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KLJUČNI INDIKATORI ZELENE TRANZICIJE: PRIMER SRBIJE

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„Zelena tranzicija predstavlja težak izazov za kreatore politika, jer su posledice neuspeha značajne, dok je put do uspeha tako složen.“

Christine Lagarde, Predsednica Evropske centralne banke

Govor „Ka uređenoj energetske tranziciji“, Pariz, 29. septembar 2023.

Rezime: Srbija, kao i skoro svaka druga zemlja na svetu, sprovodi strategiju zelene tranzicije kako bi stvorila nisko-karbonsku ekonomiju zasnovanu na ciljevima održivosti. Kao rezultat, uspostavljen je sistem koji će rasti i razvijati se principima zaštite životne sredine uz poštovanje društvenih i ekonomskih aspekata poslovanja. Cilj rada jeste procena ključnih indikatora zelene tranzicije na primeru Srbije. Konkretno, posmatraćemo indeks zelenog rasta, indikatore većeg korišćenja zelene energije i emitovanje zelenih finansijskih instrumenata. Ova tri indikatora su odabrana da pokažu napredak Srbije ka održivom razvoju i zelenoj tranziciji, što je ključno za primenu strategija prilagođavanja i ublažavanje efekata klimatskih promena. U pogledu metodologije, analiza Sarkodie et al. (2023) nam je poslužila za izradu zelenog indeksa na podacima za Srbiju. Uprava za javni dug Ministarstva objavljuje podatke o emitovanju zelenih finansijskih instrumenata, dok Elektroprivreda Srbije objavljuje podatke za analizu energetske tranzicije. Prema analizi, Srbija je ostvarila značajan napredak u pogledu analiziranih indikatora zelene tranzicije.

Ključne reči: zelena tranzicija, ključni indikatori, indeks zelenog rasta, tranzicija zelene energije, zeleni finansijski instrumenti.

JEL klasifikacija: O44, Q01, Q54, Q58

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Uvod

Republika Srbija, kao i većina drugih zemalja, primenjuje održive poslovne strategije i tehnologije kako bi podstakla ekonomski rast uz minimiziranje negativnih uticaja na životnu sredinu. Ključni indikatori, kao što su procenat obnovljivih izvora energije u ukupnoj proizvodnji električne energije, emisije gasova staklene bašte, upravljanje otpadom, indikatori biodiverziteta, ulaganja u zelenu tehnologiju i otvaranje zelenih radnih mesta, neophodni su za praćenje napretka u zelenoj tranziciji. Kako bi pratila zelenu tranziciju, svaka zemlja treba da izabere dovoljan skup ključnih indikatora koji su prilagođeni jedinstvenoj ekonomskoj strukturi date zemlje, ekološkim problemima i izvorima proizvodnje električne energije. U ovom radu, na primeru Srbije, analiziraćemo ključne indikatore zelene tranzicije. Konkretno, sagledaćemo indeks zelenog rasta, tranziciju ka većoj upotrebi zelene energije i emitovane zelene instrumente. Praćenje ovih indikatora pružiće nam temeljno razumevanje pristupa Srbije ka postizanju održivog razvoja, do sada postignutih rezultata i oblasti koje zahtevaju dalju pažnju.

Sledeća istraživačka pitanja (eng. *Research questions* – RQ) su zastupljena u ovom radu:

RQ 1: Koji je optimalni indeks zelenog rasta za Republiku Srbiju?

RQ 2: Koje inicijative je Republika Srbija preduzela za povećanje učešća obnovljivih izvora energije?

RQ 3: Koje zelene finansijske instrumente i pod kojim okolnostima je do sada emitovala Republika Srbija?

Ovaj rad je strukturiran na sledeći način: Nakon uvoda sledi pregled relevantne literature. Analiza metodologije istraživanja i prezentacija izvora podataka koji se koriste za analizu tranzicije zelene energije i emitovanih instrumenata zelenog finansiranja, kao i formiranje indeksa zelenog rasta Republike Srbije, primarne su teme drugog dela rada. U zaključku ćemo sumirati najvažnije nalaze rada.

Pregled literature

Zelena transformacija je postala jedan od glavnih pravaca budućeg razvoja na globalnom nivou i obuhvata razvoj zelene tehnologije i primenu propisa koji će omogućiti primenu ekološki prihvatljivih rešenja. Dakle, zelena transformacija podrazumeva ekonomski rast koji kombinuje zaštitu životne sredine sa očuvanjem životnog standarda za sadašnje i buduće generacije, kao i racionalno korišćenje raspoloživih prirodnih resursa (Cheba et al., 2022 i Acosta et al., 2020). Cilj postizanja zelene ekonomije je zaštita životne sredine i očuvanje interesa svih članova društva. Važni elementi te transformacije uključuju ekološku sertifikaciju, ekološku reviziju i druge aktivnosti (Vukovic et al., 2019). Za merenje napretka u postizanju zelene tranzicije neophodno je imati ključne indikatore koji će služiti za merenje napretka u postizanju ciljeva održivog rasta i razvoja. Prilikom izbora ključnih indikatora koje će svaka država pratiti, potrebno je uzeti u obzir karakteristike same privrede kako bi se razvila adekvatna metodologija za njihovo praćenje, zatim je potrebno izabrati one indikatore koji imaju visok stepen granularnosti, što je posebno važno kada je u pitanju izveštavanje o rezultatima i konačno je potrebno izvršiti adekvatno strukturiranje izveštaja i razviti neophodne standarde izveštavanja koji će omogućiti automatsko praćenje odabranih ključnih indikatora.

Postizanje zelene ekonomije jedan je od ključnih ciljeva formalno usvojenih na Konferenciji Ujedinjenih nacija o održivom razvoju održanoj u Rio de Žaneiru 2012. godine (Timonen et al., 2021). Razvoj u primeni koncepta održivosti i dostupnost novih podataka zahtevaju stalnu proveru seta indikatora koji će na najbolji način meriti nivo društvenog blagostanja (Rotondo et al., 2022). Na globalnom nivou, Ujedinjene nacije su u Agendi za održivi razvoj 2030 objavile ciljeve održivog razvoja za period 2016-2030, koji obuhvataju 17 ciljeva i 169 ciljeva za njihovu implementaciju. Time je na globalnom nivou uspostavljen set indikatora

koji odražavaju ideologiju održivog razvoja i stvaraju ravnotežu između društvenih, ekonomskih i prioriteta očuvanja životne sredine (Dahaeva i Amirova, 2023).

Važan doprinos analizi koncepta zaštite životne sredine, društvene odgovornosti i korporativnog upravljanja (eng. *Environmental, Social and Governance - ESG*) dale su međunarodne organizacije poput Organizacije za ekonomsku saradnju i razvoj i Ujedinjene nacije. Fokus analize u izveštaju „*ESG Investing: Environmental Pillar Scoring and Reporting*“ Organizacije za ekonomsku saradnju i razvoj je kako izmeriti uticaj u okviru dela E (eng. *Environmental*) koncepta ESG kako bi se na bolji način razumeli izlazni efekti kao što su emisije ugljen-dioksida, ali i negativan uticaj određenih ekonomskih aktivnosti na životnu sredinu. Time ova analiza može da koristi boljem razumevanju da li stub u okviru dela E (eng. *Environmental*) može da na adekvatan način pomogne tržištima i investitorima, koji poštuju koncept ESG ulaganja, kako bi povećali otpornost svog portfelja na prisustvo fizičkog rizika i na sprovođenje klimatske tranzicije. U izveštaju iz 2022. godine, pod nazivom „*ESG ratings and climate transition*“ Organizacija za ekonomsku saradnju i razvoj je ukazala na oblasti u kojima se može poboljšati deo E (eng. *Environmental*) koncepta ESG kako bi se ispunili ciljevi prelaska na nisko-karbonsku ekonomiju i time pružila podrška međunarodnim naporima u sprovođenju zelene tranzicije. Ovaj izveštaj posebno ukazuje na značaj efikasnog praćenja napretka u procesu tranzicije na nisko-karbonsku ekonomiju od strane svih tržišnih učesnika. U godišnjem izveštaju o globalnoj korporativnoj održivosti za 2024. godinu Organizacija za ekonomsku saradnju i razvoj ukazuje da značaj analize o primenjenim strategijama održivosti širom sveta. Analiza se bazira na prikazu principa korporativnog upravljanja, zatim obelodavanje podataka o održivosti, ali i ukazuje na neophodnost da postoji efikasan dijalog između svih zainteresovanih strana poput upravnog odbora i akcionara.

Ujedinjene Nacije su u izveštaju o ciljevima održivog razvoja za 2023. godine predstavile sveobuhvatan prikaz napretka ka postizanju 17 ciljeva održivog razvoja, čime su istakli uspehe, ali i izazove sa kojima se zemlje suočavaju u postizanju održivog razvoja. Kako bi se postigao napredak u postizanju ciljeva održivog razvoja Ujedinjene nacije su u Izveštaju o globalnom održivom razvoju za 2023. godinu istakle ključne transformacije koje je neophodno primeniti u različitim sektorima kroz struktuiran i sistemski pristup. Te ključne transformacije se odnose na ljudsko blagostanje, stvaranje održive i pravedne ekonomije, uspostavljanje sistema zdrave ishrane i primenu dekarbonizacije u proizvodnji energije. Navedeni izveštaji Ujedinjenih nacija ukazuju na posvećenost koju ova organizacije posvećuje unapređenju principa ESG na globalnom nivou, uz istovremeno uspostavljanje okvira da se postigne održivi razvoj.

Iz perspektive analize Evropske komisije (2009), ključni indikatori u oblasti primene ESG mogu se podeliti na opšte ESG, koji se odnose na oblasti o kojima sve kompanije treba da izveštavaju (kao što je energetska efikasnost) i specifični ESG, koji predstavljaju oblasti o kojima izveštavaju kompanije iz određene industrije (na primer skladištenje otpada u vezi sa industrijama kao što su proizvodnja gasa i hemikalija). ESG kriterijumi predstavljaju set standarda koje banke i drugi investitori razmatraju ukoliko imaju težnju da ulažu novac u ekološke i društveno korisne projekte (Petrović Tomić, 2023).

Franco et al. (2023) ističu važnost praćenja energetske indikatora u cilju praćenja energetske tranzicije i ukazuju na to da je neophodno okarakterisati energetska sastav svake pojedinačne industrije kako bi se kreirao energetska miks koji podržava zelenu tranziciju. Autori ukazuju da energetska efikasnost zavisi od mogućnosti korišćenja obnovljivih izvora energije, njihove dostupnosti i brzine implementacije. Prelazak na održivo društvo i neutralnost ugljenika od 2050. godine zahteva značajno korišćenje obnovljivih izvora energije, što značajno utiče na stabilnost postojeće energetske mreže (Airò Farulla et al., 2021). Ryszawska (2014) u svojoj analizi ukazuje na značaj praćenja globalnog indeksa zelene ekonomije, koji predstavlja

sinte- tički pristup za praćenje stepena ostvarenosti zelene ekonomije na globalnom nivou. Ovaj indeks se bazira na četiri dimenzije: liderstvo, koje ima ponder od 15%, politika (ponder 35%), investicije u čiste tehnologije (ponder 35%) i održivi turizam (ponder 15%). Time su ovim indeksom definisani prioriteti za sprovođenje debate na globalnom nivou o ostvarivanju ciljeva zelene ekonomije u smislu veće zastupljenosti obnovljivih izvora energije, ulaganja u čiste tehnologije i većeg učešća nacionalnih privreda u međunarodnim inicijativama koji podržavaju zelenu tranziciju. Neophodno je da se, pored indikatora koji prate promene u životnoj sredini (kao što su praćenje prosečne temperature, emisija staklene bašte, degradacije zemljišta), posmatraju i prate indikatori van životne sredine koji će omogućiti zajednicama, regionima i čitavim državama da postanu socijalno i ekološki održiva društva. S tim u vezi, Barry i Hoyne (2021) predlažu da se uz ekološke indikatore pažljivo analiziraju i ekonomski indikatori (kao što su eko-inovacije i finansiranje razvojnih projekata) i socijalno-kulturni indikatori (kao što su percepcija rizika i obrazovanje). U narednom delu rada predstavimo metodologiju istraživanja odabranih ključnih indikatora zelene tranzicije na primeru Srbije.

