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THE DEVELOPMENT OF RENEWABLE HEATING AND COOLING IN THE DANUBE REGION

NATIONAL ENERGY AND CLIMATE PLANS IN THE DANUBE REGION

- Renewables in the heating and cooling (H&C) sector accounts for a very significant part of overall RES consumption in the DR even though the sector does not have near the level of applied support schemes and policies as sectors like power and transport sectors.
- Most of the DR countries plan to increase RES-H&C until 2030 which will continue to be underpinned by strong dependency on biomass.
- Although geothermal energy has strong potential to contribute to decarbonisation goals and reduce fossil fuel import dependency in the heating sector, it receives little attention in DR national strategic documents.
- Despite ambitions to radically reduce national GHG emissions, the huge potential of the LULUCF sector to cheaply sequester and store carbon is not seriously targeted by DR climate policy measures, evidenced by the projected drop in net sequestration from 68 million tons of CO_{2eq} in 2018 to 20 million tons CO_{2eq} by 2030.
- Policy instruments should be redesigned to avoid erosion of natural sequestration caused by poor forest management by properly valuing its climate and economic role and striking a balance between biomass use as energy source and carbon sink.
- Given all the legitimate concerns about use of biomass resources, the fact that its use in electricity wastes about half of the useful energy compared to heat should be reflected in policies.

This policy brief is part of a series based on the study National Energy and Climate Plans of the Danube Region *commissioned by the Ministry of Foreign Affairs and Trade of Hungary in 2020.*
Other policy briefs cover the electricity (2021/04), natural gas (2021/05) *and* transport (2021/07).

CURRENT SITUATION AND TARGETS

The 2018 Renewable Directive (EU 2018/2001, RED II) does not define binding sectoral RES share targets but sets the following for heating and cooling:

- Increase RES share by an indicative annual average of 1.3% from 2021
- Set a minimum level of RES for new buildings and buildings subject to major renovation, if economically and technically feasible
- Increase the share of renewable and waste heat / cooling in district heating and cooling systems by 1% annually.

District heating companies are also obliged to connect providers with renewable heat sources to their network unless it is not feasible, in which case a detailed justification must be submitted listing the conditions for possible connection.

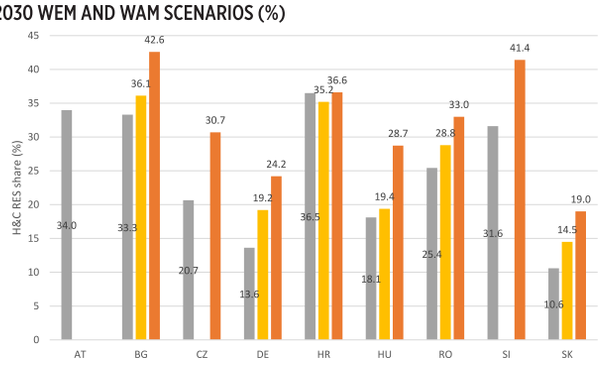
For the most part EU DR Member States must meet the above-mentioned criteria, though situational modifications can be made for local conditions, e.g., the mandatory growth rate is 1.15% in Bulgaria, 1.1% in Czechia, while Slovakia will follow a 1.4% growth rate between 2020-2025.

Although there is not an exogenously defined sectoral RES share target, each DR country defines its own ambition. 11 of the 14 DR countries have achieved their 2020 targets and in many cases surpassed them. Outside of Germany and Slovakia, renewable heat represents more than 20% of heat demand, with 4 countries near 40% or more. Clearly the heating and cooling sector plays a very important role in reaching the overarching RES targets of EU DR countries.

The NECPs project what a country can achieve over the decade with currently existing measures (the WEM scenario) and more ambitious measures (the WAM scenario).[1] Since non-EU DR countries have not completed NECPs or produced these 2030 estimates, only EU DR members are assessed in this subsection.

