2.4 Renewable energy policy

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In this section, we first give an overview of what renewable energy is and explore why the EU cares about it. We then look at how renewable energy is used in different sectors. Finally, we describe the most relevant strategies and legislation to mainstream renewable energy in the EU.

2.4.1 What is renewable energy?

According to the EU's Renewable Energy Directive (2018/2001,Art. 2), as it is currently in force, wind, solar (thermal and photovoltaic) and geothermal energy, osmotic energy, ambient energy, tide, wave and other ocean energy, hydropower, biomass, landfill gas, sewage treatment plant gas and biogas are renewable energy.[83] It is important to note that renewable and non-greenhouse gas (GHG) emitting energy sources are not synonyms according to this definition. For example, nuclear power plants do not pollute the air or emit GHG when producing electricity, but the material most often used to generate nuclear energy, uranium, is generally a non-renewable resource and as a consequence nuclear energy is not considered renewable. The 2023 amendment of the Renewable Energy Directive through Directive (EU) 2023/2413, which we will discuss more extensively below, included new definitions of renewable energy sources (RES) and some modifications of the existing ones. One of the main updates was a 'generalisation' of the definition of renewable fuels of non-biological origin (which replaces the previous renewable liquid and gaseous transport fuels of non-biological origin).

The (increasing) penetration of RES in an energy system is typically measured using metrics such as the RES share in primary energy demand or in gross final consumption of energy.[84] Regarding the power system, other metrics such as electricity production (in GWh) and installed capacity (in GW) are typically used.

2.4.2 Why does the EU care about renewable energy?

Several reasons justify the EU's interest in promoting RES. Among them is the aim to achieve a more environmentally sustainable energy system. This is seen in how RES contribute to reducing GHG emissions and local pollutants and consequently to climate change mitigation and improvement of air quality.

Furthermore, penetration of RES in the energy mix can also help with other traditional aims of EU energy policy, such as competitive energy prices and reducing reliance on fossil fuel imports. Such considerations are linked with the objectives of ensuring security of supply and price affordability, which became very pressing as a result of the energy crisis. Moreover, promoting renewable energy can create new opportunities for employment in the EU, help ensure the leadership of EU manufacturers in green technologies and contribute to overall economic growth. The benefits and risks related to decarbonisation of the energy sector are also considered in a Communication from the EC that updates the 2020 New Industrial Strategy (EC, 2021). Among other things, the document aims to promote investment in

83 A discussion of what renewable gas is can be found in the March 2018 FSR Topic of the Month, available at https://fsr.eui.eu/what-is-renewable-gas/ (accessed 10 February 2023). A more recent discussion on renewable gases is provided in Conti (2020).

84 Gross final consumption of energy is defined in Article 2(4) of Directive (EU) 2018/2001 as the "*the energy commodities delivered for energy purposes to industry, transport, households, services including public services, agriculture, forestry and fisheries, the consumption of electricity and heat by the energy branch for electricity, heat and transport fuel production, and losses of electricity and heat in distribution and transmission*."

renewables and increase the ambitions of Member States but without overlooking dependency on foreign countries for raw materials that are strategic in new technologies (see Section 3.5 for further details).

The EU's commitment to renewable energy has long been established and is attested by Art. 194 of the Treaty on the Functioning of the European Union (TFEU), which states that Union policy on energy shall promote the development of new and renewable forms of energy in a spirit of solidarity between the Member States. However, the same article specifies that the promotion of RES shall be without prejudice to the right of Member States to determine the conditions for exploiting their energy resources, their choices between different energy sources and the general structure of their energy supply (see Section 1.2).