Metodologija istraživanja

Metodologija istraživanja korišćena u ovom radu kombinuje sveobuhvatan pregled literature, prikazan u prethodnom delu rada, uz analizu indeksa zelenog rasta za Republiku Srbiju. Pored navedenog, za analizu energetske tranzicije u Srbiji korišćeni su podaci Elektroprivrede Srbije, Ministarstva energetike i Digitalnog atlasa klime Srbije, dok su u slučaju analize emitovanih zelenih finansijskih instrumenata, korišćeni podatci Uprave za javni dug, Ministarstva finansija Republike Srbije.

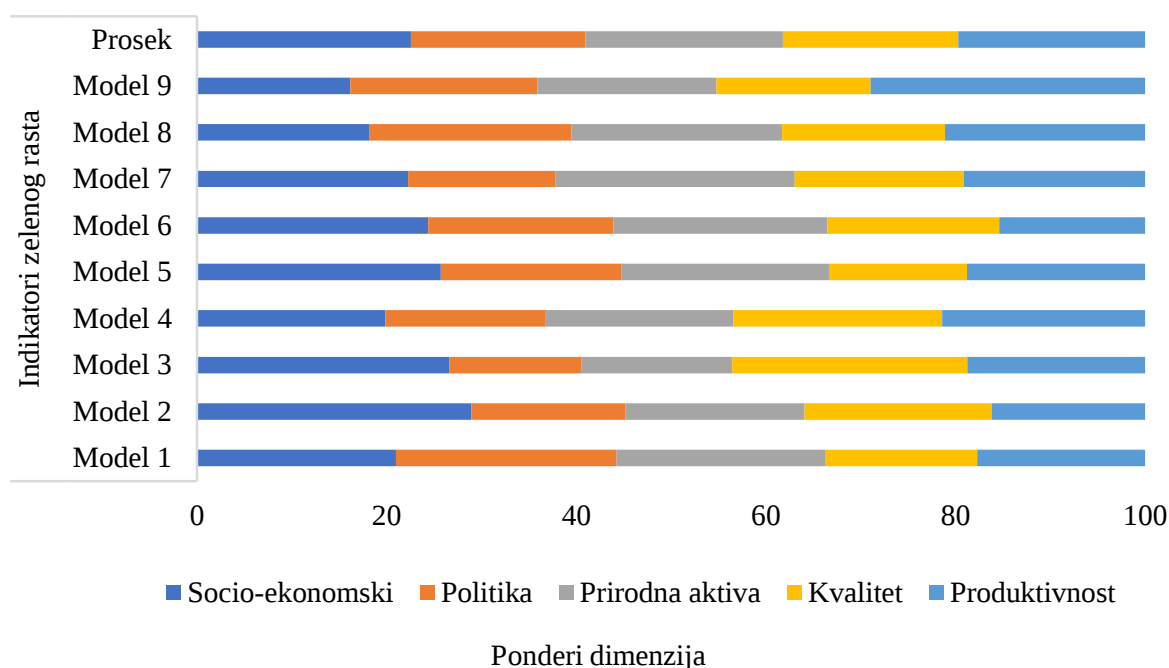
U kreiranju zelenog indeksa koristimo pristup koji su razvili Sarkodie et al. (2023) u cilju izračunavanja vrednosti indeksa zelenog rasta na podacima za Srbiju. Prema pomenutim autorima, zeleni rast obuhvata pet dimenzija:

- (1) Baza prirodnih dobara koja obuhvata podatke o vodnim, zemljišnim, šumskim i životinjskim resursima, kao i podatke o atmosferi i klimi;
- (2) Politika, koja uključuje podatke o patentima, razvojnoj pomoći, međunarodnim finansijskim tokovima, tehnologiji i inovacijama, ekološkim porezima i transferima, kao i propisima i upravljanju;
- (3) Socio-ekonomski, koji obuhvata podatke iz socijalne i ekonomske dimenzije;
- (4) Kvalitet života koji obuhvata podatke o pristupu vodi za piće i izloženosti riziku od uništavanja životne sredine i
- (5) Produktivnost, koja obuhvata podatke o produktivnosti korišćenja ugljen-dioksida, energetske produktivnosti, produktivnosti neenergetskih materijala i ekološkoj produktivnosti.

Ovaj izbor pet dimenzija za kreiranje indeksa zelenog rasta u skladu je sa analizom Organizacije za ekonomsku saradnju i razvoj iz 2014. godine, koja je konstatovala da je za formiranje tih pet dimenzija potrebno 25 do 30 indikatora. Ova analiza ukazuje da predložene dimenzije indikatora nisu konačne i da ovaj predlog daje jasan signal da se radi o fleksibilnom pristupu koji zemlje mogu prilagoditi svojim karakteristikama. Indeks zelenog rasta u analizi Sarkodie et al. (2023) zasniva se na kreiranju sumarnog indeksa primenom metode generalizovanih najmanjih kvadrata, pri čemu se izračunavanje indeksa zasniva na primeni ponderisanja pet dimenzija podataka – Grafikon 1. Pored navedenog pristupa, prema Institutu za globalni zeleni rast, indeks zelenog rasta može se izračunati korišćenjem podataka iz četiri dimenzije iz kojih se može generisati 36 indikatora: (1) efikasno i održivo korišćenje resursa; (2) zaštita prirodnog kapitala; (3) zelene ekonomske mogućnosti i (4) socijalna uključenost.

Na osnovu Grafikona 1, može se videti da je moguće izračunati deset modela indeksa zelenog rasta koji se međusobno razlikuju na osnovu korišćenih pondera. Modeli se međusobno razlikuju po tome koja od pet dimenzija podataka se koristi za izračunavanje, odnosno promena predznaka znači da se dimenzija podataka kreće u suprotnom smeru. Unutar modela 1, suprotan predznak se koristi za bazu prirodnih dobara, ekološku produktivnost i kvalitet životne sredine, za model 2 se ne koristi suprotan znak, za model 3 suprotan znak se koristi za ekološku produktivnost, za model 4 suprotan znak se koristi za kvalitet životne sredine, za model 5 za bazu prirodnih dobara, za model 6 za ekološku produktivnost i kvalitet, za model 7 za ekološku produktivnost i bazu prirodnih dobara, za model 8 za kvalitet životne sredine i bazu prirodnih dobara, za model 9 za odgovor politike, socio-ekonomiju, kvalitet životne sredine, bazu prirodnih dobara i ekološku produktivnost. Model 10 označava prosek pondera korišćenih u proračunu modela 1-9.

Grafikon 1 - Ponderi koji se koriste za konstruisanje indikatora zelenog rasta



Izvor: Sarkodie et al. (2023)

Prilikom izračunavanja indeksa zelenog rasta, prvi korak je izvor varijabli, da bi se zatim izvršila njihova klasifikacija, tretman nedostajućih podataka, podešavanje predznaka za svaku varijablu (gde je to moguće), postavljanje pondera za svaku dimenziju podataka i izračunavanje indeksa.

Za podatke koji nedostaju se dodeljuje fiksna vrednost nula. Ovo dodeljuje niži ponder dimenzijama podataka kojima nedostaju vrednosti. Indeks zelenog rasta izračunava se na osnovu sledeće formule:

$$\hat{s}_{i,j} = \frac{1}{W_{i,j}} \sum_{k \in K_{i,j}} w_{j,k} \frac{y_{i,j,k} - \hat{y}_{j,k}}{\sigma_{j,k}} \quad (1)$$

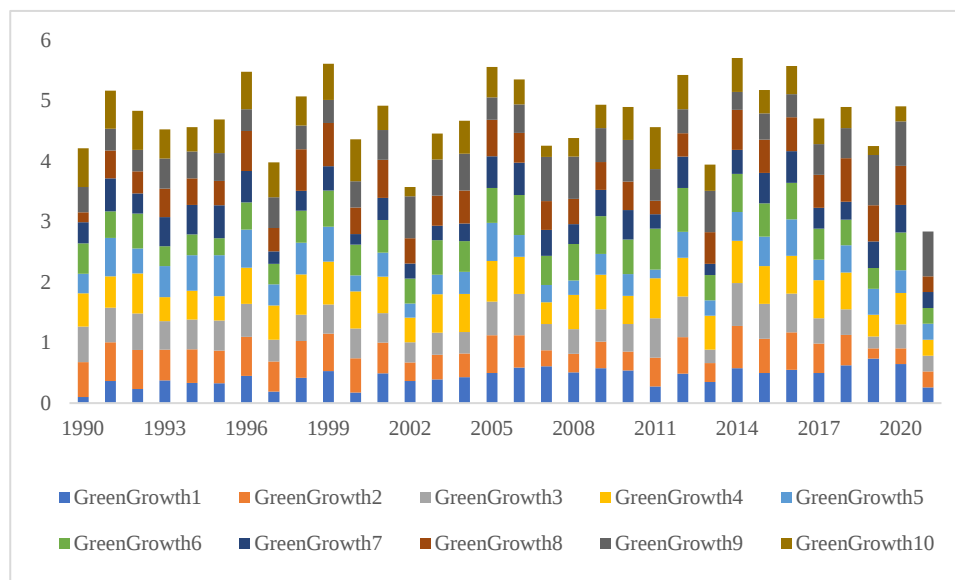
U pomenutoj formuli, $\hat{s}_{i,j}$ predstavlja konstruisani zeleni indeks rasta, dok $w_{i,j}$ i $w_{j,k}$ predstavljaju primenjene pondere, a $(y_{i,j,k} - \hat{y}_{j,k})/\sigma_{j,k}$ predstavlja normalizovani rezultat zasnovan na inverznoj matrici kovarijanse koja je predstavljena sa $\sum_j y_{i,j,k}$. Indeks zelenog rasta podrazumeva kombinovanje više varijabli u kategorije, a zatim nekoliko kategorija u dimenzije i na kraju konstrukciju indikatora zelenog rasta. U narednom delu rada predstavimo rezultate odabranih ključnih indikatora zelene tranzicije na primeru Srbije.

Indeks zelenog rasta

Da bi se rezultati dobijeni o indeksu zelenog rasta analizirali na podacima za Srbiju, potrebno je definisati šta zapravo predstavlja zeleni rast. Sam koncept zelenog rasta je relativno nov koncept sa nizom različitih definicija i bez dobro uspostavljenih metrika za njegovo praćenje. Prema Lyytimäki et al. (2017) zeleni rast je definisan kao proces tranzicije ka postizanju niskougljeničnog društva i društva u kojem će se resursi koristiti na najefikasniji način uz istovremeno postizanje ekonomskog razvoja koji će osigurati ljudsko blagostanje, socijalnu pravdu i očuvanje životne sredine. Sprovođenje ove tranzicije omogućiće dalje povećanje društvenog bogatstva i blagostanja, uz očuvanje vrednosti proizvoda, materijala i resursa u cilju racionalnog korišćenja postojećih resursa. Dakle, cilj politika zelenog rasta je da istovremeno ublaže posledice klimatskih promena uz postizanje održivog ekonomskog rasta (Herman et al., 2023).

Na osnovu prethodno analizirane metodologije za kreiranje indeksa zelenog rasta, prikazani su podaci od 1990. do 2021. godine (poslednji dostupni podaci) za izračunavanje svih deset modela indeksa zelenog rasta na osnovu podataka za Srbiju – Grafikon 2. Kada je u pitanju tumačenje postignute vrednosti modela indeksa zelenog rasta, vrednost 0 se odnosi na niske zelene performanse, dok se vrednost 1 odnosi na visoke zelene performanse. Najveća vrednost indeksa zelenog rasta Srbije u celom analiziranom periodu za sve modele ostvarena je u okviru modela 9 u 2019. godini, kada je vrednost indeksa iznosila 0,83. Te godine, u okviru modela 9, najveći doprinos je dala dimenzija produktivnosti, u kojoj je najveći doprinos dala produktivnost neenergetskih materijala. Kada je reč o najnižoj postignutoj vrednosti, indeks zelenog rasta je 1990. godine u modelu 1 dostigao 0,10. Najoptimalniji model indeksa zelenog rasta je broj dva, u okviru kojeg se ponder od 28,95% odnosi na socio-ekonomsku dimenziju, ponder od 19,74% se odnosi na kvalitet, ponder od 18,87% se odnosi na bazu prirodnih dobara, ponder od 16,25% se odnosi na odgovor politike, a ponder od 16,18% na produktivnost. Na osnovu prikazanih podataka o kretanju indeksa zelenog rasta, može se zaključiti da Republika Srbija ima prosečan nivo zelenog razvoja, imajući u vidu da je prosečna vrednost svih modela u celom analiziranom periodu 0,47. Dobijeni rezultati ukazuju da je neophodno da Republika Srbija nastavi sa promocijom zelenih transformacija kako bi se u narednom periodu ostvario visok nivo zelene tranzicije.

