SOLAR HEATING & COOLING PROGRAMME
INTERNATIONAL ENERGY AGENCY

Regulations for Heating Systems

National Situation and International Overview

IEA SHC TASK 71 | Life Cycle and Cost Assessment for Heating and Cooling Technologies

Technology Collaboration Programme
by iea

SOLAR HEATING & COOLING PROGRAMME
INTERNATIONAL ENERGY AGENCY

Regulations for Heating Systems

This is a report from SHC Task 71: Life Cycle and Cost Assessment for Heating and Cooling Technologies and work performed in Subtask A: Cooperation with ongoing or upcoming SHC Tasks and related Tasks from other IEA TCPs

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The Solar Heating and Cooling Technology Collaboration Programme began its work in 1977 as one of the first multilateral technology initiatives ("Implementing Agreements") of the International Energy Agency.

Our mission: *To bring the latest solar heating and cooling research and information to the forefront of the global energy transition.*

IEA SHC members carry out cooperative research, development, demonstrations, and exchanges of information through Tasks (projects) on solar heating and cooling components and systems and their application to advance the deployment and research and development activities in the field of solar heating and cooling.

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- Solar Heat for Industrial and Agricultural Processes (Tasks 29, 33, 49, 62, 64, 72)
- Solar District Heating (Tasks 7, 45, 55, 68)
- Solar Buildings/Architecture/Urban Planning (Tasks 8, 11, 12, 13, 20, 22, 23, 28, 37, 40, 41, 47, 51, 52, 56, 59, 63, 66)
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1 Executive Summary

Heat supply for buildings is a significant and important part of global energy consumption. This sector is therefore structured by regulations, which aim to reduce greenhouse gas emissions and/or fossil fuel consumption. The regulations are motivated by international agreements, like the Paris Agreement or the UN Sustainable Development Goals and by strategic economic and ecological goals of the national governments. Eco labels or energy efficiency labels and declarations are key tools of these regulations.

The status, kind, and level of detail of the specific regulations differ significantly between countries, even in Europe where a common basic legislation and common goals are defined by the European Union. Even still, an explicit emphasis is put on these EU policies and regulations as overarching framework. Some countries focus on building related regulations with an emphasis on energy efficiency. Others have developed a regulatory system which also specifies qualities of specific technologies or energy types used. Often a share of required renewable energy is defined as mandatory. Typically, the regulations include transitional periods which can be very long, in some cases more than a decade. Also, there is a differentiation between newly build buildings and existing buildings.

This report provides an overview of the situation in ten countries by briefly describing the general national strategy and goals, and by grouping regulations addressing the Energy Efficiency in Buildings, District Heating and Cooling, and Renewable Energy.

It is important to mention that the report can only give a general overview and cannot provide detailed information for each specific country as the regulatory system in the heating sector is very dynamic throughout all countries reported on.

2 Introduction

Heating Systems for residential buildings represent an important topic for energy use around the world. Typical systems differ significantly, depending on the available and established technologies, the climatic conditions and typical building types in specific regions or countries.

The relationship between energy use, in our case for heating systems, and climate change is the leading cause for all the current efforts and regulations related to heating systems. General approaches are twofold, first, changing energy sources from fossil fuels to alternative, lower GHG and CO_2 emissions sources, second, increasing heating systems energy efficiency.

2.1 Energy and Climate Change

Energy supplied by fossil fuels is agreed by the scientific community to be the driver for climate change due to the related emissions of CO_2. A direct correlation between the use of fossil fuels and emitted CO_2 is understood so the replacement of fossil fuels by other energy sources can be directly translated into CO_2 emission reductions. Taking this fact into account, many national governments and multi-national organisations have introduced measures and regulations to limit CO_2 emissions and to foster the transformation of the heating sector to non-fossil fuel technologies.

2.2 Energy Efficiency

The previously mentioned regulations addressing the transformation of fossil fuel driven heating systems to renewable energies can be supported by energy efficiency measures, which are motivated by the fact that, each kWh of energy which does not have to be generated with fossil fuels will not create CO_2 emissions.

Regulations related to energy efficiency partly address heating directly. Most regulations focus on the reduction of the heating demand of buildings and so are more related to the building sector.

3 International and Multi-National Regulations

It is because of the global scale of climate change and its mitigation measures that international agreements set worldwide goals as well as the framework for national activities and measures.

All regulations are part of political discussions and so quite dynamic. This report describes the situation of Q4/2024 and has been reviewed in November 2024.

3.1 International Regulations

On the international level the topic climate change mitigation is typically discussed on a fundamental level, and agreements describe the broad goals and/or measures to be taken by countries. International agreements are not a specific regulation type like on a national level since they typically do not directly influence the situation for stakeholders. International regulations usually are translated into national regulations and so describe the basic approaches and goals.

3.1.1 Paris Agreement

The Paris Agreement represents a breakthrough in global efforts to reduce greenhouse gas emissions. Adopted at the United Nations Climate Change Conference (COP21) of 2015, it is the first legally binding treaty for climate goals agreed upon universally – 195 out of 198 Parties have joined the agreement. Its overarching goal is to strengthen the international response to climate change, by:

'Holding the increase in the global average temperature to well below 2 °C above pre-industrial levels and pursuing efforts to limit the temperature increase to 1,5 °C above pre-industrial levels, recognizing that this would significantly reduce the risks and impacts of climate change'[1].

In practice, each signatory Party submits on a five-year cycle a pledge with ongoing or planned domestic actions to reach the goals of the Paris Agreement. This is referred to as Nationally Determined Contributions or NDCs. Notably, the most pursued emission mitigation strategies are renewable energy generation (>80% of NDCs) and energy efficiency improvement for buildings (>60% of NDCs[2]). At COP28 in 2023, governments have committed to increase ambitions in their NDCs, and reaffirmed efforts to limit the temperature increase to 1,5 °C. As underscored by the United Nations Intergovernmental Panel on Climate Change and 1,5 °C compliant scenarios, global greenhouse gas emissions should peak by 2025 at the latest, being reduced by 43% by 2030 relative to 2019, and global net zero CO_2 emissions should be reached in the early 2050s[3].

However, despite significant efforts by some countries, a new United Nations report on climate change released on November 14, 2023, concludes that national climate action plans remain insufficient to limit global temperature rise to 1.5 degrees Celsius and meet the goals of the Paris Agreement. The report shows that much more immediate action is needed to further tilt down the global emissions trajectory and avoid the worst impacts of climate change.

3.1.2 UN Sustainable Development Goals

Adopted in 2015 by the United Nations (UN) member states, the 2030 Agenda for Sustainable Development is a universal roadmap towards economic, social, and environmental sustainability. It consists of 17 Sustainable Development Goals (SDGs) and 169 targets. The energy topic is explicitly addressed under SDG 7 'Ensure access to affordable, reliable, sustainable and modern energy for all', and especially:

- SDG7.2 'By 2030, increase substantially the share of renewable energy in the global energy mix'.
- SDG7.3 'By 2030, double the global rate of improvement in energy efficiency'.

1 "Paris Agreement", United Nations (2015)
2 "Nationally determined contributions under the Paris Agreement. Synthesis report by the secretariat", UNFCC (2023) https://unfccc.int/documents/632334
3 IPCC, 2023: Summary for Policymakers. In: Climate Change 2023: Synthesis Report. Contribution of Working Groups I, II and III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change [Core Writing Team, H. Lee and J. Romero (eds.)]. IPCC, Geneva, Switzerland, pp. 1-34, doi: 10.59327/IPCC/AR6-9789291691647.001

The latest report published on the status of the SDG 7 notes that we are not currently on track to achieve these objectives. Therefore, it should be emphasized that the global political and scientific community affirms that the transition to a more climate-friendly energy system should not be slowed down but strongly accelerated.

3.2 European Regulations

There are regulations on European level which directly describe national law and there also European regulations which describe the goals and the framework for national regulations.

General remark: EU policies mainly take the form of Regulations and Directives: Regulations have binding legal force throughout every Member State and enter into force on a set date in all the Member States. Directives lay down certain results that must be achieved but each Member State is free to decide how to transpose directives into national laws.

3.2.1 European Green Deal

In late 2019, the EU presented the European Green Deal (COM (2019)). proposing a new strategy towards a prosperous and just society, based on a resource-efficient economy, with the goal of achieving climate neutrality by 2050. The Green Deal aims to make the EU's climate, energy, transport, and taxation policies fit for reducing net greenhouse gas emissions by at least 55% by 2030, compared to 1990 levels. These indications become a binding obligation in the European Climate Law (Regulation (EU) 2021/1119) where the energy objectives are decisive: producing cleaner energy through technological research and innovation and investing in renovated and energy-efficient buildings.

The regulation highlights the importance of energy production and consumption for the level of greenhouse gas emissions, stressing that it is essential to ensure a transition to a secure, sustainable and affordable energy system, based on the deployment of renewable energies, a well-functioning internal energy market and the improvement of energy efficiency, while reducing energy poverty.

In light of the 2050 climate-neutrality objective, by 2030 greenhouse gas emissions should be reduced and removals enhanced, so that net greenhouse gas emissions, that is emissions after the deduction of removals, are reduced economy-wide and domestically by at least 55% by 2030 compared to 1990 levels. The European Council endorsed that target in its conclusions of 10 and 11 December 2020. It also provided initial guidance on its implementation.'

The "Fit for 55" legislative package was announced in the 2021; the goal is to implement the objectives stated on the 'European Climate Law'. It covers a range of policy areas including energy efficiency, renewable energy, land use, land change and forestry, energy taxation, effort sharing, emissions trading, and alternative fuels infrastructure.

The **national energy and climate plans (NECPs**) were introduced by the Regulation on the governance of the energy union and climate action (EU)2018/1999, agreed as part of the *Clean energy for all Europeans* package. The NECPs contain the strategies of each of the member countries, with a 10-year plan, to meet the EU's energy and climate targets for 2030.

The national plans outline how the EU countries intend to address energy efficiency, renewables, greenhouse gas emissions reductions, interconnections, research, and innovation. The national plans include, for example, renewable energy targets by sector or goals on renewable share in the electricity mix, in some cases they also include road maps for hydrogen and for biogas among others.

The final integrated national energy and climate plans for the period from 2021 to 2030, was submitted by EU countries in 2020. The EU countries were also required to develop national long-term strategies by 1 January 2020 and ensure consistency between long-term-strategies and the 10-year NECPs.

3.2.2 Energy Efficiency in the Building Sector

Directive 2010/31/EU on the Energy Performance of Buildings (EPBD): This directive replaced Directive 2002/91/EC and introduced more ambitious requirements for new and renovated buildings. It introduced the concept of "nearly zero-energy buildings" and set specific targets for Member States to improve the energy efficiency of their buildings. Both directives were amended in 2018 and 2019. The **Directive 2018/844/EU** (amending Directive 2010/31/EU) introduced amendments to further strengthen energy efficiency policies in EU

buildings. It established additional measures to promote the decarbonization of buildings, such as the installation of electric vehicle charging infrastructure and the promotion of energy renovations.

To guarantee that buildings are fit for the enhanced climate ambition, as presented in the 2030 Climate Target Plan, and reflected in the “Delivering the European **Green Deal Package**” in July 2021, the Commission’s presents a new proposal which aims to contribute to reaching the target of reductions of at least 60% of emissions by 2030 in the building sector in comparison to 2015 and achieve climate neutrality by 2050. This will go hand in hand with other initiatives of the European Green Deal package, in particular with the review of the proposed new emissions trading system for fuels used in buildings, the Energy Efficiency Directive, the Renewable Energy Directive, as well as the Alternative Fuels Infrastructure Regulation.

