GENERAL INFORMATION

Title of NAMA

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

Description

- **Description of the Mitigation Action**

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.

The NAMA involves refurbishment of 23 schools and 26 hospitals throughout Serbia.

The total potentially refurbished area of the 23 schools is 76,483 m^2 with expected CO_2 emission reduction of 2,142 tones/annually and the total potentially refurbished area of the 26 hospitals is 143,825 m^2 with expected CO_2 emission reduction of 6,184 tones/annually.

The total potentially refurbished area of the 23 schools and 26 hospitals is 220,308 m^2 with expected CO_2 emission reduction of 8,326 tones/annually.

The NAMA will contribute to climate change mitigation as refurbished Public buildings will use less energy and consequently emit less CO_2 for about 8,326 tones/annually during their life cycle that would be emitted in absence of the mitigation action.

Detailed list of the 23 schools and 26 hospitals are given in tables in annex.

- **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.

Location

- 23 locations of schools and 26 locations of hospitals are shown in the maps below
  Numerations are according tables in annex

SCHOOLS

HOSPITALS

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

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: CO_2

FINANCIAL INFORMATION

Finance and Cost

- Expected cost of **preparation**: **1.6 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
  - Please see Attachment for the investment cost of each building

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

- **Financial sources** identified: 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**: Please see Attachment for expected investment cost and payback period for each of the building.

INFORMATION ON SUPPORT REQUIRED

Description of Support Required

Type of Support	Support required for preparation	Support required for implementation
Financial	Expected cost of preparation and MRV of **1.6 million euro** is about 15% of Total expected cost for implementation for: – Detailed audits - checking of the primary defined EE measures by Preliminary audits – Preparation of project documentation, – Building Certification – Tendering, – Supervision	Expected cost of implementation of refurbishment 23 schools and 26 hospitals throughout Serbia is **10.9 million euro.**
Technical	x	X
Capacity Building	x	x

EXPECTED GHG EMISSION REDUCTIONS AND MRV

Expected Mitigation Potential

- **Annual reduction**:

  Schools: 2,142 tCO_{2e}/y

  Hospitals: 6,184 tCO_{2e}/y

  Total: 8,326 tCO_{2e}/y

- **Total reduction**: 208,150 tCO_{2e} (25 years)
- **BAU scenario:** Energy efficiency level of schools and hospitals remains same as the current level
- **Calculation of emission reduction**

Ex-ante 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)." Both projects involved installation to the same types of public buildings, i.e. schools and hospitals, of energy saving measures such as window replacement, modernization of boiler rooms and substations, installation of radiator thermostatic valves, etc.

In these previous projects, the NAMA implementing entity conducted monitoring of the buildings by measuring the amount of energy consumption by each building and calculating CO_2 emissions before and after rehabilitation.

Results of the monitoring activities are shown below.

Building type	Project name	Number of monitored buildings	Total area of the building (m^2)	CO_2 emission reduction (kg CO_2/m^2y)
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**

Average value of CO_2 emission reduction from all monitored schools in SEEP I and SEEP II (28 kg CO_2/m^2y) was applied to the total floor size of the 23 schools of the proposed NAMA project in order to estimate the expected annual CO_2 emission reduction from schools:

$$\Delta CO_2 = 76{,}483\ m^2 \cdot 28\ kg\ CO_2/m^2y = 2{,}142\ t\ CO_2/y$$

Similarly, average value of CO_2 emission reduction from monitored hospitals in the previous projects (43 kg CO_2/m^2y) was applied to 26 hospitals for NAMA. Total expected annual CO_2 emission reduction from hospitals is:

$$\Delta CO_2 = 143{,}825\ m^2 \cdot 43\ kg\ CO_2/m^2y = 6{,}184\ t\ CO_2/y$$

Measurement, Reporting, and Verification (MRV)

Monitoring plan

Ex-post calculation of GHG emission reduction will be conducted based on the information on CO_2 emissions before and after rehabilitation of each target building, which will be contained in an official document called "Energy Passport," which is required to be prepared by each building owner and be submitted to the ministry under the Serbia's regulation "Regulation on Certification of Energy Performance of Buildings."

Regulation on Certification of Energy Performance of Buildings requires building owners to prepare energy performance improvement plan for their building before rehabilitation works, and have to receive **energy audit and certification** by accredited companies and then submit the "**Energy Passport**" to responsible ministries or municipalities. After implementation, building owners have to receive re-certification by accredited companies

and submit revised Energy Passport to responsible ministries or municipalities.

