Energy Community

Renewable Energy

# *Assessment of the Progress in the Promotion and Use of Renewable Energy in the Energy Community*

TU Wien

July 2017



This report was financed by the Energy Community.

# Assessment of the Progress in the Promotion and Use of Renewable Energy in the Energy Community

## Final Report

**Energy Community**
**Final Report**

**Status:**
**final**

**Dissemination level:**
**Public**

**18 July 2017**

TECHNISCHE UNIVERSITÄT WIEN



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# List of abbreviations

| | |
|---|---|
| BiH | Bosnia and Herzegovina |
| CP | Contracting Party |
| DSO | Distribution system operator |
| ECS | Energy Community Secretariat |
| EU | European Union |
| FIT | Feed-in Tariff |
| FIP | Feed-in Premium |
| BIH(FBiH) | Federation of Bosnia and Herzegovina |
| BIH(RS) | Republika Srpska |
| FYR of Macedonia | Former Yugoslav Republic of Macedonia |
| GFEC | Gross Final Energy Consumption |
| GDP | Gross Domestic Product |
| KO* | Kosovo* |
| ME | Montenegro |
| MO | Moldova |
| MS | Member States |
| NREAP | National Renewable Energy Action Plan |
| OECD | Organisation for Economic Co-operation and Development |
| PR | Progress Report |
| REAP | Renewable Energy Action Plan |
| RES | Renewable Energy Source |
| RES-E | Renewable Electricity |
| RES-H&C | Renewable Heating & Cooling |
| RES-T | Renewable Energy in Transport |
| RS | Serbia |
| TSO | Transmission system operator |
| UA | Ukraine |

# 1 Introduction

## 1.1 Background

In 2012, the Ministerial Council of the Energy Community adopted Decision 2012/04/MC-EnC on the implementation of the Renewable Energy Directive 2009/28/EC and amending Article 20. Article 20 of the Treaty includes an obligation for the Contracting Parties to implement the Renewable Energy Directive.

Each of the Contracting Parties, namely Albania, Bosnia and Herzegovina, Kosovo*, former Yugoslav Republic of Macedonia, Moldova, Montenegro, Serbia, and Ukraine agreed to binding renewable energy targets by 2020 modelled on the same methodology as for the European Union Member States (EU MS). Following the Ministerial Council Decision, the eight Contracting Parties submitted their NREAPs to the Energy Community Secretariat (ECS). These plans map down each Contracting Party's expected steps to reach the legally binding renewable energy target by 2020. They include sector targets, a commitment to a RES expansion trajectory and a description of the policy measures the Parties intend to undertake to overcome the barriers in developing renewable energy.

Article 15 of the Ministerial Council Decision 2012/04/MC-EnC also requires the Contracting Parties to report to the Secretariat on the progress in the promotion and use of the energy from renewable sources for the first time by 31 December 2014 and every two years afterwards. These reports shall detail the points of Article 22 of Directive 2009/28/EC and in particular the sectoral and overall shares of renewable energy in the two preceding calendar years and the measures taken at national level to promote renewable energy.

In October 2014, Energy Community Secretariat contracted a consortium led by Energy Research Center of the Netherlands (ECN) to provide technical assistance to the Secretariat in the assessment NREAPs, the 2014 progress reports and national energy legislations in Energy Community Contracting Parties. The study *"Assessment of Renewable Energy Action Plan Implementation and Progress of Renewable Energy in Energy Community"* (ECS 2015) provided a quantitative assessment of the viability to reach the 2020 targets and analysed where adjustments needed to be made.

As of May 2017, the Energy Community Secretariat (ECS) has requested an update of the said study. The update shall assess the progress made by the Contracting Parties during the last two years (i.e.2014/2015) in the promotion and use of renewable energy. It includes an assessment of the viability of the each Contracting Party RES policy framework to reach the 2020 RES targets.

## 1.2 Study objectives, scope and output

This assignment aims to provide technical support to the Energy Community Secretariat in evaluating, monitoring and reporting obligations to the Ministerial Council. The main output of this assignment is an assessment of the progress made in the promotion and use of renewable energy in the Energy Community in the years 2014/2015, the prospective RES developments until 2020 and of the national policies and measures included in the second progress reports. More specifically the assignment includes:

- Activities for the assessment of progress in renewable energy during 2014-2015 and of projections of renewable energy shares up to 2020 based on the current policy framework. The assessment involves quantitative analysis (incl. modelling) as well as the collection of the necessary underlying data. The quantitative assessment is built upon the analysis of the

second progress reports submitted by each of the eight Contracting Parties to the Secretariat in 2016-2017 in accordance with Article 22 of the RES Directive as well as on energy balances sheets 2010-2015 compiled in accordance with EUROSTAT methodology on energy statistics or other sources. The assessment of the progress is made against the interim trajectories and the measures described either in the NREAP or in the second progress reports. For the prospective assessment (i.e. expected 2020 progress) the specialised energy system model Green-X is applied. If target shortfall is foreseeable, recommendations concerning the technology mix, the policy settings or administrative and institutional conditions are provided.

- Assessment of the national policies and measures included in the second progress reports in each Contracting Party to identify whether they sufficiently trigger the development of use of energy from renewable sources to keep them on track and allow the Contracting Party to comply with the interim trajectory and target of its NREAP.

# 2 Assessment of progress in the share of RES in Contracting Parties

## 2.1 Introduction

This task aims at a detailed analysis of progress in renewable energy at CP and at aggregated level, at present and in future.

Below we summarise the approach and present draft outcomes of the work undertaken, starting with the quantitative assessment of past progress. Next to that, we illustrate the outcomes of our assessment of future (2020) progress.

## 2.2 Assessment of past progress (towards 2014/2015 interim targets for RES)

Firstly, the progress of RES deployment in each of the Contracting Parties in 2014 and 2015 towards the 2014/2015 interim targets for RES in line with the indicative trajectory laid down in Annex I part B of the RES Directive. The indicative trajectory is in this respect defined as an average share of energy from renewable sources in the gross final energy consumption (GFEC) for the two-year period 2014 to 2015.

### *2.2.1 Method of approach*

The assessment is based on energy balances of 2014 - 2015, compiled according to EUROSTAT methodology. This comprises data reported in the CP's Progress Reports; complemented by energy statistics of the International Energy Agency (IEA) and alternative data sources applicable at CP level, such as EUROSTAT data for CP's in accession process available on EUROSTAT database (e.g. for Albania, FYR of Macedonia, Montenegro, Serbia) and data provided by the ECS for the year 2014. In addition to the data collection on past actual RES developments, the work also includes to take stock of the planned RES expansion trajectories per energy scenarios of the NREAPs in the Energy Community CPs. This serves as basis for the evaluation of past progress in achieving interim targets as set out, on the one hand, in the RES Directive and, on the other hand, in the NREAPs: the 2013/2014 indicative trajectory and their non-mandatory 2014 and 2015 NREAP target.

The detailed quantitative assessment is complemented by qualitative explanations of observed deviation from the target based on the assessment of Contracting Parties policies and measures, electricity grid development and administrative).

### *2.2.2 Results*

We summarise outcomes of the assessment of past RES progress, starting with a cross-country comparison of overall RES deployment and with details on the RES deployment on sector-level. For both, deployment as well as target achievement is indicated in relative and absolute terms. In relative terms, this represents the share of RES in gross final energy consumption (GFEC), which serves as the central indicator for a target achievement including binding interim targets and the target share in 2020 defined in the RES directive. Later on, CP specific results are illustrated, indicating historic developments and the status quo of RES deployment.

#### *Underlying statistical data and constraints*

All historic energy data was obtained from EUROSTAT (EUROSTAT, 2017) provided by the ECS. The data was provided in the form of renewable shares calculation tools, filled by the CPs. Partly these

tables included data deviating from the CPs own Progress Reports. These deviations will be shown for the years 2014 and 2015 in the following tables and figures in this section of the report. The most notable deviations occurred for Moldova and Montenegro. For Moldova the problem arises within the data for the year 2015. The electricity consumption for the region Transnistria was not included in the calculation tool for the year 2015. As a result, the RES share in the electricity sector is vastly overestimated in the year 2015. In the case Montenegro the revision on the solid biomass accounting was included in the EUROSTAT data, but was not included in the statistic used for their progress report. For this reason the data as of EUROSTAT and their Progress Report is deviating extensively. The data of Bosnia and Herzegovina could not be compared to its Progress Report, as it has not been published by this point in time.

### *Overall RES deployment*

Table 1 and Figure 1 show the median RES shares of GFEC of the years 2013/2014. This is compared to the indicative trajectory set out in part B of Annex I of DIRECTIVE 2009/28/EC, in advance referred to as renewable directive or RED. The RED indicative trajectory for 2013/2014 sets a relatively strict interim target. This can be seen, when this target is compared to the interim targets to which the CPs committed themselves through their NREAPs (cf.-Figure 3 or in Table 2). All interim targets of the NREAPs for 2014 show a lower percentage target than the RED indicative trajectory for 2013/2014. Figure 1 shows that all CPs except for Montenegro fail to reach their RED indicative trajectory for 2013/2014. Montenegro actually already now reaches its 2020 RES target. As intensively discussed in (ECS 2015), this is due to its retrospectively changed biomass data in the heating sector, which largely exceeds the solid biomass data reported in its NREAP. For the other CPs countries, the deviations between the median shares of 2013/2014 and the RED indicative trajectory 2013 range from -0.7 pp for Albania to -4.5 pp for FYR of Macedonia. The RED target 2020 lies for each of the CPs 5 to 9 pp over the median RES share in 2013/2014. The observed deviations indicate that significant efforts in the promotion of the use of RES remain to be done in the upcoming years in order to reach the 2020 targets.

**Table 1: The median RES share in gross final energy demand by 2013/2014 compared to the RED indicative trajectory. (EUROSTAT, 2017; DIRECTIVE 2009/28/EC)**

| The median RES share in gross final energy demand by 2013/2014 | RES share as of EUROSTAT data provided by the ECS | RED indicative trajectory (RED) | | Percentage points deviation of indicative trajectory (RED) | |
|---|---|---|---|---|---|
| | Median 2013/2014 | Median 2013/2014 | 2020 Target | Median 2013/2014 | 2020 Target |
| *Contracting Party* | [%] | [%] | [%] | [pp] | [pp] |
| Albania | 32.6% | 33.2% | 38% | -0.7% | -5.4% |
| Bosnia and Herzegovina | 32.6% | 35.8% | 40% | -3.2% | -7.4% |
| Kosovo* | 19.1% | 20.7% | 25% | -1.6% | -5.9% |
| Moldova | 12.3% | 13.4% | 17% | -1.1% | -4.7% |
| Montenegro | 36.3% | 28.3% | 33% | 8.0% | 3.3% |
| FYR of Macedonia | 19.0% | 23.5% | 28% | -4.5% | -9.0% |
| Serbia | 22.0% | 22.9% | 27% | -0.9% | -5.0% |
| Ukraine | 3.0% | 7.2% | 11% | -4.1% | -8.0% |

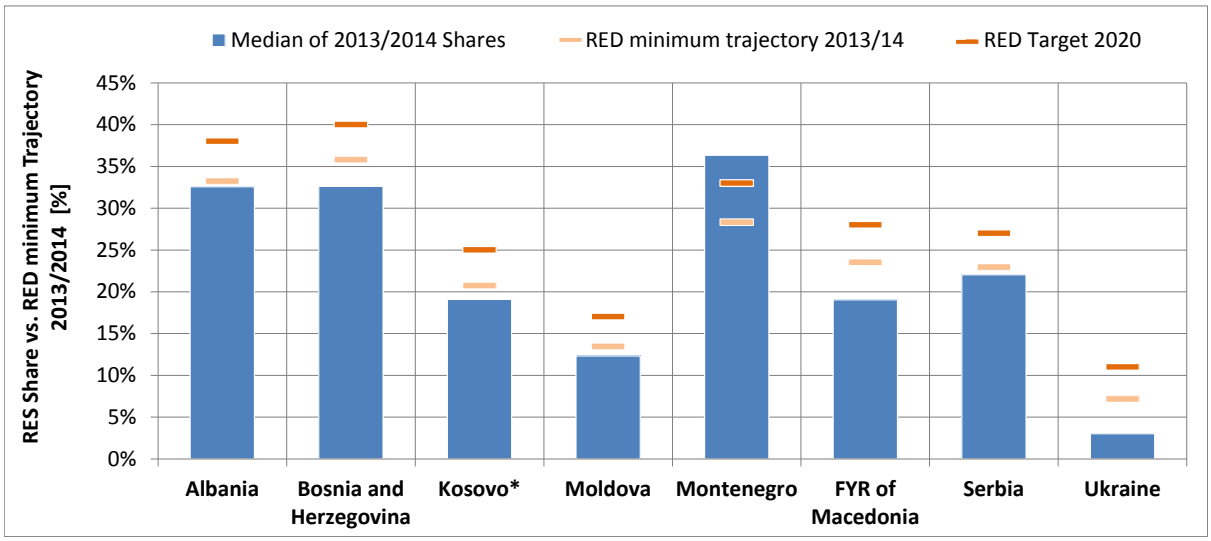


Figure 1: The Median RES shares of in 2013/2014 of the gross final energy demand for all CPs compared to the 2013/2014 indicative trajectory in the directive. (EUROSTAT, 2017; DIRECTIVE 2009/28/EC)

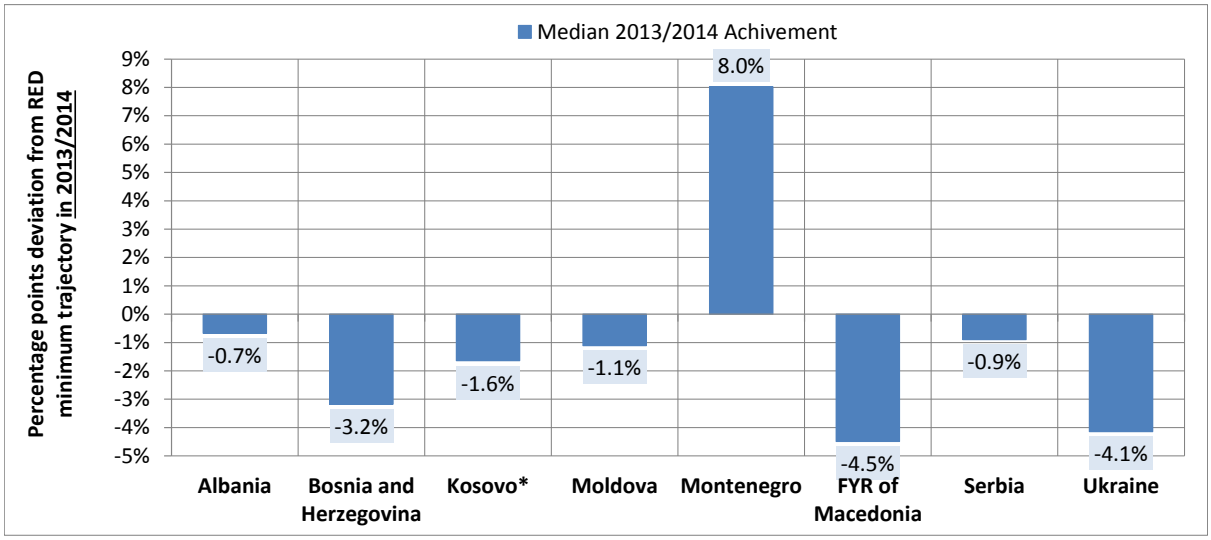


Figure 2: The deviation of the median 2013/2014 RES shares of GFEC from the renewable energy directive (RED) indicative trajectory in percentage points. (EUROSTAT, 2017; DIRECTIVE 2009/28/EC)

Figure 2 depicts the deviations in percentage points from the RED indicative trajectory for all CPs. Table 1 presents its underlying data.

Table 2: The RES share in gross final energy demand by 2013 and 2014 compared to the NREAP planned trajectory. (EUROSTAT, 2017; CPs NREAPs, draft NREAPs and Progress Reports)

| RES share in gross final energy demand by 2014 and 2015 | RES share as of EUROSTAT data provided by the ECS | | RES share as of Progress Report data | | NREAP planned trajectory | | Percentage points deviation from NREAP planned trajectory | |
|---|---|---|---|---|---|---|---|---|
| | 2014 | 2015 | 2014 | 2015 | 2014 | 2015 | 2014 | 2015 |
| *Contracting Party* | [%] | [%] | [%] | [%] | [%] | [%] | [pp] | [pp] |
| Albania | 32,0% | 34,9% | 32,0% | 34,9% | 31,6% | 34,0% | 0,3% | 0,9% |
| Bosnia and Herzegovina | 41,1% | 41,5% | n.a. | n.a. | 35,0% | 35,8% | 6,1% | 5,7% |
| Kosovo* | 19,5% | 18,5% | 19,4% | 19,1% | 19,3% | 19,7% | 0,3% | -1,2% |
| Moldova | 12,4% | 15,8% | 13,5% | 14,2% | 13,5% | 14,3% | -1,1% | 1,5% |
| Montenegro | 37,2% | 37,7% | 32,0% | 31,7% | 31,1% | 31,8% | 6,1% | 5,9% |
| FYR of Macedonia | 19,6% | 19,9% | 19,7% | 19,9% | 17,2% | 17,5% | 2,4% | 2,4% |
| Serbia | 22,7% | 21,8% | 22,7% | 21,0% | 19,7% | 20,9% | 3,0% | 0,9% |
| Ukraine | 3,3% | 4,3% | 3,9% | 4,9% | 5,9% | 6,7% | -2,6% | -2,4% |

In a next step, Figure 3 and Table 2 contrasts the RES shares for the years of 2014 and 2015 and the reported shares of the CPs Progress Reports are compared to their respective shares from the NREAP. The RES shares from EUROSTAT data and the shares documented in the CP's progress reports mostly coincide, except for Montenegro and Moldova. Montenegro's progress reports presents around 5-6pp lower than the respective Eurostat dataset. In case of Moldova, EUROSTAT and the Progress Report show strongly opposing trends between 2014 and 2015. Contrary to the comparison towards the indicative interim targets (cf. Figure 1), five CPs meet their NREAP planned trajectory in 2015 according to their progress reports. (cf. Figure 4 and for deviation in percentage points from NREAP planned trajectory). Deviations by 0.2 pp and less are assumed to fall into the error margin and are thus considered to be in accordance with the CP's NREAPS. Ukraine and Kosovo distinctively fail to reach their self-imposed NREAP targets in 2015, while Kosovo was actually still on track in 2014. That implies that Kosovo's RES deployment stagnated between 2014 and 2015. With a surplus of 2.4 pp, the FYR of Macedonia presents the biggest surplus in both years according to the CPs Progress Reports. Restrictively, it must be stated that the NREAP of FYR of Macedonia is not designed to meet the 2020 targets and accordingly the observed overfulfilment is no indicator for a particularly ambitious RES policy. In the EUROSTAT dataset, BiH and Montenegro show surpluses of up to 6 pp. Percentage point wise, RES shares improved to most in Moldova between 2014 and 2015. While 2014 it still missed its target by 1.1 pp, it surpasses it by 1.5 pp in 2015. However, the reliability of the RES share calculation for 2015 in Moldova is impaired due to missing electricity procurement data from Moldovan region Transnistria. Deviations from the NREAP target shares improve from 2014 to 2015 in only three of the Contracting parties, namely Moldova, Albania and Ukraine, while in the other 5 the deviations either stagnate or even aggravate.

