

# **Comprehensive energy refurbishment of an existing building in nZEB standard**

3<sup>rd</sup> meeting of the “ODYSEE – MURE” project, 15<sup>th</sup> – 16<sup>th</sup> November 2021  
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**1975.**

## ZG Moderna

**Energy class F**

Beginning of thermal insulation  
Glazing without shading  
DHC, window type DX AC



**2023.**

## nZEB + smart

**Energy class A / A+**

Building envelope class A  
Geothermal heat pump  
BIPV and batteries  
E-mobility  
Fully digitalized  
Mechanical resistance and stability

**2050.**

## Smart city

ZG?



01

02

03

04

05



**2001.**

## 1. Energy refurbishment

**Energy class C / F**

Add. TI, DHC, heat pump with ice bank, BMS, Mechanical resistance and stability



## nZEN + smart

Zero emission neighbourhood?

**2030.**



EIHP 2020 Energy and water	Unit	Reference values			
		Annual consumption	Annual energy consumption	Annual costs without VAT	Annual CO <sub>2</sub> emission
		[unit/year]	[kWh/year]	[EUR/year]	[t/year]
Electricity	kWh	186,539	186,539	20,693.33	43.837
Heat energy	kWh	134,000	134,000	10,112.58	46.364
Water	m <sup>3</sup>	1,051	-	3,683.84	0.236
<b>Total</b>			320,539	34,489.75	90.437

EIHP 2024 Energy and water	Unit	Reference values			
		Annual consumption	Annual energy consumption	Annual costs without VAT	Annual CO <sub>2</sub> emission
		[unit/year]	[kWh/year]	[EUR/year]	[t/year]
Electricity	kWh	93,785	93,785	3,651.89	7.721
Heat energy	kWh	60,786	60,786	-	-
Water	m <sup>3</sup>	21,051	-	6,350.51	0.472
<b>Total</b>			32,999	10,002.40	8.193

# Energy simulations

## Existing building

Data on building systems, use,  
energy consumption, weather  
data

## Definition of energy efficiency measures

Building envelope  
HVAC system  
Lighting system

## Dynamic simulations



## Multicriteria analysis

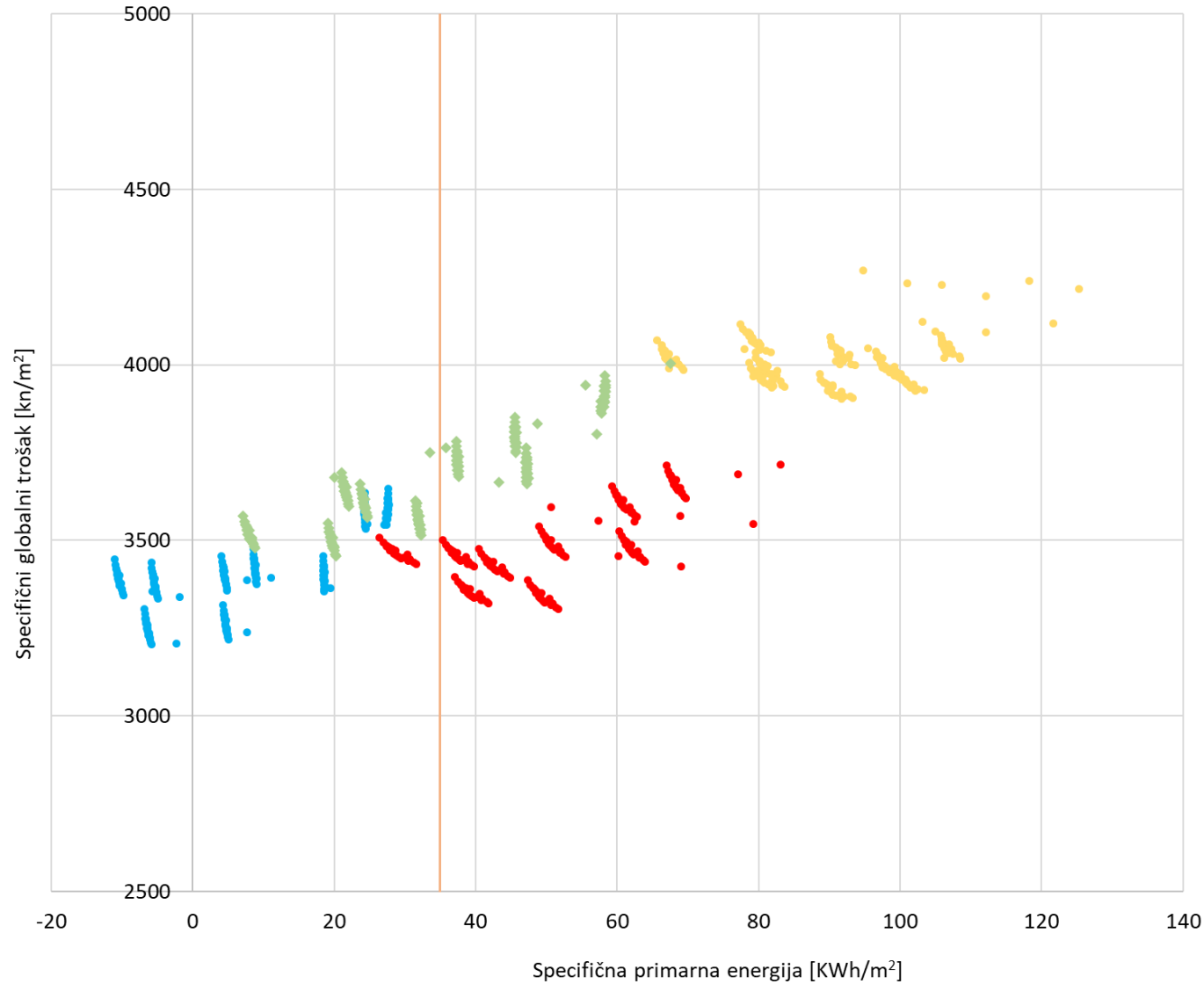
Primary energy  
Cost-optimal  
CO<sub>2</sub> mitigation  
Energy and water costs

