CEER
Council of European Energy Regulators

## RES WS

# CEER Paper on unsupported RES

## Ref: C23-RES-83-05

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**INFORMATION PAGE**

## Abstract

This document (C23-RES-83-05) presents a paper on unsupported RES installations.

With this briefing, the Renewable Energy Systems Work Stream (RES WS) within the Electricity Working Group (EWG) aims to provide an updated assessment of the status quo of formally supported RES installations and an analysis of any changes that were made to the market model**.**

## Target audience

CEER members and observers

## Keywords

Support schemes; renewables; renewable energy.

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## Related documents

CEER Document

- Status Review of Renewable Support Schemes in Europe for 2020 and 2021, September 2023, Ref: C22-RES-80-04
- CEER 2nd Paper on Unsupported RES, October 2021, Ref: C21-RES-75-05
- Status Review of Renewable Support Schemes in Europe for 2018 and 2019, June 2021, Ref: C20-RES-69-04
- CEER Paper on Unsupported RES, May 2020, Ref: C19-RES-64-04a
- Status Review of Renewable Support Schemes in Europe for 2016 and 2017, December 2018, Ref: C18-SD-63-03.
- Status Review of Renewables Support Schemes in Europe 2014 and 2015, April 2017, Ref. C16-SDE-56-03.
- Key support elements of RES in Europe: moving towards market integration, January 2016, Ref: C15-SDE-49-03.
- Status Review of Renewables and Energy Efficiency Support Schemes in Europe 2012 and 2013, January 2015, Ref. C14-SDE-44-03.
- Status Review of Renewable and Energy Efficiency Support Schemes in Europe, December 2012, Ref: C12-SDE-33-03.
- Status Review on Renewable Energy Support, May 2011, Ref: C10-SDE-19-04a.

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# EXECUTIVE SUMMARY

Member Countries (MC) have been promoting the deployment of generation from Renewable Energy Sources (RES) for over a decade or longer through dedicated support schemes. With varying support time duration, MC are progressively being confronted with an increasing number of RES installations reaching the end of their support time (EOS), which, in many cases, will differ from their technical lifetime end.

From a socioeconomic perspective, it may be advisable to implement an enhancing framework allowing RES installations to continue producing and selling their RES electricity beyond the period of support instead of having them repowered or dismantled. In addition to support systems, new business models, market players and/or market products will emerge to accommodate both new and existing EOS installations as they strive for adequate market earnings. To reflect these developments, adaptations of national legal frameworks governing connection and dispatch arrangements might become relevant in selected MC.

This paper follows three main objectives: (1) Assessing the magnitude of RES installations, which will be running without support, notably after their support time has ended, in the coming years. (2) Identifying the upcoming regulatory challenges and, if needed, the changes to the legal framework and (3) showing alternative business strategies for RES installations running without support.

Against this background, CEER has gathered information via a questionnaire sent to all NRAs during autumn 2023. Compared to the last report, four countries (Denmark, Latvia, Norway and Slovenia) did not respond this time. However, seven other countries that did not respond previously have provided responses this time (Belgium, Cyprus, Estonia, Finland, Croatia, Ireland and Netherlands). Based on the responses provided, the following messages can be brought forward:

- For the time being only a small share of RES installations is not being supported. However, around 33 % of currently supported installed capacity will reach EOS by 2030;

- The legal framework governing RES installations has so far not been adapted. This is either because the framework does not differentiate between supported and unsupported RES or because the support period is still running and adaptation will be needed only in the future; and

- The strategies followed by unsupported RES installations are manifold. The most likely approach is – at least in case of larger installations – to rely on the market as a source of income. Smaller ones, mainly PV, are expected to focus on self-consumption. However, the decommissioning of the installation also seems to be a serious option for operators. The next years, with the rising capacity reaching EOS, will show if and how MC adapt their legal schemes to make decommissioning less attractive.

# 1 Introduction

An increasing number of Renewable Energy Sources (RES) installations will reach the end of their support time (EOS) in the upcoming years. Meanwhile, in some CEER Member Countries (MC), formerly supported RES installations are already running without any financial support. For the time being, no major changes or planned adjustments to the legal framework that would affect the general circumstances for unsupported RES installations can be observed in MC. Coming from a Feed-in-Premium (FiP) system which was not in place in the early 2000s, one would expect RES plant operators to be familiar with a market environment since they have been selling their electricity on a marketplace from the start. However, it is notable that installations coming directly from a Feed-in-Tariff (FiT) system do not necessarily get decommissioned after the end of their support period. These installations can often market or use their electricity successfully. With an increasing share of formerly supported installations, some challenges might intensify, such as taking on balancing responsibility or empowering operators of small installations to get actively involved in the energy market. For MC relying only on a FiT scheme for RES support, the question is whether there will be sufficient knowhow and new players available to effectively handle formerly supported electricity in a market environment.

Some MC mentioned that the quantitative data they provided on unsupported installations for this report does not clearly distinguish between installations after EOS and those that have never received any support. Therefore, the authors worked with the data as provided. Readers should be aware that this data may not reflect the actual situation in some MC. For transparency, the data provided is published with this report so that readers can make their own analyses.

# 2 Type and duration of support schemes for RES electricity

On a biennial basis, CEER publishes the main features – including costs – of national renewable support schemes. According to the 2011 CEER RES Status Review[1], which depicts support systems in place in 2009, the main support instruments in place were FiTs. As such, it is very likely that most RES installations have already reached or are about to reach the end of their support scheme in the coming years. In the latest CEER RES Status Review[2], which provides an overview of the support schemes by technology in 2017, a steady move toward market-oriented support schemes (FiP or green certificates) for newly installed RES capacities can be observed.

The majority of current RES installations which are about to reach their EOS have not operated under market conditions and will therefore be confronted with a completely new environment as opposed to the one they fit under so far (FiT scheme).

To assess the magnitude of unsupported RES installations, the RES WS has asked its members to provide further information about the initial support received by RES installations and the time span of the financial support that was granted. Based on the responses provided by the members (N=22), we observe that RES installations have already been financially supported in some MC as early as the late 1980s (e.g. Portugal) or in the 1990s (Italy, Luxemburg, Spain, Latvia), years before the first European Directive 2001/77/EU on the promotion of Renewable Energy was adopted in 2001.

[1] https://www.ceer.eu/1278.
[2] https://www.ceer.eu/1519.

Following Portugal in 1988, more and more MC introduced national support schemes for RES installations (see Table 1).

Support times for new installations are depicted in Table 2 and Table 3. They range from 13 years up to 30 years for PV installations in Spain or hydropower installations in the Czech Republic.

| | solar | onshore | offshore | biomass | biogas | hydro |
|---|---|---|---|---|---|---|
| **AT** | 2002 | 2002 | | 2002 | 2002 | 2002 |
| **BE** | | | 2009 | | | |
| **CY** | 2005 | 2009 | | 2007 | | |
| **CZ** | 2006 | 2006 | | 2006 | 2006 | 2006 |
| **DE** | 2000 | 2000 | 2000 | 2000 | 2000 | |
| **EE** | 2007 | 2007 | 2007 | 2007 | 2007 | 2007 |
| **ES** | 1998 | 1998 | | 1998 | | 1998 |
| **FI** | 2018 | 2011 | 2011 | 2011 | 2011 | |
| **HR** | 2007 | 2007 | 2007 | 2007 | 2007 | 2007 |
| **HU** | 2002 | 2002 | | 2002 | 2002 | 2002 |
| **IE** | 2020 | 1995 | 1995 | 1995 | 1995 | 1995 |
| **IT** | 1992 | 1992 | 1992 | 1992 | 1992 | 1992 |
| **LT** | 2002 | 2002 | 2023 | 2002 | 2022 | 2022 |
| **LU** | 1993 | 1993 | | 1993 | 1993 | 1993 |
| **MK** | 2010 | 2015 | | 2007 | 2015 | 2010 |
| **MT** | 2006 | | 2006 | | | |
| **NL** | 2008 | 2008 | 2008 | 2008 | 2008 | 2008 |
| **PL** | 2004 | 2004 | 2021 | 2004 | 2004 | 2004 |
| **PT** | 1988 | 1988 | 1988 | 1988 | 1988 | 1988 |
| **RO** | 2011 | 2011 | | 2011 | 2011 | 2011 |
| **SE** | 2003 | 2003 | 2003 | 2003 | 2003 | 2003 |
| **UK** | 2002 | 2002 | 2002 | 2002 | 2002 | 2002 |

