LEDS
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PLATFORM

LEDS-EEP City Energy Planning Toolkit

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ABBREVIATIONS

IT - Information technology
CO2 – Carbon dioxide
CORINE - Coordination of Information on the Environment
EU – European Union
MACC - Marginal cost abatement curve
MCDA - Multi-criteria decision analysis
GIS – Geographic information system
TED – Technology and Environmental Database
O&M – Operation and maintenance
GDP – Gross domestic product
CEEP – Critical excess electricity production
PETA – Pan-European Thermal Atlas
IAEA – International Atomic Energy Agency
RES – Renewable energy sources
3D – Three-dimensional
SEAP – Sustainable energy action plan
LAREAs – Local and regional energy agencies
BEI – Baseline emissions inventory

I. INTRODUCTION

The United States Agency for International Development (USAID) initiated the LEDS Europe and Eurasia Platform (LEDS-EEP) as a follow-up to the U.S. Government programme "Enhancing Capacity for Low Emission Development Strategies" (EC-LEDS), which enables peer-to-peer learning and builds capacities in partner countries by providing technical assistance and creating a shared global knowledge base on low-emission development.

The LEDS-EEP links policy makers, practitioners and the donor community through meetings, working groups and resource sharing on topics relevant to low-emission development strategies. Currently, the LEDS-EEP covers the Europe and Eurasia region, with an initial focus on Albania, Armenia, Bosnia and Herzegovina, Georgia, Kosovo, the former Yugoslav Republic of Macedonia, Moldova, Montenegro, Serbia and Ukraine. Outside the region, the LEDS-EEP connects to the LEDS Global Partnership (LEDS GP) and other regional platforms in Latin America and the Caribbean, Africa and Asia, to create new learning and collaboration opportunities that facilitate the development and implementation of meaningful policy.

In this context, and as part of this mission, the LEDS-EEP organised its first webinar programme "Tools and Methodologies for Municipal and Regional Sustainable Energy Planning." A series of 10 webinars were organised between September and November 2017, covering a wide range of approaches and tools for sustainable energy planning in urban areas and providing an overview of state-of-the-art approaches to municipal and regional energy sector planning. The webinars introduced a set of tools that can be used by practitioners working on the development of municipal and regional energy plans; provided an opportunity for discussing methods and challenges related to data availability and collection; and presented examples of the use of simple and advanced tools for energy planning in several European countries (e.g. Georgia, Greece, Italy, Portugal and the United Kingdom) and the United States.

The toolkit

The present toolkit is a compendium of the issues explored during the webinar programme, and follows up on the LEDS-EEP workshop "Tools and Methodologies for Municipal Sustainable Energy Planning", which took place on July 10 and 11, 2017, in Kyiv, Ukraine. Participants at the workshp — energy planning practitioners and energy modelling experts from Albania, Georgia, Moldova and Ukraine — expressed their interest in having a concise guidebook on the most relevant energy modelling tools that can be used for city energy system planning, considering that most of the existing guidebooks provide rather limited guidance on this issue.

Modern societies are heavily dependent on the availability of secure, affordable and clean energy. There is an ongoing paradigm shift in energy sectors worldwide, which includes a change from fossil fuel–based systems to systems based on decentralised renewable energy sources, energy efficiency and smart grids, competitive energy markets, the electrification of the transport sector and the potential integration of power, heating, cooling, transport, water and waste management systems. Such changes are significantly raising the importance of cities and municipal authorities, giving them possibilities to influence the development of sustainable energy sectors in their communities.

There are numerous guidance documents currently available for developing municipal energy and climate plans, such as the *Carbon-Free City Handbook* of the Rocky Mountain Institute (RMI 2017); the EU Covenant of Mayors *Guidebook on How to Develop a Sustainable Energy Action Plan* (EC 2010); the *Global Protocol for Community-Scale Greenhouse Gas Emission Inventories* of the World Resources Institute, ICLEI and C40 Cities (WRI 2014); and the *Energy System Transformation Playbook* of the Carbon Neutral Cities Alliance (CNCA 2016). The ICLEI Toolbox of Methodologies on Climate and Energy contains over 500 resources in

various languages, providing good guidance on energy planning steps, developing baselines, identifying barriers and opportunities, setting goals, selecting strategies and actions, identifying co-benefits and involving stakeholders.

Energy systems in urban communities can be rather sophisticated, thus comprehensive energy planning often requires the use of sophisticated methods and tools. The LEDS GP Energy Toolkit provides a collection of leading instruments and methodologies for climate-compatible energy planning, offering energy practitioners, policy makers and experts a quick reference guide to some of the best instruments available at no or low cost. The toolkit includes a compilation of 25 tools from agencies around the world.

The present toolkit is designed to complement the LEDS GP Energy Toolkit, providing more focused guidance on the use of sophisticated energy modelling tools for developing municipal energy plans. Aimed at employees of municipalities responsible for city planning and energy sector issues, energy consultants, NGO experts and students, this toolkit offers an overview of city energy planning processes, key tools, implementation options, service procurement guidance and the available resources within the Europe and Eurasia region, including a case study and a list of energy consultants providing energy planning services in the region.

It first highlights the importance of timely energy sector planning in cities due to ongoing structural changes in energy sectors worldwide, while at the same time focusing on the key planning steps and the role and use of energy modelling tools for city energy planning.

It also provides guidance on energy modelling services procurement, addressing procurement processes, the preparation of terms of reference, the selection of the best offer, the supervision of contract implementation, and how to ensure quality within implementation.

The toolkit is not intended to cover other aspects of city energy planning, such as identifying barriers and opportunities, selecting strategies and actions, stakeholder involvement, implementation per se, financing and monitoring, as these issues are sufficiently covered by other toolkits, and, because practices and legal requirements may differ from country to country.

Finally, the toolkit contains a “yellow pages” section that showcases energy modelling providers in the region, allowing municipalities to consult available experts and invite them to tender.

II. THE IMPORTANCE OF ENERGY PLANNING IN CITIES

According to the United Nations (2014), in a context of increasing urbanisation worldwide, the world’s population living in urban areas is expected to increase to 66 percent by 2050, going well beyond today’s 54 per cent range. Moreover, the C40 Cities Climate Leadership Group (2012) indicates that urban areas are currently responsible for over two-thirds of the world’s energy consumption, and that they account for over 70 percent of the carbon dioxide emissions worldwide. Therefore, local governments are facing the challenge of how to achieve the sustainable development of communities while meeting the diverse needs of their citizens (UN 2016). At the same time, there are ongoing international efforts towards climate change mitigation in the framework of the United Nations Framework Convention on Climate Change (UNFCCC). This highlights the important contribution of city-level energy systems to global efforts, as well as the need to mainstream climate and sustainable energy objectives into urban planning.

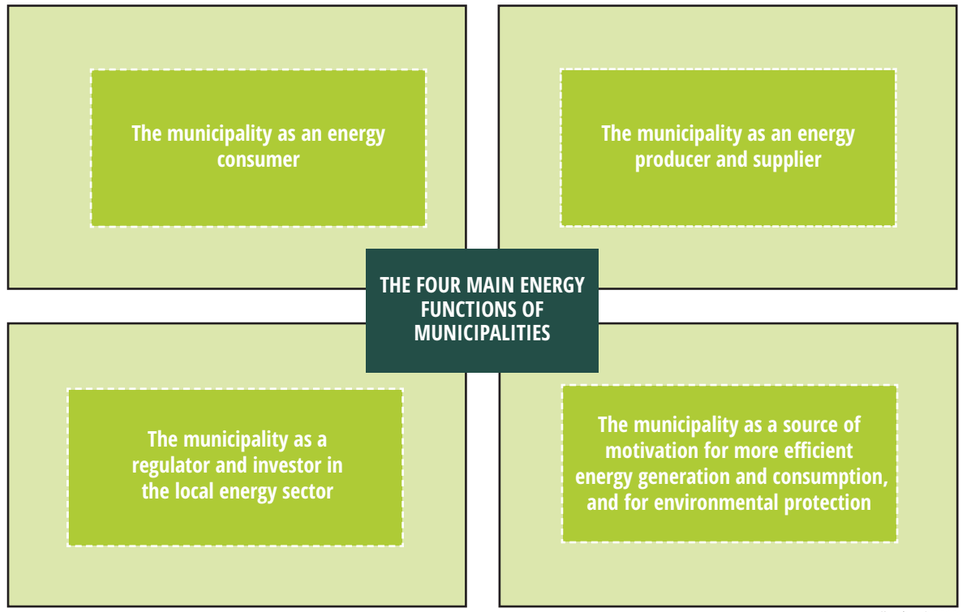
As part of the ongoing energy transition, energy sectors worldwide are being transformed into systems that are based on distributed renewable energy sources, digital technologies and smart grids, decentralised and deregulated energy production, efficient and competitive energy markets and demand response programmes, the electrification of the transport sector, energy storage and other in-

novations. Municipal decision makers need to be aware of these innovations and of their interactions with features of the traditional energy sector, characterised by long investment cycles, large-scale projects, national regulations and centralised energy sector management. The ongoing changes are giving cities and municipal authorities a significantly greater role in shaping the energy systems of the future than they had in previous decades.

The improvement of energy efficiency, the deployment of local renewable energy technologies and the establishment of diverse and competitive energy markets can significantly increase energy security at both local and national level (EC 2014). The urban energy transition, if well planned, can also alleviate energy poverty, support economic growth, create new jobs and contribute to climate change adaptation. Energy poverty — often defined as a situation in which households are unable to afford adequate heating or other necessary energy services — currently affects around 54 million people, or around 11 percent of the EU population, and it is important to ensure that the interests of these citizens are taken into consideration (Pye et al. 2015). The urban energy transition can contribute to addressing social issues, since the installation of renewable energy systems, the renovation of existing buildings, the installation, operation and maintenance of energy storage technologies and energy management systems are labour-intensive activities that can support job creation in the regions.

City authorities play four key roles in the energy sector (see Figure 1), and can influence energy sector development in each role. As an energy consumer, the city is responsible for a secure energy supply for public buildings, vehicles, street lighting and other uses. It can influence energy consumption via energy efficiency measures, such as building insulation; efficient lighting, appliances and heating systems; and other demand-side measures.

FIGURE 1 The main functions of the municipality in the energy sector



Source: Laušević et al. 2016

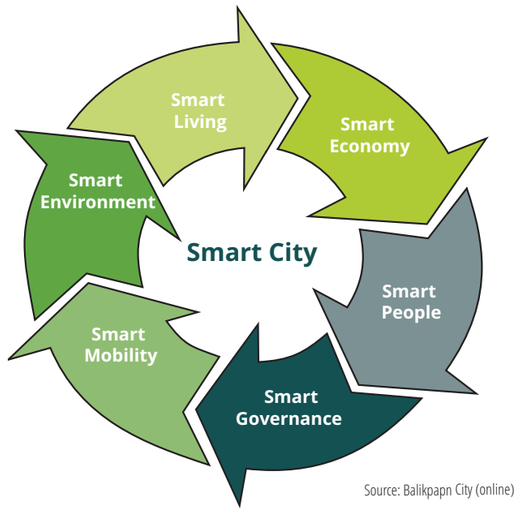
The city can own producers or distributors of electricity, gas, heating and cooling within its territory, but can also play the role of "prosumer", by producing or procuring energy from solar, wind and heating installations. As an energy regulator, city authorities can influence the energy sector via regulatory tools, taxation policies or financial interventions such as subsidies or grants supporting energy efficiency or renewable energy initiatives. It can provide motivation through good practice examples by implementing renewable and energy efficiency technologies in public buildings and facilities, or by assisting homeowners in upgrading the energy performance of residential buildings by offering advisory services, removing local regulatory barriers, and de-risking and bundling smaller projects.

City energy planning opens up new opportunities for the transformation of energy sectors and provides multiple benefits for citizens. The deployment of modern and sustainable technologies for energy generation, storage and management can facilitate the development of so-called smart cities, providing economic growth and job opportunities (see Figure 2). In addition to energy sector innovations, the smart city concept embraces socially responsible businesses, smart mobility, smart governance and other features.

Strategic energy planning can help cities to adapt to fundamental ongoing and future changes in the energy sector, capture their benefits, and use them to address issues specific to their communities. Among the numerous benefits of proper energy planning (e.g. environmental, social), the greatest financial benefit lies in preventing lies in preventing the lock-in of public funds in cities — that is, commitment to capital-intense, fossil fuel energy projects that may be obsolete or overly expensive and ultimately prevent flexible, distributed-scale renewable energy solutions. Energy sector projects are capital intensive, and some can be avoided by the appropriate planning and prioritisation of measures, thus freeing funds for other priorities.

Through the development and analysis of different future scenarios, a city can choose a path and adjust its trajectory according to current needs and possibilities. Strategic energy planning results in benefits through the integration of different sectors, such as power, heating, cooling, transportation, water and waste. It is a source of valuable data and provides a foundation for the setting of city goals and the preparation of strategies and urban development plans. It also helps local decision makers to choose the best pathway towards climate change mitigation, address environmental challenges, and boost job creation and economic growth based on low-emission development.

FIGURE 2 The smart city concept



Source: Balikpapn City (online)

III. KEY STEPS AND THE ROLE OF ENERGY TOOLS AND MODELLING IN CITY ENERGY PLANNING

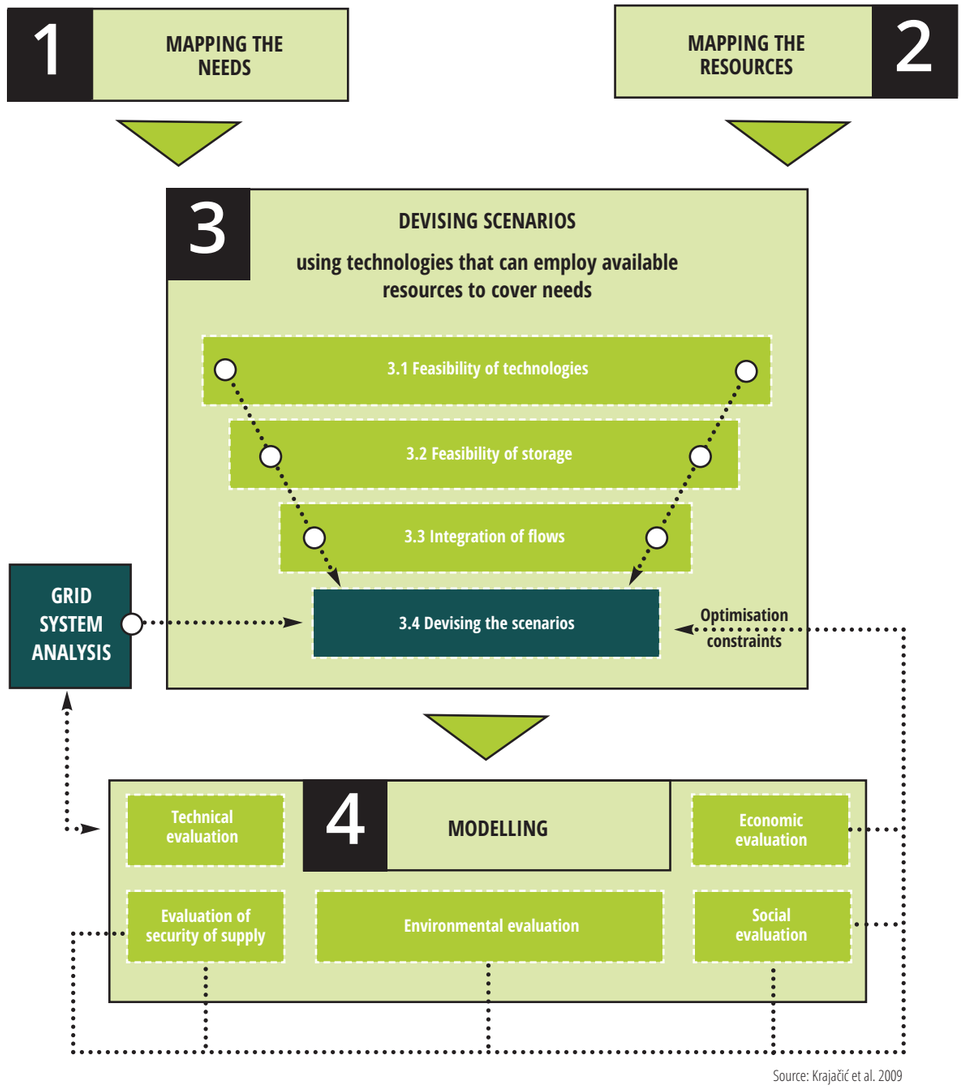
There are many ways in which the municipal energy sector planning exercise can be divided into individual steps. Good examples can be found in the Covenant of Mayors guidebook *How to Develop a Sustainable Energy Action Plan* (EC 2010); the *Energy System Transformation Playbook* developed for the Carbon Neutral Cities Alliance by Integral Group (CNCA 2016); or the ICLEI Local Governments for Sustainability–USA Five Milestones process (Ramaswami et al. 2011).