Optimal nZEB  
combination

# Energy simulations

720 combination of different technical systems

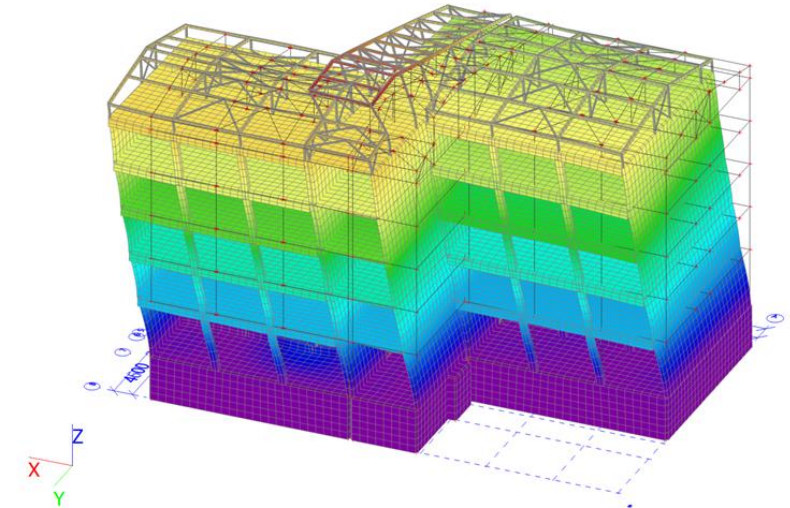
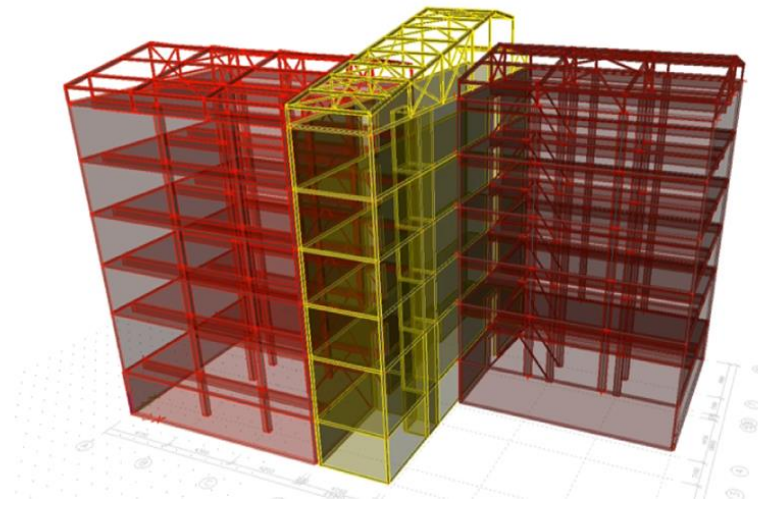
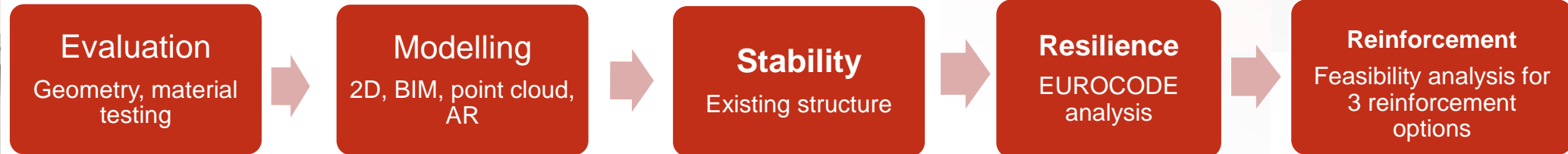
Building envelope		type	Mineral wool $\lambda=0,036$ (W/m <sup>2</sup> K)				
	External wall	thickness (cm)	10	14	15	20	
	Flat roof	thickness (cm)	10	14	16	20	25
	Windows	U (W/m <sup>2</sup> K)	1,4	0,8	0,66		
HVAC	Heating	System	District heating	Micro CHP	HP air/water	HP water/water	
		Energy source	District heat	Natural gas	Electricity		
	Cooling	System	Chiller	HP air/water	HP water/water		
		Energy source	Electricity				
Lighting	Lighting		Fluorescent lighting	LED light	LED lamps, occupancy , daylighting		
Building integrated PV							