Grafikon 2 - Indeksi zelenog rasta za Srbiju



Izvor: prikaz autora prema

https://figshare.com/articles/dataset/Comprehensive_green_growth_indicators_across_countries_and_territories/22291069

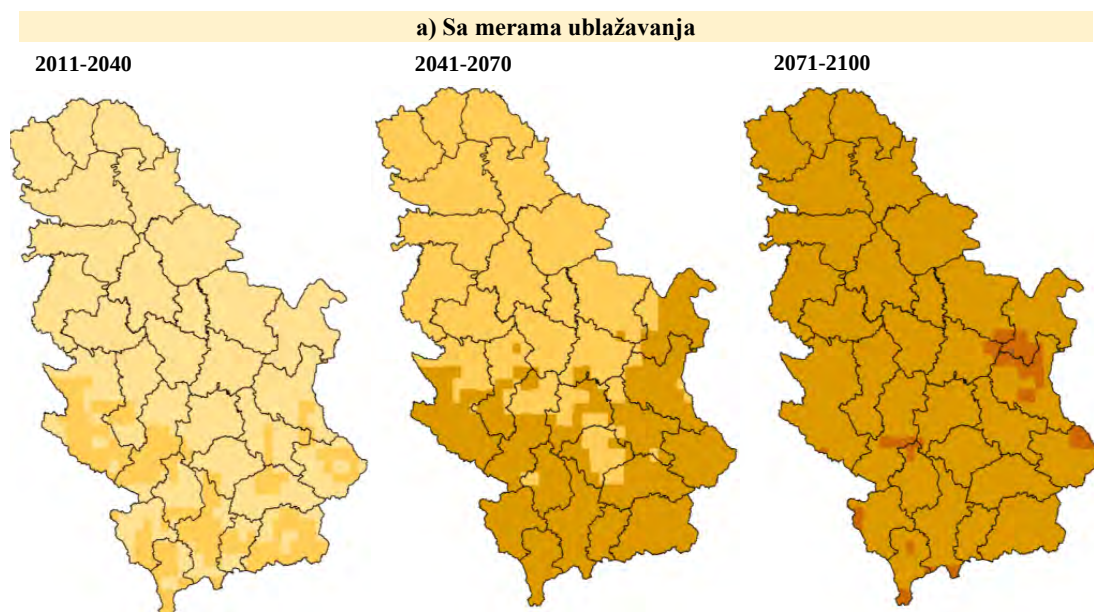
Tranzicija ka zelenoj energiji

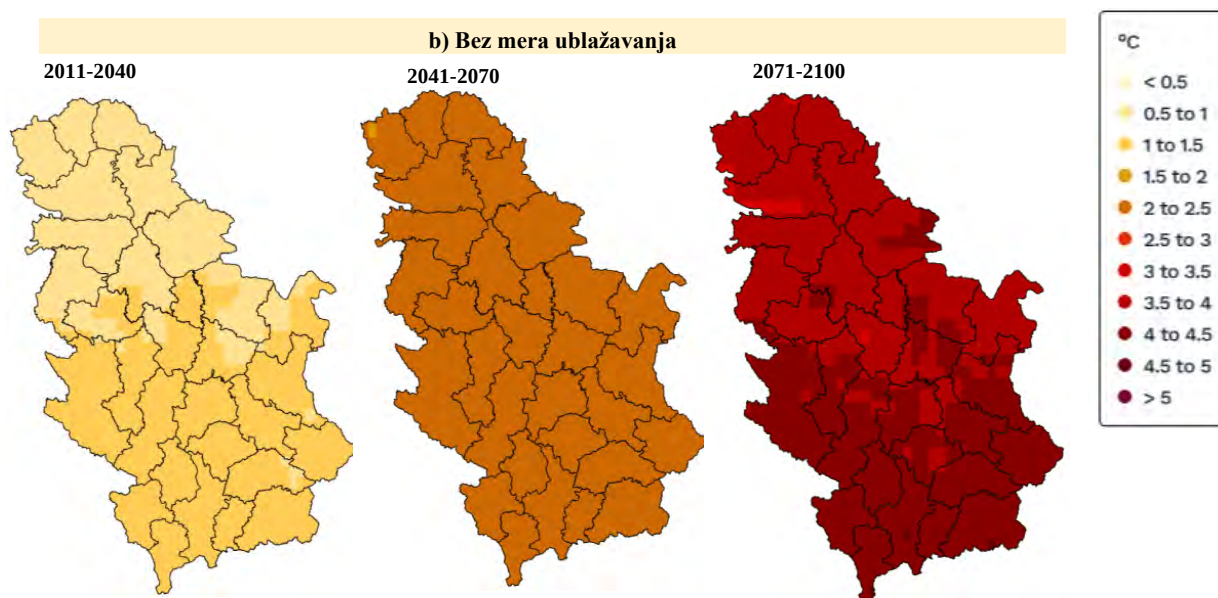
Energetska tranzicija predstavlja jedan od najvećih izazova današnjice, imajući u vidu da njena implementacija predstavlja promenu u snabdevanju i potrošnji energije u nacionalnom energetsom sistemu. Dakle, energetska tranzicija predstavlja prelazak na održive izvore energije u cilju ublažavanja negativnog uticaja klimatskih promena. Cilj energetske tranzicije je smanjenje emisije gasova staklene bašte kako bi se smanjio udeo proizvodnje električne energije iz fosilnih goriva.

U cilju sprovođenja politike klimatske neutralnosti i dekarbonizacije do 2050. godine, kao i ostvarivanja puta ka energetskej tranziciji, Republika Srbija je ratifikovala i potpisala niz međunarodnih akata. Srbija je ratifikacijom Pariskog sporazuma u okviru Ujedinjenih nacija o klimatskim promenama iz 2015. godine preuzela obavezu smanjenja emisije gasova staklene bašte i prihvatila potrebu sprovođenja mera i aktivnosti koje vode ka prilagođavanju na promenjene klimatske uslove, dok je potpisivanjem Ugovora o klimatskim promenama Energetske zajednice i Sofijske deklaracije o Zelenoj agendi za Zapadni Balkan, preuzela obaveze izrade Integrisanog nacionalnog i klimatskog plana. U programu prilagođavanja na izmenjene klimatske uslove za period od 2023. do 2030. godine, Ministarstvo zaštite životne sredine Republike Srbije ističe da se zemlja zagreva brže i više od svetskog proseka. Na globalnom nivou porast srednje temperature iznosi 1,1°C, dok je u Srbiji 1,8°C, a leti je čak i iznad tog nivoa (2,6°C). Pored toga, Srbija je u periodu od 2000. do 2020. godine zabeležila gubitke od čak 6,8 milijardi evra kao rezultat značajnih promena vremenskih uslova i ekstremnih klimatskih uslova.

Od navedenog iznosa, više od 70% se odnosi na štete izazvane visokim temperaturama i sušom, dok su drugi glavni uzrok poplave koje su bile posebno razorne u 2014. godini. Prema podacima Republičkog hidrometeorološkog zavoda Srbije, leto 2024. godine je bilo najtoplije za period meteoroloških merenja od 1951. do 2024. godine, dok su sva tri letnja meseca - jun, jul i avgust - takođe bila najtoplija od 1951. godine. Tople zime u poslednjih nekoliko godina idu u prilog manjoj potrošnji električne energije, ali ekstremno topla leta dovode do veće potrošnje električne energije tokom letnje sezone, a dodatno utiču na manju proizvodnju iz hidroloških izvora usled malih padavina. Ukoliko se ne preduzmu značajne promene u energetsom sistemu Srbije i pređe na obnovljive izvore energije, Republika Srbija bi u narednom periodu mogla da zabeleži značajan porast potrošnje električne energije. Na osnovu interaktivne mape, koju je izradio Digitalni atlas klime Srbije, može se videti da se od Republike Srbije očekuje porast temperature u narednom periodu, posebno ukoliko ne sprovede mere za ublažavanje posledica klimatskih promena, uključujući i prelazak na obnovljive izvore energije. Na Grafikonu 3 prikazane su projekcije srednje dnevne temperature za celu teritoriju Republike Srbije za tri projekciona perioda: 2011-2040, 2041-2070 i 2071-2100. Za prikaz projekcija srednje dnevne temperature u slučaju primene mera za ublažavanje klimatskih promena korišćen je scenario Reprezentativnih puteva koncentracije (eng. Representative Concentration Pathways - RCP) 4.5, koji se zasniva na projekciji da će se emisija gasova staklene bašte stabilizovati na 4,5 W/m² do 2100. U slučaju projekcija ukoliko se ne sprovedu mere za ublažavanje klimatskih promena, korišćen je scenario RCP 8.5, koji podrazumeva da će nivo ugljen-dioksida porasti na 936 delova na milion do 2100. godine, što bi povećalo globalnu temperaturu za oko 5-6°C do 2100. Ovaj vizuelni prikaz projektovane prosečne dnevne temperature može najbolje da ilustruje važnost implementacije tranzicije energije.

Grafikon 3 - Buduća klimatska projekcija srednje dnevne temperature za Srbiju - referentni period 1971-2000





Izvor: prikaz autora prema <https://atlas-klime.eko.gov.rs/eng/map?dataType=obs&visualization=pro&area=regions>

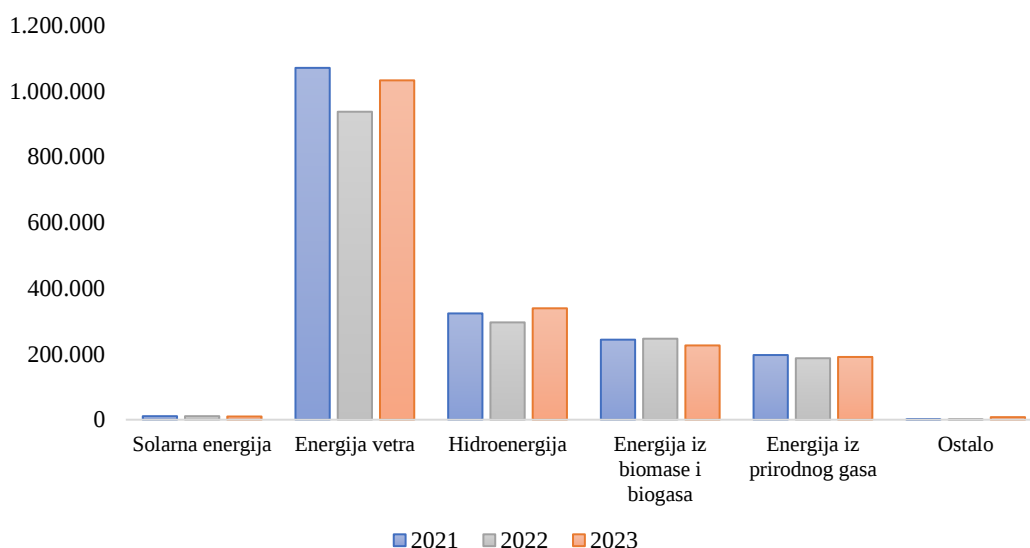
Značajno povećanje letnjih temperatura dovodi do značajne potrošnje električne energije, koja se u Republici Srbiji najvećim delom proizvodi u termoelektranama (oko 70%), dok se 30% dobija iz 16 hidroelektrana. U termoelektranama se najviše koristi ugalj iz površinskih kopova, najviše lignit. Prikazani podaci ukazuju da se većina električne energije u Srbiji proizvodi iz fosilnih goriva.

