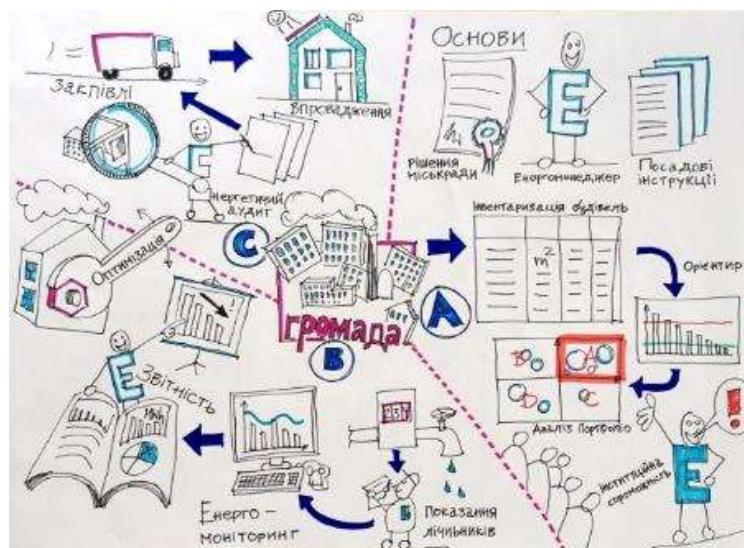


Municipal Energy Management (MEM)

in Ukrainian Territorial Communities

MEM Modules

Modules Basic Document



elaborated by

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Municipal Energy Management [MEM] - Modules

Introduction into MEM for Ukrainian Municipalities and Hromadas

This document is related to Municipal Energy Management projects of GIZ in Ukraine. It contains the definitions of the different tasks of a Municipal Energy Management and names factors for success, resources, and templates as well as information on necessary technical equipment (see misto-em.org.ua.)

The idea is, to offer a stepwise approach for municipalities to implement an energy management adjusted to their actual needs. The concept now defines 3 levels of a Municipal Energy Management – from a low-threshold start for small municipalities with no experience and low resources to a holistic MEM that covers all relevant areas for municipal buildings.

This document is supplemented by a “Handbook” for each of the three MEM levels which is combined with a “Self-assessment Tool” to define the status quo on different stages of MEM implementation.¹

Moreover, further support is provided by the Guideline “Municipal Energy Management (MEM) in Amalgamated Hromadas - Step by step improvement of energy efficiency in public buildings” and a brochure for buildings responsible²

Level A	Level B	Level C
Basics	Basics	Basics
Building Inventory	Building Inventory	Building Inventory
Portfolio-Analysis	Portfolio-Analysis	Portfolio-Analysis
Capacity Building	Capacity Building	Capacity Building
	Energy Monitoring	Energy Monitoring
	Optimisation	Optimisation
	Reporting	Reporting
		Energy Audits
		Implementation
		Procurement
	street lighting*	
	district heating*	
	OSBB Multi-storey buildings*	

*not included in the MEM training program

¹ Handbook and Self-Assessment are already available for Level A and in preparation for Level B and C – contact: misto-em.org.ua

² See: <http://misto-em.org.ua/fond-znan/vse-dlya-energomenedzhentu/dodatkovy-materialy/> та http://misto-em.org.ua/wp-content/uploads/2020/06/Broshura-Prosti-zahody-z-pidvyshhennya-energoefektyvnosti-u-gromadskyh-budivlyah.pdf?fbclid=IwAR09tEWWAFmWYjOv_T0ZMXWGTvoROxER-D5HNtiaCLOdJMC15rZwwFulp3Y

Level A

Basics:

A Municipal Energy Management requires some basic administrative and organizational topics to ensure political will and support on a long-term basis. The municipality has to provide adequate and sufficient time and budget resources for the sustainable installation and performance of the MEM. The below mentioned topics have to be fulfilled and documented:

- City council decision on the implementation of Municipal Energy Management
- Formal nomination of responsible person(s) as Energy Manager(s)
- Job description and allocated time budget for the Energy Manager(s)
- Information of the relevant departments, from which cooperation is necessary
- Possibility for the Energy Manager(s) for qualification, education and sharing knowledge
- Willingness to provide basic technical equipment for the Energy Manager(s)

Factors for success:

- A caring person / an initiator that starts the process in the municipality

Templates / Resources:

- City council decision
- Job description Energy Manager

Technical Equipment:

- Not yet needed

Building Inventory:

