Energy efficiency strategic planning for municipalities

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MODULE 1

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1.1. The importance of energy efficiency actions in the municipal public sector

Governments are responsible for significant energy demand in public buildings, transportation infrastructure and utilities as they deliver municipal public services (see Table 1.1). It is in the interest of local governments and populations that municipalities provide publicly funded services as efficiently and cost-effectively as possible[4].

On this basis, this module aims to provide a brief systematic guide on how to create robust and operable strategic energy efficiency (EE) plans for the municipal public sector. It focuses on the municipality's functions as an energy consumer and how municipalities can lead by example and improve EE in their own activities. It first explains what a municipal EE strategy is and why it is necessary and relevant to develop one. It then provides a six-step guide on how to prepare a municipal strategy based on existing studies and practices.

There is extensive literature on how to conduct EE planning at national and sub-national levels, often also including the private sector, renewable energy and other climate mitigation and adaptation actions. The sources used in this module are marked as footnotes and sources for further readings can be found at the end of this module.

1.2. About strategic planning, its contents and use

1.2.1. Public-sector strategic planning and its key features

The roots of public-sector strategic planning are originally military and tied to statecraft. Governments at all levels make many different plans in their activities. What special features does strategic planning have that makes it different from other routine and non-strategic planning activities?

Table 1.1 The municipal public sector and its energy demand

Municipal public sector		Energy service
Public buildings	Offices	Lighting, appliances and equipment, space heating and space cooling, mobility and hot water
	Educational facilities	
	Health care facilities	
	Public/social housing	
	Other: sports, culture and entertainment facilities, such as libraries, theatres, museums and sports centres	
Transportation	Public vehicle fleets	
	Transport infrastructure: mass transit facilities	
Utilities	Heat and hot water supply	
	Centralized cooling	
	Power and public lighting	
	Water supply and wastewater treatment	
	Waste removal and disposal	

Based on Energy Charter Secretariat, 2008[5]

[4] The Regional Environmental Center for Central and Eastern Europe (REC) 2018. LEDS-EEP City Energy Planning Toolkit. 2018. Available at: http://documents.rec.org/publications/LEDSToolkitFinal.pdf
[5] Energy Charter Secretariat 2008. Energy Efficiency in the Public Sector- Policies and Programmes in ECT Member Countries.

Box 1.1. Differences among vision, strategy, strategic planning, roadmap and action plan when addressing EE at the municipal level.

Vision, Strategy, Strategic Planning, Roadmap and Action Plan

Governments around the world are using different terms for actions developed to achieve their goals. These are normally covered in a strategic document composed of a vision, strategic plan, roadmap and action plan. When integrating energy actions in the municipal agenda, it is important to first understand the differences between each of them and how each of these should address different aspects.

A **vision** is a description of outcomes that the municipality will strive to achieve. Related to EE, this typically refers to the outlook on how much energy and carbon emissions the municipality aims to reduce.

A **strategic plan** is a document that is used to communicate the municipality's goals and how it will achieve those goals. It can be used to create consensus among different stakeholders, secure resources and continuous efforts and hold relevant organizations accountable for achieving the goals. In this way, it is important that the energy system and its potential efficiency is included in the strategy plan from an early stage.

A **roadmap** normally covers one decade or longer and includes detailed steps to achieve certain objectives. To address EE aspects, the roadmap should make a distinction among the various sectors, including potential synergies among them.

An **action plan** addresses the schedule of actions to be taken to achieve certain goals. In recent years, many countries and local governments have issued their climate action plans. It is important that these plans set clear and quantifiable actions to reduce energy use.

On the basis of a comprehensive literature review, Bryson and Edwards (2017)[6] identified the following features that make public sector planning strategic:

- *Alignment with context*. Paying close attention to context and tailoring the strategic planning approach to the context, even though the planning typically aims to change the context. At a municipal level this might refer to demographic developments, local employment or pollution.
- *Specific purposes and goals*: Careful thinking about purposes and goals, including attention to situational requirements (e.g., political, legal, administrative, ethical and environmental requirements). For instance, municipalities should ensure sustainable development of their jurisdiction from an environmental as well as social perspective.
- *Prioritization*: An initial focus on a broad agenda and later moving to a more selective action focus. Some municipalities might face pressing issues on particular topics, such as local job creation.
- *An emphasis on systems thinking*. Strategic planning is based on understanding the dynamics of the overall system being planned for as it functions – or ideally should function – across space and time, including the interrelationships among constituent subsystems. To ensure EE improvements, it is important to take into consideration the complete energy systems perspective.
- *Stakeholder engagement.* Typically, multiple levels of government and multiple sectors are explicitly or implicitly involved in the process of strategy formulation and implementation. Key stakeholders at a municipal level are local and regional administrations, financial suppliers/investors, energy suppliers, sector representatives, citizens, government, property developers, etc.
- *SWOT analysis.* A focus on strengths, weaknesses, opportunities and threats, and a focus on competitive and collaborative advantages. In the context of EE at a municipal level this needs to assess what is most beneficial for most civilians without taking any risks for future generations.
- *Future-oriented thinking:* A focus on thinking about potential futures and then making decisions in light of their future consequences. Particularly at a national and

[6] Bryson, J. and Edwards, L. H., 2017. Strategic Planning in the Public Sector. Oxford Research Encyclopedias. DOI: 10.1093/acrefore/9780190224851.013.128

sub-national level, it is important to not lose perspective and outlook on any relevant prospects.