*Table 1: Introduction of national support schemes*

| | solar | onshore | offshore | biomass | biogas | hydro |
|---|---|---|---|---|---|---|
| AT | 20 years | 20 years | | 20 years | 20 years | 20 years |
| BE | In the Walloon region : Currently 10 years - In the Flemish region, there is no duration for new solar PV installations, a premium is given once. | In the Walloon region : currently 20 years - In the Flemish region, depending on the type of installation, the maximum support duration is 22 years | between 20 and 17 years (decreasing for youngest parks) | In the Walloon region : currently 15 years - In the Flemish region, the maximum support duration is 17 years. | In the Walloon region : currently 15 years - In the Flemish region, the maximum support duration is 17 years. | In the Walloon region : currently 25 years |
| CY | 15 - 20 years | 20 years | | 15 years | | |
| CZ | PV systems commissioned after 2013 do not receive operational support | 20 year | | 20 year | 15/20 years For landfill and sludge gas is the financial support duration 15 year and for biogas is the financial support duration 20 years. | 30 years |
| DE | 20 years | 20 years | 20 years | 20 years | 20 years | |
| EE | 12 years. The maximum production quantity for all producers in total for which the subsidy is paid is 650 GWh per calendar year. The winner of the lower tender is obliged to produce at least 50% of the annual amount of elec. | 12 years. The maximum production quantity for all producers in total for which the subsidy is paid is 650 GWh per calendar year. The winner of the lower tender is obliged to produce at least 50% of the annual amount of elec. | 12 years. The maximum production quantity for all producers in total for which the subsidy is paid is 650 GWh per calendar year. The winner of the lower tender is obliged to produce at least 50% of the annual amount of elec. | 12 | Elering accept grant applications from February 6, 2018 until June 30, 2024 or until the end of the budget funds intended to support the activity. The amount of available funds is directly equal to the actual revenue obtained | 12 |
| ES | 30 years | 20 years | | 25 years | | 25 years |
| FI | No operating aid is provided to solar PV: | 12 years fixed term | Fixed term, 12 years | 12 years | 12 years | No support |
| HR | 12 years | 12 years | 12 years | 12 years | 12 years | 12 years |
| HU | 15-25 years | It was 16,5 years for projects in the former FiT scheme. No new wind projects supported yet in the premium scheme. | | 5-20 years | 5-15 years | 15 years |
| IE | Usually 15 years but can be up to 16.5 years | Usually 15 years but can be up to 16.5 years. | 15 years usually but can be up to 16.5 | Usually 15 years but can be up to 16.5 years | Usually 15 years but can be up- to 16.5 years | Usually 15 years but can be up to 16.5 years |
| IT | 20 years | 20 years | 25 years | 20 years | 20 years | 20-30 years |
| LT | 12 years | 12 | 15 | 12 | 12 | 12 |
| LU | 15 years | 15 years | | 15 | 15 to 30 years | 15 to 30 years |
| MK | 15 years | 20 yeras | 0 | 15 | 15 years | 20 years |

*Table 2: Support times for new installations in 2023*

| | solar | onshore | offshore | biomass | biogas | hydro |
|---|---|---|---|---|---|---|
| MT | Financial support (FIT/FIP) payable for the duration of 20 years and capped at kW x 1600h per annum. | | | | | |
| NL | 15 Years, 840 - 1190 fullload hours pa | 15 years fullload hours conform local windenergy analyses probability 50% | 15 years fullload hours conform local windenergy analyses probability 50% | 8-15 years, the fullload hours vary per categorie between 3000-8500 | 12 years, 8000 fullload hours | 15 years, fullload hours vary per category between 2600-5200 |
| PL | As a rule, the period of the RES support system is 15 years from the first introduction of electricity to the grid, and in the case of offshore wind installation it is 25 years. | As a rule, the period of the RES support system is 15 years from the first introduction of electricity to the grid, and in the case of offshore wind installation it is 25 years. | For offshore wind farms, the maximum support period will be 25 years from the first introduction of electricity to the grid. | 15 years | 15 years | 15 years |
| PT | 15 years or 21 GWh/MW. The energy limite or yearly limit depends on what comes first | 15 years or 33 GWh/MW. The energy limite or yearly limit depends on what comes first. | 15 years or 33 GWh/MW. The energy limite or yearly limit depends on what comes first. | 25 years. | 15 years. | 20 years or 52 GWh/MW. The energy limite or yearly limit depends on what comes first. |
| RO | 15 years | 15 years and 7 years for wind installations that were previously used | | 15 years for the scheme mention above or less than 15 years in the case of receiving green certificates prior to the application of the promotion system in force since 2011 | 15years | 15 years; 10 years for retechnological unit; 3 years for unretechnological unit |
| SE | Solar PV is also granted tax reduction for installation costs, 20% or max 50 000SEK. Tax reduction is granted private persons, not organizations or companies. Tax reduction started 1 Jan 2021, before that investment support | The elcertificate system is closed for new electricity production facilities since 31 december 2021. But elcertificates will be issued to the RES production facilities within the system until year 2035. Max 15 years. | The elcertificate system is closed for new electricity production facilities since 31 december 2021. But elcertificates will be issued to the RES production facilities within the system until year 2035. Max 15 years. | The elcertificate system is closed for new electricity production facilities since 31 december 2021. But elcertificates will be issued to the RES production facilities within the system until year 2035. Max 15 years. | 0 | The elcertificate system is closed for new electricity production facilities since 31 december 2021. But elcertificates will be issued to the RES production facilities within the system until year 2035. Max 15 years. |
| UK | 20 years | 20 years | 20 years | 20 years | 20 years | 20 years |

*Table 3: Support times for new installations in 2023*

# 3 Installed capacity and installed capacity reaching EOS

This chapter gives an overview over the installed capacity of supported RES installations at the end of 2022 as well as the amount of capacity that will reach EOS by the end of 2030.

## 3.1 Installed supported capacity at the end of 2022

Figure 1 and Figure 2 show the overall installed supported capacity per MC at the end of 2022 (in total around 327 GW of which Germany has the largest share with 123 GW). The following figures also indicate how much installed supported capacity will reach the EOS. Looking at the data provided by MC, we conclude that around 33 % of the supported installed capacity at the end of 2022 will no longer be supported by 2030.

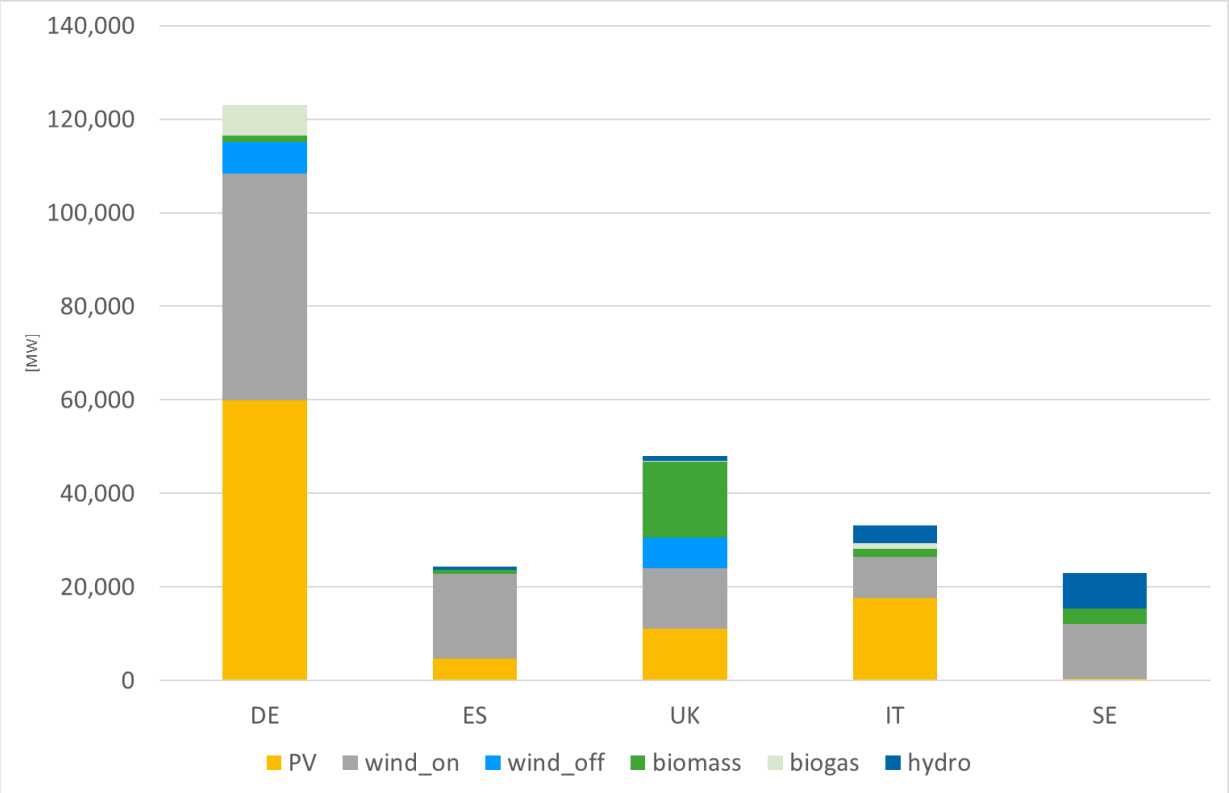


Figure 1: Installed supported capacity per country (>20 GW)

