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Regional Analysis on Policies for the Transition to Low Carbon Energy in SHREC countries

Project acronym

SHREC

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 Partner 4 – South Muntenia Regional Development Agency

Deliverable Author Stanislav Laktiš, Monica MAGUREANU, Madalina DINU,
 Andreea Dogaru, Bianca POPESCU, Andreea ROGOZEA

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1. The EU policy for the energy transition to green (renewable) energy

1.1. Progress of renewables in Europe

As a technology, renewable energy is not new, and it has a strong foothold in Europe. Already in 1991, Denmark installed the **world’s first offshore wind farm “Vindeby”** which included 11 wind turbines. Germany introduced, in the same year, Europe’s first ‘feed-in-tariff’ for renewables; a policy mechanism designed to accelerate investment in renewable energy technologies. By 2000, Europe accounted for more than 70% of all wind power installed in the world and 20% of global solar photovoltaics installations.

In 2000 the world’s first large-scale wind farm ‘Horns Rev’ saw the light – also this time in Denmark. It used many technologies that later became industry standards for offshore wind. Europe also became the largest market for solar photovoltaics by covering more than 70% of the market by 2008. In the same year, the Olmedilla Photovoltaic park in Spain – a 60 megawatt power plant, making it the largest in the world – generated enough solar energy to power 40 000 homes per year.

As the rest of the world is increasingly using and producing renewables, Europe has continued to be a frontrunner. In July 2019, Portugal achieved the lowest cost of a solar photovoltaics park worldwide – a record which still holds today.¹

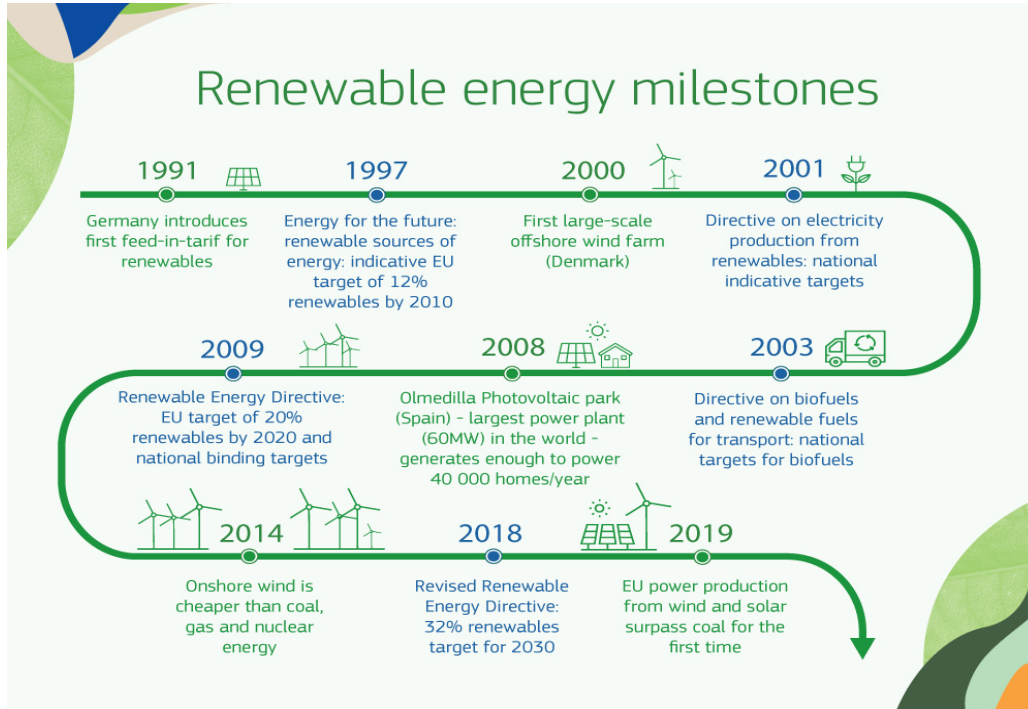


Figure 1 Renewable energy milestones, European Commission

¹ https://ec.europa.eu/info/news/focus-renewable-energy-europe-2020-mar-18_en

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1.2. Current state of RES

Across the EU, the share of renewable energy in gross final energy consumption has increased over recent years from 9.6% in 2004 to **18.9% in 2018**. The five EU countries with the largest share of their energy coming from renewable energy sources (based on 2018 data from Eurostat) are Sweden, Finland, Latvia, Denmark and Austria.

Moreover, according to the EU's latest energy statistical datasheets², renewables are currently the leading source of electricity generation in the EU.

The EU's target is to have a 20 % share of its gross final energy consumption from renewable sources by 2020; this target is distributed between the EU Member States with national action plans designed to plot a pathway for the development of renewable energies in each of the Member States. Figure 2 shows the latest data available for the share of renewable energies in gross final energy consumption and the targets that have been set for 2020.

This positive development has been prompted by the legally binding targets for increasing the share of energy from renewable sources enacted by Directive 2009/28/EC on the promotion of the use of energy from renewable sources. While the EU as a whole is on course to meet its 2020 targets, some Member States will need to make additional efforts to meet their obligations as regards the two main targets: the overall share of energy from renewable sources in the gross final energy consumption (see Figure 2) and the specific share of energy from renewable sources in transport (see Figure 12).

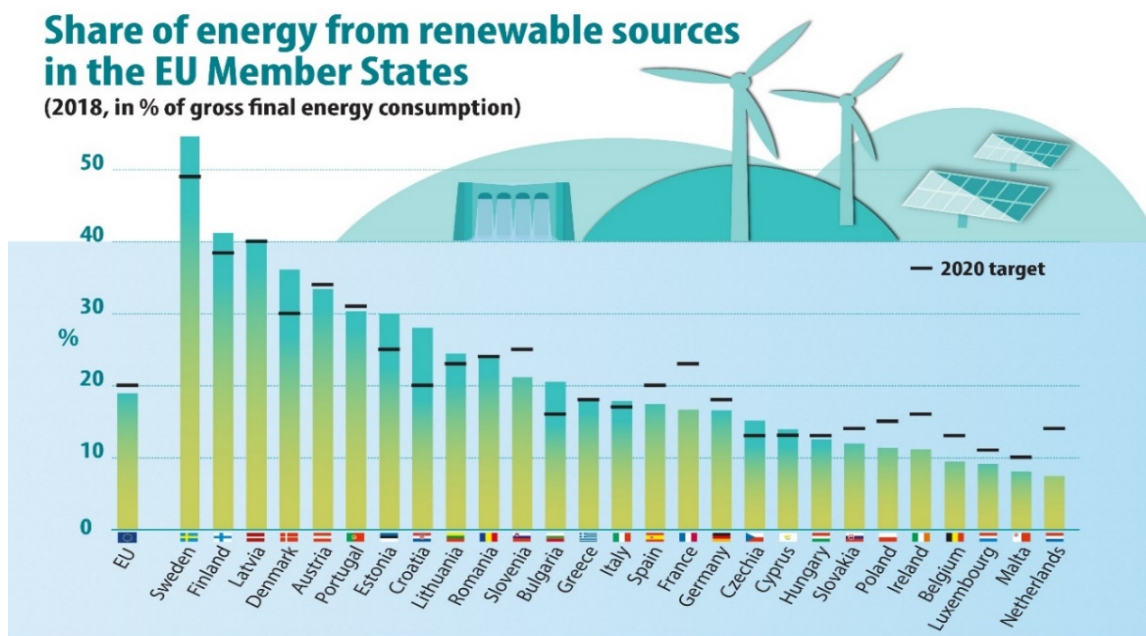


Figure 2 Share of energy from renewable sources in the EU member states, Eurostat



² See https://ec.europa.eu/energy/data-analysis/energy-statistical-pocketbook_en?redir=1#country-datasheets , last update 15/06/2020

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With more than half (54.6 %) of energy from renewable sources in its gross final consumption of energy, Sweden had by far the highest share among the EU Member States in 2018, ahead of Finland (41.2 %), Latvia (40.3 %), Denmark (36.1 %) and Austria (33.4 %). At the opposite end of the scale, the lowest proportions of renewables were registered in the Netherlands (7.4 %), Malta (8.0 %), Luxembourg (9.1 %) and Belgium (9.4 %). Compared with the most recent data available for 2018, the targets for France and the Netherlands require them to increase their share of renewable energy in final energy consumption by at least 6.4 and 6.6 percentage points, respectively. By contrast, twelve of the Member States had already surpassed their target for 2020; the extent to which the targets have been exceeded was particularly large — in the range of 5.0 to 8.0 percentage points — in Croatia, Sweden, Denmark and Estonia.

1.2.1. Electricity generated by RES

The share of energy from RES in gross electricity consumption is **32,2% in 2018**. However, there is a significant variation between EU Member States. In Austria (73.1 %), Sweden (66.2 %) and Denmark (62.4 %) at least three fifths of all the electricity consumed was generated from renewable energy sources — largely as a result of hydro and wind power — while more than half the electricity used in Latvia (53.5 %) and Portugal (52.2 %) came from renewable energy sources. On the other hand, in Cyprus (9.4 %), Luxembourg (9.1 %), Hungary (8.3 %) and Malta (7.1 %) the share of electricity generated from renewable sources was less than 10 %.

During the period from 2008 – 2018, in terms of electricity production, expansion of three renewable energy sources were recorded - principally wind power, but also solar power and solid biofuels (including renewable wastes). In 2018 wind power is the single largest source for renewable electricity generation in the EU. The amount of electricity generated from hydro was relatively similar to the level recorded a decade earlier. By contrast, the quantity of electricity generated in the EU from solar and from wind turbines was 15.5 times and 2.9 times as high in 2018 as it had been in 2008. The growth in electricity from solar power has been dramatic, rising from just 7.4 TWh in 2008 to 115.0 TWh in 2018.

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Share of energy from renewable sources in gross electricity consumption, 2004-2018

(%)

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
EU-27	15.9	16.4	16.9	17.7	18.6	20.7	21.3	23.3	25.2	26.9	28.7	29.7	30.2	31.1	32.2
EU-28	14.2	14.8	15.3	16.1	16.9	19.0	19.7	21.6	23.5	25.3	27.4	28.8	29.5	30.7	32.1
Belgium	1.7	2.4	3.1	3.6	4.6	6.2	7.1	9.1	11.3	12.5	13.4	15.6	15.9	17.3	18.9
Bulgaria	8.4	8.7	8.7	8.9	9.5	10.9	12.4	12.6	15.8	18.7	18.7	19.0	19.1	19.0	22.1
Czechia	3.7	3.8	4.1	4.6	5.2	6.4	7.5	10.6	11.7	12.8	13.9	14.1	13.6	13.7	13.7
Denmark	23.8	24.6	24.0	25.0	25.9	28.3	32.7	35.9	38.7	43.1	48.5	51.3	53.7	60.0	62.4
Germany	9.5	10.6	12.0	13.8	15.2	17.6	18.3	21.0	23.6	25.3	28.2	30.9	32.3	34.6	38.0
Estonia	0.5	1.1	1.4	1.4	2.0	6.0	10.3	12.2	15.7	12.9	14.0	15.1	15.5	17.4	19.7
Ireland	6.0	7.2	8.5	9.7	10.8	14.0	15.6	18.3	19.8	21.3	23.5	25.5	26.8	30.1	33.2
Greece	7.8	8.2	8.9	9.3	9.6	11.0	12.3	13.8	16.4	21.2	21.9	22.1	22.7	24.5	26.0
Spain	19.0	19.1	20.0	21.7	23.7	27.8	29.8	31.6	33.5	36.7	37.8	37.0	36.6	36.4	35.2
France	13.8	13.7	14.1	14.3	14.4	15.1	14.8	16.2	16.5	17.0	18.5	18.8	19.2	19.9	21.2
Croatia	35.0	35.2	34.8	34.0	33.9	35.9	37.5	37.6	38.8	42.1	45.2	45.4	46.7	46.4	48.1
Italy	16.1	16.3	15.9	16.0	16.6	18.8	20.1	23.5	27.4	31.3	33.4	33.5	34.0	34.1	33.9
Cyprus	0.0	0.0	0.0	0.1	0.3	0.6	1.4	3.4	4.9	6.7	7.4	8.4	8.6	8.9	9.4
Latvia	46.0	43.0	40.4	38.6	38.7	41.9	42.1	44.7	44.9	48.7	51.0	52.2	51.3	54.4	53.5
Lithuania	3.6	3.8	4.0	4.7	4.9	5.9	7.4	9.0	10.9	13.1	13.7	15.5	16.9	18.3	18.4
Luxembourg	2.8	3.2	3.2	3.3	3.6	4.1	3.8	4.1	4.7	5.3	6.0	6.2	6.7	8.1	9.1
Hungary	2.2	4.4	3.5	4.2	5.3	7.0	7.1	6.4	6.1	6.6	7.3	7.3	7.3	7.5	8.3
Malta	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	1.1	1.6	3.3	4.3	5.7	6.8	7.7
Netherlands	4.4	6.3	6.5	6.0	7.5	9.1	9.6	9.7	10.4	9.9	9.9	11.0	12.5	13.8	15.1
Austria	61.6	62.9	63.8	65.7	65.9	68.6	68.4	68.8	67.4	68.9	71.1	71.5	72.5	71.6	73.1
Poland	2.2	2.7	3.0	3.5	4.4	5.8	6.6	8.2	10.7	10.7	12.4	13.4	13.4	13.1	13.0
Portugal	27.4	27.7	29.3	32.3	34.1	37.6	40.6	45.8	47.5	49.1	52.1	52.6	54.0	54.2	52.2
Romania	28.4	28.8	28.1	28.1	28.1	30.9	30.4	31.1	33.6	37.5	41.7	43.2	42.7	42.0	41.8
Slovenia	29.3	28.7	28.2	27.7	30.0	33.8	32.2	31.0	31.6	33.1	33.9	32.7	32.1	32.4	32.3
Slovakia	15.4	15.7	16.6	16.5	17.0	17.8	17.8	19.3	20.1	20.8	22.9	22.7	22.5	21.3	21.5
Finland	26.7	26.9	26.4	25.5	27.3	27.3	27.7	29.4	29.5	30.9	31.4	32.5	32.9	35.2	36.8
Sweden	51.2	50.9	51.8	53.2	53.7	58.3	55.8	59.6	59.8	61.7	63.2	65.7	64.9	65.9	66.2
United Kingdom	2.5	3.2	3.7	4.1	4.7	6.0	6.9	8.3	10.3	13.4	17.5	21.9	24.0	27.4	30.9
Norway	98.0	97.4	100.8	99.1	100.2	105.2	98.2	105.9	104.6	106.9	110.1	106.8	105.7	104.9	106.8
Montenegro		39.1	37.7	37.6	38.3	46.6	45.7	41.6	42.8	49.1	51.4	49.6	51.0	50.1	52.4
North Macedonia	14.5	14.0	14.0	13.7	13.8	15.5	15.8	14.8	16.7	18.2	19.3	21.7	24.1	24.8	24.8
Serbia	18.5	22.4	23.6	24.8	25.9	28.3	28.2	27.5	28.5	28.0	30.3	28.9	29.2	27.4	28.7
Albania	70.0	76.1	74.2	79.6	73.3	70.7	74.6	66.1	72.4	62.7	71.0	79.2	82.1	91.0	92.5
Turkey	27.9	26.3	24.7	23.2	22.8	24.7	25.3	25.1	27.1	30.0	30.5	33.2	34.8	35.1	37.5
Kosovo*	0.5	0.6	0.9	1.0	1.0	1.1	1.4	1.4	1.5	1.6	1.9	1.8	4.0	3.6	4.2

Note: "-" means data not available

* This designation is without prejudice to positions on status, and is in line with UNSCR 1244/1999 and the ICJ Opinion on the Kosovo declaration of independence.

Source: Eurostat (online data code: nrg_ind_ren)

eurostat

Table 1: Share of energy from renewables in gross electricity consumption 2004-2018, Eurostat

1.2.1.1. Electricity mix in EU, Q1 2020

The first quarter of 2020, especially since March, Europe was heavily hit by COVID-19 pandemic. The pandemic paralyzed the economies of all EU Member states. The energy sector was influenced as well.

We can say that the current crisis caused by pandemic situation showed us the future of the electricity generation and demand. In the beginning of 2020 we have seen gradual increase of the share of fossil fuels in the electricity mix, following by its decrease going forward and increase of the share of renewables³. Since start of the lockdown, renewables have claimed a greater share⁴ of electricity generation as a result of lockdown measures and depressed electricity demand. According to IEA's Global energy review the trend for renewables will maintain the course.

³ Increase from 30% (week 4) to 42,6% in week 14

⁴ 42,6% in week 14

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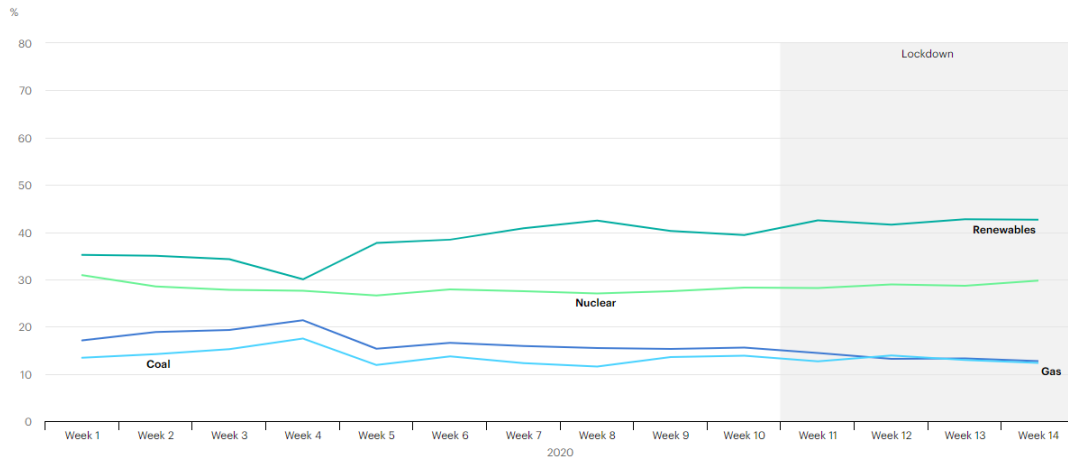
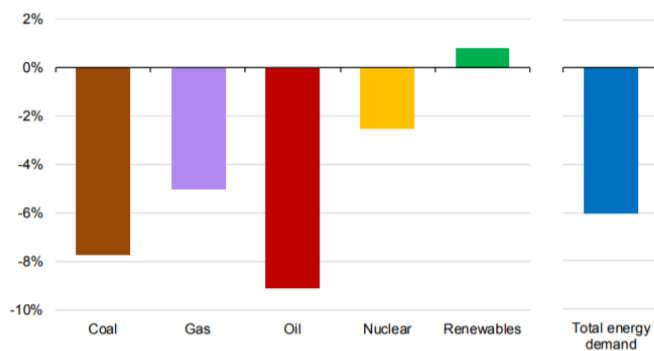


Figure 3 Electricity mix in EU, Q1 2020, IEA World energy review 2020

Moreover, it is projected that the demand for energy generated by renewables will, as the only source, increase globally by 1% in 2020 relative to 2019. On the other hand, demand for energy from fossil fuels and nuclear power sources will decrease ranging from 5% (Gas) to nearly 10% (oil).

Projected change in primary energy demand by fuel in 2020 relative to 2019



IEA 2020. All rights reserved.

Figure 4 Primary energy demand in 2020, IEA World energy review 2020

The current situation is giving us opportunity to kick-start the economy in different way, the greener way. EU is making great efforts to accelerate the transition to clean energy in the light of the pandemic and supporting Member states in green recovery.

1.2.1.2. Future of the offshore wind

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According to the **Offshore wind outlook 2019** analysis prepared by International Energy agency (IEA), the offshore wind is set to become the **largest source of electricity** in the European Union by 2040, complementing other renewables towards a fully decarbonised power system.

Shares of electricity generation by technology in the European Union, Sustainable Development Scenario

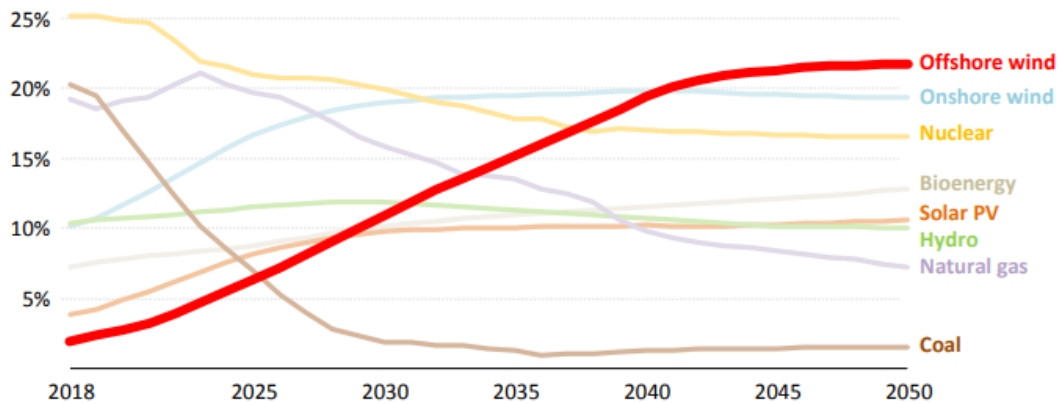


Figure 5: Shares of electricity generation in EU by technology, source IEA Offshore wind outlook 2019

Based on the latest satellite data on wind speed and new turbine designs, offshore wind has vast potential. It is capable of generating more than 18-times global electricity demand today. European Union has a significant offshore wind potential, the largest in the world.

Offshore wind technical potential and electricity demand in 2018

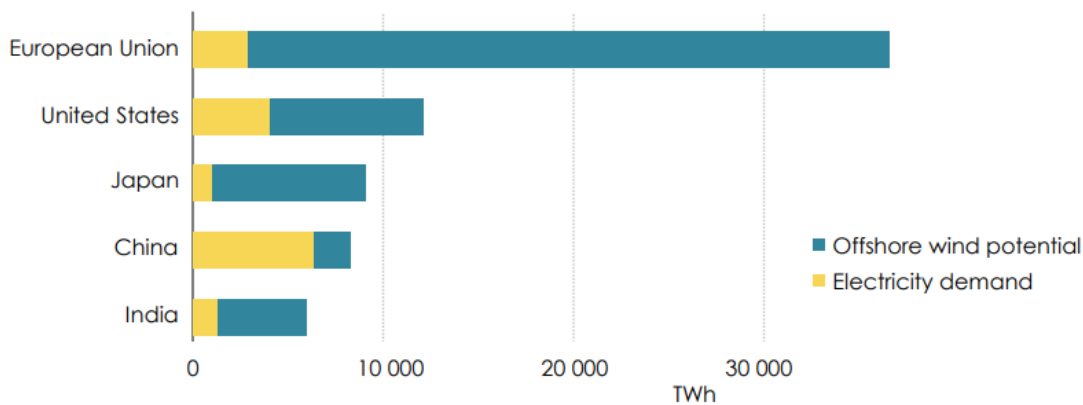


Figure 6: Offshore wind technical potential and electricity demand in 2018, in TWh, IEA Offshore wind outlook 2019

The growth of the offshore wind industry has been fostered in European countries bordering the North Seas, where high quality wind resources and relatively shallow water have provided exceptionally good conditions in which to develop offshore wind technologies and bring them to

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market. Policy support has helped the European Union reach nearly 20 GW of offshore wind capacity by the end of 2018. In 2019 the installed capacity of offshore wind was nearly 22 GW⁵.

Offshore wind is set for robust growth in the EU, with current policies aiming to multiply offshore wind capacity by 4 over the next decade.

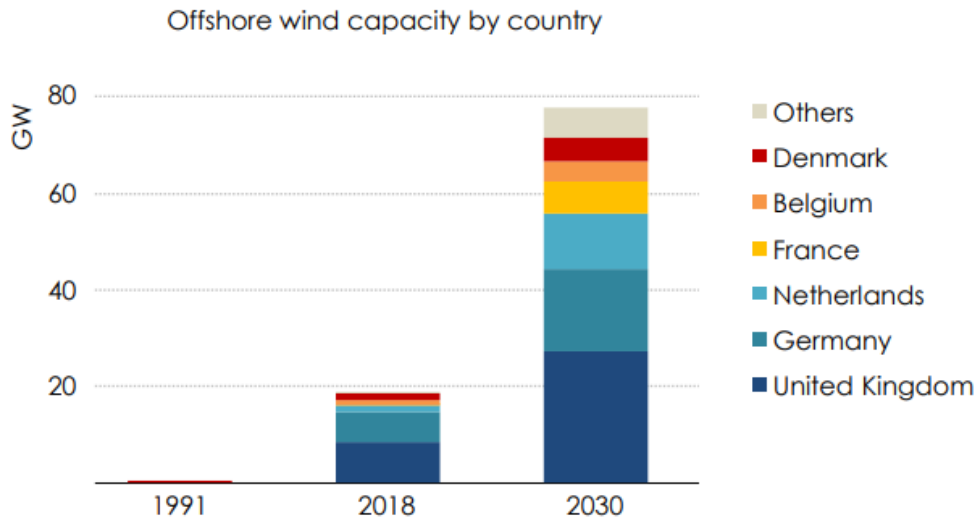


Figure 7 Offshore wind capacity by country, IEA offshore wind outlook 2019

Offshore wind is set to grow all around the world, but EU is still at the forefront. While European Union continues to be in the driver's seat through to 2040, China moves strongly forward and many new markets gain more than a foothold.

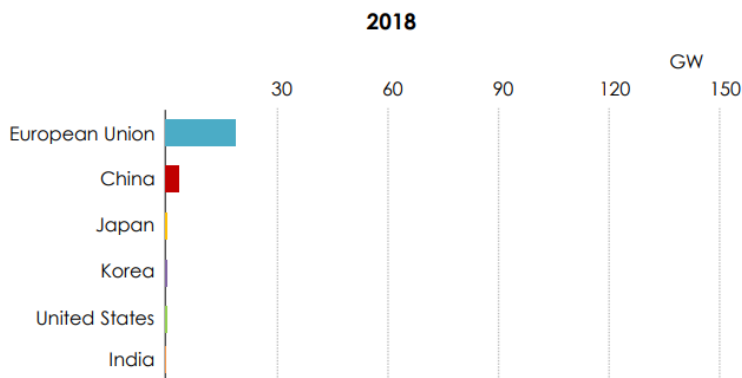


Figure 8 Installed capacity of offshore wind worldwide in 2018 in GW, IEA Offshore wind outlook 2019

⁵ Wind Energy Barometer, EurObserv'ER, 2019, Table No. 1

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It is assumed that by 2040 China will have the installed capacity slightly lower than European union.

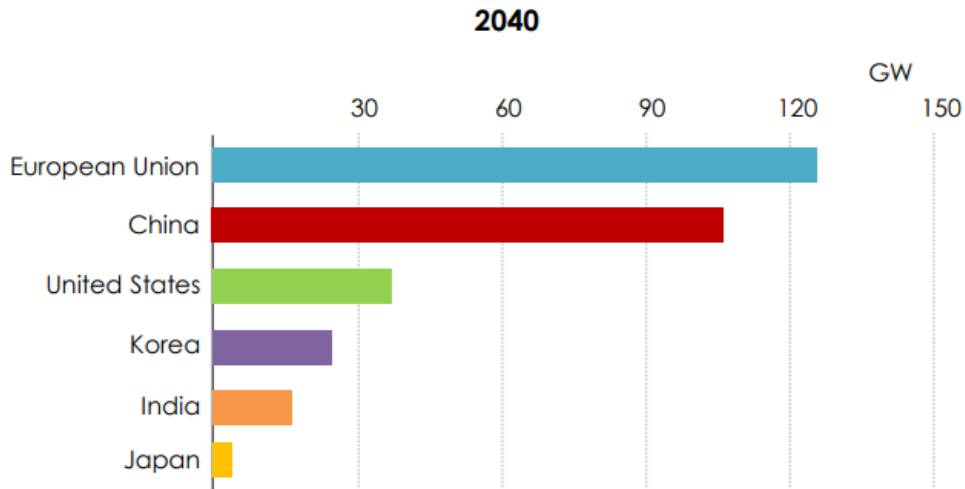


Figure 9 Projected offshore wind installed capacity in 2040, IEA Offshore wind outlook 2019

By 2050 European Commission expects even larger installed capacity – more than 250 GW. This ambition is supported by the **European Green deal** which states that offshore wind production will play an instrumental role in building a power system largely based on renewables and contribute to the 2030 and 2050 energy and climate objectives. It also calls for tapping into the growing potential of emerging offshore renewable energy (floating wind, wave, tidal, salinity gradient, ocean thermal energy conversion, floating photovoltaic), while at the same time managing the maritime space sustainably. The Green Deal also emphasizes the importance of **regional cooperation** between Member States to achieve these objectives. Finally, it addresses the key role of a **common grid** able to transmit efficiently on land the energy generated offshore.

The current offshore wind and renewable development pace is far too slow and constrained to meet the needed massive scale up to ensure climate neutrality by 2050. To ensure that offshore renewable energy can help reach the EU's ambitious energy and climate targets, the Commission will put forward a **dedicated strategy by the end of 2020** that will assess its potential contribution and propose ways forward to support the long-term sustainable development of this sector.

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1.2.1.3. Wind power and hydrogen

Beyond electricity, offshore wind's high capacity factors and falling costs makes it a good match to produce **low-carbon hydrogen**, a versatile product that could help decarbonise the buildings sector and some of the hardest to abate activities in industry and transport. For example, a **1 gigawatt offshore wind project** could produce enough low-carbon hydrogen to **heat about 250 000 homes**. Rising demand for low-carbon hydrogen could also dramatically increase the market potential for offshore wind.

