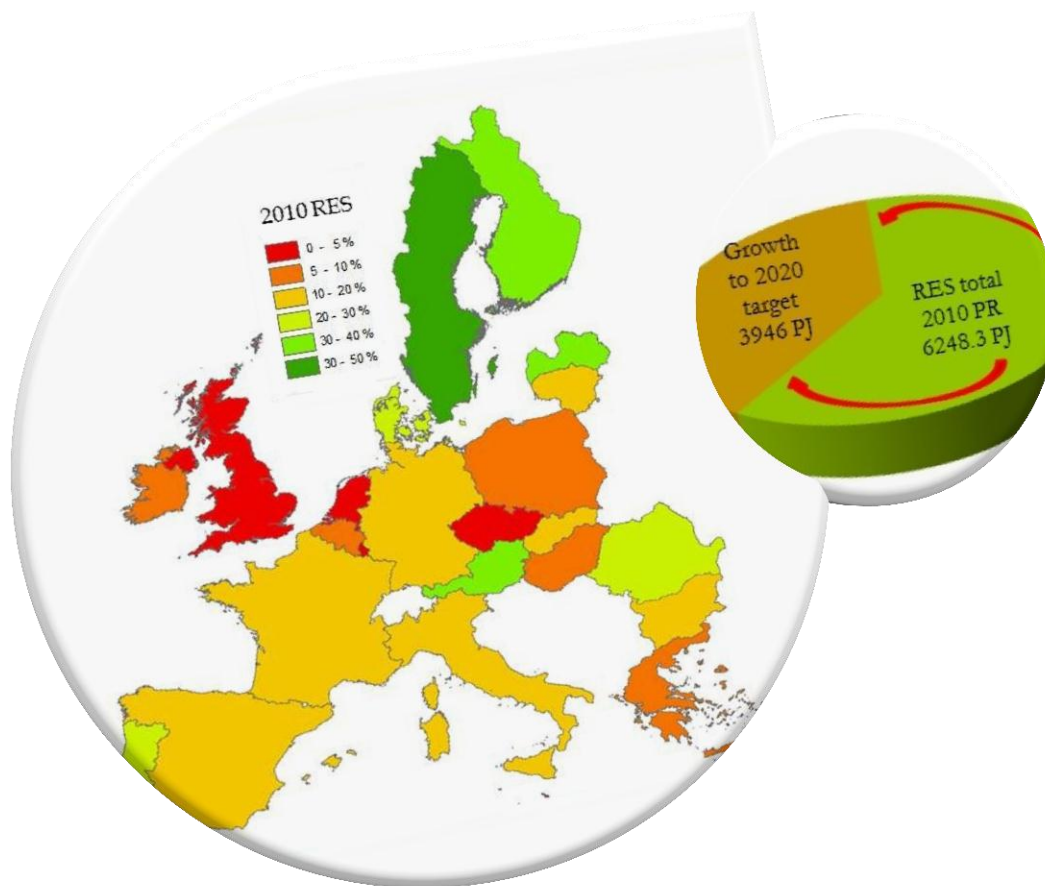




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## RENEWABLE ENERGY PROGRESS IN EU 27 2005-2020



Manjola Banja, Nicolae Scarlat,  
Fabio Monforti-Ferrario, Jean-François Dallemand

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(2005-2020)

**Manjola Banja, Nicolae Scarlat**  
**Fabio Monforti-Ferrario, Jean-François Dallemand**

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## Preface

The vision set by the Renewable Energy Directive 2009/28/EC – a directive setting wide targets for all EU-27 Member States to increase their share of renewable energy in the national energy mix – continues to stand out as the primary example of a coordinated effort to lead a large-scale energy transformation.

In the time of writing of this report all Member States (MS) of EU-27, except Czech Republic<sup>1</sup>, had delivered, according to Article 22 of the Directive 2009/28/EC, a Progress Report to the European Commission on the progress in the promotion and use of energy from renewable sources covering years 2009 and 2010 and describing the overall renewable energy technology, policy developments and their compliance with the measures set out in the Directive and in their National Renewable Energy Action Plans.

The next Progress Report, which will cover the development of renewable energy in European Union during period 2011-2012, is expected to be submitted by MS to the European Commission by end December 2013.

This report combines the analysis of EU 27 MS National Renewable Energy Action Plans and Progress Reports to identify the trend up to 2020 of the renewable energy development in three main sectors: Electricity, Heating/Cooling and Transport.

This report also complements the JRC report EU 26338 EN that is mainly focused on the developments of renewable energy in each Member State in three main sectors since 2005 according to their first Progress Reports as well as the progress expected to be made until 2020, as projected in the NREAPs.

The planned development of these sectors and each renewable technology for period 2005-2010 in EU 27 is compared with the actual development achieved in the same period and the expected trend to reach 2020 target is compared with the planned one.

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<sup>1</sup> CZ has indeed submitted a limited subset of the data requested in the template including the overall share of RE in the gross energy consumption.

## Executive Summary

The Renewable Energy Directive (RED) adopted in 2009 sets binding targets for renewable energy. It focuses on achieving a 20% share of renewable energy in the EU overall gross energy consumption by 2020. The target is not equally split among the Member States (MS), but each of them has to reach an individual targets for the overall share of renewable energy in energy consumption. In addition, in the transport sector, all Member States have to reach the same target of a 10% share of renewable energy.

These targets can be reached by increasing the share of energy coming from different renewable sources and technologies, including wind power (both onshore and offshore), solar power (thermal, photovoltaic and concentrated), hydro-electric power, heat pumps, tidal power, geothermal energy and biomass (including biofuels and bioliquids).

This report is especially focused on to identifying the trends up to 2020 of the renewable energy development in three main sectors: Electricity, Heating/Cooling and Transport and in comparing them with the actual penetration of RE according to the latest Progress Reports (PR) from Member States covering 2009-2010 developments.

The main finding of this report can be summarized as:

- Gross Final Energy Consumption in EU 27 decreased less than planned in 2010 and the absolute gap to reach the 2020 target is now almost 3 times higher than planned in MS NREAPs. In 2010 the Gross Final energy Consumption in EU 27 reached 50175.5 PJ exceeding the NREAPs planned value by 1.1% (+566.3 PJ). EU 27 needs **to slow down the consumption** of its Gross Final Energy to reach the 2020 targets. Nevertheless, there are national differences: 10 MS consumed in 2010 less energy than in baseline year while 9 MS need to consume less energy to reach their 2020 targets;
- Despite a decrease in Gross Final Energy Consumption took place in Heating /Cooling sector, EU 27 consumed in 2005-2010 more energy than planned in this sector reaching in 2010 the amount of 23699 PJ which was 3.9% (+893 PJ) above the NREAPs planned value. The absolute difference between the planned 2020 and the achieved 2010 Gross Final Energy Consumption in this sector is now 2 times larger than planned one showing that EU 27 needs to slow down the consumption of energy in this sector at a faster rate in order to be in line with the projected value. More than half of MS reduced their energy consumption during 2005-2010 and half of MS will need to reduce their energy consumption during 2010-2020;
- EU 27 met in 2010 the NREAPs expectations in Gross Final Energy Consumption in electricity sector (11867 PJ) keeping unchanged the absolute gap to be filled till 2020 from 2010 level compared with the planned one. Actually one-third of MS reduced their energy consumption in electricity sector during period 2005-2010. Only 5 MS will need to reduce this consumption during 2010-2020;
- The Gross Final Energy Consumption in transport sector in 2010 amounted to 12685 PJ which was 3.3 % (-438.5 PJ) lower than the planned target, decreasing by 0.5% (-358 PJ) from 2005 level. For period 2010-2020 energy consumption in this sector is planned to be increased with 0.3 % (+410 PJ). 13 MS decreased their energy consumption in this sector during 2005-2010 and 5 MS will need to decrease it during 2010-2020;
- Total RES share is planned to be increased from 8.1% in baseline year 2005 to 20.6% in target year 2020. **In 2010 the total RES share was equal to 12.6%, i.e.1.1% points higher than the planned share for that year (11.5%)**. Actually only in Malta the RES share during period 2005-2010 has decreased. UK had a very low RES share increase

during period 2005-2010 and it is the MS that will need to increase significantly its RES share in order to be in good track to its 2020 target;

- EU 27 is expected to triplicate the renewable installed capacity in electricity sector during period 2005-2020, from 167.7 GW to 473.2 GW. EU 27 reached in 2005-2010 a renewable installed capacity smaller than what had planned. In period 2010-2020 EU 27 should double (+232.0 GW or +9.6% per annum in average) its total RES installed capacity in order to be in good track for the achievement of the 2020 target.;
- EU 27 average annual growth rate for RES absolute contribution in GFEC during 2005-2010 period was 10.2% and the absolute RES contribution reached the amount of 6248.3 PJ (149.2 Mtoe) in 2010. All MS increased their RES generation during 2005-2010 period. Annual growth rate of total RES for period 2009-2010 in EU 27 amounted to 11% indicating that **if EU 27 will maintain the same set of policy measures applied during the 2009-2010 period it is likely to be able to reach the target of introducing a 20% RES quota in the gross final energy consumption even before 2020;**
- The share of renewable energy generated in heating/cooling sector in gross final energy consumption is projected to be increased from 9.3% in the baseline year up to 21.3% in 2020. In year 2010 the share of renewable energy in this sector reached 14.4% of the gross final energy consumption in EU 27 instead of 12.5% that was planned. RES H/C share for 2010 was already exceeded in 2009 in EU 27. All MS have increased their RES share in this sector in 2010;
- RES contribution in heating/cooling sector in 2010 amounted to 3379.8 PJ representing more than half of total RES generated in EU 27. During period 2005-2010 the additional RES-H/C contribution was the doubled of what was originally planned. For this reason even one half of the average growth rate in RES contribution shown in 2005-2010 would be enough for EU-27 in order to be in good track with the 2020 sectorial target;
- RES share in electricity sector will be increased during period 2005-2020 from 14.7% to 33.8%. Nevertheless, RES share in this sector in 2010 was 19.7% missing the planned share reported in NREAPs by just 0.1% points. All MS, except Latvia, increased their RES share in electricity sector during period 2005-2010. All MS will increase their RES share in this sector during period 2010-2020;
- RES consumption share in transport sector during period 2005-2020 in EU 27 is planned to increase by a factor of more than 5, from 2% in baseline year to 11.1 % in target year. According to NREAPs the RES consumption share in transport sector in period 2005-2010 increased with only 2.8 percentage points missing the planned share by 0.2 percentage points;
- RES in transport taking into account multiple counting amounted to 173.3 PJ (4.1 Mtoe) in 2005 reaching 628.8 PJ in 2010 missing by 3.1% (-20.3 PJ) the NREAPs planned value. The share of RES in gross final energy consumption in 2010 in this sector reached the level of 4.96% compared with 4.95% planned at NREAPs.
- Hydropower installed capacity in EU 27 in 2005 was 108.3 GW, in 2010 reached ~101 GW missing by 9% (~10 GW) the planned capacity and it is projected to increase up to 124.7 GW in 2020. A total of 9 MS reported in 2010 a smaller hydropower capacity than what they have reported in 2005;
- Renewable electricity generated from hydropower technology decreased in 2010 to 1201.4 PJ from 1206 PJ that was in 2005. It missed the 2010 planned renewable electricity production from this technology by 1.8% (-21.9 PJ). Nevertheless, in the 2010-2020 period renewable electricity expected to be produced by hydropower technology needs to be increased annually by only 1% in order to reach the target of 1306.8 PJ representing 30.2% of total renewable electricity in EU 27 in 2020. Moreover, 4 MS,



Bulgaria, Germany, Ireland and Sweden, have already reached in 2010 their 2020 electricity generation targets in this technology;

- Geothermal power installed capacity was estimated at 741.2 MW in 2005 and it is projected to increase to 1612.9 MW in 2020. In 2010 geothermal installed capacity increased to 823 MW compared to the planned capacity of 816 MW with an average annual growth rate of 2.2%. The additional geothermal installed capacity in 2010-2020 is expected amount to 790 MW in the EU27, almost doubling the 2010 existing geothermal capacity;
- Geothermal electricity and heat production increased in 2010 to 42.2 PJ from 38.2 PJ in 2005. This is 16.1% (8.1 PJ) below the 2010 renewable electricity and heat planned to be produced from this technology. The additional production of geothermal energy in 2010-2020 is expected to amount to 107.1 PJ, which is about 254% of the 2010 use of geothermal energy;
- Marine energy was used in 2010 only in two Member States to produce electricity – France and United Kingdom. The marine power installed capacity in 2005 was estimated at 240 MW and it is projected to increase to 2253 MW in 2020. In 2010 marine installed capacity reached 242.6 MW missing by 1% (-2.4 MW) the NREAPs planned value. The additional marine installed capacity in 2010-2020 is expected to be 2010 MW, which represent a significant increase of the existing plant capacity (almost 10 times higher);
- During period 2005-2010 the electricity generated from marine technology decreased with an average rate of 2.1% reaching in 2010 the amount of 1.72 PJ (478 GWh) missing by 4.6% (-0.1 PJ) the NREAPs planned value of 1.8 PJ. According to NREAPs the electricity generation in 2020 from marine technology in EU 27 should increase significantly with an average growth rate equal to 126.2% in order to be in good track for the fulfillment of 2020 target of 23.4 PJ (6.5 TWh);
- Solar installed capacity in electricity sector in the EU 27 was estimated at 2221 MW in 2005 and it is projected to increase to 90447 MW in 2020 with an additional capacity from 2010 equal to 60720 MW, which represent more than doubling of the existing plant capacity in EU 27. In 2010 the solar installed capacity reached 29727 MW exceeding by 14.4% (+3738 MW) the NREAPs planned value;
- Solar energy (solar thermal and solar electricity) increased significantly in the EU27, reaching 146.2 PJ with an additional use from 2005 equal to 112.1 PJ or an average growth rate per year of 65.6%. In 2010 the solar energy exceeded by 7.2% (+9.8 PJ) the NREAPs planned value. The additional use of solar energy in 2010-2020 is expected to be 483.9 PJ, which is about 330% of the 2010 use of solar energy;
- The electricity generation from solar energy has increased since 2005 from 1470 GWh (5.2 PJ) to 23202 GWh (83.5 PJ) in 2010. The additional solar electricity generation from in 2010-2020 is expected to be 77861 GWh (280.3 PJ), which is more than three times the 2010 solar electricity production. In 2010 the electricity generated from this technology exceeded by 11.9% (+2461 GWh or +8.9 PJ) the NREAPs planned value;
- The heat generation from solar energy has increased significantly since 2005 from 28.9 PJ (690 ktoe) to 62.7 PJ (1497 ktoe) in 2010 exceeding by 1.6% (+1 PJ) the NREAPs planned value. The additional solar heat generation in 2010-2020 should be 203.5 PJ (4861 ktoe), which is more than four times more compared to the 2010 solar heat production;
- Wind power installed capacity was estimated at 40441 MW in 2005 and it is projected to increase to 210593 MW in 2020, the highest installed capacity of all RES. In 2010 the wind installed capacity reached 84317 MW which was 1.4% (-1155 MW) below the NREAPs planned value. The additional wind installed capacity in 2010-2020 is expected to be 126275 MW (+15%) in the EU27, which represent 1.5 times more the existing plant capacity;

- Wind power generation increased significantly in the EU27 from 2005, reaching 155.1 TWh (558.3 PJ) in 2010 missing by 6.5% (-1.16 TWh or -38.6 PJ) the NREAPs planned value. The additional wind power generation from in 2010-2020 is expected to be 333.0 TWh (1199 PJ), which is more than two times more than the 2010 wind electricity production;
- The heat generation from heat pumps increased since 2005 from 25.0 PJ to 182.6 PJ in 2010 which is 8.7 % (+14.7 PJ) above the NREAPs planned value. The additional heat generation from heat pumps in 2010-2020 is expected to be 327.8 PJ, with an average growth rate of 17.9% compared to the 2010 heat generation from heat pumps;
- Bioenergy (biomass use for electricity and heating/cooling and biofuels) increased significantly in the EU27, reaching 4115.4 PJ in 2010 with an additional bioenergy generation from 2005 equal to 1529.5 PJ exceeding by 14.9% (+534.5 PJ) the NREAPs planned value. The contribution of bioenergy in total RES in 2010 was 65.9%. For period 2010-2020 the development of bioenergy will lead to an additional bioenergy generation equal to 1703 PJ, which is about 41.4% of the 2010 bioenergy production. The contribution of bioenergy in total RES is expected to slightly decrease to 57.0% until 2020;
- Biomass electricity installed capacity was estimated at 15739 MW in 2005 and it is projected to increase to 43592 MW in 2020. In 2010 the biomass installed capacity reached 25088 MW being 10.6% (+2408 MW) above the NREAPs planned value. The additional biomass installed capacity in 2010-2020 is expected to be 18504 MW in the EU27, with an average growth rate of 7.4% compared to the existing plant capacity;
- Biomass electricity generation increased significantly in the EU27, reaching 123.6 TWh (444.9 PJ) in 2010 exceeding by 8.2% (+33.5 PJ) the NREAPs planned value. The additional biomass electricity generation from in 2010-2020 is expected to be 108.3 TWh (392 PJ), which is almost 88% of the 2010 biomass electricity production. In 2010 the contribution of biomass electricity in total renewable electricity was 19.3%;
- Biomass was a major contributor to the heat production in the EU27 in 2010, with 3112.5 PJ (74341 ktoe), representing 92.1% of the total renewable heat generation and 13% of heat demand in EU 27. In 2010 the biomass heat production was 20% (+518.9 PJ) above the NREAPs planned value. The additional heat generation from biomass in 2010-2020 is expected to be 656.2 PJ (15673 ktoe), with an average growth rate of 2.1% compared to the 2010 biomass heat production;
- Solid biomass electricity installed capacity was estimated at 10566 MW in 2005 and it is projected to increase to 27769 MW in 2020. In 2010 solid biomass installed capacity reached the amount of 19158 MW with an average growth rate of 16.3% and being 32.8% (+4737 PJ) above the NREAPs planned value. The additional solid biomass installed capacity in 2010-2020 is expected to be 8611 MW in the EU27, needing an average growth rate equal to 4.5% compared to the existing plant capacity;
- Solid biomass electricity generation increased significantly in EU27, reaching 92773 GWh (334 PJ), representing 14.5% of the total renewable electricity generation in 2010 and exceeding by 20.9% (+16069 GWh or 57.8 PJ) the NREAPs planned value. The additional biomass electricity generation from in 2010-2020 is expected to be 62981 GWh (226.7 PJ), with an average growth rate of 6.8% compared to the 2010 biomass electricity production;
- Biogas power installed capacity was estimated at 2665 MW in 2005 and increased to 4558 MW in 2010 missing by 16.1% (-872 MW) the NREAPs planned value. The biogas installed capacity is projected to further increase to 11192 MW in 2020. The additional biogas electricity installed capacity in 2010-2020 is expected to be 6634 MW in the EU27, with an average growth rate of 14.6% compared to the existing plant capacity;

- The biogas electricity generation has increased since 2005 from 12482 GWh (44.9 PJ) with an additional electricity generation in 2010 of 11971 GWh (43.1 PJ) and an average growth rate equal to 19.2%. In 2010 the electricity generated from biogas missed the NREAPs planned value by 14.8% (-4232 GWh or 15.2 PJ). For 2020 the electricity generation from biogas is projected to reach 63656 GWh (229 PJ) having an additional electricity generation of 39203 GWh (141.1 PJ) and an average growth rate equal to 16%;
- The bioliquids power installed capacity was estimated at 368 MW in 2005 and increased to 1382 MW in 2010 exceeding by 33.1% (+344 MW) the NREAPs planned value. The bioliquids installed capacity it is projected to further increase to 1711 MW in 2020;
- The bioliquids electricity generation has increased since 2005 from 1470 GWh (5.3 PJ) with an additional electricity generation of 4881 GWh (17.6 PJ) and an average annual growth rate equal to 66.4%. The electricity generated from bioliquids in 2010 missed by 26.4% (-2282 GWh or -8.2 PJ) the NREAPs planned value. For 2020 the electricity generation from bioliquids is projected to reach 12747 GWh (45.9 PJ) having an additional electricity generation of 6396 GWh (23.0 PJ) and an average growth rate equal to 10.1%;
- The use of biomass in households increased since 2005 from 1181.4 PJ (28218 ktoe) to 1604 PJ (38311 ktoe) in 2010 being 26.7% (+338.2 PJ or 8078 ktoe) above the NREAPs planned value and 7.7% above the projected contribution of biomass in households in 2020 (1479.7 PJ or 35341.7 ktoe);
- Biofuel use in transport has increased to 558 PJ (13327 ktoe) in 2010, from 125.4 PJ (2994 ktoe) in 2005. In 2010 biofuel use in transport sector missed by 3.1% (-18 PJ) the NREAPs planned value of 575.7 PJ. Considering that biofuels will contribute by 1210.6 PJ (28915 ktoe) to the energy use in transport, the additional biofuels use in 2010-2020 is expected to provide 652.7 PJ (15588 ktoe) in the EU27 with an average growth rate of 11.7%;
- Bioethanol use in transport has reached 114.5 PJ (2735 ktoe) in 2010, from 22.5 PJ (537.8 ktoe) in 2005, representing 20.6% of the biofuels used, as compared with 17.9% in 2005. In 2010 bioethanol use in transport sector missed by 4.9% (-5.9 PJ) the NREAPs planned value. Bioethanol use in transport is expected to increase to 305.9 PJ (7307 ktoe) and to a share of 25.3% in biofuels used in transport in 2020. The additional bioethanol use in 2010-2020 is expected to amount to 191.4 PJ (4573 ktoe) in the EU27, with an average growth rate equal to 16.7%;
- Biodiesel use in transport has increased to 433.5 PJ (10354 ktoe) in 2010, from 94.5 PJ (2258 ktoe) in 2005. In 2010 biodiesel use in transport sector missed by 2.8% (-12.4 PJ) the NREAPs planned value of 445.9 PJ. Biodiesel is the main biofuel used in transport, with a contribution of 78.0% of the biofuels used in 2010, as compared with 75.3% in 2005. Biodiesel use is expected to increase to 873.4 PJ (20862 ktoe) and to a lower share of 72.2% in biofuels used in transport in 2020;
- The use of other biofuels (biogas, vegetable oils, etc.) in transport is rather marginal in the EU27. Their use has decreased to 7.8 PJ (187 ktoe) in 2010, from 8.3 PJ (199 ktoe) in 2005 missing the NREAPs planned value by 11.5% (-1 PJ). The use of other biofuels is expected to increase to 31.1 PJ (742 ktoe) and to reach a share of 2.6% in biofuels used in transport in 2020;
- The use of art 21.2 biofuels increased to 23.8 PJ (567.5 ktoe) in 2010, from 1.4 PJ (34.5 ktoe) in 2005 exceeding by 35.3% (+6.2 PJ) the NREAPs planned value. Their use is expected to increase to 107.2 PJ (2559.8 ktoe) in 2020. Their share in the biofuels used in transport (single counting) increased from 1.2% in 2005 to 5.0% in 2010 and this is expected to increase to 8.9% in 2020;

- The use of biofuels from import in the transport sector has increased to 185.5 PJ (4430 ktoe) in 2010, from 7.1 PJ (171 ktoe) in 2005. In 2010 biofuels from import used in transport sector were 0.6% (-1.1 PJ) below the NREAPs planned value. Their use is expected to increase to 459.0 PJ (10962 ktoe) in 2020. Their share in the biofuels used in transport increased from 5.7% in 2005 to 33.2% in 2010 and this is expected to further increase to 37.9% in 2020.

The summary of Gross Final Energy Consumption, Renewable Energy Sources and Renewable Energy Technologies progress in three main sectors (heating/cooling, electricity and transport) in EU 27 for period 2005-2010 and 2010-2020 are presented in the Annex of this report.

## Abbreviations

ETBE – Ethyl Tertiary Butyl Ether  
GFEC – Gross Final Energy Consumption  
GW – Gigawatt  
GWh – Gigawatt-hour(s)  
H/C – Heating /Cooling sector  
ktoe – kilo-ton oil equivalent  
Mtoe – Mega-ton oil equivalent  
MS – Member States  
NREAPs – National Renewable Energy Action Plans  
PR – Renewable Energy Progress Reports  
PV – Solar photovoltaic  
PJ – Petajoule  
RES – Renewable Energy Sources  
RES-H/C- Renewable Energy Sources in Heating/Cooling sector  
RES-E – Renewable Energy Sources in Electricity sector  
RES-T – Renewable Energy Sources in Transport sector  
TWh- Terrawatt-hour(s)

## Units

General conversion factors for energy

1 Mtoe = 41.868 PJ = 11.63 TWh

1 ktoe = 41.868 TJ = 11.63 GWh

1 PJ = 0.278 TWh = 0.024 Mtoe

1 TWh = 3.6 PJ = 0.086 Mtoe

1 TJ = 277.8 MWh

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## Renewable Energy in EU 27 (2005-2020)

### Introduction

This report gives a comprehensive assessment of renewable energy progress in EU 27 from baseline year up to 2020. The assessment methodology is based on data reported in Table 1 (Additional Energy Efficiency Scenario), 3, 10, 11 and 12 of National Renewable Energy Action Plans and Tables 1, 1b, 1c and 1d of Renewable Energy Progress Reports whenever available. The assessment shows how each sector and renewable technology has evolved so far and how it is expected to evolve in order to achieve the 2020 planned values. The assessment is based on the comparison of planned, achieved and average growth rates in different sectors and for different technologies for periods 2005-2010, 2009-2010<sup>2</sup> and 2010-2020.

More in detail, the following indicators are reported for each quantity X:

2005-2010 planned annual growth of X =  $((X_{\text{NREAP2010}} - X_{\text{NREAP2005}})/X_{\text{NREAP2005}})/5$

2005-2010 reported annual growth of X =  $((X_{\text{PR2010}} - X_{\text{NREAP2005}})/X_{\text{NREAP2005}})/5$

2009-2010 reported growth of X =  $(X_{\text{PR2010}} - X_{\text{PR2009}})/X_{\text{PR2009}}$

2010-2020 planned annual growth of X =  $((X_{\text{NREAP2020}} - X_{\text{NREAP2010}})/X_{\text{NREAP2010}})/10$

2010-2020 target annual growth of X =  $((X_{\text{NREAP2020}} - X_{\text{PR2010}})/X_{\text{PR2010}})/10$

where  $X_{\text{NREAP}}$  are the data reported in NREAP for the relevant years and  $X_{\text{PR}}$  are the data reported in progress reports for the relevant years.

Of course, for each variable a 2010 value larger than planned implies a 2005-2010 reported growth larger than the 2005-2010 planned growth and, as a consequence, a 2010-2020 target growth smaller than its planned value. Vice-versa, a 2010 value smaller than planned implies a 2005-2010 achieved smaller than planned and conversely a target 2010-2020 growth larger than planned.

The 2009-2010 growth, being the most recent available data, can be read as the present tendency growth. In particular, the comparison between the tendency growth and the target growth value is an indication for the country being “in track” with the growth needed to reach the 2020 planned values.

Due to the fact that CZ has not submitted data in its Progress Report according to the required Template, the analysis of renewable energy progress in EU 27 for year 2010<sup>3</sup> will include the same contribution that this MS has reported in its latest NREAP update.

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<sup>2</sup> Data on annual growth rate 2009-2010 do not normally include the contribution of CZ

<sup>3</sup> The 2010 overall values of GFEC, RES and technologies in this report are comparable with the overall values for this year reported in Chapter 2 of EUR 26166 EN report "Renewable Energy Development in EU 27 (2009-2010).



## 1. Gross Final Energy Consumption

EU 27 has planned to reduce its gross final energy consumption in 2020 compared with 2005 (51175 PJ) and 2010 (50176 PJ) reaching 49308.6 PJ (1177.7 Mtoe). The average growth rate for period 2005-2010 showed that in EU 27 the annual gross final energy consumption decreased less than it was planned (-0.4% instead of -0.6%) and the absolute gap needed to reach the 2020 target will be almost 3 times larger than planned. Moreover, the annual growth rate 2009-2010 was 4.6%, i.e., positive and much larger in absolute value than the negative target growth rate needed to reach the 2020 the planned GFEC value. This indicates that EU 27 needs to reverse the 2009-2010 trend and to slow down the consumption of its gross final energy in order to be in line with the projections until 2020.

Figure 1 and Table 1 present the gross final energy consumption development in EU 27 during period 2005-2020.

For period 2005-2010 only Germany and Ireland have shown the same average growth rate in gross final energy consumption compared to the planned value. For period 2010-2020 Germany, Ireland and Spain will need to respect the average growth rate in gross final energy consumption that was planned to remain in track for 2020 target.

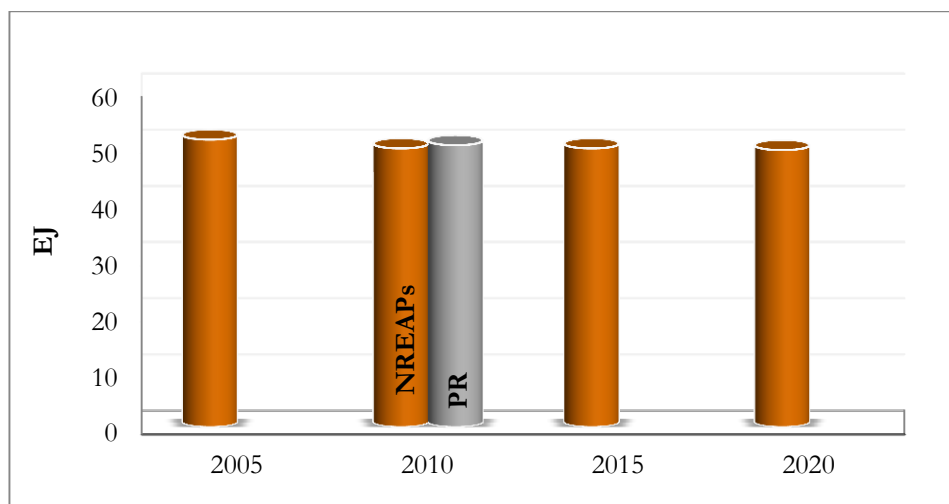


Figure 1. EU 27 GFEC progress, 2005-2020

16 MS, Denmark, Germany, Spain, France, Italy, Latvia, Luxemburg, Hungary, Netherlands, Austria, Poland, Portugal, Romania, Slovenia, Finland and United Kingdom planned to reduce their gross final energy consumption in 2010 compared with 2005. Half of this group, Germany, Spain, France, Italy, Luxemburg, Hungary, Austria, Romania and United Kingdom, followed their plans for 2010 reducing their gross final energy consumption. Nevertheless Spain, France, Luxemburg, Austria and United Kingdom didn't reduce at the planned scale their gross final energy consumption in this year while Italy, Hungary and Romania reduced their GFEC even more than planned.

On the contrary, Greece was the only MS planning an increase in energy consumption in the 2005-2010 time span, that reported an actual annual average decrease of GFEC (-1.4%), with a marked reduction of -5.6% in 2009-2010 only.

According to NREAPs only Germany, France and United Kingdom had planned to reduce their gross final energy consumption in period 2010-2020. Progress Reports for year 2010 showed

that actually gross final energy consumption for this period will be reduced in 9 MS, Bulgaria, Denmark, Germany, France, Cyprus, Netherlands, Portugal, Slovenia and United Kingdom.

Moreover, 21 MS on 27 (Belgium, Bulgaria, Denmark, Germany, Estonia, Spain, France, Italy, Latvia, Lithuania, Luxemburg, Hungary, Netherlands, Austria, Poland, Portugal, Slovenia, Slovakia, Finland, Sweden and United Kingdom) showed a GFEC growth rate for period 2009-2010 higher (and sometimes much higher) than the target annual growth rate for period 2020-2010 indicating a clear tendency for consumption to grow much more than it would be needed to reach the 2020 planned value.

Table 1. EU 27 GFEC progress, absolute and relative deviations, 2005-2020

	2005	2010	Growth		Growth		2020
	NREAPs	PR	2005-2010		2010-2020		NREAPs
	PJ	PJ	PJ	av.%	PJ	av.%	PJ
BE	1599.7	1636	36.7	0.5	41.2	0.3	1677.7
BG	431.8	463	31.1	1.4	-13.3	-0.3	449.6
CZ	1242.0	1232.2	-9.8	-0.2	15.6	0.1	1247.8
DK	689.8	712	21.9	0.6	-27.3	-0.4	684.4
DE	9591.6	9372	-219.5	-0.5	-1116.7	-1.2	8255.4
EE	129.7	134	4.5	0.7	10.2	0.8	144.5
IE	487.3	507	20.0	0.8	84.7	1.7	592.1
EL	906.4	845	-61.8	-1.4	165.0	2.0	1009.6
ES	4258.8	4050	-208.8	-1.0	82.1	0.2	4132.1
FR	6978.9	6961	-17.9	-0.1	-460.2	-0.7	6500.8
IT	5912.9	5337	-575.7	-1.9	233.1	0.4	5570.2
CY	56.5	83	26.0	9.2	-11.4	-1.4	71.1
LV	177.6	188	10.6	1.2	12.7	0.7	200.8
LT	205.4	212	6.2	0.6	43.1	2.0	254.7
LU	186.6	175	-11.5	-1.2	9.0	0.5	184.0
HU	833.6	717	-116.3	-2.8	105.2	1.5	822.5
MT	0.0	17	17.3		5.0	2.9	22.4
NL	2249.1	2364	114.9	1.0	-248.3	-1.1	2115.7
AT	1167.1	1133	-33.8	-0.6	22.0	0.2	1155.3
PL	2595.8	2837	240.9	1.9	60.6	0.2	2897.3
PT	819.9	840	20.5	0.5	-25.3	-0.3	815.0
RO	1152.2	1035	-116.7	-2.0	232.2	2.2	1267.7
SI	213.1	230	16.8	1.6	-7.0	-0.3	222.9
SK	427.0	448	21.4	1.0	21.6	0.5	470.0
FI	1099.5	1112	12.6	0.2	67.4	0.6	1179.4
SE	1445.2	1538	92.6	1.3	104.7	0.7	1642.5
UK	6317.9	5996	-322.0	-1.0	-272.5	-0.5	5723.4
EU 27	51175.3	50175.5	-999.8	-0.4	-866.9	-0.2	49308.6

## 1.1 GFEC Heating/Cooling

The energy consumed in Heating/Cooling sector in EU 27 was planned to be reduced during period 2005-2010 with an average growth rate of -1.5%. Even though a decrease actually took place, during the same period EU 27 consumed in this sector more energy than planned showing an average growth rate of -0.8%. In 2010 the Gross Final Energy Consumption in this sector reached 23699 PJ which was 3.9% (+893 PJ) above the NREAPs planned value. The absolute

difference between the planned 2020 and the achieved 2010 gross final energy in this sector is now 2 times larger than planned one showing that EU 27 needs to slow down the consumption of energy in this sector at a faster rate in order to be in line with the projected value.

The share in gross final energy consumption has changed from 48.2% that was in 2005 to 47.3% in 2010. In 2020 this share is projected to decrease further up to 44.2%.

Figure 2 and Table 2 report the progress of gross final energy consumption development in heating/cooling sector in EU 27 for period 2005-2020.

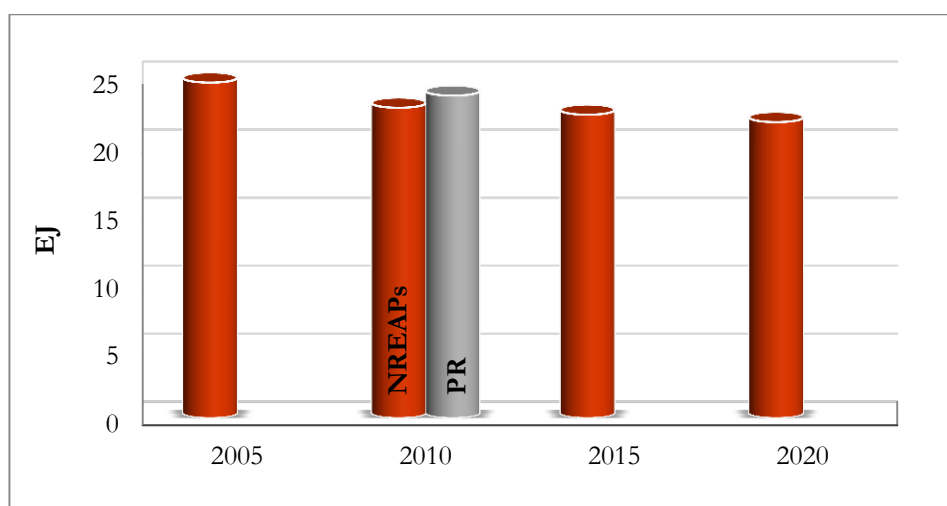


Figure 2. EU 27 GFEC in Heating/Cooling progress 2005-2020

Belgium is the only MS that has planned to keep at the same level its gross final energy consumption during period 2005-2020 in this sector. Actually in 2010 its gross final energy consumption increased by an average growth rate of 1% (45.5 PJ) compared to the 2005 level. In order to be in good track with its NREAP plan Belgium will need to reduce with the same amount its gross final energy consumption in heating/cooling sector during 2010-2020 time period.

Spain was the only MS that maintained the average growth rate in gross final energy consumption during period 2005-2010 in heating/cooling sector at the same rate as the planned one. As a consequence it will have the same average growth rate in gross final energy consumption for 2010-2020 time span.

Greece, Luxemburg, Finland and Sweden had planned to increase their gross final energy consumption in this sector during period 2005-2010. Actually only Sweden increased its gross final energy consumption while the other MS, Greece, Luxemburg and Finland decreased it by respectively 3.8%, 0.9% and 0.03%.

In 12 MS, Germany, Estonia, Ireland, Spain, Italy, Cyprus, Hungary, Austria, Portugal, Romania, Slovakia and United Kingdom, Gross Final Energy Consumption in heating/cooling sector dropped as planned in 2010 and in Italy, Cyprus, Hungary and Slovakia such a decrease was higher than what was planned.

8 MS, Denmark, Germany, Ireland, Spain, France, Hungary, Slovakia and United Kingdom had planned to reduce the gross final consumption in heating/cooling sector in 2020 compared to 2010. According to 2010 PR data there are in fact 14 MS, Belgium, Bulgaria, Denmark, Germany, Estonia, Ireland, Spain, France, Latvia, Netherlands, Poland, Slovenia, Slovakia and

United Kingdom, that need to reduce their gross final energy consumption in this sector in 2020 in order to achieve the planned values.

Hungary had planned to reduce its energy consumption in transport sector during period 2005-2010 but this reduction was more than planned being 9.3% (40.8 PJ) below the NREAP value. Bulgaria, Denmark, France, Latvia, Netherlands, Poland and Slovenia had planned to reduce their final energy consumed in this sector in 2010 but in fact this has actually increased as shown by the positive consumption growth rate for period 2005-2010.

23 MS have reported a growth rate for period 2009-2010 higher than the target growth rate that it is needed to reach the 2020 targets putting the achievement of their consumption planned values for 2020 at risk. Only Greece, Cyprus and Malta had a growth rate for 2009-2010 lower than the target growth rate needed to achieve the targets with Cyprus being the only MS with a negative growth rate for 2009-2010 period.

The highest absolute increase from year 2010 in gross final energy consumption in heating/cooling sector until 2020 will take place is Sweden with 85 PJ (2 Mtoe). The highest absolute decrease in 2020 compared to 2010 will take place in Germany with 835.7 PJ (20 Mtoe).

Table 2. EU 27 MS GFEC-H/C progress, absolute and relative deviations, 2005-2020

	2005	2010	Growth		Growth		2020
	NREAPs	PR	2005-2010		2010-2020		NREAPs
	PJ	PJ	PJ	av.%	PJ	av. %	PJ
BE	912.9	958.4	45.5	1.0	-45.5	-0.5	912.9
BG	190.2	196.2	6.0	0.6	-2.0	-0.1	194.2
CZ	738.7	723.7	-15	-0.4	-29.3	-0.4	694.4
DK	337.9	358.8	20.9	1.2	-38.4	-1.1	320.4
DE	4891.9	4735.3	-156.7	-0.6	-835.7	-1.8	3899.5
EE	67.6	67.0	-0.6	-0.2	-0.9	-0.1	66.1
IE	230.9	218.0	-12.9	-1.1	-11.5	-0.5	206.5
EL	349.8	282.9	-66.9	-3.8	122.2	4.3	405.0
ES	1674.0	1498.1	-175.9	-2.1	-203.2	-1.4	1294.9
FR	2886.8	2944.7	58.0	0.4	-432.6	-1.5	2512.1
IT	2868.0	2432.4	-435.6	-3.0	129.3	0.5	2561.7
CY	22.2	19.2	-3.0	-2.7	2.8	1.5	22.1
LV	109.1	110.7	1.5	0.3	-1.3	-0.1	109.4
LT	108.1	111.8	3.6	0.7	0.6	0.1	112.4
LU	49.8	47.4	-2.4	-0.9	5.7	1.2	53.1
HU	510.5	398.7	-111.8	-4.4	14.9	0.4	413.5
MT	0.0	1.3	1.3		1.7	12.8	3.0
NL	1190.6	1282.4	91.8	1.5	-236.2	-1.8	1046.2
AT	552.9	529.2	-23.7	-0.9	6.8	0.1	536.0
PL	1553.3	1617.7	64.4	0.8	-164.9	-1.0	1452.8
PT	331.9	324.1	-7.8	-0.5	19.1	0.6	343.2
RO	786.2	687.2	-99.0	-2.5	79.7	1.2	766.9
SI	95.9	99.7	3.8	0.8	-14.8	-1.5	85.0
SK	258.0	249.4	-8.6	-0.7	-14.4	-0.6	235.0
FI	584.9	584.7	-0.2	0.0	55.9	1.0	640.6
SE	552.2	625.3	73.0	2.6	85.0	1.4	710.2
UK	2801.0	2595.4	-205.6	-1.5	-439.1	-1.7	2156.2
EU 27	24655.4	23699	-955.7	-0.8	-1946.4	-0.8	21753.3

## 1.2 GFEC-Electricity

In 2010 the gross final energy consumption in electricity sector amounted to 11867 PJ (283 Mtoe) meeting the NREAPs planned value having the same average growth rate for period 2005-2010 (+0.2%). EU 27 kept in this way unchanged the absolute gap to be filled until 2020 from 2010 level compared with the planned one (+810 PJ). The annual growth rate for period 2009-2010 was 4.1% indicating that EU 27 tends to move faster in the direction of increasing energy consumption in this sector.

In 2010 the electricity share in gross final energy consumption was 23.6%, changing slightly compared with the level of year 2005 (23%). In 2020 this share is projected to be increased up to 25.7%.

Figure 3 and Table 3 report the progress of gross final energy consumption development in electricity sector in EU 27 for period 2005-2020.

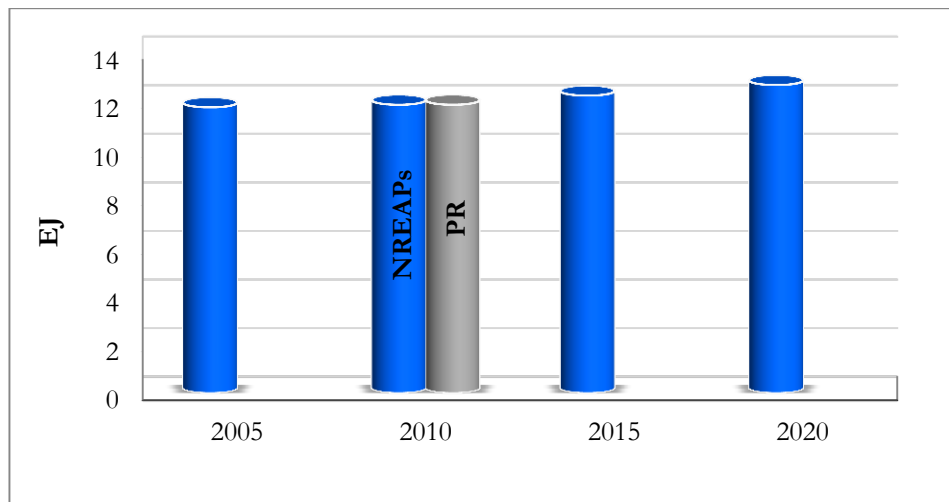


Figure 3. EU 27 GFEC electricity progress, 2005-2020

Denmark, Greece, Lithuania, Luxemburg, Austria, Poland, Slovenia and United Kingdom, had planned to reduce their gross final energy consumption in the electricity sector during period 2005-2010. From this group Greece, Lithuania, Austria and Slovenia actually dropped their energy consumption in this sector. Ireland, France, Italy and Sweden decreased their consumption despite they had planned an increase.

13 MS, Belgium, Bulgaria, Denmark, Germany, Estonia, Spain, Latvia, Lithuania, Luxemburg, Poland, Slovenia, Finland and United Kingdom, increased their gross final energy consumption in period 2005-2010 by more than what was expected in their plans.

The highest absolute increase in gross final energy consumption in this sector for period 2005-2010 was planned to be found in Italy with almost 40 PJ (0.95 Mtoe). According to Progress Reports the highest absolute increase in gross final energy consumption for this period actually took place in Poland with 35.3 PJ (0.84 Mtoe).

Greece had planned to have the highest absolute decrease in gross final energy consumption in electricity for this time span with 17.8 PJ (0.42 Mtoe) but in fact it was Italy that had the highest decrease in consumption with 49 PJ (1.2 Mtoe).

According to NREAPs only Germany had originally planned to reduce its gross final energy consumption in electricity for period 2010-2020, which was confirmed by the actual energy consumption in 2010. Three MS, Bulgaria, Denmark and Luxemburg, have now joined Germany in needing an overall reduction in 2010-2020, since their consumption in 2005-2010 period went beyond the planned value.

