Energy Community

Study on 2030 overall targets for the Energy Community

Energy efficiency, RES, GHG emissions reduction

TU Wien, EEG,
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Final report

Study on 2030 overall targets (energy efficiency, RES, GHG emissions reduction) for the Energy Community

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List of abbreviations

BA	Bosnia and Herzegovina
BAU	Business as usual
CP	Contracting Party
EC	European Commission
ECS	Energy Community Secretariat
EE	Energy Efficiency
EED	Energy Efficiency Directive
ETS	Emission Trading Scheme
ESD	Energy Service Directive
EnC	Energy Community
EU 28	European Union which consists of 28 Member States
FIT	Feed-in Tariff
FIP	Feed-in Premium
MK	North Macedonia
GFEC	Gross Final Energy Consumption
GDP	Gross Domestic Product
GHG	Greenhouse Gas
IMF	International Monetary Fund
KO*	Kosovo[1]
ME	Montenegro
MO	Moldova
MS	Member State of the European Union
NEEAP	National Energy Efficiency Action Plan
NM12	Country group of 12 new Member States as of the fifth and sixth enlargement of the European Union, Malta, Cyprus, Estonia, Latvia, Lithuania, Poland, Czech Republic, Slovakia, Slovenia, Hungary, Bulgaria and Romania
RE	Renewable Energy
RE-E	Renewable Electricity
RE-H&C	Renewable Heating & Cooling
RE-T	Renewable Energy in Transport
RS	Serbia
TSO	Transmission system operator
PEC	Primary Energy Consumption
UA	Ukraine
WB6	Country group of 6 western Balkan countries, which are all Contracting Parties of the Energy Union; Namely these are Albania, Bosnia and Herzegovina, North Macedonia, Kosovo*, Montenegro and Serbia

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

1 Introduction

Technische Universität Wien (TU Wien), represented by the Energy Economics Group at the Institute of Energy Systems and Electric Drives, has been assigned to perform a continuation[2] of a study on 2030 overall targets (Energy Efficiency, Renewable Energy Sources, GHG Emission Reduction) for the Energy. This research has been launched by the Energy Community Secretariat (Secretariat in the following) to support Energy Community Contracting Parties (CPs), the Energy and Climate Committee (ECC) and its Technical Working Group (TWG), to further refine a methodology and a quantitative assessment for achieving calculated 2030 energy efficiency, RE and GHG emissions reduction targets equally ambitious to the EU targets.

This study has capitalized on previous analysis and results. It proposes a range of targets that may be expected under aligned framework conditions in the CPs, taking into account differences in economic development. TU Wien has brought in its broad experience in the respective fields and has been counting on the assistance from two other key partners – namely Joanneum Research and the Regional Centre for Energy Policy Research (REKK).

This report represents the final outcomes of our underlying study. Subsequently, a set of options for setting 2030 energy and climate targets for the Energy Community and its Contracting Parties is introduced. The report describes the methodologies, data and key assumptions for deriving 2030 energy and climate targets within the Energy Community and its Contracting Parties. A set of options that can be used for target setting has been derived within each respective field, i.e. for energy efficiency, renewable energies and for overall GHG emission reduction. Apart from methods we also present the outcomes of applying these, and, as far as feasible under the given limitations in terms of time and budget, we discuss and/or assess impacts that can be expected from target achievement. In doing so, an alignment to what has been done at EU level appears of key relevance while taking into account the peculiarities and specifics of the countries assessed.

1.1 Rationale / Understanding

During the meeting of the Energy and Climate Committee, held in Vienna on 5 September 2017, it was acknowledged that stable national energy and climate plans up to 2030 (and possibly beyond) should be accompanied by three overall targets, namely for the increase of renewable energy (RE) in overall energy consumption, increased energy efficiency and greenhouse gas emissions reduction. In order to assist the Energy and Climate Committee, the Secretariat contracted the “Study on 2030 overall targets (energy efficiency (EE), renewable energies (RE), greenhouse gas (GHG) emissions reduction) for the Energy Community” to our team in 2017. Its core objective was to develop a methodology and to conduct a quantitative assessment to show pathways for achieving calculated 2030 energy efficiency, RE and GHG emissions reduction targets that can be expected under aligned framework conditions in the Energy Community Contracting Parties.

The draft Final Report was presented and discussed at the 2nd meeting of the TWG on Energy and Climate on October 9, 2018 and at the Energy and Climate Committee on October 10, 2018, where it was stressed the importance of the methodology proposed as well as the timeliness and significance of a political consensus on the 2030 target setting. At the same time, it was suggested for work at technical level to be further continued until May 2019, in order to adequately reflect an equal EU ambition level.

[2] The continuation of the study was not possible to foreseen at an earlier stage. It was agreed with the European Commission to further refine and provide continuity to the ongoing work at technical level for the development of a methodology that reflects an equal EU ambition level.

1.2 Objectives and expected results

The **core objective** of this project **is to further develop the methodology and to conduct a quantitative assessment of pathways for achieving calculated 2030 energy efficiency, RES and GHG emissions reduction targets that can be expected under aligned framework conditions in the Energy Community Contracting Parties**.

For doing so, we have aligned our methodologies to the approaches and aim for achieving a comparable level of effort as used for energy and climate target setting at EU Member State level. Furthermore, we made use of specialised energy system models for assessing certain impacts related to that. **As key outcome apart from reporting an MS Excel Tool has been developed to inform on data used and on indicators and results derived at CP as well as at EnC level**.

1.3 Structure of this report

Subsequently within each topical area – i.e. energy efficiency (chapter 2), renewable energies (chapter 3) and greenhouse gas emission reduction (chapter 4), we start with a recap of the approaches derived for target setting as outlined in detail in Resch et al. (2018). Next to that, we introduce alternative concepts and approaches where reasonable and feasible from our perspective.[3] Specifically for renewable energies a further subsection is then dedicated to discuss possible impacts arising from target fulfilment, indicating the required deployment as well as corresponding costs and benefits. Please note further that for illustrating the interlinkage of target setting in all three areas, two elements appear of relevance: On the one hand, a sensitivity analysis on the impact of the EE ambition is included in our overall assessment of the required uptake of renewables. On the other hand, a subsection (cf. section 4.7) within the overall analysis of GHG emissions is dedicated to the contribution of energy efficiency measures and renewable energies towards climate mitigation. The report ends with a recap of key findings and conclusions (chapter 5).

[3] This appears necessary for energy efficiency due to possible weaknesses of the default method. Here most controversial discussions took place during the course of 2018.

2 Energy efficiency

2.1 Introduction

Energy efficiency is often classified as "no regret" option for combating climate change and to slow down resource depletion. In practical terms, there are however hurdles that need to be overcome or at least respected. For establishing reasonable targets for the Energy Community and/or its Contracting Parties, various options exist. Before shedding light on these, we take a closer look at the approach taken at EU level.

Target setting at EU level

2020 context

The energy efficiency target established within the European Union (EU28) for 2020 aimed for a reduction of 20% compared to baseline trends – i.e. more precisely, as defined by the 2007 PRIMES baseline scenario. This relative target translates into the following primary/final energy targets for 2020 (EU, 2012):

- 1483 Mtoe in terms of primary energy consumption and
- 1086 Mtoe in terms of final energy consumption

Therefore the **Energy Efficiency (EE) Directive 2012/27/EU** (EU, 2012) sets a legal framework for energy efficiency improvements in the timeframe from 2014 to 2020. This Directive was approved in October 2012. For reaching these objectives, EU Member States have to set their own individual indicative Energy Efficiency (EE) targets, having in mind the overall EU target, and report them to the EU. Member states have the flexibility to express their EE targets either in primary or final energy consumption, primary or final energy savings or in energy intensity. These targets have to be reported to the EU also by means of absolute values of primary and final energy consumption in 2020. By setting these domestic targets, Member States can also consider country-specific circumstances like:

- Remaining potential for cost efficient energy savings,
- Development of GDP,
- Developments in energy imports and exports,
- Development of renewable energy sources, nuclear energy and carbon capture and storage, and
- Early actions.

The EE Directive predefines various measures that need to be adopted in order to assure reaching the overall energy efficiency target(s) such as (EU, 2012; EC, 2017b):

- Annual new reduction of 1.5% in national energy sales based on the average of energy sales by volume over the last three years (2010-2012). There are some exceptions when calculating the volume of energy sales that can be applied – for example to partially or fully exclude energy sales used in transport. Furthermore, the 1.5% target can also be achieved by applying alternative strategic policy instruments.
- Energy efficient renovations to at least 3% of buildings owned and occupied by central governments per year based on the total floor area of heated and/or cooled buildings and also establishing a long-term strategy for mobilising investment in the renovation of the national stock of residential and commercial buildings (public and private);
- Mandatory energy efficiency certificates accompanying the sale and rental of buildings;
- Minimum energy efficiency standards and labelling for a variety of products such as boilers, household appliances, lighting and televisions (ecodesign);
- National Energy Efficiency Action Plans have to be submitted by the MSs to the EC every three years;
- Rollout of smart meters for electricity and for gas by 2020;
- Energy audits for large companies at least every four years;

- For a better management of energy consumption the right of consumers to receive easy and free access on their real time consumption and historical data.

The original targets reported by the MSs to the EC in 2013 indicated an under-fulfilment of the overall EU target both in terms of primary and final energy (see Table 1). However, due to national efforts taken subsequently the situation has changed: according to the updated national targets of MSs (as of 2014-2016) it turns out that the targeted value in terms of final energy can be reached by 2020. When looking at the updated targets in terms of primary energy, one can see that a further strengthening is required, despite the progress achieved so far.

Table 1: Energy efficiency targets for 2020 at EU level translated to absolute values based on different sources. (EC, 2017a)

[Mtoe]	Sum of original targets as notified from Member States in 2013	Sum of updated targets as notified in the NEEAPs 2014 or other reports in 2015 and 2016	EU 28 target for 2020
Primary Energy Consumption (PEC)	1,550	1,526	1,483
Final Energy Consumption (FEC)	1,091	1,077	1,086

In the report from the Commission on the 2018 assessment of the progress made by Member States towards the national energy efficiency targets for 2020 and towards the implementation of the Energy Efficiency Directive as required by Article 24(3) of the Energy Efficiency Directive 2012/27/EU concludes the following. Final energy consumption in the EU fell by 5.9 %, from 1193 Mtoe in 2005 to 1122 Mtoe in 2017. This is 3.3 % above the 2020 final energy consumption target of 1086 Mtoe. It decreased at an annual average rate of 0.5 % between 2005 and 2017, although the downward trend was interrupted in 2015 when final energy consumption started to rise again (it rose by 1.1 % in 2017 compared to the previous year). Primary energy consumption in the EU dropped by 9.2 %, from 1720 Mtoe in 2005 to 1561 Mtoe in 2017. This is 5.3 % above the 2020 target of 1483 Mtoe. It decreased on average by 0.8 % per year between 2005 and 2017, but has been rising again since 2015. A year-on-year increase of 0.9 % was recorded in 2017. (EC, 2019)

2030 context

In November 2016, the European Commission proposed an update to the Energy Efficiency Directive (EC, 2016c) in the context of the "Clean Energy package"[4], including a new EU energy efficiency target for 2030, and measures to update the Directive to assure target achievement in the 2030 timeframe. An energy efficiency target at EU level of 30% was proposed for 2030. After negotiations of the Commission's proposals with co-legislators (EU Parliament and Council), an agreement was achieved for a more ambitious EU28 target of 32,5%, which was adopted in December 2018 within the Amending Energy Efficiency Directive (EU)2018/2002). Similarly to the framework in place for 2020, also for 2030 the Directive does not establish national targets. Member States are required to set their national contributions for 2030 in their National Climate and Energy Plans (NECPs) in 2019, following the requirements and timeline of the new Governance Regulation. The EU targets for 2030 are set to:

- 1273 Mtoe in terms of primary energy consumption, and
- 956 Mtoe in terms of final energy consumption.

[4] https://ec.europa.eu/energy/en/news/commission-proposes-new-rules-consumer-centred-clean-energy-transition

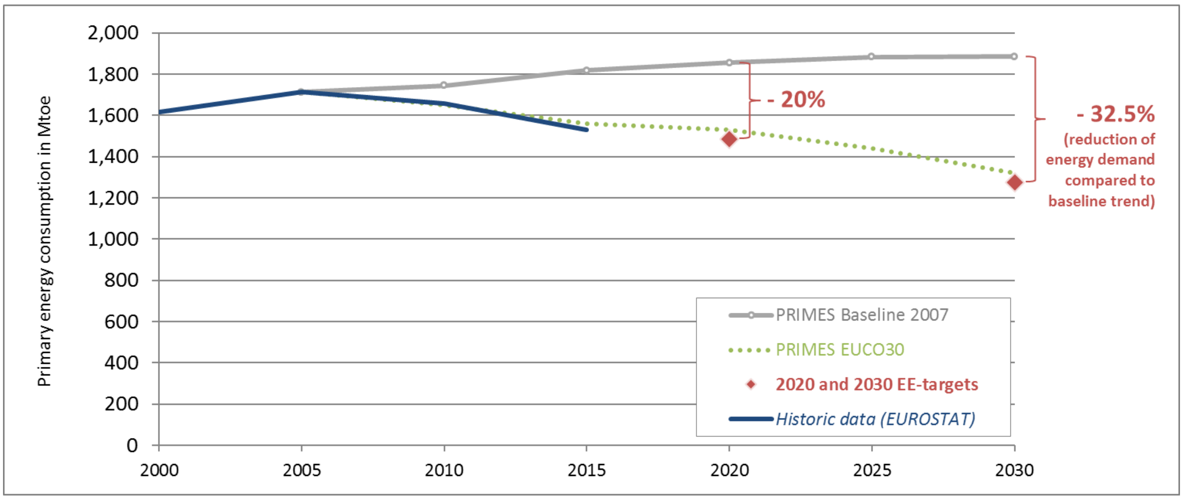

Figure 1: EU targets for energy efficiency in 2020 and in 2030. (Source: E3MLAb and IIASA, 2007; EUROSTAT, 2017b; EC, 2006; EU, 2008; EC, 2016c)

Notes: A baseline trend forecast of energy demand, taken from PRIMES modelling, serves as benchmark for determining the targeted increase in energy efficiency, corresponding here to reductions in energy demand (i.e. -20% by 2020, -32.5% by 2030).

Please note that Figure 1 above provides an illustration of the energy efficiency target set for 2030 (and for 2020) at EU level, illustrating the required reduction in energy demand compared to a baseline trend. More precisely, this graph depicts expected future primary energy consumption according to the PRIMES Baseline scenario (as of 2007) as well as in accordance with the recent PRIMES EUCO30 scenario (as of 2016) that reflects the envisaged demand reductions for the EU28 region in the initial Commission's proposal. Complementary to expected future developments, it also shows the historic development for the years 2000 until 2015 (in five-year time steps). Moreover, the graph indicates the relative EE-targets for 2020 and 2030, referring to the PRIMES Baseline (2007) scenario as baseline trend (on which targeted demand reductions are defined).

Concerning the updates introduced in the Energy Efficiency Directive ((EU)2018/2002), Article 7 has been extended to the time period post 2020: energy savings of 0.8% final energy consumption should be achieved in the time period 2021 to 2030 based on the average levels of final energy consumption of the last three year period (2016-2018). The rules of calculations of energy savings have been simplified and updated, and a new guidelines to facilitate the implementation of the new rules is under preparation by the Commission services, While Energy efficiency obligation schemes are identified as one main instruments to achieve savings at national level, similar to the 2020 framework, the 0,8% target can also be achieved by applying alternative strategic policy instruments.

Principles and prerequisites

Several approaches exist to define an energy efficiency target for the Energy Community as well as at the level of individual CPs which could be considered of comparable ambition than the one set at EU level

At EU level, a 20% reduction of energy demand compared to baseline projection is targeted for 2020 as outlined in Directive 2012/27/EU on energy efficiency. For 2030 a political agreement has been achieved on the overall ambition level – i.e. a 32.5% reduction of energy demand compared to projected baseline conditions shall be achieved by 2030 at EU level. This corresponds to a net increase of the EE effort by 12.5 percentage points at EU level from 2020 to 2030 and to a reduction of -20% and -26% to historical consumption levels observed in 2005 for FEC and PEC, respectively. The Commission proposal for the 2030 target for the EU28 was based on a comprehensive impact assessment exercise, which took also into account the macro-economic impacts on GDP and employment.

There is however no single way how to translate this exercise for the EnC, and the analysis should start from an assessment of the data and projections available, both on the energy system and on the economic fundamentals.

Following the same ambition at EnC level could imply for example to aim for a reduction of energy consumption of 32.5% by 2030 at EnC level, as compared to baseline conditions. A severe challenge in applying this approach to the EnC arises from the following issue: a suitable baseline scenario is not so easy to determine for the EnC as whole as well as for selected CPs, due to data limitations. A second limitation is that such methodology might not be well suited to take into account the differences in economic development of the EnC compared to the EU28, as the -32,5% was identified as cost-optimal level for the EU.

Figure 2 shows the fundamental challenge in selecting a suitable baseline scenario and defining a suitable ambition level at EnC level. As can be seen in Figure 2, the gap between (previously derived) energy scenarios and actual energy consumption is substantial. At the same time, however, the economic development of the countries must be taken into account when setting the ambition level for energy efficiency targets. Here, similar to energy consumption, actual figures are far below previously projected ones. Thus, based on historical economic developments and scenarios up to 2030, the level of ambition may be well above, but also below the -32,5% set at EU 28 level. To overcome such limitations a set of **prerequisites** for target setting have been identified during the course of the previous study. These can be summarised as follows:

- Map the data available across CPs, both from statistical sources (for historical data) and from existing scenario exercises;
- Calculate relevant parameters and indicators;
- Develop appropriate baseline scenarios taking into account potentials and economic development;
- Check data for plausibility through additional indicators such as Primary energy consumption/GDP and Final energy consumption/GDP, income level/affordability, energy prices, GDP/capita, etc., and compare their trend in the Energy Community, as well as in EU Member States.

Based on them, two main exercises have been made for all CPs to pave the way for target setting:

- Two main options have been identified and developed to set up baseline scenarios with the best data and projections available (Sections 2.4). As a first indication, a range of possible targets was calculated on such baselines.
- In order to guarantee a similar effort for all CPs, taking into account their economic development, a set of indicators were derived to put economic development and energy consumption into perspective, and to test and assess the range of options identified for target setting. Special attention was paid here to the relation between primary energy consumption and economic development, characterised by a CP's gross domestic product (i.e. PEC/GDP indicator), in order to emphasise the importance of their harmonisation among CPs. We will discuss this issue in the next sections of this report.

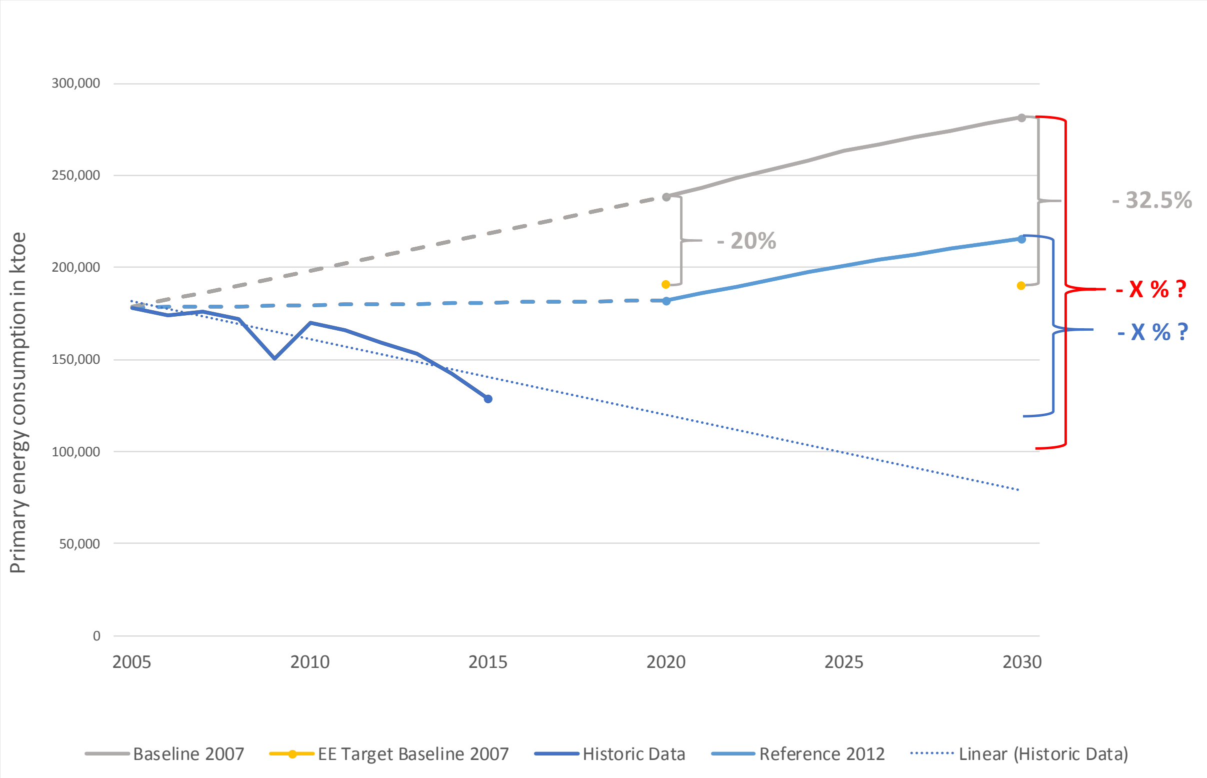

Figure 2: **Comparison of different EnC primary energy consumption scenarios between 2020 and 2030, historic development and possible EE targets in 2030.**

Source: Energy Strategy, 2012; EUROSTAT, 2018; IEA, 2018; IMF, 2019; NEEAP, 2017; NEEAP, 2018; NTUA, 2012; own calculations

A set of **prerequisites** for target setting have been identified during the course of the previous study. These can be summarised as follows:

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2.2 Options for Energy Efficiency target setting

Thus, the following three principal methodological options for EE target setting are analysed:

- **Baseline approach**
- **Base year approach**
- **National scenarios**

Please note that since the EE target also has a direct impact on the expansion targets setting for renewable energies as well as on greenhouse gas emissions, we showcase in the corresponding analyses the consequences of the EE ambition on RE and on GHG emission reduction. In this context, three distinct ambition levels on EE will be incorporated into the follow-up analyses undertaken on renewables and on GHG emission reduction, cf. section 3.2 for renewables and section 3.3 for the GHG part.

Baseline approach

The central element of a baseline approach is to first derive or make use of a projection of future primary and/or final energy consumption under baseline conditions, i.e. in the absence of proactive energy efficiency measures that limit demand growth. In a second step, an energy efficiency target is then determined on the basis of this energy consumption for the year under consideration, in our case 2030. This energy efficiency target can then be calculated or expressed as a relative reduction, but also as an absolute reduction compared to this baseline scenario in 2030.

This approach was followed at EU level where the overall EU target for 2020 and 2030 has been set on the basis of a baseline projection derived by PRIMES modelling already in 2007 (i.e. 2007 PRIMES baseline scenario). MS-specific contributions to the EU target are then also defined in comparison to the corresponding baseline trend. It is of core relevance in this approach to ensure that the data basis used and the approach taken for the baseline projection is consistent and uniform for all involved national entities, so that subsequently equally ambitious targets can be formulated for them. In other word, the main problem with a baseline scenario approach is that the projected development of energy consumption depends significantly on the future development of factors such as economic development, population growth, income and the general economic structure. This also means that, depending on the data available and the expected development, these energy consumption scenarios may differ significantly to the status quo and the same relative energy efficiency target may therefore be unequally challenging for different countries. Thus, if for these factors no consistent basis can be found, the usefulness of the overall approach can consequently be questioned.

For our assessment of EE target setting we make use of the Baseline III scenario for the EnC and its CPs. As discussed above, this baseline trends appears most balanced across the EnC and aims to incorporate all relevant caveats and characteristics of the different CPs. On the basis of this baseline trend we then define three different ambition levels for the 2030 EE target:

- As default, in accordance with the EE ambition imposed at EU level numerically, we assume a (moderate) reduction of 32.5% compared to baseline,
- Then we add a corridor of +/- 20% to that, leading to a (high) EE target of 39% and a (comparatively low) EE target of 26%.

The historic and the required future development of final energy consumption in accordance with this target setting approach is exemplified in Figure 3 for all three different levels of EE ambition. As illustrated in Figure 3, the upper bound (EnC - Baseline 26) of the range would allow the EnC to increase their current consumption by 12.3% compared to 2017. A more detailed description of the Baseline approach is provided in Annex I - Development of a baseline scenario – recap of the Baseline III approach.

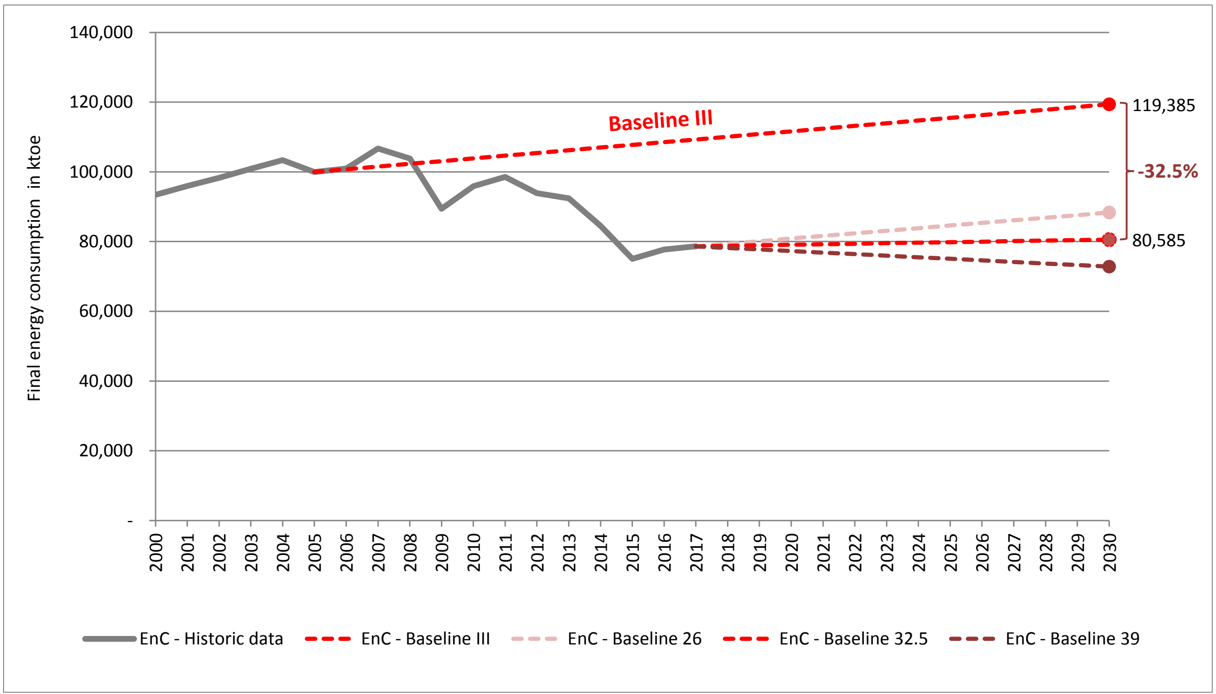


Figure 3: **Basic principle of EE target setting based on the Baseline approach**

Base year approach

In contrast to the baseline approach, an energy efficiency target following the base year approach does not express the targeted reduction of energy demand compared to a forecasted development of energy consumption in the focus year. The target is expressed as an absolute or relative reduction target for primary and/or final energy consumption in comparison to a base year in the past. The advantage of this methodology is that for target setting there is no need for modelling the development of energy consumption under baseline conditions in future years, therefore reducing the uncertainties linked to future projections, which can be significant in presence of data limitations. However, it is important to identify a representative base year that allows for describing the energy system adequately for all involved countries. Consequently, also here it is important to have a common and consistent data basis among all involved countries, in particular for the base year, so that energy supply and demand are accounted according to agreed principles and methods, and that the underlying statistical data is of reasonably good quality.

For the EU 2005 is often used as a common base year in communication and in target definition. We have selected the year 2008 as base year for the EnC and its CPs since that appears as most suitable compromise in terms of data availability under given geographical constraints. On the one hand, 2008 is closer to the base year chosen at EU level (i.e. 2005), meaning it is still prior to impacts arising from the global financial and economic crisis that actually started in autumn 2008. On the other hand, it is late enough so that for all geographical entities statistical data is available (at an acceptable quality).

This approach for EE target setting is also illustrated graphically in Figure 4 for different levels of EE ambition. It is to be noted that at EU level the 2030 goal of 32,5% corresponds to reduction of -20% and -26% to historical consumption levels observed in 2005 for FEC and PEC, respectively. Similar to the baseline approach we have chosen the default ambition level of 19%, here compared to the final energy consumption in 2008, in accordance with the EE ambition set at EU level for the year 2030.[5] We then add two variants (9% reduction and 1% reduction

[5] In other words, if one takes the given 2030 EE target at EU28 level and sets the corresponding final energy consumption in comparison to the historic level in 2008, it corresponds to a reduction of 19% in final energy consumption.

of final energy consumption compared to 2008) and consequently introduce a corridor concerning the EE ambition. The spread of the level of ambition is comparable to the baseline approach in regards to its absolute change in energy consumption by 2030.

