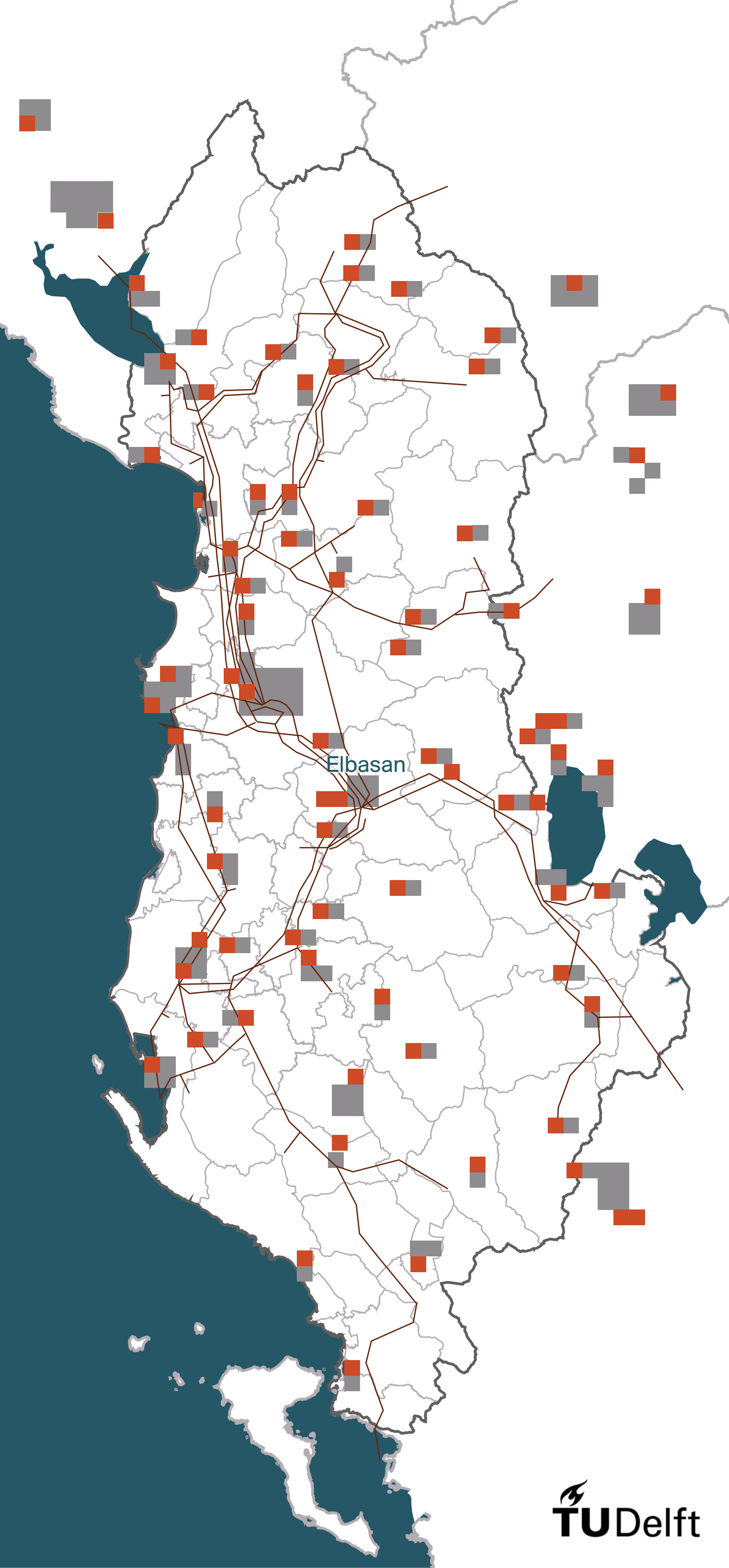
Re-Defining Energy Scapes in Elbasan, Albania

Establishing a synergy between communist industrial sites and residential areas in the context of energy transition.



TU Delft

Redefining Energy Scapes in Elbasan, Albania

Establishing a synergy between communist industrial sites and residential areas in the context of energy transition.

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abstract

Current energy transition towards a carbon neutral urban environment urgently calls for understanding how energy scapes should be redefined, while tmeeting energy demand and controlling the social-environmental impacts of this transition within a specific territorial context. The energy system in Albania is characterized by traces of the previous energy-space nexus, which manifest as abandoned remnants of the past, referred in this project as Patterns of Production, or as automated landscapes of the present. Amidst these spatial uncertainties, Albania faces the challenge of climate vulnerability of the current energy infrastructure, alongside with energy poverty and environmental degradation of communist industrial sites, all standing as three primary challenges in the country's energy transition. Therefore, the following research question emerges: "How can the energy-space nexus in the Pattern of Production contribute to energy security for a socially and environmentally sensitive transition in Elbasan?"

This project aims to establish a new synergy between former communist industrial sites and residential areas within the Pattern of Production of Elbasan, while diversifying energy sources, and considering the social and environmental impacts of this synergy simultaneously. This endeavor addresses the spatial challenges and potentials of integrating communist industrial spaces into the energy transition, while acknowledging their local strengths, opportunities, weaknesses, and threats. Using the maximization method, three scenarios have been developed to enhance energy security, energy equity, and environmental qualities in Elbasan. These scenarios employ the Multi-Level framework to create a pattern language for the energy-space nexus under each maximization pillar. To visualize the implementation of the desired energy-space nexus in 2050, they are overlapped to define the vision in macro scale and strategic plan of Elbasan in meso scale, while considering the phased implementation of this strategy and stakeholder integration.

This project yields transferable insights applicable to other Patterns of Production in Albania with overarching recommendations such as: deep understanding of the specific context and aligning the energy-space nexus with local potentials and limitations, designing spaces of consumption and production according to the needs of local residents, defining community-based spaces, increasing accessibility to clean energy sources, and creating ecological synergies between energy production and consumption. Additionally, this project contributes to the existing literature on the spatial notion of a sustainable energy transition, specifically focusing on the Balkan countries, which have been underrepresented in current academic research.

Keywords: energy-space nexus, sustainable energy transition, energy security, Pattern of Production, Multi-Level framework.

reading guides

Chapter 1: introduces the motivation, problem statement, the aim and objectives of this project, followed by the main research question and the methodology that will be used in this thesis to answer this qeustion and its subquestions.

Chapter 2: analyze literature review and theories to create a strong foundation for this project and to come up with a conceptual framework that will guide the analysis and design phases of the project.

Chapter 3: frames the diagnosis of the case study by coming up with the findings of context-specific analysis that will give the first inputs towards design.

Chapter 4: illustrates the developed scenarios through Maximization and Pattern Language design tools

Chapter 5: shows future vision of Elbasan region, the strategic plan of the Pattern of Production and the assessment of the proposed design by the stakeholders.

Chapter 6: draw the conclusion and answers of the main research question, within a detailed reflection of this thesis.

glossary

Energy-space nexus: the relation between energy and landscape which is not only about the footprint of energy production sites, but entails integrating social, environmental and context specific elements.

Pattern of Production: a spatial pattern identified in Albania that consist of the past and present relations between the residential and Communist industrial areas.

Energy security: is defined in this project as the state of meeting energy demand of current and future generations without being vulnerable to external factors.

Energy equity: providing accessible and affordable clean energy sources for everyone, to complete their needs.

Environmental qualities: refers to Greenhous Gas emissions of energy system and quality of space within its parameters for a healthy environment.

Sustainable energy transition: the process of reaching energy security while maximizing the spatial, social and environmental benefits through context-specific interventions.

Systemic design: integration of design and systemic thinking approaches a within a 7-steps framework (Namahn's Kristel van Ael's team).

Multi-Level Perspective theory: framework of transitions of socio-technical systems through a non-linear interplay between three levels: socio-technological landscape, regimes and niches (Geels, 2002).

Energy landscape: spaces of renewable energy production and consumption patterns through the lens of ecology, while considering its social, environmental and economical impacts (Stremke, 2010).

Energy sufficiency: "a state in which people's basic needs for energy services are met equitably, and ecological limits are respected." (Darby et. al., 2018).

ANNOTATIONS

- AKBN: National Agency of Natural Resources
- ALPEX: Albania Power Exchange
- EEA: Energy Efficiency Agency
- ERE: Energy Regulatory Authority
- EU: European Union
- FiT: Feed-in-Tariff program
- GhG: Greenhouse gas emissions
- GIZ: German Development Fund
- HPP: Hydropower Plants
- INSTAT: Institute of Statistics in Albania
- IRENA: International Renewable Energy Agency
- KESH: Albanian Power Corporation
- MARDWA: Ministry of Agriculture, Rural Development and Water Administration
- MFE: Ministry of Finance and Economy
- MIE: Ministry of Infrastructure and Energy
- MLP: Multi-Level Perspective framework
- MTE: Ministry of Tourism and Environment
- NDC: Nationally Determined Contribution
- NEA: National Environmental Agency
- NECP: National Energy and Climate Plan
- NGOs: Non-Governmental Organizations
- OSHEE: Electricity Distribution System Operator
- OST: Transmission System Operator
- SWOT: Strength-Weakness-Opportunity-Threat
- UN: United Nations
- UNDP: United Nations Development Programme
- UNEP: United Nations Environment Programme
- USAID: United States Agency for International Development

table of contents

I. introduction

This chapter starts with an overview of the current energy context, challenges, and potentials in Albania, both on the European and national scales. It emphasizes the critical need for energy security and explores its social and environmental impacts in this specific context, which reframes my professional motivation too. Additionally, the chapter delves into the historical unconscious relationship between energy and space in Albania, underscoring the significance of the energy-space nexus during the transition to a sustainable energy system. It identifies Patterns of Production in Albania as remains of energy-space relation and potential areas to foster energy transition. After the introduction of the identified Pattern of Production in Elbasan city, the chapter summarizes the problem statement of the Albanian energy system and the Elbasan case study. It underscores the necessity for a systemic change in the Pattern of Production, focusing on achieving energy security alongside optimized social and environmental benefits. This leads to the articulation of the aim, main research question, subquestions, and methodology of this project.

figure 1: high depndency on electricity to complete energy demand (photo by the author)

i. the big picture

In the 2018 document published by the European Commission titled "A Clean Planet for All," the strategic vision of Europe towards achieving a net-zero greenhouse gas economy is outlined (European Commission, 2018). This strategic vision outlines the Europe's transition path toward achieving climate neutrality in 2050, by emphasizing the integration of economic and social transformations for an equitable transition where no country is left (European Commission, 2018). It places energy at its core, as it is responsible for over 75% of the EU's greenhouse gas emissions (European Commission, 2018).

The European Union's commitment to supporting the Western Balkans, especially in these trying times, has been significant. The recent allocation of energy support fund demonstrates the dedication to foster cleaner, more sustainable energy systems in the whole Europe without considering the country's borders. As the shift from fossil fuels to clean energy production gains momentum, it is essential to also reinforce three main pillars for a more sustainable and resilient energy transition: energy security, energy equity, and environmental sustainability through different scales (World Energy Council, 2022). These pillars have specific objectives: energy security aims to meet the energy demand of current and future generations, energy equity focuses on providing access to affordable energy for all, and environmental sustainability seeks to prevent potential environmental harm (World Energy Council, 2022).

Albania is among the most climate-vulnerable countries in Southeast Europe. The three pillars of sustainable energy transition emerge as three crucial challenges of its energy system. In Figure 2 it is illustrated that this country heavily relies on hydropower as its primary energy source, making it susceptible to the climatic challenges (IRENA, 2021). It is facing changing weather patterns characterized by higher temperatures, decreased summer rainfall, and extreme flooding and drought events, which impact directly the energy production of hydropowers. Moreover, Albania is reflecting an energy poverty, particularly affecting the elderly and low-income families. 35.8% of the households couldn't heat their homes in 2021 (Eurostat, 2021), making energy equity as one of the main urgencies too (Figure 3). Lastly, the primary energy of transportation in Albania heavily relies on fossil fuels. This dependence results in increased greenhouse gas emissions posing a significant threat to air quality. Figure 4 shows that on a rate from 0-100 of GhG intensity growth, Albania stands between 40-49 in 2022 (Yale University's

Environment Performance Index, 2022). Thus, energy security, energy equity and environmental qualities stand as three main pillars and urgencies of this project.

Regarding the open data available in this context, it is acknowledged that Albania is notably absent in most European datasets. This data gap interferes with the country's active participation in Europe's energy transition efforts and slows the progress toward its 2050 climate neutrality targets. Thus, it is imperative to devise a new methodology that navigates this transition despite the lack of comprehensive data for Albania. Furthermore, there exists a notable disconnect between perspectives within the energy industry and spatial planning in the country where energy is addressed as a technical problem and not as a spatial challenge. Consequently, integrating the energy-space nexus into the transition process leads to a more holistic and interconnected approach.

To conclude, it is crucial to address energy security, equity, and environmental qualities as the primary challenges in Albania through a comprehensive approach, which tackles issues such as the lack of data and spatial planning within the energy system.

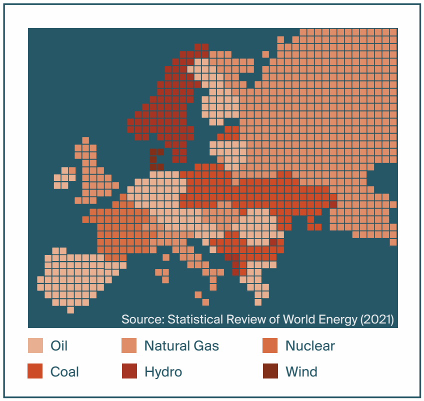

figure 2: primary energy sources

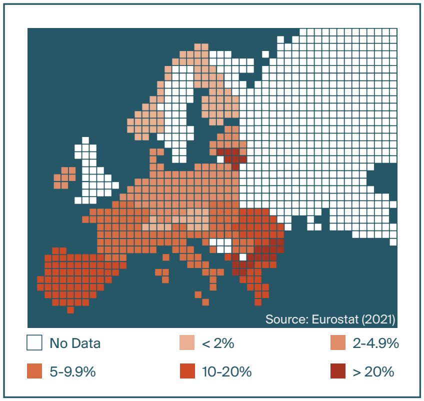

figure 3: energy poverty in 2021

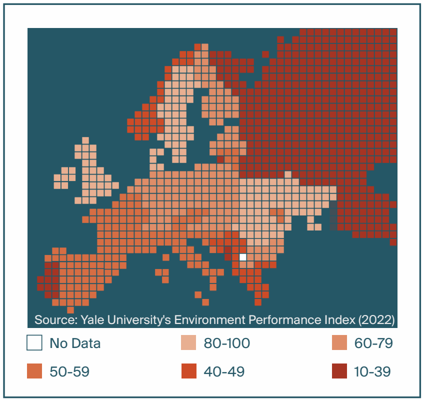

figure 4: Greenhouse Gas Intensity Growth Rate

ii. energy status-quo in Albania

Albania is not self sufficient and remains a net energy importer due to challenges in meeting the total demand for petroleum products and electricity. The transport sector's high dependence on fossil fuels and the reliance on hydropower production, coupled with annual rainfall fluctuations, contribute to this situation.

The primary energy sources in Albania vary from oil and hydropower, which dominate the energy system, to biomass, lignite, natural gas and a small percentage of solar energy (World Bank Group, 2021). According to the data gathered from the Institute of Statistics in Albania (INSTAT), the primary energy production is dominated by fossil fuels based (crude oil, natural gas and lignite) with 53% of the overall primary sources in 2022, with crude oil as the main source covering 41% of the fossil fuel-based sources (Figure 5). Whereas, the hydropower is the second largest contributor with a percentage of 37% in 2022 (INSTAT, 2023). Biomass and other energy sources, such as solar energy, account for 10% of the total primary energy sources (INSTAT, 2023). According to Figure 6, the transportation, households and industrial sectors are the biggest energy consumers with 36%, 37% and 22% of the final energy consumption, respectively (INSTAT, 2023). According to a study done by IRENA in 2021, the transport sector meets its energy demand through the

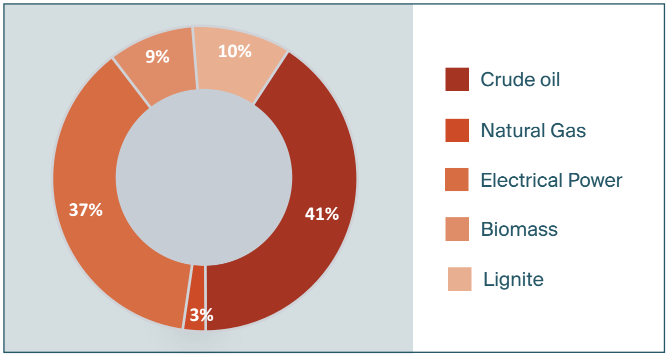

figure 5: primary energy priduction in Albania (INSTAT, 2023)

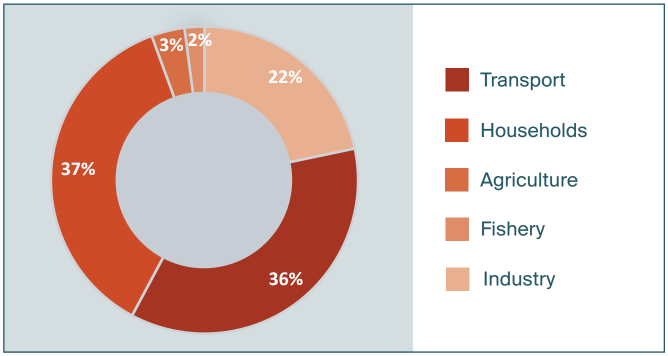

figure 6: energy consumption per sector in Albania (INSTAT, 2023)

usage of fossil fuels. Whereas, the households' sector is the largest consumer of electricity, in which the most of this electricity consumptions goes for heating and cooling (IRENA, 2021). While, the energy consumption in urban areas relies on fossil fuels and electricity, the rural areas are widely using biomass, such as fuelwood as energy source (World Bank Group, 2021). Albania is a net energy importer (Figure 7). Even though this country is the largest producer of unrefined crude oil in the South-Eastern Europe, it exports this product and imports refined petroleum products (IRENA, 2021). At the end of 2020, 17% of the electricity was imported from neighboring countries, an amount which has been decreased with 28% from 2013 due to the investment to reduce electricity losses in the grid infrastructure (USAID, 2018). Figure 8 illustrates the graduall decrease of energy losses in the electricity infrastructure in Albania from 2014 to 2019. While 39% of the gross consumption in 2022 was coming from the primary energy sources, 37% of the energy was imported (INSTAT, 2023).

To conclude, Albania's primary energy supply is dominated by oil, hydropower, and imported electricity, which shows that imports of oil by products, electricity and a small amount of coal comprise over 56% of all primary energy consumption.

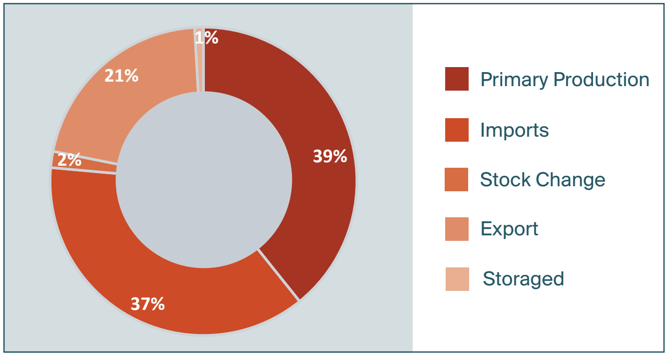

figure 7: balance of import-export-storaged energy in Albania (INSTAT, 2023)

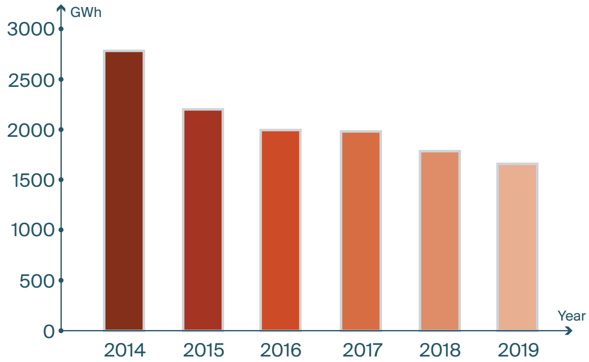

figure 8: electricity losses in Albanian system (GWh)

[A] The current energy context

Figure 9 illsutrates the grid infrastructure and power plants location in Albania. It consists of transmission lines at various voltage levels (400 kV, 220 kV, 150 kV, and 110 kV) and includes 15 substations (IRENA, 2021). Albania's electricity system is interconnected with neighboring countries through six lines, with three 400 kV lines linking to Greece, Montenegro, and Kosovo, two 220 kV lines connecting to Montenegro and Kosovo, and one 150 kV line connecting to Greece (IRENA, 2021).

Significant electricity losses occur within the grid infrastructure. In 2019, these losses accounted for slightly over a fifth (21.7%) of final electricity consumption (INSTAT, 2020b). Transmission network losses, approximately 2%, are heavily influenced by the performance of hydropower plants (HPPs) on the Drin River cascade (OST, 2018). The majority of losses occur in the distribution network, primarily due to technical issues resulting from inadequate upgrades.

The aging 45,000 km distribution network, with 82% composed of overhead cable lines, contributes to electricity losses (IRENA, 2021). Among the 178 substations, 40% have been operational for more than 70 years, operating manually without real-time information or demand forecasting (IRENA, 2021). OSHEE's immediate priority is to plan for an active grid capable of bidirectional electricity flow, accommodating renewable energy prosumers, and focusing on grid upgrades near renewable energy generation zones.

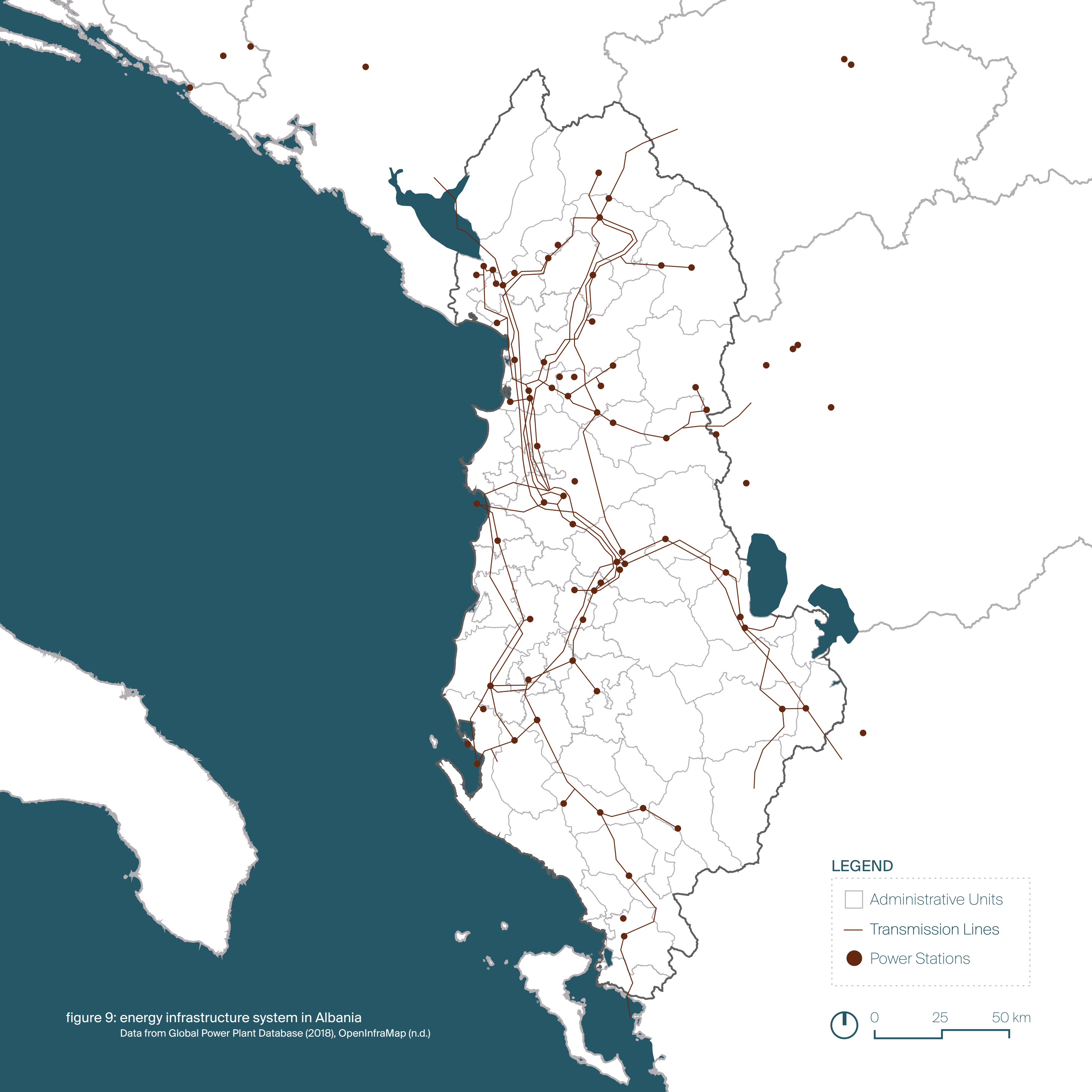

figure 9: energy infrastructure system in Albania

Data from Global Power Plant Database (2018), OpenInfraMap (n.d.)

[B] Renewable energy context

Albania possesses significant potential for integrating clean energy sources into its current energy system, thanks to its diverse natural resources and climate context. Abundant water sources make hydropower the dominant renewable energy source in the current context (Figure 10). Additionally, there are significant potentials to incorporate solar and wind energy (Figure 11), alongside exploring the possibilities of biomass and geothermal energy (Figure 12), leveraging existing resources for a more comprehensive and sustainable energy system.

Hydropower energy

Albania has one of the largest renewable energy productions as the primary energy supply in the South-Eastern European countries, with 45% of the total primary energy sources coming from hydropower (Deutsche Energie-Agentur GmbH, 2021). In recent years, Albania has been working to change its energy efficiency policy to incentivize the use of renewable energy sources, making it a core element of the country's energy strategy. However, local production of oil, gas and petroleum products currently fulfill 15% of the economy needs and play an important part in the local market due to an increase of domestic production that will also help to establish fair equilibrium in the supply sectors (World Bank Group, 2021).

Energy produced from hydropower sector dominates the electricity production in Albania, with river Drin alone being responsible of 90% of the country's electricity supply (IRENA, 2021). The hydropower system is trying to increase its capacity to complete the energy demand needed in the country and by the end of 2018, there are 525 new small hydropower stations planned to be built, by which 165 are already producing energy and 316 are under construction (MIE, 2019).

Figure 10 illustrates the spatial distribution of the main hydropowers in Albania in connection with the existing river network and energy infrastructure. Hydropower energy is spread evenly in the whole country and produces electricity for all urban and rural areas.

figure 10: hydropower energy in Albania
Data from Global Energy Monitor (2023), Copernicus Land Monitoring Service (2020)

[C] Renewable energy potentials

Solar Energy

Due to the country geographical location in the Mediterranean climate area, there are counted on average 220 days of sun per year, which lead to high potentials to develop solar energy structures (IRENA, 2021). Also, there is done a study by the United Nations Development Programme (UNDP) that estimates that the construction of Solar Water Heating projects in public buildings alone will save in total 100GWh electricity per year, which could be used for meeting the demand of hot water (UNDP, 2017). The community in Albania is installing solar panels to heat the water too and there are also being developed solar photovoltaic panels parks, such as the one of Nova Construction Group in Korca. Figure 11 illustrated the highest potential areas to develop solar photovoltaic panels structures to produce clean energy. The assessment is done by IRENA in 2021 for its report Renewable Readiness Assessment in Albania, and it shows that the western area of the country has higher potentials for solar energy development due to larger amount of sunlight per year (IRENA, 2021).

Wind Energy

Regarding the wind energy, even though there are still no wind power plants constructed in Albania, there are plans to invest on wind energy in the next few years in a proposed 2000MW new generation capacity (MIE, 2017). After the introduction of the Feed-in-Tariff (FiT) program, there have been 70 applications for wind energy plants of 3MW and three of them are selected to construct a capacity of 9MW (MIE, 2019). The wind speed in Albania goes from 3.3 meters per second (m/s) to 9.6 m/s, while the most suitable wind speed for wind energy production varies from 5.8 m/s to 7 m/s (IRENA, 2021). After analyzing the areas with the most suitable wind speed and their protected areas, land use, topography, population growth and proximity to transmission lines, Figure 11 shows areas of highest potential for wind energy production in the south and north of the country (IRENA, 2021).

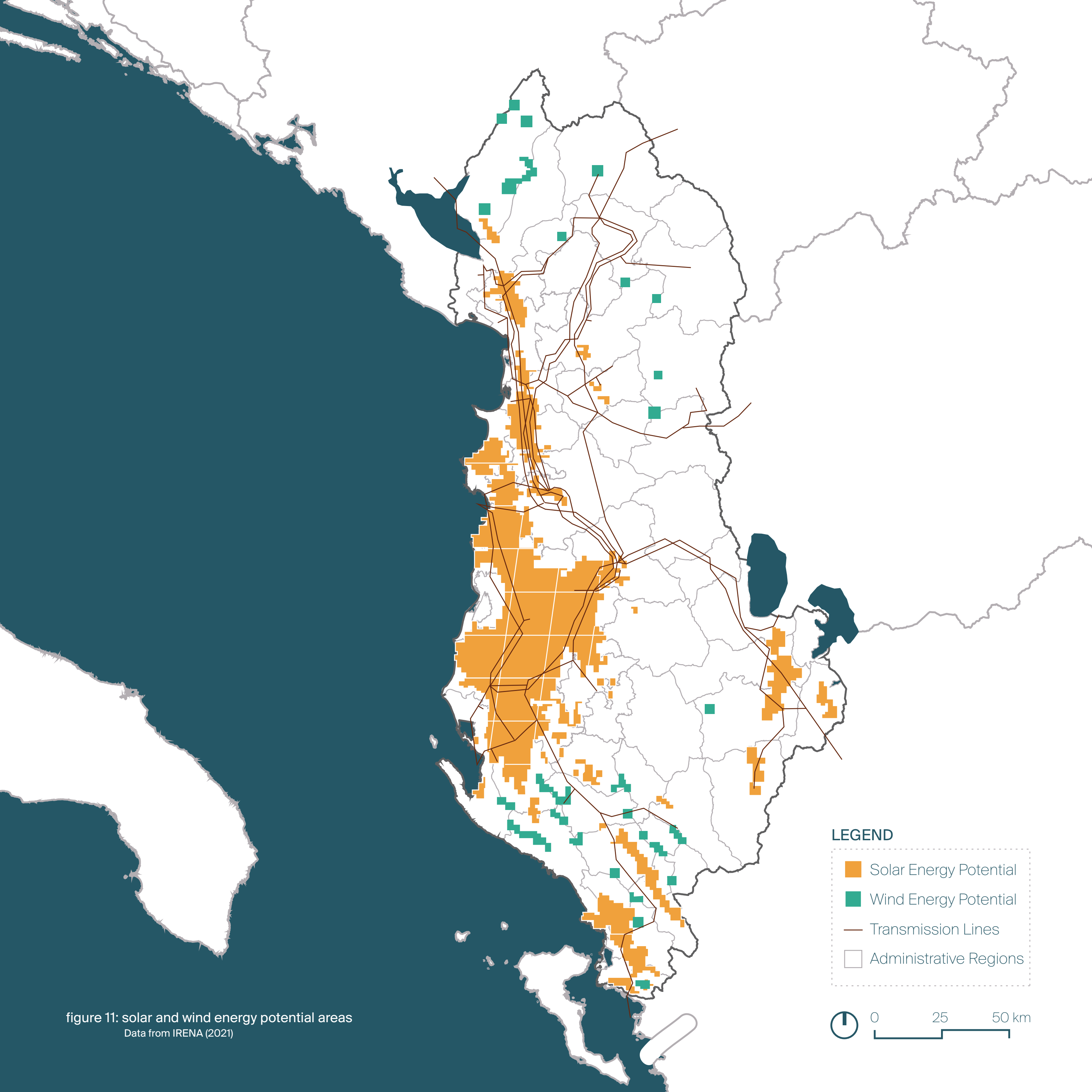

figure 11: solar and wind energy potential areas
Data from IRENA (2021)

[C] Renewable energy potentials

Geothermal Energy

Albania is characterized by geothermal energy sources, particularly of underground warm water with a maximum temperature of 80°C and abandoned vertical wells with oil and gas sources (MIE, 2017). Geothermal spaces of Ardenica, Kruja and Peshkopia are considered as areas with the highest potentials to be used as energy sources (MIE, 2017). Also, in Elbasan region, there are three thermal springs in Kozan, Llixhe and Supal with a range of temperature from 30 to 58°C (MIE, 2017). Figure 12 illsutrates the main corridor with geothermal reosurces and the spatial distribution of the thermal sprins with temperatures varying from 20°C to 60°C and above 80°C. Even though there is no attempt to involve these sources in the current energy system, they have very high potentials to be used for heating purposes (MIE, 2017).

Biomass Energy

Figure 12 also shows that 36 percent of the land is Albania is forest, 16 percent is pasture and agricultural land contains 24 percent (MIE, 2017). Biomass energy can be produced from their wastes, such as stem-wood biomass and residues from thinning and annual harvesting, industrial wood residues like saw-dust and recycled wood from building materials (MIE, 2017). Most of the people living in rural areas and the ones with low-income background use biomass for heating and cooking, counting 2 million m3 of firewood consumption, half of which is provided from illegal cutting (MIE, 2017). Albania has also 403,651 ha bare land that can be used for artificial plantations with short- rotation, including willow, eucalyptus, poplar, acacia, in order to increase the potentials to use biomass energy and reduce the illegal cutting of forests (MIE, 2017).

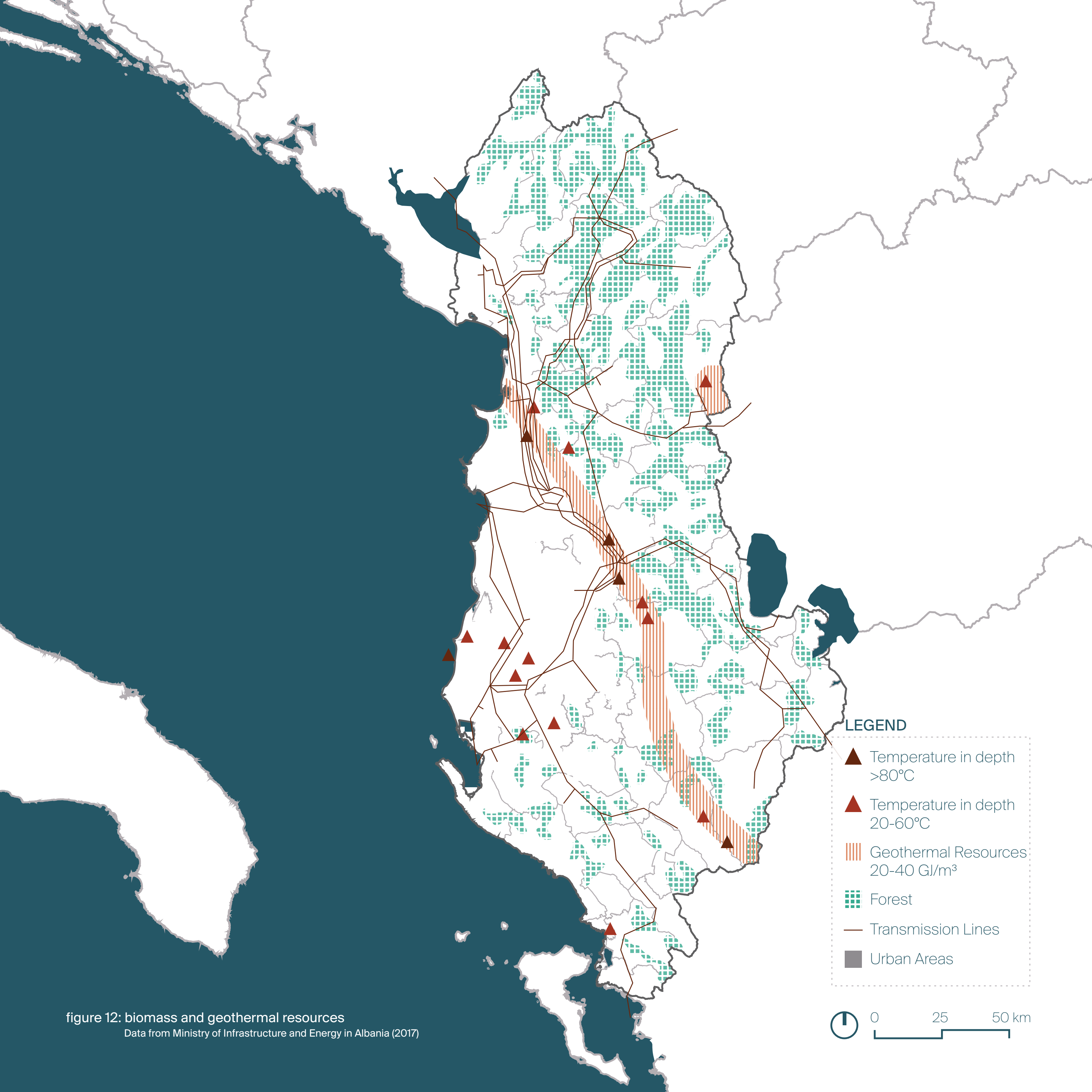

figure 12: biomass and geothermal resources
Data from Ministry of Infrastructure and Energy in Albania (2017)

[D] Climate change challenge in energy system

The primary challenges facing Albania's energy system include climate vulnerability, energy equity for a fair distribution of clean energy sources to every citizen, and addressing the environmental footprint of past energy remains and current greenhouse gas emissions. Despite the significant potential of clean energy sources, the most pressing challenge for the energy system in Albania is intricately linked to climate change, impacting both energy supply and demand.

The energy system in Albania is seasonal variable due to its dependency on hydropower production (IRENA, 2021). During winter months, the annual precipitations cover 90% of the total annual rainfalls and hydropower generation is higher ending up to a surplus which is being exported (IRENA, 2021). Whereas during summer season, the country produces less electricity and cannot complete its energy demand (Figure 13), resulting in importing the energy needed (IRENA, 2021).

Due to the climate change crisis, Albania is expected to decrease annual precipitations up to 6.3% by 2050 comparing with 2019 data (World Bank, 2020a). At the same time, the annual temperatures are predicted to rise by 2.5°C by 2050 (World Bank, 2020a). These variations will have a direct impact in the energy system, due to its dependency on hydropower production. The big hydropower plants are expected to decrease their annual energy production by 15% on 2050 and small ones

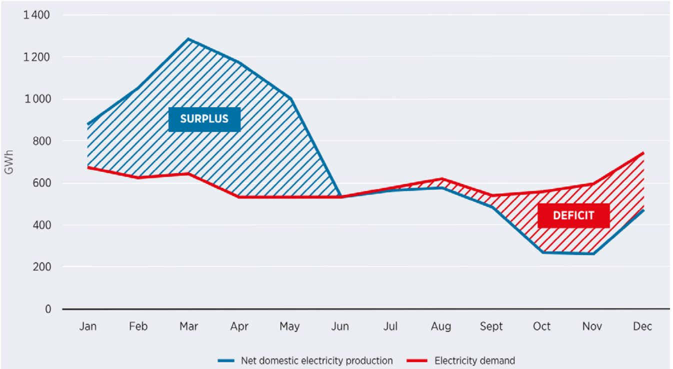

figure 13: electricty production and demand in 2018 (IRENA, 2021)

by 20% (Ebiger, 2010). Moreover, the anticipated rise in annual temperatures and a decrease in annual precipitation in the country are also depicted on a map by the European Environment Agency (EEA), specifically illustrated in Figure 14, which presents projected changes for 2071-2100 compared to data from 1971-2000 (EEA, 2015). The increase of extreme weather intensity with droughts and flooding and the rise of energy demand (Figure 15) are expected to have a negative impact on the current energy infrastructure with a potential to overwhelm and damage the infrastructure (World Bank Group, 2021).

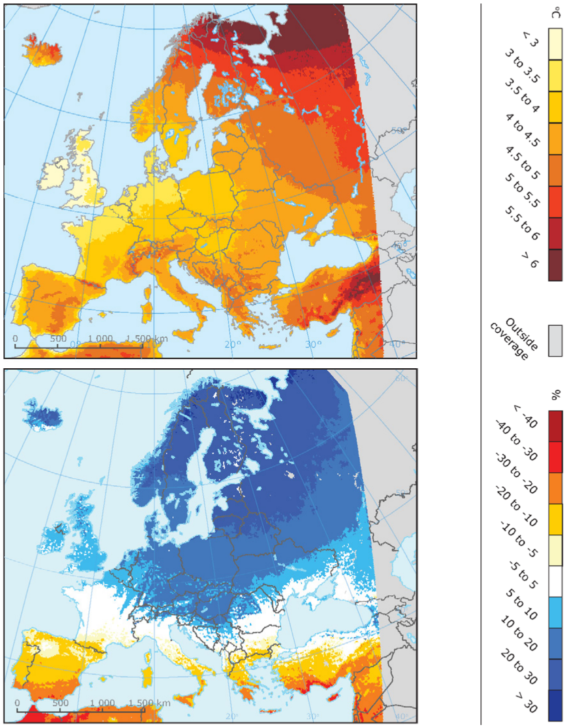

figure 14: Projected changes in annual mean temperature (top) and annual precipitation (down) (EEA, 2015)

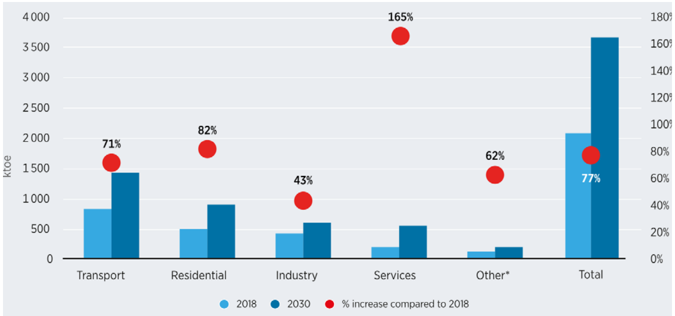

figure 15: energy demand in 2018 comapred to 2030 forecast (ktoe, %) (IRENA, 2021)

Consequently, energy security emerges as the primary challenge for Albania's energy system. A sustainable energy transition should prioritize investment in climate-resilient energy production. Urgent action is needed to diversify Albania's energy production by incorporating various renewable sources and advanced technologies to address the challenges posed by climate change and meet future energy demands (IRENA, 2021).

[E] Environmental challenge of energy systems

The second challenge of Albanian is the environmental impact of the current energy system and reduction of GhG emissions to reduce pollution. The contribution of Albania to global GhG emissions is 0.02% (CAIT, 2020). In 2019, Albania was ranked the second lowest country in Europe with a GhG emissions rate of 1.68 tC02e per capita (International Monetary Fund, 2022). Anyhow, Albania has committed to reduce the total GhG emissions with 18.7% by 2030, based on the National Energy and Climate Plans document (Albania, 2022). It has also committed to become climate neutral by 2050 by signing the Sofia Declaration on the Green Agenda for the Western Balkans in 2020 (International Monetary Fund, 2022).

According to the national data used as a base for the Nationally Determined Contribution (NDC) projections, energy sector in Albania was responsible of 46% of the total GhG emissions in 2016 (Albania, 2021). The energy used in transportation sector has the highest negative impact on GhG emissions and air pollution, due to the high number of fossil-fuel based cars (Figure 16) used in this country (UN, 2018). Also, extracting industries of energy sources in Albania lack reliable data and monitoring structures of their environmental impact, such as deforestation, toxic substance in water and air, soil contamination and erosion (WeBalkans, 2023). At the same time, hydropower energy system has been criticized for its negative impact of the habitat of the rivers and local communities around these areas (WeBalkans, 2023). Thus, it is crucial to assess the environmental impact of energy systems not only for their contribution to GhG emissions, but also for their impact on water, soil and habitats of their surrounding environments.

figure 16: fossil fuel based transportation in Elbasan (photo by the author)

Energy systems do not impact the environment only when they are actively producing energy, but also when they are left as ruins of the past. There are several abandoned industrial sites in Albania which are not operating since 1990. Even though these areas are abandoned, they are sources of contamination in soil and groundwater of the surrounding landscape (UN, 2018). The Metalurgjiku facilities in Elbasan is an example of an abandoned industrial complex which is still impacting the soil and water contamination caused by the disposal of 2.0 million tons of solid waste of heavy metals and household wastes (Figure 17) (UNEP, 2000). Agricultural lands surrounding this abandoned industrial complex are mostly contaminated by heavy metals with the presence of carbon and iron oxide in a radius of 5 km from the footprint of this complex, causing serios health issues to people living close to it with pneumatic disorders (Vrusho, 2017). When this industrial area was in production, all the wastes were transported with pipelines in a lake close to a valley of a small river and Shkumbini river, and a soil sample taken in this area in 2000 has proved that there is a high level of heavy metals in the soil which is still impacting the environment and the local communities living in this city (UNEP, 2000). According to the data of Municipality of Elbasan, the pollution radius of Metalurgjiku is 30 km, with a huge impact on agricultural land, residential areas, water facilities and air quality (Vrusho, 2017).

The rehabilitation of these areas to increase the quality of the environment should be a priority in Albania when aiming for climate neutrality, while reusing their existing infrastructures of road connectivity, electrical and water supplies for a sustainable energy production future (UNEP, 2000).

figure 17: pollution in industrial area in Elbasan (photo by the author)

[F] Social challenge of energy systems

The third challenge is represented by the social impact of energy system for a fair distribution of clean resources and for meeting the energy demand of everyone living in this country. Most of the people living in Albania cannot afford to properly heat their houses and are using wood as an energy source to complete their energy demand.

Energy poverty concept is not clearly address in Albanian policies and national strategies (Ban et.al, 2021). The Albanian law on the Power Sector identifies a vulnerable consumer as "a household customer which due to social reasons, is entitled of certain special rights regarding the electricity supply." (On Power Sector, 2015). In Article 95 of this law, the criteria to be considered vulnerable consumers are residents with low economical background who use electricity to power their dwelling, residents who use electricity through a single-phase system with a maximum output of 16 Amperes, the highest amount of electricity used per person accounts for seasonality, the extent of the national budget's direct assistance (On Power Sector, 2015). There are current policies that protect 213,000 vulnerable communities with compensation schemes of 640 ALL (5.17 Euro) per month for consumption of less than 200kWh and 648 ALL (5.23 Euro) for temporarily vulnerable consumers with electricity consumption up to 300 kWh per month (Ban et.al, 2021). These two financial schemes for vulnerable communities in Albania represent short-term support without considering to change the behavior of consumers for a decrease in energy consumption or increase energy

figure 18: heating systems in poor houses (photo by the author)

efficiency of the dwelling where low-income families live (Ban et.al, 2021). Figure 18 shows a photo of a family living in a house with bad conditions in Elbasan, whom cannot afford to heat their houses by electrical supplies and uses wood during winter season. For a long-term vision which aims to tackle the issue of energy poverty, it is crucial to rethink policies and financial schemes while decreasing energy consumption and completing at the same time the energy demand of vulnerable communities in Albania.

Figure 19 shows a graph illustrating the average consumer price index increase in energy from 2019 to 2023, with a 6.7% rise in 2022 and a 4.8% increase in 2023 (INSTAT, 2023). This had a significant impact on the citizens living in Albania, many of whom could not afford to pay their electricity bills. The most vulnerable social groups are the elderly, due to their very low average pensions of 110 Euro per month (Heuvelmans, 2022). The electricity bill to properly heat a room during winter in Albania goes in average 25 Euro per month, which counts for 13-29% of the total amount elderly's pension (Heuvelmans, 2022). Following the energy poverty literature, if the heating consumption bills exceeds 10% of the household incomes, then this household is facing with energy poverty (Boardman, 1991). In January 2022, a 67-year-old woman living in Fier city was living in difficult conditions and she lost her life due to the inability to properly heat her house (Top Channel,, 2022). This tragic condition is reflected in 318 thousand pensioners over the age of 65 years in Albania who need to survive the cold with their 110 Euros per month (INSTAT, 2015).

So, energy poverty in Albania is a critical social impact of the current energy system which needs to be addressed in the strategies of the national energy transition vision.

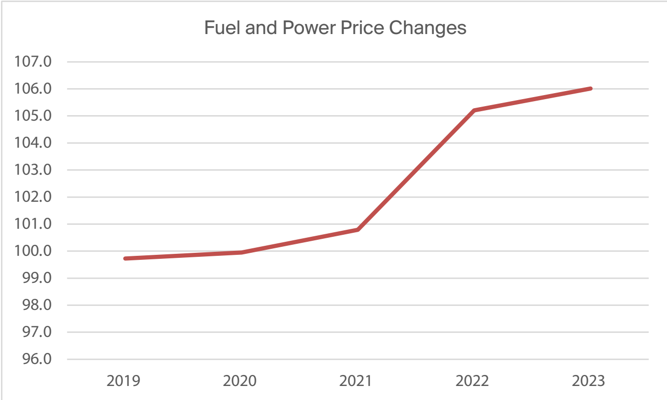

figure 19: average fuel and power price index changes from 2019 to 2023 (adapted by the author from INSTAT, 2023)

[G] Energy ambition for 2030

The National Energy and Climate Plan (NECP) in Albania was approved by the European Union in December 2021 setting up the targets and goals of Albanian energy system for 2030. In the National Energy Strategy 2018-2030 there is emphasized for the first time the importance of Energy Efficiency with a target of 15% by 2030 (USAID, 2018). The energy ambition in this document is stated as follows:

"Development of domestic energy sources, leading to a regional integrated and diversified energy system based on market principles, able to meet demand for energy and for sustainable development of the economy, ensuring security and quality of supply, safety, environmental protection and climate action, and increased welfare." (USAID, 2018)

The document places a strong emphasis on ensuring energy security by meeting the demands for a sustainable transition while considering environmental qualities and welfare. However, there is a lack of a clear target and strategy to address energy poverty, and a significant gap exists in addressing the energy-space nexus. It is crucial to understand how the government and urban planners envision the transition of the landscape while aiming to achieve a sustainable energy system by 2030.

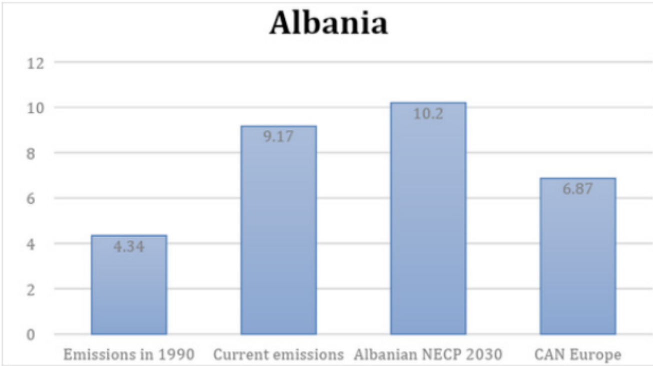

figure 20: Albania's GhG emissions ambition (MtCO2eq) (Antonovska et.al, 2022)

The NECP document outlines three main headline targets: climate ambition to reduce greenhouse gas (GHG) emissions, renewable energy production and consumption, and energy efficiency for 2030 (Antonovska et. al., 2022). Regarding climate ambition, Albania aims to reduce GhG emissions by 18.7% in 2030 as illsutrated by

Figure 20 (MIE, 2021). Despite the fact that electricity production in Albania comes from renewable sources like hydropower, there is still a high reliance on fossil fuels, directly impacting the increase in GhG emissions. The country is exploring possibilities to address this dependency by considering the inclusion of gas pipelines from the Trans-Adriatic pipeline system in the current energy production system of Albania (Antonovska et. al., 2022).

Regarding targets for renewable energy, Albania aims for 54.4% of renewable energy in the final gross consumption by 2030 (MIE, 2021). In 2020, the gross final consumption from renewables was 45.01%, making the target achievable by 2030 (Antonovska et. al., 2022). However, it is crucial to consider changing weather patterns and their impact on hydropower production when setting this target. Diversifying clean energy sources is essential for building a more secure and climate-resilient energy system by 2030

Lastly, the energy efficiency goal in the NECP document is 8.4% (MIE, 2021), a target that does not align with the National Energy Strategy of 2030, which aims for a 15% increase in energy efficiency by 2030. While this plan will improve the energy efficiency of buildings, there is a foreseen increase in energy demand due to the lack of high and smart technologies. Anyhow, this raises the importance of managing the future energy demand by not only aiming for energy efficiency, but also energy sufficency and try to change the people' behaviour to consume less and save more energy.

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The NECP document will significantly transform Albania's current energy system and the national policies directly impacting this process. While there are policy suggestions mentioned, such as those related to energy poverty (Antonovska et. al., 2022), there is still a need for a comprehensive overview of existing policies impacted by this process and potential adjustments for a smoother and more sustainable energy transition.

iii. energy-space nexus

This project puts the energy-space nexus concept at its core and intends to explore the past, present, and future spatial dimensions of energy systems. A fundamental challenge lies in the lack of comprehensive spatial data and scientific research to comprehend the complex relationship between space and energy transition. Space in this dimension is not only about the footprint of energy production sites, but entails integrating social, environmental and context specific elements. To address this data gap and analyze the historical remnants of energy systems in space, a retrospective examination was conducted to understand how energy has shaped space and vice versa throughout the historical background of Albania (Figure 21).

Albania underwent isolation during the communist regime from 1944 to 1989. The nation aimed for self-sufficiency sparking significant changes in both the energy and space. During this period, 24 out of 41 new urban centers were established as hubs for economic and industrial development, strategically linked to mineral and energy sources extractions and refineries (Rugg, 1994). This led to extensive oil and gas extraction areas, mining villages and the transformation of rural landscapes into industrial urban centers and the construction of the first hydropower plant on the Drin River (Rugg, 1994). In older cities like Elbasan, substantial industrial sites were developed for mineral refinement (Rugg, 1994). So, energy was shaping space.

oil and gas districts
Photo by Eltjon Valle

mining districts
Photo by CharlesFred

first hydropower in Drin River
Photo by Korporata Energjetike Shqiptare

industries in main cities
Photo by Alfred Dielbold

urban spr
Photo by Tir

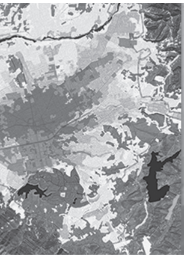
1944

1989

figure 21: historical background of energy-space nexus in Albania

However, the downfall of the regime and the opening of borders, Albania witnessed dramatic shifts in its social, political, and economic landscape, significantly impacting its built environment. Most of the industrial sites were closed and abandoned, turning into forgotten sites of the past. Rural inhabitants migrated to urban centers in search of employment, resulting in urban sprawl characterized by informal buildings and poorly developed infrastructure (Manahasa and Manahasa, 2020). This urbanization, combined with the lack of public transportation, led to a surge in private car usage based on fossil fuels. So, space was shaping energy. The insufficiently insulated prefabricated buildings from the communist era resulted in increased energy demands for heating and cooling, and air conditioning, escalating electricity demand (Islami et.al, 2018). In response to this challenge, new hydropower plants were constructed, making Albania today heavily reliant on hydropower production as its primary energy source (IRENA, 2021).

Throughout these historical transitions, the interconnection between space and energy has been profound making energy-space nexus fundamental core at energy transition. This complex historical background is manifested in space, life and urban characteristics of cities and rural areas, where the layers of these historical phases coexist, either in harmony or as abandoned remnants of former communist industrial sites.



rawl in cities
ana municipality

boom in cars
Photo by Artan Fuga

cooling and heating systems
Photo by Gjergj Islami

new hydropowers
Photo by Statkraft

solar panels
Photo by Belinda Balluku

2023

[A] Patterns of production

This project intend to focus on and explore the potentials and limitations of spaces shaped by energy during the Communist period, which were left abandoned after 1990, with the objective of guiding the energy transition process. It endeavors to establish a new vision for sustainable connections between these areas and residential zones, drawing upon the local identity and historical background of Albania. Identifying these spaces as Patterns of Production due to the repetition of their spatial characteristics and local contexts, the project seeks to contribute to a secure, equitable, and environmentally sensitive energy transition. The thesis will outline the new vision within one of these patterns, specifically in Metalurgjiku in Elbasan city, and provide guidelines on replicating similar energy strategies in other areas of Albania.

The 41 urban centers developed during Communism coexist with the residential areas as abandoned memories of the past (Figure 22). Despite the social, environmental, and political sensitivities surrounding these locations, this project identifies substantial potential in these patterns of production they embody to drive the energy transition process on both a national and citywide level. In the past, there existed multiple connections linking the industrial sites with the city, functioning as a singular system, even though it used to be an unhealthy system due to high pollution of water, air and soil). Today, while the heavy metals pollution remains confined to the site, it still leaches into areas where people live, creating an undesirable and neglected space.