In December 2021, the Commission proposed a revision of the EPBD (COM (2021) 802 final) as part of the 'fit for 55' package, to meet a minimum 55% reduction in greenhouse gas (GHG) emissions by 2030 in the EU. This revision sets out how the EU can achieve a net-zero-emission and fully decarbonise its building stock by 2050, by increasing the rate of renovations as well as a gradual phasing out of the worst performing buildings in each EU Member State leading to a continuous improvement of the building stock.

The Council reached an agreement (October 2022) on a proposal to revise EPDB. Therefore, for existing residential buildings, Member States agreed to introduce a maximum consumption of primary energy per m^2 per year. For existing non-residential buildings, Member States agreed to set maximum thresholds, based on primary energy use. A first threshold would draw a line 15% below the primary energy use of the very poorly performing non-residential buildings in a Member State. A second threshold would be set 25% below. Member States agreed to bring all non-residential buildings below the 15% threshold by 2030 and below the 25% threshold by 2034. The thresholds would be set based on the energy use of the national building stock on 1 January 2020.

The national trajectory should lead to the decrease of the average primary energy use in the whole residential building stock over the period from 2025 to 2050 with two control points: by 2033 the average primary energy use of the whole residential building stock is at least equivalent to the D energy performance class level, and by 2040 is equivalent to a nationally determined value derived from a gradual decrease of the average primary energy use from 2033 to 2050.

The Council and the European Parliament published the 24 April 2024 the revised EPBD (IV), Directive EU 2024/1275 which aims to position Europe on the path to achieving a fully decarbonized building stock by 2050 by stimulating renovations, particularly of the worst performing buildings. It reflects greater climate ambition alongside social action and provides Member States with the flexibility to consider differences in the building stock across Europe. The main highlights and changes on the revised EPBD are:

For residential buildings, each Member State should reduce their average primary energy use by 16% by 2030 and 20-22% by 2035, ensuring that at least 55% of the decrease of the average primary energy use is achieved through the renovation of the worst-performing buildings.

As regards non-residential buildings, foresees the gradual introduction of Minimum Energy Performance Standards to renovate the 16% worst-performing buildings by 2030 and the 26% worst-performing buildings by 2033. The updated EPBD introduces ‘Building Renovation Passport' schemes to help planning building renovations. Member States will have to set out in their Building Renovation Plans their policies and measures regarding the phase out of fossil fuels in heating and cooling with a view to a phase-out of fossil fuel boilers by 2040.

The revised Directive makes **zero-emission buildings the new standard for new buildings.** All buildings must have zero on-site emissions from fossil fuels, from 2028 for publicly owned buildings and from 2030 for all other new buildings. Furthermore, 100% of the total annual primary energy use will have to be covered by renewable energy generated onsite, nearby or from a renewable energy community, energy from an efficient district heating and cooling system or energy from carbon free sources. The revised EPBD supports high indoor environmental standards by requiring that new non-residential zero-emission buildings are equipped with measuring and control devices for monitoring and regulating indoor air quality.

Member States shall ensure that the life cycle GWP is calculated (in accordance with Annex III) and disclosed in the energy performance certificate of the building: (a) from 1 January 2028, for all new buildings with a useful floor area larger than 1 000 m^2; (b) from 1 January 2030, for all new buildings.

The Energy Performance Certificates and Smart Readiness Indicator will provide visibility to the buildings that have control and monitoring systems for indoor environmental quality installed.

The Commission has established a set of standards and accompanying technical reports to support the directive called the energy performance of buildings standards (EPB standards) which are managed by the European Committee for Standardization (CEN).

Each Member state have transposed the European EPDB to their own Technical Building Codes.

The Concerted Action EPBD (CA EPBD) is a joint initiative between the EU member states and the European Commission aims to contribute to the reduction of energy use in European buildings through the exchange of knowledge and best practices between all member states plus Norway. The objective is to enhance the sharing of information and experiences from national adoption and implementation of EPBD. The current CA sixth phase has as its main objective to transpose and implement the EPBD amended Directive 2018/844/EU and the revised EPBD adopted in 2024.

3.2.3 District Heating and Cooling

European Standards for District Heating and Cooling: The European Committee for Standardization (CEN) has developed a series of standards for district heating and cooling systems. These standards cover various aspects, including design, installation, operation, and maintenance, with the aim of ensuring the quality, efficiency, and safety of such systems.

EU Directive 2012/27 on energy efficiency specifies that necessary measures must be taken to develop an urban heating and/or cooling infrastructure in those areas where high efficiency co-generation potential is identified.

3.2.4 Renewable Energy

EU Directive 2018/2001 on the promotion of the use of energy from renewable sources introduces specific provisions to accelerate the development of renewables in heating and cooling, by increasing policy prioritisation of this sector. These include indicative targets where each EU country must increase the share of renewables in heating and cooling by an indicative 1.1 percentage point every year, with a similar target for district heating and cooling.

The 2021 proposal for a review of the **Renewable Energy Directive** strengthened the heating and cooling target (**Article 23**), as well as the district heating and cooling target (**Article 24**). It also extends the measures EU countries can take to achieve these targets and includes specific provisions on integrating waste heat and cold and enhancing the role of the heating and cooling sector in the integration of energy systems. In addition, the provisions on training and certification of installers of heating and cooling systems (Article 18, Annex IV) and measures for integrating renewables in the EU building stock (new Article 15a), the largest heating and cooling end-use sector, were also strengthened.

The EU renewable energy target has interactions with the EU energy efficiency targets and measures. The increase in energy savings facilitates compliance with the renewable energy share target for EU countries. Furthermore, renewable heat sources (ambient and geothermal energy used mainly via heat pumps, solar thermal, etc.) provide low temperature heat (up to 200 °C), working most optimally with highly energy efficient well-insulated buildings or low-temperature process heat (for example, breweries and food drying).

The Commission conducted a series of studies (4 reports, https://energy.ec.europa.eu/publications/) on the heating and cooling sectors, published in June 2022, with the objective of promoting the implementation of renewable energy. The studies include best practices for renewable energy communities, while modelling possible decarbonization pathways. A study on a roadmap for policy support for heating and cooling decarbonization sets out a roadmap for heat decarbonization and recommendations for policies covering space heating in buildings and the heat for industrial processes.

3.2.5 Circular Economy

One of the main pillars of the European Green Pact is the **Circular Economy Action Plan (CEAP)** adopted in March 2020. This new agenda sets out the transition of the EU to a circular economy that is based on sustainable growth, a prerequisite for achieving the 2050 climate neutrality target of the EU and reversing biodiversity loss. This action plan contains initiatives throughout the entire life cycle of products. It focuses on how products are designed,

promotes circular economy processes, encourages sustainable consumption, and aims to ensure that waste is avoided, and resources used are kept in the EU economy for as long as possible.

Table 1. Ecodesign Heat and Cooling Appliances Product Evaluations

Product	**Ecodesign Directive 2009/125/EC**	**Energy Labelling Regulation (EU) 2017/1369**	**Evaluations, review / rescaling**		**Status/ next steps**
Air conditioners and comfort fans (including air to air heat pumps)	(EU) No 206/2012	(EU) No 626/2011	30/03/2017	2016-07-26 2023-08-02	Revision on-going
Water heaters and hot water storage tanks + solar devices	(EU) No 814/2013	(EU) No 812/2013	26/09/2018	26/09/2018 02/08/2025	Planned Revision on-going
Space and combination heaters	(EU) No 813/2013	(EU) No 811/2013	26/09/2018	16/09/2018 02/08/2025	Revision on-going
Local space heaters Solid fuel local space heaters	(EU) 2015/1188 (EU) 2015/1185	(EU) 2015/1186 (no labels for electric local heaters)	01/01/2018 01/01/2024	02/08/2023	Revision on-going
Solid fuel boilers	(EU) 2015/1189	(EU) 2015/1187	2022-01-01		Revision on-going
Air heating products, cooling products, high temperature process chillers and fan coil units	(EU) 2016/2281		2022-01-01		Revision on-going

To achieve targets, it establishes a **sustainable product policy framework**, including measures in three areas: fostering sustainable product design; empowering consumers and public buyers; and promoting circularity in production processes. The goal of the Sustainable Products Initiative is to “make sustainable products the norm”. The Ecodesign directive for Sustainable Products Regulation (**ESPR**) covers the environmental aspects.

3.2.6 Ecodesign and Energy Labelling

The EU has developed three tools for improving the energy efficiency and sustainability of products: the sustainable product policy, Ecodesign legislation and energy labelling. They promote the environmental performance of products throughout the internal market.[4]

A proposal for an updated sustainable products initiative (ESPR) was adopted as part of a circular economy package on 30 March 2022 (repealing **Directive 2009/125/EC**). ‘*The main objectives of this regulation are to reduce the negative life cycle environmental impacts of products and improve the functioning of the internal market. These objectives seek to resolve the problems, and their causes analysed in the impact assessment’. ”Finally, until this regulation is in place, the Commission will ensure work under the existing Ecodesign Directive continues, including via adoption of a new Ecodesign and Energy Labelling Working Plan for the period 2022–2024, addressing new energy-related products and updating and increasing the ambition of those already regulated.”.*

The **Ecodesign Directive 2009/125/EC** provides consistent EU-wide rules for improving the environmental performance of products, such as household appliances, information and communication technologies or engineering. The directive sets out minimum mandatory requirements for the energy efficiency of these products.

The Ecodesign Directive is implemented through product-specific regulations, directly applicable in all EU countries. The products are grouped by categories. Air heating and cooling products is a category. Ecodesign requirements for air heating and cooling products, high temperature process chillers and fan coils are mandatory for all manufacturers and suppliers wishing to sell their products in the EU (**Regulation EU 2016/2281**). They cover energy performance, energy efficiency and the emission of nitrogen oxides. The requirements apply to air heating products with a rated heating capacity of up to 1 MW, cooling products and high temperature process chillers with a rated

[4] https://single-market-economy.ec.europa.eu/industry/sustainability/sustainable-product-policy-ecodesign_en

cooling capacity of up to 2 MW, and fan coil units. In 2018, the EU published a Guideline to facilitate the implementation of the Regulations with regards to Ecodesign requirements for air heating products, cooling products, high temperature process chillers and fan coil units. **Error! Reference source not found.** presents an overview of the Ecodesign Regulations for different space heating, space cooling and water heating products.

Another product category addresses requirements applying to air conditioners with a rated capacity smaller than or equal to 12 kW for cooling (or heating if there is no cooling function) and to comfort fans with an electric fan power input smaller than or equal to 125 W.[5]

At the time of writing (12/2023) the Ecodesign Directive regulates **31 product** categories. However, the new ESPR wants to cover the "broadest possible range of products" with more diverse Ecodesign criteria. This means the EU still must draft new regulations and perform many studies before the ESPR enters into force. This is called the **Ecodesign and Energy Labelling Work Plan.**

Each regulated product group in the Ecodesign Directive has its own "implementing act" making the Ecodesign criteria mandatory. Currently, the EU is developing the implementation of acts for new product groups and old ones are under revision. Once the ESPR enters into force, it will take over these acts and replace the current Ecodesign directive.

The Ecodesign Directive and the Energy Labelling Regulation are related and working together. Ecodesign sets common EU wide minimum standards to eliminate the least performing products from the market. The energy labels provide a clear and simple indication of the energy efficiency and other key features of products at the point of purchase.

The **Energy Labelling Regulation (EU) 2017/1369** setting a framework for energy labelling may complement those Ecodesign requirements with mandatory labelling requirements. Energy labelling applies to 15 product groups. The European Product Registry for Energy Labelling (EPREL), a database listing labelled products has been created.

