficiency obligations for businesses and industries.

It introduces tools such as faster permitting for efficiency projects, improved metering and billing systems, financial incentives, and strengthened governance mechanisms. Expected results include lower energy costs, reduced reliance on fossil fuel imports, job creation in green sectors, and enhanced competitiveness while ensuring a fair and inclusive transition to a sustainable energy system.

The previous legal acts are bundled and strengthened through the European Green Deal, adopted in 2019 and serving as the EU's overarching strategy for achieving climate neutrality and decoupling economic growth from resource use. It includes specific mechanisms to ensure that no region or worker is left behind in the transition to clean energy.

To operationalize the Green Deal, the EU introduced the Fit for 55 package and the Just Transition Mechanism (JTM). The former, aimed to reducing GHG emissions by at least 55% by 2030, includes updates to key legislative instruments such as the EU ETS and the mentioned Renewable Energy and Energy Efficiency Directive, ensuring that emission reductions are balanced with economic and social considerations.

The JTM is a dedicated EU financial instrument designed to assist carbon-intensive regions in their transition away from fossil fuels. It consists of three main pillars:

- the Just Transition Fund (JTF), which provides grants to regions most affected by the transition, supporting economic diversification, reskilling programs and job-search assistance, active inclusion of



jobseekers' programmes, environmental rehabilitation, clean energy, and infrastructure investments. The JTF is equipped with EUR €19.2 billion and it is expected to mobilise around EUR €25.4 billion in investments with national co-financing and voluntary transfers from other funds. JTF will alleviate the socio-economic costs triggered by climate transition, supporting the economic diversification and reconversion of the territories concerned;

- the Invest EU Just Transition Scheme, which mobilizes private investments to complement public funding for green energy projects and employment opportunities in affected regions;
- the Public Sector Loan Facility, which supplies concessional loans to public authorities to fund transition projects.

Furthermore, recognizing the socio-economic impacts of climate policies, the EU created the Social Climate Fund, which aims to mitigate energy poverty and assist vulnerable households, micro-enterprises, and transport users in adapting to cleaner energy solutions.

Each EU Member State is requested to submit a Territorial Just Transition Plan (TJTP) outlining how JTF funds will be allocated to support workers, businesses, and communities affected by the transition. These plans ensure that funds are tailored to regional needs and that transition measures align with national energy and climate strategies.

The EC supports Member States through the implementation of a Just Transition Platform, i.e. a single access point and helpdesk for technical and advisory assistance. Authorities and beneficiaries can access information on funding, regulations, and sector-specific initiatives, helping in preparing the TJTPs, outlining priority areas for support and strategies to address social, economic, and environmental challenges.

Finally, to assess the effectiveness of JET policies, the EU employs robust monitoring mechanisms. The European Environment Agency (EEA) and the EC publish periodic reports tracking progress on emissions reduction, social impact, and economic transformation in transition regions.

Looking ahead, the EU continues to refine its JET framework through policy adjustments, increased funding, and enhanced cooperation among member states. The upcoming revision of the Energy Taxation Directive and the expansion of the ETS to new sectors are expected to further align economic incentives with social equity goals. The EU's JET framework represents a comprehensive, multi-faceted approach to achieving a sustainable and inclusive energy transformation. By integrating legal mandates, financial instruments, and participatory governance mechanisms, the EU seeks to ensure that the shift to clean energy benefits all citizens, leaving no one behind.

1.1.2 National and Regional policies

The European Union's ambitious climate goals, anchored in Regulation (EU) 2021/1119 (European Climate Law), define a legally binding path toward climate neutrality by 2050. This framework, strengthened



through directives such as RED III (Directive (EU) 2018/2001) and the Energy Efficiency Directive (Directive (EU) 2018/2018), cascades into the national strategies of Member States. A core pillar of implementation at the national level is the Just Transition Mechanism (JTM), including the Just Transition Fund (JTF), designed to provide socio-economic support during the energy transition. This chapter critically reviews how nine Member States - Hungary, Italy, Germany, Slovenia, Croatia, Czechia, Slovakia, Poland, and Austria - have interpreted and operationalized this EU framework, focusing on legislative instruments, key actors, targeted beneficiaries, and the justice dimensions of their national energy transitions.

Hungary's strategy centers on the implementation of the Just Transition Fund (JTF), targeting three counties (Baranya, Borsod-Abaúj-Zemplén, and Heves) where industries like coal and cement dominate the regional economies. The legislative framework supporting these actions is provided through the Government Decree 256/2021, enabling the allocation of approximately EUR 250 million in EU funds. These interventions seek not only to reduce emissions but to restructure local economies through SME support and the retraining of workers. The emphasis on justice is explicit, addressing the vulnerability of local SMEs, workers, and households. However, the implementation has been marred by delays and conflicts of interest, particularly with stakeholders resistant to phasing out coal.

Regional projects in the country exemplify a multifaceted strategy targeting deeply entrenched coal economies through structural transformation, social mitigation, and legal reform. The “LIFE-IP North-HU-Trans” and “Environment and Energy Efficiency Operational Programme Plus (EEEOPP)” initiatives directly support the National Energy and Climate Plan (NECP) and the national application of the Just Transition Fund (JTF). These projects address the Mátra Power Plant and the coal-intensive counties of Baranya, Borsod-Abaúj-Zemplén, and Heves, targeting decarbonization while safeguarding socioeconomic equity.

Key beneficiaries include lignite-sector workers, SMEs, and low-income households. Activities range from creating transition roadmaps, training experts, and establishing energy communities, to retrofitting buildings and repurposing mining lands for tourism. Particularly noteworthy is the establishment of the Coal Commission—a multistakeholder platform to guide policy development—showcasing alignment with EU principles of participatory governance. Nonetheless, challenges such as institutional coordination, limited innovation capacity, and entrenched socio-economic dependencies on fossil industries persist. Hungary's regional plans, while ambitious and EU-aligned, remain constrained by systemic implementation barriers.

Italy's Just Transition Fund implementation is focused on the heavily deindustrialized regions of Taranto and Sulcis Iglesiente, both out from the JETforCE area. The national legal and institutional apparatus includes the Department for Cohesion Policies and the Prime Minister's Department, supported by regional governments and municipal agencies. Italy's strategy aligns with EU principles by emphasizing economic diversification, requalification of workers, and environmental remediation. Projects such as green fuel synthesis and phytoremediation of polluted lands exemplify the integration of ecological restoration with job creation. However, the regions' historical economic dependence on metallurgy and mining poses significant transformation challenges.



Regional strategies such as those found in Emilia-Romagna under the ERDF framework emphasize ecological transition through energy efficiency, renewable energy, and resilience building, reinforcing Italy's broader Just Transition objectives. ERDF targets a wide array of stakeholders -public bodies, private enterprises, and vulnerable households - addressing both infrastructural transformation and social equity. Key activities involve building renovations, decentralization of renewable energy systems, and urban resilience projects. Importantly, the plan integrates climate goals with inclusive socioeconomic planning, evident in its attention to energy poverty and regional equity.

Particularly interesting is the Italian Strategy for the Inner Areas (SNAI), inaugurated in 2017 in a pilot form to support the socio-demographic development of municipalities in areas furthest from service provision nodes, and evolved in last years in projects supported at the regional level. This is what happens in Emilia-Romagna with the Territorial Strategy for Inner and Mountain Areas (STAMI), which is applied since 2021 in 15 mountain municipalities of the Metropolitan City of Bologna. The strategy includes projects promoting energy and digital transitions, such as energy-efficient upgrades to public facilities, schools, and public lighting. This transition is not only technological but socially equitable, as interventions are locally tailored and community-driven, ensuring benefits are distributed across the 15 participating municipalities. By aligning ecological goals with localized needs, the project fosters both environmental sustainability and social inclusion.