- *Emphasis on implementation and operability*. The strategy needs to be operable. To this end, a solid analysis of necessary and available resources needed to implement the actions should be undertaken at a very early stage in the process.
- *Pre-determined strategy and flexibility in implementation.*The strategy combines both stability and flexibility in goals, policies, strategies and processes to manage complexity, take advantage of important opportunities and advance public purposes, resilience and sustainability in the face of an uncertain future. At a municipal level there are many variables and agents that need to converge. Not every plan can be implemented as initially conceived and some flexibility will be required, especially during the implementation phase.

Although many of these actions were conceived for a national level, they can still be applied on a municipal scale. In practice, strategic plans often cover five years or longer, to provide some certainty over multiple years. During the implementation process, it needs to be reviewed regularly to assess effectiveness, make further adjustments and adapt in an iterative way. Due to rapid technology and market changes, it is advised to review the strategy at least every three years.

1.2.2. The contents and benefits of strategic energy efficiency planning for municipalities

Municipalities, in their role as a municipal public resource managers and public interest protectors, need to mainstream EE in their operations and investments and be a model to the residential and business sector in EE actions.

Strategic EE planning for municipalities is necessary and beneficial for multiple reasons. It:

- engages various stakeholders and raises the awareness on EE among them,
- creates a common understanding and on EE actions,
- creates certainty and enables long-term investment.

The size and contents of the public sector's energy consumption vary from one municipality to another. However, given the size of the public sector, municipal public energy consumption is substantial; cities are the centres of economic activity and energy consumption. For example, the public sector in Kazakhstan consumes 15 per cent of electricity and 30 per cent of the heat generated[7]. Ireland has set a target to improve the EE of its public sector by 33 per cent from the 2009 basis by 2020. One key measure was the enactment of a Public Sector EE Strategy in 2017. By the end of 2018, the country's public sector had improved 27 per cent from 2009, resulting in EUR 1.3 billion in energy savings and 4.6 million tonnes of CO_2 emissions avoided since 2009[8]. To effectively coordinate actions to tap into the enormous opportunities for EE improvement in the public sector, it is necessary to carry out strategic planning for EE-focused actions ats a municipal level.

1.3. Steps in strategic planning

To initiate the strategic planning, the core team, various key actors involved and overall terms of references for the task are developed, including the duration of the strategy, expectations for the strategic planning, timeframe, budgeting and work plan. This section presents a comprehensive approach to developing strategic planning for EE actions by municipal public sector based on six key steps (Figure 1.1).

Figure 1.1 Steps for EE strategic planning

[7] World Bank, 2018. Synthesis Report Unlocking Energy Efficiency Potentials in Cities in Kazakhstan. Available at: http://documents.worldbank.org/curated/en/267161521612788850/pdf/124484-ESM-PUBLIC-P130013-Synthesis MarchFinal.pdf

[8] Sustainable Energy Authority Ireland, 2019. Annual Report 2019 on Public Sector Energy Efficiency Performance An SEAI Report prepared for the Department of Communications, Climate Action & Environment.

Step 1 consists of a mapping of the existing goals, policies and measures to make sure that the strategy for municipal EE actions is aligned with existing policies and strategies. Step 2 involves mapping the municipal public sector's energy use – identifying how the municipal public institutions use their energy, in which forms and for what purposes (creation of baselines). Step 3 deals with estimating the technical potential for EE improvements in different energy uses and in different public institutions, with the aim of creating a strategy. Step 4 encompasses the development of a plan of action. It prioritizes the various EE improvement opportunities, based on cost and benefit analysis, and stakeholder consultation, as well as taking into account the various social, economic and environmental benefits from such actions. Step 5 is barrier analysis, stakeholder consultation and the creation of a measuring, reporting and verification (MRV) system, which allows the tracking of progress and results of any given intervention included in the strategic plan. The last step, Step 6, is about formulating, revising, finalizing and launching the strategy. The module ends with a conclusion section, on the implementation and review of the strategy.

1.3.1. Step 1 - Mapping the existing goals, policies and measures in the municipal context

Energy performance is an integrated aspect of public sector operations and investment. Implementation depends on public support and resource availability. To make the energy strategies practical and operable, it is key to analyse the municipality's framework conditions, such as mapping the existing goals, development strategies, plans and policies (especially those related to EE, low-carbon development, and green growth). Mapping the existing policies and context for the strategic mapping consists of three aspects: relevant national/regional policies, municipal policies and context, and background and expectations for the strategic planning exercise (Figure 1.2). This step helps to put the strategy in the local context and align it with existing policies and strategies to reduce the barriers to implementation.

