SLOVAKIA CATCHING-UP REGIONS

ENERGY EFFICIENCY OF PUBLIC BUILDINGS IN THE PREŠOV REGION

European Commission
PREŠOVSKÝ SAMOSPRÁVNY KRAJ
DEPUTY PRIME MINISTER'S OFFICE FOR INVESTMENTS AND INFORMATIZATION OF THE SLOVAK REPUBLIC
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STRATEGIC PLANNING FOR SCALING-UP EE IN PSK BUILDINGS

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ACRONYMS AND ABBREVIATIONS

BoF	Buildings for the Future
CEB	Council of Europe Development Bank
EC	European Commission
EBRD	European Bank for Reconstruction and Development
EE	Energy Efficiency
EEAP	Energy Efficiency Action Plans
EED	Energy Efficiency Directive
EEEF	European Energy Efficiency Fund
EERP	European Economic Recovery Program
EIB	European Investment Bank
ELENA	European Local Energy Assistance
EMS	Energy Management System
ENECO	Energy Service Company of Prešov
EPC	Energy Performance Contract
ESCO	Energy Service Company
ESIF	European Structural and Investment Funds
EU	European Union
GES	Guaranteed Energy Savings
GHG	Greenhouse Gas
GWh	Gigawatt-hour
IFI	International Finance Institutions
IPMVP	International Performance Measurement and Verification Protocol
IROP	Integrated Regional Operational Program
JESSICA	Joint European Support for Sustainable Investment in City Areas
MoE	Ministry of Economy
MWh	Megawatt-hour
MunSEFF	Municipal Energy Efficiency Support Instrument
MLEI	Mobilization of Local Energy Investments
MoF	Ministry of Finance
NZEB	Nearly zero-energy building
OP QE	Operational Program Quality of Environment
PJ	Petajoule
PMD	Property Management Department
PSK	Prešov Self-governing Region
RRA	Regional Roads Administration
SIEA	Slovak Innovation and Energy Agency
SlovSEFF	Slovak Energy Efficiency Support Program
TJ	Terajoules
TWh	Terawatt-hour
WB	World Bank

INTRODUCTION – THE IMPERATIVE TO IMPROVE EE IN PUBLIC BUILDINGS

The activity on "Enhancing Energy Efficiency of Public Buildings in the Prešov Region" is designed to assess the existing regulatory framework and financial alternatives, and recommend strategic planning options to implement an energy efficiency (EE) program in public buildings in the Prešov Self-governing Region (PSK). The activity is also designed to assist the PSK in establishing an energy management unit within the PSK's Property Management Department (PMD).

This report on "Strategic Planning for Scaling-up EE in PSK Buildings" examines financing mechanisms for investment in energy efficiency projects in public buildings in the Slovak Republic, the readiness of the market participants, such as the Energy Service Companies (ESCOs) and installers, and the supportive legal framework for ESCOs to implement projects in public buildings. The report provides a systematic process to identify and prioritize EE investment projects, and a financial framework for undertaking investments in PSK public buildings. The report has been prepared in close collaboration with the relevant teams from the PSK office, with input from multiple stakeholders in the Slovak Republic.

This report builds on the earlier task which prepared a "Diagnostic Assessment of the Regulatory and Institutional Framework to Increase Opportunities for the Implementation of EE in PSK Public Buildings." That diagnostic report provided an overview and analysis of the existing EE regulatory and legal mandates, implementation instruments, regional procurement regulations, and the financing schemes at the central and regional levels, which are included in the first part of this report.

EE is an important focal issue in the EU and Slovak energy policies, and as of November 2016, the EU's EE Directive includes a 30% target for energy efficiency by 2030, up from 20% in the EE Directive of 2012. To meet the new target, the EU's EE Directive now requires member countries to take measures that include renovating annually at least three percent of the total floor area of central government-owned buildings to meet the minimum energy performance requirements. Public buildings are also required to meet new standards for nearly zero-energy buildings (NZEB), which will require greater use of renewable energy sources. The new EE directive also requires energy distributors or retail energy sales companies to achieve annual energy savings equivalent to one and a half percent of their annual energy sales through EE measures.

Given the imperative of energy security to the Slovak Republic, the energy policy supports self-sufficiency in energy through an optimal energy mix that promotes low-carbon technologies and domestic renewable energy, and increased efficiency in energy use in all sectors of the economy. The targets of the energy sector are consistent with the EU targets for reduced greenhouse gas (GHG) emissions, increased EE, and increased use of renewable energy systems.

Improving EE in public buildings in the PSK will help the country meet its commitments under the energy policy, lead to lower expenditure on energy, more efficient use of public resources, and lower emissions from the use of fossil fuels. Improved EE in public buildings will also reduce the consumption of natural gas, which is the primary fuel used for heating public buildings in the PSK, and help improve energy security for the Slovak Republic, which imports natural gas.

Implementation of EE in public buildings in the PSK will reduce its annual expenditures on fuel, and permit funds to be used for other infrastructure and economic development activities. A large-scale EE program will also support economic growth by creating new job opportunities, which is crucial for the economic development of the PSK.

OVERVIEW OF THE EE REGULATORY FRAMEWORK IN THE SLOVAK REPUBLIC

The Energy Policy of the Slovak Republic defines the goals and objectives of the energy sector to 2035, with a view to 2050. The Ministry of Economy, which is responsible for the energy sector, is responsible for preparing and updating it every five years, so that it is consistent with the country's national economic strategy, since reliable and competitive energy is critical to achieving sustainable economic growth in the economy.[1] The Energy Policy of the Slovak Republic is consistent with European Union (EU) goals for energy as outlined in the Europe 2020 strategy.

The Slovak energy policy supports self-sufficiency in energy through an optimal energy mix that promotes low-carbon technologies and domestic renewable energy, and increased efficiency in energy use in all sectors of the economy. The targets of the energy sector are consistent with EU targets for reduced greenhouse gas emissions, increased energy efficiency, and increased use of renewable energy systems. The government has also established Energy Efficiency Action Plans (EEAPs) that support achieving the energy policy's priorities for improving energy efficiency (EE) and lowering energy intensity. The key priorities of the Slovak Energy Policy are listed in Table 1 below.

TABLE 1 Priorities of the Slovak Energy Policy and Energy Efficiency Action Plan

Priorities of the Slovak energy policy	A functioning and competitive energy market with affordable prices
	Energy security through an optimal energy resource mix
	Improving energy efficiency and lowering energy intensity
	Competitiveness and affordability of energy
	Diversification of energy sources and the development of low carbon technologies and renewable energy sources
Priorities for improving EE in the Slovak Republic	Reduce energy intensity to the level of the EU average
	Establish a scheme for financing energy efficiency and prepare a financing plan to implement specific measures
	Adopt a robust measurement, monitoring, and evaluation framework for energy efficiency
	Disseminate energy efficiency goals and targets through information and education campaigns
	Introduce intelligent metering systems and create an intelligent help network, so consumers can make informed decisions about energy use
	Implement an effective demand-side management program

Source: Ministry of the Economy of the Slovak Republic, 2017

The Slovak government has prepared four EEAPs to systematically improve energy efficiency. The EEAP 2017–2019 (with projections for 2020) establishes the following targets for energy savings:

- **National indicative energy efficiency target** – The Slovak Republic has EE targets for 2020 pegged to both the primary energy consumption and the final energy consumption, as compared to the PRIMES[2] 2007 reference scenario. A target of 20 percent (191 terrawatt-hours [TWh] or 686 petajoules [PJ]) for primary energy consumption in 2020, and a target of 31 percent (105 TWh or 387 PJ) for final energy consumption.

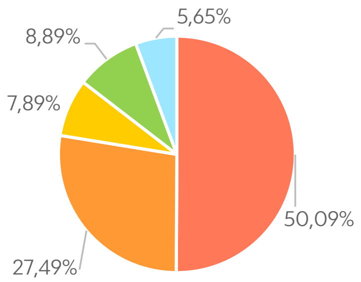
- **Building energy savings target** – The Slovak Republic's target is to annually renovate three percent of the total floor area of buildings owned and occupied by all public buildings, at least to a level of the minimum building energy performance requirements. The Slovak Republic's target for 2020 is 52.17 gigawatt-hours (GWh) per year (365.19 GWh by 2020).

- **Final consumer energy savings target** – The Slovak Republic aims to save one and a half percent of the annual energy sales to customers for each energy supplier. The country's target is estimated at 948.75 GWh per year (26,565 GWh or 3,415.5 terajoules (TJ) up to the year 2020).

The building sector accounted for half the entire energy savings during the previous EEAP period (2014–2016). The 2017–2019 EEAP attributes this, in part, to the additional financial resources allocated from three operational programs (OP) in the 2007–2013 programming period.[3] The EE potential from the building sector was also high, reportedly due to the introduction of compulsory energy audits in 2009, and the availability of financing. The EE measures implemented in the buildings focused primarily on the following: (i) thermal retrofitting of existing buildings through major or partial renovation; (ii) EE measures in building energy systems (heating, hot water, lighting, and so on); and (iii) the construction of new low-energy, ultra-low-energy buildings, and nearly zeroenergy buildings.

Savings came mainly from building renovations and new efficient buildings in the residential sector. Thermal retrofitting was undertaken in multifamily residential buildings with support from the Joint European Support for Sustainable Investment in City Areas (JESSICA) program.[4] The State Housing Development Fund received financing from the three operational programs. Additionally, central government funding of more than €262 million was available for thermal retrofitting of multifamily buildings. A further €30 million from the central government budget was allocated in 2016 for the *Single-family Building Insulation Support Program*. The Slovak government's *Living with Energy* project, co-funded by the EU and implemented by the Slovak Innovation and Energy Agency (SIEA) in 2014–2016, supported building renovation and the new efficient construction of buildings. The installation of meters to monitor heat and hot water use, and support for energy audits and consulting services, also contributed to energy savings in the buildings.

FIGURE 1 Reduction in final energy consumption in various market sectors (2014 – 2016)



Sector:	Saving [TJ]
Buildings	5,051.22
Industry	2,772.04
Public sector	795.73
Transport	896.52
Appliances	569.77
Total:	**10,085.28**

Source: EEAP 2017 – 2019 with an Outlook up to 2020, Ministry of the Economy of the Slovak Republic, Bratislava 2017

The reduction in the final energy consumption in public sector buildings over the period 2014–2016 was based on public sector financing. There are approximately 15,000 public buildings in the Slovak Republic that are largely neglected in terms of maintenance and major renovation, that may, therefore, provide considerable potential for energy savings. It is estimated that budgetary support for EE in public buildings from the central and local governments, contributed to less than 10% of the overall energy saving achieved. Funding from national and international programs, as well as funds such as the Environmental Fund, Eko-Fund[5] and the municipal energy efficiency support instrument (MunSEFF)[6] contributed about 20% to the energy savings achieved. Funding from own resources and EU funds contributed to the rest of the energy savings achieved. About €57 million was available from the Operational Program Competitiveness and Economic Growth 2007–2013 to upgrade public lighting systems. Energy services were used to improve building energy systems and resulted in about 10% savings. Energy savings in public buildings during the period 2014–2016 are shown in the table below.

TABLE 2 Energy savings in public buildings in 2014–2016

Public Buildings Renovated in 2014–2016	2014 (GWh/year)	2015 (GWh/year)	2016 (GWh/year)	Total (GWh/year)
Administration buildings – renovation	0.85	13.88	10.79	25.52
Buildings of schools and school facilities – renovation	-	24.68	9.96	34.64
Hospital buildings – renovation	-	15.57	4.67	20.24
TOTAL	**0.85**	**54.13**	**25.42**	**80.40**

Source: INFOREG information system (2015, 2016, 2017)

Although energy saving in buildings has achieved important results, it has been mostly in the residential sector and much untapped potential remains in the public buildings sector. The EEAP 2017–2019 noted that the main reasons for not meeting the energy savings target for buildings in 2016 were the lack of public resources for both the application of EE measures and the renovation of the buildings of the state administration's central bodies, as well as the delay in the implementation of projects financed by the European Structural and Investment Funds (ESIF).

The SIEA has estimated the potential for energy savings in public buildings to be about 650 TJ by 2019. It is estimated that to realize these energy savings, about €180 million of financing is needed. The fourth EEAP expected that, similar to the period 2014–16, own resources of the public facilities would contribute up to 49% of the financing, with operational programs contributing about 42%, and other foreign funds and the national budget together contributing about eight percent. However, the current government is looking for ways in which energy services can account for a larger proportion of the financing required for investing in energy efficiency in public buildings. Table 3 shows the target for energy savings in the primary and final energy consumption in public buildings, as well as the financing required, for the periods 2017–2019 and 2017–2020. The annual financing required for the building sector and the public sector is shown in Table 4. The average investment intensity for implementing the EE measures in public buildings is estimated to be €1,176/megawatt-hours (MWh).

TABLE 3 **Energy savings targets and the financial resources required in 2017–2019, with an outlook up to 2020**

Sector	2017–2019			2017–2020		
	Energy saving (FEC)	Energy saving (PEC)	Total financial resources	Energy saving (FEC)	Energy saving (PEC)	Total financial resources
	(TJ)	(TJ)	(EUR thousands)	(TJ)	(TJ)	(EUR thousands)
Public buildings	1,362	2,132	636,111	1,706	2,670	800,486

Source: Energy Efficiency Action Plan 2017-2019 with an Outlook up to 2020, Ministry of the Economy of the Slovak Republic, Bratislava 2017

TABLE 4 **Estimated annual financial resources required to achieve the energy savings for 2017–2019, with an outlook up to 2020**

Sector	Total estimated financial resources (EUR thousands)					
	2017	2018	2019	2020	2017 – 2019	2017 – 2020
Public buildings	179,654	231,834	224,624	164,375	636,111	800,486

Source: Energy Efficiency Action Plan 2017-2019 with an outlook up to 2020, Ministry of the Economy of the Slovak Republic, Bratislava 2017

LEGISLATIVE ACTS AND BUILDING CODES

The Slovak Republic has building codes and standards that address energy use in buildings, and standards for the heating of buildings. Consistent with EU directives, the legislative acts and building codes have become progressively more stringent and require increased efficiency in the use of energy. The acts and codes generally apply to new construction, and not to the existing stock of buildings.

The new EU legislation (the Energy Performance of Buildings Directive) requires all new buildings to be nearly zero-energy buildings (NZEBs) by the end of 2020, and all new public buildings to be NZEBs by 2018, provided they are cost-effective. In compliance with this directive, the Slovak Republic has also revised its building codes to meet the new energy performance requirements. The performance specified in the building code for both the new and existing stock of buildings is the same—to meet the 'A0' standard of EE. Recognizing that renovation of the existing buildings to meet the new performance standards may be difficult, there is a provision that the existing buildings need only renovate those measures which are technically feasible and cost-effective. While cost-effectiveness is defined as a measure that has a payback period of less than 15 years, the technical feasibility is not defined. Existing buildings could thus use this provision to not undertake renovations as required by the NZEB regulations.

The table below provides the energy performance standards to be met for different categories of buildings. Buildings are classified by class, depending on their energy performance. The latest guidelines, as they relate to NZEBs, will require buildings to meet the energy performance classified as 'A0'.

TABLE 5 **Global indicator scale for energy classification of buildings – primary energy in kilowatt-hours / square meters/year**

Building Energy Efficiency Classes	A0	A1	B	C	D	E	F	G
Family houses	≤ 54	55–108	109–216	217–324	325–432	433–540	541–648	> 648
Apartment houses	≤ 32	33–63	64–126	127–189	190–252	253–315	316–378	> 378
Administrative buildings	≤ 61	62–122	123–255	256–383	384–511	512–639	640–766	> 766
School buildings and school facilities	≤ 34	35–68	69–136	137–204	205–272	273–340	341–408	> 408
Hospital buildings	≤ 98	99–197	198–393	394–590	591–786	787–982	983–1179	> 1179
Hotel buildings and restaurants	≤ 82	83–164	165–328	329–492	493–656	657–820	821–984	> 984
Sports halls and other sports buildings	≤ 46	47–92	93–181	182–272	273–362	363–453	454–543	> 543
Buildings for wholesale and retail services	≤ 107	108–213	214–425	426–638	639–850	851–1062	851–1275	> 1275

Source: Decree no. 364/2012 Coll.
Decree of the Ministry of Transport, Construction and Regional Development of the Slovak Republic implementing Act no. 555/2005 Coll. on Energy Performance of Buildings and on Amendments and Supplements to Certain Acts, as amended
(as amended by No. 324/2016 Coll.)

