[CROATIA] Energy Renovation Programme for Public Sector Buildings (2014 – 2015)

About the measure

Policy instrument	Sector	Starting date and status
Financial (grants)	**Public**	**[2014] – [December 2018]**

The Energy Renovation Programme for Public Sector Buildings from 2014 to 2015 (with a following programme from 2016 to 2020, which is now in its first stages) aims at reducing total energy consumption of public sector buildings with 30-60% (corresponding to approximately 150 kWh/m^2) for **200 public sector buildings** with approx. **420,000 m²** of usable floor area through increase of energy efficiency and a higher renewable energy ratio. Further goals are to reduce CO_2 emissions by 20,500 tonnes per year, foster investments for the amount of HRK (Croatian kuna) 400 million (approx. **€ 53 million**) and support the development of the ESCo (Energy Services Companies) market. The Programme is implemented in the following **5 stages**: introduction of a public sector building into the Programme, preparation of tender documentation, public procurement procedure, implementation (through an ESCo company) and monitoring of programme results. The implementation of the Programme is administered by the **Agency for Transaction and Mediation in Immovable Properties (APN)** through Energy Performance Contracting (EPC) and co-financed by the **Environmental Protection and Energy Efficiency Fund (FZOEU)**. FZOEU provided funds for co-financing the implementation of the Energy Renovation Programme for Public Sector Buildings of Croatia for the period 2014-2015, by granting financial assistance in the total amount of up to HRK195 million (€26 million) or 40 % of eligible costs for the period until 31 December 2018 (NEEAP, 2017). This means that even after the 2014-2015 period, there were contracts being signed in 2016 due to further availability of subventions. Projects under the Programme are eligible to be concluded by 2018. Any public body can apply based on a selection of parameters (relative and absolute energy savings, investment to annual energy savings ratio, CO_2 reduction, investment to annual CO_2 reduction, period of construction and total investment).

Expected energy savings in 2020	Benchmark
Objective for the 2014-2015 programme: contract the renovation of 200 public sector buildings (for about **420,000 m²** of usable floor area) by the end of 2015, in order to **reduce the energy consumption of these buildings by 40-60%** (i.e. approximate savings of 150 kWh/m².year), leading to expected **final annual energy savings** of about **0.23 PJ/year** in 2016 and 2020 (source: NEEAP 2014, p.87). This number represents total savings achieved in 2016, calculated as a sum of achieved annual savings in a given year. The number is the same for 2020 as all savings will still be valid in this year. The targeted cumulative savings for the whole period 2014-2020 calculated using EED art.7 methodology is 1.24 PJ, while the targeted cumulative savings only for period 2014-2016 is 0.477 PJ (source: NEEAP 2014, p.35)	The National Information System for Energy Management, controlled and managed by APN, reported a **total scope of 13.8 million m² of usable floor area in public sector buildings** (with 43.9% of heated usable floor area), for a total energy consumption of **1.63 PJ/y** (source: NEEAP 2014, p.87).

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Means and outputs

Within the 2014-2015 Programme, 57 public procurement procedures were implemented, **21 EPCs** (Energy Performance Contracts) were signed over 2014-2016 for **68 buildings** with a total area of **225,000 m²**, for a total contracted value of HRK 750 million (**€99.4 million**) (without VAT). (Source: official webpage of the Croatian Ministry of Construction and Spatial Planning [http://www.mgipu.hr/default.aspx?id=15086]).

Data about energy savings

Unit	Main source of data
Cumulative annual final energy savings (PJ/year)	NEEAP (based on monitoring, SMiV)

According to the Croatian National Energy Efficiency Action Plan (NEEAP 2017, draft version), the data from the System for Monitoring and Verifying Energy Savings (SMiV) and national annual report on progress in achieving energy saving targets, the following has been achieved:
Final annual energy savings in 2016: 0.177 PJ/y (in comparison to planned 0.23 PJ) **for actions implemented from 2014 to 2016** within the Public Sector Buildings Renovation Programme (NEEAP 2017, p.21, p.30)
Cumulative energy savings in 2016 calculated for the period 2014-2016 with EED art.7 methodology amount to 0.301 PJ (NEEAP 2017, p.30)
New annual final energy savings for actions installed in 2016: **0.053 PJ** (data from SMiV)