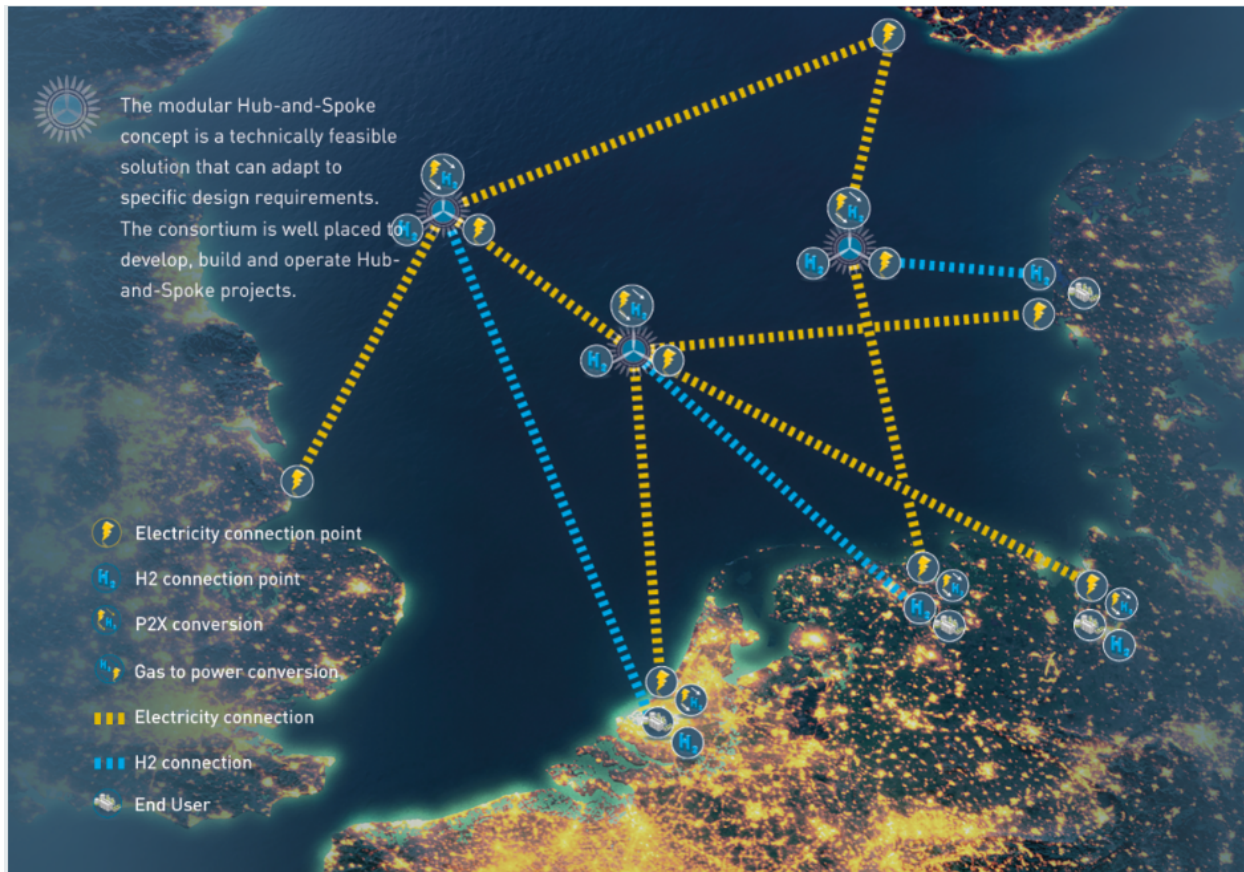
Europe is looking to develop **offshore "hubs"** for producing electricity and clean hydrogen from offshore wind. For example, the Danish government plans to extend its offshore wind potential by creating an **artificial island in the North Sea** in order to increase the capacity of its offshore wind sector to 10 GW by 2030. Not only does it aim to achieve 100% renewable electricity but also develop technologies that will enable it to convert green electricity into hydrogen or hydrogen derivatives for aviation, naval fleets and industry. The Danish plan, announced in December 2019, provides for a 200–300 billion Danish krone investment (27–40 billion euros), that according to its Ministry of Energy and Climate, will be primarily funded by private investors.



Figure 10 Design for artificial island hub in the North sea. It will be equipped by solar panels and 7000 wind turbines. Source: TenneT

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Moreover, international consortium North Sea wind power hub (NSWPH)⁶ is ready to use the potential of the North Sea. As the North Sea is hosting a large potential for offshore wind power, the implementation of 180 gigawatts offshore wind can be achieved by 2045 by the consortium’s approach. The consortium is using the modular Hub-and-Spoke concept, which is key to large-scale



offshore wind energy deployment in the North Sea. Central to the vision is the construction of modular hubs in the North Sea with interconnectors to bordering North Sea countries and sector coupling through power-to-Hydrogen conversion.⁷

Figure 11 Modular Hub-and-Spoke concept by North sea wind power hub (NSWPH)

Another example is project European Hydrogen Valley – also known as NorthH2- which was revealed by the Shell petroleum group, the Dutch gas supplier Gasunie and the Port of Groningen in February 2020. Their plans could constitute the world’s biggest green hydrogen. A project feasibility study envisages the construction of an offshore wind farm in the North Sea with 3–4 GW capacity devoted to producing hydrogen. The electrolyzers will be located at Eemshaven, along the Netherlands’ northern coasts, and potentially installed offshore. The NorthH2 project could save 1 billion euros by 2040 by producing 800 000 tonnes of hydrogen.⁸

For support of the clean hydrogen production EU has prepared **Hydrogen strategy** which is described in dedicated section.

⁶ Partners in the consortium are Energinet, Gasunie and TenneT, strategic partner is Port of Rotterdam.

⁷ <https://northseawindpowerhub.eu/project/>

⁸ Wind Energy Barometer, EurObserv’ER, 2019

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1.2.2. Renewables in Heating and cooling sector

In 2018, half (49%) of all renewable energy sources were used for heating⁹ and renewable energy accounted for 21.1 % of total energy use for heating and cooling in the EU. This is a significant increase from 11.7 % in 2004. Increases in industrial sectors, services and households (building sector) contributed to this growth. Aerothermal, geothermal and hydrothermal heat energy captured by heat pumps is taken into account, to the extent reported by countries. The share of energy from renewable sources in heating and cooling is presented in Table 2.

Share of energy from renewable sources for heating and cooling, 2004-2018

(%)

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
EU-27	11.7	12.4	13.2	14.8	15.3	16.8	17.0	17.5	18.7	19.1	20.0	20.4	20.6	21.0	21.1
EU-28	10.4	11.1	11.9	13.3	13.9	15.3	15.5	16.1	17.1	17.5	18.5	18.9	19.1	19.5	19.7
Belgium	2.8	3.4	3.7	4.6	5.0	5.9	6.1	6.6	7.3	7.4	7.7	7.8	8.1	8.0	8.2
Bulgaria	14.1	14.3	14.8	13.9	17.3	21.6	24.3	24.8	27.2	29.2	28.5	28.9	30.0	29.9	33.3
Czechia	9.9	10.8	11.2	12.4	12.9	14.3	14.1	15.4	16.3	17.7	19.5	19.8	19.9	19.7	20.6
Denmark	20.6	22.8	23.7	26.8	28.0	29.5	30.4	32.1	33.3	34.8	38.2	40.3	41.7	45.8	47.4
Germany	7.2	7.7	8.4	10.2	10.3	11.2	12.1	12.6	13.4	13.4	13.4	13.4	13.0	13.4	13.6
Estonia	33.3	32.2	30.7	32.7	35.5	41.8	43.3	44.0	43.0	43.0	45.0	49.4	51.1	51.4	53.7
Ireland	2.8	3.4	3.5	3.8	3.5	4.1	4.3	4.7	4.8	5.1	6.2	6.1	6.3	6.7	6.5
Greece	13.5	13.4	13.1	14.7	14.7	17.2	18.7	20.1	24.1	27.4	27.9	26.6	25.4	26.6	30.2
Spain	9.5	9.4	11.4	11.2	11.6	13.3	12.6	13.6	14.1	14.1	15.7	16.9	17.2	17.6	17.4
France	12.5	12.4	11.7	12.8	13.3	15.0	16.2	15.9	17.2	18.2	18.8	19.5	20.8	21.1	21.8
Croatia	29.4	30.0	29.1	29.2	28.6	31.2	32.8	33.7	36.5	37.2	36.1	38.5	37.6	36.5	36.5
Italy	5.7	8.2	10.1	13.3	15.3	16.4	15.6	13.8	17.0	18.1	18.9	19.3	18.9	20.1	19.2
Cyprus	9.3	10.0	10.4	13.1	14.5	17.3	18.8	20.0	21.8	22.6	22.3	24.1	24.5	26.1	36.8
Latvia	42.5	42.7	42.6	42.4	42.9	47.9	40.7	44.7	47.3	49.7	52.2	51.7	51.8	54.6	55.9
Lithuania	30.4	29.3	29.2	29.1	32.0	33.7	32.5	32.8	34.5	36.9	40.6	46.1	46.6	46.5	45.6
Luxembourg	1.8	3.6	3.6	4.4	4.6	4.7	4.7	4.8	5.0	5.5	7.2	7.1	7.3	7.8	8.8
Hungary	6.4	9.9	11.4	13.5	12.0	17.0	18.1	20.0	23.3	23.7	21.3	21.3	21.0	19.9	18.1
Malta	1.0	1.0	1.4	1.5	1.7	2.0	7.3	12.0	13.4	15.4	15.0	14.6	16.9	19.6	23.4
Netherlands	2.2	2.4	2.7	2.9	3.0	3.4	3.1	3.7	3.8	4.0	4.9	5.2	5.2	5.7	6.1
Austria	20.2	22.9	24.6	27.2	27.3	29.6	30.9	31.5	33.0	33.4	33.6	33.3	33.5	33.7	34.0
Poland	10.2	10.2	10.2	10.5	10.8	11.5	11.7	13.1	13.4	14.1	14.0	14.5	14.7	14.6	14.8
Portugal	32.5	32.1	34.2	35.0	37.5	38.0	33.9	35.2	33.2	34.6	40.4	40.1	41.6	41.0	41.2
Romania	17.3	17.9	17.6	19.5	23.2	26.4	27.2	24.3	25.7	26.2	26.7	25.9	26.9	26.6	25.4
Slovenia	18.4	18.9	18.5	20.4	19.2	27.6	28.1	30.3	31.5	33.4	32.4	33.9	34.0	33.2	31.6
Slovakia	5.1	5.0	4.5	6.2	6.1	8.2	7.9	9.3	8.8	7.9	8.9	10.8	9.9	9.8	10.6
Finland	39.5	39.2	41.5	41.5	43.3	43.1	44.2	45.9	48.4	50.8	52.0	52.6	53.7	54.6	54.6
Sweden	46.6	50.7	54.2	56.2	57.6	61.3	59.1	60.1	62.7	63.5	64.6	65.4	65.5	65.8	65.4
United Kingdom	0.7	0.8	0.9	1.0	2.4	2.9	3.2	3.7	3.9	4.7	5.5	6.2	6.7	6.9	7.5
Norway	25.6	28.9	28.5	29.4	31.0	32.0	33.1	33.7	32.7	32.5	31.0	34.5	34.2	34.0	34.5
Montenegro	:	53.9	52.1	50.1	46.8	62.5	76.6	81.4	79.9	68.6	67.7	68.6	69.2	65.8	64.5
North Macedonia	23.3	24.7	24.9	22.5	24.6	29.2	26.5	27.3	29.6	31.8	35.0	34.5	30.9	36.3	32.2
Albania	33.1	37.8	31.0	33.1	37.1	34.7	31.3	31.4	39.1	37.8	31.0	34.6	32.5	24.2	22.7
Serbia	14.0	15.6	15.8	13.2	16.7	26.5	23.2	21.1	23.2	25.1	28.8	26.9	25.1	24.9	24.3
Turkey	17.6	17.0	15.2	14.6	15.0	15.4	14.4	12.0	12.1	12.6	12.3	12.1	11.7	9.6	9.6
Kosovo*	51.9	49.5	48.9	49.2	47.8	47.8	45.5	44.7	49.3	48.2	51.8	46.7	51.8	50.5	58.3

Note: ":" means data not available

* This designation is without prejudice to positions on status, and is in line with UNSCR 1244/1999 and the ICJ Opinion on the Kosovo declaration of independence.

Source: Eurostat (online data code: nrg_ind_ren)

Table 2: Share of energy from renewables for heating and cooling, 2004-2018, Eurostat

1.2.3. Renewables in Transport

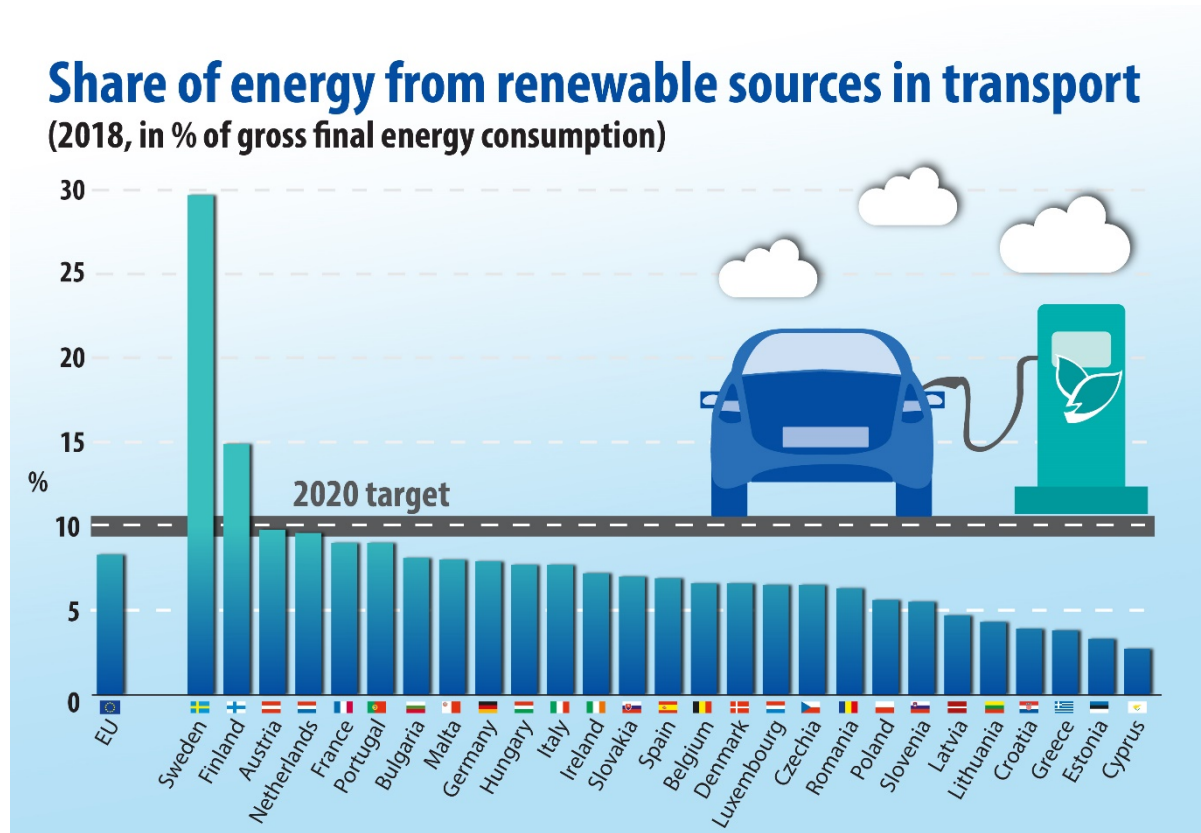
⁹ Renewable energy in Europe: key for climate objectives, but air pollution needs attention, EEA, 2019

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The EU agreed to set a common target of 10 % for the share of renewable energy (including liquid biofuels, hydrogen, biomethane, ‘green’ electricity, etc.) used in transport by 2020.

The average share of energy from renewable sources in transport increased from 1.5 % in 2004 to 8.3 % in 2018. Among the EU Member States the share of renewable energy in transport fuel consumption ranged from highs of 29.7 % in Sweden, 14.9 % in Finland and 9.8 % in Austria down to less than 4.0 % in Croatia (3.9 %), Greece (3.8 %), Estonia (3.3 %) and Cyprus (2.7 %), see Figure 12.

In 2019, 22 EU-27 Member States registered an increase in the average share of energy from renewable sources in transport compared with 2018, with the largest increases observed for Finland (+3.6 percentage points (pp)), Croatia (+3.3 pp), the Netherlands (+2.9 pp) and Slovenia (+2.5 pp). The EFTA country Norway also registered a substantial increase (+6.1 pp).



ec.europa.eu/eurostat 

Figure 12 Share of energy from renewables in transport, Eurostat

2. EU as a global leader in Climate Action and energy transition

The EU should raise its profile as a global leader in climate action by adopting a long-term climate strategy aimed at making the EU carbon neutral by 2050. The EU is aware of its position and takes

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action to be at the forefront of international efforts to reduce greenhouse gas emissions and to secure clean energy for all and thus safeguard the planet's climate.

To achieve the carbon neutrality target by 2050 the crucial element of the target is the energy transition. The energy transition is a pathway towards transformation of the global energy sector from fossil-based to zero-carbon by 2050. At its heart is the need to reduce energy-related CO₂ emissions to limit climate change.

Decarbonisation of the energy sector requires urgent action on a global scale, and while a global energy transition is underway, further action is needed to reduce carbon emissions and mitigate the effects of climate change. The energy transition will be enabled by information technology, smart technology, policy frameworks and market instruments

The EU was an early mover on renewable energy and has made significant efforts, through EU law, to better integrate renewable sources in European energy systems. In striving for global leadership in renewables, the EU has set a clear path for others to follow. When the Renewable Energy Directive (2009/28/EC) established national targets for EU member countries, it was seen as a “novelty act”. Today, 173 countries in the world have such targets.

The 2009 directive was revised in December 2018, and adopted as part of the Clean energy for all Europeans’ package. It includes a new binding renewable energy target for 2030 of at least 32%, with a clause for a possible upwards revision by 2023.

Driving the ambition further, the European Green Deal outlines a number of initiatives across all policy sectors, aimed at making EU climate neutral by 2050. Renewable energy, together with energy efficiency, is a fundamental energy pillar that will help us reach this ambitious goal. As part of this effort, the European Commission will present new measures aimed at embracing technological advance across all sectors of the energy system. This initiative for so-called “smart sector integration” will help build the European energy system of the future.

Later in 2020, the Commission will also launch a new strategy meant to boost offshore wind power. This strategy will address opportunities and challenges, impact on energy grids and markets, management of maritime space and industrial policy dimensions of offshore wind. In addition, EU renewable energy legislation will be reviewed, and where necessary revised, by June 2021.

The EU is raising its efforts to combat the climate change and support the clean energy and started to build the pathway to low carbon economy. The EU and its member states are setting more and more ambitious goals to achieve the carbon neutrality by 2050. To help achieve these goals EU prepared several strategies, roadmaps and directives. To confirm the position of the global leader EU committed to achieve targets that were set for 2020, 2030 and 2050. Throughout the years the urgency and need for clean energy emerged and was more visible and EU reacted by putting the clean energy and use of renewables to the list of top priorities. The next pages will show the efforts of EU in projecting these priorities in policies and strategies to achieve targets of 2020, 2030 and 2050.

2.1. Energy related policies

2.1.1. Climate and energy package - 2008

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In 2008 the European parliament and European council have adopted the 2020 package. The 2020 package is a set of binding legislation to ensure the EU meets its climate and energy targets for the year 2020.

The package sets three key targets:

- 20% cut in greenhouse gas emissions (from 1990 levels)
- 20% of EU energy from renewables and 10% in transport,
- 20% improvement in energy efficiency

The targets were set by EU leaders in 2007 and enacted in legislation in 2009. They are also headline targets of the **Europe 2020 strategy** for smart, sustainable and inclusive growth

2.1.2. Directive 2009/28/EC on the promotion of the use of energy from renewable sources

This directive, which amends and repeals earlier Directives 2001/77/EC and 2003/30/EC, creates a common set of rules for the use of renewable energy in the EU so as to limit greenhouse gas emissions and promote cleaner transport. It is one of the most important policy instruments in promotion of the renewables in EU. Directive implements one of the 20-20-20 targets from the EU's 2020 Climate and Energy package – 20% of EU energy and 10% of energy specifically in the transport sector from renewables¹⁰ and sets national binding targets to achieve the 2020 goals.

The key points of the directive were:

- improve the legal framework for promoting renewable electricity,
- required national action plans that establish pathways for the development of renewable energy sources including bioenergy and create way to achieve the national targets for renewables in gross final energy consumption as well as the 10% target for renewable energy sources in transport,
- created cooperation mechanisms to help achieve the targets cost effectively and established the sustainability criteria for biofuels¹¹,
- Each EU country must be able to guarantee the origin of electricity, heating and cooling produced from renewable energy sources¹²,
- EU countries should build the necessary infrastructure for using renewable energy sources in the transport sector.

To help achieve targets in a cost-effective way, EU countries can exchange energy from renewable sources. To count towards their action plans, EU countries can also receive renewable energy from countries outside the EU, provided that energy is consumed in the EU and that it is produced by modern/efficient installations. It also supports joint renewable energy projects and joint renewable energy support schemes.

¹⁰ both measured in terms of gross final energy consumption, i.e. total energy consumed from all sources, including renewables

¹¹ <https://www.buildup.eu/en/practices/publications/directive-200928ec-promotion-use-energy-renewable-sources-23-april-2009>

¹² https://ec.europa.eu/energy/topics/renewable-energy/renewable-energy-directive/overview_en

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This directive was recasted and repealed by Directive (EU) 2018/2001 on the promotion of the use of energy from renewable sources as part of the A Clean energy for All Europeans package in 2018.

2.1.3. A Strategy for Competitive, Sustainable and Secure Energy – 2010

In 2010 EU needed to bring a stimulus for member states to achieve the 2020 goals as there was a big gap in delivery of these goals. The EU cannot afford to fail in its energy ambitions therefore the Commission proposed new energy strategy towards 2020 - „A Strategy for Competitive, Sustainable and Secure Energy“. New strategy consolidated the measures which had been taken so far and stepped up activity in areas where new challenges had been emerging. The new energy strategy focuses on five priorities:

1. Achieving an energy efficient Europe;
2. Building a truly pan-European integrated energy market;
3. Empowering consumers and achieving the highest level of safety and security;
4. Extending Europe's leadership in energy technology and innovation;
5. Strengthening the external dimension of the EU energy market.

2.1.4. The 2050 energy roadmap – 2011

The EU has set itself a long-term goal of reducing greenhouse gas emissions by 80-95%, when compared to 1990 levels, by 2050. The Energy Roadmap 2050 (COM/2011/0885) explores the transition of the energy system in ways that would be compatible with this greenhouse gas reductions target while also increasing competitiveness and security of supply.

To achieve the new energy system, the roadmap identifies the following factors:

- the existing 2020 energy strategy, with its ability to help reduce emissions by 40 % by 2050, must be fully implemented;
- the prime focus should be on energy efficiency, especially in new and old buildings, transport, products and appliances;
- renewables have the potential to provide some 30 % of total EU energy consumption by 2030;
- higher public and private investment is needed in R & D and technological innovation to make low-carbon energy commercially viable;
- substituting gas for coal and oil can reduce emissions with existing technologies until at least 2030 or even 2035;
- energy prices need to better reflect actual costs, especially when new investments are being made. The earlier this is done, the easier the change to a low-carbon system;
- new energy infrastructure, for electric vehicles for example, and storage facilities are needed inside the EU and in neighbouring countries;
- safety and security of traditional and new energy sources must remain paramount;
- the EU should take a broader and more coordinated approach towards its international energy relations and moves to tackle climate change;

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- concrete milestones must be set for achievable goals and to give guidance to investors as the EU takes the next step by defining its 2030 policy framework.

The roadmap was noted by the Council in its conclusions of 17 May 2011, and endorsed by the European Parliament in its resolution of 15 March 2012

2.1.5. The 2030 climate and energy framework – 2014

In October 2014, the European Council agreed on the 2030 climate and energy framework for the EU. In particular the Council endorsed four important targets by 2030:

- 1) a binding EU target of at least **40% less greenhouse gas emissions** by 2030, compared to 1990
- 2) a target, binding at EU level, of **at least 27% renewable** energy consumption in 2030
- 3) an indicative target at EU level of **at least 27% improvement in energy efficiency** in 2030
- 4) support the completion of the internal energy market by achieving the existing **electricity interconnection target of 10%** as a matter of urgency no later than 2020, in particular for the Baltic states and the Iberian Peninsula, and the objective of arriving at a 15% target by 2030

2.1.6. Energy union Strategy – 2015

The European Commission launched a new strategy for a **resilient Energy Union** with a forward-looking climate change policy in February 2015. The Energy Union strategy, as a key priority of the Juncker Commission (2014-2019), aims at building an energy union that gives EU consumers - households and businesses - **secure, sustainable, competitive and affordable energy** by overhauling European energy and climate systems and policies.

2.1.6.1. Five building blocks of Energy union

The energy union builds five closely related and mutually reinforcing dimensions:

- **Security, solidarity and trust** - diversifying Europe's sources of energy and ensuring energy security through solidarity and cooperation between EU countries
- **A fully integrated internal energy market** - enabling the free flow of energy through the EU through adequate infrastructure and without technical or regulatory barriers
- **Energy efficiency** - improved energy efficiency will reduce dependence on energy imports, lower emissions, and drive jobs and growth
- **Climate action, decarbonising the economy** - the EU is committed to a quick ratification of the Paris Agreement and to retaining its leadership in the area of renewable energy
- **Research, innovation and competitiveness** - supporting breakthroughs in low-carbon and clean energy technologies by prioritising research and innovation to drive the energy transition and improve competitiveness.

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2.1.6.2. State of energy union – 4th report from April 2019¹³

The State of the Energy Union monitors the progress made in a year and highlights the issues where further attention is needed. It shows progress made since the Energy Union Framework Strategy was adopted to accomplish the transition to a low-carbon, secure and competitive economy. The fourth State of the energy union report was published in April 2019¹⁴ and shows that Europe's energy supply is now safer, more viable and more accessible to everyone than it was only a few years ago.

The report shows some trends and policy observations regarding renewable energy. The report is very comprehensive, therefore we picked only observations connected to the renewable energy sources.

Greenhouse gas emissions and energy consumption are increasingly **decoupled** from economic growth. The figure 13 shows that between 1990 and 2017, the EU economy grew by 58 %, while emissions decreased by 22%.

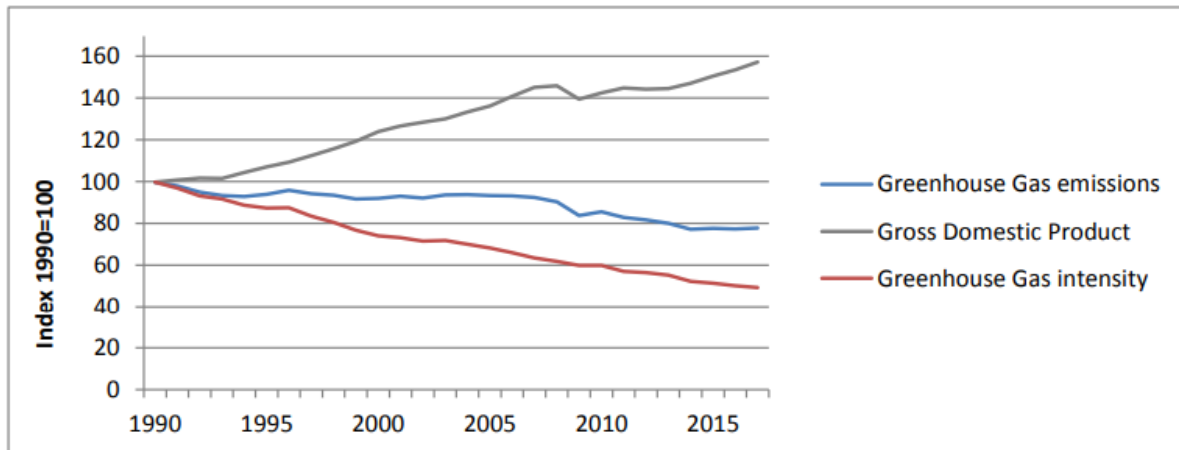


Figure 13 GHG emission decoupled from GDP in period from 1990 to 2017, 4th report of Energy union 2019

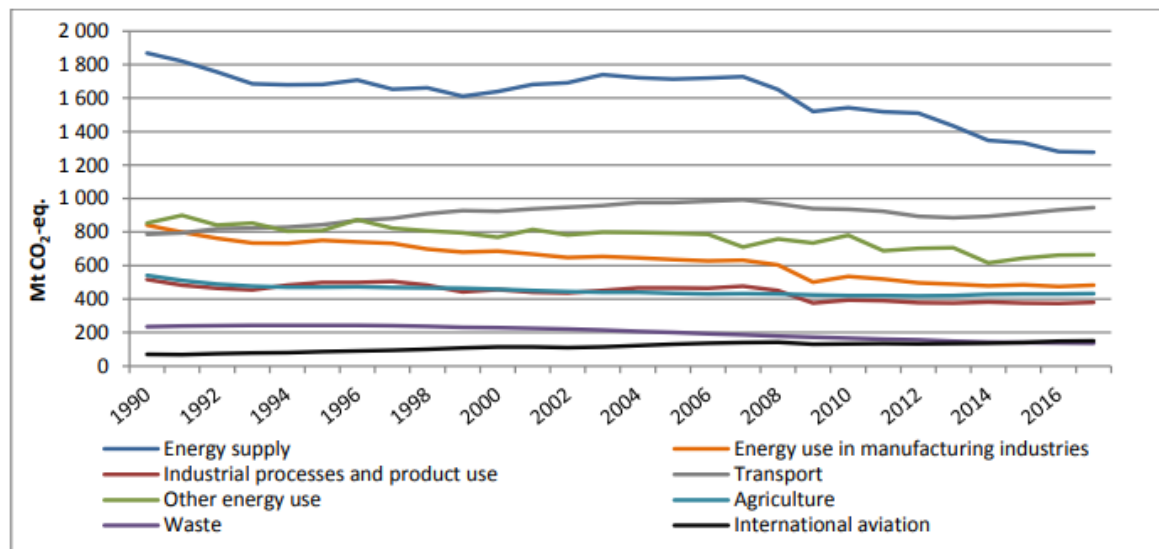
¹³ Operating with data from 2017

¹⁴ 5th report is planned to be published in October 2020

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In the **transport sector**, which appears to be an issue, energy consumption and emissions decreased between 2007 and 2013, but are now roughly **back at 2005 levels**. The positive impact of efficiency policies has been outweighed by increased transport activity, and low capacity utilisation in road- freight transport.