Despite its progressive orientation, Italy's challenge lies in overcoming structural inertia and bureaucratic rigidity, particularly in harmonizing local initiatives with national priorities and EU funding streams. Nonetheless, the regional approach demonstrates the potential for leveraging EU cohesion policy to cultivate localized, sustainable energy ecosystems.

Germany has adopted a dual legislative strategy: the *Klimaschutzgesetz* (Climate Protection Act) and the National Hydrogen Strategy. The former mandates binding, sector-specific emission reductions aiming for climate neutrality by 2045. It is accompanied by extensive monitoring and adaptation mechanisms. The hydrogen strategy complements this by promoting industrial decarbonization, especially in coal-dependent areas like Lusatia and North Rhine-Westphalia. A strong emphasis is placed on retraining workers and establishing hydrogen infrastructure. While Germany exemplifies comprehensive climate governance, its ambitious targets—such as the goal of installing 10 GW of electrolysis capacity by 2030—highlight financial and infrastructural challenges.

Germany's regions exemplify a high level of institutional maturity and funding coherence, yet face persistent challenges such as local resistance to change, high upfront investment requirements, and the need for long-term intergovernmental coordination. Nevertheless, their strategic embrace of hydrogen technology positions Germany as a frontrunner in aligning regional development with the EU's net-zero trajectory.

Regional projects, such as the Just Transition Fund in Saxony and the Net Zero Valley initiative in Lusatia, reflect the dual emphasis on technological innovation and labour market resilience. These align closely



with Germany's national legislative tools and the overarching objectives of the European Climate Law. The Just Transition Fund in Saxony supports economic diversification, education, and green infrastructure, directly benefitting workers and communities in coal-dependent regions. Lusatia's Net Zero Valley initiative seeks systemic transformation by converting legacy industries into decarbonized production hubs, emphasizing stakeholder engagement, inclusive planning, and robust public-private partnerships.

Slovenia's approach is deeply rooted in regional revitalization, guided by its Territorial Just Transition Plan. The JTF focuses on the coal-dependent regions of Savinjsko-Šaleška and Zasavska, with the dual goals of reducing greenhouse gas emissions and fostering inclusive economic growth. The strategy includes the development of clean technologies, such as green hydrogen and battery laboratories, and the rehabilitation of post-mining industrial zones. Local communities play an active role in decision-making, aligning with EU principles of participatory governance. However, progress remains nascent, with projects still in initial stages and facing complex structural and economic challenges.

Slovenia's regional programs, particularly the ERDF and Podravje Development Plans, present a holistic and inclusive model for energy transition. They emphasize enhancing energy efficiency, renewable energy deployment, and infrastructural resilience, while centring equity and territorial cohesion. Beneficiaries span municipalities, SMEs, and educational institutions, reflecting a broad and community-centric engagement strategy. Activities include climate adaptation projects, local energy communities, business incubation, and low-carbon mobility infrastructure. The justice dimensions are clearly embedded—access to clean energy, mitigation of urban-rural disparities, and support for socially vulnerable groups are prioritized.

Administrative decentralization and a strong role for regional development agencies ensure alignment with both the EU Green Deal and national frameworks. However, the uneven distribution of funds and underutilization of renewable energy potentials signal the need for more effective policy implementation and greater financial inclusion mechanisms.

Croatia demonstrates a layered policy framework. Its National Development Strategy (until 2030), Integrated National Energy and Climate Plan (NECP), and JTF implementation all converge on shared goals: emission reductions, economic modernization, and energy poverty alleviation. Key beneficiaries include rural populations and aging demographics, with strategies addressing regional inequalities and migration trends. Notably, Croatia incorporates dedicated energy poverty mitigation measures, such as housing retrofitting and renewable energy access in marginalized areas. While these policies promise broad social inclusion, challenges persist in administrative inefficiencies and disparities between urban and rural development capacities.

The Istrian County Implementation Programme illustrates Croatia's distinctive approach to just transition, primarily focusing on human capital development. Measures target secondary education reform, vocational training, and curriculum alignment with future labour markets, thereby contributing indirectly to energy justice by enhancing employability in green sectors. Although not primarily an energy policy,



the plan complements national strategies by preparing the labour force for structural shifts in the economy. The program's alignment with the JTF underscores Croatia's recognition of the social underpinnings of the green transition.

Yet, Croatia's regional efforts are hindered by infrastructural deficits and limited financial and human resources. As noted, the rigidity of the educational system and inadequate funding mechanisms pose risks to the successful operationalization of transition goals. Nevertheless, the program lays essential groundwork for long-term labour market flexibility and regional resilience.

Czech Republic aims for a complete coal phase-out by 2033, supported by a suite of policies including the National Energy and Climate Plan and National Recovery and Resilience Plan. The dual leadership of the Ministry of Environment and Ministry of Industry and Trade reflects a balance between ecological goals and energy security. Emphasis is placed on developing renewable and nuclear energy, retraining displaced workers, and investing in energy efficiency. However, resistance from coal regions and financial limitations pose obstacles to implementation and complicates the pathway to a just transition.

Czechia's regional focus, exemplified by the Vysočina Region's Spatial Energy Concept, integrates long-term energy planning with district heating modernization, energy efficiency, and stakeholder coordination. This technocratic orientation aligns with national frameworks such as the National Energy and Climate Plan and leverages EU support through instruments like the Just Transition Fund

The region adopts a systematic approach to upgrading energy systems while also fostering stakeholder participation through working groups. Primary beneficiaries include DHS operators, public institutions, and users of alternative fuels. Activities are infrastructural and regulatory in nature—ranging from guidelines for compliance and renewable integration to workshops and awareness campaigns.

Despite its comprehensive design, Czechia's energy transition at the regional level faces financial and coordination challenges, particularly in scaling renewable deployment. However, its commitment to transparent governance and alignment with both EU and national energy strategies offers a replicable model for policy integration and implementation.

Slovakia's legislative and strategic landscape is anchored in its Territorial Just Transition Plan and the National Energy and Climate Plan. The JTF targets three critical regions, addressing economic diversification, environmental remediation, and skills development. The national framework places strong emphasis on education, research, and SME support. Key results include the termination of coal combustion in Upper Nitra and Vojany by early 2024. Despite this progress, limited local administrative capacities and the short timeframe of EU funding present barriers. The participatory design of the TJTP is regarded as a best practice, emphasizing localized solutions and community involvement.

Slovakia presents a nuanced and robust suite of regional projects, spanning from educational investments in the Banská Bystrica region to transformative actions in the Upper Nitra coal basin. These initiatives directly respond to the JTF framework and the EU's climate neutrality mandate, emphasizing socioeconomic stabilization during industrial restructuring. Key initiatives include vocational school



modernization, retraining programs, and energy audits in public buildings. Projects target a diverse group: students, unemployed workers, and marginalized populations. Activities are designed to mitigate social displacement while preparing the labour market for green technologies and digitalization.

Challenges include mono-industrial dependency, demographic decline, and infrastructural gaps. However, the projects demonstrate a clear recognition of these barriers and integrate multi-scalar solutions—ranging from community energy projects to national retraining schemes. The strategic interplay between regional specificities and EU policy frameworks marks Slovakia as a proactive actor in operationalizing just transition principles.

Poland adopts a decentralized and consumer-focused approach, exemplified by the “My Electricity” (*Mój Prąd*) program. This policy empowers households to become energy prosumers by installing photovoltaic systems, heat pumps, and energy management technologies. The program provides subsidies covering up to 50% of eligible costs, thereby democratizing access to renewable energy. However, challenges such as low public awareness and limited familiarity with EU funding mechanisms hinder widespread adoption. Poland’s energy transition also includes regional anti-smog resolutions and urban decontamination programs, reflecting a growing municipal engagement in national decarbonization efforts.

Poland’s Lodzkie Region strategy (“European Funds for Lodzkie in Transformation”) exemplifies a decentralized, innovation-led approach to energy transition. Rooted in the Territorial Just Transition Plan, the program addresses regional economic transformation, skills enhancement, and energy decentralization. The regional program emphasizes digitalization, renewable energy development, and vocational upskilling. Projects support SMEs, vocational schools, and public institutions across 35 communes affected by lignite mining decline. Importantly, it seeks to empower individuals through adult education vouchers and career consulting.