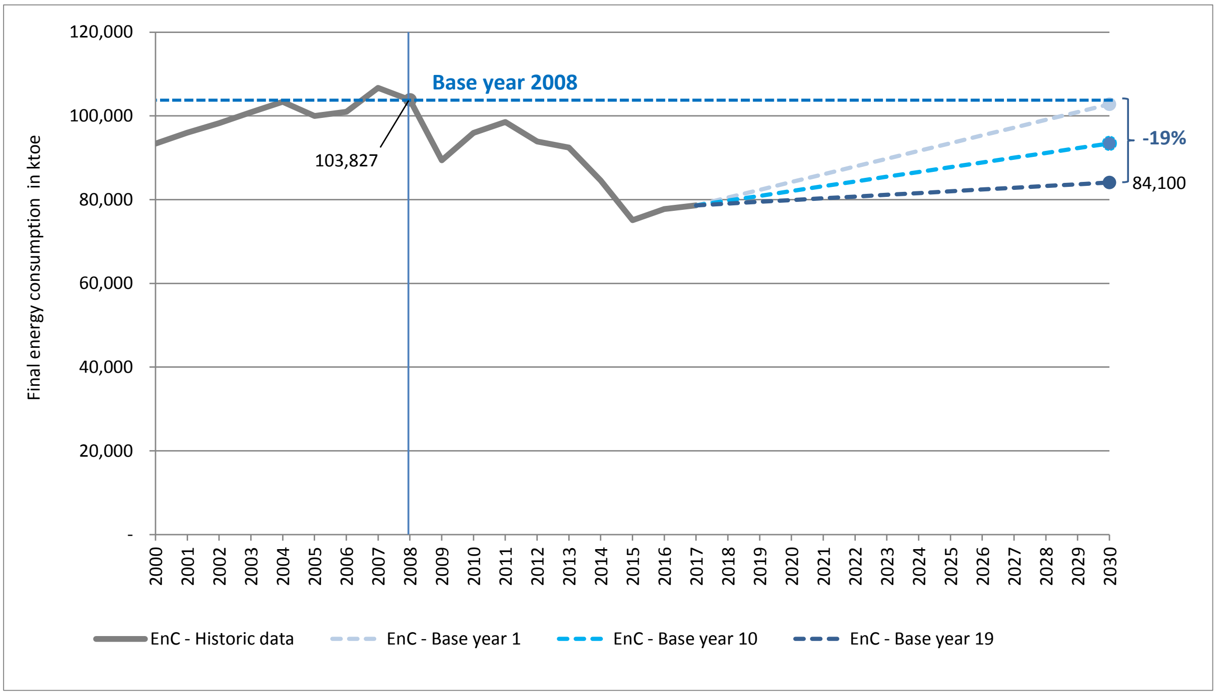


Figure 4: Basic principle of EE target setting based on the Base year approach

Domestic perspective

Where available, we also looked into country-specific baseline- and energy efficiency scenarios developed by the CPs themselves. These scenarios are of interest as the CPs themselves often are in the best position regarding data to develop these scenarios. However, the problem is that the data and approaches used by the CPs have not been harmonised and that, consequently, the correspondingly projected developments in energy consumption within the CPs are difficult to compare and aggregate at EnC level. For the CPs where such scenarios and data are available, they will however be also compared to the two main target setting approaches explained above, in order to get a comprehensive and detailed overview on available options and trends.

2.3 Socio-economic parameters

A set of relevant indicators illustrating the socio-economic conditions and their historical and projected evolution over time in CPs was collected, to test and assess the implications of the range of possible EE target, and allow for a comparison of their trajectories with the EU28 and with specific EU countries. A comprehensive dataset was built at that purpose, including all relevant parameters assessed in this report.

The first indicator is simply **population**, using the latest statistics and projection of Eurostat (2019) for the EU 28 region. For the CPs and the EnC projections by the IMF (2019) until 2024 and beyond that, growth trends of the United Nation (2019) are used. The analyses of such data allows for gaining some further insights for all CPs. Figure 5 shows a comparatively strong downward trend for population in the EnC region as a whole. This trend contrasts the growing population numbers for the EU 28.

Next, we take a closer look at general welfare trends. Here **GDP and its related growth** serves as key indicator, see Figure 6 and Figure 7. In this context, Figure 7 shows historic and projected future growth rates for all CPs, the Energy Community region and the EU 28. The GDP data used in Figure 6 was normalized to the year 2008, showing relative growth trends for the selected countries and regions. The GDP data used for this assessment in general is expressed in real terms (chain linked volumes in Euro 2010). Eurostat (2019) is used as a primary data source until 2018. Since some CPs are not represented in the Eurostat dataset or some values for the years 2017 and or 2018 were missing, IMF (2019) is used as a secondary source. IMF (2019) is also used as a source to include the most recent economic outlook for economic growth perspectives for CPs until the year 2024. The growth rate assumptions from 2024 to the year 2030 are in line with the NTUA (2012) PRIMES Reference scenario assumptions. Given that not all CPs were included in this modelling exercise, namely Georgia, Moldova and Ukraine, growth assumptions for these CPs were extracted from their respective National Energy Efficiency Action Plans (NEEAP) as the IMF projections only cover the years from 2019 until 2024.

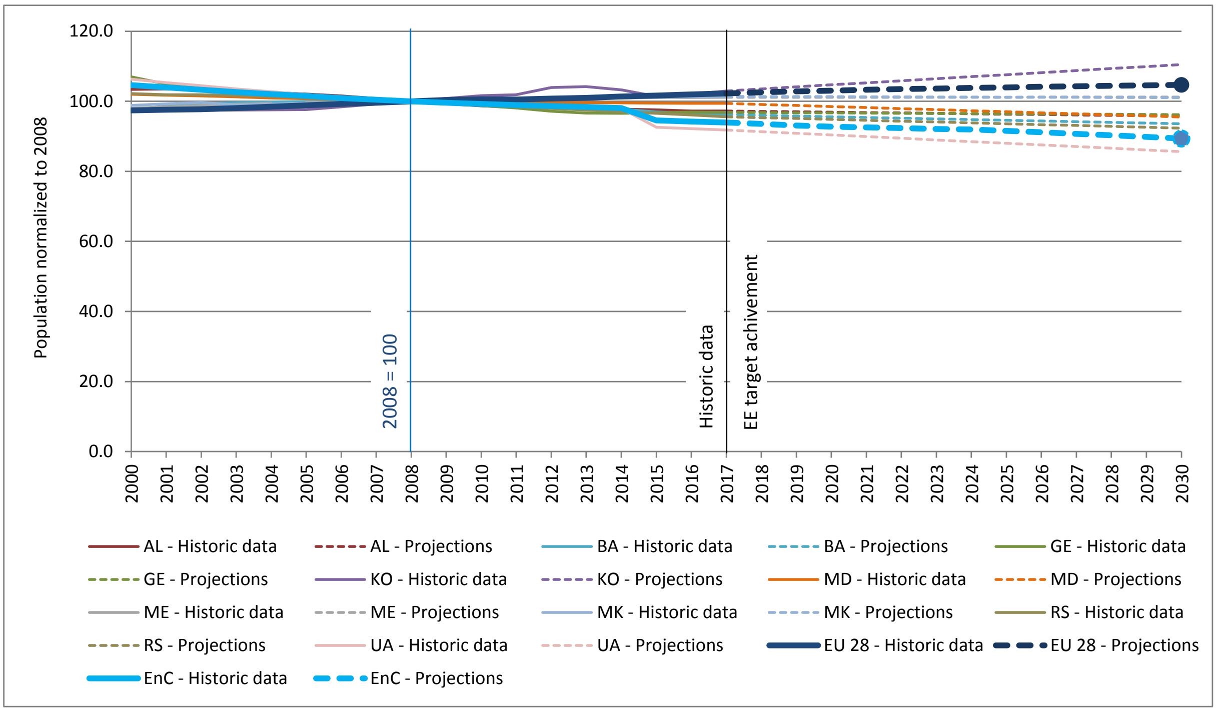


Figure 5: Development of the total population for all CPs and the EnC. Source: Eurostat, 2019; IMF, 2019; UN, 2019.

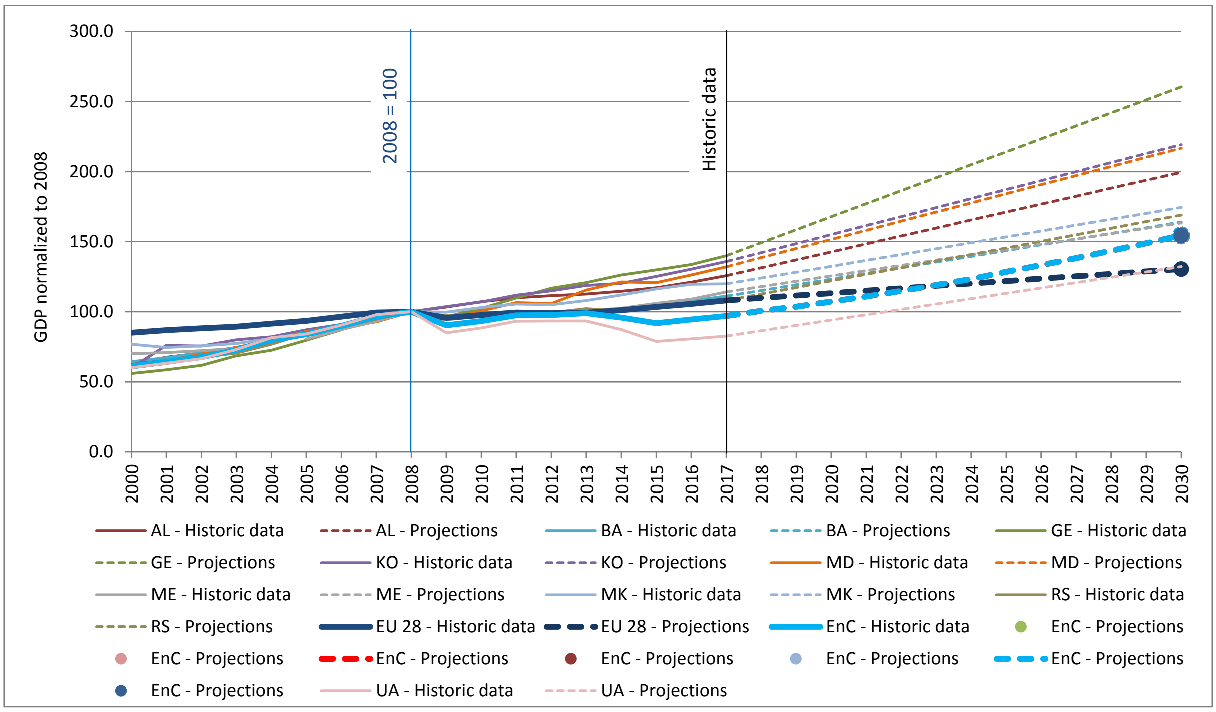


Figure 6: **Historic and projected GDP for all CPs, the EU 28 and EnC. Source: Eurostat, 2019; IMF, 2019; NTUA, 2012, 2017.**

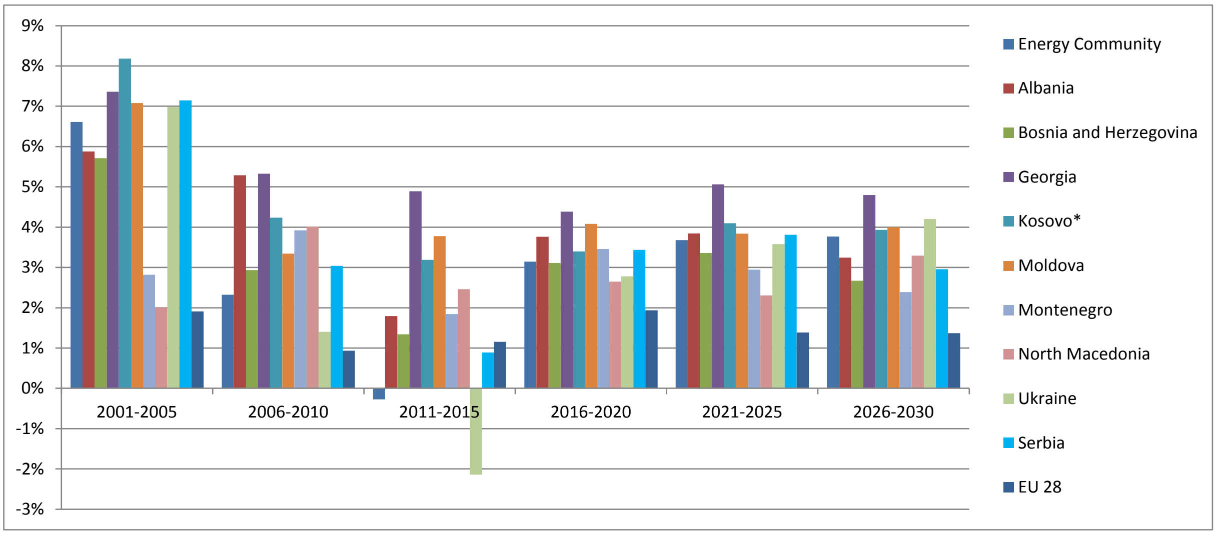


Figure 7: **Historic and projected GDP growth rates for all CPs, the EU 28 and EnC. Source: Eurostat, 2019; IMF, 2019; NTUA, 2012, 2017.**

The forth indicator, shown in Figure 8 and Figure 9 normalized to the level in 2008, represents GDP per capita. The expressed data is derived by dividing the GDP data and projections (expressed in real Euro 2010) shown in Figure 6 by the population data and projections shown in Figure 5. The GDP per capita data is used for calculation in all three parts of this study (EE, RES and GHG subchapters - 2, 3 and 4).

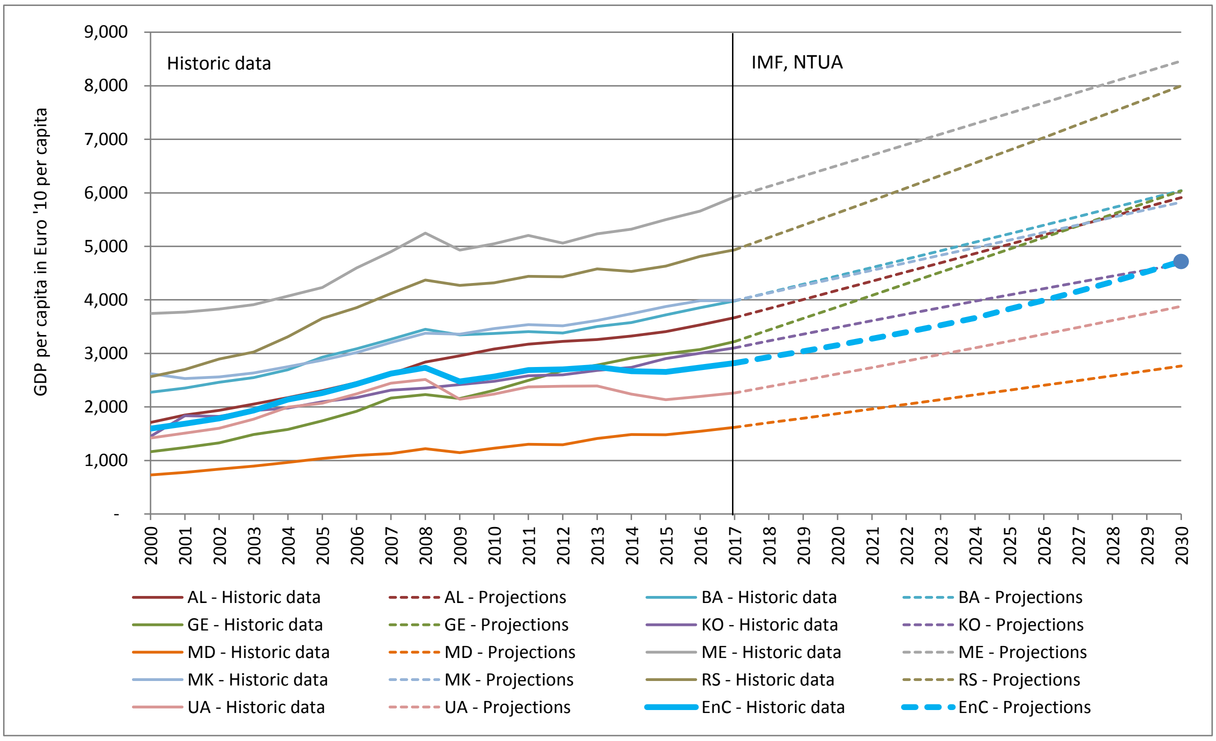


Figure 8: Development of the GDP per capita in all CPs, the EU 28 and EnC. Source: Eurostat, 2019; IMF, 2019; UN, 2019; NTUA, 2012, 2017.

Figure 8 depicts the absolute GDP per capita values. The overall GDP per capita for the EnC region is ranging from 1,593 Euro in the year 2000 to 2,820 in 2017. Until 2030 the GDP per capita is projected to reach 4,718 Euro per capita. The numbers for the EU 28 are not included in this figure. They range from 22,938 in 2000 to 27,791 in 2017. The projections until 2030, using assumption from NTUA (2017) also known as EUCO scenarios, show and level of 32,752 Euro per capita for the EU 28 in the respective year. The normalized numbers for this indicator shown in Figure 9 better represent the relative development for the discussed timespan. It may be seen, that the overall growth in the EnC region is higher compared to the EU 28. In the year 2000 the GDP per capita in the EnC is just 7% of the average EU 28 level. This gap is projected to become smaller until 2030. In 2030 the EnC GDP per capita is 14.4% of the average level in the EU28.

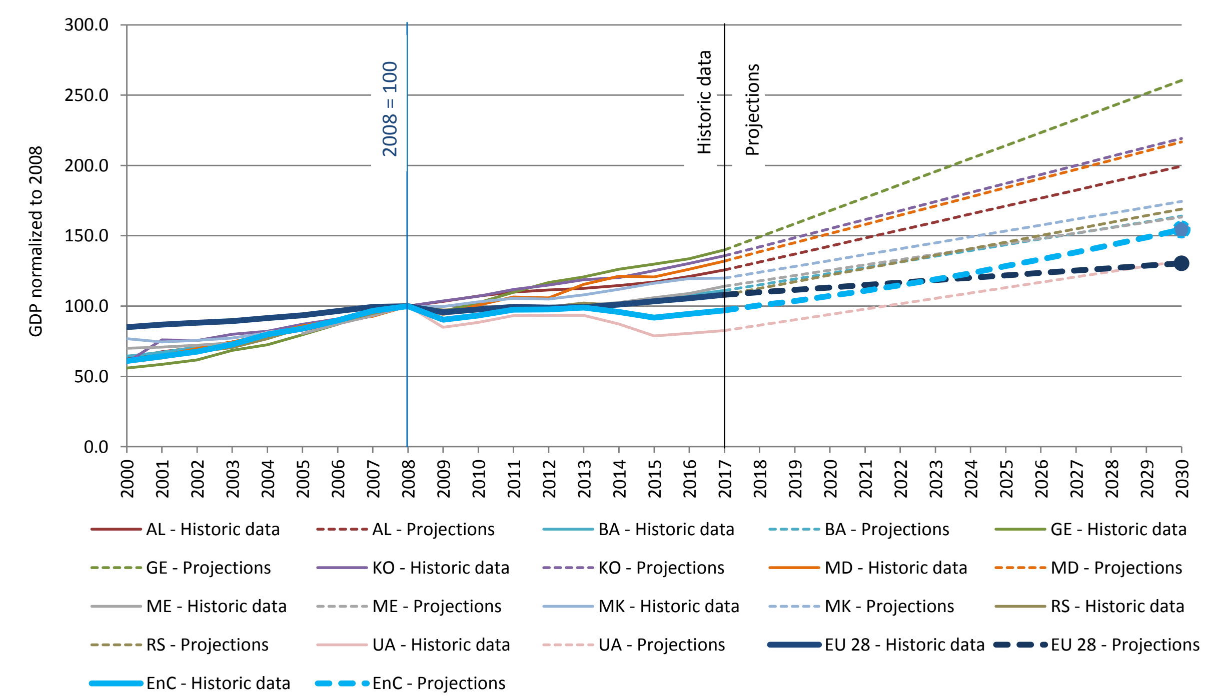


Figure 9: Development of the GDP per capita normalized to 2008 in all CPs, the EU 28 and EnC. Source: Eurostat, 2019; IMF, 2019; UN, 2019; NTUA, 2012, 2017.

2.4 Pathways for Energy Efficiency in accordance with target setting options

In this section, the previously presented methodologies for target setting are applied to derive a range of possible energy efficiency targets for 2030 for each CPs. Thanks to the socio-economic indicators collected, it is possible to apply an indicator-based analysis, assessing socio-economic and energy performance trends to see the implications arising from the different EE target setting options which have been described in Section XX.

2.4.1 Overview on the assessed Energy Efficiency target setting options

Baseline approach: A reduction of 32.5% was set for the EU 28. This percentage of reduction is here used to calculate a corridor/range of alternative ambition levels. More precisely, we add a corridor of +/- 20% to the default reduction target of 32.5%, leading to a (high) EE target of 39% and a (comparatively low) EE target of 26%. This means that we are looking at the following reduction targets compared to the Baseline III scenario for primary and final energy in 2030:

- **Baseline 26**: Reduction of 26% compared to Baseline (i.e. the Baseline III scenario) in 2030
- **Baseline 32.5**: Reduction of 32.5% compared to Baseline in 2030
- **Baseline 39**: Reduction of 39% compared to Baseline in 2030

Base year approach: In determining the range of target for the base year approach, we have chosen the default ambition level of 19%, here compared, unless otherwise stated, to the final energy consumption in 2008, in accordance with the EE ambition at EU level.[6]

While selecting the appropriate range to apply, it became clear that the 19% target can already be classified as ambitious. We are therefore setting a corridor between 1% and 19% in relation to final energy consumption in the base year. This means that we are looking at the following reduction targets compared to the base year in terms of final energy:

- **Base year 1**: Reduction of 1% compared to the Base year 2008
- **Base year 10**: Reduction of 10% compared to the Base year 2008
- **Base year 19**: Reduction of 19% compared to the Base year 2008

Based on the relative FEC/PEC target ratio of the EU 28 in 2030 (19%/25% = 0.76) these target corridors will then be translated to primary energy. However, the names of the individual scenarios will not be changed. The specific perspectives of individual CP's are already reflected in the base year and this methodology already assumes a certain convergence of Primary Energy and Final Energy.

This means that we are looking at the following reduction targets compared to the base year in terms of primary energy:

- Base year 1: Reduction of 1.3% compared to Base year
- Base year 10: Reduction of 13.2% compared to Base year
- Base year 19: Reduction of 25% compared to Base year

Domestic perspective: This approach reflects an published by two of the CPs, namely Georgia, Serbia and Ukraine; For Georgia: Assistance with the *Drafting of the First National Energy Efficiency Action Plan (Phase I)*

[6] In brief, if one takes the given 2030 EE target at EU28 level and sets the corresponding final energy consumption in comparison to the historic level in 2008, it corresponds to a reduction of 19% of final energy consumption.

More precisely, we have converted the 32.5% target of the EU27 (as there has not yet been a baseline 2007 scenario for the EU28) to a complementary target based on the base year 2008. This calculation shows that a -32.5% baseline target can be converted to a -19% base year target in terms of final energy. In terms of primary energy the calculation shows that a -32.5% baseline target can be converted to a -25% base year target in terms of final energy.

(NEEAP Expert team, 2019); For Serbia *Energy Sector Development Strategy of the Republic of Serbia for the period by 2025 with projections by 2030* (Republic of Serbia Ministry of Mining and Energy, 2016, 89) and the *Study on Energy Efficiency Potential in Ukraine*, Interim Progress Report - Milestones 1 and 2 (Trypolska et al., 2018, 40.). All other domestic perspective scenarios are cited from the following report: Western Balkans Investment Facility Infrastructure Project Facility Technical Assistance 5 (IPF 5), (WYG, 2018).

2.4.2 Overview of Energy Efficiency Targets for all CPs and the EnC

The results of the calculations for all CPs and the EnC, described in the previous subchapter, are shown in Table 2 in terms of final energy consumption. The corresponding data in terms of primary energy is provided in Table 3. In the first section these tables show historic energy consumption data for the year 2008 and 2017 and the Baseline III scenario based on Resch et al. (2018). The seven possible energy efficiency targets expressed in absolute consumption caps for 2030 are included in the second section of both tables. In the third section the seven EE targets for 2030 are expressed in relative terms compared the respective energy consumption in 2017. A graphical illustration of the data listed in these tables is given in Figure 10 in terms of final energy consumption, Figure 11 in terms of primary energy consumption and in Figure 12 showing the absolute consumption caps for all scenarios for 2030 in absolute values.

Table 2: Energy Efficiency targets for all CPs and the EnC in terms of final energy consumption for different scenarios. Eurostat, 2019; IEA, 2019; IMF, 2019; NTUA, 2012; own calculations.

Energy Efficiency targets for CPs and the Energy Community	Albania	Bosnia and Herzegovina	Georgia	Kosovo*	Moldova	Montenegro	North Macedonia	Serbia	Ukraine	Energy Community
Final energy consumtion in ktoe										
Historic data for 2008	1,767	3,347	2,458	1,163	2,211	868	1,803	9,465	80,744	103,827
Historic data for 2017	2,079	3,674	4,142	1,522	2,526	743	1,888	8,831	53,195	78,601
Baseline III in 2030	3,070	5,578	5,070	2,335	3,692	1,318	2,957	13,652	81,713	119,385
Consumption cap in 2030 in ktoe										
Domestic perspective	3,118	4,744	6,257	1,729	2,988	1,102	2,030	11,078	57,199	90,246
Base year 1	1,749	3,314	2,434	1,152	2,189	859	1,785	9,371	79,936	102,789
Base year 10	1,590	3,012	2,212	1,047	1,990	781	1,623	8,519	72,670	93,445
Base year 19	1,431	2,711	1,991	942	1,791	703	1,461	7,667	65,403	84,100
Baseline 26	2,272	4,128	3,752	1,728	2,732	976	2,188	10,102	60,468	88,345
Baseline 32.5	2,072	3,765	3,422	1,576	2,492	890	1,996	9,215	55,156	80,585
Baseline 39	1,873	3,403	3,093	1,424	2,252	804	1,804	8,328	49,845	72,825
Change in final energy consumtion compared to 2017 in %										
Domestic perspective	+50%	+29.1%	+51.1%	+13.6%	+18.3%	+48.3%	+7.5%	+25.4%	+7.5%	+14.8%
Base year 1	-15.9%	-9.8%	-41.3%	-24.3%	-13.3%	+15.6%	-5.4%	+6.1%	+50.3%	+30.8%
Base year 10	-23.5%	-18%	-46.6%	-31.2%	-21.2%	+5.1%	-14%	-3.5%	+36.6%	+18.9%
Base year 19	-31.2%	-26.2%	-51.9%	-38.1%	-29.1%	-5.4%	-22.6%	-13.2%	+22.9%	+7%
Baseline 26	+9.3%	+12.3%	-9.4%	+13.5%	+8.1%	+31.3%	+15.9%	+14.4%	+13.7%	+12.4%
Baseline 32.5	-0.3%	+2.5%	-17.4%	+3.6%	-1.4%	+19.8%	+5.7%	+4.3%	+3.7%	+2.5%
Baseline 39	-9.9%	-7.4%	-25.3%	-6.4%	-10.9%	+8.2%	-4.4%	-5.7%	-6.3%	-7.3%

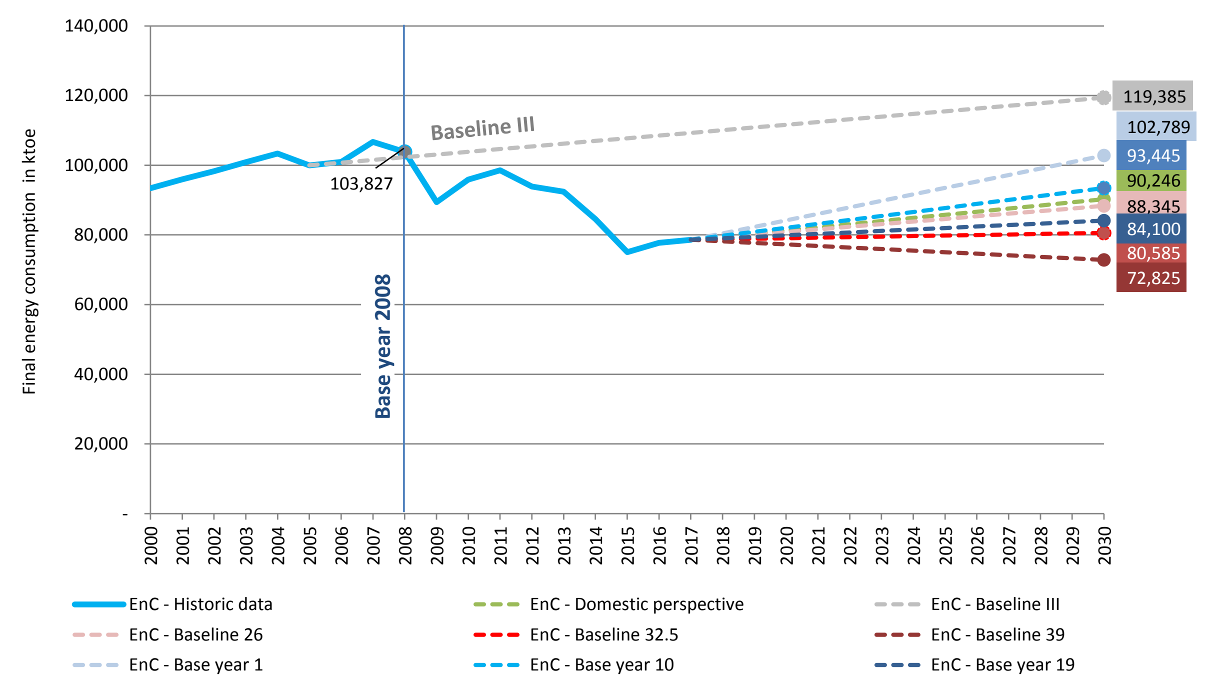


Figure 10: Energy Efficiency targets for the Energy Community in terms of final energy according to assessed scenarios. Baseline compared to Base year approach vs. Domestic perspective. Eurostat, 2019; IEA, 2019; own calculations.

Table 3: Energy Efficiency targets for all CPs and the EnC in terms of primary energy consumption for different scenarios. Eurostat, 2019; IMF, 2019; NTUA, 2012; own calculations.

