

# Retrofit HUB: Training Summary

## GBC training: Energy renovation of multifamily buildings – Obstacles, solutions and opportunities

### Introduction

The Retrofit HUB project is being implemented to educate a wide range of stakeholders on all important aspects of the energy renovation of multifamily buildings. Therefore, the project aims to bring together co-owners of multifamily buildings, condominium representatives, facility managers, experts, engineers, energy renovation service providers, representatives of co-financing institutions and relevant ministries.

The course of the project includes the implementation of necessary activities for collecting and summarizing important information about obstacles, solutions and procedures for the implementation of energy renovation:

**Interviews with stakeholders** – research on the renovation process, existing practices, challenges and opportunities for improvement through interviews with stakeholders involving engineers, and representatives of the Ministry of Physical Planning, Construction and State Assets. Furthermore, a representative from the Environmental Protection and Energy Efficiency Fund participated; then managers, representatives of cities and condominium representatives.

**Overview of current practices** – the conclusions of the interviews are summarized in a document that provides a broad overview of the current approach and the challenges of energy renovation.

Conducting meetings of National Focus Groups (**NFG I, NFG II, NFG III**) – okupljanje dionika s ciljem definiranja potrebe za edukacijom o energetskej obnovi višestambenih zgrada. The conclusions included learning about the information needed to raise stakeholders' awareness of renovation, how the process works, and how to properly use renovated buildings. The structure of the Guidebook for energy renovation of multifamily buildings was also discussed at the meetings.

**Implementation of training on energy renovation of multifamily buildings** – free training for all stakeholders in the renovation process with the aim of educating the public and experts on the regulatory framework of renovation, technical solutions and the financial aspect of building

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renovation.

**Conducting case study workshops on specific buildings** – gathering of condominium representatives of certain buildings to produce optimal measures for energy renovation of buildings. The workshops were held in July 2023 and brought together representatives of 6 buildings from the City of Zagreb, experts (engineers of various technical professions) and representatives of the Environmental Protection and Energy Efficiency Fund.

## Training implementation methodology

GBC training on the topic of Energy renovation of multifamily buildings was held in January and February 2023 (January 25, February 1, February 8), i.e. in a cycle of three consecutive weeks. Through each day, the training aimed to cover three main aspects of energy renovation of multifamily buildings: regulatory framework, technical solutions and renovation financing. Considering the comprehensiveness of the approach, the training gathered as many as 24 lecturers:

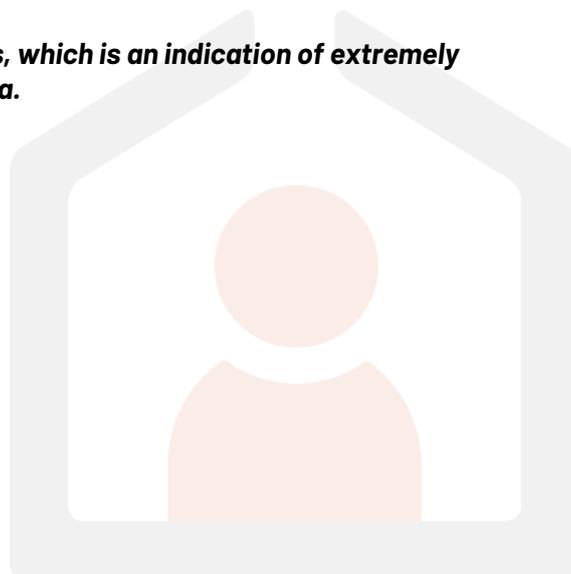
**25.1. (renovation regulatory framework):** representatives of ministries, the Environmental Protection and Energy Efficiency Fund, building managers, and condominium representatives.

**1.2. (technical solutions):** architects, civil engineers, mechanical engineers, and representatives of heat energy suppliers.

**8.2. (renovation financing):** representatives of ministries, representatives of banks, engineers, representatives of thermal energy suppliers.

Due to the comprehensive nature of the training topic, a short **Q&A** was planned after each lecture, during which the participants asked more than 100 questions.

