ALAT ZA KLASIFIKACIJU ENERGETSKE UČINKOVITOSTI

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Što je EN 15232?

EN 15232: "Energy performance of buildings – Impact of Building Automation, Controls and Building Management„

HRN EN 15232: "Energijska svojstva zgrada – Utjecaj automatizacije zgrada, upravljanja i upravljanja zgradama"

Standard CEN (Comité Européen de Normalization, odnosno Europski odbor za standardizaciju), razvijen u okviru projekta standardizacije kojeg sponzorira EU kako bi se poboljšala energetska učinkovitost zgrada u državama članicama EU

HRVATSKA KOMORA INŽENJERA STROJARSTVA

Standard EN15232 određuje:

- strukturirani popis funkcija kontrole, automatizacije zgrada i funkcija tehničkog upravljanja zgradama koje utječu na energetsku učinkovitost zgrada

- metodu za definiranje minimalnih zahtjeva u vezi s funkcijama upravljanja, automatizacije zgrada i tehničkog upravljanja zgradama koje će se provoditi u zgradama različite složenosti,

- detaljne metode za procjenu utjecaja tih funkcija na energetsku učinkovitost određene zgrade. Ove metode omogućuju uvođenje utjecaja tih funkcija u izračune energetskih svojstava i pokazatelja izračunatih prema relevantnim standardima,

- pojednostavljenu metodu za prvu procjenu utjecaja tih funkcija na energetske karakteristike tipičnih zgrada

Ukupne klase učinkovitosti BACS-a

EN 15232 definira četiri različite klase učinkovitosti BACS-a za automatizaciju i upravljanje zgradama.
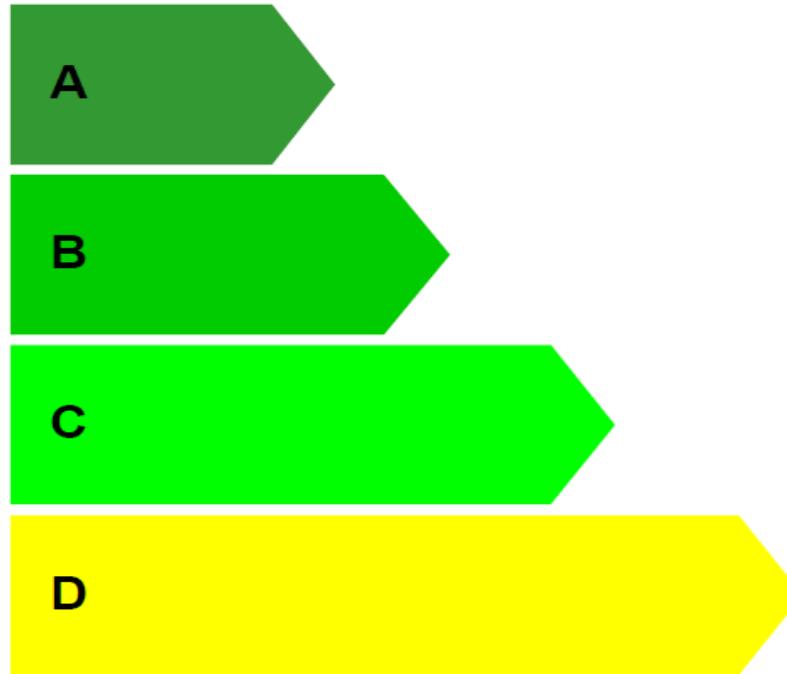
BACS - Building Automation and Control System (Sustav automatizacije i upravljanja zgradom)
TBM - *Technical Building Management* (Sustav tehničkog upravljanja zgradom)

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Klasa A odgovara visokoj energetskoj učinkovitosti BACS i TBM
- Umrežena automatizacija prostorija s automatskom kontrolom potražnje
- Planirano održavanje
- Nadgledanje energije
- Održiva energetska optimizacija

Klasa B odgovara naprednim BACS i nekim specifičnim TBM funkcijama
- Umrežena automatizacija prostorija bez automatske kontrole potražnje
- Nadgledanje energije

