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Energy efficiency NEWS at SEVEn from the Czech Republic and EU

SEVEn THE ENERGY EFFICIENCY CENTER, z.ú.

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SRI: The Smart Readiness Indicator

The Smart Readiness Indicator (SRI) is an indicator of the readiness of buildings for smart solutions. This is a new building evaluation system from the point of view of "smart" systems for the technical equipment of buildings, the purpose of which is to reduce energy consumption, increase comfort, prepare buildings for smart networks, etc. The SRI is based on the requirements of the European EPBD (Energy Performance of Buildings Directive) and offers a broader evaluation than the building's energy performance certificate (PENB). The SRI is now enshrined in European legislation as an optional assessment.

The SRI is a comprehensive assessment of the building, in which individual technical areas are assessed in contrast to impact criteria. The main technical areas include heating, hot water preparation, ventilation, lighting, but also electric car charging, building envelope, and consumption management. The key impact criteria are primarily energy efficiency, comfort, maintenance, →5

Emission-free buildings

The draft amendment to the Energy Performance of Buildings Directive (EPBD IV) from 2021 (as of August 2023 still in the amendment process) introduces a new energy standard for new buildings, the so-called Zero Emission Building, which will replace the existing building standard with nearly zero energy consumption (nZEB).

Directive 2010/31/EU on the energy performance of buildings (EPBD II) introduced the energy standard for the so-called nearly zero energy building (nZEB) more than 10 years ago. The directive also set deadlines for the overall introduction of this standard by the end of 2018 (for public buildings) or 2020 (all other buildings). Meanwhile, a revision of the Energy Performance of Buildings Directive (EPBD III, 2018/844) was issued in 2018, which addressed the long-term strategy of building renovation, →7

Energy efficiency projects for Ukraine

Energy efficiency must play a key role in the efforts to reconstruct and rebuild Ukraine. The energy intensity of the Ukrainian economy has been three to four times higher than the European Union average, driven by high demand in residential heating and industrial structures concentrated in energy-intensive activities, with energy-inefficient technologies and decades of underinvestment. By undertaking energy efficiency improvements, Ukraine could ensure a significant decrease in energy intensity, estimated by up to 60% by 2050.

One of the areas of low efficiency in Ukraine is the residential buildings sector, which is in a critical situation. Around 85% of the buildings date back to the pre-1991 Soviet era, leading to outdated infrastructure and high energy consumption. →5

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Energy savings in 2023

A downward trend in energy consumption is being confirmed in the Czech Republic. Compared to 2022, roughly 13% less natural gas was consumed in May 2023 in the country, after adjusting for the effect of weather, and 9% less in June. Electricity consumption was about 7.5% lower this year, in comparison with 2022. This continues the trend from 2022, when, according to the Energy Regulatory Office, natural gas consumption decreased by 28.5%, in comparison with 2021.

In addition, the country has partly succeeded in reducing dependence on Russian fuels, especially natural gas, the import of Russian gas having been reduced from 97% to zero in 2023 and an embargo on the import of Russian coal having been applied. From 2024, even Russian nuclear fuel should not be used. However, the shift away from Russian fuels is not going well in oil imports, where the Czech Republic's 50% import dependence in 2021 has risen to 53% in 2022, even with overall consumption growth of 2.1%. From 2025 onwards, however, the connection to the TAL oil pipeline should free the country of this dependence as well.

It is becoming clear that energy savings bring much more benefits than it was thought. Besides protecting the climate and local air quality, they also protect wallets and public budgets. In addition, energy savings also provide energy security, as it allows the Czech Republic to liberate itself from dependence on fuel imports from Russia, which uses this money for murdering people and brutal acts of terrorism in Ukraine. By saving energy, the Czech Republic is also pushing against price increases and enabling faster filling of natural gas reservoirs for the upcoming heating season.

Energy savings, together with the necessary development of renewable energy sources, the shift away from fossil fuels and the diversification of energy sources are therefore basic tools for breaking away from dependence on fossil fuels. In the new edition of our News from SEVEn newsletter, we will therefore present you with several specific examples of activities that can be used to achieve energy savings. Thank you for your interest in this topic!

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The Smart finance for Smart Buildings roundtables brought together the construction industry, energy and the financial sector

From the beginning of 2022, representatives of the public sector, companies, associations and banks met in organized roundtables with the aim of identifying and supporting possible measures to increase the number and size of energy saving projects in the Czech Republic. The implementation of defined measures will fundamentally increase the country's energy savings.

During the first year of the roundtables, it was possible to create a group of cross-cutting measures that were mostly not related to a specific type of building. These were the topics of sustainable financing, the impacts of non-financial reporting and the introduction of the ESG concept in the construction sector, financial instruments, Energy Performance Contracting (EPC) and performance design & build (PD&B). There were also discussions on the planning of investments in energy savings and renewable sources within the urban sustainable energy and climate plans (SECAP), the emergence of energy communities or the impact of the manifestations of energy poverty on the achievement of energy savings.

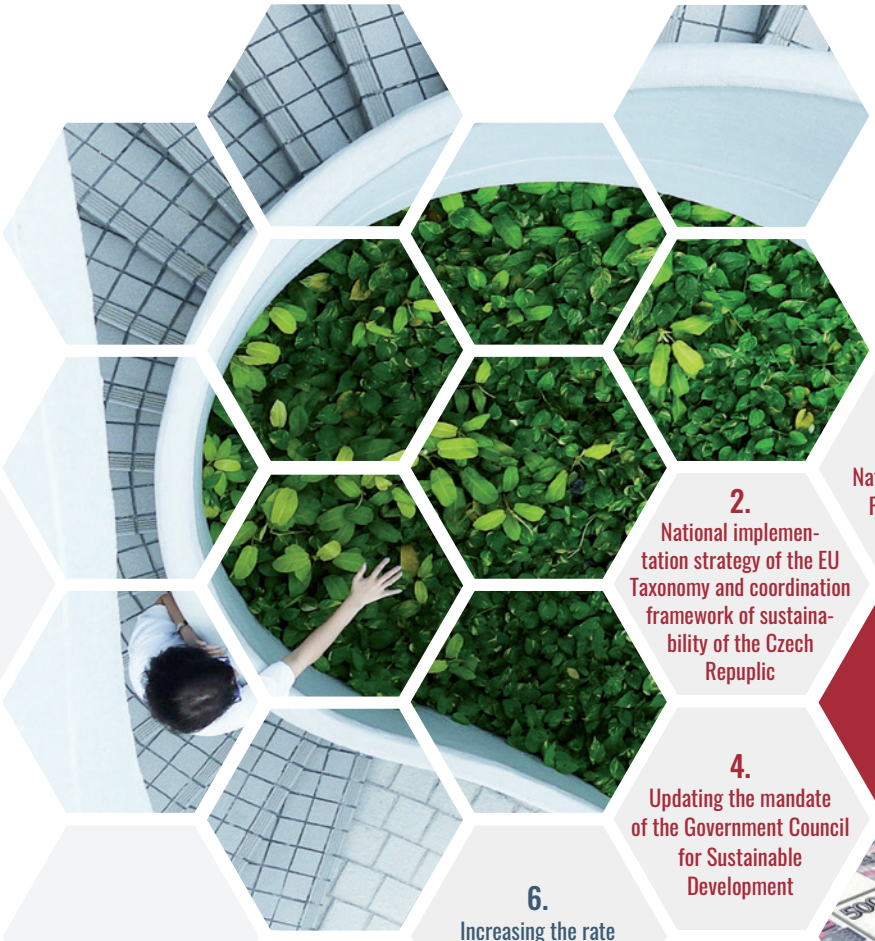
In 2023, we focused on residential buildings, urban infrastructure, industry and services. A total of 20 essential measures have been identified so far, some of which have already started to be implemented, for example: Sustainable Financing Strategy or ESG Methodology in the construction industry. A broad group of more than 150 involved participants will further devote themselves to a detailed description of the measures, including the parties involved, and the preparation of the implementation of the above-mentioned measures.

