

Republic of Serbia
Ministry of Energy, Development and
Environmental Protection

Energy Efficiency Improvements in Public Buildings: 23 schools and 26 hospitals - Serbian Energy Efficiency Project (SEEP) -

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"Balkan Regional Seminar on
Nationally Appropriate Mitigation Actions"
4. and 5. February 2013

National Assembly House,
Nikola Pasic Square, No.13,
Small plenary hall



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Energy Efficiency Improvements in Public Buildings: 23 schools and 26 hospitals - Serbian Energy Efficiency Project (SEEP) -

The overall goal of the
Project is to provide
optimal conditions for the
people living and working
in public buildings:

- 23 schools and
- 26 hospitals,

in an energy efficient and
sustainable manner.



Belgrade - SERBIA



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Description of the Mitigation Action

The total potentially refurbished area of the:

- 23 schools is **76,483 m²** with expected CO₂ emission reduction of **2,142 tones/annually** and
- 26 hospitals is **143,825 m²** with expected CO₂ emission reduction of **6,184 tones/annually**.
- 23 schools and 26 hospitals is **220,308 m²** with expected CO₂ emission reduction of **8,326 tones/annually**.
- Total reduction: 208,150 tCO_{2e} (25 years)

The NAMA will contribute to climate change mitigation as refurbished Public buildings will use less energy and consequently emit less CO₂ for about 8,326 tones/annually during their life cycle that would be emitted in absence of the mitigation action.



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Technologies/ measures

The measures proposed can be divided into two
general groups:

1. Upgrading the **building envelope** (e.g. insulating walls, roofs, ceiling, basement; replacing windows; etc.);
2. Upgrading the **heating system** (equipment and controls – both central plant and local terminal units);

Detailed list of the measures proposed on 23 schools and 26 hospitals are given in tables in annex of the MAMA Short Description.



