ENERGY EFFICIENCY IN MUNICIPAL BUILDINGS

Clara Camarasa

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UNEP DTU PARTNERSHIP | COPENHAGEN CENTRE ON ENERGY EFFICIENCY

SEforALL EE HUB

About the speaker

Clara Camarasa is a researcher and project manager with more than 8 years of experience in the field of energy efficiency (EE) in the building sector. Passionate about the decarbonization of the building sector, she has gathered both practical and theoretical experience on relevant aspects of this topic: from pre-feasibility studies to the design and construction of nearly zero-energy buildings (nZEB).

In the past years of her career, she has focused on generating building data, along with other analytical frameworks needed to describe and accelerate the diffusion of EE technologies.

As a Project Manager for the Building Market Brief EIT Climate-KIC project, Clara was able to co-design, replicate and coordinate the implementation of a pan-European initiative involving more than 15 organizations, from the public and private sector.

AGENDA

Objective: share insights on the importance of energy efficiency (EE) improvements in municipal buildings, key actions and pathways to implement them

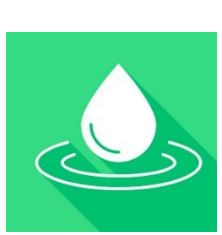
#	Minutes (aprox.)	Title	Description
1	5 min	Fundamental Concepts	Basic terms and concepts of EE measures in buildings
2	10 min	EE in Municipal Buildings	Methodological framework, including steps and data required in the evaluation of EE of municipal buildings
3	5 min	Case Study: EE measures in Municipal Buildings around the world	Analysis, results and lessons learned of the case of EE measures in Municipal Buildings in Canada, Ukraine and Turkey
4	15 min	Q&A	Open session to respond to your questions

Source: Unsplash

WHY SHOULD WE IMPLEMENT EE IN MUNICIPAL BUILDINGS?

- Achieve a reduction in energy consumption while maintaining (or even increasing) the comfort levels of the users of the facilities and the quality of the service
- Reduction of greenhouse gas emissions (GHG) into the atmosphere
- Reduce equipment operation and maintenance costs, extending their useful life
- Adapt the equipment and facilities to current regulations
- Air pollution reduction
- Promote the use of renewable energies
- Generate local job creation
- Lead by example / Improve the image of the Municipality
    - Promote awareness
    - Acquire experience & test the framework conditions

TARGET: NET-ZERO ENERGY



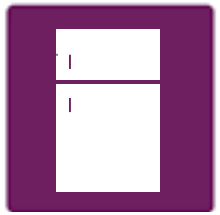
WATER SUPPLY

HEATING & HOT WATER

COOLING

LIGHTING

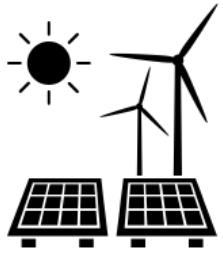
PUMPS AND FANS



ELECTRIC APPLIANCES

÷ GROSS BUILDING AREA

=  INTENSITY OF ENERGY USE

−  RENEWABLES

= 0 NET-ZERO ENERGY

Main idea

Why is it so important to achieve net-zero energy?

- **Buildings and their components work as a system, especially when it comes to energy consumption**
- They cannot be approached a single element (e.g. windows) without taking into account the rest of the building elements > **"Lock-in" effect**

CLASSIFICATION OF EE MEASURES IN BUILDINGS

Passive systems

- **Efficient skin**
  - Envelope insulation
  - Windows and doors
- **Minimize solar heat gain**
  - Green roof and facade
  - Parasols and canopies
- **Capitalize on daylight**
  - Building orientation
  - Solar shelves
  - Mirror duct
- **...**

Active systems

- **Efficient lighting or lights**
- **Efficient air conditioning, heating and ventilation installations (HVAC)**
- **Active controls; energy management system**
- **...**

Generic improvements

- **Proper maintenance of facilities**
- **Adapting the schedule to capitalize daylight**
- **Good energy consumption practices among users**
- **Energy management plan**
- **Quantification of savings and investments**
- **...**

NZEB IN NEW CONSTRUCTION AND EXISTING BUILDINGS

nZEB – New construction
Picture: BuildUp EU

nZEB - Existing building (deep retrofit), Before and After
Pictures: O'Riain, O'Connell