2.4.3 How is renewable energy used in different sectors?

The use of RES has experienced rapid growth in recent years in the EU, driven by falling costs and policy support. Through appropriate technologies, RES can be used in different sectors, namely electricity, transport and heating and cooling. For the time being, RES penetration in the electricity sector has attracted most attention due to the availability of relatively more mature technologies like solar photovoltaics (PV) and onshore wind. According to Eurostat, the share of RES in the EU electricity sector in 2022 was 41.2%.[85]

However, electricity currently represents only a quarter of European final energy consumption. The transport sector and the heating and cooling sector represent about 20% and 50% respectively.[86] These sectors cannot be ignored if one aims to achieve significant decarbonisation of the energy system, but efforts to increase the use of RES have so far obtained limited results. Among the sparse success stories are Sweden in general, or Finland and the Baltic states when it comes to the use of RES in heating and cooling. The overall EU picture looks very different, however. According to Eurostat, the share of RES was only 9.6% in the EU transport sector and 24.8% in heating and cooling in 2022. To reach decarbonisation objectives, electrification of the transport and heating and cooling sectors should go hand in hand with mainstreaming the use of RES in these sectors.

85 See Eurostat's renewable energy statistics, available at https://ec-europa-eu.eui.idm.oclc.org/eurostat/statistics-explained/index.php?title=Renewable_energy_statistics (accessed 5 March 2024).

86 See Eurostat's energy statistics, available at https://ec.europa.eu/eurostat/statistics-explained/index.php/Energy_statistics_-_an_overview#Final_energy_consumption (accessed 5 March 2024) and https://energy.ec.europa.eu/topics/energy-efficiency/heating-and-cooling_en#:~:text=Heating%20and%20cooling%20plays%20a,of%20both%20transport%20and%20electricity (accessed 5 March 2024).

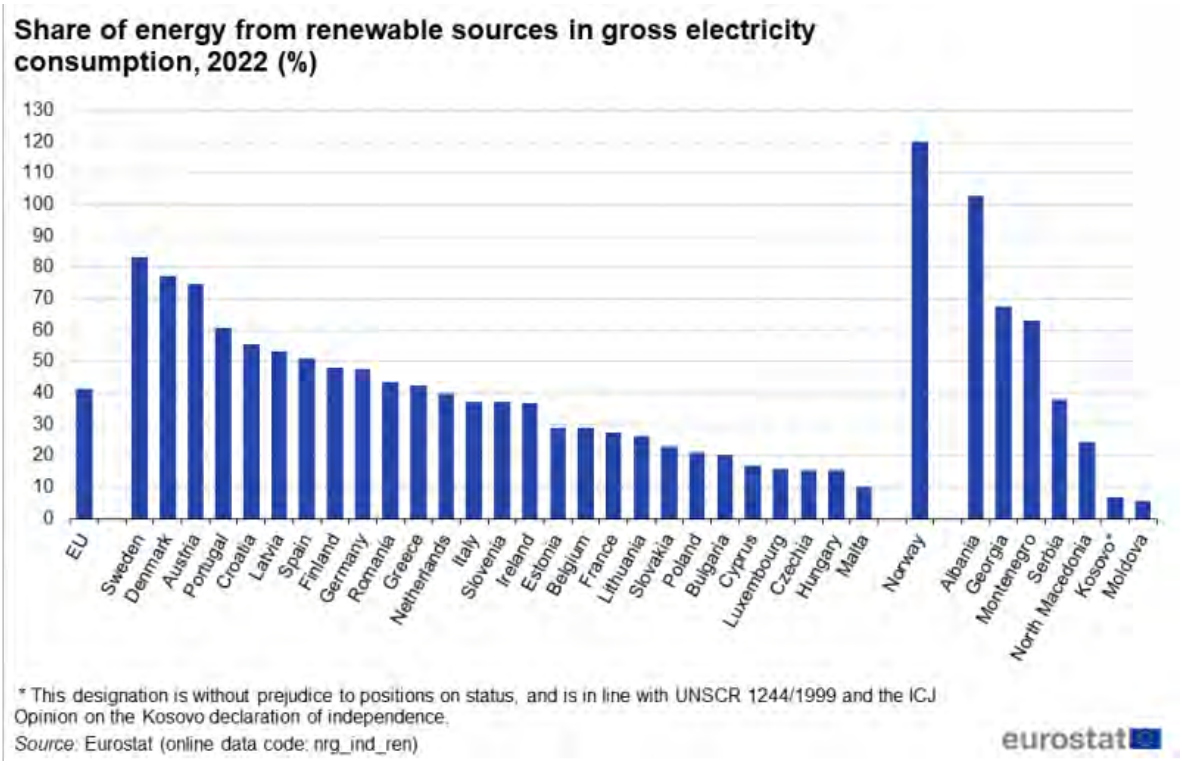

Figure 2.3: Share of energy from renewable sources in gross electricity consumption, 2022 (source: Eurostat, 2023)

