

IMPROVEMENT OF OLD RESIDENTIAL BUILDINGS' ENVELOPE

NATIONALLY APPROPRIATE MITIGATION ACTION
OF THE REPUBLIC OF SERBIA

Mitigation Action

- Residential buildings in Serbia built before the 80's consume huge amount of energy for space heating due to lack of any thermal insulation
- The objective of the project:
rehabilitation of about **10% of the existing residential buildings** in Serbia built in the period from 50's to 80's
- Energy efficiency improvements in selected residential buildings aim to:
 - ▣ **reduce heat energy consumption and costs;**
 - ▣ **increase the level of indoor comfort and end users' satisfaction;**
 - ▣ **reduce GHG emission.**

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Technology/ measures

- Rehabilitation of buildings' envelope – thermal insulation of non-transparent elements including external walls, partitions to unheated spaces, roofs, ceilings, etc.
- Replacement of windows – installing new five-chamber PVC frames, double glazing, low-emissivity glass, filled with argon gas.
- Measures will result in
decrease of specific annual energy consumption for heating from 160 kWh/m²y to 70 kWh/m²y

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Potential Number of sites for NAMA project and Location

- The number of potential sites for NAMA project is about **10,000 residential buildings** located throughout Serbia.
- total surface floor area of 9.66 million square meters (10 % of the total surface)

(The source of data: Population and housing census in Serbia as well as Statistical Yearbook; surface area of windows and walls was estimated for typical buildings in Serbia built in the period from 1950 to 1980)

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Timeline

□ Implementing Schedule

Depending on financial resources dynamic, the project could be implemented continuously or in phases.

□ Expected starting date of Action

Buildings rehabilitation will start in 2013. Start of operation will continuously happen as each building's rehabilitation is completed. The reconstruction of app. 10,000 buildings should be finished in 2020.

□ Lifetime

Expected lifetime of thermal insulation and new windows is approximately 30 years.

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Current Status

□ In 2012, former Ministry of Environment, Mining and Spatial Planning granted funds of 1.3 billion RSD (approximately 13 million Euro) to tenants for rehabilitation of existing buildings.

□ Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH (GIZ) Project currently being implemented aims to support the Serbian government by

improving the existing legal framework,
raising awareness on the importance and benefits of energy efficiency
providing information and financial resources.

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Expected Mitigation Potential

□ Annual reduction: 503,929 tCO_{2e}

□ Total reduction: 15,117,870 tCO_{2e} (30 years)

Methodologies and Assumptions

□ BAU scenario: The rehabilitation of existing residential buildings without building envelope thermal insulation is not conducted. Energy efficiency of these residential buildings remains very low.

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Calculation of emission reductions:

Baseline GHG emission

□ Total floor areas to be rehabilitated in the existing buildings built from the 50's to the 80's: 9,666,000 m²

□ Average energy consumption for heating for buildings without thermal insulation built 30-50 years ago: 160 kWh/m²y

□ Total annual energy consumption for these buildings: 160 kWh/m²y x 9,666,000 m² = 1,546,560,000 kWh/y

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Baseline GHG emission

□ Energy is supplied by various sources (% share in the market based on the data from PE “Belgrade District Heating”):

| Fuel/energy | Share of the market [%] | Final energy [GWh/y] | Conversion factor to primary energy | Primary energy [GWh/y] | Primary energy [TJ/y] |
|------------------|-------------------------|----------------------|-------------------------------------|------------------------|-----------------------|
| Electricity | 40 | 618.62 | 1 | 618.62 | 2,227.03 |
| District heating | 40 | 618.62 | 1.3* | 804.21 | 2,895.16 |
| Coal | 10 | 154.66 | 1.3** | 201.06 | 723.82 |
| Natural gas | 10 | 154.66 | 1.1** | 170.13 | 612.47 |
| Σ | | 1,546.56 | | 1,794.02 | 6,458.48 |

