GREEN HEAT FOR ALL 2

ANNEX 2: ANALYSIS OF THE NECPS

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Abbreviations

NECP: National Energy and Climate Plan
NECP-2019: National Energy and Climate Plan, published in 2019
NECP-2023: draft version of National Energy and Climate Plan, published in 2023
PV: photovoltaic (electricity production with solar cells)
RE: renewable energy
RES-H: renewable energy sources for heating

CHAPTER 1: GENERAL OVERVIEW

The primary objective of this report is to illustrate how Member States plan to transform the heating sector based on their National Energy and Climate Plans (NECPs), with a particular focus on greenhouse gas emissions and renewable energy sources, including ambient heat and heat pump technology. The EU mandated its Member States to publish and implement ten-year NECPs in 2019, which cover the period 2021-2030. These initial plans aim to outline the objectives, policies, and measures that will help Member States achieve the EU's 2030 emission reduction targets.

In the subsequent phase, Member States were required to submit updated draft plans to the European Commission by June 30, 2023, and the final NECPs by June 30, 2024. Unfortunately, only a minority of Member States met this deadline, and the majority of countries were still behind schedule even in mid-August. Therefore, a comprehensive comparison and analysis were not feasible at this stage.

On August 15th, the collection of incoming documents was closed. For the 15 countries that had not yet published the new draft NECP-2023s by that date, data from the old NECP-2019s had to be used for the analysis. If newer information was published in other documents, that was taken into account in the analysis. Another limiting factor was the uneven quality of the material submitted to NECPs; many documents were incomplete or inaccurate, which hindered the comparison of the 2030 targets.

1.1 PLANS TO REDUCE ENERGY CONSUMPTION FOR HEATING AND COOLING

The scarcity of environmental resources, high dependence on imports, and environmental crises, including climate change, necessitate significant reductions in energy consumption for heating and cooling across the European region for all countries and most households. Simultaneously, the transition to environmentally friendly use of renewable energy sources is a key element of this transition. To achieve these goals, the European Union expects Member States to transform their energy systems through meticulous and well-thought-out planning. One of the tools in this complex planning process is the NECP. These plans are considered state-of-the-art if they focus not only on **energy efficiency** (pure technical solutions) but also on **sufficiency**, which means implementing advanced knowledge and the principle of moderation in energy planning and use.

As a result of new European research, the **CLEVER scenario**, a Collaborative Low Energy Vision for the European Region[1], proposes such an ambitious sufficiency-based decarbonization pathway for the EU. It has been developed through a bottom-up approach, beginning with the national trajectories constructed by 26 national partners from academia, research, or civil society. The research indicates that by 2050, EU27 countries could reduce their energy consumption by 55%, and the remaining energy demand could be met entirely by renewable energy sources, including thermal energy. Similar conclusions are also presented by the PAC scenario, a bottom-up modeling exercise conducted by a consortium of civil society organizations, including EEB and CAN-E.

EU countries have published significantly different figures related to the use of thermal energy, mainly influenced by two factors: climate and population. Regarding the latter, a clearer picture emerges when expressing thermal energy consumption in terms of a specific indicator relative to the number of inhabitants (see Figure 1) or heated area (see Figure 3).

[1] https://clever-energy-scenario.eu/#european-energy-scenario

According to the available information in NECPs, the **average heat consumption** for EU countries in 2020/2021 was **12.71 MWh per person** (calculated for 25 countries, with Latvia and Spain excluded due to a lack of relevant data). The list of countries in groups is shown below:

Low (between 5-10 MWh/person): Bulgaria (6.81), Cyprus (7.03), Greece (6.44), Portugal (5.9), Romania (8.62), Slovenia (9.93).

Average (between 10-15 MWh/person): Croatia (10.71), Denmark (14.87), Estonia (13.19), France (10.33), Germany (14.34), Hungary (12.96), Ireland (11.23), Italy (10.51), Lithuania (12.66), Poland (11.49), Slovakia (12.25).

High (between 15-20 MWh/person): Austria (16.94), Belgium (18.65), Czechia (15.15), Netherlands (16.81), Sweden (17.69).

Very high (above 20 MWh/person): Finland (31.0), Luxembourg (20.3).

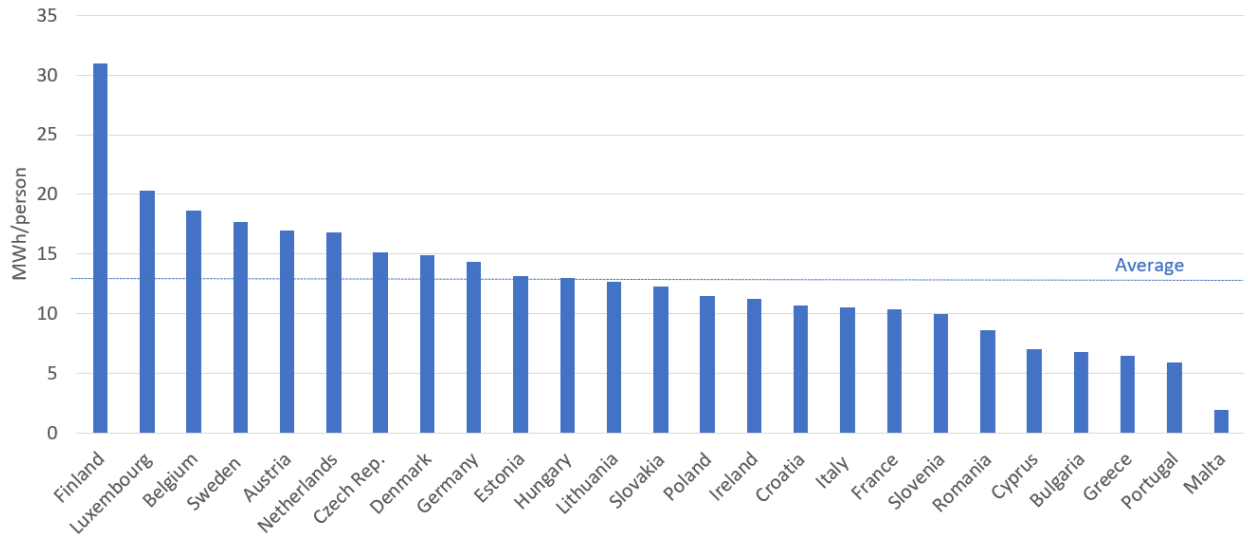

Figure 1. *Heating and cooling energy consumption per capita (MWh/person) - Latvia and Spain were not included due to a lack of relevant information. Calculation based on the latest NECPs available.*

Per capita heat energy consumption is predominantly influenced by **climatic conditions**. Notably, Nordic countries exhibit higher-than-average consumption, primarily attributable to their colder winters, which result in increased heating demand. Conversely, Mediterranean countries experience lower heating demand due to milder winters. However, certain countries, such as **Luxembourg and Belgium**, have consumption levels that defy climatic justifications. This **overconsumption** may be linked to significantly larger property sizes compared to the European average of **130 m2** for 4-member households.

Based on calculations derived from the Eurostat database[2], it becomes evident that **dwellings exceeding 150 m2** are considered typical in six countries, including **Luxembourg, Belgium, Sweden, and Denmark**. In the latter two countries, this may account for higher heating energy usage, but the enhanced energy efficiency of buildings in these Nordic nations appears to offset, at least partially, the impact of larger home sizes.

[2] *https://ec.europa.eu/eurostat/databrowser/view/ilc_hcmh01/default/table?lang=en*

Notably, Cyprus stands out with an average dwelling size of nearly 200 m2, yet this does not lead to concerning overconsumption, thanks to the region's mild winters.

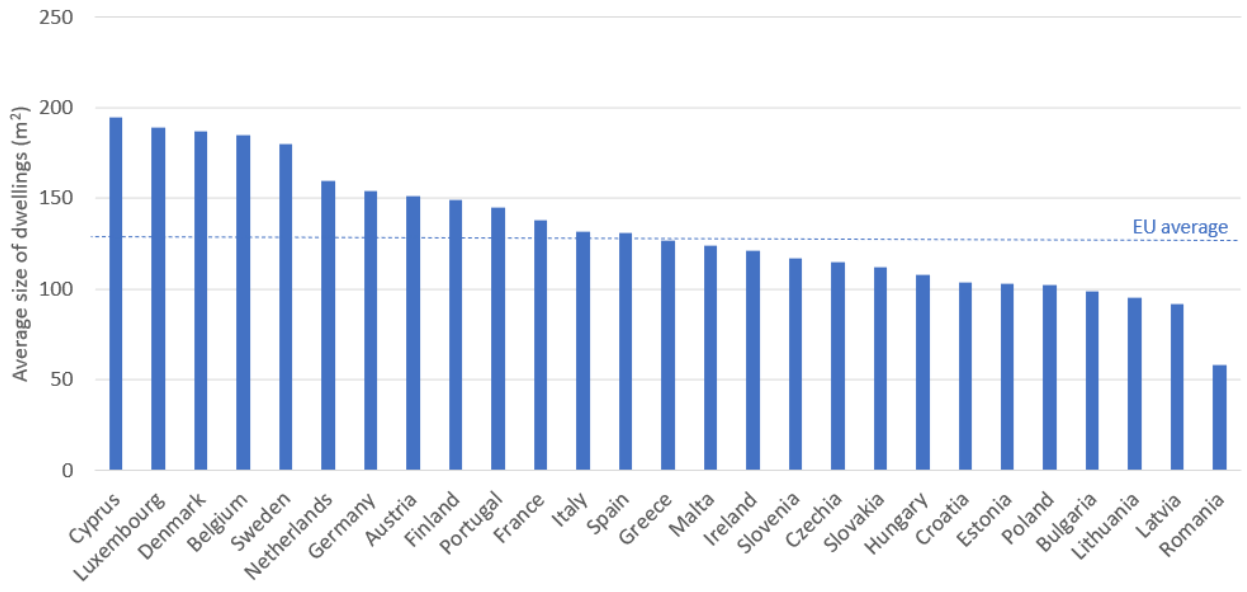

Figure 2. Calculated a*verage for a household with four members in EU countries (m²). Source: calculated based on Eurostat, 2019*
https://ec.europa.eu/eurostat/databrowser/view/ilc_hcmh01/default/table?lang=en

As previously discussed, utilizing the 2030 targets and projected population figures can facilitate the calculation of future per capita heating and cooling energy usage, thereby providing valuable insights into each country's climate policy commitments. However, a significant challenge arose due to the delayed publication of plans by most countries. In such cases, estimates were derived for the year 2030 based on trends observed in the NECP-2023 documents submitted on time.

Considering only the commitments outlined in the punctual submissions, these EU countries collectively aim for a **25.5% reduction** in energy consumption for heating and cooling between 2010/2011 and 2030. This suggests the possibility of assuming a similar reduction for countries that failed to submit their planning documents on time. In light of their commitments from the NECP-2019s, the average heating and cooling energy demand is projected to be 10.64 MWh per person in 2030, representing a modest 16.5% decrease.

Taking into account the aforementioned 25.5% average reduction, the new target for these countries should be **9.45 MWh per person, aligning with the European average**. However, it's important to acknowledge that there are considerable variations in potential outcomes, primarily influenced by recent energy consumption in member countries, the condition of their existing building stock, and the level of ambition in their energy policies.

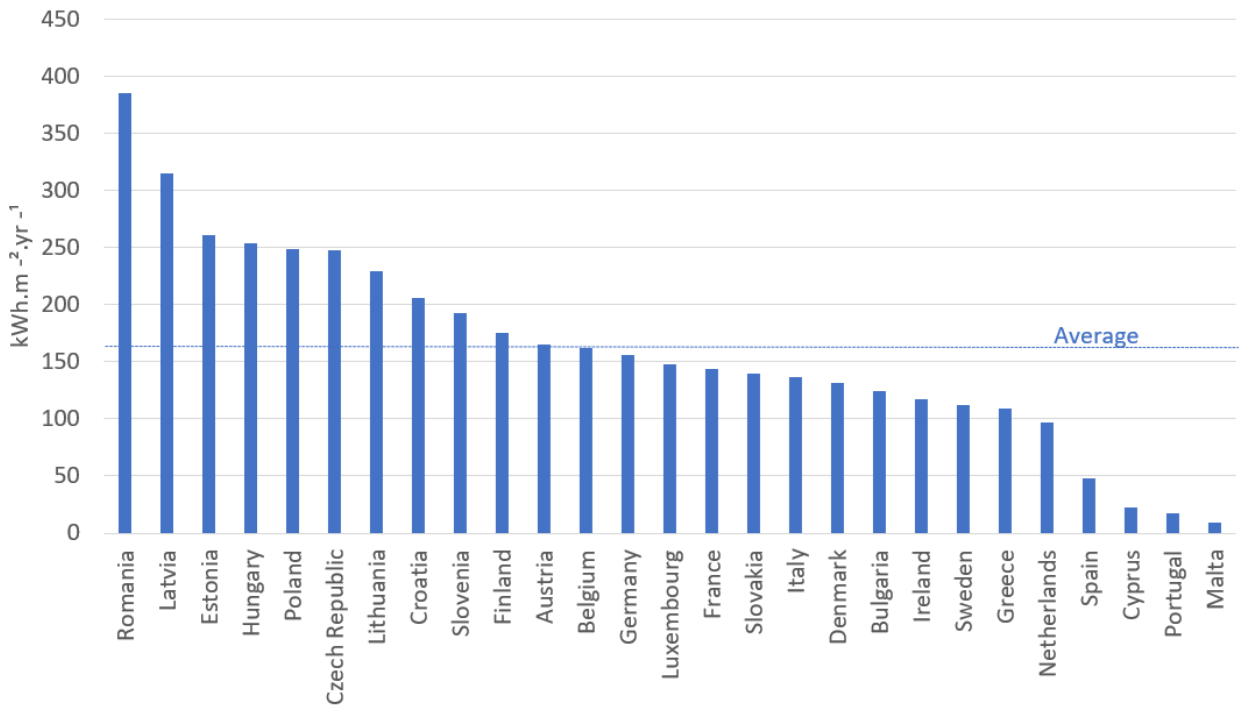

Figure 3. Average annual heating consumption per unit of living area. Source: EU Building Stock Observatory, Eurostat, 2016.

The recent study conducted by the **Buildings Performance Institute Europe**[3] underscores a compelling opportunity: by renovating all existing residential buildings in the EU to meet targeted U-values, it is possible to save a substantial 777 TWh of energy, equating to a remarkable 44% reduction in final energy consumption for space heating. Notably, the countries with the highest absolute final energy consumption and corresponding savings in residential space heating include **Germany** (453 TWh, resulting in a savings of -214 TWh), **France** (283 TWh, leading to -113 TWh in savings), **Italy** (233 TWh, with -115 TWh in savings), and **Poland** (135 TWh, with -52 TWh in savings).

According to the study, the greatest relative savings can be achieved in **Luxembourg** (60%), the **Netherlands** (57%), **Romania** (56%), and **Bulgaria** (56%). Impressively, a third of EU countries stand to realize a reduction in final energy consumption of at least 50%, while over half of the countries have the potential to save a substantial 45% or more of their final energy allocated for space heating in residential buildings.

[3] https://www.bpie.eu/wp-content/uploads/2022/12/How-to-stay-warm-and-save-energy_final-report.pdf

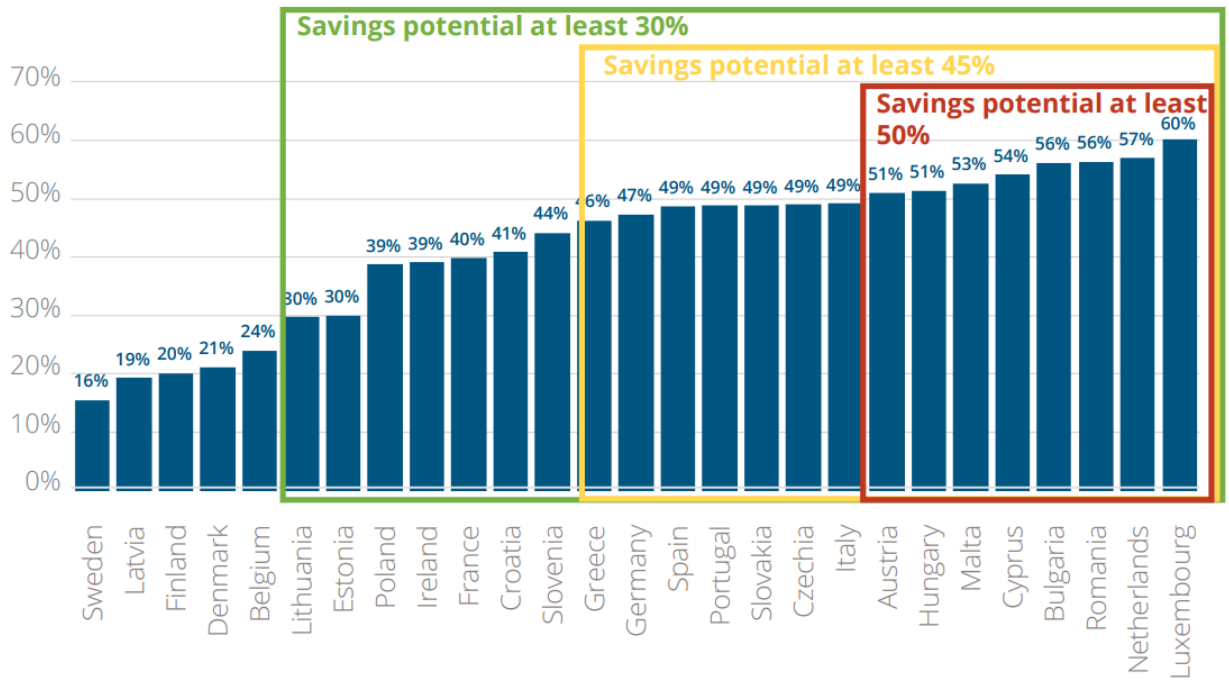

Figure 4: Final energy savings potential for residential heating in EU Member States (source: BPIE 2023[4])

1.2 PLANS FOR THE RENEWABLE ENERGY (RE) USE (BETWEEN 2021 AND 2030/2040)

The objective is to **increase the proportion of renewable energy in gross final energy consumption from 28% to 42% by 2030.** It's important to note that the European Commission's JRC publication[5] reveals slightly different figures, indicating a range of 30% (2021) to 46% (2030). When dissected by sector, EU countries have comparable targets for heating and cooling, relatively less ambitious goals for transport, and notably more ambitious objectives for electricity, averaging around 60%.

Consequently, the average increment in renewable energy utilization amounts to 14-16 percentage points. Some countries, such as **Cyprus** (with an 8 percentage point increase) and **Croatia** (projecting an 11 percentage point rise), have set more conservative targets. In their cases, these targets represent incremental growth from a relatively low starting point. In contrast, **Sweden** aims for a 13 percentage point expansion, which, while seemingly moderate on the surface, entails substantial steps given their already high starting point of 62.6%.

The most rapid growth, exceeding 40 percentage points, is forecasted in **Lithuania**, where the goal is to achieve an overall share of over 70% by 2030, positioning the country as a leader in European climate performance. Three countries have set targets surpassing 70% (**Denmark, Lithuania, Sweden**), with Sweden being the most ambitious at 75%.

Remarkably, **Cyprus** not only holds the most conservative growth target but also maintains the least ambitious objective (27%) for the proportion of renewable energy in gross final energy consumption by 2030. This is somewhat surprising, considering the island nation's vulnerability as it heavily relies on imported

[4] https://www.bpie.eu/wp-content/uploads/2022/12/How-to-stay-warm-and-save-energy_final-report.pdf
[5] https://publications.jrc.ec.europa.eu/repository/handle/JRC124024

energy supplies. A straightforward solution to this issue would involve transitioning to indigenous renewable energy sources, although such a shift does not seem to be part of their plans.

1.3 PLANS FOR THE USE OF RENEWABLE ENERGY SOURCES IN THE HEAT SECTOR (BETWEEN 2021 AND 2030/2040)

Taking into consideration the current landscape, the average renewable energy utilization in the heating and cooling sector stands at 29%. Notably, **the lowest-performing countries in this regard are Belgium, the Netherlands, and Ireland,** where the contribution of renewables falls below 10% in the heating and cooling sector. Conversely, **Estonia, Finland, Latvia**, and Sweden have emerged as frontrunners, achieving shares exceeding 50%, with **Sweden surpassing an impressive 60%.** In all four cases, biomass, particularly firewood, accounts for the bulk of this high share, and it remains a vital renewable energy source for heat production in most other countries as well.

Analyzing the trends indicated by the National Energy and Climate Plans (NECPs), it becomes evident that the average ratio of renewable energy is poised to increase from 29% in 2020/2021 to 41% by 2030. Nevertheless, it's crucial to underscore that significant disparities persist among countries, both in terms of historical performance and the robustness of their set targets.

Over the past 2-3 years, numerous national plans have laid out targets for the transition to renewable energy. Remarkably, this progress is observable even in cases where the NECP-2023s of Member States experiencing delays were not available, thereby necessitating reliance on the older commitments from the NECP-2019s. Nonetheless, the prevailing expectation is that the NECP-2023s will incorporate more ambitious objectives in comparison to their outdated counterparts.

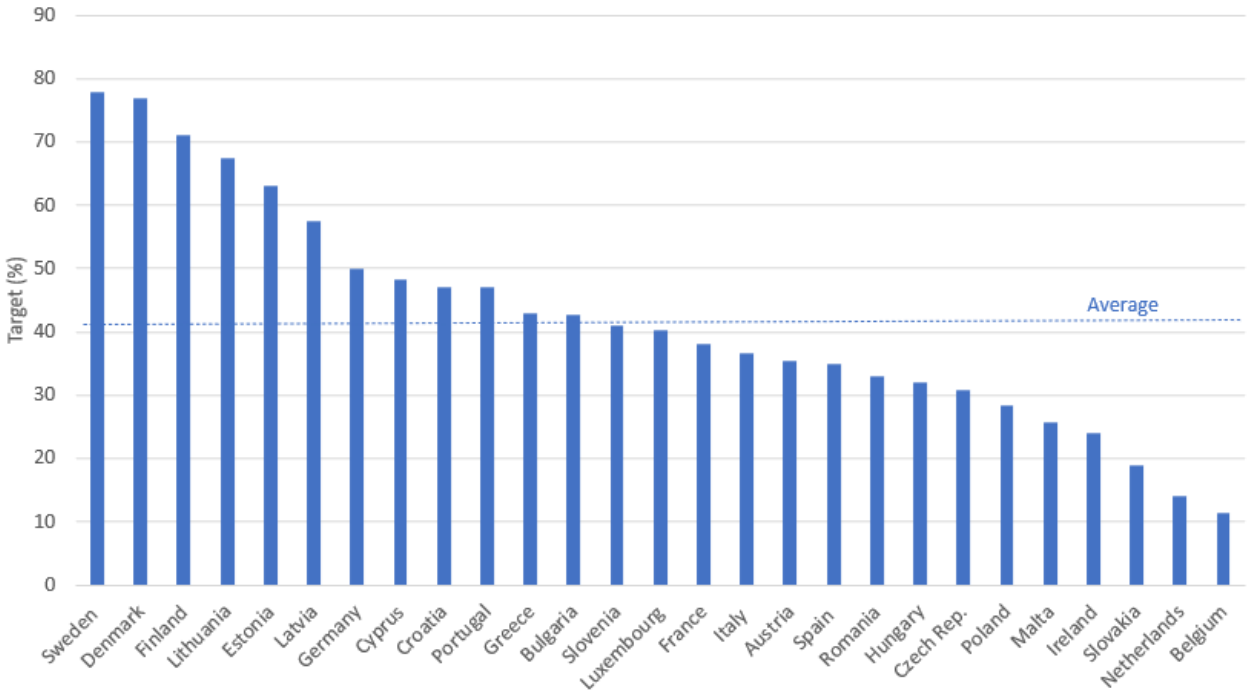

Figure 5. *Target share of renewables in the heating and cooling sector in 2030. Source: according to the published 13 NECPs.* Source: Draft NECPs 2023: Croatia, Cyprus, Denmark, Estonia, Finland, Hungary (preliminary), Italy, Luxembourg, Lithuania, The Netherlands, Portugal, Slovenia, Spain,

Sweden. NECP 2018: Austria, Belgium, Bulgaria, Czech Republic, France, Ireland, Germany, Greece, Latvia, Malta, Poland, Romania, Slovakia.

Among the data taken from the NECP texts, the commitments of six countries stand out prominently. Notably, **Luxembourg** and Ireland are setting the bar high with the most ambitious growth targets, endeavouring to elevate their renewable heat production shares from 12.9% to 40.3% and from 7.8% to 24%, respectively. Their objectives represent a three to fourfold increase over their current renewable heat share. Additionally, **Hungary, Italy, Slovakia, and Spain** have made substantial commitments, aiming to double or even triple their existing renewable heat percentages. **Denmark**'s commitment is equally notable, given its aspiration to significantly enhance its already high rate from 42% to an impressive 77%.

These targets are influenced by an array of factors, encompassing climate conditions and available infrastructure, such as district heating and gas network accessibility, as articulated in the analysis presented by the European Commission, Directorate-General for Energy (as delineated in **Table 1**). Moreover, it's essential to acknowledge the attitudes and readiness of decision-makers. In several countries, the presence of political figures who either deny or downplay the significance of climate change can result in climate policy objectives that do not fully harness their nation's genuine potential.

Country Cluster	Countries	Characterisation
A	CY, ES, GR, MT, PT	Warm climate, low to medium future relevance of district heating
B	BG, CZ, IE, PL, RO, SL	Medium climate, medium to high future relevance of district heating, moderate availability of gas infrastructure
C	DK, EE, FI, LT, LV, SE	Cold climate, high potential relevance of district heating, low to moderate availability of gas infrastructure
D	AT, BE, DE, FR, HR, HU, IT, LU, NL, SK, UK	Medium to cold climate, medium to high future relevance of district heating, high availability of gas infrastructure,

Table 1. Clusters of countries by heat sector endowments (source: Kranzl, L., Fallahnejad, M., Büchele, R., et al. 2022. Renewable space heating under the revised Renewable Energy Directive: ENER/C1/2018-494: final report, Publications Office of the European Union, European Commission, Directorate-General for Energy, https://data.europa.eu/doi/10.2833/525486)

In the realm of scientific research pertaining to this subject, it is imperative to underscore the considerable research endeavors that support EU member states' experts and decision-makers. Several noteworthy EU-level research projects contribute to this field:

Heat Roadmap Europe (HRE)[6]: HRE addresses the issue of heat wastage during electricity generation in Europe, where more heat is discarded than is required to heat all buildings. By harnessing waste heat from industrial processes and electricity generation and implementing intelligent district heating grids, it is feasible to replace the entirety of natural gas currently utilized for heating buildings across Europe. The recently launched 5.2 version of this project offers enriched content that includes efficiency and

[6] https://heatroadmap.eu/

transportation aspects, along with an extensive spatial database, thereby serving as an invaluable resource for professionals.

Hotmaps[7]: The overarching objective of Hotmaps is to create an open-source mapping and planning toolbox for heating and cooling, supplying default data for EU28 at both national and local levels. These data and tools empower public authorities to identify, analyze, model, and map resources and energy supply solutions within their jurisdiction in a resource-efficient and cost-effective manner. The results derived from Hotmaps aid authorities in formulating heating and cooling strategies on local, regional, and national scales that align with renewable energy and CO2 emission targets at both national and EU levels.

Thermos[8]: Thermos stands as a user-friendly, open-source software designed to expedite heat network planning while enhancing efficiency and cost-effectiveness. Developed through collaborative efforts by a team of planning experts and practitioners from various European countries, including the UK, Spain, Poland, Latvia, Denmark, Germany, Portugal, and Romania, this software originates from the THERMOS (Thermal Energy Resource Modelling and Optimisation System) EU Horizon 2020-funded research project. It represents a significant advancement in optimizing heat network planning processes.

These initiatives collectively contribute to the scientific foundation of the topic, aiding researchers, experts, and policymakers in their efforts to address and mitigate heating and cooling challenges across Europe.

1.4 RENEWABLE ENERGY SOURCES IN NATIONAL ENERGY AND CLIMATE PLANS

Considerable variations exist in terms of solar radiation, precipitation, biomass yield, and wind dynamics across EU countries, and, in certain instances, within individual countries. Paradoxically, these disparities represent the very attributes and resources that hold the potential for harnessing a wide array of renewable energy sources. It is crucial to emphasize that these resources are accessible to varying degrees in all countries, yet their utilization predominantly hinges on political decisions and choices.

1.4.1. ROLE OF BIOMASS

Biomass stands as the primary renewable energy source within the European heating sector, constituting approximately 70-80% of the energy mix in most countries. In more affluent regions, this translates to a higher share of well-processed fuels like pellets and specialized combustion equipment. However, a consequence of this reliance on biomass is a diminished energy return on investment (EROI or EROEI).

In Central and Eastern European regions, biomass combustion is typically a straightforward process, often involving wood with high moisture content. While heat storage would enhance efficiency, this is often overlooked, resulting in lower-than-expected efficiency levels. These boilers also facilitate the incineration of municipal waste, a widespread practice not only in rural but also in urban settings. Regrettably, this practice contributes to significantly reduced air quality, particularly during the heating season[9].

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[7] https://www.hotmaps-project.eu/

[8] https://www.thermos-project.eu/home/

[9] https://airmine.ai/air-quality-in-europe-its-going-the-right-way/

Given these concerns, there's a compelling case for either enhancing the conditions for domestic firewood heating or transitioning to more controllable district heating solutions[10], which offer the potential for both efficiency and improved air quality.

1.4.2. ROLE OF AMBIENT HEAT

The National Energy and Climate Plans (NECPs) outline a notable contrast in the projected use of heat-pumping technology. The EU average for per capita heat consumption by 2030 is estimated at 927 kWh, which stands in stark contrast to the comparatively lower 179 kWh projected for solar thermal energy production. Consequently, the emphasis on heat pumping within these plans is more than five times greater.

These plans lean towards the dominance of aerothermal and ground-source heat pumps, with geothermal energy being a viable option in select countries (e.g., France, Germany, Hungary), albeit primarily in conjunction with district heating systems.

Surprisingly, Northern European nations, including Denmark, Finland, and Sweden, rank at the forefront. This suggests a significant advancement in heat pump technology, enabling cost-effective deployment even in colder winter conditions. It also hints at the changing climate, with Northern European winters being less severe than in the past two to three decades. Additionally, the higher purchasing power of Northern European consumers plays a pivotal role in facilitating investments in heat pumping, given its capital-intensive nature.

Conversely, Poland, Bulgaria, and Belgium, followed by Hungary and the Czech Republic, find themselves at the lower end of the commitment spectrum. This implies that energy planners in former socialist countries exhibit less enthusiasm for this technology. Notably, there is a striking 30-fold difference between Poland's modest commitment (96 kWh per capita) and Denmark's ambitious pledge (2918 kWh per capita).

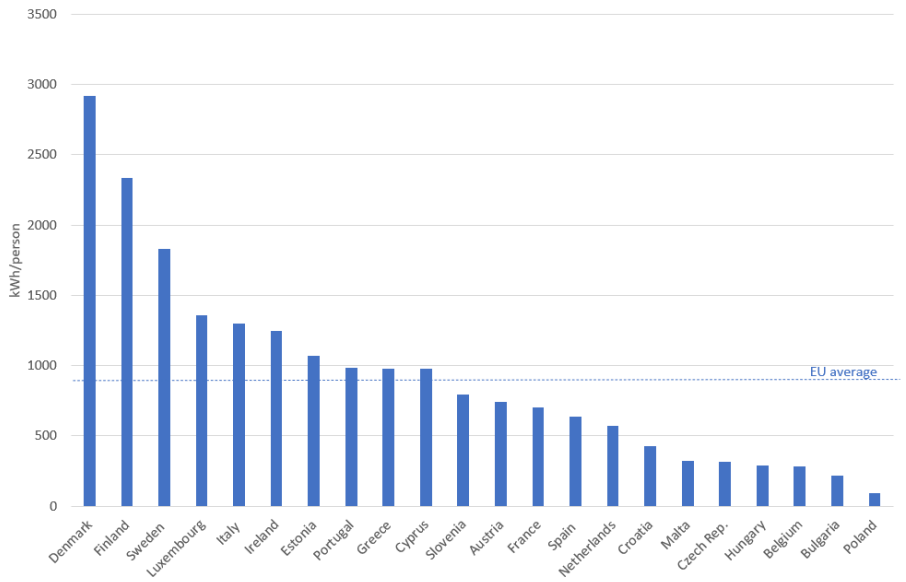


Figure 6. Target for heat production of heat pumps (HPs) in 2030 in relation to the population (kWh/person). Source: NECP-2023: Croatia, Cyprus, Denmark, Estonia, Finland, Hungary (preliminary), Italy, Luxembourg, The Netherlands, Portugal, Slovenia, Spain, Sweden. NECP-2019: Austria, Belgium, Bulgaria, Czech Republic, France, Greece, Ireland, Malta, Poland. No target specified for Germany, Latvia, Lithuania, Romania, or Slovakia.

[10] https://www.thelancet.com/journals/lanplh/article/PIIS2542-5196%2820%2930224-2/fulltext

1.4.3. ROLE OF SOLAR THERMAL

Significant disparities already exist among countries in terms of solar thermal energy usage, and these differences are expected to become even more pronounced in the future, as indicated by the NECPs. Naturally, Mediterranean countries lead the way in this regard, given their highly favorable irradiation conditions. This contrast becomes particularly evident when examining planned heat production per capita. **Cyprus**, for instance, exhibits an exceptionally high projected value at 1317.4 kWh per person, while **Greece and Portugal** also anticipate above-average production in this category, at 176.1 kWh per person.

However, it's surprising to observe that countries like **France, Croatia, Bulgaria**, and notably Malta have set targets well below the European average, despite their conducive natural conditions, which could support far more ambitious objectives.