***The training brought together more than 900 participants, which is an indication of extremely high interest in the subject of energy renovation in Croatia.***



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## Training content

During the training, the lecturers provided the participants with relevant information about the renovation process, possible obstacles, technical solutions and financing models. In the rest of the document, the main information and conclusions are presented.

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## Regulatory framework of renovation

During the presentation of the regulatory framework, strategies and goals, the bottom-up approach was emphasized as a method of reconstruction, which includes seismic measures without evicting tenants. Funds from the Environmental Protection and Energy Efficiency Fund from the sale of emission units in the Republic of Croatia are earmarked for the energy renovation of family houses and multifamily buildings, and public invitations should be issued by September 2023.

At the training, the possibility of participation of local self-government units in the renovation of multifamily buildings was mentioned, and the lecturers highlighted the possibility of involvement in the preparation of technical documentation and co-financing of the renovation through certain local budgets. Also, it was repeatedly emphasized that during the renovation of multifamily buildings, they are viewed as **architectural units**, which require the involvement of all entrances. Buildings that have undergone renovation cannot be retroactively applied for co-financing with EU funds. The cost must be incurred after the application and approval of public co-financing.

At the training, two models of energy renovation financing were discussed: **co-financing with public funds and independent financing with the co-owners own funds and loans from private banks**. Despite the interest in renovation through public co-financing with EU funds, the problem in Croatia is the low standard of living and the lack of funding sources. The improvement would be noticeable by increasing the allocation of funds, simplifying administrative procedures and introducing sustainable financial co-financing models.

Positive examples of building renovations were highlighted, where energy savings were realized through the gradual implementation of renovations and tenants accumulated funds in the reserve account, which they used in the following period for additional renovation measures. In the example of a building in Osijek, an example of a successful implementation of energy renovation is shown, **with the achievement of savings in electrical and thermal energy through the implementation of certain measures, without increasing the reserve**.

The Law on Management and Maintenance of Buildings is awaited, which, according to the Ministry of Physical Planning, Construction and State Assets, could go to consultation in the current year 2023 and enter into force at the end of the year or in the coming 2024. Some of the obstacles to the implementation of energy renovation have been highlighted: co-owners are not willing to increase the reserve and hardly bring decisions. It is complicated by the fact that one building has several entrances and the co-owners fail to register for public calls and do not understand the procedures and paperwork. It was pointed out that public co-financing will not be enough and that the co-owners should start energy renovation themselves and enroll in education about it.

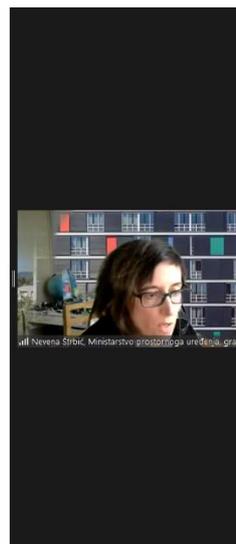
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## Financiranje

U prvom trogodišnjem razdoblju 2022.-2024. iz Mehanizma za oporavak i otpornost prema NPOO:

- 39.816.842,52 EUR investicija u energetska obnova VSZ neoštećenih u potresu
- Procjena od 22.894.684,45 EUR - investicija u energetska obnova zgrada oštećenih u potresu
- U Pozivu od 1. travnja 2022.(C6.1.R1-I1.01) – do kraja 2022. ugovoren je 91 projekt s iznosom bespovratnih sredstava od 39.544.665,19 EUR

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## REKONSTRUKCIJA SUSTAVA GRIJANJA- rezultati:

- Smanjena angažirana snaga sa 1.213,691 kW na 932,023 kW (smanjenje za 281,668 ili 23,2%)
- Smanjenje potrošnje toplinske energije 36 %
- Pojava plijesni na hladnim mostovima – posebno u stanicama s novijom stolarijom