The European Commission proposed the Product Environmental Footprint (PEF) and Organizational Environmental Footprint (OEF) methods as a common method for measuring environmental performance (**European Commission Recommendation 2021/2279**). The PEF and the OEF are the methods based on Life Cycle Assessment (LCA) that are recommended by the EU to quantify the environmental impact of products (goods or services) and organizations. The overall objective is to reduce the environmental impact of goods, services and organizations by considering the activities in the supply chain (from the extraction of raw materials, through production and use, to final waste management). This purpose is achieved by obtaining data, inventories and detailed requirements for modelling the environmental impacts of material/energy flows and emissions and waste streams associated with a product or an organization throughout its life cycle.

4 Ecology Labels and Environmental Declarations

Voluntary Eco-labelling systems have spread all over the world and many countries have their own labelling system. It is a sign or distinctive that aims to recognize products or services that meet certain criteria of "environmental friendliness" in the manufacturing, use, marketing and disposal of a product. The overall objective of eco-labelling is to use market mechanisms to stimulate continuous environmental improvement.

According to ISO standards, there are three eco-labelling systems, and they are classified as follows:

- Ecolabel type I (ISO 14024 standard). Ecolabelled products and services meet strict, pre-established environmental criteria. An example is the **European ecolabel** (11 product categories) which however does not cover products related to heating or cooling.
    - Ecolabel type II (ISO 14021 standard) - Environmental self-declarations
    - Environmental declarations type III (ISO 14025 standard). Unlike type I eco-labels, environmental declarations do not define criteria for the environmental preference of products, nor do they establish minimum criteria to be met.

[5] https://commission.europa.eu/energy-climate-change-environment/standards-tools-and-labels/products-labelling-rules-and-requirements/energy-label-and-ecodesign/energy-efficient-products/air-conditioners-and-comfort-fans_en.

4.1 The International Environment Product Declaration System

The Environmental Product Declaration (EPD) is an ISO type III Environmental Declaration according to ISO 14025 standard, which reports objective, transparent, comparable and third-party verified data about products and services' environmental performances. The EDP is based on life cycle assessment (LCA) methodology to evaluate the product's environmental performance over its entire life cycle. It takes into consideration the full product life, from material extraction to manufactured product, its usage stage and end of life

Currently, there are different Environmental Product Declaration (EPD) programs around the world with some years of experience, such as in Sweden, Norway, Canada, Japan or Korea. Other countries, such as Germany, Denmark and Italy, are starting their own programs. Finally, other countries, such as Finland, France, the Netherlands, Switzerland, the United Kingdom and the United States, have initiated similar systems. Table 2. , contains some worldwide environmental declarations, which are distributed by categories and product families.

Table 2. Overview on existing EDPs and ecology labels (not complete)

EPD	Countries	Operated by/ Institution	Products
The International EPD System	Sweden Representations all around the world (16 countries)	EPD International AB (Sweden)	Product Category Rules (PCRs) PV components: invertors, battery energy storage systems, combiner boxed and tracker systems (2023-01-02)
Nordic swan	Norway, Sweden, Finland, Iceland and Denmark.	Nordic Ecolabelling	20,000 ecolabelled product and services Covers 67 different product groups
Blauer Engel	Germany	Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety	
NF Environnement	France	A voluntary certification mark issued by AFNOR Certification	Covers 52 different products or service groups
ECO Mark	India	Government of India. administered by the Bureau of Indian Standards	
BAU-EPD	Austria, Germany and Switzerland	BAU EPD GmbH (merger of ÖGNI and ÖGNB)	Baubook is a database for ecological building and renovation; TQB Total Quality Building Certificate and Building Certificate klimaaktiv
MILIEUKEUR	Netherlands		
Environmental Choice	New Zealand		
Choix Environmental	Canada		
ECOMARK	Japan		
AENOR-Medio Ambiente	Spain	Gestionada desde la Asociación Española de Normalización y Certificación (AENOR)	

5 National Regulations

Many countries have issued regulations addressing the shift towards the use of renewable sources in heating systems and the reduction of related CO_2 emissions. The strategies and topics of the countries differ, and the specific regulations are also quite different regarding their intentions, content, administration, and fulfilment requirements.

Especially for industries addressing markets in different countries with different regulatory systems, it can result in a significant effort to ensure that products fulfil all the relevant efficiently regulations.

The following sections provide an overview of the specific regulations for countries which contributed to Task 71.

The regulations are marked with the following colour scheme.

General Strategy
Energy efficiency in the building sector
District heating and cooling
Renewable energy

All regulations are part of political discussions and so quite dynamic. This report describes the situation of Q4/2024 and has been reviewed in November 2024.

5.1 Austria

Austria has set the goal of becoming climate neutral by 2040. Corresponding measures are to be implemented in a revised Climate Protection Act with binding reduction pathways until 2040, interim targets until 2030, and clear responsibilities and timelines. Measures include an eco-social tax reform, the greening of the building sector, massive expansion of renewable energy sources according to ecological criteria, incentives for investors, and a mobility master plan. Currently, partial targets are included in the following national laws.

Regarding renewable electricity generation, Austria set targets and measures until 2020 in the Green Electricity Act. This was supplemented in 2021 by the Renewable Energy Expansion Act (EAG), which was comprehensively amended in 2023. Accordingly, Austria is to cover its electricity consumption "in balance" from renewable energy sources by 2030 (see § 4 para. 2 EAG). The law provides for investment subsidies on the one hand and so-called market premiums on the other. To accelerate approval procedures for renewable electricity generation, the Environmental Impact Assessment Act (UVP-G) was also amended in 2023.

The Renewable Heat Act (EWG) came into force on February 29, 2024, and aims to advance the decarbonization of the building sector. Not only may no new oil boilers be installed in new buildings, but no decentralized gas heating systems either. Public subsidies are provided for switching to non-fossil energy sources in existing buildings, leading to a replacement of investment costs of up to 75%. Further requirements for the building stock in Austria are regulated in the OIB Guidelines.

The Federal Energy Efficiency Act (EEffG) to implement the Energy Efficiency Directive was comprehensively amended in 2023. It sets the following national energy efficiency targets: Firstly, the annual final energy consumption (of a regular year; note) must not exceed 920 petajoules (PJ) in 2030. Secondly, a total of at least 650°PJ must be saved by 2030.

Further legislative proposals are currently in preparation or parliamentary consultation in Austria. For example, in February 2024, a government bill for a Renewable Gas Act – EGG (2455 d.B.) was introduced. Gas suppliers are to be required to have a green gas quota in the future, replacing a certain proportion of fossil natural gas with domestically produced renewable gas. Further government bills exist for a Hydrogen Promotion Act and an amendment to the Electricity Industry and Organization Act.

Table 3: General summary and overview of the regulations for Austria (not complete).

The NECPs containing the strategies of each of the member countries (period from 2021 to 2030)				
	Renewable strategy generation	Renewables on heating and cooling	DHC strategies	Energy efficicency
Austria's strategies contained in the NECP (period from 2021 to 2030)	The target of covering total electricity consumption 100 % (nationally balanced) from renewable energy sources by 2030. Target of climate neutrality energy supply by 2040.	Target is full decarbonisation of heat supply until 2040. Ban on oil heating in new builds (since January 2020)	Expansion of district heating networks from 5,600 km in 2020 (share of DHC 27%) to around 6,500 km in 2030 is forecast. The aim is to achieve an average annual increase of 1.5 per cent in renewable energy production and waste heat in district heating grids, as well as a 60 per cent share of renewables by 2030 and an 80 per cent share by 2035.	The targets for cumulative final energy saving measures are 650 PJ (by the end of 2030).
Energy efficiency in the buildings sector				
Regulatory framework establishing the basic quality requirements to be met by buildings	Renewable energy in buildings	Energy consumption in buildings	Energy demand in buildings	Thermal system/equipment
Renewable-Heat-Law (BGBl. I 8/2024) Date of last amendment (in force): February 2024 (EWG) https://www.bmk.gv.at/themen/klima_umwelt/energiewende/waermestrategie/ewg.html	The Federal Act on the Renewable Heat Supply in New Buildings (Renewable Heat Act (EWG)), is intended to generally prohibit the installation of heat supply systems based on fossil fuels for space heating and/or hot water preparation in new buildings (with corresponding transitional provisions for projects under construction).			
OIB guidlines 6 Energy saving and thermal insulation; The OIB guidelines serve to harmonise building regulations throughout Austria. They are issued by the OIB and adopted into building law by the federal states. Date of last amendment (in force): May 2023 https://www.oib.or.at/de/oib-richtlinien/richtlinien/2023/oib-richtlinie-6; https://www.oib.or.at/sites/default/files/oib-rl_6_ausgabe_mai_2023.pdf	Requirements for the proportion of renewable energy in new builds and major renovations; detailed descriptionin 5.2	4.2 describes Energy performance requirements for new builds and major renovations		Use of highly efficient alternative energy systems, description in 5.1
A basic document for the development of OIB Guideline 7 - Sustainable Use of Natural Resources was published for the first time. This quotes the 7th basic requirement for buildings from the EU Construction Products Regulation. Date of last amendment (in force): May 2023 https://www.oib.or.at/sites/default/files/oib-rl_7_grundlagendokument_ausgabe_mai_2023.pdf				
District heating and cooling				
Regulatory framework establishing the basic quality requirements to be met by DHC	Are specific programs promoting district heating and cooling?	Particularities		
Renewable Energy Expansion Act (EAG) - § 88 include DHC	Yes	§88 provides for a percentage breakdown of primary energy sources into renewable energy, waste heat and cooling, fossil energy or other energy sources. This applies to operators of district heating or district cooling plants with more than 250 customers or 3 GWh of heat sales per year per interconnected district heating or district cooling network. https://www.ris.bka.gv.at/GeltendeFassung.wxe?Abfrage=Bundesnormen&Gesetzesnummer=20011619		
Renewable-Heat-Act (BGBl. I 8/2024)	Yes	Quality-assured district heating: originates at least 80% from energy from renewable energy sources, heat from highly efficient combined heat and power plants, from waste heat or a combination or is equipped with a binding decarbonisation plan according to §25 Enviornmental Support Act. https://www.ris.bka.gv.at/GeltendeFassung.wxe?Abfrage=Bundesnormen&Gesetzesnummer=20012541&FassungVom=2024-05-15		
Renewable Energy				
Regulatory framework establishing the basic quality requirements to be met by DHC	Targets for renewables in overall energy consumption	Targets for renewables in electricity generation	Energy efficiency	GHG emissions
National Energy and Climate Plan (NEKP) Date of last amendment (in force): July 2023 https://www.bmk.gv.at/themen/klima_umwelt/klimaschutz/nat_klimapolitik/energie_klimaplan.html	Austria has set itself the goal of achieving climate neutrality by 2040.	The target of covering total electricity consumption 100 % (nationally balanced) from renewable energy sources by 2030.	New energy efficiency target for 2030 of 11.7% compared to the projections of the 2020 reference scenario.	Austria has set itself the target of reducing its greenhouse gas emissions in sectors outside emissions trading by 48% by 2030 compared to 2005 levels.
Renewable Energy Extension Act (EAG) Date of last amendment (in force): July 2021 https://www.ris.bka.gv.at/GeltendeFassung.wxe?Abfrage=Bundesnormen&Gesetzesnummer=20011619		The Renewable Energy Expansion Act (EAG) defines the target of covering total electricity consumption 100 % (nationally balanced) from renewable energy sources by 2030.		
Energy Efficiency Reform Act 2023 - EEff-RefG 2023 (draft) Date of last amendment (in force): 2023 (draft) https://www.parlament.gv.at/gegenstand/XXVII/ME/240?selectedStage=100			To achieve annual cumulative final energy savings of at least 650 petajoules by 31 December 2030, thereby contributing in particular to environmental and climate protection, to improving air quality and to the EU-wide and national climate and energy targets.	