For the introduction of a MEM for all buildings of a municipality – independent on the size of the public body – it is essential to have concrete information about the buildings owned and used by itself. A first step is the overview over the municipal building stock with a compilation of relevant basic data. This will serve as a data basis for the next steps of the MEM like selection of priority buildings and a Benchmark to assess the necessity and possibilities. The data base must include as a minimum:

- Building: official name of the building
- Address of the building
- Category - building use including possible specific features in the use
- Occupancy – is the municipality the owner or is the building leased / rented
- Status in context of refurbishment (already refurbished, in plan for next years, etc.)
- Year of construction and refurbishment(s)
- Surface area in m²
- Conditioned surface area in m²
- Heating system
- Main energy source for heat – energy carrier
- Annual energy consumption for heat, electricity (and water)
- If available: costs for energy and water consumption

Factors for success:

- Good collaboration between departments to gather relevant data
- Basic know-how of the energy manager about municipal buildings

Templates and Resources:

- Excel-sheet “Basic data”
- Glossary of Building Categories³

Technical Equipment:

- PC or Laptop with basic Software for text and spreadsheets
- Optional: Internet for data exchange via E-Mail

³ Example from Germany – building categories are included in this document:
https://www.bbsr.bund.de/BBSR/DE/veroeffentlichungen/bbsr-online/2009/DL_ON092009.pdf?__blob=publicationFile&v=1

Portfolio-Analysis

After the collection of the basic data, an analysis of the energy consumption of the buildings should follow. This is an important task for the evaluation of the energetic performance of the building stock on the one hand side and to estimate the possible savings that can be achieved with an MEM on the other hand. With data about the energy consumption, specific values can be calculated and be compared with reference values from existing building benchmarks. The specific values of energy consumption indicate the energetic performance of a building independent from the size of the building. With the break-down to the consumption per square-meter of conditioned surface area, buildings of different sizes but of the same use or category can be compared. The following information and the following steps are necessary:

- Gather data of heat consumption [kWh or Gcal] and electric energy [kWh] for at least one year
data source: e.g., accounting from energy supplier
- Gather information on conditioned surface area of the buildings [m²]
- Climate Correction of heat consumption
- Calculation of specific energy consumption for heat and electricity [kWh/m²a]
- Comparison with reference values from (national or regional) databases
- Calculation of the deviation from the reference values [%]
- Visualisation with a portfolio-diagram

Factors for success:

- Good collaboration between departments to gather relevant data
- Basic know-how of the energy manager about climate correction

Templates and Resources:

- Climate correction: degrees and long-term average consumption for a long period (30 years)⁴
- Reference values from surveys / statistical data⁵

Technical Equipment:

- PC or Laptop with basic Software for text and spreadsheets
- Optional: Internet for data exchange via E-Mail

⁴ Приклади з Німеччини:

http://www.coaching-kommunaler-klimaschutz.de/fileadmin/inhalte/Dokumente/StarterSet/BMVBS_Energieverbrauchskennwerte_und_der_Vergleichswerte_im_Nichtwohngesetz_C3%A4udebestand.pdf

⁵ Reference values of energy consumption calculated within "Energy efficiency in Municipalities-II" Project you may find here:

<http://misto-em.org.ua/wp-content/uploads/2021/06/EEMII-etalonni-znachennya.pdf>

Capacity Building:

Caretakers and the maintenance personnel as well as the building users have a high influence on the energy consumption of municipal buildings thru their daily behaviour and the operation of the technical infrastructure. With information and motivation, it is possible to very fast achieve first energy savings. Because their collaboration is needed for the implementation of the next steps of the MEM, it is essential to incorporate them early in the process. The minimum recommendation for an annual ½-day training(s) for the caretakers are:

- Information on status and plans of the implementation of a MEM (e.g. city council decision, goals, introduction of Energy Manager)
- Teaching of basic technical information on building operation (e.g. heating curve, hydraulic, ventilation, electric energy etc.)⁶
- Discussion of actual problems and request for ideas of technical and organizational improvements
- Possibility for networking and know-how-exchange

Factors for success:

- Moderation and presentation skills of the Energy Manager
- Know-how of the energy manager about technical infrastructure and building operation
- Involvement of department leader or mayor for welcome speech

Templates and Resources:

- Agenda and invitation for training day
- Contact to caretakers (E-Mail or postal address for official invitation)
- Presentation / Slides ⁷
- Room and Catering

Technical Equipment:

- PC or Laptop with presentation-software
- Beamer and silver screen
- Optional: demonstration material (thermostat valves etc.)