Klasa C odgovara standardnom BACS-u
- Umrežena automatizacija primarnih postrojenja
- Nema elektroničke automatizacije prostorija, termostatski ventili za radijatore
- Nema nadgledanja energije

Klasa D odgovara ne-energetski učinkovitom BACS-u
Zgrade s takvim sustavima bi trebale biti modernizirane. Nove zgrade ne bi trebale biti opremljene takvim sustavima.
- Bez umreženih funkcija automatizacije zgrada
- Nema elektroničke automatizacije prostorija
- Nema nadgledanja energije

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Ukupni BACS faktori učinkovitosti za toplinsku energiju
Nestambene zgrade

Non-residential building types	BACS efficiency factors thermal $f_{BAC,th}$			
	D	**C**	**B**	**A**
	Non energy efficient	**Standard (reference)**	Advanced energy efficiency	High energy performance
Offices	1.51	1	0.80	0.70
Lecture halls	1.24	1	0.75	0.5 [a]
Educational buildings (schools)	1.20	1	0.88	0.80
Hospitals	1.31	1	0.91	0.86
Hotels	1.31	1	0.85	0.68
Restaurants	1.23	1	0.77	0.68
Wholesale and retail buildings	1.56	1	0.73	0.6 [a]
Other types: • Sport facilities • Storage • Industrial facilities • etc.		1		
[a] The values are highly dependent on heating/cooling demand for ventilation				

Ukupni BACS faktori učinkovitosti za toplinsku energiju
Stambene zgrade

Residential building types	BACS efficiency factors thermal $f_{BAC,th}$			
	D	**C**	**B**	**A**
	Non energy efficient	**Standard (reference)**	Advanced energy efficiency	High energy performance
• Single family dwellings • Multi family houses • Apartment houses • Other residential or residential-like buildings	1.10	1	0.88	0.81

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Ukupni BACS faktori učinkovitosti za električnu energiju
Nestambene zgrade

Non-residential building types	BACS efficiency factors electrical $f_{BAC,el}$			
	D	C	B	A
	Non energy efficient	Standard (reference)	Advanced energy efficiency	High energy performance
Offices	1.10	1	0.93	0.87
Lecture halls	1.06	1	0.94	0.89
Educational buildings (schools)	1.07	1	0.93	0.86
Hospitals	1.05	1	0.98	0.96
Hotels	1.07	1	0.95	0.90
Restaurants	1.04	1	0.96	0.92
Wholesale and retail buildings	1.08	1	0.95	0.91
Other types: • Sport facilities • Storage • Industrial facilities • etc.		1		

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Ukupni BACS faktori učinkovitosti za električnu energiju
Stambene zgrade

Residential building types	BACS efficiency factors electrical $f_{BAC,el}$			
	D	C	B	A
	Non energy efficient	Standard (reference)	Advanced energy efficiency	High energy performance
• Single family dwellings • Multi family houses • Apartment houses • Other residential or residential-like buildings	1.08	1	0.93	0.92

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Primjer kalkulacije za neku poslovnu zgradu

Description	No.	Calcu-lation	Unit	Heating	Cooling	Ventila-tion	Lighting
Thermal energy							
Energy demand	1		$\frac{kWh}{m^2 \cdot a}$	100	80		
Plant losses Reference case	2		$\frac{kWh}{m^2 \cdot a}$	22	28		
Energy expense for Reference class C	3	Σ 1+2	$\frac{kWh}{m^2 \cdot a}$	122	108		
BACS factor thermal Reference class C	4			1	1		
BACS factor thermal Actual case (Class B)	5			0.80	0.80		
Energy expense Actual case class B	6	$3 \cdot \frac{5}{4}$	$\frac{kWh}{m^2 \cdot a}$	98	86		
The expense of thermal energy must be distributed among various energy carrier to complete the calculation.							
Electrical energy							
Auxiliary energy class C	7a		$\frac{kWh}{m^2 \cdot a}$	5	20	21	
Lighting energy	7b						34
BACS factor electrical Reference class C	8			1	1	1	1
BACS factor electrical Actual case (class B)	9			0.93	0.93	0.93	0.93
Auxiliary energy Actual case (class B)	10	$7 \cdot \frac{9}{8}$	$\frac{kWh}{m^2 \cdot a}$	4.6	18.6	19.5	31.6