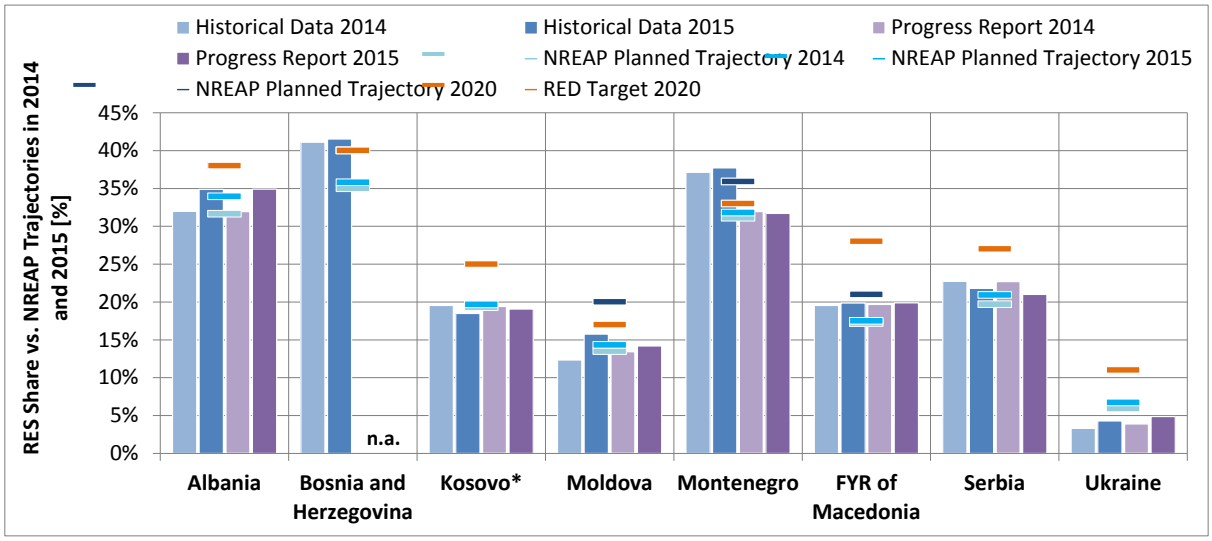


Figure 3: The RES shares for 2014 and 2015 of the gross final energy demand for all CPs compared to the reported shares of CP's Progress Reports and the non-binding 20124 and 2015 shares of the CPs NREAP trajectories. (EUROSTAT, 2017; CPs NREAPs and Progress Reports)

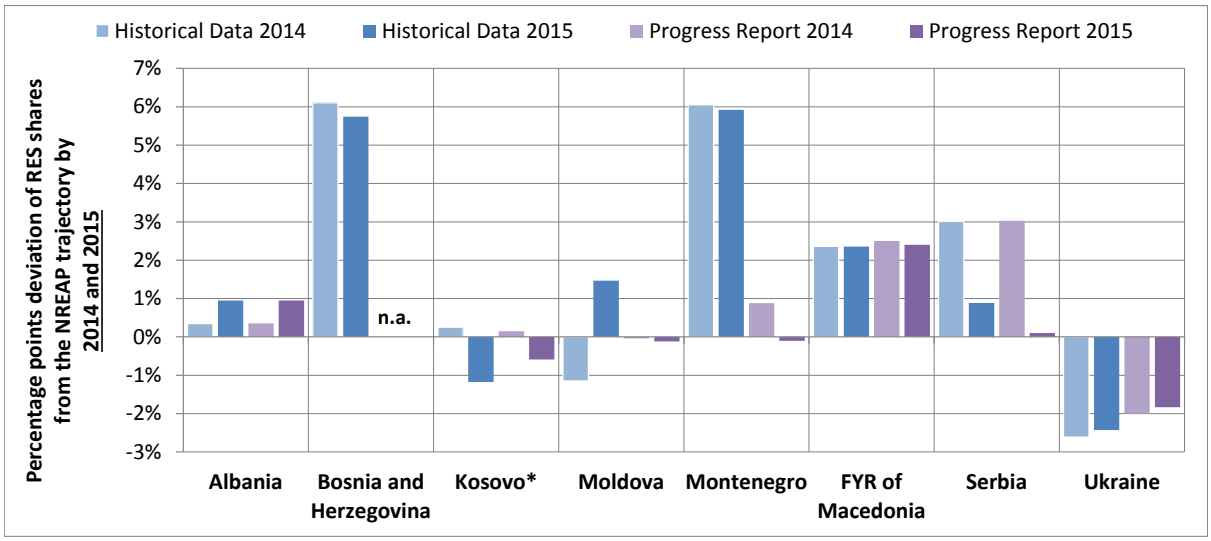


Figure 4: The deviation of RES shares of GFEC from the NREAP planned trajectory by 2014 and 2015 in percentage points. (EUROSTAT, 2017; CPs NREAPs and Progress Reports)

The absolute RES deployment in ktoe of 2014 and 2015 is shown in Figure 5. In addition, Figure 6 depicts the percentage deviation of the CPs absolute deployment of 2014 and 2015 to the planned absolute RES deployment as of the NREAPs. As regards the Eurostat data, it shows that Albania surpasses its absolute target by 5.2 % in 2014 and misses it by 1.6 % in 2015. Bosnia and Herzegovina reaches its absolute target in both 2014 and 2015 with a positive deviation of 30.7 % and 37.3 % respectively. Kosovo misses its target by 12.4 % in 2014 and by 21.2 % in 2015. Moldova surpasses its target by 6.1 % in 2014 and 9.5 % in 2015. Montenegro surpassed its absolute target in 2014 by 5.6 % and 1.8 % in 2015. FYR of Macedonia exceeds its target in 2014 by 19.1 % and by 13.6 pp in 2015. Ukraine falls short of its targets by 49.1 % and 52.0 % respectively. Overall, four of CPs met their absolute NREAP targets in 2015 while five did in 2014.

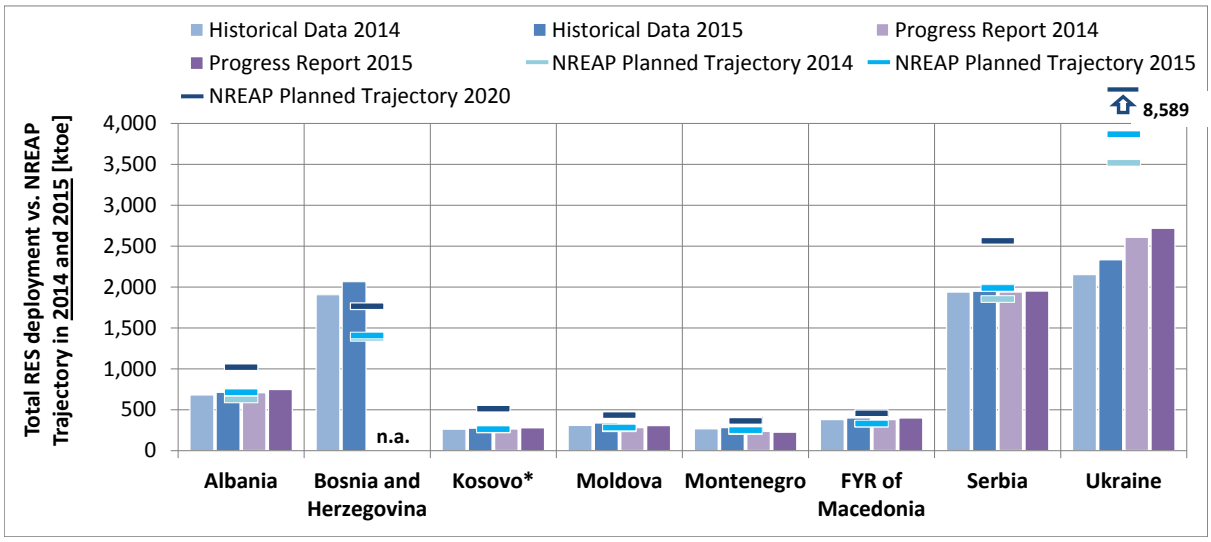


Figure 5: Absolute RES deployment in 2014 and 2015 from Eurostat data and Progress reports compared to the planned NREAP trajectories. (EUROSTAT, 2017; CPs NREAPs and Progress Reports)

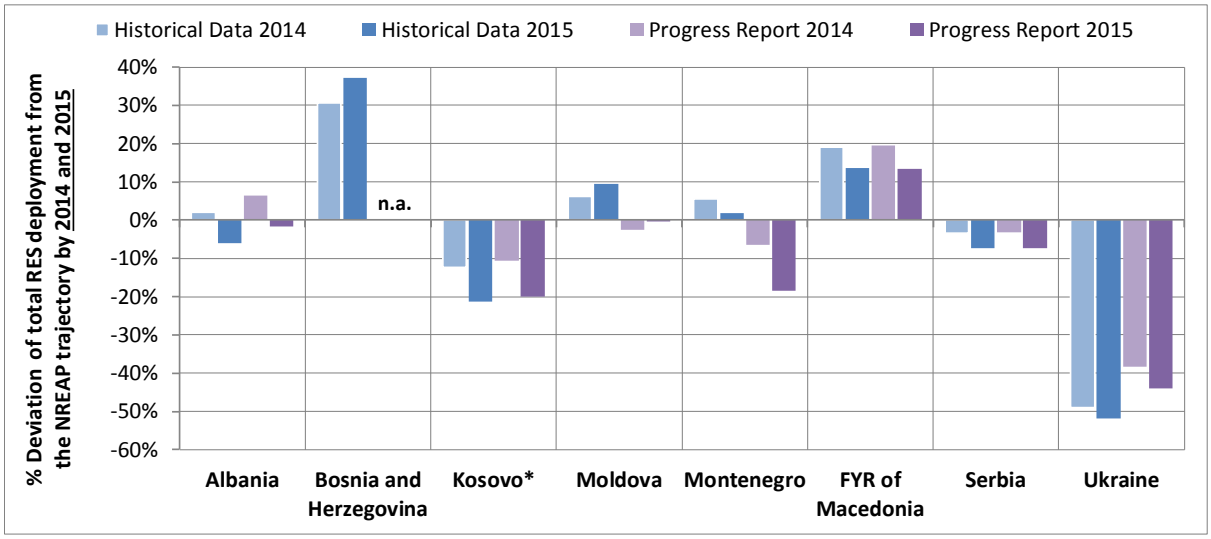


Figure 6: The percentage deviation of the absolute RES deployment in 2012 and 2013 from the absolute RES targets set in the CPs NREAPs. (EUROSTAT, 2017; CPs NREAPs and Progress Reports)

### *RES deployment in the electricity sector*

As regards the RES deployment in the electricity sector, Figure 7 depicts the historical and planned RES-E shares for the years 2014 and 2015. Figure 8 shows the deviation of the RES-E shares from the planned shares as of the CPs NREAPs in percentage points. According to the Eurostat data, Albania, Moldova and FYR of Macedonia are the CPs, which meet their NREAP RES-E target shares. In 2015, Albania and Moldova show a surplus of 8.7 pp and 33.3 pp respectively. It must be pointed out however that the high RES-E share for Moldova is mostly a result of the significant drop observed in the electricity demand in the EUROSTAT dataset due to the omission of Transnistria in 2015. FYR of Macedonia just hits its target. The other Contracting Parties fall short of their RES-E target shares. Their deficits in 2015 range from 2.3 pp for Serbia to 11.9 pp in the case of Kosovo. Note that in the case of Moldova there is no data missing; instead, the deviations from the NREAP trajectory are too small to be visible in both years. For Bosnia Herzegovina no progress report has been published to date.

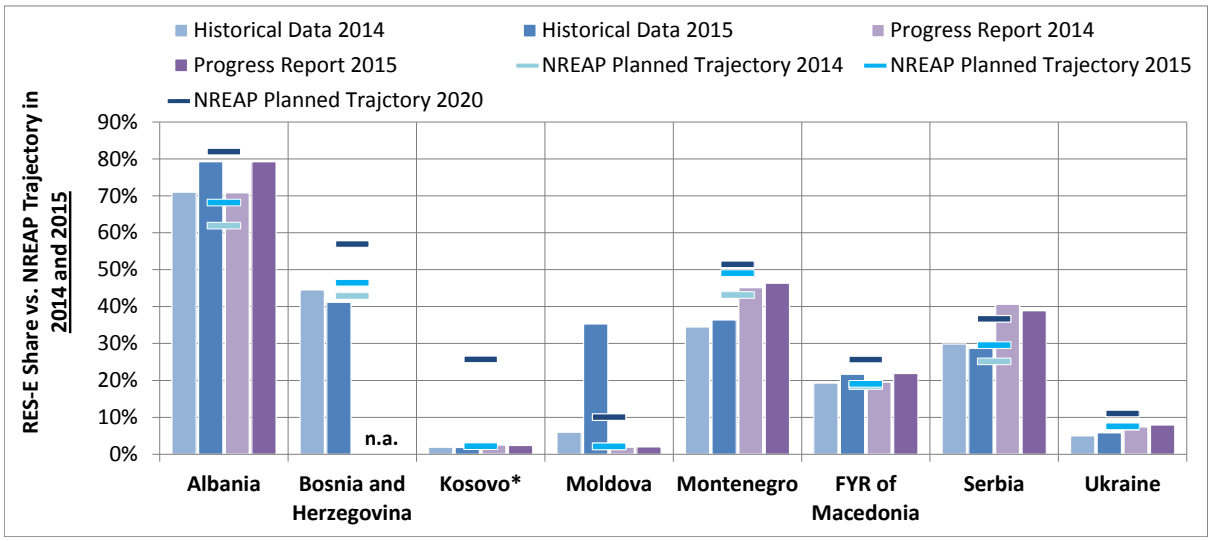


Figure 7: RES-E share in 2014 and 2015 of the gross electricity demand for all Contraction Parties compared to the not binding NREAP targets. (EUROSTAT, 2017; CPs NREAPs and Progress Reports)

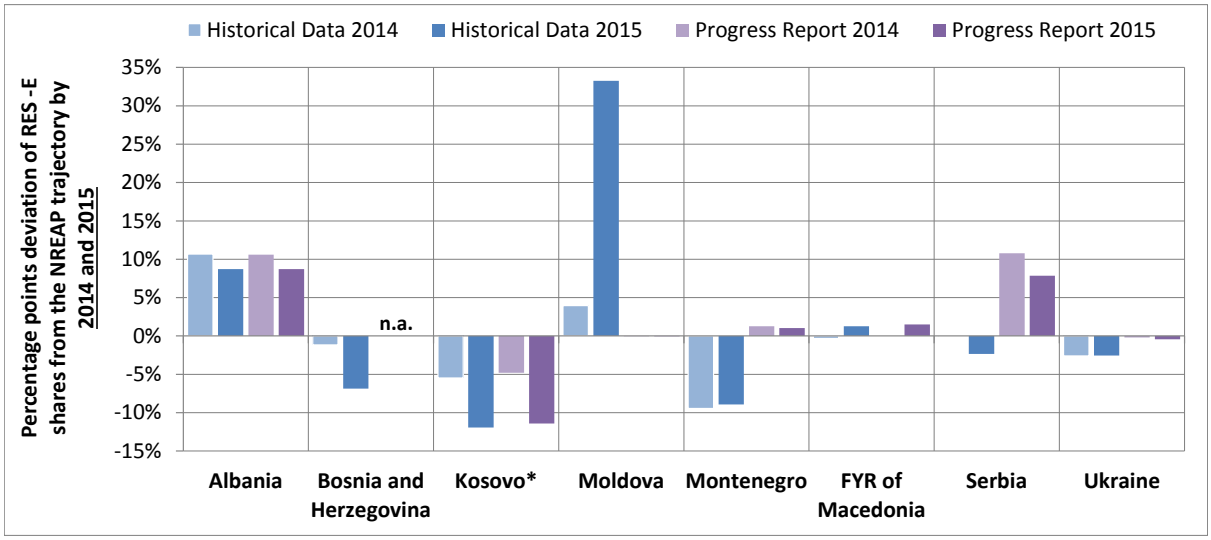


Figure 8: The deviation of the RES-E share in 2014 and 2015 from the RES-E target shares set in the CPs NREAPs in percentage points. (EUROSTAT, 2017; CPs NREAPs and Progress Reports)

The absolute RES-E deployment as of statistical data and Progress Reports and NREAP trajectories for 2014 and 2015 are shown in Figure 9. The percentage deviations of the absolute RES-E deployment in 2014 and 2015 from the absolute RES-E targets set in the CPs NREAPs are depicted in Figure 10. Contracting Parties which failed to meet their relative targets also missed their absolute deployment targets and vice versa. The only exception is Montenegro, which misses its absolute RES-E deployment targets by 20 % in 2015, yet overachieves slightly in relative terms. The EUROSTAT data for Moldova shows a positive deviation of over 300 % while according to its own progress report no deviation at all occurs. Again, this is the result of the significant drop observed in the electricity demand in the EUROSTAT dataset due to the omission of Transnistria in 2015.It can also be observed that in four of the Contracting Parties the Progress Reports present a significantly better target alignment with the CPs NREAPs then the data resulting from (EUSTOSTAT 2017).