As mentioned before, this situation is replicated in nearly all 41 urban centers established during the communist era, revealing a pattern of production fraught with potential, limitations, and conflicts, yet possessing significant spatial qualities pivotal for driving the energy transition process.

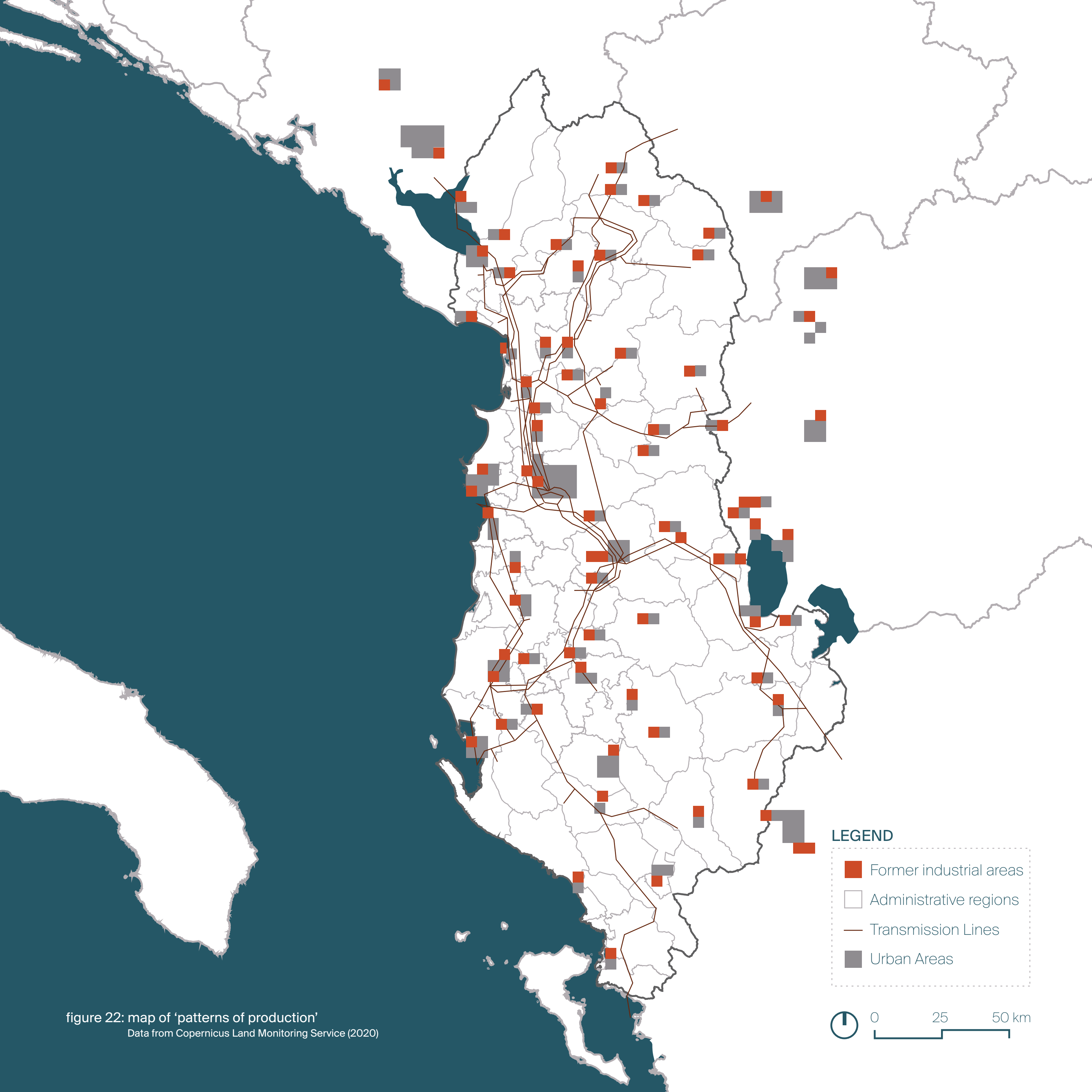


figure 22: map of 'patterns of production'
Data from Copernicus Land Monitoring Service (2020)

[B] The case study of Elbasan

The city of Elbasan is the case study selected for this project (Figure 23) due to its strategical location at the nexus of the country's energy infrastructure (National Agency of Energy, 2003) and its importance as the house of one of the largest former communist industrial sites 'Metalurgjiku'.

Elbasan is considered an important regional area that could serve as a strategical center of development in a national scale for the energy system, while building an interconnection axis with other important cities (Vrusho, 2017). During Communist regime, Elbasan was the center of industry and to minimize the loss of electricity coming in this area from the transmission lines, the regime invested on providing electricity and constructed high-transmission infrastructure from Elbasan to the whole country (Bici, 2007). In the territory of Elbasan region, there were developed also an oil refinery factory in Cerrik and mines in Përrenjas as energy sources for Metalurgjiku and the whole country (Bici, 2007).

From all the data and research collected to analyze the current energy system in Albania, considering the potentials for renewables and challenges towards a sustainable transition, this project identifies Elbasan as an area with a lot of potentials to lead the diversification of clean energy sources with solar, geothermal, and biomass energy and create foundations for a sustainable energy transition (Figure 24).

figure 23: Elbasan city center (photo by the author)

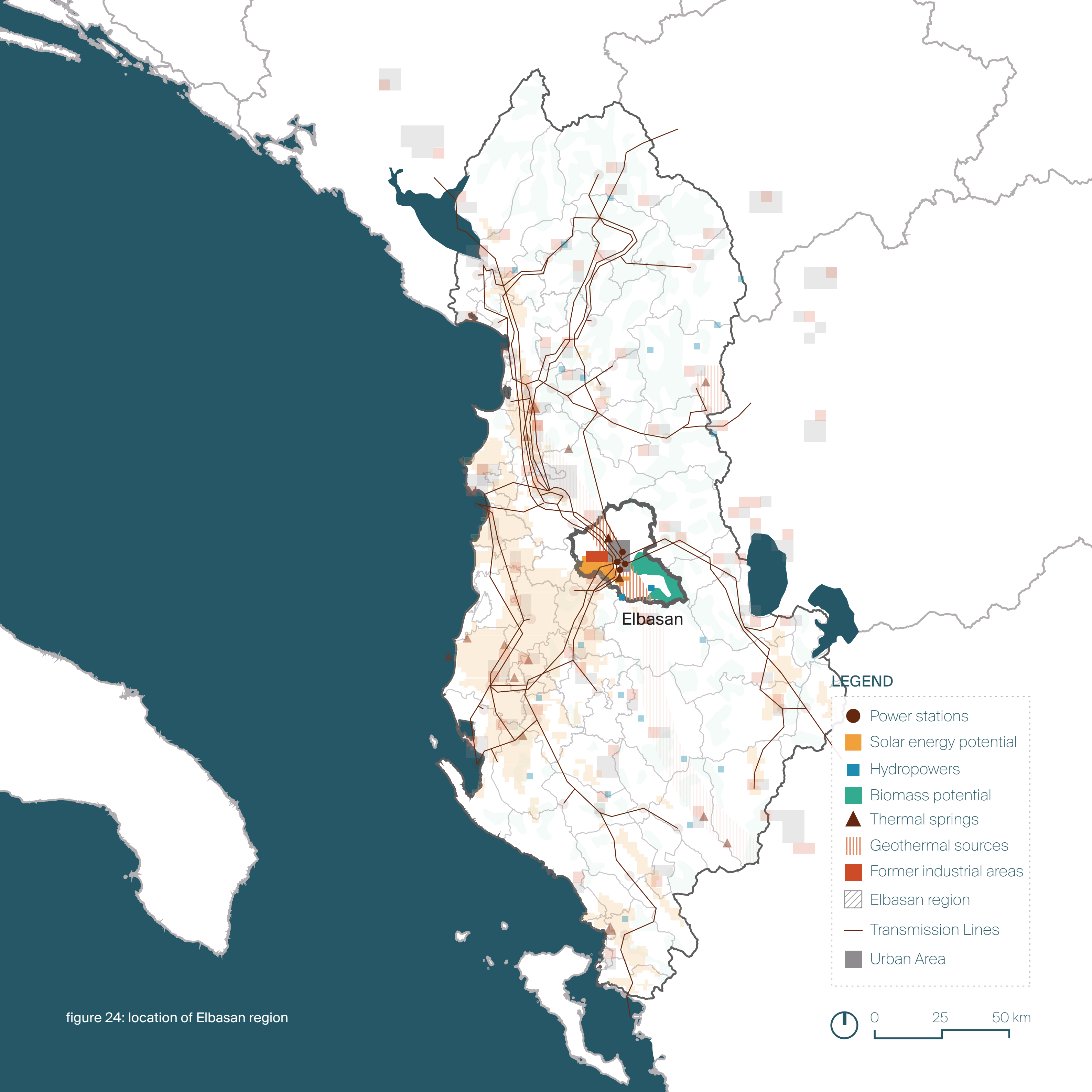


figure 24: location of Elbasan region

[B] The case study of Elbasan

While analyzing the primary layers of the city, it is crucial to comprehend both the layers and spatial characteristics of this area (Figure 27). This substraction of the city space seeks to draw the main connections, past and present flows in this Pattern of Production and the land use typologies surrounding the site.

The former industrial site (Figure 25), which is half the size of the city, is connected to it by a river, an abandoned railway infrastructure, the main vehicular road which is the entrance to Elbasan and an electricity grid. Notably, two power stations were strategically positioned, serving to complete the city and Metalurgjiku energy demand. The Shkumbini River links the former Metalurgjiku with the city along their edges. There is also a railway constructed from volunteer work of the local communities (Figure 26) that connects Elbasan to other cities, such as Pogradec and the capital Tirana, and to Metalurgjiku too (Bici, 2007). In the past, numerous connections and flows existed between the former Communist industrial site and the city; however, today, what remains are only pollution and social sensitivity between these two zones.

Nowadays, the city is transformed from industrial based to agriculture based, the mobility system is based on private cars rather than railway and industrial site stands as ruins of the past with so many conflicts within itself.

figure 25: Metalurgjiku, former Communist industrial area (photo by the author)

figure 26: Railway in Elbasan city (photo by the author)

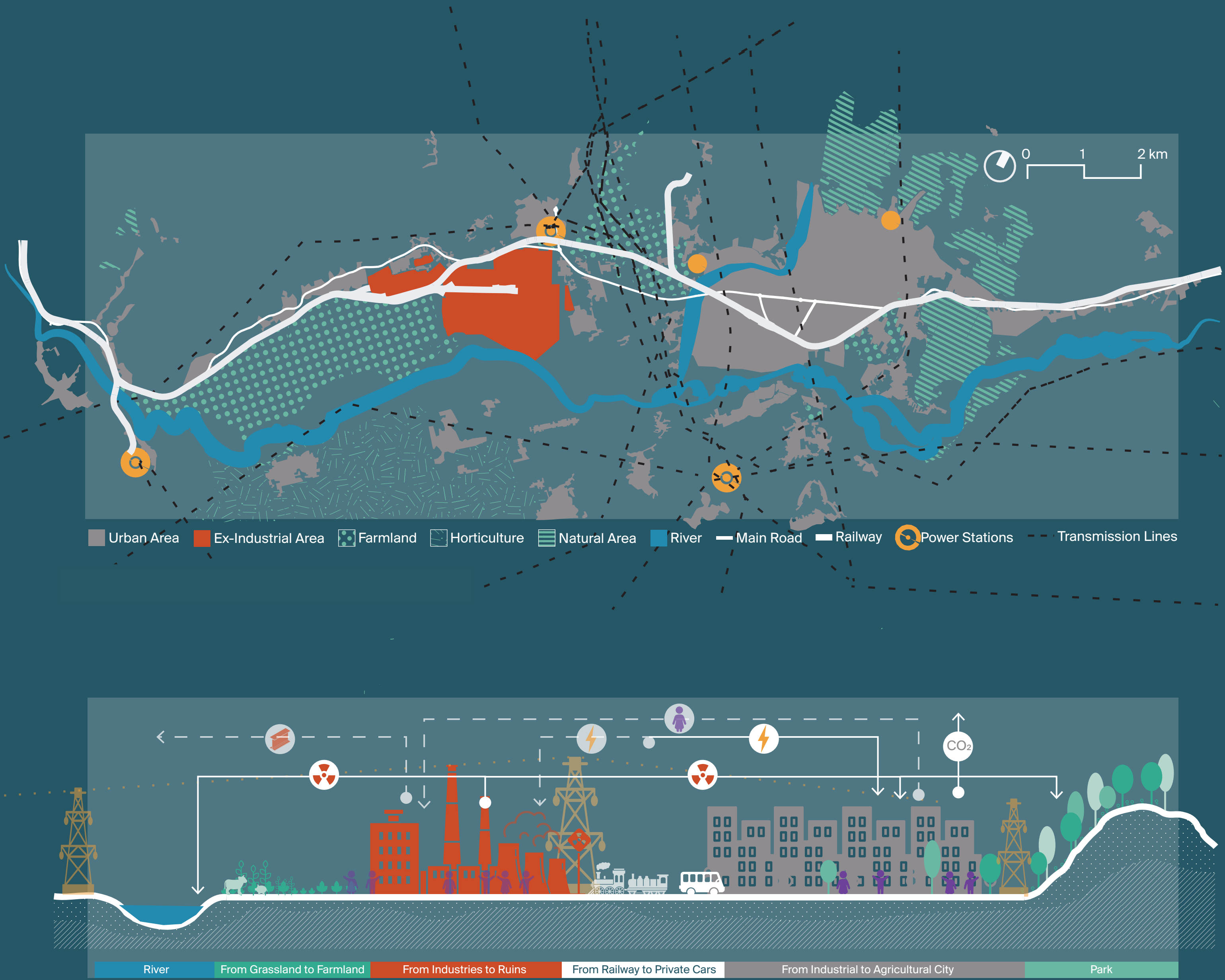


figure 27: land use plan (top) and systemic section of the past and current flows (bottom) of the Pattern of Production, Elbasan city
(Source: adapted by the author from OpenStreetMap)

iv. problem statement

Albania is among the most climate-vulnerable countries in Southeast Europe, facing changing weather patterns characterized by higher temperatures, decreased summer rainfall, and extreme flooding and drought events (World Bank, 2013). The country heavily relies on hydropower as its second main energy source, making it susceptible to the climatic challenges it has experienced in recent years (IRENA, 2021). For instance, in 2017, domestic electricity production from hydropower dropped to 63% due to extreme drought events, while energy demand for cooling significantly increased (IRENA, 2021). Therefore, ensuring energy security is a primary goal for Albania's energy system to meet future energy demands and reduce vulnerability to external climate changes.

While aiming to achieve energy security, it is crucial to assess the social and environmental impacts of this transition in the specific context of Albania. This country is reflecting energy poverty, particularly affecting the elderly who struggle to afford electricity for heating and cooling to meet their energy needs (Heuvelmans, 2022). At the same time, the primary energy production in Albania heavily relies on fossil fuels, ranging from 46% to 68% over the last five years (IRENA, 2021). This dependence results in increased greenhouse gas emissions and air pollution issues. The impact of this pollution on the health of citizens and vulnerable groups has not been adequately assessed due to data limitations (UN, 2018). It is crucial to evaluate not only the social and environmental impacts of the current energy system, but also the impact of achieving energy security along these two perspectives.

Within the challenge of reaching energy security and encour its environmental and social outcomes for a clean, affordable and accessible energy system, the biggest uncertainty relies on the way how energy shapes space and space energy. Energy system in Albania is shaped by uncertainties of energy-space nexus due to unpredictable impacts that energy has in spatial, social and environmental contexts. Starting with Communist period, drastic transformation in space were made to complete energy demand, where extensive oil and gas fields, mining villages, first hydropower plants and big industrial complexes were constructed by changing the landscapes from rural to industrial based area. During this period, 41 new urban centers were established as hubs for economic and industrial development, strategically linked to mineral and energy sources extractions and refineries. These 41 new urban centers create a Pattern of

Production that consists of the residential area and industrial sites. This Pattern is identified in this project as a reflection of uncertainties of energy-space relation in Albania, which contain potentials to foster energy transition by redefining these spaces into a sustainable energy-space nexus relation.

But are these uncertainties only a problem of the past?
Energy-space uncertainties are not only recognized during Communist regime, but also today. Albania has a lot of potentials for solar energy and wind energy in the north and south of the country. It has also geothermal resources that could be used for heating. Nowadays, the government is prioritizing investment in renewable energy. The main policies show that diversification of clean energy sources, energy efficiency and technology advancement are main goals of energy transition in Albania. And still energy space nexus is missing. There are being constructed big solar energy prodution sites, transforming large hills landscape into sites of energy production, with a fossil fuel thinking mindset where energy production is priority, rather than the spatial, social and environmental imapcts that these sites will have in Albania. The same energy system thinking as during Communism, where space is not considered and social environmental impacts are neglected, is being followed even nowadays while Albania is aiming to foster energy transition.

While zooming in at the city of Elbasan, a city situated at the nexus of the national energy infrastructure and housing one of these largest former communist industrial sites, there are many limitations, conflicts and potentials when considering to include this space in the energy transition process. In the past, there existed multiple connections linking the industrial sites with the city, ending up nowadays into an undesirable and neglected space. This complex background is manifested in space, life and urban characteristics of this city where the layers of historical phases coexist, either in harmony or as abandoned remnants of former communist industrial sites.

To sum up, as energy security stands at the core of energy transition in Albania, with Elbasan as the case study, it is crucial to consider the social, environmental and other context-specific impacts of this process through the lens of energy-space nexus.

v. aim

The **primary aim** of this project is to investigate the integration of energy-space nexus in the process of energy transition, while following the potentials and limitations of the local context of Albania.

It seeks to construct a new synergy between the former communist industrial sites with the residential areas in the case study of Elbasan, while diversifying the energy production and completing energy demand for 2050. This synergy will represent the spatial challenges and potentials of integrating the communist industrial spaces in the energy transition, without neglecting their social and political conflicts. It will be established within the framework of energy security while assessing the social impact on energy poverty and environmental impact of regenerating these industrial sites into green energy production zones.

The objectives are to:

- Build a strong theoretical foundation and conceptual framework that can guide the diagnosis and design chapters;
- Identify the relation between energy and space in the case study of Elbasan, by analyzing the spatial characteristics of this Pattern of Production, the energy demand and supply, social-environmental context, policies and stakeholders;
- Spatially design the optimized scenario in Elbasan for 2050 by combining the maximized scenarios of conceptual framework 3 pillars;
- Define a project of interventions in the scales from MLP framework to design the strategies needed for this transition;
- Create a comprehensive assessing framework of patterns that can be used in similar contexts and different scales.

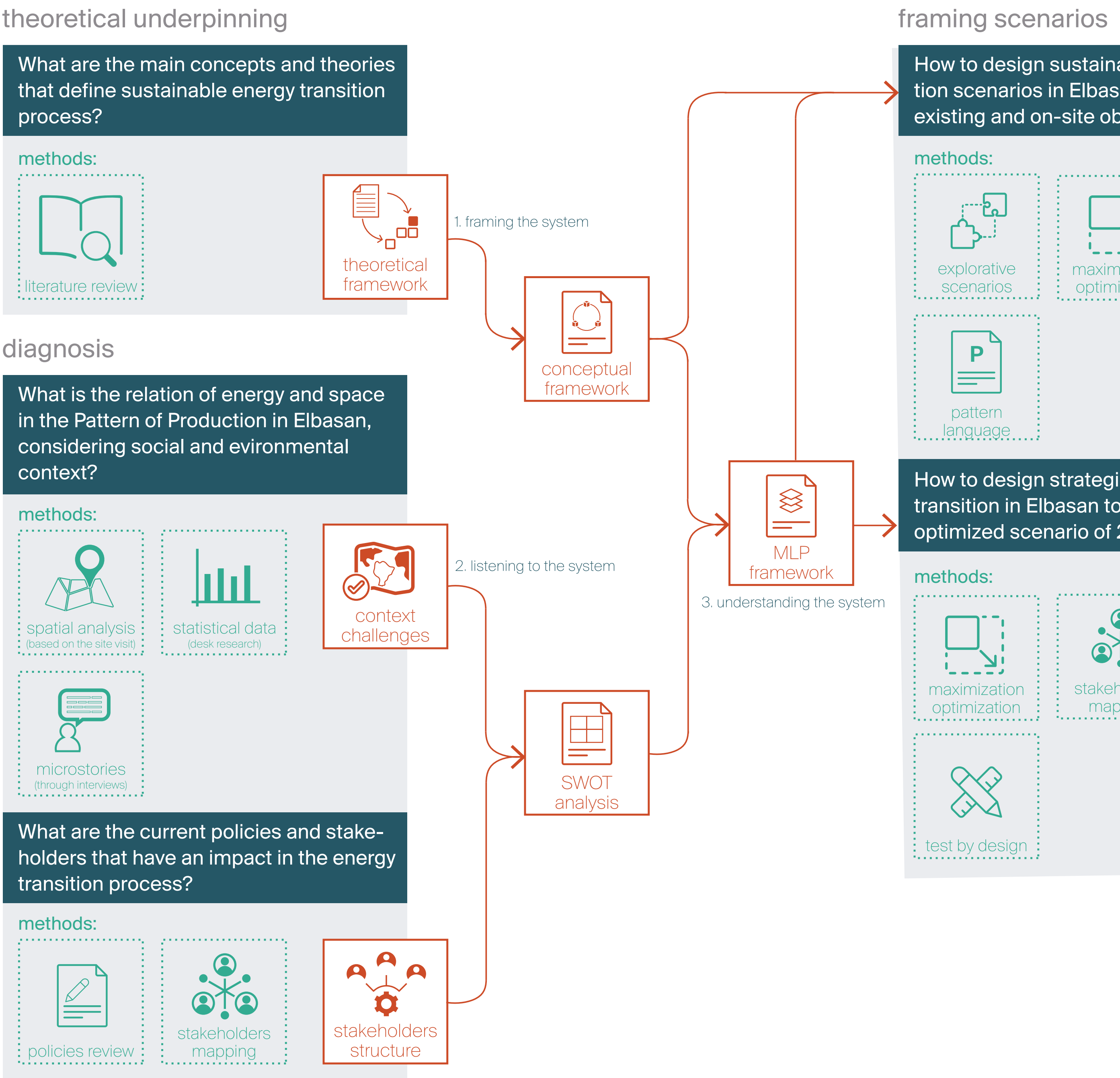
vi. research question

"How can the **energy-space nexus** in the **Pattern of Production** contribute to **energy security** for a social and environmental sensitive transition in Elbasan?"

Research subquestions are listed below:

1. What are the main concepts and theories that define sustainable energy transition process?
2. What is the relation of energy and space in the Pattern of Production in Elbasan, considering social and evironmental context?
3. What are the current policies and stakeholders that have an impact in the energy transition process?
4. How to design sustainable energy transition scenarios in Elbasan, considering existing and on-site observed patterns?
5. How to design strategies for the areas of transition in Elbasan to achieve the optimized vision of 2050?
6. What is the assessment of the new energy-space nexus in Elbasan in terms of completing the locals needs?

vii. methodology



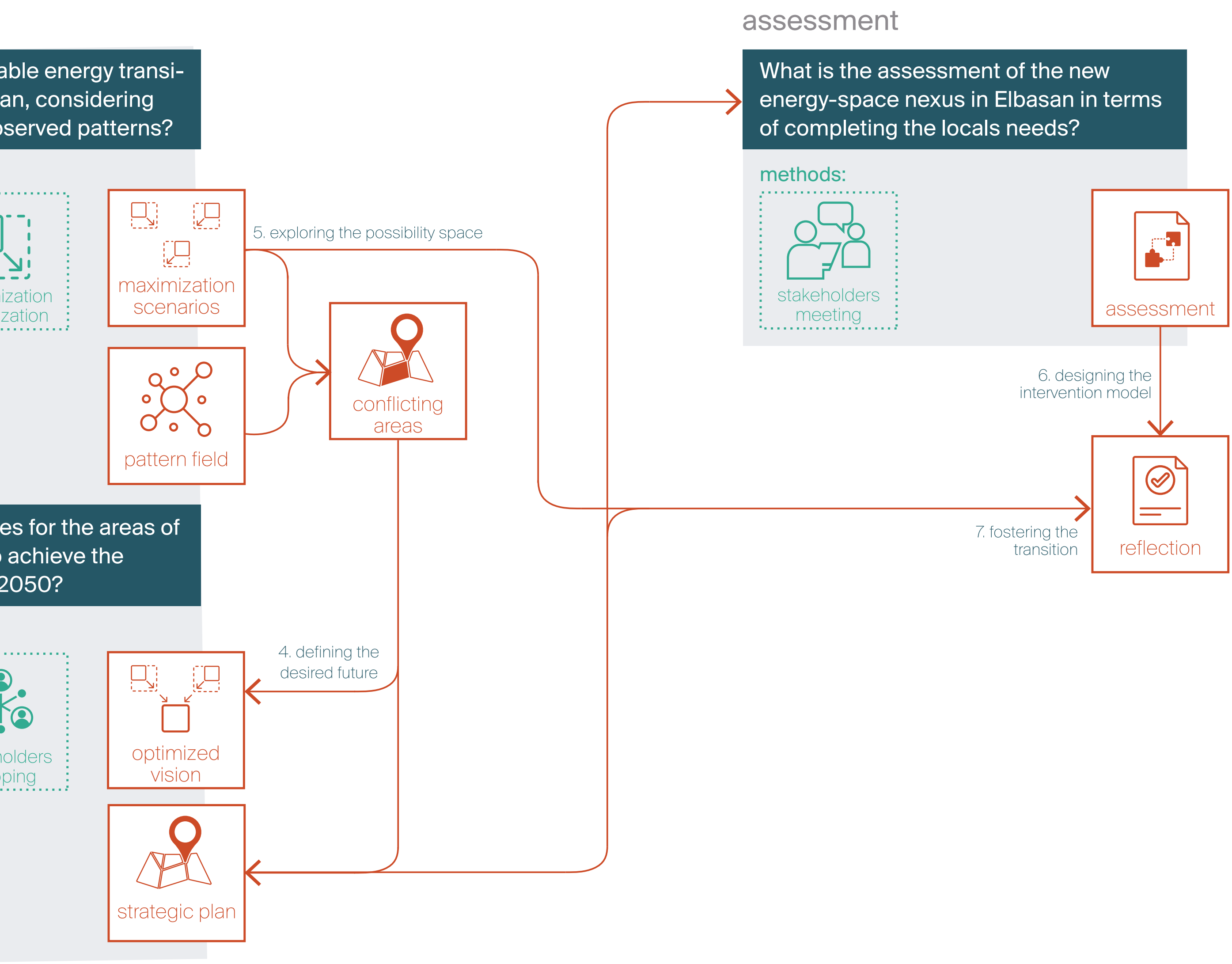


figure 28: methodology framework (by the author)

viii. methodology

The structure of this project follows the systemic design approach, where design and systemic thinking are both integrated within a 7-steps framework. System thinking consist of different elements and stakeholders that are connected with each other in nonlinear multi-level perspectives (Curatella, 2020). Whereas, design thinking focuses on finding solutions and use imagination to deal with uncertainties and possible future scenarios (Pourdehnad et.al., 2011). The integration of these two approaches within a single framework helps to guide complex transition, such as energy transition, following the steps identified by Namahn's Kristel van Ael's team: (1) Framing the system, (2) Listening to the system, (3) Understanding the system, (4) Defining the desired future, (5) Exploring the possibility space, (6) Designing the intervention model, (7) Fostering the transition (Figure 29).

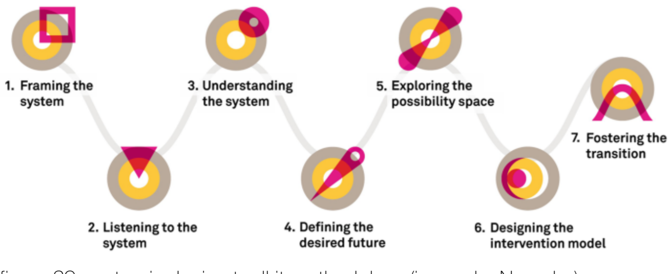


figure 29: systemic design toolkit methodology (image by Namahn)

The methodology employed in this project consists of four phases aligned with the 7 steps of systemic design thinking (Figure 29). The first phase aims to (1) frame the system by properly defining sustainable energy transition process through a critical review of different literature and theories. A theoretical framework will be designed for a comprehensive understanding of the main theories that support the main research question. At the end, a conceptual framework will be constructed to guide the subsequent phases of the project.

The second phase, named Diagnosis, involves analyzing the current and future challenges of Elbasan by (2) listening and (3) understanding the energy system and its local identity. It consists of two primary sections:

- the connection between energy and space in the Pattern of Production along with the analysis of energy demand-supply and their social and environmental context
- the review of policies and stakeholders structure that impact energy transition.

The first section will be using spatial data gathered by the site visit and statistical data from the official website of INSTAT. Also it will define microstories from the informal interviews with various stakeholders and citizens.

Integrating these tools with the review on policies and stakholders, this chapter aims to identify areas of potentials and stakoholders structure within their conflicts and limitations. SWOT analysis will assess the findings and define criterias of transition.

The third phase will involve designing three explorative scenarios and one optimized scenario for 2050 using pattern language and maximization tools, specifically by (4) defining the desired future. The pattern language will be identified through on-site observation and reference projects. Each scenario will depict spatial transformations while maximizing the three main pillars of the conceptual framework: energy security, energy equity, and environmental qualities of energy transition. The combination of these scenarios, where the conflciting areas are defining new Patterns, will establish the vision for Elbasan in 2050. After establishing the 2050 vision, this project will (5) explore the possibility space of establishing the energy-space nexus within the Pattern of Production by defining a strategic plan that is developed in 5 phases within the timeline of2050.

The findings of the design process will guide the assessment step, which is also the final phase of this project. In this phase the pattern field designed in the pattern language used for the definition of scenarios and the strategic plan will be assessed based on meeting the needs identified from the microstories on a scale from 1 to 5. The aim is to (6) design the intervention model for sustainable energy transition within every Pattern of Production identified in Albania and other similar contexts, placing the energy-space nexus and context-specific characteristics at the core of the process while assessing the interventions with different stakeholders to evaluate how much this design complete their needs.

In conclusion, after the completion of this study and design process, we can address the main research question regarding how energy-space nexus in the Pattern of Production of Elbasan can achieve energy security when considering its social and environmental impacts. While acknowledging the limitations of this project due to data constraints and identifying potential areas for future research, this thesis will establish a robust scientific foundation for guiding sustainable energy transition processes in developing countries with a Communist historical background.

II. theoretical underpinning

This chapter establishes the framework for the energy system by constructing a theoretical foundation that critically reviews various literatures, aiming to define key concepts guiding a sustainable energy transition. It summarizes three main groups of theories, namely systemic thinking, energy and space and demand-production, highlighting the main drivers of the energy transition process. Subsequently, a conceptual framework is created by integrating research findings on the local context of Albania and theories on sustainable energy transition. This framework emphasizes key concepts shaping the transition in this specific context: **energy security** standing as the primary aim, while assessing the imapcts on **energy equity** and **environmental qualities** to promote health and justice within the energy-space nexus. triking a balance among these pillars is crucial for creating synergy between communist industrial sites and residential areas, fostering energy transition. These chapter would guide the diagnosis of the nergy-space nexus in Elbasan, the design of the maximilized and optimized scenarios and the build of the startegies and Pattern Language book.

figure 30: abandonded building in Communist Industrial site in Elbasan (photo by the author)

i. theoretical framework

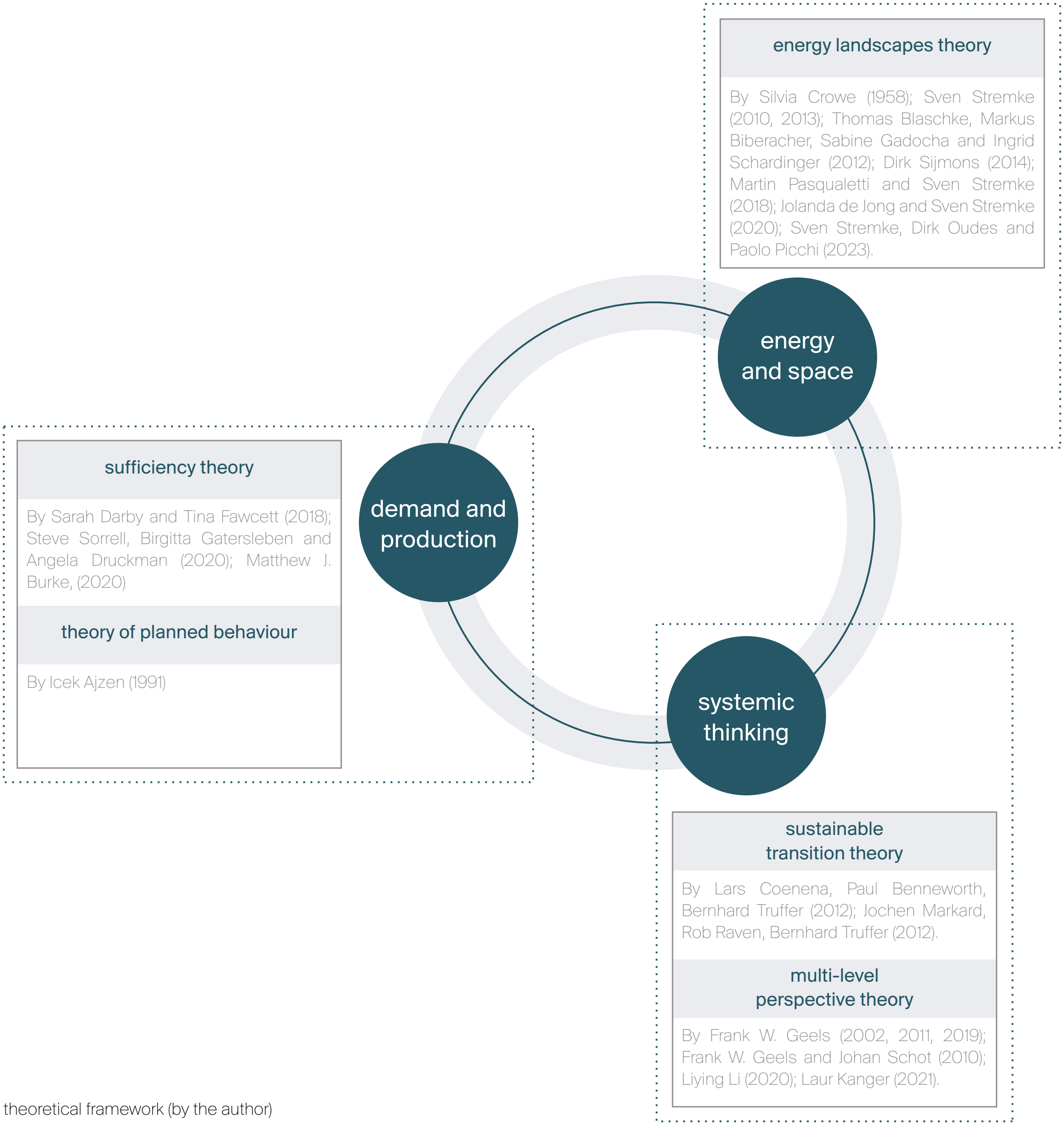


figure 31: theoretical framework (by the author)

The theories on energy and space, systemic thinking, and energy demand and production stand as the backbone elements of this thesis. They have been critically analyzed to define the concept of sustainable energy transition and have played a crucial role in addressing the main research question by building a strong theoretical foundation. The theories on systemic thinking highlight the importance of adopting a multi-level perspective for a sustainable transition, particularly emphasizing the relationship between energy security and social and environmental systems. The energy and space theories introduce the concept of energy landscapes, forming the basis for the energy-space nexus. Finally, the theories on demand and production incorporate sufficiency theory and the theory of planned behavior as fundamental elements for achieving energy security. A more detailed description of each of these three group of theories are described below.

Systemic thinking theories

Transitions are described as a co-evolution and transformation of socio-technical systems and multiple stakeholders which aim for an extreme change within a long-term vision of 50 years (Geels and Schot, 2010). At the same time, Jochen Markard et al. interprets sustainability transition concept as 'long-term, multi-dimensional, and fundamental transformation processes through which established socio-technical systems shift to more sustainable modes of production and consumption' (Markard et al., 2012). Socio-technical systems are structured arrangements of stakeholders, policies and technologies designed to accomplish the needs of the society (Kanger, 2021). They involve not only the evolution on technology, but also the developments on people's behavior, cultural norms and business strategies (Geels, 2019). The research on socio-technical systems is prominent by the Multi-Level Perspective (MLP) theory which analyzes transitions of socio-technical systems through a non-linear interplay between three levels (Figure 32): socio-technological landscape, regimes and niches (Geels, 2002).

Socio-technical landscape represents the external and wider context that has a direct impact on niches and regimes (Geels, 2011). Due to the wide context that landscapes have by including demographic and spatial features, social and cultural values, and political and economic trends, they can change slowly, but still stabilize or destabilize regimes and niches (Geels, 2011).

i. theoretical framework

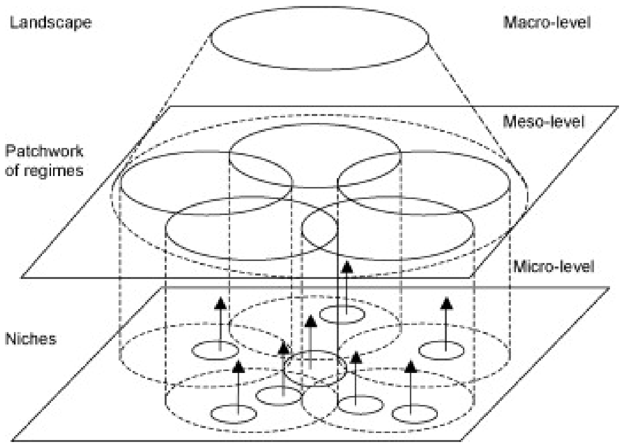


figure 32: The hierarchy of the multiple levels perspective elements
(source: Geels, 2002)

Climate change, energy security crisis and the urgency for renewable sources are destabilizing factors of the socio-technical landscapes that influence the regimes and niches in the lens of energy transition (Li, 2020). Socio-technical regimes represent the structure of a current socio-technical system, that ensures stability between different rules, actors and existing technologies involved in this system (Geels, 2002). They consist of technological trajectories which guide the actors and activities in the same path, characterized by regulations, institutional frameworks, users and market practices, and social and scientific insights (Geels, 2011).

Energy transition is a process that would create chaos in the current energy regime, due to the crucial role of existing policies, industries and actors on the economy and global business models (Li, 2020). For a successful accomplishment of energy transition goals, regimes need to go through a process of change by structuring the right policies in the current system, unifying the opportunities discovered in Niches level with the existing technologies and directing market practices and structure on the right path (Li, 2020). Niches act as insulated areas from the existing market of the regime where innovations are created and grown up through time (Geels, 2002). They support emerging demands by dealing with uncertainties, learning processes and building a network of innovative actors willing to disturb the Regime structure (Geels, 2011). Niches provide the roots of change and are crucial in transition processes (Geels, 2002). The renewable energy technologies are created in the niche level, providing a radical innovation which is facing many challenges to disturb the existing regime through the political and economic lens, but is starting to deviate and compete the dominance of this Regime in the current energy system (Li, 2020). While the radical innovations in the Niche level stabilize into one novelty and the socio-technical landscape is slowly changing through time (Figure 33), they destabilize the system on the Regime level, creating this way opportunities for transitions (Geels, 2002). When the Regime is stabilized after the new innovations have intervened its structure, it starts to influence and shape the socio-technical landscape

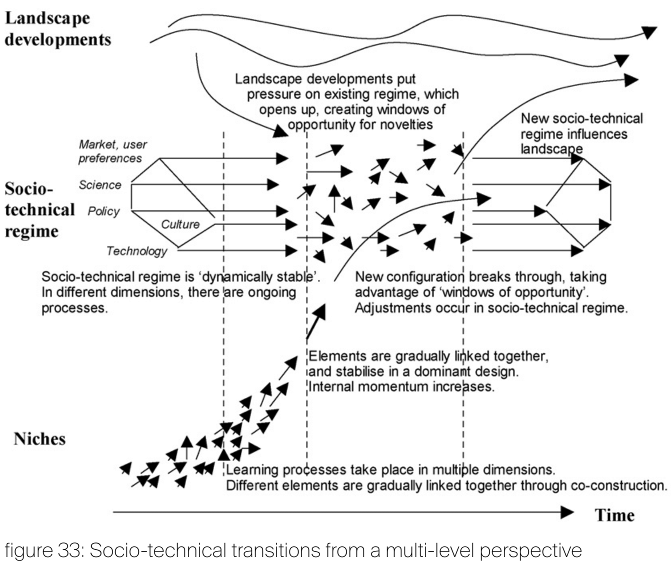


figure 33: Socio-technical transitions from a multi-level perspective (source: Geels, 2002)

and opens spaces for new niches development (Geels, 2011). The MLP theory emphasizes that for this transition to happen, it is crucial that all the levels of niche-regime-landscape processes should be harmonized and work together (Geels, 2011).

However, his theory lacks a spatial dimension perspective, which must be taken into account when aiming for a sustainable transition (Coenen et al., 2012). The introduction of space and scale in this theory addresses the issue of causality within the framework of time and place, explicitly specifying where and when the transition is occurring (Coenen et al., 2012). Although the MLP levels are not inherently geographically related, the multi-level approach could easily be connected with the multi-scalar perspective (Coenen et al., 2012). Within this multi-scalar perspective, it is recognized that differences in localities have varying impacts at different scales, and global strategies are shaped differently based on these local characteristics (Coenen et al., 2012). Therefore, adapting this theory through the lenses of multi-scalar and spatial perspectives can provide a more robust framework for a sustainable transition. Based on this critical analysis of systemic thinking theories, this project aims to identify areas of transitions (niches) to foster the energy transi-

i. theoretical framework

tion, while considering the pressure from climate change (landscape) within the current energy system (regime).

Energy and space theories

Energy transition process is not only about emitting CO2 emissions and investing on the latest technologies, but also about shaping the landscape and changing the space where humans and non-humans live (Stremke et al., 2023). Our energy demands and consumption patterns are giving rise to 'energy landscapes' that directly impact both the quality of life and the environment (Stremke et al., 2023). Research conducted by Jolanda de Jong and Sven Stremke in the case study of Western has demonstrated that all historical phases of energy transition faced by mankind, driven by the introduction of new energy sources, have manifested in 'energy landscapes' distinguished by their spatial and temporal features. (Jong and Stremke, 2020). This landscape evolution will continue to change by the ongoing renewable energy transition process, resulting in permanent or temporal transformations (Jong and Stremke, 2020).

Anyhow, the definition of the 'energy landscape' and the strategies for achieving a sustainable energy landscape remain somewhat ambiguous. Silvia Crowe is one of the first scholars to introduce this concept by putting an emphasis on the importance of analyzing the landscape within its past, present and future visions, due to its continuously evolving character (Crowe, 1958). Another perspective on the definition of the energy landscape is presented by Blaschke et al., who highlight its importance not only as a connection between energy technologies and consumption with the spatial footprint of this system, but also as a concept that incorporates people and local contexts as integral components of this new landscapes (Blaschke et al., 2012). Sven Stremke introduced the concept of sustainable energy landscapes by emphasizing the importance of understanding renewable energy production and consumption patterns through the lens of ecology, due to the direct impact that energy landscapes have on the social, environmental and economical perspectives (Stremke, 2010). Dirk Sijmons in his book 'Landscape and Energy: Designing Transitions' shows with concrete case studies how energy and space have shaped each other by proving that energy transition is not only a challenge for engineers, but also of spatial planners and local communities (Sijmons, 2014). Pasqualetti and Stremke have defined energy landscapes as a 'co-constructions of space and society that come into existence through a series of material and social relations' by creating spaces according to energy sources used by the society (Pasqualetti and Stremke, 2018). They have introduced three drivers of energy landscapes that inform the spatial typologies of these spaces (1) substantive qualification which identifies different types of energy landscapes according to the density of energy sources in this space; (2) spatial qualification that differentiates energy landscapes according to the visual and appearance dominance of energy infrastructures and technologies (3) temporal qualification that varies from short timeframe of energy infrastructures to permanent energy spaces that remain as ruins of the past energy systems (Pasqualetti and Stremke, 2018).

To conclude, energy landscapes do not represent only a physical space, but also a spatiotemporal perspective of the environment (Stremke, 2013). It is crucial to keep reminding that renewable energy is not always sustainable if they do not preserve the local qualities of the landscape and of the environment, they are part of (Stremke, 2013). Decisions on the quantity and quality of renewable energy sources and technologies create energy landscapes with a direct impact on the global climate crisis, energy security, environmental qualities and energy equity too (Stremke et al., 2023). These impacts may be temporal or permanent, affecting the present and future spatial development of energy systems in humans' living environment (Jong and Stremke, 2020). So, energy transition should be based on an 'energy-conscious spatial design' process that assess the social and environmental impact of energy landscapes for a sustainable approach of future energy systems (Stremke, 2010). These theories emphasize the pivotal role of energy-space nexus in energy transition process, which is not a representation of just a physical space, but also a reflection of the local identity, social norms, spatiotemporality of the environment and the driver towards energy security, energy equity and environmental qualities. This is the leverage point in this project that can stimulate the change on the current energy system.

Demand and production theories

This project expands upon theories underscoring the significance of projecting not only the current and future energy demand and production of the energy system, but also critically evaluating these figures through the lens of equal well-being and consumer behaviors. Its objective is to emphasize that an increase in energy usage

i. theoretical framework

does not contribute to well-being and is not a solution for a sustainable energy transition. The rise in energy consumption will likely result in increased energy inequalities among different groups of people and permanent environmental damage (Burke, 2020). It draws the line of energy demand and production, while considering the maximum social and environmental benefits of a specific context.

The theory of energy sufficiency introduces a boundary between energy needs and wants by establishing a new relationship between energy demand and well-being (Burke, 2020). While the definition of energy sufficiency remains unclear, its core remains consistent in various definitions found in literature, translating into two main pillars: lower energy consumption and the reduction of greenhouse gas emissions. Matthew J. Burke outlines four main charcteristics of sufficiency: (1) a balance between maximum and minimum energy use, (2) achieving less energy consumption with more social and environmental benefits, (3) recognizing the social and context-specific line between needs and wants, and (4) integrating smart technology and energy efficiency within the goals (Burke, 2020). Whereas, Sarah Darby and Tina Fawcett define energy sufficiency as "a state in which people's basic needs for energy services are met equitably, and ecological limits are respected," placing high emphasis on energy services as benefits derived from energy within planetary boundaries (Darby et. al., 2018). Figure 34 illsutrates the adaptation done of the Doughnut economy diagram within the main drivers of energy sufficiency. The external limits are defined by materials used to complete demand and supply, biodiversity and availability of the land, air pollutants and GhG emissions (Darby et. al., 2018). At the core of the diagrams stand the energy services to complete the basic needs of a healthy person (Darby et. al., 2018). So, the definitions of energy sufficiency mentioned above emphasize the importance of completing the needs of people without damaging the needs of future generations by respecting the environmental boundaries, being in line with sustainability definition, proving that this concept is fundamental for a sustainable energy transition process (Darby et. al., 2018).

For a successful energy sufficiency strategy, it is required changes in social and cultural behaviors of a society (Spangenberg et. al., 2019). Sufficiency behavior can be more accepted when societies shift consumption patterns to prioritize having enough for a healthy lifestyle, rather than perceiving it as a sacrifice for a future uncertainty (Spangenberg et. al., 2019). It should be framed within consumer freedom, making it natural to consume less and even mainstreaming this behavior (Spangenberg et. al., 2019). The Theory of Planned Behavior offers a framework to analyze the current "values-beliefs-norms" of a society toward energy usage and understand predictable behavior patterns of people in relation to consumption (Ajzen, 1991). It can then control people's behavior by normalizing sufficiency and delineating the border between needs and wants. This theory is built upon three key pillars: attitudes, subjective norms, and perceived behavioral control (Ajzen, 1991). Attitudes pertain to individuals' perceptions and evaluations of their personal ability and benefits toward a particular behavior (Ajzen, 1991). Subjective norms explain the impact of social and cultural norms on individuals' decisions to engage in specific behaviors, while perceived behavioral control focus on personal beliefs and thoughts concerning one's ability to perform a behavior (Ajzen, 1991). So, successful behavior change occurs when there is a reduction in perceived behavioral control regarding a crisis, prompting shifts in social norms and attitudes that lead individuals to easily embrace this new behavior (Spangenberg et al., 2019).

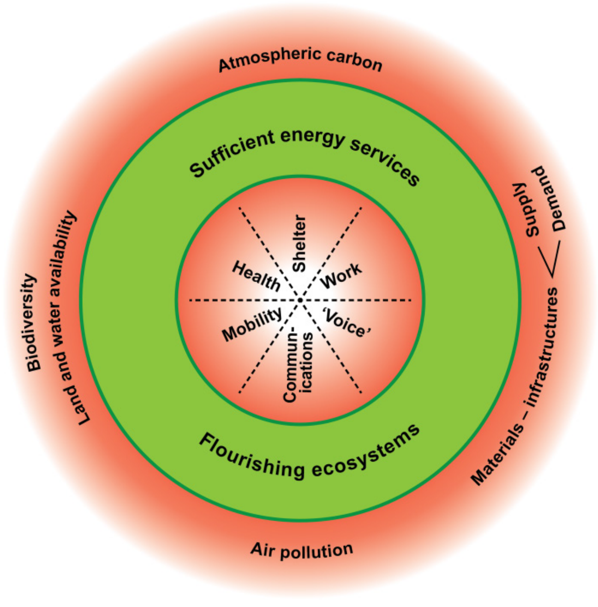


figure 34: adaptation of the doughnut economy diagram for energy sufficiency
(source: Darby et. al., 2018)

To conclude, these theories emphasize the importance to rethink energy demand and production within the boundaries of energy sufficiency, without living behind the pivotal role of social behaviours and context-specific inputs to foster a sustainable transition.

ii. conceptual framework

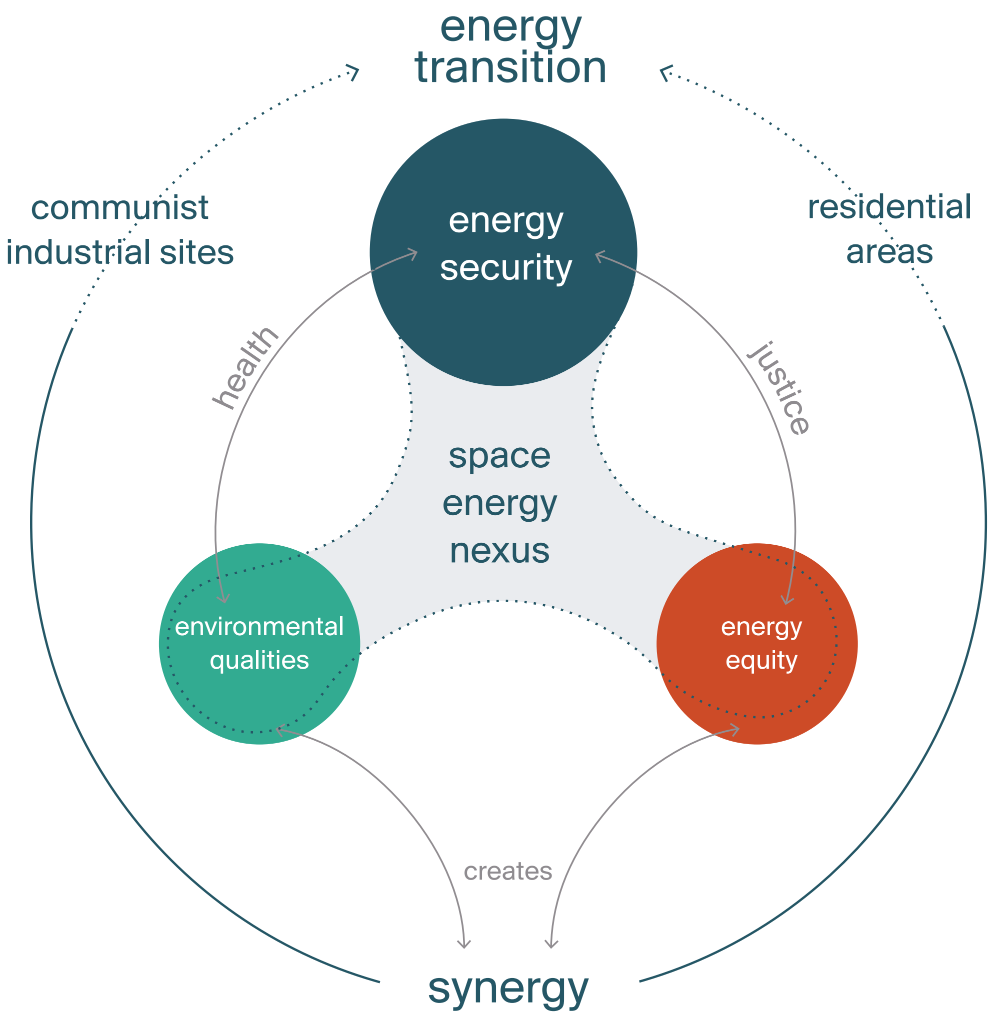


figure 35: conceptual framework (by the author)

This scheme visualizes the exploration of Albania's energy transition by adopting a systemic approach that considers the energy landscape, local identities and current challenges, while providing a comprehensive understanding of the transition process through the lens of space-energy nexus.

While energy security stands out as the biggest urgency and challenges of the enrgy system in Albania, primarily due to its reliance on hydropower production, it serves as the primary impetus for this project. However, acknowledging that energy security alone cannot ensure a sustainable transition, this project recognizes the need for a holistic approach. The development of energy security will hinge on the intricate interplay between social and environmental factors. The goal is to assess how interventions aimed at achieving security will impact energy equity and the environmental landscape, using the case study of Elbasan.

This synergistic relationship aims to foster values such as health and justice throughout the energy transition process in Albania, addressing two major challenges following energy security in the prospective energy system.

Simultaneously, it is imperative to underscore that the interaction of energy security with social and environmental aspects will be framed within the context of the space-energy nexus, a core concept of the conceptual framework. This nexus will be intricately woven with the local identity, acknowledging both limitations and potentials. The overarching objective is to create synergy between residential areas and former communist industrial sites, thereby designing a new Pattern of Production that propels the energy transition forward.

III. diagnosis

This chapter delves into diagnosing the energy-space nexus in Elbasan across different scales. It involves analyzing the current context of energy and landscape within the municipal borders. The next step entails an in-depth analysis of the spatial characteristics of the Pattern of Production, identifying spatial typologies, listing to people's perspectives, building microstories for each typology, and reflecting these characteristics on energy usage and demand. The findings are translated into a diagram illustrating the challenges of energy security in Elbasan and the social and environmental context, responding to Sub-question 2. Lastly, this chapter identifies the stakeholders involved in the energy transition process of the Pattern of Production in Elbasan and reviews policies to better understand the system, marking conflicts and limitations of this project. At the end of the chapter, the findings of the energy-space nexus in Elbasan are summarized by an assessment diagram through Strenths-Weaknesses-Opportuntiies-Threads (SWOT) analysis.

figure 36: a neighborhood in Elbasan city (photo by the author)

i. energy and space in Elbasan

Elbasan municipality consists of a strong infrastructure connection with the capital of Albania, Tirana, and also Durres and Pogradec cities acting as a bridge with the South-east cities of Albania (Figure 37). The intersection of this infrastructure lays at the edge of Metalurgjiku, the biggest Communist industrial site of Albania. It also goes within the residential area, emphasizing the strong connection between Elbasan city with industrial sites and other big cities of Albania. In terms of infrastructure connection, there is also an abandonded railway along along this road that used to be serving the industrial site mainly.

In terms of natural layers, Elbasan city is surrounded by agricultural lands, which is also the main current economical activity of the city. It also is rich on water resources with Shkumbini River passing at the edge of the residential and industrial sites, connecting these two areas also through natural corridors. There are also two thermal springs with potentials to be used as clean energy sources for heating and several hydropowers already producing energy.

