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Effectiveness of the Implementation of Local Energy Plans

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Abstract:

In the context of the European Green Deal and the EU's multilevel energy and climate governance framework, local energy and climate plans have become key strategic instruments for steering cities toward carbon neutrality. These plans—such as Sustainable Energy and Climate Action Plans (SEAPs/SECAPs) and Climate Air Energy Territorial Plans (PCET/PCAETs)—seek to operationalize national and EU targets through local measures that integrate energy efficiency, spatial planning, and collaborative governance. Yet despite growing political commitment and technological innovation, their implementation remains slow and uneven, and a persistent gap endures between strategic decision-making and operational execution. This research investigates the causes of this gap and the weak linkage between strategy and action in local energy plans. It explores why implementation progresses at a low pace, why projects face delays or failure, and why, in some cases, targets are unmet. Adopting a comparative approach, the study analyzes six cases—three in Italy and three in France—focusing on (SEAPs/SECAPs) and (PCET/PCAETs). Qualitative data from plans, monitoring reports, and interviews were systematically coded and analyzed using MAXQDA. The findings reveal that while municipalities define ambitious strategic goals, effectiveness is constrained by fragmented institutional capacity, financial uncertainty, and limited adaptive learning. Integrating perspectives from multi-level governance, socio-technical transitions, and organizational learning, the study shows that successful implementation occurs when governance coherence, technological innovation, and institutional learning are aligned. The multidimensional framework (D1–D8) developed here provides a replicable tool for assessing and improving the effectiveness of local plans, reframing local climate governance as a dynamic process of coordination, innovation, and continuous learning.

Key words: Effectiveness, Local Energy Plans, SEAPs/SECAPs, PCET/PCAETs

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Chapter 1:

Introduction



Background and Context

Climate change mitigation and the transition to sustainable energy systems represent one of the most urgent global challenges of the twenty-first century. The European Union (EU) has committed to achieving carbon neutrality by 2050 through the European Green Deal and the Fit for 55 packages, which emphasize energy efficiency, renewable integration, and the decarbonization of urban systems (European Commission, 2019; 2021). Following that, an increasing number of international organizations, for example, the European Commission (EC, 2016), the International Energy Agency (IEA, 2008 and 2016), or the International Renewable Energy Agency (Giorio & Paparella, 2023) have been occurred. Within this framework, local governments have gained a strategic role in operationalizing national and European climate targets as well as defining some international plans and projects. The Covenant of Mayors for Climate and Energy was launched in 2008, institutionalizing this local commitment by encouraging cities to develop Sustainable Energy (and Climate) Action Plans (SEAPs/SECAPs) aimed at reducing greenhouse gas (GHG) emissions and improving energy resilience (Covenant of Mayors, 2020).

On the urban scale, energy transition policies rely heavily on planning instruments that combine technical, organizational, and governance dimensions. These plans translate broad climate targets into local actions involving public institutions, private stakeholders, and citizens. However, the implementation of these plans often faces significant barriers—ranging from financial constraints and fragmented institutional arrangements to low social acceptance and technical limitations (Kern & Bulkeley, 2009; Smedby & Quitzau, 2016).

Both France and Italy have been at the forefront of local energy planning within the EU, and there are differences both in their governance and institutional frameworks. This difference creates a unique comparative context for exploring the effectiveness of local energy plans' implementation across two planning systems with shared European goals but distinct institutional architectures.

Problem Statement

Cities are particularly prominent examples of places where “policy meets people,” i.e., where the citizens—and their city leaders—most directly confront the issues involved in tackling environmental issues (climate change, energy consumption, etc.) (European missions, 2021). Today, local authorities, which are closest to where energy is consumed

and have decision-making and implementation powers, must play a central role in reducing energy consumption (Cacic, 2009). The implementation and efficiency of energy consumption reduction and optimization plans by local authorities is a very complex issue (MacCallum, 1970).

In the past, in France, energy-related plans and decisions were made at the national level, but since the 2000s, the priority and importance of energy management at the urban level have given greater importance to the local decision-making scale (Cacic, 2009). Energy plans are central to energy transition processes toward efficient and low-carbon energy supply (Bertelsenmet et al., 2021). They are made to inform and guide energy transition processes. Decentralization in the energy transition is a process initiated in many developed countries for several years, including France. This decentralization has moved local authorities to liberalize. And this liberalization of energy markets forced local authorities to position themselves in the market offers for their own needs, thereby appropriating more specifically energy issues. Lastly, local strategies implemented with shared governance are essential to make the ownership of the energy transition by citizens and stakeholders.

Based on the 2030 SDG1 (Sustainable Development Goals) Agenda goals, especially goals number 11 (Sustainable cities and communities), 7 (Clean and accessible energy), and 13 (Fight against climate change), to improve the quality of life and increase livability in cities, as well as to protect the planet, cities and urban plans should move towards green plans, which can be done through the implementation of various plans such as nature-based plans, green infrastructure, use of renewable energies in cities, etc. For example, based on the 2030 Agenda for Sustainable Development and the Paris Agreement targets, renewable energies must achieve at least a 63% share of the energy system by 2040 to reach both Sustainable Development and the Paris Agreement goals (United Nations, 2017). However, as pointed out by many stakeholders and as requested by the professional sector, in urban planning and design, there is a strong need to bridge the gap between the conception of green and energy actions on the territory and their practical implementation.

For several years now, urban planning has integrated environmental issues. For instance, in Italy, since Law 10/1991 (Articles 5–6), local authorities have been encouraged (and, in municipalities with more than 50,000 inhabitants, required) to elaborate Municipal Energy Plans (Piani Energetici Comunali) to manage energy demand, promote renewables, and improve efficiency (Energy Cities, 2024). Alongside these mandatory tools, various environmental and energy-transition strategies (such as Sustainable Energy Action Plans (SEAPs), Sustainable Energy and Climate Action Plans (SECAPs), local adaptation strategies, Renewable Energy Communities (RECs), and sustainable-mobility initiatives) have become central in shaping Italian urban policies (Marra, 2024; Zanon, 2013). These approaches implanted climate and energy goals into territorial governance and urban design, and they support Italy's broader transition toward carbon neutrality.

At the same time, environmental and energy-transition strategies (such as adaptation plans, local energy & climate action plans, district or neighborhood-scale initiatives, and

renewable energy communities) have become increasingly important in the conduct of urban planning and the built environment across Italian cities. For example, local authorities are now often considered key actors in deploying energy transition and climate action (Nucci & Prontera, 2023).

Importantly, local energy plans in Italy are not limited to assessing the renewable-energy potential of territories; they also work on energy-efficiency potentials, focusing on building-stock renovation, district-heating and cooling networks, and integration with spatial-planning tools (Minoia et al., 2009; Pietrapertosa et al., 2020). This dual perspective—renewable assessment and efficiency improvement—aligns with both national and European decarbonization frameworks.

Moreover, given Italy's multilevel governance system (with national, regional, and municipal levels), regional energy-environmental plans (for example, Piani Energetici Ambientali Regionali) and local urban-energy/climate action plans (SEAPs and SECAPs) provide frameworks for municipalities to interpret and localize national and regional targets by combining renewable-energy deployment, energy efficiency, and urban planning techniques (Nucci & Prontera, 2023; Cignini et al., 2023).

It can be said that, in Italy, local energy and climate plans have developed into key strategic instruments of urban planning, not only to evaluate renewable-energy potential, but also to structure the energy transition of cities through efficiency, spatial integration, and collaborative governance (Tedeschi, 2024; Moretti & Stamponi, 2023).

And in France, as another example, Local Energy Plans and Energy Master Plan projects have been done by some local authorities to make the most of the new competencies that were given to local authorities in the field of energy. In addition, environmental plans (Agenda 21, climate plan, Positive Energy District, and NeSighborhood, Zero Carbon, etc.) (Hinterberger, 2020) have become important in the conduct of urban planning and the construction of the built environment for most cities in Europe. It is necessary to mention that Local Energy Plans are not only an evaluation of the local potentials of renewable energy, but at the same time, it is a way to work on energy efficiency potentials.

Although these plans, which have been developed over several years, have not easily and quickly found practical and effective implementation, in addition to that, despite increasing political commitment and technical innovation, there remains a consistent gap between strategic decision-making and operational implementation of local energy plans. Many municipalities develop ambitious climate and energy strategies, but actual project execution often proceeds slowly, with delays, partial coverage, or unrealized targets (Broto & Bulkeley, 2013; Castán Broto, 2015). There are some observations for that as follows,

Observation a: urban sprawl continues, and the consumption of natural resources by urbanization is slowing down (energy and water consumption, pollution, etc.)

Observation b: construction projects for neighborhoods, industrial sectors, commercial centers, etc., integrating the major environmental objectives defined by the urban development plans or schemes at a rate and to an extent that are deemed insufficient in

terms of environmental objectives and climate imperatives. Or, apart from the major, highly emblematic projects, the other projects are slow to be ambitious in this respect.

It has to be pointed out that most of these plans are highly dependent on local context, with many factors, such as the available renewable energy sources, energy storage potential, population, energy consumption behavior, costs, and regulations. For example, energy access practitioners emphasized that consumer energy use requires tailored solutions that respond to the consumer's needs, preferences, and budgets (Ballesteros, 2013).

This leads to an interest in what happens between plans and implementation: Why is there a lack of links? Why is there such a weak translation of objectives and orientations, and plans within operational projects? How could it be possible to explain it? To answer these questions, it is necessary to examine the process of implementing energy-related projects by analyzing local authorities' and energy communities' policies and actions.

Research Significance and Rationale

This research addresses a crucial gap in the literature: while numerous studies have assessed energy efficiency or emission reduction outcomes, fewer have examined the organizational and governance dimensions that determine implementation effectiveness (Guy & Shove, 2000; Nilsson et al., 2012).

By comparing local energy planning in France and Italy, this work contributes to understanding how institutional arrangements, stakeholder networks, and socio-technical capacities interact to shape outcomes. The study combines engineering-oriented assessment with governance-oriented analysis. The findings inform both policymakers and practitioners by identifying which governance mechanisms and organizational models facilitate the translation of strategic goals into tangible energy outcomes.

Research Aim and Objectives

The main objective is to find the reasons for the weak relationship between the strategies related to energy plans and their implementation in reality, and the reasons for the very low speed of energy plan implementation, and also, in some cases, the failure and delay of some projects and not achieving the aims during implementation. In fact, the aim is to go beyond and deepen the current explanations regarding the effectiveness and, in some cases, efficiency of energy solutions at the local level by paying much more attention to the question of the articulation of the organizational dimension with local environmental specificities as well as technical approaches.

The Ph.D. thesis aims to analyze this gap between the decision-making and action spheres by observing and analyzing the six energy action plans in six different cities in France and Italy (three in each country), from the first plan to the monitoring one. The thesis analyses different themes but mostly focuses on building actions that have been defined in the energy plans.

The aim is to carry out empirical and comparative work on the translation of current plans in France and Italy, using an organizational and socio-technical analysis grid.

1- Comparative study of the national and local frameworks of local energy plans (PCET/PCAET and SEAP/SECAP) in France and Italy.

2- Comparative study of the degree of effectiveness in implementing building-related actions in six selected cities.

3- Identifying institutional, financial, and socio-technical factors influencing plan implementation.

4- Draw up a portrait of the Italian and French local energy plans development and patterns of success and failure across the two countries.

5- Proposing recommendations to enhance the operationalization of local energy and climate plans.

Research Questions

Main Questions:

How is it possible to define the Effectiveness of Local Energy Plan Implementation?

Detailed Questions:

1. What explains the varying degrees of effectiveness in the implementation of local energy plans?

2. How do governance structures, institutional capacity, and technical mechanisms influence outcomes?

3. To what extent do contextual conditions (national policy frameworks, local capacities, socio-economic contexts) shape implementation performance?

4. What common barriers and success factors can be identified between the French and Italian cases?

The research question has been investigated in the inter-organizational and organizational relationships that are involved in urban projects from a mission or a goal to action.

Hypothesis

Main Hypothesis: The effectiveness of local energy plan implementation depends on the degree of institutionalization and integration of the plan within existing governance and socio-technical systems.

Sub-Hypothesis: The presence of monitoring and evaluation mechanisms promotes learning and adaptive management, enhancing the continuity and long-term effectiveness of energy plans.

Conceptual and Analytical Focus

The research is grounded in a multi-dimensional understanding of effectiveness, encompassing both measurable outcomes and process-related factors.

- Effectiveness: defined as the degree to which local energy plans achieve their stated objectives within defined timeframes and resource constraints (Mickwitz, 2003).
- Governance: focuses on multi-level interactions among institutions, actors, and policies shaping implementation (Hooghe & Marks, 2003).
- Socio-technical systems: recognize that energy transition outcomes depend on technological innovation, infrastructure, and human behavior (Geels, 2002).

The study chose to employ three theoretical lenses after reviewing related theories:

1. Multi-Level Governance (MLG) – to capture coordination between national, regional, and local levels.
2. Socio-Technical Transitions (MLP) – to interpret technological change and integration within local contexts.
3. Capacity Building and Organizational Learning – to assess institutional adaptation and monitoring feedback mechanisms.

This integrated analytical approach allows for evaluating both the process effectiveness (how plans are managed) and outcome effectiveness (what is achieved).

Scope and Delimitations

The comparative analysis in this research focuses on the implementation effectiveness of local energy and climate plans in Italy and France. Although both countries are aligned with the European Union's overarching climate and energy objectives, the institutional frameworks and local planning instruments through which municipalities act differ significantly. Therefore, selecting comparable plans required attention not to identical legal instruments but to those that perform equivalent functions within each national governance context.

➤ Italy: SEAPs and SECAPs under the Covenant of Mayors

In Italy, local climate–energy action has largely developed within the framework of the EU Covenant of Mayors for Climate and Energy (European Commission, 2008). Through this initiative, municipalities voluntarily commit to preparing a Sustainable Energy Action Plan (SEAP)—and, since 2015, a Sustainable Energy and Climate Action Plan (SECAP)—to achieve specific CO₂ reduction targets and, later, to incorporate climate adaptation (Covenant of Mayors, 2016).

While SEAPs/SECAPs are not legally mandatory under Italian law, they have become the de facto local planning instruments for energy transition and climate mitigation. This is due to strong political support and technical guidance from national and regional authorities (ENEA, 2021; ISPRA, 2020), as well as the integration of SEAP/SECAP

principles in several regional energy–environmental plans (Piani Energetici Ambientali Regionali, PEAR or PEARER) (Regione Emilia-Romagna, 2017; MASE, 2023).

For this reason, SEAPs (and in Bologna’s case, the later SECAP) were selected as the Italian cases. SEAPs and SECAPs represent the most operational and comparable local energy–climate planning instruments in Italy, as they provide a standardized framework for integrating energy efficiency, renewable energy, and climate-mitigation (and, in the case of SECAPs, adaptation) strategies at the municipal level (Tedeschi, 2024; Zanon, 2013; Di Nucci & Prontera, 2023; Moretti & Stamponi, 2023).

➤ **France: From PCET to PCAET and Local Climate Plans**

In France, SEAPs and SECAPs—developed under the voluntary EU Covenant of Mayors framework—are not mandatory for municipalities. Consequently, many cities did not continue updating these plans once the national Plan Climat-Air-Énergie Territorial (PCAET) became compulsory, which has since become the main local instrument for climate and energy planning (Bertoldi et al., 2018; Dall’O’ & Sarto, 2013; ADEME, 2020)

In contrast, France has a nationally regulated system of local climate and energy planning, established through the Grenelle II Law (Law n°2010-788) and later strengthened by the Energy Transition for Green Growth Law (Law n°2015-992). These legislative frameworks introduced and consolidated two successive local planning instruments:

- the Plan Climat-Énergie Territorial (PCET), and
- the Plan Climat-Air-Énergie Territorial (PCAET).

Both plans serve as mandatory frameworks for local authorities (Établissements Publics de Coopé-ration Intercommunale – EPCI) to organize and implement energy transition, GHG mitigation, adaptation, and (in the PCAET) air-quality actions (ADEME, 2018; Code de l’Environnement, 2023).

Although the initial research design aimed to examine SEAPs in both countries, it became evident that in France SEAPs were not implemented in a comparable way: French municipalities operate almost exclusively under the PCET/PCAET system, which fulfills a similar strategic function but is rooted in national regulation rather than EU voluntary frameworks (Berthinier-Poncet, 2017; Rüdinger et al., 2014). Thus, the French PCET/PCAET were selected as the functional counterparts to the Italian SEAPs/SECAPs.

For Paris, the 2018 Paris Climate Action Plan (Plan Climat de Paris) was included as a representative case. Although locally tailored, it aligns with the PCAET framework in structure and objectives and serves as the city’s strategic document for achieving carbon neutrality by 2050 (ADEME, 2020; Ville de Paris, 2018).

Table 1: Compare the alignment of SEAP/SECAP in Italy and PCET/PCAET in France

Dimension	Italy	France	Alignment
Legal nature	Voluntary (EU initiative)	Mandatory (national law)	Institutional difference, but similar function
Focus	Energy & CO ₂ mitigation (SEAP), + adaptation (SECAP)	Climate, energy, air, adaptation	Substantive equivalence
Governance	Bottom-up (EU–local)	Top-down (national–local)	Complementary perspectives
Role in local climate policy	Main operational instrument	Legally required local framework	Functionally comparable

Hence, while SEAP/SECAPs and PCET/PCAETs differ in legal basis and administrative hierarchy, they both serve as the core strategic tools for local energy and climate policy in their respective national systems. Their comparison allows investigation not only of implementation effectiveness but also of how different governance models influence local energy transition outcomes.

The research covers six case studies—Milan, Bologna, and Bolzano (Italy), and Paris, Lille, and Metz (France), and the focus is on building-related actions, given their central role in municipal energy consumption and climate targets. The temporal scope spans 2010 to 2025, covering the adoption, revision, and monitoring of local energy plans. While the transport, waste, and renewable sectors are considered for contextual understanding, they are not analyzed in depth.

Just as a summary of the limitations, they include data heterogeneity across municipalities, variable monitoring quality, the number of studied cases and their documentations, availability of a limited number of stakeholders for interviews, linguistic and translation challenges, and the temporal scope of the study (2010–2025).

Methodological Overview

The research employs a comparative, multi-case study design that combines qualitative and quantitative approaches.

Data sources include:

- Policy and planning documents (SEAPs, PCAETs, monitoring, and evaluation reports).
- Semi-structured interviews with municipal officials and energy managers.
- Technical indicators (energy use, emissions, retrofit numbers) drawn from monitoring data.

Analysis follows a three-step process:

- Document analysis, including interviews—to map goals, actions, and outcomes.
- Coding and thematic analysis—using categories derived from the eight effectiveness dimensions (D1–D8).

- Cross-case comparison—identifying patterns of effectiveness and implementation barriers.

MAXQDA was used as a tool to support qualitative data organization, while quantitative data from monitoring reports enabled descriptive evaluation of progress indicators.

Structure of the Thesis

The thesis chapters are organized as follows:

- **Chapter 1 – Introduction**
- **Chapter 2 – Literature Review and Conceptual Framework**
- **Chapter 3 – Methodology and case studies**
- **Chapter 4 – Results: Italian Case Studies**
- **Chapter 5 – Results: French Case Studies**
- **Chapter 6 – Discussion, Conclusions, and Suggestions**

Chapter 2:

Literature Review and Conceptual Framework



Source: Author

Literature Review

A literature review is crucial to identify gaps in what we currently know, applying the study in the larger academic area context, and making the research questions or hypotheses more precise. It also helps gain knowledge from previous investigations, methods, and theoretical frameworks to ensure that new research expands on what has previously been researched instead of repeating it (Hafeznia, 2024). In this case, a general and academic literature review of connected keywords with significant points has been done to establish a theoretical framework.

Effectiveness in Energy Planning

Generally speaking, effectiveness refers to the capacity of an action or process to achieve its intended goals. The Oxford Languages Dictionary puts it as how successfully a result is delivered. Similarly, the Cambridge Dictionary explains it as being able to be successful in achieving an intended outcome, and the Collins Dictionary takes a similar view, emphasizing that something effective works well and delivers the anticipated outcomes.

Effectiveness, in the context of energy planning and local energy planning, advances beyond only meeting set goals and achievement; it includes the capacity of a plan's ability to catalyze meaningful and sustainable change in a community (Gunten et al., 2021). This means having a comprehensive understanding of how well the plan's objectives align with the actual needs and priorities of the local context, as well as how well the plan encourages collaboration and engagement among different stakeholders (Marinakakis et al., 2015).

Lammers and Hoppe (2018) defined effectiveness in local energy planning as portrayed in their research as encompassing the successful realization of energy goals, clear governance, equitable cost-benefit distribution, and reduced institutional barriers. Effectiveness can be explained as follows:

- **Achievement of Project Goals:** Effectiveness pertains to successfully achieving the objectives of local energy initiatives, such as reaching climate targets, implementing renewable energy technologies, or enhancing energy efficiency at the local level.
- **Stakeholder Engagement and Clarity in Roles:** Effectiveness depends on clear roles and responsibilities among stakeholders and well-functioning institutional arrangements that enable decision-making and implementation.

- **Balanced Costs and Benefits:** Fairness in sharing costs and benefits among involved actors is mentioned as integral to effective implementation.
- **Reducing Delays Caused by Institutional and Financial Barriers:** Effectiveness would imply minimizing delays due to financial uncertainties, lack of information, or dependency on certain actors, such as private utilities.

In addition to the previous dimension, the same authors noted that the lack of information on “positions,” “net costs and benefits,” and “outcomes” in the literature limits deeper insights into effectiveness, pointing toward the need for empirical case studies to better define and measure it.

Based on the previous definitions, effectiveness in energy planning can be defined as the extent to which planning efforts achieve their stated objectives, align with the specific needs and priorities of the local context to promote sustainable and long-term impacts, and enable inclusive stakeholder engagement and collaboration.

Institutional and the concept of power

The concept of power, like many other social phenomena, has different types that will be associated with different layers of society. However, power relations are generally limited to a position of authority based on institutional, legal, and organizational positions. The institutional type is the most fundamental part of applying power. This type, however, is the only one that will be presented in one of society’s layers and exist in combination with other types through a comprehensive perspective.

As a general rule, power has been considered a unified structure and, ultimately, a division between government and capital. According to Steven Lukes (2005), who is directly influenced by Robert Dahl (1957), there will be three types of power: the first type, material power, is possessed and applied by an individual or a group. It is, therefore, highly actor-oriented at this point. In the second type, institutional power, the inclusion of legal and institutional tendencies will be considered. Finally, another aspect of power will show itself in instructing collective regulations. Non-decision-making, so in this state, is using power to eliminate, filter or change what has been identified and what has been ignored in political processes (Bachrach & Baratz, 1962; Haugaard, 2002).

Effectiveness and institutional capacity

Jose Maria Valenzuela (2024) declares that local institutional capacity in the context of energy planning means that local institutions, like government agencies, utilities, and research centers, can keep developing, maintaining, and using their expertise, tools, and knowledge in real-world planning exercises. This means having skilled staff, the right amount of funding, clear responsibilities, and ongoing chances to do analysis and work directly with the government to support long-term, context-specific energy planning decisions. One-time training doesn't build local institutional capacity; instead, institutions need to keep "learning by doing" so they can adapt to new technologies and planning problems. He mentioned that effectiveness and institutional capacity in energy planning is closely tied to maintaining local institutional capacity through continuous

practice, stable funding, and strategic delegation, rather than short-term outsourcing or sporadic training programs. Each has been explained as follows.

1. Continuous Application Builds Effectiveness:

Effectiveness in energy planning relies on maintaining institutional capacity through ongoing, practical engagement rather than one-off training. Continuous real-world involvement allows experts to develop and retain relevant skills, ensuring better-informed decisions and adaptability to changing circumstances.

2. Funding and Responsibilities Affect institutions Capacity:

Stable funding and clear delegation of planning tasks are crucial for sustaining local expertise. Without recurring contracts or work programs, institutions lose skills and experience over time, as seen when Mexico's local research institute lost capacity due to funding cuts and personnel retirements.

3. Risks of Outsourcing to International Consultants:

Relying heavily on external consultants for energy planning can yield short-term results but undermines the development of local institutional capacity. This jeopardizes the long-term effectiveness of planning efforts, as local institutions miss opportunities to build expertise.

4. Building institutions Capacity is a Long-Term Endeavor:

Sustaining institutional capacity is a continuous, endurance-based challenge that requires policymakers to invest time and patience. Successful cases like Chile demonstrate how governments partnering with local research institutions can maintain and grow expertise over time.

5. Local Institutions are Best Positioned:

Governments and utilities are the best placed to assign responsibilities, channel funding, and think broadly about multiple uses of planning tools, ensuring the continuous development and retention of institutional knowledge critical to effective energy planning.

Wretling and Balfors (2021) discuss effectiveness in the context of institutional capacity building, regional networks, and governance processes for climate change mitigation. It relates to the capacity to implement strategies, mobilize resources, and facilitate inter-municipal cooperation to advance climate goals. They also mention that effectiveness can be understood as the extent to which institutional capacity (comprising knowledge resources, relational resources, and mobilization capacity) is successfully built and utilized by municipalities and governance networks to achieve the concrete integration of climate change mitigation aspects into spatial planning and local governance processes. This includes having dedicated personnel, integrated policy documents, and active participation in regional and inter-municipal networks that facilitate knowledge exchange and collaborative actions. The presence or absence of key positions, such as

comprehensive planners and energy/climate strategists, and their workload, affect an organization's capacity to integrate climate policies.

Institutional arrangements

Institutional arrangements are significant factors for strengthening governance across territorial levels. These networks empower coordination among actors and contribute to more effective, multi-level institutional frameworks (Wretling & Balfors, 2021). These arrangements shape decision-making, influence actor involvement, and can hinder or facilitate project success (Lammers & Hoppe, 2021). Notably, Institutional factors play an important role in the allocation and utilization of land (He et al., 2023).

The Institutional Analysis and Development (IAD) Framework

The Institutional Analysis and Development (IAD) framework is utilized to examine the complex institutional dynamics and decision-making contexts in local renewable energy governance. Developed by Elinor Ostrom (2011). This framework deconstructs 'action situations' into distinct elements such as actors, available actions, rules-in-use, information, outcomes, and material conditions. It allows a systematic analysis of multi-actor governance settings and outlines seven key components:

1. Actors (Positions): Participants and their respective roles.
2. Actions: Available strategies and choices.
3. Outcomes: Results of actor interactions.
4. Information: Access to or lack of relevant knowledge.
5. Control Rules: Legal, normative, and institutional constraints.
6. Costs and Benefits: Perceived or actual risks and rewards.
7. Physical and Material Conditions: Resources and infrastructure shaping actions.

Applying the framework to local energy governance helps identify institutional gaps (such as unclear roles or insufficient information) that hinder project success. It also enables comparative analysis across cases or countries by highlighting how specific rules and external factors shape stakeholder behavior and outcomes. Thus, the IAD framework serves as a robust tool for understanding and improving the institutional arrangements that support local renewable energy implementation (Ostrom, 2011; Ostrom, 2009; lychetti et al., 2017).

Actor Coordination

Coordination across municipal departments, as well as between municipalities and external actors such as energy companies (or private energy actors), is a crucial factor in integrated climate and energy planning on a local scale (Wretling & Balfors, 2021). There is a strong emphasis on cooperation structures with multiple stakeholders to collect ideas and ensure commitment from actors. Also, the use of formal groups and cross-sectoral participation fosters coordinated action (Bertoldi et al., 2010). A key issue among

the actors is poor coordination, with some critical stakeholders (such as homeowners and distribution system operators) often excluded or weakly involved. This restricts effective cooperation, information sharing, and project progress (Lammers and Hoppe, 2021) via public consultations, workshops, and working groups, etc. (Scorza and Santopietro, 2024), and clearly, the increasing number of potentially involved actors makes local energy planning more complex (Eli et al., 2002).

Generally, better coordination between different levels of government (local, national, and even European) can improve the implementation of renewable energy strategies significantly (when these levels align, instead of working in silos). It can be done via:

- Shared strategies and responsibilities (instead of fragmented or one-off projects).
- Bridging national and local efforts.
- Smarter, more integrated planning.
- Supportive conditions for Renewable Energy Sources (RES) rollout.
- Harmonized rules and regulations

Also, it is necessary to mention that several specific changes in regulations could create a more supportive and effective environment for urban renewable energy development, for example, by simplifying authorization processes and streamlining bureaucratic procedures, setting clear local priorities, and making regulations flexible and responsive and etc. (Schenone and Delponte, 2021).

Local energy plan

A local energy plan is a kind of plan that helps a community identify current and future energy needs, set priorities, and explore development opportunities. It is created by local people in collaboration with stakeholders like local authorities, network operators, and generators ([Community-led local energy plan toolkit. https://localenergy.scot/hub/local-energy-plans/](https://localenergy.scot/hub/local-energy-plans/)).

Local authorities and their role in energy plans implementation

Local authorities play a crucial role in shaping energy plans across Europe, and they are becoming more involved in local governance and energy management processes; however, their roles were mostly different before the electricity market liberalization, which will be discussed a little.

Before the electricity Market Liberalisation, Electricity markets in many European countries were monopolies and mostly publicly owned or heavily regulated. Then, Reforms were introduced to open up the electricity market to competition, and it involved unbundling—separating generation, transmission, distribution, and supply operations to allow new actors entry. as a result, state-owned monopolies were privatised or transformed into profit-oriented companies, then new market actors emerged, including private companies, community energy initiatives, prosumers (consumers who also produce electricity), aggregators, and energy service companies (ESCOs)(Lammers & Hoppe, 2018)

After that, in the era of Post-Liberalization Electricity Markets, clear roles and responsibilities have been lost, especially at the local level (Verbong et al., 2013). The second issue was that decision-making in local energy planning became more complex due to the increased number of stakeholders, including private companies and new actors with varying interests (Elle et al., 2002). Thirdly, local governments no longer had monopoly control and often lost direct ownership of production and supply assets; many sold their stakes in energy companies (Kist, et al., 2008). All of this complexity caused challenges in implementing renewable energy projects locally, with unclear governance arrangements, fragmented responsibilities, and a high dependence on subsidies (Lammers & Hoppe, 2018).

Local authorities' role is essential for implementing effective energy efficiency measures; however, their capabilities often vary significantly depending on the level of institutional support and available resources. Local authorities have a growing role in EU policies, allowing them to contribute directly to energy planning and community engagement efforts (Integration in decision-making) (Wiehler & Stumm, 1995). They receive training and tools to enhance energy efficiency in public buildings, which has led to the development of actionable energy plans and initiatives (Support for energy efficiency) (Herrando et al., 2022). They still face some challenges as it is hard to figure out who does what in local renewable energy planning, and it relies a lot on financial help (Lammers & Hoppe, 2018). Local authorities are being increasingly encouraged to use multidisciplinary data for producing short-term energy plans; however, there is a need for improved methods to analyze this data effectively (Androulaki et al., 2016). It is necessary also to mention that There is no standardized institutional arrangement across countries or cases, making local energy planning highly diverse and complex (Lammerd & Hoppe, 2018).

Losing local energy planning capacity and its long-term impacts

Jose Maria Valenzuela (2024), in their research, discusses that losing local capacity threatens the sustainability, adaptability, and contextual relevance of a country's long-term energy strategies, making it harder to plan effectively for the future. They also explain the ways in which losing local energy planning capacity negatively impacts long-term energy strategies:

1. When local institutions lose capacity, governments often turn to international consultants who may provide quick, short-term solutions but do not build sustainable local expertise. This reliance undermines the development of a robust local knowledge base necessary for ongoing and future planning challenges.
2. Without internal expertise, governments struggle to address new planning challenges, such as integrating emerging technologies or setting updated renewable energy targets. For example, Mexico lacked relevant expertise inside the Ministry of Energy when defining new targets, resulting in repeated reliance on external support.
3. Capacity loss often coincides with staff retirements and a lack of funding to hire or train new talent, leading to skill attrition and weakened institutional knowledge.

This impairs the continuous improvement and refinement of planning capabilities necessary for long-term strategies.

4. Remaining local entities, such as system operators, may focus solely on regulated or official grid expansion plans and cannot support more speculative or alternative scenario planning (like decarbonization pathways), limiting the ability to explore diverse futures for the energy system.
5. International consultants may not fully capture locally relevant factors, whereas strong local institutions bring insights rooted in the specific political, economic, and technical context, which is crucial for effective long-term planning (Jose Maria Valenzuela , 2024)

Organizational Dimensions of Energy Plan Implementation

Scorza and Santopietro (2024) in their research discussed the organizational aspects through the involvement of stakeholders, allocation of responsibilities, and planning of resources (financial and human) within the SECAP framework. They mentioned the need for effective participation methods to engage actors meaningfully. It has to be mentioned that after the liberalization of the EU's electricity markets, some challenges were created which affect the energy actions' performance:

- **Unclear Roles and Responsibilities (Actors' positions, who does what):** Legislation no longer clearly defines stakeholders' roles and responsibilities regarding local renewable energy projects.
- **Positions and Ownership:** Local governments frequently initiate projects but lack ownership of the required infrastructure or sites, particularly in residential zones. Consequently, they rely on housing associations or private landowners for implementation.
- **Cooperation Challenges:** Ambiguous stakeholder roles often hinder effective cooperation, resulting in poor coordination, decision-making inefficiencies, and project delays. While local governments set ambitious targets, they typically act as facilitators rather than direct implementers, relying on others to take initiative—an approach that frequently proves ineffective (Lammers and Hoppe, 2021).

Socio-Technical Perspectives on Energy Transitions

The integration of social and technical considerations is paramount in understanding the complexities of energy transitions at the local level (Heidari et al., 2018). A socio-technical perspective emphasizes the interconnectedness of technological systems and the social structures, institutions, and behaviors that shape their development and deployment (Basosi et al., 1999). It is crucial to acknowledge that energy systems are not merely technical artifacts but are deeply embedded within social contexts, influenced by cultural norms, political agendas, and economic realities. By adopting a socio-technical lens, this research seeks to unravel the intricate relationships between technological

solutions and the organizational and social dynamics that influence their successful implementation.

In fact socio-technical system refers to the integration of energy efficiency, renewable energies, and district heating in municipal energy systems and the use of simulation models (e.g., REAM) to assess long-term system behavior (Bertoldi et al., 2010). It has to be mentioned that focus on renewable energy sources (photovoltaic plants, biomass), energy communities, and the integration of new technological pathways such as heat pumps and electrical storage (though not included in the modeling) indicate attention to technological change and innovation uptake (Di Paolo et al., 2023).

Instruments Addressing Barriers in Energy Transitions

Effectively navigating the complexities of energy transitions demands the strategic deployment of a robust instrument mix rather than relying on a single, isolated policy. Using multiple policy tools simultaneously is often the most effective way to address the diverse environmental challenges and deep-seated barriers that hinder energy sector shifts. A fundamental part of this approach is policy integration, which means that governance efforts should be broad and include not just producing and supporting new, clean energy solutions but also intentionally phasing out old or carbon-intensive technologies. To make sure these instrument mixes achieve their intended results, seamless coordination across sectors and various levels of government is essential; this prevents redundancy, closes potential regulatory loopholes, and enhances overall policy effectiveness. Ultimately, the effective execution of any policy combination depends on the full involvement of many stakeholders, including governmental entities, the corporate sector, and civil society (Karoline et al., 2017).

Energy Plan Implementation

Wretling and Balfors (2021) discuss the role of municipal energy plans (by emphasizing in Swedish municipalities) and energy and climate strategies, noting that while municipal energy plans are expected to be up-to-date concerning energy supply and distribution, many municipalities develop broader energy and climate strategies voluntarily. The incorporation of these strategies into spatial planning, particularly through the comprehensive plan, is regarded as critical for effective implementation. The involvement of energy companies and grid operators, even when not municipally owned, is highlighted as essential.

Scorza and Santopietro (2024) analyzed the implementation of SECAPs (Sustainable Energy and Climate Action Plans), and they emphasized challenges related to the effectiveness and coherence of action plans at the municipal level. They mentioned the importance of detailed planning of mitigation and adaptation actions, such as budgeting, responsibility allocation, and timelines, to ensure the certainty of implementation of energy plans.

Lammers and Hoppe (2021) note that although local governments often initiate projects, they frequently adopt a passive role afterward and mostly leave the implementation phase dependent on other actors. This situation complicates decision-making and slows project progress.

Lack of Monitoring Reports (MRs), the dependence on qualified technical support, and the voluntary nature of SEAPs are some of the influential challenges of implementation of SEAPs, which affect their commitment and effectiveness of the plans (Santopietro and Scorza, 2024).

The main criteria that affect Sustainable Energy Action Plan (SEAP) implementation, based on Rivas et al. (2015), include: the quality and completeness of baseline data, stakeholder and citizen engagement, effective monitoring and reporting, availability of financial resources, political commitment, regulatory support, and a clear sectoral focus with prioritization of measures.

In the following table (2), the big challenges for local actors and municipalities in implementing Sustainable Energy Plans based on experiences of different countries and different research have been categorized.

Table 2: Challenges for local actors and municipalities in implementing Sustainable Energy Plans

Challenges	Key Notes / Explanation	Sources
Governance & Political Commitment / Government Ownership and Leadership	• Political support is essential to initiate and sustain SEAPs. • Risk of disruption due to political turnover. • Institutionalizing energy offices and clear governance helps ensure continuity. • Bureaucratic delays and institutional barriers can slow or prevent implementation, requiring stable administrative coordination. • Governments taking direct responsibility for energy planning ensure alignment with policy and accountability. • In some cases, ministries (e.g., Mexico, Chile, UK) have assumed planning responsibilities from utilities to ensure long-term capability building.	Bertoldi et al., 2010; Delponte, 2017; Lammers & Hoppe, 2021; Rivas et al., 2015; Valenzuela, 2024
Policy & Planning Integration / System Operator Role	• Lack of coherent integrated energy policies for buildings; partial focus. • Actions must be cost-effective and suitable for local contexts. • Must balance technical potential, financial limits, and expected outcomes. • Prioritization is often difficult. • Integration of energy and climate strategies into spatial/comprehensive	Nastasi & Matteo, 2016; Bertoldi et al., 2010; Wretling & Balfors, 2021; Scorza & Santopietro, 2024; Valenzuela, 2024

	planning is essential for coherent implementation. • System operators often focus on regulated grid activities and have limited capacity for broader strategic energy planning (e.g., decarbonization pathways).	
Financial & Economic Barriers / Funding for Operational Activities	• High upfront costs, uncertain economic returns. • Funding is crucial for SEAP execution. • Requires strategic planning and management to access grants, subsidies, and financing. • Financial management is often a limiting factor. • Consistent funding (contracts or programs) is essential to maintain institutional capacity and tools. • Inconsistent or discontinued funding leads to skill attrition and limits institutional ability to update and maintain planning systems.	Nastasi & Matteo, 2016; Bertoldi et al., 2010; Delponte, 2017; Scorza & Santopietro, 2024; Valenzuela, 2024
Technical, Climatic & Data Challenges / Use of Skilled Human Resources	• Variable solar irradiation: performance and integration difficulties. • Reliable local-level data is foundational. • Essential for setting realistic targets and evaluating progress. • Data collection is complex and requires technical resources. • Dependence on qualified technical support affects the reliability and consistency of monitoring. • Continuous real-world technical tasks are essential for maintaining skill levels; over-reliance on consultants limits institutional expertise.	Nastasi & Matteo, 2016; Bertoldi et al., 2010; Delponte, 2017; Scorza & Santopietro, 2024; Rivas et al., 2015; Valenzuela, 2024
Monitoring, Reporting & Evaluation / Adoption and Maintenance of Modeling Tools	• Progress tracking needs robust indicators and quality tools. • Consistent reporting ensures transparency and continuous improvement. • Monitoring alone (e.g., updating Baseline Emission Inventories) is insufficient — evaluation is needed to assess action effectiveness. • Continuous validation and updating of methods are required to adapt to evolving strategies and ensure reliable results. • Choice and maintenance of modeling software (e.g., WASP, Plexos) significantly affect planning quality and long-term data management	Bertoldi et al., 2010; Delponte, 2017; Scorza & Santopietro, 2024; Valenzuela, 2024

	capacity. • Lack of transition support between tools leads to obsolescence of local technical expertise.	
Stakeholder Engagement & Institutional Capacity / Coordination Between Institutions	• Stakeholder acceptance and coordination challenges. • Engagement of various stakeholders (citizens, suppliers, experts) is critical. • Capacity building improves effectiveness and long-term support. • Partnerships between government, utilities, and research institutions foster expertise sharing and coordinated planning. • Example: Chile's collaboration between government, system operators, and universities strengthened technical expertise and planning capacity.	Nastasi & Matteo, 2016; Bertoldi et al., 2010; Delponte, 2017; Wretling & Balfors, 2021; Rivas et al., 2015; Valenzuela, 2024
Architectural & Morphological Constraints (specifically for buildings)	• Constraints with listed and heritage buildings limiting retrofitting. • The large size of ST equipment for buildings.	Nastasi & Matteo, 2016

Theories of Policy Implementation

Rivas et al. (2015), in a report of the Covenant of Mayors: In-depth analysis of sustainable energy action plans, analyzed the Sustainable Energy Action Plans (SEAPs) of various cities, such as Amsterdam, Riga, Dublin, etc., focusing on energy consumption, CO2 emissions, and measures to improve energy efficiency and sustainability. Based on their evaluations, some core theories and their associated themes/variables can be obtained as follows (Table 3).

Table 3: Core theories and their associated themes/variables of SEAPs

Core Theory	Themes/Variables	City	Examples / Evidence
1. Multi-Level Governance (MLG)	- Institutional arrangements & governance roles - National/local delegation	Riga, Zagreb, Amsterdam, Dublin	- Several SEAPs emphasize the interaction between municipal authorities and national governments. For instance, Riga cooperates with the national Government and Parliament to

	- Country-specific context (moderators)		ensure energy efficiency and renewables remain high on the political agenda. - Zagreb benefits from a favorable national context with ambitious national targets, which accelerates local implementation. - Dublin’s analysis underlines difficulties encountered due to incongruence between baseline years and reporting frameworks—a reflection of governance and coordination challenges spanning multiple levels. - The regulatory frameworks and legislative context are frequently mentioned as key moderators affecting implementation success. - Stakeholder involvement also implies a layered governance structure where multi-level actors (municipal departments, national bodies, citizens) play roles in implementation and monitoring.
2. Socio-Technical Transitions (MLP)	- Market & technological dynamics - Renewable integration, EV infrastructure - Innovation uptake, infrastructure readiness	Amsterdam, Riga, Stockholm, Dublin	- Amsterdam’s Climate Programme explicitly pursues energy savings, sustainable energy, and transitioning fossil energy usages — demonstrating a multi-pathway technological transition. - Detailed measures include installation of charging stations for electric vehicles, heat pumps, solar energy collectors, and district heating network expansion. - The technological readiness of infrastructures such as district heating in Riga and the move from oil heating to biofuel district heating in Stockholm underlines the

			management of socio-technical transitions. - Transport sector strategies include priority public transport lanes, green vehicles, and traffic management systems reflecting transitions in mobility infrastructures. - Financial mechanisms and innovation diffusion, such as revolving funds (Zagreb), illustrate pathways for sustaining technological and infrastructural transitions.
3. Capacity Building & Organizational Learning	- Technical tools and capacity - Monitoring, learning loops - Stakeholder engagement and implementation ability	Riga, Zagreb, Dublin, Stockholm, Amsterdam	- Monitoring mechanisms are stressed across several SEAPs. For example, Riga's plan features yearly monitoring and priority adjustments, although implementation reports are missing in some cases. - Dublin's plan includes a detailed study by an energy agency used as a basis for consultations, supporting organizational learning. - Stakeholder engagement is identified as a "key success factor" in Riga's case, highlighting co-creation and participatory governance to enhance capacity and legitimacy. - Several cities report on the identification of responsible persons/departments for each measure, indicating development of organizational structures to support energy plan implementation. - Use of user-friendly tools like carbon abatement cost curves serves to help policy makers learn and prioritize actions. - Capacity limitations are noted as challenges in some plans, implying

			the need for improved technical expertise and monitoring capabilities.
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Overall, Multi-Level Governance was recognized as a critical condition shaping success, especially regarding delegation of responsibilities, legal frameworks, and intergovernmental cooperation. Also, they mention the importance of capacity building through technical systems, stakeholder processes, and institutional learning, which reflect the theory's core insights. All of these three theories will be discussed more as follows,

Policy Coherence

Wretling, V., & Balfors, B. (2021) highlight the importance of **policy integration or coherence** between comprehensive plans and energy, climate, or environmental strategies. The main goal here is two-way integration that enhances clarity and guidance across policy documents to support coherent planning and implementation processes, linking strategic spatial plans with energy policies. In some plans, like SECAPs, despite their broader scope, they still suffer from a sectoral approach that results in fragmented and incoherent actions. It emphasizes the need for stronger integration with urban planning policies to ensure that SECAP measures are coherent across sectors and aligned with broader strategic objectives (Scorza and Santopietro, 2024).

There may be gaps in policy coherence and implementation responsibility because of local governments setting ambitious energy and climate targets while expecting other actors to make the required investments and actions. Although local governments often set ambitious climate and energy targets, the supporting policies and tools are frequently misaligned or unclear, creating confusion among stakeholders. Inconsistent information and vague policy guidelines further hinder stakeholders' ability to navigate legal and financial support systems. Ultimately, this lack of coherence undermines stakeholder engagement and complicates the governance structures essential for local renewable energy adoption (Lammers and Hoppe, 2021).

Urban Governance and Multi-Level Governance in Energy Transitions

The role of urban governance structures is very significant, including the creation of structures such as Steering Groups, Reference Groups, and Working Groups to involve diverse stakeholders and experts from different sectors. These organizational dimensions help ensure political commitment, stakeholder involvement, and coordination (Bertoldi et al., 2010). Multi-level governance is defined as a key enabling framework comprising vertical and horizontal coordination among municipal, sub-regional, and regional actors through structured networks, which has an important role in effective integration of climate change mitigation in spatial planning and local climate governance (Wretling and Balfors, 2021).

Multi-Level Governance (MLG) in energy planning refers to the collaborative and structured coordination of policies and decision-making processes across various governmental levels, from local to national. It is also reflected in collaboration between local authorities, regional/national agencies, and European organizations, as well as integration of EU-level funding and frameworks in local plans (Bertoldi et al., 2010). Some research discusses the significance of MLG in enabling effective energy transitions and the role of different stakeholders in shaping local and regional energy initiatives (Dobravec et al., 2021; Hofbauer et al., 2022; Marquardt, 2014; Larsson et al., 2014).

Local power relations and governance structures are emphasized as critical for spatial planning towards energy-efficient urban structures. It can be defined by municipal competences, stakeholder involvement, coordination between neighboring municipalities and regional bodies, and the role of municipal ownership or involvement in energy companies for governance effectiveness. Also, it has to be mentioned that the interaction between politicians, officials, and various municipal administrations reflects aspects of urban governance practices (Wretling and Balfors, 2021).

Multi-Level Governance (MLG) in energy planning in Italy

Based on some of the researches, although multi-level governance (MLG) in Italy's energy planning shows that regional and municipal governments work well together they demonstrate a complex interplay between regional and local authorities to come up with long-term plans, and they seek to implement sustainable strategies among a variety of structural challenges, and it faces mostly problems with fragmentation and inefficiency. Some of the research's significant points are as follows:

One of these problems (in many cases) is the weakness of integration between Regional Sustainable Development Strategies (RSDS) and local governance structures which makes it difficult to implement cohesive energy planning (Regional and local alignment). The other challenge is Fragmented governance. Sectoral fragmentation within governance existence can threaten holistic sustainability efforts, and it needs integrated approaches to enhance cooperation (Bianchi & Richiedei, 2023). Another issue is political accountability. When actions come to the operations, it is harder to hold people accountable, and as a result, they may shift blame for policy failures, complicating stakeholder engagement (Milio, 2014). For Effective energy planning need for adaptive strategies that account for the diverse geographic and administrative contexts within Italy, with emphasis on synergies among stakeholders (Ottone & Barbieri, 2025). To have better local energy initiatives in Italy, working on better data availability and spatial energy planning is so important because current MLG structures are often inadequate (Dobravec et al., 2021). Specifically for SEAP, achieving institutionalization requires establishing dedicated departments or offices with the necessary competence and budget (Bertoldi et al., 2010).

Sociotechnical Transitions (Multi-Level Perspective, MLP) and Organizational Constraints

The Multi-Level Perspective (MLP) has become one of the dominant frameworks for analyzing sustainability and energy transitions. It conceptualizes change as a dynamic interaction between three analytical levels: the socio-technical landscape (macro-level context and external pressures), the socio-technical regime (the dominant configurations of technologies, institutions, and practices), and niches (protected spaces for innovation and experimentation) (Geels, 2002; Geels & Schot, 2007; Smith et al., 2005). Transitions occur when niche innovations gain momentum, align with external pressures, and challenge the stability of existing regimes, leading to reconfiguration or transformation (Geels, 2011). The MLP highlights how technological change is embedded within complex systems of rules, routines, and institutional structures, where governance, policy, and organizational behavior interact with material and technical innovation (Kemp et al., 2001; Rip & Kemp, 1998).

Within the energy sector, the MLP has been widely used to explain how local and national systems evolve through the adoption of renewable energy technologies, energy efficiency measures, and new governance arrangements (Verbong & Geels, 2007; Markard et al., 2012). Municipal and regional governments often serve as niche actors—initiating pilot projects, experimenting with governance instruments, or testing new business models within the broader national and European policy “landscape.” However, while the MLP framework emphasizes the co-evolution of technology and institutions, it often treats organizations as relatively stable intermediaries rather than dynamic entities with internal limitations (Fuenfschilling & Truffer, 2014). This omission is critical when considering local energy and climate plans, where organizational constraints—staffing, expertise, financial continuity, and bureaucratic routines—strongly influence implementation outcomes.

Organizational constraints refer to the structural and procedural barriers that shape how institutions adopt, adapt, and routinize innovation (March & Olsen, 1989; Argyris & Schön, 1996). These include limited technical capacity, fragmented interdepartmental coordination, risk aversion, and dependency on external funding or short-term projects (Lammers & Hoppe, 2021; Rivas et al., 2015). From a socio-technical perspective, these constraints act as regime stabilizers, reinforcing existing practices and slowing down transitions. For instance, municipal administrations often operate under entrenched procedural norms, regulatory obligations, and accountability structures that discourage experimentation (Hodson & Marvin, 2010). As a result, even when technological innovations—such as building retrofitting systems or district heating expansions—are available, organizational inertia or lack of learning mechanisms can prevent full-scale adoption (Bolton & Hannon, 2016; Turnheim et al., 2015).

Recent studies have sought to integrate the MLP with organizational learning and capacity-building perspectives, emphasizing that transitions depend not only on technological or policy innovation but also on the ability of institutions to learn and adapt (Van der Brugge & Rotmans, 2007; Sengers et al., 2019). Organizational reflexivity—the

capacity to reflect on and adjust routines—becomes a decisive factor in bridging the gap between pilot projects (niches) and mainstream institutional practices (regimes). In local energy planning, this reflexivity is often constrained by limited monitoring, inconsistent evaluation, and fragmented governance structures (Scorza & Santopietro, 2024). Consequently, socio-technical transitions unfold unevenly across contexts, depending on how effectively local organizations convert strategic goals into operational capabilities.

Thus, combining the MLP with an understanding of organizational constraints provides a more comprehensive explanation of transition dynamics. It shows that sustainability transitions are not only technological or policy challenges but also deeply organizational: in another word, they require institutions that can learn, coordinate, and adapt across governance levels. This perspective is essential for assessing the effectiveness of local energy and climate plans, where the success of technological innovation ultimately depends on organizational capacity and institutional learning.

Capacity Building & Organizational Learning

Capacity building and organizational learning explain how institutions acquire, retain, and adapt knowledge to translate strategic energy plans into operational practice. While multi-level governance defines structural roles and socio-technical transitions emphasize innovation pathways, this perspective focuses on the process dimension—the ability of municipalities to learn, coordinate, and evolve through experience.

Five principles underpin this approach. Continuous learning occurs through feedback, monitoring, and reflexive evaluation (Argyris & Schön, 1996). Institutional memory ensures that knowledge and expertise persist despite political or staff turnover (Levitt & March, 1988). Adaptive management promotes flexibility through iterative review and course correction (Pahl-Wostl, 2009). Multi-actor learning highlights collaboration among governments, agencies, and citizens to co-produce knowledge (van Buuren & Edelenbos, 2004). Finally, knowledge co-production connects technical and social actors, transforming energy governance from compliance to joint problem-solving (Senge, 1990; UNDP, 2009).

In local energy planning, these principles manifest in monitoring systems, interdepartmental cooperation, and partnerships with intermediaries such as energy agencies. Cities that institutionalize monitoring as a learning process—such as Lille or Milan—tend to adapt strategies more effectively, whereas others remain constrained by fragmented structures and indicator overload (Hoppe et al., 2014; Lammers & Hoppe, 2021). Building capacity thus involves not only technical training but also managerial stability, communicative competence, and governance reflexivity.

It can be said that capacity building and organizational learning transform municipalities from static implementers into adaptive, learning organizations capable of bridging the gap between strategic goals and operational outcomes. They provide the foundation for sustained effectiveness in local energy plan implementation, complementing the structural insights of multi-level governance and the innovation dynamics of socio-technical transitions.

Additionally, the role of participatory processes, analytical tools like cost-benefit analysis (CBA), cost-effectiveness analysis (CEA), and Decision Support Tools are highlighted for learning and improving SEAP implementation. This matches the principles of organizational learning and capacity building through monitoring, engagement, and iterative refinement (Delponte, Pittaluga, & Schenone, 2017).

Identifying Gaps by Reviewing Related Research

Lammers and Hoppe (2018) in a systematic literature review titled “Analyzing the institutional setting of local renewable energy planning and implementation in the EU” defined some main factors affecting local energy plan implementation including, Unclear Roles and Responsibilities, Lack of Policy Coherence, Information Deficits, Financial Uncertainties and Economic Risks, Dependence on Private Sector Utilities and Insufficient Stakeholder Engagement and secondary factors such as Institutional Complexity and Variation and Action Situation Elements (positions, rules, outcomes).

Schenone and Delponte (2021), in their research on the subject of "Renewable energy sources in local sustainable energy action PLANS (SEAPs)" said that the implementation of renewable energy (RES) plans in cities is facing serious challenges. Some progress has been made, primarily in heating and cooling for buildings and cities with similar climates in the EU, where different approaches to renewable energy sources are adopted, indicating that strategies often do not follow logical patterns, such as size or location. It illustrates that the way renewable energy sources (RES) are integrated into Sustainable Energy Action Plans (SEAPs) is inconsistent. In many cases, plans are pieced together from isolated, short-term projects rather than being built on coherent policies or long-term visions. This lack of structure makes it hard to plan effectively based on a city's specific energy potential. Another significant gap is community involvement. Unfortunately, most of the existing plans do not mention enough to this point. And the last issue is at the policy level of urban energy planning to respond to local needs. Mostly, decisions are shaped by national directives that don't match the realities of local energy production and consumption. They said that this transition should go toward smarter, more locally grounded, and people-focused energy planning.

Rivas et al. (2015) in a report, analyze the Sustainable Energy Action Plans (SEAPs) of various cities, including Amsterdam, Riga, Dublin, and Stockholm, focusing on energy consumption, CO2 emissions, and measures to improve energy efficiency and sustainability. They discuss several criteria and factors that affect the implementation of Sustainable Energy Action Plans (SEAPs), such as:

1. Data Quality and Methodological Approach for evaluation, etc.
2. Stakeholder Engagement, such as energy suppliers, transport companies, citizens, and public institutions
3. Regular Monitoring and Reporting
4. Financial Mechanisms and Funding Availability
5. Political Commitment and Coordination
6. Regulatory and Policy Framework (Supportive national and local regulations)

7. Sectoral Focus and Prioritization (EX, how emissions are spread out by sector)

Scorza and Santopietro (2024), in their research, highlighted the weaknesses of SEAPs (Sustainable Energy Action Plans). They said that, firstly, SEAPs focus on predefined sectors without considering interlinkages or system-wide urban impacts (Sectoral Approach). Secondly, actions appear as disconnected interventions, lacking a coherent strategy, especially where broader urban plans are weak; it can be described as a Lack of Integrated Urban Vision. Thirdly, there is a poor linkage between actions and local contexts that reduces relevance, monitoring, and effectiveness. And finally, SEAPs may result in 'patchy interventions' that are not well integrated spatially or functionally, which can limit potential synergies and undermine broader sustainability goals, can say Fragmented Implementation (Scorza and Santopietro, 2024).

Berghi (2016) in his research titled “Energy planning for metropolitan context: potential and perspectives of Sustainable energy action plans (SEAPs) of three Italian big cities,” analyzed the Sustainable Energy Action Plans (SEAPs) of three major Italian metropolitan areas—Milan, Palermo, and Rome—representing diverse urban governance, morphology, climate, and economic structures. This study focused on the implementation and dissemination of renewable energy sources (RES) at the municipal scale. Based on it, Milan’s SEAP emphasizes indirect measures such as reductions in planning fees and benefits to buildings, alongside specific actions and pilot projects for heat pumps and district heating networks. The paper proposes a multidimensional framework using three dynamic databases—Potential, Planning, and Scenario—to harmonize SEAPs, standardize data, and coordinate actions across municipalities. This is aimed at boosting coordination, resource use, and shared renewable strategies; it emphasizes subsidiarity and participation, though further testing is needed in varied contexts.

Nastasi et Matteo, 2016, by analyzing some Italian cities, specifically Rome, Milan, and Naples, faced several challenges and barriers related to the implementation of Sustainable Energy Action Plans (SEAPs) actions focused on buildings. The highlights can be summarized as follows (Table 4):

Table 4: Summary of Building-Specific Challenges of Implementation of SEAPs

Challenge Type	Description
Architectural & morphological	Constraints with listed and heritage buildings limiting retrofitting, the large size of ST equipment for buildings
Technical & climatic	Variable solar irradiation: performance and integration difficulties
Financial & economic	High upfront costs, uncertain economic returns
Policy & planning	Lack of coherent, integrated energy policies for buildings; partial focus
Social & institutional	Stakeholder acceptance and coordination challenges

Delponte (2017) and his colleagues discuss several challenges in monitoring the Sustainable Energy Action Plan (SEAP) progress that cities normally face. They are mostly included:

1. **Data Collection and Quality Issues:** Monitoring is hindered by incomplete, inconsistent, or outdated data spread across different sources and stakeholders.
2. **Changing External Conditions:** Economic shifts or energy price changes can distort expected outcomes, requiring cities to adjust their plans.
3. **Complexity of Multi-level Monitoring:** Tracking both individual actions and their combined environmental effects makes monitoring complex.
4. **Continuous Validation and Updates:** Monitoring methods must evolve to stay accurate, adapting to new strategies and policy needs.
5. **Financial and Bankability Challenges:** Limited funding often blocks implementation, highlighting the need to assess project bankability.
6. **Stakeholder Involvement:** Success depends on citizens, business, and academic engagement, but ensuring active participation is difficult.
7. **Evolving Planning Needs:** SEAPs must adapt to new technologies, policies, and regulations, requiring flexible, iterative monitoring.
8. **Procedural and Institutional Gaps:** Bureaucratic delays and institutional barriers slow down or prevent effective implementation.

They also mention that the effectiveness of SEAP implementation is closely linked to the Monitoring and Evaluation (M&E) process, which involves continuous assessment and dynamic adjustment of actions to ensure they contribute effectively to reducing GHG emissions. Monitoring alone, such as tracking the progress of actions or updating the Baseline Emission Inventory (BEI), is insufficient to guarantee effective implementation. Evaluation is necessary to assess the efficacy of each action and guide decision-making to enhance outcomes. In addition, financial factors, particularly bankability assessment, are critical for effective implementation since actions without financial viability often suffer and fail to be realized. Another important key is the Inclusion of citizen participation and fostering a network of cooperation involving public administrations, businesses, and academics, which improves implementation by enabling data collection and increasing support for SEAP measures. And finally External changes (e.g., economic conditions, policy updates, technological innovations) significantly influence the actual effectiveness of the plan, requiring iterative review and adaptation to maintain relevance and efficacy.

Bertoldi, P. et al. (2010) identified Key Steps in SEAP Development, upon a five-step approach to successful SEAP implementation:

- Commitment (getting political buy-in and establishing governance structures)
- Understand (collecting energy and emission data and analyzing the existing framework)
- Plan and Organize (setting objectives, identifying potentials, and preparing action plans)

- Act (implementing selected energy efficiency and renewable energy measures)
- Control, Monitor & Review (tracking progress and adjusting plans accordingly)

They also mention the Biggest Challenge for Municipalities in Implementing Sustainable Energy Plans as,

- Securing and Maintaining Political Commitment
- Stakeholder Engagement and Capacity Building
- Accurate Data Collection and Baseline Emission Inventories
- Prioritizing and Selecting Appropriate Measures
- Monitoring and Reporting Progress
- Access to and Management of Financial Resources

Barichella A. (2023) discussed key challenges in coordinating climate governance across different levels of France. He mentioned that in France, coordinating climate governance across levels faces several obstacles. Regional governments have only limited competencies, which prevents them from developing comprehensive climate policies. The system remains highly centralized, with the state retaining control while multiple territorial layers—regions, départements, communes, and intercommunal ties—coexist without a clear hierarchy, producing a complex “millefeuille administratif” that complicates coordination. National laws, such as the Grenelle II, impose rigid procedures and deadlines for local climate plans, ensuring alignment but limiting flexibility. At the same time, communes benefit from broader policy discretion than regions, creating asymmetry in roles and capacities. The overlapping responsibilities among these different layers often generate fragmentation, while effective progress frequently depends on the presence of strong leadership and cooperation between actors, such as municipalities and regions. Overall, constrained competences, rigid legal frameworks, fragmented governance layers, and reliance on leadership make multilevel climate governance in France difficult to align and coordinate.

In different research, several key challenges in local energy plan implementation in the post-liberalization era of the EU’s electricity markets have been discussed, such as:

- Unclear Roles and Responsibilities
- Passive Role of Local Governments
- Insufficient Actor Involvement and Coordination
- Information Deficits
- Dependence on Subsidies and Economic Uncertainty
- Absence of a Standard Governance Model
- Poor Information Sharing

Collectively, these challenges contribute to delays, inefficiencies, and, in some cases, project failure. Addressing institutional ambiguity, enhancing stakeholder engagement, improving information flows, and stabilizing financial conditions are essential for more effective local renewable energy implementation (Lammers and Hoppe, 2018; Verbong, et al., 2013; Elle, et al., 2002)

Selected Core Theory Evidence in the analysis includes

Based on the literature, reviewing different related theories and scientific research, which have discussed the similarities between theories, and the focus plans (SEAP and PCET/PCAET) have been analyzed, and the following theories have been confirmed and selected as the core theories:

1. Multi-Level Governance (MLG), which refers directly to intergovernmental cooperation (national-municipal), regulatory frameworks, and governance roles as important contextual factors
2. Socio-Technical Transitions (MLP) focus precisely on technological pathways (EV infrastructure, renewables, district heating), innovation uptake, and systemic transport-energy transitions
3. Capacity Building & Organizational Learning includes monitoring processes, stakeholder engagement, responsibility assignment, and the use of analytical tools, suggesting iterative learning.

The variables related to the implementation of energy plans

In addition to these effectiveness dimensions, the study identifies key variables from the literature that influence the success or failure of implementation to support the mentioned dimensions. These variables were divided into different types of variables: Dependent, Independent, Intervening, and Moderator

1. Dependent Variable

A dependent variable is the outcome or response that is measured to assess the effect of the independent variable(s). It represents the phenomenon that the researcher seeks to explain or predict (Neuman, 2014; Creswell & Creswell, 2018)

2. Independent Variables

An independent variable is the factor that is deliberately manipulated or selected by the researcher to determine its effect on another variable. It represents the presumed cause or predictor in a causal relationship (Creswell & Creswell, 2018; Babbie, 2021)

3. Intervening Variables (Mediators)

An intervening variable (also known as a mediator) explains the mechanism through which an independent variable influences a dependent variable. It represents a process or condition that transmits part of the causal effect (Baron & Kenny, 1986; MacKinnon, 2008).

