

International Energy Agency

Implementation of Energy Strategies in Communities (Annex 63) Volume 1: Inventory of measures

**Energy in Buildings and Communities Programme
September 2017**



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Published by SIR – Salzburg Institute for Regional Planning and Housing, Schillerstraße 25, 5020 Salzburg, Austria

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ISBN (13-digit): none

Participating countries in EBC:

Australia, Austria, Belgium, Canada, P.R. China, Czech Republic, Denmark, Finland, France, Germany, Ireland, Italy, Japan, Republic of Korea, the Netherlands, New Zealand, Norway, Portugal, Singapore, Spain, Sweden, Switzerland, United Kingdom and the United States of America.

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Preface

THE INTERNATIONAL ENERGY AGENCY

The International Energy Agency (IEA) was established in 1974 within the framework of the Organisation for Economic Co-operation and Development (OECD) to implement an international energy programme. A basic aim of the IEA is to foster international co-operation among the 29 IEA participating countries and to increase energy security through energy research, development and demonstration in the fields of technologies for energy efficiency and renewable energy sources.

THE IEA ENERGY IN BUILDINGS AND COMMUNITIES PROGRAMME

The IEA co-ordinates international energy research and development (R&D) activities through a comprehensive portfolio of Technology Collaboration Programmes. The mission of the IEA Energy in Buildings and Communities (IEA EBC) Programme is to develop and facilitate the integration of technologies and processes for energy efficiency and conservation into healthy, low emission, and sustainable buildings and communities, through innovation and research. (Until March 2013, the IEA EBC Programme was known as the IEA Energy Conservation in Buildings and Community Systems Programme, ECBCS.)

The R&D strategies of the IEA EBC Programme are derived from research drivers, national programmes within IEA countries, and the IEA Future Buildings Forum Think Tank Workshops. These R&D strategies aim to exploit technological opportunities to save energy in the buildings sector, and to remove technical obstacles to market penetration of new energy efficient technologies. The R&D strategies apply to residential, commercial, office buildings and community systems, and will impact the building industry in five areas of focus for R&D activities:

- Integrated planning and building design
- Building energy systems
- Building envelope
- Community scale methods
- Real building energy use

THE EXECUTIVE COMMITTEE

Overall control of the IEA EBC Programme is maintained by an Executive Committee, which not only monitors existing projects, but also identifies new strategic areas in which collaborative efforts may be beneficial. As the Programme is based on a contract with the IEA, the projects are legally established as Annexes to the IEA EBC Implementing Agreement. At the present time, the following projects have been initiated by the IEA EBC Executive Committee, with completed projects identified by (*)

and joint projects with the IEA Solar Heating and Cooling Technology Collaboration Programme by (☀):

- Annex 1: Load Energy Determination of Buildings (*)
- Annex 2: Ekistics and Advanced Community Energy Systems (*)
- Annex 3: Energy Conservation in Residential Buildings (*)
- Annex 4: Glasgow Commercial Building Monitoring (*)
- Annex 5: Air Infiltration and Ventilation Centre
- Annex 6: Energy Systems and Design of Communities (*)
- Annex 7: Local Government Energy Planning (*)
- Annex 8: Inhabitants Behaviour with Regard to Ventilation (*)
- Annex 9: Minimum Ventilation Rates (*)
- Annex 10: Building HVAC System Simulation (*)
- Annex 11: Energy Auditing (*)
- Annex 12: Windows and Fenestration (*)
- Annex 13: Energy Management in Hospitals (*)
- Annex 14: Condensation and Energy (*)
- Annex 15: Energy Efficiency in Schools (*)
- Annex 16: BEMS 1- User Interfaces and System Integration (*)
- Annex 17: BEMS 2- Evaluation and Emulation Techniques (*)
- Annex 18: Demand Controlled Ventilation Systems (*)
- Annex 19: Low Slope Roof Systems (*)
- Annex 20: Air Flow Patterns within Buildings (*)
- Annex 21: Thermal Modelling (*)
- Annex 22: Energy Efficient Communities (*)
- Annex 23: Multi Zone Air Flow Modelling (COMIS) (*)
- Annex 24: Heat, Air and Moisture Transfer in Envelopes (*)
- Annex 25: Real time HVAC Simulation (*)
- Annex 26: Energy Efficient Ventilation of Large Enclosures (*)
- Annex 27: Evaluation and Demonstration of Domestic Ventilation Systems (*)
- Annex 28: Low Energy Cooling Systems (*)
- Annex 29: ☀ Daylight in Buildings (*)
- Annex 30: Bringing Simulation to Application (*)
- Annex 31: Energy-Related Environmental Impact of Buildings (*)
- Annex 32: Integral Building Envelope Performance Assessment (*)
- Annex 33: Advanced Local Energy Planning (*)
- Annex 34: Computer-Aided Evaluation of HVAC System Performance (*)
- Annex 35: Design of Energy Efficient Hybrid Ventilation (HYBVENT) (*)
- Annex 36: Retrofitting of Educational Buildings (*)
- Annex 37: Low Exergy Systems for Heating and Cooling of Buildings (LowEx) (*)
- Annex 38: ☀ Solar Sustainable Housing (*)
- Annex 39: High Performance Insulation Systems (*)

- Annex 40: Building Commissioning to Improve Energy Performance (*)
- Annex 41: Whole Building Heat, Air and Moisture Response (MOIST-ENG) (*)
- Annex 42: The Simulation of Building-Integrated Fuel Cell and Other Cogeneration Systems (FC+COGEN-SIM) (*)
- Annex 43: ☀ Testing and Validation of Building Energy Simulation Tools (*)
- Annex 44: Integrating Environmentally Responsive Elements in Buildings (*)
- Annex 45: Energy Efficient Electric Lighting for Buildings (*)
- Annex 46: Holistic Assessment Tool-kit on Energy Efficient Retrofit Measures for Government Buildings (EnERGo) (*)
- Annex 47: Cost-Effective Commissioning for Existing and Low Energy Buildings (*)
- Annex 48: Heat Pumping and Reversible Air Conditioning (*)
- Annex 49: Low Exergy Systems for High Performance Buildings and Communities (*)
- Annex 50: Prefabricated Systems for Low Energy Renovation of Residential Buildings (*)
- Annex 51: Energy Efficient Communities (*)
- Annex 52: ☀ Towards Net Zero Energy Solar Buildings (*)
- Annex 53: Total Energy Use in Buildings: Analysis and Evaluation Methods (*)
- Annex 54: Integration of Micro-Generation and Related Energy Technologies in Buildings (*)
- Annex 55: Reliability of Energy Efficient Building Retrofitting - Probability Assessment of Performance and Cost (RAP-RETRO) (*)
- Annex 56: Cost Effective Energy and CO₂ Emissions Optimization in Building Renovation (*)
- Annex 57: Evaluation of Embodied Energy and CO₂ Equivalent Emissions for Building Construction (*)
- Annex 58: Reliable Building Energy Performance Characterisation Based on Full Scale Dynamic Measurements (*)
- Annex 59: High Temperature Cooling and Low Temperature Heating in Buildings (*)
- Annex 60: New Generation Computational Tools for Building and Community Energy Systems (*)
- Annex 61: Business and Technical Concepts for Deep Energy Retrofit of Public Buildings (*)
- Annex 62: Ventilative Cooling
- Annex 63: Implementation of Energy Strategies in Communities
- Annex 64: LowEx Communities - Optimised Performance of Energy Supply Systems with Exergy Principles
- Annex 65: Long-Term Performance of Super-Insulating Materials in Building Components and Systems
- Annex 66: Definition and Simulation of Occupant Behavior in Buildings
- Annex 67: Energy Flexible Buildings

- Annex 68: Indoor Air Quality Design and Control in Low Energy Residential Buildings
- Annex 69: Strategy and Practice of Adaptive Thermal Comfort in Low Energy Buildings
- Annex 70: Energy Epidemiology: Analysis of Real Building Energy Use at Scale
- Annex 71: Building Energy Performance Assessment Based on In-situ Measurements
- Annex 72: Assessing Life Cycle Related Environmental Impacts Caused by Buildings
- Annex 73: Towards Net Zero Energy Public Communities
- Annex 74: Competition and Living Lab Platform
- Annex 75: Cost-effective Building Renovation at District Level Combining Energy Efficiency and Renewables
- Annex 76: ☀ Deep Renovation of Historic Buildings Towards Lowest Possible Energy Demand and CO₂ Emissions
- Annex 77: ☀ Integrated Solutions for Daylight and Electric Lighting

Working Group - Energy Efficiency in Educational Buildings (*)

Working Group - Indicators of Energy Efficiency in Cold Climate Buildings (*)

Working Group - Annex 36 Extension: The Energy Concept Adviser (*)

Working Group - HVAC Energy Calculation Methodologies for Non-residential Buildings

Project Overview

BACKGROUND

Energy Efficient Communities (IEA-EBC Annex 51) suggested that successful urban energy planning is only possible, if energy planning is integrated in the entire urban planning process. However, research in both Annex 51 and Annex 63 has found that in many countries consideration of energy issues is missing in urban planning processes. This is of great concern, since, with the growing challenge of climate change, municipalities and energy utilities are charged with implementing both measures that adapt to the present conditions and measures that mitigate against future impacts. Both parties, municipalities and energy utilities, must coordinate their actions and both need a comprehensive set of tools and strategies to manage their resources so as to minimise the generation of greenhouse gases.

The linkage between urban form, energy use and climate change has been recognised for many years yet there still remain significant barriers separating the goals of urban planning and those of efficient energy delivery. In current practices energy related issues are still isolated from virtually all other municipal services; building codes for example often limit their scope to building safety and ignore the impact of energy consumption. By integrating strategies about optimizing supply, delivery and consumption of energy with (municipal or utility) planning protocols both municipalities and utilities can deliver to their constituents a powerful set of strategies with which to address climate change.

A natural connection should exist between urban development and energy development. Historically, the separation of each field's priorities and practices has created an energy efficiency challenge that requires a new and improved set of planning tools and strategies.

CONTENT

IEA-EBC-Annex 63 aims to identify strategies that can unify urban and energy planning communities and allow both parties to engage in the process of change to reach long term targets. The research addresses key barriers that expand the scope of planning and lead to a more comprehensive understanding of the new, urban, low-carbon environment. The outcome of this project is that governments, urban decision makers, utilities and urban planning departments can develop a clearer understanding as to how they integrate energy issues into urban planning processes and what actions they must undertake and when, in order to be successful.

PARTICIPATING COUNTRIES

Following countries (represented by 19 organisations) have been participating in Annex 63: Austria, Canada, Denmark, France, Germany, Ireland, Japan, the Netherlands, Norway, Switzerland and the United States of America.

INVOLVED CITIES

Following cities were involved in Annex 63: Salzburg, Vienna (Austria), Burlington, Guelph, London (Ontario), Toronto (Canada), Egedal, Middelfart, Roskilde, Skive (Denmark), Lille, Strasbourg (France), Aachen, Ludwigsburg, Karlsruhe (Germany), Kitakyushu, Yokohama (Japan), Maastricht (the Netherlands), Oslo, Bergen (Norway), Basel (Switzerland), Minneapolis (USA). Also Graz (Austria), Ottawa, Pickering (Canada), Ballerup, Lyngby (Denmark), Bottrop (Germany), Amsterdam, Parkstad (the Netherlands) and Zürich (Switzerland) supported the project team with information and case studies.

METHODOLOGY

To better understand the composition of suitable energy strategies, the research program adopted the following approach:

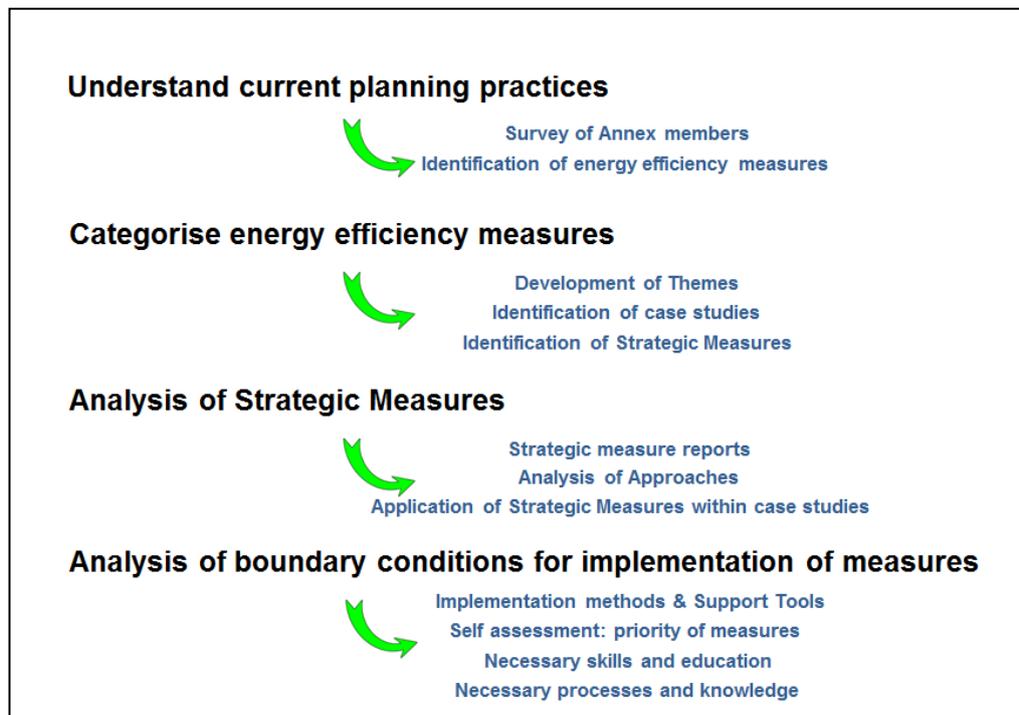


Figure A: Research Methodology (NRCan, 2017)

OUTPUTS

The results of Annex 63 (Implementation of Energy Strategies in Communities) are documented in six Volumes (sequenced according to the development progress). For orientation, the name and content of each Volume is described in the following overview:

Volume 0 – Documentation of workshops and involvement of cities: This report describes the information exchange and dissemination activities undertaken within this research. The information exchange activities were essential to get and understand all relevant information for answering the research question and to contribute to practical appropriability. In total 143 information exchange activities with 2,394 people were carried out.

Volume 1 – Inventory of measures: This report describes the existing national political framework conditions, energy and land-use planning processes, strategies for energy planning and existing national measures in the field of urban and energy planning. In this research, the term measure refers to any action, program, policy or other activity that can demonstrate or influence a change in process. Amongst other background information, 22 planning processes and 89 measures from 11 countries are described in detail in this report.

Volume 2 – Development of strategic measures: This report describes the further development of the analysed measures from Volume 1 into strategic measures. As with the term measure, a strategic measure refers to an essential measure in concept that can be used to develop individual implementation strategies on a local level for part or the whole life cycle of a project (from the first vision to monitoring of the implemented solution). The developed strategic measures deal with the following topics:

- Setting Vision and Targets
- Developing Renewable Energy Strategies
- Making Full use of Legal Frameworks
- Designing an Urban Competition Processes
- Making use of Tools Supporting the Decision Making Process
- Implementing Monitoring of Energy Consumption and GHG Emission practices
- Enhancing Stakeholder Engagement & Involvement
- Including Socio Economic Criteria
- Implementing Effective and Efficient Organisational Processes

The report includes both a summary of each strategic measure supported by nine appendices, each a detailed description of each strategic measure.

Volume 3 – Application of strategic measures: This report describes, for different scales (city, district and project level) and for 29 conceptualised case studies, how implementation champions can apply the strategic measures from Volume 2. Implementation champions are hereby understood as stakeholders in the city who take the initiative to lead and facilitate implementation processes.

Volume 4 – Stakeholder support materials: This report describes, in more detail, within the framework of Annex 63 elaborated stakeholder support materials and their application. The materials deal with the following topics:

- Municipality Self-Assessment tool
- Capacity building and skills
- Workshop format and procedures
- Informational slides for presentations
- Education materials

Volume 5 – Recommendations: This report contains central recommendations for different target groups (e.g. policy makers, researchers, planners), for implementation and for further investigation. Justifications and examples in the field of urban and energy planning are central elements of this report.

HOW TO READ

Depending of the interest of the reader whether the focus might be on the application of results or on the methodology of producing the results, figure B shows the sequence of how best to use the Volumes.

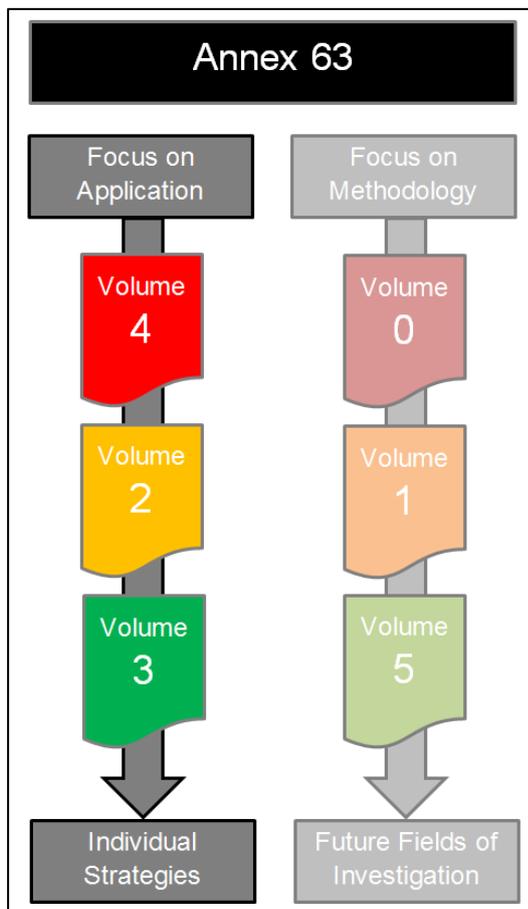


Figure B: How readers should apply the produced documents (SIR, 2017)

If the focus of the reader lies on the application of the elaborated results, the Volume 4 should be read first. The appendix of Volume 4 contains a municipality self-assessment tool that allows the reader to identify the strengths and weaknesses within the current municipal structure. Volume 4 also contains additional working materials (e.g. necessary capacities and skills, suitable workshop formats, informational slides for presentations and education materials) that support the implementation of strategic measures. Recommendations for the successful implementation of specific strategic measures can be found in appendix of Volume 2, leading to the application of different strategic measures as outlined in Volume 3. In this way, the reader gains from the three reports all relevant information for the development of individual implementation strategies.

If the reader is interested on methodological aspects of Annex 63, Volume 0 should be read first. Volume 0 contains the central information regarding the information exchange activities and input from the variety of annex stakeholders (cities, local stakeholder groups, project team, national and international networks, IEA Technology Collaboration Programmes). Principal output of this consultation process is also described in detail in Volume 1 (local framework conditions in 11 countries and 22

cities). Finally, all relevant recommendations for different target groups are summarised in Volume 5. Again, the reader gets in the three reports all the relevant information for further fields of investigation.

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1. Introduction

OECD research (Kamal-Chaoui and Robert, 2009) suggests that cities are major contributors to CO₂ emissions.

Between 60 to 80% of the world's energy production is consumed by urban cities and this consumption results in an equal share of the global CO₂ emission. In an attempt to mitigate the impact that these emissions are having on the average global temperature, drastic reduction measures must be prescribed across the board, sufficient to maintain the global average temperature rise below 2°C and preferably closer to 1.5°C. These reduction measures must encompass all aspects of urban development: housing, buildings and transportation.

Traditionally, research in building sector has focused on technological innovation to achieve these reductions and has undoubtedly created improvements, more often than not at the scale of the individual building. This approach has met with success in reducing GHG emissions but recognizes that to achieve the required global targets something is missing: greater attention must be paid to the interactions within the community form and the magnifying effect they have as a system on the overall energy needs. "Community" is hereby understood as a functioning part of a city and can be a municipality or a smaller sub-area, for example a district or a neighbourhood.

EXPANDING UPON ANNEX 51

In 2008 EBC - Annex 51 *Case Studies and Guidelines for Energy Efficient Communities* (Jank et al., 2013) was initiated on the assumption that 'technical' barriers existed that prevented communities from implementing successful greenhouse gas reduction measures. These barriers were associated with the development and implementation of long term municipal energy and climate change policies and prevented the wide-scale transition to a low carbon environment. The case studies of communities that had overcome such barriers evaluated as part of the research program however, clearly revealed that the assumption of technical problems at the municipal level was incorrect and that technical barriers were not the principal limiting factor. The analysis identified the management of the task as being the critical issue; in particular the ability to facilitate a sufficient degree of inter-sectoral communication to enable the transition process.

The identification and inclusion of resources, necessary to reduce local energy demands or to convert local energy systems to a more low-carbon future does not as yet appear as a line-item in many municipal development budgets. Municipal land-use planning practices, for various reasons do not commonly include the explicit discussion of generation, distribution or use of energy supply even though the citizens are its primary consumers. In a commercial market place it is common practice for business to understand, and even work with, its customer base to improve market share yet to date in many countries close cooperation between producers and consumers in the energy sector has been the exception rather than the rule.