Project web: GreenDeal4Buildings.eu

GreenDeal4Buildings

20 ESSENTIAL MEASURES

SMART FINANCE FOR SMART BUILDINGS



Sustainability in financing

1. National Sustainability Financing Strategy
2. National implementation strategy of the EU Taxonomy and coordination framework of sustainability of the Czech Repuplic
3. Coordination Group and Advisory Group on Sustainable Finance
4. Updating the mandate of the Government Council for Sustainable Development
5. Comparative study of the institutional sustainability system and reform proposal

Increasing the efficiency of financial instruments

6. Increasing the rate of use of financial instruments
7. Optimization and streamlining of the administrative process
8. Communication of measures towards potential applicants
9. Information campaign for the construction value chain on the topic of implementation of European climate policies
10. Creation of a unified methodology for non-financial ESG reporting for the Czech Republic

Supporting Energy Performance Contracts (EPC) implementation at public institutions

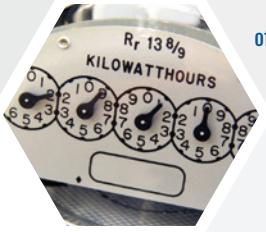
11. Exempt public EPC projects from the prohibition to accept supplier loans
12. EPC contract without effect on national debt
13. Explaining the EPC model to public institutions

Risks associated with the introduction of ESG in the construction sector

Support for citiesand municipalities as investors in energy-saving projects

14. Awareness raising and SECAP preparation
15. Provision of technical support for municipalities
16. Emulation of the EU City Facility program in the Czech Republic
17. Make support for complex renovations of buildings more attractive
18. Offer preferential interest rates for renovation, green and smaller projects, with regard to lower administrative burden

Increasing the share of complex renovations



19. Technological transformation of the construction industry*
20. Support for education in the construction industry

Support for the construction industry

* acceleration of the construction process, increase in work productivity and use of digitalization in situ

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Decarbonization of the heating industry using heat pumps

Reducing the production of carbon dioxide (CO2) emissions is one of the main measures to mitigate climate change. The concentration of CO_2 in the atmosphere increased by a third between 1960 and 2022, from 315 to 421 ppm. Given that most of the energy in the Czech Republic (67% of heat and 50% of electricity) is still produced from fossil fuels (mainly brown coal, natural gas and hard coal), decarbonization of heat production is an important mitigation measure for the Czech Republic that industrial heat pumps can help with.

In the past, the thermal energy production process was significantly streamlined thanks to the development of combined heat and power (CHP) systems, which achieve an efficiency of up to 95% and, above all, often use biogas. With the advent of new technologies, such as large (also called industrial) heat pumps, the achieved resource efficiency improves even more.

Large industrial heat pumps with outputs of 100 kWt to 20 MW_t and in assemblies with even hundreds of MW of thermal output can be used as a very efficient ecological source of heat, but also of cold for thermal energy supply systems (TESS) in cities and municipalities. For such purposes, heat pumps of the water-to-water type are the most suitable, as examples from abroad, especially Scandinavia (Sweden, Finland, Norway and Denmark) show. The source of heat can be surface water (river and sea) or, more often, wastewater from wastewater treatment plants (WWTP) and industrial operations, and to a lesser extent geothermal water. Water from WWTPs, coming mainly from households, is usually warmer and has a more constant temperature throughout the year, which makes it a better source of low-potential energy than surface water. High-temperature pumps cool the supply water at a temperature between 10 and 20 °C, and thus they remove heat up to 4 °C and use compressors to heat the heating water to a temperature level suitable for heat supply systems (60 to 120 °C). When designing heat pumps, it is necessary to consider the effect of lowering the ambient temperature. When water or earth is used as a source medium, the environment gradually cools down.

Large heat pump assemblies located in energy centres with a heat output of up to hundreds of MW_t can gradually reduce the share of thermal energy supplied from coal or natural gas-burning heating plants, thereby significantly contributing to the decarbonization of the heating industry. Energy centres with heat pumps that are connected to TESS abroad (Stockholm 230 MW_t, Goteborg 160 MW_t, Helsinki 123 MW_t, Oslo 40 MW_t, Drammen (Norway) 13 MW_t, Skjern (Denmark) 4 MW_t or Plessis-Robinson (France) 6 MW_t) cover 60 to 85% of the delivered heat in local TESS. An example from the Czech Republic is Děčín, where a CHP with an output of 3.56 MWt using geothermal energy accounts for approximately one third of the heat supplied to the local TESS. For the sake of completeness, it is necessary to add that energy centres with industrial high-temperature CHPs have a non-negligible consumption of electricity for their operation. For the decarbonization of the heating industry to be complete, in addition to replacing all coal and gas-fired heating plants, it is also necessary to ensure the supply of electricity from renewable sources for heat pumps and entire energy centres. In cities, rooftop photovoltaic systems can mostly do the job, while in municipalities wind power plants supplemented in the future with, for example, agrovoltaics and battery storage would be suitable.