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EPC alat procjenjuje BACS klasifikaciju energetske učinkovitosti vaše zgrade na temelju standarda EN 15232-1: 2017

Ključne funkcije alata su:

- Akvizicija trenutnog stanja postojećeg BACS-a i dodjeljivanje njegovih kontrolnih funkcija klasama energetske učinkovitosti A do D

- Određivanje novog stanja BACS-a nakon modernizacije i poboljšanja kontrolnih funkcija klasama energetske učinkovitosti A do D

- Određivanje godišnje potencijalne uštede energije i indikacija u odgovarajućoj valuti

- Pružanje informacija o vremenu povrata

- Brzo priređivanje prateće dokumentacije

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Potencijalne uštede su izvedene prema odjeljku 6 standarda EN 15232-1:2017 u…
- litrama
- kWh
- CO_2

Posebne funkcije:
· Alat se može koristiti *online* ili lokalno na računalu
· Svi standardni web-preglednici su podržani
· Rad s alatom i standardni tekstovi za EN 15232 mogu se odabrati na različitim jezicima

Procjena automatizacije i upravljanja zgradama:
· Pomoću ukupnih ili pojedinačnih faktora prema EN 15232-1:2017
· Korištenjem ponderiranja na temelju iskustava dobivenih procjenom vrijednosti eu.bac sustava

Ako nema podataka o potrošnji zgrade (financijski troškovi i potrošnja energije (kWh, litri, m3, itd.)), korisna osnova za akcije su i potencijali uštede energije u postocima
Potrebna poboljšanja mogu se opisati u obliku kataloga mjera

Poveznica na *online* alat https://hittest.sbt.siemens.com/EPC-Tool/

HRVATSKA KOMORA INŽENJERA STROJARSTVA

Kreiranje novog projekta

Unošenje "Informacija i projektu" i početna pohrana

HRVATSKA KOMORA INŽENJERA STROJARSTVA

Unošenje „Informacija o klijentu"

Uređivanje funkcija
Status "Danas" prije uređivanja

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Uređivanje funkcija
Padajući izbornik

HRVATSKA KOMORA INŽENJERA STROJARSTVA

Uređivanje funkcija
Definiranje klase učinkovitosti za određenu funkciju

Pregled rezultata
Rezultati „u skladu s EN15232-1:2017"

