

*Gordana Stojanović*

Energy Efficiency Agency of the Republic of Serbia, Belgrade, Serbia

## **3M – Measure and Monitor to Manage Sustainable Results in Energy Efficiency Public Buildings' Retrofit**

Technical paper

*The two main pillars of sustainable energy consumption are energy efficiency and renewable energy use. In the context of civil and mechanical engineering, these pillars are deeply rooted in the foundations of energy policy. In case that these industries are solitary based on the two narrow terms, construction and installation, they bear a huge responsibility to reduce their contribution to the current energy crisis and to minimise the risks of growing cost portfolios in the context of energy-aware construction.*

*Energy efficiency is a global issue and it cannot be solved by unilateral approaches. It is a multidisciplinary challenge, combining several issues related to technique and technology, social impact and common sense, environmental protection and ecology.*

*The smart solutions for energy efficiency management should bring into harmony resource-use efficiency (inputs) with cost effectiveness (economy), users' comfort and satisfaction (social issues), and environmental protection.*

*This calls for an alignment of goals, strategy, and metrics. This simultaneously requires the creation of 3M approach: measurement – metrics framework (including common technical solutions) and monitoring by setting up key performance indicators (based on available and reliable information). Reliable information is essential for evaluation and decision making. Statistically acquired data, based on technical and economic performance, should embrace energy efficiency considerations, finally contributing to the sound energy management.*

*3M tools should bring coherent comparability of the achievements between various interventions and energy efficiency applications in building stock and else.*

*Key words: sustainability, energy efficiency, monitoring, environmental protection*

### **Introduction**

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The smart solutions for energy efficiency management should bring into harmony resource-use efficiency (inputs) with cost effectiveness (economy), users' comfort and satisfaction (social issues), and environmental protection.

This calls for an alignment of goals, strategy, and metrics. This simultaneously requires the creation of 3M approach: measurement – metrics framework (including common technical solutions), monitoring by setting up key performance indicators (based on available and reliable information). Reliable information is essential for evaluation and decision making. Statistically acquired data, based on technical and economic performance, should embrace energy efficiency considerations, finally contributing to the sound energy management.

3M (measurement, monitoring, management) tools should bring coherent comparability of the achievements between various interventions and energy efficiency applications in building stock and else.

### **Serbia energy efficiency project**

#### *The pillar of bringing forward and maintaining sustainable results – 3M*

*Background:* In regard to supporting and declaring its commitment to the idea of energy efficiency (as well arising from Energy law clauses), the Government of Serbia has established the Serbian Energy Efficiency Agency – SEEA, with a goal to initiate activities in the field of energy efficiency, and provide the required expertise for developing and implementing programs and projects, as well as to provide related advisory services to the government.

According to Serbian Energy Efficiency Project's Appraisal Document (PAD), signed on February 18, 2004, SEEA has been designated as the implementation body, portrayed as Component C – Technical Assistance, delegated to implement 3M process.

Envisaged are following *responsibilities and duties* for SEEA prior to implementation process:

- *Energy audits:* to organize and carry out *preliminary energy audits* of proposed public buildings within education and health sector for potential energy efficiency retrofit; to advise and assist MoH and MoE during selection process of eligible schools' and hospital's buildings for energy efficiency retrofit; to organize and manage detailed energy audits of selected schools and hospitals.

*Responsibilities and duties* for SEEA during implementation process:

- *Design and Supervision (D&S) and Monitoring and Evaluation (M&E) and Communication:* to propose investment packages for each year of project implementation for selected public buildings; to organize and manage commissioning of relevant consultancy services; procurement procedures for selection of consultant firms for design and supervision, social monitoring and preliminary energy auditing;
- To advise and assist Ministry of Health (MoH) and Ministry of Education (MoE) in procurement procedures for the selection of construction companies and to participate in the tendering process, evaluation of bids, and contract award for component B;

- To co-ordinate Design and Supervision (D&S) consultant designing process, bidding documents' preparation, technical specifications, and works' supervision;
- To monitor the execution and provide Quality Assurance (QA) of works and their compliance to the provisions stipulated within awarded works contracts;
- To co-ordinate monitoring and evaluation of retrofitting of public buildings;
- To develop and co-ordinate communication campaign for the project.