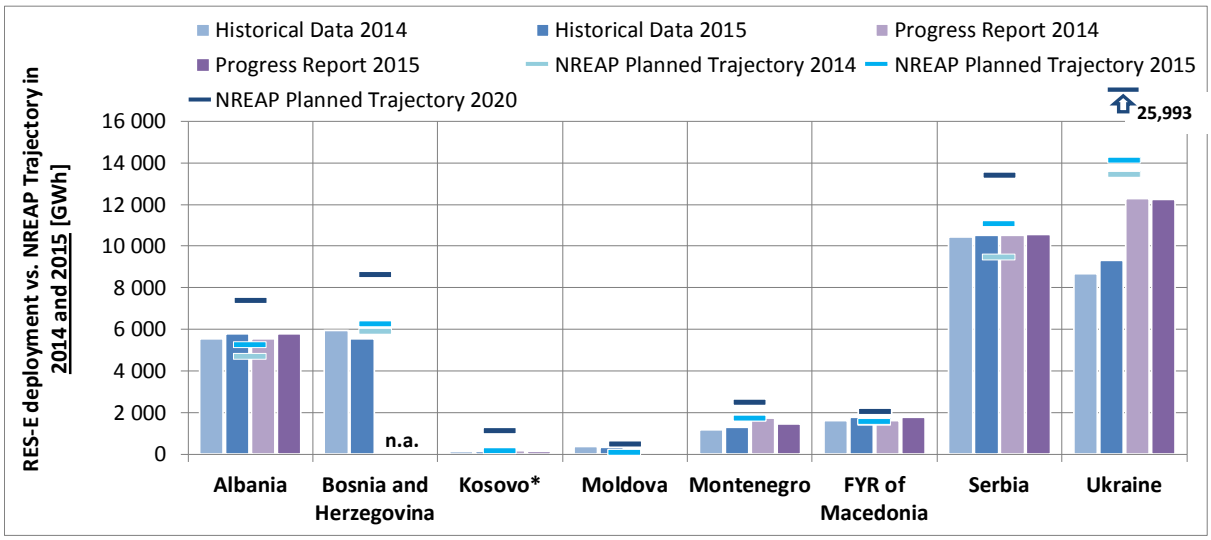


Figure 9: Absolute RES-E deployment in 2014 and 2015 for all CPs compared to the indicative NREAP targets. (EUROSTAT, 2017; CPs NREAPs and Progress Reports)

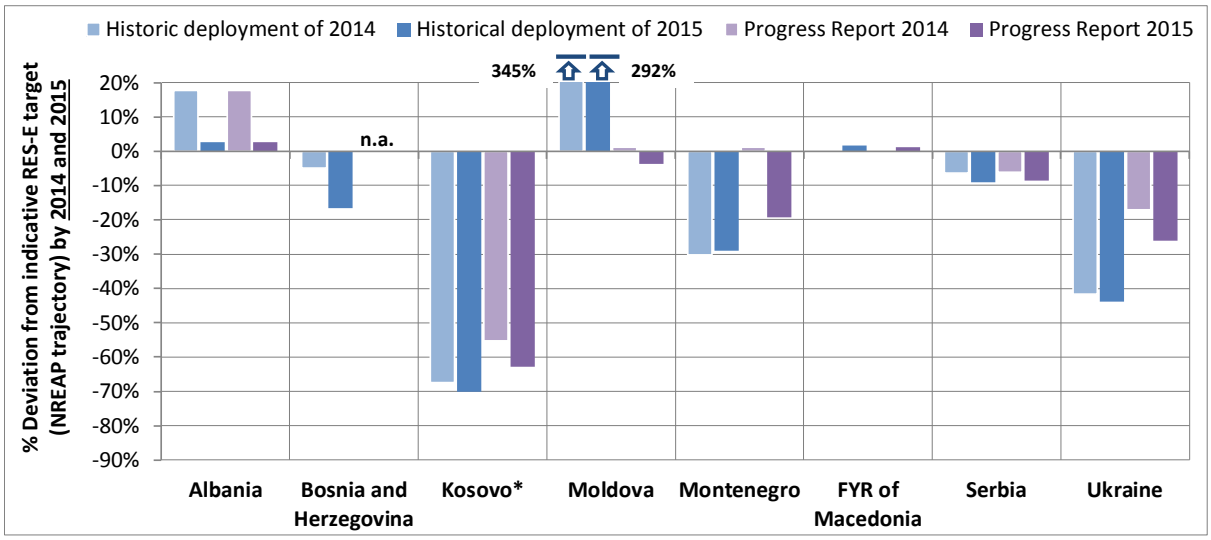


Figure 10: The percentage deviation of the absolute RES-E deployment in 2014 and 2015 from the absolute RES-E targets set in the CPs NREAPs. (EUROSTAT, 2017; CPs NREAPs and Progress Reports)

### *RES deployment in the heating and cooling sector*

The actual and planned development of the CPs RES shares in the heating and cooling sector (RES-H shares) is depicted in Figure 11. The deviations in percentage points of the CPs actual and planned RES share in the heating and cooling sector in 2014 and 2015 is depicted in Figure 12. Six of the Contracting Parties managed to meet their RES-H target shares in both 2014 and 2015. Moldova misses its target in 2014 with a deviation of 2.6 pp yet overachieves in 2015 with 3.5 pp. Ukraine presents deficits of about two pp in both years.

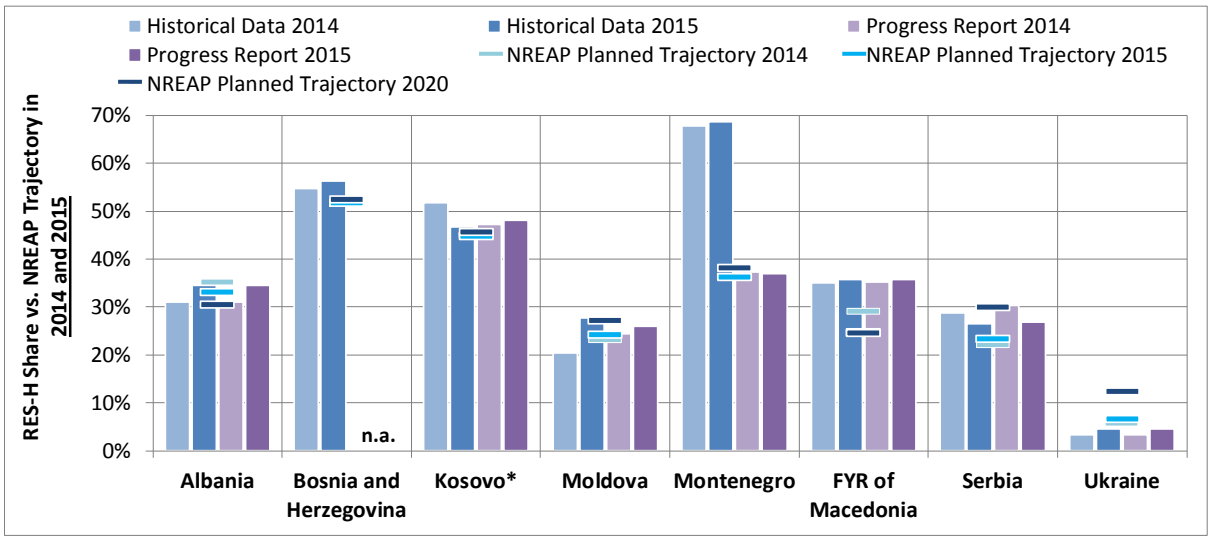


Figure 11: RES-H share in 2014 and 2015 of the gross heating and cooling demand for all Contraction Parties compared to the NREAP targets. (EUROSTAT, 2017; CPs NREAPs and Progress Reports)

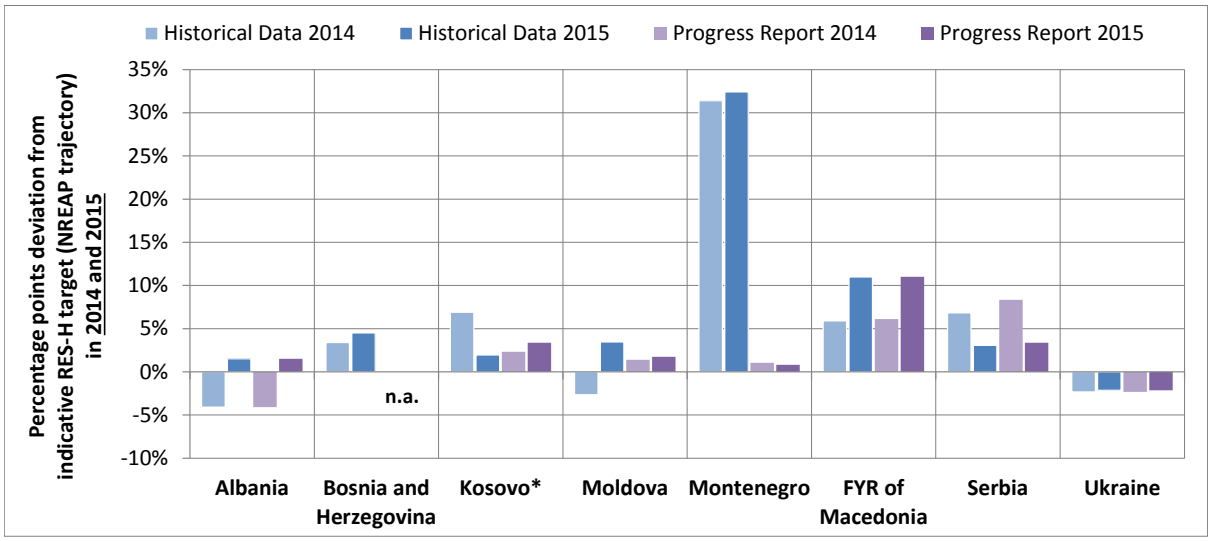


Figure 12: The deviation in percentage points of the RES-H shares in 2014 and 2015 from the RES-H target shares set in the CPs NREAPs. (EUROSTAT, 2017; CPs NREAPs and Progress Reports)

In terms of absolute RES-H deployment, as depicted in Figure 13, Albania, FYR of Macedonia and Ukraine fell short of their targets, while the first two reached their relative targets. Moldova in 2014 presents the contrary development; the absolute target is surpassed by 5.1 %, while the relative presents a deficit of 2.6 pp. The percentage deviations of the absolute RES-H deployment in 2014 and 2015 from the absolute RES-E targets set in the CPs NREAPs are shown in Figure 14 .

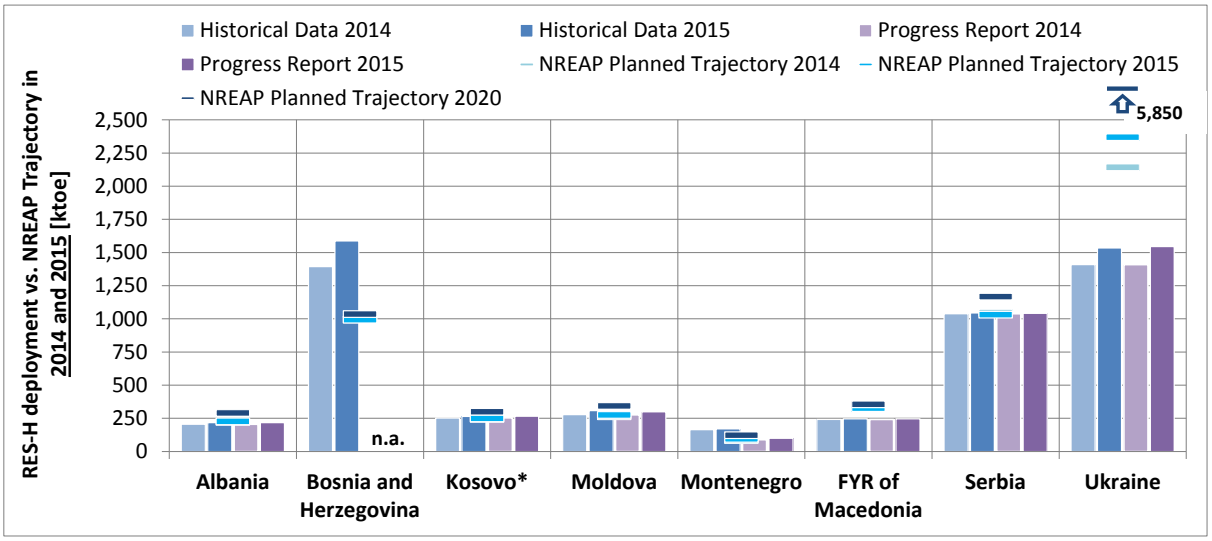


Figure 13: The absolute RES-H deployment in 2014 and 2015 of the gross heating and cooling demand for all Contraction Parties compared to the NREAP targets. (EUROSTAT, 2017; CPs NREAPs and Progress Reports)

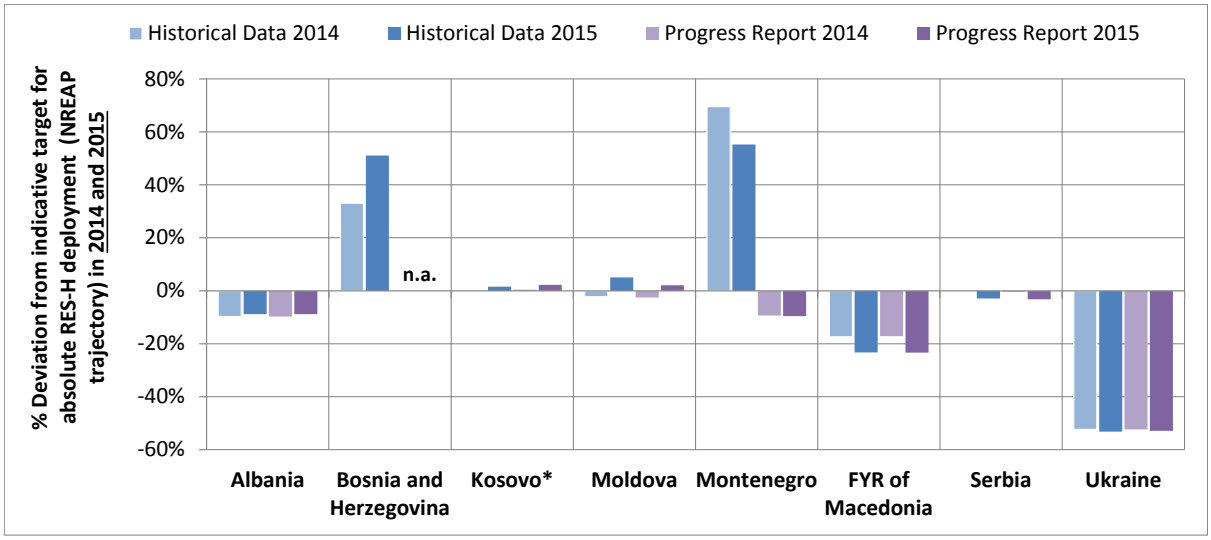


Figure 14: The percentage deviation of the absolute RES-H deployment in 2014 and 2015 from the absolute RES-H targets set in the CPs NREAPs (EUROSTAT, 2017, CPs NREAPs and Progress Reports)

### *Biofuel deployment in the transport sector*

In a last step, the deployment of biofuels in the CPs transport sector is discussed in this paragraph. As shown in Figure 15, there was no deployment of biofuels of any CP stated in the EUROSTAT data. Albania reported the consumption of 29 ktoe of biodiesel in 2014 and 33 ktoe in 2015. None of these biofuels complied with Article 21.2 of the renewable energy directive (RED) (2009/28/EC). The same is true for the FYR of Macedonia which reported a use of biodiesel with the amounts 0.31 ktoe in 2014 and 0.32 in 2015. The consumption of bioethanol in the transport sector was included in the Progress Report of the Ukraine. It is stated that 42.4 ktoe of Bioethanol were consumed in 2014 and 35.1 ktoe in 2015. Also in this case none of these biofuels complied with Article 21.2 of the RED (2009/28/EC).

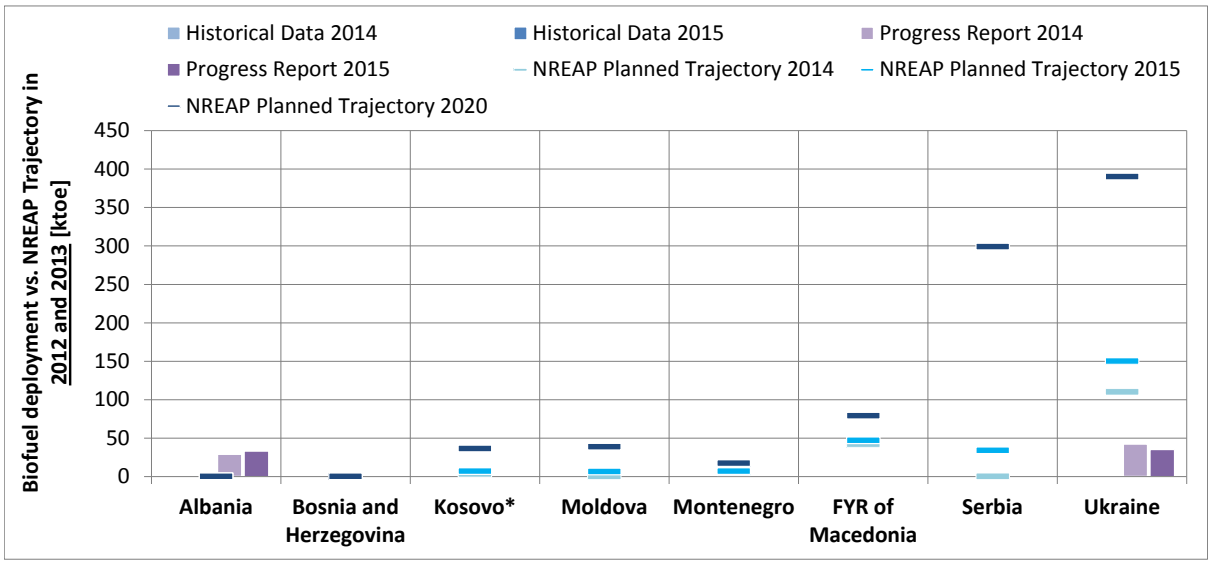


**Figure 15: The absolute deployment of biofuels in 2014 and 2015 for all Contraction Parties compared to the NREAP targets. (EUROSTAT, 2017; CPs NREAPs and Progress Reports)**

## 2.3 Assessment of future progress (towards meeting the 2020 targets)

### *2.3.1 Method of approach*

The general approach used for this analysis of Contracting Parties expected future progress is to conduct a model-based quantitative assessment of future RES deployment in absolute (i.e. GWh produced) and relative terms (i.e. RES shares on gross demands), reflecting assumptions also on future energy demand, comprising trend expectations for 2020.

The scenario calculation is performed by applying the Green-X model (explained in Box 1), a well-established simulation tool for policy instruments in the European RES market indicating consequences of policy choices on deployment and cost of RES technologies in a comprehensive manner. Although Green-X is capable of providing details for a broad set of RES technologies used for power generation or in heating and cooling, for the transport sector Green-X is only capable to model biofuel deployment but not electro-mobility. For the assessment of overall RES target achievement at Contracting Party level this does not represent any constraint since RES target achievement is measured by summing up RES use in the electricity sector, in heating and cooling and biofuels in transport, and the sum is subsequently divided by gross final energy demand. For the transport-specific sector RES target, where an indicative RES share of 10% shall be achieved by 2020, however only the contribution of biofuels can be assessed.

**Box 1: Short characterisation of the Green-X model**

Short characterisation of the Green-X model:

The model Green-X has been developed by the Energy Economics Group (EEG) at the Vienna University of Technology under the EU research project "Green-X–Deriving optimal promotion strategies for increasing the share of RES-E in a dynamic European electricity market" (Contract No. ENG2-CT-2002-00607). Initially focussed on the electricity sector, this modelling tool, and its database on renewable energy (RES) potentials and costs, has been extended to incorporate renewable energy technologies within all energy sectors.

Green-X covers the EU-28, the Western Balkans, Turkey and North Africa and has been be extended within the course of this study to other CPs, such as Ukraine or Moldova. It allows the investigation of the future deployment of RES as well as the accompanying cost (including capital expenditures, additional generation cost of RES compared to conventional options, consumer expenditures due to applied supporting policies) and benefits (for instance, avoidance of fossil fuels and

corresponding carbon emission savings). Results are calculated at both the country- and technology-level on a yearly basis. The time-horizon allows for in-depth assessments up to 2030, accompanied by concise outlooks for the period beyond 2030 (up to 2050).