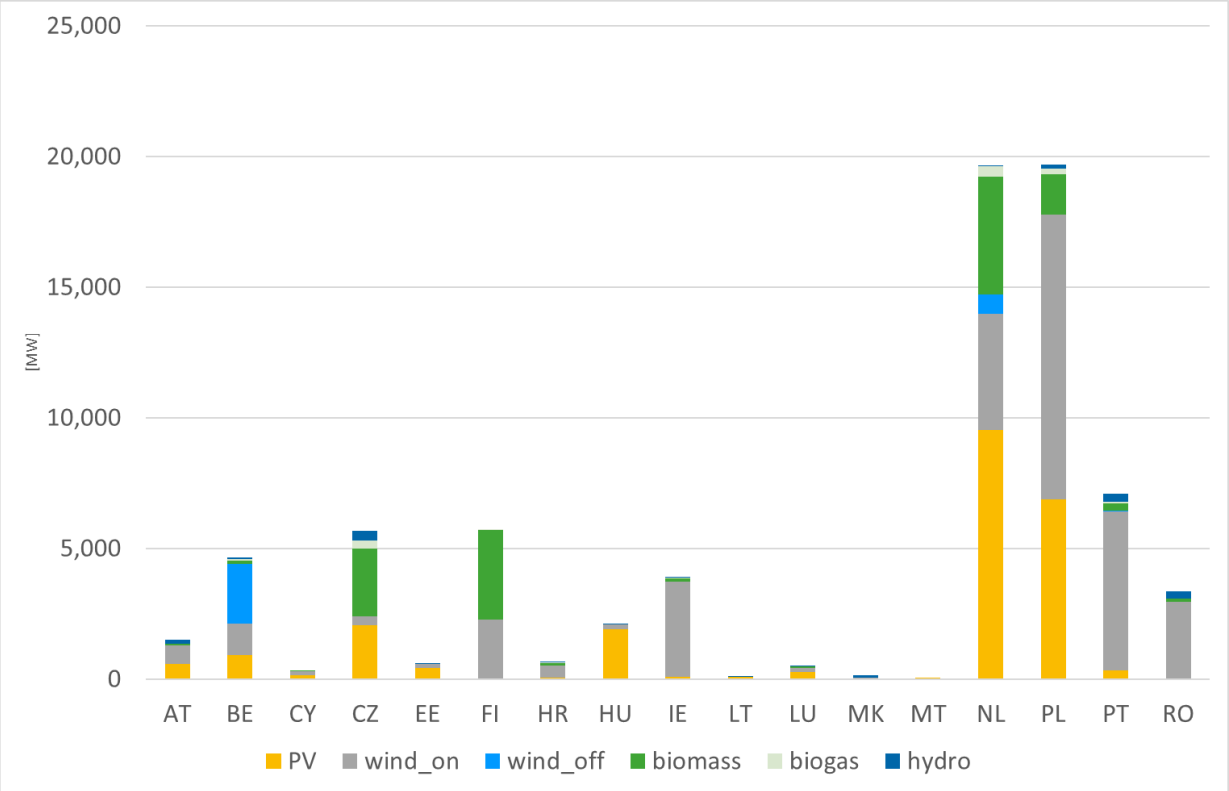


Figure 2: Installed supported capacity per country

## 3.2 Installed capacity reaching end of support time

Since most RES support schemes have been introduced in the early 2000s, and support times often last for 20 years, an increasing number of supported RES installations will start to reach their EOS from 2022 onwards. The data included in this chapter has also been made available in a separate Excel file.

Figure 3 depicts the installed photovoltaic capacity that will reach EOS by 2030. Major shares of PV installations will reach their EOS mainly starting from 2028 onwards, as can also be seen in Figure 3 and Figure *4*.

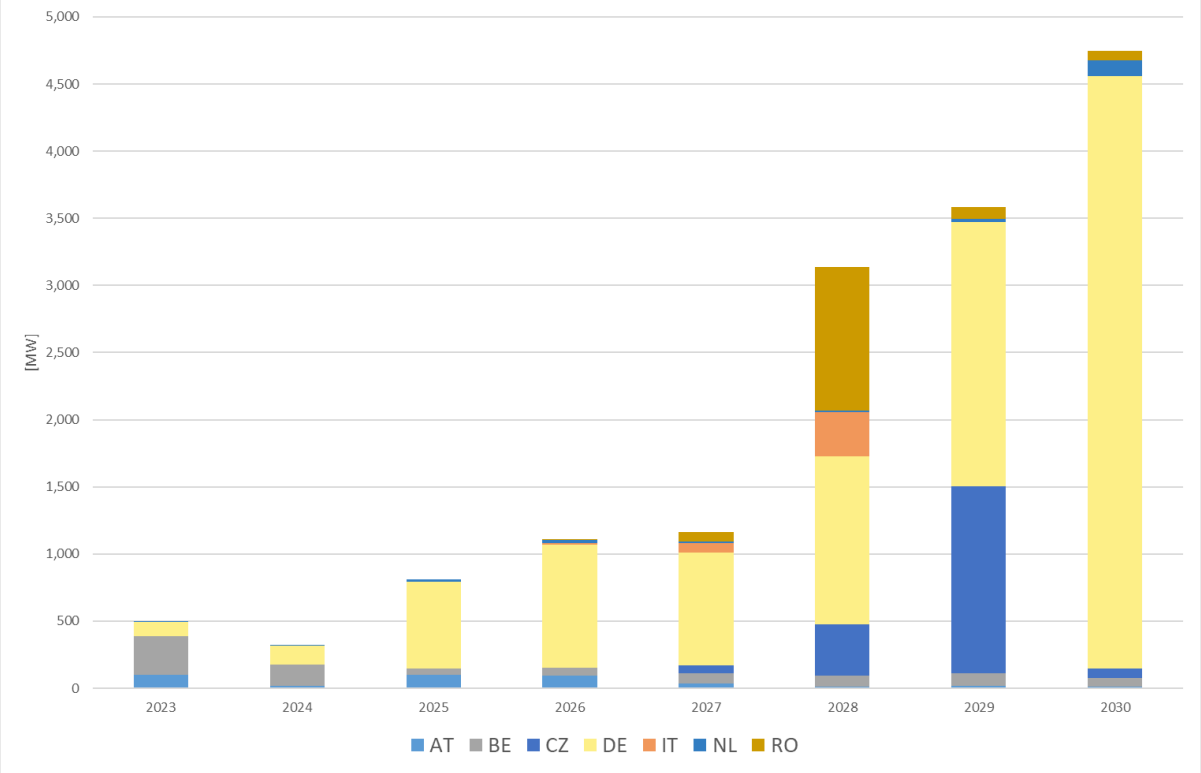


Figure 3: PV-installations reaching end of support by year

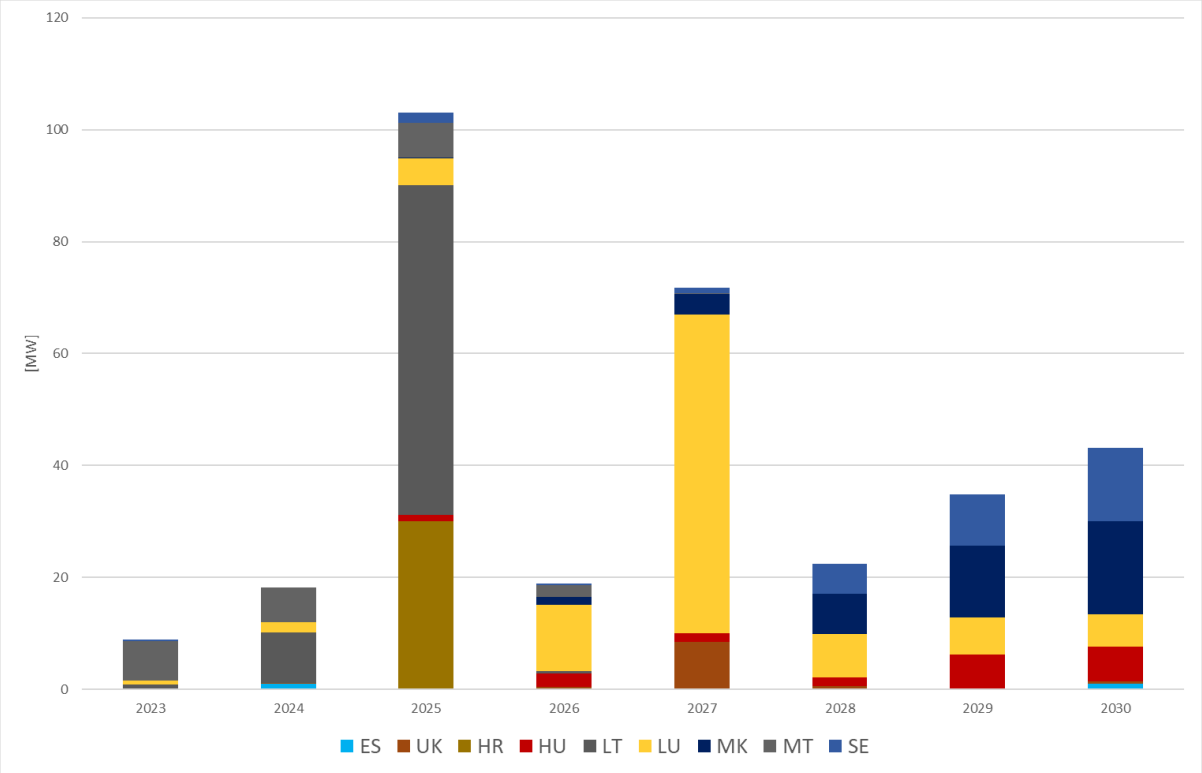


Figure 4: PV-installations reaching end of support by year

Figure 5 and Figure *6* illustrate the EOS trend for onshore wind installations. Onshore wind has the largest share of overall installed capacity falling out of the support system according to the data received for this study. Between the end of 2022 and end of 2030, around 53 GW of onshore wind capacity will gradually fall out of the RES support schemes. Spain tops the list with around 16 GW followed by Germany with around 15 GW.