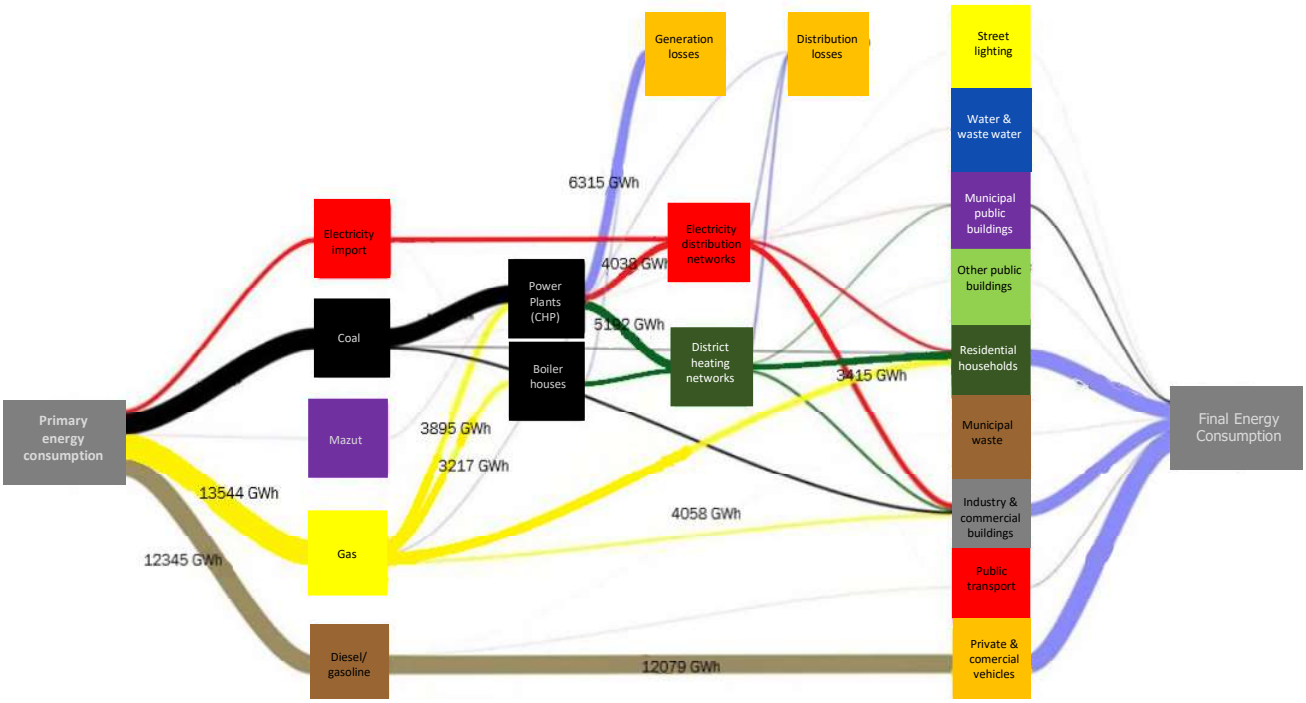
Figure 1.2 Mapping existing policies and context for the strategic planning

Another preparatory piece of work is mapping the stakeholders for municipal public sector EE, as well as their roles and responsibilities in the strategic planning process. This can include the technical and expert team, which is responsible for data collection and drafting of the strategic plan, the stakeholders to be consulted and the final decision-makers.

1.3.2. Step 2 - Mapping the energy use of the municipal public sector

Identifying the type of energy sources available is the primary step for the municipality to take informed decisions with respect to sustainable energy use, competitive economics, long-term trouble-free maintenance and operations. The decisions inevitably depend on factors such as (not limited to) geography, climatic conditions, political stability and its impact on relevant policies, market maturity of available technologies, type of energy use and availability of trained professionals to carry out all these activities. For example, while the municipalities that are catered for by fossil fuel-based electrical energy of thermal power plants, the fast-paced introduction of renewable energy and other sustainable modes of energy are expected to change the dynamics of the energy markets. This will force the municipalities to assess, understand and act accordingly with respect to efficient operations in most economical conditions. This can be presented in a Sankey diagram as shown in Figure 1.3.

Figure 1.3 Sankey Energy Flow Diagram for Almaty City in 2015 (GWh/year)



Source: World Bank's Energy Sector Management Assistance Program (ESMAP), 2017[9]

Unlike **the factors** mentioned in the previous paragraph, on which the decisions are dependent upon, mapping of energy use is often well within the reach of municipal sector. In line with the three focus areas (street lighting, municipal water supply systems and public buildings) being discussed in this Sourcebook, municipalities more likely have enough in-house resources to take different available energy infrastructure into account and cater to **the needs** of the end energy users.

The main objective is for the municipality to know and understand how much energy is used, where and, if possible, at what time. This may be provided through the analysis of desegregated energy bills, conventional metering and smart metering for all the energy sources available (electricity, gas, biomass, etc.). This way it would be possible for the municipalities to create baselines and map out the biggest energy users in their territory.

Energy mapping is a holistic approach, with the end goal being to define and integrate energy solutions across as many end users as possible[10]. Energy mapping is applicable at different scales (national, municipality level or even system level). It gives an understanding of the types and quantum of energy used for different types of end-use application based on strategic steps with reference to planning, implementation, operations and economics of related activities. While some level of mapping is available at national or even municipal level with reference to the flow of energy supply and demand, the crux of challenge lies in understanding this at a facility and system level.

Box 1.2 Key recommended steps in the energy mapping approach

- Identify high energy intensity facilities through a gate-to-gate defined boundary approach
- Develop each facility's process/system layout
- Define technology used in each section within the facility
- Determine the energy used

[9] ESMAP, 2017. Kazakhstan: Energy Efficiency Transformation in Astana and Almaty https://openknowledge.worldbank.org/bitstream/handle/10986/28927/121463-ESM-P130013-PUBLIC-KEEPAlmatyEE-PlanNovengfinal.pdf?sequence=1&isAllowed=y

[10] The City of Edmonton Energy Transition Plan, Energy Mapping Feasibility Study, Edmonton. 2014. Available at: https://www.edmonton.ca/city_government/documents/PDF/Report_3_-_Energy_Mapping.pdf

A generic approach on how it may be carried out is available in "Annex I. Guide to develop an energy mapping on a municipal level".

