

KREDITNI PROGRAM ZA UNAPREĐENJE ENERGETSKE EFIKASNOSTI U DOMAĆINSTVIMA: ANALIZA I PERSPEKTIVE

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Apstrakt

Usled nedostatka finansijskih sredstava i visokih početnih troškova investicije u energetske efikasne tehnologije značajni potencijali za uštedu energije u domaćinstvima se ne koriste. Za prevazilaženje finansijskih prepreka u bankocentričnim finansijskim sistemima ključni su krediti za energetske efikasne domaćinstva. U radu se analizira korišćenje ovih kredita u zemljama Zapadnog Balkana i razmatraju primeri uspešne prakse sa ciljem utvrđivanja mogućnosti za unapređenje programa za zeleno finansiranje i energetske efikasnosti domaćinstava. Primeri uspešne prakse u domaćinstvima analizirani su korišćenjem metode studija slučaja, analize sadržaja i metode komparacije. Rezultati istraživanja pokazuju da su krediti za energetske efikasne i podsticaji Evropske unije motivisali domaćinstva da koriste energetske efikasne tehnologije. Inovativne tehnologije omogućile su uštedu energije, finansijske uštede i smanjenje emisije ugljen-dioksida (CO₂).

Ključne reči: kreditne linije, zelene finansije, energetska efikasnost, domaćinstva, Zapadni Balkan

JEL: F33, G21, O13

Uvod

Posledice globalnog zagrevanja i aktuelna energetska kriza pokazali su da je unapređenje energetske efikasnosti značajno u svim zemljama (Nikolić, Milojković, 2023; Nikolić et al., 2024), a posebno u onima u kojima je energetska intenzitet viši od proseka Evropske unije (EU) i zemljama koje su zavisne od uvoza energije. Najveća globalna potrošnja energije u svetu zabeležena je u gradovima, gde se troši više od 2/3 globalne energije. Prema procenama, urbane oblasti doprinose 70% globalnoj CO₂, pri čemu najveći uticaj na to imaju saobraćaj i izgradnja (UN Environment Programme, 2024; UN Environment Programme, 2024a). Uvođenje energetske efikasne tehnologije u domaćinstvima u gradovima može značajno smanjiti potrošnju energije i emisiju CO₂. Time se doprinosi održivom razvoju (Ignjatijević et al., 2020).

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U zemljama Zapadnog Balkana (Srbiji, Crnoj Gori, Bosni i Hercegovini, Severnoj Makedoniji i Albaniji) prosek energetskeg intenziteta je 3 puta veći od proseka Evropske unije. Prema procenama Svetske banke, 35% ukupne potrošnje energije u domaćinstvima može da se uštedi (European Commission, 2016). Imajući u vidu ove podatke i činjenicu da se prekomerno troši energija koja je skupa, potrebno je analizirati mogućnosti da se njena potrošnja racionalizuje i da se energetska miks u sektoru domaćinstva promeni. U ovim zemljama je i visoka emisija CO₂ (Janković & Golubović, 2024).

Nedostatak finansijskih sredstava za investiranje u energetska efikasnija tehnologija, visoki početni troškovi, dug period povraćaja investiranih sredstava, nedostatak informacija i nizak nivo svesti stanovništva najčešće su prepreke za unapređenje energetske efikasnosti u sektoru domaćinstva (Arakkal, 2021; Hesselink, Chappin, 2019; Caird et al., 2008). U zemljama sa bankocentričnim finansijskim sistemima banke imaju značajnu ulogu u povećanju energetske efikasnosti u domaćinstvima (Migliorelli, Dessertine, 2019; Vesić et al., 2023).

Bankocentričnost finansijskog sistema je evidentna u zemljama Zapadnog Balkana. Banke su posrednici između finansijski suficitarnih i finansijski deficitarnih transaktora i imaju ključnu ulogu u unapređenju energetske performansi domaćinstava u ovim zemljama (Nikolić et al., 2024). Kao partnerske finansijske institucije u programu za zeleno finansiranje one omogućavaju da se sredstva iz kreditne linije za zeleno finansiranje (Green Economy Financing Facility - GEFF) plasiraju domaćinstvima putem kredita za energetska efikasnost (Stojanović, 2020). U ovom radu analizira se korišćenje kredita za energetska efikasnost za investiranje u energetska efikasna tehnologija u domaćinstvima u zemljama Zapadnog Balkana.

Ostatak rada podeljen je na sledeći način. U prvom delu rada ukazuje se na cilj istraživanja i metodologiju koja je korišćena za analizu kredita za energetska efikasnost u zemljama Zapadnog Balkana. Rezultati analize i diskusija predstavljeni su u drugom delu rada. Zaključci istraživanja zajedno sa preporukama i ograničenjima istraživanja dati su u poslednjem delu rada.

Cilj rada i korišćena metodologija

Evropska banka za obnovu i razvoj (European Bank for Reconstruction and Development - EBRD) je 2013. godine uz podršku Evropske unije i partnerstvom sa Sekretarijatom energetske zajednice (Energy Community Secretariat - ECS) pokrenula Regionalni program za energetska efikasnost (Regional Energy Efficiency Programme – REEP) za zemlje Zapadnog Balkana. Nakon uočavanja brojnih prepreka za unapređenje energetske efikasnosti domaćinstva u ovim zemljama u okviru REEP Plus programa, obezbeđene su kreditne linije za domaćinstva za zemlje Zapadnog Balkana (Western Balkans Sustainable Energy Financing Facility - WeBSEFF- Residential), kako bi se stimulisala da koriste

energetski efikasnije tehnologije (European Commission, 2016). U okviru ovog programa realizuje se kreditna linija za zeleno finansiranje na Zapadnom Balkanu od 2017. godine. Finansiranje domaćinstava putem GEFF-a u ovim zemljama vrši se preko lokalnih partnerskih finansijskih institucija (banaka) koje fizičkim licima koja zadovoljavaju utvrđene kriterijume prihvatljivosti odobravaju sredstva iz ovog programa (GEFF Serbia, 2024b). Domaćinstvima koja koriste ove kreditne linije odobravaju se i podsticaji od strane EU u vrednosti do 20%, dok je za stambene zgrade vrednost podsticaja do 35% prihvatljivih troškova (GEFF Serbia, 2024).

Do sada je više od 18000 domaćinstava na Zapadnom Balkanu investiralo preko 100 miliona eur u energetski efikasne tehnologije. Investicije u nove tehnologije omogućile su uštedu energije od 70000 MWh/god. i smanjenje emisije CO₂ za 25000 t/god. (GEFF, 2024).

U radu se analiziraju studije slučaja domaćinstava zemalja Zapadnog Balkana kako bi se utvrdile mogućnosti za unapređenje programa za zeleno finansiranje i energetske efikasnosti domaćinstava.