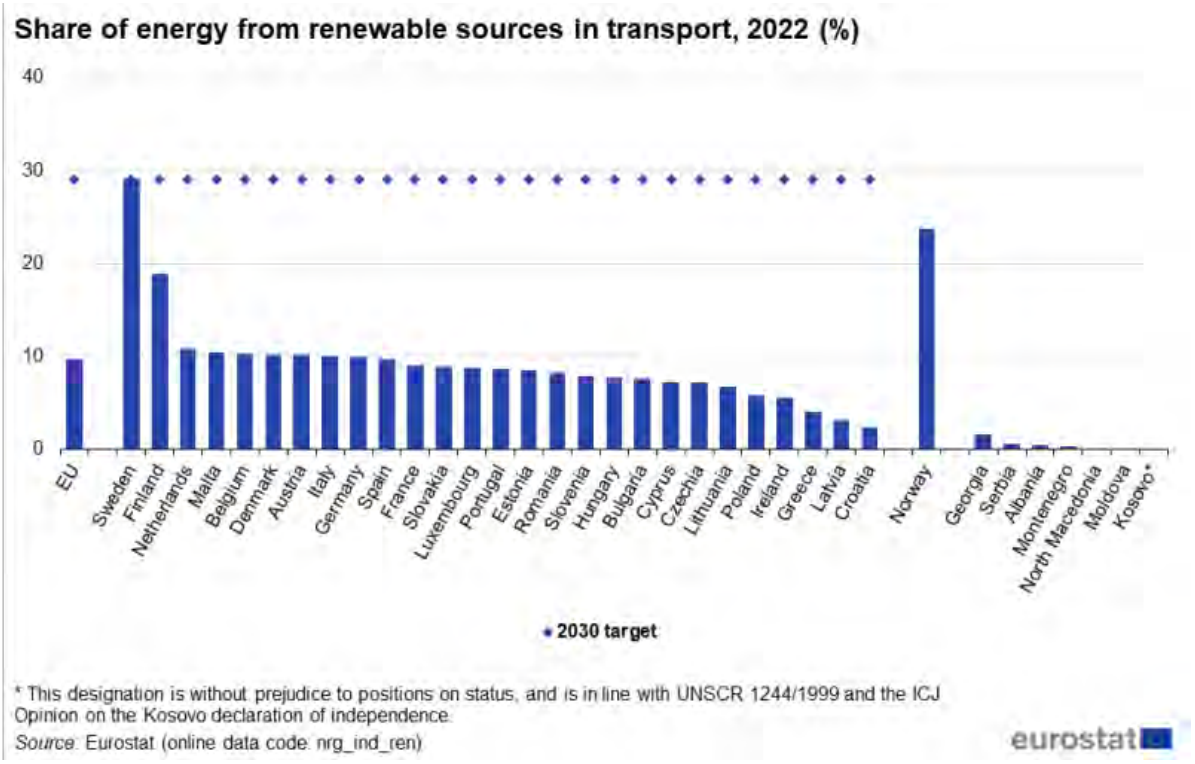

Figure 2.4: Share of energy from renewable sources in transport, 2022 (source: Eurostat, 2023)