7 MS, Ireland, Greece, Spain, Cyprus, Lithuania, Malta and Finland, had a growth rate for period 2009-2010 lower than the average growth rate needed to reach the 2020 targets which indicate their tendency towards 2020 consumption lower than the planned targets.

Spain is expected to show the highest absolute increase in gross final energy consumption in this sector for period 2010-2020 with 286.6 PJ (6.8 Mtoe) while Germany will show the largest absolute decrease with 171.5 PJ (4.1 Mtoe).

Table 3. EU 27 MS GFEC-E progress, absolute and relative deviations, 2005-2020

	2005	2010	Growth		Growth		2020
	NREAPs	PR	2005-2010		2010-2020		NREAPs
	PJ	PJ	PJ	av. %	PJ	av. %	PJ
BE	331.3	358.1	26.9	1.6	40.7	1.1	398.8
BG	131.0	152.5	21.5	3.3	-20.7	-1.4	131.8
CZ	251.8	252.7	0.9	0.1	32.4	1.3	285.1
DK	132.6	143.7	11.2	1.7	-7.8	-0.5	135.9
DE	2169.3	2194.4	25.1	0.2	-171.5	-0.8	2022.9
EE	30.9	34.9	4.0	2.6	4.3	1.2	39.3
IE	98.0	97.4	-0.6	-0.1	20.4	2.1	117.8
EL	229.7	227.2	-2.5	-0.2	19.2	0.8	246.5
ES	1050.0	1051.5	1.5	0.0	286.6	2.7	1338.1
FR	1897.3	1885.3	-12.0	-0.1	78.9	0.4	1964.2
IT	1245.5	1196.6	-48.9	-0.8	152.7	1.3	1349.3
CY	15.7	18.7	3.1	3.9	7.8	4.1	26.5
LV	24.3	27.0	2.6	2.2	4.3	1.6	31.2
LT	41.2	39.4	-1.8	-0.9	10.5	2.7	49.9
LU	23.7	25.4	1.7	1.4	-1.6	-0.6	23.8
HU	151.1	153.4	2.3	0.3	31.6	2.1	185.0
MT	0.0	7.8	7.8		3.5	4.5	11.3
NL	433.2	435.1	1.9	0.1	53.9	1.2	489.1
AT	239.7	227.9	-11.8	-1.0	39.1	1.7	267.0
PL	523.4	558.7	35.3	1.4	52.6	0.9	611.3
PT	190.8	194.7	3.9	0.4	37.5	1.9	232.2
RO	192.6	198.7	6.1	0.6	66.5	3.3	265.2
SI	53.3	53.1	-0.2	-0.1	3.1	0.6	56.2
SK	101.0	102.5	1.6	0.3	17.5	1.7	120.0
FI	315.3	328.1	12.8	0.8	37.8	1.2	365.9
SE	543.7	540.9	-2.8	-0.1	15.6	0.3	556.6
UK	1344.0	1361.3	17.4	0.3	-4.8	0.0	1356.5
EU 27	11760.4	11867.4	107.0	0.2	810.1	0.7	12677.5



### 1.3 GFEC Transport

According to NREAPs the gross final energy consumed in this sector in EU 27 was planned to change slightly both in 2005-2010 (+0.1% or +81 PJ) and 2010-2020 (-0.02% or -30 PJ) time span. Contrary, according to Progress Reports, the gross final energy consumption in this sector in period 2005-2010 decreased by 0.5% reaching 12685 PJ in 2010 which was 3.3% lower than the planned consumption of 13124 PJ. For period 2010-2020 the gross final energy consumption is planned to be increased by 0.3 % (+410 PJ). The growth rate of gross energy consumption in this sector for period 2009-2010 (-0.4%) was lower than the expected average growth rate for period 2010-2020 indicating that the EU 27 tendency towards an increase in 2020 of energy consumption in transport sector is lower than the forecasted projections.

The transport share in gross final energy consumption remains nearly the same during period 2005-2010, respectively 25.5% and 25.3%. In 2020 this share will reach the level of 26.5%.

Figure 4 and Table 4 report the progress of gross final energy consumption development in transport sector in EU 27 for period 2005-2020.

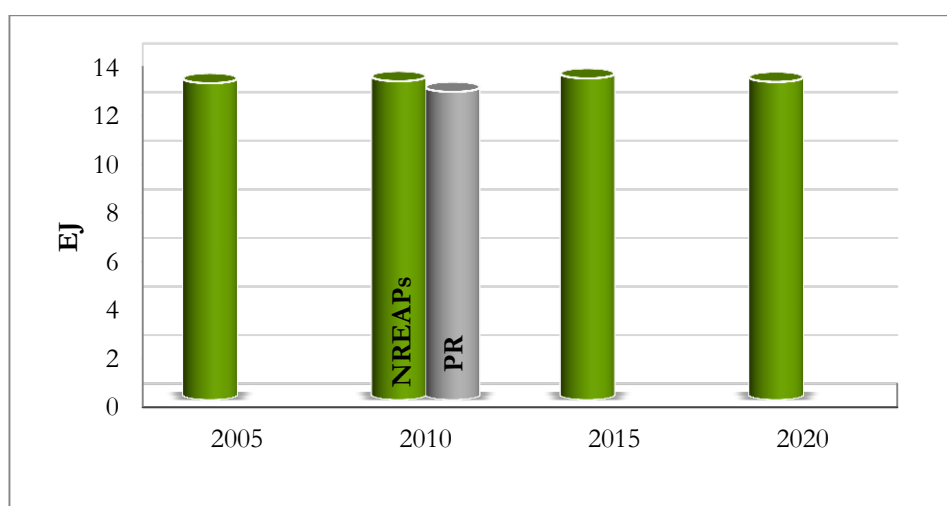


Figure 4. EU 27 GFEC progress in transport sector, 2005-2020

9 MS, Germany, Greece, Spain, Italy, Luxemburg, Austria, Portugal, Finland and United Kingdom, had planned to reduce their gross final energy consumption in transport sector during period 2005-2010 while Belgium, Bulgaria, Denmark, Estonia, Ireland, France, Cyprus, Latvia, Lithuania, Hungary, Netherlands, Romania, Slovenia, Slovakia, Finland and Czech Republic had planned to increase their gross energy consumption in transport sector during period 2005-2010.

According to Progress Reports 16 MS reported gross final energy consumption in transport lower than their planned 2010 values while Greece, Cyprus, Luxemburg, Austria, Portugal, Romania, Slovenia, Slovakia, Sweden and United Kingdom consumed more energy than planned in transport sector during this period.

During period 2010-2020 Belgium, Germany, Greece, Italy, Netherlands and Portugal, had originally planned to decrease their gross final energy consumption in transport sector. According to Progress Reports the gross final energy consumption in this sector for years 2010-2020 will be expected to decrease in Germany, Greece, France, Italy, Austria and Portugal.

12 MS, Belgium, Denmark, Germany, France, Cyprus, Latvia, Luxemburg, Poland, Slovenia, Slovakia, Finland and Sweden, have shown in period 2009-2010 a growth rate higher than the average growth rate expected for period 2010-2020.

Estonia actually consumed in transport in 2010 half of its planned gross final energy with an average growth rate of -9.8% showing a much lower growth rate for period 2009-2010 (-16.5%) comparing to the target average growth rate originally planned to reach the 2020 target (14.6%). Estonia has shown in 2010 a gross final energy consumption in transport sector much lower than its 2020 target.

Ireland is in similar conditions as Estonia since its gross energy consumption in transport dropped in 2010 when it had planned to increase it and the growth rate for period 2009-2010 was much lower than the target average growth rate originally planned to reach the 2020 targets. Even Ireland has shown in 2010 a gross final energy consumption in transport sector lower than its 2020 target.

Netherlands had planned to increase its gross final energy consumption in 2010 from the baseline year, but this consumption reached only 74% of what was planned. Also it had a negative growth rate for period 2009-2010 (-10.2%) compared to the growth rate originally planned to reach the 2020 target (2.6%).

Poland will show the highest absolute increase (190.3 PJ or 4.5 Mtoe) in gross final energy consumption in transport sector for period 2010-2020 while the highest absolute decrease will take place in Germany with 145.4 PJ (3.5 Mtoe).

Table 4. EU 27 MS GFEC-T progress, absolute and relative deviations, 2005-2020

	2005	2010	Growth		Growth		2020
	NREAPs	PR	2005-2010		2010-2020		NREAPs
	PJ	PJ	PJ	av. %	PJ	av. %	PJ
BE	355.6	324.1	-31.5	-1.8	41.9	1.3	365.9
BG	110.6	97.7	-12.9	-2.3	25.9	2.7	123.6
CZ	251.5	255.8	4.3	0.3	12.4	0.5	268.2
DK	173.5	173.9	0.4	0.04	7.5	0.4	181.4
DE	2244.2	2167.7	-76.5	-0.7	-145.4	-0.7	2022.3
EE	31.2	15.9	-15.3	-9.8	23.2	14.6	39.1
IE	163.8	162.2	-1.5	-0.2	78.4	4.8	240.6
EL	275.0	278.4	3.4	0.2	-13.1	-0.5	265.3
ES	1357.8	1279.6	-78.2	-1.2	72.8	0.6	1352.4
FR	1887.4	1869.9	-17.5	-0.2	-107.2	-0.6	1762.6
IT	1632.9	1436.2	-196.6	-2.4	-13.9	-0.1	1422.3
CY	28.6	31.3	2.8	1.9	0.8	0.3	32.2
LV	41.1	39.3	-1.8	-0.9	15.1	3.8	54.4
LT	47.4	53.6	6.2	2.6	19.0	3.5	72.6
LU	101.2	90.3	-10.8	-2.1	7.4	0.8	97.7
HU	166.0	169.4	3.5	0.4	54.5	3.2	224.0
MT	0.0	3.5	3.5		3.4	9.8	6.9
NL	475.2	354.5	-120.8	-5.1	90.7	2.6	445.2
AT	374.5	377.9	3.4	0.2	-25.6	-0.7	352.3
PL	519.2	642.9	123.8	4.8	190.3	3.0	833.2
PT	260.5	261.1	0.5	0.0	-20.6	-0.8	240.4

RO	173.3	204.0	30.7	3.5	31.6	1.6	235.6
SI	63.9	73.7	9.8	3.1	8.1	1.1	81.8
SK	73.0	93.2	20.1	5.5	21.9	2.3	115.0
FI	176.7	163.8	-12.8	-1.5	7.0	0.4	170.8
SE	312.9	326.9	14.0	0.9	12.7	0.4	339.6
UK	1746.1	1738.2	-7.8	-0.1	11.0	0.1	1749.2
EU 27	13043.1	12685.1	-358	-0.5	410	0.3	13095

## 2. Total Renewable Energy (RES)

### a. Total RES share

EU 27 had planned to increase the share of total renewable energy in gross final energy consumption in 2020 up to 20.6%. During the period 2005-2010 the overall RES share in gross final energy consumption increased from 8.1% to 12.6% exceeding the planned share for 2010 by 1.1 % points. EU 27 exceeded its overall RES share in gross final energy consumption since in 2009 reaching the level of 11.9%.

Figure 5 and Table 5 report the development of overall RES share in gross final energy consumption in EU 27 during period 2005-2020.

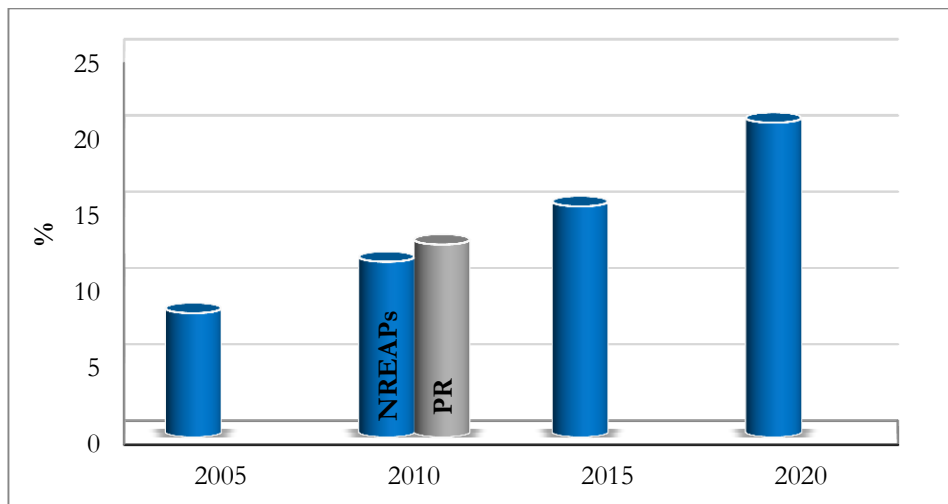


Figure 5. EU 27 total RES share in GFEC progress, 2005-2020

Poland and Malta didn't report overall RES share in gross final energy consumption for baseline year 2005. Poland almost reached its planned overall RES share in year 2010 while in contrary Malta halved it.

Only Romania and Finland had planned to reduce the overall RES share in their gross final energy consumption during period 2005-2010. Actually only Latvia decreased by 0.1 percentage points its overall RES share in this time span.

8 MS, Denmark, Ireland, Cyprus, Latvia, Malta, the Netherlands, Austria and Poland didn't exceed in 2010 their planned overall RES share in gross final energy consumption. For this reason these MS will need to increase at a rate faster than planned their overall RES share during period 2010-2020 in order to be in good track with the projected targets. The rest of MS increased more than planned their overall RES share during period 2005-2010 and for period 2010-2020 they will need to increase their overall RES share at a rate slower than originally planned. None of the MS has already reached in 2010 its 2020 target so they all will need to increase their RES shares compared to 2010.

Romania was in 2010 the MS with the highest absolute difference between achieved and planned overall RES share in gross final energy consumption with 4.9 additional % points compared with planned share for this period followed by Finland with 4.4 % points more than planned and halving the absolute difference needed to reach the 2020 target. Sweden was in the third place in

this period with an increase larger by 4.3 percentage points of what it was expected and diminishing by more than 50% the absolute difference needed to reach the 2020 target.

The highest absolute increase in the 2005-2010 period for RES share took place in Poland (+9.5% points) followed by Sweden (+8.1% points) and Austria (+7.5% points). The highest absolute increase in overall RES share for period 2010-2020 is expected to take place in United Kingdom with 11.7 % points followed by Netherlands with 10.8 % points, Ireland with 10.5% points, France with 10.2% points and Malta with 9.3 % points.

Table 5. EU 27 Total RES share in GFEC progress, 2005-2020

	2005	2010	Growth		Growth		2020
	NREAPs	PR	2005-2010		2010-2020		NREAPs
	%	%	% points	av. %	% points	av. %	%
BE	2.2	5.1	2.9	25.9	8.0	15.7	13.0
BG	9.6	12.6	3.0	6.3	3.4	2.7	16.0
CZ	6.1	8.8	2.7	8.9	5.2	5.9	14.0
DK	17	21.8	4.8	5.6	8.6	4.0	30.4
DE	6.5	11.3	4.8	14.8	8.3	7.3	19.6
EE	16.6	24.0	7.4	8.9	1.0	0.4	25.0
IE	3.1	5.5	2.4	15.5	10.5	19.1	16.0
EL	6.96	9.7	2.8	8.0	8.3	8.5	18.0
ES	8.2	13.5	5.3	12.9	7.3	5.4	20.8
FR	9.6	12.8	3.2	6.7	10.2	8.0	23.0
IT	4.91	10.1	5.2	21.2	6.9	6.8	17.0
CY	2.9	5.2	2.3	15.9	7.8	15.0	13.0
LV	32.6	32.5	-0.1	-0.1	7.5	2.3	40.0
LT	15	19.7	4.7	6.3	4.3	2.2	24.0
LU	0.9	3.0	2.1	45.6	8.1	27.3	11.0
HU	4.2	8.8	4.6	21.9	5.9	6.7	14.7
MT	0	0.9	0.9		9.3	103.3	10.2
NL	2.5	3.7	1.2	9.6	10.8	29.2	14.5
AT	23.3	30.8	7.5	6.4	3.4	1.1	34.2
PL	0	9.5	9.5		6.4	6.7	15.9
PT	19.8	24.6	4.8	4.8	6.4	2.6	31.0
RO	17.9	22.4	4.5	5.0	1.6	0.7	24.0
SI	16.2	19.9	3.7	4.6	5.4	2.7	25.3
SK	6.7	10.2	3.5	10.4	3.8	3.7	14.0
FI	28.8	33.1	4.3	3.0	4.9	1.5	38.0
SE	39.7	47.8	8.1	4.1	2.4	0.5	50.2
UK	1.4	3.3	1.9	27.1	11.7	35.5	15.0
EU 27	8.1	12.6	4.5	11.0	8.0	6.3	20.6

## b. Total RES installed capacity

EU 27 had planned to triplicate during period 2005-2020 its total RES installed capacity. According to NREAPs in period 2005-2010 total RES installed capacity was planned to be increased by 78.4 GW (+9.3% yearly) to reach an amount equal to 246.1 GW. According to Progress Reports the total renewable installed capacity in EU 27 in 2010 accounted for 241.1 GW being 8.8% (+73.4 GW) higher than the capacity in 2005. In period 2010-2020 EU 27

should almost double (+232.0 GW or +9.6% per annum in average) its total RES installed capacity in order to reach the 2020 target.

Figure 6 and Table 6 Report the detailed development of total RES installed capacity in EU 27 during period 2005-2020.

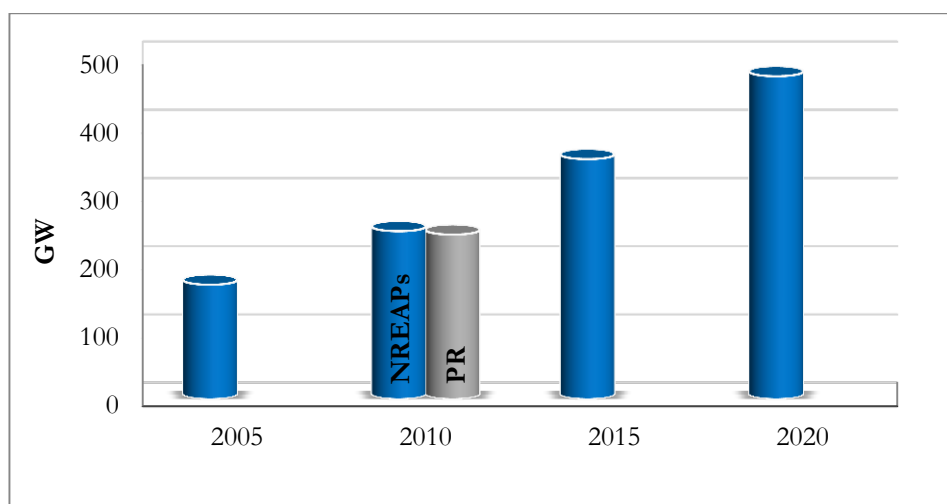


Figure 6. EU 27 total RES installed capacity progress, 2005-2020

According to Progress Reports in 2010 13 MS, Bulgaria, Ireland, Greece, France, Italy, Lithuania, Malta, the Netherlands, Austria, Portugal, Romania, Slovenia and United Kingdom, show an installed renewable capacities lower than their plans for this year.

Finland was the only MS that had planned to reduce its total RES installed capacity for 2010 compared with baseline year, 2005, decreasing the biomass installed capacity in this period. The additional capacity for this MS needs to be equal to 40% of the 2020 target on RES installed capacity.

Cyprus showed a very high relative increase in total RES installed capacity during period 2005-2010 mainly because of its very low baseline year value (0.2 MW).

Germany was the leading country in additional RES installed capacity during 2005-2010 with 27.7 GW (+19.9% yearly) and it is expected to keep this leading position even for period 2010-2020 with a planned additional RES capacity of 55.3 GW (+10% yearly).

The lowest increase in total RES installed capacity for period 2010-2020 will be in Malta with 166 MW.

Table 6. EU 27 total RES progress, absolute and relative deviations, 2005-2020

	2005	2010	Growth		Growth		2020
	NREAPs	PR	2005-2010		2010-2020		NREAPs
	MW	MW	MW	av. %	MW	av. %	MW
BE	640	2710	2069	64.6	5545	20.5	8255
BG	2059	2169	110	1.1	2156	9.9	4325
CZ	1079	3106	2027	37.6	1050	3.4	4156
DK	3919	4906	987	5.0	1849	3.8	6755
DE	27898	55590	27692	19.9	55345	10.0	110935
EE	36	181	145	79.5	477	26.3	658

IE	748	1627	879	23.5	3484	21.4	5111
EL	3623	4060	437	2.4	10791	26.6	14851
ES	23663	39391	15728	13.3	24370	6.2	63761
FR	22785	26469	3684	3.2	30894	11.7	57363
IT	18787	26343	7556	8.0	17480	6.6	43823
CY	0.2	97	96	12042.5	488	50.5	584
LV	1572	1622	50	0.6	546	3.4	2168
LT	134	278	144	21.6	597	21.5	875
LU	102	124	22	4.3	223	18.0	347
HU	0	862	862		676	7.8	1537
MT	0	2	2		166	993.8	168
NL	2440	3567	1127	9.2	11428	32.0	14995
AT	9600	10112	512	1.1	3068	3.0	13180
PL	1322	2556	1234	18.7	7229	28.3	9785
PT	6372	8553	2181	6.8	10647	12.4	19200
RO	6290	6771	480	1.5	5818	8.6	12589
SI	999	1135	136	2.7	558	4.9	1693
SK	1651	1967	316	3.8	779	4.0	2746
FI	5260	5245	-15	-0.1	3295	6.3	8540
SE	19410	22505	3095	3.2	1281	0.6	23786
UK	7323	9204	1881	5.1	31816	34.6	41020
EU 27	167713	241150	73436	8.8	232055	9.6	473205

### c. Total RES contribution<sup>4</sup>

EU 27 had planned to increase its total RES contribution during period 2005-2010 with an average growth rate<sup>5</sup> of 7.8% in order to reach 5757.5 PJ (137.5 Mtoe). The actual average growth rate for this period was higher (10.2%) diminishing the absolute gap (490.5 PJ above the 2010 planned value) needed to reach the 2020 target and the average growth rate (from 7.7% to 6.3%). In 2020 EU 27 has planned to generate 10194.2 PJ (243.5 Mtoe) energy from renewables with an additional energy equal to 3946 PJ (94.2 Mtoe).

Figure 7 and Table 7 report the detailed development of total RES generated in EU 27 during period 2005-2020.

Growth rate of total RES contribution for period 2009-2010 in EU 27 amounted to 11% indicating that **if EU 27 will maintain the same set of policy measures applied during this period it is likely to be able to reach the target of introducing a 20% RES quota in the gross final energy consumption even before 2020.**

Only three MS, Latvia, Romania and Finland, had planned to decrease their total RES contribution during period 2005-2010. On the contrary, according to Renewable Energy Progress Report all MS increased their total RES generation during this period. The highest increase relative was reported from Hungary mainly because of its very low baseline year value.

<sup>4</sup> Renewable electricity in transport sector is not taken into account in this calculation of total RES contribution

<sup>5</sup> Here and in the following analyses growth rate is calculated based on absolute values of total RES in order to avoid the influence of GFEC changes.

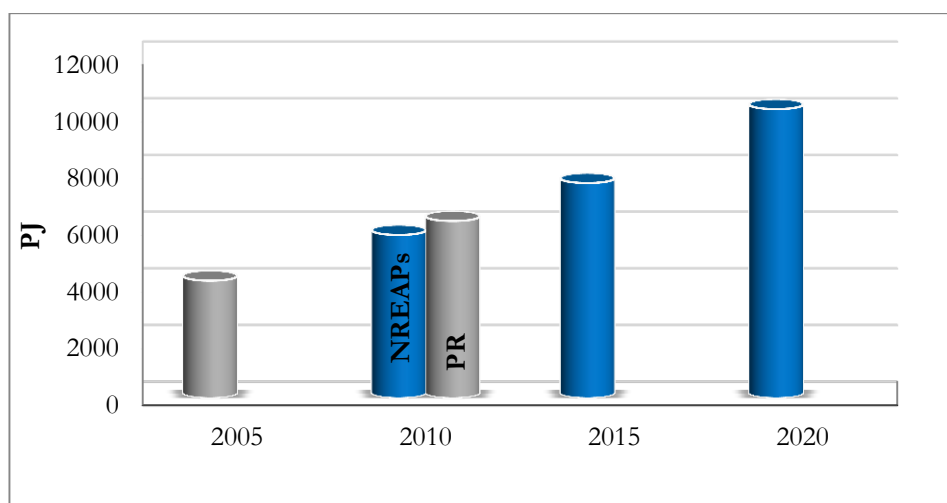


Figure 7. EU 27 total RES contribution progress, 2005-2020

Ireland, Greece, France, Malta and The Netherlands were the only MS-s that during period 2005-2010 contributed with less renewable energy than planned but they still were able to maintain an increasing trend in this period. For these MS the present target average growth rate for period 2010-2020 is larger than the originally planned one, which means that they should speed up the increase of total RES contribution (or further decreasing their gross final energy consumption) in order to achieve the 2020 targets.

Nevertheless, 10 MS, Ireland, Greece, Cyprus, Latvia, Lithuania, Luxemburg, Malta, The Netherlands (it had a negative 2009/2010 growth rate), Slovakia and United Kingdom, showed a tendency growth rate 2009-2010 lower than the target growth rate needed to reach the 2020 targets. The rest of MS showed that if they will be able to maintain the present growth rate they should be able to reach the 2020 NREAPs targets.

The highest absolute increase in total RES contribution for period 2010-2020 is expected from United Kingdom with 661.3 PJ (15.8 Mtoe) and the lowest will be in Malta with 2.3 PJ (56 ktoe).

Table 7. EU 27 MS total RES contribution progress, 2005-2020

	2005	2010	Growth		Growth		2020
	NREAPs	PR	2005-2010		2010-2020		NREAPs
	PJ	PJ	PJ	av. %	PJ	av. %	PJ
BE	29.4	82.5	53.1	36.1	142.1	17.2	224.7
BG	41.4	58.2	16.8	8.1	27.4	4.7	85.6
CZ	69.3	107.9	38.0	10.9	65.9	6.1	173.8
DK	113.8	154.6	40.7	7.2	57.3	3.7	211.9
DE	625.0	1052.3	427.3	13.7	562.2	5.3	1614.4
EE	21.7	32.2	10.5	9.7	3.9	1.2	36.0
IE	17.0	27.9	10.9	12.8	67.1	24.1	95.0
EL	67.6	82.1	14.4	4.3	128.0	15.6	210.1
ES	347.6	544.5	196.9	11.3	314.8	5.8	859.4
FR	683.4	884.5	201.1	5.9	654.0	7.4	1538.5
IT	290.7	531.9	241.2	16.6	367.9	6.9	899.7
CY	1.9	4.3	2.4	25.1	6.7	15.6	11.0
LV	57.7	61.0	3.3	1.1	19.4	3.2	80.4
LT	30.6	41.7	11.1	7.3	20.0	4.8	61.6
LU	1.6	5.1	3.4	42.2	11.3	22.2	16.4



HU	0.2	62.4	62.2	5943.2	57.1	9.2	119.5
MT	0.0	0.2	0.2		2.3	149.1	2.5
NL	57.7	86.4	28.7	10.0	220.9	25.6	307.3
AT	285.1	340.9	55.9	3.9	47.0	1.4	388.0
PL	20.1	268.7	248.6	247.5	176.3	6.6	445.0
PT	138.1	205.7	67.6	9.8	47.4	2.3	253.1
RO	191.2	230.1	38.9	4.1	72.8	3.2	302.9
SI	34.6	45.8	11.2	6.5	10.5	2.3	56.3
SK	32.0	45.4	13.5	8.4	25.7	5.7	71.1
FI	316.9	367.4	50.4	3.2	80.5	2.2	447.8
SE	580.6	729.2	148.6	5.1	96.3	1.3	825.5
UK	88.8	195.5	106.7	24.0	661.3	33.8	856.8
EU 27	4144.3	6248.3	2104	10.2	3946	6.3	10194.2

#### d. Total RES consumption<sup>6</sup>

EU 27 had planned to increase its total RES consumption during period 2005-2010 with an average growth rate of 7.7% in order to reach 5811.8 PJ (138.8 Mtoe). The actual average growth rate for this period was even higher (10.0%) diminishing the absolute gap (483.1 PJ below the planned value) needed to reach the 2020 target and the necessary average growth rate (from 7.8% to 6.4%). In 2020 EU 27 has planned to generate 10329.3 PJ (246.7 Mtoe) of energy from renewables with an additional amount of renewable energy equal to 4034.3 PJ (96.4 Mtoe).

Figure 8 and Table 8 report the detailed development of total RES consumption in EU 27 during period 2005-2020.

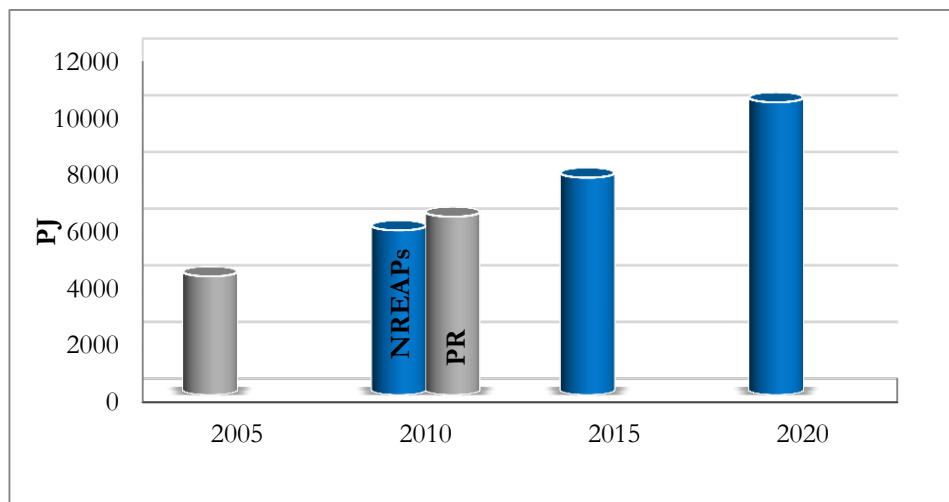


Figure 8. EU 27 total RES consumption progress, 2005-2020

Three MS, Latvia, Romania and Finland, had planned to decrease their total RES consumption during period 2005-2010. On the contrary, according to Renewable Energy Progress Report all MS increased their total RES consumption during this period. The highest average growth rate was reported from Hungary due to the very low total RES consumption in the baseline year.

<sup>6</sup> Contribution of all sources ( bioethanol, biodiesel, renewable electricity and others) in transport sector is taken into account in the calculation of total RES consumption

Ireland, Greece, Cyprus, Latvia, Lithuania, Luxemburg, Malta, The Netherlands (it had a negative 2009/2010 growth rate), Slovakia and United Kingdom, showed a tendency growth rate 2009-2010 lower than the target growth rate needed to reach the 2020 targets. The rest of MS showed that if they will be able to maintain the present growth rate they should be able to reach the 2020 NREAPs targets.

United Kingdom and France will have the highest absolute increase during period 2010-2020 with respectively 670.1 PJ and 664.3 PJ while the lowest increase is expected for Malta and Estonia with 2.4PJ and 3.9 PJ.

Table 8. EU 27 total RES consumption progress, 2005-2020

	2005	2010	Growth		Growth		2020
	NREAPs	PR	2005-2010		2010-2020		NREAPs
	PJ	PJ	PJ	av.%	PJ	av.%	PJ
BE	30.1	82.6	52.5	34.9	146.1	17.7	228.7
BG	41.5	58.3	16.8	8.1	27.9	4.8	86.2
CZ	70.1	108.2	38.1	10.9	66.5	6.1	174.7
DK	114.2	155.0	40.8	7.1	58.1	3.7	213.1
DE	632.0	1059.1	427.0	13.5	583.3	5.5	1642.4
EE	21.5	32.2	10.7	9.9	3.9	1.2	36.1
IE	17.0	27.9	10.9	12.7	68.6	24.6	96.5
EL	67.6	82.2	14.5	4.3	128.6	15.6	210.8
ES	352.1	546.7	194.6	11.1	333.7	6.1	880.4
FR	689.3	891.0	201.7	5.9	664.3	7.5	1555.3
IT	296.5	539.6	243.1	16.4	375.6	7.0	915.2
CY	1.9	4.3	2.4	25.1	6.7	15.7	11.0
LV	57.8	61.1	3.3	1.1	19.5	3.2	80.6
LT	30.6	41.7	11.1	7.3	20.0	4.8	61.8
LU	1.7	5.2	3.5	41.5	11.6	22.5	16.8
HU	0.2	63.0	62.8	6003.2	57.5	9.1	120.6
MT	0.0	0.2	0.2		2.4	151.0	2.5
NL	58.0	87.5	29.4	10.1	222.8	25.5	310.3
AT	291.9	349.1	57.2	3.9	50.3	1.4	399.4
PL	20.1	269.5	249.4	248.3	177.1	6.6	446.6
PT	138.6	206.5	67.9	9.8	49.0	2.4	255.5
RO	192.9	231.5	38.6	4.0	73.6	3.2	305.1
SI	34.7	45.7	11.0	6.4	11.0	2.4	56.7
SK	32.3	45.7	13.5	8.3	26.1	5.7	71.8
FI	317.8	368.1	50.3	3.2	81.4	2.2	449.5
SE	585.6	735.1	149.4	5.1	98.7	1.3	833.8
UK	93.6	197.9	104.3	22.3	670.1	33.9	868.0
<b>EU 27</b>	<b>4189.8</b>	<b>6294.9</b>	<b>2105.2</b>	10.0	<b>4034.4</b>	6.4	<b>10329.3</b>

## 2.1 RES Heating/Cooling

### a. RES-H/C share

The share of renewable energy generated in heating/cooling sector in gross final energy consumption is projected to be increased from 9.3% in the baseline year up to 21.3% in 2020. In

year 2010 the share of renewable energy in this sector reached 14.4% of the gross final energy consumption in EU 27 instead of 12.5% that was planned. EU 27 exceeded since in 2009 by 1.2 percentage points the planned RES-H/C share for 2010.

Figure 9 and Table 9 report the development of RES-H/C share in gross final energy consumption in each MS of EU 27 during period 2005-2020.

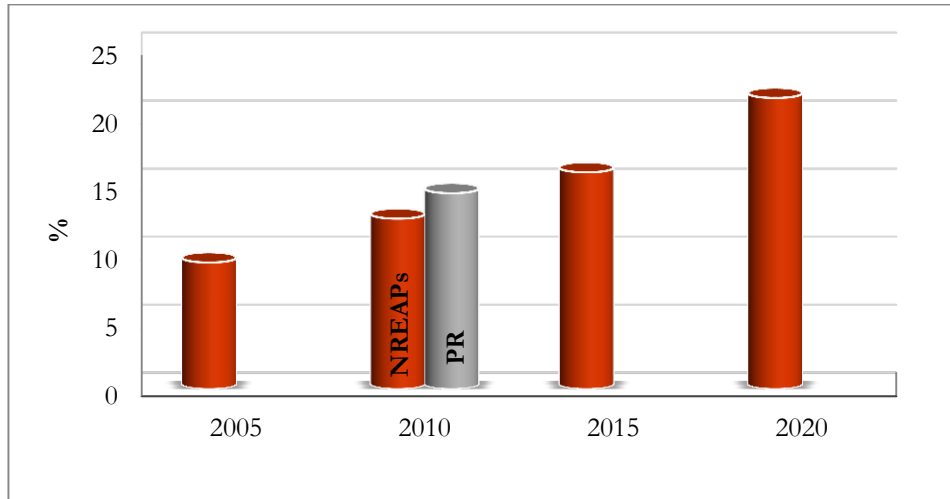


Figure 9. EU 27 RES-H/C share in GFEC-H/C progress, 2005-2020

Only 3 MS, Portugal, Romania and Finland had planned to reduce their renewable energy share in this sector during period 2005-2010. Actually none of MS reduced the renewable energy share in this sector for this time span.

4 MS, Denmark, Latvia, the Netherlands and Poland didn't increase during 2005-2010 their RES share in this sector at the planned level. The rest of MS increased the RES share more than their plans. Finland had the highest exceedance (+9.4 % points) from its 2010 planned share together with Sweden (+8.3 % points) and Romania (+6.4 % points).

Malta and Poland didn't report in their NREAPs on RES share in heating/cooling sector for baseline year. Poland reached almost the planned RES share in this sector while Malta exceeded it by 1.6 percentage points.

Italy had planned to double its renewable share in heating/cooling sector during period 2005-2010 while according to its Progress Reports it increased more than 3 times its RES share in this sector for this period, from 2.8% to 9.5%.

Finland reached in 2010 almost its 2020 target in RES share in heating/cooling sector.

Austria and Poland showed in 2010 the highest absolute increase (+12 % points) in RES share in this sector from the baseline year. Sweden had the third highest absolute increase for this period with 11.6 percentage points followed by Estonia with 11.3 % points.

The lowest absolute increase in RES share in heating/cooling sector in 2010 from the baseline year was reported by Netherlands with only 0.2 % points.

For period 2010-2020 the RES share in this sector does not need to increase in 3 MS, Estonia, Malta and Portugal. Actually this group will be joining by Romania and Sweden who will also not

need to increase their RES share in this sector in 2020 in order to be in good track with their plans.

Lithuania will keep the same absolute increase of RES share in heating/cooling in 2020 from its 2010 level as during the period 2005-2010 (+6.0 percentage points). France will have the highest absolute increase in 2020 from its 2010 level with 15.9 % points. United Kingdom will have the second highest absolute increase with 10.2 % points and the highest relative increase with 56.7%.

Table 9. EU 27 RES-H/C share in GFEC, absolute and relative deviations, 2005-2020

	2005	2010	Growth		Growth		2020
	NREAPs	PR	2005-2010		2010-2020		NREAPs
	%	%	% points	av.%	% points	av.%	%
BE	2.3	4.5	2.2	19.2	7.4	16.4	11.9
BG	15.9	20.1	4.2	5.3	3.7	1.8	23.8
CZ	8.4	10.2	1.8	4.3	3.9	3.8	14.1
DK	23.2	30.6	7.4	6.4	9.2	3.0	39.8
DE	6.6	11.0	4.4	13.3	4.5	4.1	15.5
EE	31.3	42.6	11.3	7.2	-4.2	-1.0	38.4
IE	3.5	4.4	0.9	5.1	7.6	17.3	12
EL	12.76	17.2	4.4	6.9	2.5	1.5	19.7
ES	8.9	11.9	3.0	6.7	5.4	4.5	17.3
FR	13.6	17.1	3.5	5.1	15.9	9.3	33
IT	2.8	9.5	6.7	47.6	7.6	8.1	17.1
CY	9.1	17.7	8.6	18.9	5.8	3.3	23.5
LV	42.7	43.8	1.1	0.5	9.6	2.2	53.4
LT	27	33.0	6.0	4.4	6.0	1.8	39
LU	1.7	5.0	3.3	38.5	3.5	7.1	8.5
HU	5.4	11.1	5.7	21.0	7.8	7.1	18.9
MT	0	9.5	9.5		-3.3	-3.5	6.2
NL	2.5	2.7	0.2	1.6	6.0	22.2	8.7
AT	20.2	32.2	12.0	11.9	0.4	0.1	32.6
PL	0	12.0	12.0		5.1	4.2	17.0
PT	31.9	34.5	2.6	1.6	-3.9	-1.1	30.6
RO	18.72	24.2	5.5	5.9	-2.2	-0.9	22.0
SI	20	26.6	6.6	6.6	4.2	1.6	30.8
SK	6.1	9.2	3.1	10.2	5.4	5.9	14.6
FI	40	46.4	6.4	3.2	0.6	0.1	47
SE	53.7	65.3	11.6	4.3	-3.2	-0.5	62.1
UK	0.7	1.8	1.1	31.4	10.2	56.7	12
EU 27	9.3	14.4	5.1	10.9	6.8	4.8	21.3

## b. Contribution of RES in heating/cooling sector

Contribution of renewable energy in this sector in baseline year was 2284 PJ having a share of 55% in total RES. According to NREAPs the renewable energy to be generated in EU 27 during period 2005-2010 was planned to be increased with an average growth rate<sup>7</sup> of 5% (+567.8 PJ or 13.6 Mtoe). Actually the average growth rate for this time span was higher reaching 9.6% (+1096

<sup>7</sup> Growth rate is calculated based on absolute values of RES-H/C in order to avoid the influence of GFEC changes

PJ or 26.1 Mtoe) and EU 27 doubled the planned additional amount of renewable energy generated in this sector.

Figure 10 and Table 10 Report the detailed development of total RES contribution in EU 27 during period 2005-2020.

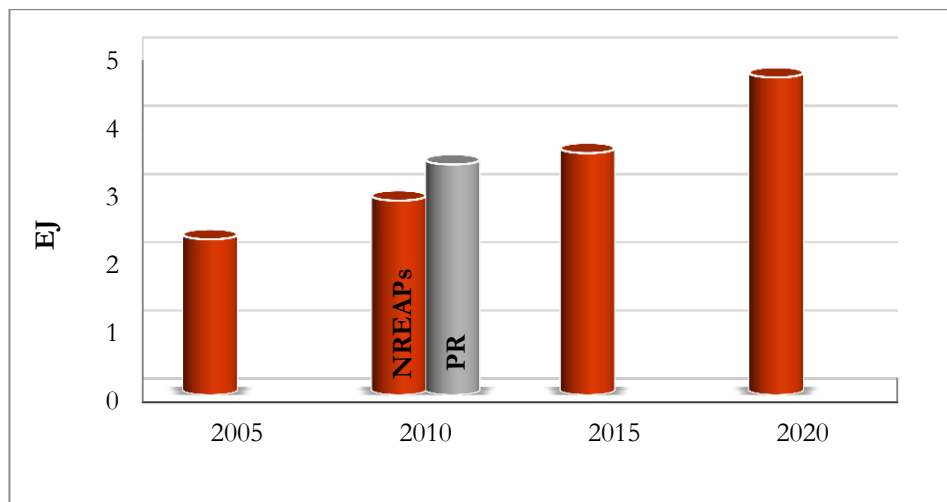


Figure 10. EU 27 RES progress in heating/cooling sector, 2005-2020

The renewable energy generation in EU 27 in this sector for period 2010-2020 will need to increase with an average growth rate of 3.8% which is lower than the planned value of 6.3% reducing by 1.4 times the absolute gap needed to reach the 2020 target of 4655.5 PJ (111.2 Mtoe).

The share of renewable energy in this sector in total RES in 2005 was 55%, in 2010 it decreased slightly reaching 54% and in 2020 is expected to decrease up to 46%.

In period 2009-2010 EU 27 had an annual growth rate in renewable energy generation in heating/cooling sector equal to 13.3% indicating that EU 27 does not need to speed up the renewable energy generation in this sector in order to fulfill the projected target in 2020.

7 MS, Latvia, Lithuania, Portugal, Romania, Slovenia, Finland and United Kingdom, had originally planned to reduce the RES generation in heating/cooling sector for period 2005-2010 while according to Renewable Energy Progress Reports all MS increased their RES generation in heating/cooling sector for this period. Greece, Malta and the Netherlands also increased their renewable energy generation but they missed their planned level.

Portugal had planned to keep almost at the same level the renewable energy generated in this sector in 2005 and 2020. According to its Progress Report, Portugal exceeded the planned renewable energy generation in this sector for year 2010 and also already the 2020 target.

Latvia had planned to reduce its renewable energy generation in this sector during period 2005-2010. Actually it generated more than planned reducing the absolute gap needed to reach the 2020 target having an average growth rate till in 2020 equal to 2.1% instead of 3.7%.

Estonia had planned to increase its renewable energy generation in this sector in 2005-2010 period. In 2010 it generated a larger amount of renewable energy already exceeding by 12.5% (3 PJ or 76 ktoe) the 2020 target.

Slovenia had planned to generate less renewable energy in this sector for 2005-2010 period. According to its Progress report it generated in 2010 almost 42.5% (+189 ktoe) more renewable energy than planned exceeding its 2020 target. Moreover Slovenia had in 2009-2010 time span a growth rate 2 times higher than the growth rate for 2005-2010 indicating that it is moving very fast in the direction of renewable energy increase in heating/cooling sector.

United Kingdom had planned a significant increase in its renewable energy generation in heating/cooling sector for period 2005-2020 by a factor of 11. Nevertheless for period 2005-2010 it had originally planned to reduce its renewable energy generation. Actually it almost doubled its renewable energy generation in the sector in this time span (from 24.7 PJ to 46.7 PJ), halving the average growth rate needed for period 2010-2020. Nevertheless, the growth rate for period 2009-2010 was lower than the average growth rate of period 2005-2010 indicating that UK needs to speed up the generation of RES in this sector in order to be in line with its 2020 target.

15 MS, Bulgaria, Denmark, Germany, Estonia, Spain, France, Italy, Hungary, Austria, Poland, Portugal, Romania, Slovenia, Finland and Sweden showed an annual growth rate 2009-2010 higher than both planned and achieved average growth rates of period 2010-2020 indicating that they are speeding up their RES generation in this sector and may reach their 2020 targets even before.

6 MS, Ireland, Latvia, Lithuania, Netherlands, Slovakia and United Kingdom, had a growth rate 2009-2010 lower than both planned and achieved average growth rates for period 2010-2020 indicating the need of speeding up growing rate in this sector.

The highest absolute increase in renewable energy generation for period 2010-2020 will take place in France with 322 PJ (7.7 Mtoe) together with United Kingdom with 212 PJ (5.1 Mtoe) and Italy with 207 PJ (5 Mtoe).

