



**Review of instruments and tools
used for energy and urban planning
in Amsterdam/Zaanstad, Berlin, Paris,
Stockholm, Vienna, Warsaw and Zagreb**

Synthesis report of Work Package 3 “Instruments and tools under scrutiny”
(D 3.2)

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1. Introduction

This work package aims to improve the cities' understanding of currently used instruments¹ and tools² and their relevance for integrating energy aspects into the planning processes. Working on the awareness of gaps and missing links, the cities should increase the knowledge on which instruments and tools need to be adjusted and how, and which innovative instruments and tools should be added.

Over 170 instruments and tools had been identified and 44 were selected and mapped by the cities. The analysis of each city's results has identified seven common gaps and allowed learning from each other.

2. Main findings and conclusions

The first observation is that none of the cities presented any instrument that is solely dedicated to energy planning. Many cities have expressed the lack of interoperability between the different diagnosis tools (maps); because of that, it is difficult for city officials to obtain a clear picture of where the city is headed. As a result, it becomes more difficult to involve external stakeholders. Another important finding is that using contracts or competitions are important factors that help stimulate the market and innovation thereby improving project performance. In connection with WP4 (governance), some cities have highlighted the lack of process and quality assurance management throughout the project, from strategic concept to implementation to operation. Furthermore, monitoring after implementation of various projects seems to be an important issue for most of the cities. Indeed, there are tools to check energy performance or to take into account embodied energy (during life cycle analyses) of a building, but these tools are not being used. Three cities intend to develop and use a label system for urban quarters integrating environmental and energy aspects. Finally, the majority of the consortium agreed that energy planning for the building stock is a bigger challenge than for new buildings. For that there is a lack of instruments and tools.

Despite those deficiencies, some cities are moving ahead and are already working on finding viable solutions to the different challenges described above. For example:

- Amsterdam selected the TRANSFORM tool (GIS-based decision support tool to analyze energy supply options) as a good practice to improve the local diagnosis;
- Paris presented the "Label Ecoquartier" which aims to transfer the overall state objectives for developing sustainability to the scale of a development project;
- The tool "Stockholm Royal Seaport" is an important monitoring tool;
- The Public property development competition used in Vienna is a good example as to how to ensure qualities beyond building regulations from planning to implementation.

These and other good practices will be presented in detail in D3.3.

To strengthen this report, a benchmark of tools or instruments is needed. It should consider private or public initiatives in order to provide more solutions to the challenges the cities have identified.

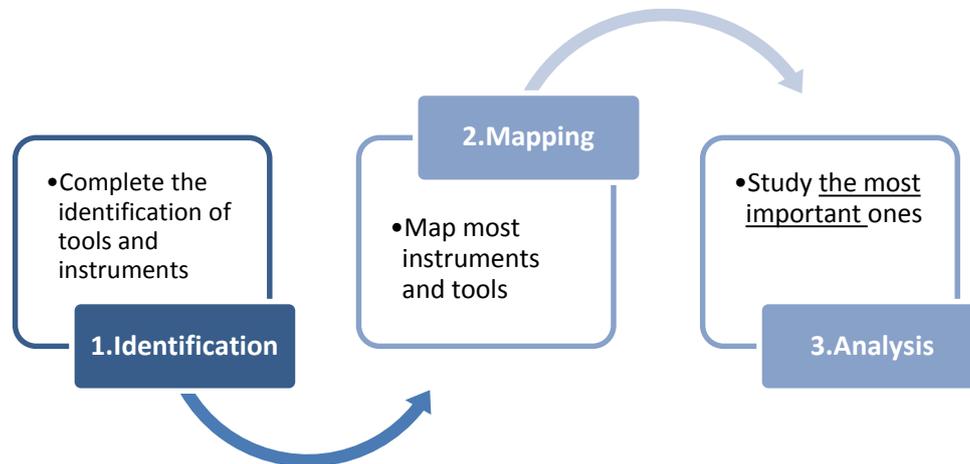
¹ "Instruments" refer to different ways of influencing urban energy planning.

² "Tools" refer to supporting means used when applying an instrument.

3. Identification and Mapping

3.1. Methodology

The first step was to identify all instruments and tools, currently used by each city administration, that have an impact on integrating energy issues into their urban planning processes. After the identification, cities had to place the instruments and tools on a map and select the most relevant ones to be analyzed in depth in the analysis grid. (See guiding principles in D3.1)



To have a clear understanding of the instruments and tools currently used by the cities, every city has mapped them in a template. Each instrument and tool was aligned to spatial level and type. There are four **spatial levels**: city/region, district, quarter, building; and the different types of **instruments** (regulation/law, strategy plan, competition, financial aid, guide lines) and **tools** (certification/label, GIS interactive, database, contract, software, website, other) are visible on the x-axis.

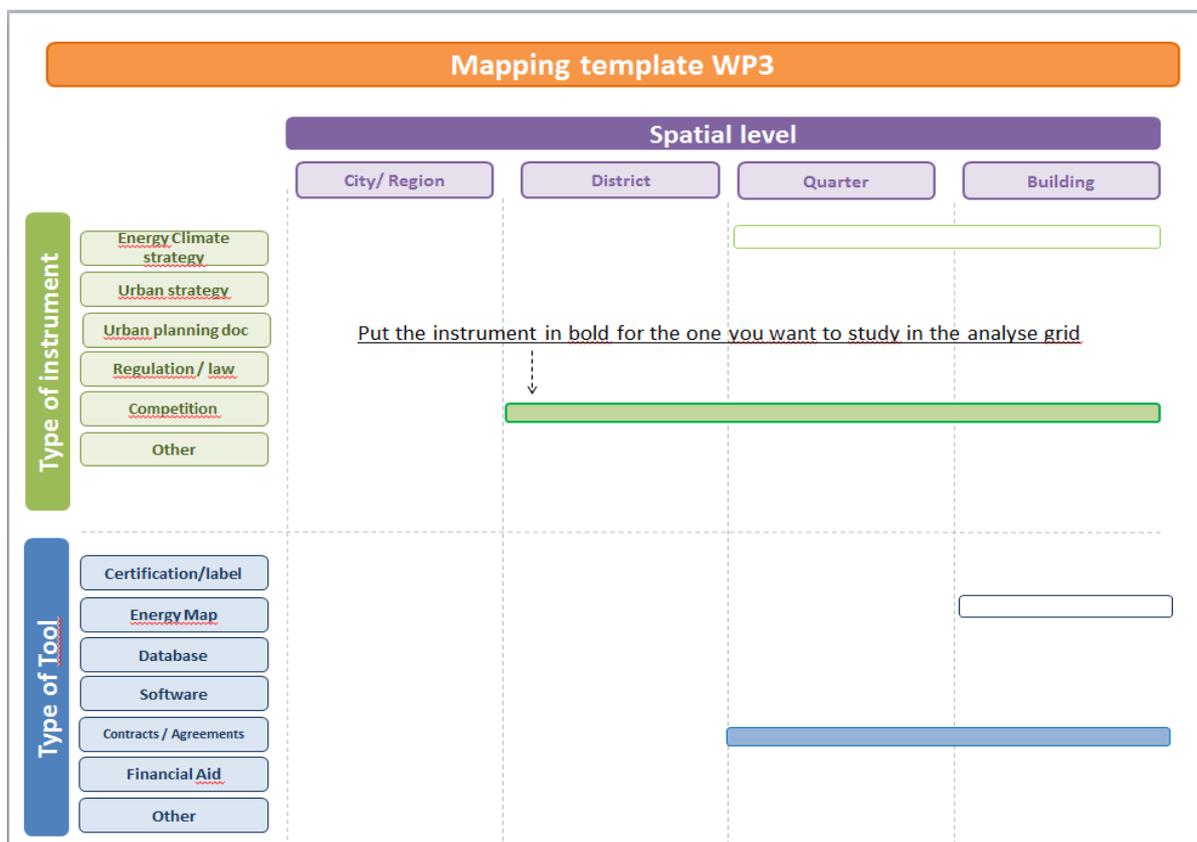


Figure: 1 Mapping Template Results

3.2. Results

Over **170 instruments and tools** have been identified (104 instrument and 66 tools) by the cities. Due to the high number of instruments and tools, the analysis only considered the most important ones (chosen by the cities themselves) to avoid having to fill out the grid for each.

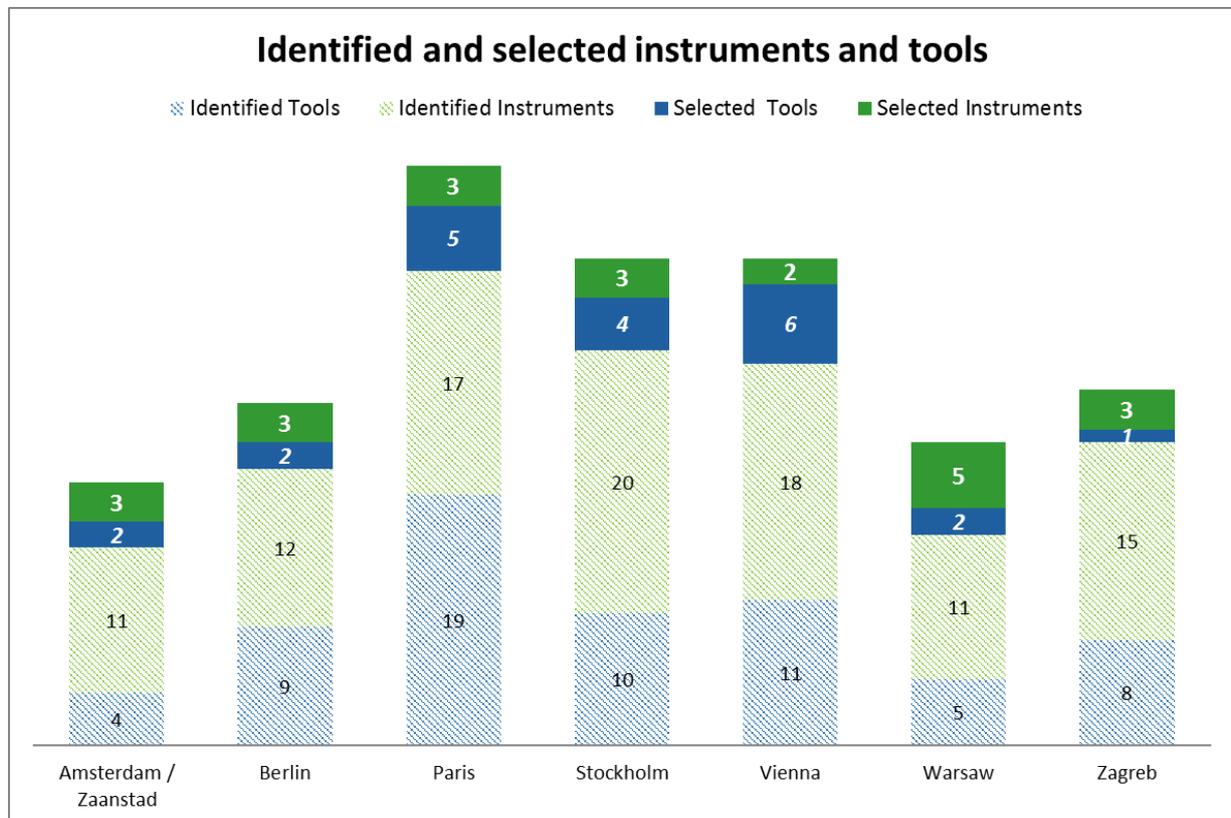


Figure: 2 Identified and selected instruments and tools

44 instruments and tools were selected and mapped by the cities. (See global mapping below)

The selection of instruments and tools was based on what instruments and tools are currently in use in the UL project city administrations (instruments or tools used by private stakeholders or examples from other cities were not included) and the relevance for energy integration – which has been determined by each city regarding its own urban (re)development process.

The in-depth analysis will follow in Part 3 (gaps and adaptations).