INCREASED BENEFITS

The benefits of this closer coordination between the municipality and the energy utilities have been demonstrated at the project level through initiatives such as Energy Utility Basel or the development of Rice Creek Commons in St Paul, Minnesota, USA. In each initiative, the sharing of understanding and knowledge steps outside of the bounds of their traditional business models to produce a solution of greater benefit to society and the community at large. It requires *coordination* on the part of the initiative leader to manage the process as well as openness and trust to enable the participants to confidently make decisions that may not traditionally be those of a single organization but rather one that will function at its best when combined with the input of others. This coordinative task supports the overarching long-term goals and strategy of the local government through the municipality's energy plan.

2. Frameworks

It is well understood that reducing CO₂ at a community level is a more complex undertaking than at a single building level. As in any situation, the level of greenhouse gas generated is the product of two specific decision pathways: 1) the choice of energy that is supplied to the community and 2) the manner in which that energy is consumed. Unless the community includes significant industrial activity and process loads then it is likely that the buildings and transportation within the community are the principal energy consumers and hence emitters of CO₂. Buildings and transportation should therefore be central to any discussions of urban emission reduction measures. In land development their form and design are at the core of the central discussion; the urban development approval process.

The development of urban form within any community includes input from many stakeholders with a variety of corporate mandates and expectations that may or may not be aligned with the single direction of the municipality. The increasing challenge of climate change has resulted in the role of city planning evolving to encompass a range of issues beyond the central core activities of the municipal government. Not only the buildings but aspects of energy, transportation, waste, health, water etc. have all been shown to impact air quality and climate change. Considering them within the development of urban form necessitates growing the planning community. Within the expanded group of stakeholders, it remains the municipal planners and the energy utilities who are the key players and their involvement is critical to the functionality of the community – considering existing market conditions. To that end a positive relationship between the two provides strong support for achieving prescribed climate change objectives.

For many countries and communities the responsibility for land-use decisions and those for energy infrastructure decisions remain separated. As identified within the participant survey (discussed in detail in section 3) the relationship between the municipal planner and the energy utility varies widely. In Berlin for example close cooperation exists between the two planning activities while in Canada a strict arms-length relationship is preferred. In Norway, legislation exists that requires a joint approach to land-use and energy planning but even this does not guarantee cooperation.

While it is agreed in most jurisdictions that the municipality should be responsible for GHG reduction planning and implementation related to land-use, the challenge still remains therefore to align the multi-stakeholder decision making activities with the existing policies and practices required for governing and managing a community.

2.1. Objectives

While the business structures of energy utilities across Europe and North America may vary from municipally owned through state-owned or private, the choice regarding the form of energy provided to the community, its availability, quality, rates and other characteristics have traditionally been based upon the economics of production. Energy utilities are required by law to conform to specified limits of reliability and availability of supply and are consequently risk averse and conservative in nature. Likewise, the decisions regarding the urban form, structure, design, access, etc. are the responsibility of the local planning authority, often the City Hall or its planning department. Environmental constraints such as GHG emission limits or those of Critical Air Contaminants are imposed on both by senior government such as Provincial or State (in North America) or the European Union or national governments. The separation of responsibilities however, between the municipal planner and utility planner creates opportunities for differing approaches to the same problem depending on their viewpoints and objectives.

The increasing concerns over climate change has resulted in a growing number of municipalities and cities taking a greater interest in the business of energy delivery, even owning or operating their own energy systems so as to maximise the greenhouse gas reductions by integrating renewable or low carbon energy into their communities. This has created the need for municipalities' to define the priorities for their constituents and evaluate closely the risks involved with their particular decisions. In other countries where the corporate separation remains, an enhanced level of discussion has been created between the various players as regards future sustainability planning. In Norway for example, it is a requirement that energy utilities with energy distribution licences participate in the energy planning process. It is unfortunate that there are still many other countries where there is little or no recognition in the urban or energy planning processes of the benefits that can be accrued through the linking together of urban form and its energy supply.

In an attempt to reduce this inequity and enable communities to maximise their carbon reduction potential there is a need for a clear approach or an effective set of tools that draws together the many stakeholders and coordinates the procedural change needed to move the community towards a lower carbon future.

A CLEARER APPROACH

Such an approach might call for:

- Application of a methodology for the effective translation of a city's energy efficiency / CO₂ reduction goals to a community scale,
- Optimization / creation of policy instruments for the integration of energy / CO₂ reduction goals into standard urban planning processes,
- Development of new techniques for stakeholder cooperation along with holistic business models, and
- Implementation of methods for the monitoring and evaluation of both energy-related criteria, as well as the effectiveness of policy instruments.

With the diversity in planning protocols that are currently in use within EBC member countries, a comprehensive set of measures that addresses these objectives and that can be administered effectively is neither obvious nor clear for planners and stakeholders alike. In many cases the desire to be holistic leads to multi-stakeholder discussions where progress is limited by the complexity of codes, standards and other regulatory issues. A complex initiative such as a transition to a low carbon community impacts many stakeholders, protocols and regulations. A great deal of change is required if a change in process is to be made: drivers and rewards must be created so as to reinforce the benefits that exist and the need for an integrated approach.

The overall objective of this annex is therefore to provide guidance and suggestions for procedures that may assist stakeholders in addressing key stages in implementing urban energy strategies. The suggestions will encourage a coordinated approach to planning so as to contribute to the energy and climate protection targets while complying with existing principles of operation. It should be noted that the use of the term community implies that the tools are functional within all or a part of a municipality.

2.2. Planning boundaries

Planning for the growth of urban needs; buildings, transport, services, etc. and planning needed for the delivery and distribution of energy share similar traits and can both be considered at varying levels of detail: general and site specific, direct and proxy. The level of detail required will relate to the level of planning authority imposed. For example the planning undertaken at a national issues might be generic, lacking in specifics and involve lengthy timeframes.

Within a local or specific planning framework however, the questions or techniques proposed generally relate to activities directed at achieving design-related goals (e.g. compliance with regulations, codes, structure, efficiency or reliability). Planning would therefore function within a finite boundary of conditions and must be direct, focussed and related to a shorter time-frame.

As noted in section 2.1 the focus of Annex 63 is to provide guidelines and suggestions that support the development of energy efficient urban developments, allowing each to have a low carbon impact within their community. As such the Annex research relates to the distribution and use of energy at the community scale, whether that is a neighbourhood of several thousand inhabitants with a single development plan or a complete city where multiple development plans might be needed and which interact under a larger city-wide strategy. The Annex does not include the generation and distribution of energy at the national scale nor does it refer to the micro systems within individual buildings.

URBAN BOUNDARIES

Within this work-scope therefore, the potential relationships between the development of energy and the resulting emission targets are directly applicable to the level of the urban development. At the macro or state level, emission or reduction targets can be defined as needed to achieve national or global climate change objectives. However, in the complex mix of urban form, applying such targets can prove difficult: the results dependent upon the choice of the urban “boundaries”.

Energy infrastructure planning at the national level has traditionally been a top-down driven activity undertaken by energy suppliers or by the senior government. The intent is to ensure that every citizen has access to the appropriate supply of electricity, gas and district energy. The degree to which the latter commodities are included within the infrastructure planning process is known to vary between countries. Ensuring an adequate and reliable supply using tried and tested technologies generally outweighs consideration of innovative, possibly more benign approaches to generation and delivery. This bias towards established technologies is as would be expected when profitability of operation is driven primarily by the sale of the product. Infrastructure planning was therefore concerned with the long-term planning horizon in order to create or manage continent-scale power grids.

EMISSION TARGETS

The inclusion of emission targets within infrastructure plans at the regional level is uneven. In some countries, targets and policies are developed and applied to all forms of energy supply based upon their individual emissions as well as to the end users of those energies. In other countries however, governments provide less direction to the supply industry and target only the end-users. In this way there is an assumption that the consumers, through the marketplace will influence the supply of energy, technologies and primary fuel. This is undoubtedly a slower process to effect any change in emissions since the ability for an energy supplier to make technological changes requires a significant financial reinvestment that would impact the competitive nature of the marketplace. In this situation the involvement of suppliers in end-user conservation measures to date has therefore been mostly limited to programs for energy efficiency, home fuel switching, appliance refurbishment and other types of peak demand reduction. Given the high financial cost of technology conversion at the national or regional scale then it would seem that the introduction of distributed and localised energy generation and distribution would assist in the reduction of energy use and energy emissions. Assuming that the localised energy source is low carbon or renewable then third party involvement in its ownership and operation could benefit the community as well as supporting the overall emission reduction targets.

It is not uncommon in the participating countries to see a separation in responsibility between the electrical and thermal suppliers of energy. Predominantly, electricity is provided through nation-wide organisations while thermal energy (district energy) is provided by local or private sector operations. Often the former is subject to national or international market regulation, while the latter is depending on locally agreed contracts between public and private actors. The task of energy supply choice is aggravated with “clean” electricity being recommended more and more for space heating purposes. The calculation of CO₂-conversion factors on local/regional scale for (natural gas) heating is relatively straightforward, is very difficult to perform for the electricity grid. For this, the factors depend on market conditions, national policies in other regions and countries, summer/winter differences, etc. It exceeds the decision-boundaries of a single supplier making it different to evaluate heat supply concepts and make clear decisions.

The level of cooperation between the different industry sectors is therefore essential but often limited, resulting in separate approaches to energy delivery and a lesser reduction in overall emissions.

THE CHALLENGE OF AN INTEGRATED APPROACH

The challenge of applying an integrated approach where each supplier has his or her own shareholder commitments lies in defining the coverage of the plan: what is in and what is out and what is the scope of the project. Expanding a planning area from a single technology to a single building through a neighbourhood to a city or a region begins to incorporate issues that are mutual in nature and may not fall under the control of either the planning authority or the participating stakeholders. As an example of this a regional approach to long term planning for electricity infrastructure is being developed in Ontario, Canada with the process being led by the provincial electricity authority. At the provincial scale, planning the distribution network lends itself to a regional approach in which the costs and resources are distributed amongst a large number of communities. In the Ontario example, the province is divided into 23 regions, each a manageable area that encompasses a wide variety of communities and all the land in between. The planning process extends beyond utility generation and distribution technology and includes input from the municipalities as to their future electrical needs. This is intended to create a sense of ownership in the complete system rather than simply the electricity that is delivered and to better understand the supporting infrastructure and inter-connections between communities and the distributing network. The discussion forum leading up to the plan also serves to permit alternative approaches to energy delivery to be considered, along with their costs, social and environmental impacts. A similar process exists in France where regional discussions are held to better understand the impact of renewable energy systems on the middle voltage level distribution network. It should be noted that in Ontario, while this process focuses on electricity generation and distribution the equivalent natural gas and district energy distribution planning is largely ignored. Provincial discussions hope to change this.

Conventional land-use planning is governed by the municipal boundary, a politically derived area of known population. The use of water-sheds or air-sheds to monitor environmental attributes allows the plan to extend beyond a single community and include consideration of the activities within adjacent lands. Likewise, transportation system planning for interstate highways requires a detailed understanding of proposed growth patterns for the encompassed communities.

REDUCED EMISSIONS FROM INTEGRATION

Integrating the energy, economic and transportation needs within a municipal boundary, research suggest that the changes in urban configuration required could reduce (or influence) energy related emissions within a city by between 5 % and 12 % (Jaccard & Associates, 2010). Additional social and economic benefits would also be obtained in the form of employment and increased Gross Domestic Product. Depending on the particular situation obtaining this level of GHG reduction solely through technology or fuel switching may prove difficult and it becomes important that urban land-use planning also be included in any regional discussion. However, the integrated approach requires input from the energy planners at a level of detail greater than required for the regional plan. This level of detail is not always available. Planning for urban development or redevelopment requires an understanding of the proposed / predicted growth of multiple communities and their interactions as well as the zoning

and urban / economic development criteria. Regional planning, for the sake of simplicity, generally remains at a higher, more conceptual level.

Integrated planning at the city or municipality level would normally be undertaken using its political boundaries to define the scope of the exercise. These boundaries define the degree of assigned jurisdiction for the land-use planning but not necessarily for the energy planning. For urban use, the community's "official" plan or equivalent document acts as the guide for a range of more detailed plans pertaining to specific activities in the municipal region – GHG plans, transportation plans, emergency plans, etc. Each of these secondary level plans then have their own boundaries and conditions with the consequential need to translate the city-wide targets into a more tangible reduction measures so as to implement the task and monitor the results, demonstrating the success or otherwise of the measure.

LOCAL AND REGIONAL PLANS

For consistency the energy requirements integrated within the "Official" plan would be fed back to the regional plan. In many instances a local authority of some description has been created for a community to act as a middle-man between the regional or state supplier and the final end-user. However, as with the development of planning regions described earlier, the territorial boundary for the local distributor does not always align itself with the municipal boundary. Neither too does the authority given to the local distribution company always extend to system reconfiguration or operational changes that might be suggested by an integrated planning process. The challenge will be to relate the operational criteria of current predictable, unidirectional and regional distribution system to the futuristic more irregular and multi-directional series of neighbourhood energy nodes resulting from a localised energy network. Figure 2.2-1 attempts to describe the format of the two potential system approaches; uni- and multi-directional.

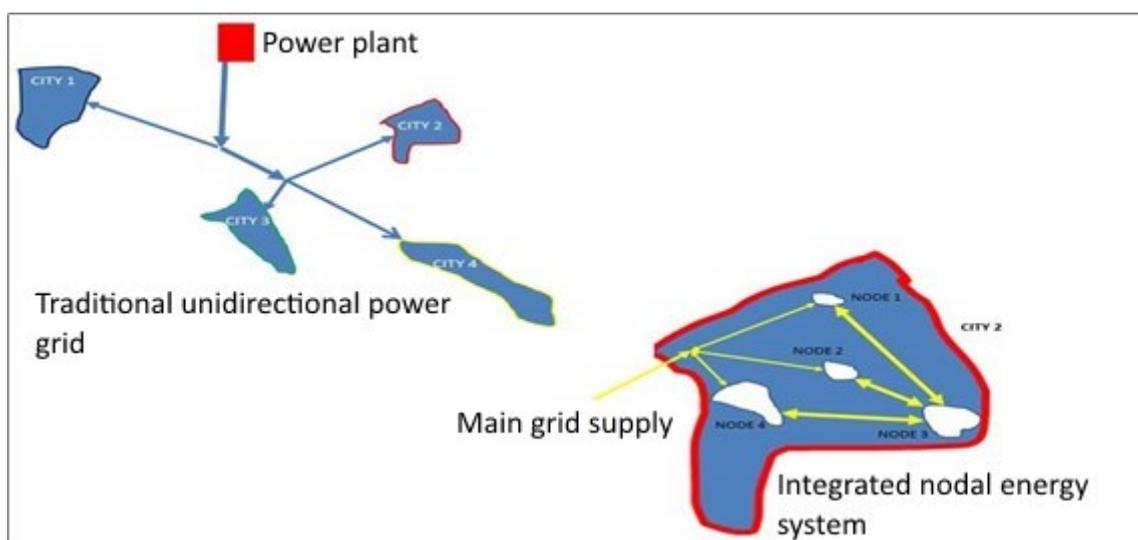


Figure 2.2-1: Traditional and Integrated energy systems (NRCan, 2016)

If it is envisioned that the benefits from an integrated approach to planning can outweigh the additional effort required by both land-use and energy infrastructure planners then additional methodology will be required to identify and translate key or critical targets (e.g. emissions limits, costs, capacities) of the regional energy network

for use in the more detailed world of land-use planning (e.g. spatial needs, demands). The methods available for that conversion are issues that are to be discussed later in this research annex.

To clarify the shared approach to energy efficient planning the planner might transcribe the political planning boundary (or series of targets) from a functional or political basis (as assigned broadly to a municipality) to one based on property or neighbourhood characteristics. For example, time itself might be considered as a boundary for energy efficiency planning: energy efficiency programs might address issues pertaining to stationary equipment or buildings within certain age ranges. Periodic revisions to local or state level building code might also denote periods within which building typologies exhibited specific characteristics. These periods would offer the opportunity for programs to address GHG reduction.

Mention was made earlier to the use of water-sheds and air-sheds as geographic boundaries for air- and water-borne emissions. Mountainous regions such as British Columbia in western Canada pay specific attention to emitting activities (e.g. lumber mills) and their impact on air-sheds. Their operations are monitored vicariously through the air quality readings for the community. Variations in air quality as compared to breathing related issues might lead to recommendation regarding their internal energy needs and possible process modifications.

The availability of local resources could also characterise neighbourhood planning. Growth strategies could be based on the use of specific local resources such waste biomass from lumber mills, reject heat from local factories or access to local aquifers. Neighbourhood layout and building typology might support the use of such energy with the planning boundary being limited by the economic distribution of energy or the transportation of the fuel.

3. Country Analysis – Methodology

The initial intent of the project was to evaluate the energy infrastructure planning issues and the land-use planning issues separately but in parallel with each other. However, it became apparent that even in instances where the two were entirely independent at the community level that some interaction was present in terms of the overarching legislation, the approval authorities and the need for stakeholder engagement. Therefore, to avoid complex and repetitive questionnaires of the planning community, it was decided that amalgamate the two issues.

As noted earlier in Figure 1 and to ensure a common understanding of the current situation and practices between the member countries participating within the annex, a questionnaire was developed and provided to each country member for completion by the appropriate planning authority. The document included questions relating to both land-use activities and to those engaged in future energy delivery and supply. These could be completed and returned or could be used to guide discussions.

Also included within the questionnaire was the requirement for each country to identify key measures that utilised within their country to encourage the development of sustainable urban developments. It was considered that these measures would highlight issues that were already seen as being of concern. Understanding their use and their degree of success might enable others to adopt or convert their practices for use elsewhere. The measures and the issues that they address would also be central to identifying the key research areas as outlined in section 4.

To maximise the relevancy of the work, participating members were asked to engage communities and experts within their countries as “sounding boards” for ideas and to provide guidance and information as to current needs and practices. More information about this process is summarised in the Annex 63 report: Documentation of workshops and involvement of cities.

The completed documents were then synthesised to describe the political frameworks as they pertain to land-use and energy planning, the key players and their responsibilities. They would also provide guidance as to the nature of any linkages between the two practices and the optimal form and extent of the deliverable from this research annex. The questionnaire is included in Appendix A.

4. Country Analysis – Results

Responses were received from all 11 annex participants. The questions and a summary of the responses are provided in Appendices A and B. Additional clarification and information was provided by workshops and meetings (see also Annex 63 report: Documentation of workshops and involvement of cities).

4.1. Planning processes

From the responses it became clear that other than for the Netherlands and Denmark, planning practices for urban development and for energy infrastructure were essentially separate undertakings with little exchange of information guiding the delivery of energy to the community or influencing the form of the built environment.

In the Netherlands the two planning departments are co-housed in the same building to encourage and facilitate communication. Also, in both countries there exist energy strategies that involve practices that have been developed at the federal government level. In Denmark, the implementation of the Heat Supply Act and the requirement that municipalities account for the energy use within their communities and this, in turn, necessitates a close relationship between the municipality and the energy suppliers.

In general, all participating countries can identify specific projects where interdisciplinary cooperation was high and where innovative approaches produced highly efficient designs and probably low emissions. However, these are specific projects and not representative of the day-to-day operations within the city. The cooperation exhibited during these individual projects demonstrated improvement but was rarely transferred back to the stages of the routine planning namely: target setting, analysis of situation, potential analysis, project planning, realisation and monitoring.

4.2. Responsibility for implementation

The distribution of responsibility for energy and emissions reduction followed a similar pattern in most countries with overall responsibility for state environmental targets and goals lying with the senior levels of government who, in turn, transfer downwards the responsibility for implementation to lower levels of government or directly to the municipalities themselves. It is these environmental targets and goals which must then be translated by the municipality in terms of tangible and measurable actions. It is often the case however that while the municipality is responsible for the creation of the localised targets they are rarely the party with decision-making authority over their implementation.

Planning for the development and delivery of energy (electricity, natural gas, district heating, etc.) to a community also follows similar paths in each country. History has often seen fit to treat the delivery of energy in an arms-length manner: an established authority with a mandate independent of the municipality defines the type and manner by which energy will be delivered, often based upon traditional economic reasoning.

Even in conditions of supply monopoly exists there can exist a high degree of confidentiality about their behaviour. Outwardly there is interest and concern over compliance with national and local environmental targets yet inwardly there is limited public engagement or flexibility in design choice. In Ontario, Canada for example only after repeated lobbying was municipal input sought for regional planning of electricity supply infrastructure. Planning for natural gas supply process is not included in the provincial document. The natural gas supplier is a private sector operation and needs not provide the information.

Elsewhere, energy infrastructure planning and approvals are undertaken in a variety of ways: in the United States, where most energy suppliers operate in the private sector, energy infrastructure plans are produced by the energy suppliers and reviewed only at the State level for compliance with State requirements. In Salzburg, Austria the city owned company Salzburg AG, owns the energy infrastructure within the city and therefore prepares a plan for review by the city's council. In Japan the energy suppliers are nationally based and their plans are reviewed at a national level rather than at a city level. In all cases there is room for an increased level of information sharing that would facilitate the development of more energy efficient communities.