HRVATSKA KOMORA INŽENJERA STROJARSTVA
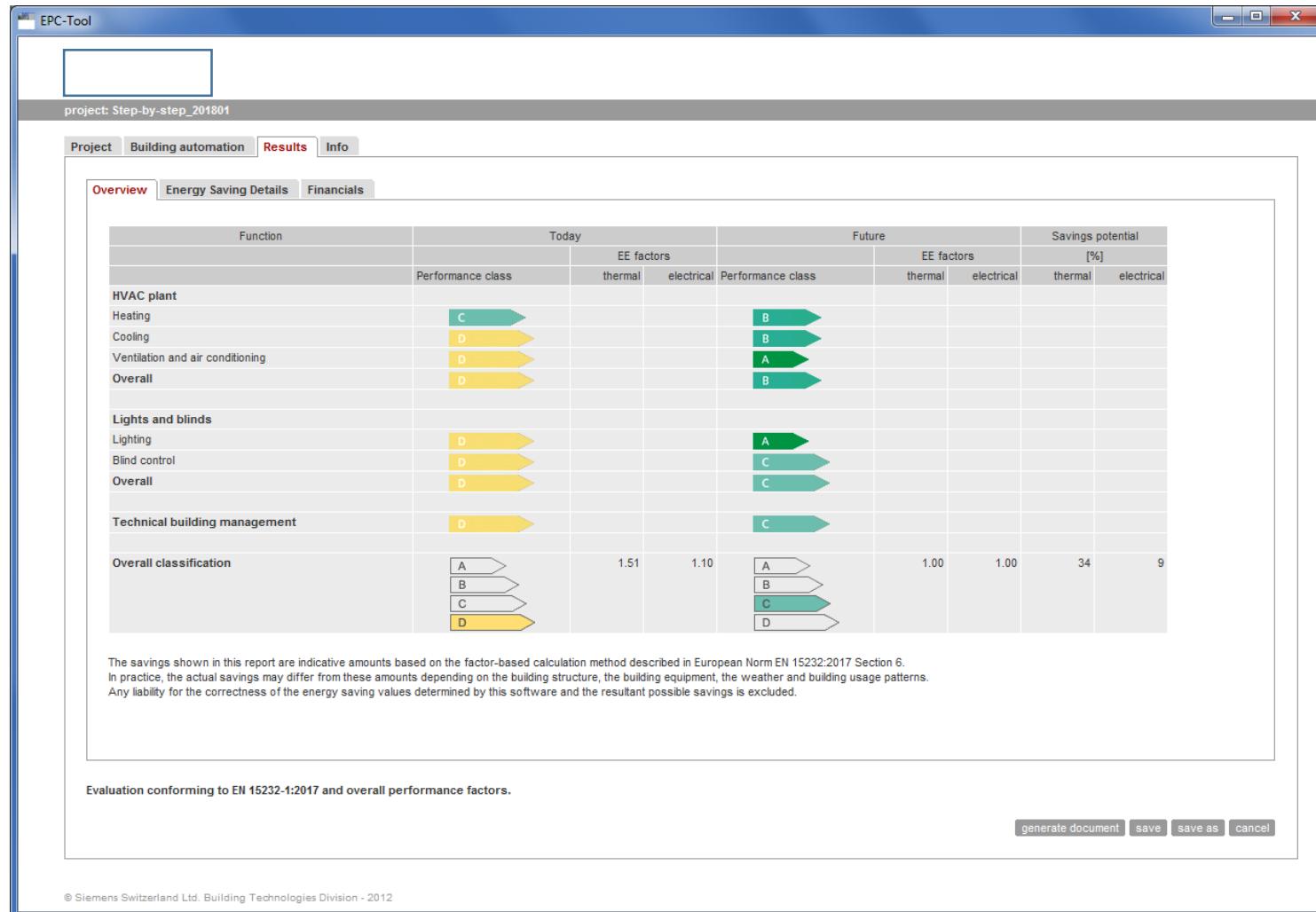
Detalji o uštedi energije
Odabir izvora energije / dodavanje potrošnje uklj. cijene i emisija CO_2

EPC-Tool

project: Step-by-step_201801

Project | Building automation | Results | Info

Overview | Energy Saving Details | Financials

Energy consumption and savings

Function	Energy source	Consumption/Year		Cost [EUR]	Savings/Year		Cost savings [EUR]	Savings [%]
Thermal energy for heating	Oil	45,000	Liter	38,250	17,378	Liter	14,771	39
Thermal energy for cooling	Electricity	37,000	kWh	4,440	14,289	kWh	1,715	39
Electrical energy for light and auxiliary	Electricity	32,000	kWh	3,840	4,334	kWh	520	14
Overall				46,530			17,006	37

CO_2-emissions and -savings

Energy source	CO_2-Emmission [kg]	CO_2-Saving [kg]	Saving [%]
Oil	118,800	45,878	39
Electricity	52,440	14,153	27
Overall	171,240	60,031	35

Energy source

Energy source	Price per unit		CO_2-Emission per unit	
Oil	0.85	EUR / Liter	2.640	kg / Liter
Electricity	0.12	EUR / kWh	0.760	kg / kWh

Energy Costs (Savings)

50000
40000
30000
38250

CO2 Emissions (savings)

200000
150000
118800

Evaluation by weighting factors method and overall performance factors.