Portugal can have the highest absolute decrease in renewable energy generation in this sector during 2010-2020 with 6.7 PJ (0.16 Mtoe).

Table 10. EU 27 RES-H/C generation progress, absolute and relative deviations, 2005-2020

	2005	2010	Growth		Growth		2020
	NREAPs	PR	2005-2010		2010-2020		NREAPs
	PJ	PJ	PJ	av.%	PJ	av.%	PJ
BE	20.5	43.2	22.7	22.1	65.1	15.1	108.4
BG	30.3	39.4	9.1	6.0	6.7	1.7	46.2
CZ	61.2	79.2	18.0	5.9	28.2	3.6	107.4
DK	78.3	109.9	31.7	8.1	16.8	1.5	126.8
DE	322.7	520.9	198.2	12.3	83.3	1.6	604.2
EE	21.1	28.6	7.4	7.0	-3.1	-1.1	25.4
IE	8.1	9.6	1.5	3.7	15.2	15.8	24.7
EL	44.6	48.6	3.9	1.8	31.3	6.4	79.9
ES	148.2	178.3	30.0	4.1	46.0	2.6	224.3
FR	393.4	503.5	110.1	5.6	322.6	6.4	826.1
IT	80.3	230.1	149.8	37.3	207.7	9.0	437.8
CY	1.9	3.4	1.5	15.7	1.8	5.2	5.2
LV	46.6	48.5	1.8	0.8	10.0	2.1	58.4
LT	28.8	36.9	8.1	5.6	7.1	1.9	44.0
LU	0.8	2.4	1.5	37.4	2.2	9.1	4.5

HU	0.0	44.2	44.2		33.8	7.7	78.0
MT	0.0	0.1	0.1		0.1	10.5	0.3
NL	31.6	34.6	3.0	1.9	56.6	16.3	91.2
AT	134.5	170.4	35.9	5.3	4.5	0.3	174.9
PL	4.2	194.1	189.9		53.8	2.8	247.9
PT	106.0	111.7	5.7	1.1	-6.7	-0.6	105.0
RO	133.3	166.4	33.2	5.0	2.6	0.2	169.1
SI	19.4	26.5	7.2	7.4	-0.4	-0.1	26.2
SK	15.1	22.9	7.8	10.4	11.4	5.0	34.3
FI	231.5	271.3	39.8	3.4	33.1	1.2	304.4
SE	296.6	408.3	111.7	7.5	33.1	0.8	441.4
UK	24.7	46.7	22.0	17.8	212.8	45.6	259.5
EU 27	2283.8	3379.8	1096.0	9.6	1270.8	3.8	4648.9

## 2.2 RES Electricity

### a. RES-E share

EU 27 has planned to increase its renewable energy share in electricity sector during period 2005-2020, changing from 14.7% to 33.8%. In year 2010 this share reached 19.7% being 0.1 percentage points above the planned NREAPs share.

Figure 11 and Table 11 report the development of RES-E share in gross final energy consumption in each MS of EU 27 during period 2005-2020.

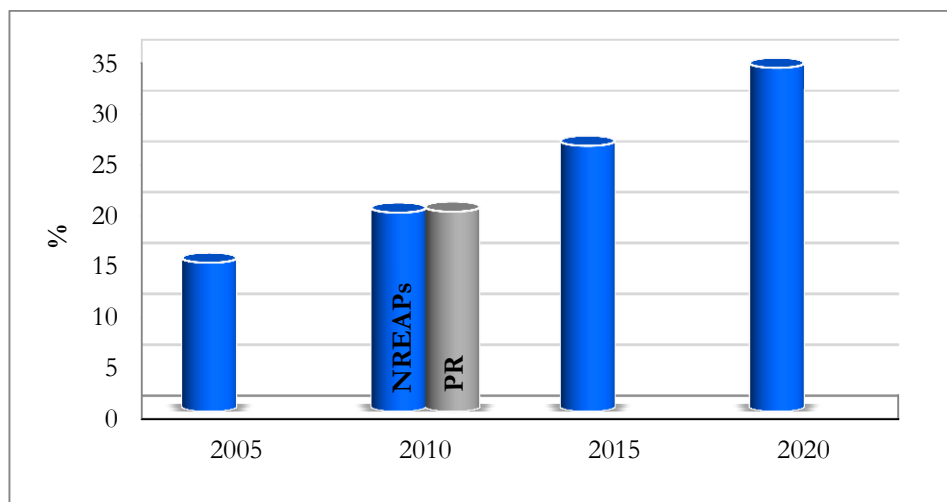


Figure 11. EU 27 RES-E share in GFEC-E progress, 2005-2020

Malta and Cyprus did not report on RES share in electricity sector for the baseline year. Both these MS did not reach their planned shares for period 2005-2010 by respectively 2.9 percentage points and 0.5 percentage points.

Only 3 MS, Latvia, Romania and Finland had planned to reduce their RES share in electricity sector during period 2005-2010. Actually only Latvia decreased its RES share in this sector for this period by 2.8 percentage points (-1.2% yearly).

More than half of MS did not exceed their planned RES share in electricity sector for year 2010 having then the need to increase their RES share during period 2010-2020 more than it was initially planned in order to fulfill the NREAPs targets.

Austria had the highest negative discrepancy between planned and achieved RES share in electricity sector for this time span with 7.9 percentage points below the target while Romania showed the highest absolute 2010 target exceedance with 4.6 additional percentage points.

Estonia had the highest relative increase in RES share by 153% because of both a low baseline RES share was and its larger than planned increase in 2005-2010.

Only Austria had originally planned to decrease its RES share in electricity sector for period 2010-2020 but actually all MS will need to increase their RES share in electricity sector in this period in order to follow their projections up to 2020.

The three highest absolute increases for RES share in electricity sector during period 2010-2020 will be expected to be in Ireland (+27.7 percentage points), Greece (+27.4 percentage points) and Netherlands (+27.3 percentage points).

Hungary will have the lowest increase of RES share in electricity sector in this period with only 3.8 percentage points.

Table 11. EU 27 RES-E share progress, absolute and relative progress, 2005-2020

	2005	2010	Growth		Growth		2020
	NREAPs	PR	2005-2010		2010-2020		NREAPs
	%	%	% points	av.%	% points	av.%	%
BE	2.7	7.0	4.3	31.6	13.9	20.0	20.9
BG	8.4	12.0	3.6	8.6	8.8	7.3	20.8
CZ	4.5	8	3.5	15.6	14.3	6.3	7.9
DK	26.8	31.0	4.2	3.2	20.9	6.7	51.9
DE	10.2	18.4	8.2	16.1	20.2	11.0	38.6
EE	1.2	10.4	9.2	153.3	7.2	6.9	17.6
IE	6.9	14.8	7.9	22.9	27.7	18.7	42.5
EL	8.0	12.4	4.4	10.8	27.4	22.1	39.8
ES	18.4	29.2	10.8	11.7	9.8	3.4	39.0
FR	13.5	14.7	1.2	1.8	12.3	8.4	27.0
IT	16.3	20.1	3.8	4.7	6.3	3.1	26.4
CY	0.0	1.4	1.4	n.a	14.6	104.3	16.0
LV	44.9	42.1	-2.8	-1.2	17.7	4.2	59.8
LT	4.0	7.4	3.4	17.0	13.6	18.4	21.0
LU	3.2	3.8	0.6	3.8	8.0	21.1	11.8
HU	4.3	7.1	2.8	13.0	3.8	5.4	10.9
MT	0.0	0.1	0.1	n.a	13.7	1715.0	13.8
NL	6.0	9.7	3.7	12.3	27.3	28.1	37.0
AT	59.8	65.3	5.5	1.8	5.3	0.8	70.6
PL	0.0	6.7	6.7		12.4	18.6	19.1
PT	29.3	41.2	11.9	8.1	14.1	3.4	55.3
RO	30.1	32.1	2.0	1.3	10.6	3.3	42.6
SI	28.5	32.2	3.7	2.6	7.1	2.2	39.3
SK	16.7	18.6	1.9	2.3	5.4	2.9	24.0



FI	27.0	27.6	0.6	0.4	5.4	2.0	33.0
SE	50.9	56.0	5.1	2.0	6.9	1.2	62.9
UK	4.7	7.4	2.7	11.5	23.6	31.9	31.0
EU 27	14.7	19.7	5.0	6.8	14.1	7.2	33.8

### b. Contribution of RES in electricity sector

According to Progress Reports EU 27 slightly slowed down its renewable energy contribution in electricity sector in 2005-2010 comparing the expectations showing a lower average growth rate (6.6%) compared with what was planned (6.9%). It reached in 2010 the amount of 2310.5 PJ (55.1 Mtoe) just 19.5 PJ (0.9 Mtoe) below the NREAP target.

Figure 12 and Table 12 report the development of RES-E contribution in electricity sector in EU 27 during period 2005-2020.

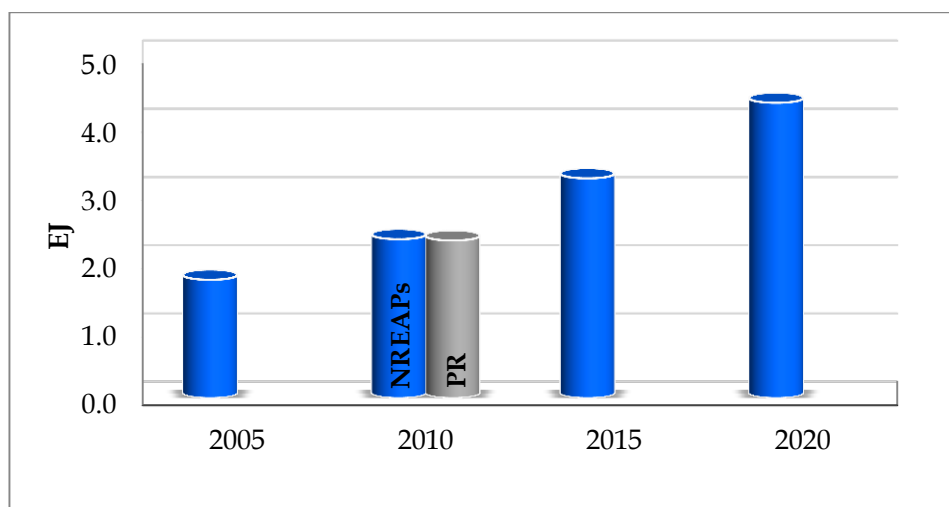


Figure 12. EU 27 RES-E contribution progress, 2005-2020

EU 27 energy contribution in electricity sector is planned to be increased up to 2020 reaching the amount of 4328.2 PJ (103.4 Mtoe) with an average growth rate of 8.7% which is slightly higher than the planned average growth rate of 8.6%.

The share of RES-E in total RES decreased from 42% that was in baseline year to 37% in 2010 and is expected that in 2020 to be increased again reaching the same share as in baseline year.

For period 2009-2010 renewable energy generation in electricity sector growth rate was found to be 7.7% which is lower than larger than the average growth achieved in 2005-2010 but smaller than the planned 2010-2020 growth rate, indicating that EU 27 should speed up carefully the increase in RES electricity generation for period 2010-2020 in order to achieve the Directive 2009/28/EC targets.

According to NREAPs only Finland had planned to reduce the energy generation in electricity sector for period 2005-2010. Actually all MS increased their renewable energy contribution in this sector during this period.

Denmark, Spain and Italy generated in this sector in 2005-2010 almost the same renewable energy that they had planned in their action plans keeping unchanged their average growth rates

while 8 MS, Ireland, Greece, France, Lithuania, Austria, Poland, Portugal and United Kingdom increased their renewable energy in this sector even they did not exceed their planned levels.

For period 2010-2020 none of MS had originally planned to decrease its RES generation in electricity sector. Actually all MS will increase their renewable energy generation in electricity sector for this period of time.

Malta and Cyprus will have the highest average growth rates in renewable energy generation for period 2010-2020 both because of their low baseline level and the significant increase in energy generation they had projected a up to 2020.

Luxemburg had on 2009-2010 period a very low growth rate (0.4%) in renewable energy generation in electricity sector compared with the average growth rate needed to reach the 2020 targets (19.1%) indicating that it needs to speed renewable electricity penetration in order to reach the target as planned.

According to its Renewable Energy Progress Report Slovenia showed that it increased the RES generation in this sector more than planned in 2005-2010 but it had a negative growth rate for period 2009-2010 (-3.3%) which indicate a slowdown in the achievements of 2020 target even that the average growth rate to be reached is 2.9%.

Bulgaria had a very fast growth in period 2009-2010 (+50.6%) in renewable energy generation in electricity sector showing that it may reach the target even before 2020 if it maintains this growth trend.

Table 12. EU 27 RES-E progress, absolute and relative deviations, 2005-2020

	2005	2010	Growth		Growth		2020
	NREAPs	PR	2005-2010		2010-2020		NREAPs
	PJ	PJ	PJ	av.%	PJ	av.%	PJ
BE	8.9	25.0	7.2	36.3	9.1	23.3	83.3
BG	11.1	18.3	7.0	13.1	23.8	5.0	27.4
CZ	8.5	18.9	10.4	24.7	19.4	10.3	38.3
DK	35.6	44.6	181.8	5.1	377.3	6.6	74.2
DE	222.0	403.8	3.2	16.4	3.3	9.3	781.1
EE	0.4	3.6	5.5	168.4	35.7	9.0	6.9
IE	8.9	14.4	5.2	12.5	76.2	24.7	50.1
EL	23.0	28.1	113.4	4.5	214.4	27.1	104.3
ES	193.6	307.0	4.1	11.7	282.0	7.0	521.5
FR	273.1	277.1	37.5	0.3	115.7	10.2	559.1
IT	202.9	240.4	0.3	3.7	4.0	4.8	356.1
CY	0.0	0.3	0.4	20805.7	7.3	151.2	4.2
LV	10.9	11.4	1.3	0.8	7.7	6.5	18.7
LT	1.7	2.9	0.2	15.2	1.8	26.5	10.7
LU	0.8	1.0	10.9	5.0	9.3	19.1	2.8
HU	0.0	10.9	0.0		1.7	8.5	20.2
MT	0.0	0.0	16.1		139.0	2700.1	1.7
NL	26.1	42.2	0.0	12.3	39.8	32.9	181.2
AT	148.8	148.8	23.8	0.0	77.2	2.7	188.6
PL	13.6	37.4	48.1	34.9	47.9	20.6	114.7
PT	32.1	80.2	5.8	29.9	49.3	6.0	128.1

RO	57.9	63.7	1.9	2.0	5.0	7.7	113.0
SI	15.2	17.1	2.2	2.5	9.7	2.9	22.1
SK	16.8	19.1	5.1	2.7	29.5	5.1	28.8
FI	85.4	90.6	25.9	1.2	47.3	3.3	120.0
SE	277.0	302.9	39.7	1.9	320.5	1.6	350.2
UK	61.0	100.7	571.9	13.0	2022.1	31.8	421.2
EU 27	1735.1	2310.5	575.3	6.6	2017.7	8.7	4328.2

## 2.3 RES Transport

### a. RES-T share<sup>8</sup>

RES share in transport sector during period 2005-2020 in EU 27 is planned to increase by a factor of more than 5, from 2% in baseline year to 11.1 % in target year. According to NREAPs the RES share in transport sector in period 2005-2010 was planned to be increased by 3 percentage points (+30.1% yearly). Actually it increased with only 2.8 percentage points (+28.5% yearly) missing the planned share by 0.2 percentage points.

Figure 13 and Table 13 report the development of RES-T share in gross final energy consumption in each MS of EU 27 during period 2005-2020.

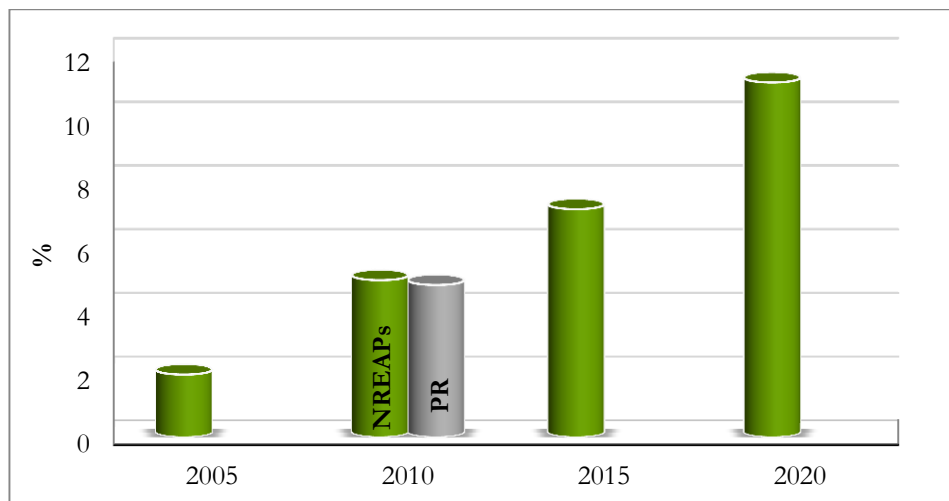


Figure 13. EU 27 RES-T share in GFEC-T progress, 2005-2020

In baseline year only 5 MS, Germany, Spain, France, Romania and Sweden had a RES share in transport sector above 1%. 9 MS, Belgium, Estonia, Ireland, Greece, Cyprus, Luxemburg, Malta, Poland and Finland, did not report any RES share for that year and the rest of MS had a RES share below 1%.

Only Spain had planned to reduce its RES share in transport sector during period 2005-2010 as actually happened. During 2005-2010 period 10 MS, Belgium, Estonia, Greece, Italy, Hungary, Austria, Poland, Portugal, Slovenia and United Kingdom, increased their RES share in transport sector even more than they had planned. Italy had the highest absolute increase with 1.3 percentage points.

<sup>8</sup> RES share in transport takes into account the final consumption of renewable energy in transport sector as recommended by Article 5(c) of Directive 2009/28/EC

Romania had planned to increase almost 4 times its RES share in transport sector during 2005-2010 period. Actually in 2010 its RES share was half of the baseline share due to the fact that the sustainability criteria for biofuels according to Article 5(1) of the RES Directive were reported not to be in place in 2010. Denmark was in the same situation as Romania regarding the framework setting for sustainability criteria from its biofuels. Due to this fact the planned increase by a factor of 5 in its RES share in transport sector was not possible to be reported for period 2005-2010.

All MS will increase the RES share in transport sector during period 2010-2020 as it was planned in their NREAPs. 10 MS will need to increase their RES share in transport in this period less than planned due to the fact that they increased this share more than planned during the previous 2005-2010 period.

The highest absolute increase in RES share in transport sector for period 2010-2020 will take place in Finland with 16.2 percentage points (+42.6% relative yearly) while the lowest absolute increase will be in Cyprus with only 3 percentage points (+15% relative yearly).

Table 13. EU 27 MS RES-T share in GFEC-T progress, 2005-2020

	2005	2010	Growth		Growth		2020
	NREAPs	PR	2005-2010		2010-2020		NREAPs
	%	%	% points	av.%	% points	av.%	%
BE	0.0	4.5	4.5		5.7	12.7	10.1
BG	0.1	0.6	0.5	100.0	10.2	170.0	10.8
CZ	0.1	4.1	4.0	800.0	6.7	16.3	10.8
DK	0.2	0.3	0.1	6.0	9.8	378.5	10.1
DE	3.9	6.2	2.3	11.8	7.0	11.3	13.2
EE	0.0	0.2	0.2		9.8	490.0	10.0
IE	0.0	2.4	2.4		7.6	31.7	10.0
EL	0.0	2.0	2.0	1950.0	8.1	41.3	10.1
ES	8.0	4.8	-3.2	-8.0	6.5	13.5	11.3
FR	1.2	5.9	4.7	78.3	4.6	7.8	10.5
IT	0.9	4.8	3.9	90.6	5.3	11.1	10.1
CY	0.0	2.0	2.0		3.0	15.0	5.0
LV	0.9	3.3	2.4	53.3	6.7	20.3	10.0
LT	0.3	3.6	3.3	219.3	6.4	17.9	10.0
LU	0.0	2.0	2.0		8.0	39.0	10.0
HU	0.2	4.7	4.5	409.1	5.3	11.2	10.0
MT	0.0	0.7	0.7		10.0	152.1	10.7
NL	0.1	3.0	2.9	580.0	7.3	24.3	10.3
AT	0.6	7.9	7.3	243.3	3.7	4.7	11.6
PL	0.0	5.9	5.9		5.5	9.3	11.4
PT	0.2	5.6	5.4	568.4	4.4	7.9	10.0
RO	1.4	0.7	-0.7	-10.2	9.3	137.1	10.0
SI	0.3	2.9	2.6	171.3	7.6	26.6	10.5
SK	0.6	4.0	3.4	113.3	6.0	15.0	10.0
FI	0.0	3.8	3.8		16.2	42.6	20.0
SE	4.0	7.3	3.3	16.5	6.5	8.9	13.8
UK	0.2	2.9	2.7	270.0	7.4	25.5	10.3
EU 27	2.0	4.8	2.8	28.5	6.4	13.3	11.1

## b. Use of RES in transport sector

Renewable energy used<sup>9</sup> in transport sector in baseline year was 170.8 PJ (4.1 Mtoe) and in 2010 it increased by 50.8 % reaching the amount of 604.6 PJ (14.4 Mtoe) and missing the planned amount of 630.2 PJ (15 Mtoe).

In 2020 the RES use in transport sector is projected to reach 1345.7 PJ (32.1 Mtoe) increasing from year 2010 with 12.3% instead of 11.4% as it was reported in NREAPs.

Its share in total RES consumption increased from 4% that was in 2005 to 10% in 2020 and is expected to reach 13% in 2020.

Annual growth rate of renewable energy used in transport sector for period 2009-2010 was only 0.1 percentage points higher than the average growth rate for period 2010-2020 indicating that EU 27 should keep this speed in order to be in good track with the 2020 target.

Figure 14 and Table 14 report the development of RES-T use in EU 27 during period 2005-2020.

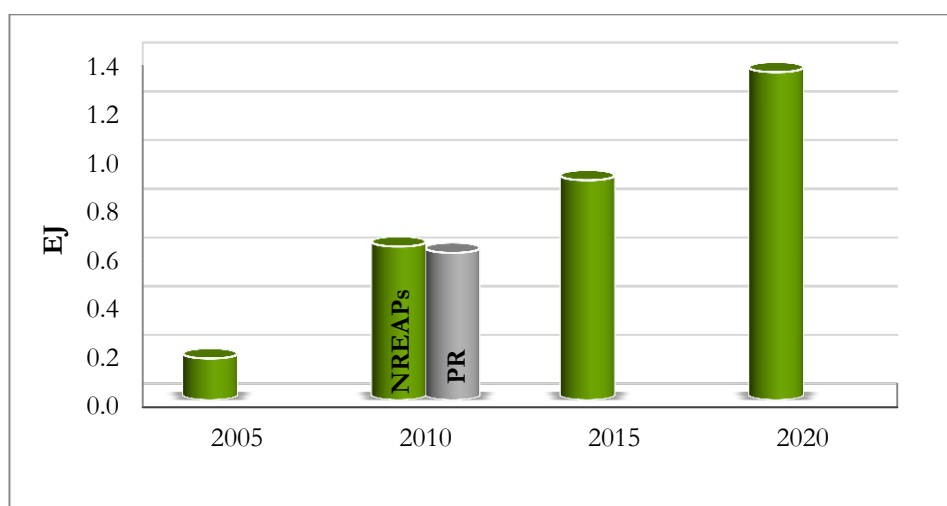


Figure 14. EU 27 RES-T use progress, 2005-2020

According to NREAPs only Estonia had planned to reduce the RES use in transport sector for period 2005-2010 but actually two MS, Estonia and Romania, reduced their RES use for this period. The rest of MS increased their RES use in transport sector following the trend they had planned in their NREAPs.

The RES use in this sector during this time span was increased in 9 MS, Greece, Italy, Luxemburg, Hungary, Austria, Portugal, Slovenia, Sweden and United Kingdom.

During period 2010-2020 none of MS will reduce the RES use in transport sector following what they had planned in their NREAPs. The growth rate in RES use during this period was planned to be 11.3% per annum in average (+715 PJ or 17.1 Mtoe) while actually an average growth rate of 12.3% (+741.1 PJ or 17.7 Mtoe) in RES use in transport sector for this period was reported. RES use in this sector for period 2005-2010 in Denmark was planned to be increased by 73.3% (from 0.4 PJ to 1.8 PJ). Actually Denmark used only 0.5 PJ in 2010 with an average growth rate

<sup>9</sup> Renewable energy used in transport sector includes the contribution of all sources ( bioethanol, biodiesel, renewable electricity and others) as recommended by Article 5(c) of Directive 2009/28/EC (double counting of renewable electricity) and it is used in the calculation of overall RES share in GFEC in EU 27

of 4%. For period 2010-2020 the expected increase in RES use in this sector should have a factor of 26.5 (259.4% yearly instead of 59.3% yearly) in order to reach the target of 291 PJ as planned in its NREAP. Nevertheless, data for Denmark are affected by the reported lack of a framework for dealing with biofuels sustainability criteria.

The highest absolute increase in RES use in transport sector for period 2010-2020 will take place in United Kingdom with 136.8 PJ and the lowest in Malta with 0.5 PJ.

Table 14. EU 27 RES-T use progress, 2005-2020

	2005	2010	Growth		Growth		2020
	NREAPs	PR	2005-2010		2010-2020		NREAPs
	PJ	PJ	PJ	av.%	PJ	av.%	PJ
BE	0.7	14.5	13.8	401.0	22.7	15.7	37.1
BG	0.1	0.6	0.5	73.3	12.1	205.7	12.6
CZ	0.4	10	9.7	513.3	19	18.9	29.1
DK	0.4	0.5	0.1	4.0	11.7	259.4	12.2
DE	87.4	134.4	47.0	10.8	122.7	9.1	257.1
EE	0.2	0.0	-0.1	-15.8	3.7	1174.2	3.8
IE	0.1	3.9	3.8	795.8	17.8	45.8	21.7
EL	0.1	5.5	5.4	2163.3	21.1	38.4	26.5
ES	10.3	61.4	51.2	99.8	73.2	11.9	134.6
FR	22.8	110.3	87.5	76.9	59.7	5.4	170.1
IT	13.3	69.1	55.8	83.8	52.3	7.6	121.4
CY	0.0	0.6	0.6		1.0	15.7	1.6
LV	0.3	1.3	1.0	68.6	2.2	16.8	3.5
LT	0.2	1.9	1.8	235.6	5.2	26.8	7.1
LU	0.1	1.8	1.8	399.0	7.6	41.4	9.5
HU	0.2	8.0	7.8	744.0	14.4	18.0	22.4
MT	0.0	0.0	0.0		0.5	235.8	0.6
NL	0.3	10.6	10.3	615.0	27.3	25.6	37.9
AT	8.6	29.9	21.3	49.6	6.0	2.0	35.8
PL	2.3	37.9	35.7	315.6	46.1	12.1	84.0
PT	0.5	14.6	14.1	561.0	7.8	5.3	22.4
RO	1.7	1.4	-0.3	-3.8	21.7	156.2	23.1
SI	0.2	2.1	2.0	239.1	6.4	30.1	8.5
SK	0.3	3.7	3.4	202.5	4.9	13.3	8.7
FI	0.8	6.2	5.4	128.7	18.9	30.3	25.1
SE	12.1	23.9	11.8	19.6	18.3	7.7	42.2
UK	7.9	50.4	42.5	108.1	136.8	27.1	187.2
EU 27	170.8	604.6	433.8	50.8	741.1	12.3	1345.7

### c. Contribution of RES in transport sector

According to NREAPs the contribution of RES<sup>10</sup> in transport sector in baseline year was 125.4 PJ (3 Mtoe) accounting for a share of 3% in total RES.

<sup>10</sup> RES contribution in transport sector does not include the renewable electricity used in this sector and is used to calculate the total RES contribution in Gross Final Energy Consumption

In 2010 RES transport increased significantly with an average growth rate of 69.0% reaching 558 PJ (13.3 Mtoe) and its share in total RES increased up to 9%. Nevertheless it missed the planned amount for this year by 18.0 PJ (0.4 Mtoe) and the planned share in total RES of 10%.

In 2020 the RES contribution in transport sector is planned to reach 1210.6 PJ (28.9 Mtoe) with an average growth rate of 11.7% instead of 11% as it was reported in the NREAPs. This increase should follow the projections in order to reach in 2020 a RES share equal to 12%.

In period 2009-2010 the annual growth rate of RES contribution in transport sector was 12.8%, slightly higher than both planned and actual RES contribution average growth rate for period 2010-2020 indicating that EU 27 is in good track for the fulfillment of 2020 target.

Figure 15 and Table 15 report the development of RES-T contribution in EU 27 during period 2005-2020.

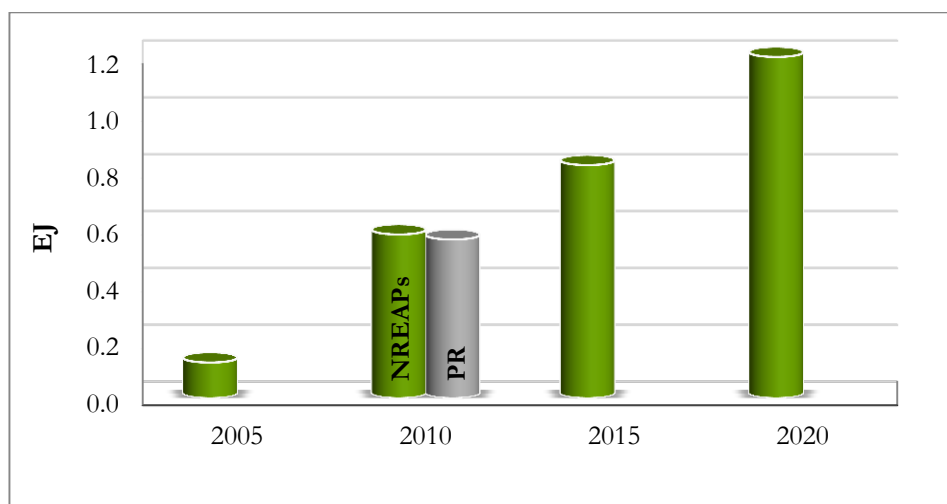


Figure 15. EU 27 RES-T contribution progress , 2005-2020

All MS had planned to increase their RES contribution in transport sector for 2005-2010 and 2010-2020 time span. Actually all MS increased their RES contribution in this sector during period 2005-2010 and are planned to increase it even during period 2010-2020.

In baseline year 12 MS, Belgium, Bulgaria, Denmark, Estonia, Cyprus, Malta, Netherlands, Portugal, Romania, Slovenia, Slovakia and Finland did not report any RES contribution in transport sector. In this group only 3 MS, Denmark, Estonia and Romania reported no RES contribution in this sector for period 2005-2010 due to the fact that their biofuels did not fulfill the sustainability criteria as defined in Article 5 of the Directive.

9 MS, Belgium, Greece, Italy, Hungary, Austria, Portugal, Slovenia, Sweden and United Kingdom, reported a higher RES contribution in transport sector than what they had planned for period 2005-2010. For period 2010-2020 these MS do not need to speed up their RES contribution in this sector in order to reach their projected 2020 targets.

The highest increases of RES contribution in transport sector for period 2010-2020 will be expected in United Kingdom with 128 PJ (3.1 Mtoe) and Germany with 101.5 PJ (2.4 Mtoe) while the lowest increase is projected for Malta with 0.5 PJ (4.1 ktoe).

Bulgaria will have the highest relative increase of RES contribution in transport sector for this period with 251% on a yearly base. During period 2009-2010 it reached an annual growth rate

equal to the half of the average annual growth rate needed to reach the 2020 target indicating that it needs to speed up the increase of its RES contribution in transport sector during period 2010-2020.

Malta will have the second highest relative increase with 223% yearly from 33% planned for this period. During period 2009-2010, Malta had indeed a negative annual growth rate of RES contribution in transport sector.

Table 15. EU 27 MS RES-T progress, 2005-2020

	2005	2010	Growth		Growth		2020
	NREAPs	PR	2005-2010		2010-2020		NREAPs
	PJ	PJ	PJ	av. %	PJ	av.%	PJ
BE	0.0	14.4	14.4		18.7	13.0	33.0
BG	0.0	0.5	0.5		11.6	250.9	12.0
CZ	0.1	9.8	9.6	1533.3	18.4	18.8	28.1
DK	0.0	0.0	0.0		11.0		10.9
DE	80.3	127.6	47.3	11.8	101.5	8.0	229.1
EE	0.2	0.0	-0.2		3.7		3.7
IE	0.1	3.9	3.8	1417.5	16.3	42.4	20.2
EL	0.1	5.4	5.3	2113.3	20.5	38.2	25.8
ES	5.8	59.2	53.4	185.5	54.4	9.2	113.6
FR	16.9	103.8	87.0	103.1	49.4	4.8	153.2
IT	7.5	61.4	53.9	143.8	44.5	7.3	105.9
CY	0.0	0.6	0.6		1.0	15.3	1.6
LV	0.1	1.1	1.0	160.0	2.1	18.5	3.2
LT	0.2	1.9	1.7	230.0	5.1	27.1	7.0
LU	0.0	1.8	1.7	820.0	7.3	41.4	9.0
HU	0.2	7.4	7.2	684.0	14.0	19.0	21.4
MT	0.0	0.0	0.0		0.5	223.1	0.5
NL	0.0	9.6	9.6		25.3	26.4	34.9
AT	1.8	21.7	19.9	221.4	2.7	1.3	24.5
PL	2.3	37.1	34.9	308.5	45.3	12.2	82.4
PT	0.0	13.8	13.8		6.2	4.5	20.0
RO	0.0	0.0	0.0		20.8		20.7
SI	0.0	2.1	2.1		5.9	27.7	8.0
SK	0.0	3.4	3.4		4.6	13.4	8.0
FI	0.0	5.5	5.5		17.9	32.6	23.4
SE	7.0	18.0	11.0	31.5	15.9	8.8	33.9
UK	3.1	48.1	44.9	286.1	128.0	26.6	176.1
EU 27	125.4	558	432.6	69.0	652.7	11.7	1210.6

#### d. RES-T 2020 target

According to Directive 2009/28/EC the contribution of renewables in transport sector in EU 27 should reach 10% target in 2020. Multiple counting calculations according to the methodology presented in Table 4b of the Template established by the Commission Decision of 30.06.2009 are used to assess the progress of this target in EU 27 MS during period 2005-2020.

RES in transport taking into account multiple counting amounted to 173.3 PJ (4.1 Mtoe) in 2005 with a share in gross final energy consumption in this sector of 1.3%.



Figure 16 and Table 16 report the development of RES-T with multiple counting in each MS of EU 27 during period 2005-2020.

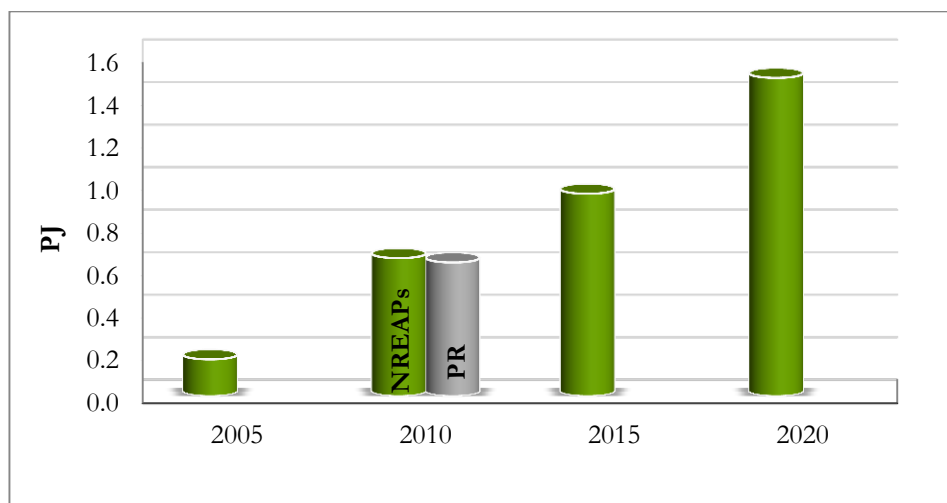


Figure 16. EU 27 RES-T with multiple counting progress, 2005-2020

In 2010 multiple counting RES in transport sector reached 628.8 PJ and increased from baseline year with an average rate of 52.6%. The share in gross final energy consumption in 2010 in this sector reached the level of 4.96% compared with 4.95% planned at NREAPs.

During period 2010-2020 EU 27 should double its additional contribution in RES with multiple counting in transport sector in order to reach the 2020 target of 10%. According to NREAPs EU 27 will reach in 2020 the amount of 1496.6 PJ (35.7 Mtoe) with a share in gross final energy consumption in this sector of 11.4%. During period 2010-2020 the average growth rate of RES with multiple counting in EU 27 will be 13.8% which is equal to the annual growth rate for period 2009-2010 indicating that EU 27 is in good track for the fulfilment of this specific target in 2020.

Only Estonia and Romania had a decrease in RES with multiple counting in 2010 compared with the baseline year. France, Austria and Portugal will show an additional amount of RES with multiple counting in transport sector during period 2010-2020 smaller the additional amount achieved in 2005-2010. The rest of MS will need an additional RES with multiple counting in transport sector in the 2010-2020 higher than the additional RES achieved during period 2005-2010.

Table 16. EU 27 MS RES-T with multiple counting progress, 2005-2020

	2005	2010	Growth		Growth		2020
	NREAPs	PR	2005-2010	av. %	2010-2020	av. %	NREAPs
	PJ	PJ	PJ		PJ		PJ
BE	0.7	14.5	13.8	401.0	27.9	19.3	42.4
BG	0.1	0.6	0.5	73.3	12.7	217.1	13.3
CZ	0.4	10.0	9.7	513.3	31.5	31.3	41.5
DK	0.4	0.5	0.1	4.0	18.0	397.4	18.4
DE	87.4	134.4	47.0	10.8	143.6	10.7	278.0
EE	0.2	0.1	-0.1	-13.2	3.7	724.7	3.8
IE	0.1	7.7	7.6	1310.9	16.2	20.9	23.9
EL	0.1	6.1	6.1	2413.3	20.8	33.9	26.9

ES	10.3	61.6	51.4	100.2	91.2	14.8	152.9
FR	22.8	113.0	90.2	79.2	66.1	5.9	179.1
IT	14.2	70.7	56.5		73.6	10.4	144.3
CY	0.0	0.6	0.6		2.6	41.2	3.2
LV	0.4	1.4	1.1	60.0	4.0	28.2	5.4
LT	0.2	2.0	1.8	243.9	5.1	25.7	7.1
LU	0.2	1.8	1.7	214.7	7.9	43.1	9.8
HU	0.2	8.0	7.8		15.7	19.6	23.7
MT	0.0	0.0	0.0		0.7	151.1	0.7
NL	0.3	14.2	13.9	830.0	31.7	22.2	45.9
AT	8.6	29.9	21.3	49.6	10.3	3.4	40.1
PL	2.3	46.8	44.5	394.1	47.8	10.2	94.6
PT	0.5	14.8	14.3	570.0	9.2	6.2	24.0
RO	2.4	1.4	-1.0	-8.5	27.2	195.9	28.6
SI	0.2	2.1	2.0	239.1	6.4	30.4	8.6
SK	0.3	3.7	3.4	202.5	7.8	20.8	11.5
FI	0.8	6.2	5.4	128.7	27.1	43.5	33.3
SE	12.6	26.2	13.6	21.5	20.5	7.8	46.7
UK	7.9	50.4	42.6	108.1	138.6	27.5	189.1
EU 27	173.3	628.8	455.5	52.6	867.8	13.8	1496.6

### 3. Renewable Energy Sources

#### 3.1 Hydropower

##### a. Installed capacity

Hydropower installed capacity in 2005 was 108.3 GW, in 2010 reached ~101 GW and it is projected to increase to 124.7 GW in 2020. In 2010 the hydropower installed capacity dropped by 7.4 GW compared with 2005 and is expected to be increased by 23.7 GW in 2020.

The share of installed hydropower capacity in the total renewable electricity capacity has decreased from 64.6% in 2005 to 41.9%, below the expected share of 45.7% for 2010. Since the hydro plant capacity is expected to increase to a limited extent until 2020 in comparison with other renewables, the share of installed hydro plant in total renewable capacity is expected to further decrease down to 26.8% until 2020.

Figure 17 and Table 17 report the development of hydropower technology in EU 27 during period 2005-2020.

According to Progress Reports 9 MS, Bulgaria, Denmark, Greece, France, Italy, Lithuania, Austria, Portugal and United Kingdom reported for 2010 a smaller hydropower installed capacity than what was reported for 2005 baseline year at the NREAPs. The highest absolute decrease in hydropower installed capacity compared with 2005 was reported by United Kingdom as 2.64 GW (-12.3% yearly growing rate) followed by France with 2.58 GW less (-2.5% yearly) and Italy with 1.23 GW less (-1.6% yearly).

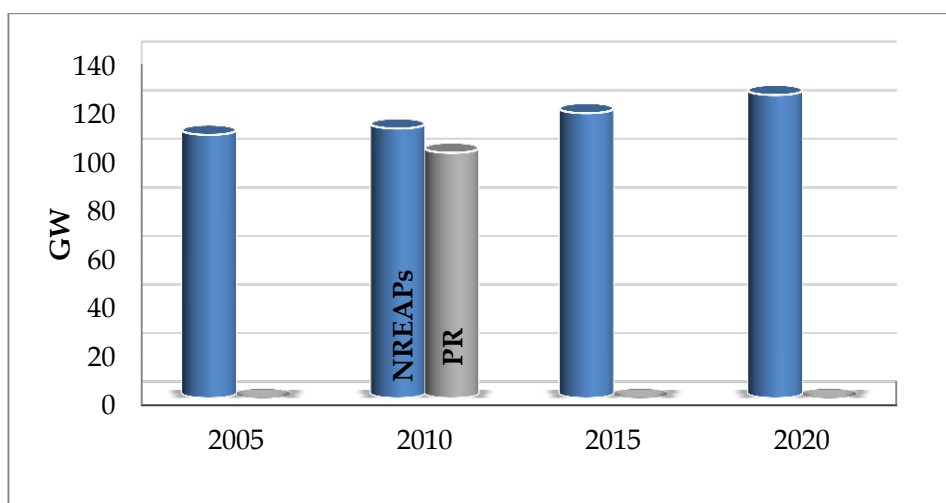


Figure 17. Hydropower installed capacity in the EU 27, 2005-2020

The highest increase in hydropower installed capacity during period 2005-2010 was found in Sweden with an additional capacity equal to 322 MW (+0.4% yearly). Spain followed with 104 MW more (+0.2% yearly) together with Finland that had an additional hydropower capacity 100 MW (+0.7% yearly).

In period 2010-2020 the highest absolute increase in hydropower installed capacity will be expected in United Kingdom with 6.1 GW (+36.8% yearly) together with Portugal with 5.5 GW (+13.8% yearly), France with 5 GW (+2.7% yearly), Italy with 3.6 GW (+2.5% yearly) and Greece with 2 GW (+8.0% yearly).

5 MS, Germany, Ireland, Latvia, Finland and Sweden will need to slow down their increase on hydropower installed capacity in order to reach in 2020 the planned targets as reported in their NREAPs.

Romania had in 2005 the highest share of hydropower in RES electricity installed capacity with almost 100%, Bulgaria 99.6%, Slovenia 98.2%, Czech Republic 97.8% and Latvia 97.7%. In 2010 the highest shares were found in Latvia with 97.2%, Slovenia with 94.6%, Romania with 94.3%, Slovakia with 81.3% and Austria with 77.6%. Slovenia will have the highest share in 2020 with 79.9% together with Latvia with 71.5%, Sweden with 68.6%, Austria with 68.3% and Slovakia with 66%.

Table 17. EU 27 hydropower installed capacity progress, 2005-2020

	2005	2010	Growth		Growth		2020
	NREAPs	PR	2005-2010		2010-2020		NREAPs
	MW	MW	MW	av.%	MW	av.%	MW
BE	108	119	11	2.0	21	1.8	140
BG	2051	1653	-398	-3.9	771	4.7	2424
CZ	1020	1048	28	0.5	49	0.5	1097
DK	10	9	-1	-2.0	1	1.1	10
DE	4329	4400	71	0.3	-91	-0.2	4309
EE	5	6	1	2.2	2	3.0	8
IE	234	237	3	0.3	-3	-0.1	234
EL	3107	2516	-591	-3.8	2015	8.0	4531
ES	13084	13188	104	0.2	673	0.5	13861
FR	21046	18464	-2582	-2.5	5032	2.7	23496

IT	15466	14234	-1232	-1.6	3566	2.5	17800
CY	0	0	0		0		0
LV	1536	1576	40	0.5	-26	-0.2	1550
LT	128	116	-12	-1.8	25	2.1	141
LU	34	34	0	0.0	10	2.9	44
HU	0	53	53		14	2.6	67
MT	0	0	0		0		0
NL	37	37	0	0.0	31	8.4	68
AT	7907	7843	-64	-0.2	1155	1.5	8998
PL	915	937	22	0.5	215	2.3	1152
PT	4816	4013	-803	-3.3	5535	13.8	9548
RO	6289	6382	93	0.3	1347	2.1	7729
SI	981	1074	93	1.9	279	2.6	1353
SK	1597	1600	3	0.0	212	1.3	1812
FI	3040	3140	100	0.7	-40	-0.1	3100
SE	16302	16624	322	0.4	-307	-0.2	16317
UK	4289	1649	-2640	-12.3	3271	19.8	4920
EU 27	108331	100952	-7380	-1.4	23757	2.4	124709

## b. Electricity generation

In 2010 hydropower was still the highest contributor to the renewable electricity generation with 1201.4 PJ (333.7 TWh). The electricity generation from hydropower was planned to increase from 2005 by 1.4% yearly but in fact it dropped by 0.1% yearly (4.6 PJ or 1.3 TWh)

The share of hydropower in total renewable electricity generation has decreased from 69.6% in 2005 to 52% in 2010. For 2020 the electricity generation from hydropower is projected to reach 1306.8 PJ (363 TWh) representing 30.2% of the total renewable electricity generation. The additional electricity generation from hydro in 2010-2020 is expected to be 105.4 PJ (29.3 TWh) with an average growth rate of 0.9%.