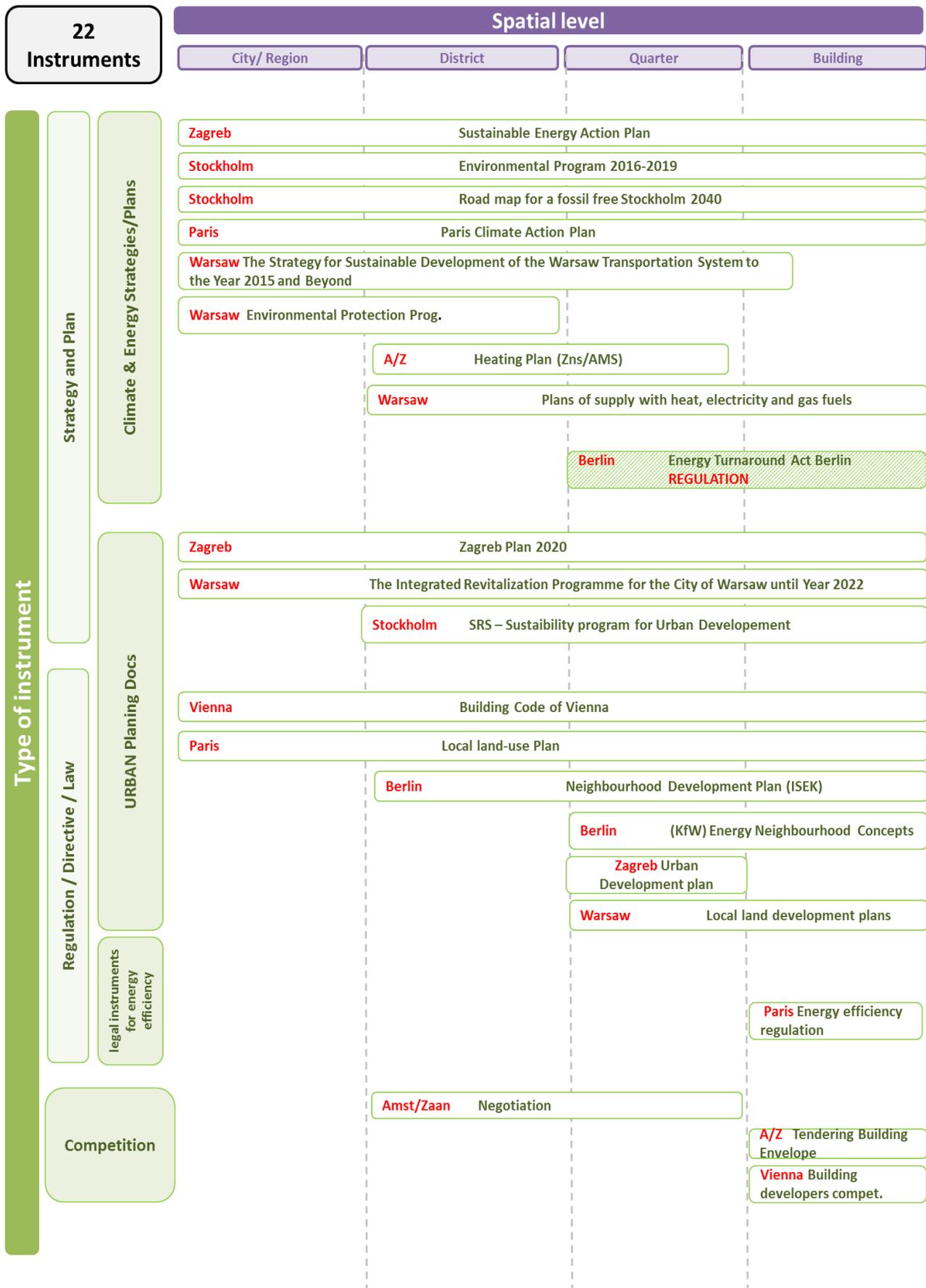


Figure: 3 Mapping of instruments

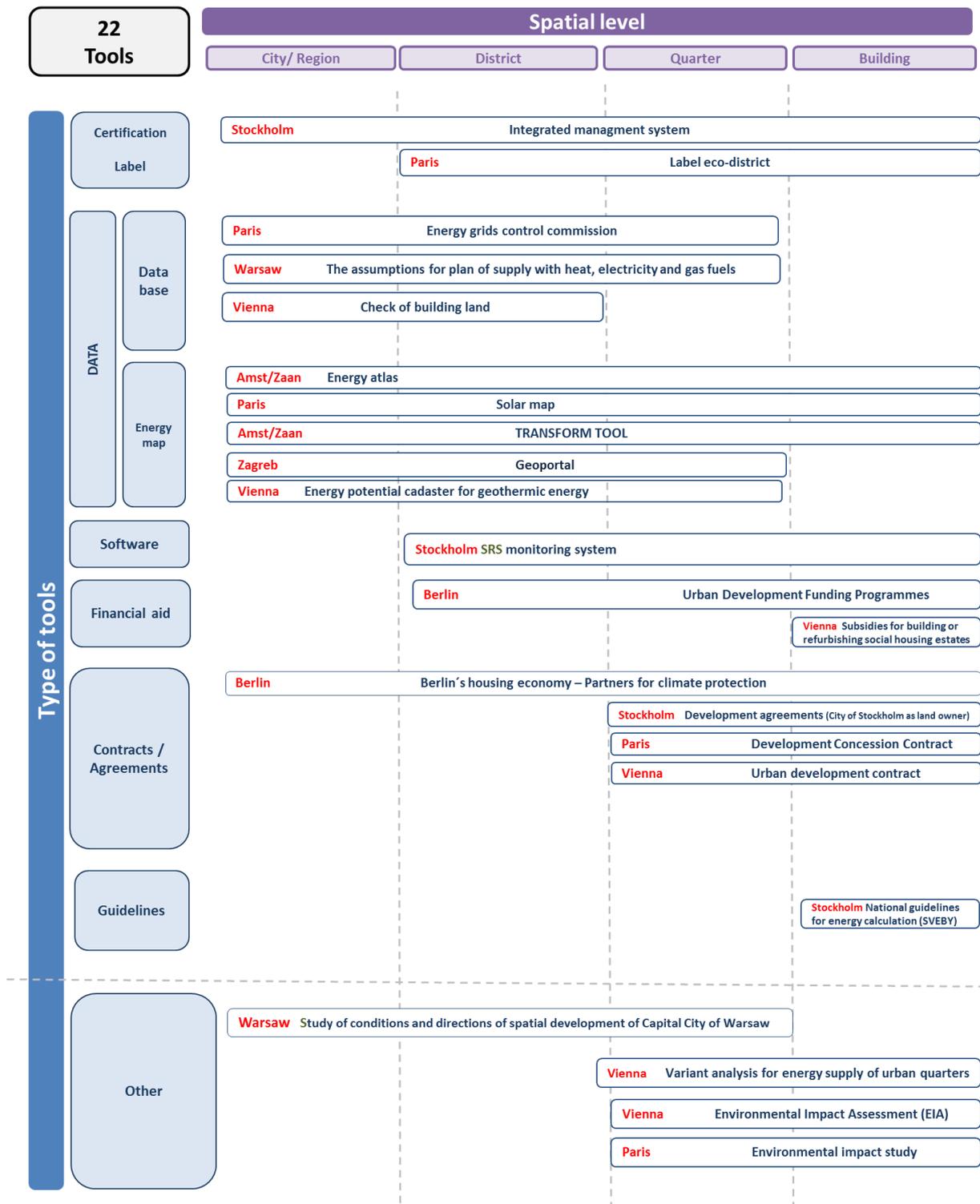


Figure: 4 Mapping of Tools

3.2.1. Selected instruments: mostly energy/climate strategies and urban documents

The cities have selected 22 instruments with a majority (18) of them being strategic documents (partly mandatory) and regulations/laws (mandatory). These two types of instruments include either energy and climate strategies or plans (SEAPs, Roadmaps...) and urban planning documents.

Some cities have also found that competition (e.g. Tendering building envelope for Amsterdam and Zaanstad or Building developers competition for Vienna) can also have a positive influence on energy integration. Only one city has chosen an energy efficiency law (French energy efficiency regulation).

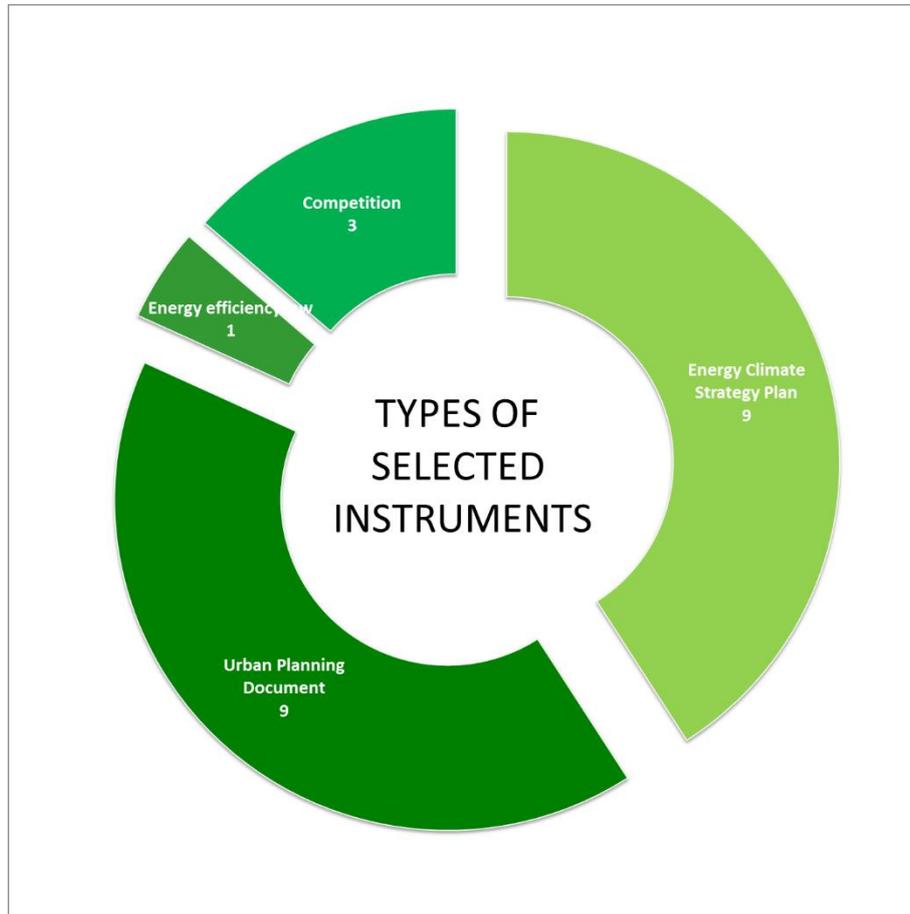


Figure: 5 Types of instruments

Observations:

- > Strategic documents of the selection usually apply to the city scale. Indeed, selected strategic documents are cross-disciplinary documents regarding energy as well as environmental issues. There is only one instrument dedicated to the transport sector, one heating plan and one plan of supply with heat, electricity and gas.
- > Regulations and laws selected apply to a smaller scale (from the building to the district).
- > In many countries, energy efficiency of buildings falls under the jurisdiction of the states. The European directive of December 16th, 2002 (2002/91/EC), aims to promote the improvement of the energy performance of buildings. Only one city has selected a legal instrument for energy efficiency - this is quite surprising given that this type of instrument imposes energy consumption thresholds.

3.2.2. Selected tools: adapted to each city situation

22 tools were selected; they can be categorized in 9 different types. A big part of the selection shows data based tools (9), including different energy maps and energy databases as well as check of building land and monitoring system software. Cities were interested in sharing examples of contracts or agreements (4) along with certification and labels (2) especially at larger scales than building level.

Two cities highlighted financial aid tools (urban development funding programs for Berlin and subsidies for building or refurbishing social housing estates for Vienna).

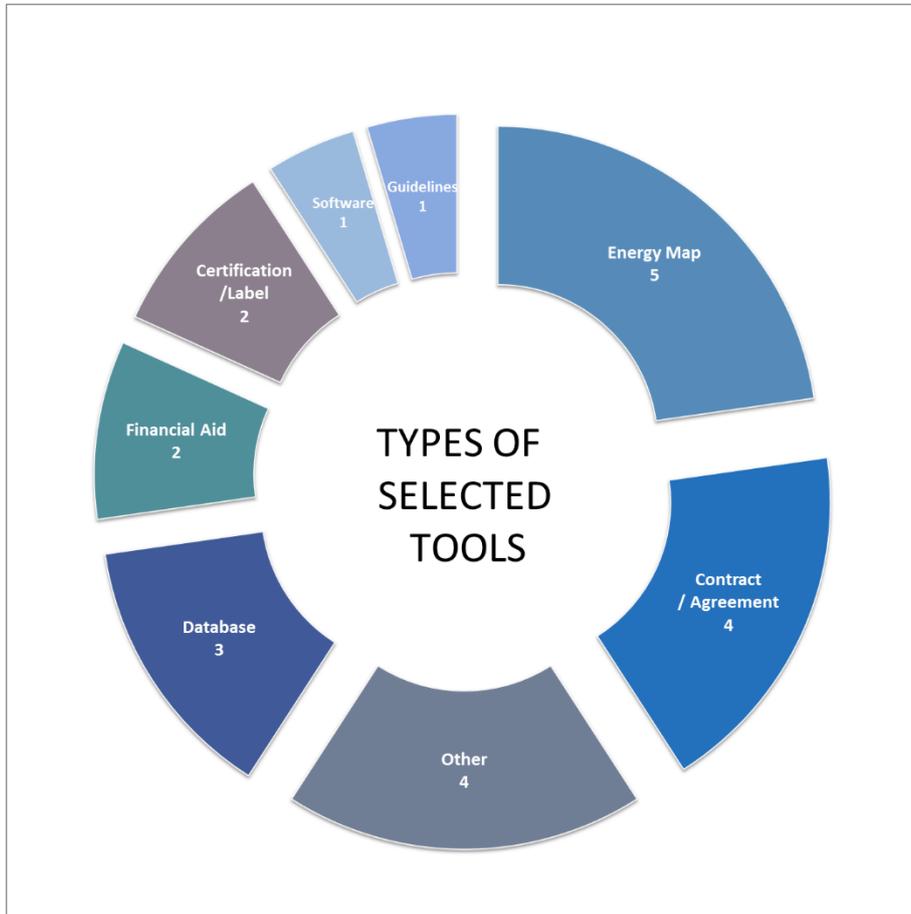


Figure: 6 Types of tools

Observations:

- > Energy data based tools are easily available at city scale but less at building scale
- > The two certifications chosen by the cities apply to a larger than the building scale
- > Selected contracts are for buildings or quarter scale
- > There is no tool applying only to district or quarter level in the selection

4. Gaps and possible adaptations

All the selected instruments and tools had been studied more accurately in a common analysis grid. (See the common analysis grid in D3.1 with guidance and questions asked). Around 30 questions for each tool and instrument have been asked to identify weaknesses, strengths, gaps and possible adaptations. Each city commented on its own results (see part 4). The synthesis of these cities' reports resulted in the following seven main conclusions:



Regarding gaps and needs for improvements, UL cities share some future concepts, including instruments and tools that are being developed or are in a testing phase, to respond to needs that they identified (see tabs below “filling the gaps and work in progress”).

4.1. Lack of adequate instruments for energy planning

Current situation

None of the UL cities presented any instrument solely dedicated to energy planning. Actually there are no laws (national or European) that compel cities to develop energy planning instruments. Furthermore, the responsibilities about energy planning are not clear. Indeed, cities have existing documents like urban planning documents and SEAPs which are related to energy issues, but it cannot be equated to real energy planning.

Filling the gaps and work in progress

Two options have been identified; either integrating energy aspects into existing (urban planning) instruments, or developing a new energy planning instrument to steer energy demand and supply. In some cases both options might be needed.

a) Adaptation of existing urban documents



The mandatory nature of some urban documents offers the opportunity to introduce energy requirements at the very beginning of urban (re)development projects. Vienna and Paris are working on integrating energy requirements into their urban planning instruments.

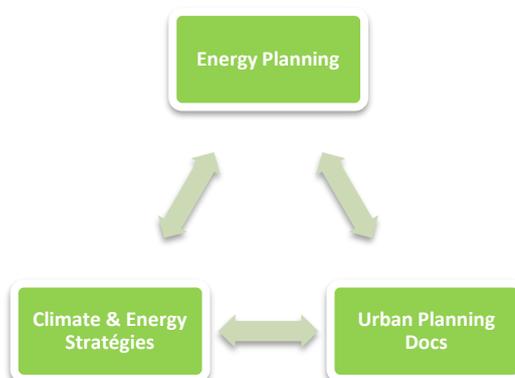
Stage	Work in progress	City
Discussion	Building Code (law)	Vienna
Achievement	Art.15 Local Land Use Plan (July 2016)	Paris

The Building Code of Vienna is the legal basis for spatial/urban planning as well as building regulations. This law determines very important objectives for the development of the city but at the moment, there are no energy or climate protection objectives listed in the document. Nevertheless, Vienna being a province can adapt this law and is currently in the process of doing so.

In Paris, the Local Land Use Plan (PLU) with its legal aspects is a key instrument and thanks to a new measure in the French Urbanism Code, the municipality introduced a new article, “Article 15” (July 2016). This new article defines obligations imposed on buildings, works, facilities and equipment, in terms of energy and environmental performances. However, the City of Paris keeps in mind that these obligations include exceptions.

b) New instruments to steer energy demand and supply

The Netherlands are working on a new, integrated national law on physical and environmental planning that merges 26 existing laws into one. Vienna and Paris are already working on new instruments to help the coordination between existing energy and urban documents. It should help to provide a clear common vision of energy orientations for all stakeholders.



Stage	Work in progress	City
DEVELOPMENT	National physical and environmental planning law (2016)	Amsterdam
	Integrative energy planning concept (2017/18)	Vienna
	Energy Framework Strategy (2017)	Vienna
	Scheme for energy planning for the entire city (2019)	Paris
STUDY	Legal aspects for integrative energy planning	Vienna

A strategic working group in the City of Vienna is currently developing an “Energy Framework Strategy” (Energierahmenstrategie) for the city, which is supposed to be finalized and adopted by the city council by spring 2017. The strategy builds on the Smart City Vienna Framework Strategy and will serve as a framework document for all other energy-related documents in Vienna. It is expected to be adopted by the city council in the spring of 2017. In addition, this strategy will guide the development of an “Integrative Energy Planning Concept” (Fachkonzept Energieraumplanung) for the whole city, which in turn will be part (thematic concept) of the Urban Development Plan (STEP 2025) (2017/2018). An important basis for these documents is a study on legal aspects for integrative energy planning, which will be finalised at the beginning of 2017.

Due to national regulation, Paris is working on different development schemes for each energy grid at city scale for 2019. These instruments should provide orientation about what energy sources will supply each urban area.

The Netherlands are working on a new integrated national law on physical and environmental planning. This law will integrate 26 laws and the zoning plan will be part of it. On the basis of this new law, municipalities will create new environmental and urban planning visions at city level. Cooperation between neighboring cities and towns with regard to certain aspects of spatial development will be easier in the future. Energy goals can be part of it. However, it is currently not possible for a municipality to impose stricter energy regulations in a zoning plan than the national Building Code states.

4.2. Need for improvement of diagnosis tools for a better use at an early stage

Current situation

During the last ten years, the cities have developed different tools to evaluate the renewable energy sources potential such as solar maps (Paris), geothermal maps (Vienna) or heating maps. These data help as well as promote a better integration of these energy sources into cities. However, many cities have expressed the lack of interoperability between the different maps, which can create interpretational difficulties for stakeholders. Therefore, an accurate assessment at this point is often neither simple nor accurate.

Filling the gaps and work in progress

GOOD PRACTICE Amsterdam has presented the tools “Transform” (Decision Support Environment utilizing the power of energy data) and “Energy Atlas” which are good examples to overcome the above mentioned deficiencies (please refer to Best Practice Showcase). The Energy atlas and the TRANSFORM tool form a symbiosis: the atlas provides the databases and the TRANSFORM tool makes it possible to apply the data and e.g. generate maps.