4.3. Energy & emission reduction programs and options

The approach to emission reduction within the participating countries has typically focussed on end-users rather than supplier. In some countries, chiefly European, directives have been issued that stipulate a level of renewable energy within the energy mix. In many instances that has only been effective when municipalities have authority to negotiate with or instruct change in fuel or technologies (e.g. Germany). In most cases the municipalities have limited influence on the actions of the private sector suppliers who see market share and competition between suppliers as being equally important to their economic wellbeing. In Canada for example when peak demand for electricity threatened to exceed capacity incentives for peak demand reduction measures were presented. However, the separation between a public sector electricity generator and a private sector natural gas supplier prevented cooperative measures such as combined heat and power or the use of renewable energy. In the United States too the ability to reconfigure energy supplies to a community is limited by the scope of the franchise agreement between that municipality and the (often) state-wide supplier.

Municipally based incentive programs for energy and emission reduction is often driven by the authority provided to the municipality. The majority of measures relate to the residential market and the ability to attain deep energy or emission reductions in commercial or private sector / industry invariably depends on the ability to persuade the various stakeholders to share the relevant information. Implementing federal or state programs can be a time consuming process and the impact on private sector industries can be limited without the support of some form of legislation (e.g. heat mapping, compulsory reporting). For example, while it is felt by many that an awareness of heat sources within a community would lead to its increased use along with the incumbent benefits, industry partners see that knowledge as a way of determining a production plant's operating efficiency and consider it proprietary information.

4.4. Transportation

When developing a municipal emissions inventory and subsequent plan, transportation emissions often constitute the weakest link. Information on energy consumption for urban form is generally available even if difficult to access in contrast to information on the emissions from transportation which is at best, statistically estimated. Few participants include transportation as a planning component but rather include projects that encourage a shift in modal split from vehicular traffic to active transportation or public transit. The results are somewhat less predictable and rely more on behavioural change in the community. The general emphasis among responding countries is to encourage the development of electrically powered mass transit systems, linking nodes of higher density development.

4.5. Monitoring and feedback

At the municipal level of government there is significant transparency regarding the development and assigning of emission targets to the various sectors of the community. However there was minimal indication of follow-up to ascertain the impact on performance or to verify the initial target levels. The availability of funding and other resources were commonly identified as hurdles in many municipalities.

The development of emission inventories, while providing a practical way to monitor progress must often contain assumptions and best estimates where information is lacking. In some cases emission targets were re-evaluated to be based more on the community's capacity to create change than on the country's set targets. In these cases the proposed action invariably became less than optimal.

5. From Measures to Strategic Measures

A measure is considered as any action, program, policy or other activity that can demonstrate or influence a change in process. As noted in section 3 the questionnaire was used to collect information from Annex participants that identified a list of measures that are used within their own countries and within their candidate cities. In this way, a total of 89 separate measures were identified.

To further assess these measures it was necessary to understand the **intent** of each measure. Therefore, each measure was categorized by using the words enable, encourage or enforce.

This categorization was further specified, by describing the role of each measure within the overall planning process and in addition to that role, the necessary input and expected output. Input and output themes were used to describe the purpose of the measure. Each was therefore considered as to what role it played in the development process: Did the measure provide: Authority, Targets, Information, Instruments or Feedback.

- **Authority:** Does it ensure that the proposed discussion on energy and decision making becomes a legitimate part of the finished product? How do planners generate support from management, stakeholders and public alike for the concept and the resulting change in established process?
- **Targets:** Is the Measure providing methods to transcribe global or sectoral energy and emission targets into values that apply to community scale developments? How does it ensure that these targets are practical, measureable and enforceable?
- **Information:** What site-specific data or knowledge do it provide in order to better understand the relationship between energy and the urban form at the community scale? How will this information and understanding instill change in the decision making process and reinforce the project?
- **Instruments:** Is this an instrument that is available to translate this information into actions that initiate the change? Instruments – computational tools, procedural methods, financial instruments, technologies, policies, organisational structures, etc.
- **Feedback:** Does it identify progress of whether a proposed change in the established process is producing the required results?

Assessing each measure according to the role they played in practice resulted in nine common strategic measures evolving, each of which connect in different degrees to the five themes. Each of the nine strategic measures hosted a critical issue that required further discussion and research:

- **Set Vision and Targets:** Creating a workable community vision, translating national or regional reduction targets into localised goals and targets, techniques for generating stakeholder commitment for targets.
- **Develop Renewable Energy Strategies:** Development of overall renewable energy goals and targets, available technologies and their impact on urban development, stakeholder input, strategy development.
- **Make Full Use of Legal Frameworks:** Elaboration of guiding questions that can be used as basis for making full use of existing legal frameworks for implementation of energy strategies on site as example regulatory frameworks for energy planning, urban planning and contracts.
- **Design of Urban Competition Processes:** Competition types and success factors for the integration of sustainable criteria into competition processes.
- **Make Use of Tools Supporting the Decision Making Process:** Scope of decision support, community modelling tools, non-computer options and approaches.
- **Implement Monitoring of Energy Consumption and GHG Emissions:** Methods and tools to include energy efficiency and GHG monitoring into urban planning and urban development procedures; assessment of smart metering solutions in residential and commercial/industrial buildings, questions of protection of personal data versus transparency of energy consumption, strategic monitoring on municipal level/community level ex ante and ex post.
- **Stakeholder Engagement & Involvement:** Types and purpose of stakeholder engagement, techniques for identifying stakeholders, optimal timing and involvement of participants, input and expectation of discussions.
- **Include Socio Economic Criteria:** Decision making criteria, types of financial models, monetising socio-benefits, sources of information.
- **Implement Effective and Efficient Organisational Processes:** Success factors and framework conditions of the analysis of international “best practices”, organisation forms for a cross-sectoral process, linkage of the external stakeholders to the public administration, the importance of a monitoring process and an exchange of knowhow, bottom up and top down approaches.

The intention of each measure and their allocation to a related theme and strategic measure is represented in Appendix B.

Finally, the outputs from this report form the basis of the process analysis and are described in Volume 2: Development of strategic measures.

5.1 Content of Volume 2

The process analysis of the identified strategic measures was performed by internal working groups. Each working group addressed the analysis and further development of one strategic measure and consisted of the following project partners (see table 5-1):

Table 5-1: Composition of the individual working groups

Strategic Measure	Working Group
Set Vision and Targets	ENCO, Natural Resources Canada, EIfER, IREES, ZUYD University
Develop Renewable Energy Strategies	DTU, Fraunhofer ISE
Make Full Use of Legal Frameworks	SIR, B.&S.U., Intep GmbH
Design of Urban Competition Processes	Intep GmbH, SIR, EIfER, Osaka University
Make Use of Tools Supporting the Decision Making Process	RWTH Aachen University, University of Minnesota, ENCO
Implement Monitoring of Energy Consumption and GHG Emissions	B.&S.U., EIfER
Stakeholder Engagement & Involvement	Natural Resources Canada, Aalborg University, RWTH Aachen University, University of Minnesota
Include Socio Economic Criteria	ZUYD University, Natural Resources Canada, Cenergia a part of Kuben Management, Intep GmbH, Tokyo Gas
Implement Effective and Efficient Organisational Processes	DV e.V., SIR, DTU, EIfER, RWTH Aachen University

Each working group was tasked with identifying the nature of the strategic measure and how the international examples (and others) could assist communities to address each barrier and thereby increase the potential for including energy considerations within the concept of urban development. To create a baseline for the analysis, each measure was assessed according to its use within the urban planning process; namely its entry point, the motivation for its use and its distribution and benefit (Appendix B).

To ensure consistency between the various groups a development scenario was considered, that of an urban redevelopment involving residential, retail and commercial type construction such as found in many major cities.

6. Conclusion

Examination of the land use and energy infrastructure planning procedures in eleven countries appears to confirm that a separation exists between the energy and urban planning practices. It is common to many countries that that limited discussion or sharing of information exists between the two planning groups as regards potential energy savings

Only in the event of a special project is a special effort made by one or other party to change the status quo and pursue an alternative approach such as for energy generation, delivery or distribution. As often as not though, the lessons learned from such initiatives rarely become absorbed within the standard urban development process. Societal or political barriers are well entrenched in the procedures and the accountability protocols within either party effectively prevents ongoing collaboration or consideration of improved energy use on a larger than single project basis.

An approach must be created that allows the planner (typically the planner involved with assessing and approving urban development or the installation of energy infrastructure) to move towards a consensus position with all parties and stakeholders sharing an understanding of the benefits and risks of an alternative approach and are prepared to share in the project itself.

The questionnaire identified a series of research challenges addressing barriers to many planners, either knowingly or unknowingly.

- Setting environmental targets and goals for municipal development.
- Developing an implementable strategy around the wide-scale use of renewable energy.
- Creating and using enabling legislation to encourage the transition process.
- Creating the framework for competitive design that maximises environmental benefit.
- Developing and using planning and decision support tools based on available information.
- Establishing a workable monitoring program.
- Gaining stakeholder engagement, input and uptake of the process.
- Monetising the non-financial benefits of the transition process.
- How to structure the organisation to ensure fluidity of action.

These challenges appeared a varying stages of the planning process: the setting of targets, analysis of the situation, potential analysis, project planning, realisation and monitoring as outlined in Figure 6-1 below.

Figure 6-1 summarises the methodology and the outcomes from the carried out development process.

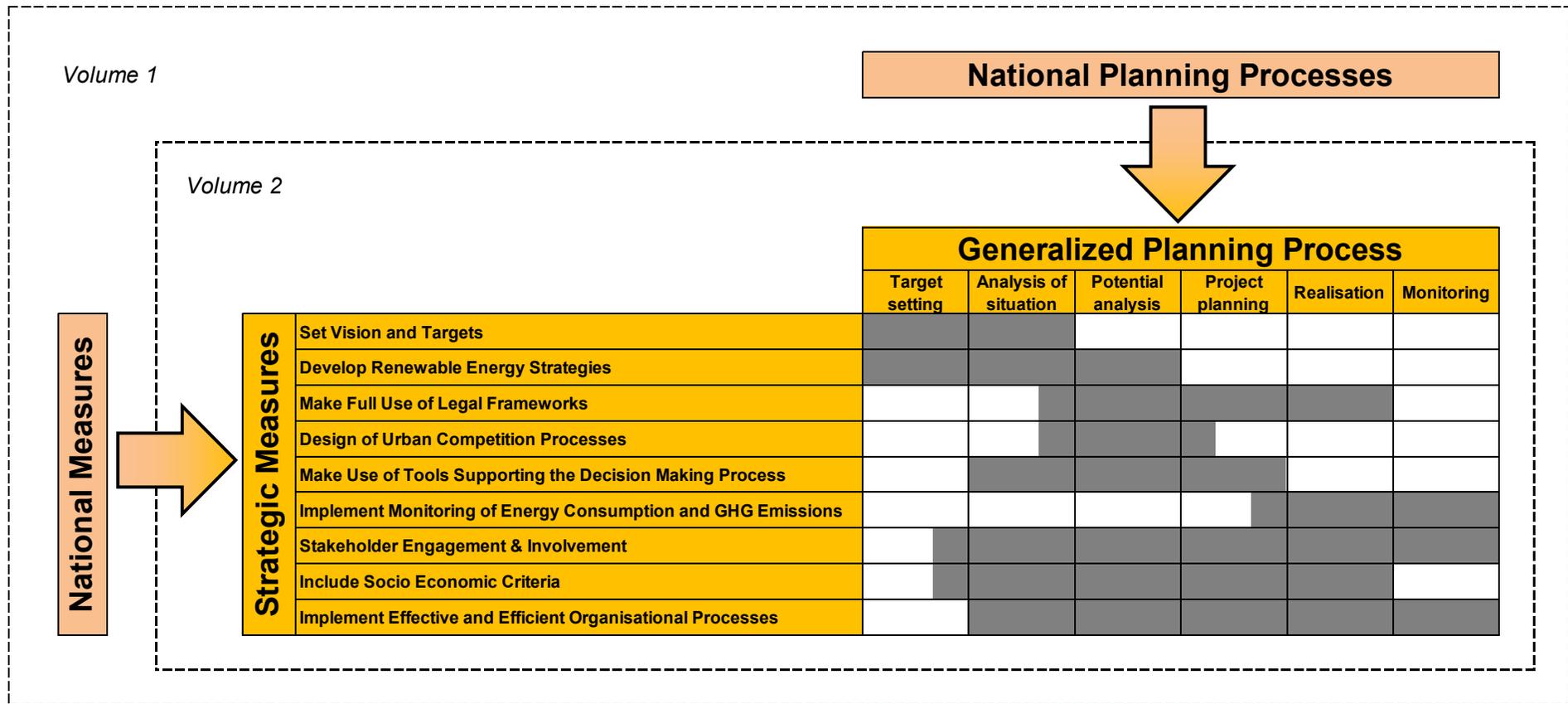


Figure 6-1: Methodology and results from the analysis carried out in volume 1 (SIR, 2017)

Volume 2: Development of strategic measures will address each strategic measure, providing ideas and concepts that move a community towards a more comprehensive position. Existing tools and measures identified in Appendix B create the basis for discussion and help to address each theme. They have been tried and tested under localised conditions within the various annex member countries and the experience gained supports their transition to other jurisdictions. This transfer constituted a stage within the research where the working groups discussed and debated each theme and measure and suggested their potential for wider scale application. The results are delivered in volume 2.

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Appendix A – Questionnaire

The aim of the research was to compare the **processes** of energy and land-use planning and to facilitate the identification of issues that help or prevent their integration. Volume 3 of Annex 63 then described these issues in detail through examples of how they may be addressed (Application of strategic measures).

Two levels of planning exist, depending upon the timeframe being considered:

1. Activities involved in the periodic review of a community's Official Plan or a utility's infrastructure needs.
2. Activities involved in the day-to-day planning and approval of a large scale urban development / construct.

While this comparison process should ideally be independent of site-specific issues of a particular municipality it will no doubt be easier for the interview to consider a specific location as a backdrop to any discussion. Some level of general information should be provided therefore to familiarise the reader with the site.

General Information

- Municipal name
- Population
- Type of municipality (e.g. urban centre, rural, industrial complex, etc)
- Energy supplies available within the municipality (e.g. electricity, natural gas, district energy, coal, peat, oil)
- Names and contact information of interviewees (for possible future discussion, if necessary)

Sustainability Drivers

- What targets exist at municipal level for land-use, energy efficiency or energy infrastructure planning (e.g. GHG reduction, carbon footprint, peak energy reduction, others (economic, employment)?
- In the case of energy or climate related targets, where do the targets originate from (e.g. are they national targets, locally derived, voluntary or legislated)?
- Who or what office in the municipality is responsible for developing specific plans or activities aimed at achieving the targets?
- What is their strategy to achieve the targets (e.g. modelling, energy efficiency programs, personal reduction targets, industry sector targets)?
- Is there a system in place to measure progress or monitor success?

Planning Process

Planning at the level of the Official Plan

For the purpose of this work, the term “Official Plan” refers to documentation, periodically prepared to define to senior government the future activities of the municipality. Creation of the documentation therefore describes a process by which the needs for future population growth are accommodated. Similar documentation may also be produced by energy providers (Utilities) to define their future infrastructure needs.

- For the Long Term Energy Infrastructure Plan
- Does a long term energy infrastructure (or equivalent) plan exist?
- How often is this document prepared and who approves it?
- What legislation governs the content of the document?
- Does the public have input to the development of the document?
- Is the document or process done in consultation with the municipality?
 - If so, what form does the consultation take?
- Does the document address future energy efficiency and/or the distribution and use of energy within the municipality?
- What tools (GIS, energy modelling, etc.) are used to assess the future impact on energy use and energy demands of technologies, urban design, demographic shift, economy, etc.?
- Are there regular exchanges of information between energy providers and City Hall as regards energy use and the form of infrastructure within the municipality?
- For the Municipal Official Plan
- Who is responsible for compiling the municipal official plan (e.g. planning department, planning consultant)?
- How often is this document prepared and who approves it?
- What legislation governs the content of the document?
- Do energy related stakeholders have an active role in the development of the document (Active role – inputting information to the planning process rather than reviewing a draft document)?
 - If so, which stakeholders?
 - If not, are there separate long term strategic plans developed by the municipality or the energy providers that address energy demand and supply.
- Does the document address future energy efficiency and/or the distribution and use of energy within the municipality?

- How is transportation considered within the document?
- Is there any legislation that specifies the availability of energy within the municipality?
- What tools (GIS, energy and transportation modelling, etc.) are used to assess the future impact on land use and energy demands of technologies, urban design, demographic shift, economy, etc.?
- Is there regular exchanges of information between City Hall (urban planners) and energy providers as regards energy use and infrastructure within the municipality?

Information relating to the design approval process as applied to Urban Redevelopment Projects

Note1: to avoid misinterpreting terminology a flowsheet could be created of the design approval process, indicating the roles and responsibilities of the various approving parties.

Note2: it is assumed that each municipality has a default energy provider for both gas and electricity (and possibly district energy) but that independent entities may be created to own or operate localised systems.

- How are the sustainability targets discussed earlier, addressed in terms of land-use practices, zoning, energy selection and other design criteria at the scale of a large redevelopment project (e.g. energy density, labelling, LEED, performance certificates)?
- What legal framework exists to direct or limit the urban and energy planning processes (e.g. building regulation, caps on building energy)?
- Who is responsible (typically, in your experience) for the design and installation of the energy distribution within a redevelopment project (e.g. developer, existing energy provider, municipality, architect.)?
- In the event that a stand-alone energy provider is created for the development:
 - What is the working relationship (casual, contractual, etc.) between the stand-alone energy provider and the default energy provider within the community?
 - How is the pricing structure for the energy assessed?
 - Is the pricing structure for the sale of energy regulated or managed by an external body? If so, who?
- In the event that no stand-alone provider is created:
 - is the default provider involved in the design of the energy system?
 - at what stage of the redevelopment design approval process would the default energy provider normally become involved (e.g. concept stage, design approval)?

- is the ownership of the energy system transferred to the default energy provider? If so, at what stage is this transfer undertaken and how is its value assessed?
 - How is the infrastructure cost for the development accounted for within the existing infrastructure budget?
 - How is the pricing structure for the sale of energy assessed in relation to the existing city-wide system?
- What level of coordination is formally required between municipal planners and energy providers during the design stage of a development as regards the supply and use of energy infrastructure (electricity, gas and district energy)?
 - In your experience, is this level of communication sufficient?
 - How could it be improved?
- What “tools” are used assess the potential impact on sustainability targets of proposed innovative approaches to energy supplies for urban developments (“tools” refer to computational and/or procedural measures that aid the development of a solution)?

Appendix B – Responses

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B-1. Austria

B-1.1 Political system

- Austria is a federal state with three political levels: the federal government, nine federal provinces and 2,100 municipalities (see also figure B-1.1).

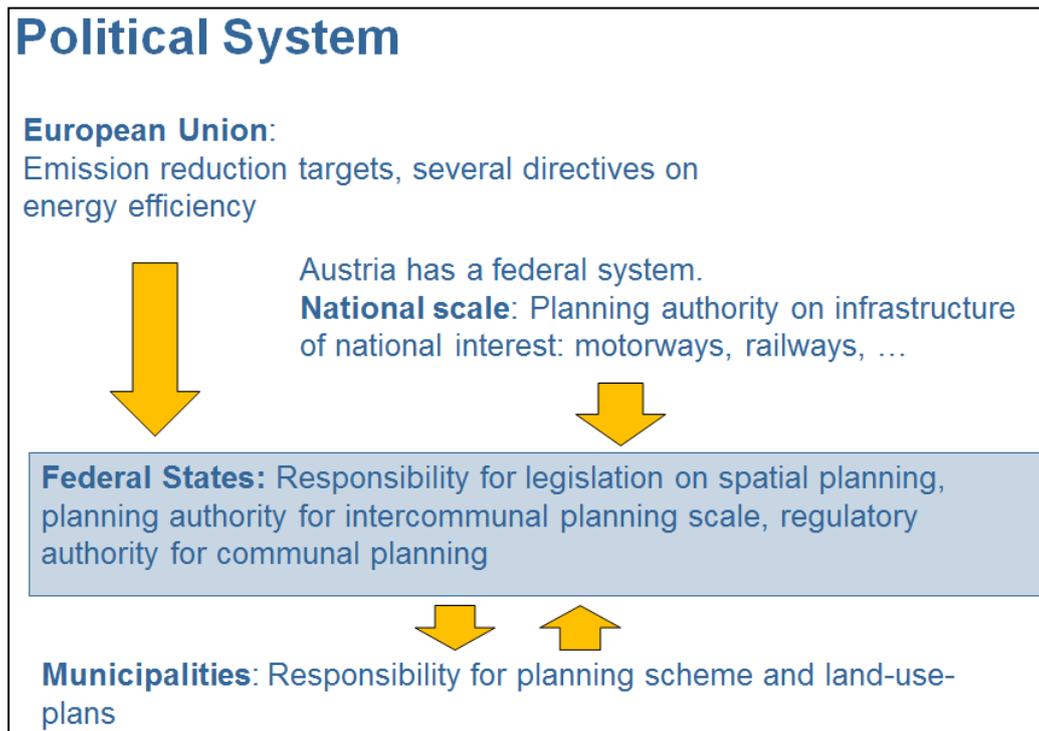


Figure B-1.1: Political Structure within Austria (Source: SIR, 2016)

- EU-Level: Since Austria is part of the European Union it has to implement EU-directives into national law, such as emission reduction targets and several directives on energy efficiency.
- National level: At the national level there is no spatial planning law, only a framework legislation and planning authority for infrastructure of national interest, such as motorways and railways.
- Federal level: Provinces have the responsibility of legislation on spatial planning. This means Austria has nine different spatial planning laws. The provinces are also planning authority on intercommunal planning scale and regulatory authority for communal planning.