Energy Passport includes the following information;

1. General information of the building, energy certificates for buildings
2. Data on building, climate condition, HVAC (heating, ventilation, and air conditioning), building envelope
3. Data on heating system of the building, heating control system, heat loss of the building, energy needs of the building, energy consumption
4. CO_2 emissions from the building (automatically calculated)
5. Proposals for improvement of the energy efficiency of the building

Through comparing CO_2 emissions described in each Energy Passport, which is prepared before and after rehabilitation takes place, CO_2 emission reduction will be confirmed.

Energy Manager who will be assigned for a certain public building(s) will monitor Energy Passports issued both before and after implementation of the proposed rehabilitation works, and confirm CO_2 emission reductions of the building.

Energy manager will also be responsible for reporting the calculated amount of CO_2 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 CO_2 emissions data contained in these Energy Passports, which will make the monitoring activity even more efficient and transparent.

Total CO_2 emission reduction (ER) from all target schools and hospitals will be calculated as follows.

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

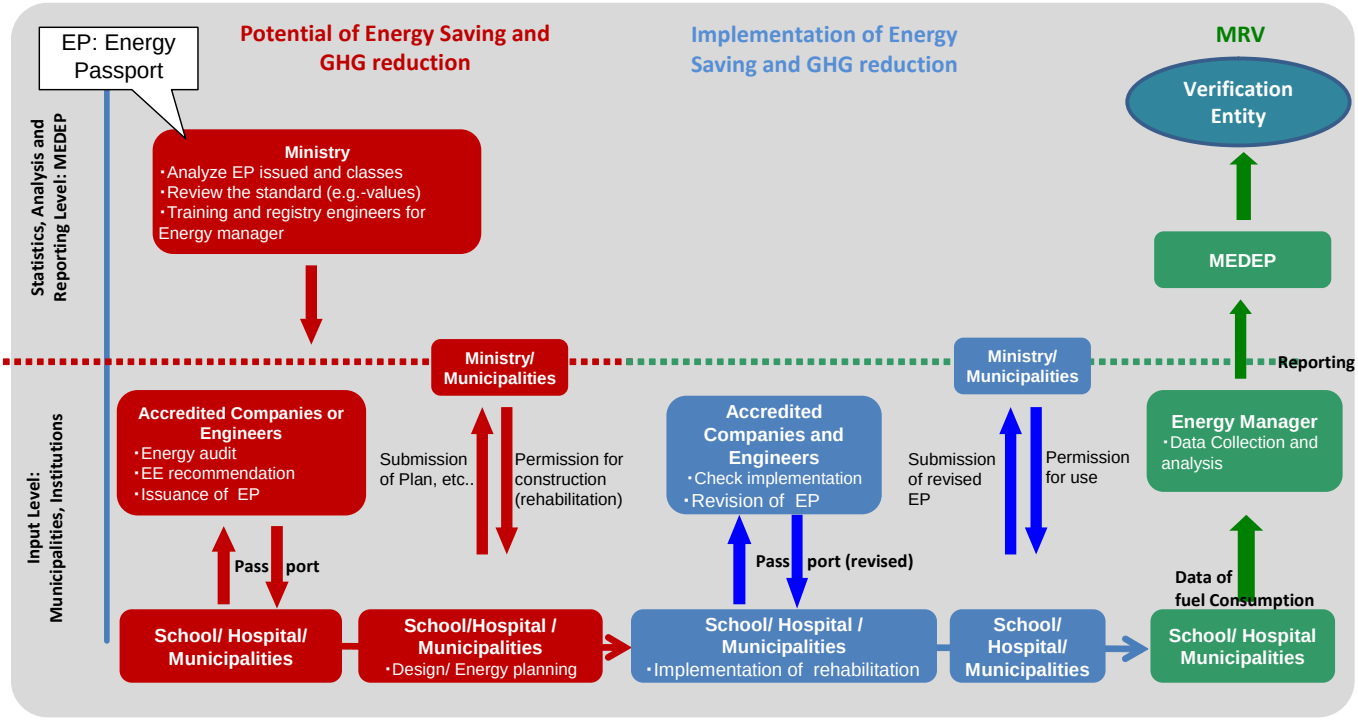
- **Data and parameters to be monitored**:

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 issued to each rehabilitated building before rehabilitation - Energy Passport issued to each rehabilitated building after rehabilitation
Measurement procedures	Energy Manager will monitor all Energy Passports 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

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



Domestic MRV arrangements

- Domestic MRV arrangement of Serbia is currently under development.
- It is expected that under the Serbian domestic MRV system, a NAMA implementing entity is responsible for the Measurement (M) and Reporting (R) activities, which will go through Verification (V) from third party.
- 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 1) the detailed result of the monitoring activities conducted based on the monitoring plan, 2) 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.