5.2 China

China is on track to achieve peak carbon by 2030 and carbon neutrality by 2060. The State Council of China has issued a "Peak Carbon Action Programme by 2030" to achieve this goal step by step. By 2025, the share of non-fossil energy consumption will reach about 20%, energy consumption per unit of GDP will be 13.5% lower than in 2020, and carbon dioxide emissions per unit of GDP will be 18% lower than in 2020. By 2030, the share of non-fossil energy consumption will reach about 25%, and carbon dioxide emissions per unit of GDP will be more than 65% lower than in 2005, successfully achieving the goal of carbon peaking by 2030.

Table 4 General summary and overview of the regulations for China (not complete).

The NECPs containing the strategies of each of the member countries (period from 2021 to 2030)				
	Renewable strategy generation	Renewables on heating and cooling	DHC strategies	Energy efficicency
China's strategies	The Chinese government plans to achieve carbon neutrality by 2060, and the first step of this plan is to achieve a 25% share of non-fossil energy in total energy consumption by 2030. In addition, the installed capacity of wind and solar power will exceed 1.2 billion kilowatts in 2030	China expects to heat 2.5 billion square metres with renewable energy in 2025, but this will still be dominated by geothermal and biomass heating, with a small amount of wind and solar heating. By 2030, the area heated by renewable energy will reach 4.5 billion square metres.	The heating areas of cities in northern China have basically achieved residential heating through the establishment of district heating systems, but this has not yet been achieved in some areas in northwestern China, and the government is currently seeking to achieve centralised heating in these cities through centralised solar district heating technology. However, for large rural areas where centralised heating is not possible. If the "double carbon" target promotes the development of renewable energy, the heating area of renewable energy will reach 4.5 billion square metres in 2030 and 6 billion square metres in 2035. At that time, the rural energy system dominated by renewable energy can be basically formed, and the heating area of renewable energy can account for more than 80%, and the bulk burning of coal and traditional biomass in China's civil sector will basically return to zero.	By 2025, total renewable energy consumption will reach about 1 billion tonnes of standard coal, accounting for about 18% of primary energy consumption. The scale of non-electric use of solar energy, geothermal heating, biomass heating and biomass fuels has reached more than 60 million tonnes of standard coal.
Energy efficiency in the buildings sector				
Regulatory framework establishing the basic quality requirements to be met by buildings	Renewable energy in buildings	Energy consumption in buildings	Energy demand in buildings	Thermal system/equipment
General code for energy efficiency and renewable energy application in buildings (GB 55015- 2021) Date of last amendment (in force): April 2022 http://www.nea.gov.cn/2022-06/01/c_1310611144.htm https://mp.weixin.qq.com/s/ohG6XwTe9t7BSsAIpyhj5A	When using renewable energy, the proportion or guarantee rate of energy that can be provided by the energy should be determined according to the applicable conditions and the scale of investment. It is estimated that the heating area of renewable energy will reach 2.5 billion square meters in 2025, which is still dominated by geothermal heating and biomass heating, with a small amount of scenery heating. In 2030, the heating area of renewable energy will reach 4.5 billion square meters.	The average energy consumption index of heating and cooling of all kinds of new buildings is limited according to different thermal zoning. Residential building heating energy consumption of 2.2-223MJ/(㎡·a), cooling energy consumption of 7.1-23MJ/(㎡·a). The average energy consumption for heating, cooling and lighting in public buildings is 25-181MJ/(㎡·a).	Based on the building energy efficiency design implemented in 2016, in the building energy efficiency design implemented in 2022, the design energy consumption of residential buildings is reduced by 30%, and the energy consumption of public buildings is reduced by 20%. It stipulates the relevant energy-saving requirements and measures of the building and enclosure structure, heating, ventilation and air conditioning for the energy-saving design of new buildings, and the design requirements for the application system of renewable energy buildings such as solar energy, ground source and air source heat pumps.	In building heating, ventilation and air conditioning systems, restrictions are imposed on the performance coefficient of heat pumps, lighting power, solar heat collection efficiency, etc
District heating and cooling				
Regulatory framework establishing the basic quality requirements to be met by DHC	Are specific programs promoting district heating and cooling?	Particularities		
Technical Regulations for District Heating and Cooling Systems T/CECS 666-2020	Yes	The technical system proposed in the "Technical Regulations for District Heating and Cooling Systems" T/CECS 666-2020 has been applied in a demonstration project of 103300 square meters. After testing, the system energy efficiency of the demonstration project has increased by 6.86% compared to the national standard level one energy efficiency, and the renewable energy utilization rate has reached 37.12%, which is 21.55% lower than the average carbon emissions of buildings in the same climate zone, type, and level during the 12th Five Year Plan period. As the first technical standard in China for the application of district heating and cooling systems, the Regulations regulate and guide the design and implementation methods related to the regional energy industry, and are an important basis for the promotion and application of district heating and cooling technology. Since its release, the application scope and scale of district heating and cooling projects have seen significant growth.		
Renewable Energy				
Regulatory framework establishing the basic quality requirements to be met by DHC	Targets for renewables in overall energy consumption	Targets for renewables in electricity generation	Energy efficiency	GHG emissions
Renewable Energy Development Plan for the 14th Five-Year Plan (release) Date of last amendment (in force): October 2021 https://www.ndrc.gov.cn/xxgk/zcfb/ghwb/202206/P020220601501054858882.pdf	In 2025, the total consumption of renewable energy will reach about 1 billion tons of standard coal. "During the Fourteenth Five-Year Plan period, renewable energy will account for more than 50 per cent of the increase in primary energy consumption.	By 2025, the annual power generation capacity of renewable energy will reach about 3.3 trillion kilowatt-hours. "During the Fourteenth Five-Year Plan period, the incremental power generation from renewable energy sources will account for more than 50 per cent of the incremental power consumption of society as a whole, and the power generation from wind power and solar energy will be doubled.		
Modern Energy System Planning for the 14th Five-Year Plan Date of last amendment (in force): January 2022 https://www.nea.gov.cn/1310524241_16479412513081n.pdf	Increase the share of non-fossil energy consumption to around 20% by 2025	The share of electricity generation from non-fossil energy sources reaches about 39 percent	Energy saving and consumption reduction have been effective, and energy consumption per unit of GDP has dropped by 13.5% over the past five years.	emissions per unit of GDP by a cumulative 18% over five years.

5.3 Denmark

An increasing part of Danish buildings will be heated by district heating and heat pumps, since the government economically supports the increase of existing district heating networks, new district heating networks and the use of heat pumps. The Danish government also plans to drastically increase electricity production from wind turbines and PV panels. Part of this electricity production will be used to power heat pumps, for both small individual buildings and large heat pumps used for heating buildings in district heating areas.

Table 5 General summary and overview of the regulations for Denmark (not complete).

The NECPs containing the strategies of each of the member countries (period from 2021 to 2030)				
	Renewable strategy generation	Renewables on heating and cooling	DHC strategies	Energy efficicency
Denmark's strategies contained in the NECP (period from 2021 to 2030)	Off shore wind energy capacity will be increased by a factor of 7 by 2030 compared to 2024. Towards 2040 the capacity will be increased by additionally 10 GW. Denmark has additional set an ambition for an increase of renewable energy capacity on land by a factor of 4, corresponding to 50 TWh.	An increasing part of the heating demand will be covered by electricity in the future	Number of district heating grids will be increased by 2028	EU's directive on energy efficiency directive will be obeyed
Energy efficiency in the buildings sector				
Regulatory framework establishing the basic quality requirements to be met by buildings	Renewable energy in buildings	Energy consumption in buildings	Energy demand in buildings	Thermal system/equipment
BR20 Bygningsreglementet.dk Date of last amendment (in force): January 2023 Bygningsreglementet.dk	No requirements	Maximum energy for heating, ventilation, cooling and domestic hot water supply: 30 kWh/m² buiding per year	For new construction, there are requirements for dimensioning transmission loss. This requirement will ensure well-insulated constructions. It also ensures that you cannot meet the energy framework mainly with renewable energy; regardless of the use of renewable energy, the constructions must always be well insulated.	No requirements
District heating and cooling				
Regulatory framework establishing the basic quality requirements to be met by DHC	Are specific programs promoting district heating and cooling?	Particularities		
All municipalities have in 2023 worked out plans for new district heating grids. All planned grids must be establihed by 2028	Yes	66% of all buildings are heated by district heating		
Renewable Energy				
Regulatory framework establishing the basic quality requirements to be met by DHC	Targets for renewables in overall energy consumption	Targets for renewables in electricity generation	Energy efficiency	GHG emissions
Klimaprogram 2023: Regeringen vil bygge vejen til 2025- og 2030-målet færdig Date of last amendment (in force): September 2023 https://ens.dk/ansvarsomraader/energi-klimapolitik/national-energi-og-klimaplan-til-eu	Denmark must be free of fossil fuels by 2050	Off shore wind energy capacity will be increased by a factor of 7 by 2030 compared to 2024. Towards 2040 the capacity will be increased by additionally 10 GW. Denmark has additional set an ambition for an increase of renewable energy capacity on land by a factor of 4, corresponding to 50 TWh. The electricity consumption must be doubled by 2030 compared to 2023, and fivefold by 2050	EU's directive on energy efficiency directive will be obeyed	GHG emissions must be reduced by 70% in 2030 compared to 1990

5.4 France

Over the last ten years, France has adopted several laws and regulations to provide a framework for its energy policy objectives. The National Low Carbon Strategy (SNBC) from 2020 defines the long-term objectives until 2050. The goals are ambitious, with the country aiming to cover 100% of its energy consumption with low-carbon technologies by the middle of the century. This includes renewable technologies as well as nuclear power. In terms of CO_2 emissions, the aim is to achieve an 82% reduction by 2050 compared with 2018.

The interim targets for 2030 were first set out in the 2015 Energy Transition for Green Growth Act (LTECV). The National Energy and Climate Plan (NECP) requested by the European Commission defines updated and precise targets for 2030 and extends to 2035. In particular, the NECP sets quantified targets for installed renewable capacity by technology in the power sector, as well as ambitious targets for achieving a 45% share of renewables in the heating and cooling sector by 2030 and 55% by 2035.

In the building sector, the “Réglementation Environnementale” (RE) sets the targets that buildings must meet in terms of energy performance. The RE 2020 is the latest to come into force and introduces a novelty compared to previous regulations in that it covers not only the use phase of the building, but also the materials used and the construction phase. Regarding district heating and cooling, 25 specific measures have been defined in 2019 by the government to achieve the objectives set out in the NECP.

At an operational level, a Multiannual Energy Plan defines specific targets in terms of energy efficiency, installed capacity of the different technologies and CO_2 emission reductions for a given period. The current Multiannual Energy Plan is valid for ten years, until 2028.

Table 6 General summary and overview of the regulations for France (not complete).