Conversely, certain nations, such as **Denmark**, are renowned for their substantial centralized systems that primarily contribute heat to district heating systems. Remarkably, the NECPs in Denmark do not exhibit any ambition to further augment the existing 700 GWh of heat production. In **Austria**, household-scale solar collectors installed on detached houses significantly supplement this production. Regrettably, documents from **Spain and Sweden** appear to lack substantial mentions of this domain.

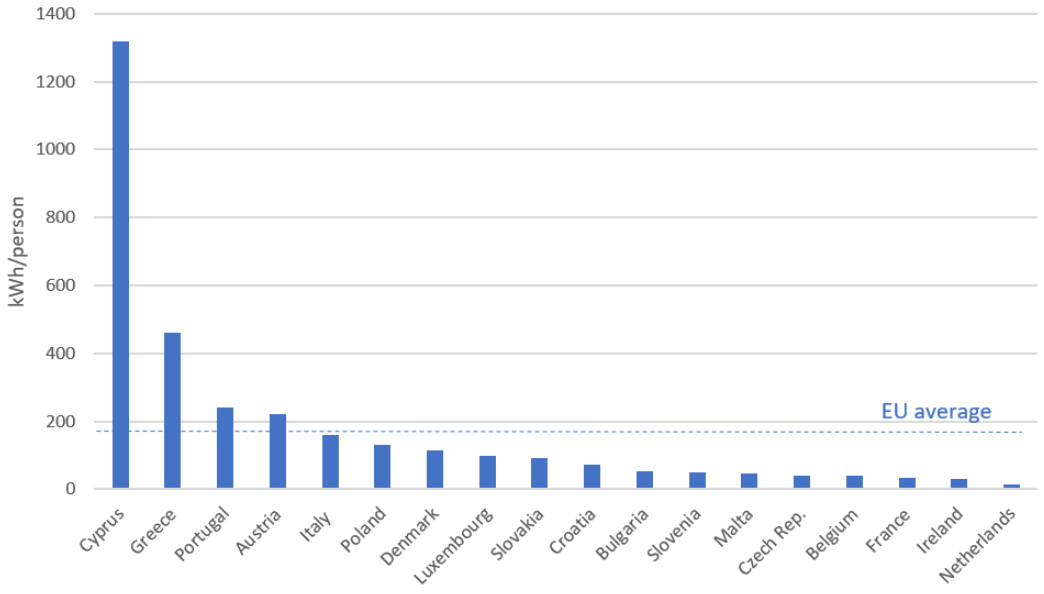


Figure 7. Target solar thermal heat production in relation to the population by 2030. Source: NECP-2023: Croatia, Cyprus, Denmark, Italy, Luxembourg, The Netherlands, Portugal, Slovenia, Spain, Sweden. NECP-2019: Austria, Belgium, Bulgaria, Czech Republic, France, Greece, Ireland, Malta, Poland, Slovakia. No target specified for Estonia, Finland, Germany, Hungary, Latvia, Lithuania, or Romania.

1.5 PLANS FOR GREENHOUSE GAS (GHG) REDUCTION

The ultimate objective is to reduce the greenhouse gas emissions originating from our societies and economies.

To achieve this, a comparative analysis was conducted between the emission reduction targets articulated in 2018 and those declared in 2023. These targets delineate the extent to which emissions should decrease by 2030, relative to 2005 levels. On average, these reduction targets aim for a 33% decrease in emissions.

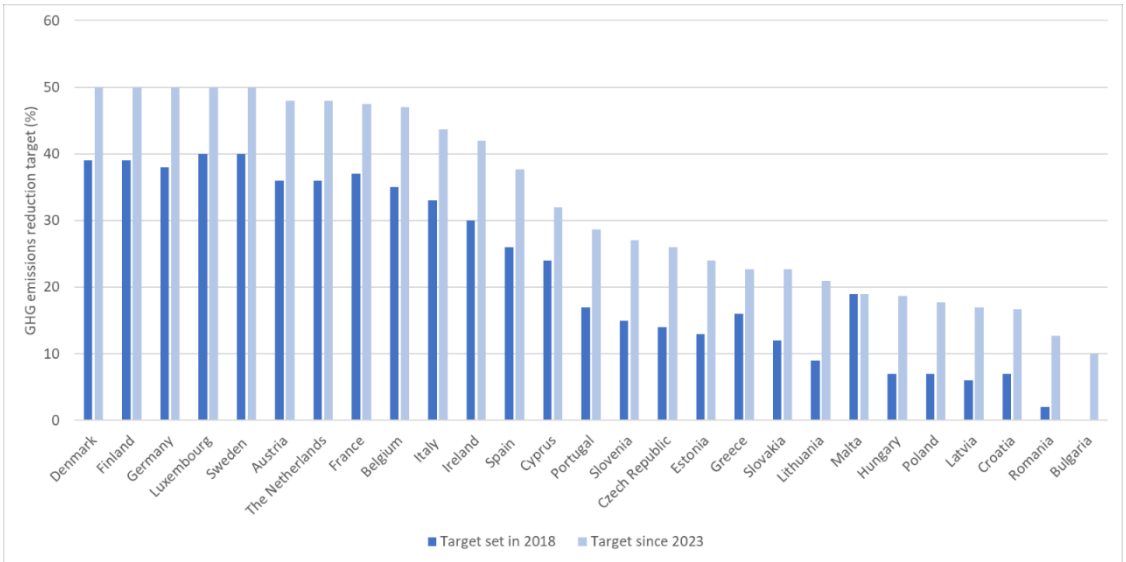


Figure 8. Greenhouse gas emissions reduction targets for 2030 in comparison to 2005 levels. Source: EC (https://climate.ec.europa.eu/eu-action/effort-sharing-member-states-emission-targets/effort-sharing-2021-2030-targets-and-flexibilities_en)

Tendencies

NECPs employ a variety of approaches when determining their greenhouse gas emission reduction targets. While some nations establish their targets for 2030 relative to the 1990 baseline, others use the 2005 baseline. As a result, a comprehensive comparison of all NECPs in this context proves challenging. Equity in such a comparison is elusive, primarily because, for many Central European countries, the most suitable benchmark differs from the standard 1990, as it harkens back to a time when heavy industry production and output were at their zenith.

Few countries, such as Croatia and Lithuania, offer the most precise and comprehensive insights by presenting emission reductions across three distinct comparisons: 1990-2030, 2005-2030, and 1990-2050.

1.6 BAN ON SALES OF FOSSIL HEATING EQUIPMENT

A total of eleven countries have set forth plans to eventually prohibit the sale of fossil-based heating systems before the year 2050. In Belgium, a regional regulation prohibits the installation of oil boilers in both new and renovated buildings beginning in 2022. Additionally, Flanders in Belgium will impose a gas connection ban for all new constructions commencing in 2025. Italy, on the other hand, mandates a 60% inclusion of

renewable energy in new buildings from 2022 onward. In Denmark, a strategic initiative aims to have approximately 50% of buildings heated by district heating by 2028, with the remaining 50% utilizing heat pumps as their primary heating source by 2029.

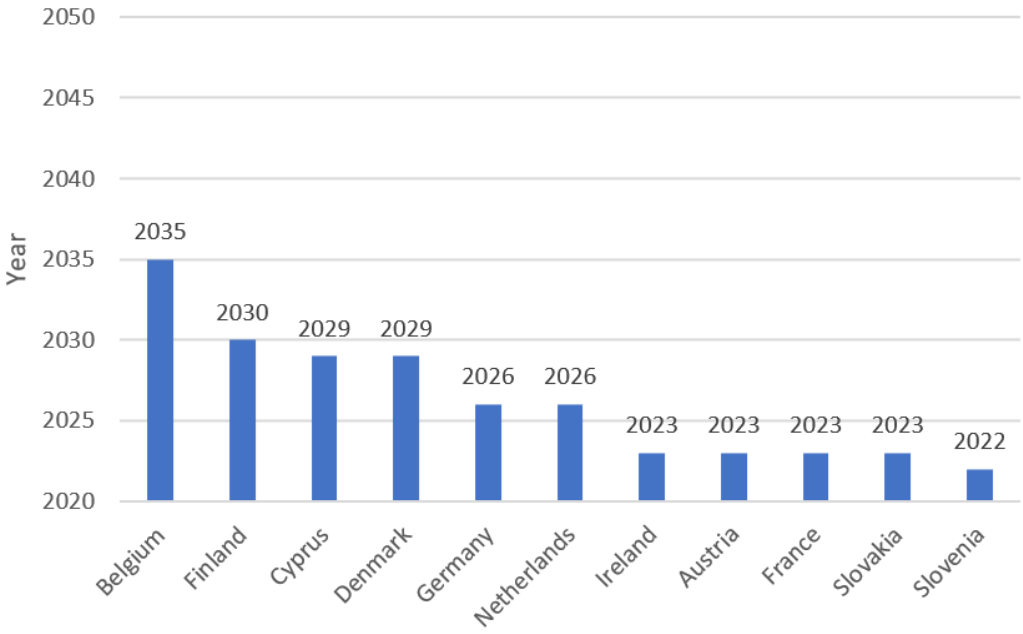


Figure 9. Expected ban on fossil heating sales. Source: EHPA (https://www.ehpa.org/which-countries-are-ending-fossil-fuel-heaters/) and draft NECPs. Other countries: not specified.

Notes:

- **Austria:** Pertains to natural gas boilers in new homes; coal and oil boilers in new homes were prohibited in 2020
- **Belgium:** Addresses oil boilers, with a regional ban in Flanders on installing oil boilers in both new and renovated buildings starting in 2022.
- **France:** Bans oil boilers in all buildings from 2022, followed by a ban on gas boilers in new buildings from 2023.
- **Germany:** Addresses oil and coal boilers in new and existing buildings, accompanied by regional mandates for renewable heating.
- **Ireland:** Targets oil and gas boilers in newly constructed homes, with a pending ban on installations in existing houses anticipated from 2025.
- **Luxembourg:** Addresses oil and gas boilers.
- **The Netherlands:** Prohibits connection to the gas grid for new buildings since 2018, with a mandatory minimum standard of hybrid heat pumps from 2026.
- **Slovakia:** Pertains to oil boilers.
- **Slovenia:** Targets oil boilers.

1.7 SCENARIOS OF DECARBONISATION THROUGH A BAN ON FOSSIL HEATING

Decarbonization scenarios were constructed based on the prevailing composition of residential heating equipment and the rate at which boilers are replaced. To determine the current average replacement rate of outdated boilers with newer models, sales data on boilers and heat pumps were employed.

Three distinct scenarios were formulated for the phased reduction of oil and gas utilization, involving the prohibition of conventional oil and gas boilers. These scenarios entail a potential ban in 2025, an alternative ban in 2029, and a third scenario without any ban.

These scenarios were devised for ten countries with robust data regarding heating equipment inventory and the sales of various heating technologies, encompassing heat pumps, biomass boilers, solar thermal systems, and fossil-fueled boilers. The outcomes of these scenarios are detailed in the Country Reports chapter.

By employing the inventory composition of heating sources, including natural gas, oil, and coal boilers, the calculation of CO2 emissions underpins the examination of the impact of prohibiting fossil boilers. Furthermore, the potential contributions of each scenario toward achieving the NECP target for an overall reduction in CO2 emissions by 2030 were evaluated.

1.8 SOME OF THE EFFICIENCY IMPROVEMENT MEASURES AND METHODOLOGIES IMPLEMENTING ARTICLE 7 OF THE ENERGY EFFICIENCY DIRECTIVE 2012/27/EU

- Multi-Apartment Buildings: This initiative encourages owners of multi-apartment buildings constructed in compliance with technical construction standards prevailing until 1993 to renovate and modernize these structures. The primary goal is to enhance building energy performance. The Renovation of Multi-Apartment Buildings Program offers owners of apartments and other premises preferential credits and statutory state support, promoting energy-saving measures. It further empowers property owners to take the initiative in implementing these improvements.

- Public Building Renovation: This measure aims to bolster heat and electricity efficiency in public buildings, reduce greenhouse gas emissions, and ensure public building infrastructure aligns with hygiene standards. The program stipulates a core requirement, mandating that renovated buildings must achieve at least an energy performance class B rating. Financing for enhancing energy efficiency in public buildings derives from the State budget, municipal budgets, European Structural Investment Funds, international organizations, private investors, and various funding sources.

- Energy Supplier Partnerships for Consumer Education: The objective here is to educate and advise consumers on energy-saving measures and solutions that can instigate changes in consumer behavior, fostering improved energy efficiency. Energy suppliers take the lead in executing the scope of consumer education and advice through agreements or arrangements with other stakeholders.

- Transition to More Efficient Heat Production Technologies: This financial measure encourages residents to shift from inefficient heat production systems to more efficient technologies that utilize renewable energy for heat generation. In alignment with Directive 2012/27/EU of the European Parliament and the Council, Lithuania prioritizes this policy measure in the decentralized household sector. It plays a pivotal role in

achieving energy efficiency and climate neutrality goals by transitioning from low-efficiency, high-emission fuels to more sustainable options. The measure promotes the adoption of heat pumps, environmentally compliant biofuel boilers, and other strategies to enhance heat energy efficiency.

- Renovation/Modernization for Natural Persons: This financial incentive targets owner-occupied houses, encouraging them to renovate their individual homes. The prerequisite is achieving a minimum energy performance class B rating for the house.

CHAPTER 2: COUNTRY REPORTS

As of the official deadline at the end of June, fewer than 10 countries had submitted their updated draft National Energy and Climate Plans (NECPs). By August 15th, only **12 countries** had made their documents **available** on the official EU website. These countries include Croatia, Cyprus, Denmark, Finland, Italy, Lithuania, Luxembourg, the Netherlands, Portugal, Slovenia, Spain, and Sweden. In contrast, **15 countries** had **not yet provided** their new NECP documents, which include Austria, Belgium, Bulgaria, the Czech Republic, Estonia, France, Germany, Greece, Hungary, Ireland, Latvia, Malta, Poland, Romania, and Slovakia. For these countries, lacking the latest data, the analysis used the previous NECP data as a foundation, with Fit55 expectations applied.

The analysis is further complicated by disparities in the quality of NECP documents, variations in data content, and inconsistencies within the text. In certain countries, like Estonia, Hungary, Latvia, and Lithuania, even basic information, such as the current or projected share of renewable energy sources, is notably absent from their NECPs. Adding to the complexity, there's an agreement to gradually enhance renewable energy targets for heating and cooling. This entails a mandatory annual increase of 0.8% until 2026, followed by a further increase of 1.1% from 2026 to 2030[11].

AUSTRIA (NO NEW DRAFT NECP PUBLISHED BY 15 AUGUST 2023)

1. TARGETS

1.1. TARGETS ON RENEWABLE ENERGY IN THE HEATING AND COOLING SECTOR

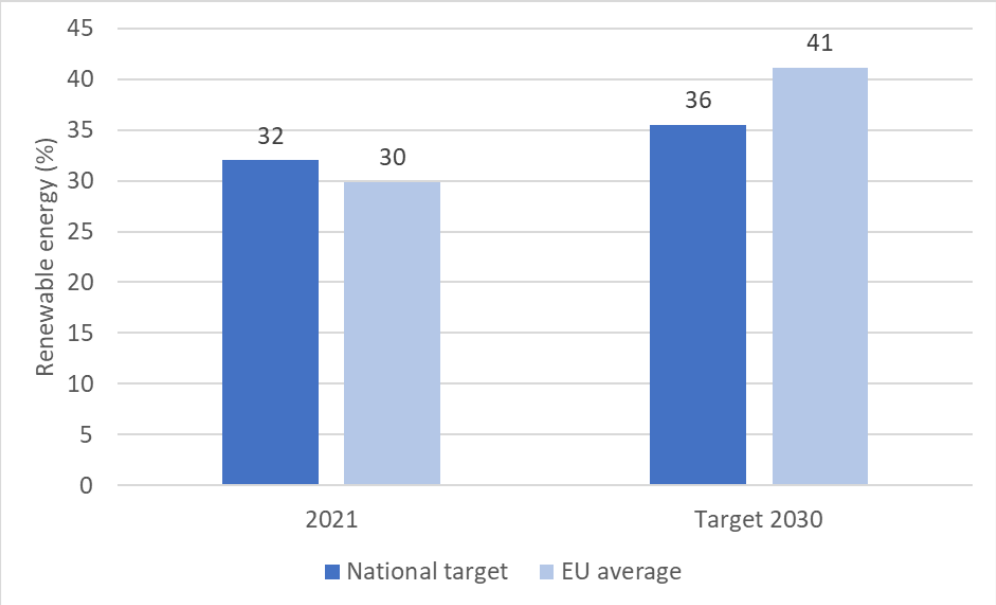


Figure 1. Renewable heating and cooling in 2021 and target (NECP-2019) for 2030.

1.2. GHG EMISSION TARGETS FOR NON-ETS SECTORS

[11] https://www.consilium.europa.eu/en/policies/green-deal/fit-for-55-the-eu-plan-for-a-green-transition/

- 36% GHG emission reduction target for 2030 (compared to 2005) “with additional measures” (WAM) scenario.

1.3. ENERGY IMPORT TARGETS

N.A.

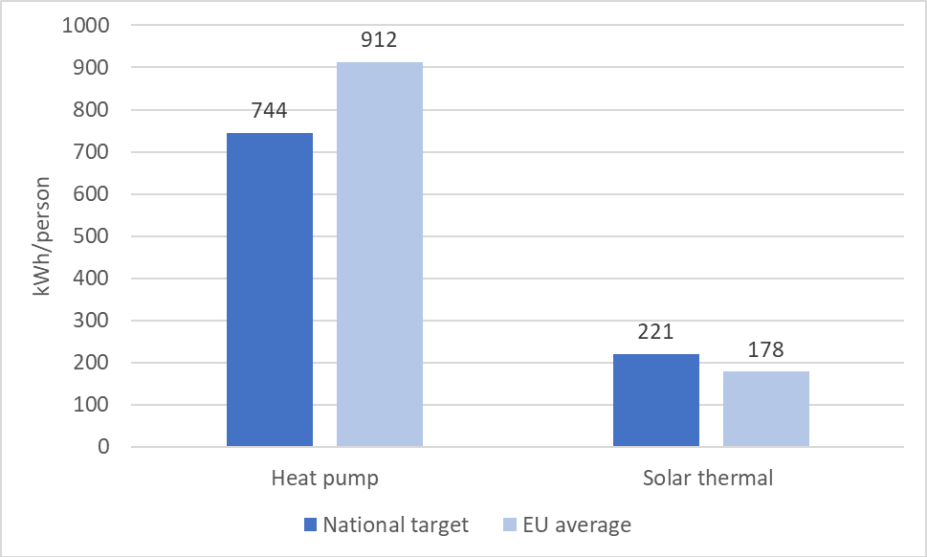
1.4. TARGETS ON HEATING (HEAT PUMPS, BAN ON FOSSIL HEATING)

The Federal Government's integrated Climate and Energy Strategy outlines measures aimed at gradually phasing out heating systems reliant on fossil fuels, particularly heating oil. The strategy advocates transitioning to renewable energy sources, heat pumps, and efficient district heating. Notably, the previous NECP-2019 indicated Austria's commitment to reducing heating and cooling demand by 3% annually, underscoring a robust focus on energy efficiency.

Key Initiatives Include:

- Ban on Oil and Coal Boiler Installation in New Homes: Effective from 2020, this regulation prohibits the installation of oil and coal boilers in new residential buildings.
- Prospective Bans on Oil and Gas Heaters: From 2023, Austria plans to enforce a ban on oil and gas heaters in new constructions and aims to extend this prohibition to existing buildings.
- Fossil-Fuel Heating Phase-Out by 2040: Austria is working towards a complete phase-out of fossil-fuel-based heating systems by 2040.

The federal and state governments have proactively encouraged the adoption of eco-friendly alternatives. Substantial budgets have been allocated to support these efforts, including the "Get out of oil and gas" subsidy program, known as "kesseltausch.at." Funding for the renovation initiative has been secured until 2025, with an unprecedented budget exceeding 1 billion EUR allocated for the entire duration. Additionally, over 300 million EUR have been earmarked to facilitate boiler replacements in low-income households, offering reimbursement of up to 100% of the investment in environmentally friendly heating systems[12].



[12] https://www.eurobserv-er.org/pdf/renewable-energy-policy-factsheet-2023-austria

Figure 2. Target for heat production using heat pumps and solar thermal systems in 2030. The EU average comprehends countries that announced targets for these technologies. Not all countries specified this target. **Source:** NECP.

2. POLICIES TO ACHIEVE THE HEATING TARGETS

Law for Climate Protection - 2011 (Klimaschutzgesetz)
Austrian Strategy for Adaptation to Climate Change – 2012, latest in 2017
Renewable Energy Expansion Act - 2021 (Erneuerbaren-AusbauGesetz)
Austrian Heating Strategy - 2022 (Die österreichische Wärmestrategie)

3. SCENARIOS FOR DECARBONISATION

- The NECP target is likely to be achieved without a ban on boilers. However, a ban from 2025 would further increase the share of renewable energy in heating.
- A ban from 2025 would contribute approximately 15% of the total target for CO2 emission reduction.

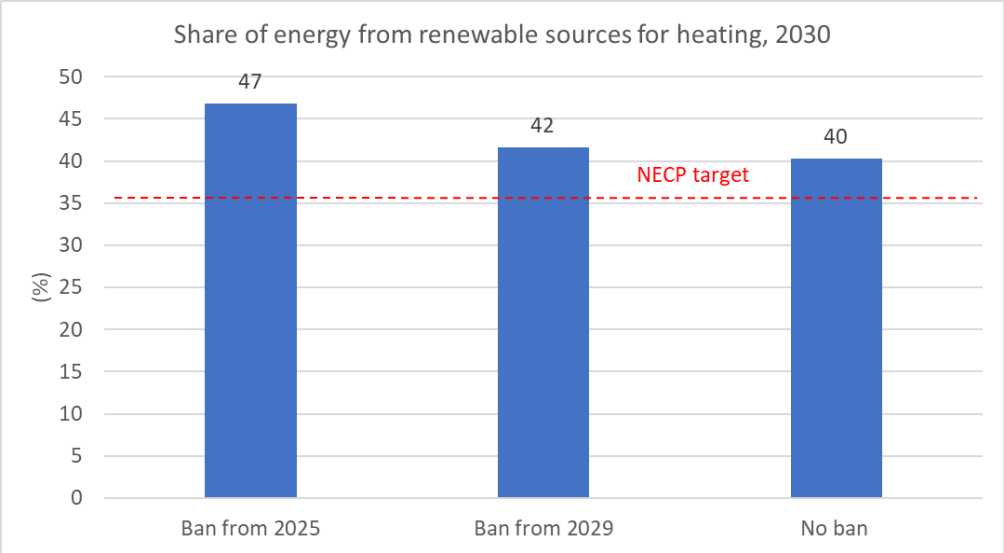


Figure 3. Share of energy from renewable sources for heating, 2030. Source: scenario calculation.

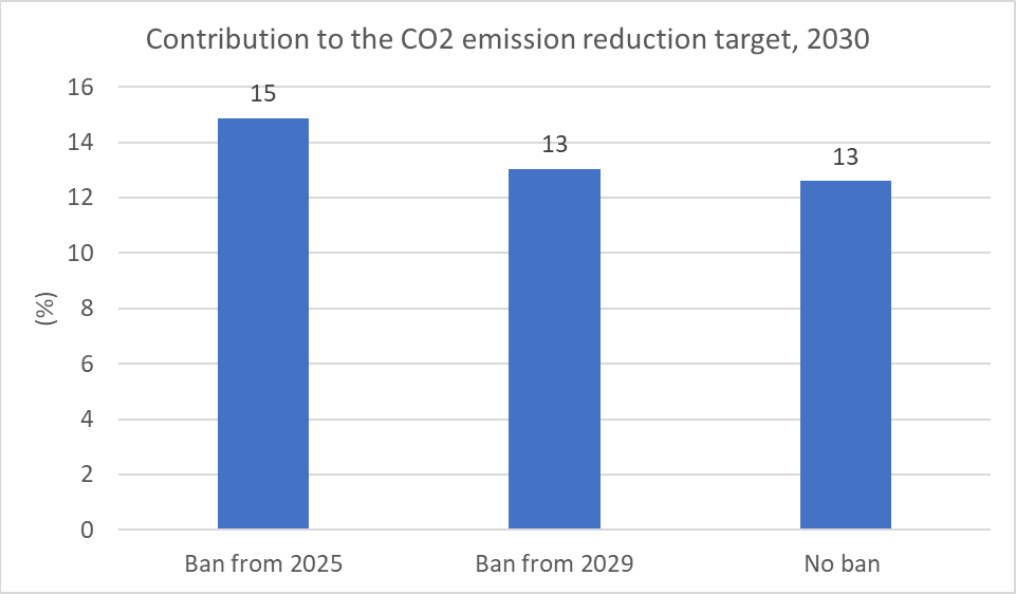


Figure 4. Contribution to the CO2 emissions reduction target, 2030. Source: scenario calculation.

4. SUGGESTIONS

Austria has demonstrated commendable expertise in household-level heat energy utilization. Notably, the widespread adoption of district heating systems, even in small communities, holds great promise. These systems, known for their reliance on locally available energy sources, contribute to their sustainability. While small-scale projects might not offer stellar returns on investment, their numerous positive externalities justify the continued development of such initiatives in the long run.

Austria has set high standards in wood-fired heating and heat pump technologies, serving as an exemplar in these domains. Therefore, the proposal emphasizes maintaining a pioneering role in these areas.

In terms of solar collectors, the 2030 target of 220.8 kWh per capita exceeds the EU average of 179 kWh per capita. This objective aligns well with regional climatic conditions and is considered reasonable.

However, Austria's heat pump target of 743.8 kWh per capita for 2030, while substantial, falls short of the European average target of 927 kWh per capita. Given Austria's robust economic capabilities and the innovative heat pump technologies developed by Austrian manufacturers, there exists potential for a more ambitious target in this regard.

BELGIUM (NO NEW DRAFT NECP PUBLISHED BY 15 AUGUST 2023)

1. TARGETS

1.1. TARGETS ON RENEWABLE ENERGY IN THE HEATING AND COOLING SECTOR

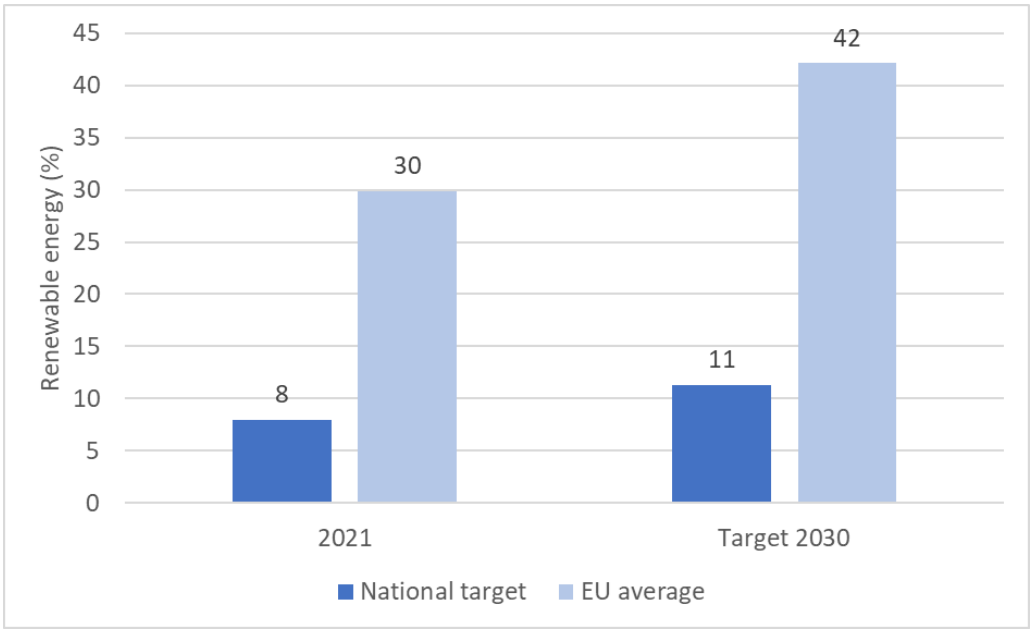


Figure 1. Renewable heating and cooling in 2021 and target (NECP) for 2030.

1.2. GHG EMISSION TARGETS FOR NON-ETS SECTORS

Target for 2030 (based on 2005) in WAM scenario: 35%

1.3. ENERGY IMPORTS TARGETS

N.A.

1.4. TARGETS ON HEATING (CONSUMPTION, HEAT PUMPS, BAN/PHASE-OUT OF FOSSIL HEATING)

The "*Summary of the Commission assessment of the draft National Energy and Climate Plan 2021-2030*[13]" reveals that Belgium's climate protection targets are perceived as somewhat conservative in various aspects. Notably, the heating sector faces unique challenges due to Belgium's housing stock, which comprises a significant number of older buildings. In the buildings sector, residential buildings account for the majority of energy demand (64% in 2020). This demand primarily relies on natural gas (39% in 2020), followed by a notably high dependence on heating oil (33%), electricity (21%), and bioenergy (7%). Compared to many other European countries, Belgium utilizes district heating[14] to a limited extent. Belgium has enacted a range of regional measures to address these challenges, including:

[13] https://energy.ec.europa.eu/system/files/2019-06/necp_factsheet_be_final_0.pdf
[14] IEA (2022). Belgium 2022. Energy Policy Review.

- Regional Ban in Flanders: Starting in 2022, there is a regional ban in Flanders on the installation of oil boilers in new and renovated buildings.
- Gas Connection Ban in Flanders: In 2021, a ban on gas connections for large new building projects in Flanders was imposed, followed by a comprehensive gas connection ban for all new Flanders buildings from 2025.
- No bans have been declared in Wallonia; initiatives include the provision of zero-percent interest loans to encourage adoption.
- The federal government actively promotes renewable energy in heating and cooling through various means, including tax deductions, research and development programs, and training for installers.

In the Brussels Capital Region, stringent measures have been implemented to reduce fossil fuel usage, including bans on coal-fired appliances since 2021 and heating oil appliances from 2025. Wallonia is actively supporting projects that inject biomethane into the natural gas grid and has introduced incentives to boost renewable heating and cooling. For instance, they have reduced VAT on solar PV thermal collectors and heat pumps to 6% for 2022 and 2023. (Source: IEA: Belgium 2022 - Energy Policy Review).

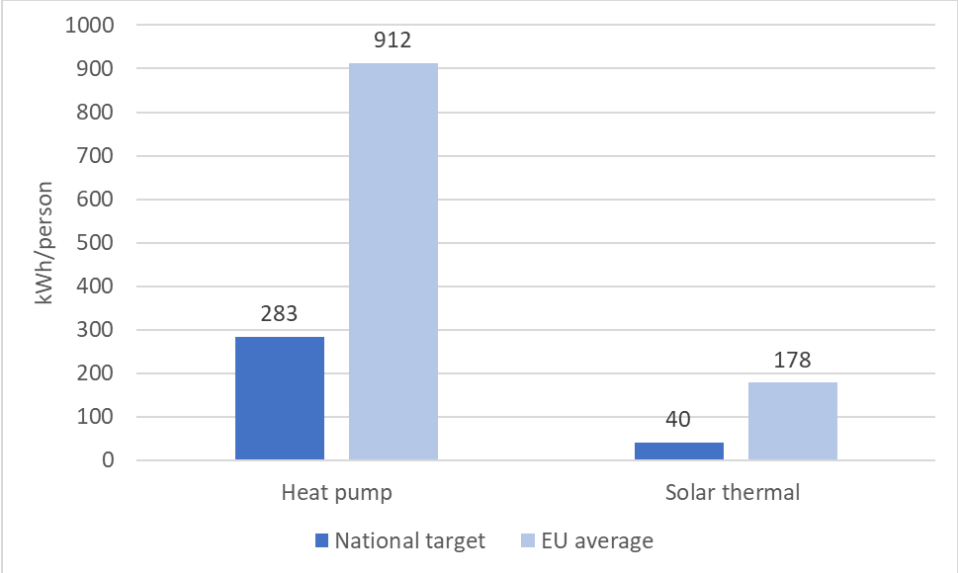


Figure 2. Target for heat production using heat pumps and solar thermal systems in 2030. The EU average comprehends countries that announced targets for these technologies. Not all countries specified this target. Source: NECP.

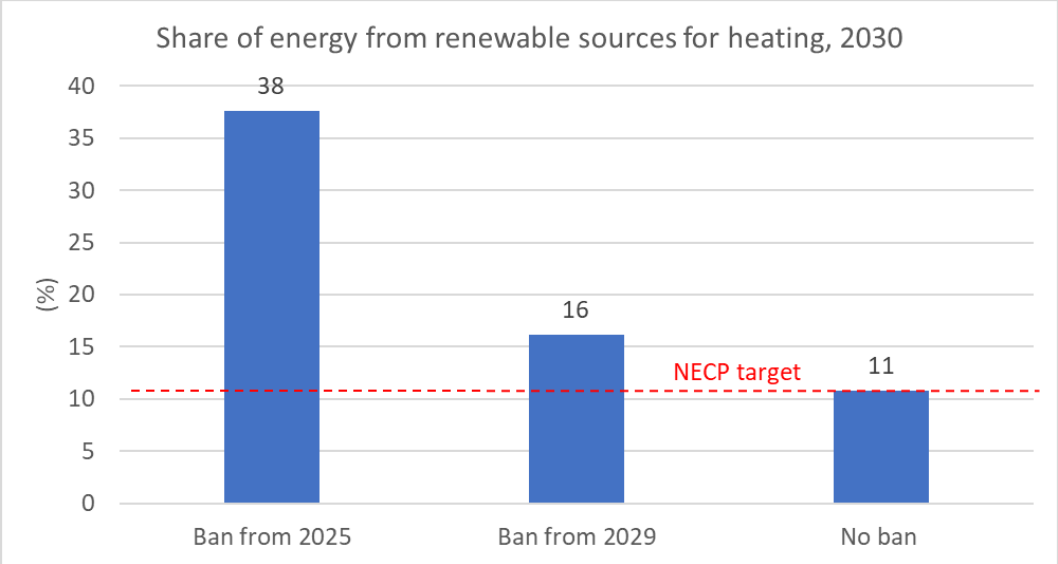
Building owners who install renewable heating and cooling systems can benefit from a property tax exemption. In addition, programs for Research, Development, and Demonstration (RD&D) specific to RES-H (Renewable Energy Sources for Heating) installers are available. There are also location-specific complementary measures, including a renewable heating quota in Flanders and zero-interest loans to support RES-H implementation in Wallonia[15].