Snaga prije razdjelnika:	1.213,691
Snaga nakon ugradnje razdjelnika:	932,023
Smanjenje snage:	281,668
Cijena snage za proizvodnju:	4,32 kn/kWh
Cijena snage za distribuciju:	4,11 kn/kWh
Snaga ukupno:	8,43 kn/kWh
Ušteda na snazi mjesečna:	2.374,46 kn/mj
<b>Ušteda na snazi godišnja:</b>	<b>28.493,53 kn/god</b>
Trošak proizvodnje energije:	0,149 kn/kWh
Trošak distribucije energije:	0,011 kn/kWh
Energija ukupno:	0,160 kn/kWh
Prosječna potrošnja 2008 - 2015. g.:	1.507,017,857 kWh
Ušteda na grijanju:	542.526,429 kWh
<b>Godišnja ušteda na energiji:</b>	<b>86.804,23 kn/god</b>
<b>Ukupna godišnja ušteda Energija + snaga:</b>	<b>115.297,76 kn/god</b>
Povrat investicije (JPP):	4,41 god

**Napomena:** neke zgrade su provele projekt energetske učinkovitosti, postavile izolaciju, a da nisu zamijenili ventile i ugradili razdjelnike. Nakon provedbe energetske obnove, regulacije temperature se vrši otvaranjem prozora!



Aleksandar Jelo...

Aleksandar Jelovac,Hrv...

Mladen Ilijević,...

Mladen Ilijević, Fond z...

Vanja Keindl, KE...

Vanja Keindl, KEINDL B...

Tanja Mance, Hr...

Tanja Mance, Hrvatski ...

Ivana Cepić, Za...

Ivana Cepić, Zagrebačk...

## Technical solutions

It was concluded that the renovation of the outer envelope or the change of technical systems is possible and there are a large number of solutions, each of which has its own advantage, but it is crucial that the design, execution and supervision be left to expert and authorized persons. Some professional terms important for technical systems are also highlighted: initial and return lines; air-water, water-air, air-air, and water-water systems. It was said that the condensate of the condensing boilers was acidic, and the condensate of the heat pump should be taken somewhere. It was emphasized that energy renovation should not be undertaken until, with the objective advice of experts, a decision has been made in which direction to proceed with the renovation. There was also talk about renewable energy sources in multi-apartment buildings, which are technically and regulatory possible, but not yet a common practice in Croatia. Also, if we talk about energy renovation as an economic activity, the initial condition should be the

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individualization of energy consumption measurement.

## Financing of renovation

"Green financing" was defined and its purpose related to renewable energy sources and energy efficiency; pollution prevention and control, environmentally sustainable management, clean forms of transport, sustainable water and wastewater management, adaptation to climate change and green/sustainable buildings.

The advantages of centralized heat systems are highlighted, which include higher energy efficiency of heat energy production than with individual systems, easier integration of renewable sources, lower greenhouse gas emissions, simpler energy source change, greater comfort for the end user, greater security of supply, less susceptibility to price changes and a reduction in options the occurrence of fires, explosions and carbon monoxide poisoning.

The ESCO model and its applicability for co-financing the renovation of multi-apartment buildings and certain renovation activities were also presented, and the current events of European funds for energy renovation and alternative sources of funds to encourage renovation were highlighted.

## Conclusion

The training sessions on the energy renovation of multifamily buildings provided an excellent overview of the regulatory framework, technical systems and renovation financing models. Such an overview provided the starting point for the case study workshops, where they tried to determine the optimal measures for the renovation of specific buildings. The final and main product of the Retrofit HUB project is a Guidebook for the energy renovation of multifamily buildings, which will primarily provide representatives of co-owners and other owners of apartments in multifamily buildings, as well as facility managers, with the steps that need to be taken in order to achieve the energy renovation of the building. The guide will also serve other stakeholders as it will provide a general overview of the building renovation process and will serve as a flowchart of all renovation process activities. The Croatia Green Building Council in partnership with the Councils from Poland and Hungary is intensively working on the creation of the Guide, which, along with other documents, will be available for download on the project's online platform: <https://retrofithub.eu/>.