STEPS IN THE IMPLEMENTATION OF EE MEASURES IN EXISTING MUNICIPAL BUILDINGS

1. • **Appoint the person responsible for the energy management improvement plan + energy audit expert**
2. • **Collect building energy consumption data**
3. • **Inventory of installed energy consuming equipment & status of building components**
4. • **Survey on users' consumption habits**
5. • **Evaluation of the building's energy consumption**
6. • **Proposal of EE improvement measures**
7. • **Selection of EE improvement measures according to the defined objectives**
8. • **Development of an action plan for the implementation of EE measures**
9. • **Monitoring of results, control of consumption and periodic monitoring of indicators**
   • Communication, awareness raising, revision of framework conditions (e.g. building codes)

Source: Adaptation from Spanish Federation of Municipalities and Provinces

1. DESIGNATE THE PERSON RESPONSIBLE FOR THE ENERGY MANAGEMENT IMPROVEMENT PLAN - ENERGY AUDIT EXPERT

Recommendations

- Set up a specialized team for energy performance optimization, preferably staff with this as their only responsibility (otherwise overwhelmed of other duties).
- This working group should include, as part of this team, an expert in energy audit of buildings. Someone with technical background in this field: either architect or engineer
- Decide from who and when logging of results will be performed (+/-3 days).
- Allocate a well defined budget with associated responsibilities within the team.
- Formulate duties and authorizations.
- Inform citizenship and public servants about the EE plan

Source: Adapted from Region Gotland

Source: www.digitalicon.com.sa/

2. COLLECT BUILDING ENERGY CONSUMPTION DATA

2. General data of the building

- ❑ **Type of building according to your program:** town hall, library, sports facility, school, etc.
- ❑ **Useful area:** Useful area of the building in square meters (m2)
- ❑ **Climatic zone**
- ❑ **Year of construction**
- ❑ **Building typology***

*Building typology

Detached Attached

Source: IVE

3. Use of the building

- ❑ **Number of regular users**
- ❑ **Hours of operation**
- ❑ **Hours of operation per year** (approximate)
- ❑ **Users per day** (approximate)

2. COLLECT BUILDING ENERGY CONSUMPTION DATA

4. Energy consumption of the building

Based on energy bills:

	Energy consumption (kWh/year)	Expenses (EUR/year)
Electricity		
Natural gas		
Diesel oil		
Biomass		
LGP*, Propane, Butane *liquid gases from petroleum*		

3. INVENTORY OF INSTALLED ENERGY CONSUMING EQUIPMENT & STATUS OF BUILDING COMPONENTS

ENVELOPE - PASSIVE SYSTEM

- Glazed windows
- Enclosure of the enclosure

HVAC - ACTIVE SYSTEM

- Centralized
- Decentralized

SANITARY HOT WATER SYSTEM (ACS) – ACTIVE SYSTEM

LIGHTING – ACTIVE SYSTEM

- Inside the building
- Outside of the building

SMART ENERGY MONITORING & MANAGEMENT SYSTEMS - ACTIVE SYSTEM

+ RENEWABLE ENERGY GENERATION– ACTIVE SYSTEM

- Solar, Biomass, Geothermal, etc.

4. SURVEY ON USERS' CONSUMPTION HABITS

General

Is an energy service company contracted or is it planned to be contracted, and does it have active policies of training and good practices in energy consumption in the building?

Hot water

At what temperature (° C) do you regulate the hot water equipment in your building?

Heating / Cooling

What months of the year do you use the heating/cooling system regularly? If you can regulate the temperature of the heating/cooling system, at what temperature (° C) do you regulate it regularly? Do you carry out regular maintenance of your heating/cooling system?

Envelope

In summer, do you open more than one window with different orientation to keep your building cool?

