

Why and how to implement progressive energy performance requirements for residential buildings in the Czech Republic

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After an in-depth expert discussion, the Initiative CHANCE FOR BUILDINGS presents the following recommendations for the new energy performance standards for residential buildings in the Czech Republic. The recommendations for public sector, administrative and commercial buildings are likely to be similar; nevertheless, specific definitions, requirements and deadlines are still subject to further expert debate.

This document provides a basis for further discussion and is open to further clarification of individual requirements presented here.

Summary

			2013 „low-energy house“	2015 „passive house“	2020 „nearly-zero energy house“
NEW BUILD	I. criterion	Specific energy need for spatial heating	50 kWh/m ² a	15 kWh/m ² a (AB) 20 kWh/m ² a (FH)	(remains)
	II. criterion	Primary energy for heating, cooling, ventilation and hot water		60 kWh/m ² a	(remains)
	III. criterion	Share of renewables on total primary energy consumption			more than half of consumption covered by RES
RENOVATION	- partial (up to 60% envelope)	U-values	Today's "recommended U-values" become required	Today's "target U-values" become required	(remains)
	- complete (over 60% envelope)	Specific energy need for spatial heating	40 kWh/m ² a (CPH) 55 kWh/m ² a (AB) 70 kWh/m ² a (FH)	20 kWh/m ² a (CPH) 30 kWh/m ² a (AB) 40 kWh/m ² a (FH)	(remains)

Types of buildings: CPH = concrete panel house; FH = family house (includes CPH, if not specified separately); AB = apartment building

It should be noted that in all cases of setting energy performance requirements it is also necessary - as a prerequisite for success - to provide a **clear methodology of their calculation** and to ensure **adequate air exchange** and **thermal stability in summer** during the design and construction phases. Also a **minimum efficiency of applied technical systems** should be defined. These prerequisites are discussed in more in detail below.

In accordance with the Directive, exclusion of historical buildings, occasionally occupied buildings (cottages, chalets) and small buildings under 50 m² of floor area should be allowed.

Why was this document created?

The energy consumption per unit of GDP in the Czech Republic (CR) is 50% higher than the EU27 average¹ and still very dependent on fossil fuel resources. This means that the CR is 50% more vulnerable to risks such as major price changes or significant power outages, whether caused by political or natural circumstances. At the same time, the Czech Republic produces 36% more CO emissions than the EU27 average.²

Czech buildings use 65% of the final heat consumption and 49% of final electricity consumption.² The vast majority of buildings waste energy, although proven and cost-effective methods of reducing their energy consumption by up to 90% are available. Prefabricated concrete-panel houses are a typical example. The vast majority of them are today giant heat radiators, but at the same time there are great opportunities for highly energy-efficient renovations due to their compactness. Sadly, new construction is also often unnecessarily at much worse level than it could be in terms of energy efficiency.

Energy-efficient construction as well as renovation will pay for itself over time and will produce significant savings in energy costs. This should be a reason for the owners to invest in these measures. However, pure market solutions are impeded by certain barriers, such as incompatibility of interests of investors, owners and tenants (the agency problem), or externalities, which in effect results in social inefficiency.

Increasing energy efficiency in buildings is however also of public interest:

- Reduction of energy consumption means increased energy security of the country, which further means less dependence on energy imports from unstable regions
- Support for energy-efficient construction and renovations means support for mainly small and medium construction enterprises, which helps counter the economic crisis significantly:
 - Creation of jobs especially in small and medium companies with a high multiplication effect
 - Support of regional development evenly spread throughout the Czech Republic (as opposed to large infrastructure and energy projects, where the effect is centralized)
 - All the support will remain in the domestic economy, there is no leak across the borders (such as for car scrap scheme)
 - Support of small and medium enterprises is a tool for steady economic recovery
- Energy efficient construction has a strong and positive social impact. High payments for electricity affect primarily low income groups, because the elasticity of demand is very low. Reducing energy bills is thus significant particularly for low-income households.
- Reduction of energy consumption means lower emissions of energy production
 - Reduction of CO₂ emissions means more free emission allowances, which can be sold
 - Reduction of local pollution (SO_x, NO_x, dust, VOC) in the affected regions

The Initiative CHANCE FOR BUILDINGS endorses the relevant conclusions of the final report of the so-called Pačes Commission (governmental advisory body that operated in 2007 and 2008), which considered energy saving in buildings crucial: "In the Czech Republic the potential of energy saving in residential building sector and public administration is ... 46.3% of total achievable saving in the

1 Source: EEA 2007 (<http://www.eea.europa.eu/data-and-maps/figures/total-energy-intensity-1995-2007>)

2 Source: IEA 2008 (http://www.iea.org/stats/electricitydata.asp?COUNTRY_CODE=CZ)

country." (p. 213). "The key sectors on which to focus first are residential building and buildings in the tertiary sector, other important areas being industry and transportation." (p. 214)

We are aware of the fact that not only the state but especially industry must take this opportunity very seriously. If the Czech construction industry does not respond in time, it will be exposed to competition from Western Europe, where low energy or passive houses are already becoming the standard.³ On the contrary, if the Czech industry will reflect this challenge, it will become more competitive and it will be able to enter the markets of Eastern Europe, but also prospectively the NIS markets. We believe, therefore, that both the Czech construction industry and the state must pay adequate attention to the issue of energy-efficient buildings and must both contribute to its development.