1.3.3. Step 3 - Assess the energy efficiency improvement potential

Several countries have included energy conservation under their legislative acts and policy instruments, mandating EE regulations to achieve their NDC mitigation targets[11]. As these national targets trickle down to sectorial targets, municipalities are one of the key stakeholders in driving city- or community-level targets.

In addition to addressing increasing GHG emissions, rising energy prices, burgeoning populations, uncontrollable growth in energy consumption and rising water demand makes it inevitable for municipalities to adopt EE measures.

EE potential scale

Box 1.3. Examples for municipal-level EE potential achieved/identified

1. Energy efficiency interventions by the Ministry of Regional Development, Construction, Housing and Municipal Economy of Ukraine and Federal Ministry for Economic Cooperation and Development (BMZ) has resulted in 5-10 per cent reduction of the annual energy cost of the municipalities. ((BMZ), 2015)[12]
2. Energy audit studies of municipal water systems in India have indicated at least 25 per cent energy and monetary savings potential. ((IFC), 2008)[13]
3. Energy conservation measures in water utilities of Sharjah Electricity Water Authority have resulted in more than 56 per cent energy savings. (TERI, 2016)[14]
4. An estimated 80 per cent of economically viable energy savings in buildings are untapped. (ESMAP, 2019)[15]
5. Local technological improvements of street lighting systems in Timeri, Guyana resulted in a 29.7 per cent lighting energy consumption reduction. (TERI, 2014)[16]

Though some countries and regions are advancing on EE technologies, as seen in the above examples, there is still significant unrealized EE potential. This calls for relentless efforts by all stakeholders.

The gap in some countries and the success stories in other countries also indicate the abundance of energy and business opportunities that exist to create and manage a sustainable environment. Further deep dive exercises shall reveal gaps at technological and operational level.

Methodology and approach

At a national, regional, municipal or city level, strategies to tackle EE activities generally use a top to bottom approach, which predominantly relies on energy and production data. The outcomes from these results are policies and mandates that are enforced upon users and suppliers. Often these parameters are also influenced by changes in their volumes and the characterstics of the economy (Abeelen, 2013)[17].

While the approach may seem acceptable, the impact of external factors directs us to also consider a bottom-up approach, in which policies are framed based on ground data. The strategies formed are more customized to sector, technology or monetary challenges, where feasible business models such as bundling of projects may make investments in EE projects more attractive and results oriented.

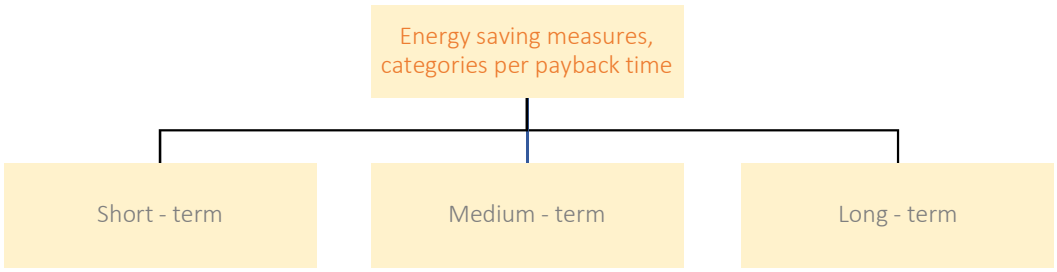
For any entity to improve their energy quality and optimize energy costs, it is invariably important to take an additional step beyond mapping, such as energy audits. Energy audits are key to a systematic approach for decision-making in the area of EE and management, which is comprehensively defined as "the strategy of adjusting and optimizing energy, using systems and procedures so as to reduce energy requirements per unit of output while holding constant or reducing total costs of producing the output from these systems" (Bureau of Energy Efficiency)[18].

The EE process starts with a review of the baseline to provide critical inputs to the energy policy for planning and developing an energy management strategy. The key interventions, entailing operational and technical measures identified in the plan, are implemented. The EE potential at system level, facility level or at a larger national level are checked, if possible, with a monitoring and auditing system followed by a

[11] Available at: https://www.wri.org/indc-definition
[12] BMZ, 2015. Energy efficiency in municipalities. Bonn: GmbH, Deutche Gesellschaft für Internationale Zusammenarbeit (GIZ)
[13] IFC, 2008. India Manual for the Development of Municipal Energy Efficiency Projects. Retrieved from Bureau of Energy Efficiency, Government of India, Ministry of Power. Availble at: https://beeindia.gov.in/sites/default/files/ctools/ManualfortheDevelopmentofMunicipalEnergyEfficiencyProjects.pdf
[14] TERI, 2016. Comprehensive Energy Audit Falaj Pumping Station SEWA. Sharjah: TERI.
[15] ESMAP, 2019. Energy Efficiency. Retrieved from ESMAP. Available at: https://www.esmap.org/energy_efficiency
[16] TERI, 2014. Energy Efficiency omprehensive Energy Audit Falaj Pumping Station SEWA. Sharjah: TERI.
[17] Abeelen, C., 2013. From top-down to bottom-up: two ways to monitor energy-efficiency in Dutch voluntary agreements. Europeon Council for an Energy Efficiency Economy. Netherlands.
[18] Bureau of Energy Efficiency, Govt. of India. 2020. Energy Management and Audit,. Available at: https://beeindia.gov.in/sites/default/files/1Ch3.pdf

review to provide further feedback to the planning stage. A brief ten-step methodology for identifying the EE potential in any system or facility is in "Annex II. Identifying EE potential through detailed energy audits". The identified energy saving measures may be further categorized as follows to justify decisions.