Figure 18 and Table 18 report the development of hydropower technology in each MS during period 2005-2020.

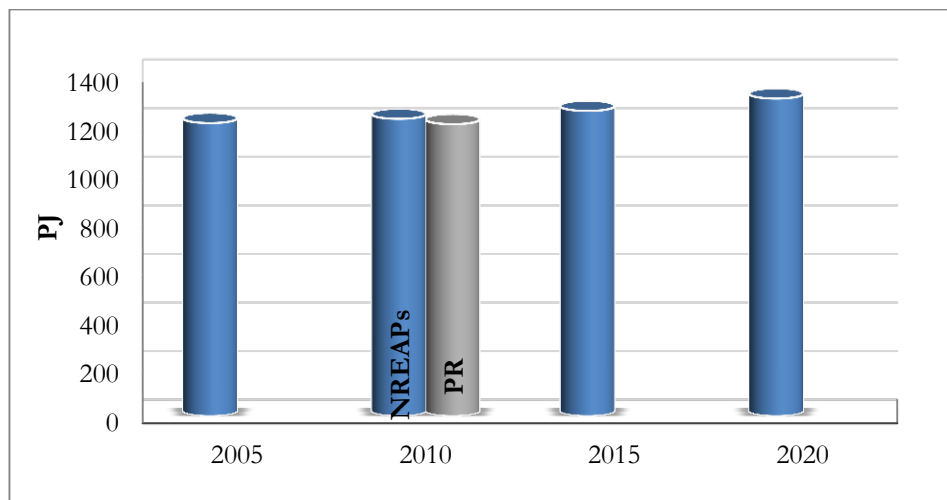


Figure 18. EU 27 hydropower electricity generation progress, 2005-2020

4 MS, Czech Republic, Ireland, Italy and Sweden had set their 2005 baseline hydropower electricity generation higher than their 2020 targets. During period 2005-2010 11 MS, Czech Republic, Ireland, Greece, France, Italy, Lithuania, Austria, Slovakia, Finland, Sweden and United Kingdom decreased their hydropower electricity generation.

Portugal had the highest absolute increase in 2005-2010 period with 19.7 PJ (5.5 TWh) together with Germany with 13.4 PJ (3.7 TWh).

During period 2010-2020 4 MS, Bulgaria, Germany, Ireland and Sweden do not need to increase their hydropower electricity generation to be in good track for their 2020 targets in this technology as their 2010 reported value was higher than their 2020 target.

The highest absolute increase during period 2010-2020 in hydropower electricity will be in France with 40.6 PJ (11.3 TWh), Austria with 26.9 PJ (7.5 TWh) and Portugal with 12.6 PJ (3.5 TWh).

The highest share of hydro power production in total RES electricity was achieved in 2010 in Romania with 97.9%, Latvia with 96.8%, Slovenia with 95.0%, Slovakia with 87.1% and Bulgaria with 85.2%. In 2020, the highest hydropower share in renewable electricity generation is expected to be reached in Slovenia with 83.6%, followed by Austria with 80%, Sweden with 69.9%, Slovakia with 67.5% and Romania with 63.0%.

Table 18. EU 27 MS hydropower generation progress, 2005-2020

	2005	2010	Growth		Growth		2020
	NREAPs	PR	2005-2010		2010-2020		NREAPs
	PJ	PJ	PJ	av. %	PJ	av. %	PJ
BE	1.3	1.34	0.08	1.3	0.24	1.8	1.58
BG	11.0	15.59	4.54	8.2	-2.22	-1.4	13.36
CZ	5.8	7.80	1.97	6.8	1.94	2.5	9.74
DK	0.1	0.08	0.00	0.0	0.03	3.5	0.11
DE	70.9	84.24	13.37	3.8	-12.24	-1.5	72.00
EE	0.1	0.08	0.01	1.9	0.03	3.6	0.11
IE	2.74	2.70	-0.04	-0.3	-0.17	-0.6	2.52
EL	18.1	16.29	-1.77	-2.0	7.38	4.5	23.67
ES	109.3	113.56	4.30	0.8	4.57	0.4	118.13
FR	252.9	217.54	-35.32	-2.8	40.6	1.9	258.13
IT	157.6	148.52	-9.04	-1.1	2.68	0.2	151.20
CY	0.0	0.00	0.00		0.00		0.00
LV	10.6	10.92	0.33	0.6	0.07	0.1	10.98
LT	1.6	1.51	-0.12	-1.4	0.18	1.2	1.69
LU	0.4	0.39	0.04	2.0	0.06	1.5	0.45
HU	0.0	0.76	0.76		0.09	1.2	0.85
MT	0.0	0.00	0.00		0.00		0.00
NL	0.4	0.36	0.00	0.2	0.30	8.2	0.66
AT	133.7	124.73	-8.92	-1.3	26.9	2.2	151.60
PL	7.9	8.60	0.68	1.7	2.08	2.4	10.69
PT	18.4	38.10	19.68	21.4	12.6	3.3	50.66
RO	57.9	62.37	4.44	1.5	8.80	1.4	71.17
SI	14.8	16.24	1.48	2.0	2.20	1.4	18.44
SK	16.7	16.60	-0.09	-0.1	2.84	1.7	19.44

FI	50.1	49.98	-0.10	0.0	1.93	0.4	51.91
SE	246.3	245.85	-0.46	0.0	-1.05	-0.0	244.80
UK	17.7	17.24	-0.47	-0.5	5.65	3.3	22.90
EU 27	1206.1	1201.4	-4.65	-0.1	105.4	0.9	1306.8

### 3.2 Geothermal

The use of geothermal energy for electricity and heating and cooling increased to a limited extent in the EU27, reaching 42.2 PJ with an additional use of geothermal energy from 2005 equal to 4.0 PJ or an average growth rate per year of 2.1%. For 2020, the use for electricity, heating and cooling is projected to reach 149.3 PJ in 2020 with an average growth rate per year equal to 25.4%. The additional use of geothermal energy in 2010-2020 is expected to be 107.1 PJ, which is about 254% of the 2010 use of geothermal energy.

Figure 19 and Table 19 report the development of the use of geothermal energy in EU 27 during period 2005-2020.

The share of geothermal energy use for electricity, heating and cooling in the total use of renewable energy was rather marginal in 2010 and decreased from 0.9% in 2005 to 0.7% in 2010, below the expected share of 0.9% for 2010. The share of geothermal energy into total renewable energy is expected to slightly increase to 1.5% until 2020.

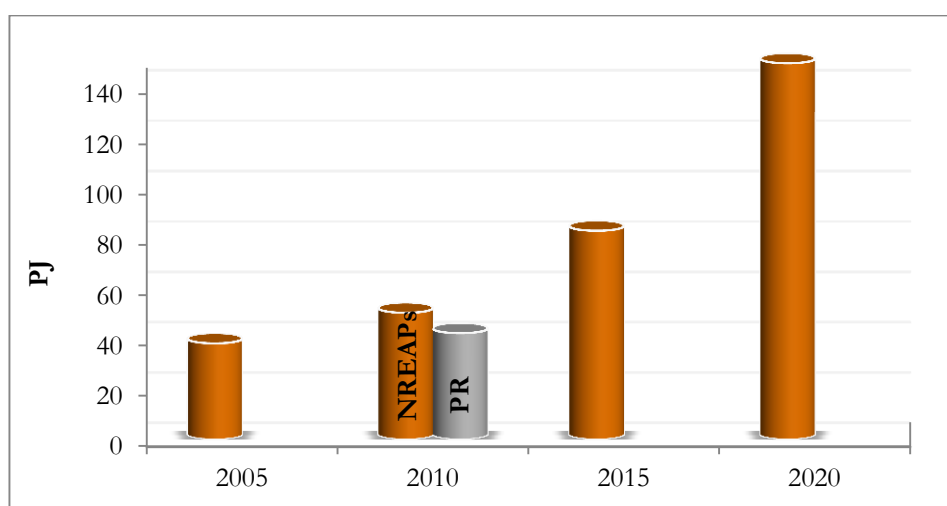


Figure 19. EU 27 geothermal energy progress, 2005-2020

Leading countries in the use of geothermal energy (both electricity and heating and cooling) in 2010 were Italy with 25.2 PJ, Hungary with 4.1 PJ, France with 3.8 PJ, Bulgaria with 1.4 PJ and Germany with 1.2 PJ. In 2020, leading countries in geothermal energy are expected to be Italy with 36.9 PJ, Germany with 34.7 PJ, France with 22.6 PJ, Hungary with 16.4 PJ and the Netherlands with 10.8 PJ.

The leading countries with the highest share of geothermal energy in total RES use in 2010 were Hungary with 6.6%, Italy with 4.7%, Slovenia with 2.5%, Bulgaria with 2.4% and Greece with 0.8%. In 2020, the highest shares of geothermal energy in total RES use is expected to be reached in Hungary with 13.7%, Slovakia with 5.5%, Italy with 4.1%, the Netherlands with 3.5% and Greece with 2.3%.

Table 19. EU 27 MS geothermal energy progress, 2005-2020

	2005	2010	Growth		Growth		2020
	NREAPs	PR	2005-2010	av.%	2010-2020	av.%	NREAPs
	PJ	PJ	PJ	av.%	PJ	av.%	PJ
BE	0.1	0.1	0.0	-6.4	0.3	33.2	0.3
BG	0.0	1.4	1.4		-1.0	-7.3	0.4
CZ	0.0	0.0	0.0		0.7		0.7
DK	0.0	0.2	0.2		-0.2	-10.0	0.0
DE	0.5	1.2	0.7	25.9	33.5	290.3	34.7
EE	0.0	0.0	0.0		0.0		0.0
IE	0.0	0.0	0.0		0.0		0.0
EL	0.4	0.7	0.3	12.0	4.1	61.4	4.8
ES	0.2	0.2	0.0	1.1	1.3	78.3	1.5
FR	5.8	3.8	-2.0	-6.8	18.8	49.2	22.6
IT	28.1	25.2	-2.9	-2.1	11.7	4.6	36.9
CY	0.0	0.0	0.0		0.0		0.0
LV	0.0	0.0	0.0		0.0		0.0
LT	0.1	0.1	0.0	6.7	0.1	15.0	0.2
LU	0.0	0.0	0.0		0.0		0.0
HU	0.0	4.1	4.1		12.3	29.6	16.4
MT	0.0	0.0	0.0		0.0		0.0
NL	0.0	0.3	0.3		10.5	313.8	10.8
AT	0.8	0.8	0.0	1.0	0.8	10.0	1.7
PL	0.5	0.6	0.1	3.5	6.9	122.8	7.5
PT	0.2	1.1	0.9	74.0	1.7	14.9	2.8
RO	0.7	1.0	0.3	8.6	2.3	22.9	3.3
SI	0.7	1.1	0.4	12.5	-0.3	-2.3	0.8
SK	0.1	0.3	0.2	33.3	3.5	105.7	3.9
FI	0.0	0.0	0.0		0.0		0.0
SE	0.0	0.0	0.0		0.0		0.0
UK	0.0	0.0	0.0	0.0	0.0	-10.0	0.0
EU 27	38.2	42.2	4.0	2.1	107.1	25.4	149.3

### 3.2.1 Geothermal electricity

#### a. Installed capacity

Geothermal power installed capacity was estimated at 741.2 MW in 2005 and it is projected to increase to 1612.9 MW in 2020. In 2010 geothermal installed capacity increased to 823.0 MW compared to the expected capacity of 816.0 MW with an average growth rate of 2.2%. The additional geothermal installed capacity in 2010-2020 is expected to be 790 MW in the EU27, reaching an amount that represent almost double of the existing geothermal capacity. The average growth rate of geothermal installed capacity during this period will be 9.6%.

Figure 20 and Table 20 report the development of geothermal installed capacity in EU 27 during period 2005-2020.

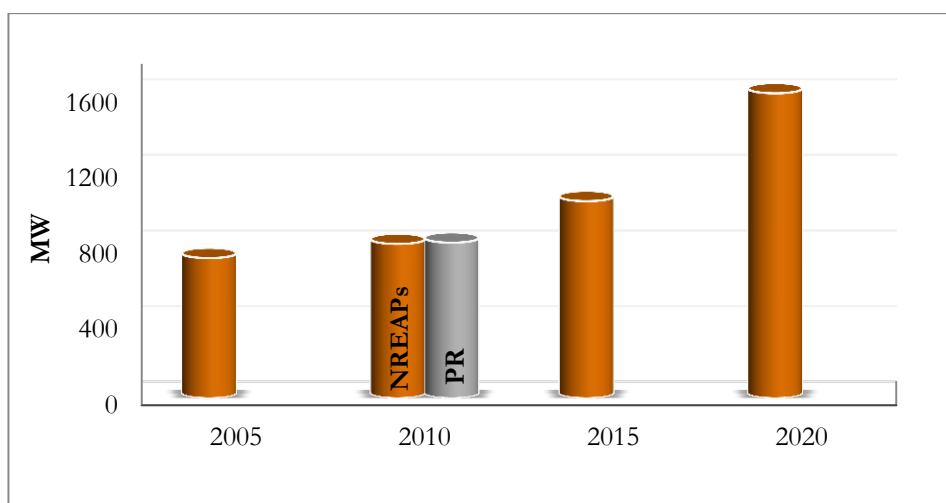


Figure 20. EU 27 geothermal electricity installed capacity progress, 2005-2020

The installed geothermal power plant capacity is marginal in the EU27, with a share of only 0.3% in the total renewable power capacity, decreasing from 0.4% in 2005. Although the geothermal plant capacity is expected to double until 2020, the share of installed geothermal plant capacity is expected to remain at the same low level of 0.3% in the EU27 in 2020.

In 2010 only 5 MS, Germany, France, Italy, Austria and Portugal, had installed capacity in geothermal technology. Italy had the highest installed capacity in geothermal technology with an additional capacity in 2010 compared with 2005 equal to 61 MW (+1.72% yearly)

Only 10 MS, Belgium, Czech Republic, Germany, Greece, Spain, France, Italy, Hungary, Portugal and Slovakia set a 2020 target in the geothermal capacity. The highest absolute increase during period 2010-2020 will be expected in Germany with 288 MW followed by Italy with 148 MW and Greece with 120 MW.

Table 20. EU 27 geothermal capacity progress, absolute and relative deviations, 2005-2020

	2005	2010	Growth		Growth		2020
	NREAPs	PR	2005-2010		2010-2020		NREAPs
	MW	MW	MW	av. %	MW	av. %	MW
BE	0	0	0	0	4	0	4
BG	0	0	0	0	0	0	0
CZ	0	0	0	0	4	0	4
DK	0	0	0	0	0	0	0
DE	0	10	10	980	288	288	298
EE	0	0	0	0	0	0	0
IE	0	0	0	0	0	0	0
EL	0	0	0	0	120	0	120
ES	0	0	0	0	50	0	50
FR	15	15	0	0	65	43.3	80
IT	711	772	61	1.72	148	1.9	920
CY	0	0	0	0	0	0	0
LV	0	0	0	0	0	0	0
LT	0	0	0	0	0	0	0
LU	0	0	0	0	0	0	0
HU	0	0	0	0	57	0	57



MT	0	0	0	0	0	0	0
NL	0	0	0	0	0	0	0
AT	1	1	0	0	0	0	1
PL	0	0	0	0	0	0	0
PT	14	25	11	15.7	50	20.0	75
RO	0	0	0	0	0	0	0
SI	0	0	0	0	0	0	0
SK	0	0	0	0	4	0	4
FI	0	0	0	0	0	0	0
SE	0	0	0	0	0	0	0
UK	0	0	0	0	0	0	0
EU 27	741	823	82	2.2	790	9.6	1613

## b. Electricity generation

Geothermal energy was also a minor contributor to the 2010 electricity generation in the EU27, with 20.2 PJ (5.6 TWh), representing 0.9% of the total renewable electricity generation. The electricity generation from geothermal energy is planned to show an increasing trend since 2005 from 19.7 PJ (5.5 TWh) to 39.2 PJ (10.9 TWh) in 2020. The average growth rate in 2005-2010 was only 0.5% and for 2010-2020 period will be 9.4%.

Figure 21 and Table 21 report the development of RES-E contribution in electricity sector in EU 27 during period 2005-2020.

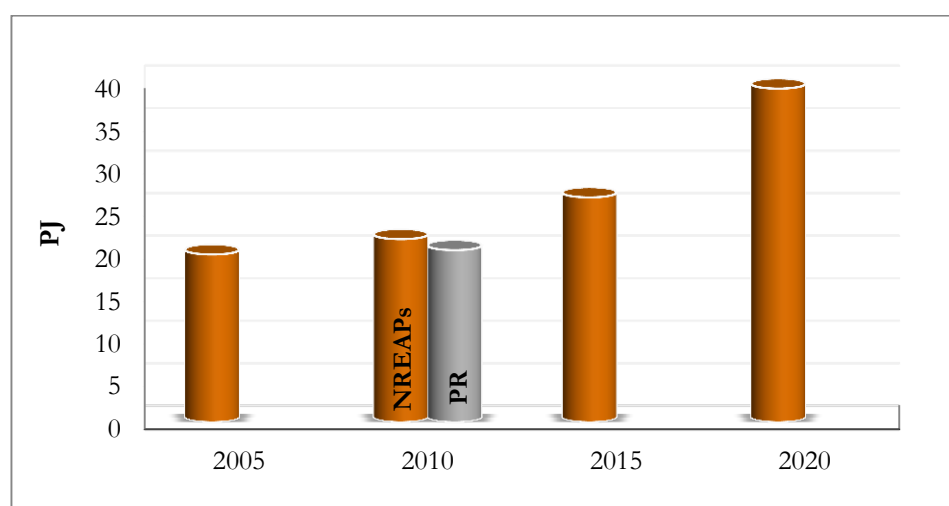


Figure 21. EU 27 geothermal electricity generation progress, 2005-2020

In period 2005-2010 only 5 MS, Germany, France, Italy, Austria and Portugal generated electricity from this technology. Portugal had the highest absolute additional electricity generation from geothermal with 0.51 PJ (142 GWh).

The additional electricity generated from geothermal during period 2010-2020 should be increased 38 times in order to reach the 2020 EU 27 target for this technology. The highest absolute increase from 2010 level will be in Germany with 5.8 PJ (1.6 TWh) and Italy with 4.9 PJ (1.1 TWh).

Table 21. EU 27 geothermal electricity progress, 2005-2020

	2005	2010	Growth		Growth		2020
	NREAPs	PR	2005-2010		2010-2020		NREAPs
	PJ	PJ	PJ	av.%	PJ	av.%	PJ
BE	0	0	0	0	0.10	0	0.1
BG	0	0	0	0	0	0	0
CZ	0	0	0	0	0.07	0	0.07
DK	0	0	0	0	0	0	0
DE	0.001	0.108	0.11	2980	5.8	541.3	6.0
EE	0	0	0	0	0	0	0
IE	0	0	0	0	0	0	0
EL	0	0	0	0	2.6	0	2.6
ES	0	0	0	0	1.1	0	1.1
FR	0.34	0.05	-0.29	-16.8	1.7	306.7	1.7
IT	19.2	19.4	0.18	0.2	4.9	2.6	24.3
CY	0	0	0	0	0	0	0
LV	0	0	0	0	0	0	0
LT	0	0	0	0	0	0	0
LU	0	0	0	0	0	0	0
HU	0	0	0	0	1.5	0	1.5
MT	0	0	0	0	0	0	0
NL	0	0	0	0	0	0	0
AT	0.007	0.004	0	-10.0	0	10.0	0.01
PL	0	0	0	0	0	0	0
PT	0.20	0.71	0.51	51.6	1.0	14.8	1.8
RO	0	0	0	0	0	0	0
SI	0	0	0	0	0	0	0
SK	0	0	0	0	0.1	0	0.11
FI	0	0	0	0	0	0	0
SE	0	0	0	0	0	0	0
UK	0	0	0	0	0	0	0
EU 27	19.7	20.2	0.51	0.5	19.0	9.4	39.2

### 3.2.2 Geothermal Heating/Cooling

Energy generated in heating/cooling sector from geothermal technology was marginal in 2005 representing only 0.8% of the total RES generated in this sector. During period 2005-2010 the energy generated from geothermal increased by 3.2 PJ (84 ktoe) with an average growth rate of 3.8% and its share in total RES generated in this sector in 2010 reached only 0.65% which was lower than the expected share of 1%. In 2020 the energy generated from geothermal technology in heating/cooling will increase by a factor of 5 compared with the 2010 level reaching the amount of 110 PJ (2.6 Mtoe) having an average growth rate equal to 40%. The additional energy generated during period 2010-2020 will be 25 times larger than the additional energy for period 2005-2010.

Figure 22 and Table 22 report the development of this technology in EU during period 2005-2020.

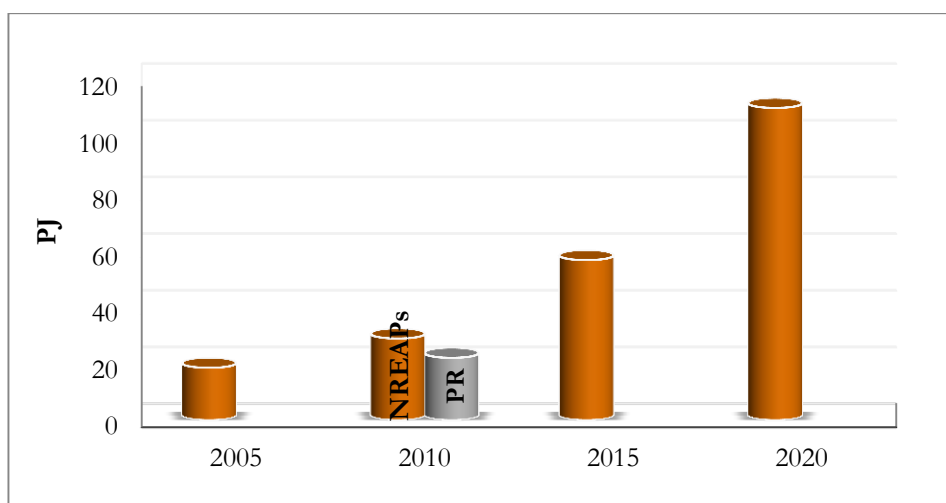


Figure 22. EU 27 geothermal heating/cooling progress, 2005-2020

Half of MS in EU 27 reported in baseline year renewable energy generated from this technology. In 2010 only 10 MS didn't introduce this technology in heating/cooling sector. During period 2005-2010 only 3 MS, Belgium, France and Italy decreased their renewable energy respectively with 6.4%, 6.2% and 6.9%. The highest absolute increase in this period took place in Hungary with 4.14 PJ (99 ktce).

During period 2010-2020 4 MS, Bulgaria, Denmark, Slovenia and United Kingdom, will need to reduce their renewable energy generated from this technology in heating/cooling sector in order to meet their 2020 targets. The highest absolute increases will be in Germany with 27.7 PJ (+264.4 %), France with 17.2 PJ (+45.6%) and Hungary with 10.8 PJ (+26.1%).

Table 22. EU 27 geothermal H/C progress, absolute and relative deviations, 2005-2020

	2005	2010	Growth		Growth		2020
	NREAPs	PR	2005-2010	av. %	2010-2020	av. %	NREAPs
	PJ	PJ	PJ	av. %	PJ	av. %	PJ
BE	0.12	0.08	-0.04	-6.4	0.16	20	0.24
BG	0	1.38	1.38	0	-1.00	-7.3	0.38
CZ	0	0	0	0	0.63	0	0.63
DK	0	0.21	0.21	0	-0.21	-10	0
DE	0.50	1.05	0.54	21.7	27.67	264.4	28.72
EE	0	0	0	0	0	0	0
IE	0	0	0	0	0	0	0
EL	0.42	0.67	0.25	12.0	1.47	21.9	2.14
ES	0.16	0.17	0.01	1.1	0.23	13.8	0.40
FR	5.44	3.77	-1.67	-6.2	17.17	45.6	20.93
IT	8.92	5.82	-3.10	-6.9	6.74	11.6	12.56
CY	0	0	0	0	0	0	0
LV	0	0	0	0	0	0	0
LT	0.06	0.08	0.02	6.7	0.13	15.0	0.21
LU	0	0	0	0	0	0	0
HU	0	4.14	4.14	0	10.80	26.1	14.95
MT	0	0	0	0	0	0	0.00
NL	0	0.33	0.33	0	10.51	313.8	10.84

AT	0.80	0.84	0.04	1.1	0.84	10.0	1.67
PL	0.48	0.56	0.08	3.5	6.89	122.8	7.45
PT	0.04	0.42	0.38	180	0.63	15.0	1.05
RO	0.71	1.02	0.31	8.6	2.33	22.9	3.35
SI	0.67	1.09	0.42	12.5	-0.25	-2.3	0.84
SK	0.13	0.33	0.21	33.3	3.43	102.5	3.77
FI	0	0	0	0	0	0	0
SE	0	0	0	0	0	0	0
UK	0.03	0.03	0	0	-0.03	-10.0	0
EU 27	18.48	22.00	3.52	3.8	88.12	40.1	110.12

### 3.3 Marine

#### a. Installed capacity

Marine energy was used in 2010 only in two Member States to produce electricity – France and United Kingdom. The marine power installed capacity in 2005 was estimated at 240 MW and it is projected to increase to 2253 MW in 2020. In 2010 marine capacity reached the amount of 242.6 MW having an average growth rate equal to 0.2%

Figure 23 and Table 23 report the development of this technology in EU during period 2005-2020.

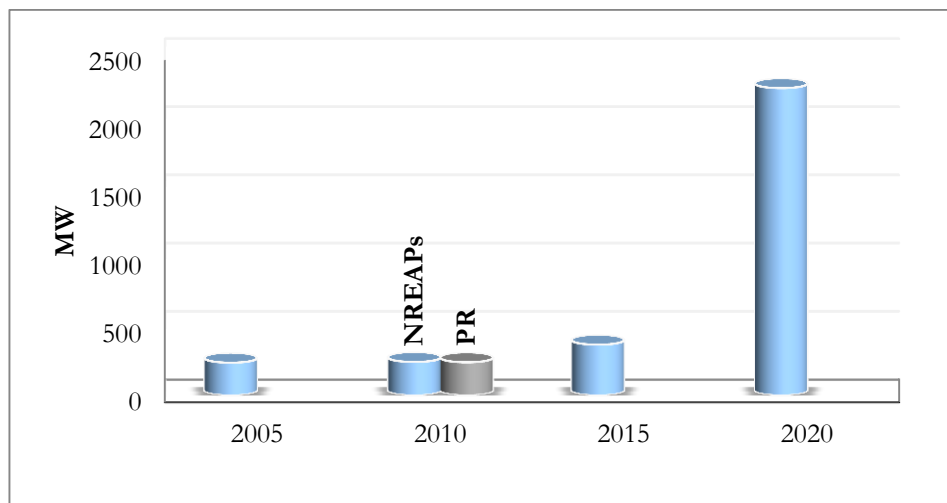


Figure 23. EU 27 marine installed capacity progress, 2005-2020

The additional marine installed capacity in 2010-2020 is expected to be 2010 MW in the EU27, which represent a significant increase of the existing plant capacity (almost 10 times higher), while the additional plant capacity was marginal in 2005-2010 period.

The installed marine capacity is limited in the EU27, with a share of only 0.1% in the total renewable power capacity. Although the marine capacity is expected to increase significantly until 2020, the share of installed marine capacity is expected remain at the same low level of 0.5% in the EU27 in 2020.

During 2005-2010 period no significant changes were reported installed capacity from this technology. Marine energy is used for electricity generation only in France and United Kingdom, with an installed plant capacity in 2010 of 240 MW and 2.6 MW, respectively.

By 2020, one third of MS, Ireland, Spain, France, Italy, the Netherlands, Portugal, Finland and United Kingdom will produce electricity from marine sources. The highest absolute and relative increases will take place in United Kingdom with 1297 MW (+4990 % yearly).

Table 23. EU 27 MS marine capacity progress, 2005-2020

	2005	2010	Growth		Growth		2020
	NREAPs	PR	2005-2010		2010-2020		NREAPs
	MW	MW	MW	av. %	MW	av. %	MW
BE	0	0	0		0		0
BG	0	0	0		0		0
CZ	0	0	0		0		0
DK	0	0	0		0		0
DE	0	0	0		0		0
EE	0	0	0		0		0
IE	0	0	0		75		75
EL	0	0	0		0		0
ES	0	0	0		100		100
FR	240	240	0	0	140	5.8	380
IT	0	0	0		3		3
CY	0	0	0		0		0
LV	0	0	0		0		0
LT	0	0	0		0		0
LU	0	0	0		0		0
HU	0	0	0		0		0
MT	0	0	0		0		0
NL	0	0	0		135		135
AT	0	0	0		0		0
PL	0	0	0		0		0
PT	0	0	0		250		250
RO	0	0	0		0		0
SI	0	0	0		0		0
SK	0	0	0		0		0
FI	0	0	0		10		10
SE	0	0	0		0		0
UK	0	2.6	2.6		1297	4990	1300
EU 27	240	242.6	2.6	0.2	2010	82.9	2253

## b. Electricity generation

Electricity generation from this technology reached in baseline year the amount of 1.9 PJ (535 GWh). During period 2005-2010 the electricity generated from marine technology decreased with an average rate of 2.1% reaching the amount of 1.72 PJ (478 GWh). According to NREAPs the electricity generation in 2020 from marine technology in EU 27 should reach the amount of

23.4 PJ (6.5 TWh). This means that the electricity generation from marine in EU 27 during period 2010-2020 should increase significantly with an average growth rate equal to 126.2% in order to be in good track for the fulfillment of 2020 target.

The share of marine technology in total RES electricity generation remains very marginal changing from 0.1% in 2005 to 0.07% in 2010 and 0.5% in 2020.

Figure 24 and Table 24 report the development of marine technology in EU 27 during period 2005-2020.

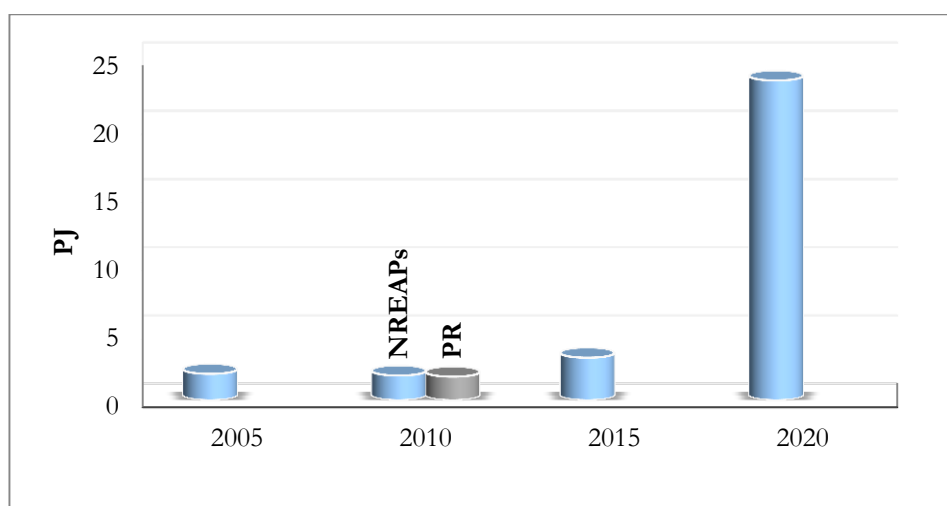


Figure 24. EU 27 marine electricity generation progress, 2005-2020

In 2005 the electricity generated from marine devices amounted to 1.93 PJ (476 GWh) which was totally concentrated to France that was the only MS that reported electricity generated from this technology. In 2010 United Kingdom introduce the electricity generation from marine technology with 0.006 PJ (1.8 GWh). During period 2005-2010 France decreased the electricity generated from marine with 2.1 PJ (-2.2%).

For period 2010-2020 almost a quarter of MS, Ireland, Spain, France, Italy, the Netherlands, Portugal and United Kingdom, have forecasted to report electricity generation from marine technology. United Kingdom will have the highest absolute increase with 14.2 PJ (3.9 TWh). France will need to double its additional electricity generation in order to be in good track for the achievement of 2020 target in this technology.

Table 24. EU 27 marine electricity generation progress, 2005-2020

	2005	2010	Growth		Growth		2020
	NREAPs	PR	2005-2010	av. %	2010-2020	av. %	NREAPs
	PJ	PJ	PJ		PJ		PJ
BE	0	0	0		0		0
BG	0	0	0		0		0
CZ	0	0	0		0		0
DK	0	0	0		0		0
DE	0	0	0		0		0
EE	0	0	0		0		0
IE	0	0	0		0.83		0.83
EL	0	0	0		0.0		0

ES	0	0	0		0.79		0.79
FR	1.93	1.71	-0.212	-2.21	2.43	14.16	4.14
IT	0	0	0		0.02		0.02
CY	0	0	0		0		0
LV	0	0	0		0		0
LT	0	0	0		0		0
LU	0	0	0		0		0
HU	0	0	0		0		0
MT	0	0	0		0		0
NL	0	0	0		2		1.85
AT	0	0	0		0		0
PL	0	0	0		0		0
PT	0	0	0		1.57		1.6
RO	0	0	0		0		0
SI	0	0	0		0		0
SK	0	0	0		0		0
FI	0	0	0		0		0
SE	0	0	0		0		0
UK	0	0.006	0.01		14.21	21934.4	14.2
EU 27	1.93	1.72	-0.21	-2.14	21.70	126.17	23.4

### 3.4 Solar

The use of solar energy (solar thermal and solar electricity) increased significantly in the EU27, reaching 146.2 PJ with an additional use of solar energy from 2005 equal to 112.1 PJ or an average growth rate per year of 65.6%.

For 2020, the use of solar electricity and solar thermal energy is projected to reach 630.1 PJ in 2020 with an average growth rate per year equal to 33.1%. The additional use of solar energy in 2010-2020 is expected to be 483.9 PJ, which is about 330.1% of the 2010 use of solar energy.

Figure 25 and Table 25 report the development of the use of solar energy in EU 27 during period 2005-2020.

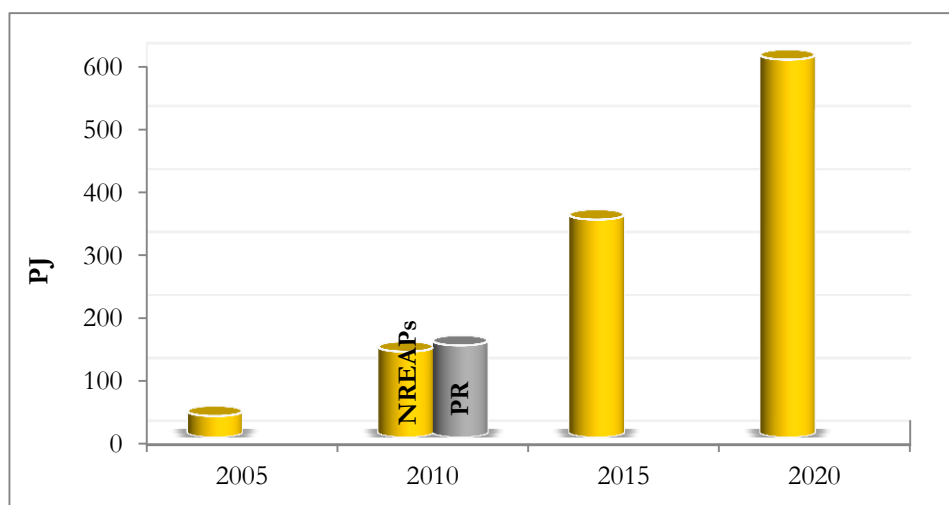


Figure 25. EU 27 solar energy progress, 2005-2020

The share of solar energy in the total use of renewable energy was rather low in 2005 but increasing from 0.8% in 2005 to 2.3% in 2010, below the expected share of 2.4% for 2010. The use of solar energy is expected to further increase to 6.2% until 2020.

Leading countries in the use of solar energy (both solar electricity and solar thermal) in 2010 were Germany with 60.8 PJ, Spain with 33.2 PJ, Italy with 12.5 PJ, Greece with 8.3 PJ and Austria with 7.2 PJ. In 2020, leading countries in solar energy are expected to be Germany with 201.2 PJ, Spain with 123.2 PJ, Italy with 107.3 PJ, France with 63.6 PJ and Greece with 27.8 PJ.

The leading countries with the highest share of solar energy in total RES use in 2010 were Malta with 70.2%, Cyprus with 60.1%, Greece with 10.1%, Spain with 6.1% and Germany with 5.8%. In 2020, the highest shares of solar energy in total RES use is expected to be reached in Cyprus with 51.9%, Spain with 14.3%, Greece with 13.3%, Germany with 12.5% and Italy with 11.9%.

Table 25. EU 27 MS solar energy progress, 2005-2020

	2005	2010	Growth		Growth		2020
	NREAPs	PR	2005-2010		2010-2020		NREAPs
	PJ	PJ	PJ	av.%	PJ	av.%	PJ
BE	0.1	2.5	2.4	330.6	9.9	39.5	12.4
BG	0.0	0.5	0.5		2.0	41.7	2.4
CZ	0.1	2.6	2.5	599.8	7.4	28.5	10.0
DK	0.4	0.6	0.2	10.5	0.0	0.5	0.7
DE	14.6	60.8	46.3	63.5	140.3	23.1	201.2
EE	0.0	0.0	0.0		0.0		0.0
IE	0.0	0.2	0.2		0.6	26.1	0.8
EL	4.2	8.3	4.0	19.1	19.6	23.7	27.8
ES	2.7	33.2	30.5	226.1	90.0	27.1	123.2
FR	1.7	6.2	4.5	53.8	57.4	93.2	63.6
IT	1.2	12.5	11.2	180.8	94.8	76.0	107.3
CY	1.7	2.6	0.9	9.9	3.1	12.1	5.7
LV	0.0	0.0	0.0		0.1		0.1
LT	0.0	0.0	0.0		0.4		0.4
LU	0.1	0.1	0.0	11.4	0.5	46.6	0.6
HU	0.0	0.2	0.2		3.5	164.9	3.7
MT	0.0	0.1	0.1		0.2	14.5	0.3
NL	0.8	1.2	0.4	10.0	1.8	14.7	3.0
AT	3.9	7.2	3.3	16.6	5.2	7.2	12.4
PL	0.0	0.1	0.1	234.4	21.1	1980.2	21.2
PT	0.9	2.7	1.8	38.7	12.9	47.1	15.6
RO	0.0	0.0	0.0		4.1	566966.7	4.1
SI	0.1	0.3	0.1	20.8	1.1	43.9	1.4
SK	0.0	0.0	0.0		2.3	579.9	2.3
FI	0.0	0.0	0.0		0.0	-10.0	0.0
SE	0.3	0.5	0.2	15.9	-0.2	-4.1	0.3
UK	1.2	3.8	2.5	40.5	5.7	15.2	9.5
EU 27	34.2	146.2	112.1	65.6	483.9	33.1	630.1



### 3.4.1 Solar electricity

#### a. Installed capacity

Solar installed capacity in the EU 27 was estimated at 2221 MW in 2005 and it is projected to increase to 90447 MW in 2020. Solar electricity capacity increased to 29727 MW in 2010, compared to the expected installed plant capacity of 25989 MW. The additional solar power installed capacity in 2010-2020 is expected to be 60720 MW in the EU27, which represent more than doubling of the existing plant capacity, while the additional plant capacity was 27506 MW in 2005-2010, with an 13 times increase.

Figure 26 and Table 26 report the development of solar electricity capacity in EU 27 during period 2005-2020.

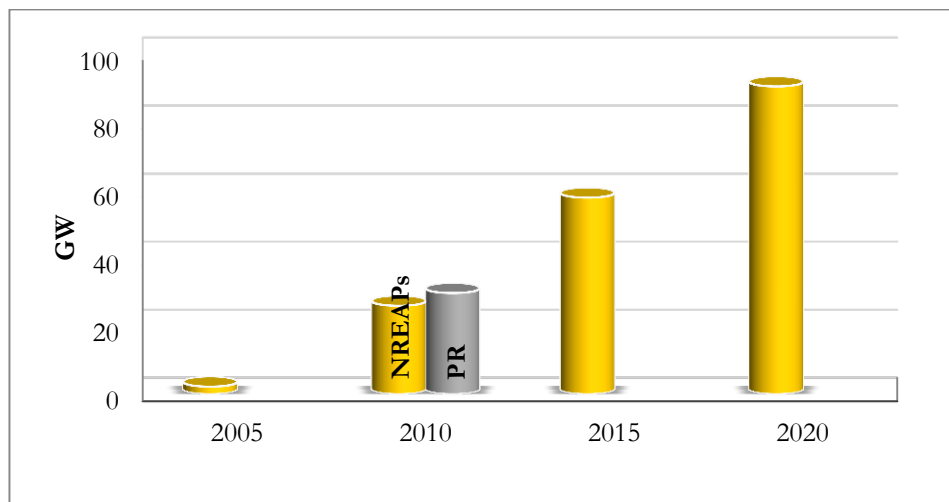


Figure 26. Solar installed plant capacity in the EU 27 2005-2020

The majority of the solar electricity plant capacity is represented by solar photovoltaic systems with an installed capacity in 2010 of 29045 MW compared to expected capacity of 25352 MW. Concentrated solar power had in 2010 an installed capacity of 682 MW compared to expect 637 MW. The share of concentrated solar power in total solar electricity capacity is expected to increase from 2.3% in 2010 to 7.5% in 2020.

The installed solar power plant capacity contribution to the overall renewables has become important in the EU27 in 2010, with a share of 12.3% in the total renewable power capacity, increasing from only 1.3% in 2005. With an even more significant increase in the solar plant capacity expected until 2020, the share of installed solar plant capacity in total renewable power capacity is expected to reach 19.0% in the EU27 in 2020. Solar electricity installed capacity increased significantly in the last years. The leading countries in solar power installed capacity in 2010 were Germany 17320 MW, followed by Spain with 4598 MW, Italy with 3470 MW, France with 1072 MW and Belgium with 661 MW. The installed capacity of solar plants in these five countries reached 27121 MW in 2010, representing 91.5% of the solar power plant capacity in the EU27.

In 2020, the leading countries in solar power installed capacity are expected to be Germany with 51753 MW, followed by Spain with 12050 MW, Italy with 8600 MW, France with 5400 MW and the UK with 2680 MW. The installed capacity of solar plants in these five countries should grow to 80483 MW in 2020, representing 89.4% of the solar power plant capacity in the EU27.

Table 26. EU 27 MS Solar power installed capacity progress, 2005-2020

	2005	2010	Growth		Growth		2020
	NREAPs	PR	2005-2010		2010-2020		NREAPs
	MW	MW	MW	av.%	MW	av.%	MW
BE	2	661	659	6425.9	679	10.3	1340
BG	0	25	25		278	111.2	303
CZ	1	1727	1726	34520.0	391	2.3	2118
DK	3	7	4	26.7	-1	-1.4	6
DE	1980	17320	15340	154.9	34433	19.9	51753
EE	0	0	0		0		0
IE	0	1	1		-1	-10.0	0
EL	1	203	202	4040.0	2247	110.7	2450
ES	60	4598	4538	1512.7	7452	16.2	12050
FR	25	1072	1047	837.6	4328	40.4	5400
IT	34	3470	3436	2021.2	5130	14.8	8600
CY	0	7	6	805.0	260	394.5	267
LV	0	0	0		2		2
LT	0	0	0		10		10
LU	24	29	5	4.2	84	29.0	113
HU	0	2	2		61	305.0	63
MT	0	2	2		26	156.9	28
NL	51	88	37	14.5	634	72.0	722
AT	22	93	71	64.5	229	24.6	322
PL	0	0	0		3	899.1	3
PT	3	132	129	860.0	1368	103.6	1500
RO	0	0	0		260	12990.0	260
SI	0	12	12		127	105.8	139
SK	0	186	186		114	6.1	300
FI	0	7	7		3	4.3	10
SE	4	9	5	25.0	-1	-1.1	8
UK	11	77	66	121.3	2603	338.1	2680
EU 27	2221	29727	27506	247.7	60720	20.4	90447

## b. Electricity generation

Solar electricity production increased significantly in the EU 27 has increased since 2005 from 1470 GWh (5.2 PJ) to 23202 GWh (83.5 PJ) in 2010, which is 11.9% above the expected level of 20741 GWh (74.7 PJ) in 2010.

Figure 27 and Table 27 report the development of solar electricity generation in EU 27 during period 2005-2020.

For 2020 the electricity generation from solar energy is projected to reach 363.8 PJ (101 TWh) in 2020. The additional solar electricity generation from in 2010-2020 is expected to be 77861 GWh (280.3 PJ), which is more than three times the 2010 solar electricity production. In comparison, solar electricity production has increased by 21732 GWh (78.2 PJ) in 2005-2010.