The Prešov Region applies all applicable national policies, laws and regulations of the Slovak Republic. The PSK does not have any additional or specific laws that apply only to the region. An exception is the public procurement law for which the Prešov Self-governing Region has a directive on the procedure for the application of Act No. 433/2015 Coll. on public procurement. This regional directive applies to public procurement below a certain threshold.

FINANCING FOR EE INVESTMENTS IN PUBLIC BUILDINGS

The Slovak Republic has experienced relatively high economic growth rates in Europe, with the economy growing by about 4.1 percent in 2018. The gross domestic product (GDP)'s annual growth rate in the Slovak Republic averaged 3.97 percent from 1996 until 2018,[7] which is one of the highest in the European Union (EU). Public debt remains low at 50.9 percent of the GDP. The corporate and retail banking sector in the country has consequently been quite strong, with relatively high liquidity in the capital markets. The Slovak banking sector consists of 27 financial institutions with banking licenses. Most are universal banks, focused on retail and corporate banking.[8] According to the Slovak Banking Association, most Slovak banks are controlled by foreign banking groups, with only three commercial banks fully controlled by domestic investment groups.

COMMERCIAL FINANCING FOR EE PROGRAMS IN PUBLIC BUILDINGS

The Slovak banking sector is reported to be concentrated within the hands of three major players – Slovenska Sporitelna (Erste Bank), VUB Banka (Intesa), and Tatra Banka (Raiffeisen) – which together control more than 50 percent of the banking assets in the country. The Slovak Guarantee and Development Bank, a public bank, is the first Eastern European bank to promote the development of small and medium enterprises (SMEs), as well as to finance the projects of the municipalities and towns in the country. The National Bank of Slovakia, the country's central bank, supervises financial institutions and banks in the Slovak Republic, and works with the European Central Bank, as well as other central banks in the Eurozone.

The funding of the Slovak banks is based primarily on the deposits of domestic clients, and retail loans are reported to dominate in the domestic lending market. Corporate loans are also rising and are reported to have exhibited a seven percent year-on-year growth rate. The banking association notes that while Slovak banks are profitable, low interest rates have affected interest rate margins, and income and prospects for banks may be weakening.[9]

Commercial banks have been involved in the market for financing energy efficiency services in both the public and private sectors. Banks have provided financing for EE projects to creditworthy clients following normal lending practice. They apply the same lending principles when financing either public agencies or ESCOs to undertake EE in public buildings. In addition to the commercial banks, the Slovak Guarantee and Development Bank also provides loans and guarantees to SMEs, local communities, and municipalities. It uses domestic resources and foreign credit lines to fund its operations. This bank could also finance regional governments, although financing is provided on a per project basis. The amount of financing available in the domestic banking sector could not be ascertained, since banks have not assessed the market for EE services and the need for financing.

Banks generally have a division that focuses on municipal and public sector financing. For instance, the VUB Bank noted that it is financing about 600 municipalities and over 3,000 villages and towns in the country. Although municipalities and public agencies in the Slovak Republic have a limit of up to 60% debt, most cannot go beyond the 35 to 40% debt levels, which limits their debt capacity. Commercial banks consider municipalities and public agencies a low-risk debtor. Consequently, they are offered lower interest rates and longer tenors in comparison to private firms. For instance, municipalities are offered debt at under one percent compared to about three and a half percent for a commercial energy service provider.

Banks also have experience with financing ESCOs. They note that financing for ESCOs is based on standard bank due diligence processes and practices. Banks would readily finance large ESCOs such as Siemens or Engie. However, these ESCOs do not typically seek working capital loans. Smaller ESCOs that may really need financing to expand to additional projects, are likely to reach a debt ceiling, and may then not be eligible for further financing. Unlike construction firms that are able to securitize their receivables and refinance projects at a lower cost, there is no experience with collateralizing ESCO receivables to reduce the debt burden. This approach has not been tried with ESCO projects, perhaps because EE project loans and receivables are relatively small compared to large construction projects.

LINES OF CREDIT AND CREDIT ENHANCEMENT INSTRUMENTS FROM INTERNATIONAL FINANCE INSTITUTIONS (IFIS)

Some of the large commercial banks, have experience with credit lines with international finance institutions (IFIs). For instance, the Slovenska Sporitelna, CSOB, and VUB Banka have experience with credit lines from the European Bank for Reconstruction and Development (EBRD) to finance EE programs in small and medium industries (SlovSEFF) and in municipalities (MunSEFF). SlovSEFF provided a grant of up to 20%, which was very attractive to SMEs. The MunSEFF financing facility was attractive to municipalities, since the program offered loan tenors of 10-15 years, and a 10-15% grant. Municipalities were able to obtain financing at 40 basis points above London InterBank Offered Rate (LIBOR), which was very attractive. It is important to note that MunSEFF was largely used for street lighting projects, which are relatively simple to implement and have low payback periods. Given this experience, commercial banks are willing to fulfill reporting requirements, as required by IFIs, and they noted that EBRD had contracted a firm (Enviros) to support banks and clients. The basic structure of financing for EE projects in public buildings through either a typical credit line facility to support ESCOs (or public buildings directly), or a risk-sharing facility to support ESCOs, is illustrated in Figures 2 and 3 below.

FIGURE 2 Credit line facility to support ESCOs and/or the PSK to finance EE in public buildings

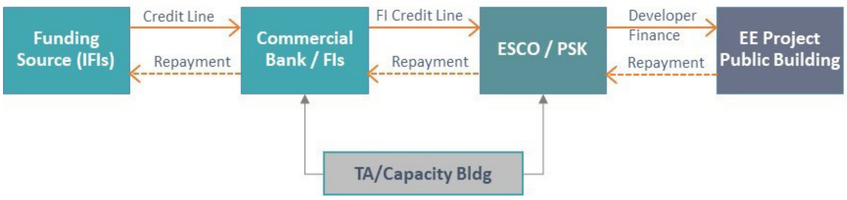
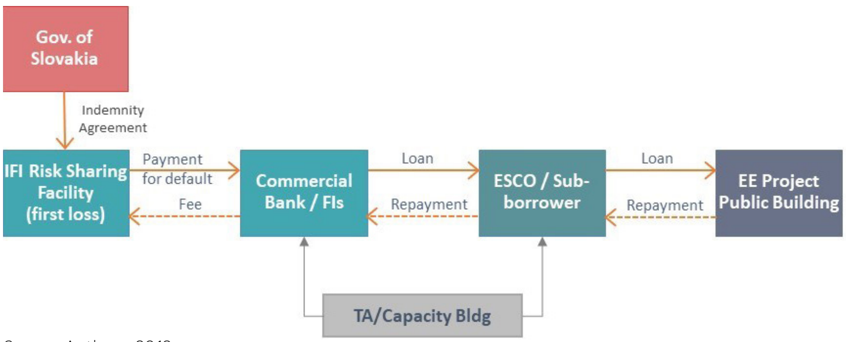


FIGURE 3 Risk sharing facility to support ESCOs to finance EE in public buildings



Source: Authors, 2019

Although there is liquidity in the Slovak capital markets, the situation could change as the EU pulls back on quantitative easing and interest rates go up, then lines of credit or risk sharing mechanisms could become more attractive to commercial banks. Given the current liquidity in the market, commercial banks do not generally need additional financial support lending for EE. However, in case the situation changes, lines of credit or credit enhancement products are considered useful in helping to lower risk and develop preferential loan products to support EE projects. The banks' willingness and interest in participating in programs with IFIs will depend on: the terms of the financing, any grant component that is included, and the technical assistance being offered, something that is attractive to both the banks and the borrowers. In the case of EE projects, there is some concern that: (i) the transaction costs of a guarantee for small EE projects may be too high; and (ii) the risk of default from the municipalities and public agencies responsible for debt service is considered low.

THE ENERGY PERFORMANCE CONTRACT (EPC) ACT

The Ministry of Finance has been leading the efforts to develop the Energy Performance (EPC) Act[10] so it conforms to Eurostat guidelines.[11] For this purpose, it has been working on developing an EPC model contract that needs to be approved by EUROSTAT. Once the EPC model contract is approved, it will be the first one in Europe to conform to these guidelines. Once approved, it will be the first one in Europe to conform to these guidelines. The EPC Act is designed to enable ESCOs to finance and implement EE projects in public buildings and recover costs from guaranteed energy savings. *Public buildings that have annual energy bills in excess of €50,000, and projects with a minimum contract period of eight years, are eligible to be implemented under the EPC Act*. The government is incentivizing the use of the EPC for the financing of EE upgrades in public buildings and would like public agencies to use debt finance for any other infrastructure investments that are needed. The EPC model contract is structured to ensure that the public agency does not assume any debt (as required by Eurostat guidelines). The EPC Act and model contract is designed to implement only energy-related projects and not to undertake deep building renovation that may include non-energy related elements. The EU's EPBD (Energy Performance Building Directive) has also been amended to require EE measures to be financed from energy savings, and to include all end uses and fuels in determining the building certificate. These changes will also apply to the Slovak Republic. The EPC model contract is going through final approvals within the ministries of the Slovak Republic and is expected to be approved by June 2019.

Payment provisions under the EPC Act. Under the EPC Act, the ESCO will finance and implement EE measures in public buildings and guarantee energy savings during a defined period. The beneficiary (the municipality, regional or central government owning the public building) will make two payments: a *partial payment for guaranteed energy savings* (GES) towards the investment, and a payment for *reimbursement for services*, which will cover non-investment costs, including any maintenance and operational costs and the profit margin. On an annual basis, the ESCO will prepare an *assessment report* that will include any excess or shortfall in savings. In the case of a shortfall in savings, the ESCO's entitlement to the payments for GES will be reduced based on the shortfall, and the ESCO will have to make payments to the beneficiary to make up for the shortfall. In case of excess savings, the ESCO will be entitled to additional remuneration in the amount of two-thirds of the excess financial savings. The ESCO will prepare an *annual settlement* report that provides the details of all payments made, and will also prepare a *final amount of the payments for GES* accordingly.

Financing of the project. Under the provisions of the act, the ESCO will finance the renovation and provision of services as per the contract with the beneficiary, and may do so with its own resources, or by financing it. In the case where the ESCO finances the project externally (through a commercial loan), the beneficiary is required to directly make partial payment toward GES to the financial institution providing the financing. This assignment of payment by the ESCO to the financial institution (factoring or forfeiture of payment) is not considered a liability on the books of the public agency, as long as the public agency has: (i) full recourse to any shortfall in savings guaranteed by the ESCO; (ii) can offset such shortfalls against future payments to the ESCO; and (iii) shortfall payments are made within a period of one year (as defined in the Eurostat Guide for EPC of May 5, 2018).

As per the Eurostat guidance, any financing or grant provided by the public agency to the ESCO to implement the project is considered to be on the balance sheet of the public agency, if the financing support exceeds 50 percent or more of the capital expenditure to be incurred in the construction and/or installation of the EPC assets. However, an EU financing (for example a grant or loan) toward the project is not counted as government financing, and any financing arranged between the ESCO and the European Investment Bank (EIB), or any other IFI, is considered to be financing from the private sector.

A year after construction, the ESCO could be allowed to sell the receivables toward partial payment for GES. This will permit the ESCO to reduce its debt burden and assume additional debt for other EPC projects. The ESCO would not be able to collateralize the partial repayment for services (say, 20 percent), which would remain at risk, and could serve as a first-loss facility for any risk sharing instrument to be supported by IFIs. Insurance companies could also insure the ESCO for the performance guarantee. These provisions for financing are still unclear, and will need to be tested.

While the guidance permits the combination of funds from the EPC and ESIF, the business model has not been tested and could potentially complicate the public procurement process. Given the provisions of the EPC Act, the financing institution (in case the project is externally financed) is assured of repayments from the public agency even if the project is terminated.

Key stakeholders have participated in the EPC model contract consultation process, but they are waiting for the approval and publication of the final version. The IFIs and commercial banks have had various discussions with the Ministry of Finance and are waiting to examine the financing and legal framework of the EPC model contract, once it is approved and made public. The ESCO Association of the Slovak Republic and SIEA have also been involved in the consultations and are expecting the final published document. For all of them, having a pilot to test the EPC model contract with public entities is fundamental for its success in the public realm.

READINESS FACTORS IN THE LOCAL EE MARKET

ESCOS IN THE SLOVAK REPUBLIC

The ESCO Association of the Slovak Republic has 17 members, though only eight companies operate as ESCOs in the Slovak Republic. This includes large international firms, such as Engie and Siemens, and smaller domestic ESCOs. Utilities and district heating companies are also keen to provide ESCO services, but are not presently undertaking projects, since they are not permitted to finance projects on behalf of beneficiaries. However, the number of ESCOs is expected to grow as market demand increases in the country.

According to the ESCO Association of the Slovak Republic, ESCOs collectively implement about 30 projects a year, and have the capacity to undertake projects of about a €3-4 million investment at a time, which translates into about 10 buildings. In terms of the project size, the large ESCOs would obviously prefer to implement larger projects, and they would also prefer that some bids be bundled to obtain a project size of 500,000 to 1 million euros. However, some of the smaller ESCOs, which typically would like to bid on public building projects, would be interested in undertaking projects of even €10,000. The ESCO association notes that the present loan default rate for ESCOs is about five percent, which is very nominal and acceptable by bank standards.

The average duration of ESCO projects, and the average capital cost of projects implemented by ESCOs in the Slovak Republic is as follows:

TABLE 6 **Average duration of ESCO projects**

Project Duration	Percentage of Projects
Less than 5 years	10%
5-10 years	70%
11-15 years	20%

TABLE 7 **Average capital cost of ESCO projects**

Project Cost	Percentage of Projects
Under $200,000	10%
$200,000 - $500,000	40%
$500,000 - $1 million	30%
$1 million - $5 million	10%
Over $5 million	10%

Source: IEA, Report on EE in the Slovak Republic (https://www.iea.org/topics/energyefficiency/escos/Slovakia)

EE ESCO contracts have been done in projects with relatively short payback periods that entail equipment replacement rather that thermal retrofitting, and have mostly not involved public buildings. Old public buildings with little maintenance typically require improvements of the building envelope, indoor ventilation to improve air quality, and other refurbishments that are likely to entail payback periods well beyond 15 to 20 years. These types of projects have not been attractive to ESCOs, especially since commercial financing is generally not available for tenors beyond 15 years. ESCOs, therefore, do not finance deep building renovation. Instead, they focus on projects with relatively short payback periods of about 5 to 10 years, which mainly involve equipment upgrades. The ESCO association notes that deep building renovation projects would, therefore, need to be financed by the municipality or public agency, with the ESCO only financing equipment and retrofits directly related to energy savings.

Under an ESCO contract, project beneficiaries can use savings from the maintenance and operational costs (including any saving in human resource costs) in addition to the monetary savings from reduced energy use, to make payments to the ESCO. This approach provides an additional revenue stream, which helps the ESCO recover its investment within the tenor of its financing (for example, about 5 to 10 years).

At present ESCOs can obtain financing for 10 years at an interest rate of 2.5 to 3.5 percent , and some banks may extend the tenor to 12 years at a higher interest rate. Loan tenors beyond that are generally not available to ESCOs, except at higher interest rates and with secured loans.

EQUIPMENT MANUFACTURERS, SUPPLIERS AND INSTALLERS

Buildings for the Future (BoF) is a very large association whose membership is composed of the associations of manufacturers, installers, ESCOs, the Green Building Council (GBC), and other manufacturers and suppliers. BoF notes that presently about 100 public buildings in the Slovak Republic are renovated annually, and the association estimates that an additional five percent of the public buildings (about 50 buildings) across the Slovak Republic could be refurbished annually, based on the present capacity of the marketplace.

BoF notes that the PSK has a geographic advantage, since the Prešov and Košice regions have a strong base of construction companies. However, if the PSK wants to scale up, it will be important to plan a phased approach. If the region wants to renovate between 15 to 20 buildings annually, it may be challenging to secure enough labor force. Therefore, an effort should be made to follow a phased approach that could be disseminated around the neighboring regions, especially in the Košice region. It is also worth considering that, in general, construction firms and installers are not keen to participate in the public procurement processes, given the time it takes and the cost of the transactions. To mitigate risks, the strong dissemination of the procurement process within the market, and even the bundling of public buildings with different lots, may be considered.

SLOVAK INNOVATION AND ENERGY AGENCY (SIEA)

The SIEA uses ESIF funds to support public agencies to undertake EE projects, performs energy audits, and provides training to personnel. Starting in 2014, about €300 million has reportedly been available for project calls, and about €10 million is available in 2019; though much of these funds have already been programmed for use. SIEA states that the average payback period for thermal retrofit projects was 33 years. The PSK has participated in some of SIEA's project calls and has benefited from its support.