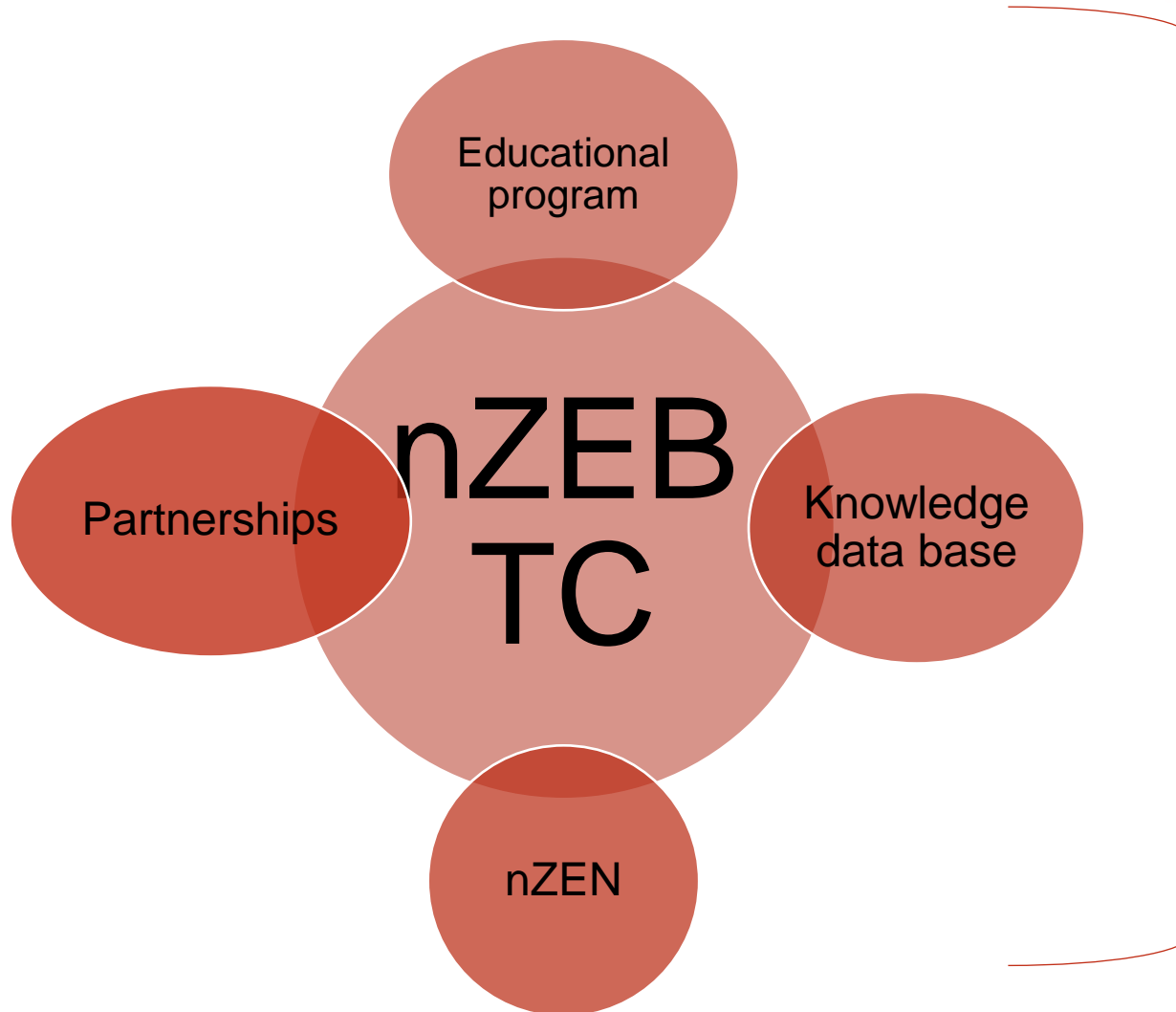
- Granica primarne energija Primary energy value
- Mikro CHP Micro CHP
- DT - voda/voda Water/water heat pump
- DT - zrak/voda Air/water heat pump
- Daljinsko grijanje District heating