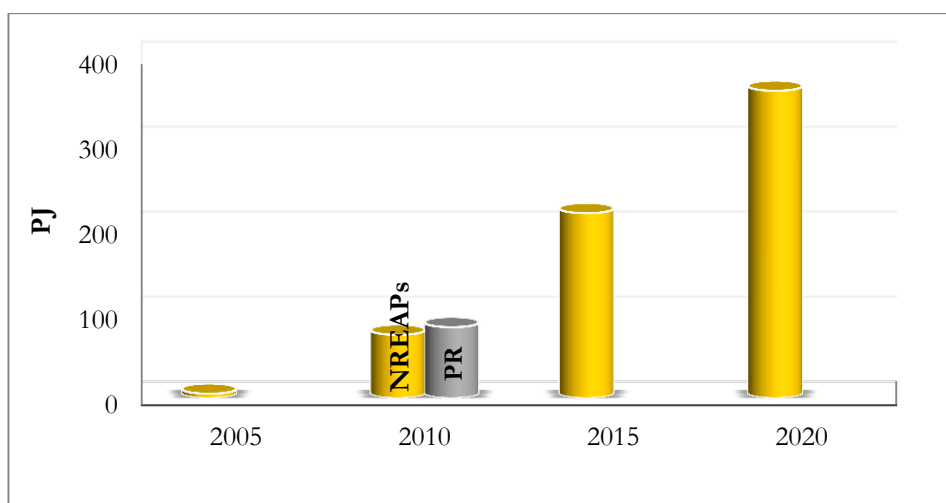


Figure 27. Solar electricity generation in the EU 27, 2005-2020

The share of solar electricity in total renewable electricity generation has increased from 0.3% in 2005 to 3.6% in 2010, above the expected share of 3.2 % for 2010. Solar electricity share is expected to further increase to 8.3% until 2020.

Leading countries in solar electricity production in 2010 were Germany with 11700 GWh (42.1 PJ), Spain with 7105 GWh (25.6 PJ), Italy with 1906 GWh (6.9 PJ), France with 676 GWh (2.4 PJ) and Belgium with 661 GWh (2.4 PJ). In 2020, leading countries in solar electricity production are expected to be Germany with 41389 GWh (149.0 PJ), Spain with 26735 GWh (96.2 PJ), Italy with 11350 GWh (40.9 PJ), France with 6885 GWh (24.8 PJ) and Greece with 3605 GWh (13.0 PJ).

The share of solar electricity in total RES electricity in 2010 amounted to 100% in Malta, 10.4% in Germany, 9.5% in Belgium, 8.8% in Cyprus and 8.3% in Spain. In 2020, the share of solar electricity in total RES electricity is expected to reach 45.4% in Cyprus, 19.1 in Germany, 18.5% in Spain, 14.8 in Czech Republic and 12.4% in Greece.

Table 27. EU 27 MS solar electricity generation progress, 2005-2020

	2005	2010	Growth		Growth		2020
	NREAPs	PR	2005-2010	av. %	2010-2020	av. %	NREAPs
	PJ	PJ	PJ		PJ		PJ
BE	0.004	2.0	2.0	10701.2	2.1	10.4	4.1
BG	0	0.1	0.1		1.5	280.0	1.6
CZ*	0	2.2	2.2		6.4	29.0	8.7
DK	0.007	0.0	0.0	40.0	0.0	-3.3	0.0
DE	4.6	42.1	37.5	162.5	106.9	25.4	149.0
EE	0	0.0	0.0		0.0		0.0
IE	0	0.0	0.0		0.0	-10.0	0.0
EL	0.003	0.6	0.6	3691.1	12.4	205.9	13.0
ES	0.15	25.6	25.4	3445.9	70.7	27.6	96.2
FR	0.08	2.4	2.4	594.5	22.4	91.8	24.8
IT	0.11	6.9	6.8	1209.7	34.0	49.5	40.9
CY	0	0.0	0.0	1805.7	1.9	824.1	1.9
LV	0	0.0	0.0		0.0		0.0
LT	0	0.0	0.0		0.1		0.1

LU	0.06	0.1	0.0	3.7	0.2	30.0	0.3
HU	0	0.0	0.0		0.3	800.0	0.3
MT	0	0.0	0.0		0.1	236.6	0.2
NL	0.14	0.2	0.1	10.0	1.8	85.0	2.1
AT	0.08	0.3	0.2	64.8	0.8	24.4	1.1
PL	0	0.0	0.0		0.0	7.9	0.0
PT	0.01	0.7	0.7	1320.0	8.2	113.1	8.9
RO	0	0.0	0.0		1.2	159990.0	1.2
SI	0	0.0	0.0		0.5	96.9	0.5
SK	0	0.0	0.0		1.0	262.7	1.1
FI	0	0.0	0.0		0.0	-10.0	0.0
SE	0	0.0	0.0	1780.0	0.0	-5.6	0.0
UK	0.03	0.1	0.1	62.5	7.9	668.8	8.1
EU 27	5.3	83.5	78.2	295.7	280.3	33.6	363.8

### 3.4.2 Solar heating/cooling

Solar energy is still a minor contributor to the heat generation in the EU27. Nevertheless, the heat generation from solar energy has increased significantly since 2005 from 28.9 PJ (690 ktoe) to 62.7 PJ (1497 ktoe) in 2010, compared to projected solar heat generation of 61.7 PJ (1474 ktoe) in 2010. A large growth in solar heat is expected for 2020, with a contribution to reach 266.2 PJ (6358 ktoe).

The additional solar heat generation in 2010-2020 should amount to 203.5 PJ (4861 ktoe), which is more than four times the 2010 solar heat production. In comparison, solar heat production has increased during 2005-2010 by 33.8 PJ (807 ktoe) with an average growth rate of 23.4%.

The share of solar heat in total renewable heat generation has increased from 1.3% in 2005 to 1.9% in 2010, but it is expected to increase to 5.7% until 2020.

Figure 28 and Table 28 report the development of solar heat generation in EU 27 during period 2005-2020.

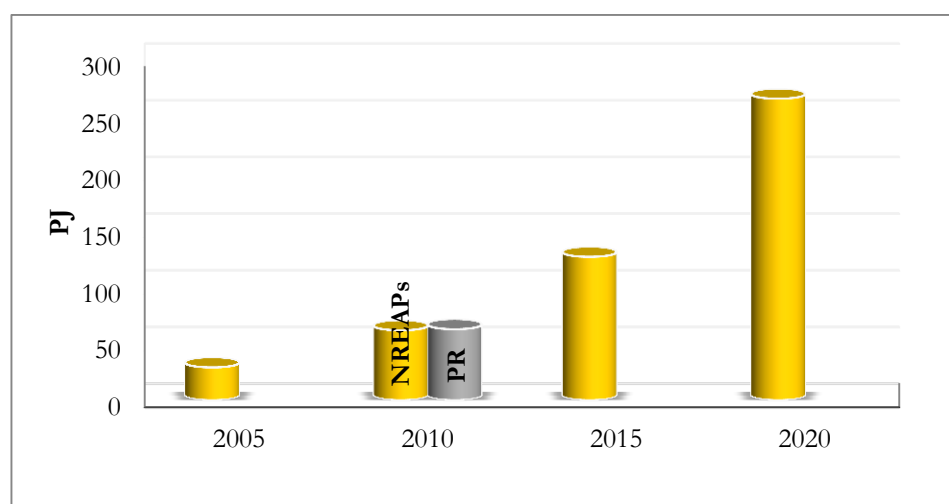


Figure 28. Solar heat generation in the EU 27, 2005-2020

Leading countries in solar heat production in 2010 were Germany with 18.7 PJ (447 ktoe), Greece with 7.7 PJ (183 ktoe), Spain with 7.7 PJ (183 ktoe), Austria with 6.9 PJ (164 ktoe) and Italy with 5.6 PJ (134 ktoe). The solar heat generation in these five countries reached 46.5 PJ (1111 ktoe) in 2010, representing 74.3% of the solar heat in the EU27. Leading countries in the share of solar heat in total RES heat in 2010 were Malta with 81.5%, Cyprus with 75.2%, Greece with 15.8%, UK with 7.8% and Spain with 4.3%.

In 2020, leading countries in solar heat are expected be Italy with 66.4 PJ (1586 ktoe), Germany with 52.1 PJ (1245 ktoe), France with 38.8 PJ (927 ktoe), Spain with 27.0 PJ (644 ktoe) and Poland with 21.2 PJ (506 ktoe). The solar heat generation in these five countries should reach 205.3 PJ (4908 ktoe) in 2010, representing 77.3% of the solar heat in the EU27. In 2020, the highest shares of solar heat in total RES heat are expected to be reached in Cyprus with 73.2%, Malta with 44.5%, Greece with 18.6%, Italy with 15.2% and 12.0% in Spain.

Table 28. EU 27 MS solar heat generation progress, 2005-2020

	2005	2010	Growth		Growth		2020
	NREAPs	PR	2005-2010		2010-2020		NREAPs
	PJ	PJ	PJ	av.%	PJ	av.%	PJ
BE	0.14	0.50	0.4	52.1	7.8	155.6	8.3
BG	0.00	0.42	0.4		0.5	11.0	0.9
CZ	0.08	0.38	0.3	70.0	1.0		1.3
DK	0.42	0.63	0.2	10.0	0.0	0.7	0.7
DE	9.96	18.71	8.8	17.6	33.4	17.9	52.1
EE	0.00	0.00	0.0		0.0		0.0
IE	0.00	0.23	0.2		0.6		0.8
EL	4.23	7.66	3.4	16.2	7.2	9.4	14.9
ES	2.55	7.66	5.1	40.0	19.3	25.2	27.0
FR	1.59	3.73	2.1	26.8	35.1	94.2	38.8
IT	1.13	5.61	4.5	79.3	60.8	108.4	66.4
CY	1.73	2.56	0.8	9.6	1.2		3.8
LV	0.00	0.00	0.0		0.1		0.1
LT	0.00	0.00	0.0		0.4		0.4
LU	0.01	0.04	0.0	70.0	0.3		0.3
HU	0.00	0.21	0.2		3.2	154.0	3.4
MT	0.00	0.10	0.1		0.0		0.1
NL	0.67	1.00	0.3	10.0	0.0	-0.4	1.0
AT	3.85	6.87	3.0	15.7	4.4	6.4	11.3
PL	0.01	0.10	0.1	220.0	21.1	2098.3	21.2
PT	0.92	2.01	1.1	23.6	4.7	23.3	6.7
RO	0.00	0.00	0.0		2.9		2.9
SI	0.13	0.21	0.1	13.3	0.7	32.0	0.9
SK	0.00	0.00	0.0		1.3		1.3
FI	0.00	0.00	0.0		0.0		0.0
SE	0.25	0.42	0.2	13.3	-0.2		0.3
UK	1.21	3.64	2.4	40.0	-2.2	-6.1	1.4
EU 27	28.9	62.7	33.8	23.4	203.5	32.5	266.2

### 3.5 Wind

#### a. Installed capacity

Wind power installed capacity was estimated at 40441 MW in 2005 and it is projected to increase to 210593 MW in 2020, the highest installed capacity among all RES technologies. Wind power capacity increased to 84317 MW in 2010, only 1.4% below the expected installed plant capacity of 85472 MW. The additional wind installed capacity in 2010-2020 is expected to amount to 126275 MW (+15% yearly) in the EU27, which represent 1.5 times more the existing plant capacity, while the additional plant capacity was 43877 MW (+21.7% yearly) in 2005-2010, has already doubled the installed capacity in that period.

Figure 29 and Table 29 report the development of wind installed capacity in EU 27 during period 2005-2020.

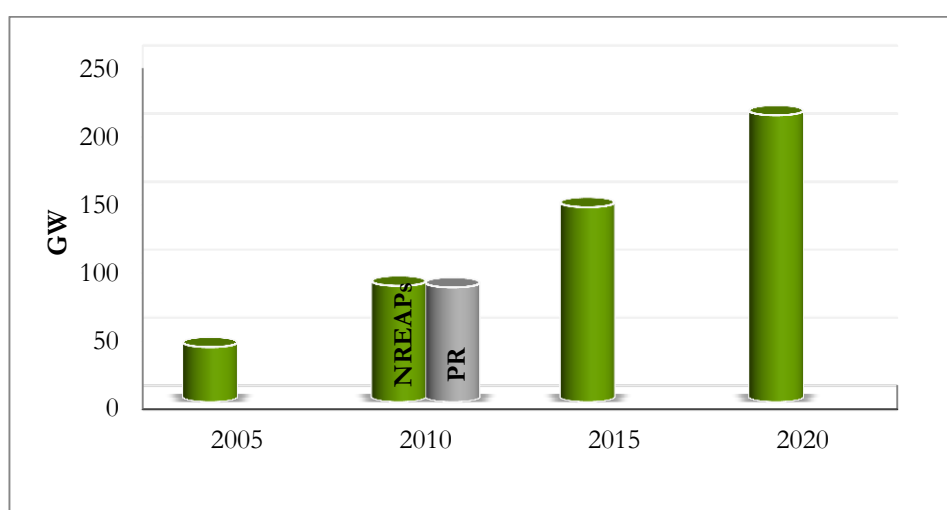


Figure 29. Wind power installed capacity in the EU 27

The installed wind power plant capacity has become important in the EU27, with a share of 35.2% in the total renewable power capacity, increasing from 24.5% in 2005. An even higher wind power capacity is expected until 2020 accounting for a 44.8% share of the total installed renewable power capacity.

The leading countries in wind power installed capacity in 2010 were Germany with 27210 MW, followed by Spain with 20759 MW, Italy with 5814 MW, France with 5729 MW and the UK with 5378 MW. The installed capacity of wind plants in these five countries reached 64890 MW in 2010, representing 76.9% of the wind plant capacity in the EU27.

In 2020, the leading countries in wind power installed capacity are expected to be Germany with 45750 MW, followed by Spain with 35750 MW, the UK with 27880 MW, France with 25000 MW and Italy with 12680 MW. The installed capacity of wind plants in these five countries should reach 147060 MW in 2020, representing 69.8% of the wind plant capacity in the EU27 in that year.

Table 29. EU 27 MS wind installed capacity progress, 2005-2020

	2005 NREAPs	2010 PR	Growth 2005-2010		Growth 2010-2020		2020 NREAPs
	MW	MW	MW	av.%	MW	av.%	MW
BE	190	920	729	76.7	3401	37.0	4320

BG	8	488	480	1200.0	952	19.5	1440
CZ	22	213	191	173.6	360	16.9	573
DK	3129	3642	513	3.3	318	0.9	3960
DE	18415	27210	8795	9.6	18540	6.8	45750
EE	31	108	77	49.7	542	50.2	650
IE	494	1389	895	36.2	3260	23.5	4649
EL	491	1298	807	32.9	6202	47.8	7500
ES	9918	20759	10841	21.9	14991	7.2	35750
FR	752	5729	4977	132.4	19271	33.6	25000
IT	1639	5814	4175	50.9	6866	11.8	12680
CY	0	82	82		218	26.6	300
LV	26	30	4	3.1	386	128.7	416
LT	1	133	132	2640.0	367	27.6	500
LU	35	44	9	5.1	87	19.8	131
HU	0	293	293		457	15.6	750
MT	0	0	0		110		110
NL	1224	2237	1013	16.6	8941	40.0	11178
AT	694	977	283	8.2	1601	16.4	2578
PL	121	1180	1059	175.1	4920	41.7	6100
PT	1063	3796	2733	51.4	3079	8.1	6875
RO	1.3	389	387	5868.0	3611	92.9	4000
SI	0	0	0		106		106
SK	5	3	-2	-8.0	347	1156.7	350
FI	80	188	108	27.0	2312	123.0	2500
SE	536	2018	1482	55.3	2529	12.5	4547
UK	1565	5378	3813	48.7	22502	41.8	27880
EU 27	40441	84317	43877	21.7	126275	15.0	210593

## b. Electricity generation

Wind power generation increased significantly in the EU27, reaching 155084 GWh (558.3 PJ), with the share of wind electricity in total renewable electricity generation increasing from 14.6% in 2005 to 24.3% in 2010, below the expected share of 25.6% for 2010. Wind electricity is expected to further increase to 40.6% until 2020, to become the dominant RES electricity source.

Figure 30 and Table 30 report the development of wind power generation in EU 27 during period 2005-2020.

For 2020 the electricity generation from wind power is projected to reach 488082 GWh (1757 PJ) in 2020. The additional wind power generation from in 2010-2020 is expected to amount to 332998 GWh (1199 PJ), which is more than two times the 2010 wind electricity production. In comparison, wind power production has increased by 84727 GWh (305 PJ) in 2005-2010.

Leading countries in wind power production in 2010 were Germany with 43100 GWh (155.2 PJ), Spain with 42732 GWh (153.8 PJ), the UK with 11239 GWh (40.5 PJ), France with 10499 GWh (37.8 PJ) and Italy with 8787 GWh (31.6 PJ).

In 2020, leading countries in wind electricity production are expected to be Germany with 104435 GWh (376.0 PJ), UK with 78270 GWh (281.8 PJ), Spain with 72556 GWh (261.2 PJ), France with 57900 GWh (208.4 PJ) and the Netherlands with 32408 GWh (116.7 PJ).

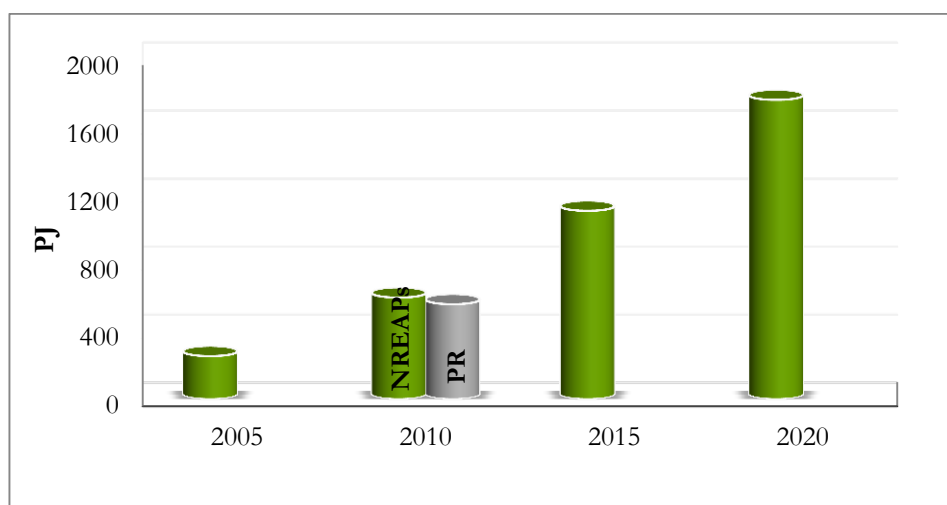


Figure 30. EU 27 wind power production progress, 2005-2020

The leading countries with the highest share of wind electricity in total RES electricity in 2010 were Ireland with 80.6%, Denmark with 62.4%, Spain with 50.1%, Cyprus with 43.0% and UK with 40.2%. In 2020, the highest shares of wind power in total RES electricity are expected to be reached in Ireland with 86.1%, Estonia with 80.3%, UK with 66.9%, The Netherlands with 64.4% and Greece with 58.0%.

Table 30. EU 27 MS wind power production progress, 2005-2020

	2005	2010	Growth		Growth		2020
	NREAPs	PR	2005-2010		2010-2020		NREAPs
	PJ	PJ	PJ	av.%	PJ	av.%	PJ
BE	1.2	5.7	4.6	79.5	32.0	55.9	37.7
BG	0	2.6	2.6		6.7	25.9	9.3
CZ	0	1.2	1.2	408.8	2.4	19.6	3.7
DK	23.8	27.8	4.0	3.4	14.3	5.2	42.2
DE	96.0	155.2	59.2	12.3	220.8	14.2	376.0
EE	0	0.9	0.7	71.5	4.6	52.2	5.5
IE	5.7	11.6	5.9	20.7	31.5	27.1	43.1
EL	4.6	10.5	5.9	25.9	50.0	47.8	60.5
ES	74.6	153.8	79.2	21.2	107.4	7.0	261.2
FR	4.1	37.8	33.7	166.2	170.6	45.1	208.4
IT	9.2	31.6	22.4	48.7	40.4	12.8	72.0
CY	0	0.1	0.1		1.7	149.1	1.8
LV	0	0.2	0.0	3.4	3.1	155.5	3.3
LT	0	0.9	0.9	2420.0	3.6	41.2	4.5
LU	0.2	0.2	0.0	1.0	0.7	33.5	0.9
HU	0	1.9	1.9		3.7	19.8	5.6
MT	0	0.0	0.0		0.9		0.9
NL	7.4	16.2	8.8	23.6	100.5	62.0	116.7
AT	4.8	7.3	2.5	10.3	10.0	13.6	17.3



PL	0	6.1	5.6	230.0	46.7	76.2	52.8
PT	6.4	30.2	23.8	74.7	22.3	7.4	52.5
RO	0	1.1	1.1	26329.0	29.2	270.9	30.2
SI	0	0.0	0.0		0.7		0.7
SK	0	0.0	0.0	-2.9	2.0	923.3	2.0
FI	1	1.1	0.6	21.9	20.5	181.1	21.6
SE	3	13.7	10.3	60.9	31.3	22.9	45.0
UK	10.5	40.5	30.0	57.4	241.3	59.6	281.8
EU 27	253.3	558.3	305.0	24.1	1198.8	21.5	1757.1

### 3.5.1 Onshore wind

#### a. Installed capacity

Onshore wind installed capacity was estimated at 39756 MW in 2005, has increased to 81436 MW in 2010, compared to the expected installed plant capacity of 82712 MW and it is projected to increase to 168619 MW in 2020.

Figure 31 and Table 31 report the development of onshore wind capacity in EU 27 during period 2005-2020.

The onshore wind installed power capacity has increased from 23.7% of the total renewable electricity capacity in the EU27 to reach 33.8% in 2010. Considering the onshore wind capacity expected until 2020, the share of installed onshore wind power capacity in total renewable electricity should reach 35.6% in the EU27 in 2020.

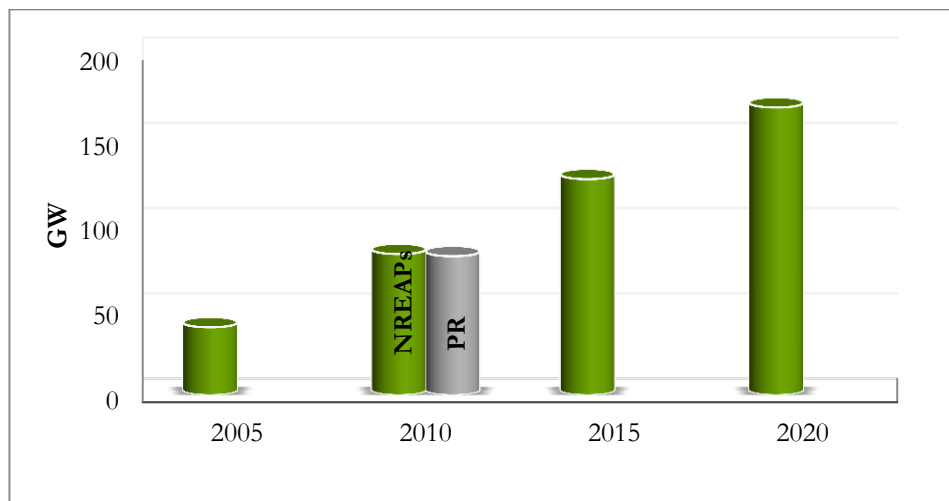


Figure 31. Onshore wind installed capacity in EU 27, 2005-2020

The additional onshore wind installed capacity in 2010-2020 is expected to amount to 87183 MW in the EU27, doubling the plant capacity existing in 2010, while the additional plant capacity was 41680 MW in 2005-2010, increasing almost by the same factor of two the installed capacity in 2005.

The leading countries in onshore wind power installed capacity in 2010 were Germany with 27030 MW, followed by Spain with 20759 MW, Italy with 5814 MW, France with 5729 MW and United Kingdom with 4037 MW. The installed capacity of onshore wind plants in these five

countries reached 63369 MW in 2010, representing 77.8% of the onshore wind plant capacity in the EU27.

In 2020, the leading countries in offshore wind power installed capacity are expected to be Germany with 35750 MW, followed by Spain with 35000 MW, France with 19000 MW, United Kingdom with 14800 MW and Italy with 12000 MW. The installed capacity of onshore wind plants in these five countries should increase to 116640 MW in 2020, representing 69% of the onshore wind plant capacity in the EU27 in that year.

Table 31. EU 27 MS onshore wind installed capacity progress, 2005-2020

	2005	2010	Growth		Growth		2020
	NREAPs	PR	2005-2010		2010-2020		NREAPs
	MW	MW	MW	av.%	MW	av.%	MW
BE	190	723	533	56	1597	22.1	2320
BG	8	488	480	1200	952	19.5	1440
CZ	22	213	191	174	360	16.9	573
DK	2706	2877	171	1	-256	-0.9	2621
DE	18415	27030	8615	9	8720	3.2	35750
EE	31	108	77	50	292	27.0	400
IE	469	1364	895	38	2730	20.0	4094
EL	491	1298	807	33	5902	45.5	7200
ES	9918	20759	10841	22	14241	6.9	35000
FR	752	5729	4977	132	13271	23.2	19000
IT	1639	5814	4175	51	6186	10.6	12000
CY	0	82	82		218	26.6	300
LV	26	30	4	3	206	68.7	236
LT	1	133	132	2640	367	27.6	500
LU	35	44	9	5	87	19.8	131
HU	0	293	293		457	15.6	750
MT	0	0	0		15		15
NL	1224	2009	785	13	3991	19.9	6000
AT	694	994	300	9	1584	15.9	2578
PL	121	1180	1059	175	4420	37.4	5600
PT	1063	3796	2733	51	3004	7.9	6800
RO	1	389	387	5868	3611	92.9	4000
SI	0	0	0		106		106
SK	5	3	-2	-8	347	1156.7	350
FI	80	188	108	27	1412	75.1	1600
SE	513	1855	1342	52	2510	13.5	4365
UK	1351	4037	2686	40	10853	26.9	14890
EU 27	39756	81436	41680	21	87183	10.7	168619

## b. Electricity generation

The onshore wind electricity generation has increased since 2005 from 66848 GWh (240.6 PJ) to 149038 GWh (536.5 PJ) in 2010. The electricity generation from onshore wind power is projected to reach 351546 GWh (1265.6 PJ) in 2020.

The share of onshore wind electricity in total renewable electricity generation has increased from 13.9% in 2005 to 23.2% in 2010, below the expected share of 24.2% for 2010. Onshore wind electricity share is expected to further increase to 29.2% until 2020. The share of onshore wind electricity in total wind electricity produced increased from 95% in 2005 to 96% in 2010 but it is expected to decrease to 72% until 2020.

Figure 32 and Table 32 report the development of onshore wind generation in EU 27 during period 2005-2020.

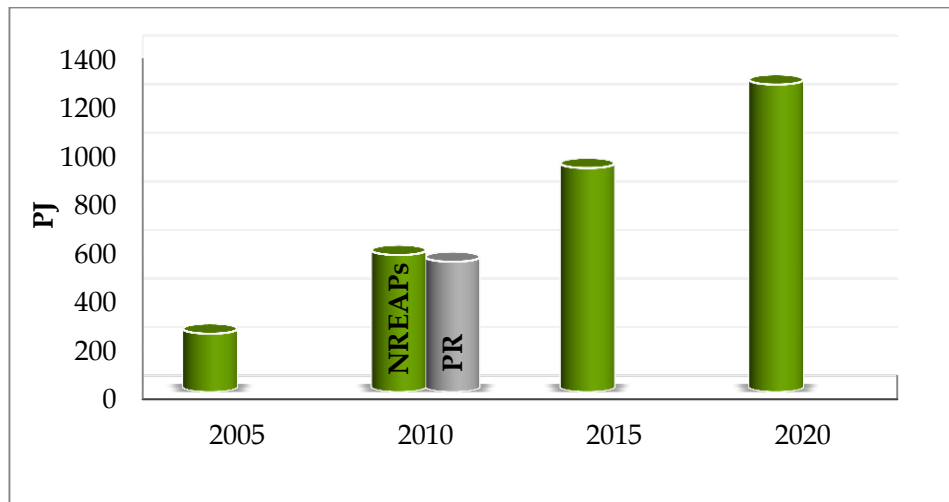


Figure 32. EU 27 onshore wind generation progress, 2005-2020

The additional wind onshore power generation in 2010-2020 is expected to be 202508 GWh (729 PJ) with a growth rate from 2010 of 13.6% per annum in average. In comparison, onshore wind power production has increased by 82190 GWh (296 PJ) with an average growth rate of 24.6% during period 2005-2010.

Leading countries in onshore wind power production in 2010 were Germany with 42900 GWh (154.4 PJ), Spain with 42732 GWh (153.8 PJ), France with 10499 GWh (37.8 PJ), Italy with 8787 GWh (31.6 PJ) and Portugal with 8395 GWh (30.2 PJ). The electricity generation from onshore wind plants in these five countries reached 113313 GWh (408 PJ) in 2010, representing 76% of the onshore wind electricity generation in the EU27.

In 2020, leading countries in onshore wind power production are expected to be Germany with 72664 GWh (261.6 PJ), Spain with 70734 GWh (254.6 PJ), France with 39900 GWh (143.6 PJ), United Kingdom with 34150 GWh (123 PJ) and Italy with 18000 GWh (64.8 PJ). The electricity generated from onshore wind plants in these five countries should increase to 235448 GWh (847.6 PJ) in 2020, representing 67% of the onshore wind electricity generation in the EU27.

The leading countries with the highest share of onshore wind electricity in total RES electricity in 2010 were Ireland with 79%, Spain with 50%, Denmark with 49.3%, Cyprus with 43% and Germany with 38.2%. In 2020, the highest shares of onshore wind power in total RES electricity are expected in Ireland with 73.5%, Greece with 55.6%, Estonia with 51%, Spain with 48.8% and Cyprus with 42.2%.

Table 32. EU 27 MS onshore wind generation progress, 2005-2020

	2005	2010	Growth		Growth		2020
	NREAPs	PR	2005-2010		2010-2020		NREAPs
	PJ	PJ	PJ	av.%	PJ	av.%	PJ
BE	1.2	5.0	3.9	67.6	10.3	20.5	15.4
BG	0.0	2.5	2.4	2704.0	6.9	28.1	9.3
CZ	0.1	1.2	1.2	408.8	2.4	19.6	3.7
DK	18.6	22.0	3.4	3.7	1.0	0.5	23.0
DE	96.0	154.4	58.5	12.2	107.2	6.9	261.6
EE	0.2	0.9	0.7	71.5	2.6	29.4	3.5
IE	0.0	11.4	11.4		25.4	22.3	36.8
EL	4.6	10.5	5.9	25.9	47.6	45.5	58.1
ES	74.6	153.8	79.2	21.2	100.8	6.6	254.6
FR	4.1	37.8	33.7	166.2	105.8	28.0	143.6
IT	9.2	31.6	22.4	48.7	33.2	10.5	64.8
CY	0.0	0.1	0.1		1.7	149.1	1.8
LV	0.2	0.2	0.0	3.4	1.7	84.4	1.9
LT	0.0	0.9	0.9	2420.0	3.6	41.2	4.5
LU	0.2	0.2	0.0	1.0	0.7	33.5	0.9
HU	0.0	1.9	1.9		3.7	19.8	5.6
MT	0.0	0.0	0.0		0.1		0.1
NL	7.4	13.5	6.0	16.2	34.7	25.8	48.1
AT	4.8	7.3	2.5	10.3	10.0	13.6	17.3
PL	0.5	6.1	5.6	230.0	41.3	67.4	47.4
PT	6.4	30.2	23.8	74.7	21.7	7.2	51.9
RO	0.0	1.1	1.1	26329.0	29.2	270.9	30.2
SI	0.0	0.0	0.0		0.7		0.7
SK	0.0	0.0	0.0	-2.9	2.0	923.3	2.0
FI	0.5	1.1	0.6	21.9	11.5	101.5	12.6
SE	3.2	12.6	9.4	59.7	30.6	24.4	43.2
UK	9.0	30.2	21.2	47.1	92.7	30.7	122.9
EU 27	240.7	536.5	295.9	24.6	729.0	13.6	1265.6

### 3.5.2 Offshore wind

#### a. Installed capacity

The installed capacity of offshore wind was estimated at 685 MW in 2005 and it is projected to increase to 41974 MW in 2020. This increased to 2899 MW in 2010, compared to the expected installed plant capacity of 2541 MW.

Figure 33 and Table 33 report the development of offshore wind installed capacity in EU 27 during period 2005-2020.

The share of offshore wind installed power capacity has increased from 0.4% of the total renewable power capacity in the EU27 to reach 1.2% in 2010. Considering the offshore wind capacity expected until 2020, the share of installed offshore wind power capacity in total renewable electricity should reach 8.8% in the EU27 in 2020.

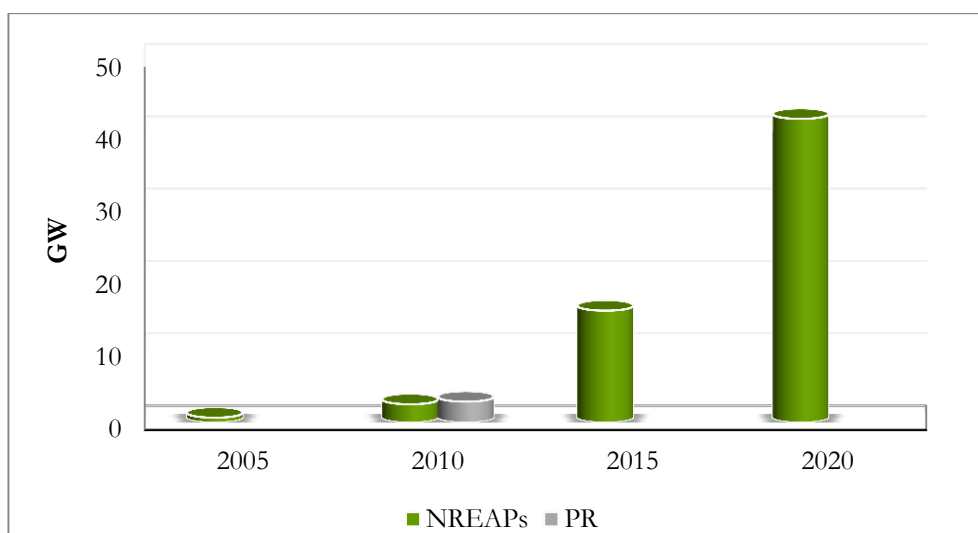


Figure 33. EU 27 offshore wind installed capacity progress, 2005-2020

The additional offshore wind installed capacity in 2010-2020 is expected to be 39076 MW in the EU27, which represent 15 times the existing plant capacity in 2010, while the additional plant capacity amounted to 2214 MW in 2005-2010, four times the installed capacity in 2005.

The leading countries in wind power installed capacity in 2010 were UK 1341 MW, followed by Denmark with 765 MW, The Netherlands with 228 MW, Belgium with 197 MW and Germany with 180 MW. The installed capacity of offshore wind plants in these five countries reached 2710.5 MW in 2010, representing 93.5% of the offshore wind plant capacity in the EU27.

In 2020, the leading countries in offshore wind power installed capacity are expected to be UK with 12990 MW, followed by Germany with 10000 MW, France with 6000 MW, the Netherlands with 5178 MW and Belgium with 2000 MW. The installed capacity of offshore wind plants in these five countries should increase to 36168 MW in 2020, representing 86.2% of the offshore wind plant capacity in the EU27.

Table 33. EU 27 MS offshore wind installed capacity progress, 2005-2020

	2005	2010	Growth		Growth		2020
	NREAPs	PR	2005-2010		2010-2020		NREAPs
	MW	MW	MW	av. %	MW	av. %	MW
BE	0	197	197		1804	917.8	2000
BG	0	0	0		0		0
CZ	0	0	0		0		0
DK	423	765	342	80.9	574	75.0	1339
DE	0	180	180		9820	5455.6	10000
EE	0	0	0		250		250
IE	25	25	0	0.0	530	2,120.0	555
EL	0	0	0		300		300
ES	0	0	0		750		750
FR	0	0	0		6,000		6000
IT	0	0	0		680		680
CY	0	0	0		0		0
LV	0	0	0		180		180
LT	0	0	0		0		0

LU	0	0	0		0		0
HU	0	0	0		0		0
MT	0	0	0		95		95
NL	0	228	228		4950	2,171.1	5178
AT	0	0	0		0		0
PL	0	0	0		500		500
PT	0	0	0		75		75
RO	0	0	0		0		0
SI	0	0	0		0		0
SK	0	0	0		0		0
FI	0	0	0		900		900
SE	23	163	140	608.7	19	11.7	182
UK	214	1341	1127	527.2	11649	868.7	12990
EU 27	685	2899	2214	323.3	39076	1348.1	41974

## b. Electricity generation

The offshore wind electricity generation has increased since 2005 from 1921 GWh (6.9 PJ) to 6046 GWh (21.8 PJ) in 2010. The electricity generation from offshore wind power is projected to reach 136535 GWh (491.5 PJ) in 2020.

The share of offshore wind electricity in total renewable electricity generation has increased from 0.4% in 2005 to 1.0% in 2010, below the expected share of 1.3% for 2010. Offshore wind share in RES electricity is expected to further increase to 11.3% until 2020. The share of offshore wind electricity in total wind electricity produced increased from 2.7% in 2005<sup>11</sup> to 4.1% in 2010 and this is expected to increase to 28% until 2020.

Figure 34 and Table 34 report the development of offshore wind generation in EU 27 during period 2005-2020.

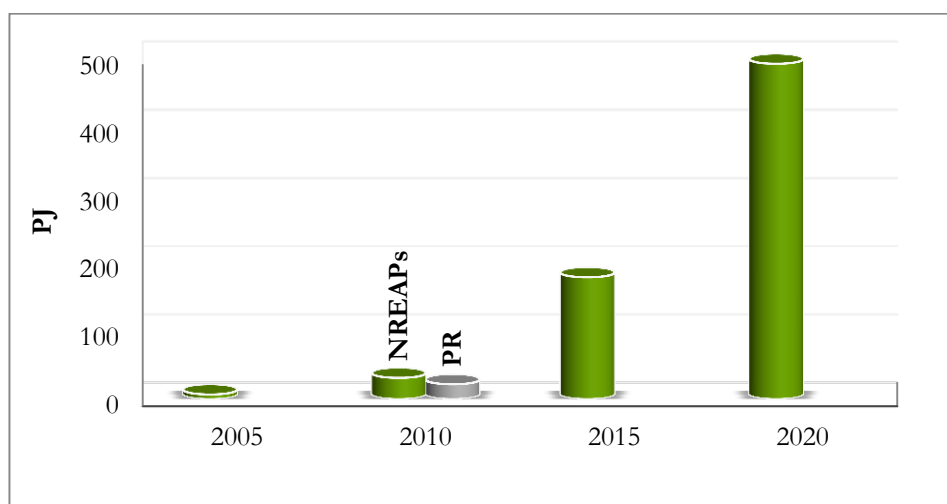


Figure 34. EU 27 offshore wind generation progress, 2005-2020

<sup>11</sup> IE has reported for 2005 only the total renewable electricity produced by wind without dividing it in sub-categories. For this reason the sum of onshore and offshore wind electricity shares in total wind electricity is not equal to 100%.

The additional offshore wind power generation in 2010-2020 is expected to be 130489 GWh (469.8 PJ), having an annual average growth rate equal to 215.8%. In comparison, offshore wind power production has increased by 4125 GWh (14.9 PJ) or 42.9% per annum in average in 2005-2010.

Leading countries in offshore wind power production in 2010 were United Kingdom with 2847 GWh (10.2 PJ), Denmark with 1622 GWh (5.8 PJ), the Netherlands with 765 GWh (2.8 PJ), Sweden with 450 GWh (1.6 PJ) and Germany with 210 GWh (0.8 PJ). The electricity generated from offshore wind plants in these five countries reached 5751 GWh (20.7 PJ) in 2010, representing 95.1% of the offshore wind electricity generation in the EU27.

In 2020, leading countries in offshore wind power production are expected to be United Kingdom with 44120 GWh (158.8 PJ), Germany with 31771 GWh (114.4 PJ), The Netherlands with 19036 GWh (68.5 PJ), France with 18000 GWh (64.8 PJ) and Belgium with 6200 GWh (22.3 PJ). The electricity expected to be generated from offshore wind plants in these five countries should amount to 119127 GWh (428.9 PJ) in 2010, representing 87.2% of the offshore wind electricity generation in the EU27.

The leading countries with the highest share of offshore wind electricity in their total RES electricity in 2010 were Denmark with 13.1, UK with 10.2%, The Netherlands with 6.5%, Belgium with 2.7% and Sweden with 0.5%. In 2020, the highest shares of offshore wind power in total RES electricity is expected to be reached in Malta with 46.1%, The Netherlands with 37.8%, UK with 37.7%, Estonia with 29.4% and Belgium with 26.8%.

Table 34. EU 27 MS offshore wind generation progress, 2005-2020

	2005	2010	Growth		Growth		2020
	NREAPs	PR	2005-2010		2010-2020		NREAPs
	PJ	PJ	PJ	av.%	PJ	av.%	PJ
BE	0.0	0.7	0.7		21.6	317.0	22.3
BG	0	0.1	0.1		-0.1	-10.0	0.0
CZ*	0	0.0	0.0		0.0		0.0
DK	5.2	5.8	0.6	2.3	13.3	22.8	19.2
DE	0.0	0.8	0.8		113.6	1502.9	114.4
EE	0	0.0	0.0		2.0		2.0
IE	0.0	0.2	0.2		6.0	259.8	6.3
EL	0.0	0.0	0.0		2.4		2.4
ES	0.0	0.0	0.0		6.6		6.6
FR	0.0	0.0	0.0		64.8		64.8
IT	0.0	0.0	0.0		7.2		7.2
CY	0	0.0	0.0		0.0		0.0
LV	0	0.0	0.0		1.4		1.4
LT	0	0.0	0.0		0.0		0.0
LU	0.0	0.0	0.0		0.0		0.0
HU	0	0.0	0.0		0.0		0.0
MT	0	0.0	0.0		0.8		0.8
NL	0.0	2.8	2.8		65.8	238.8	68.5
AT	0.0	0.0	0.0		0.0		0.0
PL	0	0.0	0.0		5.4		5.4
PT	0.0	0.0	0.0		0.6		0.6

RO	0	0.0	0.0		0.0		0.0
SI	0	0.0	0.0		0.0		0.0
SK	0	0.0	0.0		0.0		0.0
FI	0	0.0	0.0		9.0		9.0
SE	0	1.1	0.9	79.0	0.7	6.3	1.8
UK	1.5	10.2	8.8	121.3	148.6	145.0	158.8
EU 27	6.9	21.8	14.9	42.9	469.8	215.8	491.5

### 3.6 Heat Pumps

Heat generation from heat pumps provides a still small but increasing contribution to renewable heating/cooling production. The heat generation from heat pumps increased since 2005 from 25.0 PJ (597.9 ktoe) to 183.0 PJ (4362 ktoe) in 2010, which is above the expected level of 149.2 PJ (4012 ktoe) in 2010. For 2020 the heat generation from heat pumps is projected to reach 510.4 PJ (12191.7 ktoe).

Figure 35 and Table 35 report the development of wind power generation in EU 27 during period 2005-2020.

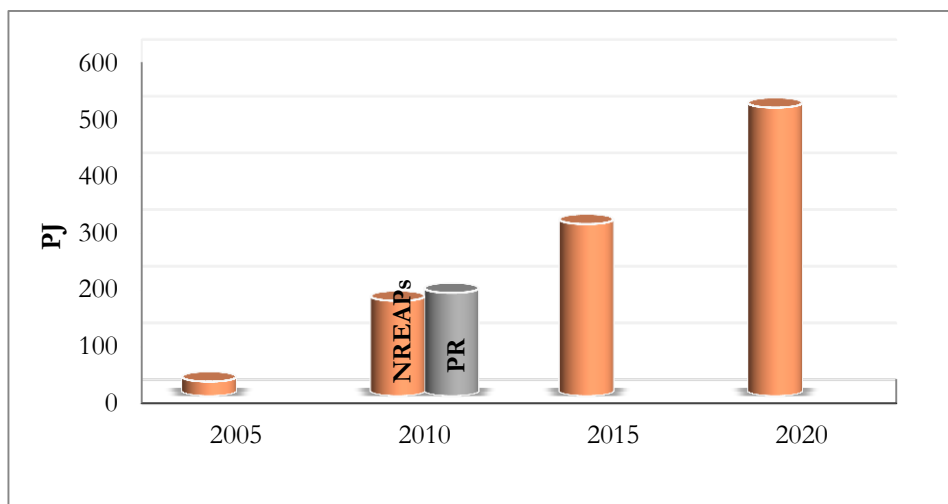


Figure 35. EU 27 heat generation from heat pumps progress, 2005-2020

The additional heat generation from heat pumps in 2010-2020 is expected to be 327.8 PJ (7787 ktoe), with an average growth rate of 17.9% compared to the 2010 heat generation from heat pumps. In comparison, heat production from heat pumps has increased by 158.0 PJ (3764 ktoe) with an average growth rate of 125.9% in 2005-2010.

The share of heat from heat pumps in total renewable heat generation has increased from 1.1% in 2005 to 5.3% in 2010, below the expected share of 5.9%. This share is expected to increase to 10.9% of total renewable heat in 2020.