SIEA's regional office in Košice provides advisory support for EE. It could also support the PSK's technical staff with energy audits, including training for the PSK staff on conducting audits, interpreting results, and identifying EE measures. SIEA staff can also inform and train the PSK staff on building standards to be met when renovations are conducted; especially given the fact that the existing stock of public buildings are expected to meet class A1 or class A0 standards (although, only if technically possible and economically feasible, as projects with payback periods under 15 years are considered feasible). SIEA can also help the PSK prepare building energy certificates. The PSK would have to apply for a project call to benefit from these advisory services from SIEA. In addition, SIEA could also support the PSK's EE program through its lists of certified energy auditors and qualified installers.

THE NEED FOR A PILOT TO TEST THE EPC ACT ON PUBLIC BUILDINGS

Banks and the EPC Act

The banks have had discussions with the Ministry of Finance on the EPC Act, and although in principle they agree to it, they still need to examine the approved act and test its design with public agencies. Banks are waiting to examine the financing and legal framework of the EPC model contract, once it has been approved and made public. At present, the banks are not clear about the proposed provision in the EPC model contract, which seeks to transfer debt service obligations to the municipality, in order to lower the debt burden on the ESCO. The debt is not off-balance sheet and would remain with the ESCO, which could limit the borrowing capacity of smaller ESCOs, as well as their ability to implement additional projects. The banks would prefer the municipality or public agency to take debt, since they are more creditworthy than smaller ESCOs, but the EPC Act is designed to keep the debt off the books of the public agency. The banks are also not sure if public agencies would be able to retain monetary savings from the EE projects, and would prefer a model where monetary savings from the projects are ring-fenced for debt service.

The banks are not clear on the provisions of the EPC model contract that seek to separate the EE projects from any construction-related elements of a project, which is generally necessary in public buildings that need deep renovation. Buildings may have to process separate contracts for construction and for EE, which may result in a more complex project implementation. Banks note that tailored financing products may be needed to finance projects under the EPC model contract. Standardized formats and processes, and bundled projects could help lower the transactions costs.

The EBRD is examining how the EPC Act could be used to support increased lending for EE in public facilities, especially since the investment is off-balance sheet for the public agency. For them, financing could be provided on a limited recourse basis, since the public agency would make debt payments on behalf of the ESCO. The EBRD is considering the creation of a specific financing facility to provide support to ESCOs in the Slovak Republic that undertake projects under the EPC model contract. However, the details on the program are not yet available.

The EBRD is supportive of developing a pilot project in the Prešov Region to test the provisions of the EPC Act and its model contract. Like the commercial banks, the EBRD would like to see the development of a standardized framework and process to identify projects, develop baselines, and undertake monitoring and verification. Developing a pipeline of projects and the bundling of projects for implementation would also help lower transaction costs and portfolio risk.

ESCOs and the EPC Act

The ESCOs are keen to provide services to the public agencies under the new EPC Act and its model contract, and the ESCO association has been actively providing its views and input to the Ministry of Finance. In their view, some provisions of the EPC Act may make the market less attractive to ESCOs. Specifically, the EPC Act permits repayments to the ESCO only from monetary savings that come from reduced energy, and not from reduced maintenance and operational costs (as had been the case so far). This could be a limitation, since maintenance of the equipment/facility would be an obligation of the ESCOs under the EPC Act (facility owners presently pay for maintenance), and this additional cost may not be adequately or quickly recovered from savings in energy costs alone. If there is a shortfall in the guaranteed savings, it would further reduce the revenue stream available to make repayments.

The ESCO association does not expect demand for ESCO services to grow rapidly with the introduction of the EPC model contract, since the municipalities and public agencies do not have the capacity to develop bid documents for EPC projects. While the regional self-governments, such as the PSK, may have an advantage, given their size and the resources available to them, all the public agencies would need capacity development to prepare and implement EPC projects. The EU's ELENA initiative could support municipalities in developing bid documents, but it would require the municipality to pay 10% of the costs, and achieve a financing leverage of 1:20, barring which the municipality is required to repay ELENA for its support. Dedicated funds for capacity building in EE would thus be preferable.

The ESCO association is thus supportive of a pilot project for buildings in the PSK to test the provisions of the EPC model contract. This support could lead to the development of standardized processes and template documents, which will be important assets for the public agencies in developing bid documents.

SIEA and the EPC Act

In support of the EPC Act, the Ministry of Economy has designated SIEA to provide support for the implementation of the EPC Act. SIEA is presently in discussions on the design of the new OP, which is intended to support implementation of the EPC Act. SIEA has offered to examine if the new OP could be used to carve out a framework to provide assistance to the PSK under the Catching-up Regions (CuR) Initiative, and to support a pilot project to test the provisions of the EPC Act. SIEA is also considering launching an awareness campaign to promote the provisions and benefits of the EPC Act. Given the limited funds, the public agencies would need to apply when SIEA has calls for project support.

The need for a pilot with the public agencies to test the EPC Act

Multiple provisions and requirements of the EPC Act have not been tested, and it remains unclear how they will actually work in the Slovak Republic. Therefore, it seems desirable to demonstrate the provisions of the EPC Act and its model contract though a pilot program to improve the energy performance of public buildings under the PSK. Furthermore, the EPC model itself has not been tested in the Slovak Republic, or in Europe. Therefore, it too needs to be piloted before the mechanism can be fully understood. The Ministry of Finance, the Ministry of Economy, SIEA, the ESCO Association of the Slovak Republic, and the banks are all very supportive of piloting a program in the PSK to test the provisions of the EPC Act. The pilot would also help develop baselines, and undertake monitoring and verification, and create a standardized framework and process to identify a pipeline of projects that can potentially be bundled together—all with the aim of testing and lowering transaction costs and portfolio risk.

STRATEGIC APPROACH TO ENHANCE EE IN PUBLIC BUILDINGS IN THE PSK

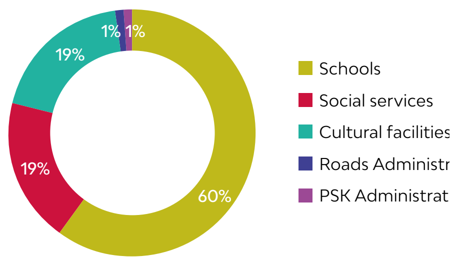
EXISTING STOCK OF PUBLIC BUILDINGS IN THE PSK

The PSK owns 133 public facilities which include secondary schools, assisted living facilities (social services), cultural facilities, buildings of the Regional Roads Administration (RRA), and the administrative buildings of the PSK.[12] The 133 public facilities encompass some 488 public buildings with most facilities comprising multiple buildings. It should be noted that the PSK operates only two buildings, namely the administrative buildings of the PSK. The operation and maintenance budget for the PSK public facilities is not enough to cover expenses, especially in wintertime, when much of the emergency budget is used to cover increased heating costs. Public buildings and facilities may be characterized as shown in the following tables below.

TABLE 8 Characterization of public buildings in the Prešov Region

Facility	Number of Facilities	Number of Buildings	Floor Area (m2)
Schools	80	239	580,000
Social Services	25	87	91,000
Cultural Facilities	26	71	73,000
Road administration and maintenance	1	89	32,000
PSK buildings	1	2	12,000
Total	**133**	**488**	**788,000**

Share of Facilities



Source: PSK, 2018

The public facilities are managed independently by directors or managers, who coordinate with the relevant director in the PSK to plan and budget operational and capital improvement projects. The public schools, social services facilities, and cultural facilities benefit from financial support from the Slovak central government, with the relevant ministries providing budgetary support, and the facilities individually managing their energy facilities and paying their utility bills. However, any increase in energy consumption negatively affects the operational budgets of the facilities. At times of budgetary shortfalls, the PSK provides incremental financing to cover utility bills; this generally happens during the winter months, when heating bills can be high.

A relatively small number of public buildings in the PSK have been renovated. Public buildings are relatively old structures with poor thermal insulation and often outdated energy equipment. This greatly increases the payback periods, as additional investments are needed that are directly related to energy efficiency (for example, leaky roofs, humidity issues, structural issues, and so on). For instance, many of the investments of municipal buildings in the Prešov Region identified under the EU's ELENA initiative had payback periods of about 40 to 50 years.

In the PSK, routine maintenance of public buildings is conducted by technicians and equipment operators within the facilities, and major maintenance and repairs are contracted out to specialized firms. The individual public facilities are unable to raise financing for capital improvements, so capital projects are financed by the PSK. The individual facilities also do not have the technical expertise to undertake energy analysis and to identify opportunities for energy savings. Such analysis is either undertaken by technical staff in the PSK, or by contractors and equipment suppliers.

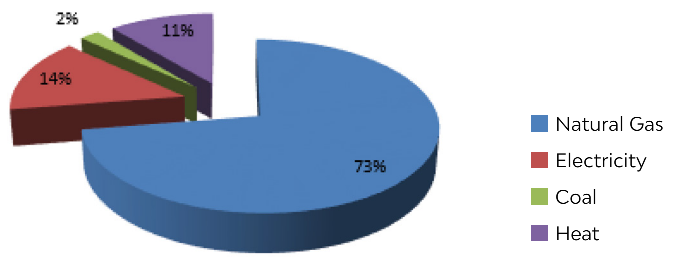
TABLE 9 Renovation status of the PSK public buildings

Facility	Number of Renovated Public Buildings	
	Fully Renovated (% renovated)	Partial or No Renovation
Schools	38 (16%)	201
Social services	19 (22%)	68
Cultural facilities	10 (14%)	61
Road administration and maintenance	1 (0%)	88
PSK buildings	2 (100%)	-
Total	70 (14%)	418

Source: PSK, 2018

The annual energy consumption in public buildings over the period 2010 to 2017 is shown in Table 10 and Figure 4 for each fuel source in the buildings. Consumption of all fuels is reported in megawatt-hours (MWh) for consistency, and to enable comparison of per unit consumption with the new building performance standards. On average, the consumption of natural gas accounts for over 72 percent of total fuel consumption, and electricity usage accounts for about 14 percent (see Figure 4).

FIGURE 4 Average fuel use in PSK public buildings



Source: Authors, 2019

TABLE 10 Annual energy consumption in the PSK public buildings

Type of Fuel	Annual Energy Consumption (MWh)								
	2010	2011	2012	2013	2014	2015	2016	2017	Average Consumption
Natural gas	61,040	57,627	56,858	53,964	40,560	44,121	46,317	47,805	51,037
Electricity	10,573	10,360	9,919	9,788	9,618	9,836	10,113	10,125	10,041
Solid fuels	1,671	1,861	1,767	1,894	995	1,151	1,322	1,340	1,500
Purchased heat	7,207	6,610	6,263	5,972	6,735	9,668	9,859	10,246	7,820
Total fuel consumption	80,491	76,458	74,806	71,618	57,908	64,776	67,612	69,517	70,398
Estimated CO2 emissions (t)	16,813	15,900	15,578	14,858	12,031	13,499	14,074	14,489	14,655

Source: ENECO, PSK, 2018

Energy use information for individual public facilities from utility bills is not collated and databased centrally. This makes it difficult to analyze energy bills on a periodic basis and to properly manage annual budgetary spending on energy consumption. A lot of work was done with the PSK and the ENECO consulting firm to develop an updated database that would provide initial estimates on energy consumption. If the PSK wants to have a more sustainable approach to energy management of public facilities, then it should continue to update the database to include key variables, and it should also request each individual facilities' manager to report back on their energy consumption bills.

From the aggregated database, the following information can be extracted:

- The main energy use is for space heating. The fuel sources include natural gas, some biomass, and purchased heat (from the local district heating companies).
- The main EE opportunities are not in fuel switching, but in the use of more efficient equipment and thermal insulation.
- Although energy use in heating has increased, most schools do not fully heat all areas to an optimal temperature, in order to keep energy expenditures low.
- Unlike public schools, social services facilities are fully heated throughout the heating season and use significant amounts of hot water, since they care for the elderly population, and sometimes include health and nursing services. Three-quarters of the energy consumption is for space and water heating. Electricity usage accounts for about 23% of the total energy consumption.
- The cultural facilities are diverse, ranging from museums, to theaters and a planetarium. Therefore, energy use varies significantly, depending on the function and hours of operation. Energy consumption tends to be lower in these facilities, and most of it (about 60%) is for heating.
- Regional Roads Administration facilities vary in their function and the hours of operation (including offices, workshops, maintenance facilities, storage facilities, and staff changing rooms). However, about 87 percent of their energy consumption is for heating.
- PSK administration buildings use energy for space heating, lighting and office equipment. The main administrative building is connected to the local district heating network, and the second building is heated with a gas-based heating system. Both buildings have been renovated.

Some limitations of the database became apparent, when it was used to analyze energy use in various buildings in the PSK. The energy intensity of individual buildings within a public facility varied widely, and it provided no usable information which could help identify facilities and buildings that could be prioritized for investments in EE measures. While some of the information in the database is yet to be verified and validated, the preparation of the database is an important step in the process of undertaking the systematic analysis of public buildings.

SYSTEMATIC ANALYSIS TO PRIORITIZE PSK INVESTMENT IN PUBLIC BUILDINGS

The PSK would benefit from a systematic analysis of its stock of public buildings to identify and prioritize investment opportunities to implement EE measures. A four-step process is suggested for the PSK to identify and prioritize EE projects and investments in public buildings (see Figure 5).

Step 1: Development of a longlist of projects. Use the database of public buildings to conduct a statistical analysis to identify buildings with high energy consumption that should be examined further, and to develop a longlist of projects. The analysis should be based on such key variables as energy intensity, age of building, usage characteristics, and so on.

Step 2: Development of a shortlist of projects. Use the Excel-based building energy model to analyze opportunities for energy savings in buildings included in the project longlist. The assessment includes evaluation of different EE measures with actual installation cost information, to provide the economic rate of return and payback periods. The outcome of the analysis is the preparation of a shortlist of buildings that should be prioritized for investment.

Step 3: Identify top priority investments projects. Data and information for buildings on the shortlist is validated with site visits, review of records, and preliminary or walk-through energy audits.

Step 4: Preparation of bid documents. Energy audits and feasibility studies may be conducted for the final shortlist of projects, followed by the preparation of bid documents for tendering the projects for implementation.

FIGURE 5 Four-Step Process for Identifying and Prioritizing EE Investments in Public Buildings

Step 1	Step 2	Step 3	Step 4
Longlist—Preliminary identification of projects based on improved energy database	**Shortlist—based on energy modeling assessment**	**Top priority—verifications based on site visit**	**Preparation of feasibility studies/bid documentation for tender**

Source: Authors, 2019

Development of the first level of systematic analysis

The first level of analysis included the incorporation of additional categorization fields to be able to obtain more granular data, to be able to then identify a longlist of investments. The database was modified with additional fields to subcategorize public buildings based on the type of facility and the building usage. For instance, schools are further categorized by the type of school (vocational, grammar school, hotel management, and others) and the usage of building (classroom, dining facilities, gymnasium, and so on). These additional subfields in the database have helped better categorize buildings, and understand and compare energy use in such facilities.

Having a better categorization of the buildings will reduce variations in energy intensity and strengthen the first level database. The wide variations in energy intensity in all the different sectors indicate either that energy use is being allocated to buildings which do not use much energy, or that the data is poorly recorded. The problem is compounded by the fact that, generally, there is only a single metering point in a given facility. As a result, it is difficult to allocate energy use across the various buildings. This made it quite difficult to prioritize and identify a shortlist of buildings. The tables below illustrate the wide variation levels found in all sectors without using the updated database.

TABLE 11 Energy intensity in public buildings under the PSK

Schools (average age: 47 years)	Intensity of Energy Use		Range of Energy Intensity (individual buildings)	Energy Intensity to Meet A1 Standard[a]
	2014	2017	2017	
Energy used for heating (kWh/m²/yr)	56	69	8–940+	< 28
Electricity use (kWh/m²/yr)	9.7	9.7	1–1,000	< 9

Social services (average age: 73 years)	Intensity of Energy Use		Range of Energy Intensity (individual buildings)	Energy Intensity to Meet A1 Standard
	2014	2017	2017	
Energy used for heating (kWh/m²/yr)	118	131	49–1,000+	< 35
Electricity use (kWh/m²/yr)	28	30	1–450+	< 16

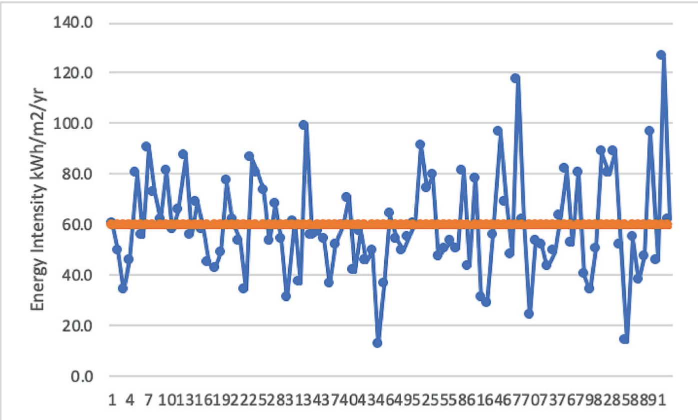
a As per EU directives, renovated public buildings will have to meet A0 standards, provided it is technically and financially feasible. Meeting A1 standards is more feasible.