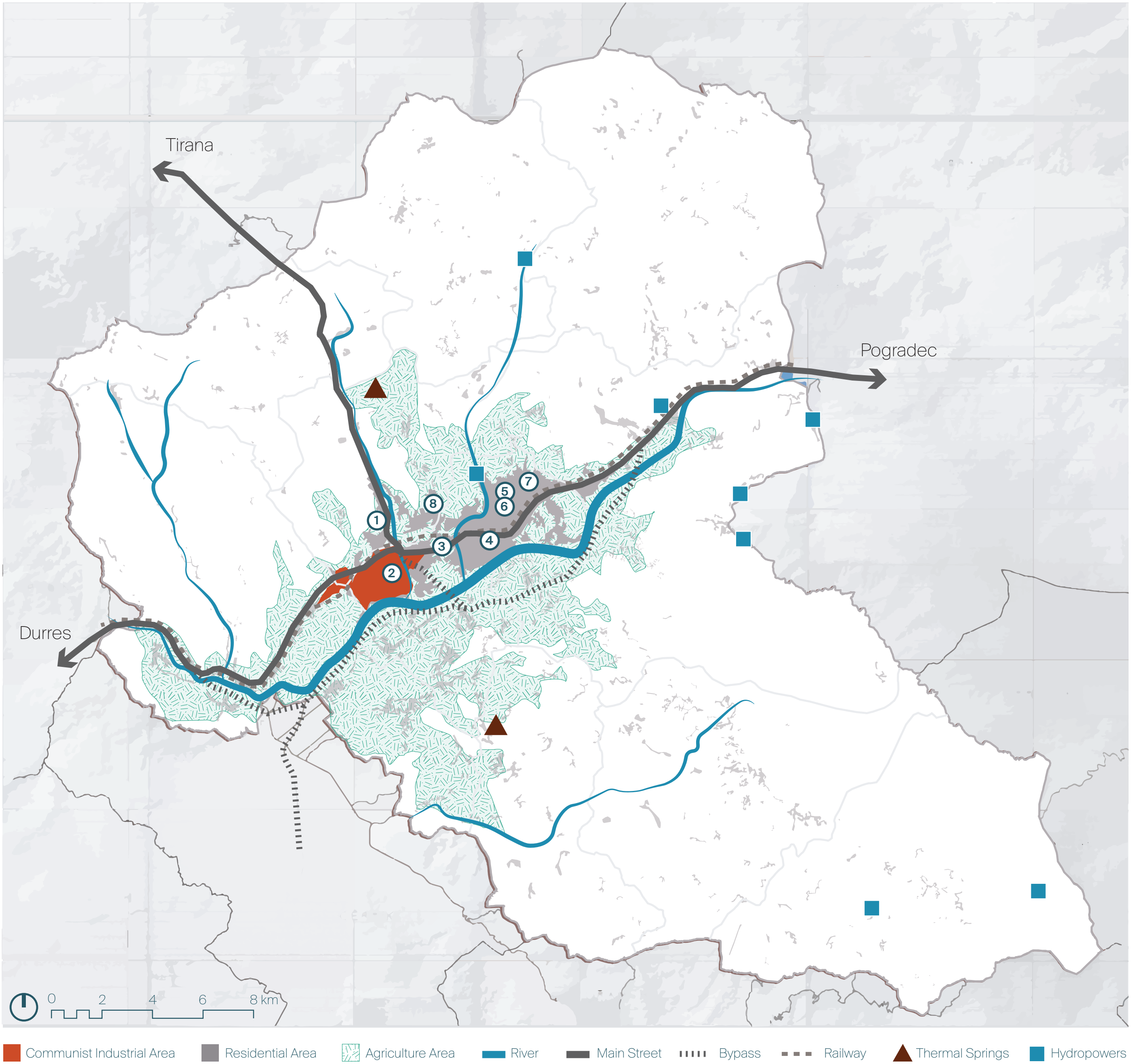


figure 37: urban layout of Elbasan municipality (data from National Territorial Planning Agency of Albania, 2016)

[A] Energy demand and production

Even though there are clean energy sources that could be used for heating in Elbasan Municipality, such as geothermal and hydropower production, the table illsutrated in Figure 38 shows that wood and coal stand as the main heating source during 2018-2020 (INSTAT, 2021). This is a relfection of energy poverty, where people living in Elbasan cannot afford to use the clean energy sources provided in this area. Anyhow it is crucial to notice that there is an increase on the percentage of using electricity for heating in 2020 comparing with previous years (INSTAT, 2021), and this percentages is excpeted to increase even more with climate change happening.

Figure 39 shows the area of the highest electricity consumption in Elbasan, which overlaps with the Pattern of Production identified in the analysis of this space and with the agricultural activity areas too. This proves that electricity is the primary energy sources in the city and economical focal points of Elbasan, whereas wood and coal are mainly used by the villages inside the municipality borders.

Municipality	Year	Primary heating source in %			
		Gas	Electricity	Wood, Coal	Lignite, Oils
	2018	3,3	28,8	67,8	0,1
Elbasan	2019	2,0	20,9	77,1	-
	2020	2,9	31,5	65,2	0,4

figure 38: primary heating sources used during 2018 - 2020 in Elbasan municipality (data from INSTAT, 2021)

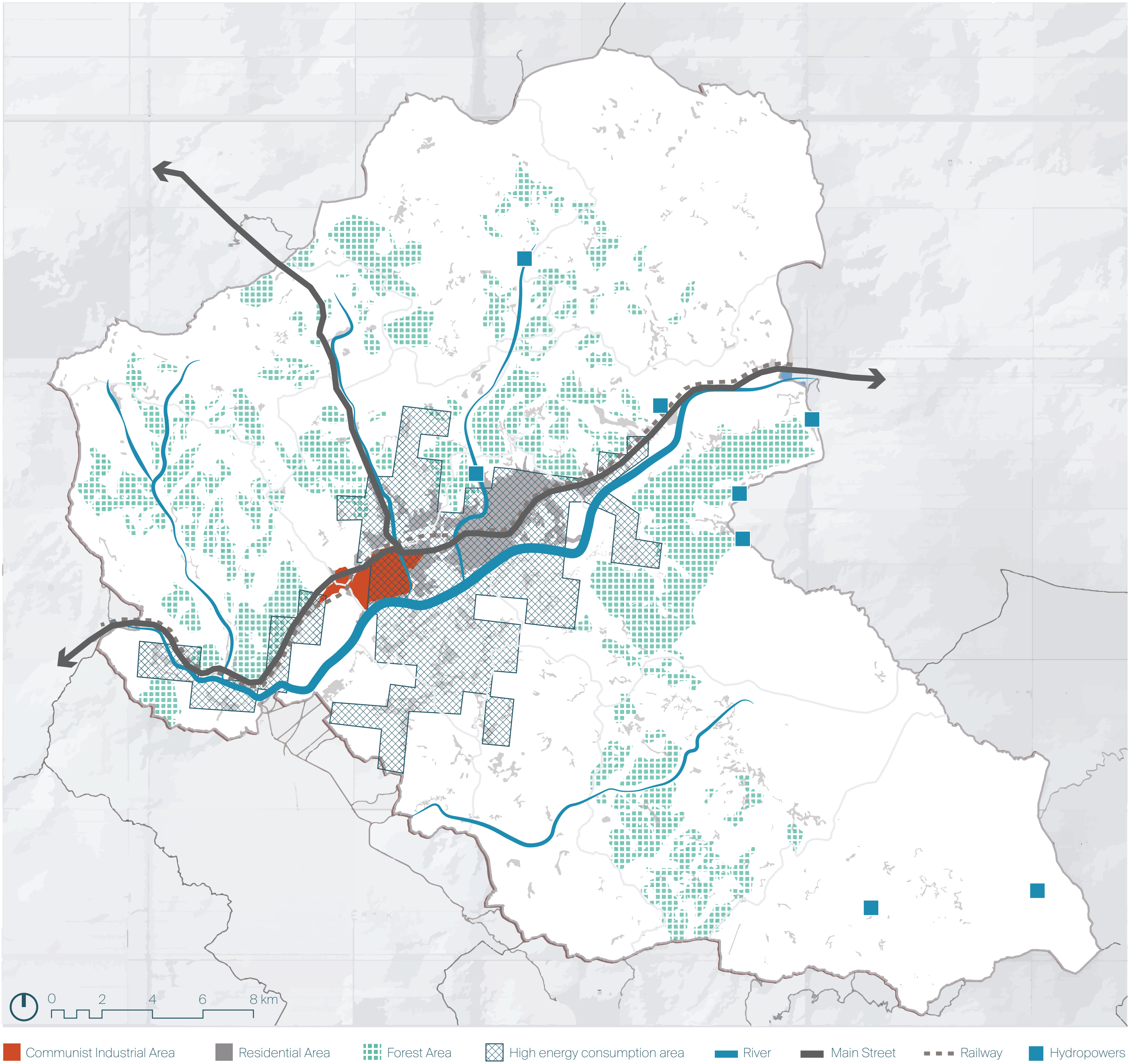


figure 39: areas of highest electricity consumption and energy production sources in Elbasan municipality (data from Municipality of Elbasan and CO-PLAN, 2015)

[B] Environmental and social context

The water stream of Zaranika and the main road connecting Elbasan with other cities serve as boundaries within the residential area, distinguishing between poor and middle-high income neighborhoods in the city. These boundaries highlight instances of social segregation in Elbasan, a phenomenon that is also reflected in the energy and environmental challenges faced by these neighborhoods, while being part of the 'hotspot' areas identified by the Municipality of Elbasan in 2015 (Figure 42). During the site visit, I observed that the majority of buildings in poor neighborhoods primarily use wood for heating, while neighborhoods close to city center rely on electricity as their main energy sources. Consequently, the spatial segregation of poor neighborhoods (Figure 40) not only signifies social disparities but also directly impacts the environment quality and energy consumption patterns.

Other 'hotspots' identified in Elbasan concerning environmental concerns are (1) Metalurgjiku, the former communist industrial site (Figure 41), (2) the industrial zone situated between the ring road and the Shkumbini river, which has emerged with residential buildings, (3) waste collection at the periphery, and (4) waste chemicals treatment area in Balez.


figure 40: the environmental issues of segregated areas

figure 41: the environmental pollution of Metalurgjiku Hotspot

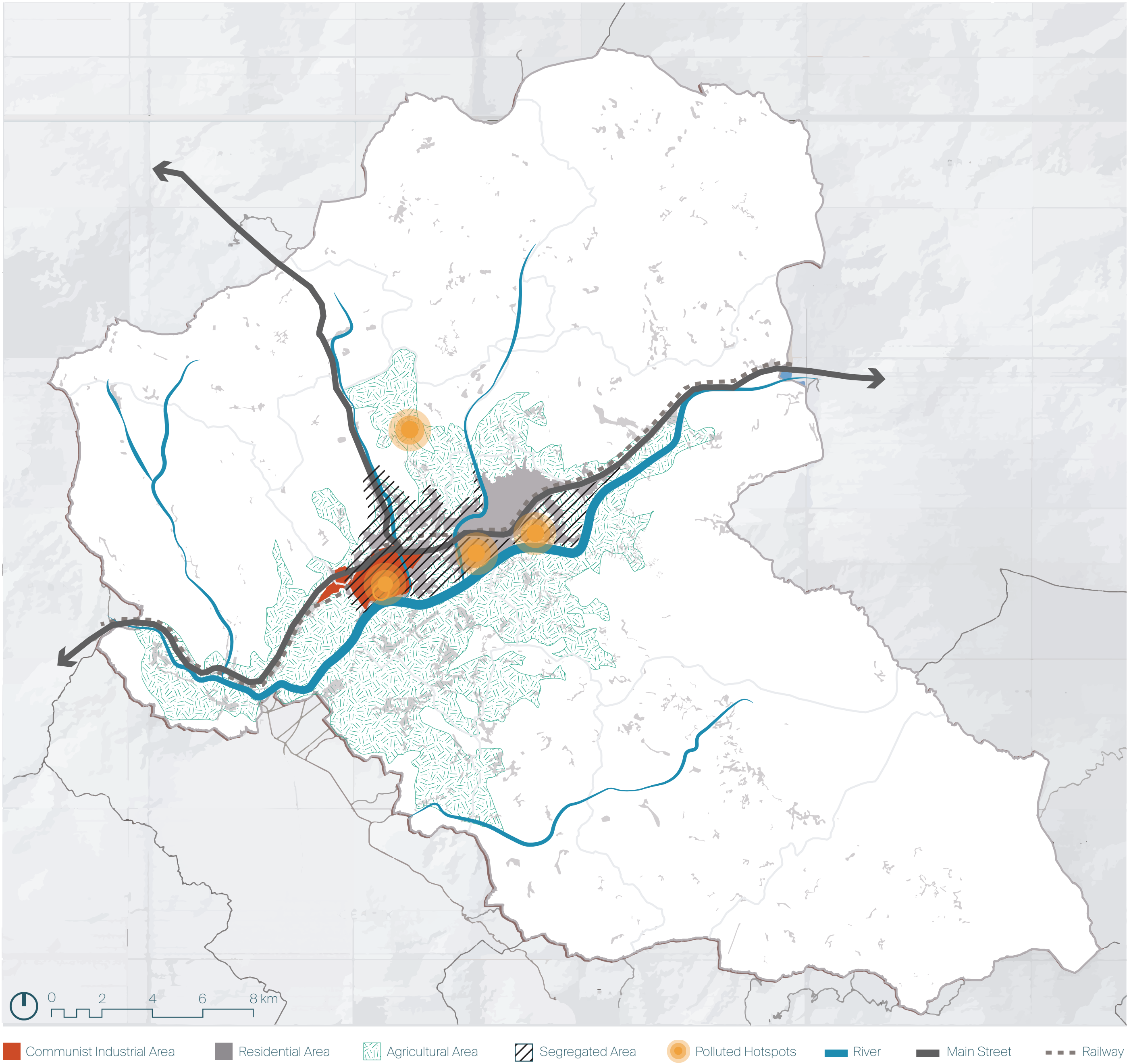


figure 42: highest polluted areas named as 'environmental hotspots' and segreated zones in Elbasan municipality (data from Municipality of Elbasan and CO-PLAN, 2015)

[C] Urban vision of Elbasan

While analyzing the vision map of Elbasan Municipality in Figure 45, approved in 2016 by the National Government, a notable shift towards transforming Elbasan into an agricultural-based city, as opposed to its previous industrial orientation, becomes apparent (Figure 43). Nevertheless, the plan still consideres to activate the Communist industrial sites for light industrial activities without taking into account the environmental and social challenges that these areas already contain (Figure 42). The vision includes also activization of geothermal energy from the thermal springs in Elbasan and use electricity coming form the hydropowers that will be constructed there for a clean energy system. Even though there is an initiative to foster towards renewables, the vision does not consider the cliamte change impact on these energy sources.

Therefore, a critical review of the Municipality's vision is imperative. This review should emphasize the necessity of proposing economic activities that not only promote social and environmental well-being but also effectively address the current challenges facing the city in these realms. Furthermore, it should take into account the potential impact of climate change on the energy system, fostering a more sustainable vision for the city's future.

Figure 43: new agricultural opportunities in Elbasan (EU, 2023)

Figure 44: new steel industry activity in Metalurgjiku area

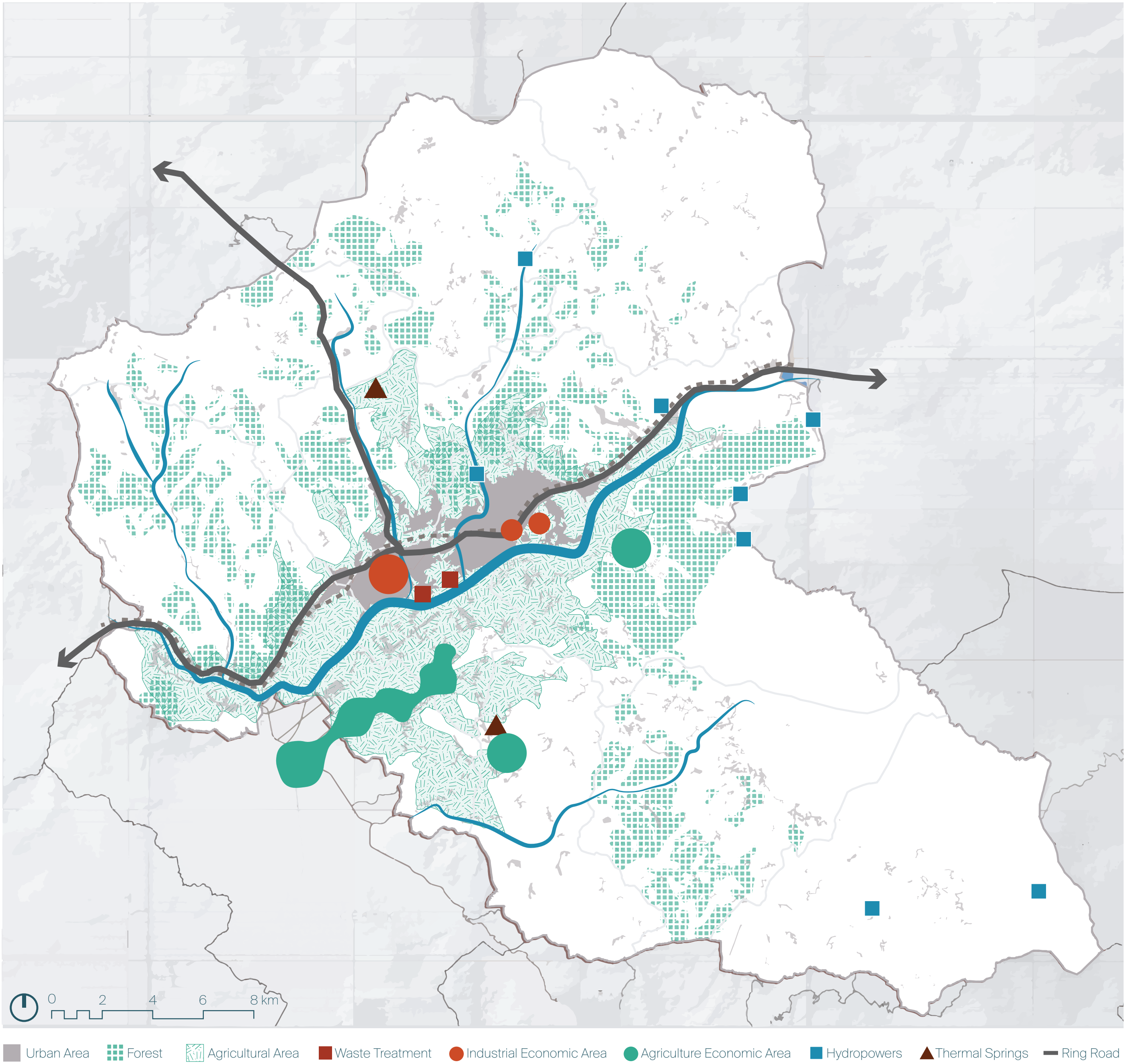


figure 45: strategic vision map of Elbasan municipality (data from National Territorial Planning Agency of Albania, 2016)

(D) Takeaways for SWOT analysis

Figure 46 shows the spatial distribution of the identified problems from the analysis conducted in the Elbasan Region. These problems are categorized according to the main pillars of the conceptual frameworks, illustrating their correspondence to challenges in energy security, energy equity, and environmental quality.

This map can inform local stakeholders in the decision-making process for energy transition by providing clear information on where specific problems are most evident and where to prioritize actions. It serves as the first step towards defining a regional vision for Elbasan that accomplishes the goals of the energy transition process while addressing these context-specific issues. The problems depicted on the map are listed below:

1. Climate vulnerability of local vision
The local vision of the Municipality of Elbasan for Strategic Development does not take into account the climate change challenge of the current energy system

2. Increase of electricity demand
Data showing an increase of electricity demand arise the urgency to add more clean energy sources to complete the citizens energy needs.

3. Energy-social segregation
Energy poverty is reflected in the social and spatial segregated neghborhoods of Elbasan.

4. High usage of wood as energy source
Wood as primary energy source as a reflection of clean energy poverty causes environmental issues and pollution.

5. Environmental 'hostspots'
The most polluted areas are located along the water infrastructure, where industrial and residential sites are unifyed.

6. Social sensitivity of the industrial area
Even though this site is allocated in very good national infrastructure conenctions, it is left abandond and as a 'victim' of unplanned development.

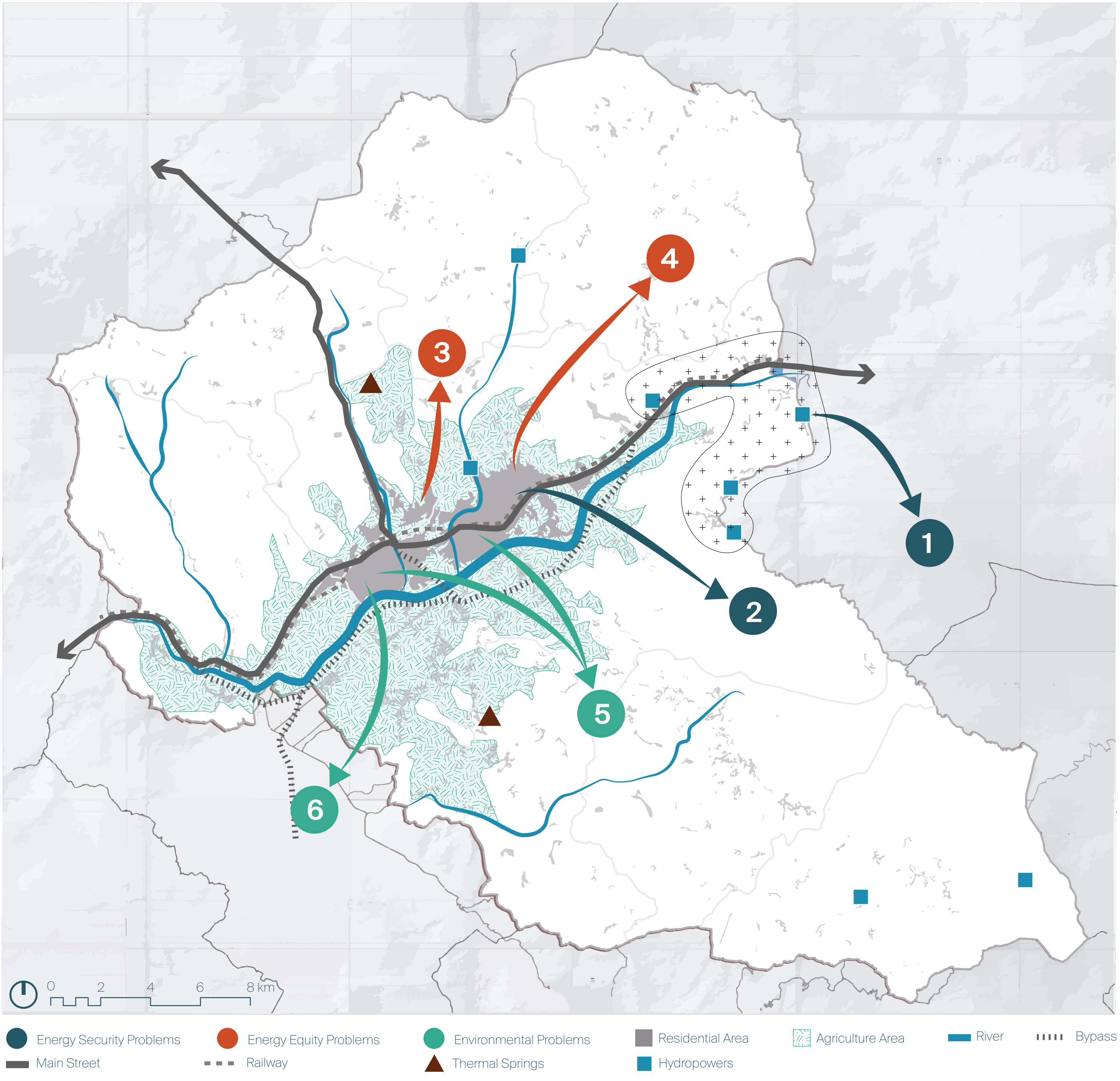


figure 46: summary of the analysis in Elbasan region scale (data of the base map from National Territorial Planning Agency of Albania, 2016)

ii. exploring the Pattern of Production

The Pattern of Production consist of the Communist industrial area ‘Metalurgjiku’ and residential area of Elbasan city. When examining the spatial arrangement of these zones in relation to each other, it becomes apparent that the industrial site, although less dense than the residential area, occupies a space nearly equal in size to the urbanized part of Elbasan. Both areas are situated between the existing national energy infrastructure and along the Shkumbini River, interconnected by infrastructure roads, the water resources of the river, and agricultural lands featuring dispersed single housing units (Figure 47).

Figure 48 illustrates in a section various spatial qualities and areas identified while exploring this Pattern of Production. It highlights current flows that silently interconnect the residential and Communist industrial site, while posing significant challenges to the environmental and social isues of the city. Howerver, despite these connections within the Pattern of Production, a significant barrier exists between the residential and industrial areas due to their historical background and social sensitivity. Given the strategic location of the Communist industrial site, which possesses extensive physical and natural connections with its surroundings, it is crucial to overcome these barriers. This involves establishing a new synergy and narrative for these sites, transforming them into production sites for clean energy that benefit the community and contribute to a healthy environment.

To conduct a more comprehensive analysis of these areas and identify their main characteristics, challenges, and potentials, a detailed examination of each zone has been undertaken. This involves the identification of typologies of spaces, reflecting on these spaces through microstories from individuals or stakeholders, and assessing spatial distribution, as well as examining energy usage and environmental impacts.

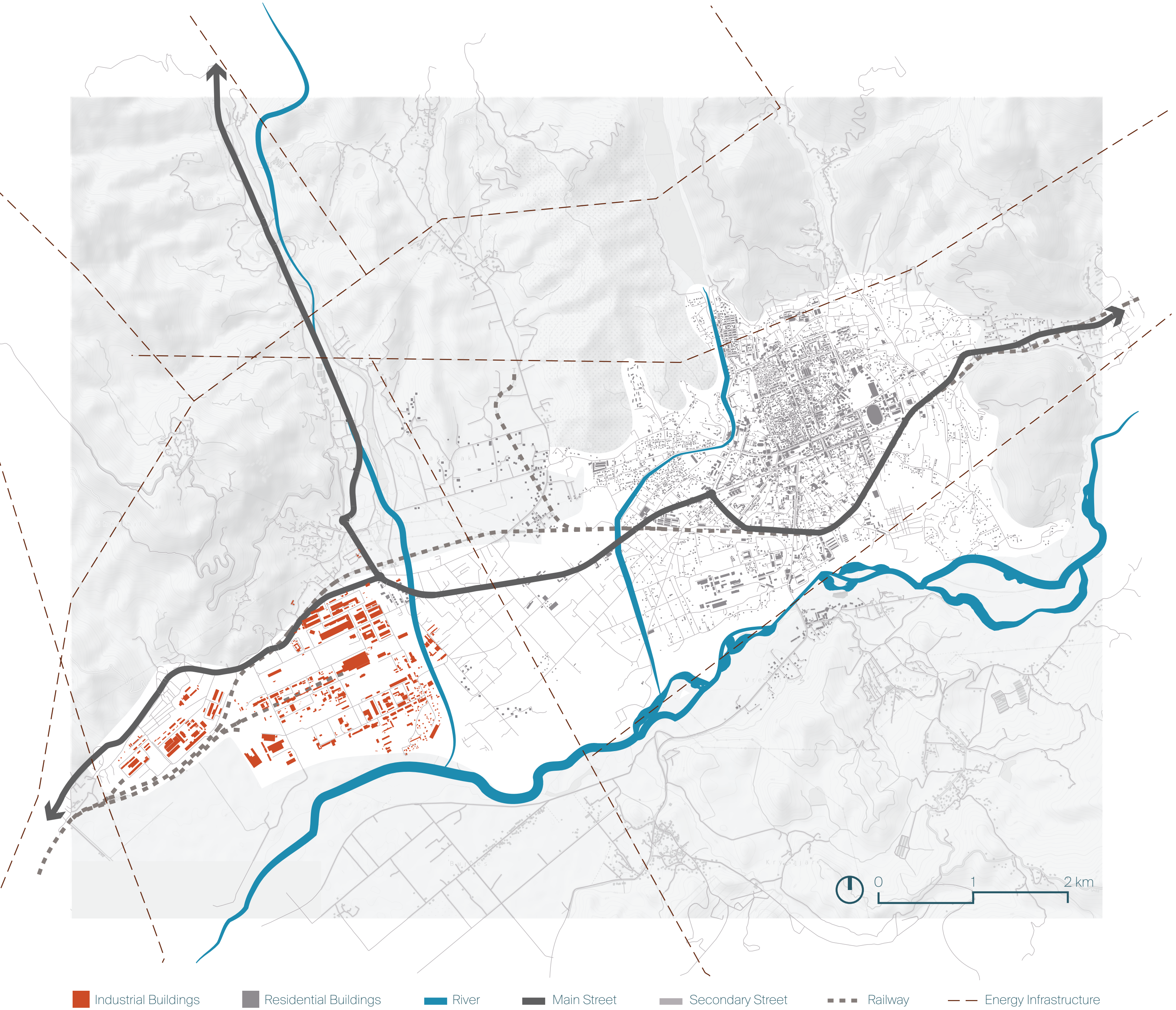


figure 47: spatial distribution of the pattern of production in Elbasan (data from OpenStreetMap, n.d.)

[A] Current situation

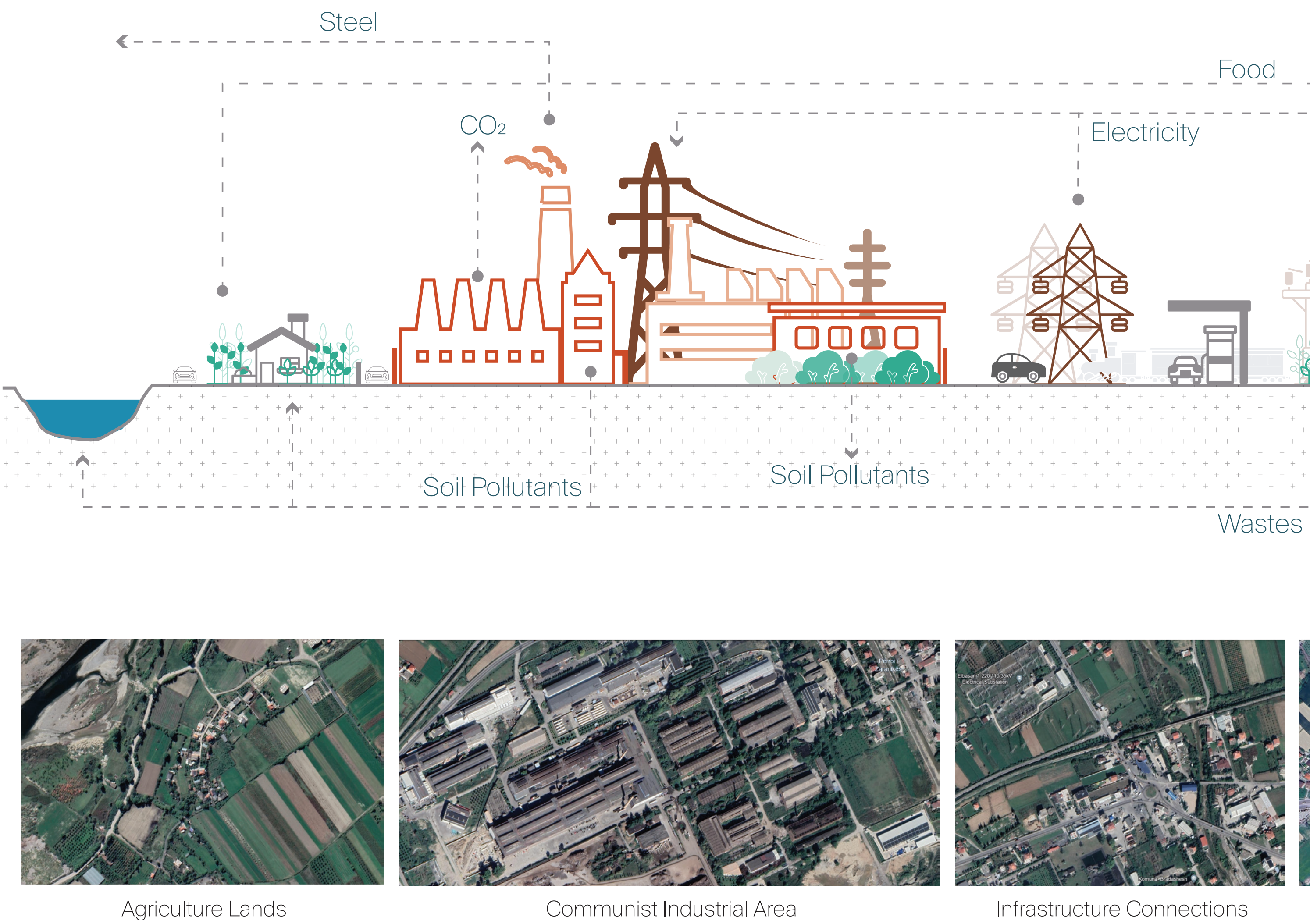
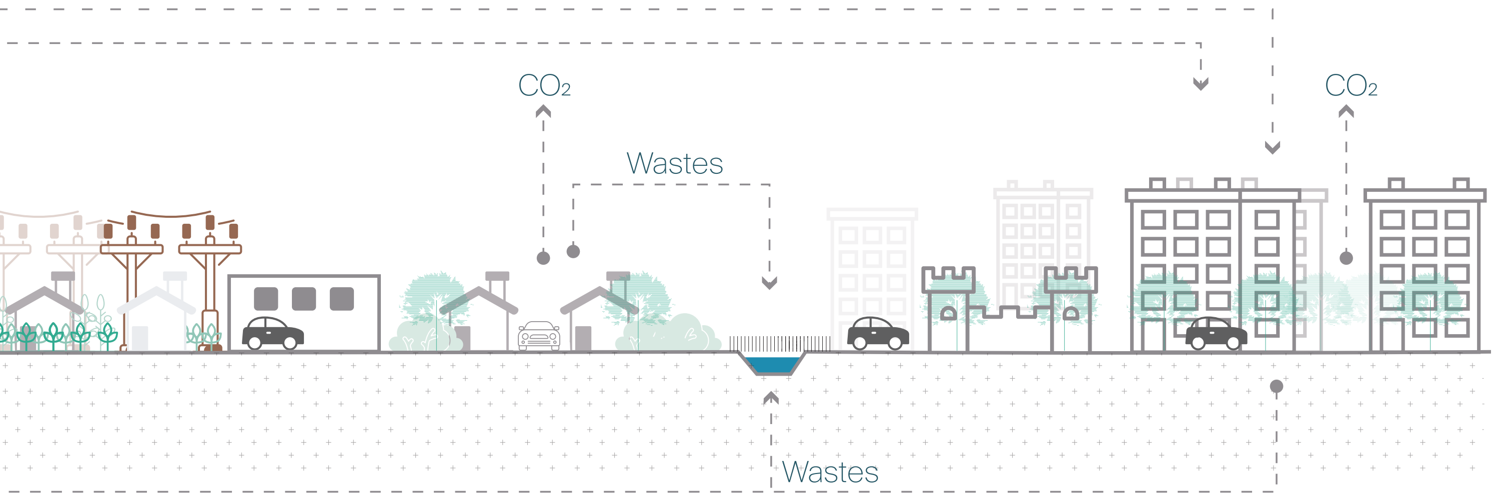


figure 48: section of different spaces in the pattern of production in Elbasan (data from OpenStreetMap, n.d.)



In-Between Space

Residential Area-Periphery

Residential Area-City Center

[B] Exploring the Communist industrial site

Four main typologies have been identified within the industrial area based on the current conditions of the area:

a. Active Steel Industry
b. Abandond Industrial Buidlings
c. Reconstructed Industrial Buidlings
d. Residential Areas

These diverse typologies underscore the complexity of actors and stakeholders involved in this region, alongside the varied spatial qualities shaping the ongoing transformation of the industrial site since the decline of the Communist regime. Recognizing this complexity in stakeholder management and spatial dynamics is a crucial step in understanding current conflicts within these sites and harnessing the potential of this area within the energy-space nexus during the energy transition process.

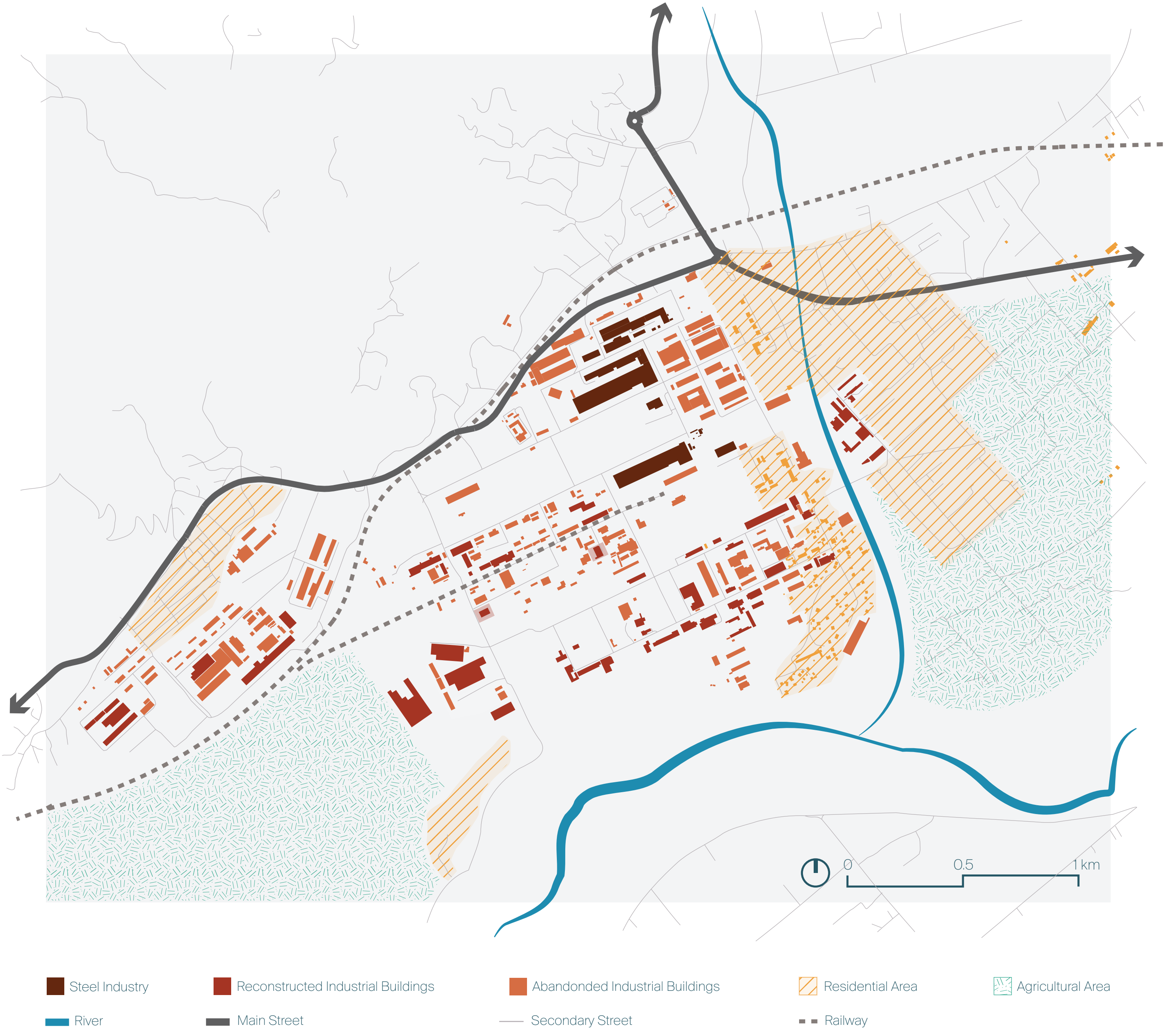


figure 49: spatial typologies identified in industrial area in Elbasan (data from OpenStreetMap, n.d. and site visit exploration)

[C] Exploring the city

Four primary typologies have been identified within the residential area too based on an examination of their spatial characteristics and energy consumption patterns:

a. Communist Blocks
b. Historical Housing
c. In-between Communist Blocks
id. Segregated Suburban Areas

Each typology reflects distinct spatial characteristics that play significant influence in navigating the interplay of energy consumption, social dimension and environmental dynamics. Recognizing the distinct needs of these typologies during the energy transition process is imperative for effectively addressing the relationship between energy consumption patterns and the spatial configurations of the urban landscape within the city.

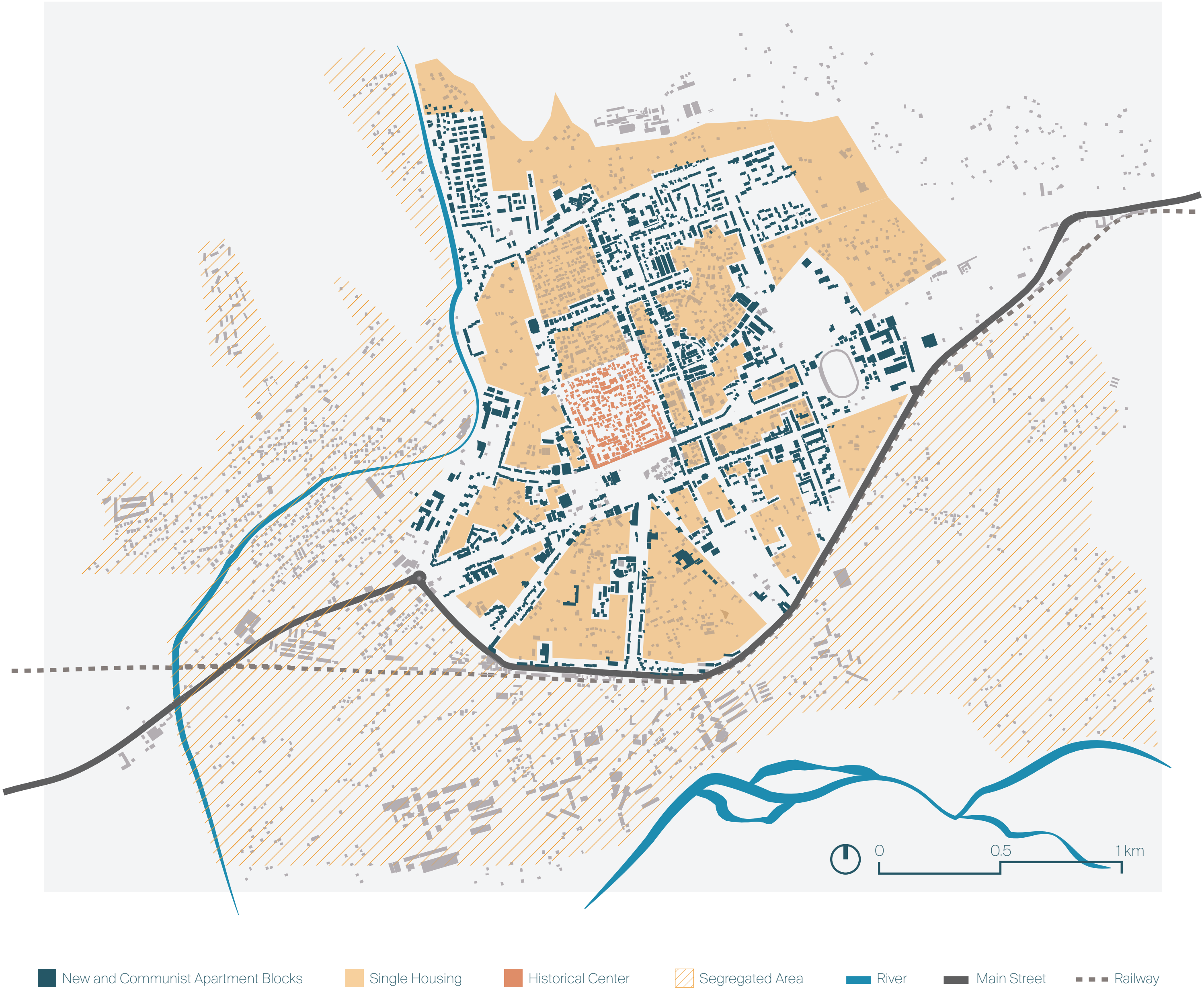


figure 50: spatial typologies identified in residential area in Elbasan (data from OpenStreetMap, n.d. and site visit exploration)

[D] Understanding typologies

Active Steel Industry

It is a public builidng leased under concession from the Ministry of Finance and Economy to a private steel production factory

Abandond Buidlings

These industrial structures, reclaimed by nature, stand in solemn abandonment, serving as silent reminders of the past.

Reconstructed Buidlings

These areas have been redeveloped by private owners and now function as rental storage spaces for various industries.

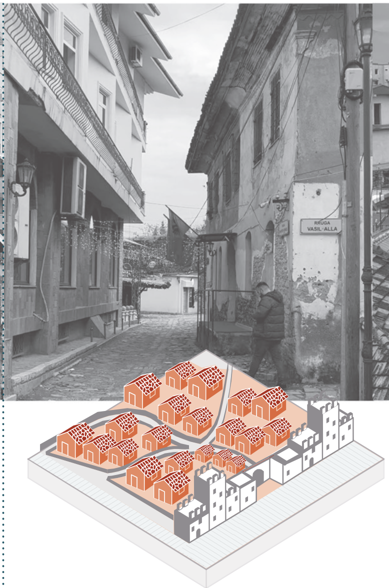
Residential Buidlings

Consist of single houses with their own gardens and small agricultural lands, together with industrial buildings adjusted from people as living apartments.

figure 51: spatial exploration of the typologies in the Pattern of Production

Communist Blocks

Consist of 5-6 story prefabricated multifamily housing structures, lacking energy efficiency and primarily relying on electricity for heating and cooling.



Historical Housing

Characterized by single houses with private gardens aligning in narrow streets, this typology has adapted to electric systems, although some buildings still employ wood for heating.

In-between Communist Blocks

includes single houses which are constructed without a cohesive plan, occupying vacant spaces within the city. Their primary energy source is wood.

Segregated Suburban Area

Found in poorly connected and maintained zones on the city's center outskirts, this typology consists of single houses lacking appropriate energy infrastructure.

[E] Microstories

Within the spatial and energy consumption differentiations of the identified typologies in the residential area, there is also a divergence in the people's perceptions living there regarding their energy needs and their vision for the ideal outcome of energy transition.

Having a clear understanding of the needs of residents living in various spatial and economic conditions (figure 52) is crucial, as it can guide the energy transition process to align with the local context and address specific site-related issues. These needs can also serve as assessment criteria to determine whether specific strategies in the energy transition process are aligning with and fulfilling the desires of the community or not, thereby drawing the path towards a successful and sustainable energy transition process.

People living in there and stakeholders that are part of these typologies have defined microstories for each of these typologies by answering the following questions:

From your perspective, what does **energy security** mean?

How do you perceive the **Communist Industrial area?**

Looking ahead, what do you envision as the **ideal outcome of the energy transition** in this area?

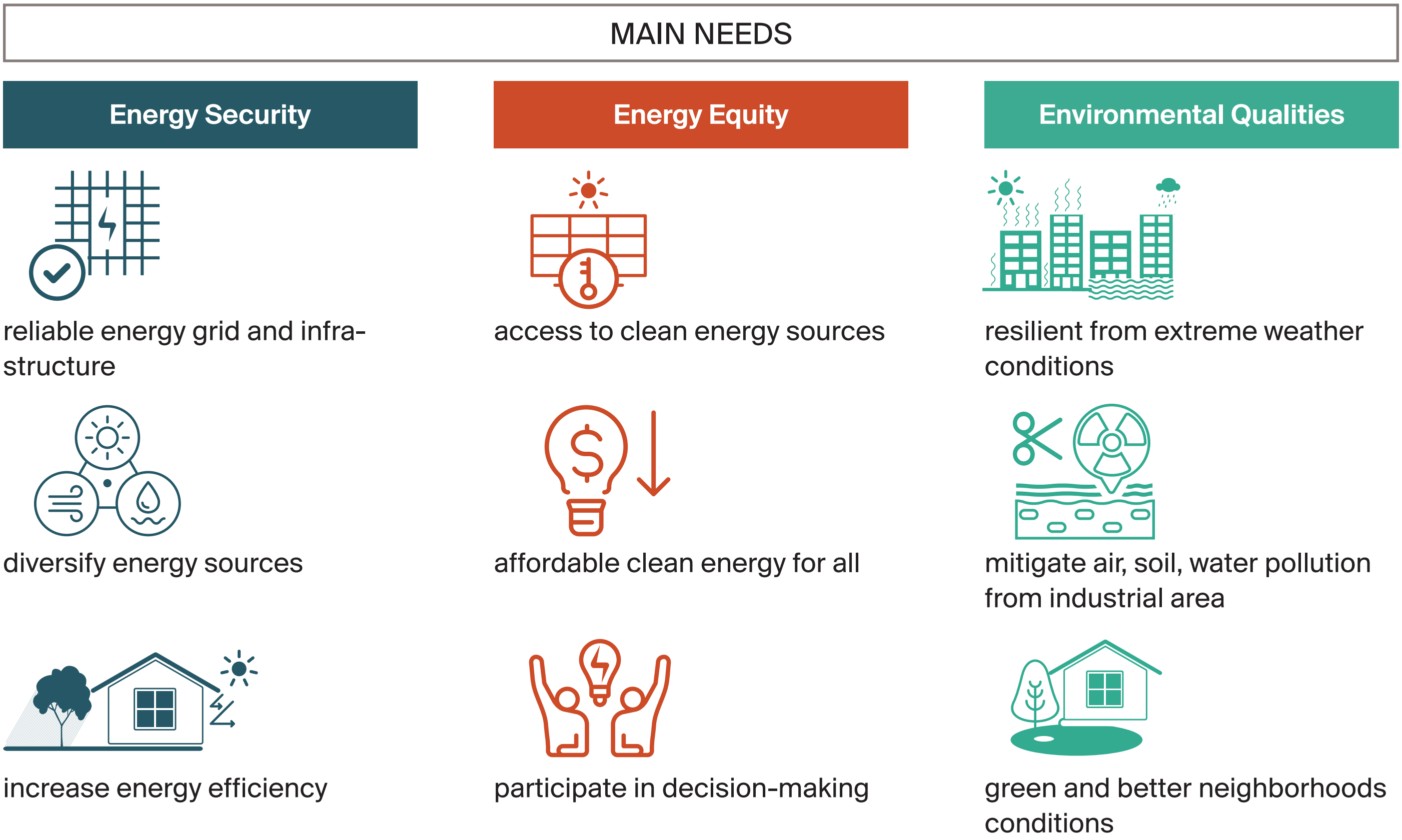


figure 52: needs identified from different target groups in Elbasan city during the microstories collection

[F] Takeaways for SWOT analysis

Figure 53 shows a diagram that illustrates the problems identified within the typologies of the Pattern of Production, organizing them based on their spatial distribution.

An important finding is that these issues align with the three pillars of the conceptual framework while being concentrated according to the spatial distribution of the typologies. Energy security emerges as the primary concern within the high-density residential area, while energy poverty is prevalent in the low-density residential area situated between the city and the industrial site. Environmental quality issues are primarily observed in the industrial area but also manifest in the residential zones.

This finding can inform the city's strategic planning during the energy transition process by providing a clear focus on the pillar that predominates as an issue within the diverse spatial typologies of the city. It can guide on defining spatial strategies that enhance the synergy between the three pillars and main areas of the Pattern of Production, and at the same time it can further help on understanding context specific actions of each of these areas that need to be taken into account within this strategical plan of the city.

1. Non energy efficient structures
The communist and historical buidlings are not insulated, increasing the energy needs and consumption.

2. Wood as primary heating source
The single-housing areas cannot afford using clean energy source, using wood as primary energy source.

3. Urban heating island effect
The high density areas in the city center are dealing with urban heat island effect due to lack og green spaces in the city and increase of temperatures.

4 Unhealthy environment
Using wood as primary energy source increases air pollution and deforestation.

5. Degradation
Abandonded buildings are a wasted land of degraded buildings, being a serios harm of the environment

6. Environmental "hotspot"
Metalurgjiku is having serious environmental issues, due to its heavy metals industrial activity for many years.

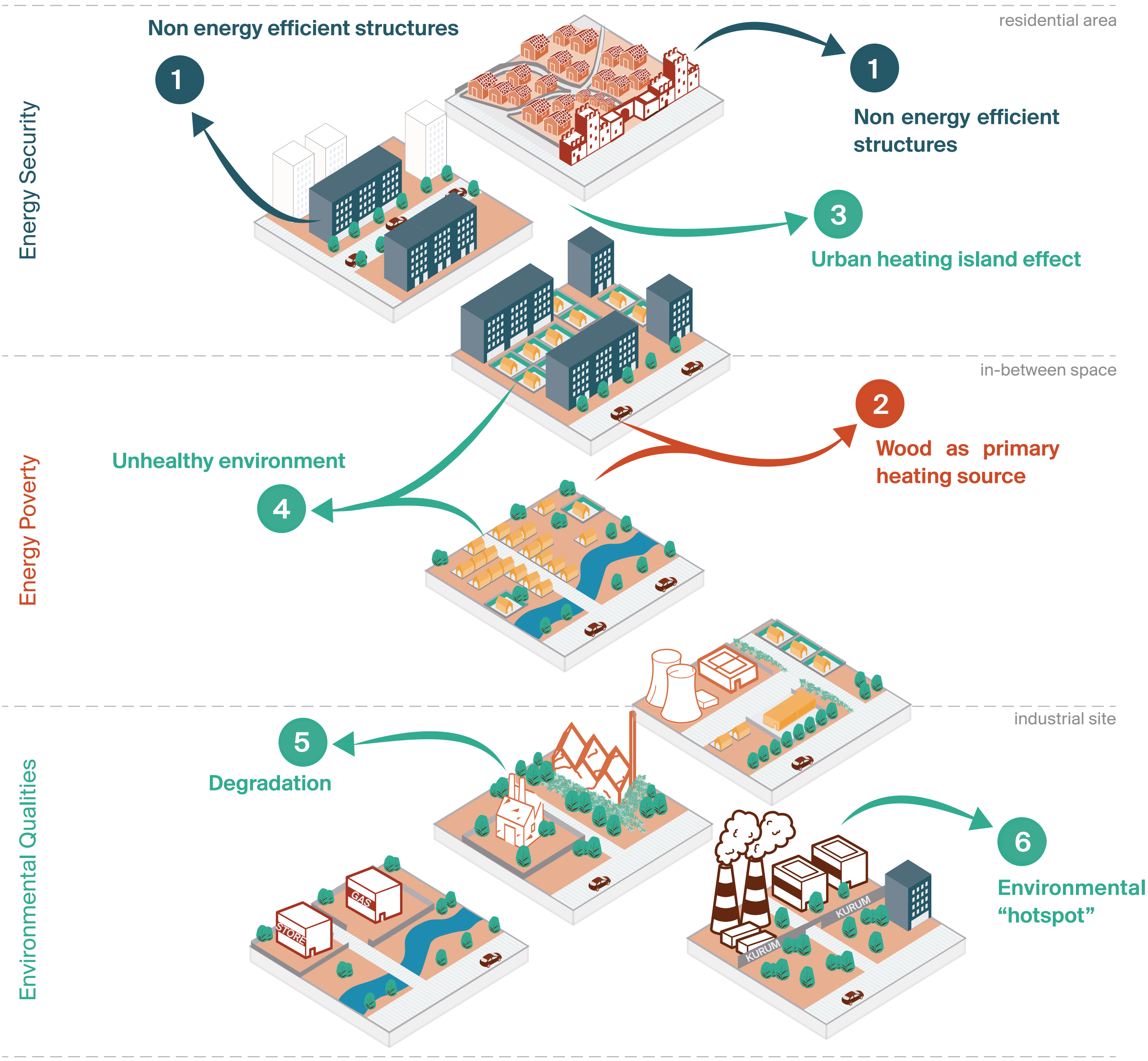


figure 53: Systemic diagram of findings in the Pattern of Production

iii. stakeholders analysis

Three main groups of stakeholders are identified in this context, whom have an impact on the energy transition process of Albania and in Elbasan: public, private and civic stakeholders (Figure 54).

Public sector consist of: Ministry of Infrastructure and Energy (MIE), Ministry of Tourism and Environment (MTE), Ministry of Agriculture, Rural Development and Water Administration (MARDWA), MInistry of Finance and Economy (MFE), National Agency of Natural Resources (AKBN), National Environmental Agency (NEA), Energy Efficiency Agency (EEA), Energy Regulatory Authority (ERE), Transmission System Operator (OST), Albanian Power Corporation (KESH), Electricity Distribution System Operator (OSHEE), local municipalities, universities, research institutes. The public sector comprises a highly organized top-down hierarchical system, wherein each stakeholder is assigned specific tasks and holds power only within certain scales (IRENA, 2021).

Private sector consist of: Hydropower Plants Companies (HPP), Albania Power Exchange (ALPEX), oil companies, private investitors, local companies and land owners. These stakeholders are not directly reliant to other actors and operate as independent stakeholders with varying degrees of power and interest in the topic of energy transition.

Public sector consist of nature, Non-Governmental Organizations (NGOs), citizens, experts, urban planners, low-income residents and farmers. These stakeholders have the least power and, due to the top-down approach of the stakeholder system, they rarely participate in the decision-making process.

figure 54: stakeholders mapping

[A] Relationship analysis

Figure 55 depicts the conflicting and complementary relationships among stakeholders within the Multi-Level Framework scales: macro for the national scale, meso for the city scale, and micro for a neighborhood scale.