Energy Efficiency targets for CPs and the Energy Community	Albania	Bosnia and Herzegovina	Georgia	Kosovo*	Moldova	Montenegro	North Macedonia	Serbia	Ukraine	Energy Community
Primary energy consumtion in ktoe										
Historic data for 2008	1,767	3,347	2,458	1,163	2,211	868	1,803	9,465	80,744	103,827
Historic data for 2017	2,079	3,674	4,142	1,522	2,526	743	1,888	8,831	53,195	78,601
Baseline III in 2030	3,070	5,578	5,070	2,335	3,692	1,318	2,957	13,652	81,713	119,385
Consumption cap in 2030 in ktoe										
Domestic perspective	3,461	7,500	7,610	3,011	3,308	1,569	2,300	17,629	109,124	155,514
Base year 1	2,023	5,883	2,965	2,183	3,301	1,181	2,961	15,721	126,004	162,223
Base year 10	1,780	5,178	2,610	1,921	2,906	1,039	2,606	13,837	110,898	142,775
Base year 19	1,538	4,473	2,254	1,660	2,510	898	2,251	11,952	95,792	123,327
Baseline 26	2,549	6,753	4,563	3,009	3,963	1,088	3,137	17,039	122,047	164,149
Baseline 32.5	2,325	6,160	4,162	2,745	3,615	993	2,862	15,542	111,327	149,730
Baseline 39	2,101	5,567	3,762	2,480	3,267	897	2,586	14,045	100,607	135,312
Change in primary energy consumtion compared to 2017 in %										
Domestic perspective	+48.5%	+12.1%	+66.3%	+19.1%	-12.2%	+56.6%	-14.2%	+18.4%	+18.4%	+19.1%
Base year 1	-13.2%	-12.1%	-35.2%	-13.7%	-12.4%	+17.8%	+10.4%	+5.6%	+36.7%	+24.2%
Base year 10	-23.6%	-22.6%	-43%	-24%	-22.9%	+3.7%	-2.8%	-7.1%	+20.3%	+9.3%
Base year 19	-34%	-33.2%	-50.7%	-34.4%	-33.4%	-10.4%	-16.1%	-19.7%	+4%	-5.6%
Baseline 26	+9.4%	+0.9%	-0.3%	+19%	+5.2%	+8.6%	+17%	+14.4%	+32.4%	+25.7%
Baseline 32.5	-0.2%	-7.9%	-9%	+8.6%	-4%	-0.9%	+6.7%	+4.4%	+20.8%	+14.6%
Baseline 39	-9.8%	-16.8%	-17.8%	-1.9%	-13.3%	-10.5%	-3.6%	-5.7%	+9.2%	+3.6%

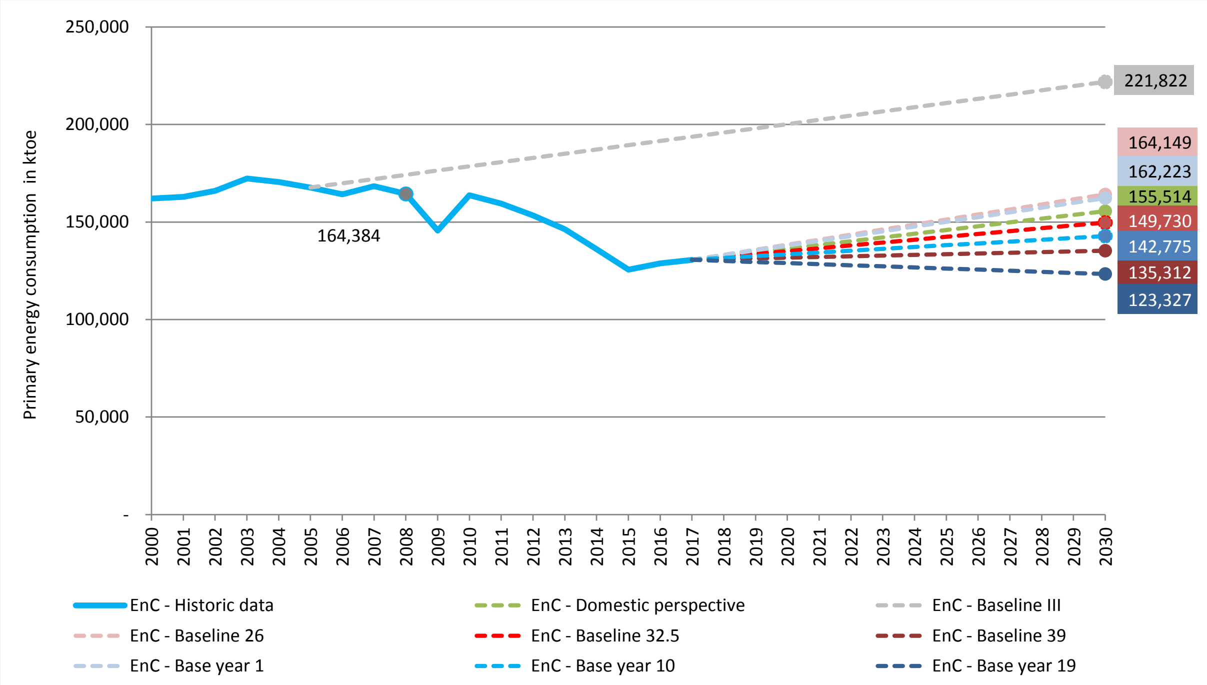


Figure 11: Energy Efficiency targets for the Energy Community in terms of primary energy according to assessed scenarios. Baseline compared to Base year approach vs. Domestic perspective. Eurostat, 2019; IEA, 2019; own calculations.

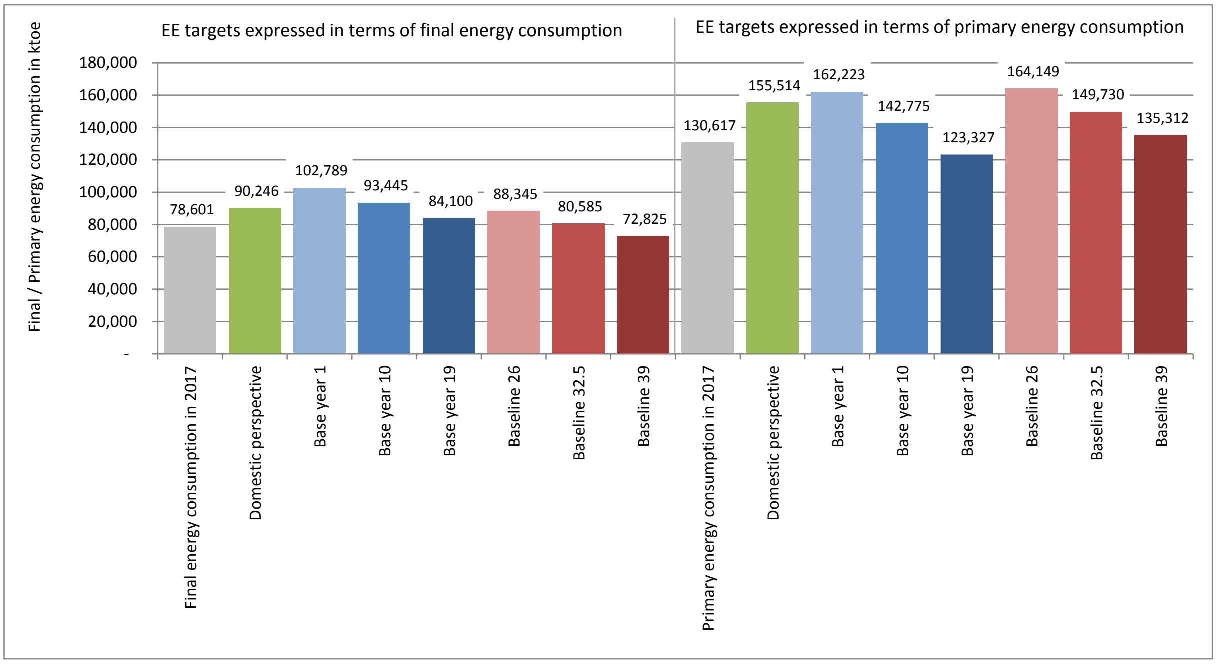


Figure 12: Energy efficiency targets for the EnC in terms of final- (left) and primary energy (right) for different scenarios. Baseline (reddish) vs. Base year approach (blueish) vs. Domestic perspective (green) and energy consumption (grey). Eurostat, 2019; own calculations.

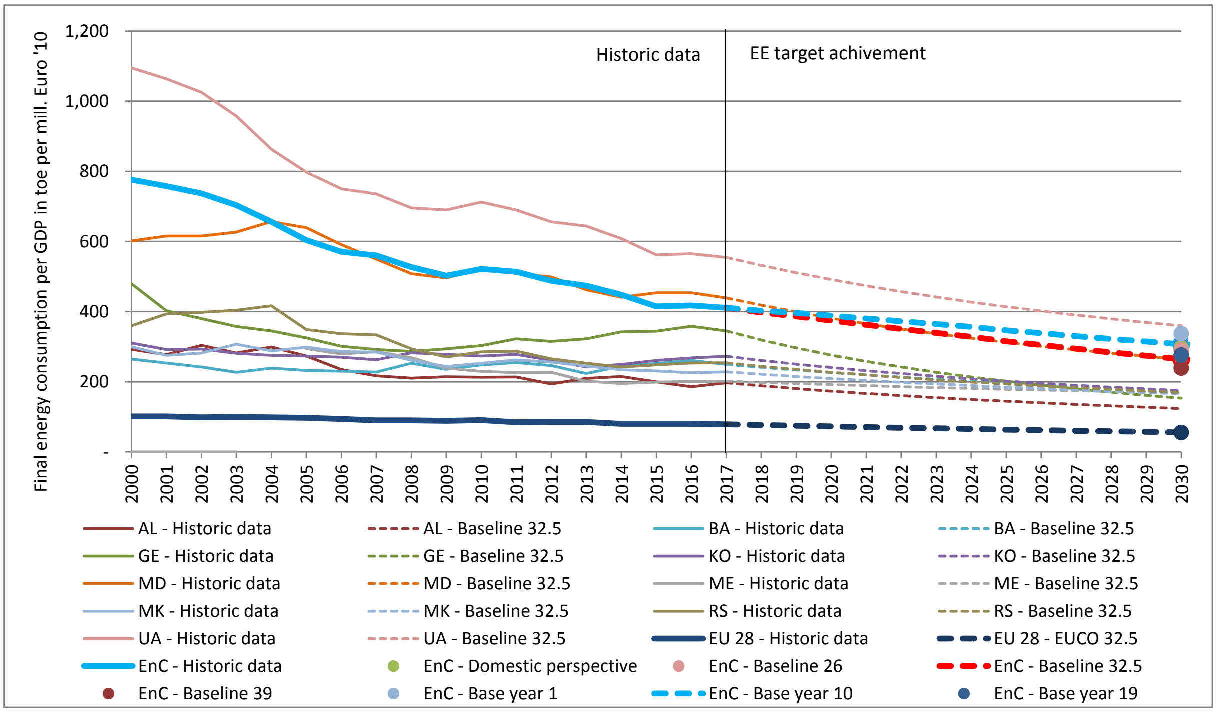


Figure 13: Development of FEC/GDP in the EnC compared to the EU 28 and all CPs. Source: Eurostat, 2019; IMF, 2019; NTUA, 2012, 2017.

Figure 13 to Figure 16 present the overall Energy Community EE target options in terms of FEC and PEC per GDP and FEC and PEC per capita. All four figures compare the EnC Region to all nine CPs and the EU28. The projected scenario for the time between 2017 and 2030 for the CPs is the Baseline 32.5 scenario. In terms of energy intensity per GDP the Ukraine is showing the highest values followed by Moldova. The lowest energy intensity in 2017 is displayed for Albania, followed by Montenegro and North Macedonia.

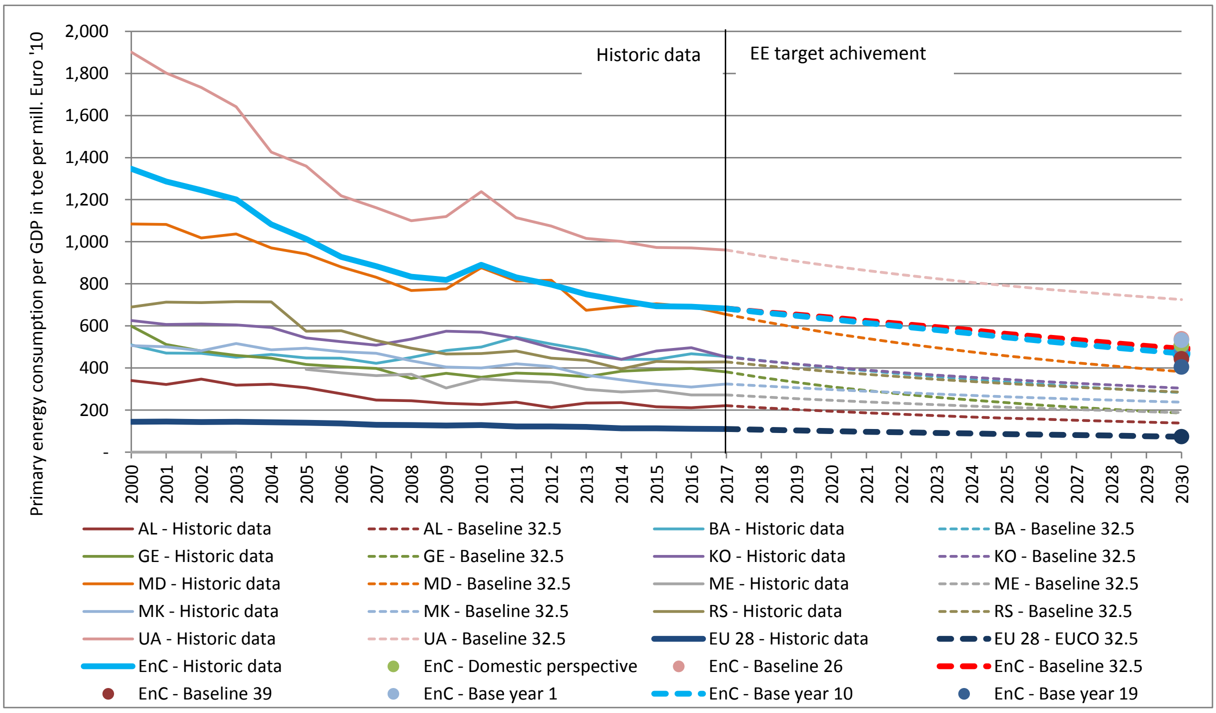


Figure 14: Development of PEC/GDP in the EnC compared to the EU 28 and all CPs. Source: Eurostat, 2019; IMF, 2019; NTUA, 2012, 2017.

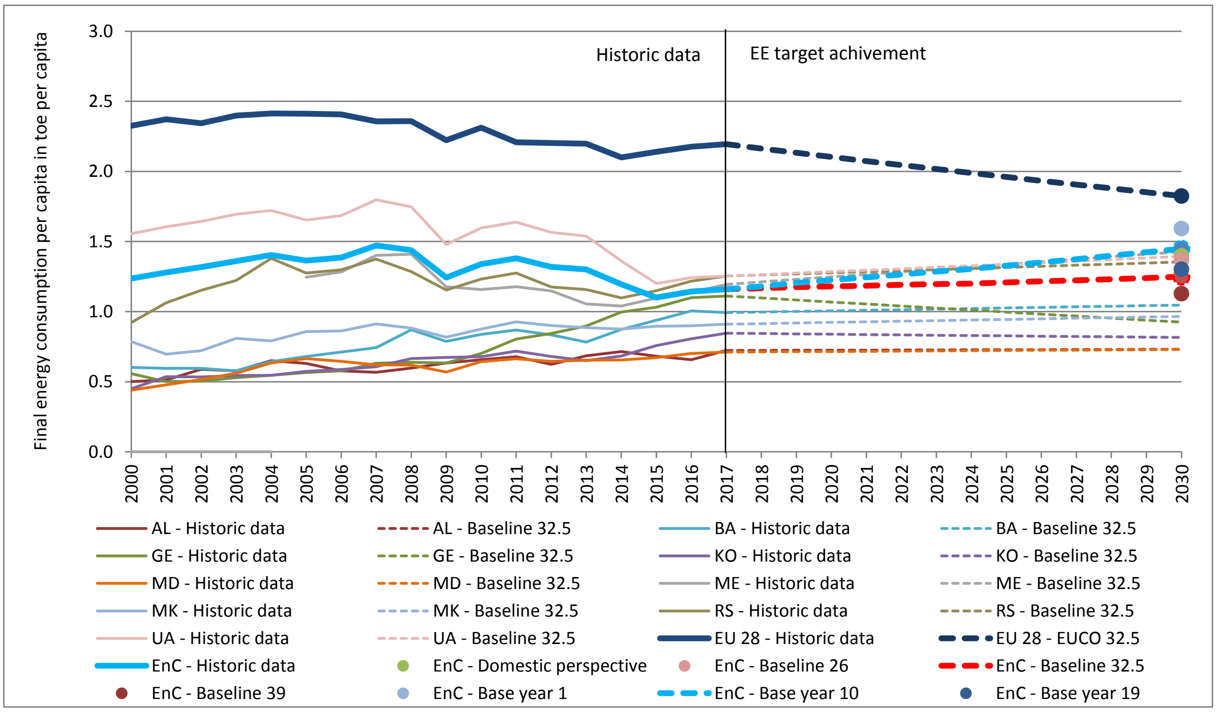


Figure 15: Development of FEC/Capita in the EnC compared to the EU 28 and all CPs. Source: Euro-stat, 2019; IMF, 2019; NTUA, 2012, 2017.

In terms of energy use per capita Ukraine is leading the CPs again. This time Moldova joins Albania on the lower end of the country group. The overall energy intensity per capita in the EnC is about half as high as in the EU 28 in 2017 in regards to final energy consumption (see Figure 15). The primary energy use per capita in the EnC in 2017 is about two thirds as high as in the EU 28 (see Figure 16).

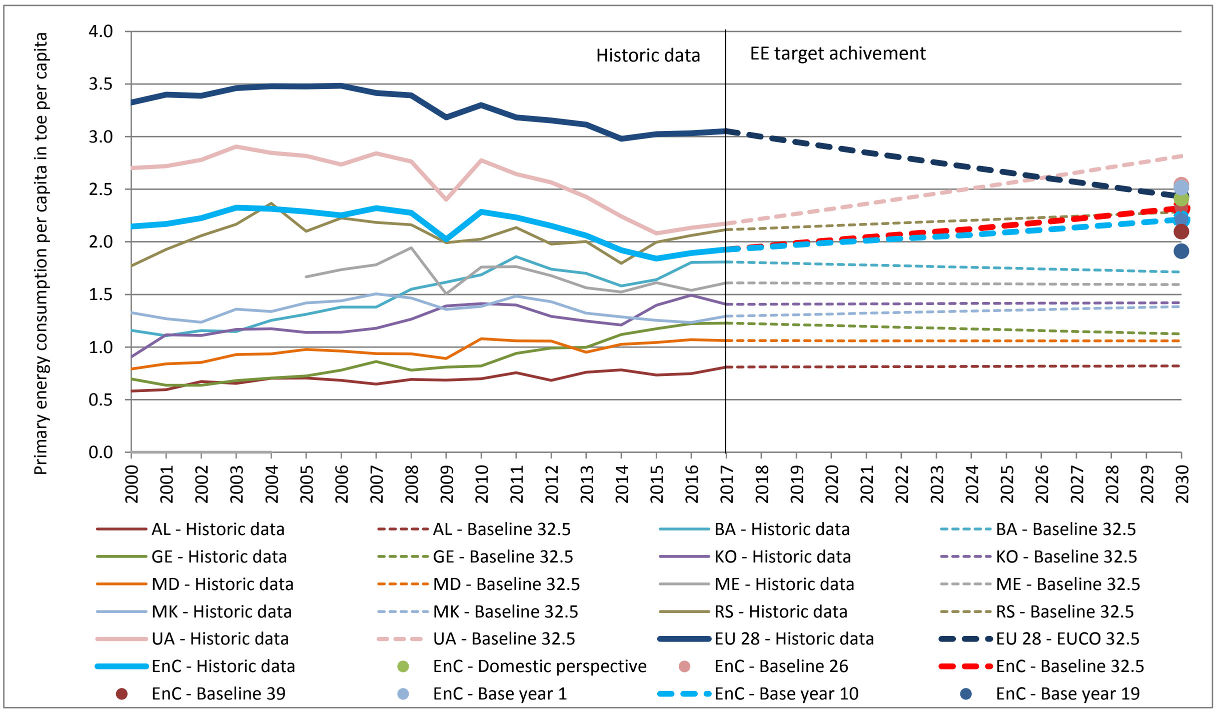


Figure 16: Development of PEC/Capita in the EnC compared to the EU 28 and all CPs. Source: Eurostat, 2019; IMF, 2019; NTUA, 2012, 2017.

2.5 Resulting Energy Efficiency Target ranges by Contracting Party

In this section we take a closer look at the individual Contracting Parties of the Energy Community and we illustrate the resulting EE target setting options for each CP. The ranges are presented and illustrated to allow to put them in perspective of the national socio-economic conditions and their expected evolution.

2.5.1 Resulting Energy Efficiency Targets for Albania

The resulting wide range of possible energy efficiency targets for 2030 for Albania are shown in Table 4 in terms of final energy consumption. Table 5 includes the respective targets in terms of primary energy consumption. Additionally, Figure 17 provides an overall comparison of the various options for 2030 EE target setting, both in terms of final and primary energy. A closer look at the timely evolution of final energy demand according to the various target setting options is then shown in Figure 18. The corresponding illustration in terms of primary energy is shown in Figure 19. As applicable in tables and graphs, the range of possible 2030 energy efficiency targets for considered scenarios for final energy varies between 1.4 Mtoe (Base year 19) and 3.1 Mtoe (Domestic perspective). In terms of primary energy, the range lies between 1.5 Mtoe (Base year 19) and 3.5 Mtoe (Domestic perspective).

Table 4: EE targets in terms of final energy for Albania for different scenarios

EE targets for Albania in terms of final energy consumption	Historic data for 2008 [ktoe]	Historic data for 2017 [ktoe]	Baseline III in 2030 [ktoe]	Consumption cap in 2030 [ktoe]	Change compared to 2008	Change compared to 2017	Change compared to Baseline III in 2030
Domestic perspective	1,767	2,079	3,070	3,118	+76.4%	+50%	**+1.6%**
Base year 1	1,767	2,079	3,070	1,749	-1%	-15.9%	**-43%**
Base year 10	1,767	2,079	3,070	1,590	-10%	-23.5%	**-48.2%**
Base year 19	1,767	2,079	3,070	1,431	-19%	-31.2%	**-53.4%**
Baseline 26	1,767	2,079	3,070	2,272	+28.6%	+9.3%	**-26%**
Baseline 32.5	1,767	2,079	3,070	2,072	+17.3%	-0.3%	**-32.5%**
Baseline 39	1,767	2,079	3,070	1,873	+6%	-9.9%	**-39%**

Table 5: EE targets in terms of primary energy for Albania for different scenarios

EE targets for Albania in terms of primary energy consumption	Historic data for 2008 [ktoe]	Historic data for 2017 [ktoe]	Baseline III in 2030 [ktoe]	Consumption cap in 2030 [ktoe]	Change compared to 2008	Change compared to 2017	Change compared to Baseline III in 2030
Domestic perspective	2,050	2,330	3,444	3,461	+68.9%	+48.5%	**+0.5%**
Base year 1	2,050	2,330	3,444	2,023	-1.3%	-13.2%	**-41.3%**
Base year 10	2,050	2,330	3,444	1,780	-13.1%	-23.6%	**-48.3%**
Base year 19	2,050	2,330	3,444	1,538	-25%	-34%	**-55.3%**
Baseline 26	2,050	2,330	3,444	2,549	+24.3%	+9.4%	**-26%**
Baseline 32.5	2,050	2,330	3,444	2,325	+13.4%	-0.2%	**-32.5%**
Baseline 39	2,050	2,330	3,444	2,101	+2.5%	-9.8%	**-39%**

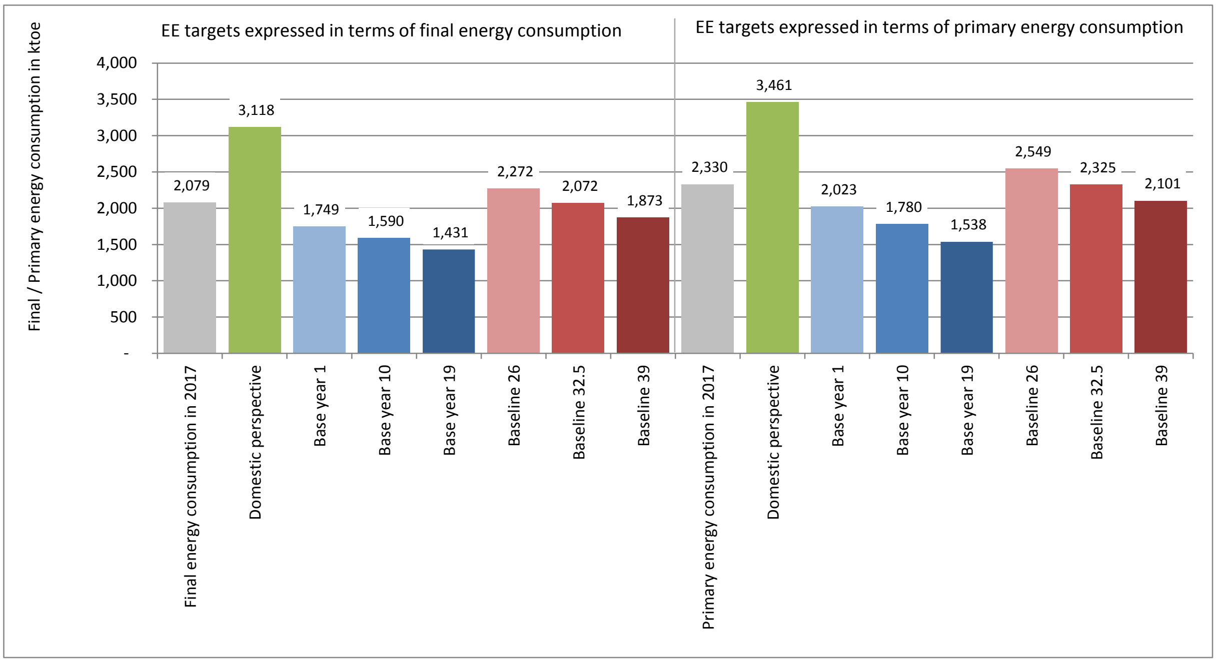


Figure 17: **Energy efficiency targets in terms of primary and final energy for different scenarios. Baseline vs. Base year approach vs. Domestic perspective**

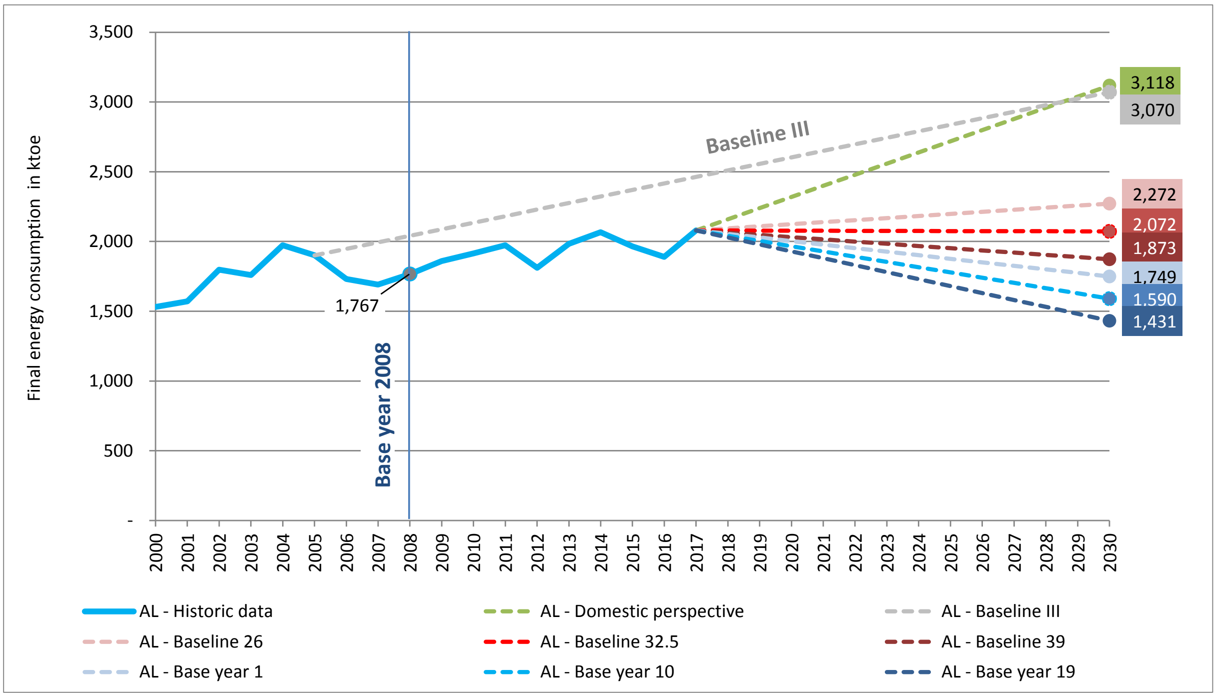


Figure 18: **Energy Efficiency targets in terms of final energy for different scenarios. Baseline compared to Base year approach vs. Domestic perspective**

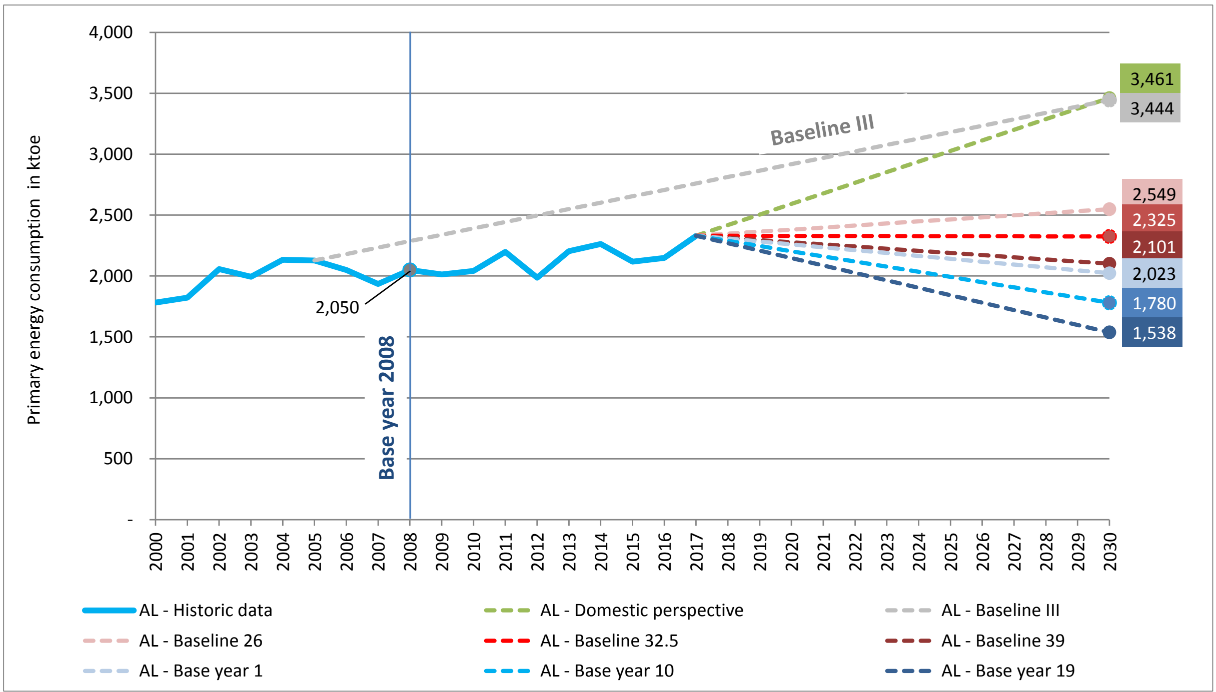


Figure 19: **Energy efficiency targets in terms of primary energy for different scenarios. Baseline compared to Base year approach vs. Domestic perspective**

2.5.1.1 Indicators for analysing energy performance

The indicator-based analysis shall assist in putting the range of energy efficiency target setting options into a broader perspective. By use of these indicators, we illustrate how the targets examined match with historic trends and with EE target setting in other countries or regions. The overall aim is to assist in the identification of a target setting option that would lead to a comparable effort with the EE target set at EU level, while respecting difference in economic welfare. After the introduction of socio-economic indicators like population, GDP and related growth trends for all CPs in section 2.3, we aim in this CP specific section to incorporating the energy perspective into that.