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Financije
Dodatni financijski izračuni

EPC-Tool

project: Step-by-step_201801

Project | Building automation | **Results** | Info

Overview | Energy Saving Details | **Financials**

	Calculation 1	Calculation 2	Calculation 3	Calculation 4
Financial calculation variant	Basic variant	no subsidies	higher energy prices	minimal variant
Cost savings [EUR]	17,006	17,006	17,006	17,006
manual adjustment factor	1.00	1.00	1.00	0.90
Total energy cost difference [EUR]	17,006	17,006	17,006	15,305
Investment for EE-functionality [EUR]	75,000	75,000	75,000	7,500
Corporate tax rate (once initially) [%]	25.0	25.0	25.0	25.0
Subsidies (once initially) [%]	5.0	0.0	5.0	50.0
Investment incl. tax red., subsidies [EUR]	52,500	56,250	52,500	1,875
Payback time for investment [years]	3.1	3.3	3.1	0.1
Cash value / Net present value (over 10 years)				
Interest rate / Discount rate [% per year]	4.0	4.0	4.0	4.0
Change of energy prices [% per year]	2.0	2.0	5.0	2.0
Addl. costs (+), savings (-) [EUR per year]	5,000	5,000	5,000	5,000
2018	-52,500	-56,250	-52,500	-1,875
2019	-40,494	-44,244	-40,494	8,430
2020	-28,815	-32,565	-28,324	18,441
2021	-17,457	-21,207	-15,990	28,164
2022	-6,413	-10,163	-3,489	37,603
2023	4,322	572	9,181	46,765
2024	14,754	11,004	22,020	55,654
2025	24,890	21,140	35,031	64,276

Evaluation by weighting factors method and overall performance factors.

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Dokumenti
Funkcije

Dokumenti
Usporedba „Danas" i „Budućnost", rezultati

Office building "Step-by-step"
ECO Ltd.
6300 Zug, Switzerland
01.02.2018

3 Comparison of functions between today and future

3.1 Heating control

	Today		Future	
1. Emission control	Individual room control	C	Individual room control with communication and occupancy detection	A
2. Emission control for TABS (heating mode)	-- not applicable --		-- not applicable --	
3. Control of distribution network hot water temperature (supply or return)	Outside temperature compensated control	C	Demand based control	A
4. Control of distribution pumps in networks	On off control	C	Variable speed pump control	A
5. Intermittent control of emission and/or distribution	Automatic control with fixed time program	C	Automatic control with optimum start/stop	B

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ECO Ltd.
6300 Zug, Switzerland
01.02.2018

4 Results - Overview

Evaluation by weighting factors method and overall performance factors.
The savings shown in this report are indicative amounts based on the factor-based calculation method described in European Norm EN 15232:2017 Section 6.
In practice, the actual savings may differ from these amounts depending on the building structure, the building equipment, the weather and building usage patterns.
Any liability for the correctness of the energy saving values determined by this software and the resultant possible savings is excluded.

Function	Today			Future			Savings potential	
		EE factors			EE factors		[%]	
	Performance class	thermal	electrical	Performance class	thermal	electrical	thermal	electrical
HVAC plant								
Heating	C			B-A				
Cooling	D-C			B-A				
Ventilation and air conditioning	D-C			A				
Overall	D-C			B-A				
Lights and blinds								
Lighting	D-C			A				
Blind control	D			C				
Overall	D-C			B				
Technical building management	D-C			C-B				
Overall classification		1.23	1.05		0.76	0.90	39	14

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ECO Ltd.
6300 Zug, Switzerland
01.02.2018

5 Energy Saving Details

Evaluation by weighting factors method and overall performance factors.
The savings shown in this report are indicative amounts based on the factor-based calculation method described in European Norm EN 15232:2017 Section 6.
In practice, the actual savings may differ from these amounts depending on the building structure, the building equipment, the weather and building usage patterns.
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5.1 Energy consumption and savings

| Function	Energy source	Consumption/Year		Cost [EUR]	Savings/Year		Cost savings [EUR]	Savings [%]
Thermal energy for heating	Oil	45,000	Liter	38,250	17,378	Liter	14,771	39
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Electrical energy for light and auxiliary	Electricity	32,000	kWh	3,840	4,334	kWh	520	14
Overall				46,530			17,006	37

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Dokumenti
Financije, popis akcijskih stavki

Office building "Step-by-step"
ECO Ltd.
6300 Zug, Switzerland
01.02.2018

6 Financials

Evaluation by weighting factors method and overall performance factors.
The savings shown in this report are indicative amounts based on the factor-based calculation method described in European Norm EN 15232:2017 Section 6.
In practice, the actual savings may differ from these amounts depending on the building structure, the building equipment, the weather and building usage patterns.
Any liability for the correctness of the energy saving values determined by this software and the resultant possible savings is excluded.