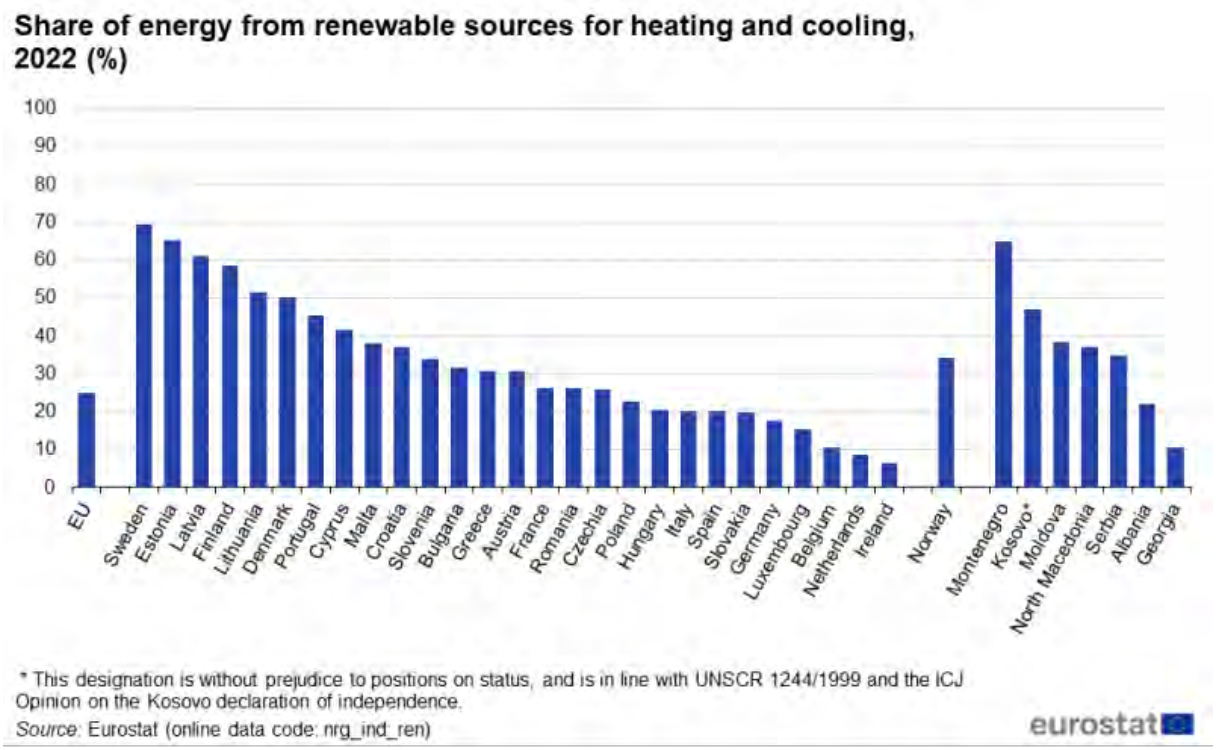

Figure 2.5: Share of energy from renewable sources for heating and cooling, 2022 (source: Eurostat, 2023)

2.4.3.1 RES in the electricity sector

In the electricity sector, RES are used to produce electricity with negligible or zero direct GHG emissions. The most relevant sources in this regard are bioenergy, hydro, solar and wind energy. Their penetration in the electricity system depends on several factors, such as the availability of primary energy resources, their cost-effectiveness vis-à-vis other energy sources and the presence of other environmental and power system constraints. Hydropower and bioenergy are considered flexible as their inputs (water and biomass) can be stored cost-effectively. In contrast, wind and solar energy are known as Variable Renewable Energy (VRE) or non-dispatchable or intermittent renewables due to their intermittent availability, which makes electricity generation not fully controllable. Therefore, a massive uptake of VRE challenges the traditional approach to electricity system operation, based on the idea that supply follows demand.

2.4.3.2 RES in the transport sector

In the transport sector, the penetration of RES is driven by the switch to renewable transport fuels and by the uptake of electric mobility (electrification), subject to the electricity being generated from renewable sources. Renewable transport fuels can be biofuels, power-to-fuels (e.g., hydrogen and synthetic liquid fuels) or biomethane. Biofuels are frequently divided into three categories or generations: first-generation biofuels are directly produced from food crops; second-generation biofuels are derived from a set of different feedstocks and do not generally involve food crops; third-generation biofuels – still at an early development stage – are obtained from algae and other such micro-organisms.

2.4.3.3 RES in the heating and cooling sector

In the heating and cooling sector, RES are used in various forms. Traditionally, biomass was utilised as fuel for space and water heating and cooking. More recently, heat pumps are being

installed to provide heating and cooling with the use of ambient or geothermal energy and (renewable) electricity. Today, most of the heating and cooling needs in the EU are still satisfied with the use of fossil fuels. The European Commission has recognised the decarbonisation of the heating and cooling sector as a priority in the years to come. Further electrification, the development of highly efficient cogeneration and district heating, and the uptake of power-to-gas are considered among the main pathways to achieve the decarbonisation of the sector.

