

# Heating-Matrices showing recommended RES Heating Technologies fitting to various Building Types & Qualities

Report D4.1

Project Coordinator: Austrian Energy Agency – AEA Work Package 4 Leader Organization: WIP

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This document and the interactive heating matrices are available on: <u>www.replace-project.eu</u>

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#### Background and purpose of this report

The heating matrix provides an initial overview of which heating system based on renewable (non-fossil) energy sources or district heat is most suitable for your building.

Space heating systems based on energy from renewable sources use solar energy both directly via solar collectors for domestic hot water preparation and possibly also for auxiliary space heating, and indirectly in its stored form as biomass for boilers or ambient heat (water, earth, air) for heat pumps.

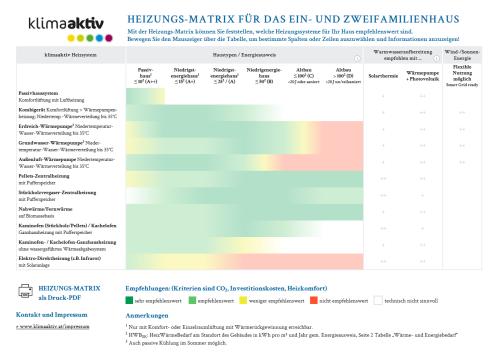
#### **Introduction to Heating Matrices**

The so-called heating matrix, developed within the Austrian climate protection initiative "klimaaktiv" of the Austrian Federal Ministry for Climate Protection, Environment, Energy, Mobility, Innovation and Technology (BMK), is a tool that gives an overview of available alternative (non-fossil) energy sources for heating systems in different types of buildings and a broad range of thermal insulation qualities.

#### Heating matrix for "single and double family houses" and "large volume buildings"

There are two versions of the heating matrix: One is for single and double family houses and the other one is for larger houses as multi-family houses or hotels, etc.

The heating matrix for single and double family houses gives advice to homeowners or planners of single and double family houses which heating system(s) based on non-fossil fuels is/are the best choice for a certain building. The same applies to the heating matrix for large volume buildings. The existing German version of the heating matrix for single and double family houses is shown below.



#### Adaptation to conditions in target regions of REPLACE

The matrices presented in this report, starting from the Austrian blueprints, were adapted regionally with regard to structural and environmental conditions, building standards and the economic viability with regard to renewable (non-fossil) energy source (RES) based heating technologies recommended in the matrices. This means that different climatic conditions, shares of coal, oil and gas in the national electricity mix (emission factor) for the operation of heat pumps, modern RES based ovens not in use in Austria etc. were taken into account adequately on a regional level.



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## 1 | Legal Disclaimer

The beneficiaries of the European Horizon 2020 project REPLACE have prepared the present heating matrices for single and double family houses and larger volume buildings in accordance with the original heating matrices elaborated within the Austrian klimaaktiv programme<sup>1</sup> of the Austrian Federal Ministry for Climate Protection, Environment, Energy, Mobility, Innovation and Technology (BMK) to the best of their knowledge and belief.

The matrices published in this report have been prepared for the target country in question by the respective project partner in consultation with relevant regional actors with the greatest care, taking into account country- resp. region-specific conditions. However, the participating authors cannot assume any liability for the correctness, completeness and topicality of the content. Furthermore, all authors in charge are not liable for any damages, in particular direct or indirect as well as material or immaterial damages caused by the use of the information provided.

The same applies to the European Commission, which financed the production of this website, and the Austrian BMK, which provided the original versions.

<sup>&</sup>lt;sup>1</sup> klimaaktiv is the Austrian climate protection initiative and integral part of the Austrian climate strategy. Its primary objective is to launch and promote climate-friendly technologies and services. In doing so, klimaaktiv focuses on high standards of quality, provides education and training of professionals, gives advice and cooperates with a large network of partners (see <u>klimaaktiv.at</u>).



### **Introduction to the REPLACE Project**

REPLACE is a European project with the aim of informing and motivating people in nine different countries to replace old and inefficient heating systems in residential buildings with environmentally friendly alternatives. Funded under the EU Horizon 2020 programme for three years (2019 – 2022), REPLACE develops and implements boiler and oven replacement campaigns to support changes towards achieving the climate targets and making Europe independent of oil, coal and natural gas.

Half of Europe's energy consumption is used for heating or cooling. However, two thirds of the heating systems installed in Europe (80 million units) are inefficient. As a rule, these outdated heating systems are only replaced when they fail completely during use or are about to fail. This often leaves no time for informed decisions or a change of energy source. In addition, the amount of information required for a switch is high: many questions have to be clarified and different actors need to be consulted. Often people do not have enough money to be able to afford (currently still) more expensive low-CO<sub>2</sub> systems, even if the life cycle costs are already significantly lower and much less risky.

REPLACE wants to tackle those and other local challenges and barriers by developing and testing locally adapted, tailor-made replacement campaigns – for the first time, in parallel – across ten European pilot regions with a total population of 8 million. Those are the ten European pilot regions in the nine participating countries:

- Austria: Federal State of Salzburg
- Bosnia and Herzegovina: Canton of Sarajevo
- Bulgaria: Rhodope Mountain Region
- Croatia: Primorsko goranska County, City of Zagreb incl. three bordering counties
- Germany: Bavarian Oberland
- North Macedonia: KAGoP Region
- Republic of Serbia: City of Šabac
- Slovenia: Slovenia
- Spain: Castilla y León Region

Specifically, the project targets consumers, investors/owners as well as intermediaries, like installers, chimney sweeps, energy advisors and consultants, and helps them to make well-informed decisions. Simple renovation measures that pay-off quickly as they reduce overall space heating consumption for a low investment and which are implemented as coordinated community actions are also part of the programme.