Prema projekcijama Strategije razvoja energetike Republike Srbije do 2025. godine sa projekcijama do 2030. godine, koja je usvojena početkom decembra 2015. godine, ukupan potencijal obnovljivih izvora energije u našoj zemlji iznosi 5,65 miliona tona naftnih ekvivalenata po godini. Radi regulisanja pitanja vezanih za obnovljive izvore energije, njihovo učešće u bruto finalnoj potrošnji energije, kao i integraciju energije iz obnovljivih izvora za tržište, Republika Srbija je u aprilu 2021. godine donela Zakon o korišćenju obnovljivih izvora energije. Nakon dve godine, u aprilu 2023. godine, usvojen je Zakon o izmenama i dopunama Zakona o korišćenju obnovljivih izvora energije, koji je stupio na snagu početkom maja 2023. godine. Ovim izmenama i dopunama Zakona utvrđena je integracija obnovljivih izvora energije u elektroenergetski sistem sa nastojanjem da se obezbedi bezbedan rad sistema.

Najveći proizvođač električne energije u Srbiji je Elektroprivreda Srbija, čiji je cilj postepeno povećanje kapaciteta iz obnovljivih izvora energije uz istovremeno postizanje karbonske neutralnosti i sprovođenje mera zaštite životne sredine. Prema podacima Elektroprivrede Srbije, u 2023. godini iz obnovljivih izvora energije proizvedeno je 1.806.631,76 MWh električne energije.

U obnovljivim izvorima energije najveće učešće ima energija vetra sa učešćem od 57,2% u 2023. godini, zatim hidroenergija (18,8%) i energija iz biomase i biogasa (12,5%) – Grafikon 4. U narednom periodu cilj Elektroprivrede Srbije ostaje da nastavi da ulaže u životnu sredinu, kao i da sprovodi razvojne planove koji se odnose na povećanje udela obnovljivih izvora energije. Do 2030. godine cilj je da Elektroprivreda Srbije investira oko 3,5 milijardi evra u nove obnovljive izvore, pre svega u hidroenergiju i solarnu energiju, što će u tom periodu predstavljati oko 37 odsto ukupnih investicija kompanije. Ukoliko se uključe ulaganja u nove hidroelektrane, ukupna ulaganja u obnovljive izvore energije Elektroprivrede Srbije do 2030. godine iznosiće oko 5,4 milijarde evra, odnosno više od polovine ukupnih investicija.

Grafikon 4 - Proizvodnja električne energije iz obnovljivih izvora u Srbiji (u MWh)



Izvor: prikaz autora prema <https://www.eps.rs/cir/Pages/tehnicki-izvestaji.aspx>

Veliki doprinos povećanju udela obnovljivih izvora energije dalo je Ministarstvo rudarstva i energetike, koje je do sada raspisalo dve aukcije za dobijanje ponuda za obnovljive izvore energije. Cilj je da se kroz sistem podsticaja obezbedi 1.300 MW iz zelene energije za period od tri godine (2023-2025). Prva aukcija održana je sredinom avgusta 2023. godine, na kojoj se prijavilo 16 investitora za ukupnu elektranu od 816,48 MW, od čega je za popunjavanje kvote ponuđeno 602,8 MW, dok je procenjena vrednost ulaganja svih elektrana 1,26 milijardi evra. Od ukupnog broja registrovanih investitora, 11 učesnika se kvalifikovalo za fazu nadmetanja. U postupku aukcije za vetroelektrane kvotu su popunila četiri investitora, dok su na aukciji za solarne elektrane kvotu popunila tri. Najniža ponuđena cena bila je 64,48 evra po megavat-satu (EUR/MWh) za vetroelektrane ili 88,65 evra po megavat-satu za solarne elektrane. U februaru 2024. godine Ministarstvo rudarstva i energetike najavilo je da će do kraja 2024. godine organizovati drugi krug aukcija za novi kapacitet od 400 MW iz obnovljivih izvora energije. Krajem novembra 2024. godine Ministarstvo rudarstva i energetike je objavilo drugi krug aukcija za dodelu tržišnih premija za obnovljive izvore energije, na kojima će se investitori nadmetati

za raspodelu kvota od ukupno 424,8 MW (300 megavata predviđeno je za vetroelektrane, a 124,8 MW za solarne elektrane). Rok za podnošenje prijave za učestvovanje na drugoj aukciji ističe 5. februara 2025. godine.

Pored aukcija za dodelu tržišnih premija za obnovljive izvore energije, potpisano je nekoliko važnih ugovora za povećanje učešća obnovljivih izvora energije. Početkom jula 2024. godine potpisani su ugovori i sporazumi kojima je zaokruženo finansiranje za realizaciju novog programa sa Evropskom bankom za obnovu i razvoj u vrednosti od 40,5 miliona evra, kojim se obnovljivi izvori energije uvode u 10 toplana u Srbiji. Evropska banka za obnovu i razvoj kreirala je program Green Economy Financing Facility (GEFF) koji podržava zelene investicije u Srbiji i sprovodi se u okviru Regionalnog programa energetske efikasnosti za Zapadni Balkan (eng. Regional Energy Efficiency Program for the Western Balkans - REEP Plus). Sredinom oktobra 2024. godine potpisan je ugovor za realizaciju projekta izgradnje samobalansiranih solarnih elektrana u Srbiji, koje će obezbediti 1 GW novoinstalisane snage preko solarnih panela. Očekuje se da će prvi kapaciteti biti uključeni već 2027. godine, a ceo projekat, odnosno najveće solarne elektrane, biće završen sredinom 2028. godine. Važno je istaći podršku građanima da zamene dotrajalu stolariju, fasade, izolacije, neefikasne kotlove, ali i da ugrade solarne kolektore i panele za proizvodnju električne energije za sopstvene potrebe. U uslovima energetske krize, veća energetska efikasnost u domaćinstvima postaje sve važnija tema, kako za kućne budžete, tako i za zaštitu životne sredine. Za subvencije koje u zavisnosti od paketa mera mogu da idu i do 65 odsto vrednosti investicije. Primena mera energetske efikasnosti donosi mnoge prednosti, kao što su ušteda novca, povećanje udobnosti življenja i povećanje vrednosti imovine u kojoj živite.

Zeleni finansijski instrumenti

Kretanje važnih makroekonomskih indikatora je nesumnjivo pod uticajem globalnog zagrevanja i njegovih efekata na klimatske promene, što primorava kreatore ekonomske politike da sprovedu proces zelene transformacije. Da bi se to postiglo, moraju se razviti zeleni finansijski instrumenti koji uzimaju u obzir društvene faktore i faktore životne sredine prilikom donošenja investicionih odluka. Ovo će podstaći više ulaganja u ekološki održivo poslovanje. Zelene finansije igraju značajnu ulogu u finansiranju inicijativa koje imaju za cilj unapređenje opšteg blagostanja privrede i društva, kao i postizanje globalnih ciljeva zacrtanih u strateškim programima kao što su Evropski zeleni dogovor i Agenda za održivi razvoj do 2030. godine, od kojih oba imaju kao primarni cilj smanjenje emisije gasova staklene bašte. Stoga, postizanje ciljeva zelene ekonomije predstavlja izazov i šansu za finansijski sektor da stvori održivo finansiranje. Održivo finansiranje se može posmatrati kroz široki spektar aktivnosti: od digitalizacije aktivnosti banaka, smanjenja nivoa ugljenika u njihovim svakodnevnim aktivnostima, do ponude održivih finansijskih proizvoda (Sredojević and Sredojević, 2021). Značajnu ulogu u razvoju zelenih finansijskih instrumenata pored poslovnih banaka imaju i centralne banke koje su u poslednjih nekoliko godina izložene novim izazovima i zadacima sa kojima je potrebno da se suoče. Jedan od tih izazova predstavljaju klimatske promene, koje direktno utiču na glavne ciljeve centralne banke, a to je postizanje i održavanje cenovne i finansijske stabilnosti (Martin, 2022).

Emitovanje zelenih finansijskih instrumenata ubrzano raste u poslednjih nekoliko godina, a očekuje se veći rast u bliskoj budućnosti. To se odnosi na finansiranje preduzeća, projekata i drugih poduhvata koji pomažu u postizanju održivog, pravičnog rasta, jer direktno unapređuje ciljeve održivog razvoja. U tom svetlu, trend „ozelenjavanja“ finansija postaje sve značajniji, zahvaljujući rastućem interesovanju javnosti za očuvanje i zaštitu životne sredine, kao i povećanom protoku informacija, uglavnom putem medija. To je trend koji je nastao iz potrebe da se profit preoblikuje kao primarni cilj i umesto toga uokviren kao uspostavljanje ravnoteže između profita i očuvanja životne sredine. Zeleni razvoj je globalni pokret koji guraju najmoćnije međunarodne organizacije i jedan je od glavnih prioriteta.

Bankarski sektor u Srbiji se sve više uključuje u ovu oblast i razume prednosti finansiranja ekološki prihvatljivih inicijativa. Do sada su se krediti najvećim delom odobravali za razvoj vetroelektrana, reciklažu, solarnu energiju, prečišćavanje vode i projekte u energetske sektoru sa ciljem smanjenja emisije CO₂. Sve su popularniji krediti za kupovinu električnih vozila, zeleni poljoprivredni investicioni krediti, krediti za projekte visoke energetske efikasnosti, investicioni krediti u oblasti obnovljivih izvora energije. Banka podstiče pojedince ili privredne subjekte da donose odluke koje su prihvatljive za životnu sredinu postavljanjem uslova kreditiranja, koje uključuju kamatnu stopu, iznos kolateralu i druge prednosti ili komponente kredita. Smanjenjem finansijskih zahteva i ograničenja, posebno za projekte koji ne štete životnoj sredini, utvrđeni su prioriteti finansiranja.

Postizanje održivog privrednog rasta i unapređenje održivog finansiranja na globalnom finansijskom tržištu su prioriteti za Republiku Srbiju. Zajedno sa kontinuiranim rastom tradicionalnih finansijskih instrumenata, napreduju i održivi finansijski instrumenti (Martin, 2023). Republika Srbija je do danas izdala dva održiva finansijska instrumenta: zelenu obveznicu u septembru 2021. i održivu obveznicu u junu 2024. godine. Republika Srbija je prvi put u svojoj istoriji emitovala zelenu evroobveznicu od 1,0 milijardi evra sredinom septembra 2021. godine. Obveznica ima rok dospeća od sedam godina, stopu prinosa od 1,26% i najnižu stopu kupona ikada zabeleženu - 1,00%. Republika Srbija je postala jedna od retkih zemalja u Evropi - i jedina koja nije deo Evropske unije - kada je prvi put izdala zeleni instrument. Prilikom izdavanja zelenih obveznica poštovani su principi zelenih obveznica Međunarodnog udruženja tržišta kapitala, a objavljivanje Okvira zelenih obveznica Republike Srbije u septembru 2021. godine regulisalo je korišćenje prikupljenih sredstava. U junu 2022. godine, Republika Srbija je dobila nagradu „Pionir suverenog zelenog tržišta u 2021“ od Climate Bond Initiative, demonstrirajući ekološku svest naše zemlje.

Republika Srbija je početkom juna 2024. godine uspešno emitovala održive dolarske evroobveznice na svetskom finansijskom tržištu. Prihod od prodaje obveznica biće namenjen finansiranju ekološki osvešćenih projekata i društveno svesnih poduhvata. Ukupna vrednost prodatih hartija od vrednosti bila je 1,5 milijardi dolara, ali je tokom dana potražnja investitora bila daleko veća i premašila je 6,5 milijardi dolara. Kao i kod drugih emisija evroobveznica u dolarima, Republika Srbija je takođe zaključila ugovore o hedžingu kako bi smanjila kamatnu stopu javnog duga i devizni rizik i pokazala odgovornost za njegovu održivost. Kroz ove transakcije, primenjen je unakrsni međuvalutni svop po osnovu kojeg je došlo do zamene obaveze po osnovu izdavanja dolarskih evroobveznica u obaveze u evrima. Republika Srbija je ovu hedžing transakciju zaključila sa Deutsche Bank AG, Bank of America, BNP Paribas i MUFG Securities (Europe) N.V. Ovo je smanjilo stvarni trošak zaduživanja Republike Srbije na 4,75%, uz smanjenje izloženosti deviznom riziku kretanja dolara u odnosu na evro. U izdavanju obe ponude zelenih obveznica praćeni su Okvir održivog finansiranja Republike Srbije i Drugo partijsko mišljenje (eng. Second Party Opinion - SPO) o okviru održivog finansiranja, koje je izradila Uprava za javni dug, Ministarstvo finansija. Ovi dokumenti pokazuju posvećenost Republike Srbije postizanju ciljeva agende održivog razvoja u cilju stvaranja održive budućnosti za generacije koje dolaze. Ovo daje utemeljenje za sprovođenje nacionalne dekarbonizacije i očuvanje životne sredine.