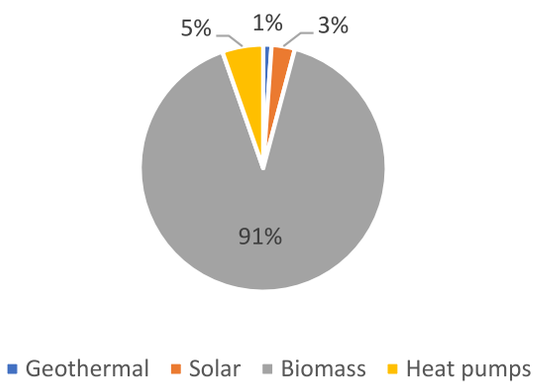
1 WEM and WAM refer to the scenarios 'With Existing Measures' and 'With Additional Measures'.

FIGURE 1. SHARE OF RENEWABLE ENERGY IN THE H&C SECTOR COMPARED TO 2030 WEM AND WAM SCENARIOS (%)



Source: EUROSTAT SHARES database, NECPs of the presented countries

FIGURE 2. DISTRIBUTION OF APPLIED RES TECHOLOGES IN THE DANUBE REGION COUNTRIES, 2018 (WITHOUT UA)



Source: EUROSTAT SHARES database, NECPs of the presented countries

Figure 1 compares the 2030 WAM scenario to current (2018) levels and the WEM scenario. It is evident that the countries expect their additional measures to have a substantial effect, resulting in 2-3 times higher share of RES-H shares compared to the WEM scenarios (except Croatia where the current share is already very high). The biggest contrast can be found in Hungary, with WAM leading to more than eight times higher RES share than WEM.

Besides increasing RES-H supply, energy efficiency measures reducing H&C demand are also used to increase the share.

POLICIES AND MEASURES

Compared to other energy sectors, H&C does not have much experience with feed-in-tariff or premium systems. Investment support is the most common application for RES-H, which is usually uneven, while operating support is rare. Czechia is the only DR country providing both investment and operating support. Other forms of financial support like the introduction of guarantees of origin are planned in Austria and Bulgaria. District heating receives most of the support for renovations and RES integration, where again only Czechia is in a planning phase.

All EU DR countries aim to mitigate fossil fuel reliance, mainly through biomass applications. Figure 2 shows the overwhelming majority of current DR H&C RES-H is biomass based. Furthermore, biomass is mostly consumed in the residential sector, in outdated, heavily polluting stoves, often mixed with coal or trash.

Table 1 presents the expected distribution of RES technologies in 2030 compared to 2018. Slovenia is the only country which aims to reduce biomass usage, and Croatia and Slovakia plan to keep it at a nearly constant level but outside of these three countries it will grow 15-47% compared to 2018. The expected expansion of solar heat is mostly concentrated in Hungary and Slovakia, with expected 2030 values 4-6 times higher than in 2018. Along with Czechia, they are the most ambitious for promotion of heat pumps. However, the share of these technologies stays at 30% or lower in 2030.

TABLE 1. EXPECTED USAGE OF RES TECHNOLOGIES IN THE H&C SECTOR 2030, KTOE

	BG		CZ		DE		HR		HU		RO		SI		SK	
	2018	2030	2018	2030	2018	2030	2018	2030	2018	2030	2018	2030	2018	2030	2018	2030
Biomass	1161	1508	2656	3085	12162	14000	1151	1175	1700	2504	3435	n/a	540	387	627	650
Solar	25	30	18	38	763	n/a	14	34	13	47	1	n/a	11	17	7	43
Geotherm.	35	35	0,0	39	117	n/a	8	38	127	117	31	n/a	14	n/a	5	50
Heat pump	92	122	173	288	1153	n/a	15	n/a	8	14	n/a	120	38	n/a	n/a	94
Other	n/a	n/a	n/a	481	n/a	6000	n/a	97	n/a	n/a	n/a	264	n/a	208	n/a	100
SUM	1313	1695	2847	3931	14194	20000	1188	1343	1847	2681	3467	n/a	603	612	639	937

Source: EUROSTAT , NECPs. Note: n/a – data are non-availabe. In the German NECP „other" category includes all RES technologies excep biomass, Romanian NECP inlcudes projections only for heat pumps and derived heat (other).