In order to develop efficient and strongly service-oriented campaigns as well as user-friendly information tools, REPLACE identifies requirements for implementation actions concerning infrastructure, regulations and law, it investigates stakeholders' mind-sets and their needs, refers to lessons learnt from previous projects, and develops action plans tailor-made for each pilot region. The replacement campaigns are to be launched and supported by the project partners on-site by local working groups, bringing public authorities, end consumers, installers, chimney sweepers, energy consultants, equipment manufacturers, energy supply companies, policy makers and other key players



to one table. Together, they will design comprehensive, locally adapted effective action packages tackling the main barriers and challenges end consumers and installers face when boilers or ovens shall be replaced.

REPLACE's primary objectives are to

- understand the heat markets as well as the mind-sets and needs of end consumers, intermediaries (like installers, chimney sweepers, energy advisers) and investors,
- identify and reduce market barriers and to foster an enabling environment as well as better and trustworthy services,
- improve framework conditions, planning and investment security,
- better inform all stakeholders of the benefits of a heating or cooling system replacement, according to their information needs and preferred formats,
- enable consumers to take informed decisions, encouraging sustainable energy behaviour,
- strengthen the trust of end consumers in intermediaries and in the reliability of renewable HC systems and related (service) suppliers,
- transfer know-how from more advanced to less advanced countries in this field, e.g. by training of installers in South-Eastern European countries,
- create and implement locally adapted, tailor-made replacements campaigns addressing and overcoming replacement barriers in ten European pilot regions, while also testing, steering and improving them on-site, and
- to make the project's findings available for replication in other countries and regions.

REPLACE also addresses fuel poverty and gender issues and reduces the risk of a heating crisis by supporting the use of regional renewable energy sources (such as solar, ambient heat or biomass) and HC equipment produced within the EU (biomass boilers, heat pumps, solar collectors, etc.).



## 2 | Matrices of REPLACE Pilot Region "Federal State of Salzburg" in Austria

In the following chapters screenshots of the two matrices for each country resp. region are shown. The matrices will also be available on the project website.

			Warmwass empfo	Wind-/ Sonnenene						
Heizungssystem		Passiv- haus³ ≤ 10 kWh/m² a (A++)	Niedrigstenergiehaus <sup>1</sup> ≤ 15 kWh/m² a (A+)	Niedrigstenergiehaus¹ ≤ 25 kWh/m² a / (A)	Niedrigenergiehaus ≤ 50 kWh/m² a (B)	Altbau ≤ 100 kWh/m² a (C) <20) oder saniert	Aitbau > 100 kWh/m² a (D) >20J un/teilsaniert	Solarthermi e	Wārmepum pe i + Photovoltaik	möglici Smart Gi
Passivhaussystem Komfortlüftung mit Luftheizung		Ø	- 79	0	73	0	0	+	++	
Kombigerät Komfortlüftung + Wärmepumpenheizung; NiedertempWärmeverteilung bis 35°C	<b>A</b>	Ø	0	0	0			+	++	++
Erdreich-Wärmepumpe <sup>2</sup> liedertemperatur-Wasser-Wärmeverteilung bis 35°C		0	0	Ø	0	0	θ	+	++	+
Grundwasser-Wärmepumpe <sup>2</sup> ieder-temperatur-Wasser-Wärmeverteilung bis 35°C					Ø	Ø		+	++	+-
Außenluft-Wärmepumpe Niedertemperatur-Wasser-Wärmeverteilung bis 35°C		Ø	0	Ø		Ø		+	++	++
Pellets-Zentralheizung mit Pufferspeicher						0	0	++	++	
Stückholzvergaser-Zentralheizung mit Pufferspeicher			Ø	0	0	0		++	+	
Nahwärme/Fernwärme auf Biomassebasis		Ø				0	0	+	++	
Kaminofen (Stückholz/Pellets) / Kachelofen Ganzhausheizung mit Pufferspeicher				0		1	0	++	+	
Kaminofen- / Kachelofen-Ganzhausheizung ohne wassergeführtes Wärmeabgabesystem	0			Û	Ø	.73		+	++	
Elektro-Direktheizung (z.B. Infrarot) mit Solaranlage	Ê		0	0	Ø	0	0	++	++	
veichbar mit Somfort oder Einedværsliftung var mit Wärmeräckgewiene were Kolhorg auch im Sommer miglich.	rei	SEHR EMPFEHLENSWERT	empfehi	LENSWERT	WENIGER EMPTEMBAR	NICHT EN	APFOHLEN		CH NICHT OHLEN	

### **2.1** Heating Matrix for single and double family houses

Figure 1: Heating Matrix for single and double family houses for Austria (is applicable on federal level, countrywide too), Source: Austrian climate protection initiative "klimaaktiv" of BMK, graphically adapted by ENOVA