Figure 14 GHG emissions by sector from 1990 to 2017, 4th report of Energy union 2019



Strong growth continued in the renewable sector but with an **unequal deployment**. Since 2014, the share of RES in the energy mix increased significantly, but the penetration of renewable energy varies across sectors, with renewable energy reaching 30.8 % in the electricity sector, but only 19.5 % in the heating and cooling sector, and 7.6 % in the transport sector.¹⁵

To meet the 2020 renewable energy targets and sustain these levels as a baseline from 2021 onwards, Member States should continue to **increase their efforts** to both **deploy renewables and reduce energy consumption**. In 2017, for 11 Member States¹⁶, the policies being planned or implemented to promote renewable energy appeared insufficient to meet their indicative trajectory if only domestic supply, without cooperation mechanisms, is considered. Moreover, for 7 Member States¹⁷, there is some uncertainty on whether they will achieve the 2020 renewable targets. European Commission suggest to consider the possibility of **using statistical transfers**, as provided for in the Renewable Energy Directive¹⁸, either to ensure that they achieve the target when there is a deficit or to sell their potential surpluses to other Member States. The Commission stands ready to support Member States in this.

Under the Juncker's Commission, the EU adopted a **completely new legislative framework for energy and climate policies**. Most important, energy related, was the Clean Energy for All Europeans package. This comprehensive legislative framework forms a robust basis for the EU to deliver on its climate and energy policies for 2030 and beyond. The updated legislative framework sets

¹⁵ The report is operating with data from 2017. In 2018 the total share was 18,9%, in electricity production 32,2%, in Heating and cooling 21,1% and in transport 8,3%

¹⁶ Belgium, Ireland, Greece, France, Cyprus, Luxembourg, Malta, the Netherlands, Poland, Portugal and the United Kingdom

¹⁷ Austria, Germany, Spain, Latvia, Romania, Slovenia and Slovakia

¹⁸ Directive 2009/28/EC

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out **quantified objectives and a clear ‘direction of travel’ to 2030**. The objectives are shown in the Figure 15.

2030 FRAMEWORK FOR CLIMATE AND ENERGY — AGREED TARGETS

	GREENHOUSE GAS EMISSIONS	RENEWABLE ENERGY	ENERGY EFFICIENCY	INTER-CONNECTION	CLIMATE IN EU-FUNDED PROGRAMMES	CO2 FROM:
2020	-20%	20%	20%	10%	2014-2020 20%	
2030	≥ -40%	≥ 32%	≥ 32.5%	15%	2021-2027 25%	CARS -37.5% Vans -31% Lorries -30%

Unwards revision clause by 2030

Figure 15 2030 Framework for climate and energy

In terms of energy policy, very important milestone was creation of **National energy and climate plans** by all EU member countries. This obligation was set in the Clean energy for all Europeans package¹⁹. More achievements are shown in the infographic below (Figure 16)

¹⁹ In Governance of the energy union and climate action (EU) Regulation 2018/1999

ACHIEVEMENTS IN THE 5 DIMENSIONS OF THE ENERGY UNION



1. Energy Security

- Enhanced resilience of the European energy system by preventing and managing gas crises
- Continued efforts to diversify external supply sources and new arrangements to ensure increased solidarity and regional cooperation [e.g. southern gas corridor]
- Over 30 projects of common interest implemented + 75 more to be implemented by 2022
- €3.4 billion in connecting Europe facility energy funding since 2014
- €1.3 billion from the European fund for strategic investment (EFSI)
- EU public funding in energy infrastructure has leveraged total investments of around €50 billion



2. The internal energy market

- More robust infrastructure increasing fluidity of the network
- Integration of isolated and disconnected regions [e.g. Baltics, Iberian Peninsula]
- Making the grid fit for an increased share of renewable energy
- Putting the consumer at the heart of the energy market
- Market coupling - reduced and more equal energy costs for consumers throughout Europe
- Over the past seven years, day-ahead market coupling alone has rendered a benefit of approximately €1 billion per year to European consumers



3. Energy Efficiency

- New energy efficiency target of at least 32.5% by 2030
- New energy performance of buildings rules aiming at decarbonisation of building stock by 2050
- Clearer and simpler energy efficiency labelling rules help households save almost €500 per year
- Between 2014 to 2020, €18 billion from the European structural investment fund are allocated to energy efficiency
- There are 900.000 jobs in the energy efficiency sector in Europe today
- €2.5 billion Horizon 2020 funding for the period 2018-2020 to decarbonise the EU's building stock



4. Decarbonisation

- The EU was instrumental in brokering the Paris Agreement and making it operational
- The EU has put in place a comprehensive legislative framework to achieve at least 40% emission reduction by 2030
- New renewable energy target of at least 32% by 2030
- 4 million 'green jobs' in the EU today, 1.4 million jobs in the renewable energy sector
- Decarbonisation strategy "clean planet for all" for a climate neutral Europe in 2050
- 17.5% of final energy consumption in Europe came from renewable energy in 2017



5. Research and Innovation

- Under the revised EU Emission Trading System the Commission set up the Innovation Fund, which will pool together resources amounting to around €10 billion to support the demonstration of low-carbon technologies and processes
- Loans from the Innovfin Energy Demonstration Project financial instrument of Horizon 2020 have provided €107 million loaned to 4 first-of-a-kind energy demonstration projects since 2016
- With the strategic action plan for batteries, the Commission adopted a comprehensive set of measures to develop an innovative, sustainable and competitive battery production chain

Figure 16 Achievements of Juncker's Commission in 5 dimensions of Energy union

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In conclusion, creating the Energy union has required close **cooperation** between the EU institutions, Member states and all segments of society and this cooperation need to be **maintained and strengthened**. And not only the cooperation, also **integration and innovation** of all economic sectors is essential. Not less important will be promoting **consistency** between a wide range of related policies and various scales of action.

Thanks to the cooperation and integration it is visible that Energy union achieved great results which EU can build upon to achieve the climate neutrality and transition to low carbon economy by 2050.

The European Commission needs to continue to **engage citizens, local authorities and industry** to foster cooperation, create **complete industrial value chains** and strengthening urban **innovation and investment**. In particular, securing the necessary funding will be key — the financial sector in the EU has the potential to deliver the yearly investment needs of almost EUR 180 billion.

2.1.7. Paris Agreement - 2015

At COP 21 in Paris, on 12 December 2015, Parties to the UNFCCC reached a landmark agreement to combat climate change and to accelerate and intensify the actions and investments needed for a sustainable low carbon future. Since then the Paris agreement is the corner-stone of energy and climate related policies around the world.

The Paris Agreement's central aim is to strengthen the global response to the threat of climate change by keeping a global temperature rise this century **well below 2 degrees Celsius** above pre-industrial levels and to pursue efforts to limit the temperature increase even further to **1.5 degrees Celsius**. Additionally, the agreement aims to increase the ability of countries to deal with the impacts of climate change, and at making finance flows consistent with a low GHG emissions and climate-resilient pathway. To reach these ambitious goals, appropriate mobilization and provision of financial resources, a new technology framework and enhanced capacity-building is to be put in place, thus supporting action by developing countries and the most vulnerable countries, in line with their own national objectives. The Agreement also provides for an enhanced transparency framework for action and support.

To this date, **189 Parties** have **ratified** of 197 Parties to the Convention²⁰.

²⁰ Data from United nations, see <https://unfccc.int/process/the-paris-agreement/status-of-ratification>

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2.1.8. Clean energy for all Europeans Package - 2018

The EU has agreed a comprehensive **update of its energy policy framework** to facilitate the transition away from fossil fuels towards cleaner energy and to deliver on the EU's Paris Agreement commitments for reducing greenhouse gas emissions.

The completion of this new energy rulebook – called the Clean energy for all Europeans package - marks a significant step towards the implementation of the energy union strategy, adopted in 2015.

Based on Commission proposals published in November 2016, the Clean energy for all Europeans package consists of **eight legislative acts**. After political agreement by the Council and the European Parliament in 2018 and early 2019, enabling all of the new rules to be in force by mid-2019, EU countries have 1-2 years to transpose the new directives into national law.

The changes will bring considerable benefits from a consumer perspective, from an environmental perspective, and from an economic perspective. It also underlines EU leadership in tackling global warming and provides an important contribution to the EU's long-term strategy of achieving carbon neutrality by 2050

This package consists of 8 legislative acts:

1. Energy Performance of Buildings Directive 2018/844 –

Member States are required to transpose new EU rules on the use of energy in buildings into national law **by 10 March 2020**, thereby helping citizens to consume less energy, save money and live in healthier buildings. The Energy Performance of Buildings Directive (EPBD) also sets 10 March 2020 as the deadline for Member States to put in place national long-term building renovation strategies, setting the path, policy measures and mobilise financing needed to decarbonise their existing building stock by 2050.

The legislation that is now applicable all over the EU includes measures that will accelerate the rate of building renovation, strengthen the energy performance of new buildings and make them smarter.

This is important as the EU building sector is the largest single energy consumer in Europe and is responsible for **36% of the EU CO2 emissions**. In addition to saving energy and reducing CO2 emissions, the new rules will create jobs, help alleviate energy poverty and improve comfort and sanitary conditions of dwellings.

Main points of the new EPBD:

- Creates a **clear path** towards a low and zero-emission building stock in the EU by 2050 underpinned by national roadmaps to decarbonise buildings.
- Encourages the use of **information and communication technology (ICT)** and **smart technologies** to ensure buildings operate efficiently for example by introducing automation and control systems.
- Supports the rollout of the infrastructure for **e-mobility** in all buildings.
- Introduces a "**smart readiness indicator**" which will measure the buildings' capacity to use new technologies and electronic systems to adapt to the needs of the consumer, optimise its operation and interact with the grid.
- Integrates and substantially strengthens **long term building renovation strategies**.

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- Mobilises **public and private financing and investment**.
- Helps **combatting energy poverty** and **reducing the household energy bill** by renovating older buildings.

2. The recast Renewable Energy Directive (EU) 2018/2001. It establishes a common system to promote energy from renewable sources across the different sectors.

The directive ensures that the EU's binding target is achieved **cost-effectively**. It also establishes a **stable, market-oriented** European **approach** to renewable electricity and provides **long-term certainty** for investors and speeds up procedures for permits to build projects. The directive enables **consumers to take part in the energy transition** with the right to produce their own renewable energy. In the **heating and cooling** and the **transport sectors, it supports** increasing the use of renewables and strengthens EU sustainability criteria for bioenergy.

In particular, the directive includes:

- a binding EU overall target for 2030 of at **least 32% of energy from renewable sources**;
- **rules for cost-effective and market-based** financial support for electricity from renewable sources;
- **protection of support schemes** from modifications which put existing projects at risk;
- **cooperation mechanisms** between EU countries, and between EU countries and non-EU countries;
- **simplification of administrative procedures** for renewables projects (including one-stop-shops, time-limits, and digitalisation);
- an **improved guarantee of origin system**, extended to all renewables;
- rules allowing **consumers to produce their own electricity**, individually or as part of renewable energy communities, without undue restrictions;
- in the **heating and cooling sector**:
 - an annual **increase of 1.3 percentage points** in the share of renewable energy in the sector
 - the right for consumers to **disconnect from inefficient district heating and cooling systems** and
 - **third-party access** for suppliers of renewables and waste heat and cooling to district heating and cooling networks;
- in the **transport sector**:
 - a **binding target of 14%** with
 - a specific sub-target for **advanced biofuels of 3.5%** and
 - caps on conventional biofuels and on high indirect land use change risk biofuels;
- Strengthened EU **sustainability criteria for bioenergy**, by extending their scope to cover all fuels produced from biomass regardless of their final energy use.

The recast renewable energy directive entered into force in December 2018.

3. The revised Energy Efficiency Directive (EU) 2018/2002 - Putting **energy efficiency first** is a key objective in the package, as energy savings are the easiest way of saving money for consumers and for reducing greenhouse gas emissions. The EU has therefore set binding targets of at least

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32.5% energy efficiency by 2030, relative to a 'business as usual' scenario. The amending directive on energy efficiency has been in place since December 2018.

4. **Governance of the energy union and climate action (EU) Regulation 2018/1999** - The package includes a robust governance system for the energy union, through which each Member State is required to submit **integrated 10-year national energy and climate plans (NECPs) for 2021 to 2030** to the Commission²¹. The NECPs outline how EU countries will achieve their respective targets on all dimensions of the energy union, including a longer-term view towards 2050. The Regulation on the governance of the energy union and climate action (EU)2018/1999 is in force since December 2018.
5. **Regulation on risk-preparedness in the electricity sector (EU) 2019/941** - requires EU Member States to prepare plans for **how to deal with potential future electricity crises**, and put the appropriate tools in place to prevent, prepare for and manage these situations. The new regulation requires that Member States, using common methods, identify **all possible electricity crisis scenarios** at national and regional levels and then prepare risk preparedness plans based on these scenarios. Above all, this preparation requires EU countries to cooperate and coordinate with neighbouring member states in a spirit of solidarity. It also establishes a new framework for a more systematic monitoring of security of supply issues via the **Electricity Coordination Group**.
6. **Regulation establishing a European Union Agency for the Cooperation of Energy Regulators (EU) 2019/942** - ACER's main role was originally confined to coordination, advising and monitoring. As the new market design rules foresee much more cross-border cooperation, the lack of regional, cross-border oversight was seen as a potential problem, with the risk of diverging decisions and unnecessary delays. Regulation (EU) 2019/942 establishing a EU Agency for the cooperation of energy regulators recasts the regulation 713/2009.

In addition to coordinating the action of national energy regulators, ACER has therefore been granted additional competences in those areas where fragmented national decisions of cross-border relevance are likely to lead to problems for the internal energy market. For example, ACER will have oversight on the future regional entities ("Regional Coordination Centres") where TSOs (Transmission System Operators) will be able to decide on those issues where fragmented and uncoordinated national actions could negatively affect the market and consumers. The proposed approach will also streamline regulatory procedures. National regulators, deciding within ACER on those issues through majority voting, will remain fully involved in the process.
7. **Directive on common rules for the internal market for electricity (EU) 2019/944** which replaces Electricity Directive (2009/72/EC), and
8. the new **Regulation on the internal market for electricity (EU) 2019/943**, which replaces the Electricity Regulation (EC/714/2009) on January 1 2020, introduce a new limit for power plants eligible to receive subsidies as capacity mechanisms (confirming the phasing out of subsidies to generation capacity emitting 550gr CO₂/kWh or more). Furthermore, **the consumer is put at the centre of the clean energy transition** and the new rules enable the active participation of consumers, whilst putting in place a strong framework for consumer protection.

²¹ As of 13th of July 2020 of EU-27 only Ireland did not submit the NECP ,
https://ec.europa.eu/energy/topics/energy-strategy/national-energy-climate-plans_en

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By allowing electricity to move freely to where it is most needed, society will increasingly benefit from cross-border trade and competition. They will drive the investments necessary to provide security of supply, whilst decarbonising the European energy system.

The new rules contribute to the EU's goal of being the world leader in energy production from renewable energy sources by allowing more flexibility to accommodate an increasing share of renewable energy in the grid. The shift to renewables and increased electrification is crucial to achieve carbon neutrality by 2050. The new electricity market design will therefore help to achieve the goals set out in the European Green Deal, and contribute to the creation of jobs and growth.

2.1.9. A clean planet for all – 2050 vision - 2018

The Commission set out its vision for a climate-neutral EU by 2050 in November 2018, looking at all the key sectors and exploring pathways for the transition.

The Commission's vision covers nearly all EU policies and is in line with the Paris Agreement objective to keep the global temperature increase to well below 2°C and pursue efforts to keep it to 1.5°C.

A clean planet for all is setting the road to a net-zero greenhouse gas economy which could be based on joint action along a set of seven main strategic building blocks. One on the building blocks emphasises the need to **maximise the deployment of renewables and the use of electricity to fully decarbonise Europe's energy supply**. The vision says that the clean energy transition would result in an energy system where primary energy supply would largely come from renewable energy sources, thereby significantly improving security of supply and fostering domestic job. The dependence on energy import (mostly gas and oil) will **fall from today's 55% to 20%** in 2050. This would positively impact EU's trade and geopolitical position as it would result in a sharp reduction of fossil fuel import expenditures (currently € 266 billion), with **imports falling by over 70%** in some scenarios. The cumulative savings from a reduced import bill will amount to € 2-3 trillion over the period 2031-2050, freeing resources for further potential investments into the modernisation of the EU economy.

The vision sees great opportunity in **electricity production**. The large-scale deployment of renewables will lead to the electrification of our economy and to a high degree of decentralisation. By 2030, the share of **renewable energy in the electricity** mix should double to **55-60%**, and projections show a share of around **84% by 2050**. Together **with a nuclear power** share of ca. 15%, this will be the **backbone of a carbon-free European power system**. Electrification will open up new horizons for European companies in the global clean energy market worth today ca. € 1.3 trillion. For the EU, which currently hosts 6 of the 25 largest renewable energy businesses and employs almost 1.5 million people (out of 10 million worldwide), this will be a unique business opportunity. It will also give an **important role to consumers** that produce energy themselves (**prosumers**), and **local communities** to encourage residential take-up of renewables.

The competitive deployment of renewable electricity also provides a major opportunity for the decarbonisation of other sectors such as heating, transport and industry, either through direct use of electricity or indirectly through the production of e-fuels through electrolysis (e.g. e-hydrogen).

The transition towards a largely decentralised power system based on renewables will require a smarter and flexible system, building on consumers' involvement, increased interconnectivity,

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improved energy storage deployed on a large scale, demand side response and management through digitalisation.

As part of the European Green Deal, the Commission proposed on 4 March 2020 the first European Climate Law to enshrine the 2050 climate-neutrality target into law.

2.1.10. The European Green deal - 2019

On 11th of December 2019 European Commission presented very ambitious roadmap for EU's climate neutrality – the European Green Deal (EGD).

The European Green Deal aims to transform the 27-country bloc from a high- to a low-carbon economy, **without reducing prosperity** and while **improving people's quality of life**, through cleaner air and water, better health and a thriving natural world. It outlines investments needed and financing tools available, and explains how to ensure a just and inclusive transition.

To enshrine the EU's political commitment, coming from the EGD, in legislation, European Commission has prepared proposal of the **European Climate law**.

To secure financing of the measures of the EGD, the Commission has prepared the **European Green deal Investment plan (EGDIP)** and **Just transition mechanism (JTM)**.

In the EGDIP assumes mobilisation of at least **€1 trillion** of sustainable investments over the next decade. A great share of investments will come from the EU budget with a key role played by European Investment bank. To unlock and redirect the public and private investments, EU will provide incentives and tools for investors by putting the sustainable finance at the heart of the financial system. The Commission will provide support to public authorities and project promoters in planning, designing and executing sustainable projects.

JTM is a key tool to ensure the transition towards a climate-neutral economy happens in a **fair way, leaving no one behind**. JTM will support the regions which are to be affected by the energy transition the most. The Just Transition Mechanism will consist of three main sources of financing:

- 1) **A Just Transition Fund**, which will receive €7.5 billion of fresh EU funds, coming on top of the Commission's proposal for the next long-term EU budget
- 2) **A dedicated just transition scheme under InvestEU** to mobilise up to €45 billion of private investments
- 3) **A public sector loan facility with the European Investment Bank** backed by the EU budget to mobilise between €25 and €30 billion of investments. It will be used for loans to the public sector (for district heating or renovation of buildings)²²

2.1.10.1. Clean, affordable and secure energy

The EGD is very comprehensive roadmap covering multiple areas. This analysis focuses in details on policy area **Clean, affordable and secure energy**.

In terms of the clean energy, EGD is following 3 main principles:

²² See more at https://ec.europa.eu/commission/presscorner/detail/en/ip_20_17

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- I. Prioritise **energy efficiency** and develop a power sector based largely on **renewable sources**
- II. **Secure and affordable** EU energy supply
- III. Fully **integrated, interconnected and digitalised** EU energy market

In light of the principles, the EGD identified steps which are necessary to make to transform to economy and the energy sector:

- **Interconnect energy systems** and better **link/integrate renewable energy sources** to the grid;
- Promote **innovative technologies** and modern infrastructure;
- Boost **energy efficiency** and **eco-design** of products;
- **Decarbonise the gas sector** and promote **smart integration** across sectors;
- **Empower consumers** and help Member States tackle energy poverty;
- Promote EU energy standards and technologies at **global level**;
- Develop the full potential of Europe’s **offshore wind energy**;
- **Increase cross-border and regional cooperation** to better share clean energy sources.

European Commission also set concrete actions:

- 1) By the end of June 2020 the assessment of the **final National Energy and Climate plans (NECP)** was planned. By this time 26 of the member states have submitted their NECP. Subsequently in 2021, relevant energy legislation will be reviewed and where necessary revised by June 2021. The NECPs of Member states will then be updated in 2023, to reflect the new climate ambitions.
- 2) In 2020 the EGD expects the evaluation and review of the **Trans-European network – Energy regulation**.
- 3) The building sector is also part of the energy transition. The EGD aims to kick-start the **“Renovation wave”** and has started the Renovation wave initiative. From June to July 2020 The European Commission conducted public consultation on boosting the renovation of buildings across the EU. The aim was to gather views and input from broad range of stakeholders (national, regional and local authorities, businesses, unions, consumers, education organisations, etc.). The Commission has confirmed the intention to publish a strategic communication and an action plan with concrete measures to deploy faster and deeper renovation in the autumn 2020²³.
- 4) The Commission committed to prepare strategies for **smart sector integration** and **offshore wind**. Strategy for offshore wind will be published by the end of the 2020. Smart integration strategy has been published together with **Hydrogen strategy** in July 2020. The Offshore wind strategy will be released until the end of year 2020.

2.1.11.Climate law-proposal – 2020

In March 2020 the Commission presented proposal of new Climate law. Its goal is to **enshrine in legislation the EU’s political commitment** to be climate neutral by 2050 and proposes **binding target** of net zero greenhouse gas emissions by 2050. The EU Institutions and the Member States are collectively bound to take the necessary measures at EU and national level to meet the target. The

²³ https://ec.europa.eu/info/news/preparing-future-renovation-wave-initiative-have-your-say-2020-jun-12_en

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Climate law also **sets direction for policies**, and gives **predictability** for public authorities, businesses and citizens.

The Climate Law includes measures to keep track of progress and adjust the actions accordingly, based on existing systems such as the governance process for Member States' National Energy and Climate Plans, regular reports by the European Environment Agency, and the latest scientific evidence on climate change and its impacts. It also includes necessary steps to get to the 2050 target:

- The Commission will propose a **new EU target for 2030 greenhouse gas emissions reductions**. This part of the Law will be amended following the completion of the impact assessment.
- By June 2021, the Commission will **review**, and where necessary propose to **revise**, all relevant **policy instruments** to deliver the additional emissions reductions for 2030.
- The Commission proposes the adoption of a **2030-2050 EU-wide trajectory** for greenhouse gas emission reductions, to measure progress and give predictability to public authorities, businesses and citizens.
- By **September 2023**, and **every five years** thereafter, the Commission will assess the consistency of EU and national measures with the climate-neutrality objective and the 2030-2050 trajectory.
- The Commission will be empowered to issue **Recommendations to Member States** whose actions are inconsistent with the climate-neutrality objective, and Member States will be obliged to take due account of these Recommendations or to explain their reasoning if they fail to do so.
- Member States will also be required to develop and implement **adaptation strategies** to strengthen resilience and reduce vulnerability to the effects of climate change.

2.1.12. Hydrogen strategy – 2020

In July 2020 EU Commission presented Hydrogen strategy together with Energy system integration strategy. The EU's hydrogen and energy system integration strategies will set a new clean investment agenda for the bloc.

The presented Hydrogen strategy will give a boost to clean hydrogen production in Europe. This strategy goes in line with the recovery plan "**Next generation EU**" which highlights **hydrogen as an investment priority** to boost economic growth and resilience, create local jobs and consolidate the EU's global leadership.

The Commission sets a pathway for the creation of European hydrogen eco-system in three phases:

1. **Phase 1: From July 2020 to 2024**, EU will support installation of **at least 6GW of renewable hydrogen electrolyzers** in the EU, and the production of up to **1 million tonnes** of renewable hydrogen. Electrolyzers will be built mainly where the demand is higher – larger refineries, steel plants, and chemical complexes – and ideally powered by local renewable energy sources. hydrogen refuelling stations will be needed for the uptake of hydrogen fuel-cell buses and at a later stage trucks. Also, existing hydrogen production plants should be decarbonised.

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To support the development of hydrogen industry in Europe, the Commission has created **European Clean Hydrogen Alliance** which will also help build up a robust pipeline of investments. Member of the Alliance will be Member states, Regions, companies²⁴, civil society, associations, hydrogen experts, research and innovation communities. The European Clean Hydrogen Alliance will act as a platform that enables close cooperation and coordination along the value chain.

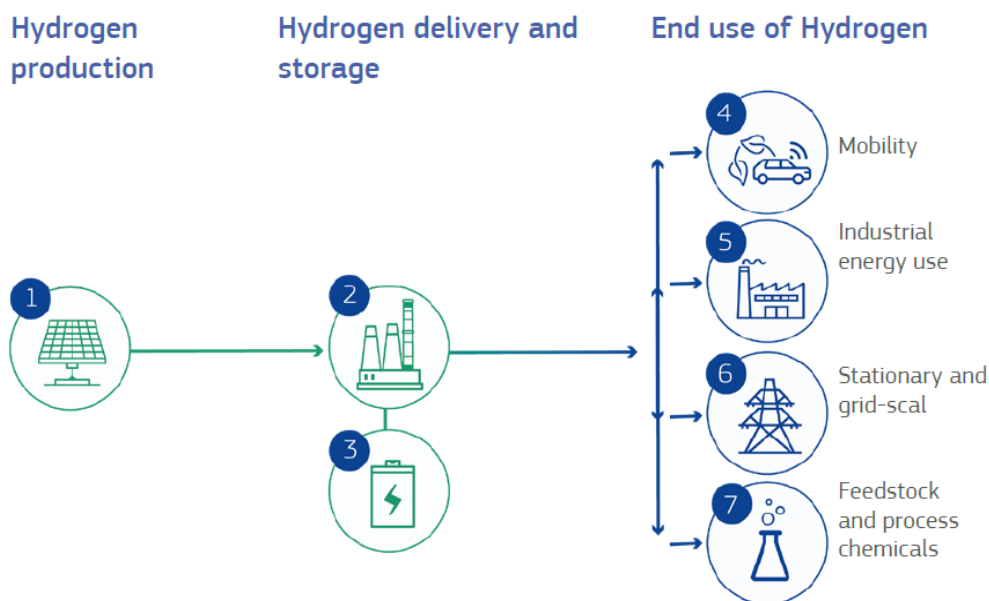


Figure 17 Hydrogen value chain, EU Hydrogen strategy

In terms of **policy**, the focus will be on laying down the **regulatory framework** for functioning hydrogen market and on creating incentives on both supply and demand side. Enabling framework conditions will push concrete plans for **large wind and solar plants** dedicated to gigawatt-scale renewable hydrogen production before 2030.

- Phase 2: From 2025 to 2030** - hydrogen needs to become an intrinsic part of our integrated energy system, with at least **40GW** of renewable hydrogen electrolyzers and the production of up to **10 million tonnes** of renewable hydrogen in the EU.

Local **hydrogen clusters**, such as remote areas or islands, or regional ecosystems – so-called “**Hydrogen Valleys**” – will develop, relying on local production of hydrogen based on decentralised renewable energy production and local demand, transported over short distances. In such cases, a dedicated hydrogen infrastructure can use hydrogen not only for industrial and transport applications, and electricity balancing, but also for the provision of heat for residential and commercial buildings.

- Phase 3: from 2030 onwards and towards 2050** - renewable hydrogen technologies should reach **maturity** and be deployed at large scale to reach all **hard-to decarbonise sectors** where other alternatives might not be feasible or have higher costs.