At that purpose, energy-related indicators like Primary Energy Consumption (PEC) per GDP and Final Energy Consumption per GDP which represent the energy intensity of the country, and also GDP per Capita, PEC/Capita and FEC/Capita will be analysed for each of the EE target options. These indicators combine the perspective of energy consumption with socio-economic parameters and therefore provide important insights on how energy consumption is influenced by economics and the development of demographic parameters and vice versa. This is of particular importance for the target setting procedure since the analysis of the possible future developments of energy consumption without consideration of the underlying economic development does not provide meaningful insights, ignoring for example the perspective and perceptions of enhancements on an efficient use of energy. Furthermore, the comparability between MSs and CPs of trends drawn by these indicators is of essential importance. Such comparison allows to undertake plausibility checks for all proposed methods and, accordingly, for the target ranges which have been calculated. In addition, such analysis would also focus on how the EE targets options for CPs, exemplified here for the case of Albania and then replicated for all CPs, align with the ambition set at EU level and by EU MSs. For the EU member states, the targets for primary energy consumption and final energy consumption for the year 2030 have been used in line with the national contributions and the energy consumption reported in their draft integrated National Energy and Climate Plans (NECP) submitted at the end of 2018.

Please note that in order to make these figures easier to read, we have avoided illustrating all seven previously calculated EE objectives as a graph. Instead, only the trajectories of the middle scenarios from the baseline and the base year approach are presented, all other scenarios are presented only as endpoints to get an idea of what the differences in the underlying approaches mean compared to the indicators mentioned above.

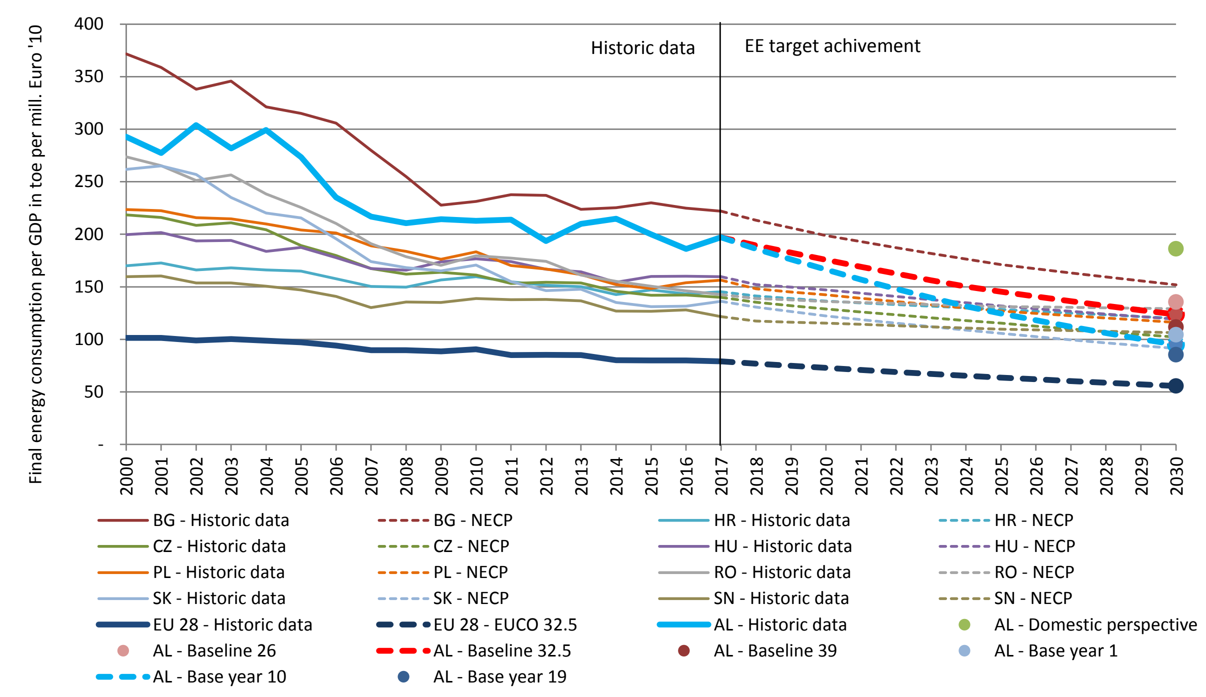


Figure 20: Development of FEC/GDP in Albania compared to the EU 28 and selected MS. Source: Eurostat, 2019; IMF, 2019; NTUA, 2012, 2017.

In 2017, final energy consumption per GDP was about 197 toe/mill. Euro ’10 in Albania (see). Under both considered EE target setting options, energy consumption per GDP will drop significantly until 2030 – i.e. to about 124 toe/mill. Euro '10 under the expressed Baseline variant (i.e. Baseline 32.5) and to about 95 toe/mill. Euro '10 according to the indicated base year option (i.e. Base year 10).

If one considers primary energy per GDP, it can be seen that Albania and Poland have a comparatively similar present level and historic record (see). If a baseline approach is followed for Albania and a moderate EE target of 26% is introduced therein, then also a similar future trend can be expected in both countries.

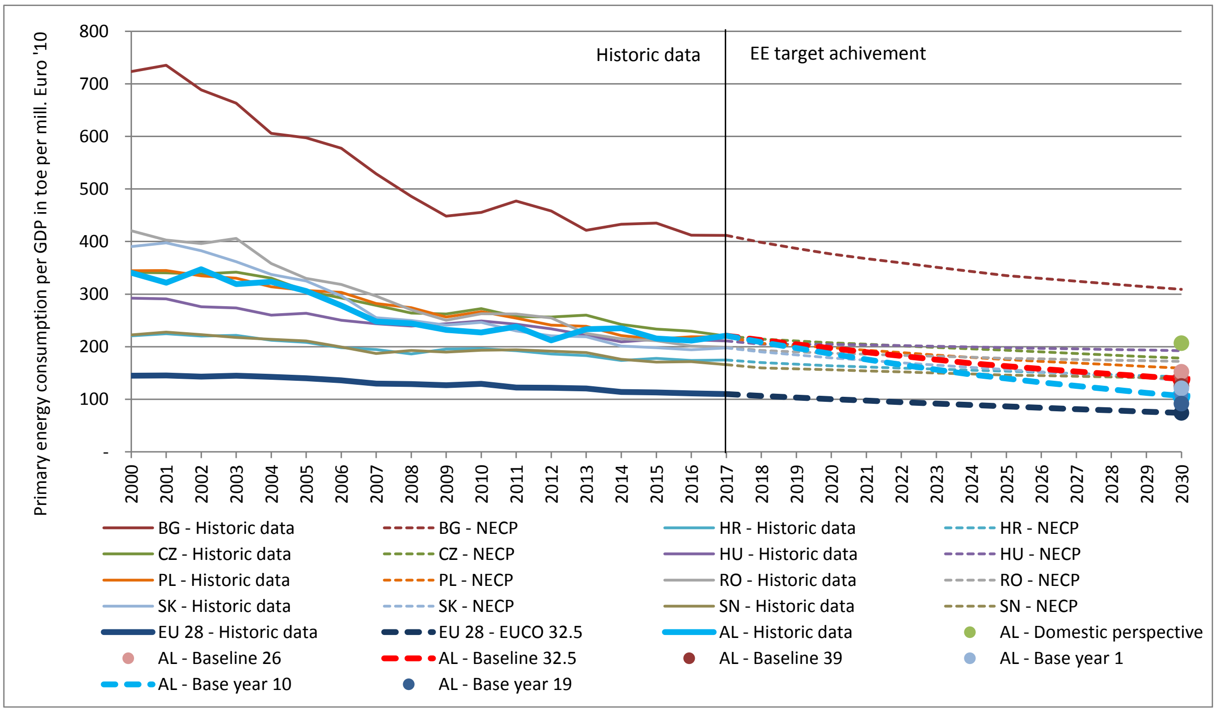


Figure 21: **Development of PEC/GDP in Albania compared to the EU 28 and selected MS. Source: Eurostat, 2019; IMF, 2019; NTUA, 2012, 2017.**

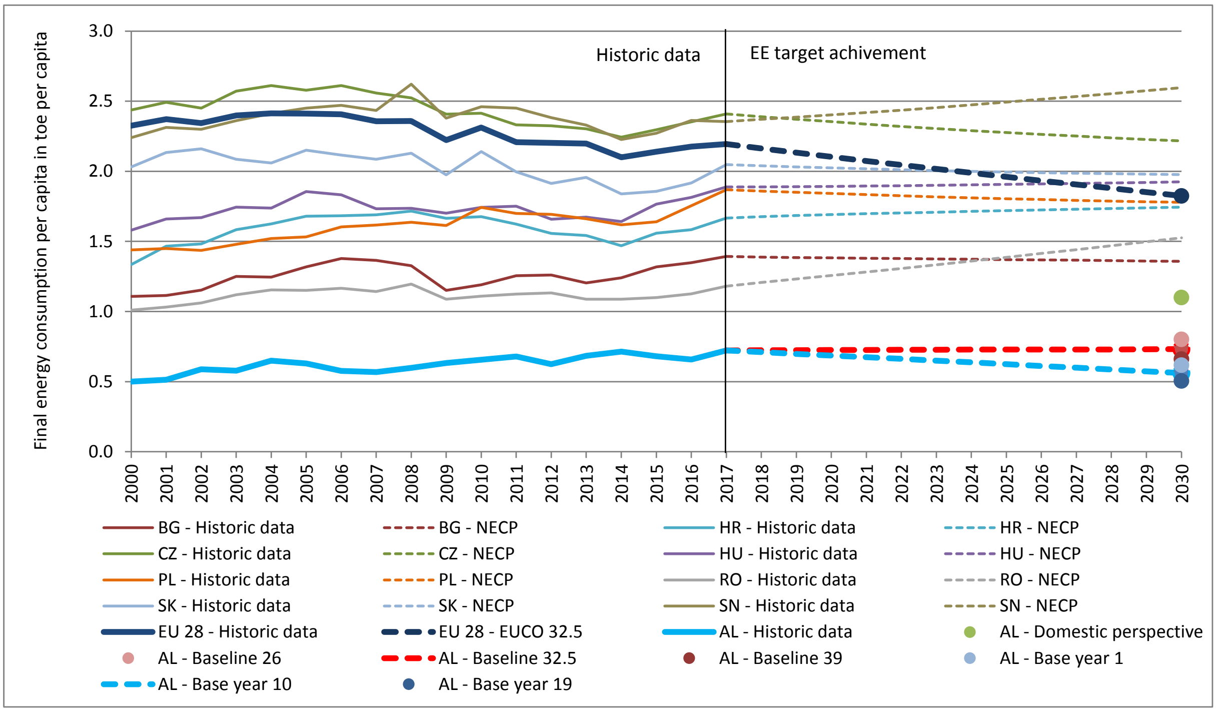


Figure 22: **Development of FEC/Capita in Albania compared to the EU 28 and selected MSs. Source: Euro-stat, 2019; IMF, 2019; NTUA, 2012, 2017.**

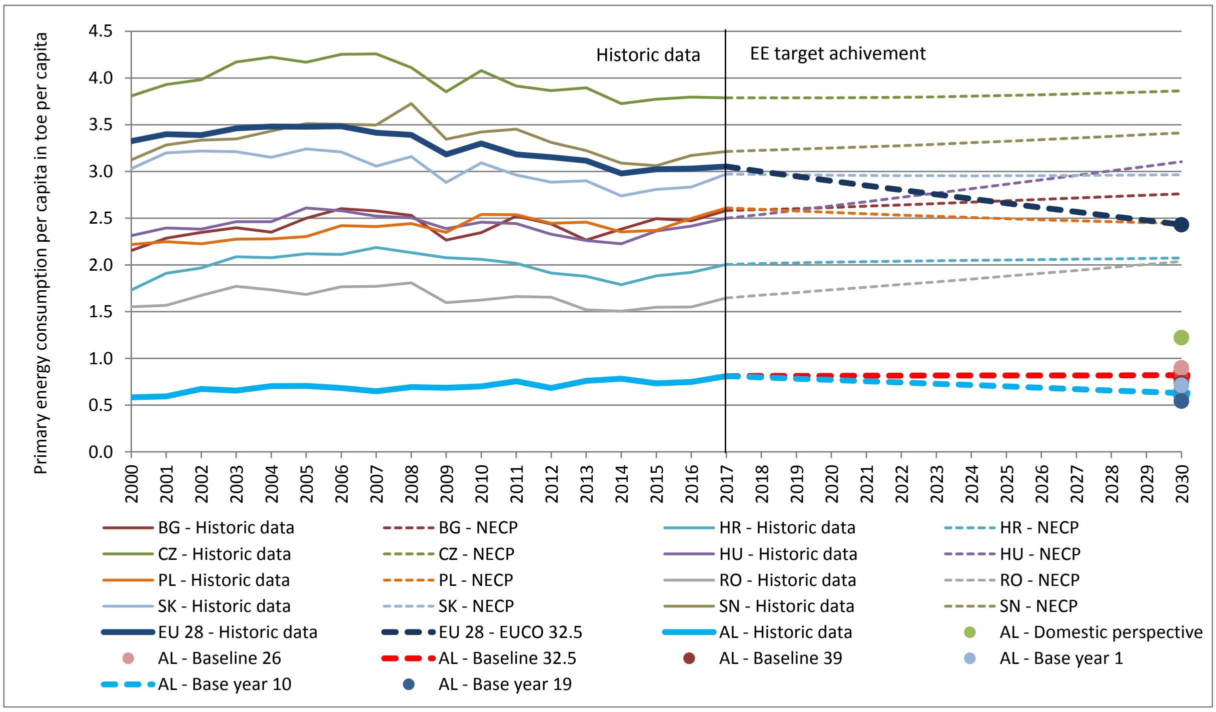


Figure 23: Development of PEC/Capita in Albania compared to the EU 28 and selected MS. Source: Eurostat, 2019; IMF, 2019; NTUA, 2012, 2017.

Figure 21 depicts the development of final energy per capita in absolute terms. A comparison between EU MSs and Albania shows that in absolute terms Albania has comparatively low per capita final energy consumption. In the Base year scenario (Base year 10), energy consumption per capita would have to further decrease until 2030 whereas in the Baseline scenario (Baseline 32.5), energy consumption per capita may stay constant until 2030.

Figure 22 indicates the development of primary energy per capita in absolute terms. A comparison between EU MSs and Albania shows that in absolute terms Albania has comparatively low per capita primary energy consumption. In the Base year scenario (Base year 10), energy consumption per capita would have to further decrease until 2030 whereas in the Baseline scenario (Baseline 32.5), energy consumption per capita may stay constant until 2030.

2.5.1.2 Advanced indicators to assess energy efficiency performance

Within this section we aim for further broadening the analysis, introducing advanced indicators that combine both aspects discussed above – i.e. the general socio-economic perspective together with the view on energy performance. By use of these advanced indicators, we indicate how the derived options for 2030 EE target setting match with historic trends and with EE targets in other countries or regions. The overall aim remains to assist in the identification of a target setting option that would lead to a comparable effort with the EE target set at EU level, while respecting difference in economic welfare.

Indicators on economic structure

The indicators on the economic structure should help putting the Albanian economic development in context to selected EU MSs. Figure 24 to Figure 27 show the development of the share of agriculture, manufacturing (as an important part of the industry sector), industry and services in % of GDP related to the GDP per capita showing historical values from 2000 to 2017 in Albania compared to the EU 28 and selected MSs.

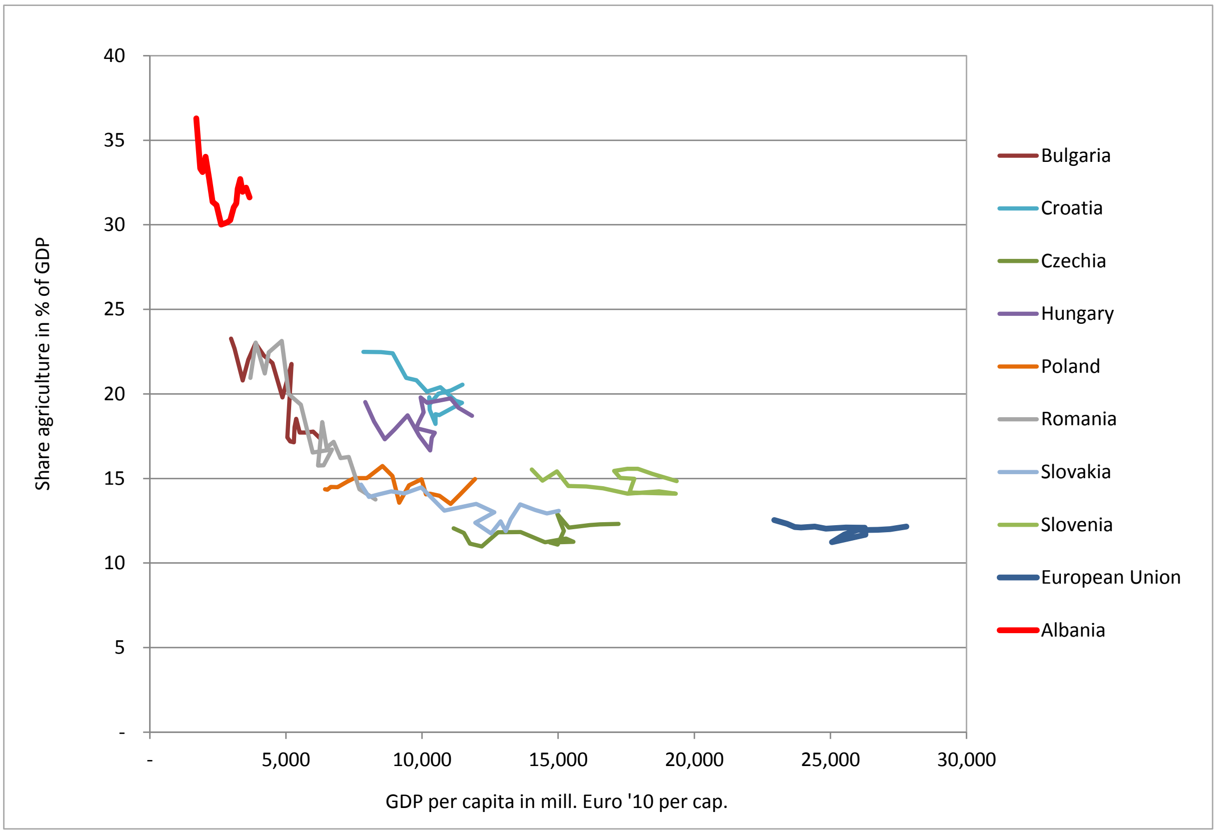


Figure 24: Development of the share of agriculture in % of GDP related to the GDP per capita showing historical values from 2000 to 2017 in Albania compared to the EU 28 and selected MSs. Source: Eurostat, 2019; IMF, 2019; Worldbank, 2019.

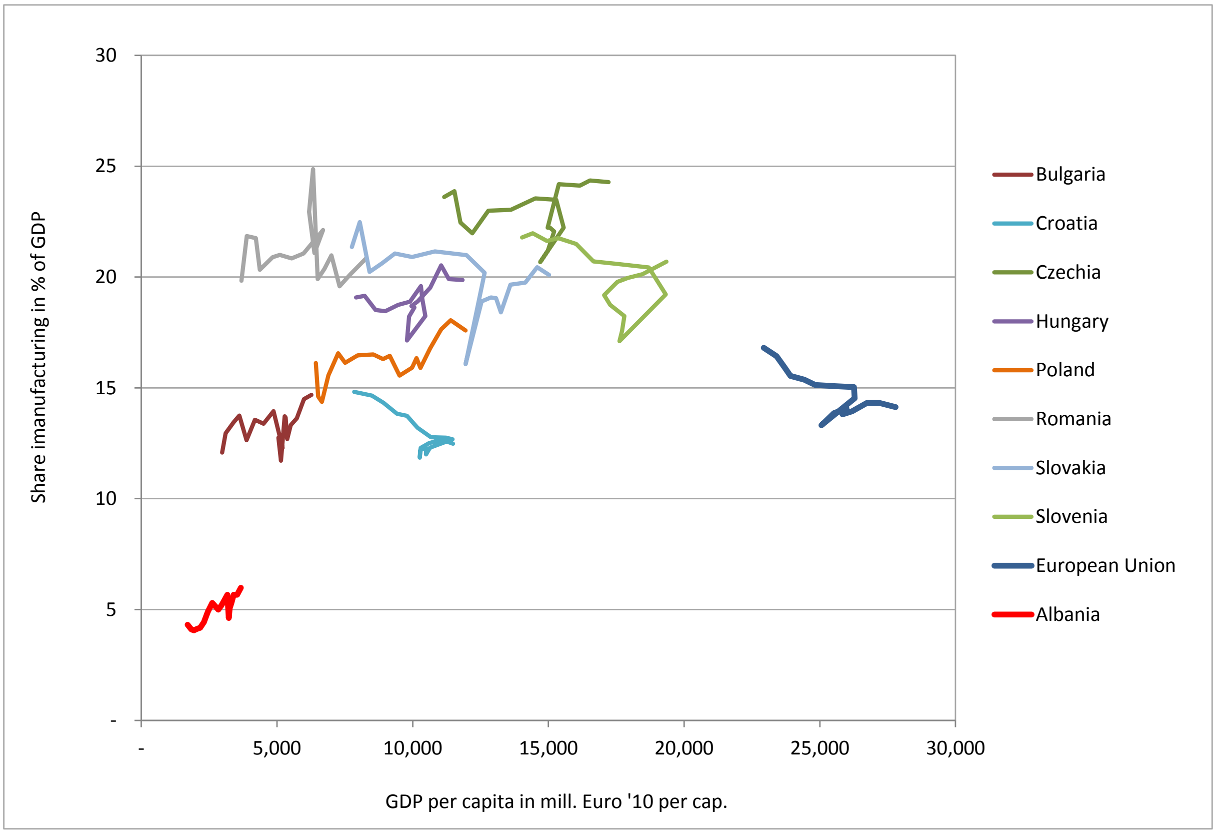


Figure 25: Development of the share of manufacturing in % of GDP related to the GDP per capita showing historical values from 2000 to 2017 in Albania compared to the EU 28 and selected MSs. Source: Eurostat, 2019; IMF, 2019; Worldbank, 2019.

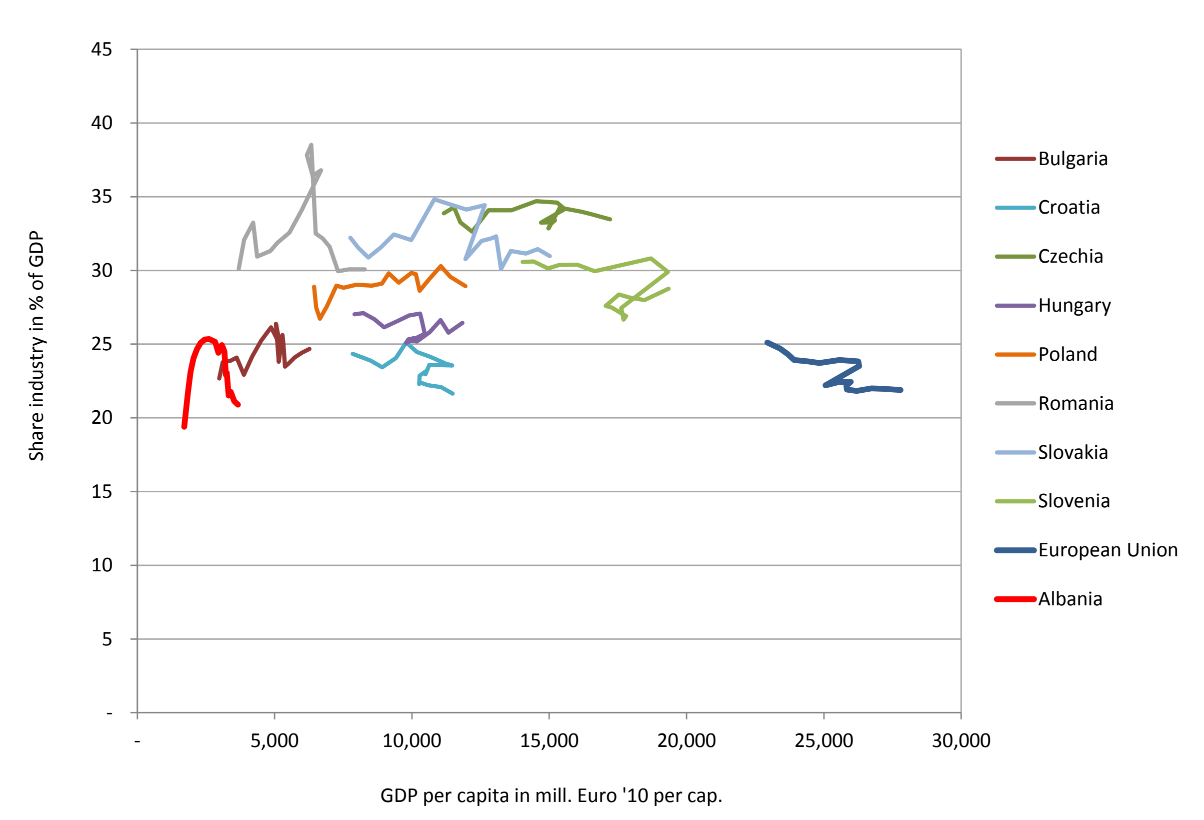


Figure 26: **Development of the share of industry in % of GDP related to the GDP per capita showing historical values from 2000 to 2017 in Albania compared to the EU 28 and selected MSs. Source: Eurostat, 2019; IMF, 2019; Worldbank, 2019.**

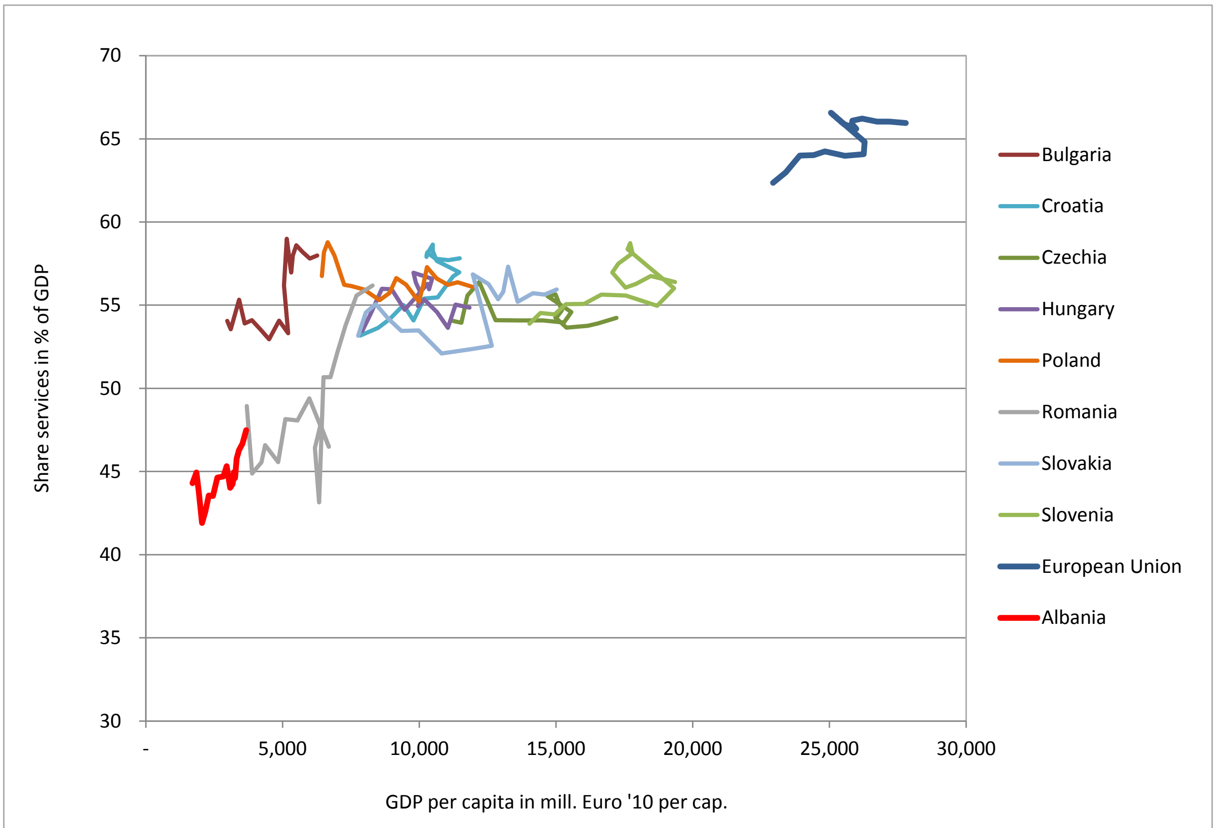


Figure 27: **Development of the share of services in % of GDP related to the GDP per capita showing historical values from 2000 to 2017 in Albania compared to the EU 28 and selected MSs. Source: Eurostat, 2019; IMF, 2019; Worldbank, 2019.**

Figure 24 depicts that the share of agriculture sector is as high as 31.6% expressed in % of GDP in 2017. This share is significantly higher as it was in Bulgaria in the year 2004 and Rumania in 2004 with a share of 23%. No other MSs in this comparison shows a share in % of GDP as high as in Albania. The opposite is true for the manufacturing sector, as can be seen in Figure 25. The share of manufacturing in GDP ranges between 4.1 and 6% for the given timespan. All MSs included in this comparison show shares in the historic records about twice as high and higher. The lowest share of any MS was Bulgaria, which had a sectoral share of 11.7% in the year 2010. The share of the industry sector overall is as well on the lower end in the comparison depicted in Figure 26. Bulgaria's share of industry and GDP per capita in 2001 was in a similar range as it was in Albania in 2013. The service sector in Albania grew steadily over the last 4 years, reaching 47.5% in % of GDP in 2017. This level can be compared to Romania in the year 2000 (see Figure 27). Overall Albania's economy is, compared to other EU MSs, to a significantly larger extent dominated by the agricultural sector.