Dieses Projekt wird aus dem Innovationsprogramm Horizont 2020 der U im Rahmen der Finanzhilfevereinbarung Kr	Europäischen Unior			IEIZU	INGS	-MAT	RIX		1	repl	ace		
		Niederte		abgabesystem u auftemperatur <3	nd Warmwasserb 35 ° C	ereitung	Hochte	Hochtemperaturwärmeabgabesystem und Warmwasserbereitung Vorlauftemperatur >55 °C					
Systemkombinationen				Gebäudeklassen					Gebäudeklassen				
Pelletzentralheizung + Solaranlage	Ĩ												
Hackgutheizung + Solaranlage	Ĩ												
Biomasse Nahwärmeheizung + Solaranlage	Ĩ												
Erdreich-Wärmepumpe mit Erdkollektor + Solaranlage													
Erdreich-Wärmepumpe mit Erdsonde + Solaranlage													
Grundwasser-Wärmepumpe + Solaranlage													
Luft-Wärmepumpe + Solaranlage	1												
Gut/weniger gut: Luft-Wärmepumpen mit zusätzlicher WA Abluft aus Hallenbad oder Welinessbereich sind bei Geb Klassen A + und A ++ ebenfalls sehr gut geeignet			SEHR GUT		G	л		WENIGER GUT		NIC GEEK			
Haftungsausschluss: Weder die Europäische Kommission noch eine im Namen der Komn spiegeln nicht unbedingt die Ansichten der Europäischen Kommissi								erten Ansichten lieg	en in der alleinigen	Verantwortung der A	lutoren und		

Figure 2: Heating Matrix for larger volume buildings for Austria (is applicable on federal level, countrywide too), Source: Austrian climate protection initiative "klimaaktiv" of BMK, graphically adapted by ENOVA



## 3 | Matrices of REPLACE Pilot Region "Canton of Sarajevo" in Bosnia and Herzegovina

#### **3.1** Heating Matrix for single and double family houses

			Preporuka pripreme po vo	Energija sunca/vjet					
Sistem grijanja		Pasivna kuća¹ ≤ 15 kWh/m² a (A+)F	Niskoenergetska kuća¹ ≤ 27 kWh/m² a / (A)	Niskoenergetska kuća 45 kWh/m² a (B)	Stara zgrada (<10 godina ili obnovljena) ≤ 90 kWH/m2 a (B)	Stara zgrada (>10 godina) >90 kWH/m2 a (C)	Solarni kolektori	Toplotna pumpa + fotonaponski paneli	Moguća fleksibili upotreb "Smart G ready"
Kombinovani uređaj ventilacija zraka sa izmjenom toplote + toplotna vumpa; niskotemperaturni režim grijanja do 35 °C	<b>A</b>	0	Ø	Ø	- 70	10	+	++	++
Geotermalna toplotna pumpa <sup>2</sup> niskotemperaturni režim grijanja do 35 °C		0	0	Ø	0	Ø	+	++	++
Toplotna pumpa voda/voda² niskotemperaturni režim grijanja do 35 °C		0	Ø	Ø	Ø		+	++	++
Toplotna pumpa zrak/voda niskotemperaturni režim grijanja do 35 °C		0	Ø	Ø	Ø		+	++	++
Sistem centralnog grijanja na pellet sa spremnikom toplote		Ø	Û	Ø	0	Ø	++	++	
stem centralnog grijanja sa pirolitičkim kotlom na drvnu biomasu sa spremnikom toplote		Ø	Û		0	0	++	+	
Daljinsko grijanje (drvna sječka)		0	Û		0	0	+	++	
Peć na drva (drvna sječka, pelet) sa radijatorskim sistemom centralnog grijanja			0	0	(D)	0	++	+	
Peć na drva/kaljeva peć bez toplovodnog sistema za grijanje			Û	Ø	0		+	++	
Električna energija	(f)	0	0	Ø	Ø	Ø	++	++	
		VEOMA DOBRO	DOBRO	P	RIHVATLJIVO	NUE PRIHVATLIIVO			NIČKI ZUMNO

<sup>1</sup> Moguće postići uz sistem mehaničke ventilacije <sup>2</sup> Moguće je i pasivno hlađenje ljeti.

Izjova o odricenju odgovornosti: Ni Evropska komisija, ni bilo koja osoba koja djeluje u ime Komisije nije odgoverna za upotrebu sljedećih informacija. Za stavove izražene u ovoj publikaciji isključiva je odgovornost autora i ne odražavaju nužno stavove Evropske komisije.

Figure 3: Heating Matrix for single and double family houses (is applicable in whole Bosnia and Herzegovina), Source: ENOVA, graphically edited by ENOVA



Ovaj projekt je finaniran iz prog Horizon 2020 Europske unije bespovratnih sredstava br. 8470	prema sporazumu o		ſ	MATR	ATRICA GRIJANJA 🛛 🖌 🖌 🖌 🚽 repla					ace		
		Nisko-tem		grijanja i priprem peratura polaza <	a potrošne tople 35°C	vode (PTV)	Nisko-tem		a grijanja i priprema potrošne tople vode (PTV) peratura polaza < SS*C			
Kombinacija sistema grijanja	L		En	ergijski razred zgr	ade				ergijski razred zgr	ade		
Centralno grijanja na pelet + solarni kolektori												
Centralno grijanja na drvnu sječku + solarni kolektori												
Daljinsko grijanje na biomasu + solarni kolektori												
Toplotna pumpa sa ravnim kolektorom + solarni kolektori												
Toplotna pumpa sa dubinskom sondom + solarni kolektori												
Toplotna pumpa voda - voda + solarni kolektori	<b>م</b>											
Toplotna pumpa voda - zrak + solarni kolektori	<b>"</b> "											
F Dobra / manje dobra pogodnost: Zračne toplotne izvorom topline, odvodni zrak iz zatvorenih područja, također su vrlo pogodne za zgrade klase	bazena ili wellness		VEOMA DOBRA		DO	BRA		SLABA		NI PRIKL		