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THE EFFICIENCY INDICATOR OF HEAT PUMPS IS THE **HEATING FACTOR** ALSO CALLED A **COEFFICIENT OF PERFORMANCE** (COP). *It indicates the theoretical ratio between the heat produced and the electricity consumed. In optimal conditions for heat pump operation, the COP can reach up values of 5 or 6. In that case, the outside temperature or water temperature is high, while the internal temperature of the medium (heating water or air) is kept low, e.g., a situation where the outside temperature is 10°C and the heating water temperature is 35°C. If, on the other hand, radiators are used, requiring a higher heating water temperature of more than 55°C, and it is cold outside, e.g., slightly below freezing point, then the COP is only around 2–2.5. That is why Seasonal Coefficient of Performance (SCOP) has been introduced to offer a more comprehensive view of the efficiency of the heat pump during the entire heating season. SCOP takes into account the average outdoor temperature as well as the working temperature of the heating water. A floor heating a system, with water temperature of 35°C, achieves better performance than conventional radiators.*

Energy efficiency projects...

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The average energy consumption in the residential sector is two to three times higher than EU standards. Additionally, the damages caused by the brutal and illegal Russian invasion into Ukraine have further worsened the state of the housing stock, with estimated replacement costs of USD 53.6 billion. Over 150,000 residential buildings have been damaged or destroyed, alongside more than 3,000 schools and over 1,500 hospitals and healthcare facilities.

To tackle these challenges, numerous projects and initiatives are fortunately being initiated, to ensure that Ukraine will not only be renovated and rebuilt, but that it will berebuilt in a way that is as energy efficient as possible, alongside efforts to build renewable energy capacities and use climate-friendly technologies whenever possible.

One of the key activities in this field includes the establishment of the ***State Fund for Decarbonization and Energy Efficiency Transformation***, which will support Ukrainian government programs for energy efficiency, alternative energy sources and decarbonization, and coordinate financial instruments to support energy efficiency, such as international loans and grants for the implementation of investment projects as well as direct foreign investments. For the first time, the "polluter pays" principle has been encoded into the respective law. The Fund will be replenished through an environmental tax on CO_2 emissions, paid for mainly by large industrial enterprises. It is expected to start operation from January 2024.

Another institutional example includes ***The National Decarbonization Platform***, launched by the State Energy Efficiency Agency of Ukraine with the aim of becoming the main platform introducing a number of financial instruments, services, as well as modern equipment and technologies for communities and businesses.

Various international, multinational and bilateral partnerships are also already being negotiated and planned, aiming to restore the Ukrainian energy system and economy, while increasing the energy efficiency and use of renewable energy sources.

One example of such projects is the ***European Commission*** support. Ukraine is expected to receive PVE panels with a total capacity of 200 MW. The panels will be installed to meet the needs of key public buildings and critical infrastructure, including hospitals. The European Commission is also financing the supply of up to 30 million LED lightbulbs for Ukraine estimated to save 1 GW – the annual electricity output of a nuclear power plant.

Olha Khabatiuk

For more examples of assistance programs and projects, visit: www.svn.cz/en/news-article/energy-efficiency-projects-ukraine

SRI: The Smart Readiness...

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SRI-ENACT
Smart Readiness Indicator (SRI)
Nástroje a služby pro hodnocení připravenosti budov pro chytrá řešení

www.svn.cz/sri

user information and energy storage. The result of the evaluation is the overall SRI score, which represents the degree of the building's capability and ability to work smart inside and out.

The methodology for evaluating the readiness of buildings for smart solutions consists in evaluating the individual services of the building according to a predetermined catalogue. Two methodologies are prepared: simplified methodology A, evaluating 27 services of the building, and full-fledged B, evaluating additional 27 services. A simplified assessment is particularly suitable for single-family houses and smaller non-residential buildings, while a full assessment is more universal but at the same time more demanding. The evaluation methodology also works with weighting factors that partially change according to the geographical location as well as the type of the building in question.

As part of IV recast to the EPBD, several fundamental changes to the legislative framework of the energy performance of buildings are being considered. One of the topics being discussed is the introduction of the SRI as an option to increase the energy efficiency and flexibility of buildings. The overall SRI concept has been in preparation for several years and pilot evaluations are underway.
SEVEn participates in the SRI-ENACT project, one of four European initiatives focused on national adaptations of the methodology, training and general promotion of the SRI.

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EPC with subsidies will save up to a third of energy costs

The rise in energy prices last year increased the cost of running public buildings and strained the budgets of public sector organizations. State administration, cities, authorities and other public institutions are therefore looking for ways to reduce energy costs. A suitable solution is offered by EPC – Energy Performance Contracting, which, in combination with subsidies, can significantly reduce energy costs in complex renovation of public buildings with relatively low demands on own resources. The Czech Republic thus offers extremely advantageous conditions to public organizations that it would be a shame not to take advantage of. Complex renovations of buildings not only bring savings, but also reduce the demands for operating energy systems and technological equipment of buildings, increase the comfort of users and, finally, limit greenhouse gas emissions and other negative impacts on the environment.

EPC – Energy Performance Contracting *enables building owners to implement energy-saving measures even without the right to own capital investment, as the investment is repaid over the years from the saved costs. The benefit of the EPC model is also that it provides the client with a turnkey service, where one entity oversees the design of the concept, preparation, projecting, implementation and commissioning of energy-saving measures – the ESCO (Energy Services Company), which assumes most of the risks associated with implementation. Here, the key advantage for the client is that the provider guarantees the achievement of the contractually agreed level of savings and is obliged to compensate the client for any unachieved savings for the entire duration of the contract (usually 8–12 years). The achieved savings are determined in a transparent manner using measurement and verification according to the methodology specified in the contract. To successfully select a provider and conclude a contract that is as advantageous as possible for the client, it is advisable to use one of the consulting firms that have sufficient experience with EPC projects.*

In ordinary EPC projects, mainly technological measures to increase energy efficiency are implemented, most often in the form of renovation of lighting to LED light sources and installation of measurement and regulation of heat consumption. In addition, when EPC is combined with subsidies, comprehensive renovation of buildings can be carried out, including insulation, where subsidies cover a significant part of the investment in measures with a long-term return. This includes, in particular, construction measures such as the insulation of building envelopes and the installation of high-quality windows.

The combination of both types of measures will bring the greatest positive effect to clients. By using the combination of EPC and subsidies from programs of the State Environmental Fund of the Czech Republic, renovations can often be carried out with a small share of own funds, usually in the range of 20–40% of the total investment costs.