4. Moderator Variables

A moderator variable affects the strength or direction of the relationship between an independent and a dependent variable. It identifies conditions under which certain effects are stronger, weaker, or reversed (Hayes, 2018; Baron & Kenny, 1986).

Table 5: Different themes of variables that affect energy plan implementation and their related theoretical lens

Theme	Variable Type	Example Variables	Theoretical Lens
Institutional Arrangements & Governance	Independent	Delegation of planning roles, local vs. national actors, ownership, governance structures	Institutional Theory, Multi-Level Governance, Policy Implementation Theory
Stakeholder Roles & Engagement	Independent / Intervening	Roles of homeowners, utilities, citizen involvement, participation quality	Participatory Governance, Stakeholder Theory, Theory of Planned Behavior
Resources & Financial Factors	Independent	Investment levels, subsidies, economic incentives, availability of funds	Resource-Based View (RBV), Public Administration Theory, Fiscal Federalism
Regulatory & Policy Frameworks	Independent / Moderator	Building codes, energy policies, national legislation, and EU directives	Policy Coherence Theory, Regulatory Governance, Sustainability Transitions Theory
Technical Tools & Capacity	Independent / Intervening	Planning tools, technical skillsets, data quality, innovation uptake	Organizational Learning Theory, Technology Acceptance Model, Capacity Building Theory
Monitoring, Evaluation & Learning	Intervening	Reporting systems, feedback mechanisms, learning loops	Adaptive Management Theory, Results-Based Management, Performance Management
Outcomes (Energy, Emissions, Targets)	Dependent	CO ₂ reduction, kWh savings, target fulfillment	Not directly theory-mapped; these are empirical indicators

Trust, Behavior & Public Support	Moderator	Public acceptance, behavioral norms, trust in institutions	Social Capital Theory, Behavioral Economics, Theory of Planned Behavior, Energy Culture Theory
Contextual & Economic Conditions	Moderator	Baseline emissions, infrastructure readiness, economic conditions	Contextual Interaction Theory, Path Dependency Theory
Market & Technological Dynamics	Moderator	Renewable integration, district heating maturity, EV infrastructure	Socio-Technical Transitions Theory, Innovation Systems Theory

The Covenant of Mayors

The Covenant of Mayors (Kona et al., 2019; Peduzzi et al., 2020) is a significant environmental and energy policy project, commonly regarded as the largest European municipal energy and climate action (EC, 2014). This organization is a voluntary initiative that engages cities and local authorities in committing to sustainable energy and climate goals, particularly in line with the EU 20-20-20 objectives and beyond (Schenone and Delponte, 2021).

Based on Pietrapertosa et al. (2018), this plan, initiated in 2008, defined the preceding decade, imparting a crucial influence on EU energy policy and delineating essential traits of European strategy (Haupt, 2018), which guide the choices and decisions of the current decade.

A number of reports and evaluations have been made that look at the SEAPs submitted by CoM signatories. These reports focus on the overall performance, monitoring indicators, and the progress made in renewable energy deployment and climate policies at the urban level (Schenone and Delponte, 2021).

To sum up, it is imperative to examine the outcomes of the Sustainable Energy Action Plans (SEAPs) that have effectively implemented the overarching principles of the Covenant of Mayors into actionable measures. This analysis enables us to discern successful strategies, identify shortcomings, and determine the necessary decisions to enhance the efficacy of environmental energy policies at the urban level.

Comparative Frameworks for Energy Planning in France and Italy

A comparative analysis of energy planning approaches in France and Italy reveals distinct institutional frameworks, policy priorities, and socio-economic contexts that shape the implementation of local energy plans. Understanding these differences is critical for

identifying best practices and tailoring strategies to specific national and regional conditions.

The following are two tables (6 & 7) of Italy and France's main energy and/or climate-related planning instruments across scales. Abbreviation meanings are: mitigation(M), adaptation (A), air quality (AQ), energy (E), mandatory (Req.), or voluntary (Vol.).

Table 6: Italy's main energy and/or climate-related plans

Instrument	Scale	Focus	Req./Vol.	Core Purpose / Notes	Official Reference
PNIEC – Piano Nazionale Integrato per l'Energia e il Clima (2030)	National	E, M	Req.	Italy's integrated NECP; defines 2030 energy-climate targets.	mase.gov.it
PNACC – Piano Nazionale di Adattamento ai Cambiamenti Climatici	National	A	Req.	National adaptation plan approved in 2023.	mase.gov.it
PAEE – Piano d'Azione per l'Efficienza Energetica	National	E, M	Req.	National energy efficiency action plan under the EU Directive.	mase.gov.it
Piani di qualità dell'aria	Regional	AQ	Req.	Regional air quality plans under D.Lgs. 155/2010.	mase.gov.it
Strategie climatiche regionali	Regional	M, A, E	Policy	Regional strategies integrating mitigation, adaptation, and energy.	regioni.it
PEAR/PREC	Regional	E, M	Policy	Regional energy and climate plans (names vary by region).	regioni.it
PUMS – Piani Urbani della Mobilità Sostenibile	Urban/Metro	M, AQ	Req.	Sustainable urban mobility plans reduce emissions.	mit.gov.it
SECAP/PAESC	Local/Metro	M, A, E	Vol.	Voluntary Covenant of Mayors plans integrating mitigation and adaptation.	covenantofmayors.eu

SEAP/PAES (legacy)	Local/Met ro	M, E	Vol.	Earlier version of SECAP focused on mitigation and energy efficiency.	covenant ofmayors .eu
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Table 7: France's main energy and/or climate-related plans

Instrument	Scale	Focus	Req./Vol.	Core Purpose / Notes	Official Reference
Stratégie nationale bas-carbone (SNBC)	National	M	Req.	Long-term GHG pathway & carbon budgets to 2050 (SNBC-3 updating 2024–2038).	ecologie.gouv.fr
Programmation pluriannuelle de l'énergie (PPE)	National	E, M	Req.	Sets 5–10-year energy mix trajectories and targets.	ecologie.gouv.fr
Plan national d'adaptation au changement climatique (PNACC)	National	A	Req.	National adaptation plan; framework for local authorities.	ecologie.gouv.fr
Plan national de réduction des émissions de polluants atmosphériques (PREPA)	National	AQ	Req.	Plan to meet EU pollutant emission caps.	ecologie.gouv.fr
SRADDET	Regional	E, M, A, AQ	Req.	Integrated regional planning framework including energy, climate, air.	
SRCAE (legacy)	Regional	E, M, A, AQ	Req.	Former regional climate-air-energy plans;	i4ce.org

				now integrated into SRADDET.	
S3REnR	Regional/Grid	E	Req.	Regional grid plans to connect renewables; prepared by RTE, approved by the State.	rte-france.com
PCAET	Intercommunal (EPCI)	E, M, A, AQ	Req. (>20k)	Territorial climate-air-energy plans; key local action plans.	ecologie.gouv.fr
PPA	Urban	AQ	Req.	Air quality plan for polluted zones.	ecologie.gouv.fr
Plan de mobilité (PDM/PDMS)	AOM territory	M, AQ	Req.	Mobility plans reduce emissions and improve air quality.	ecologie.gouv.fr
SDIRVE	Local/Inter-local	E	Vol.	EV-charging infrastructure masterplan.	ecologie.gouv.fr
SCoT	Supra-communal	E, M, A, AQ	Req.	Strategic land-use plan integrating PCAET and energy objectives.	ecologie.gouv.fr
PLU/PLUi	Communal	E, M, A	Req.	Local land-use plan integrating energy efficiency and renewable.	ecologie.gouv.fr
Agenda 21 local / Agenda 2030	Local	E, M, A	Vol.	Voluntary sustainable development plans.	ecologie.gouv.fr

Convention des Maires – SEAP/SECAP (PAED/PAEDC)	Commune/EPCI	M, A, E	Vol.	EU voluntary climate-energy plan under the Covenant of Mayors.	joint-research-centre.ec.europa.eu
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Italy:

Sustainable Energy Action Plans (SEAPs)

Sustainable Energy Action Plans (SEAPs) are strategic documents developed by municipalities as part of the Covenant of Mayors initiative, which aimed to achieve local CO2 emission reductions and promote sustainable energy use. It is necessary to mention that signatories to the Covenant of Mayors (CoM) and their Sustainable Energy Action Plans (SEAPs) play a major role in the task of designing and implementing policies for the reduction of greenhouse gas emissions on the local level (Plans, E. A. 2016).

SEAP signatories commit to follow the reporting guidelines provided by the Covenant of Mayors Office (CoMO) and the Joint Research Centre (JRC) of the European Commission. These guidelines formalize the major requirements for SEAP reporting, including the timelines for implementation reports and emission inventories, as well as content standards.

Municipalities must submit implementation reports every two years, and MEI updates every four years, with detailed information on staff involvement, budgets, barriers encountered, and emission reduction progress (Delponte, Pittaluga, & Schenone, 2017).

Table 8: Details of the of SEAPs

Category	Details
1. Context and Purpose	- Address local energy challenges - Promote energy efficiency - Mitigate climate change via emission reductions - Set ambitious GHG reduction targets - Promote multi-sectoral and stakeholder involvement
2. Sectors Covered	- Energy production and consumption - Transport - Housing - Public services
3. Stakeholders Involved	- Local government departments - Businesses - Civil society organizations - Citizens

4. History and Development	- Influenced by broader efforts like the Kyoto Protocol - Initiated by political consensus and prior climate activities (e.g., Hannover since 1992) - Promoted through the Covenant of Mayors as a voluntary commitment - Evolved into Masterplans for long-term goals (e.g., Hannover's Masterplan 2050)
5. Structure and process	- Sectoral working groups (e.g., industry, offices, housing) - Led by administrative departments (environment, energy, infrastructure) - Political involvement through approvals or advisory roles - Participatory processes include consultations and stakeholder networks
6. Implementation and Support	- Networking at regional, national, international levels - Support from regional coordination (e.g., Emilia-Romagna, Barcelona) - Local utilities may act as key partners - Challenges include political support, integration across governance levels, and public engagement
7. Transparency and Monitoring	- Monitoring tools and public info portals managed by climate protection units - Public access to local measures and progress data promotes transparency and knowledge sharing

Source: Summarizing from Plans, E. A. (2016)

As a summary, SEAPs are comprehensive, participatory, and evolving municipal plans that align with EU climate goals. They involve multi-level governance, stakeholder engagement, and continuous improvement toward ambitious climate protection targets.

SEAPs and SECAPs:

SEAPs (Sustainable Energy Action Plans) were earlier Covenant of Mayors tools focused on energy and GHG reduction, but they used a sectoral approach without integrating climate adaptation or broader urban sustainability, and **SECAPs** (Sustainable Energy and Climate Action Plans) evolved from SEAPs, combining energy efficiency, mitigation, and adaptation in an integrated urban planning framework to improve municipal climate resilience.

SECAPs advance beyond SEAPs by addressing interrelations among urban sectors, but still inherit some methodological issues from SEAPs, such as fragmented interventions and weak integration with urban planning. Overall, SEAPs were a limited first step; SECAPs aim for broader, integrated climate–energy action at the municipal level (Scorza, & Santopietro, 2024).

The key elements of SEAPs implementation

The report, “Existing Methodologies and Tools for the Development and Implementation of Sustainable Energy Action Plans (SEAP),” which was published by the Covenant of Mayors, highlighted several important aspects of the effectiveness of SEAPs implementation.

Table 9: Different aspects of the effectiveness of SEAPs implementation

Aspect	Key Notes / Explanation
Success Factors and Challenges	• The effectiveness of SEAP implementation largely depends on the engagement and commitment of local authorities and stakeholders throughout the process. • Proper involvement of stakeholders and citizens ensures broader support and higher chances of successful implementation. • Projects that incorporate detailed project management, including defined responsibilities and timelines, tend to implement measures more effectively [T7], [T8].
Methodological Support and Tools	• Tools like the European Energy Award® offer a certification and quality management system that helps municipalities identify strengths and weaknesses, systematically evaluate measures, and benchmark progress. • Climate Compass and similar tools provide tailored compendiums of measures aligned with the city's ambition level, facilitating targeted and practical implementation strategies.
Limitations and Areas for Improvement	• Some methodologies and guides focus more on early stages (political commitment, stakeholder involvement) but lack depth in financial planning, project management, monitoring, and reporting.

	• The absence or weakness in financial planning and continuous monitoring/review are cited as common gaps that can reduce the effectiveness of SEAPs.
Monitoring and Reporting	• Continuous monitoring, reporting, and adaptation of measures during implementation are key to ensuring effectiveness and achieving intended targets [T7]. • Transparent communication of progress helps maintain or increase political and public support [T7].

Source: Bertoldi, et al., 2010

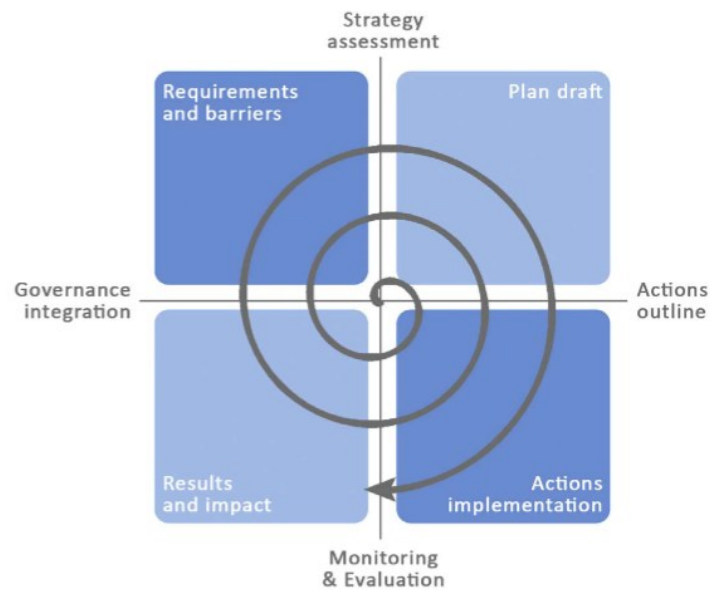
There are some important key elements about the effectiveness of SEAPs implementation in three Italian big cities, primarily through the development and use of a dynamic, multidimensional metropolitan energy planning framework designed to support and harmonize SEAPs at the municipal level (Berghi, 2017).

Monitoring Process of SEAPs

The monitoring process of SEAPs has a dual nature: Monitoring and Evaluation (M & E), and generally, they have been done by municipalities themselves, not another organization, as detailed:

- The SEAP monitoring process is not limited to data collection or simple tracking of actions but integrates evaluation to assess the effectiveness and relevance of each action over time,
- This dual process allows feedback from real implementation to inform and steer decision-making dynamically, enhancing the chance of achieving the emission reduction targets.

Figure 1: Cyclical monitoring process of SEAPs



(Delponte, Pittaluga, & Schenone, 2017).

It can be said that the SEAP Monitoring Process is based on,

1. **Baseline Emission Inventory (BEI):** Establish a baseline to measure initial greenhouse gas (GHG) emissions.
2. **Monitoring Emission Inventory (MEI):** Prepare updated emission inventories every four years to monitor progress against the baseline.
3. **SEAP Implementation Status Report:** Submit reports every two years that contain qualitative and quantitative information on interventions, including staff capacity allocation, budget spent, and barriers encountered during SEAP implementation.
4. **Monitoring and Evaluation (M & E) Process:** Implement an integrated process of surveying, controlling, and managing actions to assess efficacy, rank options, and decide on further steps. This includes feedback and adjustment mechanisms beyond simple trend tracking.
5. **Cost-Benefit Analysis (CBA) / Cost-Effectiveness Analysis (CEA) and Bankability Assessment:** Use financial and economic evaluation tools to select and ensure the feasibility of actions for real implementation.
6. **Peer Review and Participatory Level:** Employ external review and involve citizens and stakeholders in data collection and decision-making to enhance cooperation and refine the SEAP.

7. **Continuous Validation and Dynamic Strategy Development:** Continuously validate monitoring content and methods, adjusting the strategy to reflect changing scenarios and ensure long-term GHG emission reductions.

This sequence forms an iterative and organic process that helps the SEAP to evolve dynamically and effectively manage urban energy sustainability (Delponte, Pittaluga, & Schenone, 2017).

Challenges affecting the effectiveness of SEAP implementation in Italy

Based on the Santopietro and Scorza (2021) and Delponte et al. (2017), challenges affecting the effectiveness of SEAP implementation in Italy mostly include Limited technical capacity, weak monitoring, uneven stakeholder engagement, funding constraints, and poor integration with planning frameworks, which hinder SEAP implementation. However, it can be different in different cities. Also, voluntary commitments and top-down approaches further limit effectiveness, with smaller municipalities facing the greatest challenges.

Table 10: Challenges affecting the effectiveness of SEAP implementation in Italy

Challenge	Key Points
Monitoring Reports & Data Gaps	Only ~32% of reports are available on the CoM website; lack of support for uploading/reporting reduces transparency and hinders evaluation.
Technical Weakness & Limited Capacity	Municipalities often lack technical expertise, funding, and ongoing support after initial SEAP development, limiting long-term action.
Voluntary Nature & Weak Commitment	SEAPs are voluntary, leading to uneven municipal commitment and low follow-through once plans are drafted.
Top-Down Bias & Limited Private Engagement	Focus on municipal/public actors; weak inclusion of private stakeholders and citizens limits investment and broad transformations.
Incoherence with Urban Planning	SEAPs sometimes act as substitute planning tools instead of being integrated into existing urban/spatial frameworks, causing misalignment.
Weak Multi-Level Governance & Participation	Limited involvement of SMEs, private investors, and citizen groups; lack of

	bottom-up engagement undermines acceptance and collective action.
Governance-Oriented vs. Strategic Planning	Monitoring often expands to include opportunistic actions, reflecting target-driven governance rather than coherent long-term strategy.
Geographical & Size Disparities	Regional differences in adoption; small municipalities struggle due to fewer resources and need more technical assistance.
Funding Challenges	Lack of post-plan funding undermines maintenance/scaling; funding availability often dictates project choice over sustainability goals.
Insufficient Monitoring & Feedback	Incomplete submissions and weak guidelines reduce adaptive management and learning.

Source: (Santopietro and Scorza, 2021)

France:

Evaluating PCET/PCAETs of different municipalities sheds light on effective practices and areas for improvement in local climate governance, which can be very valuable for a Comparative analysis (Sartre et al., 2021).

Territorial Climate-Air-Energy Plan (PCET/PCAET)

The Territorial Climate-Air-Energy Plan (PCET/PCAET) in France plays a significant role in local-level climate and energy governance. This plan embodies a strategic framework for local authorities to address climate change through energy transition and resilience building. It is worth noting that this reflects a shift towards greater involvement of local authorities amid decentralized energy policies.

The PCET/PCAET (Plan Climat-(Air)-Énergie Territorial) is a legally mandated framework in France that integrates climate, air quality, and energy objectives at the territorial level. The plan started by the 2010 *loi Grenelle II* (law of Grenelle II), one of the requirements is that communities with over 50,000 inhabitants develop comprehensive climate and energy plans following national guidelines. While the plans must meet specific legal and procedural standards, local authorities retain flexibility in their implementation. Led by EPCIs, the PCET/PCAET develops collaboration among local stakeholders—such as ADEME and municipal actors—encouraging participatory planning and coordination. Although adaptation measures are still limited, the PCET/PCAET strengthens local climate governance through co-construction and stakeholder engagement (Barichella, 2023). It is significant to note that the monitoring part, similar to Italian SEAPs, has also been done by municipalities themselves, not another organization. The details of PCET/PCAET have been explained as follows,

Table 11: Details of Territorial Climate-Air-Energy Plan (PCET/PCAET)

Category	Details
Context and Purpose	Territorial climate, air, energy plans aligning local-national policy contribute to territorializing climate policy, promoting local emission reductions and energy transition tailored to specific contexts.
Sectors Covered	Buildings and energy efficiency (both residential and service sectors) • Transportation and mobility • Land use and spatial planning • Waste management and sustainable consumption • Air quality (noted by inclusion of "Air" in PCET/PCAET) • Renewable energy development
Stakeholders Involved	Local/regional authorities, national government (Prefect), political coalitions and parties influencing local leadership and ambition, Broader civil society, and potentially private sectors during consultation phases
History and Development	From voluntary PCETs to mandatory PCAETs under the law of Grenelle II (2010) Paris adopted its first voluntary PCET in 2007, updating it after Grenelle II to comply with national standards.
Structure and Process	• Completing the BEGES emissions inventory. • Drafting the climate, air, and energy targets and strategic orientations. • Public consultation and administrative validation (details not expanded). • Adoption by the territorial community council. • periodic update
Implementation and Support	• Implementation includes specific measures targeting energy efficiency, renewables, transport emissions, and urban planning. • Support comes from multilevel coordination, with regions like Île-de-France leading local execution. • Success depends on leadership, political will, and cooperation.
Transparency and Monitoring	• The compulsory GHG inventory (BEGES) is the main monitoring tool. • Data must be regularly updated to track progress. • Results guide plan updates and strategy adjustments • legal enforcement of deadlines

Source: Barichella, 2023

Opportunities and challenges of climate action and energy transition in France

Opportunities and challenges in France's climate action and energy transition, particularly through the implementation of PCET/PCAETs, reflect a complex interplay between decentralization, regulation, and governance. Although local and regional authorities have gained greater responsibilities in energy and climate policies, genuine power transfer remains constrained by regulatory and institutional limits (Poupeau, 2022). Many local governments still face barriers in acting effectively within the framework of national energy market regulations, leading to gaps between declared climate ambitions and actual outcomes, as seen in the Île-de-France region (Coutard & Gallez, 2025). Moreover, inequities in adaptation planning persist, as local plans often overlook socio-economic disparities and environmental justice dimensions, emphasizing the need for more inclusive and data-driven methodologies in PCET/PCAET implementation (Lioubimtseva & Cunha, 2023). The importance of structured methodological frameworks to support effective local energy transition planning has also been highlighted (Moreau, 2019), yet these efforts are further complicated by the numerous legal and environmental obligations embedded in the French policy framework (Novel, 2022).

The PCET/PCAET initiative operates within a centralized and hierarchical system that offers limited local autonomy, where national law defines many procedural elements and standards (Barichella, 2023). The “millefeuille administratif” — the layered configuration of regional, departmental, communal, and intercommunal authorities — often generates overlapping competences and coordination difficulties (Barichella, 2023). Successful PCET/PCAET implementation depends on effective multilevel synchronization, as illustrated by the time lag between Paris's early PCET adoption and the subsequent regional plan in Île-de-France (Barichella, 2023). Additionally, outcomes vary widely across territories, often relying on strong local leadership and cooperative networks (Barichella, 2023). While PCET/PCAETs promote transversality and stakeholder engagement to drive dynamic local climate governance (Sartre et al., 2021), they continue to face challenges linked to procedural rigidity, fragmented governance, and uneven capacities among local actors. Tools such as ADEME's *Bilan Carbone* methodology provide valuable frameworks for emissions inventories and energy planning, supporting efforts to bridge these governance and implementation gaps (Bertoldi et al., 2010).

It is worth noting that the centralized model has traditionally dominated the French electricity sector, and transitioning to a decentralized model may face challenges such as, Resistance from centralized forces, Regulatory barriers, Technical and infrastructure limitations and Coordination and governance issues.

To explain more about the Decentralization and the Energy Transition in France, it can be said that the French electricity sector has long been characterized by a centralized model, and transitioning to a decentralized model faces several notable challenges. First, resistance from established centralized actors remains strong, given their entrenched interests in maintaining the existing status. For example, the reforms introduced by the Loi relative à la transition énergétique pour la croissance verte* (2015) highlight the

institutional inertia embedded within the French power system (Poupeau, 2020). Second, regulatory barriers continue to hinder decentralization, it means the existing framework is not yet fully supportive of distributed production and self-consumption models, making it difficult for local authorities and alternative energy actors to navigate grid-connection and tariff regulations (Poupeau, 2020). Third, technical and infrastructure limitations pose a major obstacle. Implementing a decentralized model requires significant investments in generation, storage, and distribution systems, while integrating renewable energy and smart grids introduces logistical and coordination challenges (France Stratégie, n.d.). Finally, governance and coordination issues are critical which means managing interactions among local authorities, energy companies, and communities in a decentralized system is complex, and effective governance mechanisms are essential for successful implementation (Poupeau, 2020).

In fact, successful decentralization depends on several enabling factors. Political will from decision-makers at national, regional, and local levels shapes supportive policies, regulatory reforms, and financial incentives. A coherent regulatory framework is essential for enabling mechanisms such as net metering, feed-in tariffs, and local self-consumption schemes that promote distributed generation (Ministère de la Transition Écologique, 2016). Technological advancements in renewables, energy storage, and smart grids enhance efficiency, reliability, and cost-effectiveness. Access to financing mechanisms (grants, subsidies, and innovative investment models) helps overcome cost barriers to decentralized projects. And finally, local engagement and capacity-building efforts empower municipalities, cooperatives, and community groups to participate actively in the energy transition.

In 2015, the Energy Transition for Green Growth Act (Loi n°2015-992) established several key objectives for local energy planning. These include the mandatory development of Local Climate and Energy Plans (Plans Climat-Énergie Territoriaux, PCET) for authorities above population thresholds, the creation of Energy Transition Agendas (Agendas de la Transition Énergétique, ATE) in collaboration with local stakeholders, and the promotion of renewable energy projects and energy efficiency measures. The Act also emphasizes citizen participation and local engagement in planning processes (Ministère de la Transition Écologique, 2016). Overall, it aims to increase a sustainable and low-carbon energy system by empowering local authorities to lead in the energy transition and tailor solutions to their territorial contexts.

Review of decentralization of energy transition obstacles in France and Italy

Recent research emphasizes that the decentralization of energy systems in France and Italy is shaped by multi-level governance, regulatory constraints, and socio-technical capacities. Debref and Sergi (2021) provide a comparative overview of how both countries manage the balance between central authority and local autonomy in energy transition, identifying persistent regulatory and institutional barriers. Maisonobe and Bahers (2020) highlight the role of local authorities in France, noting that while municipalities are increasingly recognized as key actors, they face administrative fragmentation and limited

financial autonomy in implementing decentralized energy systems. Similarly, Sergi and Debref (2020) explore the Italian context, where local governments often engage in pilot projects but remain constrained by inconsistent national frameworks and uneven regional capacities.

At the policy level, ADEME (2018) identifies regulatory complexity, financing gaps, and grid-access limitations as major barriers to decentralized renewable-energy deployment in France. Global and comparative insights from IRENA (2019) and the World Bank (2020) emphasize that supportive regulation, financing instruments, and participatory governance are universal prerequisites for successful decentralization. Finally, Becker and Naumann (2017) introduce the concept of “energy democracy,” arguing that local participation and social innovation are essential to making decentralization both effective and equitable. Together, these works underline that decentralization is not purely technical but deeply political and institutional, requiring adaptive governance, empowered local authorities, and coherent national frameworks.

Conclusion: Conceptual Framework and Analytical Approach

Conceptual Foundation

The implementation of local energy and climate plans requires bridging the gap between policy design and operational action. This research conceptualizes this process as a dynamic interaction between institutional, technical, and contextual dimensions operating within multi-level governance systems. The conceptual framework integrates perspectives from policy evaluation, urban governance, and socio-technical transition theories to assess the effectiveness of local energy plan implementation.

In line with Mickwitz (2003) and Vedung (1997), effectiveness is defined as the degree to which a policy or plan achieves its intended objectives within its operational and contextual constraints. However, as Bulkeley and Betsill (2005) and Broto and Bulkeley (2013) observe, urban energy governance depends not only on goal attainment but also on the processes of coordination, stakeholder engagement, and institutional learning that sustain policy delivery. Therefore, this research adopts a multi-dimensional framework that evaluates effectiveness both as outcome (what is achieved) and process (how it is achieved).

Theoretical Lenses

Three complementary theoretical perspectives underpin this framework, based on the literature, are:

Multi-Level	Governance	(MLG)
The MLG perspective highlights the vertical and horizontal interactions between national, regional, and local actors in implementing energy transition policies (Kern & Alber, 2009). It helps explain why institutional fragmentation or overlapping competencies can hinder		

local implementation, especially when cities depend on higher-level funding or regulatory instruments.

Socio-Technical

Transitions

(MLP)

The Multi-Level Perspective (Geels, 2002; Smith et al., 2005) situates local energy transitions within broader technological, social, and infrastructural systems. It allows analysis of how local innovations—such as energy-efficient buildings or district heating networks—are embedded within technical regimes and socio-economic contexts.

Capacity

Building

and

Organizational

Learning

Derived from Argyris & Schön (1978), this perspective emphasizes how institutions adapt through learning-by-doing, monitoring, and feedback. Implementation effectiveness depends on whether organizations can learn from evaluations and integrate lessons into future planning cycles.

Effectiveness Framework for Local Energy Plan Implementation

Synthesizing these theoretical strands and relevant empirical studies (Mickwitz, 2003; Broto & Bulkeley, 2013; Smedby & Quitzau, 2016; Bertoldi et al., 2020), eight analytical dimensions were identified to evaluate plan implementation. These dimensions reflect both technical performance and organizational effectiveness.

Table 12: Effectiveness Framework of the research

Dimension (D)	Core Indicators	Evaluation Criteria / Reference Sources
D1. Achievement of Project Goals	Degree to which energy and climate objectives are met; interim milestones reached; evaluation reports produced.	Mickwitz (2003); Covenant of Mayors Guidelines (2016).
D2. Contextual Relevance	Alignment of plan with local socio-economic and environmental conditions.	Broto & Bulkeley (2013); Howlett & Ramesh (2003).
D3. Sustainability and Impact	Long-term environmental, economic, and social co-benefits.	European Commission (2019); Guy & Shove (2000).
D4. Stakeholder Engagement and Governance Clarity	Participation and coordination among public and private actors; role definition.	Bulkeley & Betsill (2005); Smedby & Quitzau (2016).
D5. Institutional Capacity	Human, technical, and organizational resources; leadership; inter-departmental cooperation.	Argyris & Schön (1978); Nilsson et al. (2012).
D6. Cost-Benefit Balance and Financial Viability	Diversity of funding sources; risk management; stakeholder	Vedung (1997); Covenant of Mayors

	confidence in financing mechanisms.	Monitoring Reports (2020).
D7. Information Availability and Procedural Efficiency	Accessibility of information; communication quality; data transparency; process flexibility.	Geels (2002); OECD Governance Indicators (2019).
D8. Monitoring, Evaluation, and Adaptive Management	Frequency and quality of monitoring; feedback integration; policy learning.	Pressman & Wildavsky (1973); Mickwitz (2003).

It has to be mentioned that these dimensions formed the conceptual bridge between theoretical understanding and empirical observation. Each dimension corresponds to specific indicators observable in municipal documents (plans, monitoring reports) and stakeholder interviews.

Variables Related to Implementation

In addition to these dimensions, the study identifies key variables that influence the success or failure of implementation to support the dimensions for the complete analysis. These variables were extracted from empirical literature on urban sustainability transitions, governance, and policy evaluation, and classified as dependent, independent, intervening, or moderating factors.

Table 13: Research Variables Related to Implementation

Variable Type	Theme	Variable / Factor	Main References
Dependent	Implementation Outcome	Achievement or delay of plan objectives; degree of goal attainment.	Mickwitz (2003); Bertoldi et al. (2020).
Dependent	Process Effectiveness	Quality of coordination and speed of implementation.	Pressman & Wildavsky (1973).
Independent	Institutional Arrangements	Role clarity, regulatory framework, and governance structures.	Kern & Alber (2009).
Independent	Resources and Capacities	Financial and human resources, technical expertise.	
Intervening	Institutional Learning	Monitoring practices and feedback loops.	Argyris & Schön (1978).
Intervening	Knowledge and Perception	Stakeholder understanding and social acceptance.	Guy & Shove (2000).
Moderator	Political / Policy Context	Political will, national legislative environment.	Kern & Alber (2009)

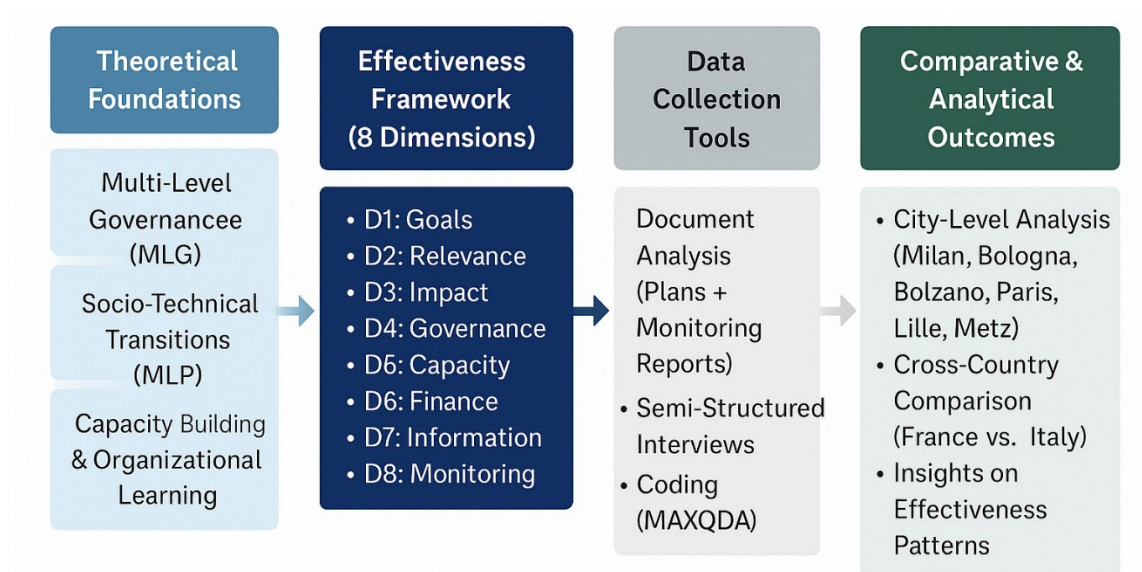
Moderator	Technological and Market Dynamics	Innovation uptake, market conditions, and energy costs.	Geels (2002); Smith et al. (2005).
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Generally, the above variables capture both *structural* (institutional and policy) and *dynamic* (learning and behavioral) components of implementation.

Conceptual Framework Diagram

The figure below (2) shows the conceptual flow of the research that links theories, dimensions, variables, data collection tools, and comparative and analytical outcomes.

Figure 2: Conceptual Framework of the research

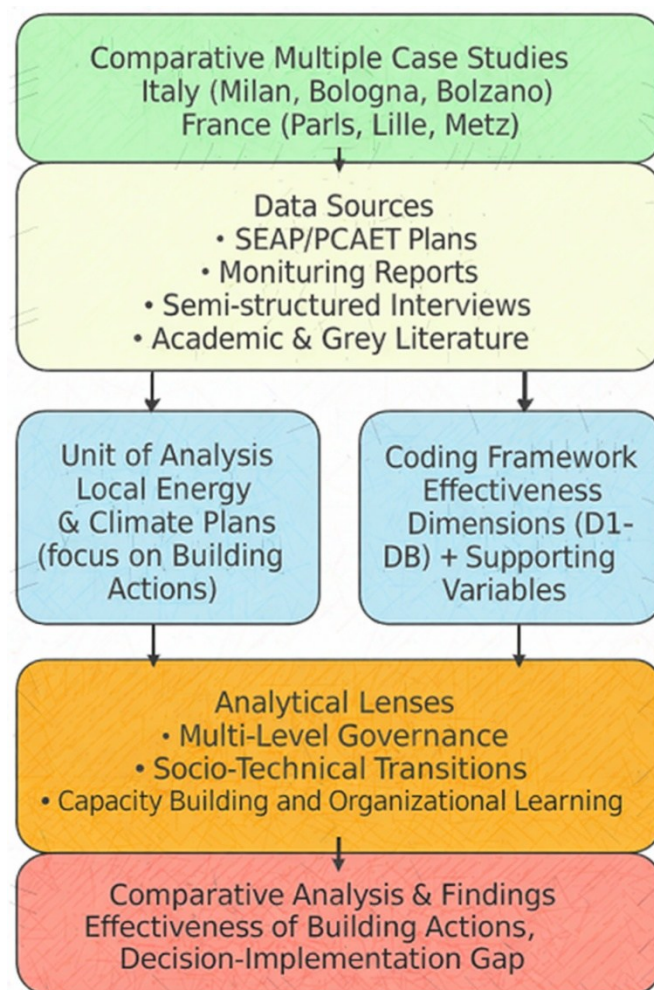


This conceptual structure plays a base role and guides all empirical stages of the research:

- The interview was derived from the D1–D8 dimensions and variable themes.
- Document analysis of SEAP/PCET(PCAET) and monitoring reports was aligned with the same categories.
- Coding in MAXQDA used hierarchical nodes reflecting both theoretical (D1–D8) and empirical (variable) layers.
- Cross-case analysis compared patterns across Milan, Bologna, Bolzano, Paris, Lille, and Metz, maintaining a consistent analytical grid.

Chapter 3:

Methodology and Case Studies



Introduction to Methodology

- Research objectives and methodology selection

The objective of this thesis is to investigate the effectiveness of local energy action plans, with a particular focus on building-related measures, in order to understand the gap between decision-making and implementation. By comparing three Italian cities (Milan, Bologna, Bolzano) and three French cities (Paris, Lille, Metz), the research seeks to identify the factors that explain why some planned measures are successfully implemented, while others face delays, modifications, or failure. The chosen methodology is particularly suited to this objective for three reasons.

1. Comparative Case Study Design.

Following the replication/contrast logic of multiple-case designs (Yin 2009; Goodrick 2014), the comparison between Italian SEAPs and French PCET/PCAETs provides analytical leverage; They have similar objectives in the two different countries and both are mandatory in the selected case studies; however, they have differences such as governance structures and available resources (Goodrick 2014; Pahl-Wostl et al., 2021). Using multiple cases allows for the identification of both country-specific factors and cross-cutting explanations.

2. Qualitative Content and Document Analysis.

Using the approach of Bowen (2009) and Morgan (2021), a qualitative content/document analysis of planning documents, monitoring reports, and interviews was conducted, it possible to reconstruct not only the formal objectives and reported outcomes, but also the narratives, barriers, and contextual dynamics behind them. This method is well adapted to studying “effectiveness” as a multidimensional concept, not reducible to quantitative indicators alone.

3. Triangulation of Data Sources.

To increase credibility and depth, we employ a triangulation strategy (Denzin 1978; Patton 1999; Carter et al. 2014), comparing and cross-checking findings from policy/planning documents, monitoring reports, interviews, and secondary sources. This approach captures the difference between how actions are planned, how they are officially evaluated, and how they are experienced by practitioners.

Overall, the methodology provides a framework to analyze the effectiveness of building-related actions within local energy plans and to explain differences between the Italian and French cases. This analytical step bridges theory and practice by linking the coded empirical material (effectiveness framework D1–D8) to broader theoretical perspectives such as Multi-Level Governance (Pahl-Wostl 2009), Socio-Technical Transitions (Köhler et al. 2019), and Capacity Building and Organizational Learning (Argyris & Schön 1996),

following approaches that view coding as the interpretive bridge between data and theory (Linneberg & Korsgaard 2019; Goodrick 2014).

-Research approach

The methodology chapter describes the methodical strategy to answer the study's research questions (Creswell, 2013). The intricacy of the issue under study must be reflected in the research design, whether qualitative, quantitative, or a combination of the two. A mixed method has been chosen for this research. In this instance, mixed methodologies are well-suited to address the intricacies of local energy plan effectiveness, as per Bryman (2017), who contends that the research design should align with the study's objectives. Creswell (2013) defines a mixed method approach as a combination of qualitative and quantitative methods with philosophical assumptions and distinct methodological procedures. The approaches are integrated to strengthen the study beyond what could be achieved by either method alone.

This study adopts a comparative case study design across six cases. Comparative case studies systematically examine multiple bounded cases to generate an in-depth understanding of both unique contextual factors and recurring explanatory mechanisms (Stake, 1995; Creswell, 2013). Following the principles of replication logic (Yin, 2018; Eisenhardt, 1989; Gerring, 2007), each case is treated as a discrete analytical unit whose findings are compared with others to identify similarities and theoretical contrasts.

In this logic, repetition of a case's findings in other settings reinforces the validity and transferability of conclusions (literal replication), while purposeful contrasts between cases enable theoretical replication—testing propositions under differing conditions (Yin, 2018; Gerring, 2007; Ridder, 2017). This comparative approach thus strengthens the explanatory power of the analysis and supports analytic generalization, extending insights to broader theoretical constructs rather than to statistical populations (Eisenhardt, 1989; Ridder, 2017).

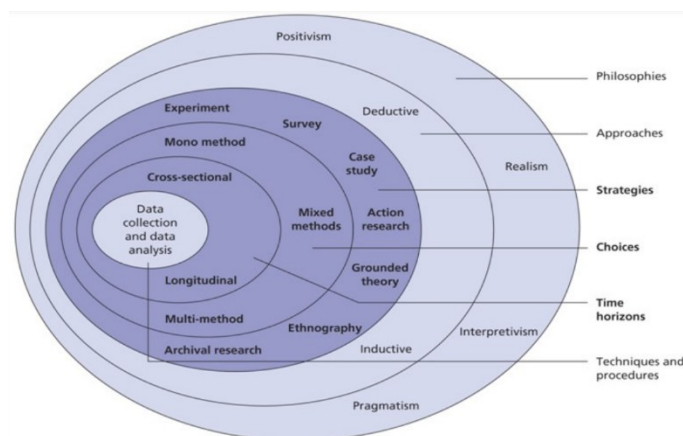
Each case constitutes a bounded system, delimited by time, activity, and institutional scope (Stake, 1995; Creswell, 2013). The research involves the collection of rich qualitative material (planning documents, monitoring reports, and interviews) over sustained periods, enabling deep contextual understanding and systematic cross-case comparison.

The study followed methodological recommendations for maintaining detailed case study protocols and a structured case study database to ensure transparency and replicability (Yin, 2018). This documentation preserves a clear chain of evidence, allowing external review and facilitating replication of findings in future comparative research (Crowe et al., 2011; Gerring, 2007).

Based on the research onion model (Figure 3) presented by Saunders et al. (2009) The philosophy (the first layer) of the current research follows the interpretivism perspective. The paradigm that governs this research is the interpretive paradigm because it seeks to understand and recognize variables (independent, dependent, and intervening), and the process and implementation of programs and projects related to energy at the local scale, which is based on epistemology. And how the phenomenon is emphasized. The approach (the second layer) of this research is deductive. Case study, survey, and experiment were used as research strategies (the third layer). The current research has mixed methods as choices (fourth layer) and

will use both quantitative and qualitative approaches in its process. For the time horizons, this research is cross-sectional data.

Figure 3: Research onion



Saunders et al. (2009)

This research adopts a comparative, qualitative case study approach, complemented by selected quantitative elements. The comparative dimension lies in the analysis of six municipalities, three in Italy (Milan, Bologna, Bolzano) and three in France (Paris, Lille, Metz), which allows the identification of cross-country differences as well as shared challenges in plan implementation. The core of the research is qualitative, relying on document analysis (plans, monitoring reports) and semi-structured interviews to capture strategies, processes, and barriers. At the same time, quantitative indicators from monitoring reports (e.g., CO₂ reductions, number of retrofits, energy savings) are integrated where available, both to ground the analysis of effectiveness and to strengthen the comparability of the cases. This mixed orientation ensures that the research remains sensitive to local contexts while also enabling systematic comparison of implementation outcomes.

Case and Plan Selection: Italy vs France

The comparative analysis in this research focuses on the implementation effectiveness of local energy and climate plans in Italy and France. Although both countries are aligned with the European Union's overarching climate and energy objectives, the institutional frameworks and local planning instruments through which municipalities act differ significantly. Therefore, selecting comparable plans required attention not to identical legal instruments, but to those that perform equivalent functions within each national governance context.

Italy: SEAPs and SECAPs under the Covenant of Mayors

In Italy, local climate–energy action has largely developed within the framework of the EU Covenant of Mayors for Climate and Energy (European Commission, 2008). Through this initiative, municipalities voluntarily commit to preparing a Sustainable Energy Action Plan (SEAP)—and, since 2015, a Sustainable

Energy and Climate Action Plan (SECAP)—to achieve specific CO₂ reduction targets and, later, to incorporate climate adaptation (Covenant of Mayors, 2016).

While SEAPs/SECAPs are not legally mandatory under Italian law, they have become the de facto local planning instruments for energy transition and climate mitigation. This is due to strong political support and technical guidance from national and regional authorities (ENEA, 2021; ISPRA, 2020), as well as the integration of SEAP/SECAP principles in several regional energy–environmental plans (*Piani Energetici Ambientali Regionali*, PEAR or PEARER) (Regione Emilia-Romagna, 2017; MASE, 2023).

For this reason, SEAPs (and in Bologna’s case, the later SECAP) were selected as the Italian planning framework. They represent the most operational and comparable local energy–climate plans in Italy, integrating energy efficiency, renewable energy, and mitigation policies at the municipal level.

France: From PCET to PCAET and Local Climate Plans

In contrast, France has a nationally regulated system of local climate and energy planning, established through the *Grenelle II Law* (Law n°2010-788) and later strengthened by the *Energy Transition for Green Growth Law* (Law n°2015-992). These legislative frameworks introduced and consolidated two successive local planning instruments:

- the Plan Climat-Énergie Territorial (PCET), and
- the Plan Climat-Air-Énergie Territorial (PCAET)

Both plans serve as mandatory frameworks for local authorities (*Établissements Publics de Coopération Intercommunale – EPCI*) to organize and implement energy transition, GHG mitigation, adaptation, and (in the PCAET) air-quality actions (ADEME, 2018; Code de l’Environnement, 2023).

Although the initial research design aimed to examine SEAPs in both countries, it became evident that in France SEAPs were not implemented in a comparable way: French municipalities operate almost exclusively under the PCET/PCAET system, which fulfills a similar strategic function but is rooted in national regulation rather than EU voluntary frameworks (Berthinier-Poncet, 2017; Rüdinger et al., 2014). Thus, the French PCET/PCAET were selected as the functional counterparts to the Italian SEAPs/SECAPs.

For Paris, the 2018 Paris Climate Action Plan (*Plan Climat de Paris*) was included as a representative case. Although locally tailored, it aligns with the PCAET framework in structure and objectives and serves as the city’s strategic document for achieving carbon neutrality by 2050 (ADEME, 2020; Ville de Paris, 2018).

Table 14: Alignment of SEAPs/SECAPs and PCET/PCAET

Dimension	Italy	France	Alignment
Legal nature	Voluntary (EU initiative)	Mandatory (national law)	Institutional difference, but similar function
Focus	Energy & CO ₂ mitigation (SEAP), + adaptation (SECAP)	Climate, energy, air, adaptation	Substantive equivalence
Governance	Bottom-up (EU–local)	Top-down (national–local)	Complementary perspectives

Role in local climate policy	Main operational instrument	Legally required local framework	Functionally comparable
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Hence, while SEAP/SECAPs and PCET/PCAETs differ in legal basis and administrative hierarchy, they both serve as the core strategic tools for local energy and climate policy in their respective national systems. Their comparison allows investigation not only of implementation effectiveness, but also of how different governance models (voluntary vs. regulatory) influence local energy transition outcomes.

Research Design

- **Comparative Case Study Approach**

This research is designed as a comparative multiple case study that investigates the effectiveness of local energy and climate action plans, with a particular emphasis on building-related measures. Based on the population, data, and national recognition of both countries, they were chosen. The comparative dimension allows for the exploration of both national and local specificities by examining three Italian municipalities (Milan, Bologna, Bolzano) and three French municipalities (Paris, Lille, Metz). These cities were selected based on the availability of Sustainable Energy Action Plans (SEAPs) or Plans Climat Air Énergie Territoriaux (PCAETs), the existence of monitoring reports, and their comparability in terms of size and urban characteristics, and also, for most of them, their participation in the Covenant of Mayors framework. It has to be mentioned that the selected cities in the two countries, two by two, have similarities in terms of scale and population, as well as almost the same year of publishing and implementing the plans.

The research approach combines qualitative and quantitative elements. The qualitative component is central and is based on detailed document analysis (plans, monitoring reports, and evaluations) as well as semi-structured interviews with municipal officials and relevant stakeholders directly involved in the preparation and implementation of the plans. The quantitative element is incorporated through the systematic use of monitoring data and indicators (e.g., CO₂ reduction figures, numbers of retrofitted buildings, energy savings) where available, in order to assess the extent to which objectives have been achieved.

- **Unit of Analysis**

The design follows triangulation logic (Denzin 1978; Patton 1999; Carter et al. 2014): plans represent the intentions of municipalities, monitoring reports provide official assessments of implementation, interviews capture practitioners' perspectives, and secondary literature provides additional external analysis. By comparing these sources, the research identifies the gap between decision-making and actual implementation.

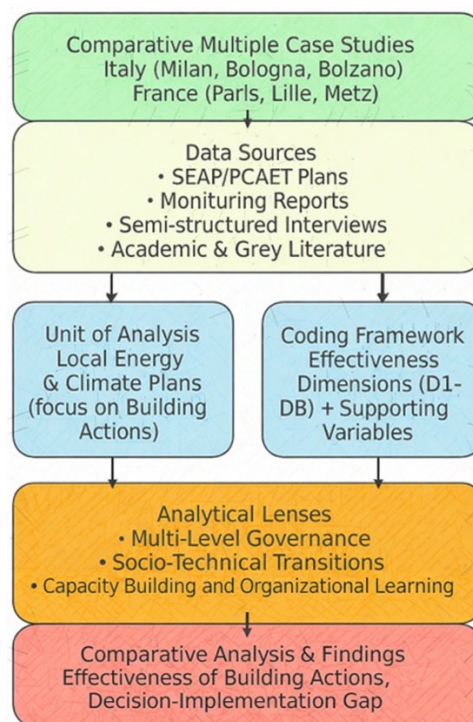
The unit of analysis is the local climate and energy plan (SEAP or PCET/PCAET) and its associated implementation process, with a particular focus on the building sector. This sector was selected as a

common and critical area of intervention across all cities, and as one that illustrates particularly well the challenges of turning strategic goals into operational actions.

To guide the analysis, the research employs a coding framework based on eight effectiveness dimensions (D1–D8), complemented by explanatory variables relating to governance, resources, and contextual factors. This framework is connected to three theoretical perspectives — Multi-Level Governance, Socio-Technical Transitions, and Capacity Building & Organizational Learning — which provide lenses through which the coded results are interpreted.

The design is thus suited to capture both the breadth (through comparison across countries and cities) and the depth (through within-case document and interview analysis) of local energy plan effectiveness.

Figure 4: Research design framework



The study follows a comparative multiple case study approach across six cities in Italy and France. Data sources (plans, monitoring reports, interviews, literature) are analyzed through a coding framework (D1–D8 and supporting variables) and interpreted with three theoretical lenses (Multi-Level Governance, Socio-Technical Transitions, Capacity Building).

Conceptual and Theoretical Framework

The methodological design is anchored in a comparative effectiveness framework structured around eight analytical dimensions (D1–D8) that operationalize effectiveness in local energy plan implementation. These dimensions were translated into codes and interview themes, enabling systematic analysis of plans, monitoring reports, and stakeholder perspectives.

Complementing these dimensions, a set of variables—including institutional arrangements, resources and capacities, stakeholder engagement, financial viability, and monitoring practices—was developed from the literature on policy implementation and urban energy governance. These variables function as explanatory factors for differences in effectiveness, linking theoretical perspectives to empirical evidence. The framework ensured analytical consistency and allowed cross-case comparison between the six municipalities, while the theoretical lenses provided interpretive depth. From here to the rest of the research, they were named codes (D1–D8) as follows:

Effectiveness Dimensions based on the Framework (D1–D8)

D1 – Achievement of Goals

→ To what extent were objectives met? Covers progress, results, emission reductions, energy savings.

D2 – Contextual Relevance

→ How well the plan fits local socio-economic, cultural, and environmental conditions.

D3 – Sustainability & Impact

→ Long-term benefits: environmental, economic, social, and resilience.

D4 – Stakeholder Engagement

→ Involvement of actors: municipalities, agencies, citizens, businesses, NGOs.

D5 – Institutional Capacity

→ Human/technical resources, staff continuity, leadership, and interdepartmental coordination.

D6 – Financial Viability

→ Costs, subsidies, financing mechanisms, perceived risks, payback times.

D7 – Information & Procedures

→ Data availability, transparency, communication, procedural clarity, indicators.

D8 – Monitoring & Adaptation

→ Frequency/quality of monitoring, learning, adjustments, mid-term evaluations.

Supporting Variables (IA, RC, KP, etc.) → explain drivers/barriers.

❖ ***Institutional & Arrangements***

IA1 – Institutional Arrangements → Roles, responsibilities, rules, governance structures.

❖ ***Resources & Capacities***

RC1 – Funding Availability → Financial resources, subsidies, investment levels.

RC2 – Technical Capacity → Technical skills, know-how, staff expertise (linked to IL1 too).

❖ ***National/External Context***

NC1 – National Context → Influence of national policy/regulation on local action.

EC1 – Economic Conditions → Broader economic factors (crises, inflation, population growth).

❖ ***Perceptions & Social***

KP1 – Perceptions of Risk → Financial or technical uncertainty, reluctance to invest.

SB1 – Stakeholder Trust → Confidence in plans, willingness to cooperate, citizen acceptance.

❖ ***Learning & Knowledge***

IL1 – Institutional Learning → Knowledge gained through EU projects, training, trial-and-error.

❖ Technology

TC1 – Technology Change → Innovation, market liberalization, technical feasibility.

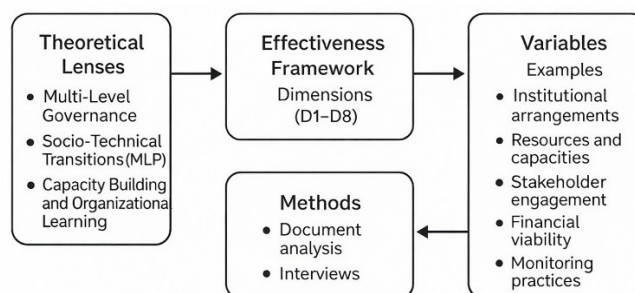
Theoretical Lenses:

The research is guided by three main theoretical perspectives:

- Multi-Level Governance (MLG) – to analyze coordination between national, regional, and municipal authorities.
- Socio-Technical Transitions (MLP) – to contextualize technological adoption and innovation within urban systems.
- Organizational Learning – to interpret how local governments adapt through monitoring and feedback loops.

This combination provided a comprehensive lens for evaluating how governance structures, institutional arrangements, and technical measures interact in shaping the effectiveness of local energy plan implementation. Together, these theories guide the operationalization of the effectiveness dimensions and associated implementation variables, shaping the design of interview questions, coding structure, and cross-case comparison (Geels, 2002; Pahl-Wostl, 2009; Argyris & Schön, 1996).

Figure 5: Conceptual flow (theories, framework, and variables)



Data Sources and Collection

Primary Sources

The main source of original data for this thesis consists of semi-structured interviews conducted with municipal officials and stakeholders directly involved in the design, implementation, and monitoring of local climate and energy plans. The statistical population selected for the interview was judgmental. The interviews followed a coding framework derived from the effectiveness dimensions (D1–D8) and supporting variables, ensuring that questions consistently addressed goals, actions, results, funding, monitoring, and obstacles, with a particular focus on building-related measures. Interviewees were provided with an information sheet and a consent form before participation, in line with ethical and legal requirements. Where direct interviews could not be arranged, written responses were accepted using the same question guide to ensure comparability. In some cases, in addition to the interview, a written document as a reply to the interview questions has been received, and in two cases, just a written version has been received. It has

to be mentioned that all the answers (as an interview or written version) were done by the main responsible office of the SEAP or PC(A)ET of each city municipality.

Secondary Sources

SEAP/PCAET(PCET) plans and monitoring reports: These documents constitute the backbone of the analysis, as they set out the strategic intentions of municipalities (plans) and the reported implementation outcomes (monitoring/evaluation reports). They were systematically screened for building-related goals, actions, and results.

**It is necessary to mention that during the plan analysis, some general objectives and actions have been noted too, as they were inseparable or connected to the building objectives and actions, so as part of the research, they have also been analyzed, and all are mentioned in the results chapter.

Academic and grey literature: Scholarly publications, EU project reports, and national/regional policy documents were used to complement municipal sources. They provided contextual insights, independent assessments of implementation challenges, and information on broader governance frameworks. In some cases, the same plans in the same cities had been analyzed.

Document Selection

The selected documents reflect both the historical trajectory of energy and climate planning and the availability of data. For instance, Bologna's 2012 SEAP was chosen because it represented the first generation of local plans under the Covenant of Mayors in Italy and was accompanied by early monitoring reports. By contrast, Paris's 2018 Climate Action Plan was selected because it marked the introduction of the second-generation PC(A)ET framework, with updated obligations and mid-term monitoring data available. Metz was chosen in place of Lyon because its plan and monitoring provided clearer city-specific coverage and data accessibility. Across all cases, the principle guiding document selection was comparability: ensuring that each city was represented by one official plan and at least one monitoring or evaluation report.

Language and Data Accessibility

Given the cross-national scope, documents were in both Italian and French, and in some limited cases, they had English reports (especially for monitoring parts). Sources were maintained in their native language during coding to preserve meaning, with selected excerpts translated into English for analysis and reporting. This approach ensured accuracy while facilitating cross-case comparison. Accessibility varied across cases: The Italian cases had easier accessibility to organized documentation than the French ones (mostly). While Paris and Lille provided extensive monitoring documentation, Italian cities often presented fragmented or less detailed reporting. These differences are treated as part of the comparative findings and not merely as technical limitations.

Data Preparation

- **Transcription & Cleaning** (interviews).

All semi-structured interviews conducted with municipal officials and stakeholders were recorded (with consent) and subsequently transcribed. The interviews (except for two French ones) were carried out in English, and the transcripts were maintained for analysis and reporting. A process of cleaning was undertaken to ensure consistency: interviewer prompts were standardized, filler words removed, and overlapping sentences clarified. Where transcription errors occurred (due to automated speech transcription), corrections were made manually by cross-checking with the original audio. Each transcript was categorized into a format that aligned with the coding framework.

- **Extraction of Building Actions** (plans/monitoring).

Because the thesis focuses specifically on the effectiveness of building-related actions, a systematic procedure was applied to extract all building measures from the SEAPs/PCAETs (PCET) and their associated monitoring reports. This included both public-sector interventions (e.g., retrofitting municipal buildings, school upgrades, district heating connections, LED lighting programs) and private-sector measures (e.g., condominium retrofits, household solar installations, energy audits). Extraction was carried out manually and automatically by scanning each document for relevant keywords (e.g., retrofit, audit, insulation, EPC, heating, PV, renovation, housing) and recording the full text excerpts in structured tables. Monitoring reports were analyzed for both planned indicators (objectives, targets) and reported outcomes (energy savings, CO₂ reductions, number of buildings renovated). These excerpts were then prepared for coding in MAXQDA by assigning them to the categories of Goals, Actions, Results, Funding, Monitoring, or Obstacles.

- **Use of Frequent Keywords and Conjunctions in Monitoring Reports** (discourse layer)

In addition to the coding of actions, results, and obstacles using the effectiveness framework (D1–D8 and supporting variables), in this study, a complementary textual analysis of the monitoring reports was conducted. This analysis focused on identifying frequent words and their conjunctions with primary concepts (e.g., “retrofit,” “building,” “funding,” “barrier”), which were done automatically by using a tool in the MAXQDA application, and then were summarized to the five most frequent words.

The objective of this step was not to quantify performance, but rather to capture the discursive emphasis of the municipalities. By analyzing which terms appear most frequently, and in connection with which concepts, it is possible to identify the priority areas of discourse and the institutional narratives surrounding implementation.

This approach complements the coding of concrete actions and results by revealing the language and framing used in official evaluations. It also strengthens the comparative dimension: by contrasting the discourses across different municipalities, it is possible to highlight not only what was done or achieved, but also how local authorities perceived, justified, and communicated their actions.

Analytical Approach

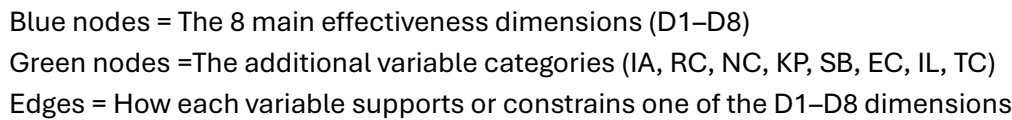
Coding Framework

Two layers of code were used during the coding of the collected data:

1. **The 8 main dimensions (D1–D8)**, which come from the research *Effectiveness Framework in Local Energy Planning* (Achievement of Goals, Monitoring, Stakeholder Engagement, etc.), are based on the literature review.
2. **Additional variable categories** (IA, RC, NC, KP, SB, EC, TC, IL, etc.), which come from the list of Variables from the literature review (Independent, Intervening, Moderator variables).

After that, some connections between D1–D8 (dimensions) and the variables (IA1, RC1, etc.) had been identified again based on the Effectiveness Framework and Variables Tables and Comparative literature about SEAPs/SECAP, PC(A)ETs, Covenant of Mayors evaluation report, EU research projects (e.g., POCACITO, InSMART, Horizon2020 studies on local energy plans), and Academic papers on SEAPS of Milan, Bologna, etc. These consistently show that, for example, *institutional arrangements* and *technical capacity* are not separate outcomes — they mediate or constrain effectiveness dimensions. And their connections can be defined as follows (visual codebook map, Figure 6),

Effectiveness Framework & Variable Codes - Conceptual Map



Use of MAXQDA

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coded segments to analytical categories, and generate structured outputs that support both interpretative and comparative analysis (Kuckartz & Rädiker, 2019; Paulus & Lester, 2016; Silver & Lewins, 2014; Lewins & Silver, 2014).

MAXQDA is widely applied across social science disciplines, including policy analysis, governance studies, and sustainability research, where it supports approaches such as thematic analysis, qualitative content analysis, grounded theory, and mixed-methods designs. By combining manual interpretive coding with computational tools for frequency analysis, co-occurrence mapping, and visualization, the software helps researchers identify patterns, relationships, and recurring themes within complex qualitative datasets (Paulus et al., 2014; Rädiker & Kuckartz, 2020; Rädiker, 2023). While the software supports the organization and systematic analysis of qualitative material, the interpretation of coded data and identification of themes remains the responsibility of the researcher (Silver & Lewins, 2014; Lewins & Silver, 2014).

In this study, MAXQDA is used to support the systematic coding of qualitative material and the production of structured analytical outputs. These outputs serve not only to code qualitative material but also to generate comparative analytical insights, such as code frequency tables, code co-occurrence matrices, case-by-case comparisons, and word frequency analyses (Rizzo et al., 2024; Gizzi & Harm, 2021; Rädiker, 2023; Rädiker & Kuckartz, 2020). The software supports a range of functions that combine qualitative interpretation with frequency-based summaries and visual mapping (Kuckartz & Rädiker, 2019; Paulus & Lester, 2016; Silver & Lewins, 2014). These outputs allow both systematic cross-case comparison and the identification of recurrent barriers and enablers influencing the effectiveness of the analyzed actions, with particular attention to building-related energy actions.