The Green-X model develops nationally specific dynamic cost-resource curves for all key RES technologies, including for renewable electricity, biogas, biomass, biowaste, wind on- and offshore, hydropower large- and small-scale, solar thermal electricity, photovoltaic, tidal stream and wave power, geothermal electricity; for renewable heat, biomass, sub-divided into log wood, wood chips, pellets, grid-connected heat, geothermal grid-connected heat, heat pumps and solar thermal heat; and, for renewable transport fuels, first generation biofuels (biodiesel, biomethane and bioethanol), second generation biofuels (lignocellulosic bioethanol, biomass to liquid), as well as the impact of biofuel imports. Besides the formal description of RES potentials and costs, Green-X provides a detailed representation of dynamic aspects such as technological learning and technology diffusion.

Through its in-depth energy policy representation, the Green-X model allows an assessment of the impact of applying (combinations of) different energy policy instruments (for instance, quota obligations based on tradable green certificates / guarantees of origin, (premium) feed-in tariffs, tax incentives, investment incentives, impact of emission trading on reference energy prices) at both country or European level in a dynamic framework. Sensitivity investigations on key input parameters such as non-economic barriers (influencing the technology diffusion), conventional energy prices, energy demand developments or technological progress (technological learning) typically complement a policy assessment.

Within the Green-X model, the allocation of biomass feedstock to feasible technologies and sectors is fully internalised into the overall calculation procedure. For each feedstock category, technology options (and their corresponding demands) are ranked based on the feasible revenue streams as available to a possible investor under the conditioned, scenario-specific energy policy framework that may change on a yearly basis. Recently, a module for intra-European trade of biomass feedstock has been added to Green-X that operates on the same principle as outlined above but at a European rather than at a purely national level. Thus, associated transport costs and GHG emissions reflect the outcomes of a detailed logistic model. Consequently, competition on biomass supply and demand arising within a CP from the conditioned support incentives for heat and electricity as well as between CPs can be reflected. In other words, the supporting framework at MS level may have a significant impact on the resulting biomass allocation and use as well as associated trade.

Moreover, Green-X allows an endogenous modelling of sustainability regulations for the energetic use of biomass. This comprises specifically the application of GHG constraints that exclude technology/feedstock combinations not complying with conditioned thresholds. The model allows flexibility in applying such limitations, that is to say, the user can select which technology clusters and feedstock categories are affected by the regulation both at national and EU level, and, additionally, applied parameters may change over time.

The modelling work is closely linked to other parts of this study. Thus, the assessment of future progress builds on the analysis of historic RES deployment (cf. previous sections), using the latest available historic data as starting point for the new RES deployment that can be anticipated in the period up to 2020. Moreover, the prospective assessment reflects findings gained with respect to achieved progress in mitigating non-cost barriers. Obviously, this quantitative assessment is also closely linked to the overall qualitative RES policy assessment, building on the collected policy information and providing input to the overall policy analysis.

### *2.3.2 Scenario definition*

This task comprises the prospective RES policy assessment, dedicated to provide a model-based analysis to analyse to what extent currently implemented RES policies (Current Policy Initiatives (CPI)), complemented by Planned Policy Initiatives (CPI+PPI) are sufficient to trigger the targeted RES deployment in subsequent years up to 2020 at Contracting Party level.

Information on Current (RES) Policy Initiatives (CPI) is primarily based on the RES policy database developed within the Energy Community project: *"Assessment of Renewable Energy Action Plan Implementation and Progress of Renewable Energy in Energy Community"* and updates of that gained within this project through additional data gathering.

Information on Planned Policy Initiatives (PPI) and Current Policy Initiatives (CPI) was collected from CP's NREAPs and the current 2016 Progress Reports, as well as through the RES-legal database (cf. www.res-legal.eu) Since CPs reported on planned improvements in a non-homogenous manner a comprehensive reassessment of the originally provided information was needed. As a first step, measures were differentiated between current and planned measures. Next, reported CP-specific measures were grouped into:

- non-cost barriers, and
- financial support measures.

### *2.3.3 Sensitivity analysis*

Note that a *brief sensitivity analysis* has been undertaken for the assessed case, relating to the expected future energy demand (growth): two revised scenarios of future energy demand developments up to 2020 (i.e. efficiency and reference demand development) form the basis for our assessment whereas CPs default demand trends as reported in their NREAPs are used for a sensitivity assessment. More precisely, expectations on future energy demand were originally taken from the CPs NREAPs but have been compared with actual data for the status quo (2014 and 2015) and were corrected, respectively.[1]

### *2.3.4 Results*

Next the outcomes of our model-based assessment of expected future progress are discussed. For RES overall, two figures will be presented for 2020:

(1) Overview figure comparing for each CP expected RES deployment with RED indicative trajectory targets (i.e. required deployment) and planned NREAP targets (i.e. planned progress);
(2) CP's deviation from planned deployment, i.e. the NREAP target as set for 2020.

All data on expected RES deployment stems from Green-X modelling. The data is included as "Current Policy Initiatives plus planned measures (CPI+PPI)" scenario in its two variants (i.e. with low and high demand growth). For the three sectors RES-E, RES-H&C, and biofuels in transport, we present figures (1) and (2) as well but since no targets are prescribed at sector or technology level expected deployment is only compared to the planned one (i.e. the NREAP target).

[1] Demand projections provided by most CPs NREAPs appeared to reflect latest developments generally more adequate than alternative data sources. A correction and validation process at CP level in order to reflect recent changes in energy consumption, i.e. incorporating the impact of the financial/economic crisis that was significant in magnitude in parts of Europe, was however indispensable for being capable to provide suitable short-term projections. Implications arising from this validation and correction process on future energy demand developments are subject of the corresponding sensitivity assessment on future energy demand (growth) where we propose that, in short, either a permanent change (low demand) or only an short-term change followed later on (up to 2020) by a full alignment with past NREAP projections (high demand case) will be assumed.

*Overall RES deployment*

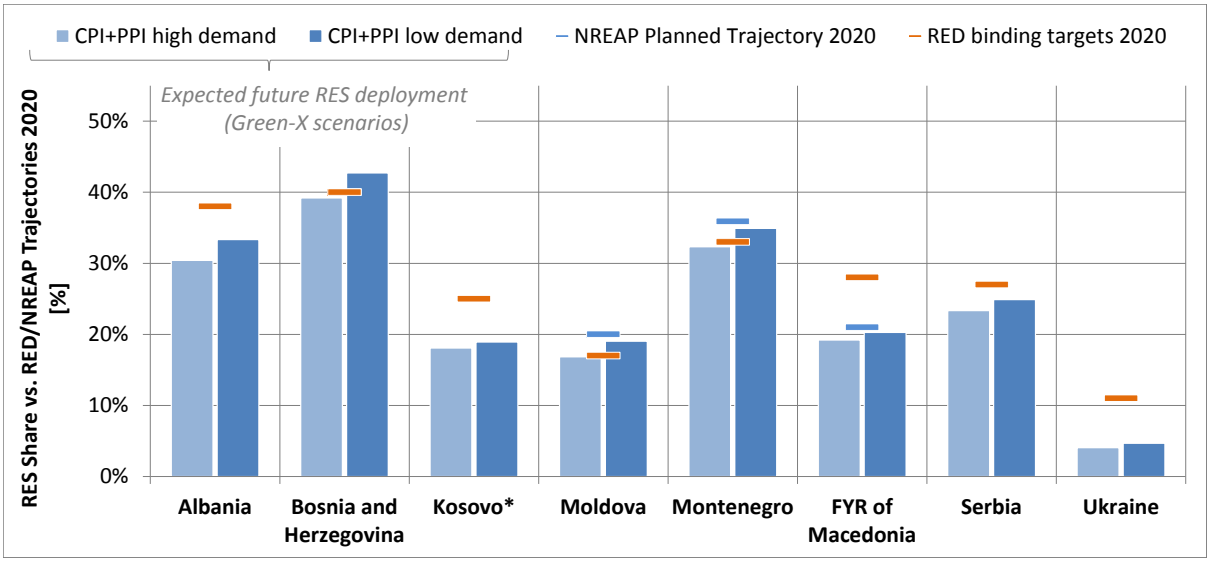


**Figure 16: Expected RES share in 2020 vs. 2020 RED indicative trajectory and 2020 (NREAP) target (%).**

Modelling results show the projected future progress by 2020 (i.e. against the binding 2020 RES target), indicating by CP the likeliness of delivering as required under the RES directive (i.e. indicative targets for overall RES deployment under the indicative trajectory, Annex I part B of the RES directive). As a starting point, Figure 16 and Table 3 show the expected RES deployment in relative terms, expressing the RES share in gross final energy demand in 2020 by CP according to assessed Green-X scenarios. The basket of assessed cases includes two distinct scenarios that differ by the expected demand developments (i.e. reference and efficiency trend, originally based on CPs NREAPs but corrected in accordance with actual demand developments).This graph allows for a comparison with targeted RES volumes, showing the binding 2020 RES target as given by the RES directive.

Results, shown in Figure 17 and Table 3, suggest that three CPs, namely Bosnia and Herzegovina, Moldova and Montenegro, are expected to reach the given 2020 target with currently implemented and planned policy measures – if energy demand will develop as planned according to the low demand case (assuming complementary energy efficiency measures to be taken or other reasons that justify the low demand path). Despite the expected increase in absolute terms, Albania, Kosovo*, FYR of Macedonia, Serbia and Ukraine would fail to achieve their 2020 RES targets.

**Table 3: Expected, planned and required RES shares in 2020.**

| RES share in gross final energy demand by *2020* | Expected RES share 2020 (CPI+PPI scenario) | | RED target 2020 | NREAP planned trajectory - RES share 2020 | *Deviation from **binding 2020 RED target** share (CPI and CPI+PPI scenario)* | | *Deviation from **planned 2020 trajecotry** share as of NREAP (CPI and CPI+PPI scenario)* | |
|---|---|---|---|---|---|---|---|---|
| | high demand | low demand | | | high demand | low demand | high demand | low demand |
| *Contracting Party* | [%] | [%] | [%] | [%] | [%] | [%] | [%] | [%] |
| *Albania* | 30.4% | 33.3% | 38.0% | 38.0% | *-20.0%* | *-12.3%* | *-20.0%* | *-12.3%* |
| *Bosnia and Herzegovina* | 39.2% | 42.7% | 40.0% | 40.0% | *-2.0%* | *6.8%* | *-2.0%* | *6.8%* |
| *Kosovo** | 18.1% | 18.9% | 25.0% | 25.0% | *-27.7%* | *-24.3%* | *-27.7%* | *-24.3%* |
| *Moldova* | 16.8% | 19.0% | 17.0% | 20.0% | *-1.0%* | *12.0%* | *-15.8%* | *-4.8%* |
| *Montenegro* | 32.3% | 34.9% | 33.0% | 35.9% | *-2.0%* | *5.8%* | *-9.9%* | *-2.8%* |
| *FYR of Macedonia* | 19.2% | 20.3% | 28.0% | 21.0% | *-31.4%* | *-27.6%* | *-8.5%* | *-3.4%* |
| *Serbia* | 23.4% | 24.9% | 27.0% | 27.0% | *-13.5%* | *-7.8%* | *-13.5%* | *-7.8%* |
| *Ukraine* | 4.1% | 4.7% | 11.0% | 11.0% | *-63.1%* | *-57.5%* | *-63.1%* | *-57.5%* |

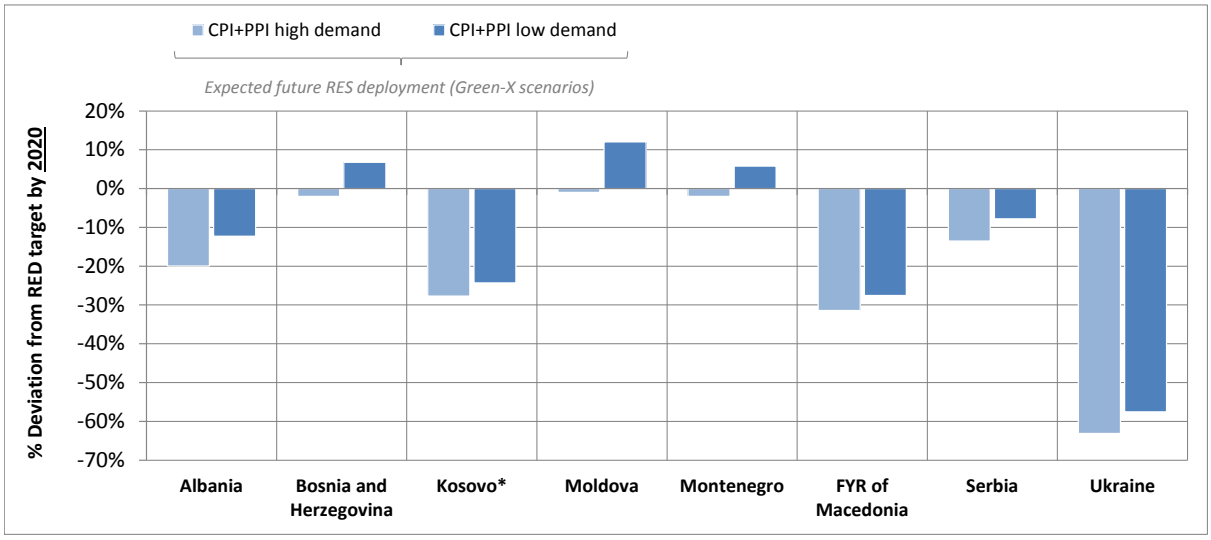


Figure 17: Deviation of expected RES shares (Green-X scenarios) from binding RED target by 2020.

Next a closer look is taken on the expected progress in meeting planned (i.e. according to NREAPs) RES deployment by 2020 (see Figure 16). A graphical illustration of the deviation of expected RES deployment from the targeted one – that is the planned progress as prescribed in the CP's progress reports – is given by Figure 18. As applicable from this graph as well as from Figure 16, only few CPs have established a higher RES deployment target than their required one, namely Moldova and Montenegro. Thus, the number of CPS that are expected to meet their planned trajectory is diminishing compared to above – i.e. only Bosnia and Herzegovina can expect to reach the own defined target if a low demand development can be established in forthcoming years and if the RES uptake materializes as projected. Generally, deviations are modest in Moldova, Montenegro and FYR of Macedonia whereas all other CPs may end up with a delivery gap larger than 20% (compared to target 2020 RES share).

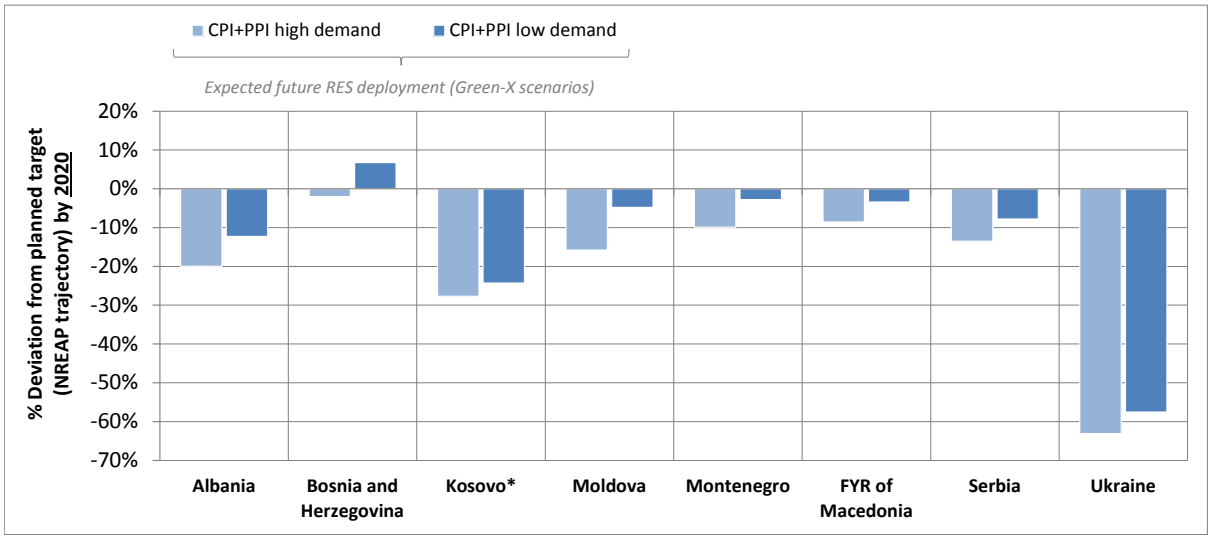


Figure 18: Deviation of expected RES shares (Green-X scenarios) from planned NREAP target by 2020.

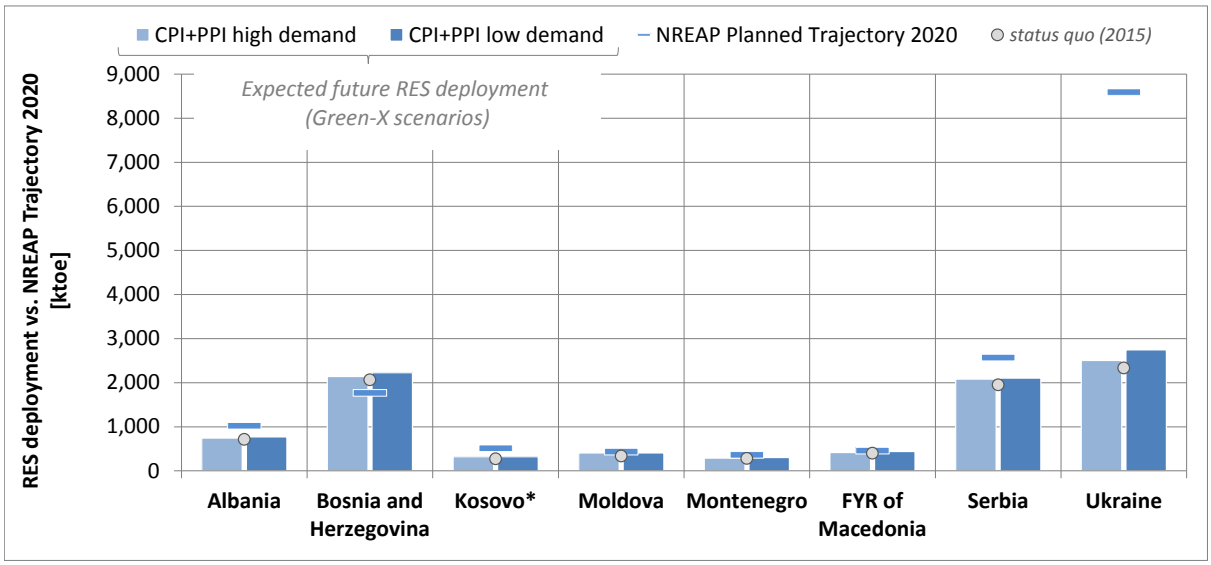


**Figure 19: Actual (2012) and expected RES deployment (in absolute terms) in 2020 vs. 2020 (NREAP) target.**

Complementary to above, Figure 19 indicates for each CP the expected 2020 RES deployment in absolute terms, that is, the sum of electricity, heat and transport fuels stemming from renewable sources. For comparison also historic data is provided, showing actual RES generation (with normalisation of the electricity produced at hydropower plants) in the year 2015. Apparently, in all CPs a moderate increase in RES deployment can be expected in forthcoming years. Remarkably are for example expected developments in Ukraine where the scenarios indicate considerable increases in RES deployment in forthcoming years. Despite these growth trends, it can however be expected that – with the exception of Bosnia and Herzegovina – all CPs fail to comply with their own plans in terms of produced Mtoe that stem from renewable sources.