Zaključak

Cilj zelene tranzicije je razvoj i implementacija zelenih i održivih rešenja u cilju očuvanja životne sredine. Danas su klimatske promene globalna pretnja koja zahteva hitnu akciju kako bi se otklonile posledice ovih promena. Ovo daje mogućnost, u zavisnosti od primenjenih mera, da se stvori resursno

efikasna, moderna i konkurentna ekonomija zasnovana na primeni zelene tehnologije i održivih poslovnih rešenja. Pretvaranje klimatskih i ekoloških izazova u prilike učiniće tranziciju pravednom i inkluzivnom za sve. Srbija, kao kandidat za članstvo u Uniji, ide u korak sa zahtevima, donoseći planove, mere i aktivnosti u oblasti zelene tranzicije.

U cilju praćenja napretka i uspeha u sprovođenju mera zelene tranzicije, potrebno je odabrati i pomno pratiti ključne indikatore zelene tranzicije, pri čemu njihov izbor treba prilagoditi karakteristikama privrede svake konkretne zemlje. Cilj ovog rada je da predstavi ključne indikatore zelene tranzicije na primeru Srbije, gde smo predstavili tri: indeks zelenog rasta, tranziciju ka većem korišćenju zelene energije i instrumente zelenog finansiranja. Formiranje indeksa zelenog rasta zasniva se na metodologijiku su razvili Sarkodie et al. (2023), a koja se bazira na kreditiranju zbirnog indeksa metodom generalizovanih najmanjih kvadrata, gde se izračunavanje indeksa zasniva na primeni ponderisanja pet dimenzija podataka (društveno-ekonomski, politika, prirodna dobra, kvalitet i produktivnost). Analiza je pokazala da je Srbija u analiziranom periodu (1990-2021) imala prosečnu vrednost zelenog indeksa rasta od 0,47 po svim modelima, što ukazuje da zemlja ima prosečan nivo zelene tranzicije. Navedeni rezultat ukazuje na neophodnost da Srbija nastavi da sprovodi zelenu transformaciju kako bi vrednost indeksa bila blizu 1, što predstavlja vrednost visokih zelenih performansi.

U oblasti tranzicije ka većoj upotrebi zelene energije, Srbija je ratifikovala i potpisala veliki broj međunarodnih sporazuma (kao što su Pariski sporazum, Sofijska deklaracija o Zelenoj agendi za Zapadni Balkan i Ugovor o energetske zajednici) sa ciljem postizanja klimatske neutralnosti i dekarbonizacije. Kako leta postaju toplija, a proizvodnja električne energije iz hidroenergije opada zbog manje padavina, potrebno je povećati učešće obnovljivih izvora energije kao što su solarna energija i energija vetra. U cilju postizanja navedenog, Republika Srbija je u aprilu 2021. godine usvojila Zakon o korišćenju obnovljivih izvora energije, a nakon dve godine je došlo do izmene tog zakona. Najveći proizvođač električne energije u Srbiji je Elektroprivreda Srbije, koja najveći deo obnovljivih izvora energije proizvodi iz energije vetra, a slede hidroenergija i energija iz biomase i biogasa. Cilj ove kompanije je da do 2030. godine investira oko 3,5 milijardi evra u obnovljive izvore energije. Veliki doprinos zelenoj tranziciji u oblasti energetike daje Ministarstvo rudarstva i energetike, koje ima plan da proizvede 1.300 MW od zelenih izvora energije do 2025. godine. U cilju ostvarivanja ovog ambicioznog cilja, Ministarstvo organizuje aukcije za dobijanje ponuda za obnovljive izvore energije, potpisuje ugovore sa međunarodnim finansijskim organizacijama, poput Evropske banke za obnovu i razvoj, kako bi povećalo učešće obnovljivih izvora energije i daje subvencije domaćinstvima za zamenu dotrajale stolarije, fasade, izolacije, neefikasnih kotlova, ali i za postavljanje solarnih kolektora i panela za proizvodnju električne energije za sopstvene potrebe. Sve navedeno doprinosi jačanju energetskih kapaciteta zemlje, koji se zasnivaju na očuvanju životne sredine.

Da bi se sprovela zelena tranzicija potrebna su značajna ulaganja. S tim u vezi, važno je aktivno raditi na razvoju zelenih finansijskih instrumenata. Republika Srbija je do sada emitovala dva održiva finansijska instrumenta: zelenu obveznicu u septembru 2021. godine i održivu obveznicu u junu 2024. godine. Sredinom septembra 2021. godine, prvi put na međunarodnom finansijskom tržištu, emitovala je zelenu evroobveznicu od jedne milijardi evra sa rokom dospeća od sedam godina. Ova zelena obveznica je imala stopu prinosa od 1,26% i kuponsku stopu od 1,00%. Početkom juna 2024. godine, Republika Srbija je na međunarodnom finansijskom tržištu emitovala održivu evroobveznicu od 1,5 milijardi dolara sa rokom dospeća od deset godina i kuponskom stopom od 6,00%. Sredstva prikupljena od ove emisije biće uložena u nekoliko programa definisanih zelenom agendom, kao i u društveno odgovorne poduhvate.

Analiza je pokazala da je Republika Srbija, na osnovu prikazanih rezultata tri indikatora zelene tranzicije, postigla značajne rezultate u oblasti zelene transformacije, uz neophodnost da nastavi rad usmeren

na izgradnji energetske efikasne privrede koja zasniva svoju konkurentnost na principima održivosti. Sve je to u skladu sa strateškim opredeljenjem zemlje u pristupnim pregovorima za članstvo u Evropskoj uniji i ostvarivanjem ciljeva zelene agende za postizanje klimatske neutralnosti na nivou Evropske unije do 2050. godine.

Tema zelene tranzicije je vrlo inspirativna za dalja istraživanja koja bi mogla da se bave dodatnom analizom energetske efikasnosti poput sagledavanja modela energetske efikasnosti, ukazivanja na neophodnost postojanja javne svesti i važnosti obrazovanja u sprovođenju efikasnih strategija energetske efikasnosti, ali i ispitivanje veze između energetske efikasnosti, ekonomskog rasta i zaštite životne sredine. Kada je reč o zelenim finansijskim instrumentima, dalja analiza bi mogla da se sprovede na podacima konkretnih banaka i drugih finansijskih institucija, imajući u vidu sve veću potrebu za odobravanjem kredita za kupovinu električnih vozila, zelenih poljoprivrednih kredita, kredita za projekte implementacije energetske efikasnosti i investicionih kredita u oblasti obnovljivih izvora energije. Navedeno ukazuje da je potrebno da centralne banke i finansijski regulatori ulože zajedničke napore, kako bi svako iz domena svoje nadležnosti podržao razvoj zelenih finansija i uspostavljanje zelene ekonomije.

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KEY PERFORMANCE INDICATORS IN GREEN TRANSITION: THE CASE OF SERBIA

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„The green transition poses a uniquely difficult policy challenge, because the stakes of failure are so high and yet the path to success is so complex“

Christine Lagarde, President of the European Central Bank

Speech “Towards an Orderly Energy Transition”, Paris, 29 September 2023

Summary: Serbia, like nearly every other nation in the world, is putting into practice a green transition strategy to create a low-carbon economy founded on sustainability objectives. As a result, a system is established that will grow and develop based on protecting the environment while honoring the social and economic facets of business. This paper aims to assess the major performance indicators in the green transition using Serbia as an example. Specifically, we will look at the green growth index, the shift to using more green energy, and the issuance of green financial instruments. These three metrics were selected to demonstrate Serbia's advancement toward sustainable development and the green transition, both of which are critical to the deployment of adaption strategies and the mitigation of climate change's effects. In terms of methodology, the analysis by Sarkodie et al. (2023) served us to create a green index based on data for Serbia. The Ministry of Finance's Public Debt Administration provided data for emissions of green instruments, while the Electric Power Company of Serbia provided data for the analysis of the energy transition. According to the analysis, Serbia has made significant progress in terms of the green transition indicators examined.

Keywords: green transition, key performance, green growth index, green energy transition, green finance instruments.

JEL classification: O44, Q01, Q54, Q58

**The views expressed in this paper are those of the author and do not necessarily represent the official view of the Economists Association of Belgrade.*

Introduction

The Republic of Serbia, like the majority of other nations, is putting sustainable business strategies and technologies into place to foster economic growth while minimizing negative environmental effects. Key performance indicators, such as the percentage of renewable energy sources in total electricity production, greenhouse gas emissions, waste management, biodiversity indicators, investments in green technology, and the creation of green jobs, are necessary to track progress in the green transition. In order to monitor the green transition, each nation must select a sufficient set of key performance indicators that are tailored to the nation's unique economic structure, environmental concerns, and electrical generation sources. Using Serbia as an example, we will analyze key performance indicators in the green transition in this paper. Specifically, we will look at the green growth index, green energy transition, and green financing instruments. Keeping an eye on these metrics will provide you a thorough understanding of Serbia's approach to sustainable development, the outcomes attained thus far, and the areas that require further attention.

This paper's primary research questions (RQs) are:

RQ 1: What is the Republic of Serbia's optimal green growth index?

RQ 2: What initiatives has the Republic of Serbia undertaken to increase the share of renewable source of energy?

RQ 3: Which green financial instruments, and under what circumstances, has the Republic of Serbia issued up to this point?

This paper is structured as follows: A review of the relevant literature follows the introduction. The research methodology analysis and presentation of the data sources utilized for the analysis of the green energy transition and issued green finance instruments, as well as the formation of the Republic of Serbia's green growth index, are the primary topics of the second part of the paper. In the concluding remarks, we will summarize the primary findings of the paper.

Literature Review

Green transformation has become one of the main directions of future development at the global level and includes the development of green technology and the implementation of regulations that will enable the application of environmentally friendly solutions. Thus, green transformation implies economic growth that combines environmental protection with the preservation of living standards for current and future generations, as well as the rational use of available natural resources (Cheba et al., 2022 and Acosta et al., 2020). The goal of achieving a green economy is to protect the environment and preserve the interests of all members of society. The important elements of that transformation include ecological certification, ecological audit and other activities (Vukovic et al., 2019). In order to measure progress in achieving the green transition, it is necessary to have key performance indicators that will serve to measure progress in achieving the goals of sustainable growth and development. When choosing key performance indicators that each country will monitor, it is necessary to take into account the characteristics of the economy itself in order to develop an adequate methodology for their monitoring, then it is necessary to choose those indicators that have a high degree of granularity, which is especially important when it comes to reporting on results and finally it is necessary to carry out adequate structuring of the report and develop the necessary reporting standards that will enable automatic monitoring of the selected key performance indicators.

Achieving a green economy is one of the key goals formally adopted at the United Nations Conference on Sustainable Development held in Rio de Janeiro in 2012 (Timonen et al., 2021). The development in the application of the concept of sustainability and the availability of new data require constant checking of a set of indicators that will measure the level of social well-being in the best way (Rotondo et al., 2022). At the global level, the United Nations has announced sustainable development goals for the period 2016-2030 in the 2030 Agenda for Sustainable Development, which include 17 goals and 169 targets for their implementation. This creates indicators on a global level that reflect the ideology of sustainable development and create a balance between social, economic and environmental preservation priorities (Dahaeva and Amirova, 2023).