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# Additional photo documentation from the training

**Energetska zajednica građana**

Jedinica lokalne samouprave

Trafostanice TS 10/0,4 kV

Članovi

Dijeljenje energije

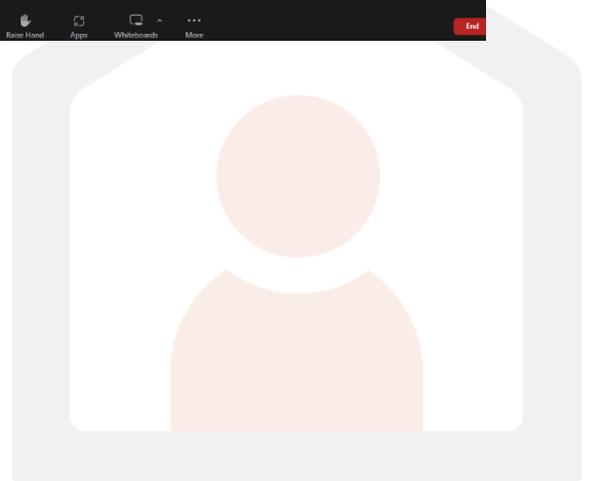
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**5. Analiza potrošnje toplinske energije prije i nakon ugradnje razdjelnika topline**

- obuhvaćene tri slične zgrade priključene na CTS grada Zagreba
- postotak ugrađenosti 100%

Objekt	Površina (m <sup>2</sup> )	Broj stanova	Snaga (kW)
SZ Argentinska 1-3	1617	30	228,79
SZ Sigetje 4-6	1640	30	224,68
SZ Paška 2	1862,53	34	259,337

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## RetrofitHUB 6. Zaključak

- ✓ smanjenja potrošnja toplinske energije na zajedničkom mjerilu toplinske energije
- ✓ autonomija u reguliranju temperature prostora na razini prostorije
- sumnja u ispravnost uređaja, razdjelnici ne pripadaju zakonskom mjeriteljstvu, povećanje broja reklamacija
- učestale promjene Pravilnika o načinu raspodjele i obračunu troškova za isporučenu toplinsku energiju (NN 99/14, 27/15 i 124/15)
- velik broj varijabli u izračunu energija grijanja
- neuređeno područje licenciranja tvrtki za ugradnju razdjelnika
- ugradnja termostatskih radijatorskih ventila bez izmjene postojećih cirkulacijskih pumpi grijanja i balansiranja instalacije grijanja – nejednolika progrijanost ogrjevnih tijela
- dodatni trošak očitavanja razdjelnika topline, zamjena razdjelnika nakon 10 godina

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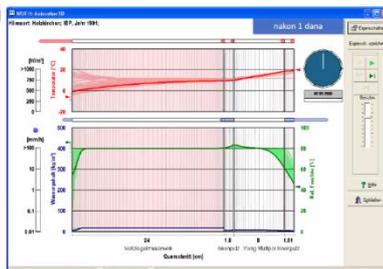


## RetrofitHUB

### Ispravnim odabirom materijala do uspješne obnove

Dokaz difuzije vodene pare proračunom

Razna programska rješenja (WUFI)  
Dinamički proračun difuzije vodene pare  
Period provjere 2 godine  
Klasični proračun ne daje ispravne rezultate



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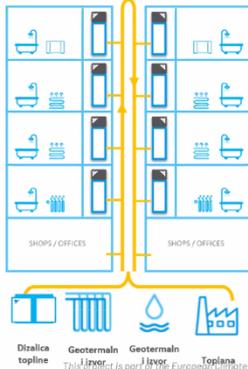
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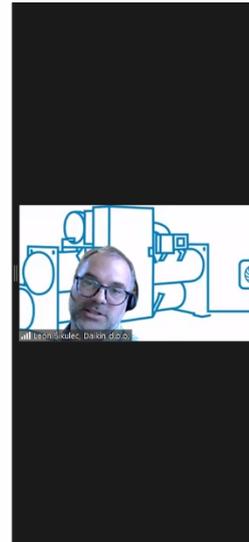
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## Sanacija sa etažnim dizalicama Voda-Voda