Indicators on energy system

The advanced indicators shown below correlate the energy intensity and energy use per capita, both in terms of final energy and primary energy consumption, to the country's GDP per capita. Energy intensity acts as an indicator for energy efficiency. It is a measure of how efficient an economy uses energy. It is calculated as units of energy, in this case either final or primary, per unit of GDP. High energy intensities indicate a high price or cost of converting energy into GDP. Low energy intensity indicates a lower price or cost of converting energy into GDP. Mostly high energy intensity means high industrial output as portion of GDP. Countries with low energy intensity signify a labour intensive economy.

Figure 28 and Figure 29 below put final- and respectively primary energy consumption per GDP in relation to GDP per capita. This is shown in both figures for Albania, the EU28 and our suite of selected MSs, and by country we connect therein the different data points, referring to distinct years, with a coloured line. All seven proposed EE target setting options for 2030 for Albania are shown by circular dots using different colours – these dots are on a vertical line since all make use of the same GDP per capita projection.

A closer look at the latest statistical data for the historic record (2017) in Figure 28 shows that Albania is by far the least energy intensive countries with less than 200 toe of final energy use per million Euro of GDP in 2017. Figure 28 and Figure 29 show a very high correlation between, on the one hand, energy use per GDP and, on the other hand, GDP per capita. When moving to the right on the horizontal axis a reduction in energy intensity is observable among all assessed countries. This is however not only true for a cross-country comparison – the same trend pattern can be observed when comparing different points in time for a single country: Both figures show here in general terms a clear downward trend, meaning a decline of energy intensity that goes hand in hand with an increase of economic welfare. The development over time contains some irregularities for the historic record from 2000 to 2017. These variations are mostly caused by the economic recession during this time span. This recession hit different MSs and Albania with different severity. The projected future trend from 2017 to 2030, assuming the achievement of the national contribution set in draft NECP for the EU countries, shows again a strict downward-looking trend. This trend has a steeper slope for countries with higher energy intensities at present as they have a higher potential for EE measures, and also a higher potential for a structural shift to a more service-orientated economy.

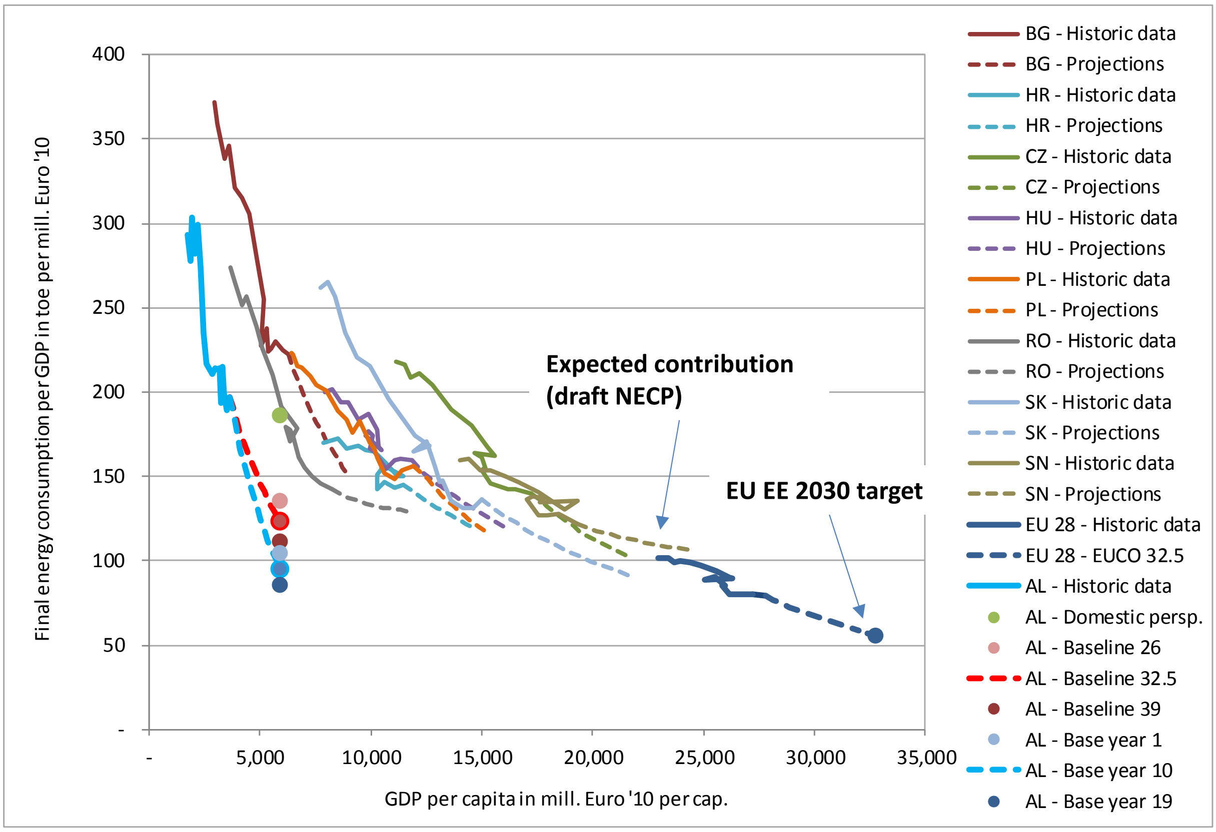


Figure 28: **The development of FEC per GDP related to the GDP per capita showing historical values from 2000 to 2017 and projections from 2018 to 2030 assuming an EE target achievement in Albania compared to the EU 28 and selected MSs. Source: Eurostat, 2019; IMF, 2019; NTUA, 2012, 2017.**

Table 6: **Qualitative assessment of all EE target setting options concerning FEC per GDP (Albania)**

Indicator	Domestic	Baseline 26	Baseline 32.5	Baseline 39	Base year 1	Base year 10	Base year 19
FEC per GDP	Intermediate (ambition)	Reasonable		Intermediate (constraining)		Too constraining	

Concerning the assessed EE target setting options the following observations based on the analysis of the indicators illustrated in Figure 28 and Figure 29 appear of relevance:

- Base year 1, 10 and 19 and Baseline 39 appear to imply a quite strict pathway for the next decade, as the data point for 2030 would be out of, or more precisely, below the EU28 spectrum, while accounting for the lower energy intensity of Albania's economic structure.
- Baseline 26 and 32.5 seems to identify a reasonable level of ambition, when accounting for the lower energy intensity of Albania's economic structure.
- The approach based on national scenario is lacking in ambition

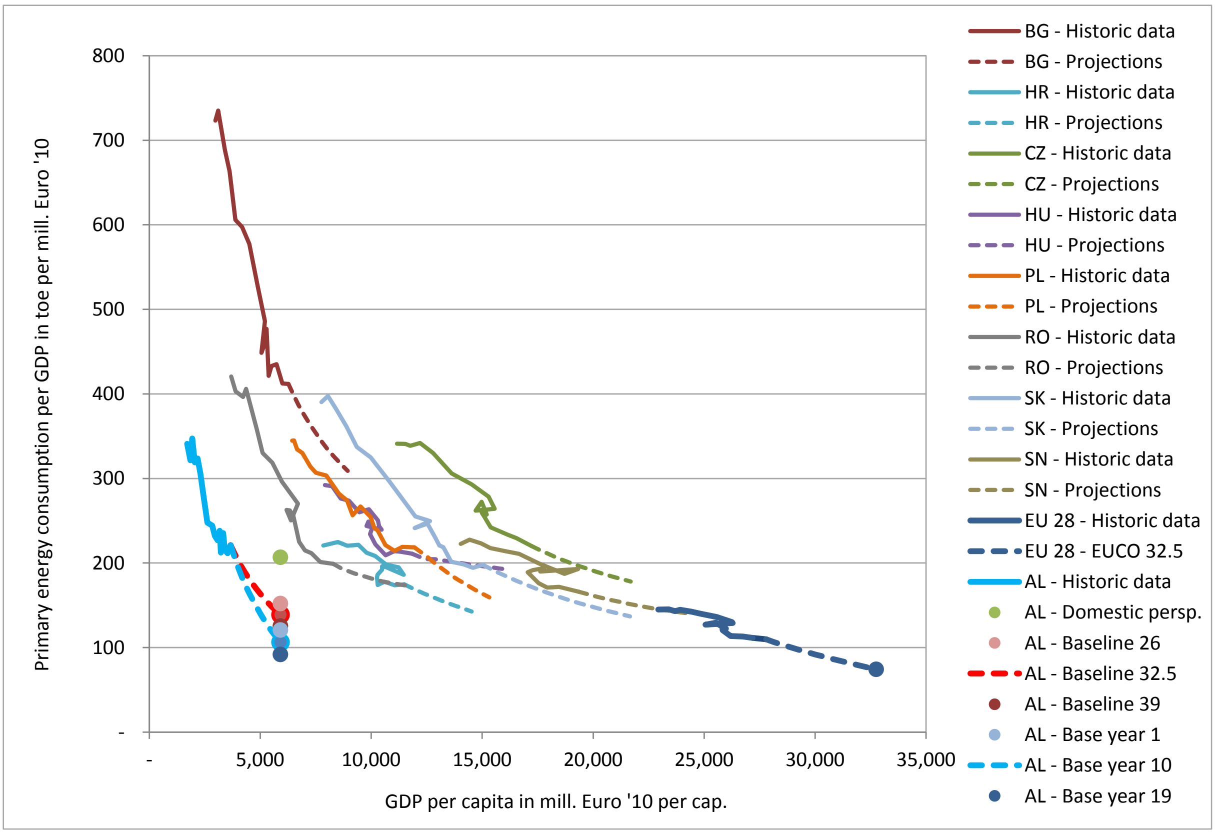


Figure 29: **The development of PEC per GDP related to the GDP per capita showing historical values from 2000 to 2017 and projections from 2018 to 2030 in Albania, the EU 28 and selected EU MSs. Source: Eurostat, 2019; IMF, 2019; NTUA, 2012, 2017.**

Table 7: **Qualitative assessment of all EE target setting options concerning PEC per GDP (Albania)**

Indicator	Domestic	Baseline 26	Baseline 32.5	Baseline 39	Base year 1	Base year 10	Base year 19
PEC per GDP							

Figure 30 and Figure 31 below put final and primary energy consumption per capita in relation to GDP per capita. The graphs include trend data for Albania, the EU28 and our suite of selected MSs, and, similar to above, we connect therein for a single country the different data points, referring to distinct years, with a coloured line. Again, all seven proposed EE target setting options for 2030 for Albania are shown by circular dots using different colours – these dots are on a vertical line since all make use of the same GDP per capita projection.

In contrast to the previous figures, the trend pattern expressed in these graphs is much harder to interpret. The overall correlation is lower (compared to energy consumption per GDP) both for the historic development and for projections towards 2030.

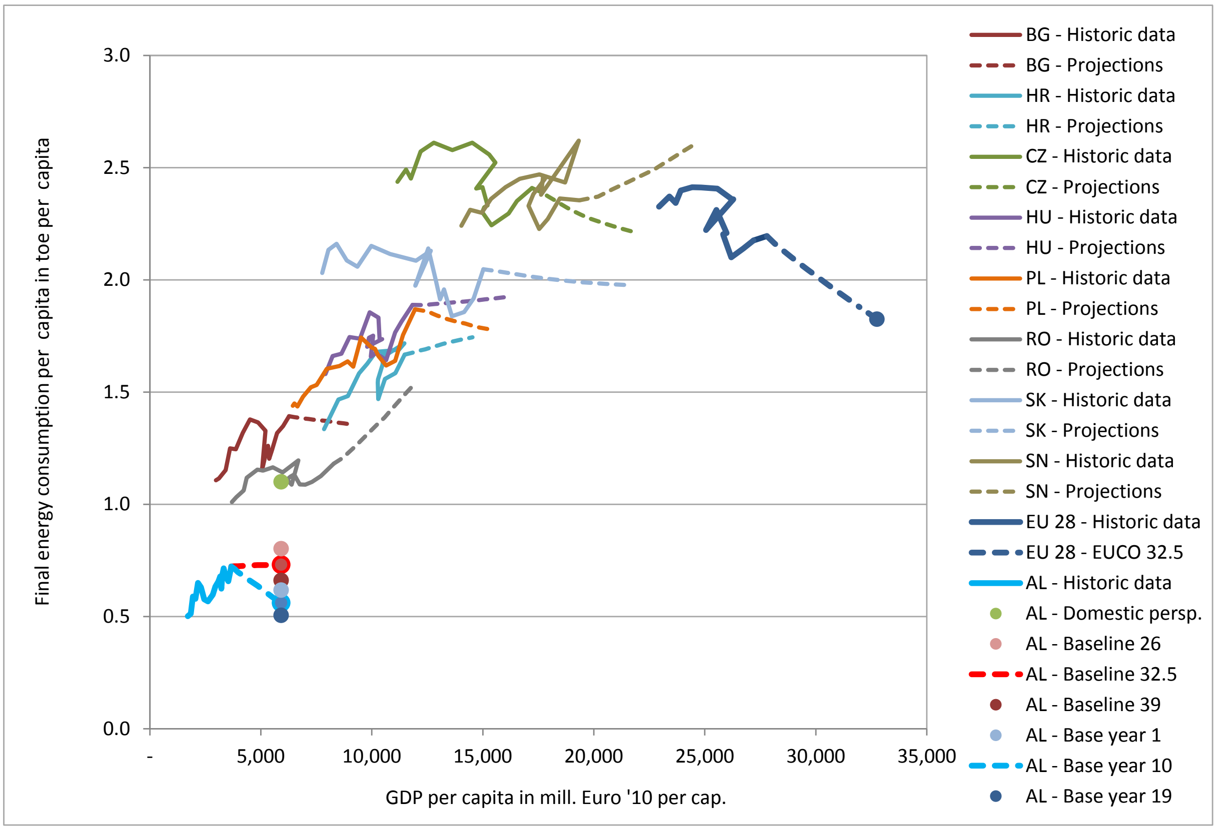


Figure 30: The development of FEC per capita related to the GDP per capita showing historical values from 2000 to 2017 and projections from 2018 to 2030 assuming an EE target achievement in Albania compared to the EU 28 and selected MSs. Source: Eurostat, 2019; IMF, 2019; NTUA, 2012, 2017

Table 8: Qualitative assessment of all EE target setting options concerning FEC per capita (Albania)

Indicator	Domestic	Baseline 26	Baseline 32.5	Baseline 39	Base year 1	Base year 10	Base year 19
FEC per capita							

The following observations based on Figure 30 and Figure 31 appear of relevance with respect to the analysed EE target setting options:

- Base year 1, 10 and 19 as well as Baseline 32.5 and 39 appear rather strict.
- Only the Baseline 26 target appears reasonable, as it still allows for growing energy consumption per capita, which is currently very low compared to EU MSs
- The low per capita energy consumption is a consequence of the present economic structure
- The domestic perspective seems to be lacking in ambition, as it would mean a very rapid growth per capita energy consumption, which appears rather unrealistic when compared to past trends.

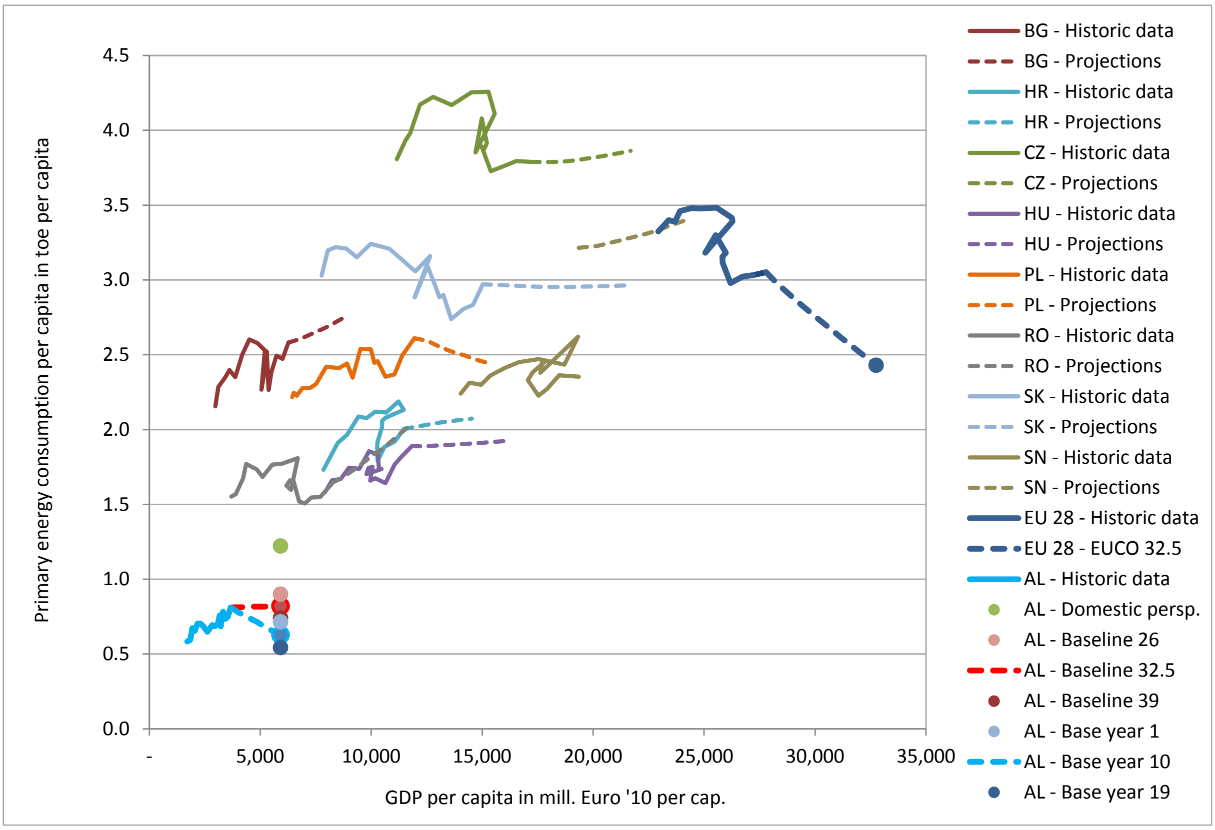


Figure 31: The development of PEC per capita related to the GDP per capita showing historical values from 2000 to 2017 and projections from 2018 to 2030 assuming an EE target achievement in Albania compared to the EU 28 and selected MSs. Source: Eurostat, 2019; IMF, 2019; NTUA, 2012, 2017.

Table 9: Qualitative assessment of all EE target setting options concerning PEC per capita (Albania)

Indicator	Domestic	Baseline 26	Baseline 32.5	Baseline 39	Base year 1	Base year 10	Base year 19
PEC per capita							

2.5.1.3 Summary & Conclusions for Energy Efficiency Targets of Albania

Table 10: Summary table for the qualitative assessment of all EE target setting options (Albania)

Indicator	Domestic	Baseline 26	Baseline 32.5	Baseline 39	Base year 1	Base year 10	Base year 19
FEC per GDP	Intermediate (ambition)	Reasonable		Intermediate (constraining)			Too constraining
PEC per GDP							
FEC per capita							
PEC per capita							

Table 10 summarizes the assessment of all seven EE target setting options done in subchapter 02.5.1. It shows that the Baseline 26 and partly Baseline 32.5 approach come to the most reasonable EE targets for 2030. These scenarios stay within the range of comparable efforts. This is based on a comparison with EU MSs which show the most similarities when compared to Albania in regards to their economic structure

2.5.2 Resulting Energy Efficiency Targets for Bosnia & Herzegovina

The results for calculated EE targets are presented in Table 11 in terms of final energy demand and in Table 12 in Terms of primary energy demand. The absolute consumption caps for 2030 are shown in Figure 32. A closer look at the evolution over time of final energy demand according to the various target setting options is then shown in Figure 138. The corresponding illustration in terms of primary energy is shown in Figure 34.

Table 11: EE targets in terms of final energy for Bosnia and Herzegovina for different scenarios

EE targets for Bosnia and Herzegovina in terms of final energy consumption	Historic data for 2008 [ktoe]	Historic data for 2017 [ktoe]	Baseline III in 2030 [ktoe]	Consumption cap in 2030 [ktoe]	Change compared to 2008	Change compared to 2017	Change compared to Baseline III in 2030
Domestic perspective	3,347	3,674	5,578	4,744	+41.7%	+29.1%	-14.9%
Base year 1	3,347	3,674	5,578	3,314	**-1%**	-9.8%	-40.6%
Base year 10	3,347	3,674	5,578	3,012	**-10%**	-18%	-46%
Base year 19	3,347	3,674	5,578	2,711	**-19%**	-26.2%	-51.4%
Baseline 26	3,347	3,674	5,578	4,128	+23.3%	+12.3%	**-26%**
Baseline 32.5	3,347	3,674	5,578	3,765	+12.5%	+2.5%	**-32.5%**
Baseline 39	3,347	3,674	5,578	3,403	+1.7%	-7.4%	**-39%**

Table 12: EE targets in terms of primary energy for Bosnia and Herzegovina for different scenarios

EE targets for Bosnia and Herzegovina in terms of primary energy consumption	Historic data for 2008 [ktoe]	Historic data for 2017 [ktoe]	Baseline III in 2030 [ktoe]	Consumption cap in 2030 [ktoe]	Change compared to 2008	Change compared to 2017	Change compared to Baseline III in 2030
Domestic perspective	5,962	6,691	9,126	7,500	+25.8%	+12.1%	-17.8%
Base year 1	5,962	6,691	9,126	5,883	**-1.3%**	-12.1%	-35.5%
Base year 10	5,962	6,691	9,126	5,178	**-13.1%**	-22.6%	-43.3%
Base year 19	5,962	6,691	9,126	4,473	**-25%**	-33.2%	-51%
Baseline 26	5,962	6,691	9,126	6,753	+13.3%	+0.9%	**-26%**
Baseline 32.5	5,962	6,691	9,126	6,160	+3.3%	-7.9%	**-32.5%**
Baseline 39	5,962	6,691	9,126	5,567	-6.6%	-16.8%	**-39%**

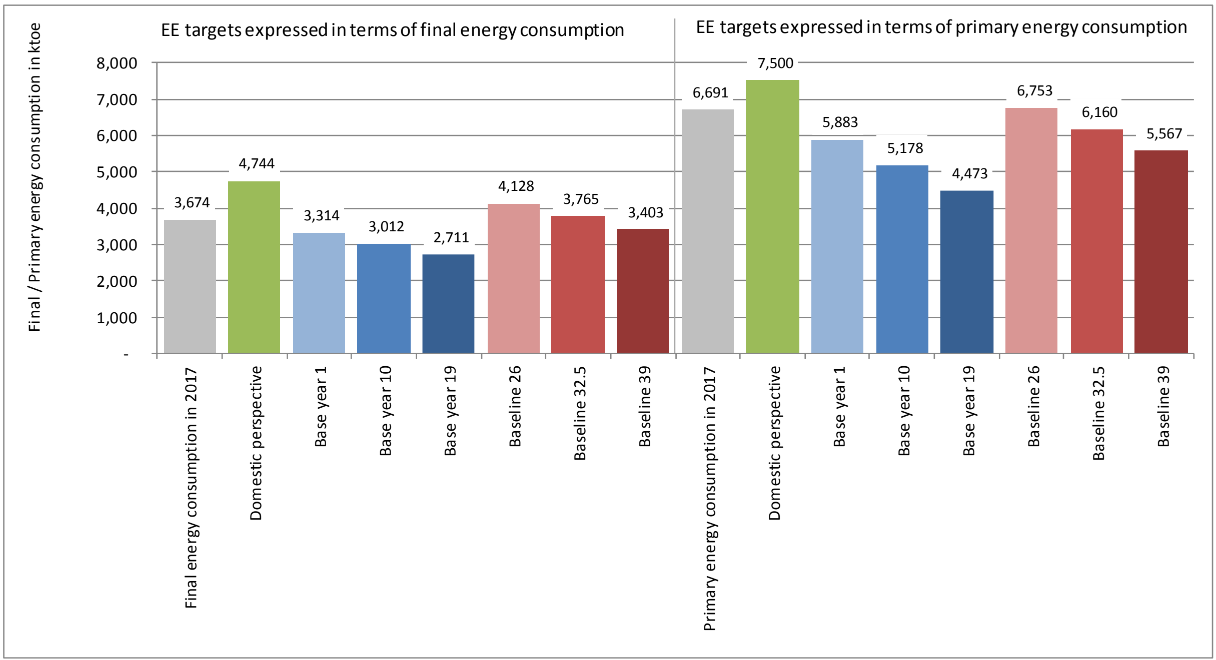


Figure 32: **Energy efficiency targets in terms of primary and final energy for different scenarios. Baseline vs. Base year approach vs. Domestic perspective**

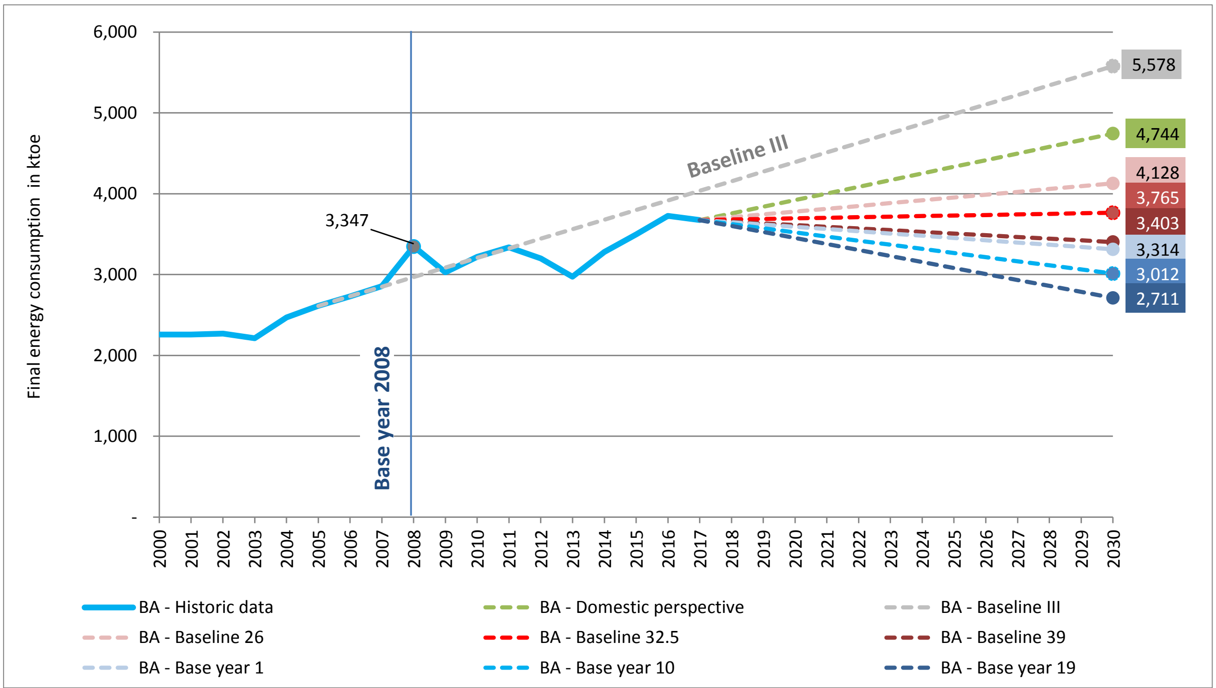


Figure 33: **Energy Efficiency targets in terms of final energy for different scenarios. Baseline compared to Base year approach vs. Domestic perspective**

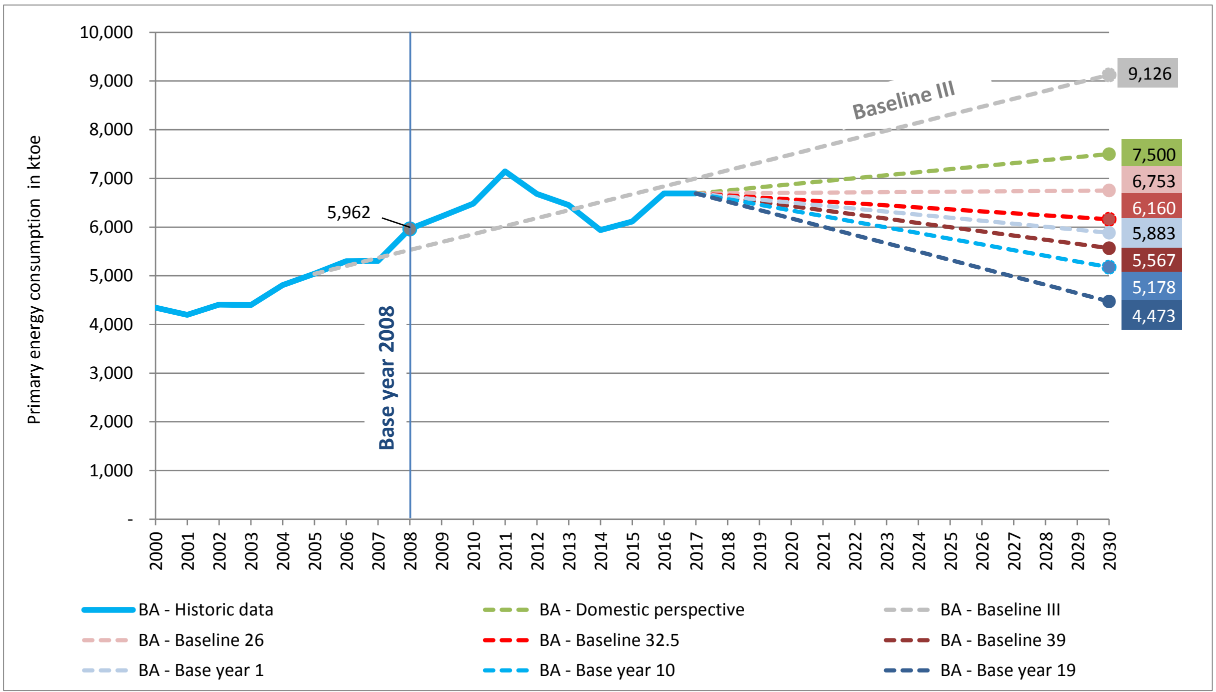


Figure 34: Energy efficiency targets in terms of primary energy for different scenarios. Baseline compared to Base year approach vs. Domestic perspective

2.5.2.1 Indicators for analysing energy performance

In 2017, final energy consumption per GDP was about 250 toe/mill. Euro ’10 in Bosnia and Herzegovina (see Figure 35). Under both considered EE target setting options, energy consumption per GDP will drop significantly until 2030 – i.e. to about 173 toe/mill. Euro '10 under the expressed Baseline variant (i.e. Baseline 32.5) and to about 139 toe/mill. Euro '10 according to the indicated base year option (i.e. Base year 10).