B-1.2 Energy planning in Austria

- Austria has to meet some different energy goals which are implemented in laws and regulations at the following levels shown on the example of Salzburg. Other provinces have slightly different instruments and regulations.

B-1.2.1 Climate goals – International

- Kyoto-protocol

B-1.2.2 Climate goals - National

- Austrian Climate Change Bill “**Österreichische Klimaschutzstrategie**” (2002), the National implementation of Kyoto-protocol obliges provinces to implement Kyoto.
- Austrian Climate Protection Law “**Österreichisches Klimaschutzgesetz**” (2012)

B-1.2.3 Climate goals - Provincial

- “**Salzburg 2050 – Energieautonom und klimaneutral**” (Salzburg 2050 - energy independent and climate neutral) (2015) - this is a climate and energy strategy, enacted by the province of Salzburg without the participation of the city of Salzburg.
- **Salzburger Raumordnungsgesetz ROG (1998)** (Spatial Planning Law) – defines the instruments for spatial planning in the province and city of Salzburg.
- “**Masterplan Kooperatives Raumkonzept für die Kernregion Salzburg**” (Masterplan cooperative spatial concept for the core region of Salzburg) – a political commitment similar to the “Masterplan 2025” of the city of Salzburg
- “**Sachprogramm für Arbeiten und Wohnen im Salzburger Zentralraum**” (2009) (Sectoral programme for working and living in the core region of Salzburg) – legally binding

B-1.2.4 Climate goals – Municipal

- City of Salzburg joined the **Klimabündnis** (Climate Alliance Austria) in 1990 (council order 14.11.1990) - Goals: 50% CO2 reduction until 2030, support of indigenous peoples and rain forests and their biological diversity. = voluntary
- “**Räumliches Entwicklungskonzept**” REK (Regional Development Concept) of the City of Salzburg (17.12.2008) = mandatory, resolution from 17.12.2008
- “**Smart City Masterplan 2025**” political agreement, signed on 19.9.2012, but no law = voluntary
- Both, the Masterplan and REK were developed by stakeholder processes but not by breaking down national goals.
- Member of EEA-programme since 2015, first Audit 2016

B-1.3 Land-use planning in Austria

- Municipalities are the ones who apply the law by creating land-use plans and development plans. These plans are binding. The provinces are the regulatory bodies and have to verify the municipal plans.
- There is no obligatory energy planning process in Austrian municipalities. You can see the conventional planning process in the left column where energy supply is simply ordered at the local energy utility without any innovative demands or higher standards. The right column shows the enhanced process. The city of Salzburg has defined its own energy reduction goals in “Smart City Masterplan”. This legally not binding but it is the declaration of the political will.

B-1.4 Strategies for energy planning

- Joining Climate Alliances / Self-commitment - such as “Klimabündnis” (climate alliance Austria) by council acts and showing the political will to improve on this field.
- Using legally binding instruments to set climate goals - such as “Räumliches Entwicklungskonzept” (Regional Development Concept) or “Bebauungspläne” (Land-Use Plans) in order to force investors to meet specific standards.
- Specification of energy goals voluntarily - Some municipalities set their own energy goals such as “Smart City Masterplan Salzburg 2025” which is obligatory and shows the political will. Since it is signed by the city council it is a form of self-commitment and has to be implemented.
- Urban Design Competitions - This is a proper instrument to implement technical innovation into real building projects.

Figure B-1.2 shows a usual and enhanced planning process.

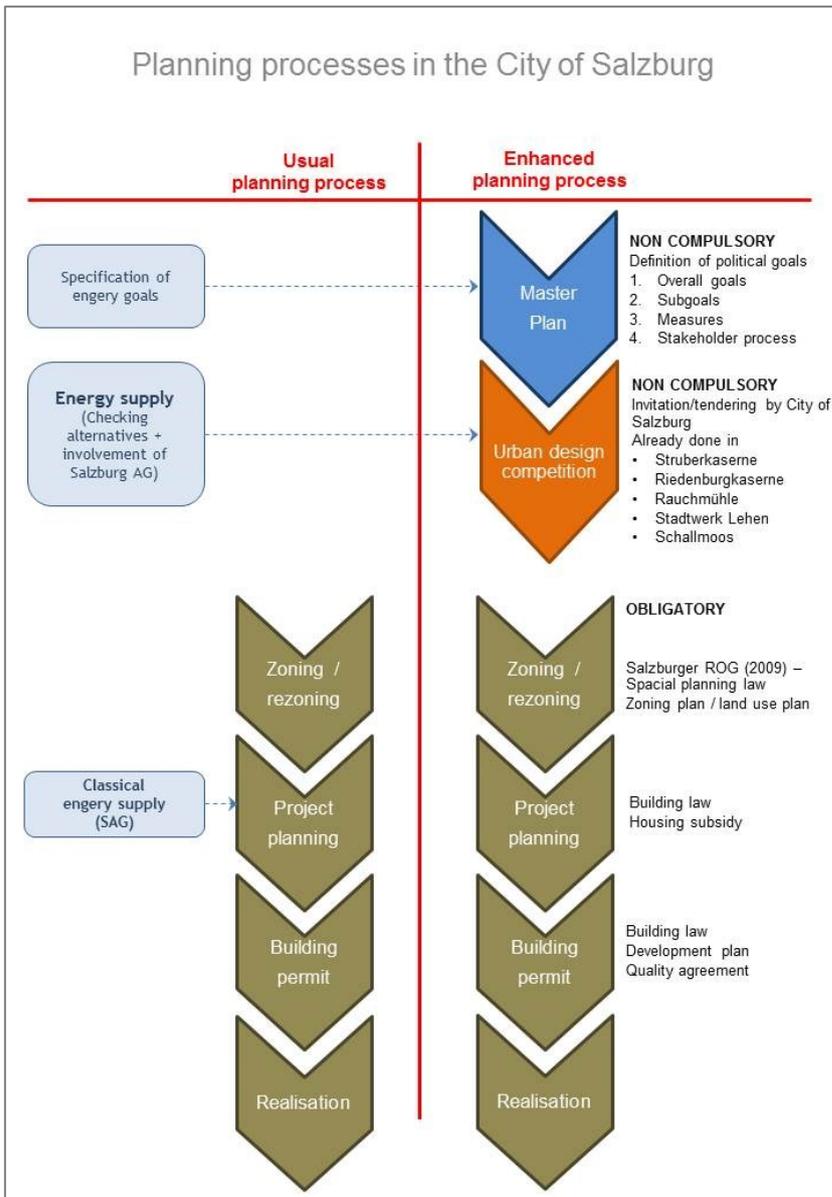


Figure B-1.2: Planning protocol for Salzburg (Source: SIR, 2016)

Table B-1.1: Austrian Measures Part 1

No	Measures	Intent of Measure	Related Themes	Related Strategic Measures
1	Joining Climate Alliances / Self-commitment	Encourage	Authority	Set Vision and Targets
2	Using legally binding instruments to set climate goals. Regional development concept	Enforce	Authority	Make Full Use of Legal Frameworks
3	Specification of voluntary energy goals. Smart City Masterplan	Encourage	Targets	Stakeholder Engagement & Involvement
4	Urban design competitions	Encourage	Tools	Design of Urban Competition Processes
5	Using legally binding instruments to set climate goals. Local development plan	Enforce	Authority	Make Full Use of Legal Frameworks
6	European Energy Award (eea)	Encourage	Targets, Feedback	Implement Monitoring of Energy Consumption and GHG Emissions
7	Stakeholder involvement in site planning	Encourage	Authority	Stakeholder Engagement & Involvement

Table B-1.2: Austrian Measures Part 2

No	Entry point Urban Planning	Entry point Energy Planning	Motivation to using	Distribution/Benefit
1	/	/	Contribution to meet the global emission goal	/
2	Revision of regional development concept	/	Contribution to meet National Climate Goals	Through legislation
3	Precondition for development of any building projects	Basis of energy planning process	Contribution to meet National Climate Goals; respect and publicity of the public	Urban planning process (voluntary)
4	As early as possible / as a first step when developing a building project	As early as possible / as a first step when developing a building project	Achieve innovative approaches; achieve best economic solution	Tendering procedure
5	Development of local development plan of the concerned area	Binding act / Making all planned measures legally binding.	To get higher acceptance plus commitment	By Local Development Plan By Legislation
6	Ongoing	Ongoing	Create awareness and promote use of RE and EE	Evaluation plus documentation of activities on a municipality level
7	As early as possible	/	To get higher acceptance plus commitment	Urban planning process (voluntary)

Contact person for further information: Helmut Strasser, SIR

B-2. Canada

B-2.1 Political system

- Canada is a federal democracy (Confederation) of 10 provinces and 3 territories, containing over 5,600 separate communities.
- The constitution of Canada provides authority to each province for specific activities and for their oversight of the municipalities within their jurisdiction. As such each province may set its own planning priorities.
- The provision of energy and land-use planning are the responsibility of the provincial governments unless conducted on crown land, by first nations, nuclear or transboundary in nature whereupon it remains under federal control but conducted in the spirit of the provincial legislation.
- Federal government retains control over end-use and component efficiencies while the provincial governments are responsible for all legislation pertaining to the design and construction of buildings, urban infrastructure, power generation and distribution systems.

Figure B-1-1 illustrates relative responsibility for energy regulation within Canada.

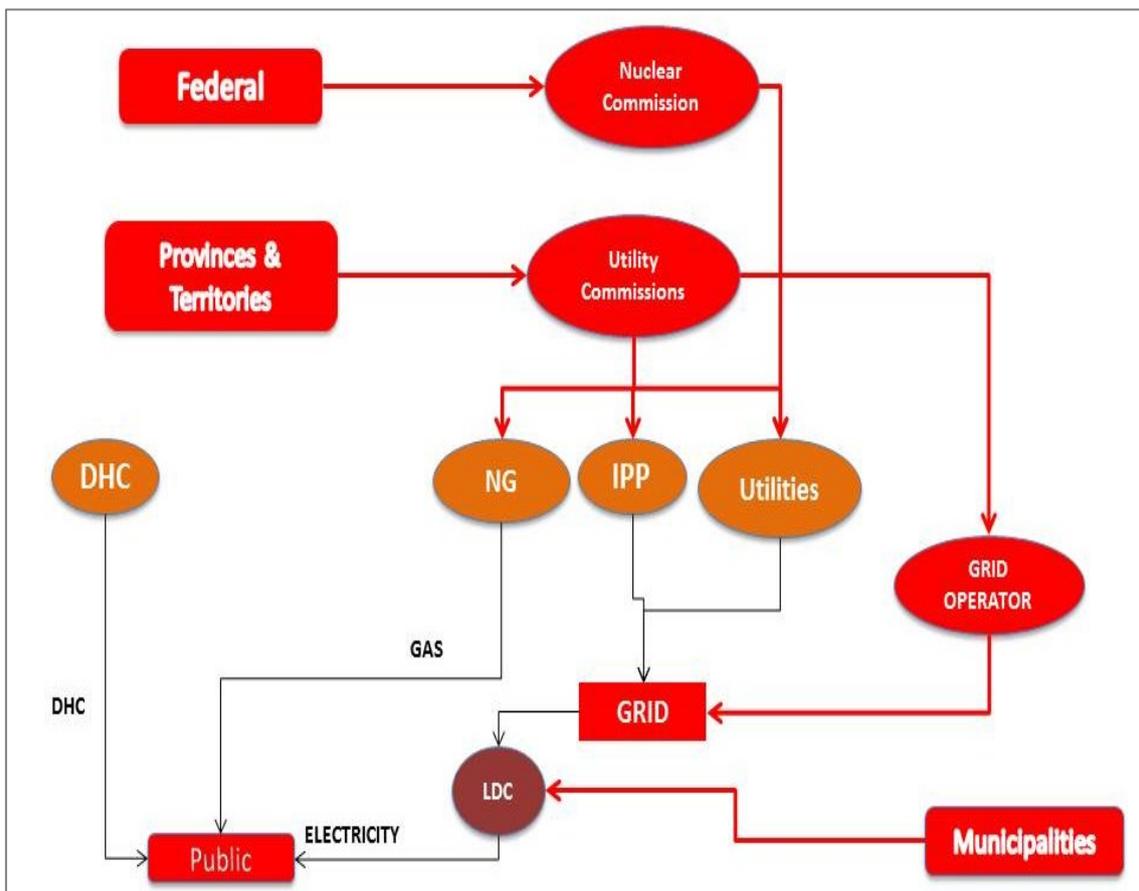


Figure B-1.1: Canada's energy framework (Source: Natural Resources Canada, 2016)

B-2.2 Energy Planning in Canada

Energy planning - Provincial (Ontario) level

- In Ontario, electricity distribution is through a crown owned electricity grid while natural gas is delivered by private sector companies.
- For electricity production and delivery, two levels of energy infrastructure planning is undertaken within the province, one that examines the overall supply of electricity to the grid and a second, a Regional Resource Planning process that includes input from municipal representatives as to their long term needs and plans.
- Regional Planning divides the province of Ontario into 21 sections, reviewed sequentially over a period of 5 years.
- Long term planning for natural gas is proprietary to the natural gas suppliers with public involvement only during project proposal review.
- The Provincial Government is examining options to include natural gas infrastructure planning in future Regional Planning.
- Energy efficiency measures, related to the use of electricity, are managed through the Independent Energy System Operator. Those related to the use of natural gas are managed through the natural gas distributors.

Energy planning - Municipal level

- Local Distribution Companies (LDCs) exist in some communities in Ontario to provide distribution support for the municipal electrical supply. In those communities without an LDC, this support is provided by the default electricity provider (Hydro One). Natural gas suppliers provide similar support through their privately owned and operated, regional offices.
- LDC's are municipally owned but reports to the provincial energy regulator and operates separately from the municipalities with limited design & planning capacity.
- LDCs and natural gas suppliers provide technical input to, and review of, the municipal Official Plan and are involved in planning approvals to ensure compliance with provincial standards.

B-2.3 Land-use planning in Canada

Land-use planning - Provincial (Ontario) level

- The provision and oversight of legislation that guides the land-use planning practices in Ontario (Provincial Policy Statement, Ontario Planning Act, etc).
- The resolution of any planning conflicts through the Ontario Municipal Board.
- The review and approval of Municipal Official Plans.

Land-use planning - Municipal level

- The development of the long term (5 year) Official Plans describing future growth or other development of the municipality. The plans include input by stakeholders and are subject to public review and approval of the Provincial Government.
- The assessment and approval of development proposals and plans to ensure compliance with provincial design standards, Building code and legislation as well as the community's own long term Official Plan.
- Requesting site specific studies of the Developer during design approval to assess environmental impacts of issues such as: shading, traffic, waste, noise, etc. Recent changes in the Provincial Policy and Planning Act has increased the importance of energy use as a design constraint within the urban design and positioned the responsibility for energy efficiency within urban planning.
- Responsible for conducting public review and obtaining input on any plan before prior to its approval by City Council.
- Existing legislation requires energy and service providers to review any proposal only after Planning Approval has been obtained. However, their involvement could be earlier in the process if requested by the Developer.
- There is limited, if any, discussion between land-use planners and energy infrastructure planners as part of their regular business practices. Some communities create unofficial committees to review overall planning activities to prevent duplication of maintenance activities (trenching, etc).

Figure B-1.2 describes a typical land-use planning approval process.



Figure B-1.2: Land-use planning approval framework (Source: Natural Resources Canada, 2016)

B-2.4 Strategies for energy planning

- The task of energy planning linking urban development and energy infrastructure is not yet an established position in Canada.
- Electricity reduction targets (MWpeak or MWh) are specified by the System Operator based on available capacity while natural gas reduction measures and programs are initiated by the natural gas suppliers based on economic conditions. Both are subject to environmental constraints dictated by the provincial government.
- Municipal reduction measures are derived either from top down or bottom up analysis to comply with provincially set targets.
- Energy mapping and community energy planning is increasing in popularity

Table B-2.1: Canada's Measures Part 1

No	Measures	Intent of Measure	Related Themes	Related Strategic Measure
8	Project champion	Encourage	Authority, Targets	Stakeholder Engagement & Involvement
9	Energy manager	Enable	Authority	Stakeholder Engagement & Involvement
10	Aligning targets with zoning requirements	Enable	Targets	Set Vision and Targets
11	Short or long term cooperation through projects/institutions	Encourage	Information	Stakeholder Engagement & Involvement
12	Socio-economic / GIS mapping	Enable	Tools	Include Socio Economic Criteria
13	Energy assessment process	Enable	Tools	Include Socio Economic Criteria
14	Service-area bylaws	Enforce	Tools	Make Full Use of Legal Frameworks
15	Annual GHG inventories	Enforce	Feedback	Implement Monitoring of Energy Consumption and GHG Emissions
16	Annual review of investment strategies	Enforce	Feedback	Include Socio Economic Criteria

Table B-2.2: Canada's Measures Part 2

No	Entry point Urban Planning	Entry point Energy Planning	Motivation to using	Distribution/Benefit
8	Project initiation.	Project scoping	Consistent point of view	Maximising awareness / opportunities for exposure
9	Project initiation	Project initiation	Single point of contact. Unbiased access to all stakeholders	Report directly to senior management
10	Official Plan	Energy supply selection	Consistent division of responsibility.	Include within zoning bylaws
11	Information sharing / trust building	Information sharing / trust building	Multiple perspectives and experience. Access to customer base	Publicly available database
12	Official Plan Information database	Energy efficiency program development	Cross-cutting thinking (social / technical) What-if scenario builder	Coordinate databases within the community
13	Initial scoping / design	Infrastructure planning & upgrade	Rapid scoping of technology options	Publicly available information on available methods
14	Economic analysis	Infrastructure planning & upgrade	Improved economics Reduced marketing	Clear definitions of bylaw requirements
15	Compliance with emission caps	Compliance with emission caps	Justification of decisions	Publicly available disaggregated results
16	Investment reporting	Investment reporting	Development of policy support	Publicly available disaggregated results

Contact person for further information: Ken Church, Natural Resources Canada

B-3. Denmark

B-3.1 Political system

- Denmark is a constitutional monarchy, based on the principles of a parliamentary, representative democracy. The state is divided into three administrative layers: the national level, five regions and 98 municipalities.
- The federal government is developing a roadmap for national spatial development and focus areas for municipal urban planning. To ensure the implementation of national policy objectives, the Ministry of Business and Growth controls aspects of greater concern, for example national infrastructure projects, the capital regions and coastal zone management. In addition, national planning is reinforced in relation with its capacity to intervene in municipal planning themes and projects of national or regional relevance through the right of veto. The five regions have with a few exceptions no legislative powers.
- Municipalities are the most important administrative level. As outlined in the Constitution of Denmark, municipalities have the right “[...] to manage their own affairs independently, under State supervision [...]”. That leads to the municipalities being the decision makers influencing spatial distribution of land-use actively and on a related note energy use passively.

B-3.2 Energy planning in Denmark

- While the national energy strategy is set and monitored by the *ministry of energy, utilities and climate*, concrete energy planning is happening likewise to urban planning at the municipality level. Electric energy planning has been strongly influenced by the cogeneration of electricity for district heating systems, the shift from oil and coal to nature gas and biomass, and the extension of wind energy. Thus, electric energy – with the exception of onshore wind power – hasn’t been in the focus of municipal energy policy, but is more of a national task.
- Municipalities are required by law to develop a Municipal Heating Plan, which is normally happening in close cooperation with the local utilities. The heating plans identify current and future heating energy demand of buildings and in most cases they also show which heat resources are available in a municipality.
- The document is legally binding and is integrated into the overall Municipal Plan. Further, it is used as decision-making basis for the heating energy supply of urban developments and local development plans. During the process of developing heating strategies an assessment of the most cost-effective options is made. Because of the societal system in Denmark – which is not primarily based on the greatest individual, but more off societal prosperity – the full societal costs for energy projects get calculated. In contrast to cost-benefit analysis of private companies, this secures that mainly projects with the best net-benefit for society get realized. The Danish Energy Agency and the municipalities are monitoring this and intervene in case of societal suboptimal variants and too high prices.