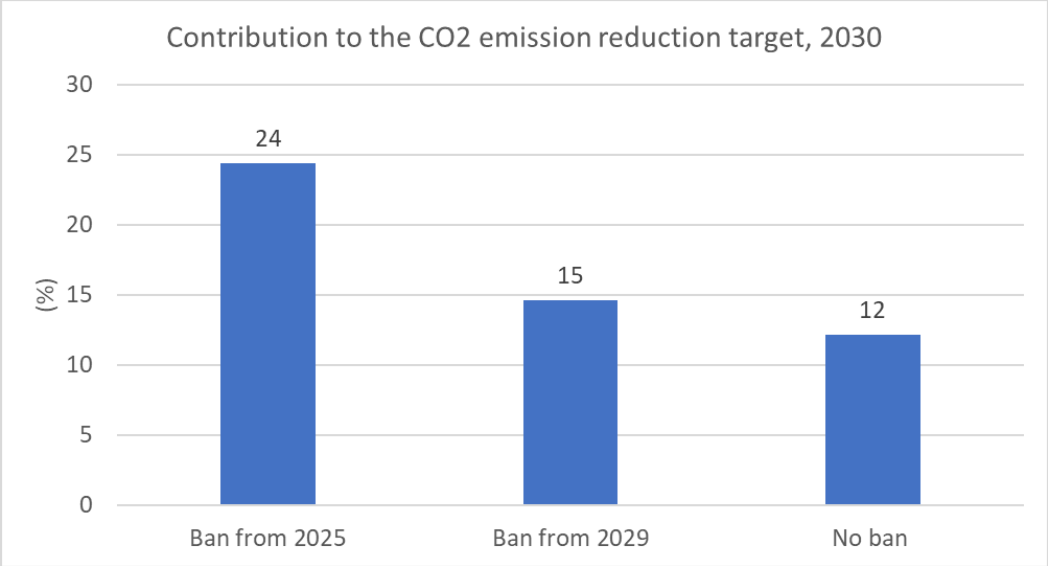
Flanders: Introduces regulations related to insulation, energy performance, and indoor climate for residential buildings, aligning with the EPB directive.

[15] eurobserv-er.org-Belgium-2023-Renewable-Energy-Policy-Factsheet%20(1).pdf

Brussels: Offers support for the development and promotion of exemplary buildings with minimal energy consumption and high environmental quality in the tertiary sector. This includes financial assistance, technical guidance, and increased public recognition for building projects that excel in energy and environmental performance, serving as showcases for their technical feasibility and economic viability.

3. SCENARIOS FOR DECARBONISATION





4. SUGGESTIONS

Belgium's plans for heating and cooling must be significantly more ambitious. According to the NECP-2019, the target for renewable energy stands at just 11.3% by 2030, which is a mere 3% point increase (in contrast to the EU's 12% point average). This places Belgium among the countries with the lowest rate of increase in

the EU. It's important to note that Belgium's economic capacity is well above the EU average[16], which implies that more extensive research and financial resources can and should be dedicated to climate protection.

Belgium boasts some of the largest houses and flats in Europe, indicating untapped potential in terms of sufficiency. Simultaneously, the average annual heating consumption per unit of living space closely aligns with the European average, highlighting room for substantial improvement in heating energy efficiency.

The national targets for 2030, as published in 2019, fall far below expectations. For instance, the commitment to solar thermal energy production, at 40 kWh/capita per year, is only 22% of the European average (179 kWh/capita). A similar underachievement is seen in heat pump targets, which are just 30% of the EU average in the NECP-2019. Given Belgium's significant economic power, it should set far more ambitious targets, even considering the limited solar energy potential due to climate constraints.

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[16] https://ec.europa.eu/eurostat/web/products-eurostat-news/w/ddn-20230323-1

BULGARIA (NO NEW DRAFT NECP PUBLISHED BY 15 AUGUST)

As per the "Summary of the Commission assessment of the draft National Energy and Climate Plan 2021-2030"[17], Bulgaria's climate protection targets are in many ways considered too modest. There's no clear coal phase-out plan by 2030, and the absence of a just transitions strategy is evident. Interestingly, Bulgaria's National Recovery and Resilience Plan sets a coal phase-out goal for 2038.

1. TARGETS

1.1. TARGETS ON RENEWABLE ENERGY IN THE HEATING AND COOLING SECTOR

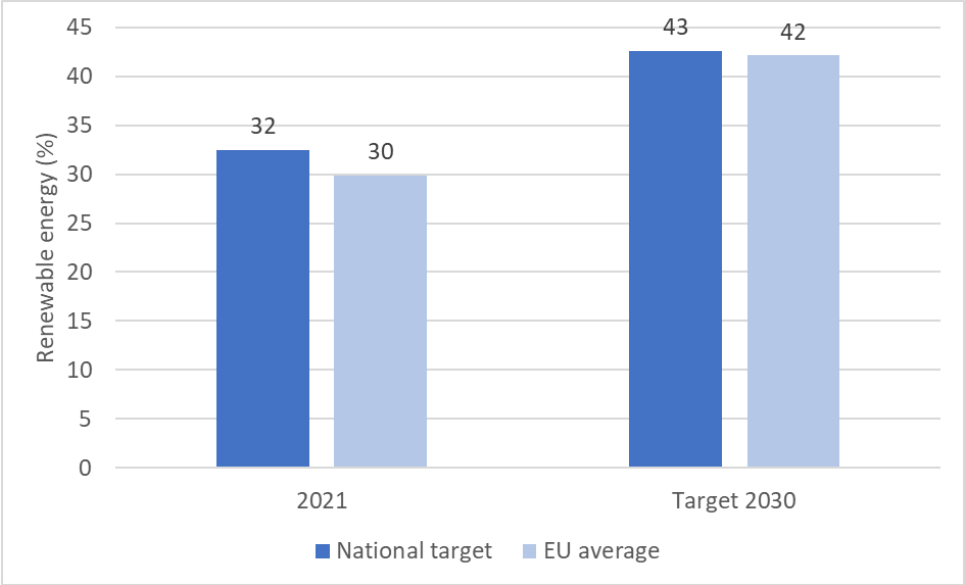


Figure 1. Renewable heating and cooling in 2021 and target (NECP) for 2030.

1.2. GHG EMISSION TARGETS FOR NON-ETS SECTORS

Target announced in 2023: 10% reduction in comparison to 2005 levels.

1.3. ENERGY IMPORTS TARGETS

37.85% in 2030, which means a growing tendency from 37.4% in 2019.

1.4. TARGETS ON HEATING (CONSUMPTION, HEAT PUMPS, BAN/PHASE-OUT OF FOSSIL HEATING)

Bulgaria is committed to surpassing the 3% annual renovation target mandated by EU regulations, aiming for a minimum of 5% of the total building stock. This ambitious goal equates to upgrading 8% of residential and non-residential buildings between 2021 and 2030, with the target increasing to a 20% share from 2041 to 2050. By 2050, the plan is to have renovated 60% of the housing stock and nearly 17% of non-housing buildings, ultimately resulting in over 45% of the entire building stock being upgraded.

[17] https://energy.ec.europa.eu/system/files/2019-06/necp_factsheet_bg_final_0.pdf

In the year 2030, Bulgaria anticipates a 2% reduction in final energy consumption for heating and cooling compared to 2020 levels. These efforts are expected to yield positive outcomes, including a decrease in district heating losses, with projections indicating a drop from 2,229 GWh in 2020 to 1,574 GWh in 2030. In this context, Member States are encouraged to elevate the use of renewable energy, waste heat, and waste cooling in their district heating and cooling systems, with an annual increase of 1.15 percentage points, exceeding the general EU-level requirement of 1%.

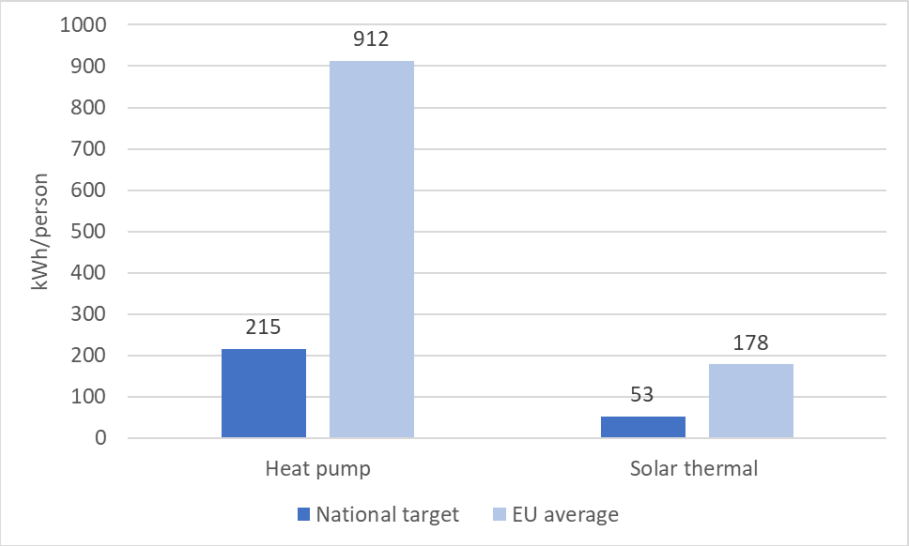


Figure 2. Target for heat production using heat pumps and solar thermal systems in 2030. The EU average comprehends countries that announced targets for these technologies. Not all countries specified this target. Source: NECP.

2. POLICIES TO ACHIEVE THE HEATING TARGETS

The targets set for renewable energy sources (RES) and energy efficiency in Bulgaria lack clear connections to specific policy measures, action plans, and detailed cost assessments. Notably, the NECP-2019 places emphasis on ambitious yet costly projects, such as the NPP Belene and the Turkish Stream gas pipeline[18].

Nevertheless, Bulgaria has taken steps to promote renewable energy through the Renewable Energy Act, which encourages the development of heat transmission networks using renewable sources, the installation of small, decentralized heating and cooling systems, and the integration of renewable heat generation units with heat transmission networks. Additionally, it supports the procurement of RES-H where both technical feasibility and economic viability are established. There are ongoing plans in Bulgaria to expand district heating networks and evaluate the potential revitalization of heat transmission systems[19].

3. SCENARIOS FOR DECARBONISATION

N.A.

[18] https://csd.bg/fileadmin/user_upload/publications_library/files/2020_05/BRIEF_92_ENG.pdf
[19] https://energy.danube-region.eu/wp-content/uploads/sites/6/sites/6/2021/03/NECP_Danube_Region_REKK_2020_final_0215logo.pdf

4. SUGGESTIONS

Bulgaria's climate protection targets do not appear particularly ambitious, which can be attributed to several factors, including limited economic opportunities, with Bulgaria having the lowest GDP per capita in the EU.

A notable challenge is the significant number of **coal-fired** households in the country. While it's desirable to phase them out promptly, Bulgarian policymakers have not set a specific target date for this transition. As a result, the country aims to increase biomass utilization for heating by approximately 30% by 2030.

In regions where favorable natural conditions for renewable energy are present, Bulgaria maintains surprisingly low expectations. For instance, their targets for solar energy fall well below the European average, even though other less affluent countries have set more ambitious goals. Given Bulgaria's favorable natural conditions, there's an opportunity to establish more robust plans for **solar thermal** applications, possibly through integration into developing district heating systems. Their target for solar thermal production by 2030 is only 52.5 kWh/capita, significantly lower than the EU average.

Furthermore, the broader use of **heat pumps** could be an effective strategy in many areas of the country. However, Bulgaria's target for heat production through heat pumps by 2030 is only 215 kWh/capita*year, representing less than a quarter of the EU average. Given the country's natural conditions, it would be reasonable to significantly raise these targets in both areas.

Improving energy efficiency in buildings, especially in mountainous regions, is also crucial. Enhanced efficiency will lead to reduced fuel consumption and less heating-related air pollution during the colder winter months.

CROATIA

1. TARGETS

1.1. TARGETS ON RENEWABLE ENERGY IN THE HEATING AND COOLING SECTOR

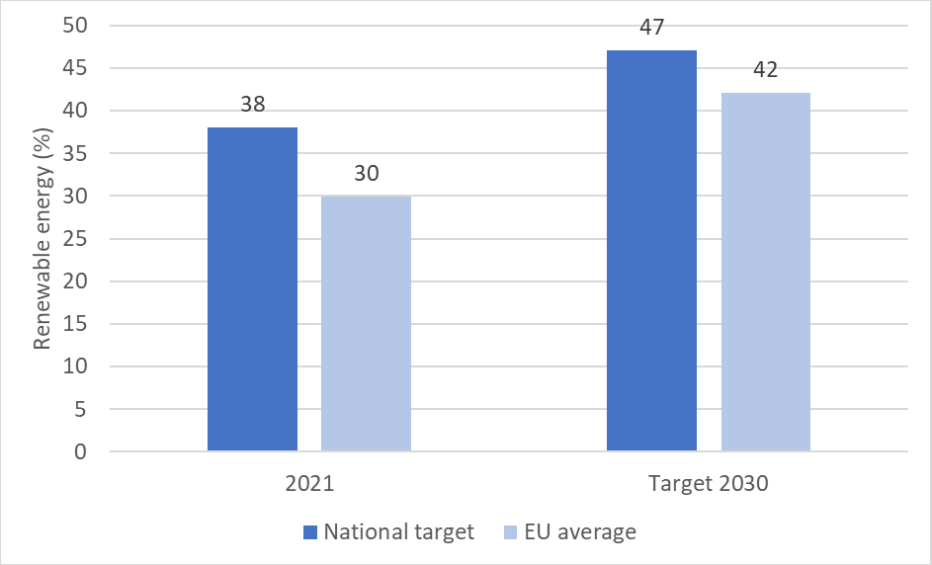


Figure 1. Renewable heating and cooling in 2021 and target (NECP) for 2030.

1.2. GHG EMISSION TARGETS FOR NON-ETS SECTORS

- 34% GHG emission reduction by 2030 compared to 1990.
- 62% GHG emission reduction by 2030 compared to 2005.

1.3. ENERGY IMPORT TARGET

- Energy imports in 2021 were 54% of total consumption. The objective is to reduce the dependence on imports to 33% by 2030.

1.4. OTHER TARGETS ON HEATING (HEAT PUMPS, BAN ON FOSSIL HEATING)

- There is currently no set deadline for the ban on the sale and installation of fossil fuel boilers.
- The schedule for prohibiting individual heating and cooling systems that rely on fossil fuels is yet to be developed.
- The average building renovation rate is projected to increase from 1% in 2021 to 2% between 2021 and 2030. As a result, the average final energy consumption in the residential sector will be 30 kWh/m² for both newly constructed and renovated buildings.
- According to the NECP, heat pumps are expected to generate 135.8 ktoe (1.58 TWh) of heat in 2030, accompanied by an electricity consumption of 50.3 ktoe (0.59 TWh). These figures suggest a Seasonal Coefficient of Performance (SCOP) of 2.7, which appears lower than anticipated.
- Heat pumps are also part of the WAM scenario, specifically in district heating systems. According to the document, the use of heat pumps to harness ambient heat is projected to grow from 48.3 ktoe in 2030 to 82.1 ktoe in 2050. Additionally, the associated electricity demand will increase from 14.2 ktoe in 2030 to 24.2 ktoe in 2050.

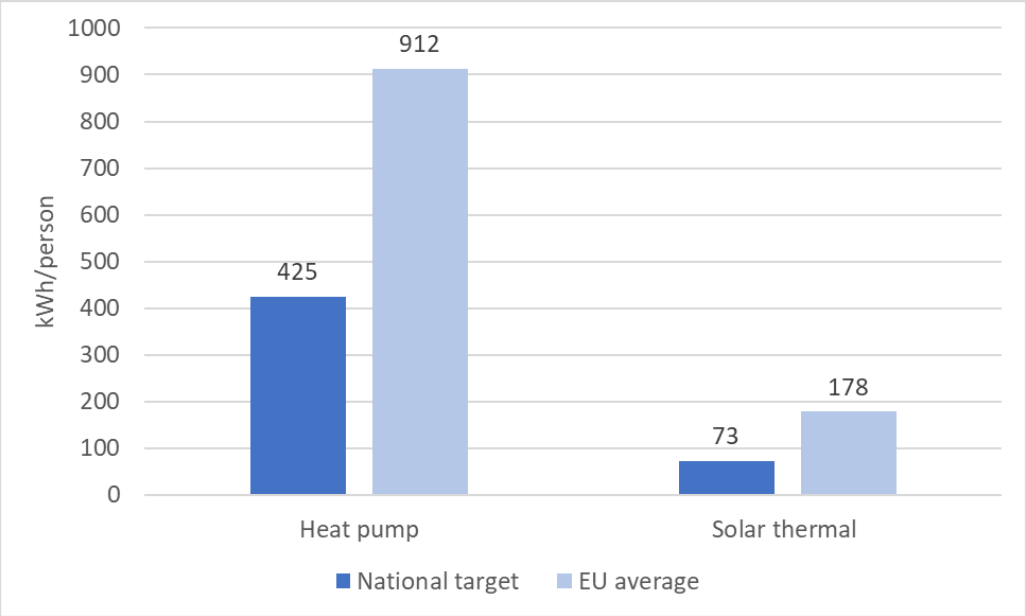


Figure 2. Target for heat production using heat pumps and solar thermal systems in 2030. The EU average comprehends countries that announced targets for these technologies. Not all countries specified this target. Source: NECP.

2. POLICIES TO ACHIEVE THE HEATING TARGETS

Measure/policy name	**Description**	**Period of application**
Reducing the use of fossil fuels for thermal purposes in individual thermal systems	By-laws should prohibit the sale and installation of individual heating and cooling systems that use fossil fuels for all buildings that wish to maintain or achieve the status of almost zero energy buildings.	2023 – 2030
Energy renovation program for apartment buildings	A total of 6.27 million m^2 of multi-apartment buildings should be renovated in the period up to 2030. It is planned to renovate an average of about 700,000 m^2 of multi-apartment buildings per year.	2021 - 2030
Energy renovation program for family houses	In total, over 11.5 million m^2 should be renovated by 2030. This would mean the annual renovation of an average of 13,500 houses or 1.35 million m^2 per year.	2021 - 2030
Elimination of fossil fuel subsidies	Analysis of the current system of subsidies, identify accompanying social programs that will reduce the impact on the poorest citizens, and define a plan for their cancellation.	2021 - 2030

Development and maintenance of the district heating system	District heating systems have been defined as one of the priorities of the energy policy of Croatia. The development targets include the replacement of natural gas boilers with renewable energy technologies, such as compression heat pumps.	2021-2030

3. SCENARIOS FOR DECARBONISATION

N.A.

4. SUGGESTIONS

The documents submitted to the EU are comprehensive, encompassing a wide array of climate policies and instruments. Nevertheless, some of the specific objectives remain challenging to discern within the extensive 300+ pages of text and annexes. Therefore, it would be beneficial to clearly outline the main indicators and commitments and emphasize them in the text.

Given the favorable natural conditions, there is a clear opportunity to develop more ambitious plans for **solar thermal applications**, both at the household level and for integration into district heating systems.

Reducing the use of fossil fuels for thermal purposes in individual thermal systems: The measure will ensure a reduction in the use of fossil fuels in total energy consumption and consequently a reduction in greenhouse gas emissions. The measure will significantly improve air quality in all urban areas where fossil fuels are used for heating and cooling purposes.

Energy renovation program for apartment buildings: Reduction of thermal needs and energy consumption in multi-apartment buildings and increase in the use of RES and consequent reduction of CO2 emissions; estimated savings in final consumption in 2030 amount to 1.87 PJ (44.55 ktoe; 518.16 GWh); estimated reduction in CO2 emissions in 2030 124.88kt CO2); cumulative energy savings in the period 2021-2030 8.45 PJ (201.82 ktoe; 2,348.0 GWh); cumulative reduction in CO2 emissions in 2021- 2030 565.87 ktCO2.

Energy renovation program for family houses: Reduction of thermal needs and energy consumption in family houses and increase of RES use and consequent reduction of CO2 emissions; estimated savings in final consumption in 2030 amount to 4.47 PJ (106.76 ktoe; 1.241,80 GWh); estimated reduction in CO2 emissions 195 in 2030 299.27 kt CO2; cumulative energy savings in the period 2021-2030 20.26 PJ (483.90 ktoe; 5,627.2 GWh); cumulative reduction in CO2 emissions in 2021-2030 1,356.16 ktCO2.

CYPRUS

1. TARGETS

1.1. TARGETS ON RENEWABLE ENERGY IN THE HEATING AND COOLING SECTOR

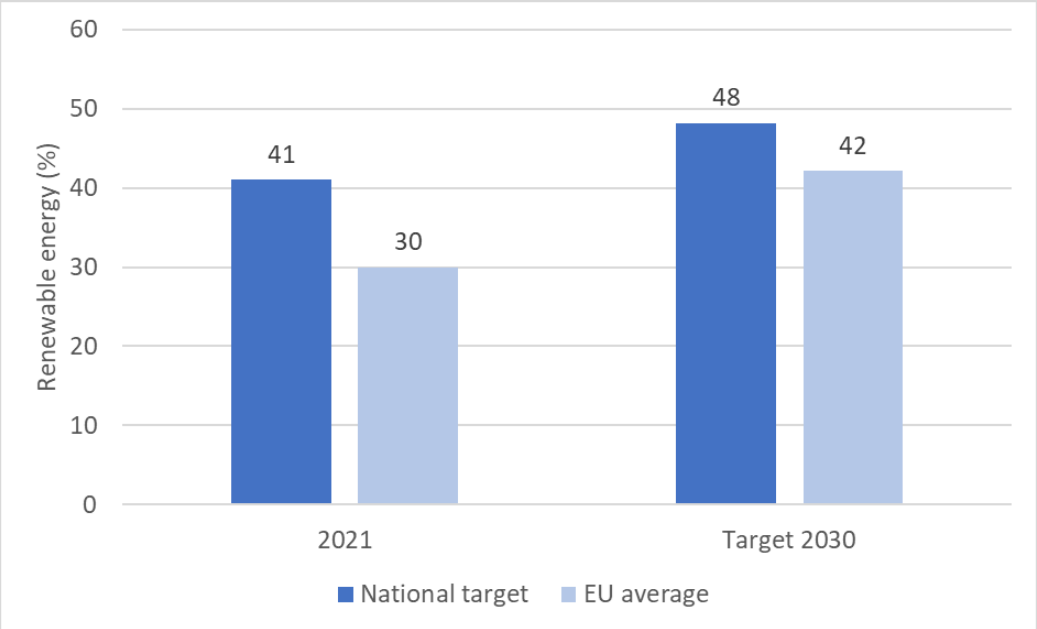


Figure 1. Renewable heating and cooling in 2021 and target (NECP) for 2030.

1.2. GHG EMISSION REDUCTION TARGETS

- 32% GHG emission reduction by 2030 compared to 2005.

1.3. ENERGY IMPORT TARGET

- Energy imports in 2021 were approximately 92% of total consumption. The objective is to reduce the dependence on imports to around 82% by 2030.

1.4. OTHER TARGETS ON HEATING (HEAT PUMPS, BAN ON FOSSIL HEATING)

- The ban on the sale and installation of fossil heating systems lacks a specified deadline.
- As of 2021, the renewable energy sources (RES) share in the heating and cooling sector stood at 41.3%, surpassing the 32.6% target outlined in the NECP.
- The dominance of solar energy, primarily facilitated through widespread solar thermal systems for water heating, constitutes a significant portion of the RES share in the heating and cooling sector. Other key contributors include heat pumps and the utilization of biomass, particularly wood products, for heating. Additionally, RES cooling using heat pumps makes a noteworthy contribution.
- It's worth noting that nearly all existing residences have adopted solar water heating systems, continuing to play a central role in the energy landscape.

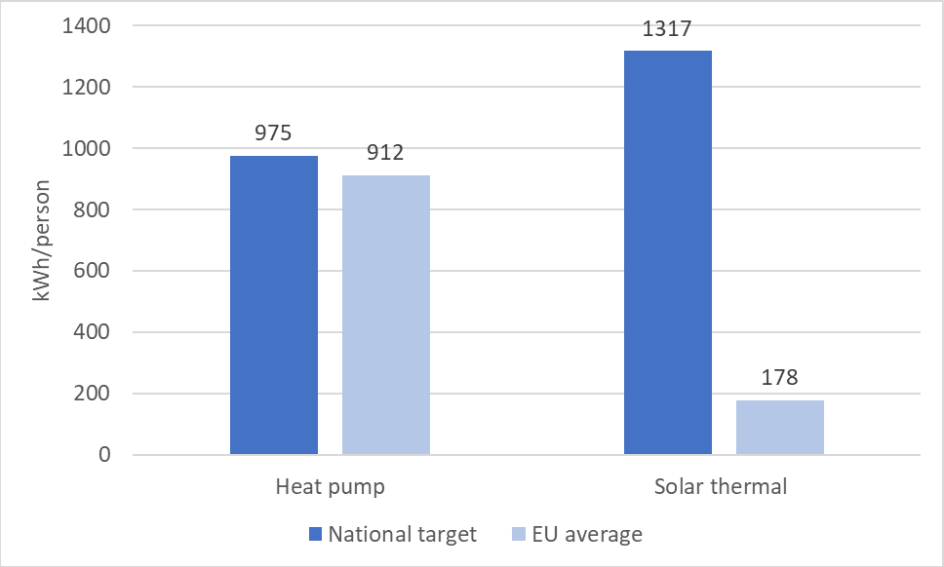


Figure 2. Target for heat production using heat pumps and solar thermal systems in 2030. The EU average comprehends countries that announced targets for these technologies. Not all countries specified this target. Source: NECP.

2. POLICIES TO ACHIEVE THE HEATING TARGETS

In the heating and cooling sector, support schemes to provide financial incentives for installing or replacing **solar domestic hot water systems** continue to be implemented. Support measures will also be implemented to further promote high-efficiency **heat pumps** for heating and cooling. At the same time, sponsorship schemes for the energy **upgrading of existing buildings** continue, including subsidies for RES heating and cooling systems (solar thermal, heat pumps, geothermal systems, etc.).

Measure/policy name	**Description**	**Period of application**
Installation of heat pumps	Economic incentives for the installation of high-efficiency heat pumps and the replacement of old oil boilers.	2024 - 2030
Sponsorship scheme for the installation or replacement of a solar system for the production of hot water for use in dwellings	Financial support measure for the installation or replacement of solar hot water production in existing dwellings with a building permit before 21/12/2007.	2004 - 2030
Sponsorship scheme to encourage the use of RES in dwellings	Financial aid measure for installation of PV systems in dwellings with a building permit before 01/01/2017.	2018 - 2030
Sponsorship scheme to encourage the use of RES in homes for vulnerable consumers	Financial aid measure for vulnerable consumers to install PV systems in dwellings with a building permit before 01/01/2017.	2013 – 2030

3. SCENARIOS FOR DECARBONISATION

N.A.

4. SUGGESTIONS

Cyprus presents a unique scenario due to various factors: larger household sizes compared to the European average, yet relatively low heat consumption due to mild winters, and its status as an island with high import dependence.

While Cyprus lags behind the European average in expanding its renewables sector (7% points compared to the EU's 12% points), it has set an ambitious plan for solar energy expansion. By 2030, its per capita heat production target will be seven times higher than the EU average. Given that Cyprus experiences minimal heating needs for around four months and increased **cooling** energy demand for approximately eight months, the role of air-to-air heat pumps becomes crucial. Moreover, it's imperative to encourage the widespread installation of household-level solar panels alongside the promotion of heat pumps.

To address the undervalued aspects of energy consumption for cooling, awareness campaigns should target two key areas. Firstly, these campaigns should promote various shading techniques to make them more accessible to the public. Secondly, a significant focus should be placed on enhancing green spaces, where Cyprus currently falls short of the European average.

CZECH REPUBLIC (NO NEW DRAFT NECP PUBLISHED BY 15 AUGUST 2023)

1. TARGETS

1.1. TARGETS ON RENEWABLE ENERGY IN THE HEATING AND COOLING SECTOR

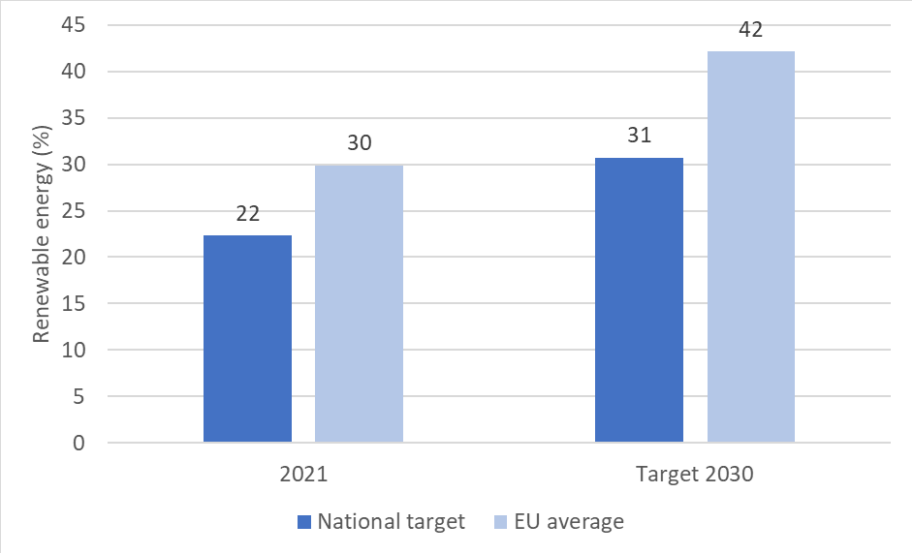


Figure 1. Renewable heating and cooling in 2021 and target (NECP) for 2030.

1.2. GHG EMISSION TARGETS FOR NON-ETS SECTORS

2019: 14% GHG emission reduction by 2030 compared to 2005,
2023: 26% according to the EC[20].

1.3. ENERGY IMPORTS TARGETS

N.A.

1.4. TARGETS ON HEATING (CONSUMPTION, HEAT PUMPS, BAN/PHASE-OUT OF FOSSIL HEATING)

Czech Republic is aiming to enhance the incorporation of renewable energy, waste heat, and waste cooling in their district heating and cooling systems by 1.1 percentage points each year, surpassing the standard 1% annual increase. However, it's worth noting that the NECP-2019 does not specify any targets for household-level heating.

[20] https://climate.ec.europa.eu/eu-action/effort-sharing-member-states-emission-targets/effort-sharing-2021-2030-targets-and-flexibilities_en

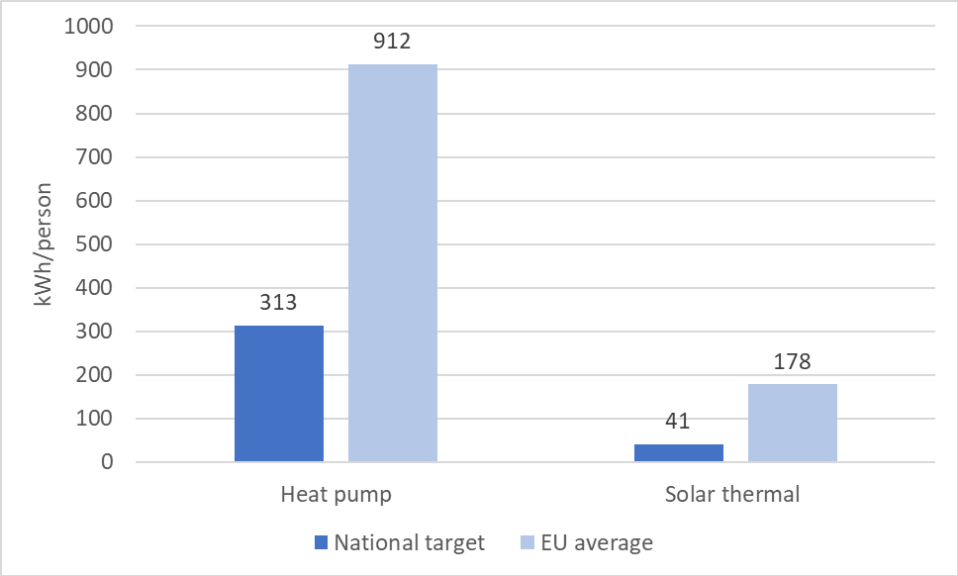


Figure 2. Target for heat production using heat pumps and solar thermal systems in 2030. The EU average comprehends countries that announced targets for these technologies. Not all countries specified this target. Source: NECP.

2. POLICIES TO ACHIEVE THE HEATING TARGETS

Czechia offers financial support for both investment and operations of renewable energy sources (RES). Additionally, RES installations enjoy an exemption from immovable property tax. The country is considering implementing an **Annual Green Bonus** system, which would use auctions to facilitate the construction of new biogas, biomass, and geothermal power plants while offsetting the cost difference between RES and non-RES fuels.

3. SCENARIOS FOR DECARBONISATION

N.A.

4. SUGGESTIONS

The NECP-2019 outlines a plan to increase the renewable energy ratio in heating by 8.4%, which falls short of the 12% EU average. While an increase at this rate from an already high percentage might be acceptable, both the current (22.3%) and planned rates (30.7%) in the Czech Republic are lower than the EU average. This indicates that Czech commitments to green heating are not ambitious enough.

These modest targets also extend to sub-areas. For heat pumps, the targeted yearly heat production is only around 1/3rd (313 kWh/capita) of the calculated EU average (927 kWh/capita) by 2030. The solar thermal target is even lower, at 41 kWh/capita, which is less than 1/4th of the EU average (179 kWh/capita). Given that some less-favored countries have set much higher targets and may have already achieved them (e.g., Denmark), it's reasonable to suggest that the Czech Republic should adopt more ambitious commitments in the fields of heat pumps and solar collectors.