Analiza se zasniva na sekundarnim podacima GEFF-a zemalja Zapadnog Balkana koje su objavile studije slučaja za domaćinstva – Srbije, Bosne i Hercegovine i Severne Makedonije. Za teorijsku i empirijsku analizu energetske efikasnosti i finansiranja energetski efikasne tehnologije korišćen je metod analize. Primeri uspešne praksi domaćinstava u izabranim zemljama analizirani su primenom metode studije slučaja, metoda analize sadržaja i metoda komparacije.

Hipotetičko-deduktivna metoda korišćena je prilikom definisanja i provere sledećih hipoteza:

- H1: Krediti za energetsku efikasnost zemalja Zapadnog Balkana i finansijski podsticaji EU motivišu domaćinstva da koriste energetski efikasne tehnologije;
- H2: Broj domaćinstva koja koriste kredite za energetsku efikasnost se povećava;
- H3: Investicije u energetski efikasne tehnologije omogućavaju uštede energije i finansijske uštede u domaćinstvu, i smanjenje zagađenja životne sredine.

Za sumiranje rezultata, donošenje zaključaka i davanje preporuka korišćena je metoda sinteze.

Rezultati i diskusija

Analiza uspešnih primera domaćinstva koja su koristila kredite za energetsku efikasnost i dobile podsticaje EU obuhvatila je 13 studije slučaja (12 domaćinstva i 1 stambenu zgradu) u tri zemlje Zapadnog Balkana – Srbiju, Bosnu i Hercegovinu i Severnu Makedoniju. GEFF program za Zapadni Balkan u okviru koga su odobreni krediti za energetsku efikasnost analiziranim domaćinstvima podržan je od strane Evropske unije, Saveznog Ministarstva Austrije i

Investicionog okvira za Zapadni Balkan (Western Balkan Investment Framework –WBIF).

Srbija

Studije slučaja domaćinstava koja su koristila kredite za energetske efikasnost GEFF programa za Zapadni Balkan u Srbiji pojavile su se među prvima. Analizom su obuhvaćena 4 domaćinstva čije su studije slučaja objavljene u periodu od 2019-2023. godine (*Tabela 1.*).

Sa ciljem smanjenja troškova grejanja tokom zime domaćinstvo Grubac iz Beograda odlučilo je da kotao na drva zameni novim kotlom na biomasu. Koristeći kredit za energetske efikasnost investirali su 3070 eur u ovaj kotao. Pored kredita, porodica Grubac je dobila i podsticaj u vrednosti od 460 eur. Investicija u energetske efikasnije grejanje omogućila je uštedu energije od 2,40 MWh/god. i smanjenje troškova grejanja. Smanjena je i emisija CO₂, a time i zagađenje životne sredine (GEFF Serbia, 2019).

Domaćinstvo Stojković iz Sremske Mitrovice odlučilo je da smanji potrošnju energije prilikom gradnje nove kuće. Investirali su u toplotnu izolaciju i visoko energetske efikasne PVC prozore i vrata. Porodica Stojković je dobila kredit za energetske efikasnost u vrednosti od 3700 eur i podsticaj u vrednosti od 740 eur. Korišćenje energetske efikasne tehnologije omogućilo je uštedu energije od 5,00 MWh/god., uštedu novca, povećanje komfora i smanjenje zagađenja životne sredine (GEFF Serbia, 2019a).

U nameri da postane energetske nezavisno i da smanji zagađenje životne sredine domaćinstvo Rađenović iz Beograda ugradilo je solarne panele u porodičnoj kući. Finansiranje solarnih panela vršili su iz kredita za energetske efikasnost u vrednosti od 9000 eur i podsticaja od 1600 eur. Nakon instaliranja nove tehnologije ovo domaćinstvo se u potpunosti napaja električnom energijom iz solarnih panela i nema dodatne troškove za električnu energiju. Godišnje uštede energije procenjene su na 4,65 MWh, a očekivani period povraćaja uložene sredstava je 7-10 godina (GEFF Serbia, 2022).

Domaćinstvo Đukanović iz Beograda je 2022. godine pokrenulo adaptaciju svoje kuće od 250 m² ulaganjem u energetske efikasne tehnologije. Cilj ove investicije bio je da se smanji potrošnja energije, pronađu održiva energetska rešenja i poboljša komfor tokom zime. Dobili su dva kredita za energetske efikasnost u ukupnoj vrednosti od 31000 eur i podsticaj od 5800 eur (GEFF Serbia, 2023). Sredstva su investirali u toplotnu pumpu, podno grejanje, solarne panele i energetske efikasne prozore. Nakon završenih radova, kuća je doživela potpunu transformaciju – ostvarena je ušteda energije od 7,80 MWh/god., smanjeni su troškovi grejanja, povećan je komfor u kući i smanjena je emisija CO₂ za 3,60 t/god. Zahvaljujući ovim uštedama procenjuje se da će se investirana sredstva vratiti za 7 godina (GEFF Serbia, 2023).

Tabela 1. Studije slučaja domaćinstava koja su koristila kredite za energetske efikasnosti u Srbiji

Investitor	Lokacija	Investicija	Vrednost investicije i granta (eur)	Finansijski rezultati (PPI)*	Ušteda energije (MWh/god)	Smanjena emisija CO ₂ (t/god)
Domaćinstvo Grubac	Beograd	Kotao na biomasu	3 070 460	-	2,40	-
Domaćinstvo Stojković	Sremska Mitrovica	Toplotna izolacija, PVC prozori	3 700 740	-	5,00	-
Domaćinstvo Radenović	Beograd	Solarni paneli	9 000 1 600	7-10 god.	4,65	-
Domaćinstvo Đukanović	Beograd	Solarni paneli, toplotna pumpa, podno grejanje, PVC prozori	31 000 5 800	7 god.	7,80	3,60

Izvor: Ilustracija autora na osnovu: GEFF Serbia, 2024a

Napomena: * period povraćaja investicije (godine)

Bosna i Hercegovina

Najveći broj primera uspešne prakse unapređenja energetske efikasnosti domaćinstava zabeležen je u Bosni i Hercegovini. Analizirane studije domaćinstava koja su koristila kredite za energetske efikasnosti GEFF programa u periodu od 2018-2020. godine obuhvatile su 6 domaćinstava i 1 stambenu zgradu (Tabela 2.).

U domaćinstvu u Ustikolini, domaćin Tešević renovirao je porodičnu kuću u kojoj provodi svoje slobodno vreme. Nakon što je investirao 5700 eur u toplotnu izolaciju i kotao na pelet, ova kuća je potpuno transformisana u energetske efikasnu kuću koja je toplija i komfornija. Za nabavku ovih tehnologija koristio je kredit za energetske efikasnosti i dobio podsticaj od 1000 eur. Procenjene uštede energije na godišnjem nivou su 6,00 MWh. Korišćenje kotla na pelet umesto kotla na drva doprinelo je smanjenju zagađenja životne sredine (GEFF Bosnia and Herzegovina, 2018c).