Most of the cities want to connect their different energy maps to create a sophisticated tool in order to manage the existing energy infrastructures and to help to develop a better energy planning strategy, which would cover both energy demand and supply. Therefore, cities will have to use GIS to improve their decision-making capacities. A quick overview of work in progress in the UL cities can be found below:

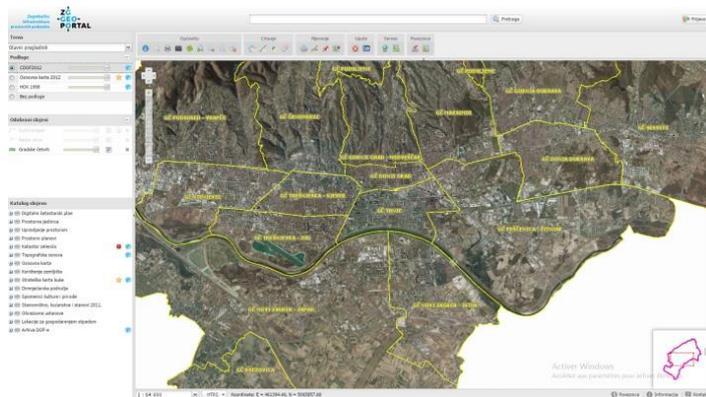
Stage	Work in progress	City
UPDATE	TRANSFORM	Amsterdam
	Plan to update the existing layers of Geoportal	Zagreb
TEST	Energy refurbishment Map : ACCENT	Paris
DEVELOPMENT	Cadaster for waste heat	Vienna
	Creation of a database (1 st step) → Map (2 nd step)	Warsaw
CONCEPT or ongoing discussions	Energy refurbishment atlas	Berlin
	GIS Energy Maps	Stockholm

Amsterdam: The yearly update of the data will partly be realized by making the Energy atlas a national instrument (currently underway) and a national responsibility. Another improvement of the tool is to sharpen the calculation of energy needs and energy potential.



→ [Energy Atlas & TRANSFORM](#)

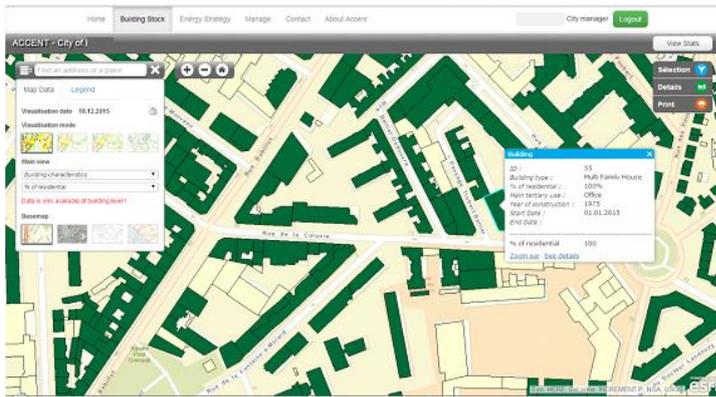
Zagreb: Geoportal is a web portal that provides access to spatial information and a variety of related services (search, browse, download, transformation, service discovery). ZG Geoportal is a hotspot of Zagreb spatial data infrastructure.



Available economic, social and energy data can be introduced and combined into a GIS database, such as data from the annual 'Energy Balance' or solar map data and locations of charging stations.

→ [ZG Geoportal](#)

Paris: "Accompany cities in energy strategy" (ACCENT) is an innovation project developed with Climate KIC (Knowledge and Innovation Community) for which Paris is a pilot city.



ACCENT will provide city stakeholders data and tools to map and assess the existing energetic situation (building stock), and design energy strategies which maximize energy efficiency.

→ [ACCENT](#)

Warsaw: the new assumptions for a plan of supply with heat, electricity and gas fuels will be adopted in the form of a database. The next step should be a graphic representation based on the data.

Berlin: An “Energy Refurbishment Atlas” has been discussed in Berlin’s LWG. The idea is to map energy related data in the urban development context and identify quarters with high feasibility for refurbishment based on a defined set of criteria.

Stockholm: the city of Stockholm is thinking about a tool with maps for various conditions including energy generation, supply and storage in order to make better analyses in the early stages, enabling the city to start up projects with the clearest-possible vision for all stakeholders.

Vienna: Vienna provides a lot of information about energy potentials on the public only city map. Some information is at building scale such as solar thermal energy and solar energy for photovoltaics. The potentials about wind energy and geothermal energy (for different depths aligned to ground water or soil down to 200 meters) are available on a rougher scale. The 3D solar potential map showing the potential of all surfaces of a building is also brand new (since November 2016).



→ [Energy maps in the online city map \(see category “Energie / Energiepotenziale”\)](#)

→ [3D Solar potential map](#)

The development of a cadaster about the potentials of waste heat is on-going. It should promote the use of waste heat for refurbished or new buildings as well as reduce the energy demand for cooling. It could also be integrated into district heating.

4.3. Missing framework to integrate energy issues in contracts or competitions

Current situation

Some cities pointed out the importance of energy clauses in contracts or competitions. The cities agreed that contracts, competitions or tendering could be a solution to improve the efficiency of urban projects.

Filling the gaps and work in progress

GOOD PRACTICE Vienna has developed a public property development competition using a quality (including ecology) assurance process for bigger building developments in the subsidized housing sector (see Best Practice Showcase). This instrument ensures high qualities; since it requires a thorough approach, some extra time needs to be planned in.

The City of Stockholm emphasizes that the city will be able to specify requirements for maximum climate impact when awarding construction contracts that are managed by the City. Urban concession contracts in Paris can also include special clauses on energy aspects. Therefore these energy obligations have to be carefully prepared at the beginning of the project to have reachable objectives. The city of Vienna would like to analyze if energy could/should be a part of urban contracts. It would ensure that certain identified solutions are actually implemented and it would provide more certainty in planning.

Stage	Work in progress	City
UPDATE	New call for project "Réinventer les ZAC" (Reinvent the urban development areas)	Paris
EXPERIMENT	Anterior agreements	Amsterdam/Zaanstad
Ongoing discussions	Energy issues to possibly be included in urban contracts	Vienna

Paris has tested an innovative competition: it issued a call for a program entitled "REINVENTER PARIS" which applies to projects at the building scale. The purpose of this call for Innovative Urban Projects is to select innovative urban projects or constructions. The intention is that these projects should be developed on sites identified within the framework of this call for projects. This innovative competition contributes to the fulfilment of the Paris municipality's objectives, where the projects were selected and reviewed on the basis of different criteria, including environmental characteristics and performances. The City of Paris intends to use the same type of competition for a larger scale "Reinvent urban development areas" to challenge urban planners and promoters of urban projects.

4.4. Lack of process management throughout the project: from strategic concept to implementation (and beyond)

Current situation

Several cities expressed the lack of an ongoing supervision of urban (re)development projects from the very beginning to the end of urban planning processes (and beyond). In Paris, accompanying a project from beginning to end turned out to be a missing aspect in the current urban planning process. In connection with WP4, a lack in process management was identified in the Parisian process, because of

a lack of a dedicated project team that is responsible for a project throughout the entire development process.

Filling the gaps and work in progress

In case of subsidized housing projects in Vienna, the Public property development competition enables a kind of quality assurance through the whole planning process.

The city of Stockholm suggested a project management tool that can be shared by all stakeholders in the urban development process, from strategic concept to implementation and management in order to create a continuous process, and to reduce risks in scheduling and transitions between various stages and stakeholders.

Stage	Work in progress	City
Ongoing discussion	Project management tool	Stockholm

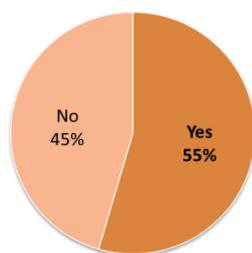
4.5. No monitoring after the implementation in most of the cities

Current situation

According to the analysis, the cities do not have any instrument or tool to check the environmental performance of their urban project during its life time. Two phases are identified after the project is built: “the urban project in operation” (during its lifetime) and the demolition phase.



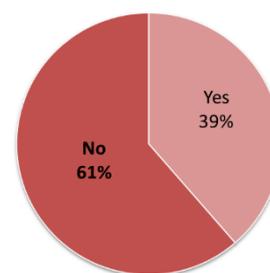
Does the instrument/tool control the energy performance of the urban project (operating/in use) ?



In use:

According to the cities, 55% of the selected tools and instruments have an influence on the energy performance of an urban project. However, no specific and efficient one has been identified in the consortium. Many cities would like to be able to monitor the energy performance of a building over its lifetime but it seems difficult for some to have access to energy performance data.

Does the instrument/tool influence the end-of-life of the urban project ?



End-of-life:

None of the cities has integrated the demolition phase of the project in their tools or instruments, yet. Is the project going to be demolished? Will a rehabilitation be preferred? Are the construction materials used easily replaceable or recyclable? Many of these questions concern the Life Cycle Assessment (LCA) and circular economy of the urban project itself. Some cities consider this topic but it needs to be strengthened to integrate them in advance into the project.

Filling the gaps and work in progress

In use:

GOOD PRACTICE The tool “Stockholm Royal Seaport” developed by the city is one idea for taking into account the in-use phase. The SRS model for monitoring (the “Sustainability Portal”) is a web-based database for reporting and monitoring performance with regard to the sustainability requirements for site allocation and development agreements used by Stockholm Royal Seaport.

Amsterdam mentioned that the Transform tool is prepared to be part of monitoring the energy use of a long-term area development (havenstad until 2050).

End-of-life

The new French energy efficiency law (2018) will cover energy and carbon aspects. To do so, the state experiments with Life Cycle Assessment issues on several buildings to set some thresholds about carbon issue for new construction. A database of industrial materials ([INIES](#)) and a software tool (ELODIE) are already available for these types of calculations.

The relevant departments and companies in the City of Stockholm have begun to work together on the development and testing of a tool for managing “embedded energy” in SRS. The “Open Environmental Calculation Tool Based on Industry Agreements” project aims to develop a free, national LCA tool for reading LCA data via building product specifications, based on a Bill of Materials (BoM). The tool will be able to generate a building’s climate declaration and will be tested during 2017/18.

Stage	Work in progress	City
TEST	Test of a tool for managing “embedded energy” in SRS	Stockholm
	“Open Environmental Calculation Tool Based on Industry Agreements” project (2017)	Stockholm
DEVELOPMENT	Energy efficiency and carbon regulation (2018)	Paris

Improving monitoring seems to be very important for the cities; however, they need to be aware that it might imply a huge effort in terms of organization and time.

4.6. Need for an environmental certification at urban project scale

Current situation

Few cities are thinking of creating or using environmental certifications to evaluate each new urban project in order to stimulate the market.

Filling the gaps and work in progress

GOOD PRACTICE The “Label Ecoquartier” is a French approach carried by the state, which aims to enforce the overall state objectives in development sustainability at the scale of an urban development project. A national validation is necessary for granting the label. The City of Paris uses this tool to evaluate the quality of its new urban projects. Three projects have been approved to be an “eco-quartier”. It gives a good overview of the environmental efficiency of the projects to the municipality.

Stage	Work in progress	City
TEST	Test of the Swiss calculation tool (label) for quarters	Vienna
UPDATE	Label Eco-quartier (2017)	Paris

The City of Vienna has tested the Swiss calculation tool (label) for quarters (2000 Watt Rechenhilfe für Areale) in two areas. The energy performance was calculated for three categories: heating/cooling, mobility, embedded energy (also regarding life cycle issues such as refurbishment and demolition). This tool was developed for small quarters according to Swiss circumstances (maximum of 30 buildings) and is related to a national certification system. It didn't fit to the situation in Vienna. Nevertheless, the methods and the process are an important input to discuss labels as well as assessment tools for quarters/urban development projects. There is an ongoing national project (2016-2018) for an assessment tool (quantitative and qualitative) for urban development projects (urban quarters). Also, urban area parameters should be developed such as thresholds for CO₂ emissions per capita or m² depending on use (primarily focusing on living). The city of Vienna will take part in the discussion about feasibility and assess the usability potential for Vienna.

The renewal of Label Eco-quartier (2017). Five new priorities: Eco districts adapted to the territory's specific aspects, the label considers all the phases of an urban project (from design to daily life of inhabitants), participation of inhabitants in the design and management of their neighborhood, health, well-being and nature in the city, and finally the quality of indoor air.

4.7. Taking into account the "Building stock"

Considering the scope of the UL project, most of the tools and instruments selected by UL cities are about new buildings, few apply to the building stock. The number of new constructions is marginal in comparison with the building stock, which is energy-inefficient. Therefore, the major issue will be the transformation of the existing building stock through refurbishment and adaptation of the energy infrastructure. However, there are many barriers – especially legal ones.

Quite a few cities appear more comfortable specifying energy-efficiency requirements for new construction than building stock. In Zagreb, the city clearly expressed a need for analysis of data on urban refurbishment potential and their use for infrastructure planning because today this infrastructure is primarily planned according to the expected volume of new developments.

A detailed analysis of the building stock should be part of the diagnosis and some cities are already working on it as it is described in the chapter on Diagnosis. In particular, Berlin presented its idea to map energy related data in an urban development context ("Energy refurbishment Atlas"), and similarly Paris is testing the new tool "ACCENT" to assess the existing energetic situation (building stock). The transformation of the building stock via refurbishment and integrated infrastructure is the main focus of the EU-H2020 project *Smarter Together* that Vienna takes part in (see <http://smarter-together.eu/>). APC participates in the European project "ACE-Retrofitting" which will aid European local authorities to accelerate their building renovation rates.

5. Analysis by city

5.1. Amsterdam/Zaanstad

In Amsterdam and Zaanstad there is a good information base on energy. A lot of data is available on energy usage and renewable energy potentials. Besides of instruments under public law, the cities make use of instruments under private law. In case of landownership sustainability criteria are part of the tendering procedures. Otherwise the municipality can negotiate a contract with sustainability criteria before the zoning plan is adapted.

In general the application of the tools and instruments can be optimized in practice. It is also necessary to create a stronger learning effect with developers and within the municipality itself. Therefore the monitoring and feedback loop could be strengthened after the building phase to create a learning effect and foster the right behavior for the next project.

The key-tool to improve is the TRANSFORM tool, the tool that was developed in the European project TRANSFORM. The tool is a decision support tool, which creates an intuitive interface between the different databases and calculation measures. In combination with the data of the energy atlas, this tool can be very powerful and also play a role in monitoring and learning.

For Amsterdam and Zaanstad new instruments under public law are in development. These are part of a broader reorganization of the spatial planning system on the national level.