Figure 4: Heating Matrix for larger volume buildings (is applicable in whole Bosnia and Herzegovina), Source: ENOVA, graphically edited by ENOVA



### 4 | Bulgaria: Rhodope Mountain Region

#### 4.1 Heating Matrix for single and double family houses

			Препоръка горещо вода	Слънчева вятърна енергия				
(котел + радиатори) Ефективни печки на дърва за огрев Централно отопление (топлофикация) врмопомпена инсталация "въздух-вода"	А+ (<48 kWh/kb.m)	А (43-95 kWh/кв.м)	В (96-190 kWh/кв.м)	с (191-240 kWh/кв.м)	D, E, F, G (>240 kWh/кв.м)	Слънчеви колектори	Термопомп а	Възможі гъвкава употреб Готова интелиген мрежа
	0	Ø	(3)	0	0	++	+	
Котелна инсталация на дърва за огрев (котел + радиатори)	0	0	0	0	0	+	+	
Ефективни печки на дърва за огрев		Ø	0	0	Ø	+	+	
	Ø	0	Ø	0	Ð	-	-	
ермопомпена инсталация "въздух-вода"	Ø	Ø	Ø	0	Ø		++	
ермопомпена инсталация "въздух-въздух" (климатици)	0	0	0	0	0	+	+	

Опкая от отговорност: Ните Европейската комисии, кито което и да е лице, действащо от името на Комисиита, не носи отговорност за канкото и да е класкаване на следиата информация. Мненината, изразени в тази публикация, са единствената отговорност на заторите и не отразваат непременно зинданията на Европейската комисии. Вългронавендането и преводал с интърговска ца са разрешени при посочване на каточника.

Figure 5: Heating Matrix for single and double family houses for Rhodope Mountain Region, Bulgaria, Source: BSERC, graphically edited by ENOVA



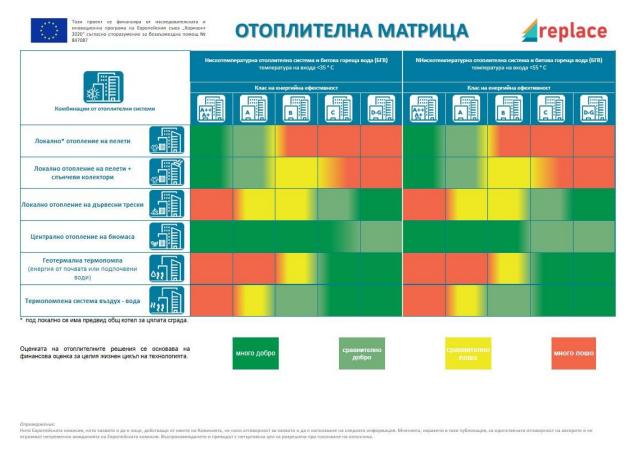


Figure 6: Heating Matrix for larger volume buildings for Rhodope Mountain Region, Bulgaria, Source: BSERC, graphically adapted by ENOVA



## 5 | Croatia: Primorsko goranska County, City of Zagreb incl. three bordering counties

#### 5.1 Heating Matrix for single and double family houses

			Preporuka za s potrošne	e Energija sunca/vjetr					
Sutar grijanja		Pasivna kuća¹ ≤ 15 kWh/m² a (A+)	Niskoenergetska kuća¹ ≤ 25 kWh/m² a / (A)	Niskoenergetska kuća ≤ 50 kWh/m² a (B)	Kuća/zgrada ≤ 100 kWH/m² a (C)	Kuća/zgrada > 100 kWH/m² a (D-G)	Solarni toplinski sustav	Dizalica topline + fotonaponski sustav	Moguća fleksibiln upotreb: Smart Gri
(ombinirani custav mohaničko vontilacijo i dizalico		0	0	0			+	++	+++
Dizalica topline zemlja-voda Dizalica topline voda-voda <sup>z</sup>		Ø	Ø	Û	<b>O</b>	Ø	+	++	++
skotemperaturni sustav distribucije topline vode do				Û			+	++	++
35°C Dizalica topline zrak-voda skotemperaturni sustav distribucije topline vode do 35°C		Ø	Ø		Ø	Ø	+	++	++
Centralno grijanje na pelete s međuspremnikom				Ø			++	++	
Centralno grijanje na kotao na drva s postupkom pirolize s međuspremnikom		0	0	Ø	0		++	+	
Lokalni/područni centralizirani toplinski sustav na biomasu	ΩΩ			Ø			+	++	
grijanje cijele kuće s međuspremnikom			Ø	Ø	Ð		++	+	
Kamin (ogrjevno drvo/peleti) / kaljeva peć grijanje cijele kuće bez sustava za pripremu tople vode			Ø				+	++	
lektrični sustav izravnog grijanja (npr. infracrveno) sa solarnim sustavom	Ð						++	++	
Kogeneracijsko postrojenja na biomasu sa spremnikom toplinske energije		Û	Ø	0	0		++	+	++
Dizalica topline morska voda-voda			Û	Ø			+	++	++
		JAKO PRIKALADAN	PRIKLAD	AN M	IANJE PRIKLADAN	NUE PRIKLADAN			NIČKI ZUMNO

Izjava o odricanju odgovornosti: Niti Europska komisija niti bilo ko

Figure 7: Heating Matrix for single and double family houses for Primorsko goranska County, City of Zagreb incl. three bordering counties, Source: REGEA, graphically edited by ENOVA