2.4.4 What are the most relevant strategies and legislation to mainstream renewables in the EU?

The promotion of RES is a long-term EU strategy, and several legislative initiatives have been taken over the years to achieve it. Among them are the establishment of an Emission Trading Scheme (ETS) (see Section 2.2), the adoption of targets to limit GHG emissions from sectors not covered by the ETS, the introduction of an electricity market design that better reflects the specificities of RES-based generation, the deployment of measures supporting energy efficiency and the definition of long-term Energy and Climate Plans (NECPs)[87] at the national level.

In addition to these policies, the EU has adopted a series of specific measures and targets for RES penetration in the energy mix. These measures and targets, which reflect the conditions in the various countries and end-use sectors, have evolved over time and aim to provide clear signals to Member States, investors, firms and energy consumers. They can be grouped according to the target year they refer to: 2010, 2020, 2030.

2.4.4.1 Targets and policies to 2010

After some early and limited attempts to promote 'alternative energy sources' in the 1970s and 1980s, the EU started to draw up a common policy on RES in the second half of the 1990s. In 1997, the European Commission issued a 'White Paper for a Community Strategy and Action Plan' (EC, 1997), which was later followed by adoption of Directive 2001/77/EC (EP and Council, 2001). The directive established two indicative targets for the use of RES in the energy sector: by 2010, 12% of gross domestic energy consumption was expected to be satisfied with RES; for electricity, the aim was set at 22.1%. Each Member State received an indicative target, which, combined with those of all the other Member States, would enable the EU to reach the overall Community target. Although national targets were not binding, Member States were expected to provide detailed justification if they had failed to meet them. With the 10 new Member States joining the Union in 2004, the 22.1% target initially set for electricity was reduced to 21%.

2.4.4.2 Targets and policies to 2020

Disappointment with the results of earlier policies, the increasing threat posed by climate change and the urgency to ensure security of supply led to the adoption of the Renewable Energy Directive 2009/28/EC (so-called 'RED I'; EP and Council, 2009). The directive was part of the 2009 EU Climate and Energy Package, also known as the '2020 Package,' and set an EU-wide binding target of a RES share of at least 20% of gross final energy consumption by 2020. This target was then allocated to individual Member States by means of binding and differentiated national targets. Note that the 20% target by 2020 for the EU was met, although not all Member States managed to meet their national individual target. The directive also set

87 For a brief overview of the NECPs, see for example a FSR blog post available at https://fsr.eui.eu/national-energy-and-climate-plans-necps/ (accessed 3 February 2023).

a minimum 10% target for the total share of RES in the transport sector that each Member State needed to ensure. However, only about half of the Member States had reached this target by 2020, while a few of them were significantly lagging behind.[88]

The RED I did not include extensive requirements for the heating and cooling sector. These were later introduced in Directive 2012/27/EU (EP and Council, 2012) on energy efficiency, which provided specific measures aiming at increasing the efficient use of cogeneration and district heating. Beyond setting targets for 2020, RED I is also important because it defined a set of policies that Member States could, or were encouraged to, implement to support the deployment of RES (e.g., support schemes, guarantees of origin, etc.). The directive also foresaw mechanisms to ensure cooperation between the Member States and third countries, such as joint projects to enhance cross-border exchanges of renewable energy, and to facilitate the achievement of national and European targets in a cost-effective manner, though little such cross-border cooperation materialised in reality.

2.4.4.3 Targets and policies to 2030

Discussions on strategies for the post-2020 era began soon after the 2009 Conference of the Parties (COP) 15 in Copenhagen. Notably, in 2011 the European Commission published a roadmap to 2050[89] and later issued a green paper on an energy and climate framework for 2030 (see Section 1.1). Building on the expected results of the 2020 Package but at the same time departing from some of its elements, the European Council adopted a clear set of goals and policy choices in October 2014 (Council, 2014). In particular, it was agreed that the EU should cover at least 27% of its final energy consumption with RES by 2030. It was also agreed that the 2030 target would not be broken down into binding targets for each Member State.