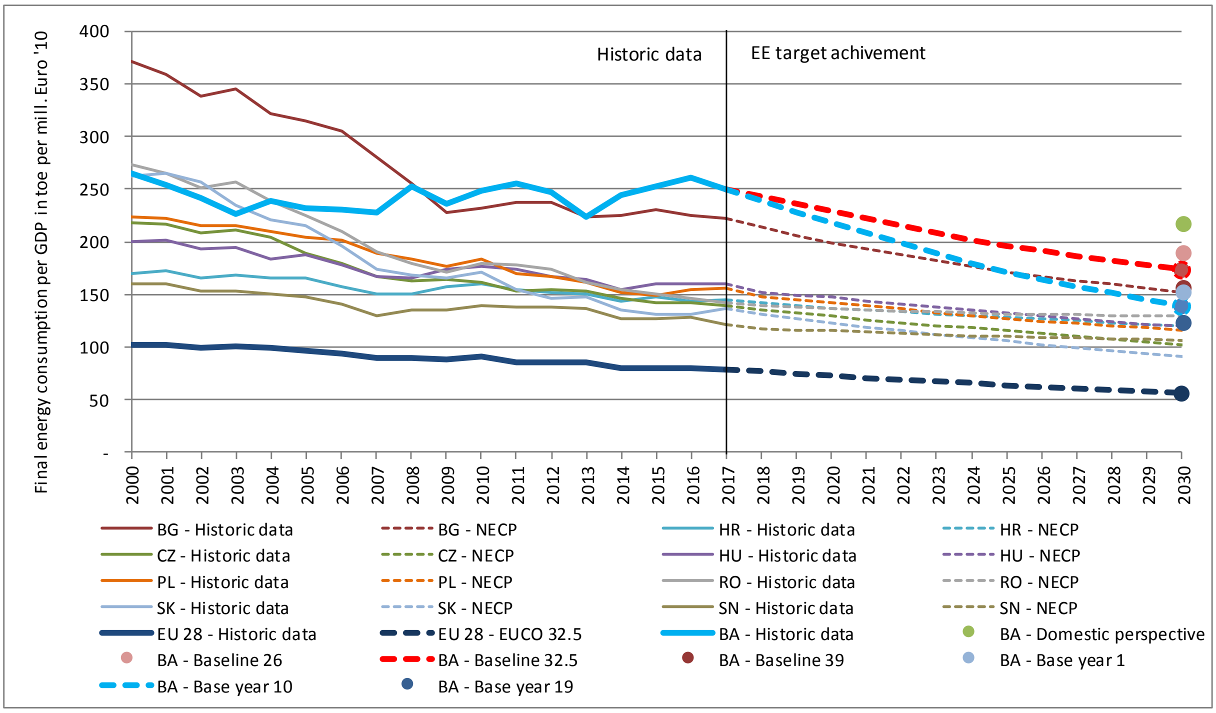


Figure 35: Development of FEC/GDP in Bosnia and Herzegovina compared to the EU 28 and selected MS. Source: Eurostat, 2019; IMF, 2019; NTUA, 2012, 2017.

Primary energy consumption per GDP was about 455 toe/mill. Euro ’10 in Bosnia and Herzegovina (see Figure 36) in 2017. Under both considered EE target setting options, energy consumption per GDP will drop significantly until 2030 – i.e. to about 283 toe/mill. Euro '10 under the expressed Baseline variant (i.e. Baseline 32.5) and to about 238 toe/mill. Euro '10 according to the indicated base year option (i.e. Base year 10).

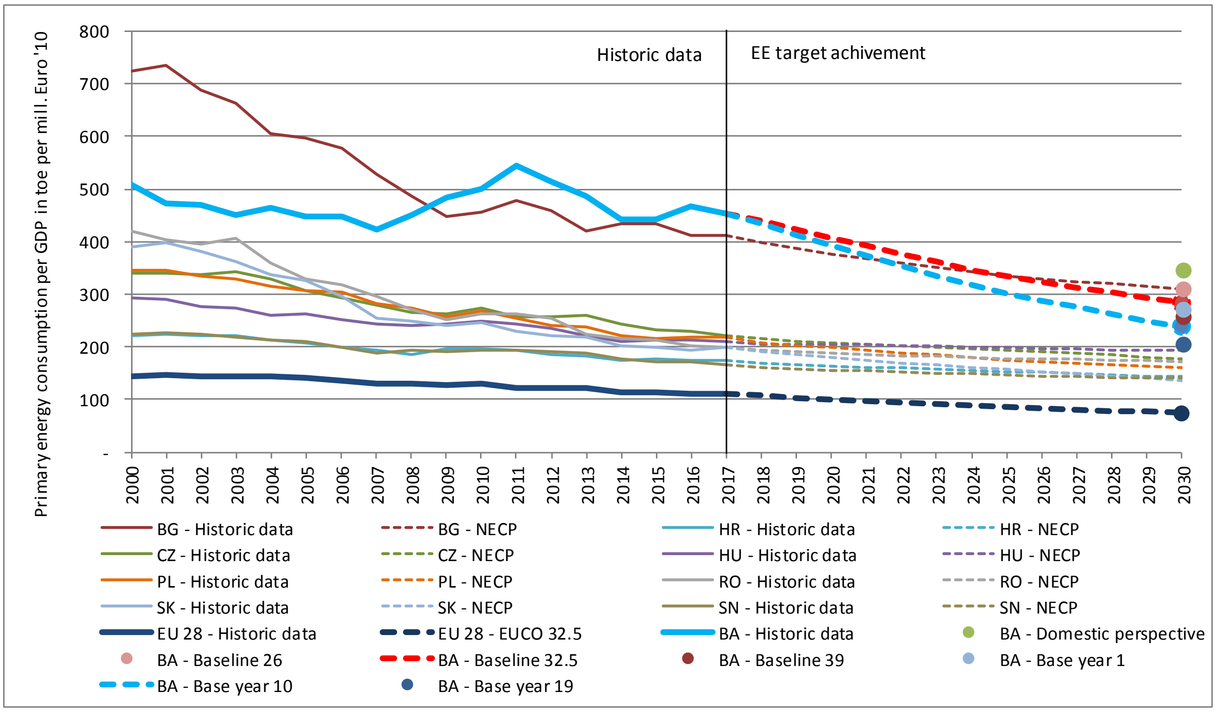


Figure 36: Development of PEC/GDP in Bosnia and Herzegovina compared to the EU 28 and selected MS. Source: Eurostat, 2019; IMF, 2019; NTUA, 2012, 2017.

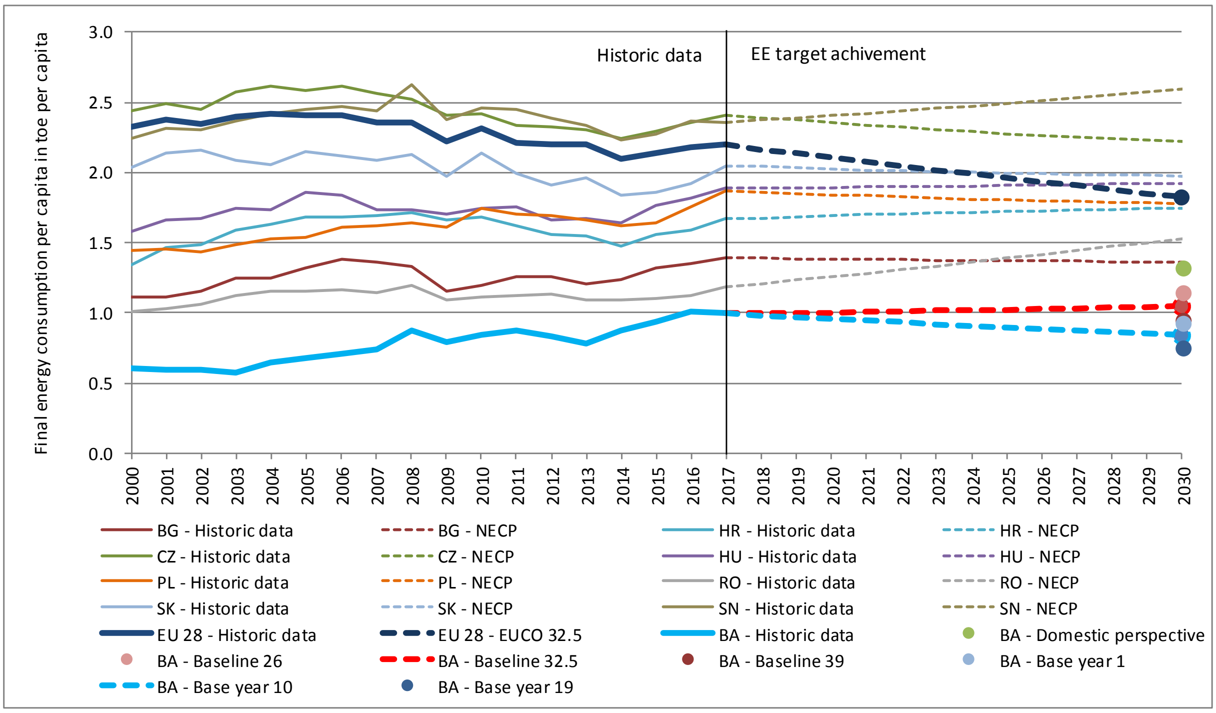


Figure 37: Development of FEC/Capita in Bosnia and Herzegovina compared to the EU 28 and selected MSs. Source: Euro-stat, 2019; IMF, 2019; NTUA, 2012, 2017.

Figure 37 depicts the development of final energy consumption per capita for Bosnia and Herzegovina according to assessed EE target setting options. Complementary to that, Figure 38 indicates the development of primary energy consumption per capita. In the considered Base year scenario (Base year 10), energy consumption per capita would have to decline stronger until 2030 whereas in the expressed Baseline scenario (Baseline 32.5), energy consumption per capita may stay constant until then

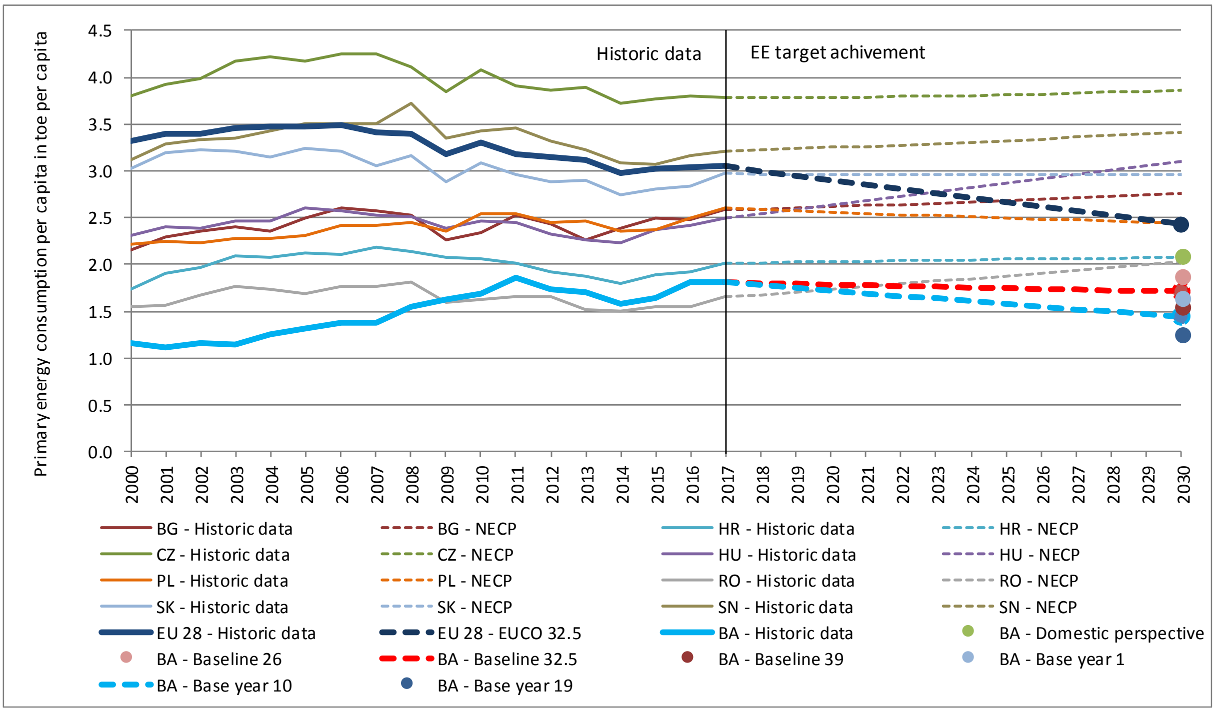


Figure 38: **Development of PEC/Capita in Bosnia and Herzegovina compared to the EU 28 and selected MS. Source: Eurostat, 2019; IMF, 2019; NTUA, 2012, 2017.**

2.5.2.2 Advanced indicators to assess energy efficiency performance

Indicators on economic structure

In a first step, indicators on the economic structure should put the Bosnia and Herzegovina economic development in context to selected EU MSs. Figure 39 to Figure 42 show the development of the share of agriculture, manufacturing (as an important part of the industry sector), industry and services in % of GDP related to the GDP per capita showing historical values from 2000 to 2017 in Bosnia and Herzegovina compared to the EU 28 and selected MSs.

Figure 39 depicts that the share of agriculture sector is as high as 23.6 expressed in % of GDP in 2017. This share is about as high as it was in Bulgaria in the year 2007 and Rumania in 2005. The share of manufacturing (cf. Figure 40) grew constantly for the last 10 years, reaching Bulgaria's share of manufacturing of 2005 in 2017. Bosnia and Herzegovina is mirroring Bulgaria's share of industry and GDP per capita of 2004 and 2005 in 2016 and 2017 respectively (cf. Figure 41). With a share of about 56% of GDP the size of its service sector is very comparable with other EU MSs (see Figure 42).

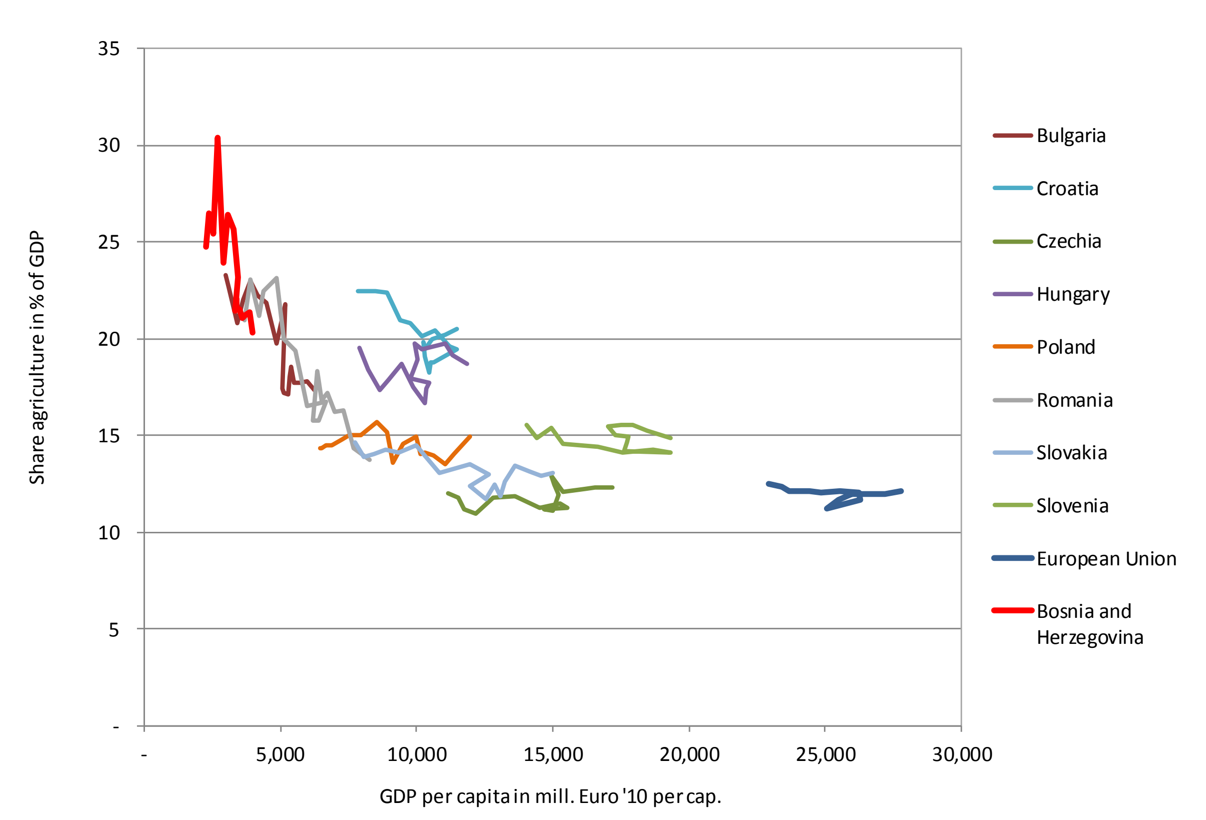


Figure 39: Development of the share of agriculture in % of GDP related to the GDP per capita showing historical values from 2000 to 2017 in Bosnia and Herzegovina compared to the EU 28 and selected MSs. Source: Eurostat, 2019; IMF, 2019; Worldbank, 2019;

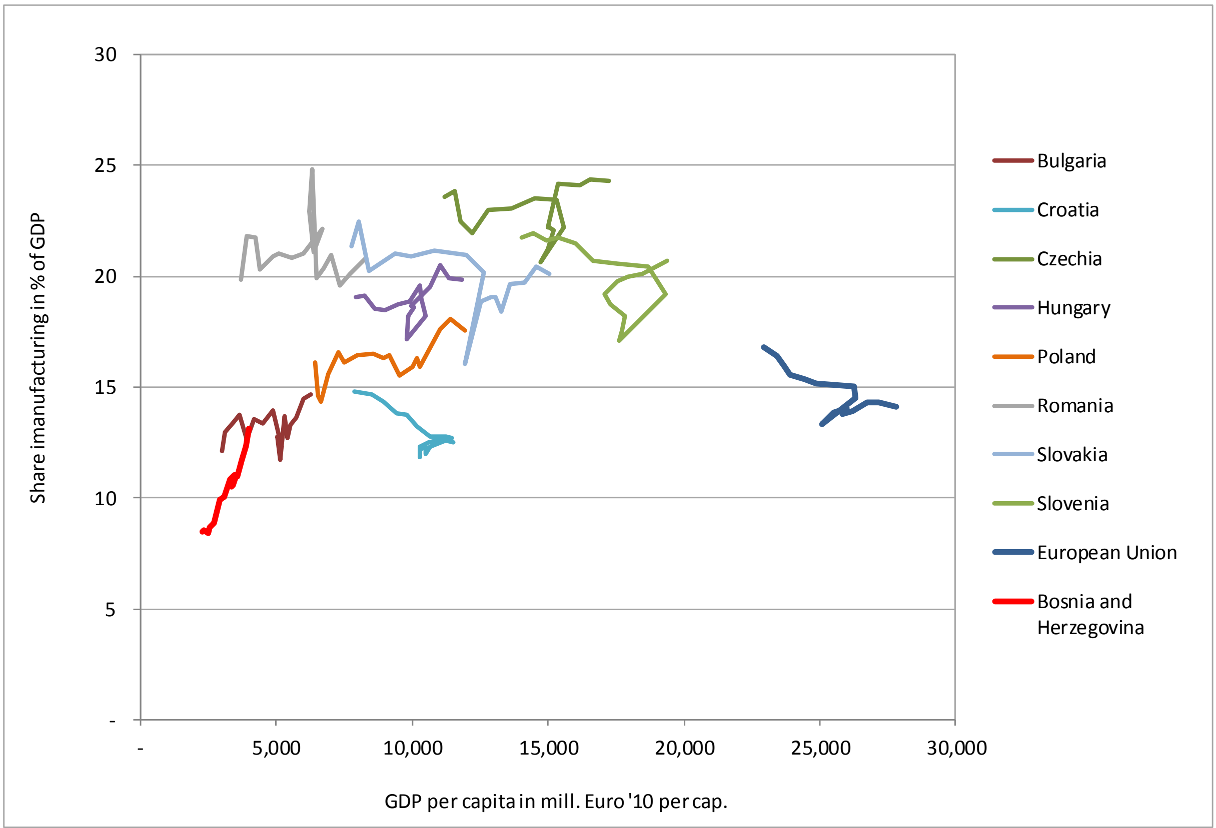


Figure 40: Development of the share of manufacturing in % of GDP related to the GDP per capita showing historical values from 2000 to 2017 in Bosnia and Herzegovina compared to the EU 28 and selected MSs. Source: Eurostat, 2019; IMF, 2019; Worldbank, 2019;

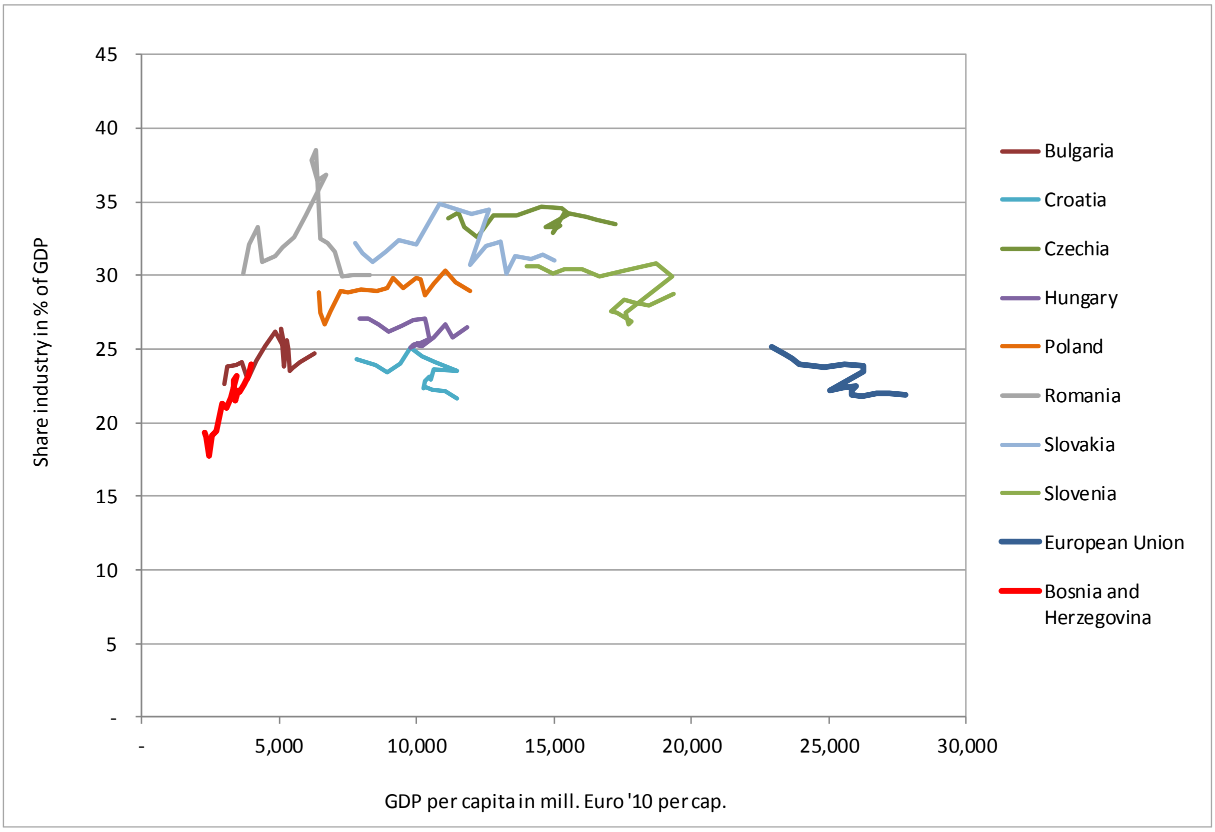


Figure 41: Development of the share of industry in % of GDP related to the GDP per capita showing historical values from 2000 to 2017 in Bosnia and Herzegovina compared to the EU 28 and selected MSs. Source: Eurostat, 2019; IMF, 2019; Worldbank, 2019;

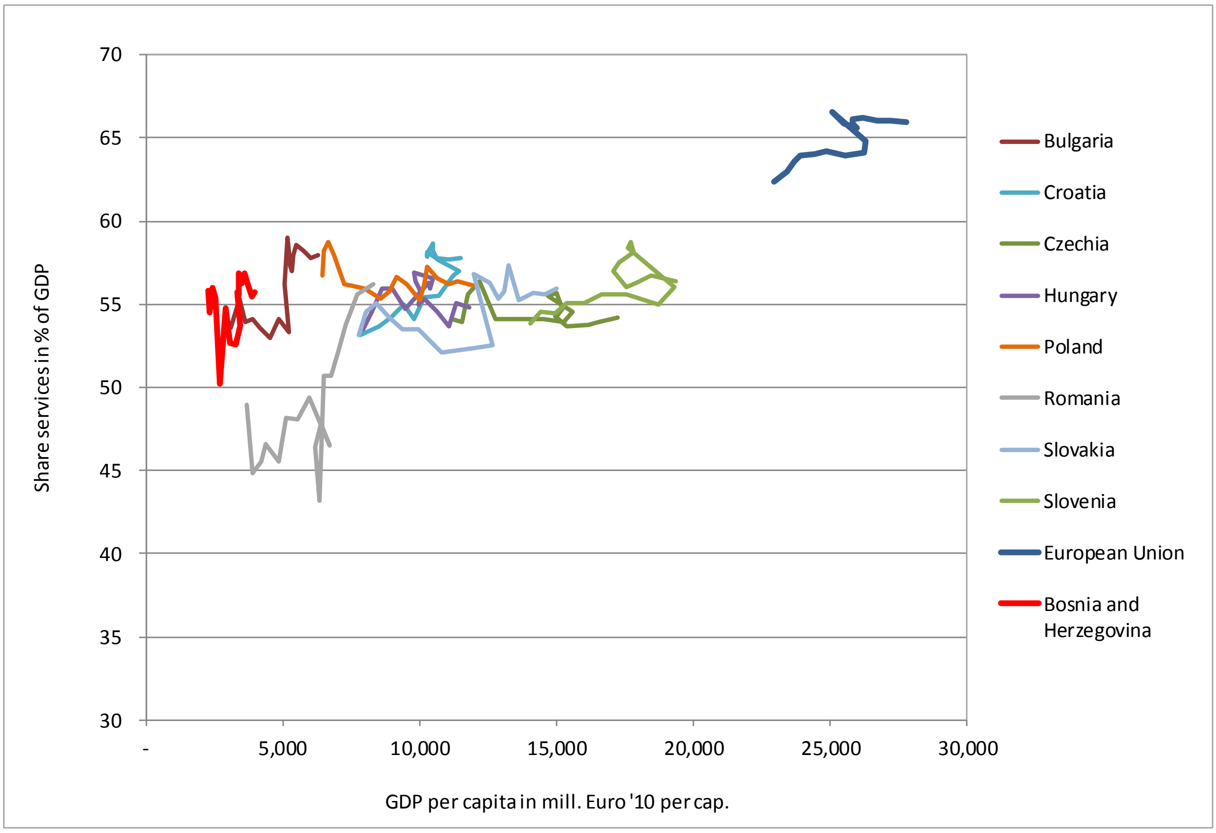


Figure 42: Development of the share of services in % of GDP related to the GDP per capita showing historical values from 2000 to 2017 in Bosnia and Herzegovina compared to the EU 28 and selected MSs. Source: Eurostat, 2019; IMF, 2019; Worldbank, 2019;

Indicators on energy system

Figure 43 and Figure 44 below put final and respectively primary energy consumption per GDP in relation to GDP per capita. This is shown in both figures for Bosnia and Herzegovina, the EU28 and our suite of selected MSs, and by country we connect therein the different data points, referring to distinct years, with a coloured line. All seven proposed EE target setting options for 2030 for Bosnia and Herzegovina are shown by circular dots using different colours – these dots are on a vertical line since all make use of the same GDP per capita projection.