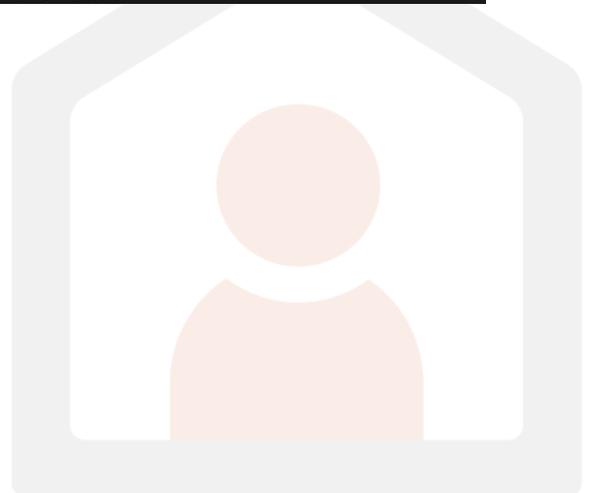
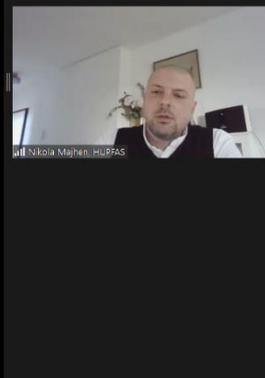
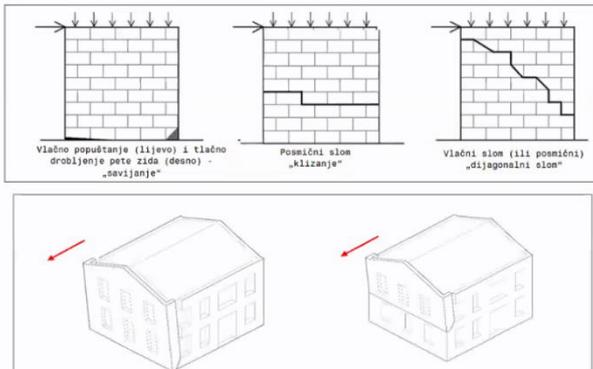


- Nema potrebe za odvojenim vanjskim jedinicama
- Sustav je namijenjen za grijanje, hlađenje i potrošnu toplu vodu (PTV)
- Niska razina buke
- Visoka učinkovitost
- Jednostavno upravljanje



## SUSTAVI OJAČANJA KONSTRUKCIJA

- KAKO IZABRATI NAJBOLJI SUSTAV ZA OJAČANJE?



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### Slučaj 3. Zamjena plinskog atmosferskog uređaja dizalicom topline



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- trošak na projekt, uređaj i montažu po stanu iznosi cca **10.000 €**
- **SCOP** - Podaci o učinku grijanja prema Uredbi EU-a br. 813/2013 (prosječni klimatski uvjeti):
  - primjena za srednje temperature (W55)
  - Energetska učinkovitost  $\eta_s$  % 152
  - Sezonski učinski koeficijent (SCOP) **3,87**
- Godišnja cijena potrošene el. energije na toplinu za grijanje i PTV = 7500 kWh / SCOP 3,87 = 1938 kWh \* 0,14 € = **271 €**



Meeting controls: Mute, Start Video, Participants (442), Q&A, Polls, Chat, Share Screen, Pause/Stop Recording, Raise Hand, Apps, Whiteboards, More.

### Razvoj novog modela financiranja energetske obnove višestambenih zgrada (Pilot projekt APN-a u okviru NPOO - C6.1.R6)

Shematski prikaz financiranja ESCO projekta uz pomoć ESIF ESCO garancije



ESCO tvrtka financira EE projekte valstitim kapitalom (equity) i kreditnim sredstvima. Realizacijom projekta ESCO tvrtka ne stječe imovinu, pa bi morala vezati vlastitu imovinu kao kolateral za kredit kroz cijelo trajanje projekta, ili pružiti neki drugi instrument osiguranja. Umjesto da veže vlastitu imovinu, ESCO tvrtka plaća naknadu Jamstvenom fondu, koji zauzvrat pruža davatelju kredita garanciju za urednu otplatu kredita.

Izvor: ENERGOVIZIJA I INŽENJERSKI INŽENJERING „Analiza o mogućnostima implementacije novog modela financiranja energetske obnove višestambenih zgrada – Prvi nacrt“ (Prosinac 2022.) u okviru NPOO projekta C6.1.R6 – Pilot projekt uspostave i provedbe sustavnog gospodarenje energijom na području jedinice lokalne (regionalne) samouprave te razvoj novog modela financiranja (Projekt provodi APN)

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Meeting controls: Mute, Start Video, Participants (463), Q&A, Polls, Chat, Share Screen, Pause/Stop Recording, Raise Hand, Apps, Whiteboards, More.

