

# Experiences in the buildings sector in Serbia

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Serbian Energy Efficiency Agency

*SYNERGY*

*Workshop on EE in Buildings and RES*  
*Athens, 20<sup>th</sup> May 2008*



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АГЕНЦИЈА ЗА  
ЕНЕРГЕТСКУ ЕФИКАСНОСТ  
REPUBLIC OF SERBIA  
ENERGY EFFICIENCY



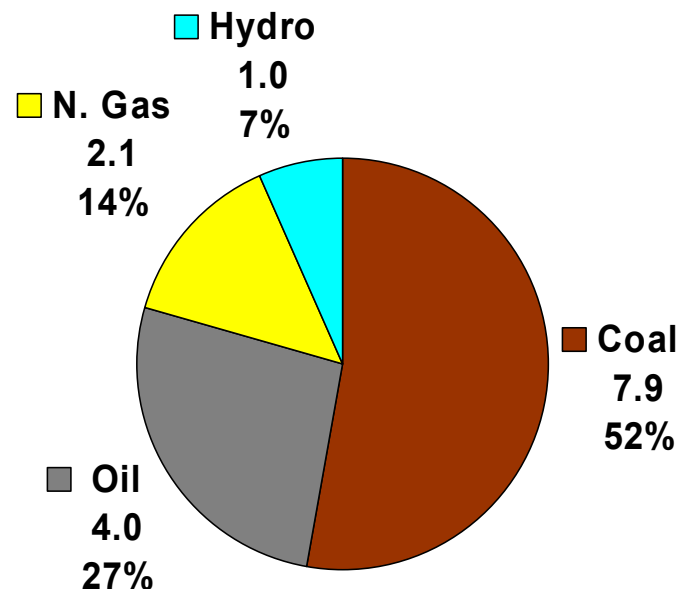
Оснивање Агенције за енергетску ефикасност финансирао је  
Европска Унија преко Европске агенције за реконструкцију

# *Institutional capacity*

- *New institutions were established*
  - Energy Efficiency Agency, Energy Agency (regulatory), Environmental Protection Agency, Environmental Protection Fund
- *Capacity building of current institutions is needed*
- *Ministry of infrastructure; Building Directorate of Serbia*
- *Strengthening cooperation between state administration and other institutions is needed*
  - Chamber of Engineers, professional associations, Chambers of Commerce, municipal associations, other
  - *Example: developing certification of energy auditors*
- *Serbian EE network – Regional EE centers*

# *Energy Consumption in Serbia*

- Total primary energy consumption in Serbia is about **15 Mtoe**
- Final energy consumption is **7.4 Mtoe**
- Total electrical energy consumption is about **3 Mtoe**
- Rate of hydro-PP in total electrical energy production **34%**



# Energy Policy

- *Energy Law*
  - Privileged electricity producers
  - Privileged heat producers
  - Entitled to facilities/should be defined by other legislation
- *Energy Development Strategy until 2015*
  - Energy Efficiency increase and wider use of renewable energy sources (RES) – prioritized objectives
- *Programs Implementation Strategy until 2012*
  - 15 parts including Energy Efficiency and RES



# Support programs (1)

- *Programs of Serbian Energy Efficiency Agency, EU (EAR) grant from CARDS 2002, € 3.8 mil, until 31 December 2006*
- *Serbian Energy Efficiency Project, IDA loan \$25 mil., social public buildings, implementation 2004-2010, Government of Serbia, continuation NEW \$30 mil. (should be approved by the parliament, IDA and IBRD conditions)*
- *National Energy Efficiency Program, around € 1 mil. annually, state budget, Ministry of science and environmental protection*
- *Objective: Energy Efficiency Improvement*



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## Support programs (2)

- *Mid Term program of Environmental Protection Fund, € 7-10 mil annually, 2006-2010.*
- *Renovation and refurbishment of school buildings, different sources, Ministry of Education*
- *Renovation and refurbishment of health buildings, different sources, Ministry of Health*
- *Rehabilitation of DH in Serbia, €20M, EU (EAR)*
- *Rehabilitation of DH in Serbia, 2 x €20M, KfW*
- *Although energy efficiency is improving, programs have other objectives than energy efficiency (except 1 KfW program)*



# Programs links

- *Official links between programs do not exist*
- *Functional links at the level of objectives, criteria, results, procedures, monitoring, evaluation, funding – do not exist*
- *Good cooperation of stakeholders within programs naturally established*
- *SEEA participate in 4 projects funded by Ministry of science*
- *SEEA support REECs established at technical faculties in Belgrade, Novi Sad, Kragujevac, Nis and Kraljevo*
- *Common state program for energy efficiency and RES is needed to optimize activities and funding*

# About SEEA

- *Established* in 2002 by Decree of the Government with financial support of EU (EAR)
- *Re-established* under Energy Law (2004)
- *Legal status*: special governmental organization
  - Potential status PUBLIC AGENCY
- *Task* defined by Energy Law
  - Capacity building of Agency needed – new employees (currently 11), new expertise (juridical)
- *Demand sector energy efficiency programs*
  - Buildings, Industry, Municipal energy, RES
  - Within 4 years more then 80 contracts
  - Public procurement under EU, WB and Serbian rules