The NECPs containing the strategies of each of the member countries (period from 2021 to 2030)				
	Renewable strategy generation	Renewables on heating and cooling	DHC strategies	Energy efficicency
France's strategies contained in the NECP (period from 2021 to 2030)	Share of renewable energy consumption in gross final energy consumption: 58 % decarbonised energy in the energy mix in 2030 and 71 % in 2035 (includes nuclear). Specific RE targets: In 2030: PV: 54 to 60 GW; Onshore wind: 33 to 35 GW; Offshore wind: 3.6 GW; Hydropower (including STEP): 26.3 GW In 2035: PV: 75 to 100 GW; Onshore wind: 40 to 45 GW; Offshore wind: 18 GW; Hydropower (including STEP): 28.5 GW	National target for the share of renewable heating and cooling in heating and cooling consumption of 45 % in 2030 (297 TWh) and 55 % in 2035 (between 330 and 419 TWh). As reference in 2021: 183 TWh (25 %).	Targets to increase DH and share of RE in DH: 2030: 68 TWh with 75 % RE; 2035: 90 TWh with 80 % RE (2021: 38 TWh with 60 % RE). Target for integrating waste heat in DH networks: 2030: 20 TWh, 2035: 25 to 29 TWh (2021: 5.4 TWh).	Target of a 30 % reduction in final energy consumption in 2030 compared to 2012, which is reflected in the following consumption by 2030: • final energy consumption: 1 209 TWh (104,0 Mtoe) • primary energy consumption: 1 829 TWh (157,3 Mtoe).
Energy efficiency in the building sector				
Regulatory framework establishing the basic quality requirements to be met by buildings	Renewable energy in buildings	Energy consumption in buildings	Energy demand in buildings	Thermal system/equipment
Réglementation Environnementale 2020 (RE2020) Date of last amendment (in force): Package of texts, with different dates, see list here: https://rt-re-batiment.developpement-durable.gouv.fr/textes-de-la-re2020-en-version-consolidee-a617.html https://rt-re-batiment.developpement-durable.gouv.fr/re2020-r320.html https://www.ecologie.gouv.fr/reglementation-environnementale-re2020	The RE 2020 does not define RE targets, but a non-renewable primary energy consumption coefficient (Cep,nr) in kWh/m²/a. The total maximum allowed non-renewable primary energy consumption of a building depends on Cep,nr (depends itself on building type) and other factors: 1/ geographic location 2/ converted attic floor area 3/ average apartment area 4/ total building area 5/ external constraints that limit the possibilities of natural ventilation. Additional indicator "$Ic_{énergie}$", which assesses the impact on climate change of the energy consumption of buildings over 50 years. A maximum value not to exceed is defined, which de facto pushes the increase of RE share. The maximum allowed emissions of a building related to energy consumption are then defined based on this indicator (which depends on building type) and the same parameters as for Cep,nr.	Similar to Cep,nr, the RE2020 defines Cep, the primary energy consumption coefficient. The maximum allowed total primary energy consumption of a building is then defined based on this coefficient (which depends on building type) and the same parameters as for Cep,nr. The difference with Cep,nr is for biomass (PEF of 1 here; 0 for Cep,nr) and district heat (PEF of 1 here; PEF depends on the share of RE for Cep,nr). PEF= primary energy factor	The Bbio coefficient (bioclimatic requirements) defines building requirements independently of chosen energy system. It takes into account building orientation; windows orientation; lighting; building compacity; UA-values of surfaces. The maximum Bbio not to exceed depends on 1/ building type 2/ geographic location 3/ converted attic floor area 4/ average apartment area 5/ total building area 6/ exposure to traffic noises.	The LCA is considered. Besides "$Ic_{énergie}$", "$Ic_{construction}$" is introduced, which assesses the impact on climate change of construction materials / equipment and of the construction phase. Maximum "$Ic_{construction}$" values not to exceed depend on 1/ building type 2/ construction year 3/ converted attic floor area 4/ Constraints on foundations 5/ distribution networks and roads/parkings 6/ geographic location 7/ PV panels installation for large buildings 8/ availability of data.
District heating and cooling				
Regulatory framework establishing the basic quality requirements to be met by DHC	Are specific programs promoting district heating and cooling?	Particularities		
NECP	Yes	The NECP defines objectives for 2030/2035 (see corresponding section in this table). 25 measures have been defined by the government (in 2019) in order to reach the objectives. The following fields are covered: 1/ Mobilisation and attractiveness of networks, 2/Consumer information and protection, 3/ Economic competitiveness of networks, 4/ Greening the energy delivered by networks, 5/ Innovation, Research & Development. Further details: https://www.ecologie.gouv.fr/sites/default/files/2019.10.07_eb_ew_dp_reseauxchaleurfroid.pdf		
Renewable Energy				
Regulatory framework establishing the basic quality requirements to be met by DHC	Targets for renewables in overall energy consumption	Targets for renewables in electricity generation	Energy efficiency	GHG emissions
Energy Transition for Green Growth Act (Loi de transition énergétique pour la croissance verte LTECV) Date of last amendment (in force): 18/05/2015 https://www.ecologie.gouv.fr/loi-transition-energetique-croissance-verte	Increase the share of renewable energy to 23 % of gross final energy consumption by 2020 and 32 % by 2030.		Reduce final energy consumption by 50 % by 2050 compared with the 2012 baseline, with an intermediate target of 20 % by 2030.	Reduce greenhouse gas emissions by 40 % between 1990 and 2030 and divide greenhouse gas emissions by four between 1990 and 2050 (factor 4).
Multiannual Energy Plan 2019-2028 (Programmation pluriannuelle de l'énergie PPE 2019-2028) Date of last amendment (in force): 21/04/2020 https://www.ecologie.gouv.fr/programmations-pluriannuelles-lenergie-ppe	No general target on RE penetration. Target of 20 % reduction in primary consumption of fossil fuels by 2023 and 35 % by 2028 compared with 2012. Specific targets on renewable heat consumption and renewable gas production.	73,5 GW in 2023 (+ 50 % compared to 2017). 101 to 113 GW in 2028 (+ 100 % compared to 2017).	Final energy consumption reduction of 6.3 % in 2023 and 15.4 % in 2028 compared to 2018.	Energy related emissions: 277 $MtCO_2$ in 2023 and 227 $MtCO_2$ in 2028, i.e. a reduction of 27 % in 2023 and 40 % in 2028 compared with 1990.
National Low Carbon Strategy (Stratégie nationale bas carbone SNBC) Date of last amendment (in force): 21/04/2020 https://www.ecologie.gouv.fr/strategie-nationale-bas-carbone-snbc	100 % low carbon energy production by 2050: biomass, energy from the environment (geothermal energy, heat pumps, etc.) and low carbon electricity.	100 % low carbon electricity by 2050, no specific target for RE.	40 % less energy consumption (not specified if primary or final) in 2050 compared to 2015 in all sectors.	445 $MtCO_{2eq}$ in 2018 (total emissions); objective of 80 $MtCO_{2eq}$ in 2050.
Law on accelerating the production of renewable energies (LOI n° 2023-175 relative à l'accélération de la production d'énergies renouvelables) Date of last amendment (in force): 10/03/2023 https://www.legifrance.gouv.fr/dossierlegislatif/JORFDOLE000046329719/	The law does not entail any target (which are defined in the SNBC, LTECV and PPE). It is an emergency legislation to accelerate the production of low carbon energy (not nuclear). The following four points are addressed: 1/ Plan with local elected representatives the deployment of renewable energies at local level 2/ Simplify authorisation procedures for renewable energy projects 3/ Mobilise areas that have already been artificialised for renewable energy development 4/ Share the value of renewable energy projects with the host regions.			

5.5 Germany

The German regulations, which are in the latest state mainly represented by the Gebäudeenergiegesetz (Building-energy-Law) is dedicated to support the national climate-protection goals. It's aims to provide economic, socially acceptable, and efficiency-increasing reductions of greenhouse gas emissions and to increase the amount of renewable energy used. It shall support the reduction of fossil energy sources and resulting import dependency and enable a sustainable transformation of the energy supply by applying the principles of economy.

Table 7 General summary and overview of the regulations for Germany (not complete).

The NECPs containing the strategies of each of the member countries (period from 2021 to 2030)				
	Renewable strategy generation	Renewables on heating and cooling	DHC strategies	Energy efficicency
Germany's strategies contained in the NECP (period from 2021 to 2030)	Achieve a 65% share of renewable energy in electricity consumption by 2030; The Federal Government is striving to achieve a renewable energy contribution of 30% to the gross final energy consumption by 2030 (share per year of 2020: 18%)	Target: Share of renewable energy in final energy consumption for heating and cooling of 14% in 2020, 20,5% in 2025 and 27% in 2030	The heat planning should represent the development of a net-zero greenhouse gas heat supply by 2045 and identify sub-areas suitable for pipeline or decentralised heat supply. The law also sets requirements for the roll-out of renewable energy and unavoidable waste heat in heat networks up to full decarbonisation in 2045	The Energy Efficiency Strategy 2050 (EffSTRA) sets out a reduction in the primary energy consumption by 30% compared to 2008 in 2030 --> Germany's contribution to the EU 2030 target.
Energy efficiency in the buildings sector				
Regulatory framework establishing the basic quality requirements to be met by	Renewable energy in buildings	Energy consumption in buildings	Energy demand in buildings	Thermal system/equipment
Building Energy Act (Gebäudeenergiegesetz, GEG) Date of last amendment (in force): January 2024 https://www.gesetze-im-internet.de/geg/index.html; - Ehttps://www.bundesregierung.de/breg-de/schwerpunkte/klimaschutz/neues-gebaeudeenergiegesetz-2184942 https://www.bgbl.de/xaver/bgbl/start.xav?startbk=Bundesanzeiger_BGBl&bk=Bundesanzeiger_BGBl&start=//*[@attr_id=%27bgbl107s1519.pdf%27]#__bgbl__%2F%2F*%5B%40attr_id%3D%27bgbl120s1728.pdf%27%5D__1701694647265	- New Heating System should have at least 65% renewable energy in new constructions in a new development area, start 01.01.2024 (depends on date of building application) - outside of new development areas, the new heating system should have minimum 65% RE - Heating systems installed before 2024 can still be operated with up to 100 percent fossil natural gas until 31 December 2044 at the latest renewable energy, start 30.06.2026 for cities with 100.000 inhabitants, 30.06.2028 for cities with less than 100.000 inhabitants	"energy performance certificate" is issued on the basis of recorded energy consumption; Primary energy demand (PED) must be calculated according to DIN V 18599: 2018-09. (Primary energy factors are provided in the GEG) For residential buildings: Data on thermal insulation and energy consumption for reference buildings is provided, new buildings must not exceed 55% of the calculated reference PED.	"energy requirement certificate" is an energy performance certificate which is based on the calculated energy demand and is issued in NAPE(National Energy Efficiency Action Plan)	No specific requirements on the technical parameters of systems. Only the required minimum share of RE is defined.
District heating and cooling				
Regulatory framework establishing the basic quality requirements to be met by	Are specific programs promoting district heating and cooling?	Particularities		
Building Energy Act (GEG), Federal Immission Control Act(BImSchG)	Yes	The German Federal Ministry for Economic Affairs, Energy and Climate (BMWK) offers financial support for the planning and implementation of highly efficient heating networks, including district heating, as part of the BEW funding programme. District heating networks are a fulfillment option in the GEG, if (at least 50% of) the heat is generated through RE, waste heat, CHP, or a combination of all		
Renewable Energy				
Regulatory framework establishing the basic quality requirements to be met by DHC	Targets for renewables in overall energy consumption	Targets for renewables in electricity generation	Energy efficiency	GHG emissions
Building Energy Act and Workingplan Energy Efficiency Date of last amendment (in force): January 2024 GEG - nichtamtliches Inhaltsverzeichnis (gesetze-im-internet.de) https://www.bmwk.de/Redaktion/DE/Downloads/Energie/20220517-arbeitsplan-energieeffizienz-energiesparen-fuer-mehr-unabhaengigkeit.pdf?__blob=publicationFile&v=6	Is the basis for complying with climate protection in the building sector and to reduce the dependence of fossil energy imports. The Switch to renewable Heating is subsidized by the state. Goal of climate neutrality by 2045. no specific numbers/shares.		Improved energy efficiency is a fulfillment option in the GEG. Targets: PED reduction by 37% until 2030 (compared to 2008), final energy demand reduction by 24% until 2030 (compared to 2008) minimum requirements for efficiency of new buildings are continously raised.	Part of the Energy Requirement Certificate and Part of the energy performance certificate; Germany's greenhouse gas reduction targets are set out in the **Federal Climate Protection Act** (as of August 2021). Emissions are to be reduced by at least 65% by 2030 and by at least 88% by 2040 (compared to 1990). In addition, permissible annual emission levels apply in individual sectors until 2030
Klimaschutzplan 2050 Date of last amendment (in force): 2016 Klimaschutzplan 2050 - Klimaschutzpolitische Grundsätze und Ziele der Bundesregierung (bmwk.de)	the energy demand in buildings is supposed to be reduced by 80% in 2050 (compared to 2008). The remaining energy demand is to be covered through RE. [Other than that, no specific numbers; Targets mostly communicated in the form of GHG-reductions.]		improve energy efficiency by decreasing the energy demand in buildings by 80% until 2050 (compared to 2008).	
EEG (Renewable Energy Law) Date of last amendment (in force): 26/07/2023 EEG_2023.pdf (gesetze-im-internet.de)	RE share of the gross electricity consumption in Germany shall be increased to at least 80% in 2030.	RE share of the gross electricity consumption in Germany shall be increased to at least 80% in 2030.		After the completion of the coal phase-out, the greenhouse gas neutrality of the electricity supply in the federal territory.