As the present toolkit focuses on the use of modelling tools for city energy sector planning, only those steps related to the energy modelling exercise are discussed in detail. As shown in Figure 3, the energy planning process can be briefly summarised in four basic steps:

1. Mapping needs and setting goals.
2. Identifying and analysing existing and potential energy resources (both supply and demand side).
3. Developing a baseline and scenarios using technologies that can employ the available resources to cover needs and achieve goals.
4. Modelling the energy scenario.

This process is explained in the RenewIslands methodology, developed by Neven Duić, Goran Krajačić and Maria da Graca Carvalho (Duić et al. 2008).

FIGURE 3 Basic steps in the energy planning process



Source: Krajačić et al. 2009

Further steps typically include the selection of the most relevant policies and measures for achieving the goals, the development of a strategic plan and the engagement of key stakeholder groups, plan implementation and financing, and the monitoring of results. These steps are well described in the municipal guidance resources referred to above, as well as in the *Carbon Free City Handbook* of the Rocky Mountain Institute (RMI 2017); the *Energy Supply Transformation Primer for U.S. Cities* (Meister Consultants Group 2017); and "Powering Sustainable Cities – Key Trends and Pathways to Success for City Leaders" (NRG 2018), among others.

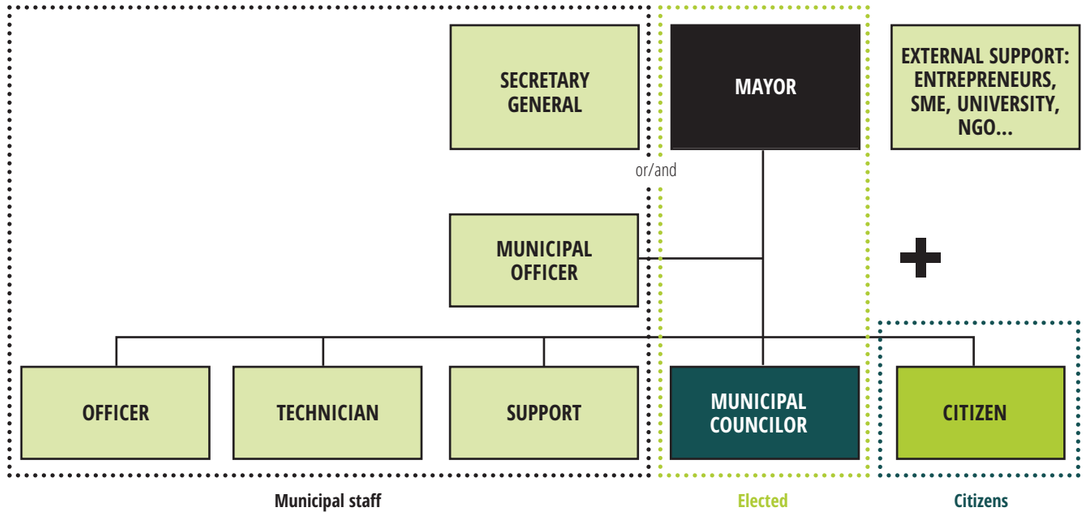
In the first step — the mapping of needs and the setting of goals and objectives — needs are defined as the commodities and services used by the local community. These include not only energy services (electricity, heat, cooling, and other fuels or energy carriers), but also other communal commodities and services such as water supply and waste and wastewater treatment, which may or may not depend on energy supply. The needs define the scope of energy planning.

It is good practice to establish SMART — specific, measurable, achievable, realistic and time bound — goals and targets (EC 2010). "Specific" means well defined, focused, detailed and concrete; "measurable" implies the goals are stated in quantifiable units, such as kWh, time, money or percentage; "achievable" and "realistic" mean that the goals can be reached using the available resources and technologies in the given timeframe; and "time bound" means that a detailed timetable is defined for each action. Examples of such unambiguous targets might be: 100 percent local (or renewable) electricity production by 2030; a 40 percent reduction in CO_2 emissions by 2030; or fully electric public transport by 2040 (see real examples in Box 1). These goals may be mandatory or voluntary, depending on the context. National and regional climate and energy objectives should be considered, since local actions should ideally be streamlined with national policies and measures.

BOX 1 Examples city goal types

GOAL TYPE		EXAMPLE
Base-year emissions goals	Single-year goal	London (UK): By 2025, a 60% reduction in GHG emissions compared to 1990 levels.
	Multi-year goal	Wellington (New Zealand): Stabilise from 2000 by 2010; a 3% reduction in GHG emissions by 2012; a 30% reduction by 2020; and an 80% reduction by 2050.
Fixed-level goals		Carbon neutral is another type of fixed-level goal. Melbourne (Australia) set a target to achieve zero net carbon emissions by 2020, and plans to achieve the goal through internal reductions and purchasing offsets.
Base-year intensity goals	Per capita goal	Belo Horizonte (Brazil): 20% GHG emissions reduction per capita by 2030 from 2007 levels.
	Per GDP goal	China is the main country adopting a goal of GHG emissions reductions per unit of GDP for cities. For example, Beijing: 17% reduction per unit of GDP in 2015 from 2010 levels.
Baseline scenario goals		Singapore pledged to reduce GHG emissions to 16% below business-as-usual (BAU) levels by 2020 if a legally binding global agreement on GHG reductions is made. In the meantime, Singapore started implementing measures to reduce emissions by 7% to 11% of 2020 BAU levels.

FIGURE 4 Example of a city energy team



Source: Vlachos 2012

Another important point is that energy planning should not be looked at as a separate process, but as part of the urban spatial planning process, which should integrate all the city's development plans and strategies. Goal-related activities can be implemented in various ways. There are several traditional "single-criteria" tools for selecting priority actions when implementing energy sector reform plans, such as cost-benefit analysis, cost minimisation and expert judgment. These approaches generally assume centralised decision making without directly involving stakeholders. The goals can be set by decision makers, such as the mayor or the city council. Decision makers' choice is a relatively quick method, but is usually based on the subjective opinion of a politician and can sometimes be influenced by lobbying groups.

Urban and energy planning using multi-criteria techniques can contribute to the identification of solutions when dealing with complex decisions where there are conflicting objectives (e.g. investment, location, management, strategy etc.) — which is the typical context of city planning activities. Multi-criteria decision analysis methods provide a better understanding of the intrinsic characteristics of the problem, promote direct participation in the decision-making process, and facilitate compromise and collective decision making, thus helping to improve the quality of the final decisions by making them more transparent, rational, acceptable and comprehensive. Decision making that involves several stakeholders yields more objective insight, since it takes place according to

Key steps and the role of energy tools and modelling in city energy planning

an agreement between diverse groups that jointly decide on a goal. The possible composition of this stakeholder group is illustrated in Figure 4.

The second step involves mapping potential energy resources on both the demand and supply side, which include the locally available potential for energy production from wind, solar, geothermal, biomass and hydro, as well as the energy infrastructure, possibilities for importing natural gas or other fossil fuels, the potential of municipal and industrial waste as a resource, and energy efficiency potential in various municipal sectors. There is a lot of publicly available information on local resources — solar irradiation and wind speeds are typically known, for example. The availability of geothermal energy and sustainable biomass is harder to assess. In the case of biomass, some public sources can be used, such as the CORINE land-cover database of the European Environment Agency, or other public cadastre of land use. Spatial and urban plans typically contain detailed data on existing powerlines, substations, and gas, district heating and water networks, as well as on plans for their further development.

The third step is the development of scenarios using technologies that can employ the available resources to cover identified needs. Here, locally available resources could have priority, in order to increase the security of supply, or technologies that offer lower overall energy costs, including energy efficiency measures. The environmental impacts of the proposed technologies should also be analysed. This step can be further divided into four sub-steps, focusing on:

- the feasibility of technologies for energy conversion, water supply, and waste and wastewater treatment;
- the feasibility of energy efficiency and storage technologies;
- the feasibility of integrating various resources and energy carriers; and
- the development of potential scenarios.

The feasibility of technologies is estimated by analysing energy demand and the availability of resources. Economic viability is estimated based on the current state of the technology and the correspondence between the demand and the available resources. Social and environmental criteria can also be part of the assessment. The feasibility of storage technologies for different energy carriers and sources should be investigated and compared with the supply costs. It is still easier and cheaper, for example, to integrate electricity production through a grid rather than through storage. It is important to consider the potential integration of electricity, heat and cooling production with waste management approaches, as processed waste or captured landfill gas can be an important energy resource. However, more environmentally friendly alternatives such as waste reduction, reuse and recycling should be considered first.

Developing potential scenarios usually results in numerous development pathways that should first be scrutinised so as to exclude those that are unrealistic, selecting only feasible scenarios for modelling in order to cut costs.

The fourth step is the detailed modelling of the viable scenarios. In this step, an energy planning tool (e.g. EnergyPLAN, Homer, H2RES, LEAP or other) can be used to perform a technical and economic evaluation of the proposed scenarios and to give parameters that should allow the user to make an environmental and socioeconomic evaluation of the scenarios. Energy planning tools support the policy-making process by providing an insight into the technical, economic, social and environmental viability of energy scenarios. The different types of energy models can provide different results — for example the models can be used to evaluate the technical feasibility of scenarios, perform energy accounting, integrate assessments of different technologies, undertake demand and supply modelling, assess the environmental impacts of technologies, and give an insight into geospatial distribution. There are numerous tools, models, methods and frameworks that can assist in the process of integrated city energy planning, and there is no "one size fits all" approach. Each city needs to select the most appropriate mix of policies and measures in consultation with citizens, businesses, energy providers, national governments and other stakeholders, and various tools can be used for this purpose. A limited selection of tools is presented in the next chapter of the present toolkit. Further information can also be found in Connolly et al. (2010a), LEDS and Worldwatch Institute (2016), Bertoldi et al. (2010) and Hall and Buckley (2016).

Data availability and quality are essential for any energy modelling exercise. Data requirements typically depend on the modelling tool. In general, data are needed on energy demand projections, available energy resources and technologies, demographic and economic trends, current and future energy policies and measures and learning curves. Data needs may vary in terms of timescale — for example 15-minute periods, hourly, weekly, yearly or even multiyear averages, depending on the model and modelling objectives.

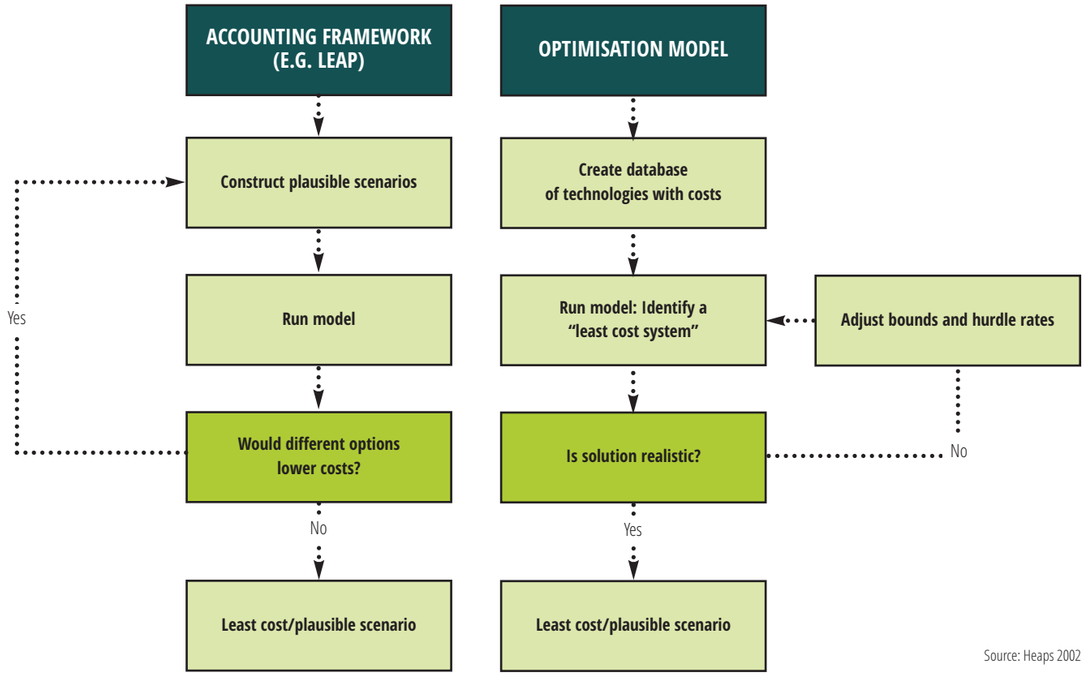
Regardless of the model used, in most cities the first step in the energy planning process should be to determine the current level of energy consumption, the available infrastructure and the energy supply — that is, to establish the energy balance. The energy balance is an accounting framework for the compilation and reconciliation of data on all energy products entering, exiting and used within the territory of a given local authority during a reference period. Such a balance must necessarily express all forms of energy in a common accounting unit and show the relationship between the inputs and outputs of the energy transformation processes (UN 2016). Data on energy consumption and greenhouse gas emissions should be compiled by sector and energy source. The key sectors for which energy consumption should be calculated are the residential and commercial sectors, industry, transportation and the public sector, which might include public buildings, street lighting, public transport fleets, and waste and wastewater management systems. It is good practice to collect data on energy consumption for at least one year and to identify energy consumption patterns for different sectors and different types of consumers. On the production side, it is recommended to collect data on local electricity, heating and cooling production, energy prices and energy imports, with individual supply patterns. Current energy demand figures are used for modelling future energy demand, which is the first step towards understanding the key parameters of future energy systems. Potential sources of data are national and regional statistics departments, energy utilities and regulators, industry reports, energy studies and reports by renewable energy agencies or associations, municipal waste management and public transport organisations, energy audit reports, biomass producers, surveys and others. Some data might already be included in the model, such as technical characteristics, costs and the emission factors of energy technologies.

IV. OVERVIEW OF KEY CITY-LEVEL ENERGY PLANNING TOOLS

Energy planning tools can be grouped in various ways, depending on their internal calculation methods, the required data inputs and the produced results. This chapter focuses on the most appropriate tools for municipal energy planning and provides a brief overview of their advantages, limitations, data requirements, costs and other relevant parameters. The available tools can be divided into four main groups: tools that can be used for long-term energy accounting, such as the LEAP or MARKAL/TIMES models; tools used for the technical simulation of new technologies, such as the EnergyPLAN model; GIS tools that provide spatial resolution; and simpler tools that are used for the accounting of baseline energy or emissions inventories.

In terms of methodology, energy demand modelling and forecasting can be divided into several approaches, such as simple trend line analysis or various sophisticated approaches based on econometrics, end use, input/output, accounting frameworks and hybrid approaches. The allocation of a tool to a certain approach is often challenging, as some models combine several approaches and are classified differently in the scientific literature. Tools can also be grouped into simulation and optimisation models, as shown in Figure 5. The Fourth

FIGURE 5 A comparison between the simulation and optimisation energy planning models



Source: Heaps 2002

Assessment Report of the Intergovernmental Panel on Climate Change (IPCC AR4) (Pachauri and Reisinger 2007) uses top-down terminology for all models that follow an integrated approach, while bottom-up terminology is used for all models that focus on individual technologies.