**M – Measurement – Metrics framework  
 (including common technical solutions)**

Chronologically, energy audits preceded implementation works and run in parallel with procurement activities of all relevant outsourced consultancy services:

- (1) SEEA developed tailored questionnaires, purposed for relevant general and technical data collection from potential beneficiary schools and hospitals. Same were widely distributed by line ministries, *i. e.* MoE and MoH.
- (2) Feedback data have been analyzed by SEEA professional staff and extended technical rank list developed and submitted to line ministries.
- (3) Furthermore, ministries nominated a census of buildings eligible for preliminary energy audits.
- (4) Upon data and targeted data analysis, provided by preliminary audit reports', SEEA carried out more detailed technical evaluation and ranking. Newly developed list has been again submitted to line ministries for final nomination of buildings that would undergo energy efficiency retrofit.

**M – Monitoring – Key performance indicators**

**Table 1. Indicators' monitoring**

Component C – Technical assistance		
Main objective: Relevant TA activities professionally implemented, on time, and within budget		
Objectives	Outcomes	Outcome results
3.1 Technical assistance for project implementation in social service buildings provided	Expertise developed, capacities build	Satisfactory progress in designing, procurement and implementation of subprojects and quality of works executed according to contracts
3.1.1 Monitoring and valuation system set up and M&E program implemented		
3.1.1.1 Technical M&E	Expertise developed, capacities build	Satisfactory progress and experience in continuous data monitoring and acquisition accomplished. Particular experience envisaged as vital input purposed to expedite 2 <sup>nd</sup> phase monitoring activities.
3.1.1.2 Social M&E	Expertise, relevant to the field – developed and SEEA capacities build Satisfactory progress and experience in sampled data monitoring and acquisition accomplished.	Quantitative and qualitative evidence of: – Indoor comfort improvements – Users' satisfaction raised – Awareness raised – Benefit sharing scheme model developed and disseminated – Memorandum of understanding for benefit sharing scheme proposed and signed

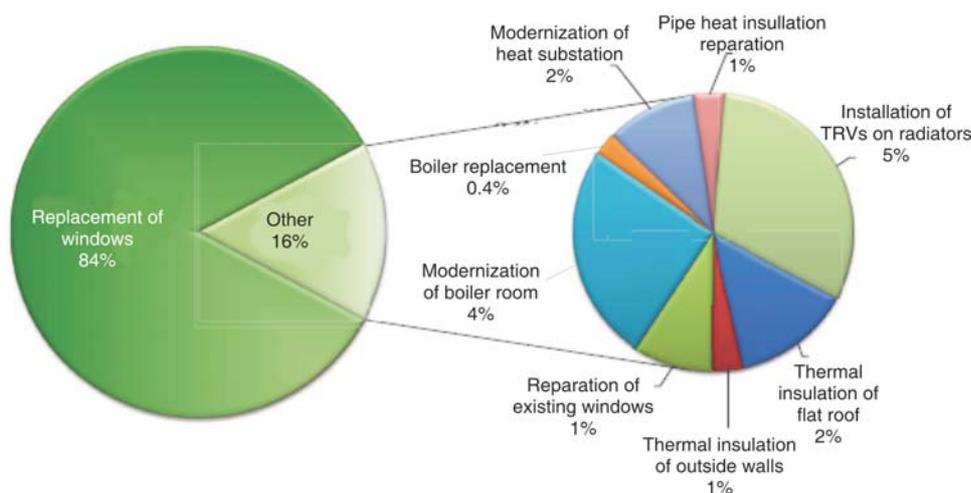


**Table 1. (continuation)**

Objectives	Outcomes	Outcome results
3.1.1.3 Project cycle M&E	Expertise, relevant to the field – developed	Particular experience envisaged as vital input purposed to expedite 2 <sup>nd</sup> phase monitoring activities.
3.2 Communications – Technical assistance provided to SEEA		
3.2.1 External communications	– Awareness on energy efficiency issues raised	Media campaign carried out successfully
3.2.2 Project's communication	<ul style="list-style-type: none"> <li>– Project outputs and desired outcomes promoted</li> <li>– The attitude toward behavioural pattern change achieved</li> <li>– The visibility of Project improved and raised</li> <li>– Champions of the projects spotted within relevant ministries</li> </ul>	<ul style="list-style-type: none"> <li>– SEEA Communications strategy prepared</li> <li>– Project communication plan prepared and consistent with Strategy</li> <li>– Total population of relevant municipalities consulted;</li> <li>– Official meetings carried out in 17 municipalities</li> <li>– Learning days in 13 schools</li> <li>– Learning days (demonstration of SEEP) in 2 SEEA implemented/EAR funded schools</li> <li>– Info sessions in 3 hospitals</li> <li>– Outreach programs and activities performed according to communication plan</li> </ul>