Sources of uncertainties about energy savings

(for the scaled savings (method 5) used for the regular monitoring)

- differences between ex-ante estimates (deemed savings) and actual energy savings (see below "*Focus on the ex-post impact evaluation*")
- use of default values instead of project and/or object specific ones
- no correction factor for rebound effect
- currently non-existing connection between consumption and action databases; which would drastically improve calculation's accuracy

Evaluation of the energy savings

Calculation method(s) and key methodological choices

- Bottom-up methodology and default values are defined in national legislation. Default (standardised) values can be used only if there are no project specific parameters available.
- Calculation method used in the evaluation was based on **scaled savings** (**method 5**)[1]. For each project, an engineering simulation and an analysis of future energy savings was performed before the start of the refurbishment/project. Those data were entered in the system for monitoring and verifying energy savings, named SMiV (further explained below), which was used by evaluators. Information on all energy efficiency projects financed with public money must be registered in that system.
- The **baseline** consumption is estimated through an energy audit ("**actual before**"), i.e. taking into account energy consumption before the renovation, analysis of the physical properties of the building, etc. The calculation considers **normalization of weather conditions, occupancy rates and operating hours**.

[1] Regulation on monitoring and verification of energy savings (Official Gazette, NN 71/2015) https://narodne-novine.nn.hr/clanci/sluzbeni/2015_06_71_1368.html

- In case some of those data are not available for a specific project then predefined default values are used (that were obtained through statistical analysis of the building stock).

Ex-post verifications and evaluations

The monitoring and verification of implemented actions is conducted through the (web based) **System for Monitoring and Verifying Energy Savings (SMiV)**, a tool defined by the legislature as obligatory for public sector representatives that have received subsidies within the Programme, according to the Article 2 of the Croatian Energy Efficiency Act (OG 127/14).

Monitoring of the programme is done continuously, as public buildings are being awarded with a grant, through the application for monitoring and verification of energy efficiency actions (SMiV). Simple indicators, such as total energy and CO_2 savings, specific energy and CO_2 savings, total amount of investments and grants provided, and cost of energy savings or CO_2 avoided can be seen with the SMiV application at any given moment for all types of measures or for different sectors. **Actual energy consumption** is **monitored** through the Energy Management Information System (ISGE), managed by APN. **If the energy savings are not actually realised, the ESCo does not receive the compensation from the public client** (as per EPC).

Detailed evaluation, i.e. an analysis focusing on cost effectiveness, is performed as new plans are being developed. Therefore, at least a rudimentary cost-effectiveness evaluation is integral part of every new plan for the new period of the programme (e.g. 2016 – 2020).

Other indicators monitored and/or evaluated

Indicator	Explanations
Avoided CO_2 emissions	Avoided CO_2 emissions are calculated by multiplying energy savings (per fuel) and official emission factors for CO_2. Expected 80,269 tCO_2 saved/year in 2020 if the renovation objectives are met (1,305,169m^2 renovated over 2015-2020, i.e. 9.46% of the public building stock) (NEEAP 2017, p.75)
Savings on energy bills	Annual savings on energy bills for the renovated buildings. According to the NEEAP 2017, the average lifetime taken into account for the savings is 25 years. Expected HRK 142 million/year (€19 million) of savings on energy bills if the renovation objectives are met (NEEAP 2017, p.75)
Total investment value	Total investments are an indicator of the additional effect that EE actions have on the economy, notably in the construction sector.
Employment effect	Number of employed persons needed for performing refurbishments, i.e. implementation of EE actions.
Geographical dispersion	Geographical dispersion is being monitored in order to foster regional diversification of implemented projects. This is a sensitive issue because of high difference in economic strength of regions, their climatic conditions, and administrative capacities.