Damir Vuletić, A...

Damir Vuletić, APN



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## Zeleno financiranje

1
2
3
4
5

### Zeleni krediti

- Financijski instrumenti za financiranje ili refinanciranje djelomično ili u cijelosti **'zelenih' projekata**
- U skladu s **EU taksonomijom i Green Loan Principles**

### 4 osnovna elementa 'zelenih' kredita

- Namjena financiranja**
- Projektna procjena i selekcija
- Upravljanje sredstvima financiranja
- Izvršavanje

### Zelena namjena financiranja

- Obnovljivi izvori energije i energetska učinkovitost
- Sprječavanje i kontrola zagađenja
- Okolišno održivi management
- Čisti oblici transporta
- Održive vode i upravljanje otpadnim vodama
- Adaptacija na klimatske promjene
- Zelene/održive zgrade

### Elementi koji mogu utjecati na cijenu kredita

Procjena investicije u odnosu na postavljene taksonomske kriterije

- prihvatljivost
- usklađenost

Procjena ESG rizičnosti klijenta

- ESG upitnik ovisno o veličini klijenta (izrada nacionalnog upitnika)
- izrada skraćene verzije ESG upitnika za manje klijente
- procjena energetske vrijednosti kolaterala

6

## Taksonomski kriteriji značajnog doprinosa za ublažavanje klimatskih promjena

1
2
3
4
5

### Kriteriji značajnog doprinosa za obnovu zgrada

- Obnova zgrada u skladu je s primjenjivim zahtjevima za veću rekonstrukciju
- Alternativno, može rezultirati smanjenjem potrošnje primarne energije od najmanje 30 %

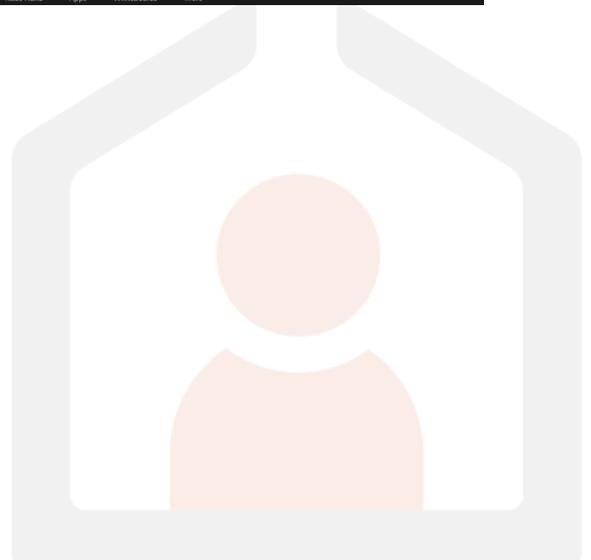
### Kriteriji značajnog doprinosa za ugradnju, održavanje i popravak opreme za energetska učinkovitost<sup>1</sup>

- dodavanje izolacije postojećim komponentama ovojnice, kao što su vanjski zidovi (+ zelene zidove), krovovi (+ zelene krovove), tavan i prizemlja (+ mjere kojima se osigurava nepropusnost zraka, mjere za smanjenje učinaka toplinskih mostova i skele) te proizvode za primjenu izolacije na ovojnicu zgrade (+ mehaničke držače i ljepila)
- zamjena postojećih prozora novim energetski učinkovitim prozorima
- zamjena postojećih vanjskih vrata novim energetski učinkovitim vratima
- ugradnja i zamjena energetski učinkovitih izvora svjetlosti
- ugradnja, zamjena, održavanje i popravak sustava grijanja, ventilacije i klimatizacije (HVAC) i sustava za grijanje vode, uključujući uređaje povezane s uslugama centraliziranog grijanja, primjenom visokoučinkovitih tehnologija
- ugradnja kuhinjskih i sanitarnih uređaja s niskom potrošnjom vode i energije koji su u skladu s tehničkim specifikacijama iz EU taksonomije, te koji u slučaju različitih tuševa, mišalica, priključaka za tuš i slavina imaju maksimalan protok vode do 6 l/minut, što je potvrđeno postojećom deklaracijom na tržištu Unije