### *RES deployment in the electricity sector*

Next a closer look is taken at the electricity sector, discussing the outcomes of the assessment of expected future progress in generating electricity from renewable sources in all CPs of the Energy Community. For the year 2020 Figure 20 compares the expected (according to Green-X scenarios) and the planned (i.e. the indicative NREAP targets) progress of RES in the electricity sector, showing RES-E deployment in relative terms, that is the RES-E share in gross electricity demand by CP. Complementary to this graph, Figure 21 illustrates the deviation of expected RES-E deployment from the indicatively targeted one (i.e. the planned progress as prescribed in the CP's NREAPs). In both figures uncertainty related to the development of future energy demand is reflected, illustrating lower (i.e. CPI+PPI min) and upper levels (CPI+PPI max) of expected RES-E shares in gross electricity consumption.

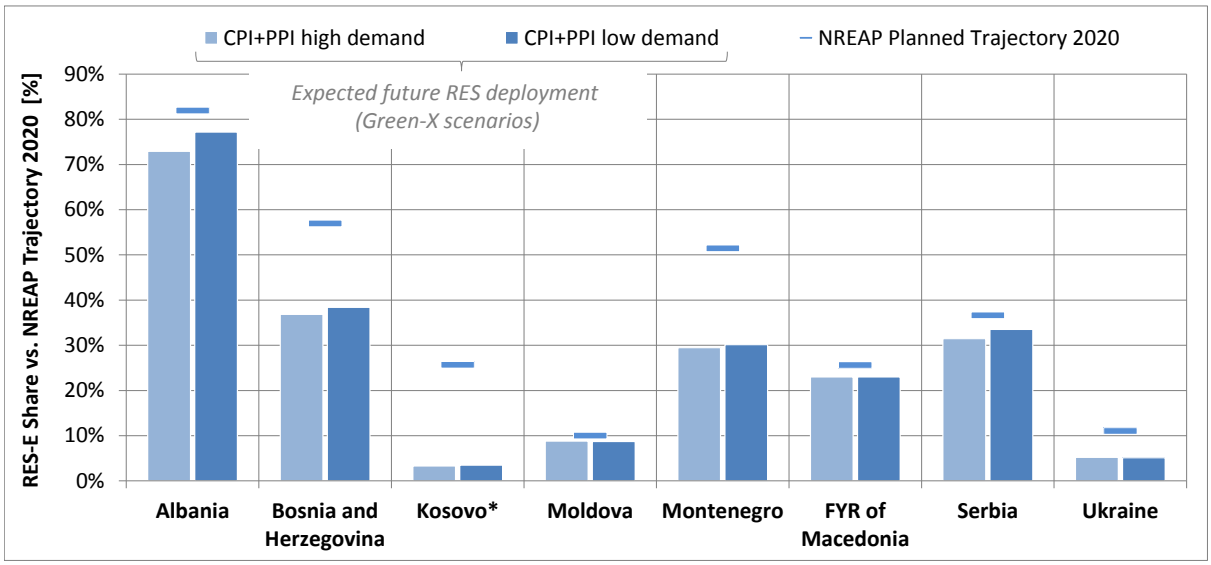


Figure 20: Expected RES-E share in 2020 vs. 2020 (NREAP) target (%).

None of the CPs is expected to comply with own deployment plans. Thus, here expected deployment lacks behind the planned one. The gap appears comparatively low in CPs like Albania, Moldova, FYR of Macedonia and Serbia, whereas high deviations (above 50% compared to planned) are apparent for Kosovo* and Ukraine. Thus, in those CPs a strengthening and fine tuning of policy initiatives offering adequate support for all available RES-E technologies and a rapid removal of non-cost barriers that hinder a rapid take-off of RES-E appear indispensable for achieving 2020 deployment plans and for meeting overall binding RES targets. A comparatively moderate deployment gap can be expected for Bosnia and Herzegovina as well as Montenegro and FYR of Macedonia.

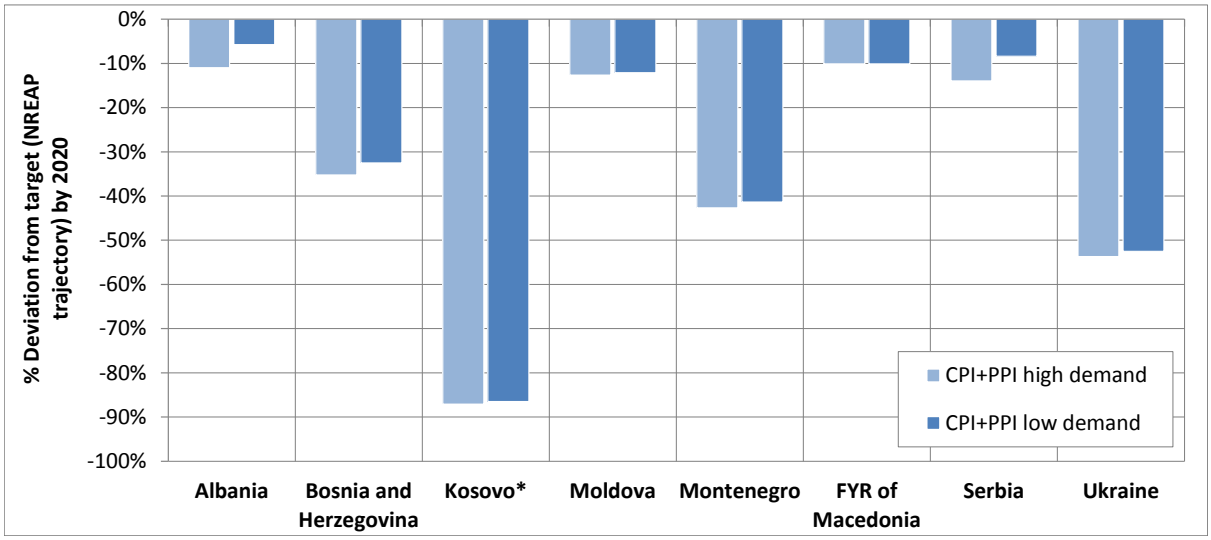


Figure 21: Deviation of expected RES-E shares (Green-X scenarios) from planned NREAP target by 2020.

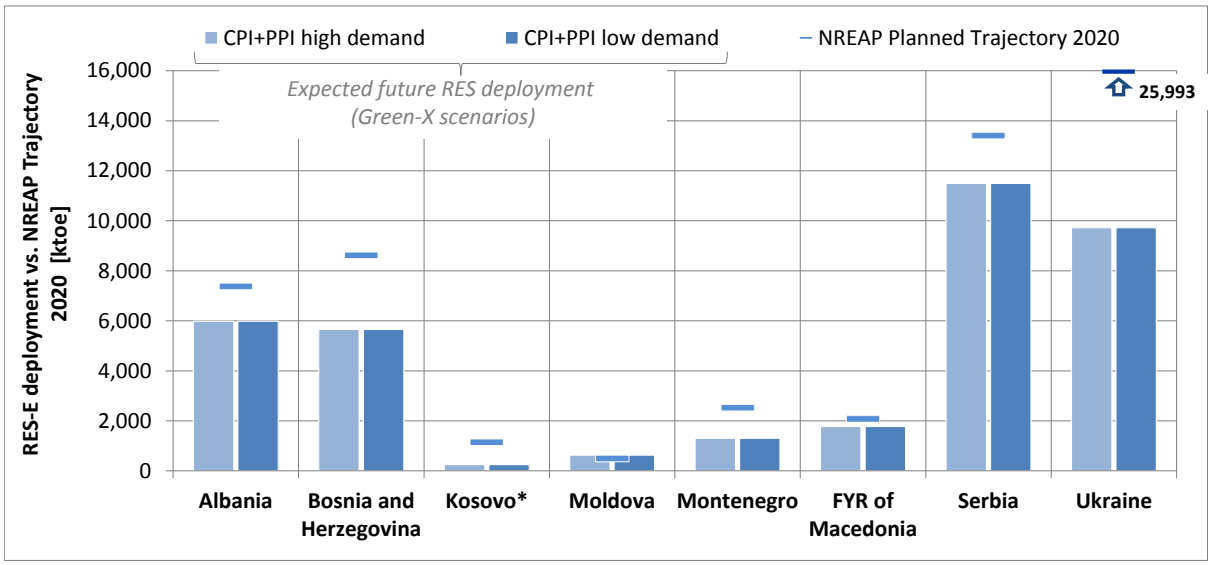


Figure 22: Expected RES-E deployment (in absolute terms) in 2020 vs. 2020 (NREAP) target.

In accordance with above, Figure 22 provides the corresponding illustration for 2020 RES-E generation in absolute terms, comparing again planned with expected 2020 RES-E deployment. Generally, results show a similar picture as discussed above when looking at RES-E deployment in relative terms. For Moldova a slight change can be identified: expected renewable electricity deployment appears in accordance with the planned one, indicating a higher demand growth than originally anticipated (in NREAPs).

### *RES deployment in heating and cooling*

Expected and planned progress in using renewables in heating and cooling is compared below across all CPs. In this context, a comparison of the expected (according to Green-X scenarios) and the planned (i.e. the indicative NREAP targets) progress in terms of RES in heating and cooling is shown in Figure 23, expressing RES-H deployment in relative terms, that is the share of RES-H in the corresponding sector demand by CP. A closer look at the deviation of the expected RES-H share from the indicatively targeted one (i.e. the planned progress as prescribed in the CP's NREAPs) is then provided in Figure 24. Similar to above, in both figures uncertainty related to the development of future energy demand is reflected, illustrating lower (i.e. CPI+PPI min) and upper levels (CPI+PPI max) of expected RES-H shares in gross final heat consumption.

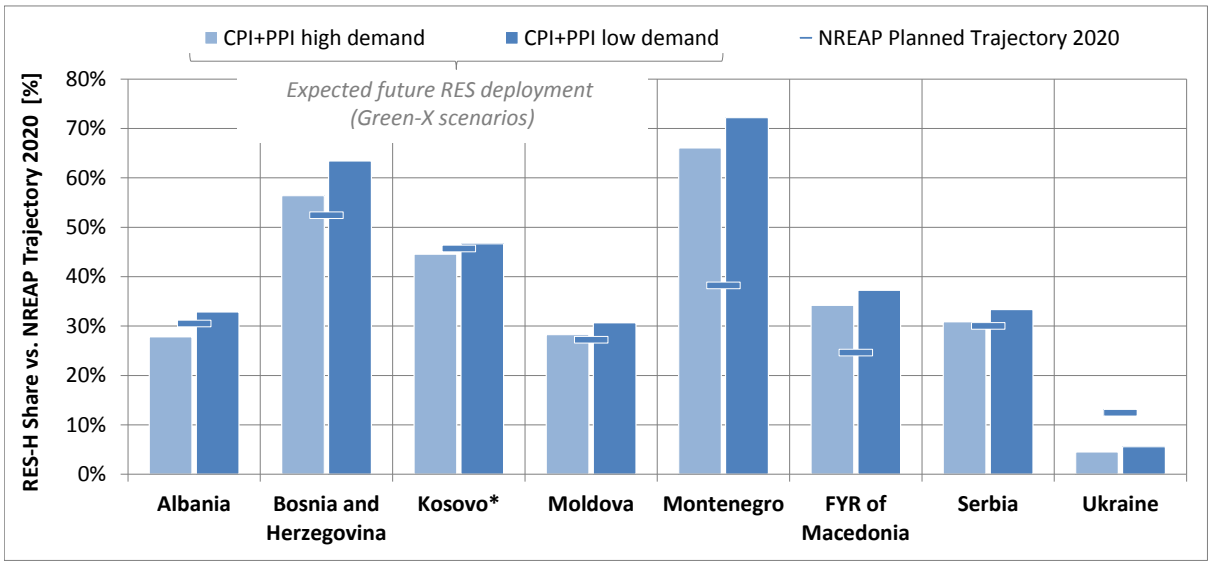


Figure 23: Expected RES-H share in 2020 vs. 2020 (NREAP) target (%).

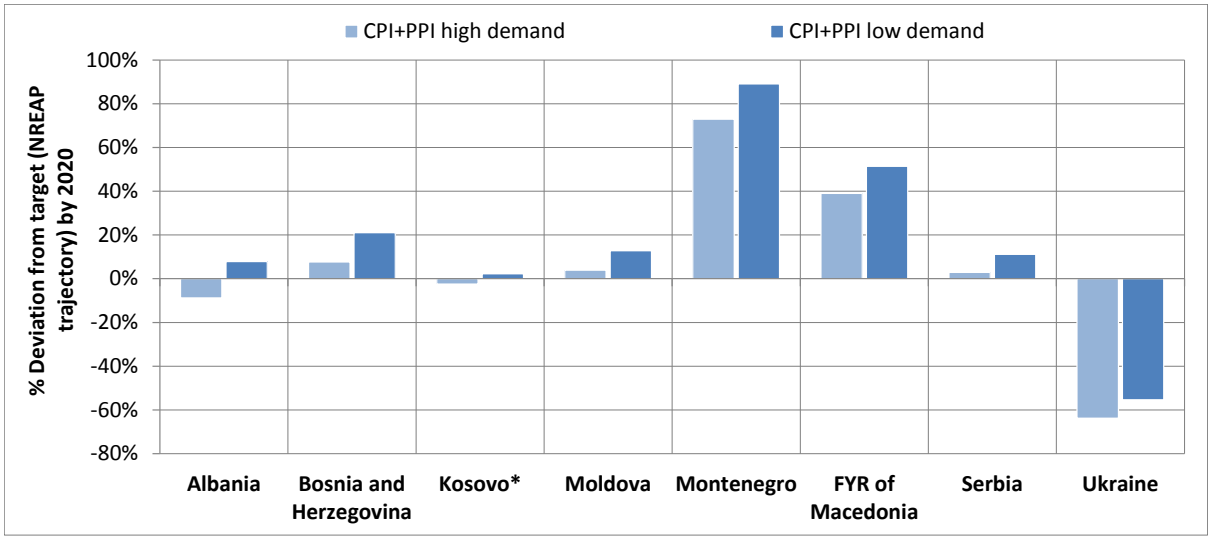


Figure 24: Deviation of expected RES-H shares (Green-X scenarios) from (NREAP) target by 2020.

It is applicable that seven of the five CPs, namely Bosnia and Herzegovina, Moldova, Montenegro, FYR of Macedonia and Serbia, are on track for complying with expressed deployment plans. The same is true for two more CPs, namely Albania and Kosovo* in the case of a low demand growth. Only Ukraine shows substantial negative deviations. Bosnia and Herzegovina as well as Montenegro show a very positive trend thanks to the retrospective change of the statistical accounting for solid biomass in the heating and cooling sector – i.e. the establishment of a biomass data accounting in accordance with Eurostat principles.

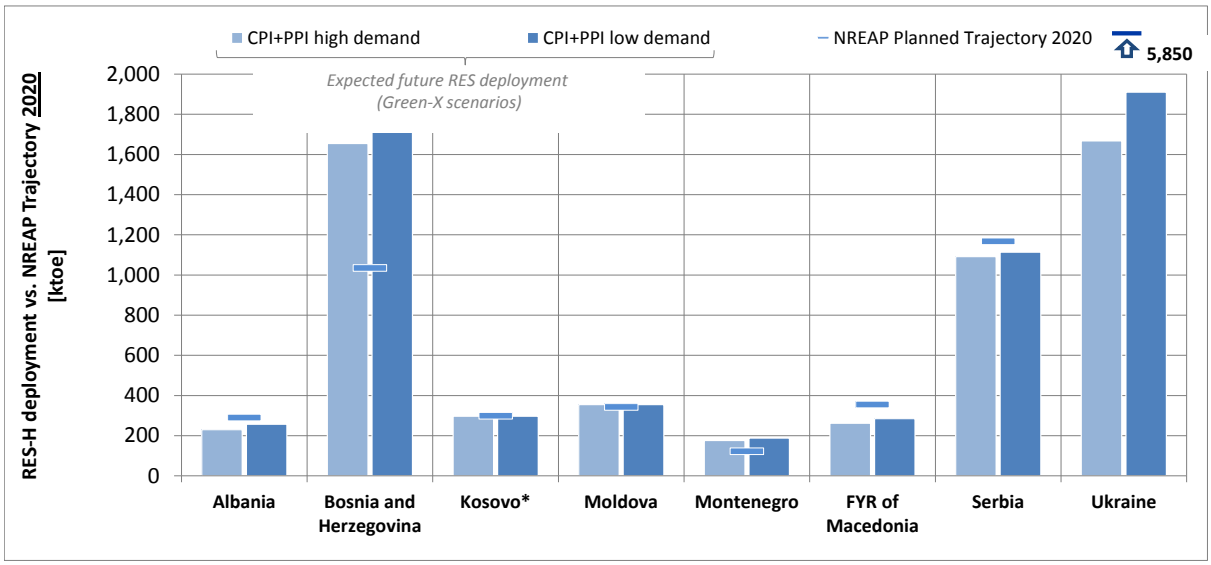


Figure 25: Expected RES-H deployment (in absolute terms) in 2020 vs. 2020 (NREAP) target.

Complementary to above, Figure 25 shows RES-H generation in absolute terms, comparing again planned with expected 2020 renewables deployment in the heating and cooling sector. It can be seen that Bosnia and Herzegovina achieves a higher progress than when comparing RES-H deployment in relative terms whereas for Albania, FYR of Macedonia, Serbia and Ukraine non-compliance with expressed plans can be identified. This points out that demand expectations do not in all cases match properly with actual (or according to recent statistics expected) demand developments – for example in Serbia actual demand is lower than the expected one (as reported in the Serbian NREAP).

Compared to other sectors, the sector of heating and cooling offers comparatively promising potentials for renewables due to suitable framework conditions like high solar infeed in Western Balkans or a high potential of biomass feedstock. Thus, renewables in heating and cooling can be classified as “low hanging fruits” in all CPs. Biomass is here the key renewable source both in terms of planned and according to modelling expected deployment. This has been recognised in several CPs, and, as the examples of Bosnia and Herzegovina and Montenegro point out, the establishment of a proper statistical accounting in accordance with Eurostat rules may help to achieve a proper representation in statistics. As outlined in the previous section related to past progress, this has led to significantly higher RES-H shares than initially anticipated. Furthermore, still other promising renewable options like solar thermal heat, the use of heat pumps or of geothermal resources are generally underrepresented in policy making and in market establishments. A combination of tailored incentives and campaigns to increase public awareness may consequently serve well to increase demand for these renewable sources in the heating and cooling sector.