Despite being in its early stages, Poland’s approach reflects an agile response to regional economic vulnerabilities. However, challenges in public engagement, service accessibility, and spatial equity highlight the need for sustained institutional support and civic participation. Poland’s model underscores the critical role of territorial planning in achieving EU-wide decarbonization goals.

Austria’s legislative cornerstone is the Climate and Energy Fund (*Klima und Energiefonds*), a long-standing financial instrument supporting innovation and green regional development. The fund backs over 440,000 projects, investing more than EUR 3.7 billion to date. Emphasis is placed on decentralized energy systems, spatial planning, and model climate-energy regions. Austria’s strategy also includes significant subsidies for replacing fossil-based heating systems, especially in low-income households. Challenges include governance complexities and long-term infrastructure planning. Nevertheless, Austria has successfully institutionalized climate innovation and promoted regional self-sufficiency as core transition principles.

Austria’s regional framework is structured around its long-standing “Climate and Energy Fund,” showcasing a mature and systemic approach to energy transition. With over EUR 3.7 billion invested in



more than 440,000 projects, Austria exemplifies how sustained institutional commitment can enable regional innovation and climate adaptation.

Regional projects focus on decentralized energy systems, climate-energy model regions, and low-income household support for heating system replacement. The approach is both participatory and forward-looking, involving municipalities, research institutions, and citizens in shaping localized transition strategies. Governance complexities and the need for long-term infrastructural planning remain notable challenges. Nevertheless, Austria's success in embedding energy transition within regional development paradigms demonstrates the value of policy continuity, institutional robustness, and public engagement.

Across the involved Member States, a common strategic orientation is evident: a commitment to achieving climate neutrality by 2050, in alignment with the EU's overarching climate legislation and goals as articulated in the European Climate Law (Regulation EU 2021/1119). While countries like Hungary, Germany, and Slovakia have formalized these objectives within binding legislative frameworks, directly referencing neutrality targets and sector-specific carbon budgets, others such as Croatia and Slovenia have opted to internalize the EU's climate objectives through broader, often development-focused instruments. These include National Energy and Climate Plans (NECPs), territorial JT strategies, and long-term development plans that address decarbonization as one of several concurrent national priorities. In some instances, notably in Germany and Italy, the national transition agenda extends beyond climate mitigation alone, encompassing comprehensive industrial modernization, technological leadership in emerging sectors (e.g., hydrogen, green fuels, and circular economy systems), and systemic innovation designed to reposition these economies at the forefront of the low-carbon transformation.

When it comes to identifying the principal targets of policy interventions, there is widespread convergence among the Member States. All countries prioritize carbon-intensive territories - particularly former or existing coal mining regions and industrial areas - as focal points for intervention. These areas often face significant socio-economic vulnerabilities, stemming from historical dependency on fossil fuel-based employment and infrastructure. As a result, displaced workers, especially from mining, metallurgy, and heavy industry, are systematically identified as key beneficiaries. Similarly, rural communities, which are frequently isolated from innovation ecosystems and infrastructural investments, receive targeted support aimed at reducing regional disparities and counteracting depopulation trends. SMEs are also widely recognized as potential engines of green growth and local revitalization across national strategies, especially in Hungary, Slovakia, and Germany, as recipients of both financial support and capacity-building initiatives. Beyond these, particular attention is given to youth populations, low-income households, and marginalized communities, as in Austria, Poland, Slovenia, and Croatia, which have integrated mechanisms to promote energy equity and mitigate the risk of social exclusion during the transition.

A diverse array of policy measures is employed by the Member States to operationalize the energy transition at the national and subnational levels. Retraining and upskilling programs, especially those aimed at workers in declining fossil sectors, feature prominently in Hungary, the Czech Republic, and Slovakia, often embedded within broader regional transformation packages. Support for SMEs emerges as



a consistent instrument for stimulating endogenous economic diversification, notably through grants, innovation hubs, and advisory services, particularly visible in Slovakia, Germany, and Hungary. Renewable energy deployment, whether through infrastructure investment, prosumer support, or fiscal incentives, is a leading intervention in Poland, Germany, and Croatia, complemented by grid modernization and storage solutions. Environmental remediation is a key focus in heavily polluted or degraded areas, with innovative examples in Italy (e.g., phytoremediation in Taranto) and Slovenia (e.g., coal region revitalization). Meanwhile, countries like Austria and Germany emphasize infrastructure development, not only in terms of physical assets (e.g., green hydrogen pipelines or public transport systems), but also in digital and administrative systems necessary to facilitate coordination and service delivery across jurisdictions.

Particularly noteworthy are the robust strategies developed by Germany and Italy, both of which have advanced beyond conventional transition planning by embedding green hydrogen and circular economy principles into their core legislative instruments. Germany's National Hydrogen Strategy and Italy's pilot projects on Green Fuel Synthesis exemplify how Member States can leverage the energy transition to drive industrial innovation, attract investment, and stimulate research and development across a wide range of economic sectors.

Justice and equity considerations are increasingly becoming integral to national energy transition policies. These concerns manifest through a variety of mechanisms: from financial subsidies and grants for low-income households (as seen in Austria and Poland) to inclusive participatory planning processes involving civil society and local communities (e.g., Slovenia, Slovakia). Slovenia and Slovakia in particular stand out for their strong participatory governance models, which include regional development agencies, citizen workshops, and stakeholder forums to ensure that local voices shape decision-making. By contrast, Hungary and the Czech Republic still face challenges in institutionalizing equity, often due to political resistance, low public awareness, or underdeveloped mechanisms for social inclusion, especially in historically coal-dependent regions. Nonetheless, there is an emerging recognition across all countries that procedural fairness and distributive justice are indispensable components of sustainable policy success.

The implementation architecture across Member States reveals the complexity of multi-level governance required to translate EU mandates into actionable national and regional policies. National ministries typically assume strategic coordination roles (e.g., Ministries of Economy, Environment, and Regional Development), while regional authorities, municipalities, and EU bodies participate in operational management and resource distribution. Germany demonstrates a mature institutional model with bodies such as the Climate Protection Council and Hydrogen Council playing strategic advisory roles. In contrast, countries like Slovenia and Slovakia rely extensively on regional development agencies and cross-sectoral committees to foster local ownership and tailor interventions to place-based needs. The effectiveness of these institutional arrangements varies significantly, influencing not only the pace of implementation but also public trust and long-term policy continuity.



Despite these well-structured efforts, several common challenges persist across the reviewed countries. Among the most pressing are socio-economic resistance to change, particularly in regions where the transition threatens livelihoods and cultural identities tied to extractive industries. This is compounded by limited administrative and technical capacity, especially at the local level, where bottlenecks in project design, fund absorption, and stakeholder coordination can delay implementation. Financial and technological constraints also hinder progress, particularly in countries where clean energy infrastructure and innovation ecosystems are still nascent. However, these challenges are counterbalanced by an array of anticipated benefits, including the creation of new and diversified employment opportunities, acceleration of technological innovation, enhancement of public health through improved air quality, and bolstered energy security and resilience—especially significant in the wake of geopolitical tensions affecting energy supply chains.

Considered at the Country level, the energy justice policies implemented in the JETforCE area reveals national approaches that, while shaped by unique historical, socio-economic, and institutional contexts, collectively embody the spirit and substance of the EU's JET agenda. There is a clear convergence around key principles: environmental sustainability, social inclusivity, technological innovation, and economic resilience. The EU's legislative instruments provide a cohesive framework, but their success is contingent on national governments' ability to translate policy into practice through effective coordination, place-sensitive implementation, and long-term financing. As the transition progresses, the challenge for Member States will be to balance ambition with equity, ensuring that no region or community is left behind while harnessing the full potential of a decarbonized future. The pathways highlighted by these national experiences can serve as valuable references for cross-country learning, policy harmonization, and continued refinement of the European green transition model.