OTHER INFORMATION

Contribution to Sustainable Development

- 23 schools and 26 hospitals will be retrofitted.
- Reduction of fuel consumption
- Energy efficiency improvement experience and awareness raising among the municipal and local government officials

- **Sector's policy / Target**

  The overview of the potential energy efficiency improvement (EEI) measures in residential sector and commercial and public to be implemented in the scope of within National Energy Efficiency Action Plan. The targets of different sectors have been set on the basis of estimated potential of various technical measures and are based on the estimated electricity consumption by sub-sectors.

  Expected energy savings in 2018 (Public and commercial activities / building) 0.22 Mtoe

Stakeholder consultation

- MEDEP plans to inform interested parties about NAMA project through: its website, mass media and direct contact with stakeholders.
  MEDEP plans to collect comments from local governments, facilities management and energy managers by e-mails and through direct contact with interested parties.

CONTACT INFORMATION

Implementing Entity

Entity Name	Ministry of Energy, Development and Environmental Protection
Contact Person	Dimitrije Lilic
Title	Senior Advisor
Phone	+381-11-3131-955
E-mail	dimitrije.lilic@merz.gov.rs

NAMA Coordinating Entity

Entity Name	Ministry of Energy, Development, and Environmental Protection Climate Change Division
Contact Person	State Secretary: Mr. Vladan Zdravkovic Head of Climate Change Division: Ms. Danijela Bozanic
Phone	+381-11-3131-355
E-mail	danijela.bozanic@merz.gov.rs

Attachment

List of target schools

No	Name of the Building	Location	Area	Investment cost	Pay back period	Proposed measures
			(m^2)	(EUR)	years	
1	Secondary school "Besedeš Jož ef" Kanjiža	Senta	2,623	291,415	7.5	1.Window Replacement 2.Wall and roof Insulation 3.Thermocontrol
2	Secondary school "Đura Jakšić" Rača (fiskulturna sala)	Kragujevac	1,455	110,580	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 "Petar Drapšin" Beograd	Beograd	2,700	202,770	11.0	1. Window Replacement 2. Mechanical works
5	Secondary school "Lazar Nešić" Subotica	Subotica	5,670	207,511	5.6	1.Window Replacement 2.Thermocontrol
6	Primary school "Veljko Vlahović" Pečenjevce	Leskovac	1,632	131,375	7.8	1.Window Replacement 2.Wall Insulation 3.Thermocontrol 4.Boiler Replacement
7	Primary school "Čeh Karolj" Ada	Senta	3,208	258,245	11.1	1.Window Replacement 2.Wall and roof Insulation 3.Thermocontrol 4.New boiler room
8	Primary school "Čibukovački partizani" Kraljevo	Kraljevo	2,667	236,296	9.8	1.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.Window Replacement 2.Wall and Ceiling Insulation 3.Thermocontrol
10	Primary school "Janko Veselinović" Crna Bara	Šabac	898	72,378	10.5	1.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 Todorović" Knjaževac	Knjaževac	4,040	460,560	20.2	1.Window Replacement 2.Wall and roof Insulation 3.Thermocontrol 4.Balancing
13	Primary school "Borivoje Milojevi ć" Krupanj	Krupanj	1,019	76,526	5.9	1.Window Replacement 2.Thermocontrol 3. Balancing 4.Heat Pipeline Reparation
14	Primary school"Vuk Karadžić" Kladovo	Kladovo	6,376	478,837	16.2	1.Window Replacement 2. Roof Insulation 3.Thermocontrol 4. Balancing
15	Technical school "Rade metalac" Leskovac	Leskovac	8,277	455,235	14.9	1.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.Window Replacement 2.Wall and roof Insulation 3.Thermocontrol 4. Balancing
17	Primary school "Hristo Botev" (Moše Pijade) Dimitrovgrad	Dimitrovgrad	4,853	266,915	14.5	1.Window Replacement 2.Wall and roof Insulation 3.Thermocontrol 4.Balancing
18	Secondary school "Miloš Savkovi ć" Aranđelovac	Arandjelovac	1,960	78,400	6.8	1.Wall and roof Insulation 2.Thermocontrol
19	Primary school "Filip Filipović"	Čačak	3,910	346,426	13.4	1.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.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	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	-	