It is currently possible to apply for funding from the Operational Program Environment for meeting the specified criteria listed under specific objective 1.1 – Support for energy efficiency and reduction of greenhouse gas emissions. The key condition is achieving at least 30% savings in primary non-renewable energy. The Operational Program Environment offers subsidies for projects throughout the Czech Republic, except for the capital city. Projects in Prague are supported separately by the ENERGov program – Energy efficiency in public buildings of the Modernization Fund. Instructions for applicants who use the EPC method with subsidy support are available for download on the State Environmental Fund's website and provide information about the various procedures that allow for EPC and subsidy support to be combined.

Another significant facilitation of the implementation of EPC projects in combination with the subsidy was brought about by enabling the purchase of receivables. Thanks to the appropriate adjustment of the conditions for the provision of State Environmental Fund subsidies, the EPC provider can now sell the receivables to the bank after the completion of the project and at the same time fulfil all the conditions for obtaining the subsidy. This is of key importance, because by selling receivables, the company recovers funds that it can invest in the implementation of other projects. The REFINE Project, funded by the EU Horizon 2020 program, in which SEVEn participated, made a significant contribution to the adoption of this adjustment.

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refineproject.eu

REFINE

Instructions for applicants who use the EPC method with subsidy support

Other benefits of energy services

Energy services are among the key solutions in sustainability and climate protection. Energy services include not only the production and supply of energy, but also the deployment of innovative technologies and concepts that support energy efficiency, renewable resources and the reduction of greenhouse gas emissions. Until now, the perception of energy services has focused mainly on benefits in the field of energy, i.e. by increasing energy efficiency or reducing the consumption of non-renewable energy. But there are also other benefits that must be considered when deciding on the implementation of cost-saving measures.

Non-energy benefits (NEBs) refer to additional or indirect benefits that come with the provision of energy services, beyond the directly energy-related services themselves. These benefits may include improvements in health, safety, productivity, comfort and environmental quality, and more. For example, energy-efficient lighting can provide better lighting quality and reduce eye fatigue, leading to increased productivity and job satisfaction. Similarly, effective air-conditioning systems can improve indoor air quality and reduce the risk of respiratory disease. Replacing local energy sources with renewable ones, for example in the form of photovoltaic panels, can significantly contribute to improving local air quality.

NEBs are important to consider when evaluating energy service offerings because they can help justify investments in more efficient and sustainable energy systems. Although these benefits are not always easy to quantify or value, they can provide significant value to individuals, businesses and society as a whole and become a useful guide for decision-making.

One of the projects that NEBs deals with is the BungEES project, whose aim is to develop new energy services integrating renewable energy sources, energy efficiency and demand flexibility services, and to develop innovative financing and reward solutions. Particular attention is paid to identifying market, regulatory and other barriers to integrated energy efficiency services that include renewable energy and demand flexibility. The project also includes a thorough analysis of non-energy benefits that are linked to the newly provided energy services. One of the partners of the project is SEVEn, which leads the part of the project focused on the development of the concept of energy efficiency services (EES) and service model innovation, which is the core of the integrated package of EES intelligent services.

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bungees.eu

BungEES

Emission-free buildings

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the economic-technical feasibility of energy-saving measures and electromobility.

The latest version of the directive, EPBD IV, responds to new goals and activities in the field of energy efficiency and renewable sources, in particular the ***Green Deal for Europe*** strategy, the ***Fit for 55*** package and the ***Renovation Wave*** strategy. In addition to the new ZEB standard, the amendment also brings, for example, passports for building renovation or Minimum Energy Performance Standards (MEPS).

A building with zero emissions represents a shift not only in the energy demand of the building, when the total annual consumption of primary energy should be covered from renewable sources on an annual or seasonal basis, but also a very significant shift in the evaluation of the carbon footprint. For a building with zero emissions, it will be necessary to evaluate the so-called ***GWP – global warming potential*** – in simple terms, it is the carbon footprint of the building as part of an assessment of its entire life cycle (LCA – life cycle assessment), while the result should be part of the building's energy performance certificate (PENB).

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COMPARISON OF NZEB REQUIREMENTS AND ZERO-EMISSION BUILDINGS

TYPE OF CLIMATE	TYPE OF BUILDING	NZEB		ZEB (ZERO EMISSION BUILDING)	
		TOTAL PRIMARY ENERGY CONSUMPTION [kWh/m² per year]	ENERGY SUPPLIED FROM RES [kWh/m² per year]	TOTAL PRIMARY ENERGY CONSUMPTION [kWh/m² per year]	ENERGY SUPPLIED FROM RES [kWh/m² per year]
Mediterranean	Residential – RD	50–65	50	< 60	100%
	Administrative	80–90	60	< 70	100%
Oceanic	Residential – RD	50–65	35	< 60	100%
	Administrative	85–100	45	< 85	100%
Continental	Residential – RD	50–70	30	< 65	100%
	Administrative	85–100	45	< 85	100%
Nordic	Residential – RD	65–90	25	< 70	100%
	Administrative	85–100	30	< 90	100%

SECAP – an energy schedule for the city

The Covenant of Mayors for Sustainable Energy and Climate is a voluntary initiative established by municipalities and cities that have committed to active climate protection. The main content of the Covenant is the climate and energy plan, the so-called SECAP, which contains the Baseline Emission Inventory and a supply of mitigation and adaptation measures. What are the main components of the SECAP and what are the common precautions?

What is mitigation and adaptation?

*European politics is full of terms that may not be comprehensible at first glance. Climate policy, or the policy of climate protection, appears in European anglophone chatter as **climate action** or **climate protection**. Climate protection proceeds in two complementary directions: mitigation and adaptation. Mitigation includes all measures to slow down or reverse climate change. Most often, it is about reducing greenhouse gas emissions. The main part of mitigation measures therefore consists in energy savings and the introduction of renewable sources, but also the development of carbon-free technologies, carbon capture and others. Adaptation, on the other hand, prepares us for the consequences of climate change. These are a set of measures in the field of water management, urban greenery and infrastructure, heat island solutions, but also coastal barriers against rising sea levels and others.*

Covenant of Mayors

The Covenant of Mayors for Sustainable Energy and Climate was created to engage and support cities and regions to commit to meeting the EU's climate and energy goals. The Covenant brings together thousands of local authorities across Europe. In the Czech Republic, less than 200 municipalities have joined the challenge.