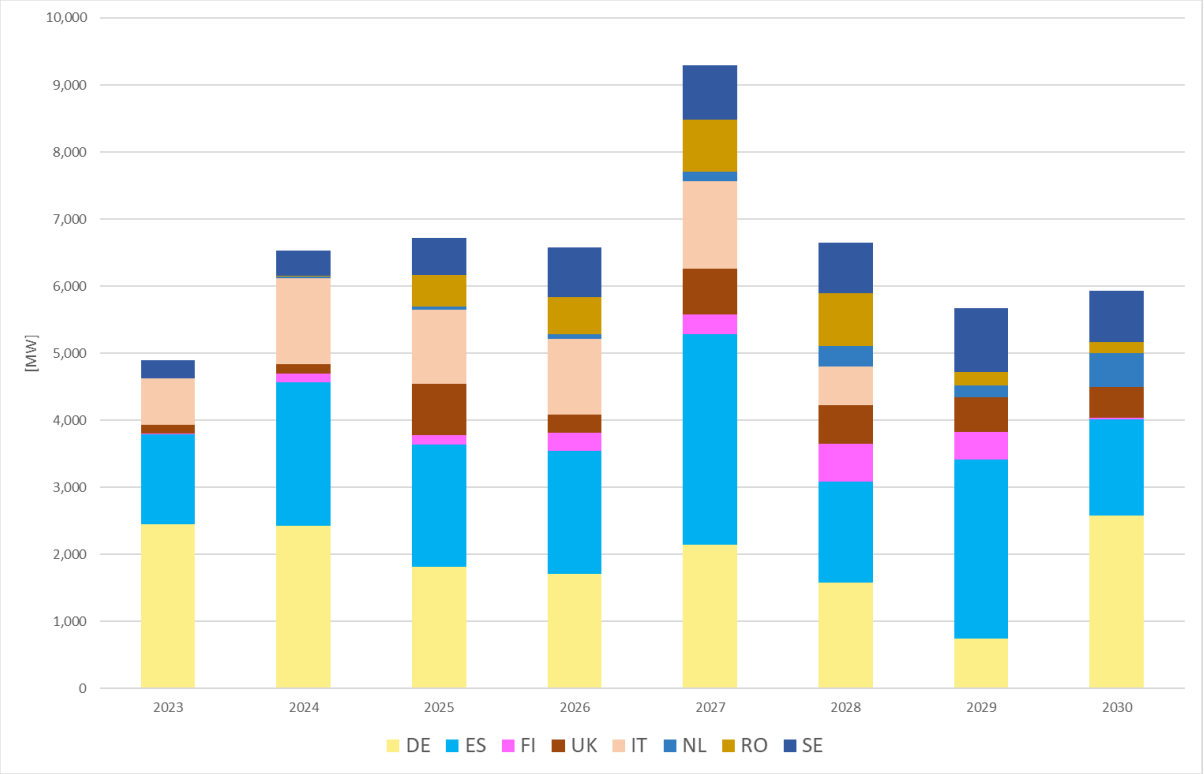


Figure 5: Onshore wind capacity reaching end of support by year

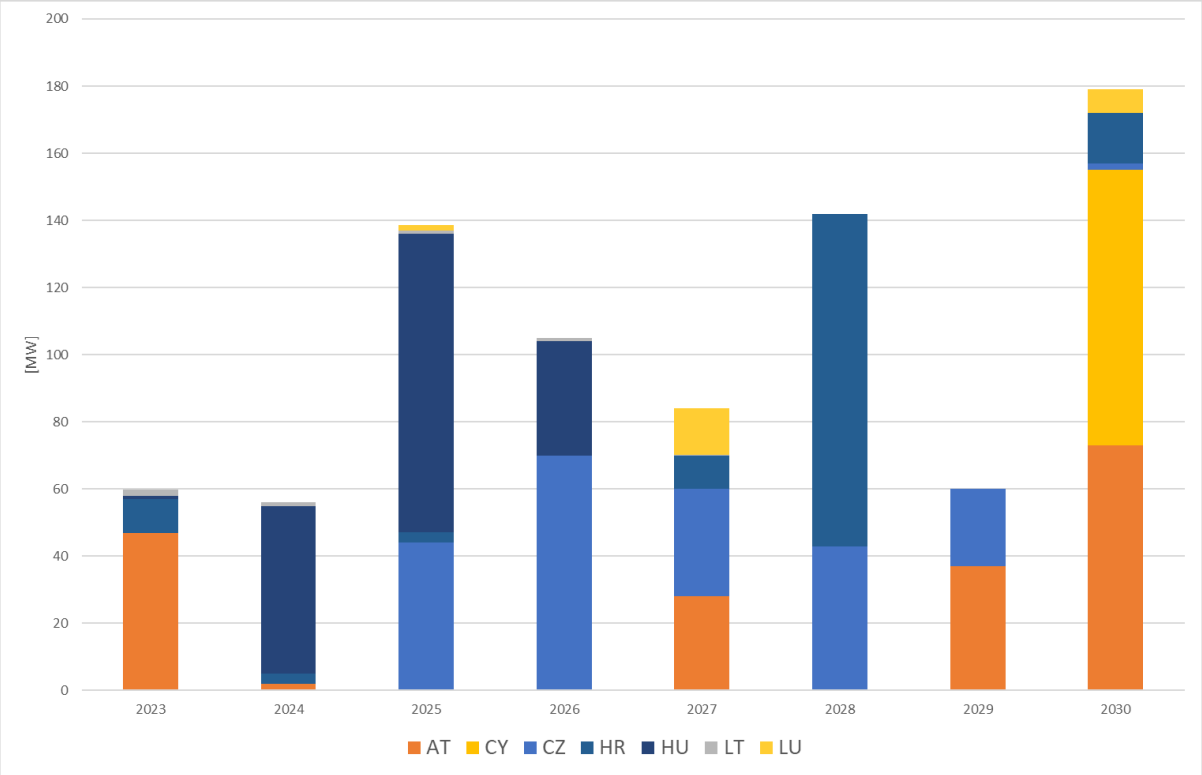


Figure 6: Onshore wind capacity reaching end of support by year

The EOS evolution for offshore wind is depicted in Figure 7. From 2028 onwards, we observe that EOS is picking up with an overall 1,550 MW.

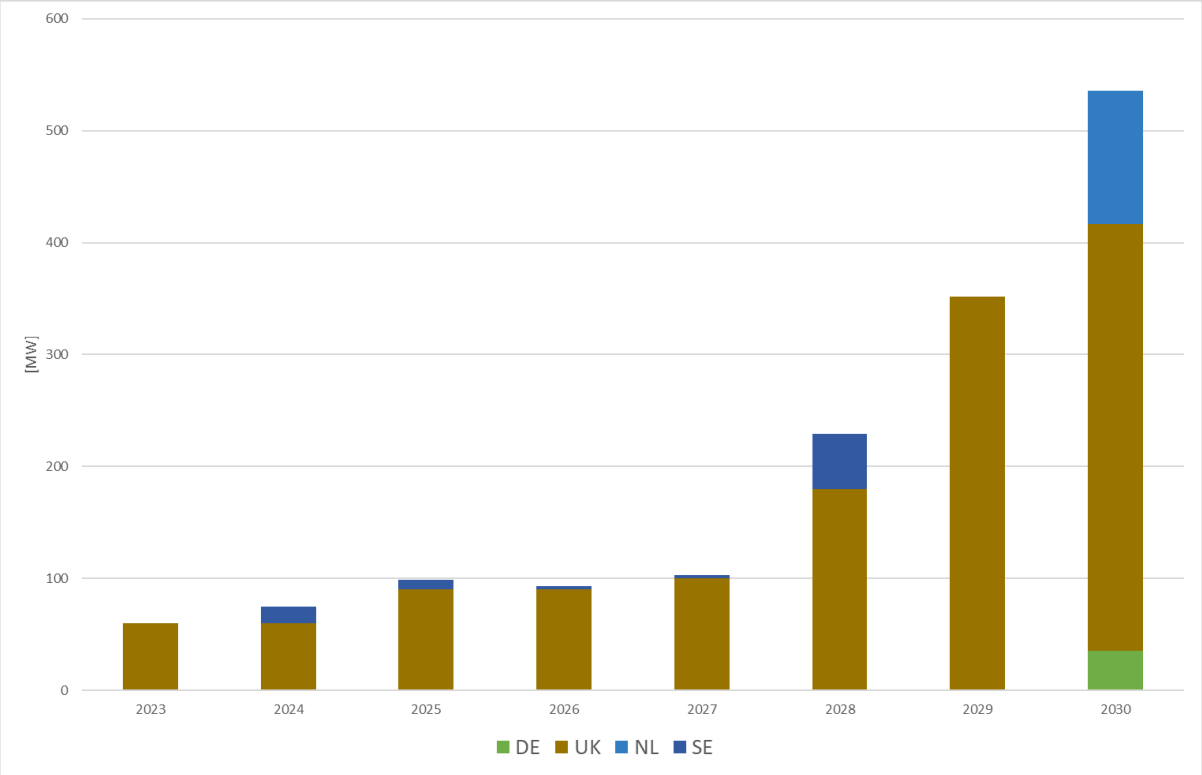


Figure 7: Offshore wind capacity reaching end of support by year

Figure 8 showcases the EOS evolution for biomass. Due to high costs of input materials, further support based on Levelised Costs of Energy (LCOE) might be needed to keep biomass plants operational after they reach their EOS. Several countries such as Austria, Germany or Hungary introduced follow up support options. Overall, 23,748 MW will reach EOS by 2030 of which nearly 40 % was expected to see their EOS in 2023 already.

