Comprehensive energy refurbishment of an existing building in nZEB standard

3rd meeting of the “ODYSEE – MURE” project, 15th – 16th November 2021

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nZEB(N) VISION

Energetski institut Hrvoje Požar

Iceland Liechtenstein Norway grants

1975.

ZG Moderna

Energy class F
Begining of thermal insulation
Glazing without shading
DHC, window type DX AC

2001.

1. Energy refurbishment

Energy class C / F
Add. TI, DHC, heat pump with ice bank, BMS, Mechanical resistance and stability

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

2030.

nZEN + smart

Zero emission neighbourhood?

2050.

Smart city

ZG?

01 02 03 04 05

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EIHP 2020 Energy and water	Unit	Reference values			
		Annual consumption	Annual energy consumption	Annual costs without VAT	Annual CO_2 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^3	1,051	-	3,683.84	0.236
Total			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_2 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^3	21,051	-	6,350.51	0.472
Total			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

python

Multicriteria analysis

Primary energy

Cost-optimal

CO_2 mitigation

Energy and water costs

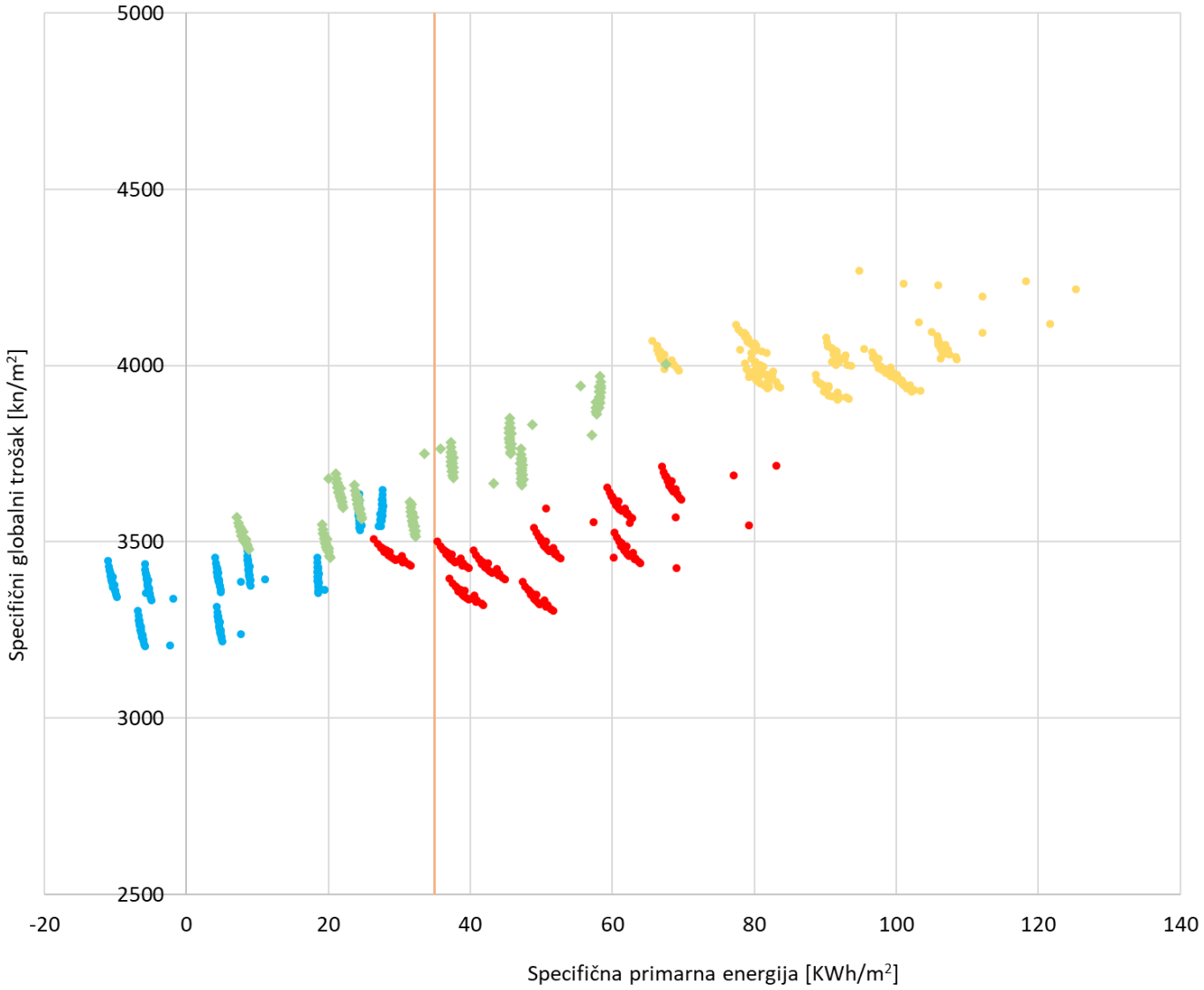
Optimal nZEB combination

Energy simulations

720 combination of different technical systems

Building envelope		type	Mineral wool λ=0,036 (W/m^{2}K)				
	External wall	thickness (cm)	10	14	15	20	
	Flat roof	thickness (cm)	10	14	16	20	25
	Windows	U (W/m^{2}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							

Cost – optimal analysis



Multicriteria analysis

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	$W/(m^2K)$	1.40
Lighting	-	LED lamps, occupancy, daylighting
Annual heat energy demand, $Q_{H,nd}$	kWh/m^2	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_2	$kgCO_2/year$	12,566
Specific global cost	EUR/m^2	426.66
Total global cost	EUR	972,996