## Technical report – Monitoring results

### INPUTS – Investments



**Figure 1. Total financial investment by energy-efficiency measure**  
(full color figure is available in electronic version)



## Final conclusion

Significant energy and cost savings have been demonstrated for all buildings. Beyond any doubt, the SEEP project has proven to be very beneficial from technical, financial, educational, and social points of view and its continuation should be encouraged.

## Social monitoring results' indicators



**Social monitoring field survey**  
(full color figure is available in electronic version)

## Conclusions

- At the beginning of evaluation, it should be said about the Project's first phase that researches confirmed reasons for which it had been launched, as well as did monitoring and evaluation of successful interventions in public buildings, which end-users/beneficiaries positively evaluated.
- Four researches of BEFORE and AFTER type in energy efficiency project implementation years 2005 and 2006 were conducted after previously approved methodology project, in cities and buildings of sampled schools and health centers.
- The Report is based upon qualitative and quantitative data interpreted by means of a newly prepared clear, comparative tables aimed for comparative observation of four series of research in two years.
- Two basic instruments were applied – questionnaire: (a) for pupils, and (b) for staff of schools and health centers.
- Results of consultant's endeavor provide grounds for a new comparative, evaluation study of findings in the phase i energy efficiency project realization.
- In a word, pupils have shown interest in energy efficiency problems, but not a sufficient information about them; willingness for further education, but also their attitude towards what they had opportunity to hear and see about energy efficiency.

- It is noticeable that with realization of the project sensibility for these problems rises, as well as number of suggestions regarding further education about and promotion of energy efficiency in working organization and its broader environment.
- Two comparative studies show important effects of the project in a number of domains, of which the most crucial is rising level of satisfaction and perception of comfort for work, stay, learning and treatment in schools and hospitals. Series of parameters from researches of BEFORE and AFTER type; It is interesting that in pupils' responses two groups of effects of different degree are visible. In the first case, they clearly speak of better working conditions at school (heating, heat control, lighting, comfort, etc.), while in the second changes in the level of information are obvious, as well as in attitudes on the applied Scale.
- Finally, the changes project implementation brought about, are positive and as projected.
- Evaluation studies confirmed conclusion of previous annual comparative studies, because the end-users/beneficiaries of reconstructions in schools and health centers confirm their effects.

**Communicating results towards external public, influencing stakeholders, and impacting energy efficiency policy in general**

Start of the Communication activities: 2005

Reporting party: World Bank, Government of Serbia and Project Coordination Unit.

Overall communication activities have been carried out in compliance to *communication plan*, generated upon scientific postulates of relatively new communicology science.

Method used: SOSTAC<sup>®</sup> Analyze (S – Situation -situation analyze and assessment); O – Objectives; S – Strategy; T – Tactics; A – Action; C – Control (Monitoring and Evaluation).

**Results from pre-test study**

- General awareness of the need of energy savings and environmental protection is quite high, but targeted public knows little about energy efficiency measures.
- Education of the young is strongly insisted on; they want high information.
- Additionally, in schools and hospitals there is strong need and will for staff education and their involvement in energy efficiency projects.
- Relationship between energy and ecology quite simplified, although basically correctly.
- High outcome expectations.
- Unclear attitudes.
- Present coverage is small thus great expectations from media.

**M – Manage – Influencing the policy**

*General objective*

- Improve energy efficiency in public social facilities – schools and hospitals.

*Specific objectives*

- Quantified decrease in energy costs and heating more affordable.
- Proven economic feasibility of the investments.
- Improved work and leaving conditions.
- Quantified reduction of local and global environmental pollution.

*Social objectives*

- Creating a positive image and reputation of a project through:
  - Increased end-user satisfaction and perception of improvements in indoor comfort of schools and hospitals,
  - Perception surveys and raised awareness of general energy efficiency benefits communication objectives, and
  - Information, dissemination and publicizing of project's goals and outcomes within defined target audiences.