Based on the coding framework (D1–D8 effectiveness dimensions and supporting variables), several types of outputs were generated using MAXQDA:

❖ Code Frequency Tables/Charts

MAXQDA generates code frequency tables that display how often each code appears across the dataset. This output provides an initial overview of which effectiveness dimensions (e.g., *Monitoring*, *Financial Viability*) are emphasized in each city and in each type of document (plans, monitoring reports, interviews). Such tables facilitate a first-level descriptive analysis of thematic salience across cases (Kuckartz & Rädiker, 2019; Bazeley & Jackson, 2013).

❖ Code Co-Occurrence Matrices

Co-occurrence matrices identify codes that appear together within the same text segments, helping to reveal interrelated barriers or enablers. For instance, this tool makes it possible to verify whether Financial Viability (D6) consistently co-occurs with Perceptions of Risk (KP1) in the context of building retrofits. Co-occurrence analysis is widely used to identify conceptual linkages and to visualize latent structures within qualitative datasets (Kuckartz & Rädiker, 2023; Paulus & Lester, 2016).

❖ Case Comparison through Code–Document Matrices

The code–document matrix feature enables the comparison of cases (e.g., Milan, Bologna) across thematic codes. Rows represent cases, and columns represent codes, allowing researchers to identify dominant themes and relative emphasis across contexts. This functionality provides an empirical foundation for cross-case comparison, enhancing the reliability of comparative interpretations (Silver & Lewins, 2014; Kuckartz, 2014).

❖ Plan–Monitoring–Interview Comparisons

By distinguishing document types, MAXQDA allows intra-case comparisons among planning documents, monitoring reports, and interview transcripts. This facilitates identifying gaps between intention and implementation—for example, where planning documents emphasize Goals (D1) but monitoring materials highlight Obstacles (D6, KP1). This type of data-source triangulation enhances validity and analytic depth (Patton, 1999; Paulus & Lester, 2016).

❖ Word Frequency and Word Clouds

The word frequency and word cloud tools visualize the most frequently occurring terms, complementing the interpretive coding by indicating which discursive elements dominate official narratives. These visualizations assist in linking content analysis with discourse analysis, revealing the rhetorical emphasis and linguistic framing adopted by municipalities (Schreier, 2012; Kuckartz & Rädiker, 2019).

❖ Keyword-in-Context (KWIC) Analysis

The keyword-in-context (KWIC) function enables examination of how specific words (e.g., retrofit, patrimoine, condominiums) are used in their textual context. KWIC analysis enriches frequency data by highlighting the semantic and pragmatic environment of key concepts, consistent with established techniques in textual and discourse analysis (Weber, 1990; Kuckartz & Rädiker, 2023).

❖ Code Relations Browser (Visual Maps)

MAXQDA's Code Relations Browser provides visual network diagrams showing relationships between codes based on their co-occurrence. Such visual mapping supports the identification of clusters of interrelated issues—for instance, the relationship among Financial Viability, Trust, and Risk in the context of private-sector retrofits (Kuckartz & Rädiker, 2019; Paulus & Lester, 2016).

❖ Retrieval of Coded Segments (Illustrative Quotes)

The software allows exporting all coded segments under each theme, enabling systematic extraction of illustrative quotations for reporting. This feature strengthens transparency and traceability, ensuring that the interpretation of findings is firmly grounded in empirical evidence (Bazeley & Jackson, 2013; Silver & Lewins, 2014)

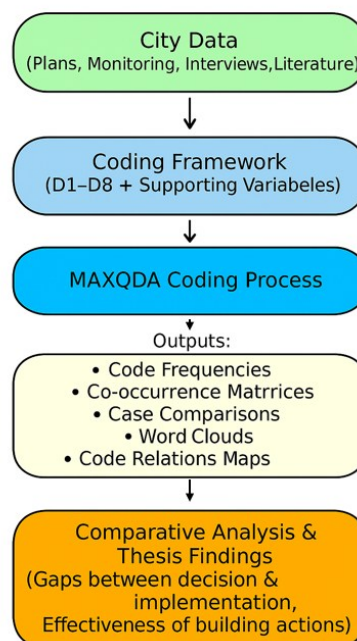
MAXQDA also supports the inclusion of quantitative variables (e.g., reported energy savings or CO₂ reductions). The integration of coded themes with numerical indicators produces mixed-method matrices, allowing exploration of correlations between qualitative categories (e.g., barriers, enablers) and quantitative performance measures. Such qualitative–quantitative integration (Fetters, Curry, &

Creswell, 2013; Kuckartz, 2014) allowing for the exploration of whether particular barriers or enablers correlate with higher or lower levels of implementation success.

Overall, these outputs will allow the research to move beyond descriptive case studies and toward a structured, comparative analysis. By combining frequency analysis, co-occurrence patterns, discourse emphasis, and illustrative evidence, MAXQDA will contribute directly to answering the central research question: why do local energy plans, particularly building-related actions, show variable levels of effectiveness between decision-making and implementation?

Figure 7: Flowchart of analysis pipeline with MAXQDA

Flow of Data Analysis with MAXQDA



Integration with Theory

The coding framework developed for this research (D1–D8 effectiveness dimensions and supporting variables) is not only a descriptive tool, but also a bridge to the theoretical perspectives guiding the analysis. The integration between coding and theory follows a mapping process that ensures that empirical findings are interpreted within a coherent conceptual structure.

Multi-Level Governance (MLG).

Codes relating to institutional arrangements (IA1), national context (NC1), and stakeholder engagement (D4) are analyzed through the lens of MLG. This perspective explains how vertical relations (between national frameworks and local implementation) and horizontal relations (between municipalities, agencies, and utilities) condition effectiveness.

Socio-Technical Transitions (MLP).

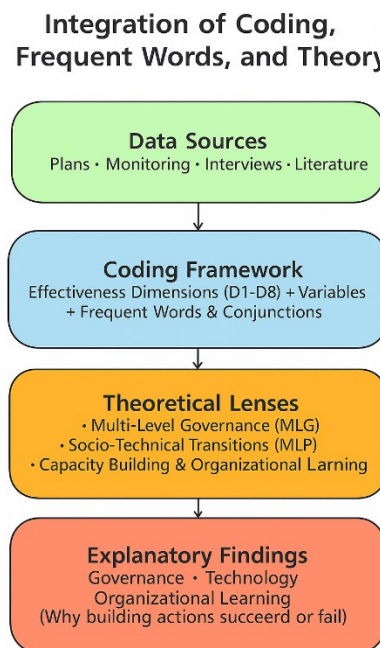
Codes that capture technological change (TC1), sustainability and impact (D3), and innovation-related obstacles are interpreted through socio-technical transitions theory. This lens emphasizes the dynamics of niche innovations and regime lock-ins, explaining why certain technological solutions (e.g., district heating in Bolzano, eco-districts in Metz, rooftop PV in Milan) succeed or fail to diffuse.

Capacity Building and Organizational Learning.

Codes linked to institutional capacity (D5), monitoring and adaptation (D8), information and procedures (D7), and institutional learning (IL1) are examined through the perspective of organizational learning. This theory highlights the ability of municipalities to learn from monitoring, adapt strategies, and build technical and organizational competence over time.

The integration of coding with theory thus enables the analysis to shift from descriptive patterns (what actions were planned, what results were achieved, and what barriers were encountered) to explanatory insights (why plans succeeded or failed under particular governance, technological, or organizational conditions).

Figure 8: Integration of coding, frequent words, and theories



Validity, Reliability, and Limitations

Ensuring the reliability, validity, and overall trustworthiness of the findings is fundamental to the credibility of this research. These quality criteria are embedded within both the comparative case study design and the mixed-methods integration strategy, which together determine how confidently the conclusions can be interpreted and transferred to similar contexts (Creswell & Plano Clark, 2018; Yin, 2018; Lincoln & Guba, 1985). A well-conceived methodological design strengthens not only the

consistency of data collection and analysis but also the interpretive rigor with which empirical evidence is linked to theoretical propositions.

Reliability Meaning

Reliability refers to the consistency and dependability of research procedures and results over time (Yin, 2018; Creswell, 2013). In the qualitative strand, reliability is enhanced through the use of case study protocols, standardized coding frameworks, and systematic documentation of analytical steps. All coding and interpretation procedures are logged within the MAXQDA software, allowing for auditability and replication of analytic logic. In the quantitative elements—such as the integration of performance indicators—reliability is supported through standard checks (e.g., internal consistency, test–retest reliability) following Creswell’s (2013) and Tashakkori & Teddlie’s (2010) recommendations.

Validity (Legitimation)

Validity concerns whether the study accurately represents and measures the intended phenomena. Within a mixed-methods and comparative design, validity is multifaceted and must be established separately for each methodological strand as well as for their integration (Creswell & Plano Clark, 2018; Onwuegbuzie & Johnson, 2006).

Qualitative validity is ensured through data triangulation, member checks, peer debriefing, and thick description of contextual factors (Lincoln & Guba, 1985; Maxwell, 2013). These strategies enhance credibility and transferability across cases.

Quantitative validity addresses internal, external, and construct validity, ensuring that observed relationships genuinely reflect theoretical constructs and can be generalized analytically (Yin, 2018; Creswell, 2013).

Mixed-methods legitimation concerns the coherence of integration—that is, the degree to which qualitative and quantitative findings inform and corroborate each other (Onwuegbuzie & Johnson, 2006). Integration occurs both at the interpretation and discussion stages to produce well-justified, philosophically consistent inferences.

Trustworthiness and Integration

Trustworthiness represents the overarching criterion that unites reliability and validity within qualitative inquiry (Lincoln & Guba, 1985). It encompasses credibility, dependability, confirmability, and transferability. In comparative case study research, trustworthiness depends on rigor within each case as well as transparency in cross-case comparison (Yin, 2018; Stake, 1995). The integration of qualitative and quantitative strands reinforces trustworthiness by balancing depth (contextual understanding) with breadth (pattern recognition).

Practical Strategies for Ensuring Quality

To ensure the overall robustness of the research design, the following strategies are systematically applied (Creswell, 2013; Lincoln & Guba, 1985; Yin, 2018):

- Maintaining comprehensive documentation of all research steps and decisions.

- Applying triangulation within and across data sources (plans, monitoring reports, interviews).
- Conducting peer audits and coding reviews to enhance inter-coder consistency.
- Implementing member checks with key informants to validate interpretations.
- Ensuring quantitative data reliability and construct validity.
- Providing rich qualitative descriptions to support analytic transferability.
- Integrating quantitative and qualitative findings during interpretation to enhance explanatory coherence.

❖ **Construct validity**

The study achieves construct validity by operationalizing the concept of “effectiveness” into a structured framework of eight dimensions (D1–D8: Achievement of Goals, Contextual Relevance, Sustainability & Impact, Stakeholder Engagement, Institutional Capacity, Financial Viability, Information & Procedures, Monitoring & Adaptation). These dimensions are directly derived from the literature on climate and energy planning effectiveness, and they are supported by additional explanatory variables (e.g., IA1 Institutional Arrangements, RC1 Funding Availability, KP1 Perceptions of Risk). This operationalization ensures that the abstract concept of effectiveness is translated into concrete, measurable indicators. Furthermore, the dimensions are explicitly linked to relevant theoretical perspectives, namely Multi-Level Governance, Socio-Technical Transitions, and Capacity Building & Organizational Learning, which further strengthen the conceptual foundation of the study. Additionally the eight dimensions and additional explanatory variables were checked and validated by two professors of the university in the same field of study.

❖ **Internal validity**

In case study research, internal validity refers to the credibility of the findings and the extent to which they accurately reflect the causal mechanisms at play. This study enhances internal validity through triangulation of data sources, following Yin’s (2018) recommendation to corroborate evidence across multiple sources and the broader guidance on credibility and triangulation from Miles, Huberman, and Saldaña (2014) and Lincoln and Guba (1985). This study ensures credibility through triangulation of data sources. Each case study relies on:

1. The original SEAP/PC(A)ET plans (representing strategic intentions),
2. Monitoring and evaluation reports (documenting implementation results),
3. Semi-structured interviews with key stakeholders (providing perceptions and explanations), and
4. Secondary academic and grey literature (offering independent assessments and contextual details).

By comparing these different perspectives, the study reduces the risk of bias arising from any single source and captures a more holistic view of plan effectiveness.

❖ **External validity**

Although case study research does not aim for statistical generalizability, it is possible to achieve analytical generalization. The research design compares three Italian cities (Milan, Bologna, Bolzano) and three French cities (Paris, Lille, Metz). The selection was based on comparable criteria: existence of SEAP/PC(A)ET plans, similar urban scale, and availability of data. This deliberate cross-national sampling

enables the identification of patterns that extend beyond individual cases and allows for cautious generalizations about the differences between Italian and French approaches to local energy planning.

Reliability of the research

As defined before, reliability in qualitative research refers to the consistency and replicability of the research process. Another researcher following the same procedures should be able to arrive at similar observations and interpretations. Several steps have been taken in this study to enhance reliability.

❖ Explicit coding framework

All data were analyzed using a transparent codebook based on the eight effectiveness dimensions and supporting variables. This codebook ensures that the same analytical categories are applied consistently across all cases, reducing interpretive bias.

❖ Standardized data preparation

All sources (plans, monitoring reports, interviews) were prepared consistently: interviews were transcribed and cleaned, documents were structured into comparable sections (Goals, Actions, Results, Obstacles), and building-related actions were extracted with special care. This uniform preparation process can guarantee that data from different cases are comparable.

❖ Documentation and audit trail

An audit trail has been maintained, including records of how cases were selected, which documents were included, and how coding decisions were made. This documentation allows others to trace the analytical steps taken and to verify the reasoning behind the conclusions.

Totally, by combining a clear operationalization of concepts (construct validity), the triangulation of multiple data sources (internal validity), and a carefully chosen set of comparable cases (external validity), the study can ensure an acceptable validity base. Reliability is enhanced by a transparent coding framework, standardized data preparation, and the maintenance of a trail.

Limitations

While the research design provided a coherent and replicable framework for evaluating local plan effectiveness, several limitations should be acknowledged to contextualize the findings.

First, the level of detail and consistency of monitoring data differed markedly between cases. French PC(A)ET reports offered extensive evaluation metrics, while Italian SEAP monitoring remained partial. This can affect the cross-country comparisons for dimensions such as D8 Monitoring & Adaptive Management and D6 Financial Viability. It is also necessary to mention here that, due to the number of case studies, it was very time-consuming to analyze the documents.

Second, the number of stakeholder interviews per city was limited by availability and institutional access. Although documentary analysis compensated for these gaps, a broader set of interviews (especially with private-sector and regional actors) could have provided deeper triangulation of findings on stakeholder engagement (D4) and institutional learning (D5–IL1).

Third, linguistic and translation challenges posed interpretive limitations, like Key governance terms such as “bilan,” “monitoraggio,” or “efficience énergétique,” which cannot be fully translated into English equivalents.

Fourth, the temporal scope of the study (2010–2025) captures a single implementation cycle. A longitudinal follow-up could reveal whether institutional learning and monitoring mechanisms become more embedded in subsequent plan generations.

Despite these limitations, the study maintains analytical reliability through methodological triangulation, consistency of coding criteria, and transparency of documentation. The constraints identified here also highlight promising directions for future research.

Ethical Considerations

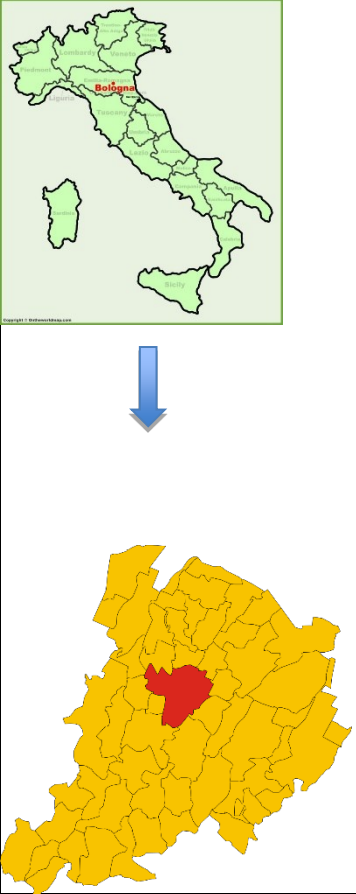
This study adheres to the ethical standards of academic research and complies with the General Data Protection Regulation (GDPR)(BERA, 2018). All interviewees were provided with an information sheet explaining the purpose of the study, the voluntary nature of their participation, and the intended use of their responses. Consent forms were collected in advance, and interviewees retained the right to withdraw at any point. Data protection measures were observed: interview recordings and transcripts were stored securely on encrypted devices, anonymized when requested, and used solely for academic purposes. No sensitive personal data beyond professional roles and institutional affiliations was collected.

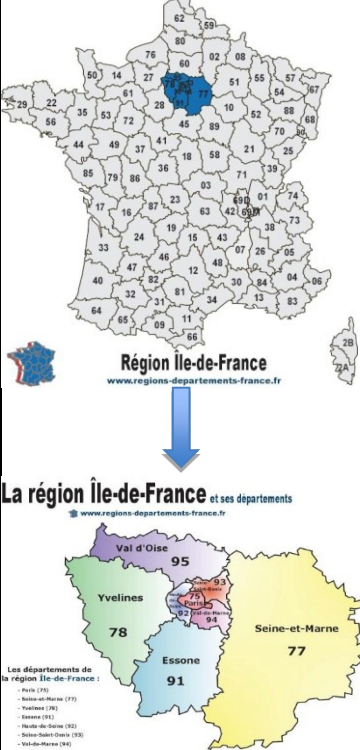
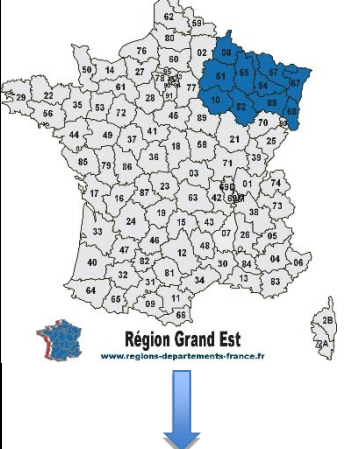
Case Studies

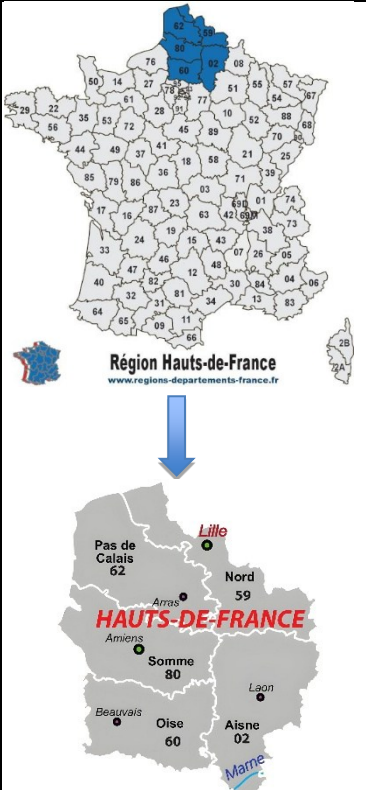
In the following table is an overview of each six case studies in both Italy and France.

Table 15: An introduction of case studies

Cases and the selected plan	Population	First plan	Monitoring	Location
Milano Sustainable energy action plan for the city of Milan	1,371,850 (in the year 2024)	2014	Yes	 

				
Bologna Action Plan for Sustainable Energy	390,518 (in the year 2024)	2012	Yes	
Bolzano The Sustainable Energy Action Plan	536,933(in the year 2024)	2013	Yes	

				
Paris Paris Climate Action Plan	2,102,650 (in year 2023)	2005-2007	Yes	
Metz Plan Climat de la ville de Metz	112,100	2011	Yes	

				
Lille The Territorial Climate Energy Plan 2013, city of Lille, Lomme, Hellemmes.	236 710 (in year 2021)	1999	yes	

Milan – Sustainable Energy Action Plan (SEAP, 2014) and Monitoring (2015–2022)

 Plan (2014)

History of the Plan

Milan adhered to the Covenant of Mayors in 2009 and committed to a 20% CO₂ reduction by 2020. The city developed its Sustainable Energy Action Plan (SEAP) between 2011–2014, officially approved in February 2014. This was Milan's first SEAP, serving also as its Municipal Energy Plan.

Timelines and Changes of the Plan

- 2009–2012: Adherence and preparation phase.

- 2014: SEAP adopted with Strategic Environmental Assessment (VAS).
- 2018: City Council reaffirmed approval and integration with environmental planning.
- 2022: Final monitoring report delivered, aligned with EU and national climate objectives.
- Long-term goals: -40% CO₂ by 2030 and carbon neutrality by 2050.

Actors, Institutions of the Plan

Key actors included:

- **Municipal Council (Giunta Comunale)** → mandate and approval.
- **Environmental & Energy Policies Department** → lead proponent and coordinator.
- **Central Directorate for Mobility, Transport, Environment & Energy** → responsible for Strategic Environmental Assessment procedure.
- **Stakeholders:** businesses, NGOs, ESCOs, professional associations, and citizens consulted through forums, workshops, and public hearings.

Funding and Process of the Plan

Funding relied on:

- **Municipal budget allocations.**
- **EU funds** (structural, Horizon, Covenant of Mayors programs).
- **Grants & subsidies** at national/regional level (e.g., tax deductions, Conto Termico).
- **Public–private partnerships** and ESCO models for building retrofits.
- **European Investment Bank (EIB)** financial support for larger energy projects.

Existing Assessment of the Plan

The SEAP incorporated a **Strategic Environmental Assessment (SEA)** and monitoring framework to track effectiveness. Assessment criteria covered CO₂ emissions, energy use, air quality, and alignment with national/EU sustainability goals.

Actions Related to Buildings in the Plan

- **Energy retrofitting** of existing public and private buildings (insulation, windows, HVAC upgrades).
- **Promotion of renewables:** solar PV, solar thermal, geothermal heat pumps.
- **Building audits** to identify efficiency measures.
- **Regulatory framework:** updated building codes and energy performance standards.
- **Incentives:** tax reductions, grants, reduced urbanization fees.
- **Awareness campaigns & training** for building owners and professionals.
- **Energy management systems** and **energy performance certificates** introduced.

Monitoring (2015–2022)

1-1: Aims of Assessment/Monitoring of Effectiveness

Monitoring aimed to evaluate progress, measure the effectiveness of specific actions, ensure accountability, support policy decisions, and adapt to changing conditions. Additional aims included: benchmarking with other cities, knowledge sharing, supporting funding applications, fostering resilience, and tracking socio-economic impacts (jobs, health, air quality).

1-2: Criteria for Assessment/Monitoring of Effectiveness

Criteria included:

- **GHG emissions:** total CO₂, % reduction vs 2005.
- **Energy consumption:** total use and savings achieved.
- **Renewable energy:** installed capacity, % of total energy mix.
- **Buildings:** number retrofitted, energy ratings improved.
- **Transport:** modal shift to public transport, EV adoption.
- **Air quality:** pollutant concentrations (PM10, NOx).
- **Engagement:** participation in programs, awareness levels.
- **Economy:** jobs in green sectors, investment volumes.
- **Integration with other plans:** mobility, air quality, and territorial planning.

1-3: Use of Data for Assessment/Monitoring

Data were used for:

- **Performance tracking** against targets.
- **Reporting** to stakeholders, EU bodies, and the public.
- **Evaluating the effectiveness** of specific actions (retrofits, renewables).
- **Integration** with other sectoral plans.
- **Adaptive management:** feedback loops for corrective measures.
- **Benchmarking** with peer cities.
- **Policy development** and funding decisions.

1-4: Types of Data Used for Assessment/Monitoring

- **Environmental data:** CO₂ inventories, pollutant concentrations.
- **Energy data:** consumption across sectors, renewables output.
- **Buildings data:** retrofits, audits, energy certificates.
- **Transport data:** ridership, emissions by mode.
- **Socioeconomic data:** jobs created, community surveys.
- **Financial data:** public/private investments.
- **Benchmarking:** comparisons with other cities.
-

1-5: Results Underlined in Monitoring

- **Emission reductions:** -24% CO₂ vs 2005 by 2020 (target surpassed). Total reduction ~1,484.5 ktCO₂/year across sectors.
 - Public buildings: -83% emissions (2005–2020).
 - Private buildings: -22% emissions.
 - Public lighting: strong reductions through upgrades.
- **Energy savings:** ~1,484 GWh/year.
- **Renewables:** Installed PV capacity +21 MW; solar thermal and geothermal supported by incentives.
- **Waste sector:** advances in waste-to-energy and recycling, contributing to energy recovery.
- **Transport:** increased public transport use, reduced emissions from vehicles.
- **Public engagement:** awareness campaigns, training, audits, education programs.
- **Challenges:** Renewable adoption below expectations; need for further investment and sustained engagement.
- **Alignment:** SEAP results consistent with EU 2020 goals and long-term climate strategies.

Table 16: Summary of Milan- SEAP (2014) & Monitoring (2015- 2022)

Category	Plan (2014)	Monitoring (2015)	Monitoring (2022)
History & Timeline	First SEAP, approved Feb 2014; Covenant of Mayors commitment (- 20% CO ₂ by 2020).	Early implementation, initial progress tracked.	Final monitoring: -24% CO ₂ vs 2005 (target surpassed); -40% by 2030, neutrality by 2050.
Actors & Institutions	Municipal Council; Environmental & Energy Dept.; Mobility/Transport Directorate; ESCOs, NGOs, citizens.	Stakeholders consulted; integration with mobility and territorial plans.	Wide involvement of businesses, NGOs, community groups, and education/training programs.
Funding & Resources	Municipal budget, EU funds, EIB loans, PPPs, and national incentives.	Tracking began, including EU & national incentives.	Significant public/private investments; incentives supported retrofits and renewables.
Building Actions	Retrofitting (insulation, windows, HVAC); audits; stricter codes; incentives; renewables (PV, solar thermal, geothermal); awareness campaigns.	Early building retrofits and audits started; codes were reinforced.	Public buildings: -83% CO ₂ ; private buildings: - 22% CO ₂ ; ~1,484 GWh energy savings; PV capacity +21 MW.
Assessment/Monitoring Aims	VAS assessment, monitoring framework built in.	Evaluate progress, measure effectiveness,	Adaptive management, benchmarking, socioeconomic impacts,

		ensure accountability, and stakeholder engagement.	and alignment with EU 2030/2050 goals.
Criteria	CO ₂ , energy use, renewables, building retrofits, stakeholder engagement, integration with other plans.	Compatibility with regulations, emission reduction progress, action effectiveness, and stakeholder involvement.	Full set: CO ₂ , energy, renewables, transport, air quality, economy, participation, jobs, investments.
Data & Utilization	Inventories (2005 baseline), audits, energy certificates, and incentives.	Used for performance tracking, reporting, and policy adaptation.	Sector-specific data (buildings, transport, waste, air quality, energy), integrated with mobility and air plans, benchmarking with other cities.
Results	Target: -20% CO ₂ by 2020.	Early progress in retrofits, renewables, and codes.	-24% CO ₂ achieved (2020); ~1,484 GWh savings; strong public building performance; PV +21 MW; waste-to-energy improvements; challenges in renewables uptake.

Bologna – Sustainable Energy Action Plan (SEAP, 2012) and Monitoring (2015 & 2018)

Plan (2012)

History of the Plan

Bologna joined the Covenant of Mayors in 2008 and drafted its Sustainable Energy Action Plan (SEAP) in 2011, approved by the City Council in May 2012. The plan aimed for a 20% reduction in CO₂ emissions by 2020 compared to the 2005 baseline, even as the population increased.

Timelines and Changes of the Plan/Plans

- 2012: SEAP approved.
- 2013 and 2018: monitoring reports produced.

- 2014–2015: complemented by the BlueAp Climate Adaptation Plan.
- 2019: Bologna joined the Covenant of Mayors for Energy and Climate, integrating SEAP and BlueAp into a single SEAPC, approved in 2021.

Actors, Institutions of the Plan

The plan was coordinated by the Municipality of Bologna with participation from neighborhood councils, NGOs, businesses, associations, researchers, and financial institutions. The Joint Research Centre (JRC) of Ispra provided Covenant of Mayors guidelines. Citizens participated through public forums and thematic working groups.

Funding and Process of the Plan

Funding came from a mix of sources: the municipal budget, European Union grants (structural funds, Horizon support), European Investment Bank loans, and public–private partnerships. Cooperation with local banks and energy service companies supported building retrofits and efficiency projects.

Existing Assessment of the Plan

The SEAP included an assessment framework from the beginning. Monitoring obligations were foreseen in 2013 and 2018 to check progress toward the 2020 CO₂ reduction target and to adapt actions if needed.

Actions Related to Buildings in the Plan

The SEAP prioritized:

- Public building retrofits and efficiency upgrades (heating systems, insulation, window replacement, efficient lighting).
- Private building renovations supported by incentives.
- Renewable integration (solar thermal, photovoltaic, geothermal, cogeneration).
- Energy audits, awareness campaigns, green building certifications, Energy Performance Contracts (EPCs), and energy management systems.

Monitoring (2015 & 2018)

1-1: Aims of Assessment/Monitoring of Effectiveness

Monitoring aimed to evaluate progress, quantify CO₂ reductions and energy savings, inform policy decisions, enhance accountability, and identify best practices. It also served to engage stakeholders, report to the JRC, and promote public awareness and education on energy efficiency.

1-2: Criteria for Assessment/Monitoring of Effectiveness

Criteria included:

- Energy consumption reduction.
- CO₂ emissions reduction (tons vs. 2005 baseline).
- Financial investment levels (public/private).

- Renewable energy production (MWh).
- Number of projects completed.
- Building performance improvements.
- Public engagement and awareness indicators.
- Compliance with EU/national/local regulations.
- Benchmarking against other municipalities.

1-3: Use of Data for Assessment/Monitoring

Data were used for:

- Performance evaluation against predefined targets.
- Reporting to local officials, citizens, and the JRC.
- Evidence-based decision-making and allocation of resources.
- Benchmarking progress with other cities or previous years.
- Identifying trends in energy use and emissions.
- Supporting stakeholder engagement and transparency.
- Creating feedback loops for continuous improvement.

1-4: Types of Data Used for Assessment/Monitoring

- Energy consumption data across residential, public, and tertiary sectors.
- CO₂ emissions inventories.
- Renewable energy production data.
- Records of municipal and private financial investments.
- Project completion lists (e.g., insulation, window replacements).
- Building energy performance certificates.
- Public participation data (surveys, workshops, education programs).
- Utility billing data for financial savings.
- Compliance reports with regulatory standards.
- Environmental impact assessments (e.g., air quality)

1-5: Results Underlined in Monitoring

- **CO₂ reductions:** ~14,548 tons/year by 2018 (~42% of SEAP target).
- **Energy savings:** ~72,020 MWh/year.
- **Investments:** ~€220 million mobilized by 2018.
- **Public engagement:** 15,000 students in education programs; ~7,000 stakeholders in participatory processes.
- **Sectoral progress:** 511 horizontal insulation upgrades, 388 vertical insulation upgrades, 15,729 window replacements, plus significant municipal retrofits.
- **Benchmark actions** identified for replication in other cities.
- **Challenges:** uneven results across sectors, regulatory barriers, and corrective actions required.

Table 17: Summary of Bologna – SEAP (2012) & Monitoring (2015, 2018)

Category	Plan (2012)	Monitoring (2015)	Monitoring (2018)
History & Timeline	SEAP approved in 2012 (Covenant of Mayors). Target: -20% CO ₂ by 2020 vs 2005.	First monitoring round. Partial progress; uneven sectoral engagement.	Second monitoring. Reported -21.6% CO ₂ (2005–2018) despite population growth.
Actors & Institutions	Municipality of Bologna; neighborhood councils, NGOs, businesses, researchers; JRC guidance; public forums.	Stakeholder involvement emphasized.	~7,000 stakeholders involved; 15,000 students in awareness programs.
Funding & Resources	Municipal budget, EU structural funds, EIB loans, PPPs.	Early tracking of investments.	~€220m invested (municipal + private).
Building Actions	Retrofits of public buildings, insulation, heating upgrades, window replacement, renewables (solar, geothermal), EPCs, audits, and awareness campaigns.	Focus on building retrofits, solar installations, and audits.	511 horizontal insulation upgrades, 388 vertical, 15,729 window replacements. Major retrofits in public buildings.
Assessment/Monitoring Aims	Built-in evaluation mechanisms.	Evaluate progress, CO ₂ reduction, inform decisions, accountability, and identify best practices.	Same aims, with emphasis on continuous improvement, education, and adaptation.
Criteria	Energy & CO ₂ reduction, efficiency measures, renewable share, public engagement.	Energy savings, CO ₂ reduction, investments, project completion, awareness, benchmarking.	Energy savings (kWh), CO ₂ (tons), renewable production (MWh), investment levels, and engagement indicators.

Data & Utilization	Inventories (2005 baseline), sector data, investments.	Used for performance evaluation, reporting, decision-making, benchmarking, and stakeholder engagement.	Data for trend analysis, corrective actions, benchmarking, and sector indicators (buildings, transport, lighting).
Results	Goal: -20% CO ₂ by 2020.	Early progress in public buildings and renewables; uneven results.	~72,020 MWh saved/year; -14,548 tons CO ₂ /year (42% of target); €220m invested; student engagement; corrective actions proposed.

Bolzano – Sustainable Energy Action Plan (SEAP, 2013) and Monitoring (2015)

Plan (2013)

History of the Plan

The SEAP for Bolzano was published in 2013 as the city's first Sustainable Energy Action Plan. It set a vision for carbon neutrality in local emissions and was aligned with the Covenant of Mayors commitments. The plan established reduction targets for 2020 (-4.5% vs 2010) and long-term goals extending to 2050.

Timelines and Changes of the Plan/Plans

- 2013: SEAP adopted.
- 2010: baseline inventory established.
- 2015: first monitoring carried out.
- Targets: -20.05% CO₂ reduction by 2020 and progressive actions toward 2050 neutrality.

Actors, Institutions of the Plan

- Municipality of Bolzano (Comune di Bolzano).
- Provincia Autonoma di Bolzano (Autonomous Province).
- Eurac Research – Renewable Energy Institute, providing technical expertise.
- SEAB SpA (local waste/energy company), Ecotherm SpA, and other local companies.

- Private real estate owners and businesses in the tertiary sector.
- Involvement of designers/planners and public forums.

Funding and Process of the Plan

Bolzano applied a diverse mix of funding mechanisms:

- European, ministerial, and provincial grants.
- Self-financing by municipality and access to credit.
- Rotational funds for efficiency projects.
- Third-party financing and leasing schemes.
- Partnerships with ESCOs and use of Energy Performance Contracts (EPCs).
- Public–private partnerships (PPPs) for large-scale initiatives.

Existing Assessment of the Plan

The plan emphasized monitoring and evaluation from the outset, integrated with municipal tools like energy audits, solar potential mapping, refurbishment programs, and urban mobility planning. Financial assessment of actions and expected results (savings, avoided CO₂) was included to ensure accountability.

Actions Related to Buildings in the Plan/Plans

- **E1:** Updating building regulations with stricter energy efficiency standards.
- **E2:** Expansion of district heating network.
- **E3a:** Energy audits of municipal buildings.
- **E3b–E3c:** Refurbishment programs and specific interventions in municipal buildings.
- **E4:** Energy mapping of private buildings. These actions targeted both public and private sectors, combining regulatory improvements, retrofits, and mapping for efficiency opportunities.

Monitoring (2015)

1-1: Aims of Assessment/Monitoring of Effectiveness

Monitoring aimed to:

- Evaluate progress toward CO₂ and energy efficiency targets.
- Ensure accountability to Covenant commitments.
- Identify areas for improvement and implement corrective measures.
- Quantify CO₂ reductions and energy savings.
- Inform future planning and policy.
- Engage stakeholders and citizens.
- Support continuous improvement in energy management.

1-2: Criteria for Assessment/Monitoring of Effectiveness

Criteria included:

- CO₂ emission reductions vs baseline (2010).
- Energy consumption across sectors.
- Implementation status of SEAP actions.
- Public engagement (campaigns, awareness).
- Renewable energy adoption.
- Compliance with EU/national regulations.
- Stakeholder feedback.
- Economic indicators (jobs, cost savings).

1-3: Use of Data for Assessment/Monitoring

- Baseline comparison with 2010 data.
- Performance evaluation of specific measures.
- Quantitative reporting of savings and emissions reductions.
- Trend identification (long-term shifts in energy use and participation).
- Decision-making for corrective actions.
- Communication with stakeholders to maintain engagement.
- Continuous improvement and policy development based on results.

1-4: Types of Data Used for Assessment/Monitoring

- Energy consumption data (residential, commercial, public lighting, municipal).
- CO₂ inventories.
- Baseline 2010 inventory for reference.
- Public engagement metrics (awareness campaigns, participation rates).
- Renewable energy production data.
- Transport data (mobility emissions, modal split).
- Economic indicators (job creation, cost savings).
- Feedback from surveys and stakeholder consultation.

1-5: Results Underlined in Monitoring

- CO₂ emissions reduced from 561,593 tons (2010) to 466,933 tons (2015): -94,660 tons (-16.9%).
- Energy consumption reduced from 1,819,154 MWh (2010) to 1,698,122 MWh (2015).
- Public lighting: -50.7% CO₂, energy savings from 9,731 MWh to 7,327 MWh.
- Residential & tertiary sectors: -24.6% emissions.
- Municipal sector: -18.8% emissions.
- Renewables: increase in share of local energy mix, though quantitative results are not detailed.
- Mobility emissions: 18% of total emissions; highlighted as an area needing stronger action.
- Compliance: Municipality on track toward Covenant target of -20.05% CO₂ by 2020.

Table 18: Summary of Bolzano – SEAP (2013) & Monitoring (2015)

Category	Plan (2013)	Monitoring (2015)
History & Timeline	SEAP adopted in 2013; targets –20.05% CO ₂ by 2020; vision to 2050 neutrality.	First monitoring shows ~17% CO ₂ reduction (2010–2015).
Actors & Institutions	Municipality, Province, Eurac Research, SEAB, Ecotherm, ESCOs, private owners, businesses.	Stakeholder engagement emphasized; citizen involvement noted.
Funding & Resources	EU/provincial grants, self-financing, rotational funds, ESCOs, EPCs, PPPs.	Investments in efficiency/renewables noted.
Building Actions	New building regulations; district heating; energy audits; refurbishments; energy mapping (public/private).	Reductions in residential/tertiary (–24.6%); municipal (–18.8%).
Assessment/Monitoring Aims	Built-in monitoring and financial/resource assessment.	Evaluate progress, quantify CO ₂ savings, inform planning, engage stakeholders.
Criteria	CO ₂ , energy, efficiency, renewables, compliance, economic impact.	Same, with focus on emissions, energy use, engagement, jobs.
Data & Utilization	Baseline 2010, audits, solar analysis, building mapping.	Used for performance evaluation, reporting, trends, continuous improvement.
Results	Target –20.05% CO ₂ by 2020.	–94,660 tons CO ₂ (–16.9%); energy –121,000 MWh; lighting –50.7%; residential/tertiary –24.6%; municipal –18.8%. Renewables increased but data incomplete.

Metz – Plan Climat (2011) and Monitoring (2015)

Plan

History of the Plan

Plan developed 2009–2011 after the Covenant of Mayors, part of Agenda 21. Adopted Dec 2011. Baseline 2010: housing (43% emissions), tertiary (42%), transport (12%). Target: –20% CO₂ by 2020.

Timelines and Challenges of the Plan

Challenges with partners: Workshops in 2010–11 with 40 partners.

City Challenges: transport emissions, building efficiency, energy poverty.

Actors of the Plan

Mayor Dominique Gros; Deputy René Darbois (Urban Ecology). ALEC (Agency for Energy & Climate) founded in 2011. 40+ partners: municipalities, associations, universities, businesses. Consultants ran GHG inventory.

Funding of the Plan

Municipal funds, regional support, ALEC financing, and possible EU Covenant funds.

Assessment of the Plan

Periodic evaluations via an independent bureau, reporting to Covenant. ALEC ensures continuous support.

Building Actions of the Plan

- Eco-neighborhood (Coteaux de la Seille: 550 BBC buildings + 1,050 passive houses).
- Energy renovations for housing & businesses (via ALEC).
- HQE standards in new construction.
- Energy poverty programs (info packs, assistance).

Monitoring (2015)

1-1: Aims of Assessment/Monitoring of Effectiveness

Evaluate progress, adapt strategies, engage stakeholders, ensure transparency, and meet COP21 commitments.

1-2: Criteria for Assessment/Monitoring of Effectiveness

- GHG levels, energy use.
- Number of retrofits, renewable installs.
- Participation in awareness events.
- Compliance with COP21 and Covenant.

1-3: Data Use for Assessment/Monitoring of Effectiveness

- Inventories of emissions, biodiversity, and building data.
- Events/participation metrics.
- Combined environmental + social data for integrated assessment.

1-4: Data Types for Assessment/Monitoring of Effectiveness

- Air quality indices, GHG inventories.
- Building retrofit/renewables data.
- Participation in events (e.g., 3,676 people in campaigns 2015).
- Eco-gesture packs (238 distributed).
- Urban biodiversity monitoring.

1-5: Results underline in Monitoring

- Strong citizen engagement (hundreds trained, events run).
- 258 m² solar thermal + 1,100 m² PV installed (80,000 kWh/year).
- Eco-gesture packs for households in precarity.
- Two HQE municipal buildings certified.
- Limited quantitative GHG/energy results provided in excerpt.

Table 19: Summary of Metz- PCET (2011) & Monitoring (2015)

Category	Plan (2011)	Monitoring (2015)
History & Timeline	Adopted in 2011, the target 20% CO ₂ by 2020.	Midterm review 2015.
Actors	Mayor, ALEC, 40+ partners, consultants.	ALEC + committees.
Funding	Municipal, regional, EU (Covenant).	Ongoing ALEC support.
Building Actions	Eco-neighborhood (1,600+ efficient homes), renovations, HQE standards, energy poverty aid.	PV + solar thermal (80,000 kWh), 2 HQE buildings, eco-gesture packs.
Aims	Reduce CO ₂ , promote renewables, combat energy poverty.	Adapt strategy, citizen engagement, and transparency.
Criteria	GHG inventories, efficiency, and public awareness.	GHG, events, energy data, eco-gestures, compliance COP21.
Data Use	Inventories, workshops, surveys.	Integration of environmental + social data.
Results	Target: -20% CO ₂ .	Citizen engagement is strong, with renewable installs and awareness campaigns.

Paris – Climate Action Plan (local version of a PCAET) (2018) and Monitoring (2018–2020)

Plan (2018)

History of the Plan

Built on the Paris Agreement (2015) and the earlier adaptation plan (2015). Adopted in 2018, with a vision to 2050.

Timelines and Targets of the Plan/Plans

- 2020: renovate 1m housing units, 20,000 trees, 30 ha green spaces.

- 2030: 40% permeable surface, 300 cool islands, factor 2 reductions.
- 2050: Factor 4 CO₂ (–75% vs 2004), neutrality goal.

Actors of the Plan

City of Paris departments (environment, planning, social affairs), ADEME, RATP, AP-HP, research bodies, NGOs, citizens, C40 network.

Funding of the Plan

City budgets, participatory financing (cooperatives, savings), EU/national programs, private investment.

Assessment of the Plan

- Built-in socio-economic studies (EY 2017).
- Legal obligation: mid-term review every 3 years.
- Uses Bilan Carbone® methodology.
- Continuous monitoring: air, energy, mobility, heat.

Building Actions of the Plan

- Renovation of social housing and condominiums.
- Stricter codes for new builds (Article 15 PLU).
- Ecoquartier projects with carbon-neutral design.
- Training eco-managers.
- Public swimming pool retrofits under CPEs.
- Citizens' access to energy data (Coach Copro).

Monitoring (2018–2020)

1-1: Aims for Assessment/Monitoring of Effectiveness

Share results, evaluate progress, influence behaviors, adapt to crises (COVID), and comply with legal evaluation.

1-2: Criteria for Assessment/Monitoring of Effectiveness

- GHG reductions (Bilan Carbone®).
- Energy use and renewable share.
- Achievement of 25% reduction by 2020 (baseline 2004).
- Thematic indicators: air quality, citizen engagement, funding flows.

1-3: Data Use for Assessment/Monitoring of Effectiveness

- Bilan Carbone integration (direct + indirect emissions).
- Combined administrative + energy + mobility data.
- Feedback loops for policy adaptation.
- Public reporting (Bleu Climat reports).

1-4: Data Types for Assessment/Monitoring of Effectiveness

- GHG inventories, energy stats, air quality (Airparif).

- Building retrofit data, renewable deployment.
- Public participation, economic flows.

1-5: Results underline the monitoring

- ~25% reduction in emissions and energy use achieved by 2020 (baseline 2004).
- +21% renewable energy share in 2020.
- Social housing: 25,000 units renovated.
- Public pools: retrofits achieving 34% energy savings, 41% GHG cuts.
- Strong uptake of the Coach Copro platform.
- Challenges: legal delays in eco-manager roll-out, renewables below expectations.

Table 20: Summary of Paris- Climate Plan (2018) & Monitoring (2018- 2020)

Category	Plan (2018)	Monitoring (2018–2020)
History & Timeline	Adopted in 2018; builds on the Paris Agreement. Targets: –75% CO ₂ by 2050.	Midterm review 2020 (COVID context).
Actors	City depts, ADEME, RATP, AP-HP, C40, NGOs, and citizens.	City + partners; participatory governance.
Funding	City budget, EU/national funds, participatory financing, cooperatives, private investment.	Same, mobilized for retrofits and ecoquartiers.
Building Actions	1m housing units to be renovated; stricter codes; ecoquartiers; eco-managers; Coach Copro.	25,000 social housing retrofitted; pools retrofitted (–34% energy); platform active.
Aims	Neutrality by 2050; resilience; equity; participation.	Evaluate progress, adapt policies, and maintain momentum despite crises.
Criteria	CO ₂ (Bilan Carbone®), energy, renewables, social equity.	Same + COVID adaptation + thematic areas.
Data Use	Bilan Carbone, inventories, socio-economic studies.	Public reports, feedback loops, integrated indicators.
Results	Ambitious factor 4 goal by 2050.	~25% reduction vs 2004; renewables 21%; significant social housing retrofits.

Lille – PCET (2013 & 2020–2025) and Monitoring (2017)

Plan (2013)

History of the Plan/Plans

- 2013: Territorial Climate Energy Plan (PCET) adopted by Lille, Lomme, Hellemmes.

- Aimed to meet EU “3x20” targets by 2020 (–20% energy, –20% CO₂, 20% renewables).
- 2020–2025: Updated into PCAET for the Metropole Européenne de Lille (MEL).

Timelines and Changes of the Plan

- 2013 actions: annual energy balance, eco-driving, pilot building retrofits, biomass transition, Cit’ergie process.
- Indicators tracked annually since 2004.
- PCAET integrated air quality into energy–climate strategy.

Actors and Institutions of the Plan

Municipality of Lille, MEL (Lille Metropole), ADEME (energy agency), Cit’ergie program, local stakeholders (businesses, NGOs, schools), technical experts, consultants.

Funding and Process of the Plan

Mix of municipal budgets, EU/national grants (ERDF), partnerships with universities, PPPs, tax incentives, and private investments (renewables, efficiency).

Existing Assessment of the Plan

Annual “bilan énergie” and “bilan GES” inventories. Evaluated via energy balances, emissions inventories, and Cit’ergie audits.

Actions Related to Buildings

- Energy audits of municipal buildings.
- Efficiency retrofits (insulation, heating, lighting).
- Renewables in public buildings (PV, biomass).
- Training staff, awareness campaigns, and eco-driving.
- Behavior-change programs in public buildings.
- Procurement contracts with efficiency clauses.

Monitoring (2017 Bilan)

1-1: Aims for Assessment/Monitoring of Effectiveness

Track progress toward 3x20, measure GHG and energy, report annually, adjust policy, and support continuous improvement.

1-2: Criteria for Assessment/Monitoring of Effectiveness

- Reductions in building energy, lighting, and transport.
- GHG reductions.
- Share of renewables.
- Financial savings.
- Cit’ergie certification.

1-3: Use of Data for Assessment/Monitoring of Effectiveness

Data compiled annually vs baseline (2004), used in reports to Council, for strategy adjustment, and shared across city-metropole levels.

1-4: Data Types for Assessment/Monitoring of Effectiveness

- Building energy use (municipal, lighting, fleet).
- Emissions data.
- Renewable adoption.
- Energy costs and savings.
- Labeling/certification records.

1-5: Results for Assessment/Monitoring of Effectiveness

- -15% energy use since 2004.
- -16% GHG emissions.
- €16.5m energy savings, though bills rose 7% (€10.24m).
- Cit'ergie labels since 2014.
- Building retrofits, LEDs, and renewable pilots contributed strongly.

Table 21: Summary of Lille- PCET (2013) & Monitoring (2017)

Category	Plan (2013; PC(A)ET 2020–25)	Monitoring (2017)
History & Timeline	PCET 2013; PCAET 2020–25; Covenant of Mayors.	Annual bilan énergie; midterm evaluation 2017.
Actors	Municipality, MEL, ADEME, Cit'ergie, NGOs, businesses.	City–Metropole coordination; stakeholders engaged.
Funding	Public budgets, EU/national grants, PPPs, private investments.	€16.5m savings identified.
Building Actions	Audits, insulation, heating, LEDs, biomass, awareness.	Renovations (15% savings), LEDs (42% in lighting), PV (10 sites).
Aims	Reach EU 3x20 targets, integrate air quality.	Reduce -20% energy/CO ₂ , +20% renewables by 2020.
Criteria	Energy, CO ₂ , renewables, costs, certification.	Same, with focus on Cit'ergie.
Data Use	Annual inventories since 2004.	Reporting, benchmarking, corrective action.

Results	Target: 3x20.	–15% energy, –16% GHG, Cit'ergie label 2014, €16.5m savings.
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Table 22: Summary of all case studies' important key elements for energy implementation

Category	Milan (2014 SEAP)	Bologna (2012 SEAP)	Bolzano (2013 SEAP)	Paris (2018 PCAET/Plan Climat)	Lille (2013 PCET / PCAET 2020–25)	Metz (2011 Plan Climat)
History & Timeline	Adhered Covenant 2009; SEAP approved 2014; targets –20% CO ₂ by 2020, –40% by 2030, neutrality 2050. Final monitoring 2022.	SEAP approved 2012; monitored 2013 & 2018; updated into SEAPC 2021.	SEAP adopted 2013; baseline 2010; target –20.05% CO ₂ by 2020; vision to neutrality 2050.	Adopted in 2018, rooted in the Paris Agreement; targets: –75% CO ₂ by 2050. Midterm review 2020.	PCET 2013 (Lille, Lomme, Hellemmes); updated into PCAET MEL 2020–25.	Plan Climat developed 2009–11, adopted Dec 2011. Target –20% CO ₂ by 2020.
Actors & Institutions	Municipality; Energy & Environment Dept.; Mobility Directorate; ESCOs; NGOs; citizens.	Municipality; neighborhood councils; NGOs; JRC Ispra; businesses; schools.	Municipality; Autonomous Province; Eurac Research; SEAB, Ecotherm; ESCOs; private owners.	City departments (environment, planning, health); ADEME; RATP; AP-HP; C40; NGOs; citizens.	Municipality; MEL; ADEME; Cit'ergie; businesses; NGOs; consultants.	Mayor & Urban Ecology Deputy; ALEC (local energy agency); 40+ partners; consultants.
Funding & Resources	Municipal budget; EU funds; EIB loans; PPPs; national tax incentives.	Municipal budget; EU structural funds; EIB; PPPs; banks; ESCO contracts.	EU, ministerial, provincial grants; rotational funds; ESCOs; EPCs; PPPs.	City budget; EU/national programs; participatory financing; cooperatives; private capital.	Public budget (MEL); EU/national funds; PPPs; grants; tax incentives; private investments.	Municipal funds; regional support; ALEC financing; EU Covenant programs.
Building Actions	Public/private retrofits; insulation; audits; stricter codes; PV, solar thermal, geothermal; incentives; awareness.	Public retrofits; insulation; heating upgrades; renewables; EPCs; audits; awareness & training; certifications.	New building regulations; district heating; audits & refurbishment (municipal/private); energy mapping.	Large-scale retrofits (1m units by 2050); social housing focus; stricter codes; ecoquartiers; swimming pool retrofits; eco-managers.	Audits; insulation; biomass boilers; LEDs; training; behavior change; PV on public sites; contracts with efficiency clauses.	Eco-neighborhood (1,600 homes); renovations; HQE standards; PV + solar thermal; anti-energy poverty programs.
Aims of Monitoring (1-1)	Track progress, effectiveness, accountability, adapt strategies, engage stakeholders, and benchmark.	Track progress toward –20% CO ₂ ; engage citizens; promote awareness; continuous improvement.	Evaluate progress, accountability, corrective measures, quantify CO ₂ , inform planning, and engage stakeholders.	Transparency, track GHG/energy, adapt to crises (COVID), engage citizens, and legal mid-term review.	Monitor progress toward 3x20; annual reporting; identify successes/challenges.	Evaluate climate/energy impacts; adapt strategies; engage citizens; comply with the Covenant & COP21.

Category	Milan (2014 SEAP)	Bologna (2012 SEAP)	Bolzano (2013 SEAP)	Paris (2018 PCAET/Plan Climat)	Lille (2013 PCET / PCAET 2020–25)	Metz (2011 Plan Climat)
Criteria (1-2)	CO ₂ reductions, energy use, renewables, transport, air quality, jobs, investments.	Energy savings, CO ₂ reductions, investments, renewable share, participation, compliance.	CO ₂ reductions, energy consumption, action implementation, awareness, renewables, compliance, and economy.	CO ₂ (Bilan Carbone), energy use, renewables, equity, adaptation, citizen engagement, finance.	Energy/GHG reductions, renewables, economic savings, certifications (Cit'ergie), alignment with EU 3x20.	GHG inventories, energy data, building retrofits, citizen involvement, eco-gestures, COP21 alignment.
Data Use (1-3)	Performance tracking, reporting, benchmarking, integration with mobility & air plans.	Evaluation, reporting, benchmarking, feedback loops, and transparency.	Baseline vs current, performance evaluation, quantitative reporting, decision-making, stakeholder communication.	Cross-sectoral integration; Bilan Carbone; feedback loops; public reports (Bleu Climat).	Annual bilan énergie/GES; comparisons vs baseline; reports to Council; data sharing with MEL.	Inventories, surveys, events data, integration with planning tools, and combined environmental & social data.
Data Types (1-4)	CO ₂ inventories; energy use; retrofits; renewables; transport; jobs; investments.	Energy use; CO ₂ emissions; investments; project lists; building certificates; public surveys.	Energy use; CO ₂ emissions; baseline 2010; renewables; transport data; engagement; economic data.	GHG (Bilan Carbone); energy/renewables; Airparif air data; retrofit & participation stats; financial flows.	Building energy use; emissions; renewables; financial data, certifications.	GHG inventories; air quality indices; retrofit data; PV/solar installs; event participation.
Results (1-5)	–24% CO ₂ by 2020 (target surpassed); ~1,484 GWh saved; PV +21 MW; –83% CO ₂ in public buildings; –22% in private.	–21.6% CO ₂ (2005–2018); –14,548 tCO ₂ /year; 72,020 MWh saved; €220m invested; 15,000 students engaged.	–94,660 tCO ₂ (–16.9%); –121,000 MWh; lighting –50.7%; residential –24.6%; municipal –18.8%; renewables increased (data incomplete).	–25% CO ₂ & energy use by 2020 vs 2004; renewables 21%; 25,000 social housing retrofits; pools retrofitted (–34% energy).	–15% energy, –16% CO ₂ since 2004; €16.5m savings; Cit'ergie label since 2014; 42% lighting savings; PV on 10 sites.	Awareness campaigns; 258 m ² solar thermal + 1,100 m ² PV (80,000 kWh); HQE buildings; eco-gesture packs; strong citizen engagement.

Conclusion

This chapter has outlined the methodological choices that structure the research. A comparative case study design was selected to analyze six municipalities across Italy and France, with a focus on building-related actions as a common sector of intervention. Data collection combined primary interviews with municipal stakeholders and secondary analysis of plans, monitoring reports, and relevant literature. Data preparation involved transcription and cleaning of interviews, systematic extraction of building-related measures, and coding according to an effectiveness framework (D1–D8). Analysis was conducted using MAXQDA, producing outputs such as code frequencies, co-occurrence matrices, and cross-case comparisons. Together, these methodological choices provide a robust foundation for analyzing the effectiveness of local energy plans in bridging the gap between decision-making and implementation. The next chapters present the empirical findings of the study, beginning with the Italian case studies before turning to the French cases, followed by a cross-country comparison and discussion.

Chapter 4:

Results of Italian Case Studies



Findings of Italian Cases

Milan

Interview findings

The interview with representatives of the Agenzia Mobilità Ambiente Territorio (AMAT), which coordinated the City of Milan's SEAP, highlighted the central role of the building sector in the city's climate strategy. According to the interviewee, municipal efforts concentrated primarily on public buildings, where schools, offices, and sports facilities were systematically renovated and equipped with energy management systems. In contrast, private-sector retrofits relied almost entirely on national incentive schemes such as the Ecobonus and Conto Termico, with the municipality playing a limited role beyond facilitation and awareness-raising.

The respondent emphasized that monitoring processes were oriented toward Covenant of Mayors reporting requirements, rather than designed for continuous local evaluation. As a result, adaptive management remained limited, and building-specific progress indicators were not always available. A further challenge was the limited municipal control over the private housing stock. Despite campaigns and workshops aimed at mobilizing condominium owners, uptake was slowed by administrative burdens and a lack of trust in incentive mechanisms.

Stakeholder engagement was described as uneven: larger utilities and public institutions generally supported the plan, while private households and smaller actors were more hesitant. According to the interviewee, this hesitation stemmed from perceived financial risks and the complexity of administrative procedures.

Building-related actions (goals, implementation, obstacles)

These actions have been extracted from all the analyzed sources, including interview plans and monitoring. The same actions were carried out for all the cities.

➤ ***Goals (SEAP 2014)***

The City of Milan's SEAP, adopted in 2014, committed to a 20% reduction in CO₂ emissions by 2020 relative to the 2005 baseline. The building sector was expected to deliver the majority of these reductions. Key planned measures included:

- ✓ Energy retrofits of municipal buildings (schools, offices, sports facilities).
- ✓ Promotion of private-sector retrofits supported by energy audits and Energy Performance Certificates (EPCs).
- ✓ Rooftop solar PV and solar thermal installations on both public and private buildings.

- ✓ Stricter building codes and procurement standards for new construction.

➤ **Implementation(Monitoring2022)**

Monitoring reports indicated that:

- ✓ Public buildings reduced their non-residential energy consumption by approximately 16% between 2013 and 2020 (from ~93,850 to ~78,500 MWh/year), while CO₂ emissions dropped by about 83% since 2005.
- ✓ Private buildings achieved an estimated 22% reduction in CO₂ emissions, largely through efficiency measures supported by national tax incentives.
- ✓ Retrofit measures included insulation upgrades, window replacement, heating system modernization, and compliance with stricter EPC standards.
- ✓ Awareness-raising activities, including citizen workshops and training sessions for building managers, were also implemented.

➤ **Obstacles**

Despite these achievements, several obstacles hindered full implementation. First, the city's reliance on national subsidies made progress vulnerable to changes in national policy. Second, monitoring reports lacked detailed quantitative indicators specifically for building retrofits, limiting the ability to track effectiveness. Third, the municipality faced challenges in mobilizing private-sector stakeholders, particularly condominium owners, who perceived retrofits as costly and administratively complex. These obstacles demonstrate the persistent gap between the city's ambitious planning goals and the slower pace of implementation in practice.

Table 23: A summary of building goals, implementation, and obstacles in Milan

Case	Goals (Plan)	Implementation (Monitoring)	Obstacles
Milan	-20% CO ₂ by 2020 (2005 baseline); retrofit public buildings; promote private retrofits (audits, EPCs); install rooftop PV/solar; strengthen building codes	Public buildings reduced energy by ~16% (2013–2020) and CO ₂ by ~83% since 2005; private buildings reduced ~22% CO ₂ (via national incentives); retrofits included insulation, heating upgrades, windows; awareness campaigns delivered	Reliance on national subsidies (vulnerable to policy shifts); monitoring lacked detailed building indicators; limited municipal control over private housing; high perceived risks and administrative complexity for condominiums

Bologna

Written responses from officials

The written replies received from Bologna municipal officials confirmed that the building sector was a declared priority within the city's SEAP (2012). Respondents highlighted that public buildings such as schools and offices were included in retrofit programs, often combined with lighting upgrades through LED installations. They also mention that the monitoring process was burdensome, as the initial SEAP contained a very large number of sub-actions and indicators. This fragmentation complicated data collection and made it difficult to track progress on building measures.

Officials acknowledged that municipal funds and national incentives supported building actions, but noted difficulties in monitoring private condominium retrofits, both because of data gaps and limited reporting by private actors. Obstacles were also attributed to staff turnover and organizational reconfiguration at the municipal level, which reduced institutional memory and slowed monitoring.

Building-related actions (goals, implementation, obstacles)

Goals (SEAP 2012).

Bologna's SEAP (2012) set a target of reducing CO₂ emissions by 20% by 2020 compared to 2005 levels. Building-related goals included:

- ✓ Energy retrofits of municipal buildings, particularly schools and offices.
- ✓ Public lighting upgrades (replacement with LED).
- ✓ Promotion of energy audits and condominium retrofits, including the possibility of rooftop PV.

Implementation (Monitoring 2015/2018)

- ✓ Retrofitting of several public schools and municipal offices resulted in observable energy savings.
- ✓ LED lighting replacement in parts of the city reduced electricity use in public spaces.
- ✓ Progress in private-sector retrofits was slower than anticipated, due to bureaucratic and financial barriers.
- ✓ Monitoring reports pointed to partial achievement of the SEAP targets, with stronger results in the public sector than in the private.

Obstacles

- ✓ Private households and condominiums faced financial and administrative difficulties in accessing incentives.
- ✓ Monitoring was hampered by the large number of indicators and insufficient data on private retrofits.
- ✓ Institutional instability, including staff turnover, limited continuity in the monitoring process

Table 24: A summary of building goals, implementation, and obstacles in Bologna

Case	Goals (Plan)	Implementation (Monitoring)	Obstacles
Bologna	-20% CO ₂ by 2020 (2005 baseline); retrofit public buildings; LED lighting; promote audits & private retrofits	Public schools/offices retrofitted; LED lighting upgrades; limited uptake in private retrofits	Bureaucratic & financial barriers for condominiums; too many indicators; staff turnover affecting monitoring

Bolzano

Interview findings

The Bolzano interview emphasized the importance of both public and private building retrofits as central to the city's SEAP (2013). Municipal schools, offices, and sports facilities underwent energy efficiency upgrades, complemented by LED lighting improvements. The interviewee noted that district heating expansion was a key measure linked to building efficiency, reflecting Bolzano's strong reliance on provincial energy planning.

According to the interview, private building retrofits were supported by provincial subsidies and national tax incentives, but uptake remained uneven. Obstacles included bureaucratic complexity and a lack of trust among private households. The respondent also acknowledged the fragmented institutional responsibilities between the municipality and the Province of Bolzano, which sometimes slowed coordination.

Building-related actions (goals, implementation, obstacles)

Goals (SEAP 2012).

Bologna's SEAP (2012) set a target of reducing CO₂ emissions by 20% by 2020 compared to 2005 levels. Building-related goals included:

- ✓ Energy retrofits of municipal buildings, particularly schools and offices.
- ✓ Public lighting upgrades (replacement with LED).
- ✓ Promotion of energy audits and condominium retrofits, including the possibility of rooftop PV.