Municipalities and cities undertake to reduce greenhouse gas emissions by at least 40% by 2030 (so-called mitigation). This can be achieved through energy savings, increased energy efficiency and the use of energy from renewable sources, especially in buildings, transport and street lighting. Appropriate adaptation measures are also an integral part of SECAP.

SECAP

After joining the Covenant, there is an obligation to prepare a so-called Sustainable Energy and Climate Action Plan ("SECAP") within two years. We can think of a SECAP as a strategic energy plan, simply put, a timetable for municipal energy.

The core part of the SECAP is the vision, i.e. the idea of what the municipality wants to achieve and where it wants to move. The analytical part of the SECAP is the Baseline Emission Inventory (BEI), against which savings measures are then measured. The BEI is created for the reference year in the past and for the current year when the latest data is available (e.g. 2000 and 2022). BEI reports energy consumption and emissions in a given year. Based on two (or more) analyzed years, the target state of emissions and consumption is then determined, typically for the year 2030 or later.

The draft part of the SECAP contains selected savings and adaptation measures that the municipality intends to gradually implement to achieve the set goal. Savings measures are evaluated not only according to the investment requirement, but the relative price of saved energy is expressed as well. Thanks to this indicator, measures can be sorted and easily prioritized.

Examples of savings measures

The most frequently represented measure is building insulation, which brings significant operating savings on heating. This is usually the most important measure, as heating is one of the largest energy expenditure items. Medium investment-intensive measures include reconstruction of internal lighting systems, reconstruction of street lighting or reconstruction of technological operations (e.g. kitchens, laundries, etc.). An example of a measure with a low to medium investment requirement is the introduction of energy management, where energy consumption is monitored and regulated in detail, e.g. thanks to the installation of thermostatic heads or remote control. A specific area is complex saving measures, which require general knowledge of the energy systems in the given municipality and its location. Thus, for example, it is possible to find a potential use of waste heat or cold, or the interconnection of several energy systems.

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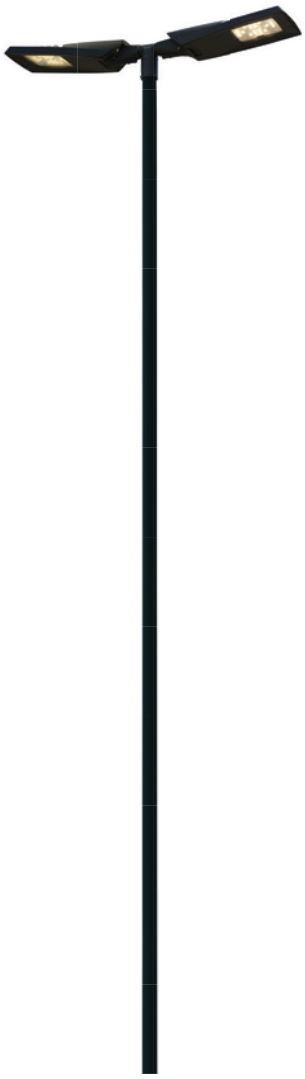
The article was created as part of the OwnYourSECAP (www.svn.cz/oys)

A new Czech standard limits light pollution

An excess of artificial light fundamentally affects biorhythms based on the natural alternation of day and night (so-called circadian rhythms). This applies not only to humans, but also to all plants and animals. The problem is exacerbated by the use of light emitting diodes (LEDs), which have a light very similar to daylight (as opposed to orange sodium discharge lamps). The new Czech standard on Limitation of Adverse Effects of Outdoor Lighting, effective from 1 March 2023, brings a long-awaited regulation in this area.



Light pollution, the so-called excess of disturbing night light, is already a worldwide problem and is also a widely discussed and often controversial topic in the Czech Republic. As light becomes cheaper in the long term, the standard of living increases and people gradually urbanize the environment around them. This leads to steady growth in the use of artificial lighting in the outdoor night environment. Sufficient light at night increases people's comfort and safety as well as the attractiveness of some places, but the increasing ubiquity of light leads to over-lighting.

To solve the problem of light pollution, a technical standardization commission led by Petr Žák developed a new Czech standard dedicated to limiting the adverse effects of outdoor lighting (ČSN 360459). The premise of the standard is that the validity of other standards will not be affected in any way and will rather be complemented by it. The challenging work led to a compromise that suitably connects the needs of modern citizens and brings regulation of artificial light, which was previously missing in the Czech environment.

The standard provides several ways to limit the adverse effects of outdoor lighting. One of the most important regulations is the introduction of a tolerance of a maximum of 30%. Other key parameters depend on the specific location of the lighting environment zone. It divides the landscape into areas from city centres, through the outskirts of cities to undeveloped zones in protected areas. The standard prescribes the strictest requirements for protected areas, where, for example, the lighting of building facades or advertising lighting is not allowed, the luminaires must have a maximum degree of shielding and a zero proportion of radiation into the upper half-space, and a colour temperature of a maximum of 2200 K (very yellow to orange) is allowed. Even for important city centres, the standard prescribes maximums for brightness on the facade and outdoor advertising. Partial emission into the upper half-space is allowed and the maximum colour temperature is 3000 K (warm white). It follows from the standard that colder shades of white (above 3000 K) are not recommended in any outdoor spaces.

Last but not least, the standard also introduces limits for maximum glare, and to reduce the adverse effects of outdoor lighting, the use of different operating modes is recommended, i.e. differentiating parameters according to the time of day. For example, it is recommended to turn off advertising, architectural and sports lighting completely at night. By its nature, the new standard introduces a comprehensive set of measures supplementing the existing lighting technical standards. If the standard is followed conscientiously, it will contribute not only to the reduction of light pollution and its undesirable effects, but also to energy savings.

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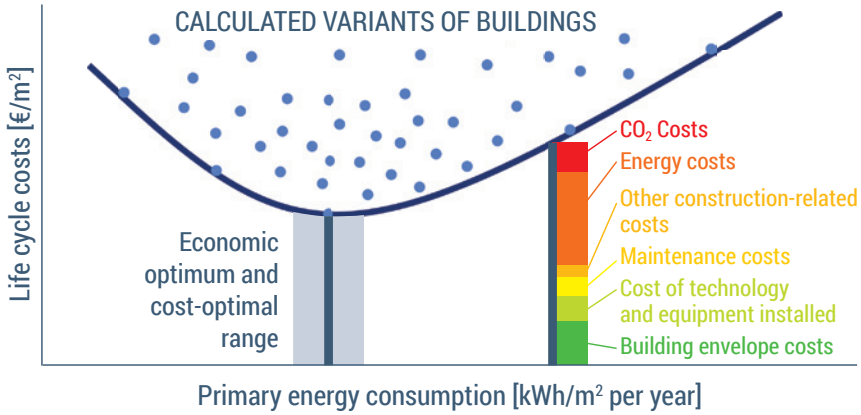
Updating the cost optimum of requirements for the energy efficiency of buildings

This year, the so-called cost optimum requirements for the energy performance of buildings were updated in the Czech Republic in accordance with the requirements of the Energy Performance of Buildings Directive (EPBD). The calculation of the cost optimum serves as a basis for setting national requirements for the energy efficiency of buildings (Decree No. 264/2020 Coll.) and at the same time represents a technical-economic analysis of various solutions for the energy efficiency of buildings.