The comparative insight in the JETforCE area testifies the critical role of regional governance in driving the EU's energy and climate transition. By embedding justice in localized energy strategies and aligning with broader national and EU legal frameworks, these initiatives provide blueprints for a more equitable and resilient energy future.

The regional projects mentioned present a rich tapestry of transition strategies shaped by national contexts and EU frameworks. A shared emphasis across all countries is the prioritization of economic diversification, workforce adaptation, and inclusive governance. Most programs explicitly address energy justice, either through targeted support for vulnerable groups, participatory processes, or infrastructure equity.

Variations emerge in focus and execution. Germany and Austria exhibit high institutional capacity and financial maturity, deploying integrated frameworks to scale innovations. In contrast, Croatia and Slovakia, while ambitious, face constraints in infrastructure, funding, and social inclusion. Hungary, Czechia, and Poland adopt region-specific interventions that reflect both historical energy dependencies and emerging resilience strategies.



In terms of beneficiaries, while all projects recognize workers and SMEs, only some, such as those in Slovenia and Italy, systematically include marginalized households and youth. Key activities likewise range from energy system overhauls and job retraining to urban renewal and education reforms. Institutional arrangements are diverse, with varying degrees of decentralization and cross-sector collaboration.

Finally, common challenges include capacity gaps, funding absorption, public resistance, and the inertia of legacy systems. However, the benefits—reduced emissions, job creation, social equity, and energy security—offer compelling incentives for sustained effort.

1.2 The JETforCE at work

Rooted in the EU's objectives to promote sustainability while ensuring equitable access to energy resources, the JETforCE project aims to develop digital tools that engage citizens and policymakers in mapping energy transition challenges and evaluating responsive technologies. A structured monitoring and evaluation framework guides the initiative, incorporating performance indicators, periodic assessments, and oversight by a transnational Monitoring Committee to ensure alignment with project goals and the generation of reliable data for policy formulation.

The implementation process involved extensive preparatory activities, including stakeholder meetings, technical testing, and local launch events tailored to regional conditions. The Digital Challenge Mapping tool was introduced across multiple partner regions to engage citizens in identifying local energy transition challenges, which would then inform policy and technological interventions. Engagement strategies varied, incorporating collaborations with municipal authorities, universities, and businesses invested in sustainability.

The results obtained reveal a mixed but promising picture. Several countries successfully introduced the tool to citizens, collecting a significant number of challenges related to energy poverty, inefficiencies in renewable energy deployment, infrastructure gaps, and policy barriers. The variety of reported challenges underscores the complexity of the energy transition and the importance of localized solutions. Despite this progress, challenges emerged in user engagement and technical performance, with concerns raised about usability, accessibility, and the long-term management of the collected data.

Among the key strengths identified is the high level of interest among certain stakeholder groups, particularly students, local governments, and businesses committed to sustainability. The initiative fostered collaboration between diverse actors, creating a foundation for sustained engagement. The monitoring methodology proved effective in identifying gaps and allowing for mid-course corrections, ensuring a responsive and adaptive approach to implementation.

However, weaknesses also surfaced. Technical difficulties with the Challenge Mapping tool, including login issues and data input inconsistencies, hindered broader adoption. Moreover, there was skepticism among users regarding the tool's long-term impact, as many feared that reported challenges would not



lead to concrete action. Some regions experienced low participation rates, highlighting the need for enhanced outreach strategies, incentives for engagement, and clearer communication of the tool's purpose and benefits.

The conclusions drawn emphasize the necessity of refining digital tools to ensure user-friendliness and reliability. Strengthening engagement strategies is critical, particularly by emphasizing the role of policymakers in responding to the reported challenges. Integrating digital solutions into existing governance structures is essential for maximizing their utility. Future phases should focus on improving the Challenge Mapping tool based on user feedback, expanding participation through targeted incentives, and ensuring that collected data translates into actionable policy recommendations. The lessons learned from this initiative will be instrumental in shaping the next phase of the JETforCE project, reinforcing its contribution to a fair and inclusive energy transition in Central Europe.

1.3 Studies and Case histories from the JETforCE area

The energy transition across Europe is not a uniform process, but a mosaic of locally anchored, nationally guided, and transnationally supported actions. Central and Eastern European countries have responded to climate and energy challenges through a diverse range of projects and studies, often aimed at both mitigating environmental impacts and alleviating energy poverty. The narratives from JETforCE partners illustrate how local conditions, policy frameworks, and institutional capacities shape the pathways to decarbonization.

The following comparative analysis reveals that while local contexts differ, the energy transition in Central and Eastern Europe is marked by creativity, inclusiveness, and an evolving commitment to justice and sustainability.

In **Hungary**, energy transition efforts have centred around public perception, equity, and localized renewable energy innovations. A key initiative is the study conducted by the Foundation for European Progressive Studies in 2021, which examined societal attitudes toward climate action and identified key socioeconomic barriers to a just transition. The findings highlight widespread public concern about affordability and access, with particular fears over the rising cost of living. These anxieties were most acute among individuals with lower education and income levels, underlining the importance of addressing distributive and recognition justice within climate policy.

Additionally, Bábolna emerged as Hungary's first fully operational Renewable Energy Community (REC), integrating local photovoltaic generation, smart storage, and an advanced energy management system. The Bábolna model represents an innovative response to both energy sovereignty and social inclusion, with future plans to extend energy discounts to vulnerable households. The municipality-led model combines public leadership with citizen participation, a structure that holds significant replicability for similar mid-sized communities.



Italy's contributions to energy transition discourse are rich in community-based practices and institutional synergies. The case of Trieste - external to the project's area, but internal to the program's - is emblematic, with the University of Trieste and local social welfare institutions conducted a comprehensive study on energy poverty within public housing districts, interlinking between health, infrastructure, and social inclusion. By leveraging community welfare networks like the "Microareas" program, researchers were able to conduct nuanced assessments and propose interventions deeply embedded in the social fabric.

Italy is also advancing the frontiers of RECs and agrivoltaic solutions. The REC in Valsamoggia (Bologna), utilizes photovoltaic installations to generate local economic value while mitigating CO₂ emissions. Meanwhile, the EAGER (Easing AGrophotovoltaic for EuRope) project, led by MCBO, stands out as a beacon of innovation, aiming to improve nine policy instruments to facilitate the expansion of agrivoltaics across the continent. EAGER's approach is noteworthy for its attempt to reconcile the productive uses of land for both energy and agriculture, fostering integrated land use and rural sustainability. This integration not only reduces land-use conflict but also empowers farmers through decentralized energy production.

In Emilia-Romagna, additional case studies on local farms further illustrate the potential of combining renewable energy with agriculture: through photovoltaic systems integrated into farming and mixed crop production, Italian initiatives exemplify holistic resource utilization.

Germany's energy transition, characterized by the concept of *Energiewende*, is both technologically advanced and socially reflexive. The transition is propelled by strong federal and subnational institutions, yet it is also deeply rooted in local participation mechanisms. Projects such as the *Energieautarkes Dorf Feldheim* showcase complete energy autonomy through wind, solar, and biogas integration. This village-level initiative witnesses local emphasis on RECs as key levers of energy democracy and decentralization.

Research conducted by the German Institute of Development and Sustainability (IDOS) reinforces the criticality of energy justice in the country's transition. The policy recommendations derived from expert interviews emphasize procedural justice, particularly in participatory decision-making, and advocate for embedding social equity into legislative frameworks. Moreover, the Citizens' and Municipalities Participation Act in Mecklenburg-Vorpommern demonstrates how legal innovation can institutionalize community stakes in energy projects, ensuring equitable financial returns.

Slovenia offers a mature and multifaceted approach to energy transition, with strong attention to vulnerable populations, institutional coordination, and technological innovation. The national action plan to combat energy poverty aligns various actors, including the Jožef Stefan Institute and the Eco Fund, in a joint effort to provide non-repayable incentives for home renovation among energy-poor households, reflecting a strong commitment to energy justice.