5.1.1. Identification Mapping – Selected instruments and tool

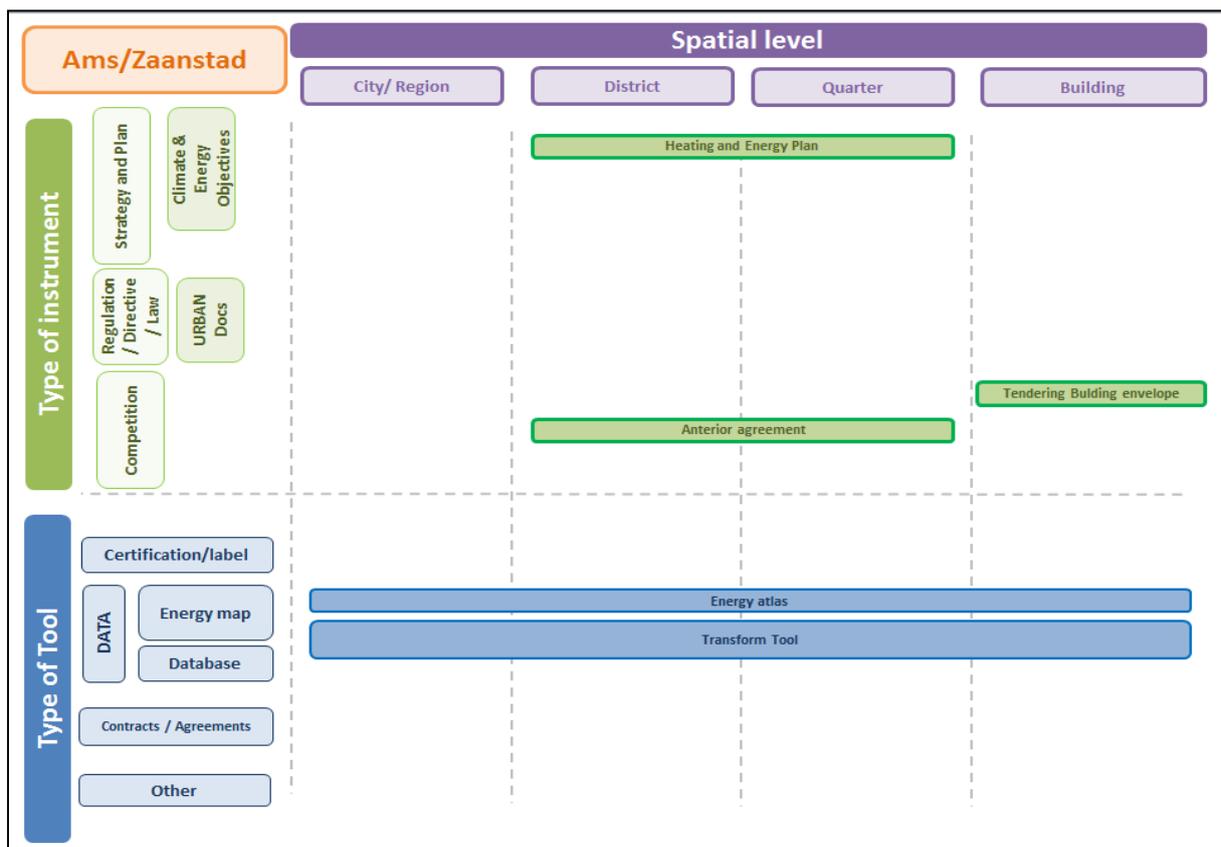


Figure: 7 Mapping of instruments and tools

Instruments

Energy Plan	The goal is defining a strategy to choose an energy system for an area and doing calculations on different possible energy systems, CO2 emission and costs.	Climate & Energy Objectives
Heating Plan	By formalizing the outcomes of the energy plan into a heating plan for a district it becomes juridical binding for developers.	Legal instrument
Tendering	By tendering rights for building plots, developing areas or rights to construct underground (energy) infrastructure, an organisation is selected partly on the base of sustainable energy criteria.	Competition
Anterior Agreement	<p>Make sustainable energy part of the development process with a private developer by signing an Anterior Agreement. The municipality can make demands on the base that the zoning plan has to be adapted.</p> <p>Example: Zaanstad used this instrument for the new district Kreekrijk. On the base of negotiations, part of the agreement are: no connection to the gasnetwork, carbon neutrality for the district (strict demands), and ecological shores, separated wastewater, environmentally friendly materials (goals).</p>	Negotiation

Conclusion:

We are experiencing a shift from the private instruments: tendering (in case of landownership) and Anterior Agreement (in case of needed change of zoning plan), towards public instruments. The possibilities for public instruments are enlarged on the national level: possibilities on Heating Plan (new legislation) and the Omgevingswet (Environmental Act: in development).

Tools

Transform best practice	Decision support, informed dialogue, based on existing, detailed and easily accessible data. Insight in energy use, energy potentials, measures that can be taken, scenario-making and cost and benefit calculation.	Software, interface
Energy atlas	Be informed of the local energy consumption, network and (renewable) energy potentials to get a grip on the energy context.	Data energy map

Conclusion:

Energy atlas and TRANSFORM tool form a symbiosis. The atlas provides the databases and the TRANSFORM tool makes it possible to work with the data.

5.1.2. Gaps and potential improvements

Instruments and tools in general

The gap in instruments and tools in 2016 in Amsterdam and Zaanstad is to control the energy consumption after the implementation phase. The reporting needs to be improved, just as the instruments to make developers comply if something comes up during the reporting phase.

Identified key tool or instrument to improve

An experiment has started for the instrument Anterior Agreement. Part of the experiment is that the developer will prove in a later stage if the energy goals were fulfilled.

At the moment, the Transform tool is prepared to be part of monitoring the energy use of a long-term area development (Havenstad until 2050). The yearly update of the data will partly be realized by using the Energy atlas as a national instrument (that is currently done). Another improvement of the tool is to sharpen the defined calculation measures. The tool-builder will work together with an energy consultant directed on Havenstad.

For both improved instruments, there is still a challenge to push developers to comply with agreements if it becomes clear the results are below the set goals. This enforcement could also be a soft instrument, like making the results publicly known. Most important is that a learning effect occurs.

5.1.3. Upcoming tools or instruments

On a national level, a new integral law is being developed on physical and environmental planning. This law will integrate 27 laws. The zoning plan will be part of it. On the base of this new law municipalities will make new environmental and physical visions on a city level. Energy goals can be part of it.

5.2. Berlin

5.2.1. Main findings and conclusion

In Berlin, a wide range of different instruments and tools already exist – they are related to urban and energy planning. Many of these different types of instruments and tools tackle energy from different perspectives and in different depth. One milestone, which has been achieved so far, is the approval of the Energy Turnaround Act in April 2016 (alternatively: Energy Transformation Act). This act enforces the public administration and related municipal institutions to carry out energy actions to achieve the objective of becoming climate neutral until 2050. The roadmap for the energy actions are outlined in the Berlin Energy and Climate Protection Program, which represents the “roadmap”. The Energy Turnaround Act and the Berlin Energy and Climate Protection Program will play a central role for future urban energy planning processes and provide a good framework.

To avoid stand-alone activities a more integrated approach of actions has to be established (energy as part of urban development). Therefore, instruments such as Energy Neighborhood Concepts, Urban Development Funding Programs and Neighborhood Development Plans are good examples to emphasize energy as part of social and economic urban development and interlink these aspects as a whole.

The interlinking of energy with social and economic aspects of urban development has proven to be a complex field of action in Berlin and requires a comprehensive understanding of the local stakeholders. The best way to tackle these challenges is to test and pilot projects, which can be used for replication and knowledge-transfer. One main focus in Berlin is the promotion of Energy Neighborhood Concepts through a goal-oriented planning and governance process.

5.2.2. Identification Mapping – Selected instruments and tool

An overview of selected instruments and tools as follows:

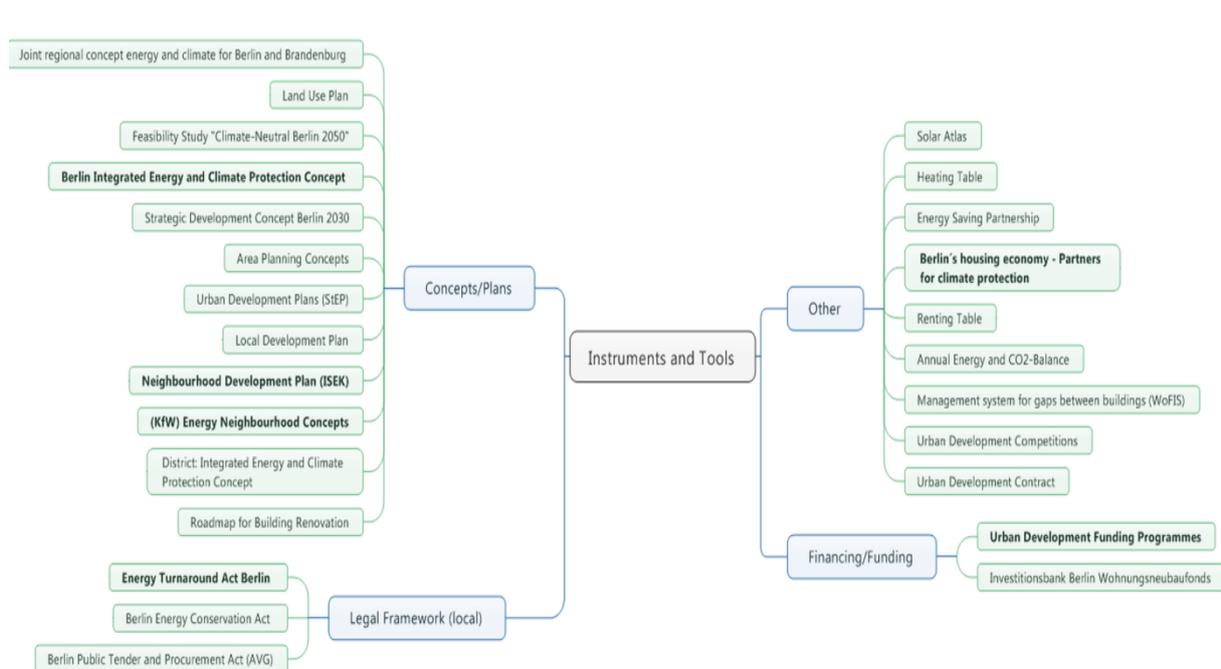


Figure: 8 Overview of selected instruments and tools

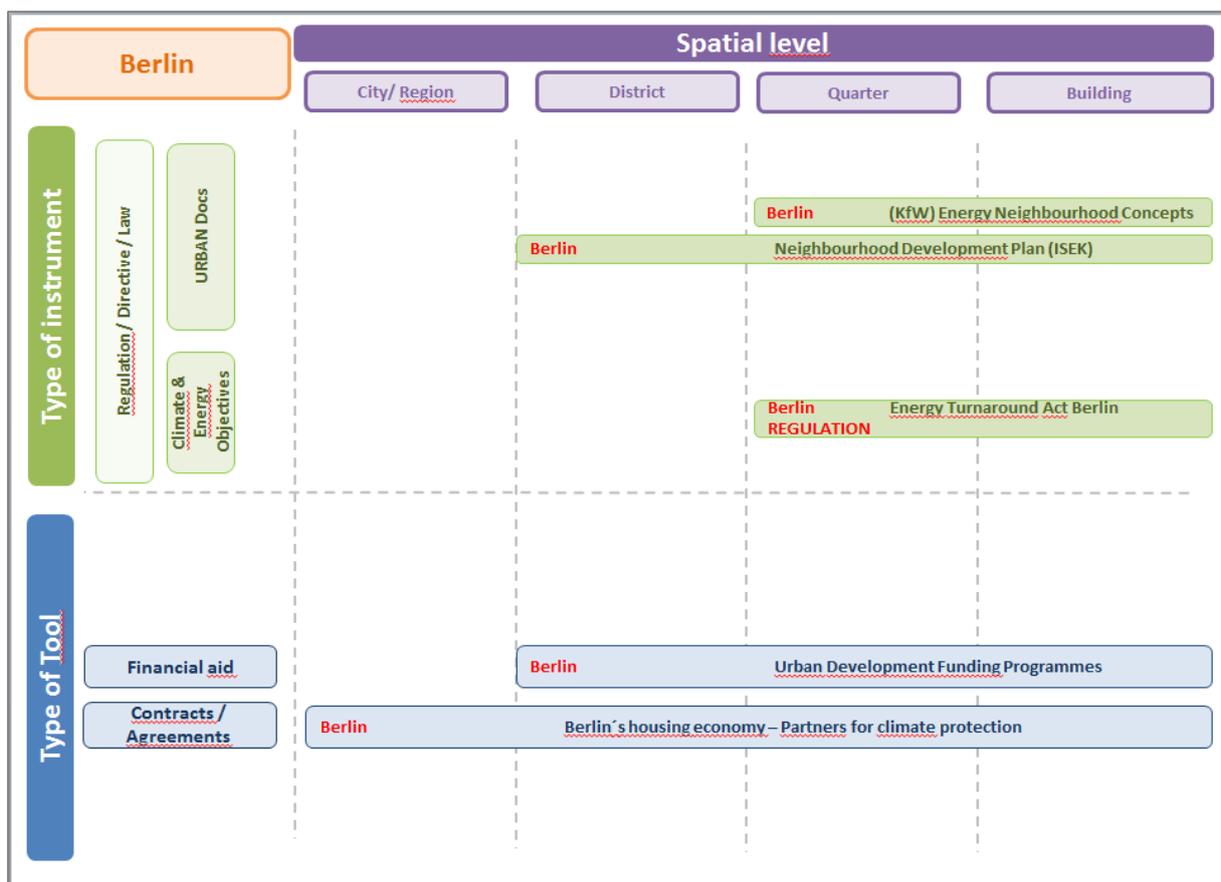


Figure: 9 Mapping of instruments and tools

Instruments

Energy Turnaround Act Berlin	<p>Legal institutionalization of climate protection goals (climate-neutral until 2050) and framework for City of Berlin for implementing measures and projects (according to Berlin Energy and Climate Protection Program)</p> <p>➔ The act obliges the local authorities to carry out energy and climate protection measures. This also includes measures on integrative urban energy planning.</p>	Climate & Energy Objectives REGULATION
Neighbourhood Development Plan (ISEK)	<p>Identify social and spatial problems at an early stage and to develop corresponding coping strategies to deal with these problems. This plan is a prerequisite for allocation of the Urban Development Funding Programs and a strategic document for urban development areas.</p> <p>➔ Energy has not been institutionalized in this plans. This should be incorporated in all plans in the future.</p>	Urban Doc
Energy Neighbourhood Concept (Program 432, funded by KfW) Key tool	<p>Prepare and support the implementation of the refurbishment of neighborhoods/quarters and sustainable energy supply/demand</p> <p>➔ In Berlin 5 concepts have been elaborated so far. Due to several reasons (e.g. lack of engagement of building owners, consultation) implementation of suggested measures has not been accomplished. This could be potentially avoided by involving stakeholders in the pre-assessment process of such concepts etc...</p>	Urban doc

Conclusion:

The selected instruments provide a strategic framework at a city level (Energy Turnaround Act) and district/quarter level for urban energy development, in particular concerning the existing building stock, which remains the major focus for energy and climate protection actions.

Tools

<p>Urban Development Funding Programs</p>	<p>Mitigate and solve social and spatial problems in city districts and quarters by providing public funding for measures at an early stage (e.g. Refurbishment of public buildings is eligible for funding and tax deduction for private building owners)</p> <p>→ The funding schemes and the actions being funded should focus more on interlinkages with energy aspects.</p>	<p>Financial aid</p>
<p>Berlin’s housing company - Partners for climate protection Best practice</p>	<p>advance the refurbishment of buildings and reduce energy and emissions</p> <p>→ Promotes a partnership with private and public housing companies to reduce the energy demand of buildings, based on a defined baseline and assessment. The partnership is publicized and highlights the engagement of the housing companies as partners for climate protection.</p>	<p>Contracts / Agreement</p>

Conclusion:

The selected tools are good examples to incentivize energy actions of private and third party stakeholders. The Urban Development Funding Programs can trigger private investments on buildings (including RES, retrofitting etc.). The partnership with housing companies also provides incentives through public advertisement etc.

5.2.3. Gaps and potential improvements

Instruments and tools in general

The instruments and tools need to be applied in a way that interlinkages and interdependencies are taken into consideration and synergies be used. This requires a comprehensive understanding of local stakeholders on the different tools and instruments being used. A leading focal point on district or city level could possibly facilitate and mitigate such approach and should provide relevant stakeholders with expertise and advices, if needed.

Identified key tool or instrument to improve

Many different improvements have already been discussed in Berlin, which are for instance outlined and addressed in the Berlin Energy and Climate Protection Program. The overall focus of improvements which are tackled within the UL-project are related to the neighborhood approach though.

A key approach is the promotion of neighborhood related energy planning and actions. The Energy Neighborhood Concepts are considered as a central instrument to promote the renovation rate of existing buildings and thus should be initiated as a base for actions on local and building level. The promotion of this instrument requires capacity development of the district authorities and an accompanying focal point to support the pre-preparation of such concepts. This will be addressed through the planned piloting of a “Service point for energetic quarter development” (see as in WP 4).

5.2.4. Upcoming tools or instruments

The appropriate use and application of tools and instruments requires a supporting advisory instance to support public administrations in organizing and implementing actions with local stakeholders (institutional arrangement/instrument). This approach will be the focus in WP 4 (“innovations of governance processes”) and lay the ground for potential “new” instruments and tools such as an “Energy Refurbishment Atlas”, which has been discussed in Berlin’s LWG. The idea is to map energy related data in urban development context (“Energy refurbishment Atlas”) and identify quarters with high feasibility for refurbishment based on a defined set of criteria.

5.3. Paris

5.3.1. Main findings and conclusion

Paris has no specific instrument or tool for integrating energy into urban development projects in a holistic approach, but the need to develop such instrument or tool is not documented today. This analysis is based on instrument and tool used by the city today. However other instruments and tools (some private) are available at national scale, we should identify and study the relevance of using them. Two major conclusions of this analysis are that reporting and monitoring should be improved and governance is a missing aspect of our instruments and tools. By monitoring we mean how to check energy efficiency during the implementation and how to control the energy consumption during the lifetime of the urban project. In connection with WP4 we also observed a lack in governance with no dedicated steering committee throughout the development project. Furthermore, we found out that the embodied energy is not part of our tools and instruments yet. However, it will be one requirement to our next energy efficiency law in 2018, which will focus on energy demand (net zero energy) and embodied energy by using national LCA tools.