Ovaj projekt financiran je istra programom Europske unije Horizon dodjeli bespovratnih sredstava br. 84	2020 prema spora:		N	ЛАТВ		GRIJA	NJA	a 🖌 🖌 🖌				
		Nis		sustav grijanja i j peratura polaza <	pripreme tople vo 35°C	de	Nis	Nisko-temperaturni sustav grijanja i pripreme tople vode temperatura polaza > 55°C				
Kombinacije sustava grijanja			Ene	rgetski razred zgr	rade			Ene	rgetski razred zgr	ade		
Centralno grijanja na pelete + solarni sustav												
Grijanja na drvnu sječku + solarni sustav												
Grijanje na biomasu + solarni sustav												
Dizalica topline zemlja - voda s kolektorom + solarni sustav												
Dizalica topline zemlja - voda sa sondom + solarni sustav												
Dizalica topline voda - voda + solarni sustav												
Dizalica topline zrak - voda + solarni sustav												
Pog Dobra / manje dobra pogodnost: Zračne dizalice top izvorom topline, odvodni zrak iz zatvorenih baze područja, također su vrio pogodne za zgrade klasa A +	na ili wellness		JAKO PRIKLADAN		PRIKL	ADAN					ue Adan	

Figure 8: Heating Matrix for larger volume buildings for Primorsko goranska County, City of Zagreb incl. three bordering counties, Source: REGEA, graphically adapted by ENOVA



### 6 | Germany: Bavarian Oberland

#### 6.1 Heating Matrix for single and double family houses

			Warmwass empfo	Wind-/ Sonnenen gie						
Heizungssystem		Passiv- haus¹ ≤ 10kWh/m² a (A++)	Niedrigstenergiehaus¹ ≤ 15 kWh/m² a (A+)	Niedrigstenergiehaus¹ ≤ 25 kWh/m² a / (A)	Niedrigenergiehaus ≤ 50 kWh/m² a (B)	Altbau ≤ 100 kWh/m² a (C) <20J oder saniert	Altbau > 100 kWh/m² a (D) >20J un/teilsaniert	Solartherm e	Wārmepum pe i + Photovoltaik	möglic Smart G
Passivhaussystem Komfortlüftung mit Luftheizung		Ø	0	0	0	0	0	+	++	
Kombigerät Komfortlüftung + Wärmepumpenheizung; NiedertempWärmeverteilung bis 35°C		Ø	Ø	0	0			+	++	++
Erdreich-Wärmepumpe <sup>2</sup> Nedertemperatur-Wasser-Wärmeverteilung bis 35°C								+	++	++
Grundwasser-Wärmepumpe <sup>2</sup> ieder-temperatur-Wasser-Wärmeverteilung bis 35°C		Ø	0	Ø	Ø		0	+	++	++
33 C Außenluft-Wärmepumpe Jiedertemperatur-Wasser-Wärmeverteilung bis 35°C		0	0	Ø	0	Ø		+	++	++
Pellets-Zentralheizung mit Pufferspeicher					0		0	++	++	
Stückholzvergaser-Zentralheizung mit Pufferspeicher		0	0	0	0	0	Ø	++	+	
Nahwärme/Fernwärme auf Biomassebasis				0	0	0	0	+	++	
Kaminofen (Stückholz/Pellets) / Kachelofen Ganzhausheizung mit Pufferspeicher				Ø	0	10	19	++	+	
Kaminofen- / Kachelofen-Ganzhausheizung ohne wassergeführtes Wärmeabgabesystem				0	Ø	.0		+	++	
Elektro-Direktheizung (z.B. Infrarot) mit Solaranlage	Ê		0	0	Ø	0	0	++	++	
reichbar mit Komfort, oder Einerkaumfüllung nur mit Wärmerlichgewinnung		SEHR EMPFEHLENSWERT	EMPFEHI	LENSWERT	WENIGER EMPTEMERAR	NICHT EN	IPFOHLEN		CH NICHT	

Figure 9: Heating Matrix for single and double family houses for Bavarian Oberland, Germany, Source: WIP, EWO, graphically edited by ENOVA



Dieses Projekt wird aus dem Innövationsprogramm Horizont 2020 der im Rahmen der Finanzhilfevereinbarung N	Europäischen Unior			HEIZU	INGS	-MAT	RIX		1	rep	lace		
		Niederte		abgabesγstem u auftemperatur <∃	nd Warmwasserb 35 ° C	ereitung	Hochte			gabesystem und Warmwasserbereitung Iftemperatur >55 ° C			
Systemkombinationen				Gebäudeklassen					Gebäudeklassen				
Pelletzentralheizung + Solaranlage	Ĩ												
Hackgutheizung + Solaranlage	Ĩ												
Biomasse Nahwärmeheizung + Solaranlage	Ĩ												
Erdreich-Wärmepumpe mit Erdkollektor + Solaranlage													
Erdreich-Wärmepumpe mit Erdsonde + Solaranlage	Ĩ												
Grundwasser-Wärmepumpe + Solaranlage	Ĩ												
Luft-Wärmepumpe + Solaranlage	Ĩ												
Gut/weniger gut: Luft-Wärmepumpen mit zusätzlicher Wi Abluft aus Hallenbad oder Welinessbereich sind bei Get Klassen A + und A ++ ebenfalls sehr gut geeignet			SEHR GUT		GI	т		WENIGER GUT		NIG GEEM			
Haftungsausschluss: Weder die Europäische Kommission noch eine im Namen der Kom spiegeln nicht unbedingt die Ansichten der Europäischen Kommissi	mission handelnde F ion wider. Vervielfäl	Person ist für o Itigung und Ob	die Verwendung de ersetzung für nicht	r folgenden Informa kommerzielle Zweci	tionen verantwortlic ke sind gestattet, sof	h. Die in dieser Veri ern die Quelle ange	öffentlichung geäuß geben ist.	erten Ansichten lieg	en in der alleinigen	Verantwortung der A	Autoren und		