Cultural facilities (average age: 35 years)	Intensity of Energy Use		Range of Energy Intensity (individual buildings)	Energy Intensity to Meet A1 Standard
	2014	2017	2017	
Energy used for heating (kWh/m²/yr)	27	44	22–196+	< 28
Electricity use (kWh/m²/yr)	13	17	1–288+	< 15

Regional Road Administration	Intensity of Energy Use		Range of Energy Intensity (individual buildings)	Energy Intensity to Meet A1 Standard
	2014	2017	2017	
Energy used for heating (kWh/m²/yr)	27	44	13–580+	< 28
Electricity use (kWh/m²/yr)	13	17	3–1,100+	< 15

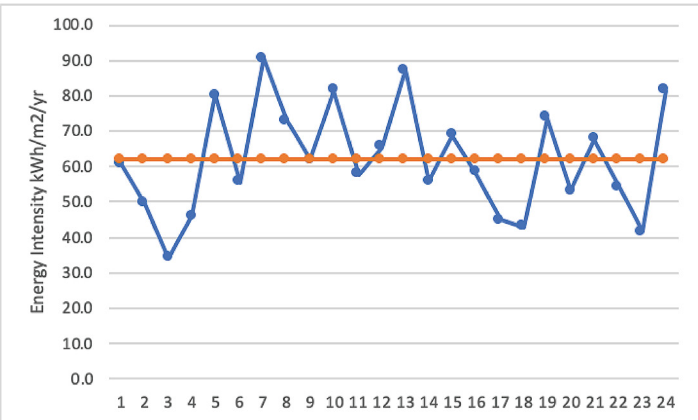
Source: Authors, 2019

FIGURE 6 Energy intensity for classrooms in all schools



Source: Authors, 2019

FIGURE 7 Energy intensity for classrooms in grammar schools (gymnasiums)



Source: Authors, 2019

To illustrate the problem with the variations in intensity of the energy use in buildings, Figure 6 shows the intensity of energy used in just classrooms (it excludes other buildings in a school facility) and the mean across all schools under the PSK. Intensity of energy use varies from about 13 to 127 kilowatt- hours/square meter/year. The mean for this data set is about 60 kWh/m2/yr., and the standard deviation is about 20 kWh/m2/yr. This dataset does not help identify schools which should be examined further to assess the potential for energy efficiency.

More meaningful information can be used after updating the database to be able to prioritize investments. Figure 7 illustrates the intensity of energy used in the classrooms of just the grammar schools (gymnasiums), and the mean based on the updated database. The intensity of energy use varies from about 34 to 90 kWh/m2/yr.. The mean for this data set is about 62 kWh/m2/yr., and the standard deviation is about 14 kWh/m2/yr. This dataset provides more meaningful information, which can be used to identify grammar schools that should be examined further to assess their potential for EE. For instance, the five schools with energy intensity above 80 kWh/m2/yr. could be included in the longlist of projects and could be analyzed further using the level two assessment (that is, the building energy model). Similarly, the schools with energy intensity closer to 40 kWh/m2/yr. could also be examined further to understand why they are more efficient. Similar analysis for other types of schools – vocational schools, hotel academies, technical schools, nursing/medical schools, and others – can be used to create a longlist of all the school facilities in the PSK that could be examined further. Annex A provides graphs for a few different types of school buildings and social service facilities.

Despite showing significant potential for EE improvements, much depends on the cost and financial feasibility of the retrofit project. Judging by the energy intensity in 2017, and the energy performance standards to be met by buildings to obtain just the class A1 level, there is significant potential for improvement in EE. A more systematic and detailed second level analysis (see next section) of the potential to implement EE measures would be needed. This analysis should be based on the actual potential to reduce energy use, taking into account the building characteristics, and the detailed costs of materials and labor, to implement the EE measures. This would indicate the economic rate of return and the payback period.

Development of second level systematic analysis

The building energy model

A building energy model has been developed, in collaboration with a technical expert from the Košice Technical University's Department of Building Energy Use and Department of Building Facilities, to conduct a detailed analysis of the opportunities to improve the energy performance of buildings. The Excel-based model has been developed specifically for the climatic and labor conditions in the Prešov Region, and was done in collaboration with the PSK staff in the Property Management Department and energy experts from ENECO.

The energy model has three principal components:

Component 1: Energy demand for heating

Component 2: Energy demand for other facilities – air conditioning, lighting, hot water

Component 3: Data on fuels and energy use (actual billing information), emissions from fuel use, material and labor costs of energy efficiency measures, and so on

The model estimates the actual heat demand for heating and hot water, and the energy demand for lighting and air-conditioning. Energy demand is estimated for both the base case established on existing building characteristics, including any installed thermal insulation. Any variations in the estimated energy from actual demand, based on energy bills, are reconciled with additional information from the building. For instance, there could be differences between the energy purchase and the energy use; although electricity and gas used in a building is consistent with metered energy use during that period, the usage of other fuels, such as coal and pellets, may not coincide with the billing period.

The energy demand for heating, post installation of thermal insulation and heat source replacement as per building codes, is then estimated, to reassess the energy demand and energy use in space heating. Energy use in other building energy systems is also estimated, based on various energy efficiency measures that can be installed. EE measures to be implemented are based on their ability to improve building energy performance and meet class A1 performance standards for each energy subsystem (that is, class A1 for heating, hot water, lighting, and so on).

The building energy model enables the generation of building certificates that are consistent with the building energy codes in the country. The model's components are the same as the energy codes and performance standards in the Slovak Republic, and therefore could be used, so that the PSK has baseline energy demand certificates in each energy subsystem of their public building portfolio. These certificates could be updated based on the estimated energy demand and use, after the energy efficiency measures have been implemented.

Technical and financial analysis is conducted for each of the EE measures considered in the model. Emissions of CO_2 from energy used in the building is also estimated, based on fuels used in each energy subsystem.

Second level assessment of the PSK buildings based on the use of the building energy model

Six buildings were identified in the first level of analysis and were selected for further analysis using the building energy model. The buildings included four school facilities, including one vocational school, and two social facilities, including a health center for the elderly, all with high energy consumption.

To ensure that the information assessed was correct, the six selected buildings were visited by the technical experts from the university, ENECO and the PSK to verify and validate the information in the energy database. Additional information needed for energy modeling was also gathered from the facilities. For each of the energy efficiency measures proposed, the energy use, investment costs, operating costs, payback period, and environmental impacts were estimated in the energy model. The energy efficiency measures shown in the table below have been considered in the energy modeling.

TABLE 12 Energy efficiency measures considered in energy modeling

Subcomponent	EE Measure
Building envelop	Thermal insulation: for wall, floor, roof, ceilings, and other building openings
Heating system	Replacement of the heat source (boiler) and related modification to the boiler room
	Replacement of the heat source (boiler) alone
	Hydraulic regulation of heat distribution system
	Optimization of heating distribution system
Hot water system	Replacement of the hot water heating system
	Change the fuel used for heating water
	Installation of a solar hot water system
	Optimization of the hot water distribution system
	Hot water accumulation
Lighting	Replacement of existing lights by LED lighting

Source: Authors, 2019

Energy savings, investment and payback period. The results from the modeling of six public buildings under the PSK is provided in Table 13. The alternative scenarios in each facility (A, B, and so on) represent the different energy efficiency measures included in the analysis. For instance, in the case of the grammar school in Poprad, scenario A includes replacement of the heating and lighting systems, and scenario B includes insulation of the walls and ceiling. The overall investment under scenario A is €39,649, and the payback period is about 20 years. Under scenario B, the investment is €112,353, and the payback period is 22 years. The payback period is more than 15 years for each of the energy efficiency packages selected for the different buildings. Many EE measures were changed and tested, to try and discover the optimal result in terms of shorter payback periods, but the modeling resulted in long payback periods. The long payback periods are consistent with what was found by SIEA, with an average payback period of 33 years for public buildings. The total investment for the entire portfolio of six buildings, considering only measures that have lower payback periods, is €857,137.

Detailed results from the energy modeling of the various measures in each of the above considered public buildings is provided in Annex B.

TABLE 13 Results from energy modeling

			plocha area	objem volume	konštrukcie construction					vykurovanie heating			tepla voda hot water			svetlo light	celkom fully
	SCHOOL																
			m2	m3	SO	PDL	SCH	STR	OZ	room	boiler	regul.	source	distr.	solar		
1	SZS POPRAD	A	1 364	4 800	-	-	-	-	-	x	x	x	-	-	-	x	
			cost	€					-			28 737			-	10 912	39 649
			payback	year					-			23.32			-	15.19	20.33
			m2	m3	SO	PDL	SCH	STR	OZ	room	boiler	regul.	source	distr.	solar		
		B	1 364	4 800	x	-	-	x	-	x	x	x	-	-	-	x	
			cost	€					83 510			17 931			-	10 912	112 353
			payback	year					30.66			26.17			-	15.19	22.05

			plocha area	objem volume	konštrukcie construction					vykurovanie heating			tepla voda hot water			svetlo light	celkom fully
	House of Social Services																
			m2	m3	SO	PDL	SCH	STR	OZ	room	boiler	regul.	source	distr.	solar		
2	DSS HANUSOVCE	A	630	1 890	-	-	-	-	-	x	x	x	x	x	x	-	
			cost	€					-			12 571			5 229	-	17 800
			payback	year					-			24.00			9.41	-	16.49
			m2	m3	SO	PDL	SCH	STR	OZ	room	boiler	regul.	source	distr.	solar		
		B	630	1 890	x	-	x	x	-	x	x	x	x	x	-	x	
			cost	€					61 380			7 522			1 559	5 040	75 501
			payback	year					39.17			25.41			23.52	19.56	28.04
			m2	m3	SO	PDL	SCH	STR	OZ	room	boiler	regul.	source	distr.	solar		
		C	630	1 890	x	-	x	x	-	x	x	x	x	x	x	x	
			cost	€					61 380			7 585			4 942	5 040	78 948
			payback	year					39.17			25.62			9.45	19.56	25.07

			plocha area	objem volume	konštrukcie construction					vykurovanie heating			tepla voda hot water			svetlo light	celkom fully
	SCHOOL																
			m2	m3	SO	PDL	SCH	STR	OZ	room	boiler	regul.	source	distr.	solar		
3	SPS SNINA	A	8 659	31 108	x	-	-	x	-	-	-	x	-	-	-	x	
			cost	€					410 430			27 969			-	69 272	507 671
			payback	year					34.09			17.28			-	19.99	26.82

			plocha area	objem volume	konštrukcie construction					vykurovanie heating			tepla voda hot water			svetlo light	celkom fully
	DORMITORY																
			m2	m3	SO	PDL	SCH	STR	OZ	room	boiler	regul.	source	distr.	solar		
4	SOS POPRAD	A	2 940	8 232	x	-	x	-	-	x	x	x	x	x	x	-	
			cost	€					163 510			27 788			47 549	-	238 847
			payback	year					57.48			52.60			19.87	-	33.84

			plocha area	objem volume	konštrukcie construction					vykurovanie heating			tepla voda hot water			svetlo light	celkom fully
	SCHOOL																
			m2	m3	SO	PDL	SCH	STR	OZ	room	boiler	regul.	source	distr.	solar		
5	OA St.LUBOVNA	A	1 770	5 670	-	-	-	-	-	-	x	-	-	-	-	x	
			cost	€					-			7 646			-	14 160	21 806
			payback	year					-			14.07			-	15.79	15.14

			plocha area	objem volume	konštrukcie construction					vykurovanie heating			tepla voda hot water			svetlo light	celkom fully
	House of Social Services																
			m2	m3	SO	PDL	SCH	STR	OZ	room	boiler	regul.	source	distr.	solar		
0	DSS BREZOVICKA	A	1 172	3 792	-	-	-	-	-	x	x	x	x	x	x	x	
			cost	€					-			20 980			19 010	9 374	49 364
			payback	year					-	-		19.14			5.58	16.22	17.08

Source: Authors, 2019

Key takeaways from the results of energy modeling

The modeling of energy efficiency measures in the six selected buildings with the highest energy consumption potential indicated that the simple payback period, in all cases, for all measures, is above 15 years. Some of the principal conclusions from the energy modeling are:

- It is not possible to meet A1 building performance standards within a 15-year payback period.
- Thermal insulation of buildings is expensive, and the investment has a simple payback period of 30 to 58 years. This is principally because changes to the building envelope are expensive to implement, especially when little maintenance has been done, and thus require investments beyond energy efficiency measures and public facilities like schools and cultural facilities are underheated.
- Buildings that use electricity as a fuel for space heating or heating hot water are good candidates for fuel switching to gas, or the use of heat pumps and solar systems, where possible.

- In cases where a building uses coal or wood as a fuel for space and water heating, the payback period for replacing the system with a new fuel source is not cost-effective. Only replacement with a more efficient system is recommended.
  Replacement of lighting systems with LED is recommended, but it is expensive, given the cost of replacement of the lamps, fixtures, cabling, sensors, and the increased lighting needed to meet the lighting norm. The cost assumption was thus €8/square meter, which is aligned with other similar lighting retrofits.
- The Property Management Department (PMD) at the PSK needs to continue doing level two assessments to complete about 12 buildings (social services or schools) with the most energy savings potential, and ensure that there is not a mix of energy efficiency packages that have a 15-year payback period. This will be important in identifying potential projects for blended finance (EPC and grant funding).

FINANCING FRAMEWORK FOR THE PSK TO INVEST IN THE ENERGY EFFICIENCY OF PUBLIC BUILDINGS

Given the deferred maintenance, most of the public buildings of the PSK will have long payback periods for energy efficiency investments. Therefore, the formulation of a suitable financing framework for this work will need to address this reality. As much as the PMD worked with ENECO and the University of Košice on assessing alternatives for EE measures in the modeling tool, the payback periods were still 15 to 28 years in the six buildings assessed. These payback periods go beyond the 15 years tenor that is usually the maximum time provided by commercial financing. Thus, alternatives need to be identified that will build a blended financing framework that offers lower payback periods that are closer to 15 years for such buildings.

The PSK has three main options for financing EE projects in public buildings, which will need to be revisited in order to address the issue of the long pay back periods of the investments. One option is for the PSK to publicly finance the project from the annual PSK budget, as the annual budget includes provisions for capital expenditures for renovation. However, there are many other pressing needs for the use of the PSK budget, and a clear strategy to prioritize the EE investments would be needed. Another alternative is for the PSK to finance the EE projects with commercial financing from banks, where it could probably obtain financing rates close to 0.5 percent. However, despite not reaching its official debt limit, the PSK has reached its internal debt limit, and it would be very unlikely to increase it for EE investments. It is important to note that the PSK is undergoing other sector reforms for which the administration would be more willing to increase its debt capacity. The central government's public policy on the EPC Act is also meant to reduce debt levels of the municipalities and public agencies for EE investments. To that end, the government has worked on the development of the EPC model contract, which is expected to be approved in June 2019, and could provide financing for ESCOs, without counting it as debt to the public agencies. The PSK needs to find a strategy to make the EPC Act work for the group of projects with payback periods closer to 15 years, to see how it can tap into these resources for the group of public buildings with longer payback periods. A proposed strategy based on the actual long payback periods is presented below.

The long payback period for implementing EE measures in the PSK buildings implies that it may not be possible to implement such measures through the EPC Act alone. While the EPC Act does not limit the time period of the contract, commercial bank financing is unlikely to be available for tenors longer than 15 years. An option for financing projects with long payback periods is to blend financing under the EPC with grant financing from ESIF or other EU funds. As per Eurostat guidelines,[13] any grant financing from EU funds provided to the project is permitted. In contract, the provision of GoSk funds as grants to co-finance the project will make the entire investment an additional debt on the books of the public agency, which is something to be avoided when working within the framework of the EPC Act.