Implementation (Monitoring 2015/2018)

- ✓ Retrofitting of several public schools and municipal offices resulted in observable energy savings.
- ✓ LED lighting replacement in parts of the city reduced electricity use in public spaces.
- ✓ Progress in private-sector retrofits was slower than anticipated, due to bureaucratic and financial barriers.
- ✓ Monitoring reports pointed to partial achievement of the SEAP targets, with stronger results in the public sector than in the private.

Obstacles

- ✓ Private households and condominiums faced financial and administrative difficulties in accessing incentives.
- ✓ Monitoring was hampered by the large number of indicators and insufficient data on private retrofits.
- ✓ Institutional instability, including staff turnover, limited continuity in the monitoring process.

Table 25: A summary of building goals, implementation, and obstacles in Bolzano

Case	Goals (Plan)	Implementation (Monitoring)	Obstacles
Bolzano	-20% CO ₂ by 2020; retrofit public buildings; LED lighting; promote private retrofits; integrate PV/solar; district heating	Public retrofits and LED upgrades achieved; private retrofits slower; subsidies stimulated uptake; district heating expanded	Bureaucratic and financial barriers; low trust in incentives; fragmented responsibilities between municipality and province

Cross-case Insights of the Italian cases

Common Strengths and Weaknesses

Strengths

- ✓ All three cities established clear CO₂ reduction goals (20% by 2020) with building actions central to achieving them.
- ✓ Public buildings (schools, municipal offices, sports facilities) were systematically targeted and achieved measurable reductions (especially in Milan and Bolzano).
- ✓ LED lighting upgrades were widely adopted, producing visible and quantifiable energy savings.
- ✓ Participation in the Covenant of Mayors provided a shared framework for planning and reporting.

Weaknesses

- ✓ Private-sector retrofits were consistently weaker than planned, hindered by reliance on national subsidies and low household trust.
- ✓ Monitoring gaps: indicators were fragmented (Bologna), too general (Milan), or uneven (Bolzano).
- ✓ Institutional challenges: staff turnover (Bologna), fragmented governance between province and municipality (Bolzano), limited municipal control (Milan).
- ✓ In all cases, financial barriers and administrative burdens were cited as obstacles to private building renovations.

Patterns in Building-Related Effectiveness

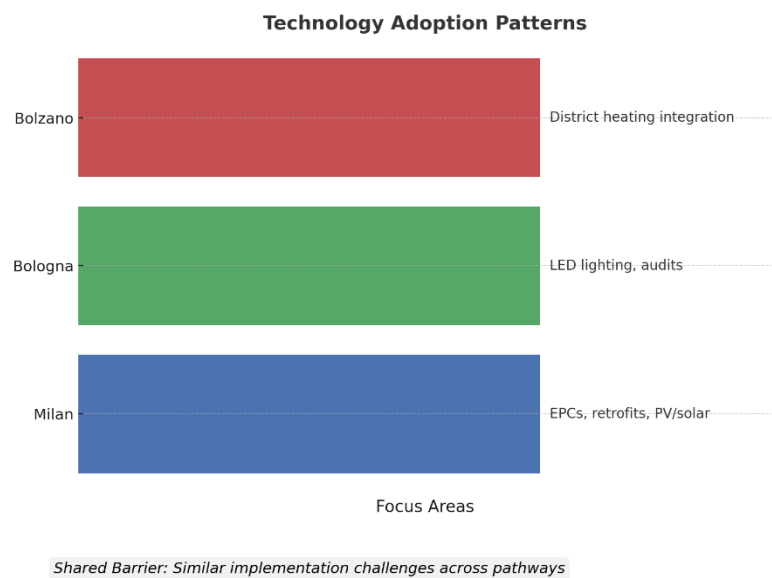
Public vs Private Divide: Effectiveness was consistently higher in public buildings, where municipalities had direct control, while private building retrofits lagged, showing the persistent gap between ambition and implementation.

Role of Higher-Level Support: Reliance on national (Italy-wide incentives) and provincial subsidies (Bolzano) shaped the pace of private retrofits, showing that effectiveness was highly dependent on external governance structures.

Monitoring as a Weak Point: Monitoring frameworks existed in all three cases, but were either too complex (Bologna), too aggregate (Milan), or limited in detail (Bolzano). This weakened adaptive learning capacity.

Stakeholder Engagement: While all three cities carried out awareness campaigns, stakeholder mobilization remained insufficient, especially among condominium owners.

Figure 9: Technology Adoption Patterns in Building-Related Effectiveness in Italian Cases



Together, these show different technological pathways, but with similar implementation barriers.

Results of MAXQDA analysis

Distribution of Effectiveness Dimensions Across All Cases

Code Frequency Tables

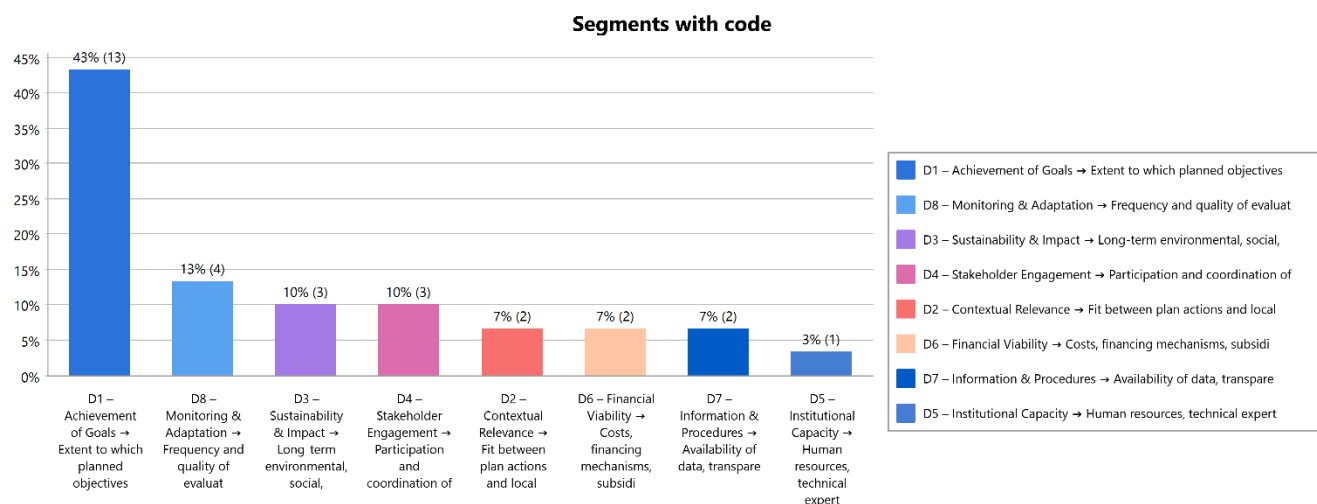
Analysis of the coded data across all Italian and French cases demonstrates that certain dimensions of effectiveness dominate more strongly than others. As follows is the result of each city’s analysis based on the different sources (interviews, plans, monitoring analysis, and other related academic documents for

each city) to the questions of how effective these plans are, and which effectiveness dimensions are most/least visible?

Milan:

As shown in Figure 10, the distribution of effectiveness dimensions across all thematic actions in Milan is dominated by Achievement of Goals (D1, 43%). This indicates that most references in plans, monitoring, and interviews focus on whether the city is on track to meet its planned objectives. Secondary dimensions include Monitoring & Adaptation (D8, 13%), Sustainability & Impact (D3, 10%), and Stakeholder Engagement (D4, 10%), showing that evaluation processes, long-term outcomes, and coordination with stakeholders are visible but less central. By contrast, Financial Viability (D6, 7%), Contextual Relevance (D2, 7%), and Information & Procedures (D7, 7%) occur much less frequently. Institutional Capacity (D5, 3%) occurs much less frequently. This suggests that while financing tools, local context, and staff capacity are present in the discourse, they are not emphasized as strongly as goal achievement. Overall, Milan's all-theme analysis portrays a goal-oriented narrative, with some attention to evaluation and sustainability, but limited focus on financial, contextual, and capacity-related concerns.

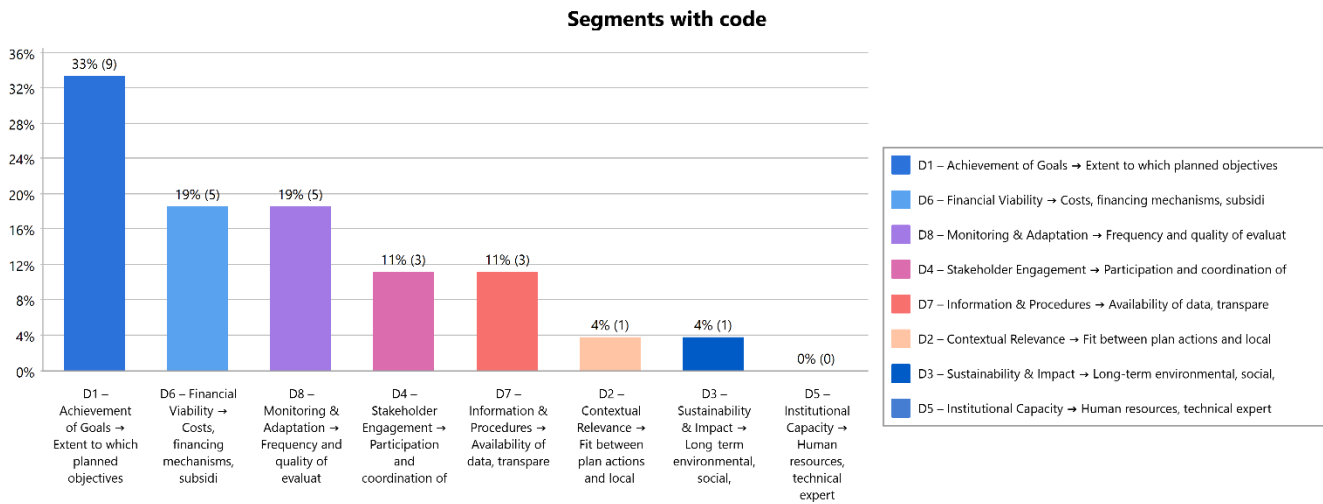
Figure 10: Effectiveness Dimensions – All Themes (Milan)



Distribution of effectiveness dimensions in all themes actions in Milan

Figure 11 illustrates that the coding of Milan's building-related actions reveals a different distribution of effectiveness dimensions. While Achievement of Goals (D1, 33%) remains the most frequent, Financial Viability (D6, 19%) and Monitoring & Adaptation (D8, 19%) emerge as much stronger concerns compared to the overall thematic analysis. This reflects the importance of financing mechanisms for retrofits and the role of consistent evaluation in the building sector. Moderate attention is given to Stakeholder Engagement (D4, 11%) and Information & Procedures (D7, 11%), highlighting the role of participation and data transparency in enabling renovations. However, Sustainability & Impact (D3, 4%) and Contextual Relevance (D2, 4%) are marginal, while Institutional Capacity (D5) is entirely absent from the coding. Taken together, the building-focused results emphasize practical barriers—funding, monitoring, and stakeholder involvement—rather than broader contextual or institutional issues. This underlines that in Milan's case, the effectiveness of building-related actions is closely tied to economic viability and the robustness of follow-up mechanisms.

Figure 11: Effectiveness Dimensions – Building Actions (Milan)



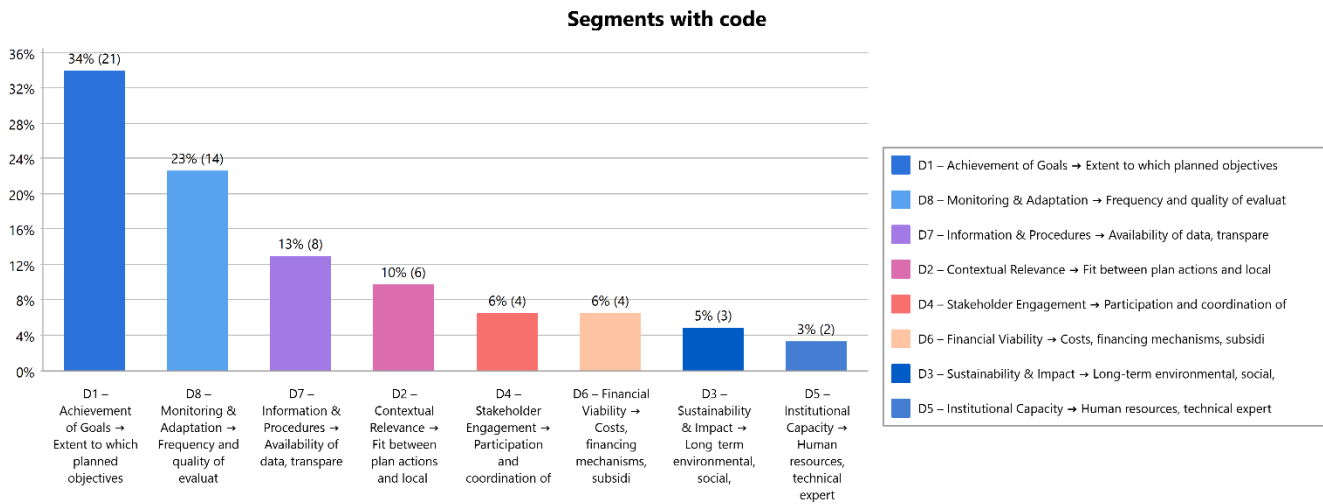
Distribution of effectiveness dimentions for buidings actions in Milan

Taken together, this comparison shows that while Milan’s overall SEAP narrative is goal-driven and broadly framed, the building-focused discussion reveals sharper concerns around financing and monitoring. This reflects the sector’s dependence on complex subsidy schemes and the need for robust follow-up mechanisms to track retrofit outcomes.

Bologna:

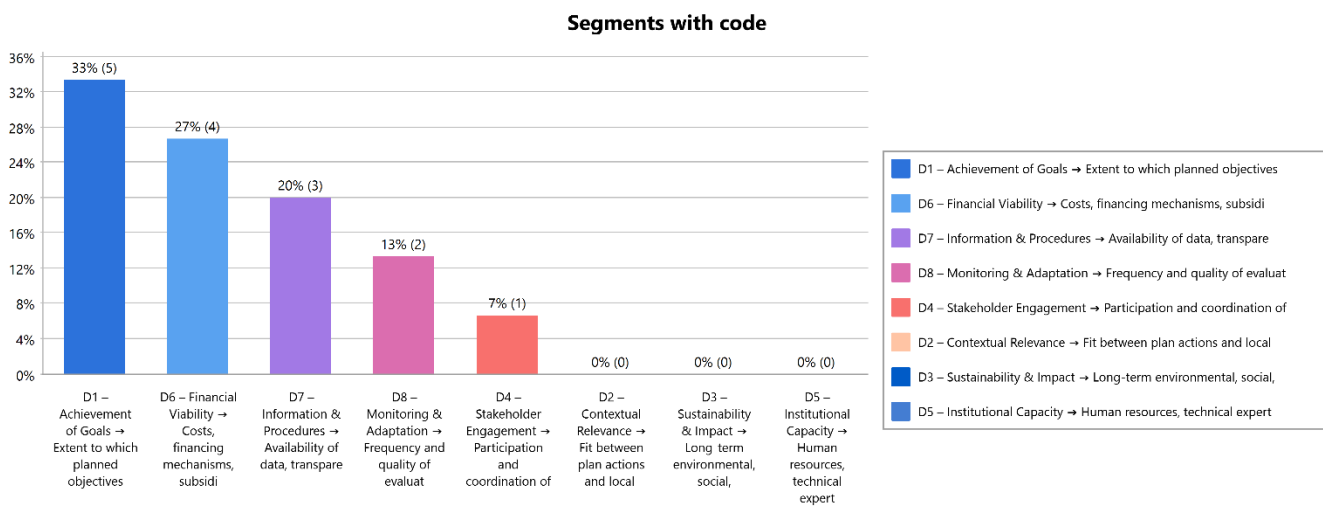
Figure 12 shows that Bologna’s overall thematic actions are dominated by Achievement of Goals (D1, 34%). This shows that the city places strong emphasis on demonstrating whether objectives are being met across its SEAP actions. The second most frequent dimension is Monitoring & Adaptation (D8, 23%), indicating a significant focus on evaluation and follow-up processes. Information & Procedures (D7, 13%) and Contextual Relevance (D2, 10%) also appear relatively strongly, reflecting attention to data transparency and the fit between plan actions and the local context. By contrast, Stakeholder Engagement (D4, 6%), Financial Viability (D6, 6%), Sustainability & Impact (D3, 5%), and Institutional Capacity (D5, 3%) occur much less often. This distribution highlights that Bologna’s broader discourse centers on goal achievement and monitoring, but pays comparatively less attention to financial resources, long-term sustainability, and organizational capacity.

Figure 12: Effectiveness Dimensions – All Themes (Bologna)



In Figure 13, about building-related actions codes related to Achievement of Goals (D1, 33%) remain the most frequent, but Financial Viability (D6, 27%) and Information & Procedures (D7, 20%) become much more prominent than in the all-themes analysis. This reflects the particular importance of financing mechanisms for retrofits and the availability of data in the building sector. Monitoring & Adaptation (D8, 13%) and Stakeholder Engagement (D4, 7%) appear at moderate levels, suggesting some attention to evaluation and stakeholder coordination. However, Contextual Relevance (D2), Sustainability & Impact (D3), and Institutional Capacity (D5) are absent from the coding for building actions. Overall, the building-focused analysis highlights practical and operational concerns, especially financing and data availability—whereas broader contextual and institutional issues visible in the all-themes analysis are absent.

Figure 13: Effectiveness Dimensions – Building Actions (Bologna)

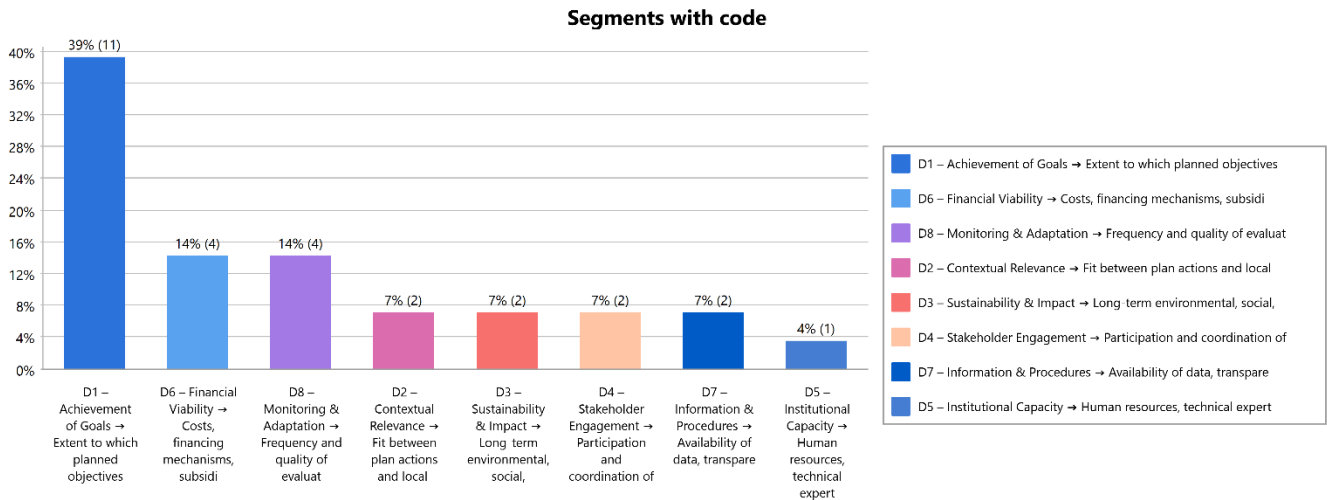


Taken together, the two distributions show that Bologna’s overall SEAP narrative is shaped by goal achievement and evaluation (D1, D8), supported by attention to information and contextual relevance. However, when zooming in on building-related actions, the emphasis shifts toward financing (D6) and data availability (D7) as the most pressing concerns, alongside achievement of goals. Broader aspects such as contextual fit, sustainability, and institutional capacity largely disappear. This contrast suggests that while Bologna positions itself as a city attentive to progress monitoring at the general level, in the building sector the practical barriers of financing and operational data dominate the discussion, reflecting the concrete challenges of scaling up renovation efforts.

Bolzano:

Figure 14 highlights that Bolzano’s thematic actions are dominated by Achievement of Goals (D1, 39%), showing a strong emphasis on whether objectives are being fulfilled. Secondary dimensions include Financial Viability (D6, 14%) and Monitoring & Adaptation (D8, 14%), reflecting concerns about the cost of measures and the quality of evaluation. Less frequent but still present are Contextual Relevance (D2, 7%), Sustainability & Impact (D3, 7%), Stakeholder Engagement (D4, 7%), and Information & Procedures (D7, 7%), suggesting that these aspects are acknowledged but less central. Institutional Capacity (D5, 4%) is only marginally represented, indicating that staffing and technical expertise are rarely discussed explicitly. Overall, Bolzano’s general discourse is goal-driven, with notable attention to financing and evaluation, but weaker references to institutional and contextual aspects.

Figure 14: Effectiveness Dimensions – All Themes (Bolzano)

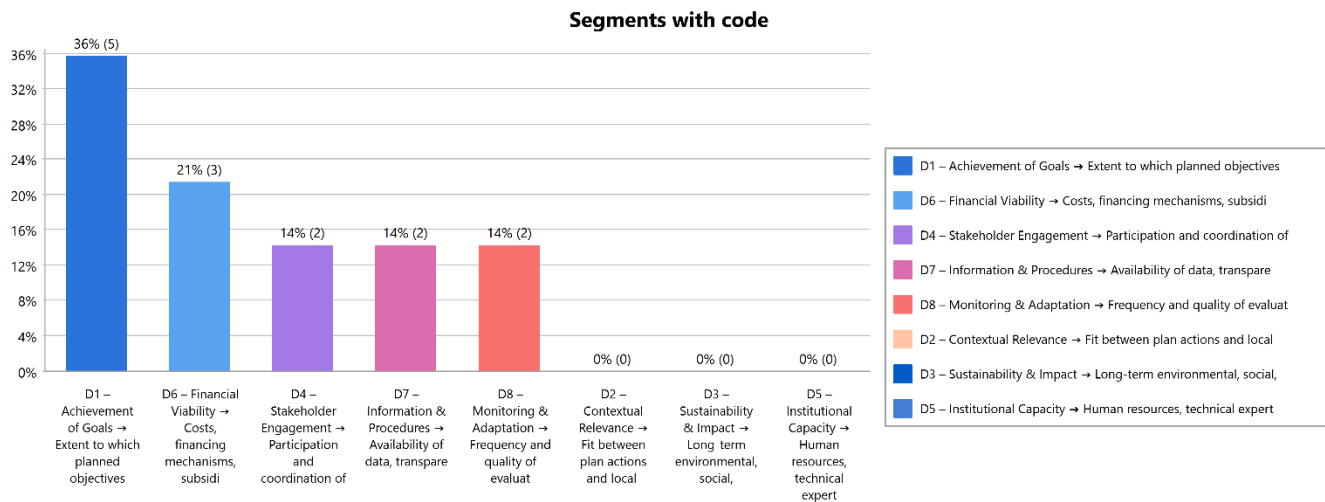


Distribution of effectiveness dimensions in all themes actions in Bolzano

In Figure 15, Achievement of Goals (D1, 36%) remains the most frequent category, confirming that success is framed largely in terms of meeting targets. However, Financial Viability (D6, 21%) becomes more prominent than in the all-themes distribution, pointing to financing as a central concern in building-related interventions. A cluster of mid-level dimensions—Stakeholder Engagement (D4, 14%), Information & Procedures (D7, 14%), and Monitoring & Adaptation (D8, 14%)—reflect the importance of participation, transparency, and evaluation in supporting renovation processes. By contrast, Contextual Relevance (D2), Sustainability & Impact (D3), and Institutional Capacity (D5) are absent from the coding in this sector. This

indicates that while financial mechanisms and stakeholder coordination are crucial in the building sector, broader issues of sustainability and institutional support are less visible.

Figure 15: Effectiveness Dimensions – Building Actions (Bolzano)



The comparison shows that Bolzano’s overall SEAP discourse emphasizes goal achievement, financing, and evaluation (D1, D6, D8), with some recognition of contextual and sustainability concerns. In the building-focused analysis, however, the narrative shifts toward a sharper focus on financial viability and participatory/data-related aspects (D6, D4, D7, D8), while broader sustainability and capacity dimensions disappear. This suggests that in Bolzano, the general plan discourse is relatively balanced across dimensions, but when it comes to building actions, attention narrows to the practicalities of financing, participation, and monitoring, reflecting the concrete challenges of implementing renovations in a mountainous, heritage-sensitive context.

Comparison Across Italian Cities

Comparison Across Italian Cities – All Themes

Looking across all themes, all three cities show a clear dominance of Achievement of Goals (D1), 43% for Milan, 34% Bologna, and 39% for Bolzano. This confirms that Italian SEAP discourses are strongly goal-oriented, with much attention given to whether objectives are being fulfilled.

Beyond this shared feature, differences emerge:

- Bologna places unusually strong emphasis on Monitoring & Adaptation (D8, 23%) and Information & Procedures (D7, 13%), suggesting a culture of evaluation and indicator use.
- Milan also values Monitoring (D8, 13%), but adds greater weight to Sustainability & Impact (D3, 10%) and Stakeholder Engagement (D4, 10%), reflecting its broader metropolitan framing.
- Bolzano, by contrast, balances Financial Viability (D6, 14%) and Monitoring (D8, 14%), while giving only modest attention to contextual and stakeholder aspects (all around 7%).

In sum, the all-themes analysis shows that while all Italian cases are goal-driven, Bologna is the most evaluation-focused, Milan highlights sustainability and participation, and Bolzano blends goals with financing and monitoring but pays less attention to institutional and contextual issues.

Comparison Across Italian Cities – Building Actions

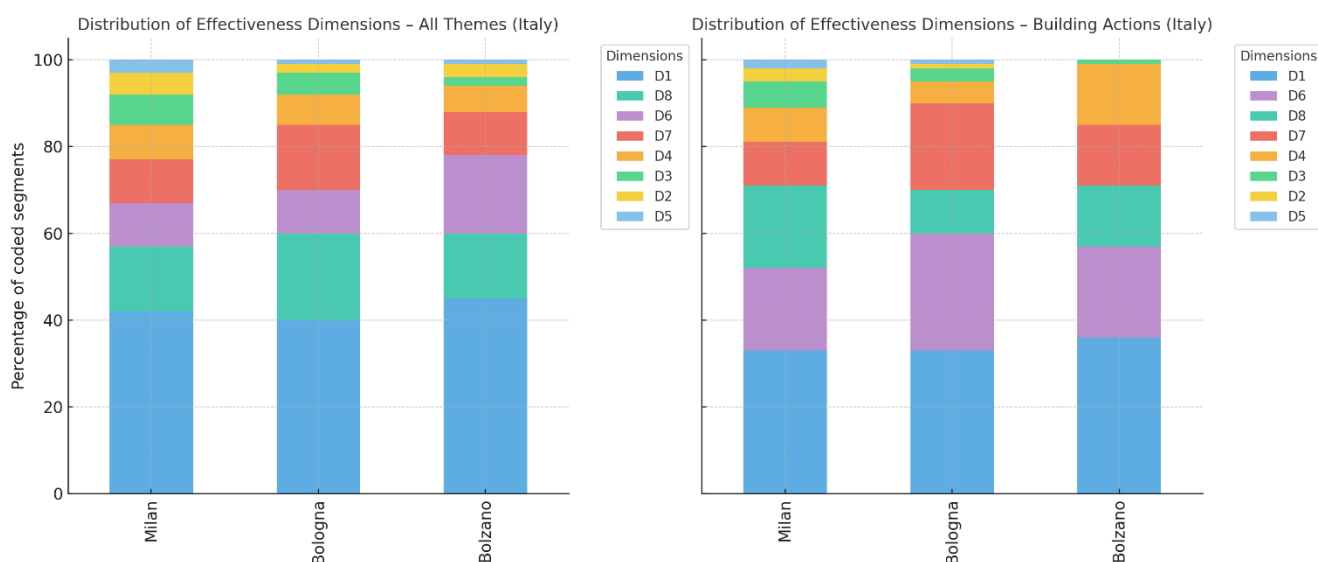
When narrowing the focus to building-related actions, the picture shifts. Again, Achievement of Goals (D1) remains dominant 33% for Milan, 33% for Bologna and 36% for Bolzano.

But the secondary emphases differ sharply:

- Milan prioritizes Financial Viability (D6, 19%) and Monitoring & Adaptation (D8, 19%), underlining challenges of financing retrofits and ensuring systematic evaluation.
- Bologna shows even stronger concern with Financial Viability (D6, 27%) and Information & Procedures (D7, 20%), pointing to the difficulty of mobilizing resources and data for renovation programs.
- Bolzano balances Financial Viability (D6, 21%) with mid-level attention to Stakeholder Engagement (D4, 14%), Information & Procedures (D7, 14%), and Monitoring & Adaptation (D8, 14%)—suggesting a more plural set of operational concerns, though sustainability and contextual aspects drop out.

Overall, the building-focused results show a common Italian pattern. Goal achievement remains central, but Financial concerns rise to the top, while contextual, sustainability, and institutional dimensions largely disappear. Milan frames these challenges around monitoring and financing, Bologna around financing and data, and Bolzano around a broader mix of financing, participation, and monitoring.

Figure 16: A visual comparison of the three Italian cities



Based on the visual comparison of the three Italian cities:

- Left chart (All Themes): shows that all cities are strongly goal-oriented (D1), but Bologna emphasizes Monitoring (D8) and Information (D7), Milan adds Sustainability (D3) and Stakeholder Engagement (D4), while Bolzano combines Financial Viability (D6) with Monitoring (D8).
- Right chart (Building Actions): again, D1 dominates, but here financial concerns (D6) rise sharply in all three cities. Bologna also highlights data (D7), Milan stresses monitoring (D8), and Bolzano shows a balanced mix of finance, participation (D4), and monitoring.

Table 26: Summary of the top two effectiveness dimensions for each Italian city

	Top 2 (All Themes)	Top 2 (Building Actions)
Milan	D1 Achievement of Goals & D8 Monitoring & Adaptation	D1 Achievement of Goals & D6 Financial Viability
Bologna	D1 Achievement of Goals & D8 Monitoring & Adaptation	D1 Achievement of Goals & D6 Financial Viability
Bolzano	D1 Achievement of Goals & D6 Financial Viability	['D1 Achievement of Goals & D6 Financial Viability

As mentioned before, across the three Italian cities, D1 (Achievement of Goals) dominates both overall and building-focused discourses.

- In the all-themes layer, cities diverge: Bologna stresses monitoring, Milan stresses sustainability and participation, and Bolzano stresses financing and monitoring.
- In the building layer, convergence emerges financing and operational barriers (D6, D7, D8) dominate everywhere, while broader contextual and institutional concerns fade.

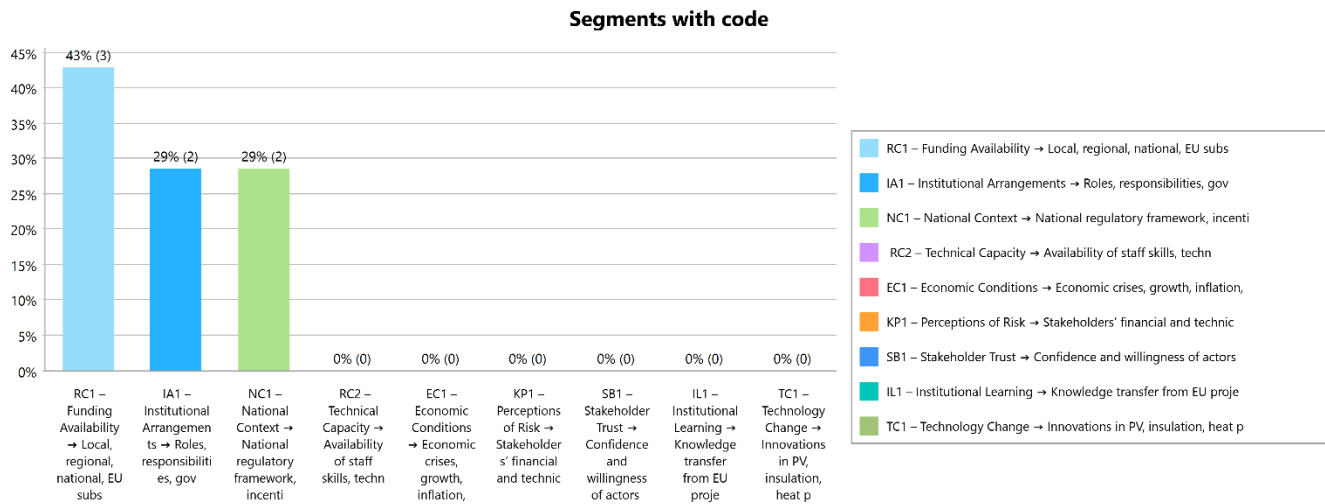
It can be said that while Italian SEAPs present themselves as ambitious and evaluative on paper, the building sector reveals the hard constraints of finance, data, and monitoring that shape actual implementation.

Distribution of Explanatory Variables:

Milan:

The explanatory variables most frequently coded are Funding Availability (RC1, 43%), Institutional Arrangements (IA1, 29%), and National Context (NC1, 29%). This indicates that Milan's plan implementation is understood primarily in terms of the financial resources available, the clarity of governance roles, and the national regulatory environment. Other potential drivers (technical capacity, stakeholder trust, institutional learning, etc.) are not visible in the discourse.

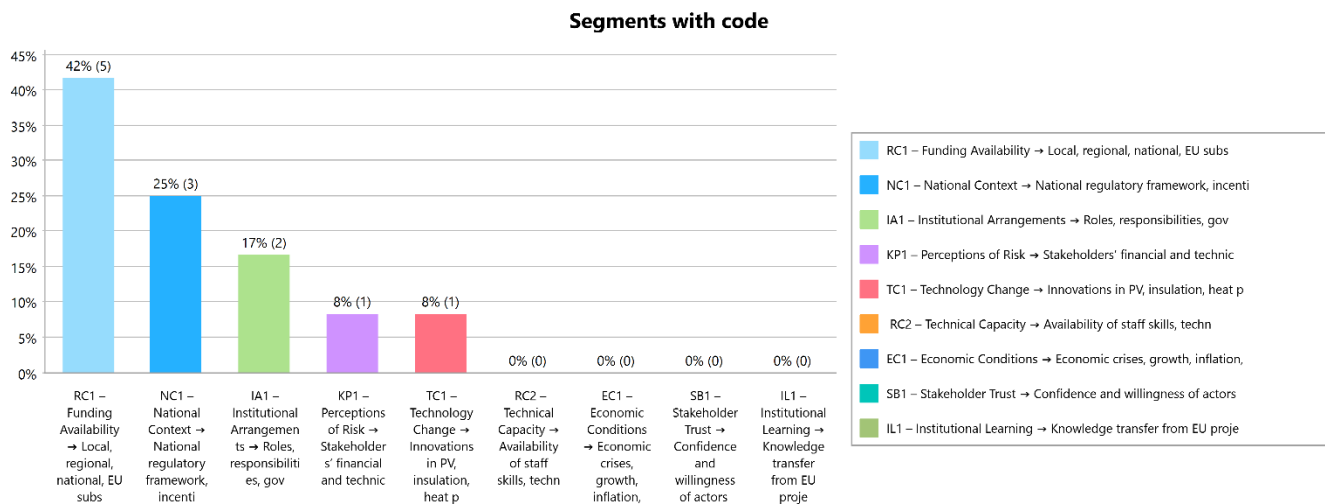
Figure 17: Frequency Distribution of Explanatory Variables- All themes (Milan)



Distribution of effective variables in all themes of Milan

For building-related actions, Funding Availability (RC1, 42%) again dominates, but here National Context (NC1, 25%) and Institutional Arrangements (IA1, 17%) are joined by new factors such as Perceived Risk (KP1, 8%) and Technology Change (TC1, 8%). This suggests that in the building sector, financial support remains crucial, but actors are also concerned about the risks of investment and the adoption of new technologies (e.g., insulation, heating systems).

Figure 18: Frequency Distribution of Explanatory Variables- Buildings (Milan)



Distribution of Buildings effective variables in Milan

The variables show what conditions make plans effective or not. In Milan, both overall and in buildings, effectiveness hinges on:

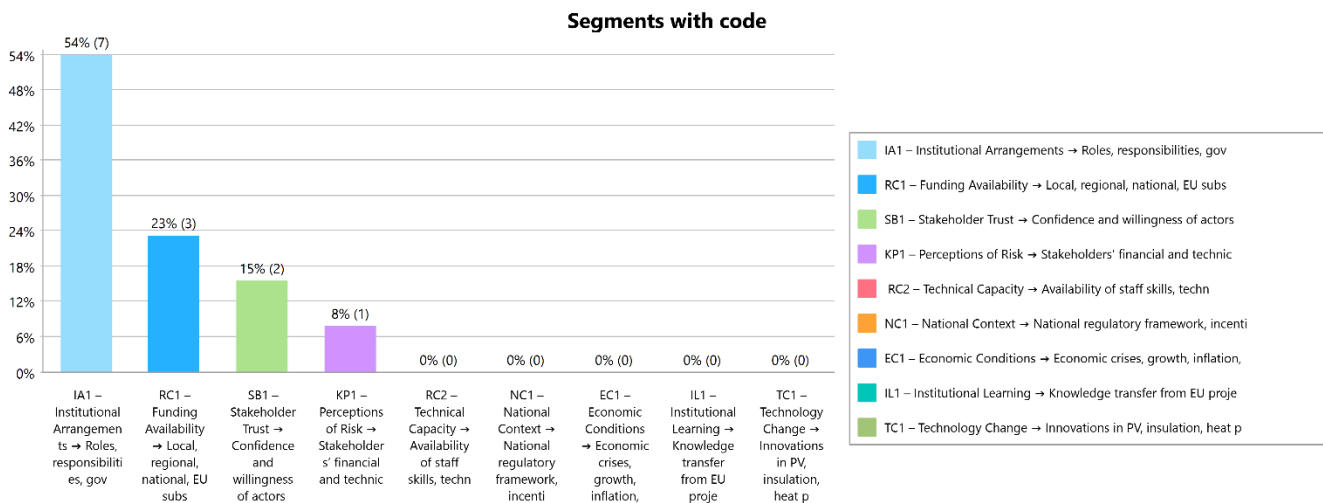
- Finance (RC1) → availability of subsidies is the single most decisive factor.
- Governance (IA1, NC1) → roles and national frameworks strongly shape outcomes.

- Risk & Technology (KP1, TC1) → more visible at the building level, where households and firms face adoption and investment challenges.

Bologna:

In Bologna's overall thematic analysis, Institutional Arrangements (IA1, 54%) dominate, showing that roles, responsibilities, and governance structures are perceived as the most decisive factors for effectiveness. Funding Availability (RC1, 23%) also plays a significant role, while Stakeholder Trust (SB1, 15%) and Perceptions of Risk (KP1, 8%) are present but secondary. Other variables, such as technical capacity, national context, or technology change, are not represented in this layer.

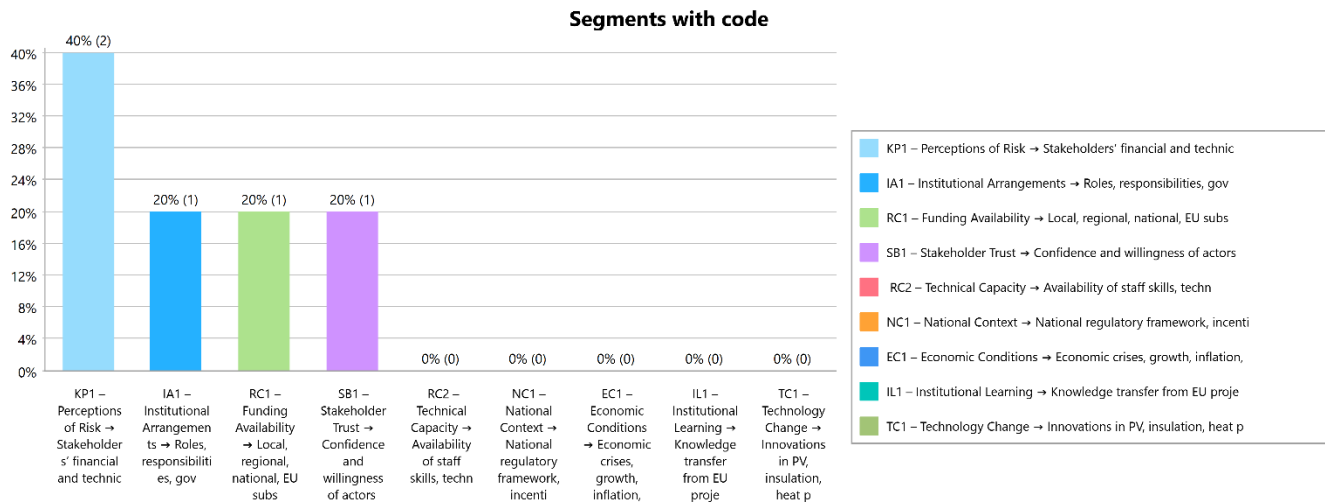
Figure 19: Explanatory Variables Affecting Plan Effectiveness – All Themes (Bologna)



Distribution of effective variables in all themes of Bologna

In the building-focused analysis, the most frequent variable shifts to Perceptions of Risk (KP1, 40%), suggesting that financial and technical uncertainties are central barriers for renovation projects. Institutional Arrangements (IA1, 20%), Funding Availability (RC1, 20%), and Stakeholder Trust (SB1, 20%) are equally important, showing that governance, finance, and trust all matter in this sector. No other variables appear in the coding

Figure 20: Explanatory Variables Affecting Plan Effectiveness – Building Actions (Bologna)

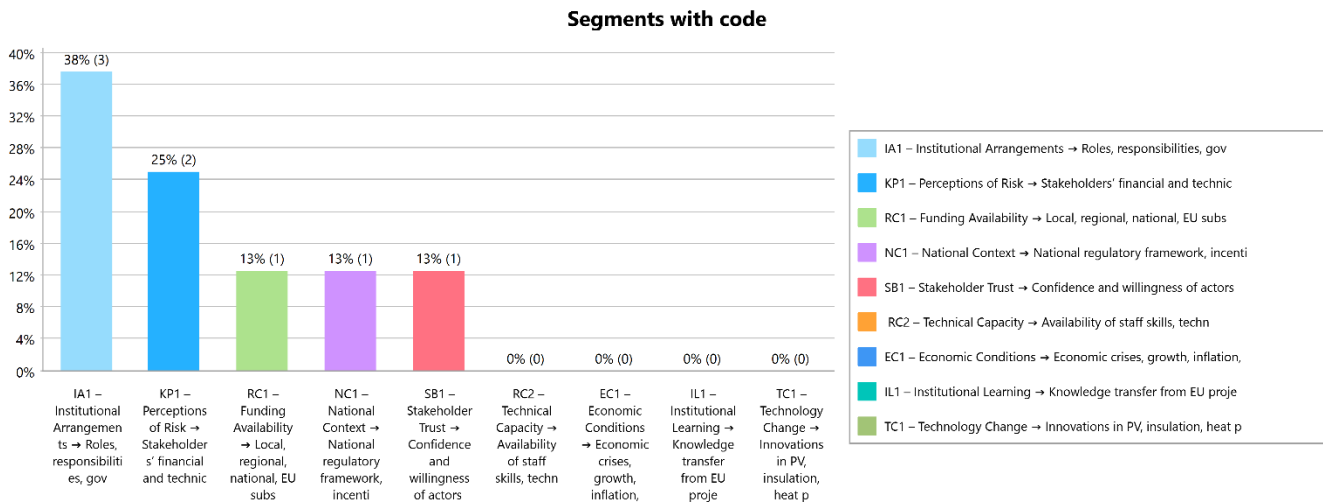


The variables highlight different conditions shaping effectiveness in Bologna. In the all-themes analysis, the city's narrative is governance-driven, with institutional roles and responsibilities (IA1) at the core, supported by funding (RC1). In the building sector, however, the emphasis shifts toward risk perception (KP1), combined with the need for finance, governance, and trust. This suggests that Bologna's overall plan effectiveness depends heavily on clear institutional arrangements, while in building retrofits, uncertainty and trust issues are equally important alongside funding.

Bolzano:

In Bolzano's all-theme analysis, Institutional Arrangements (IA1, 38%) dominate, showing that governance roles and responsibilities are central to plan effectiveness. The second most frequent factor is Perceptions of Risk (KP1, 25%), reflecting concerns about financial and technical uncertainties. A group of secondary variables – Funding Availability (RC1, 13%), National Context (NC1, 13%), and Stakeholder Trust (SB1, 13%) – indicates that financial support, regulatory frameworks, and trust among actors also play a role. In this case, there are no references coded for technical capacity, economic conditions, learning, or technology change.

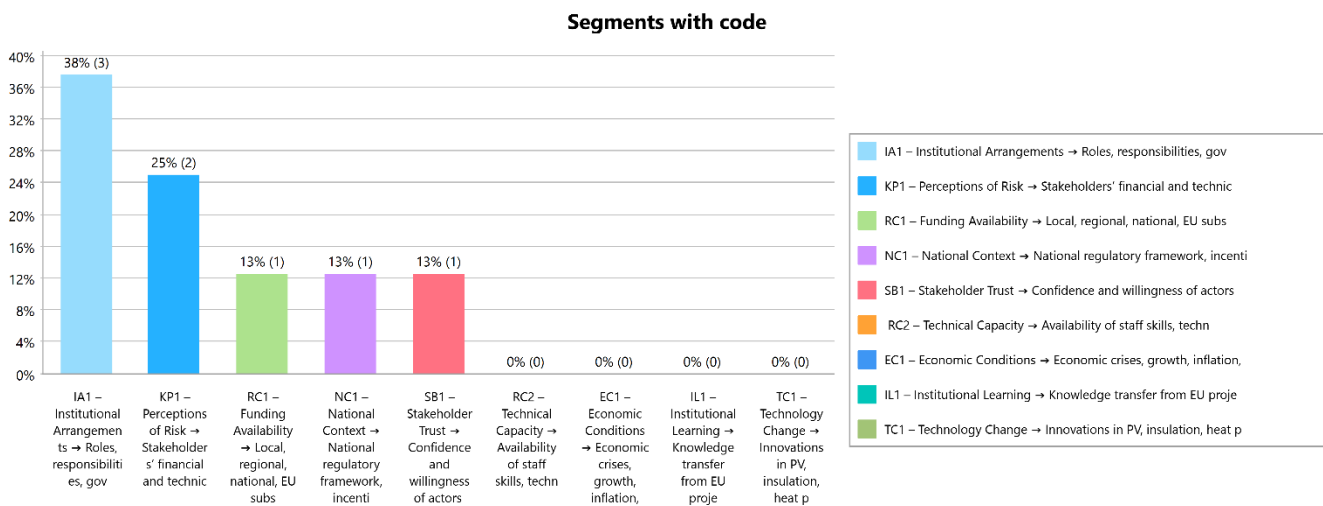
Figure 21: Explanatory Variables Affecting Plan Effectiveness – All Themes (Bolzano)



Distribution of effective variables in all themes of Bolzano

In the building-focused analysis, the distribution mirrors the all-theme picture: Institutional Arrangements (IA1, 38%) remain the most prominent, followed by Perceptions of Risk (KP1, 25%). Secondary references again include Funding Availability (RC1, 13%), National Context (NC1, 13%), and Stakeholder Trust (SB1, 13%). This suggests that the same explanatory factors are perceived as critical for both general plan implementation and building sector actions.

Figure 22: Explanatory Variables Affecting Plan Effectiveness – Building Actions (Bolzano)



Distribution of Buildings effective variables in Bolzano

For Bolzano, the variables shaping plan effectiveness are consistent across both levels. Governance (IA1) is the primary driver, emphasizing the importance of well-defined roles and responsibilities. Risk perception (KP1) strongly conditions implementation, especially in relation to financing and technical uncertainties. Finance, national frameworks, and trust (RC1, NC1, SB1) act as supporting but less dominant factors. This

stability across all themes and buildings shows that in Bolzano, effectiveness is framed less around resources or innovation, and more around governance quality and risk management.

Comparison Across Italian Cities- Explanatory Variables:

Across the Italian cases, three key patterns emerge:

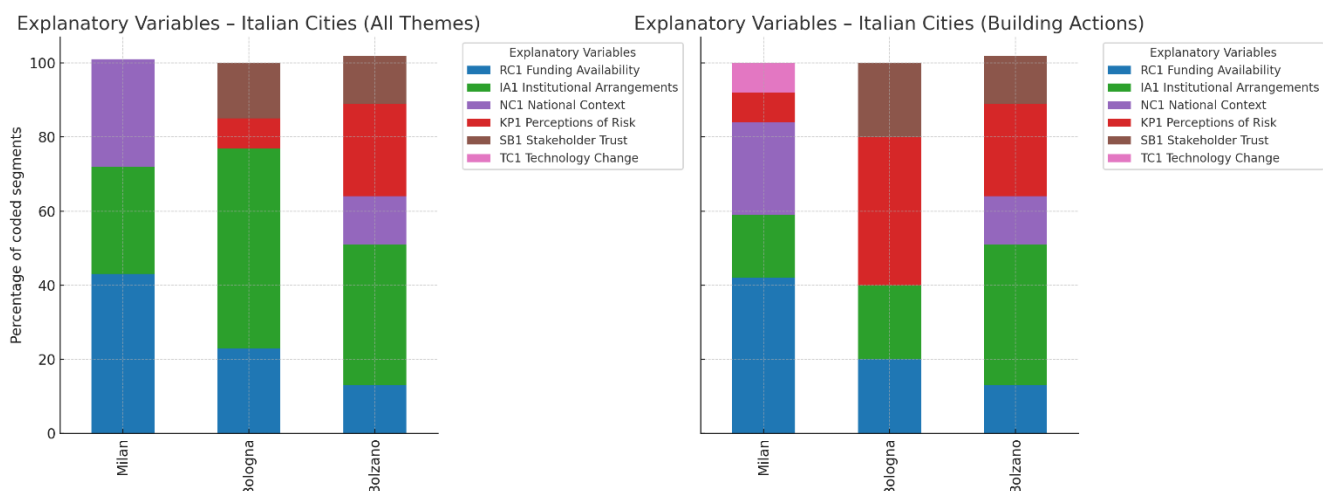
1. Governance first → Institutional arrangements (IA1) are the leading factor everywhere, showing that clarity of roles and responsibilities is seen as the foundation of effective planning.
2. Finance second → Funding availability (RC1) consistently appears as the critical enabler/barrier, particularly in Milan and Bologna.
3. Risk and trust vary by city → Bologna gives the strongest weight to risk perception, Bolzano balances risk with trust and context, while Milan highlights risk and technology adoption only in buildings.

This suggests that while Italian SEAPs share a common reliance on governance and finance, their building actions reveal diverse local challenges: risk aversion in Bologna, trust and regulatory context in Bolzano, and technological adoption in Milan.

In the all-themes analysis, the dominant factor overall is Institutional Arrangements (IA1), particularly strong in Bologna (54%) and Bolzano (38%), showing that governance clarity is central to effectiveness in these contexts. Milan presents a different profile, where Funding Availability (RC1, 43%) is most prominent, alongside significant weight for Institutional Arrangements (IA1, 29%) and National Context (NC1, 29%). Bolzano also stands out for the visibility of Risk Perception (KP1, 25%) and Stakeholder Trust (SB1, 13%), which do not appear at all in Milan's profile.

In the building-focused analysis, the explanatory balance shifts. Milan still emphasizes Funding (RC1, 42%), but here National Context (NC1, 25%) and Technology Change (TC1, 8%) emerge more strongly, reflecting the challenges of regulatory fit and innovation in retrofits. Bologna, by contrast, is dominated by Perceptions of Risk (KP1, 40%), supported equally by Governance (IA1), Finance (RC1), and Trust (SB1) (20% each). Bolzano remains consistent across both layers, with Governance (IA1, 38%) and Risk (KP1, 25%) at the core, complemented by finance, trust, and context.

Figure 23: A visual comparison across Italian Cities about the Explanatory Variables



Left side (All Themes) shows that Governance (IA1) dominates Bologna and Bolzano, while Milan balances finance and governance.

Right side (Building Actions) shows that Bologna shifts sharply to Risk (KP1), Milan adds National Context and Technology (NC1, TC1), Bolzano stays consistent with Governance + Risk.

It can be said that:

- In Governance vs. Finance: Bologna and Bolzano are governance-driven, while Milan is more finance-driven.
- In Risk and Trust: Play a strong role in Bologna (buildings) and Bolzano (both layers) but remain minor in Milan.
- In Technology & Context: Milan is the only case where technology adoption (TC1) and national regulatory frameworks (NC1) are visible in buildings.
- IN Consistency vs. Shift: Bolzano is stable across both levels; Bologna shifts from governance to risk; Milan broadens from finance/governance to include context and technology in buildings.

Table 27: A summary table of the top two explanatory variables per Italian city, comparing All Themes vs. Building Actions.

	Top Variable	Second Variable
Milan (All Themes)	RC1 Funding Availability	IA1 / NC1 (Governance & National Context)
Milan (Buildings)	RC1 Funding Availability	NC1 / IA1 (Governance & Context)
Bologna (All Themes)	IA1 Institutional Arrangements	RC1 Funding Availability
Bologna (Buildings)	KP1 Perceptions of Risk	IA1 / RC1 / SB1 (Governance, Finance, Trust)
Bolzano (All Themes)	IA1 Institutional Arrangements	KP1 Perceptions of Risk
Bolzano (Buildings)	IA1 Institutional Arrangements	KP1 Perceptions of Risk

Based on the above table (27), across Italian cities, governance and finance are the dominant explanatory variables for plan effectiveness, though their relative importance varies. Milan is consistently led by Funding (RC1), supported by governance and the national context. Bologna emphasizes Governance (IA1) in the all-themes analysis but shifts to Risk Perception (KP1) in the building sector, alongside finance and trust. Bolzano is stable across both levels, with Governance (IA1) and Risk (KP1) forming the core explanatory factors.

Overall, the Italian comparison highlights that while Institutional Arrangements and Funding are shared pillars, local challenges diverge: Milan's reliance on subsidies and regulation always led by Funding (RC1), with governance/context secondary), Bologna's risk aversion in retrofits (Governance (IA1) dominates in general, but Risk (KP1) dominates in buildings), and Bolzano's need to manage governance clarity and stakeholder risk(consistently about Governance (IA1) and Risk (KP1).

Interrelationships Between Effectiveness Dimensions

To complement the frequency analysis, co-occurrence mapping was used to examine how effectiveness dimensions and explanatory variables cluster together in practice (Hintz & Tucker, 2023).

Interrelationships Between Effectiveness Dimensions (Italy)

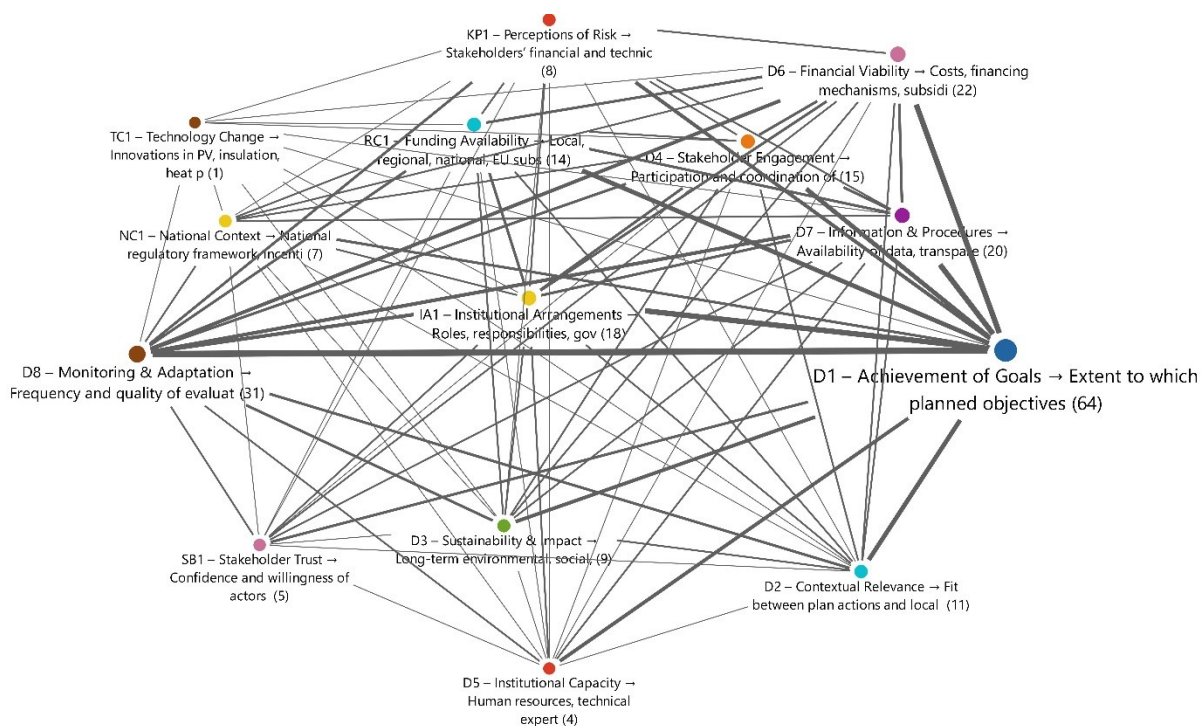
Figure 24 presents the code co-occurrence network for the Italian cases. The nodes represent dimensions (D1–D8) and explanatory variables (e.g., RC1, IA1, KP1), while the connecting lines indicate the frequency with which two codes appear in the same text segment. The thickness of the lines reflects the strength of these associations.

The results highlight several strong interdependencies:

- Achievement of Goals (D1) emerges as the most central node, closely linked to Monitoring & Adaptation (D8) and Financial Viability (D6). This indicates that goal achievement in Italian SEAPs is typically discussed in relation to both evaluation practices and the availability of financial resources.
- Institutional Arrangements (IA1) also shows strong ties to Funding Availability (RC1) and Monitoring (D8), reflecting the governance-finance nexus that underpins effective implementation.
- Stakeholder Engagement (D4) and Information & Procedures (D7) are connected to both financial and governance variables, suggesting that participation and transparency are not isolated themes but embedded within broader institutional and resource discussions.
- By contrast, dimensions such as Institutional Capacity (D5) and explanatory variables like Technology Change (TC1) show weak or marginal connections, indicating that they are less prominent in the Italian discourse.

Taken together, these patterns suggest that Italian cities frame the effectiveness of their energy plans primarily through a triangular relationship between goals, monitoring, and finance, with governance structures acting as the enabling condition. Issues such as long-term capacity building or technological innovation, while relevant in theory, play only a minor role in the observed narratives.

Figure 24: Co-occurrence network of effectiveness dimensions and explanatory variables across the Italian cases



Cross-Case Comparison

Code Distribution Models (single dimension across multiple cases)

The Code Distribution Model is used to:

1. Visualize how specific codes are spread across multiple cases and datasets (Kuckartz, 2014; Paulus & Lester, 2016).
 - Here, it shows how the importance of “Achievement of Goals” differs between cities and between “All Themes” datasets versus building-focused datasets.
2. Enable cross-case comparison (Miles, Huberman, & Saldaña, 2014; Yin, 2018).
 - By mapping code frequencies across cases, we can identify which dimensions are universally emphasized (common patterns) and which are case-specific (unique emphases).
3. Link thematic depth with comparative analysis (Bazeley & Jackson, 2013; Kuckartz & Rädiker, 2019).
 - This allows us to go beyond single-city interpretations and assess how consistently a particular theme (like goal achievement) is discussed across different contexts.

In short, this analysis helps demonstrate where effectiveness dimensions are more salient and ensures that the cross-case comparison is grounded in systematic coding patterns rather than anecdotal interpretation (Kuckartz & Shar, 2011; Rädiker, 2023). It has to be mentioned that the code distribution model was done for dimensions with the higher score compared to others, which have more than fifteen links.

Code Distribution Models for Italian cases in all themes and buildings:

Figure 25 displays the distribution of the code “Achievement of Goals” (D1) across the Italian datasets (Milan, Bologna, Bolzano; All Themes vs. Buildings). The thickness of the connecting lines indicates the frequency of coded segments in each dataset. The results show that:

- Bologna (Comprehensive All Themes) contains the highest number of coded segments for D1 (21), indicating a strong emphasis on the extent to which objectives are achieved.
- Milan (Comprehensive All Themes) and Bolzano (Comprehensive All Themes) also show substantial emphasis (13 and 11 coded segments, respectively).
- At the building-action level, Milan (9) and Bolzano (5) feature moderate attention, while Bologna (5) shows less emphasis relative to its comprehensive dataset.

This distribution highlights that across all three cities, goal achievement is the most consistently coded dimension, though the intensity varies, with Bologna standing out as the case where it is most strongly highlighted.

Figure 25: Code Distribution Model of “Achievement of Goals” (D1) across Italian cases (All Themes and Building Actions)

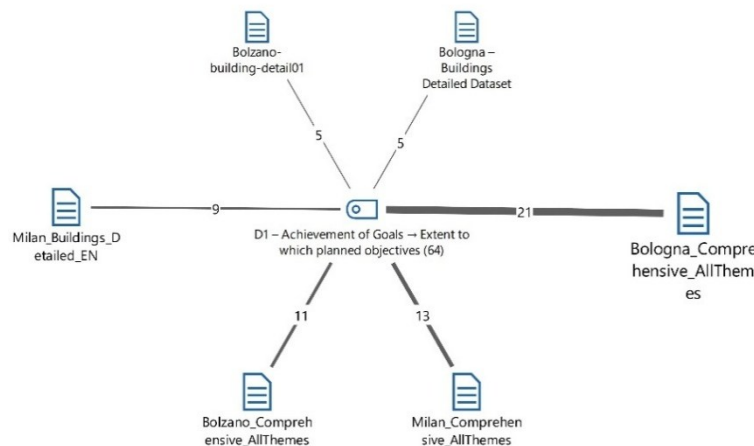


Figure 26 shows the distribution of the code “Financial Viability” (D6) across the Italian datasets. The highest frequency appears in Milan’s Buildings Detailed Dataset (5), underlining that financial concerns are most visible at the sectoral (building) level in this city. Bologna (All Themes and Buildings) and Bolzano (All Themes and Buildings) all show similar frequencies (4 each), indicating finance is a shared concern across both comprehensive and sectoral discussions. Milan Comprehensive All Themes (2) registers lower emphasis compared to its building-level analysis. This distribution suggests that financial viability is a cross-cutting issue across all Italian cases, but with particular salience in the building sector, where costs, subsidies, and financing mechanisms are immediate barriers to action.

Figure 26: Code Distribution Model of Financial Viability (D6) across Italian cases (All Themes and Building Actions)

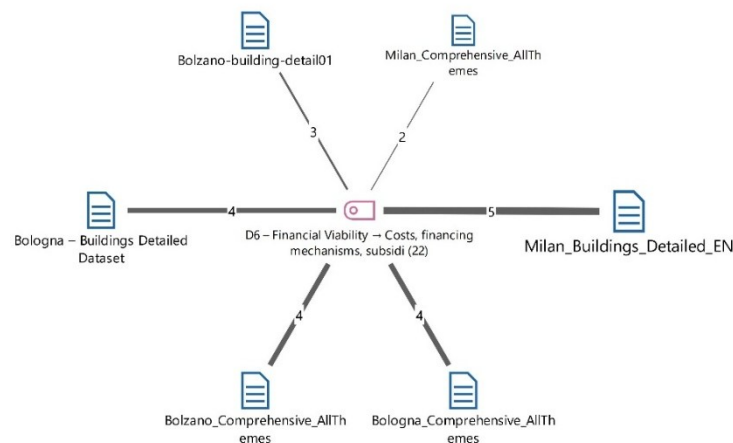


Figure 27 illustrates the distribution of the code “Information & Procedures” (D7) across Italian datasets.