Figure 10: Heating Matrix for larger volume buildings for Bavarian Oberland, Germany, Source: WIP, EWO, graphically adapted by ENOVA



### 7 | North Macedonia: KAGoP Region

#### 7.1 Heating Matrix for single and double family houses

			Препорака систем за п топл	Сончева/Ве рна енерги					
Систем за греење		Најниско енергетска куќа ≤ 15 kWh/m²a (A+)	Најниско енергетска кулса ≤ 25 kWh/m²a (A)	Нискоенергетска куќа ≤ 50 kWh/m²a (B)	Стара зграда ≤ 100 kWh/m²a (C) <200 или реновирана	Стара эграда > 100 kWh/m³a (D) >20J не/делумно реновирана (најголем дел од ноан објекти)	Сончеви колектори	Топлинска пумпа + фотоволтан ци	употреба Подготвен
Комбиниран уред за добра вентилација + греење со топлинска пумпа; истрибуција на топлина со ниска температура до 35°C	A		Ø	0	-0	- 0	+	++	++
кстриоуција на топлина со ниска температура до за с Топлинска пумпа за искористување на топлина од подземни води температура на вода за дистрибуција на топлина до 35°C			0	Ø	0	0	+	++	++
Мулти-инвертер клима уреди		0	0		0		++	++	++
Топлинска пумпа за искористување топлината од надворешниот воздух истрибуција на топлика на вода на нисна температура до 35 °			0	0	0	0	+	++	++
Централно греење на пелети со бафер		0	0	0	Ø	Ø	++	++	
Локално/Централно греење					0	0	+	++	
отел на биомаса и топлински бафер за греење на цел објект со топловодна инсталација			0	0	70	-0	++	+	
Котел за греење на цел објект без топловодна инсталација	0		Ø	Ø	0		+	++	
Електрично греење	(F)	0	Ô	Ø	0	0	++	++	
		многу добро	добр	o	приедтливо	неприфатливс		ТЕХНИЧИ	и неразум

сталовите на Европската ноимсија. Репродунција и прелод за неномерцијални цели се одобрени под услов да се принае изворот.

Figure 11: Heating Matrix for single and double family houses for KAGoP Region, North Macedonia, Source: SDEWES-Skopje, graphically edited by ENOVA



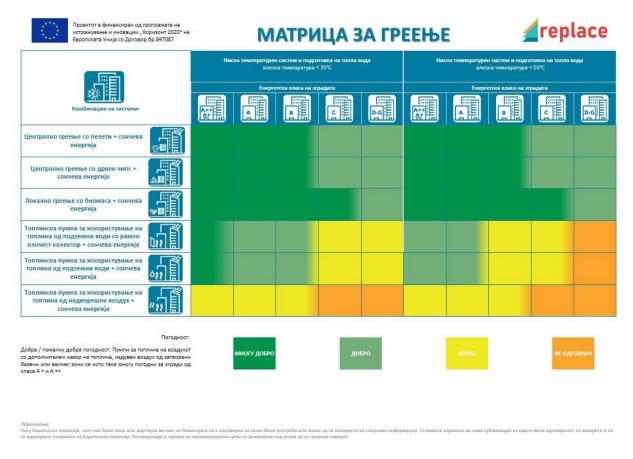


Figure 12: Heating Matrix for larger volume buildings for KAGoP Region, North Macedonia, Source: SDEWES-Skopje, graphically adapted by ENOVA



## 8 | Republic of Serbia: City of Šabac

#### 8.1 Heating Matrix for single and double family houses

			Preporuka za sistem pripreme potrošne tople vode		Energija sunca/vjet				
Sistem grejanja		Pasivna kuća¹ ≤ 15 kWh/m² a (A+)	Niskoenergetska kuća¹ ≤ 27 kWh/m² a / (A+)	Niskoenergetska kuća 45 kWh/m² a (A)	Stara zgrada (<10 godina ili obnovljena) ≤ 90 kWH/m² a (B)	Stara zgrađa (>10 godina) >90 kWH/m² a (C)	Solarni kolektori	Toplotna pumpa + fotonaponski paneli	Moguća fleksibiln upotreba "Smart Gr ready"
Kombinovani uređaj entilacija sa povratom toplote + toplotna pumpa; niskotemperaturni režim grejanja do 35 °C		Ø	Ø	Ø	(1)	0	+	++	++
Geotermalna toplotna pumpa <sup>2</sup> niskotemperaturni režim grejanja do 35 °C		Ø	Ø	Ø	0	Ø	+	++	++
Toplotna pumpa voda/voda² niskotemperaturni režim grejanja do 35 °C		0	Ø	Û			+	++	++
Toplotna pumpa vazduh/voda niskotemperaturni režim grejanja do 35 °C		0	Ø	Û	Ø		+	++	++
Sistem centralnog grejanja na pelet sa spremnikom toplote		Ø	Ø	Û	0	0	++	++	
istem centralnog grejanja sa pirolitičkim kotlom na drvnu biomasu sa spremnikom toplote		Ø	Ø	Ø	Ø	Ø	++	+	
Daljinsko grejanje (drvna sečka)		Ø	Ø	Ø	Ø	Ø	+	++	
Peć na drva (cepano drvo, pelet)/kaljeva peć Integralno grejanje sa spremnikom toplote			0	0	0	- 7)	++	+	
Peć na drva/kaljeva peć Integralno grejanje bez toplovodnog sistema za grejanje			Ø	Ø	73		+	++	
Električna energija	Ê			0	0	Ø	++	++	
		VEOMA DOBRO	DOBRO	SRI	EDNJE DOBRO	NUE PRIHVATLIIVO			INIČKI AZUMNO