Directive 2010/31/EU on the energy performance of buildings defines the cost optimum as "the level of energy performance that results in the lowest costs over the estimated economic life cycle". The cost optimum is developed for various categories of buildings, reconstructions and new constructions, while assessing all investment and operating costs and relevant technical parameters affecting the energy efficiency of the building. In graphical form, the search for the cost optimum can be expressed as the search for the lowest point on the curve that is formed by connecting the points representing the individual variants of the calculation, and can be expressed as follows (see chart below).

THE THEORETICAL OPTIMUM LEVEL OF COSTS (INVESTMENT AND OPERATING) WITH RESPECT TO ENERGY CONSUMPTION AT GIVEN CONSTRUCTION AND TECHNOLOGICAL PARAMETERS OF THE BUILDING DURING THE EVALUATION PERIOD IS ADDRESSED



The third calculation of the cost optimum for the Czech Republic (previous calculations were carried out in 2012 and 2017) was carried out by SEVEn together with the Faculty of Civil Engineering of the Czech Technical University in Prague and the Association of Construction Entrepreneurs (SPS), with the financial support of the Technology Agency of the Czech Republic*.

Due to the amount of inputs – parameters of building envelope constructions and building systems (heating, hot water heating, lighting, cooling, renewable sources, etc.), operating parameters, construction and technology costs, operating costs, energy prices and environmental costs (emission allowances) – the calculation of the cost optimum is a very complex matter. The conclusions of the current calculation from 2022 are summarized in a summary report available on the given QR link. One of the typical graphs and selected conclusions is presented on the right.

* *Project TK04010328 implemented as part of the fourth public call of the Theta program.*

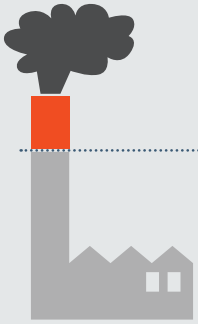
Final 2022 report on Cost optimum available in Czech language.

(www.svn.cz/cs/aktualita/aktualizace-nakladoveho-optima-pozadavku-na-energetickou-narocnost-budov)

THE PRICE OF THE ALLOWANCE WILL NOT AFFECT THE COST OPTIMUM

The search for the cost optimum includes the monitoring of important non-technical parameters that influence the results of the calculation. Legislative requirements for buildings must also be directed at these parameters to achieve energy efficient goals close to the cost optimum.

A sensitivity analysis of the input values was used to search for the parameters that most affect the calculation of the cost optimum. The analysis was performed on all types of buildings with the following parameters: discount rate, growth in energy prices, growth in investment costs and prices of emission allowances. The prices of emission allowances parameter aroused the greatest interest, mainly due to its growth and volatility. The influence of the price was examined from the point of view of the influence on the total measured costs and on the cost optimum when using different types of sources and according to the quality of the building envelope (heat transmission coefficient).



According to the results, the price of emission allowances has only a small effect on the change i n total unit costs. If the allowance price is doubled from EUR 70 to EUR 140/t CO_2, the total unit costs of the building's life cycle will increase by only 5%. From the sensitivity analysis of the price of emission allowances in combination with the different quality of the building's thermal envelope, it follows that when the price of emission allowances is increased, the difference in total specific costs between the variants with the heat transfer coefficient

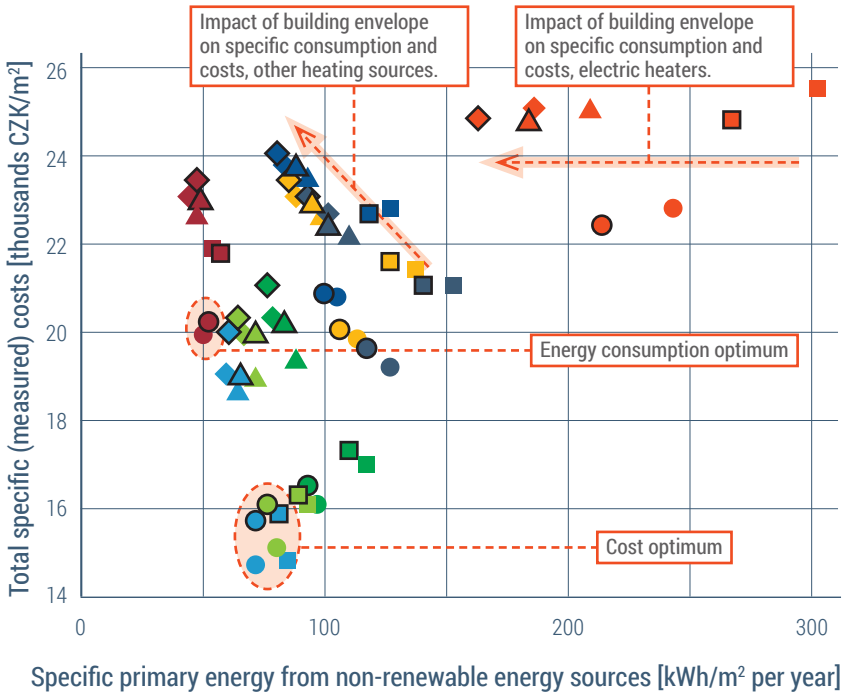
The cost optimum of parameters of the envelopes of reconstructed buildings is around the values recommended by the ČSN 73 0540-2 standard, i.e. roughly at the minimum values that result from the requirements of Decree No. 264/2020 Coll. New buildings are approaching moderate passive values.

According to the calculations, **the most suitable heating method is a heat pump**, taking into account the possibilities of its deployment from the tap water type, through groundwater to air-water.

Variants with high-quality, **energy-saving lighting** with control elements and, apart from single-family homes, also variants **with the installation of a photovoltaic system** (with or without batteries) come out at the cost optimum.