DENMARK

1. TARGETS

1.1. TARGETS ON RENEWABLE ENERGY IN THE HEATING AND COOLING SECTOR

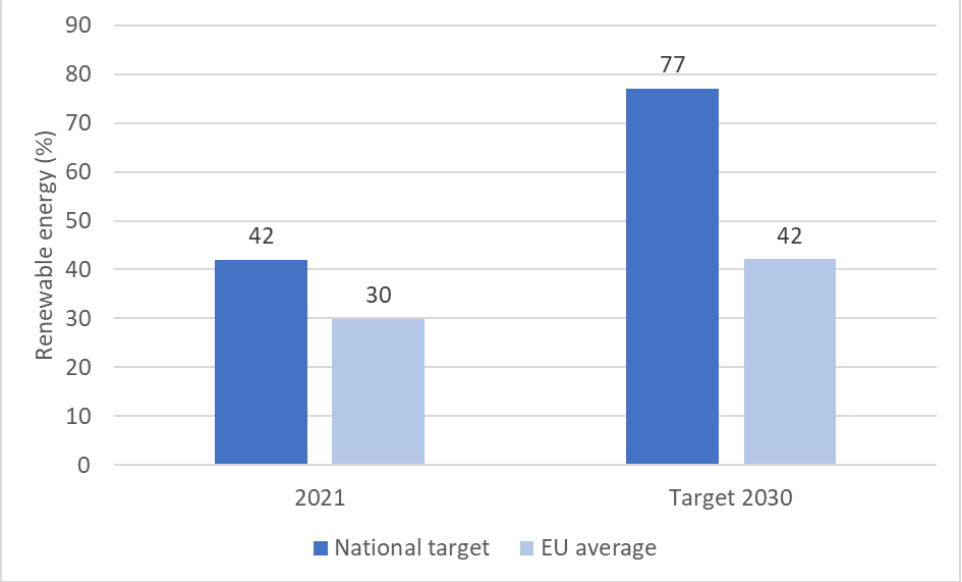


Figure 1. Renewable heating and cooling in 2021 and target (NECP) for 2030.

1.2. GHG EMISSION TARGETS FOR NON-ETS SECTORS

39% GHG emission reduction by 2030 compared to 2005.

1.3. ENERGY IMPORTS TARGETS

Minus 11% by 2030 – meaning that Denmark has a plan to be a net energy exporter, unique in the EU, according to the new draft NECPs submitted.

1.4. TARGETS ON HEATING (HEAT PUMPS, BAN ON FOSSIL HEATING)

90% of district heating consumption needs to be free of coal, oil, or gas by 2030.

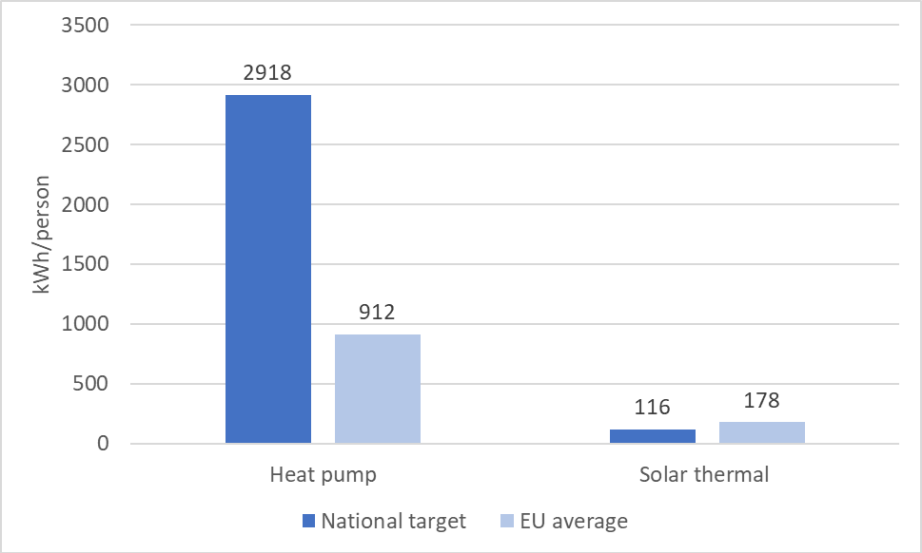


Figure 2. Target for heat production using heat pumps and solar thermal systems in 2030. The EU average comprehends countries that announced targets for these technologies. Not all countries specified this target. Source: NECP-2023.

Considering that more than 100 district heating systems in Denmark already have solar collectors, the solar thermal production target set in the NECP seems too low.

2. POLICIES TO ACHIEVE THE HEATING TARGETS

Heat pumps, district heating, and thermal storages are recognized as technologies that provide flexibility to the entire energy system. In the heating sector, a market-oriented approach is now encouraged, and a connection to district heating is no longer mandatory.

Taxes on fossil fuels (1-TD-01b: Mineral-oil Tax Act; 1-TD-02: Gas Tax Act; 1-TD-03: Coal Tax Act).

2-EN-08: Phasing out fossil fuels and promoting locally-based RE-heat by adding – alignment of requirements for district heating projects.

Strategy for investments in green research, technology, and innovation (September 2020).

The Recovery and Resilience Plan's Component 3 focuses on enhancing energy efficiency, promoting green heating, and implementing carbon capture and storage, with an allocation of €235 million. This component aims to achieve a minimum of 30% primary energy savings and will be directed toward public and private building energy efficiency, as well as industrial applications.

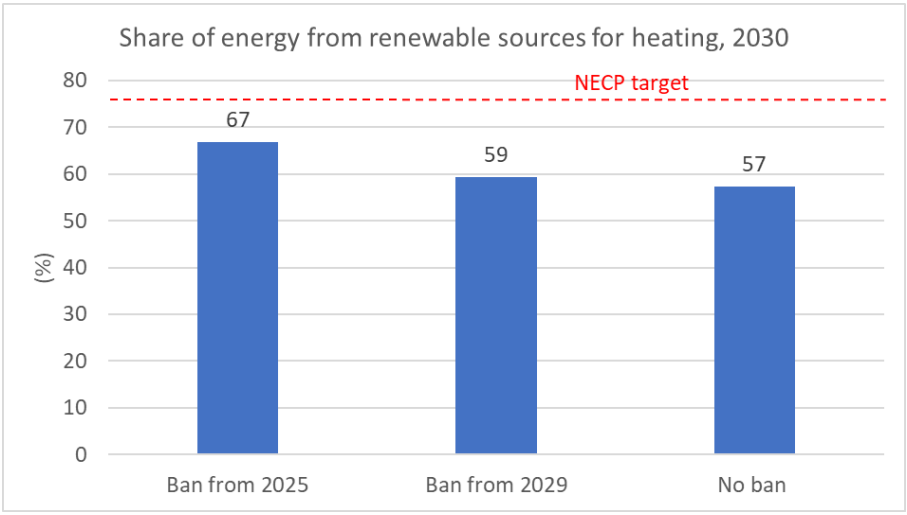
Specific investments within this plan include:

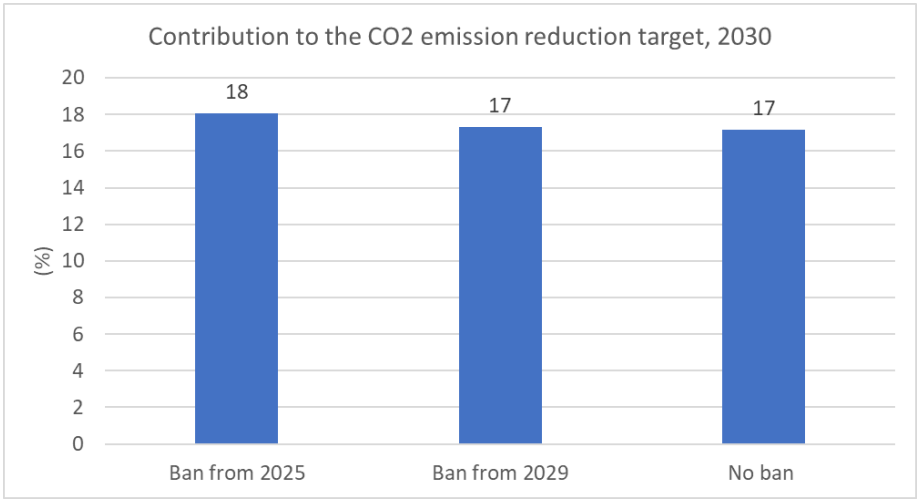
- Investment 1 - "Replacing Oil Burners and Gas Furnaces" (€65 million): This initiative seeks to phase out oil and natural gas heating systems, replacing them with **electric heat pumps** and district heating from renewable sources. Subsidies are provided to expedite the transition and reduce conversion costs for consumers.

- Investment 3 - "Energy Renovations in Public Buildings" (€40 million): This investment focuses on renovating regional and municipal buildings with low energy performance standards, especially those currently heated by oil burners and gas furnaces.

- Investment 4 - "Energy Efficiency in Households" (€63 million): This measure aims to enhance residential building energy efficiency, facilitating the **transition** from oil burners and gas furnaces **to heat pumps.** It targets energy savings in private housing through insulation, building operation optimization, and the replacement of traditional heating systems with heat pumps.

3. SCENARIOS FOR DECARBONISATION





4. SUGGESTIONS

Denmark serves as a commendable model in the renewable energy transition, exemplifying its commitment to community energy production and its associated values and achievements. It is essential to build upon this approach and leverage the results it has generated.

Denmark's ambitious renewable energy targets include a substantial deployment of **solar photovoltaic (PV)** capacity, projected to increase from 1,852 MW in 2022 to an impressive 17,744 MW by 2030. This plan coincides with a substantial expansion in **heat pump capacity**. Notably, Denmark's goal for heat pump heat generation, set at 2,918 kW per capita by 2030, stands out as the most ambitious in the EU, surpassing the EU average by more than threefold.

As a side note, it is advisable to prioritize sustainable practices in the 10-fold PV expansion plan, avoiding greenfield investments that encroach on arable land. Instead, emphasis should be placed on utilizing existing infrastructure, brownfield projects, and innovative agroPV applications to minimize environmental impact and maximize efficiency.

ESTONIA (NO NEW DRAFT NECP PUBLISHED BY 15 AUGUST 2023)

1. TARGETS

1.1. TARGETS ON RENEWABLE ENERGY IN THE HEATING AND COOLING SECTOR

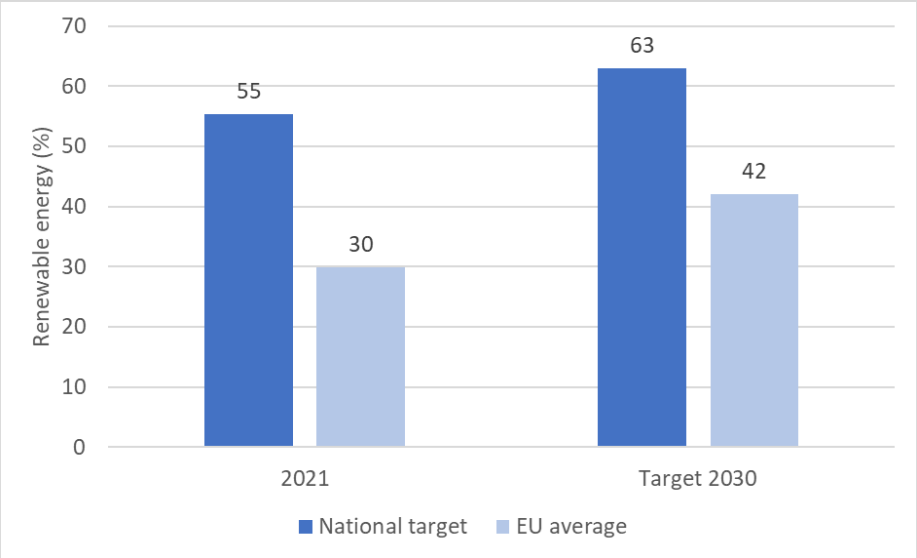


Figure 1. Renewable heating and cooling in 2021 and target (NECP) for 2030.

1.2. GHG EMISSION TARGETS FOR NON-ETS SECTORS

24% GHG emission reduction target for 2030 (based on 2005) in the WAM scenario.
80% target by 2050 (1990) in the WAM scenario.

1.3. ENERGY IMPORTS TARGETS

N.A.

1.4. TARGETS ON HEATING (HEAT PUMPS, BAN ON FOSSIL HEATING)

63% share of renewable energy in the heat economy – in this sector, exactly the same commitments appear as in the 2019 NECP. In the field of heat and cooling, the potential of Estonian wood fuels is being exploited and the share of heat pumps is increasing.

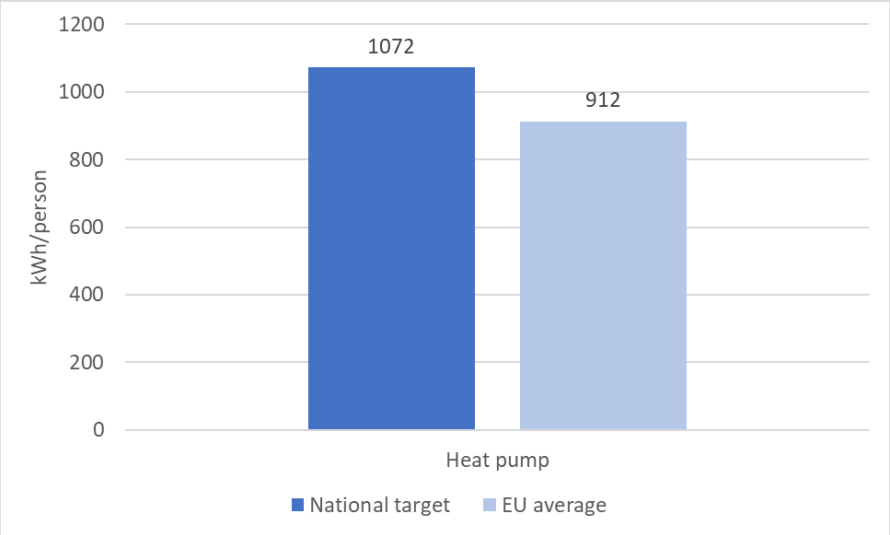


Figure 2. Target for heat production using heat pumps and solar thermal systems in 2030. The EU average comprehends countries that announced targets for these technologies. Not all countries specified this target. Source: NECP.

Fit for 55 package proposed targets:

- 35 million buildings renovated by 2030
- 49% share of renewable energy used in buildings
- National targets set in Estonia:
- 50% of apartment buildings must be renovated by 2030 (ENMAK 2030)
- 40% of single houses must be renovated by 2030 (ENMAK 2030)
- 54 million m2 of buildings renovated by 2050 (single houses 12 million m2, apartment buildings 18 million m2, not residential buildings 22 million m2)

2. POLICIES TO ACHIEVE THE HEATING TARGETS

The District Heating Act serves as the regulatory framework governing the production, distribution, and sale of heat via district heating networks, and their connection.

Estonia's Long-term Renovation Strategy provides a visionary roadmap for renovating the existing building stock, offering a range of measures to support Estonia's renovation endeavors.

Estonia's Recovery and Resilience Plan, as an annex to the recently finalized national strategy "Estonia 2035," primarily focuses on objectives, reforms, and investments funded through the European Union's Recovery and Resilience Facility (RRF). The RRP's reforms and investments align with the Estonia 2035 Strategy and its corresponding Action Plan, outlining the necessary changes to meet strategic goals and address the EC's country-specific recommendations. Key RRP investments emphasize green and digital transitions, with over €600 million allocated, a significant portion of which will benefit businesses. Trinomics has published an extensive analysis titled "Transitioning to Carbon-Neutral Heating and Cooling in Estonia by 2050," delving into this subject[21].

[21] https://energiatalgud.ee/sites/default/files/2022-12/D7%20%282%29.pdf

3. SCENARIOS FOR DECARBONISATION

N.A.

4. SUGGESTIONS

Estonia faces a notable challenge with its high average heat consumption, standing at 260 kWh/m2*year, nearly two-thirds above the EU average, ranking it as the third highest in the EU. Thus, a paramount priority is to implement substantial energy efficiency measures to significantly reduce this consumption.

The 2030 target for heat production from heat pumps is 1072 kWh per capita, which slightly surpasses the EU average. Given Estonia's commendable goal of achieving 100% renewable energy in the electricity sector by 2030, setting more ambitious targets for heat pumps would be in line with this exemplary commitment.

Although Estonia's NECPs lack data on solar thermal energy, Denmark's success in a similar geographical context highlights the substantial potential for solar thermal energy production in Estonia. It is strongly recommended to harness this potential to the fullest extent, with a particular focus on district heating systems, where Estonia already boasts an impressive 80% coverage. To ensure sustainability, these developments should favor brownfield projects over greenfield investments, and efforts can be made to combine agricultural production with solar thermal production, akin to agroPV applications.

FINLAND

1. TARGETS

1.1. TARGETS ON RENEWABLE ENERGY IN THE HEATING AND COOLING SECTOR

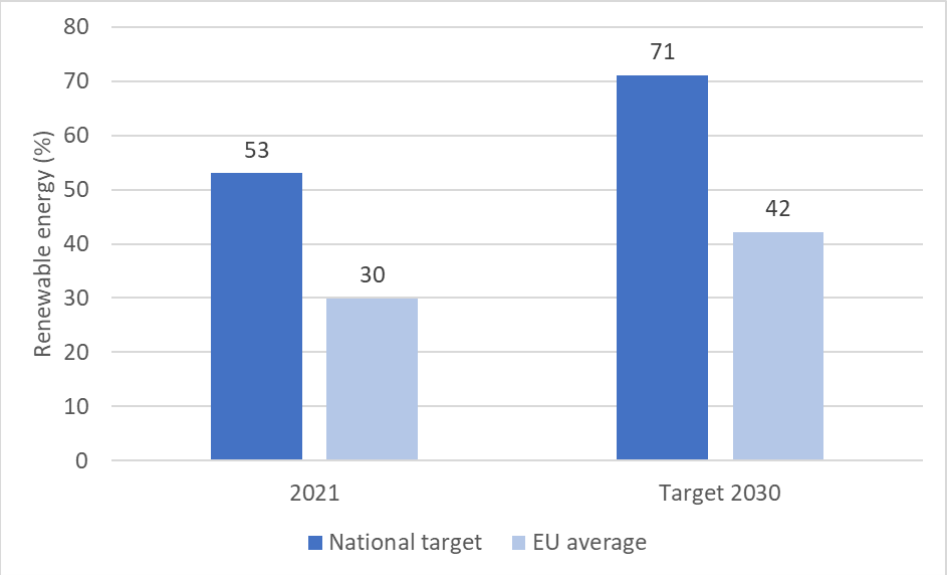


Figure 1. Renewable heating and cooling in 2021 and target (NECP) for 2030.

1.2. GHG EMISSION TARGETS FOR NON-ETS SECTORS

- 50% GHG emission reduction by 2030 compared to 2005.

1.3. ENERGY IMPORTS TARGETS

- Energy imports in 2021 were 38% of total consumption. The objective is to reduce import dependency further. However, nuclear fuel import would compromise a significant reduction in import dependency.

1.4. TARGETS ON HEATING (HEAT PUMPS, BAN ON FOSSIL HEATING)

- Finland will phase out the use of fossil fuel oil in heating by the start of the 2030s.
- The initial target levels for heating energy use of buildings are 56 TWh in 2030, 45 TWh in 2040, and 36 TWh in 2050, including the energy harvested by heat pumps.
- As for energy saving, a 3.6% decline by 2030 and a 6.7% decline by 2040 compared to 2020.

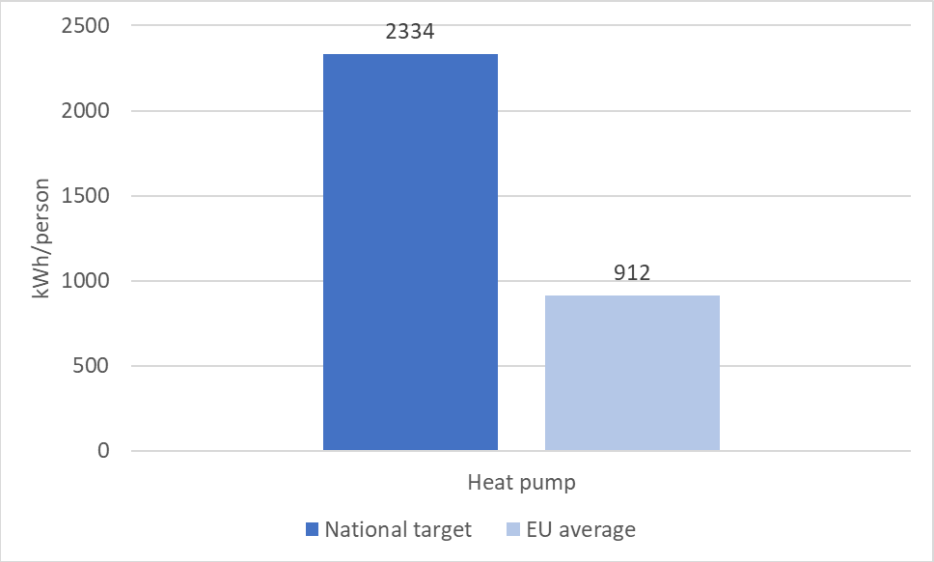


Figure 2. Target for heat production using heat pumps and solar thermal systems in 2030. The EU average comprehends countries that announced targets for these technologies. Not all countries specified this target. Source: NECP.

2. POLICIES TO ACHIEVE THE HEATING TARGETS

Finland's energy and climate policies revolve around achieving carbon neutrality by 2035, prioritizing energy security, reducing import dependency, fostering a sustainable economy, and preserving biodiversity. A central element of this strategy is the substantial increase in heat production from renewable sources. By 2030, the goal is for heat pumps to supply 23% of the total heat consumption. Nevertheless, the strategy maintains a significant reliance on nuclear energy, which raises concerns about the potential compromise of reducing import dependency.

To accelerate the phase-out of oil in residential properties, a supportive aid program has been introduced. Subsidies for detached houses are available to cover expenses related to the removal and conversion of oil heating systems in year-round residential use to alternative heating solutions. Notably, in the summer of 2022, the subsidy program was expanded to encompass the transition away from natural gas heating as well.

3. SCENARIOS FOR DECARBONISATION

N.A.

4. SUGGESTIONS

Greenhouse gas emissions resulting from oil heating in residential buildings totaled 0.8 Mt CO2 equivalent in 2019, with detached and semi-detached houses contributing to approximately 80-90% of these emissions. Notably, oil heating is responsible for approximately 40% of emissions from these housing types. The ongoing renewal of the building stock, building renovations, and transitions in heating systems are anticipated to lead to further emissions reductions. The mandated distribution of biofuel oil and the replacement of fossil oil heating with alternative heating methods are also expected to significantly curtail emissions.

In the case of heat pumps, Finland has set an ambitious target (2334 kWh/capita by 2030), ranking as the second-highest in the EU after Denmark. Finland should harness its economic tools and resources to

vigorously pursue this objective, ensuring that families are supported in transitioning from fossil fuels to eco-friendly, renewable heating alternatives.

While the NECP-2023 lacks specific targets for the thermal use of solar energy, it is advisable to establish a target of at least the average European figure (approximately 180 kWh/capita) for 2030 to drive the adoption of solar energy.

FRANCE (NO NEW DRAFT NECP PUBLISHED BY 15 AUGUST 2023)

1. TARGETS

1.1. TARGETS ON RENEWABLE ENERGY IN THE HEATING AND COOLING SECTOR

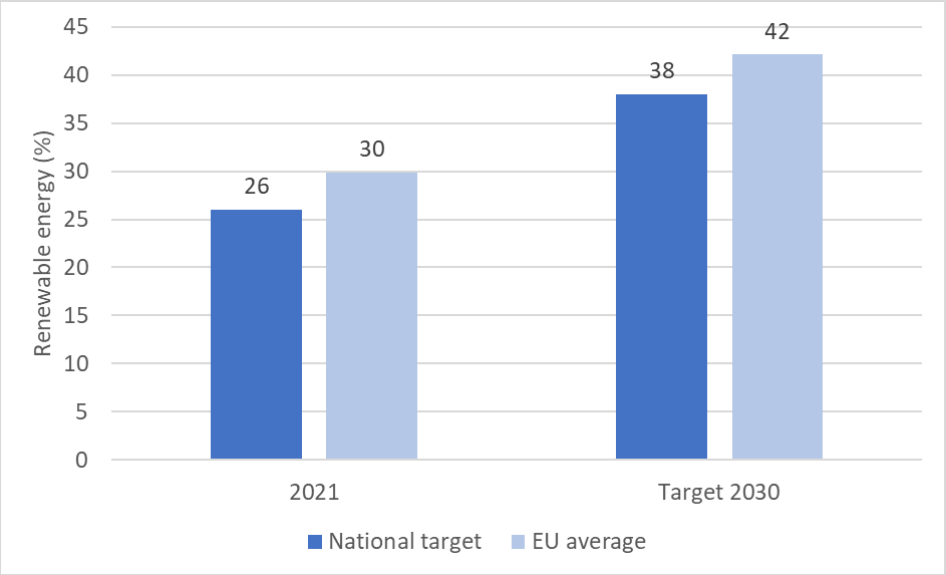


Figure 1. Renewable heating and cooling in 2021 and target (NECP) for 2030.

1.2. GHG EMISSION TARGETS FOR NON-ETS SECTORS

37% GHG reduction by 2030 (compared to 2005).

1.3. ENERGY IMPORTS TARGETS

N.A.

1.4. TARGETS ON HEATING (HEAT PUMPS, BAN OF FOSSIL HEATING)

- From July 2022 oil boilers are banned in all buildings.
- From 2023 ban on gas boilers in new buildings.
- The phase-down of coal-fired district heating and heating oil for individual heating is included in the plan, a commitment to phase out gas is missing from the NECP.
- 500,000 deep renovations foreseen in the Energy Transition Law.
- Heat production targets for 2028 in the French Strategy for Energy and Climate:
  - 1.85-2.5 TWh by **solar thermal**;
  - 4-5.2 TWh by **geothermal** energy;
  - 5-7 TWh by **geothermal heat pumps;**
  - 157-169 TWh by **air source heat pumps**[22]

[22] ttps://climate-laws.org/document/french-strategy-for-energy-and-climate_2d2e

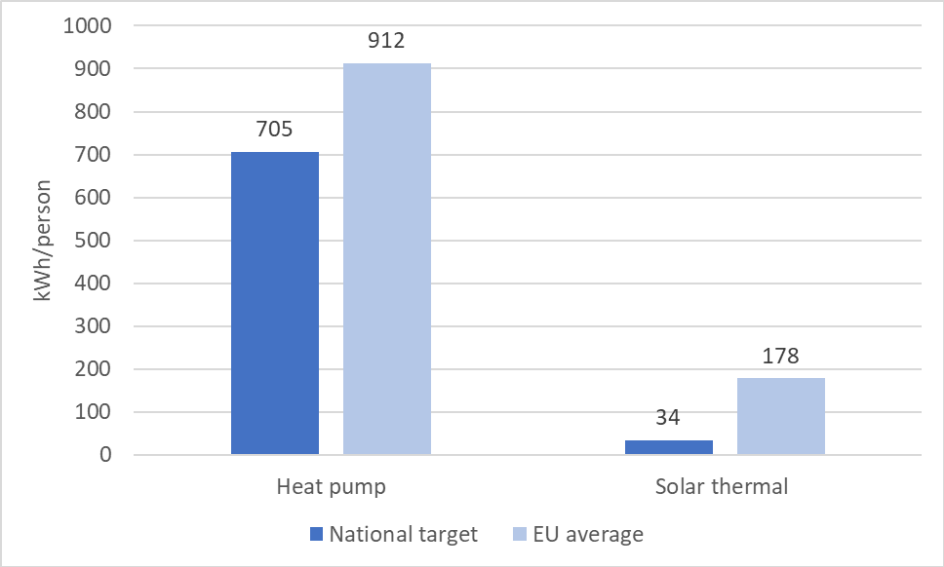


Figure 2. Target for heat production using heat pumps and solar thermal systems in 2030. The EU average comprehends countries that announced targets for these technologies. Not all countries specified this target. Source: NECP.

2. POLICIES TO ACHIEVE THE HEATING TARGETS

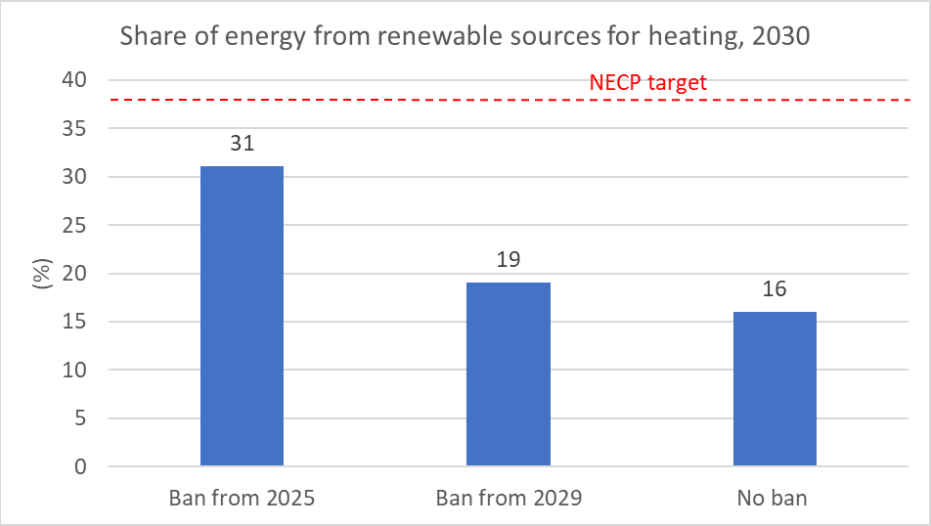
While France's response to climate change is considered to be making progress, it is still deemed insufficient, with a significant risk of not achieving its greenhouse gas reduction targets[23]. It's essential to recognize that France plans to maintain a substantial reliance on **nuclear energy**, despite evident operational challenges.

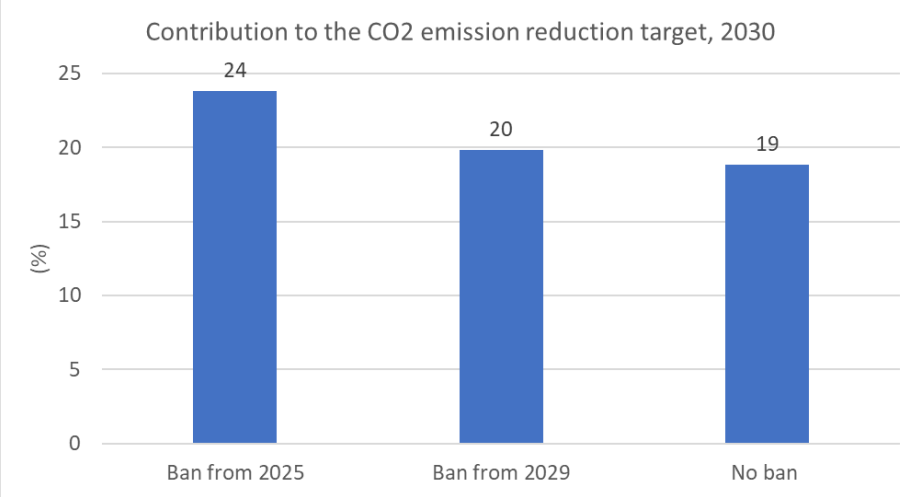
A significant portion of residential heating energy in France is sourced from gas (40%) and fuel oil (12%), with 12% originating from electrical systems. Notably, France surpasses many neighbouring countries in the adoption of heat pumps. The government has already initiated measures to phase out fossil fuels in buildings, such as prohibiting the installation of oil and coal boilers in most new and existing structures since July 2022, with a commitment to replace all oil boilers by 2028. As part of the government's Resilience Plan, the "MaPrimeRenov" subsidy scheme has been adjusted to discontinue support for gas boilers by the end of 2022, while increasing incentives for heat pumps and biomass heaters[24].

According to NECP-2019, France aimed to renovate 370,000 residential buildings annually from 2015 to 2030. However, the newly introduced energy renovation plan[25] for buildings has set a more ambitious target of renovating and insulating 500,000 buildings each year. Starting in January 2022, a new regulation known as RE2020, designed to reduce the carbon footprint of construction, will establish a GHG emissions threshold for new construction, taking into account the entire lifecycle of the building. Additionally, a voluntary label will be introduced to encourage stakeholders to exceed the regulation's objectives[26].

[23] https://www.hautconseilclimat.fr/wp-content/uploads/2022/06/Rapport-annuel-Haut-conseil-pour-le-climat-29062022.pdf
[24] https://www.carbonbrief.org/the-carbon-brief-profile-france/
[25] https://www.ecologie.gouv.fr/plan-renovation-energetique-des-batiments
[26] https://www.europarl.europa.eu/RegData/etudes/BRIE/2021/690686/EPRS_BRI(2021)690686_EN.pdf

3. SCENARIOS FOR DECARBONISATION





4. SUGGESTIONS

In general, France's plans for renewable energy-based heat production by 2030, at 38%, fall below the EU average of 42%. Given France's higher GDP per capita compared to the EU average, the country's leadership should consider more ambitious commitments.

Considering the favourable natural conditions, there was a missed opportunity to set significantly more ambitious targets for **solar thermal** applications. The current goal of reaching 34 kWh/capita by 2030 is considerably lower than the European average of 179 kWh/capita.

Regrettably, the targets for heat pumps also lack significant ambition. However, given the substantial nuclear capacity, it would be reasonable to expect a much higher heat-pump-based heat generation compared to the European average. This is because demand-side management of heat pumps can help optimize nuclear power plant production. France's target of 705.15 kWh/capita by 2030 represents only 77% of the EU average of 912 kWh/capita. Therefore, there is room for a more ambitious approach.