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List of target schools

No	Name of the Building	Location	Area (m ²)	Investment cost (EUR)	Pay back period (years)	Proposed measures
1	Secondary school "Besede Jož" "Kraljeva	Senta	2,623	291,415	7.5	1.Window Replacement 2.Wall and roof insulation 3.Thermocontrol
2	Secondary school "Dura Jakšić Rača (Istokulomasa)	Kragujevac	1,455	110,590	5.4	1.Window Replacement in the gym 2.Wall and roof insulation 3.Thermocontrol 4.Boiler reconstruction
3	Primary school "Vuk Karadžić" Lovćenac	Vrbas	3,502	310,000	17.8	1.Window Replacement 2.Wall and roof insulation 3.Thermocontrol 4.Gas burner
4	Aeronautical-technical school "Pavao Oršić" Beograd	Beograd	2,700	202,770	11.0	1.W.Window Replacement 2.Mechanical works
5	Secondary school "Lazar Nešić" Subotica	Subotica	5,670	207,511	5.6	1.W.Window Replacement 2.Thermocontrol
6	Primary school "Veljko Vlahović" Pečenjevce	Leskovac	1,632	131,375	7.8	1.W.Window Replacement 2.Wall insulation 3.Thermocontrol 4.Boiler Replacement
7	Primary school "Čeh Karoļ" Ada	Senta	3,208	258,245	11.1	1.W.Window Replacement 2.Wall and roof insulation 3.Thermocontrol 4.New boiler room
8	Primary school "Čibukovački partizani" Kraljevo	Kraljevo	2,867	236,296	9.8	1.W.Window Replacement 2.Wall and roof insulation 3.Thermocontrol 4.Balancing
9	Primary school "Svetozar Marković" Lapovo	Kragujevac	1,465	111,340	6.3	1.W.Window Replacement 2.Wall and Ceiling Insulation 3.Thermocontrol
10	Primary school "Janko Veselinović" Čma Bera	Šabac	898	72,378	10.5	1.W.Window Replacement 2.Wall and roof insulation 3.Thermocontrol 4.Boiler Replacement
11	Primary school "Vuk Karadžić" Bačko Dobro Polje	Vrbas	1,630	89,650	10.8	1.Wall and roof insulation 2.Partial Replacement of Windows and Doors 3.Thermocontrol
12	Primary school "Dimitrije Tođević" Knjaževac	Knjaževac	4,040	460,560	20.2	1.W.Window Replacement 2.Wall and roof insulation 3.Thermocontrol 4.Balancing
13	Primary school "Borivoje Mijović" Krupanj	Krupanj	1,019	76,526	5.9	1.W.Window Replacement 2.Thermocontrol 3.Balancing 4.Heat Pipeline Repair
14	Primary school "Vuk Karadžić" Kladovo	Kladovo	6,376	478,837	16.2	1.W.Window Replacement 2.Roof insulation 3.Thermocontrol 4.Balancing
15	Technical school "Rade metalac" Leskovac	Leskovac	8,277	455,235	14.9	1.W.Window replacement 2.Wall and roof insulation 3.Thermocontrol 4.Balancing
16	Primary school "Jovan Cvijić" Kostolac	Kostolac	4,958	272,250	12.9	1.W.Window Replacement 2.Wall and roof insulation 3.Thermocontrol 4.Balancing
17	Primary school "Mato Batov" (Moše Piljale) Dimitrovgrad	Dimetrovgrad	4,853	266,915	14.5	1.W.Window Replacement 2.Wall and roof insulation 3.Thermocontrol 4.Balancing
18	Secondary school "Miloš Savković" Arandjelovac	Arandjelovac	1,960	78,400	6.8	1.Wall and roof insulation 2.Thermocontrol
19	Primary school "Filip Filipović" Čačak	Čačak	3,910	346,426	13.4	1.W.Window Replacement 2.Wall and roof insulation 3.Thermocontrol 4.Balancing
20	Primary school "Ljupče Španac" Bela Palanka	Bela Palanka	3,153	173,415	11.1	1.W.Window Replacement 2.Wall and roof insulation
21	Agriculture and Forestry Secondary School "Josif Pančić" Surdulica	Surdulica	3,475	139,000	17.9	1.Wall and roof insulation 2.Thermocontrol 3.Balancing
22	Secondary Economic School Valjevo	Valjevo	3,714	69,160	5.6	1.Only works in boiler room (windows replaced in 2003, brick facade, flat roof in good condition)
23	Primary school "Vuk Karadžić" Loznica	Loznica	3,298	131,920	17.4	1.Wall and roof insulation 2.Thermocontrol
Average			3,325	216,096	11.3	* Windows have already been replaced if not given
Total			76,483	4,970,204	-	