5.3.2. Identification Mapping – Selected instruments and tool

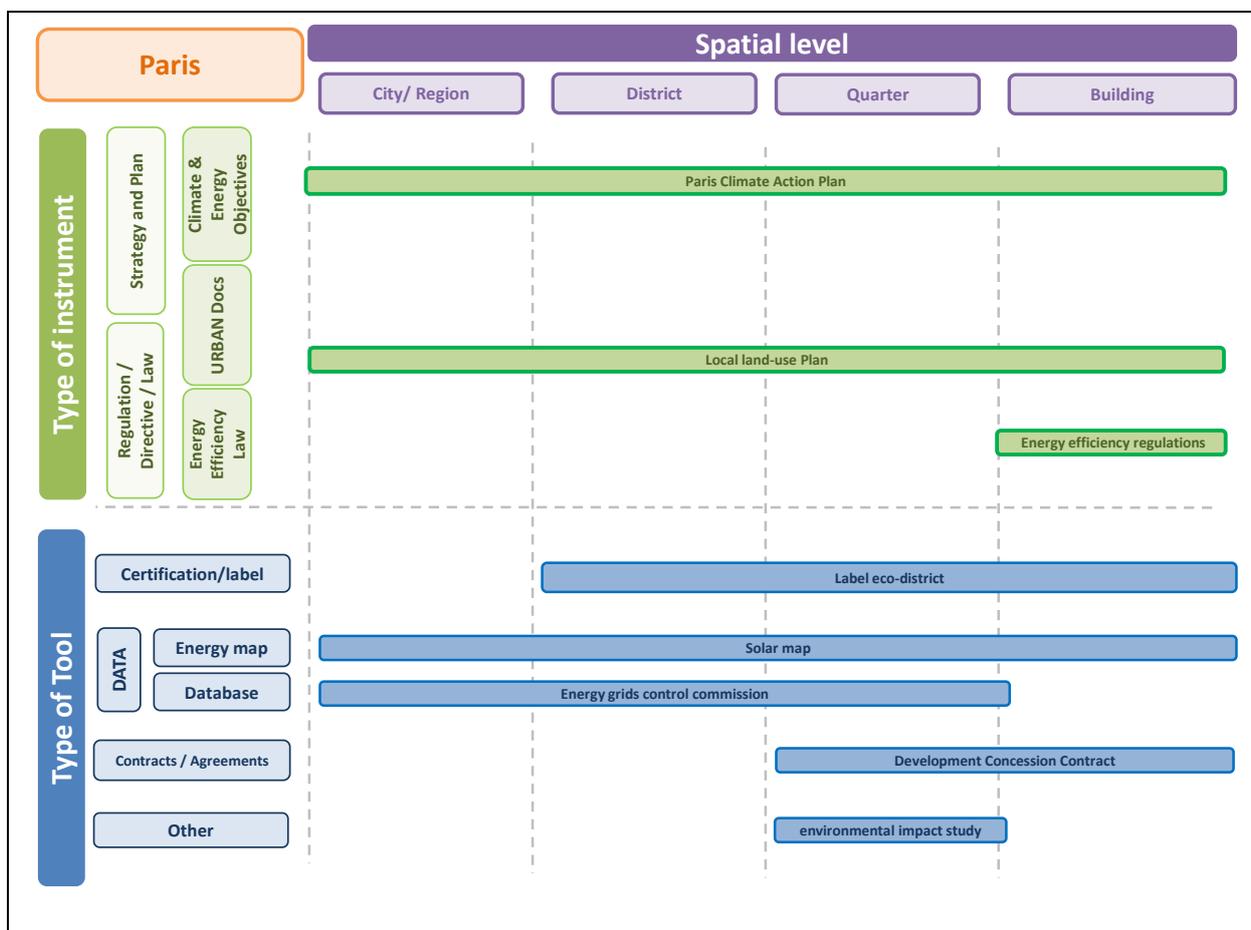


Figure: 10 Mapping of instruments and tools

Instruments

Local land use plan	The PLU is both a strategic document (presentation report, PADD), which defines the general guidelines of urban planning and development for the next 15 years, and a regulatory document (OAP, Regulations, annexes) that governs the evolution of plots.	Urban document
energy efficiency law	The energy efficiency regulation aims to reduce the energy need of the new construction. The 2012 energy efficiency regulation is quite ambitious compared to the other one. The threshold is 50 kWh(primary)/sqm for 5 items (heating, cooling, lightning, hot water, ventilation). There are three geographical zones to modulate the threshold.	Regulation
Paris Climate Action Plan	This plan leads the City to achieve factor 4 (decrease by 75% of GHG emissions) in 2050. In 2020, the City has to reduce GHG emissions and energy consumption by 25% and to increase renewable energy in energy consumption to 25%. The plan defines specific targets and aims for the different topics: urban planning, housing, economic activities, transport, food and waste, and adaptation to climate change. The plan is about to be revised in 2017 to integrate carbon neutral vision and 100% renewable territory aim in 2050 and dedicated targets for 2030.	Climate & Energy Objectives

Conclusion:

Paris presents strong architectural and patrimonial constraints that can slow the energy integration in existing buildings and refurbishment. However, the **national energy efficiency law (2012)** drives all stakeholders to a good understanding of energy issues of new constructions. The next Energy Efficiency law (2018) will be even more ambitious (zero energy buildings).

Moreover, the **Local Land Use Plan (PLU)** with its legal aspects is a key instrument and Paris introduced a new article, "Article 15" (July 2016), which defines obligations imposed on buildings, works, facilities and equipment, in terms of energy and environmental performance. We can now observe the impact of these new obligations but we keep in mind that these obligations include exceptions, justified by technical impossibilities, by constraints related to the integration of projects in the built environment or, for existing buildings, by heritage preservation constraints. The Local Land Use Plan presents a strong technical complexity and the City of Paris is working on its accessibility with an online GIS (interactive system) <http://cageo.sig.paris.fr/Apps/ParisPLU/>

Furthermore, the **Paris Climate Action Plan** is well known and integrated by all city departments and new Climate Air Energy Action Plan (revision in 2017) will define more accurate and feasible objectives and improve involvement of private stakeholders in a carbon-free vision for 2050.

Tools

<p>Label eco-district</p> <p>Best practice</p>	<p>The Label EcoQuartier (eco-district) is a national approach carried by the state, which aims to decline the overall state objectives in development sustainability at the scale of a development project. A national validation is necessary for the granting of the label. Technical profile of the approach: the label includes a commitment charter and objectives structured in 4 dimensions and 20 commitments, which allow actors to organize and to assess the quality of the development by a committee of experts. This approach requires regular monitoring to obtain the label, which is conditioned by the achievement of targets in line with the context of the transaction and the proposed territory which is part. The eco-district should have a positive impact on its territory</p>	<p>Certification</p>
<p>Paris Solar Map</p>	<p>The solar map provides information about the average sunshine received by the Parisian rooftops and about potential for solar panels' production. Moreover, existing solar installations are identified annually by the City of Paris with social landlords and voluntary condominiums. Last update February 2013</p>	<p>GIS interactive</p>
<p>Energy grid control commission</p>	<p>The different energy grids (electricity, gas, heating, cooling) belong to the city, that delegates through a concession development and maintenance of these grids to companies. A specific control commission for each energy grid undertakes an annual review of the concession. The commission members include deputy mayors, borough mayors, city department, associations, national and regional organisations. CRAC: a report produced by the concession holder describes works for maintenance and development of the energy grids. It also indicates the financial and technical results (amount of energy, number of customers, power, grid length, power plants, incomes and expenditures...). During the session, the committee members approve annual profit and loss account and investment plan. It is a key moment for the city to have a discussion with concession holders on implementations and upcoming projects.</p>	<p>Data base</p>
<p>Development concession contract</p> <p>Key tool</p>	<p>A management concession is an administrative contract by which a person public entrusts an operator, public or private, carrying out a development project. The development concession involves the transfer of project management responsibility for the operation to the operator.</p>	<p>Contract</p>

Conclusion:

Paris has some "legal tools" (environmental impact study, energy grid control commission) that refer to energy but they do not help to really think about this issue in the right moment of the process. The issue is not really about when to think about it but mostly about how to integrate it.

Label eco-district is one of our **best practices** because the label requires the commitment of municipality and includes objectives structured in 4 dimensions and 20 requirements that help actors to organize themselves and insure the quality of urban project. However, management is not the strength of this tool, which is more an assessment tool to give a clear visibility of the project. Paris is thinking about using additional tools to improve the management in urban development projects.

5.3.3. Gaps and potential improvements

Instruments and tools in general

The City of Paris has to think of a tool or an instrument dedicated to check the real efficiency of the urban development project after its implementation. This missing point could be integrated in the future Paris Climate Air and Energy Action Plan in 2017. The embedded energy is nowadays not enough taken into account but the next energy efficiency regulation (2018) would cover energy and carbon issues. Energy distribution has no specific instrument at the moment but Paris is working on establishing different schemes dedicated to energy development and district supply for each energy source.

Identified key tool or instrument to improve

Development concession contract appeared as a **key tool** in our process of urban development. Indeed, the contract can include special clauses on energy aspects. Therefore, these energy obligations have to be accurate and specific to each project. They have to be carefully prepared at the beginning of the project to have reachable objectives, considering also the other instruments of the city. The tool itself cannot be improved because a contract but we can improve the quality of the study as well as the governance process before writing the concession contract. This improvement is deeply linked to the work we did on the WP4.

5.3.4. Upcoming tools or instruments

Paris aims to develop and improve some new and existing tools or instruments. The first one is a GIS interactive maps: An innovative tool conceived to support urban energy planning for buildings, ACCENT provides maps and data to design actions reducing the carbon intensity of the city. Paris is a pilot city for this tool. New documents at metropolitan scale could provide opportunities to the municipality but could also put the brakes on Paris ambitions: Metropolitan Climate Action Plan (2018) and urban planning coordination Plan (to coordinate all Local Land Use Plan (PLU) of the metropolitan area) (2018). Moreover, the city is thinking about a new call for project "Réinventer les ZAC" (Reinvent the urban development areas) which might change the organization of urban process. Paris is also working on different schemes for energy planning at city scale for 2019. This instrument should give orientation of which energy source will supply each urban district. It will obviously contribute to respond the urban learning problematic in general.

5.4. Stockholm

5.4.1. Main findings and conclusion

The City of Stockholm uses a broad range of tools and instruments to regulate and target energy and mitigation in the planning process.

The selection of tools and instruments in this report is based on their relevance for energy but the report doesn't cover all relevant instruments and tools since the project had to reduce the number for deeper analysis. The Stockholm LWG decided early on, with the same motive, not to include mobility in the analysis but to focus on the built environment.

The Climate and energy objectives for the City of Stockholm are recently updated and points out clear measures for the transition toward both more renewable energy and higher energy efficiency.

In WP4, Governance, the analyses of our current process pointed out that improving the process management in the planning phase and to develop stricter requirements in our land allocation and development contracts are the two strongest solutions at hand to improve energy integration in the Stockholm urban planning process.

The current key tool to regulate requirements for energy demand, used when selling land owned by the City, is the land allocation and development agreements which has been used with more stringent requirements than the building codes applied in Sweden over the past 20 years. The City of Stockholm owns about 70% of all land in the metropolitan area – which explains the major impact of these specifications, because a major proportion of all development in Stockholm is subject to these energy-performance requirements.

To improve the process management in the urban planning process a number of tools and instruments has to be improved and/or developed. Tools used for analyses in the early planning stages, in drafts and feasibility studies should be developed to identify the conditions for supply, storage and local production of energy and to calculate LCA and energy efficiency at an early stage.

The tools for monitoring performance such as the SRS monitoring system, and tools for the achievement of policy objectives linked to budgets (IMS) needs to be further developed and applied on the city scale.

The process itself needs to be transparent and systematized and to achieve this, the Stockholm LWG has decided on to focus our work improving the Ledstången (the Handrail), tool which is an existing tool used to coordinate the various parties involved in the urban development process.

Tools like the SPUD and its action program, enables the process manager to put strict requirements on energy through the whole process from an early planning stage to the completed city district which is why we have chosen the “The SRS Sustainability Program for Urban Development” and its related action plans and the related Monitoring System of SRS to be our best practice.

5.4.1. Identification Mapping – Selected instruments and tools

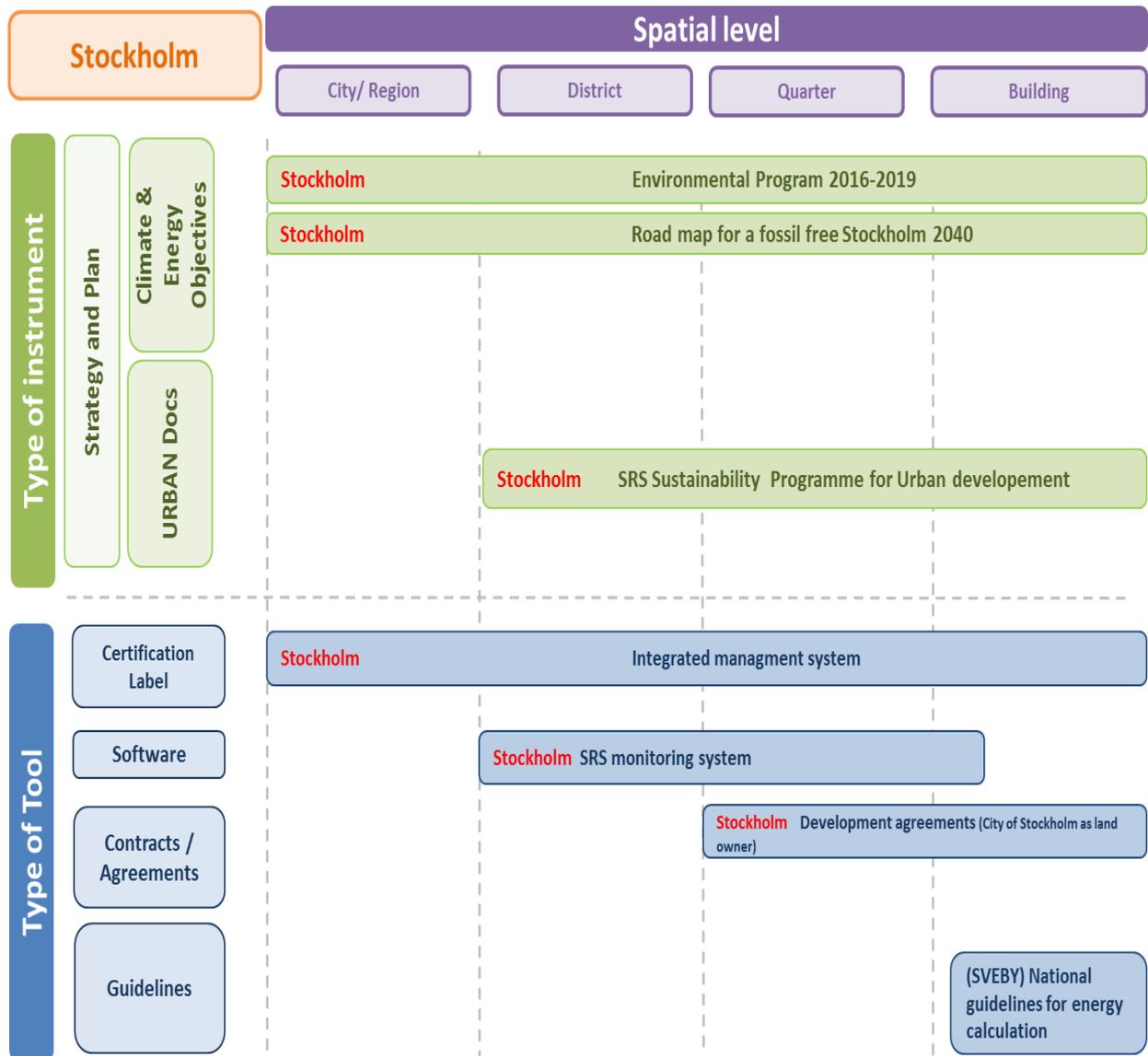


Figure: 11 Mapping of instruments and tools

Instruments

Roadmap for a fossil-fuel free Stockholm 2040	Roadmap for a fossil-fuel-free Stockholm 2040 is a strategic policy document describing how Stockholm will be fossil-fuel-free by 2040. The strategy contains a transition to both renewable energy and energy efficiency. Measures for the next four years (2016-2019) are described in detail, and calculated on the basis of energy savings and the reduction of greenhouse gases, in the document: Stockholm Action Plan for Climate and Energy 2016-2019.	Climate and energy objectives
Environmental Program 2016-2019	“The Environmental Program” is a policy document (six different target areas, of which one is energy efficiency). The program aims to develop a city in which buildings and infrastructure are created using sustainable energy solutions, and designed for adaptation to climate change. The Environmental Program is a City-wide regulatory document, and breaks down the goals of the City Council’s operations into more manageable interim targets.	Climate and energy objectives
The SRS Sustainability Program for Urban Development and its action plans for developers Best practice	The SRS Sustainability Program for Urban Development (SPUD) is a policy document containing five strategies, of which one focuses on energy performance and climate change. The energy-performance and climate-change strategy has three main targets: a focus on energy-efficient buildings and infrastructure, a fossil-fuel-free urban district by 2030, and embedded energy. The energy-performance and climate-change targets are broken down into sets of requirements that are binding for developers and the City. The requirements are specific to each different stage, and compiled in action plans. The requirements of the action plans are included in the site allocation and development agreements and are mandatory for developers. The requirements of the City’s action plan are included in the planning and construction of infrastructure. Measurement and monitoring are mandatory, and controlled by the City at regular intervals.	Sustainability Program and action plan

Conclusion:

The **Roadmap for a fossil-fuel-free Stockholm 2040** and **“The Environmental Program”** provides a strategic framework on city level for how energy should be dealt with in the development of the city for the years to come. They are not only focusing on city development, but targeting the energy issue on a broader level. **The SRS Sustainability Program for Urban Development (SPUD)** is directly oriented towards the planning process regulating energy in a more specific way. It specifies when in the process energy should be dealt with and specifies the specific demands for every plot of land through action plans for developers. In this way integrating the energy issue with the urban planning process.