Izjava o odricanju odgovornosti: Niti Evropska komisija niti bilo k

Figure 13: Heating Matrix for single and double family houses for City of Sabac, Serbia, Source: GRAD SABAC, graphically edited by ENOVA



Ovaj projekat finansira program za istraživanje Horizont 2020 Evropske unije u okviru sporazuma 847087.	MATRICA GREJANJA						<b>freplace</b>					
	Nisko-ten	Nisko-temperatumi sistem grejanja i priprema tople potrošne vode (PTV) temperatura na ulazu < 35°C					Nisko-temperaturni sistem grejanja i priprema tople potrošne vode (PTV temperatura na ulazu < 55°C					
Kombinacije sistema grejanja		Ene	ergetski razred zg	rade			Ene	rrgetski razred zg	rade			
Centralno grejanje na pelet + solarno												
Centralno grejanja na drvnu sečku + solarno												
Lokalno (daljinsko) grejanje na biomasu + solarno												
Geotermalna toplotna pumpa sa ravanskim kolektorima + solarni												
Geotermalna toplotna pumpa sa dubinskom sondom + solarna												
Toplotna pumpa za podzemnu vodu + solarna												
Toplotna pumpa koja koristi spoljni vazduh kao izvor toplote + solarna												
Prikladnost siste Dobra / manje dobra pogodnost: Vazdisme toplotne pump dodatnim izvorom toplote, izduvni vazduh iz zatvorenih bazer velnes zona takođe su vrlo pogodne za zgrade klase A + i A ++	sa	VRLO DOBRO		DO	BRO		LOŠE			UE ADNO		

Figure 14: Heating Matrix for larger volume buildings for City of Sabac, Serbia, Source: GRAD SABAC, graphically adapted by ENOVA



### 9 | Slovenia: Slovenia

#### 9.1 Heating Matrix for single and double family houses

		Tip stanovanjske stavbe / energijski razred								
Sistem agrevanja	Pasivna stavba <sup>i</sup> ≤ 10 kWh/m³a (A1)	Pasivna stavba ¹ ≤ 15 kWh/m² a (A2)	Nizkoenergijska stavba ≤ 35 kWh/m³ a / (B)	Energijska učinkovita stavba ≤ 60 kWh/m² a (C)	Energijsko neučinkovita stavba ≤ 105 kWh/m² a (D)	Energijsko neučinkovita stavba > 105 kWh/m² a (E, F, G)	Solarni ogrevalni sistem	Toplotna črpalka + sončna elektrarna	Prilagodl odjem Smart Gr	
Sistem pasivne hiše Ugodno prezračevanje z ogrevanjem zraka	0	7)	(7)	(7)	(7)	(7)	+	++		
ombinacija prisilnega prezračevanja in toplotne črpalke prezračevanje + toplotna črpalka za ogrevanje		0	0	0			+	++	++	
oplotna črpalka, ki temelji na izkoriščanju podtalnice <sup>2</sup> kotemperaturni sistem temperatura grelnega medija je navzgor omejena s temperaturo 35°C	0	Ø	0	Ø	Ø	0	+	++	++	
Toplotna črpalka, ki temelji na izkoriščanju toplote zemljine <sup>a</sup> ikotemperaturni sistem temperatura grelnega medija je navzgor omejena s temperaturo 35°C	0		Ø	Û	O	Ø	+	++	++	
Toplotna črpalka, ki temelji na izkoriščanju toplote zunanjega zraka	0	Ø	Ø		Ø		+	++	++	
Biomasni kotli na pelete z vmesnim pomnilnikom	0		Ø	Ø	Ø	Ø	++	++		
Biomasni uplinjevalni kotli	0	Ø	0	Ø	Ø		++	+		
Daljinsko ogrevanje biomasa/toplovod/plin	0		Ø	0	0	Ø	+	++		
Toplovodni kamin (drva/peleti) Hišno ogrevanje z vrnesnim skladiščem	0		0	Ø			++	+		
Kamin/kaminska peča/krušna peč brez vodnega sistema za odvajanje toplote	0		Ø	Ø	(7)		+	++		
Direktno električno ogrevanje (npr. IR paneli)	0		0	0	0	0	++	++		

Figure 15: Heating Matrix for single and double family houses for Slovenia, Source: JSI, graphically edited by ENOVA



#### projekt financira raziskovalni in inovacijski program ropske unije Obzorje 2020 v okviru sporazuma o dodelitvi edstev št. 847087. replace **OGREVALNA MATRIKA** nja in priprava san P-GI Centralno ogrevanje s peleti + sončna energija Centralno ogrevanje na sekance + sončna energija ⊾∭ Daljinsko ogrevanje z biomaso + sončno energijo Toplotna črpalka zemlja/voda s prizontalnimi kolektorji + sončna energija 122 Toplotna črpalka zemlja/voda z globinsko sondo + sončna energija 22 Toplotna črpalka voda/voda + sončna 022 energija Toplotna črpalka zrak/voda + sončna energija 22 25 Primernost Dobro / manj dobro udobje: Zračne toplotne črpalke z dodatnim virom toplote, izpušni zrak iz notranjih bazenov ali wellness prostorov so zelo primerne tudi za stavbe razreda A + in A ++ ZELO DOBRO