List of target hospitals

No	Name of the Building	Location	Area	Investment cost	Pay back period	Proposed measures
			(m²)	(EUR)	years	
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 Zotović" 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" Mataruška Banja	Kraljevo	5,939	478,683	6.7	1.Window Replacement 2.Wall and roof Insulation 3.Thermocontrol 4.Gas Boiler Room
5	Institute for Thyroid Gland and Metabolism "Čigota" Zlatibor (Block A)	Zlatibor	2,425	195,455	6.5	1.Window Replacement 2.Roof Insulation 3.Thermocontrol 4.Gas Boiler Room
6	Clinical Centre (Orthopaedic Ward and Traumatology) Novi Sad	Novi Sad	1,520	60,800	3.8	1.Window Replacement 2. Roof Insulation 3.Thermocontrol
7	General Hospital Leskovac	Leskovac	2,425	160,292	6.6	1. Window Replacement 2.Wall and roof Insulation 3.Thermocontrol 4.Balancing
8	Medical Centre Prokuplje	Prokuplje	2,776	183,493	4.5	1.Window Replacement 2.Wall and roof Insulation 3.Thermocontrol 4. Balancing
9	Special Hospital "Ozren" (Department of Thoracic Medicine) Sokobanja	Sokobanja	5,936	478,442	13.4	1.Partial Window Replacement 2.Ceiling Insulation 3.Thermocontrol 4.Boiler Reconstruction
10	Special Hospital "Sveti Vračevi" Novi Kneževac	Kikinda	3,489	167,921	7.9	1.Window Replacement 2.Wall and roof Insulation 3.Thermocontrol 4. Pipe insulation
11	Medical Centre Zaječar	Zaječar	3,476	235,673	3.5	4.Heat Pipeline Reparation 5. Boiler Room Reconstruction
12	Special Rehabilitation Hospital (Children's Ward) Banja Koviljača	Loznica	1,502	60,080	6.5	1.Window and Door Replacement 2.Roof Insulation 3.Thermocontrol 4.Balancing
13	Medical Centre Užice	Užice	26,244	787,320	11.9	1. Window Replacement 2.Thermocontrol
14	Medical Centre "Kosta Sredojević Š ljuka" Kikinda	Kikinda	11,575	347,250	9.3	1.Window Replacement 2.Thermocontrol 3. Pipe insulation 4.Balancing
15	Polyclinic Kula	Vrbas	2,520	138,300	6.4	1.Wall and roof Insulation 2.Thermocontrol 3.Gas Boiler Room
16	Special Hospital «Rusanda» Melenci	Zrenjanin	10,533	526,650	12.3	1.Window Replacement 2.Wall and roof Insulation 3.Thermocontrol 4.Heat Pipeline Reparation
17	Polyclinic Novi Kneževac	Kikinda	1,078	109,872	17.3	1.Window Replacement 2.Wall and roof Insulation 3.Thermocontrol 4.Gas Boiler Room
18	Medical Centre "Dr Dragisa Mišović" Č ačak / Polyclinic Ivanjica	Čačak	3,301	218,196	11.2	1.Window Replacement 2.Wall Insulation 3.Thermocontrol 4.Balancing
19	Special Hospital "Dr Borivoje Gnjatić" Stari Slankamen	Novi Sad	6,857	351,764	12.0	1.Window Replacement 2.Wall and roof Insulation 3.Thermocontrol
20	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
21	Medical Centre Bor	Bor	4,194	153,500	5.7	1.Wall and roof Insulation 2.Thermocontrol 3.Balancing
22	Clinical Hospital Centre (pharmacology) Kragujevac	Kragujevac	582	18,915	4.5	1.Window Replacement 2.Ceiling Insulation
23	Medical Centre	Jagodina	7,920	316,800	10.1	1.Roof Insulation 2.Thermocontrol 3. New Boiler
24	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
25	Medical Centre "Dr Radivoje Simonovi ć" Sombor	Sombor	6,181	80,165	8.1	1.Door replacement 2.Thermocontrol 3.Heat Pipeline Reparation
26	Polyclinic Ljubovija	Ljubovija	3,312	99,369	9.7	1.Roof Insulation 2.Thermocontrol 3.Balancing
Average			**5,532**	**228,189**	**8.2**	* Windows have already been replaced if not given *Thermocontrol - replacement of all radiators' valves and thermostatic valves
Total			**143,825**	**5,932,905**	**-**	