Tools

Integrated Management System	<p>All planning and monitoring is to comply with the City's management model: the integrated system for management and governance of operations and finances (ILS).</p> <p>In the annual budget, the City Council establishes orientation goals and targets for the operational areas, indicators and activities. The indicators measure target attainment, and the City Council sets an annual target for each indicator. The committees and boards define concrete goals for the City Council's operational areas in the form of department/company targets.</p>	Certification/label
SVEBY	<p>SVEBY is a development program for energy performance driven by the construction and property industry. SVEBY stands for Standardise and Validate Energy Performance in Buildings, and contains several sub-projects that can be classified under three main headings – calculations, agreements and verification. The SVEBY program requires construction companies and property developers to standardise the input data used for the calculation and verification of energy performance. The SVEBY program also serves as the industry's interpretation and expression of the functional requirements in building regulations regarding energy efficiency.</p>	Guidelines
SRS monitoring system <i>Best practice</i>	<p>The Stockholm Royal Seaport (SRS) model for monitoring (the "Sustainability Portal") is a web-based database for reporting and monitoring performance with regard to the sustainability requirements in site allocation and development agreements used by Stockholm Royal Seaport. The main objectives are to enable a more systematic, structured and fair monitoring process, and to provide a tool for gathering and saving all process-related information in one place. The tool also enables the extraction of results from registered data for different kinds of reports that can provide either a brief summary, or more in-depth results of performance based on a range of sustainability indicators.</p>	Software
Site allocation and development agreements <i>Key tools</i>	<p>The City of Stockholm has been using site allocation and development agreements for a long time. In most development projects, the City owns the land (<70%) and can stipulate stricter sustainability requirements in the site allocation and development agreements than the national standard.</p> <p>Since the late 1970s, the City's environmental targets have been defined in an environmental program covering all of the City's departments. The environmental program is revised on a four-year basis, in conjunction with the new political majority.</p>	Contract Agreement

Conclusion:

The tools listed above are the most important and frequent used tools in the city to regulate energy in the urban development process. They should be further developed to integrate/regulate/monitor more energy aspects. Other new tools are needed as well, especially targeting the early strategic part of the process.

The Integrated management system (IMS) and the SRS Monitoring system are important tools in the City's work on measuring and following up the impact of the efforts put to reduce energy demand and raise the production of renewable energy in the city. The SVEBY program is a set of guidelines agreed upon by the vast majority of the Swedish building sector which is why the city has chosen to use definitions deriving from it when regulating energy issues in the site allocation and development agreements.

5.4.2. Gaps and potential improvements

Instruments and tools in general

- **New construction versus building stock**

The City of Stockholm is best when it comes to specifying energy-performance requirements for new construction. We are regulating energy when the city is refurbishing our own building stock but we need to start focusing our efforts on how to enable/promote energy refurbishment of the large building stock owned by private property owners. One way that the city could influence this would be to provide a service to better coordinate the actors in development by finding out when in time they are planning to renovate, improve or build new structures. There is a Tool developed by the traffic administration called GSP, which could be developed to collect and geographically determine the location of incoming building applications. This would open up possibilities for the city to locate clusters of buildings in need of energy refurbishment, to find co-operational winnings and prevent colliding interest and loss of resources.

- **Monitoring / Data / Indicators**

In general, it would be worthwhile for the City to acquire control and responsibility for the distribution networks and to further develop the monitoring of results for energy efficiency in the built environment over time. This would be difficult to implement, because we do not have right of disposition in this issue.

Updating of IMS indicators so that the requirements in the action plans can be monitored and reported to policy.

A need to develop relevant indicators that can be measured

SRS monitoring system: further develop the database to facilitate the compilation of results, and to ensure that the database is used by the entire City

How can we make sure that we add historical data, such as when an owner-occupied apartment association has taken over? Which department is responsible?

Politicians have instructed the City's departments to design a method for calculating CO₂/cap in an urban district. The aim is to verify the cumulative effects of multiple measures.

- **Life Cycle Assessment**

The development of tools to improve efforts with embedded energy, Life Cycle Assessment (LCA) of materials, is in progress but needs to be strengthened, since this will become increasingly relevant to requirements for energy efficiency in the built environment.

The City would like to be able to monitor changes in the energy performance of a building over its lifetime. This is difficult, however, because the City does not have access to performance data. Since energy performance data is classified information, the City requires the consent of all energy purchasers in order to make a survey of a building. This would be both time-consuming and expensive. If a purchaser does not want the City to see this information, we cannot gain access. However there is an ongoing discussion, in which members of the Urban Learning LWG has participated, on this topic where one suggested solution would be a national system for collecting and analyzing data monitored by the Swedish housing agency, Boverket.

Identification of key tool or instrument for improvement

- **Site allocation and development agreements**

The site allocation and development agreement is a key tool for the city but it is only forceful when the city is landowner. It could be developed in many ways, by strengthening the criteria for energy demand but also for other aspects such as LCA and embedded energy. The criteria are regulated through the environmental program, adopted by the politicians.

- **Development of Ledstången (the Handrail)** is not in the mapping since it is lacking energy aspects as of today. The tool is a governance tool, mapping the process and defining related action/quality plans for each stakeholder involved in the process. This tool can be developed so that we can include energy-related issues in all relevant stages, with clarity in terms of responsibility and the right to specify requirements, and to lead the project towards its objective.

5.4.3. Upcoming tools or instruments

- **Governance - Project management tool**

A project management tool that can be shared by all stakeholders in the urban development process, from strategic concept to implementation and management in order to create a continuous process, and to reduce risk in schedules and transitions between various stages and stakeholders. The first step will be the development of Ledstången.

- **GIS Energy Map**

A tool with maps for various conditions in terms of energy generation, supply and storage in order to make better analyses in the early stages, enabling the City to start up projects with the clearest-possible vision for all stakeholders. This should also serve as joint planning for the City's upcoming and ongoing projects.

- **Modelling tool**

Energy estimation at early stages, enabling the City to allocate land with clear instructions for the expected energy performance based on the local conditions of a site.

- **LCA tool**

The relevant departments and companies in the City of Stockholm have begun working together on the development and testing of a tool for managing "embedded energy" in SRS. In 2017, the City will take part in the "Open Environmental Calculation Tool Based on Industry Agreements" project (a development project led by IVL, funded by the Swedish Energy Agency). The project aims to develop a free, national LCA tool for reading LCA data via building product specifications, based on a Bill of Materials (BoM). The tool will be able to generate a building's climate declaration. The tool will be tested during 2017/18.

During the testing period, the City of Stockholm will perform LCAs for some buildings in order to evaluate the method of calculation. In the long term, the City intends to specify requirements for LCA calculations for all new construction throughout the city (on land owned by the City). After a trial period, the City will be able to specify requirements for maximum climate impact when constructing new buildings and facilities.

- **Contracts – Climate Requirements**

Another aim is that the City will be able to specify requirements for maximum climate impact when awarding construction contracts under the City's management.

5.5. Vienna

5.5.1. Main findings and conclusions

The analysis shows that at the moment Vienna uses a number of different instruments and tools throughout the urban planning processes that partly explicitly address energy aspects and partly not. However, there is no single overarching instrument that steers how energy is supposed to be considered in a spatially differentiated manner during the entire planning and implementation process.

Most of the instruments and tools apply to new buildings, fewer apply to the building stock. Most of the tools are for the initial phases of a project and few apply in the actual implementation phase or to life cycle issues.

The selection and analysis focuses on heating, cooling and mobility in line with the competencies at city level. The instruments/tools selected were issued by the city and are effective at city or quarter level. The two instruments were selected as they are highly relevant for energy and have the potential to consider energy much more prominently; however, up to this point energy has been playing a rather subordinate role.

So far the City of Vienna does not use tools considering embodied energy. However, the Swiss calculation tool (label) for quarters (2000 Watt Rechenhilfe für Areale), which features embodied energy as a major element, is currently tested.

There is a need for energy planning to steer the energy supply for new developments and support the transformation of the building stock while reducing infrastructure redundancies of parallel grids of gas and district heating. This could be ensured by new instrument(s) and/or by the adaptation of existing ones. Two major changes should thus be initiated: the legal base, the Building Code of Vienna, needs to be adapted to include energy and climate issues as objectives for spatial planning and urban development. Vienna also is in the process of developing an Energy Framework Strategy which would function as an important guidance document and should be approved in 2017. The on-going development of the “Integrative Energy Planning Concept” will provide another very important basis for integrated energy planning in the future. Existing tools and the integration of new tools should support this process of energy planning.

5.5.2. Identification Mapping - Selected instruments and tools

The following figure shows the selected instruments and tools for Vienna by spatial level. The selection is based on their actual relevance for energy.

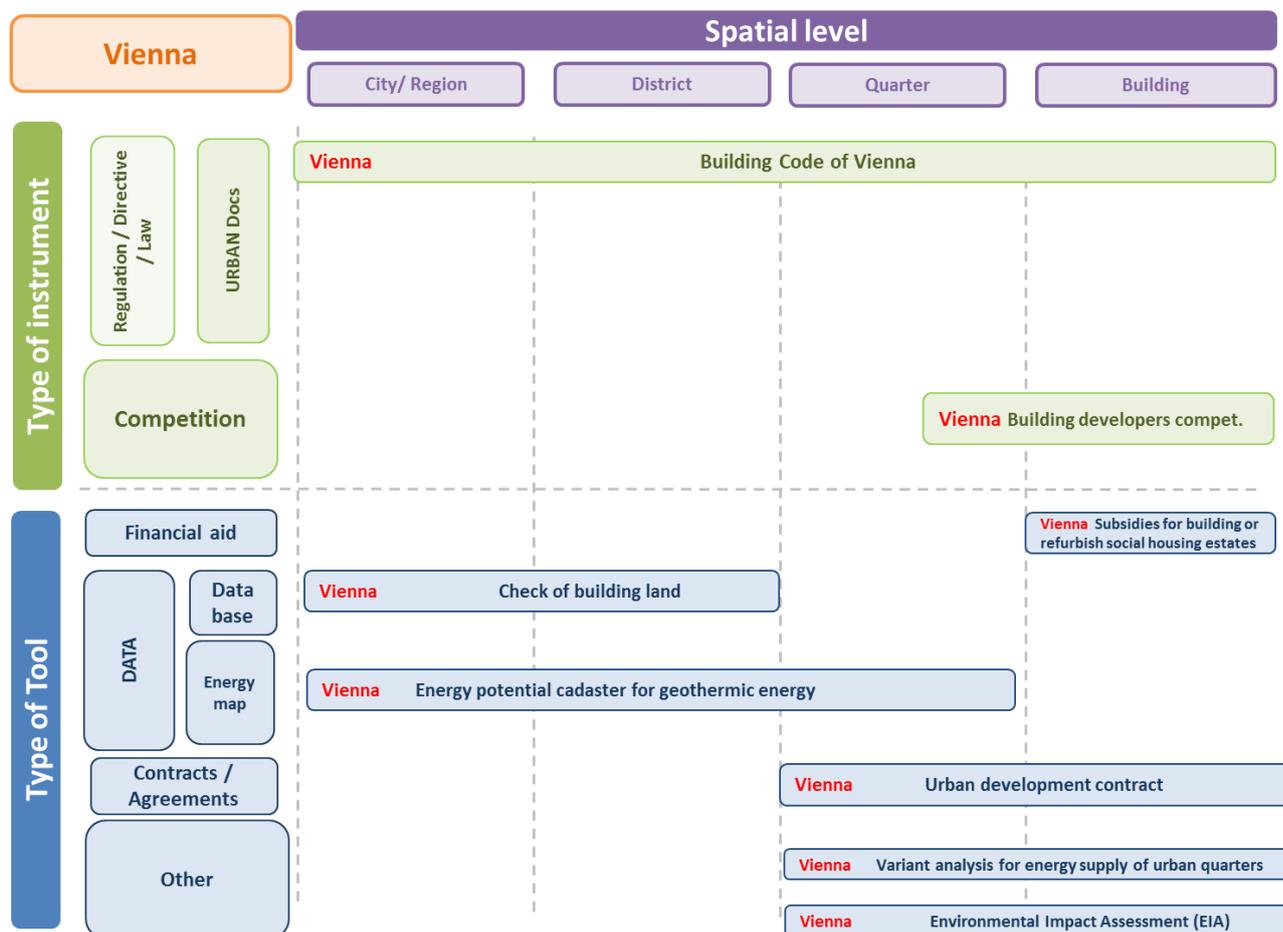


Figure: 12 Mapping of instruments and tools

Instruments

Building Code of Vienna³	In Vienna the legal basis for the spatial/urban planning is the Building Code ³ , which governs the Land Use Plan (for instance zoning categories) and the Building Regulation Plan. This law with subsequent ancillary laws and ordinances determines very important objectives and qualities for the development of the city. Vienna as province has the legal power to adapt this law.	Urban Doc (Law)
Public property development competition (former Building developers competition) <i>best practice</i>	Competition as quality assurance process for bigger building developments in the subsidised housing sector as a well-established instrument for urban development in Vienna. Qualities defined by the 4 pillars of sustainable development economy, ecology, social, architecture. Energy is part of the pillar ecology. Energy relevance: The relevance of energy issues for each housing project depends on the criteria fixed in the tender as well as the assessment by the board (more details see below).	Competition

³ Wiener Stadtentwicklungs-, Stadtplanungs- und Baugesetzbuch (Bauordnung für Wien – BO für Wien)
D 3.2 Synthesis report

Instruments - Conclusions

The City of Vienna does not have a single instrument for integrated energy planning but applies a combination of different instruments throughout the urban planning process. It is thus important to integrate energy in all phases - from requirements for planning to implementation (as well as transformation of the building stock).

The Building Code of Vienna is the central legal base for all urban planning. It is therefore crucial to integrate energy as well as low-carbon qualities in its objectives and implementing articles. As part of the Building Code the possibility for urban development contracts, in this context identified as potentially important tool, has been created a few years ago (2014).

Further in the planning process public property development competitions have proven to be an effective way to ensure high (energy) qualities, but also require a considerable effort in terms of organisation and time.