Forced air exchange with recuperation will significantly reduce the amount of supplied energy. Although forced ventilation is more expensive than natural ventilation, it ensures a high-quality indoor environment and comfort while reducing thermal energy losses through ventilation in winter.

NEW BUILDING – FAMILY HOUSE



HEAT SOURCE FOR HEATING

- Natural gas condensing boiler – source efficiency 98%
- Electric direct heaters – source efficiency 98%
- Air/water heat pump – SCOP 3,1
- Coal-fired boiler – source efficiency 85%
- Biomass boiler – source efficiency 85%
- Central heat supply -source efficiency 98%
- Water to water heat pump SCOP 5,1
- Ground-to water heat pump SCOP 4,3

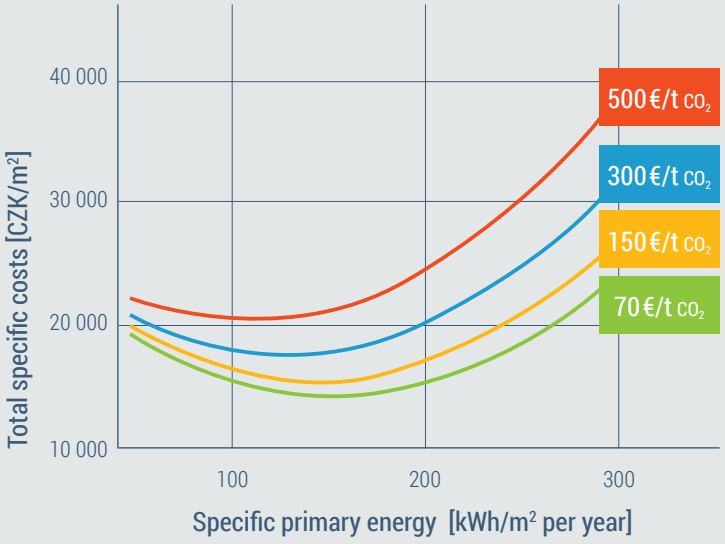
HEAT TRANSFER COEFFICIENT OF THE STRUCTURE

Values required	Recommended values	Passive house (higher, i.e. more moderate values)	Passive house (lower, i.e. stricter values)

TYPE OF VENTILATION

without a frame	Natural ventilation	*with a frame*	Forced ventilation with heat recovery, efficiency 75%

HOW CARBON PRICE AFFECTS TOTAL LIFE CYCLE COSTS OF A BUILDING.



for a passive house and the optimal level of the variant with the recommended values is reduced. Increasing the price of emission allowances thus increases the importance of the quality of the building envelope, which is related to the fact that for the variant with the lowest heat transfer coefficient (required value), the increase in specific total costs is noticeably higher compared to the other variants. In the measured range of the price of emission allowances (EUR 100 to 900/t CO_2), there was no change in the optimal level for any of the variants of the heating source.

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Without education reform, the construction industry has no future

In the last issue of News from SEVEn, we reported on the preparations for a study on the state of the Czech construction industry, which aimed to evaluate the sector's readiness for the changes that await it. The status quo analysis is now complete and paints a picture of a construction industry that is truly on the brink of an existential challenge. Is the construction industry ready for the upcoming changes?

Construction is a key sector of the economy. It generates between 5 and 6% of GDP and employs 7 to 8% of the workforce, with a total workforce of around 400,000 people in 2022. In addition, the construction sector is essential for achieving the decarbonization of the economy. It carries out renovations that increase the energy standard of buildings. At the same time, the reduction of energy consumption in buildings will form a crucial part in lowering greenhouse gas emissions.

However, today's construction industry is not capable of fulfilling ambitious goals. The labour force is shrinking and labour productivity cannot be increased in the long term. While other industries are adopting new technologies at an ever-faster pace, digitizing, introducing robotics and artificial intelligence, the construction industry is lagging behind. It can be said without too much exaggeration that without a reformed construction industry, the Czech Republic will not achieve a carbon-free economy.

Human resources

The main problem of the current construction industry is human resources. Interest in construction majors at high schools and universities has been declining, and the number of graduates is far from enough to cover the number of people leaving the construction industry. The long-term deficit is made up by foreign workers, especially from Ukraine, who can leave quickly as their country begins to recover. Education, therefore, is a key factor in ensuring sustainable growth and quality of the sector. Education not only affects the qualifications of workers, but also contributes to the introduction of innovations, increasing efficiency and the ability to adapt to rapidly changing conditions. The following factors illustrate how important education is in the context of the construction industry.

The industry faces the problem of a shortage of skilled workers. Ensuring a sufficient number of quality craftspeople and experts is crucial to maintaining a high level of construction and project reliability. However, the number of graduates at all school levels is an order of magnitude lower than the number of people leaving the industry each year, and this deficit has not yet been reduced in any way. Around 20k students attend construction high schools and additional 13k are enrolled in civil engineering and architectural university programmes.

Modern technologies and education

The lack of qualified workers is behind the slow pace of innovation. Modern technologies such as 3D printing, virtual reality and other innovations are rapidly changing how the construction industry works. Workers must be able to use new tools and procedures. Education has a key role to play in how effectively workers can use technology and innovation to improve outcomes and reduce costs and therefore to achieve the desired increase in sector productivity. The lack of well-trained workers increases the risk of errors and low-quality work. Education can help workers be better prepared for challenging tasks and work more effectively as a team. One remedial measure is maximum support for continuing education for adults with the potential to fill gaps in the knowledge and skills of workers currently working in the industry.

Encouraging young people's interest

If education is to become an effective tool for the development of the construction industry, it is necessary to create relevant, high-quality, and flexible educational programs capable of responding to the changing needs of the industry and technological innovation. Securing the future of the construction industry also includes encouraging young people's interest in training in the industry. Information campaigns and educational activities could increase the attractiveness of construction as a career path.

Cooperation between construction companies and educational institutions

The key to successfully adapting education to the needs of the industry is to start cooperation between construction companies and educational institutions, which is still far below its potential. Practice and theory must be connected so that graduates are well prepared for work in the real world.

The importance of construction education is clear and the challenges are visible. Ensuring a sufficient number of qualified workers able to work with modern technologies and innovations is necessary to maintain the quality and competitiveness of this vital industry. Only with the help of functional education can the construction industry successfully face current and future challenges and thereby strengthen its position as an integral part of sustainable development.