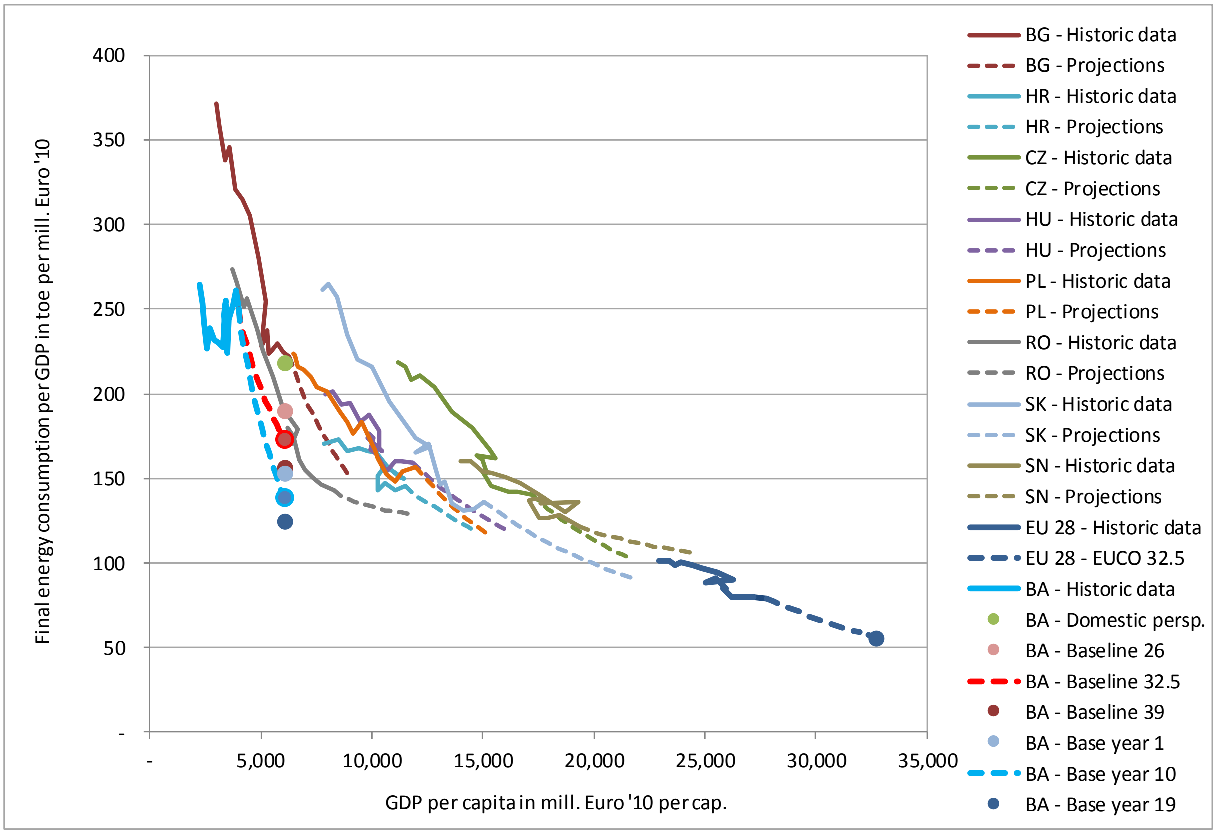


Figure 43: **The development of FEC per GDP related to the GDP per capita showing historical values from 2000 to 2017 and projections from 2018 to 2030 assuming an EE target achievement in Bosnia and Herzegovina compared to the EU 28 and selected MSs. Source: Eurostat, 2019; IMF, 2019; NTUA, 2012, 2017.**

Table 13: **Qualitative assessment of all EE target setting options concerning FEC per GDP (Bosnia and Herzegovina)**

Indicator	Domestic	Baseline 26	Baseline 32.5	Baseline 39	Base year 1	Base year 10	Base year 19
FEC per GDP	Intermediate (ambition)		Reasonable	Intermediate (constraining)		Too constraining	

A closer look at the latest statistical data for the historic record (up to 2017) in Figure 43 shows that Bosnia and Herzegovina is missing a clear downward trend in its final energy intensity of GDP with a rising GDP per capita (see Figure 43). This negative correlation is as also missing when looking at its primary energy intensity of GDP (Figure 44).

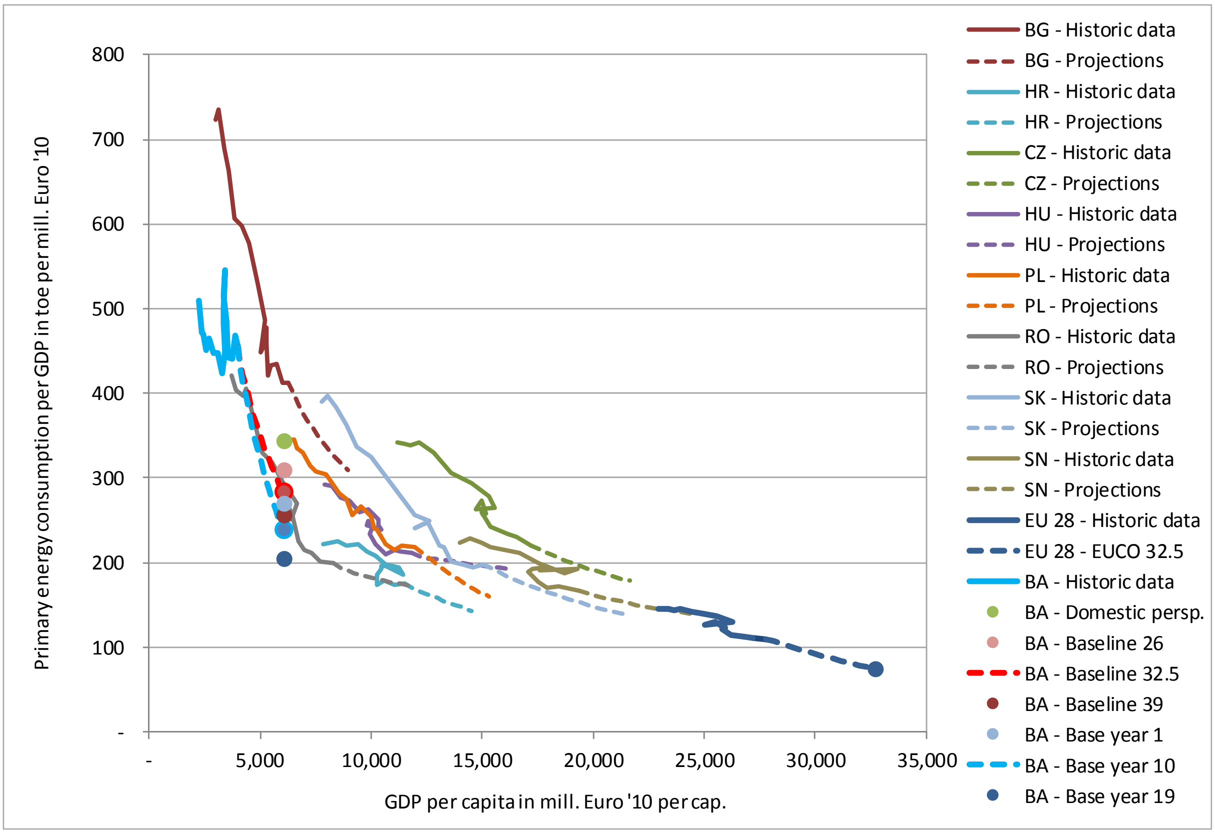


Figure 44: **The development of PEC per GDP related to the GDP per capita showing historical values from 2000 to 2017 and projections from 2018 to 2030 in Bosnia and Herzegovina , the EU 28 and selected EU MSs. Source: Eurostat, 2019; IMF, 2019; NTUA, 2012, 2017.**

Table 14: **Qualitative assessment of all EE target setting options concerning PEC per GDP (Bosnia and Herzegovina)**

Indicator	Domestic	Baseline 26	Baseline 32.5	Baseline 39	Base year 1	Base year 10	Base year 19
PEC per GDP							

Figure 45 and Figure 46 below put final and respectively primary energy consumption per capita in relation to GDP per capita. The graphs include trend data for Bosnia and Herzegovina, the EU28 and our suite of selected MSs, and, similar to above, we connect therein for a single country the different data points, referring to distinct years, with a coloured line. Again, all seven proposed EE target setting options for 2030 for Bosnia and Herzegovina are shown by circular dots using different colours – these dots are on a vertical line since all make use of the same GDP per capita projection.

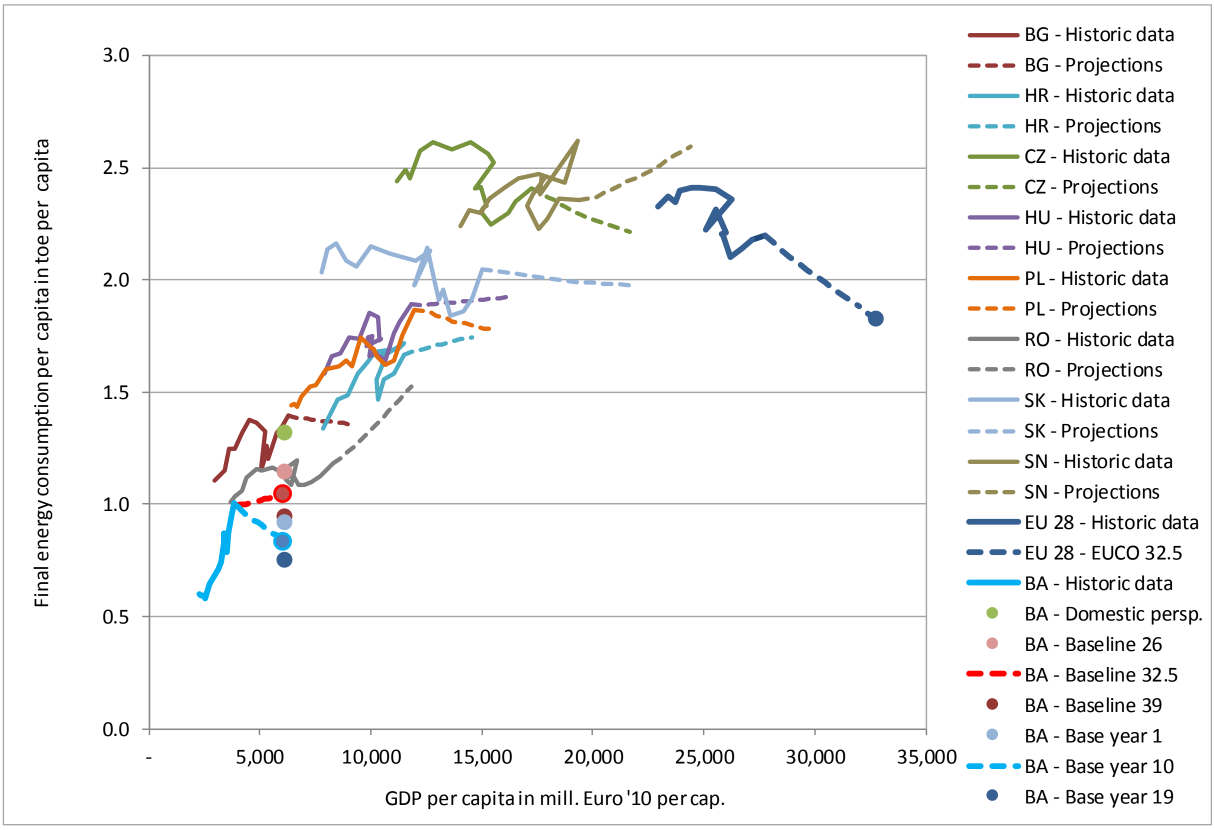


Figure 45: **The development of FEC per capita related to the GDP per capita showing historical values from 2000 to 2017 and projections from 2018 to 2030 assuming an EE target achievement in Bosnia and Herzegovina compared to the EU 28 and selected MSs. Source: Eurostat, 2019; IMF, 2019; NTUA, 2012, 2017**

Table 15: **Qualitative assessment of all EE target setting options concerning FEC per capita (Bosnia and Herzegovina)**

Indicator	Domestic	Baseline 26	Baseline 32.5	Baseline 39	Base year 1	Base year 10	Base year 19
FEC per capita							

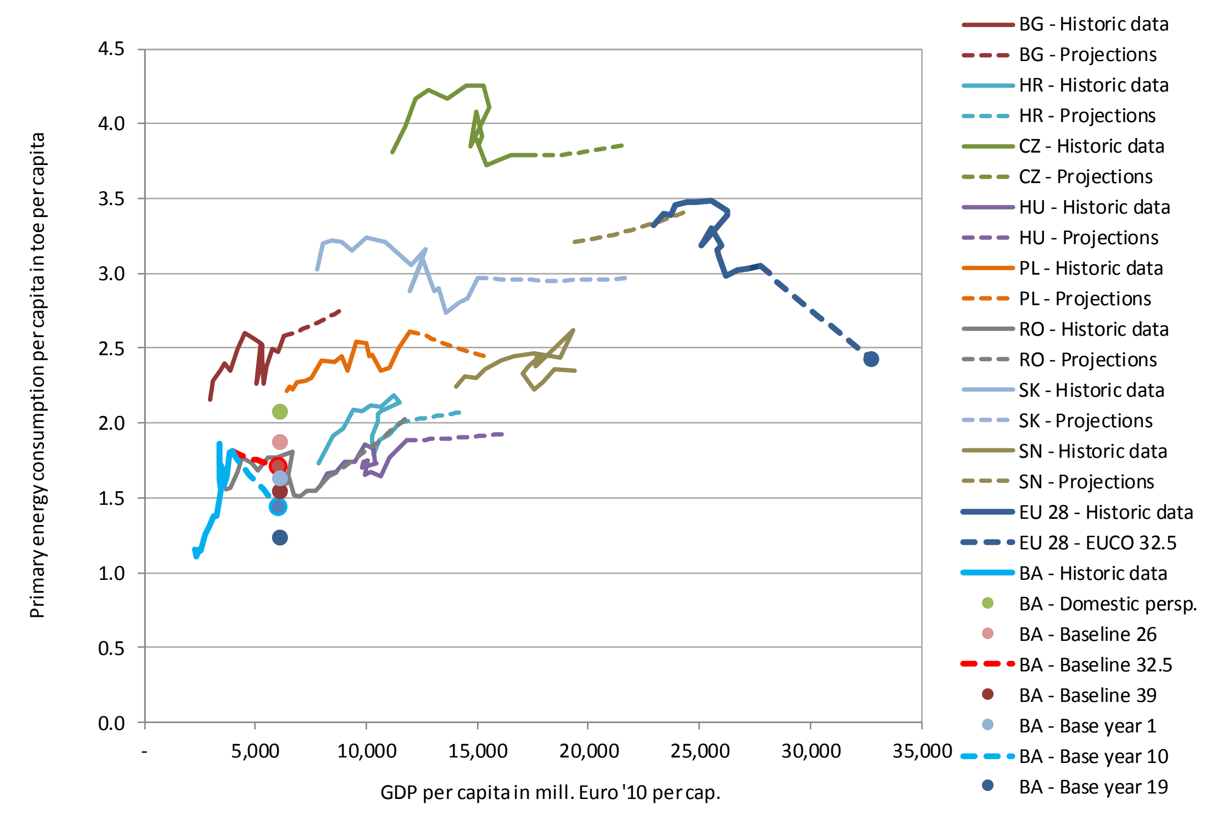


Figure 46: **The development of PEC per capita related to the GDP per capita showing historical values from 2000 to 2017 and projections from 2018 to 2030 assuming an EE target achievement in Bosnia and Herzegovina compared to the EU 28 and selected MSs. Source: Eurostat, 2019; IMF, 2019; NTUA, 2012, 2017.**

Table 16: **Qualitative assessment of all EE target setting options concerning PEC per capita (Bosnia and Herzegovina)**

Indicator	Domestic	Baseline 26	Baseline 32.5	Baseline 39	Base year 1	Base year 10	Base year 19
PEC per capita							

2.5.2.3 Summary & Conclusions for Energy Efficiency Targets of Bosnia and Herzegovina

Table 17 summarizes the assessment of all seven EE target setting options done in subchapter 2.5.2.2. It shows that the Baseline 26 and 32.5 approaches come to the most reasonable EE targets for 2030. This is based on a comparison with EU MSs which show the most similarieties when compared to Bosnia and Herzegovina in regards with to their economic structure.

Concerning the assessed EE target setting options the following observations appear of relevance:

- Base year 10 and 19 are too strict as the data point for 2030 would be out of, or more precisely, below the EU28 spectrum.
- Both the Base year 1 and the Baseline 39 appear also very ambitious in terms of EE ambition, as they would imply a very significant change of direction compared to the pathways observed so far in energy intensity.

Table 17: Summary table for the qualitative assessment of all EE target setting options (Bosnia and Herzegovina)

Indicator	Domestic	Baseline 26	Baseline 32.5	Baseline 39	Base year 1	Base year 10	Base year 19
FEC per GDP	Intermediate (ambition)		Reasonable	Intermediate (constraining)		Too constraining	
PEC per GDP							
FEC per capita							
PEC per capita							

2.5.3 Resulting Energy Efficiency Targets for Georgia

The results for calculated EE targets for Georgia are presented in Table 18 in terms of final energy demand and in Table 19 expressed in primary energy terms. The absolute consumption caps for 2030 are shown in Figure 47. A closer look at the timely evolution of final energy demand according to the various target setting options is then shown in Figure 48. The corresponding illustration in terms of primary energy is given by Figure 49.

Table 18: EE targets in terms of final energy for Georgia for different scenarios

EE targets for Georgia in terms of final energy consumption	Historic data for 2008 [ktoe]	Historic data for 2017 [ktoe]	Baseline III in 2030 [ktoe]	Consumption cap in 2030 [ktoe]	Change compared to 2008	Change compared to 2017	Change compared to Baseline III in 2030
Domestic perspective	2,458	4,142	5,070	6,257	+154.5%	+51.1%	**+23.4%**
Base year 1	2,458	4,142	5,070	2,434	-1%	-41.3%	**-52%**
Base year 10	2,458	4,142	5,070	2,212	-10%	-46.6%	**-56.4%**
Base year 19	2,458	4,142	5,070	1,991	-19%	-51.9%	**-60.7%**
Baseline 26	2,458	4,142	5,070	3,752	+52.6%	-9.4%	**-26%**
Baseline 32.5	2,458	4,142	5,070	3,422	+39.2%	-17.4%	**-32.5%**
Baseline 39	2,458	4,142	5,070	3,093	+25.8%	-25.3%	**-39%**

Table 19: EE targets in terms of primary energy for Georgia for different scenarios

EE targets for Georgia in terms of primary energy consumption	Historic data for 2008 [ktoe]	Historic data for 2017 [ktoe]	Baseline III in 2030 [ktoe]	Consumption cap in 2030 [ktoe]	Change compared to 2008	Change compared to 2017	Change compared to Baseline III in 2030
Domestic perspective	3,005	4,576	6,167	7,610	+153.3%	+66.3%	**+23.4%**
Base year 1	3,005	4,576	6,167	2,965	-1.3%	-35.2%	**-51.9%**
Base year 10	3,005	4,576	6,167	2,610	-13.1%	-43%	**-57.7%**
Base year 19	3,005	4,576	6,167	2,254	-25%	-50.7%	**-63.4%**
Baseline 26	3,005	4,576	6,167	4,563	+51.9%	-0.3%	**-26%**
Baseline 32.5	3,005	4,576	6,167	4,162	+38.5%	-9%	**-32.5%**
Baseline 39	3,005	4,576	6,167	3,762	+25.2%	-17.8%	**-39%**

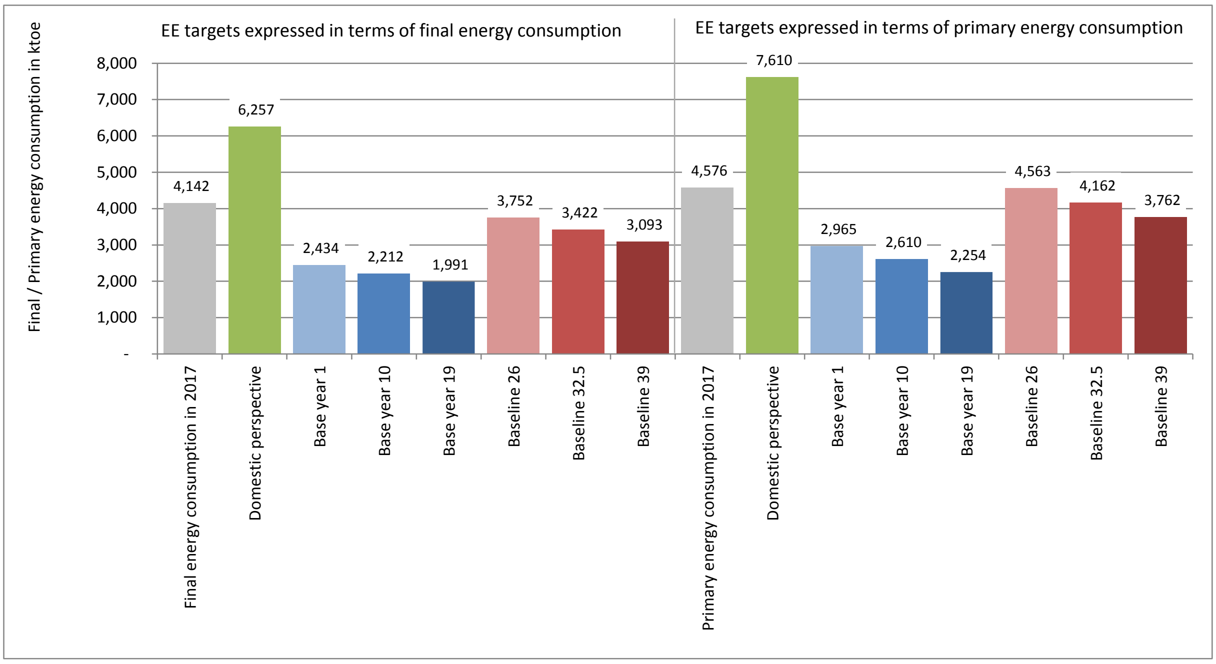


Figure 47: **Energy efficiency targets in terms of primary and final energy for different scenarios. Baseline vs. Base year approach vs. Domestic perspective**

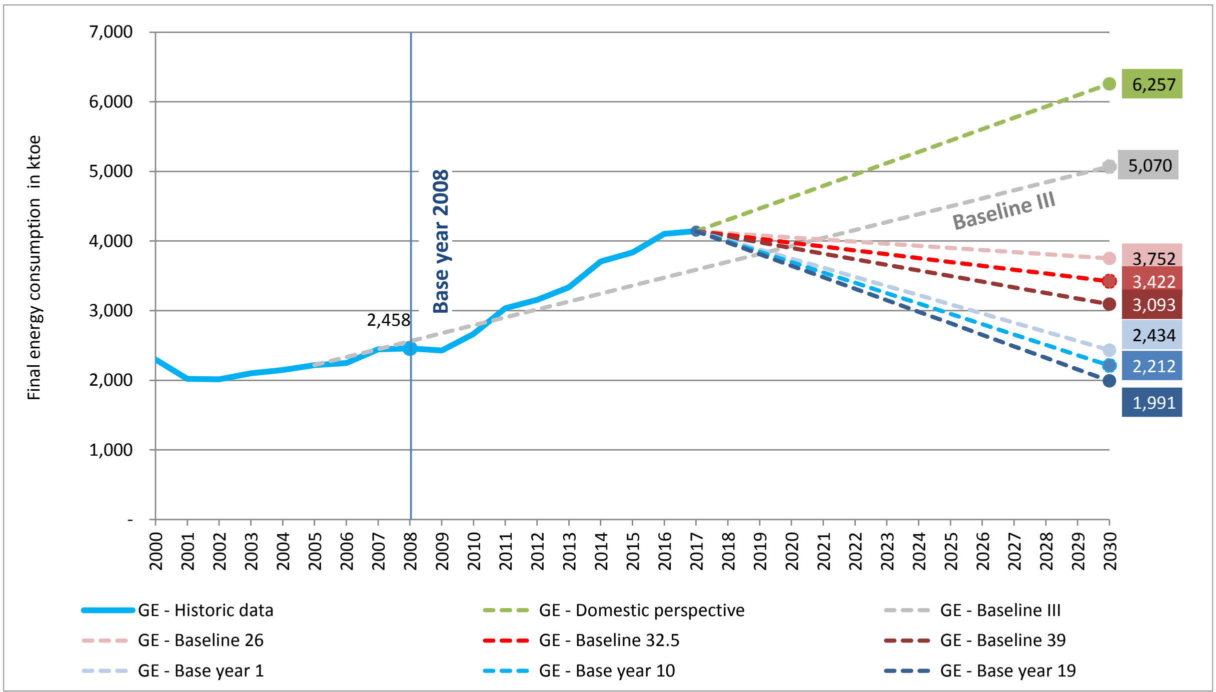


Figure 48: **Energy Efficiency targets in terms of final energy for different scenarios. Baseline compared to Base year approach vs. Domestic perspective**

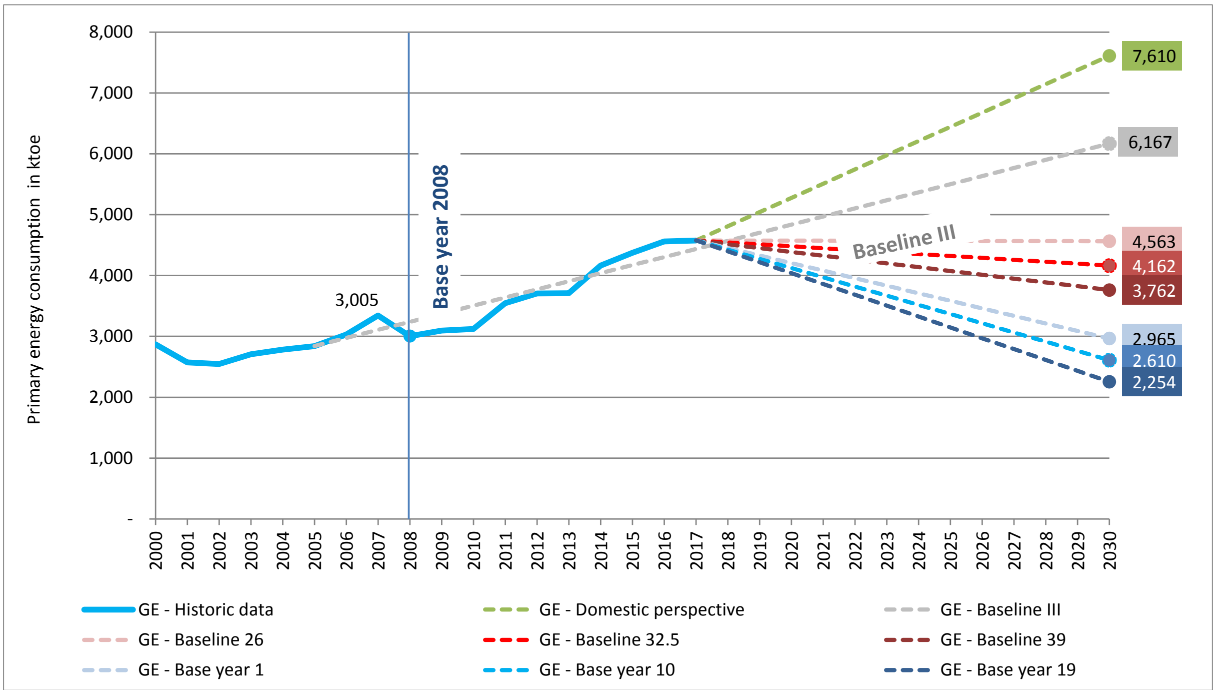


Figure 49: **Energy efficiency targets in terms of primary energy for different scenarios. Baseline compared to Base year approach vs. Domestic perspective**

2.5.3.1 Indicators for analysing energy performance

As prescribed previously, this indicator-based analysis shall assist in putting the range of energy efficiency target setting options into a broader perspective. We consequently illustrate how the targets examined match with historic trends and with EE target setting in other countries or regions. By doing so we aim for providing guidance in the identification of a target setting option that would lead to a comparable effort with the EE target set at EU level, while respecting differences in economic welfare. Complementary to socio-economic indicators like population, GDP and related growth trends for all CPs as introduced and discussed in section 2.3, we aim here to bring in the energy perspective.

Thus, the graphs below provide energy-related indicators like Primary Energy Consumption (PEC) per GDP (Figure 50) and Final Energy Consumption per GDP (Figure 51) which both represent the energy intensity of the country. Figure 52 and Figure 53 complement subsequently with an illustration of trends in PEC/Capita and in FEC/Capita.