Mainly through investment support, solar heat and heat pumps are incentivized for individual heating, and waste heat and geothermal in the district heating sector.

Although geothermal energy for heating could be available for more than 25% of the EU population , it receives little attention in NECPs. As shown by Figure 3, the dense structure of district heating infrastructure in CEE would be well complimented by geothermal energy.

Geothermal district heating and heat use in industry, agriculture and other sectors represent 5,5 GWth installed capacity in 327 systems across 25 European countries . 5 DR countries are among the top 10 in the EU (Germany, Hungary, Romania, Slovakia, Serbia), with Germany and Hungary having the highest deployment rate. Both countries support geothermal energy through various programs, although the pace of planned deployment and exploitation is not in line with the potential. Slovakia has moderate targets, while Romania and Serbia are behind owing to complex and long licencing procedures.

Of the other countries with significant untapped potential (Slovenia, Croatia, Austria), Croatia has several plants under development and envisage further deployment, but Austria and Slovenia do not set any related NECP targets. In Ukraine geothermal research and utilization is at a very early stage, and other non-EU DR countries do not include geothermal development in their strategies (BA, BG, ME, MD).Even though geothermal energy could contribute significantly to reaching the decarbonisation goals and alleviating fossil fuel dependency, it receives little emphasis in the NECPs and energy strategies of DR.

At the same time, upgrading and expanding district heating networks is planned in all EU DR countries, with Germany targeting modern low-temperature heat networks.

Only Austria, Bulgaria, Slovakia, and Moldova mention awareness raising programmes related to H&C in national strategic documents, .

FIGURE 3. EUROPEAN CITIES WITH DISTRICT HEATING SYSTEMS (LEFT) AND GEOTHERMAL HEAT AT 2000 M DEPTH

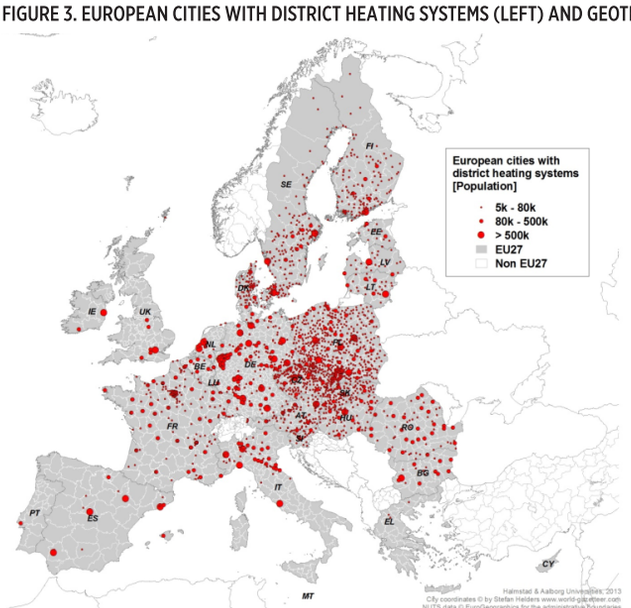


Figure 9: Cities with district heating systems in EU27 by city size and for cities having more than 5000 inhabitants. The map shows 2188 cities with 2445 systems [8].