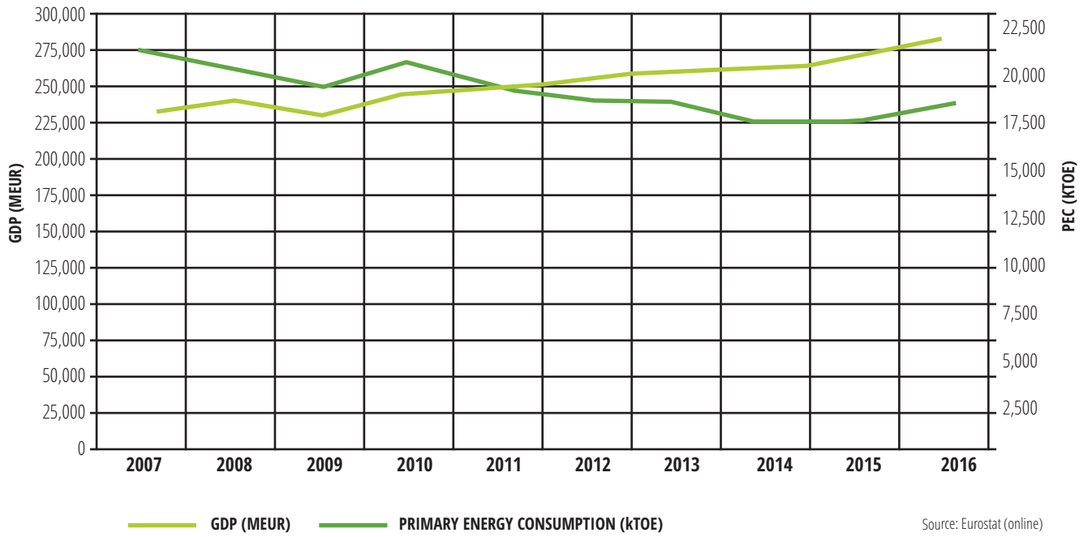
Classic energy demand planning typically focuses on establishing a relationship between economic variables and energy consumption. This is usually done by analysing historical data and processing them in a relatively straightforward way, such as by carrying out a trend line analysis. This approach has recently been questioned, as numerous countries managed to decouple their economic growth and energy consumption, thus other approaches need to be used. The example of Denmark is shown in Figure 6.

Long-term energy accounting models

Rather than simulating the decisions of energy consumers and producers, long-term energy accounting models explicitly account for the outcomes of these decisions. Accounting frameworks simply examine the implications of a scenario that achieves

Overview of key city-level energy planning tools

FIGURE 6 The decoupling of energy consumption and economic growth: The example of Denmark



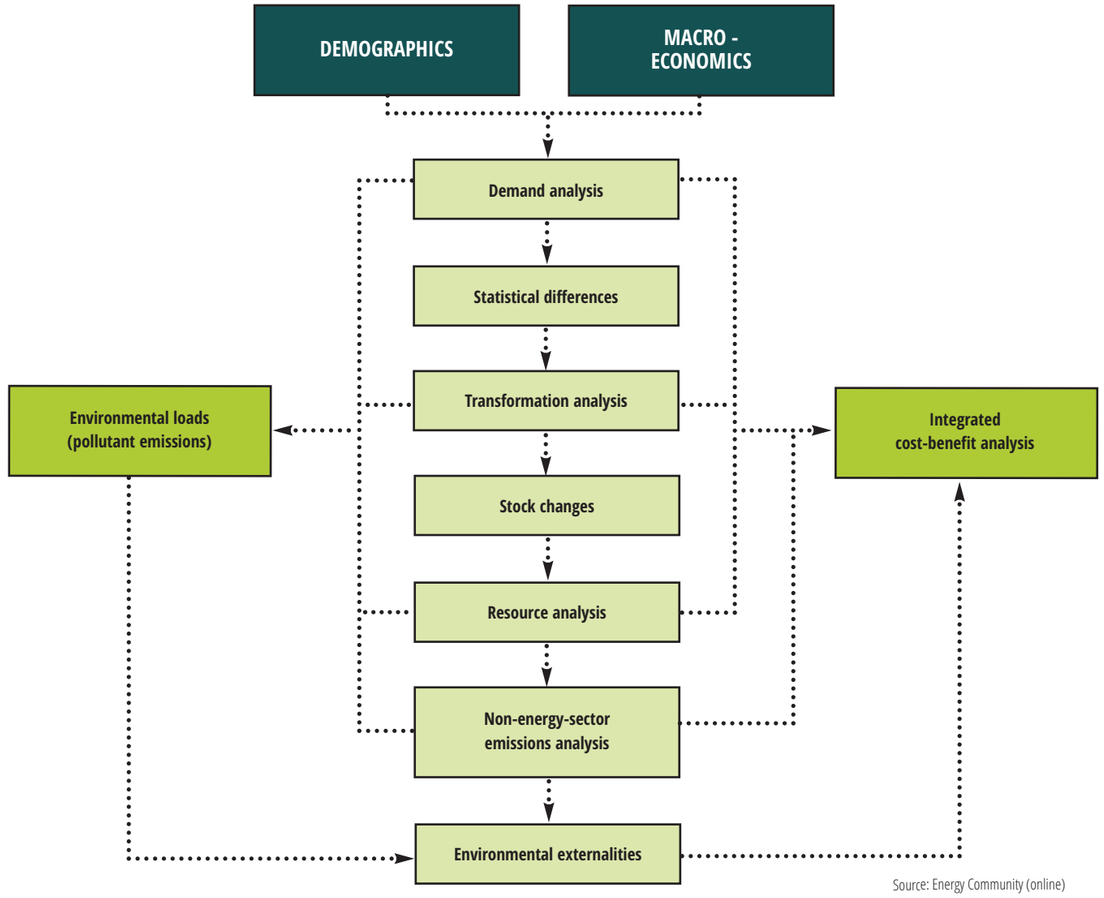
Source: Eurostat (online)

a certain market share. One example of a question solved by these models is: "What will be the costs of the energy system and GHG emissions if small-scale renewable energy technologies are promoted instead of investing in a new fossil-fuel power plant to meet growing energy demand?" The key advantages of this type of tool are their ease of use, transparency and flexibility. Users can relatively quickly run simulations with lower data input requirements, such as hourly demand and supply curves. These models do not assume perfect competition and are very helpful in capacity-building applications. However, they do not identify least-cost solutions, merely a range of feasible scenarios, and are less suitable for analysing very complex energy systems. Nor do they automatically yield price-consistent solutions.

LEAP

The Long-Range Energy Alternatives Planning system (LEAP) is a software based on the accounting framework. It is a user-friendly scenario-based, integrated energy-environment model-building tool. The tool calculates energy demand and supply, the use of resources, environmental loads and non–energy sector emissions, and carries out a cost-benefit analysis. The tool can be used for medium- to long-term energy planning, with annual time-steps, and the simulation can be done for an unlimited number of years. The tool offers a flexible approach to energy modelling, in which basic relationships are all based on non-controversial physical accounting. The data requirements for the tool are also flexible, depending on their availability.

FIGURE 7 The structure of LEAP calculations



Source: Energy Community (online)

Initially, a simulation can be done with a limited amount of new data. The model includes the Technology and Environmental Database (TED), which contains the technical characteristics, costs and emission factors of around 1,000 energy technologies. The model is applicable to almost every level of energy planning and can therefore be used at local, national or regional level. The model is available free of charge to students, governments, NGOs and academic organisations from developing countries (except high-income countries on the World Bank list). The cost in other countries can be checked on the LEAP website: www.energycommunity.org/default.asp?action=introduction.

The LEAP tool can be used for strategic integrated energy-environment scenario studies, energy system forecasting, integrated resource planning, greenhouse gas mitigation analysis, energy balance and environmental inventories. Energy demand is modelled via the hierarchical accounting of energy, a choice of methodologies and the optional modelling of stock turnover. Energy resources are modelled by tracking production, sufficiency, imports and exports. The model performs optional land-area-based accounting for biomass and renewable resources and can simulate any energy conversion sector. The electric system dispatch is based on electric load duration curves. All system costs — such as capital, operation and maintenance, fuel, saved energy, environmental externalities and others — are included in the model. The model also includes all sources and sinks of emissions in the energy system and non-energy sector (Figure 7).

MARKAL/TIMES

The MARKAL/TIMES family of tools is a long-term accounting model that can be used at global, multi-regional, national, state/province or community level. The model itself is available for free, although the interface and solver must be purchased. The learning process can last several months, due to the complexity of the model. However, it provides numerous simulation possibilities.

Technical simulation models

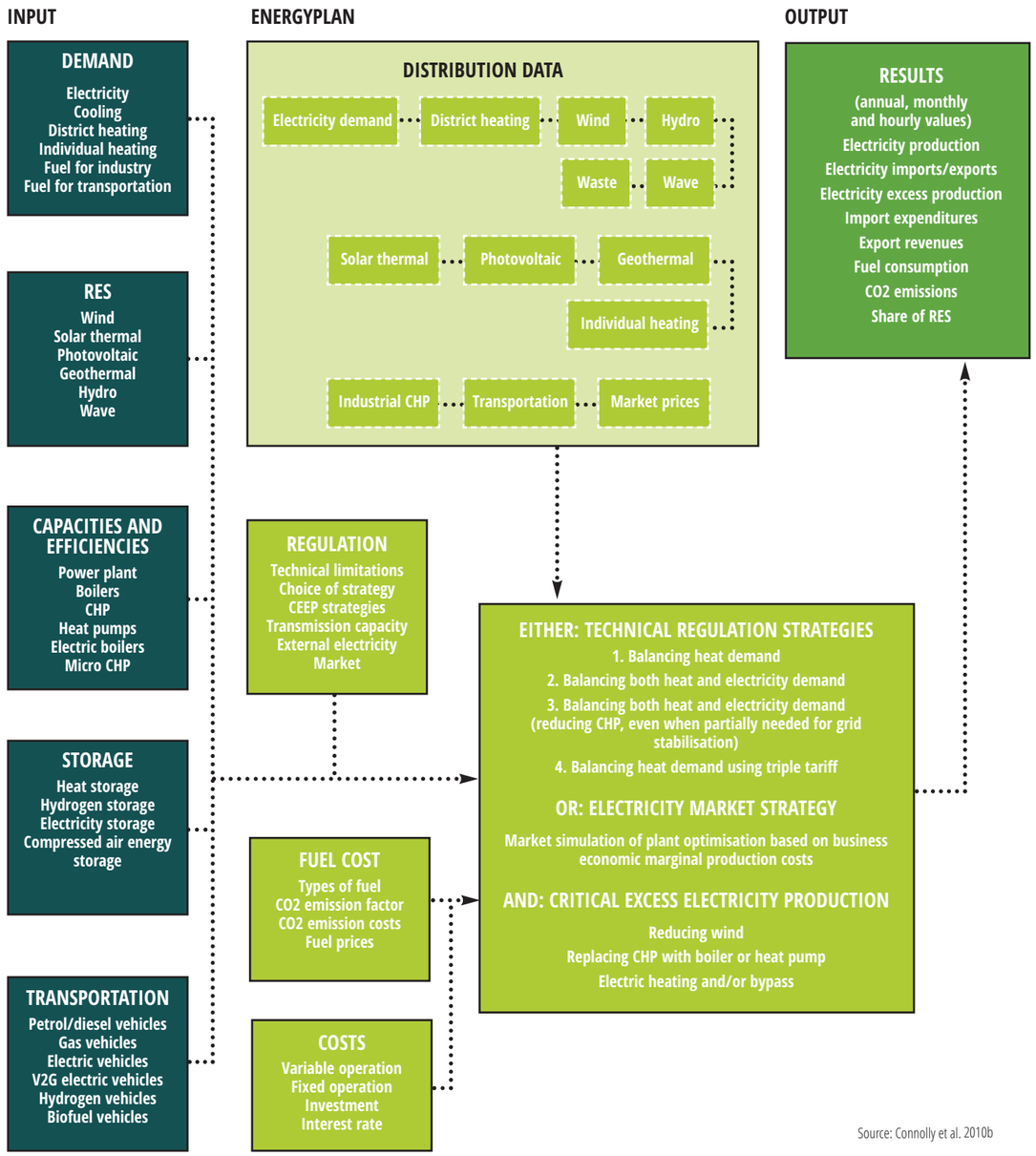
EnergyPLAN

The focus of the EnergyPLAN advanced energy system analysis computer model is the analysis of the integration of intermittent renewable energy sources. Model outputs are yearly, monthly and hourly values for electricity production, import/export balances, critical excess production, share of renewables and greenhouse gas emissions, as shown in Figure 8. The model is used for the integration of solar and wind production into existing energy systems by limiting critical excess electricity production (CEEP) and by introducing various demand response technologies such as electric vehicles in the vehicle-to-grid concept, heat pumps, flexible power plants, energy storage and the power-to-heat approach. The model can be downloaded free of charge after registering on the EnergyPLAN website (www.energyplan.eu).

Geographic information system–based energy planning tools

The geographic information system (GIS) family of tools is based on software designed to capture, store, analyse, model and present spatial or geographical data. The use of GIS tools in energy planning allows for precise and integrated city planning as it provides a set of data coupled with the geographical location. It thus provides synergetic results for municipal departments in charge of spatial planning, infrastructure development, energy, transport and waste management. Geospatial distribution provides quick and easy access to vital information in one place. The represented data can be used for the planning and optimisation of activities such as waste management and the planning of transport routes and energy infrastructure to match supply and demand. One example of the use of GIS tools is the set of Heat Roadmap Europe Pan-European Thermal Atlas (PETA) maps (www.heatroadmap.eu/peta4.php), where heat consumption is matched with heat production and excess heat sources. The density of heat demand shown on the map can be used to investigate the potential for the expansion or construction of district heating systems. The quality of spatial data distribution is highly dependent on the availability of heat consumption data. Among the most popular software packages are ArcGIS (www.arcgis.com/features/index.html) (commercial) and QGIS (https://qgis.org/en/site) (public).

FIGURE 8 The EnergyPLAN model, with inputs and outputs



Source: Connolly et al. 2010b

Tools accounting for the baseline emissions inventory

One of the tools that can be used to establish the current state of emissions is ICLEI Europe's Basic Greenhouse Gas Inventory Quantification Tool (http://iclei-europe.org/ccp/basic-climate-toolkit/). The tool is based on Excel sheets that are used to calculate overall energy consumption and quantify GHG emissions. The sheets are divided into government and community sectors. Government sectors are further divided into buildings, vehicles, public lighting, water and sewage and waste management. Community sectors are divided into residential, commercial, industry, transportation, waste, agriculture and local energy production. The tool automatically calculates energy consumption in MWh and emissions in tCO_2. If information on other GHGs is available, they can also be imported into the tool and it will automatically calculate their GHG potential and provide results in tCO_2 equivalent. The tool is available for free to local and regional governments, energy agencies, local government associations and networks.

Other tools

There are numerous other energy planning tools available that can be used for municipal energy planning. According to a review of computer tools for analysing the integration of renewable energy sources into various energy systems (Connolly et al. 2010a), tools can be divided into those for analysing national energy systems, and those with a specific focus. Both types can then be subdivided into time-step simulation tools and scenario tools. The review lists the main features of the tools, such as simulation, scenario analysis, equilibrium analysis, top-down or bottom-up approach, operation or investment optimisation. The tools are also divided into categories by number of users and downloads.

The most popular tools are:

- **RETScreen** (www.nrcan.gc.ca/energy/software-tools/7465) — analysis of renewables for electricity/heat in any size of system. Free, more than 200,000 downloads.
- **HOMER** (www.homerenergy.com/) — techno-economic optimisation for stand-alone systems. Free, more than 28,000 downloads.
- **BCHP Screening Tool** (https://eber.ed.ornl.gov/bchpsc/) — assesses combined heat and power in buildings. Free, more than 2,000 downloads.
- **energyPRO** (https://www.emd.dk/#) — techno-economic single-project assessments. Commercial, more than 1,000 downloads.
- **Invert** (http://www.invert.at/) — simulates promotion schemes for renewable energy. Free, from 100 to 1,000 downloads.
- **MESSAGE** (www.iiasa.ac.at/) — national or global energy systems in the medium to long term. Free, from 100 to 1,000 downloads.
- **ORCED** (https://info.ornl.gov/sites/publications/files/Pub9472.pdf) — simulates regional electricity dispatch. Free, from 100 to 1,000 downloads.
- **TRNSYS16** (http://sel.me.wisc.edu/trnsys/) — modular structured models for community energy systems. Commercial, from 100 to 1,000 downloads.
- **WASP** (www.iaea.org/topics/energy-planning/energy-modelling-tools) — identifies the least-cost expansion of power plants. Commercial/free to member states of the International Atomic Energy Agency (IAEA), from 100 to 1,000 downloads.