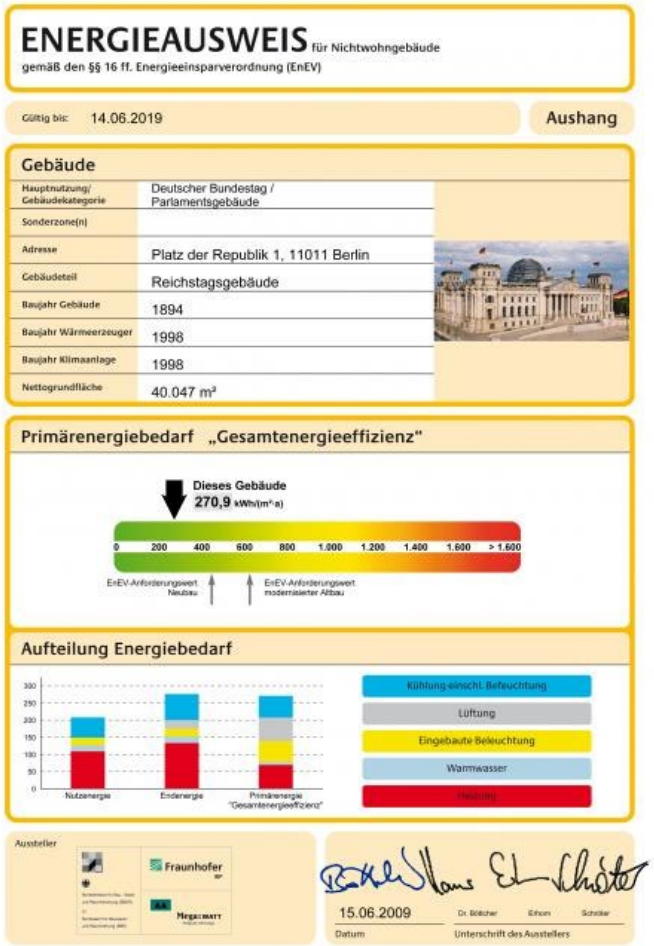
Do you open the window even though the heating/cooling is on?

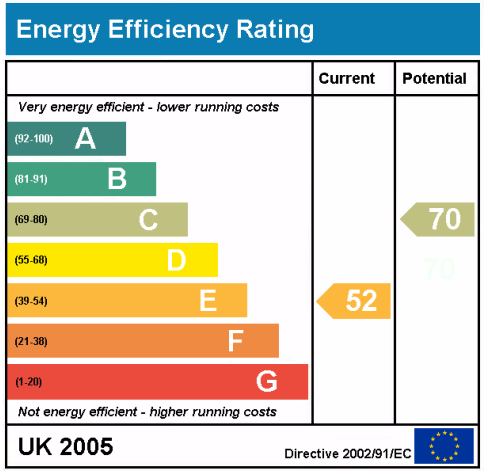
Lighting

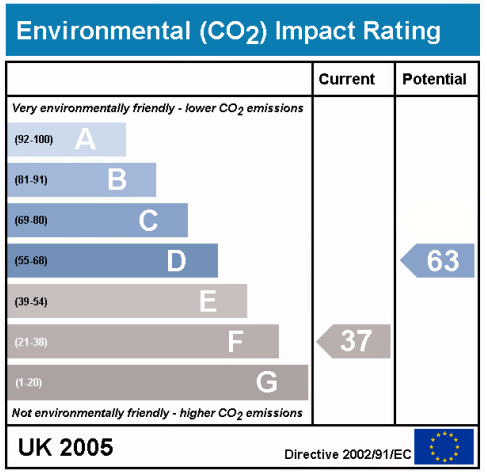
Do you have any lighting control device such as presence detectors, timers or light regulators? Do you need to turn on the lights during the day?

5. EVALUATION OF ENERGY CONSUMPTION OF THE BUILDING

Source: www.buildup.eu







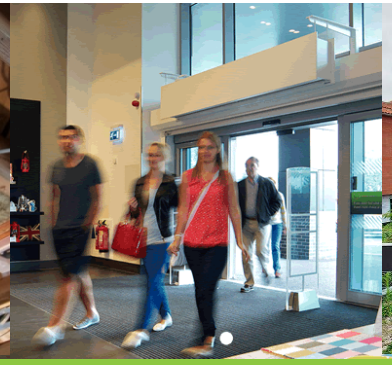
6. DEFINITION OF IMPROVEMENT MEASURES ACCORDING TO THE OBJECTIVES

Envelope

- ✓ (Improvement) insulation
- ✓ Replacement of window frames and glass
- ✓ Reduction of infiltration through doors and windows
- ✓ Install air curtains on exterior doors
- ✓ Green roof and/or facade
- ✓ Parasols and/or canopies
- ✓ Capitalizing on daylight
- ✓ Solar shelves
- ✓ …

Lighting

- ✓ Replacement of electromagnetic ballasts by electronic ballasts in luminaires
- ✓ Install presence detectors in areas of sporadic use
- ✓ Use of natural light by means of light sensors
- ✓ Lighting zoning
- ✓ Lighting with LED lamps
- ✓ Replacement of mercury/sodium vapour lamps in outdoor lighting with LEDs
- ✓ …