- The strongest emphasis is found in Bologna Comprehensive All Themes (8), highlighting the city’s concern with the availability and transparency of data.
- Both Milan (Buildings = 3, All Themes = 2) and Bologna Buildings (3) also engage with this theme, though less intensively.
- Bolzano (All Themes and Buildings = 2 each) shows relatively low emphasis compared to Bologna.

Overall, this distribution indicates that information and transparency are unevenly prioritized across cities, with Bologna clearly placing the greatest importance on data and procedural availability.

Figure 27: Code Distribution Model of Information & Procedures (D7) across Italian cases (All Themes and Building Actions)

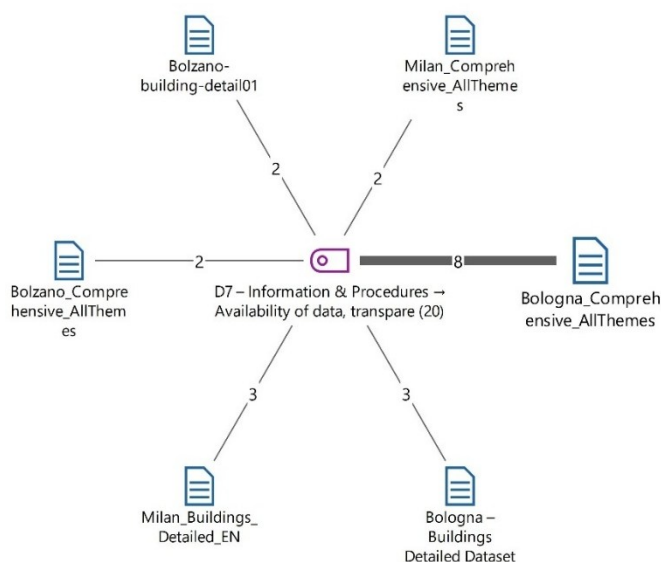
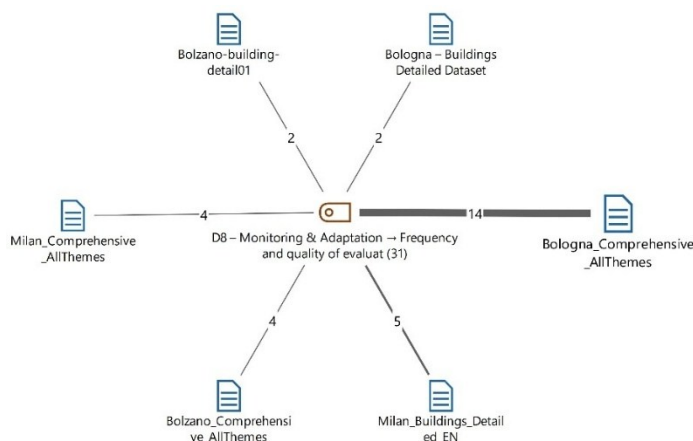


Figure 28 shows the distribution of the code “Monitoring & Adaptation” (D8) across Italian datasets.

- The strongest emphasis is found in Bologna Comprehensive All Themes (14), underlining the city’s stronger institutional focus on evaluation practices.
- Both Milan (Comprehensive = 4; Buildings = 5) and Bolzano (Comprehensive = 4; Buildings = 2) also include discussions of monitoring, but with lower intensity.
- Bologna Buildings (2) shows relatively limited emphasis compared to its comprehensive dataset.

Overall, Bologna emerges as the city where monitoring and adaptive management are most systematically integrated, whereas Milan and Bolzano treat it as a secondary theme.

Figure 28: Code Distribution Model of Monitoring & Adaptation (D8) across Italian cases (All Themes and Building Actions)



Two-Cases Models (direct pairwise comparisons)

Two-case comparisons help highlight convergences and divergences (Rädiker, 2023) across cities. By mapping which effectiveness dimensions (like goals, monitoring, or institutional arrangements) appear strongly in both cases, we can see whether cities are dealing with similar enabling conditions and barriers, or if they are shaped by distinct governance or contextual challenges.

Italian cases across all thematic datasets

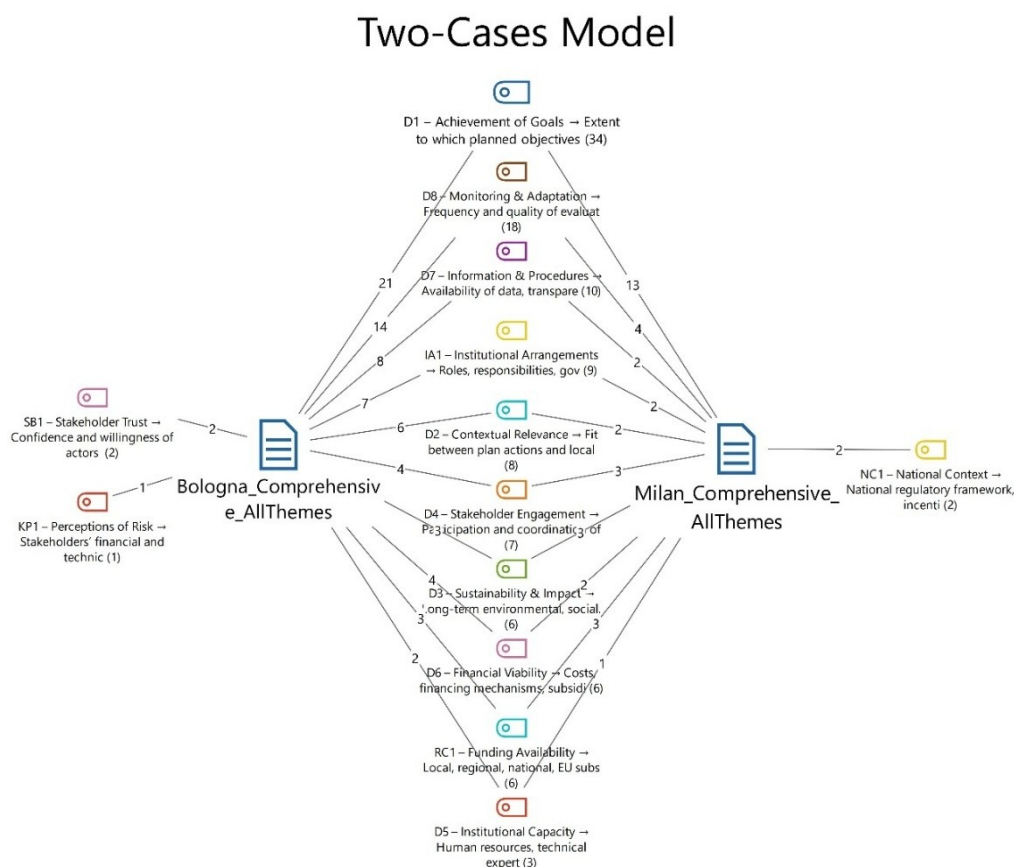
Milan–Bologna (All themes Comparison)

Figure 29 compares Bologna and Milan across all thematic datasets and the results shows that:

- Both cities strongly emphasize Achievement of Goals (D1), but Bologna (34 segments) shows much higher intensity than Milan (13), reflecting Bologna's more systematic engagement with assessing objectives.
- Monitoring & Adaptation (D8) and Information & Procedures (D7) are far more prominent in Bologna (18 and 10) than in Milan (4 and 3), suggesting Bologna places greater weight on evaluation and data transparency.
- Institutional Arrangements (IA1) and Contextual Relevance (D2) are again stronger in Bologna, confirming governance and local fit as central themes.
- Milan, by contrast, shows more emphasis on National Context (NC1) than Bologna, highlighting the role of national regulations and frameworks in shaping its discourse.
- Unlike Bologna are references to Stakeholder Trust (SB1) and Risk Perceptions (KP1), which are absent in Milan. This indicates that Bologna pays more attention to actors' willingness and concerns.

Overall, the comparison reveals that Bologna adopts a broader and more participatory framing of plan effectiveness, combining goals, monitoring, governance, and stakeholder concerns. Milan is more narrowly framed around goals and institutional/national context, showing a top-down orientation.

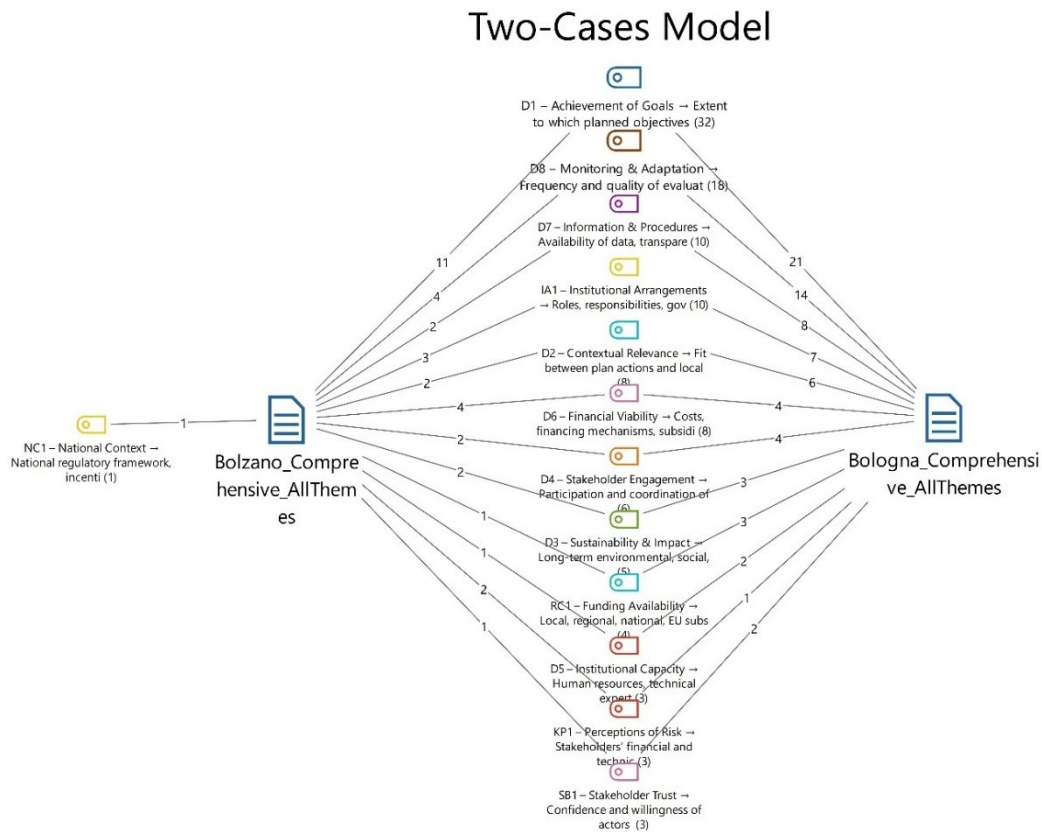
Figure 29: Two-Cases Model of Effectiveness Dimensions and Variables: Bologna vs Milan (All Themes datasets)



Bolzano –Bologna (All themes Comparison)

The following figure (30) compares Bolzano and Bologna across all thematic areas. Both cities emphasize Achievement of Goals (D1) and Monitoring & Adaptation (D8), though Bologna shows slightly stronger associations (32 vs. 18 for D8). Information & Procedures (D7) and Institutional Arrangements (IA1) are also prominent in both cases, suggesting the shared importance of governance and data transparency. Bolzano shows weaker links with National Context (NC1) and Funding (RC1), while Bologna reflects a broader spread across financial viability (D6), stakeholder engagement (D4), and sustainability (D3).

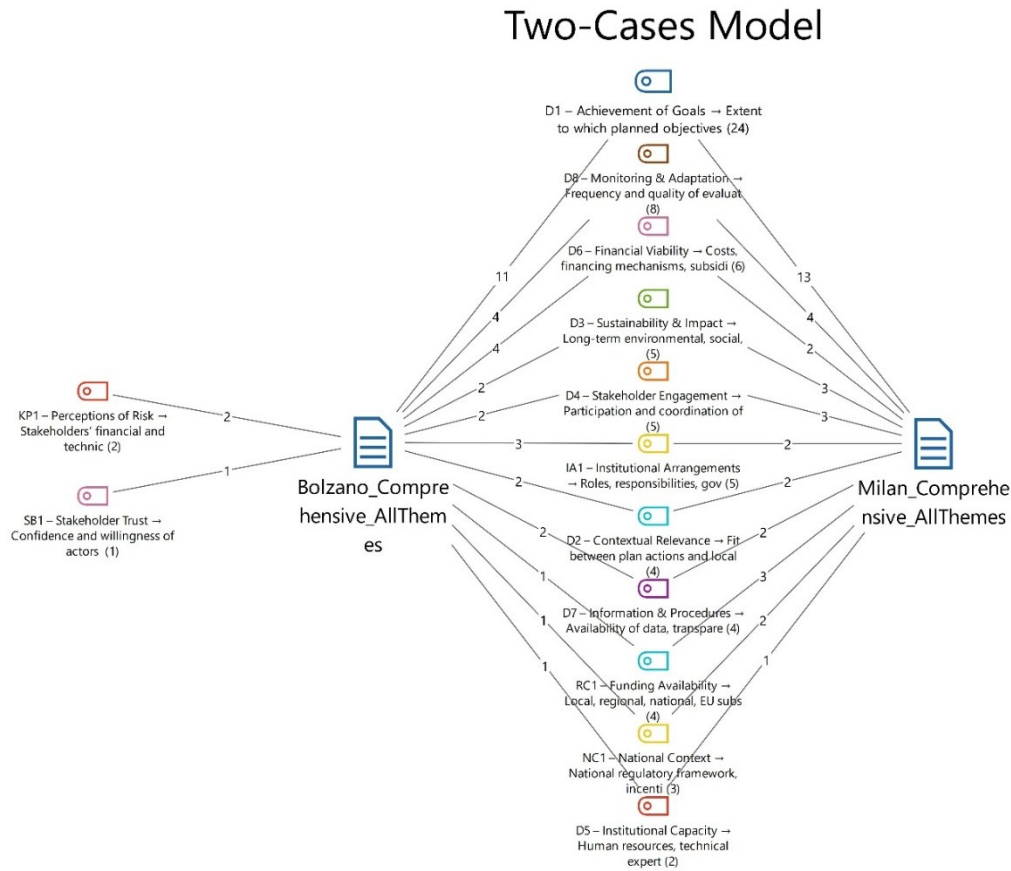
Figure 30: Two-Case Comparison of Effectiveness Dimensions: Bolzano vs. Bologna (All Themes)



Bolzano –Milan (All themes Comparison)

This comparison highlights Achievement of Goals (D1) as a central dimension in both Bolzano and Milan, strongly linked with multiple supporting variables. Milan places greater emphasis on Sustainability & Impact (D3) and Contextual Relevance (D2), while Bolzano emphasizes Monitoring & Adaptation (D8). Both cities show attention to Institutional Arrangements (IA1) and Information & Procedures (D7), but Milan shows broader integration of Financial Viability (D6) and National Context (NC1). This shows that while both cities share a focus on governance and evaluation, Milan places stronger weight on policy context and sustainability, whereas Bolzano leans toward adaptive monitoring practices.

Figure 31: Two-Case Comparison of Effectiveness Dimensions: Bolzano vs. Milan (All Themes)



Italian cases across building actions

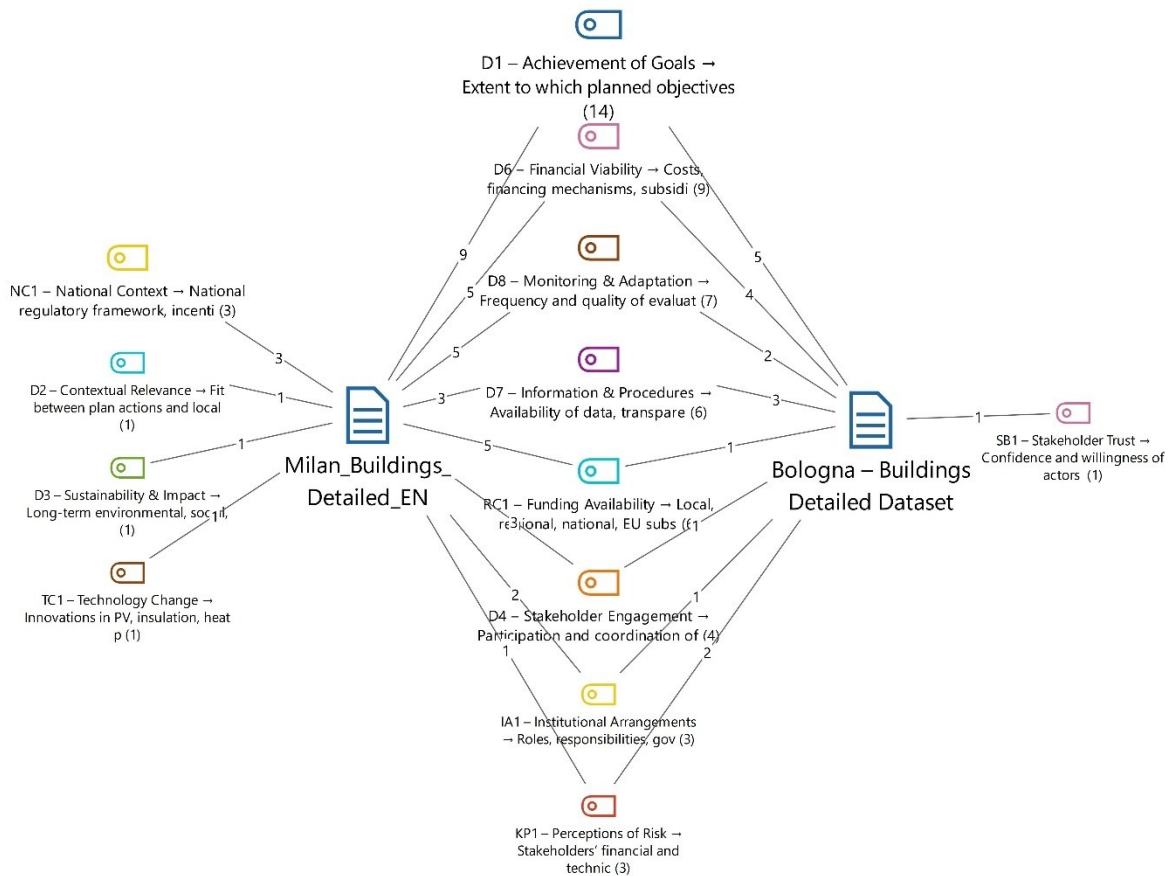
Milan–Bologna (Buildings Comparison)

This figure compares the distribution of effectiveness dimensions and variables in building-focused actions between Milan and Bologna.

- Shared drivers: Both cities highlight Achievement of Goals (D1) and Financial Viability (D6) as central.
- Milan shows stronger links to Monitoring & Adaptation (D8) and Information & Procedures (D7), while
- Bologna connects more with Stakeholder Trust (SB1) and Institutional Arrangements (IA1).

Figure 32: Two-Cases Comparison of Building Actions in Milan and Bologna

Two-Cases Model

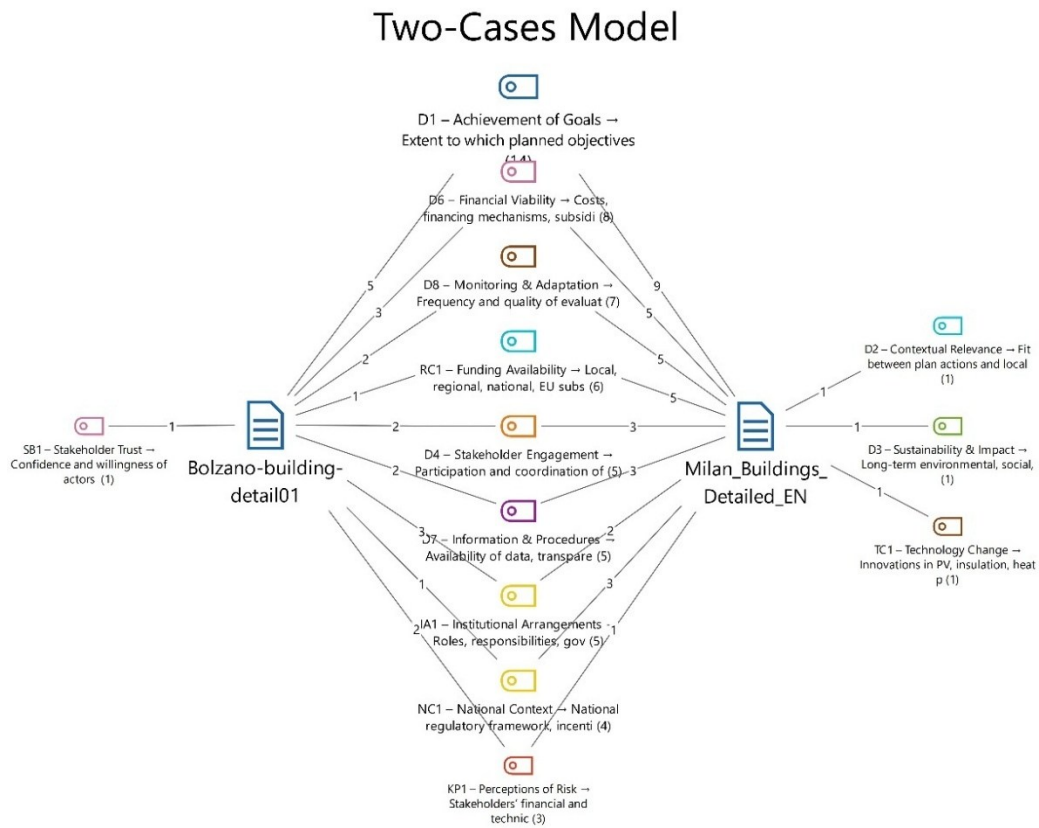


Milan–Bolzano (Buildings Comparison)

This model shows overlaps and differences in building actions between Milan and Bolzano and based on that:

- In Common nodes: Both emphasize Achievement of Goals (D1), Monitoring & Adaptation (D8), and Financial Viability (D6).
- Milan additionally stresses National Context (NC1) and Technology Change (TC1), pointing to broader policy and innovation drivers.
- Bolzano instead emphasizes Stakeholder Trust (SB1), suggesting reliance on actor confidence and engagement.

Figure 33: Two-Cases Comparison of Building Actions in Milan and Bolzano

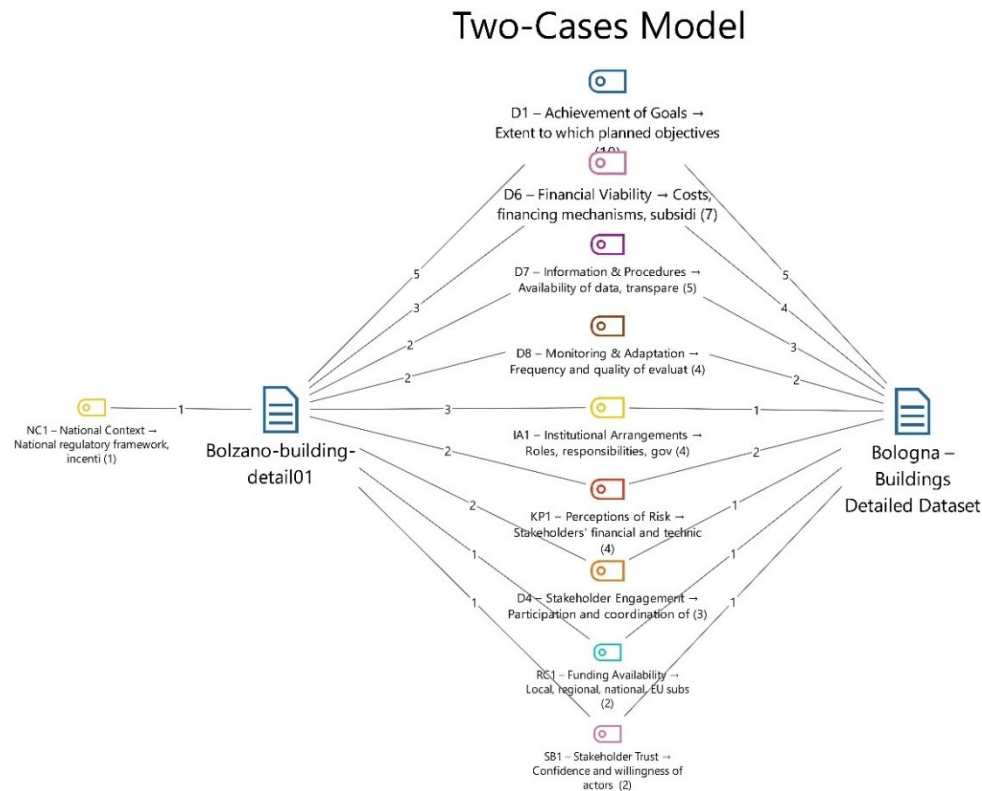


Bologna–Bolzano (Buildings Comparison)

The following figure compares building actions between Bologna and Bolzano and the finding of that show:

- Both share Achievement of Goals (D1), Financial Viability (D6), and Monitoring & Adaptation (D8) as top drivers.
- Bologna highlights Perceptions of Risk (KP1) and Stakeholder Engagement (D4), linking effectiveness to social and governance issues.
- Bolzano, meanwhile, stresses National Context (NC1), showing dependence on external policy frameworks.

Figure 34: Two-Cases comparison of Building Actions in Bologna and Bolzano



Across all three pairs, three effectiveness dimensions consistently dominate building-related energy plan implementation:

- Achievement of Goals (D1) → the central driver in every city, highlighting the importance of measuring progress against planned objectives.
- Financial Viability (D6) → recurring across all cases, showing that cost structures, subsidies, and financing mechanisms are essential for feasibility.
- Monitoring & Adaptation (D8) → strongly emphasized in Milan and Bologna, but also relevant in Bolzano, indicating that ongoing evaluation is critical to keep actions on track.

Beyond these shared drivers, city-specific differences emerge:

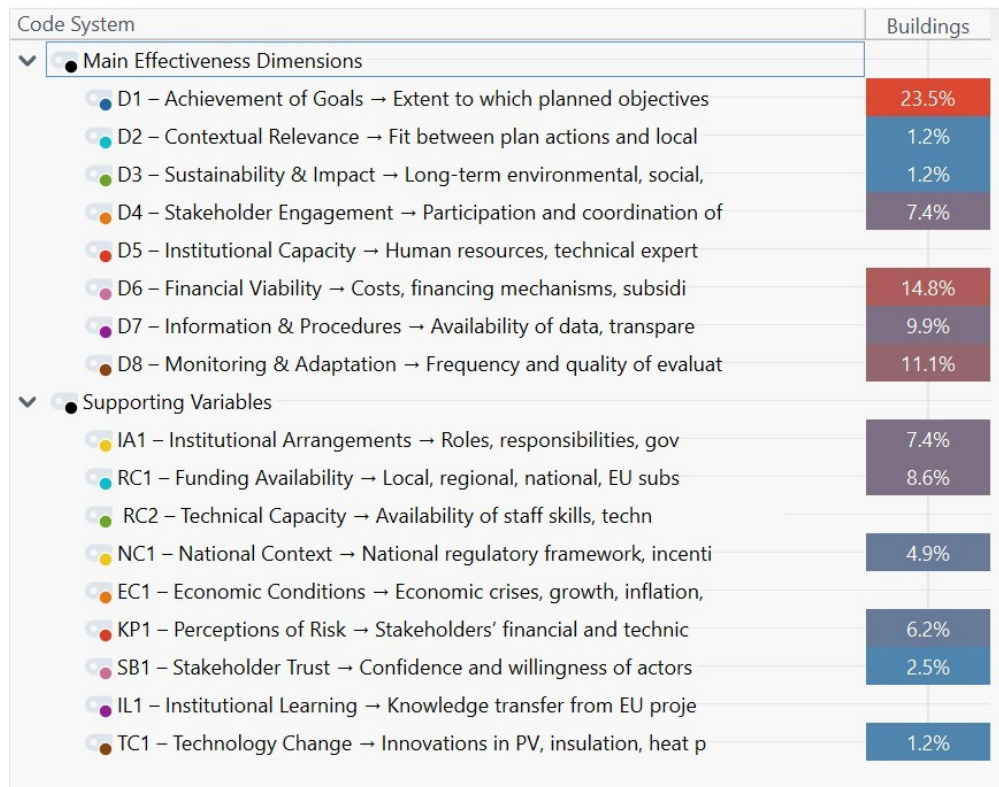
- Milan → adds weight to Information & Procedures (D7) and National Context (NC1), showing a stronger link between policy frameworks, data transparency, and innovation (Technology Change, TC1).
- Bologna → highlights Perceptions of Risk (KP1) and Stakeholder Engagement (D4), reflecting more emphasis on local actor involvement and financial confidence in building projects.
- Bolzano → stresses Stakeholder Trust (SB1) and National Context (NC1), showing a reliance on actor willingness and external regulatory support rather than purely local mechanisms.

Totally it can be said that, while all three cities depend on financial stability and goal achievement, the pathways to achieving effectiveness diverge. Milan leans on policy frameworks and innovation, Bologna on actor perceptions and engagement, and Bolzano on trust and national-level support. This highlights the contextual nature of building-sector energy governance in Italy.

Two-Cases Model of Effectiveness Dimensions: Buildings vs. All Themes

Based on the following figure in all the Italian cases analysis shows that:

Figure 35: Effectiveness Dimensions frequency in buildings sector



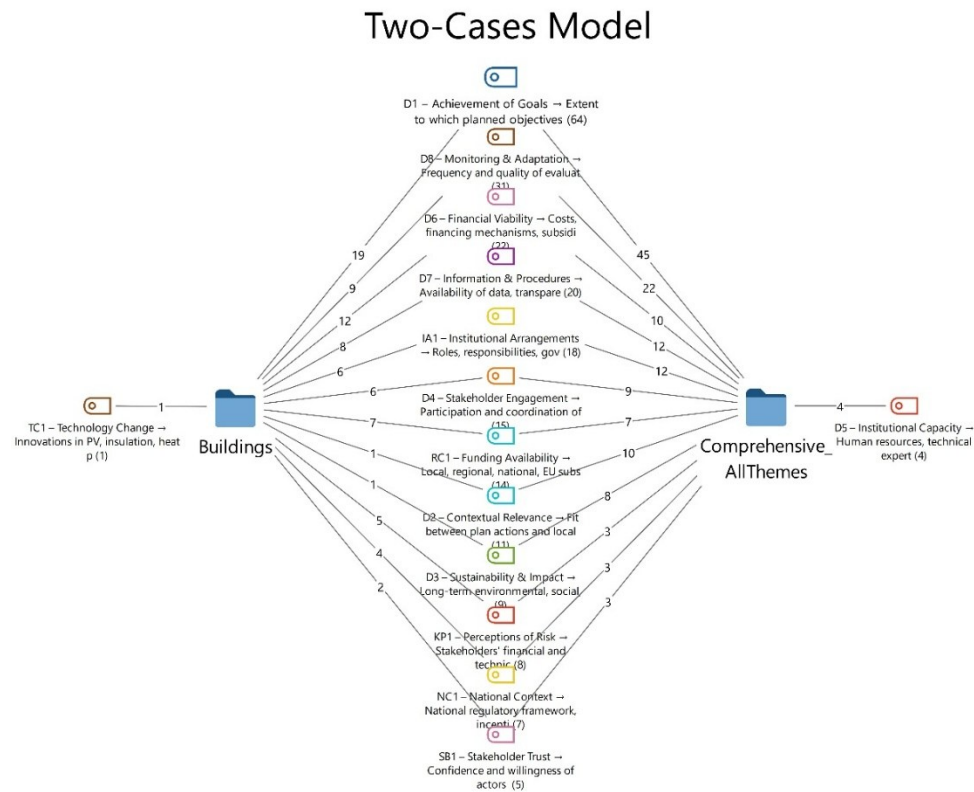
Comparing Buildings (sector-specific analysis) with All Themes (comprehensive plans) helps identify whether challenges and enablers in the building sector differ from the broader energy and climate planning framework. Since buildings are often the most resource-intensive and technically complex sector, this contrast highlights sector-specific bottlenecks versus general governance challenges.

- Shared core dimensions are strong across both sides:
 - Achievement of Goals (D1) → remains the most central element, with 64 references in Buildings vs. 45 in All Themes, underlining its dominance across both scopes.
 - Financial Viability (D6) and Monitoring & Adaptation (D8) also appear very frequently on both sides, confirming their role as systemic drivers of plan effectiveness.
- Buildings-specific emphases:
 - D1 (Achievement of Goals) is even more prominent in Buildings, showing that sectoral plans are judged very directly against results.
 - Technology Change (TC1) appears only in Buildings, reflecting innovation needs in retrofitting and energy efficiency.
- All Themes-specific emphases:
 - Institutional Capacity (D5) shows up only in All Themes, highlighting how broader plan implementation depends more on staff and expertise at the municipal level.

- Broader governance-related dimensions (IA1, D7, RC1) are slightly stronger in All Themes compared to Buildings.

The figure shows that while financial viability, monitoring, and goal achievement are central across both Buildings and All Themes, the Buildings domain places greater emphasis on measurable outcomes and technological innovation, whereas All Themes stress governance capacity and institutional arrangements.

Figure 36: Two-Cases Model of Effectiveness Dimensions: Buildings vs. All Themes

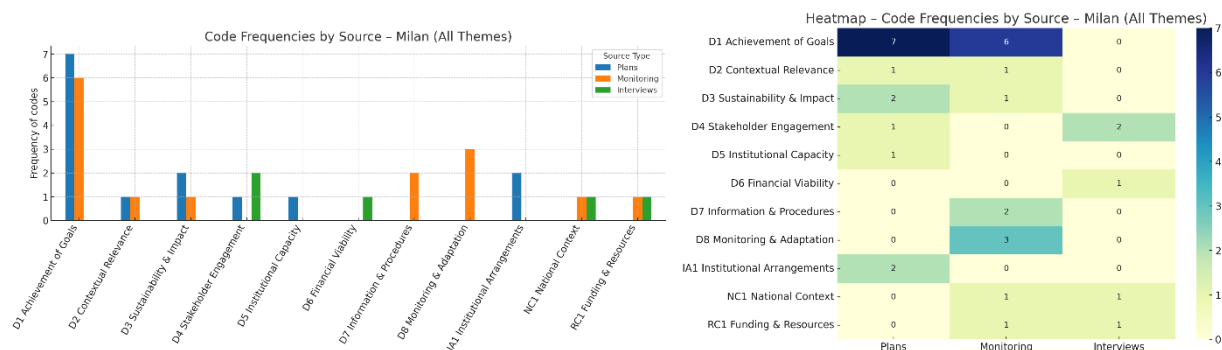


Comparison by Source Type

Milan:

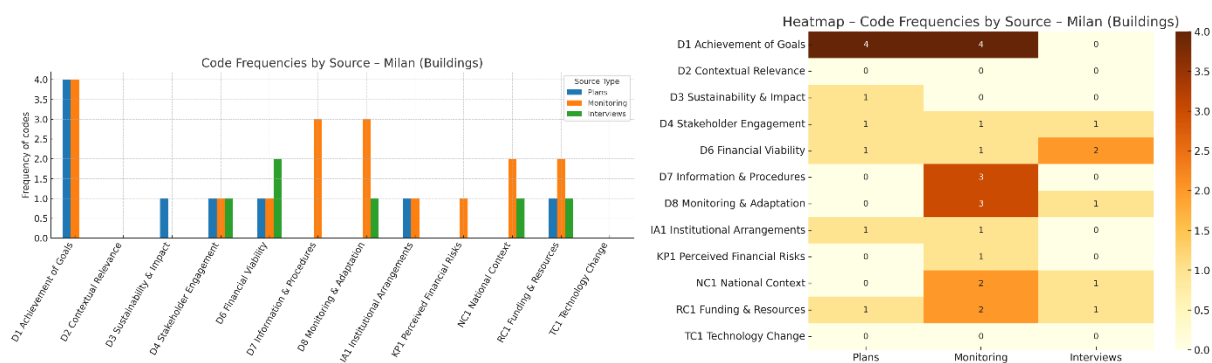
Milan — All Themes: Comprehensive materials foreground D1 Goals and IA1 Institutional Arrangements, whereas monitoring/interviews surface D6 Finance, D7 Information & Procedures, and D8 Monitoring as recurrent bottlenecks. Overall, the contrast points to a gap between governance ambition and operational delivery.

Figure 37: Codes frequency by Source Type in Milan-All themes



Milan — Buildings: Plans emphasize D1 Achievement of Goals and D3 Sustainability & Impact, while monitoring/interviews shift the focus to D6 Financial Viability, D8 Monitoring & Adaptation, and D5 Institutional Capacity. This indicates clear strategic intent but implementation bounded by finance, evaluation, and staffing constraints.

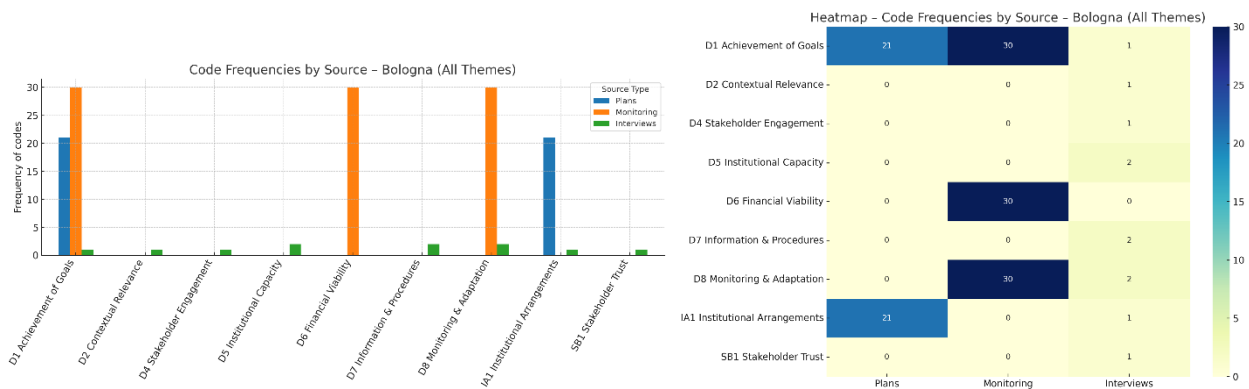
Figure 38: Codes frequency by Source Type in Milan-Buildings



Bologna:

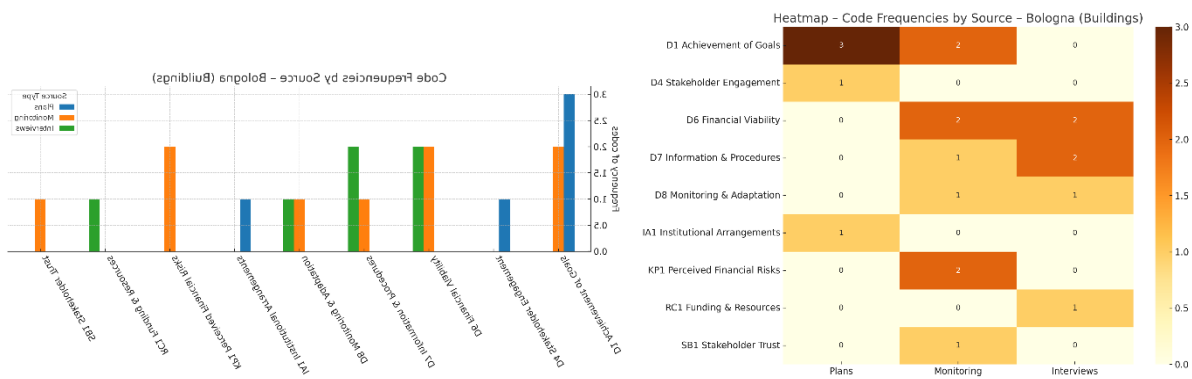
Bologna — All Themes: Comprehensive documents focus on D1 Goals and IA1 Institutional Arrangements, while monitoring/interviews elevate D6 Finance, D7 Procedures, and D8 Monitoring. The contrast points to a familiar pattern across your cases: ambitious governance framing at plan level meets operational barriers around resources, information systems, and follow-up evaluation in practice.

Figure 39: Codes frequency by Source Type in Bologna-All themes



Bologna — Buildings: Plans emphasize D1 Achievement of Goals and D3 Sustainability & Impact, whereas monitoring/interviews put more weight on D6 Financial Viability, D7 Information & Procedures, and D8 Monitoring & Adaptation (with D5 Institutional Capacity also visible). This indicates that while retrofit objectives are clearly framed, delivery is constrained by finance, data/process management, and evaluation mechanisms.

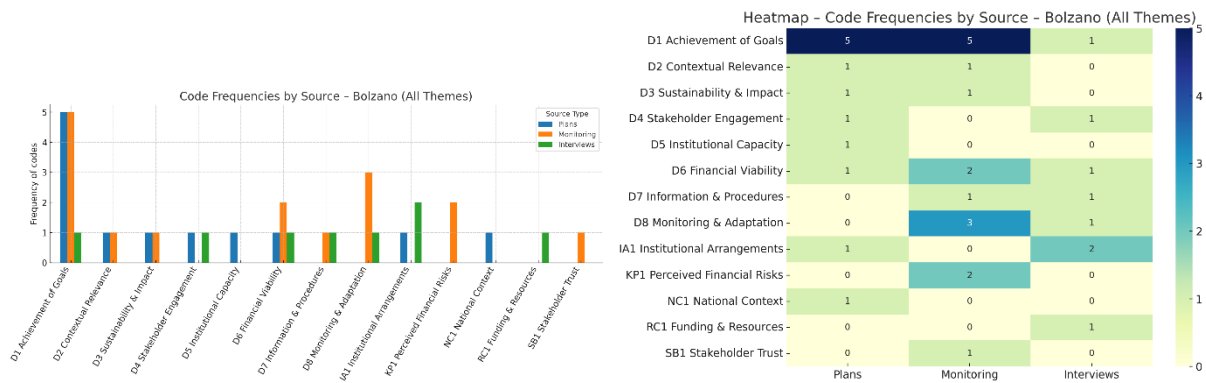
Figure 40: Codes frequency by Source Type in Bologna-Buildings



Bolzano:

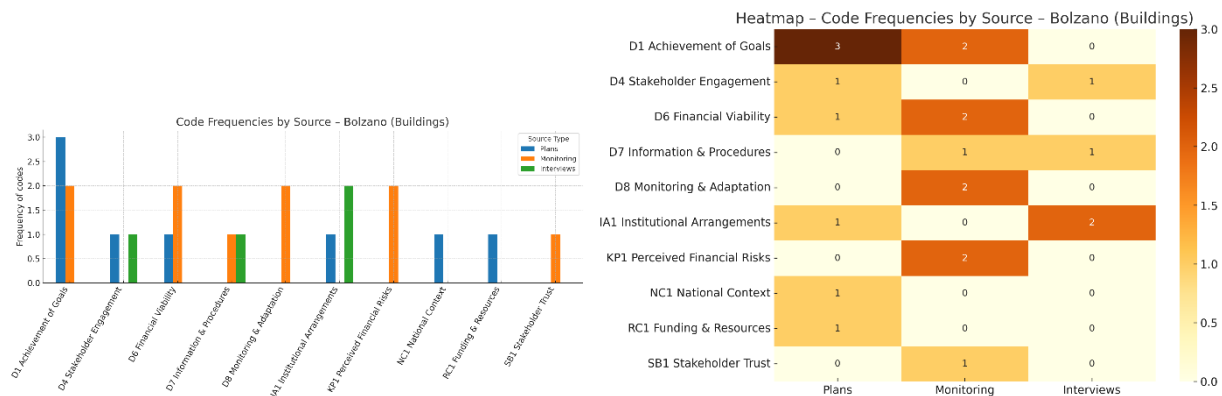
Bolzano — All Themes: Comprehensive materials emphasize D1 Goals and IA1 Institutional Arrangements, whereas monitoring/interviews elevate D6 Finance, D7 Information & Procedures, and D8 Monitoring as recurring bottlenecks. The overall pattern mirrors other cities: governance ambition vs. operational limits.

Figure 41: Codes frequency by Source Type in Bolzano-All themes



Bolzano — Buildings: Plans highlight D1 Achievement of Goals and D3 Sustainability & Impact, while monitoring/interviews are richer in D6 Financial Viability, D8 Monitoring & Adaptation, and D5 Institutional Capacity. This confirms that clear strategic building objectives confront implementation constraints tied to funding, evaluation systems, and staffing.

Figure 42: Codes frequency by Source Type in Bolzano-Buildings



Discourse Analysis

Discourse analysis has been used to show in which terms municipalities emphasize most strongly in their official documents (Plans and Monitoring). To achieve this, automatic word Frequency and Word Clouds were used to recognize them for each city. As mentioning all of them is so long, just the five most frequent ones have been cited as follows.

Milan:

The five most frequent words in the Sustainable Energy Action Plan (SEAP, 2014)" (approx. 120 occurrences), which frequently co-occurs with terms like "emissions," "energy," and "reduction". The next one is "energy" (approx. 110 occurrences), often connected with "efficiency," "renewable sources," and

"consumption". "emissions" is the other one (approx. 95 occurrences), mostly linked with "CO2," "reduction," and "health". "reduction" is another one (approx. 85 occurrences), connected with "emissions," "energy," and "objectives"; and the fifth one "efficiency" (approx. 70 occurrences), which co-occurs with "buildings," "certificates," and "energy."

Based on the monitoring (2015-2022) of the plan, the five most frequent words in the report are "emissions" (120), "energy" (110), "reduction" (95), "buildings" (80), and "efficiency" (75). And for the co-occurrence, particularly "emissions" and "reduction" appear together, "Energy" and "efficiency" often co-occur, "buildings," and "retrofitting," and finally "reduction" commonly appears alongside "buildings" and "energy".

Bologna:

The first most frequent word in the Sustainable Energy Action Plan (SEAP, 2012), (approx. 120 occurrences), which co-occurs mostly with "Energy" and "Emissions". The second one is "Energy" (approx. 85 occurrences), which links mostly with "Efficiency," "Renewables," and "Technologies,". The third one is "Municipality" (approx. 70 occurrences), which was connected to the "Actions" and "Governance". The next word is "Emissions" (approx. 65 occurrences) in links with "CO2", "reduction," and "target," and the last word is "Actions" (approx. 60 occurrences), which co-occurs with "reduction," "CO2," and "SEAP".

Based on the monitoring plan of Bologna in 2013, the first frequent word is CO2 (around 70 occurrences), and in terms of co-occurrence, it often appears together with "Reduction" and "Actions", with the second word "Actions" by about 60 occurrences with linked mostly with "CO2 Reduction" and "Progress/Status". The third frequent word is "Energy," which co-occurs frequently with "Savings" and "Investments". Municipality (around 40 occurrences) is the fourth one, which is closely linked with "Actions" and "Monitoring", and the last one is "Reduction" (about 45 occurrences), which was written next to the "CO2" and "achieved".

And the five most frequent words of Monitoring plan of Bologna in 2018 are "CO2" (carbon dioxide) (16 occurrences), "reduction" (10 occurrences), "residential" (6 occurrences), "actions" (6 occurrences), and "energy" (5 occurrences). These words co-occur primarily in the context of evaluating energy-saving actions and CO2 emission reductions across various sectors such as residential, industrial, and transport. The term "CO2" commonly appears alongside "reduction" to describe emission decreases, while "residential" is frequently mentioned with "actions" to address energy efficiency measures. "Energy" is often related to these discussions, particularly regarding savings and renewable sources.

Bolzano:

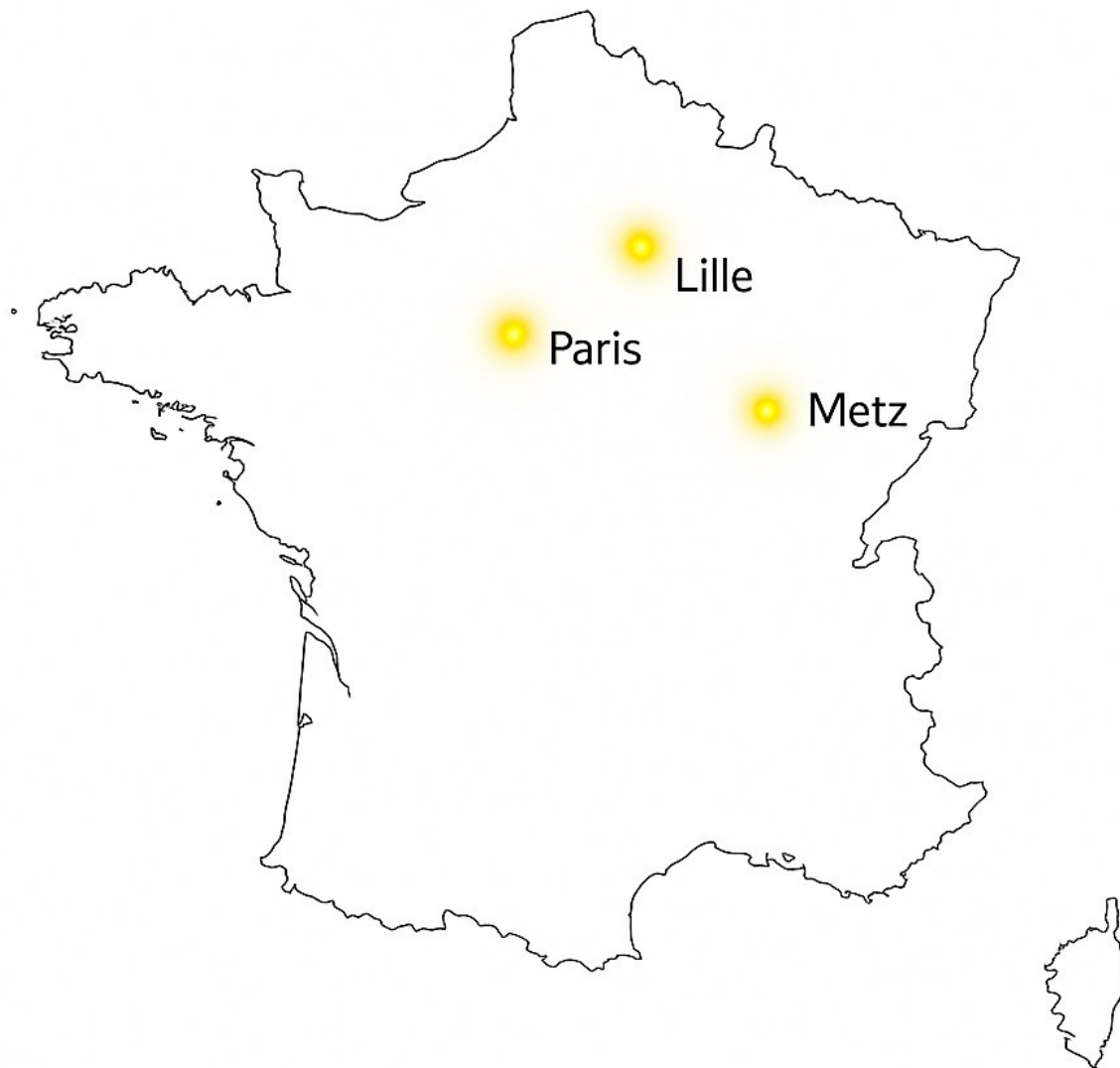
In SEAP of Bolzano (2013), the five most frequent words are "energy" (15 times), "consumption" (12 times), "emissions" (10 times), "data" (8 times), and "sector" (7 times). "energy" often appears alongside "consumption" and "emissions," reflecting the focus on measuring energy use and its environmental impact. "Energy" appears mostly with "Renewable energy" and "consumption". "Consumption" was commonly used with "Energy" and "Electricity". The third frequent word is "Emissions," which co-occurs with "CO2" and "reduction". The fourth word is "Data," which is mostly linked to "Consumption" and "Emission." And the last frequent word is "Sector" which was used as "Residential" and "Transport" sector.

The five most frequent words and their conjunctions related to the monitoring plan of SEAP in 2015 of Bolzano include: "Reduction" which appears frequently in conjunction with both "CO2 Emissions" and "Energy Consumption," , next one is "Efficiency" that mostly associated with "Energy Consumption," "Public Lighting," and "Sustainable Energy,.". The third one is "Monitoring " this term is often linked to "CO2 Emissions" and "Action Plan,.". The fourth one is Targets/Goals which these words are frequently used alongside "Reduction Targets" and "Action Plan," and the last word is "Renewable Energy" which is linked with "Sources" and "Production,."

The five most frequent words in the SEAPC of Bolzano are "CO2" (approximately 40 times), "Emissions" (about 35 times), "Municipality" (around 30 times), "Action" (around 30 times), and "Energy" (approximately 25 times).in this regards, "CO2" commonly co-occurs with "Emissions" and "Reduction", "Municipality", "Municipal offices", and "Action" appear together describing responsibility and implementation and "Energy" linked with "Consumption" and "Efficiency" in relation to improving energy use.

Chapter 5:

Results of French Case Studies



Findings of French Cases

Paris

Interview findings

The details responses of Paris municipal representatives emphasized that the city's Climate Action Plan (2018, revised 2020) was designed as a long-term framework with 2030 and 2050 targets. The respondent noted that Paris placed a strong emphasis on heritage buildings, which represent a unique challenge due to strict conservation rules. This constraint often slowed retrofits or required costly, specialized solutions.

The official described a robust monitoring system, with biennial reports and mid-term evaluations, but acknowledged that indicators often covered city-wide performance rather than specific building actions. Stakeholder engagement was carried out through thematic workshops and neighborhood-level consultations, yet difficulties persisted in mobilizing private condominium owners and small landlords. Interviewees stressed that national programs, such as MaPrimeRénov' and other subsidies, were decisive in encouraging private retrofits, while the city's role was to provide coordination, technical support, and communication.

Building-related actions (goals, implementation, obstacles)

Goals (Paris Climate Plan 2018/2020).

- ✓ Achieve –50% CO₂ emissions by 2030 and carbon neutrality by 2050.
- ✓ Retrofit 100% of public buildings (municipal schools, offices, social housing).
- ✓ Facilitate large-scale private housing renovations, particularly condominiums.
- ✓ Expand renewable energy integration (solar PV, district heating).

Implementation

- ✓ Public buildings: retrofits ongoing, with several hundred municipal buildings upgraded (schools and childcare centers prioritized). Social housing operators (Paris Habitat, RIVP) launched renovation programs with energy savings between 20–40%.
- ✓ Private housing: support mechanisms include local one-stop-shops for energy renovation advice and coordination with national incentives. Uptake improved but remained below trajectory needed for 2030 targets.
- ✓ District heating: expanded to cover a growing share of residential and tertiary buildings, helping reduce emissions.
- ✓ Awareness campaigns: focused on condominium associations, but participation uneven.

Obstacles

- ✓ Strong heritage constraints (historic Haussmann buildings, monuments) limit technical solutions and increase costs.
- ✓ Mobilizing condominium co-owners remains difficult due to administrative complexity and financial barriers.
- ✓ Monitoring indicators not always granular enough to track building-specific performance.
- ✓ Reliance on national incentives creates vulnerability to policy changes.
- ✓ Despite ambitious goals, the scale of private renovations is insufficient to reach 2030 targets without acceleration.

Table 28: A summary of building goals, implementation, and obstacles in Paris

Case	Goals (Plan)	Implementation (Monitoring/Evaluation)	Obstacles
Paris	- 50% CO₂ by 2030, carbon neutrality by 2050.- Retrofit 100% of public buildings (schools, offices, social housing).- Scale up private housing renovations (condominiums).- Expand district heating & renewable energy integration.	- Hundreds of municipal buildings retrofitted (schools, childcare centers prioritized).- Social housing operators launched programs (20–40% energy savings).- Private renovations supported by one-stop shops + national schemes (MaPrimeRénov'). Uptake improving but below trajectory.- District heating expanded to residential & tertiary buildings.- Awareness campaigns targeted condominiums; mixed participation.	- Strong heritage constraints (historic Haussmann buildings, monuments) raise costs & limit technical options.- Condominium mobilization difficult (administrative & financial barriers).- Monitoring indicators too broad for building-level performance.- Reliance on national subsidies vulnerable to policy changes.- Private renovations insufficient to reach 2030 targets.

Metz

Interview findings

The Metz interview reinforced the picture of a compulsory PCAET with strong diagnostic requirements but an implementation phase constrained by funding and human capacity. The respondent described a financing architecture that routinely combines 8–10 sources (EU, State, Region, Department, BEI loans, municipal budgets) and emphasized the need to rebalance efforts from diagnostics to execution. Stakeholder engagement occurred in phases—from sectoral one-to-one meetings to large workshops with communes—yet cultural resistance and limited staff capacity in building services remained obstacles. The interview also highlighted the value of trust-building, long-term relationships, and a shared vocabulary with urban planners and developers to accelerate building renovations.

Building-related actions (goals, implementation, obstacles)

Goals (PCAET 2015–2021).

- ✓ Improve energy performance of public buildings through audits, monitoring, and renovation works.
- ✓ Launch innovative financing mechanisms to reinvest energy savings in further upgrades.
- ✓ Support the rehabilitation of private housing stock, particularly older homes built between 1945–1990.
- ✓ Address energy poverty through targeted programs and better communication with residents.

Implementation

- ✓ Public buildings: 15 audited; 9 equipped with fluid consumption monitoring; renovation works initiated; a mission officer dedicated to building actions appointed; Intracting mechanism operational.
- ✓ Opéra Théâtre: achieved –17% energy reduction over six years, below the –48% target; gains mainly in electricity, while heating energy savings were not achieved.
- ✓ Centre Technique Communautaire (CTC): energy consumption remained flat 2015–2020; objectives largely unmet despite new tools.
- ✓ Private housing: energy poverty formally recognized; communication efforts via ALEC ongoing; strong need for uptake in rehabilitation of older housing stock.

Obstacles

- ✓ Pace of renovations judged too slow and not systemic; actions remain fragmented rather than massive.
- ✓ Heavy reliance on complex financing packages slows down implementation.
- ✓ Persistent staff shortages and cultural resistance in technical services.
- ✓ Private sector hesitant due to costs and risk perceptions, despite subsidies.
- ✓ Lack of binding measures on worst-performing buildings reduces effectiveness.
- ✓ Political will identified as decisive for accelerating progress.

Table 29: A summary of building goals, implementation, and obstacles in Metz

Case	Goals (Plan/PCAET)	Implementation (Monitoring/Evaluation)	Obstacles (Docs + Interview)
Metz	Improve energy performance of public buildings (audits, metering, works, internal financing); accelerate private housing	Public buildings: 15 audited; 9 with fluid tracking; dedicated mission officer; Intracting financing running; Opéra Théâtre –17% energy in 6 years (below –48% target); heating savings not yet achieved. CTC: consumption flat 2015–2020 (targets unmet). Private housing: energy poverty defined; support mechanisms in	Funding intensity vs pace; car dependence crowds climate co-benefits; lack of binding regulation on polluting vehicles & energy-intensive buildings; staff capacity limits; cultural

	renovation (esp. pre-1990 stock); address energy poverty; integrate governance tools (Cit'ergie, ALEC).	place; communication/accompaniment must increase; older stock (60% 1945–1990) → high need/low performance; metro energy/inhabitant higher than peers.	resistance in building services; need for commune coordination & shared language with planners; renovation not massive/systemic yet; upfront costs & owner risk perceptions.
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Lille

Interview Findings

The Lille interview highlighted that the city's building strategy has undergone significant evolution since the first local energy plan. Between 2013 and 2021, Lille Métropole achieved substantial improvements in municipal energy performance, reporting approximately a 27% reduction in energy use and a 39% reduction in greenhouse gas emissions relative to the 2008 baseline. The interviewee highlighted that initial actions primarily targeted energy system efficiency (heating, lighting, equipment), but the current approach has shifted toward envelope-level renovation and comprehensive energy retrofits, supported by increasing decarbonization of district heating networks.

Key success factors included continuity of institutional leadership, strong inter-departmental collaboration, and the existence of a long-term energy roadmap. However, financial and human resource constraints were cited as persistent challenges, especially in maintaining renovation pace across the extensive municipal building stock and scaling programs for private housing. The interviewee also noted the critical role of national and regional co-financing mechanisms, without which several public projects could not have been implemented. The process has generated significant organizational learning, leading to better monitoring tools and a culture of energy performance accountability within public facilities.

Building-related actions (goals, implementation, obstacles)

Goals (Plan / PCAET)

- ✓ Reduce CO₂ emissions by 20% by 2020 and 40% by 2030.
- ✓ Prioritize energy renovation of municipal and residential buildings.
- ✓ Promote renewable integration (solar, biomass, district heating).
- ✓ Strengthen cooperation with ALEC, ADEME, and regional partners.
- ✓ Support low-income housing renovations and advisory programs.

Implementation (Monitoring / Evaluation)

- ✓ 200+ municipal buildings retrofitted with LED lighting and automation systems.
- ✓ Achieved 27% reduction in energy use and 39% cut in GHG emissions (2008–2021).
- ✓ District heating extended and partially decarbonized using renewable and waste heat.

- ✓ Energy management systems installed; creation of a metropolitan energy observatory.
- ✓ Renovation subsidies and advisory support provided to low-income households.
- ✓ Strengthened interdepartmental cooperation and performance monitoring.

Obstacles (Docs + Interview)

- ✓ Funding intensity vs. pace of implementation; dependency on external financing.
- ✓ Limited staff capacity and workload constraints in building and energy services.
- ✓ Administrative delays and coordination challenges between city and metropolis.
- ✓ Low engagement of private owners, especially condominiums.
- ✓ Regulatory complexity and reliance on national incentives for continuity.
- ✓ Indicators still too broad to capture detailed building-level performance.

Table 30: A summary of building goals, implementation, and obstacles in Lille

Case	Goals (Plan/PCAET)	Implementation (Monitoring/Evaluation)	Obstacles (Docs + Interview)
Lille	Reduce CO ₂ emissions by 20% by 2020 and 40% by 2030; prioritize energy renovation of municipal and residential buildings; expand renewable integration (solar, biomass, district heating); strengthen local energy governance through ALEC and regional partners.	200+ municipal buildings retrofitted with LED and automation; 27% reduction in energy use and 39% GHG drop since 2008; district heating network extended and partially decarbonized; low-income housing retrofits through subsidy programs; improved monitoring via metropolitan energy observatory.	Funding and staff capacity constraints slow implementation pace; regulatory complexity and administrative delays; insufficient engagement of private sector and condominium owners; reliance on national incentives; need for more granular building-level monitoring and evaluation.

Cross-case Insights of the French cases

Common strengths and weaknesses

Strengths

- ✓ Structured and mandatory planning: All three cities are embedded in the PCAET framework, ensuring strategic continuity, regular updates, and institutional accountability. This legal obligation fosters better coordination between municipal departments and inter-municipal authorities.
- ✓ Robust governance and stakeholder systems: Existence of local climate/energy agencies (ALEC) and participatory platforms contributes to clear role distribution and data sharing. Cit'ergie certification (Metz, Lille) strengthens energy management standards and continuous improvement cycles.
- ✓ Advanced public building renovation: Each city achieved substantial reductions in public-sector energy use (Paris ~20–40%, Lille 27%, Metz 17% in flagship sites). Integration of monitoring systems and smart metering technologies improved accountability and data-driven decision-making.
- ✓ Decarbonization of district heating and renewable integration: Paris and Lille advanced in connecting new users and incorporating renewable/waste heat sources; Metz used Intracting and local financing to strengthen implementation capacity.
- ✓ Culture of evaluation and learning: Regular assessments and external audits have embedded evaluation practices, encouraging adaptation and learning across successive plans.