# Financial Sources

- *EU (EAR) – grant € 5 M (2002-2006)*
  - € 3.75 M for programs
  - Grant for running costs of SEEA (continue till May 2008)
- *WB – IDA loan \$ 21 M (2004-2010) + additional*
  - EE in social public buildings, counterpart of Serbia
- *Kingdom of Norway (2003-2007)*
  - Technical assistance to Ministry of mining and energy and SEEA, around €300,000 annually
- *Kingdom of Spain (2007-2008)*
  - Use of wind energy in Serbia, € 204,000, measurement and feasibility study for wind farm
- *State budget of Serbia – only for running costs*



# BUILDINGS SECTOR IN SERBIA – GENERAL DATA

## Total number of dwellings

2,650,000 (54% in urban area)

## Total surface of dwellings

190,000,000 m<sup>2</sup>

## Average surface of dwellings

60-65 m<sup>2</sup>

## Average number of degree-days

2400 – 3400 DD

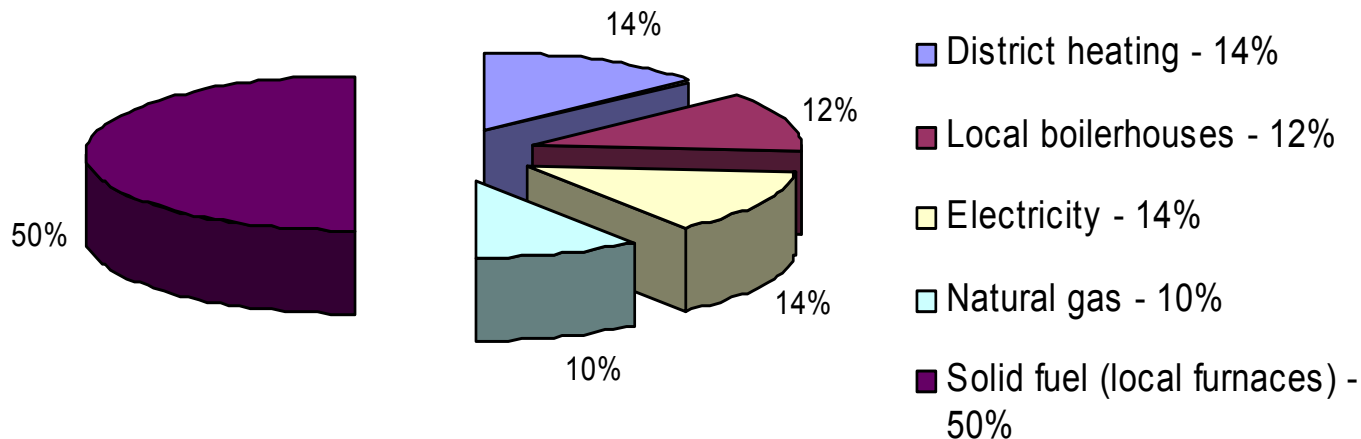
Belgrade - 2450 DD; Mt. Kopaonik - 5400 DD



# STATE EE IN BUILDINGS SECTOR IN SERBIA (1)

- Final energy consumption in 2005 - 3,29 Mtoe\*
- Share of buildings sector - 48%, out of that 65% in residential sector
- About 60% in a heating purpose

TYPE OF HEATING BUILDINGS IN SERBIA



\*) 1toe = 41,868 GJ = 11,63 MWh



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# STATE EE IN BUILDINGS SECTOR IN SERBIA (2)

Residential stock	Unit	Total	District heating	Local boilers	Electricity	Coal	Natural gas	Wood
Dwellings	No	2.650.000	391.513	259.857	874.500	400.000	150.000	574.130
Share	%	100	14,8%	9,8%	33,0%	15,1%	5,7%	21,7%
Heat consumption	MWh/year	22.086.476	4.999.950	2.777.750	3.000.000	4.622.176	1.019.990	5.666.610
Heat consumption per flat	MWh/year and flat	8,33	12,77	10,69	3,43	11,56	6,8	9,87
Efficiency of energy conversion	%	57,5	68,0	83,3	30,1	65	85,0	60,0
Fuel consumption	MWh/year	38.410.982	7.352.868	3.334.634	9.968.102	7.111.040	1.199.988	9.444.350