Public stakeholders primarily exhibit complementary relationships, due to the hierarchical structure they are organized. However, a conflict arises within the public sector between stakeholders at the macro and meso scales, specifically between the Ministry of Finance and Economy (MFE) and local municipalities and research institutes. This conflict stems from divergent visions for the Communist industrial site. The MFE, being the most influential stakeholder in the area, advocates for maintaining it as an industrial site, whereas other stakeholders envision transforming and revitalizing the area into a cultural hub or other non-industrial economic activities. These conflict was depicted from the collection of microstories and from the research conducted on previous researches from universities or researchers on how they envision the transformation of the Communist industrial site. Despite efforts, a compromise has yet to be reached in this situation.

Another conflict arises between nature as a stakeholder and private entities. Private investors, landowners, and oil companies are directly in conflict with nature, as their primary objective is to invest in the energy transition process while maximizing economic profits, often disregarding the environmental impacts on ecosystems and biodiversity. This conflict is evident in ongoing projects in Albania focused on solar energy production, where environmental consequences such as soil degradation are overlooked (figure x). The new energy-space nexus remains rooted in a fossil-fuel-centric mindset, further emphasising the conflict with nature.

Within these local relationships, international organizations play a crucial role in stakeholder analysis, directly influencing all three scales of stakeholders. Entities such as German Development Fund (GIZ), European Union (EU), and United Nations Development Programs (UNDP) provide support through funding, expertise, and oversight to oversee the developments Albania is undertaking toward the energy transition process.

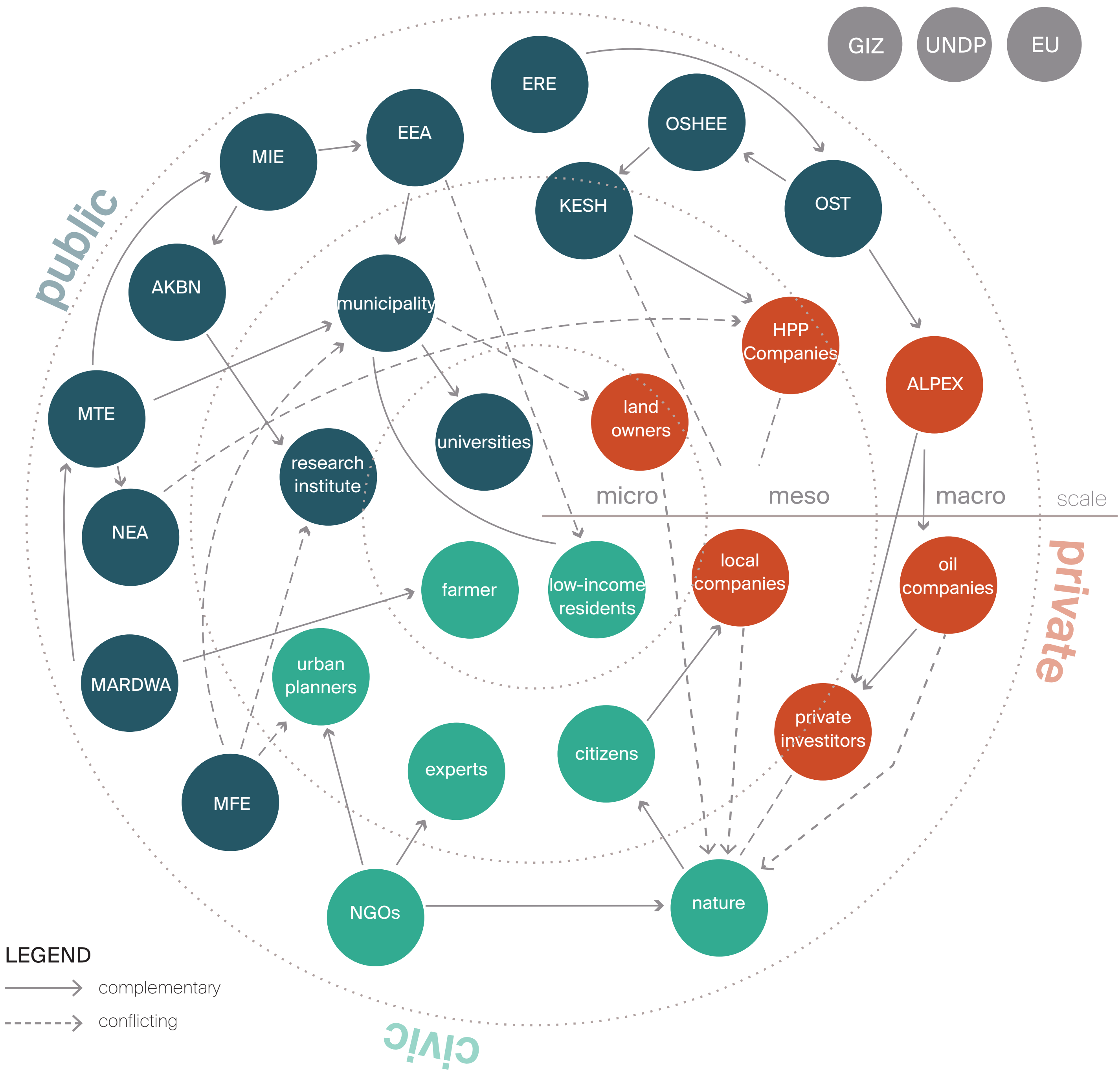


figure 55: stakeholders relationships analysis

[B] Power-interest-attitude matrix

Understanding how these stakeholders are distributed in the power-interest graph and their attitudes towards the energy transition process aids in identifying stakeholders categorized as friends, saviors, acquaintances, trip wires, time bombs, and sleeping giants within this matrix (Figure 56).

Nature, NGOs, and GIZ are categorized as friends, exhibiting low power but a positive attitude and a high interest in facilitating a sustainable energy transition process.

Similarly, the Ministry of Infrastructure and Energy, along with UNDP and EU, possess both high power and high interest, reflecting a positive attitude toward the transition. They are the savior stakeholders, whom exert direct or indirect influence on other stakeholders, offering funding, expertise, and resources to engage them in the process.

The sleeping giant, specifically HPP companies, wield high power but exhibit lower interest in the transition, despite maintaining a positive attitude. Engaging them in decision-making steps is essential to encourage their active involvement in contributing to the transition.

Oil companies and MFE are characterized by high power but low interest and attitude. Due to their considerable influence, they are identified as time bomb stakeholders, necessitating efforts to persuade them to align with the transition process before they become disruptive.

The trip wire stakeholders, including farmers and landowners, and the acquaintance stakeholders, such as low-income residents and citizens, lack both power and interest in the energy transition process, with negative or neutral attitudes stemming from a lack of trust and participation in decision-making. Engaging with these groups to understand their needs is crucial for a more successful energy transition process.

In conclusion, analyzing the relationships between stakeholders, considering their power and interests in the energy transition process, is crucial for understanding their attitudes and roles in the current system. It enables the exploration and development of new strategies that accommodates everyone's specific needs and fosters an inclusive vision for the Elbasan region.

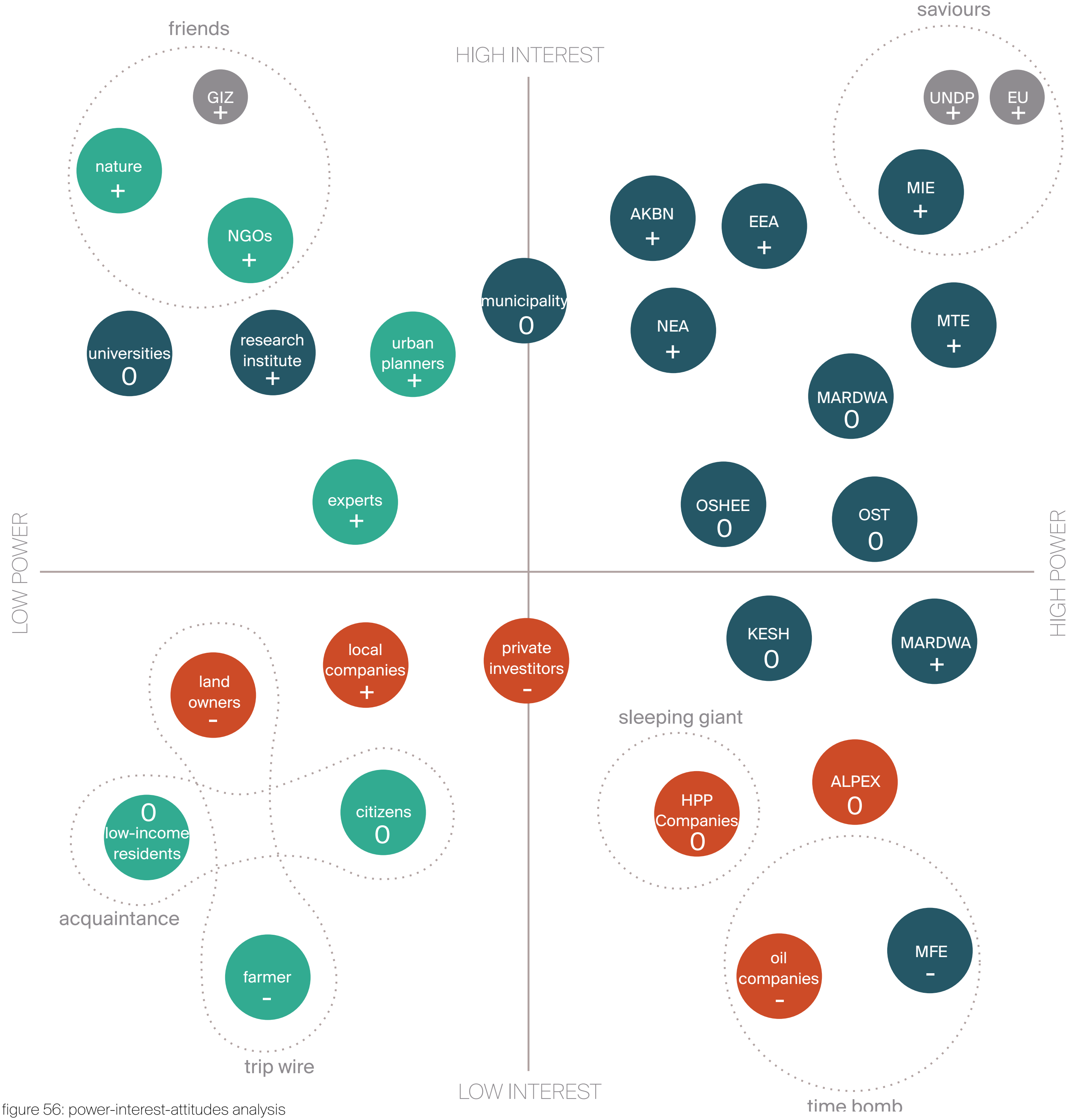


figure 56: power-interest-attitudes analysis

[C] Spatial configuration

This section zooms in at the Pattern of Production, to illustrate the conflicts identified among various stakeholders within the Multi-Level Perspective scales (Figure 57). It is evident that the Communist Industrial site emerges as a primary point of contention involving the local municipality, Ministry of Finance and Economy (MFE), landowners, private investors, and citizens. Additionally, the in-between area of the industrial and residential site, characterized by a mix of residential and industrial sites, low-income neighborhoods, agricultural lands, natural areas and gas stations, presents a conflict between the local municipality and the Ministry of Infrastructure and Energy. The latter envisions this area as a potential site for solar energy production, potentially encroach-

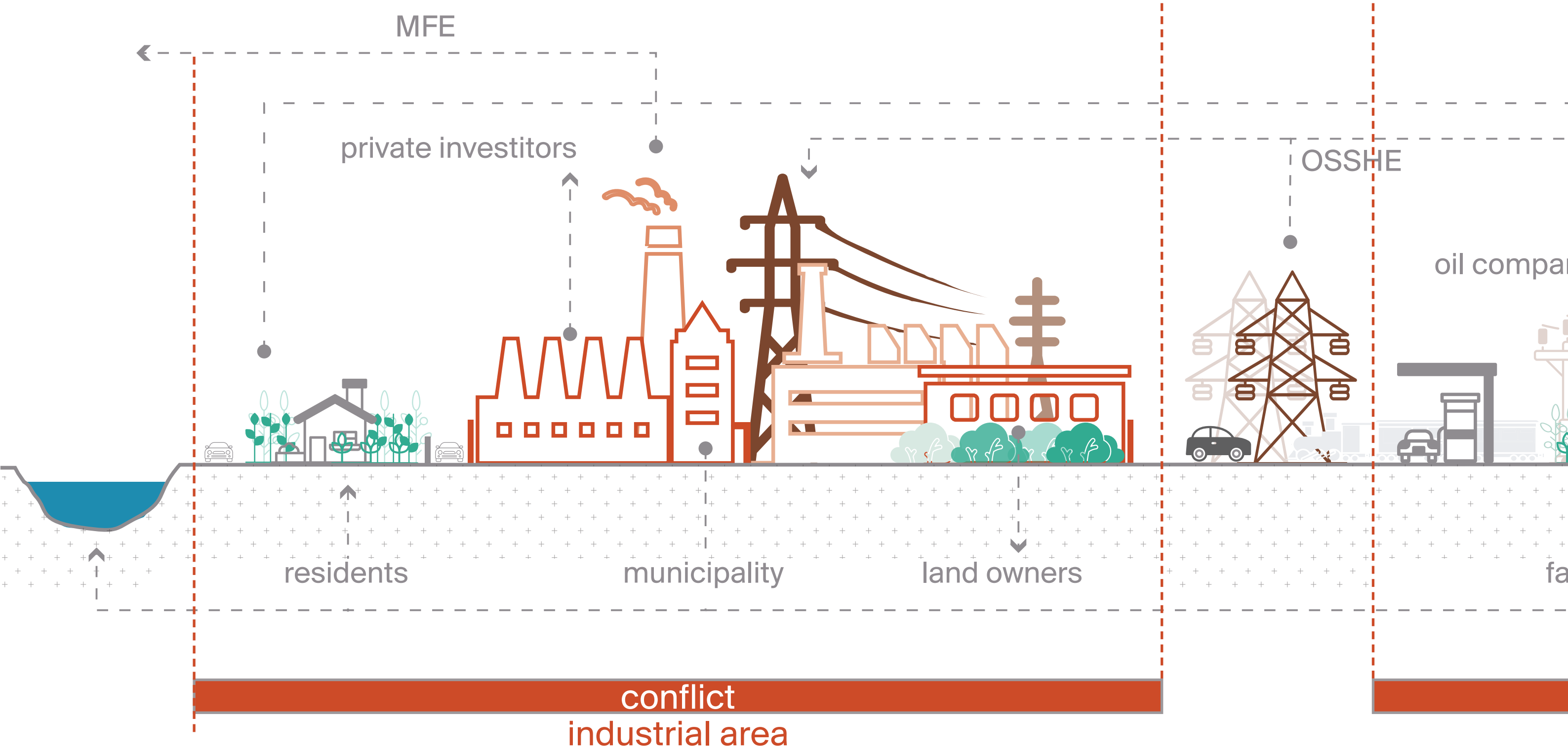
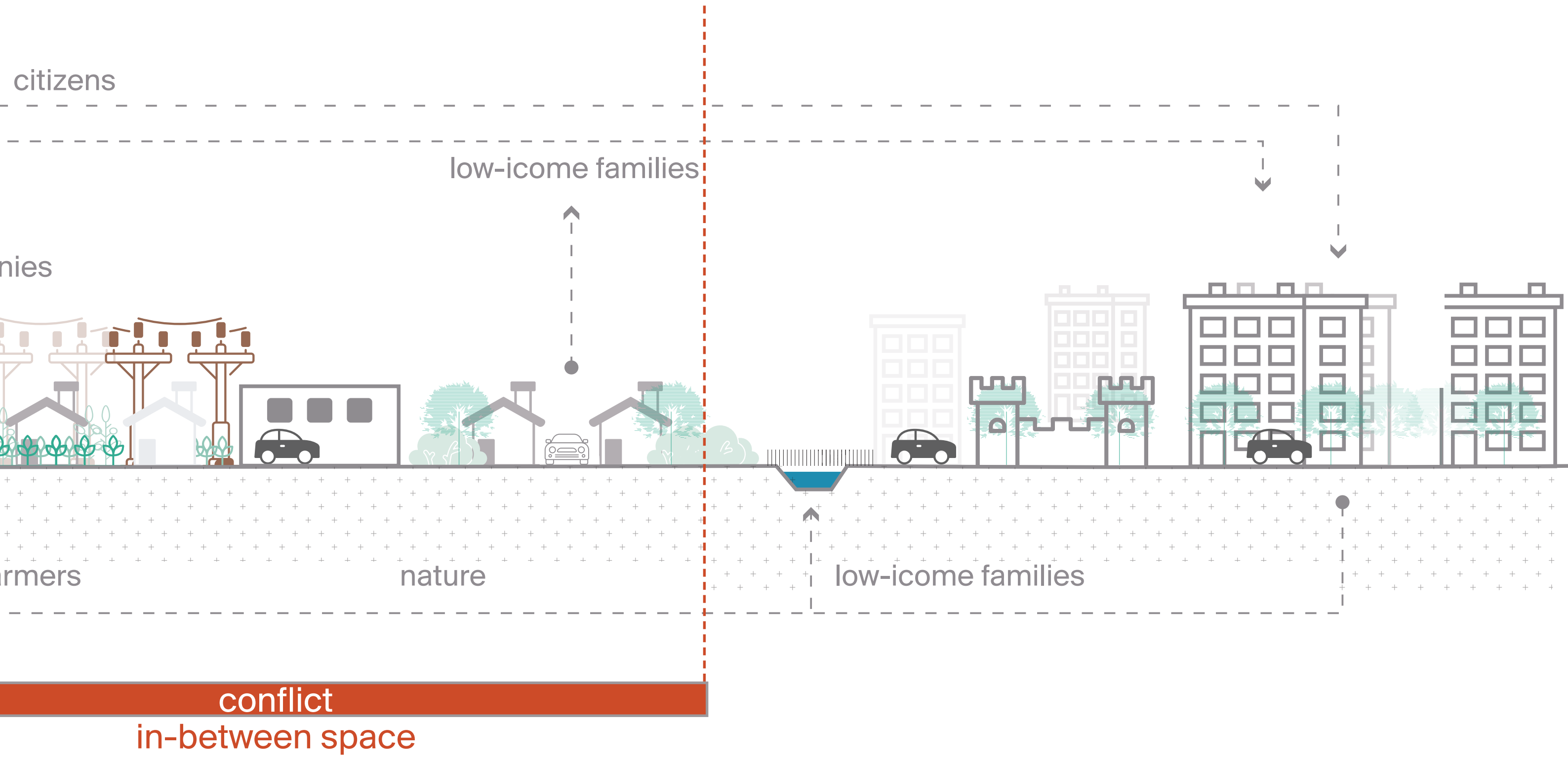


figure 57: section of the conflicting areas between stakeholders in the Pattern of Production

ing upon agricultural lands. These conflicts highlight the complexities and competing interests inherent in energy transition initiatives at the local level. Resolving such conflicts will require careful negotiation, collaboration, and innovative solutions that balance economic profits of energy security with environmental sustainability and social equity.



iv. policies review

Albania's participation in the Energy Community, funded by the European Union, led to the approval of Law 7/2017 on Renewable Energy. This legislation aims to implement policies addressing energy security and the transition to a diverse clean energy system as a priority (The Assembly of the Republic of Albania, 2017). Alongside this law, Law 155/2020 on climate change and greenhouse gas emissions was enacted, resulting in the formulation of a National Energy Sector Strategy in 2018 and a National Energy and Climate Plan in 2021. These strategic documents are designed to ensure energy security by 2030, acknowledging it as the primary challenge for Albania, while promoting a sustainable energy transition aligned with European Union goals (MIE, 2021) .

Furthermore, supportive schemes have been established to assist local communities and private companies in investing in diverse renewable energy sources. Financial mechanisms, such as those outlined in the Law "On the Power Sector, 2015," aim to help vulnerable communities afford energy bills and meet their demands, with a specific focus on energy equity.

Despite these policies (Figure 58), there remains a gap in understanding the spatial qualities and environmental impacts targeted by this transition. The failure to recognize the significance of defining an energy-space nexus and assessing the environmental impacts of actions planned up to 2030 is evident. It is imperative for all stakeholders to recognize the importance of designing energy landscapes not only to meet energy demand but also to address their social and environmental impacts. This gap is further explored in this project, underscoring its importance for achieving a sustainable, context-specific energy transition.

Law 7/2017 on Renewable Energy

Aims to increase awareness and increase usage of clean energy sources in Albania.

Law no 155/2020 on climate change

Aims reduce greenhouse gas emissions and to adaptat actions that deals wiht global climate change.

National Energy and Climate Plan , 2021

Defined the aims on renewable energy sources, energy efficiency and technological advancement of energy system by 2030, while aligning with EU goals.

National Energy Sector Strategy, 2018

Examines various energy development scenarios and objectives that will shape Albanian's energy sector over the period from 2018 to 2030.

Feed-in tariffs

Aims to support local renewable energy power plants construction of wind and solar energy production.

Premium tariff/CfD

Aims to support large and centralized renewable energy power plants construction of wind and solar energy production.

Net-metering scheme

Aims to support households on investing in solar and wind energy sources by connecting their system in electricity grid.

Law 'On the Power Sector, 2015'

Aims to support local vulnerable communities to complete their demands through financial schemes.

figure 58: main policies review that impact energy transition process

v. situation assessment

To summarize the findings of Elbasan region and Pattern of Production analysis, there are identified strengths, weaknesses, opportunities and threats of this context (Figure 59).

Elbasan's strengths include its strategic location in the national energy infrastructure, strong connectivity with the capital and largest port city, the proximity of Communist industrial sites to residential areas within the Pattern of Production offers an opportunity to produce local energy and mitigate energy losses, presence of green spaces, and flexible residential layouts aiding spatial adjustments during the energy transition.

Weaknesses encompass energy-social segregation reliant on wood as the primary energy source for heating, the lack of energy efficiency within residential areas, absence of resilient environmental goals aimed at adapting to and mitigating climate change while promoting ecological values, uncertainty regarding the principle of sufficiency to address energy poverty, the existence of off-grid residential areas, particularly in rural regions.and social sensitivity surrounding the Communist Industrial site.

Opportunities within this area lie in its high potential to harness other clean energy sources such as geothermal energy, solar energy, and river water for heating purposes. Moreover, the abandoned buildings within the industrial site present significant opportunities for renovation and adaptation for solar energy production, given their expansive flat roofs and existing infrastructure.

Threats arise from the climate vulnerability of the energy system, increasing energy demand due to rising temperatures, and environmental hotspots caused by pollution, especially as they're unaddressed in the Municipality's vision plan still advocating for industrial activities.

In the upcoming chapter on 'Framing Scenarios,' these findings are the basis of exploring the maximization scenarios, in which the identified strengths are leveraged to their fullest potential, opportunities are activated and used to their maximum capacities, weaknesses are addressed and resolved, thereby transforming them into strengths, while threats are accompanied by strategies that effectively manage and mitigate them.

Strengths

S1. strategic location in the national energy infrastructure
S2. strong connectivity with the capital and largest port city
S3. the proximity of Communist industrial sites to residential areas
S4. presence of green spaces
S5. flexible residential layouts

Weaknesses

W1. energy-social segregation
W2. wood as the primary energy source for heating
W3. lack of energy efficiency within residential areas
W4. absence of resilient environmental goals
W5. uncertainty regarding energy poverty
W6. the existence of off-grid residential areas
W7. social sensitivity of the Communist Industrial site.

Opportunities

O1. high potential to harness clean energy sources
O2. activation of geothermal energy
O3. activate solar energy
O4. using river water for heating purposes
O5. the abandoned buildings within the industrial site

Threats

T1. climate vulnerability of the energy system
T2. increasing energy demand due to rising temperatures
T3. environmental hotspots caused by pollution
T4. unaddressed evironmental pollution in the Municipality's vision plan

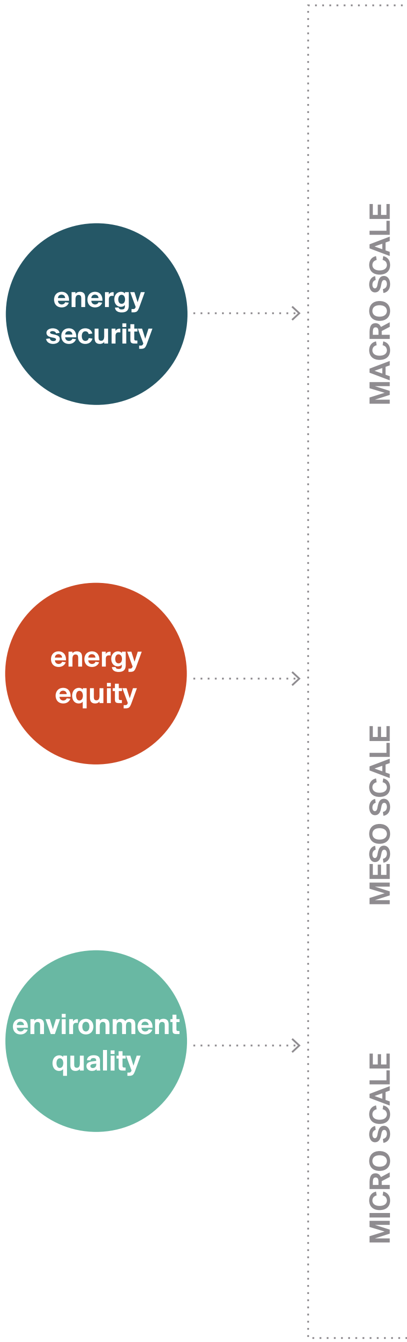
figure 59: SWOT diagram of Elbasan analysis

IV. framing scenarios

i. multi-level perspective framework
ii. maximize energy security
iii. maximize energy equity
iv. maximize environmental qualities
iv. pattern field

figure 60: Metalurgjiku in Elbasan city (photo by the author)

i. multi-level perspective framework



Returning to the theoretical framework, the multi-level perspective serves as the foundation for elaborating various scenarios of the energy-space nexus in Elbasan (Figure 61). Three scenarios are folowing the three scales, while maximizing every pillar of the conceptual framework: energy security, energy equity, and environmental quality. The integration of the Pattern Language tool helped identify principles, strategies, and actions within each scenario.

This framework delves into three primary scales to explore these scenarios and identify design patterns across all scales. The macro scale pertains to the regional plan of Elbasan city, framed by design principles. This scale guides the meso scale, which encompasses the city's strategic plan, defining patterns of strategies. The micro scale, supported by the meso scale, focuses on the residential and Communist industrial sites, reflecting how strategies being implemented in space.

Playing in multiple scales demonstrates that change originates from the macro scale, guiding the other scales, while also giving space for the bottom up actions, that can directly impact the meso and macro scales.

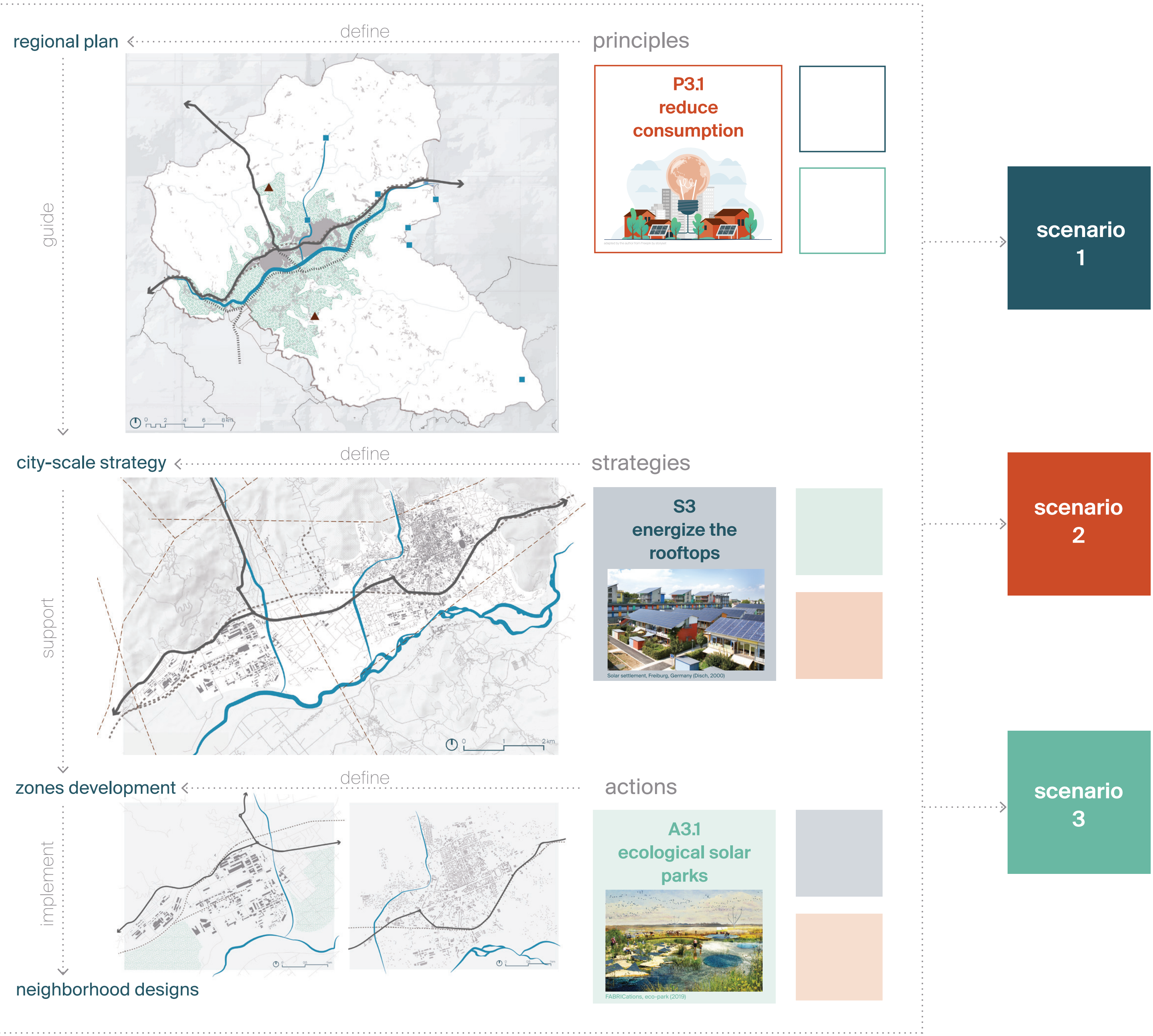


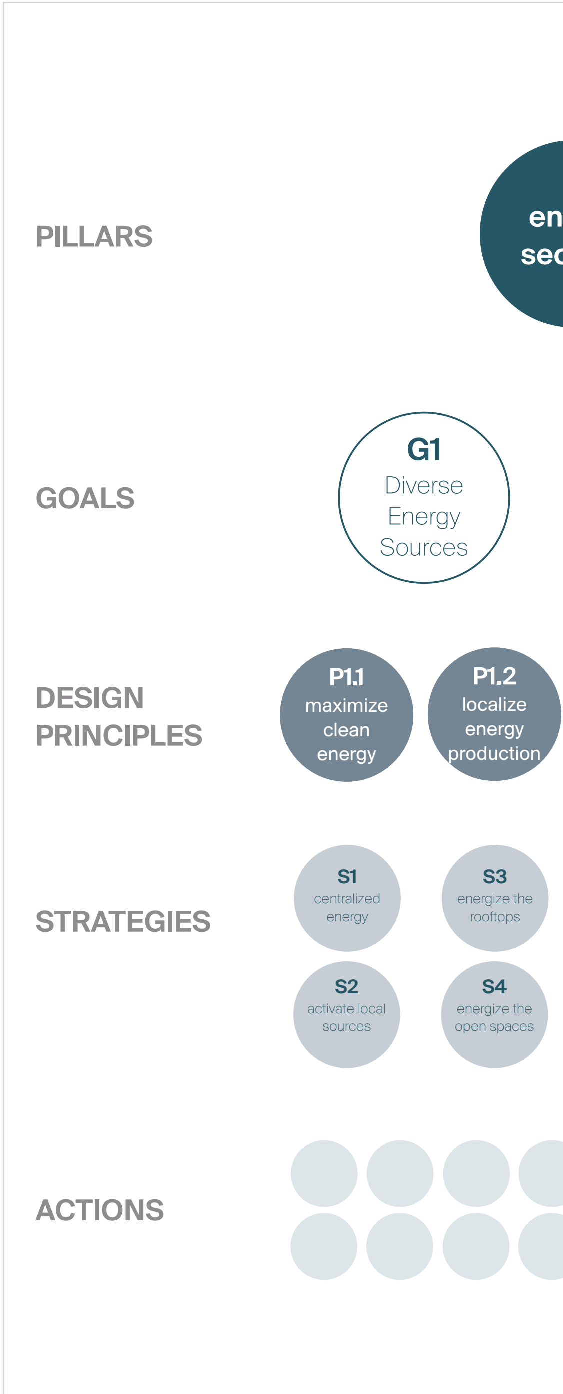
figure 61: multi-level perspective framework for building scenarios

[A] structure

The main pillars of the conceptual framework, specifically energy security, energy equity, and environmental qualities, are structured around several key spatial elements that contribute to achieving their primary goals (Figure 62).

Guiding the pursuit of these goals are the design principles, serving as fundamental directives shaping the approach on a regional scale. Spatial strategies then come into play, providing tangible representations of how these principles manifest within the city. Finally, actions are identified, outlining the concrete measures and steps necessary for implementing and assessing the effectiveness of the selected strategies. Together, these elements form a comprehensive framework aimed at guiding the process of designing scenarios and evaluating the fulfillment of the intended objectives through the lens of energy-space nexus.

Each pillar will independently form a scenario by maximizing the proposed design principles, strategies, and actions across three distinct scales. This aims to explore how space will evolve while pursuing various goals in the energy transition process.



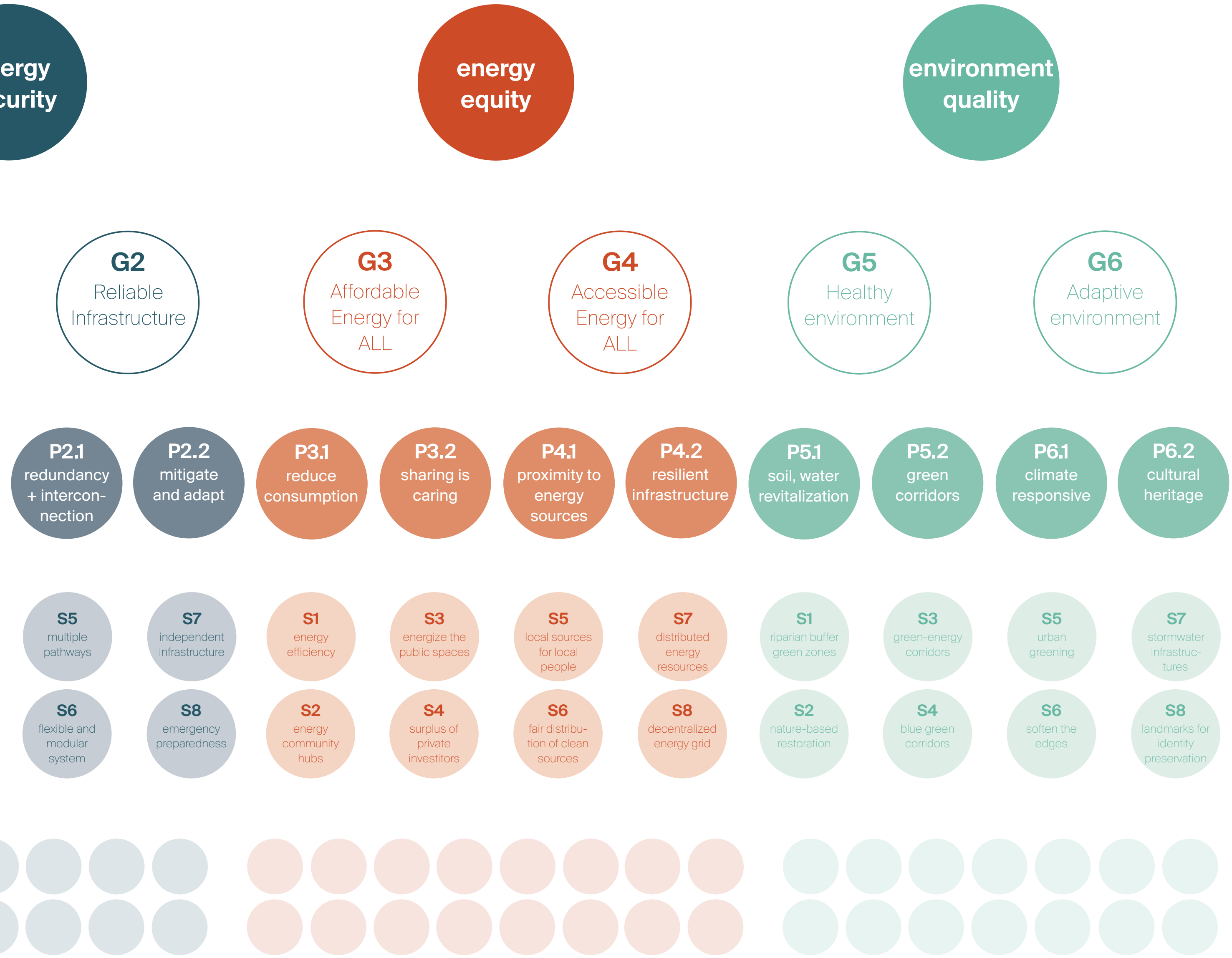


figure 62: structure of scenarios

ii. maximize energy security

Maximizing energy security, a primary challenge in Albania's energy system, creates a scenario for Elbasan city, illustrating potential spatial transformations resulting from solely meeting energy demand without considering environmental and social impacts.

It involves diversifying energy sources to mitigate climate vulnerability and reduce dependence on hydropower production. In this scenario, we maximize the utilization of all available clean energy sources in the area, including river water and geothermal sources for heating, as well as centralized and localized solar energy production, utilizing available space effectively. Additionally, it entails establishing a reliable energy infrastructure equipped with modern technology adapted to climate change. This involves minimizing losses to the energy infrastructure and restructuring the current system into modular, independent infrastructures connected with backup power systems and storage. The aim is to ensure no electricity shortages occur, enabling people to safely navigate the challenges posed by climate change.

This scenario envisions the energy-space nexus in Elbasan as a robotic landscape of energy generation, storage, and distribution. Every available flat surface is transformed into a solar panel field, integrating other economic activities such as agriculture with solar production. The river serves as a heat generator, while industrial sites become centralized energy production hubs. In residential neighborhoods, public spaces are designed to generate energy, and every house is equipped with its own solar panels on the roofs. Everyone can meet their energy demand even during storms or heatwaves in summer. The energy infrastructure is adapted to every possible scenario of climate change, incorporating the latest modern technologies.

This is how the energy-space nexus operates while maximizing energy security in Elbasan—a transformation that turns the landscape into an automated terrain producing diverse clean energy to meet the citizens' demands.

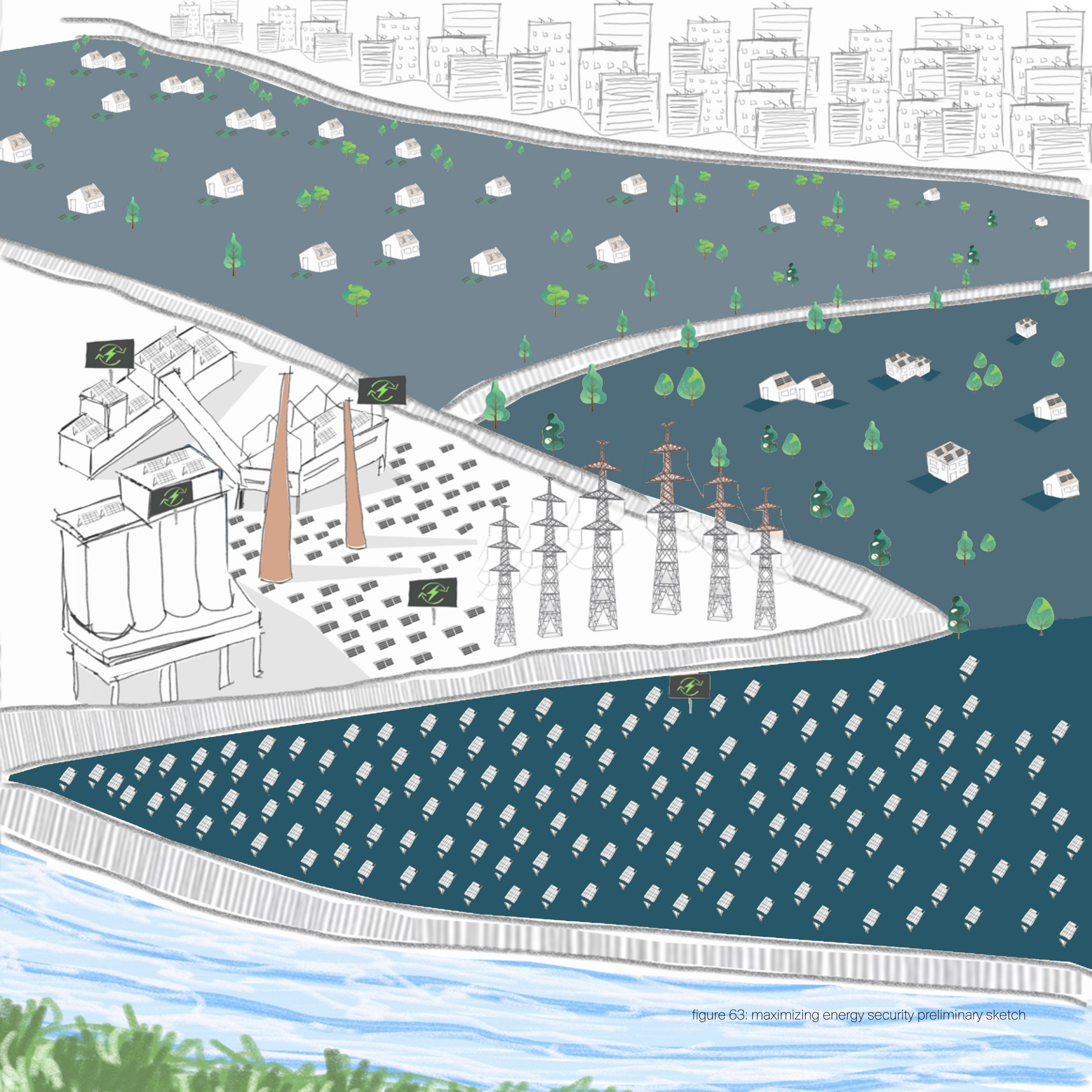


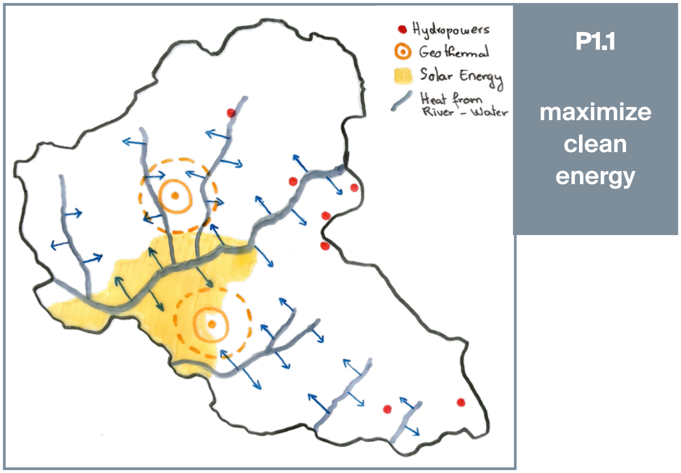
figure 63: maximizing energy security preliminary sketch

[A] macro-scale

Maximizing energy security on a macro scale illustrates spatial changes in the Elbasan Region while following the design principles of diverse energy sources and reliable infrastructure goals.

The first design principle focuses on maximizing clean energy by fully utilizing local energy sources found in the region, such as geothermal energy, solar production, hydropower, and river water for heating. This maximization creates centralized energy production sites within the region, which have a fossil-fuel thinking behind in terms of how they use space.

The second principle emphasizes localizing energy production to ensure energy security for all local citizens living in rural and urban areas. This is achieved by providing support and structures to local people and communities to install their own solar panels and fields.



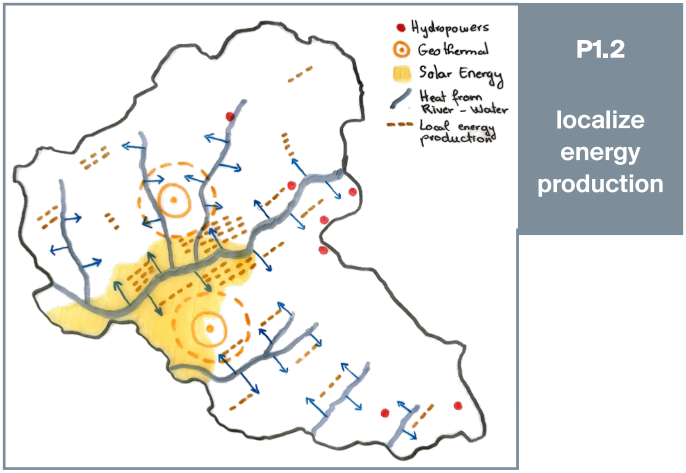
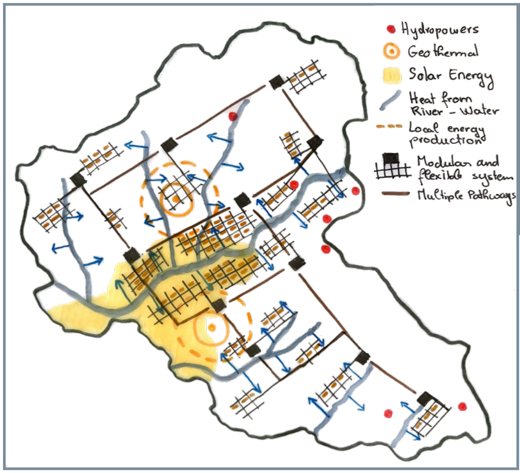


figure 64: design principles diagrams of energy security scenario

The third principle highlights redundancy and interconnections by stressing the importance of a modular and flexible system connected through multiple pathways. This ensures continuous access to energy, even in the event of infrastructure damage or overload.

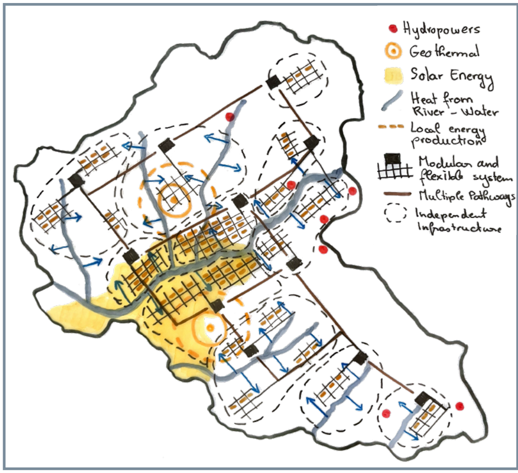
The fourth principle focuses on adapting to and mitigating the effects of climate change by establishing independent infrastructures such as microgrids. It allows the energy infrastructure to adapt to changes in energy demands and unforeseen cliamte events effectively, while improving the resilience of energy infrastructure against grid outages and disruptions.

By implementing these design principles in the scenario of Maximizing Energy Security, it can enhance energy resilience and reliability while strengthening overall energy security throughout the Elbasan region.



P2.1

redundancy and interconnections



P2.2

mitigate and adapt

[A] macro-scale

Figure 65 illustrates the transformation of the Elbasan Region and highlights areas crucial for accomplishing the principles of energy security.

The Elbasan Region boasts significant potential for solar energy production, particularly in the South-West area, which overlaps with agricultural lands and industrial sites. Additionally, there are two active geothermal sources that will play a vital role in heating nearby villages within this scenario. Moreover, water from the rivers is utilized to provide heating for rural areas and the city of Elbasan, thereby reducing reliance on wood as the primary energy source for heating, especially in rural regions.

Closeby villages are interconnected through a modular and flexible energy system, facilitating energy sharing between them to meet collective demand. The new energy infrastructure connecting the modular and flexible energy system in both rural and urban areas follows existing road structures and integrates with the national energy infrastructure, drawing a horizon line across these residential areas.

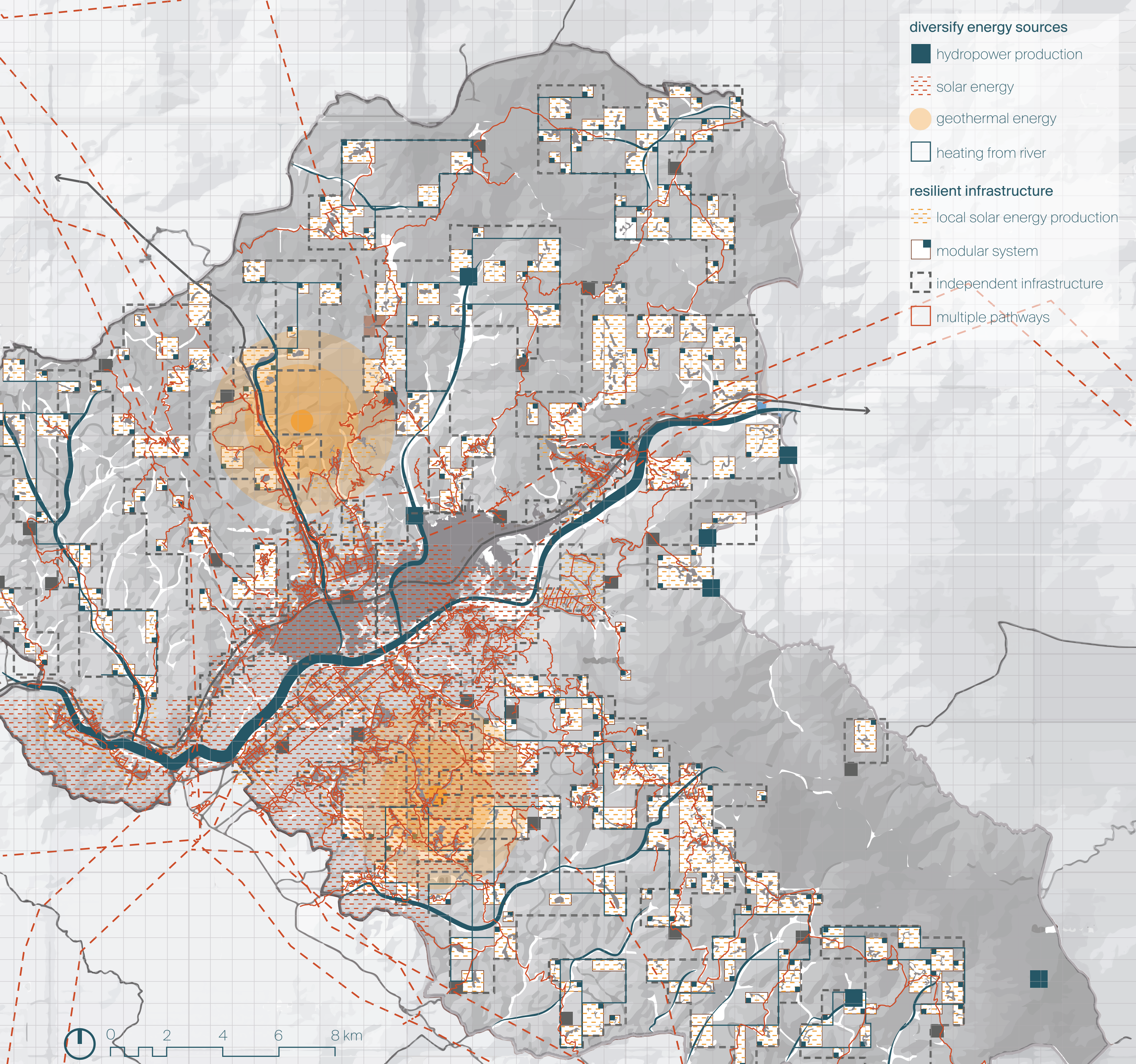


figure 65: Regional plan of energy security scenario in Elbasan city

[B] meso-scale

At the meso scale, the Maximizing Energy Security scenario provides strategies essential for Elbasan city's strategic plan to realize the design principles outlined at the regional level (Figure 66). The strategies align with the local contexts of the industrial, residential areas and in-between space, fostering a unified energy-space nexus, in which these three spaces operates independently while also being interconnected and supporting each other to complete the goals of energy security.

The industrial area undergoes a transformation into a centralized energy hub (S1), with every rooftop fitted with solar panels (S3), fostering a unified modular system (S6) that is integrated with multiple pathways (S5) with the city's energy infrastructure.

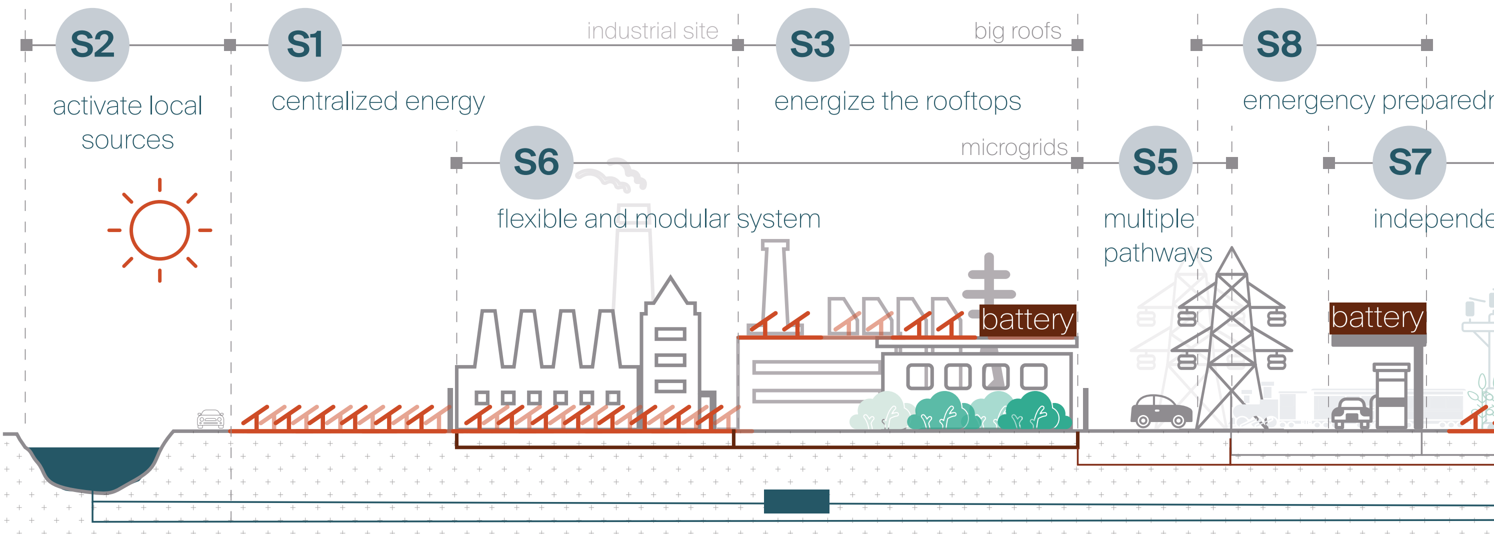
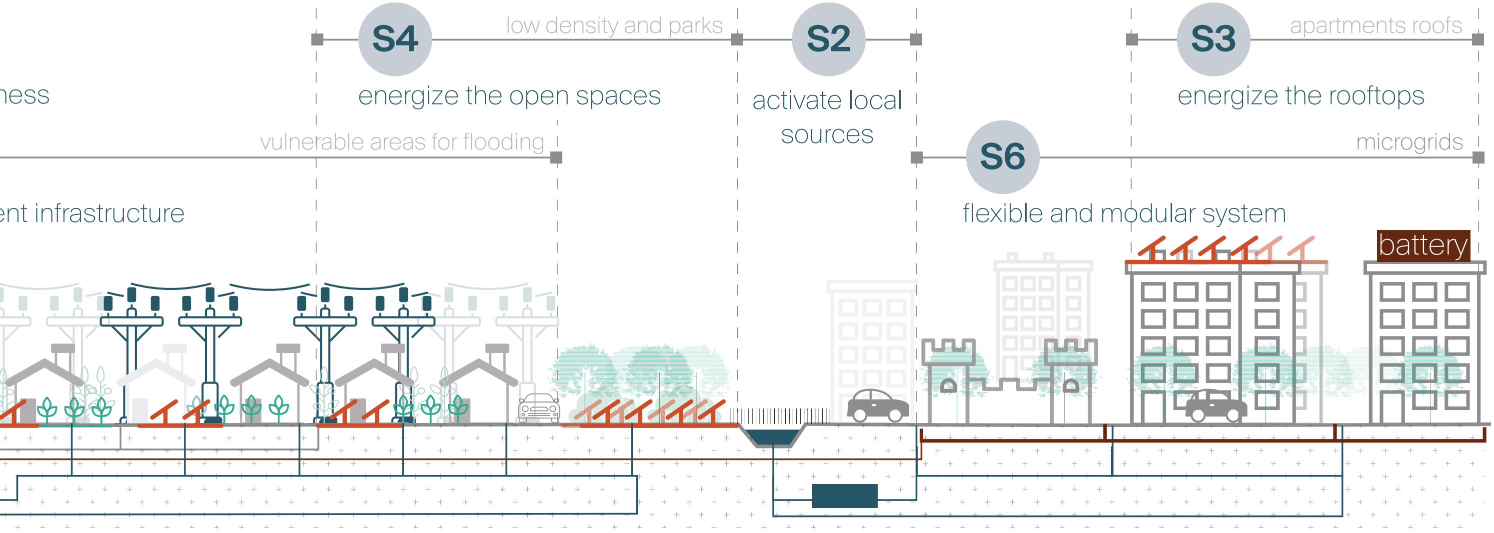


figure 66: Pattern of Production section when maximizing energy security

The space between industrial and residential zones remains an independent infrastructure (S7), characterized by open spaces due to its low density, which are utilized for solar panel installations (S4). Positioned in between the residential and industrial areas, this zone is equipped with storage and backup systems for emergency preparedness (S8).