At the community level, Slovenia has developed integrated energy solutions. The self-sufficient energy community in Luče exemplifies a local system that combines solar panels, battery storage, electric vehicle



charging stations, and advanced energy management systems. This pilot, developed under the EU-funded COMPILE project, achieves not only energy independence but also community engagement and technical resilience.

Slovenia has also pioneered agrivoltaic practices, such as the Deržič project, which combines solar power generation with sheep farming. This initiative serves as a dual-purpose land-use model that improves both agricultural productivity and energy output while protecting against climatic extremes.

Croatia's energy transition efforts have been shaped by its response to energy poverty and its attempts to institutionalize energy justice at the local level. The city of Zagreb, through collaborations with the Society for Sustainable Development Design (DOOR), has conducted extensive studies and pilot actions focused on identifying and supporting energy-poor households. These actions included energy audits, modeling of energy expenditure, and renovation proposals that combine short-term measures with long-term efficiency gains.

Cross-border initiatives such as CO-EMEP, a partnership with Hungarian municipalities, further illustrate Croatia's commitment to regional cooperation and localized energy management. The project emphasized the development of online energy management tools and pilot audits, strengthening public sector capacities in energy planning.

Additional initiatives in Istrian County, such as vocational training at Mate Blažine Labin High School and the development of entrepreneurial infrastructure, point to a systemic approach that connects green skills, educational reform, and regional economic diversification. These projects indicate Croatia's growing emphasis on structural change and future competencies in the context of energy transition.

Czech Republic has pursued a two-pronged strategy centered on coal phase-out and the empowerment of local actors. The JTF (see supra) has been instrumental in supporting municipalities, SMEs, and NGOs in coal-dependent regions like Moravia-Silesia and Ústí Nad Labem. A blend of financial assistance, strategic planning, and capacity-building workshops has allowed for gradual decarbonization accompanied by socio-economic support mechanisms.

Notably, the initiative in the Ústecký region, focused on renewable energy deployment and retraining for former coal workers, exemplifies how energy justice can be operationalized through local job creation and access to clean energy. Community cooperatives and targeted subsidies have ensured that vulnerable households benefit from the transition.

Slovakia's energy transition is encapsulated in its Territorial Just Transition Plans (TJTPs), which allocate substantial funding to phasing out coal and promoting economic diversification. Projects focus on Upper Nitra, Košice, and Banská Bystrica, with targeted investments in green technologies, worker reskilling, and sustainable agriculture. The government's collaboration with Hyundai Mobis to establish an electric vehicle components plant exemplifies strategic industrial realignment.



Complementary programs such as Obnov dom mini support vulnerable households in renovating family homes with measures including insulation, solar panel installation, and boiler replacement. These interventions are designed to improve living conditions while reducing energy costs and emissions. Community-based energy initiatives and educational investments, such as the Center of Excellence in Labin, reflect the country's attention to long-term social impacts and institutional readiness. Projects also address challenges in waste management, structural reforms, and public trust through increased transparency and public participation.

Poland's transition narrative is dominated by the decarbonization of regions like Belchatow, historically dependent on lignite. A detailed spatial analysis conducted by the Energy Forum Foundation has identified large-scale potentials for photovoltaic and wind energy, proposing that post-mining lands be repurposed for renewable energy development.

Strategic planning focuses on attracting new industries that prioritize access to low-carbon energy, transforming Poland's central location into an asset for green industrial growth. These shifts are accompanied by community education and adaptation planning, as shown in reports advocating the use of RES to support economic development while mitigating the socio-economic fallout of coal dependency.

Austria offers a refined example of how spatial and energy planning can be harmonized to support regional transitions. The integrated spatial and energy planning initiative in Styria reflects a commitment to energy-efficient urban development, participatory governance, and sustainable land use. Tools such as spatial databases and GIS mapping enhance the precision and scalability of local energy strategies.

In the town of Weiz, the establishment of the Energiewerk REC represents a practical application of inclusive energy transition. This community offers low-cost renewable electricity to local households and businesses, including low-income groups without access to their own photovoltaic systems. Innovations in heat storage, electric mobility, and public building renovations further amplify the impact of Austria's localized transition efforts.

Across the nine countries involved in JETforCE project, common themes emerge. The pursuit of energy justice is a cross-cutting concern, with special emphasis on vulnerable populations, procedural fairness, and equitable access to transition benefits. Most projects share goals of increasing renewable energy uptake, reducing energy poverty, and creating sustainable economic alternatives to fossil fuel dependence. Beneficiaries often include low-income households, local governments, SMEs, and educational institutions.

2.2 The »state of the art« in JETforCE area

The landscape of the energy transition across the JETforCE area reveals a complex and vibrant tapestry of actions, policies, and aspirations that reflect the broader European ambition for climate neutrality. As this conclusive reflection unfolds, it becomes clear that the processes set in motion across Central and Eastern Europe are as diverse as the regions they inhabit, yet united by a shared drive to ensure that the



shift to clean energy does not exacerbate existing social inequalities. Rather, these transitions aim to correct them, embedding justice at the very core of energy transformation efforts.

Throughout the examined policies and initiatives implemented in the territories and the countries involved in JETforCE, there emerges a consistent pattern of convergence around the values of fairness, inclusion, and sustainability. The EU's overarching legal framework, particularly Regulation EU 2021/1119, provides the scaffolding upon which each Member State has built its approach to energy transition. However, the ways in which this framework has been translated into national and local realities vary substantially, shaped by each country's institutional capacity, socio-economic conditions, and historical dependencies on fossil fuels.

Germany and Austria offer illustrations of institutional maturity, where innovation in governance and financial architecture has enabled complex, participatory transition strategies to flourish. In contrast, countries such as Hungary and Croatia navigate the energy transition within the constraints of limited administrative capacities and fragmented regional governance. These asymmetries, while posing challenges, also highlight the importance of tailoring transition strategies to specific territorial and social contexts. The strength of the JETforCE project lies precisely in its recognition of this diversity, and in its effort to capture a broad spectrum of localized responses to a common challenge.

Distributive, procedural, and recognitional justice has moved beyond the realm of abstract principles and has increasingly become an operational imperative. Projects and policy instruments across the area increasingly reflect a commitment to ensuring that the costs and benefits of the transition are shared equitably. In some regions, this commitment has manifested in tangible policies targeting vulnerable groups, integrating public participation into planning processes, and recognizing the cultural and economic specificities of marginalized territories. Elsewhere, however, justice remains more aspirational than realized, with participatory structures underdeveloped and vulnerable communities insufficiently engaged. Other challenges range from inadequate funding and bureaucratic hurdles to skills gaps and regional disparities.

Despite such uneven progress, some promising mechanisms are beginning to coalesce into viable pathways for inclusive transformation. A few key trends are particularly notable:

- **RECs**, prominent in Austria, Germany, Hungary, and Italy, which are gaining traction as platforms for democratizing energy production and reinvesting local value. Their success depends not only on technological and financial support, but on regulatory environments that empower local actors and reduce administrative burdens;
- **renewables in agriculture** and agriphotovoltaics, advanced by the EAGER project, which stands at the intersection of environmental innovation, rural development, and energy justice, and exemplified by Emilia-Romagna's cases and the Slovenia's Deržič model, these initiatives innovative land use and rural empowerment;



- **energy renovation of buildings**, strongly present in the experiences presented by Slovenia, Slovakia, Croatia, and Italy, where deep renovations are backed by grants and technical support;
- **green and sustainable mobility**, addressed in Germany and Slovenia through integrated community design and electric vehicles infrastructure;
- **climate adaptation and structural change**, with Slovakian and Polish cases providing systemic examples of how structural economic transformation and adaptation plans are aligned with transition goals, and the Emilia-Romagna's STAMI, which highlights socially equitable and community-driven energy transition as a propeller for sustainable development;
- **public education and skills development**, highlighted in Croatia and Slovakia, where schools and vocational centres are involved in transition planning.