⁶ See brochure: Simple measures to increase energy efficiency in public buildings – http://misto-em.org.ua/wp-content/uploads/2020/06/Broshura_Prosti-zahody-z-pidvyshhennya-energoefektyvnosti-u-gromadskiyh-budivlyah.pdf

⁷ Available from giz project Facility-Management training for IDPs - http://misto-em.org.ua/wp-content/uploads/2021/03/EEiM_FM-Brochure_UKR_FINAL_PRINT.pdf

Level B

Energy Monitoring

Energy Controlling is the basis for a Municipal Energy Management. By the monitoring of the energy consumption savings of up to 5% are possible. Higher consumption, caused by defects or malfunction is registered promptly and starting points and possibilities for optimization of the technical infrastructure can be identified.

Energy Controlling means the logging of the consumption of heat, electricity, and water on a regular basis. It includes the analysis of the acquired data and the compilation of reports. These steps and criteria should be fulfilled:

- Decision and documentation: which buildings will be integrated in the energy controlling
- The buildings are equipped with meters for heat-, electricity and water consumption
- Missing meters are installed
- Gather basic data of meters and compilation of a metering scheme:
 - Meter identification number (information congruent to energy supplier's information)
 - Energy carrier (oil, natural gas, district heat, biomass etc.) and units (kWh, m³...)
 - Areas supplied by the meter (description and size [m²])
- Meter readings on a frequent basis
 - Yearly or quarter-yearly for buildings with a very low energy consumption
 - Monthly < 500 kW or < 1 GWh/a heat consumption
 - Weekly < 3.000 kW or < 5 GWh/a heat consumption
 - Daily > 3.000 kW or > 5 GWh/a heat consumption
- Climate correction of heat consumption
- Analysis of the energy consumption with tracking of rises in consumption / aberrations of expected consumption; documentation of special events that cause a rise in consumption
- Feedback to the caretakers, maintenance personnel and building users
e.g. via short monthly reports

Factors for success:

- Know-how of the energy manager about technical infrastructure and building operation
- Directive of department leader or mayor for the caretakers to carry out frequent meter readings

Templates and Resources:

- Access to the buildings to gather relevant data of the meters
- Factors for climate correction: heating degree days and long-term average value (30 yrs.)⁸
- Constant contact with caretakers

Technical Equipment:

- PC or Laptop with energy-management-software ⁹
- Possibility to receive meter readings online, per e-mail or fax

⁸ For Germany, the Institut für Wohnen und Umwelt annually publishes factors for climate correction: <http://www.iwu.de>
<https://www.iwu.de/publikationen/fachinformationen/energiebilanzen/#c205>

⁹ https://energiertools.ea-nrw.de/tools/emsmarktspiegel/default.asp?site=ea&_ga=2.96143065.436985333.1501248401-1034347004.1501248401

Optimisation of technical infrastructure

The way a building is used and operated determines - as well as the building standard - its energy consumption. The parameters of the technical infrastructure must be adapted to the real building use. They are influenced by different factors like the quality of the building exterior (old building, new building, and passive house) and the use of the building. In the first step, the existing technical infrastructure should be optimised by low- and no-cost measures or with smaller measures that require (manageable) investments. This includes:

- Issue of an instructional note for the building operation under energy-efficient aspects
- Frequent visits of the buildings, together with the caretakers / maintenance personnel
- Check operability of the control and regulation systems
- Control, documentation and adaption of heating parameters such as:
 - Adaption of heating times according to building use
 - Adaption of room temperatures and heating curves according to the building standard
 - Hydraulic balancing and adaption of the heat circuit pumps
 - Check parameters of ventilation systems, domestic hot water generation etc.
 - Check if frequent maintenance and servicing is performed

Factors for success:

- Advanced know-how of the energy manager about technical infrastructure and building operation or
- External support and assistance from energy expert / consultant with relevant expertise
- Communication skills for contact with and support from the caretakers to implement optimization measures
- Budget for small measures e.g. replacement of control units, heating circuit pumps...