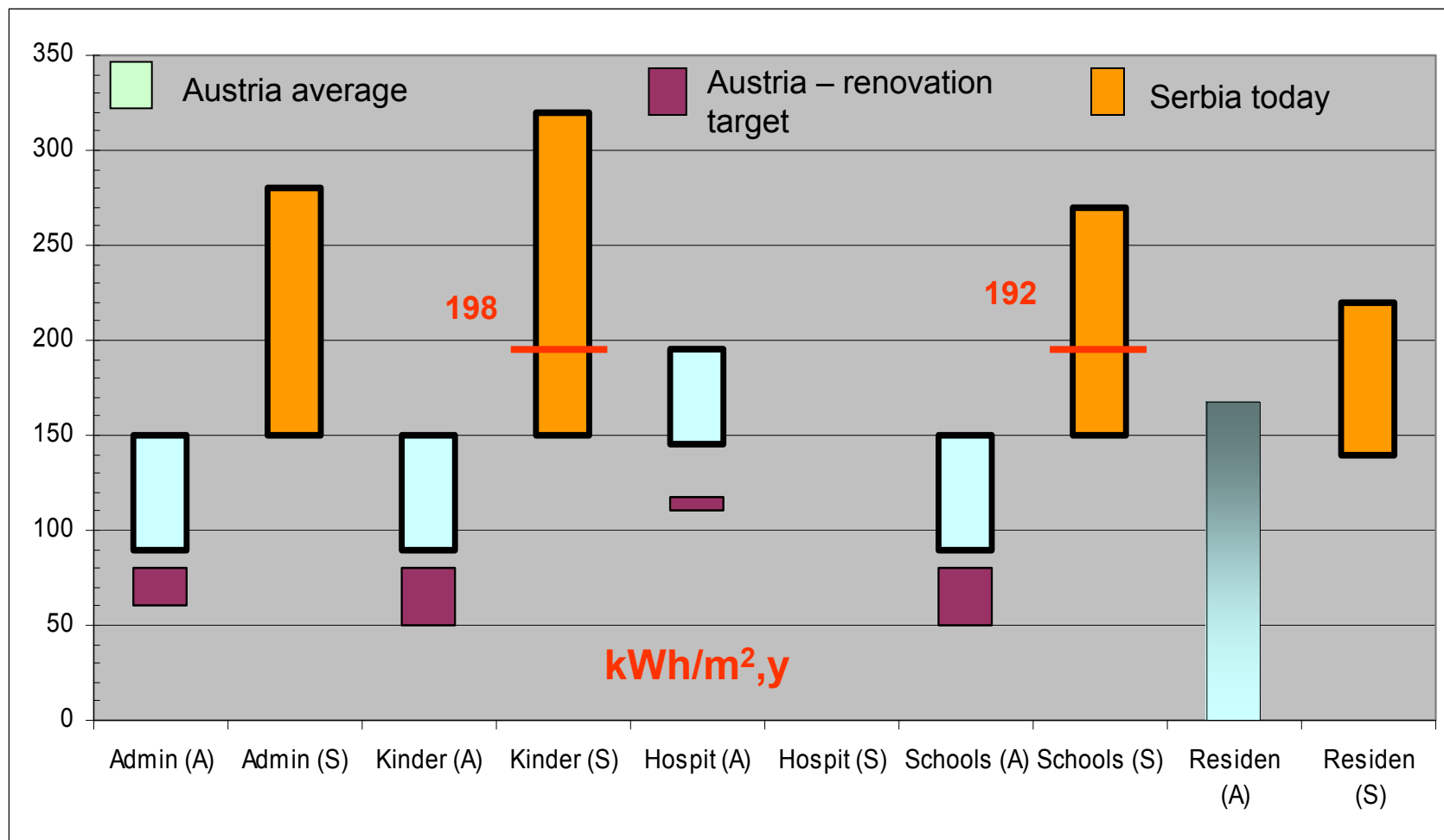


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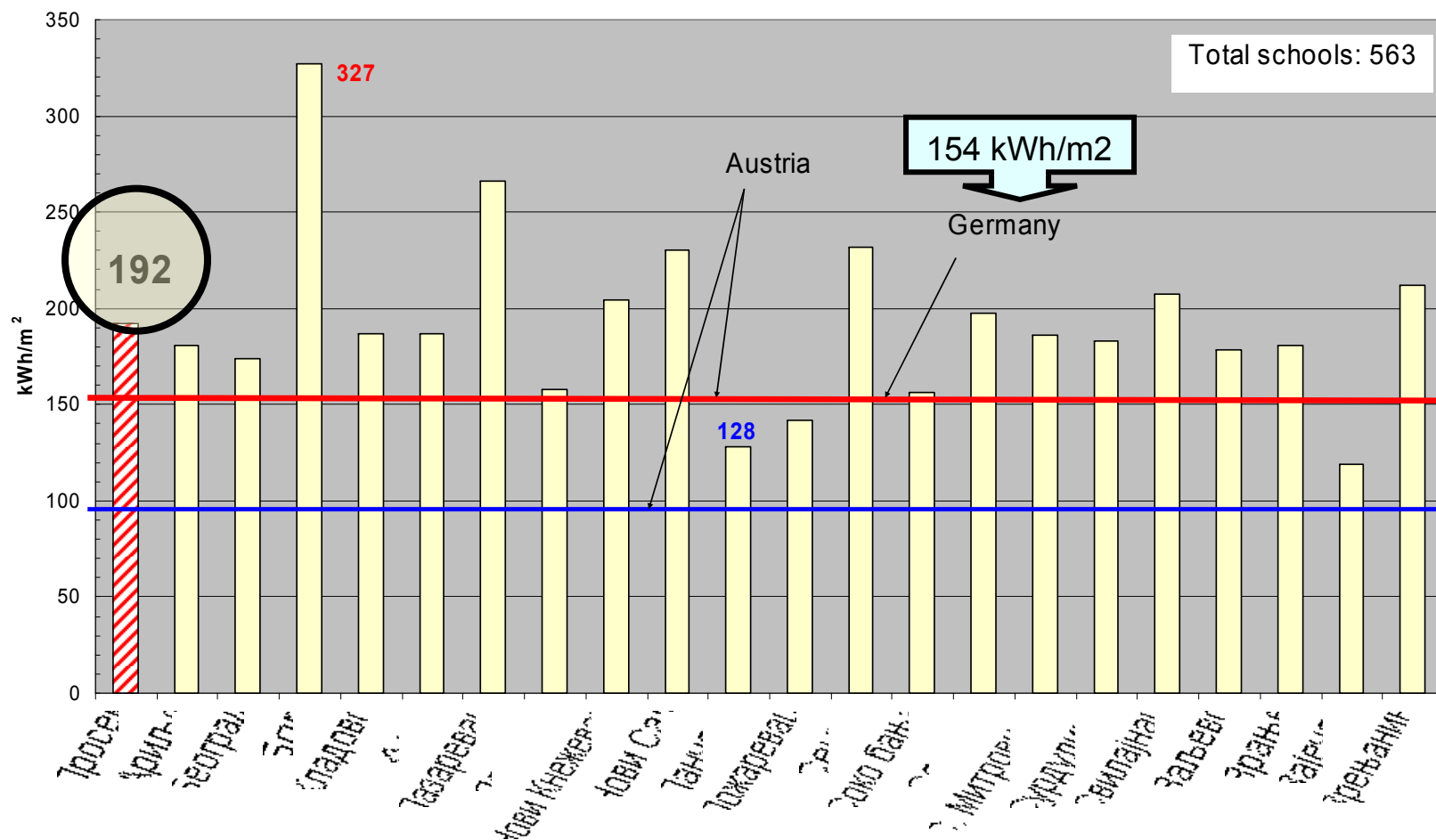
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# STATE EE IN BUILDINGS SECTOR IN SERBIA – EE indicators for heating in public buildings (3)