²⁴ Hydrogen strategy assumes 500 companies involved in 2020, 1000 in 2024 and 2000 companies in 2500

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Besides the strategic view, the Hydrogen strategy includes **concrete actions** which need to be taken in next two years:

- Commission will work to introduce **common standards, terminology and certification**, based on life-cycle carbon emissions, anchored in existing climate and energy legislation, and in line with the EU taxonomy for sustainable investments.
- Propose measures to facilitate the use of hydrogen in the Commission's upcoming **Sustainable and Smart Mobility Strategy**,
- Explore **additional support measures**, including demand-side policies in end-use sectors,
- Develop a pilot scheme for a **Carbon Contracts for Difference programme**,
- Start the **planning of hydrogen infrastructure**, including in the Trans-European Networks for Energy and Transport and the Ten-Year Network Development Plans,
- Accelerate the deployment of different **refuelling infrastructure**,
- Design enabling **market rules to the deployment of hydrogen**,
- Launch a **100 MW electrolyser and a Green Airports and Ports call** for proposals in H2020 programme,
- Facilitate the **demonstration of innovative hydrogen-based technologies** through the launch of calls for proposals under the **ETS Innovation Fund** (first call launched in July 2020),
- Launch a call for pilot action on **interregional innovation** under cohesion policy on Hydrogen Technologies in carbon-intensive regions
- Strengthen EU leadership in international fora for technical standards, regulations and definitions on hydrogen.
- Develop the **hydrogen mission** within the next mandate of **Mission Innovation (MI2)**
- Promote **cooperation** with Southern and Eastern Neighbourhood partners and Energy Community countries, notably **Ukraine** and set out a cooperation process with **African Union**

To create the hydrogen industry and value chain, a vast financing is needed. With 1.5-2.3 GW of EU green hydrogen production capacity already announced and 22 GW of electrolysers at an early stage of development, the commission anticipated €24-42 billion would be needed for electrolyser capacity up to 2030, with a total production cost bill to mid-century of €180-470 billion. Electrolysers, in turn, will require €220-340 billion for the commissioning of 80-120 GW of solar and wind generation capacity over the next decade. That will cheer renewables proponents more than the estimated €11 billion required to retrofit blue hydrogen facilities with carbon capture and storage systems over the same period.

Distributing hydrogen from production centers to end users will require a further €65 billion, according to the commission, although it was not clear over what period that expenditure would be required. A further sum of almost €1 billion would be needed to deploy 400 small hydrogen refuelling stations.

Creating demand could be expected to carry a hefty price tag too, with the average European steel factory requiring €160-200 million to convert to hydrogen use.

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Investments can be assured mainly through **European Clean Hydrogen Alliance**, whose task is to create investment agenda and build a pipeline of projects by the end of 2020. Strategic investments will be also supported through **Strategic investment Window of InvestEU (from 2021)**.

2.1.13. Energy system integration strategy – 2020

Energy system integration is the planning and operating of the energy system “as a whole”, across multiple energy carriers, infrastructures, and consumption sectors, by creating stronger links between them with the objective of delivering low-carbon, reliable and resource-efficient energy services, at the least possible cost for society. It encompasses following complementary and mutually reinforcing concepts:

1. **More ‘circular’ energy system, with energy efficiency at its core**

The current system is wasteful and energy and resources are being used inefficient, therefore, to reduce the losses and direct them towards other use, we need to come with new approach. The key tasks and challenges in this new approach will be:

- Promotion of energy efficiency
- Encourage the reuse of waste heat from industrial sites and data centres
- Improve synergies between energy infrastructures with the revision of the Trans-European
- Network in Energy Regulation
- Incentivise the use of agriculture residues to produce sustainable biogas and biofuels

2. **A cleaner power system, with greater direct electrification of end-use sectors**

To meet our emissions reduction goals and to cover the rising demand for electricity, we need to **generate more electricity** from renewables and accelerate the **use of electricity produced from renewable sources** to power buildings, industry, and transport, which traditionally relied on fossil fuels. Electrification can present challenges for the management of the electricity system. Close coordination between Member states is, therefore, required. To ensure the growth of electricity production from renewables, the strategy identifies the **offshore energy** as the future. To ensure the electrification of different sectors, it is necessary to develop more specific measures for the use of renewable electricity in transport, as well as for heating and cooling in buildings and industry. To accelerate the roll-out of electric vehicle infrastructure, the Commission committed to support building **1 million of charging points** by 2025, using available EU funds.

3. **A cleaner fuel system, with the use of renewable and low-carbon fuels, including hydrogen, for end-use applications where direct heating or electrification are not feasible, not efficient or have higher costs.**

Some sectors, like heavy transport and industry, are harder to convert to electricity, so we need to invest in cleaner fuels to power them. To do so, it is needed to:

- Unlock the potential of sustainable **biomass and biofuels, green hydrogen, and synthetic fuels**
- Enable **carbon capture, storage and use** to support deep decarbonisation, for example in cement production
- Clearly define and classify different fuels to support market uptake and transparency

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- Promote **innovative projects** based on low-carbon fuels, such as **hydrogen-fuelled clean steel plants**

4. Adapt energy markets and infrastructure to a more complex, integrated energy system.

The goal is to create integrated energy system, in which the investors and consumers will be able to choose the option that best matches their need, based on prices that reflect the true cost and efficiency. Therefore, it is important to:

- ensure **equal treatment** for all energy carriers, making electricity and gas markets fit for decarbonisation, for example with respect to taxation
- **Better inform consumers** about their options to interact with the energy market and the sustainability of the products they consume
- Support **digital energy services**, including smart meters for homes and smart chargers for electric vehicles
- Support **research and innovation** to create new synergies in the energy system

3. Europeans' at the heart of the energy transition and their attitudes on energy policies

Transition to clean energy will not be accomplished only with energy policies and technology innovation but also with people's **acceptance** of the transition and **understanding** of the new cleaner future ahead of us. Also, they need to understand the policies, the logic behind them, expected results and pathway. **Awareness** is key element in the transition.

Consumers are at the heart of the transition, therefore European Commission (DG ENER) prepared **Special Barometer 492 called Europeans' attitude on EU energy policies**. Survey was carried out in the 28 EU member states on 27 438 respondents from different social and demographic groups in May 2019. This survey seeks to gauge, for the first time, EU citizens' opinions about aspects of EU energy policy in order to:

- Review what citizens think EU energy policy is about currently and what it should aim to achieve;
- Assess awareness of and effectiveness of current energy efficiency labelling;
- Investigate what citizens believe the EU's priorities for energy policy should be in the next decade.

3.1. What does the EU policy mean to you?

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In Figure 18 are shown five most common answers (respondents could choose 3 answers). According to 41% of Europeans, the EU policy means shifting from fossil fuels to renewable energy sources to combat climate change. In Figure 19 are shown most mentioned answers by country.

QB1 What does EU energy policy mean to you? (MAX. 3 ANSWERS)
(% - EU)

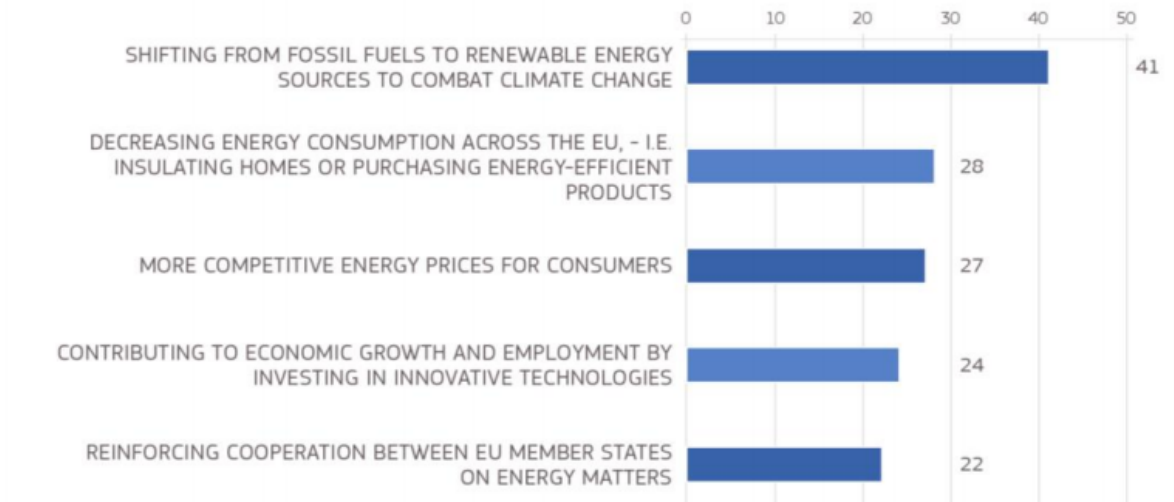


Figure 18: 5 most common answers to question 1 of EBS 492 survey

QB1 What does EU energy policy mean to you? (MAX. 3 ANSWERS)
(% - THE MOST MENTIONED ANSWER BY COUNTRY)

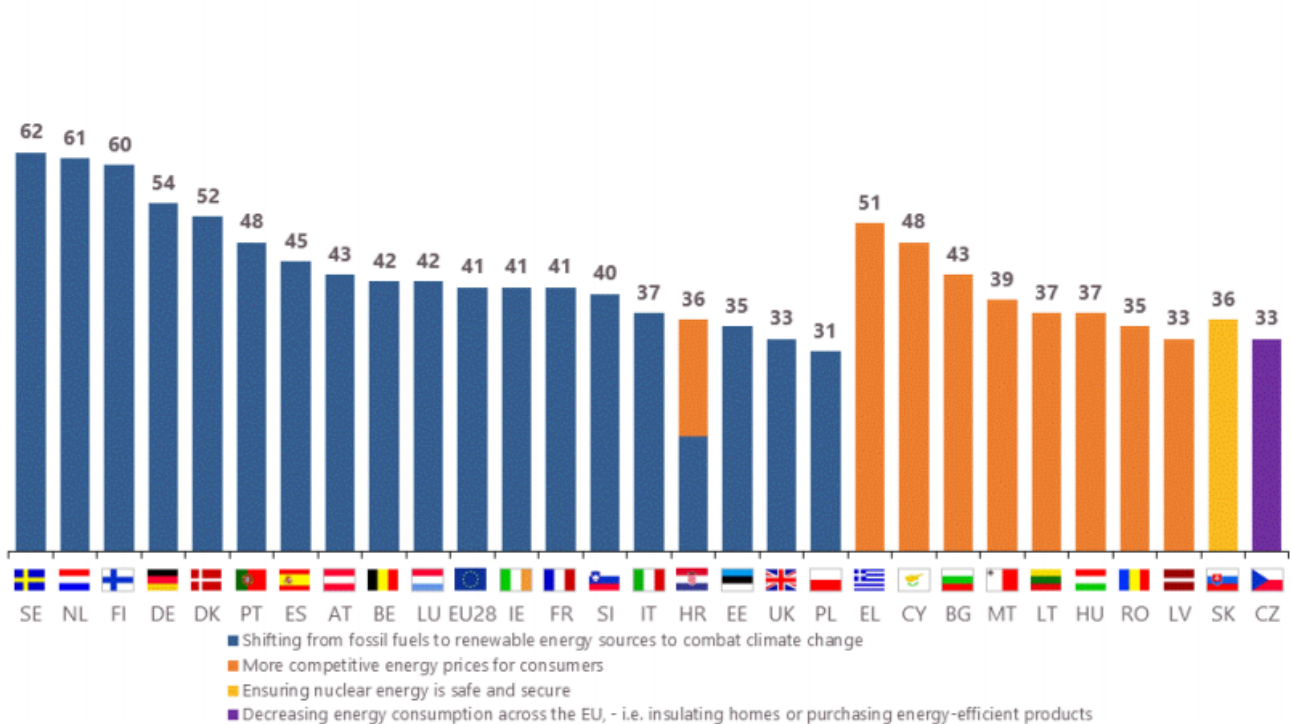


Figure 19 The most mentioned answers to question 1 by country, in %

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3.2. What should be the EU's energy priorities?

A significant majority agree that the EU must secure access to energy to all EU citizens – 92%. Nine of ten respondents also agree that:

- it is necessary to have a well-connected energy network across the EU
- the EU should encourage more investment in energy research and innovation
- the EU should address energy poverty and ensure a fair energy transition so that no citizen is left behind

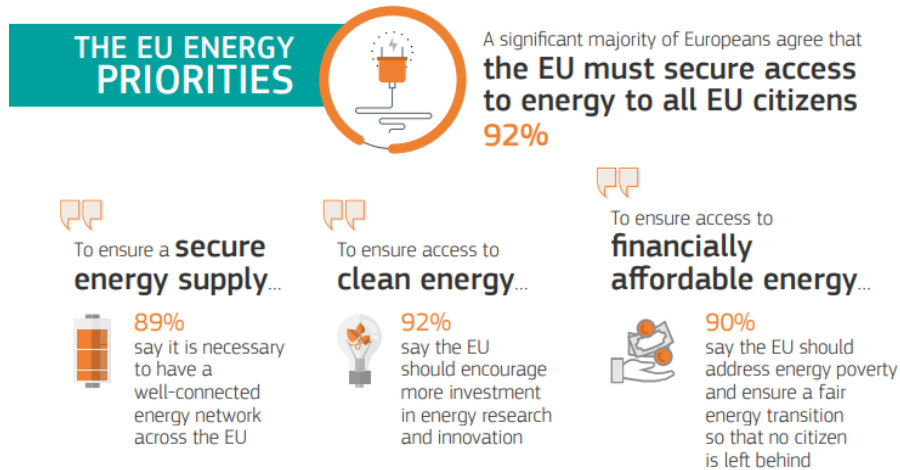


Figure 20 What should be the EU's energy priorities

QB2.1 To what extent do you agree or disagree with the following statements?
The EU must secure access to energy to all EU citizens (%)

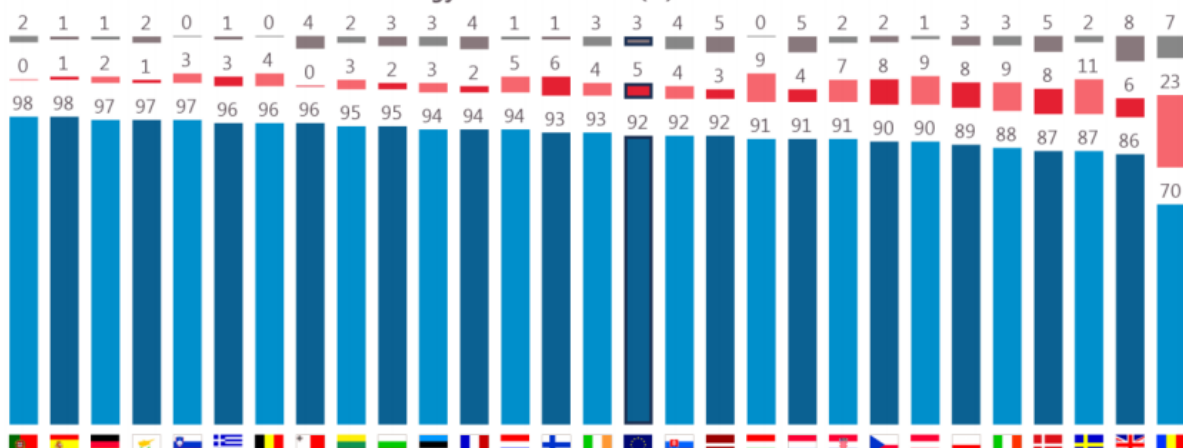


Figure 21 Opinion of EU citizens on EU's responsibility in securing access to energy to all EU citizens by country, in %

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3.3. Do you know the EU energy label?

Results can be seen in the Figure 22. The energy label is well known among the respondents – **93% have seen the EU energy label** (79% know what it stands for and 14% don't). The EU energy label has a **big influence** on Europeans' choices when buying appliances (in 79% of Europeans' purchases).

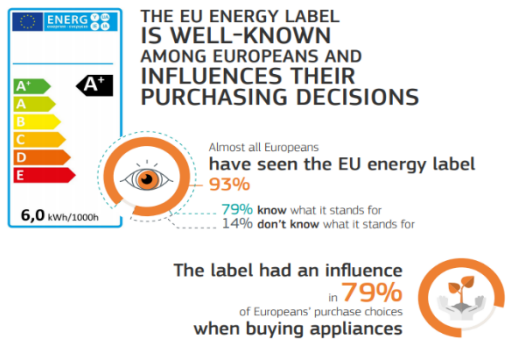
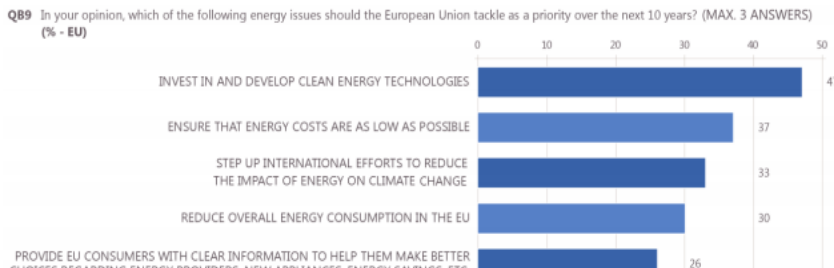


Figure 22 Recognition of energy label in EU

3.4. What should be the EU's Energy priorities in next 10 years?

Nearly half of the polled say they think the EU **should invest in and develop clean energy technologies (47%)**. Just under four in then respondents says they believe the EU **should ensure energy costs are as low as possible (37%)**. Third of the respondents think that EU should **step up international efforts to reduce the impact of energy on climate change (33%)**.



QB8 Did the EU energy label have an influence on the choice of your purchase of electric appliances (fridges, washing

Figure 23 Influence of energy labelling on consumers' purchasing decisions by country, in %

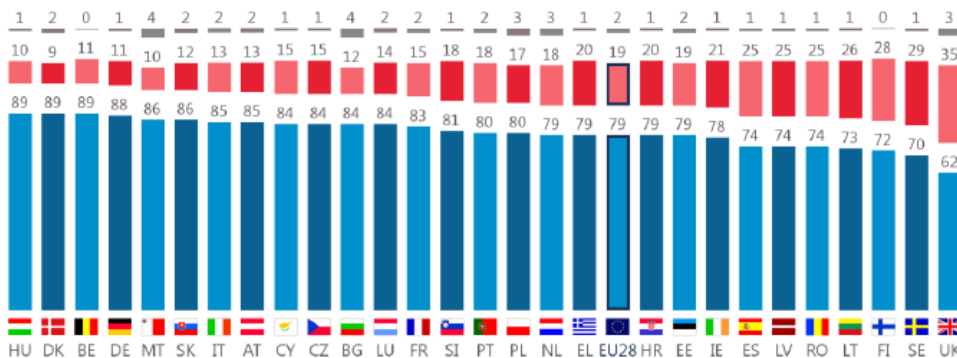


Figure 24 Five most frequent answers on EU energy priorities in next 10 years

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QB9 In your opinion, which of the following energy issues should the European Union tackle as a priority over the next 10 years?
(MAX. 3 ANSWERS)
(% - THE MOST MENTIONED ANSWER BY COUNTRY)

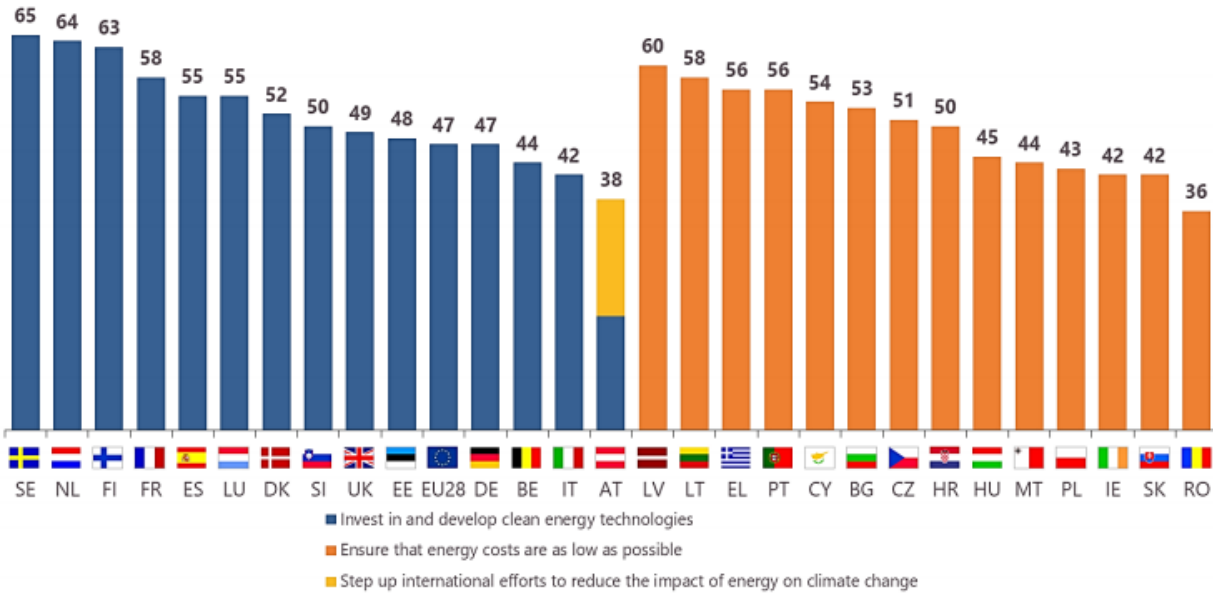


Figure 25 The most common answer about EU's energy priorities in next 10 years by country, in %

3.5. Conclusions from the survey

The survey shows that EU citizens believe that priorities now, and in the future, should be about securing clean, affordable energy.

Over four in the ten respondents say current EU policy is about moving towards clean energy sources and away from fossil fuels, while over quarter say it's about reducing energy consumption.

Significantly, over six in ten respondents think that EU should ensure secure access to energy and especially clean energy to EU citizens. Large majority says that it should be EU's responsibility to encourage more investments in renewables and energy research and innovation.

But this needs to be done affordably. Quarter of the polled say EU energy policy is about reducing costs to consumers, while over a half say EU should address the energy poverty and ensure fair energy transition and no one is left behind. Also nine in ten say the EU must be responsible for taking action to ensure competitive market prices, especially to reduce number of people who are unable to pay their energy bills.

Good news is that the EU energy label is well known with people and influence their purchasing decisions, whether to save money, to choose more environmentally-friendly appliances or both.

Looking forward to next ten years, the priorities of EU should be to invest in and develop clean energy technologies (half of respondents), third say EU should step up international efforts to reduce

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the impact of energy on climate change and four in ten respondents say the EU should focus on ensuring energy costs are as low as possible.

In socio-demographic terms, there are some interesting patterns that emerged in the survey:

- Men and women seem to agree on most topics, with only a few exceptions;
- The younger, more educated respondents who are managers and seldom struggle to pay bills are more interested in environmental issues connected with energy;
- Older, less well-educated and those who have difficulties in paying bills are more likely to raise issues associated with affordability

Awareness of the energy label, who is **issues, while lower levels of recognition are associated with more interest in reducing energy costs.**

3.6. European Climate pact

As part of the European Green Deal, the Commission will launch a European Climate Pact **in the last quarter of 2020**. It aims to inform, inspire and foster cooperation between people and organisations ranging from national, regional and local authorities to businesses, unions, civil society organisations, educational institutions, research and innovation organisations, consumer groups and individuals. Climate pact will work on three principles:

- 1. Talk about climate change** – raise awareness and build understanding about climate change
- 2. Trigger action** - promote public commitments (pledges) and support relevant initiatives with knowledge/capacity-building, to boost their impact and inspire further action across Europe and globally
- 3. Work together** - provide opportunities for communication, learning and networking, online and offline. It will help to bring together people and organisations to share ideas and experience

Europeans are encouraged to engage in the transition to clean energy, as it is crucial to create the integrated energy system. Newly created Energy system integration strategy sees the consumers (prosumers) as one of the key element of the integrated system. It also encourages them to participate in the Climate pact and other fora to advance the system integration agenda.

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4. National and regional policies and current status related to energy transition shifting towards renewable energy

4.1 Current situation in SHREC countries related to RES.

Renewable Energy is at the core of the Energy Union's priorities. In order to reach the climate and energy targets, every country and territory should promote a sustainable energy plan and they have different available resources and their own unique energy markets. This means that they have to follow distinctive paths when it comes to meeting their obligations under the renewable energy directive, including their legally binding 2020 targets. In order to understand the need and the situation of the SHREC countries in terms of energy efficiency and RES, project partners have analysed the potential of their country/ region related to renewable energy and the main steps taken and planned in order to meet their targets. Also, it was described the process that all countries have passed through in their process of transition to clean energy.

Netherlands

For Netherlands, the main need is to find green alternatives for natural gas, as a result of the decrease of natural gas production, due to the fact in March 2018, the government decided to end gas extraction in the Groningen field, in order to ensure the safety of Groningen's inhabitants. This involves major steps, due, among other things, to build an extra nitrogen plant and to intend to convert the nine largest industrial users. As of 2022, it is expected that only a limited volume of natural gas will be needed from the Groningen field. This will be reduced to zero over the course of the following years.

Thus, Netherlands is trying to find more sustainable gases to achieve the climate goals and also to preserve the existing infrastructure. Netherlands doesn't have potential to build hydro power plants, nor to have huge availability of biomass or the space to build big biogas plants, but in the northern part of the country, there are factories that produce biogas, out of biomass. This biogas is being upgraded to natural gas quality (also referred to as biomethane or green gas) and injected into the distribution grids. Although, most biogas digesters are located in the south of Netherlands (due to the large livestock farms in that area).

To counter the need of alternative gas, Netherlands identified that the biomethane is suitable for transport, via the natural gas infrastructure. Hydrogen, in particular green hydrogen, is also suitable for transport, via the natural gas grid.

The current legal framework prohibits any concentration over 0,5 mol% in the distribution grids; however, there are pilot projects running to connect an entire neighbourhood to a hydrogen grid in order for the consumers to heat their houses on hydrogen.

Thus, according to *The Climate Agreement*, Netherlands would start a hydrogen programme. This programme will focus primarily on unlocking the supply of green hydrogen, developing the necessary infrastructure and cooperating with various sector programmes, and facilitating ongoing initiatives and projects. This programme also promotes synergy between infrastructure and the use of sustainable (both blue and green) hydrogen. The ambition of this programme is to have achieved 3-4 GW installed electrolyser capacity by 2030, in which the development must be consistent with the additional growth in the share of renewable electricity.

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Moreover, another development that can contribute in achieving the climate goals is the development of off shore wind parks. In 2019 the total production capacity was almost 1 GigaWatt, with the goal to achieve 4,5 GW in 2023. This will then cover 3,3% of total share of energy in the Netherlands. In 2030 a total of 11 GW should be established, covering approximately 8,5% of all energy and 40% of their current energy consumption. Two parks, to be established in 2022 and 2023 will become the first wind parks established without subsidy in the whole world.

Also, the establishment of solar parks is growing substantially. Not only are small households investing in solar panels for on their roofs, the number of energy cooperatives is also growing fast. These energy cooperatives establishing solar parks whereby other consumers also can buy a share in these parks and gain i.e. a tax advantage

SLOVAKIA

The development of the Slovak energy sector is focused on **optimizing the energy mix** in terms of **energy security** while achieving the highest possible **energy efficiency** and consistent **environmental protection**.

Thus, regarding the renewable energy obtained from Hydropower plants, Slovakia has a total installed capacity of 2,528 MWe, from which 1,612 MWe are in flow power plants and 916 MWe in pumped storage power plants. The largest hydroelectric power plant is Gabčíkovo with an installed capacity of 720 MWe. Its annual production (2,200 GWh) is almost half of the total electricity production of hydroelectric power plants in the Slovak Republic.²⁵

According to the updated *Concept of utilizing the hydro-energetic potential of water flows in Slovakia by the year 2030*, the total theoretical hydropower potential of water flows in Slovakia is 13 682 GWh/year²⁶. The hydro-energetic production potential represents the theoretically usable hydro energetic potential, taking into account losses and economic factors. Taking into account the technically unusable streams and energy loss values when converting energy, the value received of the technical hydro-energetic potential is 6,700 GWh/year and 625 profiles in the SR.

The technical hydro energetic potential can be used to produce energy from large hydropower plants with installed capacity over 10 MW (VVE) and small hydropower plants with an installed capacity of up to 10 MW (MVE). **The technical hydro-energetic potential of watercourses is utilized at 70%**. Additional VVE will increase the utilized hydropower potential by 17.3%, which means that it is possible to meet the technical potential only by building MVEs. This is due to the fact that the water courses, which allow further construction of VVE, have filled up their hydro energetic capacity.²⁷

It is also possible to assess the feasibility of using hydro energy potential within the comprehensive use of the Danube above Bratislava and increased production of bioethanol at Enviral Leopoldov, with installed capacity of 15 MW in the form of CHP from RES.²⁸

²⁵ Progress report on the promotion and use of energy from renewable sources, Ministry of Economy 2019

²⁶ This overall theoretical potential represents the statistical volume whose value provides an image of the characteristics of the individual flows. Actually, it is the potential of surface water and groundwater that flows into the river as flow. From the point of view of usability of water courses, we recognize two types of hydro-energetic potential, namely the power potential and the production potential. The hydro-energetic power potential represents the ability of the watercourse to provide some performance that is achievable at full flow utilization.

²⁷ ANALYSIS OF HYDROPOWER POTENTIAL UTILIZATION OF WATERCOURSES IN SLOVAKIA Mirko GEJGUŠ, Christine ASCHBACHER, Jozef SABLÍK SLOVAK UNIVERSITY OF TECHNOLOGY IN BRATISLAVA, FACULTY OF MATERIALS SCIENCE AND TECHNOLOGY IN TRNAVA, INSTITUTE OF INDUSTRIAL ENGINEERING AND MANAGEMENT

²⁸ Integrated NECP for 2021-2030, Slovak Ministry of Economy, Bratislava, December 2019

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Wind energy, according to National Action Plan for RES from 2010, should also contribute to increase in the use of renewables, in particular the total installed capacity of wind farms in 2020 should be 350 MW. These targets set in the NAPRES issued in 2010 currently appear to be really very ambitious, given that no single wind power plant has been built in Slovakia for more than 10 years.²⁹ There are currently 5 wind turbines in operation in the Slovak Republic with a total installed capacity of 3.1 MW. and annual production of approximately 5.5 GWh of electricity representing the consumption of about 3,000 households.