Weaknesses

- ✓ Limited impact in private sector renovation: Despite strong institutional frameworks, private housing retrofits remain slow due to financial risk, administrative complexity, and fragmented ownership structures.
- ✓ Dependence on national instruments: Local progress relies heavily on national subsidies (e.g., MaPrimeRénov', ADEME programs), reducing municipal autonomy and flexibility.
- ✓ Human resource and technical constraints: Staff shortages, high turnover, and limited technical capacity restrict the scale of implementation and monitoring depth.
- ✓ Monitoring indicators too aggregated: Data systems are often robust at the strategic level but lack fine-grained tracking for individual buildings or actions.
- ✓ Persistent car dependence: Broader climate objectives are slowed by transport-related emissions, which limit the co-benefits of building energy progress.

Patterns in building-related effectiveness

Public buildings lead in measurable performance:

- ✓ Across all cities, municipal building stock retrofits deliver clear energy and GHG savings, driven by internal financing and performance monitoring.
- ✓ Leadership by example through schools, administrative buildings, and social housing proved effective in maintaining political commitment.

Private sector engagement remains fragile:

- ✓ Despite advisory platforms and subsidy programs, private and condominium retrofits lag behind targets due to cost barriers and coordination issues.
- ✓ Citizen participation mechanisms exist but remain underused for energy renovation campaigns.

Financial and institutional innovation as success levers:

- ✓ Intracting in Metz, Cit'ergie in Lille, and Paris's carbon fund illustrate the role of innovative financing and performance-based tools in sustaining long-term renovation cycles.
- ✓ Cities with multi-level partnerships (ADEME, regional funds) showed higher effectiveness in maintaining implementation momentum.

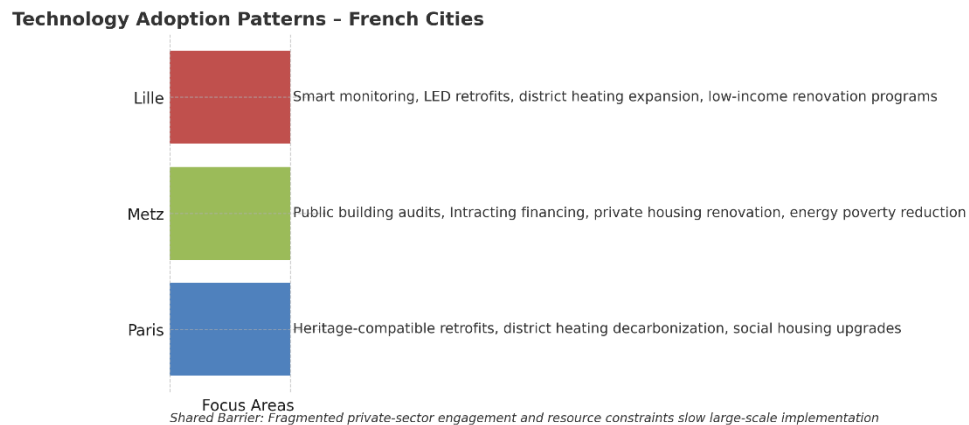
Organizational learning and evaluation maturity:

- ✓ Continuous monitoring (through ALEC, observatories, Cit'ergie) strengthened internal knowledge sharing and allowed adaptive management.
- ✓ Evaluation frameworks increasingly integrate both quantitative and qualitative indicators, reflecting a transition from compliance to performance culture.

Effectiveness vs. scale challenge:

- ✓ Although progress is evident, none of the cities achieved the scale required to reach 2030 targets; actions remain more project-based than systemic.
- ✓ Effectiveness in buildings is therefore high in institutionalization, moderate in implementation, and limited in transformation capacity.

Figure 43: Technology Adoption Patterns in Building-Related Effectiveness in French Cases



Results of MAXQDA analysis

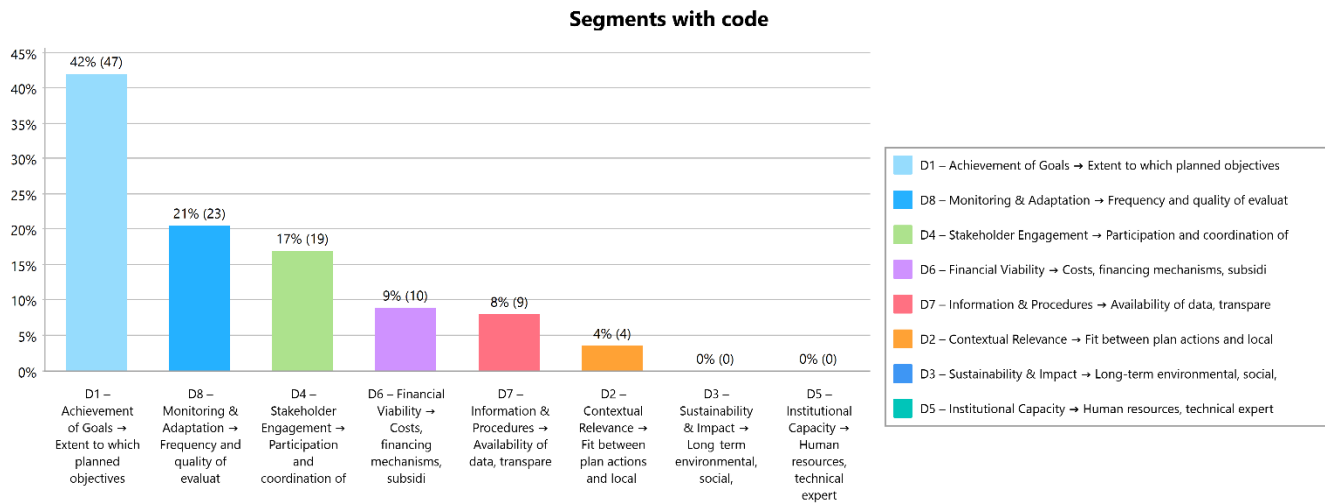
Distribution of Effectiveness Dimensions Across All Cases

Paris:

This chart shows (Figure 44) the relative weight of effectiveness dimensions across all themes in Paris. The leading factor is Achievement of Goals (D1), which dominates with 42% of coded segments (47 mentions), showing that success is mainly judged by how well objectives were met. The second strongest factor is Monitoring & Adaptation (D8) at 21% (23 mentions), highlighting the importance of regular evaluations and adjustments. Stakeholder Engagement (D4) also plays a significant role at 17% (19 mentions), underlining the importance of participatory processes. Financial viability (D6, 9%) and information transparency (D7, 8%) play moderate roles, while contextual fit (D2, 4%) appears marginal. Long-term sustainability (D3) and institutional capacity (D5) are not explicitly coded here.

For Paris, effectiveness is perceived above all as goal achievement and monitoring, implementation success, and the ability to adjust plans are more decisive than broader contextual or institutional factors.

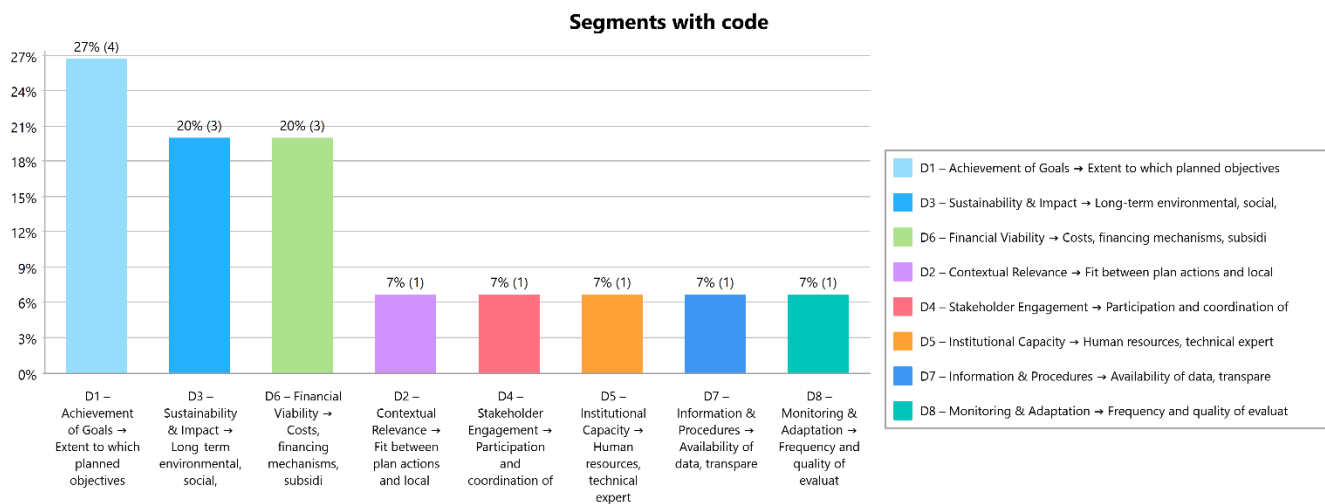
Figure 44: Effectiveness Dimensions (All Themes) in Paris



For Paris in the buildings sector, the distribution of effectiveness dimensions is more balanced compared to the “all themes” view. While Achievement of Goals (D1) still ranks highest at 27% (4 mentions), two new factors rise in importance: Sustainability & Impact (D3) and Financial Viability (D6), both at 20% (3 mentions each). This indicates that in building-related actions, long-term benefits and economic feasibility are nearly as important as meeting objectives. Other dimensions (D2 Contextual Relevance, D4 Stakeholder Engagement, D5 Institutional Capacity, D7 Information & Procedures, and D8 Monitoring & Adaptation) each appear at 7% (1 mention), suggesting they play secondary but still present roles.

Paris buildings highlight a triad of priorities: achieving concrete goals, ensuring projects are financially viable, and delivering sustainable impacts. Unlike the all-themes case, where monitoring and participation were strong, here, sustainability and finance weigh more heavily.

Figure 45: Effectiveness Dimensions (Buildings) in Paris



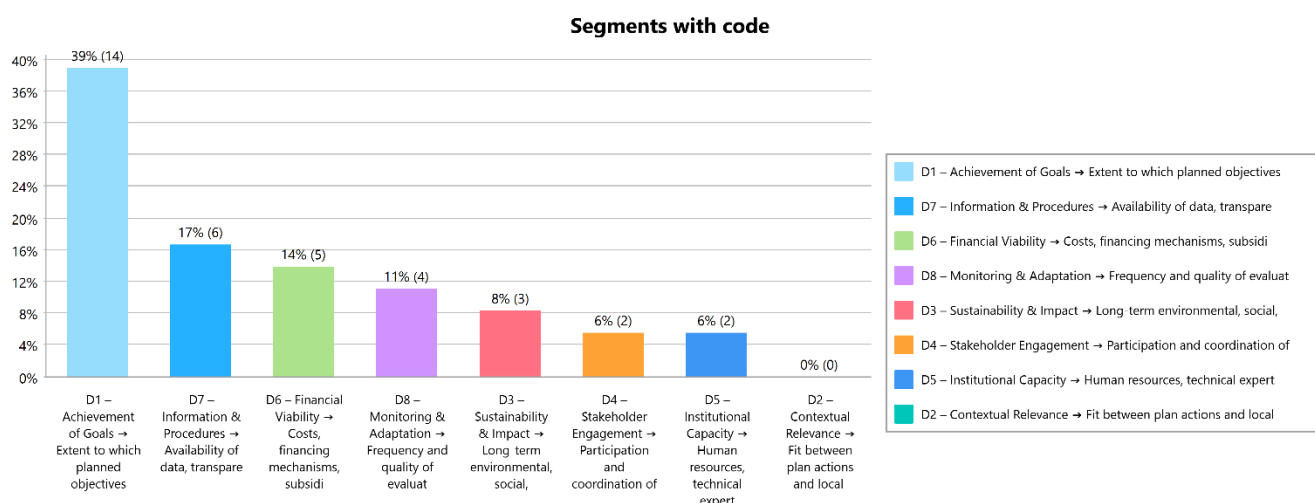
In Paris, the comparison between all themes and the building sector highlights notable shifts in emphasis. Across all themes, the effectiveness of local energy plans is strongly dominated by the achievement of goals (D1, 42%), followed by monitoring and adaptation (D8, 21%) and stakeholder engagement (D4, 17%), while sustainability (D3) and institutional capacity (D5) are entirely absent. In contrast, within the buildings sector, although goal achievement (D1, 27%) remains the leading factor, sustainability and impact (D3, 20%) and financial viability (D6, 20%) gain almost equal prominence. This indicates that in buildings, longer-term environmental outcomes and financing conditions are considered just as crucial as immediate goal attainment, whereas in the broader perspective of all themes, the focus is more on short-term progress, oversight, and governance.

Mets:

For Metz (All Themes), the distribution of effectiveness dimensions shows a clear dominance of goal achievement (D1, 39%), highlighting the strong emphasis on meeting planned objectives as the main marker of effectiveness. The next key variable is information and procedures (D7, 17%), reflecting the importance of transparent data and procedural clarity, followed by financial viability (D6, 14%), pointing to the relevance of costs, subsidies, and funding mechanisms. Monitoring and adaptation (D8, 11%) also plays a role, stressing the value of regular evaluation and plan adjustments. Lower shares are assigned to sustainability and impact (D3, 8%), stakeholder engagement (D4, 6%), and institutional capacity (D5, 6%), while contextual relevance (D2, 0%) is absent.

This suggests that in Metz, the evaluation of local energy plans is highly results-oriented, but unlike Paris, transparency of procedures and financial resources are more central to defining effectiveness. Long-term sustainability and stakeholder participation are less prioritized, showing a narrower, performance-driven focus.

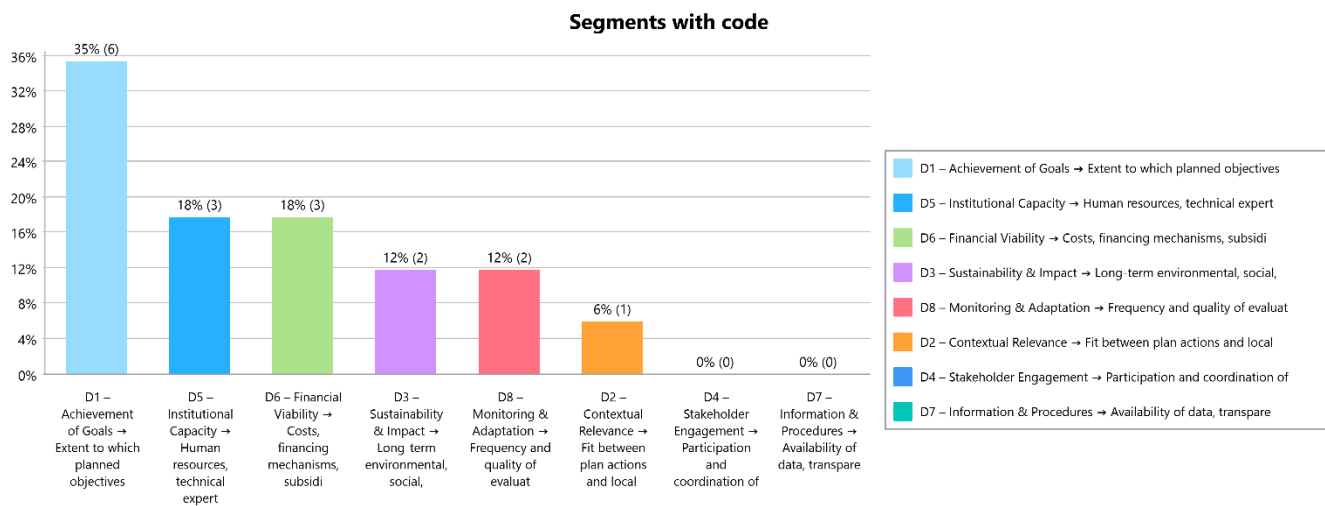
Figure 46: Effectiveness Dimensions (All themes) in Mets



For Metz – Buildings, the dominant dimension is again achievement of goals (D1, 35%), confirming that effectiveness is judged primarily in terms of whether planned objectives are met. Interestingly, institutional capacity (D5, 18%) emerges strongly here, highlighting the importance of human and technical resources

when implementing energy measures at the building level. This is coupled with financial viability (D6, 18%), showing that subsidies, costs, and financing schemes are decisive for household- and building-focused actions. Secondary but still significant dimensions include sustainability & impact (D3, 12%) and monitoring & adaptation (D8, 12%), pointing to long-term benefits and evaluation mechanisms. Contextual relevance (D2, 6%) appears marginal, while stakeholder engagement (D4) and information & procedures (D7) are absent, suggesting less emphasis on participatory processes and transparency compared to other cases. This profile underlines that in Metz's building-level actions, effectiveness is resource- and implementation-driven, with technical capacity and financial support becoming as important as meeting goals.

Figure 47: Effectiveness Dimensions (Buildings) in Metz



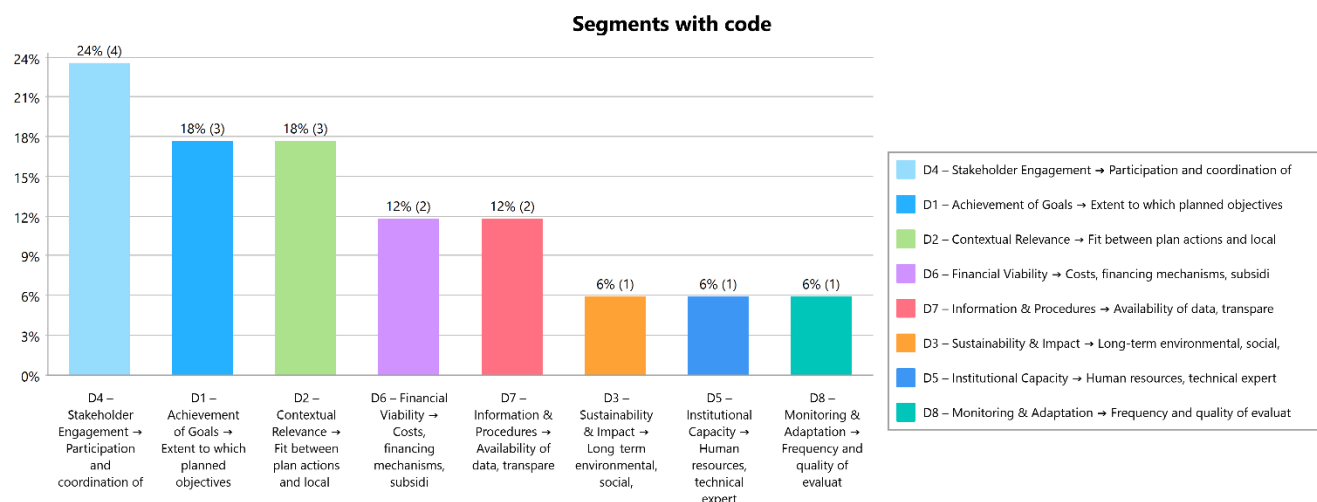
In Metz, both the all-themes and building-level analyses underline achievement of goals (D1) as the strongest dimension (39% vs. 35%), showing that success continues to be measured mainly by the extent to which objectives are met. However, the emphasis shifts when focusing only on buildings: institutional capacity (D5, 18%) becomes much more prominent compared to the all-themes dataset, where it had only a minor role (6%). This reflects how building projects rely heavily on technical staff and expertise for execution. Financial viability (D6) is important in both (14% vs. 18%), but at the building level it stands out equally with capacity as a critical enabler. Conversely, information & procedures (D7) and stakeholder engagement (D4), more visible in the all-themes perspective, are less relevant for building actions, where practical resources and financing dominate.

Lille:

In Lille, the most influential dimension is stakeholder engagement (D4, 24%), highlighting the city's strong reliance on collaboration, participation, and coordination across actors to implement energy plans. The second most important dimension is achievement of goals (D1, 18%), showing that concrete results and the extent to which objectives are met remain key markers of success. Alongside these, contextual relevance (D2, 18%) is equally central, underlining that strategies must be adapted to local conditions to be effective. Financial viability (D6, 12%) and information & procedures (D7, 12%) also play relevant supporting roles, pointing to the need for adequate funding mechanisms and transparent processes. By

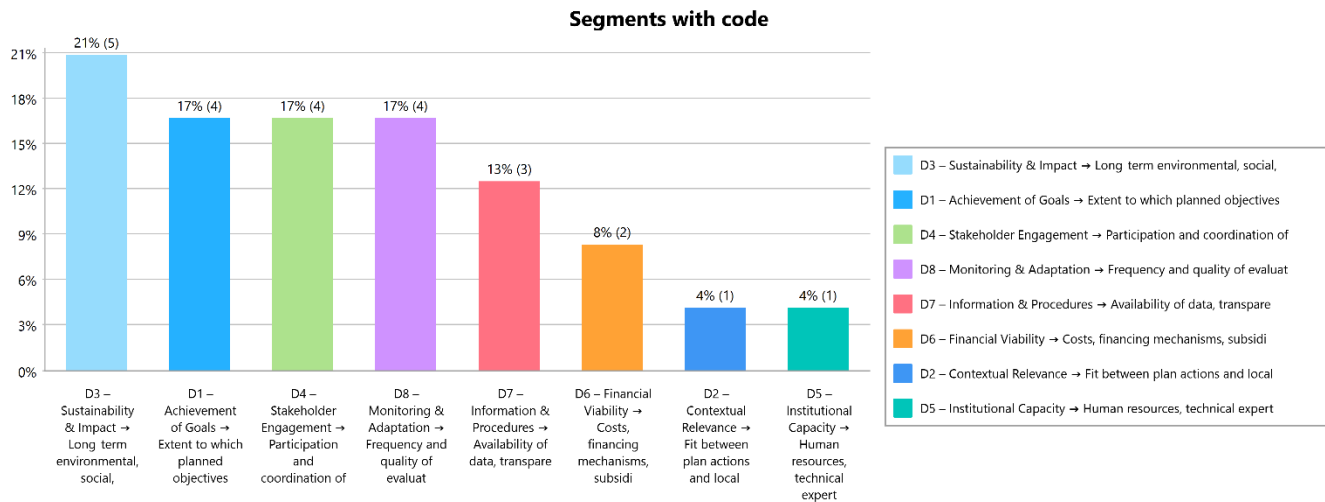
contrast, sustainability & impact (D3), institutional capacity (D5), and monitoring & adaptation (D8) each have a minor presence (6%), suggesting they are less emphasized compared to Paris or Metz.

Figure 48: Effectiveness Dimensions (All Themes) in Lille



In the Lille building sector, the most emphasized dimension is sustainability & impact (D3, 21%), indicating a strong concern with the long-term environmental, social, and economic benefits of building-related actions. This is followed by achievement of goals (D1, 17%), stakeholder engagement (D4, 17%), and monitoring & adaptation (D8, 17%), all equally important, showing that performance measurement, collaboration, and flexibility are central to implementing building measures effectively. Information & procedures (D7, 13%) also plays a relevant role, pointing to the need for clear and transparent data processes. Financial viability (D6, 8%) appears less emphasized compared to other French cases, suggesting that funding and cost issues are present but not dominant. Finally, contextual relevance (D2, 4%) and institutional capacity (D5, 4%) show limited significance, reflecting that adaptation to local contexts and available technical resources are not major concerns in Lille's building dimension compared to other drive

Figure 49: Effectiveness Dimensions (Buildings) in Lille



When comparing all themes with the building sector in Lille, some interesting differences emerge. In the all-themes analysis, stakeholder engagement (D4, 24%) stands out as the dominant dimension, followed closely by achievement of goals (D1, 18%) and contextual relevance (D2, 18%), showing a strong emphasis on collaboration, alignment of plans, and goal achievement across broader strategies. By contrast, in the building-specific analysis, the top priority shifts toward sustainability & impact (D3, 21%), with a balanced emphasis on achievement of goals (D1, 17%), stakeholder engagement (D4, 17%), and monitoring & adaptation (D8, 17%). This indicates that, while collaboration and coordination dominate across all themes, in the building sector the long-term sustainability of actions and the ability to adapt through monitoring become more prominent. Moreover, financial viability (D6) and institutional capacity (D5) play a larger role in the all-themes analysis compared to buildings, where they are less central. Overall, this suggests that Lille's broader strategies rely on institutional and financial structures, whereas building-specific actions focus more strongly on environmental sustainability and practical monitoring processes.

Comparison Across French Cities:

Comparison Across French Cities – All Themes

Across the French cities, Achievement of Goals (D1) consistently dominates, reflecting a strong policy orientation toward meeting established objectives. Paris shows the highest concentration of D1 and Monitoring & Adaptation (D8), emphasizing a results-driven and evaluative approach. Metz, while also goal-oriented, balances this with notable attention to Financial Viability (D6) and Information & Procedures (D7), indicating stronger concern with implementation resources and data transparency. Lille, by contrast, shifts the focus toward Stakeholder Engagement (D4) and Contextual Relevance (D2), highlighting governance participation and alignment with local needs.

Overall, while goal achievement and monitoring are shared anchors across the three cities, Paris represents a more performance-oriented profile, Metz reflects managerial and procedural attention, and Lille stresses participatory and contextual dimensions in implementation.

Comparison Across French Cities – Building Actions

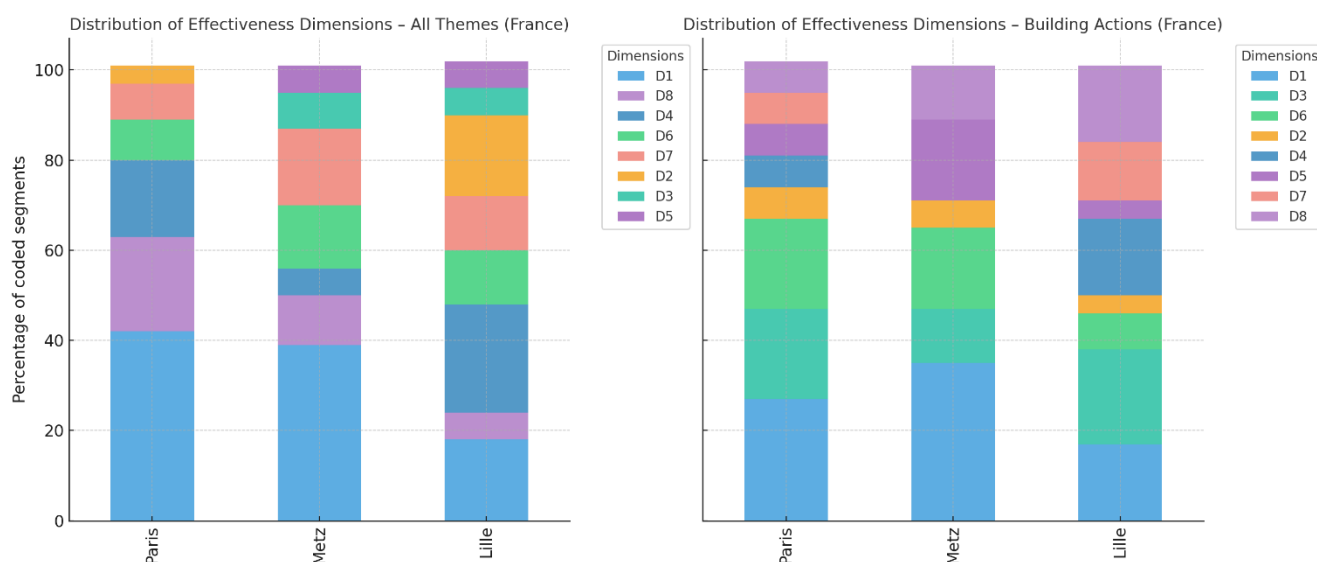
When narrowing the focus to building-related actions, the picture again shifts. While Achievement of Goals (D1) is consistently prominent, the secondary emphases vary sharply across the three cities.

- Paris places the strongest weight on Achievement of Goals (27%), but also highlights Sustainability & Impact (D3, 20%) and Financial Viability (D6, 20%), showing concern with balancing environmental ambitions and the economic feasibility of retrofits.
- Metz again emphasizes Achievement of Goals (35%), but its secondary focus is on Institutional Capacity (D5, 18%) and Financial Viability (D6, 18%), pointing to the importance of governance structures and financial resources to enable implementation.
- Lille presents a different picture, where Sustainability & Impact (D3, 21%) actually overtakes goal achievement. Here, Achievement of Goals (D1, 17%), Stakeholder Engagement (D4, 17%), and Monitoring & Adaptation (D8, 17%) are equally stressed, underlining the role of collective participation and adaptive processes alongside sustainability goals.

Overall, the French building-focused results show a distinctive pattern compared to the Italian ones:

- D1 (Achievement of Goals) remains central, but
- In France, sustainability (D3) and institutional capacity (D5) are much more visible than in Italy.
- Paris frames building challenges around sustainability and financing, Metz around institutional resources and financial viability, and Lille around sustainability, participation, and adaptation. This suggests that while Italian SEAPs reveal operational barriers (finance, monitoring, data) in the building sector, French cases retain stronger emphasis on sustainability outcomes and institutional support even when narrowed to buildings.

Figure 50: A visual comparison of the three French cities in Buildings actions



Based on the visual comparison of the three French cities:

- Left chart (All Themes): All three cities still show a strong orientation toward Achievement of Goals (D1), but with important differences. Paris combines this with strong emphasis on Monitoring & Adaptation (D8) and Stakeholder Engagement (D4), pointing to evaluation and coordination as key. Metz highlights Institutional Capacity (D5) and Financial Viability (D6) alongside D1, stressing resources and financing. Lille, by contrast, gives top weight to Stakeholder Engagement (D4), with D1 and Contextual Relevance (D2) following close, showing a participatory and context-sensitive profile.
- Right chart (Building Actions): Again, D1 (Achievement of Goals) is central, but the supporting priorities diverge. Paris places strong attention on Sustainability & Impact (D3) and Financial Viability (D6), reflecting environmental outcomes and funding concerns. Metz balances D1 with Financial Viability (D6) and D5 (Institutional Capacity), underlining financial and human resource constraints in buildings. Lille stands out by putting Sustainability (D3) in the lead, followed by D1 and a mix of engagement and monitoring, suggesting that long-term impacts dominate the building discussion.

Table 31: Summary of the top two effectiveness dimensions for each French city

City	Top 2 (All Themes)	Top 2 (Building Actions)
Paris	D1 Achievement of Goals & D8 Monitoring & Adaptation	D1 Achievement of Goals & D3 Sustainability & Impact
Metz	D1 Achievement of Goals & D7 Information & Procedures	D1 Achievement of Goals & D5 Institutional Capacity
Lille	D4 Stakeholder Engagement & D1 Achievement of Goals	D3 Sustainability & Impact & D1 Achievement of Goals

Generally, across the three French cities, D1 (Achievement of Goals) dominates in both all-themes and building-focused discussions.

- In the all-themes layer, cities diverge: Paris stresses monitoring, Metz stresses information and procedures, Lille stresses stakeholder engagement.
- In the building layer, a different pattern emerges: Paris highlights sustainability and financing, Metz emphasizes institutional capacity and finance, and Lille prioritizes sustainability, participation, and adaptation.
- Compared with Italy, French cases remain more future-oriented, keeping sustainability and institutions at the center of building strategies, rather than narrowing mainly to finance and data.

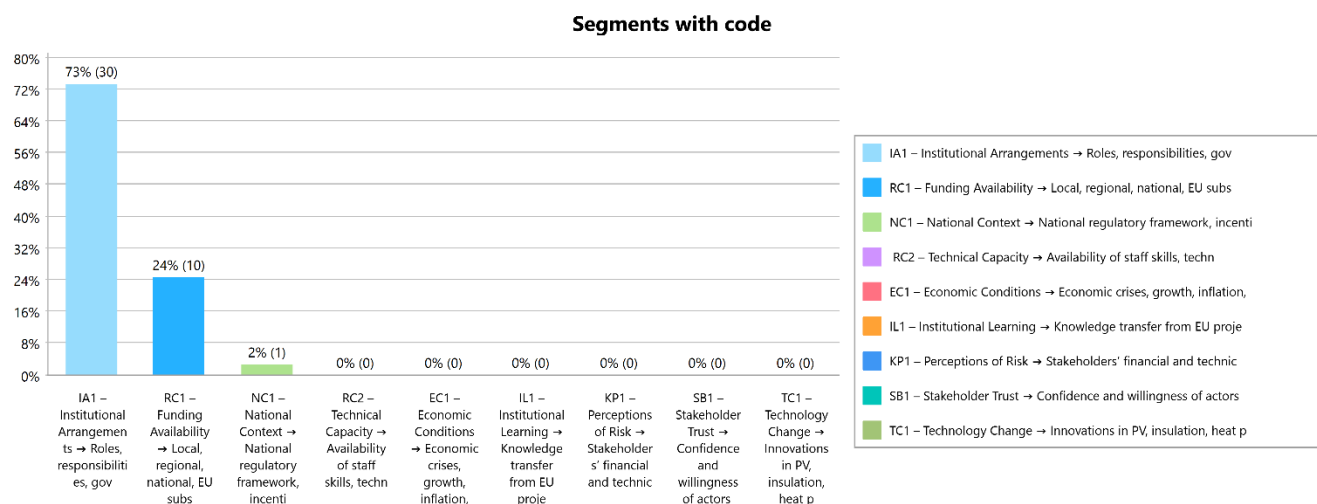
Distribution of Explanatory Variables

Paris

The Paris case is overwhelmingly shaped by Institutional Arrangements (IA1, 73%), which highlights the critical role of governance structures, distribution of responsibilities, and coordination across actors in

shaping climate and energy planning. This strong dominance suggests that institutional frameworks and clarity of roles are perceived as the most decisive factor for the city's overall strategies. The second most frequent factor is Funding Availability (RC1, 24%), pointing to the importance of financial resources, subsidies, and multi-level support in enabling implementation. Other variables, such as National Context (NC1, 2%), play only a marginal role, while dimensions like technical capacity, economic conditions, or stakeholder trust are absent from the broader narrative.

Figure 51: Frequency Distribution of Explanatory Variables- All themes (Paris)



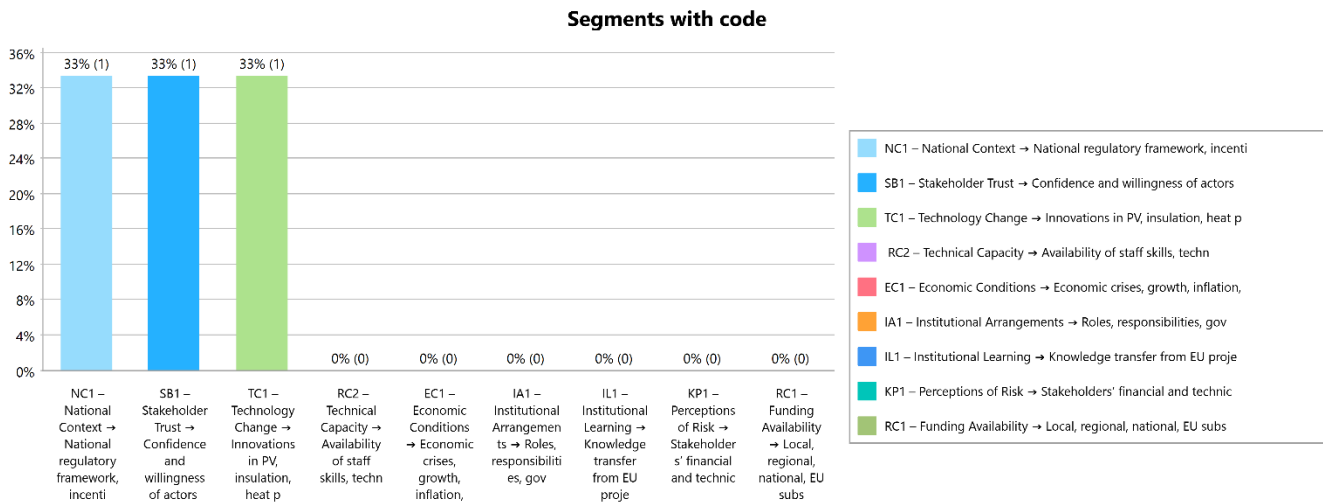
Paris (Buildings) – Explanatory Variables

In the building-focused layer, Paris shows a completely different pattern compared to the all-themes view. Instead of being dominated by governance and funding, the explanatory variables are distributed equally across National Context (NC1, 33%), Stakeholder Trust (SB1, 33%), and Technology Change (TC1, 33%). This highlights three critical factors in building-related actions:

- **National Context:** regulatory frameworks and incentives matter for enabling or constraining retrofitting and energy upgrades.
- **Stakeholder Trust:** confidence and willingness of actors play a major role in the success of building interventions.
- **Technology Change:** innovation in photovoltaics, insulation, and heating technologies is seen as a key driver for achieving targets.

All other explanatory factors—such as institutional arrangements, funding, or technical capacity—do not appear at all in the Paris building dataset.

Figure 52: Frequency Distribution of Explanatory Variables- Buildings (Paris)



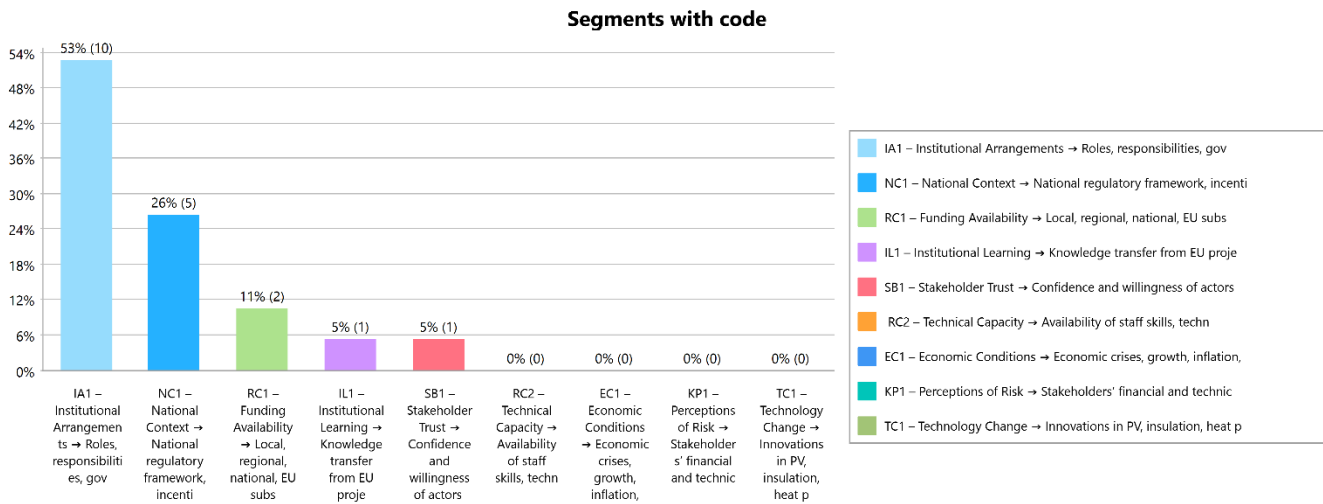
Overall, for Paris, the explanatory variables shift dramatically between the two perspectives. In the all-themes view, institutional arrangements and funding availability dominate, showing that governance structures and financial access frame the broader climate agenda. By contrast, in the building-specific layer, attention moves entirely to national regulations, stakeholder trust, and technological innovation. This indicates that while Paris relies on governance and funding to set its overall strategy, concrete building actions are driven by the interplay of external regulation, actor confidence, and available technological solutions.

Mets:

In the all-themes view for Metz, the analysis is overwhelmingly dominated by Institutional Arrangements (IA1, 53%), highlighting the importance of roles, responsibilities, and governance structures in shaping local climate planning and action. The second most significant factor is National Context (NC1, 26%), showing the weight of national regulatory frameworks and incentives. Funding Availability (RC1, 11%) also appears as a notable though secondary driver, pointing to the importance of local, regional, national, and EU subsidies in enabling projects.

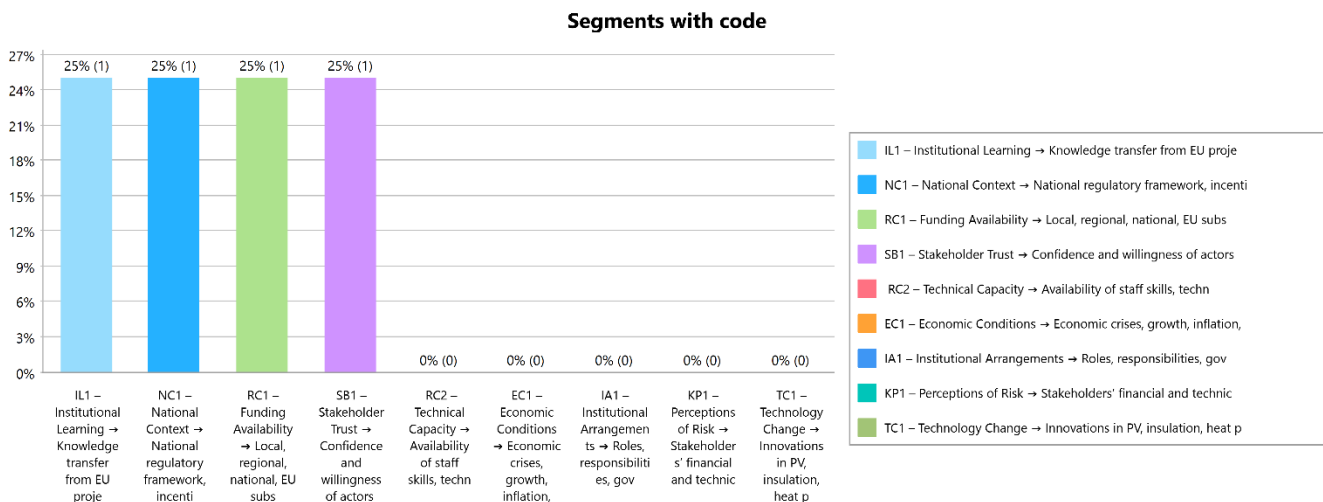
Other factors, such as Institutional Learning (IL1, 5%) and Stakeholder Trust (SB1, 5%), are present but marginal, suggesting limited recognition of knowledge transfer and actor confidence in broader planning discussions. Notably, variables such as technical capacity, economic conditions, risk perception, or technology innovation do not appear at all in the all-themes discourse.

Figure 53: Frequency Distribution of Explanatory Variables- All themes (Mets)



For the building sector in Metz, the explanatory variables are evenly distributed across four categories, each representing 25%: Institutional Learning (IL1), highlighting the role of knowledge transfer from EU projects; National Context (NC1), reflecting the impact of regulatory frameworks and incentives; Funding Availability (RC1), stressing reliance on financial mechanisms at local, regional, national, or EU levels; and Stakeholder Trust (SB1), capturing the confidence and willingness of actors. No other variables appear in this dataset, showing a concentrated but balanced mix of governance, financial, contextual, and actor-related dimensions.

Figure 54: Frequency Distribution of Explanatory Variables- Buildings (Mets)

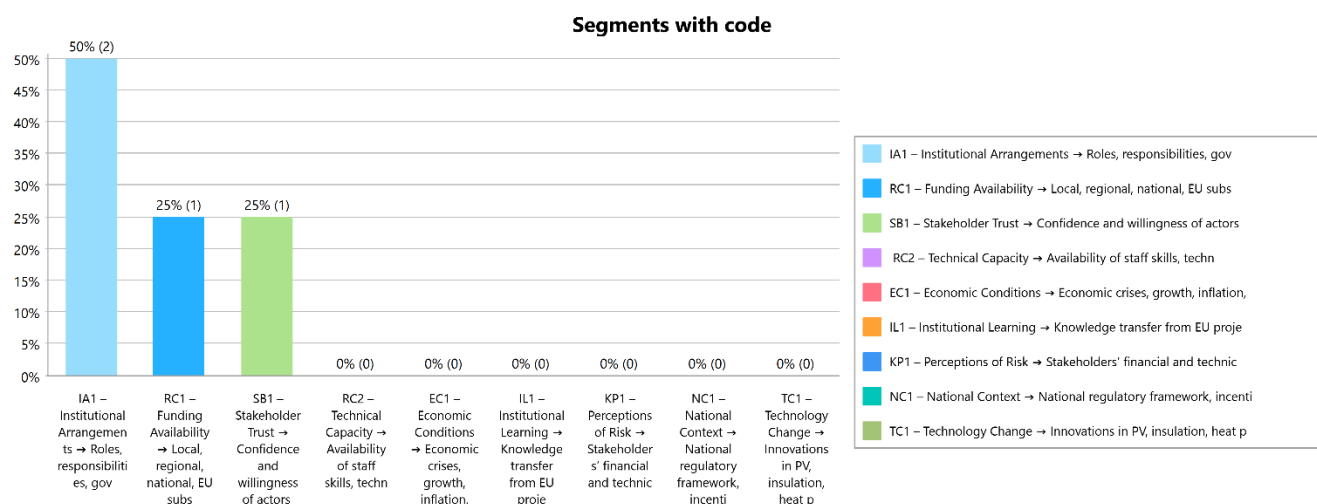


As a summary of the two parts in Metz, the all-themes level emphasized Achievement of Goals (D1) along with institutional capacity and financial viability. By contrast, in the building layer, explanatory variables shift toward an evenly distributed mix: knowledge transfer, regulation, finance, and trust. This indicates that while the broader strategy highlight's goal achievement and resources, effective implementation in buildings depends on combining external enablers with actor engagement and learning processes.

Lille:

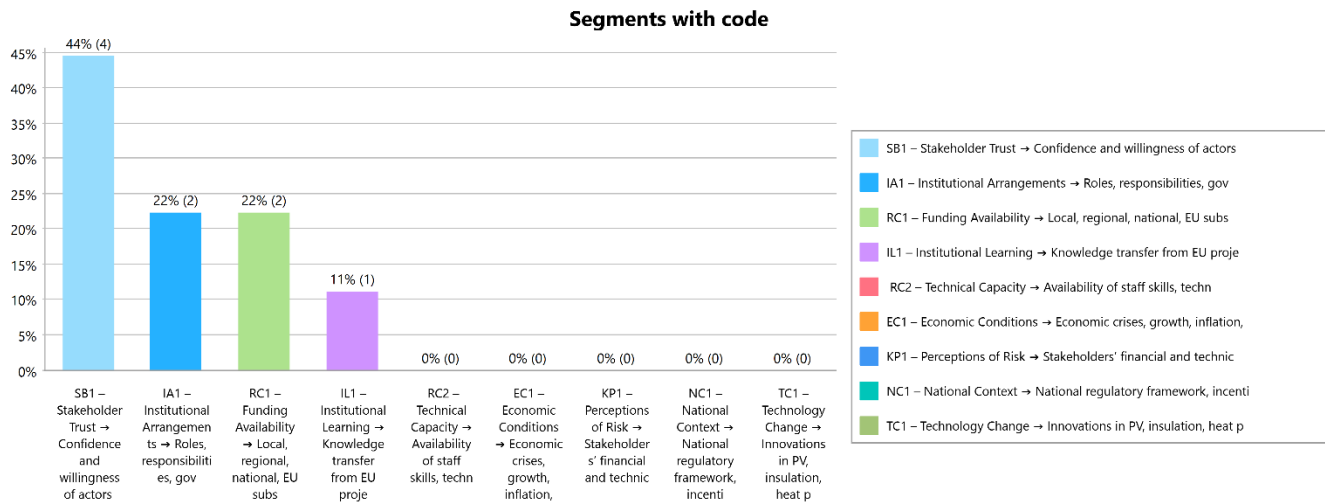
For Lille at the all-themes level, the analysis is dominated by Institutional Arrangements (IA1), which accounts for 50% of the explanatory variables. This highlights the centrality of governance structures, role allocation, and coordination in shaping the effectiveness of climate and energy planning. Secondary but still notable factors are Funding Availability (RC1) at 25%, which reflects the importance of financial support at local, national, and EU scales, and Stakeholder Trust (SB1) also at 25%, indicating that confidence and willingness among actors play an important role in the city's overall climate governance.

Figure 55: Frequency Distribution of Explanatory Variables- All themes (Lille)



For Lille's building-related actions, the most prominent explanatory factor is Stakeholder Trust (SB1), accounting for 44% of coded references. This suggests that the confidence and willingness of actors are particularly critical in enabling building-related initiatives, such as retrofits or efficiency programs. Following this, Institutional Arrangements (IA1) and Funding Availability (RC1) both stand at 22%, reflecting the dual importance of governance structures and financial resources in supporting building interventions. A smaller but still visible role is played by Institutional Learning (IL1) at 11%, pointing to some relevance of knowledge transfer from EU-level projects into local practice.

Figure 56: Frequency Distribution of Explanatory Variables- Buildings (Lille)



Comparison Across French Cities- Explanatory Variables:

Across the French cases, three main patterns stand out:

1. **Governance first, but uneven** → Paris and Metz strongly emphasize **Institutional Arrangements (IA1)** as the foundation of effective planning, while Lille gives it less weight, relying more on actor trust and collaboration.
2. **Finance and Trust interplay** → **Funding Availability (RC1)** emerges in all three cities, but always as a secondary factor. Lille, uniquely, places strong weight on **Stakeholder Trust (SB1)**, underlining that local willingness and confidence are decisive for building-related measures.
3. **Learning and Innovation** → Paris highlights **Technology Change (TC1)** in buildings, while Metz includes **Institutional Learning (IL1)**. This suggests that while governance and finance remain structural enablers, building actions depend heavily on knowledge transfer and innovation capacity.

This indicates that, compared to Italy, French PCET/PCAETs are less dominated by risk perception but more attentive to institutional learning and stakeholder trust, with governance and funding still central.

All-Themes Layer

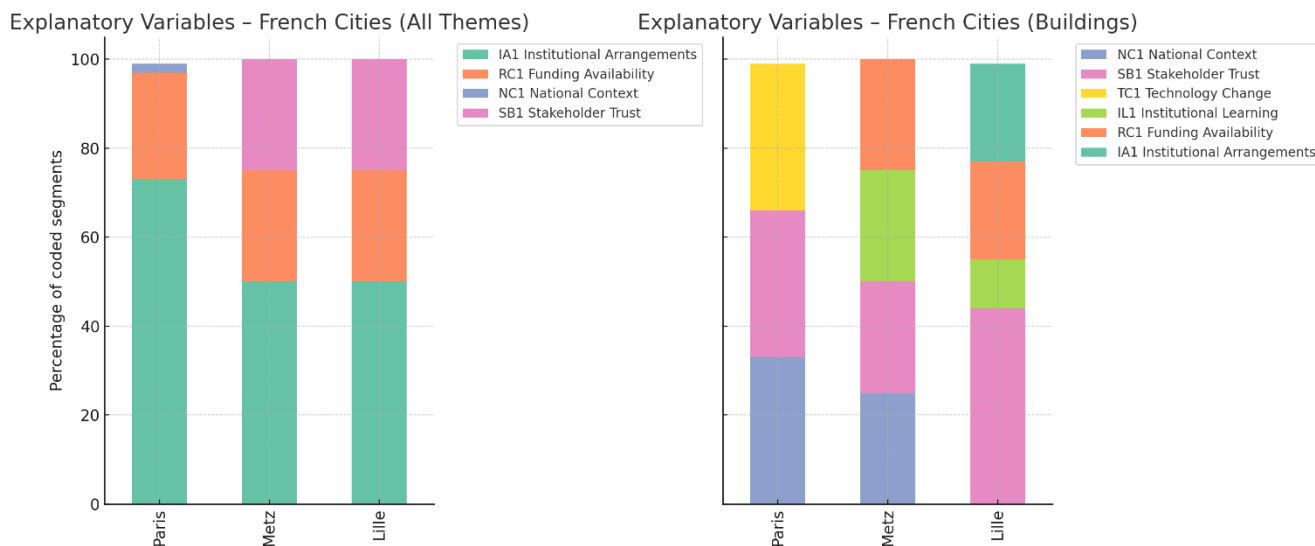
In the all-themes analysis, Paris is overwhelmingly driven by Institutional Arrangements (IA1, 73%), complemented by Funding Availability (RC1, 24%), showing a strong governance-finance nexus. Metz shows a more balanced mix, with IA1 (50%) supported by both RC1 (25%) and SB1 (25%), suggesting governance still dominates, but trust and financial access also matter. Lille, by contrast, places less emphasis on governance and instead highlights IA1 (50%) alongside RC1 (25%) and SB1 (25%), again giving greater room to trust than Paris.

Building Actions Layer

In the building sector, the explanatory balance shifts. Paris diversifies, giving equal weight to National Context (NC1, 33%), Stakeholder Trust (SB1, 33%), and Technology Change (TC1, 33%), reflecting

regulatory alignment, trust, and innovation as equally important. Metz shows a four-way split, with Institutional Learning (IL1, 25%), NC1 (25%), RC1 (25%), and SB1 (25%), highlighting the role of EU-driven knowledge, national frameworks, finance, and trust. Lille centers on Stakeholder Trust (SB1, 44%), with secondary weight to IA1 (22%), RC1 (22%), and IL1 (11%), indicating that building retrofits in Lille are above all shaped by local willingness and actor collaboration.

Figure 57: A visual comparison across French Cities about the Explanatory Variables



Based on the above visual Comparison,

- **Left (All Themes):** Paris and Metz show strong reliance on governance (IA1), while Lille balances governance, finance, and trust.
- **Right (Buildings):** Paris adds context and technology, Metz broadens to institutional learning, while Lille prioritizes trust, supported by governance and finance.

Table 32: A summary table of the top two explanatory variables per French city, comparing All Themes vs. Building Actions

City	Top Variable (All Themes)	Second Variable (All Themes)	Top Variable (Buildings)	Second Variable (Buildings)
Paris	IA1 Institutional Arrangements	RC1 Funding Availability	NC1 National Context / SB1 Trust / TC1 Tech Change (all equal)	—
Metz	IA1 Institutional Arrangements	RC1 Funding / SB1 Trust (tie)	IL1 Institutional Learning / NC1 / RC1 / SB1 (all equal)	—
Lille	IA1 Institutional Arrangements	RC1 Funding / SB1 Trust (tie)	SB1 Stakeholder Trust	IA1 Governance / RC1 Funding

Based on the above table:

- **In Governance & Finance:** Paris and Metz stress institutional clarity and finance, while Lille distributes weight more evenly.

- **In Trust & Learning:** Lille highlights stakeholder trust (especially in buildings), while Metz brings in institutional learning, showing EU knowledge transfer matters.
- **In Technology & Context:** Paris is the only case where innovation and regulatory context (TC1, NC1) emerge strongly in buildings.

In sum, French PCAETs reveal a triangular foundation of governance, finance, and trust, with city-specific emphases: Paris focuses on governance and innovation (shifts from strong governance to diverse explanatory mix in buildings), Metz balances governance with finance, trust, and learning, and Lille pivots toward trust as the decisive building-sector factor.

It can be said that, compared to the Italian cases discussed in Chapter X (p.112), French cities demonstrate stronger institutional formalization through mandatory PCAET frameworks. While Italian cases rely more on voluntary SEAP structures and external incentives, French municipalities benefit from clearer regulatory integration but face higher administrative complexity. This contrast reinforces the cross-country finding that institutionalization shapes implementation continuity.

Interrelationships Between Effectiveness Dimensions

To complement the frequency analysis, co-occurrence mapping was used to examine how effectiveness dimensions and explanatory variables cluster together in practice (Hintz & Tucker, 2023).

Interrelationships Between Effectiveness Dimensions (France)

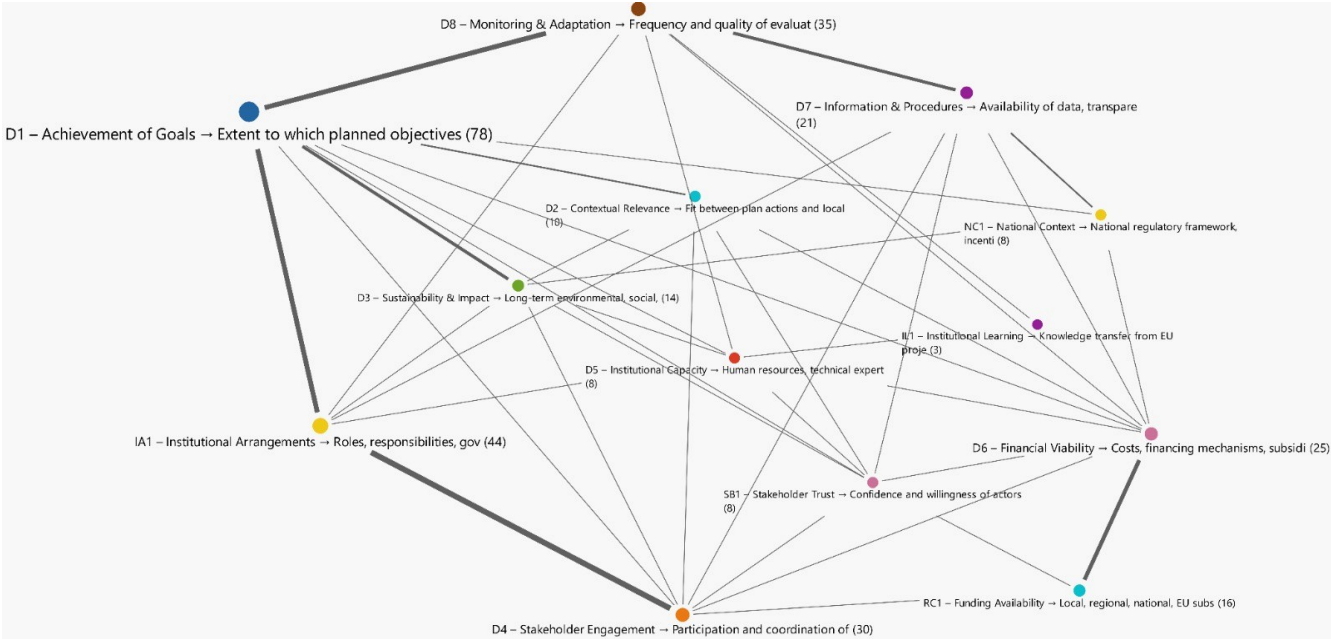
Figure 58 presents the code co-occurrence network for the French cases. The nodes represent effectiveness dimensions (D1–D8) and explanatory variables (e.g., RC1, IA1, SB1), while the connecting lines indicate the frequency with which two codes appear in the same text segment. The thickness of the lines reflects the strength of these associations.

The results highlight several strong interdependencies:

- Achievement of Goals (D1) emerges as the most central and frequently coded dimension, strongly connected to Institutional Arrangements (IA1) and Stakeholder Engagement (D4). This indicates that the discussion of goal achievement in French PCAETs is often framed through governance clarity and participatory processes. D1 also maintains significant ties to Monitoring & Adaptation (D8), pointing to the importance of evaluation practices in ensuring objectives are met.
- Institutional Arrangements (IA1) shows strong associations with Financial Viability (D6), Information & Procedures (D7), and Funding Availability (RC1), underlining the governance–finance nexus as a critical enabler of effective plan implementation.
- Stakeholder Engagement (D4) is not an isolated theme but is embedded in broader governance and resource discussions, linking both to financial variables and to social trust (SB1). This highlights the role of coordinated participation in bridging institutional structures with operational feasibility.
- Financial Viability (D6) and Monitoring (D8) serve as operational anchors, reinforcing the link between securing adequate funding and establishing systematic evaluation mechanisms.
- By contrast, dimensions such as Institutional Capacity (D5) and explanatory variables like Institutional Learning (IL1) or Technology Change (TC1) display weak or marginal connections, suggesting that capacity building, EU knowledge transfer, and technological innovation remain peripheral in the French discourse.

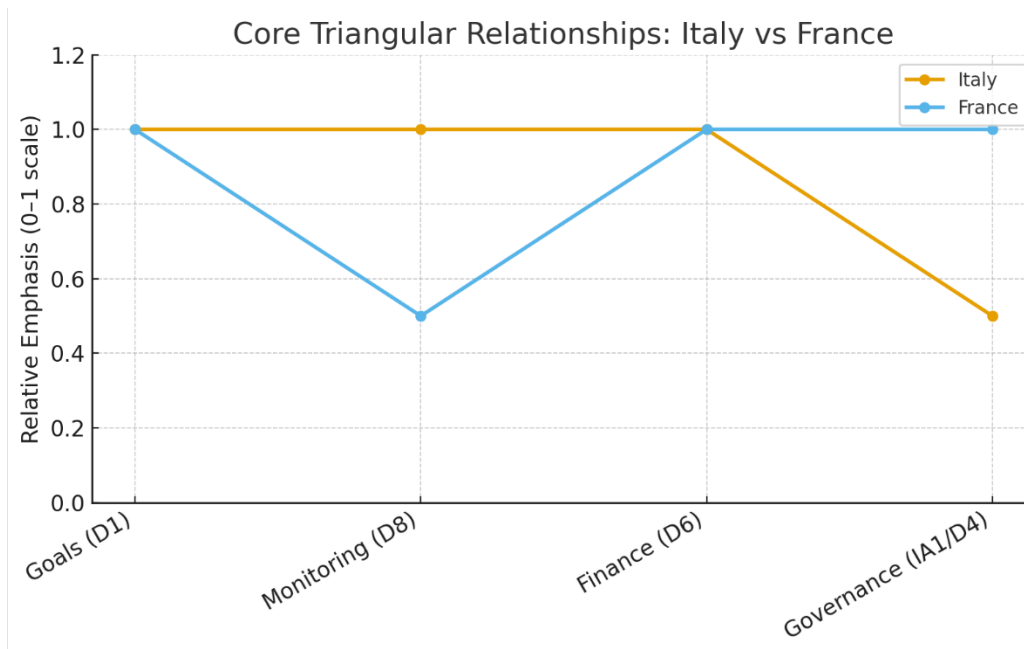
Taken together, these patterns suggest that French cities frame the effectiveness of their climate and energy plans primarily through a triangular relationship between goals, governance, and finance, with monitoring serving a supportive role. Compared with the Italian cases—where the triangular core was goals, monitoring, and finance—the French discourse places relatively greater emphasis on governance and participation as enabling conditions for achieving objectives.

Figure 58: Co-occurrence network of effectiveness dimensions and explanatory variables across the French cases



As a summary of both, a visual comparison (Figure 59) of the core triangular relationships in France vs Italy has been provided that illustrates the differences clearly as follows:

Figure 59: core triangular relationships in France vs Italy



And the result shows that in Italy, the narrative strongly emphasizes on Goals (D1), Monitoring (D8), and Finance (D6), while Governance (IA1/D4) plays a secondary but enabling role and in France, the triangle is built around Goals (D1), Finance (D6), and Governance (IA1/D4), while Monitoring (D8) is weaker in comparison.

Cross-Case Comparison

Code Distribution Models (single dimension across multiple cases)

The Code Distribution Model is used to:

4. **Visualize how specific codes are spread across multiple cases and datasets** (Kuckartz, 2014; Paulus & Lester, 2016).
 - Here, it shows how the importance of “Achievement of Goals” differs between cities and between “All Themes” datasets versus building-focused datasets.
5. **Enable cross-case comparison** (Miles, Huberman, & Saldaña, 2014; Yin, 2018).
 - By mapping code frequencies across cases, we can identify which dimensions are universally emphasized (common patterns) and which are case-specific (unique emphases).
6. **Link thematic depth with comparative analysis** (Bazeley & Jackson, 2013; Kuckartz & Rädiker, 2019).
 - This allows us to go beyond single-city interpretations and assess how consistently a particular theme (like goal achievement) is discussed across different contexts.

In short, this analysis helps demonstrate where effectiveness dimensions are more salient and ensures that the cross-case comparison is grounded in systematic coding patterns rather than anecdotal interpretation (Kuckartz & Shar, 2011; Rädiker, 2023). It has to be mentioned that the code distribution model was done for dimensions with the higher score compared to others, which have more than fifteen links.