Opis	Unit	
Heating/cooling energy source	-	Water/water heat pump
Thermal insulation of the external wall	cm	16
Thermal insulation of the flat roof	cm	20
U value for windows	W/(m <sup>2</sup> K)	1.40
Lighting	-	LED lamps, occupancy, daylighting
Annual heat energy demand, $Q_{H,nd}$	kWh/m <sup>2</sup>	21.98
Heating system capacity	kW	119
Cooling system capacity	kW	112
Annual electricity on-site production	kWh	60,786
Annual electricity consumption for HVAC and lighting	kWh	53,514
Operational cost	kn	0
Annual CO <sub>2</sub>	kgCO <sub>2</sub> /year	12,566
Specific global cost	EUR/m <sup>2</sup>	426.66
Total global cost	EUR	972,996

# Seismic analysis







- Concept and strategies for zero emission buildings
- How to achieve nZEB – experience in implementation of the nZEB retrofit
- Advanced materials technologies – the use of ecological and recycled materials
- Energy supply systems and services in nZEB
- Structural assessment and prediction of seismic safety and vulnerability of structures
- Collaborative BIM to achieve nZEB
- Dynamic energy modelling of buildings

# Thank you for your attention!

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## POZIV



za sudjelovanje u pilot projektu povećanja energetske efikasnosti zgrade na lokaciji u Zagrebu, Savska cesta 163.

Pozivamo proizvođače materijala, opreme, montažere i izvođače obrtničkih radova da se uključe u realizaciju pilot projekta povećanja energetske efikasnosti u zgradi na lokaciji u Zagrebu, Savska cesta 163, u okviru svojih mogućnosti i poslovnog interesa. Pilot projekt obuhvaća:

izradu kosog krova s limenim pokrovom

toplinsku izolaciju zgrade

izradu aluminijske fasade

postavljanje aluminijskih profila prozora

ugradnju termo-izolativnih stakala u alu profile

rekonstrukciju sustava grijanja i dogradnju hlađenja

rekonstrukciju rasvjete

mjerenje, regulaciju i nadzor energetskog sustava

Sudionici u realizaciji pilot projekta sanacije zgrade u Zagrebu, Savska cesta 163 mogu koristiti svoje sudjelovanje za promociju tvrtke. Energetski institut "Hrvoje Požar" preuzima obvezu da će putem svojih publikacija i ostalih materijala tijekom iduće godine promovirati tvrtke koje su sudjelovale u realizaciji projekta. Također, sudionici u realizaciji mogu koristiti prostore Instituta za svoje promocijske i obrazovne potrebe.

Vaše prijedloge i mogućnosti sudjelovanja u projektu, kao i vaše reference, možete dostaviti u pisanom obliku u roku od 10 dana od objave ovog poziva, na adresu:

U okviru rekonstrukcije zgrade uredit će se prostori koji će se koristiti za dopunsko obrazovanje i promociju energetskih programa i tvrtki koje pružaju svoje usluge u energetskom sektoru, a koje će sudionici u pilot projektu moći koristiti za svoje potrebe:

predavaonica za održavanje seminara, radionica i predavanja

izložbeno-promocijski prostor za promociju programa, proizvoda iz područja energetike, energetske efikasnosti i obnovljivih izvora

knjižnica sa čitaonicom

Rekonstrukcija zgrade obuhvatit će i revitalizaciju ostalih prostora i funkcija:

revitalizaciju lifta

instalaciju nove telefonske centrale

instalaciju računarske mreže

revitalizaciju sanitarnih prostora

ugradnju ormara u kancelarije

bojenje zidova i stolarije, te lakiranje parketa