Not very feasible wind conditions in Slovakia are created mainly by the inland geographical location of the country as well as by the rugged relief of the earth's surface occurring on the territory of the country. At the same time, however, the articulated relief can, in certain areas, help to speed up the average wind speed by accelerating the air flow due to the aforementioned nozzle effect. Wind turbines are expected to be installed after 2020 when new grid (2x400kV) between Slovakia and Hungary will be installed.³⁰

As a RES, biomass has the **highest technical potential for development**, which is caused by suitable natural conditions in Slovakia. The source for biomass can be products of plant or animal origin and, depending on the method of processing, a distinction is made between direct combustion, gasification and pyrolysis processes. Today, however, the situation in Slovakia is relatively complicated due to high purchase prices for electricity from biomass. Due to the high yield of private companies in the production of electricity from wood chips, wood chips made from technically processable wood logs are burned, which, however, has greater value in the form of wood chips than technically usable wood due to artificially raised electricity prices.

One of the possible ways of using biomass is co-combustion with fossil fuels in thermal power plants and in the combined production of electricity and heat. The total biomass potential in Slovakia is determined at approximately **33,400 GWh**, the assumed usable technical potential is, according to the document Strategy for Higher Use of Renewable Energy Sources in the Slovak Republic, determined at the same value, ie 33,400 GWh. Biomass is further divided into components; the percentage of the total technical potential is indicated in parentheses: forest biomass (14.1%), agricultural biomass (23.8%), biofuels (5.8%), biogas (5.7%) and other biomass (50.6%).

Forest and agricultural biomass resources are increasing every year, but its use is not optimal. Problems in the use of biomass are caused mainly by inappropriately constructed legislation. Currently, the biggest problem is that quality wood is used as a source of energy, instead of recovery through the production of products with higher added value. **Only waste biomass sources or purposefully grown energy plants should be used for energy use.**

Exploiting the potential of **geothermal energy** (GE) is currently quite demanding, whether technologically or financially. Geothermal energy can be used either for heating or for electricity generation. For this, however, the water must meet adequate conditions, which are given by the yield of the thermal well and the water temperature.

In the Slovak Republic, no electricity generation based on the use of geothermal energy has been built or is being prepared, the geothermal energy is used only for heat production. The expected contribution of geothermal energy in the National Action Plan assumes a contribution of 28 GWh in 2016 and 30 GWh in 2020. Today we can say with certainty that this assumption will not be met,

²⁹ <https://energieprevas.sk/eko/21>

³⁰ https://www.atpjournalsk/rubriky/prehladove-clanky/svita-veternym-elektrarnam-naslovensku-nalepsie-casy.html?page_id=30714

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despite the fact that GE has the second largest overall potential, which represents 48 500 GWh. The properties of geothermal waters in Slovakia predetermine the use of this energy, especially for heating and medical purposes. The technical potential is significantly lower, with a value of 6,300 GWh. This is due to technological problems related to the chemical composition of geothermal waters. Existing geothermal wells in Slovakia are used mainly for recreational and medical purposes in thermal baths due to the abundance of geothermal waters beneficial to health-promoting minerals.

Solar energy has the greatest total potential, the amount of energy falling on the territory of Slovakia is 54,038,000 GWh, but this number is misleading as the total **technical potential is only 1,540 GWh**. PV power plants located on the territory of the Slovak Republic belong to the distributed sources, which are used for local consumption in a smaller area or for direct consumption at the place of their installation. Of all distributed sources, PV plants have the highest installed capacity.

Utilization of technical PV potential is currently, compared to other technologies, more financially demanding. Due to the fact that the production corresponding roughly to the installed capacity of the photovoltaic panel is on average 4 hours a day, the return on investment is too long, therefore support in the form of subsidies and artificially raised purchase price is needed. A major shortage of renewables (applies to both wind and photovoltaics) is instability in production and difficult predictability of production, as the amount of sunlight varies from season to year, is available 8 to 16 hours a day and is affected by weather that is not predicted. is completely accurate. Therefore, before any new investment is made, it must be assessed how the fluctuations caused by these resources will be regulated, regardless of their origin. The regulation of fluctuations is achieved by means of regulating electricity, which is understood as a support service, which significantly contributes to the total energy price. The control electricity is provided by generators connected to the network, which are operated so that it is possible to regulate their output power value in both directions, which is caused by not using the maximum installed power of the device. Diesel generators are also used to provide support services, which are put into operation if necessary, which burns diesel and thus generates CO₂, which is contrary to the main idea of promoting renewables. Another currently insufficiently solved problem is the disposal of solar panels and the associated investments and the impact on the environment.

LITHUANIA

Over the past ten years, Lithuania's energy sector was basically restructuring. There were lot of structural reforms and strategic projects, energy supply routes and sources has increased, the cost of energy resources to consumers has fallen.

The European Commission has approved a €385 million renewable energy scheme to support renewables generation in Lithuania.

Sustainable development of energy from renewable sources is an important pillar of the energy policy aimed at reducing the dependence on imported fuels and fighting climate change.

The strategic objectives set in recent years in the area of renewable energy sources (RES) have enabled a robust development of local energy generation capacities from renewable sources in Lithuania. Since 2007, the share of RES in the overall final energy consumption increased up to 25,83 percentage points in 2017.

In 2017 Lithuania consumed 10,76 TWh of electricity, 3,86 TWh was produced domestically and more than 2 TWh were produced from RES. Wood and peat are important energy sources. The country's hydroelectric potential is estimated at about 2 TWh/year. Lithuania, which has set ambitious 100% renewable energy targets, is moving towards their implementation.

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After a 6 years break, first technology neutral renewable energy auction was finished, an analysis of offshore wind energy development in the Baltic Sea was published, and opening of Power Purchase Agreement market is being discussed. These are very important steps for the future of wind energy sector, so developers and investors are observing the situation very closely. Last year, wind parks operating in Lithuania produced more than 1.4 TWh of electricity which is the largest amount of electricity in the country's wind energy history. The result surpassed the record achieved in 2017, when the production volumes amounted to over 1.3 TWh.

According to the Lithuanian Energy Resources Exchange Baltpool, in december the country's wind parks generated 169.4 GWh of electricity. The overall result for 2019, according to Litgrid, the transmission system operator, was 1.453 TWh, almost 28 percent higher than in 2018, when just over 1.139 TWh was generated. Production volumes in major power plants increased by more than a quarter and in small ones by more than 40 percent.

There are currently 23 wind parks in Lithuania, with a combined capacity of 480 MW. Together with small wind turbines, the total installed capacity is 533 MW. Preliminary estimations from the association show that last year wind parks were able to generate about 13 percent of the country's final electricity consumption. In comparison: all renewable sources combined generated 26 percent of electricity.

Regarding the solar energy, Lithuania is the first country in the world to launch an online platform to buy solar energy which is available to all households in Lithuania. Solar platform gives everyone, even the people living in an apartment, the opportunity to purchase part of the solar power plant from solar parks and at the same time become a remote energy generating consumer. Almost 300 households will use the first 1 MW solar power plant. The planned lifetime of the solar power plant is 25 years. It is estimated that during this time the project will generate 25 GWh of electricity, and the use of renewable energy resources will save more than 450 thousand trees and CO₂ emissions will be reduced by almost 19 tones.

ROMANIA

Romania boasts a diversified and well-balanced mix of energy sources. This lends it the enviable status of the country with the lowest dependency on energy imports in Central and South-Eastern Europe. Romania's energy policy showed an increasing focus on renewable sources mainly in relation to the green energy commitments and EU targets and to the interest of investors.

Romania has one of Europe's highest potentials for commercial renewable energy sources (RES), as indicated in a 2017 IRENA study. As such, the country should be able to properly contribute to the EU's collective goal of 32% RES by 2030. Romania has already surpassed its 2020 obligations of 24%, reaching 24.6% of renewables in final energy consumption (including hydropower and biomass) by 2017 already.

The renewable energy sector is the one in which Romania has seen the most spectacular investment boom over the past decade – mostly from 2010 to 2016, especially for wind and solar power. The country boasts Europe's largest onshore wind park, namely the 600 MW Fantanele-Cogealac, in the region of Dobrogea.

This remarkable increase took place on the back of a generous RES support scheme, introduced through Law 220/2008. The law established a mandatory quota system, coupled with a trading scheme of green certificates (GCs). However, only two years into the application of the RES, the support scheme was curtailed.

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Regarding the South Muntenia region potential to RES, there are differences between the north and the south of the region. The potential of solar energy is very high in the south of the region, especially in Calarasi, Ialomita, Giurgiu and Teleorman counties. The other three counties (Arges, Dambovita, Prahova) have a very diversified potential, from high potential in the south to very small one in the north.

Hydro energy is the most important kind of RES in Romania. Indeed, state-owned Hidroelectrica S.A., with its around 6,500 MW of capacity, is the backbone of the Romanian energy system, given its major contribution not only to overall electricity production, but also to balancing the grid, thanks to its hydro dams' storage. As most of the country's hydro power plants were built between 1960 and 1990, the company needs massive refurbishment & modernization works. Moreover, Hidroelectrica plans to build about 200 MW worth of new capacities, pending the needed environmental permits.

Biomass is the fuel of choice in the countryside, where almost half of Romania's population resides. Indeed, most heating and cooking takes place using as fuel wood. Properly monitored and collected, such wood is being accounted for as a renewable energy source, thus contributing to the country's overall share of RES.

There are many uses and many meanings to biomass. One important thing is that the biomass industry develops in a sustainable manner, without causing deforestation, displacing food crops or resulting in carbon emissions. Consequently, there are several challenges to the sustainable biomass industry: it must be environmentally friendly, climate responsible, socially acceptable, and cost competitive. Even under all these constraints, Romania is deemed to have an exceptional potential for sustainable biomass. However, other than the use of raw firewood, there is barely any industrial development in the biomass sector.

ITALY

Italy is fully aware of the potential benefits inherent to the increased availability of renewables and energy efficiency, connected to the reduction in polluting and climate-changing emissions, improvements in energy security, and economic and employment opportunities for families and for the production system, and intends to follow this path with conviction, with an approach that increasingly focuses on citizens, including in their capacity as prosumers, and businesses, in particular small and medium-sized enterprises.

Final Energy consumptions in Italy are about 120 Mtoe. Most of the used energy is based on oil products and natural gas. Direct use of renewables is about 7%. Nevertheless, a large share of electricity comes from renewable sources, thus, the overall contribution of RES to final consumptions is about 18%. This share is increasing year by year, mainly starting from 2010.

As far as the sectoral breakdown is concerned, most of the consumptions are concentrated in the transport and building sector. The latter is to be considered as the sum of residential and tertiary sectors, that counts for more than 41% of the overall final consumptions.

Final energy consumptions in Piemonte are based on the use of natural gas. This is particularly evident comparing data at European, national and Regional level. Solid fossil fuel and petroleum products are, thus, less present in Piemonte Region, whereas the share of electricity presents similar value than EU28 and National data. Slightly higher value of renewables could be observed as well as a greater value in the derived heat contribution to final energy consumption (almost double if compared to EU28 and National share).

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In the last years, the regional consumptions have been almost stable around the average value of about 10 Mtoe. All main energy vectors record yearly fluctuations due to several reasons (climate conditions and GDP variations), nevertheless the trend stands still to the same average values.

The most dynamic vectors are RES, for which a clear growing trend is evident. As for the overall country, even for Piemonte Region the consumptions are concentrated in the building sector. Residential and tertiary sector count more than half of the total consumptions with an increasing importance. On the contrary the industrial sector is facing a decreasing trend, following the economic crisis of 2008 when most of heavy industry sectors have stopped the production, leaving space to less energy intensive production chains.

In Piemonte Region, renewable energy sources amount for 1,94 M toe, this is equal to 18,5% of the overall final energy consumptions. The total RES is almost equally divided among electricity and thermal use, as it is respectively equal to 0,92 Mtoe and 1,02 Mtoe. The importance of RES in the regional energy balance is constantly increasing.

Since 2012, thermal renewable sources increase of about 17.5%, exceeding 1 Mtoe from 2016. All renewable sources show a growth trend even though the rate is not as fast as it should be to be in line with envisaged 2030 targets. In 2017, the direct use of biomass accounted for more than 67% of total RES production for thermal use.

Between 2012 and 2017, renewable sources generating electricity grew by about 17%, as well. The growth rate stopped in the last few years in which the data are almost stable. The most growing energy production is the one produced from biomass (including solid biomass, biogas and sustainable bioliquids), which doubles in the reference period. Even for biomass, however, the figure for the last three years remains almost stationary at 160 ktep. Hydropower production appears to be oriented towards a more limited growth (+ 4%), since its exploitation has already reached a good degree of maturity. The increase in solar energy is also significant, growing by 27% between 2012 and 2017 and which, after a stasis between 2014 and 2016, recorded a very promising recovery in 2017 (+11ktep).

In conclusion, the overall contribution of total renewables on gross final consumption is 18.5%. Faced with a slowdown in the contribution of electric renewables and an increase in thermal ones, the weight of renewables has increased by about 15% since 2012.

SPAIN

Spain is one of the European countries with the highest potential for exploiting renewable energy. It extends over 50 million hectares, including large areas of low population density, and benefits from Mediterranean and Atlantic winds, high levels of sunshine, extensive forests and substantial water resources, and these are complemented by a business, technological, innovation and knowledge network in this area.

2019 marked a turning point in the transition of the peninsular electricity system towards a sustainable energy model. 2019 saw the highest increase in renewable installed power capacity in the last ten years, almost 14% more than at the close of 2018, representing an increase of 6,693 MW. For the first time since statistical records began, 50.1% of the complete set of electricity generation facilities in Spain corresponds to renewable energy facilities.

This growth is mainly due to the increase in solar photovoltaic power, which contributed 63% of the new installed renewable power capacity. The second source, although a long way behind, which

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has contributed most to the new installed renewable capacity, was wind power with an additional 2,254 MW.

The contribution of renewable energies to national electricity generation this year was slightly lower than in the previous year, with a 37.5% share compared to 38.4% in 2018. Despite this decrease, the share of renewable generation represents its fifth highest value in the last ten years.

The fall in renewable generation was caused by lower hydroelectric generation, 27.6% less than the previous year, as a result of it being a year with less rainfall. However, without taking into account hydroelectric generation, the rest of the renewable technologies in the electricity system grew by 10.5% in 2019, as all of them recorded increases with respect to the previous year. share of renewable generation represents its fifth highest value in the last ten years. It should be noted that, although renewable generation was slightly lower, the sharp drop in production with coalfired facilities, almost 66% less than in the previous year, triggered a considerable reduction in CO2 equivalent emissions, which in 2019 reached an all-time low: 50 million tonnes of CO2 equivalent, 23% less than in 2018.

Wind energy continues to be the most important renewable technology in the national generation mix, accounting for 20.8% of the total production. This year it is behind nuclear and combined cycle production. However, it continues to be the most relevant renewable technology at a national level, as in 2019 it accounted for 55.4% of all renewables.

Wind power production has continued to grow for the third consecutive year, with an increase of 9.4% compared to 2018. In total, 54,238 GWh were produced with this technology, which is very close to the all-time record for wind power production recorded in 2013, with 3.3% less installed renewable power capacity.

In 2019, solar photovoltaic facilities almost doubled their installed power capacity and increased their production by 19%, reaching 9,240 GWh, which is a new record for annual generation and represented a 3.5% share in the national generation mix.

The greatest variation in installed renewable power capacity was in solar photovoltaic which had a growth of 89.2 % compared to the previous year. In only four of the Autonomous Communities was its generation from renewable sources greater than 50%.

Generation with renewable energy sources per Autonomous Communities depends heavily on the distribution of installed power capacity within the Community and by the hydro reserves available each year. In 2019, the production of five of the Communities represented 70% of the total production.

Over the past year, the electricity generation mix has shown that Spain is strongly committed to renewable energy, but it is also making progress in the process of decarbonisation. 2019 recorded the lowest share of coal-fired technology. It represented just 4.3% of the total generation compared to 14.1% in 2018. In addition, the year closed with an unprecedented event in the history of the peninsular electricity system: the so-called 'zero' carbon or, what equates to a whole day without generating a single MWh using this fossil fuel.

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One of the main consequences of this boost to decarbonisation has been the decrease in CO₂ emissions associated with electricity generation, which have registered an all-time low since records began (1990): 25.5% CO₂ less than in 2018.

FRANCE

Renewable energy had a 23% share in total power consumption in mainland France in 2019, just slightly up from the previous year's 22.9%, driven by the increase in wind power capacity and output levels. According to the latest power report (co-authored by French grid operators RTE and Enedis with other industry professional associations), France installed 1,361 MW of wind over the year to reach 16,494 MW on December 31.

Wind farms generated 34.1 TWh, boosting production by 21.3% year-on-year and recording an overall annual share of 7.2%.

The country had a 9,436-MW-strong solar park fleet at the end of 2019 after connecting 890 MW of new capacity. Solar power production rose by 7.8% year-on-year to 11.6 TWh, accounting for a 2.5% share in the annual consumption.

Renewable hydropower plants (HPPs) injected 55.5 TWh, a 12% drop compared to 2018 levels despite a production spike in the fourth quarter. After 21 MW of new hydro installations, France boasted 25,557 MW at year's end. Hydro succeeded in covering 11.7% of consumption needs.

Lastly, the bioenergy industry reached 2,122 MW of the total installed capacity, with 75 MW installed over the year. Bioenergy power plants that use renewable feedstock generated 7.7 TWh, up 3.4% on the year, covering 1.6% of the consumption.

The Auvergne Rhône-Alpes region has favourable weather conditions and the production of electricity from renewable sources is in progress. According to a 2018 report made by "le Réseau de transport d'électricité" (RTE), on average, renewable electricity covered 45% of regional consumption. In fact, the electricity produced in the region is getting greener by the day!

The renewable electricity produced in Auvergne Rhône-Alpes, in 2018, covered 45% of the region's consumption. This figure is significantly higher than the one registered in 2017 (35%), and well above the national average where renewable electricity represents 23% of consumption. According to RTE, these results can be explained by a rise in renewable electricity generated by very favourable climatic conditions and a continued growth of wind and solar farms.

Regarding hydro-electric power production, it has risen by an astounding 27.3% in comparison with 2017, while solar and wind power productions are up 16.2% and 6.4% respectively. The renewable sector represents 48% of the installed power plants, which makes Auvergne-Rhône-Alpes the region that produces the most electricity from renewable sources.

SWEDEN

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Sweden has a rich supply of moving water and biomass, which contributes to the country's high share of renewable energy. Hydropower and bioenergy are the top renewable sources in Sweden – hydropower mostly for electricity production and bioenergy for heating.

Wind power has been the fastest growing source of renewable energy around the world in recent years, and capacity is expanding in Sweden. In 2000 Swedish production totalled 0.5 TWh, for 2018 that figure was 16.6 TWh, there are about 3,600 wind turbines in Sweden.

The largest source of bioenergy in Sweden is the forest and has more forest than most other countries – 63% of land cover. Bioenergy is primarily used for heating – both in private homes and in district heating – as well as for electricity production and for industrial processes.

The Swedish solar cell market, though still limited, has begun to grow with the aid of government funding. In 2017, the total installed capacity amounted to 231 MW. The Swedish Energy Agency invests in research into solar power, solar photovoltaics (PV) and solar fuels, and also offers investment support to private, public and commercial actors.

In the transition to a sustainable society, wave power may be an important technology in the future, but it is still relatively undeveloped. It is a challenge to make the technology commercially viable.

Using hydrogen is another potential means of decreasing carbon dioxide emission. Among with many other countries, Sweden is looking into the possibility of using hydrogen as fuel, or for electricity or heating.

The national target of a share of 49% of renewables in final consumption in 2020 was achieved in 2012 (around 55% in 2018). The country is expected to reach a share of 60% of renewables in final consumption by 2027 and 65% by 2030, according to its indicative trajectory.

The region Mid Sweden is divided in two county – the region of Jämtland/Härjedalen and the region of Västernorrland. The two regions have different territorial prerequisites as Jämtland/Härjedalen have hills and ski areas in the west and Västernorrland in the east is coastal areas/the Baltic sea and most of the regions industry. Together the both regions have 67% of forest and the total area 76 701 km², 375 000 inhabitants. The production of energy, mainly hydropower, wind, solar, heat exchange and biofuels is 38 TWh, while the use of energy is 30 TWh. There is large amount of power generated from water power in the region and the amount of wind power production is increasing. There is a surplus of energy in the region which means that region export more than 8 TWh annually both nationally and into Europe.

4.2 National policies related to RES

In SHREC countries, the main policy that is setting up the directions for the implementation of EU policies is the represented by the national energy and climate plan. 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 which was adopted in 2019.

The national plans outline how the EU countries intend to address:

- energy efficiency

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- renewables
- greenhouse gas emissions reductions
- interconnections
- research and innovation

This approach requires a coordination of purpose across all government departments and it provides a level of planning that will ease public and private investment. Beside this policy, SHREC countries have elaborated, at national or/and regional level, several strategies which are in line with the NECPs and are setting up the path in order to achieve the EU targets related to energy efficiency and transition to a low carbon economy.

Recently, the EU Commission analysed and evaluated the NECPs of the EU countries. According to the analysis, ***An EU-wide assessment of National Energy and Climate Plans*** “*Nearly all final NECPs have confirmed or in some cases increased their renewable energy ambition compared to the draft plans. However, the aggregate figures mask differences between Member State contributions. Several plans fail to include sectoral trajectories that are in line with the Renewable Directive requirements, remaining below cost-efficient national potentials. By contrast, a few Member States have set very ambitious sectoral targets for renewables. Austria and Sweden with the objective of 100% renewable electricity by 2030 and 2040, respectively.*”³¹

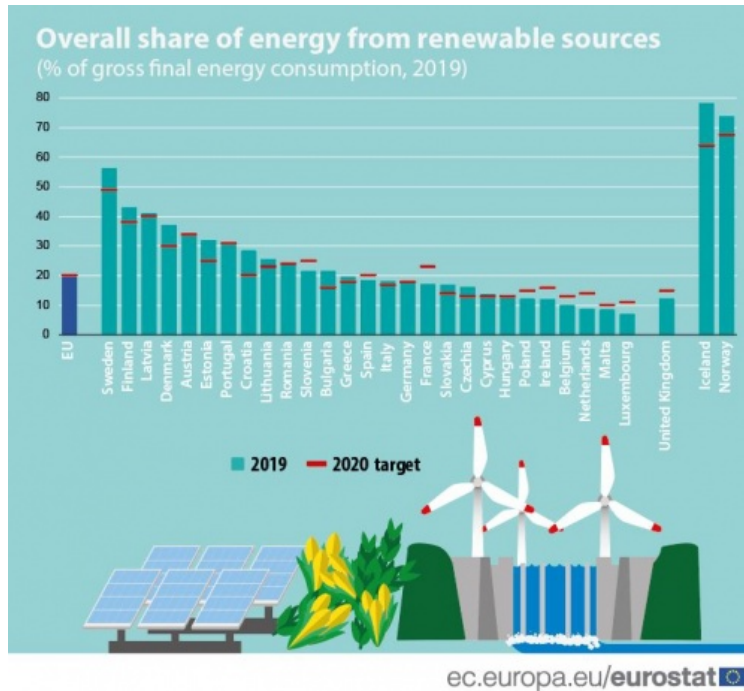
According to Eurostat³², in 2019, SHREC countries: Sweden, Lithuania, Romania, Slovakia and Italy have achieved and surpassed in some cases the target set for 2020, as it is illustrated in the graph below. However, there are also four SHREC countries which didn't manage to achieve their targets, namely: Spain, France and Netherlands and should increase their efforts in this area. This approach requires a coordination of purpose across all government departments and it provides a level of planning that will ease public and private investment.

Beside NECPs, SHREC countries have elaborated, at national or/and regional level, several strategies which are in line with the plan and are setting up the path in order to reach the EU targets related to energy efficiency and transition to a low carbon economy.

31 <https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1600339518571&uri=COM%3A2020%3A564%3AFIN>

32 https://ec.europa.eu/eurostat/statistics-explained/index.php?title=File:Share_of_energy_from_renewable_sources_2018_infograph.jpg

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Share of energy from renewable sources, 2019
(% of gross final energy consumption)
Source: Eurostat (nrg_ind_ren)

Share of renewable energy almost doubled between 2004 and 2018

At EU level, the figures have been following a positive trend between 2004 and 2018, as Eurostat shows. The EU seeks to have a 20 % share of its gross final energy consumption from renewable sources by 2020; this target has been distributed between the EU Member States with national action plans designed to plot a pathway for the development of renewable energies in each of the Member States. Figure 1 shows the latest data available for the share of renewable energies in gross final energy consumption and the targets that have been set for 2020. The share of renewables in gross final energy consumption stood at 18.9 % in the EU in 2018, compared with 9.6 % in 2004.

This positive development has been prompted by the legally binding targets for increasing the share of energy from renewable sources enacted by Directive 2009/28/EC on the promotion of the use of energy from renewable sources. While the EU as a whole is on course to meet its 2020 targets, some Member States will need to make additional efforts to meet their obligations as regards the two main targets: the overall share of energy from renewable sources in the gross final energy consumption (see Figure 1) and the specific share of energy from renewable sources in transport.

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- *Energy tax on electricity and fuels since decades*
- *Carbon dioxide taxation on fossil fuels since 1991*
- *Green certificate system for renewable energy since 2003*
- *Information and education for households, companies and the public sector, as well as support to networks to increase energy efficiency, etc.*
- *The energy research programmes have produced research findings that have applications in society. The energy research grant constitutes an important means of control for transforming the energy system.*
- *Various specific programmes and support schemes over the years, for example PFE (Programme for Energy Efficiency in Energy Intense Industry). Sweden's staple industries – mining, steel, paper and chemicals – are energy-intensive.*

Swedish Energy agency

The agency contributes with facts, knowledge, and analysis of supply and use of energy in the society, as well as work towards security of energy supply. Research on new and renewable energy technologies, smart grids, as well as vehicles and transport fuels of the future receives funding from the agency. They also support business development that allows commercialization of energy related innovations and ensure that promising cleantech solutions can be exported.

The agency has the responsibility of official energy statistics, and the management of instruments such as the Electricity Certificate System and the EU Emission Trading System. Furthermore, they participate in international collaboration with the aim of attaining Swedish energy and climate objectives and develop and disseminate knowledge for a more efficient energy use to households, industry, and the public sector.

In the table below, are presented the **main strategies / plans/ agreements / laws** related to the transition to a low carbon economy in SHREC countries, other than NECPs.