#### 9.2 Heating Matrix for larger volume buildings

Figure 16: Heating Matrix for larger volume buildings for Slovenia, Source: JSI, graphically adapted by ENOVA



### 10 Spain: Castilla y León Region

#### **10.1 Heating Matrix for single and double family houses**

Este proyecto está financiado por el investigación e innovación Horizonte 2021 Europea en virtud del acuerdo de subvención i	) de la Unión	MA	<b>FRIZ DE C</b>	CALEFACO	CIÓN			ace	
		Recomendación para el sistema de preparación de agua caliente sanitaria		Energía eólica / so					
Tipo de Sistema Térmico	Casas Pasivas	Edifico de muy baja demanda energetica (A+)	Edifcio de baja demanda energetica (A)	Edifcio de media demanda energetica ≤ 50 kWh/m² a (B)	Edificio de media demanda energética (C) Edifico antiguo o reacondicionado	Edificio de muy alta demanda energética (D) Edifico antiguo o parcialmente reacondicionado	Solar térmica	Bomba de calor + Fotovoltaica	Uso de sistema: Smart Gr ready
entilación confortable mediante calentamiento de aire	0	- 70	7)	73		7)	+	++	
ombinación de un dispositivo confort ventilación • bomba de calor para calefacción + distribución de calor a baja temperatura (hasta 35 °C)	Ø	0	Ø	Ø			+	++	++
Bomba de calor geotérmica distribución de calor hasta 35 °C	Ø	Ø	0	Û	Ø	Ø	+	++	++
omba de calor alimentada con agua subterránea distribución de calor hasta 35 °C	Ø			0			+	++	++
Bomba de calor alimentada con aire ambiente (aerotermia) con distribución de calor menor a 35 °C	0	0	Ø	0	0		+	++	++
Calefacción de pellets con almacenamiento	Û	0	Ø	0	Û	Ø	++	++	
Calefacción con gasificador de biomasa (leña)	0	0	Ø		Û	Ø	++	+	
Redes térmicas con biomasa	0	0	Ø		Ø	0	+	++	
Estufa o chimenea de biomasa (leña / briquetas / pellets) con distribución de calor mediante agua	0		0	ð	(P)	73	++	+	
Estufa o chimenea de biomasa (leña / briquetas / pellets) SIN distribución de calor mediante agua	Ø		Ø	Ø	7)		+	++	
Calefacción eléctrica directa (por ejemplo, infrarrojos) con sistema solar	0	Ø	Ø	0	Ø	0	++	++	
	MUY BUENA	BU	ENA	POBRE	INADEC	UADA		MENTE NO ISIBLE	

Figure 17: Heating Matrix for single and double family houses for Castilla y León Region, Spain, Source: EREN, graphically edited by ENOVA



Este proyecto está financiac investigación e innovación Ho Europea en virtud del acuerdo de	rizonte 2020 de la	Unión	MA	<b>TRIZ</b>	DE C/	<b>ALEF</b>		ĎΝ	1	repl	lace		
		(ACS) temperat temperatura de entrada < 35°C							ibución a baja temperatura y ACS ratura de entrada < 55°C Clase del edificio				
Combinación de sistemas													
Calefacción con pellets + solar													
Calefacción con astillas + solar													
Red térmica con biomasa + solar													
Bomba de calor geotérmica horizontal enterrada + solar													
Bomba de calor geotérmica con pozos + solar													
Bomba de calor alimentada con agua subterránea + solar	<b>م</b>												
Bomba de calor alimentada con aire ambiente (aerotermia)+ solar	<b>"</b>												
Buena / menos buena comodidad: las bombas d Vente de calor adicional, aire de escape de piscina Le bienestar, también son muy adecuadas para ec A ++	is cubiertas o áreas	1	MUY BUENA		BU	ENA		POBRE		INADE	CUADA		

Figure 18: Heating Matrix for larger volume buildings for Castilla y León Region, Spain, Source: EREN, graphically adapted by ENOVA



## 11 | Figures

Figure 1: Heating Matrix for single and double family houses for Austria (is applicable on federal level, countrywide too), Source: Austrian climate protection initiative "klimaaktiv" of BMK
Figure 3: Heating Matrix for single and double family houses (is applicable in whole Bosnia and Herzegovina), Source: ENOVA, graphically edited by ENOVA
Figure 5: Heating Matrix for single and double family houses for Rhodope Mountain Region, Bulgaria, Source: BSERC, graphically edited by ENOVA
BSERC, graphically adapted by ENOVA
Figure 9: Heating Matrix for single and double family houses for Bavarian Oberland, Germany, Source: WIP, graphically edited by ENOVA
Figure 10: Heating Matrix for larger volume buildings for Bavarian Oberland, Germany, Source: WIP, graphically adapted by ENOVA
Figure 12: Heating Matrix for larger volume buildings for Skopje Region, North Macedonia, Source: SDEWES, graphically adapted by ENOVA
Figure 13: Heating Matrix for single and double family houses for City of Sabac, Serbia, Source: GRAD SABAC, graphically edited by ENOVA
Figure 14: Heating Matrix for larger volume buildings for City of Sabac, Serbia, Source: GRAD SABAC, graphically adapted by ENOVA
edited by ENOVA
ENOVA
EREN, graphically edited by ENOVA