	Calculation 1	Calculation 2	Calculation 3
Financial calculation variant	Basic variant	no subsidies	higher energy prices
Cost savings [EUR]	17,006	17,006	17,006
manual adjustment factor	1.00	1.00	1.00
Total energy cost difference [EUR]	17,006	17,006	17,006
Investment for EE-functionality [EUR]	75,000	75,000	75,000
Corporate tax rate (once initially) [%]	25.0	25.0	25.0
Subsidies (once initially) [%]	5.0	0.0	5.0
Investment incl. tax red., subsidies [EUR]	52,500	56,250	52,500
Payback time for investment [years]	3.1	3.3	3.1

Office building "Step-by-step"
ECO Ltd.
6300 Zug, Switzerland
01.02.2018

Accumulated discounted cash flow (over 10 years)

88'591
75'110
49'823
53'573

— Basic variant
— no subsidies
— higher energy prices
— minimal variant

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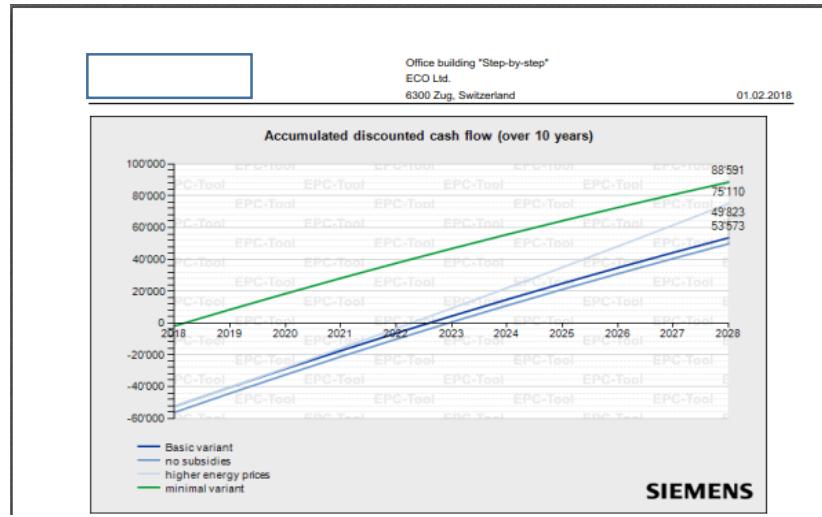
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01.02.2018

7 List of action items

7.1 Heating control

7.1.1 Emission control

Individual room control with communication and occupancy detection ☐

7.1.2 Emission control for TABS (heating mode)

-- not applicable -- þ

7.1.3 Control of distribution network hot water temperature (supply or return)

Demand based control ☐

7.1.4 Control of distribution pumps in networks

Variable speed pump control ☐

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7.3.2 Emission control for TABS (cooling mode)

-- not applicable -- þ

7.3.3 Control of distribution network cold water temperature (supply or return)

Demand based control ☐

7.3.4 Control of distribution pumps in hydraulic networks

Variable speed pump control ☐

7.3.5 Intermittent control of emission and/or distribution

Automatic control with optimum start/stop ☐

7.3.6 Interlock between heating and cooling control of emission and/or distribution

Partial interlock (dependent of the HVAC system) ☐

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HVALA NA POZORNOSTI !