Territorial equity has emerged as another key concern. As renewable energy infrastructure increasingly finds its place in rural and post-industrial regions, questions of land use, environmental justice, and local benefit sharing have become more pressing. Spatial planning, when harnessed to advance social goals, can become a powerful tool for managing this complexity. Austria's integration of energy and land-use planning offers a useful model, pointing to the potential of coordinated, cross-sectoral approaches to foster place-sensitive energy transitions.

Challenges are strong and demanding. Many regions face the inertia of legacy systems, resistance from communities with deep-rooted ties to extractive and carbon-related industries, and scepticism about the fairness and feasibility of the proposed changes. Moreover, gaps in funding access, especially for small municipalities and under-resourced institutions, risk entrenching existing disparities. The administrative complexity of navigating EU funding instruments, combined with the absence of adequate technical support, often prevents the most affected communities from benefiting from the very tools designed to assist them.

A fundamental lesson that emerges from the comparative review is that success in delivering a JET is inseparable from the quality of governance. Where public trust is low and mechanisms for participation are weak, even well-designed policies may falter. Where transparency, inclusion, and responsiveness are embedded in institutional practices, transitions are more likely to succeed and endure. The experience of the JETforCE area shows that building such governance structures is both a technical and cultural task, requiring time, capacity-building, and a shift in political norms.

The digital tools piloted through the JETforCE project, particularly the Challenge Mapping platform, offer a glimpse into the potential of participatory technologies to bridge gaps between citizens and policymakers. However, their limitations - technical, practical, and perceptual - reveal the need for deeper integration into existing governance structures and more thoughtful engagement strategies. Tools alone do not guarantee justice; they must be embedded in systems that are prepared to listen, respond, and adapt.



Looking ahead, the insights gathered here provide a valuable basis to formulate policy recommendations that not only support decarbonization but actively enhance social cohesion and territorial development. If justice is to guide the energy transition, it must be inscribed into future action plans. This means designing interventions that resonate with local realities, investing in people as much as infrastructure, and building institutions capable of navigating uncertainty while safeguarding the rights and dignity of all citizens.

The task is to translate these reflections into a roadmap that consolidates the gains made, addresses persistent shortcomings, and charts a path forward that is as inclusive as it is ambitious. The next phase of the JETforCE project must distil the diversity of regional experiences into shared principles, while offering practical guidance that supports territories in shaping energy futures that are not only sustainable, but just. It is only by anchoring the transition in fairness, and by making justice a lived reality rather than a rhetorical aim, that the energy transformation can fulfil its promise of delivering better lives in a decarbonized Europe.



2. Supporting justice in the energy transition process

2.1 The bright and dark sides of the energy transition

The process of JET represents one of the most profound transformations in contemporary societies, seeking to simultaneously decarbonize economies, regenerate territories, and promote social equity. However, the pathway is fraught with criticalities that emerge in the realms of social justice, territorial transformation, and structural change, all of which expose significant tensions between environmental objectives and socio-economic realities. Understanding who loses in the process, and what precisely is at stake, is essential to designing energy policies that go in the direction of different facets of “justice”.

Renewable energy policies must prioritize social justice, ensuring affordability, accessibility, and spatial equity. Agri-voltaic systems, promoted in Emilia-Romagna and Slovenia, illustrate how renewable expansion can align with agriculture and rural development. Tailored subsidies, dual-use land regulation, and farmer support are key. In cities, decentralized systems like Poland’s My Electricity empower households as energy prosumers—if support reaches disadvantaged groups and avoids reinforcing a digital-energy divide. Workforce adaptation is crucial. Vocational retraining in Upper Nitra (Slovakia) and educational reforms in Croatia’s Istrian County show how labour markets can transition toward green sectors. These programs must be comprehensive, future-oriented, and inclusive of sectors like renewable energy, sustainable farming, and green mobility. Poland’s Lodzkie Region piloted adult education vouchers, proving effective when coupled with personalized career support.

From the perspective of social justice, a clear and recurring criticality concerns the exposure of vulnerable populations to new forms of disadvantage. Workers in fossil-fuel industries, low-income households, marginalized rural communities, and SMEs are frequently at risk of becoming the primary losers in the transition. Their losses are multifaceted. Workers face the disappearance of entire sectors, notably coal mining and heavy industry, with limited prospects for immediate and equivalent re-employment. The loss here is not only economic but also cultural, as professions and identities tied to extractive industries dissolve. This could generate a profound sense of alienation, mistrust toward political institutions, and resistance to transition policies perceived as exogenously and top-down imposed.

Low-income households confront losses that manifest through energy poverty and affordability crises. Energy transition policies, particularly those that rely heavily on market mechanisms, can lead to higher energy prices and increased costs of living, particularly where carbon pricing - i.e. policy mechanisms that put a financial cost on GHG emissions (carbon taxes, ETS, and so on) - is implemented without compensatory measures. Vulnerable households can lose access to affordable and reliable energy services, a deprivation that exacerbates health issues, social exclusion, and intergenerational poverty. The reliance on traditional economic models, which underestimate the distributive consequences of transition policies, reinforces



these patterns. Furthermore, the lack of comprehensive, harmonized measures for identifying and targeting energy-poor households leads to fragmented interventions that fail to reach the most affected groups.

Territorial equity must be systematically integrated into the design of transition policies. Large-scale renewable energy projects should not be imposed on vulnerable territories without mechanisms for local benefit-sharing and participatory decision-making, avoiding the extractive logic that has historically characterized rural and post-industrial areas. Austria's spatial energy planning in Styria offers a blueprint for integrating renewable energy development with land-use strategies that promote sustainability, resilience, and community empowerment. Future policies should mandate that renewable energy projects in rural areas include community benefit agreements, profit-sharing mechanisms, or requirements for local ownership shares. Regions particularly exposed to industrial decline, such as coal mining territories in Slovakia, Poland, and the Czech Republic, should be supported through integrated territorial development programs that combine decarbonization with economic diversification, skills upgrading, and social infrastructure investment.

In the domain of territorial transformation, criticalities emerge from the uneven spatial distribution of benefits and burdens associated with energy transitions. Rural and post-industrial regions often become sites for capital intensive renewable energy developments, such as large-scale solar or wind farms, without sufficient mechanisms to ensure tangible benefit-sharing for local communities. These territories thus lose control over their resources and sites, becoming mere hosts for external investment flows that do not necessarily translate into local prosperity. Distributive justice failures are compounded by procedural justice deficits: many rural communities experience top-down planning processes with minimal meaningful participation, resulting in opposition, social resentment, and outright resistance to green projects.

The loss here would be twofold: on the one hand, the economic loss of failing to capture the value generated by the energy transition; on the second hand, a loss of agency and recognition, as local communities feel bypassed by decision-making processes that prioritize national targets over localized needs and identities. This dynamic has the potential to widen existing territorial inequalities, marginalizing peripheral regions even further and fuelling social polarization between urban centres, which reap the primary benefits of the green economy, and rural areas, which bear transition costs.

Structural change introduces another set of challenges and criticalities. As economies shift away from fossil fuel dependence, entire industrial structures must be modified, some of them dismantled and replaced with more sustainable sectors. This transformation is not merely technological but deeply socio-economic, affecting production patterns, labour markets, and community structures. The losers in this context are not only workers displaced by deindustrialization, but also SMEs tightly integrated into traditional industrial ecosystems and facing significant barriers to adaptation, including lack of financial resources, limited access to innovation networks, and cultural inertia.

Economic diversification requires direct support for SMEs, cooperatives, and social enterprises. Investing in local R&D centers, incubators, and cooperative platforms helps embed transformation within communities



and avoid external dependency. The *Net Zero Valley* in Lusatia, Germany exemplifies how clean tech can drive regional change when paired with social cohesion strategies. Education is central: Croatia's vocational schools incorporating green skills show how curricula must evolve. Governments should invest in sustainability education across all levels, linked to practical skills in renewables, construction, circular economy, and digital tools. Public campaigns and online learning can spread green knowledge widely across society.