*Impact objectives*

- Institutional – to actively involve into instrumentalisation of energy efficiency within legislative framework.
- Conceptual – to make an effort to influence public discourse and behavioural change.

**Conclusions from post-test study**

On project:

- Beneficiaries seem to be extremely open to receive further information and further education on energy efficiency and personal participation in similar projects, and propose strong media and other tools of publicizing. After all, this has been planned by “Learning Days” scenario - *e. g.* workshops, presentations, energy saving brochures, teaching packs, energy monitors in schools *etc.*;
- If one would summarize all suggestions, concluded is the following: the young feel that all consumers should join energy efficiency campaign, including them. In the first place, schools should teach more about energy, then lessons and advisory classes should be organized for parents in order to educate the older people, who should then pass it over to the children, provided that they themselves follow advice. From the media is in that case much more expected; and
- The Evaluation Report for the condition after, for 2005, set out that the answers are much more favorable, undoubtedly under the impact of the interventions within buildings. Nowadays, this became the statement and state description, not only the attitude.

**Conclusions**

General conclusion is that there is an evident resonant impact of project's and promotion activities. This is related to increased interest of potential beneficiaries and municipalities who directly address to PIU in favour to acquire information on possible project's replicas in their environment.

Also, there is an evident present of willingness to apply benefit sharing schemes as a first step to validate the outcomes of implemented energy rehabilitation works.

On policy:

Portraying outcomes of energy efficiency policy deployment, one must stress that sustainability ratings have improved over time, ever since the initial incentive of adopting Energy Law 2004.

Following has been a Strategy of energy development up to 2015 and the latest is the Program for strategy implementation adopted in 2007.

The role of the project's communications expertise is to, at the capacity of technical support to Serbian Energy Agency, to assist in passing necessary incentives for policy influencing and *vice versa*. To deploy adopted incentives and lessons learned whenever possible.

This interactive role, with a “push” and “pull” incentive models, has brought some insights into general tendency in energy efficiency deployment.

#### References

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## Апстракт

*Гордана СТОЈАНОВИЋ*

Агенција за енергетску ефикасност Републике Србије, Београд

### **3М – Мерењем и мониторингом ка управљању Одрживи резултати у енергетској санацији јавних зграда**

Енергетска ефикасност и употреба обновљивих извора енергије представљају два основна постаментна одрживих уштеда у потрошњи енергије за грејање. У контексту грађевинске и машинске експертизе, ови стубови су дубоко укорениени у самој политици везаној за енергетику. У случају да се ове експертизе посматрају уско, као градња и инсталација, саме по себи носе велику одговорност за сопствени допринос ублажавању постојеће енергетске кризе, као и за ублажавање и минимизацију ризика од растућег портфолиа трошкова, ослањајући се на енергетски ефикасну градњу.

Енергетска ефикасност представља глобални задатак који се не може решити једностраним приступима. То је мултидисциплинарни изазов, који комбинује неколико наука, везаних за технику и технологију, социолошки аспект у ширем смислу, као и заштиту животне средине и екологију.

Рационална решења управљања енергетском ефикасношћу доводе у хармонију ефикасно коришћење улазних ресурса (инпути) са ефикасношћу управљања трошковима (економичност), повећање комфора и задовољства корисника (социолошки аспект) и заштиту животне средине.

Наведено позива на уједињење циљева, стратегије и самог мерења. Истовремено захтева такозвани 3М приступ: *мерење* – оквир физичких јединица (укључујући усвојена техничка решења), *мониторинг* – постављање кључних индикатора, показатеља успешности решења (засновано на расположивим, поузданим подацима). Поуздане информације су есенција за процену и успешно доношење одлука. Статистички подаци, добијени на основу техничких и финансијских показатеља треба да укажу на повећање енергетске ефикасности и коначно потврде исправност рационалног *менаџмента* (управљања) енергијом.

3М алатке уводе кохерентну упоредивост између разних интервенција на примени мера енергетске ефикасности, како у зградарству, тако и у другим областима.

Кључне речи: *одрживост, енергетска ефикасност, мониторинг, заштитна животне средине*

Електронска адреса аутора: [gordana.stojanovic@seea.gov.rs](mailto:gordana.stojanovic@seea.gov.rs)

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