Porodica Lalović iz Istočnog Sarajeva zamenila je kotao na drva i ugalj novim kotlom na pelet korišćenjem kredita za energetska efikasnost. Investirali su 1360 eur u kotao na pelet i dobili podsticaj od 200 eur. Izvršene promene omogućile su smanjenje potrošnje energije za oko 1,06 MWh/god. i povraćaj investicije za 2 godine. Uvođenje energetske efikasne tehnologije doprinelo je smanjenju emisije CO₂ za 0,41 t/god. (GEFF Bosnia and Herzegovina, 2018).

Sa ciljem da obezbedi bolju toplotnu i zvučnu izolaciju, domaćin porodice Kamarić u Visokom zamenio je drvene prozore i vrata iz 80-ih godina PVC vratima i PVC prozorima sa troslojnim staklom. Korišćenjem kredita za energetska efikasnost investirao je 2711 eur u energetska efikasniju tehnologiju i dobio podsticaj od 407 eur. Zamenjena stolarija omogućila je smanjenje potrošnje energije za 1,13 MWh/god. i po tom osnovu finansijske uštede. Promenjen je vizuelni izgled kuće koja je sagrađena 60-ih godina prošlog veka (GEFF Bosnia and Herzegovina, 2018a).

Investicijom od 3656 eur u toplotnu pumpu domaćinstvo Božić iz Mostara unapredilo je energetska efikasnost svog doma, obezbedilo jednostavnije i jeftinije grejanje tokom zime, ali i hlađenje tokom leta. Nakon investiranja u energetska efikasna tehnologija dobili su podsticaj od 548 eur. Novi način grejanja omogućio im je uštedu energije od 0,70 MWh/god. i veći komfor u domaćinstvu (GEFF Bosnia and Herzegovina, 2018b).

Višestrukim merama za unapređenje energetske efikasnosti – ugradnjom PVC prozora i PVC vrata, toplotnom izolacijom i nabavkom kotla na pelet (biomasu), porodica Maslić iz Šamca omogućila je brže i bolje zagrevanje svog stambenog prostora, ostvarenje uštede energije i stvaranje boljih uslova za život (GEFF Bosnia and Herzegovina, 2019a). Investicija u nove energetska efikasna tehnologija realizovana je korišćenjem kredita za energetska efikasnost u vrednosti od 5110 eur. Porodica Maslić je za ovu investiciju dobila podsticaj u vrednosti od 1000 eur. Rezultat korišćenja nove tehnologije je ušteda energije od 3,60 MWh/god. Kako su korišćenje uglja zamenili peletom i racionalizovali potrošnju energije, smanjena je i emisija CO₂ i zagađenje životne okoline (GEFF Bosnia and Herzegovina, 2019a).

Sa ciljem smanjenja troškova grejanja domaćin Omerović investirao je 3650 eur u kotao na pelet. Sredstva za ovu investiciju obezbedio je iz kredita za energetska efikasnost, a nakon instalacije kotla dobio je podsticaj u vrednosti od 530 eur. Zamenom kotla na drva kotlom na pelet ovo domaćinstvo ostvarilo je uštedu energije od 2,80 MWh/god., koja je praćena i finansijskim uštedama. Pored toga, smanjeno je zagađenje životne sredine usled smanjenja emisije CO₂ za 1,07 t/god. (GEFF Bosnia and Herzegovina, 2019).

Korišćenjem kredita za energetska efikasnost adaptirana je višespratna zgrada u Sarajevu. Sa ciljem unapređenja energetske investirano je 34000 eur u toplotnu

izolaciju i PVC prozore. Stanari zgrade dobili su podsticaj od 11000 eur. Nove tehnologije uticale su na smanjenje potrošnje energije za 43,62 MWh/god. i troškova energije. Usled unapređenja energetske efikasnosti, smanjena je emisija CO₂ za 8,77 t/god. (GEFF Bosnia and Herzegovina, 2020).

Tabela 2. Studije slučaja domaćinstava koja su koristila kredite za energetske efikasnost u Bosni i Hercegovini

Investitor	Lokacija	Investicija	Vrednost investicije i granta (eur)	Finansijski rezultati (PPI/ušteda) *	Ušteda energije (MWh/god)	Smanjena emisija CO ₂ (t/god)
Domaćinstvo Tešević	Ustikolina	Toplotna izolacija, kotao na pelet	5 700 1 000	-	6,00	-
Domaćinstvo Lalović	Istočno Sarajevo	Kotao na pelet	1 360 200	2 god.	1,06	0,41
Domaćinstvo Kamarić	Visoko	PVC prozori i vrata	2 711 407	-	1,13	-
Domaćinstvo Božić	Mostar	Toplotna pumpa	3 656 548	250 eur	0,70	-
Domaćinstvo Maslić	Šamac	PVC prozori i vrata, kotao na biomasu, toplotna izolacija	5 110 1 000	-	3,60	-
Domaćinstvo Omerović	Tuzla	kotao na pelet	3 650 530	-	2,80	1,07
Stambena zgrada	Sarajevo	Toplotna izolacija, PVC prozori	34 000 blizu 11 000	-	43,62	8,77

Izvor: Ilustracija autora na osnovu: GEFF Bosnia and Herzegovina, 2024

Napomena: * period povraćaja investicije (godine) ili ušteda (eur)

Severna Makedonija

Domaćinstva koriste oko 40% ukupne električne energije u Severnoj Makedoniji (GEFF North Macedonia, 2020a). Od energetske neefikasnih zgrada potiče oko 40% emisija gasova sa efektom staklene bašte (GEFF North Macedonia, 2020). Potencijal za uštedu energije u domaćinstvima, finansijske uštede i smanjenja zagađenja životne sredine je veliki. Analizom studija slučaja u ovoj zemlji obuhvaćena su dva domaćinstva koja su koristila kredite za energetske efikasnost i njima finansirala nekoliko energetski efikasnih tehnologija (*Tabela 3.*).

Porodica Janakievski iz Skoplja investirala je 19500 eur u toplotnu pumpu, izolaciju krova i ugradnju novih prozora u porodičnoj kući sagrađenoj 80-ih godina. Za investiciju su koristili kredit za energetske efikasnost. Domaćinstvo Janakievski je dobilo podsticaj od 3900 eur. Nakon unapređenja energetske efikasnosti ovog domaćinstva porodica je ostvarila uštedu energije od 11,16 MWh/god. Energetski efikasne tehnologije doprinele su i smanjenju emisije CO₂ za 2,55 t/god. (GEFF North Macedonia, 2020a).