### *RES in transport*

For RES in transport no progress has been achieved in the past and as modelling points out, it can be expected that without the establishment of effective policy measures it can hardly be expected that this may change in future. Thus, for RES in transport, and here specifically for biofuels we do not expect a (significant) contribution by 2020 in any of the CPs.

# 3 Conclusions and recommendations

*Key findings and conclusions related to the assessment of past (2014/15) RES progress*

Several challenges have been identified within the assessment of past (2012/2013) RES progress in CPs:

- First, reliable and comprehensive statistical data related to the historic deployment of renewables and of overall energy consumption was not applicable for all CPs. In the case of Moldova, Montenegro and Serbia, significant deviations between EUROSTAT data and Progress Report data could be observed.
- Second, reporting on past progress was not delivered by all CPs (i.e. Bosnia and Herzegovina) and the information provided was partly incomplete or inconsistent when compared to official statistical data.

The assessment of past RES progress comprises a comparison of actual RES deployment with required (2013/2014) trajectories (according to the RED) and with CPs plans as outlined in their NREAPs (for 2014 and 2015):

- We start with assessing compliance with the required trajectories (according to the RES Directive). Only Montenegro achieved its trajectory for 2013/2014 whereas all other CPs fall short in complying. Of interest, the RED trajectories for 2013/2014 set a relatively strict interim target. When comparing these with interim targets defined by CPs in their NREAPs: all interim targets of the NREAPs for 2014 show a lower percentage target than the RED Minimum Trajectory for 2013/2014.
- A comparison of actual (based on EUROSTAT data) and planned RES shares in GFEC (in accordance with CP's NREAPs) shows that six of the CPs have managed to meet their planned overall RES shares for the years in 2015, namely Bosnia and Herzegovina, Montenegro, Moldova and FYR of Macedonia. The first two present surpluses of virtually 6 pp; Moldova and FYR of Macedonia present slight surpluses of 1.5 pp and 2.4 pp respectively. Albania and Serbia directly hit the targets (+0.9 pp). The negative deviations of actual to planned RES shares in GFEC in 2015 occur for Kosovo (1.2 pp) and Ukraine (2.34 pp). As regards the absolute RES deployment, only four CPs met their absolute NREAP targets in 2014 and 2015. Albania and Serbia were able to achieve their relative targets in 2015 yet missed their absolute targets by 6.0 % respectively 7.3%. This is due to a reduced actual GFEC compared to the projected one from the CP's NREAPs. The strongest negative deviations in 2015 of actual vs. planned can be observed with 21.2 % for Kosovo and 52.0 % in Ukraine. BiH positive deviation of total RES is exemplary; it surpasses the absolute NREAP RES target by 30.7 % in 2014 and 37.3 % in 2015. This is the case because of revised statistical data for solid biomass.
- With respect to the deployment of renewable electricity and its share of the GFEC, five out of the eight CPs are not on track. Albania and Moldova are the only CPs, which surpass their RES-E target shares with a surplus of 8.7 pp and 33.3 pp respectively in 2015 according to EUROSTAT data FYR of Macedonia directly hits its targets. Deficits for the other Contracting parties range from 2.3 pp for Serbia to 11.9 pp for Kosovo in 2015. Contracting Parties which failed to meet their relative targets also missed their absolute deployment targets and vice versa.
- With respect to the deployment of renewable heating and cooling, five of the Contracting Parties managed to meet their RES-H target shares in both 2014 and 2015. Albania and

Moldova miss their target in 2014 yet overachieves in 2015. Only Ukraine presents deficits in both years, which amount to roughly 2 pp.

*Key findings and conclusions related to the assessment of future RES progress (2020):*

Modelling results on the expected future progress by 2020 (i.e. against the binding 2020 RES target) indicate by CP the likeliness of delivering as required under the RES directive. The portfolio of assessed cases includes two distinct scenarios concerning the future development of energy demand (i.e. reference and efficiency trends, originally based on CPs NREAPs but corrected in accordance with actual demand developments).

Below we summarise key findings and conclusions derived from that:

- Results suggest that three CPs, namely Bosnia and Herzegovina, Moldova and Montenegro, are expected to reach the given 2020 target with currently implemented and planned policy measures – if energy demand will develop as planned according to the low demand case (assuming complementary energy efficiency measures to be taken or other reasons that justify the low demand path). Despite the expected increase in absolute terms, Albania, Kosovo*, FYR of Macedonia, Serbia and Ukraine would fail to achieve their 2020 RES targets.
- Next a closer look is taken on the expected progress in meeting planned (i.e. according to NREAPs) RES deployment by 2020:
    - Only few CPs have established a higher RES deployment target than their required one, namely Albania, Moldova and Montenegro.
    - The number of CPs that are expected to meet their planned trajectory is diminishing compared to above – i.e. only Bosnia and Herzegovina can expect to reach the own defined target if a low demand development can be established in forthcoming years and if the RES uptake materializes as projected.
    - Generally, deviations are modest in Moldova, Montenegro and FYR of Macedonia whereas all other CPs may end up with a delivery gap larger than 20% (compared to targeted 2020 RES share).
- It is applicable that only Albania appears being able to comply with own targets concerning the renewables share in the **electricity sector** – in this case however thanks to an unexpected low domestic RES-E target. None of the other seven CPs is expected to comply with own deployment plans. Thus, here expected deployment lacks behind the planned one. The gap appears comparatively low in CPs like Moldova, and FYR of Macedonia, whereas high deviations (above 50% compared to planned) are apparent for Kosovo*, Serbia and Ukraine. Thus, in those CPs a strengthening and fine tuning of policy initiatives offering adequate support for all available RES-E technologies and a rapid removal of non-cost barriers that hinder a rapid take-off of RES-E appear indispensable for achieving 2020 deployment plans and for meeting overall binding RES targets. A comparatively moderate deployment gap can be expected for Bosnia and Herzegovina as well as Montenegro.
- Compared to other sectors, the sector of **heating and cooling** offers comparatively promising potentials for renewables due to suitable framework conditions like high solar infeed in Western Balkans or a high potential of biomass feedstock. Thus, renewables in heating and cooling can be classified as “low hanging fruits” in all CPs. Biomass is here the key renewable source both in terms of planned and according to modelling expected deployment. Nevertheless, biomass in general and especially solid biomass is a precious resource and has to be managed and used sustainably. This has been recognised in several CPs, and, as the examples of Bosnia and Herzegovina and Montenegro point out, the

establishment of a proper statistical accounting in accordance with Eurostat rules may help to achieve also a suitable representation in statistics. As outlined in the previous section related to past progress, this has led to significantly higher RES-H shares than initially anticipated. Furthermore, other promising renewable options like solar thermal heat, the use of heat pumps or of geothermal resources are still generally underrepresented in policy making and in market establishments. A combination of tailored incentives and campaigns to increase public awareness may consequently serve well to increase demand for these renewable sources in the heating and cooling sector.

- With respect to **biofuels in transport** it can be concluded that the establishment of a real market for biofuel is key for almost all of the CPs. Blending obligations, partly combined with tax exemptions for the use of biofuels, are simple and straightforward policy measures that allow for that. This would increase overall renewables deployment significantly in all CPs that have failed to do so in prior, and, consequently, increase overall progress in terms of achieving binding 2020 RES targets.

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# ANNEX I: BACKGROUND DATA ON ENERGY DEMAND DEVELOPMENTS

This Annex provides an overview of the gross final energy consumption (GFEC) data used in Section 2.2 for the assessment of past progress and in Section2.3 for the model-based assessment of future progress. Thus, demand data served as a denominator to express the overall RES shares per CP in the specific years. For the modelling task four different assumptions were made regarding the future development of the GFEC. First, the two scenarios (i.e. reference and efficiency) of the CPs NREAPs were used. Since these scenarios were derived and published some years ago, these two scenarios had to be aligned with the recent energy demand developments. Moreover, since data on solid biomass in the heating sector of CPs was corrected (in accordance with the ECS approach), this modifications has also to be included in the overall demand data or in the energy balance of a CP. These two steps, the recent energy consumption development and inclusion of the solid biomass correction are represented by the dark blue graph in the following figures on a CP basis. The dark blue graph always stands for the modified efficiency trajectory of the GFEC. The revised reference trajectory will not be included in the following figures, but would have the same incline as the original reference GFEC scenario.

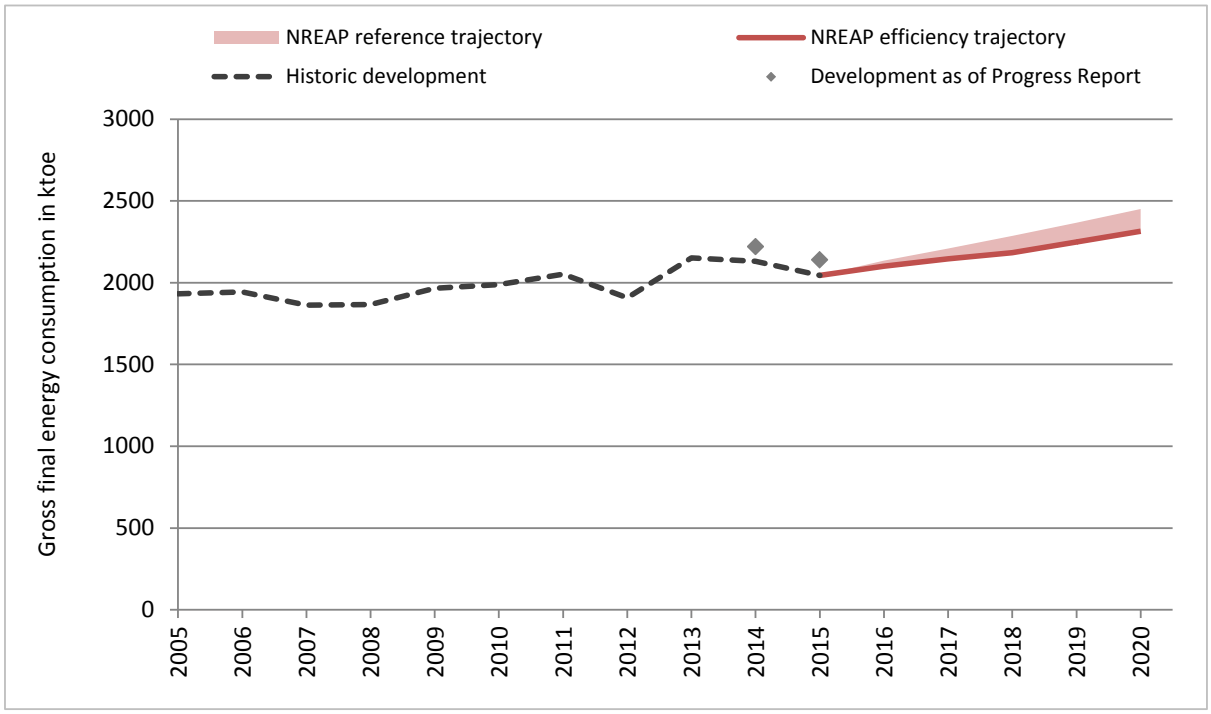


Figure 26: Gross final energy consumption according to the NREAP scenarios of Albania compared to the historic development up to 2015 and the Progress Report. (EUROSTAT, 2017; NREAP and Progress Report)

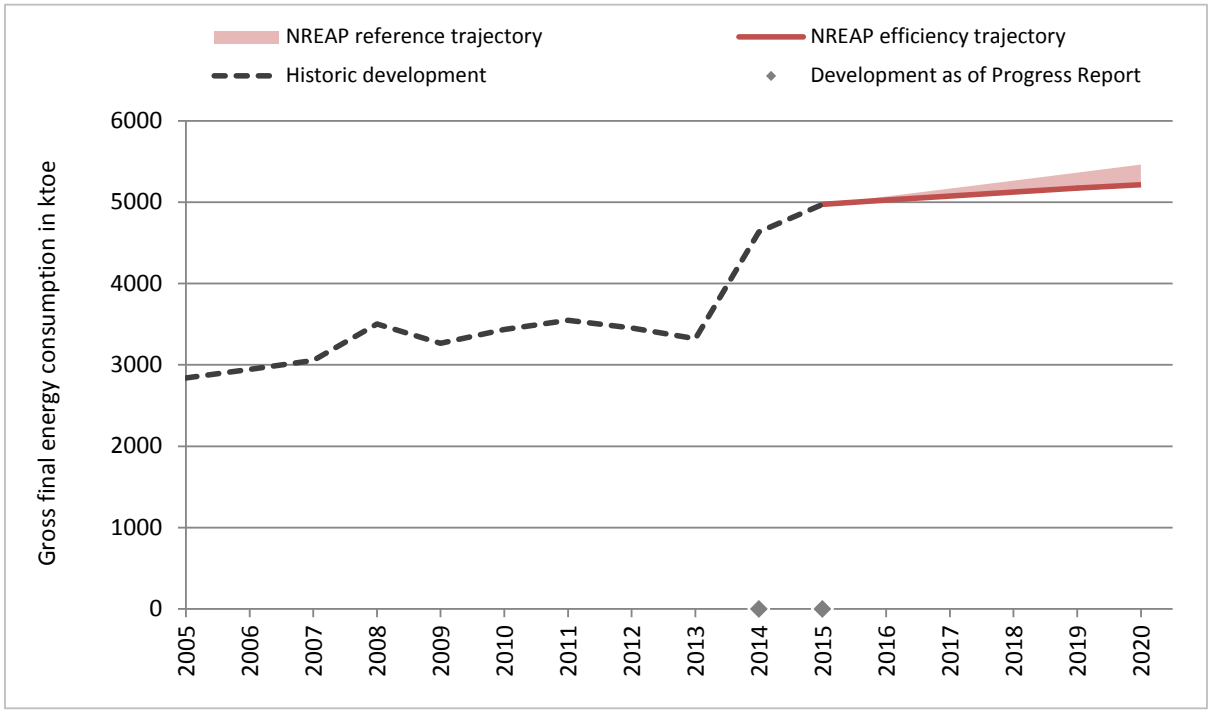


Figure 27: Gross final energy consumption according to the NREAP scenarios of Bosnia and Herzegovina compared to the historic development up to 2015. (EUROSTAT, 2017; NREAP)

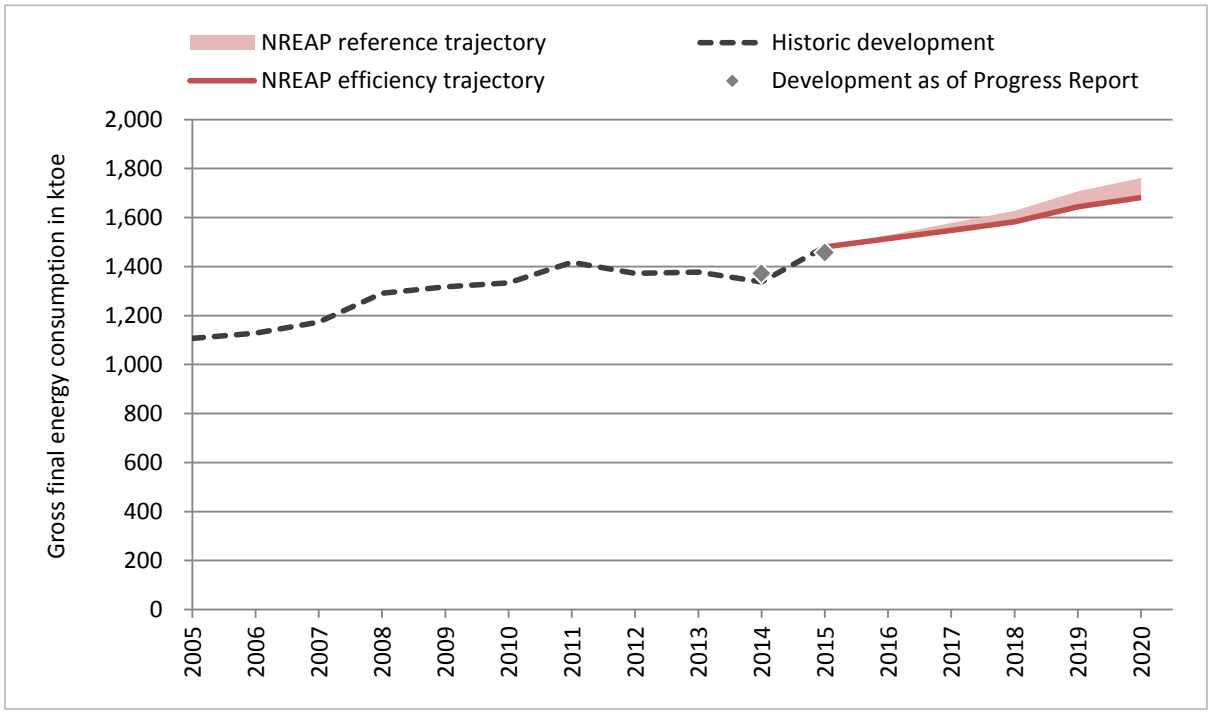


Figure 28: Gross final energy consumption according to the NREAP scenarios of Kosovo* compared to the historic development up to 2015 and the Progress Report. (EUROSTAT, 2017; NREAP and Progress Report)

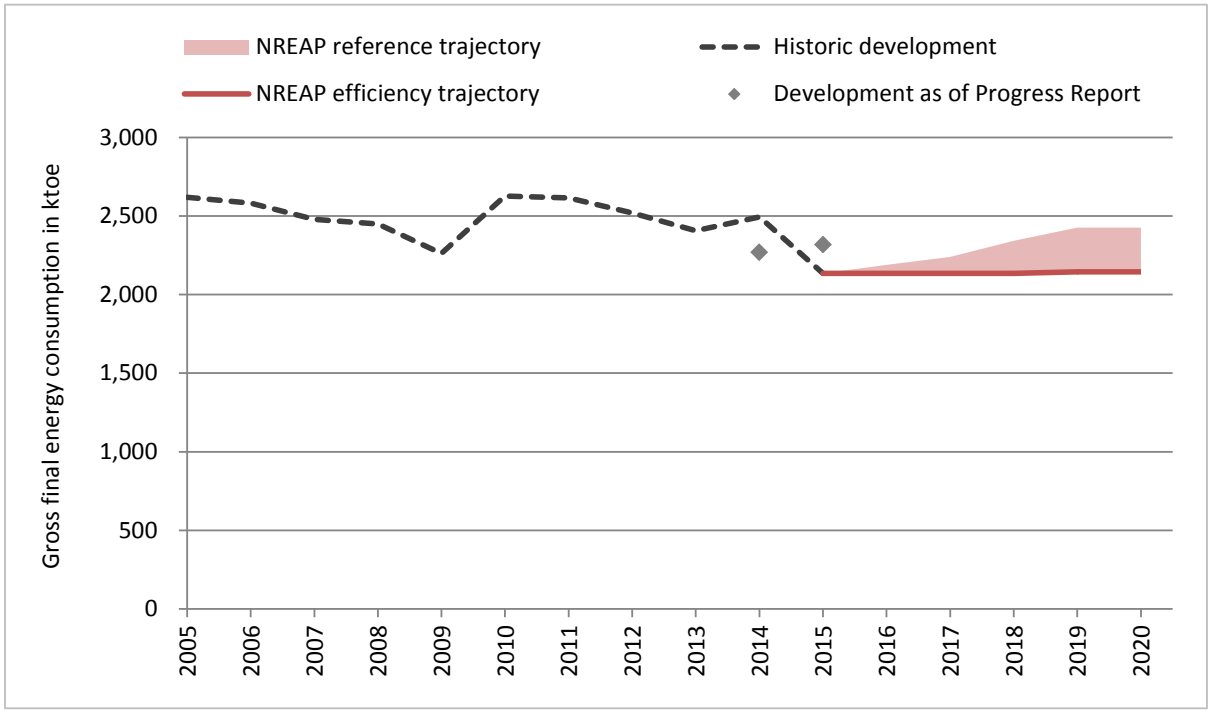


Figure 29: Gross final energy consumption according to the NREAP scenarios of Moldova compared to the historic development up to 2015 and the Progress Report. (EUROSTAT, 2017; NREAP and Progress Report)