Partner countries	Strategies/ plans/ agreements / laws related to the Transition to a Low Carbon Economy in SHREC countries – national level
Netherlands	<ol style="list-style-type: none"> 1. Urgenda case: Judgment in the climate case brought by Urgenda against the State of the Netherlands. Greenhouse gas emissions in the Netherlands must be reduced by 25% (compared to 1990 levels) by the end of 2020. 2. Climate Act legally enshrines the (long-term) objectives of the climate policy for 2030 and 2050. <ul style="list-style-type: none"> • <i>In 2050, the greenhouse gas emissions must be reduced by 95% compared with 1990;</i> • <i>An intermediate target of a 49% reduction in greenhouse gas emissions has been established for 2030;</i> • <i>Another target stipulates that electricity generation must be 100% CO2 neutral by 2050.</i> 3. Climate Agreement contains agreements with the sectors on what they will do to help achieve the climate goals. The participating sectors are: electricity, industry, built environment, traffic and transport, and agriculture. Businesses and social organisations developed measures in sectoral platforms in the fields of electricity, mobility, agriculture and land use, industry and the built-up environment with which the reduction target can be achieved. 4. Energy agreement over 40 organisations (including the government, employers, trade unions, nature and environmental organisations, social organisations and financial institutions) established their shared ambitions for sustainable growth, and made specific agreements to achieve these ambitions. In this context parties will strive to achieve the following objectives: <ul style="list-style-type: none"> • <i>A saving on final energy consumption of on average 1.5% a year;</i> • <i>Energy savings of 100 petajoules in the Netherlands' final energy consumption as of 2020 compared with 2012;</i> • <i>An increase in the share of renewable energy generation (over 4 % in 2013) to 14 % in 2020;</i> • <i>A further increase of this share to 16% in 2023;</i> • <i>At least 15,000 full-time jobs, a large number to be created over the next few years.</i>

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<p>France</p>	<ol style="list-style-type: none"> 1. The National Low Carbon Strategy (SNBC) is France's roadmap for its transition to low-carbon society: it aims to reduce France's impact on global warming. The SNBC sets the objective of achieving carbon neutrality by 2050. 2. National policy plan for energy and climate aims to: <ol style="list-style-type: none"> a. A low-carbon energy by 2050 b. A halving of energy consumption in all sectors c. A significant reduction in non-energy-related emissions d. An increase in the carbon sinks by working on forest management, wood products, other lands, capture and storage. 3. Law on Energy Transition for Green Growth sets the following targets: <ol style="list-style-type: none"> a) to increase the share of renewable energies to 23% of gross final energy consumption in 2020 and to 32% of this consumption in 2030; b) to reach 40% of electricity production from renewable sources in 2030; c) to reach 38% of the final consumption of heat from renewable sources in 2030; d) to reach 15% of final consumption of fuel from renewable sources in 2030; e) to reach 10% of renewable gas consumption in 2030; f) multiply by five the quantity of renewable and recovered heat and cooling delivered by heating and cooling networks by 2030.
<p>Lithuania</p>	<ul style="list-style-type: none"> • National Energy Independence Strategy goal is to produce all the country's electricity from renewable sources by 2050. Also, the strategy is setting up final energy consumption to: 30% by 2020, 45% by 2030 and 80% by 2050. • Other national strategies and plans related to renewable energy are: <ol style="list-style-type: none"> a. First technology neutral auction for developers of renewable energy projects b. Offshore wind potential study done by scientists revealing the potential of offshore wind energy in Lithuania's marine areas in the Baltic Sea c. Power Purchase Agreements - legislative changes to remove administrative barriers for corporate Power Purchase Agreements (PPAs) - provide the opportunity for businesses to sign PPAs with renewable energy project developers and use clean electricity in their operations.
<p>Romania</p>	<ol style="list-style-type: none"> 1. The National Renewable Energy Action Plan 2017-2020 NEEAP IV. The specific objectives is represented by the increase of energy production from less exploited renewable resources (biomass, biogas, geothermal). In this sense, action is taken to: <ul style="list-style-type: none"> • <i>Establishment and / or modernization of electricity and / or thermal energy production capacities from biomass and biogas;</i> • <i>Establishment and modernization of thermal energy production capacities based on geothermal energy;</i> • <i>Supporting investments in the expansion and modernization of electricity distribution networks, in order to take over the energy produced from renewable resources in safe conditions of SEN operation.</i> 2. The Energy Strategy of Romania 2019-2030, targeting 2050. The strategic objectives are: <ol style="list-style-type: none"> a. Clean energy and energy efficiency b. Ensuring access to electricity and heat for all consumers c. Protecting the vulnerable consumer and reducing energy poverty d. Competitive energy markets, the basis of a competitive economy e. Modernization of the energy governance system f. Increasing the quality of education and innovation in the field of energy and continuous training of human resources g. Romania, regional energy security provider h. Increasing Romania's energy contribution on regional and European markets by capitalizing on national primary energy resources 3. Integrated National Plan in Energy and Climate Change 2021-2030 set national targets and contributions to achieving the EU's climate change objectives. The share of energy from renewable sources is 30.7%.
<p>Italy</p>	<p>National Plan for Climate and Energy constitutes the instrument with which Italy establishes its contributions to the 2030 European objectives on energy efficiency and renewable sources. The objectives of the plan are: Decarbonization (including renewable sources); Energy efficiency; Energy security; Internal market and Research, innovation and competitiveness</p>

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<p>Slovakia</p>	<p>The main policies related to RES and which underlines the use and development of RES in Slovakia are:</p> <ol style="list-style-type: none"> 1. Act No 309/2009, on the promotion of renewable energy sources and high-efficiency cogeneration - – sets the legislative rules, methods of support and conditions of support for the production of electricity from renewable energy sources, electricity from high-efficiency cogeneration and biomethane and rights and obligations of the producers and market. 2. National action plan for renewable energy sources (2010) - The action plan sets Slovakia's national targets for the share of energy from renewable sources consumed in the transport, electricity generation and heat and cold production sectors in 2020, trajectories of expected growth in the use of RES in individual sectors in 2010-2020, measures to achieve the targets, support systems as well as the overall expected contribution of measures of individual technologies of energy production from RES and in the field of efficiency and energy saving to the achievement of binding goals. 3. Energy Policy (EP SR) – (2014) set goals and priorities energy sector until 2035 with a view to 2050. 4. The National Reform Programme (NRP) is a national, regularly updated programme with the main objective of meeting the Europe 2020 strategy's structural policy objectives. 5. The Slovak Republic National Strategy for Sustainable Development (NS SD). 28 strategic objectives have been defined as part of this focus on setting long-term priorities, including reducing the use of non-renewable natural sources with the concurrent rational use of renewable sources; reducing the environmental burden; mitigating the impacts of global climate change, ozone depletion and natural catastrophes; and improving the quality of the environment in the regions 6. Strategy of adaptation to climate change of the SR (updated in 2018) provides general guidance on adaptation and examples of specific adaptation measures in the transport, energy, industry and some other business areas 7. Strategy of Economy policy of SR until 2030 (2018) 8. Greener Slovakia – Strategy of the environmental policy of the Slovak republic until 2030. The basic vision of the strategy is to achieve a better quality of environment and a sustainable circular economy based on the consistent protection of environmental components using as few non-renewable natural resources and hazardous substances as possible, leading to improvement in population health. 9. Low-Carbon Development Strategy of the SR until 2030, with a View to 2050 (LCDS SR) - This study is the principal material for the preparation of the LCDS SR. The LCDS SR includes effective and cost-effective measures in the industry, energy, energy efficiency, transport, agriculture, forestry and waste management sectors
<p>Sweden</p>	<ol style="list-style-type: none"> 1. The Climate Act (2017) represents a climate policy action plan. The climate will be integrated into all relevant policy areas. The framework contains several new climate goals for Sweden: <ol style="list-style-type: none"> a. <i>By 2045, Sweden is to have zero net emissions of greenhouse gases into the atmosphere and should thereafter achieve negative emissions;</i> b. <i>By 2030, emissions from domestic transport, excluding domestic aviation, will be reduced by at least 70 per cent compared with 2010;</i> c. <i>By 2030, emissions in Sweden in the sectors that will be covered by the EU Effort Sharing Regulation² should be at least 63% lower than in 1990;</i> d. <i>By 2040, emissions in Sweden in the sectors that will be covered by the EU Effort Sharing Regulation should be at least 75% lower than in 1990.</i> 2. Sweden long-term energy policy. The agreement consists of a common road map for a controlled transition to an entirely renewable electricity system, with a target of 100 percent renewable electricity production by 2040. The Government and the parties agree that Sweden must have a robust electricity system with high security of supply and low environmental impact, and offer electricity at competitive prices. This creates a long-term perspective and clarity for actors in the market and helps generate new jobs and investment in Sweden. 3. National Strategy for the climate gives directives and guidelines to municipalities and agencies to fulfil the directives, how to behave when the climate is changing. That is, by 2030 emissions from activities in Sweden should be at least 55% lower than in 1990, and by 2040 at least 73 per cent lower than in 1990. 4. Swedish energy goals <ul style="list-style-type: none"> ✓ <i>Energy use shall be 20% more efficient compared to 2008 by 2020;</i> ✓ <i>Share of renewable energy shall be at least 50% of total energy use by 2020;</i> ✓ <i>Share of renewable energy in the transport sector shall be at least 10% by 2020;</i> ✓ <i>50% more efficient energy consumption by 2030 compared to 2005;</i> ✓ <i>100% of electricity production shall be from renewable sources by 2040. This is not a definitive date for the restriction of nuclear power.</i>

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4.3 Regional policies related to RES - description of the strategies/ plans at regional level

The regional policies in SHREC countries related to RES are in line with national/ European legislation. Most of the partner countries (France, Italy, Spain, Sweden and Netherlands) have designed regional strategies to reduce the GHG emissions; reduce the total energy consumption per inhabitant; and increase the renewable energy production & consumption. The figures differ depending on the existing strategies and the current situation in the region/country as it is shown below.

Country/region	Strategies and objectives of the strategies
France/Aura region	AURA Region energy strategy by 2030 - a reduction of GHG emissions by 32% in 2030; - a reduction of total energy consumption per inhabitant by 23% in 2030; - an increase of renewable energy production by 36% in 2030.
Netherlands	Regional Energy Strategy - assess renewable electricity generation, the heat transition in the built-up environment and the related storage and infrastructure needed Transition Vision Heat12 -within 'Transition Vision Heat' each municipality indicates how the city will become disconnected from the natural gas system or at least the use of natural gas for heating and cooking
Italy/ Piedmont Region	Regional Environmental Energy Plan Proposal -increase of energy production from renewable sources for additional 494 Ktoe in 2030 (from the 2015 baseline) for a total production of 2,382 ktoe; -reduction of gross final energy consumption by approximately 1.960 ktoe with a target value of 8.645 ktoe in 2030. This target would be achieved with an expected reduction of about 30% in respect of the business as usual trend; -achievement by 2030 of a share of 27.6% of final energy consumptions produced by RES.
Spain/ Basque Country	Climate Change Strategy of Basque Country 2050 - To reduce GHG emissions by at least 40% by 2030 and by at least 50% compared to the year 2005 - To achieve 40% of renewable energy consumption out of the final consumption by 2050 - To ensure the resilience of the Basque Territory to climate change. Gipuzkoa Klima's strategy aims: - To Reduce Greenhouse Gas Emissions (GHG) at least 40% by 2030 from 2005, and 80% by 2050 from 2005 - Reach the 80% of renewable energy in the final energy consumption mix in 2050 - Ensure territorial resilience from climate change impacts - Promote and enable climate justice and gender equality.
SWEDEN/ Mid Sweden region	Visions, goals and focus areas for Middle Norrland 2020-2030 are: • Free from fossil fuels 2030. • A reduction of greenhouse gas of 10 % annually between 2020-2030.
Lithuania	Lithuania's Law on Energy from Renewable Sources sets energy targets to be achieved by 2020 such as 20% of gross annual energy consumption and 60% of district heating generated by renewables and a target of 20% renewable energy in the transport sector. In 2019 Lithuania applied for membership in the IEA.
Romania	No regional strategy

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	Some bigger cities have developed SECAPs as members of Covenant of mayors
Slovakia	No regional strategy Some bigger cities have developed SECAPs as members of Covenant of mayors

Beside the regional policies in line with the national/ European policies, the regions have specific policies in accordance with the particularities of their area.

Auvergne Rhône-Alpes region (AURA) developed **Energy Strategy by 2030 on Energy Transition for Green Growth** which seeks to enhance France's energy autonomy, cut its greenhouse gas emissions and provide effective tools to all stakeholders in order to boost green growth. **Aura region** is focusing also on **wood energy**. In order to meet the national objectives concerning wood energy, the Auvergne Rhône-Alpes region (AURA) has set up two action plans, the Regional Wood-Forest Plan (Plan Régional de la Forêt et du Bois) and the Regional Biomass Scheme (Schéma Régional Biomasse). Efforts are mainly focused on the development of wood mobilisation in the forest, the development of production and energy recovery of related primary transformation products and the development of energy recovery from woody agricultural biomass and wood waste (Ademe, 2019). It is, in fact, planned to increase regional wood mobilization by 25% over the next 10 years and to include it in an approach to make the most of the local resource (DRAAF, 2019). Also, the State obliges each region to draw up a **regional development plan for sustainable development** and equality of territories and obliges each EPCI to draw up a **territorial PCAET climate air energy plan** in which the development objectives of renewable energies are included.

In **Netherlands**, the **Regional Energy Strategy (RES)** represents an important policy tool following from the Climate Agreement. Each energy region implements the agreements that have been made at the sector tables for Electricity and the Built Environment. Together with social partners, businesses, governments and residents, a regionally supported RES is being developed. The RES offers a new instrument in which municipalities, provinces and water boards work together at the regional level and **assess renewable electricity generation, the heat transition in the built-up environment and the related storage and infrastructure needed**. They do this together with grid operators, businesses and social parties. The focus is on the successful generation of 35 TWh of renewable energy on land by 2030 and developing a Regional Heat Structure. **Transition Vision Heat12**: Under the Climate Agreement municipalities, provinces and water authorities are obliged to work towards a more sustainable energy supply. Municipalities have to publish a so-called 'Transition Vision Heat' where each municipality indicates how the city will become **disconnected from the natural gas system or at least the use of natural gas for heating and cooking**. This Transition Vision Heat needs to be based on the Neighbourhood Implementation Plan. This plan itself starts with a vision per neighbourhood whereby types of housing, isolation of these houses, location and possible connection to (other) infrastructure are taking into consideration. The citizens of the neighbourhood should participate in the transformation of these visions into the implementation plans in order to increase the support for the energy choices laid down in the neighbourhood visions.

The **Italian Region Piedmont** has adopted the **Regional Environmental Energy Plan Proposal**, at the conclusion of the review process aimed at enhancing the observations expressed during the consultation and Strategic Environmental Assessment process of the Proposal. The planning document is setting mid-term targets (2030), in line with the objectives proposed at European level with the approval of the so-called Clean Energy Package. The Plan Proposal selects as "main objectives" of the new regional energy planning cycle, the reduction of consumption and the gradual

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transition from natural gas to renewable sources. The main strategy sets out in order to achieve the above targets, aims at reducing final energy consumption in the building and transport sector, as well as promoting the production from RES with attention paid to the environmental impact. The priority is, thus, given to RESs that do not require a combustion process, and consequently that have zero emissions, either for greenhouses gases and for local pollutants. **Piemonte Region** has been the first Italian region to adopt a **law on Energy Communities**. The Regional Law "Promotion of the institution of energy communities" Piedmont dictates the Energy Communities framework regulation.

Climate Change Strategy of Basque Country 2050 and **Basque Energy Strategy 3E 2030** are the main energy transition policy which aim reduce GHG emissions, increase renewable energy consumption and ensure the resilience of the Basque Territory to climate change. Climate Change Strategy of Basque Country 2050 has the main following objectives: to reduce GHG emissions by at least 40% by 2030 and by at least 50% compared to the year 2005; to achieve 40% of renewable energy consumption out of the final consumption by 2050 and to ensure the resilience of the Basque Territory to climate change.

Basque Energy Strategy 3E 2030 defined in 2015 aims:

- ✓ Primary energy savings of 1.250.00 TOE (tonne of oil equivalent) per year between 2016-2030 equivalent to a 17% savings in 2030;
- ✓ 126% increase in use of renewable energy, to 966.000 TOE in 2030, giving renewables a **21% share in final consumption**;
- ✓ Promotion of an example-setting commitment by Basque public authorities to reduce energy consumption in their facilities by 25% in 10 years, creating renewable energy installations in 25% of their buildings and incorporating alternative vehicles in public service fleets;
- ✓ Reduction in oil consumption of 790.000 TOE by 2030;
- ✓ **Increase in participation of CHP and renewables in power generation from 20% in 2015 to 40% in 2030**;
- ✓ Promotion of competitiveness of the network of Basque science-technology companies;
- ✓ Contribution to climate change limitation through a 3 Mt reduction in CO2 emissions.

Beside these strategies, at provincial level, was elaborated Gipuzkoa Klima's strategy that is completely aligned with the Basque Country's one Klima 2050.

Gipuzkoa Klima's strategy objectives are: Reduce Greenhouse Gas Emissions (GHG) at least 40% by 2030 from 2005, and 80% by 2050 from 2005; reach the 80% of renewable energy in the final energy consumption mix in 2050; ensure territorial resilience from climate change impacts and promote and enable climate justice and gender equality.

The **region Mid Sweden** is divided in two county – the region of Jämtland/Härjedalen and the region of Västernorrland. The Jämtland/Härjedalen region goal is connected to the Swedish, namely: free from fossil fuels 2030 and a reduction of greenhouse gas of 10 % annually between 2020-2030. In the strategy for the region reduction of greenhouse gas has declined with 3% annually since 2010-2017. In 2010 the let out of greenhouse gases was just above 800 00ton CO2 equivalents and in 2017 it was 690 000 tons. As this is not enough the goal has changed and is from 2020-2030 10% reduction every year in order to be able to reach the long-term goal.

The transportation sector is the main cause to greenhouse gases in this region. The aim is to lower the use of fossil fuel in vehicles in the agriculture, forestry and public transportation areas. The **ERDF 2014 – 2020** have been used to invest in electrical chargers for cars and vehicles in the region.

Visions, goals and focus areas for Middle Norrland 2020-2030 are:

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- *Free from fossil fuels 2030*
- *A reduction of greenhouse gas of 10% annually between 2020-2030*

Fossil free fuel in transportation and working vehicles.

1. *Forest as a source for energy and catcher of carbon*
2. *Use of renewable energy*
3. *Climate smart food*
4. *Effective transport society and fossil free transportations*
5. *Sustainable consumption*
6. *Future electrical systems*
7. *A sustainable building and property sector*
8. *A long-term bio economy*

In **Romania** and **Slovakia** energy management on regional level is underdeveloped, regions are following the national policies and regulations. Some bigger cities in both countries have developed SECAPs as members of Covenant of mayors. In South Muntenia region there the Agency for Energy Efficiency and Renewable Energy "AE3R Ploiesti- Prahova" which promotes national and local programmes. In **South Muntenia Region, Romania** there are other 12 cities which are implementing other strategies and the rest of 20 cities in the region are not active in energy efficiency. In addition, Slovakia created in recent years few regional centers of sustainable energy, but comprehensive approach is missing.

Energy Efficiency Improvement Program is a document that outlines the actions and policies that the municipalities of the cities of the **South Muntenia Region, Romania**, as local public administrations and local promoters of energy efficiency, want to be undertaken in the main sectors of activity. So that, by implementing them, the objectives of reduction of CO2 emissions at local level by gradually reducing energy consumption by at least 21% by the end of 2020. The main sectors that are intended to be improved, by adopting the right infrastructure and local policies that leads to the fulfilment of the proposed objectives are: public buildings, residential buildings and the public lighting sector. The program of thermal rehabilitation of housing blocks financed from the structural and cohesion funds of the European Union - ROP 2014-2020.

4.4 Financial instruments which aim to increase the renewable energy production and consumption

4.4.1 Financial instruments which aim to increase the renewable energy production and consumption - *National level*

The main financial instruments in SHREC countries are represented by ERDF funding for supporting energy efficiency and low carbon economy. The ERDF support is provided through

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programmes at national level in some SHREC countries while in others, at regional level. However, there are particular types of support which are specific to the partner countries.

Netherlands subsidizes renewable energy in the electricity, heat and gas sectors by covering the **unprofitable top**. Another supporting scheme is the Zip Code Regulation for large-scale projects that will generate renewable energy. Citizens and companies from surrounding zip code areas can purchase a piece of wind or sun. The arrangement is especially favourable for people who do not have their own or suitable roof area for solar panels.

France has several financial instruments for support renewable energy in the electricity sector; heat sector, thermal energy in the collective residential, tertiary, agricultural and industrial sectors. The development of renewable energies benefits from State support either upstream in the field of research and development, or in the industrialization phase in support of demand and commercial deployment (e.g. through feed-in tariffs, calls for tenders or tax schemes). The **support mechanism** for renewable energy in the **electricity sector** are the open counters, which give a right to receive support for any eligible installation and **competitive tendering procedures**, where support is awarded only to the winners of these procedures (e.g. tenders). For existing **individual households**, the development of renewable thermal energy mainly involves three support tools: the energy transition tax credit (was targeted at the most energy-efficient equipment as well as equipment using renewable energies), the zero-interest eco-loan (finance major energy renovation work) and the energy saving certificate system. The **Heat Fund** supports the development of the use of renewable thermal energies: biomass (forestry, agriculture, biogas, etc.), geothermal energy (in direct use or via heat pumps), solar thermal, recovery energies, as well as the development of heating networks using these energies.

In **Sweden**, the Energy Agency has a budget of Ca 160 million euros dedicated to financing most of the research in Sweden, from fundamental research to demonstration and business development, on energy transition the focus areas:

Fossil-independent vehicle fleet by 2030

- *Renewable fuel*
- *Electric vehicles*
- *System changes*

Power distribution system (electricity from renewables)

- *Electricity network*
- *Electricity market*
- *Technology for electricity production*

Energy efficiency in buildings

- *Measures in new and existing buildings and towns/cities*

Increased use of bioenergy

- *Fuel*
- *Fuel for electricity and heating production*

Energy efficiency in the industrial sector

- *Further reduction of energy consumption*

System studies

- *Models, scenarios, policies and measures, behavioral change*

Lithuania has several support measures aiming to increase the production and consumption of RES. One of the recent measures taken is the fact that the government will hold an auction for the distribution of renewable power each year until 2022. The process will be technologically neutral,

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meaning that it will be open for all renewable sources such as solar, wind, biomass and biogas. The main selection criteria is the lowest offered premium tariff. The main measures and preconditions for implementation of renewable energy sources (RES) in Lithuania are:

- RES1 – Support scheme for electricity produced from RES;
- RES2 – Financial support for producing consumers. Supported activities – installation of low-power solar plants. It is estimated that around 25 000 consumers will use this type of support until 2023;
- RES3 – Promotion of highly efficient cogeneration. Under this measure, two highly efficient cogeneration power plants will be built in Vilnius (Vilnius Cogeneration Power Plant – VCPP) and Kaunas (Kaunas Cogeneration Power Plant – KCPP) until 2021, which will use biofuel and municipal waste as fuel;
- RES4 – Support for the construction of biofuel boiler houses;
- RES11 – Exemption from excise duty on biofuels.
- T4 – Guarantees of origin for gas produced from RES.

Support schemes in Lithuania

Energy markets alone cannot deliver the desired level of renewables in the EU, Lithuania offers the ability for energy producers to strengthen their possibilities in the energy markets in different ways.

- Lithuania promotes the activities of electricity self-consumers from renewable energy sources who now will be able to receive the support for the installations up to 10 kW.
- The Climate Change program under the Environmental project management agency supports household renovation projects, energy efficiency measures and funds renewable energy installations in the older buildings.
- In September of 2019 the new technology neutral support scheme for electricity production from RES was launched.

In 2019 VIPA, **Ltd. Public Investment Development Agency (VIPA)** has prepared report of funding needs assessment analysis in Energy efficiency and RES areas. Based on it, VIPA has established an Investment Platform (Fund), which provides long-term credits to developers of large RES projects, energy saving service providers (ESSP) and for legal persons who are intending to become Manufacturing Users. Also, the Environmental Projects Management Agency under the Ministry of Environment of the Republic of Lithuania is a modern professional body managing projects that are funded by European Union (European Regional Development, Cohesion Funds, LIFE + programs) and National funds (LEIF, Climate Change, Waste Management, Environmental Protection) projects in the environmental and climate change sector. More than half of the investment (1,4 mln. Eur) based on 10 solar power plants which will be installed by Lithuania companies in Armenia, Sakartvel, Mongolia, Moldova and Nigeria. It already comes from the Climate Change Program administered by the Ministry of the Environment.

Summary of support schemes

- **Priority purchase of heat from renewable sources.** The state promotes the purchase of heat produced from renewable energy sources.
- **Feed-in tariffs for biogas injected into the natural gas system.** According to the Law on Energy from Renewable Sources, production of biogas is a Public Service Obligation (PSO). Natural gas system operators are obliged to allow the biogas producers to inject their biogas into the natural gas system.

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- **Climate Change Special Programme** supports projects aiming to reduce greenhouse gas emissions, including renewable energy projects. This fund provides support in the form of loans and subsidies.
- **Environmental Pollution Tax exemption.** Natural and legal persons using biogas, solid and liquid biomass for heating purposes shall be released from environmental pollution tax liability for all stationary source emissions resulting from the use of biogas, solid and liquid biomass. In general, all renewable energy technologies used for the generation of heat are eligible for at least one support scheme.

Romania provides loans dedicated to the investments aimed at saving energy and capitalizing on renewable energy sources. Also, through the **Norwegian Financial Mechanisms** provide support in following areas: energy efficiency in buildings (owned by non-economic entities); industry; infrastructure; energy performance of products and in transport sector. The main program relevant for private households to support energy efficiency is the **“Casa Verde” or “Green House” Program**. The grants for households are provided for installation of solar panels, gas based thermal energy pellets, briquettes, wood chips, and any plant debris and waste from agriculture/ forestry and heat pumps.

In 2020, the **Romanian Environmental Fund Administration** has launched the **Energy Efficient House Program**. The objective of the program is the granting of non-reimbursable financing from the Environmental Fund in order to carry out works intended to increase energy efficiency in single-family homes and reduce greenhouse gas emissions by reducing energy consumption and the use of renewable sources in single-family homes. Also, it aims to increase the energy performance and / or the use of energy from renewable sources in the existing single-family dwellings, located in a building-construction having a height regime of maximum 3 levels. The support is maximum 60% of the eligible investment and cannot exceed 15.000 euro.

Italy focuses on **qualification of plants** powered by renewable sources. It is a fundamental process to identify the plants that meet the requirements provided for by law in order to access incentive mechanisms. Also, at national level there are several incentive mechanisms that support the production of electricity from renewable sources at disposal of private subjects, companies and public administrations. Related to schemes for energy efficiency the most effective ones are the renewable energy for heating and cooling support scheme (supporting the production of thermal energy from renewables, as well as small-scale interventions of energy efficiency for private organizations and the Public Administration) and the Tax Deductions System (for the energy retrofit of the buildings heritage (Ecobonus) and the so called Home Bonus for general building retrofit).

Slovakia supports and promotes the production and distribution of energy produced by RES in households and blocks of flats, through Operational programme Quality of environment (OPQE). OPQE helped to increase the share of RES in FEC mainly via **National project Green to households**. Through this project, SIEA provides vouchers for households and blocks of flats in order to finance installation of RES – Solar PV, Solar Thermal, Heat pump and Biomass Boiler. Also, in order to achieve 2030 objectives in NECP 2021-2030, several measures for financial support are provided, such as: Operating aid for heat generation from RES; Operating aid for electricity generation in CHP plants using RES technology with installed capacity up to 1 MW; Operating aid for electricity generation in modernized combined heat and power plants using RES technology; Operating aid to maintain the combined production of electricity and heat from biomass; Operating aid for new CHP plants using renewable energy sources with an installed capacity exceeding 1 MW; Using waste and waste heat. To implement measures aimed at increasing the RES share, the use of investment aid instruments is

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also proposed: EU funds, the Modernisation Fund consisting of the sale of emission allowances and other instruments linked to the EU ETS and The Environmental Fund.

Spain has two main support schemes which are dedicated to renewables.

Lines of Aid for Investment in Renewables, namely thermal and electric Co-financed with European Union Funds whose objective is to promote renewable installations for the production of energy, both thermal as electric, throughout the national territory. These grants, financed by the European Regional Development Fund (ERDF), are executed through calls made by the IDAE in each autonomous community, with island specificity, and distribution of resources and conditions agreed with the different territories, according to criteria and typologies included in the regulatory bases.

The Aid program for energy efficiency actions in SMEs and large companies in the industrial sector (FNEE) aims to facilitate the implementation of energy saving and efficiency measures that are proposed by energy audits of the facilities, either by replacing equipment or by means of management systems.

4.4.2 Financial instruments which aim to increase the renewable energy production and consumption - Regional level

At regional level, not many countries have individual supporting schemes for renewable energy production and consumption. The only countries that have funding schemes with the purpose of increasing the consumption and production of RES are Italy, Sweden, Netherlands and France.

In **Piedmont Region, Italy**, supporting schemes for RES are funded from the ROP ERDF belonging to TO4 - Supporting the shift towards a low-carbon economy. The measures are addressed to SMEs and Public Authorities. In particular Axis IV (Sustainable energy and quality of life) is aimed, on the one hand, at reducing primary energy consumption by promoting actions on the heritage of public buildings and, on the other, at spreading innovations in the production system that lead to the adoption of technical solutions for a more rational use energy and increase the use of energy from renewable sources. The achievement of the Axis objectives is also measured in terms of greenhouse gas (CO₂) reduction. Back to back with the management of regional structural funds, several initiatives promoting Public Private partnership have been launched with the aim at mobilizing private investments by using Energy Performance Contracts (EPC). The EPCs are based on a guaranteed level of savings and with a sharing extra savings in case of overperformance. The contracts have a duration that can range from 13 to 15 years. A Measurement and Verification Plan, in line with IPMVP standard, is also presented in the tendering document and is an annex of the EPC. No specific financial tool has been offered to ESCOs, on the contrary the tender procedure allocated all the financing risk on the ESCO that must collect the financing provisions on the market or with own equity, getting direct access to available grants or incentives.

In **Sweden**, the main funding comes from the ERDF program for **Middle Norrland**, namely the TO 4 - Supporting the shift towards a low-carbon economy in all sectors. **The Operational Program 4**— Supporting the shift towards a low-carbon economy in all sectors is the key program for financing energy transition. In total it grants 9 million Euro.

Investment priorities are:

- Promoting energy efficiency and renewable energy use in enterprises

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- Supporting energy efficiency, smart energy management and renewable energy use in public infrastructure, including in public buildings, and in the housing sector. During 2014-2020 the fund has financed 2 investment projects, 5 charging infrastructure projects, 1 innovation project, 6 changing mindsets projects, 4 renewable fuels projects and 2 energy efficiency projects.

At regional level, in **Netherlands**, the main instrument for funding Green energy is the **Operational Program (ERDF) Noord** which focuses on two main priorities innovation and a low-carbon economy. The OP aims to increase the proportion of innovations that will help reduce CO2 levels. The potential beneficiary is primarily the (organised) corporate sector. A large number of measures are already being implemented at national and regional level, or are in the planning, to achieve the EU2020 low carbon targets. The vast majority of these measures relate to increasing the use of renewable energy, reducing energy consumption and promoting smart energy systems. For example, the northern provinces have (revolving) energy funds in preparation and there are various support facilities available at regional and national level for each of these three areas.

France

The **Auvergne Rhône-Alpes region (AURA) region in France** is setting up support mechanisms for renewable energies by sector in the form of calls for projects. Funding for these projects may mobilise ERDF allocations, depending on the nature or scale of the projects. The Region also supports projects in the start-up phase through a dedicated call for projects. This mechanism makes it possible to support project owners who are not yet structured as project owners and to undertake studies on the opportunity and the structuring of the project ownership of a project for the development of renewable thermal or electrical energy.

5. Consumers at the heart of energy transition

The Clean Energy for all Europeans package of the European Union puts consumers at the heart of the Energy Union, allowing them to actively take part in the clean energy transition (European Commission, 2019). This framework called for more bottom-up initiatives and “energy democracy”. It acknowledged and supported active energy citizens and communities as stakeholders in the European energy market and empowers the citizens, giving them ownership of the energy transition.