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List of target hospitals

No	Name of the Building	Location	Area (m ²)	Investment cost (EUR)	Pay back period (years)	Proposed measures
1	Medical Centre Gornji Milanovac	Gornji Milanovac	4,714	188,560	3.9	1.Window Replacement 2.Roof Insulation 3.Thermocontrol
2	Rehabilitation Institute "Dr Miroslav Zlotovic" Sokobanjska 13, Beograd	Beograd	17,500	262,500	5.1	1.Gas Boiler Room 2.Thermocontrol
3	Medical Centre Kuršumlija	Kuršumlija	1,522	63,091	3.0	1.Wall and roof insulation 2.Thermocontrol 3.Balancing
4	Special Rehabilitation Hospital "AGENS" "Maja Jukić" Babić Institute for Thyroid Gland and Metabolism "Cigeta" Zlatibor (Block A)	Kraljevo	5,939	478,683	6.7	1.W.Window Replacement 2.Wall and roof insulation 3.Thermocontrol 4.Gas Boiler Room
5	Clinical Centre (Orthopaedic Ward and Traumatology) Novi Sad	Novi Sad	2,425	195,455	6.5	1.W.Window Replacement 2.Roof Insulation 3.Thermocontrol 4.Gas Boiler Room
6	General Hospital Leskovac	Leskovac	2,425	160,292	6.6	1.W.Window Replacement 2.Wall and roof insulation 3.Thermocontrol 4.Balancing
7	Medical Centre Prokuplje	Prokuplje	2,776	183,493	4.5	1.W.Window Replacement 2.Wall and roof insulation 3.Thermocontrol 4.Balancing
8	Special Hospital "Ozen" (Department of Thoracic Medicine) Sokobanja	Sokobanja	5,936	478,442	13.4	1.Partial Window Replacement 2.Ceiling insulation 3.Thermocontrol 4.Boiler Reconstruction
9	Special Hospital "Sveti Vračević" Novi Kneževac	Kikinda	3,489	167,921	7.9	1.W.Window Replacement 2.Wall and roof insulation 3.Thermocontrol 4.Pipe insulation
10	Medical Centre Zaječar	Zaječar	3,476	235,673	3.5	1.Heat Pipeline Repair 5.Boiler Room Reconstruction
11	Special Rehabilitation Hospital (Children's Ward) Banja Koviljača	Loznica	1,502	60,080	6.5	1.W.Window and Door Replacement 2.Roof Insulation 3.Thermocontrol 4.Balancing
12	Medical Centre Užice	Užice	26,244	787,320	11.9	1.W.Window Replacement 2.Thermocontrol
13	Medical Centre "Kosta Sredojević S Juka" Kikinda	Kikinda	11,575	347,250	9.3	1.W.Window Replacement 2.Thermocontrol 3.Pipe insulation 4.Balancing
14	Polyclinic Kula	Vrbas	2,520	138,300	6.4	1.Wall and roof insulation 2.Thermocontrol 3.Gas Boiler Room
15	Special Hospital «Rusanda» Melenci	Zrenjanin	10,533	526,650	12.3	1.W.Window Replacement 2.Wall and roof insulation 3.Thermocontrol 4.Heat Pipeline Repair
16	Polyclinic Novi Kneževac	Kikinda	1,078	109,872	17.3	1.W.Window Replacement 2.Wall and roof insulation 3.Thermocontrol 4.Gas Boiler Room
17	Medical Centre "Dr Dragisa Mišević" Čačak / Polyclinic Ivanjica	Čačak	3,301	218,196	11.2	1.W.Window Replacement 2.Wall insulation 3.Thermocontrol 4.Balancing
18	Special Hospital "Dr Borivoje Gnjatić" Stari Sankamen	Novi Sad	6,857	351,764	12.0	1.W.Window Replacement 2.Wall and roof insulation 3.Thermocontrol
19	Blood Disease Institute "Anemija" Ivanjica	Ivanjica	5,614	224,560	7.0	1.Partial Window Replacement 2.Wall and roof insulation 3.Thermocontrol 4.Balancing
20	Medical Centre Bor	Bor	4,194	153,500	5.7	1.Wall and roof insulation 2.Thermocontrol 3.Balancing
21	Clinical Hospital Centre (pharmacology) Kragujevac	Kragujevac	582	18,915	4.5	1.W.Window Replacement 2.Ceiling insulation
22	Medical Centre	Jagodina	7,920	316,800	10.1	1.Roof insulation 2.Thermocontrol 3.New Boiler
23	Medical Centre «Dr Milenko Marin» (Psychiatric ward) Loznica	Loznica	690	25,254	15.0	1.Wall and roof insulation 2.Thermocontrol 3.Balancing 4.Pipe insulation
24	Medical Centre "Dr Radivoje Simonović" Sombor	Sombor	6,181	80,165	8.1	1.Door replacement 2.Thermocontrol 3.Heat Pipeline Repair
25	Polyclinic Ljubovija	Ljubovija	3,312	99,369	9.7	1.Roof insulation 2.Thermocontrol 3.Balancing
Average			5,632	228,189	8.2	* Windows have already been replaced if not given
Total			143,825	5,932,995	-	