TABLE 14 Financing options for EE in public buildings based on simple payback periods

	15–22 Years	22–35 Years	35 Years
Description	Blended finance between the EPC Act and the PSK's own resources to bring down the payback period to 15 years	Project financed by the PSK's own resources	Project financed by the PSK's own resources
Financing	• Mezzanine financing • Support from EU funds (OP and structural funds) • Option to refinance after the project is operational • Preferential financial products from the EBRD/EIB for lines of credit or risk sharing mechanism	• Public finance • Support from EU funds (OP and structural funds)	• Public finance • Support from EU funds (OP and structural funds)
Rationale	This option shifts the financing burden and the performance risk to the ESCO and is well suited for a regional or local government. The EPC Act does not place an upper boundary on the payback period or the term of the EPC contract. However, commercial financing is typically provided for tenors under 15 years. Blended finance combining ESCO financing with some grant and/or commercial financing could be considered (within the guidelines of the EPC Act) to help bring the payback period down to 15 years.	Projects with payback periods of above 22 years do not generally qualify for commercial bank financing (or it would be at high interest rates). Grant funds from EU vehicles and GoSK are best set aside for implementing projects with these long payback periods.	Projects with payback periods above 35 years would not qualify for any kind of commercial financing and should be financed with public finance of EU-based grants. Given the long payback periods, the PMD should assess the social and economic feasibility of maintaining the buildings use, as perhaps it may cost more than the PSK is willing or able to commit for the EE retrofit.

Source: Authors, 2019

The PSK has not directly contracted ESCOs to implement EE in public buildings and is keen to pilot a project under the proposed EPC model contract. But the feasibility of this option needs to be tested, and the personnel in the Property Management Department (PMD) of the PSK, need to be trained to implement projects under the EPC Act.

As for the EE projects with payback periods above 22 years, these should be financed by the PSK budget alone. Projects with these extensive payback periods would not qualify for a commercial loan, and in the cases where they do, they would have very high interest rates. These projects will most likely include building envelope insulation, which is costly, as many of the buildings have not had adequate maintenance since they were originally built. This has an impact on the cost of the investment, and a long return on investment periods; as SIEA indicated, the average payback period for public buildings is 33 years in the Slovak Republic. The PSK would need to identify a set of buildings with higher energy saving, as well as the social and economic co-benefits of the investment, in order to prioritize the buildings where the investments could be done.

In the case of payback periods beyond 35 years, although these can be financed using the PSK's own resources, a deeper social and economic assessment of the costs and benefits of doing the EE retrofit should be done. The investment may cost more than the PSK is willing or able to provide for the EE project. It may well be that the use of the building can be changed so as to use it more cost-effectively, and thereby avoid locking in investments for the next three decades. Although this is a broader question on the structure for operating and maintaining public buildings assets in the PSK, it is an important question to ask to ensure the cost-efficient use of public resources.

FINAL CONSIDERATIONS

This report reviews the options for implementing energy efficiency measures in PSK public buildings. For this review, the key considerations of the national and regional regulatory energy and energy efficiency framework were assessed. The readiness of the key stakeholders and implementation partners, such as the commercial banks, IFIs, ESCOs, and the manufacturers and equipment installers, was gauged. Finally, a review of the existing portfolio of public buildings, and their financing potential for energy efficiency measures, was done.

The government is developing an EPC model contract designed for ESCOs to finance and implement EE projects in public buildings and recover costs from guaranteed energy savings. The model contract is expected to be approved in June 2019 and is structured to enable the public agency not to incur any debt. It would finance only energy-related investments, without deep building renovation that may include non-energy related elements. To enhance energy reduction and comply with Slovak national energy saving targets, the act is supposed to enable the public agencies to keep debt off its books, and thus use this tool, instead of increasing their debt levels to finance EE in public buildings.

There is uncertainty from key stakeholders about how exactly the provisions of the EPC Act and its model contract would work for the public agencies. The EPC Act seeks to separate EE projects from any construction-related elements of a project, which is generally necessary in public buildings which need deep renovation. Buildings may have to process separate contracts for construction and for EE, which may result in a more complex project implementation. The repayments scheme has now changed, and while before monetary savings from reduced energy and from operation and maintenance could be used to pay ESCOs, now only the former is allowed. Moreover, under the EPC Act, ESCOs would have the obligation of the maintenance of the equipment and facility. Any guaranteed energy saving shortfall would further reduce the revenue stream available to make a repayment. Lack of capacity in the municipalities and public agencies to develop EPC bids has also been identified as a key limitation, and support would be needed to prepare and assess audits, and to identify the EE measures and building standards needed to meet class A1 or A0 standards.

The PSK buildings with higher energy potential could be used as a pilot to test the implementation of the EPC Act and its model contract in public buildings. The pilot could also be an opportunity to clarify implementation procedures that could serve as an example to scale up the EPC Act in the public sector. Commercial banks, the ESCO Association of the Slovak Republic, BoF, and SIEA are all supportive of developing a pilot project using a few select PSK public buildings with the highest potential to test the EPC Act. This is the first EPC model contract complying with Eurostat guidelines, and the model for public agencies has not been tested anywhere else in Europe. It needs to be piloted so that the mechanism can be fully understood to ensure that it works with the public agencies in the Slovak Republic. The EPC pilot could help develop a standardized framework and process, with standardized form, monitoring and verification protocols, benchmarking, and a clear process to identify a pipeline of projects that could potentially be bundled, all with the aim of testing the model and lowering transaction costs. The EPC pilot could also help identify specific tailored financial products that may be needed for risk mitigation purposes.

A systematic approach to identify and prioritize energy efficiency projects in public buildings in the PSK has been proposed. This approach should be complemented by the development of an energy management system within the PSK's Property Management Department that, among others, establishes clear energy reduction targets and reporting protocols for each individual public facility manager, and a systematic way to prioritize the investments in EE in public buildings. For the latter, a three-stage proposal was developed to identify a longlist of projects, EE measure modeling to define a shortlist of projects, and the verification of the EE projects for the shortlisted buildings through site visits or energy audits. For the first stage assessment, the PSK will use a comprehensive database to first create a longlist of projects based on the statistical analysis of energy intensity and other building characteristics, as appropriate. The second stage would entail the use of the building energy model developed under this activity to identify energy efficiency measures, the investment needed and its economic rate of return, the payback period, as well as to compile a shortlist of projects. The shortlist of projects would then be examined in detail through site visits and energy audits, if necessary. The outcome of this analysis would subsequently be used to prepare bid documents and to invite service providers to implement projects.

An investment framework is proposed to finance projects with different payback periods, and a blended finance approach is proposed for EE projects to bring payback periods down to 15 years, to be able to benefit from the EPC Act. The assessment using the building energy model indicated that EE projects will generally have payback periods longer than 15 years. It is recommended that a blended finance approach be taken, whereby EU grant financing is used to bring down the payback period to 15 years so that a contract with an ESCO can be used for implementation under the EPC Act. EE Projects with payback periods longer than 22 years are proposed to be financed directly by the PSK with its own budget funds.

However, for projects with payback periods longer than 35 years, a broader discussion needs to take place on what is the most cost-effective way to manage the PSK's public buildings assets. Many buildings are past their useful life, due to deferred maintenance, and would cost more than the PSK is willing or able to commit to its renovation. Therefore, a social and economic assessment of the cost-effectiveness of undergoing the EE retrofit, as compared with, for example, building a new facility meeting class A0 standards or changing the buildings use, should take place. What will be important for this discussion is for the PSK's Property Management Unit to have an updated record of all assets, in order to strategically evaluate them. This record should include: property ownership; operation costs, including the energy consumption level; and legal status. With more and better information, the PMU can make informed decisions aligned with the goals of the PSK's leadership.

ANNEX A

INTENSITY OF ENERGY USE IN A FEW DIFFERENT TYPES OF FACILITIES AND BUILDINGS IN THE PSK

The graphs below illustrate energy intensity in specific types of buildings within a facility. Data for schools and social services facilities under the PSK is illustrated.

FIGURE A1 Energy intensity for classrooms in hotel academies

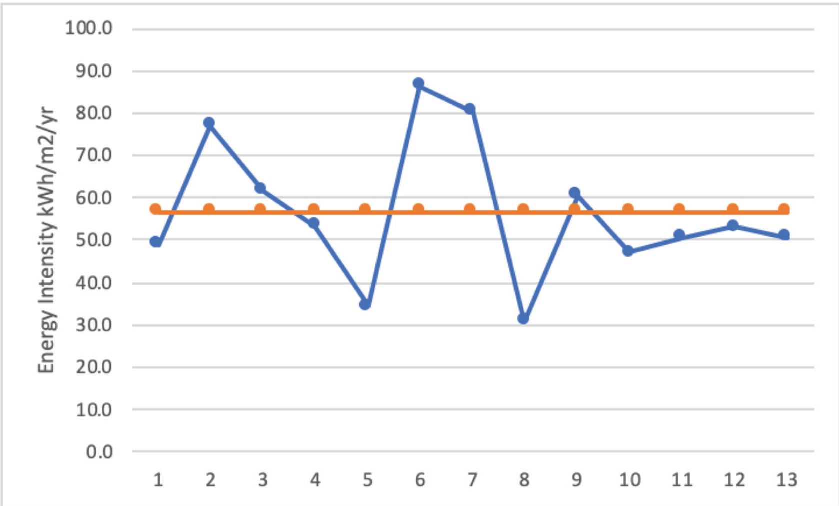
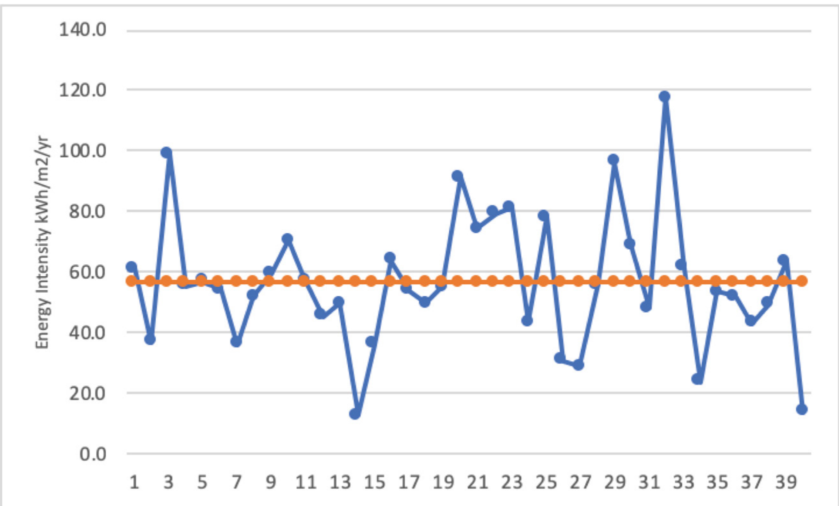


FIGURE A2 Energy intensity for classrooms in vocational schools



Source: Authors, 2019

FIGURE A3 Energy intensity for accommodations in all social services facilities

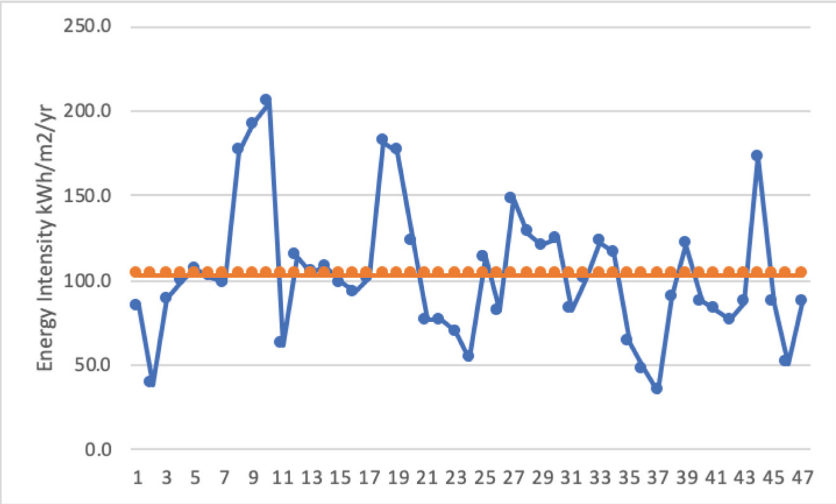


FIGURE A4 Energy intensity for accommodations in social services facilities used 5 days a week

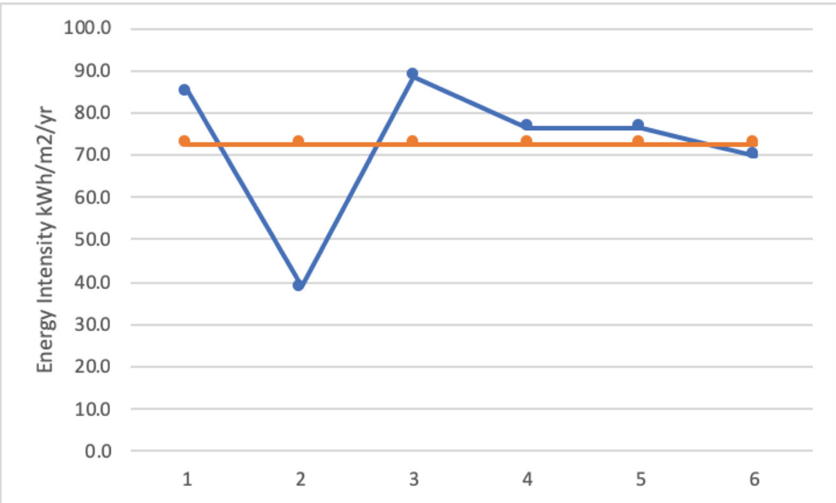
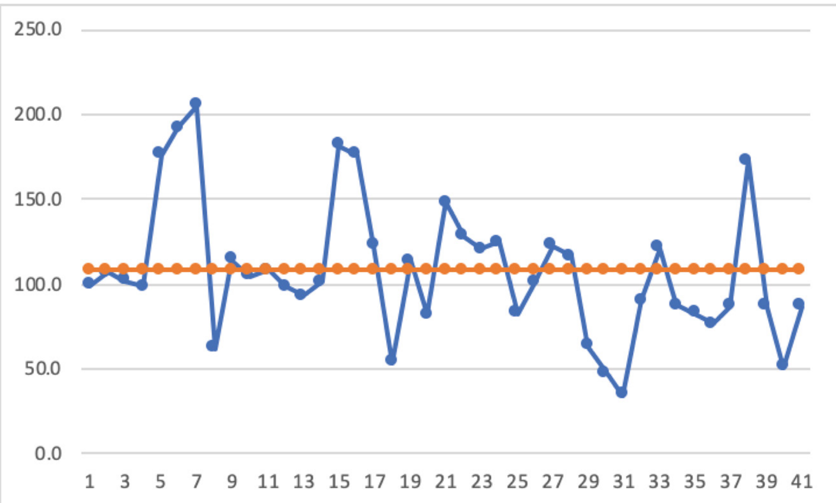


FIGURE A5 Energy intensity for accommodations in social services facilities used 24/7