If the consumers are properly empowered and financially incentivised, they can make a key contribution to lower energy prices through effective demand management; to reduce future network and generation costs and put power back in the grid.

The European Commission has emphasised that the clean energy transition must be fair and socially acceptable to all. It acknowledged that citizen participation in renewable energy projects through renewable energy communities has already resulted in substantial added value in terms of local acceptance of RES and eased access to additional private capital.

This chapter will analyse and present the specific actions and measures, the assessment of potential and barriers that the partner countries of the SHREC consortium have identified in order to align with the Commission’s vision and requirements.

Netherlands

The citizens of Netherlands have a high interest in the renewable energy sector, due to the fact that the natural gas drilling has caused earthquakes so severe and frequently that (older) houses are no longer safe to live in. For this reason, acceptance and interest in finding alternatives is higher than in Romania, for instance.

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Total number of active citizens participating in the energy transition via a cooperative and / or crowdfunding platform – around 85,000 persons.

In 2019, the initiatives by Dutch people who develop sustainable energy projects increased by 70% compared to 2018.

Slovakia

In Slovakia, consumers are involved in energy transition within two national projects.

Lithuania

In Lithuania, the state sets mandatory actions for ministries to provide information and educational programmes about the practical opportunities and benefits of developing and using RES. Exchange of experience in the field of RES use is organised between state institutions, enterprises, companies and private undertakings, and examples of good practice are available and are trying on raise awareness on this issue.

Romania

In Romania, citizens show a low interest concerning the means to reduce energy consumption as well as energy efficiency solutions, according to the Eurobarometer. Although there are several agencies and associations in Romania that are trying to raise the awareness and to promote the active involvement of the population, however, the results are low, compared to other countries such as Netherlands, Italy or France. One initiative is Your Energy programme - 5000 members which can sell solar energy.

Italy

Italy supports the establishment of Renewable energy communities, which involve groups of citizens, social entrepreneurs, public authorities and community organisations participating directly in the energy transition by jointly investing in, producing, selling and distributing renewable energy.

Spain

In Spain, the citizens are supported to use different means to reduce energy consumption as well as energy efficiency solutions. Nevertheless, there is a new legislation, which benefits shared self-consumption, opens the door to the creation of energy communities, in which active clients capable of consuming and generating their own energy, can exchange the surplus they do not consume with other members of the energy community.

Moreover, the citizens of the Basque country have endorsed a long-term vision regarding the energy system:

- *Zero consumption of oil for energy uses in 2050*
- *Maximize energy efficiency in the industry*
- *Intensify savings and renewable use in buildings*
- *Move towards sustainable transport and mobility, which requires long-term structural changes*
- *Improve the sustainability of the generation park through renewable facilities and cogeneration*
- *Promote digitalisation that makes possible a greater role for consumers for active energy management*

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France

In France, since 2011, Centrales Villageoises, companies formed locally by citizens, companies and communities to develop renewable energy projects, have been supported. Village power plants are an illustration of the appetite of citizens to develop joint projects to efficiently produce renewable energy in conjunction with local authorities.

In addition, the main incentive for citizens and consumers to invest in renewable energy is a tax incentive, Energy Transition Tax Credit (ETTC). This scheme is open to all individuals and consumers regardless of their level of resources and allows everyone to benefit from tangible support for the acquisition of a renewable energy production system.

Sweden

In Sweden, advisors financed by the municipalities and Swedish Energy Agency inform the consumers on how to build their houses in an energy effective way, how to build solar panels on your house and invest in heat exchangers, for examples. There is even a tax reduction on new electrical cars if you buy one.

Several ERDF projects were implemented in 2020 whose aim was to ease the transition to energy effectiveness and moreover, MidSweden University on behalf of the Innovation and Growth Agency run a national program supporting a newly graduated student into its first job preferably in an SME where the former student has to focus on energy efficiency, a researcher from the university acts as a mentor both for the company and for the former student.

5.1 Awareness and acceptance to actions for transition to low carbon renewable energy

Awareness among households, business and public actors of the need and opportunities to use renewable energy as the low-carbon alternative energy.

Netherlands

As living in an area where the natural gas drilling is causing earth quakes so severe and frequently that (older) houses are no longer safe to live in, the awareness of the citizens to find alternatives for natural gas used for heating and cooking is high. Furthermore, it also increases the acceptance of alternatives more than maybe in other regions.

The nearly 600 cooperatives existing in the Netherlands reach a larger group with recruitment campaigns, collective purchasing campaigns, saving campaigns and other activities. Many citizens also participate in crowdfunding campaigns. This is another type of participant (only financial participation, not owned), but actively involved in local energy projects. According the Lokale Energie Monitor 2019 the total number of active citizens participating in the energy transition via a cooperative and / or crowdfunding platform is estimated at nearly 85,000, 1% of all households.

In the Netherlands several there are several initiatives. It starts with the communication to the very young citizens whereby there are educational programs developed for children from the age from six up to twenty-one. For example, the movie Morgenland explains the importance of the energy transition, the different energy sources and how people can become more involved. Another example is the project called: "Junior Energy Coach" where families, schools and other groups can, together with children, learn about energy savings in a playful manner.

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In 2018 a report, commissioned by the Ministry of Economic Affairs, was published about different forms of communication on the transition from fossil fuels to renewable energy and climate change. The research agency examined whether referring to innovative Dutch projects and some Dutch habits can motivate people to participate in the energy transition or increase support for the energy transition. The research report shows, among other things, that in general the Dutch public is positive about the energy transition, and is prepared to contribute to this. People also think that solar panels and wind turbines fit well with the Netherlands and that they contribute positively to the image of the Netherlands.

One of the communication tools used extensively by local cooperatives is the website www.hieropgewekt.nl. This website provides interactive information about the amount of energy being produced (per second) by solar panels and wind mills. Furthermore, it publishes each year the Local Energy Monitor where all types of statistics related to the local energy production is being presented.

Government's campaigns

In 2016 the national government launched a campaign "Save Energy Now". This campaign focused on lowering the thresholds (motivation) and increasing the urgency to take subsidized insulation measures. The subsidy for homeowners to take insulation measures has now run out. Owners' Associations (VVE) can still apply for subsidy.

As of 2017, the Ministry of EZK is co-owner of the public campaign to encourage more homeowners to invest in sustainable heat appliances such as the heat pump and the solar boiler. A subsidy is also available for this, the Sustainable Energy Investment Subsidy (the ISDE scheme).

Since the collaboration of the two ministries, the concept has been changed to motivate the target group by having homeowners enthusiastically talk about energy-efficient measures they have taken. That was done with two TV commercials, radio commercials, online bets on Facebook and other channels. Online news articles and print are also part of the effort.

Other government aids include, for example, the refund of VAT on the purchase and installation (21%) of solar panels and the option to request advice from municipal energy counters. It is also possible to take out an energy saving loan at an advantageous rate for an investment in energy saving. On average, taking a measure takes eight months from idea to implementation. The campaign is therefore intended to achieve long-term effects. The message here is: 'Make your house more energy efficient by insulating and switching to sustainable heating such as a heat pump.

Slovakia

According to surveys conducted by Greenpeace Slovakia, organization Friends of the Earth-CEPA and European Barometer, people in Slovakia are very well aware of the RES benefits and support them, see climate change as serious problem, show high level of acceptance of RES and on the other hand, they do not support the use of fossil fuels.

Respondents very strongly support renewable energy sources. They see the energy future mainly in renewable alternatives (73%). 91% of Slovaks think that the Slovak Republic should provide more support to the production of energy from renewable sources. 80% want the government to support the transition of the Upper Nitra region (coal mining region) from coal to cleaner energy and clean jobs.

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The vast majority of Slovaks are in favour of a slowdown in coal mining and a slowdown in the production of electricity and heat from coal (62% of respondents). People are significantly dissatisfied with the way Slovak coal is financed. As many as 70 percent of the population do not agree with the so-called general economic interest, i.e. consumer surcharges on coal. In addition, up to 74% of respondents are generally against subsidies for coal mining companies.

People are also willing to accept a certain level of discomfort and lowering the economic growth. According to another survey conducted by organization Friends of the Earth-CEPA in three regions in the eastern Slovakia, nearly three quarters of respondents agree that stopping the burning of fossil fuels - coal, oil and gas - should be in the first place, even if economic growth stops and people have to pre-qualify for jobs that are not dependent on from fossil fuels (72-74%). Only about a fifth of respondents think that economic growth and job creation should be the main priority, even at the cost of increasing the consumption of fossil energy sources - coal, oil and gas (21-22%).

In the three regions 6 out of 10 respondents (60%) are willing to give up part of their income - if they are sure that this money will be used to reduce greenhouse gas emissions and support local energy self-sufficiency based on renewable sources. Of these, respondents with a university degree have an above-average representation (71-73%). The opposite opinion – i.e. reluctance to help in this way - was expressed by more than a third of respondents (35-36%)

Slovaks are also aware of the consequences of climate change. The recent 2019 Barometer shows that up to 95% of respondents from Slovakia consider climate change to be a serious problem. This is 2% more than in 2017 and more than the EU-wide average in the same year (93%). Since 2008, at least 9 out of 10 inhabitants of Slovakia have steadily thought so, while only in 2015 this value was lower than the EU average (EU 91%, SR 90%).

In 2019, more than a third of respondents from Slovakia (34%) admitted personal responsibility for climate destabilization, which is slightly below the EU average (36%).

Lithuania

Within their competence, state and municipal authorities, institutions and enterprises are obliged to prepare, provide and publish information on the procedures for issuing permits, licenses and certificates, procedures for examining applications for certification, information on assistance provided to applicants, and information on support schemes. Ministries, within their competence, are obliged to prepare and implement appropriate measures of informing the public and providing conscious education, as well as provide consultations and prepare educational programs about the practical opportunities and benefits of developing and using RES. Exchange of experience in the field of RES use is organised between state institutions, enterprises, companies and private undertakings, and examples of good practice are made available to the public.

Ministry of Energy of the Republic of Lithuania together with Office of the Government of the Republic of Lithuania in 2019 conducted a public consultation to identify the main barriers and to promote actions establishing RES communities.

In 2019 the RES law has changed and the new scheme of energy communities was developed. A Renewable Energy Community is defined as a legal entity that has certain criteria to own and develop, produce, store and sell energy from renewable sources in a defined area.

As renewable energy currently accounts for about 25% of total energy consumption in Lithuania – which needs to increase to 100% in the next three decades – it will be necessary for the country to roll up its sleeves and work towards its goal while ensuring close cooperation and

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knowledge sharing between all parties in the sector – both renewable energy developers and responsible authorities.

Romania

The **Romanian National Energy Efficiency Action Plan (NEEAP III)** points towards the important role the Romanian Energy Regulatory Authority (ANRE) has for informing consumers and stimulating training. Consumer information programmes and training programmes are highlighted as particularly important to ensure efficient implementation of policies and measures using appropriate financial and technical resources.

Within the 2013 campaign to inform the population and businesses on the importance of improving energy efficiency, ANRE organised 8 seminars in 6 cities (Iasi, Timisoara, Brasov, Cluj, Galati, Bucharest) attended by approximately 370 trainees (Government of Romania 2014). ANRE presented the EU Directive 27/2017, the general objectives of the energy efficiency policy in Romania, energy efficiency issues in public and residential buildings, issues related to funding facilities, issues concerning the thermal rehabilitation of buildings, etc.

The private sector in Romania supports energy efficiency in households mainly via two directions:

- *Organizing awareness raising and information and knowledge exchange programs through professional organizations partly or fully established by the private sector*
- *Initiating and implementing corporate social responsibility programmes*

Romanian Association for Promoting Energy Efficiency ARPEE is the nominated national administrator for Romania for the European Code of Conduct for Energy Performance Contracting (EPC) fulfilling all duties according to the procedures. Their fields of activity are:

- *Stating energy efficiency and energy saving as key priorities of Romania's energy and environment strategy;*
- *Promoting energy efficiency and energy saving on the whole energy chain;*
- *Reducing energy dependence of Romania;*
- *Making energy efficiency the key factor against climate changes and global warming;*
- *Making energy efficiency a major contribution to the growth of economic competitiveness, the creation of new jobs, and increase of energy bills affordability.*

ARPEEs White Book on energy efficiency in Romania introduce a broad range of possible instruments for improvements from energy efficiency services via voluntary agreements and fostering investments to an improvement of the institutional framework. The National Energy Efficiency Forum in Romania, 2014 organized by ARPEE, despite running under the title 'Energy efficiency sustaining final consumers' it mainly focused on industrial and municipality consumers.

Romanian ESCOs Companies Association, ESCOROM is a non-profit, organization that aims at contributing to the achievement of national policy and strategy objectives in energy efficiency as well as active and constructive support for implementation and enforcement of existing legislation in Romania to the European Union in the field of energy efficiency and foremost, the provisions relating to Energy Service Companies (ESCOs). ESCOROM aims specifically to improve the legislative, regulatory and market instruments, to create and develop the energy services market in Romania in order to contribute to the improvement of trade and services provided to members and potential clients.

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Italy

In the Integrated National Plan for Climate and Energy, it is envisaged the will to share the national target (expressed as a share of consumption, in order to also stimulate energy efficiency) through a burden sharing system among the Regions, as experienced with reference to the 2020 targets for renewables. The breakdown of the target implies also the identification, by the Regions, of the areas to be made available for the construction of the plants powered by RES. It is foreseen to carry out an online and interactive census of the surfaces of the roofs of the built areas, which allows to evaluate their potential energy generation.

Given the fact that this would not be sufficient to reach the National RES target, it is envisaged to identify areas with an energy vocation, as not intended for other uses. This will be done in cooperation with Regions and local Authorities. The identification of these areas will also be coupled with the coordinated development of plants, electricity network and storage systems, with authorization procedures made easier and faster.

This is a completely different approach to the one used in the past where the input was to identify the areas where it was not possible to install RES. By consequence, this new approach should promote participative processes that can push the territories to find out solutions with an increased social acceptance. Communication would, thus, play a key role and new selling reasonings should be elaborated for the local communities. This will be a big challenge for the years to come.

Besides, it is worth highlighting that during the elaboration of the Regional Energy Plan, it is a common practice to put in place consultation processes aimed at bringing together different stakeholders' perspectives on the energy issues. This is done in discussion fora/roundtables where stakeholders are invited to discuss but also provide proposals for new projects and policies. In the next years these activities must be reinforced and focused on specific topics, such as low carbon district heating systems, RES installations, energy communities, etc.

As far as communication campaigns for awareness raising are concerned, during the last years the Piemonte Region has implemented such actions focusing on the correct use and maintenance of heating systems. A precise adjustment and correct maintenance allow to significantly reduce the energy consumption and the related expense, leads to greater safety and reduce the air pollution. This was the message that was conveyed through main media, including radio newspapers and poster campaign in order to raise consumer awareness.

Finally, communication actions are implemented often back to back with project activities, mainly EU ones. Social media posts, website news are day by day implemented and public events are organized. The main target audience is the public sector (local authorities, agencies and research institutes). An average of 3 or 4 events are organized per year.

Spain

Gipuzkoa Argitu Program aims to promote the reduction of energy consumption, especially electricity, in an easy and simple way, through tools aimed at homes, businesses and small businesses in the territory, in order to prevent and reduce vulnerability and energy poverty.

Argitu started in 2015 as an experiment/project to reduce electricity consumption and promote energy efficiency in homes. Thanks to this project, the 400 households involved have managed to reduce electricity consumption by almost 6%, so it was demonstrated that knowing consumption data is directly related to its reduction. It offers practical information supported by different informative and didactic formats:

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o On-site workshops town to town in order to inform citizens about different topics related to energy saving in homes.

- Informative workshops on reducing electricity consumption
- Informative workshops on the use of renewable energy
- Informative workshops on energy efficiency
- Informative workshops on sustainable mobility
- o Video tutorials on energy management in homes in order to carry out different operations and queries related to household energy consumption
- How to access your electricity consumption data.
- How to reduce your consumption and choose the rate that best suits your needs
- o Useful information for everyone on how to reduce energy consumption
- New car ... what if it was electric? and how to recharge it in your home garage
- Saving energy in the neighbourhood
- Self-consumption and Net Balance
- Comprehensive renovations at home: interesting information
- o Energy guide

It is a document of a didactic nature and of public access that compiles practical advice on energy saving and efficiency arranged by topics.

France

The energy information service is co-financed in Auvergne-Rhône-Alpes by the French Environment and Energy Management Agency (ADEME), the Regional Council and partner local authorities, 14 structures provide the Espace INFO-ÉNERGIE service in the region, where advisors provide a free and independent local service, together with information on existing and available financial aid.

They help to make private individuals' projects a reality:

- *Renovation or construction, home insulation*
- *Choice or evolution of heating modes*
- *Lower energy bills*
- *Acquisition of equipment using renewable energy*

Green Energy

An energy supply offer is said to be "green" if the supplier can guarantee that a quantity of energy of renewable origin equivalent to the consumption of the customers of this offer has been inserted back into the network. In order to prove that an equivalent quantity of green energy has been inserted back into the network, only Guarantees of Origin (GO) have certification value.

Guarantees of Origin ensure, at European level, the administrative traceability of green energy. They are electronic certificates issued to producers in proportion to the quantity of energy produced from renewable energy sources. The company Powernext ensures the issue, transfer and use of GOs to the National Register of Guarantees of Origin.

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At regional level, Auvergne-Rhône-Alpes Region supports the Positive Energy Territories (TEPOS) initiative by 2050. This is a regional initiative that has the support of national institutions, such as the national energy agency, the delegation of the Ministry in the Region and the regional council. The aim is to support the implementation of local energy action plans through multi-level governance and finance. This initiative strongly contributes to the regional targets but also national and EU targets with a long-term vision. At regional level, the territories have to involve key stakeholders on different topics and local authorities have also to work together because the TEPOS initiative has engaged numerous territories, involving rural and urban areas. The regional consortium provides financial incentives for studies and for reinforcing human resources.

To date, there are 37 TEPOS, representing 54% of the population in the region. The objective of the Region is to have 80% of the regional territory covered by the TEPOS initiative.

Sweden

There are many activities among household and consumers to raise their awareness of transition to low CO₂ society. There are advisors in every community financed by the municipalities and Swedish energy agency whose task is to inform the consumers how to build their houses in an energy effective way, how to build solar panels on your house and invest in heat exchangers, for examples. There is even tax reduction on new electrical cars if you buy one.

In the region of Middle Norrland, an ERDF financed project is implemented in 2020 in order to in develop a charger for electrical vehicles. Another project support SME in their transition to energy effectiveness, yet another project in cooperation with Norway focuses on finding ways of implementing circular economy in the cities and build awareness of what can be done using non-profit organizations as idea generator and competence carriers. Finally, there is a national program run by MidSweden university on behalf of the Innovation and Growth Agency supporting a newly graduated student into its first job preferably in an SME where the former student has to focus on energy efficiency, a researcher from the university acts as a mentor both for the company and for the former student.

5.2 Active involvement of energy consumers

Netherlands

In 2017, Dutch businesses reported nearly 3.4 billion euros in investments in green techniques for the Environmental Investment Allowance and Random Depreciation of Environmental Investments (MIA and Vamil). This is evident from the 2017 Annual Report. These tax schemes support investments in environmentally friendly technologies.

The total investment amount in 2017 was more than 700 million euros higher than in 2016. The total number of notifications (applications) also rose from 9,700 to 13,430 within a year.

Tax benefit for business

The calculated total tax benefit offered by these schemes to the Dutch business community in 2017 was approximately 141 million euros. Investments in sustainable buildings, sustainable greenhouses and stables, sustainable mobility and circular entrepreneurship (including recycling and reduction of raw material consumption) were particularly reported.

Conservation of raw materials

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With the support of MIA and Vamil, entrepreneurs invested more than 300 million euros in recycling and raw material savings. This is 70% more than in 2016. This increase is mainly due to an increase in industry-related investments. For example:

- Raw material conservation is the process developed by Eindhoven's Ioniga to break down plastic into its chemical building blocks. PET is made without the raw materials produced
- The production of high-quality chemical raw materials by the Apeldoorn company Buchem. Instead of a large reaction vessel, the company opts for small reactors, through which chemicals flow continuously: the so-called continuous-flow reactors. That is safer and more sustainable.

Sustainable buildings

In 2017, 590 notifications were sent for investments in sustainable buildings. This is 30% more than in 2016. In total, this concerns an investment amount of 1,400 million euros. Almost a third of the available MIA and Vamil budget went to investments in sustainable buildings.

Sustainable mobility

Sustainable mobility was on the rise in 2017, companies invested nearly half a billion euros in electric cars and entrepreneurs called on MIA and Vamil more than 6,300 times for investments in fully electric passenger transport, involving around 8,500 cars. That is more than twice as much as in the previous year.

Investment amounts in electric cars and electric or hybrid mobile machines (such as excavators and cranes) increased by 70% and 200%, respectively, compared to 2016.

Large share for the agricultural sector

The agricultural sector made extensive use of these schemes. Agriculture and horticulture claimed about 35% of the available MIA and Vamil budget in 2017. In livestock farming, there is a slight decrease in environmental investments compared to 2016. Investments in agriculture and horticulture mainly concern sustainable stables and greenhouses.

Policy

With the MIA and Vamil, the Ministry of Infrastructure and Water Management, in collaboration with the Ministries of Agriculture, Nature and Food Quality and Finance, intends to boost investment in environmental innovation and sustainable economic growth.

The Cabinet aims to achieve 50% reduction in raw materials by 2030 and a reduce 7 megatons in greenhouse gases. This objective is laid down in the Government-wide Circular Economy Program. For the mobility sector, the Cabinet aims to achieve an additional CO2 emission reduction of 3.5 megatons compared to the earlier objective in the Energy Agreement. This stems from the Paris Climate Agreements.

A Heat Transition Vision gives residents, home and building owners a first picture of the step-by-step timeline towards natural gas-free. The Heat Transition Vision also indicates the neighbourhoods in which the municipality will start work before 2030, including the possible costs.

Initiatives by Dutch people who together generate sustainable energy are increasingly delivering. In 2019, the production of such projects increased by 70%, compared to 2018, according to the annual Local Energy Monitor. The number of local energy projects increased in 2020 from 69 to 582. Most citizens who join forces are committed to solar and wind energy projects.

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Wind energy capacity rose by 22 percent in 2020, partly due to the opening of the Zeeland Krammer Wind Farm in May 2019.

The total production of solar energy by the local cooperatives increased in 2019 by 60%, the wind power capacity increased by more than a fifth. The projects of the citizen cooperatives provide enough electricity for 235,000 households. At least 85,000 Dutch people participate in such an energy collective. With their projects they generate 6% of the total wind energy that is generated and 2% of the energy that is extracted from the sun. Solar energy produced by citizens or via participation of citizens in local energy cooperatives is increasing. As a result of price reduction of solar panels and the (re)introduction of a subsidy scheme for households the share of renewable energy consumption and production increases substantially.

Energie VanOns, one of the good practices within this Interreg project, is an energy supply company that sells the electricity produced by local energy cooperatives in the Northern Netherlands to households and small end users. A share of the profit will return directly to the local energy cooperative in order to further develop the local activities.

Making use of the financial instruments, such as the **Zip Code Rose Regulation** or the SDE+, the local energy cooperative is more likely to establish a solar park or a windmill. The involvement of the energy consumers in the energy transition increases when the citizens participate in the local energy cooperative actively, or passively involved by buying their energy via Energie VanOns from their local energy cooperative. Thus, the energy communities empowered under the Clean Energy Package are already developed and connected to other cooperatives as well as to citizens who are not actively participating in the cooperative.

A distinction should be made among the different local initiatives. There are local energy cooperatives where citizens are involved in multiple activities. Their objectives are broadly defined: greening their local environment and community. All aspects of the energy transition are taken into consideration. Already in the early 1990s these local cooperatives became actively involved in placing wind mills (often referred to as wind cooperatives) and most of them expanded their activities, e.g. building solar parks and placing solar panels on rooftops of buildings. In 2019 already 45 new energy cooperatives were founded. There is also another type of energy cooperative: the production cooperative.

Production cooperatives are cooperatives established for one (type of) production installation, usually a sunroof. This type of cooperative is only concerned with energy generation. Almost half of this type of production cooperative comes from an existing local cooperative. This type of cooperative is a means of separating participants, property, cash flows and risks from one specific project or from one type of project from the other activities of the wider local cooperative.

The other half of the production cooperatives were established by new initiators - a resident group, an Owners' Association, a company, or a project developer. We see these cooperatives as new independent cooperatives. The production cooperative is usually linked to one specific project and one location. This also applies to the VvEs. A new production cooperative is established for every new project.

The three provinces (Groningen, Friesland and Drenthe) that form the northern part of the Netherlands are three out of the four highest ranked provinces with regard to the amount of energy cooperatives per million citizens per province. These areas are also having a low population and thus the existing infrastructure is based on this population. However, due to an increase in local energy initiatives the number of applications for feed-in capacity on the electricity grid is very high whereby

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the system operators are not capable of providing the capacity in a short period of time. The Dutch courts, however, ruled in cases where the local energy cooperative is standing against the system operator, that the system operator is obliged to establish these connections, capacity or no capacity. The system operators, so ruled the different courts, should then perform congestion management for instance. This is one of the challenges that the northern region has to overcome.

Slovakia

The Slovak Republic has implemented legislation promoting own electricity generation by introducing the “small source” and “local source” institute. Through Act No 309/2009 on the promotion of renewable energy sources and high-efficiency cogeneration.

Small source is a device for the production of electricity from RES with a total installed capacity of up to 10 kW. The administrative burden associated with the registration of a small source is undemanding compared to other sources and the production of electricity from such a source is not considered a business. This method of production is intended exclusively for households

A local source is a device for the production of electricity, which can only be a renewable energy source (i.e. sun, water, wind, biomass or geothermal energy). However, in order for a source to be considered local, it must generate electricity to cover its own consumption and capacity of the installed device has to be up to 500kW. Unlike a small source, which is only applicable to households, local source is applicable to any producer (legal entity, public institution).

It is expected that companies with a relatively large and stable consumption of electricity throughout the year will be most interested in the use of the local source. Photovoltaic sources will be very interesting, for example for shopping centres or industrial enterprises in which there is a continuous operation or office buildings with a constant need for computing power and cooling. However, they can also be used in apartment buildings, where electrically driven heat pumps are used for heating and hot water.

By supporting the local source, Slovakia supports so called prosumers - support for small power plants for the production of electricity and heat in family and apartment houses. The beneficiaries are motivated to consume as much electricity as possible and minimize supply to the system from the small - scale electricity generation installations. This approach addresses their energy self-sufficiency and reduces the impact of variable RES on the electricity system (prosumerism). Ministry of Economy SR decided to support the prosumers even more in 2021. The Ministry set limits for the connection of RES, CHP and local sources in 2021.

National project “Live by Energy”

National project is funded from the European Regional Development Fund within the Operational Programme Quality of Environment, Priority axis 4: Energy-efficient low-carbon economy in all sectors and it is managed by SIEA. The main goal of the project is to increase the level and quality of public knowledge in energy efficiency, energy savings and renewable energy sources.

The project is designed to raise awareness and spread knowledge of the above-mentioned topics by providing free expert energy advice especially for households, public sector, students and entrepreneurs.

The project is implemented from January 2016 to December 2023. The project aims to implement 2 500 information activities in total, with 6 500 individuals involved in these activities. As of 2020, 428 information activities have taken place from the beginning of the project, with almost 100 000 persons addressed.

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Besides expert consultancy provided to target groups face to face in counselling centers, via e-mail, and via free helpline, the project includes providing free expert consultancy at several events, where a critical mass of different target groups can be impacted.

The target groups are addressed by specific TV and radio broadcasts, as well as various publications available on-site during the events and online at the project website www.zitenergiou.sk, where further information and useful links for both general and professional public can be found. The budget of the project is 31 928 607.24 EUR.

Lithuania

It is estimated that between 2020 and 2030 investments in wind and solar power plants for electricity generation will be the most attractive for investors because of their economic attractive and simple installation. RES part will be reached maintaining existing power generation capacities, modernizing them and installing new ones.

Investors are ready to invest in renewable energy in Lithuania without state support

In 2020 the National Energy Regulatory Council (NERC) has confirmed the winner of renewable energy auctions. The price premium to the electricity exchange price offered by the successful investor is EUR 0 per MWh. This means that the project will be developed without state support. The Government has approved three renewable energy auctions to be held annually until 2022. During each auction, 0.7 terawatt hours (TWh) of electricity are planned to be distributed.

Based on the European best practice, Lithuania has been organising technologically-neutral auctions which are open to all RES technologies such as sun, wind, biomass, biogas. The projects participating in auctions also have to cover all costs of joining the electricity grid and to secure balancing.

The amount of electricity distributed in the scheduled auctions will result in double amount of electricity produced from RES up to 5 TWh by 2025 and at least 38% of electricity consumed in Lithuania will be produced from RES. This increase in renewable electricity production equals more than 1 million of household consumption.

In order to promote the development of productive consumers the Producing Consumer Alliance is being developed with representatives of RES business associations and consumer organizations.

Producing consumers can be both legal and natural persons who plan to produce electricity in power plants that use solar, wind and biomass sources, and the installed power of which does not exceed 500 kW. Producing consumers can install the power plants themselves or purchase it from third parties with special contracts.

Romania

An important thing is the fact that in the first half of 2020, the first “active house” in Romania was built in Balotesti (near Bucharest), which means a house that produces more energy than it consumes. Energy efficiency is achieved from the way the house is built, its design and execution, as well as through energy from solar and photovoltaic panels and geothermal energy from the nearby lake.