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Locations

23 locations of schools and 26 locations of hospitals

SCHOOLS



HOSPITALS



NOTE: Numerations are according Lists of target schools and hospitals



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NAMA Implementing Entity

Ministry of Energy, Development and Environmental Protection - MEDEP

Implementation and Measurement, Reporting, and Verification (MRV) process should be implemented in cooperation with:

- **Energy Managers** – when system of energy managers will be established. By new Law on Efficient Use of Energy (draft) should be established this system.
- **Local Governments** – responsible for schools
- **Hospital's management** – responsible for hospitals



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NAMA – Implementing Schedule

Expected starting date of Action

- Buildings rehabilitation will start in 2013 or when the project will accept.
- Depending on financial resources dynamic, the project could be implemented continuously or in phases.

Lifetime

- 25 years for installed envelopes
- According by manufacturers specified life time of the installed equipments

Current Status

- Preliminary energy audits for target 49 public buildings completed in 2007 and 2009
- Seeking the financial source
- As project is not yet accepted there is no coordination with local governments responsible for schools and hospital's management. Only previously coordination was in the frame of the project SEEP 2.

Coverage

- Sector: Buildings
- GHG Gases: CO₂



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NAMA – Financial Information

➤ Expected cost of **preparation**: 1,60 million euro

Expected cost of preparation is about **15% of Total expected cost** for implementation:

- Detailed audits - checking of the primary defined EE measures by Preliminary audits carried out before several years,
- Preparation of project documentation,
- Building Certification,
- Tendering,
- Supervision

➤ Expected cost of **implementation**: 10.90 million Euros.

- for 23 schools is **4.97 million euro**,
- for 26 hospitals is **5.93 million euro**

NOTE: see Attachment for the investment cost of each building

➤ Expected **incremental cost** of implementation: N/A

➤ **Financial sources**:

- Not identified, but soft loan, donations, grants, etc. are possible.
- Also, ESCO model are one of the option for financing.
- One part of financial sources could be provided by building owners.

➤ **Financial analysis**: NOTE: see Attachment for expected investment cost and payback period for each of the building.



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NAMA – Calculation of emission reduction

Estimation of GHG emission reductions was conducted using the available monitored data from the previous energy efficiency improvement projects by the same NAMA implementing entity called "Serbian Energy Efficiency Project I (SEEP I)" and "Serbian Energy Efficiency Project II (SEEP II)."

Building type	Project name	Number of monitored buildings	Total area of the building (m ²)	CO ₂ emission reduction (kg CO ₂ /m ² y)
Schools	SEEP I	16	51,589	29
	SEEP II	9	32,876	27
	Average			28
Hospitals	SEEP I	12	69,577	39
	SEEP II	17	75,915	47
	Average			43

Total expected annual CO₂ emission reduction from schools:

$$\Delta \text{CO}_2 = 76,483 \text{ m}^2 \cdot 28 \text{ kg CO}_2/\text{m}^2\text{y} = 2,142 \text{ t CO}_2/\text{y}$$

Total expected annual CO₂ emission reduction from hospitals is:

$$\Delta \text{CO}_2 = 143,825 \text{ m}^2 \cdot 43 \text{ kg CO}_2/\text{m}^2\text{y} = 6,184 \text{ t CO}_2/\text{y}$$



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Monitoring plan and structure

Monitoring plan

For rehabilitated old buildings, Regulation on Certification of Energy Performance of Buildings requires from building owners to obtain the "Energy Passport" by accredited companies.

Energy Passport includes the following information:

- 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 from the building (automatically calculated)**
- Proposals for improvement of the energy efficiency of the building

Through **comparing CO₂ emissions** described in each Energy Passport (audit), which is **calculated before and after rehabilitation** takes place, **CO₂ emission reduction will be confirmed**.



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Monitoring plan and structure

Energy manager *) will also be responsible for reporting the calculated amount of CO₂ emission reduction of each rehabilitated public building to Ministry of Energy, Development and Environmental Protection (MEDEP).