Sa ciljem izgradnje energetski efikasne kuće u domaćinstvu Popov iz Skoplja instalirana je toplotna pumpa, završena je izolacija zidova i krova i postavljeni su energetski efikasni prozori. Investicija u ove tehnologije u vrednosti od 41800 eur finansirana je iz kredita za energetske efikasnost. Vrednost podsticaja za ovu investiciju bila je 8360 eur. Preduzete mere za unapređenje energetske efikasnosti ovom domaćinstvu obezbedile su uštedu energije od 86 MWh/god., a smanjeno je i zagađenje životne sredine (GEFF North Macedonia, 2020).

Tabela 3. Studije slučaja domaćinstava koja su koristila kredite za energetske efikasnost u Severnoj Makedoniji

Investitor	Lokacija	Investicija	Vrednost investicije i granta (eur)	Finansijski rezultati (PPI)*	Ušteda energije (MWh/god)	Smanjena emisija CO ₂ (t/god)
Domaćinstvo Janakievski	Skoplje	Toplotna pumpa, izolacija krova, prozori	19 500 3 900	-	11,16	2,55
Domaćinstvo Popov	Skoplje	Toplotna pumpa, izolacija, prozori	41 800 8 360	-	86,00	-

Izvor: Ilustracija autora na osnovu: GEFF North Macedonia, 2024

Napomena: * period povraćaja investicije (godine)

Analiza studija slučaja domaćinstava u zemljama Zapadnog Balkana pokazala je da su zastupljene studije slučaja porodica koje žive u glavnim gradovima (*Tabela 4.*). U Srbiji je 75% domaćinstava iz glavnog grada, dok je u Severnoj Makedoniji 100%. Za razliku od ovih zemalja, u Bosni i Hercegovini postoje studije slučajeva iz različitih gradova i teritorijalno su podjednako zastupljene. Značaj preduzimanja mera unapređenja energetske efikasnosti u velikim i glavnim gradovima je veliki, zato što je u njima najveće zagađenje životne sredine. Intenziviranje preduzetih mera uz korišćenje kredita za energetske efikasnost i podsticaja EU u ovim gradovima je neophodno. Sa druge strane, postojanje primera uspešne implementacije mera energetske efikasnosti i ušteda u manjim

mestima utiče na razvoj svesti ljudi koji žive u različitim delovima zemlje o prednostima korišćenja energetske efikasne tehnologije, mogućnostima i uslovima njihovog finansiranja iz kredita za energetske efikasne i sredstava podsticaja.

Tabela 4. Pregled studija slučaja prema geografskoj lokaciji u posmatranim zemljama

Domaćinstva u glavnim gradovima				Domaćinstva u ostalim gradovima			
Grad	Domaćinstvo	Broj	%	Grad	Domaćinstvo	Broj	%
Beograd	Grubac Rađenović Đukanović	3	75	Sremska Mitrovica	Stojković	1	14
Sarajevo	Stambena zgrada	1	17	Istočno Sarajevo	Lalović	1	14
Skoplje	Janakievski Popov	2	100	Ustokolina	Tešević	1	14
				Visoko	Kamarić	1	14
				Mostar	Božić	1	14
				Šamac	Maslić	1	14
				Tuzla	Omerović	1	14
Ukupno		6	46	Ukupno		7	54

Izvor: Ilustracija autora na osnovu: GEFF Serbia, 2024a; GEFF Bosnia and Herzegovina, 2024; GEFF, North Macedonia, 2024

Za unapređenje energetske efikasnosti korišćene su različite tehnologije (*Tabela 5.*). Najveći broj domaćinstava promenio je način grejanja - kotao na drva ili ugalj zamenjen je kotlom na biomasu (pelet) ili toplotnom pumpom. U posmatranim zemljama bilo je 9 domaćinstava koja su koristila ove tehnologije. Slede tehnologije koja se odnose na ugradnju PVC prozora i vrata i toplotnu izolaciju, koje su, takođe, zastupljene u svim analiziranim zemljama. U 6 domaćinstava i 1 višespratnoj stambenoj zgradi stari prozori i vrata zamenjeni su PVC prozorima i vratima, pri čemu su ove tehnologije podjednako korišćene u domaćinstvima u svim zemljama. Tehnologije koje se odnose na unapređenje toplotne izolacije zidova i krovova korišćene su u 5 domaćinstava i 1 stambenoj zgradi. Solarni paneli su ugrađeni samo u 2 domaćinstva u Srbiji. U ostalim studijama slučaja nije bila zastupljena ova tehnologija.

Kredit za finansiranje energetske efikasne tehnologije u Srbiji i Severnoj Makedoniji su koristila samo domaćinstva, dok je u Bosni i Hercegovini ovaj kredit korišćen za adaptaciju u domaćinstvima i za adaptaciju 1 višespratne stambene zgrade. Imajući u vidu da je podsticaj za investicije u energetske

efikasne tehnologije najveći za stambene zgrade, može se zaključiti da upravnici stambenih zgrada još uvek ne koriste ove finansijske pogodnosti.

Tabela 5. Pregled studija slučaja prema vrsti tehnologije u posmatranim zemljama

Tehnologija	Ukupno	Broj domaćinstava	Broj stambenih zgrada	Zemlja
Solarni paneli	2	2	-	Srbija
		-	-	Bosna i Hercegovina
		-	-	Severna Makedonija
Toplotna izolacija	6	1	-	Srbija
		2	1	Bosna i Hercegovina
		2	-	Severna Makedonija
PVC prozori i vrata	7	2	-	Srbija
		2	1	Bosna i Hercegovina
		2	-	Severna Makedonija
Toplotne pumpe, kotlovi, podno grejanje	9	2	-	Srbija
		5	-	Bosna i Hercegovina
		2	-	Severna Makedonija

Izvor: Ilustracija autora na osnovu: GEFF Serbia, 2024a; GEFF Bosnia and Herzegovina, 2024; GEFF, North Macedonia, 2024

Posmatranjem studija slučaja prema vrednosti investicija, može se uočiti da su najveće investicije zabeležene kod domaćinstava u Severnoj Makedoniji, koja su koristila nekoliko tehnologija za unapređenje energetske efikasnosti svojih domova (toplotnu izolaciju zidova i krovova, zamenu prozora i vrata i zamenu načina grejanja – instaliranje toplotnih pumpi). Zatim slede domaćinstava iz Srbije koja su instalirala solarne panele i druge energetske efikasne tehnologije. Visoka vrednost investicije u Bosni i Hercegovini evidentirana je samo kod studije slučaja koja se odnosi na višespratnu stambenu zgradu (*Tabela 6.*).