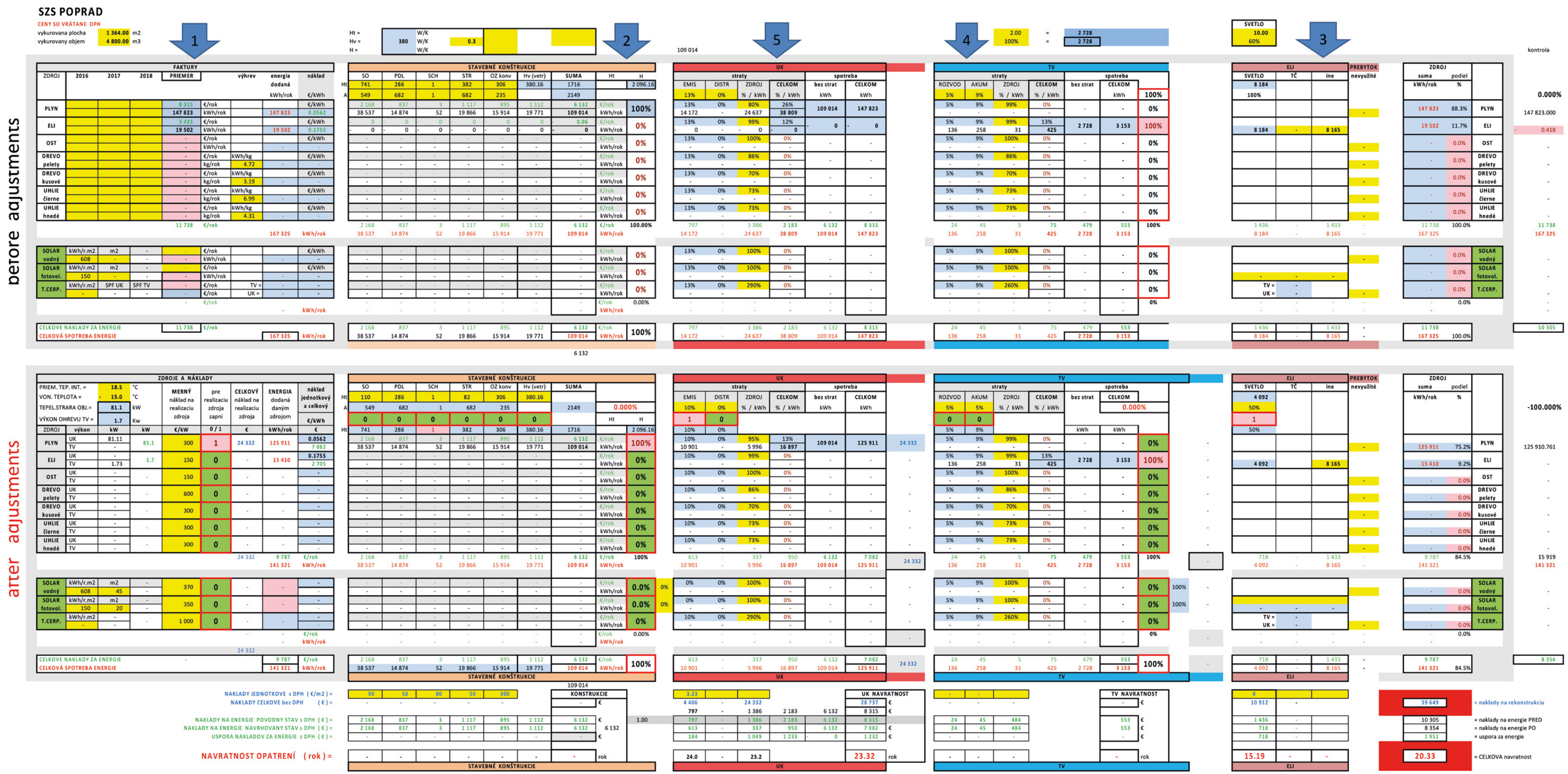


Source: Authors, 2019

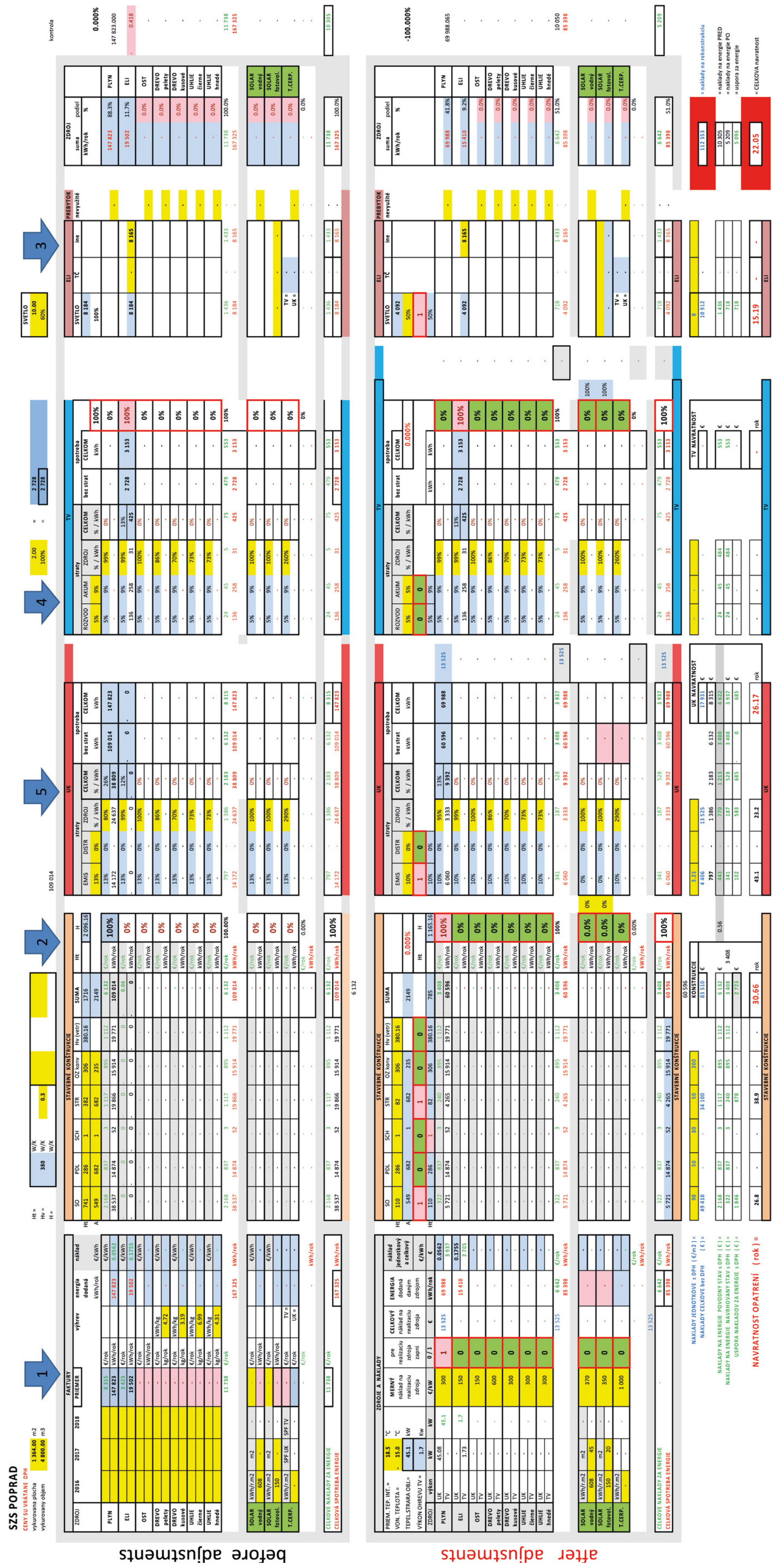
ANNEX B

RESULTS FROM THE ENERGY MODELING OF PUBLIC BUILDINGS IN THE PSK

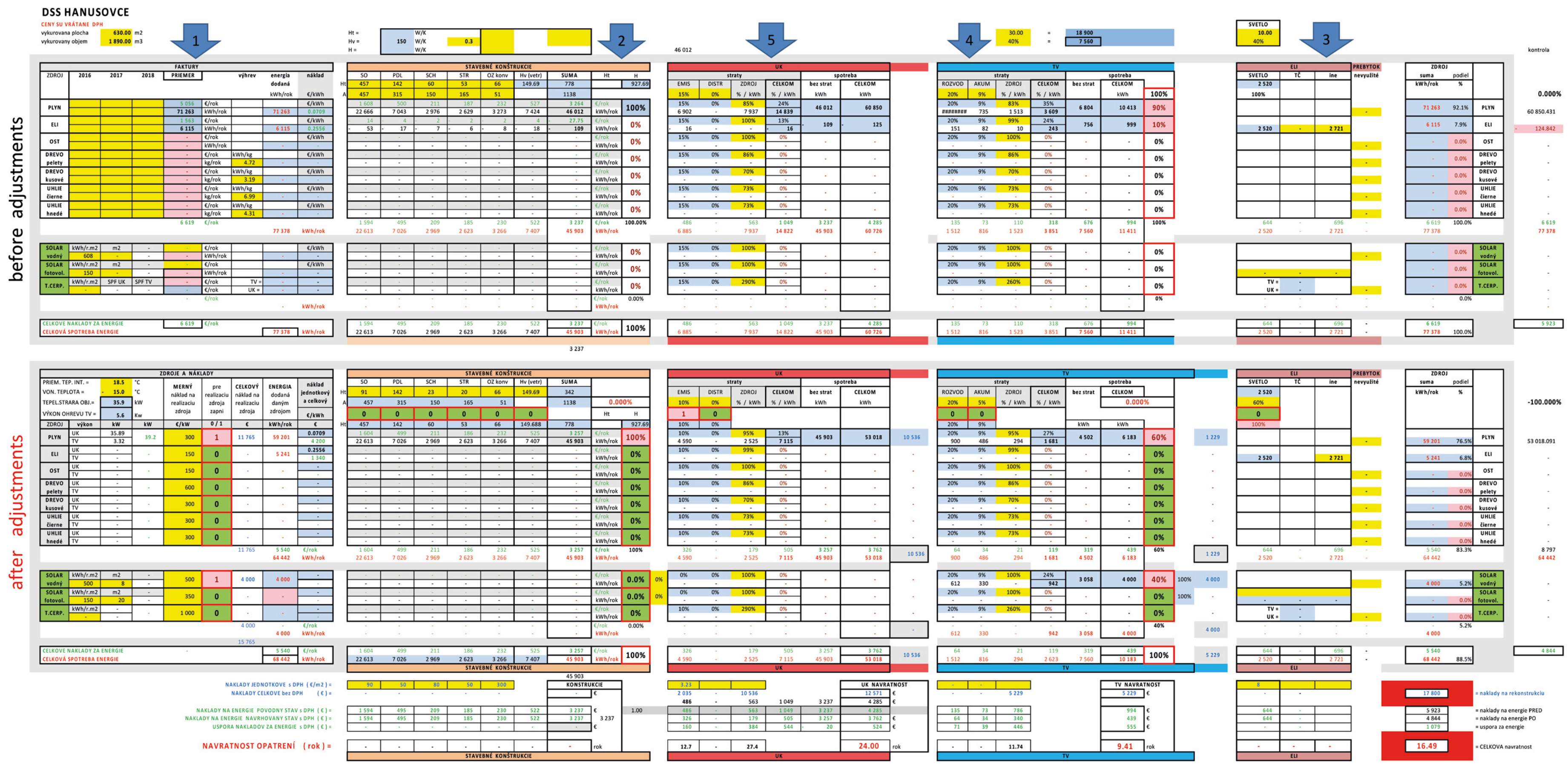
Results from the analysis of SZS, grammar school, Poprad (scenario A)



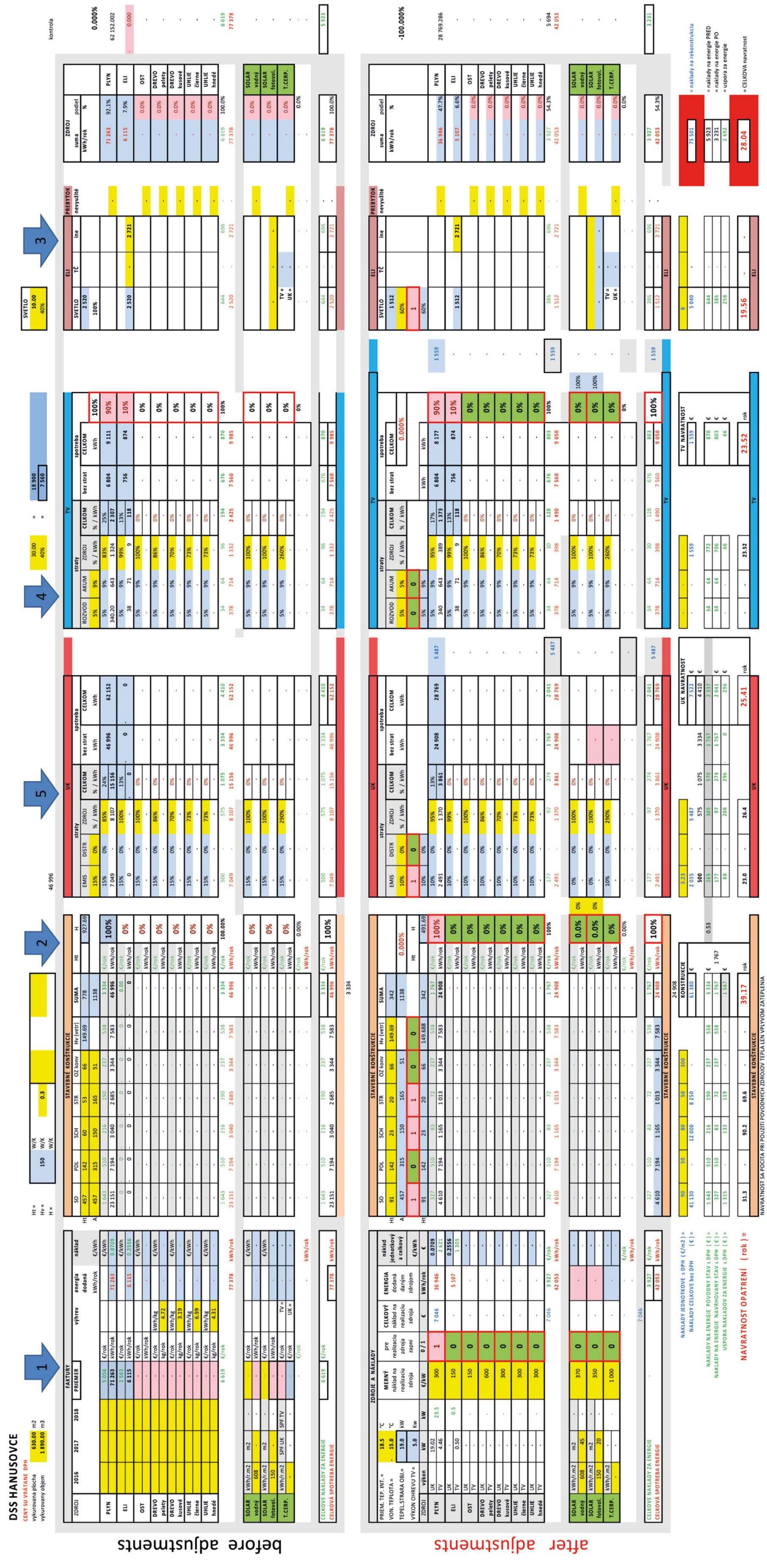
Results from the analysis of SZS, grammar school, Poprad (scenario B)



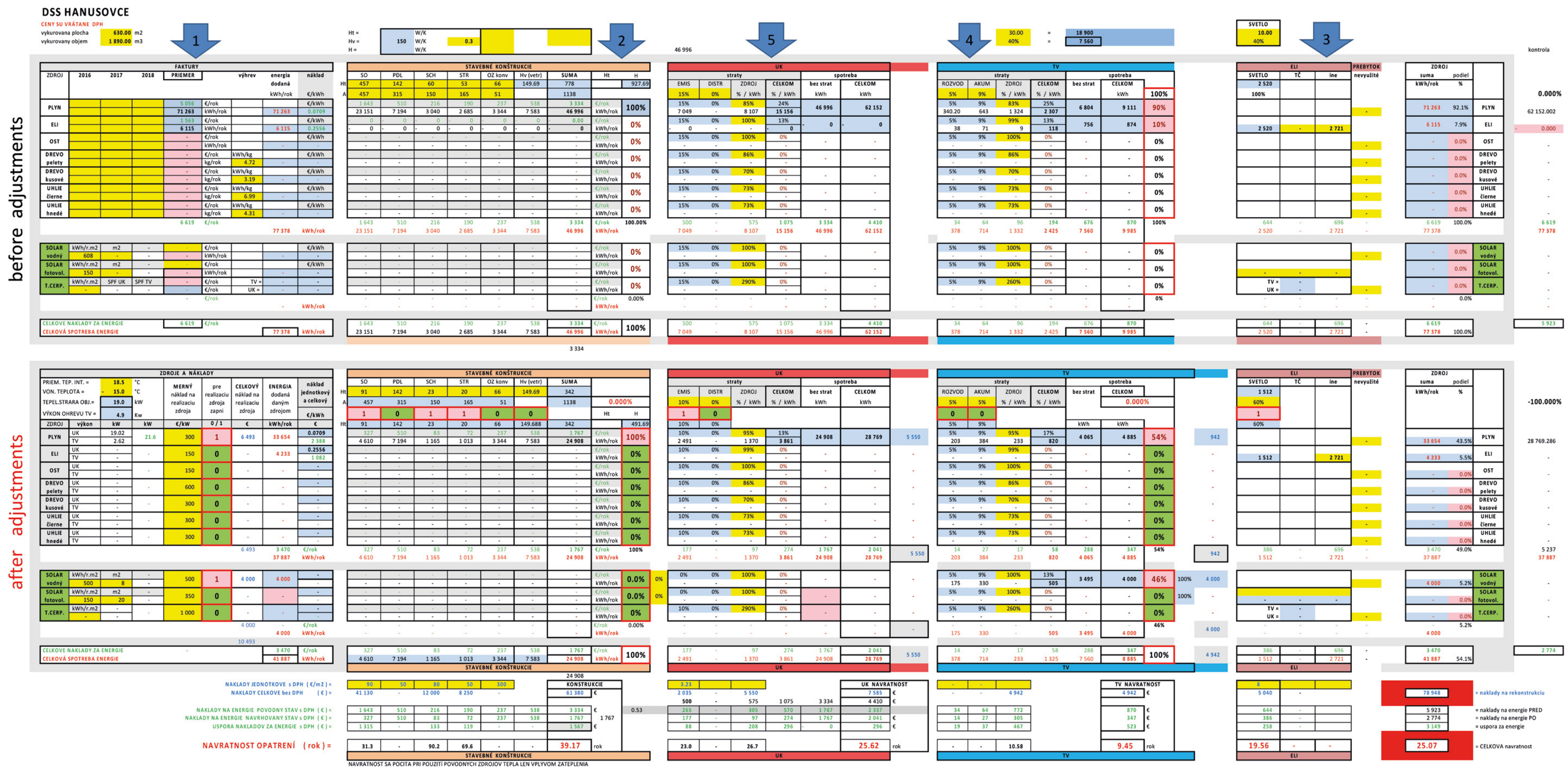
Results from the analysis of DSS, Hanusovce, 24/7 social services facility (scenario A)