An important contribution to the analysis of Environmental, Social and Governance (ESG) indicators was made by international organizations such as the Organization for Economic Cooperation and Development and the United Nations. The focus of the analysis in the report "ESG Investing: Environmental Pillar Scoring and Reporting" of the Organization for Economic Co-operation and Development is how to measure the impact within part E (Environmental) of the ESG concept in order to better understand the output effects such as carbon dioxide emissions, but also the negative impact of certain economic activities on the environment. Thus, this analysis can benefit from a better understanding of whether the pillar under Part E (Environmental) can adequately help markets and investors, who use the concept of ESG investments, to increase the resilience of their portfolios to the presence of physical risk and on the implementation of climate transition. In a 2022 report, entitled "ESG ratings and climate transition", the Organization for Economic Co-operation and Development pointed out areas where part E (Environmental) of the ESG concept can be improved in order to meet the goals of the low-carbon transition economy and thereby provided support to international efforts in implementing the green transition. This report particularly points to the importance of effective monitoring of progress in the process of transition to a low-carbon economy by all market participants. In the annual report on global corporate sustainability for 2024, the Organization for Economic Co-operation and Development indicates that the importance of analysis of applied sustainability strategies around the world. The analysis is based on the presentation of the principles of corporate governance, then the disclosure of sustainability data, but also the necessity of effective dialogue between all interested parties such as the board of directors and shareholders.

In the report on the Sustainable Development Goals for 2023, the United Nations presented a comprehensive overview of progress towards achieving the 17 Sustainable Development Goals, which highlighted the successes, but also the challenges that countries face in achieving sustainable development. To gain progress in achieving the goals of sustainable development, the United Nations in the Global Sustainable Development Report for 2023 highlighted key transformations that must be implemented in various sectors through a structured and systemic approach. Those key transformations are related to human well-being, truly sustainable and fair economies, establishing a healthy food system and applying decarbonization in energy production. The aforementioned reports of the United Nations indicate the commitment of this organization to the advancement of ESG principles at the global level, while at the same time establishing a framework to achieve sustainable development.

From the perspective of the analysis of the European Commission (2009), key performance indicators in the field of application of ESG principles can be divided into general ESGs, which refer to areas on which all companies should report (such as energy efficiency) and sector-specific ESGs, which represent the areas reported by companies from a specific industry (for example waste storage related to industries such as gas and chemical production). ESG criteria are a set of standards that banks and other investors consider if they aspire to invest money in ecological and socially beneficial projects (Petrović Tomić, 2023).

Franco et al. (2023) emphasize the importance of monitoring energy indicators in order to monitor the energy transition and indicate that it is necessary to characterize the energy composition of each individual industry in order to create an energy mix that supports the green transition. The authors indicate that energy efficiency depends on the possibility of using renewable energy sources, their availability and speed of implementation. The transition to a sustainable society and carbon neutrality from 2050 requires significant use of renewable energy sources, which significantly affects the stability of the existing energy network (Airò Farulla et al., 2021). In her analysis, Ryszawska (2014) points out the importance of monitoring the global green economy index, which represents a synthetic approach for monitoring the degree of realization of the green economy at the global level. This index consists of four dimensions: leadership, which has a weight of 15%, policy (weight 35%), cleantech investment (weight 35%) and sustainable tourism (weight 15%). Thus, this index defines the priorities for the implementation of the debate at the global level on the achievement of the goals of the green economy in terms of greater representation of renewable energy sources, investments in clean technologies and greater participation of national economies in international initiatives that support the green transition. It is essential that, in addition to indicators that monitor environmental changes (such as monitoring average temperature, greenhouse emissions, soil degradation), indicators outside the environment that will enable communities, regions and entire countries to become socially and ecologically sustainable are observed and monitored. In this regard, Barry and Hoyne (2021) suggest that economic indicators (such as eco-innovations and financing of development projects) and social-cultural indicators (such as risk perception and education) should be carefully analyzed in addition to environmental indicators. In the next part of the paper, we will present the research methodology for selected key performance indicators in green transition on the example of Serbia.

Research Methodology

The research methodology employed in this paper combines a comprehensive literature review, presented in previous section, along with the analysis of the green growth index for the Republic of Serbia. In addition to the above, for the analysis of the energy transition in Serbia, the data of the Electric Power Company of Serbia, the Ministry of Energy and the Digital Climate Atlas of Serbia were used, while in the case of the analysis of issued green financial instruments, we used the data of the Public Debt Administration, Ministry of Finance of the Republic of Serbia.

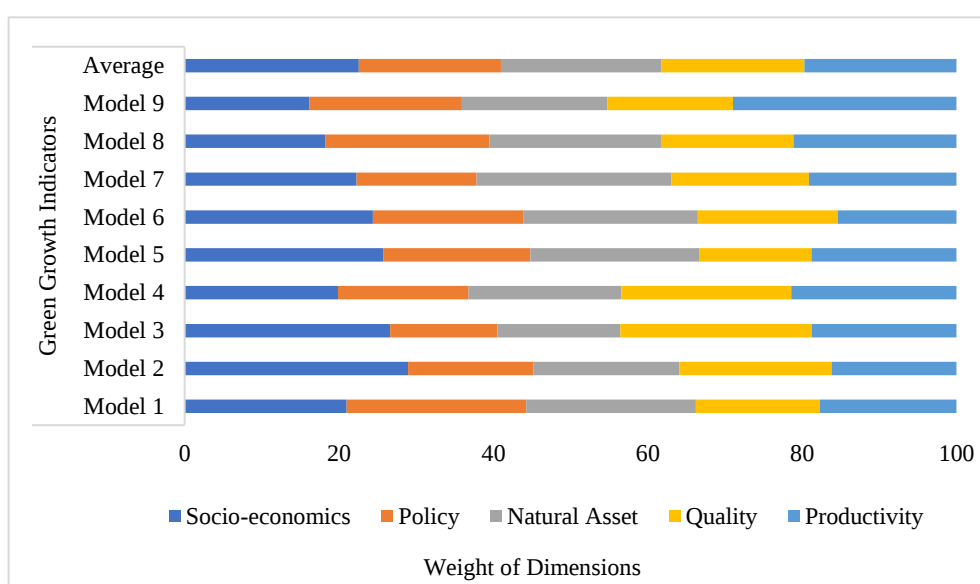
In creating the green index, we will use the approach developed by Sarkodie et al. (2023) in order to calculate the values of the green growth index on the data for Serbia. According to the mentioned authors, green growth includes five dimensions:

- (1) natural asset base that includes data on water, land, forest and wildlife resources, as well as atmosphere and climate data;
- (2) policy responses, which includes data on patents, development assistance, international financial flows, technology and innovation, environmental taxes and transfers, as well as regulations and management;
- (3) socio-economic, which includes data from the social and economic dimensions;
- (4) quality of life that includes data on access to drinking water and exposure to the risk of environmental destruction and
- (5) productivity, which includes data on the productivity of carbon dioxide use, energy productivity, productivity of non-energy materials and environmental productivity.

This choice of five dimensions for creating a green growth index is in line with the analysis of the Organization for Economic Cooperation and Development from 2014, which stated that 25 to 30 indicators are needed to form those five dimensions. This analysis indicates that the proposed dimensions of the indicators are not final and that this proposal gives a clear signal that it is a flexible approach that countries can adapt according to their characteristics. Green growth index in Sarkodie et al. (2023) analysis is based on the creation of a summary index using the method of generalized least squares, where the calculation of the index is based on the application of weighting of five data dimensions – Figure 1. In addition to the aforementioned approach, according to the Global Green Growth Institute, the green growth index can be calculated using data from four dimensions from which 36 indicators can be generated: (1) efficient and sustainable resource use; (2) natural capital protection; (3) green economic opportunities and (4) social inclusion.

On the basis of Figure 1, it can be seen that it is possible to calculate ten models of green growth indices that differ from each other based on the weights used. The models differ from each other in terms of which of the five dimensions of the data is used for calculation, i.e. changing the sign means that the dimension of the data moves in the opposite direction. Within model 1, the opposite sign is used for natural asset base, environmental productivity, and environmental quality, for model 2 there is no use of the opposite sign, for model 3 the opposite sign is used for environmental productivity, for model 4 the opposite sign is used for environmental quality, for model 5 for natural asset base, for model 6 for environmental productivity and quality, for model 7 for environmental productivity, and natural asset base, for model 8 for environmental quality, and natural asset base, for model 9 for policy response, socioeconomics, environmental quality, natural asset base, and environmental productivity. Model 10 means the average of the weights used in the calculation of models 1-9.

Figure 1 - Weight of Dimensions Used to Construct Green Growth Indicators



Source: Sarkodie et al. (2023)

When calculating green growth indices, the first step is the source of the variables, to then perform their classification, treatment of missing data, adjustment of the sign for each variable (where possible), setting submissions for each data dimension and calculation of the index. A fixed value of zero is assigned for missing data. This assigns a lower weight to data dimensions that have missing values. Green growth index is calculated based on the following formula:

$$\hat{s}_{i,j} = \frac{1}{W_{i,j}} \sum_{k \in K_{i,j}} w_{j,k} \frac{y_{i,j,k} - \hat{y}_{j,k}}{\sigma_{j,k}} \quad (1)$$

In the mentioned formula, $\hat{s}_{i,j}$ represents the constructed green growth index, while $W_{i,j}$ and $w_{j,k}$ represent applied weights, and $(y_{i,j,k} - \hat{y}_{j,k})/\sigma_{j,k}$ represents the normalized output based on the inverse covariancematrix which is represented by $\sum_j y_{i,j,k}$. The green growth index implies the combination of several variables into categories, and then several categories into dimensions and finally the construction of the green growth indicator. In the following part of the paper, we will present the results of selected key performance indicators for green transitions on the case of Serbia.

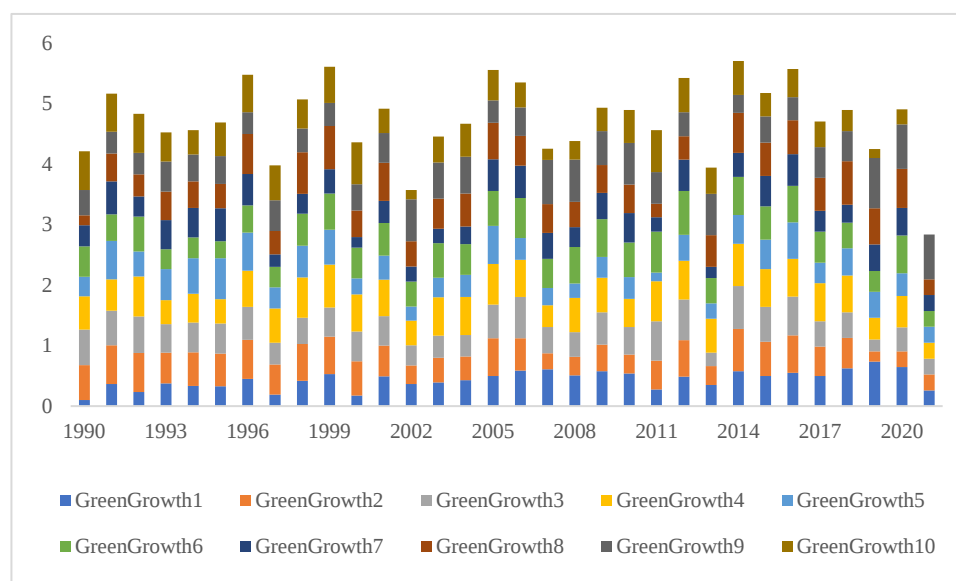
Green Growth Index

In order to analyze the results obtained on the Green Growth Index on the data for Serbia, it is necessary to define what actually constitutes green growth. The concept of green growth itself is a relatively new concept with a number of different definitions and no well-established metrics for tracking it. According to Lyytimäki et al. (2017) green growth is defined as a process of transition towards achieving a low-carbon society and society in which resources will be used in the most efficient way while at the same time achieving economic development that will ensure human well-being, social justice and preservation of the environment. The implementation of this transition will enable the further increase of social wealth and well-being, while preserving the value of products, materials and resources in order to use existing resources rationally. Thus, the goal of green growth policies is to simultaneously mitigate the consequences of climate change while achieving sustainable economic growth (Herman et al., 2023).