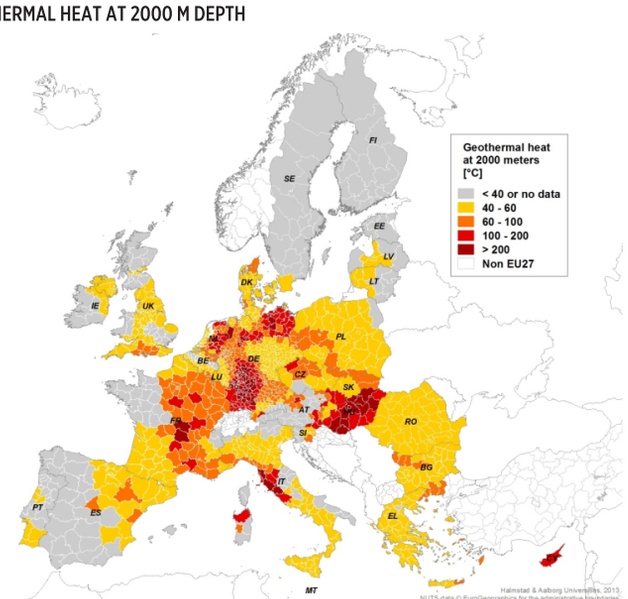


Figure 84: Identified geothermal heat resources by temperature at 2000 m depth by NUTS3 region. Source: European Commission, Atlas of Geothermal Resources in Europe. Publication EUR 17811, Luxembourg 2002.

Source: Heat Road Map Europe 2050 project, 2013

Most of the DR countries have already implemented or are planning to implement measures to promote renewable fuels other than biomass, but measures towards technological and fuel diversification must be a key priority in the whole region in the coming years to reduce biomass dependency and to open up the possibility of a wider, more significant RES expansion. Instruments, like the promotion of electrified heating or heat pumps are cited in some of the NECPs but remain an untapped opportunity for further RES expansion in the sector.

BIOMASS FOR ENERGY

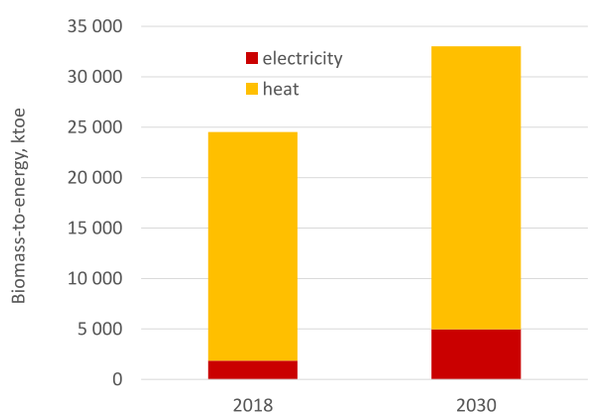
As can be seen from Table 1, biomass is the primary renewable energy option for DR countries, ubiquitous and affordable for household heating.

Despite its outweighed share, few countries have made plans for household biomass energy consumption. The most common measure is provision of public aid for the installation of more efficient biomass boilers and stoves. 5 out of the 9 EU DR countries have incorporated measures and targets, ranging from agenda setting (HU) to full blown implementation (CZ) and minimum efficiency requirements for planned units (CZ, BG).

The socioeconomics of household biomass is gaining prominence on the agenda of some DR countries. Croatia is planning further research while Slovenia has implemented an aid scheme supporting the poorest households to replace wood biomass and fossil combustion units with high-efficiency renewable alternatives. Montenegro plans to increase final consumption of wood for space heating by households and has launched free loans for households to use modern forms of biomass (pellets, briquettes, wood chips) for space heating.

Besides the historic legacy of household biomass for heating, support schemes are further enabling biomass growth in

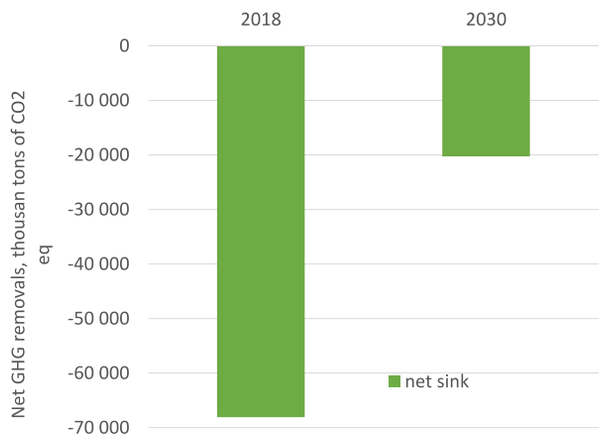
FIGURE 4. HEAT AND ELECTRICITY PRODUCED FROM BIOMASS (KTOE) IN 2018 AND 2030 WAM



Source: NECPs

Note: Heat and electricity produced from biomass is not equal to the biomass that is needed for this amount of useful energy; net efficiency rate for electricity production averages 30-40% and for heat 70-80%. Thus, the amount of input biomass is significantly higher.