Figure 1.4 Energy saving measure categorization.



Detailed strategic selection criteria for EE projects are discussed in the module as well as in modules 4 and 5 of this Sourcebook.

Benchmarks and standards

For any EE activities to be successful, and for any energy saving potential to be estimated, benchmark figures and pre-set standards, be it at facility level or equipment level, are essential. These are intended as a reference for the end user and all other applicable stakeholders in relation to existing policies and technologies.

Figure 1.5 Sample Benchmark unit parameters.

Facility area or production related	Equipment / utility related
kWh/m^2/year (Energy performance Index, EPI, of buildings)	kW/ton of refrigeration (air conditioning plant)
kWh/Mt clinker or cement produced (cement plant)	% thermal efficiency (of a boiler plant)
kcal/kWh power produced (Heat rate of a power plant	% effectiveness (in a cooling tower)

There are different EE studies, energy benchmarking reports and standards for energy-intensive sectors.

Box 1.4 Sample energy and GHG benchmarking rating systems

Depending on the location type and applicability, there are energy and GHG benchmarking rating systems, such as:

- Energy Star in the US (http://www.energystar.gov/index.cfm?c=business.bus_index)
- Energy Performance Certificates in the EU (https://ec.europa.eu/energy/eu-buildings-factsheets-topics-tree/energy-performance-certificates_en)
- National Australian Build Environment Rating Systems (NABERS) in Australia (https://www.nabers.gov.au/)
- Asia Pacific Economic Cooperation (APEC) Energy Standard Information System (ESIS) (http://www.apec-esis.org/)
- Greenhouse Gas Emission Baselines and Reduction Potential from Buildings in Mexico (https://www.unenvironment.org/resources/report/greenhouse-gas-emission-baselines-and-reduction-potentials-buildings-mexico)
- Emission Baselines and Reductions Potentials from Buildings in South Africa (https://www.unenvironment.org/resources/report/greenhouse-gas-emission-baselines-and-reduction-potentials-buildings-south-africa)
- Energy Conservation Building Code in India (https://beeindia.gov.in/sites/default/files/BEE_ECBC%202017.pdf)

The key resources in this EE process, which continuously drive the technical, financial and operational aspects, are human resources – basically qualified energy managers, energy auditors and sectorial policy analysts. Hence, building in-house capacities at national and regional level for energy auditing and management expertise is critical for municipalities.

Though international expertise is required from time to time for the municipalities, particularly in low income and other developing countries, to stay updated with international standards, frequent use of such services may turn out to be very costly and hence not sustainable at times for EE activities. In the long run, local expertise at national, regional and municipal body level needs to be developed and enhanced to carry out energy management and audits.

EE has dramatically improved through capacity-building and energy audit programmes implemented either under externally aided programmes or by private energy consultants. Such programmes have resulted in significant savings in energy and corresponding costs. In many countries, certification schemes at national level have been formulated and implemented. This has, in a few cases, led to successful market-based mechanisms in the field of EE.

Box 1.5. Example of a successful EE market mechanism[19]

The certification of energy auditors and managers in India has enabled successful implementation of Perform Achieve and Trade Mechanism (PAT) which resulted in 8.67 Mtoe/year savings, which is 30 per cent above the targeted savings from eight energy intensive sectors in the PAT Cycle-I alone.

Source: Ministry of Power, Government of India.

With the database of possible energy conservation potential and associated measures, municipalities may develop implementation strategies based on the outcomes of the energy economic feasibility studies. These are briefly introduced in the following section.

[19]Bureau of Energy Efficiency, India, n.d. Available at: https://beeindia.gov.in/content/pat-cycle

1.3.4. Step 4 - Development of an action plan, methods and criteria for strategic area selection

The prioritization of the area or areas of energy intensive facilities/production/operational units to be included in the EE strategic plan of the municipality is an important first step in the process of developing an EE strategy. It is equally important that the prioritized areas, besides being the most important areas from the point of view of energy users, are also the areas in which there is potential for new policies, programmes or projects that can help to meet the EE target set by the municipality. Regardless of the level of ambition of the EE target, achieving it will not be possible without the implementation of one or several sound programmes or projects aimed at achieving the target. For this, financial resources and existing capacity must be in place. It is therefore crucial that the prioritized areas have been selected through a systematic and thorough process, and that the benefits outweigh the costs. It is also crucial that they contribute to achieving the target for the specific area within a reasonable payback period.

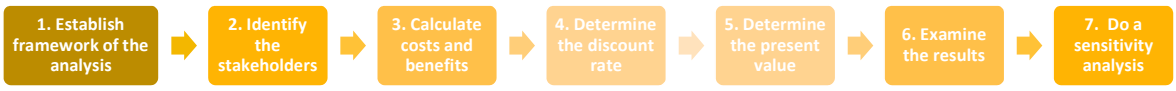
Several methodologies can be used in the prioritization process, with some of them more complicated than others, and requiring more expertise, time and resources. Two of the most-used methodologies are the cost-benefit analysis (CBA) and the multi-criteria analysis (MCA). Both methodologies have their advantages and disadvantages. Their accuracy will depend on the reliability of the data used, particularly in CBA. In both cases, the identification of relevant stakeholders to be involved in the discussions is very important. There is extensive literature on the two methodologies (see for example Oscar A. Preciado-Perez, 2017, D.W. Pearce, 1983, Robert J. Brent, 2017, Dodgson et al. 2009). Therefore, in this module we will limit ourselves to a brief introduction to these two methodologies. This will give the reader enough understanding of the methodologies and allow decision-makers to make the right choice.