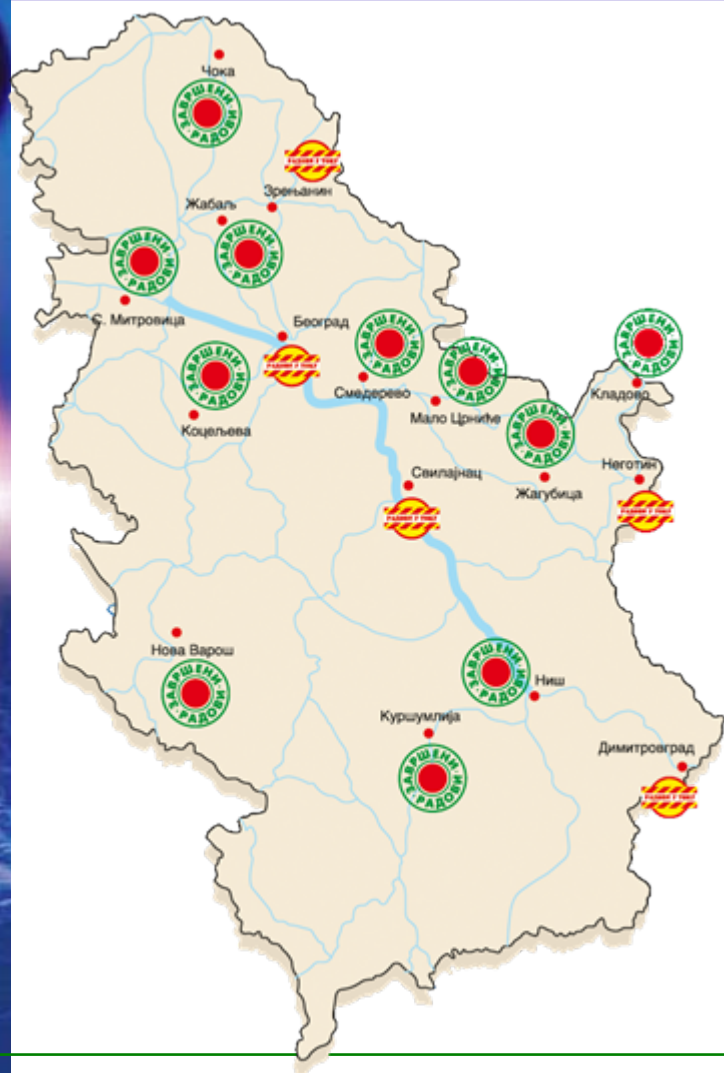


# STATE EE IN BUILDINGS SECTOR IN SERBIA – EE indicators for heating in schools (4)





# DEMONSTRATION PROJECTS



## Investments projects - Grant EU (EAR)

- **16** public buildings
- **900,000 €** grants (max 70%)
- Procedures in accordance EU procurement law
- **All completed (till the end of 2006)**
- School, kindergarten, cultural, health and administrative buildings
- Typical measures: building envelope, heating installation, lighting