5.6 India

Table 8 General summary and overview of the regulations for India (not complete).

The NECPs containing the strategies of each of the member countries (period from 2021 to 2030)				
	Renewable strategy generation	Renewables on heating and cooling	DHC strategies	Energy efficicency
Indias's strategies	500 GW installed capacity and reach 50 per cent cumulative electric power installed capacity from clean energy sources by 2030	Not Planned	Not applicable	Not applicable
Energy efficiency in the buildings sector				
Regulatory framework establishing the basic quality requirements to be met by buildings	Renewable energy in buildings	Energy consumption in buildings	Energy demand in buildings	Thermal system/equipment
In India, the Green Building Code is a medley of codes and standards contained in the State by-laws, the National Building Code, the Energy Conservation Building Code (ECBC) National Building Code (NBC 2016) and/or Energy Conservation Building Codes (ECBC 2017)	No Data- Will update once data is available	No Data- Will update once data is available	No Data- Will update once data is available	Not Applicable
District heating and cooling				
Regulatory framework establishing the basic quality requirements to be met by DHC	Are specific programs promoting district heating and cooling?	Particularities		
Not applicable in India. No district heating and cooling network at present	No			
Renewable Energy				
Regulatory framework establishing the basic quality requirements to be met by DHC	Targets for renewables in overall energy consumption	Targets for renewables in electricity generation	Energy efficiency	GHG emissions
No Policy on District Heating Cooling	To attain a sustainable energy future by decarbonizing the Indian economy with net zero vision, India is committed to achieve 500 GW of installed electricity capacity from non-fossil fuel sources by 2030. Presently, a total of 172.72 GW capacity from non-fossil fuel-based energy resources has been installed in the country.	• To achieve 500 GW installed capacity and reach 50 per cent cumulative electric power installed capacity from clean energy sources by 2030		India's NDC target is to reduce emissions intensity of its GDP by 45 percent by 2030 from 2005 leveli

5.7 Italy

Italy's Integrated National Energy and Climate Plan outlines different and complementary goals for 2030. Italy intends to pursue a target of covering 40.5% of gross final energy consumption from renewable sources in 2030. The thermal sector plays a very important role in achieving these renewable targets; in fact, a decisive technological change toward solutions that favour the penetration of renewable sources is required. At the 2030 horizon, it is expected to reduce net greenhouse gas emissions by at least 55% (for emissions trading scheme sectors). Since 2015, the energy efficiency of buildings has been regulated by "Minimum energy performance requirements", in which the ministry promotes energy deductions, incentives and energy performance certificates.

Table 9 General summary and overview of the regulations for Italy (not complete).

The NECPs containing the strategies of each of the member countries (period from 2021 to 2030)				
	Renewable strategy generation	Renewables on heating and cooling	DHC strategies	Energy efficicency
Italy's strategies contained in the NECP (period from 2021 to 2030)	The contribution in the electricity sector is expected to reach 13,7 Mtoe by 2030 for RES generation, i.e. 160 TWh, with 48.9 % coverage of gross electricity consumption with renewable energy. In a 2040 perspective, the share of RES in the trasport sector increases to 21.9%, with a significant contribution also from biomethane and the emergence of hydrogen.	The thermal sector plays an important role in the development of current renewables policies: in absolute terms, it is expected that around 14,3 Mtoe of RES in the heating and cooling sector will be reached by 2030, mainly linked to the increase in the renewable component of annual heat pumps. As of 2030, solar thermal, geothermal and bioenergy systems58 (totalling 9,5 Mtoe), heat pumps (3,7 Mtoe) and CHP heat (1,0 Mtoe) are used in the heat sector. By 2030, the share of thermal RES reached 26.8 % compared to 19.7 % in 2021 (historical figure). Looking ahead to 2040, the share of thermal RES increases by up to 29.2 %.	The Reference Scenario projections indicate that, under existing policies, the heat delivered by efficient district heating networks would be 10 TWh in 2030. In the district heating and cooling sector, an indicative increase in the renewable share is expected, leading to a value close to 48 % by 2030	In order to contribute to achieving the European Union's binding final energy consumption target (referred to in Article 4 (1) and Annex I to the EED13 III), according to the calculation formula set out in Annex I to the EED III, Italy's level of consumption should be 92,1 Mtoe of final energy and 112,2 Mtoe of primary energy in 2030
Energy efficiency in the buildings sector				
Regulatory framework establishing the basic quality requirements to be met by buildings	Renewable energy in buildings	Energy consumption in buildings	Energy demand in buildings	Thermal system/equipment
DM 26 giugno 2015 'Applicazione delle metodologie di calcolo delle prestazioni energetiche e definizione delle prescrizioni e dei requisiti minimi degli edifici. Date of last amendment (in force): 26/06/2015 https://www.mimit.gov.it/index.php/it/normativa/decreti-interministeriali/decreto-interministeriale-26-giugno-2015-applicazione-delle-metodologie-di-calcolo-delle-prestazioni-energetiche-e-definizione-delle-prescrizioni-e-dei-requisiti-minimi-degli-edifici	D Lgs 8 novembre 2021, n. 199: The minimum contribution of energy from renewable sources will cover at least 60% of the annual energy demand for DHW, Heating and Cooling. Requirement of minimum power of Photovoltaic sources for the new buildings are: P=S*K (where S is the plan surface of building and K= 0,05 for new buildings and K=0,025 for refurbishments)	The limits on energy needs are determined with the use of the reference building. A reference building refers to a building that is identical in terms of geometry, orientation, territorial location, intended use and surrounding and having situation thermal characteristics and energy parameters predetermined in accordance herewith Appendix to Attachment 1 of DM 26 giugno 2015	It imposes limits for global average heat transfer coefficient, for summer equivalent solar area (chapter 3 of annex 1 od DM 26 Giugno 2015)	It imposes limits for average efficiency of generation systems (chapter 1 of annex 1 od DM 26 Giugno 2015)
District heating and cooling				
Regulatory framework establishing the basic quality requirements to be met by DHC	Are specific programs promoting district heating and cooling?	Particularities		
NECP	Yes	In order to tap into the potential of district heating, the tools currently available will be enhanced to facilitate the new construction and expansion of urban heat distribution infrastructure, especially where heat production hubs are close to consumption sites. With this in mind, in order to exploit the potential of district heating described in Mission 2, Component 3, Investment 3.1 "Development of district heating systems" was introduced to promote the deployment of efficient district heating networks through the construction of new networks or the extension/upgrading of existing networks. The measure was implemented by means of Ministerial Decree No 263 of 30/06/2022 and Public Notice No 435 of 23/12/2023. By Directorial Decree No 435 of 23/12/2022 of the DGIE of MASE, 29 projects were approved, which will generate approximately 0,073 Mtoe/year under the scheme		
Renewable Energy				
Regulatory framework establishing the basic quality requirements to be met by DHC	Targets for renewables in overall energy consumption	Targets for renewables in electricity generation	Energy efficiency	GHG emissions
NECP It refers to NECP: https://www.mase.gov.it/sites/default/files/PNIEC_2023.pdf.	Share of energy from RES in gross final energy consumption: from 27% (Reference scenario 2030) to 38,4% - 39% (FF55 REPowerEU Goals).	Share of energy from RES in final electricity consumption: from 49% (Reference scenario 2030) to 65%	Primary energy consumption: from 130 Mtoe (Reference scenario 2030) to 112.2 Mtoe (FF55 REPowerEU Goals: unexpected); Final energy consumption: from 109 Mtoe (Reference scenario 2030) to 92.1 Mtoe (FF55 REPowerEU Goals)	1. Reduction of GHG (Greenhouse Gas) vs 2005 for all plants bound by the ETS (Emissions Trading Scheme) regulations: from -55% (Reference scenario 2030) to -62% (FF55 REPowerEU Goals). 2. Reduction of GHG vs 2005 for all non-ETS (Non-Emissions Trading Scheme) sectors: from -28.6% (Reference scenario 2030) to -43.7% (FF55 REPowerEU Goals)

5.8 Netherlands

The Netherlands has committed itself to achieving the climate goals set out in the *EU Green Deal*. To combat climate change, the Dutch government wants to reduce the Netherlands' greenhouse gas emissions by 49% by 2030, compared to 1990 levels, and a 95% reduction by 2050. These goals are laid down in the Climate Act on May 28, 2019. The *Climate Plan, the National Energy and Climate Plan (NECP) and the National Climate Agreement* contain the policy and measures to achieve these climate goals[6]. The current government (as of 24 July 2024) has committed itself to existing, agreed, goals, but also stated they will not introduce measures that are stricter than the EU requires.

Measures identified in the *Climate Agreement* of 2019[7] include improving energy efficiency and reducing emissions in the electricity, industry, mobility, agriculture, land-use and built environment sector. This entails electrification of many sectors. The Netherlands aims to realise large swaths of offshore wind turbines for electricity production (and possibly hydrogen), combined with PV onshore.

In the built environment the present plans, as presented in the *Program for speeding up the sustainability of the built environment*[8], involve adding 1 million homes to the existing housing stock to alleviate the housing shortage, adding 125 thousand hybrid heat pumps by the year 2024, adding 500 thousand homes on district heating and realising 1 million installed heat pumps by 2030.

The previous government had planned to make mandatory for certain sectors of the market, and only if the payback time could be limited to maximum 7 years, the installation of hybrid heaters (or better) when replacing an old gas boiler. However, the present government has back tracked on this measure and did not propose an alternative plan for a quick reduction of the installed base of fossil fuel boilers. The implementation of the EPBD IV is expected to maintain the momentum in reducing carbon emissions from housing.

The transition to cleaner energy and heat now follows two paths:

- An individual path, mainly supported by subsidies for production of clean and/or renewable electricity and heat in the domestic and commercial/industrial sector such as the ISDE (domestic and small commercial) and SDE++ (large commercial and industrial). The ISDE aims to subsidise some 30% of the combined purchase and installation costs of heat pumps. These subsidies are quite popular and have resulted in almost 0.6 million heat pumps installed in 2023.
- And a collective, communal path (GIW, WGIW) that give communities bigger mandates for removing the gas grid from certain areas in order to introduce district heating. The measure requires grids to be locally owned for at least 50% (in order to improve local support for the transition). However, the plans have resulted in a stand-still as investors feel uncertainties in recuperating investments.

For those areas that are hard to electrify for 100% or are not suitable for district heating, the plan is to use renewable or clean gases in hybrid heat pumps by 2050. The Netherlands has a large agricultural sector which could be the basis for green gases. The use of hydrogen for heating homes is, besides for some experiments, not seen as realistic for the short term. The development of large hydrolysers for hydrogen production is supported mainly for the industrial sector.

At the same time plans must not raise nitrogen emissions in protected environmental areas and must not increase the load in the electricity grid. As regards the latter, as over 90% of Dutch homes are heated by natural gas, the electricity grid is currently not equipped to cope with such a sudden increase of loads from PV, wallboxes for electric vehicles, electric (induction) cooking hobs and electric heaters (such as heat pumps, but also IR panels). Therefore, the Netherlands has seen a quick rise in interest in smart appliances that can react to the actual grid status.