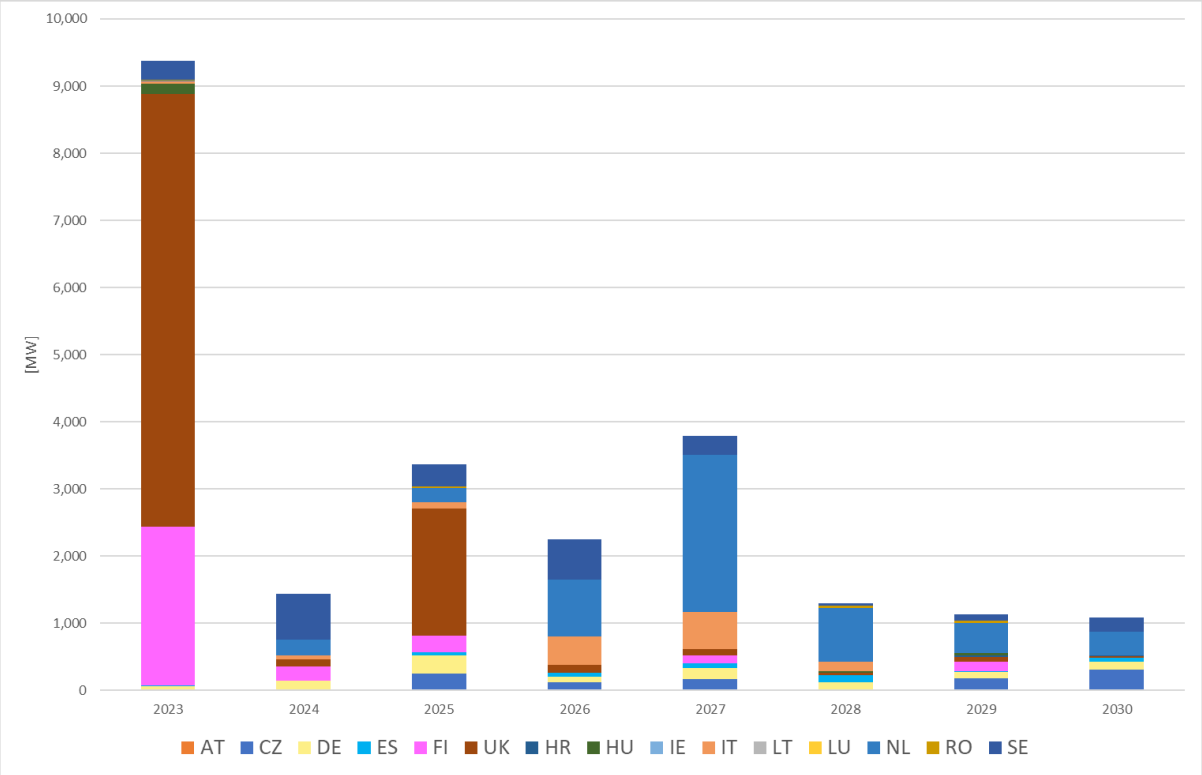


Figure 8: Biomass reaching end of support by year

The evolution for biogas reaching EOS is depicted in Figure 9. As is the case for biomass, biogas plants are also very unlikely to operate without any support after their EOS due to the high operating costs(mainly fuel costs). By 2030, around 4,755 MW will reach their EOS.

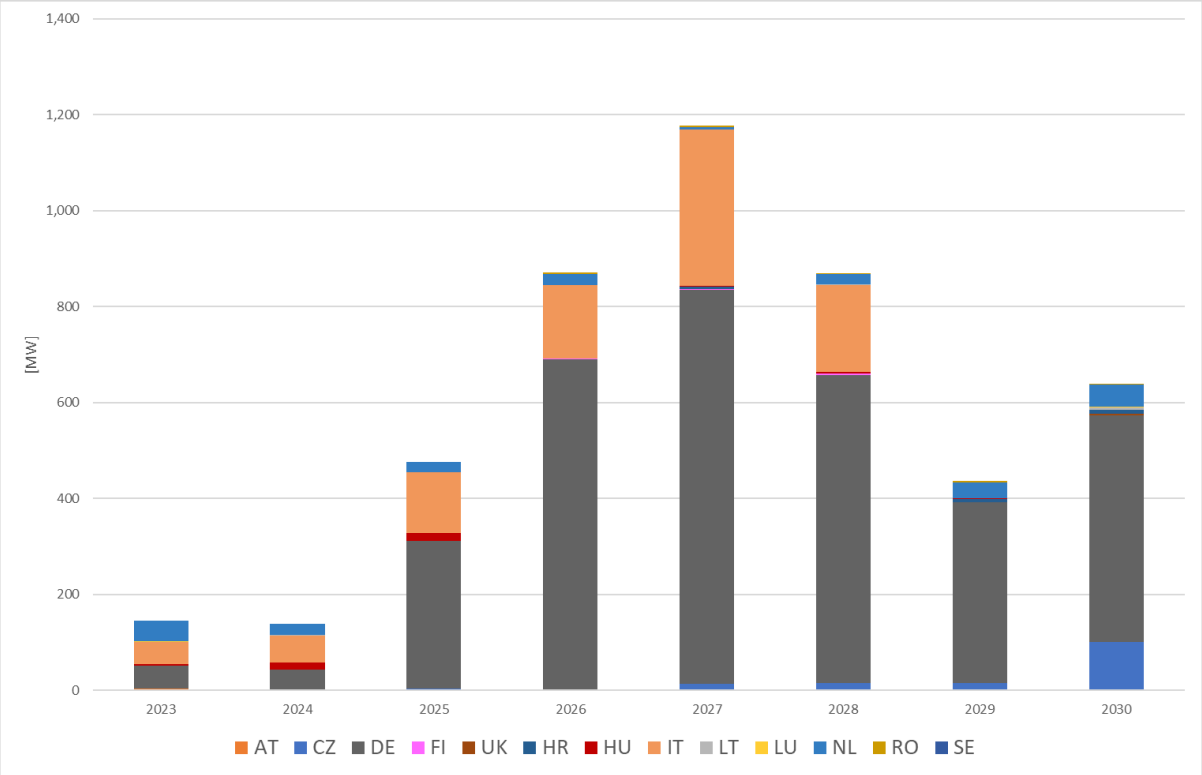


Figure 9: Biogas reaching end of support by year

Figure 10 shows the installed capacity of hydropower reaching the EOS. There is no common definition of small hydropower installations. However, large hydropower installations are usually not supported in the current support systems. The situation for hydropower is somewhat special. First of all, their lifetime is significantly longer and thanks to their low operating costs, it is likely that compared to other technologies, a larger share of those plants will be able to operate under market conditions. By 2030, over 10,300 MW will reach their EOS. Around 60 % of that capacity is located in Sweden and 30 % is located in Italy.

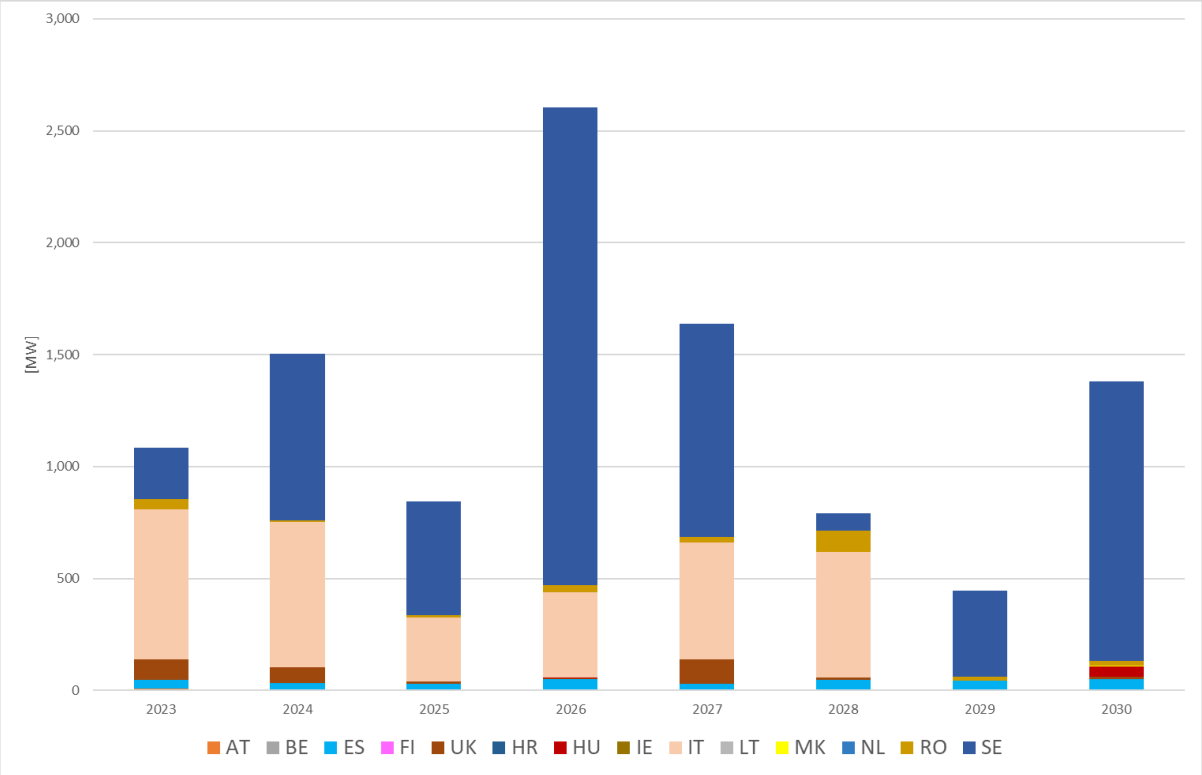


Figure 10: Hydropower reaching end of support by year

Figure 11 showcases the total RES capacity that will reach EOS between 2020 and 2030. Onshore wind accounts for around 50 % of the overall capacity, followed by biomass and PV. If permit granting procedures (building permits or rules for environmental impact assessments etc.) outside NRAs scope significantly changed, it might be difficult to repower certain assets or to reach certain goals. On the other hand, the potential for additional electricity from repowering existing plants should also be kept in mind.