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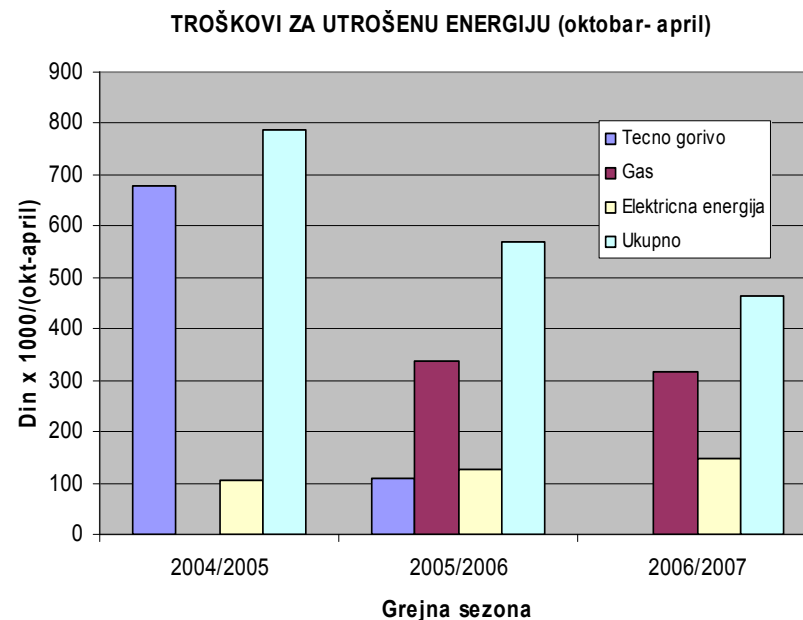
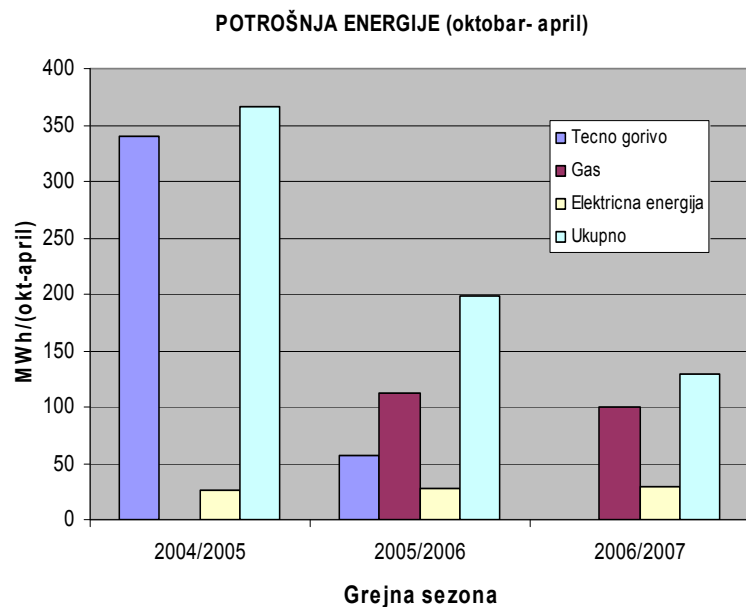


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# DEMONSTRATION PROJECTS – EVALUATION (1)

Energy consumption (left) and energy costs in school “Radivoj Popović” - Sremska Mitrovica for heating seasons 2004/05, 2005/06 and 2006/07



\*blue – liquid fuel oil, yellow – electricity, red – gas, green - total



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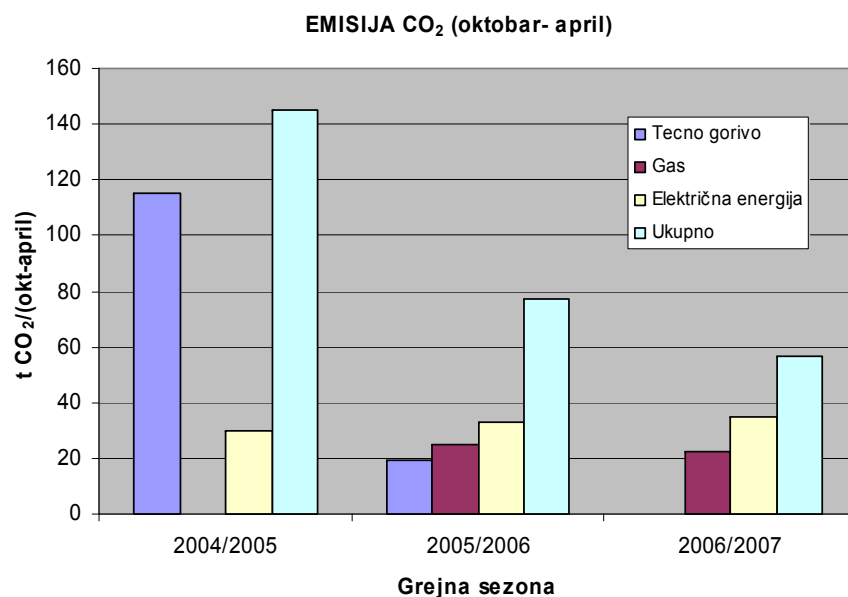


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# DEMONSTRATION PROJECTS – EVALUATION (2)

Influence of the energy consumption to CO<sub>2</sub> emission in the school “Radivoj Popović” - Sremska Mitrovica for heating seasons 2004/05, 2005/06 and 2006/07



\*blue – liquid fuel oil, yellow – electricity,  
red – gas, green - total



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# DEMONSTRATION PROJECTS – EVALUATION (3)

ENERGETSKA KARAKTERISTIKA OBJEKTA - GREJANJE

Škola "Radivoj Popović" u Sremskoj Mitrovici

Broj: 401-00-50/2004-01

Datum: 29.10.2007.

ENERGETSKA KLASA

POSLE

PRE

A

C

Energetski indikator – 01.10. do 30.04

[kWh/(m<sup>2</sup>a)]

55.18

120.18

Realizovane mere EE:

- Zamena 222 m<sup>2</sup> postojećih drvenih prozora
- Zamena kotla na lož ulje novim kotlom na prirodni gas
- Priklučenje na gasnu mrežu nove merno regulacione stanice
- Ugradnja 115 termostatskih radijatorskih ventila

Podaci o objektu:

- Škola "Radivoj Popović"
- Mesto: Sremska Mitrovica
- Površina: 2800 m<sup>2</sup>
- Izgrađena: 1914.
- Značajna adaptacija: 1984.
- Realizacija EE mera : 2006.