Najveće uštede energije u analiziranim studijama slučaja ostvarene su u Severnoj Makedoniji, gde je primenjeno nekoliko tehnologija u svakom od analiziranih domaćinstava. Ostvarene uštede se kreću u rasponu od 11,16-86,00 MWh/god. Značajne uštede energije ostvarene su i u Bosni i Hercegovini (43,62 MWh/god.) gde je adaptirana zgrada primenom nekoliko tehnologija radi unapređenja energetske efikasnosti. U domaćinstvima u Srbiji i u Bosni i Hercegovini je

ostvarena ušteda do 8, odnosno 6 MWh/god., respektivno. Uprkos malim vrednostima pojedinačnih ušteda u domaćinstvu, mogućnosti za uštedu energije u domaćinstvima su velike zbog brojnosti domaćinstava, posebno u velikim gradovima.

Tabela 6. Pregled studija slučaja prema vrednosti investicije i uštedi energije u posmatranim zemljama

Pokazatelji	Zemlja		
	Srbija	Bosna i Hercegovina	Severna Makedonija
Vrednost investicije (eur)	3 070-31 000	1 360-5 700 34 000*	19 500-41 800
Ušteda energije (MWh/god.)	2,7-7,8	0,70-6,00 43,62*	11,16-86,00

Izvor: Ilustracija autora na osnovu: GEFF Serbia, 2024a; GEFF Bosnia and Herzegovina, 2024; GEFF, North Macedonia, 2024

Napomena: * podaci za stambenu zgradu

Zaključak

Rezultati analize studija slučaja domaćinstava u Srbiji, Bosni i Hercegovini i Severnoj Makedoniji pokazali su da su krediti za energetske efikasnost i podsticaji EU ohrabрили domaćinstva da započnu investiranje u energetske efikasnije tehnologije. Sve veći broj domaćinstava koristi kredite za energetske efikasnost i podsticaje.

Investicije u pomenute tehnologije, omogućile su im da smanje potrošnju energije, uz održavanje uobičajene temperature i povećanje komfora. Uprkos nedostatku podataka o finansijskim efektima ostvarenih ušteda energije, može se zaključiti da postoje i značajne finansijske uštede u svim domaćinstvima usled smanjenja potrošnje energije. Primeri uspešnog investiranja u energetske efikasne tehnologije ovih domaćinstava i stambene zgrade mogu podstaći i druga domaćinstva i upravne stambenih zgrada da koriste kredite za energetske efikasnost i podsticaje EU za finansiranje visokih početnih troškova uvođenja ovih tehnologija. Na osnovu raspoloživih podataka 1/3 analiziranih domaćinstava o smanjenju emisije CO₂ može se zaključiti da koristi od unapređenja energetske efikasnosti domaćinstva postoje i za društvo. U prilog tome je i činjenica da se u velikom broju domaćinstava promenio način grejanja - kotlovi na drva i ugalj zamenjeni su kotlovima na biomasu (pelet).

Povećanjem broja studija slučaja o uspešnoj implementaciji energetske efikasne tehnologije u domaćinstvima i uštedama koje se po ovom osnovu ostvaruju

ostvariće se pozitivan uticaj na svest ljudi o potrebi za investicijama u ove tehnologije. Po tom osnovu može se očekivati povećanje broja domaćinstava koja investiraju u ove tehnologije i koriste kreditne programe za unapređenje energetske efikasnosti svoji domova.

Sa ciljem popularizacije kreditne linije za zeleno finansiranje (GEFF) za uvođenje energetski efikasnih tehnologija u domaćinstvima i stambenim zgradama na Zapadnom Balkanu, potrebno je kontinuirano objavljivati i analizirati studije slučaja. Pored finansijske podrške domaćinstvima i upravicima stambenih zgrada treba pružiti savetodavnu podršku prilikom utvrđivanja efekata finansijskih ušteda preduzetih mera i njihovog uticaja na smanjenje zagađenja životne sredine. Dalje, potrebno je povećati broj studija slučaja koje se odnose na stambene zgrade i stimulisati korišćenje ovih kreditnih linija za njihovu adaptaciju, posebno u velikim gradovima, gde su one brojne, a zagađenje značajno. Potpuni uvid i ocena značaja kreditnog programa za energetske efikasnosti koji banke realizuju u saradnji sa GEFF-om može da se ostvari ukoliko se formira baza podataka na sajtu GEFF-a o svim domaćinstvima i stambenim zgradama koja su koristila ove kredite za investiranje u energetske efikasne tehnologije.

Imajući u vidu da je broj studija slučaja u analiziranim zemljama još uvek mali, ovo istraživanje treba proširiti nakon objavljivanja novih studija slučaja u analiziranim zemljama Zapadnog Balkana ili povećanjem broja zemalja koje koriste GEFF program.

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THE LOAN PROGRAM FOR IMPROVING ENERGY EFFICIENCY IN HOUSEHOLDS: ANALYSIS AND PERSPECTIVES

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Abstract

Due to the lack of financial resources and the high initial costs of investment into energy-efficient technology, significant potentials for energy saving in households are not being used. Household energy-efficiency loans are crucial for overcoming financial obstacles in bank-centric financial systems. The paper analyses the use of these loans in countries of the Western Balkans and examines examples of successful practice in order to determine the possibilities for improving programs for green financing and energy-efficient households. Examples of successful practices in households are analysed using the study case method, content analysis and comparative methods. Research results show that energy-efficiency loans and grants of the European Union motivated households to use energy-efficient technologies. Innovative technologies enable energy saving, financial savings and reduction of carbon dioxide (CO₂) emissions.

Key words: credit lines, green finances, energy efficiency, households, Western Balkans

JEL: F33, G21, O13

Introduction

The consequences of global warming and the current energy crisis have shown that the improvement of energy efficiency is significant in all countries (Nikolić & Milojković, 2023; Nikolić et al., 2024), in particular in those in which the energy intensity is higher than the European Union (EU) average and in countries that depend on energy imports.

The highest global energy consumption in the world was noted in cities in which more than 2/3 of global energy is consumed. According to estimates, urban areas comprise 70% of global CO₂ emissions, whereby traffic and construction have the greatest impact (UN Environment Programme, 2024; UN Environment Programme, 2024a). The introduction of energy efficiency technologies in households in cities can significantly reduce energy consumption and CO₂ emissions. This contributes to sustainable development (Ignjatijević et al., 2020).

In countries of the Western Balkans (Serbia, Montenegro, Bosnia and Herzegovina, North Macedonia and Albania), the average energy intensity is 3

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times higher than the European Union average. According to World Bank estimates, 35% of total household energy consumption can be saved (European Commission, 2016). Having in mind these data and the fact that expensive energy is excessively consumed, the possibilities for the consumption to be rationalized and for the energy mix to be applied in the household sector must be analysed. CO₂ emissions are also high in these countries (Janković & Golubović, 2024).