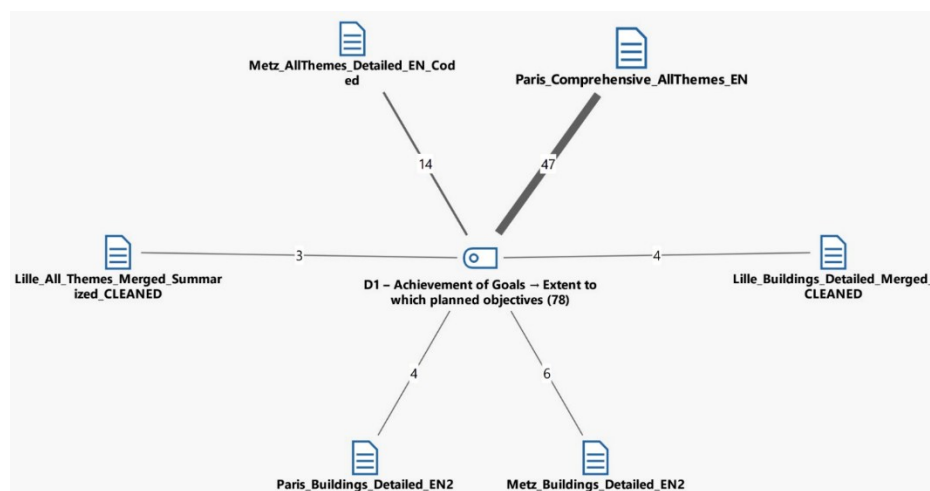
Code Distribution Models for French cases in all themes and buildings:

Figure 60 shows the distribution of the code “Achievement of Goals” (D1) across the French datasets, and the result of that illustrates:

- The highest frequency appears in Paris Comprehensive All Themes (47), confirming that goal achievement is most strongly discussed in the overarching Paris case.
- Metz All Themes (14) follows, also showing that broad, city-wide discourse emphasizes planned objectives.
- At the building level, frequencies are lower but still notable: Metz Buildings (6), Paris Buildings (4), and Lille Buildings (4) all register attention to achievement of goals, though less prominently than their comprehensive cases.
- Lille All Themes (3) shows the lowest emphasis overall, suggesting that in Lille, goal achievement is less central compared to Paris and Metz.

This distribution suggests that “Achievement of Goals” is a dominant and cross-cutting theme across all French cases, but its salience varies: Paris places particularly strong emphasis at the all-themes level, Metz shows a more balanced profile across all themes and buildings, while Lille demonstrates relatively weaker attention to this dimension in both comprehensive and building-level discussions.

Figure 60: Distribution of the code “Achievement of Goals” (D1) across the French datasets

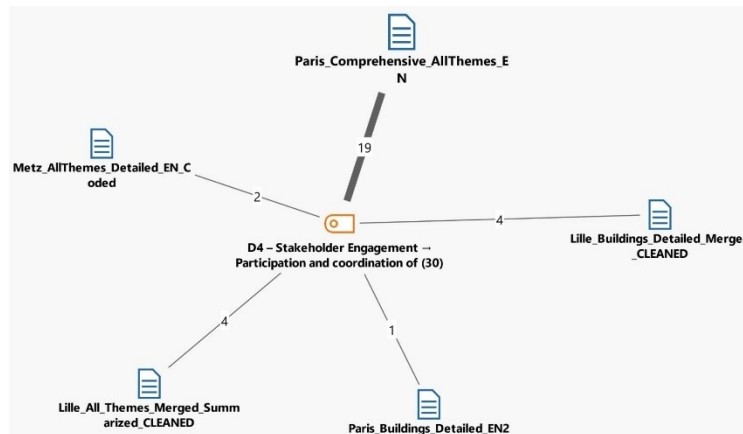


The next figure (Figure 61) shows the distribution of the code “Stakeholder Engagement” (D4) across the French datasets.

- The highest frequency appears in Paris Comprehensive All Themes (19), confirming that participation and coordination of actors are central concerns in the overarching Paris narrative.
- Both Lille All Themes (4) and Lille Buildings (4) register moderate attention, suggesting that in Lille, stakeholder participation is seen as important across both comprehensive and sectoral discussions.
- Metz All Themes (2) shows limited emphasis, while Paris Buildings (1) records only a marginal presence, pointing to weaker recognition of stakeholder engagement in building-specific debates.

Overall, this distribution suggests that stakeholder engagement is a dimension strongly foregrounded at the comprehensive level in Paris, moderately visible in Lille across both levels, and much less emphasized in Metz or Paris’s building sector. This indicates a French pattern where participation and coordination of actors are most explicitly acknowledged in overarching strategies, while operational, sectoral layers tend to downplay their role.

Figure 61: Distribution of the code “Stakeholder Engagement” (D4) across the French datasets.



The following Figure 62 shows the distribution of the code “Financial Viability” (D6) across the French datasets.

- The highest frequency appears in Paris Comprehensive All Themes (10), indicating that financial considerations—costs, subsidies, and funding mechanisms—are strongly emphasized in Paris at the strategic level.
- Metz All Themes (5) also shows notable attention, suggesting financial viability is a relevant factor for broader planning discussions in this city.
- Both Paris Buildings (3) and Metz Buildings (3) register similar mid-level concern, pointing to the importance of financing retrofits at the sectoral scale in these cities.
- By contrast, Lille All Themes (2) and Lille Buildings (2) show only limited references, implying that financial viability plays a less central role in Lille’s narrative compared to Paris and Metz.

Overall, the distribution suggests that financial viability is a cross-cutting issue across the French cases, but with a stronger presence in Paris and Metz, particularly in comprehensive planning layers. In Lille, financial concerns appear less pronounced, hinting that other explanatory factors—such as governance or trust—may take precedence in shaping the discourse.

Figure 62: distribution of the code “Financial Viability” (D6) across the French datasets.

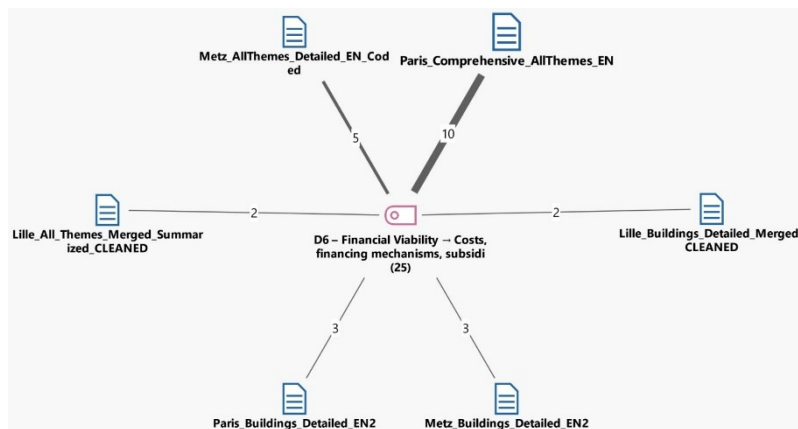


Figure 63 demonstrates the distribution of the code “Monitoring & Adaptation” (D8) across the French datasets.

- The highest frequency is observed in Paris Comprehensive All Themes (23), underscoring that evaluation practices and adaptive capacity are key concerns at the strategic level in Paris.
- Metz All Themes (4) and Lille Buildings (4) also show mid-level mentions, suggesting that both cities recognize the importance of monitoring processes, though at different scales—Metz in overall planning, Lille more explicitly in the building sector.
- Lower but still notable frequencies appear in Metz Buildings (2), Paris Buildings (1), and Lille All Themes (1), reflecting a weaker but still present discourse around evaluation in these contexts.

Overall, the distribution highlights that Paris leads in embedding monitoring and adaptation into comprehensive strategies, while Metz integrates these considerations moderately across both levels. Lille, in contrast, places more emphasis on monitoring in sectoral (building) actions rather than in broad all-themes planning.

This suggests a differentiated approach, where Paris is strategically evaluation-oriented, Metz maintains moderate but balanced attention, and Lille links monitoring primarily to operational, sectoral interventions.

Figure 63: Distribution of the code “Monitoring & Adaptation” (D8) across the French datasets

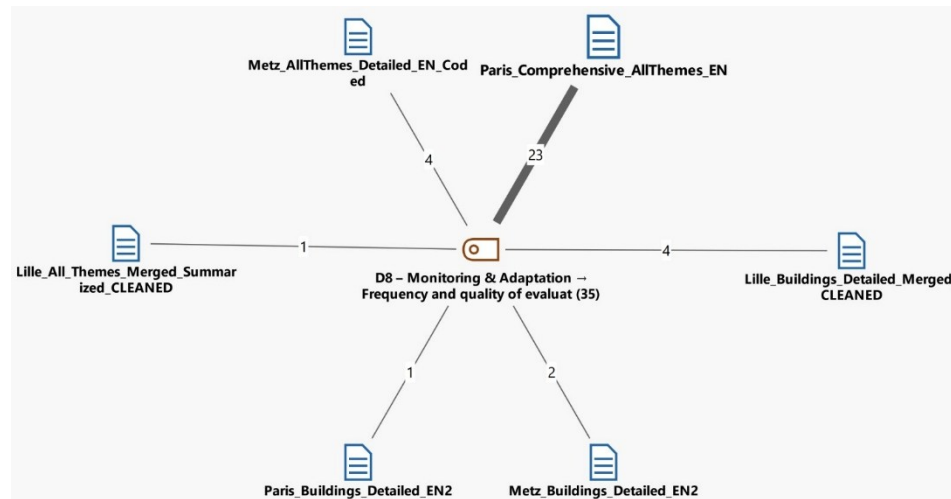
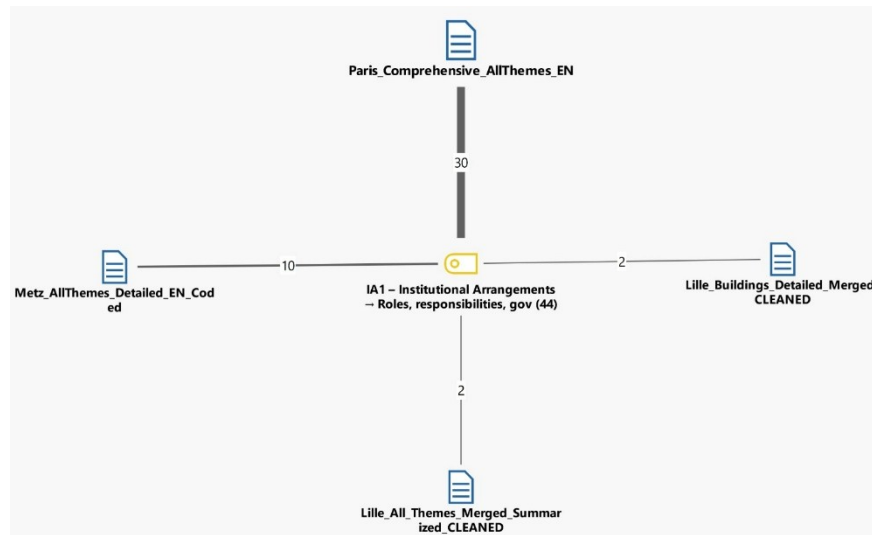


Figure 64 shows the distribution of the code “Institutional Arrangements” (IA1) from variables across the French datasets.

- The strongest emphasis is visible in Paris Comprehensive All Themes (30), underlining that governance clarity, roles, and responsibilities are central to how Paris frames its PCAET effectiveness. This suggests a strong reliance on well-structured institutional coordination in the capital’s comprehensive strategy.
- Metz All Themes (10) also places significant attention on governance, though at a lower scale, indicating that institutional arrangements are recognized but less dominant compared to Paris.
- In contrast, Lille All Themes (2) and Lille Buildings (2) show minimal references, suggesting that governance and institutional clarity are not as prominent in Lille’s discourse, either at the strategic or sectoral level.

Taken together, the distribution highlights a Paris-driven narrative where governance structures (IA1) are central to effectiveness, with Metz acknowledging institutional roles to a moderate degree, while Lille places little explicit emphasis on this dimension. Compared to other codes like monitoring (D8) or stakeholder engagement (D4), IA1 here appears to be a capital-city-led priority, less visible in smaller urban contexts.

Figure 64: Distribution of the code “Institutional Arrangements” (IA1) from variables across the French datasets



Two-Cases Models (direct pairwise comparisons)

Two-case comparisons help highlight convergences and divergences (Rädiker, 2023) across cities. By mapping which effectiveness dimensions (like goals, monitoring, or institutional arrangements) appear strongly in both cases, we can see whether cities are dealing with similar enabling conditions and barriers, or if they are shaped by distinct governance or contextual challenges.

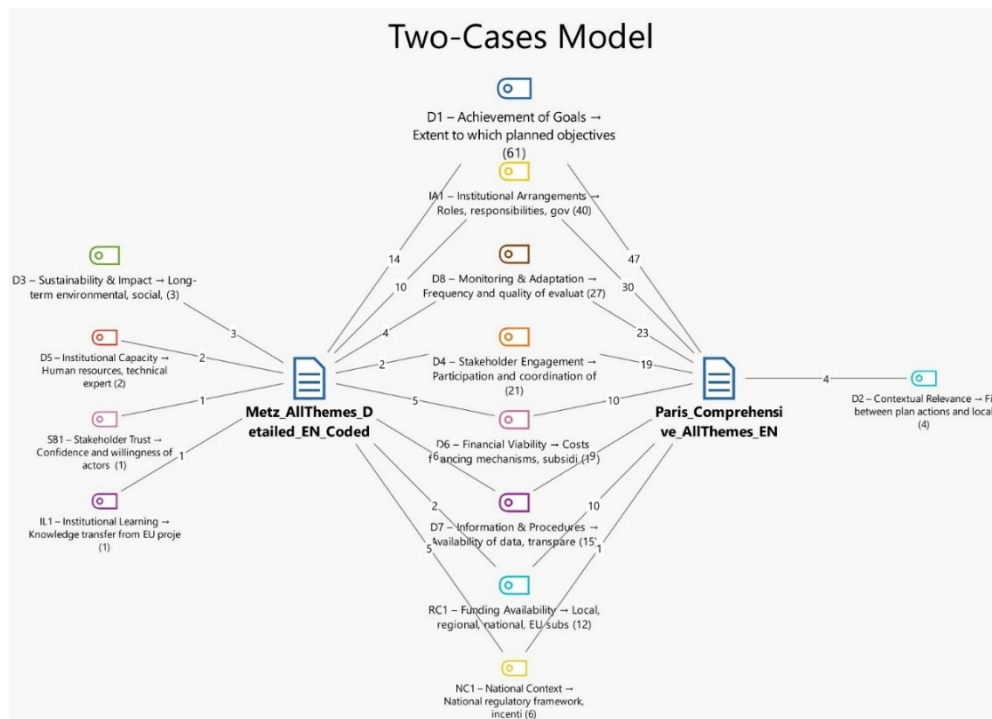
French cases across all thematic datasets

Paris –Mets (All themes Comparison)

In Paris, the analysis is dominated by Achievement of Goals (D1), strongly supported by Institutional Arrangements (IA1) and Monitoring & Adaptation (D8). Financial aspects — Financial Viability (D6) and Funding Availability (RC1) — are also significant, while Stakeholder Engagement (D4) and Information & Procedures (D7) highlight broader governance and participation concerns. In Metz, the same dimensions appear but with far lower intensity. Achievement of Goals (D1) is again most frequent, followed by Institutional Arrangements (IA1), Monitoring (D8), and Financial Viability (D6), though all at reduced levels. Metz additionally shows limited references to Sustainability (D3), Institutional Capacity (D5), and Stakeholder Trust (SB1), indicating a more fragmented profile.

Overall, Paris presents a comprehensive, governance- and finance-oriented narrative strongly anchored in monitoring and goal achievement, while Metz reflects a weaker, more dispersed emphasis with only modest attention across dimensions.

Figure 65: The Two-Cases Model for Paris and Metz across all thematic datasets

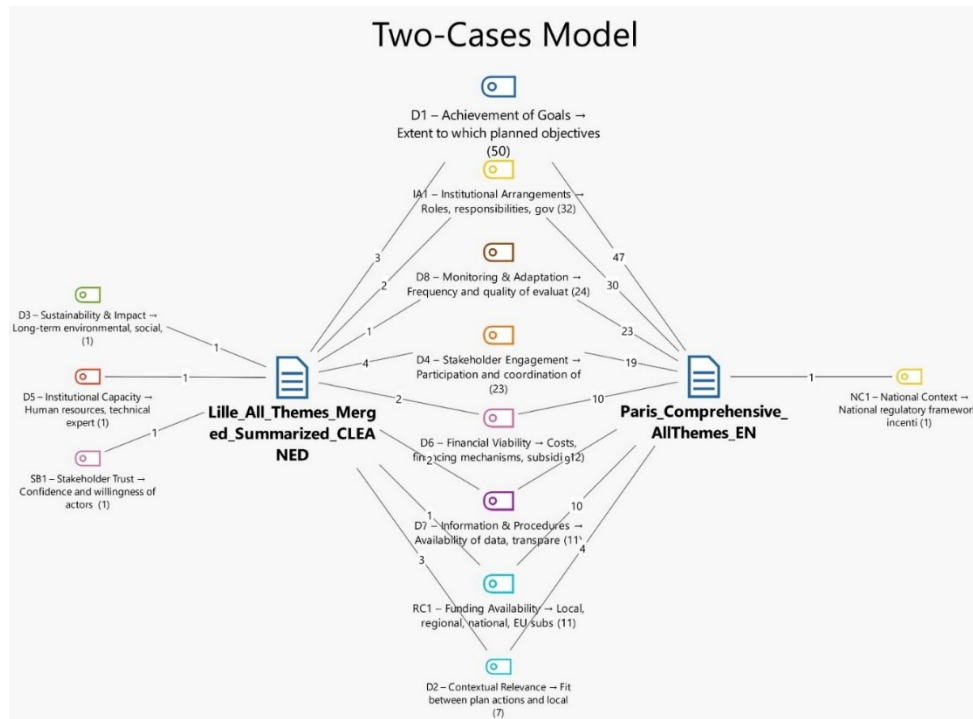


Paris –Lille (All themes Comparison)

In Paris, the distribution is dominated by Achievement of Goals (D1), followed by strong emphasis on Institutional Arrangements (IA1) and Monitoring & Adaptation (D8). Financial concerns — Financial Viability (D6) and Funding Availability (RC1) — also appear prominently, alongside Stakeholder Engagement (D4) and Information & Procedures (D7). This indicates a governance- and finance-oriented narrative where evaluation and participation are central to plan effectiveness. In Lille, the same categories appear but at a much lower frequency. Achievement of Goals (D1) remains the leading theme, supported by references to Institutional Arrangements (IA1), Monitoring (D8), and Financial Viability (D6), though far less pronounced than in Paris. Lille also shows minor mentions of Sustainability (D3), Institutional Capacity (D5), and Stakeholder Trust (SB1), suggesting a more dispersed and less consolidated profile.

Overall, Paris emerges as a structured case, strongly anchored in governance, finance, and evaluation, whereas Lille displays a weaker and more fragmented emphasis across dimensions.

Figure 66: The Two-Cases Model comparing Paris and Lille across all thematic datasets

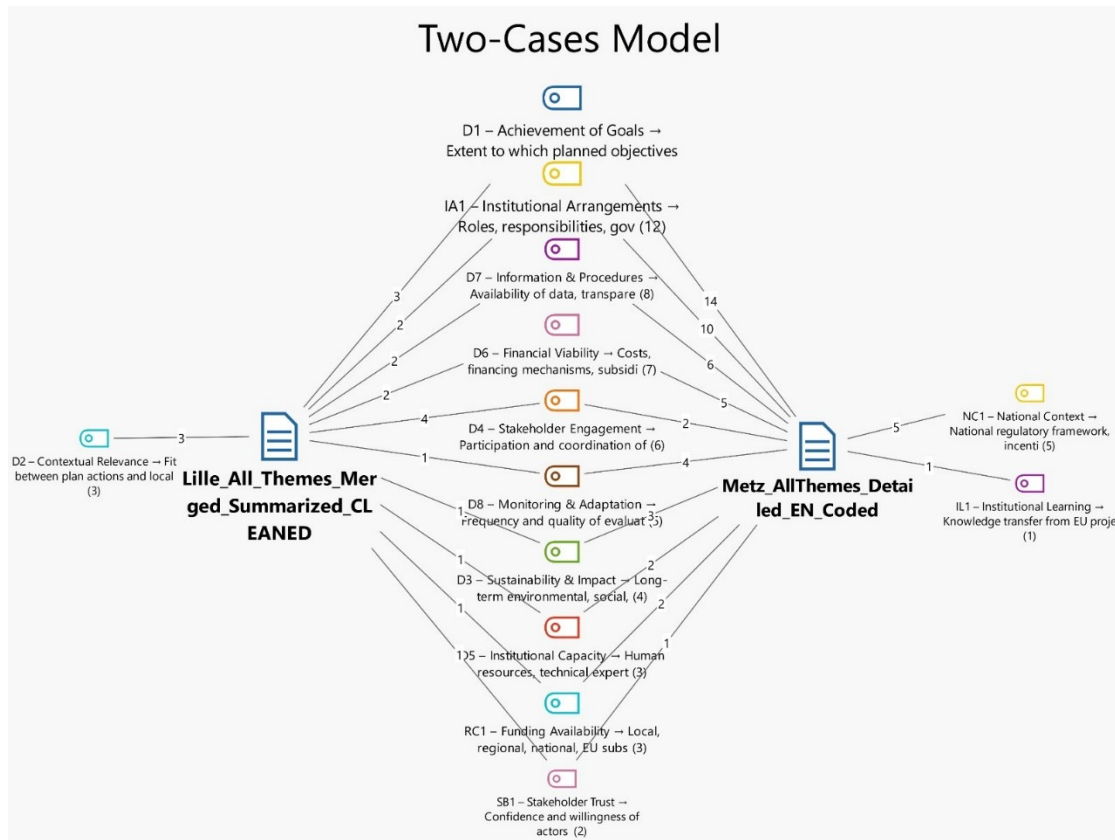


Mets - Lille (All themes Comparison)

In Metz, the code distribution is more structured and relatively balanced. The strongest emphasis lies on Achievement of Goals (D1), followed by substantial references to Institutional Arrangements (IA1), Monitoring & Adaptation (D8), and Stakeholder Engagement (D4). Financial Viability (D6) and Information & Procedures (D7) also appear consistently, while Sustainability (D3), Institutional Capacity (D5), and National Context (NC1) are present at lower levels. This suggests that Metz combines goal achievement with governance, evaluation, and financial mechanisms as the main explanatory factors. In Lille, by contrast, the distribution is far weaker and more dispersed. While Achievement of Goals (D1) remains the most frequent code, other dimensions such as Institutional Arrangements (IA1), Financial Viability (D6), and Information & Procedures (D7) are mentioned only sporadically. Additional categories such as Contextual Relevance (D2), Sustainability (D3), Institutional Capacity (D5), and Stakeholder Trust (SB1) appear, but at very low levels, suggesting a fragmented and less consolidated profile compared to Metz.

Overall, Metz shows a coherent and governance-finance oriented narrative where evaluation and participation reinforce goal achievement, while Lille's case reflects weaker engagement and a dispersed focus across many minor categories.

Figure 67: The Two-Cases Model comparing Lille and Metz across all thematic datasets



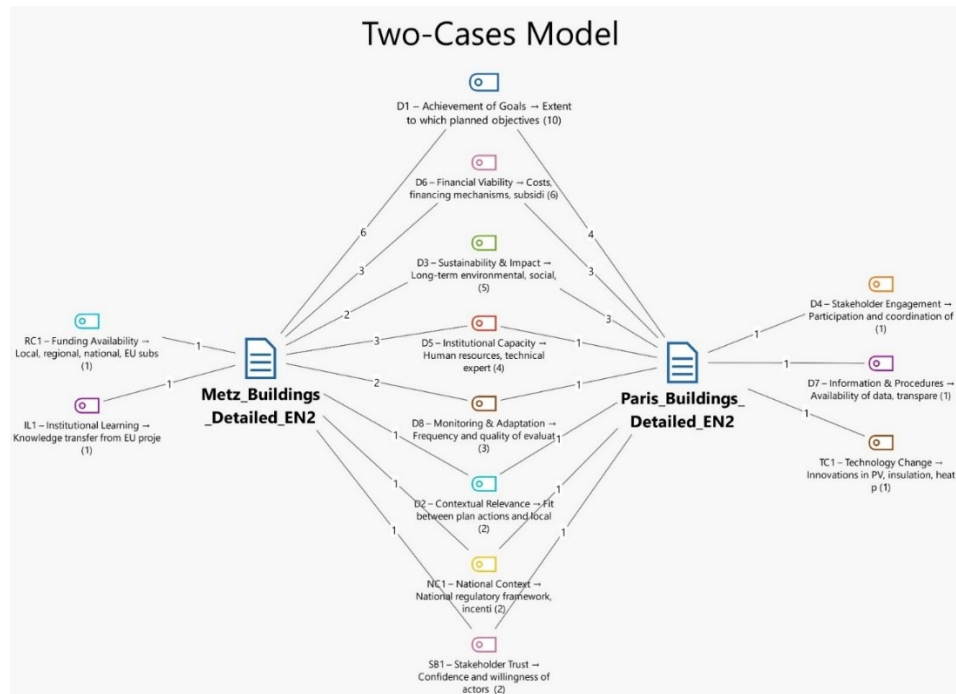
French cases across building actions

Paris –Mets (Buildings Comparison)

Based on the distribution of effectiveness dimensions in the building-focused datasets for Paris and Metz. In Paris, the most frequent dimension is Achievement of Goals (D1, 10 references), followed by Financial Viability (D6, 6) and Sustainability & Impact (D3, 5). Other dimensions such as Institutional Capacity (D5, 4), Monitoring & Adaptation (D8, 3), and Contextual Relevance (D2, 2) also appear, though with lower weight. Marginal mentions include Stakeholder Engagement (D4, 1), Information & Procedures (D7, 1), and Technology Change (TC1, 1). And Metz, it similarly emphasizes Achievement of Goals (D1, 10) as the leading dimension, followed by Financial Viability (D6, 6) and Institutional Capacity (D5, 4). Additional references highlight Sustainability (D3, 3), Monitoring & Adaptation (D8, 3), and Contextual Relevance (D2, 2). Explanatory variables such as Funding Availability (RC1, 1) and Institutional Learning (IL1, 1) are also visible, though marginal. Both cities strongly converge around Achievement of Goals (D1) and Financial Viability (D6), underlining that implementation in the building sector is primarily framed around meeting objectives while navigating financial barriers. Paris places slightly more weight on sustainability and participation, while Metz highlights institutional and regulatory aspects (capacity, funding, and learning).

Overall, the building sector narratives in both cities reveal a shared priority on goal achievement and financial constraints, but diverge in their secondary emphases: Paris leans toward environmental and participatory themes, whereas Metz underscores institutional and governance-related factors

Figure 68: The distribution of effectiveness dimensions in the building-focused datasets for Paris and Metz

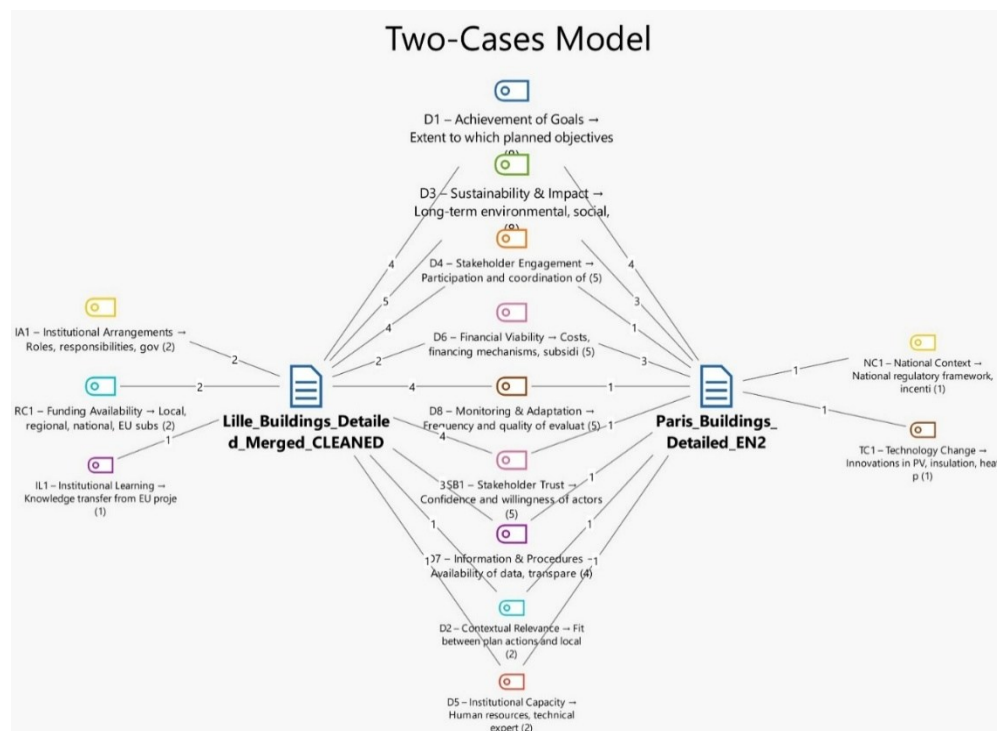


Paris –Lille (Buildings Comparison)

In Lille, A broad set of dimensions is visible, with relatively balanced attention across Achievement of Goals (D1, 6 references), Stakeholder Engagement (D4, 5), Financial Viability (D6, 5), Monitoring & Adaptation (D8, 5), and Stakeholder Trust (SB1, 5). Secondary dimensions include Information & Procedures (D7, 4), Sustainability & Impact (D3, 4), and Contextual Relevance (D2, 2), alongside mentions of Institutional Arrangements (IA1, 2), Funding Availability (RC1, 2), and Institutional Learning (IL1, 1). This shows that Lille's building discourse is dispersed across governance, finance, participation, and trust-related issues. In Paris, while the Achievement of Goals (D1, 6 references) is also central, the emphasis is somewhat narrower. Key supporting dimensions include Stakeholder Engagement (D4, 4), Sustainability & Impact (D3, 3), Financial Viability (D6, 3), and Institutional Capacity (D5, 2). Marginal themes such as Information (D7, 1), Monitoring (D8, 1), Technology Change (TC1, 1), and National Context (NC1, 1) appear but remain weakly expressed. Both cities highlight Achievement of Goals (D1) as the dominant dimension in buildings. However, Lille presents a much more multi-dimensional profile, with strong attention to finance, monitoring, engagement, and trust, suggesting an implementation discourse shaped by diverse institutional and social concerns. Paris, by contrast, remains more goal-oriented and selective, with sustainability and governance concerns present but financial and participatory barriers less prominent.

In summary, Lille's building strategy reflects a plural and institutionally grounded approach, while Paris emphasizes goal achievement with selective reference to sustainability and engagement.

Figure 69: The distribution of effectiveness dimensions in the building-focused datasets for Paris and Lille

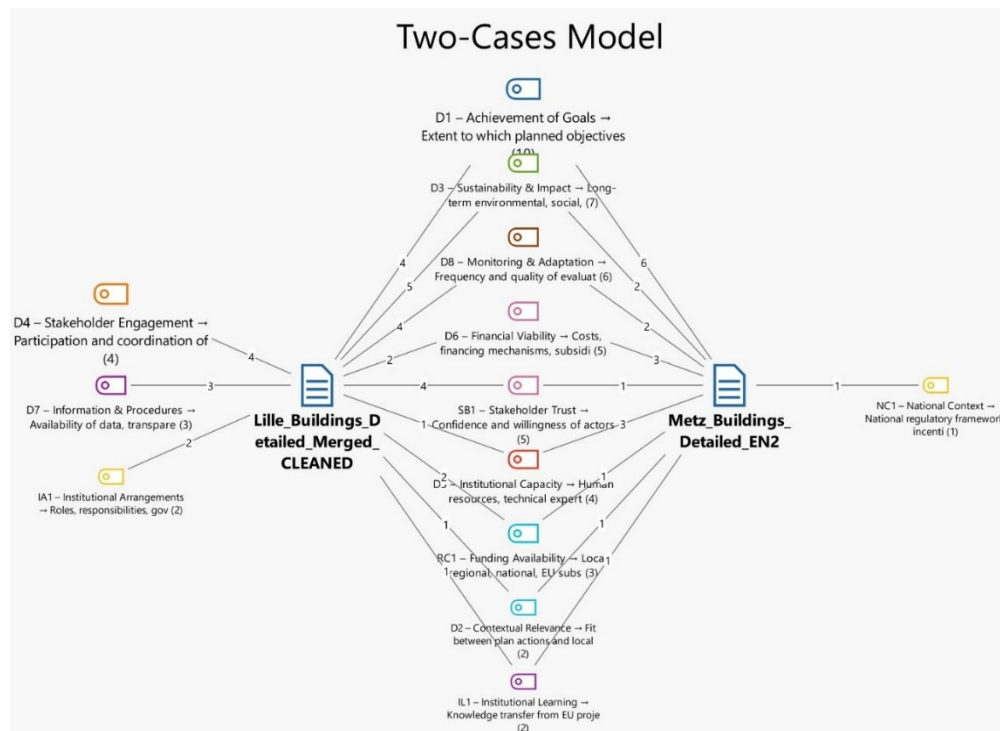


Mets –Lille (Buildings Comparison)

In Lille, the strongest emphasis is on Achievement of Goals (D1, 10 references), supported by Sustainability & Impact (D3, 7), Monitoring & Adaptation (D8, 6), Financial Viability (D6, 5), and Stakeholder Trust (SB1, 5). Participation and engagement also matter (D4, 4), along with Institutional Capacity (D5, 4) and procedural aspects such as Information & Procedures (D7, 3). Governance (IA1, 2), funding (RC1, 1), and learning (IL1, 2) appear but with lower frequency. Overall, Lille shows a multi-dimensional building discourse, spanning goals, sustainability, monitoring, finance, and trust. And in Metz, While Achievement of Goals (D1, 10 references) again dominates, the supporting dimensions differ slightly. Metz highlights Monitoring & Adaptation (D8, 6), Financial Viability (D6, 3), and Sustainability & Impact (D3, 3). Stakeholder Trust (SB1, 3) and Institutional Capacity (D5, 1) are present but weaker. Additional mentions include Funding Availability (RC1, 1), Contextual Relevance (D2, 1), Institutional Learning (IL1, 1), and National Context (NC1, 1). The profile suggests that Metz frames building actions through goal achievement linked to monitoring and finance, but with less emphasis on participation and trust compared to Lille. Both cities share a strong focus on goal achievement (D1) in buildings. However, Lille adopts a more comprehensive and balanced perspective, integrating sustainability, monitoring, finance, trust, and participation, while Metz maintains a narrower focus, centered on monitoring and financial aspects, with weaker attention to governance and engagement.

In summary, Lille's building discourse is plural and socially embedded, while Metz presents a leaner model more focused on goals, monitoring, and finance.

Figure 70: The distribution of effectiveness dimensions in the building-focused datasets for Lille and Metz



Two-Cases Model of Effectiveness Dimensions: Buildings vs. All Themes

Comparing Buildings (sector-specific) with All Themes (comprehensive plans) in France helps identify whether challenges in the building sector diverge from the broader governance of energy and climate planning. Since buildings are a technically complex and resource-intensive domain, this contrast highlights where sectoral bottlenecks differ from general plan-level enablers.

Figure 71: Frequency of Effectiveness Dimensions in each city

Code System	Lille_Buildings_Detailed_Merged_CLEANED	Metz_Buildings_Detailed_EN2	Paris_Buildings_Detailed_EN2	Lille_All_Themes_Detailed_EN2	Metz_AllThemes_Detailed_EN2	Paris_Comprehensiv...	SUM
Main Effectiveness Dimensions							
D1 – Achievement of Goals → Extent to which planned objectives	4	6	4	3	14	47	78
D2 – Contextual Relevance → Fit between plan actions and local context	1	1	1	3		4	10
D3 – Sustainability & Impact → Long-term environmental, social, (7)	5	2	3	1	3		14
D4 – Stakeholder Engagement → Participation and coordination of (4)	4		1	4	2	19	30
D5 – Institutional Capacity → Human resources, technical expert (4)	1	3	1	1	2		8
D6 – Financial Viability → Costs, financing mechanisms, subsidi (5)	2	3	3	2	5	10	25
D7 – Information & Procedures → Availability of data, transpare (3)	3		1	2	6	9	21
D8 – Monitoring & Adaptation → Frequency and quality of evaluat (6)	4	2	1	1	4	23	35
Supporting Variables							
IA1 – Institutional Arrangements → Roles, responsibilities, gov (2)	2			2	10	30	44
RC1 – Funding Availability → Local, regional, national, EU subs (3)	2	1		1	2	10	16
RC2 – Technical Capacity → Availability of staff and resources							0
NC1 – National Context → National regulatory framework, incentives (1)		1	1		5	1	8
EC1 – Economic Conditions → Economic crises, growth, etc.							0
KP1 – Perceptions of Risk → Stakeholders' financial and social risk							0
SB1 – Stakeholder Trust → Confidence and willingness of actors (5)	4	1	1	1	1		8
IL1 – Institutional Learning → Knowledge transfer from EU projects	1	1			1		3
TC1 – Technology Change → Innovations in PV, in buildings, etc.			1				1
SUM	33	21	18	21	55	153	301

Based on the following figure, findings emphasize:

- **Shared central drivers:**

- Achievement of Goals (D1) is dominant across both scopes, with 78 mentions in Buildings vs. 64 in All Themes, confirming its centrality in how effectiveness is judged.
- Financial Viability (D6) and Monitoring & Adaptation (D8) are highly frequent in both, underlining that funding challenges and evaluation processes cut across sectoral and comprehensive planning.

- **Buildings-specific emphases:**

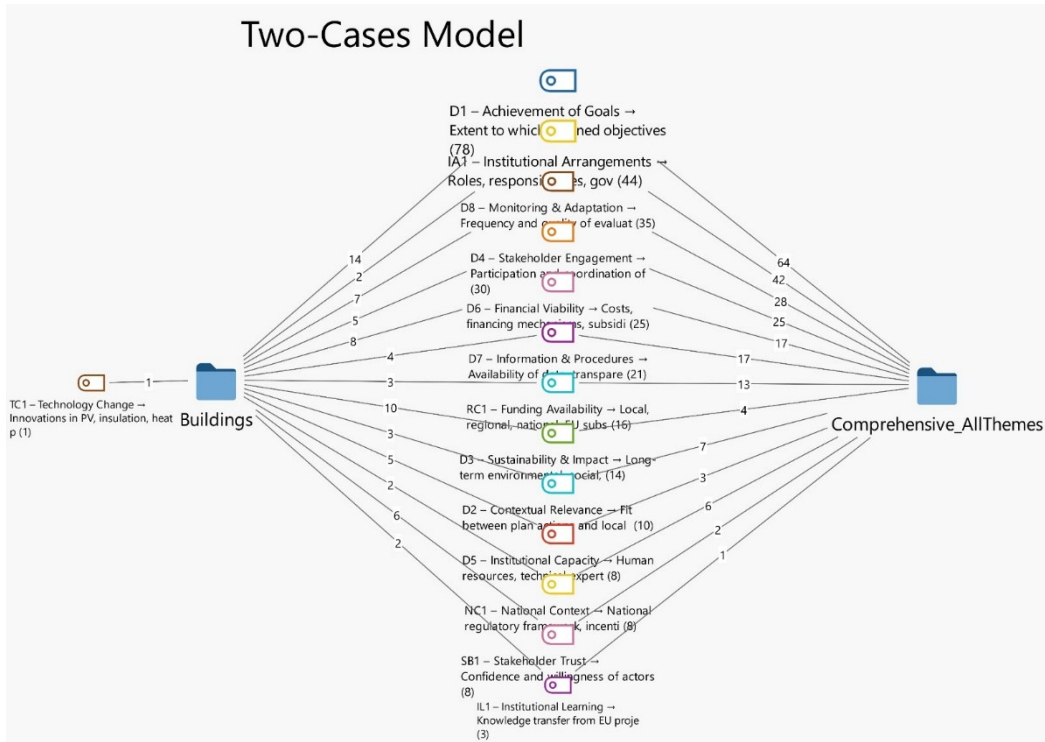
- D1 (Achievement of Goals) is even more prominent in Buildings, showing that sectoral efforts are judged in very concrete terms of outcomes (e.g., energy savings, retrofits delivered).
- Technology Change (TC1) appears exclusively in Buildings, reflecting the technological innovation dimension of retrofits, insulation, and renewable heating systems.

- **All Themes-specific emphases:**

- Institutional Capacity (D5) emerges only in All Themes, pointing to how broad SEAP/SECAP effectiveness depends on staff, technical expertise, and organizational resources.
- Broader governance-related codes such as Institutional Arrangements (IA1), Funding Availability (RC1), and Information & Procedures (D7) are somewhat stronger in All Themes, reflecting the need for coordination, transparency, and multi-level funding across the whole plan.

In summary, we can say that both levels converge on a triangle of goals, finance, and monitoring as the backbone of effectiveness. Yet, Buildings stress outcomes and innovation, while All Themes emphasize governance capacity and institutional arrangements. This suggests that while sectoral plans are performance-driven, comprehensive strategies require institutional robustness to sustain and coordinate action.

Figure 72: Two-Cases Model of Effectiveness Dimensions about Buildings vs. All Themes in all French cities

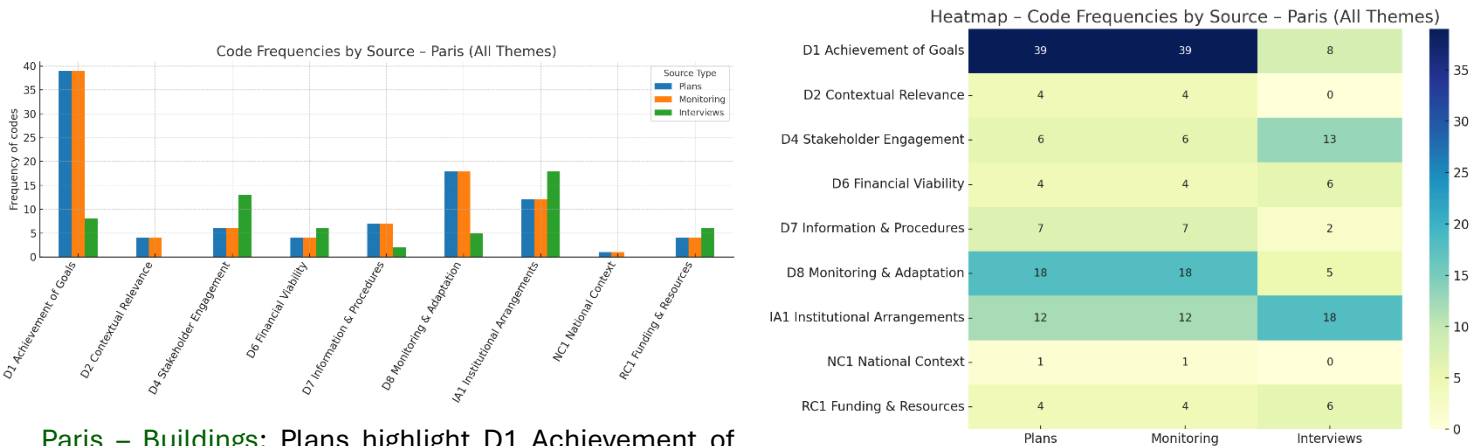


Comparison by Source Type

Paris:

Paris – All Themes: Plans are rich in D1 Achievement of Goals and IA1 Institutional Arrangements, reflecting governance and goal orientation. Monitoring and interviews shift the balance toward D6 Financial Viability, D7 Information & Procedures, and D8 Monitoring, pointing to practical resource and evaluation challenges. The contrast shows that Paris’s climate strategy is ambitious on paper but constrained by systemic financial and procedural barriers in practice.

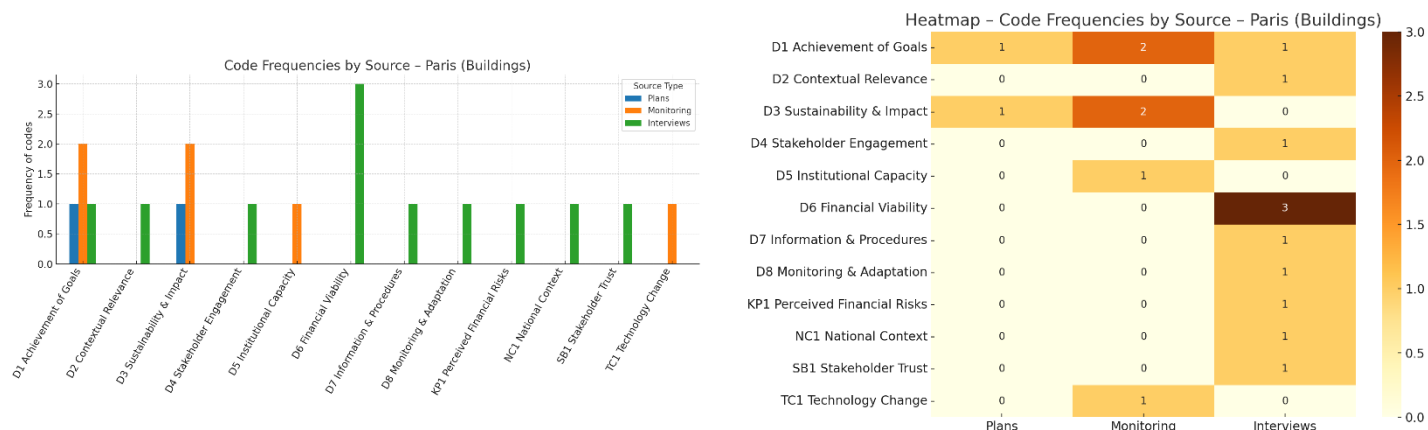
Figure 73: Code frequency by source-Paris- All themes



Paris – Buildings: Plans highlight D1 Achievement of Goals and D3 Sustainability, while interviews and monitoring bring stronger attention to D6 Financial

Viability, D5 Institutional Capacity, and D8 Monitoring & Adaptation. This indicates that while strategic building ambitions are clearly articulated, finance and capacity issues dominate in implementation.

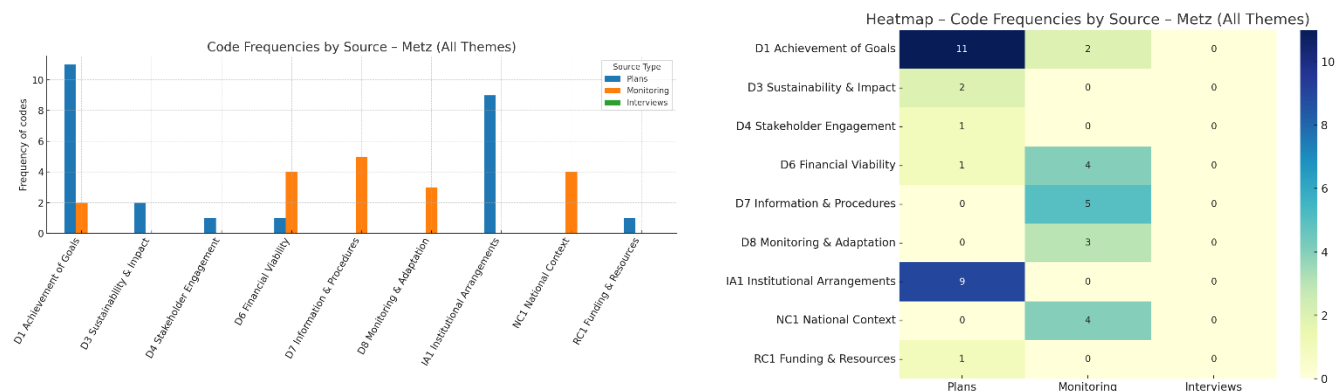
Figure 74: Code frequency by source-Paris- Buildings



Mets:

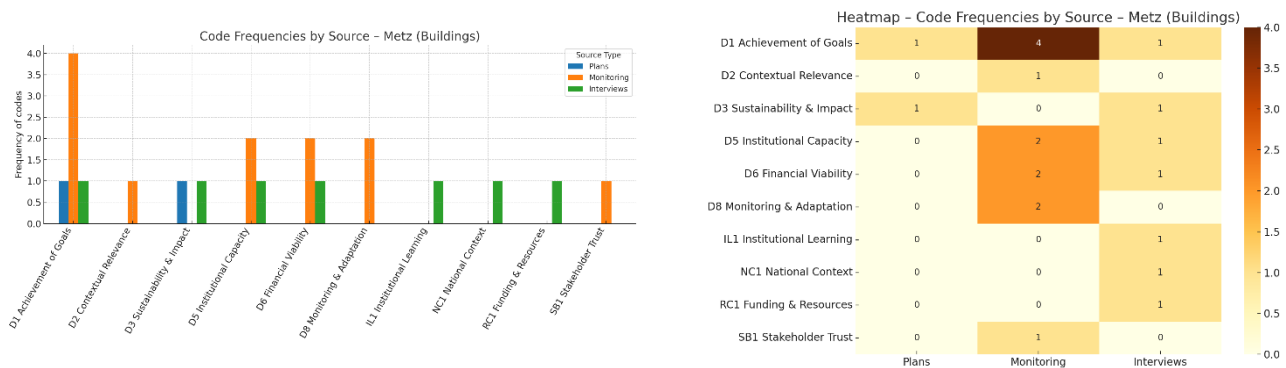
Metz – All Themes: Plans concentrate on *D1* and *IA1 Institutional Arrangements* (governance). Monitoring again carries the heavier load on *D6/D7 Information & Procedures/D8*, pointing to operational constraints. The contrast highlights a classic gap: strategic clarity in plans vs. practical barriers in monitoring.

Figure 75: Code frequency by source-Metz- All themes



Metz – Buildings: Monitoring references dominate *D1 Achievement of Goals* and the main bottlenecks—*D6 Financial Viability*, *D5 Institutional Capacity*, and *D8 Monitoring & Adaptation*. Plans are much lighter and mostly reinforce goals; interviews surface a broader mix (e.g., *RC1 Funding*, *NC1 National Context*, *IL1 Institutional Learning*). In short: plans state intentions; monitoring reveals finance/capacity hurdles.

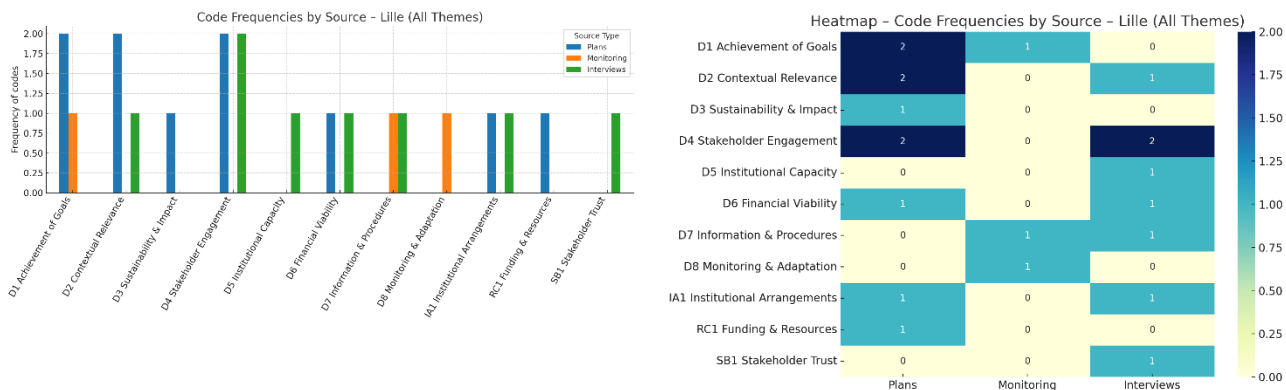
Figure 76: Code frequency by source-Metz- Buildings



Lille:

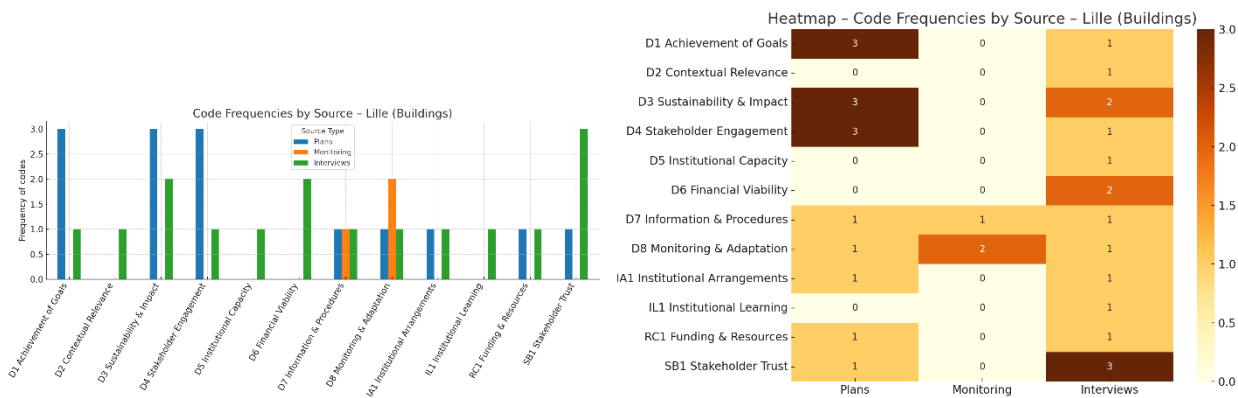
Lille – All Themes: Comprehensive plans highlight D1 Goals and IA1 Institutional Arrangements, whereas monitoring and interviews raise concerns with D6 Finance, D7 Information & Procedures, and SB1 Stakeholder Trust. This contrast underscores the gap between governance ambitions and operational challenges in practice.

Figure 77: Code frequency by source- Lille- All themes



Lille – Buildings: Plans emphasize D1 Achievement of Goals, but monitoring and interviews shift toward D6 Financial Viability, D5 Institutional Capacity, and D8 Monitoring & Adaptation. This shows that while strategic objectives are clear, implementation is hindered by finance and staff constraints.

Figure 78: Code frequency by source- Lille- Buildings



Discourse Analysis

Discourse analysis has been used to show in which terms municipalities emphasize most strongly in their official documents (Plans and Monitoring). To achieve this, automatic word Frequency and Word Clouds were used to recognize them for each city. As mentioning all of them is so long, just the five most frequent ones have been cited as follows.

Paris:

The five most frequent words in the Paris Climate Action Plan (2018) are City (approximately 420 occurrences), Paris (about 390 occurrences), Climate (around 260 occurrences), Plan (about 250 occurrences), and Energy (around 200 occurrences). These words strongly co-occur with each other, reflecting the core focus of the document on municipal climate strategy. "City" and "Paris" frequently appear together, emphasizing local governance actions. "Climate" and "Plan" are closely linked, underscoring the framework for addressing climate change. "Energy" commonly co-occurs with "Consumption," "Renewable," and "Transition," highlighting the themes of energy use, shifting towards renewable sources, and the broader energy transition central to the plan. The interrelation of these terms illustrates the document's comprehensive approach to Paris's climate challenges through city-led, energy-focused action plans.

The same five most frequent words and their co-occurrence in the Bilan (2018-2020), mi-parcours Paris, are as following however the exact number of frequency was not possible to have due to the number of tables, chart etc. : Energy (consumption and sustainability), Greenhouse Gas Emissions (notably GHG emissions as a focus of reduction efforts), Adaptation (climate resilience and urban heat), Pollutants (mainly atmospheric pollutants)Renewable Energy (goals and energy mix transitions).

Mets:

The five most frequent terms in the Climate Plan of Mets 2011 are "emissions" (20+), "gas" (20+), "effect" (20+), "greenhouse" (20+), and "plan" (15+). These frequently co-occur with the term "greenhouse gases," reflecting a focus on reducing emissions of greenhouse gases. The term "plan" prominently co-occurs with "climate," emphasizing the importance of a Climate Plan. Additionally, "reduction" commonly pairs with "emissions," highlighting the goal to reduce emissions. Plus all of them the word "energy" with "renewable,"

showing a priority on developing renewable energy sources. Lastly, "municipal" often co-occurs with "heritage" or "management," indicating efforts related to municipal property and activities in the emission-reduction strategy.

The five most frequent words in the Metz GHG emissions report 2018 are: "Emissions" (43), "Energy" (36), "Buildings" (23), "Vehicle" (15), and "Public" (12). These words co-occur mainly in the context of greenhouse gas sources and reduction actions: "Emissions" commonly co-occurs with "Energy" and "Buildings" when discussing energy consumption in municipal buildings and heating; "Vehicle" co-occurs with "Emissions" and "Energy" regarding the local authority's vehicle fleet fuel use and related reductions; "Public" often co-occurs with "Lighting" (implied) and "Energy" in discussions about energy use and savings in public lighting systems.

And finally, based on the evaluation report of the territorial air energy plan of METS in 2015-2021, the five most frequent words and their approximate frequencies, along with their common co-occurrences, are:

- PCAET (about 30 occurrences): often co-occurs with Metz Métropole, actions, evaluation, and energy.
- Metz Métropole (about 25 occurrences): frequently paired with PCAET, renovation, energy, and mobility.
- renovation (about 15 occurrences): commonly linked with buildings, energy, housing, and thermal.
- energy (about 20 occurrences): co-occurs with consumption, saving, buildings, and transition.
- buildings (about 15 occurrences): usually found with renovation, energy, housing, and performance.

Lille:

The five most frequent words in the Territorial Climate Energy Plan (PCET) 2013 of Lille are "energy" (150+ occurrences), "transition" (70+ occurrences), "climate" (60+ occurrences), "housing" (45+ occurrences), and "consumption" (40+ occurrences). Their co-occurrences for each are: "energy" commonly appears with "consumption" (energy consumption), highlighting the importance of monitoring and reducing usage; "transition" frequently links with "energy" (energy transition), emphasizing the shift towards sustainable practices; "climate" co-occurs with "energy" (climate and energy), underscoring the connection between climate action and energy management; "housing" is often paired with "social" or "landlords" (social housing, landlords), focusing on improving energy performance in residential buildings; and "consumption" also relates closely to "awareness" or "behavior" (consumption awareness), reflecting efforts to influence occupant behavior for energy savings. Together, these co-occurrences reveal a comprehensive approach combining technical, social, and territorial strategies toward successful energy transition and climate objectives.

And in the Bilan (Monitoring) of Lille 2017 energy report are energy (very high frequency, over 100), which commonly co-occurs with consumption, renewable(s), building(s), heating, cost, and energy efficiency; consumption(s) (around 50–70), frequently linked with energy, reduction, building(s), heating, electricity, and cost; building(s) (approximately 40–60), often appearing with renovation, heating, insulation, energy efficiency, and behavior; heating (about 20–40), commonly paired with reduction, contract, gas, and building(s); and renewable(s) (around 20–40), co-occurring with energy, production, biomass, photovoltaic, and wind. These associations highlight the report's emphasis on controlling energy use and expenses in municipal buildings through efficiency measures, renewable energy adoption, and behavioral adjustments.

Chapter 6:

Discussion and conclusion, and Suggestions



Source: author

Introduction

This chapter discusses how the findings address the research objectives and the central question of what factors most influence the effectiveness of local energy and climate action plans across different governance contexts. The study adopted a comparative mixed-methods design, combining qualitative content analysis of plans, monitoring reports, and interviews across Italian and French cities. Guided by a multidimensional framework, the analysis examined both effectiveness dimensions (such as goal achievement, monitoring, and financial viability) and explanatory variables (including institutional arrangements, funding, and stakeholder trust).

The results show that goal achievement, monitoring, and financial viability are consistently central to plan effectiveness, but their relative weight varies according to institutional and local contexts. These patterns reveal that effectiveness is shaped not by individual elements, but by the interaction between governance structures, resource availability, and stakeholder engagement. Together, the findings provide a comparative understanding of how European cities design and implement energy and climate plans, highlighting the institutional and operational conditions that enable or constrain their success.

Cross-Country Comparisons

Italy vs France: governance differences

Although both countries' overarching climate and energy objectives are aligned with the European Union's, the institutional frameworks and local planning instruments are significantly different in the municipalities. The comparative analysis of the Italian and French cases reveals how contrasting governance models—voluntary in Italy and mandatory in France—shape the design, implementation, and monitoring of local energy and climate plans.

In Italy, the SEAPs and SECAPs are rooted in the EU Covenant of Mayors framework, which relies on voluntary municipal participation and a bottom-up approach to local climate governance (Covenant of Mayors, 2016; ENEA, 2021). Although they are not legally mandatory under Italian law, they are mandatory under the EU Covenant of Mayors for Climate and Energy signature, which works for the Italian cases of this research. This approach encourages local initiative, experimentation, and political ownership but also leads to considerable heterogeneity in implementation capacity, especially among small and medium-sized municipalities. The lack of binding obligations and limited national coordination often results in uneven monitoring and continuity once political priorities change or external funding ends (ISPRA, 2020).

In France, by contrast, the Plan Climat-Énergie Territorial (PCET) and its successor, the Plan Climat-Air-Énergie Territorial (PCAET), are mandatory instruments defined by the Code de l'Environnement (Art. L.229-26). The French framework represents a top-down governance model, embedding local climate action within a national regulatory structure supported by ADEME and regional authorities (ADEME, 2018;

Berthinier-Poncet, 2017). This mandatory character ensures that all large intercommunal entities develop and periodically update their plans, promoting institutional continuity, standardized reporting, and integration with national strategies. However, it can also produce a more procedural or compliance-oriented culture, where the formal existence of a plan does not always translate into strong local ownership or innovative action (Rüdinger et al., 2014).

The analysis found that the effectiveness of implementation depends less on whether plans are voluntary or obligatory, and it is more on the multi-level governance support that accompanies them, particularly technical assistance, financing, and monitoring mechanisms. Strengthening these horizontal and vertical linkages could increase both systems' ability to deliver sustained local climate action.

Comparative patterns in building effectiveness

The building sector provides a particularly revealing lens because it combines high energy-saving potential with persistent operational barriers such as funding constraints, regulatory rigidity, and limited institutional coordination. The comparative analysis across Milan, Bologna, Bolzano, Paris, Lille, and Metz highlights both common challenges and structural differences rooted in the design of SEAPs and PCET/PCAETs.

Table 33: Comparative Overview of Building-Related Actions in Local Energy and Climate Plans

Building Action	Milan	Bologna	Bolzano	Paris	Lille	Metz
Large-Scale Retrofits (Private Sector / Multi-Owner)	✓	✓	✗	✓	✓	✓
Municipal Building Retrofits	✓	✓	✓	✓	✓	✓
Renewables (PV, Solar Thermal, Biomass, etc.)	✓	✓	✓	✓	✓	✓
District Heating / Cooling Systems	✗	✗	✓	✗	✓ (partial / expansion)	✗
Energy Audits / Mapping (Public & Private Stock)	✓	✓	✓	✓ (selective sectors)	✓	✓
Stricter Building Codes / Standards (Energy Performance, NZEB)	✓	✓	✓	✓	✓	✓
Awareness & Training (Capacity Building, Advisory Services)	✓	✓	✓ (public sector focus)	✓	✓	✓
Energy Poverty / Social Support Programs	✗	✗	✗	✓	✓ (low-income focus)	✓
Eco-Districts / Urban Planning Integration	✗	✗	✓ (climate district concept)	✓	✗	✓

✓ = Implemented or active measure documented in plan, monitoring, or interviews.

✗ = Not included or not prioritized in building-related actions.

Partial = implemented in a limited scope (pilot or expansion stage).

Looking at the table above, the comparison shows strong convergence on municipal retrofits, renewable integration, and building standards across all cities, reflecting the influence of EU and national frameworks. However, significant variation persists in socially oriented and systemic actions. *Energy poverty* programs appear only in the French cases (Paris, Lille, Metz), reflecting the PCAET obligation to integrate social equity. *District heating* remains a distinctive feature in Bolzano (mature system) and partially Lille (network decarbonization), while *eco-districts* and planning integration are most advanced in Paris and Metz. Italian cities show technical alignment (retrofits, codes) but weaker social and urban integration, whereas French cities combine technical measures with social and governance dimensions.