Seismic analysis

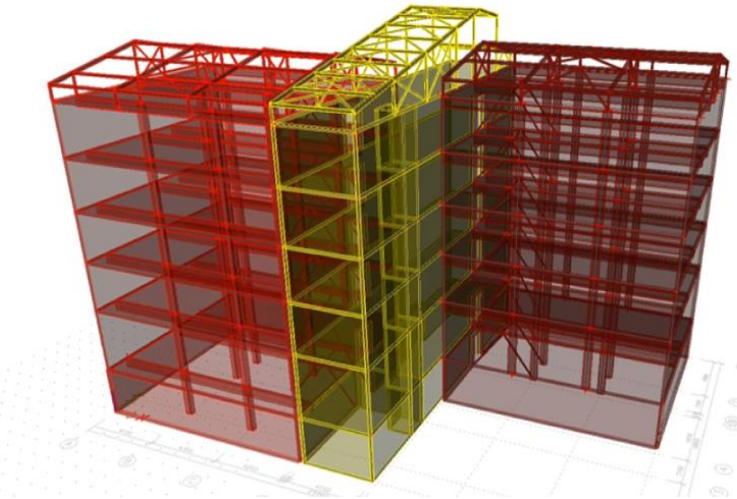
Evaluation
Geometry, material testing

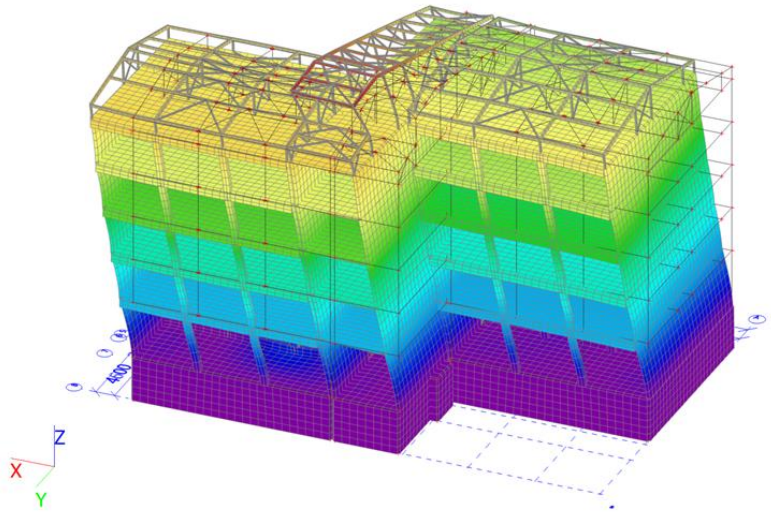
Modelling
2D, BIM, point cloud, AR

Stability
Existing structure

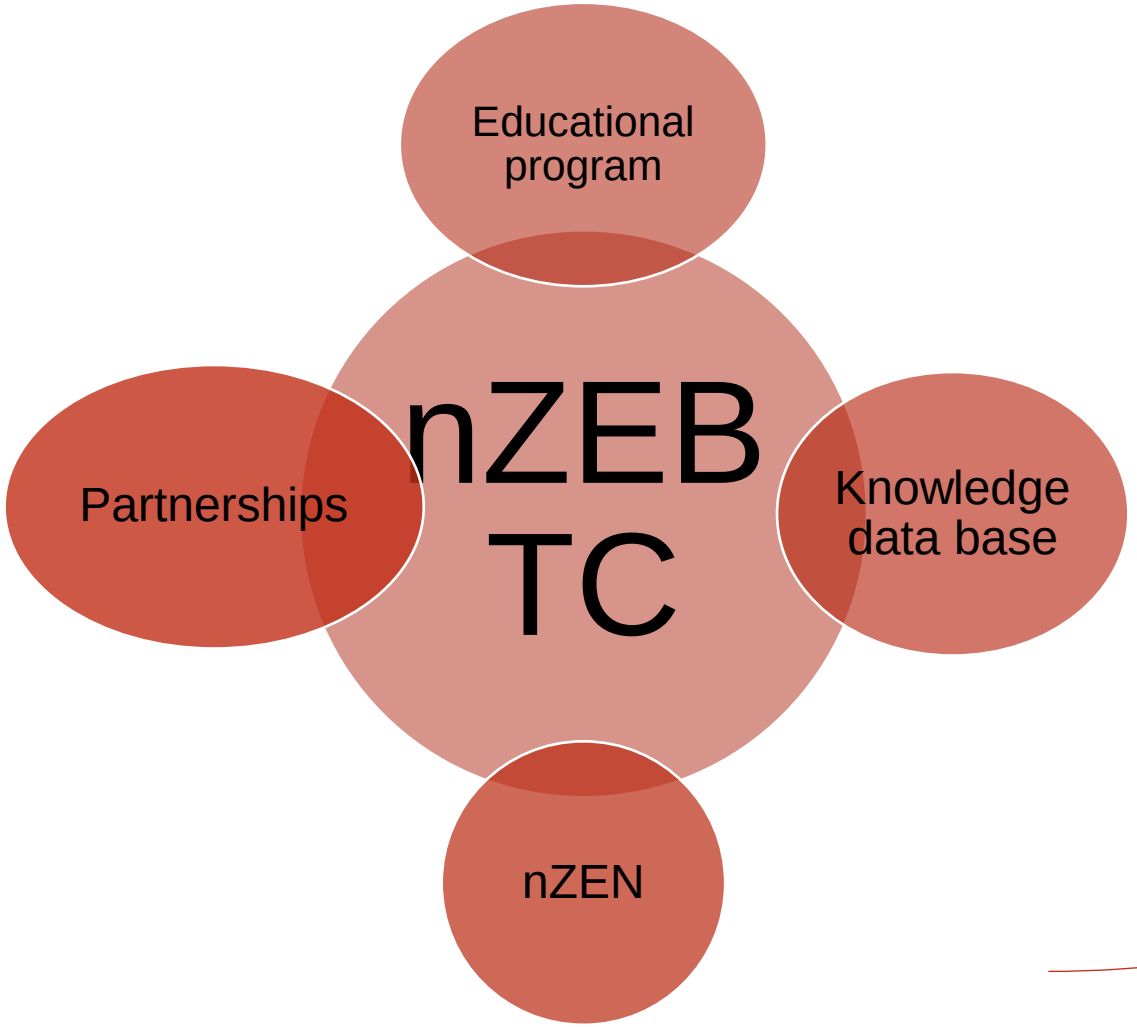
Resilience
EUROCODE analysis

Reinforcement
Feasibility analysis for 3 reinforcement options





nZEB training centre