Other aspects evaluated

In order to take full advantage of the existing potential for energy savings, the programme's goal is to perform the renovation of public sectors' buildings with the maximum **investment of private capital** in public buildings, the continuation of the **development of the energy services market** and the transfer of experience from public sector buildings to the area of energy services between private entities. Investments that have a positive impact on the state budget are boosted, and the ESCO model ensures that energy efficiency improvements in public sector buildings are implemented without additional expense of owner / user budgeting.

The ESCO market is still in its infancy in Croatia and therefore public sector refurbishment projects are seen as one of the main support tools for take-off of ESCO services in commercial and residential sectors.

Indirectly, the programme for energy reconstruction of public buildings results in increased activity of the construction sector and increased **employment** in the craft and construction sector, engineering activities as well as in the manufacturing of construction products.

(Mikulić, Bakarić, & Slijepčević, 2016a) provide assessment of **socio-economic impact** of energy savings renovation in both public and residential sectors. The **input-output methodology** was used to estimate direct, indirect, and induced growth of gross value added (GVA), employment and government revenues. The paper provides results on Net present value, financial direct costs and benefits of the overall programme, gross value added and employment, increase in government revenues, reduction of air pollutant emissions, and expected social cost and benefits of energy retrofit programmes.

Extending on the previous work, (Mikulić, Bakarić, & Slijepčević, 2016b) investigate the role of energy efficiency actions in residential buildings on regional economic development, also using an input-output methodology.

Similar to these two papers, however with additional emphasis on the City of Zagreb, a detailed analysis of socio – economic effects of energy refurbishment programme was performed in (Mikulić, Bakarić, & Slijepčević, 2017).

Focus on the ex-post impact evaluation

Usually, development of new evaluation practices, energy policies, and strategic documents includes ex-post impact evaluation that goes beyond simple energy saving indicators. In the case of public buildings **three main aspects** were identified as critical for the success of future programmes. Those are **technical results of implemented actions**, **financial challenges** and **organizational issues**. These technical results refer to final energy savings which are currently estimated before implementing the renovation projects, based on scaled savings calculations. In the future, the intention is to use „energy savings as monitored after the renovation“. Analysis of technical results is easily quantifyable and is based on available data. Analysis of the financial and organizational issues is conducted through document analysis, in-field experience of the evaluators and through interviews with identified key stakeholders in the process. That includes both national and local government officials and financial institutions. This type of analysis is qualitative and provided through narrative description (there are no quantitative indicators). With identification of key bottlenecks, evaluators also provided recommendations for solving them.

One of the **recommendations** was the development of (a) guarantee instruments, (b) equity instruments, or (c) new credit line.

Instrument (a) solves the problem stemming from the fact that the energy service provider in the energy renewal projects engages its own capital and does not acquire property on its own budget. The guarantee problem is resolved by transferring part of the risk from the energy service provider to the guarantee scheme (guarantee portfolio or guarantee fund), thus releasing part of the firm's balance sheet, which becomes available for further investment. With such a guarantee, it is possible to engage in crediting the projects on the energy service model and loan funds that otherwise would not be available.

Instrument (b) is essentially a form of equity fund that would increase the volume of own capital available for investment in energy services model projects. While the guarantee allows companies to leverage their own equity and borrowing funds, and thus realize a greater number of projects than the sole use of their own capital, this instrument works to increase the volume of own capital of energy service providers themselves.

Instrument (c) would be a specialized credit line specifically for energy renewal projects. From the relevant financial instrument, credit products intended for energy service providers, as well as companies that independently carry out energy efficiency projects, would be financed. The products that would be formed from this credit line should be structured in a way that makes it easy to combine with the underlying (a) guarantee.

Results of all those analyses are then fed into the plan for a new round of energy efficiency policy measure(s). Future policy measures are then analysed in four scenarios under different organizational and financial setting and optimal implementation model is recommended using maximum floor space of refurbished buildings with greatest energy savings as a goal function.

The optimal scenario considers technical results of a measure, alongside with economical impacts (on the construction sector).