Cost-benefit analysis (CBA)

The CBA is a tool that helps to evaluate, in monetary terms, the benefits against the costs of a given intervention, project or programme. If the benefits outweigh the costs, the intervention is normally justified. For this, a list of all the expenses and benefits the intervention is expected to give rise to should be created; this will allow a decision on whether the intervention is worth or not. From the estimated result, return on investment (ROI), internal rate of return (IRR), net present value (NPV) and the payback period can be calculated. In this context, it is very important that the data collected is accurate. It is also important that the same currency is used for the calculations, i.e., all the expenses and benefits should be converted to the same currency, thus making the comparison fair (apples to apples). Below is a suggestion of seven steps that can be followed in a CBA (see Figure 1.6):

1. Establish the framework for the analysis. Here, existing plans, municipality development priorities, baseline and EE improvement potential should be identified. This information should be distributed to the stakeholders to be involved once identified.
2. Identify the stakeholders to be involved in the discussions. All relevant stakeholders should be identified and listed from the very beginning. Involving them early will give the intervention more legitimacy and thereby greater acceptance.
3. Calculate the costs and benefits across the expected life span of the project or programme.
4. Determine the discount rate. This will express the amount of interest as a percentage of the balance at the end of a given period. See afterwards how the result could be affected by using different discount rates.
5. Determine the present value. This is a measurement of profit that is calculated by subtracting the present values of cash outflows from the present values of cash inflows over a period of time.
6. Examine the results and use them as the basis for a decision or recommendation.
7. Conduct a sensitivity analysis. Costs, benefits and risks are often not known with certainty. This allows the possibility of adapting/changing some of the key parameters to potentially mitigate some of the risks.

Figure 1.6 Sequence of the seven steps in developing a CBA.



Source: Adapted from 10 Steps to the process of Cost Benefit Analysis. Project Management Controls[20]

[20] Landau, P., 2018. Cost Benefit Analysis for Projects – A Step-by-Step Guide. Available at: https://www.projectmanager.com/blog/cost-benefit-analysis-for-projects-a-step-by-step-guide

As mentioned earlier, there are advantages and disadvantages with both methodologies. One of the advantages of the CBA, which is essentially a data-based decision-making tool, is that if reliable data is used, it can give a relatively accurate evaluation on whether a project or programme is worth implementing. Among disadvantages are the one related to the exogenous factors like interest rate and inflation, which are beyond the control of the planners and can affect the result of the evaluation.

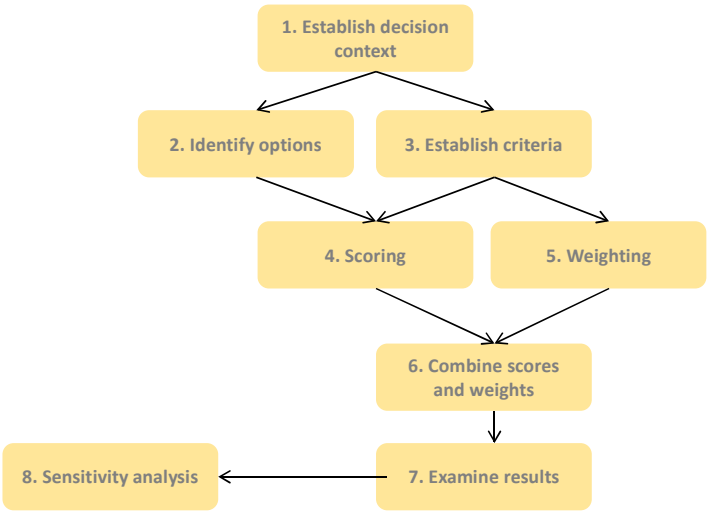
Multi-criteria analysis (MCA)

The MCA is a methodology that, in a systematic way, identifies the preferred options to achieve a specific objective or target that the corresponding municipality has set. It uses a weighting system in which different options are given numerical scores that are ranked based on predetermined criteria. The ranked options are short-listed for a subsequent evaluation. This can be done by a team of experts or/and in consultation with relevant stakeholders. The last relies on the judgements of the stakeholders or experts, thus making the MCA a more participatory approach compared to the CBA. This may give the results from the decision-making process more legitimacy when a consensus among involved stakeholders is reached and, therefore, greater public acceptance. As with the CBA, there is extensive literature on the topic; therefore, we will limit ourselves to providing a brief introduction to the methodology. For a detailed description of how the MCA works, see, for example, Dodgson et al., 2009.

Below are the eight steps that can be followed when using the MCA (see Figure 1.7).