Leading countries in heat production from heat pumps in 2010 were: Italy with 50.0 PJ (1195 ktoe), France with 42.2 PJ (1008 ktoe), Sweden with 33.2 PJ (793 ktoe), Germany with 19.1 PJ (456 ktoe) and Finland with 9.6 PJ (229 ktoe). The first five countries delivered about 154.1 PJ (3681 ktoe) heat from heat pumps, representing about 84.7% of the heat generated from heat pumps in the EU27. Leading countries in the share of heat generation from heat pumps in total RES heat in 2010 were Italy with 21.7%, the Netherlands with 11.7%, Ireland with 10.0%, France with 8.4% and Sweden with 8.1%.



In 2020, leading countries in heat produced by heat pumps are expected be Italy with 121.4 PJ (2900 ktoe), UK with 94.4 PJ (2254 ktoe), France with 77.5 PJ (1850 ktoe), Germany with 47.9 PJ (1145 ktoe) and Sweden with 43.8 PJ (10045 ktoe). The first five countries will deliver about 384.9 PJ (9194 ktoe) heat from heat pumps, representing about 75.7% of the heat generated from heat pumps in the EU27. In 2020, the share of heat generation from heat pumps in total RES heating/cooling is expected to be achieved in United Kingdom with 36.4%, Italy with 29.0%, the Netherlands with 17.6%, Ireland with 13.5% and Denmark with 11.9%.

Table 35. EU 27 MS heat production from heat pumps progress, 2005-2020

	2005	2010	Growth		Growth		2020
	NREAPs	PR	2005-2010		2010-2020		NREAPs
	PJ	PJ	PJ	av.%	PJ	av.%	PJ
BE	0.3	2.5	2	150.1	12.1	48.0	14.7
BG	0.0	0.0	0		0.0		0.0
CZ	0.5	1.8	1	50.0	4.8		6.6
DK	4.2	7.1	3	14.0	8.4	11.8	15.5
DE	8.2	19.1	11	26.5	28.8	15.1	47.9
EE	0.0	0.0	0		0.0		0.0
IE	0.4	1.0	1	26.0	2.6	26.5	3.5
EL	0.2	2.9	3	325.0	8.8	30.4	11.7
ES	0.3	0.7	0	24.7	1.4	19.9	2.1
FR	3.2	42.2	39	245.3	35.3	8.4	77.5
IT	0.9	50.0	49	1066.4	71.4	14.3	121.4
CY	0.0	0.0	0		0.1	29.6	0.1
LV	0.0	0.0	0		0.2		0.2
LT	0.0	0.0	0		0.6		0.6
LU	0.0	0.0	0	80.0	0.7	159.0	0.7
HU	0.0	0.0	0		6.0		6.0
MT	0.0	0.0	0		0.0		0.0
NL	2.3	4.1	2	15.9	11.7	28.9	15.8
AT	2.9	5.0	2	14.5	6.0	12.0	11.0
PL	0.0	0.9	1		5.3	59.8	6.2
PT	0.0	0.0	0		0.0		0.0
RO	0.0	0.0	0		0.5		0.5
SI	0.0	0.0	0		2.4		2.4
SK	0.0	0.0	0		0.4		0.4
FI	1.7	9.6	8	94.5	18.0	18.8	27.6
SE	0.0	33.2	33		10.6	3.2	43.8
UK	0.0	2.6	3		91.8	359.5	94.4
EU 27	25.0	183.0	158	125.9	327.4	17.9	510.4

### 3.7 Bioenergy

Bioenergy (biomass use for electricity and heating/cooling and biofuels) increased significantly in the EU27, reaching 4115.4 PJ in 2010 with an additional bioenergy generation from 2005 equal to 1529.5 PJ exceeding by 14.9% (+534.5 PJ) the planned value of 3580.9 PJ. The average growth rate in 2005-2010 was 11.8%, higher than the planned average growth rate of 7.7%.

Figure 36 and Table 36 report the development of bioenergy generation in EU 27 during period 2005-2020.

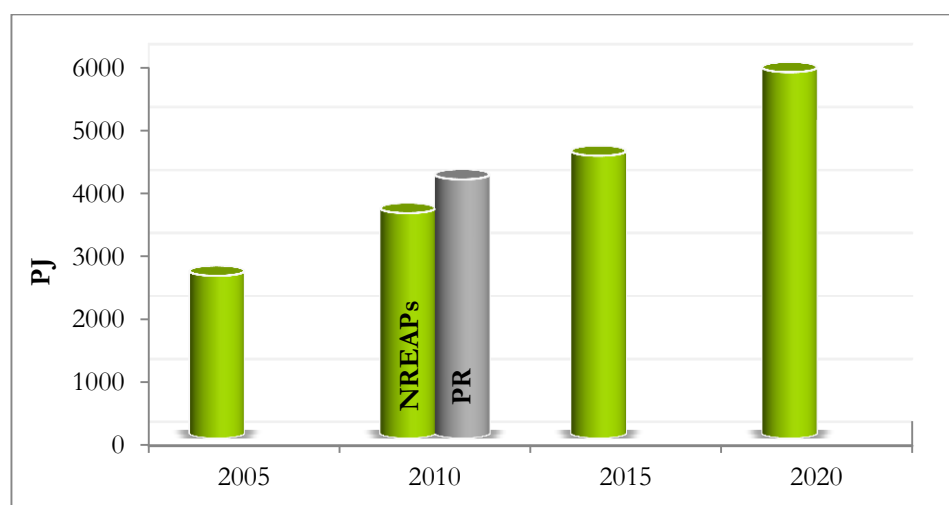


Figure 36. EU 27 bioenergy progress, 2005-2020

The share of bioenergy in the total use of renewable energy has increased from 62.4% in 2005 to 65.9% in 2010, above the expected share of 62.2% for 2010. The share of bioenergy is expected to slightly decrease to 57.0% until 2020.

For period 2010-2020 the development of bioenergy will be slightly slower than planned having an average growth rate equal to 4.1% instead of the planned 6.2%. In 2020 bioenergy is projected to reach 5816.3 PJ with an additional bioenergy generation equal to 1703 PJ, which is about 41.4% of the 2010 bioenergy production.

4 MS, Latvia, Portugal, Romania and Finland, had planned to reduce their bioenergy production for period 2005-2010. According to Progress Reports all MS increased their bioenergy production during period 2005-2010. Only 4 MS, Ireland, Greece, Malta and The Netherlands, did not increase enough their bioenergy production to meet the target planned in their action plans.

Estonia, Austria and Portugal reached in 2010 a bioenergy production which was already higher than their 2020 plans. For this reason these MS will not need to increase their bioenergy production during period 2010-2020 in order to be in good track for 2020 targets.

The highest absolute increase in bioenergy production during period 2005-2010 was found in Germany with 296.8 PJ (7.1 Mtoe) having an average growth rate of 13.7%. Poland, Italy, France and Sweden followed with respectively 241.2 PJ (5.8 Mtoe), 170.4 PJ (4.1 Mtoe), 161.4 PJ (3.8 Mtoe) and 105.4 PJ (2.5 Mtoe).

Leading countries in bioenergy production in 2010 were Germany with 731.7 PJ, France with 575.2 PJ, Sweden with 436.0 PJ, Finland with 306.6 PJ and Italy with 264.0 PJ. In 2020, leading countries in biomass electricity production are expected to be France with 904.0 PJ, Germany with 882.6 PJ, Sweden with 491.6 PJ, UK with 434.1 PJ and Italy with 410.9 PJ.

The leading countries with the highest share of bioenergy in total RES use in 2010 were Estonia with 97%, Lithuania with 94.1%, Poland with 93.9%, Hungary with 88.8% and Luxembourg with 85.4%. In 2020, the highest shares of bioenergy in total RES use are expected to be reached

in Lithuania with 88.0%, Estonia with 84.3%, Luxembourg with 83.8%, Czech Republic with 82.4% and Latvia with 81.8%.

Table 36. EU 27 MS bioenergy progress, 2005-2020

	2005	2010	Growth		Growth		2020
	NREAPs	PR	2005-2010		2010-2020		NREAPs
	PJ	PJ	PJ	av.%	PJ	av.%	PJ
BE	26.4	70.4	43.9	33.2	87.6	12.4	157.9
BG	30.3	38.2	7.8	5.2	21.9	5.7	60.1
CZ	63.3	94.5	31.1	9.8	48.6	5.1	143.1
DK	85.3	118.7	33.3	7.8	34.8	2.9	153.4
DE	434.8	731.7	296.9	13.7	150.9	2.1	882.6
EE	21.3	31.2	10.0	9.4	-0.8	-0.3	30.4
IE	8.1	12.4	4.2	10.4	31.8	25.7	44.1
EL	40.2	43.5	3.3	1.6	38.0	8.7	81.5
ES	160.5	243.0	82.5	10.3	109.4	4.5	352.3
FR	413.8	575.2	161.4	7.8	328.8	5.7	904.0
IT	93.6	264.0	170.4	36.4	146.9	5.6	410.9
CY	0.2	1.6	1.4	158.1	1.8	11.5	3.4
LV	46.9	49.9	2.9	1.3	16.1	3.2	65.9
LT	28.9	39.2	10.3	7.1	15.0	3.8	54.2
LU	1.0	4.3	3.3	65.8	9.4	21.6	13.7
HU	0.2	55.4	55.2	5276.1	31.6	5.7	87.0
MT	0.0	0.0	0.0		1.2	253.9	1.2
NL	45.2	64.2	19.0	8.4	94.2	14.7	158.5
AT	139.0	195.8	56.9	8.2	-1.8	-0.1	194.0
PL	11.2	252.4	241.2	431.1	94.3	3.7	346.7
PT	112.1	133.5	21.4	3.8	-3.6	-0.3	129.8
RO	132.6	165.7	33.1	5.0	27.8	1.7	193.5
SI	19.0	28.2	9.2	9.7	4.3	1.5	32.5
SK	15.1	28.4	13.3	17.6	14.6	5.1	43.0
FI	264.6	306.6	42.0	3.2	40.0	1.3	346.7
SE	330.5	436.0	105.4	6.4	55.6	1.3	491.6
UK	59.4	131.4	72.1	24.3	302.7	23.0	434.1
EU 27	2583.7	4115.4	1531.7	11.9	1700.9	4.1	5816.3

### 3.7.1 Biomass electricity

#### a. Installed capacity

Biomass power installed capacity was estimated at 15739 MW in 2005 and it is projected to increase to 43592 MW in 2020. Biomass electricity capacity increased to 25088 MW in 2010, exceeding by 10.6% (+2408 MW) the expected installed plant capacity of 22681 MW.

Figure 37 and Table 37 report the development of biomass installed capacity in EU 27 during period 2005-2020.

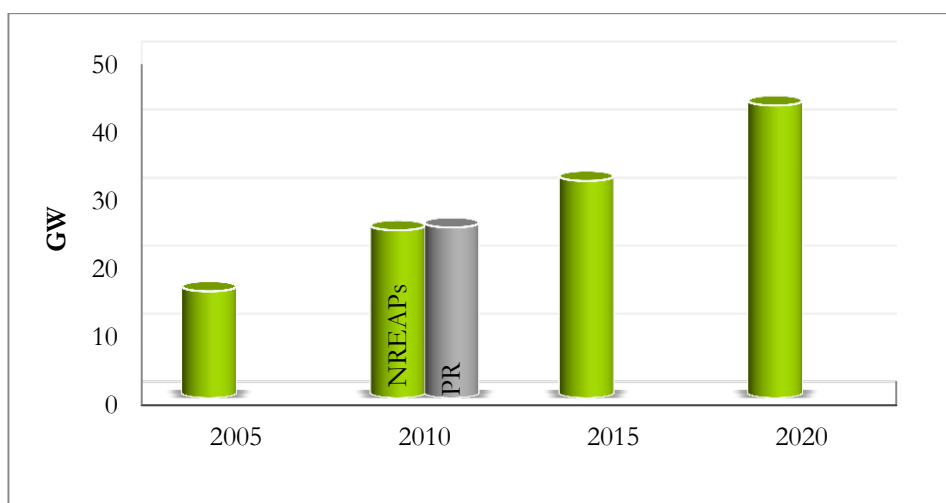


Figure 37. EU 27 biomass installed capacity progress, 2005-2020

The additional biomass installed capacity in 2010-2020 is expected to be 18504 MW in the EU27, with an average growth rate of 7.4%, while the additional plant capacity amounted to 9349 MW in 2005-2010, with an average growth rate of 11.9%.

The share of installed biomass power plant capacity in the total renewable power capacity increased from 9.4% in 2005 to 10.4% in 2010, while the projected share for 2010 was 9.1%. While a significant increase in the biomass power capacity is expected until 2020, its share in the total renewable power capacity is expected to decrease to 9.2% until 2020.

The leading countries in biomass power installed capacity in 2010 were Germany with 6650 MW, followed by Sweden with 3854 MW, UK with 2097 MW, Italy with 2053 MW and Finland with 1910 MW.

In 2020, the leading countries in biomass power installed capacity are expected to be Germany with 8825 MW, followed by United Kingdom with 4240 MW, Italy with 3820 MW, France with 3007 MW and Finland with 2920 MW.

Table 37. EU 27 MS biomass installed capacity progress, 2005-2020

	2005	2010	Growth		Growth		2020
	NREAPs	PR	2005-2010		2010-2020		NREAPs
	MW	MW	MW	av.%	MW	av.%	MW
BE	340	1011	671	39.5	1441	14.3	2452
BG	0	3	3		155	516.7	158
CZ	36	118	82	45.6	246	20.8	364
DK	777	1248	471	12.1	1531	12.3	2779
DE	3174	6650	3476	21.9	2175	3.3	8825
EE	0	67	67		-67	-10.0	0
IE	20	0	-20	-20.0	153		153
EL	24	43	19	15.8	207	48.1	250
ES	601	846	245	8.2	1104	13.0	1950
FR	707	949	242	6.8	2058	21.7	3007
IT	937	2053	1116	23.8	1767	8.6	3820
CY	0	8	8		9	11.5	17
LV	10	16	6	12.0	184	115.0	200

LT	5	29	24	96.0	195	67.2	224
LU	9	17	8	17.8	42	24.7	59
HU	0	514	514		87	1.7	600
MT	0	0	0		30		30
NL	1128	1205	77	1.4	1687	14.0	2892
AT	976	1198	222	4.5	83	0.7	1281
PL	286	439	153	10.7	2091	47.6	2530
PT	476	587	111	4.7	365	6.2	952
RO	0	0	0		600		600
SI	18	49	31	34.4	46	9.4	95
SK	49	178	129	52.7	102	5.7	280
FI	2140	1910	-230	-2.1	1010	5.3	2920
SE	2568	3854	1286	10.0	-940	-2.4	2914
UK	1458	2097	639	8.8	2143	10.2	4240
EU 27	15739	25088	9349	11.9	18504	7.4	43592

## b. Electricity generation

Biomass electricity generation increased significantly in the EU27, reaching 123577 GWh (445 PJ) with an additional electricity generation from 2005 equal to 54538 GWh (196.5 PJ) or an average growth rate of 15.8%. In 2010 renewable electricity from biomass exceeded by 8.2% (+9314 GWh or +33.5 PJ) the NREAPs planned value of 114263 GWh (411.4 PJ).

Figure 38 and Table 38 report the development of biomass electricity generation in EU 27 during period 2005-2020.

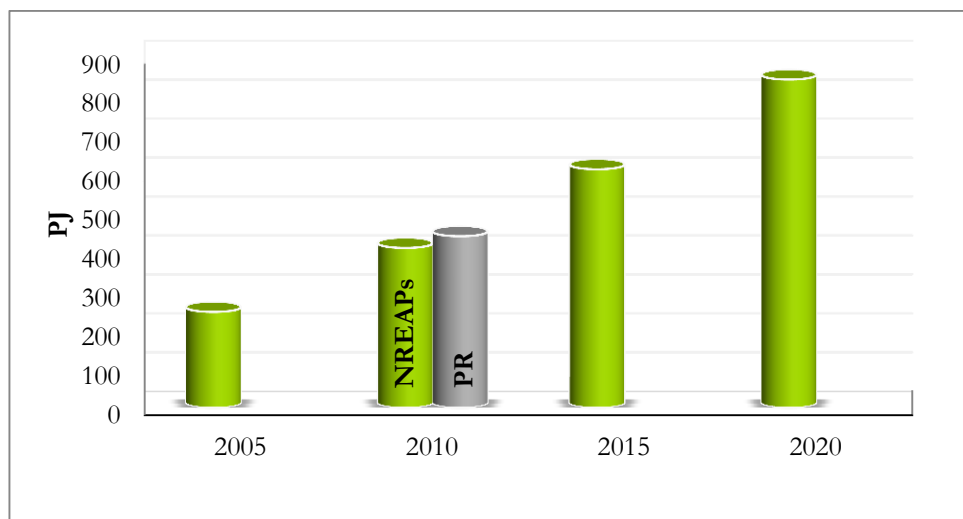


Figure 38. EU 27 biomass electricity production progress, 2005-2020

The share of biomass electricity in total renewable electricity generation has increased from 14.3% in 2005 to 19.3% in 2010, above the expected share of 17.7% for 2010. Biomass electricity share is expected to slightly increase to 19.4% until 2020. For 2020 the electricity generation from biomass is projected to reach 232503 GWh (837 PJ) in 2020 with an average growth rate equal to 8.8%. The additional biomass electricity generation in 2010-2020 is expected to amount to 108296 GWh (392 PJ), which is almost equal to the 2010 biomass electricity

production. The share of biomass electricity in total bioenergy deployment is expected to reach 14.5% in 2020.

Leading countries in biomass electricity production in 2010 were Germany with 33900 GWh (122.0 PJ), Sweden with 12029 GWh (43.3 PJ), the UK with 11914 GWh (42.9 PJ), Finland with 10948 GWh (39.4 PJ) and Italy with 9440 GWh (34.0 PJ).

In 2020, leading countries in biomass electricity production are expected to be Germany with 494575 GWh (178.0 PJ), UK with 26160 GWh (94.2 PJ), Italy with 18780 GWh (67.6 PJ), France with 17171 GWh (61.8 PJ) and Sweden 16753 GWh (60.3 PJ).

The leading countries with the highest share of biomass electricity in total RES electricity in 2010 were Hungary with 75.8%, Estonia with 73.3%, Poland with 60.6%, The Netherlands with 60.2% and Belgium with 53.3%. In 2020, the highest shares of biomass electricity in total RES electricity is expected to be reached in Hungary with 59.4%, Czech Republic with 52.8%, Belgium with 47.7%, Poland with 44.6% and Denmark with 43.0%.

Table 38. EU 27 MS biomass electricity production progress, 2005-2020

	2005	2010	Growth		Growth		2020
	NREAPs	PR	2005-2010		2010-2020		NREAPs
	PJ	PJ	PJ	av.%	PJ	av.%	PJ
BE	6.4	15.9	9.4	29.3	23.9	15.0	39.7
BG	0	0.1	0.1		3.1	530.6	3.1
CZ	3	7.7	5.1	39.0	8.5	11.1	16.1
DK	11.7	16.7	5.0	8.6	15.2	9.1	31.8
DE	50.5	122.0	71.6	28.3	56.0	4.6	178.0
EE	0	2.7	2.5	428.5	-1.4	-5.3	1.2
IE	0.4	0.1	-0.3	-15.3	3.5	362.6	3.6
EL	0.3	0.8	0.4	26.0	3.8	48.3	4.5
ES	9.5	14.0	4.5	9.4	29.9	21.3	43.9
FR	13.7	17.6	3.8	5.5	44.3	25.2	61.8
IT	16.8	34.0	17.2	20.4	33.6	9.9	67.6
CY	0	0.1	0.1		0.4	30.7	0.5
LV	0	0.2	0.1	12.2	4.2	175.8	4.4
LT	0	0.5	0.5	400.0	3.9	73.2	4.4
LU	0.2	0.3	0.1	16.4	0.9	29.8	1.2
HU	0	8.2	8.2		3.7	4.5	12.0
MT	0	0.0	0.0		0.6		0.6
NL	18.1	25.4	7.3	8.0	34.5	13.6	59.9
AT	10.2	16.4	6.2	12.3	2.1	1.3	18.5
PL	5	22.7	17.5	66.9	28.5	12.6	51.2
PT	7.1	10.5	3.3	9.4	2.2	2.1	12.7
RO	0	0.3	0.3		10.2	407.4	10.4
SI	0	0.8	0.4	18.9	1.6	20.5	2.4
SK	0	2.4	2.3	397.5	3.8	15.6	6.2
FI	35	39.4	4.6	2.7	7.1	1.8	46.5
SE	27	43.3	16.1	11.8	17.0	3.9	60.3
UK	32.8	42.9	10.1	6.2	51.3	12.0	94.2
EU 27	248.5	445	196.5	15.8	392.0	8.8	837.0

### 3.7.2 Biomass heating/cooling

Biomass was a major contributor to the heat production in the EU27 in 2010, with 3112.5 PJ (74341 ktoe), representing 92.1% of the total renewable heat generation and 13% of heat demand in EU 27. The heat generation from biomass has increased since 2005 from 2209.8 PJ (52780 ktoe) with an additional heat generation of 902.7 PJ (21560 ktoe) and showing an average growth rate equal to 8.2%.

Figure 39 and Table 39 report the development of biomass heating/cooling generation in EU 27 during period 2005-2020.

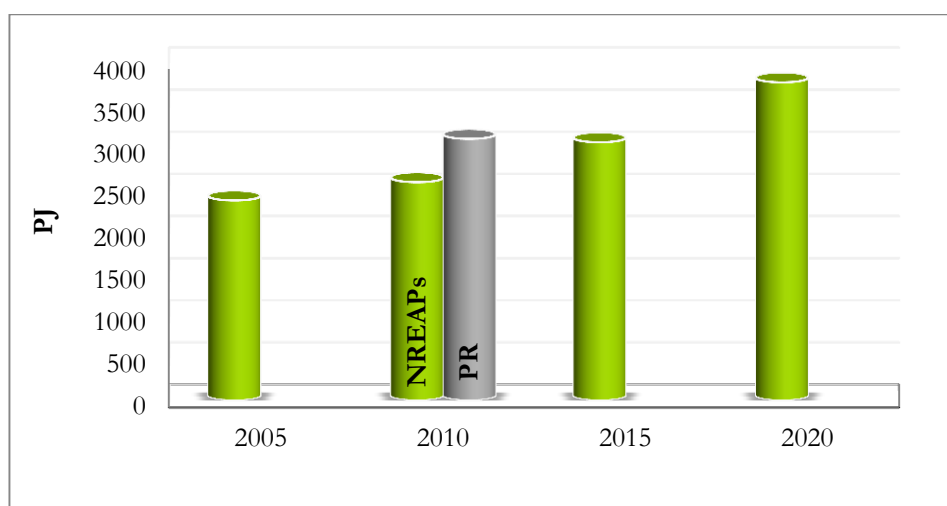


Figure 39. EU 27 biomass heating/cooling production progress, 2005-2020

The share of biomass heat in total renewable heat generation has decreased from 97.0% in 2005 to 92.1% in 2010 and is expected to decrease further in 2020 reaching 81.0% of total renewable energy production in heating/cooling sector. For 2020 the heat generation from biomass is projected to reach 3068.7 PJ (90014 ktoe) with an additional heat generation from biomass in iexpected to be 656.2 PJ (15673 ktoe) in 2010-2020, with an average growth rate of 2.1%. Heating and cooling sector will continue to be the most important sector for bioenergy in 2020 counting for 65% of the total bioenergy contribution to the RES.

Leading countries in biomass heat production in 2010 were: Germany with 482.0 PJ (11513 ktoe), France with 453.8 PJ (10840 ktoe), Sweden with 347.7 PJ (8948.0 ktoe), Finland with 6251.0 ktoe (261.7 ktoe) and Poland with 192.6 PJ (4596 ktoe). Leading countries in the share of biomass heat in total RES heat in 2010 were Estonia and Latvia with 100%, Lithuania with 99.8%, Romania with 99.4% and Poland with 99.2%.

In 2020, leading countries in biomass heat production are expected to be France with 688.9 PJ (16455 ktoe), Germany with 475.4 PJ (11355 ktoe), Sweden with 397.4 PJ (9491 ktoe), Finland with 276.7 PJ (6610 ktoe) and Italy with 237.4 PJ (5670 ktoe). In 2020, the share of biomass heat in total RES heat is expected to be 100% in Estonia, 99.7% in Latvia, 97.3% in Lithuania, 97.3% in Bulgaria and 96.0% in Romania.

Table 39. EU 27 MS biomass heating/cooling production progress, 2005-2020

	2005	2010	Growth		Growth		2020
	NREAPs	PR	2005-2010		2010-2020		NREAPs
	PJ	PJ	PJ	av.%	PJ	av.%	PJ
BE	19.99	40.12	20.1	20.1	45.0	11.2	85.2
BG	30.31	37.64	7.3	4.8	7.3	1.9	44.9

CZ	60.62	77.08	16.5	5.4	21.8	2.8	98.9
DK	73.65	101.99	28.3	7.7	8.7	0.8	110.7
DE	304.00	482.03	178.0	11.7	-6.6	-0.1	475.4
EE	21.14	28.55	7.4	7.0	-3.1	-1.1	25.4
IE	7.66	8.40	0.7	1.9	11.9	14.2	20.3
EL	39.82	37.35	-2.5	-1.2	13.8	3.7	51.2
ES	145.20	169.73	24.5	3.4	25.1	1.5	194.8
FR	383.22	453.85	70.6	3.7	235.1	5.2	688.9
IT	69.29	168.64	99.4	28.7	68.7	4.1	237.4
CY	0.18	0.81	0.6	72.5	0.4	5.5	1.3
LV	46.64	48.48	1.8	0.8	9.8	2.0	58.3
LT	28.72	36.80	8.1	5.6	6.0	1.6	42.8
LU	0.80	2.28	1.5	36.7	1.2	5.2	3.5
HU	0.00	39.82	39.8		13.8	3.5	53.6
MT	0.00	0.02	0.0		0.0	20.7	0.1
NL	27.09	29.22	2.1	1.6	34.4	11.8	63.6
AT	126.99	157.72	30.7	4.8	-6.7	-0.4	151.0
PL	3.71	192.57	188.9	1019.4	20.5	1.1	213.1
PT	105.00	109.23	4.2	0.8	-12.0	-1.1	97.2
RO	132.55	165.42	32.9	5.0	-3.1	-0.2	162.3
SI	18.59	25.25	6.7	7.2	-3.3	-1.3	22.0
SK	14.99	22.61	7.6	10.2	6.3	2.8	28.9
FI	229.86	261.72	31.9	2.8	15.0	0.6	276.7
SE	296.34	374.68	78.3	5.3	22.7	0.6	397.4
UK	23.45	40.49	17.0	14.5	123.4	30.5	163.9
EU 27	2209.81	3112.5	902.7	8.2	656.2	2.1	3768.7

### 3.7.3 Solid biomass

#### 3.7.3.1 Solid biomass electricity

##### a. Installed capacity

Solid biomass power installed capacity was estimated at 10566 MW in 2005 and it is projected to increase to 27769 MW in 2020. In 2010 solid biomass installed capacity reached the amount of 19158 MW with an average growth rate of 16.3% being 32.8% (+4737 MW) above the NREAPs planned value of 14421.4 MW. The additional solid biomass installed capacity in 2010-2020 is expected to be 8611 MW in the EU27, showing an average growth rate equal to 4.5%.

Figure 40 and Table 40 report the development of solid biomass installed capacity in EU 27 during period 2005-2020.

The share of installed solid biomass power plant capacity in the total renewable power capacity increased from 6.3% in 2005 to 8.1% in 2010, while the projected share for 2010 was 5.8%. Even with the expected increase in the solid biomass power capacity until 2020, such a share is expected to remain at 5.8% until 2020.



The leading countries in solid biomass power installed capacity in 2010 were Germany with 3707 MW, followed by Sweden with 2641 MW, the Netherlands with 1214 MW, Austria with 1099 MW and Italy with 1026 MW. The installed capacity of solid biomass plants in these five countries reached 12657 MW in 2010, representing 66.1% of the solid biomass plant capacity in the EU27.

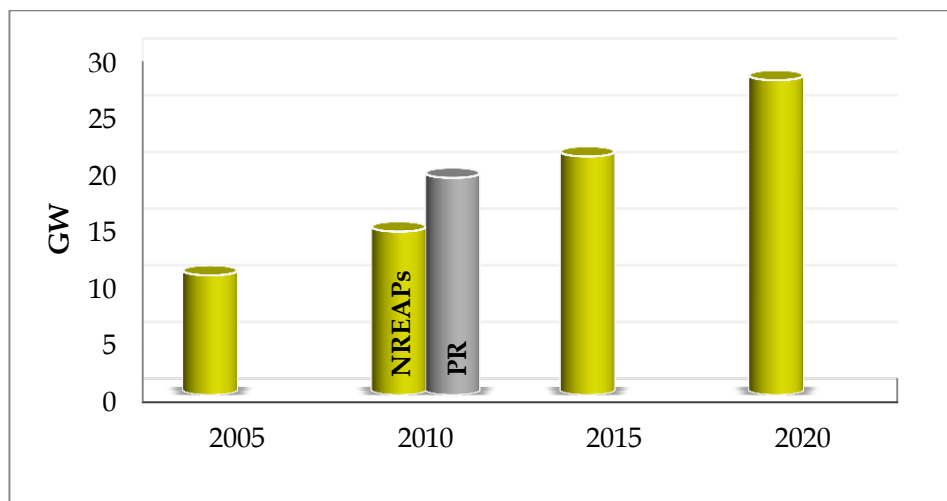


Figure 40. EU 27 solid biomass installed capacity progress, 2005-2020

In 2020, the leading countries are expected to be Germany with 4792 MW, followed by UK with 3140 MW, Sweden with 2872 MW, Denmark with 2404 MW and France with 2382 MW. The installed capacity of solid biomass plants in these five countries should increase to 15590 MW in 2020, representing 56.1% of the solid biomass plant capacity in the EU27.

Table 40. EU 27 MS solid biomass installed capacity progress, 2005-2020

	2005	2010	Growth		Growth		2020
	NREAPs	PR	2005-2010		2010-2020		NREAPs
	MW	MW	MW	av.%	MW	av.%	MW
BE	270	727	457	33.8	1280	17.6	2007
BG	0	0	0		93		93
CZ*	0	0	0	0	0	0	0
DK	740	1168	428	11.6	1236	10.6	2404
DE	2427	3650	1223	10.1	1142	3.1	4792
EE	0	63	63		-63	-10.0	0
IE	2	0	-2	-20.0	91		91
EL	0	0	0		40		40
ES	449	657	208	9.3	893	13.6	1550
FR	623	774	151	4.8	1608	20.8	2382
IT	653	944	291	8.9	696	7.4	1640
CY	0	0	0		0		0
LV	3	5	2	13.3	103	206.0	108
LT	2	16	14	140.0	146	91.3	162
LU	4	8	4	20.0	22	27.5	30
HU	0	490	490		11	0.2	500
MT	0	0	0		15		15
NL	966	992	26	0.5	1261	12.7	2253

AT	892	704	-188	-4.2	460	6.5	1164
PL	268	356	88	6.6	1194	33.5	1550
PT	178	562	384	43.1	-195	-3.5	367
RO	0	0	0		405		405
SI	15	35	20	26.7	-1	-0.3	34
SK	47	169	122	51.9	1	0.1	170
FI	0	1910	1910		-1910	-10.0	0
SE	2526	3832	1306	10.3	-960	-2.5	2872
UK	501	2097	1596	63.8	1043	5.0	3140
EU 27	10566	19158	8593	16.3	8611	4.5	27769

## b. Electricity generation

Solid biomass power generation increased significantly in EU27, reaching 92773 GWh (334 PJ), representing 14.5% of the total renewable electricity generation in 2010 exceeding by 20.9% (+57.8 PJ) the NREAPs planned value of 76704 GWh (276.1 PJ). The solid biomass electricity generation has increased since 2005 from 55054 GWh (198.2 PJ) with an additional electricity generation equal to 37719 GWh (135.8 PJ) and an average growth rate of 13.7%.

Figure 41 and Table 41 report the development of solid biomass power generation in EU 27 during period 2005-2020.

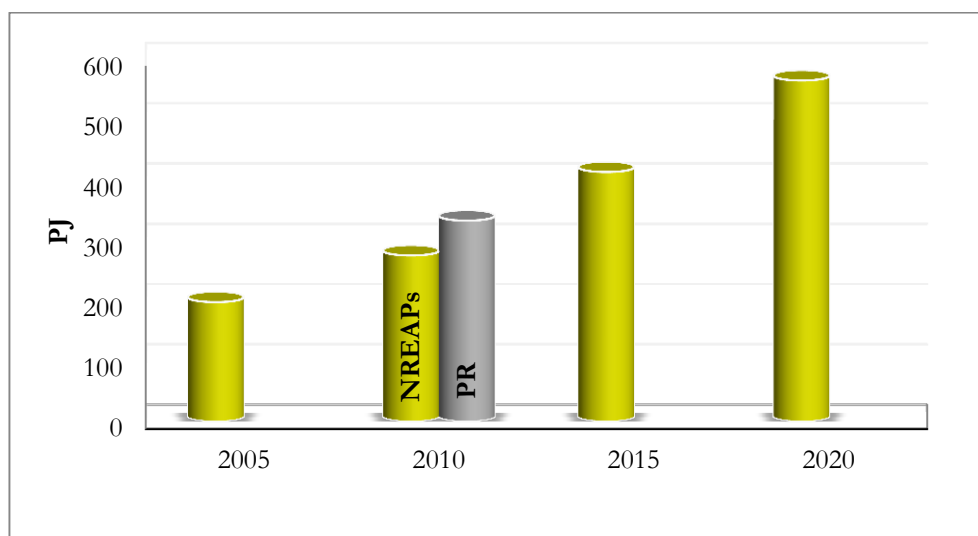


Figure 41. EU 27 solid biomass power generation progress, 2005-2020

The share of solid biomass electricity in total renewable electricity generation has increased from 11.4% in 2005 to 14.4% in 2010 and is expected to decrease to 12.8% until 2020.

For 2020 the electricity generation from solid biomass is projected to reach 155755 GWh (560.7 PJ) in 2020. The additional biomass electricity generation in 2010-2020 is expected to be 62981 GWh (226.7 PJ), with an average growth rate of 6.8%.

Leading countries in solid biomass generation in 2010 were Germany with 16000 GWh (57.6 PJ), Sweden with 11976 GWh (43.1 PJ), the UK with 11914 GWh (42.9 PJ), Finland with 10858 GWh (39.1 PJ) and The Netherlands with 5961 GWh (51.5 PJ).

In 2020, leading countries in solid biomass electricity production are expected to be Germany with 24569 GWh (88.4 PJ), UK with 20590 GWh (74.1 PJ), Sweden with 16635 GWh (59.9 PJ), France with 13470 GWh (48.5 PJ) and The Netherlands with 11975GWh (43.1 PJ).

The leading countries with the highest share of solid biomass electricity in total RES electricity in 2010 were Estonia with 72.3%, Hungary with 72.1%, Poland with 56.8%, The Netherlands with 50.9% and Belgium with 43.2%. In 2020, the highest shares of wind power in total RES electricity are expected to be reached in Hungary with 48.0%, Belgium with 41.4%, Poland with 32.0%, Denmark with 30.8% and Czech Republic with 28.2%.

Table 41. EU 27 MS solid biomass power generation progress, 2005-2020

	2005	2010	Growth		Growth		2020
	NREAPs	PR	2005-2010		2010-2020		NREAPs
	PJ	PJ	PJ	av.%	PJ	av.%	PJ
BE	5.5	12.9	7.4	27.0	21.6	16.8	34.5
BG	0.0	0.0	0.0		1.9		1.9
CZ	2.0	5.4	3.4	33.3	1.6	3.1	7.0
DK	10.7	15.5	4.8	9.0	7.4	4.8	22.8
DE	36.2	57.6	21.4	11.9	30.8	5.4	88.4
EE	0.0	2.6	2.6		-2.6	-10.0	0.0
IE	0.0	0.0	0.0	2.5	2.4	753.3	2.5
EL	0.0	0.0	0.0		1.3		1.3
ES	7.3	11.7	4.4	11.9	22.9	19.6	34.6
FR	12.0	13.9	1.9	3.1	34.6	24.9	48.5
IT	12.5	15.5	3.0	4.8	12.9	8.3	28.4
CY	0.0	0.0	0.0		0.0		0.0
LV	0.0	0.0	0.0	16.0	2.3	703.3	2.3
LT	0.0	0.4	0.4	753.3	2.5	59.8	2.9
LU	0.1	0.1	0.0	9.6	0.6	57.9	0.7
HU	0.0	7.8	7.8		1.8	2.3	9.7
MT	0.0	0.0	0.0		0.3		0.3
NL	17.1	21.5	4.3	5.1	21.7	10.1	43.1
AT	9.0	9.6	0.6	1.3	6.7	6.9	16.3
PL	4.8	21.3	16.4	68.1	15.5	7.3	36.7
PT	3.4	10.1	6.7	40.0	-4.8	-4.8	5.3
RO	0.0	0.2	0.2		6.8	271.7	7.0
SI	0.3	0.5	0.2	10.5	0.7	14.7	1.1
SK	0.1	2.3	2.2	451.1	0.8	3.4	3.1
FI	34.7	39.1	4.4	2.5	-10.8	-2.8	28.3
SE	26.8	43.1	16.3	12.1	16.8	3.9	59.9
UK	15.6	42.9	27.2	34.8	31.2	7.3	74.1
EU 27	198.2	334.0	135.8	13.7	226.7	6.8	560.7

### 3.7.3.2 Solid biomass heating/cooling

Solid biomass is a major contributor to the heat generation in the EU27, with 2898.6 PJ (69231 ktoe), representing 85.9% of the total renewable heat generation in 2010. The heat generation

from solid biomass has increased since 2005 from 2002.6 PJ (47832 ktoe) with an additional heat production of 896 PJ (21399 ktoe) and an average growth rate equal to 8.9% being 21.9% above the NREAPs planned value of 2377.2 PJ (56778 ktoe).

Figure 42 and Table 42 report the development of solid biomass in heating/cooling sector in EU 27 during period 2005-2020.

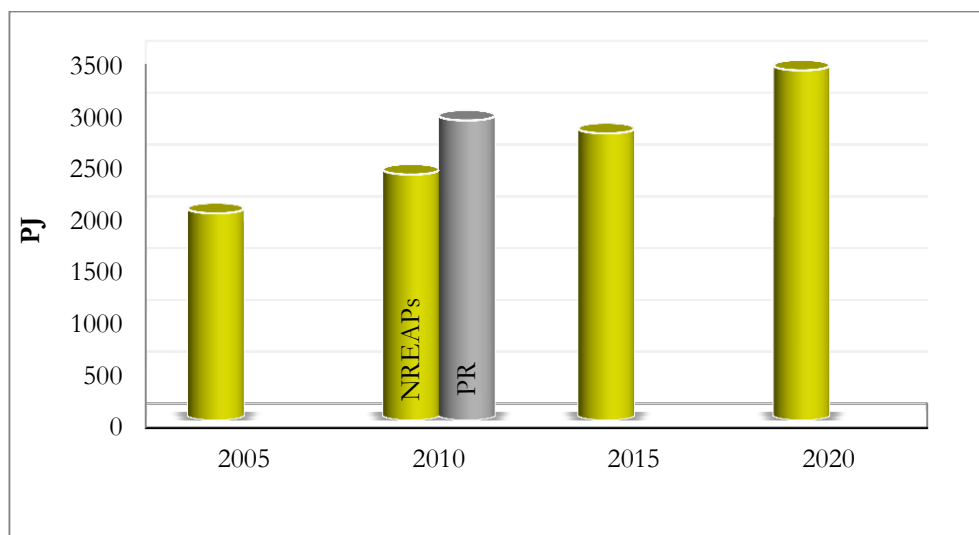


Figure 42. EU 27 solid biomass heating/cooling progress, 2005-2020

The share of solid biomass heat in total renewable heat generation has increased from 81.7% in 2005 to 85.9% in 2010, but it is expected to decrease to 72.5% of total renewable heat until 2020. Solid biomass use for heat generation has the highest share in biomass heat, with 93.3% in 2010, in comparison with 84.2% in 2005; this share is expected decrease by a little extent reaching 89.5% in 2020.

For 2020 the heat generation from solid biomass is projected to reach 3370.2 PJ (80496 ktoe) in 2020. The additional biomass heat generation in 2010-2020 is expected to be 471.6 PJ (11265 ktoe) implying an average growth rate of 1.6%.

Leading countries in solid biomass heat in 2010 were France with 448.4 PJ (10711 ktoe), Germany with 399.3 PJ (9537 ktoe), Sweden with 364.8 PJ (8713 ktoe), Finland with 259.7 PJ (6203 ktoe) and Poland with 190.7 PJ (4554 ktoe). Leading countries in the share of solid biomass heat in total RES heat in 2010 were Estonia with 99.7%, Latvia with 99.6%, Romania with 99.4%, Lithuania with 99.2% and Poland with 98.2%.

In 2020, leading countries in solid biomass heat is expected be France with 665.7 PJ (15900 ktoe), Sweden with 394.2 PJ (9415 ktoe), Germany with 374.8 PJ (8952 ktoe), Italy with 220.0 PJ (5254 ktoe), and Poland with 194.1 PJ (4636 ktoe). In 2020, the share of solid biomass heat in total RES heat is expected to be 100% in Estonia, 96.2% in Latvia, 95.5% in Bulgaria, 95.2% in Romania, 92.6% in Lithuania.

Table 42. EU 27 MS solid biomass heating/cooling progress, 2005-2020

	2005	2010	Growth		Growth		2020
	NREAPs	PR	2005-2010	av. %	2010-2020	av. %	NREAPs
	PJ	PJ	PJ	av. %	PJ	av. %	PJ
BE	19.9	37.28	17.4	17.5	44.2	11.9	81.5
BG	30.3	36.97	6.7	4.4	7.1	1.9	44.1

CZ	59.7	74.61	14.9	5.0	15.4	2.1	90.0
DK	71.8	99.94	28.2	7.9	3.5	0.3	103.4
DE	284.5	399.30	114.8	8.1	-24.5	-0.6	374.8
EE	21.1	28.47	7.3	6.9	-3.1	-1.1	25.4
IE	7.4	8.08	0.7	1.9	10.9	13.5	19.0
EL	39.8	37.26	-2.6	-1.3	13.9	3.7	51.2
ES	144.1	168.10	24.0	3.3	22.5	1.3	190.6
FR	379.6	448.45	68.8	3.6	217.3	4.8	665.7
IT	68.2	155.79	87.6	25.7	64.2	4.1	220.0
CY	0.2	0.71	0.5	61.1	0.3	4.2	1.0
LV	46.6	48.27	1.7	0.7	8.0	1.6	56.2
LT	28.7	36.59	7.9	5.5	4.1	1.1	40.7
LU	0.7	2.01	1.3	39.9	0.9	4.5	2.9
HU	0.0	39.44	39.4		11.8	3.0	51.3
MT	0.0	0.01	0.0		0.0	-10.0	0.0
NL	22.6	23.82	1.2	1.1	3.4	1.4	27.2
AT	126.7	156.34	29.7	4.7	-6.0	-0.4	150.3
PL	2.9	190.68	187.8	1302.0	3.4	0.2	194.1
PT	74.7	71.13	-3.6	-1.0	-9.0	-1.3	62.1
RO	0.0	165.39	165.4		-4.4	-0.3	161.0
SI	16.8	23.11	6.3	7.5	-2.3	-1.0	20.8
SK	14.9	22.32	7.4	9.9	4.1	1.8	26.4
FI	228.2	259.71	31.5	2.8	-94.7	-3.6	165.0
SE	292.7	364.80	72.1	4.9	29.4	0.8	394.2
UK	20.6	0.00	-20.6	-20.0	151.2		151.2
EU 27	2002.6	2898.56	896.0	8.9	471.6	1.6	3370.2

### 3.7.4 Biogas

#### 3.7.4.1 Biogas electricity

##### a. Installed capacity

Biogas power installed capacity was estimated at 2665 MW in 2005 and increased to 4558 MW in 2010 being 16% below (-867 MW) the NREAPs planned value of 5425.6 MW. The biogas installed capacity it is projected to further increase to 11192 MW in 2020. The share of installed biogas power plant capacity in the total renewable power capacity increased from 1.6% in 2005 to 1.3% in 2010, while the projected share for 2010 was 2.2%. Even with the significant increase in the biogas power capacity expected until 2020, the share of biogas in the total renewable power capacity is expected to increase only to 2.4% until 2020.

The additional biogas electricity installed capacity in 2010-2020 is expected to be 6634 MW in the EU27, with an average growth rate of 14.6%, while the additional plant capacity was 1893 MW in 2005-2010, with an average growth rate equal to 14.2%.

Figure 43 and Table 43 report the development of biogas installed capacity in EU 27 during period 2005-2020.

The leading countries in biomass power installed capacity in 2010 were Germany 2730 MW, followed by Italy with 508 MW, The Netherlands with 196 MW, Spain with 189 MW and France with 175 MW. The installed capacity of biogas plants in these five countries is expected reached 3798 MW in 2020, representing 83.4% of the biogas power plant capacity in the EU27.