The lack of financial resources for investing into energy efficiency technologies, high initial costs, a long period for the return of invested funds, lack of information and a low level of awareness among the population are the most common obstacles for improving energy efficiency in the household sector (Arakkal, 2021; Hesselink & Chappin, 2019; Caird et al., 2008). In countries with bank-centric financial systems, banks play a significant role in increasing household energy efficiency (Migliorelli, Dessertine, 2019; Vesić et al., 2023).

Bank-centricity of the financial system is evident in the Western Balkans countries. Banks are mediators between financial surplus transactors and financial deficit transactors and they play a crucial role in improving energy performance of households in these countries (Nikolić et al., 2024). As partner financial institutions within the green financing program, they enable funds from the Green Economy Financing Facility (GEFF) to be distributed to households through energy efficiency loans (Stojanović, 2020). This paper analyses the use of energy efficiency loans for investing in energy efficient technologies in households in the Western Balkans countries.

The rest of the paper is divided as follows. The first part of the paper points out the aim of the research and the methodology used for the analysis of loans for energy efficiency in the Western Balkans countries. Analysis results and discussion are presented in the second part of the paper. Research conclusions, along with the recommendations and research limitations are provided in the final part of the paper.

Aim of the paper and methodology

In 2013, the European Bank for Reconstruction and Development (EBRD) with the support of the European Union and in partnership with the Energy Community Secretariat (ECS) launched the Regional Energy Efficiency Program (REEP) for the Western Balkans countries. After noticing numerous obstacles to improving household energy efficiency in these countries the REEP Plus Program, Western Balkans Sustainable Energy Financing Facility (WeBSEFF - Residential) were provided, in order to stimulate them to use more energy efficiency technologies (European Commission, 2016). Within this program, a Green Economy Financing Facility in the Western Balkans has been implemented since 2017. Financing of households through GEFF in these countries is carried out through local partner financial institutions (banks), which grant funds from this program to natural

persons who fulfil the established eligibility criteria (GEFF Serbia, 2024b). Households using these credit lines are also receiving grants from the EU in the value of up to 20%, while the value of grants is up to 35% of eligible costs for residential buildings (GEFF Serbia, 2024).

Up to this moment, more than 18,000 households in the Western Balkans have invested over 100 million euros in energy efficiency technologies. Investment in new technologies have enabled energy savings of 70,000 MWh/year and the reduction of CO₂ emissions by 25,000 t/year (GEFF, 2024).

The paper analyses case studies on households in the Western Balkans countries in order to determine the possibilities for improving the green financing program and energy efficiency of households.

The analysis was based on secondary data from GEFF of the Western Balkans countries that published case studies for households - Serbia, Bosnia and Herzegovina and North Macedonia. The analysis method was used for the theoretical and empirical analysis of energy efficiency and financing of energy efficiency technology. Examples of successful household practices in the selected countries were analysed using the case study method, the content analysis method, and the comparison method.

The hypothetical-deductive method was used for defining and checking the following hypotheses:

- H1: Energy efficiency loans of the Western Balkans countries and financial grants of the EU motivate households to use energy efficiency technologies;
- H2: The number of households using energy-efficiency loans is increasing;
- H3: Investments in energy efficiency technologies enable energy savings and financial savings in the household, and reduction of environmental pollution.

The synthesis method was used to summarize the results, draw conclusions and give recommendations.

Results and discussion

The analysis of successful examples of households that used energy-efficiency loans and received EU grants included 13 case studies (12 households and 1 residential building) in three countries of the Western Balkans - Serbia, Bosnia and Herzegovina and North Macedonia. The GEFF program for the Western Balkans, in which loans for energy efficiency were granted to the analysed households, is supported by the European Union, the Federal Ministry of Austria and the Western Balkan Investment Framework (WBIF).

Serbia

Case studies on households using energy efficiency loans of the GEF program for the Western Balkans in Serbia were among the first that appeared. The analysis included 4 households, the case studies of which were published in the period from 2019 to 2023 (*Table 1.*).

With the aim of reducing heating costs during the winter, the Grubac household from Belgrade decided to replace the wood boiler with a new biomass boiler. Using an energy efficiency loan, they invested 3,070 euros in this boiler. In addition to the loan, the Grubac family also received a 460-euro grant. Investment in energy-efficient heating enabled energy savings of 2.40 MWh/year and the reduction of heating costs. CO₂ emissions and environmental pollution were also reduced (GEFF Serbia, 2019).

The Stojković household from Sremska Mitrovica decided to reduce energy consumption when building a new house. They invested in thermal insulation and highly energy-efficient PVC windows and doors. The Stojković family received a loan for energy efficiency in the value of 3,700 euros and a 740-euro grant. The use of energy-efficient technologies made it possible to save energy of 5.00 MWh/year, to save money, to increase comfort and reduce environmental pollution (GEFF Serbia, 2019a).

In order to become independent in terms of energy and to reduce environmental pollution, the Rađenović household from Belgrade installed solar panels in their family home. The financing of the solar panels was carried out from a loan for energy efficiency in the amount of 9,000 euros and a 1,600-euro grant. After installing new technology, this household has been powered entirely by electricity from solar panels and it has no additional electricity costs. Annual energy savings are estimated at 4.65 MWh, and the expected payback period is 7-10 years (GEFF Serbia, 2022).

In 2022, the Đukanović household from Belgrade initiated the adaptation of its 250 m² house by investing in energy efficiency technologies. The goal of this investment was to reduce energy consumption, find sustainable energy solutions and improve comfort during the winter. They were granted two loans for energy efficiency in the total value of 31,000 euros and a 5,800-euro grant (GEFF Serbia, 2023). The funds were invested for a heat pump, underfloor heating, solar panels and energy-efficient windows. After the completed works, the house experienced a complete transformation - energy savings of 7.80 MWh/year were achieved, heating costs were reduced, comfort in the house was increased and CO₂ emissions were reduced by 3.60 t/year. Owing to these savings, it is estimated that the invested funds will be returned in 7 years (GEFF Serbia, 2023).

Table 1. Case studies of households that used loans for energy efficiency in Serbia

Investor	Location	Investment	Investment and grant value (euro)	Financial result (PBP)*	Energy savings (MWh/year)	Reduction of CO ₂ emissions (t/year)
Household Grubac	Belgrade	Biomass boiler	3,070 460	-	2.40	-
Household Stojković	Sremska Mitrovica	Thermal insulation, PVC windows	3,700 740	-	5.00	-
Household Radenović	Belgrade	Solar panels	9,000 1,600	7-10 years	4.65	-
Household Đukanović	Belgrade	Solar panels, heat pump, underfloor heating, PVC windows	31,000 5,800	7 years	7.80	3.60

Source: Illustrated by the author based on: GEFF Serbia, 2024a

Note: * payback period (years)

Bosnia and Herzegovina

The largest number of examples of successful practice of improving the energy efficiency of households was recorded in Bosnia and Herzegovina. Analysed studies of households that used energy-efficiency loans from the GEFF programme in the period from 2018 to 2020 included 6 households and 1 residential building (*Table 2.*).