FIGURE 5. NET REMOVALS BY LULUCF (GG CO_{2EQ}) IN 2018 AND 2030 WEM



Source: NECPs, National Inventory Reports

transformation sectors. The widely shared conviction about the climate benefits of biomass combustion, the easily managed and economic co-firing with coal or fuel switching have made it the cheapest renewable energy technology of scale. Biomass electricity production is expected to keep growing according to EU DR NECPs. The combined increase for all DR countries (with RO missing) is surprisingly large: from 21.5 TWh in 2018 to 57.7 TWh by 2030, a rise of 268%. Germany, Croatia, and Slovenia would each more than doubles its current share of biomass in electricity.

As for built-in biomass electric power plants, while Croatia and Romania are preparing for reduction, the rest are adding significant capacities, resulting in a net increase of 15% for the DR (with AT missing). Absent Germany, aggregate EU DR investment in biomass will be 35% more in 2030 than 2020.

Similarly, non-EU DR countries seek to further increase their biomass electricity. Ukraine is promoting biomass co-firing with fossil fuels power plants and Serbia will add 1000 MW of new biomass boilers by 2050. Even countries that lack significant biomass reserves, (Moldova, Montenegro, Bosnia i Herzegovina) plan to implement support schemes for biomass electricity.

The plans for biomass-to-heat are much less ambitious than in power generation. Only Slovenia is planning to significantly reduce its biomass-to-heat share (by 30%) as depicted in Table 1. Altogether, the region is set to increase biomass heating by 24%, from 22.7 Mtoe in 2018 to 28.1 Mtoe in 2030 (with non-EU countries also included).

Given the understanding between the large disparity in energy efficiencies of biomass technology, the projected outcomes should come as a surprise. Biomass-to-electricity is usually produced at net efficiency rates of no more than 30%-40%, or at best 45%, while biomass-to-heat technologies have a minimum net energy efficiency rate of 70-80%, but can reach 85-90%. Given all the concerns about scarcity and unsustainability of biomass as a resource, the fact that biomass used for electricity produces about half of the useful energy that it would applied to heat should be reflected in plans and policies. The fact that this discrepancy is not accounted for in NECPs should become a top priority in the next revision.

BIOMASS FOR CARBON SEQUESTRATION

The forestry sector does not include an explicit quantitative target for carbon sequestration. As part of LULUCF, (Land-Use, Land-Use Change and Forestry) removals and emissions by the forestry sector are broadly implicit. Typically, forests and grasslands are net sinking subsectors, while croplands, wetlands, and settlements are massive net emitters. Several DR countries are anticipating deteriorating forestry sequestration due to the combination of intensive harvesting and disruptions of natural increments of live forest stock (climate change and aging). From a total of 68 million tons of CO_{2eq} in 2018, the EU DR will only have 20 million tons of CO_{2eq} by 2030 (WEM). To conclude, despite the high ambitions for reducing GHG emissions across the DR, the massive potential of LULUCF to cheaply sequester and store carbon is not taken seriously enough with climate policy measures.

THE FULL BIOMASS PICTURE

EU DR countries have made substantial plans for biomass use in their NECPs. Biomass-to-heat has been the single largest renewable energy segment in their energy balances, and still more is to come (24% increase between 2018-2030). Biomass electricity, though only sliver of this now, looks to boom in the forthcoming decade (168% increase). Combined, biomass will grow from 1027 PJ in 2018 to 1383 PJ in 2030 (35% increase, WAM).