- In the last decade, energy planning on a municipal level was mostly project based and has been done by energy utilities. The utilities came up with project proposals (mainly the extension or alteration of district heating systems), whereas the municipality had the responsibility to peruse and approve the proposals based on the Municipal Heating Plan. In case of a new local development plan the municipality can oblige the utility to develop an adequate heating supply solution for the project that the utility has to fulfill.
- To counteract the outmoded energy planning only focusing on heating, the *Danish Energy Agency* set up the program for Strategic Energy Plans (SEP) on regional and municipal level as voluntary addition to the municipalities' sustainability strategy. SEPs show implementation scenarios for municipalities to become independent from fossil fuels in electricity, heating and transport in an integrated way.
- It was expected that these plans will set the standard for the third generation of nationwide Municipal Energy Master Plans (due to a shift in the national government in 2015 this hasn't happened yet – nevertheless, in early 2017 more than 50% of all Danish municipalities enacted a SEP). SEPs are ideally developed in cooperation between municipalities, the local energy utilities, the regional waste treatment utility, research institutions and consultancy firms steering the process. Electricity grid operators and urban planning departments are not always included in the process. SEPs are noticeably better aligned with the Municipal Plan and the land-use strategies than the existing energy plans with the alignment of district heating strategies, city extensions and community refurbishments

B-3.3 Land-use planning in Denmark

- A direct influence by urban planning on energy use patterns is just given on municipal level (see Figure B-3.1). Nevertheless, superior administrative levels influence the decisions of urban planning. In Denmark, the *ministry of business and growth* is developing a roadmap for national spatial development and focus areas for municipal urban planning. Matters controlled by the ministry are e.g. the capital region, coastal areas or offshore wind energy. Furthermore, the ministry can intervene into municipal urban planning if matters of national interest are not respected. A spatially sharp plan document with binding stipulations for land-use exists neither on the national nor on the informal regional level.
- Urban planning in Danish municipalities has four levels, with two central plans: The Municipal Plan (MP) sets the overall targets and guidelines for the municipality's development. It contains statements about the main structure, traffic, zoning, density and uses within the municipality. Further, it contains the framework for all local development plans in the municipality, which e.g. includes the arrangement for the heating supply of the area. The MP may not deviate from national or regional directives.
- The Local Development Plan (LDP) stipulates how a specific part of the municipality may be developed and used. The plan concretizes the political strategy and objectives of the MP. LDPs can contain defaults to reach into a high level of

detail, such as building orientation and material, color, the use of renewable energies as mandatory, the building energy standards, green roofs or areas for wind power plants. LDPs are legally binding for property owners. A LDP may not contradict the MP or national planning directives. Nevertheless, the municipality may amend the MP by submitting a proposal for a MP supplement for public comment together with a LDP proposal.

- There are two ways how project developments in Denmark typically get started: First, via the municipality and second through private initiative. The latter is based on an investor or the landowner coming up with an idea and subsequently with a project suggestion. In bigger projects, exceeding one hectare, the municipality typically demands an architectural or urban design competition that should provide the basic urban design and a proposal for a LDP. In smaller projects urban design competitions are usually expendable. On basis of the urban design proposal the municipality develops in cooperation with the landowner or investor the LDP. The responsibility for land-use planning lies normally in the *administration of technology and environment*, in the *department for city development*. In the case of Copenhagen one unit of the department is responsible for city wide cross-section strategies (e.g. energy strategies are one of these), the other is responsible for urban planning.

B-3.4 Strategies for energy planning

- Alignment of energy policy towards reduced societal cost and a carbon neutral building and transport sector, which leads to a high share of district heating solutions, wind power and biomass usage.
- National guidelines for calculations of societal costs and maximum energy prices in combination with a restrictive policy and monitoring of energy utilities by municipalities and national government.
- Inclusion of heating energy stipulations into urban planning as mandatory element in all municipal planning documents.
- Strategic Energy Plans as tool for cooperation between municipalities and between the heating, cooling, electricity and transportation sectors.
- Figure B-3.1 shows the interface of Danish urban and energy planning processes.

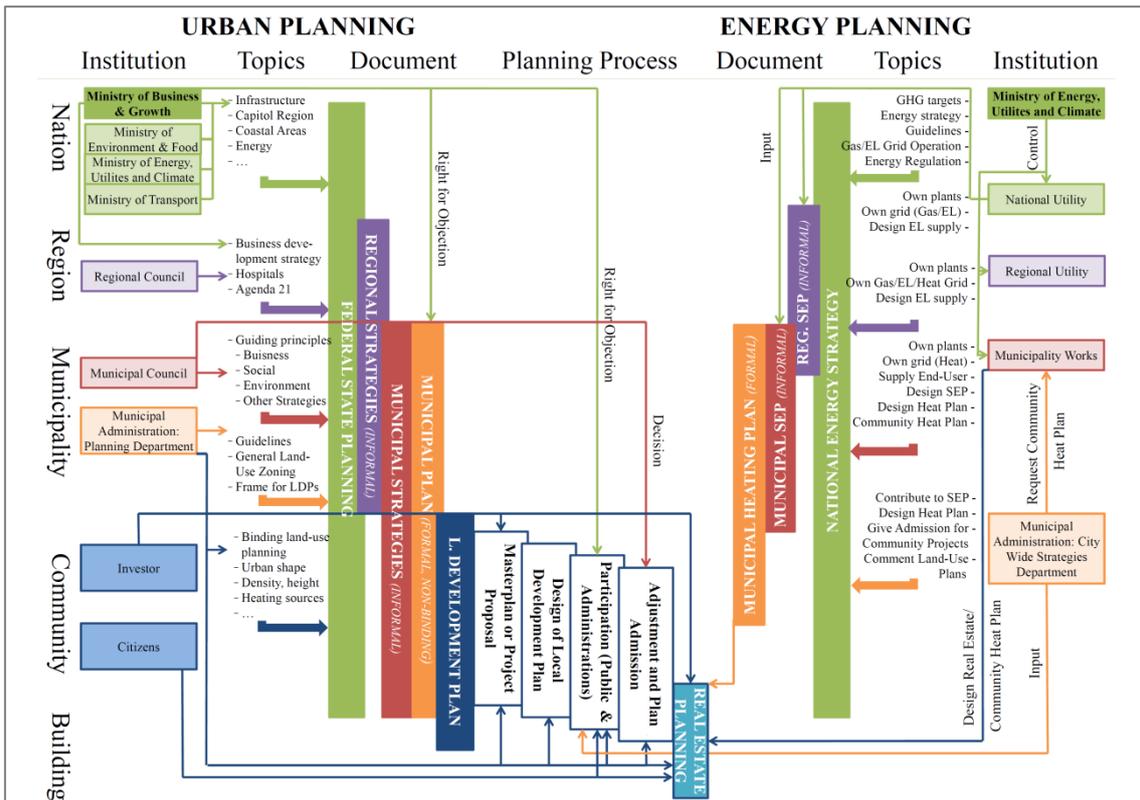


Figure B-3.1: Urban and energy planning in Denmark (Source: DTU, 2016)

Table B-3.1: Denmark's Measures Part 1

No	Measures	Intent of Measure	Related Themes	Related Strategic Measure
17	Societal costs (as decision criterion)	Enable / Enforce	Authority, Targets	Include Socio Economic Criteria
18	Municipal heating plan	Enforce	Authority, Tools	Develop Renewable Energy Strategies
19	Strategic energy plan	Encourage Enforce (if mandatory)	Tools	Develop Renewable Energy Strategies
20	GHG emissions reduction agreements (Eco-Cities)	Encourage	Targets	Set Vision and Targets
21	Annual GHG inventories	Enforce	Feedback	Implement Monitoring of Energy Consumption and GHG Emissions
22	CITIES Project Smart Cities – Quadruple Helix	Encourage, Enable	Tools	Stakeholder Engagement & Involvement, Implement Effective and Efficient Organizational Processes

Table B-3.2: Denmark's Measures Part 2

No	Entry point Urban Planning	Entry point Energy Planning	Motivation to using	Distribution/Benefit
17	Development of the Municipal Plan	Basis of energy planning strategy	Lower end-user energy costs Societal benefit included in decision making	Creates a comprehensive planning process
18	Originates from the Municipal Plan	Energy supply selection	Creates a foundation for municipal energy decisions.	Basis for future local development plans Becomes binding for the energy utility
19	Initial scoping of development scenarios	Energy strategy scenario planning with stakeholders	Definitive / holistic results Covers more than just one energy sector, which leads to synergies Combination with business growth strategies	Provides support for solutions that are the common goal of stakeholders
20	Initial scoping / design	Energy efficiency action plan development	Opportunities for certification or labelled construction Creates competition between designers.	High public visibility of results
21	Post project – compliance with emission targets	Post project – compliance with emission targets	Allows justification of decisions Enables corrective measures for errors	Improves future action plans
22	/	/	/	/

Contact person for further information: Maj-Britt Quitzau, Aalborg University; Vickie Agesen, Cenergia a part of Kuben Management, Jens-Phillip Petersen, DTU

B-4. France

B-4.1 Political system

- France is a centralised state with four political levels: The central government, 13 regions, 101 departments (including overseas departments) and around 12,000 inter-communities with about 36,000 municipalities.
- Since 2007, France has actively promoted an environmental and energy transition. Three laws were proposed (loi Grenelle 1, Grenelle 2 and Energetic transition and green growth). The first step was focused on environmental transition with an energy component within the national Grenelle debate, the results of which were approved as two laws in 2009 and 2010. These laws have defined the objectives in terms of GHG emission reductions, namely the reduction by the factor of 4 until 2015 (factor 4). This objective applies to buildings and the transportation sector. The energy transition law was approved in august 2015 and accentuates the objectives for the energy sector, namely:
 - to decrease GES emission to 40 % below 2030 and factor 4 until 2050
 - to obtain 32 % renewable energy in final consumption by 2030
 - to halve the final energy consumption by 2050.
- In parallel, territorial planning was reorganised with a strong integrated approach to reduced pollution and GHG emissions (see figure B-4.1).

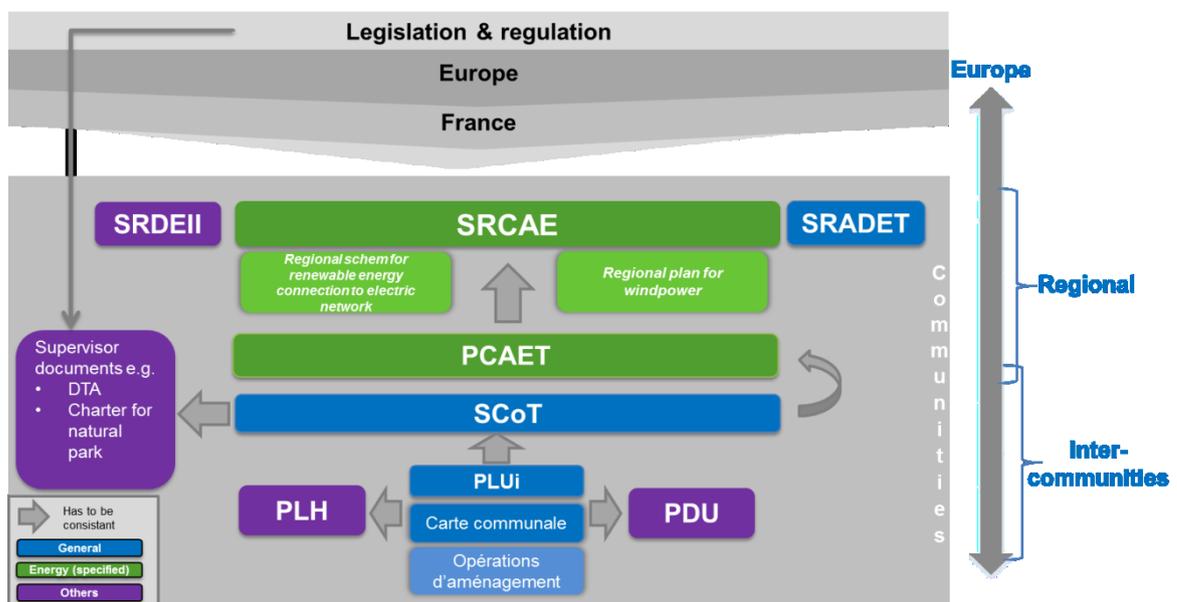


Figure B-4.1: Administrative framework in France (Source: ElfER, 2016)

- At the national level, the Ministry for Environment, Energy and Sea is responsible to promote the energy reforms, focusing in equal measure on climate and environmental sustainability, security of supply and affordability.

- The regions are responsible to apply law and strategies about energy and climate (since energetic transition law).
- The departments are in charge of social action and solidarity between the different territories
- Municipalities (inter-communities, metropole...) have to translate higher level strategies and legal obligations locally. They have the authority to organise the distribution of a network.

B-4.2 Energy planning in France

- The Regional Plan for Climate, Air and Energy (SRCAE) is a regional planning document linked to national development strategies. The SRCAE is jointly defined by the state and the region and translates European objectives to the regional level.
- With regard to regional energy planning two further documents are associated with the SRCAE: zoning for wind power development (zone de développement éolien – SDE) and a regional plan for the integration of energy from renewable sources level (46region 46regional de raccordement au réseau des énergies renouvelables – S3RenR). The former defines areas for the construction of wind turbines while the latter connects the expected increase of electricity produced from renewable fluctuating sources to the necessary capacity of the electricity grid infrastructure.
- The Local Climate and Energy Plan (PCET) is the local climate action and energy plan coordinating the regional level (SRCAE) and local planning documents (ScoT/PLU/ZAC) as discussed in the next section. It is an obligatory plan for communities above 50,000 inhabitants and is based on a greenhouse gas emission inventory as well as the definition of local strategies for mitigation and adaptation measures. The PCET includes an analysis of the state of emissions and energy use, work on future scenarios, quantified objectives which are consistent with the French interpretation of the European 20-20-20 targets and the national objectives (factor 4). Furthermore it defines suitable indicators and follow-up measures at the scale of the community.

Figure B-4.2 shows the energy planning structure for France.

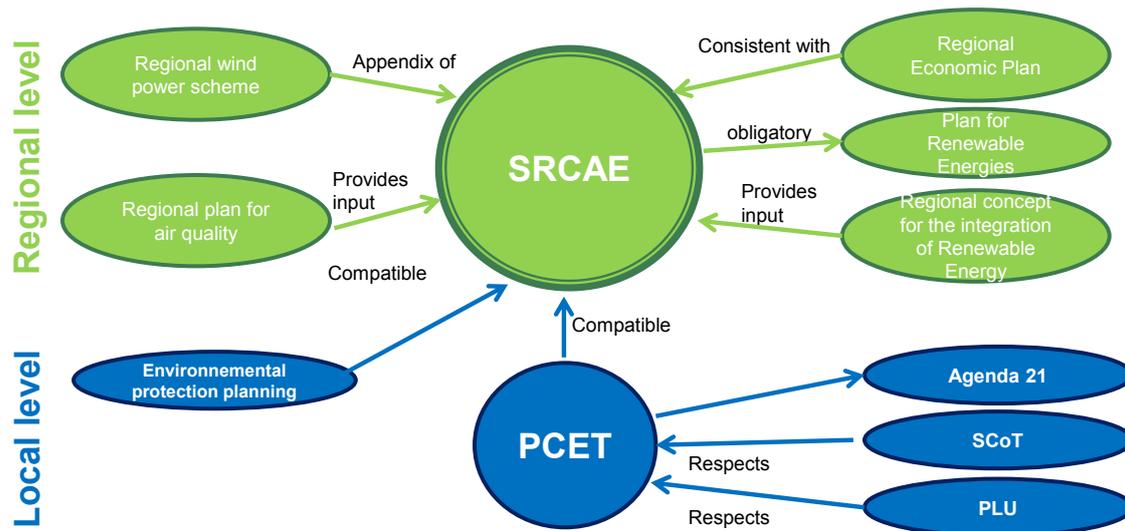


Figure B-4.2: Energy planning structure for France (Source: ElfER, 2016)

B-4.3 Land-use planning in France

- The Coherent Territorial Planning Schemes (ScoT – Source: www.territoires.gouv.fr) is the regulatory document that defines and puts into place intercommunal planning strategies in the context of sustainable urban development projects. The ScoT is designed to ensure coherence of sector-specific planning in urban planning, housing, transport, local economy, protection of landscapes and the environment. A ScoT includes : “Presentation Report, Sustainable Planning and Development Project (Projet d’aménagement et de développement durables – PADD) and a Guidance and Targeting Document (Document d’orientation et d’objectifs – DOO). » The PADD defines regional development for the next 15 to 20 years, while the DOO is a technical document providing the guidelines for communal planning documents such as Local Housing Programmes (Programmes locaux de l’habitat) and Local Urban Plans (Plans locaux d’urbanisme). The perimeter of the application is typically a grouping of multiple communities (intercommunalité).

B-4.3.1 Local urban planning

- The local urban development is described within the Local Urban Plan (PLU) which is obligatory for communities with more than 100.000 inhabitants. The development plan is defined for a community or a grouping of communities participating in the plan. The PLU sets out planning zones and rules for new construction such as rules on change of use, permitted height of buildings.
- The PLU is linked to specific planning documents including the Housing Development Plan (PLH) and the Communal Mobility Concept (PDU).
- The Housing Development Plan (PLH) PLH defines the local strategy for the private and public housing development for a period of six years at the level of multiple associated communities.

- With a time horizon of ten years the Communal Mobility Concept (plan de déplacement urbain – PDU) defines the strategy for the development of public transport
- At the local level of districts or neighbourhoods the Urban Development Zone (ZAC) constitutes a development concept for a specific urban area identified in the PLU. The development plan can include technical and architectural specifications. The ZAC should also be in line with the objectives defined in the ScoT.

Table B-4.1: France's Measures Part 1

No	Measures	Intent of Measure	Related Themes	Related Strategic Measures
23	Bilan Carbon	Enforce	Tools	Implement Monitoring of Energy Consumption and GHG Emissions
24	PCET	Enforcing	Authority	Develop Renewable Energy Strategies
25	Observatoire PCET	Enforcing	Feedback	Make Use of Tools Supporting the Decision Making Process
26	Multi-energy model	Enable	Tools	Stakeholder Engagement & Involvement
27	HQE Aménagement	Encourage	Tools	Design of Urban Competition Processes
28	ÉcoQuartier	Encourage	Information	Design of Urban Competition Processes
29	AEU2	Enable	Tools	Stakeholder Engagement & Involvement

Table B-4.2: France's Measures Part 2

No	Entry point Urban Planning	Entry point Energy Planning	Motivation to using	Distribution/Benefit
23	PCET	Emission targets	Analysis	ADEME
24	Local climate action plan	Local climate action plan	Target setting / monitoring	Legislation
25	National comparison of measures	National comparison of targets	Monitoring	ADEME
26	Early design phase	Assessment of local energy concept	Control, monitoring, communication	EIFER
27	Guidelines for sustainable construction at district scale		Provide management process to reduce environmental impact of urban development projects	HQE
28	District planning	Local energy concept	Showcase lighthouse projects	National competition and documentation Club national EcoQuartier
29	1. Vision development 2. Target setting 3. Spatial application 4. Implementation	ibid	Providing an integrated approach	Process to support sustainable urban development

Contact person for further information: Andreas Koch, EIfER

B-5. Germany

B-5.1 Political system

- Germany is a state with three political levels: The central federal government, 16 federal states and about 11,000 municipalities. All three levels of government participate in the land-use planning process.
- The Federal Ministry for Economic Affairs and Energy is responsible to promote the energy reforms, focusing in equal measure on climate and environmental sustainability, security of supply and affordability. When it comes to urban and building issues related to energy the Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety (BMUB) are also responsible.
- Municipalities act as corporate, local and self-governing bodies. They have the right to manage all the affairs of the local community on their own responsibility within the limits set by law (self-government tasks). In this respect they are exempt from direction but they are required to perform specific functions on behalf of the federal and state governments (delegated functions).
- Although there is in most federal states in Germany no specific regulation promoting any specific kind of energy resource within the municipalities, the cases of the federal states of North Rhine Westphalia and Baden Württemberg present two exceptions in which climate protection laws have been enforced since 2013 and specific funds have been targeted at fostering climate protection measures. Moreover, a diversity of funding programs promoting the use of renewable energies and energy efficiency investments both at Federal and State level are at disposal of cities (point that is further below discussed).

B-5.2 Energy planning in Germany

- The electricity grid in Germany is sub-divided into transmission grids (maximum voltage) and distribution grids (high, medium and low voltage) which are operated by four private sector transmission grid operators and over 800 distribution grid operators. They are also responsible for planning grid expansion, funded by a grid utilisation fee. All the grid operators are subject to a state regulation that covers grids security and demand side management as outlined in the German Energy Act (Energiewirtschaftsgesetz, EnWG).
- For renewable energy systems such as wind power plants, biomass and photovoltaics, the regional and zoning plans are the legal instruments to control facility siting. These lie under the Federal Building Act, operational since 1996 and updated periodically to improve conditions for renewable energy.
- Under the Energy Conservation Act (Energieeinspargesetz EnEG) landlords are legally required to adhere to certain technical standards for efficient energy use. With the introduction of the Energy Saving Ordinance (Energieeinsparverordnung EnEV 2016) as part of the act the benchmarks of energy efficiency were raised for

existing stock and new buildings. This bylaw was based on the European Energy Performance of Buildings Directive (EPBD).

- Since the beginning of 2009 the inclusion of renewable energy for heating in new buildings has been compulsory nationwide according to the Renewable Energy Heat Act (Erneuerbare-Energien-Wärme-gesetz). This obligation has since been extended to existing buildings in some federal states. For new buildings, a share of Renewable Energy Sources (RES) must cover the heating and Domestic Hot Water (DHW) demand. The exact ratio depends on the chosen energy source; the given default solutions vary in share from 15%, e.g., in the case of solar thermal power, to 50% in the case of geothermal heat.