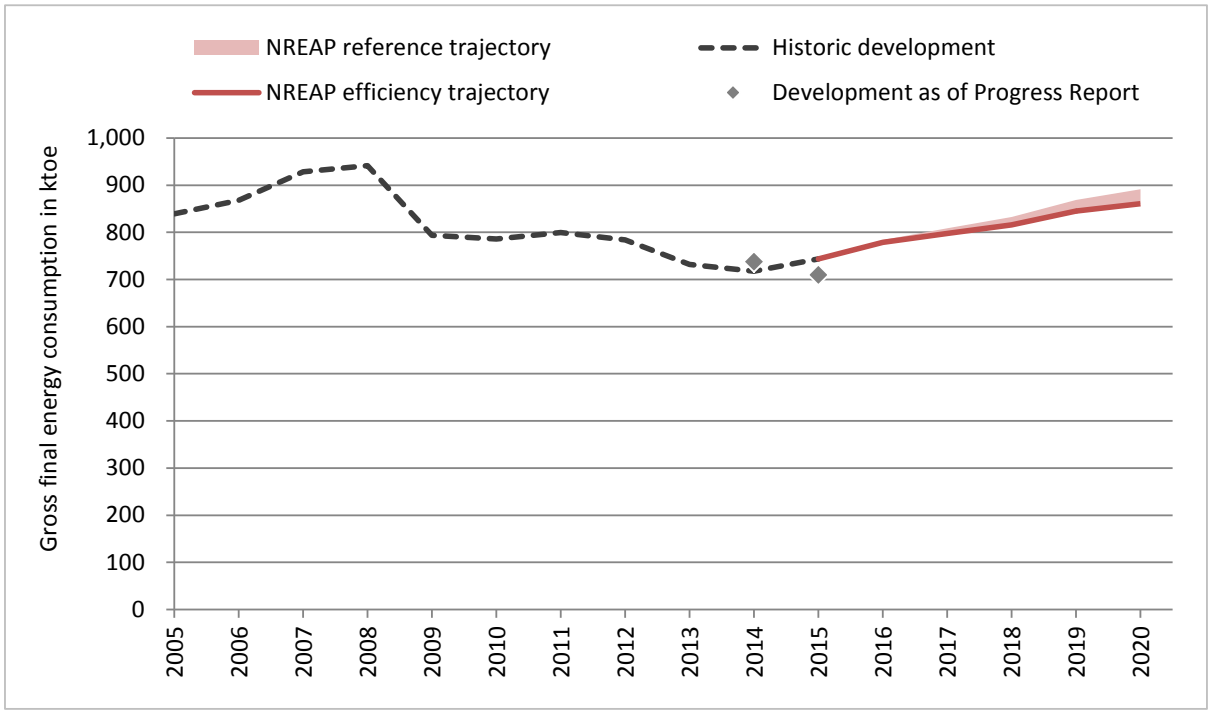


Figure 30: Gross final energy consumption according to the NREAP scenarios of Montenegro compared to the historic development up to 2015 and the Progress Report. (EUROSTAT, 2017; NREAP and Progress Report)

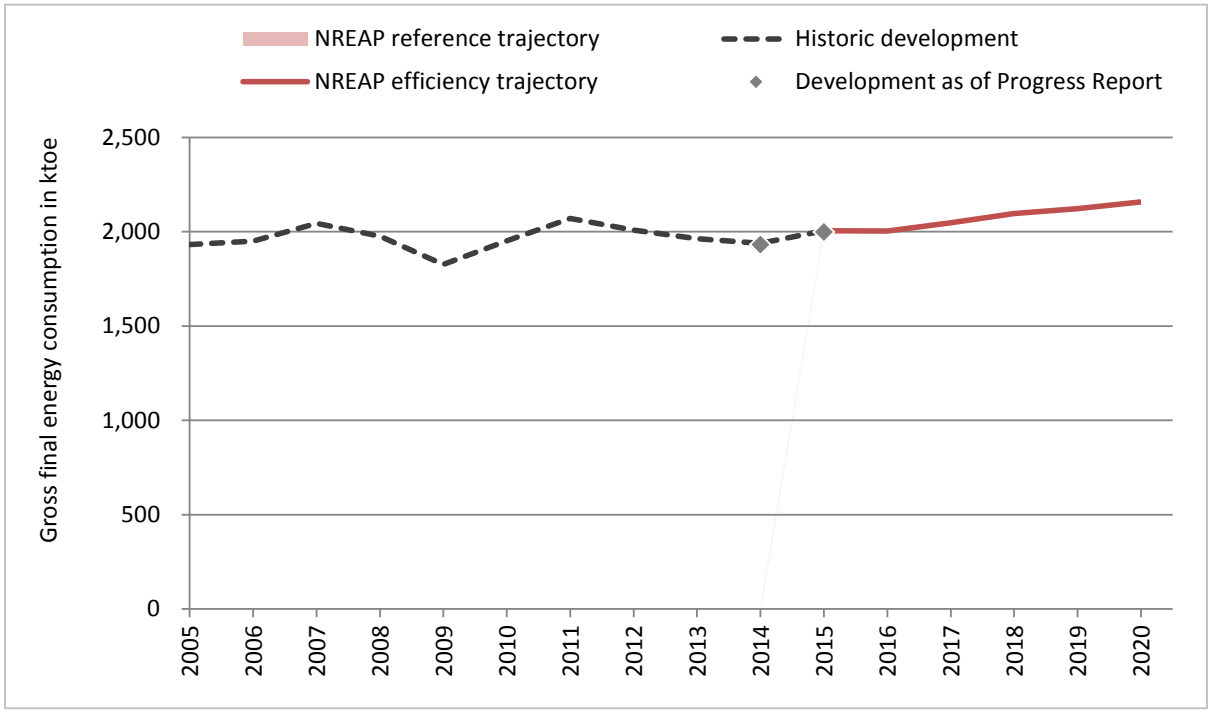


Figure 31: Gross final energy consumption according to the NREAP scenarios of FYR of Macedonia compared to the historic development up to 2015 and the Progress Report. (EUROSTAT, 2017; NREAP and Progress Report)

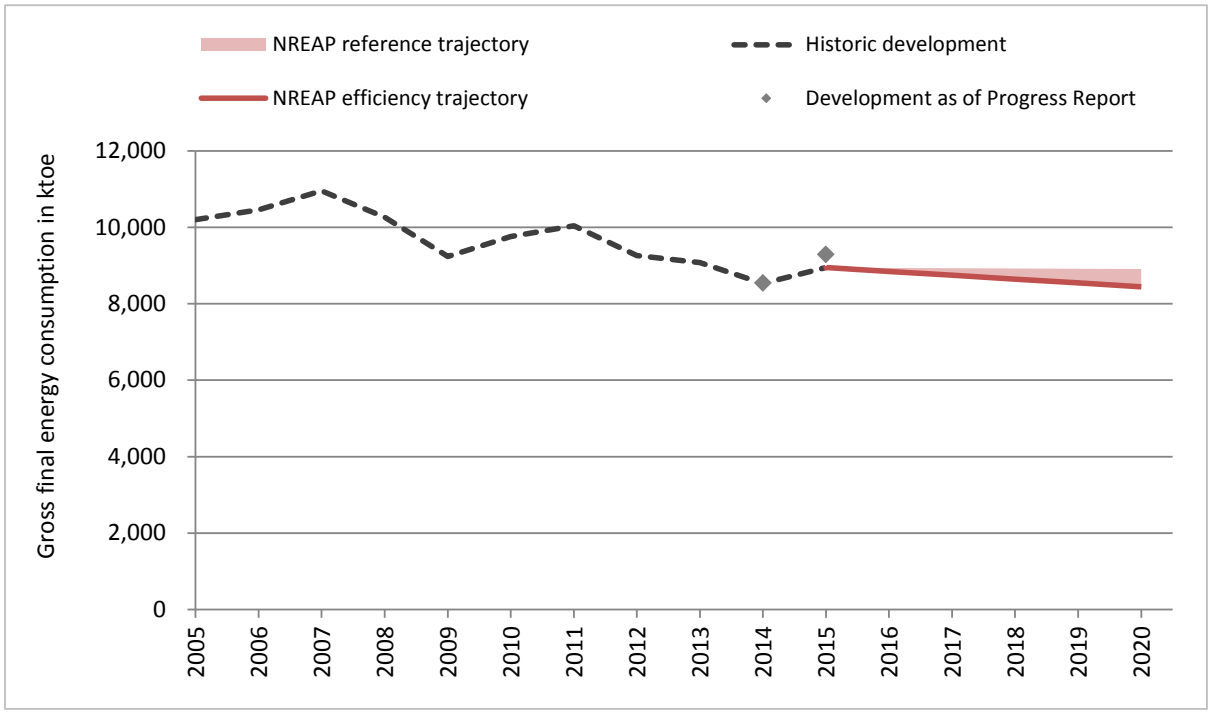


Figure 32: Gross final energy consumption according to the NREAP scenarios of Serbia compared to the historic development up to 2015 and the Progress Report. (EUROSTAT, 2017; NREAP and Progress Report)

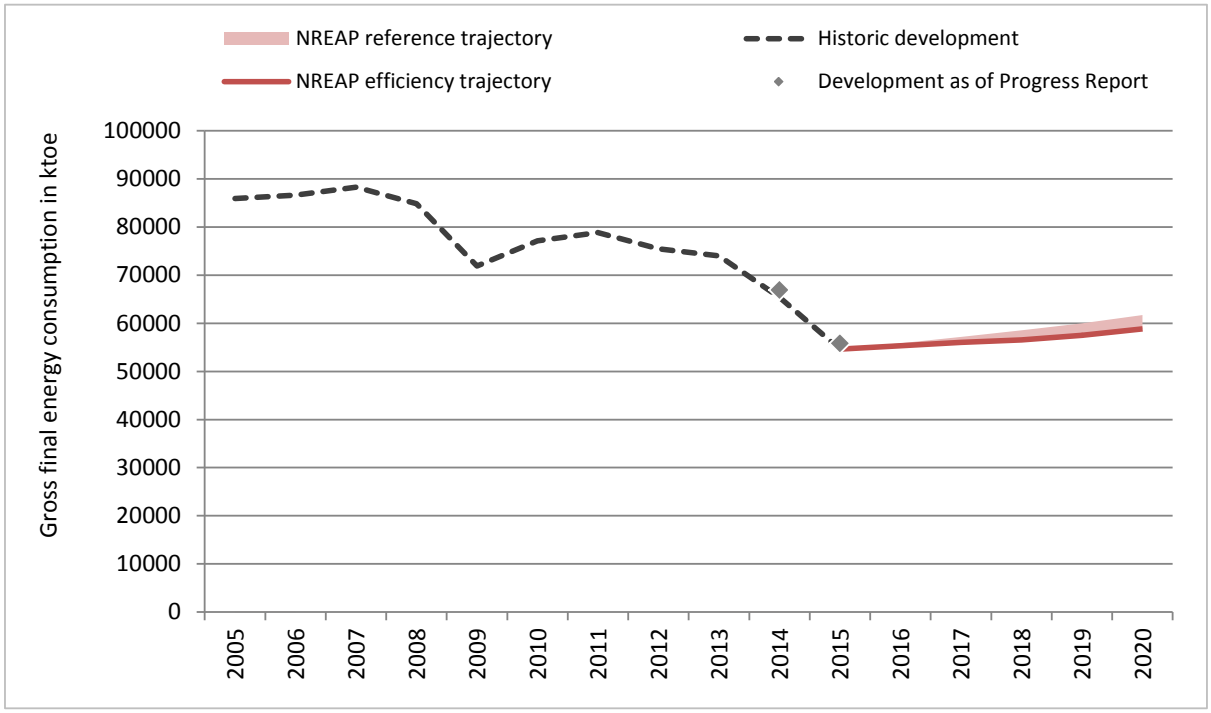


**Figure 33: Gross final energy consumption according to the NREAP scenarios of Ukraine compared to the historic development up to 2015 and the Progress Report. (EUROSTAT, 2017; NREAP and Progress Report)**

# ANNEX II: BACKGROUND DATA ON RES SHARE DEVELOPMENTS

This Annex provides an overview of RES shares data used in 2.2 for the assessment of past progress and in Section 2.3 for the model-based assessment of future progress.

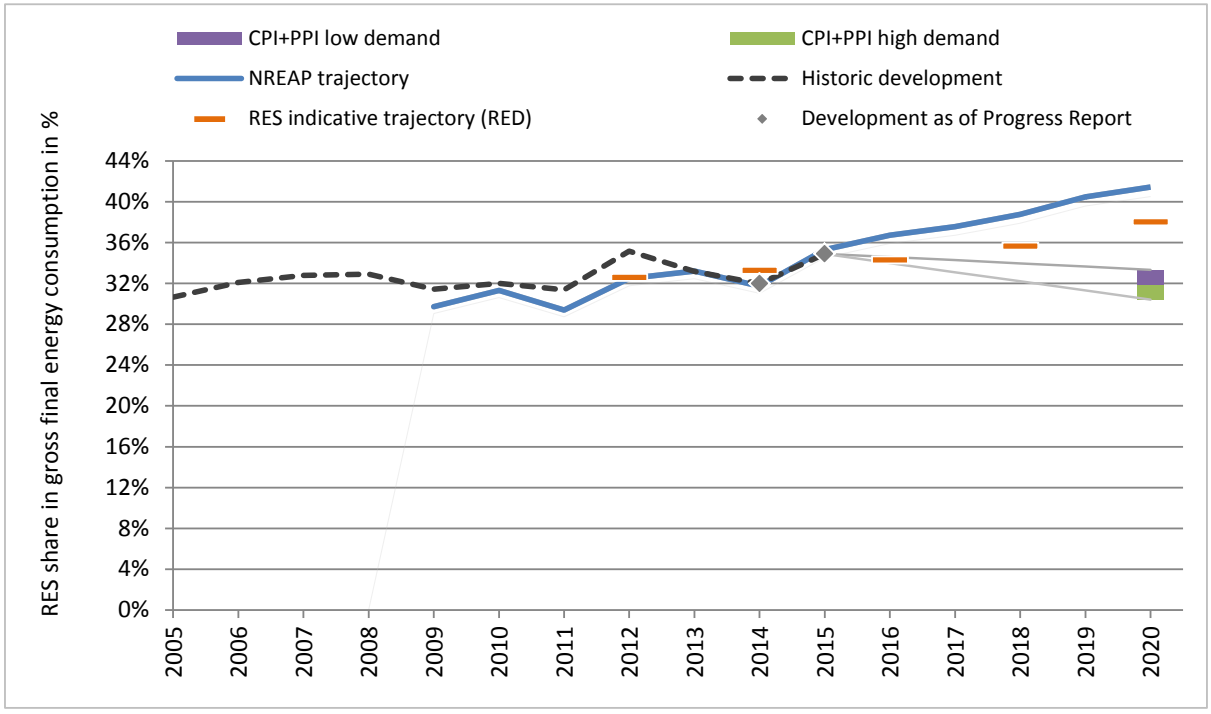


Figure 34: Share of renewable energy in the gross final energy consumption of Albania. The historic development of the RES share is compared to the NREAP trajectory, the RES indicative trajectory (RED) and Progress Report data. For the year 2020 the scenario results are included. (EUROSTAT, 2017; NREAP, Progress Report and own calculations)

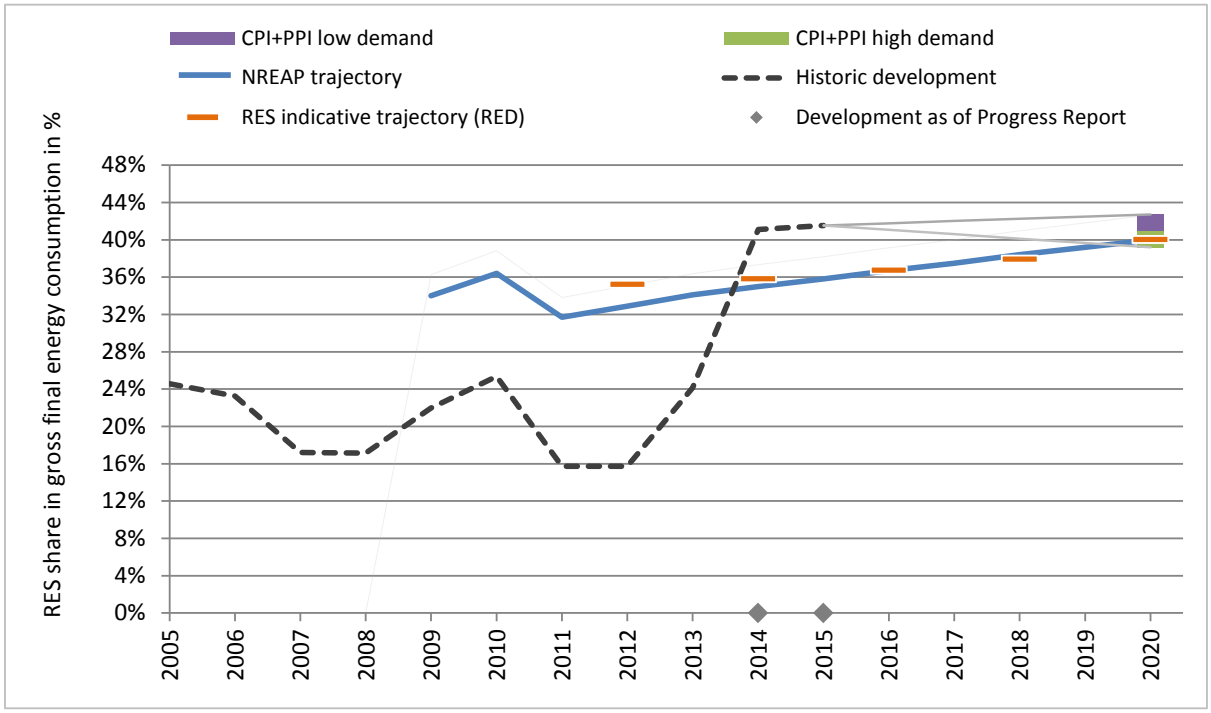


Figure 35: Share of renewable energy in the gross final energy consumption of Bosnia and Herzegovina. The historic development of the RES share is compared to the NREAP trajectory, the RES indicative trajectory (RED) and Progress Report data. For the year 2020 the scenario results are included. (EUROSTAT, 2017; NREAP, Progress Report and own calculations)