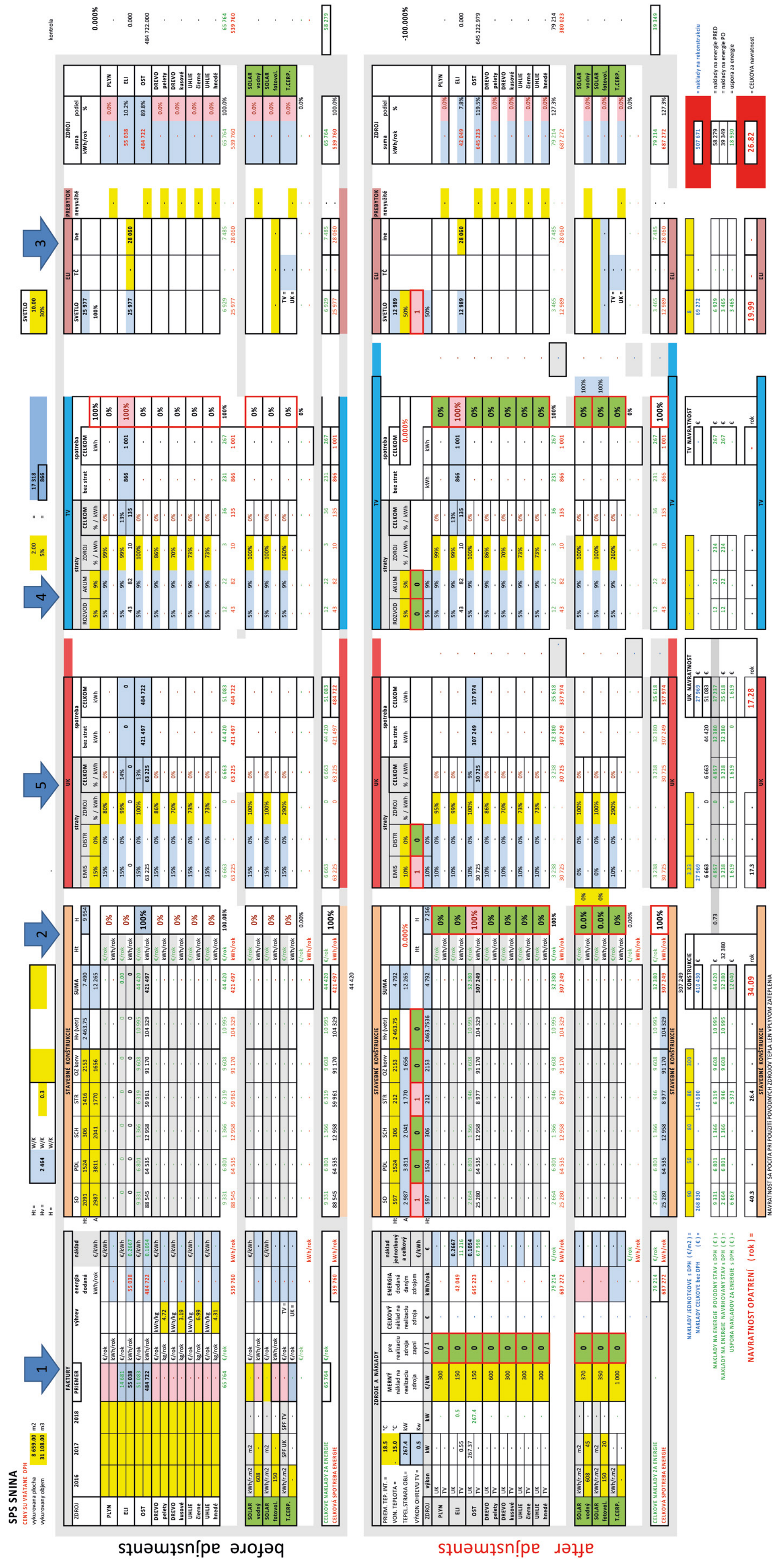
Results from the analysis of DSS, Hanusovce, 24/7 social services facility (scenario B)



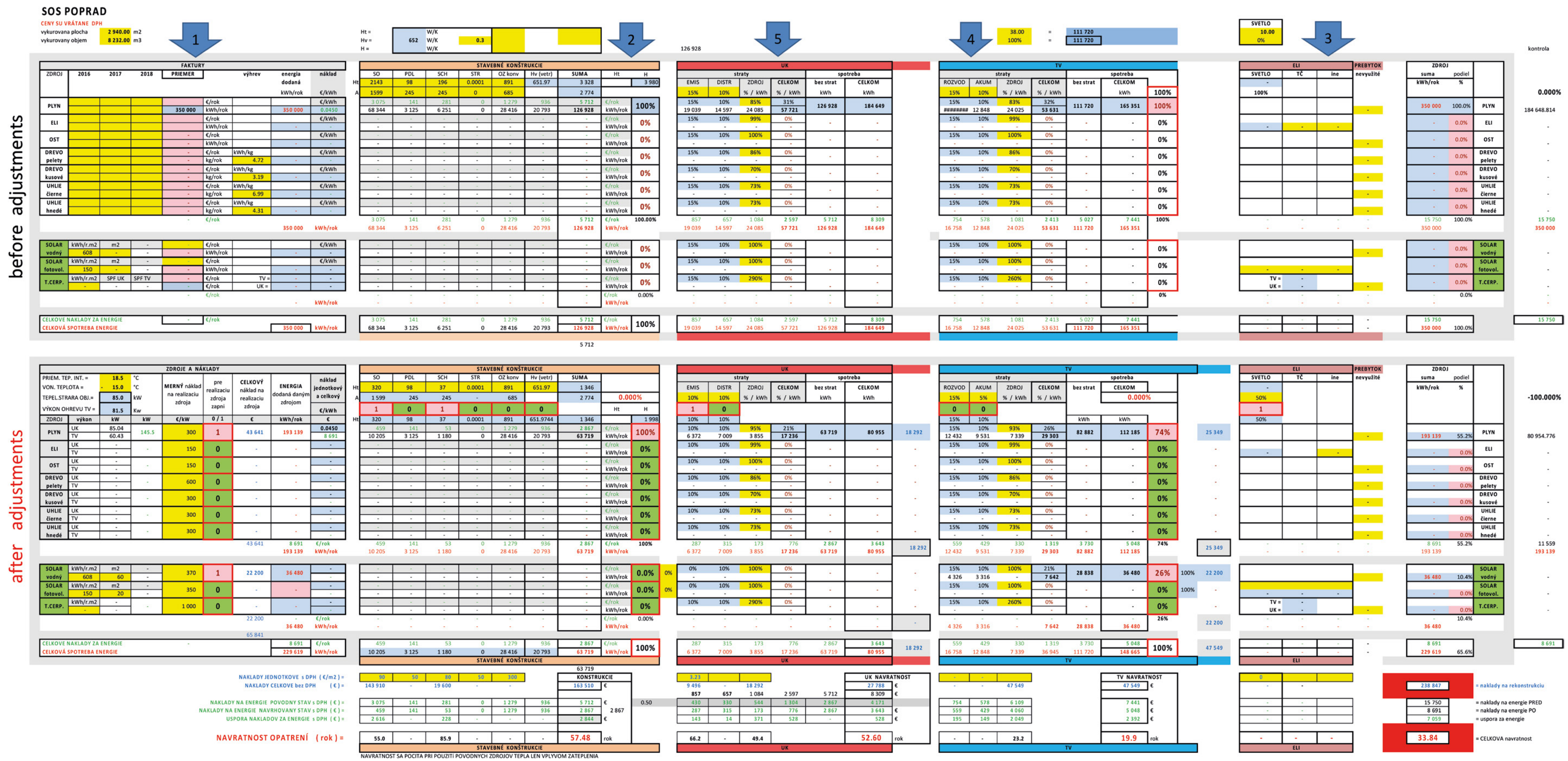
Results from the analysis of DSS, Hanusovce, 24/7 social services facility (scenario C)

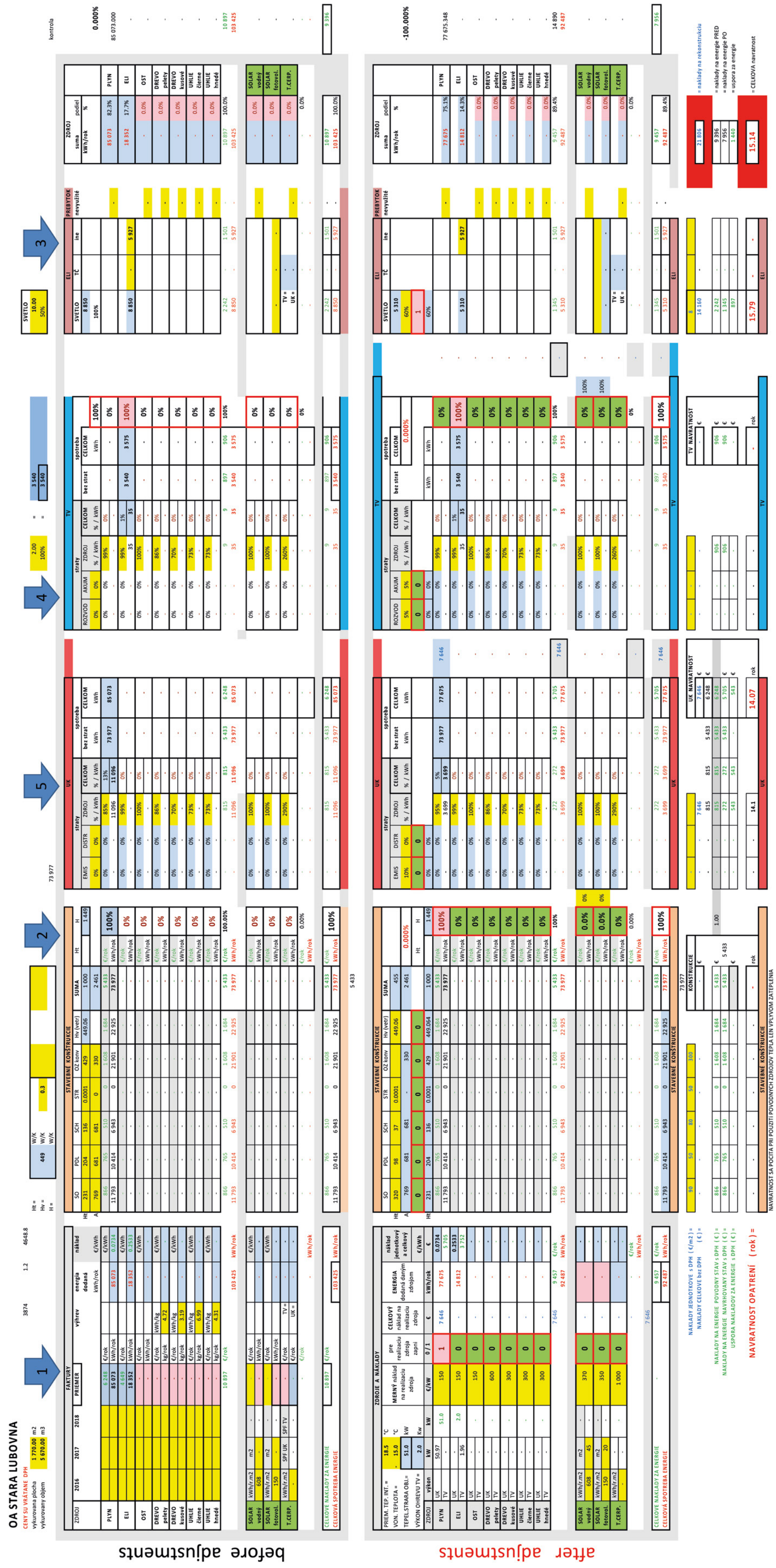


Results from the analysis of SPS SNINA, grammar school



Results from the analysis of SOS PORAD, vocational school with dormitory





Results from the analysis of OA STARA LUBOVNA, grammar school

Results from the analysis of DSS BREZOVICKA, 24/7 social services facility

BREZOVICKA

CENY SU VRÁTANE DPH

vykurovana plocha	1 171.72	m2
vykurovany objem	3 792.21	m3

Ht =		W/K	
Hv =	501	W/K	0.5
H =		W/K	

SVETLO
10.00
60%

30.00	=	35 152
100%	=	35 152

1 2 5 4 3

before adjustments

FAKTURY								
ZDROJ	2016	2017	2018	PRIEMER		výhrev	energia dodaná kWh/rok	náklad €/kWh
PLYN	-	-	-	-	€/rok			€/kWh
	-	-	-	-	kWh/rok		-	-
ELI	9 033	8 324	8 664	8 674	€/rok			€/kWh
	54 569	52 833	50 897	52 766	kWh/rok		52 766	0.1644
OST	-	-	-	-	€/rok			€/kWh
	-	-	-	-	kWh/rok		-	-
DREVO peletky	1 421	2 767	1 918	2 035	€/rok	kWh/kg		€/kWh
	8 650	8 685	8 310	8 548	kg/rok	4.72	40 348	0.0504
DREVO kusové	-	-	-	-	€/rok	kWh/kg		€/kWh
	-	-	-	-	kg/rok	3.19	-	-
UHLIE čierne	7 146	5 725	5 999	6 290	€/rok	kWh/kg		€/kWh
	27 070	21 685	23 320	24 025	kg/rok	6.99	167 935	0.0375
UHLIE hnedé	-	-	-	-	€/rok	kWh/kg		€/kWh
	-	-	-	-	kg/rok	4.31	-	-
				16 999	€/rok			
							261 049	kWh/rok
SOLAR vodný	kWh/r.m2	m2	-	-	€/rok			€/kWh
	608	-	-	-	kWh/rok		-	-
SOLAR fotovol.	kWh/r.m2	m2	-	-	€/rok			€/kWh
	150	-	-	-	kWh/rok		-	-
T.CERP.	kWh/r.m2	SPF UK	SPF TV	-	€/rok	TV =	-	-
	-	-	-	-	€/rok	UK =	-	-
				-	€/rok			
							-	kWh/rok
CELKOVE NAKLADY ZA ENERGIE				16 999	€/rok			
CELKOVÁ SPOTREBA ENERGIE							261 049	kWh/rok

STAVEBNÉ KONŠTRUKCIE	SO	PDL	SCH	STR	OZ konv	Hv (vetr)	SUMA	Ht	H
Ht	490.2	101.9	90	61.6	164.77	500.57	908.47		1 409.04
A	692.98	314.6	206.44	180.3	115.17		1509.49		
PLYN	-	-	-	-	-	-	-	€/rok	0%
	-	-	-	-	-	-	-	kWh/rok	
ELI	0	0	0	0	0	0	0.03	€/rok	0%
	0	0	0	0	0	0	0	kWh/rok	
OST	-	-	-	-	-	-	-	€/rok	0%
	-	-	-	-	-	-	-	kWh/rok	
DREVO peletky	441	92	81	55	148	450	1 267	€/rok	20%
	8 738	1 816	1 604	1 098	2 937	8 923	25 116	kWh/rok	
DREVO kusové	-	-	-	-	-	-	-	€/rok	0%
	-	-	-	-	-	-	-	kWh/rok	
UHLIE čierne	1 282	267	235	161	431	1 309	3 686	€/rok	80%
	34 235	7 116	6 285	4 302	11 507	34 959	98 404	kWh/rok	
UHLIE hnedé	-	-	-	-	-	-	-	€/rok	0%
	-	-	-	-	-	-	-	kWh/rok	
	1 723	358	316	217	579	1 760	4 953	€/rok	100.00%
	42 972	8 933	7 890	5 400	14 444	43 882	123 521	kWh/rok	
SOLAR vodný	-	-	-	-	-	-	-	€/rok	0%
	-	-	-	-	-	-	-	kWh/rok	
SOLAR fotovol.	-	-	-	-	-	-	-	€/rok	0%
	-	-	-	-	-	-	-	kWh/rok	
T.CERP.	-	-	-	-	-	-	-	€/rok	0%
	-	-	-	-	-	-	-	kWh/rok	
	-	-	-	-	-	-	-	€/rok	0.00%
	-	-	-	-	-	-	-	kWh/rok	
CELKOM	1 723	358	316	217	579	1 760	4 953	€/rok	100%
	42 972	8 933	7 890	5 400	14 444	43 882	123 521	kWh/rok	