Experience feedback from stakeholders

Interview with Marko Markić (Head of Energy Efficiency Department, Ministry of Environmental Protection and Energy)

1. **What were the main reasons to do the ex-post evaluation?**

There is no formal procedure within the Programme that includes an in-depth ex-post evaluation. Main results for energy savings within the Programme can be observed through the monitoring and verification tool that is SMiV and through the internal reports made by the Environmental Protection and Energy Efficiency Fund (FZOEU), even if they do not bring conclusive results in ex-post evaluation terms, since the calculated ex-ante savings are the ones that are taken into consideration. Detailed analysis and evaluation of the programme, alongside with identification of key obstacles, and lessons learned is performed within development of new programmes and plans.

2. **How do you deal with the issue of availability of data and measurements?**

Ex-post savings based on real data are not a requirement by the APN or FZOEU. The Energy Information Management System, which is a system managed by APN for the public sector buildings to report their energy and water consumption, provides an insight into monthly consumption data which is based on actual energy and water consumption and not on previous calculations. The next step in the development of this management tool is to connect the database of implemented projects with the consumption database which will then provide information on pre- and post-implementation energy consumption. This can currently be done manually, but the intention is to have this analysis done automatically (including calculation corrections such as climate correction, occupancy rate, etc.).

3. **What would you be interested to have information on, what indicators?**

There is a question of indicators and which indicators will be the best factors for analysis in the evaluation process. The ex-ante calculations in SMiV have three indicators based on technical (savings in Petajoules), environmental (saved tonnes of CO_2 emissions) and economic (finances spent in Croatian kuna) aspects. Outside of the methodology, where the ex-post analysis should be the main emphasis of the evaluation process, the indicators should also provide a wider overview of the policies and measures implemented within the Public Sector Renovation Programme and other energy efficiency initiatives. These indicators should not incorporate just the essential component, which is money spent per kilowatt hour (Croatian kuna or Euro per kWh), but also kWh per person living, residing or working full-time in the housing/public sector building. Further indicators in the long-term would be the impact assessment based on the calculation of a ratio of expenses on energy in an average household or public building. The number of educated, qualified work force per saved kilowatt hour would be another indicator to consider in order to make an evaluation successful and indicative of further steps to take in the energy efficiency framework.

To go further

About the measure

- Official webpage of the Croatian Ministry of Construction and Spatial Planning: http://www.mgipu.hr/default.aspx?id=14533
- Description in the MURE database:

http://www.measures-odyssee-mure.eu/public/mure_pdf/tertiary/CR15.PDF

References of the evaluation(s)

- Ministarstvo graditeljstva i prostornog uređenja. (2016). Program energetske obnove zgrada javnog sektora 2016. - 2020.

  https://narodne-novine.nn.hr/clanci/sluzbeni/2017_03_22_508.html
- Ministry for Environmental Protection and Energy. (2017). 4th National Energy Efficiency Plan (unofficial version, in English).

https://ec.europa.eu/energy/sites/ener/files/hr_neeap_2017_en.pdf
- Mikulić, D., Grubišić, M., Bakarić, I. R., Slijepčević, S., Tkalec, M., & Vizek, M. (2015). Analysis of financial viability and economic cost-benefit assessment of energy efficent renovation in residental and public buildings in Croatia: analyses of assumptions and results presented in the document „Outline for an energy efficiency scheme for p. Zagreb.
- Mikulić, D., Bakarić, I. R., & Slijepčević, S. (2017). Revitalization and Energy Renovation of Donji grad: Influence of the Implementation of Renovation Measures on Employment, Gross Domestic Product and Incentives for Economic Activities. Zagreb: Ekonomski institut, Regionalna energetska agencija Sjeverozapadne Hrvatske.

Other useful references

- Mikulić, D., Bakarić, I. R., & Slijepčević, S. (2016a). The economic impact of energy saving retrofits of residential and public buildings in Croatia. *Energy Policy*, 96, 630–644. https://doi.org/10.1016/j.enpol.2016.06.040
- Mikulić, D., Bakarić, I. R., & Slijepčević, S. (2016b). The socioeconomic impact of energy saving renovation measures in urban buildings. *Economic Research-Ekonomska Istraživanja*, 9664(May 2017), 1–17. https://doi.org/10.1080/1331677X.2016.1211952

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