Based on the previously analyzed methodology for creating the Green Growth Index, data from 1990 to 2021 (the latest available data) were used to present all ten models of green growth indices based on data for Serbia - Figure 2. When it comes to interpreting the achieved values of the Green Growth Index model, a value of 0 refers to low green performance, while a value of 1 refers to high green performance. The highest value of the green growth index Serbia in the entire analyzed period for all models was achieved within model 9 in 2019, when the value of the index was 0.83. That year, within model 9, the largest contribution came from the productivity dimension, in which the largest contribution was made by productivity of non-energy materials. When it comes to the lowest achieved value, the green growth index reached 0.10 in 1990 in model 1. The most optimal green growth index model is number two, within which a weight of 28.95% refers to the socioeconomic dimension, a weight of 19.74% to quality, a weight of 18.87% refers to the natural asset base, a weight of 16.25% is refers to policy response and a weight of 16.18% on environmental productivity. Based on the presented data on the movement of the green growth index, it can be concluded that the Republic of Serbia has an average level of green development, bearing in mind that the average value of all models in the entire

analyzed period is 0.47. The obtained results indicate that it is necessary for the Republic of Serbia to continue the promotion of green transformations in order to achieve high level of green transition in the coming period.

Figure 2 - Green Growth Indexes for Serbia



Source: compiled by authors according to https://figshare.com/articles/dataset/Comprehensive_green_growth_indicators_across_countries_and_territories/22291069

Green Energy Transition

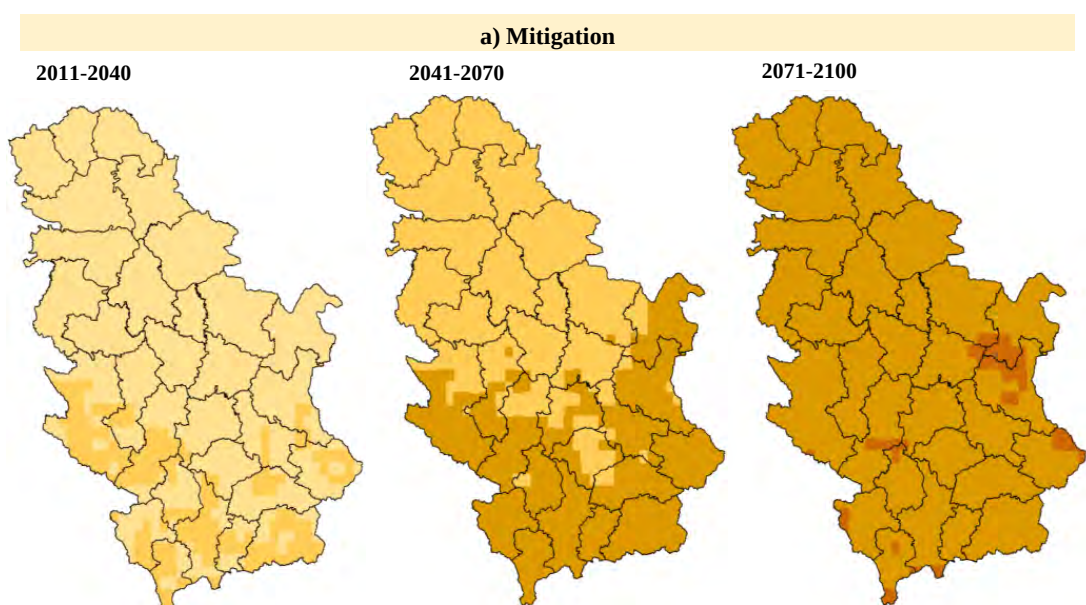
The energy transition represents one of the biggest challenges today, bearing in mind that its implementation represents a change in the supply and consumption of energy in a national energy system. Thus, the energy transition represents a transition to sustainable energy sources in order to mitigate the negative impact of climate change. The goal of the energy transition is to reduce the emission of greenhouse gases in order to reduce the share of electricity production from fossil fuels.

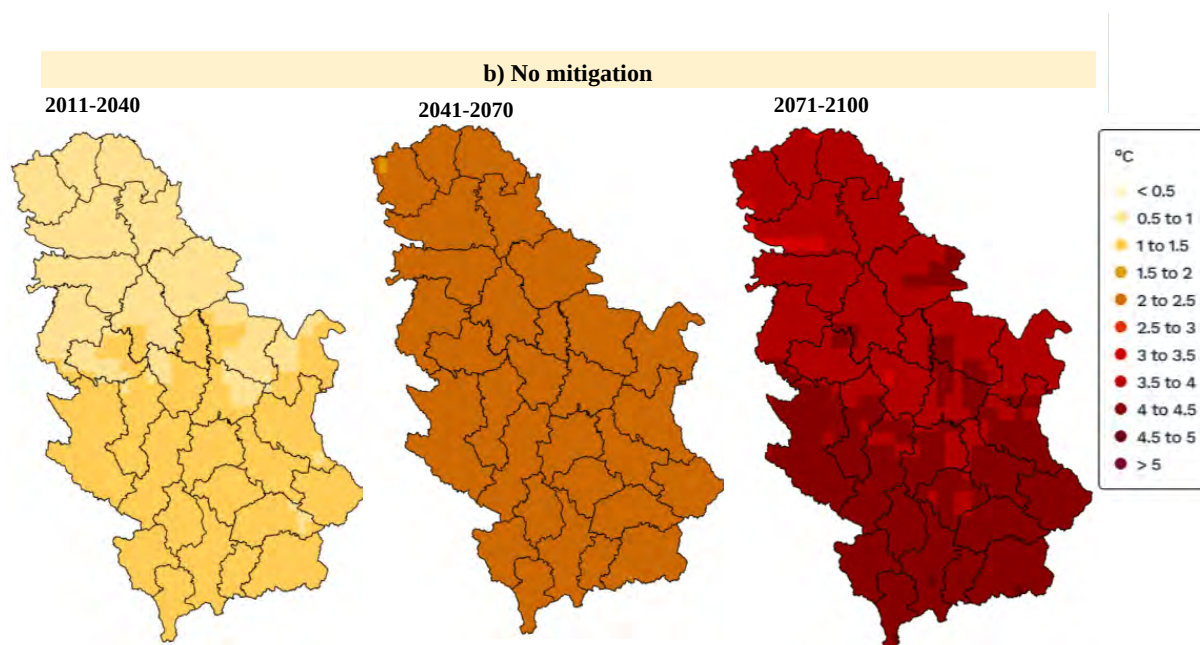
In order to implement the policy of climate neutrality and decarbonization until 2050, as well as charting the path to the energy transition, the Republic of Serbia has ratified and signed a number of international acts. By ratifying the Paris Agreement within the framework of the United Nations on climate change from 2015, Serbia assumed the obligation to reduce greenhouse gas emissions and accepted the need to implement measures and activities leading to adaptation to changed climate conditions, while by signing the Treaty on the Energy Community and Sofia Declaration on the Green Agenda for the Western Balkans, it assumed the obligations of developing the Integrated National and Climate Plan.

In the program of adaptation to changed climate conditions for the period from 2023 to 2030, the Ministry of Environmental Protection of the Republic of Serbia highlights that the country is warming faster and more than the global average. At the global level, the increase in mean temperature is 1.1°C, while in Serbia it is 1.8 °C, and in summer it is even above that level (2.6°C).

In addition, in the period from 2000 to 2020, Serbia recorded losses of as much as 6.8 billion euros as a result of significant changes in weather conditions and extreme climate conditions. Of the stated amount, more than 70% refers to the damage caused by high temperatures and drought, while the other main cause was the floods that were especially devastating in 2014. According to the data of the Republic Hydrometeorological Service of Serbia, the summer of 2024 was the hottest for the period of meteorological measurements from 1951 to 2024, while all three summer months - June, July and August - were also the warmest since 1951. Warm winters in the last few years are in favor of lower electricity consumption, but extremely hot summers lead to higher consumption of electricity during the summer season, and additionally affect lower production from hydrological sources due to low rainfall. If significant changes are not undertaken in the energy system of Serbia and it switches to renewable energy sources, the Republic of Serbia may record a significant increase in energy consumption in the coming period. Based on the interactive map, created by the Digital Climate Atlas of Serbia, it can be seen that the Republic of Serbia is expected to record an increase in temperature in the coming period, especially if it does not implement measures to mitigate the consequences of climate change, including the transition to renewable energy sources. Figure 3 shows projections of the average daily temperature for the entire territory of the Republic of Serbia for three projection periods: 2011-2040, 2041-2070 and 2071-2100. The Representative Concentration Pathways (RCP) 4.5 scenario was used to show the projections of the average daily temperature in the event that climate change mitigation measures were applied, which is based on the projection that the emission of greenhouse gases will stabilize at 4.5 W/m² by 2100. In the case of projections if climate change mitigation measures are not implemented, the RCP 8.5 scenario was used, which implies that the level of carbon dioxide will rise to 936 parts per million by 2100, which would increase the global temperature by about 5-6°C by 2100. This visual representation of the projected average daily temperature can best illustrate the importance of implementing the energy transition.

Figure 3 - Future Climate Projection for Average Daily Temperature for Serbia - Reference Period 1971-2000





Source: compiled by authors according to <https://atlas-klime.eko.gov.rs/eng/map?dataType=obs&visualization=pro&area=regions>

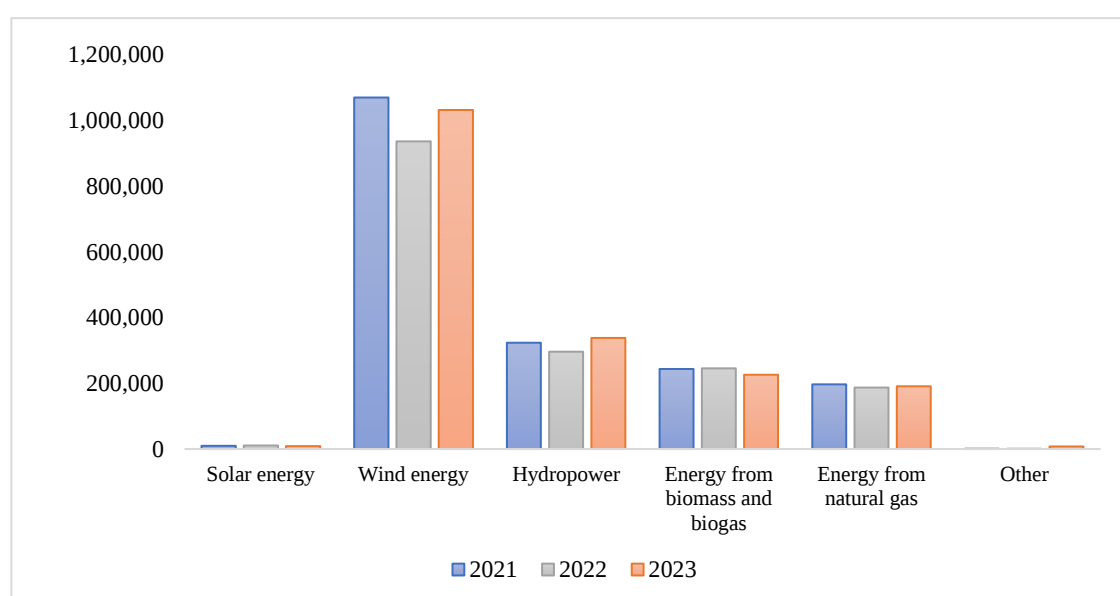
A significant increase in summer temperatures leads to a significant consumption of electricity, which in the Republic of Serbia is mostly generated in thermal power plants (about 70%), while 30% is obtained from 16 hydropower plants. Coal from surface mines is mostly used in thermal power plants, mostly lignite. The presented data indicate that most of the electricity in Serbia is generated from fossil fuels.