Structural change must also integrate climate adaptation. Poland's adaptation plans and Slovakia's economic transformation programs show how joint strategies can strengthen both environmental and social resilience. Adaptation efforts, like flood protection and ecosystem restoration, must prioritize vulnerable populations and be embedded in spatial planning and energy policy.

Another dimension of structural criticality is financial. The transition demands massive investments in infrastructure, technology, and human capital. Regions with pre-existing economic fragilities, limited institutional capacities, and low levels of private investment are at risk of lagging behind. The loss for these territories is strategic: without targeted support, they may miss the opportunity to reposition themselves within the emerging economy, remaining locked in trajectories of decline.

Across all the three axes of social justice, territorial transformation, and structural change, the question of governance emerges as a transversal criticality. Where governance structures are opaque, centralized, or unresponsive, the risk is the erosion of trust in public institutions, undermining individual well-being and threatening the legitimacy of the transition itself. Top-down approaches that neglect procedural justice principles, including transparency, inclusiveness, and responsiveness, could generate opposition movements that derailing or delaying the decarbonization efforts.

The cumulative picture that emerges from the analysis of both the scientific literature and the political and legal framework presented in previous sections of this strategy does not hide a tangible threat. The very populations and territories most affected by climate change - the old people, the rural communities, the economically deprived - are also those most exposed to the adverse effects of poorly managed energy transitions. They risk losing not only material resources but also symbolic assets: professional identities, territorial attachments, social cohesion, and trust in the institutions.

The identified criticalities highlight that the success of the JET cannot be measured solely by emission reductions or technological milestones, but even through its capacity to foster inclusive development, protect vulnerable populations, empower marginalized territories, and build resilient socio-economic systems.



2.2 Towards a JET: guiding principles and policy recommendations

A JET demands a profound rethinking of policy frameworks to ensure that environmental and climate imperatives align with social inclusion, territorial equity, and economic resilience. The criticalities identified require targeted, systemic policy interventions.

The first requirement is the institutionalization of distributive justice within energy transition strategies. Energy poverty must be addressed not as an ancillary issue but as a core objective of decarbonization policies. Policies must integrate multi-dimensional indicators of energy vulnerability that go beyond simple income metrics, incorporating housing quality, access to clean technologies, health outcomes, and territorial disparities. Initiatives like the energy renovation programs in Slovenia and Slovakia, where public subsidies support deep retrofitting for low-income households, offer replicable models. These interventions should be expanded, ensuring that grants, technical assistance, and reduced-interest loans are available to vulnerable populations. Special attention must be given to rural areas, where energy infrastructure deficits magnify poverty risks. Combining building renovation with localized renewable energy deployment, as seen in the integrated strategies pursued in Italy's Inner Areas projects and the STAMI initiative in Emilia-Romagna, can ensure that improvements in energy efficiency coincide with broader social regeneration.

A second crucial domain concerns procedural justice. The governance of the transition must be restructured to promote transparency, participation, and accountability. The participatory governance models piloted in Slovenia and Slovakia, where regional development agencies and citizen workshops play a central role in shaping transition policies, provide valuable models. The happens with RECs projects in Austria, Germany, Hungary, and Italy, showing that social acceptance, trust, and economic benefits rise dramatically whenever communities are given ownership over energy projects. Attention must be paid to ensuring that marginalized groups, such as rural populations, low-income households, and ethnic minorities, have the capacity and opportunity to participate in and benefit from RECs. Building on the lessons from the Luče energy community in Slovenia and Valsamoggia in Italy, where technological innovation was coupled with inclusive governance models, future initiatives should embed community ownership principles into national and regional renewable energy strategies.

The third pillar to be considered is recognitional justice, which demands sensitivity to territorial, cultural, and economic diversities in implementing energy transition solutions. Without such recognition, transition policies risk alienating the very communities they aim to empower, undermining the legitimacy and social acceptance of decarbonization efforts. It addresses the marginalization of rural areas hosting renewable infrastructures, as seen in the Austrian and German experiences with RECs, which promote local ownership and participation. Similarly, Italy's Inner Areas Strategy and STAMI demonstrates how tailoring transition policies to rural socio-economic contexts fosters inclusive development. Projects like the adaptation initiatives in Poland show the importance of integrating local knowledge, cultural values, and lived experiences into transition pathways.



If the three types of justice are the foundations, the preceding sections have outlined a complex landscape and a multidimensional perspective on the specific measures that constitute a JET policy. Diverse policy experiences from JETforCE partners identify shared principles for a just and inclusive energy transition. While specific measures must be adapted to each territorial context, a set of overarching recommendations can guide action:

- ensure universal accessibility to energy transition opportunities, particularly for vulnerable and marginalized groups.
- adopt a holistic policy framework that reflects the interconnected nature of societal sectors.
- encourage legal innovation and institutional reform to support decentralization, participation, and long-term resilience.
- integrate education and vocational training to spread the knowledge of JET issues and foster a skilled, future-ready workforce.

A central tenet of JET is ensuring equitable access to energy resources and technologies. Exclusionary systems that marginalize specific social groups, such as low-income households, rural communities, and workers in fossil fuel industries, are inherently unjust and unsustainable.

Scholars have long emphasized the need to account for vulnerability in energy policymaking, noting that current policy paradigms often prioritize middle- and upper-class households, thereby deepening pre-existing socio-economic divides. A JET must therefore begin with explicit recognition of energy poverty as a structural challenge, requiring direct and sustained policy responses.

Energy transitions are not confined to isolated sectors; they cut across all aspects of society, from housing and transportation to agriculture and industry. As such, policy responses must adopt a holistic approach that reflects the interdependencies of different sectors. One compelling illustration of this principle is the promotion of agri-photovoltaics, which simultaneously supports agricultural productivity and renewable energy production.

Effective implementation of JET policies requires robust and adaptive legal frameworks capable of responding to evolving challenges. Institutional maturity is particularly critical when addressing place-based needs.

Education plays a dual role in the energy transition: it prepares future generations for ecological citizenship and equips the current workforce with the skills necessary for emerging green jobs. The example of Mate Blažine Labin High School exemplifies how educational reform can support regional economic transformation through green curricula and entrepreneurial training. Similarly, Poland's Lodzkie Region strategy incorporates vocational retraining to address energy decentralization and labour market shifts.

Research highlights how large-scale renewable projects can exacerbate territorial inequalities if local communities are excluded from decision-making and value capture.



These guiding elements form the ethical and operational foundation for JET, i.e. not only to decarbonize economies but also empowering people and strengthening democratic governance. Future efforts under the JETforCE initiative should continue to refine these principles into actionable strategies, ensuring that justice is not merely a policy objective, but a lived reality.

2.3 Stakeholder Engagement and Digital Empowerment

A just energy transition demands not only sound regulatory frameworks and financial instruments but also inclusive and participatory mechanisms capable of engaging diverse social actors across territorial scales. In this context, the JETforCE project has pioneered a structured, multi-level model of stakeholder engagement through the establishment of Just Energy Transition Alliances (JETAs) at the local level and the creation of the Transnational JETA (T-JETA) as a platform for broader coordination and mutual learning. These entities are not merely advisory bodies, but operational infrastructures designed to ensure that local perspectives, lived experiences, and context-specific knowledge inform the strategic direction of the energy transition.

JETAs bring together a constellation of regional actors—municipal authorities, civil society organisations, energy providers, SMEs, academic institutions, and citizens—with a shared stake in the transformation of their energy systems. Within this framework, particular emphasis is placed on the role of Digital Ambassadors, selected through local open calls to act as facilitators between the technical tools of the project and the broader public. Digital Ambassadors are typically younger members of their communities, well-versed in digital communication and motivated to support socially and environmentally sustainable innovation. Their involvement enhances the project's capacity to reach vulnerable and underrepresented populations, including those at risk of digital exclusion, thereby reinforcing recognitional justice at the heart of transition efforts.