V. OPTIONS FOR IMPLEMENTING ENERGY MODELLING

Due to the complexity of energy systems and the specific technical expertise required, there are several ways to implement energy planning in a municipality:

- by developing internal capacity within the municipality;
- by procuring the energy modelling services on the market; and
- by building energy modelling capacity in local or regional academic and research institutes.

Whichever option (or options) is selected, energy plan development requires collaboration and coordination between various departments in the local administration, such as those responsible for environmental protection, land use and spatial planning, economics and social affairs, buildings and infrastructure management, mobility and transport, budget and financing, and procurement. Due to the different size and technical and financial capacities of municipalities, the approach must be chosen taking into consideration the available energy modelling expertise, resources and objectives (e.g. whether energy sector planning is a continuous process or an ad hoc initiative). Each option has advantages and disadvantages.

Developing internal capacity within the municipality

This approach requires rather extensive capacity building and the purchase or free downloading of an energy planning tool. The choice of tool will determine the training needs, since different tools have very different learning curves and energy modelling experts usually specialise in one tool or model. The pros and cons of this approach are outlined below, and examples are shown in Box 2.

Pros

- Development of in-house expertise
- Good knowledge of the local energy situation
- Easy communication with different local offices and stakeholders
- Knowledge of citizens' needs and preferences
- Knowledge of the economic and social situation in the municipality
- Opportunity to provide expert services to other municipalities in the region
- Easier to ensure confidentiality
- Easy to adjust the energy plan or model to reflect the latest developments in technologies and in the socioeconomic situation in the municipality without significant additional costs
- Support for the implementation and monitoring of the energy plan

Cons

- Long capacity-building and energy planning model development process
- Rather high costs for maintaining in-house expertise, especially if energy planning is not a regular exercise
- Challenges in terms of the availability of qualified expert candidates at the municipality
- Not a suitable approach for small municipalities (EC 2010)
- Need for continuous education and learning due to changes in the technologies and updates of energy planning tools and models

BOX 2 Examples of the development of internal capacities: Vienna and Malmö

The City of Vienna has set up its own municipal department to oversee energy planning in the city (www.wien.gv.at/english/urbandevelopment/energy-planning/). The main tasks are to:

- **coordinate and further develop energy concepts;**
- **monitor existing energy policies and prepare recommendations and additional measures;**
- **administer the Fund of the Province of Vienna for the promotion of green electricity;**
- **cooperate in the development and allocation of energy funding;**
- **undertake energy assessments of projects in the framework of administrative procedures;**
- **develop pilot projects to promote new energy technologies; and**
- **cooperate in projects to raise energy efficiency awareness.**

The City of Malmo has set up five working groups composed of personnel from different municipal departments to identify local environmental challenges and come up with sustainable solutions (Bringault et al. 2016). In 2009, a strategic energy and environmental plan targeting a 100 percent renewable supply, "Energistrategi för Malmö", was prepared and adopted by the city council in the same year.

Options for implementing energy modelling

Procuring energy modelling services on the market

This approach is suitable for municipalities that have limited human resources and cannot afford to have energy planning experts on their payroll. One of the most challenging issues with this type of implementation is drafting good terms of reference and ensuring the successful procurement of services. The next chapter in this toolkit contains several recommendations related to this task. Other potential challenges include the data collection process and data confidentiality. Data collection is typically a time-consuming task for external experts, and the terms of reference should clearly specify the responsible expert — that is, the municipality or the contracted energy expert. The terms of reference should also specify how data will be processed and stored and who will be responsible for data quality. It is good practice for the municipality to be responsible for data collection, otherwise procurement costs will be significantly increased, as expert fees are generally high. However, experts should be involved in ensuring the quality of data and processing data prior to entering them into a model or tool.

Pros

- Potentially a better-quality energy plan developed by a team of professional external experts
- Good knowledge of energy modelling and capacity to produce results relatively quickly
- A one-time expense for the municipality, which could be funded from international or national donor funds
- More suitable for smaller municipalities
- Opportunity to hire one expert to provide a service for several neighbouring municipalities
- Knowledge of the latest trends in energy technologies, and their performance and costs

Cons

- External experts are usually less familiar with the local energy, economic and social situation
- The modelling is usually done based on input data provided by the municipality, thus results strongly depend on data quality
- The municipality is not acquainted with the energy planning process, which could lead to the omission of important constraints or benefits not known to the external experts
- The modelling results produced by different tools and expert teams are usually not comparable and consistent
- There is the potential for leaks of confidential data
- Not appropriate for the continuous planning process, as municipalities might not have access to the same methods and analysis as an external expert

Building energy modelling capacity in local or regional academic and research institutes

In most European countries and regions there are institutions with relevant expertise in energy modelling, especially universities and research institutes. Another approach is to have regional agencies helping with municipal planning processes. For example, during the implementation of the EU's 2020 energy and climate package, several regional energy agencies were established to provide energy services at local and regional level. The provision of energy services was one of the first activities that each agency was supposed to undertake in the region. Their expertise was used to develop SEAPs within the Covenant of Mayor's initiative (EC 2010). The approach can be replicated in other regions, thus reducing the overall costs of municipal energy planning in a country.

Pros

- Possibility to share experts among several municipalities
- Possibility to subcontract experts for specific tasks only
- Use of students for data gathering

BOX 3 Examples of building energy modelling capacity in local or regional academic and research institutes: Frederikshavn and Poland

The city of Frederikshavn, Denmark, started the transition towards 100 percent renewable energy in 2006. A 3D modelling and visualisation model was developed by the University of Aalborg and was used to support the initiative based on scenarios modelled by the university expert team. The same software was also used as a communication tool (Bringault et al. 2016).

The Polish Network of Energy Cities (PNEC) has provided direct technical support since 2009 to four Polish cities that are keen to join the Covenant of Mayors. The support is based on a methodology developed under the European-funded MODEL project (Management of Domains Related to Energy in Local Authorities).

- Simultaneous training of local officials while developing energy plans
- Availability of up-to-date expertise on a continuous basis
- A uniform approach to energy modelling in the region
- Possibility to adjust energy planning models/tools for application in specific cases

Cons

- Financing from the municipality might be needed to ensure continuous support
- The energy planning tool/model used by an institution might not be suitable for the given application in a city
- Potentially limited energy modelling expertise at local level (e.g. in academic institutions)
- Potentially limited expertise in the modelling of rural or urban energy systems (e.g. in academic institutions)

Examples of this approach are provided in Box 3 (EC 2010).

Further information on the various approaches to municipal energy planning and modelling can be found in the EnergyCities publication *Cities Heading towards 100% Renewable Energy* (www.energy-cities.eu/IMG/pdf/publi_100pourcent_final-web_en.pdf); on the website of the Energy Community (https://www.energycommunity.org/default.asp?action=applications&ID=96); and the website of the Covenant of Mayors (www.covenantofmayors.eu/index_en.html).

VI. GUIDANCE ON THE PROCUREMENT OF ENERGY SECTOR PLANNING AND ENERGY MODELLING SERVICES

If a municipality does not have internal human and technical resources to prepare good-quality energy plans and there is limited interest or capabilities in this area in regional research and academic institutes, the only remaining option is to procure these services on the market.

For the purposes of this chapter, to "procure" means to define the service (e.g. for the exploration of energy sector strategies, the development of energy modelling analyses, energy system planning and policy assessment at local level) that the beneficiary intends to obtain from external consultants. An effective procurement procedure is expected to contribute to the management of a "systematic" process by which the beneficiary selects consultants. It is generally organised according to the following key steps:

- **Define the scope of the service to be procured**. The municipality's needs must first be carefully identified in order to choose which type of services will provide the best value for money (i.e. in good time, of the highest quality, and for the best price). It is important to have a good estimate of the effort level required in terms of human resources and tools so that a realistic procurement budget can be set. Checking references of similar projects and consulting with municipalities or experts that have imple-

mented similar contracts can provide useful inputs for procurement planning.

- **Select the procurement procedure**. The choice of procurement procedure may depend on specific internal operating procedures and national public procurement rules. At EU level, for example, guidance and rules on procurement procedures are provided by Directive 2014/24/EU of the European Parliament and of the Council of February 26, 2014.

The following procurement options are available:

- **Call for tenders:** The beneficiary asks potential bidders to submit an offer to supply services against a detailed tender, in the form of a list of predefined activities and tasks. This option is generally used when the beneficiary has a precise knowledge of the needs and the final objective (e.g. the preparation of a user-friendly decision support system and its implementation for the strategic energy action plan). This option can be implemented via so-called restricted procedures, where only bidders invited by the contracting authority may submit a tender; or via an open invitation to tender, where any potential supplier who can provide a guarantee of performance is welcome to apply. The restricted procedure may include the following options:
  - A competitive procedure with negotiation. Only economic operators invited by the contracting authority, following its assessment of the information provided, may submit an initial tender, which is then used as the basis for subsequent negotiations. The minimum requirements and the award criteria are not subject to negotiation.
  - Competitive dialogue. Only those economic operators invited by the contracting authority following an assessment of the information provided may participate in the dialogue. Competitive dialogue may take place in successive stages in order to reduce the number of solutions to be discussed during the dialogue stage by applying the award criteria laid down in the contract notice or in the descriptive document.
  - An innovation partnership. Such a partnership is aimed at the development of an innovative product (e.g. a tool) or service and its subsequent purchase, when not already available on the market.
- **Request for proposals:** The beneficiary identifies only the high-level needs and requirements of the service (e.g. an analysis of the sustainability challenges in the city's energy sector), while the general approach and details are proposed by the bidders, who are requested to develop a detailed proposal based on their experience, ideas and methodologies. As opposed to the previous approach, this option is used when the contractor has no interest, knowledge, time or experience to formulate a detailed and structured service request specification.
- **Individual contracts:** The beneficiary needs specific, well-defined services and directly appoints an individual consultant to perform activities or tasks. This may happen without an open competition if there are no impediments to contracting individuals with specific knowledge and skills, and it generally applies in the case of clear and quantifiable deliverables.

It is important to bear in mind that national public procurement rules may have different procurement methods, and compliance with national requirements should be ensured.

- **Define the process for acquiring the service.** Depending on the procurement procedure, the beneficiary defines rules and requirements for participation in the procedure and invites service providers to submit their bids. In the case of restricted procedures, the beneficiary can make use of consultant databases, Internet research or similar past experiences to shortlist and preselect potential service providers.

  Adequate notification must be ensured in order to give all candidates an equal opportunity to bid, and minimum service quality levels must be established, without there being excessive requirements that may restrict competition. To ensure equal treatment, the beneficiary must inform tenderers of the criteria and the arrangements for the award decision. The award criteria most frequently used are "most economically advantageous" and "best price–quality ratio".
- **Schedule activities.** To ensure the good execution of a service, it is important to properly define the milestones of the work in advance (e.g. deadlines for key deliverables), and to have a complete overview and full control of activities during service execution.

The procurement procedure might depend on the budget, as procurement rules usually have certain thresholds for different procurement types. Box 4 offers case studies of projects of varying scope and their indicative budgets for reference.

Once the procurement procedure has been selected and the scope and timing of the required services has been defined, it is essential to draft good terms of reference, as part of the procurement documents. A template for terms of reference and recommendations for procurement documents for the acquisition of energy planning and energy modelling services are provided on pages 28 to 31.

BOX 4 Project case studies and indicative budgets

The objectives and methodologies, the thematic areas covered, the skills required and the costs are city specific and goal oriented, since they depend on the actual needs, priorities and financial possibilities of the municipality. It is therefore difficult to give a general estimate of the timing and budget needed to undertake an analysis of an urban energy system without specific information on the project scope and context. Several examples are provided below for reference.

The master plan for Turin (a city in northern Italy with around 1 million inhabitants) prepared in 2013 is structured according to five thematic areas (mobility, social inclusion, health, energy and integration). The plan contains three key tasks: scenario analysis (mainly in the form of benchmarking with other cities); plan preparation (including the identification of projects in the specific thematic areas); and an analysis of the governance model (progress monitoring) and the business model (funding mechanism). The project involved 65 local stakeholder groups (the university, research centres, associations, enterprises and others) at no cost. It required approximately 10,000 person-hours of work over a 150-day period. The total investment was EUR 500,000 (covered in full by the municipality).

Within the EU-FP7 INSMART project, the preparation of a strategic energy action plan based on simulation and optimisation models for each city was structured according to five thematic areas (GIS, buildings, mobility, energy [supply, renewable, etc.] and integration). The work comprised seven key steps: involvement of local stakeholders and data collection; building modelling and simulation; transport modelling and simulation; analysis of energy use in other sectors; energy-GIS platform; implementation of city energy system modelling for integrated solutions; and the development and dissemination of a sustainable energy action plan. The direct involvement of the beneficiary (city) in the work required approximately 10,000 to 11,000 person-hours of work (over three years) per city, of which 40 percent were contributed by the municipality, with the remaining provided by the supporting technical experts. Roughly 30 percent of the effort was devoted to data collection and analysis; 50 percent to quantitative exercises; and the remaining to analysis and reporting. The total investment required was EUR 600,000 per city.

Greater or smaller efforts may be needed when approaching different city-specific issues. Although a planning exercise is typically better the more comprehensive it is, a municipality's needs may also be appropriately met by a simplified assessment.

An individual assignment for a smart urban development expert may, for example, take the form of a review of relevant available documents (action plans); assisting in the development of proposed project design; advising on institutional arrangements; carrying out a training needs assessment; identifying the scope and content of necessary studies to optimise investments; preparing reports (e.g. inception report, quarterly progress reports, final report). The indicative effort level required is 70 working days, and the budget for the consulting services could be USD 60,000.

Guidance on the procurement of energy sector planning and energy modelling services

Terms of reference for technical support on energy modelling and analysis

Terms of reference for technical support on energy modelling and analysis

1. Outline

Service location: for example, home-based services, with required presence in a city for at least xx days.

Application deadline and tender submission details: date and address (physical or virtual).

Type of contract: individual contract, or contract with a company.

Language requirements: English and/or local language.

Service starting date: dd-mm-yy

Contract duration: dd-mm-yy to dd-mm-yy

Expected effort level: minimum (approximate) number of working days over a period of xx months (if relevant).

2. Background

This section gives an overview of the context in which the project is taking place, which helps to clarify the general conditions and the reasons for undertaking the work (indicative length: around one page). Recommendations for this section are included in Box 5.

BOX 5 Recommendations for calls for tenders and requests for proposals — Background

The beneficiary/buyer briefly introduces the local system that is the subject of the analysis; provides a short normative and regulatory context; explains the key problems or challenges of the system and the way those challenges have been approached in the past; and presents the new ambitions and objectives for the future.

3. Subject of the contract

This section describes in detail the objectives, the type of services required and the expected outputs (indicative length: around one page).

BOX 6 Recommendations for calls for tenders and requests for proposals — Subject of the contract

CALLS FOR TENDERS

The beneficiary/buyer clearly describes what is required and the final goal of the service. Services potentially of interest for a local system decision maker (in the area of energy and environment) are outlined below:

- **Technical assistance in developing analyses of local challenges (e.g. support in the preparation of action plans). The final output is generally a report, document or workshop.**
- **The creation from scratch of decision support platforms for the city (the development of new tools for local experts) for the analysis of specific issues. The final output is generally one or more "turn-key" tools.**
- **Capacity building (training on analysis methods and/or modelling). The objective is to transfer knowledge to local experts and decision makers through a series of trainings.**
- **Combinations of the above services.**

REQUESTS FOR PROPOSALS

The beneficiary/buyer describes the thematic area(s) concerned and the high-level objectives.

4. Tasks to be carried out by the supplier

This section describes in detail the service required, depending on the procurement method. It should list all the activities and key steps, and explain the high-level rationale of the project. The description can be broken down by tasks and sub-tasks, and visualised through a workflow chart (indicative length: between one and five pages).

BOX 7 Recommendations for calls for tenders and requests for proposals — Tasks

CALLS FOR TENDERS

The beneficiary should provide a breakdown of the request and define specific assignments in detail. For example, in the design of a new decision-making tool, the work could be split into the following subtasks:

- **selection of the methodology to be used;**
- **data collection and processing;**
- **design of the tool;**
- **application of the tool based on beneficiary inputs; and**
- **reporting.**

REQUESTS FOR PROPOSALS

This part of the proposal is usually prepared by the service provider.