Lastly, residential sector also functions as a flexible and modular system (S6) where local energy sources (S2) are activated to reduce reliance on hydropower to meet energy demands, such as rooftops adorned with solar panels (S3) and the utilization of river water for heating.

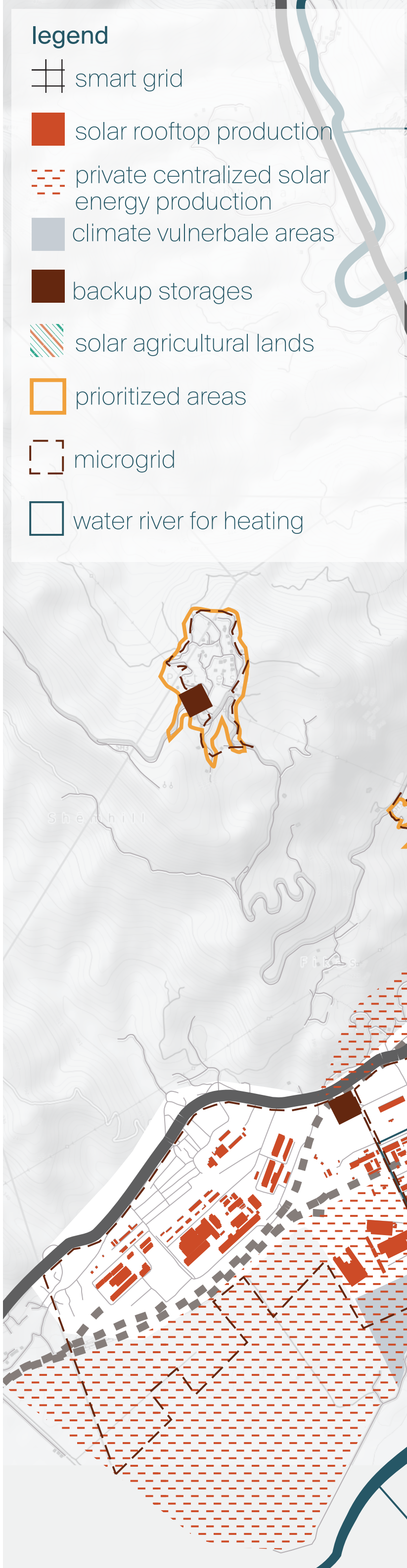


[B] meso-scale

Figure 67 illustrates the development of the Maximized Energy Security scenario at the city scale, where the strategies outlined above are translated into the spatial context of Elbasan city.

The open spaces within the industrial site are transformed into a centralized solar energy park, with flat rooftops and some large buildings renovated to integrate into this system. This makes the communist industrial site as the primary space for solar energy production. The intermediary space contains main backup systems and storages connected to the national energy infrastructure. Transitioning from a low-density area with single houses and agricultural activities, the space is reconfigured to accommodate both solar panels and agricultural activities harmoniously. In the residential area, an independent system is established with numerous distributed storages to enhance resilience against grid outages and disruptions. Additionally, all flat roofs are equipped with solar panels to diversify energy sources.

Finally, the surrounding rural areas function as microgrids and require prioritization to activate their local energy sources, such as river water for heating.



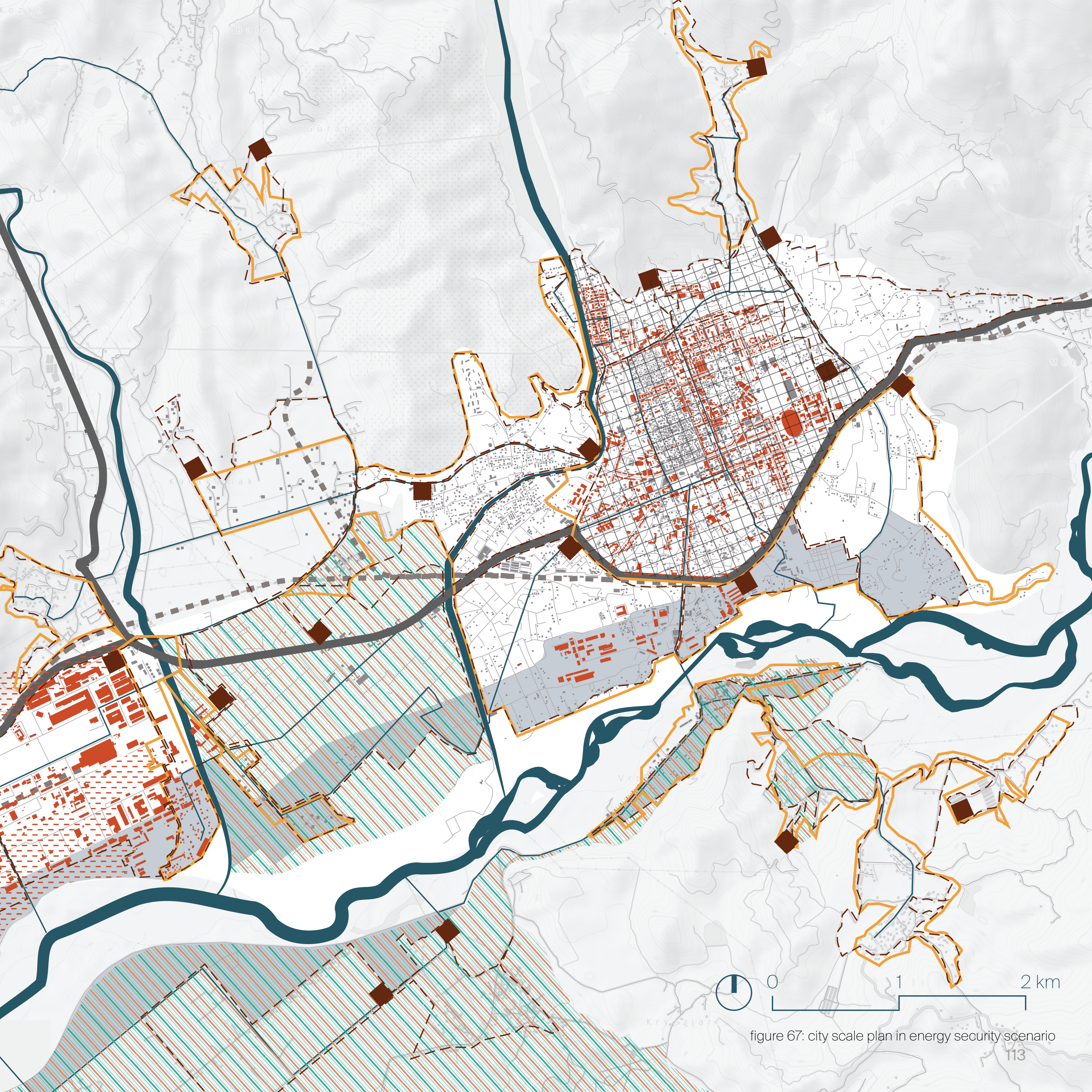


figure 67: city scale plan in energy security scenario

[C] micro-scale

figure 68: diagram of action implementation in industrial site for energy security scenario

A1.1 private solar energy park

A1.2 energize the industrial site

A2.1 water for heating

A2.2 every sunray counts

A3.1 start with public roofs

A3.2 my own solar roof

A4.1 solar agricul-tural land

A4.2 produce my court

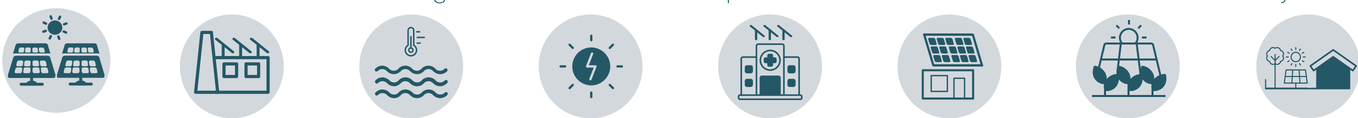


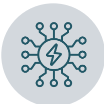
figure 69: diagram of action implementation in residential area for energy security scenario

on
yard

A5.1
upgrade
infrastructure

A5.2
grid inter-
connections

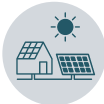
A6.1
smart
grid



A6.2
modular
solars

A7.1
community
microgrids

A7.2
close to energy
sources



A8.1
backup power
system

iii. maximize energy equity

Maximizing Energy Equity, as one of the main challenges of the energy transition process in Elbasan, envisions a scenario that prioritizes the social impact of the transition, ensuring that everyone can equally meet their energy needs and access clean energy sources. This scenario aims to create a space where all residents of Elbasan, regardless of their economic background or location within the city, can afford and directly access clean energy. It takes into account the energy demands of all individuals and how the spatial transformation should occur to equally meet these demands, without overlooking environmental and energy security considerations.

This scenario envisions the energy-space nexus in Elbasan as a community-based automated landscapes which empowers local residents to have their own control over energy resources and infrastructure. This nexus involves transforming the space through several design principles and spatial strategies: reducing energy consumption, establishing areas where surplus energy can be shared with nearby vulnerable communities, ensuring fair distribution of local clean energy sources by creating proximity between energy generation and consumption, and establishing a decentralized energy grid to foster resilient infrastructure. The aim is to ensure a space of fair and equitable access to affordable, reliable, and clean energy for all the citizens, particularly marginalized and low-income communities.

The scenario of Maximizing Energy Equity gives an overview of how the space will be transformed when incorporating principles of energy equity into urban planning and implementing spatial strategies and actions that promote a more inclusive and sustainable energy transition for all residents in Elbasan.

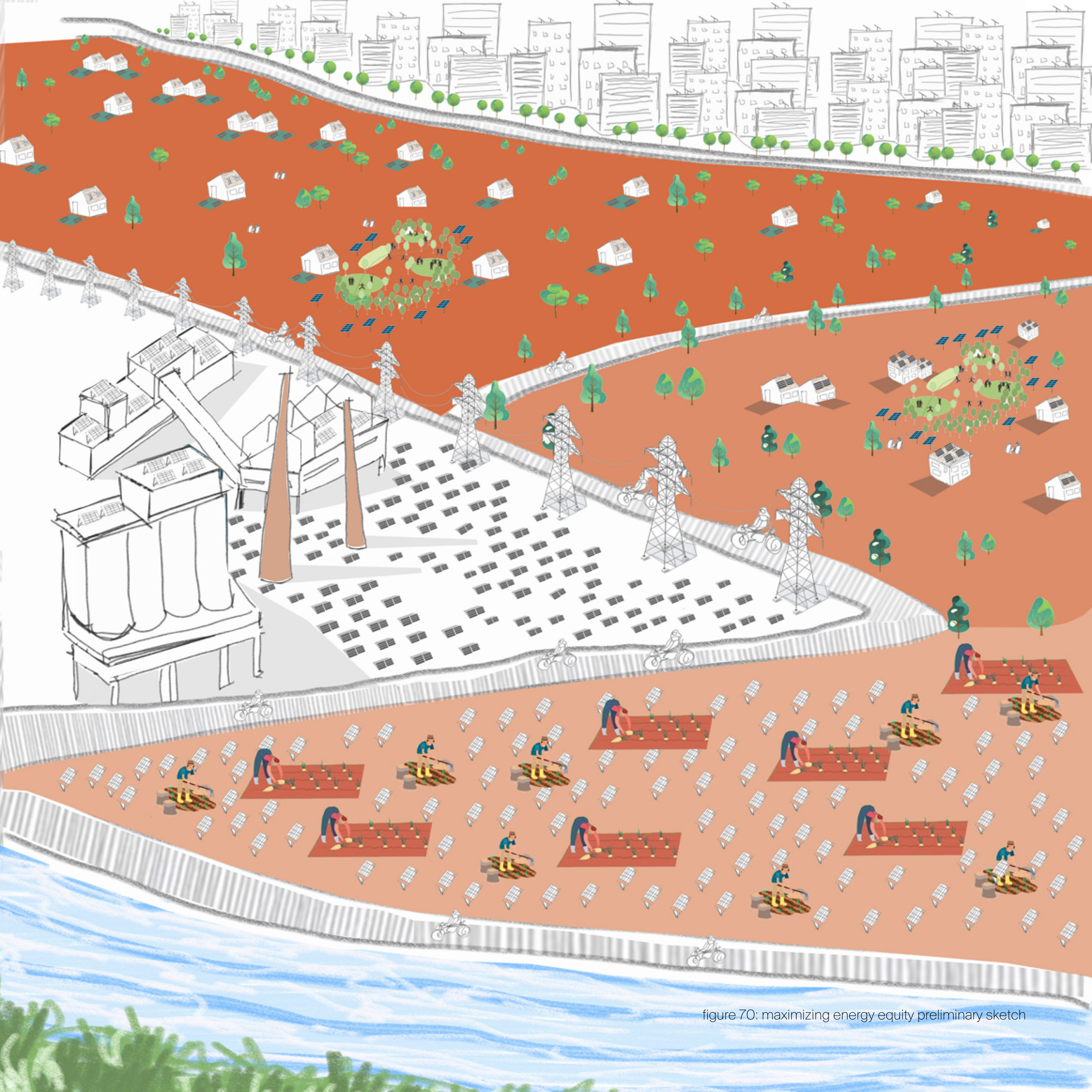


figure 70: maximizing energy equity preliminary sketch

[A] macro-scale

The first design principle of this scenario focuses on reducing energy consumption, addressing the inefficiencies present in many residential and industrial buildings. The region's changing temperatures due to climate change are driving up the demand for heating and cooling, making energy efficiency paramount.

Additionally, space should be designated for local energy production in public areas or through private investment, and share the surplus to vulnerable communities unable to install solar panels themselves.

Proximity to energy sources is another crucial design principle, especially for rural areas with aging infrastructure and limited connections to the national energy grid. This principle shapes the space to ensure that vulnerable communities have access to nearby solar energy production, geothermal sources, and rivers for heating.

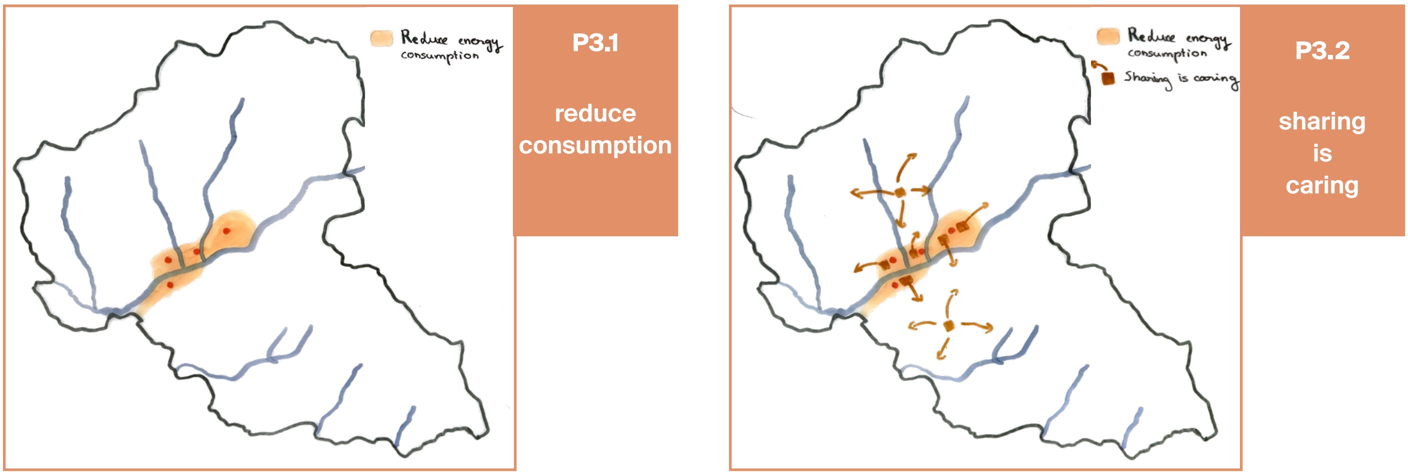
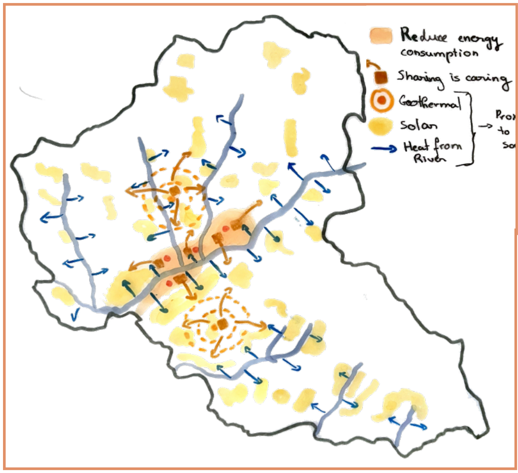


figure 71: design principles diagrams of energy equity scenario

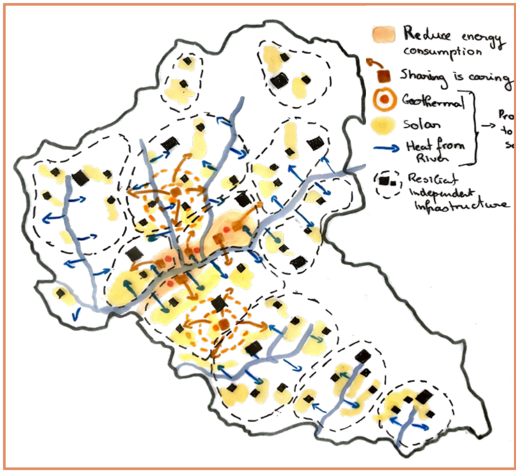
Lastly, the concept of resilient infrastructure should be embraced by rural areas with limited energy connections and marginalized communities living in areas prone to natural hazards, as they are the most vulnerable to the impacts of climate change. This could involve creating independent infrastructures and backup systems to store energy in case of emergencies. Similarly, upcoming neighborhoods and urban areas should be developed with the appropriate infrastructure to align with the concepts of resilience and climate adaptability.

This scenario essentially highlights how critical it is to give top priority to design spaces for accessible and affordable energy for all in the energy transition process, to successfully face the challenges of climate change and ensure the wellbeing of all communities.



P4.1

proximity to energy sources



P4.2

resilient infrstructure

[A] macro-scale

Figure 72 illustrates the spatial transformation in the Elbasan Region following the principles of energy equity.

The urban area of Elbasan city and its surrounding agricultural villages exhibit the highest energy demand in the region, as indicated in the Diagnosis Chapter analysis. One of the key principles aims to reduce consumption, necessitating various spatial transformations in this urban area to minimize the need for heating and cooling. Additionally, given its strategic location at the nexus of national energy infrastructure, this urban area can attract numerous investors during the energy transition process. In this scenario, open spaces are shared with these investors and the Municipality of Elbasan, with the condition that surplus energy is shared with nearby vulnerable communities.

The nearby villages are interconnected with resilient independent infrastructure tailored to their specific conditions. Isolated villages lacking access to the national energy grid function as microgrids, providing direct access to clean energy sources. In contrast, villages closer to the national energy infrastructure have their microgrids directly connected to this system.

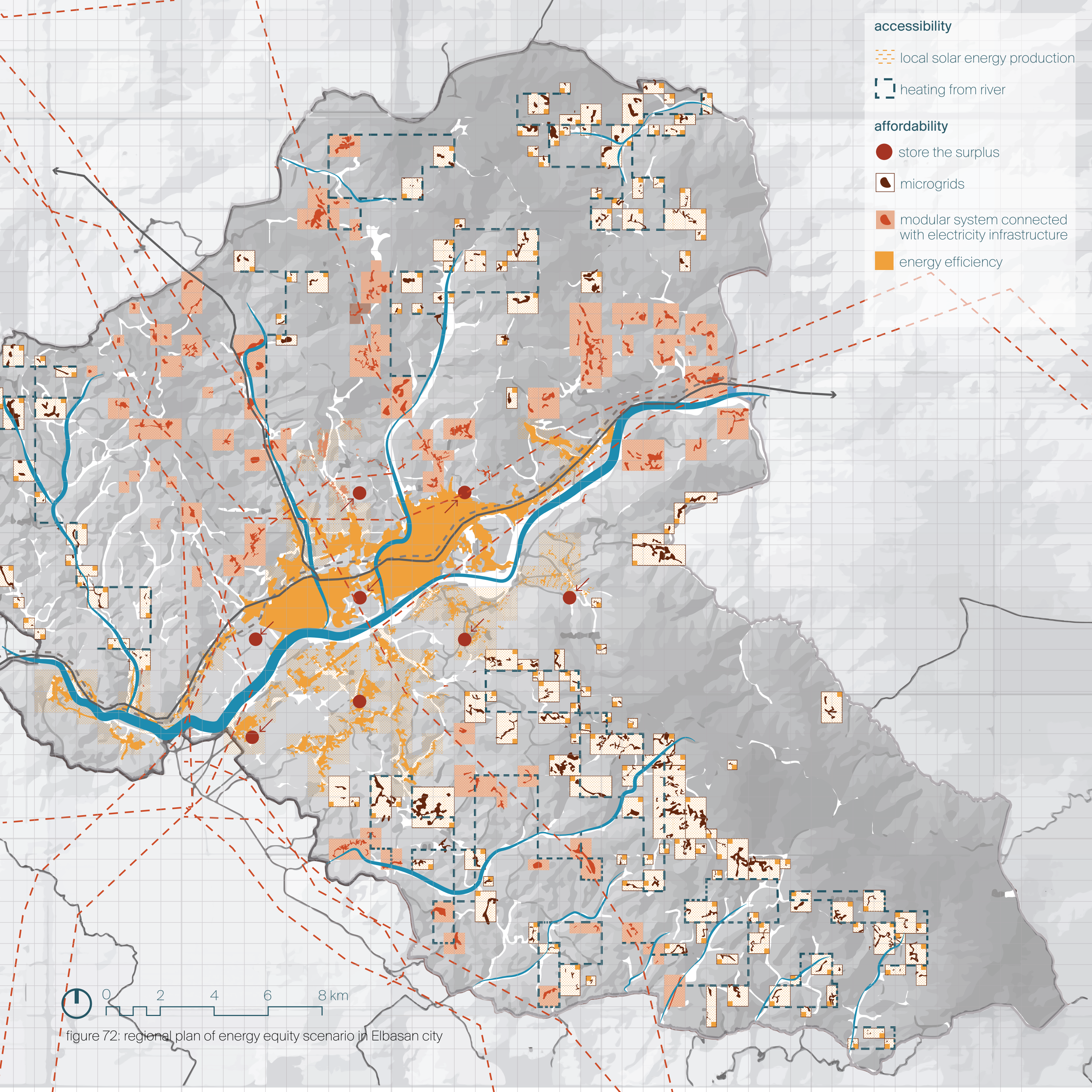


figure 72: regional plan of energy equity scenario in Elbasan city

[B] meso-scale

The meso scale introduces spatial strategies in Elbasan city, building upon the design principles established at the regional scale. These strategies are allocated based on the local conditions of different areas within the city, viewed through a social lens. They aim to foster a unified energy-space nexus that maximizes energy equity throughout the transition process. The industrial site plays a pivotal role in a decentralized energy grid (S8), where private investors can establish centralized solar energy production sites atop the flat roofs of industrial buildings, sharing surplus energy with vulnerable communities in the area. The open spaces between private buildings are repurposed into public areas integrated with energy production (S3), facilitating access to local

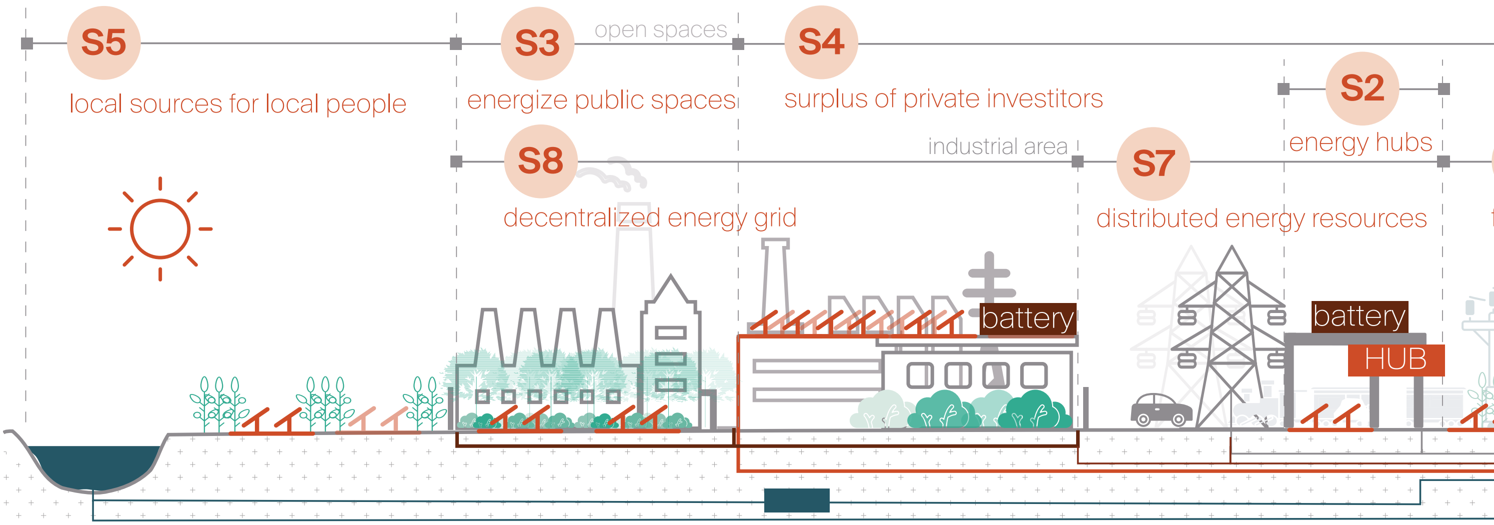
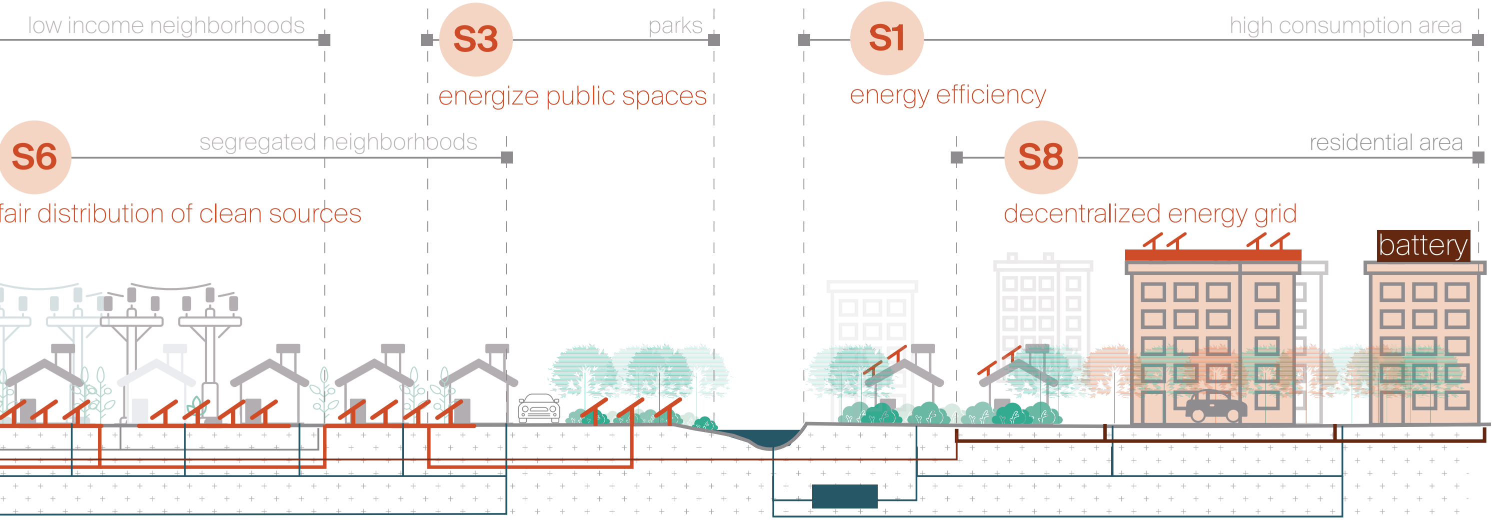


figure 73: Pattern of Production section when maximizing energy equity

energy sources for the community (S5). The space between industrial and residential areas serves as an emergency distribution area for energy resources (S7). It also caters to marginalized communities, hosting an energy hub (S2) as a community solar supply and production site that support community-led energy projects, ensuring fair distribution of clean energy sources (S6). In the residential zone, priority is given to increasing energy efficiency (S1) by insulating low-income housings and multi-family buildings and by providing tree sshading along the street. It aims to facilitate self-sustaining neighborhoods that generate, store, and manage their own energy resources. This area acts as a decentralized energy grid (S8), enhancing resilience against disruptions.

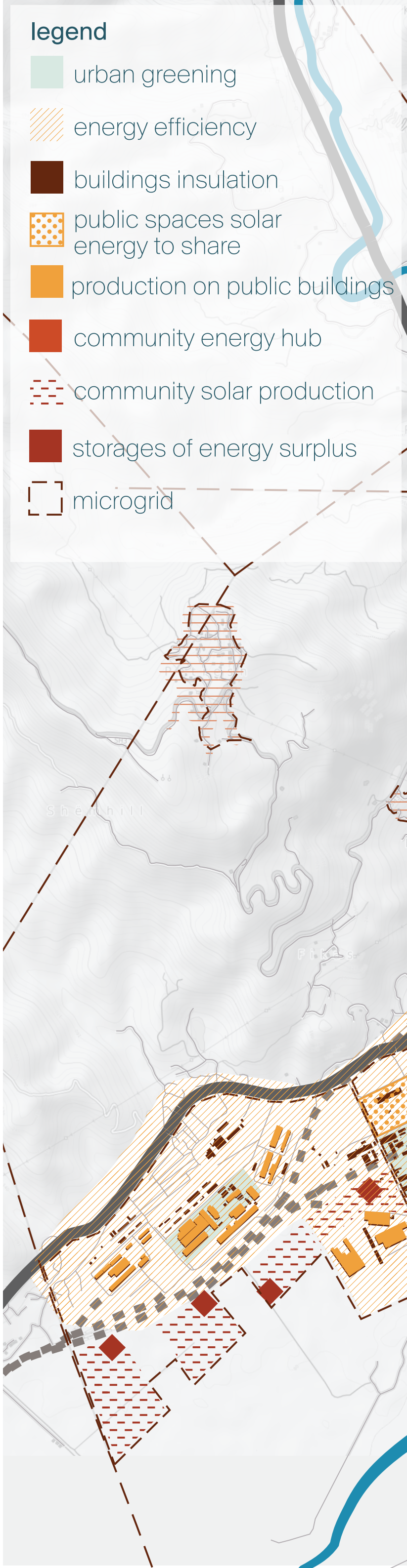


[B] meso-scale

Reducing energy consumption in residential areas is a pivotal strategy in the energy transition process. This can be achieved by insulating multifamily buildings and low-income neighborhoods to lower their energy bills. Urban greening also serves as a spatial action that helps reduce energy usage for heating and cooling.

In the industrial site, all flat roofs and open spaces between buildings are initially transformed into solar energy production surfaces for private owners or investors. Surplus energy must be shared with vulnerable communities nearby. Similarly, in the residential area, roofs of public buildings and public open spaces produce solar energy that is shared with marginalized communities in the city.

The space between residential and industrial sites is dedicated to empowering localized energy production for marginalized communities and connecting them with storage facilities in case of emergencies. Energy hubs serve as community-based spaces for individuals to learn more about energy transition, participate in decision-making processes, and access energy supply if needed.



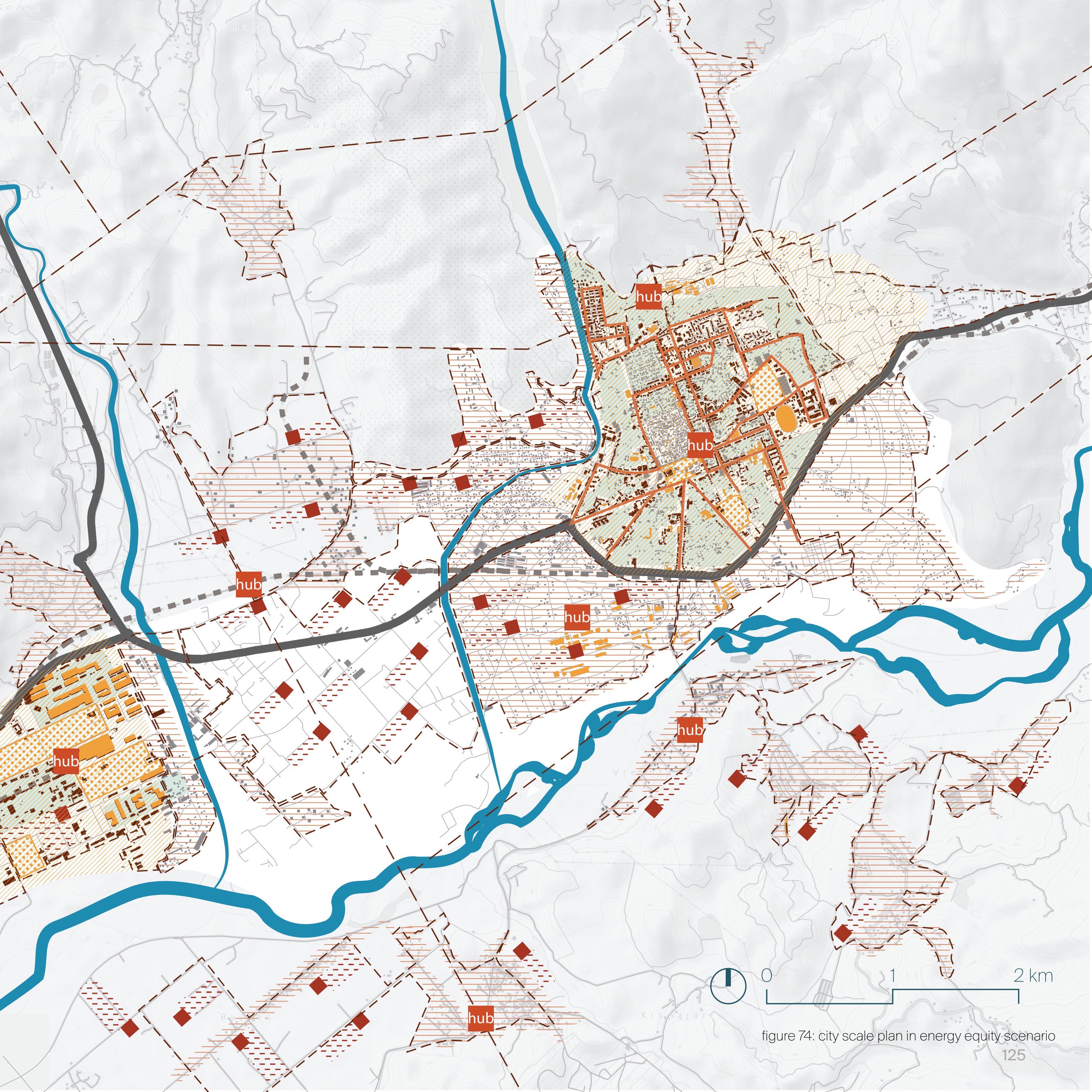


figure 74: city scale plan in energy equity scenario

[C] micro-scale

figure 75: diagram of action implementation in industrial site for energy equity scenario

A1.1 insulating buildings

A1.2 shading the facade

A2.1 shared solar parks

A2.2 localized energy supply

A3.1 energy parks open to public

A3.2 share public rooftops energy

A4.1 private storages for people

A5 wat hea

figure 76: diagram of action implementation in residential area for energy equity scenario

5.1
ter for
ating

A5.2
community
solar
production

A6.1
prioritize
marginalized
communities

A6.2
2 in 1 for
vulnerable
communities

A7.1
store local
solar energy

A7.2
fossil
fuels
storages

A8.1
community
microgrids

A8.2
community
owned
projects

iv. maximize environmental qualities

One of the main challenges facing the Elbasan region during the energy transition process is how to enhance environmental qualities and create a healthier living environment for residents. The scenario of Maximized Environmental Qualities focuses solely on cultivating a healthy and adaptive environment amidst the transition to a more sustainable energy system. But what spatial transformations would occur if we prioritized environmental qualities alone?

In this scenario, Elbasan is envisioned as a space where the energy system operates in harmony with nature and the cultural values of the context. It introduces a gentler approach to the transition, emphasizing the maximization of nature's inherent values. Spatial strategies derived from local environmental issues, such as soil and water revitalization to address heavy metal pollution from past industrial activities, are central to this scenario. Green corridors are established to bolster wildlife and promote biodiversity alongside existing energy infrastructure and water systems. Additionally, there is a focus on preserving the cultural heritage of the Communist industrial site and the historical city center, with proposed strategies that uphold these values. Finally, the scenario designs a climate-responsive environment through urban greening initiatives and stormwater catchment areas to adapt to climate change impacts and mitigate heat island effects.

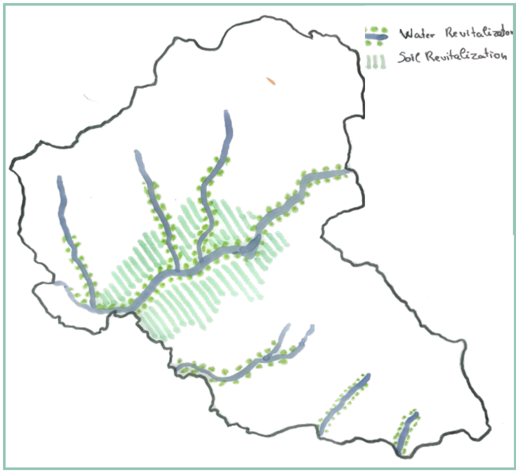
The Maximized Environmental Qualities scenario provides a blueprint for designing a space that ensures a healthy soil and water system, fosters ecological connectivity for a resilient ecosystem, adapts to climate change-induced heat island effects, and preserves cultural values while promoting a sustainable energy transition.

figure 77: maximizing environmental qualities preliminary sketch

[A] macro-scale

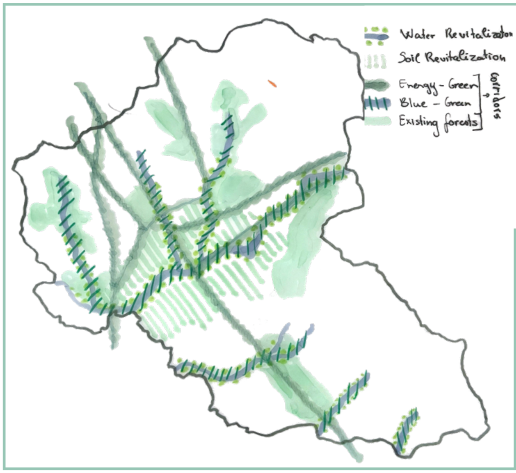
Soil and water revitalization stands as the primary design principle shaping the regional plan of Elbasan in a scenario prioritizing environmental qualities. This element is paramount due to the area's significant pollution stemming from the Communist industrial site's heavy metals production. Revitalization efforts aim to employ nature-based solutions, such as establishing riparian green buffer zones along rivers and planting trees to cleanse the soil of heavy metals.

Furthermore, the subsequent principle envisions a transformation of energy infrastructure and water systems into green corridors, fostering biodiversity and linking existing forests and green areas. Rivers are conceptualized as natural spaces where vegetation flourishes along the water's edge, while energy infrastructure guides the formation of primary wild green corridors, prohibiting construction and development.



P5.1

soil and water revitalization



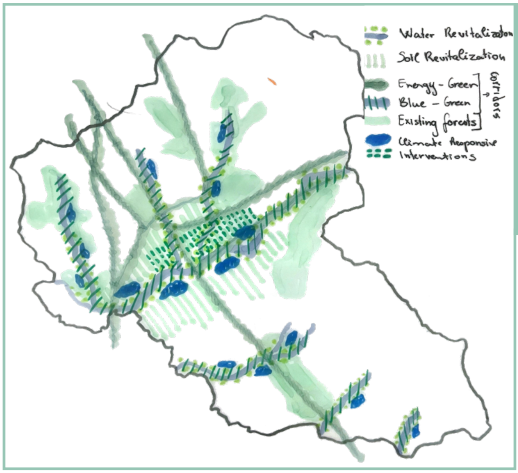
P5.2

green corridors

figure 78: design principles diagrams of environmental qualities scenario

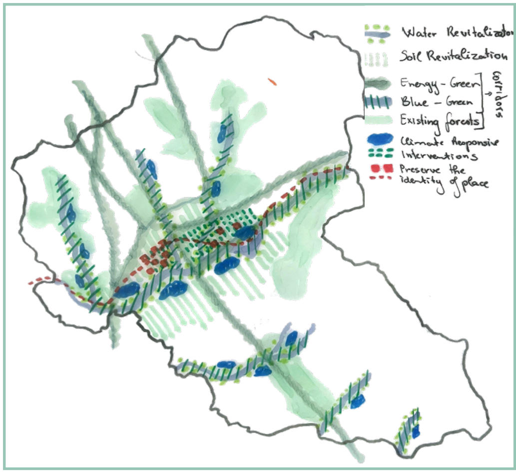
A climate-responsive design principle adapts spaces to climate change and mitigates heat island effects. Considerations include areas for stormwater collection or wetlands along rivers, which not only sequester CO2 emissions but also manage potential flood areas naturally. Urban greening initiatives, including green parks in residential zones, are essential to reducing heat island effects.

Lastly, enhancing environmental quality involves integrating cultural values sustainably into the energy transition process. This scenario underscores the critical importance of prioritizing environmental qualities, which directly impact the quality of life and space throough the energy transition.



P6.1

climate responsive



P6.2

cultural heritage

[A] macro-scale

This map visualized the spatial transformaations in Elbasan Region when maximizing environmental qualities (Figure 79).

All agricultural and urban areas near the industrial site must undergo soil revitalization procedures to cleanse them of heavy metals. This necessitates a shift in urban planning towards integrating nature within agricultural and residential lands to restore soil health. Similar efforts are required for the water system, where green edges featuring pollution-cleansing plants will be established along riverbanks, creating a green-blue corridor spanning the entire region. Existing forests will be connected via green corridors planned alongside national energy infrastructure, bolstering biodiversity and environmental quality. Rather than infrastructure overlapping with streets, houses, and other developments, the energy infrastructure will be connected in harmony with nature.

This scenario offers a vision for the Elbasan Region, depicting how space could appear when designed to enhance urban ecosystems, ensure healthy water and soil, and embrace climate-responsive design through nature-based solutions.

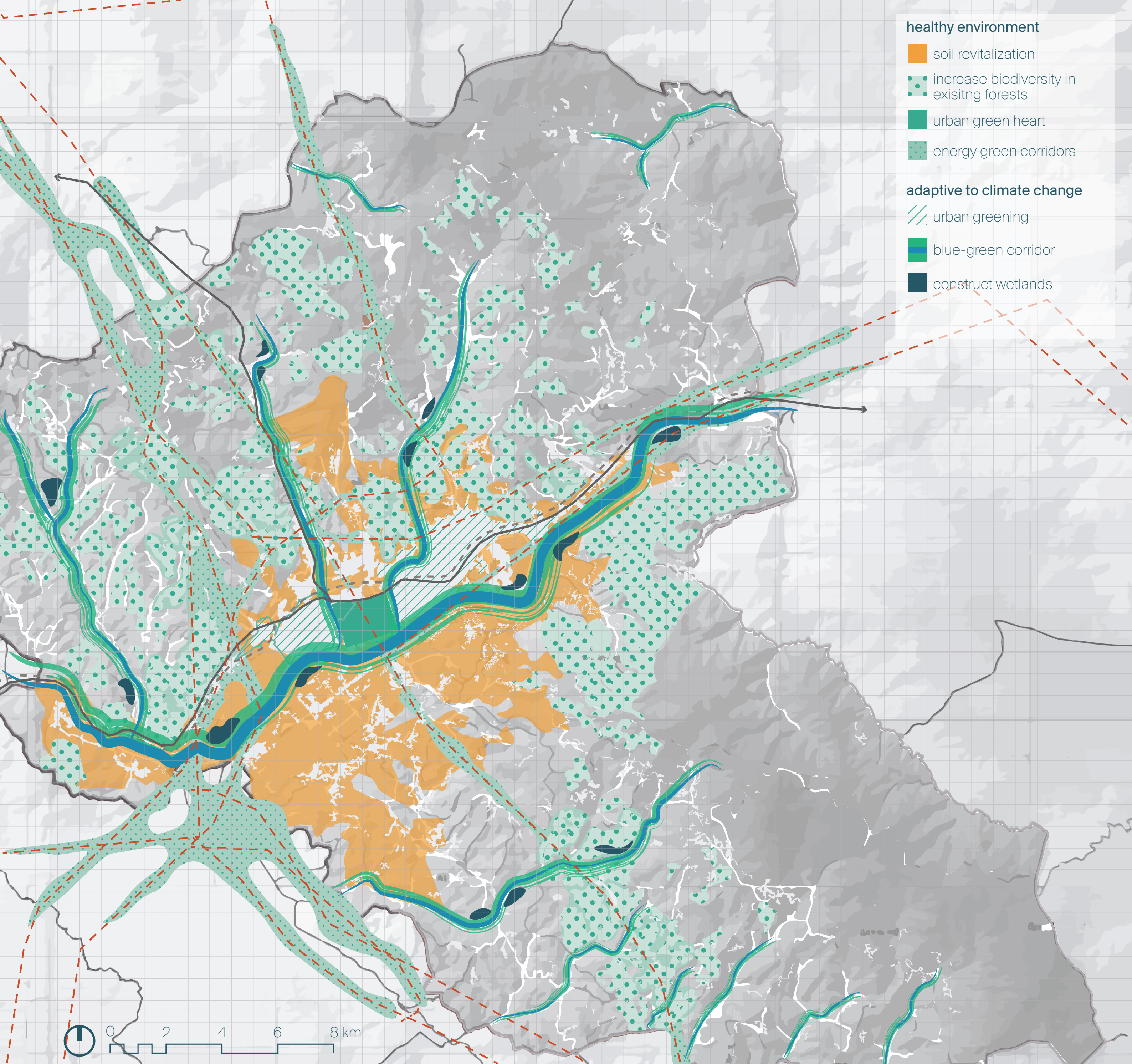


figure 79: regional plan of environmental qualities scenario in Elbasan city

[B] meso-scale

The meso scale illustrates the potential transformation of Elbasan city into a vast expanse of greenery and natural landscapes by maximizing environmental qualities. These strategies are aligned with current environmental problems and the potentials of Elbasan's spaces. This scale serves to assess the city's potential during the energy transition process with a focus on enhancing environmental qualities. While this depiction may suggest a city looking as a forest, each area serves a distinct purpose in increasing environmental quality. Areas adjacent to the river will form a blue-green corridor, offering nature-based solutions to mitigate flooding risks and clean contaminated soil and water from heavy metals. The industrial site, while retaining its cultural heritage, will

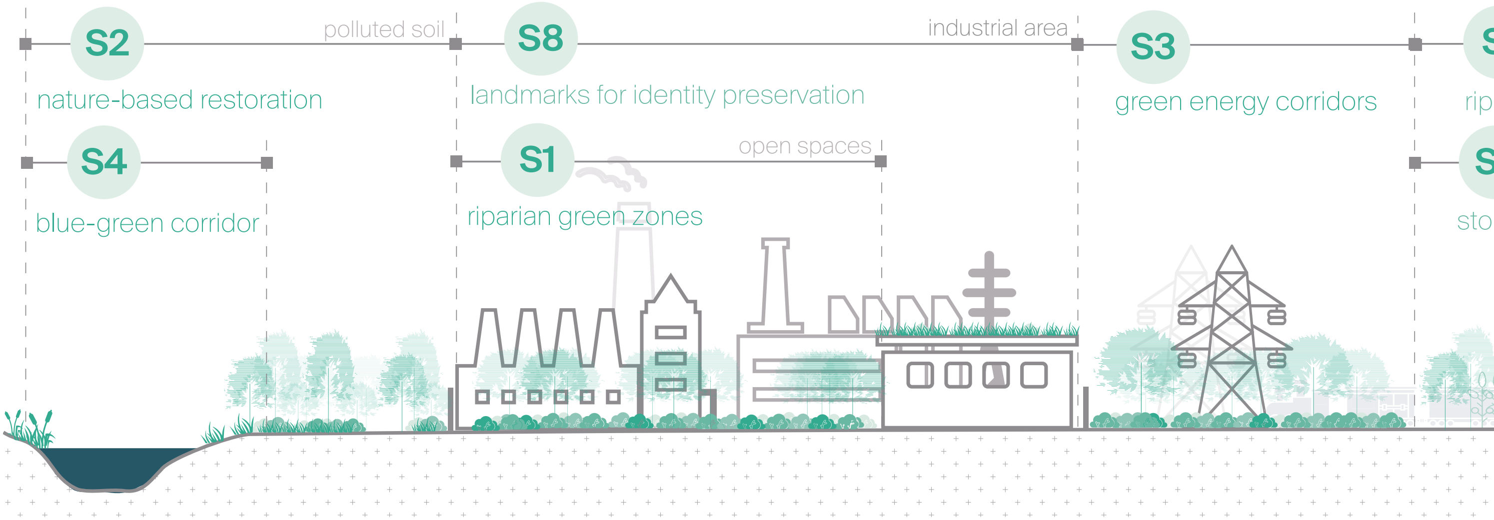
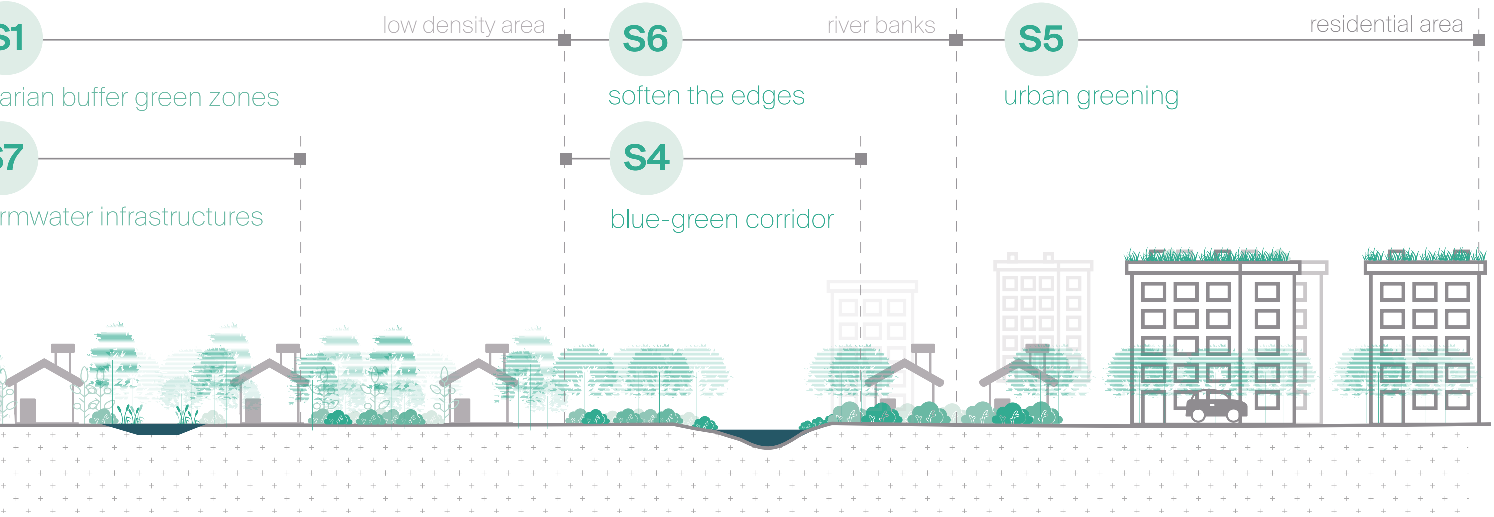


figure 80: Pattern of Production section when maximizing environmental qualities

undergo a transformation into industrial heritage green parks enhanced with green roofs and vegetation specifically selected for soil remediation. The national energy infrastructure will be integrated into a natural green corridor, fostering biodiversity. Meanwhile, the spaces between industrial and residential areas will become the city's green heart, characterized by wild trees and plants.

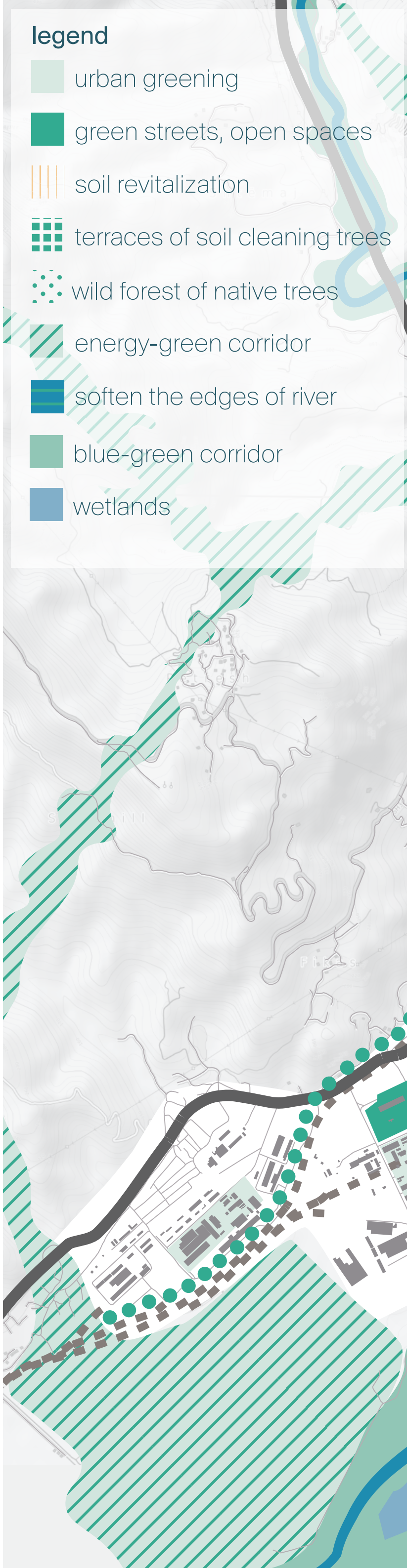
Additionally, stormwater infrastructure will be implemented to safeguard against flooding. The residential zones will prioritize green initiatives, including the cultivation of green spaces, installation of green roofs, and greening of streets to mitigate air pollution and mitigate the urban heat island effect.



[B] meso-scale

The in-between area of the industrial and residential zones emerges as the green heart of the city, boasting diverse green landscapes, ultimately becoming the largest green park in the city. It fosters connectivity between residential and industrial areas through green corridors comprising pedestrian and bike paths, enhancing biodiversity, air quality, and soil health. This connection is further facilitated by the blue-green corridor of the Shkumbini river and the activation of the green railway path along the train tracks in this scenario.

There also lies the energy-green corridor, featuring wildlife habitats, instilling in people a new sense of connection with energy as a harmonious coexistence with nature. Agricultural lands create spaces where trees for soil remediation and plants for agricultural activities coexist in harmony, transforming the landscape into a more natural agricultural environment. By softening the edges along the rivers and implementing stormwater infrastructure, we not only protect the land from flooding but also safeguard the energy infrastructure from the adverse effects of climate change. Creating a harmonious coexistence between urban development and nature, leads towards an energy transition that fosters environmental qualities.