6. DEFINITION OF IMPROVEMENT MEASURES ACCORDING TO THE OBJECTIVES

HVAC & ACS SYSTEMS

- ✓ Install thermostatic valves in radiators
- ✓ Regulation of the air conditioning temperature
- ✓ Boiler replacement by a more efficient one
- ✓ Install biomass boiler
- ✓ Insulation of the air conditioning distribution circuit
- ✓ Replacement of diesel and fuel oil with natural gas
- ✓ Boiler maintenance
- ✓ Replacement electric radiators or air heaters with heat pumps
- ✓ Covering exterior chiller and heat pump condensers
- ✓ Install geothermal energy for air conditioning
- ✓ Radiant systems (floor/ceiling cooling)
- ✓ Circuit heat recovery systems
- ✓ Install solar thermal panels
- ✓ District Heating and Cooling Systems
- ✓ Install "pearlizers" on taps
- ✓ …

6. DEFINITION OF IMPROVEMENT MEASURES ACCORDING TO THE OBJECTIVES

Equipment / appliances

- ✓ Use of multiple strips with programmable switch or plug
- ✓ Variable speed drives in motors
- ✓ High efficiency engines
- ✓ More efficient elevators
- ✓ More efficient electrical appliances
- ✓ …

Generic measures

- ✓ Good energy consumption practices among employees
- ✓ Proper maintenance of the facilities
- ✓ Energy management system
- ✓ Adaptation of the use schedule to capitalize on light
- ✓ …

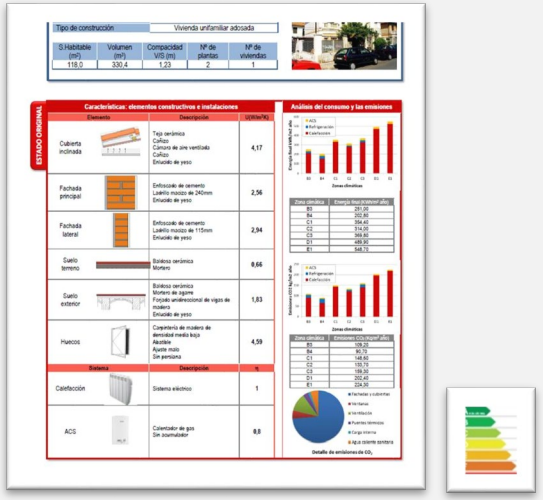
Electricity bill

- ✓ Optimization of the contracting of electrical supplies
- ✓ Use of computer tools for monitoring consumption
- ✓ District Heating and Cooling Systems
- ✓ …

EE EVALUATION DATA & NEXT STEPS

Output of the building's EE evaluation

Current



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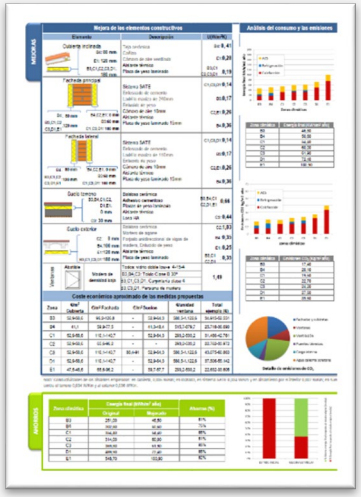
EE measures (proposal)



"Mock-up" data example (final product) of the EE evaluation in buildings

Source: IVE, for single-family house (not municipal building)

Next steps…

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CASE STUDIES AROUND THE WORLD

Canada

The Government of Canada is providing CAD 1 billion in investments to the Federation of Canadian Municipalities to retrofit buildings in Canadian communities and improve their energy efficiency. The Federation of Canadian Municipalities advocates on behalf of over 2 000 municipalities at the national level and has a longstanding partnership with the Government of Canada.

Ukraine

More than 50 municipalities in Ukraine are participating in a benchmarking system for the energy performance of their buildings, allowing each municipality to better plan and prioritise renovation activities

Turkey

The Eskisehir Urban Development Project is one among a pioneering class of ecological restorations in urban areas and a model for Turkish and global cities alike. Priority projects include: Greener Municipal Buildings, Energy Audits, Job Training, and Public Awareness-Raising.

Source: Global Alliance for Building and Construction

Thank you for your attention

Q&A

Clara Camarasa (Copenhagen Center on Energy Efficiency, C2E2)

9 September 2020 | Copenhagen

Thank you for your attention

https://c2e2.unepdtu.org/

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