1. *Establish the decision context*. Similar to the CBA, it is important to assess the current situation (baseline), the potential for EE improvements and what the municipality wants to achieve (target).
2. *Identify options*. Review existing EE plans and other national documents and discuss with the involved stakeholders, thus identifying the various options (programmes or projects) that can help to achieve the target.
3. *Establish criteria*. To compare and evaluate different options, which projects or programmes are more appropriate to achieve the target, criteria must be defined.
4. *Scoring*. The identified options are evaluated based on the selected criteria and given a numerical score (for example 1-100) based on performance. To see how well they meet the previously established criteria, a performance matrix is created, where preferred options are given a higher score.
5. *Weighting*. The level of importance among selected criteria to be used for the evaluation of the options may vary; therefore, numerical weights are given to each criterion. This allows scores to be converted to a common scale that can be used to judge the importance of each criterion.
6. *Combine scores and weights.* Scores and weights of each option (project or programme) are combined to calculate an overall value, thus getting the weighted score of each option. The total weighted score of an option (project or programme) is the sum of its scores for each criterion multiplied by the corresponding weights.
7. *Examine the results.* The ranking of the options is given by the weighted average of all the scores. Examining the results gives an indication of how much better one option is over another.
8. *Conduct a sensitivity analysis.* This allows an examination of to what extent the accuracy of the inputs or disagreements between stakeholders may affect the final result.

Figure 1.7 The eight steps to conduct the MCA suggested in this module



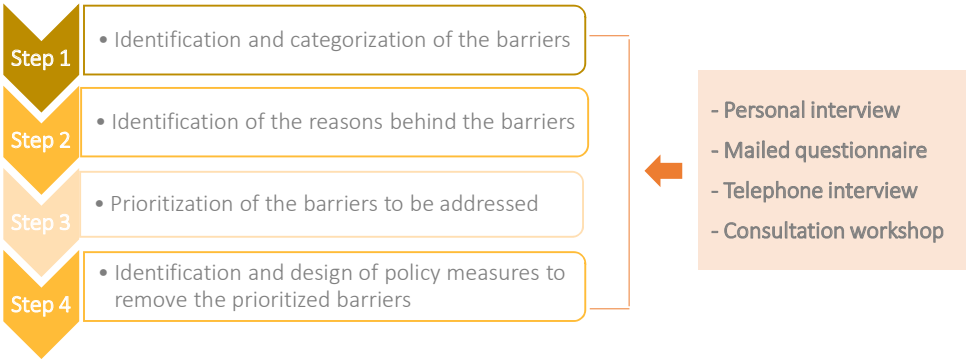
Source: Adapted from TNA step by step Guidebook, 2019[21]

[21] Haselip, J., Narkevičiūtė, R., Rogat, J. and Trærup, S., 2019. TNA Step by Step- A guidebook for countries conducting a Technology Needs Assessment and Action Plan. Available at: https://tech-action.unepdtu.org/wp-content/uploads/sites/2/2019/04/2019-02-tna-step-by-step-guide.pdf

1.3.5. Step 5 - Barrier identification and analysis through stakeholder consultations

Barriers to investing in EE can be understood as the reasons hindering or preventing investments in EE initiatives or projects from taking place. The reasons may be of varying types and degrees of importance, and vary from country to country depending on local circumstances, such as energy prices, structure of the market, regulatory frameworks, incentives/ disincentives, culture, etc. Barriers may also depend on external factors, which may be beyond the control of local authorities, low global oil market prices or political unrest being some of them. Barriers constitute a hindrance not only for investors, but in many cases an impediment for energy planners in municipalities to develop long-term EE strategic plans. It is therefore important for municipality mayors and other decision-makers at the local level to identify these barriers and understand the reasons for their existence, thus being able to address them in the best possible way before developing any EE strategy plan. In this module, a four-step process is suggested for the analysis, including the methodology to be used for the analysis (see Figure 1.8).

Figure 1.8 Barrier analysis: four-step process



The identification and categorisation of the barriers is a crucial first step in that it will help to understand the nature of the barriers and thereby, how they can be addressed. Table 1.2 shows an example of some sub-categories and the category of barrier they belong to.

Table 1.2 Barriers to EE projects on a municipal scale

Category	Sub-category
Economic and Financial	• Lack of budgetary autonomy on a municipal level • Financing restrictions, e.g. some municipalities might have caps on the amount of debt they can assume • Low global and/or local energy prices • High upfront capital expenditure (CAPEX) • High cost of capital (high interest rate) • Lack of access to financing • Long payback times, i.e. return on investment • Higher transaction costs for public sector projects
Market structure	• Few suppliers (oligopoly) of technologies/services or one single supplier (monopoly) • Limited municipal incentives to save energy and try new approaches
Legal and Regulatory	• Subsidies to existing technologies/services or energy • Highly controlled/regulated markets • Political instability
Institutional, inter-organizational and administrative	• Lack of a designated department, either in line ministries or in branch ministries, (e.g. environmental or energy department) • Lack of collaboration among institutions to bring projects forward (e.g. urban planning and energy department) • Lack of training at all levels, particularly of technical in-house competence to assess and develop EE projects • Intricate and/or inefficient bureaucratic processes • Lack of managerial skills and resources to develop EE projects • Weak monitoring and enforcement mechanisms
Awareness, information and related social barriers	• Asymmetric information on EE potential • Lack of, or distorted, information on the performance of EE technologies • Lack of, or distorted, information on the multiple benefits of EE technologies (e.g. improved energy security and economic benefits) • Lack of environmental awareness • Aversion to new solutions and technologies • Lack of technical capacity to implement, operate and maintain new EE technologies
Technological barriers	• Incompatibility between new and existing technology solutions • Technical/performance risk of the technology • Unpredictability of performance and respective energy savings • Higher maintenance requirements

To obtain the best possible results from the surveys, it is important to identify the most relevant stakeholders. This is mainly because different stakeholders will have different levels of understanding, different interests, and even a different level of influence on the institutional system and other stakeholders. Knowing which stakeholders to interview means an advantage in the sense that the responses can be considered more accurate and reliable, which will in turn give more legitimacy to the whole analysis. It is therefore important to map all relevant stakeholders before the interview process, or at least have discussions regarding the selection of the stakeholders to be interviewed.