The overview below is mainly based on plans laid out in the NECP of July 2024, published just before the current government was installed, and may be subject to change.

6 https://www.government.nl/topics/climate-change/climate-policy

7 https://www.klimaatakkoord.nl/documenten/publicaties/2019/06/28/national-climate-agreement-the-netherlands

8 In Dutch: Programma Versnelling Duurzame Gebouwde Omgeving (https://www.rijksoverheid.nl/documenten/rapporten/2022/06/01/beleidsprogramma-versnelling-verduurzaming-gebouwde-omgeving)

Table 10 General summary and overview of the regulations for the Netherlands (not complete).

The NECPs containing the strategies of each of the member countries (period from 2021 to 2030)				
	Renewable strategy generation	Renewables on heating and cooling	DHC strategies	Energy efficiency
The Dutch NECP targets and progress (2021 to 2030) - update of july 2024 [https://www.rijksoverheid.nl/documenten/kamerstukken/2024/06/21/definitieve-update-integraal-nationaal-energie-en-klimaatplan]	When limited to the built environment, the targets for 2030 are to increase the share of renewable energy to 41-48% of final energy. This is almost a tripling of the previous target of 17% and is to be achieved by employing more heat pumps and more RE in electricity. For RE as heat the target is 17-24% (0,95 % points growth per year is within reach) coming from 8.8% in 2023 and is mainly biomass; For RE in DH the target is still 51% from renewable sources (and 13% from waste heat).		The target is to add 500 thousand new connections by 2030, raising DH energy consumption from 8 PJ (2000) to 16 PJ (in 2030).	According the RED III NL is required to reduce final energy consumption by 11.7%. This appears achievable only if all measures work out as planned.
Energy efficiency in the buildings sector				
Regulatory framework establishing the basic quality requirements to be met by buildings	Renewable energy in buildings	Energy consumption in buildings	Energy demand in buildings	Thermal system/equipment
Besluit bouwwerken leefomgeving (Bbl) [https://wetten.overheid.nl/BWBR0041297/2024-08-01]	Status 2022: 8,8% of final energy consumption was renewable heat, mainly biomass. A requirement for a minimum share of renewable heat when replacing existing gas boilers (by replacing them with, at minimum, hybrid heat pumps) was recently abandoned.	There are thresholds for maximum heat demand, maximum primary energy consumption and minimum share of renewable energy in total energy consumed for new buildings (including heavily retrofitted). The specific thresholds depend on building characteristics (take into account floor/volume ratio).	Besides requirements on max. heat demand for new buildings, the NL have national subsidies for thermal insulation, and renewable heating installations in existing buildings. The goal is to insulate 2.5 million dwellings.	See targets on the lef. As regards the systems market: After some years of double digit growth (2021-2022-2023) the heat pump market has shrunk in 2024, following normalisation of gas prices and abandoning stricter system efficiency requirements.
District heating and cooling				
Regulatory framework establishing the basic quality requirements to be met by DHC	Are specific programs promoting district heating and cooling?		Particularities	
Several laws apply. Although not set in stone, the NL plan is to arrive in 2050 at 1/3 of housing stock connected to DH (which should be net zero by 2050), 1/3 all-electric (heat pumps) and 1/3 using renewable gases in (hybrid) heating solutions.	The target in the Climate Agreement is to add 500 thousand new homes heated by DH. Municipalities are required by law to develop plans for a local energy infrastructure. The WGIW, which allows municipalities to set a date for removal of gas grid, has been passed by parliament. The WCW law which requires (a.o.) that at minimum 50% of DH grids are in public hands and DH tariffs are reasonable and affordable, is currently being discussed in the parliament. Together these two laws should provide the legal framework for development of more DH.		DH grids have to report on their energy sources, heat losses en GHG emissions. Following price hikes in 2023 (because the DH tariff was linked to gas prices) the general public is now quite weary about DH and interest seems to shift to individual solutions. Policy makers and energy consultants consider (very) low temperature grid as more attractive than medium or high temperature grids, provided that domestic hot water can be produced clean (low GHG) and safe and with sufficient comfort. Low temperature grids offer a better combination with various renewable heat sources.	
Renewable Energy				
Regulatory framework establishing the basic quality requirements to be met by DHC	Targets for renewables in overall energy consumption	Targets for renewables in electricity generation	Energy efficiency	GHG emissions
Several laws apply, but targets for RE are set in overarching legislation (see NECP)	See NECP	See NECP	The NL will implement targets in accordance with RED III	The goal is to reduce GHG emissions by 55% in 2030. The plans are to achieve a 60% reduction in order to reduce risk of underperforming. However GHG accounting calculations shows that current policies achieve 39-50% reduction (insufficient) and planned policies 46-57% reduction, which could achieve the goal of 55% if all goes as planned in 2023.	

5.9 Portugal

Portugal is deeply committed to the energy transition challenges, aiming to harvest the potential benefits of a relative abundance of renewable energy resources. The national strategy is laid in two main documents, the National Energy and Climate Plan, setting the ambition and national energy policy up to 2030, and the Carbon Neutrality Roadmap 2050, which points the long-term pathways towards the goal of achieving carbon neutrality in 2050. These strategic policy documents, common to all European countries, are complemented by a set of strategies, namely:

- the National Strategy for Hydrogen, published in 2020, that aims to create hydrogen economy in Portugal by incentivizing supply and demand in several sectors, enabling the gradual introduction of hydrogen as a sustainable and integrated pilar within the wider scope of the national energy strategy.
- the Long-Term Strategy for Building Renovation, published in 2021, that identifies and quantifies relevant measures to achieve primary energy savings in the building sector of 11% by 2030 and 34% by 2050 and reduce the number of hours of discomfort by 26% in 2030 and 56% by 2050 through the deployment of energy efficiency measures within the scope of building renovation.
- the Action Plan for Biomethane, published in 2024, establishing an integrated strategy to develop the national biomethane market as a sustainable path to reduce GHG emissions, reducing natural gas imports for the industrial and residential sectors, considering also its use in the transport sector.

Other relevant documents, in terms of national legislation, include:

- the Decree-Law 15/2022, that establishes the organization and operation of the National Electric System, transposing to the national legislation the Directive (EU) 2018/2001 relative to the promotion of the use of renewable energy sources.
- the Decree-Law 101-D/2020, that establishes the applicable requirements to the construction and renovation of buildings with the aim of ensuring and promote the improvement of their energy performance and regulates a Building Energy Certification System, transposing to the national regulation Directive (EU) 2018/884 relative to the energy performance of buildings and Directive (EU) 2012/27/UE relative to energy efficiency.
- the Decree-Law 71/2008 as currently redacted, that establishes the Intensive Energy Consumption Management System, aimed at industrial facilities considered intensive energy consumers, imposing the performance of periodic energy audits focusing on the conditions of energy consumption and promoting the adoption of energy efficiency measures and integration of energy from renewable energy sources by imposing the elaboration and execution of Energy Consumption Rationalization Plans.

The following

Table 11 summarizes the main strategies, targets and regulations regarding energy efficiency and renewable energy use in Portugal.

Table 11 General summary and overview of the regulations for Portugal (not complete).

The NECPs containing the strategies of each of the member countries (period from 2021 to 2030)				
	Renewable strategy generation	Renewables on heating and cooling	DHC strategies	Energy efficicency
Portugal's strategies contained in the NECP (period from 2021 to 2030)	To achieve a 47% share of energy from renewable sources in the gross final energy consumption by 2030. The target for the power sector is 69% in 2025 and 80% in 2030 (26,3 GW and 30,5 GW to 31,5 GW of renewable capacity installed in 2025 and 2030, respectively). Decarbonization of the power sector is expected to be driven by solar and wind (on and offshore) technologies together with the incentive of distributed generation and energy storage, improvement and optimization of the power grid and promotion of pilot-projects for CSP, geothermal and wave power production technologies.	To achieve a share of energy from renewable sources in the heating and cooling sector of 45% in 2025 and 49% in 2030. The growth of the renewable heating and cooling share will be driven by energetic valorization of forestry biomass in decentralized small scale plants, blending of renewable gases in the existing natural gas network, deployment of heat pumps in the building sector and deployment of solar thermal in buildings and industries.	No strategy due to low relevance. Due to low space heating needs district heating solutions are not economically viable (for more information see https://www.dgeg.gov.pt/media/t2bngb4c/district-heating-and-cooling-potential-in-portugal-deir-studies-003-2021.pdf).	Reduction in primary energy consumption of 35% by 2030 as compared to the EU Reference Scenario of 2007 (PRIMES model). The reduction in primary energy consumption will be driven by: building renovation and construction of new buildings as NZEB - to spur these developments the Building Energy Certificate System will be revised together with the introduction of a new Energy Certificate for buildings and building renovation funding/support mechanisms will be reformulated; reduction of energy use in the transportation sector by combining active and shared mobility, strengthening public transportation systems and electric mobility schemes; promote greater efficiency in the industrial sector; etc.
Energy efficiency in the buildings sector				
Regulatory framework establishing the basic quality requirements to be met by buildings	Renewable energy in buildings	Energy consumption in buildings	Energy demand in buildings	Thermal system/equipment
Decree Decreto-Lei 78/2006, 79/2006 and 80/2006 Date of last amendment (in force): Decree Decreto-Lei n.º 101-D/2020, 7 december 2020 , decree Decreto-Lei n.º 118/2013, de 20 August 2013 and Dispatch n.º 3777/2017, de 5 May 2017 https://www.dgeg.gov.pt/pt/areas-setoriais/energia/eficiencia-energetica/edificios/; https://diariodarepublica.pt/dr/detalhe/decreto-lei/101-d-2020-150570704; https://epbd-ca.eu/wp-content/uploads/2022/10/Implementation-of-the-EPBD-in-Portugal-%E2%80%93-2020.pdf; https://files.dre.pt/2s/2021/07/126000001/0003000032.pdf	The new buildings have to be nZEB. The definition of the methodology for nearly zero-energy buildings ("nZEB"), which requires all new buildings to comply with these requirements, imposing that the energy needs of new buildings be met using a renewable component of more than 50 per cent.	Energy needs by construction period - Residential [kWh/m2 .year]: heating 146 kWh/m2 and cooling 20 kWh/m2 for building constructed before 1945; heating 37 kWh/m2 and cooling 10 kWh/m2 for building constructed after 2016 Requirements for new residential buildings (nZEB): Classe A or better; Heating energy needs ≤ 75% (I1), 85% (I2), 90% (I3) of the reference heating needs. Cooling energy needs ≤ of the reference cooling needs. Primary annual energy needs ≤ 50% of the reference primary annual energy needs.	Requirements for energy performance of residential buildings in current building code I1 – 73 kWhep/m² I2 – 97 kWhep/m² I3 – 140 kWhep/m² Average calculated primary energy needs, for new residential buildings, according to the different winter climatic zones; Requirements for energy performance of non-residential commercial buildings in current building code I1 – 312 kWhep/m² I2 – 256 kWhep/m² I3 – 346 kWhep/m² Average calculated primary energy needs, for new commercial buildings (hotels and office buildings, floor area above 1,000 m2), according to the different winter climatic zones.	Heat pumps cooling/heating : Eurovent Label B (Example: Chiller COP ≥ 3.0; EER ≥ 2.9); Heat pumps for DHW COP ≥ 2.3; Domestic Electric Storage Water Heaters must have Maximum stand-by heat loss Heat pump to be considered renewable SCOP>2.5
District heating and cooling				
Regulatory framework establishing the basic quality requirements to be met by DHC	Are specific programs promoting district heating and cooling?	Particularities		
N/A	No	Due to low space heating needs district heating solutions are not economically viable (for more information see https://www.dgeg.gov.pt/media/t2bngb4c/district-heating-and-cooling-potential-in-portugal-deir-studies-003-2021.pdf).		
Renewable Energy				
Regulatory framework establishing the basic quality requirements to be met by DHC	Targets for renewables in overall energy consumption	Targets for renewables in electricity generation	Energy efficiency	GHG emissions
National Energy and Climate Plan 2030 approved by Resolução do Conselho de Ministros n.º 53/2020 Date of last amendment (in force): 10/07/2020 https://files.diariodarepublica.pt/1s/2020/07/13300/0000200158.pdf	To achieve a 47% share of energy from renewable sources in the gross final energy consumption by 2030.	To achieve a share of electricity from renewable energy sources of 80% by 2030 and 100% by 2050.	Reduction in primary energy consumption of 35% by 2030 as compared to the EU Reference Scenario of 2007 (PRIMES model).	Reduction of 55% of GHG emissions by 2030 compared to 2005 (Lei n.º 98/2021). Emissions reduction of 85% to 90% by 2050, compared to 2005, offsetting the remaining emissions through land use and forests.
Carbon Neutrality Roadmap 2050 approved by Resolução do Conselho de Ministros n.º 107/2019 Date of last amendment (in force): 01/07/2019 https://files.diariodarepublica.pt/1s/2019/07/12300/0320803299.pdf				
Decreto- Lei n.º 15/2022 of 14 January establishing the organization and functioning of the National Electric System transposing Directive (EU) 2019/944 and Directive (EU) 2018/2001 Date of last amendment (in force): 14/01/2022 https://files.dre.pt/1s/2022/01/01000/0000300185.pdf				
Decreto-Lei n.º 84/2022 of 9 December partially transposes Directive (EU) 2018/2001 establishing targets relating with energy consumption from renewable sources in the transport sector and establishes sustainability criteria for bioenergy sources in the transport sector, establishes guarantees of origin. Date of last amendment (in force): 09/12/2022 https://files.dre.pt/1s/2022/12/23600/0000800045.pdf				