This document is the first contribution of the Initiative CHANCE FOR BUILDINGS to this topic and opens the debate that we hope will ensue.

What we want to achieve: the target for 2020 (or 2018)

Having defined our goal as a move toward energy-efficient buildings, one of the main documents specifying objectives and deadlines is the newly recast Energy Performance of Buildings Directive (EPBD).⁴ This Directive can help us to specify target, which is all new buildings to be "nearly-zero energy buildings" by 2020, with buildings occupied and owned by public authorities preceding by 2018.

The definition of nearly-zero energy buildings in the Directive is fairly flexible. After several months of in-depth expert debate, the Initiative CHANCE FOR BUILDINGS presents the following proposal for the definition of nearly-zero energy buildings using three criteria which logically follow one another:

1. **Reduction of specific energy need for spatial heating to minimum.** This criterion ensures that the building envelope is well designed as well as built. Solar and internal gains are also considered. This criterion makes a prerequisite for saving heating energy independently of the installed technologies and usage of the building.
2. **Reduction of primary energy consumption** for heating, cooling, ventilation and hot water (not including electricity for artificial lighting and appliances, which cannot be affected by the design and construction of the building). This criterion already captures both building envelope and the technologies in it, and it aims to estimate energy consumption billing. Moreover, the criterion better represents the environmental impact of building operation through the expected fuel consumption and related emissions of carbon dioxide, and other pollutants.⁵
3. **Significant coverage of total primary energy consumption by renewable sources** (including electricity consumption for artificial lighting and appliances). The criterion pushes toward reducing building environmental impacts and toward decentralization of power supply.

The path to the goal: gradual introduction of requirements

New buildings

If the target is to design new buildings as nearly-zero energy buildings by 2020 (2018 for public sector),

3 IG Passivhaus Österreich, <http://igpassivhaus.cuisine.at/presse/files/43/pk%20-%20pressetext%20zu%20tage%20des%20ph%202010.pdf>

4 Energy Performance of Buildings Directive (EPBD) 2010/31/EU from 19th May 2010

5 Carbon dioxide emissions induced by building operation should be displayed on the Energy performance certificate as a main measure of the environmental impact. We recommend to add also the level of emissions of local pollutants.

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it means that already today we must prepare gradual steps that will lead us to this goal. Apparently, gradual strengthening of requirements is a superior alternative to doing nothing and then hoping for a sudden great leap forward in 2020. In addition, based on the Directive, building requirements should be cost-optimal, which they in fact should be simply by common sense.⁶ Many studies suggest that today the existing requirements are already economically suboptimal.⁷ Both low-energy and passive energy standards are often more cost-effective than just sticking to the existing requirements. In addition, passive energy standard also addresses other issues, particularly the adverse effects of poor indoor air quality on human health. Hence, continuation of the existing requirements means a continuing societal loss.

For these reasons, the Initiative CHANCE FOR BUILDINGS proposes the introduction of low energy standard as soon as possible (we propose 2013, provided that in 2011 the regulations are approved and the two-year transition period commences). Thereafter, passive energy standard should follow shortly, as both low energy and passive standards are possible and practical today. On the other hand, the last step leading to nearly zero energy building, the introduction of minimum requirements for renewable sources of energy will be a major change compared to today's practice. Adequate preparation will be necessary for this step. This comes back to introducing passive energy standard soon, because the subsequent step of covering significant portion of energy consumption by renewable energy sources will be easier from the smallest base possible.

Year	Step	Description
2013	Low-energy standard	Specific energy need for spatial heating does not exceed 50 kWh/(m ² ·a) ⁸
2015	Passive standard	Specific energy need for spatial heating does not exceed 20 kWh/(m ² ·a) for family houses, or 15 kWh/(m ² ·a) for apartment buildings while primary energy consumption for heating, cooling, ventilation and hot water does not exceed 60 kWh/(m ² ·a). ⁹
2020	Nearly zero energy building	Buildings in passive standard, where majority of the total projected energy consumption for heating, cooling, ventilation and hot water, artificial lighting and appliances is covered by renewable sources placed on the building or nearby.