The information elicited from the surveys, either through interviews or consultation workshops, can now be analysed by the corresponding city or municipality authority and the possibilities for different policy measures be considered. The categorization and analysis of the reasons behind the barriers and prioritization of the barriers will enable the process of identifying and designing the corresponding policy measures to address those more effectively. It is very important that the categorization of the different barriers has been correctly done, since different categories of barriers will most likely require different measures. Also, some of the categories, for example financial barriers, will be more difficult to address and may require acceptance or endorsement at a higher political level, while measures like awareness-raising campaigns about the benefits of investing in EE projects may be less dependent on political acceptance and approval. In any case, the information with suggestions for policy options obtained in the surveys must be assessed by the decision-makers who can implement the appropriate options or the ones that need to be designed. Below are some examples of the most common policy measures (Table 1.3):

Table 1.3 Policy measures to overcome barriers to EE

Category	Policy measure
Financial measures	• Investment subsidies • Grants and loans • Loan guarantees • Taxation and other fiscal benefits • Use charges (e.g. congestion charges)
Non-financial measures	• Mandate to provide electricity from energy-efficient technologies • Disincentivizing the use of energy from fossil fuels (e.g. increased taxation on fossil fuels) • Information and awareness-raising campaigns of the multiple benefits of EE • Minimum Energy Performance Standards and labelling technologies • Sustainable public procurement • Promoting research and development • Training and capacity-building • Promoting public-private partnerships

Here it is important to consider the possibility of combining measures instead of addressing the barrier with only one type of measure. For instance, a good option is to combine a financial measure with a non-financial measure. One example is to combine an investment subsidy with a campaign aimed at raising awareness about the multiple benefits of EE.

Measuring, Reporting and Verification (MRV) System

MRV systems include a measurement component that refers to the collection of information that allows monitoring of implementation progress and impacts associated with a given mitigation action included in the strategic plan. The reporting component makes it possible to provide information to the corresponding authorities in a transparent manner. The verification component allows the evaluation of information that is reported in terms of its completeness, consistency and reliability by a qualified third party. Thus, the MRV system serves to ensure transparency, that the results of the implementation of a mitigation actions are occurring and that their impacts are being properly quantified and reported. More detailed information about the MRV systems is found in Module 6 (Assessing the performance and impacts of Project Bundles).

1.3.6. Step 6 - Strategy formulation and launching

All the previous steps are preparatory work for the strategic plan formulation. Normally, the strategic planning process include the high-level policymakers,

the stakeholders and the formulation group, which normally consists of a few technical experts who do the actual drafting and then revise the drafts based on feedback from stakeholders. After the final version is approved by the municipal council, the mayor's office, or other municipal decision-making body, it is formally issued for implementation by the relevant responsible organizations.

A typical strategic plan includes the following contents:

1) Official approval/endorsement.
2) Background.
3) Strategy goals (see Table 1.4).
4) The strategies and action plans for their implementation.
5) Cross-cutting issues: some strategic plans also include cross-cutting issues that are relevant for the implementation of multiple strategic goals, such as an adjustment in existing roles and responsibilities, institutional setup for coordination, funding mechanism, public procurement etc.
6) Risk management. The risk management part evaluates the risks to the achievement of each strategic goal. For each risk, the probability and impacts, as well as mitigation measures, are identified to reduce the risks.
7) Measuring, Reporting, and Verification (MRV). In practice, all municipal government agencies have some recording and auditing system on their expenses and investment. When international funding or technical support is needed, or commercial funding or private investment is utilized, there can be additional requirements on the MRV side.

Table 1.4 Example of a strategy summary table.

Strategic Goal	Strategy	Actions	Responsibility	Cost/investment estimation	Resource allocation	Timeline
Goal 1	1. The first strategy to reach Goal 1 2. The second strategy to achieve Goal 1	Underlying actions for First Strategy	Responsible agencies/organizations		Any funding plan/resource allocation	When to do what?
Goal 2	.....		...			...

Some strategic plans also contain contents on the strategy development process, including the different actors involved and the stakeholders consulted. The strategic plan needs to be SMARTER (Specific, Motivating, Achievable and Agreed, Relevant, Time-bound, Evaluation, and Readjustment).

Once the strategy is finalized, it needs to be launched online or during an event, which can be used to promote public awareness of the strategy and be used to motivate confidence and interests in EE actions among the private sector and the residential sector. Once launched and released, the strategy enters the deposit of municipal policies and needs to be made available for public access and be integrated into the work plans of relevant stakeholders and municipal government agencies.

1.4. Conclusions

Strategic planning is a process of building consensus among municipal leaders and all stakeholders. In times of rapid changes and competing needs for public resources, a strategic plan creates some stability and certainty for government efforts regarding the duration of the planned period. An agreed and well-formulated strategic plan can help to improve the understanding of available resources and enhance support from key stakeholders. Like other planning processes, a good plan is only useful when it is implemented. The strategic plan needs to be SMARTER. Moreover, there needs to be corresponding resource allocation, authorization, and other enabling and motivation mechanisms so that the relevant government agencies or public bodies can carry out the implementation activities. Clear division of roles and responsibilities, sufficient allocation of resources, as well as a strong commitment and effective support from the municipal leaders are key to the successful implementation of municipal EE strategies.

1.5. Further reading

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