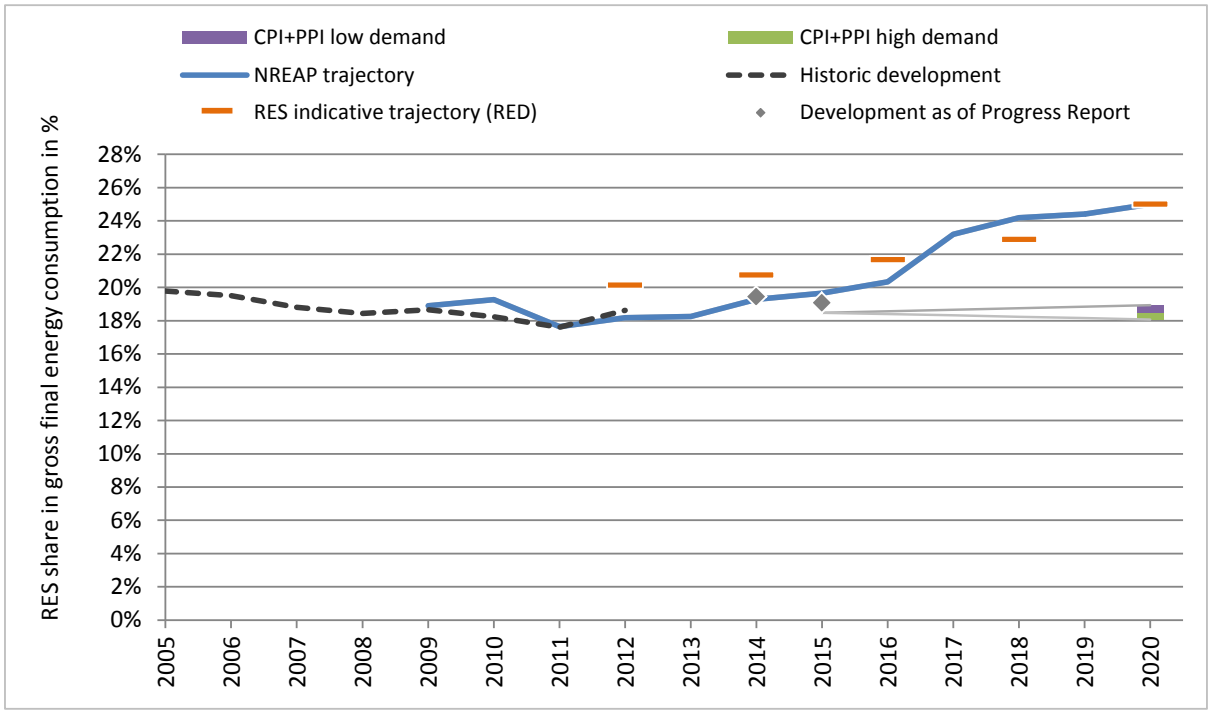


Figure 36: Share of renewable energy in the gross final energy consumption of Kosovo*. The historic development of the RES share is compared to the NREAP trajectory, the RES indicative trajectory (RED) and Progress Report data. For the year 2020 the scenario results are included. (EUROSTAT, 2017; NREAP, Progress Report and own calculations)

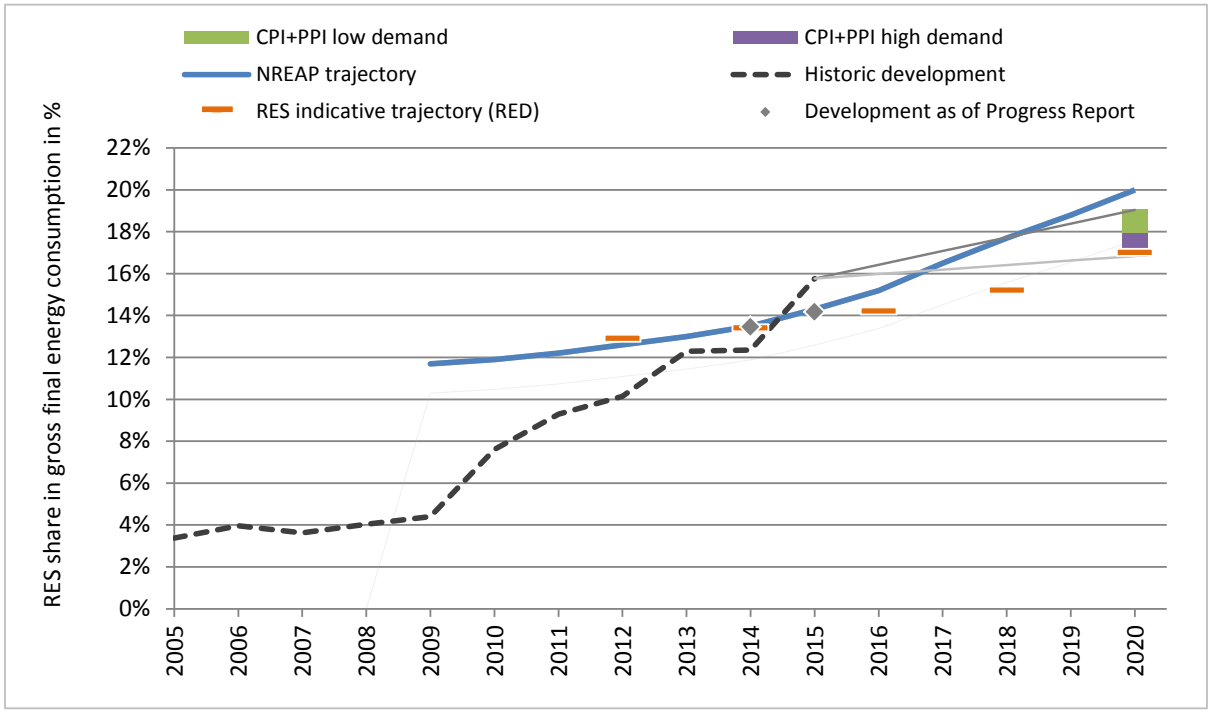


Figure 37: Share of renewable energy in the gross final energy consumption of Moldova. The historic development of the RES share is compared to the NREAP trajectory, the RES indicative trajectory (RED) and Progress Report data. For the year 2020 the scenario results are included. (EUROSTAT, 2017; NREAP, Progress Report and own calculations)

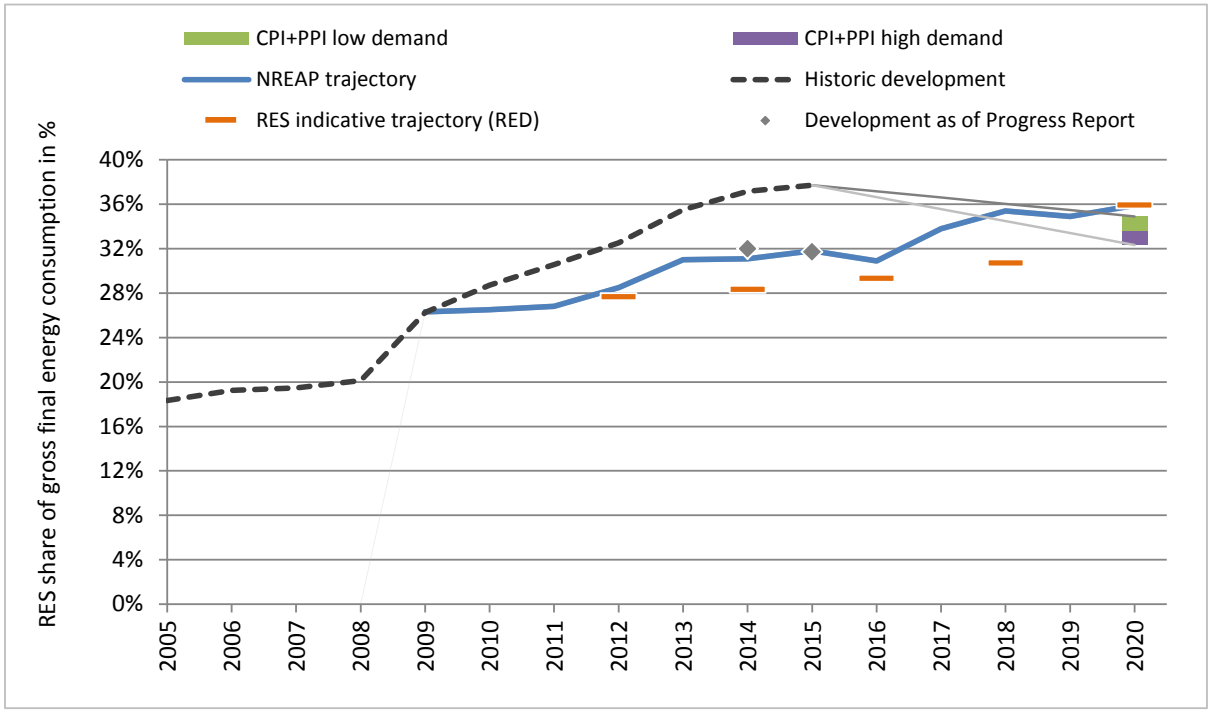


Figure 38: Share of renewable energy in the gross final energy consumption of Montenegro. The historic development of the RES share is compared to the NREAP trajectory, the RES indicative trajectory (RED) and Progress Report data. For the year 2020 the scenario results are included. (EUROSTAT, 2017; NREAP, Progress Report and own calculations)

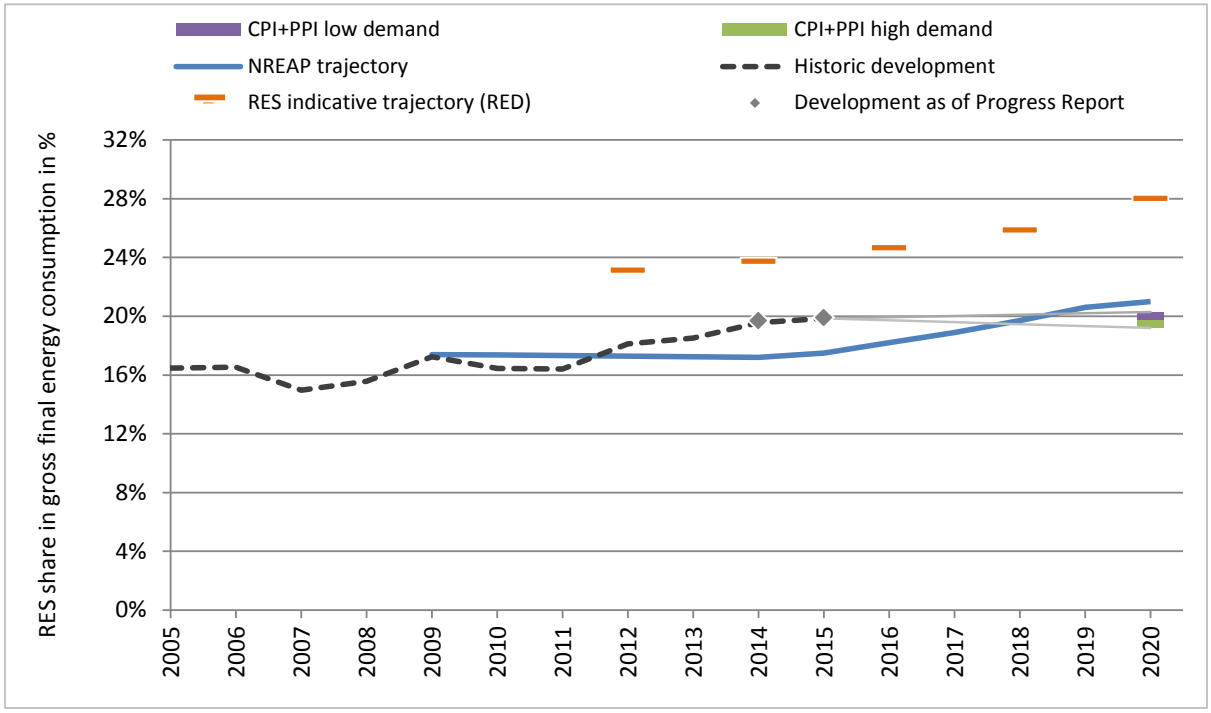


Figure 39: Share of renewable energy in the gross final energy consumption of FYR of Macedonia. The historic development of the RES share is compared to the NREAP trajectory, the RES indicative trajectory (RED) and Progress Report data. For the year 2020 the scenario results are included. (EUROSTAT, 2017; NREAP, Progress Report and own calculations)

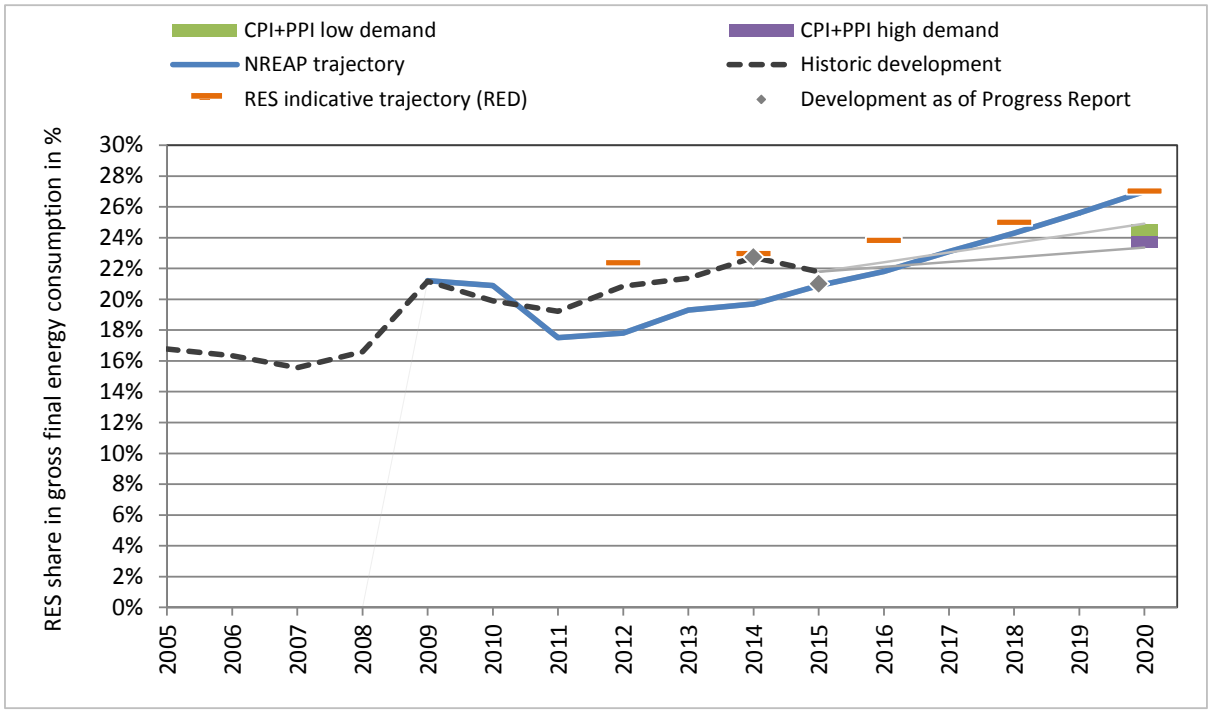


Figure 40: Share of renewable energy in the gross final energy consumption of Serbia. The historic development of the RES share is compared to the NREAP trajectory, the RES indicative trajectory (RED) and Progress Report data. For the year 2020 the scenario results are included. (EUROSTAT, 2017; NREAP, Progress Report and own calculations)

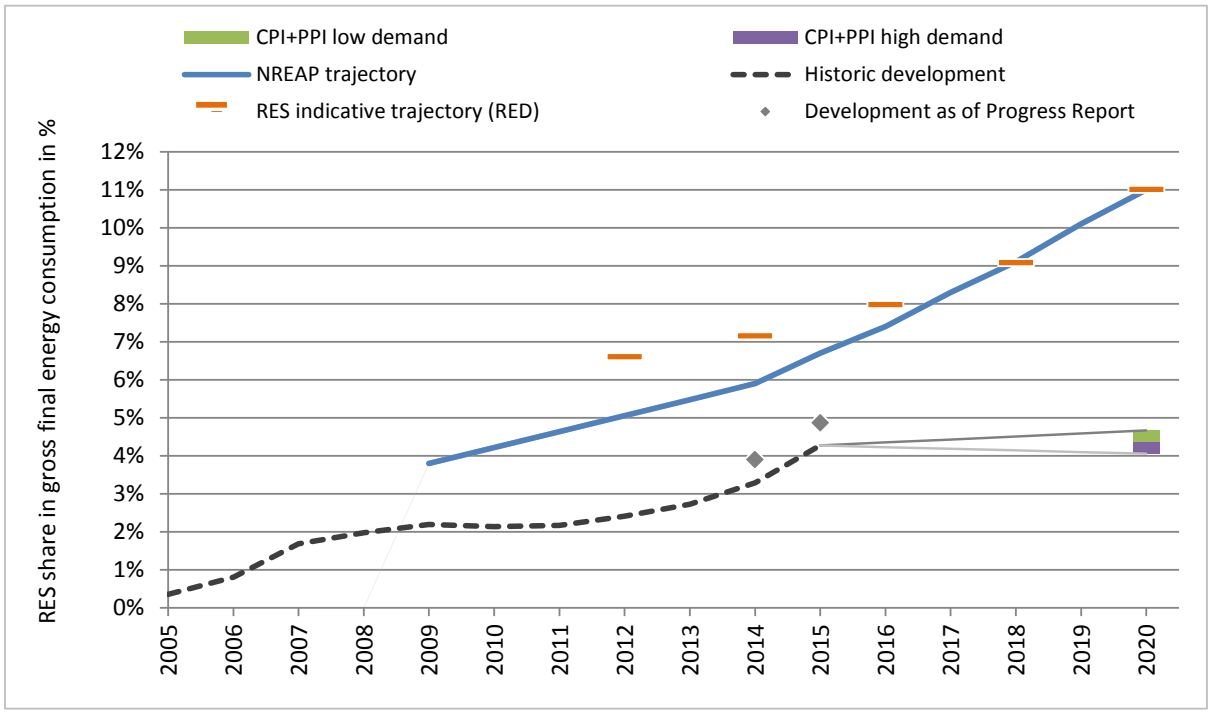


**Figure 41: Share of renewable energy in the gross final energy consumption of Ukraine. The historic development of the RES share is compared to the NREAP trajectory, the RES indicative trajectory (RED) and Progress Report data. For the year 2020 the scenario results are included. (EUROSTAT, 2017; NREAP, Progress Report and own calculations)**