Metoda: Upoređenje energetske i ekonomske parametara *posle* i *pre* realizovanih mera EE

Izvor podataka: od korisnika dostavljeni ažurirani podaci, računi za nabavljeno i utrošeno gorivo i računi za potrošenu električnu energiju i dostavljeni klimatološki podaci od RHMZ Srbije za izračunavanje grejnih stepen dana.

Napomena: Grejna sezona, 7 kalendarskih meseci, od oktobra zaključno sa aprilom naredne godine, tretirana je kao godišnja (a) potrošnja za grejanje.

KRITERIJUMI

Klasa	Poslovne zgrade	Dnevna nega	Škole	Bolnice
	kWh/(m <sup>2</sup> a)	kWh/(m <sup>2</sup> a)	kWh/(m <sup>2</sup> a)	kWh/(m <sup>2</sup> a)
A	< 80	< 80	< 65	< 160
B	81 – 120	81 – 120	66 – 100	161 – 240
C	121 – 160	121 – 160	101 – 130	241 – 320
D	161 – 190	161 – 190	131 – 160	321 – 345
E	191 – 225	191 – 225	161 – 190	346 – 365
F	226 – 335	226 – 335	191 – 290	366 – 545
G	> 335	> 335	> 290	> 545

REPUBLIKA SRBIJA

AGENCIJA ZA ENERGETSKU EFIKASNOŠĆ

11070 Novi Beograd, Omladinskih brigada 1

Telefon: +381-11-313-1957

Faks: +381-11-311-1649

E-mail: seea@seea.sr.gov.yu

Web: www.seea.sr.gov.yu

- Energy passport of the building:

120,18 → 55,18 [kWh/m<sup>2</sup>a]



C → A



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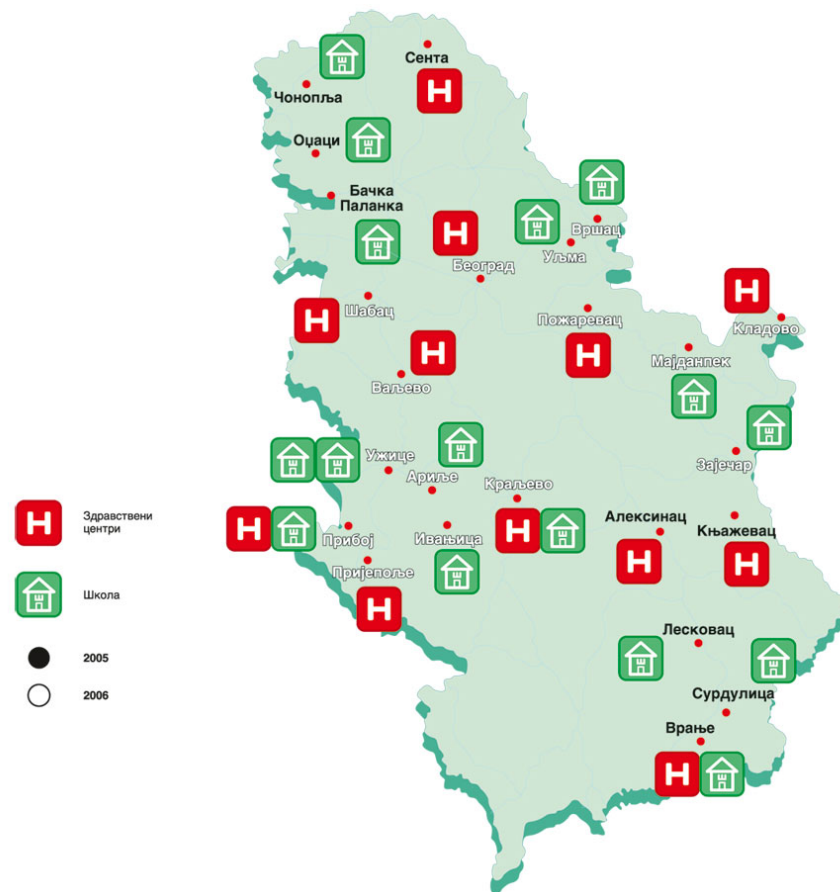
# SERBIAN ENERGY EFFICIENCY PROJECT (1)

## Investment projects

- WB (IDA credit and IBRD loan)

## Component B: SEEA is implementation body

- Phase 1 – **28** buildings (completed)
- Phase 2 – **75** buildings (starting)
- Technical monitoring
- Social monitoring
- Consultancy: BDSP-London/Energoprojekt-Entel Belgrade