GERMANY (NO NEW DRAFT NECP PUBLISHED BY 15 AUGUST 2023)

1. TARGETS

1.1. TARGETS ON % OF RE (UPDATED TARGETS ACCORDING TO DIFFERENT SOURCES)

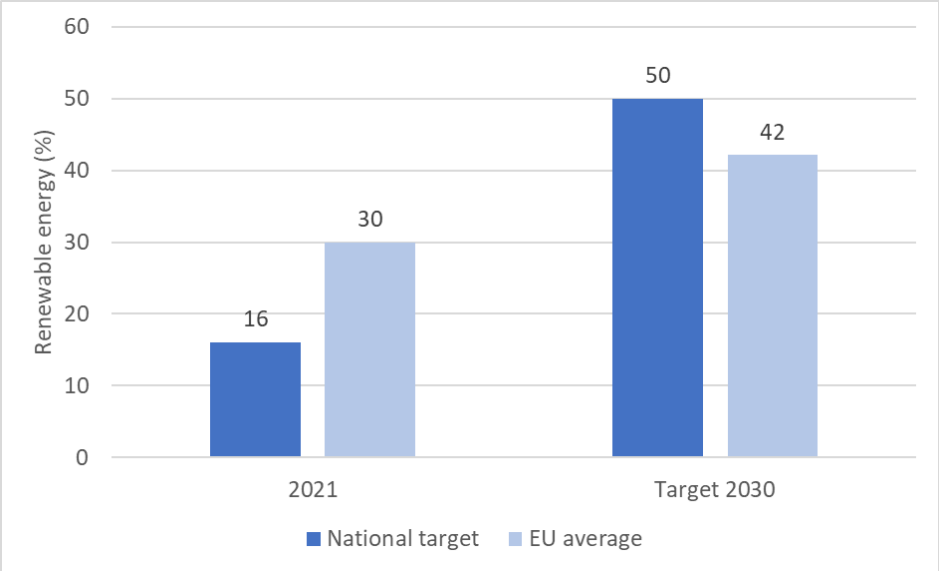


Figure 1. Renewable heating and cooling in 2021 and target (NECP) for 2030.

- 50% RE in heating by 2030.[27]
- 80% RE in electricity by 2030.[28]
- 28% RE in transport by 2030.[29]

1.2. GHG EMISSION TARGETS FOR NON-ETS SECTORS

38% GHG reduction between 2005 and 2030.

1.3. ENERGY IMPORTS TARGETS

N.A.

1.4. TARGETS ON HEATING (HEAT PUMPS, BAN OF FOSSIL HEATING)

- Ban on installations of mono-fuel oil/coal boilers from 2026 in new and existing buildings, and regional use of obligations for renewable heating.[30]
- From 2024, a share of 65% RE in heating in new and existing buildings.[31]

[27] https://www.bee-ev.de/service/publikationen-medien/beitrag/bee-waermeszenario-2045
[28] https://www.bundesregierung.de/breg-de/schwerpunkte/klimaschutz/amendment-of-the-renewables-act-2060448
[29] https://www.enerdata.net/publications/daily-energy-news/germany-targets-28-renewables-transport-sector-2030.html
[30] https://www.oeko.de/fileadmin/oekodoc/Phase-out_fossil_heating.pdf
[31] https://energypost.eu/germanys-proposed-de-facto-ban-on-new-fossil-boilers-from-2024-meets-fierce-resistance/

- From 2045, all fossil fuel heatings would be banned as part of Germany's target to become "climate neutral" by then.[32]

2. POLICIES TO ACHIEVE THE HEATING TARGETS

In Germany, significant legislative changes have been made to promote sustainability and energy efficiency in the building sector. The **Energy Performance of Buildings Act**, enacted in 2020 and subsequently amended in 2022, mandates that all newly installed heating systems in both new and existing buildings must derive a minimum of 65% of their energy from renewable sources, starting from 2024.

Furthermore, a recently introduced **draft law on heat planning and the decarbonization of heat networks**, dated June 2023, sets forth the requirement for existing district heating networks to increase their renewable energy share to 30% by 2030. However, certain exceptions allow municipalities more time, extending the deadline to 2035[33], although an earlier draft proposed a higher target of 50% by 2030.

Under the **Recovery Plan**, a substantial budget of €2.5 billion has been allocated for climate-friendly building and refurbishment initiatives. This encompasses various investments, including the advancement of environmentally friendly construction using wood, the establishment of municipal energy transition test sites, and the launch of a **federal funding program** aimed at promoting **innovation in energy-efficient building techniques.**

To support the goal of affordable housing, the Federal Government has committed to **providing €1 billion in program funds annually** to the Länder until 2024.

Germany has also introduced the **Energy Efficiency Strategy 2050**, which encompasses a range of measures aimed at boosting investments in energy efficiency across various sectors. In the realm of buildings, Germany submitted an extensive **long-term renovation strategy** in July 2020 and has developed an ambitious "Renovate" component as part of its recovery plan. This component places a strong emphasis on climate-friendly timber construction, enhanced energy efficiency in buildings, and an increased utilization of renewable energy for heating and cooling within buildings, all of which play a crucial role in expediting energy-efficient building renovations.

Moreover, the government offers tax relief for energy-efficient renovation measures, such as replacing heating systems, upgrading windows, and insulating roofs and external walls. This **tax relief** will remain in effect until the end of 2029, reducing the tax payable by 20% of the renovation costs, which can be spread over three years. It's important to note that this tax relief applies specifically to owner-occupied residential properties[34].

Beginning in 2020, property owners have been eligible for a grant of up to 45% under the Market Incentive Program (Marktanreizprogramm, MAP) when replacing outdated oil heating systems with more energy-efficient alternatives. In 2021, this program was replaced by the **Federal Funding for Energy-Efficient Buildings** (Bundesförderung für effiziente Gebäude - BEG)[35], which applies to both residential and non-residential buildings.

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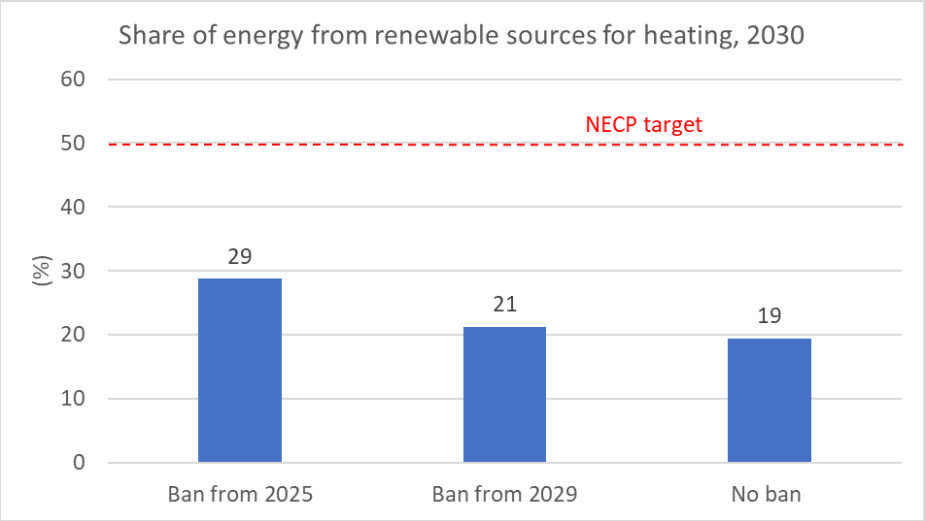
[32] https://apnews.com/article/germany-home-heating-overhaul-energy-a0bb030a4e6d4b50679238815ff60e8f

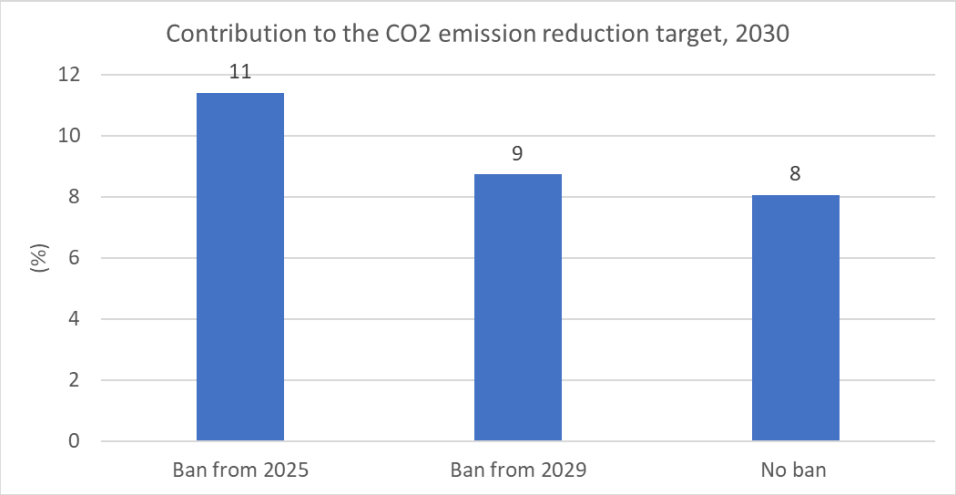
[33] https://www.bmwk.de/Redaktion/DE/Downloads/Gesetz/20230816-entwurf-waermeplanung-und-dekarbonisierung-der-waermenetze.pdf

[34] https://www.bundesregierung.de/breg-en/issues/climate-action/building-and-housing-1795860

[35] https://www.bundesregierung.de/breg-en/issues/climate-action/building-and-housing-1795860

3. SCENARIOS FOR DECARBONISATION





4. SUGGESTIONS

In 2022, a substantial portion of Germany's energy consumption for heating, roughly 50%, relied on natural gas, with an additional 30% sourced from oil. When considering fossil fuels used in district heating systems, approximately 85% of the heating energy was derived from environmentally impactful sources. Regrettably, the transition to renewable energy sources has been proceeding at a sluggish pace. Experts have noted that, in terms of heat pump adoption per capita, Germany lags behind other European nations[36]. This calls for a drastic shift in the regulation of the heating sector and a vigorous push for energy transition, especially in enhancing efficiency and substituting fossil fuels.

The annual **rate of building renovations** stands at a meager 1%, whereas achieving a decarbonized building stock by 2045 necessitates a much higher rate, around 3%[37]. Every conceivable obstacle to achieving this goal must be promptly addressed.

[36] https://www.euractiv.com/section/energy-environment/news/germany-veering-off-track-from-2030-climate-goal-experts-warn/

[37] https://il.boell.org/en/2022/04/04/state-support-energy-efficiency-buildings-view-germany

Despite the notable growth in the market share of heat pumps, conventional gas heating systems continue to dominate as the most widely adopted technology for new heating installations. To expedite the transition from fossil fuels to renewable sources like ambient heat and solar energy, economic regulatory changes and an intensive public awareness campaign are imperative.

While the current German regulatory framework may support hydrogen technology, the use of hydrogen for heating, particularly with "hydrogen-ready" boilers, should be approached with caution. Such a transition requires five to six times more renewable energy compared to heat pumps, making it a less efficient choice.

Germany has set a target of achieving 50% of its heat production from renewable sources by 2030, which is notably higher than the EU average of 42%. However, the specific targets for heat pumps and solar thermal production were not clearly outlined in the NECP-2019 document.

Approximately half of German households have the potential to transition to district heating systems for decarbonization. These systems can be more efficiently and swiftly converted to renewable energy sources and improved technologies. As such, it is advisable to significantly increase the number of households that benefit from district heating. Experts suggest that the number of such households could more than triple by 2050, provided operators are incentivized financially to overhaul the infrastructure[38].

Though this study primarily focuses on heating, it's essential to acknowledge the importance of a radical shift in approach and direction in other areas of transportation, such as airplanes, cars, and freight transport. Without substantial changes in these domains, both German and European climate targets are at risk of not being met.

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[38] https://www.wasserstoffrat.de/fileadmin/wasserstoffrat/media/Dokumente/EN/2022-12-09_Bottom-Up-Study-WEB-Bf_Short_form_report.pdf

GREECE (NO NEW DRAFT NECP PUBLISHED BY 15 AUGUST 2023)

1. TARGETS

1.1. TARGETS ON RENEWABLE ENERGY IN THE HEATING AND COOLING SECTOR

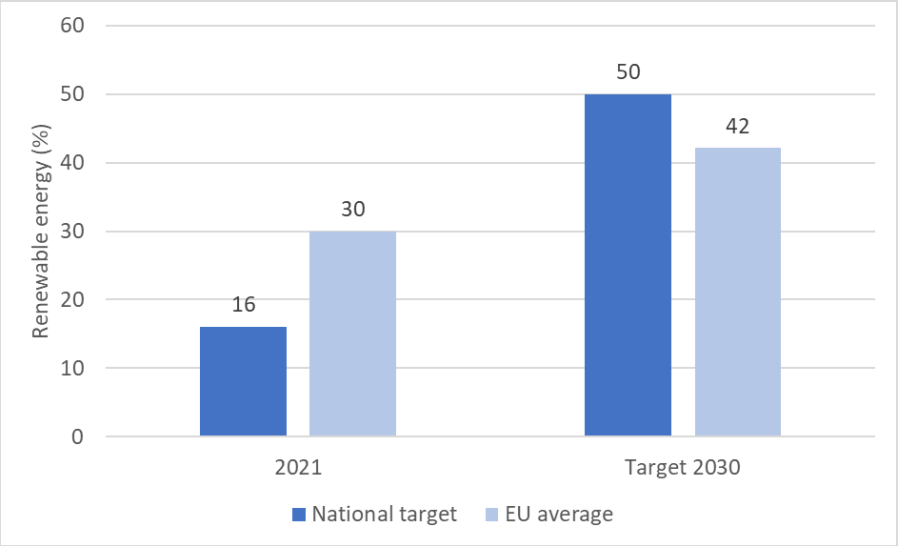


Figure 1. Renewable heating and cooling in 2021 and target (NECP) for 2030.

1.2. GHG EMISSION TARGETS FOR NON-ETS SECTORS

16% GHG emission reduction target between 2005 and 2030.

1.3. ENERGY IMPORTS TARGETS

N.A.

1.4. TARGETS ON HEATING (HEAT PUMPS, BAN ON FOSSIL HEATING)

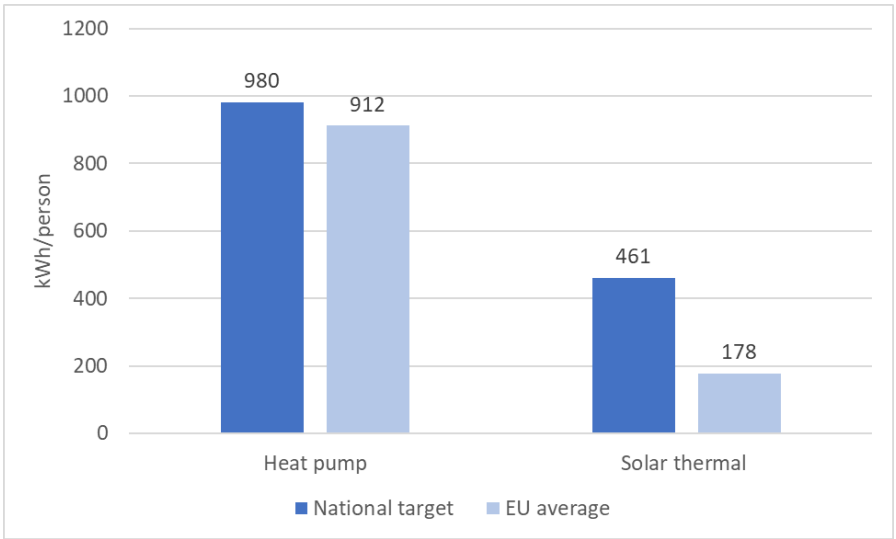


Figure 2. Target for heat production using heat pumps and solar thermal systems in 2030. The EU average comprehends countries that announced

targets for these technologies. Not all countries specified this target. Source: NECP.

2. POLICIES TO ACHIEVE THE HEATING TARGETS

"Greece 2.0," the Greek Economic Recovery Plan, is set in motion with the European Investment Bank (EIB) spearheading the management of a substantial 5 billion euros. Under Component 1.2, known as "Renovate," a comprehensive strategy is unveiled, encompassing vital reforms and investments in urban and spatial planning. Moreover, it entails the revitalization of residential, commercial, industrial, and public structures aimed at enhancing energy efficiency and curbing carbon emissions. To address energy poverty, the plan also incorporates an action initiative, alongside interventions dedicated to adaptation and mitigation.[39]

3. SCENARIOS OF DECARBONISATION

N.A.

4. SUGGESTIONS

In the context of heat production, Heat Pumps (HPs) are projected to generate 980.4 kWh per capita by 2030 in Greece. This figure only slightly surpasses the European Union (EU) average of 927 kWh per capita. Given Greece's favourable climate with mild winters, one might have expected a more significant disparity.

When we turn to the planned heat production from solar thermal systems, the picture changes. By 2030, the projection stands at 461 kWh per capita, which is a substantial 260% of the EU average of 179 kWh per capita. On the surface, this seems promising. However, when compared to Cyprus, which shares similar climatic conditions and has a target of 1314 kWh per capita, it becomes evident that Greece's goal is less ambitious, reaching only 35% of the Cypriot target. This observation suggests that there is room for Greece to set a more ambitious solar energy target.

[39] https://www.housingeurope.eu/resource-1768/resilience-and-recovery-in-germany-and-greece

HUNGARY (NO NEW DRAFT NECP PUBLISHED BY 15 AUGUST 2023)

1. TARGETS

1.1. TARGETS ON RENEWABLE ENERGY IN THE HEATING AND COOLING SECTOR

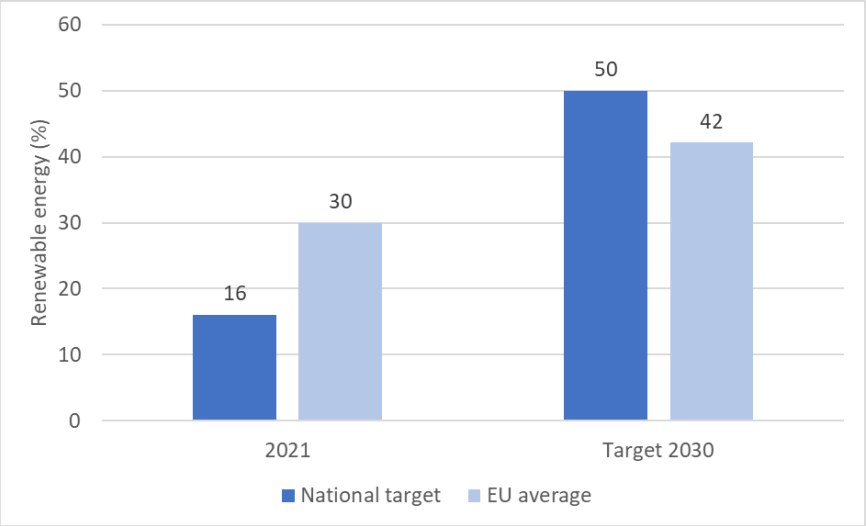


Figure 1. Renewable heating and cooling in 2021 and target (NECP) for 2030.

1.2. GHG EMISSION TARGETS FOR NON-ETS SECTORS

- 50% GHG emission reduction by 2030 compared to 1990.

1.3. ENERGY IMPORTS TARGETS

Energy imports constituted approximately 74% of the total consumption in 2021, and this figure incorporates nuclear fuel. Although the new draft National Energy and Climate Plan (NECP) has not yet been unveiled, it is expected that the ongoing industrial restructuring, marked by the construction of 40-50 new battery factories, will likely further elevate this ratio.

One contributing factor to this trend is the longstanding governmental resistance to wind farm installations in Hungary, a stance that has persisted for nearly 15 years. Unfortunately, there appears to be no indication of a forthcoming shift in this policy.

1.4. TARGETS ON HEATING (HEAT PUMPS, BAN ON FOSSIL HEATING)

- 3% of the total heat consumption will be supplied using heat pumps.

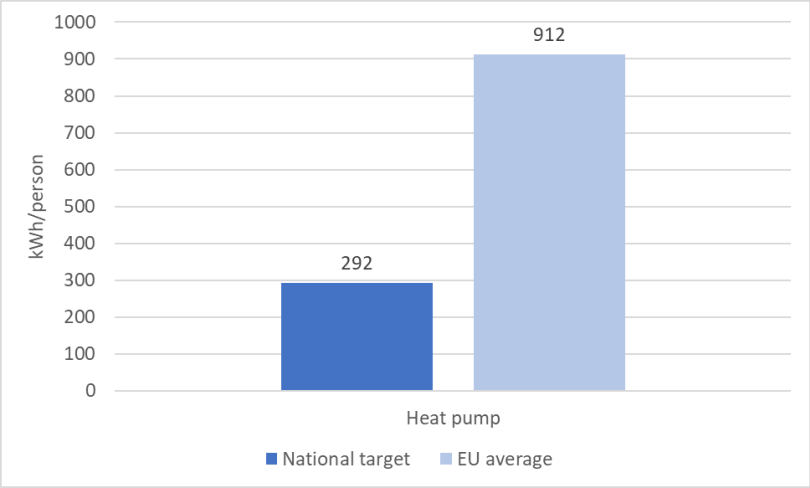


Figure 2. Target for heat production using heat pumps and solar thermal systems in 2030. The EU average comprehends countries that announced targets for these technologies. Not all countries specified this target. Source: NECP.

2. POLICIES TO ACHIEVE THE HEATING TARGETS

The transition to sustainable heating has been impeded by a series of energy planning deficiencies, notably the politically motivated emphasis on 'utility cost-cutting.' This prioritization has hindered household investments in insulation and renewable energy solutions until 2022. These shortcomings led to an unsustainable situation where low prices were no longer feasible. Consequently, in the summer of 2022, a series of transformative policy changes were implemented, resulting in a significant price surge for households with above-average energy consumption. Notably, electricity costs more than doubled for those using over 2523 kWh/year, while natural gas expenses skyrocketed, increasing sevenfold for those consuming more than 1729 m3/year. This, in turn, triggered an unprecedented surge in insulation efforts and the adoption of solar panels and heat pumps, a trend that appears poised to persist in the future.

Under the Recovery and Resilience Facility (RRF-6.2.1), there is a specific initiative titled "Support for residential solar PV systems and electrification of heating systems in combination with solar PV systems," which provides a 100% intensity direct grant (up to a maximum of HUF 11.3 million) to benefit 35,000 lower-income families seeking to embrace sustainable energy solutions.

Furthermore, the Family Homebuilding Allowance offers financial support ranging from 600,000 to 2,750,000 HUF, depending on factors like the number of children, the intended use of the apartment, and its floor area. However, it's important to note that this allowance may not be solely used for modernization purposes.

For rural areas, the Rural Family Homebuilding Allowance grants HUF 600,000 for families with one child, HUF 2.6 million for those with two children, and HUF 10 million for households with three children. A portion of this allocation should be allocated specifically for modernization efforts, rather than exclusively for energy-related upgrades.

3. SCENARIOS OF DECARBONISATION

N.A.

4. SUGGESTIONS

Average heat consumption in Hungary stands at approximately 250 kWh/m² per year, which is over 50% higher than the EU average and places Hungary as the fourth highest in the EU in this regard. As a result, a top priority is to substantially reduce this figure through a range of energy efficiency interventions.

The normalization of energy prices in 2022 is expected to boost the population's willingness to invest in energy efficiency upgrades for buildings. However, the rate of building energy renovations remains sluggish, further exacerbated by the high inflation, which is a widespread challenge at the European level. To expedite this process, appropriate subsidies will be essential.

Notably, the NECP-2019 lacks data to establish a 2030 target for solar thermal production. It is evident from the document that the Hungarian government does not prioritize this area. Conversely, the target for heat pumping, set at 292 kWh per capita, is less than one-third of the European average (927 kWh per capita). This seems contradictory to the government's messaging on the significance of electrifying heating systems.

Despite the pressure from the EU, the legal framework in Hungary remains a hindrance to the operation of energy communities for electricity and entirely prohibits such communities for heat. The government has yet to enact the necessary legislation in this regard. It is crucial to ensure that the country's legal framework, at a minimum, does not impede the establishment and effective functioning of community projects.

IRELAND (NO NEW DRAFT NECP PUBLISHED BY 15 AUGUST 2023)

1. TARGETS

1.1. TARGETS ON RENEWABLE ENERGY IN THE HEATING AND COOLING SECTOR

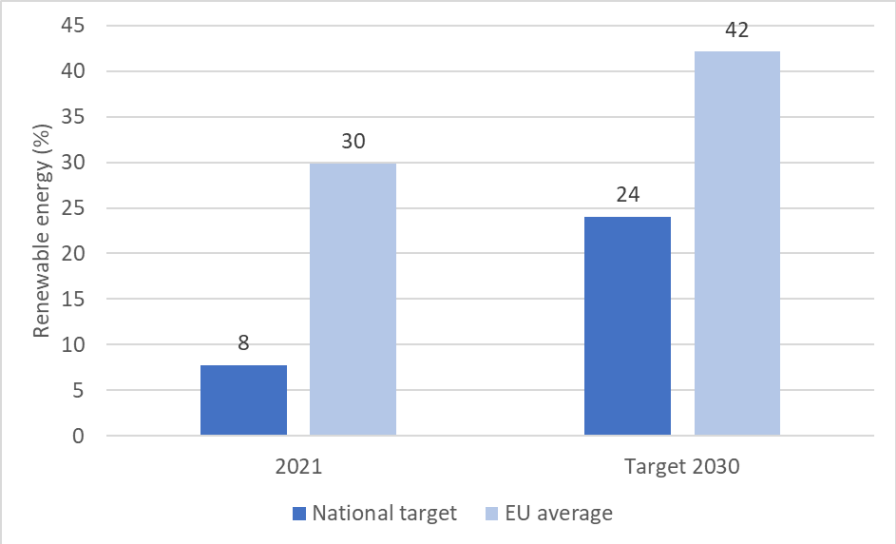


Figure 1. Renewable heating and cooling in 2021 and target (NECP) for 2030.

- 36.7% RE in heating by 2030.
- 65% RE in electricity by 2030.
- 31% RE in transport by 2030.

1.2. GHG EMISSION TARGETS FOR NON-ETS SECTORS

30% reduction in GHG emissions between 2005-2030.

1.3. ENERGY IMPORTS TARGETS

N.A.

1.4. TARGETS ON HEATING (HEAT PUMPS, BAN OF FOSSIL HEATING)

- Oil and gas boilers are to be banned from being installed in both new and existing homes. The ban would apply to newly built homes from 2023 and to installations in existing houses possibly from 2025.
- 500,000 homes retrofitted to a B2 BER or cost-optimal or carbon equivalent by 2030;
- 600,000 heat pumps to be installed over 2021-2030 (of which 400,000 in existing buildings);
- Deploy zero-carbon heating to meet the needs of 50,000 typical commercial buildings by 2030;

- Deliver up to 2.7 TWh of district heating, with the exact level to be informed by the outcome of the National Heat Study.[40]

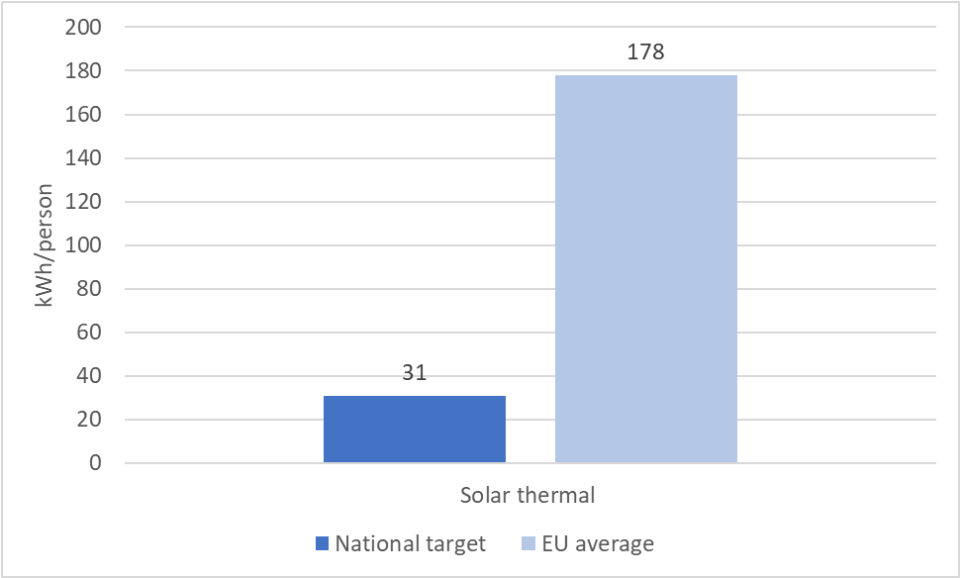


Figure 2. Target for heat production using solar thermal systems in 2030. The EU average comprehends countries that announced targets for these technologies. Not all countries specified this target. Source: NECP.

2. POLICIES TO ACHIEVE THE HEATING TARGETS

Better Energy: Homes (Residential Retrofit): This initiative offers capital grants to homeowners for the implementation of various energy efficiency measures. These measures encompass attic and wall insulation, as well as heating controls with high-efficiency boilers.

Deep Retrofit Pilot Programme: This program is designed to delve into the complexities and possibilities surrounding deep retrofits for residential dwellings. It aims to explore the challenges and opportunities associated with significantly enhancing the energy efficiency of existing homes.[41]

3. SCENARIOS OF DECARBONISATION

N.A.

4. SUGGESTIONS

In Ireland, the renewable energy target for heating by 2030, as outlined in the NECP-2019, is a modest 24%. This figure falls considerably short of the EU average of 42%. Nevertheless, it's worth noting that Ireland demonstrates significant growth potential, with a growth rate of 308%, compared to the EU average of 140%.

As for the solar heat target, it stands at 30.65 kWh per capita by 2030, ranking as the second lowest among countries that have disclosed this data. It notably lags behind the EU average of 179 kWh per capita. While this lower commitment can partly be attributed to Ireland's oceanic climate, recent trends indicate a

[40] https://www.seai.ie/publications/Net-Zero-by-2050.pdf

[41] https://www.odyssee-mure.eu/publications/efficiency-trends-policies-profiles/ireland.html#buildings

substantial upsurge in solar PV systems in the country. This suggests that Ireland may possess untapped potential for a more ambitious solar panel commitment.

Remarkably, the NECP-2019 lacks any specific commitments for heat pumps. Drawing upon Denmark's ambitious targets and similar climate conditions, one would expect a more substantial target of around 2000-3000 kWh per capita for heat pumps in Ireland.

ITALY

1. TARGETS

1.1. TARGETS ON RENEWABLE ENERGY IN THE HEATING AND COOLING SECTOR

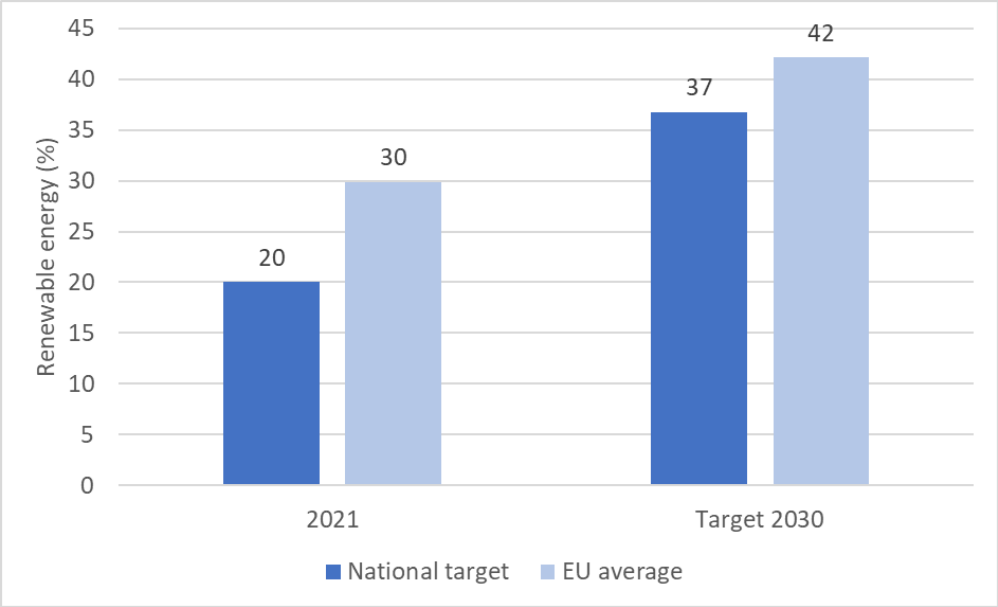


Figure 1. Renewable heating and cooling in 2021 and target (NECP) for 2030.

- 37% RE in heating by 2030.
- 65% RE in electricity by 2030.
- 31% RE in transport by 2030.

1.2. GHG EMISSION TARGETS FOR NON-ETS SECTORS

- 62% GHG emission reduction by 2030 compared to 2005.
- 52% GHG emission reduction by 2040 compared to 1990.

1.3. ENERGY IMPORTS TARGETS

In 2021, Italy's energy imports accounted for a substantial 74% of the total consumption. The aim is to significantly reduce this dependency, targeting a rate of 58% by 2030 and a further decrease to 51% by 2040. In a notable development during 2022, Italy intensified its efforts to diversify natural gas supply sources. This was achieved through the signing of new LNG and tube supply agreements and by maximizing the utilization of existing infrastructure, including storage and regasification facilities. These strategic measures successfully redirected gas supplies away from predominantly relying on sources in the Mediterranean Sea, and remarkably, Italy managed to cut its gas supplies from Russia in half during the year 2022.

1.4. TARGETS ON HEATING (HEAT PUMPS, BAN ON FOSSIL HEATING)

The widespread adoption of heat pumps as the primary heating system holds substantial potential for significantly reducing building emissions. When it comes to building heating, it is imperative to fully leverage the capacity of heat pumps to curtail energy consumption. This should be implemented not only in

comprehensive building upgrades but also as an addition to existing heat distribution systems. Furthermore, the growth of heat pumps and the electrification of various other applications will be further facilitated by the increasing popularity of domestic photovoltaic systems.