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Baseline GHG emission

| Fuel/energy | Primary energy | CO ₂ Emission factor | CO ₂ emission [t CO ₂ /y] |
|------------------|-----------------|---------------------------------|---|
| Electricity | 618,620 [MWh/y] | 0.945 [t CO ₂ /MWh] | 584,596 |
| District heating | 2,895.16 [TJ/y] | 71 [t CO ₂ /TJ]* | 205,556 |
| Coal | 723.82 [TJ/y] | 98.6 [t CO ₂ /TJ]** | 71,369 |
| Natural gas | 612.47 [TJ/y] | 56.1 [t CO ₂ /TJ] | 34,360 |
| Σ | | | 895,881 |

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GHG emission after implementing project
(10,000 buildings rehabilitated)

- Average energy consumption for heating after buildings rehabilitation (according to the new Regulation on Energy Efficiency in Buildings): 70 kWh/m²y.
- Total energy consumption: 70 kWh/m²y x 9,666,000 m² = 676,620,000 kWh/y

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GHG emission after implementing project
(10,000 buildings rehabilitation)

| Fuel/energy | Share of the market [%] | Final energy [GWh/y] | Conversion factor to primary energy | Primary energy [GWh/y] | Primary energy [TJ/y] |
|------------------|-------------------------|----------------------|-------------------------------------|------------------------|-----------------------|
| Electricity | 40 | 270.65 | 1 | 270.65 | 974.34 |
| District heating | 40 | 270.65 | 1.3* | 351.85 | 1,266.66 |
| Coal | 10 | 67.66 | 1.3** | 87.96 | 316.66 |
| Natural gas | 10 | 67.66 | 1.1** | 74.43 | 267.95 |
| Σ | | 676.62 | | 784.89 | 2,825.61 |

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GHG emission after implementing project (10,000 buildings rehabilitation)

| Fuel/ energy | Primary energy | CO ₂ Emission factor | CO ₂ emission [t CO ₂ /y] |
|---------------------|------------------|---------------------------------|--|
| Electricity | 270,650 [MWh/y] | 0.945 [t CO ₂ /MWh] | 255,764 |
| District heating | 1,266.66 [TJ]/y] | 71 [t CO ₂ /TJ]* | 89,933 |
| Coal | 316.66 [TJ]/y] | 98.6 [t CO ₂ /TJ]** | 31,223 |
| Natural gas | 267.95 [TJ]/y] | 56.1 [t CO ₂ /TJ] | 15,032 |
| Σ | | | 391,952 |

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GHG emission reduction

- Is calculated by subtracting the baseline GHG emission and calculated emission after buildings' rehabilitation.
- GHG emission reduction = 895,881 - 391,952 = 503,929 [t CO_{2e}/y]

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Legal Framework

- Law on Construction and planning (2009)
- Regulations on Energy Efficiency in Buildings (2011) prescribes how to calculate thermal performance of buildings, energy performance for new and existing facilities, categorizes buildings based on energy properties
- Regulation on Certification of Energy Performance of Buildings (2011) prescribes an energy plan for building, an energy audit and certification by accredited companies, submission of "Energy Passport" to responsible entities; re-certification by accredited companies after the measures, submission of revised Energy Passport to responsible entities

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Energy Passport includes the following

- General information of the Building, Energy certificates for buildings
- Data on building, climate condition, HVAC (heating, ventilation, and air conditioning), building envelope
- Data on heating system of the building, heating control system, heat loss of the building, energy needs of the building, energy consumption, CO₂ emissions
- Proposals for improvement of the energy efficiency of the building

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Monitoring Plan

- Ministry of Construction and Urbanism will monitor all issued Energy Passports before and after the implementation of measures, and confirm CO₂ emission of the building in each Energy Passport.
- Through comparison of the CO₂ emission described in each EP (before/ after), CO₂ emission reduction will be confirmed.