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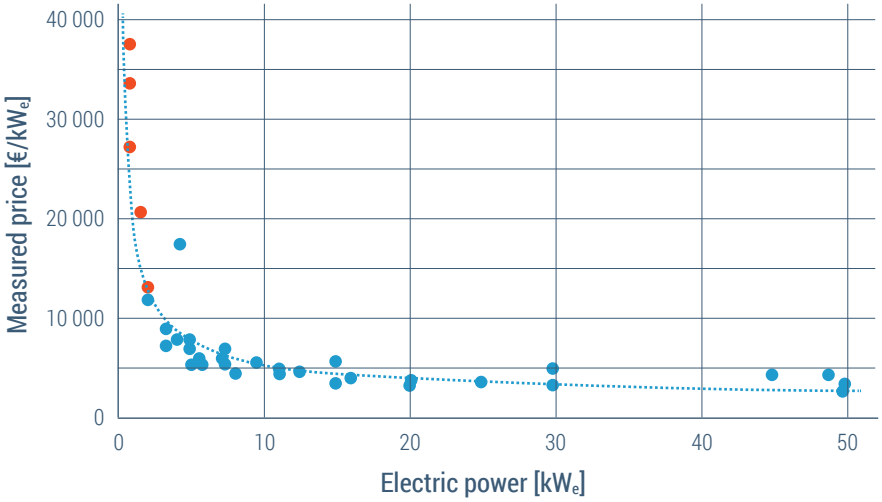
THE STATE OF THE CZECH CONSTRUCTION INDUSTRY

AT THE TURN OF 2023 AND 2024, THE FINDINGS OF THE ANALYSIS OF THE STATE OF THE CZECH CONSTRUCTION INDUSTRY WILL BE FOLLOWED BY A SO-CALLED ROADMAP, OR A SET OF MEASURES, INCLUDING FINDING SUPPORT FOR THEIR IMPLEMENTATION.

Can micro-cogeneration compete with heat pumps?

Micro-cogeneration (mKVET) can replace conventional gas boilers better than other technologies in specific conditions. mKVET can ensure year-round supply of heat and electricity for buildings ranging from single-family homes to larger buildings such as hotels, schools or office buildings. They can use biogas or biomass and partly also hydrogen. However, high investment costs are preventing further expansion. What are the possibilities of mKVET compared to heat pumps, photovoltaics and other energy sources?



DEPENDENCE OF MEASURED PRICE ON ELECTRIC POWER

- internal combustion engine (ICE)
- fuel cell (FC)

More than 150 commercial models of gas mKVET sources are currently available on the market. The majority of units (95%) work with the longest available internal combustion engine (ICE) technology, which is also produced in the Czech Republic (e.g. by TEDOM). The second technology that has been increasing its market share in recent years is the fuel cell (FC). It uses electrochemical reactions to produce electricity and heat. Units based on fuel cells usually have electrical outputs of up to 2 kWe. Most micro-cogeneration units use natural gas, LPG or biogas as fuel. The latest units are already technologically equipped enough to be able to use a mixture of fuels with up to 20% hydrogen content.

Another mKVET technology is biomass units with more than a dozen commercially available models. The most common type is the burning of solid wood biomass, where the heat is transformed using the so-called Rankine Cycle (ORC) or with the use of a Stirling engine. Biomass can also be used in liquid and gaseous state; there are even projects using gasified biomass in a gas combustion engine.

The number of mKVET installations in the Czech Republic is in the lower hundreds, especially with gas combustion engines. For example, in Japan, at least 400,000 fuel cell-based units have been installed thanks to the subsidy program that has already ended. In Europe, micro-cogeneration units are not produced in series, but only in pieces, and their investment costs thus remain high. FC units with low outputs (typically suitable for single-family homes) entail the highest investment costs measured. The difference in investment costs is illustrated by the graph on which the FC units are marked in red and the ICE units in blue.

mKVET technology brings a number of advantages. It can also operate based on biofuels, achieves high energy efficiency, ensures the supply of heat and electricity, and can operate all year round. However, the use of natural gas remains an obstacle to development, and without the introduction of serial production and drastic discounting of new units, the relative investment costs remain well above comparable technologies. Appropriately set public support for installation, operation, but also production of mKVET sources could increase demand and thus present an interesting small energy source alternative to classic boilers and also heat pumps.

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***Cogeneration**, or Combined heat and power production (CHP, in Czech KVET) **is a method of producing electricity**, where the heat released during the electricity production process is used in a useful way. This enables to achieve high efficiency of energy use in the fuel. Thanks to the efficient use of "waste heat" gained during the process of CHP, up to 70% of the energy contained in the fuel and up to 50% of emissions is saved, in comparison with separate electricity and heat generation. The thermal output of the units is typically twice the electrical output.*

Micro-cogeneration (mKVET)	=	*cogeneration units with electrical power up to 50 kW_e*
ICE	=	*Internal Combustion Engine*
FC	=	*Fuel Cell*
ORC	=	*Organic Rankine Cycle*

ESG will affect the construction industry twice

The onset of ESG (Environmental Social Governance) will bring fundamental changes in the behaviour first of large construction companies, and later also of medium and small ones. From 2024, large companies will introduce the so-called non-financial reporting towards financial institutions. In the environmental part, there is pressure to collect a significantly larger amount of data related in particular to the carbon footprint and energy intensity of production. To achieve the best possible rating, companies will have to focus on reducing their environmental impact in the next phase of the assessment.

In the construction industry, the ESG project set itself the goal of contributing to the aforementioned tasks and strengthening the value chain of the Czech construction industry in the area of implementing carbon footprint management and increasing energy efficiency with a focus on the transition to a low-carbon economy.

The first step is to determine the status and approach to ESG reporting in the construction industry in a questionnaire. Since June 2023, forms are open where construction companies, investors, designers and architects, manufacturers of building materials and construction products can participate in the creation of a national methodology for carbon management and increasing energy efficiency in the construction industry. So far, 60 mainly large and medium-sized companies have participated. Based on the initial data collection, the project will:

- Compare existing approaches to carbon management and increase energy efficiency in the EU and evaluation of their transferability to the Czech Republic.
- Create procedures for carbon management and increase energy efficiency for the construction sector in the Czech Republic, including the development of a quality manual.
- Organize educational events for construction value chain companies and other actors, especially from the public sphere (e.g. civil servants, city representatives), focusing on decarbonization and energy efficiency.
- Evaluate the pilot deployment of the carbon management methodology across the value supply chain in the construction industry in the Czech Republic.

Involvement in the project is still possible through the project questionnaire below:

www.2ask-survey.com/c/QFTPF1B6Q52HY/
www.svn.cz/esg

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NEWS at SEVEn

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