Across both national contexts, a shared pattern emerges: "Achievement of Goals (D1)" consistently dominates the coded material, showing that local plans articulate ambitious targets for energy efficiency and retrofit programs. However, this emphasis on goal setting is not matched by equivalent attention to follow-up mechanisms. "Financial Viability (D6)" and "Institutional Capacity (D5)" appear as recurrent barriers, suggesting that even where strategies are well defined, their implementation depends on the availability of funding instruments, technical expertise, and continuity of administrative support. Similarly, "Monitoring and Adaptive Management (D8)" remains underdeveloped in most cities, reflecting that evaluation systems are more formal than functional. Totally, these findings reveal a common gap between strategic ambition and operational feasibility that transcends national borders.

Despite these similarities, the results show clear contrasts in how these challenges manifest in both countries. In Italy, SEAPs are characterized by greater flexibility and local initiative, which allow for innovative approaches but also lead to inconsistent performance and fragmented monitoring. The voluntary nature of the Italian framework encourages experimentation, yet weak national coordination and unstable financial support undermine long-term implementation. By contrast, in France, the PCET/PCAET framework imposes a stronger regulatory structure that ensures procedural compliance and more coherent governance across levels. However, this institutional rigidity can constrain municipal autonomy and slow adaptation, particularly in the building sector, where technical and financial decisions require agility. Italian cities, therefore, display high variability and local innovation, but limited institutional stability, while French cities show coherent frameworks but experience bureaucratic inertia and limited flexibility in delivery.

In terms of the relations between these findings and the study's theoretical framework, which combines "Multi-Level Governance (MLG)", "Socio-Technical Transitions (MLP)", and "Capacity Building" perspectives. From a "multi-level governance" point of view, the comparison illustrates how authority distribution and coordination mechanisms influence plan effectiveness: Italian municipalities operate within a decentralized but weakly integrated system, whereas French cities function in a more hierarchical and regulated context. From a "socio-technical" perspective, both contexts face "lock-in" barriers related to existing urban forms, heritage constraints, and financial mechanisms, which slow the diffusion of building renovation technologies. Finally, through the lens of "capacity building", the results demonstrate that the most effective municipalities are those that translate procedural compliance into institutional learning and develop mechanisms for long-term knowledge retention and cross-sectoral collaboration. The next section will complete this theoretical lens of the analysis.

In summary, while both systems follow similar energy transition objectives, the implementation of building actions reveals distinct governance trade-offs. Italian cities show flexibility and local agency but struggle with fragmented financing and weak institutional coordination. French cities benefit from regulatory coherence but face constraints in adaptive management and stakeholder engagement. These findings illustrate that effective building action implementation depends less on the existence of ambitious goals than on the "institutional stability, financial mechanisms, and learning capacities" that support local execution over time.

Interpretation through Theoretical Lenses

To complete the relations between these findings and the study's theoretical framework, it has to be mentioned that cross-country analysis gains further explanatory depth when interpreted through the three theoretical lenses, which are the structure of this research (Multi-Level Governance (MLG), Socio-Technical Transitions (MLP), and Capacity Building & Organizational Learning). These frameworks connect the empirical coding results (D1–D8, IA1, RC1, KP1, IL1, SB1, NC1, TC1) with the institutional, technological, and organizational processes that jointly determine implementation effectiveness. Together, they can explain and clarify why similar objectives produced different outcomes across the six cities and two national systems, which is the reply to this research question: "How do governance structures, institutional capacity, and technical mechanisms influence outcomes?"

1. Multi-Level Governance (MLG): mandates, coordination, and institutional design

The MLG perspective emphasizes how vertical (national–regional–local) and horizontal (municipalities, agencies, utilities) interactions, mandates, and regulatory frameworks influence local capacity to deliver energy and climate objectives. This lens directly relates to the codes IA1 (Institutional Arrangements) and NC1 (National Context), which were among the most frequently connected to D1 Achievement of Goals and D8 Monitoring & Adaptation in both countries.

In Italy, governance remains predominantly voluntary under the Sustainable Energy Action Plans (SEAPs)—Milan SEAP 2011, Bologna SEAP 2012, and Bolzano SEAP 2011. The results show high frequencies for D1 (Achievement of Goals) (around one-third of all coded segments in Bologna and Milan) but lower visibility of D8 (Monitoring & Adaptation), indicating ambition without systematic evaluation. Municipalities depend heavily on national incentives such as the Ecobonus and on European co-funding. Coordination with regional and national authorities is ad hoc, and monitoring is largely self-reported, explaining the fragmentation visible in the co-occurrence patterns between IA1 and D8.

By contrast, France's PCET/PCAET framework (Lille 2013, Metz 2011, Paris 2018) illustrates a more hierarchical and legally binding model. Here, NC1 (National Context) and IA1 (Institutional Arrangements) are systematically linked with D5 (Institutional Capacity) and D8 (Monitoring & Adaptation). The mandatory character of the PCET/PCAETs ensures vertical alignment, but interviews (notably in Lille and Paris) highlight administrative rigidity and slower local responsiveness. Quantitatively, French cases show a stronger presence of D8 Monitoring & Adaptation (10–14% of coded references) than Italian ones (typically below 8%), confirming that regulatory obligations promote evaluation but may reduce flexibility.

Through the MLG lens, effectiveness thus appears conditioned by the distribution of authority and coherence of mandates. Italy's decentralized voluntarism fosters local initiative but uneven capacity, while France's top-down coherence secures procedural completeness at the cost of adaptive agility.

2. Socio-Technical Transitions (MLP): innovation uptake and regime lock-ins

The MLP framework interprets the technological dimension of implementation—how innovations emerge, diffuse, and confront existing regimes. It connects most directly with TC1 (Technology Change), D3 (Sustainability & Impact), and KP1 (Perceived Financial Risks).

In Italy, technological adoption patterns differ by local regime. Bolzano, through its district heating network and renewable integration, represents what the MLP terms a regime pathway, where innovations consolidate within stable municipal utilities. Milan and Bologna exhibit niche experimentation: energy-efficient retrofits and pilot projects appear in plans but remain dependent on temporary funding. Co-occurrence matrices show frequent pairing of TC1 with RC1 (Funding & Resources) and KP1, confirming that innovation is tightly coupled with perceptions of financial risk.

In France, Metz advances niche-to-regime transitions through eco-neighborhoods and interacting schemes, while Paris confronts strong regime lock-ins due to heritage protection and the technical rigidity of its building stock. Lille, by contrast, demonstrates incremental integration: between 2013 and 2021, it achieved a 27 % reduction in municipal energy use and a 39 % cut in GHG emissions, largely through lighting, automation, and progressive renovation rather than disruptive technology. These differences illustrate how the MLP helps interpret variations in D3 (Sustainability & Impact) and TC1 (Technology Change) frequencies: Italian cases display innovation intent but limited diffusion; French cases integrate technology within structured regimes but face inertia from complex governance chains.

Thus, from an MLP standpoint, technological transitions depend on both material infrastructure and institutional receptivity. Regime stability in France enables consolidation but slows transformation; niche openness in Italy encourages experimentation but lacks continuity.

3. Capacity Building & Organizational Learning: adaptation, monitoring, and staff development

The third lens focuses on how municipalities build internal capacity, learn, and adapt—captured in D5 (Institutional Capacity), D8 (Monitoring & Adaptation), and IL1 (Institutional Learning). The results show that organizational learning strongly differentiates cities even within the same national framework.

In Bologna, excessive indicators in its SEAP monitoring reports generated data without insight, revealing procedural rather than adaptive monitoring. Milan progressively improved its Piano Aria Clima (PAC) process after 2015, showing positive feedback loops between D8 Monitoring and IL1 Learning. Bolzano, with stable administrative structures, achieved continuity between planning and operational departments, though staff resources remained limited.

In France, Lille provides the clearest evidence of institutional learning: the creation of a metropolitan energy observatory, cross-departmental coordination, and embedded performance tracking since 2013 demonstrate increasing maturity in capacity building. Metz followed a similar trajectory, integrating evaluation into the PCET/PCAET cycle, while Paris faced coordination challenges across its large

bureaucracy despite strong analytical capacity. Quantitatively, D8 and IL1 appear 1.5 times more frequently in French than Italian datasets, confirming a stronger emphasis on organizational adaptation where monitoring is compulsory.

From this lens, effectiveness depends less on external resources than on how municipalities transform procedural requirements into internal learning systems. Cities that operationalize feedback—Bologna’s restructuring of indicators, Lille’s observatory, Milan’s adaptive PAC—illustrate how learning mediates between governance design (MLG) and innovation uptake (MLP).

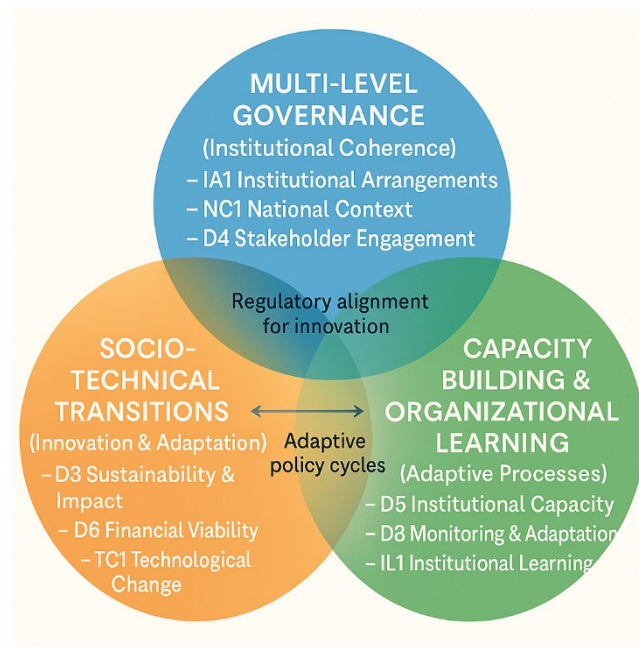
4. Integrating the three lenses: where theory and coding converge

When interpreted together, the three perspectives reveal that plan effectiveness arises from the interaction between structural governance, technological innovation, and organizational learning. In the coding framework, this convergence is visible in the frequent co-occurrence of IA1 + D8, RC1 + D6, and IL1 + D5 across cases. These intersections show that financial viability (D6) is not simply an economic issue but a governance and learning challenge—requiring institutional coordination (MLG) and adaptive management (Capacity Building). Similarly, technological change (TC1) gains traction only when regulatory stability (MLG) and organizational receptivity (Learning) align.

In comparison, Italy demonstrates flexibility and innovation potential, but weaker institutional learning and fragmented coordination; France achieves procedural coherence and stronger monitoring, but faces regime and administrative rigidity. The theoretical lenses thus converge to explain that effectiveness in local energy and climate plans is systemic, emerging not from isolated dimensions but from the alignment of mandates, innovation systems, and adaptive capacity. This synthesis bridges the empirical discussion with the broader conclusion that sustainable urban transitions depend on coupling multi-level governance coherence with socio-technical and organizational learning dynamics.

Figure 79 illustrates the conceptual synthesis of this thesis. Implementation effectiveness in local energy and climate plans emerges from the intersection of three interdependent systems: governance coherence, socio-technical adaptability, and organizational learning. Multi-Level Governance (MLG) provides the institutional structure and policy mandates required for coordination across levels (IA1, NC1, D4). Socio-Technical Transitions (MLP) capture the capacity to adopt, diffuse, and stabilize innovations through financial and technological feasibility (D3, D6, TC1, KP1). Capacity Building and Organizational Learning encompass the adaptive processes that sustain performance over time, through monitoring, feedback, and skill retention (D5, D8, IL1). The overlap between these three systems represents the point at which coordination, innovation, and learning converge — the condition under which energy plan implementation becomes effective.

Figure 79: The conceptual synthesis of the thesis: Implementation effectiveness in local energy plans



This model visually summarizes the central contribution of the thesis: effectiveness is a systemic property, not a single-variable outcome. It depends on the capacity of local governments to align governance mandates, technological innovation, and adaptive learning within coherent institutional frameworks. When any one dimension dominates or remains disconnected — as shown by the Italian–French contrasts — the gap between decision-making and implementation widens.

Discourse Analysis Layer

The discourse analysis of municipal documents (Plans and monitoring) offers complementary insight into how cities articulate priorities, justify progress, and communicate challenges. By analyzing word frequencies and co-occurrences across plans and monitoring reports (2011–2021) for all six cities, the textual evidence reveals how discourse mirrors institutional orientations and operational constraints identified through coding. Word clouds and frequency tables highlight consistent linguistic emphases on energy, emissions, and reduction, yet they also expose contrasting communicative patterns between the Italian and French governance systems.

In Italian cases, the vocabulary of implementation revolves around energy, emissions, reduction, and efficiency, echoing the dominance of D1 (Achievement of Goals) and D6 (Financial Viability) in the coded data. In Milan’s SEAP (2014) and subsequent monitoring (2015–2022), words such as “emissions,” “energy,” and “reduction” appear over 100 times each, consistently co-occurring with “buildings,” “retrofitting,” and “efficiency.” The discourse foregrounds quantitative progress—reduced emissions and improved efficiency—while offering limited linguistic space for reflection on monitoring or learning, consistent with the weaker representation of D8 (Monitoring & Adaptation) and IL1 (Institutional Learning) in the MAXQDA analysis.

In Bologna's SEAP (2012) and monitoring reports (2013–2018), the same pattern emerges. The most frequent terms—CO₂, actions, energy, municipality, and reduction—form co-occurrence pairs such as “CO₂-reduction” and “energy-investments,” showing a discourse centered on progress and outputs. The repetition of “actions” and “monitoring” in later reports signals a more procedural vocabulary but still focused on compliance rather than adaptive governance. Bolzano (SEAP 2013, monitoring 2015) introduces a slightly different profile, where “energy,” “consumption,” “data,” and “sector” dominate. This terminology reflects a data-driven and managerial approach, consistent with Bolzano's relatively higher coding of D8 (Monitoring) but still limited discussion of institutional learning. In all three Italian cities, the linguistic field is dominated by measurable indicators—emissions, efficiency, reduction—reflecting a culture of performance reporting rather than reflexive evaluation.

The French discourse displays a broader, more governance-oriented vocabulary, integrating environmental, social, and organizational dimensions. In Paris's Climate Action Plan (2018), the five most recurrent terms—City, Paris, Climate, Plan, and Energy—form a cohesive semantic cluster that situates local action within a strategic urban governance narrative. Monitoring reports (Bilan 2018–2020) expand this vocabulary to include “Greenhouse Gas Emissions,” “Adaptation,” and “Renewable Energy,” linking mitigation to resilience and energy transition, and corresponding to the strong presence of D3 (Sustainability & Impact) and D8 (Monitoring & Adaptation) codes.

In Metz, the evolution from the Climate Plan (2011) to the PCET evaluation (2015–2021) reflects increasing institutionalization of discourse. Early documents focus on “emissions–reduction–greenhouse gases,” while the later PCAET reports introduce governance terms such as “Metz Métropole,” “renovation,” “energy transition,” and “buildings.” The co-occurrence of “PCET–evaluation–actions” demonstrates a linguistic shift toward process-oriented monitoring, consistent with the growing frequency of IA1 (Institutional Arrangements) and D8 (Monitoring) in the coded results.

Lille shows a balanced discursive pattern that integrates technical and social perspectives. In its Territorial Climate Energy Plan (PCET 2013) and Bilan 2017, the dominant words—energy, transition, climate, housing, consumption—and their conjunctions (“energy–consumption,” “housing–social,” “consumption–awareness”) reflect a multi-dimensional narrative combining technological efficiency, social equity, and behavioral change. Monitoring documents strengthen this framing through terms like “building(s), renovation, heating, renewable(s),” mirroring Lille's documented progress (27% reduction in energy use; 39% reduction in GHG emissions) and the city's higher coding of D8 (Monitoring) and IL1 (Institutional Learning).

To compare the linguistic discourse in both countries, the evidence confirms that discourse acts as a mirror of institutional culture and operational focus.

In Italy, the dominant triad (energy, emissions, reduction) reveals an output-oriented logic, emphasizing target achievement and project delivery. Terms like “funding,” “projects,” and “objectives” underscore dependence on external financing and reflect a technocratic style of communication, consistent with the high coding of D1 (Goals) and D6 (Financial Viability) but limited evidence of adaptive management.

In France, discourse integrates evaluation and governance, adopting an evaluation-oriented logic that combines technical progress with institutional accountability. Frequent associations such as “bilan–suivi–

évaluation” and “rénovation–énergétique–partenaires régionaux” show a structured culture of performance review, while terms like “complexité,” “moyens humains,” and “retards” express awareness of administrative and capacity obstacles, corresponding to the presence of D5 (Institutional Capacity) and RC1 (Resources) in coded materials.

Overall, these discursive distinctions reinforce the patterns identified through coding and theoretical interpretation. Italian cities communicate progress through the language of projects, funding, and quantitative results, reflecting flexibility but also fragmentation and dependence on external resources. French cities articulate climate governance through institutionalized monitoring and multi-actor coordination, signaling stronger procedural integration but also bureaucratic inertia. Across both systems, what remains linguistically marginal is the language of learning and adaptation (a few terms explicitly reference knowledge sharing, feedback, or organizational learning), confirming that while municipalities measure performance increasingly well, they still rarely reflect publicly on how they learn to improve it.

Contributions to Literature and existing knowledge

Energy Plan Effectiveness Studies

This research contributes to the expanding field of energy and climate plan implementation studies by introducing and empirically applying a multidimensional effectiveness framework that captures the complexity of local energy governance. Previous literature has documented recurring challenges in implementing municipal energy plans, including limited financial resources, fragmented governance, weak monitoring systems, and insufficient stakeholder coordination (Bertoldi et al., 2010; Rivas et al., 2015; Lammers & Hoppe, 2021; Wretling & Balfors, 2021; Scorza & Santopietro, 2024). These studies emphasize that effectiveness depends not only on goal achievement but also on the quality of institutional arrangements, stakeholder collaboration, and adaptive capacity. Building on this foundation, the framework developed in this thesis provides a systematic and operational tool to evaluate how these dimensions interact across governance contexts.

The framework defines eight interrelated dimensions of plan effectiveness—(1) Achievement of Goals, (2) Contextual Relevance, (3) Sustainability and Impact, (4) Stakeholder Engagement and Governance Clarity, (5) Institutional Capacity, (6) Cost–Benefit Balance and Financial Viability, (7) Information Availability and Procedural Efficiency, and (8) Monitoring, Evaluation, and Adaptive Management. Each dimension includes specific indicators and evaluation criteria (see Table X), linking tangible outcomes with qualitative institutional processes. For example, Achievement of Goals (D1) measures the degree to which targets and milestones are met; Institutional Capacity (D5) evaluates human and technical resources, leadership continuity, and interdepartmental coordination; and Monitoring and Adaptive Management (D8) assesses whether feedback mechanisms from monitoring lead to strategic adjustments and policy learning.

Compared with earlier works that assessed single aspects of plan performance—such as emissions reductions (Kramers et al., 2015; Reckien et al., 2018), governance quality (De Gregorio Hurtado et al., 2019), or institutional integration (Wretling & Balfors, 2021)—this framework advances the literature by providing a comprehensive, comparative, and empirically testable model. It allows the simultaneous assessment of performance outcomes and enabling conditions, bridging what Lammers and Hoppe (2021)

describe as the gap between policy initiation and sustained implementation. Moreover, by integrating contextual relevance (D2) and sustainability and impact (D3), the framework extends previous evaluations by including long-term environmental and social benefits alongside procedural criteria such as monitoring frequency, stakeholder engagement, and financial feasibility.

Empirical application across six European cities—Milan, Bologna, Bolzano (under the voluntary SEAP framework), and Paris, Lille, Metz (under the mandatory PCET/PCAET system)—demonstrates how this model reveals the systemic interaction of effectiveness drivers and barriers. Consistent with Rivas et al. (2015) and Scorza & Santopietro (2024), the study confirms that financial viability (D6) and institutional capacity (D5) are decisive determinants of implementation success, whereas monitoring and adaptive management (D8) remain chronically underdeveloped. At the same time, the inclusion of contextual relevance (D2) and stakeholder governance clarity (D4) shows that municipal plans must be interpreted within their socio-economic and regulatory environments—a key insight aligned with Wretling and Balfors (2021), who highlight the role of spatial and institutional integration.

In theoretical terms, the research advances the concept of plan effectiveness from a static measure of goal completion toward a dynamic governance construct encompassing institutional learning, adaptive monitoring, and coordination capacity. The framework operationalizes the linkages between formal planning instruments, socio-technical systems, and organizational practices, offering a replicable structure for comparative analysis across countries and governance scales. By explicitly connecting each dimension (D1–D8) to both quantitative indicators and qualitative explanatory variables, this study provides a robust analytical bridge between implementation research and practical evaluation of local energy and climate plans. In doing so, it responds to the call in recent scholarship for integrated, process-oriented evaluations that move beyond reporting achievements to understanding how and why local governments succeed—or fail—in translating strategic commitments into operational results (De Gregorio Hurtado et al., 2019; Scorza & Santopietro, 2024).

Comparative Governance and Urban Climate Transitions

To answer the question of “What explains the varying degrees of effectiveness in the implementation of local energy plans?” in addition to the previous parts, this research also contributes to the comparative literature on urban climate governance and energy transitions, by demonstrating how institutional structures, regulatory contexts, and learning processes condition the implementation of local energy plans. While earlier studies have mapped the proliferation of urban climate initiatives and governance modes (Bulkeley & Betsill, 2013; Kern & Alber, 2008; Broto & Bulkeley, 2013; De Gregorio Hurtado et al., 2019), fewer have empirically examined how different governance architectures translate into implementation effectiveness. By systematically comparing Italian and French cases, this study bridges that gap, showing how multi-level governance design interacts with organizational capacity and socio-technical dynamics to shape outcomes on the ground.

Under Italy’s voluntary SEAP framework (Milan SEAP 2011; Bologna SEAP 2012; Bolzano SEAP 2011), local authorities operate with considerable autonomy but limited vertical coordination and financial stability. This aligns with findings by Lammers and Hoppe (2021) and Scorza and Santopietro (2024), who note that the voluntary nature of SEAPs and dependence on external technical support undermine continuity and

monitoring. In contrast, France's mandatory PCET/PCAET system (Paris 2018/2020; Lille 2018; Metz 2015–2021) exhibits strong vertical coherence and standardized procedures, consistent with Wretling and Balfors (2021), who emphasize the role of regulatory alignment and integration into spatial planning. However, the results also reveal that this procedural coherence can generate administrative rigidity, mirroring what Kern and Alber (2008) describe as “institutional lock-in” within multi-level governance systems.

Through the lens of Multi-Level Governance (MLG), the study shows that local plan effectiveness depends on the balance between autonomy and coordination. The Italian SEAPs illustrate how decentralized flexibility fosters innovation but weakens accountability, while the French PCET/PCAETs demonstrate how centralized mandates ensure reporting but limit adaptive capacity. This duality contributes to ongoing debates about the optimal design of multi-level climate governance, suggesting that hybrid arrangements—combining vertical coherence with local discretion—may achieve greater long-term effectiveness.

The study also extends the socio-technical transitions (MLP) literature (Geels, 2012; Hodson & Marvin, 2010) by demonstrating that governance context mediates how technological innovations diffuse in cities. In Bolzano, strong public utilities and stable local institutions support a regime pathway, embedding district heating and renewable integration in established systems. In Bologna and Milan, innovation follows a niche dynamic, driven by externally funded pilot projects that struggle to scale due to institutional fragmentation. In France, Paris and Metz represent regulated regimes—technologically advanced but constrained by complex ownership structures and heritage protection—while Lille's continuous performance monitoring and heating decarbonization illustrate gradual niche-to-regime consolidation. These comparative findings contribute to the literature on urban energy transitions by showing that technological change cannot be understood apart from governance coherence and institutional learning.

Finally, by incorporating Capacity Building and Organizational Learning as a third analytical dimension, this research enriches discussions on how cities learn from implementation. While earlier works (Rivas et al., 2015; Wretling & Balfors, 2021) highlight the importance of skilled staff and technical expertise, this study empirically demonstrates how institutional learning mechanisms—such as monitoring observatories (Lille), indicator revision (Bologna), and plan iteration (Milan)—translate into more adaptive governance. Across both countries, however, monitoring remains largely descriptive rather than evaluative, confirming that effectiveness is limited by the absence of feedback loops between data collection and decision-making. The findings therefore reinforce calls by De Gregorio Hurtado et al. (2019) and Scorza and Santopietro (2024) for embedding evaluation-based learning within local climate governance frameworks.

In sum, this study advances the literature on comparative governance and urban climate transitions by empirically demonstrating that plan effectiveness emerges from the alignment of three interacting subsystems: (1) multi-level governance coherence (institutional clarity and coordination), (2) socio-technical adaptability (capacity for innovation and diffusion), and (3) organizational learning (ability to evaluate, adjust, and institutionalize knowledge). By showing how these dynamics vary between Italy's flexible yet fragmented SEAPs and France's coherent yet rigid PCET/PCAETs, the research contributes a nuanced understanding of how governance design shapes the long-term effectiveness of urban energy transitions.

Table 34 synthesizes the results of the MAXQDA analyses, interviews, and document reviews, providing a united view of implementation dynamics across the six cities. The matrix highlights that financial and

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institutional capacity challenges (D5, D6) remain the most recurrent obstacles, while monitoring and learning mechanisms (D8, IL1) serve as key enablers in more advanced cases (Milan, Lille, Metz). Italian cities display greater flexibility but weaker coordination, whereas French cities exhibit stronger monitoring and evaluation but higher administrative rigidity. Overall, cities that combine stable institutional frameworks, clear stakeholder roles, and feedback-oriented monitoring show the highest potential for sustained effectiveness.

Table 34: Comparative strengths, weaknesses, and enabling factors of local energy plan implementation across six case studies (Italy–France)

City	Main Strengths	Main Weaknesses / Obstacles	Key Enablers / Unique Factors
Milan (SEAP/SECAP)	• Clear strategic emission-reduction targets (D1). • Defined monitoring framework and reporting structure (D8). • Integration with national incentive schemes (NC1).	• Fragmented interdepartmental coordination (D5). • Strong dependence on external funding and fiscal incentives (D6). • Limited private-sector engagement in condominiums (D4). • Monitoring largely procedural rather than adaptive (D8/IL1).	• Alignment with national renovation incentives. • Participation in European climate networks (Covenant of Mayors). • Political visibility of climate targets.
Bologna (SEAP 2012)	• Established technical expertise via AESS energy agency (D5). • Strong stakeholder partnerships and EU project experience (D4). • Integration of climate and mobility planning.	• Indicator overload reduced analytical clarity and learning capacity (D8). • Fragmented municipal coordination (D5). • Reliance on temporary project funding (D6).	• Stable collaboration with universities and technical partners. • Active participation in European initiatives.
Bolzano (SEAP 2011)	• Stable governance structure and staff continuity (D5). • Strong integration with public utility and district heating system (IA1/D6). • Clear long-term infrastructure orientation.	• Limited staff capacity for scaling renewable programs (D5). • High upfront retrofit costs; reliance on provincial incentives (D6). • Limited emphasis on adaptive monitoring (D8).	• Integrated local utility (Alperia) supporting implementation. • Mature district heating infrastructure. • Strong institutional alignment between municipality and province.
Paris (PCET/PCAET)	• Legally mandated planning framework ensuring continuity (IA1). • Strong coordination with regional and national authorities (NC1). • Integration of social equity and energy poverty measures (D2/D4). • Comprehensive monitoring system (D8).	• Administrative complexity across governance levels (D5). • Heritage constraints limiting building retrofits (D2). • Financial pressure due to scale of interventions (D6).	• Mandatory PCAET framework. • Strong regulatory backing. • Integration of climate planning into broader urban strategy.

Lille (PCET/PCAET)	• Strong interdepartmental cooperation and internal coordination (D5). • Effective use of monitoring data for decision-making (D8/IL1). • Expansion and decarbonization of district heating.	• Financial pressure in scaling renovations (D6). • Limited engagement of private property owners (D4). • Broad indicators still lacking building-level precision (D8).	• Culture of monitoring and institutional learning. • Metropolitan energy observatory. • Stable technical partnerships (ALEC).
Metz (PCAET)	• Strong evaluation-oriented approach (D8/IL1). • Innovation in financing tools (e.g., intracting model) (D6). • Integration of building and mobility measures.	• Limited institutional capacity compared to larger cities (D5). • Dependence on external funding programs (D6). • Uneven private-sector engagement (D4).	• Learning-based interpretation of monitoring. • Targeted innovation pilots (eco-neighborhoods). • Alignment with national climate frameworks.

The comparison reveals that Italian cities tend to rely more on voluntary governance arrangements and technical expertise, but face greater coordination and financial fragility. In contrast, French cities benefit from legally mandated frameworks and stronger integration with national policy structures, yet encounter administrative complexity and higher institutional rigidity. Across all cases, institutional capacity (D5), financial viability (D6), and monitoring and adaptation (D8) emerge as decisive determinants of implementation effectiveness.

Policy Implications

To reply to the question of "To what extent do contextual conditions (national policy frameworks, local capacities, socio-economic contexts) shape implementation performance?" the comparative evidence demonstrates that national policy frameworks decisively shape local implementation performance. In France, the *PCAET*'s legal obligation ensures procedural consistency and continuity but can generate administrative rigidity and slower adaptation. In Italy, the voluntary *SEAP/SECAP* framework allows flexibility and local innovation but lacks the institutional anchoring and long-term coordination mechanisms needed to sustain implementation. These contrasting models confirm that effectiveness is strongly mediated by the degree of national institutionalization and the autonomy afforded to local actors, reinforcing the importance of balancing structure with flexibility in multilevel climate governance.

And also for answering to the question of "what policymakers should do differently based on the findings?" it can be said that the comparative analysis of six cities across Italy and France (each implementing local energy and climate plans under different governance regimes) offers several lessons for improving plan effectiveness at both municipal and national/EU levels. Drawing on the multidimensional effectiveness framework (D1–D8) and the theoretical perspectives of Multi-Level Governance (MLG), Socio-Technical Transitions (MLP), and Capacity Building & Learning, the findings highlight the need for governance systems that combine clear mandates and stable resources with flexibility, coordination, and organizational learning. The results can expand more in different levels as follows,

1. Municipal Level

At the municipal scale, effectiveness depends on how local authorities translate strategic goals into operational routines. The analysis shows that while Achievement of Goals (D1) dominates local discourses, implementation success is constrained by limited Institutional Capacity (D5), uneven Financial Viability (D6), and weak Monitoring and Adaptive Management (D8). The translation of strategic goals into operational routines can be done through,

- ❖ Clarifying monitoring frameworks and indicators.

Cities require monitoring systems that are not merely descriptive but evaluative and adaptive. In Bologna, the proliferation of indicators fragmented analysis and obscured learning; in Milan, the iterative revision of the Piano Aria Clima (PAC) illustrates a shift toward feedback-driven evaluation; and in Lille and Metz, the creation of metropolitan energy observatories and systematic PCET reviews has improved data transparency. These experiences suggest that a limited set of strategic and outcome-oriented indicators (linked directly to budget cycles and sectoral actions) can increase institutional focus and accountability.

- ❖ Strengthening institutional capacity and continuity.

Across all six cities, three factors of staff turnover, reliance on temporary project funding, and compartmentalized governance undermine long-term implementation. Municipalities should prioritize permanent energy and climate units with dedicated personnel, technical expertise, and interdepartmental mandates. The Bolzano and Lille cases show that stable administrative structures and cross-sectoral teams enable consistent project delivery and knowledge retention. Investing in staff training, network participation, and digital data systems reinforces D5 Institutional Capacity and IL1 Institutional Learning, turning compliance tasks into opportunities for continuous improvement.

- ❖ Balancing stakeholder engagement with governance clarity.

The results confirm that Stakeholder Engagement and Governance Clarity (D4) are mutually reinforcing. Cities that maintained structured partnerships—such as Bologna’s collaboration with AESS or Lille’s with ALEC and ADEME—achieved stronger project ownership and co-financing. Conversely, in Paris and Milan, overlapping competencies and diffuse responsibilities slowed implementation. Clear role definition, participatory co-design, and early integration of utilities, housing associations, and private actors are key to reducing administrative bottlenecks and increasing legitimacy.

- ❖ Integrating evaluation into communication and learning

Discourse analysis reveals that municipalities still use the language of *performance*—focused on targets, reductions, and efficiency—more than that of *learning*, which emphasizes evaluation, adaptation, and knowledge sharing (Hajer, 1995; Feindt & Oels, 2005; Turnhout et al., 2015; Bulkeley & Betsill, 2013; Wodak & Meyer, 2016). This discursive orientation reflects a broader tendency in local climate governance to privilege managerial and quantitative reporting over reflexive, process-based learning (Nilsson et al., 2017; Turnheim et al., 2015).

Inserting communication and reporting mechanisms that emphasize lessons learned more than only achievements can empower a culture of reflexive governance. Municipal reports should develop from static

“bilans” to learning-oriented reviews, supporting D8 Monitoring & Adaptation and reinforcing organizational feedback loops.

In summary, municipalities should move from goal- and output-oriented management toward adaptive, learning-oriented implementation. This shift requires stronger coordination, stable human resources, simplified monitoring, and systematic reflection—transforming plans from administrative documents into living management tools.

2. Larger scales (National and EU Level)

At the national and European scales, the findings emphasize that local plan effectiveness is conditioned by policy coherence, funding continuity, and regulatory stability. The comparative cases demonstrate how different multi-level designs create distinct enabling or constraining environments for cities.

❖ Stabilizing incentives and long-term funding frameworks

Financial viability (D6) frequently appears as a major element of implementation. Italian cities (particularly Milan and Bologna) depend on short-term EU or national grants, leading to discontinuity once projects end. In contrast, French cities benefit from more predictable funding embedded in the PCET/PCAET system but face complex administrative procedures that delay resource allocation. It is better if national governments and EU institutions provide multi-annual funding programs tied to performance indicators rather than project completion, which allows municipalities to maintain capacity and plan long-term retrofitting strategies. Also, by simplifying access to European funds and reducing administrative fragmentation would increase absorptive capacity and equity among municipalities.

❖ Enhancing vertical coordination and policy integration

Differences between the SEAP and PCET/PCAET systems reveal the need to balance top-down mandates with local flexibility. Italy’s voluntary system fosters innovation but lacks alignment, whereas France’s mandatory framework ensures coherence but limits adaptation. Policy instruments should therefore evolve toward hybrid governance models, where national frameworks define common goals and reporting standards while granting local authorities’ discretion in design and prioritization. Creating integrated data platforms and standardized monitoring templates across the EU could ensure comparability while enabling local contextualization.

❖ Addressing social equity and heritage constraints

Both governance systems show that building-sector transitions are constrained by social and architectural factors. In Paris and Bologna, heritage preservation limits retrofit options; in Metz and Lille, energy poverty and private condominium engagement pose equity challenges. If National and EU programs could therefore combine energy efficiency subsidies with social support mechanisms, ensuring access for vulnerable groups, and revise heritage regulations, it would allow and increase energy retrofits compatible with conservation standards. This approach aligns with the Renovation Wave and Green Deal principles of combining decarbonization with inclusion.

❖ Promoting institutional learning across levels

Finally, plan effectiveness depends on whether national and EU institutions facilitate horizontal and vertical learning. Cross-city exchanges—through networks such as the Covenant of Mayors, Energy Cities, or Eurocities—can accelerate knowledge transfer on governance innovations, digital monitoring tools, and co-financing schemes. Inserting learning objectives into EU programs (e.g., Horizon Europe, LIFE) could support iterative adaptation and empower an ecosystem of municipal experimentation and feedback.

In sum, the policy implications of this research demonstrate that improving the effectiveness of local energy and climate plans requires more than better targets or additional funding. As emphasized by several interviewees across Milan, Bologna, Lille, Metz, and Paris, “the real challenge is not writing the plan but aligning institutions, learning from monitoring, and keeping cooperation alive across levels” (Interviews MIL-02; BOL-01; LIL-01; MET-01; PAR-02)¹. Effectiveness thus depends on institutional alignment, adaptive monitoring, and continuous learning within and between governance tiers. Municipalities must evolve from administrative compliance toward proactive, knowledge-based implementation; national and EU actors must create stable, coherent frameworks that reward learning and long-term coordination. The integration of these scales—where monitoring informs funding, funding sustains capacity, and capacity enables learning—defines the pathway toward genuinely effective urban energy transitions.

Table 35: Selected Interview Excerpts Illustrating Key Governance and Capacity Dimensions in Each Case

City	Interview insights linked to this part	Relevant codes/dimensions
Milan	“We have ambitious targets, but the coordination between departments and national programs is not always clear — we learn by doing, but it’s fragmented.”	D5 Institutional Capacity, D8 Monitoring, IL1 Institutional Learning
Bologna	“The real challenge is not planning, it’s keeping the cooperation between services once the SEAP is approved. Monitoring is where you realize if things are coherent.”	D4 Stakeholder Engagement, D8 Monitoring
Bolzano	“Our strength is the integration between the municipality and the energy utility. Long-term planning works because roles are clear and the district heating system is stable.”	IA1 Institutional Arrangements, D6 Financial Viability, D5 Institutional Capacity

¹ Interview codes (e.g., MIL-02, BOL-01, LIL-01, MET-01, PAR-02) refer to anonymized respondents involved in the preparation, coordination, or monitoring of Sustainable Energy and Climate Action Plans (SEAP/SECAP) or Territorial Climate-Energy Plans (PCET/PCAET) in the respective municipalities. Each code represents one semi-structured interview with municipal energy officers, project managers, or technical experts conducted between 2022 and 2024. Anonymization was applied to ensure confidentiality in accordance with the study’s ethical protocol

Lille	“The most important progress has been in our internal cooperation and in using data for decisions. Without this culture of monitoring, plans would stay on paper.”	D5 Capacity, D8 Monitoring, IL1 Learning
Metz	“We now understand that learning from evaluation is key. Monitoring is not just a report; it’s a tool for improving projects.”	D8 Monitoring, IL1 Institutional Learning
Paris	“Coordination with the region and national authorities is crucial. We need shared frameworks to turn results into funding priorities.”	IA1 Institutional Arrangements, NC1 National Context

Data from the Covenant of Mayors monitoring releases indicate that across Europe, a significant proportion of voluntarily submitted SECAPs do not progress to systematic monitoring phases. This broader procedural gap, however, primarily concerns voluntary planning frameworks. In contrast, the French cases analysed in this thesis operate under the mandatory PCAET framework, where both planning and monitoring are legally required, resulting in more structured and continuous reporting mechanisms.

Among the Italian cases, Bologna and Bolzano demonstrated relatively structured monitoring practices despite the voluntary nature of SEAPs, whereas Milan showed comparatively weaker adaptive integration of monitoring outcomes. These findings suggest that legal obligation alone does not guarantee adaptive effectiveness, but it does provide institutional continuity. The critical determinant remains the degree to which monitoring (D8) is embedded within institutional capacity (D5) and learning processes (IL1).

Methodological Reflections

This approach combines qualitative and quantitative elements that design a systematic coding framework with discourse analysis to evaluate the effectiveness of local energy and climate plans across contrasting governance systems. The methodological approach’s primary value lies in its ability to transform complex and multidimensional concepts (such as effectiveness, governance capacity, and institutional learning) into operational analytical categories. The eight effectiveness dimensions (D1–D8), complemented by explanatory variables (IA1, RC1, KP1, IL1, SB1, NC1, TC1), provided a structured foundation for examining how plans perform, why outcomes differ, and how local contexts mediate these results.

The coding framework proved particularly effective in ensuring comparability across heterogeneous datasets—including policy plans, monitoring reports, and interviews—by applying a consistent interpretive lens (Kuckartz, 2014; Schreier, 2012; Rädiker & Kuckartz, 2023). This structure enabled the detection of recurring relationships between dimensions—for example, the frequent co-occurrence of Financial Viability (D6) and Institutional Capacity (D5)—and their dependence on governance contexts, such as the contrast between voluntary SEAPs in Italy and mandatory PCET/PCAETs in France (Bertoldi et al., 2018; Scorza & Santopietro, 2024). The use of MAXQDA enhanced transparency and traceability, while the integration of discourse analysis added interpretive depth by revealing how municipalities articulate and legitimize effectiveness in textual form (Rädiker & Kuckartz, 2023; Wodak & Meyer, 2016). Frequent word patterns and conjunctions—such as “energy–reduction” in Italian reports or “bilan–évaluation” in French documents—provided insights into how local governments construct narratives of achievement, performance, and constraint (Fairclough, 2013; Hajer, 1995).

Integrating discourse analysis with coding thus enriched the interpretation of results by connecting measurable patterns (code frequencies, co-occurrences) with meaning-making processes (linguistic emphasis, framing) (Kuckartz, 2014; Rädiker & Kuckartz, 2023). This approach not only identified what dimensions matter but also how institutions talk about them, highlighting the cultural and communicative aspects of governance effectiveness (Fairclough, 2013; Hajer, 1995; Wodak & Meyer, 2016). It therefore advanced beyond traditional content analysis by aligning empirical coding with interpretive inquiry, allowing textual and discursive patterns to be examined as complementary forms of evidence rather than separate analytical levels (Mayring, 2014; Schreier, 2012).

Nonetheless, from the limitations point of view, the methodological application revealed practical boundaries. The detail and quality of monitoring data varied substantially between cities, especially between SEAP and PCET/PCAET systems. The number of documentations due to the number of cases made the time-consuming analysis, and the number of interviews (while sufficient for triangulation) was modest, limiting stakeholder diversity. It also has to be mentioned that there was a time period for the selected plans and their monitoring, starting from the year 2011, which the research found necessary for analyzing the effectiveness. Additionally, translation between Italian, French, and English occasionally risked minor semantic loss, particularly for context-specific governance terminology. Despite these constraints, triangulation across data types (plans, monitoring, interviews, and academic documentation) strengthened the internal validity of the findings and ensured that analytical conclusions rested on multiple forms of evidence rather than on any single data source.

Overall, the combined methodology demonstrated the value of multi-layered qualitative evaluation in energy and climate governance research. It operationalized theoretical constructs into a replicable framework, balanced interpretive richness with systematic rigor, and generated transferable insights for comparative analysis across diverse institutional contexts.

Conclusion

This research set out to understand why gaps persist between decision-making and implementation in local energy (climate) planning. Through the comparative analysis of six cities—Milan, Bologna, Bolzano (Italy), and Paris, Lille, Metz (France)—the study shows that these gaps arise not primarily from a lack of ambition, but from the misalignment between strategic governance frameworks, operational capacities, and learning mechanisms. Plans often demonstrate strong rhetorical and strategic intent (D1 Achievement of Goals) but fall short in operational dimensions such as Financial Viability (D6), Institutional Capacity (D5), and Monitoring and Adaptive Management (D8). The findings reveal that decision-making processes tend to be centralized and procedural, while implementation depends on distributed capacity, consistent funding, and adaptive coordination across institutions.

These findings resonate with and extend earlier research on municipal energy plan implementation. Consistent with Wretling and Balfors (2021), this thesis confirms that embedding energy strategies within spatial and governance planning is crucial for coherence and follow-through. Echoing Scorza and Santopietro (2024) and Rivas et al. (2015), it identifies financial

stability, data quality, and stakeholder coordination as recurring determinants of plan effectiveness. However, it moves beyond those studies by demonstrating empirically how these factors interact as part of a systemic triad of governance, technology, and organizational learning. Unlike Lammers and Hoppe (2021), who described widespread municipal passivity, this study finds more differentiated behavior: cities such as Milan and Lille have evolved toward active learning and performance monitoring, while Bologna and Paris remain constrained by procedural inertia. The comparative coding framework (D1–D8) also provides a replicable structure that quantifies how implementation barriers—especially D5, D6, and D8—cluster across governance contexts, offering a level of analytical precision absent from most previous research.

The results confirm that governance coherence alone is insufficient for effective implementation. Italy’s voluntary SEAPs encourage flexibility and local innovation but lack stable coordination and long-term funding. France’s mandatory PCET/PCAETs ensure procedural rigor and accountability but can generate administrative rigidity and limit local adaptation. The challenge, therefore, is to bridge these structural extremes—to move from hierarchical planning or fragmented experimentation toward adaptive, learning-oriented governance systems. Effectiveness arises when governance structures (MLG), technological transitions (MLP), and organizational learning converge. Cities that combine clear institutional roles, stable financial instruments, and monitoring mechanisms that feed back into strategies in Milan’s adaptive monitoring, Lille’s metropolitan observatory, and Metz’s integrated evaluation cycle—are better positioned to sustain transitions and respond to uncertainty.

This thesis contributes to advancing both the theory and practice of local climate action in three ways:

Conceptually, it developed a multidimensional effectiveness framework (D1–D8) that connects technical outcomes with institutional processes, offering an integrative model for assessing governance performance.

Empirically, it provides comparative evidence across two governance systems, showing how institutional design conditions the interaction between financial, technological, and organizational dimensions of plan implementation.

Methodologically, it demonstrates the added value of combining systematic coding with discourse analysis, linking what cities do with how they communicate and legitimize effectiveness.

And finally, by redefining effectiveness (as a dynamic capability, the ability to coordinate across scales, innovate within constraints, and learn from implementation), this research reframes local energy and climate governance from a static reporting exercise into a continuous learning process. It emphasizes that bridging governance, technology, and learning is essential to close the persistent gap between policy ambition and operational reality in Europe’s local energy transitions, specifically Italy and France.

Future Research and Operational Suggestions

Based on the analytical, theoretical, and empirical insights of this research, several directions for future investigation and operational development can be suggested, which could further strengthen the understanding and practice of local energy and climate plan implementation.

1. Expand Comparative and Contextual Scope

- ❖ Extending comparative analysis beyond Italy and France to include additional governance models, even the cases outside the EU (e.g., UK Local Energy Strategies, Nordic or Latin American municipal plans). Also, extending comparative analysis to different plans in both analyzed countries, such as Piani Energetici Comunali.
- ❖ A quantitative Europe-wide assessment of the transition from SECAP submission to monitoring compliance could provide systematic evidence on whether institutional capacity or funding stability determines progression rates.
- ❖ Exploring how political systems, decentralization levels, and legal mandates shape Institutional Capacity (D5), Monitoring & Adaptation (D8), and Stakeholder Engagement (D4).
- ❖ Investigating how national energy transitions interact with municipal climate governance, in other words, linking local plans to national and regional decarbonization pathways.

2. Deepen and Diversify Methodological Approaches

- ❖ Using energy performance data (such as GHG reduction rates, retrofit completion ratios) to validate coded dimensions.
- ❖ Employing statistical modeling or multi-criteria analysis to identify correlations between governance variables (IA1, RC1, IL1) and outcomes.
- ❖ Develop longitudinal research designs to follow municipalities over multiple planning cycles, capturing institutional learning and adaptation over time.

3. Strengthen Social, Equity, and Behavioral Dimensions

- ❖ Studying how local energy plans address energy poverty, housing inequality, and participation in retrofitting programs.
- ❖ Analyzing behavioral drivers (risk perception – KP1, trust – SB1) affecting household and stakeholder engagement in building renovation.
- ❖ Examining heritage and morphological constraints in historic urban areas to propose integrative design and regulatory solutions for sustainable retrofits.

4. Improve Operational Tools and Policy Integration

- ❖ Translating the effectiveness framework (D1–D8) into operational self-assessment tools for municipalities and inter-municipal authorities.
- ❖ Encouraging municipalities to develop standardized templates for annual evaluation of plan effectiveness. Also, encouraging knowledge exchange platforms between cities (like Covenant of Mayors, Eurocities) to share experiences on financing, monitoring, and capacity building, or even build standardized templates.

- ❖ Strengthening multi-level coordination by linking local monitoring outcomes with national and EU data systems to improve vertical policy coherence.
- ❖ Promoting long-term financing mechanisms and stable incentive schemes that ensure continuity of staff expertise, institutional learning, and maintenance of digital monitoring infrastructure.

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12. Paris municipality website: <https://www.paris.fr/pages/paris-pour-le-climat-2148#arrondissement-6-4iq1h> (Access on 2024)
13. The #1 qualitative data analysis software: <https://www.maxqda.com/> (Access on 2025)

Thesis Appendix:

Interview questions in English (All the Italian interviews were done in English):

Semi-Structured Interview Guide

Project: PhD Thesis – Implementation of Effectiveness Local Energy Plans (SEAPs) By Nastaran Esmaeilpour Zanjani, Pavia University, Italy

Interviewee: SEAP Expert, Municipality of Bolzano

Method: Semi-Structured Interview

Estimated Duration: 60–90 minutes

Consent: [To be handled before starting]

SECTION 1: Introduction and Background

Can you briefly describe your role in Bolzano's SEAP development and implementation?

From your perspective, what were the key strategic goals of Bolzano's SEAP — particularly in the area of building energy actions?

SECTION 2: Project Goals and Implementation (Dimension 1)

To what extent have the original goals related to building energy performance been achieved?

Were there any major delays, failures, or changes in the building-related actions compared to what was originally planned? Why?

What were the main obstacles to full implementation?

SECTION 3: Local Relevance and Context (Dimension 2)

How well did the SEAP reflect Bolzano's local needs and energy baseline conditions (e.g., building stock, socio-economic factors)?

Were there any adaptations made to better fit the local context over time?

SECTION 4: Sustainability and Long-Term Impact (Dimension 3)

Were there mechanisms in place to ensure that SEAP actions would have long-term impact beyond the plan's official timeline?

SECTION 5: Stakeholder Engagement and Governance (Dimension 4)

Which actors were most actively involved in the implementation of building-related actions?

Were roles and responsibilities clearly defined and maintained?

How would you evaluate the quality of cooperation and communication among stakeholders?

SECTION 6: Institutional Capacity (Dimension 5)

Did Bolzano have the technical staff, institutional memory, and coordination structures needed for plan implementation?

Was there any staff turnover or reorganization that disrupted capacity during implementation?

Did participation in EU networks or projects support your internal capacity?

SECTION 7: Financial Viability and Cost-Benefit (Dimension 6)

What funding sources were used for SEAP implementation — especially for buildings?

Were any co-financing challenges encountered?

How were costs and benefits distributed among actors?

SECTION 8: Information, Tools, and Processes (Dimension 7)

What tools or methods did you use to design and track SEAP actions?

Was data on progress and implementation shared with other departments or the public?

Were there delays or inefficiencies in the planning or implementation process? What caused them?

SECTION 9: Monitoring, Evaluation, and Adaptation (Dimension 8)

How often was implementation progress monitored? By whom?

Were changes made to SEAP actions based on monitoring results?

Specifically for buildings: did any planned actions get dropped, delayed, or expanded based on evaluation data?

SECTION 10: Variables Influencing Implementation

How did national policies, economic changes, or external events affect implementation?

Did stakeholders understand the purpose and benefits of the building-related energy measures?

How much did perceived financial risks or uncertainties impact participation in building actions?

Were there any key lessons or technical skills learned during implementation? How was knowledge retained?

Did technological changes affect your ability to implement actions as planned?

SECTION 11: Closing Reflection

If you could redesign or re-implement the SEAP process in Bolzano, what would you change?

What advice would you offer other municipalities starting a local energy plan today?(Key success factors or suggestions for the future)

Optional: Questions for Triangulation

Were any building actions implemented outside the SEAP framework but aligned with its goals?
What about SECAP?

Are there informal practices or lessons that were important but not documented?

Interview questions in French :

Guide d'Entretien Semi-Structuré – PCAET Metz

Projet : Thèse de doctorat – Mise en œuvre des Plans Climat-Air-Énergie Territoriaux (PCAET)

Chercheuse : Nastaran Esmaeilpour Zanjani, École nationale des ponts et chaussées & Université de Pavie

Intervenant : Expert PCAET, Eurométropole de Metz

Méthode : Entretien semi-structuré

Durée estimée : 60 minutes

Consentement : [À obtenir avant de commencer]

SECTION 1 : Introduction et Contexte

1. Pouvez-vous décrire brièvement votre rôle dans le développement et la mise en œuvre du PCAET de Metz ?
2. Selon vous, quels étaient les objectifs stratégiques clés du PCAET de Metz — en particulier dans le domaine de l'énergie dans les bâtiments ?

SECTION 2 : Objectifs et Mise en Œuvre

3. Dans quelle mesure les objectifs initiaux relatifs à la performance énergétique des bâtiments ont-ils été atteints ?
4. Y a-t-il eu des retards, des échecs ou des changements importants dans les actions liées aux bâtiments par rapport à ce qui avait été prévu initialement ? Pourquoi ?
5. Quels ont été les principaux obstacles à la mise en œuvre complète ?

SECTION 3 : Pertinence Locale et Contexte

6. Dans quelle mesure le PCAET a-t-il reflété les besoins locaux et les conditions de référence énergétique de Metz (par ex. parc immobilier, facteurs socio-économiques) ?
7. Des adaptations ont-elles été apportées au fil du temps pour mieux s'ajuster au contexte local ?

SECTION 4 : Durabilité et Impact à Long Terme

8. Des mécanismes ont-ils été mis en place pour garantir que les actions du PCAET aient un impact à long terme au-delà de la période officielle du plan ?

SECTION 5 : Parties Prenantes et Gouvernance

9. Quels acteurs ont été les plus activement impliqués dans la mise en œuvre des actions liées aux bâtiments ?
10. Les rôles et responsabilités étaient-ils clairement définis et maintenus ?
11. Comment évalueriez-vous la qualité de la coopération et de la communication entre les parties prenantes ?

SECTION 6 : Capacité Institutionnelle

12. Metz disposait-elle du personnel technique, de la mémoire institutionnelle et des structures de coordination nécessaires à la mise en œuvre du PCAET ?
13. Y a-t-il eu des changements de personnel ou des réorganisations qui ont perturbé la capacité pendant la mise en œuvre ?
14. La participation à des réseaux/projets nationaux ou européens a-t-elle soutenu vos capacités internes ?

SECTION 7 : Viabilité Financière et Coût-Bénéfice

15. Quelles sources de financement ont été utilisées pour la mise en œuvre du PCAET — en particulier pour les bâtiments ?
16. Y a-t-il eu des difficultés de cofinancement ?
17. Comment les coûts et bénéfices ont-ils été répartis entre les acteurs ?

SECTION 8 : Informations, Outils et Processus

18. Quels outils ou méthodes avez-vous utilisés pour concevoir et suivre les actions du PCAET ?
19. Les données sur les progrès et la mise en œuvre ont-elles été partagées avec d'autres services ou avec le public ?

20. Y a-t-il eu des retards ou des inefficacités dans le processus de planification ou de mise en œuvre ? Quelles en ont été les causes ?

SECTION 9 : Suivi, Évaluation et Adaptation

21. À quelle fréquence les progrès ont-ils été suivis ? Par qui ?

22. Des changements ont-ils été apportés aux actions du PCAET en fonction des résultats du suivi ?

23. Concernant spécifiquement les bâtiments : certaines actions prévues ont-elles été abandonnées, retardées ou élargies suite aux évaluations ?

SECTION 10 : Facteurs Externes

24. Dans quelle mesure les politiques nationales, les changements économiques ou les événements externes ont-ils influencé la mise en œuvre ?

25. Les parties prenantes comprenaient-elles clairement les objectifs et les bénéfices des mesures énergétiques liées aux bâtiments ?

26. Dans quelle mesure les risques financiers perçus ou les incertitudes ont-ils affecté la participation aux actions liées aux bâtiments ?

27. Quelles compétences techniques ou leçons importantes ont été tirées de la mise en œuvre ? Comment ces connaissances ont-elles été conservées ?

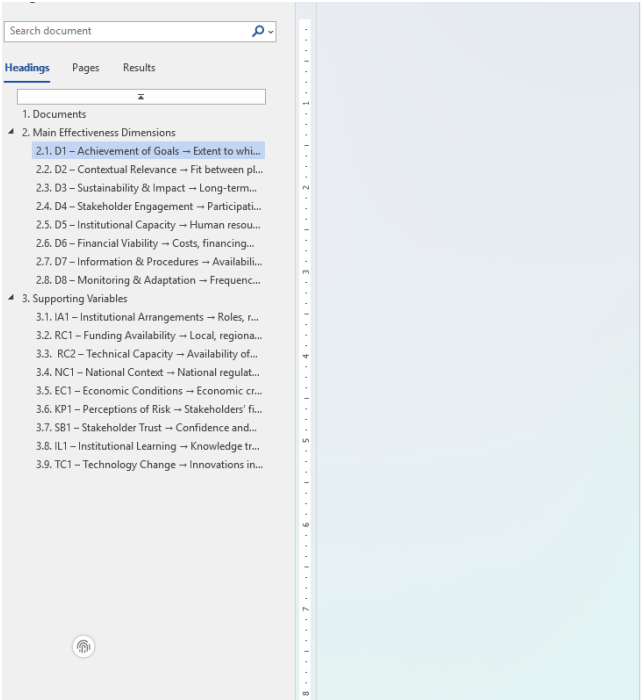
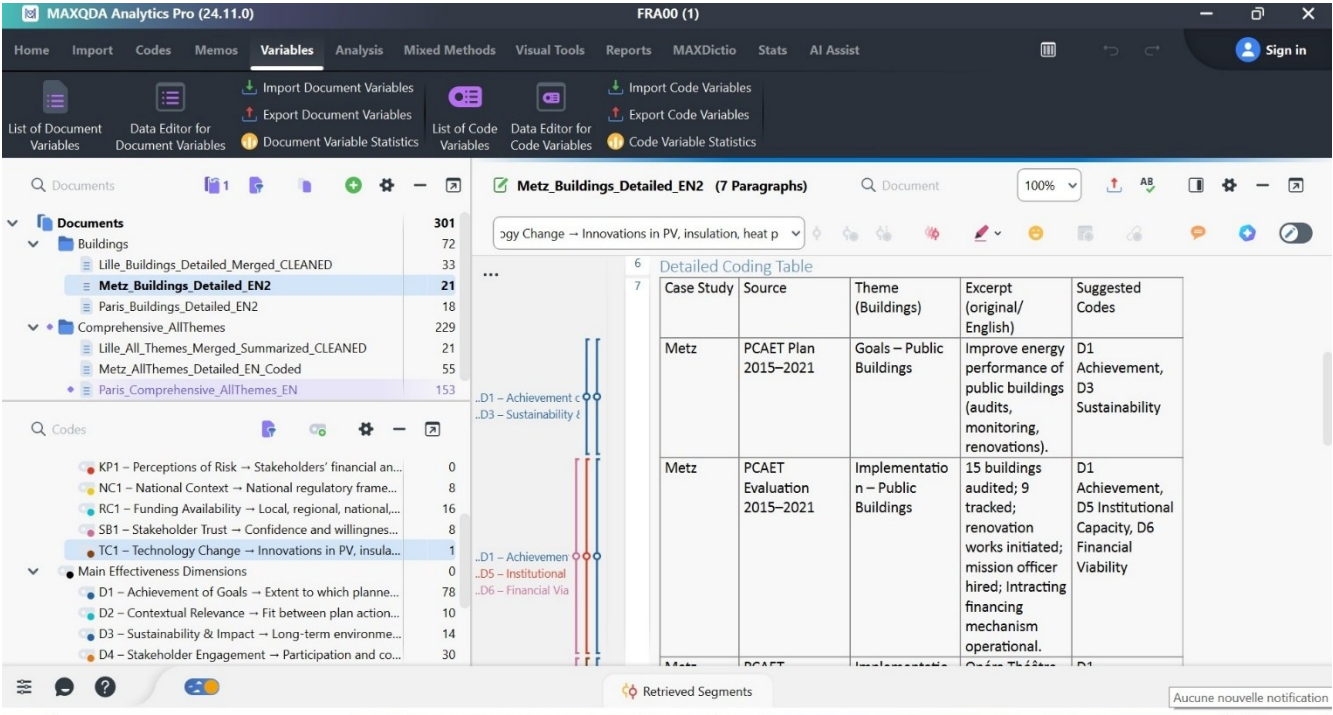
28. Les changements technologiques ont-ils eu un impact sur la capacité à mettre en œuvre les actions prévues ?

SECTION 11 : Conclusion

29. Si vous pouviez redessiner ou réimplémenter le processus du PCAET à Metz, que changeriez-vous ?

30. Quels conseils donneriez-vous à d'autres municipalités qui souhaitent lancer un plan climat-énergie local aujourd'hui ?

Some screen shots from MAXQDA and the coding system



2. Main Effectiveness Dimensions

2.1. D1 - Achievement of Goals -> Extent to which planned objectives

- "Bolzano SEAP committed to -20% CO₂ by 2020; buildings expected to contribute a major share of reductions through retrofits and district heating improvements."
Code: • D1 - Achievement of Goals -> Extent to which planned objectives Weight score: 0
Buildings > Bolzano-building-detail01, 1 - 1
Created: 8/31/2025 7:48 AM by Ashrafi-A, Modified: 8/31/2025 7:48 AM by Nastaran
Area: 157 6.41%
- "Retrofitting of schools, municipal offices, and sports facilities; LED lighting upgrades; installation of energy management systems."
Code: • D1 - Achievement of Goals -> Extent to which planned objectives Weight score: 0
Buildings > Bolzano-building-detail01, 1 - 1
Created: 8/31/2025 7:48 AM by Ashrafi-A, Modified: 8/31/2025 7:48 AM by Nastaran
Area: 132 5.39%
- "Measures included residential retrofits, energy audits, condominium refurbishments, rooftop solar integration."
Code: • D1 - Achievement of Goals -> Extent to which planned objectives Weight score: 0
Buildings > Bolzano-building-detail01, 1 - 1
Created: 8/31/2025 7:48 AM by Ashrafi-A, Modified: 8/31/2025 7:48 AM by Nastaran
Area: 110 4.49%
- "Public retrofits and lighting upgrades contributed significantly to reductions in municipal energy use and CO₂ emissions."
Code: • D1 - Achievement of Goals -> Extent to which planned objectives Weight score: 0
Buildings > Bolzano-building-detail01, 1 - 1
Created: 8/31/2025 7:48 AM by Ashrafi-A, Modified: 8/31/2025 7:48 AM by Nastaran
Area: 121 4.94%
- "Private retrofit uptake was slower than expected; incentives existed but homeowners faced financial and bureaucratic barriers."
Code: • D1 - Achievement of Goals -> Extent to which planned objectives Weight score: 0
Buildings > Bolzano-building-detail01, 1 - 1
Created: 8/31/2025 7:48 AM by Ashrafi-A, Modified: 8/31/2025 7:48 AM by Nastaran
Area: 126 5.14%
- "Milan SEAP set -20% CO₂ by 2020 vs 2005, with buildings expected to deliver the majority of

Consent Form in English (which signed forms exist for all the interviews):

Participant Consent Form and Data Protection Statement

Title of Research Project: From Decision-Making to Operation – Effectiveness of Local Energy Plans Implementation

Researcher: Nastaran Esmaeilpour Zanjani

Institution: UP Lab, DICAr- Department of Civil engineering and Architecture, University of Pavia, Italy

Supervisor: Prof. Roberto De Loto

Purpose of the Interview:

You are being invited to participate in a research interview as part of a doctoral research project analyzing the implementation of the effectiveness of local energy plans. Your insights, based on your experience with Bolzano's SEAP, will help to contextualize and validate the findings.

Participation and Confidentiality:

Participation is entirely voluntary. You may decline to answer any question and may withdraw from the interview at any time. All data will be treated confidentially. Your responses will be anonymized in the final thesis and any related publications, unless you explicitly agree to be identified.

Data Handling and Protection:

The interview will be audio recorded (with your permission) and transcribed for analysis. Data will be securely stored on password-protected devices and accessible only to the researcher and supervisor. Data will be retained for the duration required by the university's research ethics policy.

Consent Statement:

By signing below, you confirm that you have read and understood the above information, and that you voluntarily agree to participate in this interview.

Participant Name: _____

Signature: _____

Date: _____

Researcher Signature: Nastaran Esmaeilpour Zanjani

Date: 16.07.2025

Nastaran Esmaeilpour Zanjani

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