5. Time schedule and reporting

This section provides a schedule for activities, deliverables and reporting obligations (indicative length: between two and three pages).

BOX 8 Recommendations for calls for tenders and requests for proposals — Timing and reporting

CALLS FOR TENDERS

A Gantt chart can be included to illustrate the project schedule (start/end/milestones/deadlines). Alternatively, a simple two-column table can be prepared, showing actions and deliverables and the corresponding due dates.

Additional details about the type (file extension, format, language etc.) and specific content of the deliverables (e.g. method, assessment, recommendations for a report; raw data, elaboration, final results for a data repository etc.) can be specified here. In the case of energy system modelling services, typical deliverables include technical reports (.doc, .pdf and similar formats), database files (.xls, .db and similar formats), models/tools (software files) and training materials (.ppt, videos).

REQUESTS FOR PROPOSALS

Key information about project duration, milestones and deadlines for activities and deliverables should be provided.

6. Budgets and payments

Budget details and instructions for financial proposals are to be reported in this section — for example, currency unit, the maximum amount of the contract, the breakdown between fees and other costs (e.g. software, visits/travel etc.), and payment conditions and timing (e.g. two interim payments due upon delivery of key reports/service outputs) (indicative length: between one and two pages).

Terms of reference for technical support on energy modelling and analysis

BOX 9 Recommendations for calls for tenders and requests for proposals — Budgets and payments

CALLS FOR TENDERS

It should be made clear whether the price of the service is quoted free of duties, taxes and other charges, and whether it includes VAT, especially if the tender is open to international bidders. If relevant, an allocation of budget within the different project phases may be required. The tender documents may specify the maximum budget for the contract, or the minimum effort level expected in terms of expert workdays.

REQUESTS FOR PROPOSALS

The overall maximum budget, preliminary effort level and general financing rules should be specified.

7. Confidentiality

This section specifies whether the contract contains confidential elements and explains how to manage non-public data. The beneficiary may also specify any ownership requirements of the tools and other project outputs (indicative length: around one page).

BOX 10 Recommendations for calls for tenders and requests for proposals — Confidentiality

Examples of potential confidential elements include data on energy consumption by households, production levels by plant or utility, the results of the analysis, and the value and characteristics of the contract.

8. Exclusion and selection criteria

This section clearly specifies the eligibility and selection criteria for the consultants. This section should contain the exclusion conditions (a signed declaration of honour is often required), the minimum technical and professional capacity requirements (including, where needed, for the specific technical experts involved), and the evidence to be provided (indicative length: around one or two pages).

BOX 11 Recommendations for calls for tenders and requests for proposals — Exclusion and selection criteria

CALLS FOR TENDERS

Examples of criteria:

- Economic and financial capacity (only for companies): minimum average annual turnover; current assets/liabilities; any other relevant financial and economic criteria.
- Technical and professional capacity related to tenderers and the team delivering the services: at least "n" (e.g. three) projects in the field of energy modelling analyses and energy system planning at local level in the last three years (with a minimum threshold economic value); at least "n" (e.g. five) years of professional or research experience in the field of energy modelling for the components of the team delivering the service; and skills in both written and spoken English (and/or a local language).

REQUESTS FOR PROPOSALS

The section should contain key information about the eligibility of applicants and partnership requirements.

9. Award criteria

This section presents the award criteria for the bids, the weight of each criterion, and the formula for calculating overall performance. Minimum scores are sometimes also specified (indicative length: between one and three pages).

BOX 12 Recommendations for calls for renders and requests for proposals — Award criteria

A few key criteria (with some sub-criteria) can be used to evaluate proposals in energy modelling services tenders. Two examples are given below.

EXAMPLE 1 (when searching for a consultancy company):

- The technical and professional records of the bidder for similar projects (0–20 points: this requirement can be part of the selection criteria for calls for tenders).
- The quality of the proposed activity and methodology (40–60 points): How the proposed approach responds to the actual needs and objectives of the beneficiary/buyer (30 points); and the rationale, quality and consistency of the proposed technical work (modelling and analysis activity) (30 points).
- The organisation of the work (20–40 points): an assessment of the roles and responsibilities of the proposed team and how these are distributed for each task (10–20 points); and how time and resources are allocated to the project and to each deliverable, and whether this allocation is adequate for the work (10–20 points).
- Quality control (0–20 points): How a quality control system is applied to the service, for example concerning the quality of the deliverables and the tasks, language quality, and the continuity of the service in case of the absence of a member of the team (0–20 points).

EXAMPLE 2 (when searching for an individual expert):

- Educational background (max. 10 points).
- Proven work experience relevant to the selected thematic area (max. 35 points).
- Knowledge of area of work; proven work experience in the country (max. 10 points).
- Previous experience managing or advising modelling and planning projects for international organisations (max. 20 points).
- Experience with training related to the selected thematic area (max. 15 points).
- Language skills (max. 10 points).

10. Content and presentation of bids

This section contains the full list of official documents and required formats, together with instructions (e.g. language, application/submission process, due dates, contact details for questions). Two separate documents are typically requested, containing the technical and financial offers (indicative length: around one page).

VII. CASE STUDY

THE INSMART project

The INSMART project (Integrative Smart City Planning, www.insmartenergy.com) was awarded three years' funding from the European Union under the Smart Cities call of the Seventh Framework Programme for research, technological development and demonstration. The project developed a sophisticated methodology enabling European cities to plan their future energy use more smartly. The methodology was tested in four cities — Trikala (Greece), Cesena (Italy), Évora (Portugal) and Nottingham (UK) — with the support of technical specialists from the four countries. The INSMART methodology was designed to be both replicable and modular, meaning that it can be applied in its entirely in other cities in the future, or that parts of it can be used to complement other existing procedures or methods, regardless of specificity or dimension.

The INSMART methodology offers an integrated and participatory process for examining all energy-consuming sectors, together with potential local energy generation options, in order to come up with a smart development plan for the city's energy sector that is supported by all stakeholders. The approach can be integrated by municipalities participating in the Covenant of Mayors for Climate and Energy into the process of developing a sustainable energy action plan or sustainable energy and climate action plan, offering the advantage of providing a concrete scientific approach to local energy planning.

In the INSMART approach, a city's energy system is seen as an integrated network of energy flows connecting energy providers with buildings, public spaces, transport and utilities, while taking into account spatial differentiation. A multi-model approach is used to explore and rank alternative plans (combinations of actions and measures) for the sustainable development of the municipality, with a particular focus on the residential and transport sectors (the two main energy-consuming sectors in cities).

The process involves first gathering local data, then using those data in specialised simulation modelling tools to highlight energy demand profiles for buildings in alternative refurbishment scenarios, as well as shifts in mobility patterns and transportation demand in alternative transport scenarios. A city energy system model (City-ESM, based on the TIMES model generator) is then developed using all the collected information. The City-ESM includes all the energy-consuming and energy-producing sectors within the city and is used to analyse alternative scenarios for the development of the city energy system in the medium term (up to 2030). The definition of different possible scenarios and the selection of appropriate measures are key steps in the process, following a participatory workshop approach involving all the stakeholders in the city. A multi-criteria assessment, incorporating both quantitative and qualitative criteria, then provides the basis for the final ranking of measures. The final outcome of this process is the development of a mid-term implementation action plan for each city, which helps make the case for action and pave the way towards the implementation of the measures.

Compared to the most commonly used methodology for developing strategic energy action plans (SEAPs) for cities (which is generally based on the downscaling of national/regional planning approaches), the INSMART methodology makes it possible to explore multiple future planning hypotheses for the integrated urban energy system (explicitly modelled and simulated) and to engage local stakeholders in all stages of decision making. Table 1 summarises the key differences between the traditional SEAP approach and the INSMART approach, and highlights the innovative aspects of the latter. The results and findings presented in the mid-term implementation action plan should therefore be considered on the basis of the characteristics presented in the table.

The key outcomes of the INSMART project were:

- the identification of the most technically robust and socially acceptable combination of measures and actions towards the more sustainable development of municipalities;
- the quantification of expected achievements;
- a detailed economic viability analysis; and
- the identification of possible funding schemes and mechanisms.

In addition to these main outputs, a complete set of tools (i.e. GIS energy platforms, building and transport simulation tools, integrated City-ESM) and analyses were transferred to municipalities. These form the basis for future analyses, local policy developments and mentoring activities for other cities.

All the INSMART materials are available on the project website (www.insmartenergy.com), including conference information and presentations, published articles and all deliverables.

EXAMPLES TAKEN FROM THE INSMART PROJECT

1. TECHNICALLY ROBUST AND SOCIALLY ACCEPTABLE COMBINATIONS OF MEASURES AND ACTIONS TOWARDS MORE SUSTAINABLE MUNICIPALITY DEVELOPMENT

Buildings

Refurbish 25 percent of buildings currently with an energy rating equal or lower than class-E (over 130 kWh/m^2 per year) to an energy rating of class B (below 60 kWh/m^2 per year).

How can this be achieved by 2030? Key outcomes of the analysis:

a. roof insulation in 8,600 dwellings;

b. windows replaced in 5,800 dwellings;

c. wall insulation fitted in 5,150 dwellings; and

d. the most cost-effective retrofitting carried out in semi-detached dwellings built before 1980.

Renewables

Achieve a 30 percent increase (relative to 2013) in the overall use of renewable energy for the production of decentralised heat and electricity in the city system.

How can this be achieved by 2030? Key outcomes of the analysis:

a. 5,300 kW of newly installed roof solar photovoltaic capacity;

b. 10,000 kW of newly installed solar water heaters; and

c. extra investments to supply CO_2-free energy into the system (e.g. production of 15 TJ from biogas plant).

2. QUANTIFICATION OF EXPECTED ACHIEVEMENTS

a. Saved energy (with respect to the reference case): 650 TJ in residential buildings.

b. A 31 percent reduction in CO_2 emissions compared to the base year (direct emissions from analysed sectors) and a 17 percent reduction compared to the reference year of the existing SEAP (1995).

c. Per capita emissions covered by the analysis reduced to 3.2 t in 2020 and 2.5 t in 2030.

	SEAP APPROACH	INSMART APPROACH
Approach	**Top-down**: Downscaling of national targets, policies and measures	**Bottom-up**: Driven by urban specific urban needs and linked with urban planning.
Measures	**Simulation**: Cost-benefit analysis of individual stand-alone measures	**Optimisation/simulation**: "What if" analysis and an integrated system approach.
Urban/energy planning	Urban planning and energy planning are carried out **separately**.	Urban planning and energy planning are carried out **together**.
Emissions (location)	Both **direct** (i.e. within the urban area) and **indirect** (e.g. due to the gereration of electricity consumed in the urban area).	Only **direct** (i.e. within the urban area): the focus is exclusively on emissions directly generated by the "players" in the system (e.g. households).
Emissions (type)	Mainly carbon dioxide, thus the focus is mainly on climate change issues.	Carbon dioxide and local pollutants (e.g. pariculate matter): the focus is on both climate change and the local impacts of pollution.

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IX. CITY-LEVEL ENERGY MODELLING EXPERTISE IN THE REGION: CONSULTANTS

ALBANIA

Orion Zavalani

Faculty of Electrical Engineering, Polytechnic University of Tirana/Zavalani Consulting

EXPERTISE

Sustainable urban and rural energy planning, development and management

BASED IN

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PROFILE

Mr. Zavalani is an electrical engineer, researcher and educator. For over two decades he has focused on designing and developing civil, commercial and industrial electrical networks; building automation systems; low- and medium-sized voltage networks; renewable energy and energy efficiency; electro-heating; standards; and engineering education. He is the author or co-author of over 100 academic contributions to scientific meetings, journals and books. (A list of his publications can be found on Google Scholar and his LinkedIn profile). As manager of Zavalani Consulting he has been engaged in several large-scale local, regional and international engineering projects in Albania, Kosovo, Georgia, Greece, Slovenia, Finland and Armenia. He has extensive experience in project implementation with the EC, EBRD, WB and bilateral donors.

Elda Tona

Democritus University of Thrace, School of Civil Engineering

EXPERTISE

Municipal energy efficiency planning

BASED IN

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PROFILE

Developed the municipality energy efficiency plan for the city of Korca (2011-2015) using ENSI – Energy Saving International AS software and tools. Monitored the geothermal heating in the public Kindergarten no 14 in the city of Korca. Project designing and implementation of building insulation measures in municipal buildings, such as kindergartens and schools. Presentation of good practices in various workshops organized by ENSI, IFC, Academy of Political Studies (APS), Academy of Sciences of Albania, etc. Project designing and implementation of energy efficiency measures in a five-floor private residential building in the city of Korca, funded by the Ministry of Urban Development of Albania. Currently working in Regional Development Agency no 3 (Korca, Elbasan, Berat) in Albania.

BOSNIA AND HERZEGOVINA (CONT.)

Fuad Strik

Strik Consulting d.o.o. Sarajevo/Energis Centre for Education and Raising Awareness of Energy Efficiency

EXPERTISE

Sustainable urban and rural energy planning, development and management

BASED IN

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PROFILE

Areas of work include the institutional framework for the integration of renewable energy sources, with a focus on solar, biomass and hydro; energy efficiency model design and implementation; sustainable electricity use and integrated markets; energy services market development; the conceptual design and return on invested capital assessment of renewable energy sources; strategic sustainable development and the green production of energy in urban and rural areas; and the promotion of the environmental and energy efficiency aspects of modern businesses, including opportunities for energy savings, the use of RES, and evaluating impacts on CO_2 emissions. Other areas of work include supervisory control and data acquisition (SCADA); the conceptual design of energy management systems for heat and electricity production; the optimisation of energy consumption in industrial plants and buildings with a focus on SMEs; and climate-resilient and sustainable urban environments.

Hamdija Mujezin

Strik Consulting d.o.o. Sarajevo/Energis Centre for Education and Raising Awareness of Energy Efficiency

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Sustainable urban and rural energy planning, development and management

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PROFILE

Areas of work include the institutional framework for the integration of renewable energy sources; energy services market development; energy sector studies, statistics and indicators; and the conceptual design and return on invested capital assessments of RES and energy efficiency solutions (e.g. PV, wind, solar hot-water systems) and environmental technologies (air and water filtration systems). He has been involved in environmental impact assessments of power plants (thermal and renewable power plants); strategic sustainable development and green energy production in urban and rural areas; the promotion of environmental and energy efficiency aspects of modern businesses, including opportunities for energy savings, the application of RES, and the evaluation of impacts on CO_2 emissions. He is also experienced in the field of energy management systems (ISO 50001), with a focus on the SME sector; climate-resilient and sustainable urban and rural environment solutions; and environmental impact studies in relation to refrigerants.

BRAZIL

Flávia Mendes de Almeida Collaço

University of São Paulo, Brazil — Energy and Environment Institute

EXPERTISE

Urban energy planning and urban energy systems

BASED IN

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PROFILE

Flávia Mendes de Almeida Collaço has experience in megacity urban energy planning; public policy–oriented urban and energy planning; complex database analytics; multilevel database cross-over and adaptation; simulation modelling; LEAP modelling; multi-sector urban and energy data compilation and analysis; and urban and energy policy in response to the impacts of climate change.

CROATIA

Dr Neven Duić

University of Zagreb, Faculty of Mechanical Engineering, Department of Energy, Power Engineering and Environment
http://powerlab.fsb.hr/neven

EXPERTISE

Energy management; energy planning; energy markets and economics; modelling and optimisation of local, regional and national energy systems

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PROFILE

Professor Duić is a full professor at the Department of Energy, Power Engineering and Environment at the Faculty of Mechanical Engineering and Naval Architecture of the University of Zagreb. He has organised several of the conference series on the sustainable development of energy, water and environment systems and has been a member of the organising, scientific and programming committees of more than 30 scientific conferences. He has edited 20 books and more than 20 special issues of journals. He has experience in various fields of sustainable energy development, including energy management, energy planning, climate change and renewable energy sources. Together with his research group, he has been involved in several completed and ongoing projects related to energy planning. He is currently coordinating Croatian participation in several Horizon 2020 (http://planheat.eu/) and Interreg MED (https://prismi.interreg-med.eu/) projects, the Adrion project, as well as projects financed by the Danish Council for Strategic Research, AVL and the Croatian Scientific Foundation (http://het.hr/index.php?lang=en). According to the Croatian Scientific Bibliography, he has 96 publications in relevant journals, and according to the Scopus citation database, he has been cited 2,505 times and has an h-index of 25.