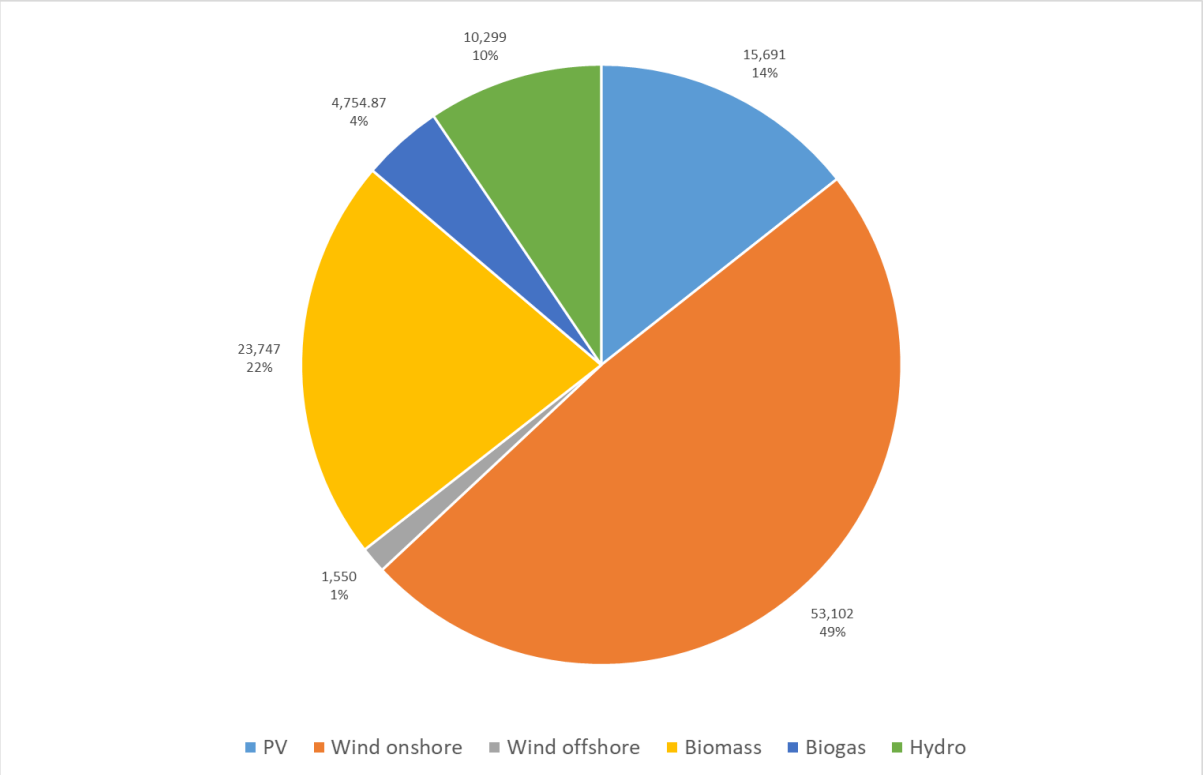


Figure 11: Sum of capacity (in MW) reaching end of support (2023 - 2030)

## 4 Running without any financial support

Table 4 provides an overview of RES installations which have never received financial support or reached EOS. For every technology, we observe that there are unsupported plants in operation. Regarding PV, onshore wind and hydro plants, a vast majority of MC reported that there are installations running without support schemes. This indicates that most MC will eventually gather experience with unsupported RES plants.

More than half of MC gave accounts of onshore wind and hydro installations which were initially supported but later reached EOS. Four (onshore) and six (hydro) MC respectively reported that these plants had never received any form of support.

On the one hand, MC should not support RES producers who can thrive under market conditions. On the other hand, and given the increasing demand for RES energy, MC have to avoid situations where RES producers decommission their plants due to a lack of support, therefore bringing RES construction to a halt. MC will have to decide which RES plants need support in order to maintain a profitable business and provide such support only to those who cannot turn a profit.

| | PV | Onshore | Offshore | Biomass | Biogas | Hydro |
|---|---|---|---|---|---|---|
| **AT** | Yes | Yes | | | | Yes |
| **BE** | Yes | Yes | No | Yes | Yes | Yes |
| **CY** | Yes | No | | No | | |

| | PV | Onshore | Offshore | Biomass | Biogas | Hydro |
|---|---|---|---|---|---|---|
| **CZ** | Yes | Yes | | No | Yes | No |
| **DE** | Yes | Yes | Yes | Yes | Yes | |
| **EE** | Yes | | | | | |
| **ES** | Yes | Yes | | Yes | | Yes |
| **FI** | Yes | Yes | No | Yes | Yes | Yes |
| **HR** | Yes | Yes | No | Yes | Yes | Yes |
| **HU** | Yes | Yes | | Yes | Yes | Yes |
| **IE** | Yes | Yes | Yes | | | Yes |
| **IT** | Yes | Yes | No | Yes | Yes | Yes |
| **LT** | Yes | Yes | No | Yes | Yes | Yes |
| **LU** | Yes | Yes | | No | Yes | Yes |
| **MK** | Yes | No | | No | Yes | Yes |
| **MT** | Yes | | Yes | | | |
| **NL** | Yes | Yes | Yes | Yes | Yes | Yes |
| **PL** | Yes | Yes | No | Yes | Yes | Yes |
| **PT** | Yes | Yes | No | No | Yes | Yes |
| **RO** | Yes | Yes | | Yes | No | Yes |
| **SE** | Yes | Yes | Yes | Yes | | No |
| **UK** | Yes | Yes | Yes | Yes | Yes | Yes |

*Table 4: RES installations running without support*

Compared to the previous edition of this report, biomass plants that run without support are becoming more common. It should nonetheless be highlighted that some MCs have introduced rules for a second support period for biomass installations. Given the high costs of input material, this is noteworthy as some MC do grant further support in line with European State Aid rules.

The majority of solar PV installations in MC have been developed in the last decade, so EOS will mainly be reached after 2030.

## 4.1 Legal schemes

In general, it appears that there are no special legal frameworks in place for RES installations once their support time has ended when compared to RES installations which have never been supported. Some differences may exist when compared to conventional plants (priority access and dispatching). However, no special rules regarding balancing responsibilities have been indicated. Responses from CEER MC regarding legal schemes are compiled in Table 5.

Preferential treatment for RES (priority access and dispatching) seems to be granted independently of the existence or not of a financial support scheme. Thus, these rules still apply once the installations no longer benefit from support schemes. Additionally, RES installations running without financial support are most likely treated like any other installation. For smaller installations, there might be some “fall back” solution in place or under discussion, notably in cases where the installation would not find a supplier to collect and sell their surplus electricity on the market.

| Current legal schemes for RES installations after EOS | |
|---|---|
| **AT** | No specific scheme for RES installations. |
| **BE** | No possibility to extend the support duration for PV Solar technologies.<br>Wind producers will be able to extend the support duration after EOS with the future mechanism of "Prolongation" (from 2024).<br>Both apply to Wallonia only. |
| **CY** | RES installations depending on support schemes may participate in the Transitional Arrangement of the market or under self-consumption (net-billing) and follow the relevant rules. |
| **CZ** | There are no mandatory differences in the legal regime for subsidised and non-subsidised PV. Systems up to 50 kW can be operated without a business licence once their subsidy period has expired. |
| **DE** | The general rules apply. |
| **EE** | Once their support time has ended, the installations can sell electricity to the market. The same general rules apply. |
| **ES** | Same legal scheme as the other generation electricity plants. |
| **FI** | There is no specific scheme for "support scheme dropouts". This applies to all generation technologies. |
| **HR** | Priority dispatch is available. Producers are responsible for balancing (they must form or join a balancing group). |
| **HU** | After the end of the support period, solar PV installations sell electricity under market conditions (no priority dispatch or balancing responsibility). |
| **IE** | Priority dispatch. |
| **IT** | The legal scheme will remain as it is during the support time as far as priority access and dispatch are concerned. RES-E plants are already responsible for imbalances. |
| **LT** | FiT, balancing responsibility and centralized trade. |
| **LU** | It is mandatory to conclude a contract, either with a supplier or with the TSO/DSO in order to sell their production at a price reflecting market prices (and have a BRP). |
| **MK** | No legal scheme. |
| **MT** | No change. |
| **NL** | No legal scheme. |

| Current legal schemes for RES installations after EOS | |
|---|---|
| **PL** | RES installations, even those not covered by a support system, still benefit from many privileges for this type of generating units, such as: reduced formalities for smaller RES installations (micro-installations – only notification to the DSO, small installations – only entry in the register), priority connection, transmission priority, reduction of connection fees for smaller RES installations, exemption from license fees for smaller RES installations, and exemption from excise tax. |
| **PT** | Regular producers. They can be represented by an aggregator to help deal with balancing. In 2022 the aggregator of last resort was introduced for temporary situations. |
| **RO** | No legal scheme. |
| **SE** | No legal scheme. |
| **UK** | Introduction of the Smart Export Guarantee (SEG) on 1 January 2020. The SEG scheme is a market-led initiative for small scale renewables. The meter used to measure generation must have an associated export meter and be registered under the Balancing and Settlement Code. |

*Table 5: Legal schemes for RES installations*

## 4.2 Changes in legal schemes

Table 6 compiles the answers provided to the question of whether any legal changes have been made to accommodate RES installations without support schemes.

Four MC reported changes to their legal schemes. The Czech Republic, Italy, Malta and Portugal have introduced new rules. Out of all CEER MC, only Portugal reported changes that affect all technologies. Malta has introduced another support period for PV installations for another 12-14 years depending on the duration of the first support period. In the Czech Republic and Italy, legal changes affecting biomass and biogas have been adopted.

| Changes in legal schemes for RES installations after EOS | |
|---|---|
| **AT** | None. |
| **BE** | None. |
| **CY** | None. |
| **CZ** | For biomass, PD can be renovated and transferred to the FiP operational support system for modernised production facilities. Since 2022, an operational support FiP for new biomass heat production has been introduced. |
| **DE** | None. |
| **EE** | None. |
| **ES** | None. |
| **FI** | None. |
| **HR** | None. |
| **HU** | None. |

| Changes in legal schemes for RES installations after EOS | |
|---|---|
| **IE** | None. |
| **IT** | For biomass, minimum guaranteed prices have been defined in order to cover operational costs up to the end of technical life. |
| **LT** | None. |
| **LU** | None. |
| **MK** | None. |
| **MT** | On 25 February 2021, legal notice 61 of 2021 established that PVs with expired FiT installed by households would continue to benefit from a FiT of 10.5c for 12 years if the original FiT was for 8 years or 14 years if the original FiT was for 6 years |
| **NL** | None. |
| **PL** | None. |
| **PT** | In 2022, the aggregator of last resort was introduced for temporary situations. |
| **RO** | None. |
| **SE** | None. |
| **UK** | None. |

*Table 6: Changes in legal schemes for RES installations so far*

Some MC have not yet adapted their framework. However, some of them may have to do so. RES operators will be obliged to sell their surplus electricity to a third party. Given that the provision for priority dispatch for small RES installations has been introduced as a mandatory provision under the RED II framework (Art. 17 and 21), national frameworks still might need to be adapted.