Tools

<p>Environmental Impact Assessment (EIA) for urban development projects</p>	<p>The Environmental Impact Assessment (EIA) for urban development projects covers all environmental topics. It is based on a national law implementing the European Directive for EIAs. Energy relevant topics are emissions, mobility, land use and energy concept. It is mandatory for large urban development projects with a surface of at least 15 ha and a gross floor area of more than 150.000 m².</p> <p><u>Energy relevance:</u> As part of the EIA the developer has to provide an energy concept for the area to ensure an energy supply for heating according to the state-of-the-art in Vienna, for which the city has determined a threshold for CO₂ emissions of 140 g CO₂/kWh (final energy consumption for heating as technical state-of-the-art) and a share of 75% of the heating demand to be covered by renewables (provided the technical and economic feasibility). The application of this threshold prevents the use of gas. The defined criteria could be revised for other areas according to the development of the state-of-the-art. For the energy part of an EIA the Department for Energy Planning (MA20) is the responsible authority for defining the state-of-the-art and for assessing the developer's energy concept.</p>	<p>Other</p>
<p>Urban development contract</p>	<p>In Vienna urban development contracts are based on civil law between the City of Vienna and a developer or land owner. In these bilateral contracts it is possible to determine issues beyond the urban planning instruments such as financing and/or constructing necessary social infrastructure. Thus, the city can split its costs for infrastructure caused by urban development projects and/or can fix qualities which might not be a part of the Land Use Plan or other instruments.</p> <p><u>Energy relevance:</u> Energy has not been an issue in these contracts up to now.</p>	<p>Contracts / Agreement</p>
<p>Subsidies for building or refurbishing social housing estates</p>	<p>In Vienna financial support is offered to developers or owners of social housing estates. There is a basic subsidy for construction costs – for new buildings but also for comprehensive refurbishments. Additional subsidies are possible for higher qualities such as passive house standard or the integration of renewable energy. The rental</p>	<p>Financial aid</p>

	<p>prices for these projects are regulated with upper limits to ensure affordable housing.</p> <p><u>Energy relevance:</u> New social housing projects have to fulfil a stricter standard than the Building Code. The allowed heating demand (reference climate conditions, per m² gross floor area and year) depends on the characteristic length (l_c = volume divided by surface) of the building (valid for new buildings since 2012):</p> <table border="1" data-bbox="507 456 1315 535"> <tr> <td>Referenzlinie für HWB <small>BGF, RK, zul</small></td> <td>1,25</td> <td>2</td> <td>3</td> <td>4</td> <td>5</td> </tr> <tr> <td>$14,67 \times (1+1,82/l_c)$</td> <td>36,0</td> <td>28,0</td> <td>23,6</td> <td>21,3</td> <td>20,0</td> </tr> </table> <p>Source: Regulation/Ordinance for new buildings 2007 adapted 2012 (Neubauverordnung 2007; released 7.3.2012)</p> <p>The formula to calculate the maximum heating demand is $14,67 \times (1+1,82/l_c)$ (compared to the building code with $16 \times (1+3/l_c)$ valid for new housing buildings till 31.12.2016). For instance, that means that the maximum heating demand for a building with a characteristic length (l_c) of 2 is 28 kWh/m²*a. The reference line of the heating demand is adapted every two years. In the future, the standard for social housing and the Building Code will converge as intended by the European Performance of Buildings Directive.</p> <p>The subsidies for social housing enable the integration of renewable energy as well as higher building standards beyond the Building Code. The usage depends on the difference between the basic subsidies (limited to € 1350 of construction costs for each m² gross floor area) and highest subsidies in the case of higher standards (limited to € 1800 of construction costs for each m² gross floor area). Around one third of construction costs are funded as loan provided by the province of Vienna with a rate of 1%. Some parts of the subsidies are non-refundable grants in the case of additional measures such as:</p> <ul style="list-style-type: none"> > passive house standard > low energy standard with regulated ventilation system > use of renewable energy (especially for heating); > the use of natural gas with high efficient condensing boilers when using solar thermal energy and if no district heating is possible; > highly efficient heat pumps with an annual Coefficient of Performance (COP) more than 4 	Referenzlinie für HWB <small>BGF, RK, zul</small>	1,25	2	3	4	5	$14,67 \times (1+1,82/l_c)$	36,0	28,0	23,6	21,3	20,0	
Referenzlinie für HWB <small>BGF, RK, zul</small>	1,25	2	3	4	5									
$14,67 \times (1+1,82/l_c)$	36,0	28,0	23,6	21,3	20,0									
<p>"Energy potential cadaster for geothermal energy & geological analysis"</p>	<p>Vienna offers cadasters displaying the energy potential for geothermal heat and groundwater. Information about restricted zones and permits are included. It is available on the online city map. See: https://www.wien.gv.at/flaechenwidmung/public/, click on 'Energie' in list of contents.</p>	<p>DATA Energy map</p>												
<p>Check of building land (Baulandcheck)</p>	<p>City-internal GIS Database for all planning departments with all development areas (size, flats, timetable, etc.).</p> <p><u>Energy relevance:</u> It is used to assess potentials to cover population growth such as the need for new residential, commercial and industrial areas. Energy is currently not part of the check. Nevertheless, the assessed issues have a high impact on energy.</p>	<p>DATA Database</p>												
<p>Variant analysis (study) for energy supply of urban quarters</p>	<p>Method for ecological, economic and technical assessment of different heat supply solutions for urban development areas. Currently at pilot stage and applied few times for some lighthouse projects.</p>	<p>Other</p>												

	<p>Energy relevance: Based on principles of life cycle analysis different options for the heat supply new urban areas are compared. Such analysis can help to clarify very early in planning, if a grid solution is recommended (especially district heating) or not (single supply of buildings while using RES). It can serve as a helpful tool to find the best solution of an energy supply for a certain area in terms of ecological, economic and technical feasibility.</p>	
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Tools - Conclusions

The City of Vienna has a number of tools available, which take energy matters into account and ensure high qualities. However, most tools are applied in very specific circumstances only and/or for specific developments, e.g. EIAs are only used for very large projects. Generally, at this point, the tools have highest relevance for the informal and formal planning phases and little attention is yet paid to the implementation phase of projects and monitoring. Decision support tools that help select from different energy supply options are not applied yet.

5.5.3. Gaps and evolution

Gaps of instruments and tools for energy planning

Instruments

The instruments currently in use in Vienna cover well the energy qualities at building level but to a much lesser extent energy qualities beyond the single building, at quarter level (with the exception of EIAs). At the moment, there is no instrument for energy planning in Vienna that helps to define zones for specific energy supply options or for a specific share of renewable energy sources or for the exclusion of certain fossil energy (e.g. heating by oil). Furthermore, in certain instruments energy is not yet explicitly considered or plays a subordinate role. There are no energy or climate protection objectives for urban planning in the Building Code of Vienna, which is a major limiting factor. Also the paragraph for highly-efficient energy systems in the Building Code has less relevance due to necessary cost-effectiveness considerations.

Tools

The City of Vienna is already providing a lot of information on energy topics and data, for instance the potential for use of solar energy and geothermal energy, many guidelines for efficiency of heating systems as well as the use of renewable energy sources. However, there is no using of decision support tools that help with the implementation of different types of energy supply in buildings such as calculators or analysis grids. Variant analyses (studies) are only at pilot stage. Furthermore, the EIA can only be used for a very limited number of projects.

The current subsidies are effective in social housing for energy issues, but not for the private building sector. The City of Vienna provides further subsidies to install renewables on buildings. Subsidies are building-based and thus not suitable for high-efficient energy supply solutions such as micro-grids based on heat pumps and solar energy beyond the level of a building.

The first urban contracts are already in use, but there is an ongoing debate as to how energy could be part of these contracts.

5.5.4. Recommended improvements

In view of population growth, limited land and the Paris Agreement to limit CO₂ emissions the city needs a more effective set of instruments to coordinate RES production as well as heating solutions (grid, non-grid) and to support the transformation of the energy system and step up all efforts for climate protection. However, there are different options for improvements possible. The city could either introduce a new instrument such as a heating map for different zones. But it could also adapt existing instrument(s) e.g. urban contracts or zones in the Land Use Plan. There needs to be a broad dialogue and more analyses to define the combination of instruments and tools that are most effective in accomplishing energy and climate objectives. This dialogue is conducted as part of the elaboration of the thematic concept on “Integrative Energy Planning Concept”.

Vienna Building Code

The Building Code is the basis for planning. Therefore, it is crucial to integrate energy and climate aspects in the articles defining the objectives of the law in order to provide a legal base for a spatial differentiation of energy supply as part of urban planning. Furthermore, energy topics could be added as one of the issues mentioned in the law which could be considered in urban contracts. In addition, the article on highly-efficient energy supply systems needs to be adapted regarding cost-effectiveness to enable appropriate solutions.

Urban contracts

There is a need to analyse if energy could/should be a part of urban contracts. It would ensure that certain identified solutions are actually implemented and provide more certainty in planning. Applying a CO₂-threshold for heating as state-of-the-art technology for energy as in an EIA could be a possible way forward here as well.

Variant analysis of potential energy supply solutions in development areas

An analysis of different solutions for energy supply and their implications for the urban planning process should be carried out as early as possible. It is essential to decide early on, if an area or parts of an area should be connected to district heating or not. Furthermore, the possible share of renewable energy sources and emissions impacts could be assessed, all based on lifecycle costs. Depending on the results, the best potential supply options are selected and can later be implemented by using certain instruments such as urban contracts. That could increase planning security for energy provider(s) and building developer(s). Moreover, it will be easier for the net operator and city institutions responsible for the infrastructure like streets or sewage, to coordinate needed measures and their construction.

5.5.5. Upcoming instruments or tools

Instruments

- Development of an “Energy Framework Strategy” (*Energierahmenstrategie*) as framework for the energy policy to help align different energy planning documents (2017)
- Development of an “Integrative Energy Planning Concept” (*Fachkonzept Energieraumplanung*) for the whole city as part (thematic concept) of the Urban Development Plan (*STEP 2025*) (2017/2018)

Both instruments will be crucial to push energy planning and the transformation of the energy supply of the city forward. Furthermore, they will be linked to other instruments/documents such as the Climate Protection Programme (KliP) or Vienna Urban Energy Efficiency Programme (SEP). Furthermore, the City of Vienna will discuss and assess if further instruments for energy planning are needed such as heating maps for different areas or zones within the land use plan.

Tools

- Cadastre for waste heat (calculated)

Adaptation of the swiss calculation tool (label) for quarters (2000 Watt Rechenhilfe für Areale) for Vienna, further discussions about labels for quarters / urban development projects.

5.6. Warsaw

5.6.1. Main findings and conclusion

Poland has a two-tier system of spatial planning. It provides for the execution of "Spatial plans for regions" which is made by regional authorities, while on the city level it includes Study of conditions and directions of spatial development and Local land development plans.

The Study is a planning document that specifies the policy of spatial development of the municipality (city) for the entire area. The findings of the "Study ..." are binding for the municipal authorities in the preparation of local plans, but does not constitute an act of local law. The local development plan includes information on: the function areas which are the subject of its development, investment areas, taking into account the type of building (residential, multi-family, single family, building loose, intense industrial development of the description of the nature of the production envisaged, distribution of public buildings - hospitals, schools, etc.). This makes it possible e.g. to determine the optimal heat supply system. Local land development plans are the only documents that constitute the local law. All other analyzed documents serve as a guide to determine what are preferences, what should be, what are the best solutions, but they are not commonly binding.

During Project meetings, an important issue was to compare the systems of energy planning in the respective capitals. Compared to other cities, it turned out that Warsaw has a different system of energy planning. This is due to the specific legal situation. The municipality of Warsaw is responsible for the supply of electricity, heat and gas. However, the municipality is not the owner of energy companies. Energy Law states that the commune's own tasks include planning and organizing the supply of heat, electricity and gas fuels within the municipality. Energy planning at local level is a two-step and two-pronged. Mayor of Warsaw prepares project of the assumptions for plan of supply with heat, electricity and gas fuels which is an inventory of all energy systems and forecast on energy demand. On the other hand energy companies prepare their own development plans.

If the assumptions are not consistent with the development plans of enterprises, the mayor of Warsaw is preparing plans for the supply of heat, electricity and gas for the individual areas for which energy companies do not provide the supply. At this moment (December 2016), the new assumptions are prepared and now it will be checked WHETHER energy companies' development plans ensure implementation of the assumptions.

Warsaw has a document "Energy Policy of the Capital City Warsaw", which includes guidelines what type of energy should be preferred due to the energy security of the city. Energy policy of Warsaw establishes preferences of the power supply to heat buildings in the following sequence: 1. heating network, 2. RES, 3. gas, 4. electricity network. Renewable energy installations should be located in areas outside the district heating network in order not to decrease the possibility of production of electricity in Combined Heat and Power Plants. This document was not analyzed in the framework of WP3. For Analysis were selected other documents – five instruments and two tools.

The Strategy for Sustainable Development of the Warsaw Transportation System and the Environmental Protection Program for the City of Warsaw are programming documents demarcating distant targets. Their form is not the most important factor. These are strategic documents required by the law.

Plan of supply with heat, electricity and gas fuels is mandatory but only if energy companies do not want or cannot provide coverage of the demand for energy in a particular area. Then plan of the supply

is created for this part of town. Typically, there is no need to make such a document. Consequently, nor is there need to be analyzed further in order to improve the Plan.

The Integrated Revitalization Program is the first document that meets the criteria of an integrated document. It is a program of deep revitalization of neglected technically districts. It presents concrete objectives and solutions. Such document is a novelty in Warsaw and now we do not know if it fulfills its role. It will be visible after some time. It is too early for any deeper analysis attempts to improve it.

Local land development plan is the best document for further analysis and optimization trials, because it is a repetitive document. Most of the information that must be included in the local plan is defined exactly by the Law. The document should describe the selected area of the city in a similar manner. Form of the document should be unified and there is a room to optimize the document.

Study of conditions and directions of spatial development is one of the most important planning documents of the city. It is continuously updated and simultaneously analyzed and optimized in terms of form. Therefore, there is no need for additional analysis in project Urban Learning.

The assumptions for plan of supply with heat, electricity and gas fuels is a document required by the Energy Law. Form of the document is not defined by the Act, and therefore it can be optimized. Concerning the form, a digital database with tables of numbers describing the various regions has been chosen. The database should be publicly available and on the basis of the information energy companies, developers and others can build their development plans. Digital form of a document can be recommended as a Best Practice for replication.

Conclusion:

After analysis, the Local land development (instrument) plan was chosen for further improvement and the assumptions for Plan of supply with heat, electricity and gas fuels (tool) was chosen as a best practice for further replication. The Local land development plan was selected because it is a repetitive document containing repetitive information for different areas, recorded in the same diagram. It is the best material for further work on improving the document form. Local plans are made continuously for individual areas as needed and improvement of the form of the plan can be implemented gradually. The Assumptions were selected as a best practice because of its form (an electronic database), which constitutes a good basis for further integrated planning. It should therefore be promoted for replication in other cities. Currently, Assumptions are already realized and now it is the next stage of proceedings, namely consultation with institutions and energy companies.