4 953

UK	straty EMIS	straty DISTR	straty ZDROJ	straty CELKOM	spotreba bez strat	spotreba CELKOM
	13%	0%	% / kWh	% / kWh	kWh	kWh
PLYN	13%	0%	80%	0%	-	-
	-	-	-	-		
ELI	13%	0%	99%	12%	0	0
	0	-	0	0		
OST	13%	0%	100%	0%	-	-
	-	-	-	-		
DREVO peletky	13%	0%	86%	22%	25 116	32 355
	3 265	-	3 973	7 239		
DREVO kusové	13%	0%	70%	0%	-	-
	-	-	-	-		
UHLIE čierne	13%	0%	73%	30%	98 404	141 220
	12 793	-	30 023	42 816		
UHLIE hnedé	13%	0%	73%	0%	-	-
	-	-	-	-		
	644	-	1 325	1 969	4 953	6 922
	16 058	-	33 997	50 054	123 521	173 575
SOLAR vodný	13%	0%	100%	0%	-	-
SOLAR fotovol.	13%	0%	100%	0%	-	-
T.CERP.	13%	0%	290%	0%	-	-
	-	-	-	-	-	-
CELKOM	644	-	1 325	1 969	4 953	6 922
	16 058	-	33 997	50 054	123 521	173 575

TV	straty ROZVOD	straty AKUM	straty ZDROJ	straty CELKOM	spotreba bez strat	spotreba CELKOM	
	22%	9%	% / kWh	% / kWh		kWh	100%
PLYN	22%	9%	99%	0%	-	-	0%
	-	-	-	-			
ELI	22%	9%	99%	26%	14 061	18 885	40%
	3 093	1 544	187	4 824			
OST	22%	9%	100%	0%	-	-	0%
	-	-	-	-			
DREVO peletky	22%	9%	86%	34%	5 273	7 993	15%
	1 160	579	982	2 721			
DREVO kusové	22%	9%	70%	0%	-	-	0%
	-	-	-	-			
UHLIE čierne	22%	9%	73%	41%	15 818	26 715	45%
	3 480	1 737	5 679	10 896			
UHLIE hnedé	22%	9%	73%	0%	-	-	0%
	-	-	-	-			
	697	348	293	1 338	3 170	4 508	100%
	7 733	3 860	6 848	18 441	35 152	53 593	
SOLAR vodný	22%	9%	100%	0%	-	-	0%
SOLAR fotovol.	22%	9%	100%	0%	-	-	0%
T.CERP.	22%	9%	260%	0%	-	-	0%
	-	-	-	-	-	-	0%
CELKOM	697	348	293	1 338	3 170	4 508	
	7 733	3 860	6 848	18 441	35 152	53 593	

ELI	SVETLO	TČ	ine	PREBYTOK nevyužité
	7 030			
	100%			
PLYN				-
ELI	7 030	-	26 851	
OST				-
DREVO peletky				-
DREVO kusové				-
UHLIE čierne				-
UHLIE hnedé				-
	1 156	-	4 414	-
	7 030	-	26 851	-
SOLAR vodný				-
SOLAR fotovol.	-	-	-	
T.CERP.	TV = -			-
	UK = -			
CELKOM	1 156	-	4 414	-
	7 030	-	26 851	-

ZDROJ	suma kWh/rok	podiel %	kontrola
			0.000%
PLYN	-	0.0%	-
ELI	52 766	20.2%	0.196
OST	-	0.0%	-
DREVO peletky	40 348	15.5%	32 354.807
DREVO kusové	-	0.0%	-
UHLIE čierne	167 935	64.3%	141 220.212
UHLIE hnedé	-	0.0%	-
	16 999	100.0%	16 999
	261 049		261 049
SOLAR vodný	-	0.0%	-
SOLAR fotovol.	-	0.0%	-
T.CERP.	-	0.0%	-
	-	0.0%	-
CELKOM	16 999		12 585
	261 049	100.0%	

after adjustments

ZDROJE A NÁKLADY								
PRIEM. TEP. INT. =	18.5	°C		MERNÝ náklad na realizaciu zdroja	pre realizaciu zdroja zapni	CELKOVÝ náklad na realizaciu zdroja	ENERGIA dodaná daným zdrojom	náklad jednotkový a celkový
VON. TEPLOTA =	-15.0	°C						
TEPEL.STRARA OBJ.=	54.5	kW						
VÝKON OHREVU TV =	25.7	Kw						€/kWh
ZDROJ	výkon	kW	kW	€/kW	0 / 1	€	kWh/rok	€
PLYN	UK	54.52	65.2	300	1	19 556	162 245	0.0562
	TV	10.67						9 118
ELI	UK	-	-	150	0	-	30 366	0.1644
	TV	-						4 992
OST	UK	-	-	150	0	-	-	-
	TV	-						-
DREVO peletky	UK	-	-	600	0	-	-	0.0504
	TV	-						-
DREVO kusové	UK	-	-	300	0	-	-	-
	TV	-						-
UHLIE čierne	UK	-	-	300	0	-	-	0.0375
	TV	-						-
UHLIE hnedé	UK	-	-	300	0	-	-	-
	TV	-						-
						19 556	14 110	€/rok
							192 611	kWh/rok
SOLAR vodný	kWh/r.m2	m2	-	370	1	16 650	27 360	-
	608	45	-					-
SOLAR fotovol.	kWh/r.m2	m2	-	350	0	-	-	-
	150	20	-					-
T.CERP.	kWh/r.m2	-	-	1 000	0	-	-	-
	-	-						-
						16 650	-	€/rok
							27 360	kWh/rok
						36 206		
CELKOVE NAKLADY ZA ENERGIE			-				14 110	€/rok
CELKOVÁ SPOTREBA ENERGIE							219 971	kWh/rok

STAVEBNÉ KONŠTRUKCIE	SO	PDL	SCH	STR	OZ konv	Hv (vetr)	SUMA	Ht	H
Ht	146.4	0	33.6	23.3	126.69	500.57			
A	693	315	206	180	115		1509.49	0.000%	
	0	0	0	0	0	0		Ht	H
Ht	490.2	101.9	90	61.6	164.77	500.57172	908.47		1 409.04
PLYN	2 415	502	443	303	812	2 466	6 942	€/rok	100%
	42 972	8 933	7 890	5 400	14 444	43 882	123 521	kWh/rok	
ELI	-	-	-	-	-	-	-	€/rok	0%
	-	-	-	-	-	-	-	kWh/rok	
OST	-	-	-	-	-	-	-	€/rok	0%
	-	-	-	-	-	-	-	kWh/rok	
DREVO peletky	-	-	-	-	-	-	-	€/rok	0%
	-	-	-	-	-	-	-	kWh/rok	
DREVO kusové	-	-	-	-	-	-	-	€/rok	0%
	-	-	-	-	-	-	-	kWh/rok	
UHLIE čierne	-	-	-	-	-	-	-	€/rok	0%
	-	-	-	-	-	-	-	kWh/rok	
UHLIE hnedé	-	-	-	-	-	-	-	€/rok	0%
	-	-	-	-	-	-	-	kWh/rok	
	2 415	502	443	303	812	2 466	6 942	€/rok	100%
	42 972	8 933	7 890	5 400	14 444	43 882	123 521	kWh/rok	
SOLAR vodný	-	-	-	-	-	-	-	€/rok	0.0% (0%)
	-	-	-	-	-	-	-	kWh/rok	
SOLAR fotovol.	-	-	-	-	-	-	-	€/rok	0.0% (0%)
	-	-	-	-	-	-	-	kWh/rok	
T.CERP.	-	-	-	-	-	-	-	€/rok	0%
	-	-	-	-	-	-	-	kWh/rok	
	-	-	-	-	-	-	-	€/rok	0.00%
	-	-	-	-	-	-	-	kWh/rok	
CELKOM	2 415	502	443	303	812	2 466	6 942	€/rok	100%
	42 972	8 933	7 890	5 400	14 444	43 882	123 521	kWh/rok	

STAVEBNÉ KONŠTRUKCIE

123 521

UK	straty EMIS	straty DISTR	straty ZDROJ	straty CELKOM	spotreba bez strat	spotreba CELKOM	
	10%	0%	% / kWh	% / kWh	kWh	kWh	
	1	0					
	10%	0%					
PLYN	10%	0%	95%	13%	123 521	142 667	17 196
	12 352	-	6 794	19 146			
ELI	10%	0%	99%	0%	-	-	-
OST	10%	0%	100%	0%	-	-	-
DREVO peletky	10%	0%	86%	0%	-	-	-
DREVO kusové	10%	0%	70%	0%	-	-	-
UHLIE čierne	10%	0%	73%	0%	-	-	-
UHLIE hnedé	10%	0%	73%	0%	-	-	-
	694	-	382	1 076	6 942	8 018	17 196
	12 352	-	6 794	19 146	123 521	142 667	
SOLAR vodný	0%	0%	100%	0%	-	-	-
SOLAR fotovol.	0%	0%	100%	0%	-	-	-
T.CERP.	10%	0%	290%	0%	-	-	-
	-	-	-	-	-	-	-
CELKOM	694	-	382	1 076	6 942	8 018	17 196
	12 352	-	6 794	19 146	123 521	142 667	

TV	straty ROZVOD	straty AKUM	straty ZDROJ	straty CELKOM	spotreba bez strat	spotreba CELKOM		
	5%	5%	% / kWh	% / kWh		0.000%		
	0	0						
	22%	9%			kWh	kWh		
PLYN	22%	9%	99%	26%	14 577	19 578	41%	2 360
	3 207	1 601	194	5 001				
ELI	22%	9%	99%	0%	-	-	0%	-
OST	22%	9%	100%	0%	-	-	0%	-
DREVO peletky	22%	9%	86%	0%	-	-	0%	-
DREVO kusové	22%	9%	70%	0%	-	-	0%	-
UHLIE čierne	22%	9%	73%	0%	-	-	0%	-
UHLIE hnedé	22%	9%	73%	0%	-	-	0%	-
	180	90	11	281	819	1 100	41%	2 360
	3 207	1 601	194	5 001	14 577	19 578		
SOLAR vodný	22%	9%	100%	25%	20 575	27 360	59%	100% 16 650
	4 526	2 259	-	6 785				
SOLAR fotovol.	22%	9%	100%	0%	-	-	0%	100% -
T.CERP.	22%	9%	260%	0%	-	-	0%	-
	4 526	2 259	-	6 785	20 575	27 360	59%	16 650
CELKOM	180	90	11	281	819	1 100	100%	19 010
	7 733	3 860	194	11 787	35 152	46 938		

ELI	SVETLO	TČ	ine	PREBYTOK nevyužité
	3 515			
	50%			
	1			
	50%			
PLYN				-
ELI	3 515		26 851	
OST				-
DREVO peletky				-
DREVO kusové				-
UHLIE čierne				-
UHLIE hnedé				-
	578	-	4 414	-
	3 515	-	26 851	-
SOLAR vodný				
SOLAR fotovol.	-	-	-	
T.CERP.	TV = -			-
	UK = -			
CELKOM	578	-	4 414	-
	3 515	-	26 851	-

ZDROJ	suma kWh/rok	podiel %	
			-100.000%
PLYN	162 245	62.2%	142 666.644
ELI	30 366	11.6%	-
OST	-	0.0%	-
DREVO peletky	-	0.0%	-
DREVO kusové	-	0.0%	-
UHLIE čierne	-	0.0%	-
UHLIE hnedé	-	0.0%	-
	14 110	73.8%	21 052
	192 611		192 611
SOLAR vodný	27 360	10.5%	-
SOLAR fotovol.	-	0.0%	-
T.CERP.	-	0.0%	-
	27 360	10.5%	
CELKOM	14 110		9 696
	219 971	84.3%	

	STAVEBNÉ KONŠTRUKCIE						KONSTRUKCIE	UK						UK NAVRATNOST	TV				TV NAVRATNOST	ELI			CELKOVA
NAKLADY JEDNOTKOVE s DPH (€/m2) =	90	50	80	50	300			3.23							-	-				8			
NAKLADY CELKOVE bez DPH (€) =	-	-	-	-	-		- €	3 785	-	17 196				20 980 €	-	-	19 010		19 010 €	9 374	-		49 364 = naklady na rekonstrukciu
								644	-	1 325	1 969	4 953		6 922 €									
NAKLADY NA ENERGIE POVODNY STAV s DPH (€) =	1 723	358	316	217	579	1 760	4 953 € (1.00)	644	-	1 325	1 969	4 953		6 922	697	348	3 463		4 508 €	1 156	-		12 585 = naklady na energie PRED
NAKLADY NA ENERGIE NAVRHOVANY STAV s DPH (€) =	1 723	358	316	217	579	1 760	4 953 (4 953)	694	-	382	1 076	6 942		8 018 €	180	90	830		1 100 €	578	-		9 696 = naklady na energie PO
USPORA NAKLADOV ZA ENERGIE s DPH (€) =	-	-	-	-	-	-	- €	50	-	943	893	1 989		1 096 €	517	258	2 633		3 408 €	578	-		2 889 = uspora za energie
NAVRATNOST OPATRENÍ (rok) =	-	-	-	-	-	-	- rok	75.2	-	18.2				19.14 rok	-	-	7.2		5.58 rok	16.22	-	-	17.08 = CELKOVA navratnost

NOTES

1. https://www.mhsr.sk/energetika/energeticka-politika
2. PRIMES is a partial equilibrium model of the EU energy system providing projections for the medium and long term starting from 2010 and running up to 2030 with results for every fifth year.
3. Regional Operational Program, the Operational Program Bratislava Region, and the Operational Program Competitiveness and Economic Growth.
4. Joint European Support for Sustainable Investment in City Areas - an initiative of the European Commission developed in cooperation with the European Investment Bank (EIB) and the Council of Europe Development Bank (CEB). It supports sustainable urban development and regeneration through financial engineering mechanisms.
5. Eko-Fund was founded by the Slovak Gas Industry (SPP) in 2007 with an aim to promote and protect the environment, support efficient energy use, and support dissemination and awareness of information.
6. The European Bank for Reconstruction and Development (EBRD) established a credit line to support EE in Slovak municipalities called MunSEFF. MunSEFF is a municipal instrument to finance sustainable energy investments. The facility provides financing of energy efficiency and renewable energy investment opportunities channeled through local banks. The credit line is supported by a technical assistance package that helps sub-borrowers prepare loan applications, and educates local bank officers in sustainable energy investment opportunities and credit appraisal methods.
7. https://tradingeconomics.com/slovakia/gdp-growth-annual.
8. Slovak banking Association (https://www.ebf.eu/slovakia/).
9. According to the World Economic Forum's Global Competitiveness Report 2017-2018, Slovakia has the third soundest banking sector in the Euro area.
10. The Government of the Slovak Republic has enacted Act 4/2019 Amendment to the EE Act for public buildings.
11. Eurostat provides additional methodological guidance documentation on the accounting rules for the EDP statistics and the GFS complementing or interpreting of the general rules of ESA 2010. Guidance notes are released under the responsibility of Eurostat, after the consultations with EU Member States. In May 2018, the document A Guide to the Statistical Treatment of Energy Performance Contracts was published. More information at: https://ec.europa.eu/eurostat/documents/1015035/8885635/guide_to_statistical_treatment_of_epcs_en.pdf/f74b474b-8778-41a9-9978-8f4fe8548ab1
12. The administrative buildings of the town and municipalities are not owned by the PSK. Elementary and middle schools, as well as other public buildings owned by the towns and municipalities, are not included in the table.
13. Eurostat provides additional methodological guidance documentation on the accounting rules for the EDP statistics, and the GFS complementing or interpreting of the general rules of ESA 2010. Guidance notes are released under the responsibility of Eurostat, after the consultations with EU Member States. In May 2018, the document A Guide to the Statistical Treatment of Energy Performance Contracts was published. More information at: https://ec.europa.eu/eurostat/documents/1015035/8885635/guide_to_statistical_treatment_of_epcs_en.pdf/f74b474b-8778-41a9-9978-8f4fe8548ab1.