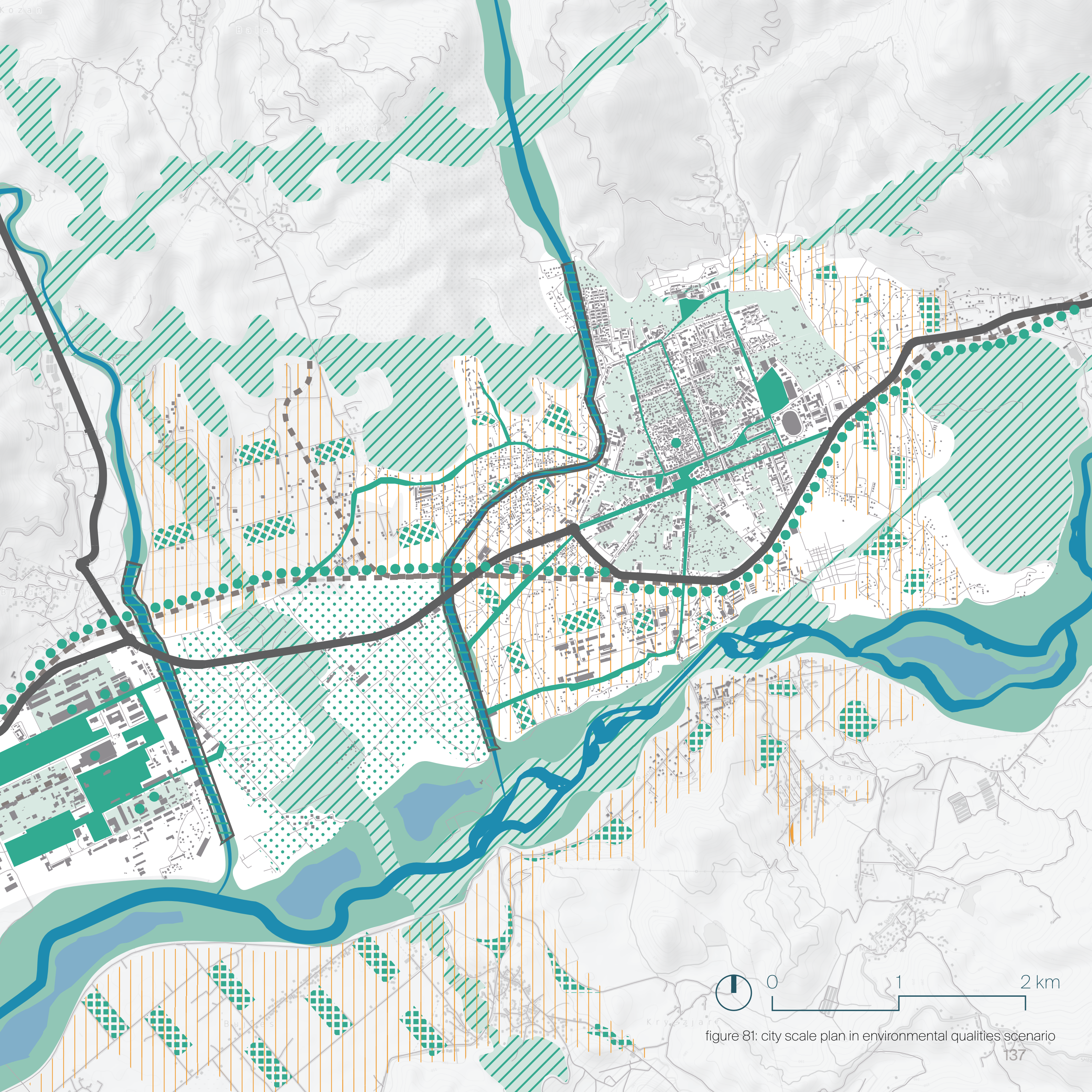


figure 81: city scale plan in environmental qualities scenario

[C] micro-scale

figure 82: diagram of action implementation in industrial site for environmental qualities scenario

A1.1 multi-layered buffer area

A1.2 terracing and swales

A2.1 soil amendments

A2.2 phytoremedi-ation terraces

A3.1 connect fragmented habitats

A3.2 ecological network

A4.1 recreational with ecologi-cal facilities

A4.2 waterfront promenac

figure 83: diagram of action implementation in residential area for environmental qualities scenario

le

A5.1
green roofs
and streets

A5.2
permeable
pavements

A6.1
stepping
stones

A6.2
riverfront
greenway

A7.1
construct
wetlands

A7.2
rainwater
harvesting

A8.1
native plants
in historical
neighborhoods

A8.2
let the nature
blow in
industrial area

v. pattern field

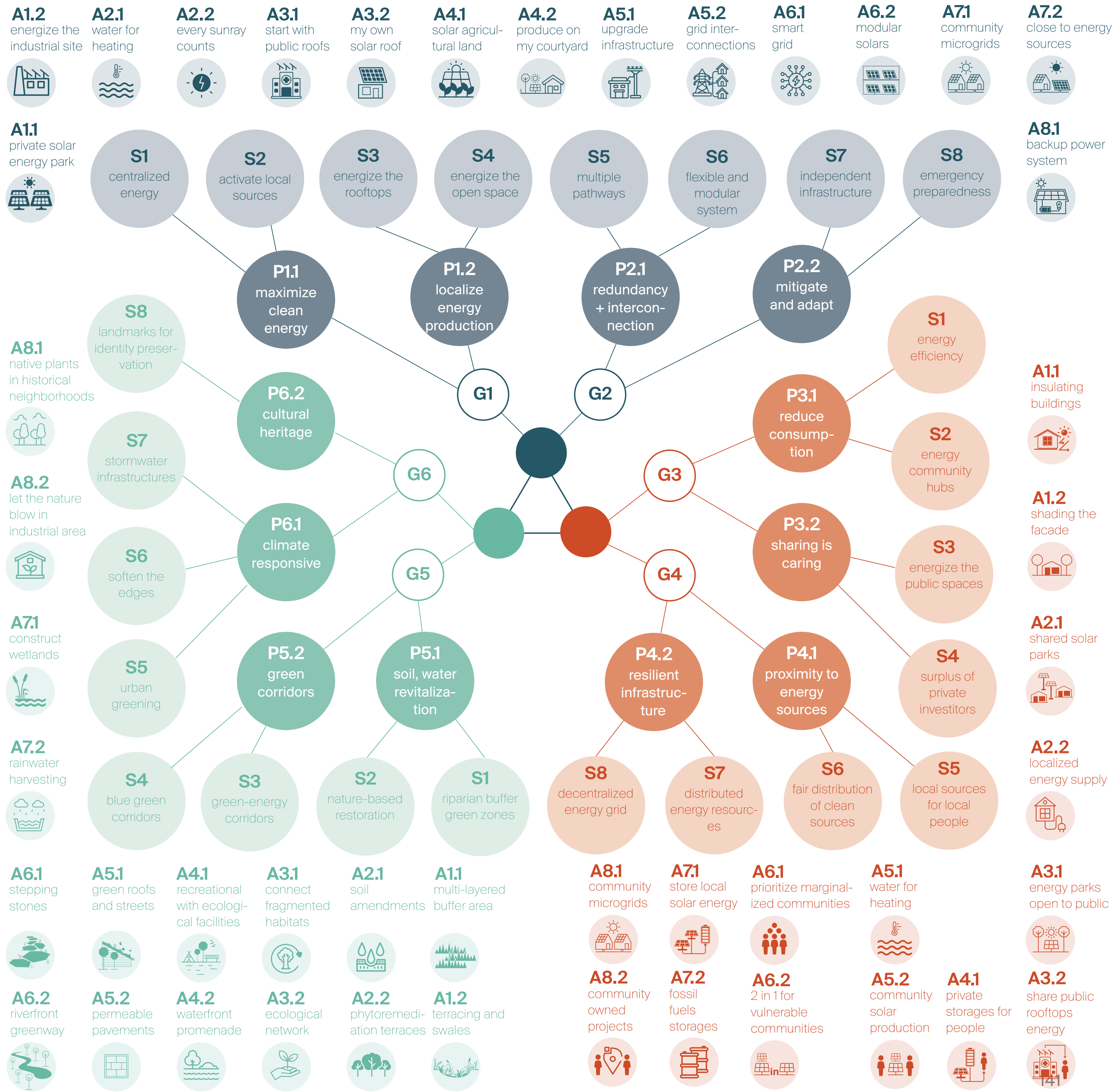
Figure 84 provides a summary of all the patterns identified through the exploration of maximized scenarios. It illustrates the pattern field comprising design principles, strategies, and actions of energy security, energy equity, and environmental qualities scenarios.

Within this pattern field, some patterns conflict with each other, while others collaborate and complement each other when juxtaposed. Notably, patterns of climate resilience in the energy security and equity pillars work together and complement each other, aiming for similar spatial and energy system changes. Conversely, patterns in these two pillars often conflict with patterns of environmental qualities, as they vie for the same space to achieve their respective goals. Environmental patterns primarily focus on the benefits of maintaining a healthy environment during the energy transition process, further contributing to the conflict with patterns in the energy security and equity pillars.

Figure 85 and 86 illustrates the conflicting design principles, strategies, and actions when integrated into a field of relations. The primary conflict between energy security and equity revolves around whether to centralize to maximize production or localize for a community-based energy production system. Meanwhile, the conflict between environmental quality and the other two pillars centers on how to use the city's natural environment to balance a green and healthy ecosystem with energy production purposes.

Following these findings, the next chapter elaborates the Optimization phase by defining a new energy-space nexus in the conflicting areas, without compromising the goals that every pillar is aiming for.

figure 84: pattern field of maximized scenarios


A1.2 energize the industrial site
A2.1 water for heating
A2.2 every sunray counts
A3.1 start with public roofs
A3.2 my own solar roof
A4.1 solar agricul-tural land
A4.2 produce on my courtyard
A5.1 upgrade infrastructure
A5.2 grid inter-connections
A6.1 smart grid
A6.2 modular solars
A7.1 community microgrids
A7.2 close to energy sources
A1.1 private solar energy park
A8.1 backup power system
S1 centralized energy
S2 activate local sources
S3 energize the rooftops
S4 energize the open space
S5 multiple pathways
S6 flexible and modular system
S7 independent infrastructure
S8 emergency preparedness
P1.1 maximize clean energy
P1.2 localize energy production
P2.1 redundancy + intercon-nection
P2.2 mitigate and adapt
G1
G2
G3
G4
G5
G6
S8 landmarks for identity preser-vation
A8.1 native plants in historical neighborhoods
P6.2 cultural heritage
S7 stormwater infrastructures
A8.2 let the nature blow in industrial area
P6.1 climate responsive
S6 soften the edges
A7.1 construct wetlands
S5 urban greening
A7.2 rainwater harvesting
P5.2 green corridors
P5.1 soil, water revitaliza-tion
S4 blue green corridors
S3 green-energy corridors
S2 nature-based restoration
S1 riparian buffer green zones
A6.1 stepping stones
A5.1 green roofs and streets
A4.1 recreational with ecologi-cal facilities
A3.1 connect fragmented habitats
A2.1 soil amendments
A1.1 multi-layered buffer area
A6.2 riverfront greenway
A5.2 permeable pavements
A4.2 waterfront promenade
A3.2 ecological network
A2.2 phytoremedi-ation terraces
A1.2 terracing and swales
S1 energy efficiency
A1.1 insulating buildings
P3.1 reduce consump-tion
S2 energy community hubs
A1.2 shading the facade
P3.2 sharing is caring
S3 energize the public spaces
A2.1 shared solar parks
S4 surplus of private investitors
A2.2 localized energy supply
P4.2 resilient infrastruc-ture
P4.1 proximity to energy sources
S8 decentralized energy grid
S7 distributed energy resourc-es
S6 fair distribution of clean sources
S5 local sources for local people
A8.1 community microgrids
A7.1 store local solar energy
A6.1 prioritize marginal-ized communities
A5.1 water for heating
A3.1 energy parks open to public
A8.2 community owned projects
A7.2 fossil fuels storages
A6.2 2 in 1 for vulnerable communities
A5.2 community solar production
A4.1 private storages for people
A3.2 share public rooftops energy

[A] conflicting patterns

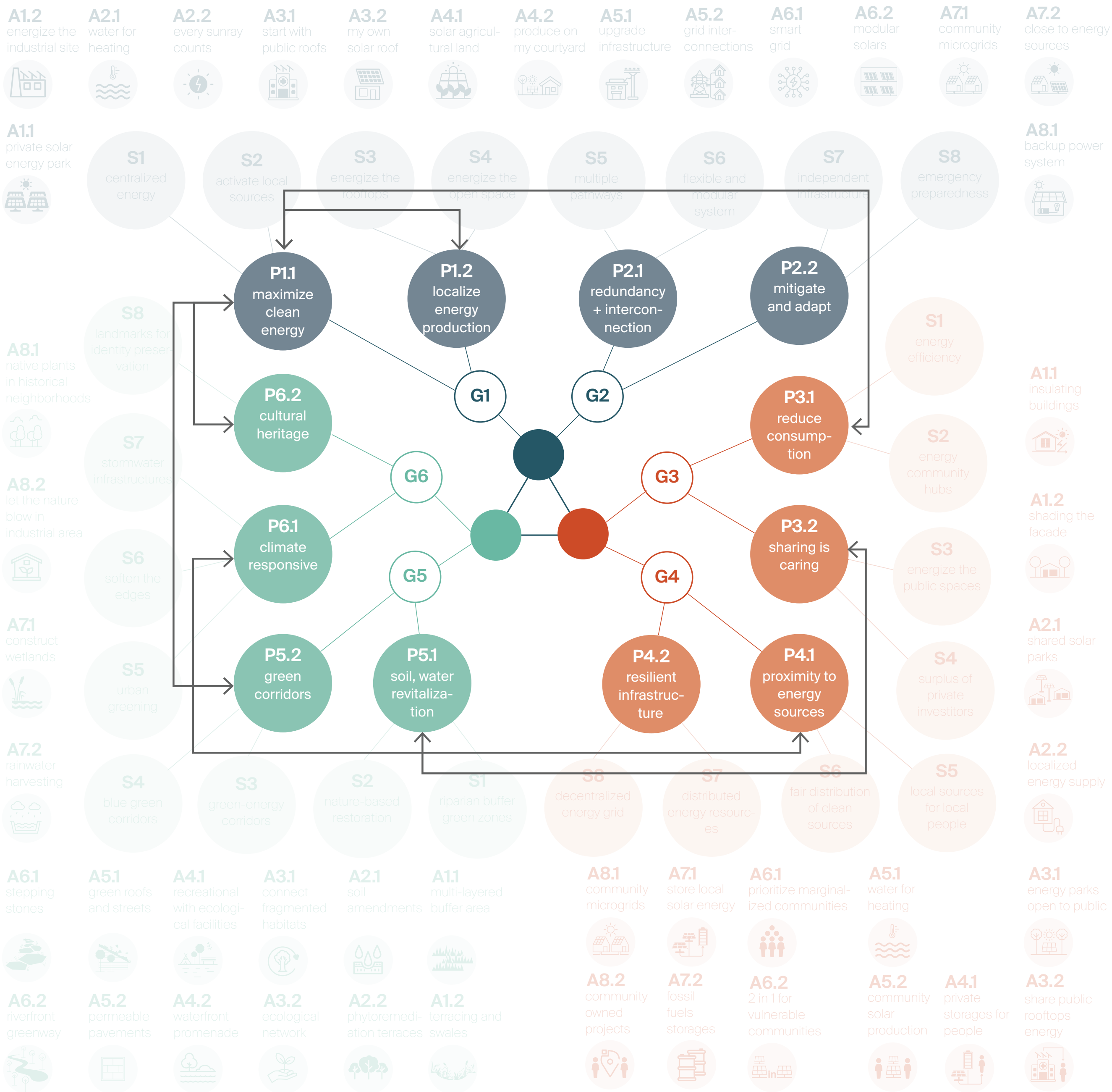


figure 85: design principles conflicting in the pattern field

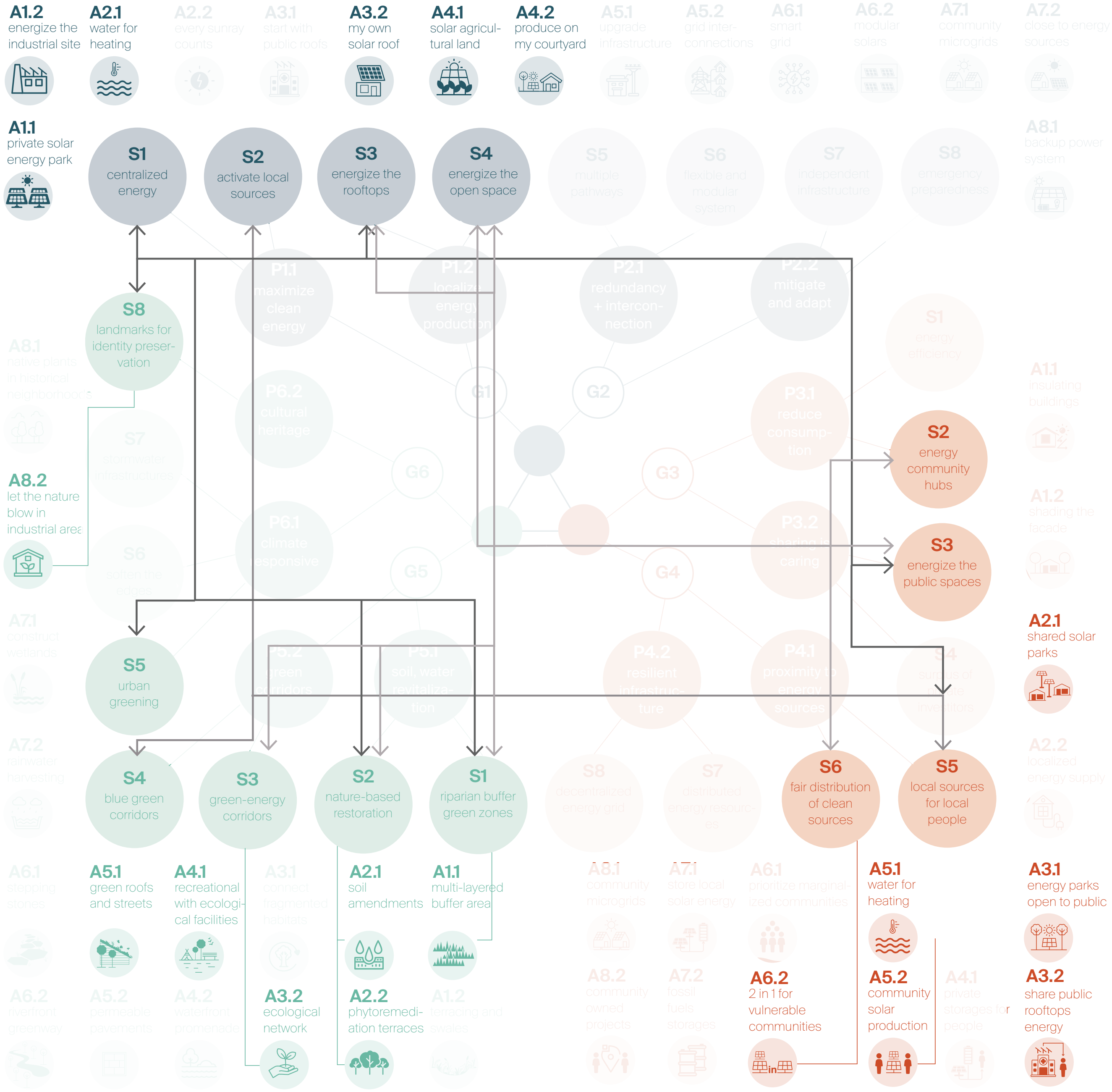


figure 86: strategies and actions conflicting in the pattern field

V. implementation

In this chapter, the previously proposed scenarios overlap, identifying areas of conflict and complementarity. Optimization tool is utilized to resolve these conflicts and visualize the ideal integration of pattern language in Elbasan's future vision during the energy transition process. Further elaboration of the vision includes a new stakeholders' strategy proposal aimed at increasing awareness of the importance of the energy-space nexus and the social and environmental impacts of energy transition. This proposal seeks to involve, collaborate, consult, and empower specific stakeholders for an inclusive transition. Optimization also addresses conflicting areas at the meso scale, highlighting which strategies and actions in the pattern field are fighting for the same space. This process results in the creation of a strategic plan for Elbasan within four new strategies to address these conflicts while solving also the problems identified during the analysis phase. The objective is to illustrate how the energy-space nexus will be established to achieve Elbasan's vision, with a focus on areas of conflicts by presenting before and after images of space changes. Subsequently, an assessment will be conducted with various stakeholders to evaluate the new patterns created during the optimization phase and the strategic plan of Elbasan city using needs identified from the microstories as an assessment criteria.

figure 87: Metalurgjiku in Elbasan city (photo by the author)

i. optimization structure

figure 88: optimization structure diagram

OPTIMIZATION

The structure of envisioning the Elbasan region's future is founded on the optimization of the maximized scenarios, as explored in the previous chapter. The convergence of energy security, energy equity, and environmental quality scenarios at the macro scale has identified areas where design principle patterns either conflict or complement each other. By optimizing these patterns according to the context specific potentials and limitations of these identified areas, the aim is to enable all conflicting patterns to coexist harmoniously and to create new spatial patterns that ultimately define the vision of Elbasan city. This vision is presented also by combining spatial principles patterns and stakeholders strategies to show the desired energy-space nexus outcome during the process of a secure, equal and environmental sensitive energy transition.

The same approach is applied to define the strategic plan for the Pattern of Production in the city. It further develops the spatial outcomes of the defined vision and principles by zooming in at the meso scale. The overlap of maximized scenarios for energy security, energy equity, and environmental quality has pinpointed areas of conflict. These conflict areas are further refined through the optimization phase, illustrating how strategies at the meso scale and actions at the micro scale can synergize to achieve the most favorable outcomes and accomplish the vision plan, thereby establishing the strategic plan for Elbasan city in the energy transition process.

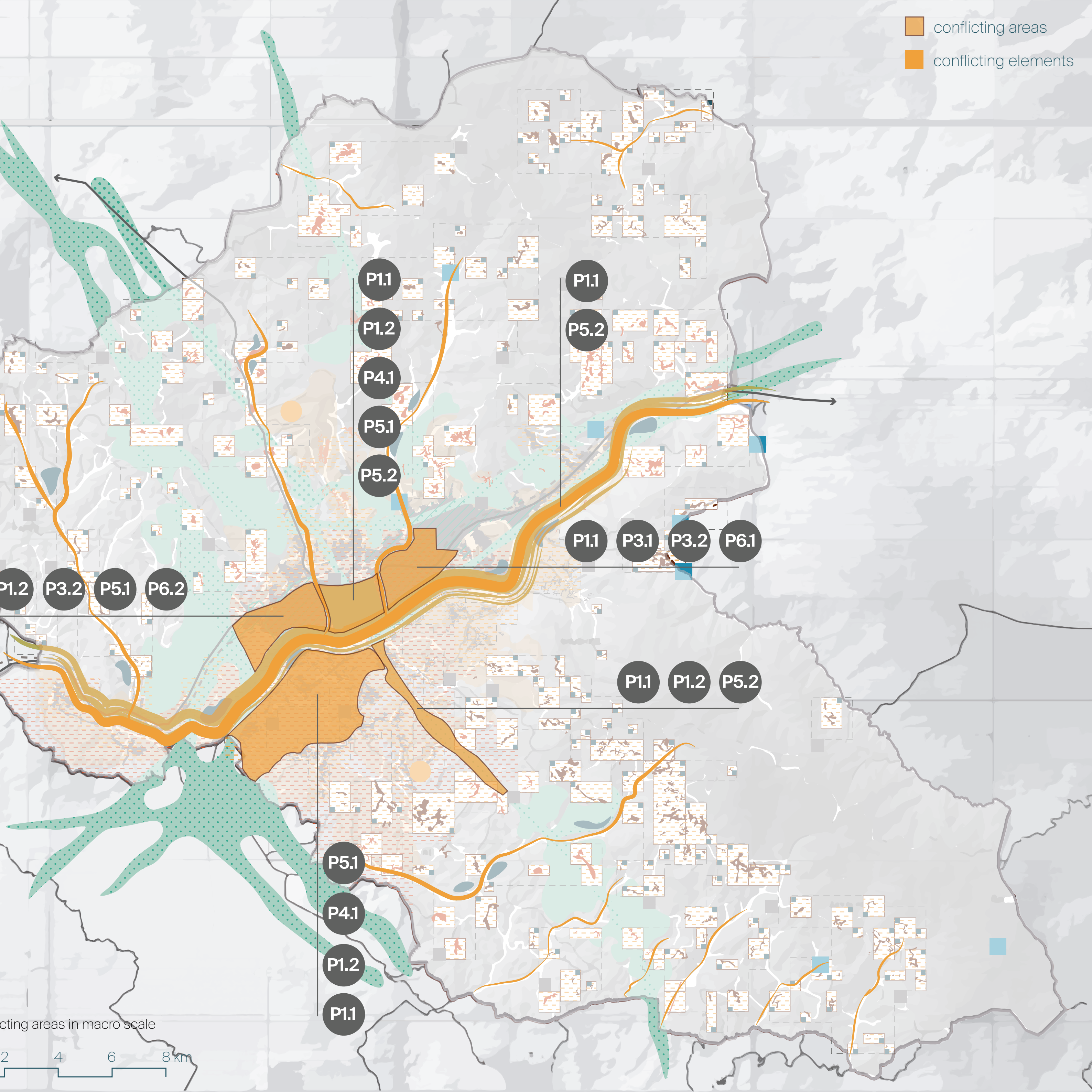
ii. vision

The overlap of the proposed scenarios on a macro scale has identified areas in the Elbasan region that are either competing or complementary.

The urban space of Elbasan must undergo a transformation to build up this vision, as the main conflicts are concentrated in the city area (Figure 89). The primary conflicts arise in how the industrial space is envisioned to be transformed, how the residential area will be adapted during this transition, how the agricultural lands will be changed to accomplish the new goals of energy transition, and whether the water bodies will be used as energy sources or blue-green corridors.

While conflicts primarily concentrate within the city area of Elbasan and its water bodies, the overlap of design principles in the surrounding rural areas achieves perfect harmony. There are identified 5 main areas of conflcits which will be further explained in detail (Figure 90).

figure 89: confli



conflicting areas
conflicting elements
P1.1
P1.2
P4.1
P5.1
P5.2
P1.1
P5.2
P1.1
P3.1
P3.2
P6.1
P1.2
P3.2
P5.1
P6.2
P1.1
P1.2
P5.2
P5.1
P4.1
P1.2
P1.1
cting areas in macro scale
2
4
6
8 km

[A] conflicting areas

1. The Riverscape
This area faces a conflict between creating a blue-green corridor to enhance ecological values or using the river water for heating, thereby maximizing the use of local resources to enhance energy security.

2. The Agricultural Zone
It is conflicted between prioritizing soil revitalization through nature-based solutions, transforming into agricultural solar production spaces and community solar production area, or developing a centralized solar park while individuals meet their own demands.

3. The Residential Area in the City Center
The conflict lies between maximizing energy production and reducing consumption through energy efficiency actions. There is also a conflict on whether to use roofs and public spaces for community or individual energy production purposes or to make them green spaces to enhance biodiversity.

4. The In-Between Space
This area is envisioned in different scenarios as the green heart of the region to boost ecological values, as a zone for centralized solar energy production, and as an area for private localized solar production with shared solar energy areas owned by the community.

5. The Industrial Site
This site faces a conflict between centralized strategies for energy security and localized strategies for energy equity and green initiatives aimed at pollution recovery and preserving the area's identity.

conflict 5

P1.1 **maximize clean energy**
A1.2 energize the industrial site

P1.2 **localize energy production**
S3 energize the rooftops

P3.2 **sharing is caring**
A3.2 shared public rooftops energy

P5.1 **soil, water revitalization**
S2 nature based restoration

conflict 3

P1.1 **maximize clean energy**
S1 centralized energy
A1.1 private solar energy parks

P3.1 **reduce consumption**
S1 energy efficiency

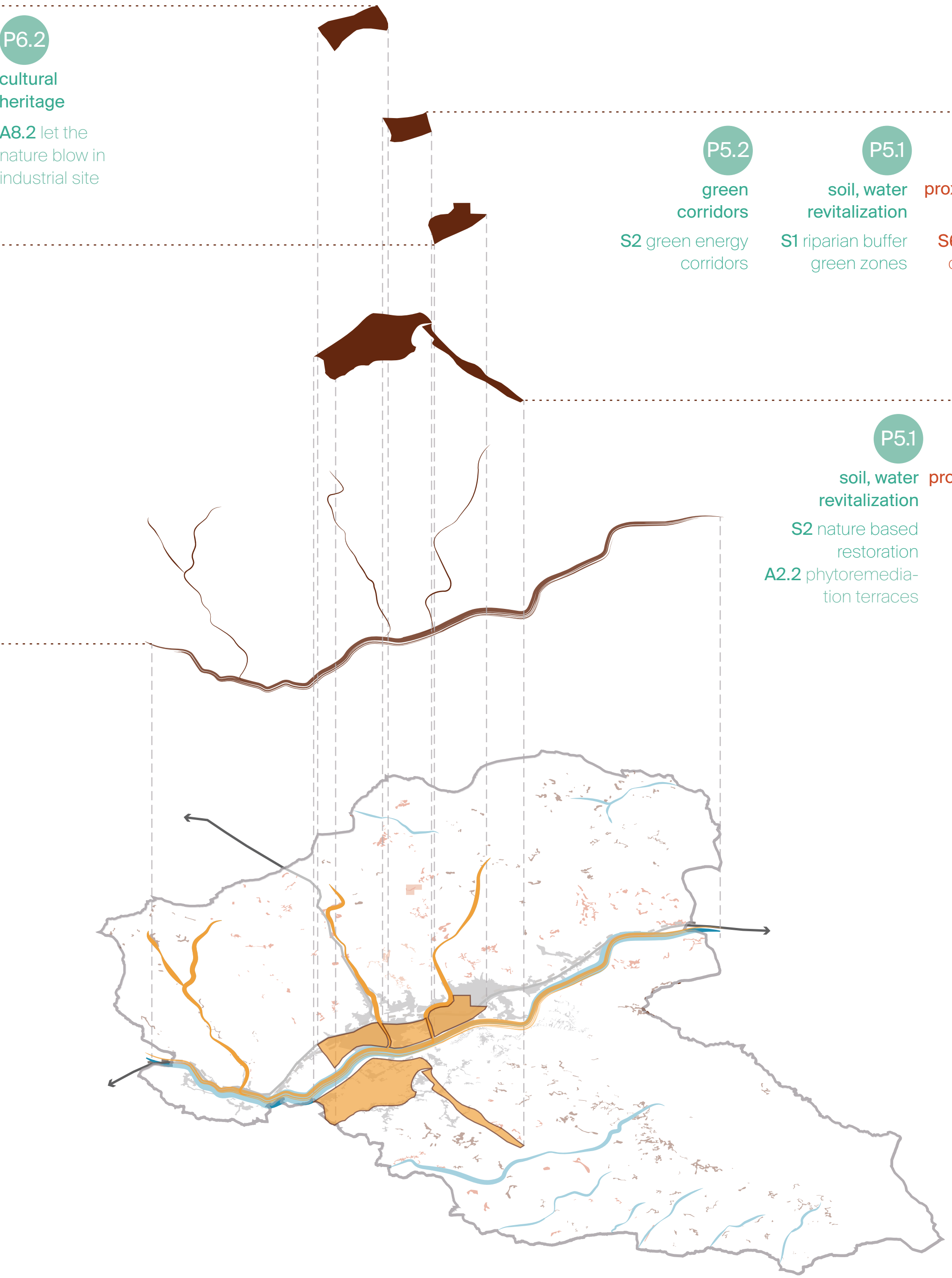
P3.2 **sharing is caring**
S3 energize the public spaces
A3.1 energy parks open to public

P6.1 **climate responsive**
S5 urban greening
A5.1 green roofs and streets

conflict 1

P1.1 **maximize clean energy**
A2.1 water for heating

P5.2 **green corridors**
S4 blue-green corridor



conflict 4

P5.2 **green corridors**
S2 green energy corridors

P5.1 **soil, water revitalization**
S1 riparian buffer green zones

P4.1 **proximity to energy sources**
S6 fair distribution of clean sources
A6.1 prioritize marginalized community

P1.1 **maximize clean energy**
S1 centralized energy
A1.1 private solar energy parks

P1.2 **localize energy production**
S4 energize the open spaces
A4.2 produce on my courtyard

conflict 2

P5.1 **soil, water revitalization**
S2 nature based restoration
A2.2 phytoremedia-tion terraces

P4.1 **proximity to energy sources**
S5 local sources for local people
A5.2 community solar production

P1.1 **maximize clean energy**
S1 centralized energy
A1.1 private solar energy parks

P1.2 **localize energy production**
S4 energize the open spaces
A4.1 solar agricultural land

figure 90: diagram of individual conflicting zones

[B] vision statement

A new energy-space nexus is established during the energy transition process in the Elbasan region. This nexus leverages the region's context-specific potentials while ensuring energy security for both rural and urban areas, enhancing energy equity by bringing clean energy sources closer to people, improving environmental quality through green-energy initiatives, and, most importantly, preserving the local identity. This approach addresses climate change mitigation and adaptation by converging all these pillars for vision of Elbasan region in 2050.

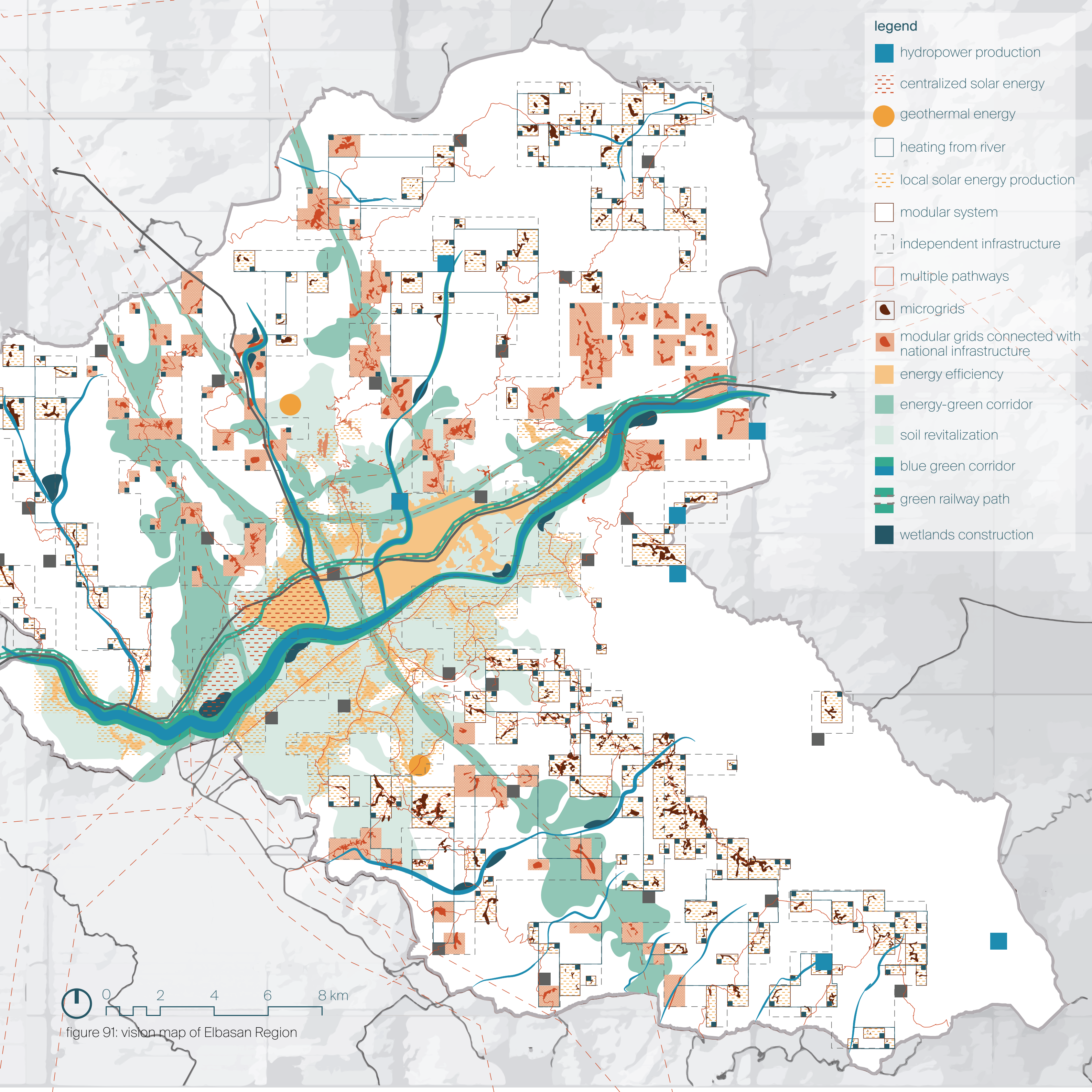


figure 91: vision map of Elbasan Region

[C] stakeholders strategy

Figure 92 illustrates the crucial steps required in stakeholder management for achieving a sustainable energy transition prioritizing security, equality, and environmental sensitivity. Following the conclusion of the current stakeholder analysis, four main steps have been identified.

Firstly, collaborating with stakeholders identified as 'friends' and 'sleeping giants' to explore the energy-space nexus of energy transition, along with its social and environmental impacts, is essential.

Secondly, increasing awareness across all three scales is paramount, ensuring stakeholders understand the importance of considering the energy-space nexus in their policies and strategies.

Thirdly, involving stakeholders identified with low power and low interest, such as the 'trip wire' and empowering 'acquaintances,' is crucial for facilitating the process. Listening to their needs and involving them in decision-making processes is vital. Also it is crucial to empower this stakeholders. They should have opportunities to participate in decision-making processes and benefit equally from the transition, potentially initiating their own energy projects or structures.

Lastly, providing consultancy and capacity building, leveraging the potential and opportunities offered by EU, UNDP, and other international organizations. This step should also focus on attracting local expertise in energy transition who understand the local context, collaborating with international experts to tailor the transition to the specific context while aligning with EU goals.

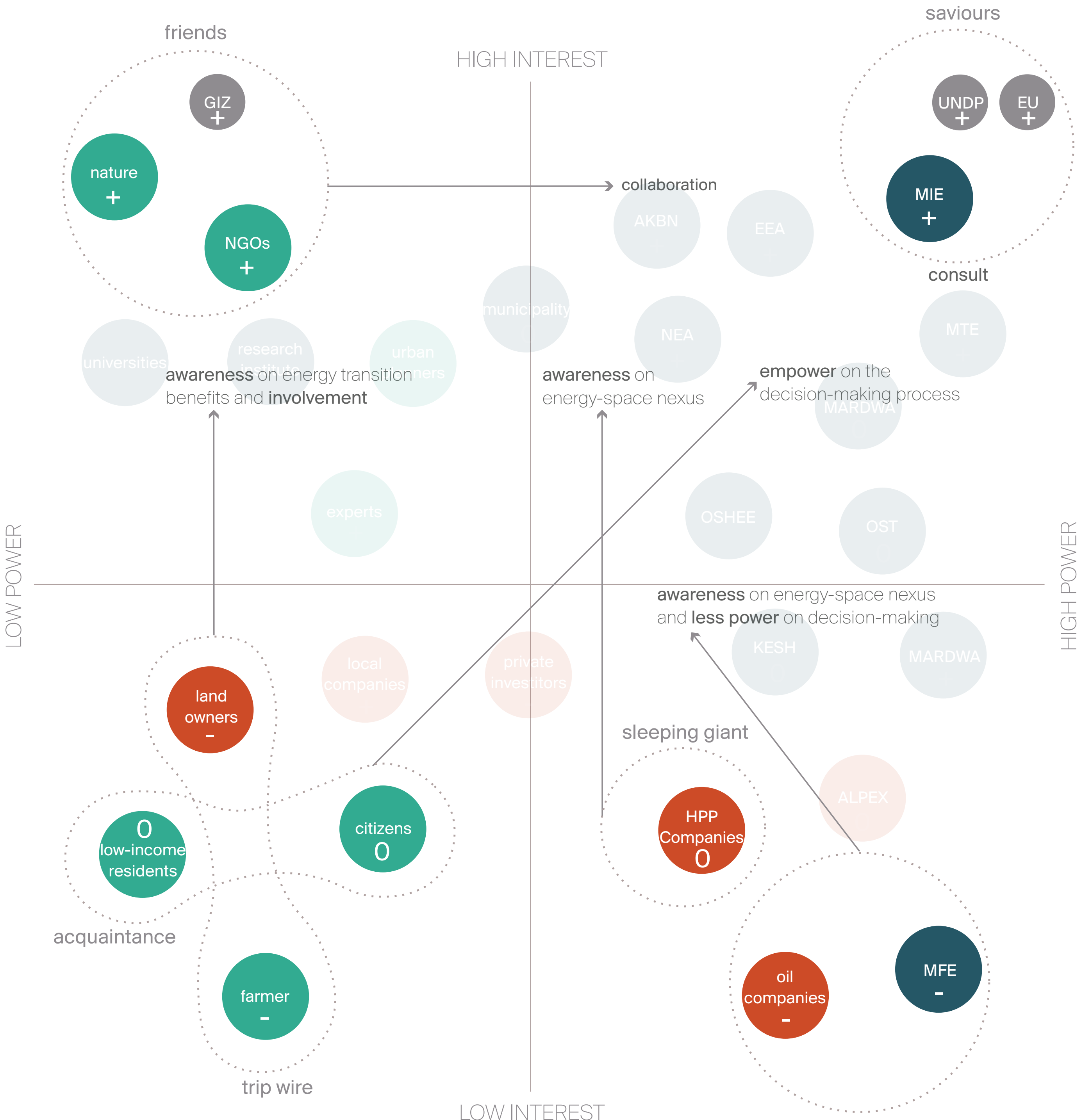


figure 92: power-interest-attitudes diagram proposal

AWARENESS

It is crucial to educate stakeholders at all levels about the concept of the energy-space nexus and the importance of a sustainable energy transition. Utilizing the expertise of organizations such as the EU, UNDP, and GIZ is the initial step at the macro scale. Subsequently, it is important to involve stakeholders at the meso and micro levels to raise awareness about the significance of energy transition and its benefits, including key stakeholders like landowners and farmers, referred to as ‘trip wire’ stakeholders. Particular attention should be given to ‘time bomb’ stakeholders, such as oil companies and the Ministry of Finance and Economy (MFE), to increase their awareness on energy-space nexus and encourage them to share decision-making power with other public and civic stakeholders to limit conflicts. Efforts should also be made to build trust with neutral stakeholders and bring them on board

INVOLVE and EMPOWER

Involving ‘trip wires’ and empowering ‘acquaintance’ stakeholders in the energy transition process allows us to identify their needs and perspectives, enhancing the success and inclusivity of the project. This step can be facilitated through workshops organized in various neighborhoods across the city, where stakeholders can be presented with proposals for the new energy-space nexus and evaluate them based on their specific needs having a power on decision-making of the area they live in. As ‘trip wires’ have the potential to impede progress, they can be involved in the design proposal process too, ensuring that the project aligns with their nneds and minimize thsi way resistance. We can create structured dialogue platform for empowered stakeholders, such as citizens and low-income families to voice their opinions, share knowledge, and contribute to the development of inclusive energy transition.

COLLABORATE

Collaboration is an important step in the stakeholders strategy as it enables the proposal of an inclusive project where everyone contributes their perspectives and knowledge. In this phase, it is important to emphasize collaboration with stakeholders acknowledged as 'friends' as they bring valuable international expertise relevant to sustainable transitions together with local experts and research institutes. We can conduct focused working groups or roundtable discussions with them to harness insights in refining project proposals to attract more funds and implementation strategies for sucessful outcomes. Developing targeted outreach campaigns or joint initiatives with the 'sleeping giant' actor to mobilize resources and support for the energy transition project, thereby leveraging their influence for broader impact is a step towards this collaboration.

CONSULT

Due to the lack of capacity and expertise in sustainable transition projects within this context, consultancy becomes a crucial step following the creation of awareness among stakeholders. This strategy involves engaging public institutions such as the local municipality as well as private stakeholders like investors. During this phase, it is imperative to enlist expertise from organizations such as the EU, UNDP, and GIZ, as well as from local research institutes, universities, and urban planners. By bringing together knowledge, a comprehensive and context-specific plan can be developed to facilitate funding for private investors, citizens, and local municipalities.

iii. strategic plan

Conflict 1
The open land between the river and industrial buildings is conflicted between becoming a centralized private solar energy park, a community solar energy area open to the public, or a green area that prioritize restoring the soil and water from pollution and emphasis ecological value.

S1. centralized energy
A1.1 private solar energy park
S3. energize the public space,
A3.1 energy parks open to public
S5. local sources for local people,
A5.2 community solar production
S1. riparian buffer green zones,
A1.1 multi-layered buffer area
S3. green-energy corridors
A3.2 ecological network

Conflict 2
This area is conflicted between becoming a centralized energy production site, featuring private solar roofs and shared public rooftop energy spaces, or being greened with nature-based solutions while maintaining its industrial identity.

S1. centralized energy
A1.2 energize the industrial site
S3. energize the rooftops
A3.2 my own solar roof
S3. energize the public spaces
A3.2 share public rooftops energy
S2. nature-based restoration
A2.1 soil amendments
S5. urban greening
A5.1 green roofs and streets
S8. landmarks for identity preservation
A8.2 let the nature blow in industrial area

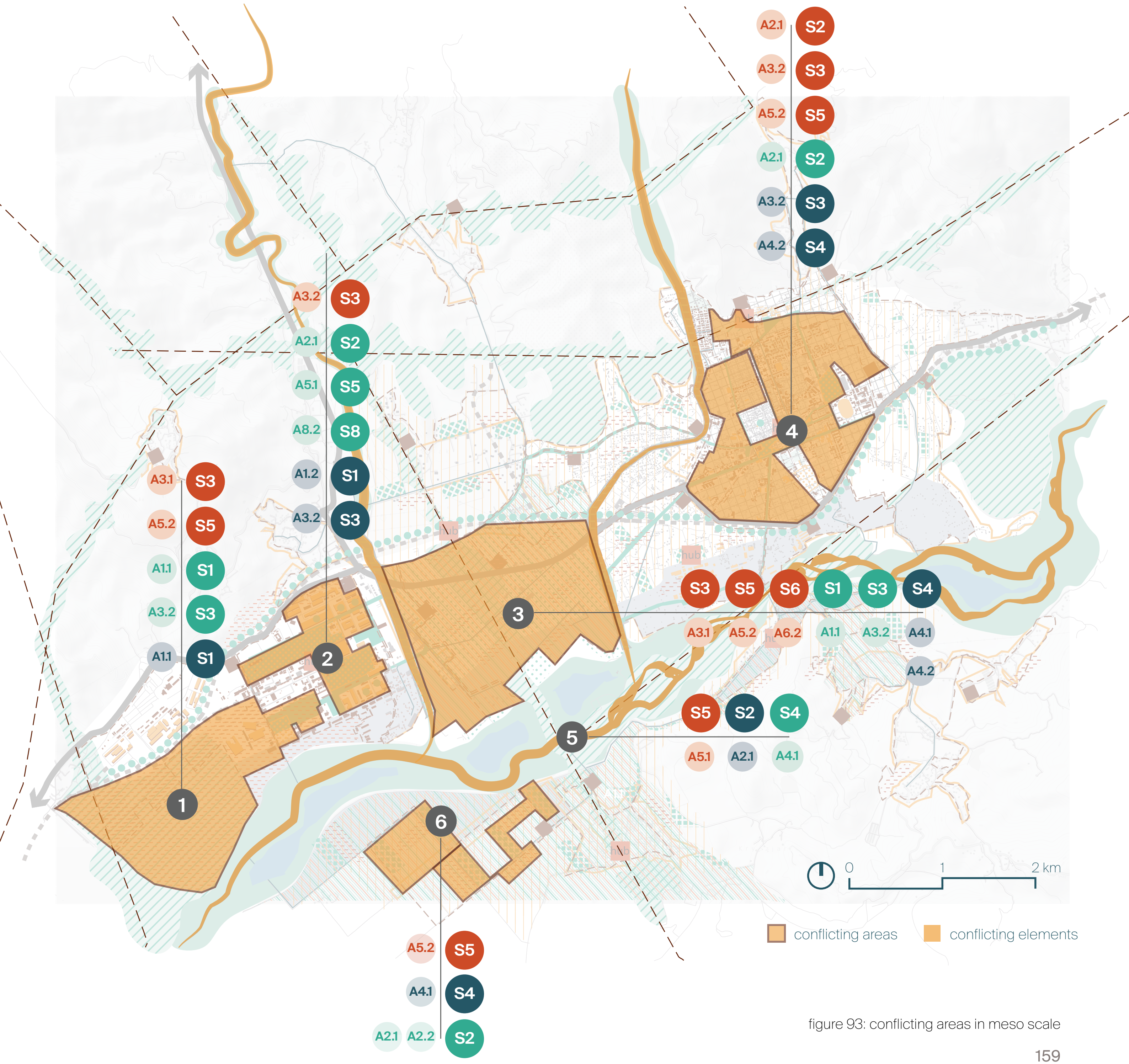


figure 93: conflicting areas in meso scale

Conflict 3

This space can be transformed into a community solar production area prioritizing equity by sharing the surplus of private investments or creating shared public rooftops under the clean energy subsidies policy. Alternatively, it is envisioned as the green heart of the city, where a green energy corridor crosses through a wildlife forest .

S4. surplus of private investitors
S3. energize the public spaces
A3.1 share public rooftops energy
S5. local sources for local people
A5.2 community solar production
S6. fair distribution of clean sources
A6.2 two in one for vulnerable communities
S1. riparian buffer green zones,
A1.1 multi-layered buffer area
S3. green-energy corridors
A3.2 ecological network

Conflict 4

The high-density residential space faces conflicts over how to use the flat rooftops and open public spaces in the city. The options include private solar energy production spots, shared solar rooftops, or green rooftops. A similar debate exists for public spaces and streets.

S3. energize the rooftops
A3.2 my own solar roof
S4. energize the open space
A4.2 produce on my courtyard
S2 energy community hubs
A2.1 shared solar parks
S3. energize the public spaces
A3.2 share public rooftops energy
S5. local sources for local people
A5.2 community solar production
S2. nature-based restoration
A2.1 soil amendments

Conflict 5

This conflict arises because the usage of water bodies in the city is envisioned differently in various scenarios. In energy security and energy equity scenarios, river water is used for heating to benefit local residents. In the environmental qualities scenario, the water bodies are transformed into a blue-green corridor with recreational and ecological facilities.

S2. activate local sources
A2.1 water for heating
S5 local sources for local people
A5.1 water for heating
S4. blue-green corridor
A4.1 recreational with ecological facilities

Conflict 6

This area is conflicted between using the space for energy production by combining existing privatized agricultural lands with solar panels, creating community solar production areas surrounded by private agricultural lands, or envisioning it solely as a green space with soil amendments and phytoremediation terraces to reduce soil pollution.

S4. energize the open space
A4.1 solar agricultural land
S5. local sources for local people
A5.2 community solar production
S2. nature-based restoration
A2.1 soil amendments
A2.2 phytoremediation terraces

[A] new patterns of conflicting areas

In the Optimization phase, each conflicting area must compromise by prioritizing patterns based on the potentials and limitations of each space to resolve conflicts. This will establish new patterns defining the energy-space nexus in these areas (Figure 94).

Conflict 1: Resolved by creating an ecological solar park where solar production is owned by a centralized company, and the ecological park is open to the public, maintaining harmony between solar energy production and nature.

Conflict 2: Resolved by energizing reconstructed industrial buildings into a centralized energy hub. Abandoned buildings retain their identity as nature reclaims them. Open spaces are used by the centralized energy company for solar production but are also accessible to the public as solar parks for recreational and educational purposes.

Conflict 3: Resolved by creating a symbiotic landscape featuring community solar gardens, a green-energy corridor, blue-green corridors on the edges, and a park of native trees acting as the green heart of the city.

Conflict 4: Resolved by allocating space in high-density areas for both green roofs and solar energy production, as well as green public spaces that also generate solar energy, creating a new pattern called 'productive rooftops and solar public spaces.'

Conflict 5: Resolved by prioritizing environmental qualities due to high pollution and lack of biodiversity. A blue-green corridor is established, connecting the residential and industrial areas with a healthy synergy.

Conflict 6: Resolved by creating a new pattern where agricultural land coexists harmoniously with solar production and natural soil restoration, named ágrivoltaic restoring landscape'.

Each of this patterns is explained in dtail the int Pattern Book that is attached to this report. Below is an example of the first two patterns on how they are constructed and what is the spatial consequences they are aiming for

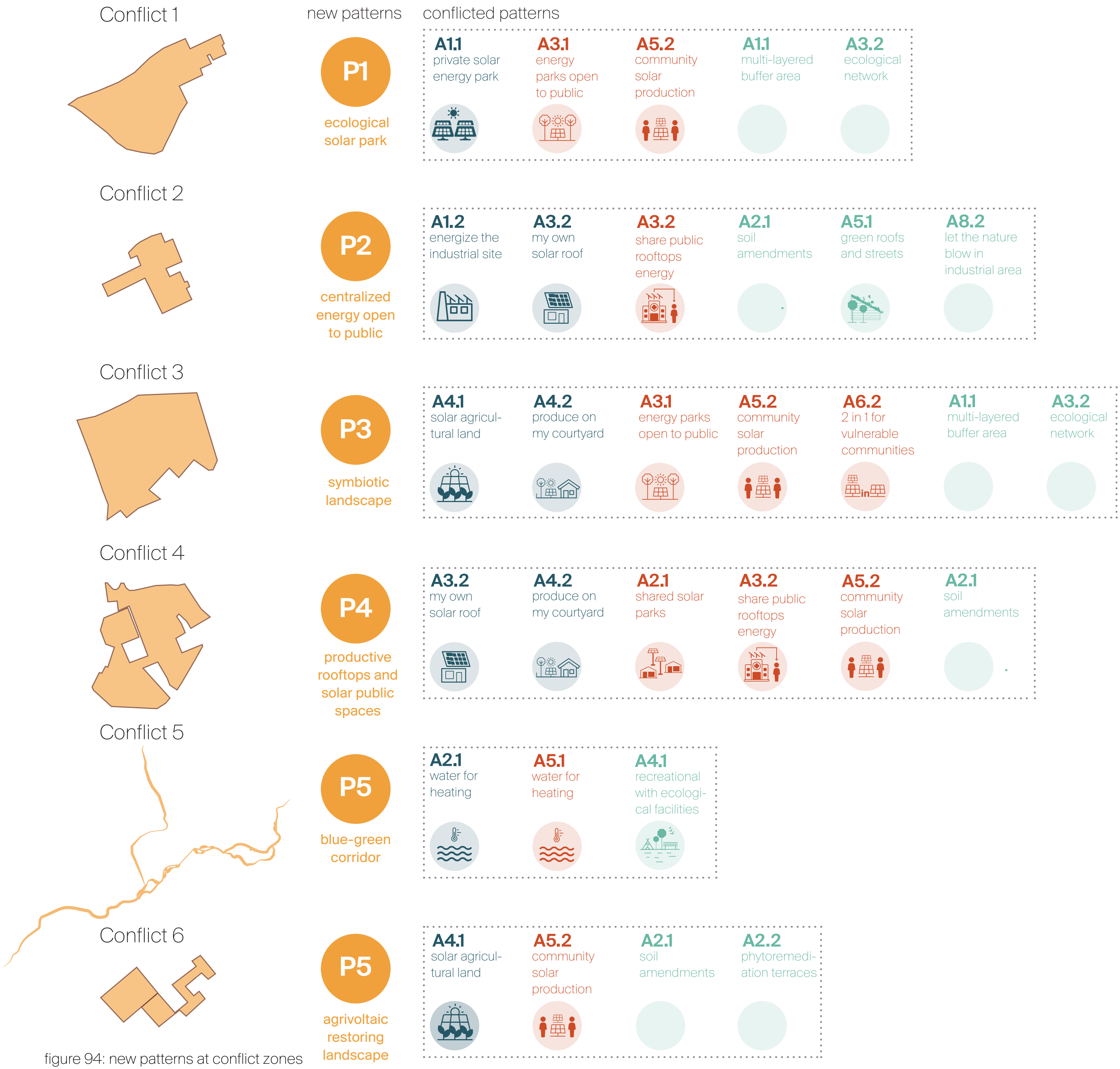
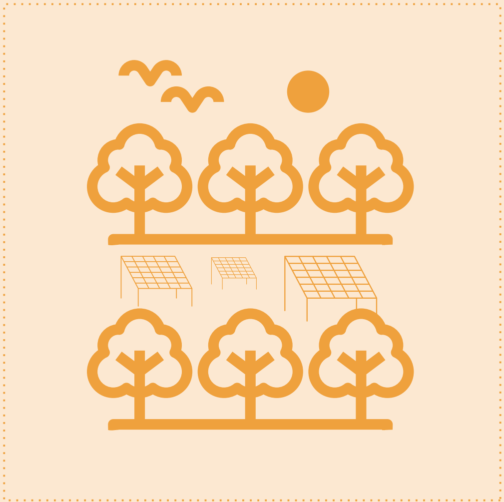


figure 94: new patterns at conflict zones

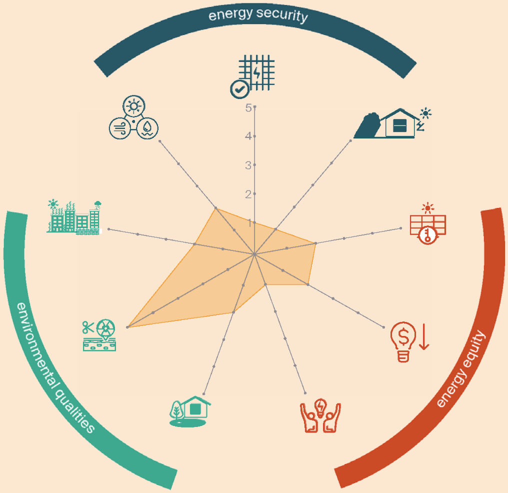
P1 ecological solar parks

building neighborhood city regional



hypothesis

Solar panels integrated into parks do not disrupt ecological values of these natural landscapes and provide clean energy production.



theoretical back-up

To create a more sustainable energy system, it's crucial to combine various renewable energy sources and integrate them into multifunctional infrastructure that serves tourism, energy, economy, and ecology, improving both aesthetics and spatial qualities (FABRICations, 2019). This approach contributes also on localizing clean energy production close to recreational spaces and cities. The citizens will not just have access to a park with ecological values and biodiversity booming, but also to clean energy and production sites.

sources:
FABRICations. (2019). FABRICations draws a framework for energy landscapes of the future Netherlands. design tree | architecture & design magazine . https://www.designboom.com/architecture/fabrications-framework-energy-landscapes-future-netherlands-02-08-2019/

practical implications

According to FABRICations, there is a need to think of solar panels in a more creative way and use this element not just as a energy source, but also as a design element. For instance, organic PV panels can enhance the dunes landscape by reflecting sunlight in different directions, leveraging light refraction to enrich the natural ambiance of the local environment (FABRICations, 2019).