Another crucial aspect to consider is the role of heat pumps in providing heating and domestic hot water (ACS). While they account for a significant 2.5 million tonnes of oil equivalent (Mtoe), their production has been experiencing a steady decline. Between 2017 and 2021, this reduction amounted to 0.15 Mtoe, representing a 6% decrease.

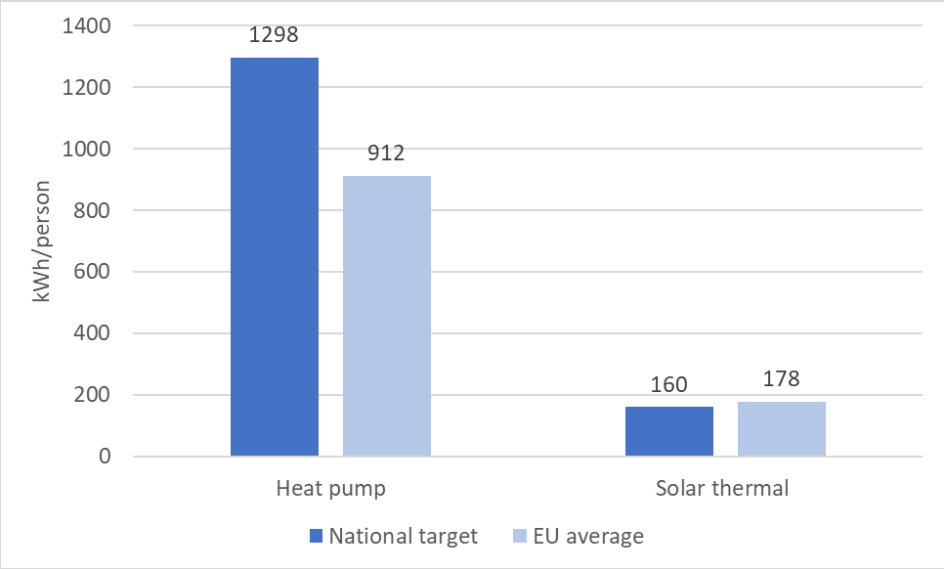


Figure 2. Target for heat production using heat pumps and solar thermal systems in 2030. The EU average comprehends countries that announced targets for these technologies. Not all countries specified this target. Source: NECP.

2. POLICIES TO ACHIEVE THE HEATING TARGETS

In Italy, there is a commitment to phase out inefficient fossil fuel subsidies by 2025 or earlier. Efforts to promote renewable energy in the heating sector are closely aligned with energy efficiency measures, especially in buildings. Measures include obligations to integrate thermal renewable energy sources into buildings, support for district heating, and mandates for renewable heat supply. Biomethane and hydrogen are also expected to play an increasingly significant role in the heating sector.

Recognizing the importance of heat pumps in reducing emissions from buildings, there is a goal to supply 13% of total heat consumption using heat pumps by 2030.

The **Strategy for the Energy Renovation of the National Building Stock** (2021) (STREPIN) outlines the state of the building stock and sets energy modernization targets. There's an emphasis on adopting an integrated approach for improved cost-effectiveness, with the need to update the strategy to align with the more ambitious European directives under the Fit for 55 packages.[42]

Within the **National Recovery and Resilience Plan** (NRRP), over 37.5% of total financial resources are allocated to support ecological transition. Mission 2, 'Green Revolution and Ecological Transition,' is the

[42] https://energy.ec.europa.eu/system/files/2021-12/2020_ltrs_italy_-_en.pdf

largest recipient of **resources**, focusing on **energy efficiency in buildings**, increasing renewable energy production, and fostering innovation in the industrial supply chain, including hydrogen.

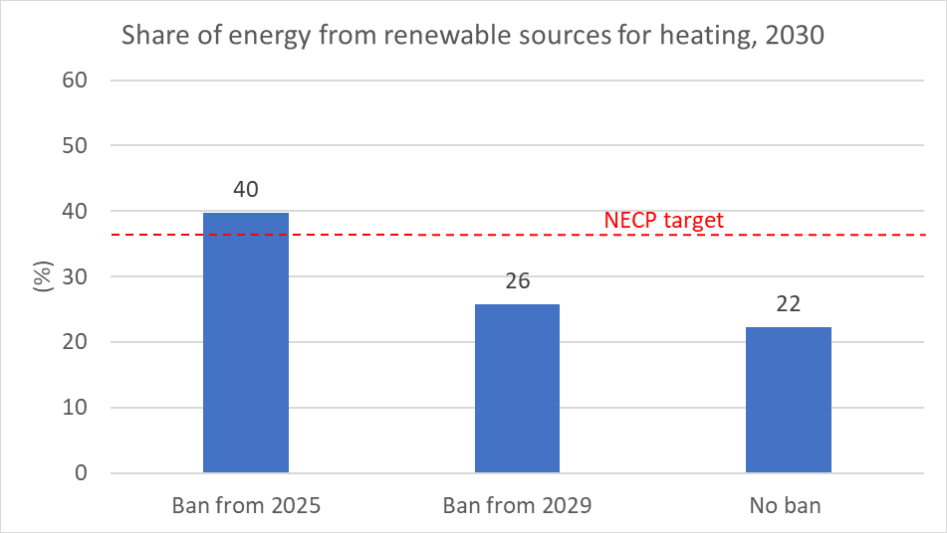
The 'Bonus Casa' (housing bonus) initiative allows for the installation of solar thermal systems, heat pumps, hybrid heat pump systems, heat pump water heaters, and biomass generators in buildings. Over 370 such measures were implemented in 2021, utilizing renewable energy sources for heat production.

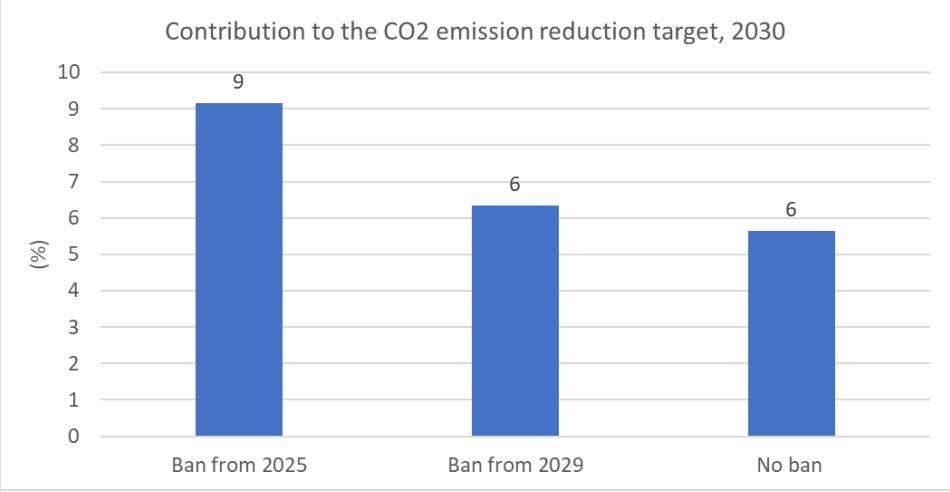
Efforts are underway to promote efficient **district heating** systems, with an increasing role for solar thermal systems in integrated, efficient, and renewable heat production, including hybrid systems and district heating plant integration, often supported by seasonal storage.

To combat local air pollution, there is a focus on encouraging the replacement of **domestic wood-burning appliances** with more efficient and environmentally friendly alternatives that meet high standards.

To promote the decarbonization of natural gas, strategies include promoting biomethane injection into the grid and its use in the heat sector. There's also a push to produce hydrogen from renewable sources and apply it in hard-to-decarbonize industrial sectors.

3. SCENARIOS OF DECARBONISATION





4. SUGGESTIONS

Italy's geographical diversity, stretching from the north to the south and including the Alpine region, results in significant climatic variations within the country. The mountainous Alpine climate further accentuates these differences. Consequently, it's challenging to formulate one-size-fits-all statements and objectives for Italy. Nonetheless, the NECP-2023 target for a 36.7% renewable energy share in heat production by 2030 appears to fall below the European average of 42%. Given Italy's climate diversity and economic strength, this target should indeed be more ambitious.

One specific area where Italy holds substantial untapped potential is solar thermal heat production. Italy's target of 160.3 kWh per capita is below the European average of 179 kWh per capita. In this regard, Greece's target of 461 kWh per capita serves as a benchmark, nearly three times higher than Italy's new draft NECP target.

Notably, Italy's commitment to heat pumps is notably more ambitious, aiming for 1297 kWh per capita by 2030. This target surpasses the European average of NECP commitments by 40%. This ambitious goal is set to be achieved by 2030.

LATVIA (NO NEW DRAFT NECP PUBLISHED BY 15 AUGUST 2023)

1. TARGETS

1.1. TARGETS ON RENEWABLE ENERGY IN THE HEATING AND COOLING SECTOR

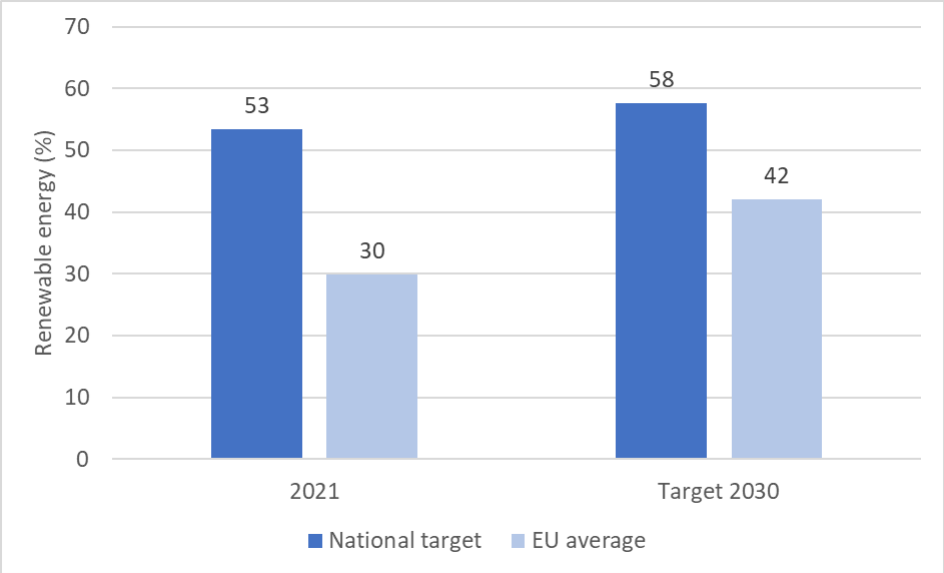


Figure 1. Renewable heating and cooling in 2021 and target (NECP) for 2030.

- 57.6% RE in heating by 2030.
- 65% RE in electricity by 2030.
- 14% RE in transport by 2030.

1.2. GHG EMISSION TARGETS FOR NON-ETS SECTORS

6% GHG reduction target between 2005 and 2030.

1.3. ENERGY IMPORTS TARGETS

N.A.

1.4. TARGETS ON HEATING (HEAT PUMPS, BAN ON FOSSIL HEATING)

Latvia's long-term strategy for the renovation of buildings states that 30% of residential apartment buildings must be renovated by 2030 and another 30% by 2040.[43]

2. POLICIES TO ACHIEVE THE HEATING TARGETS

Enhancing Energy Efficiency in Multi-Apartment Buildings: The European Regional Development Fund (ERDF) co-funds energy efficiency improvement initiatives in multi-apartment buildings as part of the National

[43] https://www.europarl.europa.eu/RegData/etudes/BRIE/2021/696194/EPRS_BRI(2021)696194_EN.pdf

Operational Programmes (NOP). Nearly 1,000 multi-apartment buildings are slated for renovation by 2023, and this initiative will persist throughout the planning period of 2021-2027.

"Let's Live Warmer" Information Program: This program encompasses a variety of actions aimed at motivating flat owners to embark on apartment building renovations. It provides valuable insights into best practices and offers guidance on maintaining these buildings post-renovation.

Promoting Energy Efficiency in Single-Family Buildings: A grant program has been established to support technical assistance and construction work for two specific groups: (i) families with a minimum of three children, and (ii) buildings located outside Riga, Jurmala city, and the surrounding municipalities of Riga city.

3. SCENARIOS OF DECARBONISATION

N.A.

4. SUGGESTIONS

Latvia stands second in the EU, right behind Romania, in terms of the energy required to heat a living space annually. The country consumes roughly twice the EU average, amounting to around 320 kWh per square meter per year for heating. As a result, the primary focus for improvement should revolve around significantly enhancing the energy efficiency of buildings.

Interestingly, Latvia's commitment to a higher renewable energy ratio, standing at 57.6%, exceeds the EU average of 42% within the heating sector. However, the quality of the NECP-2019 appears to be one of the weaker ones (with a new draft pending as of August 15). This is evident, for instance, in the lack of clarity regarding the country's commitments to solar collectors or heat pumps, information that is typically available in other countries' NECPs.

Considering Latvia's geographical similarities with Denmark, it might be advantageous to adopt Denmark's ambitious targets. This could involve setting significantly higher heat energy targets, even up to 20 percentage points higher than the current ones, to drive more comprehensive progress in the sector.

LITHUANIA

1. TARGETS

1.1. TARGETS ON RENEWABLE ENERGY IN THE HEATING AND COOLING SECTOR

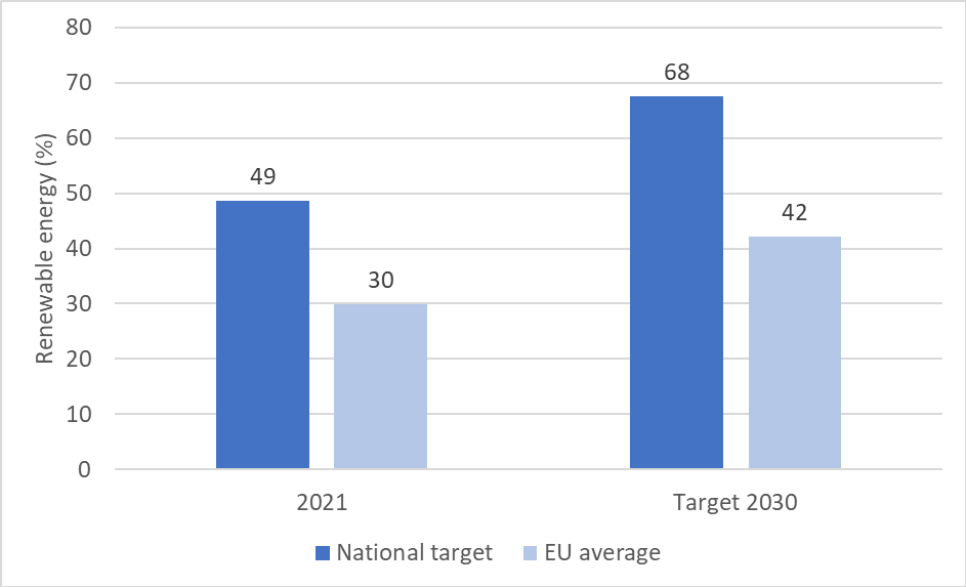


Figure 1. Renewable heating and cooling in 2021 and target (NECP) for 2030.

- 68% RE in heating by 2030.
- 100% RE in electricity by 2030.
- 15% RE in transport by 2030.

1.2. GHG EMISSION TARGETS FOR NON-ETS SECTORS

- 70% GHG emission reduction by 2030 compared to 1990.
- 30% GHG emission reduction by 2030 compared to 2005.

1.3. ENERGY IMPORTS TARGETS

- Energy imports in 2021 were approximately 75% of total consumption.

1.4. TARGETS ON HEATING (HEAT PUMPS, BAN ON FOSSIL HEATING)

- Production of 6 TWh of heat using heat pumps.
- Ban of sales of fossil heating equipment: not specified.

2. POLICIES TO ACHIEVE THE HEATING TARGETS

Lithuania has no natural gas resources and therefore relies entirely on imports for its natural gas and oil consumption. To transform from an energy technology importer into a developer and exporter, Lithuania aspires to establish itself as a hub for cutting-edge solutions in various fields. This vision encompasses information technology, cybersecurity, energy, biomass, biofuel, solar and wind energy technologies, geothermal technology, energy market development, electricity system enhancement, novel electricity system management techniques, and the execution of energy projects.

The Lithuanian National Parliament plays an integral role in shaping and implementing the National Energy and Climate Plans (NECPs). It also participates in enacting legislation and approving the state budget, allocating the necessary funds to fulfill the objectives of the Energy Union. The National Parliament further underscores its commitment to energy independence through the adoption of the National Energy Independence Strategy in 2018 and the National Climate Change Governance Agenda in 2021.

2.1. EXISTING MEASURES

- VR2-E Renovation of Heat Stations and Systems (2019-2022)
  - Focuses on upgrading heating systems in multi-apartment and public buildings.
- VR3-E: Heat Transmission Network Renovation (2018-2030)
  - Targets the renovation and upgrade of heat transmission networks and related installations.
- VR6-E: Promotion of Sustainable Biofuels (2021-2030)
  - Encourages the use of environmentally produced biofuels, mainly in district heating.
- RES3-E: Renewable Energy in Public and Residential Buildings (2021-2030)
  - Promotes the use of renewable energy sources like solar, wind, and geothermal energy in public and residential buildings for various social groups.
- RES12-E: Increased RES Usage in District Heating (2018-2030)
  - Enhances incentives for heat supply companies to adopt renewable energy sources and modernize their systems.
- RES13-E: Promotion of Solar, Heat Pumps, and Heat Storage in DH (2021-2030)
  - Supports the deployment of new low-power RES technologies and retrofitting existing ones, focusing on CHP plants and high-efficiency biofuel boilers.
- RES14-E: Deployment of Low-Capacity Biofuel Cogeneration Plants (2018-2023)
  - Funds CHP plants under construction with a capacity of up to 20 MWth and 5 MW e-power.
- RES15-E: Promotion of Low-Power Biofuel Cogeneration (2023-2029)
  - Supports CHP plants with a rated thermal input from 1 MW to 20 MW.
- RES16-E: Heat Transmission Network Upgrade (2015-2023)
  - Focuses on replacing old pipelines in the heat transmission network to reduce heat loss and enhance reliability.
- RES17-E: RES Promotion in District Heating (2021-2030)
  - Aims to transition heating farms to renewable energy sources, particularly in areas still using coal and gas oil.
- RES18-E: Utilization of Waste Heat in District Heating (2021-2030)
  - Targets the collection and efficient use of waste heat generated by chemical processes in industrial sites and power plants.
- RES19-E: Modernization of Heat Accounting
  - Aligns with EU directives, requiring the replacement of heat meters with remote reading by 2027 following a positive cost-benefit analysis.

From 2021 to 2027, several measures have been established:

- RES20-E: Local and RES CHP Projects Implementation (Years 2023-2029). Priority given to Vilnius and Kaunas.
- RES23-E: Heat Pump Installation for Enhanced Heat Production Efficiency (Years 2023-2029)
  - Focuses on optimizing heat production systems by integrating heat pumps, particularly in district heating systems. This enhances biofuel-based systems' efficiency and reduces fossil fuel reliance in natural gas systems, achieved through full or partial replacement with

compressor heat pumps. Heat suppliers and independent heat producers operating biofuels and/or natural gas systems implement this measure.

- RES24-E: Solar Commuting System Construction for District Heating (Years 2023-2029)
  - Involves the construction of solar computing systems for district heating, incorporating engineering equipment such as heat tanks, pipelines, and automation. Heat suppliers and independent heat producers operating biofuels and/or natural gas systems are responsible for its implementation.
- RES25-E: Transition to Generation IV Heat Supply Systems for District Heating Networks
  - Promotes the transition of district heating networks to generation IV heat supply systems, emphasizing lower temperature limits to reduce technological losses in heat transmission.

Between 2023 and 2029, the following measure is in effect:

- RES26-E: Biofuel Boiler Construction from Logging Residues
  - This initiative focuses on the construction of biofuel boilers that utilize logging residues, effectively reducing the dependency on fossil fuels in heat production. It is executed by heat suppliers and independent heat producers operating systems powered by biofuels and/or natural gas.

2.2. PLANNED MEASURES

- RES37-P: Restriction of Fossil Solid Fuels in High-Density Areas (Years 2024-2030)
  - This measure enforces the prohibition or restriction of fossil solid fuels for space heating in densely populated regions, with a focus on areas where particulate matter pollution poses the most significant risks.
- RES38-P: Modernization and Replacement of Aging Biofuel Boilers (Years 2023-2029)
  - This initiative aims to revamp or substitute aging biofuel boilers with other renewable energy source (RES) technologies. The responsibility for implementing this measure lies with heat supply companies and independent heat producers.

3. SCENARIOS OF DECARBONISATION

N.A.

4. SUGGESTIONS

Lithuania's commitment to renewable energy in the heating sector is notably higher, standing at 67.5%, in stark contrast to the EU average of 42%. Notably, Lithuania has set an exemplary target of 100% renewable energy for electricity, marking a significant achievement. This is especially valuable due to the potential for interconnection and synergy between sectors, as the exceptional level of environmentally friendly electricity generation creates ample opportunities for heat pump capacity expansion.

However, there is a notable gap in the new draft NECP-2023. It lacks detailed targets for heat generation and falls short of providing specific directives for heat pumps and solar thermal solutions. To ensure a successful transition, these targets should be clearly articulated in the final NECP-2023, with a firm commitment to ambitious and actionable goals.

LUXEMBOURG

1. TARGETS

1.1. TARGETS ON RENEWABLE ENERGY IN THE HEATING AND COOLING SECTOR

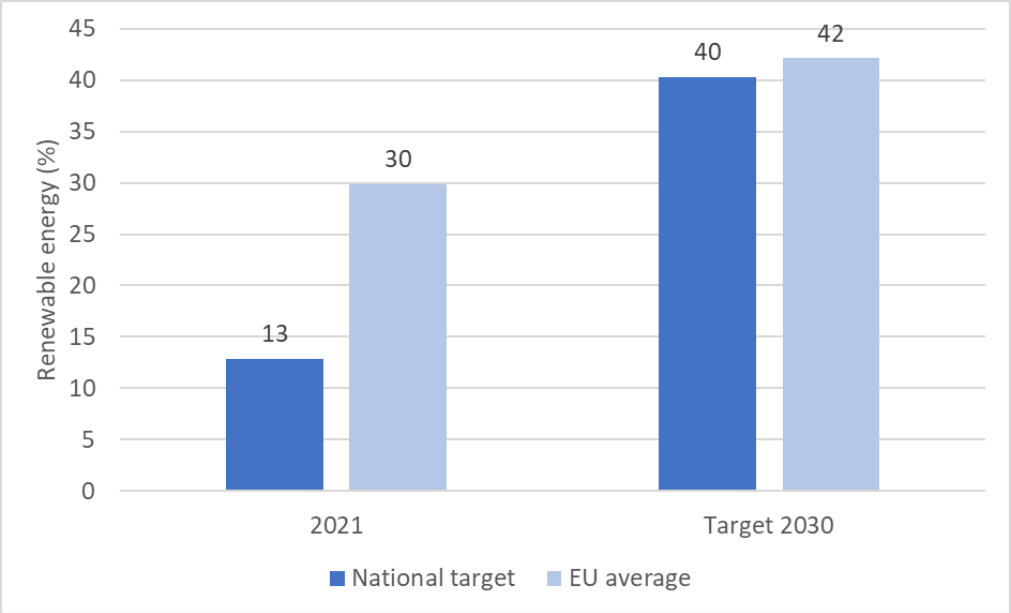


Figure 1. Renewable heating and cooling in 2021 and target (NECP) for 2030.

1.2. GHG EMISSION TARGETS FOR NON-ETS SECTORS

- 55% GHG emission reduction by 2030 compared to 2005.

1.3. ENERGY IMPORTS TARGETS

- Energy imports in 2021 were approximately 80% of total consumption. The plan is to reduce imports to 62% by 2030 and to 54% by 2040.

1.4. TARGETS ON HEATING (HEAT PUMPS, BAN ON FOSSIL HEATING)

- A significant 16-fold increase in heat from heat pumps is planned between 2021 and 2030.
- Production of approximately 1 TWh/year of heat using heat pumps which means about 10% of total heat consumption.
- Ban of sales of fossil heating equipment: not specified.

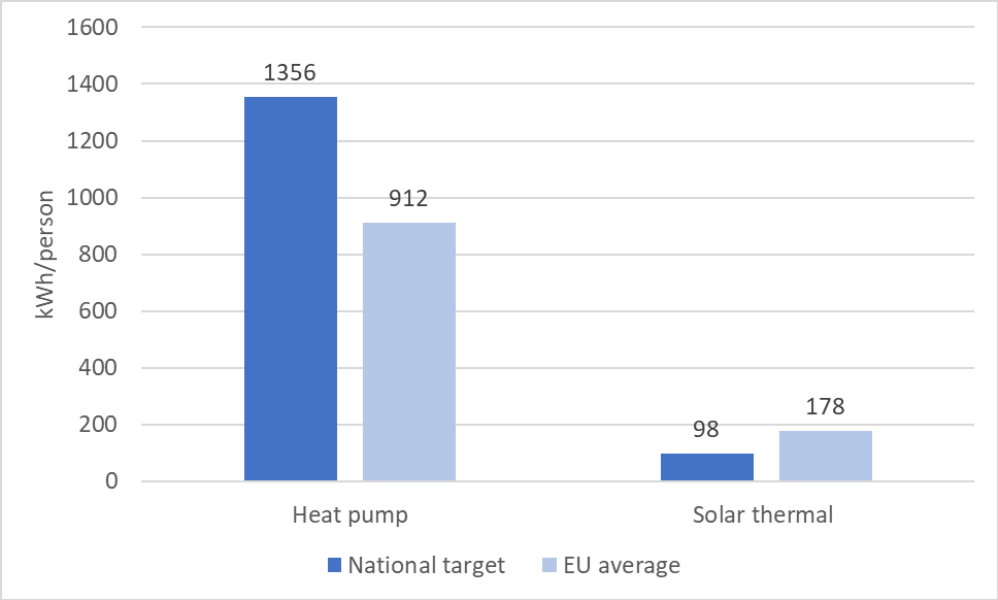


Figure 2. Target for heat production using heat pumps and solar thermal systems in 2030. The EU average comprehends countries that announced targets for these technologies. Not all countries specified this target. Source: NECP.

2. POLICIES TO ACHIEVE THE HEATING TARGETS

Aero-thermal and geothermal heat pumps have emerged as the leading technologies for heating new constructions, playing a pivotal role in the overarching goal of decarbonizing the building sector through electrification. Starting in 2023, heat pumps have been designated as the reference heating system when generating energy performance certificates for new buildings. Notably, heat pumps can be effectively integrated with photovoltaic installations to enhance the self-consumption of generated electricity. Additionally, geothermal heat pumps harness geothermal energy, significantly elevating the energy efficiency when compared to aero-thermal heat pumps, thus rendering them particularly suitable for retrofits in existing buildings.

For existing buildings, hybrid systems incorporating heat pumps represent a transitional solution on the path toward complete heating decarbonization, especially in the context of comprehensive energy upgrades.

Comparing the WEM and WAM scenarios, the defining distinction is the increased use of heat pumps, be it in residential or tertiary buildings. The objective is to achieve building decarbonization through electrification, supplemented by photovoltaic electricity generation and optimized self-consumption. By 2030, the WEM modeling exhibits significantly lower heat production from heat pumps (643 GWh) in comparison to the more robust deployment in the WAM scenario (1.036 GWh). Between 2030 and 2040, the proposed measures drive a substantial uptick, resulting in 3.901 GWh produced (WAM) as opposed to 1.242 GWh (WEM).

One of the pivotal measures is the continuation of State aid schemes for heat pumps, known as Klimabonus Wunnen.

In the initial phase of building decarbonization, the government is fostering a voluntary approach, offering citizens and businesses a wide array of coordinated and easy-to-implement solutions at the national, regional, and local levels. The focus initially lies on the tertiary sector, coinciding with planned energy audits and the replacement of fossil boilers in larger tertiary buildings. In the residential sector, the shift to **heat pumps** in lieu of fossil boilers is expected to gain momentum towards the late 2020s (notably, heat pumps are already the standard in all new constructions). Another influencing factor is the disparity in energy renovation costs,

estimated at EUR 1,000/m2 for functional buildings compared to EUR 350-750/m2 for residential buildings, contingent on the depth of renovation.

The decarbonization strategy prioritizes the expedited phase-out of fossil fuels in existing buildings, particularly those exceeding 1000 m2 in size. This transition is chiefly led by the adoption of **heat pumps**, with a particular focus on non-administrative buildings within the tertiary sector.

3. SCENARIOS OF DECARBONISATION

N.A.

4. SUGGESTIONS

In Luxembourg, the 2030 target for the thermal energy sector stands at 40.3%, slightly below the European average of 42%. Notably, the Luxembourg government has set an ambitious growth trajectory for the period 2021-2030, especially considering the modest baseline of only 12.9% in 2018.

However, the targeted per capita solar heat production is relatively low, aiming for just 98.17 kWh by 2030, significantly below the EU average of 179 kWh per capita. Given this, it's worth considering a higher target in the final NECP-2023, especially when compared to countries like Denmark, which shares many similarities and plans to produce three times as much heat per capita in 2030.

To balance this modest commitment, Luxembourg places a stronger emphasis on heat pumping, with a target of 1356 kWh per capita for 2030. This exceeds the EU average by 46%, offering a more substantial commitment to heat pump technology.

MALTA (NO NEW DRAFT NECP PUBLISHED BY 15 AUGUST 2023)

1. TARGETS

1.1. TARGETS ON RENEWABLE ENERGY IN THE HEATING AND COOLING SECTOR

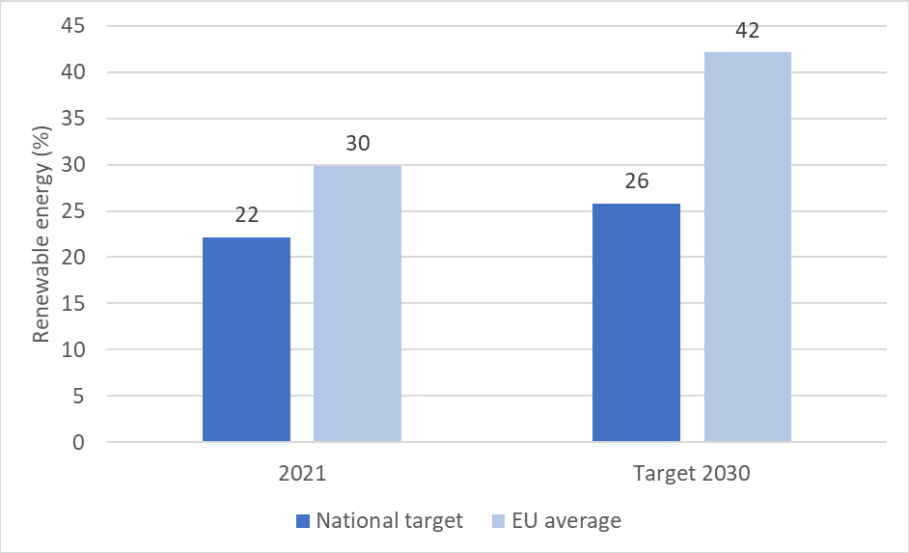


Figure 1. Renewable heating and cooling in 2021 and target (NECP) for 2030.

- 25.8% RE in heating by 2030.
- 11% RE in electricity by 2030.
- 14% RE in transport by 2030.

1.2. GHG EMISSION TARGETS FOR NON-ETS SECTORS

19% GHG emission reduction between 2005 and 2030.

1.3. ENERGY IMPORTS TARGETS

98% import.

1.4. TARGETS ON HEATING (HEAT PUMPS, BAN OF FOSSIL HEATING)

Only one area is identified clearly, as a priority in the NECP, the use of roof insulation, but no very specific targets are set.

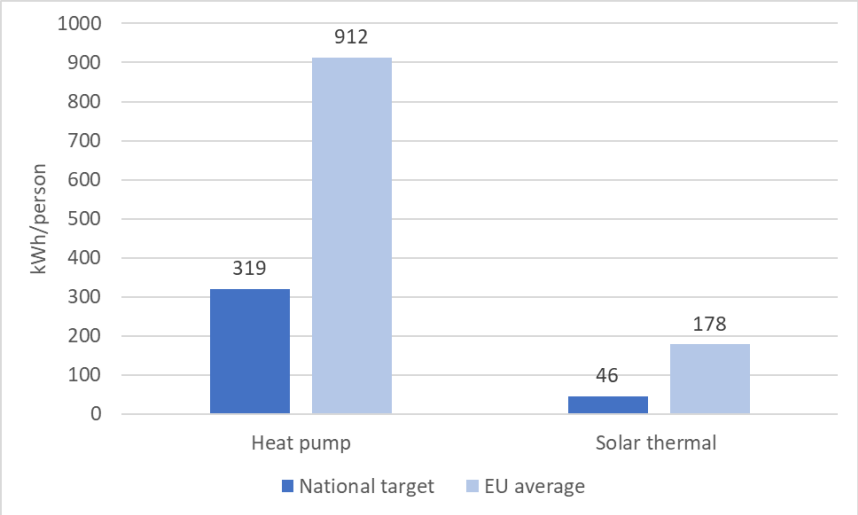


Figure 2. Target for heat production using heat pumps and solar thermal systems in 2030. The EU average comprehends countries that announced targets for these technologies. Not all countries specified this target. Source: NECP.

2. POLICIES TO ACHIEVE THE HEATING TARGETS

Malta possesses distinctive characteristics that both present limitations and opportunities in the realm of renewable energy sources. Notably, its exceptionally high population density of 1650 people per square kilometer, in contrast to the European average of 34 people per square kilometer, results in a substantial proportion of built-up areas. Consequently, the island nation's building stock and available roof surface area play a pivotal role in the transition toward sustainable energy management. Despite this, Malta's insular nature makes it highly vulnerable, exemplified by its nearly complete reliance on energy imports. Paradoxically, this vulnerability could catalyze an accelerated transition to locally accessible renewable energy sources.