Renovations

Setting progressive requirements for new buildings is an important step forward, but efficiency of the existing building stock is much more important. If some 1% of new buildings is constructed each year, that leaves us with 99% of the existing buildings, whose energy performance can be improved through renovation. The 1000 m² threshold for energy-efficient renovation was dropped from the Directive. It is

6 Cost optimum is based on the total costs (i.e. investment, maintenance and operation costs) of the building. Optimum is such combination of requirements that minimizes the total sum of these costs across the building's life cycle. For more details see for example „Cost Optimality“ by BPIE 2010 (<http://bpie.eu/brochures.html>)

7 EkoWATT (2010): VAV-SP-3g5-221-07 - Komplexní revitalizace panelových domů; Porsenna pro AVMI (2010): Jak zateplovat účinně a ekonomicky

8 Specific energy need for spatial heating includes the energy needed for spatial heating without considering the efficiency of the heating system and source. It is bound to the total indoor floor area of the building excluding uninhabited cellars and isolated unheated spaces (accordingly to TNI 730329 and TNI 730330)

9 Primary energy from non-renewable sources is derived from total energy consumption of a building multiplied by relevant energy transformation factors depending on power source (accordingly to TNI 730329 and TNI 730330)

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a great opportunity to significantly improve the entire existing housing stock, not only very large building blocks. It is necessary to stop the economically suboptimal renovations, which produce net social loss and negative “lock-in effect”.¹⁰ At the same time, it is important not to be overly restrictive and not to threaten the total volume of building renovations. After a thorough discussion, the Initiative CHANCE FOR BUILDINGS presents the following recommendations:

Scope of renovation: In accordance with the Directive we recommend using two levels for renovation: complete and partial one, with the threshold between them being 60% of the building envelope is renovated. This is in accordance with the Directive as exemplified by the table below. The Directive defines major renovation as such that over 25% of the envelope is affected¹¹, but offers two alternatives, which coincide with our proposal.

Renovation scope	Directive requirement	Our recommendation
0-25% of building envelope	requirements for renovated building elements	„partial renovation“ – requirements set for renovated elements, or first phase of complex renovation
25-60% of building envelope	„major renovation“: requirements for the building as a whole and/or renovated building elements	
60%-100% of building envelope		„complete renovation“ – requirements on the building as a whole

We propose following requirements for the two types of renovation:

- **Complete renovation** will in most cases be the final state of the building for the next 30-40 years. The target therefore should be the overall energy efficiency of the whole building, which is best captured by specific energy need for spatial heating.
- **Partial renovation** on the other hand usually should aim at further gradual stepwise renovation and is for the time being often limited by lower financial capacities of the building owners. We believe it is necessary to retain this option, but to make sure that partial renovation shall not compromise the end target of very low energy consumption. For this purpose the existing scheme of required U-values for individual building elements serves well.

10 Lock-in effect means a lost opportunity by “locking in” the potential savings by a suboptimal renovation. The full savings are prevented for a long time because the next renovation will typically take place after several decades.

11 We recommend not to use proportion of the investment costs on the value of the building for the purpose of defining major renovation. To our knowledge, this option in the Directive shall not be used by any Member State, because it is difficult to credibly calculate and costly to verify.

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For **complete renovation** we recommend introduction of following requirements on specific energy need for spatial heating.

Type of house	From 2013	From 2015
Family houses	70 kWh/(m ² a)	40 kWh/(m ² a)
Apartment buildings (not made of prefabricated concrete panels)	55 kWh/(m ² a)	30 kWh/(m ² a)
Apartment buildings made of prefabricated concrete panels	40 kWh/(m ² a)	20 kWh/(m ² a)

We realize that the requirements from 2015 on will in most of cases require installation of mechanical ventilation systems with heat recovery. However, such systems should be installed in new buildings and in complete renovations anyway to comply with existing requirements for indoor air quality. Heat recovery systems should have at least 75% efficiency.

When aiming at real energy and emission savings, complex renovations should also include efficient heating control system and also due consideration should be given to renovation or replacement of the heating technology and to using renewable energy sources.

As for **partial renovations**, we recommend using as of 2013 the existing “recommended U-values” on building elements as defined in the standard ČSN 730540-2 (amended April 2007, and as subsequently updated). As of 2015, we recommend switching to the “target U-values” according to the recently updated version of the standard (to be published in 1Q 2011) – these target U-values should be set at around 2/3 to 3/4 of the recommended U-values.

In cases in which these U-values will not be achievable (e.g. due to conflict of property rights) an alternative solution should be possible: the owner should present a concept design of complete renovation, of which the partial renovation shall be the first phase, with subsequent phases to follow later.

During partial renovation it should also be recommended to install an efficient heating control system and to consider renovation of the heating system including the heating source.