B-5.3 Land-use planning in Germany

- The Federal Building Act (Baugesetzbuch) defines the delimitation of functions between spatial planning, urban planning, and building control law/building regulations, as well as the differentiation between local self-government and direct administration by higher levels of government (Federation and state) in urban planning. The Federal Building Act required local authorities to organise and control urban development through urban land-use planning in conformity with of federal spatial planning and state spatial planning.
- Spatial planning is accordingly decentralised in Germany. The competences and functions are divided between the three levels of government but interlinked by mutual feedback as well as complex requirements of notification, participation, coordination and compliance.
- Federal spatial planning is limited essentially to the development of guiding principles for spatial planning which act as the legal basis for state spatial planning and superordinate specifications for sectoral planning.
- State spatial planning gives concrete form at the state level to the federal principles of spatial planning.
- At the local level, final planning goals are developed in compliance with both federal and state spatial planning specifications. It is the responsibility of local authorities to regulate the use of land for building and other purposes at the lowest planning level.

Figure B-5.1 shows the German planning structure.

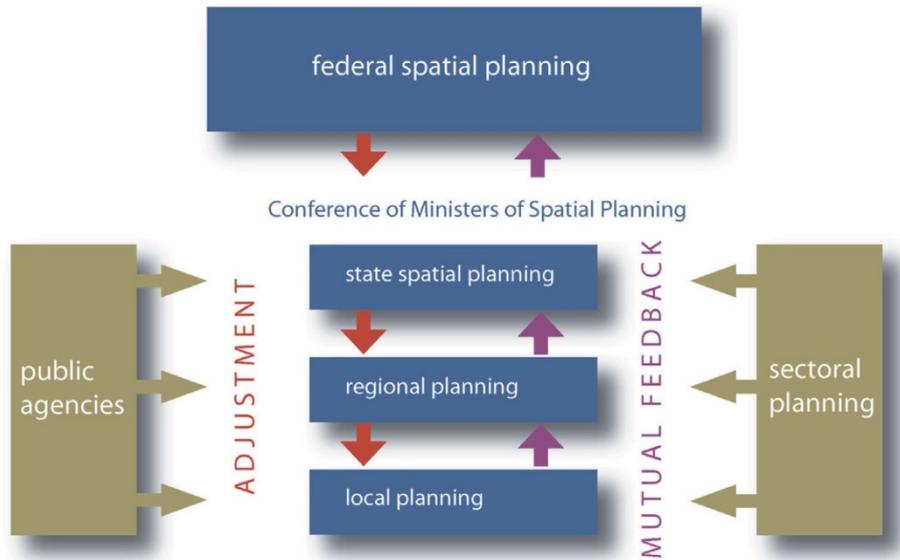


Figure B-5.1: Planning Structure for Germany (Source: Pahl-Weber and Henckel, 2008, P. 39 | The Planning System and Planning Terms in Germany - A Glossary)

- There are two mechanisms with direct impact on the inhabitants and enterprises within a municipality. The Zoning Plan (Flächennutzungsplan) and the Land-Use Plan (Bebauungsplan).
- The Zoning Plan allocates the use of the municipal area in a general way (housing, working, green areas, traffic areas, areas for production facilities or special use, e.g. for develop of power plants/cogeneration plants or local heat networks).
- The Land use plan is developed to regulate the construction activities and allocation of specific land use in a small area. It is the legal basis for building projects and issuing building permits.
- These documents are legally enforceable and binding for both public administration and private sector. Supporting these plans are:
 - District (re)development plans,
 - Energy concept, green area concept, mobility concept, etc.
- These supporting documents describe general guidelines and principles for specific areas or sectors but are not legally binding

B-5-4 Strategies for energy planning

- **Climate Action Programme 2020:** available in spring 2016 the program will be undertaken by both the German Federal Ministry for Economic Affairs and Energy (BMWi) and the Federal Environment Ministry (BMUB). It includes measures to reach the 2007 goal of 40% GHG emission reductions below 1990 levels by 2020 (BMWi and BMUB, 2016). CAP 2020 includes a strategy on climate-friendly building and housing, measures that foster energy efficiency in the transport sector as well as means to cut non-energy-related emissions in the sectors of industry,

waste management and agriculture. It also proposes a reform of emissions trading and additional measures to increase public awareness and educate the population on topics related to energy efficiency. The plan involves all sectors and its achieved results are monitored on an annual basis.

- **National Action Plan on Energy Efficiency (NAPE):** As part of the Climate Action Programme 2020, NAPE addresses all social actors; from local authorities to enterprises and consumers, and adheres to a common principle: supply information and advice, provide support for energy efficiency investments and demand action to large-scale enterprises to conduct energy audits and set standards for new installations and buildings. The target is a 20% reduction in primary energy consumption by 2020 compared with 2008 and 50% by 2050. By the year 2020, renewable energy sources must account for 35% of electricity, and 80% by 2050. The plan includes: energy efficiency in buildings, business and earnings model for energy conservation, empowerment for energy efficiency and measures to create sustainable transportation.
- **Energy Efficiency Strategy for Buildings:** included within NAPE, aimed at a climate neutral building stock by 2050 by integrating electricity from renewable resources, heat and efficiency aspects.
- **Legally binding instruments:** the *EnEV* (Energieeinsparverordnung) is the legal framework that defines energy building standards for households, offices and industry buildings, and the minimum requirements for new and old buildings. The *EEG* (Erneuerbare Energien Gesetz) regulates the grid composition and guarantees a fixed fee to its producers.
- **Regional/Urban Development Concepts:** the ISEK (Integrated Urban Development Strategies) are an informal base for the implementation of operational plans and projects in parts of the city, i.e. districts, neighbourhood areas and communities. These ISEKs cover all relevant sectors of urban planning and is therefore a necessary requirement for German cities in order to receive public urban development financing within the many urban development programmes tackling different problems.
- **Energy Consulting local organizations:** partial funding is available for cities (provided a ISEK program was developed) to set up local expert agencies to provide citizens as well as industry with consulting services on the topic of renewable energy.
- **Public Participation Processes:** Aim to bridge the gaps between urban planning departments/municipal administration/public utilities, project developers (responsible for implementation) and local stakeholders (final recipient of the plans, projects and strategies).
- **Federal Government funding:** The public bank KfW Bankengruppe is Germany's premiere bank for private individuals as well as for enterprises, cities, municipalities and non-profit and social organisations. Through the KfW bank the Federal Government finances the development of renewable energy projects (KfW, 2016). Funds are for construction and for energy-efficient refurbishment. Other initiatives include EnEff:Stadt and EnEff:Wärme, which promote energy

efficiency investments and renewable resources for buildings and heating systems; EnOB, aimed at funding research pilot projects in buildings, EnSan, aimed at financing energy-oriented refurbishments; and the En:SYS (Systemanalyse in der Energieforschung), a program promoting research projects directed to designing future optimizing energy systems.

- **Joining Climate Alliances:** Many cities participate in international climate alliances such as the European Energy Award (eea) and the Covenant of Mayors Initiative, both of which promote climate friendly policies within urban frameworks. The former provides certification regarding the climate protection activities of a specific city. In this way, the achieved milestones can be analyzed and evaluated, and a working plan can be defined. The latter, initiated in 2008, comprises local and regional authorities across Europe to implement EU climate and energy objectives and achieve a 40% reduction in GHG emissions by 2030 by relying on an integrated approach.
- **Monitoring of energy consumption on public buildings:** some cities, such as Aachen track decreasing energy consumption and identify potential scope for improvement. All public buildings undergo detailed energy monitoring and management and the data is stored to determine the GHG emissions.
- **Urban Communication Strategy:** traditional city:public communication pathways include internet portals and city journals. These are sometimes effective but in general, a strategic communication strategy is lacking. The City of Ludwigsburg retained Energetikom to define such communication strategy.
- **Consultation Services for Private Households:** the German Federal Ministry for Economic Affairs and Energy has made available to households and companies subsidised energy consulting services to raise awareness of the savings triggered by investments on energy efficiency measures.

Table B-5.1: Germany's Measures Part 1a

No	Measures	Intent of Measures	Related Themes	Related Strategic Measures
30	Climate Action Programme 2020	Enable Enforce	Targets, Information, Feedback	Set Vision and Targets
31	NAPE: National Action Plan on Energy Efficiency	Encourage Enable Enforce	Targets, Information, Tool	Set Vision and Targets
32	Energy efficiency strategy for buildings (part of the NAPE)	Encourage Enable	Targets, Information, Tool	Set Vision and Targets
33	Zoning Plan (Flächennutzungsplan)	Enforce	Authority	Make Full Use of Legal Frameworks
34	Land Use Plan (Bebauungsplan)	Enforce	Authority	Make Full Use of Legal Frameworks
35	Legally binding instruments to set climate goals (EnEV, EEWärmeG, EEG)	Enforce (EnEV, EEWärmeG) Enable (EEG)	Authority, Targets, Tools	Make Full Use of Legal Frameworks
36	Regional/Urban Development Concepts (ISEK)	Encourage	Authority, Targets, Tools	Make Full Use of Legal Frameworks
37	Set up of Energy Consulting Local Organizations (AltbauPlus + Energetikom)	Encourage Enable	Information, Tools	Implement Effective and Efficient Organizational Processes
38	Public participation processes	Enable	Authority, Information, Tools	Stakeholder Engagement & Involvement
39	Funding from KfW Bankgroup/ EnEff:Stadt	Enable Encourage	Tools	Include Socio Economic Criteria

Table B-5.2: Germany's Measures Part 2a

No	Entry point Urban Planning	Entry point Energy Planning	Motivation to using	Distribution/Benefit
30	General framework/guideline for future plans	General framework/guideline for future plans	Reach pre-established targets by 2020.	Will be published in spring 2016.
31	General framework/guideline for future plans	General framework/guideline for future plans	Foster economic use of energy across all sectors	All possible media channels.
32	General framework/guideline for future plans	General framework/guideline for future plans	Reach climate-neutral building stock by 2050.	All possible media channels.
33	Legal precondition for development of any urban projects	Legal precondition.	General allocation of municipal area.	Legislation
34	Legal precondition for development of any building projects. Developed from the Zoning Plan.	Legal precondition.	Regulate specific allocation of land use in smaller areas.	Legislation
35	Legal framework for future plans, Building permission	Legal framework for future plans	Expansion of RE and EE across all sectors Financial incentives (EEG)	Legislation
36	General framework/guideline for future plans	General framework/guideline for future plans	Informal base for future urban and energy plans at city level	Local development plans (conventional communication channels)
37	Early stage.	Early stage.	Provide extensive information and support to overall community.	Online and "in the field" presence (direct contact with citizens).
38	Precondition for development of urban projects	Early stage to receive as much public feedback as possible	Ensure well reception and effective urban/energy plans	Conventional communication channels (web portal, city journal, etc).
39	Parallel	Parallel	Promote RE and EE investments	Online portal.

Table B-5.3: Germany's Measures Part 1b

No	Measures	Intent of Measures	Related Themes	Related Strategic Measures
40	Joining Climate Alliances (EEA Certification/ Covenant of Mayors)	Encourage	Targets, Tool, Feedback	Set Vision and Targets
41	Monitoring of energy consumption on public buildings	Encourage	Tools, Feedback	Implement Monitoring of Energy Consumption and GHG Emissions
42	Urban communication strategy (Energetikom in Lugwigsburg)	Encourage	Information	Make Use of Tools Supporting the Decision Making Process
43	Consulting services for private households	Encourage Enable	Information, Tools	Make Use of Tools Supporting the Decision Making Process
44	Platform Energy Efficiency/ Initiative Energy Efficiency Networks	Encourage Enable	Information, Tools	Make Use of Tools Supporting the Decision Making Process
45	European Energy Award (eea)	Encourage	Information, Feedback	Implement Monitoring of Energy Consumption and GHG Emissions
46	DGNB certificate	Encourage	Information	Design of Urban Competition Processes
47	District heating priority zones	Enforce, encourage	Authority	Make Full Use of Legal Frameworks
48	Convoy	Encourage	Information	Include Socio Economic Criteria

Table B-5.4: Germany's Measures Part 2b

No	Entry point Urban Planning	Entry point Energy Planning	Motivation to using	Distribution/Benefit
40	Parallel	Parallel	Create awareness and promote use of RE and EE	Online portal.
41	Parallel	Parallel	Monitoring and progress evaluation.	Online portal.
42	Parallel	Parallel	Public awareness and engagement	Conventional communication channels (web portal, city journal, etc).
43	Parallel	Parallel	Foster awareness across private households Promote investments	Online Portal
44	Parallel	Parallel	Foster EE across all sectors	Online portal
45	Parallel	Parallel	Monitoring actions and progress concerning CO2 emissions	Recognition, image
46	Parallel	Parallel	Proof of high quality and a sustainable district (or building)	Recognition, image
47	Parallel	Parallel	Expansion of DH grid, cost-effectiveness of operation	Increasing number of connection to the grid, campaign, user information
48	Parallel	Parallel	To get a higher rate of renovation	Implementation of renovation measure is perhaps cheaper and faster

Contact person for further information: Uta Lynar, B.&S.U.; Jens Freudenberg, Deutscher Verband für Wohnungswesen, Städtebau und Raumordnung e.V.; Gerhard Stryi-Hipp, Fraunhofer Institut für Solare Energiesysteme ISE; Annette Roser, IREES; Rita Streblov, RWTH Aachen University

B-6. Ireland

B-6.1 Political system

- Ireland is a parliamentary democratic republic of 26 counties.
- It has a relatively centralised administration with 31 local authorities who are the main providers of local government services at county / city level. Eight Regional Assemblies co-ordinate the activities of these Local Authorities and play a monitoring role in relation to the use of EU Structural Funds.
- The constitution sets out a mandatory requirement for local elections to be held every five years, but there are no elections for the regional levels where members are nominated by their local authorities.
- Energy policy is the responsibility of the Department of Communications, Energy and Natural Resources (DCENR), while land-use planning falls within the Department of Environment, Community and Local Government (DECLG).
- Central government is responsible for all overarching legislation while the local authorities are responsible for delivery of the following services; housing, planning, roads, environmental protection, recreational facilities and amenities and community infrastructure.

B-6.2 Energy planning in Ireland

Energy planning - National level

- The overall framework which guides national energy policy up to 2030 is the Energy White Paper, published by the DCNER in December 2015.
- Energy targets are set out in the National Energy Efficiency Action Plan (NEEAP) and the Renewable Energy Strategy in which Ireland maintains its commitment to meeting its EU 2020 targets. The Sustainable Energy Authority of Ireland (SEAI) is Ireland's national energy authority, reporting to the DECNR and is responsible for implementing the measures to enable achievement of these targets.
- A National Expert Advisory Council on Climate Change with representatives from both the Environmental Protection Agency (EPA) and SEAI was established in 2015 under the Climate Action and Low Carbon Development Bill, and will advise government on the national objective of transition to a low carbon economy by 2050 this transition.
- Electricity and Gas markets: the DECNR have responsibility to formulate and implement policy and legislation on the liberalisation and regulation of the gas market. Currently approximately 96% of natural gas requirements are imported through the interconnection with Britain. The island of Ireland operates as a Single Electricity Market (SEM) which is regulated by Northern Ireland and Ireland as equal partners and a proposed north-south transmission line is under development.

The electricity distribution networks in the Republic of Ireland are owned by ESB Networks and operation of the high voltage electric grid is controlled by a state-owned company EirGrid.

- The Commission for Energy Regulation (CER) is Ireland’s independent energy regulator and is mandated to protect the interests of energy customers, maintain security of supply, and to promote competition in the generation and supply of electricity and supply of natural gas.

Energy planning - Regional / local authority level

- The preparation of a Local Authority Renewable Energy Strategy (LARES) is not a statutory requirement but a methodology is in place to assist local authorities to develop strategies.
- A total of 6 individual LARES have been prepared by local authorities. A further 3 local authorities are in the process of preparing a LARES. The SEAI methodology facilitates a consistent approach to the identification of key renewable energy resources (see also figure B-6.1).

	ACTIVITY	OUTPUT	PUBLIC CONSULTATION
PRELIMINARY PHASE	Define Requirement for LARES	Mandate to proceed with production of LARES	
	AA and SEA Screening	Decision on requirement to proceed with SEA and AA	
STEP 1	Renewable Energy Policy Review	Understanding of Renewable Energy Policy Drivers and "Snapshot" of Current Policy for inclusion in Renewable Energy Strategy	Consultation on LARES Issues Paper
STEP 2	Renewable Energy Resource Assessment	Understanding of available Resources within a Planning Authority area and Constraint and Success Factors for utilising those Resources	
STEP 3	Analysis of Constraints and Facilitators	Definition of 'Planning Authority area Renewable Energy Resource'	
STEP 4	Develop Renewable Energy Policy	Definition of Renewable Energy Policies	Draft LARES Consultation
		Definition of Planning Authority Aims and "Expectation" of Proposed Projects	
		Definition of Status of Renewable Energy within the Planning Authority area	Final LARES Consultation
		Mapping where appropriate	
		Definition of Planning Authority area Renewable Energy Objectives	

Figure B-6.1: LARES, Ireland (Source: SEAI, 2016)

B-6.3 Land-use planning in Ireland

Land-use planning - National level

- The provision and oversight of land-use planning practices in Ireland are a function of the DEHLG. The National Spatial Strategy (NSS) is the overarching national planning framework to 2020 which proposes a balanced regional pattern of spatial development. Spatial planning at the regional level must work within the overall approach taken in the NSS, while providing more detail and establishing a development and spatial framework that can be used to strengthen local authority development plans and other planning strategies at county, city and local level.
- The planning code includes primary and secondary legislation – Acts and Regulations. The overall framework is set out in the Planning and Development Acts 2000-2006 and the detail is prescribed in the Planning and Development Regulations 2001-2007. The Act is the basis of the national planning code and sets out the detail of regional planning guidelines, development plans and local area plans as well as the basic framework of the development management and consent system.
- In urban areas the Urban Regeneration and Housing Act 2015 aims to incentivise urban regeneration and increase activity in the housing construction sector. It introduced a vacant site levy and amendments in relation to the delivery of social housing to encourage mixed tenure developments.
- Resolution of planning conflicts is carried out through An Bord Pleanála, an independent statutory body. They also have a direct role in deciding on major infrastructural projects and hear applications from local authorities for projects which would have a significant environmental impact.

Land-use planning - Local authority level

- The main instrument for regulation and control is the Development Plan which sets out the land use, amenity and development objectives and policies of the planning authority for a six year period.
- Objectives are included for development and renewal of obsolete areas, preserving, improving and extending amenities, provision of water supplies and sewerage services, waste recovery and disposal facilities, zoning of areas for residential, commercial, industrial, agricultural purposes, provision of accommodation for travellers and provision of services for the community.
- Planning applications are assessed by local authorities against their development plan to assess conformity with the plan's objectives and any development permitted must normally be in accordance with the plan. The making, reviewing and varying of the plan is a function reserved for the elected members (i.e. councillors) of the planning authority following extensive public consultation.
- Following approval of a draft plan, and a 10 week public display period any comments received are taken on board, and the plan may have to go on display again for a further 4 week period if materially altered. Following consideration of any new comments the plan is formally adopted by the local area councillors.

- Generally there is limited interaction between land-use planners and energy planning however the LARES methodology gives guidelines for consideration in relation to renewable energy and land use interaction.

Figure B-6.2 shows the Irish land-use planning process.