One advantage is Malta's mild winter temperatures, leading to the country having the lowest specific heating energy demand among the 27 EU member states. However, this unique advantage seems to discourage policymakers when formulating their ideas and objectives for the energy transition.

In 2021, Malta published its **Low Carbon Development Strategy**, which, upon analysis, appears to be more of a collection of ideas lacking specificity. The document underscores the need to develop support schemes for renewable water heating, as outlined in the NECP, and to implement these plans. Malta faces the challenge of several technologies competing for limited roof space. Moreover, the government is considering offering small installation grants for various housing types, emphasizing insulation and double glazing. The strategy also mentions deep renovation, especially in the case of historically significant buildings and privately owned structures within urban conservation areas or designated as grade 1 or grade 2. Such initiatives not only preserve the aesthetic and historical value of these buildings but also introduce retrofitted green measures, thereby enhancing energy efficiency, such as installing double glazing on existing original facade timber fixtures or implementing roof insulation. It is estimated that around 12,000 units of the building stock can undergo renovation by 2030 through this measure. Furthermore, the government is contemplating the introduction of efficiency standards for new buildings to enhance performance in both electricity and heat consumption.

The **Long-Term Renovation Strategy 2050** was also published in 2021.

3. SCENARIOS OF DECARBONISATION

N.A.

4. SUGGESTIONS

The projected significant population growth in Malta is anticipated to exacerbate resource management challenges in this densely populated island nation. Therefore, a primary objective should be to address this overpopulation trend.

Regarding heat pumps, Malta has set a target of 319.3 kWh per capita, which is notably lower than the EU average of 927 kWh per capita. This discrepancy may be attributed to the country's relatively modest heating demand during the winter season.

Unfortunately, even with modest solar commitments, it is unlikely that Malta will achieve energy independence. The solar thermal target is a mere 45.8 kWh per capita by 2030, considerably lower than the EU average target of 179 kWh per capita per year. Given Malta's favourable natural conditions, this is an unacceptably low target in the NECP-2019. As of now, the NECP-2023 remains unpublished, raising hopes that it will feature a target at least three times greater for solar thermal applications.

Maltese buildings primarily rely on electricity for lighting, space heating, cooling, and water heating. Given the favourable natural conditions, there is ample room for more ambitious plans regarding **solar PV** and solar thermal applications. Since the availability of suitable surfaces is limited, it would be wise to explore **hybrid collectors (PVT)** as a potential solution, as these collectors can generate both electricity and thermal energy simultaneously.

THE NETHERLANDS

1. TARGETS

1.1. TARGETS ON RENEWABLE ENERGY IN THE HEATING AND COOLING SECTOR

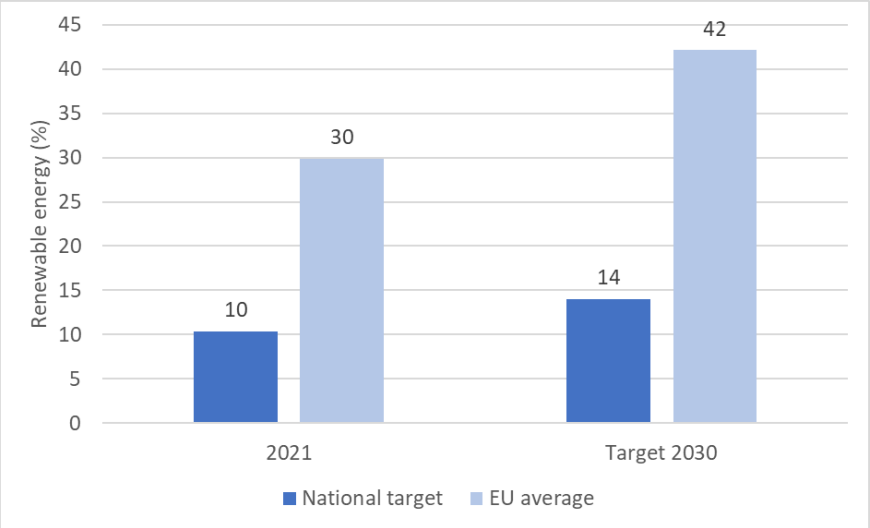


Figure 1. Renewable heating and cooling in 2021 and target (NECP) for 2030.

- 14% RE in heating by 2030.
- 86% RE in electricity by 2030.
- 28% RE in transport by 2030.

1.2. GHG EMISSION TARGETS FOR NON-ETS SECTORS

- 55% GHG emission reduction by 2030 compared to 1990.
- 100% GHG emission reduction by 2050 compared to 1990.

1.3. ENERGY IMPORTS TARGETS

- Energy imports in 2020 were approximately 68% of total consumption. However, this may increase to 71% by 2030.

1.4. TARGETS ON HEATING (HEAT PUMPS, BAN OF FOSSIL HEATING)

- Production of 10.6 TWh of heat using heat pumps by 2030.
- Ban of connection to the gas grid for new buildings from 2018.
- From 2026, hybrid heat pumps will be the mandatory minimum standard.

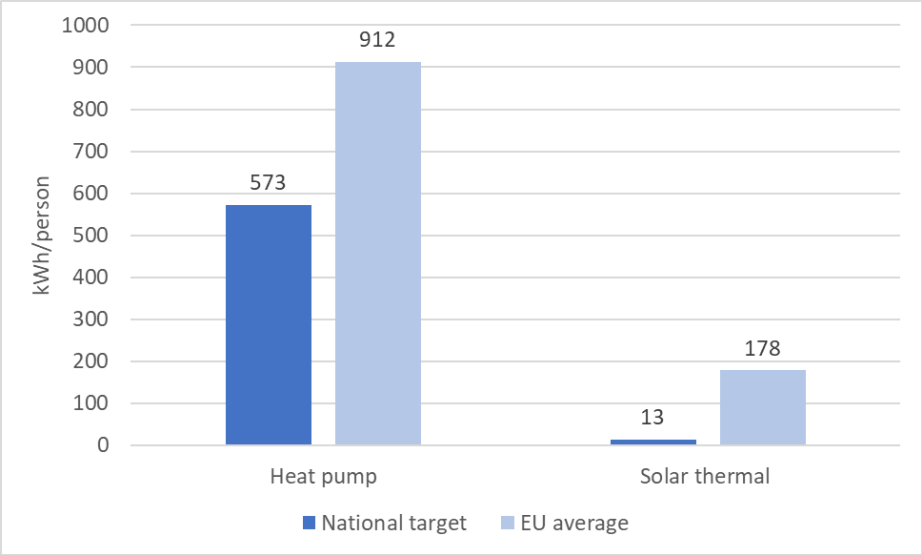


Figure 2. Target for heat production using heat pumps and solar thermal systems in 2030. The EU average comprehends countries that announced targets for these technologies. Not all countries specified this target. Source: NECP.

2. POLICIES TO ACHIEVE THE HEATING TARGETS

Sustaining growth, as frequently emphasized in the draft NECP, raises critical questions about ecological sustainability and the risk of resource depletion. In contrast, some regions have already implemented household-level bans on fossil fuel use, with the Flemish Region taking the lead:

- In 2021, a ban was imposed on connecting new apartment buildings (with 15 or more units) and new collective housing projects to the gas grid.
- In 2022, a ban was introduced on new oil boilers in both new and existing buildings.
- By 2025, there will be a ban on connecting new residential buildings to the gas grid.

While there has been a reduction in final energy consumption within the built environment since 2010, primarily attributed to enhanced insulation and more efficient space heating installations, the continuously growing number of buildings partially offsets these savings. Unfortunately, the decrease in final energy consumption has stagnated in recent years.

Renewable heat's share in final heat consumption has been consistently increasing, reaching 10.4% in 2021. Among households, biofeedstock contributes the most to renewable heat, although this share has been gradually decreasing each year. The number of dwellings connected to heat networks in 2020 stands at approximately 430,000 and these networks are required to report on their sustainability, with a renewable energy share of 38.5% in 2021.

A reduction in natural gas consumption is anticipated through several avenues, including diminishing the use of natural gas in decentralized electricity production via cogeneration, lower natural gas demand for heating buildings, and transitioning to alternative fuels like electrification, biogas, or hydrogen in industry applications.

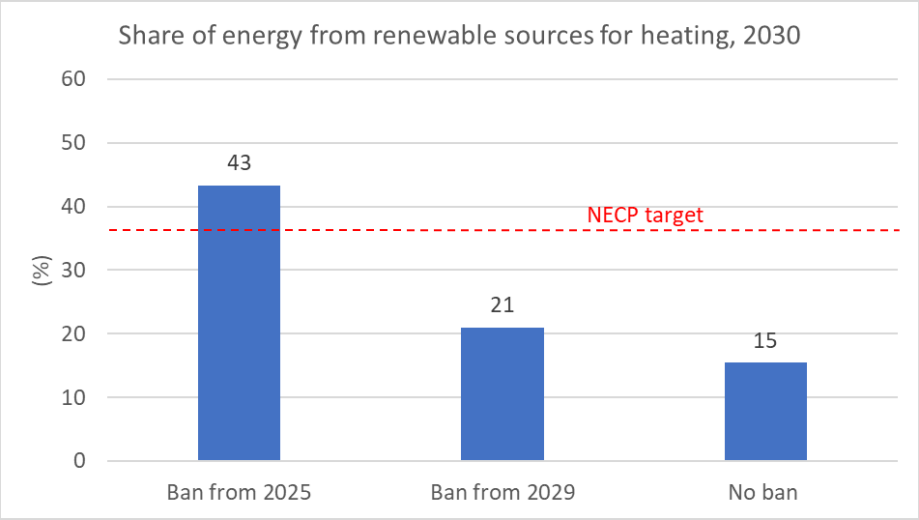
In 2021, the number of heat pumps increased by 37%, primarily in the form of air-to-air heat pumps, which are also used for air conditioning. Over 1.7 million units were installed in 2021.

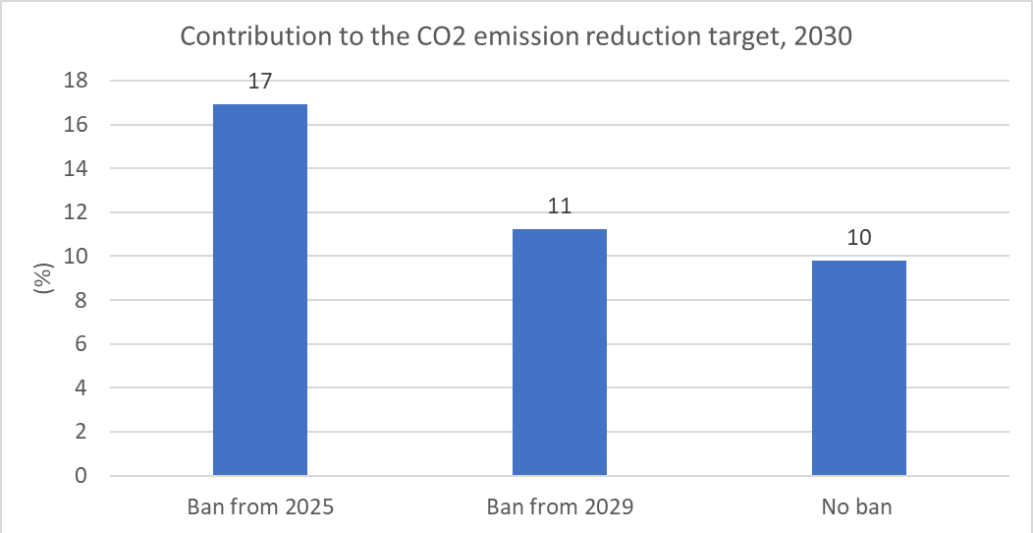
Key measures in the NECP for enhancing energy efficiency and sustainability include:

- Insulating 2.5 million **homes** (out of 8 million), with a focus on eliminating poor energy labels (E, F, and G).
    - 1.5 million owner-occupied dwellings
    - 1 million rented dwellings are insulated to the standard for housing insulation.
- Improving energy efficiency in **non-residential construction**, targeting the transformation of energy-inefficient buildings into a minimum C energy label.
    - Make 15% of the worst energy performance buildings sustainable by 2027, energy label G in accordance with the new label classification up to a minimum C energy label (60,000 buildings).
    - Make buildings with energy label F in line with the new label classification as a minimum C energy label (60,000 buildings) sustainable for 2030.
- Promoting sustainable installations and heat networks, with ambitious goals for hybrid heat pump installations and new heat network connections.
    - 1 million installed hybrid heat pumps in existing construction.
    - 500,000 new connections to a heat network in the existing building (in residential equivalents).
- Enhancing the use of sustainable resources, including the blending of green gas to achieve substantial greenhouse gas reductions by 2030.

The **Investment Subsidy Sustainable Energy and Energy Savings** (ISDE) is instrumental in providing grants for five distinct types of investments, including (hybrid) heat pumps, solar boilers, insulation measures, heat network connections, and electric cooking supplies. Subsidies are available to both business entities and owner-occupiers, with specified flat-rate subsidy amounts outlined in the scheme.

3. SCENARIOS OF DECARBONISATION





4. SUGGESTIONS

The NECP-2023 outlines a modest target for solar thermal heat production per capita in the Netherlands, aiming for just 12.56 kWh/capita by 2030, which is the lowest in the entire EU. While the Netherlands does face less favourable irradiation conditions, it's essential to note that other countries with similar climates, such as Denmark, have set much more ambitious targets for solar thermal production. Denmark, despite its oceanic climate, aspires to achieve over nine times the per capita solar thermal output of the Netherlands by 2030. Therefore, it is a strong argument to propose a new solar thermal target for the Netherlands in the final NECP-2023 document, set at least 4-5 times higher than the target initially outlined in the draft.

In the case of heat pumping, the situation is only marginally better, with the 2030 target being 573 kWh/capita year, slightly over 60% of the European average of 927 kWh/capita year. Given the Netherlands' particularly favourable climatic conditions and its substantial economic strength, there is a compelling case for setting and achieving a significantly higher heat pumping target by 2030.

With these revised targets, the Netherlands could work toward significantly reducing the projected 71% energy imports for 2030, a level considered high even by EU standards, thereby mitigating the associated vulnerabilities.

POLAND (NO NEW DRAFT NECP PUBLISHED BY 15 AUGUST 2023)

1. TARGETS

1.1. TARGETS ON RENEWABLE ENERGY IN THE HEATING AND COOLING SECTOR

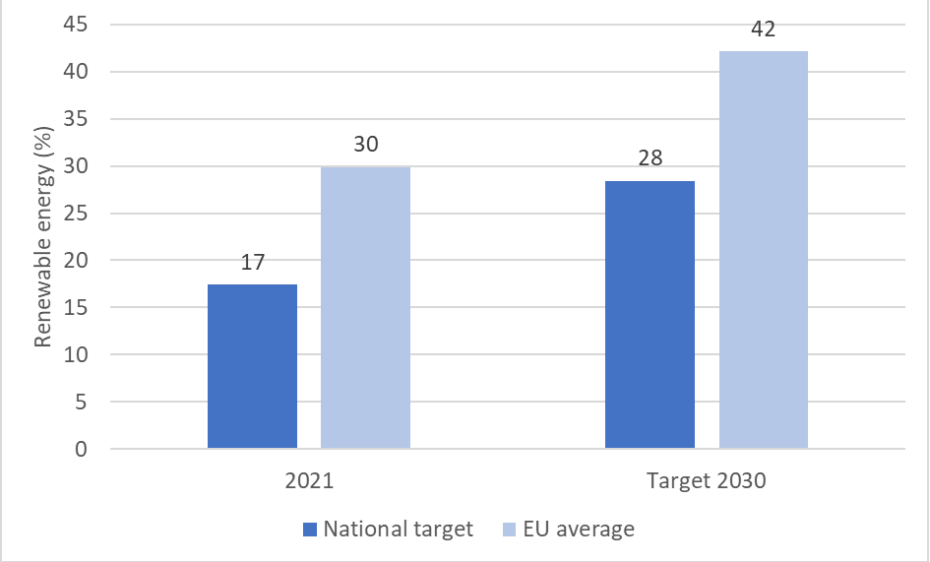


Figure 1. Renewable heating and cooling in 2021 and target (NECP) for 2030.

- 28.4% RE in heating by 2030.
- 32% RE in electricity by 2030.
- 14% RE in transport by 2030.

1.2. GHG EMISSION TARGETS FOR NON-ETS SECTORS

11% GHG emission reduction.

1.3. ENERGY IMPORTS TARGETS

There is a notable absence of information regarding the gradual reduction of fossil fuel imports in Poland's energy strategy. Poland's economy is currently heavily reliant on coal, with imported coal constituting nearly 20% of the nation's energy consumption. The preference for imported coal is due to its lower cost and superior quality when compared to Poland's domestic coal resources.

1.4. TARGETS ON HEATING (HEAT PUMPS, BAN OF FOSSIL HEATING)

According to the 2021 **Energy Policy**, the target for renewable energy in heating by 2030 is set at 28%, with an annual increase of 1.1 percentage points. The policy emphasizes the expansion of **district heating** systems, aiming for a four-fold increase in their number by 2030, which is outlined as STRATEGIC PROJECT 7. To transition towards lower emissions from individual heat sources, the policy promotes the use of heat pumps and electric heating. There is a clear objective to **phase out coal use**, with **cities expected to abandon it by 2030, and rural areas by 2040**. However, the use of "smokeless fuels" such as fossil anthracite, coke, or charcoal is to be maintained until 2040.

The Energy Policy also addresses the improvement of building energy efficiency. It highlights a nationwide initiative for the thermal modernization of residential buildings and aims to ensure environmentally friendly access to heat. This approach is expected to have a positive impact on addressing energy poverty, with a target of reducing it by 30%, bringing it down to around 6% of households by 2030.

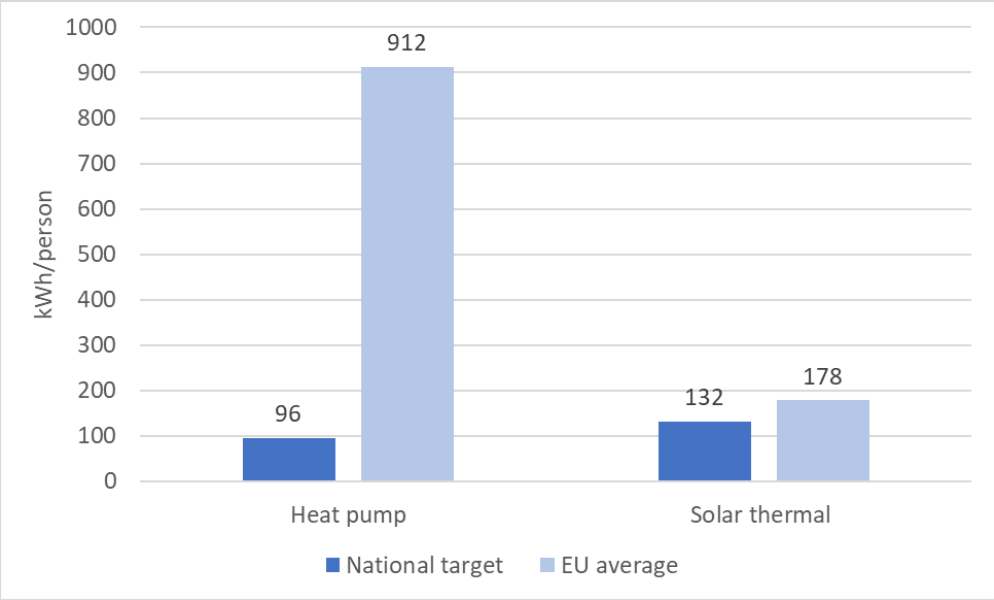


Figure 2. Target for heat production using heat pumps and solar thermal systems in 2030. The EU average comprehends countries that announced targets for these technologies. Not all countries specified this target. Source: NECP.

2. POLICIES TO ACHIEVE THE HEATING TARGETS

The European Commission's assessment of Poland's NECP-2019 was critical, deeming the renewable energy targets as "unambitious" and the energy efficiency goals as "modest." Moreover, it noted the absence of a comprehensive plan to reduce the nation's reliance on coal and lignite. Subsequently, Poland has established a coal phase-out target by 2049. In 2021, the **Energy Policy of Poland** until 2040 (EPP2040) was introduced.[44]

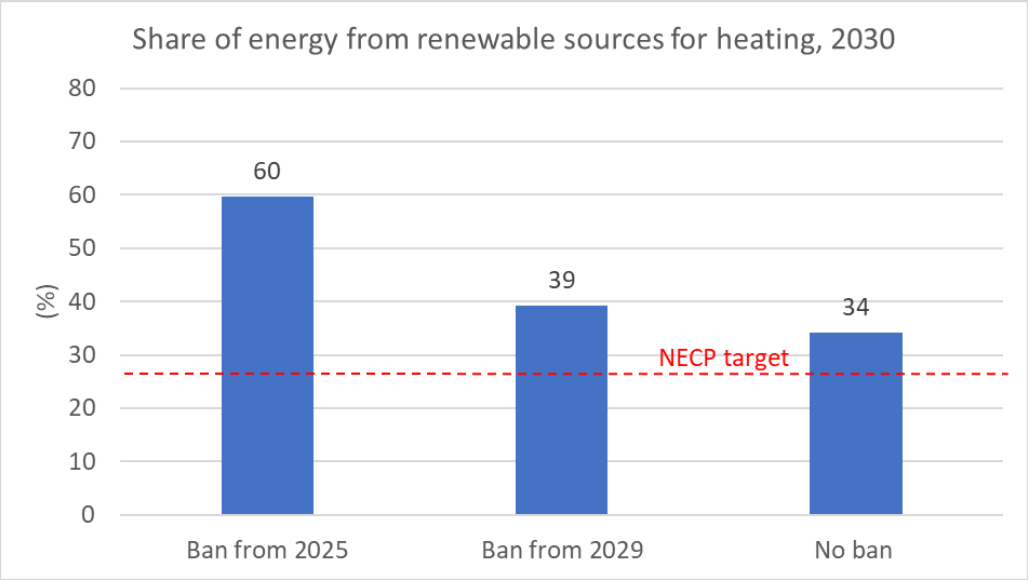
The Clean Air Priority Program, funded with a budget of 103 billion zloty (approximately €22.5 billion) for 2018-2029, is considered the largest initiative of its kind in Europe. The third edition of this program, effective from January 2022, offers enhanced subsidies, providing up to 69,000 zloty (around €15,000) to assist low-income households in upgrading heating and insulation. Previously, the maximum subsidy was capped at 37,000 zloty. This financial program also supports the replacement of coal heating systems with cleaner alternatives, particularly heat pumps.

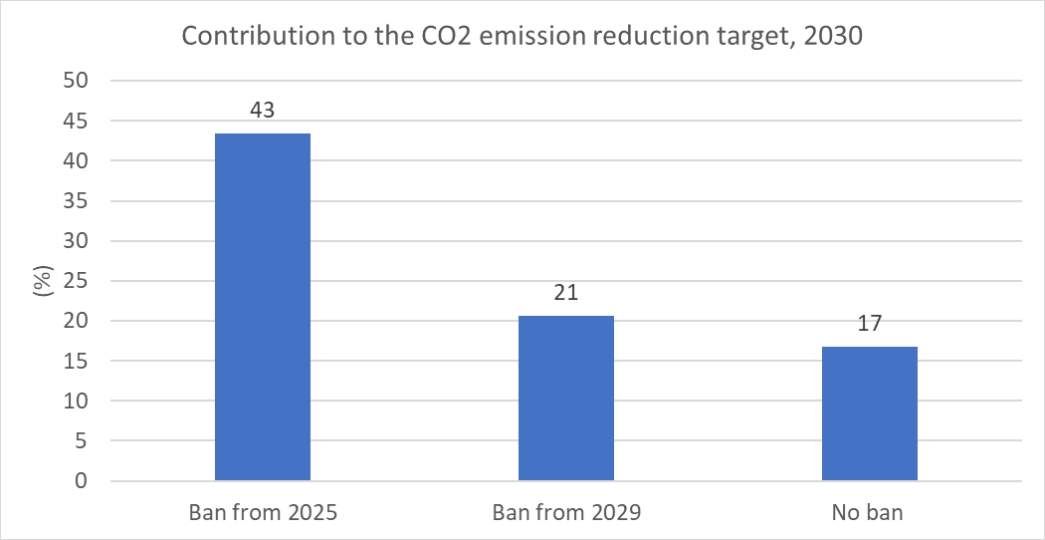
Poland has launched five Operational Programmes with Territorial Just Transition Plans (TJTPs), worth more than €3.85 billion, under the Just Transition Fund (JTF). These funds aim to facilitate a fair transition to a low-carbon economy in the coal regions of Silesia, Małopolska, Wielkopolska, Lower Silesia, and Łódzkie. The EU

[44] https://www.gov.pl/attachment/a1e42067-c749-4dbe-82bf-211d46821d9d

financing can be utilized to enhance the energy efficiency of public buildings and housing, introducing improvements such as insulation, roof-mounted solar panels, and heat pumps.[45]

3. SCENARIOS OF DECARBONISATION





4. SUGGESTIONS

Poland faces the challenge of having an average heat consumption of approximately 250 kWh/m² per year, which is more than 50% higher than the EU average and ranks as the fifth highest in the EU. Addressing this issue is a top priority, and it is imperative to initiate energy efficiency projects across all apartment buildings to measure actual heating usage accurately. This approach ensures that homeowners are billed based on their actual consumption.

[45] https://ec.europa.eu/commission/presscorner/detail/en/ip_22_7413

However, certain aspects of Poland's energy strategy require reconsideration. Allowing the use of "smokeless" fossil fuels until 2040 lacks a forward-looking perspective. Additionally, the reliance on natural gas as an option to replace coal may inadvertently perpetuate the use of climate-damaging fossil fuels for decades, mainly due to the lock-in effect. Instead, Poland should prioritize and promote the widespread adoption of heat pumps and solar thermal solutions.

In terms of specific targets, Poland's aim for heat pumps is the least ambitious in the EU, with a goal of 96 kWh per capita per year by 2030, which is only a fraction of the EU average. In contrast, the target for the thermal use of solar energy (132 kWh per capita per year) is relatively higher and closer to the EU average of 179 kWh per capita per year. Given Poland's less favourable natural conditions for solar energy compared to heat pumps, it is advisable to raise the commitment to solar energy to at least the European average target.

Poland employs a block tariff system for households, where electricity consumption below 2000 kWh per year remains at 2022 levels, with an increased tariff for consumption exceeding this limit. However, this system hinders the financial viability of heat pump installations. Therefore, it is recommended to raise the block tariff limit for heat pump owners to 5000 kWh per year to promote their adoption.

PORTUGAL

1. TARGETS

1.1. TARGETS ON RENEWABLE ENERGY IN THE HEATING AND COOLING SECTOR

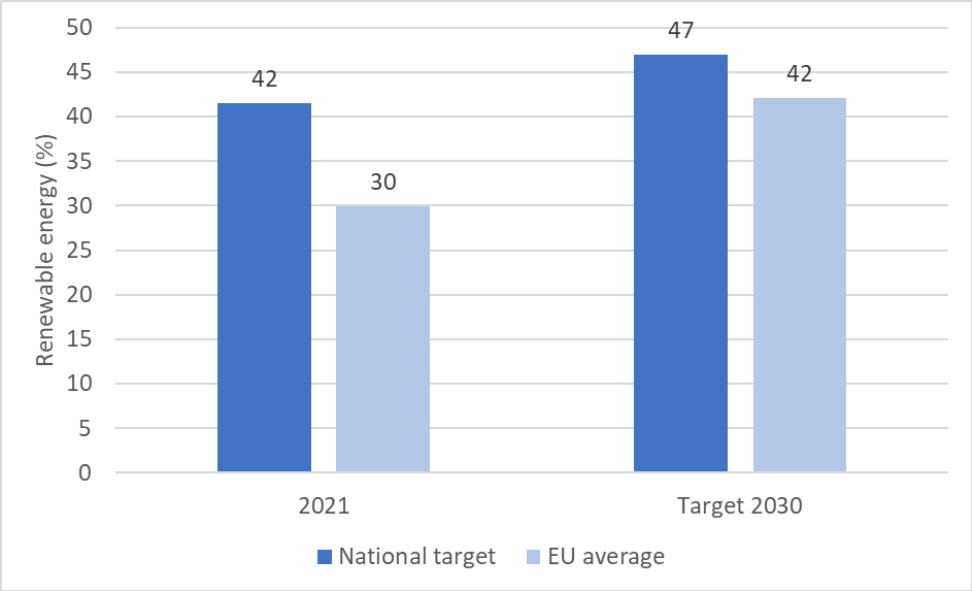


Figure 1. Renewable heating and cooling in 2021 and target (NECP) for 2030.

- 47% RE in heating by 2030.
- 85% RE in electricity by 2030.
- 23% RE in transport by 2030.

1.2. GHG EMISSION TARGETS FOR NON-ETS SECTORS

- 55% GHG emission reduction by 2030 compared to 2005.

1.3. ENERGY IMPORTS TARGETS

- Energy imports in 2021 were 69% of total consumption. The objective is to reduce the dependence on imports to 65% by 2030.

1.4. TARGETS ON HEATING (HEAT PUMPS, BAN ON FOSSIL HEATING)

In the realm of heating and cooling, Portugal anticipates a decline in the consumption of fossil fuels as a result of heightened energy efficiency measures and an increased focus on electrification. This shift will facilitate an expansion in the utilization of renewable energy, particularly through the greater adoption of renewable biomass and gases.

However, it is important to note that Portugal faces certain challenges in meeting the renewable energy targets stipulated in Directive (EU) 2018/2001. The directive requires an annual increase of 1.3% in the share of renewable energy sources in the heating and cooling sector or 1.1% under certain conditions. Portugal stands as one of the European Union countries where achieving these precise increments may present particular difficulties.

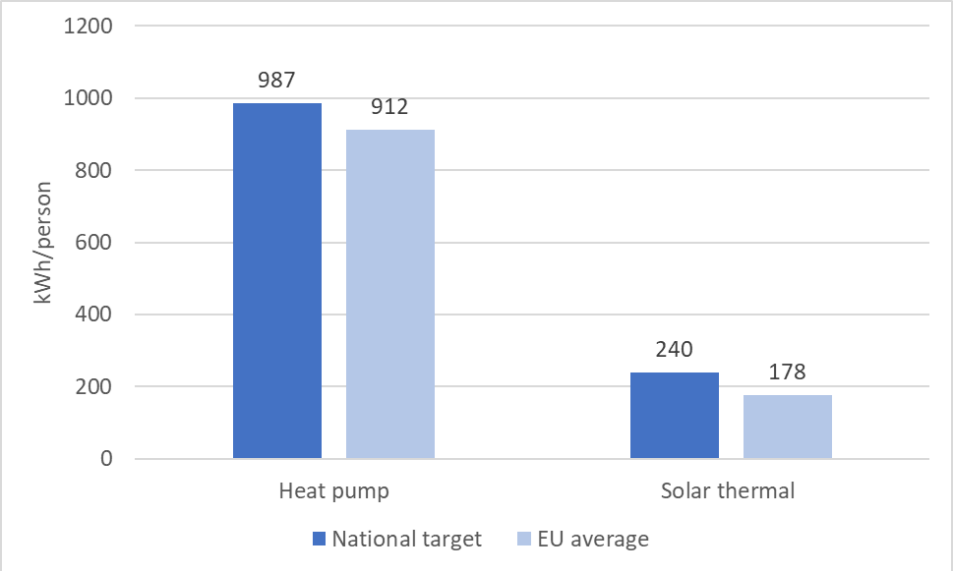


Figure 2. Target for heat production using heat pumps and solar thermal systems in 2030. The EU average comprehends countries that announced targets for these technologies. Not all countries specified this target. Source: NECP.

2. POLICIES TO ACHIEVE THE HEATING TARGETS

- In the residential sector, the aim is to increase the thermal comfort of households in heating and cooling, focusing on passive insulation, sun protection, and ventilation solutions, and continuing with the trend towards electrification of the sector and the use of renewable energy sources.
- Ban natural gas use for electricity production from 2040, provided that security of supply is ensured.

3. SCENARIOS OF DECARBONISATION

N.A.

4. SUGGESTIONS

Portugal's overall target for renewable energy-based heating and cooling surpasses the EU average. However, the rate of growth, with a 5-percentage-point increase between 2021 and 2030, falls significantly short of the EU average, which boasts a 12-percentage-point increase during the same period. It is advisable for Portugal to align its growth trajectory more closely with the EU average.

In terms of solar thermal energy, Portugal has set a target of 240 kWh per capita per year, which is approximately one-third higher than the EU average. Nonetheless, it's worth noting that this target only marginally exceeds Austria's, despite Portugal's considerably more favorable natural conditions for solar thermal energy production.

Regarding heat pumping driven by ambient heat sources, Portugal's target of 987 kWh per capita annually is just 6% higher than the EU average. Given Portugal's potential, there is room for more ambitious commitments in both solar thermal energy and heat pumping.

ROMANIA (NO NEW DRAFT NECP PUBLISHED BY 15 AUGUST 2023)

1. TARGETS

1.1. TARGETS ON RENEWABLE ENERGY IN THE HEATING AND COOLING SECTOR

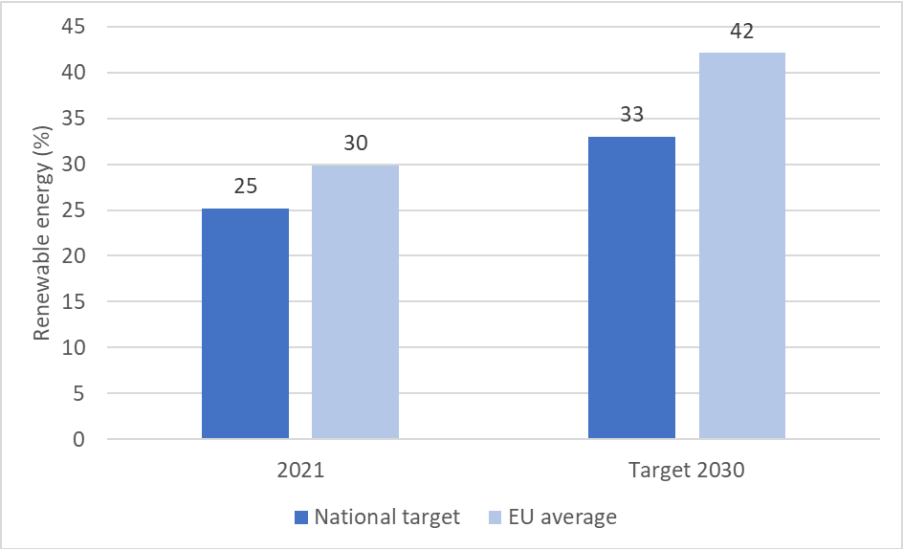


Figure 1. Renewable heating and cooling in 2021 and target (NECP) for 2030.