In the household in Ustikolina, the owner Tešević renovated the family house where he spends his free time. After investing 5,700 euros in thermal insulation and a pellet boiler, this house was completely transformed into an energy efficient house that was warmer and more comfortable. To acquire these technologies, he used an energy-efficiency loan and received a 1,000-euro grant. Estimated annual energy savings are 6.00 MWh. Using a pellet boiler instead of a wood boiler contributed to the reduction of environmental pollution (GEFF Bosnia and Herzegovina, 2018c).

The Lalović family from East Sarajevo replaced a wood and coal boiler with a new pellet boiler using an energy-efficiency loan. They invested 1,360 euros in a

pellet boiler and they were granted 200 euros. The implemented changes made it possible to reduce energy consumption by about 1.06 MWh/year and to return the investment in 2 years. The introduction of more energy-efficient technology contributed to the reduction of CO₂ emissions by 0.41 t/year (GEFF Bosnia and Herzegovina, 2018).

With the aim of providing better thermal and sound insulation, the owner of the Kamarić home in Visoko replaced the wooden windows and doors from the 80s with PVC doors and PVC windows with three-layer glass. Using the energy-efficiency loan, he invested 2,711 euros in energy-efficient technology and received a 407-euro grant. Replaced carpentry made it possible to reduce energy consumption by 1.13 MWh/year and, thus, the financial savings. The visual appearance of the house, which was built in the 60s of the previous century was changed (GEFF Bosnia and Herzegovina, 2018a).

By investing 3,656 euros in a heat pump, the Božić household from Mostar improved the energy efficiency of their home, provided simpler and cheaper heating during the winter, and cooling during the summer. After investing in energy-efficient technologies, they received a 548-euro grant. The new heating method enabled them to save energy of 0.70 MWh/year and greater comfort in the household (GEFF Bosnia and Herzegovina, 2018b).

Using multiple measures to improve energy efficiency - installation of PVC windows and PVC doors, thermal insulation and the purchase of a pellet (biomass) boiler, the Maslić family from Šamac enabled faster and better heating of their living space, saving energy and creating better living conditions. (GEFF Bosnia and Herzegovina, 2019a). Investing in new and energy-efficient technologies was realized using an energy efficiency loan in the amount of 5,110 euros. The Maslić family received a 1,000 euro grant for this investment. The result of using the new technology is an energy saving of 3.60 MWh/year. As they replaced the use of coal with pellets and rationalized energy consumption, CO₂ emissions and environmental pollution were reduced (GEFF Bosnia and Herzegovina, 2019a).

With the aim of reducing heating costs, the home owner Omerović invested 3,650 euros in a pellet boiler. He secured the funds for this investment from an energy-efficiency loan, and after installing the boiler, he received a 530-euro grant. By replacing the wood boiler with a pellet boiler, this household achieved energy savings of 2.80 MWh/year, which was also accompanied by financial savings. In addition, environmental pollution was reduced due to the reduction of carbon dioxide emissions by 1.07 t/year (GEFF Bosnia and Herzegovina, 2019).

A multi-storey building in Sarajevo was renovated using an energy-efficiency loan. With the aim of improving energy efficiency, 34,000 euros were invested in thermal insulation and PVC windows. Building tenants received 11,000-euro

grant. New technologies influenced the reduction of energy consumption by 43.62 MWh/year and energy costs. Due to the improvement of energy efficiency, the CO₂ emission was reduced by 8.77 t/year (GEFF Bosnia and Herzegovina, 2020).

Table 2. Case studies of households that used loans for energy efficiency in Bosnia and Herzegovina

Investor	Location	Investment	Investment and grant value (euro)	Financial results (PBP or savings)*	Energy savings (MWh/year)	Reduction of CO ₂ emissions (t/year)
Household Tešević	Ustikolina	Thermal insulation, Pellet boiler	5,700 1,000	-	6.00	-
Household Lalović	East Sarajevo	Pellet boiler	1,360 200	2 years	1.06	0.41
Household Kamarić	Visoko	PVC windows and doors	2,711 407	-	1.13	-
Household Božić	Mostar	Heat pump	3,656 548	250 euro	0.70	-
Household Maslić	Šamac	PVC windows and doors, biomass boiler, thermal insulation	5,110 1,000	-	3.60	-
Household Omerović	Tuzla	Pellet boiler	3,650 530	-	2.80	1.07
Residential building	Sarajevo	Thermal insulation, PVC windows	34,000 near 11,000	-	43.62	8.77

Source: Illustrated by the author based on: GEFF Bosnia and Herzegovina, 2024

Note: * payback period (years) or savings (euro)

North Macedonia

Households use about 40% of the total electricity in North Macedonia (GEFF North Macedonia, 2020a). About 40% of greenhouse gas emissions come from energy-inefficient buildings (GEFF North Macedonia, 2020). The potential for saving energy in households, financial savings and reducing environmental pollution is great. The analysis of case studies in this country includes two households that used energy-efficiency loans and used them to finance several energy-efficient technologies (*Table 3.*).

The Janakievski Family from Skopje invested 19,500 euros in a heat pump, roof insulation and installation of new windows in a family house built in the 80s. They used an energy efficiency loan for the investment. The Janakievski household received a 3,900 grant after improving the energy efficiency of this household, the family achieved energy savings of 11.16 MWh/year. Energy-efficient technologies contributed to the reduction of CO₂ emissions by 2.55 t/year (GEFF North Macedonia, 2020a).

With the aim of building an energy-efficient house in the Popov household from Skopje, a heat pump was installed, insulation of the walls and roof was completed, and energy-efficient windows were installed.. The investment in these technologies in the amount of 41,800 euros was financed from the energy-efficiency loan. The value of the grant for this investment was 8,360 euros. The measures taken to improve energy efficiency for this household provided energy savings of 86 MWh/year, and a reduction in environmental pollution (GEFF North Macedonia, 2020).

Table 3. Case studies of households that used loans for energy efficiency in North Macedonia

Investor	Location	Investment	Investment and grant value (euro)	Financial results (PBP)*	Energy savings (MWh/year)	Reduction of CO ₂ emissions (t/year)
Household Janakievski	Skopje	Heat pump, roof insulation, windows	19,500 3,900	-	11.16	2.55
Household Popov	Skopje	Heat pump, insulation, windows	41,800 8,360	-	86.00	-

Source: Illustrated by the author based on: GEFF North Macedonia, 2024

Note: * payback period (years)

Analysis of household case studies in the Western Balkans countries showed that case studies of families living in capital cities are dominant (*Table 4.*). In Serbia, 75% of households are in the capital, while in North Macedonia it is 100%. In contrast, in Bosnia and Herzegovina there are case studies from different cities and they are equally represented territorially. The importance of taking measures to improve energy efficiency in large and capital cities is great because environmental pollution is the greatest there. Intensifying measures undertaken with the use of energy-efficiency loans and EU grants in these cities is necessary. On the other hand, examples of successful implementation of energy-efficiency measures and savings in smaller towns affect the development of people's awareness of living in different parts of the country about the benefits of using energy-efficient technologies, the possibilities and conditions of their financing from energy-efficiency loans and grants.