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In terms of active involvement in energy efficiency, there are several agencies and associations in Romania that are trying to bring more value regarding awareness and to promote the active involvement of the population.

The **PRO-nZEB cluster** undertakes several events to inform citizens about the importance of energy efficiency. At the same time, the people involved have developed the Building Knowledge Hub centre in Bucharest, which provides training and consultancy for different categories of specialists. Through this project, the cluster wants to run a "caravan" type information campaign in several cities in the country. In this campaign, citizens that visit this caravan are explained what nZEB buildings mean - "zero energy".

Pro-nZEB Cluster is a non-profit association, established in early 2016, with the main objective to promote the nearly zero energy building concept (nZEB) in Romania in order to reduce the greenhouse gas emissions generated by the use of buildings, aiming at the development of market-oriented research in the field of energy efficient buildings in Romania.

The aim of the Pro-nZEB cluster is to bring together key players from the building materials market, research and development institutions, educational representative organizations, public authorities, professional associations and other organizations having a catalyst role, in order to create and improve collaborative relationships for developing and implementing in Romania the concept of nZEB.

The **Romanian Energy Agencies Federation** - FAREN, is a national organisation based in Alba Iulia. It owns a platform for joint action of its members in the field of energy and environment and to contribute to national and regional policies for sustainable development.

The objectives of the association are to:

1. Ensure representation of its members in relation to national and European institutions in promoting their own views in the fields of energy efficiency, energy management, renewable energy, environmental protection and climate change and other areas of common interest;
2. Contribute to the development of the national policy of interest;
3. Facilitate cooperation, exchange of experience and the development of partnerships in the following areas: energy management, energy efficiency, renewable energy, environmental protection and climate change in support of sustainable development;

The Territorial Association for Energy and Energy Efficiency (ATE3) is a professional non-governmental and independent association involved in the implementation of the energy sector strategy, raising awareness among stakeholder of the benefits of energy efficiency, analysing the involvement of tertiary factors (e.g. socio-political) and the maintenance of the energy balance cycle (producer – carrier – distribution – consumer) with the help of the regulating authority. It is open to companies active in energy sector, public authorities and public institutions representing the energy sector. Associate members can also be individuals, institutions like universities or any other non-governmental organizations that share the same values.

ATE3 aims to promote energy efficiency, to protect the rights of energy producers, transporters, distributors and consumers, to initiate a dialogue between all stakeholders in order to support and protect the interests of energy efficiency industry in relations with public authorities, legal entities and individuals, both national and international.

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Some of the Romanian Energy Agencies mentioned above are partners in ManagEnergy34 a technical support initiative of the Intelligent Energy - Europe (IEE) Programme of the European Commission which aims to assist actors from the public sector and their advisers working on energy efficiency and renewable energy at the local and regional level.

Romanian Committee of Domestic Equipment Manufacturers (CECED)

CECED operates in Romania as a member of the European Committee of Domestic Equipment Manufacturers (CECED) is a Brussels-based trade association that provides a single, consensual voice for the home appliance industry in Europe. Apart from other issues, CECED works in the field of energy efficiency. In relation to household energy efficiency, they have some well-known activities.

Financial institutions

With the support of the European Union the European Bank for Reconstruction and Development (EBRD) provides loans for energy efficiency projects in their Sustainable Energy Financing Facility (SEFF). The Romanian SEFF programme RoSEFF partners with financial institutions such as banks, to establish strategies for financing sustainable energy investments. In Romania these are the Romanian Commercial Bank, Raiffeisen Bank, Transilvania Bank and the Development Bank. Finance for sustainable energy projects is provided for two key areas: energy efficiency and small-scale renewable energy.

Italy

Energy Communities

Renewable energy communities involve groups of citizens, social entrepreneurs, public authorities and community organisations participating directly in the energy transition by jointly investing in, producing, selling and distributing renewable energy. So far, this concept has not been implemented in Italy due to several legislative constraints. Either at national and regional level some important steps for removing such not-technological barriers have been established.

The Italian **Integrated Plan on Energy and Climate**, emphasizes the importance of the active role of consumers, as prosumers (producers from renewable sources and consumers), also through the renewable energy communities.

An important step in this direction was made in 2019, as a testing phase for energy communities has been made possible by law, while the adoption procedure of the Directive 2018/2001 is ongoing. In this testing phase, pilot projects will be allowed to activate collective self-consumption from renewable sources, or to create renewable energy communities. End customers of the same condominium or of "energy communities", by the settlement of a contract. This way they will consume less energy from suppliers.

The legal entities that arise from consumer contracts produce energy for their own members with systems powered by new renewable sources installations, with a total power not exceeding 200 kW. Participants will share the energy produced using the existing distribution network. The shared energy must be equal to the minimum, in each hourly period, between the electricity produced and fed into the network by renewable energy plants and the electricity taken from all associated end customers. The energy will be shared for instant self-consumption. Nevertheless, Implementation rules must still be set, so that the process is ongoing but still at the beginning.

Piemonte Region has been the first Italian Region, to adopt a **law on Energy Communities**. According to this law, the Municipalities that intend to set up an Energy Community must adopt a

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specific Memorandum of Understanding, drawn up on the basis of criteria which were indicated by a subsequent regional implementing measure. The Region, through ad hoc incentives, has committed to financially support the phase of setting up the energy communities, which may also enter into agreements with the national Authority of Energy Regulation (ARERA), in order to optimize the management and use of the energy networks.

Energy communities, in which both public and private subjects can participate, can acquire and maintain the qualification of energy-producing subjects if annually the share of the energy produced for self-consumption by members is not less than 70% of the total. They also must draw up an energy balance within six months of their establishment and, after one year, they have to draft a strategic document identifying the actions for the reduction and consumption of energy from non-renewable sources and the efficiency of energy consumption.

With the **Regional Formal Resolution** (D.G.R. Piemonte 2019), the implementing provisions of the Law have been approved:

- the criteria for the adoption of a memorandum of understanding by the municipalities that intend to propose the establishment of an energy community, or join an existing energy community. Alternatively, a single municipality can: propose the establishment of an energy community and be part of it as a producer and consumer of energy or only a consumer; propose the establishment of an energy community without being part of it or joining an existing energy community and being part of it.
- The minimum requirements for the establishment of an energy community are: the annual electricity consumption of at least 0.5 GWh which can be inferred from the analysis of a representative time period (at least the last two years); at least half of the minimum 70% share of energy produced destined for self-consumption, must be produced from renewable energy sources available locally; the presence of a plurality of subjects producing and consuming electricity.
- the criteria for the preparation of the energy balance of the energy communities, which the communities are required to draw up within six months of their establishment. It shall quantify: 1. the consumption of thermal and electrical energy of the members registered in a year and preferably broken down by type of use (for example: summer and winter air conditioning, heat production, internal lighting, external lighting, loads inside the building, etc. .); 2. the thermal and electrical load curve of the energy community in relation to the different seasons; 3. gross and net production of thermal and electrical energy breakdown down by sources used in the generation system and with the quantification of the percentage of renewable energy produced; 4. the energy balance and an emission balance considering all the energy carriers of the members of the Energy Community; 5. energy consumption for the mobility system of members of the Energy Community, if it also includes the transport sector for the calculation of the percentage of self-consumption.

A first call for interest was launched in late 2019, addressed to municipalities with a budget of 50,000 €. It is envisaged that about five energy communities would be created. In the framework of the Interreg Europe SHREC project, Piemonte Region will establish a roundtable with this stakeholder in order to boost opportunities of knowledge transfer in such new topic. This is for Piemonte an important step in the direction of energy self-sufficiency and the construction of a new model of virtuous territorial cooperation.

Spain

Government of Spain, Institute for the Diversification and Saving of Energy, IDAE.

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o **Aid program for the energy rehabilitation of existing buildings (Pareer Program)**

An Aid programme to undertake the energy rehabilitation of buildings in our country. The objective of the actions eligible for aid is to achieve a reduction in CO2 emissions and the final energy consumption of buildings, by improving energy efficiency, so that the buildings in which actions are carried out improve, at least, in one letter its energy rating. Financed through the European Regional Development Fund (ERDF)

o **Aid program for the renovation of exterior lighting (FNEE)**

The Aid Programme for the renovation of municipal outdoor lighting installations (FNEE) establishes a line of financing for local entities so that they can carry out the renovation of their outdoor lighting installations under energy-efficient designs.

o **Aid programme for sustainable urban development. Projects of local entities that favour the transition to a low carbon economy (ERDF 2014-2020)**

Aid Calls to Local Entities for unique projects of local entities that benefit the transition to a low carbon economy within the framework of the ERDF operational program for sustainable growth 2014-2020. It is a direct granting program of subsidies to Local Entities, for investment projects in the field of the low carbon economy.

o **Vehicle and mobility aid programme**

The purpose of this program is to contribute to the decarbonisation of the transport division by promoting alternative energies to achieve the objectives set by the National Integrated Energy and Climate Plan 2021-2030, promoting the implementation of actions to support mobility based on criteria of energy efficiency, sustainability and promotion of the use of alternative energies, including the provision of adequate electric vehicle charging infrastructures throughout the national territory.

- Basque Government, Basque Energy Agency EVE

o **Aid programme for investments in renewable energy installations for electric self-consumption**

Aid for the period 2020, for investments in renewable energy facilities to produce electricity for self-consumption, including:

- New isolated from the electrical network facilities, either photovoltaic, wind or mini hydroelectric power plants, provided that the nominal installed generation power does not exceed 250 kW
- New facilities connected to the photovoltaic type electrical network, for self-consumption purposes in accordance with current regulations
- New installations connected to the electricity grid, of the wind type or mini hydroelectric power plants, provided that the nominal installed generation power does not exceed 1 MW.

o **Aid program for investments in energy efficiency and solar thermal in the tertiary sector 2020**, including:

- Implementation of comprehensive energy management systems (SIGE).
- Renovation of energy installations in existing buildings
- Renovation of interior lighting installations.
- Renovation of exterior lighting installations.
- New cogeneration facilities

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- Comprehensive energy efficiency energy audits and implementation of energy management systems based on the UNE-EN-ISO 50001 standard
- Solar thermal installations.
- o Aid program for investments in geothermal utilization facilities 2020, including:
 - Open circuit geothermal installation without reinjection:> 70 kW
 - Open circuit geothermal installation with reinjection:> 70 kW
 - Geothermal installation of closed circuit with horizontal exchange:> 70 kW
 - Geothermal installation of closed circuit with vertical exchange:> 70 kW
 - Geothermal installation of closed circuit with vertical exchange: <= 70 kW
 - Geothermal installation configured as district heating-cooling:> 70 kW
 - New couplings to existing geothermal installations configured as district heating-cooling.

France

Individual self-consumption: a purchase rate

The State has introduced a photovoltaic feed-in tariff specifically for the sale of electricity in excess of self-consumption to encourage individuals to use the photovoltaic energy produced on their buildings. This tariff applies in addition to a premium for investment in photovoltaic collectors.

Climate Law: Opening up to renewable energy communities

A renewable energy community is an autonomous legal entity based on open and voluntary participation. Moreover, its "primary objective is to provide environmental, economic or social benefits to its shareholders or members or to the local territories where it operates, rather than to seek profit".

This community may "produce, consume, store and sell renewable energy, including through renewable electricity purchase contracts". To do so, it has access to all relevant energy markets, either directly or through an aggregator.

The energy produced by the community's renewable installations may also be shared between members or shareholders. However, a community may not own a distribution network. The amendment specifies that public distribution system operators must co-operate with renewable energy communities "to facilitate energy transfers within these communities".

Since 2010, **Energie Partagée Investissement** is the first financial tool in France for citizen investment in renewable energy production and energy efficiency. This tool enables project owners and local players to raise the equity capital needed to launch a project. Energie Partagée Investissement is a public company with variable capital whose share price is set at 100 euros to allow all citizens to subscribe.

Regional: Positive Energy Territories

The region has launched a support scheme for positive energy territories. These territories receive engineering support in order to establish an energy transition strategy and define an action programme.

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The region also supports projects in the start-up phase through a dedicated call for projects. This mechanism makes it possible to support project owners who are not yet structured as project owners and to undertake studies on the opportunity and legal structuring of project ownership for a renewable thermal or electrical energy development project.

Centrales villageoises

Since 2011, AURA-EE has been supporting the rise of Centrales Villageoises, which are companies formed locally by citizens, companies and communities to develop renewable energy projects. As of December 2019, there are 300 photovoltaic installations in operation. They are operated by 23 Village Power Plants companies. The other 25 Centrales Villageoises companies have projects under development that are not yet producing.

In addition to photovoltaic roofs, some plants have invested in wind power, micro-hydroelectric plants or wood-fired boilers, in addition to photovoltaic roof tops.

Sweden

The Swedish Government's policy for the electricity market is that it shall be efficient, competitive and provide electricity at internationally competitive prices. Since the 1990's the electricity market is completely liberalised. This means that an electricity consumer can choose the company to provide electricity and also choose between several types of contracts. The Government encourages active consumers and the development of a market for energy services.

Concerning the price each consumer pays, the electric power is traded on the Nordic Power Exchange spot-market called Nord Pool and there is a high degree of interconnectivity (more than 20 percent) between the Nordic countries. In recent years our Baltic neighbour countries have joined and as of 2014 there is a price coupling between 15 countries – mostly in northern Europe, but also France and the Iberian Peninsula.

The main grid is owned and maintained by Svenska Kraftnät (the National Grid Authority, and the local grids are owned privately or by municipalities. The Energy Markets Inspectorate oversees the non-government distribution systems for electricity and natural gas.

The electricity certificate system is a means of promoting electricity production from renewable energy sources. For each megawatt-hour (MWh) of renewable energy produced, the producers can receive an electricity certificate from the state. They can then sell the electricity certificate on an open market where the price is set between seller and buyer. The electricity certificate thus provides extra income for the renewable electricity production, in addition to the normal electricity sales.

The electricity certificate system has existed in Sweden since 2003, and is part of a joint system with Norway since 2012. The goal is that the joint Swedish/Norwegian electricity certificate market is to supply 28,4 terawatt hours (TWh) of renewable electricity production by 2020. Since then, the Swedish government has extended the system with another 18 TWh to be built by 2030.

The demand for electricity certificates is created via quota obligations. Parties with quota obligations must purchase a certain number of electricity certificates in relation to the sale or consumption of electricity. Money received by the state is used to promote the expansion of renewable energy production (wind power, solar power, wave power, etc.)

The el-certificate system is technology-neutral and market-based, which has led to a low cost for the end-consumer.

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6. Key findings

A main conclusion of the current report is the fact that all SHREC countries have taken several measures in order to reach EU Commission targets. Despite of the common efforts, not all countries managed to reach their goals. However, there are several countries which have succeeded to reach and, in some cases, surpass their targets, here being the case of Sweden, Lithuania, Romania and Italy. On the other hand, the SHREC countries which didn't manage to achieve their targets, are: Spain, France, Slovakia and Netherlands.

Analysing the efforts made, the policies, financing schemes and the community engagement and awareness, the situation is not the same. Thus, it has been noticed a high interest for RES research, investment and policies with high objectives are being implemented in the countries such as: Netherlands, Sweden and Lithuania. In Netherlands, it was noticed a high involvement of citizens in the energy transition. This was mainly due to the fact that public awareness, compared to other EU countries, such as Romania, is very high, this being translated into the **Urgenda** case. The **Urgenda Climate Case** against the Dutch Government was the first in the world in which citizens established that their government has a legal duty to prevent dangerous climate change. On 24 June 2015, the District Court of The Hague ruled the government must cut its greenhouse gas emissions by at least 25% by the end of 2020 (compared to 1990 levels). The ruling required the government to immediately take more effective action on climate change. Also, Dutch citizens have a high interest RES, mainly due to the government efforts to raise the awareness and the civil society. Also, several funding opportunities, education programmes, promotion of RES and incentives have been provided, which also, helped increasing the awareness and appetite for RES.

Although Romania is one of the EU countries with the highest natural potential in terms of renewable energy sources, the resources are not that very well exploited. Also, the citizens show a low interest concerning the ways to reduce energy consumption and energy efficiency solutions, according to the Eurobarometer. The study places Romanian consumers at the last place in the EU, regarding their interest in ways to reduce energy consumption as well as energy efficiency solutions. This lack of interest may be explained by the fact that few awareness raising campaigns were developed, thus the impact was minimal. Also, the education in this area is inexistent, compared to other countries where educational programmes are dedicated to children from early stages.

In other SHREC countries, such as France, citizens develop joint projects to efficiently produce renewable energy in conjunction with local authorities. On the other hand, there are countries in which the change is concluded in a top-bottom approach. For instance, the Slovak government, set as one of the priorities of Ministry of Economy in next programming period 2021-2027 is to create regional centres' for sustainable energy which will help to create regional strategies for development a to implement the national policies and strategies on regional level. In the period 2020-2030, Lithuania will encourage investment into sustainable forms of energy production in accordance with technically feasible and economically beneficial prospects of increasing energy production from renewable energy. In this period, transport sector will become more sustainable by gradual switch to more environmentally friendly vehicles powered by electricity or vehicles running on alternative fuels.

In Spain, the new legislation, which benefits shared self-consumption, opens the door to the creation of energy communities, in which active clients capable of consuming and generating their own energy, can exchange the surplus they do not consume with other members of the energy

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community. In order to reach 2030 goals, Italy aims at promoting energy communities, where consumers and end users will be put at the center of the energy system.

Lithuania

Over the past ten years, Lithuania's energy sector was basically restructuring. There were lot of structural reforms and strategic projects. The European Commission (EC) has approved a measure to support the production of electricity from renewables and electricity-heavy industrial consumers in Lithuania. Lithuania has developed a National energy and climate action plan for 2021–2030 years. Lithuania's Law on Energy from Renewable Sources sets energy targets to be achieved by 2020 such as 20% of gross annual energy consumption and 60% of district heating generated by renewables and a target of 20% renewable energy in the transport sector.

During the period from 2020 to 2030 Lithuania will aim for higher sustainability of the energy sector, primarily through increasing the share of renewable energy sources in final consumption of the electricity, heating and transport sectors. The country will encourage investment into sustainable forms of energy production in accordance with technically feasible and economically beneficial prospects of increasing energy production from renewable energy. In this period transport sector will become more sustainable by gradual switch to more environmentally friendly vehicles powered by electricity or vehicles running on alternative fuels.

Lithuania is No. 2 globally for wind & solar share in total electricity generation. Wind & solar accounts more than 40% electricity generation in the country. Between 2020 and 2030 investments in wind and solar power plants for electricity generation will be the most attractive for investors because of their economic attractive and simple installation. RES part will be reached maintaining existing power generation capacities, modernizing them and installing new ones.

Lithuania, which has set ambitious 100% renewable energy targets, is moving towards their implementation. Long work is needed to achieve the goals, the first results are already visible. After a 6 years break, first technology neutral renewable energy auction has been finished, an analysis of offshore wind energy development in the Baltic Sea was published, and opening of Power Purchase Agreement market is being discussed. These are very important steps for the future of wind energy sector, so developers and investors are observing the situation very closely. There are currently 23 wind parks in Lithuania, with a combined capacity of 480 MW. Together with small wind turbines, the total installed capacity is 533 MW. Preliminary estimations from the association show that last year wind parks were able to generate about 13 percent of the country's final electricity consumption. In comparison: all renewable sources combined generated 26 percent of electricity.

Another interesting initiative is *Power plants for home*. "Ignitis Group" aims to increase the number of prosumers in the country by offering individual solar power plants. It is a popular alternative for energy and consumption conscious residents as well as businesses.

Lithuania also has interest in research and promote Hydrogen production and consumption. Thus, hydrogen technologies for vehicles already in use in Lithuania. The Marijampole, Telsiai and Ukmerge bus fleets use up to 10% of hydrogenated natural gas. Company SG dujos Auto belonging to corporate group SG dujos has been engaged in exploration of alternative fuels since the year 2012. It is the first laboratory of such type in Lithuania and it is also considered unique throughout Eastern and Northern Europe. This laboratory employs the team of scientists from Vilnius Gediminas Technical

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University which successfully studies the possibilities of hydrogenation of natural gas, cooperates in the field of scientific research and develops technologies for global concern Scania.

Lithuania is a member of the **International Renewable Energy Agency (IRENA)** that supports countries in their transition to a sustainable energy future and serves as a center of excellence and a repository of policy, technology, resource and financial knowledge on renewable energy. In 2015 Lithuania reached its national renewable energy target for 2020 and on October 2017 Lithuania and Luxembourg signed a cooperation agreement on the statistical transfer of renewable energy amounts for the first time ever in the EU, agreement helps Luxembourg achieve its national renewable energy target for 2020.

Netherlands

The Northern Netherlands is a region with a high involvement of citizens in the energy transition. Over hundred local energy cooperatives produce renewable electricity making use of the two most important schemes: Zip Code Rose regulation or the SDE+. Currently, in several places the number of requested connections for installing solar parks or wind mills is higher than the system operator can facilitate based on the available capacity. Thus, a huge challenge is how to expand the infrastructure in a short time in order to connect all of the upcoming solar parks and wind mills. The involvement of citizens in the northern region of the Netherlands is high. Either participation actively in a local energy cooperative, or passively by buying the energy via Energy VanOns from their local energy cooperative, a substantial percentage of citizens are involved in the energy transition. The national policy is helping to accelerate the energy transition; however, as proven by the Urgenda case a lot of work still needs to be done.

France

The main incentive for citizens and consumers to invest in renewable energy is a tax incentive: The Energy Transition Tax Credit (ETTC). This scheme is open to all individuals and consumers regardless of their level of resources and allows everyone to benefit from tangible support for the acquisition of a renewable energy production system.

Schemes to set up local citizen companies producing renewable energy are more recent and are not yet sufficiently known by the general public. There are no tax incentives to encourage citizens to invest preferentially in this type of company. The benefit to shareholders of these companies is only the ability to invest more massively in production tools.

Village power plants are an illustration of the appetite of citizens to develop joint projects to efficiently produce renewable energy in conjunction with local authorities.

The network of Energy Info Centres informs and raises awareness among citizens and consumers about the environmental, social and economic benefits of using renewable energies to cover their electricity and heat needs.

The network of positive energy territories contributes to raising the awareness of inhabitants to the challenges of energy transition and the development of renewable energies.

Romania

Romania's natural potential for using renewable sources exceeds 3 times the capacity required to reach the 35% threshold in final consumption. Solar power has a potential of 54 GW (19

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GW industrial and 35 GW on roofs), onshore wind parks 12 GW, offshore 4GW, while hydropower could reach 11 GW.

South Muntenia Region has one of the highest solar potential - in the southern part (Teleorman, Giurgiu, Ialomița, Calarasi counties and south of Arges, Dambovita, Prahova counties), which is in zone II of solar radiation and the wind potential is, on average, the first one in the national context, except for the northern part of the region (the mountain area in the north of the counties of Prahova, Dambovita and Arges).

According to the latest inventory of greenhouse gas (GHG) emissions made by Romania (in 2014), the emissions related to the Energy sector represented approx. 70% of total GHG emissions at national level. In addition to energy efficiency measures, renewable energy sources are emerging as the most sustainable alternative to reducing GHG emissions, as well as other atmospheric pollutants (SO₂, NO_x, etc.) in the medium and long term.

Romania is one of the EU countries with the highest natural potential in terms of renewable energy sources. Given the balanced energy mix of Romania and the technological developments in the field of renewable energy sources, it is warranted to carefully examine the ways of exploiting the potential of renewable energy. In Romania, citizens show a low interest concerning the ways to reduce energy consumption as well as energy efficiency solutions, according to the Eurobarometer. The study places Romanian consumers at the last place in the EU, regarding their interest in ways to reduce energy consumption as well as energy efficiency solutions. Although there are several agencies and associations in Romania that are trying to raise the awareness and to promote the active involvement of the population, however, the results are low, compared to other countries such as Netherlands, Italy or France.

Slovakia

The Slovak Republic takes air quality, reducing greenhouse gas emissions, mitigating climate change, increasing the share of RES, the security of supplies of all energy types and their affordability, extremely seriously. In 2019, Slovakia has committed to achieve carbon neutrality by 2050.

The development of the Slovak energy sector is focused on optimizing the energy mix in terms of energy security while achieving the highest possible energy efficiency and consistent environmental protection. Emphasis is placed on the use of domestic energy sources and low-carbon technologies such as renewables and nuclear energy.

The final energy consumption is on high level with large portion of fossil fuels. Good news is that the share of RES has doubled from 2005 reaching 12,3% share in FEC but unfortunately the 2020 target will likely not be accomplished. Supreme audit office of Slovakia sees as one of the main reasons for not achieving the 2020 target insufficient and ineffective state support of the RES, specifically photovoltaics and biofuels. In the next years development of RES is expected. Slovakia has adopted NECP in order to achieve the 2030 targets. Moreover, openly supports the European Green deal and is also committed to achieve the 2050 carbon neutrality.

According to the updated Concept of utilizing the hydro-energetic potential of water flows in Slovakia by the year 2030, the total theoretical hydropower potential of water flows in Slovakia is 13 682 GWh/year.

Wind energy, according to National action plan for RES from 2010, should also contribute to increase in the use of renewables, in particular the total installed capacity of wind farms in 2020 should be 350 MW. The total production of electricity through the use of wind energy should thus reach

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560,000 MWh in 2020. As a RES, biomass has the highest technical potential for development, which is caused by suitable natural conditions in Slovakia. The total biomass potential in Slovakia is determined at approximately 33,400 GWh, the assumed usable technical potential is, according to the document Strategy for Higher Use of Renewable Energy Sources in the Slovak Republic, determined at the same value, 33,400 GWh. Solar energy has the greatest total potential, the amount of energy falling on the territory of Slovakia is 54,038,000 GWh, but this number is misleading as the total technical potential is only 1,540 GWh.

One of the priorities of Ministry of Economy in next programming period 2021-2027 is to create regional centers for sustainable energy which will help to create regional strategies for development to implement the national policies and strategies on regional level.

As a best practice SIEA identified the national projects operated within the OPQE – Green to households and Live by energy. One is helping to increase the share of RES and the other increase the awareness about RES.

Spain

Energy is a key factor for the Basque Country development, as it is the engine of industry, economic growth and the citizens well-being. In three decades, the Basque energy mix is constantly evolving thanks to renewable energies and natural gas, coal has been eliminated and the use of oil in the productive sectors has been reduced. The Basque energy model continues to move forward, in transition towards a more sustainable model, based on an increasing contribution from renewable sources and minimizing the use of petroleum derivatives, replaced by other cleaner energies such as natural gas.

The main goals are:

- ✓ Zero consumption of oil for energy uses in 2050
- ✓ Intensify savings and renewable use in buildings
- ✓ Move towards sustainable transport and mobility, which requires long-term structural changes

The new legislation, which benefits shared self-consumption, opens the door to the creation of energy communities, in which active clients capable of consuming and generating their own energy, can exchange the surplus they do not consume with other members of the energy community.

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The Basque energy model continues to move forward, in transition towards a more sustainable model, based on an increasing contribution from renewable sources and minimizing the use of petroleum derivatives, replaced by other cleaner energies such as natural gas. The long-term vision aims of the Basque energy system are zero consumption of oil for energy uses in 2050, intensify savings and renewable use in buildings, move towards sustainable transport and mobility, which requires long-term structural changes. In terms of self-consumption, the new legislation, which benefits shared self-consumption, opens the door to the creation of energy communities, in which active clients capable of consuming and generating their own energy, can exchange the surplus they do not consume with other members of the energy community.

Italy

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Piemonte Region is one of the most important Regions of Italy in terms of energy consumption and production of renewable energy sources. It is also pretty much committed in the energy transition making the best use of available fundings (first of all Structural Funds, but also funds made available at National and EU level). This is a good sign but the efforts to reach the 2030 targets require a leap forward in both energy efficiency and use of RES. The Region, as government public authority, has a key role in the ongoing energy transition and plays often a role of front runner. An exemplary case is the promotion of energy communities, where consumers and end users will be put at the center of the energy system. A lot is to be done in this field, creating the suitable framework conditions at legislative level and implementing pilot projects where research and showcases can be highlighted for the ongoing improvement and widespread of such practice.

Sweden

Sweden is the best performing country in EU, in terms of energy efficiency. In 2018, Sweden has surpassed the 2020 target of 49%, reaching 54.6% share of energy from renewable sources. Moreover, Sweden has set ambitious goal for transformation of the energy system. The Energy Agency aim is to push the development. The target under the Swedish Energy Agreement is that by 2030, energy use will be 50% more efficient compared to 2005. Also, by 2040, Sweden aims to produce 100% renewable electricity. According to the country's NECP, this is a target, not a deadline for banning nuclear power, nor does mean closing nuclear power plants through political decisions.

The Government and the parties agree that Sweden must have a robust electricity system with high security of supply and low environmental impact, and offer electricity at competitive prices. This creates a long-term perspective and clarity for actors in the market and helps generate new jobs and investment in Sweden. The Swedish Energy Agency is leading the energy transition into a modern and sustainable, fossil free welfare society - applying its credibility, a comprehensive approach and courage. They contribute with facts, knowledge, and analysis of supply and use of energy in the society, as well as work towards security of energy supply.

The goal of the 2015 Paris Agreement is that by 2030, transport emissions will be 70% lower than in 2010 and by 2045, to have no net emissions of greenhouse gases into the atmosphere and should thereafter achieve negative emissions. The energy agency has taken stock in five challenges each of them with different perspective on research performed, which solves relevant and societal challenges of today. They are: complete renewable energy systems; resource effective society; innovation for job and climate; co-operation in the energy system; flexible and robust energy system.

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