- 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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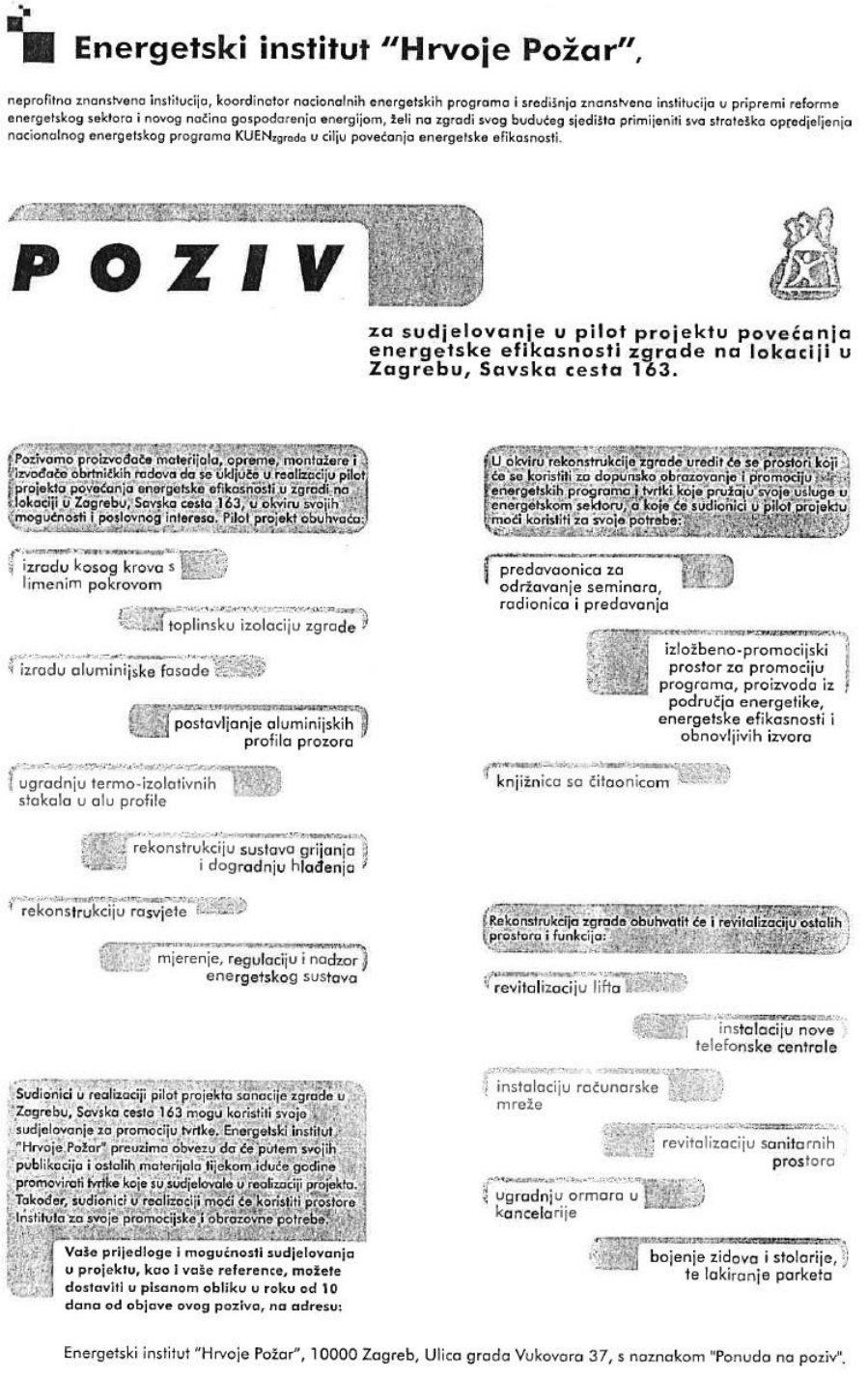

Energetski institut "Hrvoje Požar",

neprofitna znanstvena institucija, koordinator nacionalnih energetskih programa i središnja znanstvena institucija u pripremi reforme energetskog sektora i novog načina gospodarenja energijom, želi na zgradi svog budućeg sjedišta primijeniti sva strateška opredjeljenja nacionalnog energetskog programa $KUEN_{zgrada}$ u cilju povećanja energetske efikasnosti.

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

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

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 moći će 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:

Energetski institut "Hrvoje Požar", 10000 Zagreb, Ulica grada Vukovara 37, s naznakom "Ponuda na poziv".