- 33% RE in heating by 2030.
- 34% RE in electricity by 2030.[46]
- 23% RE in transport by 2030.

1.2. GHG EMISSION TARGETS FOR NON-ETS SECTORS

2% GHG emission reduction between 2005 and 2030.

1.3. ENERGY IMPORTS TARGETS

N.A.

1.4. TARGETS ON HEATING (HEAT PUMPS, BAN OF FOSSIL HEATING)

The phase-out of coal by 2032 is among the important targets. However, no such target is outlined for natural gas.

2. POLICIES TO ACHIEVE THE HEATING TARGETS

Romania's progress can be characterized as "*slow progress towards unambitious targets*".

[46] https://www.romania-insider.com/romania-revise-renewable-energy-target

Under the **"Casa Verde" green homes scheme**, subsidies for residential heat pump installations and insulation enhancements have been accessible since 2010. This assistance can reach up to RON 70,000 (approximately EUR 14,000), covering a maximum of 60% of the total investment cost. For heat pump expenses, specific aid of up to RON 8,000 (EUR 1,600) is available, though it does not apply to all heat pump types.

3. SCENARIOS OF DECARBONISATION

N.A.

4. SUGGESTIONS

In Romania, there are several indications of a lack of government commitment to climate change planning. The quality of NECP-2019 is notably poor, with even its basic targets being unclear. For instance, specific targets for solar and heat pump heat generation are not discernible in the document. The only reference point available is the general target for the proportion of heat generated from renewable sources, which stands at 33%. When compared to the EU average of 42%, it becomes apparent that a more ambitious plan could be warranted. Another sign of this disinterest is the failure to upload the new draft version (NECP-2023) to official websites, even well past the deadline of August 15th.

Furthermore, Romania's residential buildings exhibit exceptionally high yearly thermal energy consumption per square meter, reaching 380 kWh, nearly 2.4 times the EU average. Thus, the primary objective should be a substantial reduction in building energy consumption, given the significant potential in this area.

Concurrently, Romania must accelerate the adoption of renewable energy sources. While the national plan lacks specific details, Romania's favourable natural conditions suggest that far more ambitious plans for **solar thermal** applications could be developed.

SLOVAKIA (NO NEW DRAFT NECP PUBLISHED BY 15 AUGUST 2023)

1. TARGETS

1.1. TARGETS ON RENEWABLE ENERGY IN THE HEATING AND COOLING SECTOR

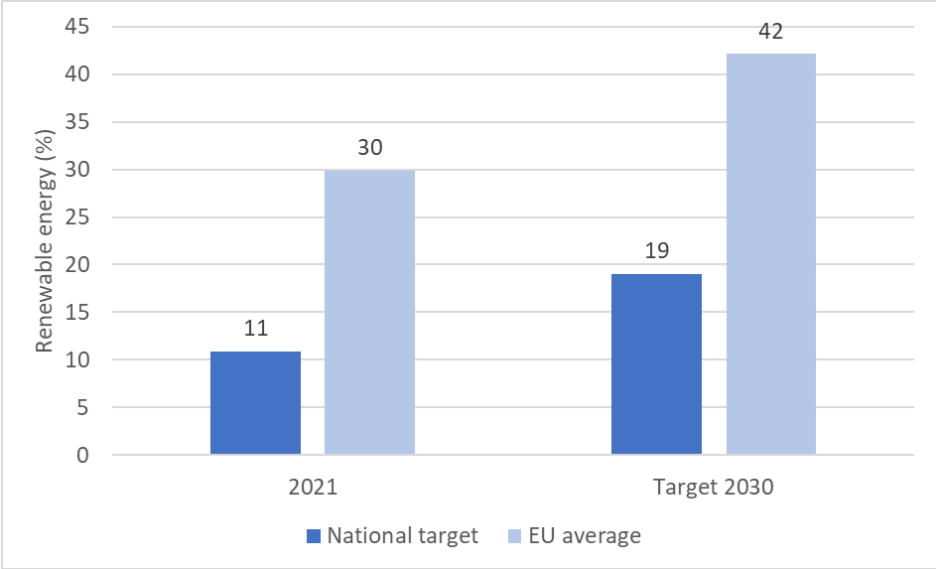


Figure 1. Renewable heating and cooling in 2021 and target (NECP) for 2030.

- 19% RE in heating by 2030.
- 27,3% RE in electricity by 2030.
- 14% RE in transport by 2030.

1.2. GHG EMISSION TARGETS FOR NON-ETS SECTORS

Slovakia will have to reduce its GHG emission by 12 % by 2030 but is aiming for 20%.

1.3. ENERGY IMPORTS TARGETS

N.A.

1.4. TARGETS ON HEATING (HEAT PUMPS, BAN OF FOSSIL HEATING)

- Plans on banning sales and installations of new fuel and oil boilers by 2023.
- Slovakia shall seek to increase the share of renewable energy, waste heat ,and waste cooling in their district heating and cooling systems by 1.4 percentage points annually (only 1% point is the general requirement for the EU member states).

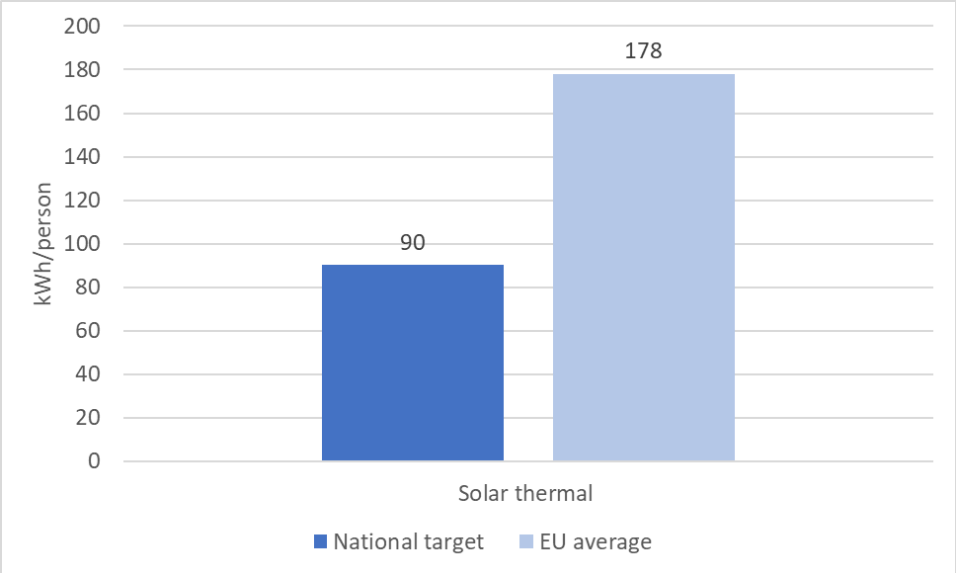


Figure 2. Target for heat production using solar thermal systems in 2030. The EU average comprehends countries that announced targets for these technologies. Not all countries specified this target. Source: NECP.

2. POLICIES TO ACHIEVE THE HEATING TARGETS

In the autumn of 2022, a **Green Recovery Program** was initiated, with a key requirement being a 30% energy savings target for eligible homes to qualify for financial assistance. Each house can receive a maximum contribution of EUR 16,600. A noteworthy aspect of this program is its emphasis on comprehensive house renovations.

Additionally, there is the **Green Houses Program**, which offers rebates for the installation of various renewable energy systems such as solar water heaters, solar systems (up to 10 kW), heat pumps, biomass systems, and solar collectors. Project developers can avail of one-time payments covering up to 50% of the purchase and installation costs for these systems. The maximum reimbursement is €3,400 for heat pumps, €1,500 for solar panels and biomass systems, and €1,750 for solar collectors. Over 41,000 installations are expected to benefit from this initiative.

Furthermore, there is **support allocated to District Heating Networks**, with a total budget of up to EUR 1,050 million over 15 years, equating to a maximum of EUR 70 million per year. This funding is flexible and can be used for various connected projects, including enhancing the efficiency of existing high-efficiency cogeneration facilities, promoting the transition from coal to natural gas or renewable energy sources, and encouraging investments in new high-efficiency cogeneration installations.

3. SCENARIOS OF DECARBONISATION

N.A.

4. SUGGESTIONS

Slovakia, like many Eastern European countries, appears to show limited sensitivity to the importance of climate planning and action. In its NECP-2019 document, Slovakia set a relatively unambitious general target for heat production at 19% from renewable energy sources, ranking it third lowest, with only Belgium and

the Netherlands having less ambitious targets (although those countries have more ambitious plans for electricity production).

Specifically, there is no information available about the planned figures for heat pumps in Slovakia's NECP-2019. Regarding the target for solar thermal heat, the goal is set at 90.1 kWh/capita of yearly heat production by 2030. This represents just 50% of the EU average. Given the available possibilities and the mounting pressures to address climate change, a more ambitious target, closer to the EU average, would be both feasible and beneficial.

As for the new draft of NECP-2023, it was not uploaded by the deadline, and even later, on the 15th of August. This is unexpected, considering that Slovakia has a relatively high dependence on energy imports, surpassing 60%. A well-planned, swift transition to local (renewable) energy sources could prove highly advantageous for the entire Slovakian economy and society.

SLOVENIA

1. TARGETS

1.1. TARGETS ON RENEWABLE ENERGY IN THE HEATING AND COOLING SECTOR

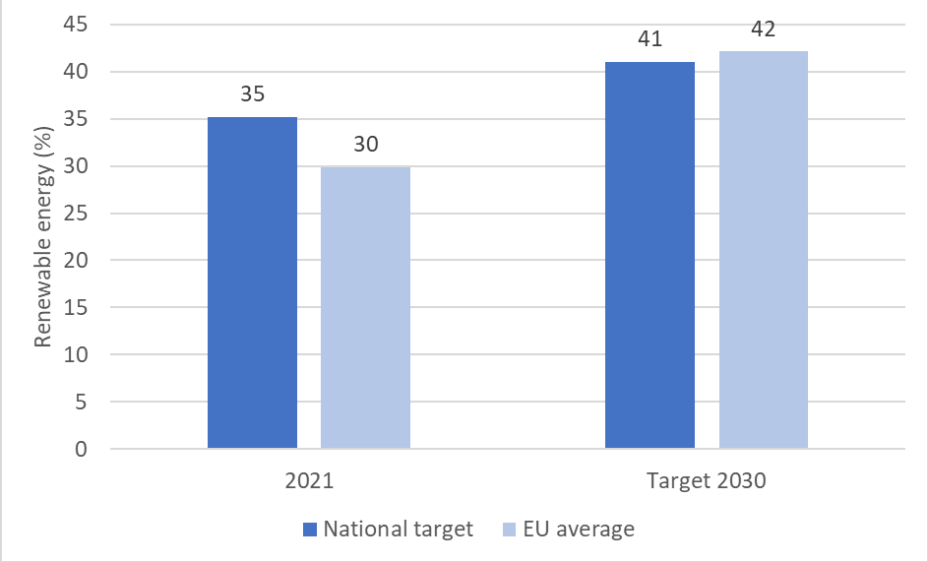


Figure 1. Renewable heating and cooling in 2021 and target (NECP) for 2030.

- 41% RE in heating by 2030.
- 52% RE in electricity by 2030.
- 26% RE in transport by 2030.

1.2. GHG EMISSION TARGETS FOR NON-ETS SECTORS

- 38.5% GHG emission reduction by 2030 compared to 2005.

1.3. ENERGY IMPORTS TARGETS

- Energy imports were 47% of total consumption in 2021.

1.4. TARGETS ON HEATING (HEAT PUMPS, BAN OF FOSSIL HEATING)

- There is no deadline for the ban on the sale and installation of fossil fuel boilers.
- Heat pumps deliver approximately 22% of total heat consumption by 2030.

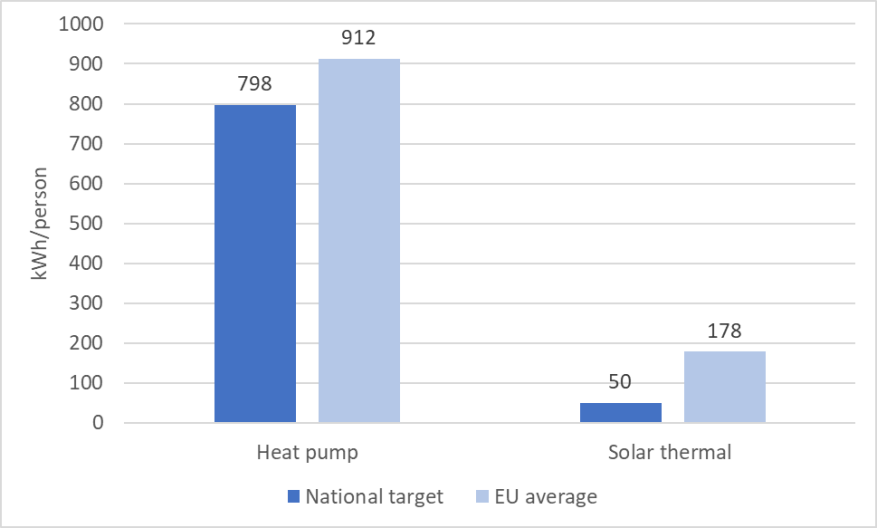


Figure 2. Target for heat production using heat pumps and solar thermal systems in 2030. The EU average comprehends countries that announced targets for these technologies. Not all countries specified this target. Source: NECP.

2. POLICIES TO ACHIEVE THE HEATING TARGETS

At least 85 % of electricity supply from installations in Slovenia by 2030 and 100% by 2040. This plan is mainly based on the continued development of nuclear energy and the decision to build a new nuclear power plant as soon as possible, but no later than 2027. Regarding the heating sector, there are no detailed information about the plans in the NECP-2023 document.

3. SCENARIOS OF DECARBONISATION

N.A.

4. SUGGESTIONS

Slovenia's overall commitment to renewable energy closely aligns with the EU average within the heating sector, as the target is to achieve a 41% renewable energy ratio by 2030, which is only 1 percentage point lower than the EU average. However, when examining the specific details outlined in the NECP-2023, some disparities become evident.

The solar thermal target for Slovenia is set at 49.6 kWh per capita per year, significantly lower than the EU average of 179 kWh per capita per year. Given Slovenia's favourable climate and solar potential in comparison to countries like Poland and Denmark, the current per capita target appears rather modest. It is advisable to significantly increase this target to better harness the available solar energy potential.

On the other hand, the heat pump target, standing at 798 kWh per capita per year, is somewhat closer to the per capita EU average, reaching 86% of this figure according to the NECP-2023. Even so, in the realm of heat pumps as well, Slovenian experts and decision-makers should aim for at least achieving the European average to maximize the benefits of this technology.

SPAIN

1. TARGETS

1.1. TARGETS ON RENEWABLE ENERGY IN THE HEATING AND COOLING SECTOR

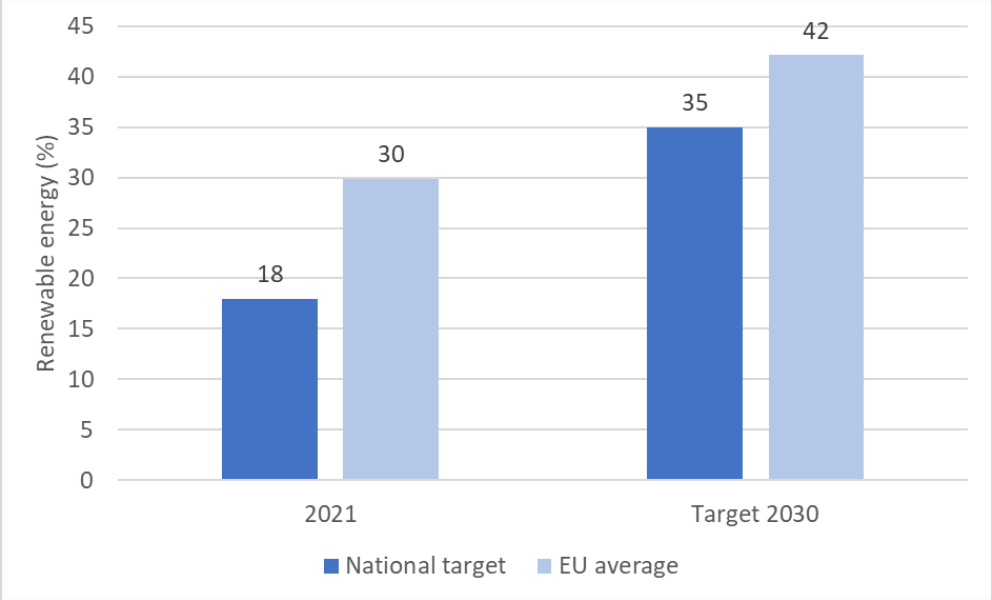


Figure 1. Renewable heating and cooling in 2021 and target (NECP) for 2030.

- 35% RE in heating by 2030.
- 81% RE in electricity by 2030.
- 25% RE in transport by 2030.

1.2. GHG EMISSION TARGETS FOR NON-ETS SECTORS

- 32% GHG emission reduction by 2030 compared to 1990.

1.3. ENERGY IMPORTS TARGETS

- Energy imports were 73% of total consumption in 2021. The objective is to reduce the dependence on imports to around 51% by 2030.

1.4. TARGETS ON HEATING (HEAT PUMPS, BAN OF FOSSIL HEATING)

- There is no deadline for the ban on the sale and installation of fossil fuel boilers.

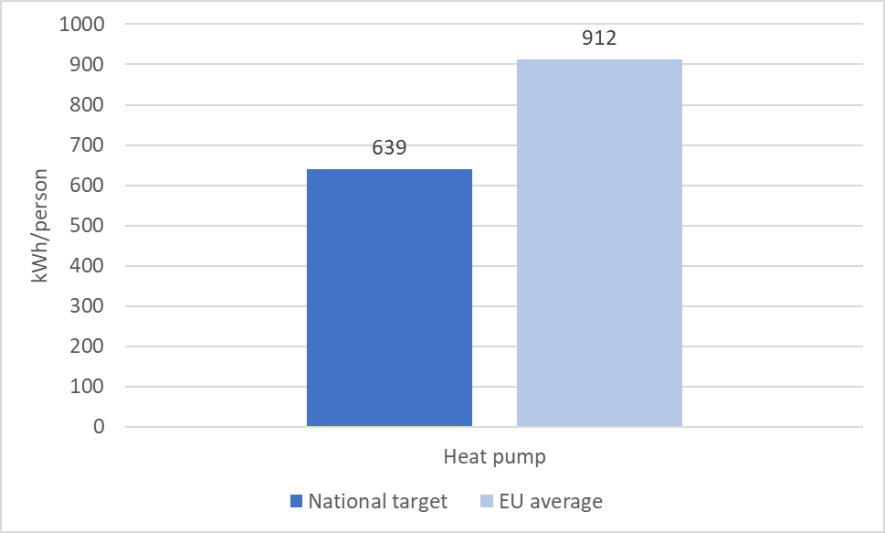
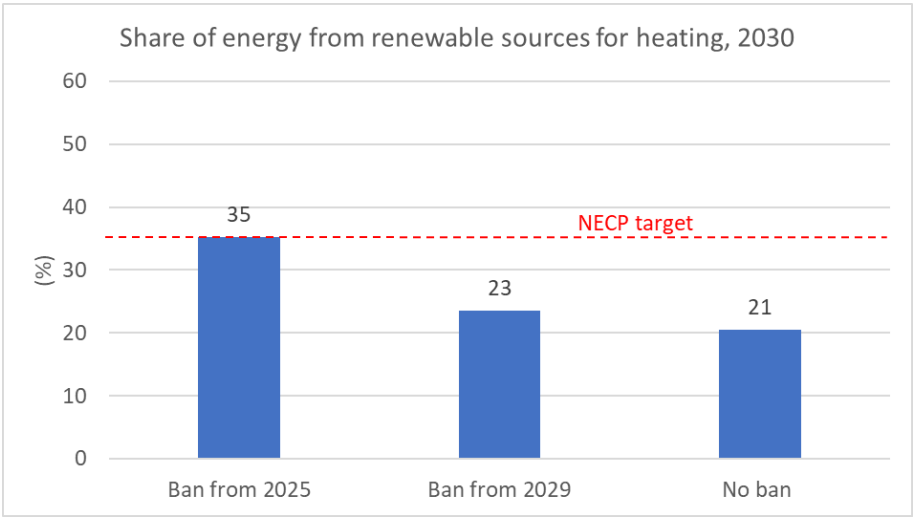


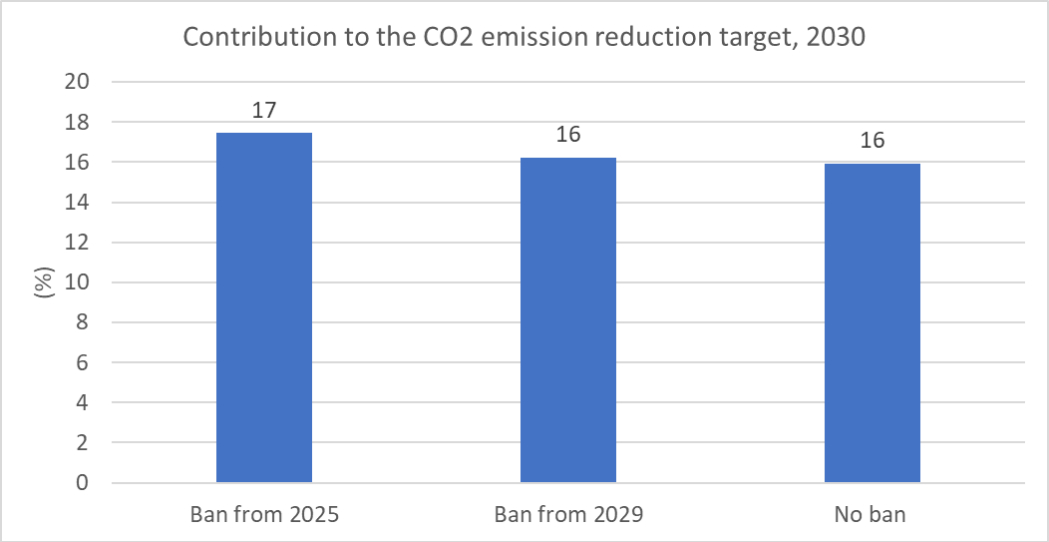
Figure 2. Target for heat production using heat pumps and solar thermal systems in 2030. The EU average comprehends countries that announced targets for these technologies. Not all countries specified this target. Source: NECP.

2. POLICIES TO ACHIEVE THE HEATING TARGETS

The NECP-2023 does not contain detailed information about the plans for the heating sector. However, it is mentioned that heating and cooling networks will enable the highest and most efficient contribution of renewable energy to the air conditioning of urban buildings in the country.

3. SCENARIOS OF DECARBONISATION





4. SUGGESTIONS

According to the NECP-2023, the proposed measures are expected to have a significant impact on economic growth and employment, resulting in an annual increase in GDP of EUR 34.7 billion and the creation of 522,000 new jobs. However, given the favourable climate conditions and the relatively low general commitment of the country, which aims for a 35% renewable energy ratio in heating, there is potential for even greater positive effects with more ambitious goals. As a minimum, Spain should target the EU average of 42% in renewable energy for heating.

It's worth noting that the document lacks a specific target for the thermal use of solar energy. However, it is mentioned that the heat pump target is set at 639.5 kWh per capita by 2030, which is less than 70% of the EU average. To align with European standards, this heat pump target should be adjusted to meet the EU average.

SWEDEN

1. TARGETS

1.1. TARGETS ON RENEWABLE ENERGY IN THE HEATING AND COOLING SECTOR

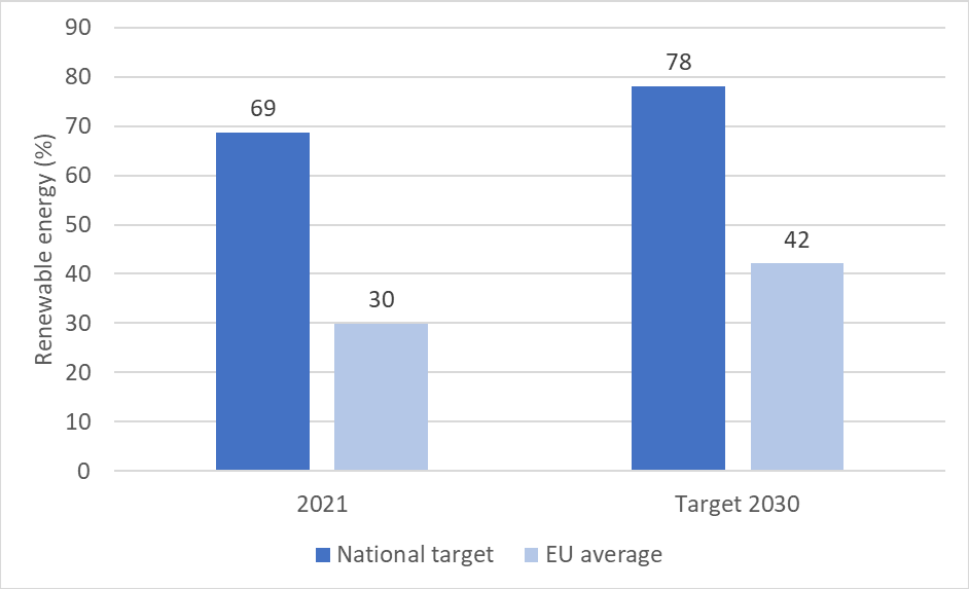


Figure 1. Renewable heating and cooling in 2021 and target (NECP) for 2030.

- 78% RE in heating by 2030.
- 88% RE in electricity by 2030.
- 73% RE in transport by 2030.

1.2. GHG EMISSION TARGETS FOR NON-ETS SECTORS

- 57% GHG emission reductions by 2030 compared to 1990.

1.3. ENERGY IMPORTS TARGETS

- Energy imports in 2021 were 49% of total consumption. The objective is to reduce the dependence on imports by 2030.

1.4. TARGETS ON HEATING (HEAT PUMPS, BAN OF FOSSIL HEATING)

- Ban of fossil heating: no deadline available.
- Heat production of heat pumps by 2030: 20 TWh.

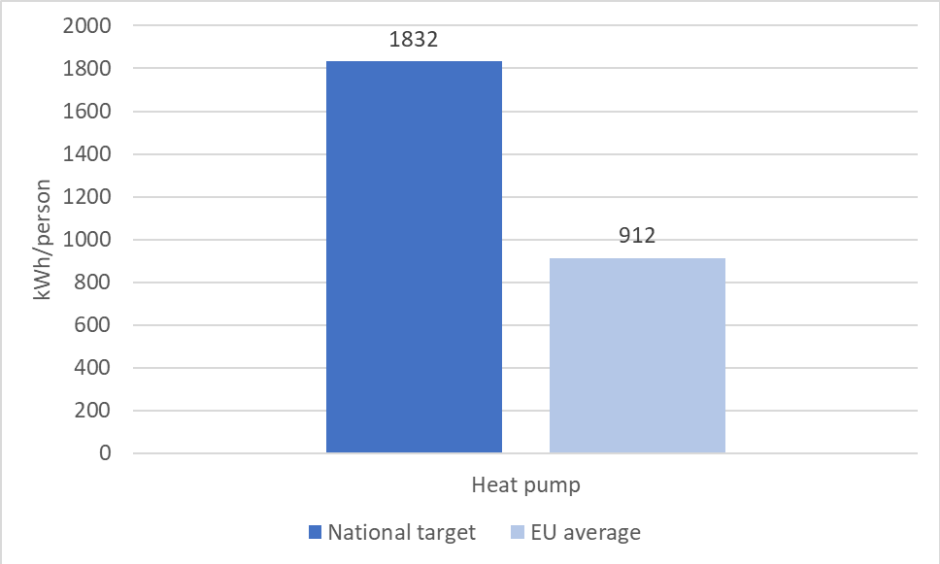


Figure 2. Target for heat production using heat pumps and solar thermal systems in 2030. The EU average comprehends countries that announced targets for these technologies. Not all countries specified this target. Source: NECP.

2. POLICIES TO ACHIEVE HEATING TARGETS

In 2021, Sweden's renewable energy consumption reached 250 TWh, marking a notable increase of 12 TWh compared to the previous year. Over the span of the past 16 years, there has been a substantial growth of 85 TWh in renewable energy usage since 2005. It's worth highlighting the role of heat pumps, which have seen their contribution rise from 7 TWh in 2005 to 19 TWh in 2021. During the same year, the proportion of renewable energy in the total energy consumption amounted to approximately 63%. The NECP aims to further boost this share to an ambitious target of 75%.

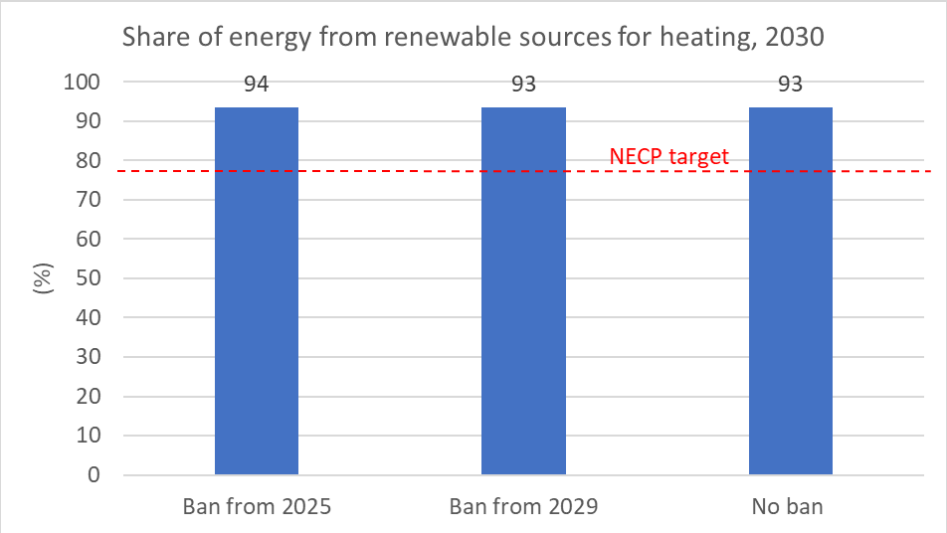
Sweden employs a comprehensive energy taxation system that combines a CO2 tax on fuels, an energy tax on fuels, and an energy tax on electricity.

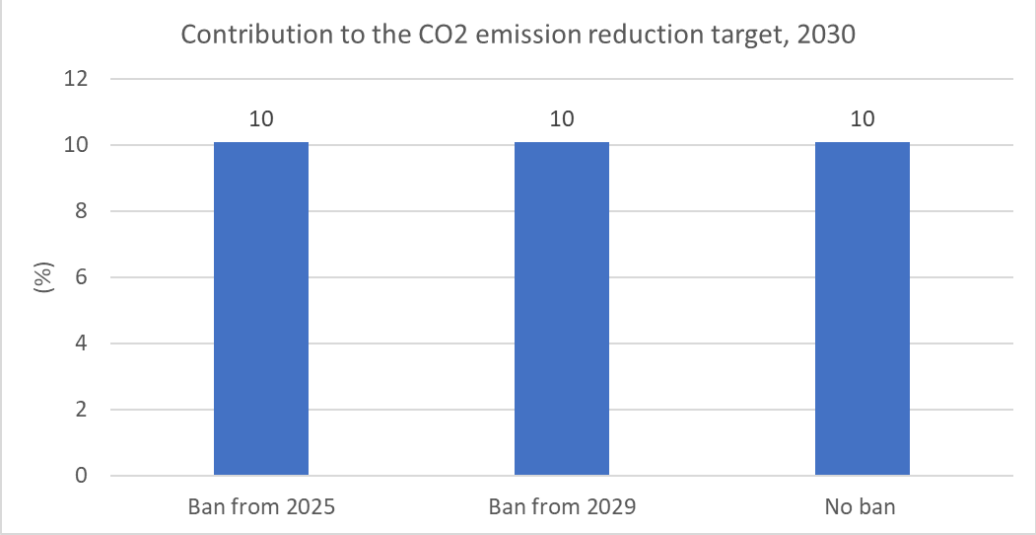
In March 2019, the Swedish Government introduced a **national air pollution control program**, outlining the measures and tools to achieve the required emission reductions mandated by cap directives.

Additional measures encompass:

- the Directive on the Energy Performance of Buildings;
- the Ecodesign Directive;
- and the Energy Labelling Regulation.

3. SCENARIOS OF DECARBONISATION





4. SUGGESTIONS

The NECP-2023 sets highly commendable targets, particularly in the heating sector. For instance, the aim to achieve a 78% renewable energy ratio in the heating sector by 2030 is the most ambitious in the entire EU, notably surpassing the EU average of 42%.

Biomass presently serves as the primary source of renewable thermal energy. However, it is vital to minimize its use by transitioning to local resources and enhancing energy efficiency and sufficiency. Unfortunately, the NECP-2023 lacks clarity regarding solar energy targets. Nevertheless, it does specify a heat pump target of 1832 kWh/capita by 2030, nearly twice the EU average of 927 kWh/capita. This goal should be pursued vigorously to successfully attain this ambitious objective.

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