City-level energy modelling expertise in the region: Consultants

CROATIA (CONT.)

Nikola Matak

Faculty of Mechanical Engineering and Naval Architecture, University of Zagreb
https://www.fsb.unizg.hr/?fsblocator

EXPERTISE

Local energy planning and the development of business models for RES implementation; sustainable energy action plans

BASED IN

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PROFILE

Nikola Matak is a PhD student and employee at the Faculty of Mechanical Engineering and Naval Architecture of the University of Zagreb. He graduated in 2015 from the Department of Energy, Power Engineering and Environment, with master's degree, having submitted the thesis "Joint Sustainable Energy Action Plan for Municipalities of the Korcula Island According to Option 2 of the Covenant of Mayors." He works as an expert associate on the RESFlex project "Energy-Independent Croatia based on the High Penetration of Renewable Energy Sources and Demand-Response Technologies". He has participated in the implementation of several EU projects: "Promoting Renewable Energy Sources Integration for Smart Mediterranean Islands" (PRISMI); "Beyond Energy Action Strategies" (BEAST); MESHARTILITY; and Alterenergy, where he contributed to the development of nine sustainable energy action plans in Dubrovnik Neretva County. He is a member of the local organising committee of the Sustainable Development of Energy, Water and Environment Systems (SDEWES) conference.

Dr Goran Krajačić

Faculty of Mechanical Engineering and Naval Architecture, University of Zagreb, Croatia
http://www.powerlab.fsb.hr/gkrajacic/

EXPERTISE

Energy planning; energy management; energy markets; island energy system modelling and optimisation; development of models for the simulation of energy systems

BASED IN

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PROFILE

Goran Krajačić is an assistant professor at the Department of Energy, Power Engineering and Environment of the University of Zagreb (www.depee.fsb.hr). He defended his PhD thesis "The role of energy storage in the planning of 100% RES systems" in 2012. In 2011, he won an award from the Association of University Professors and Scientists in Zagreb. Since 2002, he has been a member of the local organising committee for the Conference on Sustainable Development of Energy, Water and Environment Systems (http://www.sdewes.org/). The results of his scientific work have been published in 31 papers and cited more than 630 times, with an h index of 18. Important projects include the Horizon 2020 project "People for the European Bioenergy Mix (Phoenix); "Beyond Sustainable Energy Action Strategies "IEE BEAST"; "The ICT-Aided Integration of Electric Vehicles into Energy Systems with a High Share of Renewable Energy Sources (iRESEV); and the FP7 project "Distributed Knowledge-Based Energy Saving Networks" (DISKNET). Other projects include JORIEW, ADEG, WEB-ENV, WEB-MOB, STORIES, GERONIMO, SMART and BIOSIRE, as well as the national project "Smart Energy Storage for Sustainable Development of Energy Systems".

GERMANY

Alexander Ochs

SD Strategies

EXPERTISE

Energy policy and strategy development

BASED IN

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PROFILE

Managing Director of SD Strategies, a Berlin-based policy and communications consultancy. Alexander has been advising top government officials and private sector representatives for more than 20 years. Currently, he also serves as Chair of the LEDS GP Energy Working Group, President of the Forum for Atlantic Climate and Energy Talks, Adviser to the International Climate Initiative, and Clean Energy Solution Center Senior Expert. He serves on multiple international advisory boards and carries several senior academic positions. He has been providing energy policy and strategy development and evaluation for dozens of governments worldwide for 20 years. His work focuses on economic and social development through sustainable energy and climate mitigation, and has worked in the design and implementation of Sustainable Energy Roadmaps and Implementation Plans for multiple countries and regions. He has developed the LEDS Energy Toolkit and created trainings for multiple facets of energy planning, as well as worked in transport and energy sector integration, and in energy access and rural electrification strategies.

INDIA

Soumya Chatuvedula

ICLEI – Local Governments for Sustainability South Asia Secretariat (ICLEI South Asia)

EXPERTISE

Urban energy planning and consulting, renewable energy systems implementation, demand side management and energy auditing

BASED IN

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PROFILE

Involved in devising mitigation and adaptation strategies for cities, sub-national and national governments. Expertise in Energy Efficiency (EE) measures/demand side management (including ESCOs for street lighting, building EE), renewable energy projects like solar PV, biomethanation, bioenergy, etc. Feasibility studies and detailed project report preparations for RE and EE projects. Investment grade energy audit study to support LED retrofit of 100,000 HPSV streetlights in Malaysia's Melaka province. Rapid assessments to establish feasibility of district energy (cooling) systems in 5 Indian cities (http://www.districtenergyincities.org/). Overall project management, strategic direction and execution for many international projects such as Urban-LEDS (http://urbanleds.iclei.org/) and CapaCITIES (http://capacitiesindia.org/). Instrumental in developing Harmonised Emission Analysis Tool Plus (HEAT+) (http://heat.iclei.org/heatplusgpc/indexnew.aspx), which has been used for energy and climate mitigation action planning by 35+ cities across the Asian region and beyond. Nationally appropriate mitigation action (NAMA) research study in India, Philippines and Indonesia. Rich working experience in the South/South-East Asia region countries.

INDIA (CONT.)

Nikhil Kolsepatil

E4SMA
ICLEI – Local Governments for Sustainability South Asia Secretariat (ICLEI South Asia)

EXPERTISE

Urban energy and climate action planning, energy demand assessments, feasibility studies and energy audits for renewable energy and energy efficiency implementation

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PROFILE

Certified lead auditor - ISO 50001 Energy Management System. Developing baseline energy profiles, identifying appropriate pilot scale interventions and packaging them into investment portfolios for tendering through projects like Urban-LEDS (http://urbanleds.iclei.org/) and CapaCITIES (http://capacitiesindia.org/).

LED Street lighting retrofits: 10,000 street lights in Thane city – ESCO model, infrastructure upgrade for 5000+ streetlights in Panaji, Gwalior and Rajkot cities. Investment grade energy audit for retrofitting 100,000 HPSV streetlights, Malaysia's Melaka province.

Grid interactive solar PV systems, Thane & Rajkot. EE implementation and smart controls in buildings. Rapid assessments to establish feasibility of implementing district cooling systems in five Indian cities — 'District Energy in Cities' (http://www.districtenergyincities.org/). Pre-feasibility studies for developing district cooling project proposal for investment. Rich experience of supporting cities in South/South East Asia in city-wide energy planning using the HEAT+ tool. Preparation of the Energy and Climate Master Plan, Melaka Province, Malaysia. Energy audit/conservation measures/verification in Tea Industry & development of financing models for implementation.

ITALY

Dr Alessandro Chiodi

E4SMA
Energy Analyst and Modeler

EXPERTISE

Development of integrated energy system modelling tools; technology assessments; GHG emissions; scenario and policy analysis

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PROFILE

Dr. Chiodi's work has involved tracking the progress of member states in the EU Energy Union Governance Process; providing assistance to the Enel Foundation on the analysis of two European energy systems (Italy and Spain); informing the Government of Ireland about key energy and climate policy developments; and supporting the development of new methodologies to enable cities to plan their future energy use more smartly (through the InSMART EU FP7 project).

ITALY (CONT.)

Salvatore Fabozzi

Parthenope University of Naples, Engineering Department

EXPERTISE

Smart energy systems planning

BASED IN

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PROFILE

Mr. Fabozzi has contributed to the sustainable energy action plans for Pompeii, Capri, Anacapri, Altavilla Silentina, Giungano, Quarto Pozzuoli and Procida, using CO20 and PVGis software. He has undertaken the energy analysis of a small geothermal district heating/cooling system in Southern Italy using TRNSYS software; and an economic and energy feasibility analysis of a renewable energy system in a small city in Southern Italy, with the aim of converting it to a zero-GHG city by 2030 (including consideration of the electrification of the transport sector). He has analysed the urban energy system in Southern Italy using EnergyPLAN software to evaluate streams combination and potential synergies between different sectors. To improve the analysis, photovoltaic technology was simulated in the TRNSYS environment. He has worked on optimisation criteria to evaluate and define a new energy policy in order to switch from an individual to a district heating and cooling system in the city of Pompeii; and contributed to the development of strategies and actions towards a smart renewable energy system for the Campania Region of Italy in line with the 2030 European targets.

Rocco De Miglio

E4SMA
Energy System Modeller and Analyst.

EXPERTISE

Integrated energy system analysis; policy analysis; systems modelling; optimisation techniques (mono-multi objectives); mathematical programming; scarce resource management (water)

BASED IN

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PROFILE

Rocco De Miglio has been involved in projects to support the Energy Union Governance Process (EC, DG-ENER); to provide assistance to member states in developing national GHG projections (EC DG CLIMA); to develop new methodologies to enable cities to plan their future energy use more smartly (www.insmartenergy.com); and to assist the Ministry of Energy and Coal Industries in the development of energy scenarios, policies and the National Energy Strategy to 2035 (Ukraine). He is an energy system modeller and trainer for the project "Technical Assistance to Support the Reform of the Energy Sector in the Arab Republic of Egypt (TARES).

FORMER YUGOSLAV REPUBLIC OF MACEDONIA

Aleksandar Dedinec

Macedonian Academy of Sciences and Arts – Research Center for Energy and Sustainable Development

EXPERTISE

Energy planning, climate change, local pollution, renewable energy, energy efficiency

BASED IN

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PROFILE

Aleksandar Dedinec has experience in the development of GHG inventories; MARKAL energy strategy modelling; the modelling of the SEE power network; the modelling of SEE energy; decision making on establishing/joining a power exchange; projects and document development related to sustainability, renewable energy, energy efficiency and climate change; the EU Renewable Energy Directive, Energy Efficiency Directive, Large Combustion Plants Directive and other directives; the development of scenarios related to RES and their impact on climate change; and policy and strategy design at national level. Further information is available on the website of the Research Center for Energy and Sustainable Development.

Dr Viktorija Mangaroska

Faculty of Architectural Engineering, University of Saints Cyril and Methodius

EXPERTISE

Energy efficiency of buildings; passive house standards; sustainable architecture; sustainable urban planning

BASED IN

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PROFILE

Dr. Mangaroska is the author of the scientific paper "Urban Sustainability Indicators and Green Strategies in Urban Planning". She was the coordinator of the university educational team, in cooperation with a civil engineering company, for the promotion of passive houses (with A+ energy efficiency rating). She contributed to the international workshop "The role of energy efficiency for preventing air pollution" as part of the SHAPE ENERGY project funded by Horizon 2020; and to the international conference "Towards the Free Movement of Professionals – Implementing the EU Acquis on the Mutual Recognition of Professional Qualifications" in the framework of an EU project. She received international grants for study visits to the Institute for Advanced Sustainability Studies (IASS) in Potsdam, Germany; and to participate in the UNESCO programme for Sustainable Architecture. She participated in the regional conference "Cross-border Cooperation in the Field of Water Management" and the international conferences "Climatters 2017"; and "Climate Change and Green Economy – Adaptation of the Educational System". She is author of the scientific papers "Green Buildings and Passive House Standard Buildings for Climate Conditions in Macedonia"; "Urban Adaptation Planning as a Factor for Sustainable Development in Cities"; and "Green Cities, Urban Heat Island and Urban Climate Adaptation". She holds certificates in green building solutions and sustainable architecture following her work on the architectural project "Smart Living Design Study – New Neighbourhoods". She was selected to participate at the 21st annual conference of ENCATC (the European network on cultural management and policy) "Rethinking Education on Arts & Cultural Management", held in Antwerp, Belgium, in November 2013.

MOLDOVA

Alexandr Iscenco

Moldovan Environmental Governance Academy (MEGA)

EXPERTISE

Environmental economics, economic valuation, environmental impact assessment

BASED IN

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PROFILE

Mr. Iscenco is an environmental economist, who provides support to the economic and social aspects of energy planning programmes. He has experience in undertaking socioeconomic surveys and cost benefit analyses for evaluating the specific attributes of programmes; determining consumer preferences in energy matters; and helping to determine the most effective and efficient options. He also has experience in assessing the cost-effectiveness and social implications of solar and wind energy in Denmark, as well as in carrying out stated preference valuation studies.

Sergiu Robu

Institute of Power Engineering, Academy of Sciences of Moldova

EXPERTISE

Energy planning

BASED IN

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PROFILE

Sergiu Robu is involved in long-term energy planning for the Republic of Moldova using advanced modelling tools (i.e. MARKAL, MESSAGE, FINPLAN, WASP and MAED) to model supply and demand for energy policy decision making. He contributed to the development of the Energy Efficiency Programme for the City of Calarasi, and of the Regional Programme on Energy Efficiency for Development Regions of Moldova. Further examples of his work can be found in the ocument "Modernization of local public services in the Republic of Moldova", and a project pipeline for investment in energy efficiency can be found here.

MOLDOVA (CONT.)

Sergiu Ungureanu

LECB Moldova, Novaservice Mol

EXPERTISE

Energy efficiency; renewable energy; GHG reductions; sustainable development

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PROFILE

An energy efficiency expert, Sergiu Ungureanu has worked as a professor/lecturer at the Energy Faculty of the Technical University of Moldova. He also has experience in private-sector energy efficiency measures, as an expert on the Moseff programme of the EBRD. He was manager of Moldova's Low-Emission Capacity Building (LECB) programme and developed four proposals for nationally appropriate mitigation actions (NAMAs); the monitoring, reporting and verification system; and an improved GHG inventory system. He has carried out over 30 audits for the private sector (including energy efficiency and renewable sources), around 40 audits for the public sector (e.g. schools and hospitals), and audits for agricultural sector efficiency. As part of a team, he was involved in the energy audits for the mayoralty of Chisinau in 2012, auditing 10 specific objects, including the water distribution system. In 2017, with a team from Novaservice, he performed an audit for the railway system and trains of Moldova as part of an EBRD project.

NEPAL

Anita Prajapati

Tribhuvan University, Institute of Engineering, Pulchowk Campus, Department of Mechanical Engineering, Lalitpur, Nepal

EXPERTISE

Energy System Modelling and Analysis; Renewable Energy

BASED IN

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PROFILE

Anita Prajapati has contributed as an energy modeller using MARKAL and MAED in the projects "Water Resources and Energy Vision 2050 for Nepal" and "Low-Carbon Economic Development Strategy for Nepal". She worked with the International Centre for Integrated Mountain Development in Nepal on the development of Nepal's GHG inventory and the inventory of short-lived climate pollutants (SLCPs) from energy and non-energy sources/activities and their impacts on human health, agriculture and climate using LEAP-IBC. She worked as an energy modeller for the technology needs assessment for climate change mitigation in Nepal using MCDA. Having been awarded the EnPe-Norad scholarship, she is currently working for a PhD at the Institute of Engineering of Tribhuvan University, Nepal, with a focus on transport planning for sustainable transport in Kathmandu valley.

NEPAL (CONT.)

Utsav Shree Rajbhandari

Tribhuvan University, Institute of Engineering, Department of Mechanical Engineering

EXPERTISE

Energy System Modelling and Analysis; Renewable Energy

BASED IN

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PROFILE

Mr. Rajbhandari has worked as a energy modelle using MARKAL and MAED for the projects "Water Resources and Energy Vision 2050 for Nepal" and "Low-Carbon Economic Development Strategy for Nepal". He has provided energy analysis services for district climate and energy planning in 35 of Nepal's 75 districts, using a self-developed Excel-based energy model toolkit. He worked with the International Centre for Integrated Mountain Development (ICIMOD), Nepal, on the development of Nepal's GHG inventory and the inventory of short-lived climate pollutants from energy and non-energy sources/activities and their impacts on human health, agriculture and climate, using LEAP-IBC. He contributed to the development of a green building rating system for residential buildings in Nepal with UN-Habitat. He is currently working for a PhD at the Institute of Engineering, Tribhuvan University, Nepal, focusing on urban energy systems and air pollution in Kathmandu Metropolitan City.