Consumption of so much more biomass for energy does carry the risk of losing forest carbon stocks to the atmosphere. Although there is not enough data in the NECPs to evaluate this issue in its entirety, there are clues from plans regarding the LULUCF sectors. EU DR countries are preparing for a significant loss of LULUCF carbon sinks of 70% by 2030 with existing measures. (Note that forestry is usually the only subsector of LULUCF with negative carbon inventory – net sinking.)

These two trends should be alarming for climate policy makers. It is one-sided climate policy to support the consumption of forestry biomass with zero accounted carbon emissions while ignoring the climate economic value of forest sequestration and carbon storage. A decade-long climate policy ignoring these issues could have severe consequences, so timely action is needed to address this policy failure. Policy instruments should be redesigned to avoid loss of natural sequestration caused by poor forest management biased towards biomass for the energy purposes at the expense of forest ecosystems. Without integrative climate policy instruments to target biomass resources as well, any further support for biomass-to-energy should be reconsidered.

This holds for EU and non-EU DR countries, all going down the same path with biomass expansion and on a track to lose a significant part of their LULUCF carbon stocks and the corresponding carbon sequestration potential.

Given all the worries about scarcity and unsustainability of biomass resources, it should be making a huge difference in policy that biomass electricity wastes about half of the useful energy that is available from biomass-to-heat. Why this aspect is not found to prevail in the NECPs – it is a question that remains unanswered and deserves a high rank on policy agenda when NECPs are next updated.

SUMMARY AND RECOMMENDATIONS

The H&C sector is of great importance to achieving overall renewable goals in the DR. However, current and future RES-H expansion depends much too heavily on the use of biomass resources. Our recommendations are the following:

- Stable and predictable support for modern renewable H&C systems to create a level playing field for biomass alternatives in the district heating and household heating sectors.
- The potential for geothermal energy needs to become a higher priority where it can be exploited at a reasonable cost. Modern individual and collective heating systems shall are positioned to replace fossil-fuel-based heating, including the use of natural gas.
- Household firing of biomass in old, outdated stoves should be phased-out with support for modern heating devices and energy efficiency improvements.
- Climate and energy related strategies should consider the huge potential of the LULUCF sector to cheaply sequester and store carbon through the introduction of policy instruments that reward its economic value.

REKK FOUNDATION

The goal of the REKK Foundation is to contribute to the formation of sustainable energy systems in Central Europe, both from a business and environmental perspective. Its mission statement is to provide a platform for open-ended, European-wide dialogue between government and business actors, infrastructure operators, energy producers and traders, regulators and consumers, professional journalists and other interested private entities. The Foundation will develop policy briefs and issue papers with forward-looking proposals concerning challenges posed by energy and infrastructure systems and organize regional forums allowing stakeholders to become familiar with the latest technological and regulatory developments within the industry.

Bettina Dézsi joined REKK as a research associate in October 2017. She completed her MA degree in economics at Eötvös Lóránd University in 2016 and her BA degree in applied economics at Corvinus University of Budapest in 2012. During her university studies she was a member of Rajk László College for Advanced Studies, a college of Corvinus University of Budapest. Before joining REKK she was working at McKinsey & Company as a research analyst, where she was performing support analysis in a wide range of topics and industries.

Gabriella Szajkó graduated at the Budapest University of Economics in 1992. She worked as a research assistant and as a research associate at the Economics Department of the Central European University through 1997. She was a PhD student at the Graduate School of the Corvinus University of Budapest between 1997 and 2002 studying and teaching environmental economics. She wrote her PhD dissertation about CO2 emission markets and got her PhD in 2005. In parallel, she worked at the Ministry of Economics in 1998-2000 and at the Hungarian Energy Regulator in 2000-2003, in charge of analyzing energy markets and environmental regulation. She was faculty member at the Department of Environmental Economics and Technology at the Corvinus University of Budapest between 2003 and 2007. She was founding member of REKK in 2004 and has become a full-time senior research fellow since 2007. She has focused on economic research of environmental regulation in the energy sectors. She has been lead author of several papers, i.e.: national greenhouse gas emission projections, domestic biomass markets research, emerging renewable energy markets monitoring project.

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