**DNSH kriteriji za ostale taksonomske ciljeve kao i usklađenost sa minimalnim zaštitnim mjerama utvrđuju se putem upitnika samoprocjene za klijente**

7

<sup>1</sup> Djelatnost se obavlja provedbom neke od navedenih pojedinačnih mjera pod uvjetom da su u skladu s minimalnim zahtjevima utvrđenima za pojedinačne komponente i sustave u primjenjivim nacionalnim mjerama kojima se provodi Direktiva 2010/31/EU i, ako je primjenjivo, da su svrstani u dva najviša razreda energetske učinkovitosti u skladu s Uredbom (EU) 2017/1369 i delegiranim aktima donesenima na temelju te uredbe



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## Modeli financiranja stambenih zgrada

	Postojeći model	Novi model – razvoj modela u tijeku
Ugovorne strane; Ugovorno pravo	Upravitelj; Zakon o obveznim odnosima	Upravitelj, stambena zgrada tj. suvlasnici zgrade zastupani po predstavniku suvlasnika; Zakon o potrošačkom kreditiranju
Namjena	Redovno i izvanredno održavanje zajedničkih dijelova zgrade i opreme; ulaganja u energetska učinkovitost	Redovno i izvanredno održavanje zajedničkih dijelova zgrade i opreme; ulaganja u energetska učinkovitost; obnova od potresa
Kreditna sposobnost	Urednost naplate pričuve – u zadnjih 12 mjeseci u iznosu min. 00%	Urednost naplate pričuve – u zadnjih 12 mjeseci u iznosu min. 00%; 'zatvorena' financijska konstrukcija
Max iznos kredita/ anuiteta; Rok korištenja	U skladu s procjenom novčanog toka zgrade – mjesečni anuitet max 90% od prosječne mjesečne pričuve; rok korištenja do 12 mjeseci	Max iznos EUR 400tis; U skladu s procjenom novčanog toka zgrade – mjesečni anuitet max 90% od prosječne mjesečne pričuve; rok korištenja do 10 mjeseci
Ročnost; Otplata	Max 10 godina; otplata u mjesečnim anuitetima	Max 15 godina; otplata u mjesečnim anuitetima
Kamatna stopa; Naknada	Kamatna stopa ovisi o kreditnoj sposobnosti Upravitelja; Naknada 0,5% jednokratno	U procesu definiranja
Kolaterali	Nema	Nema
Ostali uvjeti	Izravno terećenje s računa pričuve; Polica osiguranja zgrade	Izravno terećenje s računa pričuve; Polica osiguranja zgrade



## NACIONALNI PLAN OPORAVKA I OTPORNOSTI 2021.-2026.

MPGI – Tijelo državne uprave nadležno za inicijativu C6. Obnova zgrada (NT)



Sufinancira  
Europska unija

C6. OBNOVA ZGRADA	
C6.1. R1-I1 Energetska obnova zgrada	
POZIV NA DOSTAVU PROJEKTNIH PRIJEDLOGA (sustav eNPOO) • objavljen u travnju, zatvoren u kolovozu 2022.	NPOO.C6.1.R1-I1.01 Energetska obnova višestambenih zgrada
PRIJAVLJENO PROJEKTNIH PRIJEDLOGA	235
ODOBRENO PROJEKTNIH PRIJEDLOGA	95
UGOVORENI PROJEKTI (do kraja 2022.)	91
ALOKACIJA POZIVA (mil €)	39,82 + 3,98 povećanje
UGOVORENO - MOO (mil €)	39,54
POVRŠINA ZGRADA (GBP/m <sup>2</sup> )*	391.181,39
PROSJEČNA PROJEKTIRANA UŠTEDA Eprim (%) - ugovoreni projekti	60
PROSJEČNA PROJEKTIRANA UŠTEDA QH,nd (%) - ugovoreni projekti	70