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Odabir opcija
„Vrsta zgrade"
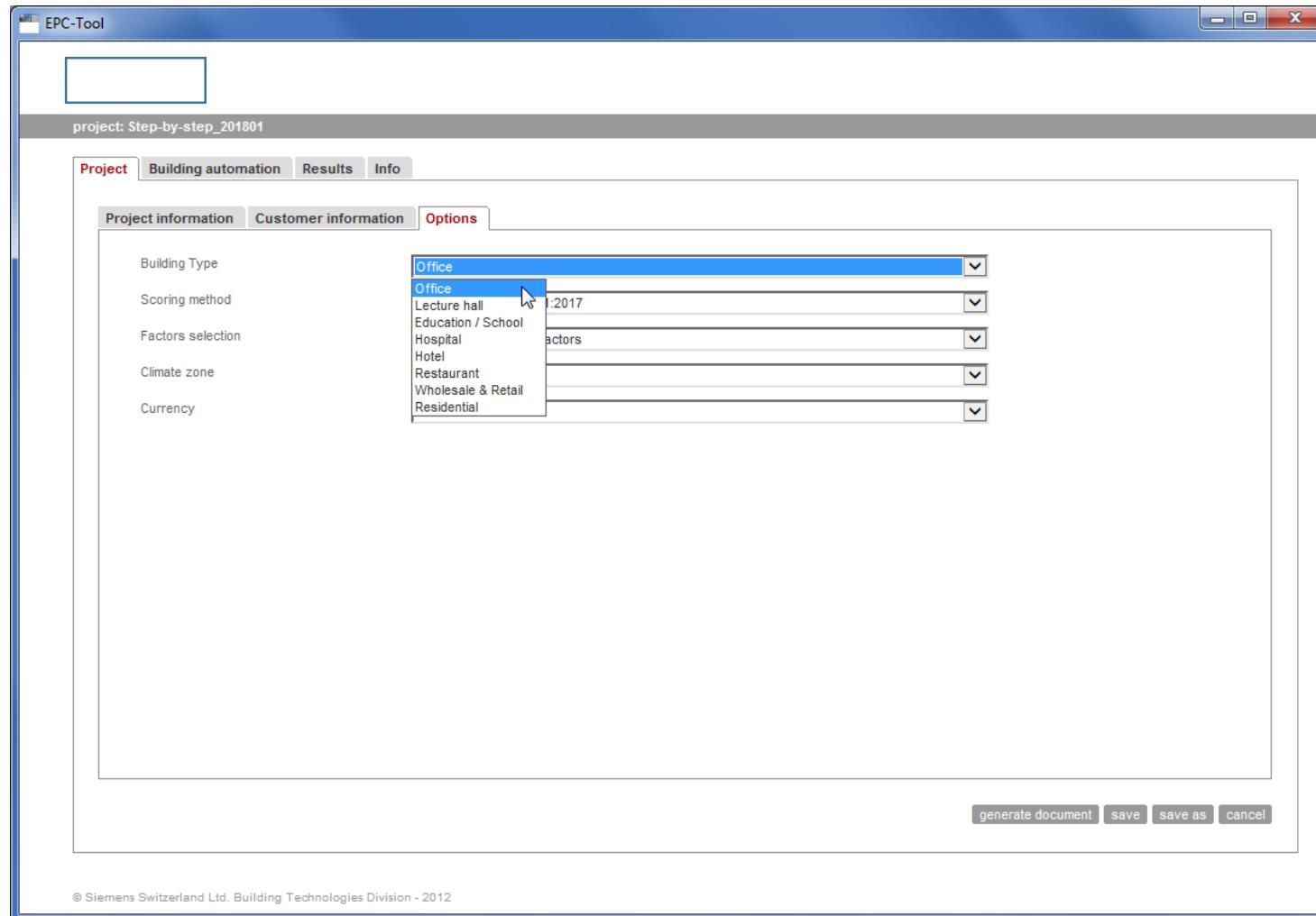
Odabir opcija
„Metoda bodovanja"

EPC-Tool

project: Step-by-step_201801

Project | Building automation | Results | Info

Project information | Customer information | **Options**

Building Type — Office

Scoring method — conform to EN 15232-1:2017
Weighting factors
conform to EN 15232-1:2017

Factors selection

Climate zone — Moderate

Currency

"Weighting factors" :
Weighting factors according to building type and impact on energy savings are added to the functions (see eu.bac System certification). The evaluation of the functions now appears in a bandwidth (for example C-B).
This impacts the calculation of the saving potentials.

"conform to EN 15232-1:2017" :
The functions are evaluated according to their lowest evaluated sub-function

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Uređivanje funkcija
Prozor s informacijama

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Uređivanje funkcija
Status "Danas" nakon uređivanja

HRVATSKA KOMORA INŽENJERA STROJARSTVA

Promjena u status "Budućnost"
Kopriranje iz statusa "Danas"

HRVATSKA KOMORA INŽENJERA STROJARSTVA