SERBIA

Dr. Ilija Batas Bjelić

University of Belgrade, School of Electrical Engineering

EXPERTISE

Sustainable energy systems planning

BASED IN

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PROFILE

Dr. Bjelić was involved in the sustainable national energy system planning for Serbia using EnergyPLAN soft-link with GenOpt tool. He has experience in the simultaneous modelling of supply, demand-side and technical measures for the achievement of policy goals. He worked on sustainable cities energy system planning for Šabac and Subotica using the HOMER tool and has experience in smart energy infrastructure planning, including PV panels, electric vehicle charging points and demand response. He has contributed to the energy planning of eco-tourism resorts using the HOMER tool with DigSilent for the explicit modelling of power flows; and to feasibility checks for small modular renewable district heating and cooling in the cities of Šabac (Serbia), Visoko (Bosnia and Herzegovina), Ozalj (Croatia), Ljutomer (Slovenia) and Karpoš (Former Yugoslav Republic of Macedonia), based on local self-government concepts and business plans. Examples of his work can be found on the website of the School of Electrical Engineering of the University of Belgrade and the website of the CoolHeating project.

SERBIA (CONT.)

Jovanović Popović Milica

University of Belgrade, Faculty of Architecture

EXPERTISE

Energy efficiency in buildings; buildings typologies.

BASED IN

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PROFILE

Building typologies are the basis for defining reference buildings and calculating potential energy savings and CO2 emissions reductions during retrofitting. Typologies are also used for the development of the long-term renovation strategies required from EU and Energy Community member states. Ms. Milica has worked on special methodologies for the definition of residential and public building typologies at state and local level. The methodology is being used in Serbia, Bosnia and Herzegovina and Montenegro.

Mirjana Filip Opačić

Innovation Center, Faculty of Mechanics, University of Belgrade

EXPERTISE

Energy efficiency; energy sustainability; environment; renewable energy

BASED IN

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PROFILE

In the field of energy planning, Ms. Opačić has worked in the technical and financial optioneering of environment and energy efficiency projects and has developed and managed project-specific quality procedures. She has developed action plans for the improvement and reduction of energy costs, and has analysed budget requirements and risks in the business sector, working in coordination with external advisors, stakeholders and partners. She also has experience in assessing quality management levels and in environment and energy management systems. She contributed as a consultant to the project "Women in Sustainable Energy in South East Europe" and to the 2016 project "Renewable Energy in the Grid", funded by the Japan International Cooperation Agency (JICA). She completed the training for instructors of building energy auditors provided by JICA, held in Belgrade in 2017.

X. CITY-LEVEL ENERGY MODELLING EXPERTISE IN THE REGION: INSTITUTIONS

UKRAINE

Oksana Kysil

Kyiv National University of Trade and Economics

EXPERTISE

Sustainable energy planning; financial issues

BASED IN

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PROFILE

As national expert for the Covenant of Mayors in Ukraine, Oksana Kysil has practical experience in sustainable energy planning, sustainable energy investments/finance and project pipelines in more than 176 municipalities. She has a vast knowledge of Ukraine's energy legislation and sustainable energy policies at state, regional and local levels. Her experience covers the monitoring and evaluation of project results; training activities and capacity-building events for municipalities; the provision of assistance and financial expertise in energy efficiency and RES projects; and feasibility studies, business planning and financial mechanisms following donor/IFI requirements.

ALBANIA

Creative Business Solutions

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ABOUT

Creative Business Solutions (CBS) is a business consultancy and project implementation firm. It implements development projects in Albania with a spillover effect in the Western Balkans. It has established expertise in agriculture, banking, technology, green energy and tourism. Since 2014, CBS has implemented 18 development projects with a combined total budget of USD 5 million. It employs 35 professionals at its head office in Tirana and four local branches in Fier, Peshkopi, Korce and Gjirokaster.

EXPERTISE HIGHLIGHTS

Creative Business Solutions has ISO 14001:2015 certification and has established an environmental management system (EMS) that enables the organisation to reduce its environmental impact and increase its operating efficiency. Auditing staff can assist SMEs and NGOs at any stage of EMS implementation, from project planning to system development, documentation drafting, the preparation of registers of legislation, implementation, pre-assessment audits, training and certification. The consultancy carries out energy audits for organisations, helping them to understand their current energy situation and assess their energy savings. It is currently developing an innovative green financing platform to allow SMEs with environmentally friendly practices to obtain financing from banks and grants.

ALBANIA (CONT.)

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ABOUT

Milieukontakt Albania over 18 years of experience working with civil society on environment, nature and sustainable development, as well as with authorities dealing with these issues in Albania. Milieukontakt Albania initiates partnerships to improve the quality of life by enhancing people's participation in the development of ecologically sustainable societies.

EXPERTISE HIGHLIGHTS

Milieukontakt plays a role in stimulating the bottom up and local approach to greening the economy and fighting climate change in terms of CO2 emissions and the need for adaptation measures. Milieukontakt can mobilize knowledge/expertise in support of NGOs and local communities. Regarding the energy sector, MiA supports any initiative on the use of alternative green energies, energy efficiency (reduce heat/losses ratio in buildings by achieving a thermal conformation, reducing energy bills), and, more importantly, protecting the environment by reducing CO2 emissions. It does so by working with local government to develop sustainable energy and climate action plans and working on the fields of environmental protection and management plans, education and sustainable development, climate change and energy, energy efficiency at school building, and national policies, regulations and programs. Examples can be found here and here.

BOSNIA AND HERZEGOVINA

Center for Education and Raising Awareness of Energy Efficiency

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ABOUT

The Center for Education and Raising Awareness of Energy Efficiency (Energis) is a non-profit organisation dedicated to promoting energy efficiency, clean energy and a healthy environment, and their positive impacts on the economy of Bosnia and Herzegovina. Energis is Bosnia and Herzegovina's premier advocate for the rapid adoption of energy efficiency and clean energy alternatives, and an active participant in public education and population outreach, as well as legislative and regulatory affairs. Its fields of expertise include sustainable development planning and management, the implementation of energy efficiency (energy management, the development of an energy services market and the improvement of efficiency in energy supply), the energy performance of buildings, promotion of renewable energy sources (drafting action plans, market-based support schemes, licensing and permitting), renewable energy and energy efficiency consultancy services (the development of models/trajectories and targets, technology assessment, community energy, energy service companies, emissions analyses, assessments of renewable energy potential), and capacity building and training in energy efficiency and renewable energy services.

EXPERTISE HIGHLIGHTS

Energis project highlights include Sustainable Development/Clean Energy Sector Assessment (USAID); the Energy Efficiency Obligation Scheme (USAID); Energy Efficiency in Function of Increasing Competitiveness and Employment (Federal Ministry of Development, Entrepreneurship and Crafts); Residential Energy Efficiency for Low-Income Households (Habitat for Humanity); and Techno-economic Analysis of Investment Potential in the Renewable Energy Sector of BiH, with recommendations for future investors.

BOSNIA AND HERZEGOVINA (CONT.)

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ABOUT

StrikConsulting is a private company providing full service consultancy, primarily for organisations operating in BiH and the South Eastern European region. StrikConsulting services are integrated into three main divisions: SC Energy, Management Consulting, and Operational Efficiency. Through SC Energy, a wide range of technical assistance is provided in the field of energy efficiency improvement and renewable energy sources projects, the primary goal of which is to contribute to the reduction of greenhouse gas emissions.

EXPERTISE HIGHLIGHTS

StrikConsulting's fields of expertise include sustainable development planning and management; policy framework assessment and improvement; energy efficiency improvement assessments; the development of energy efficiency projects; feasibility studies and technical and economic analyses; energy audits in the industrial and residential sectors; renewable energy sources integrated energy design; the management of energy investment projects; and electrical energy trading. Projects highlights include REPOWER-KOSOVO (USAID/AICOM); the Promotion of RES in Bosnia and Herzegovina (GIZ); the Development of Small Hydropower Plants (HE Invest); Feasibility Study for a Cogeneration Plant and Potential for Energy Savings in CCHBC Hadzici (VPP Energy); Green Tunnel – Energy-Efficient and Environment-Friendly Solutions for the "Vijenac" Tunnel – Corridor 5c (EBRD); Capacity Building for Renewable Energy and Energy Efficiency in South East Europe (GIZ); and Transnational Cooperation for the Improvement of Building Energy Performance and Efficiency (SERDA).

CROATIA

Society for Sustainable Development Design

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ABOUT

The Society for Sustainable Development Design (DOOR) is a civil society organisation staffed by experts devoted to the promotion of sustainable energy development. The organisation has successfully implemented more than 100 projects on topics such as climate change mitigation, encouraging public participation in sustainable energy policy making, improving education about renewable energy sources, and alleviating energy poverty. It has organised over 100 workshops, roundtables, trainings, conferences and other public events, published several manuals, organised a number of study trips, and established ongoing cooperation with numerous organisations.

EXPERTISE HIGHLIGHTS

The organisation's projects in the field of energy planning include "Measure and Share Data with Utilities for the Covenant of Mayors" (MESHARTILITY), financed by IEE, the municipalities of Nijemci, Petlovac and Pirovac, and the city of Našice; "South East Europe Sustainable Energy Policy" (SEESEP), financed by IPA Western Balkans and the Office for Cooperation with NGOs of the Government of Croatia; "Strengthening the Role of NGOs in Public Dialogue on Climate Protection in South East Europe" (STRONG SEE), financed by DBU; "Increasing Understanding of EU Climate and Energy Policy and Its Impacts on Everyday Life (CLICK), financed by IPA INFO, the Office for Cooperation with NGOs of the Government of Croatia, and the Environmental Protection and Energy Efficiency Fund; "Climate Change, People Change" (CCPC), financed by Erasmus+; Compete4SECAP, financed by the EU Horizon 2020 Research and Innovation Programme; "Promoting and Testing Soft Measures for Energy Saving in Croatia (ENCRO), IPA 2008; and the development of numerous strategic and legislative documents related to sustainable development, including sustainable energy action plans.

GERMANY

SD Strategies

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ABOUT

SD Strategies is a policy and communications consultancy. We focus on issues at the intersection of economic and social development, energy, and the environment. Headquartered in Berlin, Germany, SD Strategies often works as a collaborative work-desk partnering with leading individuals and institutions from all over the world. Our partners and clients are governments, international organizations, civil society actors and representatives of the private sector.

EXPERTISE HIGHLIGHTS

We have worked on the development of Sustainable Energy Roadmaps and Implementation Plans for multiple countries and regions; on energy policy and strategy development for several governments worldwide; on the LEDS Energy Toolkit development and trainings for multiple facets of energy planning; on transport and energy sector integration; on energy access and rural electrification strategies; and on improving economic and social development through sustainable energy and climate mitigation.

GEORGIA

Ministry of Economy and Sustainable Development of Georgia (MOESD) – Energy Policy Department

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Georgia

ABOUT

The Ministry of Economy and Sustainable Development of Georgia (MOESD) deals with the main sectors of Georgia, including the energy sector, where the Energy Policy department, among different duties, is responsible the elaboration and implementation of sustainable development policy, strategy, short, medium and long term programs/plans of the energy sector within its competence; the development and implementation of short, medium and long-term programs, in accordance with international standards, in order to develop renewable energy; encouragement of energy efficiency legislation in accordance with directives envisaged by the Association Agreement between Georgia and the EU; development and implementation of short, medium and long term programs, in accordance with international standards, in order to encourage implementation of energy efficiency measures.

EXPERTISE HIGHLIGHTS

As a Deputy head of Energy Policy Department at MOESD, Associate Professor of the Power Engineering and Telecommunication Faculty at the Georgian Technical University, and former head of the Renewable Energy and Energy Efficiency Division at the Ministry of Energy of Georgia, Mrs. Margalita Arabidze has been responsible for/involved in: EU directives harmonization process; fulfillment of the Paris Agreement obligations in the field of renewable energy and energy efficiency; fulfillment of renewable energy and energy efficiency obligations; transposition of Energy Community Directives; promoting the implementation of clean development mechanism projects; preparing recommendations on the effective operation of the Georgian energy sector; and studying the alternative energy sources of Georgia and preparing the pertaining recommendations.

GEORGIA (CONT.)

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Georgia

ABOUT

The Energy Efficiency Centre (EEC) was established in 1998 by the European Union within the framework of the EU TACIS project "Creation of an Energy Efficiency Centre and Development of a Natural Energy Study in Georgia." The main objectives of the EEC are to support renewable energy and energy efficiency use for sustainable development, and, as a result, improve national energy security and minimise negative environmental impacts; and to increase awareness among civil society and the country's decision makers on environmentally friendly and economically sound energy production and consumption and the potential for renewable energy and energy efficiency. The EEC is a member of the European Council for an Energy-Efficient Economy (ECEEE), the World Renewable Energy Network (WREN), the European Small Hydropower Association (ESHA), the International Network of Organizations for the Promotion of Energy Technologies (OPET), and the International Network on Small Hydropower. Since 2014, the EEC has been a supporter of the Covenant of Mayors (Covenant Supporter). The EEC is also a registered observer to the Green Climate Fund. Clients and associates include the EU, USAID, IFC, WB, EBRD, UNDP, UNECE, BP-Georgia, and many international consulting and engineering firms

EXPERTISE HIGHLIGHTS

The EEC has extensive experience in all aspects of renewable energy resources (RES) and energy efficiency (EE). Throughout its 18 years of operation, the EEC has implemented more than 80 projects. These include feasibility studies, technical and economic studies, comprehensive market research, pilot and demonstration projects, trainings in various RES & EE technologies, promotion and dissemination, and project financing. It also has a profound understanding of the wider policy and investment issues facing the energy sector.

The EEC is actively involved in climate policy in terms of the Covenant of Mayors Policy for Climate and Energy, and in supporting municipalities to reduce CO2 emissions through the establishment of RES and EE technologies. It works with municipalities in Georgia to build the capacities of their personnel and to develop EE action plans and guidelines for municipal energy planning and manuals on energy auditing, training, the implementation of pilot projects, awareness-raising campaigns and the organisation of annual sustainable energy weeks events. Further information is available on the EEC website: http://eecgeo.org/en/projects.htm

GEORGIA (CONT.)

World Experience for Georgia

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ABOUT

World Experience for Georgia (WEG) is an independent non-for-profit think tank that operates in the fields of energy and environment. It contributes to the successful development of Georgia through the promotion of effective and sustainable policy, as an independent, professional, value-driven policy research organisation that learns and shares the best national and international policy practices developed in a collegial, trustful and flexible working environment. It cooperates with other actors and also connects to universities for broader influence. It provides technical assistance via expert support in the development of analytical tools (models) to support informed decision making, training and capacity building in energy planning tools and techniques, analysis and research.

EXPERTISE HIGHLIGHTS

World Experience for Georgia has good experience in energy planning models. Between 1998 and 2000, WEG experts were involved in the development of an integrated planning model for capacity expansion planning for the Georgian power sector. Since 2009, WEG has been working on the development of the MARKAL model for Georgia, with WEG experts leading both the technical set-up of the model as well as building the capacities of key stakeholders in energy planning tools. The model has been used as an analytical tool for economic and GHG emission reduction assessments of various policies — including climate change mitigation measures — within the development of the country's strategic documents (e.g. the National Energy Efficiency Action Plan, Low Emissions Development Strategy and intended nationally determined contributions. Recently, WEG experts have developed a power sector capacity expansion planning model — WASP IV — for Georgia and onducted a series of capacity-building workshops for key stakeholders. Experts from WEG are experienced in all stages of energy planning processes, including, but not limited to, data collection and processing, model set-up and scenario development, the interpretation and analysis of results, presentation to policy makers and the development of policy briefs.

INDIA

ICLEI – Local Governments for Sustainability South Asia Secretariat (ICLEI South Asia)

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ABOUT

ICLEI is the world's leading association of more than 1500 metropolises, cities, urban regions and towns. ICLEI South Asia - the South Asian arm of ICLEI - Local Governments for Sustainability has a membership base of 70 cities and promote local action for global sustainability and support cities to become sustainable, resilient, resource-efficient, biodiverse, low-carbon, productive, eco-mobile; to build a smart infrastructure; and to develop an inclusive, green urban economy with sustainable procurement with the ultimate aim of achieving healthy and happy communities.