- do kraja 2022. ugovoren 91 projekt EO postojeće VSZ (neoštećene u potresu) u okviru inicijalne alokacije u 18 hrvatskih županija
- 75 integralna EO, 15 dubinska obnova i 1 integralna EO s mjerama zaštite od požara
- prijelaz energetskeg razreda D → B
- najveća projektirana ušteda QH,nd 86,06%
- najveća projektirana ušteda Eprim 86,65%
- najveći GBP zgrade 16.634,20 m<sup>2</sup>
- na 37 projekata se provode horizontalne mjere (elementi pristupačnosti - dizala, rampe i sl.; uređenje zelenih površina; parkirališta za bicikle)
- 27.12.2022. povećana alokacija na 43,8 milijuna eura
- u tijeku je postupak dodjele za projektne prijedloge koji ulaze u dodatnu alokaciju Poziva nakon čega će s uspješnim prijaviteljima biti sklopljeni Ugovori o dodjeli bespovratnih sredstava

\*NPOO pokazatelj - ugovoreni projekti (NPOO ciljna vrijednost 180.000 m<sup>2</sup>)



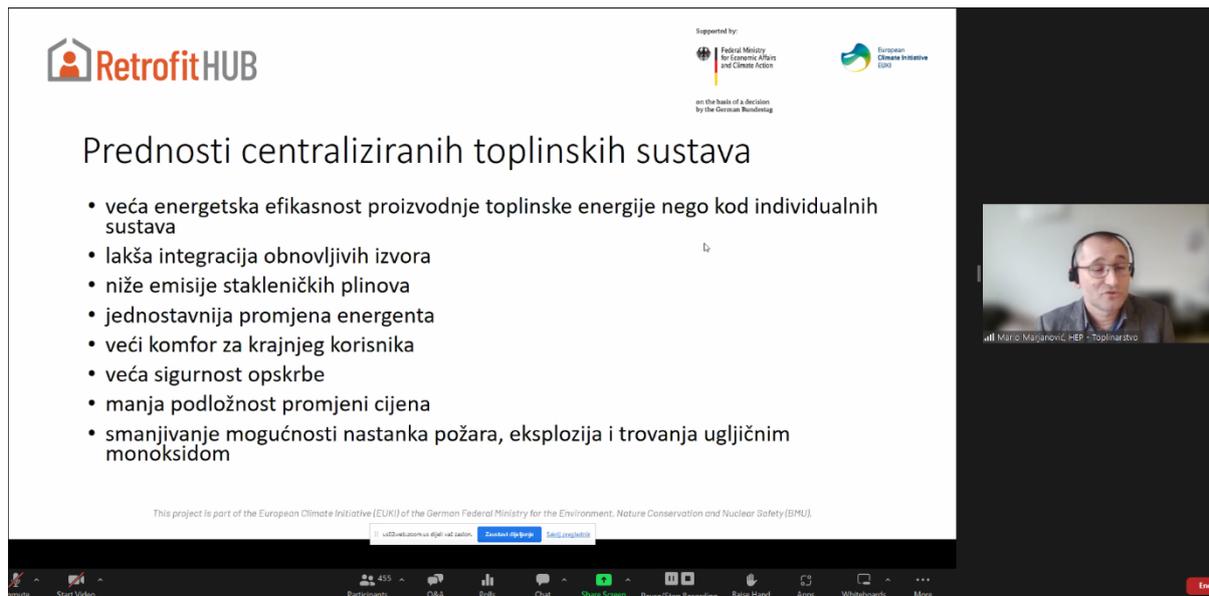
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This project is part of the European Climate Initiative (EUKI) of the German Federal Ministry for Economic Affairs and Climate Action (BMWK).





**RetrofitHUB**

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## Prednosti centraliziranih toplinskih sustava

- veća energetska efikasnost proizvodnje toplinske energije nego kod individualnih sustava
- lakša integracija obnovljivih izvora
- niže emisije stakleničkih plinova
- jednostavnija promjena energenta
- veći komfor za krajnjeg korisnika
- veća sigurnost opskrbe
- manja podložnost promjeni cijena
- smanjivanje mogućnosti nastanka požara, eksplozija i trovanja ugljičnim monoksidom

This project is part of the European Climate Initiative (EUKI) of the German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU).

Participants: 455  
Q&A  
Polls  
Chat  
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