# SERBIAN ENERGY EFFICIENCY PROJECT (2)



ANALYSE

**MEASURES**

MEASURING



INTERVIEW

**'BEFORE'**

WORKS



MEASURING

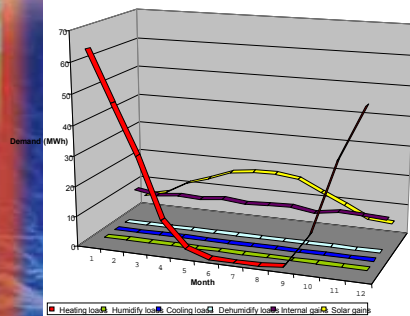
INTERVIEW

**'AFTER'**

**EVALUATION**

**PROCESS**

Monthly Total Demand for Combined Zones in Odzaci.bso

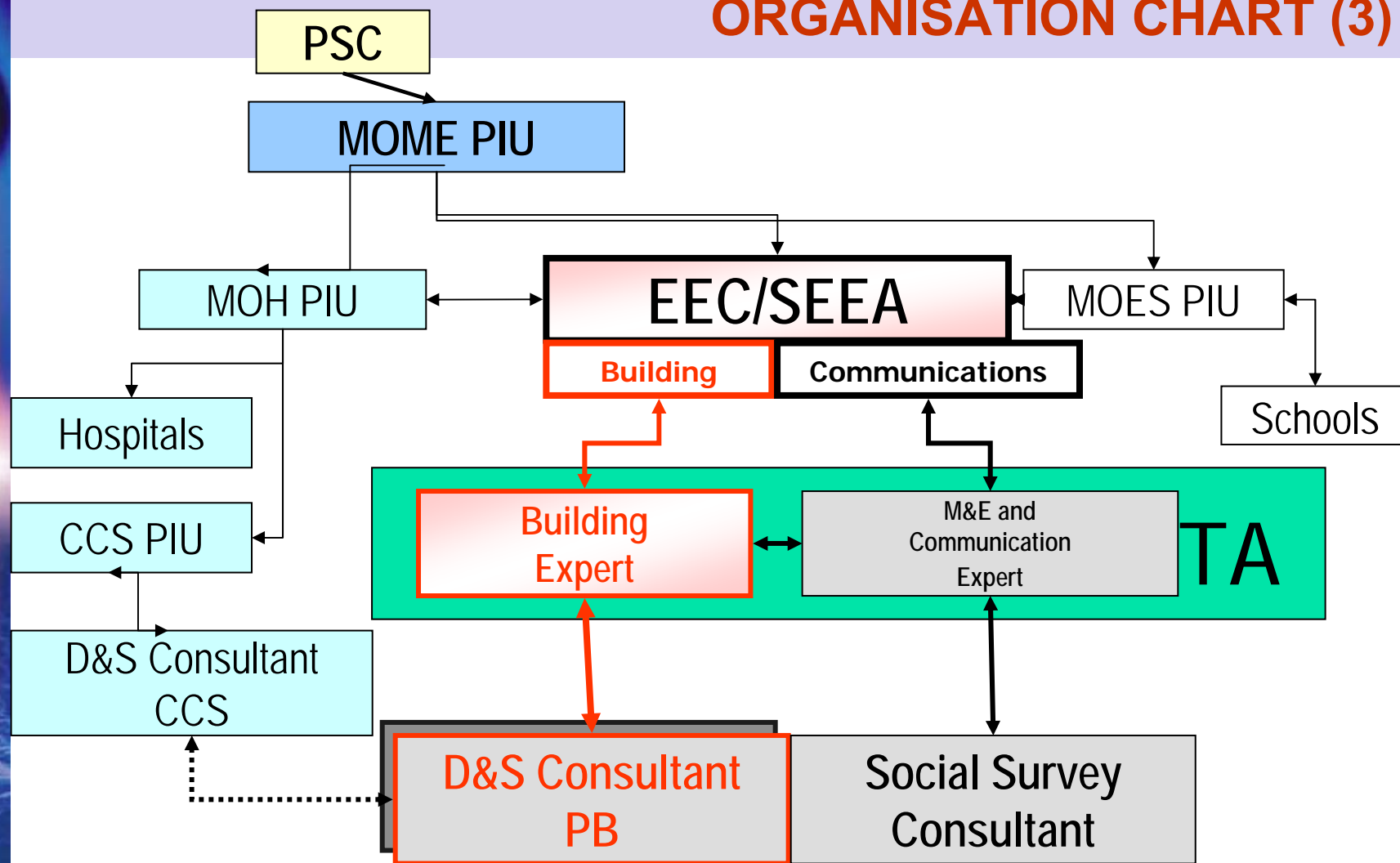


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# SERBIAN ENERGY EFFICIENCY PROJECT – ORGANISATION CHART (3)



PIU - Project Implementation Unit

PB – Public Building



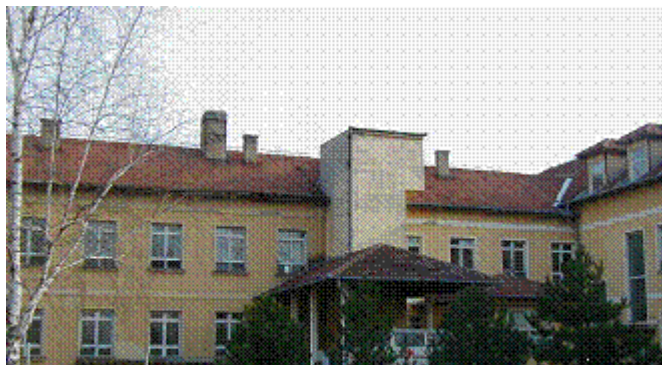
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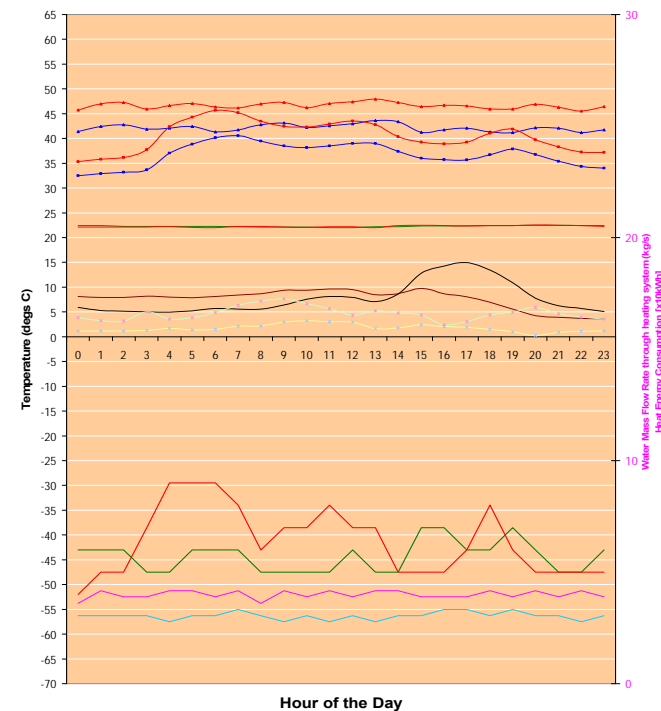
# SERBIAN ENERGY EFFICIENCY PROJECT – EXAMPLE (4)