Table 4. Overview of study cases according of their geographical location in the observed countries

Households in capital cities				Households in other cities			
City	Household	Number	%	City	Household	Number	%
Belgrade	Grubac Rađenović Đukanović	3	75	Sremska Mitrovica	Stojković	1	14
Sarajevo	Residential building	1	17	East Sarajevo	Lalović	1	14
Skopje	Janakievski Popov	2	100	Ustokolina	Tešević	1	14
				Visoko	Kamarić	1	14
				Mostar	Božić	1	14
				Šamac	Maslić	1	14
				Tuzla	Omerović	1	14
Total		6	46	Total		7	54

Source: Illustrated by the author based on: GEFF Serbia, 2024a; GEFF Bosnia and Herzegovina, 2024; GEFF, North Macedonia, 2024

Various technologies were used to improve energy efficiency (*Table 5.*). The largest number of households changed the heating method - wood or coal boilers were replaced by biomass (pellet) boilers or a heat pump. In the observed countries, there were 9 households that used these technologies. The following technologies are related to the installation of PVC windows and doors and thermal insulation, which are also represented in all analysed countries. In 6 households

and 1 multi-storey residential building, old windows and doors were replaced with PVC windows and doors, and these technologies were used equally in households in all countries. Technologies related to the improvement of thermal insulation of walls and roofs were used in 5 households and 1 residential building. Solar panels were installed in just 2 households in Serbia. This technology was not dominant in the other case studies.

Loan for financing energy efficiency technologies in Serbia and North Macedonia was used only by households, while in Bosnia and Herzegovina this loan was used for adaptation in households and for the adaptation of 1 multi-storey residential building. Considering that the grant for investments in energy efficiency technologies is the highest for residential buildings, it can be concluded that the managers of residential buildings are not using these financial benefits yet.

Table 5. Overview of case studies according to the type of technology in the observed countries

Technology	Total	Number of households	Number of residential buildings	Country
Solar panels	2	2	-	Serbia
		-	-	Bosnia and Herzegovina
		-	-	North Macedonia
Thermal insulation	6	1	-	Serbia
		2	1	Bosnia and Herzegovina
		2	-	North Macedonia
PVC windows and doors	7	2	-	Serbia
		2	1	Bosnia and Herzegovina
		2	-	North Macedonia
Heat pumps, boilers, underfloor heating	9	2	-	Serbia
		5	-	Bosnia and Herzegovina
		2	-	North Macedonia

Source: Illustrated by the author based on: GEFF Serbia, 2024a; GEFF Bosnia and Herzegovina, 2024; GEFF, North Macedonia, 2024

By observing case studies according to the value of investments, it can be noticed that the largest investments were recorded by households in North Macedonia, which used several technologies to improve the energy efficiency of their homes (thermal insulation of walls and roofs, replacement of windows and doors and replacement of the heating method - installing heat pumps). This is followed by households from Serbia with installed solar panels and other energy-efficient technologies. The high value of the investment in Bosnia and Herzegovina was recorded only in the case study related to a multi-storey residential building (*Table 6.*).

The largest energy savings in the analysed case studies were achieved in North Macedonia, where several technologies were applied in each of the analysed households. The achieved savings are in the range of 11.16-86.00 MWh/year. Significant energy savings were also achieved in Bosnia and Herzegovina (43.62 MWh/year), where the building was adapted using several technologies to improve energy efficiency. Households in Serbia and Bosnia and Herzegovina achieved savings of up to 8 and 6 MWh/year, respectively. Despite the small values of individual household savings, the opportunities for household energy savings are high due to the number of households, especially in large cities.

Table 6. Overview of study cases according to the value of investment and energy saving in the observed countries

Indicators	Country		
	Serbia	Bosnia and Herzegovina	North Macedonia
Investment value (euro)	3,070-31,000	1,360-5,700 34,000*	19,500-41,800
Energy saving (MWh/year)	2.7-7.8	0.70-6.00 43.62*	11.16-86.00

Source: Illustrated by the author based on: GEFf Serbia, 2024a; GEFf Bosnia and Herzegovina, 2024; GEFf, North Macedonia, 2024

Note: * data for the residential building

Conclusion

Results of the case study analysis of households in Serbia, Bosnia and Herzegovina and North Macedonia showed that energy-efficiency loans and EU grants encouraged households to start investing in energy-efficient technologies. An increasing number of households use energy-efficiency loans and EU grants.

Investments in the aforementioned technologies allowed them to reduce energy consumption, while maintaining the usual temperature and increasing comfort.

Despite the lack of data on the financial effects of energy savings, it can be concluded that there are also significant financial savings in all households due to the reduction in energy consumption. Examples of successful investments in energy efficient technologies of these households and residential buildings can encourage other households and managers of residential buildings to use energy efficiency loans and EU grants to finance the high initial costs of introducing these technologies. Based on the available data of 1/3 of the analysed households on the reduction of carbon dioxide emissions, it can be concluded that there are benefits from improving household energy efficiency for the society as well. In support of this is the fact that in a large number of households the heating method has changed - wood and coal boilers were replaced by biomass (pellet) boilers.

By increasing the number of case studies on the successful implementation of energy-efficient technologies in households and the savings realized on this basis, a positive impact will be achieved on people's awareness about the need for investment in these technologies. Based on this, an increase in the number of households that invest in these technologies and use loan programs to improve the energy efficiency of their homes can be expected.

With the aim of popularizing the Green Economy Financing Facilities (GEFF) for the introduction of energy-efficient technologies in households and residential buildings in the Western Balkans, it is necessary to continuously publish and analyse case studies. In addition to financial support to households and managers of residential buildings, advisory support should be provided when determining the effects of financial savings of the measures taken and their impact on reducing environmental pollution. Furthermore, it is necessary to increase the number of case studies related to residential buildings and to stimulate the use of these loan lines for their adaptation, especially in large cities, where they are numerous and pollution is significant. A complete insight and assessment of the importance of the loan programme for energy efficiency that banks implement in cooperation with GEFF can be achieved if a database is created on the GEFF website about all households and residential buildings that used these loans to invest in energy efficiency technologies.

Considering the fact that the number of case studies in the analysed countries is still small, this research should be expanded after the publication of new case studies in the analysed countries of the Western Balkans or by increasing the number of countries using GEFF program.

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