The political decisions taken in October 2014 were later turned into legislative proposals and subjected to the ordinary legislative procedure. As part of the Clean Energy Package, the Renewable Energy Directive (EU) 2018/2001 (so-called 'RED II'), which was adopted after intense political negotiations, set a target of at least 32% share of energy from renewable sources in the Union's gross final consumption of energy in 2030. The set target showed a higher ambition compared to the abovementioned 27%, but it was still a compromise, given that the European Parliament had proposed a target of at least 35%. The legislative process of finalising a revised Renewable Energy Directive thus resulted in an increase in ambition when compared to the preceding policy documents.[90]

A major difference from the RED I is that under the RED II the target is set at the EU level, and no allocation of individual binding targets for the Member States follows. However, Member States are obliged to define NECPs under Regulation 2018/1999 in which they explain in detail how they plan to contribute to the common European targets and what measures they expect to put in place (see Section 1.2.4.2). To promote RES, Member States typically use 'support schemes.' These are different instruments, including fiscal incentives, such as tax instruments, direct price schemes, such as guaranteed tariffs (feed-in tariffs) and market premiums, and quota obligations.[91] In practice, the use of direct price support, normally allocated following a

88 'EU energy statistical pocketbook', available at https://ec.europa.eu/energy/data-analysis/energy-statistical-pocketbook_en (accessed 3 February 2023).

89 https://www.roadmap2050.eu.

90 Note also that the EC's adoption of guidelines on State Aid for environmental protection and energy (EEAG) in 2014 already anticipated the more market-oriented approach to renewables support schemes that was introduced by RED II in 2018. The EEAG have since been amended and are now termed guidelines on State aid for climate, environmental protection and energy (CEEAG). For more information, see https://ec.europa.eu/commission/presscorner/detail/en/qanda_22_566.

91 On the rationale and application of support schemes in the EU, see Iliopoulos (2020).

competitive bidding procedure, has prevailed. In addition, Member States promote the development of RES through simplifying the administrative procedures (e.g. for permits or grid connection), facilitating the participation of investors in RES in the energy markets, properly disseminating information, etc.

However, the Commission soon recognised that an increased ambition and enhanced targets were necessary to reach the long-term goal of net-zero GHG emissions by 2050. The arrival of the European Green Deal and the 2030 increased greenhouse gas reduction target of 55% made a corresponding revision of the RES target inescapable. In July 2021, the Commission thus published the 'Fit for 55' Package and submitted a proposal for an early amendment of the RED II. It included an upward revised RES target of 40% by 2030. The energy crisis that began in late 2021 and was exacerbated by Russia's February 2022 invasion of Ukraine, added a powerful energy security rationale to the need for a rapid expansion of the share of renewable energy in gross final energy consumption. The 'REPowerEU Plan' of May 2022 (EC, 2022a; see Section 1.1) thus also included several measures to increase the roll-out of renewable energy. In December 2022, emergency Regulation 2022/2577 was enacted, specifying strict deadlines that Member States must respect during the permit-granting process for RES plants installations, and explicitly recognising that their planning, construction and operation, as well as their connection to the grid, is in the overriding public interest, which has practical consequences in the balancing with classic environmental interests (Council, 2022). In November 2023, having evaluated the performance of the emergency regulation, the Commission proposed a prolongation of Regulation 2022/2577 until June 2025 (EC, 2023a), which was subsequently adopted by the Council. In October 2023, an amendment to the Renewable Energy Directive was adopted, which raised the target share of RES in the EU's overall energy consumption to 42.5% by 2030 with an additional 2.5% indicative top up that would allow to reach 45%. This increase in ambition, too, was a result of the REPowerEU Plan, leading to a 2030 target that was higher than the originally-proposed 40% contained in the Fit for 55 legislative package. Each Member State is expected to contribute to the common target. Further, the amendment also inserted the acceleration and simplification of permitting procedures for RES projects into the directive, meaning that these provisions will remain in force even after the expiry of the aforementioned emergency measures.

By the end of June 2023, Member States had to submit draft updates to their NECPs, showing how they plan to contribute to the increased 2030 target. An assessment by the Commission of draft updates to NECPs in December 2023 revealed a gap to target, with proposed measures adding up to a 38.6-39.3% share of RES in gross final energy consumption (EC, 2023b).[92] At the time of writing, less than half of final NECPs have been submitted.