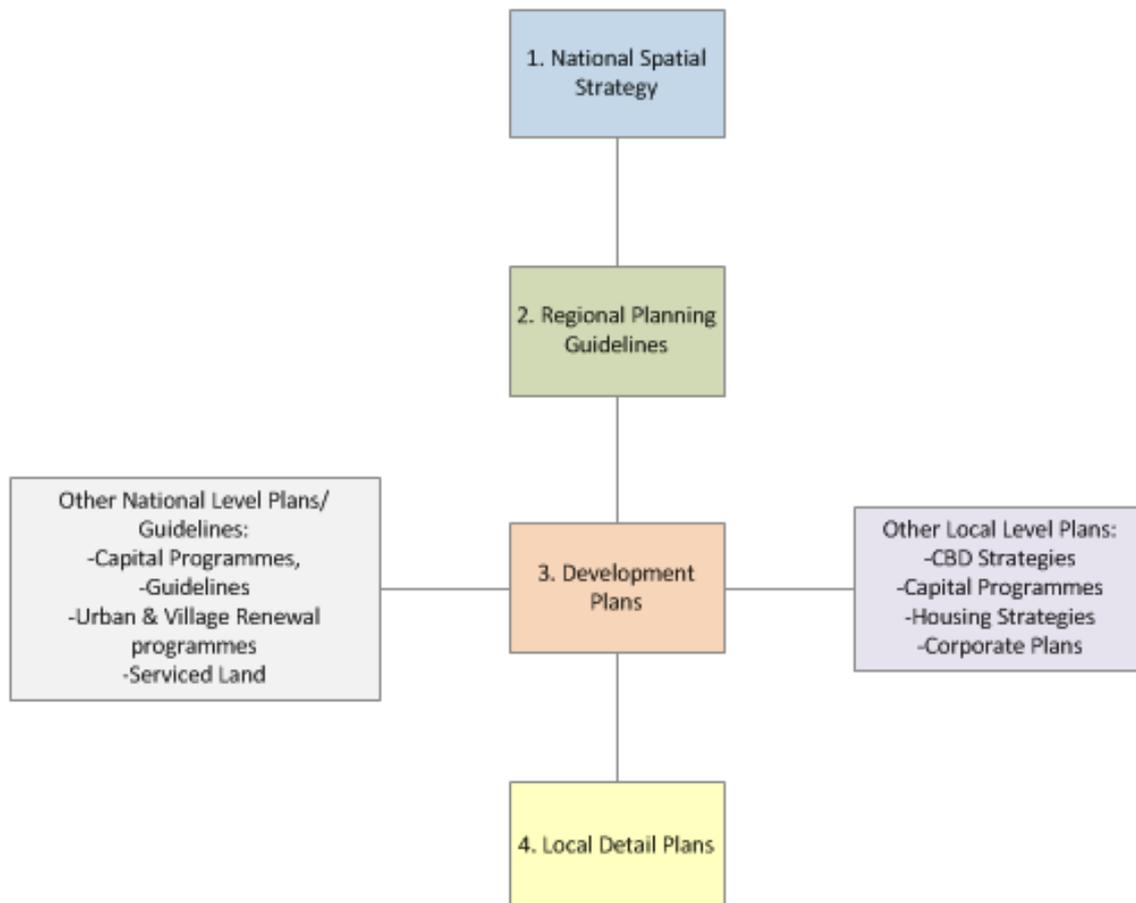


Figure B-6.2: Land-use planning process in Ireland (Source: SEAI, 2016)

B-6.4 Strategies for energy planning

- Ireland's climate change and energy targets are bound by the 20% reduction objectives of the EU 2020 Climate and Energy Package. Within this, Ireland must achieve a renewables target of 16% of gross final energy consumption by 2020 through 40% of electricity consumption, 10% of transport energy and 12% of heat energy being obtained from renewable sources.
- The task of energy planning linking urban development and energy infrastructure is not yet an established position in Ireland. Local authorities are encouraged to develop their own renewable energy strategies although it is not a statutory requirement.
- A new position of Climate Change Officer has recently been created within local authorities, although the specific expertise and responsibilities of those appointed to the roles has yet to be clarified.

- Participation in the EU SPECIAL project with significant outputs in the IPI Spatial Planning and Energy Journal, The Pan-European Guide for Spatial Planners and a series of Expert Papers produced as part of the project.

Figure B-6.2 shows Ireland's energy structure.

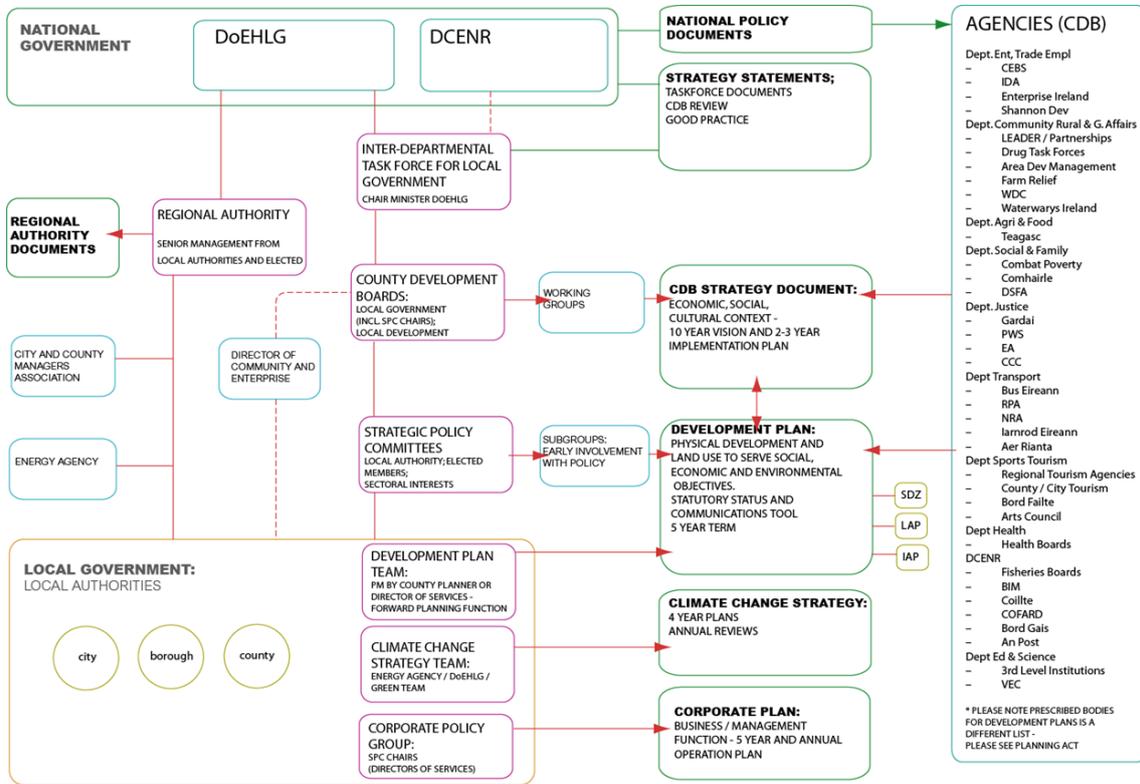


Figure B-6.3: Energy Structure - Ireland (Source: SEAI, 2016)

Table B.6.1: Ireland's Measures Part 1a

No	Measures	Intent of Measure	Related Themes	Related Strategic Measures
49	LARES methodology	Encourage	Authority, Targets	Develop Renewable Energy Strategies
50	Development Plans	Enable	Authority, Targets	Develop Renewable Energy Strategies
51	Climate change officers	Enable	Authority, Information, Feedback	Implement Effective and Efficient Organizational Processes
52	National expert advisory council	Encourage	Targets, Feedback	Implement Effective and Efficient Organizational Processes
53	National energy forum	Encourage	Targets, Information, Feedback	Stakeholder Engagement & Involvement
54	National Spatial Strategy	Enforce	Targets	Develop Renewable Energy Strategies
55	SEC Programme (Sustainable Energy Communities)	Enable & Encourage	Information	Stakeholder Engagement & Involvement
56	Wind Atlas	Enable	Information	Make Use of Tools Supporting the Decision Making Process

Table B.6.2: Ireland's Measures Part 2a

No	Entry point Urban Planning	Entry point Energy Planning	Motivation to using	Distribution/Benefit
49	Executive planning in relation to Development Plan reviews	Renewable energy strategies	Consistency of approach to RE across all local authority areas	Contact with Local Authorities through public consultation
50	Executive function in drafting the development plan	Energy planning not a direct function of the development plan	Opportunity for the public to engage in local area planning.	Opportunity for input and future repeat projects
51	Project outset: embed position in the Local Authority	Liaise with embedded position in the Local Authorities	Environmental issues are more mainstream in local authority decision making processes	Facilitates the integration of energy in future planning
52	No clear entry point as no local authority representation	Cross sectoral: will advise government on actions required to decarbonise the economy	Development of a national mitigation plan and policies to bring about a low-carbon economy	Includes the EPA and SEAI in addition to research institutes and economists
53	Provide evidence based inputs to energy transition plans	Provides evidence based inputs on energy transition challenges	Meets periodically, to stimulate national debate	Will include community, business, and researchers.
54	Internal DECLG senior advisors	Internal DECNR energy analysts	Overarching framework – strategic guidance	National support for change
55	Encourages local renewable energy strategy development. Participation in development of national community energy generation models and supporting policies.	All stages of energy infrastructure planning, may also be the Local Authority acting as an SEC and undertaking Local Authority Renewable Energy Strategy (LARES)	Funding available, support to develop energy master plan for community, training and networking opportunities made available, local and regional representation. Technical advisors available to support plans.	80 communities across Ireland involved. Community led energy projects delivering 100M of energy upgrades each year. Developing the 'Energy Citizen' and encouraging wider participation in local and national energy projects.
56	LARES (voluntary)	Identification of suitable sites for wind development	Guidance only.	Clearly identifies areas of greatest opportunity. Enables consideration of areas for further analysis and testing. Also supported by Biomass and Geothermal Maps as well.

Table B.6.3: Ireland Measures Part 2a

No	Measures	Intent of Measure	Related Themes	Related Strategic Measures
57	Public Bodies Monitoring	Enforce	Authority, Targets, Information, Feedback	Implement Monitoring of Energy Consumption and GHG Emissions
58	LECP Local Economic Community Plan	Enable & Encourage	Information	Include Socio Economic Criteria, Stakeholder Engagement & Involvement

Table B.6.4: Ireland Measures Part 2b

No	Entry point Urban Planning	Entry point Energy Planning	Motivation to using	Distribution/Benefit
57	Not applicable (to the best of my knowledge)	Informs Public sector renovation and retrofit strategies and priorities.	Required to use this process. Scorecard is sent to each Local Authority Chief Executive on a regular basis to inform of progress against established target.	Nationally applied, consistent model that is comparable across different Local Authority Regions.
58	Policy is led by planning department.	Energy can be considered as part of this plan.	Each Local Authority is required to prepare an LECP in consultation with the community and update on a fixed schedule. Includes substantial consultations phases and engagement. (still in 1st cycle)	Sets out community development objectives and can depend on local priorities that may not include energy.

Contact person for further information: Ruth Buggie, SEAI

B-7. Japan

B-7.1 Political system

- Japan is a constitutional monarchy with 47 administrative divisions (Prefectures) governed by a parliament, containing over 1,700 separate municipalities. The Prefectures form the first level of jurisdiction and administrative division of Japan.
- The energy market is overseen by the Ministry of Economy, Trade, and Industry (METI), which is responsible for policy planning and regulation through the Agency for Natural Resources and Energy.
- The provision of energy to the communities is the responsibility of the private sector through franchise agreements. Current energy distribution is through 10 regional electricity and a number of natural gas monopolies although it is proposed to spin off the transmission and distribution portions of these monopolies resulting in more cost effective energy deliveries.
- Full liberalization for electricity and gas at the retail level are proposed for 2016 and 2017, respectively. It is proposed that a variety of businesses including: trading companies, oil wholesalers, mobile service providers and municipalities will be allowed to sell electricity. Energy “packages” will be available for residential customers containing both electricity and natural gas.

B-7.2 Energy planning in Japan

- Energy delivery companies are private sector and need share no information with the municipality as regards its growth or other plans.
- The rate structure for district energy is regulated by the Heat Supply Business Act and must be approved by the METI. From 2016, most of DHC will be free from this regulation.
- Installation of infrastructure must comply with the Official or other plans and must be approved by City Hall
- Limited exchange of information between energy companies and the municipalities unless related to specific tasks (plans, approvals, etc.).
- After Great East Japan Earthquake in 2011, BCP (Business Continuity Plan) becomes important issue in energy planning. Distributed generation is an important element of BCP.

B-7.3 Land-use planning in Japan

Land-use planning - Prefecture level

- Planning in Japan uses the term City Planning to denote the origin and responsibility of planning lies with the Prefecture and City. The City Planning Law is applied to an area designated as the city planning area.
- The City Planning Law covers the control of land uses and the designation of Urbanisation Promotion Areas and Urbanisation Control Areas. The former is available for development while the latter is heavily restricted in its use (primarily agricultural).
- Applies the Low Carbon City Act for promotion of global warming countermeasures.

Land-use planning - City level

- Urban Development Projects are large-scale projects that benefit an entire city or area. The City is authorized to implement urban area development, over-ruling landowners using the legal framework provided by the Urban Development Projects System.
- Urban Development Projects consist of land readjustment projects, urban redevelopment projects, residential block improvement projects, etc.
- Until 2011, The City had been responsible for developing Official Plans according to the Local Autonomy Act and for reviewing and updating the plans on a 10 year cycle.
- The City develops a variety of plans (Action Plans, District Plans, etc.) that address emission and energy reduction targets along with energy infrastructure and building energy requirements. For example, building owners (>2000 m²) are regulated to consider renewable energy facilities and to report their decisions to City Hall.
- The City is also responsible for undertaking annual emission inventories to monitor progress.

B-7.4 Strategies for energy planning

- At the national level, the “Long-term Energy Supply and Demand Outlook”, which presents ideal structure of energy demand and supply in 2030, was released in 2015. In this outlook, renewable energy will become 22 to 24 % of the total power source mix and energy end-use demand of commercial and residential sector will be decreased by 14% and 27% respectively from 2013 level. Based on this outlook, the government has responsibility for the Act on Promotion of Global Warming Countermeasures (26% GHG reduction until 2030 from the 2013 level).
- Environmental division of the local municipal government allows the demonstration of local environment strategies. All prefectures and large cities must establish action plans for their local governments for GHG reduction in their territories.

- In the environmental assessment of city block development, CASBEE (Comprehensive Assessment System for Built Environment Efficiency) is often applied for whole city block (CASBEE for urban development) and/or each building (CASBEE for buildings for new construction).
- Several cities were selected as “Eco-model City” and/or “Future City” by Japanese Government. These cities are working on ambitious goals and making pioneering efforts to realize the low-carbon society. Future city aims to create the urban city and community with the sustainable economic and social system that can respond to the issues of aging and the environment.

Table B.7.1: Japan’s Measures Part 1

No	Measures	Intent of Measure	Related Themes	Related Strategic Measures
59	Eco-Model City / Future city	Encourage	Authority	Set Vision and Targets, Implement monitoring of energy consumption and GHG emissions
60	Low-Carbon City Act	Enable	Authority	Make Full Use of Legal Frameworks
61	Liberalization of energy market	Encourage	Authority	Implement Effective and Efficient Organizational Processes
62	Stakeholder cooperation	Enable	Authority	Stakeholder Engagement & Involvement
63	CASBEE	Encourage	Tools	Design of Urban Competition Processes

Table B.7.2: Japan's Measures Part 2

No	Entry point Urban Planning	Entry point Energy Planning	Motivation to using	Distribution/Benefit
59	Project initiation	Project scoping	Enables ambitious target setting for entire project	Provides examples to future projects
60	Project initiation and target setting	Project initiation	Low Carbon City Development Plan	Provides transparency for public review
61	Project initiation	Design strategies / scoping.	Allows renewable energy options and energy management to be included	Immediate acceptance of renewable options
62	Project initiation Allows target setting through wide-scale discussion	Project initiation	Accepted standards for Building Energy Efficiency, DHC, etc.	Transparency in approach by both land-use and energy planners
63	Design scoping & selection	Design scoping & selection of renewable energies	Across the board use of comprehensive assessment tool for building, residential building, community, city.	Consistent approach to energy improvements

Contact person for further information: Yoshiyuki Shimoda, Osaka University

B-8. Netherlands

B-8.1 Political system

- A decentralised unitary state, the Netherlands comprises 12 provinces and 418 municipalities. All three levels of government participate in the land-use planning process.
- The energy supply and distribution in the Netherlands is overseen by the Ministry of Economic Development which is responsible for the regulation and pricing of the energy delivered throughout the country.
- The country has a significant internal supply of natural gas and refining capacity for oil. It has a good reputation for energy efficiency but needs a lot of effort to achieve its 14% of renewable electricity goal on the distribution grid in 2020.

B-8.2 Energy planning in the Netherlands

- The State government will specify routes for power lines (from 220 kV) and sites for power generation (from 500 MW). It will also initiate the discussion on a transition to a sustainable, renewable energy supply. This includes making the electricity infrastructure suitable for more decentralised power generation in the longer term.
- The State government along with the provincial authorities will plan space for major energy delivery infrastructure such as onshore wind farms. It will also ensure a similar area of space is reserved for offshore generation.
- Both State and Provincial governments prepare visions for the delivery and consumption of energy within the country. Overall planning for energy infrastructure planning is undertaken in close cooperation with the land-use planning through a country-wide Spatial Planning Strategy.
- The provision of energy to the communities is the responsibility of the private sector through franchise agreements.

B-8.3 Land-use planning in the Netherlands

- Guidance for spatial planning is governed by the Spatial Planning Act and delivered by the Ministry of Infrastructure and the Environment.
- The planning process in the Netherlands involves the State, Provincial and Municipal governments producing structured visions that are related to their strategic policies as well as directions as to how to execute these policies. An important feature is that each vision applies only to the level of government that created it – i.e. the requirements placed on a provincial government are not transferred downwards to the municipal governments (no shifting of responsibilities).

- Municipal governments are also responsible for developing land-use zoning plans for existing as well as future land use. These land-use zoning plans are submitted and approved by the respective provincial government.
- Collaboration between provinces and municipalities to create regional plans is also possible, creating focus on specific issues such as economic competitiveness (Amsterdam Metropolitan Area development 2040) or energy security (Parkstad Limburg Energy transition Palette).

B-8.4 Strategies for energy planning

- Regional & cooperative arrangements between province, municipalities and cities to address shared issues and to reduce the overall infrastructure costs.
- In some cities roadmaps are developed to reach ambitious long term goals (e.g. by the method of Integral Spatial Realistic Scenario)
- In Amsterdam the urban planners and energy planners are organised in one department and develop an atlas for all energy and urban planning issues. They make use of the same atlas in which data is collected for the whole city with respect to most of all resources.
- Some cities combine energy planning with urban harvest approaches (UHA)
- National programmes for sustainable zero-energy renovation ('Energiesprong') (Long term) Energy Agreements between the relevant private sectors,(local) governments and knowledge institutions.

Table B.8.1: Netherland's Measures Part 1

ar	Measures	Intent of Measure	Related Themes	Related Strategic Measures
64	Trajectory approach (Research / Demonstration / Implementation)	Encourage	Authority, Targets	Implement Effective and Efficient Organizational Processes
65	The application of the ISRS (Integral Spatial Realistic Scenario) for reaching zero-energy on a city level	Encourage Enable	Authority, Targets, Tools	Develop Renewable Energy Strategies, Set Vision and Targets
66	Energy potential mapping	Enable	Tools	Make Use of Tools Supporting the Decision Making Process
67	Urban Harvest Approach (UHA)	Enable Enforce	Tools	Make Use of Tools Supporting the Decision Making Process
68	Energy Atlas	Encourage Enable	Authority, Tools, Feedback	Develop Renewable Energy Strategies
69	Long term agreements	Enforce	Authority, Feedback	Stakeholder Engagement & Involvement
70	Strength of the regions	Enable, encourage	Information, Feedback	Set Vision and Targets
71	Integration of urban and energy planning	Enable , enforce	Authority, Tool	Implement Effective and Efficient Organizational Processes

Table B.8.2: Netherland's Measures Part 2

No	Entry point Urban Planning	Entry point Energy Planning	Motivation to using	Distribution/Benefit
64	Planning scenarios	Energy planning strategy & future scenarios	Proven concept on a system level	Within the scope of housing company, locally and on a national scale
65	Project outset	Energy planning scenarios & strategy	Creates realistic scenarios for the overall strategy Energy neutral approach to growth	Applies across the board; from cities to individual institutions
66	Scenario building	Infrastructure assessment & strategy scenarios	Makes effective use of all energy and land-use resources in the area	Holistic information transferable to future projects
67	Project initiation	Project scoping	Integral approach to planning. Evaluates and includes all local resources and material flows	Maximises local benefits
68	Scenario building	Project outset	Encourages stakeholder involvement based on all available and realistic data	Open source information and transferable
69	Stakeholder engagement	Stakeholders engagement	Quantifies stakeholder responsibility	Open source / transparent agreements
70	Making the business case more healthy, by including energy benefits	Energy Transition needs an broader approach	Making both the energy transition and sustainable regional development more feasible	Exchange bottlenecks and solutions between regions. Optimising the national instruments.
71	Energy Atlas	Energy Atlas	Shared responsibility urban and energy planners	Within the municipality and meeting national goals

Contact person for further information: Jacques Kimman, ZUYD University & Netherlands Enterprise Agency (RVO.nl)

B-9. Norway

B-9.1 Political system

- A political system functioning as a democratic constitutional monarchy.
- Executive power is exercised by the King's council with a cabinet led by the Prime Minister of Norway. Legislative power is vested in both the government and the Storting (parliament) which is elected along multi-party lines. The Judiciary is independent of both the executive branch and the legislature.
- Although a constitutional monarchy, the King holds essentially symbolic power. The Council of State is formally convened by the reigning monarch as is the appointment of the Prime Minister. The Council of State consists of the Prime Minister and his/her council.

B-9.2 Energy planning in Norway

Energy planning - State Level

- Norway is one of the largest energy exporters in the world.
- Electricity generation is predominantly hydraulically produced. Direction from the state government has been passed to the municipalities to promote the use of renewable energy to displace the small amount of fossil power remaining for heating purposes.
- Acting on EU directives as regards climate change and greenhouse gas reduction requirements, the state government created a White Paper on energy policy in 2016 to cover the period up to 2030. The main message is that security of supply along with consequences for climate and economic growth must be considered together to secure an efficient and climate friendly energy supply. Norway has GHG reduction target of 40% by 2030 and aims to be carbon neutral in 2050.
- The national government is responsible for providing guidelines for the monitoring and measurement of GHG emissions, thereby providing consistent tools for municipal use.
- The state government also provides guidance on the national issues associated with energy generation and delivery. This includes the development of prosumer agreements, defining the terms and conditions for energy interchange.
- The use of district energy is managed at the state level by the allotment of district energy operating licences for specific areas.