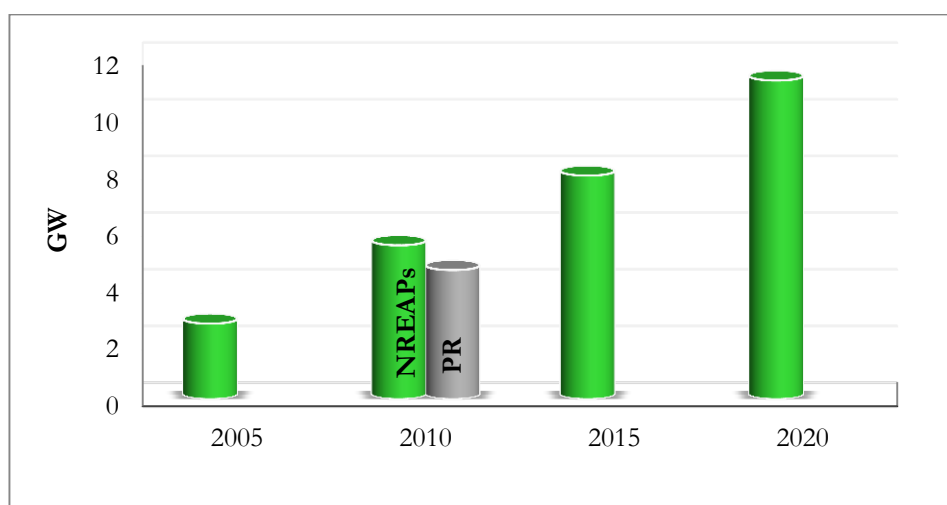


Figure 43. EU 27 biogas installed capacity progress, 2005-2020

In 2020, the leading countries in biogas power installed capacity are expected to be Germany with 3796 MW, followed by Italy with 1200 MW, UK with 1100 MW, Poland with 980 MW and the Netherlands with 639 MW. The installed capacity of biogas plants in these five countries is expected to reach 7715 MW in 2020, representing 68.7% of the biogas power plant capacity in the EU27.

Table 43. EU 27 MS biogas installed capacity progress, 2005-2020

	2005	2010	Growth		Growth		2020
	NREAPs	PR	2005-2010		2010-2020		NREAPs
	MW	MW	MW	av.%	MW	av.%	MW
BE	57	124	67	23.4	303	24.5	427
BG	0	3	3		62	206.7	65
CZ	36	118	82	45.6	246	20.8	364
DK	37	80	43	23.2	269	33.6	349
DE	693	2730	2037	58.8	1066	3.9	3796
EE	0	4	4		-4	-10.0	0
IE	18	0	-18	-20.0	62		62
EL	24	43	19	15.8	167	38.8	210
ES	152	189	37	4.9	211	11.2	400
FR	84	175	91	21.7	450	25.7	625
IT	284	508	224	15.8	692	13.6	1200
CY	0	8	8		9	11.2	17
LV	7	11	4	11.4	81	73.6	92
LT	3	13	10	66.7	49	37.7	62
LU	5	9	4	16.0	20	22.2	29
HU	0	24	24		76	31.7	100
MT	0	0	0		15		15
NL	162	196	34	4.2	443	22.6	639

AT	72	171	99	27.5	-69	-4.0	102
PL	18	83	65	72.1	897	108.2	980
PT	9	25	16	35.6	125	50.0	150
RO	0	0	0		195		195
SI	3	14	11	73.3	47	33.6	61
SK	2	9	7	70.0	101	112.2	110
FI	0	0	0		0		0
SE	42	22	-20	-9.5	20	9.1	42
UK	957	0	-957		1100		1100
EU 27	2665	4558	1893	14.2	6634	14.6	11192

## b. Electricity generation

Renewable electricity produced from biogas increased from 12482 GWh (44.9 PJ) in 2005 to 24453 GWh (88 PJ) with an average growth rate of 19.2% missing by 14.8% (-4292 GWh) the NREAPs planned value of 28685.3 GWh (103.3 PJ). In 2020 the renewable electricity produced from biogas is expected to reach 63656 GWh (229.2 PJ) with an average growth rate equal to 16%. The additional renewable electricity from biogas in period 2010-2020 is expected to be 39203 GWh (141 PJ) compared with additional renewable electricity of 11971 GWh (43 PJ) during period 2005-2010. The share of biogas electricity in total renewable electricity generation has increased from 2.6% in 2005 to 3.8% in 2010 and is expected to increase to 5.3% until 2020.

Figure 44 and Table 44 report the development of biogas electricity generation in EU 27 during period 2005-2020.

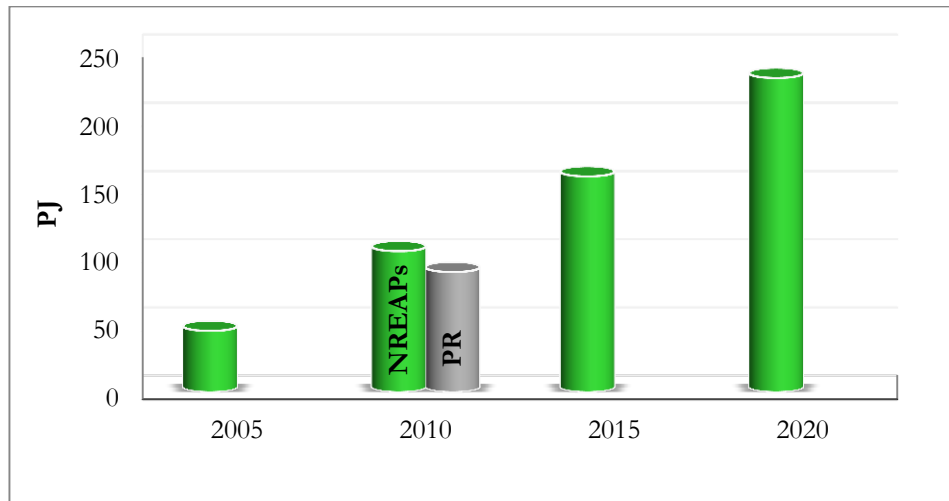


Figure 44. EU 27 biogas electricity generation progress, 2005-2020

Leading country in biogas power production in 2010 was Germany with 16200 GWh (58.3 PJ), followed by far by Italy with 20547 GWh (7.4 PJ), the Netherlands with 1044 GWh (3.8 PJ), France with 1013 GWh (3.6 PJ) and Spain with 653 GWh (2.4 PJ). The biogas electricity generation plants in these five countries delivered 20964 GWh (75.5 PJ) in 2010, representing 85.8% of the biogas electricity in the EU27.

In 2020, leading countries in biomass electricity production are expected to be Germany with 23438 GWh (84.4 PJ), Italy with 6020 GWh (21.7 PJ), the Netherlands with 4664 GWh (16.8 PJ), France with 3701 GWh (13.3 PJ) and Spain 2600 GWh (9.4). The biogas electricity

generation plants in these five countries should produce delivered 43710 GWh (157.4 PJ) in 2010, representing 68.3% of the biogas electricity in the EU27.

The leading countries with the highest share of biogas electricity in total RES electricity in 2010 were Cyprus with 48.2%, Luxembourg with 20.8%, Germany with 14.4%, Czech Republic with 12.0% and the Netherlands with 8.9%. In 2020, the highest shares of biogas power in total RES electricity is expected to be reached in Czech Republic with 24.6%, Luxembourg with 18.4%, Malta with 18.2%, Lithuania with 14.0% and Poland with 12.6%.

Table 44. EU 27 MS biogas electricity generation progress, 2005-2020

	2005	2010	Growth		Growth		2020
	NREAPs	PR	2005-2010		2010-2020		NREAPs
	PJ	PJ	PJ	av.%	PJ	av.%	PJ
BE	0.8	2.0	1.2	28.4	3.1	15.3	5.2
BG	0	0.1	0.1		1.2	209.4	1.3
CZ	1	2.3	1.7	58.9	6.8	29.9	9.1
DK	1.0	1.2	0.2	3.5	7.8	64.9	9.0
DE	13.1	58.3	45.2	68.7	26.1	4.5	84.4
EE	0	0.0	0.0		0.0	-10.0	0.0
IE	0.4	0.1	-0.3	-16.7	1.1	167.2	1.1
EL	0.3	0.8	0.4	26.0	2.4	31.4	3.2
ES	2.2	2.4	0.1	1.0	7.0	29.8	9.4
FR	1.7	3.6	1.9	22.4	9.7	26.5	13.3
IT	4.3	7.4	3.1	14.3	14.3	19.3	21.7
CY	0	0.1	0.1		0.4	30.7	0.5
LV	0	0.2	0.1	11.7	1.9	92.5	2.1
LT	0	0.1	0.1	135.0	1.4	123.2	1.5
LU	0.1	0.2	0.1	21.2	0.3	15.7	0.5
HU	0	0.4	0.4		1.9	46.8	2.3
MT	0	0.0	0.0		0.3		0.3
NL	1.0	3.8	2.7	53.8	13.0	34.7	16.8
AT	1.0	2.3	1.3	25.9	-0.2	-1.0	2.1
PL	0	1.4	1.0	51.8	13.0	90.9	14.5
PT	0.1	0.4	0.2	38.8	1.5	42.5	1.9
RO	0	0.0	0.0		3.4	38765.5	3.4
SI	0	0.3	0.2	40.6	1.0	27.8	1.3
SK	0	0.1	0.1	108.0	3.0	258.8	3.1
FI	0	0.3	0.2	69.0	0.7	20.3	1.0
SE	0	0.1	-0.1	-6.4	0.1	4.7	0.2
UK	17.1	0.0	-17.1	-20.0	20.1		20.1
EU 27	44.9	88.0	43.1	19.2	141.1	16.0	229.2

### 3.7.4.2 Biogas heating/cooling

Biogas use for heating/cooling has increased to a large extent, contributing to the heat generation in the EU27 with 83.2 PJ (1988 ktoe) in 2010 with an average growth rate from 2005 equal to 45% exceeding with 21 PJ (+34% yearly) the NREAPs planned value of 62 PJ (1484



ktoe). The heat generation from biogas has increased since 2005 from 25.6 PJ (611 ktoe) and this is projected to reach 189.2 PJ (4520 ktoe) in 2020.

The share of biogas heat in total renewable heat generation has increased from 1.1% in 2005 to 2.4% in 2010, and it is expected to increase to 4.0% of total renewable heat until 2020. Biogas use for heat generation had a share of 2.6% in biomass heat in 2010, in comparison with 1.2% in 2005; this share is expected to further increase to 5.0% until 2020.

The additional heat generation from biogas in 2010-2020 is expected to be 106 PJ (2532 ktoe) with an average growth rate of about 12.7%. In comparison, biogas heat production has increased by 57.7 PJ (1377 ktoe) with an average growth rate of 45.1% in 2005-2010.

Figure 45 and Table 45 report the development of solid biomass installed capacity in EU 27 during period 2005-2020.

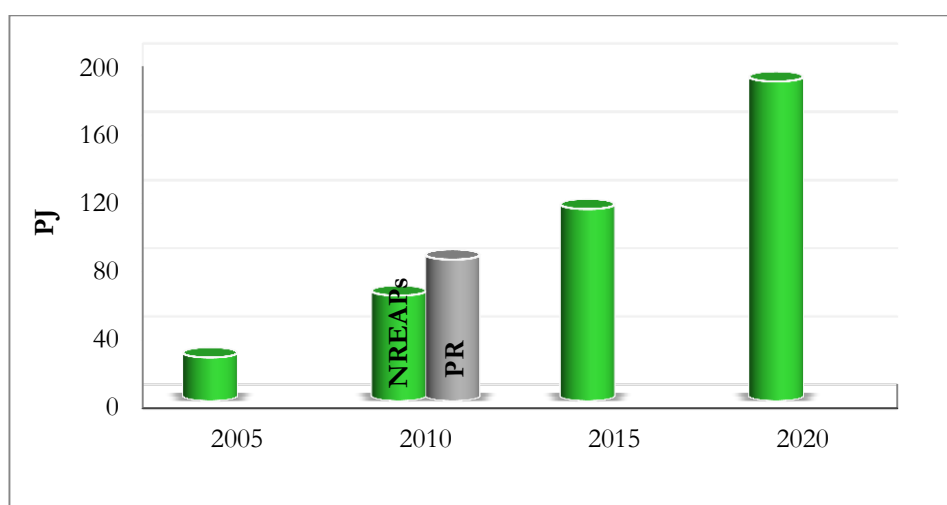


Figure 45. EU 27 biogas heating/cooling progress, 2005-2020

Leading country in biogas heat production in 2010 was Germany with 54.1 PJ (1293 ktoe), followed by far by France with 5.4 PJ (129 ktoe), the Netherlands with 4.9 PJ (116 ktoe), Sweden with 3.5 PJ (83 ktoe) and Denmark with 2.1 PJ (49 ktoe). The biogas heating /cooling plants in these five countries delivered 69.9 PJ (1670 ktoe) in 2010, representing 84.3% of the biogas heating/cooling in the EU27.

Leading countries in the share of biogas heat in total RES heat in 2010 were The Netherlands with 14.0%, Luxembourg with 11.5%, Germany with 10.4%, Malta with 5.0% and Ireland with 3.3%.

In 2020, leading countries in biogas heat are expected be Germany with 70.8 PJ (1692 ktoe), France with 23.2 PJ (555 ktoe), Poland with 12.6 PJ (453 ktoe), UK with 12.6 PJ (302 ktoe), and the Netherlands with 12.1 PJ (288 ktoe). The biogas heating /cooling plants in these five countries are expected to produce 137.7 PJ (3290 ktoe) in 2020, representing 73.5% of the biogas heating /cooling in the EU27 in that year.

Table 45. EU 27 MS biogas heating/cooling progress, 2005-2020

	2005	2010	Growth		Growth		2020
	NREAPs	PR	2005-2010		2010-2020		NREAPs
	PJ	PJ	PJ	av.%	PJ	av.%	PJ
BE	0.1	1.1	1.0	255.8	1.2	11.0	2.3
BG	0.0	0.1	0.1		0.7	56.7	0.8

CZ	1.0	2.5	1.5	31.3	6.4	25.8	8.8
DK	1.9	2.1	0.2	1.8	4.9	23.7	6.9
DE	6.4	54.1	47.7	147.9	16.7	3.1	70.8
EE	0.0	0.1	0.1		-0.1	-10.0	0.0
IE	0.3	0.3	0.0	1.7	1.1	33.4	1.4
EL	0.0	0.1	0.1		-0.1	-10.0	0.0
ES	1.1	1.6	0.5	8.9	2.6	15.6	4.2
FR	3.6	5.4	1.8	10.0	17.8	33.0	23.2
IT	1.1	1.1	0.0	0.0	10.0	92.3	11.1
CY	0.0	0.1	0.1		0.2	15.1	0.3
LV	0.0	0.2	0.1	60.0	1.9	112.5	2.1
LT	0.0	0.2	0.2	80.0	1.9	90.0	2.1
LU	0.1	0.3	0.1	20.6	0.3	10.6	0.6
HU	0.0	0.4	0.4		2.0	52.2	2.3
MT	0.0	0.0	0.0		0.1	104.7	0.1
NL	2.9	4.9	2.0	13.6	7.2	14.8	12.1
AT	0.3	1.2	0.8	50.0	-0.5	-4.3	0.7
PL	0.8	1.9	1.1	26.2	17.1	90.0	19.0
PT	0.4	1.3	0.9	44.0	0.2	1.6	1.5
RO	0.0	0.0	0.0		0.8	222.6	0.8
SI	0.0	0.2	0.2		-0.2	-10.0	0.0
SK	0.0	0.3	0.3	120.0	2.2	75.7	2.5
FI	1.7	0.3	-1.3	-16.0	2.2	65.0	2.5
SE	0.9	3.5	2.6	59.0	-3.0	-8.7	0.5
UK	2.8	0.0	-2.8	-20.0	12.6		12.6
EU 27	25.6	83.2	57.7	45.1	106.0	12.7	189.2

### 3.7.5 Bioliqids

#### 3.7.5.1 Bioliqids for electricity

##### a. Installed capacity

The bioliqids power installed capacity was estimated at 368 MW in 2005 and increased to 1382 MW in 2010. The bioliqids installed capacity it is projected to further increase to 1711 MW in 2020. The share of installed bioliqids power plant capacity in the total renewable power capacity increased from 0.2% in 2005 to 0.6% in 2010, while the projected share for 2010 was 0.4%. Even with some increase in the bioliqids power capacity expected until 2020, their share of installed biomass power capacity is expected to remain at the level of 0.4% until 2020.

The additional bioliqids electricity installed capacity in 2010-2020 is expected to be 276 MW in the EU27, with an average growth rate per year of 2.0%, while the additional plant capacity was 1014 MW in 2005-2010, with an average growth rate equal to 55.1%.

Figure 46 and Table 46 report the development of bioliqids installed capacity in EU 27 during period 2005-2020.

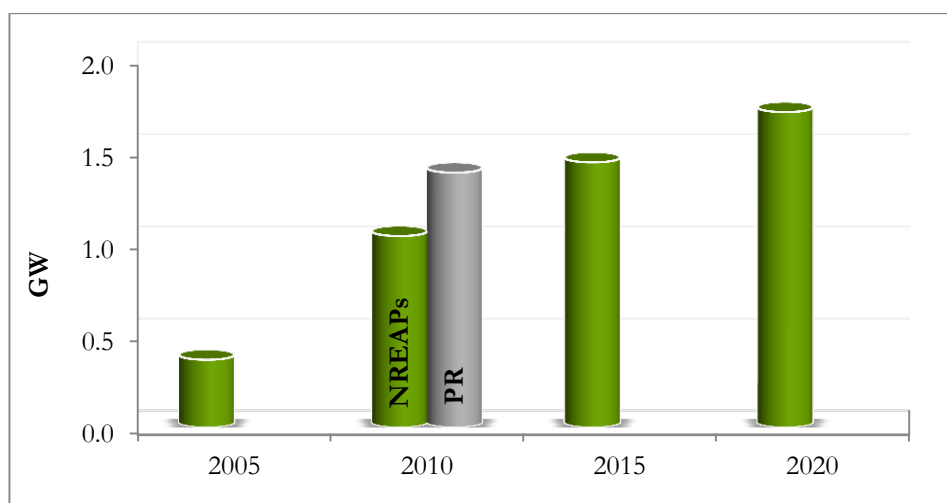


Figure 46. EU 27 bioliquids installed capacity progress, 2005-2020

The leading countries in bioliquids power installed capacity in 2010 were Italy with 601 MW, followed by Austria with 324 MW, Germany with 280 MW, Belgium with 160 MW and the Netherlands with 17 MW.

In 2020, the leading countries in bioliquids power installed capacity are expected to be Italy with 980 MW, followed by Portugal with 435 MW, Germany with 237, Denmark with 26 MW and Belgium with 18 MW.

Table 46. EU 27 MS bioliquids installed capacity progress, 2005-2020

	2005	2010	Growth		Growth		2020
	NREAPs	PR	2005-2010		2010-2020		NREAPs
	MW	MW	MW	av.%	MW	av.%	MW
BE	13	160	147	226.5	-143	-8.9	18
BG	0	0	0		0		0
CZ	0	0	0		0		0
DK	0	0	0		26		26
DE	54	280	226	83.7	-43	-1.5	237
EE	0	0	0		0		0
IE	0	0	0		0		0
EL	0	0	0		0		0
ES	0	0	0		0		0
FR	0	0	0		0		0
IT	0	601	601		379	6.3	980
CY	0	0	0		0		0
LV	0	0	0		0		0
LT	0	0	0		0		0
LU	0	0	0		0		0
HU	0	0	0		0		0
MT	0	0	0		0		0
NL	0	17	17		-17	-10.0	0
AT	12	324	312	520.0	-309	-9.5	15
PL	0	0	0		0		0
PT	289	0	-289	-20.0	435		435

RO	0	0	0		0		0
SI	0	0	0		0		0
SK	0	0	0		0		0
FI	0	0	0		0		0
SE	0	0	0		0		0
UK	0	0	0		0		0
EU 27	368	1,382	1,014	55.1	276	2.0	1,711

## b. Electricity generation

Bioliqids electricity generation increased significantly in the EU27, reaching 6351 GWh (22.9 PJ) in 2010 missing by 26.4% (-8.2 PJ) the NREAPs planned value of 8633 GWh (31.2 PJ). The bioliqids electricity generation has increased since 2005 from 1470 GWh (5.3 PJ) with an additional electricity generation of 4881 GWh (17.6 PJ) and an average annual growth rate equal to 66.4%. For 2020 the electricity generation from bioliqids is projected to reach 12747 GWh (45.9 PJ) with an additional electricity generation of 6396 GWh (23.0 PJ) and an average growth rate equal to 10.1%.

The share of bioliqids electricity in total renewable electricity generation has increased from 0.3% in 2005 to 1.0% in 2010 and is expected to slightly decrease to 1.1% until 2020.

Figure 47 and Table 47 report the development of bioliqids electricity generation in EU 27 during period 2005-2020.

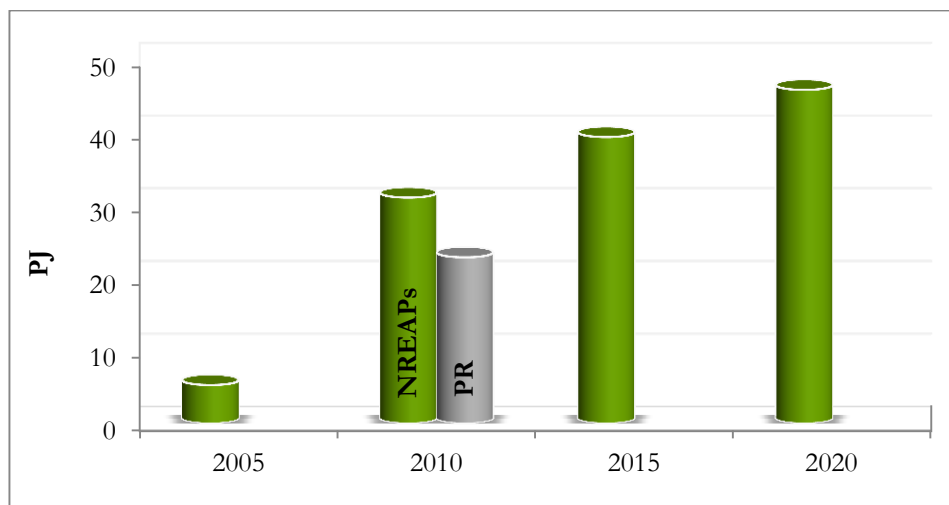


Figure 47. EU 27 bioliqids electricity generation progress, 2005-2020

The leading country in bioliqids power production in 2010 was Italy with 11.1 PJ, followed by Germany with 6.1 PJ, Austria with 4.4 PJ, Belgium with 1.0 PJ and the Netherlands with 0.2 PJ. In 2020, leading countries in bioliqids electricity production are expected to be Italy with 17.5 PJ, Finland with 17.2 PJ, Portugal with 5.5 PJ, Germany with 5.2 PJ and Sweden with 0.2 PJ.

The leading countries with the highest share of bioliqids electricity in total RES electricity in 2010 were Italy with 4.6%, Belgium with 3.9%, Austria with 3.0%, Germany with 1.5% and the Netherlands with 0.5%. In 2020, the highest shares of bioliqids power in total RES electricity is expected to be reached in Finland with 14.3%, Italy with 4.9%, Portugal with 4.3%, Germany with 0.7% and Belgium with 0.1%.

Table 47. EU 27 MS bioliquids electricity generation progress, 2005-2020

	2005	2010	Growth		Growth		2020
	NREAPs	PR	2005-2010		2010-2020		NREAPs
	PJ	PJ	PJ	av. %	PJ	av. %	PJ
BE	0.1	1.0	0.8	134.1	-0.9	-9.1	0.1
BG	0.0	0.0	0.0		0.0		0.0
CZ	0.0	0.0	0.0		0.0		0.0
DK	0.0	0.0	0.0		0.0		0.0
DE	1.2	6.1	4.9	83.3	-0.9	-1.5	5.2
EE	0.0	0.0	0.0		0.0		0.0
IE	0.0	0.0	0.0		0.0		0.0
EL	0.0	0.0	0.0		0.0		0.0
ES	0.0	0.0	0.0		0.0		0.0
FR	0.0	0.0	0.0		0.0		0.0
IT	0.0	11.1	11.1		6.4	5.8	17.5
CY	0.0	0.0	0.0		0.0		0.0
LV	0.0	0.0	0.0		0.0		0.0
LT	0.0	0.0	0.0		0.0		0.0
LU	0.0	0.0	0.0		0.0		0.0
HU	0.0	0.0	0.0		0.0		0.0
MT	0.0	0.0	0.0		0.0		0.0
NL	0.0	0.2	0.2		-0.2	-10.0	0.0
AT	0.1	4.4	4.3	726.7	-4.3	-9.7	0.1
PL	0.0	0.0	0.0		0.0	-10.0	0.0
PT	3.6	0.0	-3.6	-20.0	5.5		5.5
RO	0.0	0.0	0.0		0.0		0.0
SI	0.0	0.0	0.0		0.0		0.0
SK	0.0	0.0	0.0		0.0		0.0
FI	0.0	0.0	0.0		17.2		17.2
SE	0.2	0.1	-0.2	-14.8	0.2	28.2	0.2
UK	0.0	0.0	0.0		0.0		0.0
EU 27	5.3	22.9	17.6	66.4	23.0	10.1	45.9

### 3.7.5.2 Bioliquids heating/cooling

The use of bioliquids for heating/cooling has increased to a large extent, contributing to the heat generation in the EU27 with 90.2 PJ in 2010. Nevertheless the heat produced from bioliquids in 2010 missed by 41.4 % (-63.7 PJ) the NREAPs planned value of 153.8 PJ. The heat generation from bioliquids has increased since 2005 from 49.1 PJ and this is projected to reach 209.3 PJ in 2020.

The additional heat generation from bioliquids in 2010-2020 is expected to be 119.1 PJ with an average growth rate per year of about 13.2%. In comparison, bioliquids heat production has increased by 41.1 PJ with an average growth rate of 16.8% in 2005-2010.

The share of bioliquids heat in total renewable heat generation has increased from 2.2% in 2005 to 2.7% in 2010, and it is expected to increase to 4.5% of total renewable heat until 2020. The

use of bioliquids for heat generation accounted for a share of 2.9% in biomass heat produced in 2010, in comparison with 2.2% in 2005; this share is expected to further increase to 5.6% until 2020.

Figure 48 and Table 48 report the development of the use of bioliquids for heating / cooling in EU 27 during period 2005-2020.

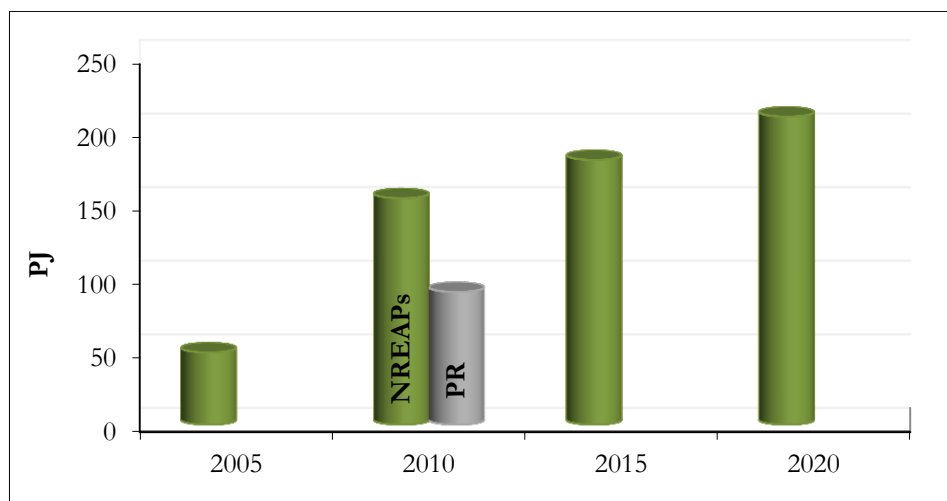


Figure 48. EU 27 bioliquids heating/cooling progress, 2005-2020

The leading country in bioliquids heat production in 2010 was Portugal with 36.8 PJ, followed by Germany with 28.2 PJ, Italy with 11.8 PJ, Sweden with 6.4 PJ and Slovenia with 1.9 PJ. Leading countries in the share of bioliquids heat in total RES heat in 2010 were Portugal with 32.9%, Slovenia with 7.3%, Germany with 5.5%, Italy with 5.1% and Belgium with 4.0%.

In 2020, leading countries in bioliquids heat are expected to be Finland with 109.3 PJ, Portugal with 33.5 PJ, Germany with 29.8 PJ, the Netherlands with 24.4 PJ, and Italy with 6.3 PJ. Leading countries in the share of bioliquids in the renewable heat are expected to become Finland with 35.9%, Portugal with 32.0%, the Netherlands with 26.7%, Germany with 4.9% and Slovenia with 4.5%.

Table 48. EU 27 MS bioliquids heating/cooling progress, 2005-2020

	2005	2010	Growth		Growth		2020
	NREAPs	PR	2005-2010		2010-2020		NREAPs
	PJ	PJ	PJ	av.%	PJ	av.%	PJ
BE	0.0	1.7	1.7		-0.4	-2.3	1.3
BG	0.0	0.5	0.5		-0.5	-10.0	0.0
CZ	0.0	0.0	0.0		0.0		0.0
DK	0.0	0.0	0.0		0.3		0.3
DE	13.1	28.6	15.5	23.6	1.2	0.4	29.8
EE	0.0	0.0	0.0		0.0		0.0
IE	0.0	0.0	0.0		0.0		0.0
EL	0.0	0.0	0.0		0.0		0.0
ES	0.0	0.0	0.0		0.0		0.0
FR	0.0	0.0	0.0		0.0		0.0
IT	0.0	11.8	11.8		-5.5	-4.7	6.3
CY	0.0	0.0	0.0		0.0		0.0

LV	0.0	0.0	0.0		0.0		0.0
LT	0.0	0.0	0.0		0.0		0.0
LU	0.0	0.0	0.0		0.0		0.0
HU	0.0	0.0	0.0		0.0		0.0
MT	0.0	0.0	0.0		0.0	-10.0	0.0
NL	1.6	0.6	-1.0	-12.6	23.8	405.7	24.4
AT	0.0	0.2	0.2		-0.2	-10.0	0.0
PL	0.0	0.0	0.0		0.0		0.0
PT	29.9	36.8	6.9	4.6	-3.2	-0.9	33.5
RO	0.0	0.0	0.0		0.5		0.5
SI	1.8	1.9	0.1	1.4	-0.8	-3.9	1.2
SK	0.0	0.0	0.0		0.0		0.0
FI	0.0	1.7	1.7		107.6	642.5	109.3
SE	2.7	6.4	3.7	27.1	-3.7	-5.8	2.7
UK	0.0	0.0	0.0		0.0		0.0
EU 27	49.1	90.2	41.1	16.8	119.1	13.2	209.3

### 3.7.6 Biomass use in households

Biomass use in households is a major component of the biomass use for heat generation in the EU27. The use of biomass in households increased since 2005 from 1181.4 PJ (28218 ktoe) to 1604 PJ (38311 ktoe) in 2010 exceeding by 26.7% (+338.2 PJ or 8078 ktoe) the NREAPs planned value. For 2020 biomass use in households is projected to reach 1479.7 PJ (35341.7 ktoe) in 2020. Thus, the level achieved in 2010 is already 124.6 PJ (2969.3 ktoe) or 7.7% above the projected contribution of biomass in households in 2020.

Figure 49 and Table 49 report the development of biomass used in households in EU 27 during period 2005-2020.

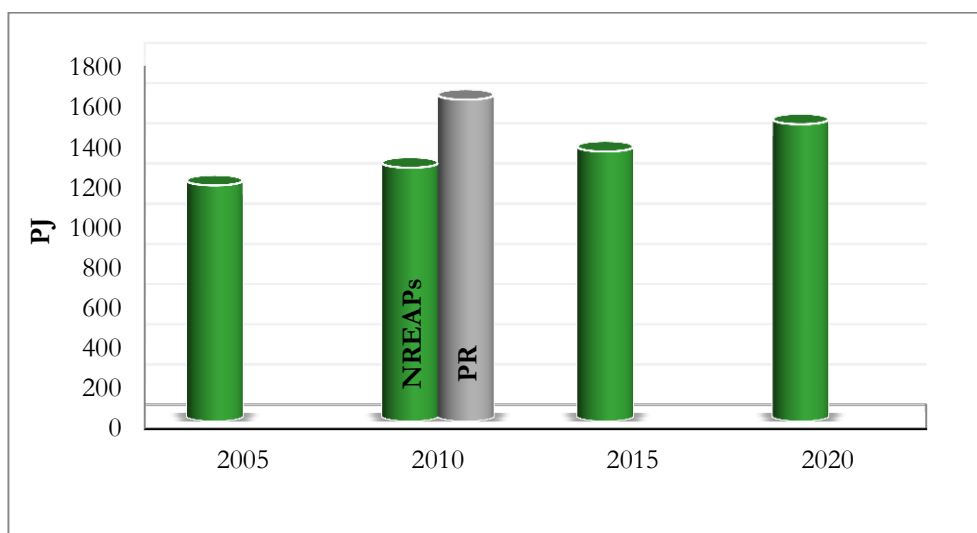


Figure 49. EU 27 biomass use in households progress, 2005-2020

Biomass use in households had a share of 53.5% of the biomass heat in 2005, which decreased to 51.6% in 2010 and it is expected to further decrease to 39.3% in 2020. The share of biomass use in households in total renewable heat generation has decreased from 51.9% in 2005 to 47.5% in 2010, and it is expected to further decrease to 31.8% in total renewable heat until 2020.

Since the expected target for 2020 of biomass use in households was already exceeded in 2010, the additional biomass use in households in 2010-2020 is expected to be -122.1 PJ (2916 ktoe), which is about -7.6% below the biomass use in households in 2010. In comparison, biomass consumption in households has increased by 464.4 PJ (10185 ktoe) or 7.3 per annum in average<sup>0</sup> in 2005-2010.

Leading countries in biomass use in households in 2010 were France with 317.4 PJ (7581 ktoe), Germany with 261.7 PJ (9537 ktoe), Romania with 147.6 PJ (3526 ktoe), Estonia with 86.0 PJ (2055 ktoe) and Denmark with 78.2 PJ (1867 ktoe). These five leading countries used about 972.0 PJ (23215 ktoe) biomass in households, representing about 60.7% of the biomass in households in the EU27. Leading countries in the share of biomass use in households in total RES heat in 2010 were Romania with 88.7%, Slovenia with 72.7%, Denmark with 71.1%, France with 63.0% and Hungary with 62.4%.

In 2020, leading countries in biomass use in households are expected to be France with 309.8 PJ (7400 ktoe), Germany with 250.2 PJ (5975 ktoe), Italy with 151.6 PJ (3620 ktoe), Austria with 121.6 PJ (2905 ktoe), and Romania with 112.0 PJ (2676 ktoe). The first five countries should use about 945.2 PJ (22576 ktoe) biomass in households, representing about 63.9% of the biomass in households in the EU27. In 2020, Leading countries in the share of biomass use in households in total RES heat are expected to be Bulgaria with 91.7%, Austria with 69.5%, Romania with 66.3%, Slovenia with 63.0% and Latvia with 56.9%.

Table 49. EU 27 MS biomass use in households progress, 2005-2020

	2005	2010	Growth		Growth		2020
	NREAPs	PR	2005-2010		2010-2020		NREAPs
	PJ	PJ	PJ	av. %	PJ	av. %	PJ
BE	8.0	10.4	2	6.0	4.4	4.2	14.8
BG	30.3	29.7	-1	-0.4	12.6		42.4
CZ	43.5	48.5	5	2.3	9.4	1.9	57.9
DK	29.3	78.2	49	33.3	-38.5	-4.9	39.7
DE	184.5	261.7	77	8.4	-11.6	-0.4	250.2
EE	12.3	17.7	5	8.9	-3.7	-2.1	14.0
IE	0.7	1.3	1	20.0	-0.3	-2.5	1.0
EL	24.5	24.9	0	0.3	0.0	0.0	24.9
ES	85.0	86.0	1	0.3	2.6	0.3	88.6
FR	274.2	317.4	43	3.2	-7.6	-0.2	309.8
IT	47.9	132.5	85	35.3	19.1		151.6
CY	0.1	0.2	0	34.4	0.3	14.7	0.5
LV	32.2	30.8	-1	-0.9	2.5		33.2
LT	2.4	24.7	22	183.5	-23.1		1.6
LU	0.7	0.8	0	3.6	0.7	8.6	1.5
HU	0.0	27.5	28		10.9	4.0	38.4
MT	0.0	0.0	0		0.0		0.0
NL	6.7	12.4	6	17.1	-5.7	-4.6	6.7
AT	112.6	70.4	-42	-7.5	51.2	7.3	121.6
PL	0.0	112.7	113		-112.7		0.0
PT	48.7	29.6	-19	-7.9	-4.3		25.3
RO	132.6	147.6	15	2.3	-35.6	-2.4	112.0



SI	13.8	19.3	6	8.0	-2.8	-1.5	16.5
SK	1.4	1.8	0	6.1	0.5	2.8	2.3
FI	46.5	60.0	14	5.8	-14.0	-2.3	46.1
SE	43.7	43.8	0	0.1	5.6	1.3	49.4
UK	0.0	14.0	14		15.7	11.2	29.7
EU 27	1181.4	1604.0	423	7.3	-124.3	-0.78	1479.7

### 3.8 Biofuels

Biofuel use in transport has increased to 558 PJ (13327 ktoe) in 2010, from 125.4 PJ (2994 ktoe) in 2005. The additional biofuels used in transport sector during period 2005-2010 was 432.6 PJ (10332 ktoe) with an average growth rate equal to 69.0%. In 2010 biofuel use in transport sector missed by 3.1% (-18 PJ) the NREAPs planned value of 575.7 PJ.

Considering that biofuels will contribute by 1210.6 PJ (28915 Ktoe) to the energy use in transport, the additional biofuels use in 2010-2020 is expected to amount to 652.7 PJ (15588 ktoe) in the EU27 with an average growth rate of 11.7%.

Contribution of biofuels to the gross final energy consumption in transport has increased from 1.0% in 2005 to 4.7% in 2010, which is above the NREAPs expected contribution of biofuels of 4.5%. The contribution to the biofuels that will be consumed in 2020 in the transport sector only is projected to be 10.1%, for biofuels contribution alone (without including renewable electricity) overcoming the 10% renewable energy in transport target imposed by the RE Directive. Transport sector will be the second important sector in bioenergy deployment with a share of 20.8% in 2020 in total bioenergy contribution in RES.

Figure 50 and Table 50 report the development of biofuel use in transport in EU 27 during period 2005-2020.

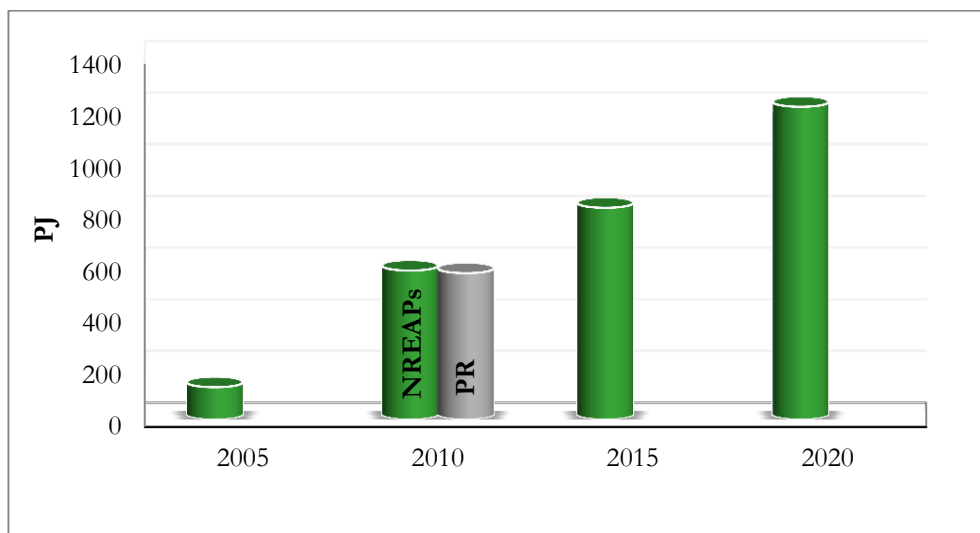


Figure 50. EU 27 biofuels in transport progress, 2005-2020

Biodiesel is the main biofuel used in transport, with a contribution of 77.6% of the biofuels used in 2010, as compared with 75.4% in 2005. This share is expected to decrease to 72.2% in 2020. Bioethanol/bio-ETBE is following with a contribution in 2010 of 21.1%, increasing from a share of 18.0% in 2005 and expected to increase to 25.3% in 2020. The share of wastes, residues, non-food cellulosic material, and ligno-cellulosic material, the so called art 21.2 biofuels has

increased from 1.2% in 2005 to 5.1% in 2010, in comparison with an expected contribution of 3.0%. In 2020, art 21.2 biofuels are expected to account for about 9.0% of the biofuels used in transport.

Leading countries in biofuel use in transport in 2010 were Germany with 127.6 PJ (3048 ktoe), France with 103.8 PJ (2480 ktoe), Italy with 61.4 PJ (1466 ktoe), Spain with 59.2 PJ (1414 ktoe) and UK with 48.1 (1148 ktoe).

In 2020, leading countries in biofuel use in transport are expected to be Germany with 229.1 PJ (5473 ktoe), UK with 176.1 PJ (4205 ktoe), France with 153.2 PJ (3660 ktoe), Spain with 113.6 PJ (2713 ktoe) and Italy with 105.9 PJ (2530 ktoe).

Table 50. Biofuel use in transport in EU 27, achieved and expected development

	2005	2010	Growth		Growth		2020
	NREAPs	PR	2005-2010		2010-2020		NREAPs
	PJ	PJ	PJ	av. %	PJ	av. %	PJ
BE	0.0	14.4	14.4		18.7	13.0	33.0
BG	0.0	0.5	0.5		11.6	250.9	12.0
CZ	0.1	9.8	9.6	1533.3	18.4	18.8	28.1
DK	0.0	0.0	0.0		11.0		11.0
DE	80.3	127.6	47.3	11.8	101.5	8.0	229.1
EE	0.0	0.0	0.0		3.7		3.7
IE	0.1	3.9	3.8	1417.5	16.3	42.4	20.2
EL	0.1	5.4	5.3	2113.3	20.5	38.2	25.9
ES	5.7	59.2	53.4	185.5	54.4	9.2	113.6
FR	16.9	103.8	87.0	103.1	49.4	4.8	153.2
IT	7.5	61.4	53.9	143.8	44.5	7.3	105.9
CY	0.0	0.6	0.6		1.0	15.3	1.6
LV	0.1	1.1	1.0	160.0	2.1	18.5	3.2
LT	0.2	1.9	1.7	230.0	5.1	27.1	7.0
LU	0.0	1.8	1.7	820.0	7.3	41.4	9.0
HU	0.2	7.4	7.2	684.0	14.0	19.0	21.4
MT	0.0	0.0	0.0		0.5	223.1	0.5
NL	0.0	9.6	9.6		25.3	26.4	34.9
AT	1.8	21.7	19.9	221.4	2.7	1.3	24.5
PL	2.3	37.1	34.9	308.5	45.3	12.2	82.4
PT	0.0	13.8	13.8		6.2	4.5	20.0
RO	0.0	0.0	0.0		20.8		20.8
SI	0.0	2.1	2.1		5.9	27.7	8.0
SK	0.0	3.4	3.4		4.6	13.4	8.0
FI	0.0	5.5	5.5		17.9	32.6	23.4
SE	7.0	18.0	11.0	31.5	15.9	8.8	33.9
UK	3.1	48.1	44.9	286.1	128.0	26.6	176.1
EU27	125.4	558.0	432.6	69.0	652.7	11.7	1210.6

### 3.8.1 Bioethanol/bio-ETBE

Bioethanol use in transport has reached 114.5 PJ (2735 ktoe) in 2010, from 22.5 PJ (537.8 ktoe) in 2005, representing 20.6% of the biofuels used, as compared with 17.9% in 2005. In 2010 the bioethanol use in transport sector missed by 4.9% (-5.9 PJ) the NREAPs planned value of 120.4

PJ. Bioethanol use in transport is expected to increase to 305.9 PJ (7307 ktoe) and to account for a share of 25.3% in biofuels used in transport in 2020. The additional biofuels in 2010-2020 is expected to be 191.4 PJ (4573 ktoe) in the EU27, with an average growth rate equal to 16.7%. Figure 51 and Table 51 report the development of bioethanol/bio-ETBE in EU 27 during period 2005-2020.

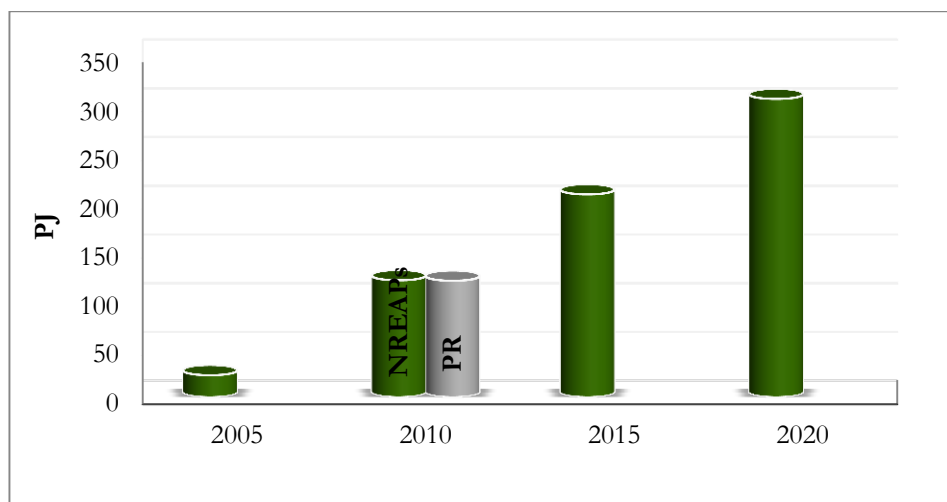


Figure 51. EU 27 Bioethanol/Bio-ETBE use in transport, 2005-2020

Contribution of bioethanol to the gross final energy consumption in transport increased from 0.2% in 2005 to 0.9% in 2010. The contribution of bioethanol to the energy that should be consumed in 2020 in the transport sector only is projected to be 1.46%.