2.4.4.4 RES in the electricity sector

Apart from the above initiatives, the Commission has also highlighted the need for a better planning of locations for RES projects, and the facilitation of renewable energy purchase agreements. In addition, it has stressed the importance of the participation of citizens, households, local communities, and energy communities in renewable energy projects, and the optimisation of grids' use and management, including the provision of information on grid capacities by TSOs and DSOs (EC, 2022b).

In addition, in accordance with the European Parliament's amendments to the RED II revision, by 31 December 2025 each Member State shall enter into cooperation agreements to establish at least two joint projects for the production of renewable energy. In particular, countries

92 Note, however, that the Commission was only able to review 21 draft updates since six Member States did not submit their updated plans in time.

bordering a sea basin will cooperate to jointly define the amount of offshore renewable energy they plan to produce in the sea basin by 2050, with intermediate steps in 2030 and 2040 (EP, 2022). This is in line with the EU strategy on offshore renewable energy (EC, 2020), which aims to further foster the deployment of offshore renewable energy. More details are discussed in Section 3.3. Moreover, in the revised RED II, the role played by biomass as a sustainable primary energy source is reconsidered. In fact, the amendment introduced an obligation to phase out support to the production of electricity from forest biomass in electricity-only-installations (with limited exceptions), while other measures aim to reduce the risk of market distortions and of biodiversity degradation resulting from support schemes for biomass.

The amended directive strengthens the sustainability criteria for biomass use for energy, in order to reduce the risk of unsustainable bioenergy production. It ensures the application of the cascading principle, with a focus on support schemes and with due regard to national specificities.

2.4.4.5 RES in the transport sector

Regarding the transport sector, the revision of the RED II obliges Member States to impose new obligations on fuel suppliers. Accordingly, they shall ensure that

- the amount of renewable fuels and renewable electricity supplied to the transport sector leads to a greenhouse gas intensity reduction of at least 14.5% by 2030,
- the combined share of advanced biofuels and biogas produced from certain feedstock and of renewable fuels of non-biological origin (i.e., mainly hydrogen) will reach a minimum of 1% in 2025 and 5.5% in 2030, of which at least 1% should be of non-biological

In this regard, the directive encourages the use of advanced biofuels and biogas by limiting the amounts of first-generation biofuels that can be counted towards the target. It introduces an additional obligation for fuel suppliers: from 2030, they shall deliver at least 1.2% renewable fuels of non-biological origin and renewable hydrogen, to the hard-to-abate maritime in Member States that have maritime ports.

The amended directive gives the possibility for Member States to choose between:

- a binding target of 14.5% reduction of greenhouse gas intensity in transport from the use of renewables by 2030,
- or a binding target of at least 29% share of renewables within the final consumption of energy in the transport sector by 2030.

2.4.4.6 RES in the heating and cooling sector

For the heating and cooling sector, the amended directive sets an indicative target of at least a 49% renewable energy share in buildings in 2030. It provides for a gradual increase in renewable targets for heating and cooling, with a binding increase of 0.8% per year at national level until 2026 and 1.1% from 2026 to 2030. The minimum annual average rate applicable to all Member States is complemented with additional indicative increases calculated specifically for each Member State. The starting point is the RES share in the heating and cooling sector recorded in 2020. RED II already included provisions on the efficiency of district heating and cooling. It allows consumers with non-efficient district heating and cooling systems to terminate or modify their contracts. In this respect, the proposal to revise RED II emphasises provision of consumer access to information on energy performance, the share of RES and the energy efficiency of their district heating and cooling systems.

2.4.4.7 RES in the industry sector

The amended directive provides that industry should increase their use of renewable energy annually by 1.6%. 42% of the hydrogen used in industry should come from RFNBOs by 2030 and 60% by 2035.

Member States may reduce the contribution of RFNBOs in industry use by 20% under two conditions:

- if the member states' national contribution to the binding overall EU target meets their expected contribution; and
- the share of hydrogen from fossil fuels consumed in the Member State is not more than 23% in 2030 and 20% in 2035.

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