5.10 Spain

Spain is progressing toward its 2030 decarbonization targets, especially in the electricity sector. The share of renewables in the national electricity mix grew from 33% in 2010 to 44% in 2020. Spain's overall energy strategy employs an 'efficiency first' principle and promotes increasing renewable energy installations in buildings and for industry. It also intends to support the production of advanced biofuels, renewable gases and hydrogen. Spain's draft updated NECP, submitted on 28 June 2023, has as main target a reduction of -44.7% for Greenhouse (GHG) emissions in Effort Sharing Regulation (ESR) sectors in 2030 (compared with 2005). The NECP outlines the energy efficiency measures in existing buildings in the residential sector. The government is promoting energy upgrades of the existing building stock, prioritising the thermal envelope of buildings as well as thermal installations for heating, cooling and hot water.

Table 12 General summary and overview of the regulations for Spain (not complete).

The NECPs containing the strategies of each of the member countries (period from 2021 to 2030)				
	Renewable strategy generation	Renewables on heating and cooling	DHC strategies	Energy efficicency
Spain's strategies contained in the NECP (period from 2021 to 2030)	The NECP projects the installation of about 60 GW of new renewable generation through 2030 (almost 6 GW annually), led by wind and solar, amounting to 74% of total electricity generation that year	Spain's NECP includes ambitious plans to double the contribution of renewables in the heating and cooling sector by 2030, from 16.8% in 2015	The government is looking to expand district heating and cooling installations that use renewable sources from currently low levels. At present, just 0.15% of the heating and cooling sector uses district heating and cooling networks	Energy efficiency improvement of 39.5% by 2030 (relative to 2007 levels), which will translate into primary energy consumption of 98.5 Mtoe.
Energy efficiency in the buildings sector				
Regulatory framework establishing the basic quality requirements to be met by buildings	Renewable energy in buildings	Energy consumption in buildings	Energy demand in buildings	Thermal system/equipment
Technical Building Code (Royal Decree 314/2006) Date of last amendment (in force): June 2022 (Royal Decree 450/2022) https://www.codigotecnico.org/	The minimum contribution of energy from renewable sources will cover at least 70% of the annual energy demand for DHW Requirement of minimum generation of electricity from renewable sources when the constructed area exceeds 1000m2.	Limitation on the primary energy comsuption for new buidings. The limitation depends on climatic zone. Non renewable primary energy: For residential buildings varies between 20 and 43 kWh/m2y for new buildings and between 40 and 80 kWh/m2y for refurbishments Total primary energy: For residential buildings varies between 40 and 86 kWh/m2y for new buildings and between 55 and 115 kWh/m2y for refurbishments	It imposes limits for thermal transmittance of the envelope and internal partitions, solar control of the thermal envelope and condensation control	In order to be considered as a renewable contribution, heat pumps intended for the production of DHW must have a seasonal average efficiency value (SCOPdhw) equal to or greater than 2.5 when electrically driven and equal to or greater than 1.15 when driven by thermal energy
District heating and cooling				
Regulatory framework establishing the basic quality requirements to be met by DHC	Are specific programs promoting district heating and cooling?	Particularities		
NECP	Yes	In particular, in the NECP, district cooling networks are considered one of the tools that will increase the share of renewable energy in the consumption of heating and cooling by 1.3% per year from 2020 levels.		
Renewable Energy				
Regulatory framework establishing the basic quality requirements to be met by DHC	Targets for renewables in overall energy consumption	Targets for renewables in electricity generation	Energy efficiency	GHG emissions
Bill on Climate Change and Energy Transition approved on May 2021 (Law 7/2021) Date of last amendment (in force): May 2021 https://www.boe.es/diario_boe/txt.php?id=BOE-A-2021-8447	To achieve a penetration of renewable energies in final energy consumption of at least 42% by the year 2030	To achieve an electricity system with at least 74 % of generation from renewable energy sources by 2030	Improve energy efficiency by reducing primary energy consumption by at least 39.5%, with respect to the baseline by 2030	
Decarbonization Strategy to 2050 (EPL 2050) Date of last amendment (in force): November 2022 https://ec.europa.eu/clima/sites/lts/lts_es_es.pdf	The ELP 2050 sets out a path that will allow a fully renewable energy end-use by mid-century	2050 objective of 97% renewable energy in the total energy mix. As such, it is centred on the massive development of renewable energy, energy efficiency, electrification and renewable hydrogen.		It sets the reduction of greenhouse gas (GHG) emissions by 90% by 2050 compared to 1990. The remaining 10% will be absorbed by carbon sinks.

5.11 Switzerland

Switzerland's national regulations and strategies aim to address climate protection goals, with particular focus on the energy sector. The Swiss Energy Strategy 2050 lays out a comprehensive plan for transitioning Switzerland towards a more sustainable and energy-efficient future. It includes detailed targets for reducing energy consumption and greenhouse gas emissions in the building sector. The strategy sets forth goals such as a 50% reduction in building-related GHG emissions by 2030 compared to 1990 levels and ultimately achieving net-zero emissions by 2050. Cantonal regulations, such as the MuKEn (Model Regulations of the Cantons in the Energy Sector), establish energy performance standards for new constructions and major renovations. These regulations also provide incentives for retrofitting existing buildings to enhance thermal insulation and integrate renewable heating systems. The overall goal is to decrease reliance on fossil fuels, improve energy efficiency, and support the transition to a carbon-neutral building sector.

Table 13 General summary and overview of the regulations for Switzerland (not complete).

The NECPs containing the strategies of each of the member countries (period from 2021 to 2030)				
	Renewable strategy generation	Renewables on heating and cooling	DHC strategies	Energy efficicency
Switzerland's strategies contained in the NECP (period from 2021 to 2030)	Average domestic production renewable energies without hydropower - in the year 2020: 4'400 GWh - in 2035: 11,400 GWh Electricity generation from renewable energies: new installation of about 10.5 TWh until 2030, and 42 TWh until 2050			Article 3 of the Energy Act (EnG) stipulates that final energy consumption per capita is to be reduced by 43% and electricity consumption by 13% by 2035 compared to 2000.
Energy efficiency in the buildings sector				
Regulatory framework establishing the basic quality requirements to be met by buildings	Renewable energy in buildings	Energy consumption in buildings	Energy demand in buildings	Thermal system/equipment
In the Energy Act of September 30, 2016 (EnG) sets out the framework conditions in buildings, which are then implemented at cantonal level. Date of last amendment (in force): February 2024 https://www.fedlex.admin.ch/eli/cc/2017/762/de https://www.endk.ch/de https://www.endk.ch/de/ablage/dokumentation-archiv-muken/Gebaeudepolitik_2050-PLUS_D_20220826.pdf/at_download/file	The Energy Act sets out the framework conditions for renewable energies in buildings, which are then implemented at cantonal level: - Art 45 (EnG): The cantons shall issue shall issue regulations on: a. the maximum permissible proportion of non-renewable energies to cover the heat requirement for heating and hot water; b. the new installation and replacement of stationary electric resistance heating systems; c. the consumption-based billing of heating and hot water costs for new buildings and for significant renovations of existing buildings; d. the production of renewable energies and energy efficiency - Art 54a of EnG: Obligation to utilise solar energy in buildings which exceed a building area of 300m2 (solar energy use can be PV and solar thermal energy)	The Energy Act sets out the framework conditions for energy consumption in buildings, which are then implemented at cantonal level.	The Energy Act sets out the framework conditions for energy requirements in buildings, which are then implemented at cantonal level.	The Energy Act sets out the framework conditions for heat, which are then regulated at cantonal level. Energy Strategie 2050+ of Conference of Cantonal Energy Directors: - New buildings are supplied entirely with renewable heat. - Only renewable heating systems will be installed in existing buildings. - By 2050 at the latest, all buildings must be CO2-free.
District heating and cooling				
Regulatory framework establishing the basic quality requirements to be met by DHC	Are specific programs promoting district heating and cooling?	Particularities		
NECP	Yes	Integration with Renewable Energies: Switzerland emphasizes integrating district heating and cooling networks with renewable energies to reduce CO2 emissions and promote sustainability. Network Planning and Expansion: Planning and expanding district heating and cooling networks often require coordination with other infrastructure projects to leverage synergies and save costs. Price Regulation: Some cantons have price regulations for district heating and cooling to ensure transparency and fair prices for consumers.		
Renewable Energy				
Regulatory framework establishing the basic quality requirements to be met by DHC	Targets for renewables in overall energy consumption	Targets for renewables in electricity generation	Energy efficiency	GHG emissions
Energy perspectives (Energieperspektiven, EP) 2050+ Date of last amendment (in force): June 2021; On June 9, 2024, Switzerland will vote on a federal law for renewable energies that creates the basis for more electricity from water, sun, wind and biomass. https://www.bfe.admin.ch/bfe/de/home/politik/energieperspektiven-2050-plus.html	42 TWh electricity generation from renewable energies by technology in the ZERO basis scenario 2050	24.2 TWh 2050; Three expansion paths for renewable electricity production (excluding hydropower) are considered. The "balanced annual balance 2050" strategy variant aims to cover future Swiss electricity demand by decarbonizing the energy system. This is the focus of the short report. The "reference values/expansion targets" variant is based on the expansion targets of the Energy Act (2035: 11.4 TWh) and the targets of the Energy Strategy 2050 (24.2 TWh by 2050). The "current framework conditions" variant takes into account the existing laws and market conditions.	Article 3 of the Energy Act (EnG) stipulates that final energy consumption per capita is to be reduced by 43% and electricity consumption by 13% by 2035 compared to 2000.	In the net zero scenario, Energy Perspectives 2050+ examine an energy system development aligned with the 2050 target of net zero greenhouse gas emissions.