Templates and Resources:

- Instructional note on energy efficient building operation ¹⁰
- Information on possible low- and no-cost measures ¹¹
- Transportation for visits of the buildings

Technical Equipment:

- PC or Laptop with basic Software for text and spreadsheets
- Basic technical equipment¹²
e.g. Multitool, Camera, Laser-Thermometer, Thermo/Hygrometer, gas-analyser, data-logger

<https://energiemanagement.stadt-frankfurt.de/Betrieboptimierung/Anweisungen-fuer-Hausverwalter/Anweisungen-fuer-Hausverwaltungen.pdf>

¹⁰ Example: Energy Management department of the city of Frankfurt: <https://energiemanagement.stadt-frankfurt.de/Betrieboptimierung/Anweisungen-fuer-Hausverwalter/Anweisungen-fuer-Hausverwaltungen.pdf>

¹¹ See Brochure "Simple measures to increase the energy efficiency of public buildings" - http://misto-em.org.ua/wp-content/uploads/2020/06/Broshura_Prosti-zahody-z-pidvyshhennya-energoefektyvnosti-u-gromadskiyh-budivlyah.pdf

¹² See: http://misto-em.org.ua/wp-content/uploads/2019/03/2019_03_05_Equipment_UA.pdf

Reporting

The preparation of an annual energy report serves as an instrument for public relation: on the one hand towards the city councils' decision on the implementation of an MEM, and on the other hand towards the public audience. It is the documentation of the MEM-process and the implemented measures. It proves evidence of the energy and cost savings as well as the reduction of CO₂-emissions. Based on the Energy Controlling in consideration of the energy bills from the supply companies, an annual report is created and made available / published. The preparation (and publication) of annual energy reports include:

- display and presentation of the energy consumption of the different sectors (heat, electricity, water) and energy carriers (oil, natural gas, district heating etc.) with numbers and graphs
- display and presentation of the trend of the energy prices and costs
- calculation of CO₂-emissions for heat and electricity
- statement of the savings (energy, costs and CO₂-emissions) related to the MEM
- documentation of the tasks and achievements of the MEM, including the description of implemented measures

Factors for success:

- Collaboration between departments to get energy suppliers statements
- Communication skills (writing and presentation) to describe goals, measures and achievements in a non-technical way, so that mayor, city council and public is well informed.

Templates and Resources:

- Template for annual energy report
- Factors for climate correction: heating degree days and long-term average value (30 yrs.)
- Factors for calculation of CO₂-emissions¹³

Technical Equipment:

- PC or Laptop with basic Software for text and spreadsheets
- Printer for energy reports

¹³ Example for factors used in Germany:

http://inas.org/tl_files/inas/downloads/GEMIS/2010_GEMIS_EF_KWK-LHM.pdf
<https://www.kea-bw.de/kommunaler-klimaschutz/angebote/co2-bilanzierung>

Level C

Energy Audits

The collection and interpretation of the consumption data from the Energy-Monitoring is a solid starting point for the constant improvement of the municipal building stock. After the low- and no-cost measures are implemented, further savings can be achieved with renovation of the building exterior (walls, windows, and roof) and the retrofitting of the technical infrastructure.

For the planning and implementation of measures, a stepwise approach is recommended. It is wise to go from coarse to fine: identify possible measures first, set-up a long-term strategy as a decision guideline and then plan the renovation measure in detail – prior to the implementation.

- 1. Step: Portfolio Analysis for identification of the priority buildings (large buildings with noticeable deviations of the specific values from the reference values)
- 2. Step – Express Audits: preliminary Analysis of the selected buildings to gather information on the energetic status and the state of repair
- 3. Step: compilation of the results to a long-term strategy for the renovation of the building stock - including measures for step-by-step renovation or deep renovation of single buildings.
- 4. Step: incorporation of the long-term strategy in the budget planning of the municipality
- 5. Step Detailed-Audits: Analysis and calculations prior to the implementation of measures
- 6. Step: Implementation of measures with Monitoring of the success of energy reduction
- 7. Step: periodic update of the long-term strategy

Factors for success:

- Advanced know-how of the Energy-Manager
- Involvement of Energy Manager / Energy Agency in budget planning

Templates and Resources:

- Template for Portfolio Analysis (also see Building Inventory)
- Template for preliminary analysis
- Template for long-term renovation strategy
- Template for Detailed Analysis
- Transportation for visits of the buildings

Technical Equipment:

- PC or Laptop with basic Software for text and spreadsheets and printer
- Simulation software for detailed analysis
- Basic technical equipment
e.g., Multifunctional Tool, Camera, Laser-Thermometer, Thermos/Hygrometer, Gas-analyser, Data-logger

Implementation of measures

The principal function of the Energy Manager / Energy Management department is the improvement of the energetic performance of the municipal buildings. The identification and implementation of measures is an important task within this function. Depending on the dimension of the measure, the Energy Manager(s) can take over different functions:

Small measures (e.g. replacement of heat-circuit pumps, installation of control and regulation systems, hydraulic balancing) can be implemented by the Energy-Management department itself:

- Plan demand and specifications of the planned measure
- Prepare tenders or invite offers
- Awarding contracts
- Supervision of works / Quality control
- Approval of works and processing of invoice
- Verification of targeted savings

Renovation measures (e.g. renovation of the building exterior, replacement of windows, insulation of walls and roof) are usually planned and implemented by the public works department. The Energy-Management should be involved and should contribute to this process:

- Consulting on specifications of measures:
e.g. conformity to laws and regulations, energetic quality, products etc.
- Expert advice in planning-process:
e.g. calculation of energy balance, planning of air tightness and heat bridges
- Assistance with financing thru acquisition of subsidies and loans
- Quality control during implementation:
e.g. correct use of materials, secure building tightness, check functionality
- Approval of works after implementation
- Verification of targeted savings

Factors for success:

- Advanced know-how of the Energy-Manager
- Experiences with the work and assignment of companies, craftsmen
- Communication skills for collaboration with public works department
- Experience in the acquisition of subsidies and loans, national and international
- Language skills – English for communication with international funding institutions

Templates and Resources:

- Monetary budget for small measures
- Time budget for supervision of renovation measures
- Transportation for visits of the buildings

Technical Equipment:

- PC or Laptop with basic Software for text and spreadsheets and printer
- Simulation software,
- Basic technical equipment: e.g., Multifunctional Tool, Camera, Laser-Thermometer, Thermos/Hygrometer, gas-analyser, data-logger

Procurement

Finally, after the reduction of the energy consumption and the CO₂-emissions with energy controlling, the optimization of low- and no cost measures, there is the possibility of cost reductions by the active management of the provisioning of energy. Especially with liberation of energy markets, huge cost saving potentials will develop thru the public tendering of supply contracts for heat, electricity and water¹⁴.

Municipalities are committed to the economical and economical use of their budgetary resources to fulfil this obligation, the local authorities can comply with procurement by tendering for the necessary services, to determine the most economic offers in competitive procedures. Basically, it is necessary to check whether there is an obligation for public tenders.¹⁵

For the procurement of energy, one must distinguish between grid-bound¹⁶ and non-grid-bound¹⁷ energy carriers.

Additionally, to the procurement of energy, the Energy-Manager(s) can influence the way, investment decisions for provisions and equipment in a municipality are done. Here ecological and energetic parameters and specifications can be implemented. Especially the consumption of electric energy correlates with the quality and efficiency of the existing appliances. In an office building, the energy consumption of electronic devices can sum up to 30-40% of the total consumption.

For the procurement of energy, the following approach is recommended:

- Overview of existing energy supply contracts including
 - Building / entity
 - Energy carrier / medium
 - Supply company
 - Price components: cost for grid-connection, demand charge, consumption rate
 - Amount of purchased energy
 - Duration of contracts
- Check possibilities or obligation for procurement by public tender
- Prepare tender for single buildings or pool of buildings with consideration of:
 - Amount and structure / load-profile of energy demand
 - Existing or planned plants for self-generation of electric energy (e.g., combined heat and power, photovoltaics)
 - Plans for reduction of energy consumption thru efficiency measures may apply to ordered power-load and scaled prices for consumption
 - Specifications or obligations to purchase green- or renewable energies
 - Clarification of law and regulation issues

For the buying of office equipment, the following should be taken into consideration:

- Assessment of demand (PC or Laptop, Monitor, printer, print-scan-fax)
- Definition of quality criteria with use of labels (Energy Star, eco-label, TCO)
- Implementation of criteria in tender offer
- Information and motivation of the users on the energy-efficient operation of the devices
- Make use of it for public relations

¹⁴ In Germany, supply of water and waste-water treatment is a municipal task. So, no possibility to change water supplier.

¹⁵ According to the "Regulations for the provision of services - excluding construction works (VOL)", energy supplies above certain thresholds have to be advertised Europe-wide.

¹⁶ Grid-bound: natural gas, district heating, electric energy

¹⁷ Non-grid-bound energy carriers: oil, liquid gas, wood / biomass

Factors for success:

- Knowledge in energy business and public procurement laws
- Technical know-how on energy use in public buildings

Templates and Resources:

- Contacts to energy supply companies (both private and public)

Technical Equipment:

- PC or Laptop with basic Software for text and spreadsheets and printer
- Internet access and e-mail for communication

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