At the transnational level, the T-JETA offers a platform for exchange, coordination, and capacity-building among JETAs and project partners. Its activities include participatory workshops, where stakeholders from multiple countries gathered to discuss the challenges and opportunities of citizen engagement, digital participation, and policy alignment.

Digital engagement is both a methodological and a substantive component of the JETforCE strategy. The Challenge Mapping tool, for example, enables citizens to identify and report energy-related challenges in their communities through a secure, blockchain-based platform. While its deployment has revealed technical limitations and varying degrees of local uptake, it has nonetheless opened new channels for bottom-up information gathering and policy feedback. The active involvement of Digital Ambassadors in promoting and testing this tool, supported by JETA networks, underscores the importance of coupling digital innovation with human infrastructure. Moreover, the creation of a dedicated digital communication platform for T-JETA and Digital Ambassadors further institutionalizes transnational cooperation and ensures the long-term sustainability of engagement efforts.



By embedding stakeholder participation into the core of its governance model, JETforCE not only enhances procedural justice but also strengthens the legitimacy, responsiveness, and effectiveness of its interventions. The JETA model exemplifies how decentralised, digitally supported, and youth-inclusive mechanisms can deepen democratic engagement in energy transition processes and serve as replicable models for other regions facing similar structural challenges.

2.4 Financing Just Energy Transition

A relevant, specific issue for JET is given by the financing mechanisms, which must ensure accessibility, equity, and long-term impact. The Just Transition Fund represents a critical step in this sense, but its scope must be sharpened to avoid the dilution of resources across overly broad mandates, and other schemes can be devised and implemented.

The World Bank (2023) explored the challenges and strategies for financing a JT, ensuring that the shift to a low-carbon economy does not disproportionately affect vulnerable workers, communities, and industries. The JT concept integrates climate objectives with social equity, acknowledging that significant financial resources beyond public funding are required, with private finance playing a crucial role.

The report highlights that JT finance faces unique challenges. Unlike climate finance, which can be measured by greenhouse gas reductions, JT finance is shaped by social values of fairness, making it difficult to define and assess its impact. The lack of standardized indicators and clear targets complicates investment decisions and increases the risk of “social washing”, where companies exaggerate their contributions to social justice. As a result, market forces alone cannot drive JT finance; a well-structured policy framework is necessary to guide investments and align incentives.

As anticipated in Section 2.1, the EU is ahead of other major jurisdictions in implementing policies that address JT priorities. The Just Transition Mechanism (JTM) is central to these efforts, supporting affected regions through financial and technical assistance. The Just Transition Fund (JTF), which provides grants to mitigate economic and employment impacts, is a key fiscal transfer tool. However, the scope of the JTF is broad, covering social support, economic revitalization, and land restoration, potentially diluting its effectiveness. Additionally, while the EU has introduced financial disclosure requirements and sustainability taxonomies, efforts to integrate JT principles into financial regulations remain limited.

The assessment of the EU framework provides several insights: i. there is a need to narrow the focus of JT funding to avoid spreading resources too thinly. Targeting social support and land restoration while encouraging private investment for economic revitalization could enhance efficiency; ii. improved data collection on the social impact of climate policies is necessary to prevent social washing and strengthen accountability; iii. embedding JT considerations in sustainability regulations, such as corporate sustainability reporting and financial risk assessments, would help integrate social equity into investment decision-making.



Further policy recommendations include providing clearer guidance for financial firms on JT risks, particularly regarding litigation and liability. Encouraging the development of financial instruments tailored for the JT, such as sustainability-linked bonds and social loans, could facilitate private capital mobilization. Additionally, multilateral development banks (MDBs) should play a more active role in derisking JT investments, particularly in Central and Eastern European countries where financial resources and institutional capacity are limited.

Overall, while the EU has made significant progress in developing a JT framework, gaps remain in mobilizing private finance at scale. A more structured approach, focusing on targeted funding, improved regulation, and better risk assessment, will be crucial to ensuring that the transition to a sustainable economy is both equitable and effective.

2.5 The contributions from the Action Plans: work in progress

The previous recommendations and principles should guide the definition of local action plans for JET, as well, which on one hand must attune the general JETforCE strategy to territorial idiosyncratic features, and on the other hand could serve as a framework for the illustration and the assessment of the pilot projects.

The JETforCE project requires the definition of at least two pilot projects to implement the principles of JET in partner areas. The selected projects are summarized and systemized in the next table.

	REC	Energy mgmt and structural change	Susta- inable Mobility	Renova- tion/RES in buildings	RES in agri- culture	Education	Territorial balanced dev.	District heating	Adaptation plans to CC	Waste mgmt	Storage Systems
AUT											
CRO											
CZE											
GER											
HUN											
ITA											
POL											
SLK											
SLO											

More specifically, the Austrian partner (AUT) decided to focus on Renewable Energy Communities (RECs) to foster local energy production and consumption, enhancing community resilience and autonomy. A second pilot project is supposed to be a district heating networks to reduce fossil fuel dependency in urban and peri-urban areas, especially leveraging industrial and geothermal heat sources. Furthermore, the partner supports the deployment of electrical storage systems to stabilize the grid and optimize the use of renewable energy, ensuring consistent supply even during intermittent production.

Croatian (CRO) partner's strategy includes developing RECs to empower municipalities and citizens in energy transition processes. The education system plays a key role through targeted training and involvement of



schools, aiming to build a workforce capable of supporting the green economy. The third pilot is related to the promotion of green mobility solutions, including the adoption of electric public transport and cycling infrastructure, to reduce emissions in urban areas.

The Czech partner (CZE) concentrates its efforts on enhancing energy management systems in public institutions and integrating renewable energy sources into public buildings. These initiatives aim to cut operational costs, improve building performance, and set an example for broader community action. Additional focus is given to implementing smart monitoring tools and energy audits to optimize resource usage.

Germany partners (GER) are pioneering a comprehensive approach to structural transformation driven by its fossil fuel phase-out policy. The establishment of RECs supports a decentralized model of energy production, giving communities a stake in the energy transition.

Hungarian (HUN) focus includes promoting RECs to decentralize energy governance and encourage citizen participation. A second pilot project deals with sustainable urban mobility, including integrated public transport systems and pedestrian-oriented infrastructure. The last initiative concentrates on the renovation of buildings, particularly targeting inefficient residential and public stock to reduce emissions and support energy savings.

Italian partner (ITA) combines REC development with innovative agri-photovoltaic projects that allow for dual land use, i.e. energy production and agriculture. The strategy supports energy efficiency interventions in Inner Areas, aiming to revitalize depopulated and economically marginal territories.

Poland region (POL) is intentioned to implement frameworks to manage the energy transition effectively, with a focus on coal regions. Adaptation plans to climate change are developed to enhance regional resilience against extreme weather and shifting climatic patterns. The polish partner is also prioritizing improvements in waste management infrastructure and practices, integrating circular economy principles.

Slovakia (SLK) decided to work on the increase of regional attractiveness through sustainable infrastructure and community-driven development. Justice and inequality issues are tackled by ensuring vulnerable populations benefit from the energy transition.

Slovenia (SLO) supports the creation of RECs to boost local energy resilience and citizen involvement. A significant investment is being made in renewables within the agriculture sector, particularly solar and biogas solutions tailored to rural needs. Community education initiatives are central, aiming to build widespread understanding and engagement in energy projects from planning to implementation.

The formulation of Local Action Plans across partner regions will be enriched by inputs from the strategy for stakeholder engagement in Just Energy Transition defined during the JETforCE project. Their participatory role, facilitated through hybrid engagements, online consultations, and localized mapping of energy transition challenges, will ensure the contextualization of pilot priorities. This co-design approach enhances the legitimacy and responsiveness of JET interventions at the territorial level.