Out of all MC who provided answers, only the UK indicated some possible future changes for all RES technologies. Currently, the UK government is exploring the most appropriate revenue support mechanism to efficiently re-use existing installations that are currently reaching EOS and might be decommissioned. Newly connected Czech PV installations can receive an investment support rather than operational support.

| | PV | Onshore | Offshore | Biomass | Biogas | Hydro |
|---|---|---|---|---|---|---|
| **CZ** | Yes | | | | | |
| **UK** | Yes | Yes | Yes | Yes | Yes | Yes |

*Table 7: Possible legal changes*

# 5 Business models for RES installations and challenges

## 5.1 Possible business models

Looking at business models adopted by RES installations after their EOS, we can distinguish between (1) making major changes (e.g. decommissioning, repowering) and applying for new support in various ways or (2) not making any or only minor changes to the existing plant and making use of the generated electricity under market conditions. MC have been asked which business models could be used for the respective RES after the EOS. MC could select between the following predefined possibilities:

- Power Purchasing Agreements (PPA)
- Selling to the market via retailer
- Self-consumption
- Repowering (including new support)
- Any kind of follow up support scheme
- Decommissioning
- TSO/DSO/central entity has to buy (market value only) RES electricity

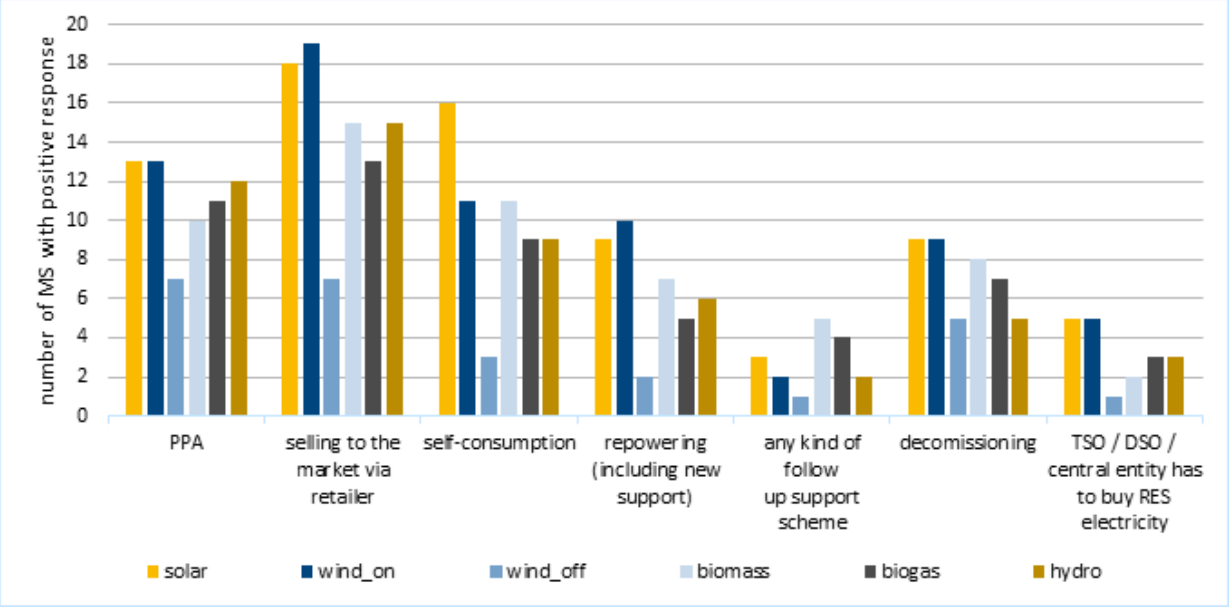


Figure 12: Business models followed by RES installations once their support time ended by number of MC with positive responses

As displayed in Figure *12* and as observed in the previous report, the most frequent answer was “selling to the market via retailer” for all technologies.

For onshore wind installations, 19 MC consider regular market participation as a feasible business model in their respective countries. 18 MC consider it feasible for solar, 15 MC consider it feasible for biomass and hydro and 13 MC consider it feasible for biogas.

In this edition, PPAs are the second most mentioned business model. As for solar and wind onshore, 13 MC consider PPAs as a possible business model. Furthermore, for hydropower, PPAs seems to be a frequently used business option in many MC. In comparison, only 7 MC consider self-consumption for offshore wind turbines as a possibility.

Self-consumption seems to be specifically relevant for solar, but also for wind onshore, biomass, biogas and hydro installations. Figure *12* shows that more MC regard decommissioning as an option for RES once support ends as opposed to repowering. It also seems to be rather rare that the TSO/DSO/central entity has to buy electricity from unsupported RES.

Additionally, Lithuania mentioned that there are bilateral contracts with DSOs or independent electricity suppliers. Five MC also consider energy communities as a future possibility for solar systems. Estonia replied that the producer has the right to receive a renewable energy subsidy for the electricity transmitted to the consumer via direct line and the line holder (i.e. the producer who uses the direct line to transmit electricity) has the obligation to pay the renewable energy fee for the electricity transmitted to the consumer via the direct line.

It should be noted that only a few MC named possible business models for unsupported onshore wind installations. This may be due to the fact that several years remain before the first plants no longer receive subsidies. Geothermal and concentrated solar power still aren't included in Figure *12* as there have only been a few or no answers concerning possible business models.

## 5.2 Reasons for producers to build RES installations without support

The previous chapter focussed on RES installations that received subsides at some point during their lifespan. For this chapter, MC were asked why producers decided to build RES installations without any support scheme in the first place. MC could choose between the following options:

- No support scheme available for the technology/size of the plant
- Existing support schemes impose constraints on the projects
- Producers expect higher profitability without support
- Other.

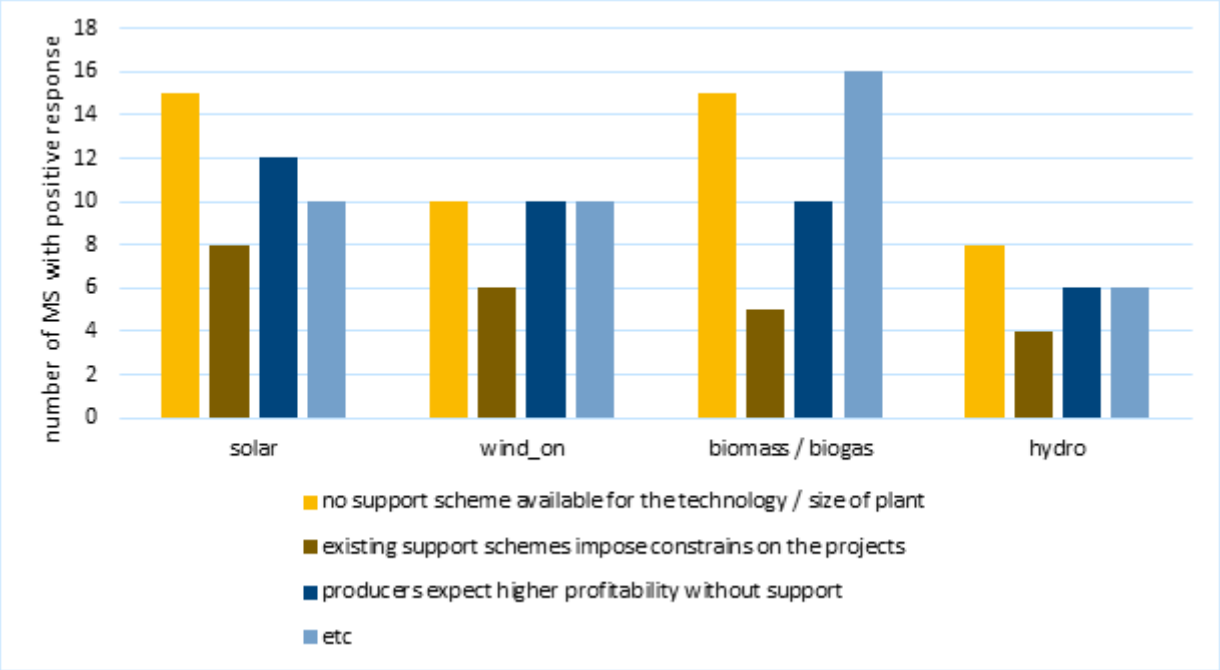

Figure 13: Reasons for producers to build RES installations without support by number of MC with positive response

As indicated in Figure 6, no support scheme available for the technology/size of the plant was chosen by most MC and according to the answers, the reason seems to be specifically relevant for solar installations. In addition to predetermined responses, MC provided additional reasons. As observed in the previous report, especially regarding solar installations, multiple MC have identified self-consumption and/or net metering as reasons for producers building RES installations without support. The advantage of self-consumption is the use of electricity without using the public grid and thereby mainly incurring the cost of producing the electricity. Depending on the countries' electricity market model, some additional charges may apply to self-consumed electricity. However, the advantage of avoiding grid charges and possibly other grid related charges (indirect support) also makes self-consumption an attractive option for small new installations being built without any direct support.

Other reasons were put forward by MC when building unsupported RES installations, including that installations would be profitable even without subsidies, that producers react to market demand or also that producers failed to get support. However, the capacity of RES installations that have never received any support remains limited and therefore some MC have emphasised that they do not have any installations that were built without any form of support.

## 5.3 Challenges for RES installations after EOS

Challenges for unsupported RES producers have remained unchanged and arise from leaving the secure conditions of support schemes, which in the case of FiTs often meant priority access to the grid, priority dispatch, direct off-take by the TSO, only partial (or no) balancing responsibility and, in some MC, simplified permitting procedures. RES plants operating in premium schemes may find the transition towards full market conditions easier, as they have already been acting in a market environment, while being shielded from mid- to long-term price risks.