The government of Serbia in cooperation with GIZ is currently developing an online system to manage all the issued Energy Passports and CO₂ emissions data contained in these Energy Passports, which will make the monitoring activity even more efficient and transparent.

Total CO₂ emission reduction (ER) from all target schools and hospitals will be calculated as follows.

$$ER = ER_{school} + ER_{hospital}$$

$$ER_{school} = \sum (BE_{school} - PE_{school})$$

$$ER_{hospital} = \sum (BE_{hospital} - PE_{hospital})$$

*) Energy Managers – By new Law on Efficient Use of Energy (draft) should be established Energy Management system.



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Monitoring plan and structure

Data and parameters to be monitored:

Data / Parameter	ER
Unit	kg-CO ₂ / year
Description	Amount of CO ₂ emission reduction achieved through installing energy saving measures at each building
Source of data	-Energy Passport (audit) issued to each rehabilitated building <u>before</u> rehabilitation -Energy Passport issued to each rehabilitated building <u>after</u> rehabilitation
Measurement procedures	Energy Manager will monitor all Energy Passports (audit) issued before and after implementation of rehabilitation works, and confirm CO ₂ emissions of the building. Through comparison of the CO ₂ emissions described in each Energy Passports (before/ after), CO ₂ emission reduction will be calculated.
Monitoring frequency	Yearly

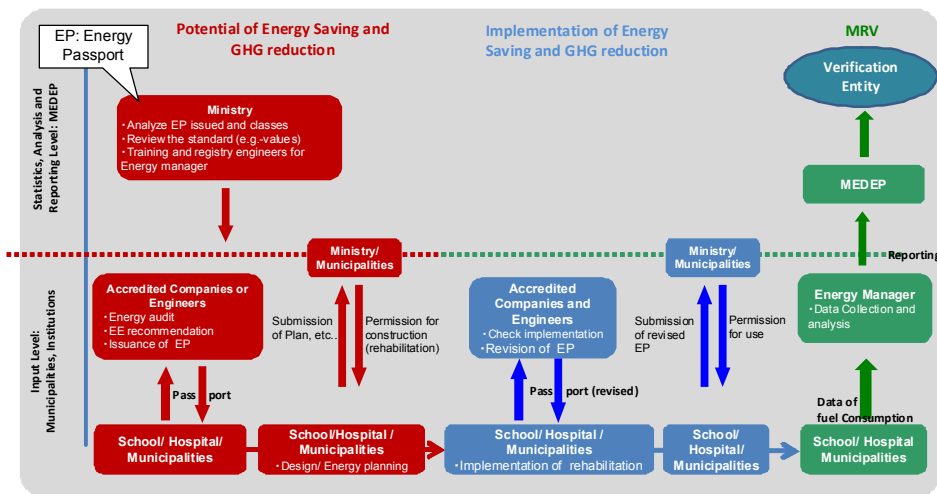


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Monitoring plan and structure

MRV process should be established and implemented in cooperation with:

- Ministry of Energy, Development and Environmental Protection (MEDEP)
- Energy Managers
- Local Governments – responsible for schools
- Hospital's management – responsible for hospitals



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Monitoring plan and structure

Domestic MRV arrangements

- Domestic Measurement (M), Reporting (R) and Verification (V) arrangement of Serbia is currently under development.
- It is expected that the MRV of the proposed NAMA will be conducted in the following manner:
 1. MEDEP will supervise the Measurement activities based on the above-mentioned monitoring plan in order to calculate the emission reductions achieved by the NAMA.
 2. MEDEP will prepare a Report that contains information on:
 - the detailed result of the monitoring activities conducted based on the monitoring plan,
 - the result of emission reduction calculation based on the above mentioned methodology, and 3
 - any support received under NAMA scheme from Annex-I countries or international organization regarding financial support, technical support, or support on capacity building.



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Contact Information

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THANK YOU FOR YOUR ATTENTION!

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