Energy planning - Municipal Level

- Municipalities should incorporate the impact of climate and energy in their planning. In support of this there exists national planning guidelines.
- Municipalities and the utilities are responsible for implementing the energy and climate change policies described in the government's white paper and energy act. Many communities have therefore developed green strategies and many of them propose targets beyond those specified by the national government.

- The energy utilities are responsible for preparing periodic regional power system studies that highlight the need for system improvements. They are also required to provide input and reviews for the Municipal Master Plans. In some communities the utilities are required to be involved with municipal planning issues when energy demand is implicated.
- The energy utility is responsible for the delivery of energy to the outside of the property and the developer / building owner is responsible from that point on.

B-9.3 Land-use planning in Norway

- Municipalities are responsible for implementing climate change strategies proposed by the national government through the application of the Planning and Building Act. While not having explicit control over energy generation and distribution the municipal planner is nevertheless responsible for urban form and climate and therefore has influence over the nature of the energy supply. The use of incentives and bylaws for developers to include renewable energy systems or connect to renewable energy networks are typical tools used in municipalities.
- The Master Plan comprises two sections, one related to social issues and the other related to land-use. The section concerning social issues must contain a 4-year plan with associated actions that are revised annually. The land-use section includes roads, railways, airports as well as cycling networks, public transport networks and hubsparking and pathways. All plans are approved by Council.
- The Master Plan, as required by the Planning and Building Act is supported by a climate plan and energy plan and Action Plans as required. The Action Plan must be reviewed / updated annually and must have at least a 4-year cycle. Climate and Energy plans need revision only when in conflict with the municipal master plan.

B-9.4 Strategies for energy planning

- Some municipalities develop their own Green Strategies in which they define long term climate change goals and actions that will lead to their completion. For example The *Green Strategy* for Bergen indicates an internal directive to move the building sector to fossil-free by 2030. To support this (and other) moves the city has created a Climate & Environment Fund with an input of NOK 500,000 per year. Likewise the Oslo *Green Change* proposes a series of strategic objectives including awareness building, industrial involvement and the use of climate budgets in the municipal budgeting process.
- Utilities are involved in energy related urban planning. The use of simulation tools allows them to examine the use of alternative approaches. For example, Oslo is developing a map for the use of solar energy.
- Suggestions are to employ greater use of visualisation tools to better understand the holistic impact of GHG targets and proposed actions.

Table B-9.1: Norway's Measures Part 1

No	Measures	Intent of Measure	Related Themes	Related Strategic Measure
72	Enova Funding	Encourage	Tools	Make Use of Tools Supporting the Decision Making Process
73	Prosumer agreements	Enabling	Authority, Tools	Make use of Tools supporting the decision-making process, Make full use of legal frameworks
74	Green Strategies	Encourage	Information	Develop Renewable Energy Strategies
75	Large scale deployment of smart meters	Enforce	Feedback	Implement Monitoring of Energy Consumption and GHG Emissions
76	EI Hub	Enable	Tools, Feedback	Stakeholder Engagement & Involvement, Make use of Tools supporting the decision-making process
77	Strategy for charging stations	Encourage	Information	Develop Renewable Energy Strategies

Table B-9.2: Norway's Measures Part 2

No	Entry point Urban Planning	Entry point Energy Planning	Motivation to using	Distribution/Benefit
72	Preliminary design	Preliminary design	Proven concept, known to attract industrial partners	Reduced fossil fuels and increased renewable energy
73	Final design	Final design	Facilitates multiple stakeholders in the operation of the energy grid	Transparency of operation
74	Project concept	Project concept	A plan that involves the greatest portion of the population	Has the buy-in from both the public and the authorities
75	Project approval	Ongoing	Provides detailed monitoring approach to verify the actions	The collected data creates a sound basis for future planning and decision making
76	Preliminary design	Preliminary design	Provides a resource for the simulation of action options	Transparency in decision making
77	Project concept	Project concept	Facilitates the inclusion of alternate transportation means.	Removes responsibility from developer.

Contact person for further information: Inger Andresen, NTNU; Åse Lekang Sørensen, SINTEF

B-10. Switzerland

B-10.1 Political system

- The politics of Switzerland take place in the framework of a multi-party federal democratic republic, with the Federal Council of Switzerland as the collective head of government and state.
- Executive power is exercised by the government and the federal administration rather than any one single body. Legislative power is vested in both the government and the two chambers of the Federal Assembly.
- The same system is used for the three administrative levels of the 2,600 municipalities in the 26 cantons. If the community is of village size then the parliament representing the people does not exist. Also the ordinary law does then not exist, only the constitution of the village.
- It is important to note that citizens are charged with a high level of political decision making in Switzerland. Direct democracy allows any citizen to challenge any law approved by the parliament or propose modifications to the federal Constitution. In addition, the municipal assemblies vote on changes to "town statutes" (Gemeindereglement), addressing such matters as the use of public space or financial commitments that go beyond the authority of the executive branch, and on immigration.

B-10.2 Energy planning in Switzerland

Energy planning - Canton level

- The Cantons are responsible for Regional Energy Planning that consists of a map and a report that oversees at least the electricity grid of the region.
- Cantons also identify the potential for external heat potential such as the use of waste incineration plants, sewage plants etc, the areas for which protection must be applied for ground water, eliminating the use of ground water heat exchange and indication for potential for wind parks. Some Cantons also oblige municipalities to develop and adopt a local spatial energy planning and define priorities for the use of heat sources.

Energy planning - Municipal level

- Each municipality is responsible for its Local Spatial Energy Planning which has to be in line with the overlying principals of the Regional Energy Planning undertaken at the Canton level.
- The municipality is also responsible for setting the legal basis for certain aspects of land use planning

B-10.2.1 Energy planning in Basel

- No official Energy Planning Process as yet in Basel
- Energy Utility Basel (IWB) does Energy Planning:
 - Commissioned by the city of Basel to guarantee a sustainable energy supply
 - Private company of the canton and an independent public institution
 - Their assignment is constituted in the cantonal IWB law
 - IWB law demands for a well-balanced energy supply based on different energy carriers and to provide and push renewable energies.
- Involvement of the population:
 - The top management body is the board of directors
 - Together with their members they have the entrepreneurial responsibility
- Strategy of IWB:
 - Offer 100% renewable heat by 2020 (42% of the houses in Basel are connected to the district heating system). Today it's about 60%.
 - IWB offers only renewable electricity to their clients as regional production

B-10.3 Land-use planning in Switzerland

Figure B-10.1 shows the Swiss urban planning process.

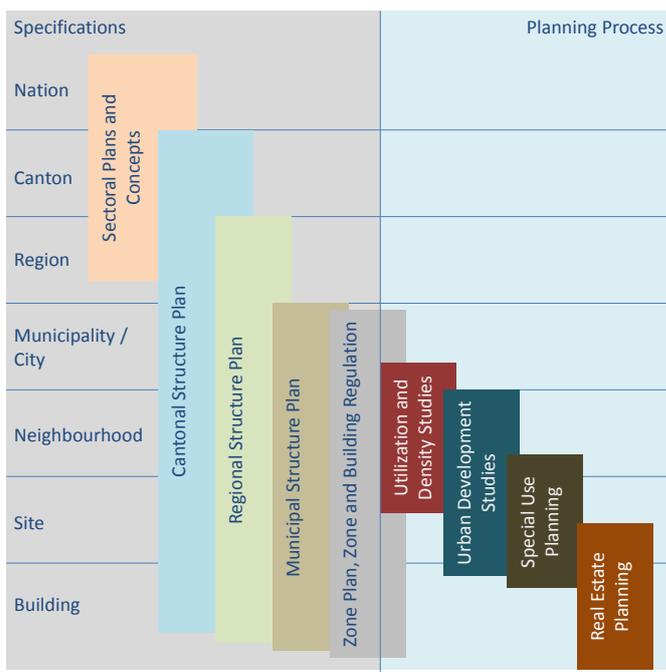


Figure B-10.1: Urban planning process in Switzerland (Source: Intep GmbH, 2016)

- The spatial planning tasks of the federal government:
 - Framework legislation
 - Promotion and co-ordination of cantonal spatial planning
 - Taking account of spatial planning when fulfilling federal tasks
- The spatial planning tasks of the Cantons:
 - Spatial planning and building regulations
 - Cantonal structure plan (binding on authorities and covering whole territory)
- The spatial planning tasks of the Municipalities:
 - Land use planning binding on landowners (building area and the non-building area and type and extent of specific building use in the building zones)
 - Special land use plans which often regulate very specific building projects

B-10.4 Strategies for energy planning

- Special-use plan - Special use plans specifies the use and defines the principles of design for certain areas in which the construction and legal framework is insufficient. In settlement area special use plans often have the purpose to secure urban and architectural quality. Often special use plans are also used to regulate the construction and operation of large, space -related buildings and equipment, for example energy related requirements often with the counter offer of a higher degree of utilization.
- 2000-Watt-Society – the vision for a "2000 Watt Society" was developed in 2006 at the Swiss Federal Institute of Technology (ETH) in Zurich, Switzerland (2000Watt, 2016). It calls for a continuous reduction in Switzerland of energy consumption from 6,500 watts primary energy today to an average global energy consumption of 2,000 watts per capita (1,500 watts renewable and 500 watts non-renewable energy) and a cut in Global Warming Potential from 8.7 tons to 1 ton CO₂-equivalent until 2100 at the latest. The advantage of this vision is that it is applicable in the global, national as well as local levels. Some cities in Switzerland have asked their citizens for a commitment and an explicit mandate to follow the goals of the "2000-Watt-Society". In a referendum held in 2008, three-quarters of the Zürich population voted in favour of achieving the 2000-Watt Society by 2050, making it the first city in the world to give these ambitious goals a democratic legitimacy and enshrine them in the constitution (Stadt Zürich, 2016) The vision of the "2000-Watt-Society" founds the basis for the "2000-Watt-Site" certification scheme
- 2000-Watt-Site certification scheme - On a development site scale (e.g. former industrial area), a research project funded by the Swiss Federal Office of Energy and the Office for Building Construction of the city of Zurich has developed a methodology and tool to calculate and plan the energy efficiency of areas to be

developed. The simple tool assists investors and planners in calculating the total energy consumption and greenhouse gas emissions on the basis of the preliminary design stage with a limited amount of information: retrofit or new construction, planned mix of use (e.g. living, restaurant, floor area). The underlying default values can be adapted on the basis of the full planning stage. The results are presented in a way to easily gather insights, where the project could be improved in terms of energy efficiency and environmental impact. The methodology makes use of the principles applied to single buildings in the Energy Path of Efficiency document published by the Swiss Society of Architects and Engineers as well as from the “Energy City” (“Energierstadt”) quality management and certification system for energy efficient municipalities (Energierstadt, 2016).

- The project is validated using a twofold approach that comprises quantitative evidence, described above and qualitative assessment. Like the «Energierstadt» label for municipalities, the qualitative assessment for the 2000- Watt Site uses a point system. The qualitative assessment covers five areas: management system, communication and cooperation, supply and disposal buildings and mobility. To apply for the certificate, at least 50% of the potential points must have been obtained in each area. The certificate for 2000-Watt Sites is fixed-term. It must be periodically renewed with a current performance assessment.
- Spatial Energy Planning - Energy City (Energierstadt) offers a tool box for communities to plan a future-proof energy supply. It is made out of seven modules: Purpose and Meaning, Action, Energy Demand, Energy Potential, Heat Generation, District Heat System, Application and Learning Control.
- The Spatial Energy Planning coordinates the energy supply and brings it in agreement with the structural development of a municipality e.g by defining priority areas for certain energy uses such as District Energy. With a focus on the heat supply and the use of local renewable energy sources, the spatial energy planning can be an important component of a holistic municipal energy concept. The latter also deals, among other things, with the areas of electricity and mobility.

The spatial energy planning provides the basis to optimize the heat supply in the community and to design it future-proof. At the same time the energy policy principles can be set binding. The following criteria must be observed, security of supply, cost effectiveness and environmental sustainability. It is a strong instrument, e.g. local authorities are allowed - based on the priorities defined in spatial energy planning – to issue obligations for house owners to connect to a district heating grid when substituting/restoring their heating system. (However, it has to be considered that obligations binding for landowners usually need to be agreed on by the municipal assemblies.)

The spatial energy planning is also helpful to coordinate infrastructure investments between the energy suppliers active in the region. This is often relevant regarding district heating systems and natural gas grid. Usually it makes sense to define separate “priority areas” for the two systems to avoid competing for connections in the same area, as this could result in low heat density and make both systems inefficient and expensive.

Table B-10.1: Switzerland's Measures Part 1

No	Measures	Intent of Measure	Related Themes	Related Strategic Measure
78	2000-Watt-Site Certification scheme	Encourage (when voluntary) Enforce (when in special use plan)	Targets, Information, Tools	Design of urban competition processes, Implement monitoring of energy consumption and GHG emissions, Stakeholder Engagement & Involvement
79	2000-Watt-Society	Encourage Enforce (when in special use plan)	Targets	Set Vision and Targets
80	Spatial energy planning	Enforce (when obligations for landowners) Encourage (when coordination between energy suppliers)	Tools	Develop Renewable Energy Strategies
81	Energy City	Encourage	Tools, Feedback	Implement monitoring of energy consumption and GHG emissions, Develop Renewable Energy Strategies
82	Special Use Planning	Enforce	Authority	Make Full Use of Legal Frameworks

Table B-10.2: Switzerland's Measures Part 2

No	Entry point Urban Planning	Entry point Energy Planning	Motivation to using	Distribution/Benefit
78	Design approval	Information from Energy Structure Plan (if existing)	Higher value of the energy efficient buildings & freedom to optimize Private: setting themselves off from the crowd Less tenant turnover High publicity Assurance that site is in line with energy strategy	Through Special Use plans & high publicity Supports implementation of long term targets of Energy Cities Cooperation tool for planning authorities and investors (creates a common language) Holistic approach
79	Any planning stage	Basis of energy planning process Can be entered at any point in the planning process	Global goal High publicity Covers more than the planning and construction process	Through legislation (e.g. Zürich) Through Special Use plan Through Energy plan Creates a common vision
80	Special Use Planning & Regular zonal planning	During Zone Planning process or Special Use Plan Can be entered at any point in the planning process	High publicity Facilitates the sustainable and efficient heat use	Efficient heat supply on local level Holistic information
81	Any planning stage, accompanying the whole process	When organising, designing, implementing and monitoring the energy concept	Holistic approach for considering the inclusion of energy related topic in each of the planning phases	Audit and certification as prove of action and for political buy-in Integration of all departments (horizontal involvement)
82	Zone planning (basis) Project design (concrete application)	When designing the project incl. energy concept	Possible Win-win situation for municipality (better energy concept) and developer (higher floor area ratio)	In zone planning

Contact person for further information: Maren Kornmann, ENCO; Daniel Kellenberger, Intep GmbH

B-11. United States of America

B-11.1 Political system

- The United States of America is a federal constitutional republic of 50 States, containing nearly 20,000 separate incorporated communities.
- The provision of energy to the communities is largely the responsibility of the private sector through franchise agreements, though some community cooperatives serve local and regional customers. The large energy companies often provide electricity and/or natural gas to a variety of states. For the State of Minnesota for example much of the electricity and natural gas is provided by Xcel Energy. Additional gas and electric energy companies, such as Centerpoint Energy and Minnesota Power serve some regions.
- In general, each State has adopted in principle the use of the Uniform Building Code or more recently the International Building Code; standards that have been developed through a consortium of organisations across the US.
- Municipalities have the responsibility for land-use planning, including developing Comprehensive Plans that cover a variety of issues from land use to housing, transportation to parks. Zoning ordinances are widely used to regulate land use and development at the municipal scale.
- Comprehensive Plans are mostly autonomous although a State or regional government review is sometimes undertaken.

B-11.2 Energy planning in the USA

Energy planning - State level

- Energy planning is undertaken by the energy provider based on the expected growth projections for the franchise area. Finished plans are confidential and public involvement is minimal.
- Submissions must be made to the Public Utilities Commission relating to infrastructure cost projections and rate estimates.
- Energy efficiency and other behavioural change programs may be part of the planning process where it reduces projected costs.

Energy planning - Municipal level

- Municipal or public involvement in energy planning is limited, especially relative to large scale energy utilities. Public or municipal representation at Public Utility Commission review hearings is possible to provide input or rectify complaints.

- A small number of municipalities have publicly owned utilities and produce infrastructure and energy efficiency plans for their own communities.
- Comprehensive Plans, developed by the municipalities, do not typically address energy use or energy efficiency measures.

B-11.3 Land-use planning in the USA

Land-use planning - State level

- States adopt a uniform building code but defer land-use planning authority to local units of government, including counties, municipalities, and townships.
- Many States provides population growth estimates that assist local governments as they develop Comprehensive Plans.

Land-use planning - Municipal level

- When not set by State or Regional authorities, the local unit of government is responsible for establishing guidelines for the contents and the development of a Comprehensive Plan.
- The plan typically includes reference to: land-use, transportation, housing, parks and recreation, public facilities and economic development as they might impact the future of the community over the next 10-30 years. Typically, energy is not addressed in community comprehensive plans. However, some plans may include energy or sustainability as additional subjects. Population growth scenarios use input from the State or Regional authorities. Most local governments update their plans every ten years. Updates are sometimes required by State or Regional authorities, but in other cases are conducted at the discretion of the local government.
- Energy stakeholders may be engaged in developing plans, but do not have a formal role beyond the engagement that typically occurs with all interested parties. Plan development typically includes extensive public engagement and in some cases includes the establishment of advisory groups around key issues.
- Typically, information exchange between the cities and energy providers is minimal although specific programs such as the Clean Energy Partnership in Minneapolis provide a means to ensure ongoing collaboration and facilitate the achievement of the City's energy goals/strategies with support of the utilities.
- There is typically no formal mechanism for assessing the energy impacts of proposed redevelopment projects although proponents can opt to pursue LEED or other certification, sometimes with municipal incentives. Planning incentives (density bonus, etc.) are sometimes used to encourage sustainable developments.
- No formal process for developers of alternative energy systems. Coordination with relevant private or cooperative utilities and local units of government is needed in order to develop and interconnect such systems.

B-11.4 Strategies for energy planning

- The creation of a Sustainability Office to champion the development of targets and the implementation of GHG reduction measures.
- In some municipalities the prescribed energy efforts are pursued as special initiatives of the mayor and run directly out of his/her office, thereby adding credibility.
- Develop a greenhouse gas inventory that identifies energy users and greenhouse gas impacts and then present energy-related efforts via programs, plans, and policies associated with related issues including urban planning and sustainability.
- Pursue a focus on incentives and technical assistance to homeowners and building owners to pursue efficiency updates.
- Develop agreements with private utilities to work cooperative with cities in advancing energy goals.

Table B-11.1: USA's Measures Part 1

No	Measures	Intent of Measure	Related Themes	Related Strategic Measure
83	Municipal – utility partnership	Encourage	Tools	Implement Effective and Efficient Organizational Processes
84	Building disclosure policy	Encourage	Information	Make Use of Tools Supporting the Decision Making Process
85	Greenhouse gas inventory	Enable	Tools	Implement Monitoring of Energy Consumption and GHG Emissions
86	Climate action planning targets	Enable	Authority	Set Vision and Targets
87	Climate action planning engagement	Enable	Feedback	Stakeholder Engagement & Involvement
88	Solar potential mapping	Enable	Tools	Make Use of Tools Supporting the Decision Making Process
89	Environmental impact assessment	Enable	Information	Include Socio Economic Criteria

Table B-11.1: USA's Measures Part 2

No	Entry point Urban Planning	Entry point Energy Planning	Motivation to using	Distribution/Benefit
83	Project initiation	Local goal and private utility target setting	Collaboration of diverse parties	Visible support for project
84	Data planning	Data planning	Supports design and efficiency programs	Improved collaborative design
85	Data tools for planning	Data tools for planning	Consistent assumptions in decision making	Limited ambiguity between partners
86	Target setting for planning	Energy planning strategy	Foundation for local decisions related to urban planning and energy planning (if local), basis for negotiation with utility (if private)	Transparency in vision and progress
87	Community support for planning	Community support for energy planning	Clear levels of public support with multiple perspectives	Long term vision support
88	Data collection and planning	Data collection and planning	Targets incentive programs	Ongoing technical support
89	In some U.S. states (e.g. California, Massachusetts, Minnesota), environmental impact assessment (EIA) is required for some (typically larger) public and private urban development projects. EIA analyses document a range of environmental impacts and in some cases are required to account for social and environmental impacts such as environmental justice and economic development.	EIA, when required, can provide a means of identifying environmental impacts associated with energy production, consumption, and conservation. Only California has well-developed standards for assessing GHG emissions and associated impacts from urban development projects.	At the scale of urban development projects, EIA is typically only conducted when it is required. In some cases, urban development project developers may conduct a voluntary or more extensive analysis in order to respond to public concerns related the project.	Data and analysis provided in EIA documents related to environmental impacts, including economic and social impacts, is provided with the intent of informing the project decision making. The EIA must be completed before a final decision (e.g. permit approval) is made related to the project. The public and decision makers can review the information in the EIA in order to inform their comments and decisions.

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