Leading countries in bioethanol use in transport in 2010 were Germany with 31.4 PJ (749 ktoe), France with 16.5 PJ (394 ktoe), UK with 13.4 PJ (321 ktoe), Spain with 9.7 PJ (231 ktoe) and Sweden with 8.5 PJ (203 ktoe).

In 2020, leading countries in bioethanol use in transport are expected to be UK with 73 PJ (1743 ktoe), Germany with 35.9 PJ (857 ktoe), France with 27.2 PJ (650 ktoe), Italy with 25.1 PJ (600 ktoe) and Sweden with 19.5 PJ (465 ktoe).

Table 51. EU 27 MS Bioethanol/Bio-ETBE use in transport, 2005-2020

	2005	2010	Growth		Growth		2020
	NREAPs	PR	2005-2010	av. %	2010-2020	av. %	NREAPs
	PJ	PJ	PJ		PJ		PJ
BE	0.0	1.6	1.6		2.2	13.9	3.8
BG	0.0	0.0	0.0		2.5		2.5
CZ	0.0	2.5	2.5		2.8	11.3	5.4
DK	0.0	0.0	0.0		3.9		3.9
DE	6.0	31.4	25.3	84.0	4.5	1.4	35.9
EE	0.0	0.0	0.0		1.6		1.6
IE	0.0	1.3	1.3	59980.0	4.6	36.3	5.8
EL	0.0	0.0	0.0		17.3		17.3
ES	4.7	9.7	4.9	20.9	7.1	7.3	16.7
FR	3.1	16.5	13.4	85.1	10.7	6.5	27.2
IT	0.0	6.5	6.5		18.6	28.7	25.1
CY	0.0	0.0	0.0		0.6		0.6
LV	0.0	0.3	0.3		0.4	12.5	0.8

LT	0.0	0.4	0.4	230.0	1.1	26.0	1.5
LU	0.0	0.0	0.0		0.9	221.0	1.0
HU	0.2	2.4	2.2	208.0	10.3	43.3	12.7
MT	0.0	0.0	0.0		0.2		0.2
NL	0.0	5.6	5.6		6.2	11.0	11.8
AT	0.0	2.8	2.8		0.5	1.8	3.3
PL	1.6	7.9	6.3	79.5	11.0	13.9	18.9
PT	0.0	0.0	0.0		1.1		1.1
RO	0.0	0.0	0.0		6.8		6.8
SI	0.0	0.0	0.0		0.8		0.8
SK	0.0	0.6	0.6		2.5	39.7	3.1
FI	0.0	3.0	3.0		2.4	8.2	5.4
SE	6.0	8.5	2.5	8.2	11.0	12.9	19.5
UK	0.8	13.4	12.7	336.7	59.5	44.3	73.0
EU 27	22.5	114.5	92.0	81.7	191.4	16.7	305.9

### 3.8.2 Biodiesel

Biodiesel use in transport has increased to 433.5 PJ (10354 ktoe) in 2010, from 94.5 PJ (2258 ktoe) in 2005 missing by 2.8% (-12.4 PJ) the NREAPs planned value of 445.9 PJ. Biodiesel is the main biofuel used in transport, with a contribution of 78.0% of the biofuels used in 2010, as compared with 75.3% in 2005. This is expected to increase to 873.4 PJ (20862 ktoe) and to a lower share of 72.2% in biofuels used in transport in 2020.

Figure 52 and Table 52 report the development of biodiesel use in transport sector in EU 27 during period 2005-2020.

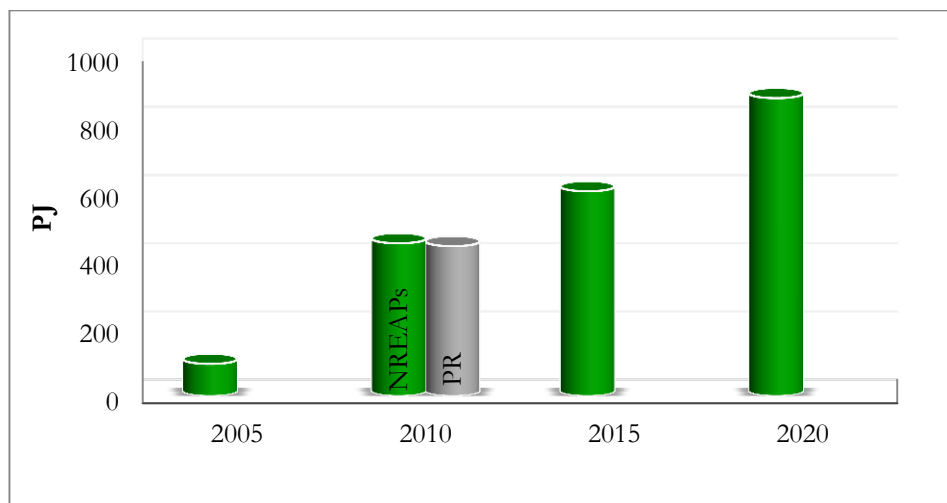


Figure 52. EU 27 biodiesel use in transport, 2005-2020

Considering that biodiesel should contribute by 873.4 PJ (20862 Ktoe) to the energy use in transport, the additional biofuels in 2010-2020 is expected to be 439.9 PJ (10507 ktoe) in the EU27, with an average growth rate of 10.1%. The additional biofuels amounted 345.9 PJ (8262 ktoe) in 2005-2010, with an average growth rate of 71.7%..

Contribution of biodiesel to the gross final energy consumption in transport has increased from 0.7% in 2005 to 3.5% in 2010, in comparison with the expected share of 3.4%. The contribution

of biodiesel to the energy that should be consumed in 2020 in the transport sector only is projected to be 6.7%.

Leading countries in biodiesel use in transport in 2010 were Germany with 94.0 PJ (2244 ktoe), France with 87.3 PJ (2086 ktoe), Italy with 54.9 PJ (1311 ktoe), Spain with 49.5 PJ (1183 ktoe) and UK with 34.6 PJ (827 ktoe). These five countries used 320.3 PJ of biodiesel in the transport sector, representing 72.9% of the biodiesel use in 2010 in the EU27.

In 2020, leading countries in biodiesel use in transport are expected to be Germany with 186 PJ (4443 ktoe), France with 119.3 PJ (2850 ktoe), UK with 103.1 PJ (2462 ktoe), Spain with 96.8 PJ (2313 ktoe) and Italy with 78.7 PJ (1880 ktoe). These five countries are expected to use 584.0 PJ of biodiesel in the transport sector, representing 78.7% of the biodiesel use in 2020 in the EU27.

Table 52. EU 27 MS biodiesel use in transport, 2005-2020

	2005	2010	Growth		Growth		2020
	NREAPs	PR	2005-2010		2010-2020		NREAPs
	PJ	PJ	PJ	av.%	PJ	av.%	PJ
BE	0.0	12.8	12.8		16.4	12.8	29.2
BG	0	0.5	0.5		8.7	174.0	9.2
CZ	0.1	7.2	7.1	1420	13.5	18.8	20.7
DK	0	0	0.0		7		7
DE	66.9	94	27.1	8.1	92	9.8	186
EE	0	0	0.0		2.1		2.1
IE	0	2.5	2.5		11.8	47.2	14.3
EL	0.1	5.4	5.3	1060	3.1	5.7	8.5
ES	1	49.5	48.5	970	47.3	9.6	96.8
FR	13.7	87.3	73.6	107.4	32	3.7	119.3
IT	7.5	54.9	47.4	126.4	23.8	4.3	78.7
CY	0	0.6	0.6		0.4	6.7	1
LV	0.1	0.8	0.7	140	0.4	5.0	1.2
LT	0.1	1.5	1.4	280	4	26.7	5.5
LU	0	1.7	1.7		6.4	37.6	8.1
HU	0	5	5.0		3.5	7.0	8.5
MT	0	0	0.0		0.3		0.3
NL	0	4	4.0		19.1	47.8	23.1
AT	1.5	15.7	14.2	189.3	1.5	1.0	17.2
PL	0.7	29.2	28.5	814.3	31.6	10.8	60.8
PT	0	13.6	13.6		5.2	3.8	18.8
RO	0	0	0.0		13.6		13.6
SI	0	0	0.0		7.3		7.3
SK	0	2.8	2.8		1.8	6.4	4.6
FI	0	2.5	2.5		15.5	62.0	18
SE	0.4	7.5	7.1	355	3	4.0	10.5
UK	2.4	34.6	32.2	268.3	68.5	19.8	103.1
EU 27	94.5	433.5	339.0	71.7	439.9	10.1	873.4

### 3.8.3 Other biofuels

The use of other biofuels (biogas, vegetable oils, etc.) in transport is rather marginal in the EU27. Their use has decreased to 7.8 PJ (187 ktoe) in 2010, from 8.3 PJ (199 ktoe) in 2005 missing the NREAPs planned value by 11.5% (-1 PJ). Other biofuels (have a minor contribution to biofuels

used in transport, representing 1.4% of the biofuels used in 2010, as compared with 6.6% in 2005. This is expected to increase to 31.1 PJ (742 ktoe) and to a share of 2.6% in biofuels used in transport in 2020.

Figure 53 and Table 53 report the development of use of other biofuels in transport sector in EU 27 during period 2005-2020.

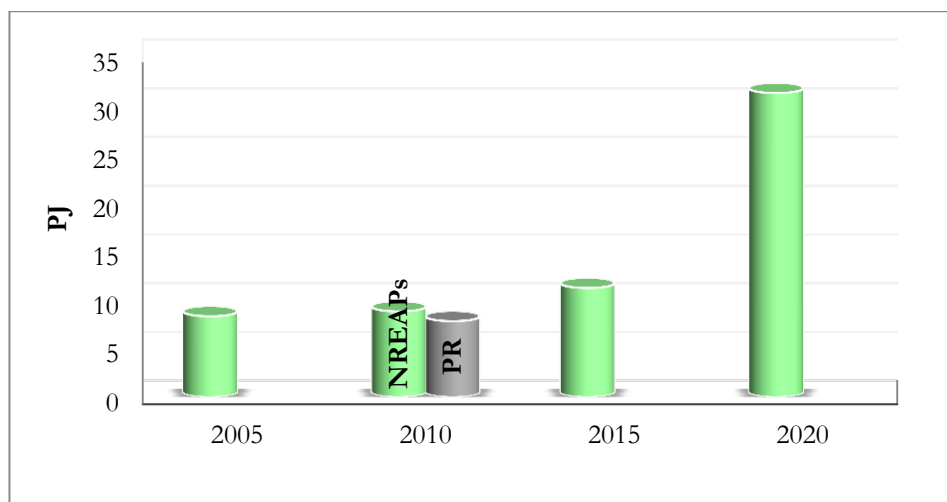


Figure 53. EU 27 progress of other biofuels use in transport, 2005-2020

Considering that other biofuels should contribute by 31.1 PJ (742 ktoe) to the energy use in transport, the additional biofuels in 2010-2020 is expected to be 23.3 PJ (555 ktoe) in the EU27, with an average growth rate of 29.7%. The contribution of other biofuels decreased by 0.5 PJ (12 ktoe) in 2005-2010, with an average growth rate of -1.2%.

Contribution of other biofuels to the gross final energy consumption in transport remained at a low level, 0.06% until 2010, while their share in the energy that should be consumed in 2020 in the transport sector only is projected to be 0.24%.

Only a few Member States used other biofuels (in transport. Leading countries in the use of other biofuels in transport in 2010 were Austria with 3.2 PJ (77 ktoe), Germany with 2.3 PJ (55 ktoe), Sweden with 2.1 PJ (49 ktoe), Portugal with 0.2 PJ (3.6 ktoe) and Ireland with 0.1 PJ (2 ktoe).

In 2020, leading countries in the use of other biofuels are expected to be Germany with 7.2 PJ (173 ktoe), France with 6.7 PJ (160 ktoe), Austria with 3.9 PJ (94 ktoe), Sweden with 3.9 PJ (94 ktoe) and Poland with 2.8 PJ (66 ktoe). These five countries are expected to use about 24.6 PJ of other biofuels (biogas, vegetable oils, etc.) in transport, representing about 79.1% of such biofuels in the EU27.

Table 53. EU 27 MS use of other biofuels in transport, 2005-2020

	2005	2010	Growth		Growth		2020
	NREAPs	PR	2005-2010		2010-2020		NREAPs
	PJ	PJ	PJ	av.%	PJ	av.%	PJ
BE	0.0	0.0	0.0		0.0		0.0
BG	0.0	0.0	0.0		0.3		0.3
CZ	0.0	0.0	0.0		2.1		2.1
DK	0.0	0.0	0.0		0.0		0.0
DE	7.4	2.3	-5.1	-13.8	4.9	21.5	7.2
EE	0.0	0.0	0.0		0.0		0.0
IE	0.0	0.1	0.1	60.0	0.0	-5.5	0.0

EL	0.0	0.0	0.0		0.0		0.0
ES	0.0	0.0	0.0		0.0		0.0
FR	0.0	0.0	0.0		6.7		6.7
IT	0.0	0.0	0.0		2.1		2.1
CY	0.0	0.0	0.0		0.0		0.0
LV	0.0	0.0	0.0		1.3		1.3
LT	0.0	0.0	0.0		0.0		0.0
LU	0.0	0.0	0.0		0.0		0.0
HU	0.0	0.0	0.0		0.2		0.2
MT	0.0	0.0	0.0		0.0		0.0
NL	0.0	0.0	0.0		0.0		0.0
AT	0.3	3.2	2.9	172.5	0.7	2.2	3.9
PL	0.0	0.0	0.0		2.8		2.8
PT	0.0	0.2	0.2		-0.2	-10.0	0.0
RO	0.0	0.0	0.0		0.3		0.3
SI	0.0	0.0	0.0		0.0		0.0
SK	0.0	0.0	0.0		0.2		0.2
FI	0.0	0.0	0.0		0.0		0.0
SE	0.5	2.1	1.5	55.4	1.9	9.2	3.9
UK	0.0	0.0	0.0		0.0		0.0
EU 27	8.3	7.8	-0.5	-1.2	23.2	29.7	31.1

### 3.8.4 Biofuels Article 21.2

Biofuels produced from wastes, residues, ligno-cellulosic material (art 21.2 biofuels) still have a small contribution to the biofuels used in transport. The use of art 21.2 biofuels increased to 23.8 PJ (567.5 ktoe) in 2010, from 1.4 PJ (34.5 ktoe) in 2005 exceeding by 35.3% (+6.2 PJ) the NREAPs planned value of 17.6 PJ. Such a contribution is expected to increase to 107.2 PJ (2559.8 ktoe) in 2020. Their share in the biofuels used in transport (single counting) increased from 1.2% in 2005 to 5.0% in 2010 and this is expected to increase to 8.9% in 2020.

Figure 54 and Table 54 report the development of use of biofuels article 21.2 in transport sector in EU 27 during period 2005-2020.

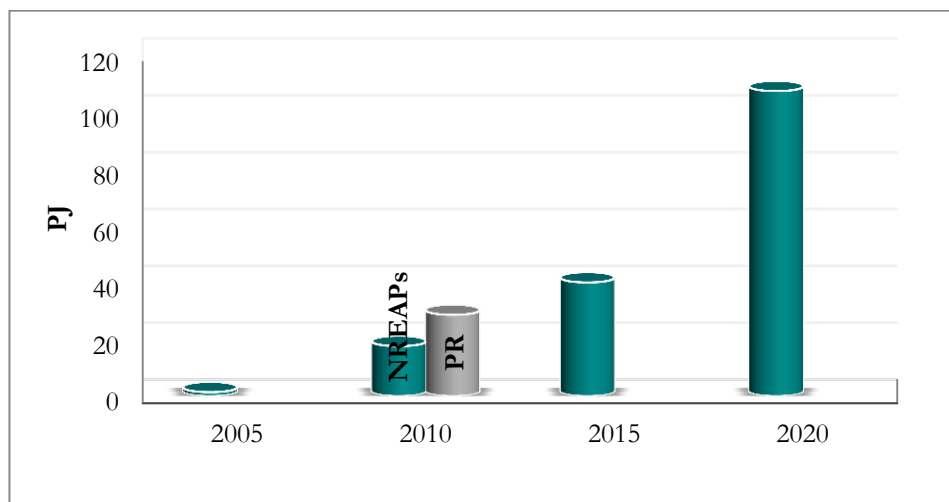


Figure 54. EU 27 use of biofuels article 21.2 in transport, 2005-2020

The contribution of art 21.2 biofuels to the gross final energy consumption in transport has increased from 0.01% in 2005 to 0.2% in 2010 and it is projected to reach 0.8% in 2020.

Considering that art 21.2 biofuels should contribute by 107.3 PJ (2564 ktoe) to the energy use in transport, the additional biofuels in 2010-2020 is expected to be 78.7 PJ (1880 ktoe) in the EU27, with an average increase growth of 35.1%. In comparison, the additional art 21.2 biofuels amounted 27.2 PJ (650 toe) in 2005-2010.

Leading countries in the use of art 21.2 biofuels in transport in 2010 were Poland with 8.9 PJ (212 ktoe), Romania with 4.9 PJ (137 ktoe), Ireland with 3.9 PJ (92 ktoe), the Netherlands with 3.6 PJ (86 ktoe) and France with 2.6 PJ (63 ktoe). These five countries used about 23.8 PJ (569 ktoe) in transport in 2010, representing 83.2% of the art 21.2 biofuels used in the EU27.

In 2020, leading countries in the use of art 21.2 biofuels in transport are expected to be Germany with 17.0 PJ (406 ktoe), Italy with 16.7 PJ (400 ktoe), Czech Republic with 12.2 PJ (292 ktoe), Spain with 10.6 PJ (252 ktoe) and Poland with 10.1 PJ (242 ktoe). The five countries are expected to use about 66.6 PJ (1592 ktoe) in transport in 2020, representing 62.1% of the art 21.2 biofuels used in the EU27.

Table 54. EU 27 MS use of art 21.2 biofuels in transport, 2005-2020

	2005	2010	Growth		Growth		2020
	NREAPs	PR	2005-2010		2010-2020		NREAPs
	PJ	PJ	PJ	av.%	PJ	av.%	PJ
BE	0.0	0.0	0.0		2.6		2.6
BG	0.0	0.0	0.0		0.2		0.2
CZ	0.0	0.0	0.0		12.2		12.2
DK	0.0	0.0	0.0		5.5		5.5
DE	0.0	0.0	0.0		17.0		17.0
EE	0.0	0.0	0.0		0.0		0.0
IE	0.0	3.9	3.8	3660.0	-3.8	-9.9	0.0
EL	0.0	0.5	0.5		-0.5	-10.0	0.0
ES	0.0	0.2	0.2		10.3	494.0	10.6
FR	0.0	2.6	2.6		-0.5	-2.1	2.1
IT	0.9	1.6	0.7	16.2	15.2	95.3	16.7
CY	0.0	0.0	0.0		1.6	4190.0	1.6
LV	0.0	0.0	0.0		1.8		1.8
LT	0.0	0.0	0.0		0.0		0.0
LU	0.0	0.0	0.0		0.0		0.0
HU	0.0	0.0	0.0		1.1		1.1
MT	0.0	0.0	0.0		0.1	47.3	0.1
NL	0.0	3.6	3.6		2.9	8.0	6.5
AT	0.0	0.0	0.0		0.0		0.0
PL	0.0	8.9	8.9		1.3	1.4	10.1
PT	0.0	0.2	0.2		0.2	10.5	0.3
RO	0.0	0.0	0.0		4.6		4.6
SI	0.0	0.0	0.0		0.0		0.0
SK	0.0	0.0	0.0		2.5		2.5
FI	0.0	0.0	0.0		7.5		7.5



SE	0.5	2.3	1.8	64.6	1.6	7.1	3.9
UK	0.0	0.0	0.0		0.0		0.0
EU 27	1.4	23.8	22.3	309.0	83.4	35.1	107.2

### 3.8.5 Biofuels from import

The use of biofuels from import in the transport sector has increased to 185.5 PJ (4430 ktoe) in 2010, from 7.1 PJ (171 ktoe) in 2005. In 2010 biofuels from import used in transport sector were 0.6% (-1.1 PJ) below the NREAPs planned value of 186.6 PJ. This is expected to increase to 459.0 PJ (10962 ktoe) in 2020. Their share in the biofuels used in transport increased from 5.7% in 2005 to 33.2% in 2010 and this is expected to further increase to 37.9% in 2020.

Figure 55 and Table 55 report the development biofuels from import in transport sector in EU 27 during period 2005-2020.

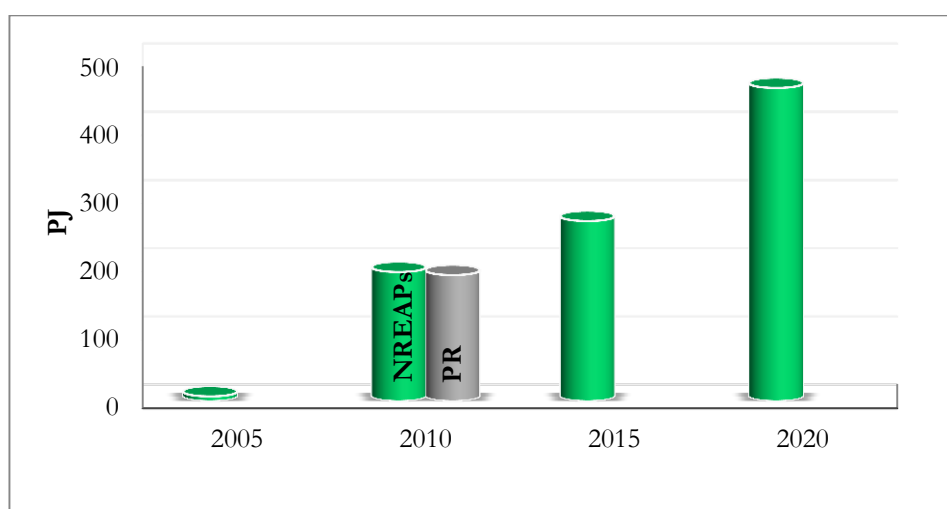


Figure 55. EU 27 biofuels from import use in transport, 2005-2020

Contribution of biofuels from import to the gross final energy consumption in transport has increased from 0.05% in 2005 to 1.5% in 2010 and it is expected to reach 3.5% in 2020.

The additional biofuels expected to be imported in 2010-2020 amount to 274.1 PJ (6548 ktoe) in the EU27, with an average annual increase of 14.7%. The import of biofuels increased by 178.5 PJ (4244 ktoe) in 2005-2010, with an average annual increase of about 510%.

Leading countries in the use of biofuels from import in transport in 2010 were UK with 39.2 PJ (937 ktoe), Spain with 32.4 PJ (773 ktoe), Italy with 29.9 PJ (713 ktoe), Poland with 18.8 PJ (449 ktoe) and France with 15.2 PJ (363 ktoe). These five countries used about 135.4 PJ (3235 ktoe) in transport in 2010, representing 73.3% of the biofuels from import used in the EU27.

In 2020, leading countries in the use of biofuels from import in transport are expected to be UK with 154.4 PJ (3687 ktoe), Germany with 130.8 PJ (3124 ktoe), Italy with 41.9 PJ (1000 ktoe), The Netherlands with 21.6 PJ (516 ktoe) and France with 18.8 PJ (450 ktoe). These five countries are expected to use about 367.5 PJ (8777 ktoe) in transport in 2020, representing 80.1% of biofuels from import used in the EU27.

Table 55. EU 27 biofuels from import use in transport, 2005-2020

	2005	2010	Growth		Growth		2020
	NREAPs	PR	2005-2010		2010-2020		NREAPs
	PJ	PJ	PJ	av. %	PJ	av. %	PJ
BE	0.0	13.0	13		-13	-10	0
BG	0.0	0.0	0		0.4		0.4
CZ	0.1	0.7	0.6	120	6.5	92.9	7.2
DK	0.0	0.0	0		10.9		10.9
DE	0.0	0.0	0		130.8		130.8
EE	0.0	0.0	0		0		0
IE	0.0	1.5	1.5		12.7	84.7	14.2
EL	0.0	0.6	0.6		16.7	278.3	17.3
ES	0.0	32.4	32.4		-22.7	-7.0	9.7
FR	0.5	15.2	14.7	588	3.6	2.4	18.8
IT	0.0	29.9	29.9		12	4.0	41.9
CY	0.0	0.4	0.4		1.2	30	1.6
LV	0.0	0.0	0		0.7		0.7
LT	0.0	0.6	0.6		-0.6	-10	0
LU	0.0	1.8	1.8		7.2	40	9
HU	0.0	2.7	2.7		-2.7	-10	0
MT	0.0	0.0	0		0.4		0.4
NL	0.0	0.0	0		21.6		21.6
AT	1.4	15.1	13.7	195.7	-7.3	-4.8	7.8
PL	0.0	18.8	18.8		-18.8	-10	0
PT	0.0	0.7	0.7		-0.7	-10	0
RO	0.0	0.0	0		0		0
SI	0.0	0.0	0		0		0
SK	0.0	0.0	0		0		0
FI	0.0	3.1	3.1		-3.1	-10	0
SE	4.9	9.7	4.8	19.6	2.5	2.6	12.2
UK	0.0	39.2	39.2		115.2	29.4	154.4
EU 27	7.0	185.5	178.5	510	273.5	14.7	459

## **ANNEX**

### **SUMMARY OF RENEWABLE ENERGY PROGRESS IN EU 27, 2005-2020**



Table A 1. EU 27 progress in total GFEC and GFEC in main sectors, 2005-2020

	2005	2010	Growth		Growth		2020
	NREAPs	PR	2005-2010		2010-2020	av.%	NREAPs
	PJ	PJ	PJ	av.%	PJ	av.%	PJ
GFEC-H/C	24655.4	23700	-955.7	-0.8	-1946.4	-0.8	21753.3
GFEC-E	11760.4	11867.4	107.0	0.2	810.1	0.7	12677.5
GFEC-T	13043.1	12685.1	-358	-0.5	410	0.3	13095
GFEC total	51175.3	50175.5	-999.8	-0.4	-866.9	-0.2	49308.6

Table A 2. EU 27 progress in total RES share in GFEC and main sectors, 2005-2020

	2005	2010	Growth		Growth		2020
	NREAPs	PR	2005-2010		2010-2020	av.%	NREAPs
	%	%	% points	av.%	% points	av.%	%
RES-H/C	9.3	14.4	5.1	10.9	6.8	4.8	21.3
RES-E	14.7	19.7	5.0	6.8	14.1	7.2	33.8
RES-T	2.0	4.8	2.8	28.5	6.4	13.3	11.1
RES-T (for 10% target)	1.3	4.96	3.66	56.3	6.44	13.0	11.4
RES total	8.1	12.6	4.5	11.0	8.0	6.3	20.6

Table A 3. EU 27 RES contribution in GFEC progress, 2005-2020

	2005	2010	Growth		Growth		2020
	NREAPs	PR	2005-2010		2010-2020	av.%	NREAPs
	PJ	PJ	PJ	av.%	PJ	av.%	PJ
RES-H/C	2283.8	3379.8	1096.0	9.6	1270.8	3.8	4648.9
RES-E	1735.1	2310.5	575.3	6.6	2017.7	8.7	4328.2
RES-T contribution	125.4	558	432.6	69.0	652.7	11.7	1210.6
RES-T (for 20% target)	170.8	604.6	433.8	50.8	741.1	12.3	1345.7
RES-T (for 10% target)	173.3	628.8	455.5	52.6	867.8	13.8	1496.6
RES total	4144.3	6248.3	2104	10.2	3946	6.3	10194.2

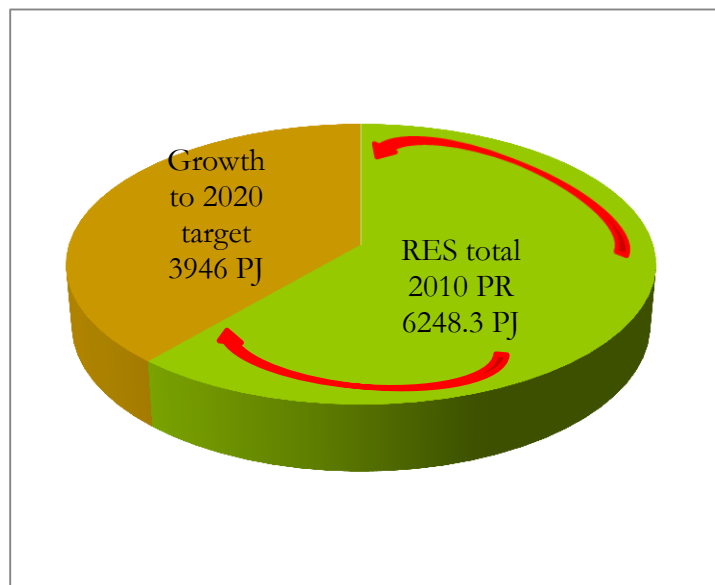


Figure A 1. RES total in EU 27 in 2010 and expected growth to 2020 target

Table A 4. EU 27 RES installed capacity progress, 2005-2020

	2005 NREAPs	2010 PR	Growth 2005-2010		Growth 2010-2020		2020 NREAPs
	MW	MW	MW	av. %	MW	av. %	MW
Hydropower	108331	100952	-7380	-1.4	23757	2.4	124709
Geothermal	741	823	82	2.2	790	9.6	1613
Solar	2221	29727	27506	247.7	60720	20.4	90447
Marine	240	242.6	2.6	0.2	2010	82.9	2253
Wind	40441	84317	43877	21.7	126275	15.0	210593
<i>Onshore</i>	39756	81436	41680	21	87183	10.7	168619
<i>Offshore</i>	685	2899	2214	323.3	39076	1348.1	41974
Biomass	15739	25088	9349	11.9	18504	7.4	43592
<i>Solid biomass</i>	10566	19158	8593	16.3	8611	4.5	27769
<i>Biogas</i>	2665	4558	1893	14.2	6634	14.6	11192
<i>Bioliquids</i>	368	1382	1014	55.1	276	2.0	1711
All RES-E	167713	241150	73436	8.8	232055	9.6	473205

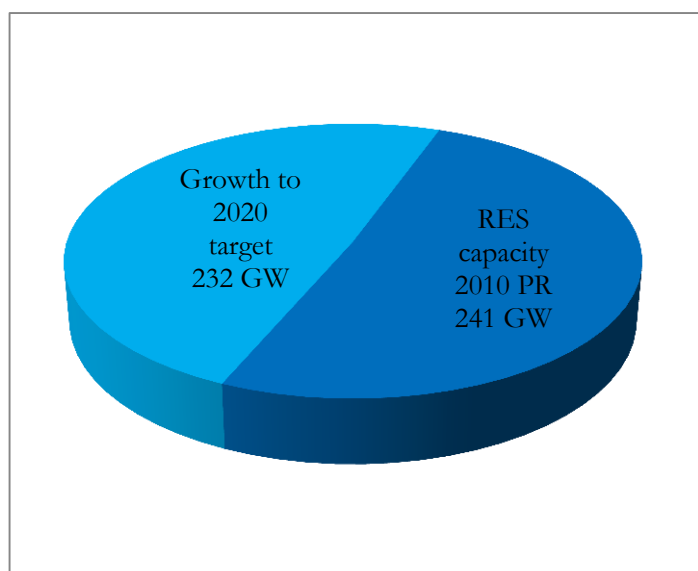


Figure A 2. RES capacity in EU 27 in 2010 and expected growth to 2020 target

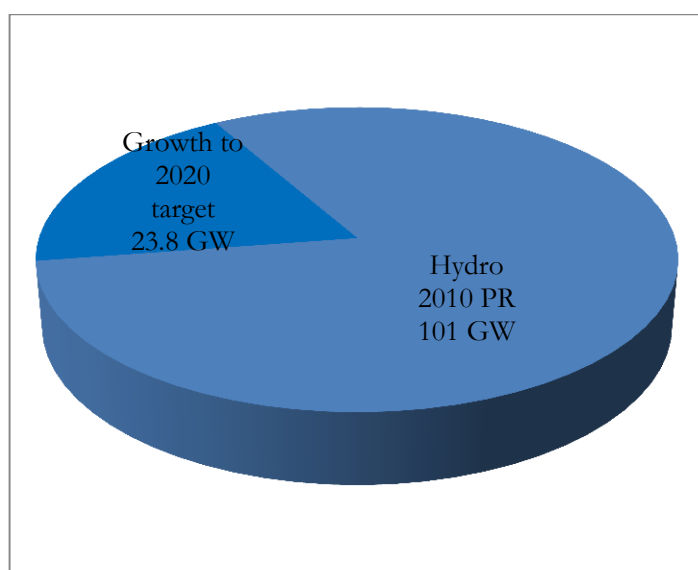


Figure A 3. Hydro capacity in EU 27 in 2010 and expected growth to 2020 target

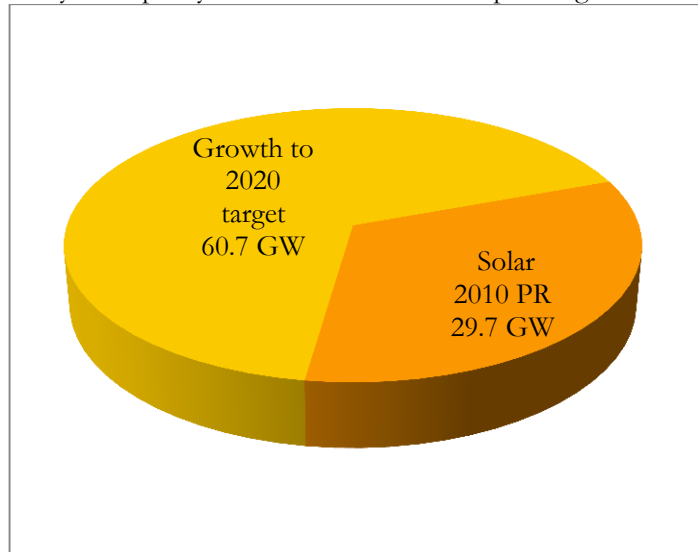


Figure A 4. Solar capacity in EU 27 in 2010 and expected growth to 2020 target

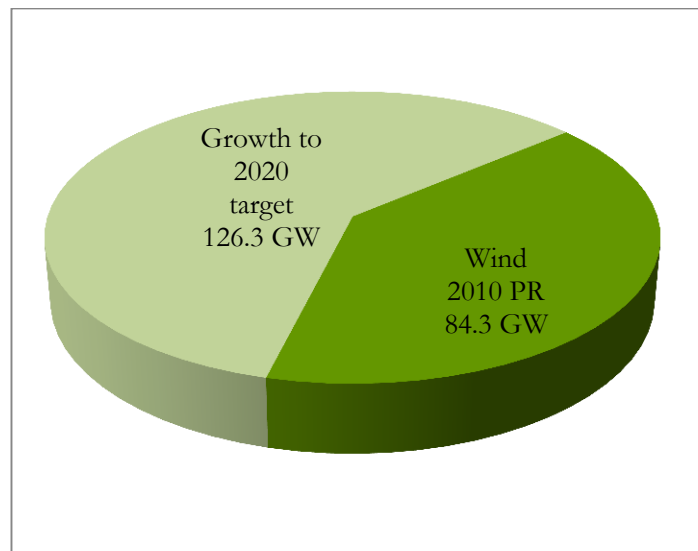


Figure A 5. Wind capacity in EU 27 in 2010 and expected growth to 2020 target

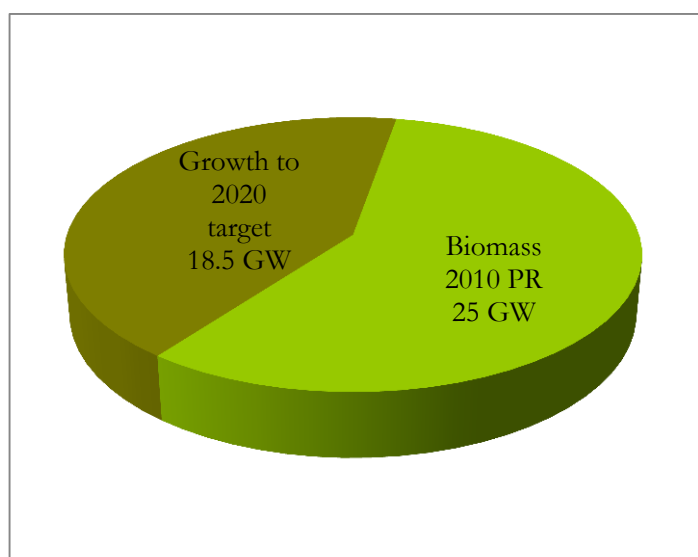


Figure A 6. Biomass capacity in EU 27 in 2010 and expected growth to 2020 target

Table A 5. EU 27 renewable technologies progress, 2005-2020

	2005	2010	Growth		Growth		2020
	NREAPs	PR	2005-2010		2010-2020		NREAPs
	PJ	PJ	PJ	av. %	PJ	av. %	PJ
Hydropower	1206.1	1201.4	-4.65	-0.1	105.4	0.9	1306.8
Geothermal	38.2	42.2	4.0	2.1	107.1	25.4	149.3
<i>Geothermal -E</i>	19.7	20.2	0.51	0.5	19.0	9.4	39.2
<i>Geothermal – H/C</i>	18.48	22.00	3.52	3.8	88.12	40.1	110.12
Solar	34.2	146.2	112.1	65.6	483.9	33.1	630.1
<i>Solar electricity</i>	5.3	83.5	78.2	295.7	280.3	33.6	363.8
<i>Solar thermal</i>	28.9	62.7	33.8	23.4	203.5	32.5	266.2
Marine	1.93	1.72	-0.21	-2.14	21.70	126.17	23.4
Wind	253.3	558.3	305.0	24.1	1198.8	21.5	1757.1
<i>Onshore</i>	240.7	536.5	295.9	24.6	729.0	13.6	1265.6
<i>Offshore</i>	6.9	21.8	14.9	42.9	469.8	215.8	491.5
Heat pumps	25.0	183.0	158	125.9	327.4	17.9	510.4
Biomass -E	248.5	445	196.5	15.8	392.0	8.8	837.0
<i>Solid biomass</i>	198.2	334.0	135.8	13.7	226.7	6.8	560.7
<i>Biogas</i>	44.9	88.0	43.1	19.2	141.1	16.0	229.2
<i>Bioliquids</i>	5.3	22.9	17.6	66.4	23.0	10.1	45.9
Biomass H/C	2209.81	3112.50	902.7	8.2	656.2	2.1	3768.7
<i>Solid biomass</i>	2002.6	2898.56	896.0	8.9	471.6	1.6	3370.2
<i>Biogas</i>	25.6	83.2	57.7	45.1	106.0	12.7	189.2
<i>Bioliquids</i>	49.1	90.2	41.1	16.8	119.1	13.2	209.3
Biofuels	125.4	558.0	432.6	69.0	652.7	11.7	1210.6
<i>Bioethanol/ bio-ETBE</i>	22.5	114.5	92.0	81.7	191.4	16.7	305.9
<i>Biodiesel</i>	94.5	433.5	339.0	71.7	439.9	10.1	873.4
<i>Other</i>	8.3	7.8	-0.5	-1.2	23.2	29.7	31.1
All RES	4144.3	6248.3	2104	10.2	3946	6.3	10194.2

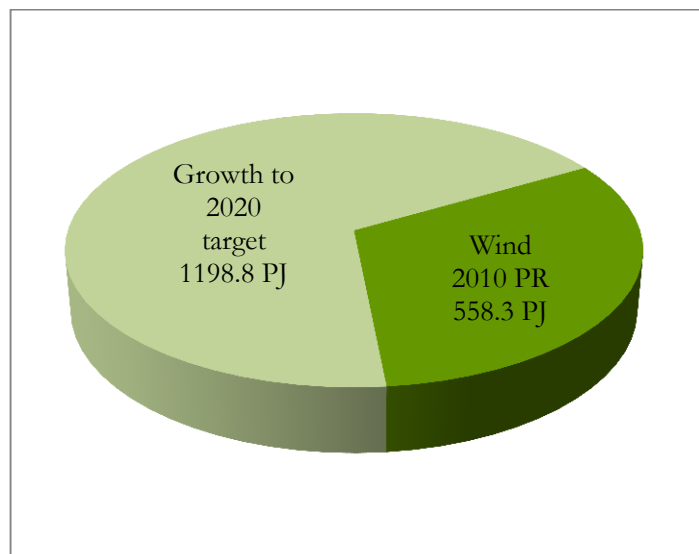


Figure A 7. Wind electricity generation in 2010 and expected growth to 2020 target



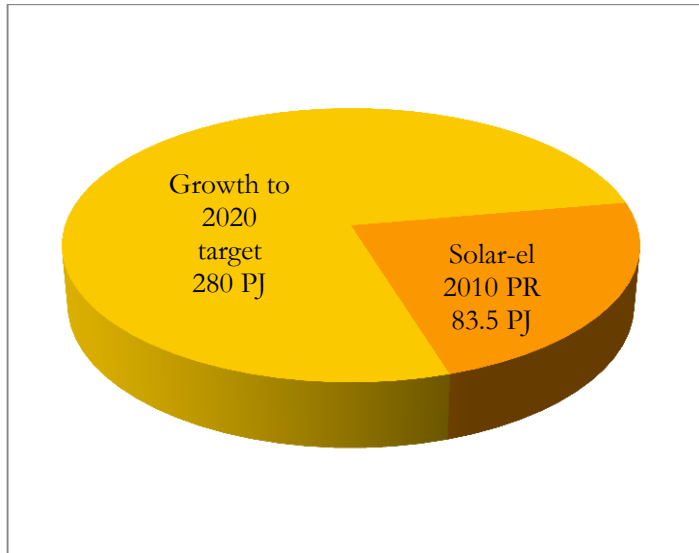


Figure A 8. Solar electricity generation in EU 27 in 2010 and expected growth to 2020 target

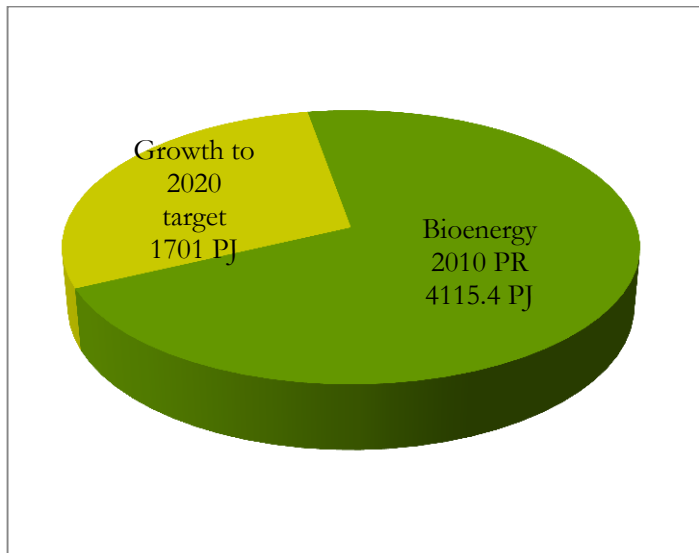


Figure A 9. Bioenergy in EU 27 in 2010 and expected growth to 2020 target

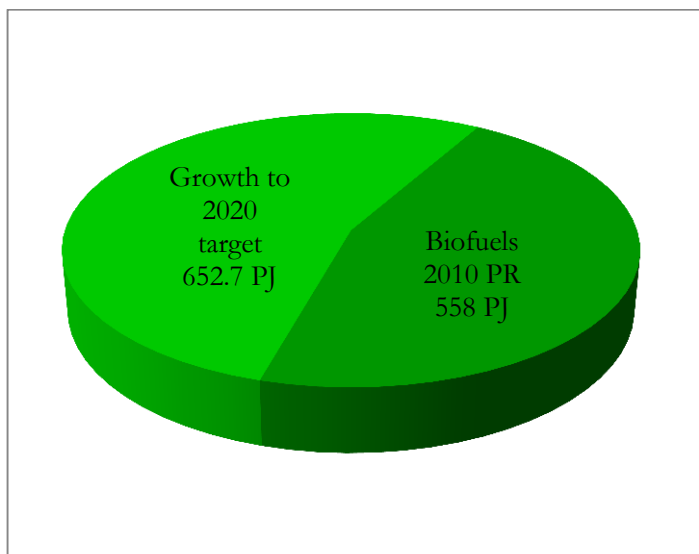


Figure A 10. Biofuels use in EU 27 in 2010 and expected growth to 2020 target

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#### Abstract

The report present the combined analysis of EU 27 National Renewable Energy Action Plans and Progress Reports to identify the 2005-2010 and 2010-2020 trends of the renewable energy development in three main sectors: Electricity, Heating/Cooling and Transport. The planned development of these sectors and each renewable technology in EU 27 is compared with the actual development achieved in the same time span and the expected trend to reach 2020 target is compared with the planned one.

As the Commission's in-house science service, the Joint Research Centre's mission is to provide EU policies with independent, evidence-based scientific and technical support throughout the whole policy cycle.

Working in close cooperation with policy Directorates-General, the JRC addresses key societal challenges while stimulating innovation through developing new standards, methods and tools, and sharing and transferring its know-how to the Member States and international community.

Key policy areas include: environment and climate change; energy and transport; agriculture and food security; health and consumer protection; information society and digital agenda; safety and security including nuclear; all supported through a cross-cutting and multi-disciplinary approach.