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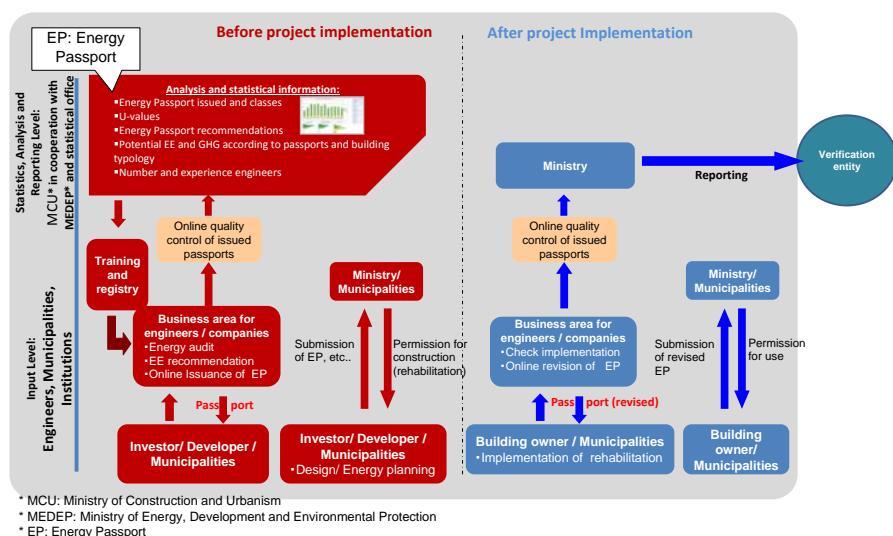
Data and parameters to be monitored:

CO₂ Emission reduction will be calculated as follows.

- $$ERY = \sum n(BE_i - PE_i)$$
- ER y = Emission Reduction in Year y
- n = Number of rehabilitated buildings that are issued with Energy Passport.
- BE i = CO₂ Emission before rehabilitation in building i
- PE i = CO₂ Emission after rehabilitation in building i

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Monitoring structure of NAMA



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Domestic MRV arrangements

- Domestic MRV arrangement is currently under development.
- NAMA implementing entity is expected to be responsible for the Measurement (M) and Reporting (R) activities, which will go through Verification (V) from third party.
- MRV of the proposed NAMA will be conducted in the following manner:

Ministry of Construction and Urbanism will conduct and supervise the Measurement activities based on the monitoring plan in order to calculate the emission reductions achieved by the NAMA.

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Finance and Cost

Report prepared by the Ministry of Construction and Urbanism containing

- 1) the detailed result of the monitoring activities conducted based on the monitoring plan,
- 2) the result of emission reduction calculation,
- 3) any support received under NAMA scheme from Annex-I countries or international organizations regarding financial support, technical support, or support on capacity building.

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- Expected cost of preparation: EUR 5 million (General design or/and Feasibility study for each of the buildings)
- Expected total cost of implementation: EUR 723.48 million
- The details regarding the financial sources necessary will be analyzed in the Feasibility study.
- The financial mechanism will be decided upon the completion of the Feasibility study.

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Support Required

| Type of Support | Support required for Preparation | Support required for implementation |
|-------------------|----------------------------------|-------------------------------------|
| Financial | EUR 5 million | EUR 723.48 million |
| Technical | x | x |
| Capacity Building | x | x |

- Total cost of the project EUR 723.48 million of which EUR 144.696 million (20 % of the total cost) - covered by building owners.
- total expected amount of support required is EUR 578.784 million (80 % of the total cost)
- state would ask a grant to offer it to the owners as a form of state subsidy in total of EUR 217.044 million (30 % of the total cost)
- some sort of non-commercial loan in total of EUR 361.74 million (50 %).

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Contribution to Sustainable Development

Positive economic, social and environmental effects:

- Involvement of local partners in production of construction products, project design and execution of works
- Increase in demand and production of construction products, in revenue and employment of local companies
- Economic development of all regions of Serbia
- Involvement of stakeholders at local level (enterprises, certified engineers, local authorities for issuing building permits).
- Positive environmental impact (reduction of energy consumption, reduction of GHG emissions)
- Better living conditions
- Increase of indoor comfort and end users' satisfaction.

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- Hvala na pažnji!
- **ありがとうございました！**

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