Eco-park by FABRICations, 2019

P2 centralized energy open to public

building neighborhood city regional

theoretical back-up

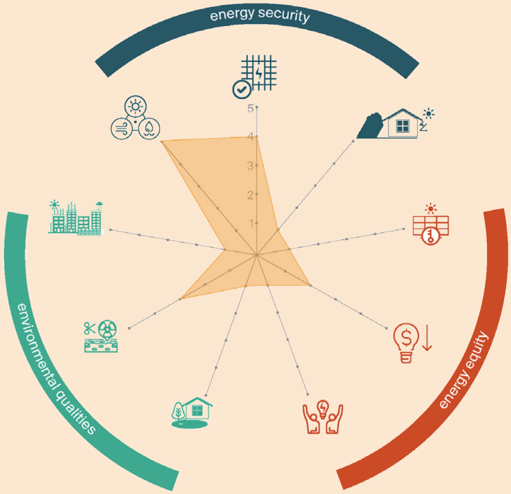
Copenhagen's CopenHill Energy Plant, which converts waste to energy, is a successful project. It helps the city reach its goal of being carbon-neutral by 2050 and also offers a recreational center for urban residents (Pintos, 2022). This project has turned an industrial site into a new landmark where people can engage in leisure activities (Pintos, 2022). Although concerns exist about noise and aesthetic impacts affecting the recreational areas, the design can prioritize habitat restoration to support recreational use (Public Service Commission of Wisconsin, n.d.). Transforming the rooftops of power plants into public spaces enhances both the quality of these areas and the overall environment.

sources:
Pintos, P. (2022). CopenHill Energy Plant and Urban Recreation Center / BIG. Arch Daily https://www.archdaily.com/925970/copenhill-energy-plant-and-urban-recreation-center-big

Public Service Commission of Wisconsin (n.d.). Environmental Impacts of Power Plants. Public Service Commission of Wisconsin

hypothesis

Designing centralized solar energy production areas as a public space for the residents increases the environmental qualities of the city and this energy scape specifically.

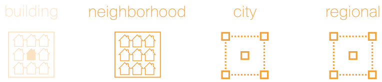


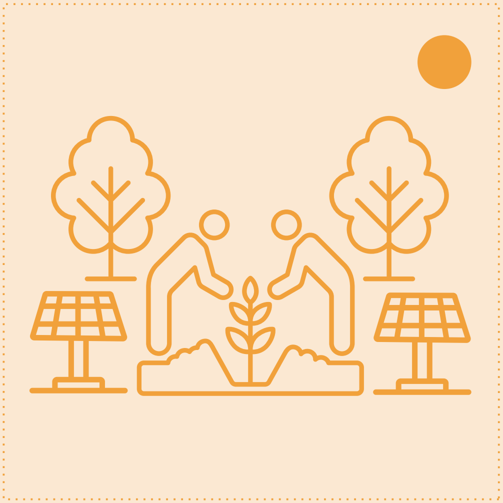
practical implications

It is crucial to think of how can you use the rooftop of the power plants to be accessible by everyone. It can also be designed for a specific target group or recreational activity. Also the facade of the building should 'hide' the industrial processes and make this landmark more attractive and welcoming for people.

CopenHill Energy Plant, Copenhagen

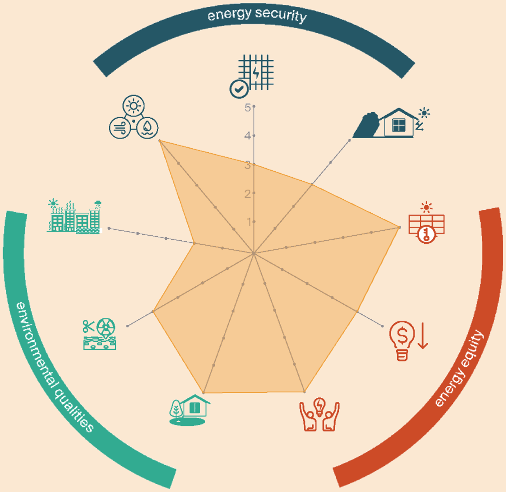
P3 symbiotic landscape





hypothesis

Providing structures for the marginalized community to have their own solar green garden increases energy equity and environmental qualities.



theoretical back-up

A recent study by researchers at Lawrence Berkeley National Laboratory (LBNL) highlights community solar gardens as a significant intervention for promoting energy equity (O'Shaughnessy et al., 2024). These gardens provide direct access to clean energy for people living in multi-family housing, those who cannot afford their own solar panels, and residents whose roofs are unsuitable for solar installation (O'Shaughnessy et al., 2024). By eliminating initial financial barriers, community solar gardens enable broader participation in clean energy.
The study also reveals that there are already existing supportive policies that have enhanced these access benefits, particularly those aimed at assisting low-income households and marginalized communities (O'Shaughnessy et al., 2024). Statistical analysis shows that these policy supports account for about two-thirds of the differences in income levels between community and rooftop solar adopters, approximately 40% of the differences in renter rates, and around 20% of the differences related to multifamily housing (O'Shaughnessy et al., 2024).

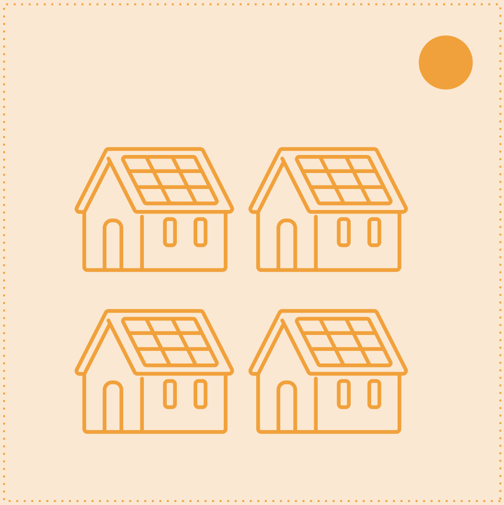
sources:
O'Shaughnessy E., Galen L. B., Sudha K., Jenny S. (2024). Evaluating community solar as a measure to promote equitable clean energy access. Nature Energy.

practical implications

The solar panels should be managed and owned by the community, while being implemented with using subsidies and funding from local and national stakeholders. It should focus on marginalized communities neighborhoods and multifamily housing areas, in order to avoid the financial barrier and ownership if the land issues.

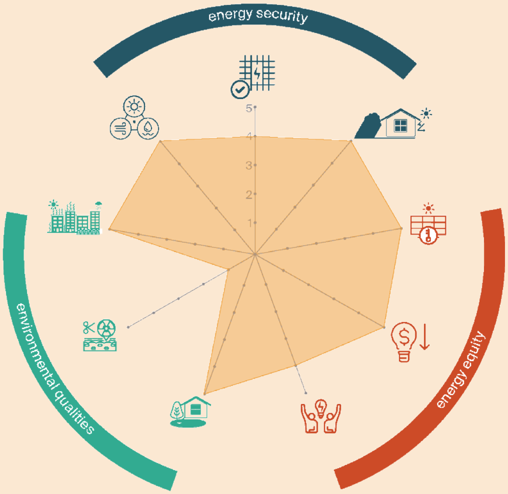
Derbyshire Community Garden (Photo by Embry-Riddle/Bernard Wilchusky)

P4 productive rooftops



hypothesis

Using the rooftop for solar energy production and greenery gives people direct access to clean energy and reduces the risk of high urban island effect in the densified areas.



theoretical back-up

The distribution of wind and solar energy potential areas are not homogenously distributed in the whole region, leading to unequal distribution of the these renewable sources (Rhoden et al, 2021). Thus, centralizing the energy production only in specific sites creates social conflicts and inequalities (Rhoden et al, 2021). In order to meet the future energy demands, minimize environmental impact and provide energy security to everyone, it is important to localize the renewable energy sources (Li, 2005). Using the rooftops to produce solar energy is one of the actions that gives direct clean energy access to people. And at the same time, these rooftops can be integrated with greenery to maximize the benefits of flat roofs in terms of reducing temperature and capturing rainwater.

sources:

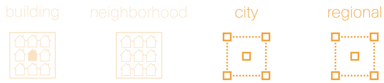
Rhoden, I., Vögele, S., Ball, C., Kuckshinrichs, W., Simon, S., Mengis, N., Baetcke, L., Yeates, C., Steuri, B., Manske, D., & Thrän, D. (2021). Spatial heterogeneity – Challenge and opportunity for net-zero Germany. Helmholtz Climate Initiative.

Li, X. (2005). Diversification and localization of energy systems for sustainable development and energy security. Energy Policy, 33(17), 2237-2243. https://doi.org/10.1016/j.enpol.2004.05.002.

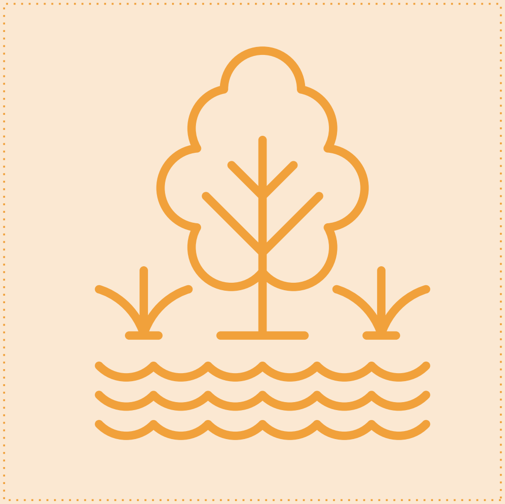
practical implications

Before implementing the solar pannels integrated with plants, there is a need to assess sunlight, shading, and orientation factors of the roof. Then, an energy audit should be conducted to determine energy needs and the sizing of the system that needs to be constructed. After installing the system, it should be connected to the existing grid and set up a maintenance schedule to track and maintain system performance.

“Biosolar” roof by Vegetek, France (Puthod, 2024)

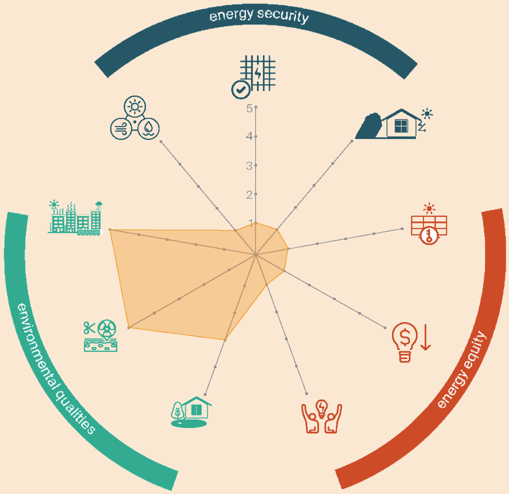


P5 blue-green corridor



hypothesis

Transforming the river into a blue-green corridor will increase ecological values, biodiversity and protect from flooding in extreme weather conditions.



theoretical back-up

The European Commision defines blue-green infrastructure as "a strategically planned network of natural and semi-natural areas with other environmental features designed and managed to deliver a wide range of ecosystem services. It incorporates green spaces (or blue if aquatic ecosystems are concerned) and other physical features in terrestrial (including coastal) and marine areas. On land, green infrastructure is present in rural and urban settings." (European Commission, 2013). At the same time, this infrastructure is defined by Ghofrani as "an interconnected network of natural and designed landscape components, including water bodies and green and open spaces, which provide multiple functions such as: (i) flood control, (ii) water storage for irrigation and industry use, (iii) wetland areas for wildlife habitat or water purification, among many others." (Ghofrani, 2016). Thus, blue-green corridor does not contribute only to the environmental qualities, but also to climate change.

sources:
European Commission. Green Infrastructure (GI)—Enhancing Europe's Natural Capital; European Commission: Brussels, Belgium, 2013.

Ghofrani, Z.; Sposito, V.; Faggian, R. Designing resilient regions by applying blue-green infrastructure concepts. Wit Trans. Ecol. Environ. 2016, 204, 493–505.

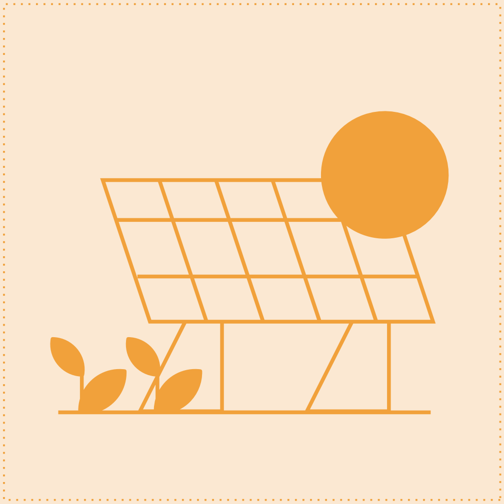
practical implications

The edges of the river should be soften with local plants and the river should become accessible by the locals. There can be a path along the river bank for pedestrians and cyclist. Some parts can be used as flooding areas, by constructing wetlands which also contribute in reducing CO2 emissions.

Public Space Merwede in Utrecht, NL (LOLA, 2023)

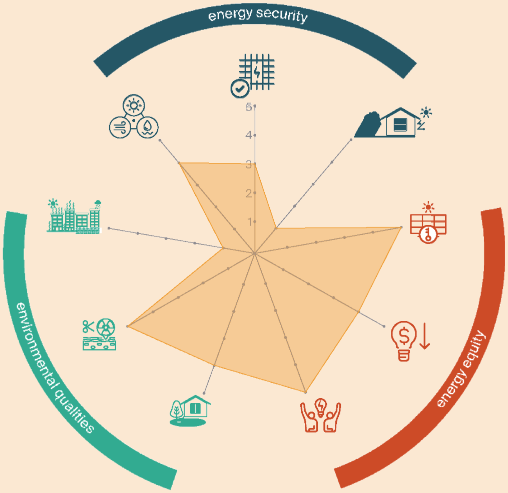
P6 agrivoltaic restoring landscape

building neighborhood city regional



hypothesis

Elevated solar panels integrated with trees that remove heavy metals from the soil in agricultural lands contribute to healthier soil and food for locals, while also producing clean energy.



theoretical back-up

One of the first definitions of agrivoltaic (APV) system was defined in 1982 by Goetzberger and Zastrow, whom describe this system as one that involves placing solar panels above areas where crops are cultivated, allowing crops to grow underneath (Goetzberger & Zastrow, 1982). For optimal crop growth, it's essential to minimize shaded areas so the solar panels need to be careful adjusted in specific distances and angles to ensure that the plants below receive sufficient light for their growth (Hernandez et. al., 2019). This approach not only provides a supplementary income stream for farmers through agricultural activities and solar energy production but also addresses environmental challenges.

sources:
GOETZBERGER, A., & ZASTROW, A. (1982). On the Coexistence of Solar-Energy Conversion and Plant Cultivation. International Journal of Solar Energy, 1(1), 55–69. https://doi.org/10.1080/01425918208909875

Hernandez, R. R., Armstrong, A., Burney, J., Ryan, G., Moore-O'Leary, K., Diédhiou, I., ... & Kammen, D. M. (2019). Techno-ecological synergies of solar energy for global sustainability. Nature Sustainability, 2(7), 560-568.

practical implications

Solar panels should be elevated above agricultural lands to allow sunlight to pass through. Specific plants that benefit from the heat generated by the solar panels should be grown beneath them to maximize this synergy. Agricultural fields should adopt mixed farming practices and include trees that clean the soil from pollutants. These trees should be planted at a distance from the solar panels to avoid shading that could interfere with energy production.

Solar farm in Kenya. Photo is by Chloride Exide

[B] strategy decomposition

The projected rise in temperatures for Elbasan in the coming years, attributed to climate change, leads to the heat island effects, especially in its residential areas. The lack of building insulation and green spaces compounds this challenge. Consequently, this situation is going to escalate energy demand, posing a potential threat to the city's energy security in the future.

The strategy of **'Urban Greening and Building Insulation for Reduced Energy Demand'** aims to mitigate the urban heat island effects within existing residential areas. This approach serves as a guiding principle for future residential developments as well and residential neighborhoods in the suburban areas of Elbasan. Each block of houses should incorporate a green community courtyard in open spaces or parking areas adjacent to the residences. Additionally, streets should be lined with trees to provide shading on building facades, and green ecological corridors that are being connected with surrounding green spaces throughout the city.

This strategy introduces an energy-space nexus not focused on energy production but on energy consumption, environmental quality, and climate change mitigation.

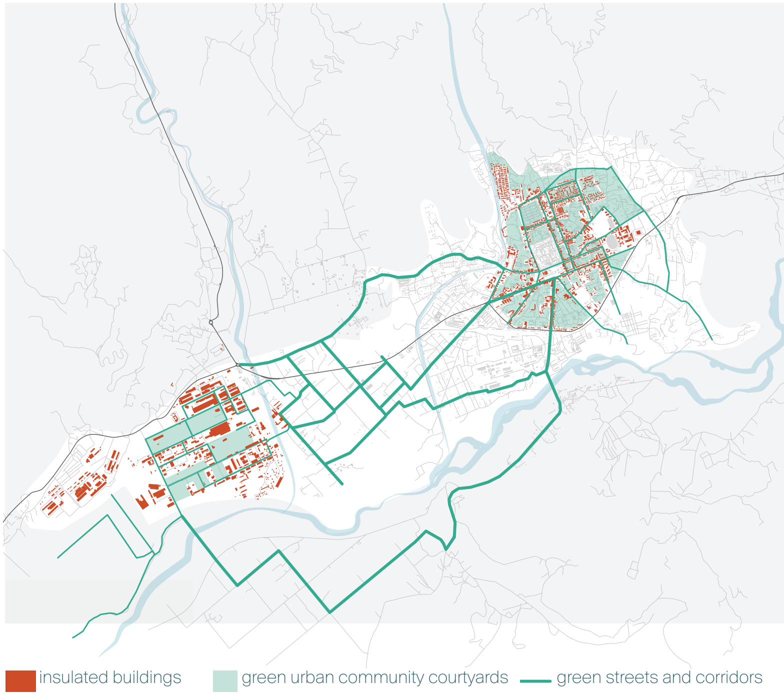


figure 95: diagram of first strategy in Elbasan city

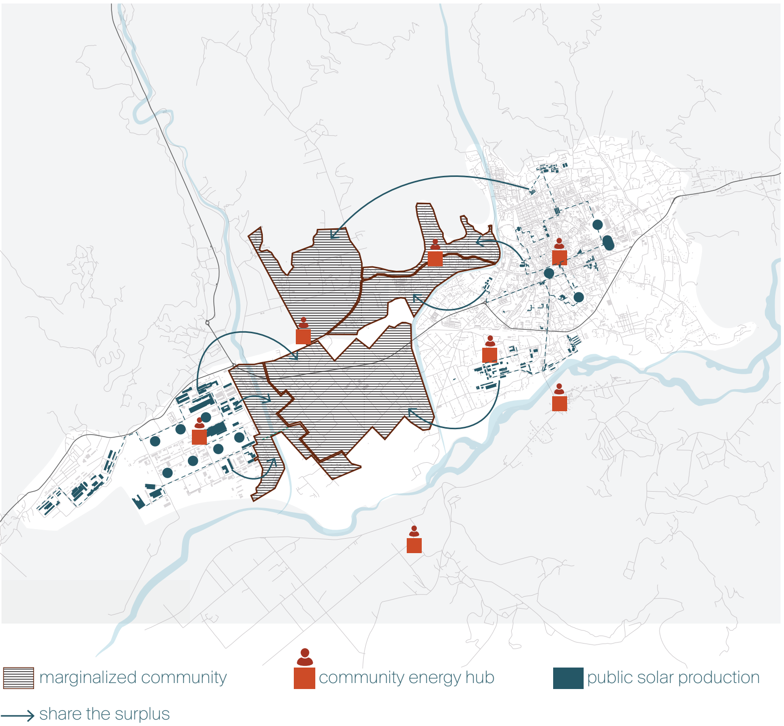


figure 96: diagram of second strategy in Elbasan city

Energy poverty, evident in Elbasan where many residents rely on wood for heating, along with energy-social segregation identified in the city, stands out as a key issue requiring attention during the energy transition for an equitable and sustainable process.

To address this challenge, the project introduces ' **Community empowerment for an inclusive energy-space nexus'** strategy for the optimization phase. It prioritizes community and social impacts of the energy transition by developing an energy-space nexus that address their basic energy needs and foster areas for community-based projects within segregated neighborhoods. Energy hubs will be constructed to introduce them to energy transition and help with energy supply or energy subsidies applications. The new energy system harnesses solar energy from public buildings, spaces, and private investments, storing it in backup systems and local storages for use by vulnerable communities.

This strategy ensures not only energy equity and security but also it enhances environmental qualities and connectivity of segregated neighborhoods with the new energy landscapes in the city.

[B] strategy decomposition

One of the primary challenges identified during the site analysis of Elbasan is the vulnerability of its current energy system to climate-related factors, compounded by the absence of an energy-space nexus in the city's existing vision plan.

To address this issue, the initial spatial strategy driving the optimization phase of the project is '**Diverse Energy-Space Landscapes within a Resilient Energy Infrastructure.**' This strategy aims to create a variety of clean energy systems throughout the city, leveraging local spatial contexts and potentials to establish a robust energy-space nexus. These systems will be developed through a climate-responsive and resilient framework incorporating microgrids, storage solutions, smart grids, and multiple pathways for energy interconnections between producers and consumers.

The new energy-spaces range from a centralized energy system in the industrial area, to community solar areas in low-density areas, agrivoltaic parks in rural agricultural lands, and local solar rooftop production in the high density area.

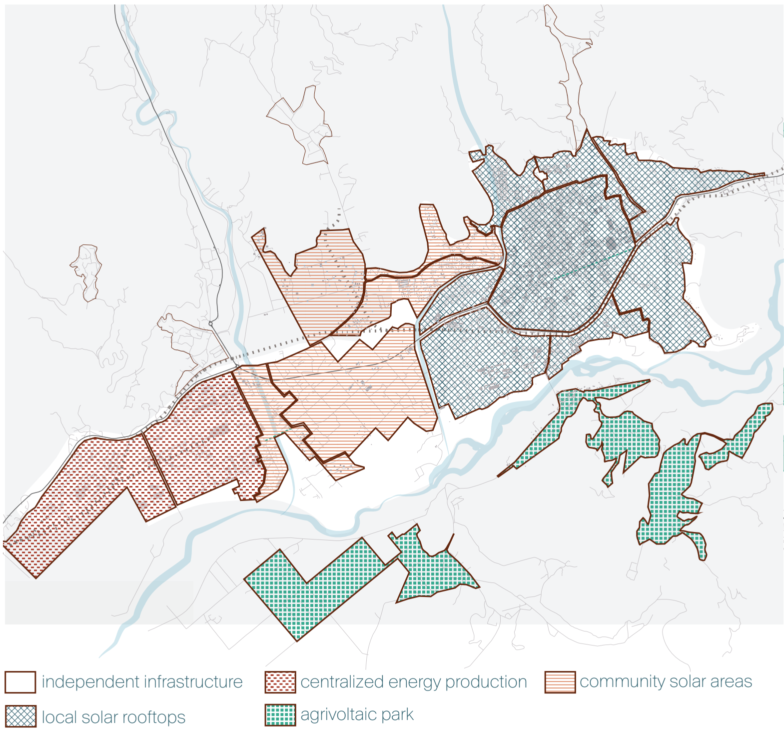


figure 97: diagram of third strategy in Elbasan city

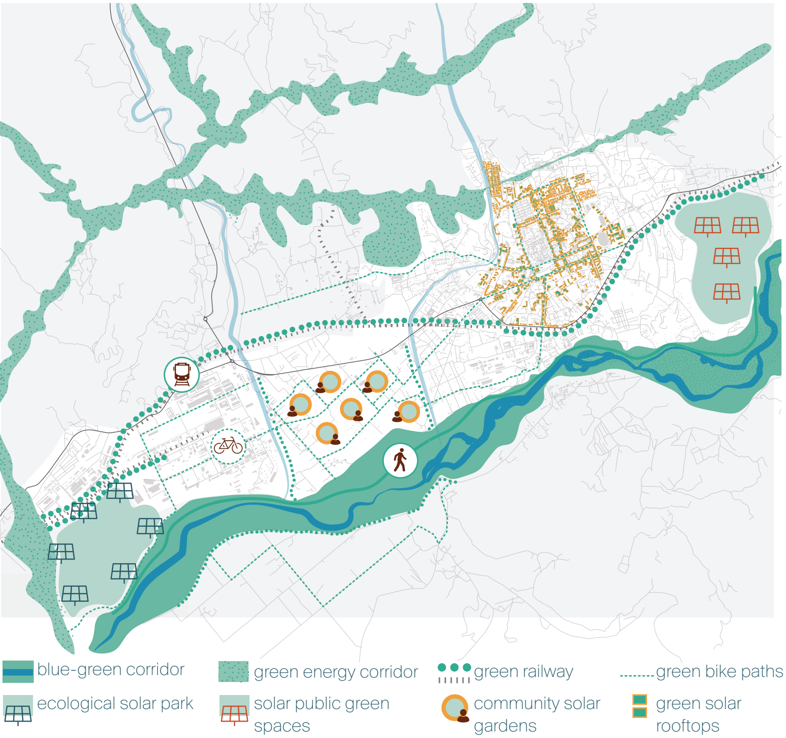


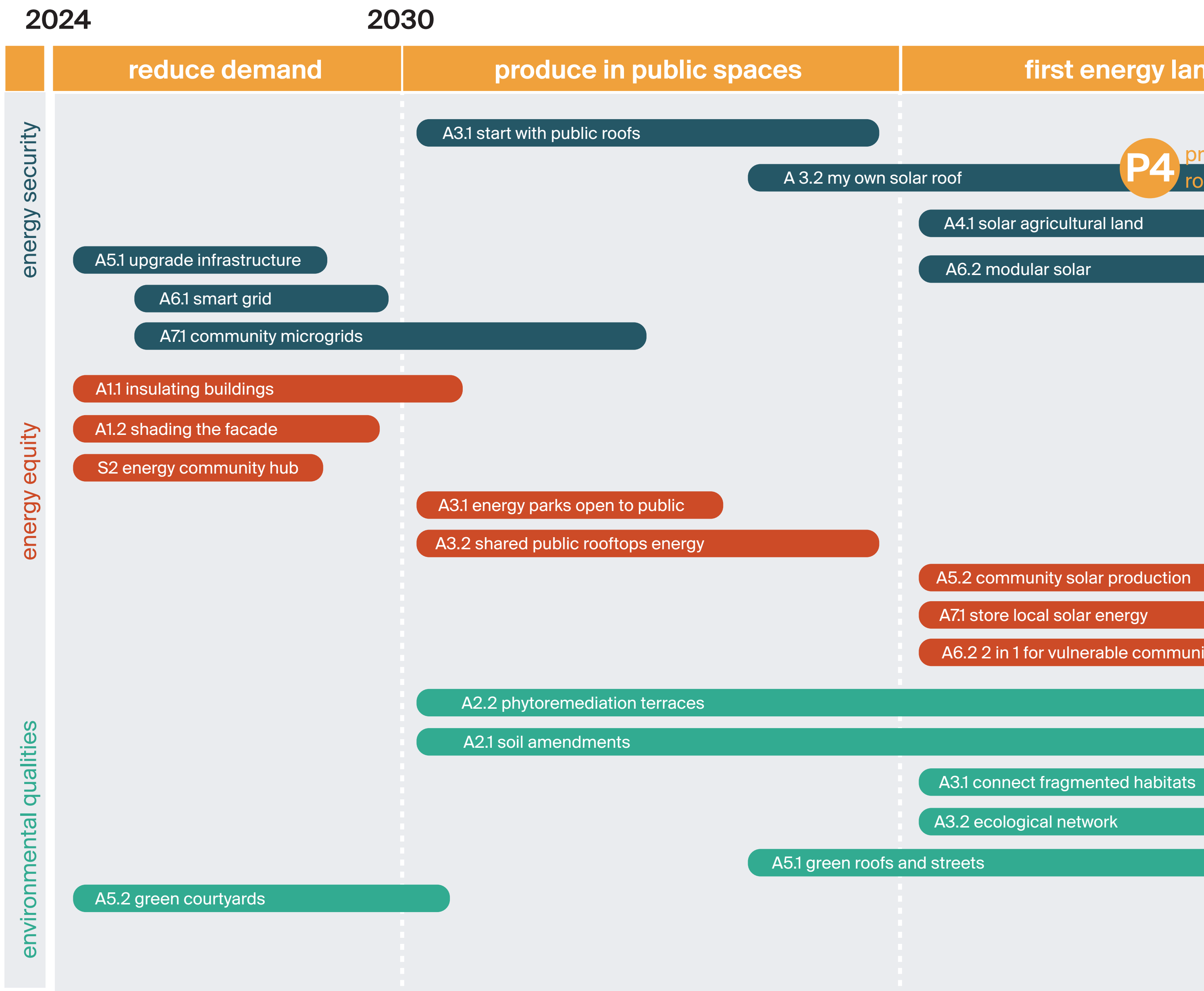
figure 98: diagram of forth strategy in Elbasan city

The significant soil and air pollution, contributing to an unhealthy environment and biodiversity loss, poses a pressing local issue for citizens. Alongside the degradation of the Communist industrial environment, which carries social and political sensitivities, another spatial strategy in the optimization phase is **'Fostering a Green Synergy in the Pattern of Production.'**

This strategy aims to enhance connectivity between residential and industrial areas by leveraging existing assets such as blue-green corridors, railway path, green streets and green-energy corridors. It aims to enhance ecological values while improving citizen access to industrial area through the design of pedestrian and bike paths within these green corridors. These paths go through local tree patches, strategically planted to clean the soil from heavy metals, decrease air pollution and to promote biodiversity.

The new strategy, aligned with solar energy production, creates diverse energy-space landscapes, including ecological solar parks, solar public green spaces, community solar gardens, and green-solar rooftops.

[C] timeline of strategy plan



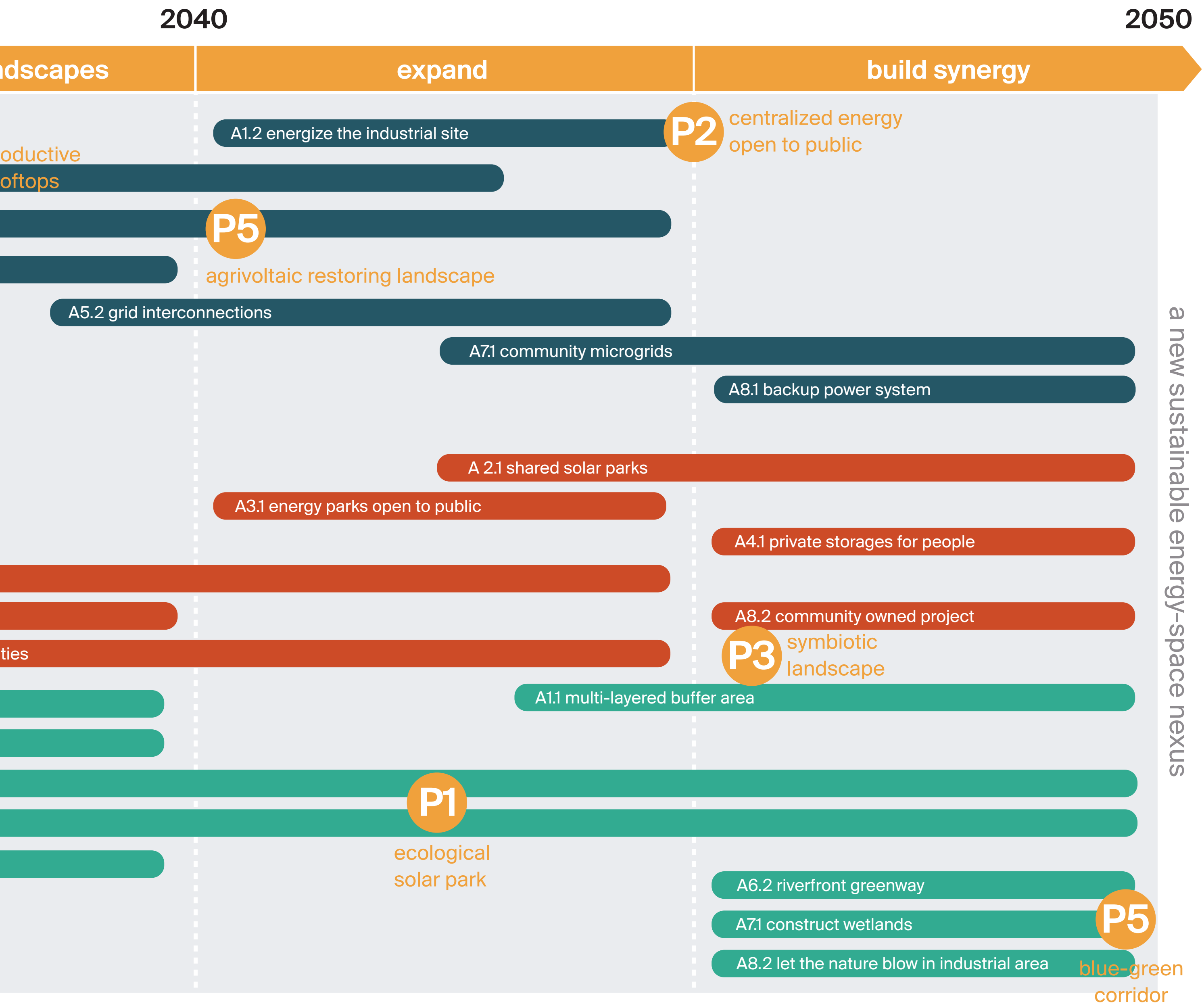


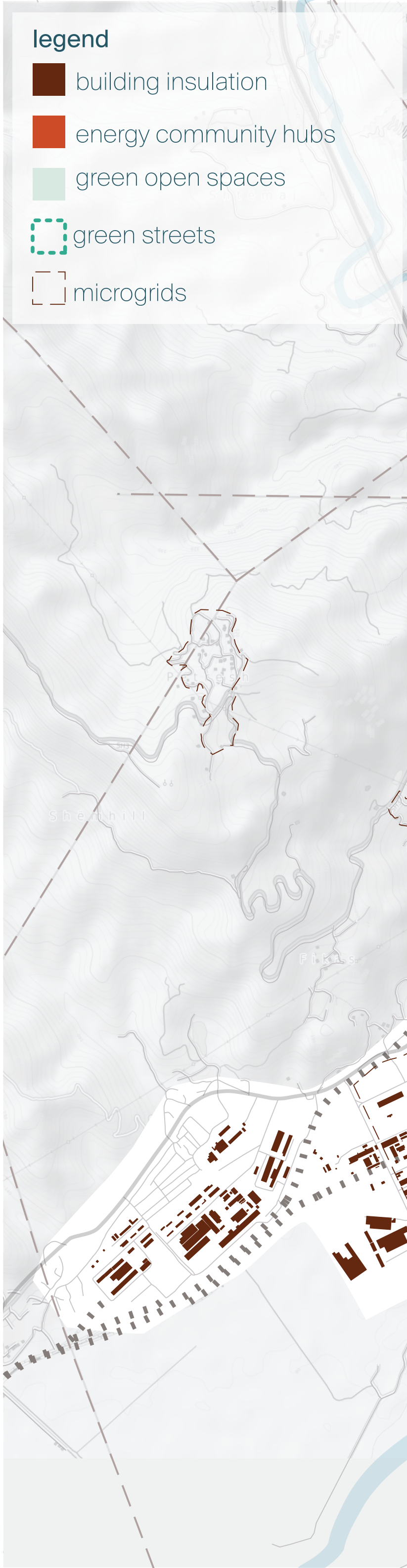
figure 99: timeline of actions in the strategic plan of Elbasan

[D] phase 1 - start with reducing demand

The first phase of the strategic plan in Elbasan city focuses on reducing energy demand in residential and industrial areas. This step aims to increase awareness among local residents and stakeholders about the importance and benefits of energy transition. Energy hubs will be established in various neighborhoods to inform locals about subsidies and other funding options for investing in sustainable energy solutions for their homes or businesses.

Additionally, the energy grid will undergo modernization, incorporating high technology to reduce energy losses in transmission lines. Independent energy structures will be created in different neighborhoods, acting as the primary microgrids of the city.

This phase includes several actions such as installing prefabricated building insulation, greening the spaces between Communist-era blocks, and planting trees along streets to provide shade for building facades.



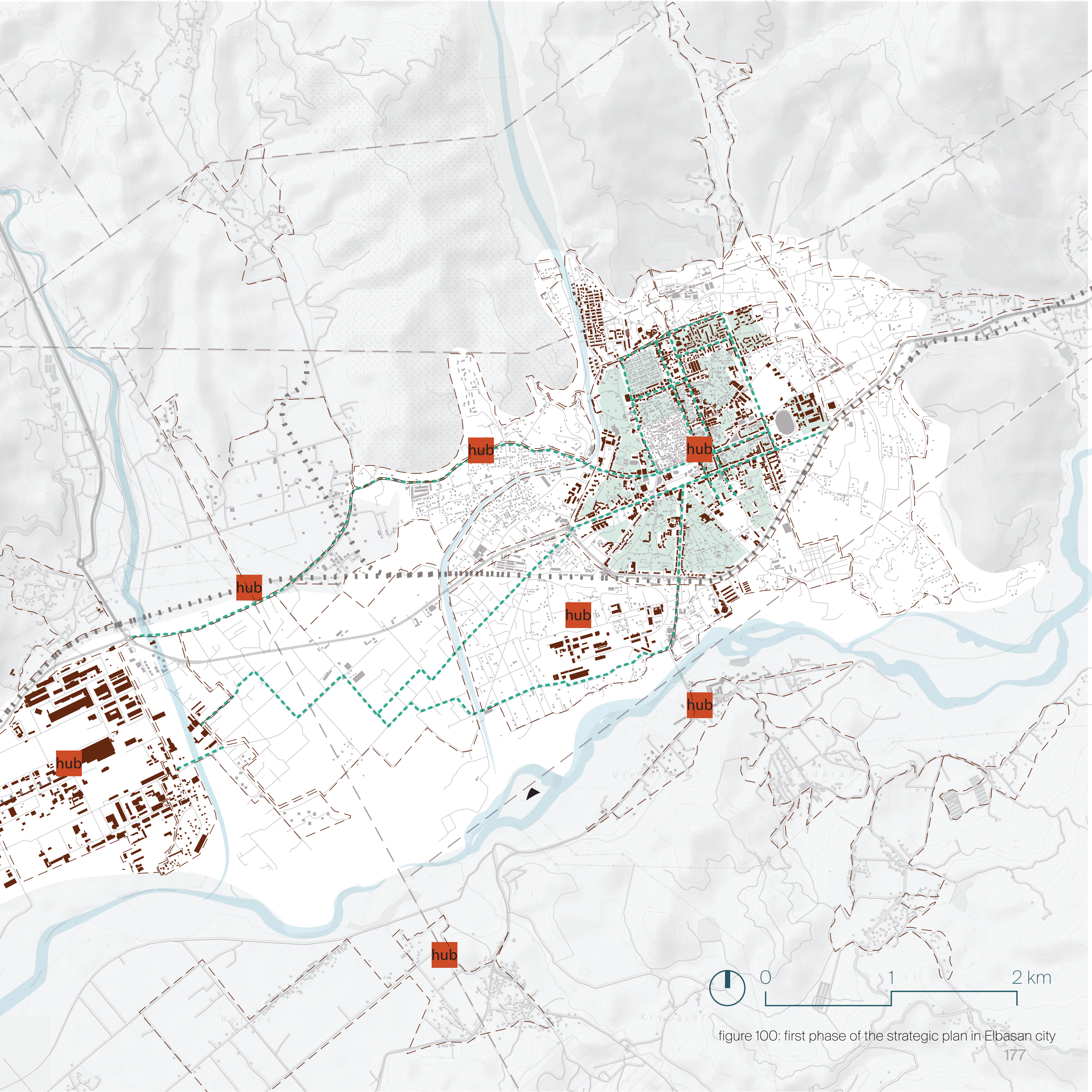


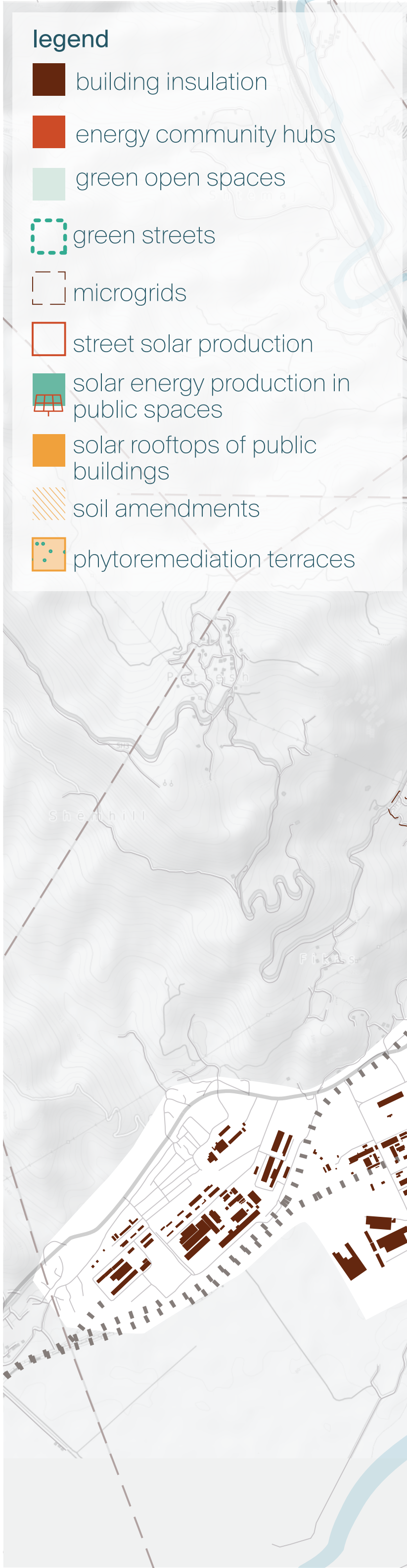
figure 100: first phase of the strategic plan in Elbasan city

[E] phase 2- producing in public areas as a start

The next phase involves integrating solar energy production in the city after completing all feasible actions to reduce energy demand. By this stage, people are already aware of the benefits of energy transition and will now witness the initial spatial interventions in public spaces, streets, and rooftops of public buildings to minimize resistance from them when expanding these implementation in other spaces.

Installing solar panels on the rooftops of public buildings, using solar panles in the street ligthnening and incorporating solar installations in green areas, which do not negatively impact habitats and biodiversity, will set an example for local residents. These areas will demonstrate how solar panels are implemented, how they work, how much energy they produce, and the benefits they offer. So, people will see the tangible implications of the energy transition.

Lastly, this phase will involve preparations for future phases by restoring soil from pollution using nature-based solutions. Techniques such as soil amendments and phytoremediation terraces will firstbe implemented in public spaces without ownership conflicts.



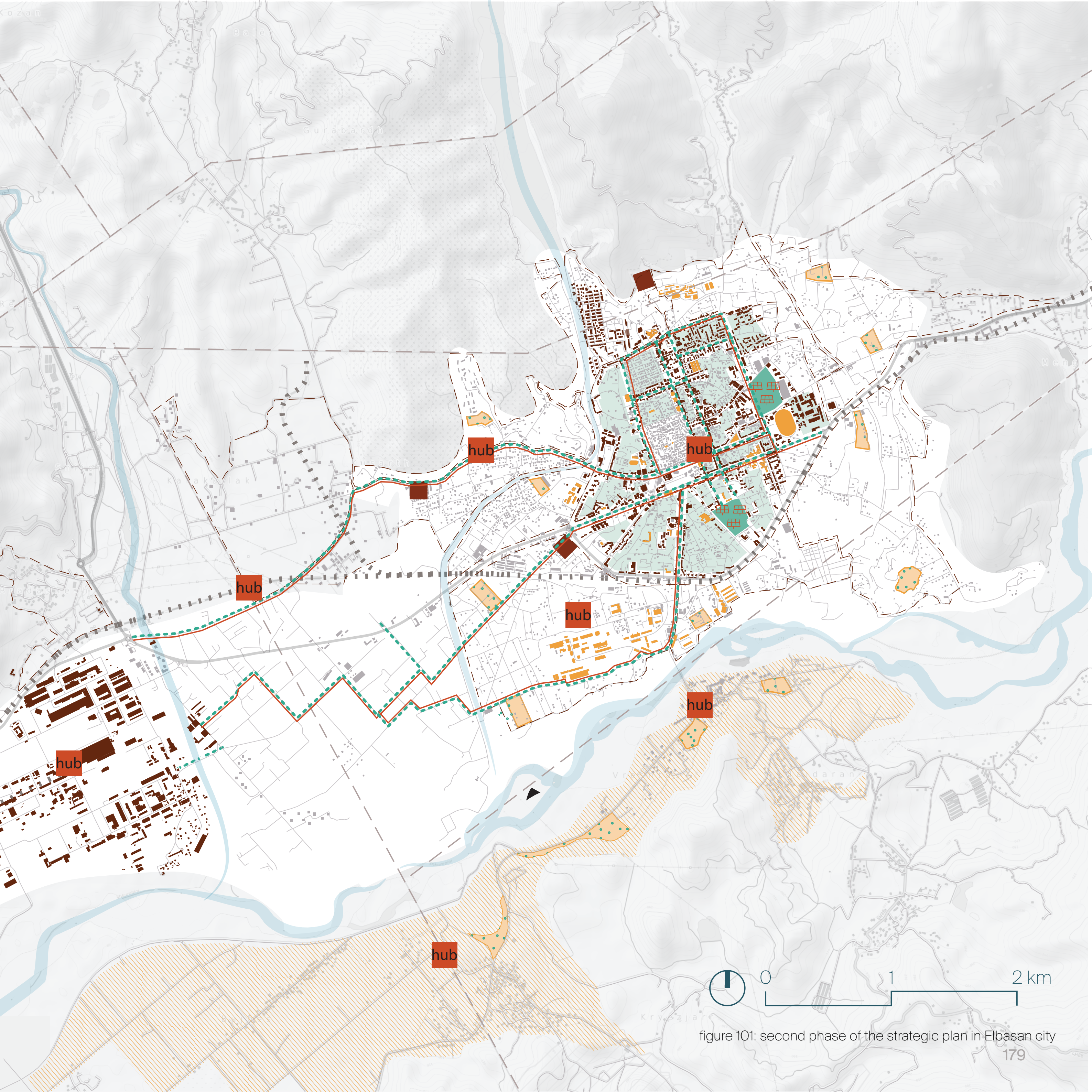


figure 101: second phase of the strategic plan in Elbasan city

[F] phase 3 - cleaning soil and popping up first energy landscapes

Residents are now installing private solar panels on their rooftops of single houses and multifamily buildings with green mixed-use solar rooftops. First marginalized communities receive additional funding through the '2in1 solars for vulnerable communities' policy, and surplus energy from public areas is stored and shared with them.

Additionally, this phase demonstrates sustainable solar panel integration in open spaces. It introduces agrivoltaic parks on agricultural lands, showing farmers how they can benefit from this transition. Community solar gardens in low-density residential areas increase neighborhood interactivity, with the energy belonging to the community. The national energy infrastructure is incorporated with green and wild forests for enhanced safety and aesthetics. Finally, abandoned industrial buildings in residential areas are transformed into small centralized energy production sites with ecological solar parks, adding value to the social and environironmental aspects of the city.

Lastly, this phase expands the areas where the actions to clean the soil are happening, including the agricultural lands for healthier food production and Communist industrial site to prepare it for further actions.

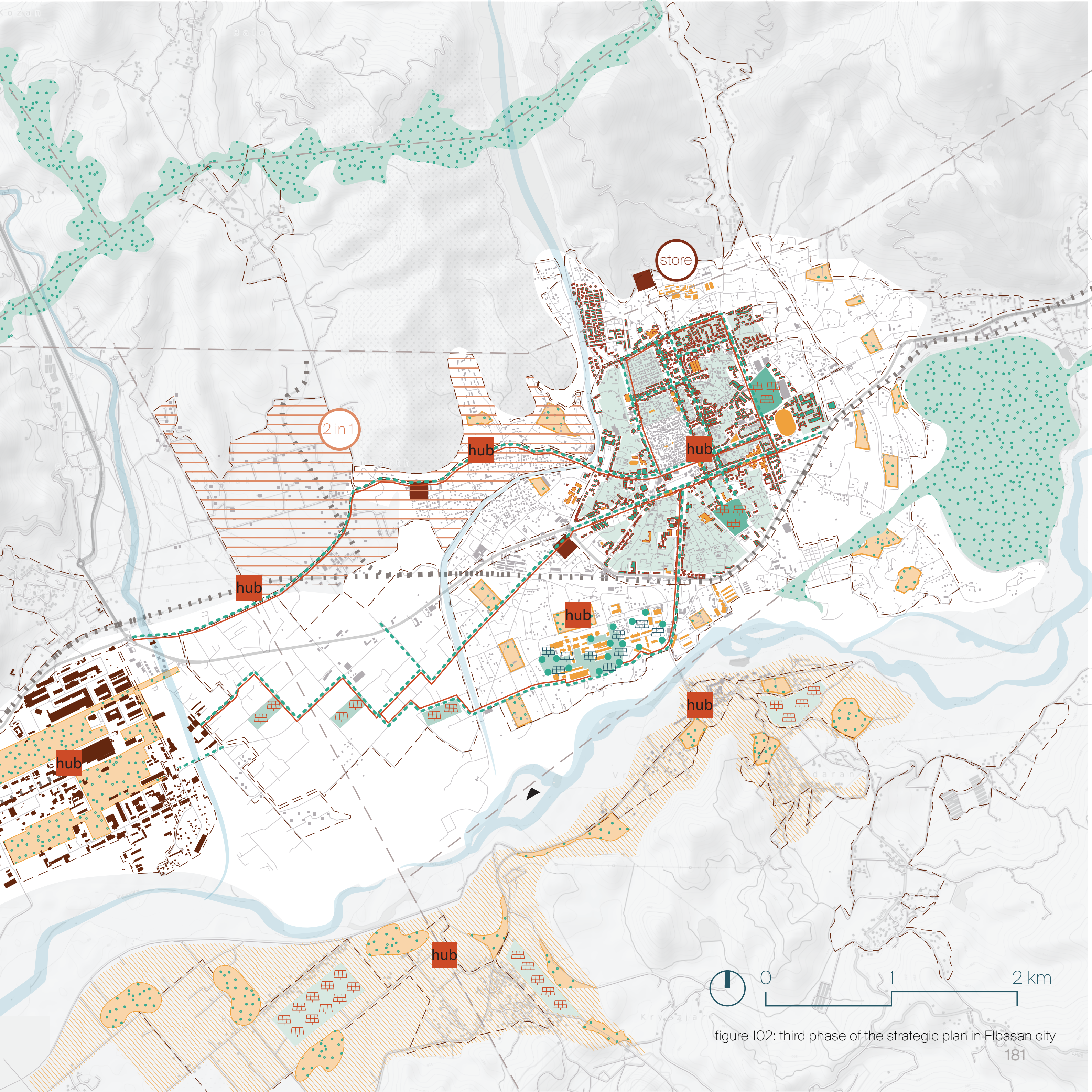


figure 102: third phase of the strategic plan in Elbasan city

[G] phase 4 - expand the new energy-space nexus

The fourth phase focuses on expanding the new energy-space nexus after resolving spatial and stakeholder conflicts.

The agrivoltaic landscape is extended throughout the agricultural and rural areas, while community solar gardens become common in the spaces between industrial and residential zones. The green energy corridor follows the ehole national energy infrastructure in the city. And the "2in1" policy is now available to all marginalized communities, prioritizing these citizens for more solar panel installations to meet their basic needs.

The area undergoing soil recovery in the former Communist industrial site is transformed into an ecological solar park open to the public. The energy produced in this site is centralized, with the surplus stored and shared with local residents. Restored building rooftops are used for centralized solar energy production, and the open spaces between them serve as green areas for public use, educating children and other visitors about clean energy and sustainable energy-space integration. Abandoned buildings are preserved as landmarks to maintain the area's identity, allowing nature to reclaim them.

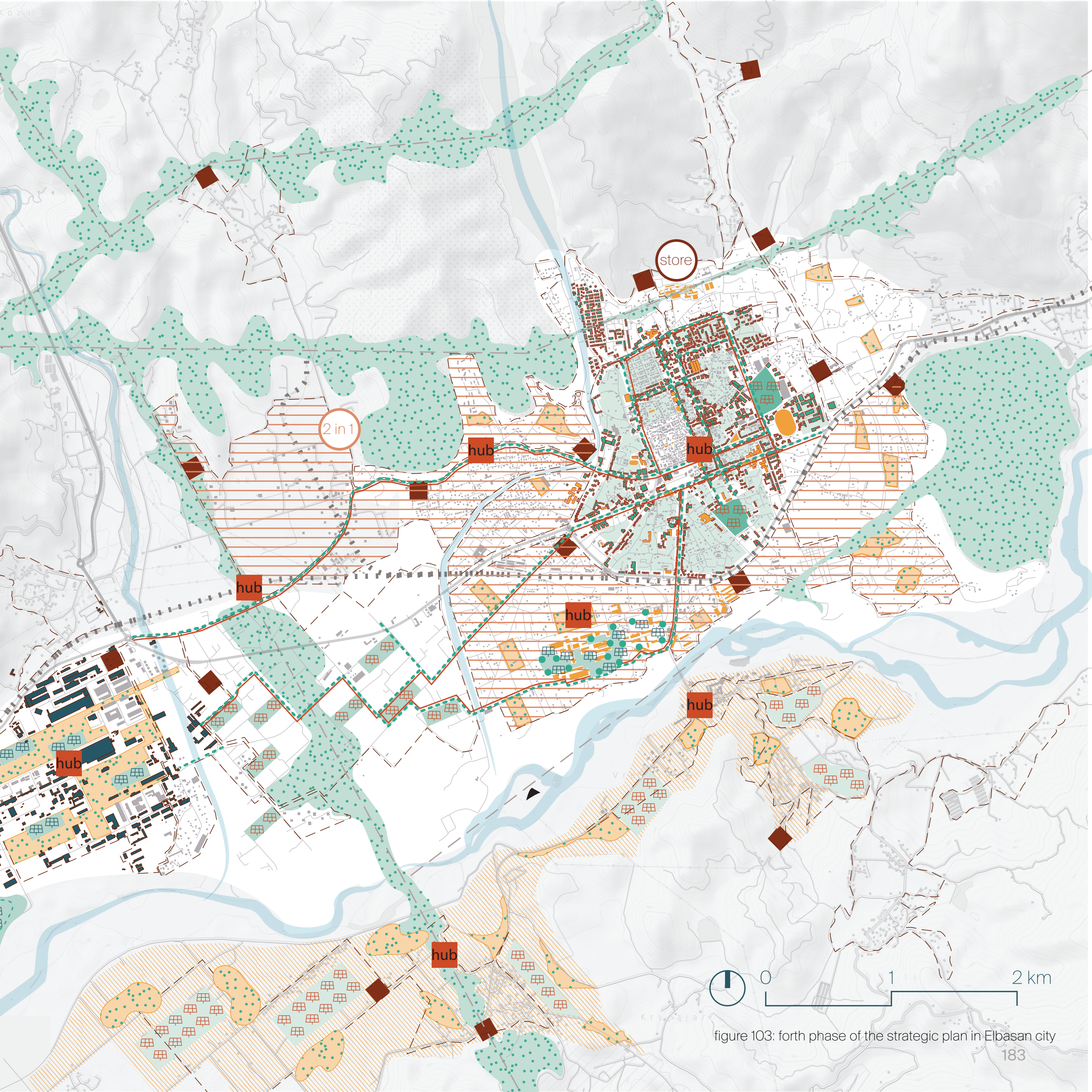


figure 103: forth phase of the strategic plan in Elbasan city

[H] phase 5 - build a green synergy

The final phase aims to establish a healthy and green synergy in this Pattenrn of Production breaking the social sensitivity of the Communist Industrial area and the neagitve attachment that residents have with it.