This time, 19 MC responded to the question concerning challenges, which might indicate that more and more RES projects has been affected and unsupported RES has become more of an issue then in the previous years.

The number of answers received is consistent amongst all technologies. Three main challenges can be put forward as shown below. For an overview of the full list, please refer to Table 8:

- **Building permits:** Obtaining the necessary permits and approvals can be a time consuming and costly process. Specifically, environmental permits can be lengthy, and requirements can vary depending on the size, location and technology of the installation. This is causing project delays because of difficulties in the planning processes and increasing costs.

- **Grid access and connection:** Grid connection process is lengthy, including complex technical requirements and potential delays, which can significantly affect profitability. Furthermore, existing and planned RES face limitations in the capacity of the power grid. This can lead to a decline of connections for producers planning to generate electricity in RES installations because of technical reasons and network congestion.

- **Balancing responsibility:** This is regarded as the major challenge for unsupported RES. Production schedules of variable solar and wind are difficult to match with real-

time production, thus balancing costs can rise substantially. Constant development of forecasting techniques and services, as well as market models that allow for modifying production schedules close to delivery, may reduce balancing costs. Aggregating different sources and locations for RES projects can also help keep deviations from production schedules low. Some MC stated that the challenges faced by operators depend on the capacity of the plants. This supports the assumption that balancing responsibilities are especially demanding for small plants.

| | PV | onshore | offshore | biomass | biogas | hydro |
|---|---|---|---|---|---|---|
| **AT** | | Wind locations are getting scarce. Federal states have to designate more areas. | | | Fluctuating fuel prices are the major challenge for biogas plants. | |
| **BE** | No adapted support for particular technologies like "Agri-PV" (Answer for the Walloon region only) | Projects could be contested at the state council (Answer for the Walloon region only) | Major challenges to have the required transmission capacity built on time to connect the offshore windfarms (onshore grid development) due to permitting issues | | | |
| **CY** | Building and environmental permits. | | | | | |
| **CZ** | Amendments to the Energy Act have changed the possibility of installing and operating a renewable energy source without a licence from 10 kW to 50 kW. Further amendments to the Energy Act are | Permitting procedures and the NIMBY effect appear to be the biggest obstacles to wind power construction. | | Amendments to the Energy Act have changed the possibility of installing and operating a renewable energy source without a licence from 10 kW to 50 kW. Further amendments to the Energy Act are expected within the next year, including energy communities, simplification of connection procedures, etc. | | |

| | PV | onshore | offshore | biomass | biogas | hydro |
|---|---|---|---|---|---|---|
| | expected within the next year, including energy communities, simplification of connection procedures, etc. | | | | | |
| **EE** | Grid connection is one of the major challenges for renewable energy generators in Estonia. The connection process can be lengthy, with complex technical requirements and potential delays, which can significantly impact the profitability of the installation. Permitting and administrative processes can also be a challenge. The process for obtaining environmental permits can be lengthy and expensive, and requirements can vary depending on the size, location, and technology of the installation. Balancing responsibility is another challenge faced by renewable energy installations. | | | May face challenges related to the availability and cost of biomass feedstock. Biomass installations require a steady supply of feedstock in order to operate, and the cost and availability of biomass can vary | | Main challenges for hydro power installations in Estonia is the lack of suitable water resources. Estonia's rivers are generally low-flow and unsuitable for large-scale hydro power generation. Additionally, the country's topography and climate make it difficult to identify suitable areas for building dams or other hydropower infrastructure. |
| **ES** | Grid access and connection Issues. For almost all plants. | | | Grid access and connection Issues. For almost all plants. | | In the case of hydropower, the challenge is the lack of natural resource. In |

| | PV | onshore | offshore | biomass | biogas | hydro |
|---|---|---|---|---|---|---|
| | | | | | | general, the main challenges are grid access and connection issues |
| **FI** | For large scale PV, building permit delays are a major issue. | Building permit related delays. | Not competitive vis-a-vis onshore wind. | None. | Lack of economic viability, specifically the outlook for price of biomethane is that it will be expensive. | There is limited untapped potential for new hydropower in Finland. |
| **HR** | Energy permit regulation | | | Energy permit regulation | | |
| **HU** | Rentability, financing | | | No information available. | | |
| **IE** | Receiving planning permission and grid connection are the main challenges. | Answer as for PV | Not applicable | Unknown | | |
| **IT** | The most important challenge has regarded permits and balancing responsibility. | | | The most important challenge has regarded permits | | |
| **LT** | We don't have the information | | | We don't have the information | | |
| **LU** | In LU, the ministry of energy is on charge of organising tenders targeting SMEs to big companies as well as farmers, but the NRA is not | In LU, the ministry of energy is in charge of organising tenders but the NRA is not aware of any of the burdens mentioned. | | Not aware of any particular burden. | No data/info on the subject. | No data/info regarding this issue. |

| | PV | onshore | offshore | biomass | biogas | hydro |
|---|---|---|---|---|---|---|
| | aware of any of the burdens mentioned. | | | | | |
| **MK** | For the PVPP which use FiT, the electricity market operator takes the balance responsibility for these producers. Main challenges that PPVP currently face is gaining the building permit and the connection to the distribution or transmission grid. | Building permits and connection to the grid. | | Building permits and connection to the grid. | | |
| **NL** | The major issue for new projects is network congestion, inflation, increased interest. | The major issues for new projects are network congestion, building permits, increased interest. | Increasing hours of low or even negative electricity prices. | Building permits (emissions e.g. NOx), sustainability issues biomass. | Major challenge is rentability, sustainability of biomass. | There is lack of potential (height decay) in the Netherlands! |
| **PL** | Currently, the biggest issue is the limitations in the capacity of the power grid in relation to the existing and planned renewable energy generation capacities. For these technical reasons, an increasing number of producers who plan to generate electricity in renewable energy installations are refused connection. | | n/a | Currently, the biggest issue is the limitations in the capacity of the power grid in relation to the existing and planned renewable energy generation capacities. For these technical reasons, an increasing number of producers who plan to generate electricity in renewable energy installations are refused connection. | | |

| | PV | onshore | offshore | biomass | biogas | hydro |
|---|---|---|---|---|---|---|
| **PT** | No available information. | | | | | |
| **RO** | According to DSOs' data, there are some challenges in integrating the new capacities from producers and prosumers. | | | | | |
| **UK** | Planning processes, network/system constraints, market conditions and availability of private finance. | | | | | |

*Table 8: Challenges for not supported RES installations (only countries displayed which provided information)*

# 6 Main findings and conclusions

As of 2020, the support time for an increasing number of RES installations has ended throughout Europe. In countries with shorter support times, the EOS has already been reached. Nevertheless, no major changes were made or are expected to the electricity market models for those installations.

Based on the responses provided by CEER NRAs, the following limited messages can be brought forward:

- For the time being, only a small share of RES installations is not being supported.
- An increasing amount of capacity will be confronted with EOS in the coming years and by 2030, around 33 % of currently installed capacity will reach EOS.
- The legal framework governing RES installations has not been adapted so far: either because the framework does not distinguish between supported and unsupported RES or because support is still ongoing, and adaptation will only be needed at a future stage.
- The handling of balancing responsibility will become a reality and could constitute a major challenge for existing RES plants.
- Besides other advantages, the transition to market-based support systems gives an advantage to installations built under the market-based support system because they already have the possibility to gain market experience which should make production without support schemes easier.
- PPAs were the second most mentioned business model for RES installations after their EOS, preceded by “selling to the market via retailer” and followed by “self-consumption”.

We have observed that the strategies pursued by unsupported RES installations are manifold. The most likely approach is – in the case of larger RES installations – to rely on the market as a source of income. Smaller RES installations, mainly PV, will most likely focus on self-consumption. However, the decommissioning of installations also seems to be a serious option for operators. The upcoming years will be marked by a rise in capacity reaching EOS and will illustrate if and how MC adapt their legal schemes to render decommissioning less attractive.

## Annex 1 – List of Abbreviations

| Term | Definition |
|---|---|
| DSO | Distribution System Operator |
| EEAG | Environmental and Energy State Aid Guidelines |
| EOS | End of Support |
| FiP | Feed-in-premium |
| FiT | Feed-in-tariff |
| GW | Gigawatt |
| kWh | Kilowatt hour |
| LCOE | Levelized Costs of Energy |
| MC | Member Country |
| MW | Megawatt |
| NRA | National Regulatory Agency |
| PPA | Power Purchase Agreement |
| RES | Renewable Energy Source |
| TSO | Transmission System Operator |

## Annex 2 – About CEER

The Council of European Energy Regulators (CEER) is the voice of Europe's national energy regulators. CEER's members and observers comprise 39 national energy regulatory authorities (NRAs) from across Europe.

CEER is legally established as a not-for-profit association under Belgian law, with a small Secretariat based in Brussels to assist the organisation.

CEER supports its NRA members/observers in their responsibilities, sharing experience and developing regulatory capacity and best practices. It does so by facilitating expert working group meetings, hosting workshops and events, supporting the development and publication of regulatory papers, and through an in-house Training Academy. Through CEER, European NRAs cooperate and develop common position papers, advice and forward-thinking recommendations to improve the electricity and gas markets for the benefit of consumers and businesses.

In terms of policy, CEER actively promotes an investment friendly, harmonised regulatory environment and the consistent application of existing EU legislation. A key objective of CEER is to facilitate the creation of a single, competitive, efficient and sustainable Internal Energy Market in Europe that works in the consumer interest.

Specifically, CEER deals with a range of energy regulatory issues including wholesale and retail markets; consumer issues; distribution networks; smart grids; flexibility; sustainability; and international cooperation.

CEER wishes to thank in particular the following regulatory experts for their work in preparing this report: Michael Sorger, Nikolas Schmitz, Frank Weiss.

More information is available at www.ceer.eu.