According to the projections of the Energy Development Strategy of the Republic of Serbia until 2025 with projections until 2030, which was adopted at the beginning of December 2015, the total potential of renewable energy sources in our country amounts to 5.65 million tons of oil equivalents per year. To regulate matters related to renewable energy sources, their participation in gross final energy consumption, as well as the integration of energy from renewable sources for the market, the Republic of Serbia adopted the Law on the Use of Renewable Energy Sources in April 2021. After two years, in April 2023, the Law on Amendments to the Law on the Use of Renewable Energy Sources was adopted, which entered into force at the beginning of May 2023. These amendments to the Law established the integration of renewable energy sources into the power system, with an effort to ensure the safe operation of the system.

The largest producer of electricity in Serbia is Elektroprivreda Srbija, whose goal is to gradually increase capacity from renewable energy sources while at the same time achieving carbon neutrality and implementing measures to protect the environment. According to the data of the Elektroprivreda Srbija, in 2023, 1,806,631.76 MWh of electricity was produced from renewable source of energy.

Wind energy has the largest share in renewable energy sources, with a share of 57.2% in 2023, followed by hydropower (18.8%) and energy from biomass and biogas (12.5%) - Figure 4. In the following period, the goal of Elektroprivreda Serbia remains to continue investing in the environment, as well as implementing development plans related to the increase in the share of renewable energy sources. By 2030, the goal is for Elektroprivreda Srbije to invest about 3.5 billion euros in new renewable sources, primarily in hydropower and solar power, which in that period will represent about 37% of the company's total investments. If investments in new hydropower plants are included, the total investments in renewable energy sources of the Electric Power Company of Serbia by 2030 will amount to around 5.4 billion euros, i.e. more than half of the total investments.

Figure 4 - Electricity Production from Renewable Sources in Serbia (in MWh)



Source: compiled by authors according to <https://www.eps.rs/cir/Pages/tehnicki-izvestaji.aspx>

A major contribution to the increase in the share of renewable energy sources was made by the Ministry of Mining and Energy, which has so far announced two auctions for obtaining bids for renewable energy sources. The goal is to provide 1,300 MW from green energy through the incentive system for a period of three years (2023-2025). The first auction was held in mid-August 2023, where 16 investors applied for a total power plant of 816.48 MW, of which 602.8 MW was offered to fill the quota, while the estimated investment value of all power plants is 1.26 billion euros. Out of the total number of registered investors, 11 participants qualified for the bidding phase. In the auction procedure for wind power plants, the quota was filled by four investors, while in the solar power plant auction, the quota was filled by three. The lowest price offered was 64.48 euros per megawatt-hour (EUR/MWh) for wind power plants or 88.65 euros per megawatt-hour for solar power plants. In February 2024, the Ministry of Mining and Energy announced that it would organize a second round of auctions for a new 400 MW capacity from renewable energy sources by the end of 2024. At the end of November 2024, the Ministry of Mining and Energy announced the second round of auctions for the allocation of market premiums for renewable energy sources, at which investors will compete for the allocation of quotas of a total of 424.8 MW (300 megawatts planned for wind farms, and 124.8 MW for solar power plants).

important topic, both for household budgets and for environmental protection. For subsidies that, depending on the package of measures, can go up to 65 percent of the investment value. Implementing energy efficiency measures brings many advantages, such as saving money, increasing the comfort of living, and increasing the value of the property you live in.

Green Finance Instruments

The movement of important macroeconomic indicators is undoubtedly impacted by global warming and its effects on climate change, which forces those who design economic policies to carry out the green transformation process. To achieve this, green financial instruments that take social and environmental factors into account when making investment decisions must be developed. This will encourage more investments in ecologically sustainable operations. Green finance plays a significant role in funding initiatives that aim to enhance the overall well-being of the economy and society as well as achieving global goals outlined in strategic programs like the European Green Deal and the Agenda for Sustainable Development until 2030, both of which have as their primary objective the reduction of greenhouse gas emissions. Thus, reaching the objectives of the green economy poses both a challenge and a chance for the financial sector to create sustainable funding. Sustainable financing can be seen through a wide range of activities: from digitalization of bank activities, reducing carbon levels in their daily activities, to offering sustainable financial products (Sredojević and Sredojević, 2021). In addition to commercial banks, central banks also play a significant role in the development of green financial instruments, which in the last few years have been exposed to new challenges and tasks that they need to face. One of those challenges is climate change, which directly affects the main objectives of the central bank, which is to achieve and maintain price and financial stability (Martin, 2022).

The issuance of green financing instruments has been increasing rapidly over the last few years, and more growth is anticipated in the near future. The financing of businesses, projects, and other endeavors that help achieve sustainable, equitable, and growth is referred to here, as it directly advances the objectives of sustainable development. In light of this, the trend of "greening" finance is becoming more and more significant, owing to the public's growing interest in environmental preservation and protection as well as the increased flow of information, mostly via the media. It is a movement that emerged from the necessity to reframe profit as the primary objective and instead frame it as striking a balance between profit and environmental preservation. Green development is a global movement that is being pushed by the most powerful international organizations, and it is one of the top priorities. The banking sector in Serbia is becoming more and more involved in this area and understands the benefits of funding environmentally friendly initiatives. Thus far, the most prevalent loan approvals have gone to wind farm development, recycling, solar energy, water purification, and power sector projects with the goal of lowering CO₂ emissions. Loans for the purchase of electric vehicles, green agricultural investment loans, loans for projects with high energy efficiency, and investment loans in the field of renewable energy sources are all becoming more popular. The bank encourages an individual or business to make environmentally friendly decisions by setting lending circumstances, which include the interest rate, amount of collateral, and other advantages or loan components. By lowering funding requirements and constraints, particularly for projects that do not harm the environment, funding priorities were established.

Achieving sustainable economic growth and advancing sustainable financing on the global financial market are priorities for the Republic of Serbia. Together with the continuous growth of traditional financial instruments, sustainable financial tools are also advancing (Martin, 2023). To date, the Republic of Serbia has released two sustainable financial instruments: a green bond in September 2021 and a sustainable bond in June 2024. For the first time in its history, the Republic of Serbia issued a

1.0-billion-euro green Eurobond in mid-September 2021. The bond had a seven-year maturity, a yield rate of 1.26%, and the lowest coupon rate ever recorded - 1.00%. The Republic of Serbia became one of the few nations in Europe - and the only one not part of the European Union - when it first issued the green instrument. The International Capital Markets Association's Green Bond Principles were followed in the issuance of the green bonds, and the Republic of Serbia's September 2021 publication of the Green Bond Framework governed the use of the collected funds. In June 2022, the Republic of Serbia received the "Sovereign Green Market Pioneer in 2021" award from Climate Bond Initiative, demonstrating our nation's environmental consciousness.

The Republic of Serbia successfully floated dollar sustainable Eurobonds on the global financial market at the beginning of June 2024. The proceeds from the sale of the bonds will go toward financing environmentally conscious projects and socially conscious endeavors. The overall quantity of securities sold was 1.5 billion dollars, but during the day, investor demand was far higher and exceeded 6.5 billion dollars. As with other dollar Eurobond issuance, the Republic of Serbia also completed hedging contracts to lower the public debt's interest rate and foreign exchange risk and demonstrate accountability for its sustainability. Through these transactions, it quickly applied a cross-currency swap to transform obligations based on the issuance of dollar Eurobonds into liabilities in euros. The Republic of Serbia concluded this hedging transaction with Deutsche Bank AG, Bank of America, BNP Paribas and MUFG Securities (Europe) N.V. This decreased the Republic of Serbia's actual cost of borrowing, bringing it down to 4.75% after hedging for the Eurobond, in addition to lowering the exposure to the foreign exchange risk of the dollar's movement against the euro. The Sustainable Finance Framework of the Republic of Serbia and the Second Party Opinion (SPO) on the Sustainable Finance Framework, which was created by the Public Debt Administration, Ministry of Finance, were followed in the issuance of both green bond offerings. These documents demonstrate the Republic of Serbia's commitment to achieving the objectives of the sustainable development agenda in order to create a sustainable future for coming generations. This lends credence to national decarbonization and environmental conservation.

Conclusion

The goal of the green transition is the development and implementation of green and sustainable solutions in order to preserve the environment. Today, climate change is a global threat that requires urgent action to remedy the consequences of these changes. This gives the possibility, depending on the applied measures, to create a resource-efficient, modern and competitive economy based on the application of green technology and sustainable business solutions. Turning climate and environmental challenges into opportunities will make the transition just and inclusive for all. Serbia, as a candidate for membership in the Union, keeps pace with the requirements, bringing plans, measures and activities in the field of green transition.

In order to monitor progress and success in the implementation of green transition measures, it is necessary to select and closely monitor key performance indicators in green transition, whereby their selection should be adapted to the characteristics of the economy of each specific country. The aim of this paper is to present key performance indicators in green transition on the example of Serbia, where we have presented three: green growth index, green energy transition and green finance instruments. The formation of the green growth index is based on the methodology developed by Sarkodie et al. (2023) which represents the creation of a summary index using the method of generalized least squares, where the calculation of the index is based on the application of weighting of five data dimensions (socio-economics, policy, natural asset, quality and productivity).

The analysis showed that in the analyzed period (1990-2021), Serbia had an average green growth index value of 0.47 according to all models, which indicates that the country has an average level of green transition. The above result indicates the necessity for Serbia to continue implementing the green transformation in order for the value of the index to be close to 1, which represents the value of high green performance.

In the field of green energy transition, Serbia has ratified and signed a large number of international agreements (such as the Paris Agreement, Sofia Declaration on the Green Agenda for the Western Balkans and Treaty on the Energy Community) with the aim of achieving climate neutrality and decarbonization. As the summers become hotter and the production of electrical energy from hydropower decreases due to less precipitation, it is necessary to increase the participation of renewable energy sources such as solar and wind energy. In order to achieve the above, the Republic of Serbia adopted the Law on the Use of Renewable Energy Sources in April 2021, and amended it two years later. The largest producer of electricity in Serbia is Elektroprivreda Srbija, which generates the largest part of renewable energy sources from wind energy, followed by hydropower and energy from biomass and biogas. The goal of this company is to invest around 3.5 billion euros in renewable energy sources by 2030. A major contribution to the green transition in the field of energy is provided by the Ministry of Mining and Energy, which has a plan to generate 1,300 MW from green energy sources until 2025. In order to achieve this ambitious goal, the ministry organizes auctions for obtaining bids for renewable energy sources, signs contracts with international financial organizations, such as the European Bank for Reconstruction and Development, in order to increase the share of renewable energy sources and provides subsidies for households to replace worn-out carpentry, facades, insulation, and inefficient boilers, but also to install solar collectors and panels for the production of electricity for their own needs. All of the above contributes to the strengthening of the energy capacities of the country, which are based on the preservation of the environment.

In order to implement the green transition, significant investments are required. In this regard, it is important to actively work on the development of green financial instruments. The Republic of Serbia has so far issued two sustainable financial instruments: a green bond in September 2021 and a sustainable bond in June 2024. In mid-September 2021, for the first time on the international financial market, it issued a green Eurobond of one billion euros with a maturity of seven years. This green bond had a yield rate of 1.26% and a coupon rate of 1.00%. At the beginning of June 2024, the Republic of Serbia issued a sustainable Eurobond of 1.5 billion dollars with a maturity of ten years and a coupon rate of 6.00% on the international financial market. Funds raised from this emission will invest into several programs defined by the green agenda, as well as socially conscious ventures.

The analysis showed that the Republic of Serbia, based on the presented results of the three green performance indicators, achieved significant results in the field of green transformation, with the necessity to continue the work focused on building an energy-efficient economy that bases its competitiveness on the principles of sustainability. All this is in line with the country's strategic determination in the accession negotiations for membership in the European Union and the achievement of the goals of the green agenda to achieve climate neutrality at the level of the European Union by 2050.

The green transition topic is highly motivating for future research that could address additional analysis of energy efficiency, including examining energy efficiency models, highlighting the need for public awareness and the role of education in putting effective energy efficiency strategies into practice, and investigating the relationship between environmental protection, economic growth, and energy efficiency. Given the increasing need to approve loans for the purchase of electric vehicles, green agricultural loans, loans for energy efficiency implementation projects, and investment loans in areas of

renewable energy sources, more research on green financial instruments could be done on the data of particular banks and other financial institutions. According to the aforementioned, central banks and financial regulators need to work together to encourage the growth of green finance and the creation of a green economy within their respective purviews.

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