## General hospital in Senta



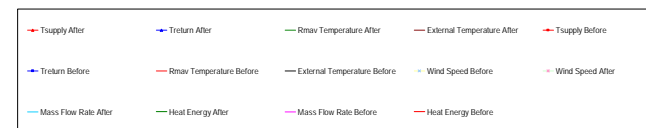
Senta hospital				
Heated Area [m <sup>2</sup> ]		3,856		
Annual Degree Hours		64,724		
Annual Degree Days		2,697		
Results		Measuring Results	Evaluation Report	
BEFORE	Annual Heating Energy Consumption [MWh]	1155	1235	
	Annual Heating Energy Consumption per m <sup>2</sup> [kWh/m <sup>2</sup> ]	316	338	
	Annual CO <sub>2</sub> Emission [t]	300	321	
AFTER	Annual Heating Energy Consumption [MWh]	714	695	
	Annual Heating Energy Consumption per m <sup>2</sup> [kWh/m <sup>2</sup> ]	195	190	
	Annual CO <sub>2</sub> Emission [t]	186	181	
SAVINGS	in absolute terms	Annual Heating Energy Consumption [MWh]	441	540
		Annual CO <sub>2</sub> Emission [t]	115	140
	in percentage terms	Annual Heating Energy Consumption [MWh]	38%	44%
		Annual CO <sub>2</sub> Emission [t]	38%	44%

Dynamic Behaviour over a 24 Hour Cycle (Weekday)  
SENTA SCHOOL: "AFTER vs. BEFORE"



**Before:**  
Daily Heating Energy Consumption: 1530 kWh  
Average Daily Temperature: 22.3°C  
Degree Hours: 259

**After:**  
Daily Heating Energy Consumption: 1370 kWh  
Average Daily Temperature: 22.3°C  
Degree Hours: 261



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In the frame of the National EE Program Agency is participant in the Project:

**“Usage of European procedures for calculation and determination allowable specific energy consumption necessary for heating new and existing residential buildings”**

**Type of the Project:**

- research
- theoretical – experimental
- demonstration with measurement on the object

**Goal of the research:**

Background for domestic standard for calculation and determination allowable specific energy consumption for new and existing buildings in the frame of EU Directive



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### ■ National investment plan

- **10 mil EUR** for improvement EE of family houses (under preparation)
  - interest rate - 0
  - payment period - 5 years
  - grace period - 2 years
- **2,5 mil EUR** for special program increasing EE and heat energy conservation by the installment of calorimeters
  - Beneficiaries – district heating companies



### Commercial banks - example

- purpose: EE projects of reconstruction and adaptations business facilities and offices
- beneficiaries: micro, small and medium enterprises and registered agriculture farms
- effective interest rate – from 9.928%
- payment period - 5 years

### International financial institutions

- EBRD, KfW etc. (signified)

# NATIONAL TECHNICAL LEGISLATION

## *Next relevant standards are active:*

- ЈУС.У.Ј5.510: Методе прорачуна коефицијената пролаза топлоте у зградама, 1987  
*Calculation methods of heat transfer coefficient in buildings*
- ЈУС.У.Ј5.520: Прорачун дифузије водене паре у зградама, 1998  
*Calculation of water vapor diffusion in buildings*
- ЈУС.У.Ј5.530: Прорачун фактора пригушења и прорачун кашњења осцилација температуре кроз спољашње грађевинске конструкције, 1998  
*Calculation of the shading factor and calculation of the temperature oscillation delay through the exterior building structures*
- ЈУС.У.Ј5.600: Технички услови за пројектовање и грађење зграда, 1980  
*Technical conditions of design and construction of the buildings*
- ЈУС.У.Ј5.100: Топлотна техника у високоградњи – ваздушна пропустљивост стана, 1983  
*Thermal technique in the building stock - air leakage of dwellings*



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## CONCLUSIONS

- Harmonization of technical standards for new objects and revitalisation existing buildings with European practice
- Harmonization legislation with EU directives (EPBD, etc.)
- Building of infrastructure (institution, staff, trainings, licence programs etc.) in a purpose of realization measures and activities
- Establishing EE fund (predicted)
- Introducing other stimulative measures
- Realization of the “good practice” and demonstration projects (passive house, etc.)



# REPUBLIC OF SERBIA ENERGY EFFICIENCY AGENCY (SEEA)

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