5.6.2. Identification Mapping – Selected instruments and tools

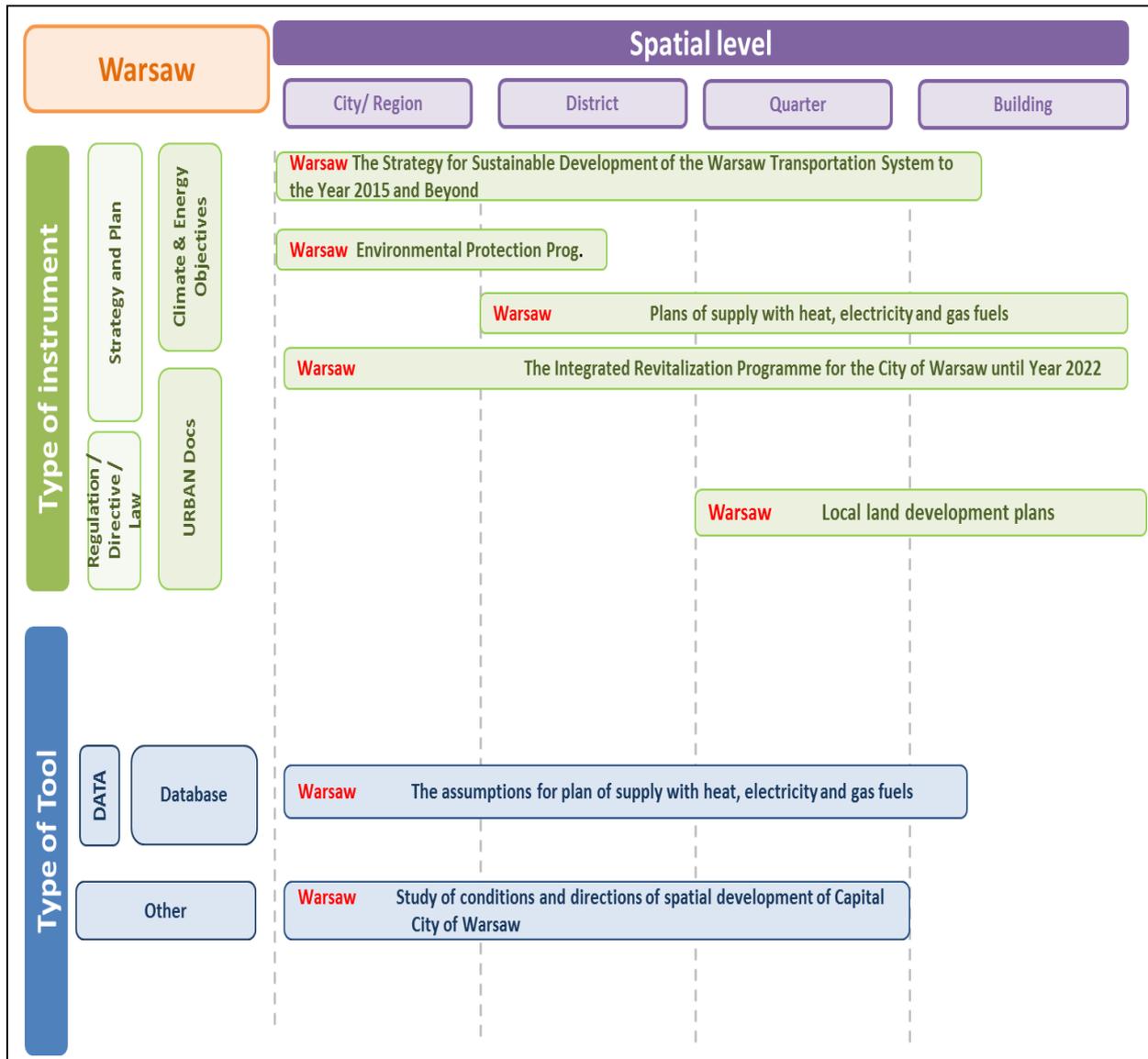


Figure: 13 Mapping of instruments and tools

Instruments

The Strategy for Sustainable Development of the Warsaw Transportation System until 2015 and beyond	Transport system's development. Creating conditions for an efficient and safe mobility of people and freight. Establishing directions, implementation instruments and tasks to be performed in each transport subsystem.	Climate & Energy Objectives
The Environmental Protection Program for the City of Warsaw for Years 2009-2012, Perspective until Year 2016	The obligation concerning such programs arises from the Law on Environmental Protection from 2001. The primary objective of the Program is achieving sustainable and durable development of Warsaw through preserving important features of natural environment, improving status quo as to natural environment, improving spatial order and developing infrastructure on environmental protection.	Climate & Energy Objectives
Plan of supply with heat, electricity and gas fuels	The plan, next to its main function of providing energy security for the given area, constitutes the basis to classify the specific investments as justifiable expenses, which allows for taking them into account while calculating energy prices (tariffs) prepared by energy companies, and allows for inclusion of necessary energy-related investments in the budget of the municipality.	Climate & Energy Objectives
The Integrated Revitalization Program for the City of Warsaw until Year 2022	The Program (ZPR) serves to achieve the primary objective: renewal, revitalization and social/economic inclusion of selected Warsaw areas, currently affected by crises. The long-term goal here is improving level of development of these areas to the level of areas located on the left bank of the Vistula River.	Climate & Energy Objectives
Local land development plan	It sets precise conditions for land use and building parameters, e.g.: principles of spatial order and environment protection, land use and built indicators (max. and min. building intensity, min. percentage of biological surface, max. building height, parking indicators) rules of land replotting and land filling, principles of transportation system and infrastructure development, and others.	Urban doc

Conclusion:

Analysis of instruments led to conclusion that most of these documents are either one-off documents (e.g. the revitalization program) or too general (e.g. the Strategy for Sustainable Development of the Warsaw Transportation System). Only the local land development plan is more universal and better fit for replication. Therefore, the local land development plan was chosen for further improvements.

Tools

The assumptions for plan of supply with heat, electricity and gas fuels Best practice	Inventory of all energy systems and forecast on energy demand is mandatory by the virtue of the Polish law. Both urban and rural municipalities are responsible for the supply with heat, electricity and gas fuels, so each Polish city has an obligation to prepare the Assumptions.	Data Database
Study of conditions and directions of spatial development of the Capital City of Warsaw	The obligation concerning such municipal studies arises from the Law on Spatial Planning and Land Management from 2003, which is the fundamental legal instrument of spatial planning in Poland. The Study plays a coordinating role in programming the development of the city and preparing multiyear investment plans as well as in the implementation of public investment projects, it provides guidelines for the formulating the rules, conditions and standards in local land development plans, it is a formal document in preparing application for financing from EU funds.	Other

Conclusion:

The assumptions for plan of supply with heat, electricity and gas fuels was selected as the best practice.

The new assumptions (currently prepared, but waiting for the official adoption) are in the form of tables with numbers describing each particular area of Warsaw in terms of energy and population. It is a publicly available database. Every person can perform a series of calculations and simulations using such a form of data base. This database is useful for construction developers, designers, planners, architects, energy companies, etc. In accordance with the Polish law, the assumptions should be obligatory updated every three years, but the annual updating would be the best solution as to merits. These yearly updates would not be comprehensive, but would include only data that needs to be changed.

Assumptions as a generally accessible digital database can be suitable for replication by other cities. A particular advantage of similar databases in individual cities would be an easiness for comparison between cities. Today, it is almost impossible due to the specific local circumstances, which are different in each city. Such energy and population database can constitute a basis for future extension to other thematic areas, such as transportation, education, social welfare and so on.

Each city has an obligation to prepare such a document. However, in many Polish cities, the document was adopted mainly due to formal obligations to do so, and their staff is not using the local assumptions often in practice. The situation is different in Warsaw, due to e.g. more complicated situation on the local energy market and difficulties with balancing energy supply and demand. This is why Warsaw officials need to use the assumptions in their work on a regular basis – and why there arose a need for changing their form for more modern and more convenient. Therefore, such modern form of the document, which is easy to use for interested parties and is expected to be formally adopted in Warsaw shortly, it could be recommended as a best practice for URBAN LEARNING purposes.

5.6.3. Gaps and potential improvements

Instrument and tools in general

As to Polish local land development plans, the text is binding and the graphic part serves only as additional information. It is their weakness since at daily work graphic part is more clear and easy in use. Another weakness is that the Law on Spatial Planning contains a list of topics that must be included in the local plan, but there is still a large margin of flexibility when creating plans. Too much flexibility means that entries are sometimes inconsistent. One should strive for the greatest possible unification of the provisions of the plan.

As to general weaknesses of Warsaw instruments and tools, it needs to be mentioned that they are in general too many of them and not adequately integrated with each other. Even in the same thematic category – energy planning – we have 4 general documents: not only the assumptions for plan of supply with heat, electricity and gas fuels, but also Warsaw Energy Policy, Sustainable Energy Action Plan and Low-Carbon Economy Plan. It results in lack of clarity as to where borders between contents of specific planning documents should be drawn and often leads to confusion among their readers and users.

Identified key tool or instrument to improve

The Local land development plan was selected for further improvement. Its final form has not yet been selected. There is an ongoing discussion of what form should this document have. This is due to the fact that in Warsaw until now the text of plan is binding, and the graphic part is an additional auxiliary information. Therefore, every word in the text of the plan matters and must be very precise. In some other cities of our URBAN LEARNING consortium, the graphic part is the basis and the text is complementary. Nevertheless, there is also a third way and maybe legislation will move in this direction. Namely, local land development plan can be in the form of a table, where individual entries are given in the form of table of numerical values and references of what is allowed, what is permissible and what is prohibited in the particular area of the plan.

Thus, the plan will be subject to further work in order to find the optimal solution.

5.6.4. Upcoming tools or instruments

Graphic representation of database:

The new assumptions a for plan of supply with heat, electricity and gas fuels are to be adopted in a form of database. The next step should be a graphic representation of numbers from the database. The digital form of information is very convenient for data processing, but the results are better presented in graphical form. Therefore, the next task will be to link the database with a map of areas with the ability to read data online by every user. Thus, we are considering maps of the city, which will include elements allowing for easy identification and use. They would include e.g. branding specific regions in different colors corresponding to the numeric data levels (like 0-100 – yellow, 100-200 – orange, etc.) for these regions, which are contained in the database. When one clicks on a particular area, it should be received a numerical value corresponding to the color. Graphical representation of data is more useful for decision-makers, whereas the numeric part is necessary for work of a more engineering nature.

5.7. Zagreb

5.7.1. Main findings and conclusion

Zagreb has a top-down approach to spatial planning and energy vision (ZagrebPlan, SEAP) in the city area. Currently set goals reach up to 2020, but development of long term (at least up to 2030) aims is underway. Instruments in effect are covering wide range of issues – energy system, building structure, water, waste, environmental issues, etc. and sectors.

The supporting tools for implementation of instruments currently in force and for development of new strategies are being considered and developed, with Zagreb Geoportal being the data base backbone.

As City Authorities are driving force for new urban and energy concept developments, there is a high share of monitoring and reporting commitments imposed on the City Offices.

5.7.2. Identification Mapping – selected instruments and tool

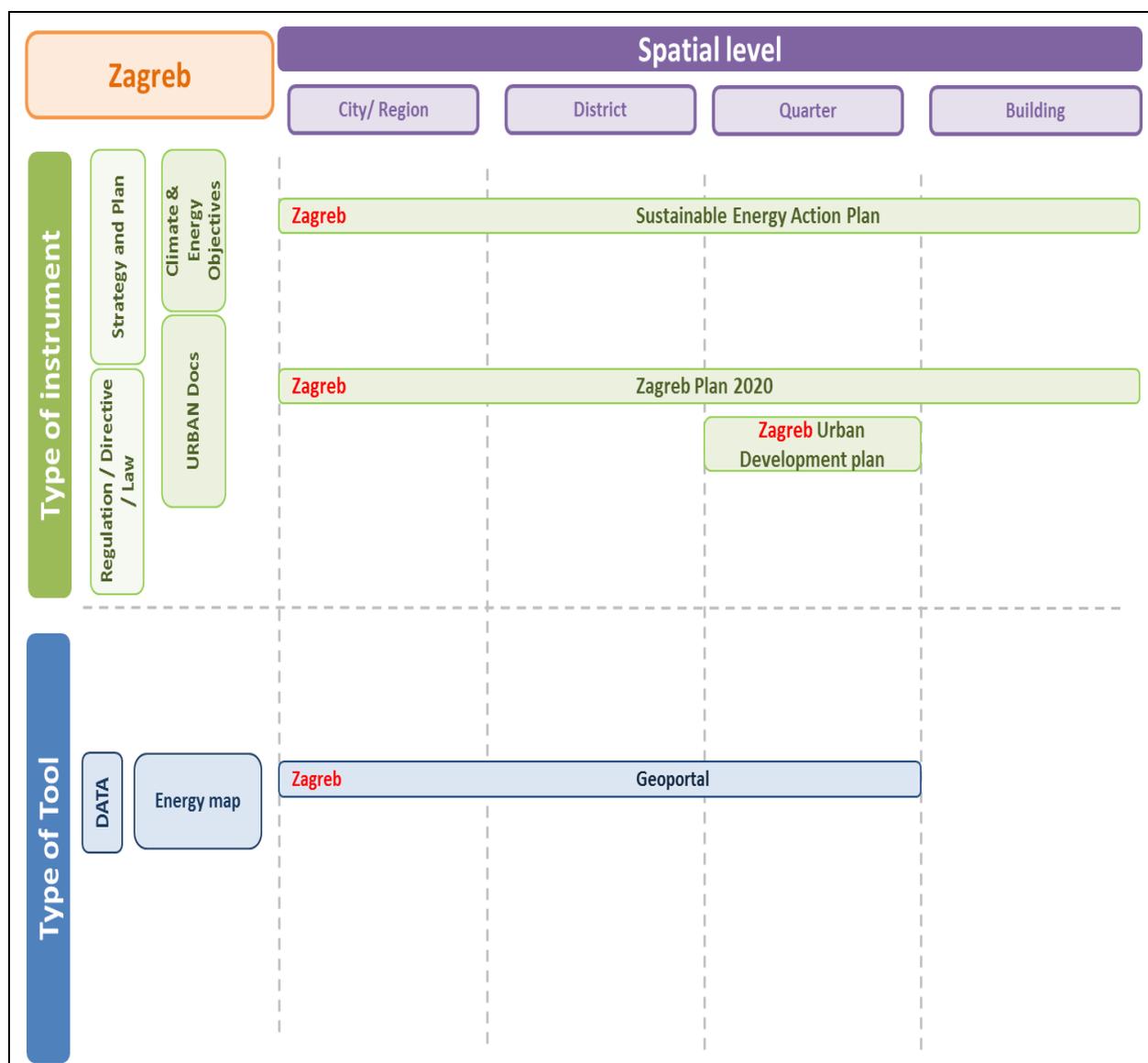


Figure: 14 Mapping of instruments and tools

Instruments

Sustainable Energy Action Plan	City of Zagreb was one of the first European capital cities to join the Covenant of Mayors initiative, launched by the European commission in January 2008 (commitment made by signatory towns and cities to go beyond the objectives of EU energy policy in terms of reduction in CO ₂ emissions through enhanced energy efficiency and cleaner energy production and use.)	Climate & Energy Objectives
Zagreb Plan 2020	Defines vision of the City as “Urban incubator of sustainable concepts, entrepreneurship and new values”. + development priorities (18) and measures (70), financial framework, action plan and communication strategy.	Strategic docs
Urban Development Plan	Prescribes requirements for implementation of projects for non-developed parts of building areas and for built-up parts of these areas planned for urban transformation or urban remediation.	Urban docs

Conclusion:

Hierarchy and impact of documents is as follows: Zagreb Plan communicates strategic planning goals, Sustainable Energy Action Plan defines actions related to sustainable energy use and Urban development Plan integrates and enforces various issues from obligatory documents, plans and rules for specific neighbourhood.

Tools

Geoportal	ZG Geoportal is a hotspot of Zagreb spatial data and documents infrastructure, and is created in accordance with the Regulations on the design, content and management of the Zagreb Spatial Data Infrastructure. It provides access to spatial information and a variety of related actions (search, browse, download, transformation, service discovery).	GIS Spatial and Infrastructure Map
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Conclusion:

All existing and planned infrastructure systems and energy generation facilities are displayed. Various layers of information can be combined to compare inputs.

5.7.3. Gaps and potential improvements

Instruments and tools in general

Many requirements for new buildings are related to sustainable energy use but there is little information on actual energy consumption on neighborhood level which is usually comprised of existing and new buildings. In Urban Plans the energy infrastructure is planned according to expected volume of new developments but there is a trend of refurbishments where energy source might be replaced and available infrastructure capacities might not be available. There is a need for analysis of data on urban refurbishment potential and their use for infrastructure planning.

Identified key tool or instrument to improve

The intention is to frequently update the existing layers of the Geoportal tool with up-to-date data. The City of Zagreb Energy Balance, which shall be periodically produced and cover the neighbourhood level as well, is planned to also include data on energy consumption, energy needs and the newly formed trends as compared to the previous period. In this way, insight on energy use will be integrated and available for planning and development process.

5.7.4. Upcoming tools or instruments

The intention is to frequently update the existing layers of the Geoportal tool with up-to-date data.