The abandoned railway has been renovated, now serving as a green corridor connecting these two zones, adorned with lush trees. This railway goes through a green park featuring native plants, revitalizing the soil and serving as the city's largest connecting green space, uniting all surrounding areas as a verdant hub. The river acts as a blue-green corridor, safeguarding against flooding with wetlands construction and multi-layered green buffers. Within this corridor lies a pedestrian path, inviting people to stroll amidst nature while traversing from the city center to the Communist Industrial site. Green streets, equipped with solar energy infrastructure, link all energy landscapes in Elbasan via a dedicated bike lane.

This represents the strategic plan for Elbasan city in 2050, where the energy-space nexus is realized by leveraging context-specific potentials and addressing limitations, thereby enhancing energy security and facilitating a social and environmental sensitive energy transition.

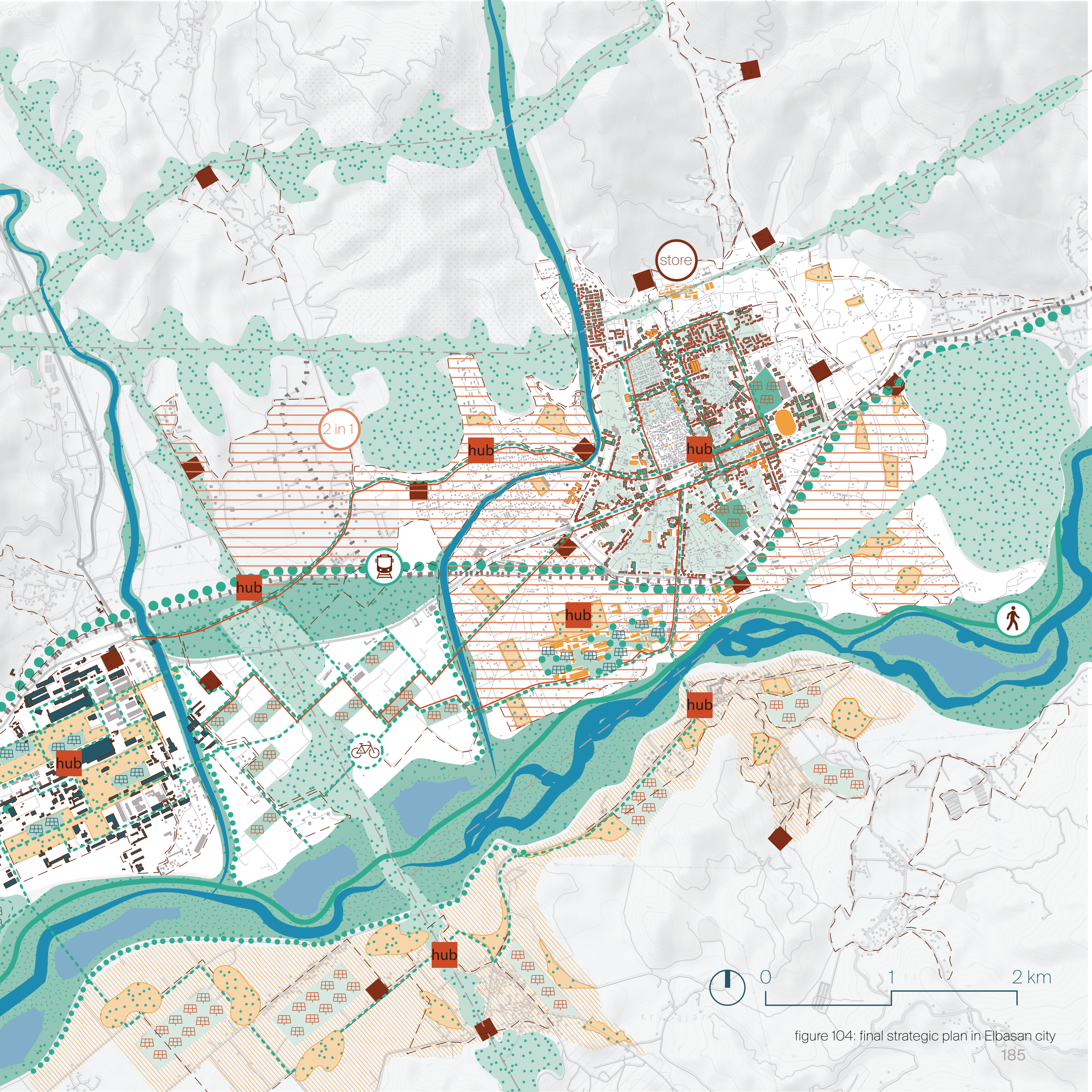
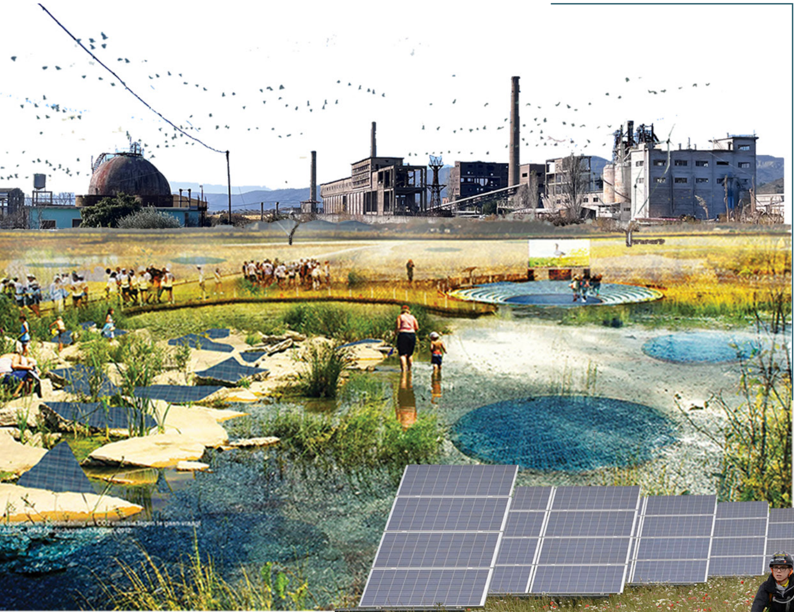


figure 104: final strategic plan in Elbasan city

iv. energy-space nexus

FABRICations, 2015



Damian Hol

MrRenewables, 2012

FABRICations, 2022

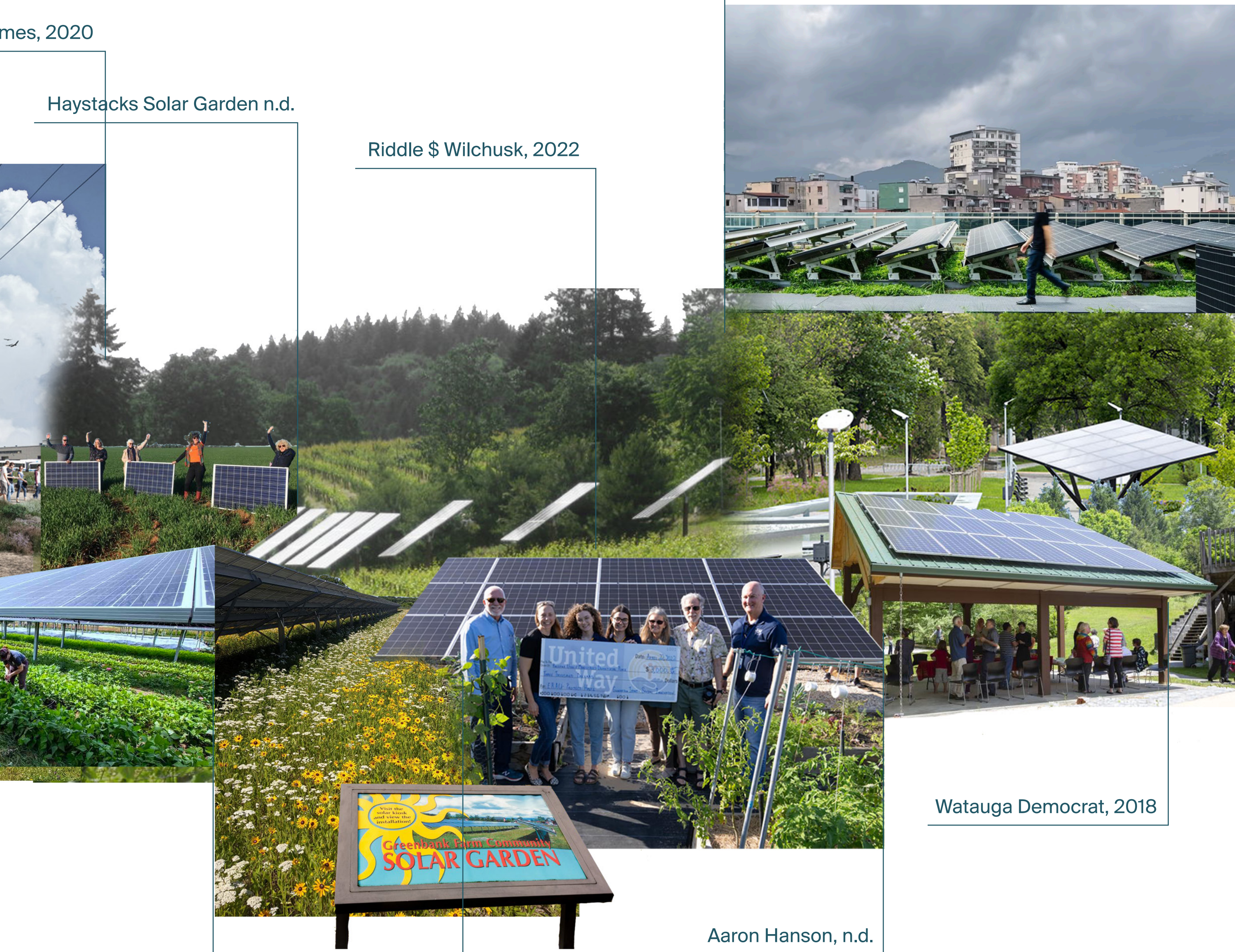
reve, 2024

Iñaki Ábalos , 2022

mes, 2020

Haystacks Solar Garden n.d.

Riddle $ Wilchusk, 2022



Watauga Democrat, 2018

Aaron Hanson, n.d.

ACK Solar, n.d

Aaron Hanson, n.d.

figure 105: collage of reference projects of the new energy-space nexus established in Elbasan

[A] ecological solar park

figure 106: before and after collage of Communist industrial site

[B] centralized energy production open to public

figure 107: before and after collage of Communist industrial site

[C] symbiotic landscape

figure 108: before and after collage of in-between space


Community
Garden

[D] productive rooftops

figure 109: before and after collage of iresidential area

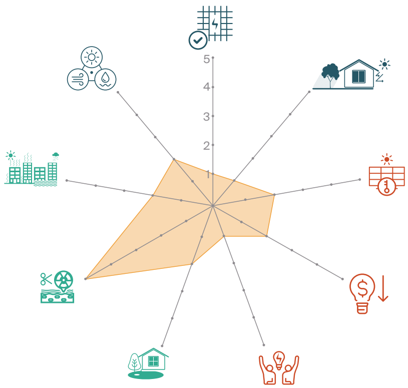
v. assessment

The design assessment was conducted through one-on-one meetings with stakeholders. Each new pattern of the strategy was evaluated using a spider map, with a ranking from 1 to 5, to determine their contribution on the needs of energy security, energy equity, and environmental quality identified during the microstories. The final evaluation of the strategy was defined by calculating the overall average of these individual assessments. Different stakeholders prioritized various needs during the evaluation process of the patterns, reflecting their distinct perceptions of energy security, energy equity, and environmental quality. Citizens and urban planners focused on the social and environmental impacts of the patterns, while public and international stakeholders concentrated mainly on how these patterns addressed energy security needs and the climate change challenge.

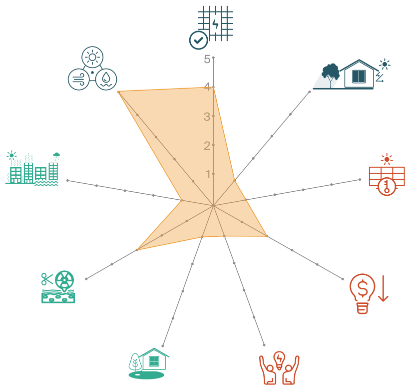
'Ecological Solar Park' Pattern received high scores for fulfilling environmental needs, primarily by mitigating pollution. However, it was perceived as contributing less to energy security and equity because it remains part of a centralized energy system. The limited energy production surfaces mean it will not produce a significant amount of clean energy.

'Centralized Energy Open to Public' Pattern scored highly on energy security by contributing to reliable energy infrastructure and diversifying energy sources in the area. Although it proposed a system where people have access to its spaces and can interact with energy production sites, it was perceived as having a low impact on energy equity and environmental quality.

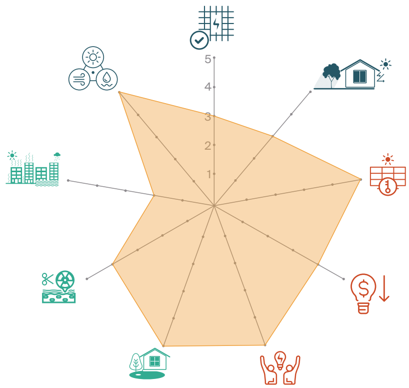
'Symbiotic Landscape and Productive City' Patterns garnered considerable interest from many stakeholders and ranked higher for all three pillars compared to others. They scored high for contributing to energy equity and security by diversifying local energy sources and increasing energy efficiency. Solar energy in these patterns provides shading to building facades, localizes clean energy production, and offers direct access to communities in peripheral and central residential areas of Elbasan. These patterns empower citizens to manage and decide on the functioning of these energy spaces. They also ranked high on environmental quality by contributing to greener neighborhoods and providing resilient energy spaces against extreme weather conditions, such as urban heat islands and flooding, through features like green rooftops and community gardens.



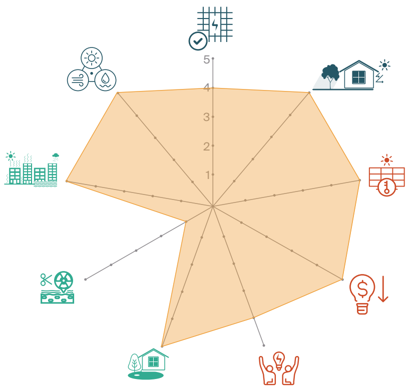
'Ecological Solar Park' Pattern



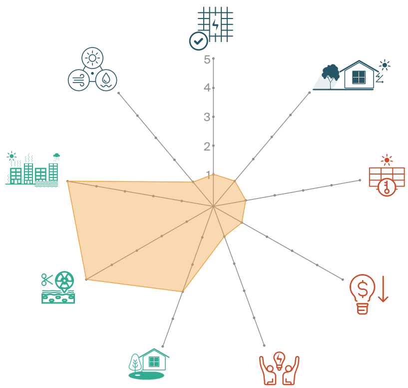
'Centralized Energy Open to Public' Pattern



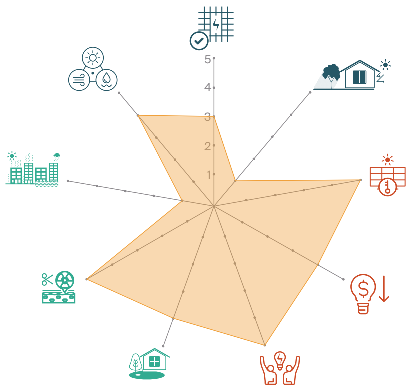
'Symbiotic Landscape' Pattern



'Productive City' Pattern



'Blue-Green Corridor' Pattern



'Agrivoltaic Restoring Landscape' Pattern

figure 110: main assessment of the strategic plan

'Blue-Green Corridor' Pattern: All stakeholders rated this pattern highly for its contribution to environmental quality. It cleans water pollution and creates resilient, nature-based infrastructure that protects residential areas from river flooding.

'Agrivoltaic Restoring Landscape' Pattern: Most stakeholders viewed this as one of the most effective patterns. It aligns with their vision of initiating solar energy production in Elbasan, where agriculture is a primary economic activity. They see farmers as key stakeholders who can participate in decision-making and invest in implementing this pattern, supported by funds from international organizations and local municipalities. This pattern diversifies energy sources by utilizing agricultural lands for energy production, not only benefiting farmers but also meeting city needs. It increases local accessibility to clean energy and helps mitigate soil pollution in agricultural lands, while also designing greener neighborhoods for rural residents.

In summary, Figure 111 illustrates the overall assessment of the proposed strategy plan for Elbasan by various stakeholders, highlighting different perspectives on how the energy-space nexus established in this strategy meets the needs of local residents in the sustainable energy transition process. One main conclusion is that while the strategy scores high on energy security by diversifying energy sources, some stakeholders find it unclear whether it will meet the city's energy needs by 2050 due to the absence of specific calculations and kWh numbers. Nevertheless, the strategy is perceived as providing new perspectives on designing the city's landscape for energy transition, considering the social and environmental impacts of these interventions on the local context of Elbasan.

Overall, the assessment of the new patterns in the strategy plan, as per stakeholder evaluations, shows the highest contributions to energy equity and environmental quality, with scores ranging between 3 and 4. However, energy security scores lower compared to the other two pillars. This lower score is attributed to the lack of quantitative data and calculations in the project, as well as differing interpretations and definitions of energy security among stakeholders.

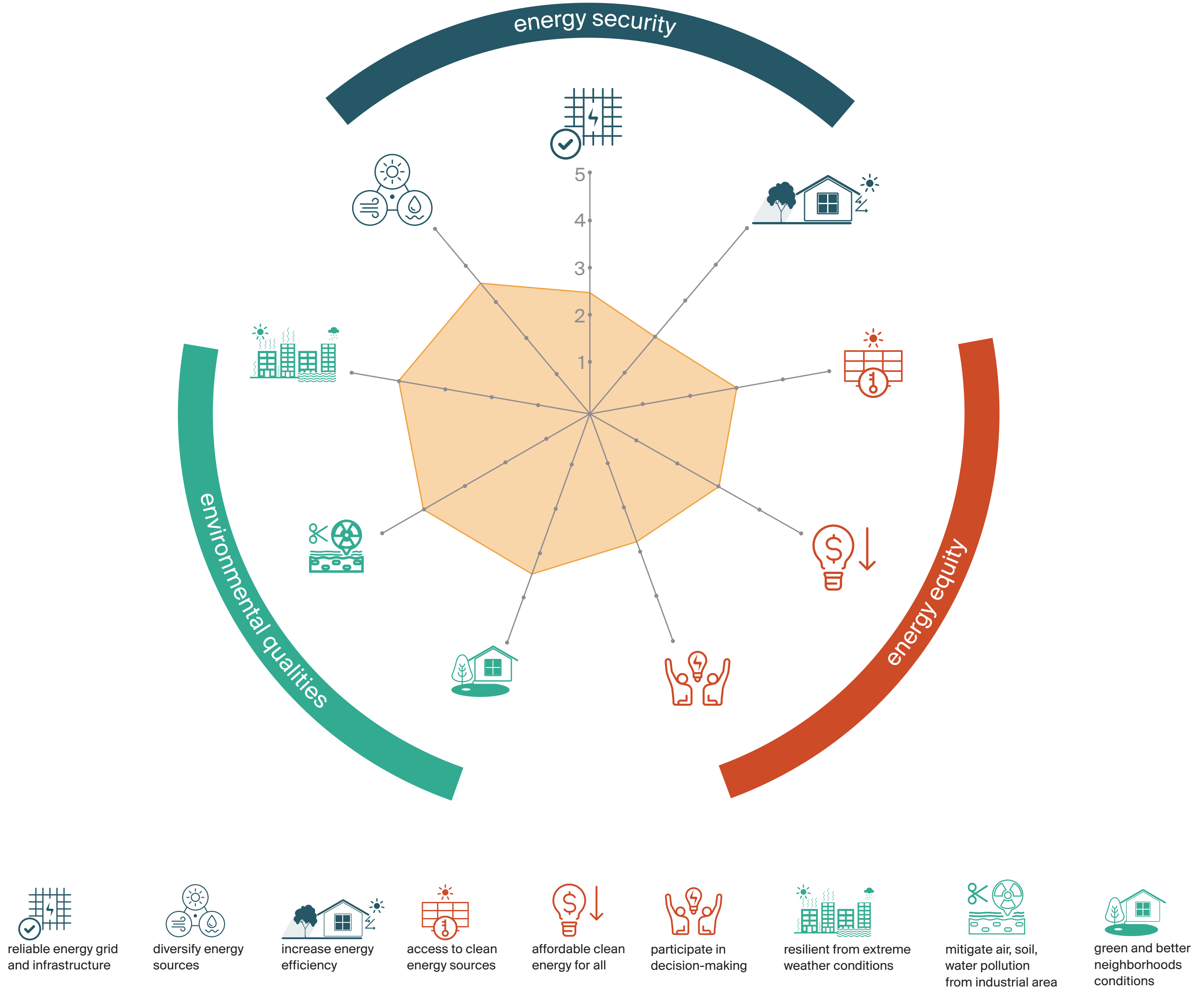


figure 111: main assessment of the strategic plan

VI. conclusion and reflection

conclusion

Ensuring energy security alone cannot drive a sustainable energy transition. It must align with energy equity and environmental quality in a systemic relationship, following the context-specific strengths, weaknesses, opportunities, and threats, elements which need to be examined through the spatial lens of urbanism to ensure a sustainable transformation of urbanized territories. This is why the energy-space nexus is placed at the core of a sustainable energy transition process in this project.

In response to the main research question, "How can the energy-space nexus in the Pattern of Production contribute to energy security for a socially and environmentally sensitive transition in Elbasan?", it is crucial to redefine the energy-space nexus represents as the temporal footprint in the landscape energy landscapes we are aiming for, with direct short- and long-term impacts not only on energy production and consumption patterns but also on social and environmental aspects. This energy-space nexus can contribute to energy security, energy equity, and environmental quality through a deep understanding of the specific context and aligning this nexus with local potentials, limitations, and citizens' needs.

In the Pattern of Production, the energy-space nexus has recreated the lost synergy between the former communist industrial sites and the residential areas through sustainable and healthy strategies. It connects different energy landscapes, increasing the interconnection of the spatial consequences of the energy transition process and demonstrating that energy security can be successfully achieved while respecting the social and environmental qualities of a space.

Thus, the energy-space nexus in the Pattern of Production can contribute to energy security by designing the spaces of consumption and production according to the needs of local residents and the potentials of the site. Simultaneously, it can promote energy equity by defining community-based spaces and increasing accessibility to clean energy sources. Lastly, it addresses environmental impacts by creating synergies between energy production or infrastructure and ecological facilities in specific natural areas. The synergy built in the Pattern of Production in Elbasan is the picture of the new energy-space nexus that can be established through a sustaianble energy transition process.

What are the main concepts and theories that define sustainable energy transition process?
A sustainable energy transition is defined by three main groups of theories that serve as its foundation: systemic thinking, energy and space, and energy demand and production. These theories work together as a cohesive backbone, where each element is crucial for a successful transition.

Systemic thinking forms the main structure of the energy transition process. It emphasizes the need to integrate actions across different scales of the system, harmonizing efforts to effect change. By exploring how macro-scale interventions can guide meso-scale strategies and support micro-scale actions, and vice versa, we understand that a sustainable transition can originate from any level but must engage all scales for success. This theory highlights the impact of even the smallest actions on other scales and underscores how macro-scale decisions directly influence micro-scale social and environmental quality. The multi-level perspective theory (Geels, 2002) is the primary framework used in projects like the one in Elbasan to explore the potential for energy transition. This framework is adaptable and can be applied to other locations to define sustainable energy transition processes.

Energy and space theories are central to a sustainable energy transition, reflecting the spatial dimensions of other theories. Recognizing that energy production and consumption patterns leave a temporal spatial footprint on the landscape, which directly affects quality of life and environmental conditions (Stremke et al., 2023), is essential. Increasing awareness of the energy-space nexus in energy transition and prioritizing it in every process is crucial for enhancing sustainability. This theory emphasizes the interconnectedness of energy systems with local potentials, context-specific limitations, social and cultural backgrounds, and environmental qualities. Energy transition cannot be uniform; it must integrate the unique spatial context and work collaboratively with the environment and local communities for success. This project advocates for a spatially conscious energy transition system guided by context-specific limitations and potentials, aiming to maximize spatial qualities and positive social and environmental impacts.

Theories of energy demand and production, such as sufficiency (Darby et al., 2018) for achieving energy equity and the Theory of Planned Behaviour (Ajzen, 1991) for changing local consumption patterns, are vital concepts in this process. Although these theories are more conceptual, they must be considered in a sustainable energy transition, as different contexts have varying energy consumption and production patterns. Within a single location, these patterns can also differ based on people's economic and social backgrounds. Utilizing microstories and site visits to delve deeper into these theories is crucial during the energy transition process.

In conclusion, this project demonstrates the importance of the energy-space nexus in energy transition and its exploration across different scales through a systemic thinking approach while understanding local energy production and consumption patterns. Therefore, energy and landscape theories, specifically energy landscape and energy-space nexus theories, along with Multi-Level Perspective and systemic thinking theories, and sufficiency and behavioral theories, must work together to form a strong foundation for a sustainable energy transition process.

What is the relation of energy and space in the Pattern of Production in Elbasan, considering social and evironmental context?

The pattern of production in Elbasan reveals a hidden energy-space relationship that significantly influences the spatial, social, and environmental context of the city.

During the Communist regime, the necessity for self-sufficiency transformed Elbasan's landscape from a natural environment into an industrial site. The industrial site's high energy demands placed Elbasan at the nexus of national energy infrastructure, transforming it from a rural city with agricultural lands as the main landscape to a heavy industrial landscape with electrical cables framing the sky. This industrialization has had lasting social and environmental impacts, even after the regime's fall in 1990. So, the energy and space relation has left footprints of the past on the current landscape of the city demonstrating that there is a strong relation of energy-space nexus in the Pattern of Production that has directly impacted the city's environmental health and social life.

A closer examination of the residential and industrial areas within this Pattern of Production reveals more about the energy-space relationship in Elbasan. In residential areas, different spatial typologies reflect variations in the social and economic backgrounds of the inhabitants and their energy needs. For instance, Communist-era apartment blocks, characterized by five-story prefabricated buildings arranged in grids or along main streets, predominantly rely on electricity. These buildings often face energy efficiency issues due to inadequate insulation. Conversely, peripheral neighborhoods, marked by poor housing and infrastructure conditions with scattered single houses, struggle with energy poverty, relying on wood as their primary energy source because they cannot afford electricity. Thus, the social and spatial configuration within the pattern of production directly affects environmental quality and the energy system.

To conclude, the analysis phase of this project identified several key problems within the Pattern of Production that illustrate the energy-space relationship. It varies according to the spatial characteristics of different areas and their social-environmental backgrounds. This relationship manifests energy security as the main pillar of energy-space nexus in residential areas, energy equity in intermediary areas, and environmental qualities in industrial sites.

What are the current policies and stakeholders that have an impact in the energy transition process?
Current policies directly impact the energy transition process by shaping its progression and determining the focus areas for implementation. These policies outline a roadmap toward a sustainable energy system by 2030, addressing energy security challenges and supporting vulnerable communities through various schemes. Energy security is the primary goal of these policies, and current energy landscapes are designed with this focus, often neglecting the social and environmental impacts of the areas where implementations occur.

To achieve a socially and environmentally sensitive energy transition, current policies need to be reframed to incorporate the energy-space nexus. This project demonstrates how placing the energy-space nexus at the core can address identified gaps in policies and stakeholder knowledge. By doing so, it is possible to create a more holistic and sustainable approach to energy transition that considers the interconnections between energy systems, social contexts, and environmental quality.

Stakeholders impacting the energy transition process in Elbasan can be grouped into three categories: public stakeholders (including governmental institutions), private stakeholders (such as private investors and organizations), and civic stakeholders (citizens and nature). Each group holds power and jurisdiction over specific scales and topics. The Ministry of Infrastructure and Energy is the most important public macro-scale stakeholder, making key decisions on energy transition and influencing all other scales with its authority. This ministry consistently consults with the European Union and international stakeholders to align with their goals and frameworks for a sustainable transition.

At the local level within the Pattern of Production, the local municipality plays a crucial role in influencing the energy transition for this area and its citizens. Despite its limited power, the municipality's involvement is essential for successful and inclusive implementation. However, spatial conflicts within the Pattern of Production hinder the energy transition process. These conflicts occur between the Ministry of Finance and Economy and private owners of industrial buildings in Metalurgjiku, as well as between the local municipality, farmers, and citizens regarding the area between residential and industrial-zones, and agricultural lands.

Creating a strategic plan to bridge these stakeholder conflicts is crucial, as these disputes slow down the transition process and prevent the most sustainable interventions for the area. Addressing these conflicts while adapting spatially, socially, and environmentally conscious energy policies will facilitate a smoother and more effective energy transition.

How to design sustainable energy transition scenarios in Elbasan, considering existing and on-site observed patterns?
Designing sustainable energy transition scenarios for the complex site of Elbasan requires a framework that combines various design tools. This project has created a design methodology structured around the Multi-Level Perspective Framework, the Maximization tool, and the Pattern Language tool, aiming to identify the context-specific potentials and limitations of the space in Elbasan during a sustainable energy transition process.

It's important to jump in different scales while building scenarios to explore how different measures impact the energy-space nexus at different levels. The Multi-Level Perspective framework is used as a basis for developing macro, meso, and micro scales scenario. It illustrates specific measures that support and guide changes in spatial, social, and environmental life of the city while understanding the complementary relationship that different scales have with each other.

The maximization method is a valuable tool for designing various energy scenarios for a sustainable energy transition process, leveraging spatial strengths and opportunities while mitigating weaknesses and threats identified during the analysis phase. This tool considers the existing situation of the area and seeks to maximize each pillar of the conceptual framework: energy security, energy equity, and environmental quality, by creating one scenario for each. It helps explore the maximum capacities of a specific context to reach certain goals in the energy transition process, making urban planners aware of the site's potential. Although all three pillars aim for a sustainable transition, overlapping these scenarios can reveal conflicting areas of action, as each scenario competes for the same space to maximize its own goals. This competition creates spatial conflicts, requiring compromises to prioritize actions that address the most pressing problems of the site while still working towards a sustainable transition.

Lastly, the maximization tool needs to be integrated with other design tools, such as Pattern Language, to more specifically define the spatial configuration of these energy scenarios. This integration helps establish clear principles, strategies, and actions, making it easier to visualize the energy-space nexus that each scenario aims for in the energy transition process. By combining the Maximization tool with Pattern Language, stakeholders can more easily understand and visualize how space will change in each scenario by implementing these patterns during the energy transition.

In conclusion, sustainable energy transition scenarios for Elbasan can be created by combining different design tools that allow the exploration of the site's maximum spatial capacities within its existing limitations and potentials. This approach involves a multiscale understanding to formulate scenarios and exploring their influence across various levels. It also facilitates easy communication with stakeholders, helping them understand how the design is accomplished and the spatial consequences of these scenarios.

How to design strategies for the areas of transition in Elbasan to achieve the optimized vision of 2050?
The optimized vision for Elbasan's sustainable energy transition is established by resolving conflicts in the competing spaces of the three developed scenarios. These conflicts are identified after overlapping all maximized scenarios. To accomplish this vision, stakeholders and spatial strategies at the city scale are defined. Stakeholder strategies aim to provide a roadmap for resolving conflicts between different stakeholders and addressing the spatial dimension of the energy-space system in this

context. Spatial strategies illustrate how to enrich the vision of 2050 for Elbasan by showing the transformations in the landscape.

Four main strategies are identified in developing Elbasan's strategic plan:
1. Urban Greening and Building Insulation for Reduced Energy Demand
2. Community empowerment for an inclusive energy-space nexus
3. Diverse Energy-Space Landscapes within a Resilient Energy Infrastructure
4. Fostering a Green Synergy in the Pattern of Production

Each of these strategies addresses a context-specific challenge and problem, demonstrating how this nexus is established with specific actions. To better understand how these strategies can be implemented, a timeline diagram and a phasing plan of the strategic plan are provided. These illustrate who is involved in certain steps and how each step impacts the upcoming ones until the completion of the final vision in 2050.

To conclude, designing strategies for the areas of transition to achieve a defined vision in 2050 requires (1) identifying the main context-specific problems of the area, (2) showing how to tackle these problems, and (3) illustrating the spatial consequences. These strategies also need to be established within a timeline and phasing plan to go step by step on the way how they are developed and impacting each other, and how the new energy-space nexus is being established over time.

What is the assessment of the new energy-space nexus in Elbasan in terms of completing the locals needs?

The assessment of the new energy-space nexus involved evaluating the patterns used to address conflicting areas in the strategic plan of Elbasan through one-on-one meetings with stakeholders. Each pattern in the strategy was assessed based on its contribution to energy security, energy equity, and environmental quality, as identified during the microstories. This participatory approach has established a framework for engaging stakeholders in the energy transition process, ensuring an inclusive process where all needs are heard and considered.

One key conclusion is that the strategy scores high on energy security, particularly for diversifying energy sources, and on energy equity, creating an affordable and accessible energy system. However, it falls short in calculating how much energy will be needed by 2050 and whether this scenario meets that need. The varied perceptions of energy security lead to different assessments of the strategy.

A significant challenge was avoiding influence on stakeholders' perspectives during the assessment. I strived to let them evaluate the strategy according to their definitions of the main concepts. However, at times, I inadvertently influenced their judgments by presenting definitions of energy-space nexus, energy security and equity specific to the project, aiming to focus the discussion. Another limitation was the lack of discussion between different stakeholders due to the one-on-one meeting format. This approach made the evaluation subjective and potentially biased from their individual perspectives.

To conclude, the assessment of the new energy-space nexus scores a rate between 4 to 3 from 5 maximum for completing the needs on energy equity and environmental qualities, and 2 to 3 for energy secuirty due to the uncertainties that the defintion of this concept has in different stakeholders perspectives. Anyhow on the completion of the goals for each of the patterns on how they solve the conflicts, the feedback was quite positive.

reflection

1. Personal reflection

This project has been a journey filled with enthusiasm, uncertainties, challenges, and new explorations of myself as a new urbanist and as a person born and raised in Elbasan city. It has been a journey that represents not only my professional growth but also my personal growth. I have always wanted to bring a piece of my country to TU Delft and, at the same time, make even a small contribution to my hometown through research on sustainable transitions—research that is nonexistent up to now, keeping this place in the shadow and unknown for many international reasearchers and urbanists.

It has been an amazing experience viewing my hometown from an urbanist perspective. I felt like I was getting to know this place more deeply by exploring areas I had never visited before, talking to people, and understanding their stories as an urbanist planning a strategic plan to meet their needs. I have always considered my city a ‘grey city’ due to its history as one of the most heavily polluted industrial cities in Albania. Now, I see Elbasan as ‘the city of hidden opportunities’ because, after this project, I recognize it as the most potential space to start a sustainable energy transition in this country.

Exploring the city, I was amazed by the enormous Communist industrial site, Metalurgjiku. This space has stood as a remnant of the past, gradually being reclaimed by nature. People have adapted the area to meet their housing needs by planting trees and vegetables or farming, and private businesses have been emerging in an unplanned way, bringing life back to this area. I felt ashamed that I had never visited this amazing place before, having always considered it forbidden due to its heavy pollution and the negative memories it held. But now, I see it as a space that can guide energy transition for Elbasan and provide different energy landscapes for its citizens.
While walking around different neighborhoods in the city, I discovered how much people living in single houses rely on wood to meet their energy demands, something I had never noticed before since I have always lived in a prefabricated Communist apartment block where electricity and air conditioning have been our primary energy sources for years. During these walks, I revisited my childhood memories. I remembered that when I was a kid, we also used a wood stove to warm the house and cook. As the lights were off almost every day, I had a vision of a girl studying by candlelight, making fun with her sister by creating shadow animals on the wall to break the silence of the darkness. And this vision is still there! Many people in Elbasan are still stuck in time, living in these conditions because they cannot afford electricity. It was a sad realization, but it made me aware that this situation does not belong only to the past. It is part of the present and could be the future for everyone if there is no process of energy transition to diverse, clean energy sources happening. This realization made me more aware of the importance of a sustainable energy transition that focuses on energy security and equity. We need to act as soon as possible to leave these memories in the past and build a safe and resilient future for the upcoming generations.

But what is my role as an urbanist in the energy transition? This was the biggest dilemma I faced at the start of this project. Even though I have always been interested in exploring the spatial dimensions of sustainable transitions and learning how to implement them in different contexts and systems, I struggled to envision the role of space in energy systems. Delving into literature, theories, and reference projects helped me realize that the energy-space nexus needs to be at the core of sustainable energy transitions. This realization marked a significant shift in my mindset. Previously, I viewed energy systems as the domain of engineers and technical experts. However, I came to understand that urbanists are integral to this system, directly interacting with the landscape to create sustainable energy-space nexuses. These nexuses not only aim for energy security and a resilient grid but also consider the social and environmental aspects of future energy systems. Without urbanists, the energy transition cannot be considered sustainable. I also discovered a significant spatial gap in the mindsets of stakeholders, policies, and national documents on energy transition, where the energy-space nexus is often overlooked. This leads to spatial uncertainties in the current energy transition in Albania and Elbasan. Through this project, I bridged this gap and demonstrated the importance of urbanists in this transition. I developed a methodology that could be used by other researchers and stakeholders to establish an energy-space nexus for a sustainable energy transition process. This project proved to me the critical role of urbanists in ensuring a holistic and sustainable energy future.

Lastly, I want to emphasize that I am proud of this work. Despite the journey being filled with difficulties and challenges, this research is one of the first projects in Elbasan, Albania, to focus on the spatial translation of the energy transition process. It builds a vision of how a sustainable energy-space nexus can be established and what it might look like. This project can serve as a foundation for local stakeholders to further explore the energy-space nexus that can be developed in Albania. I am very happy that this thesis contributes to the local sustainable energy transition processes in a context where local institutions face a lack of expertise. This project fills a gap in research not only in Albania but also in a broader context. Due to a lack of data and funding, there is a scarcity of international research on Albania, and many people are unaware of its potential for a sustainable energy transition. I am delighted that this project can shed light on the opportunities and challenges in Albania and Elbasan, paving the way for future research and projects in the country's path toward energy transition.

2. Relation between the graduation project topic and the Urbanism master track

This project explores the uncertainties of the energy-space nexus within the context of a post-Communist country, focusing specifically on Albania. The primary aim is to address the pressing need for energy security in a region highly vulnerable to climate change. It tackles current challenges related to energy demand and supply, energy poverty, and environmental concerns, viewing these issues through the lens of urbanism to facilitate a sustainable energy transition.

By approaching these urgencies from an urbanist perspective, the project positions the energy-space nexus as a central element in Albania's energy transition. This approach is crucial, as energy in this context is often perceived solely as a technical issue, overlooking its broader spatial implications. The project leverages planning and design disciplines to emphasize the pivotal relationship between energy and space, demonstrating the power of design in addressing the outlined challenges through the case study of Elbasan.

Throughout my experiences in the Urbanism track, one consistent theme has been the systemic design thinking approach to uncertainties posed by the climate change crisis. This principle guides my thesis, which critically investigates potential future scenarios of urban transformation and their impacts on other systems. The project aims to facilitate a sustainable transition not only in energy systems but also in the built environment, social lifestyle, and ecological values. This guiding principle aligns closely with the overarching goals of the Metropolitan Ecologies of Places studio, which illustrates the profound capability of urban planning to design places, systems, and life, motivating stakeholders while addressing complexities and limitations within a specific context under sustainable transition frameworks.

In the Metropolitan Ecologies of Places studio, I learned the importance of systemic thinking when designing projects aimed at sustainable transitions and used it not only to analyse the context and the xurrent system, but also as a design tool to explore scenarios of the future for the case study of Elbasan. It made me realize that energy transition is not merely about meeting energy demand but is intricately connected to social and environmental aspects. The studio taught me to critically diagnose a system and be aware during the design phases of how decisions influence not only the energy system but also the space, society, and environment of a context. It provided me with a strong foundational knowledge of concepts and methods to approach the complex process of energy transition in contexts where data and scientific research are lacking.

3. Building a relation between research and design

The relationship between research and design in this project forms a continuous loop where each informs and enhances the other.

The design process begins with the development of a conceptual framework and methodology, derived from research focused on the urgencies, current context, and theories regarding sustainable energy transition. This framework guides further research on the case study of Elbasan, leading to the development of scenarios and spatial design strategies using the Pattern Language tool. Even in establishing the elements of the Pattern Language, there is a cyclical relationship between research and design. In the final phase, the design findings inform the research and stakeholders about Albania, viewed as a Mediterranean country with a climate-vulnerable energy system, a Western-Balkans country lacking data and scientific studies, and a post-Communist society with lingering socio-political sensitivities affecting space and lifestyle.

With a working and educational background as an architect, I used to start a project by analyzing the context without deeply integrating academic research and systemic urban landscape analysis. Design was the core of my projects, with site analysis merely guiding the design criteria. That is why, the approach of this project led to numerous challenges in aligning research with design across different project stages. I struggled to transition smoothly from research to design, maintaining consistency while utilizing the gathered information. To address this, I revisited the research conducted in the Introduction and Diagnosis chapters multiple times, refining my findings to frame scenarios and the vision for Elbasan in 2050.

Furthermore, I compiled a list of key findings from each research step, using this summary as a foundation for my design phases. I created a structured relationship between findings and their application in the design stages. Defining the SWOT analysis, Conceptual Framework, and the needs of local citizens as assessment criteria strengthened the research-design relationship, providing guiding frameworks for scenario development and vision implementation. National-scale analysis and research on the current energy system informed an understanding of Elbasan's potentials and limitations, guiding the design of the new energy-space nexus. The SWOT analysis facilitated the exploration of optimized scenarios, while the conceptual framework pillars underpinned scenario development. Theories like the Multi-Level Perspective and systemic design were utilized as tools for different scales of design implementation. The Pattern Language tool in the design phase highlighted the need to revisit research, define new patterns, and refine theoretical backgrounds, creating a continuous loop that helped me overcome past challenges and learn the value of a strong research-design relationship.

Another challenge was understanding how my design would inform research. Previously, I considered a project finished once the design was completed. This project introduced a different experience, teaching me that design is not the end product. The final output includes assessing and reflecting on the knowledge, transferability, limitations, and relevance of the design. Evaluating the project from diverse perspectives and receiving feedback was a learning experience, revealing how different people perceive the same project and opening new questions and perspectives for further development. I learned that there is no "done" project when planning for a sustainable future; there will always be room for improvements, adaptations, and adjustments.

Reflecting on this process clarifies the contribution of research in design and how design informs research. This project proposes a design framework for Albania, a country lacking scientific research on sustainable transitions and their spatial outcomes, and contributes to current research on establishing an energy-space nexus within a specific context. The project acknowledges the lack of official data and subjective site visit interpretations, highlighting the need for further refinement, exploration, and testing of research-design relationships for more effective and sustainable decisions. Future research can follow the methodology developed in this project to define short-term scenarios and research-by-design strategies, assessing the impact of spatial interventions on energy demand, production, energy equity, and environmental qualities.

4. The value of my way of working

The key values of my approach, methods, and methodology for this project are:

1. Commitment to Collect and Critically Analyze Data: I critically analyze various sources and data to understand the current energy system in Albania and Elbasan, building a robust analytical foundation in a context where scientific research and open data are lacking.

2. Comprehensive Site Visits: I use site visits not only to understand the physical site but also to listen to people's needs, explore new city spaces, and reconnect with my childhood memories of Elbasan. By living in the city for a few months, I experience it from a new perspective as an urbanist researching sustainable futures. This immersive approach aids in framing scenarios and assessing designs with local stakeholders.

3. Integration of theoretical and designing tools: I integrate Pattern Language and Maximization tools to design scenarios and the 2050 vision for Elbasan through the Multi-Level perspective framework theory. These are structured based on the key findings from the research, creating a strong relationship between research and design and establishing a connection between the local context and the energy-space nexus necessary for a sustainable energy transition.

4. Collaborative Assessment: I engage with various stakeholders to understand different perspectives on the proposed strategic plan, identifying areas for further improvement or exploration.

5. Systemic Thinking: I build a methodological framework that can be applied to other Patterns of Production areas in Albania or similar global contexts. This framework aims to define the energy-space nexus while achieving energy security, energy equity, and environmental quality.

This project is buit upon a methodology that aims to deal with the uncertainties and limitations of a context, followed by the lack of data, lack of previous scientific research, social and political sensitivity of its historical background and the cultural challenges to interview locals and get in touch with all the stakeholders that foster energy transition. In the analytical phase, I adhered to a comprehensive framework outlined by the literature review, reports analysis, and statistical data gathering to gain a profound understanding of the energy-space system in Albania and Elbasan. I acknowledge that spending more time to critically examine theories and concepts related to the space-energy nexus and people's behavior in sustainable energy transitions could have potentially strengthened the foundations of this project.

Given the scarcity of spatial and qualitative open data in this context, site visits played a crucial role. Through video recording, exploring the city on foot, engaging with locals, meeting stakeholders, and building micro-stories, I successfully identified various typologies of the relationship between space, energy, and community in both residential and industrial areas of Elbasan. This approach allowed me to uncover the hidden characteristics of the city and understand spatial energy behavior, particularly during the winter season. A similar exploration during summer season can be further explored to gain insights into how the place copes with heat and how the new energy-space enxus contribute to lower temperatures and energy needs in summer time too.

During my intensive studies, while exploring the Pattern Language tool, I concluded that integrating this method into my project would be highly beneficial. Its structured approach—designing based on theoretical background, site observations, or reference projects, and later assessing its impact within the system—aligns well with the project's objectives. In situations where the spatial aspect of energy transition is ambiguous, I see the Pattern Language tool as a method that can effectively visualize the energy-space nexus amidst the challenges of the energy system in Albania. This tool can simplify the complexity of the energy-space nexus by providing not only theoretical background but also practical implementation details and reference images, making the information more accessible to various stakeholders and the public. Additionally, my use of this tool revealed its potential to involve locals and stakeholders in a participatory way, enabling them to individually evaluate the porposed interventions. It facilitates inclusive discussions on whether the new energy-space nexus meets their needs, bringing everyone to the table. The Pattern Language tool's ability to clearly illustrate complex spatial interventions, adapt to local needs and different context, and serve as a participatory medium for knowledge exchange are its most valuable assets that make it appropriate for designing complex systems in a challenging context like Albania. However, I found it challenging to finalize the proposed patterns due to their seemingly infinite connections and potential new patterns. This selection process is a limitation of the tool itslelf that i discovered while using it, as it can be bias as it lacks an entirely objective development process.

To conclude, my way of working during this project brings value by creating an approach on how to deal with specific contexts similar to Albania and manage the scarcity of information available in these countries, within its limitations and conflicts.

5. Academic and societal values

The social relevance of this project is reflected in two main concepts: (1) listening to the locals, their needs, their relation to energy and post-Communist remains, and build microstories to analyse the space and propose a design for the people within the local sensitivity, limitations and values of the area; (2) energy equity, which is one of the main global social challenges of energy system, as one of the main pillars to be considered when transitioning for a more secure energy system in Albania. This project directly explores the dynamic interaction between energy and space, embedded within the context of local values and challenges a post-communist society. Placing people's stories and needs as one of the main pillars of this project, highlights the intricacies and complexities of the energy transition process dictated by political, social, and spatial considerations. The project seeks to redefine the narrative surrounding communist industrial sites and their relationship with the local population, by designing a new perspective for these areas, emphasizing their potential qualities and impacts at local and national levels. Moreover, this project prompts a fundamental point by proving that energy security alone is not sufficient to address the challenge of energy transition. It brings attention to the pressing issues of energy poverty and environmental quality when fostering a transition. The incorporation of energy equity concept within the design of energy transition in Albania, strives to ensure that no one is left behind and the environment qualities are maximized.

The scientific relevance of this project is demonstrated through the translation of energy transition into the spatial context of Albania, a post-Communist country that reflect climate vulnerability, energy poverty and environmental issues of the current energy system and is lacking data and scientific research for a data-driven methodology. It involves the transformation of current energy challenges by aligning them within the local limitations and values of a specific case study, particularly in Elbasan, where scientific research in this topic is relatively limited. This project acts as a bridge that fills the knowledge gap in Albania, enabling a deeper comprehension of energy as a spatial concern, and effectively translating this understanding into tangible solutions that act as blueprint strategies for similar global contexts. Moreover, the research offers a fresh perspective on the layers of Communist Industrial sites left behind, presenting them as potential areas for energy transition. This approach addresses the current energy challenge of energy security within its social and environmental impacts, by identifying limitations and opportunities within the historical context that paves the way of energy transition process. Lastly, this study makes a valuable contribution by consolidating critical data and a systemic design framework for Albania, a region relatively lacking in European datasets. It creates a methodology that could serve as a valuable tool for decision-makers, local authorities and other researchers, by showing the importance of site visits, microstories and design to empower the energy transition process through informed, data-driven and context specific decisions. This framework formulates effective strategies to align the steps of Elbasan and Albanian Government within the European goal of achieving climate neutrality by 2050.

In terms of professional relevance, this project underscores the pivotal role of urban planners in the energy transition process, emphasizing that energy is not merely a technical challenge but also a spatial one with direct implications for the spatial, social, and environmental qualities of an area. It presents an approach for fostering energy transition in areas characterized by a lack of data and a sensitive historical context. This proposed method shows the power of design to shift the local perspectives of specific sites, from areas of conflicts and limitations to areas of potentials.
An ethical dilemma within this project revolves around the decision-making process for designing post-Communist industrial sites for energy transition, taking into account their social and political sensitivity. The doubt lies between restoring the site as an industrial heritage area to preserve its history and memories and frame energy strategies within the boundaries that a heritage site should contain, or consider the site as an industrial area that has a lot of potentials for economical developments and energy production. While trying to find a balance between these two options, I recognize that this decision is subjective and tries to prove the potentials of space through the eyes of an urbanist. To arrive at a more objective decision, it would be valuable to incorporate the opinions of all stakeholders and residents of the city regarding the transformation of this space and their preferences.

Additionally, another dilemma arises in how I interpret the micro-stories collected from individuals during site visits. The information gathered will inform the design phases of the project, potentially leading to oversights in considering crucial aspects that the space should address to facilitate energy transition. Due to time constraints and limitations on involving all stakeholders, this project may fall short in capturing all the perspectives necessary for an effective design where everyone's input is considered. Another research effort, focusing more on stakeholders' involvement and a participatory design approach, needs to be undertaken to test the proposed design effectively.

Lastly, the absence of comprehensive data and the individual interpretation of spatial data for the case study of Elbasan hinder a data-driven and quantified approach that could accurately assess the impacts of the design on society and the environment.

6. Transferability

According to Lincoln and Guba (1985), transferability is a crucial criteria for evaluating how the methodology or findings of a project can be applied to different contexts and areas (Lincoln & Guba, 1985). This concept is further enhanced by the ability to conceptualize findings into a theoretical perspective, creating a framework that either relates to existing theories or contributes to new ones (Denise & Beck, 2010). This project is evaluated on how it contributes to these two main aspects of transferability.

I have defined a methodology that connects research with design through a conceptual framework in this thesis. This framework can serve as a model for exploring and establishing new energy-space nexuses in post-Communist countries seeking sustainable energy transitions. The methodology used to frame scenarios and design the strategic plan for Elbasan can be applied to defining new energy-space nexuses in the 41 Patterns of Production areas identified during the analysis phase in Albania. Each of these Patterns of Production faces similar issues related to energy security, energy equity, and environmental quality as those found in Elbasan. These areas, characterized by former Communist industrial sites, have been abandoned without a vision for integrating them into a sustainable transition. The scales, spatial characteristics, and the cultural, social, and political sensitivities of these areas are similar to those of Elbasan.

Moreover, the research data and findings from this project provide a valuable starting point for students and professionals interested in exploring post-Communist society and space within the framework of energy transition. The insights gained from the Elbasan case study and the methodology used to bridge the lack of data contribute not only to the specific context of Albania but also offer methods and tools applicable to similar urban environments in the Western Balkans which also have a lack of scientific research on sustainable transitions. This project is the first scientific research focusing on the energy-space nexus within Albania's energy system, adding value to European sceintific research on how to bring the Post-Communist countires of Europe on the board of climate change by emphasizing the spatial outcomes of energy transition processes and their social and environmental impacts in specific contexts. It also underscores the global importance of recognizing that the energy-space nexus varies according to local context and societal needs.

One of the main challenges I faced in terms of transferability was integrating the theoretical framework into the design process and determining how the design process could add value to energy transition theories. With an architectural background, I typically approached design based on concepts, viewing the process as a practice of testing the "best" design rather than relying on theoretical and conceptual frameworks.

This project showed me the role of theories in creating a strong foundation and guiding the design phase through contemporary concepts and innovations in energy transition. Theories are not just reflections of other researchers' work; they provide essential support for the project. The Multi-Level Perspective (MLP) framework, with its niches, regime, and landscape levels, was particularly helpful. In this project, these levels were translated into three scales for developing future scenarios and exploring spatial possibilities and their impacts across different scales. I realized that the energy transition system is a systemic process, where a small measure at any scale can directly impact other systems, creating complementary or conflicting spaces. By integrating this theory into the design phases, the project contributes to the theoretical background by showing how a theory can be translated into a practical design tool and the importance of integrating this theory with other design tools for a comprehensive view of the energy-space nexus. And at the same time, this project contributes to the existing theories of energy landscapes too by demonstrating that conflicts can arise within a sustainable energy-space nexus. Even when context-specific and sensitive to social and environmental needs, compromises on some qualities are often necessary.

Thus, the project advances the concept that an energy-space nexus is not merely a sustainable spatial translation of energy transition but also a balance of conflicting goals that must be assessed according to the most predominant issues in a specific context to achieve a truly sustainable solution.

7. Aspects of energy transition not considered

This thesis does not calculate the exact amount of energy projected to be needed in 2050 to meet demand while considering all the possible scenarios of climate change challenges, extreme weather conditions, and the potential population growth or decline of Elbasan. Additionally, it does not offer a fixed overview of policies for the energy system framework on how low-income individuals will afford their own solar energy systems and marginalized communities will be involved in the process. This project offers an overview of the energy-space nexus potentials that can be constructed in the city, considering the three pillars of a sustainable energy transition—security, equity, and environmental quality in line with the locals needs. Further research, including detailed numerical analysis and software modeling, would add value by validating the energy-space nexus envisioned for Elbasan.

Moreover, economic and cost-benefit analyses of the proposed design are excluded. The proposal involves transforming Communist-era industrial sites into clean energy production areas for Elbasan without addressing the economic considerations associated with this transformation, such as costs, job creation, welfare implications, income effects, and other financial parameters. Future research could build on this project to evaluate the economic constraints and benefits of the proposed scenarios and design interventions.

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- diagram by the author

- diagram by the author

Figure 97: diagram of third strategy in Elbasan city, source:
- diagram by the author

Figure 98: diagram of forth strategy in Elbasan city, source:
- diagram by the author

Figure 99: timeline of actions in the strategic plan of Elbasan, source:
- diagram by the author

Figure 100: first phase of the strategic plan in Elbasan city, source:
- map by the author

Figure 101: second phase of the strategic plan in Elbasan city, source:
- map by the author

Figure 102: third phase of the strategic plan in Elbasan city, source:
- map by the author

Figure 103: forth phase of the strategic plan in Elbasan city, source:
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Figure 104: final strategic plan in Elbasan city, source:
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Figure 111: main assessment of the strategic plan, source:

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