EXPERTISE HIGHLIGHTS

ICLEI SA has been actively involved in furthering the energy and climate agenda with cities and local authorities in the South Asian region. It provides services of research and consultancy; city-level strategy and actions plans for energy and climate change; assessment of existing energy mix and potential for integration of local renewables; feasibility studies, audits, support for tendering, MRV arrangements for RE and EE projects in cities; financing and implementation mechanisms for energy projects; policy analysis and development for building efficiency and green buildings; energy and GHG inventory analysis and planning for cities using ICLEI's HEAT + tool. Some key projects are: 1) at city level, Assessing Potential for District Energy Systems, Cities for Climate Protection (CCP) Campaign, CapaCITIES, SE4ALL Building Efficiency Accelerator; 2) at Sub-National level, GHG Emissions Inventory & Climate Action Plan, Melaka State, Investment Grade Energy Audit for Road Lighting, Melaka State, State Action Plan on Climate Change, Delhi; at 3) at national level, GHG Platform India, Solar Cities' programme; and 4) at supra-national level: Asia LEDS Partnership; Development of NAMA research study; Local Renewables-South South Cooperation.

ITALY

E4SMA S.r.l

Energy Engineering Economic Environment Systems Modelling and Analysis

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ABOUT

Offering experience to companies, institutions and government agencies who are responsible for decision making in the energy and environmental fields, E4SMA provides technical assistance, expertise in the preparation of ad hoc decision support tools (models) at different geographical scales, training and capacity building, and research and analysis.

EXPERTISE HIGHLIGHTS

E4SMA led the modelling activities in the EU FP7 project "Integrative Smart City Planning (InSMART)." It has also given its support and assistance to the development of energy systems models (based on the TIMES modelling framework) at several institutions and on various geographical scales. At city level, it has supported Cesena (Italy) and Nottingham (United Kingdom); at sub-national level Wallonia (Belgium) and Lombardy (Italy); at national level Italy, Spain, Scotland, Ireland and Kazakhstan, among others; and at supra-national level the EU, Central Asia and globally. It also supported the EU Energy Union Governance Process, including integrated national energy and climate plans. It participated in the project "Interdisciplinary Strategic Intelligence Warehouse and Think-Tank for Energy" (Insight_E EU FP7). Finally, E4SMA provides assistance, training and capacity building on TIMES energy systems models.

ITALY (CONT.)

OPTIT S.R.L.

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ABOUT

Founded in 2007, OPTIT is a private company and a spin-off of the Operations Research team at the University of Bologna, It develops innovative decision support systems based on forecasting, data analytics, simulation and optimisation tools. The 20-strong OPTIT team comprises skilled mathematical modelling specialists, data scientists, a consolidated software development team and many experienced business and management consultants. This combined expertise ensures the rapid development and effective delivery of innovative solutions and services to enable the effective management of complexity, achieving significant cost reductions, margin enhancements and business process improvement. Leveraging on its strong scientific and academic background, OPTIT has a solid track record in various industries such as energy and utilities, transportation and logistics, environment, and retail and financial services, using state-of-the-art operations research and advanced analytics to deliver practical business and economic benefits. Based on its success, OPTIT and its customers have been selected as finalists for some of the most important global operations research awards, such as the Euro Excellence in Practice Award (in 2012 and 2013), the Wagner Prize for Excellence in Operations Research Practice (2013), the Veolia Waste Logistics Innovation Challenge (2014), and the SMAU Digital Innovation Award (2015). More recently, OPTIT was one of the founders of the Euro Working Group on the Practice of Operations Research, along with various other initiatives at national level.

EXPERTISE HIGHLIGHTS

The company's expertise in the energy sector is driven by longstanding collaboration with leading Italian utility companies, with a particular focus on district heating and cooling assets development and operations management, where OPTIT has developed and continues to improve innovative solutions. These include: 1. The district heating network OptiDHN, which supports optimal development decisions by focusing on strategic investments and asset design, and integrating technical, thermal-hydraulic and economic drivers to define scenarios with maximum net present value (e.g. GIS-based web applications; providing the most profitable investment plan for network expansion starting from either an existing network or a "blank canvas" scenario; the detailed economic and technical configuration of the network; and reliable thermal-hydraulic models for feasibility validation); 2. The energy production management system OptiEPM, which supports optimal energy dispatching from complex, often hybrid, combined heat, cooling and power production plants with the aim of maximising operating margins while respecting all regulatory and technical constraints (e.g. web applications currently used in the daily management of more than a dozen plants; forecasts for all energy vectors — heat, electricity, cooling — starting from historical data and weather forecasts; and both short-term scheduling for daily operations and long-term optimisation for budgetary purposes for the best management of annual constraints); and 3. The automatisation of optimisation according to a scheduled process, making it possible to calculate the optimal production plan and present it in an appropriate format for direct implementation in field.

FORMER YUGOSLAV REPUBLIC OF MACEDONIA

Macedonian Centre for Energy Efficiency

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Former Yugoslav Republic of Macedonia

ABOUT

The mission of the Macedonian Centre for Energy Efficiency (MACEF) is to improve energy efficiency and environmental protection via capacity-building activities and by identifying and implementing energy efficiency measures in cooperation with government institutions, engineers, donors and ecologists at the national and regional levels. The MACEF brings together engineers, investors, ecologists, economists and executive policy decision makers at government level to improve energy efficiency and mitigate the impacts of climate change. The staff of the 20 active established members of the MACEF include experts in their field, among them eight people with PhDs, five with master's degrees, 10 certified energy auditors, two CDM specialists, and designers.

EXPERTISE HIGHLIGHTS

The MACEF has been involved in both national and local energy planning services. At national level, it participated in the preparation of the National Strategy for the Development of Energy Efficiency of the former Yugoslav Republic of Macedonia up to 2020, using MARKAL and the LEAP tool, as well as in the preparation of three national energy efficiency action plans using both bottom-up and top-down approaches accompanied by appropriate tools (e.g. the Monitoring and Verification Platform, or MVP). At local level, the MACEF has prepared two sustainable energy action plans, as well as numerous municipal energy efficiency programmes and action plans. It has competence in using tools such as LEAP and EnergyPlan for planning and the MVP for the monitoring and verification of savings. It also uses highly customised approaches tailored by local self-government needs in every step of the planning and implementation processes for energy policies.

City-level energy modelling expertise in the region: institutions

FORMER YUGOSLAV REPUBLIC OF MACEDONIA (CONT.)

Research Centre for Energy and Sustainable Development – Macedonian Academy of Sciences and Arts

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ABOUT

The Macedonian Academy of Sciences and Arts (MASA), the most prestigious scientific institution in the former Yugoslav Republic of Macedonia, plays a central role in national energy planning and related fields of vital national importance. In cooperation with other stakeholders in the energy sector, the MASA has prepared national energy strategies, the National Strategy for Renewable Energy Sources, the National Strategy for Sustainable Development (in relation to the energy sector) and programmes for the realisation of energy strategies. The development of these strategies was founded on well-established and long-lasting partnerships with the key national energy stakeholders, including policy makers, local authorities, energy companies and SMEs.

EXPERTISE HIGHLIGHTS

The Research Centre for Energy and Sustainable Development (RCESD) at the MASA has been active in the field of climate change for more than a decade. Its main activities include the preparation of the national inventory of GHG emissions and mitigation analyses for the purpose of national communications under the UNFCCC, and the first and second biennial update reports; analytical support to the intended nationally determined contributions, as well as energy sector modelling as part of the Green Growth and Climate Change Analytic and Advisory Support Programme. As national focal point for the Intergovernmental Panel on Climate Change, RCESD-MASA is also involved in international climate change–related research activities, contributing mitigation analyses from the perspective of developing economies in transition countries. The RCESD-MASA has vast energy-related knowledge and is the steward of the Macedonia MARKAL model for energy planning, having participated in a number of international and national energy projects, including FP6 and FP7 projects (e.g. RISE, LPMAS, More MICROGRIDS).

MOLDOVA

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ABOUT

ENERGPLAN SRL was established in 2015 and specialises in the long-term planning of energy system development and consulting services. ENERGPLAN offers its experience to enable informed decision making in the areas of energy and environment. It provides technical assistance, energy audits, training and capacity building.

EXPERTISE HIGHLIGHTS

ENERGPLAN has developed and implemented a number of projects in Moldova related to energy and environment impact assessments for energy system development. Company experts are certified in the implementation of energy management systems, steam systems optimisation, International Performance Measurement and Verification Protocol (IPMVP), and European Energy Manager (EUREM) training. Its services include capacity building and training; the elaboration of feasibility studies, cost benefit analyses, preliminary studies, final designs etc.; the preparation of tender documents and the provision of support throughout the procurement phase; technical assistance for projects and management bodies; long-term energy planning; financial services for environmental projects; environmental impact assessments; legal support on environmental issues; energy trainings; and project management. ENERGPLAN has provided assistance, training and capacity building on the MARKAL energy systems model through the project "MARKAL application in the Republic of Moldova for Energy Efficiency and RES Analysis". The project was presented at the Energy Technology Systems Analysis Program (ETSAP) workshop in Sweden in 2010. The presentation is available via the ETSAP website: https://iea-etsap.org/workshop/stockholm_sweden_2010/e2-etsap_markal_d_moldova_2010-final.pdf

PORTUGAL

Center for Environmental and Sustainability Research

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ABOUT

The Center for Environmental and Sustainability Research (CENSE), based at NOVA University in Lisbon, is devoted to the promotion of interdisciplinary research in environmental sciences and engineering. The Energy and Climate Research Group is frequently invited by the Government of Portugal and local institutions to develop policy support studies on climate mitigation, low-carbon futures and the competitiveness of renewables. The centre also coordinates Climate-KIC Portugal, the European Institute of Innovation and Technology (EIT) Regional Innovation Scheme.

EXPERTISE HIGHLIGHTS

The CENSE Energy and Climate group has extensive expertise in energy planning using different tools (IEA-TIMES and LEAP) and at different scales of action (local, regional and national). The research group has developed urban energy planning and modelling activities under various projects, including for Évora municipality (Portugal) under the EU FP7 project "Integrative Smart City Planning" (InSMART); and for Almada municipality (Portugal), under the ERA-NET project "SureCity – Sustainable and Resource Efficient Cities." Other city energy planning expertise includes: assessments the potential of decentralised/urban renewable energy sources (solar PV); city strategies for adaptation to climate change (as a partner in the ClimAdaPT.Local project); the development of decision-making support tools, communication and knowledge transfer (as a partner in the INTERREG MED project PrioritEE – Prioritise energy efficiency measures in public buildings, a decision support tool for regional and local public authorities); the identification of a cost-optimal mix of measures required to meet sustainable energy targets; the urban water–energy nexus: systems assessment and efficiency opportunities; and the design of future mobility scenarios.

SLOVAKIA

Habitat for Humanity International – Europe Middle East and Africa

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ABOUT

Habitat for Humanity International (HFHI) is a non-profit organization that seeks to eliminate poverty housing and homelessness from the world and make decent shelter a matter of conscience and action worldwide. Habitat for Humanity works in 70 countries worldwide in Africa, Central and Eastern Europe, Middle East, Asia and Latin America. Habitat's Housing and Sustainable Development in Europe and Central Asia themes of work are: water and sanitation, residential energy efficiency for multi-unit buildings, advocacy and housing rights, housing micro-finance, skills training and financial literacy, housing of vulnerable groups (Roma).

EXPERTISE HIGHLIGHTS

Habitat for Humanity and USAID run a common project called REELIH – Residential energy efficiency for low-income households. The project aims to improve living standards in multi-unit apartment buildings in the Eurasia region. It is focusing on developing a regional effort, resources and networks to address the impact of rising energy prices on collective housing. REELIH develops a sustainable model for financing and management of residential energy efficiency improvements in selected multi-unit apartment buildings in Armenia, Bosnia and Herzegovina and Macedonia. We bring together all the stakeholders such as municipalities, governments, banks and finance institutions and homeowners to improve the residential energy efficiency and refurbish multi-apartment buildings in the centuries and the region. The overall objectives of the project are: Improve the REE investment environment in the region through a regional platform for knowledge sharing, awareness raising and advocacy, addressing financing approaches, promoting entrepreneurial solutions, developing jobs, and making available appropriate technical information; develop and test replicable financing models; combining capital and subsidies for lower income households to decrease energy consumption and cost; national institutional capacity development; and improve management and maintenance of collective residential units by homeowner associations and/or other stakeholders in the public and private sectors.

UKRAINE (CONT.)

Ecological Systems Energy Service Company

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ABOUT

The energy service company Ecological Systems Ltd. (ESCO EcoSys) was one of the first energy service companies in Ukraine, established in 1991. EcoSys specialises in the design, implementation, financing preparation and dissemination of energy efficiency programmes and projects in Ukraine. Since 2009, the company has focused on energy planning and municipal energy efficiency projects, particularly for public and residential buildings, and district heating.

EXPERTISE HIGHLIGHTS

Expertise includes the development of sustainable energy plans and strategies for cities and regions; the development of municipal energy plans and programmes; and the creation of municipal energy agencies. EcoSys has developed sustainable energy action plans for five Ukrainian cities (Kiev, Pavlograd, Zaporizhia, Kherson and Kramatorsk). These plans are available (in Ukrainian) on the company website: http://seap.ecosys.com.ua. EcoSys has also developed municipal energy plans for six Ukrainian cities (Kyiv, Pavlograd, Kupiansk, Kherson, Kramatorsk and Zaporizhia), which are also available (in Ukrainian) on the EcoSys website: http://mep.ecosys.com.ua. Further information about the municipal energy plan for Zaporizhia is also available in English: http://mep.ecosys.com.ua/index_eng.htm.

UKRAINE (CONT.)

Energy Efficient Cities of Ukraine

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ABOUT

The association Energy-Efficient Cities of Ukraine (EECU) was founded in 2007 and currently comprises over 80 large and small cities from throughout Ukraine. The association builds relationships with key stakeholders at local and national level to help communities on the path towards energy security, environmental protection, improved quality of life and reduced climate change impacts. Since 2008, EECU has been the national support structure for the Covenant of Mayors initiative in Ukraine and provides a complete range of services to municipalities for the implementation of covenant commitments.

EXPERTISE HIGHLIGHTS

The association's activities help cities and communities in developing effective systems for municipal energy management in accordance with ISO: 50001; developing municipal sustainable energy policies and sustainable energy action plans; preparing informative and analytical documents and reports, case studies and guidelines for local authorities; promoting the Covenant of Mayors initiative and supporting covenant signatories; increasing public awareness on energy efficiency, energy security and global climate change; networking, promoting European energy standards and good practices and sharing experience in the municipal energy sector; and developing innovative financing mechanisms for municipal energy efficiency programmes.

UKRAINE (CONT.)

Institute of Finance and Law

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ABOUT

The Institute of Finance and Law, in cooperation with partners, has implemented a number of projects in the area of public procurement and public policy. It has drafted and lobbied for normative and legal acts targeting efficient energy use (input outsourcing) by the communal heating enterprises in Poltava oblast; the redistribution of income from the extraction of hydrocarbons between the state budget and the budgets of local self-government bodies; and the substitution of energy inputs from extractive hydrocarbons in the transport sector with biofuels.

EXPERTISE HIGHLIGHTS

The institute's ongoing research on biofuels (bioenergy) as a potential substitute for non-renewable energy sources, such as extractive minerals, especially within the transport sector, is available in Ukrainian on its website: www.institutefl.org/nadra.htm.

UKRAINE (CONT.)

NGO Ecoclub

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ABOUT

Our mission: create a future with green energy by empowering communities and influencing policy. We have more than 10 years of energy efficiency experience, including organizing educational events (seminars, lectures and trainings), street actions, lobbying and advocacy activities and studies. We publish analytical reports and research, and broadcast through media our views on energy policy and energy efficiency.

EXPERTISE HIGHLIGHTS

The main goal for Ecoclub is to implement our mission; therefore, we are open to all proposals that may result in higher energy efficiency and RES development. We work by strengthening the capacity of local authorities to support energy efficiency and RES; awareness raising of citizens and local officials (http://ecoclubrivne.org/sprava2/); we have developed specialized software for energy monitoring (http://www.energobalans.com/), the cheapest solution on the market which is implemented in 25 cities of 3 countries; we have jointly developed with city councils support programs for energy efficiency measures, training of specialists, development and quality assessment of SECAPs of Ukrainian cities, study tours, commenting national normative acts in order to reflect civil society positions; we develop SECAPs for communities; and look for the democratization of energy by supporting local CSOs active in the EE and RES fields, as well as support the Ukrainian climate network.

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EUROPE AND EURASIA
PLATFORM

www.leds-eep.org