Critical date

The critical date for the energy performance requirements as outlined above should be the date of application for urban planning permit in case of new construction; and the date of application for construction permit in case of renovation. It is essential that the requirements are clearly communicated to the public and especially to the building sector, to avoid potential wasted investments in non-compliant projects.

Buildings financed by the public funds and/or buildings occupied by public institutions have to set the example. Public administration should therefore set earlier goals for implementation of the above mentioned requirements. Critical date in this case should be the announcement of the public procurement for the project design.

Key prerequisites for success

In order to really deliver energy savings in buildings and to increase the comfort of living it is vital that following requirements are met during the design and construction process. Some of them are in fact already mandatory today:

- **Introduction of a clear calculation methodology** for each criterion with clearly defined set of input data. Without it, it will not be possible to avoid “creative” improvement of the energy rating, which is possible and unfortunately fairly common today. Existing standards TNI 730329 for family houses and TNI 730330 for apartment buildings can be of help here.
- **Ensuring required air exchange** according to existing regulation 268/2009 Coll.¹² Air exchange in occupied rooms is critical factor affecting inhabitants. Lack of fresh air is currently the biggest problem especially in renovations of existing buildings and some public buildings such as schools in particular. Unfortunately, adequate air exchange and thus healthy environment is frequently neglected in today’s practice.
- **Thermal stability in the summer time** as defined in ČSN 730540-2. It is vital to take appropriate measures against overheating in summer (according to ČSN 730540-2, April 2007, Thermal protection of buildings: Chapter 8.2. Thermal stability of the room in summer).
- **Setting minimum efficiency for indoor technologies** that affect energy performance of the building (e.g. minimum efficiency of heat recovery system should be set at 75%).
- **Reduction of total energy consumption**, not only heating, cooling, ventilation and hot water related energy, that can be influenced by the design and building phase, but also electricity for artificial lighting and appliances which depend on behavior of inhabitants.
- **Proactive early communication** of the requirements to the building owners, construction sector, architects, engineers and other professionals. All activities should be also adequately supported via trainings and education.

Financing and government support

The Initiative CHANCE FOR BUILDINGS recommends that a reasonable approach is taken to financial support for energy savings and renewable energy in residential buildings. On one hand, energy savings are economically rational and are already being realized on market principles. On the other hand, as mentioned above, there are certain objective obstacles, such as the incompatible interests of landlords and tenants or relatively high initial investment costs. There is also a public interest in reduction of the energy consumption in the Czech Republic.

Energy-savings have until recently been supported mainly by the Green Investment Scheme and by EU Structural Funds (OP Environment, Axis 3.2). These programs led to significant increase of public interest in energy efficiency in buildings and despite their administrative problems they did lead to overall improvement in the capacity of the construction sector to design, build and retrofit low energy homes.

We suggest that these programs continue after 2012 in order to leverage the synergies they create in

12 Regulation 268/2009 Coll. about technical requirements on the buildings specifies minimum air exchange during occupancy at 25m³/h.person or at complete air exchange once in two hours. Another indicator of intensity and quality of ventilation is maximum permissible limit of the CO₂ concentration, which is set at 1000ppm. These conditions should be met while preserving high energy performance, for instance using mechanical ventilation system with heat recovery.

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social, economic as well as environmental area.

The Czech Republic has an opportunity to earn money by selling carbon credits to polluters. If carbon credits are not distributed among energy producers for free, but sold in auctions, that would bring some 40 bn CZK (above 1.5 bn euro) every year between 2013 and 2020.¹³

Initiative CHANCE FOR BUILDINGS proposes that at least 15 bn CZK of that revenue is set aside for continuation of the programs which promote energy efficiency in buildings. Additional funding may come from ERDF after 2013 and other sources.

At the same time, due attention should be given to smart policies, which could further improve effectiveness of the supporting schemes and which can mobilize private capital. This includes for instance PAYS scheme (Pay As You Save) in the UK (which enables third-party financing with charge attached to the property rather than the owner), tax deductions in Belgium or advantageous mortgages when good energy standard is met. Initiative CHANCE FOR BUILDINGS offers maximum assistance and cooperation in providing examples of best practice of existing schemes across EU. An economic analysis discussing these mechanisms by Mr. Miroslav Zamecnik (leading Czech economist) is to be published soon.

Any type of financial mechanism should be set in such way, that only such an energy standard which goes beyond current requirements is supported. Conversely, measures at the level of current requirements should not be supported. This will ensure that public funds will help preparing the investors and the building sector for the upcoming higher levels of energy standards.

About the Initiative CHANCE FOR BUILDINGS

The Initiative CHANCE FOR BUILDINGS is a joint initiative by the Czech Green Building Council and the Passive House Centre, which represent over 100 relevant companies in the construction sector and financial services.

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