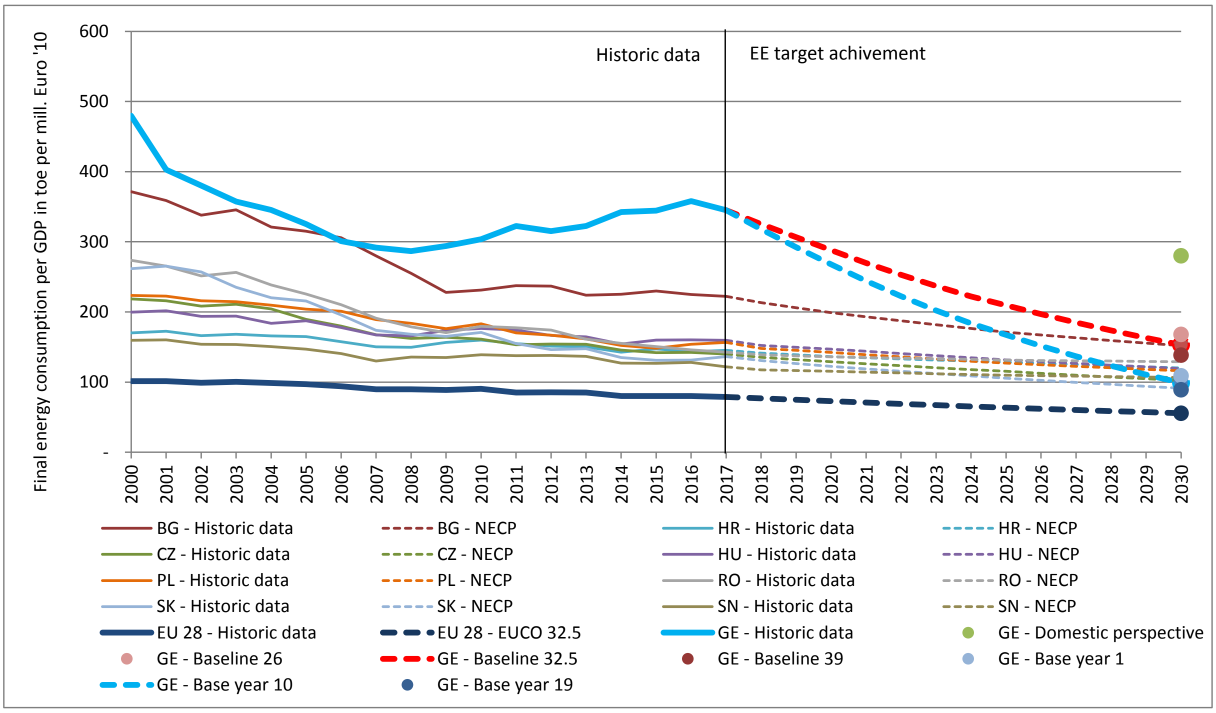


Figure 50: **Development of FEC/GDP in Georgia compared to the EU 28 and selected MS. Source: Eurostat, 2019; IMF, 2019; NTUA, 2012, 2017.**

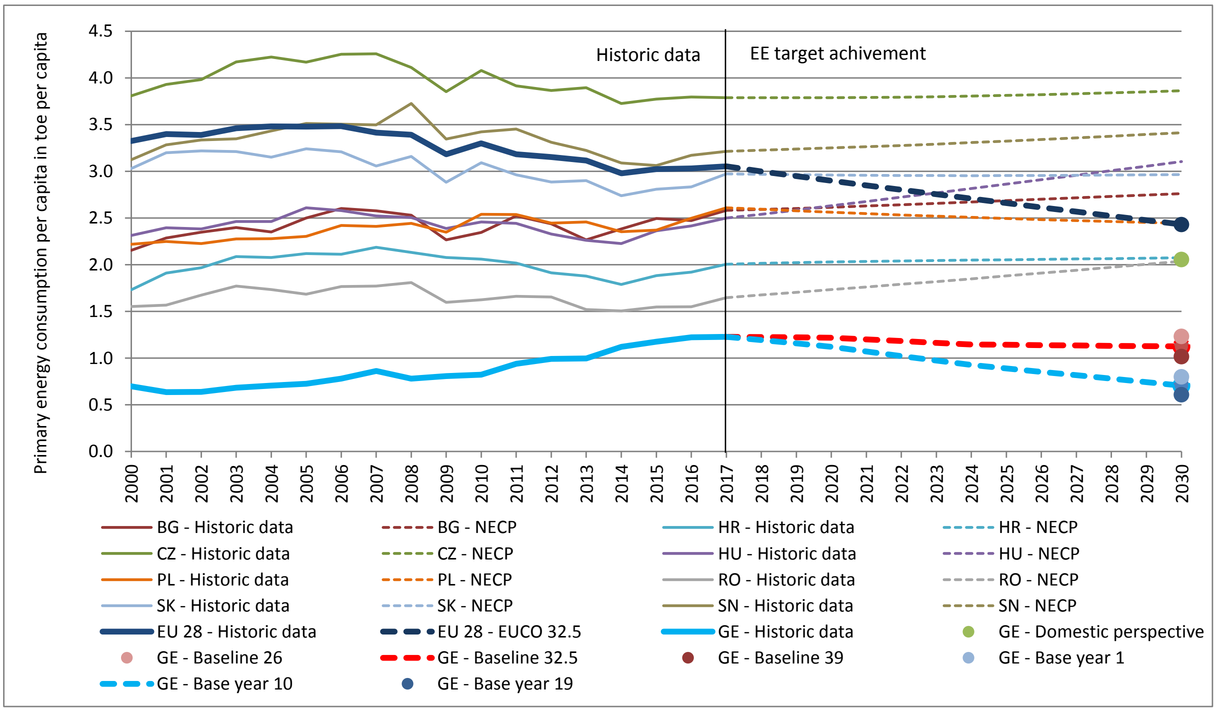


Figure 51: **Development of PEC/GDP in Georgia compared to the EU 28 and selected MS. Source: Eurostat, 2019; IMF, 2019; NTUA, 2012, 2017.**

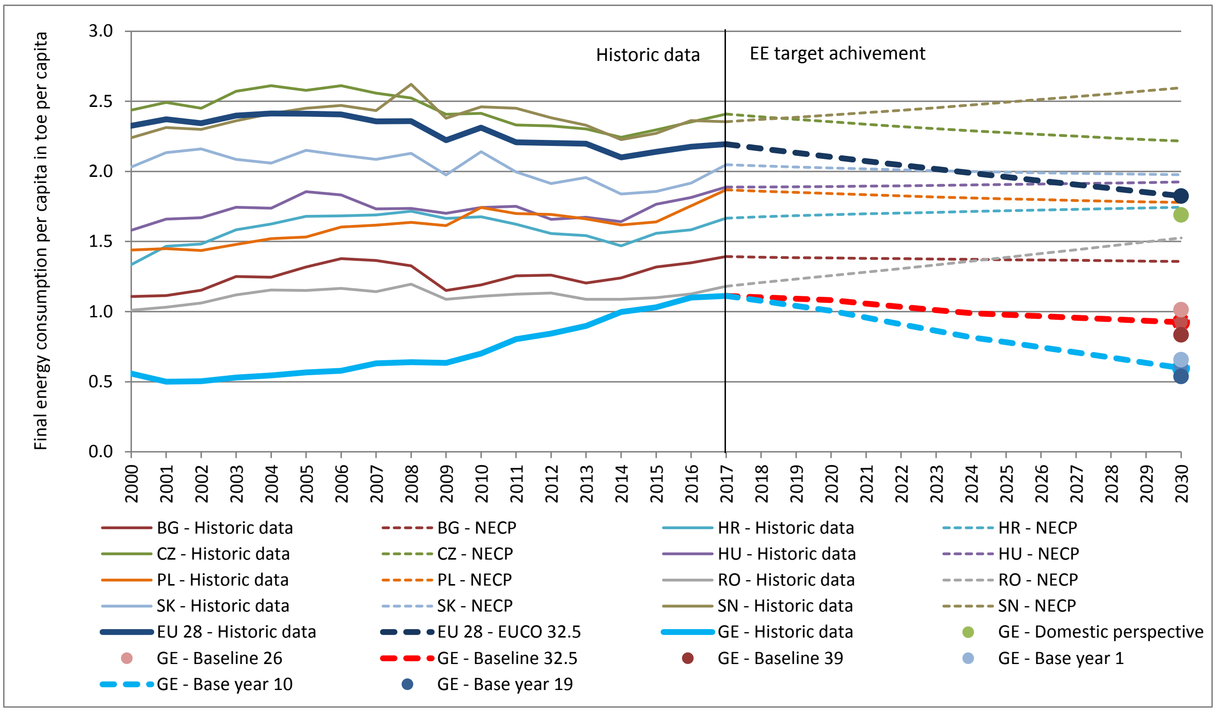


Figure 52: **Development of FEC/Capita in Georgia compared to the EU 28 and selected MSs. Source: Euro-stat, 2019; IMF, 2019; NTUA, 2012, 2017.**

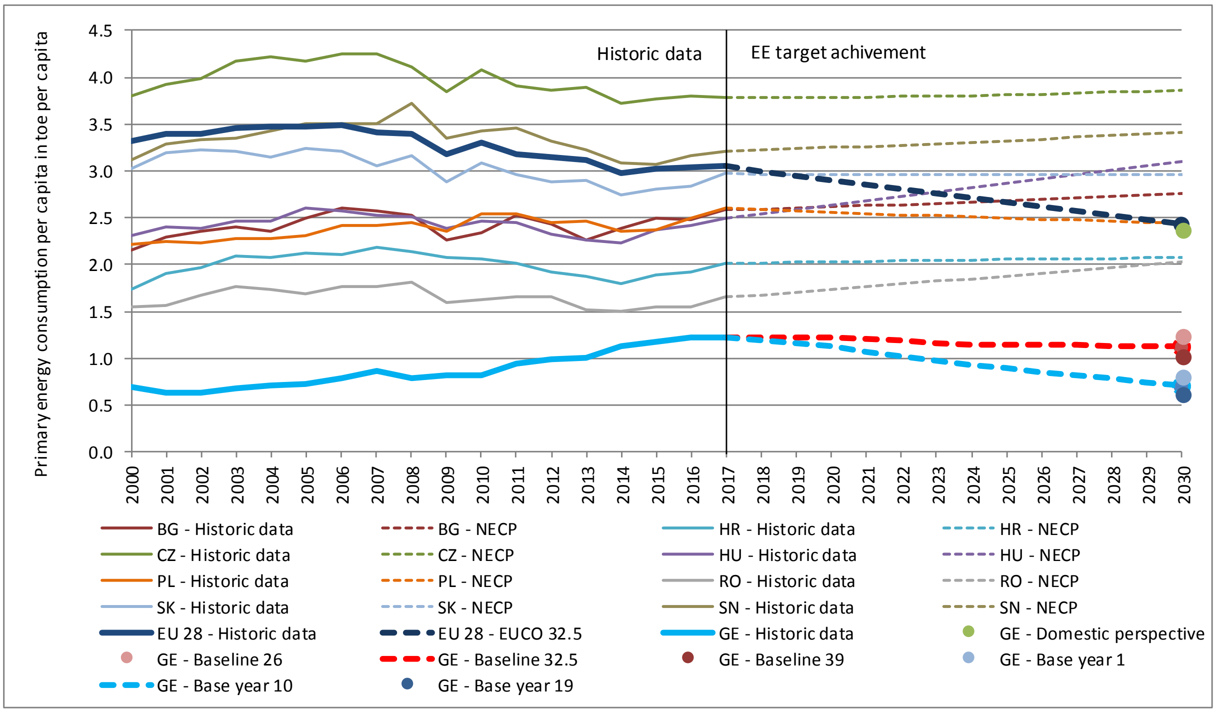


Figure 53: **Development of PEC/Capita in Georgia compared to the EU 28 and selected MS. Source: Eurostat, 2019; IMF, 2019; NTUA, 2012, 2017.**

Please note that in order to make above figures easier to read, we have avoided illustrating all seven previously calculated EE objectives as a graph. Instead, only the trajectories of the middle scenarios from the baseline and the base year approach are presented, all other scenarios are presented only as endpoints to get an idea of what the differences in the underlying approaches mean compared to the indicators mentioned above.

2.5.3.2 Advanced indicators to assess energy efficiency performance

Indicators on economic structure

Indicators on the economic structure help to set the economic development in Georgia into perspective with selected other countries. Figure 54 to Figure 55 shed light on the importance of certain sectors for Georgia's economy. Thus, these graphs show the development of the share of agriculture, manufacturing (as an important part of the industry sector), industry and services in % of GDP (on the vertical axis) related to the GDP per capita (on the horizontal axis) showing historical values from 2000 to 2017 in Georgia compared to the EU28 and selected MSs.

Some key observations drawn from these graphs are:

- In overall terms, latest (2017) figures on GDP per capita show that Georgia has reached a level that was achieved in Bulgaria in 2001, and overall growth seems to be more slowly than in the EU, or in assessed MSs.
- The manufacturing industry has not played an important role in Georgia in the past and at present. The respective share in overall GDP is shrinking, and it is lower than in Croatia or any other EU MS.
- Similarities with Croatia can be identified for the industry sector in general: historically the share (in overall GDP) was shrinking between 2005 and 2009, and today (2017) it is comparable to Croatia as of 2014.
- In contrast to above, we see a growing importance of the service sector: here its share (in total) is growing fast between 2003 and 2010, and today (2017) its relative share (in overall GDP) is about as high as in Poland, Croatia, Slovenia and Bulgaria.
- As indicated by Figure 54, one can see a decline of the importance of agriculture: its share (in total GDP) is shrinking between 2005 and 2010, and today (2017) it is about as high as in Croatia or Hungary (in relative terms).
- In general terms, the economic structure of Georgia shows similarities to Croatia but with a GDP per capita being about 30% of that. Compared to the EU average GDP per capita in Georgia stands at 12% of that.

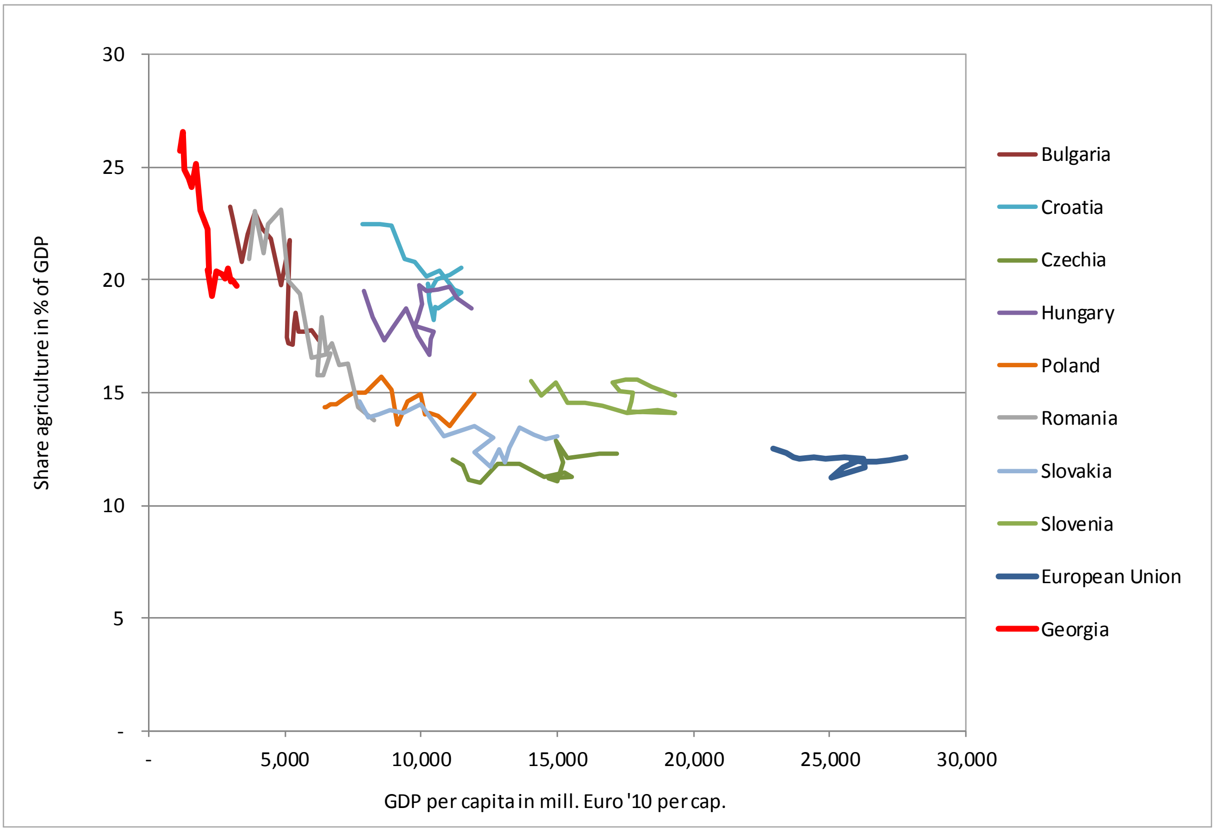


Figure 54: **Development of the share of agriculture in % of GDP related to the GDP per capita showing historical values from 2000 to 2017 in Georgia compared to the EU 28 and selected MSs. Source: Eurostat, 2019; IMF, 2019; Worldbank, 2019;**

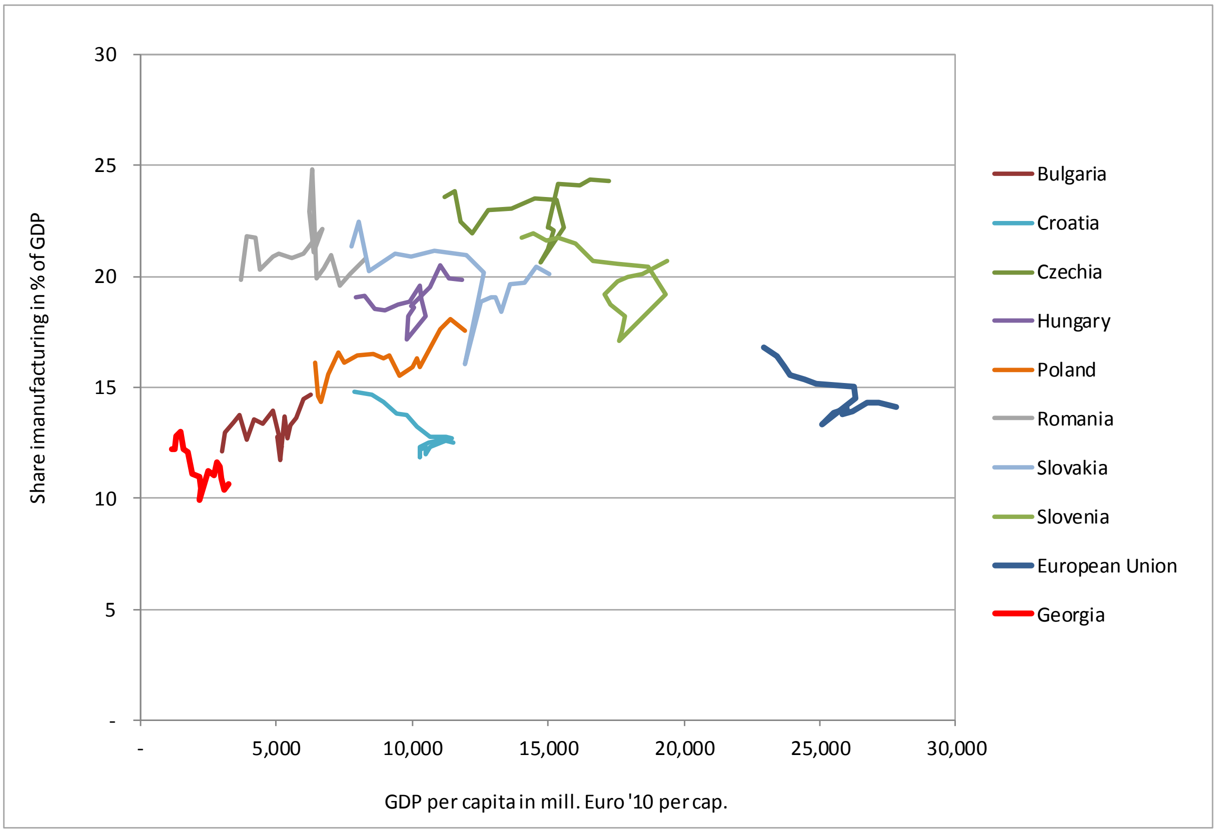


Figure 55: **Development of the share of manufacturing in % of GDP related to the GDP per capita showing historical values from 2000 to 2017 in Georgia compared to the EU 28 and selected MSs. Source: Eurostat, 2019; IMF, 2019; Worldbank, 2019;**

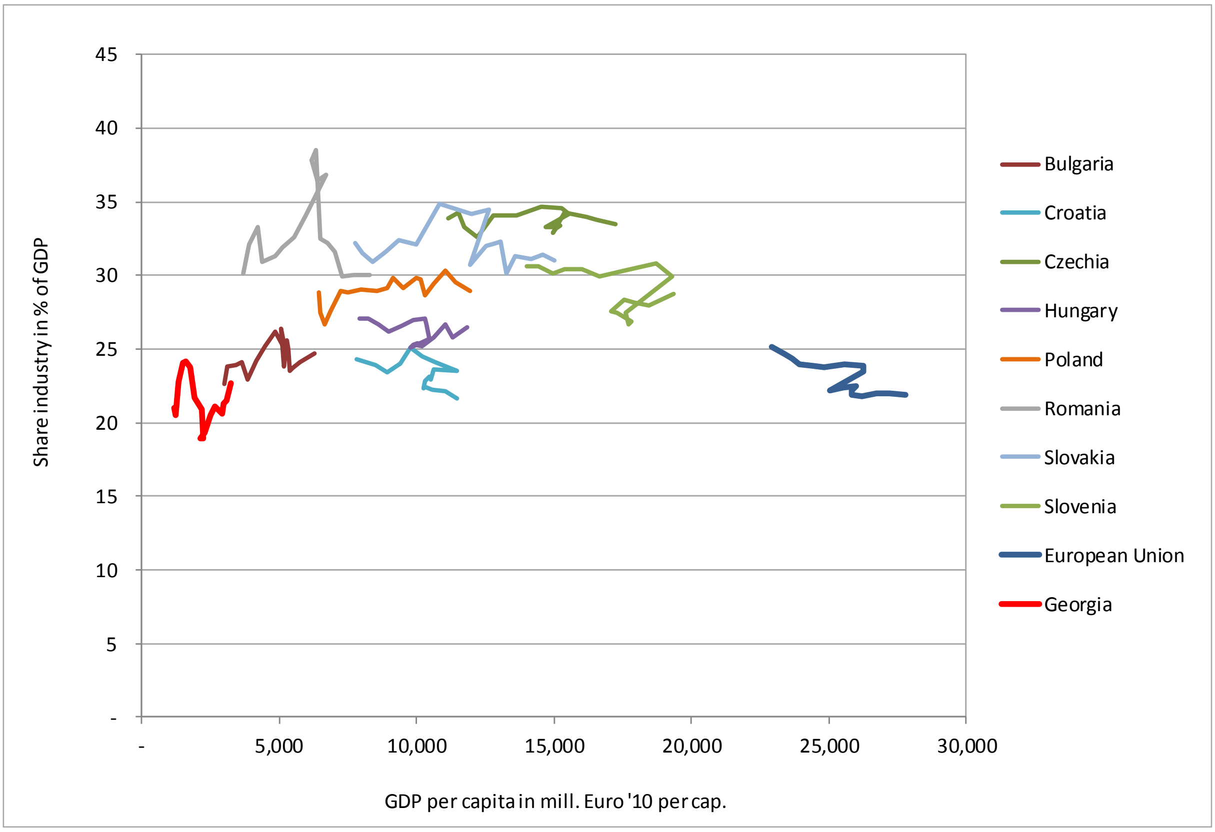


Figure 56: **Development of the share of industry in % of GDP related to the GDP per capita showing historical values from 2000 to 2017 in Georgia compared to the EU 28 and selected MSs. Source: Eurostat, 2019; IMF, 2019; Worldbank, 2019;**

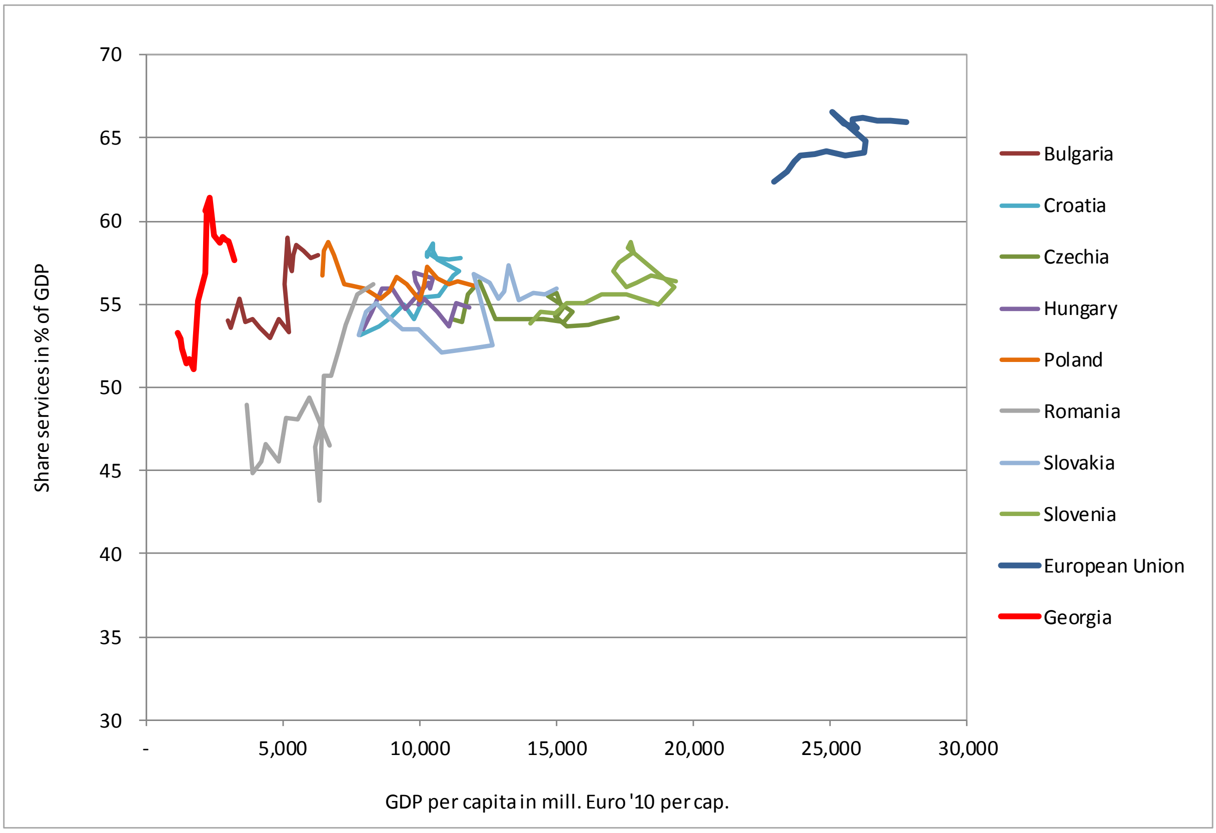


Figure 57: **Development of the share of services in % of GDP related to the GDP per capita showing historical values from 2000 to 2017 in Georgia compared to the EU 28 and selected MSs. Source: Eurostat, 2019; IMF, 2019; Worldbank, 2019;**

Indicators on energy system

Advanced indicators as illustrated below put the energy intensity and energy use per capita, both in terms of final energy and primary energy consumption, in comparison to the country's GDP per capita. In this context, energy intensity acts as an indicator for energy efficiency, measuring how efficient an economy uses energy. It is calculated by dividing energy use, in this case either final or primary, by GDP. High energy intensities indicate a high price or cost of converting energy into GDP, and vice versa. In most case a high energy intensity indicates also a high industrial output as portion of GDP, and, in contrast to above, countries with low energy intensity signify a labour intensive economy.

Figure 58 and Figure 59 below put final- and respectively primary energy consumption per GDP in relation to GDP per capita. This is shown in both figures for Georgia, the EU28 and our suite of selected MSs. For each country or region we connect therein the different data points, referring to distinct years, with a coloured line. All seven proposed EE target setting options for 2030 for Georgia are shown by circular dots using different colours – these dots are on a vertical line since all make use of the same GDP per capita projection.

As applicable from these graphs, in accordance with previous statements, GDP per capita in Georgia today (2017) is about as high as in Bulgaria more than 15 years ago (2001); and the projected GDP per capita in 2030 for Georgia is comparable to Bulgaria as of today (2016).

A comparison of EE target setting options indicates:

- An EE target in accordance with the Domestic Perspective looks not ambitious enough – i.e. there is hardly any change in energy use imposed by that.
- Targets following the Base year approach, and using 2008 as base year, would lead to very strict EE targets in 2030. Energy consumption would then be by far lower than any observed performance across all EU MSs. Thus, all corresponding EE target setting options – i.e. the variants of the Base year approach – appear all too constraining for Georgia.
- Among the Baseline options the "Baseline 26" appears reasonable when compared to trends and performances observed in other countries. In contrast to that, Baseline 32.5 and 39 seem to be intermediate constraining.

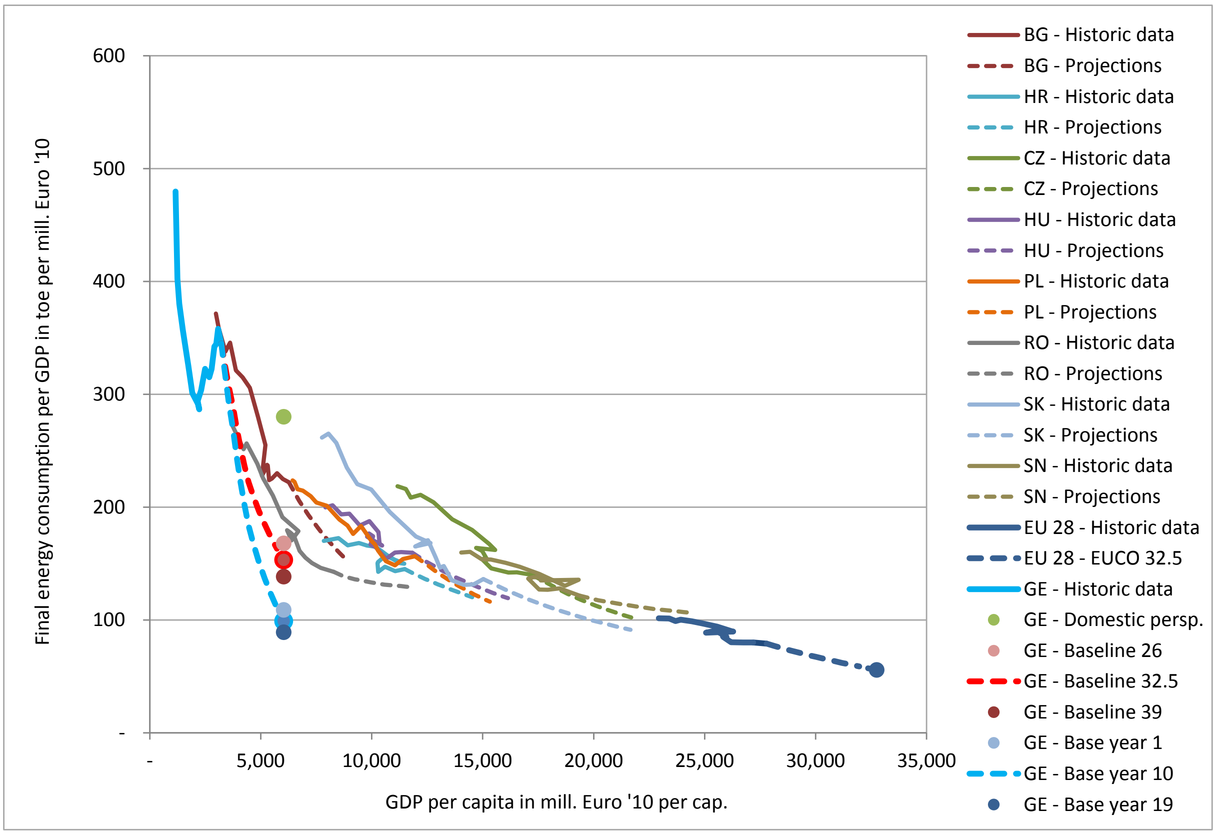


Figure 58: **The development of FEC per GDP related to the GDP per capita showing historical values from 2000 to 2017 and projections from 2018 to 2030 assuming an EE target achievement in Georgia compared to the EU 28 and selected MSs. Source: Eurostat, 2019; IMF, 2019; NTUA, 2012, 2017.**

Table 20: **Qualitative assessment of all EE target setting options concerning FEC per GDP (Georgia)**

Indicator	Domestic	Baseline 26	Baseline 32.5	Baseline 39	Base year 1	Base year 10	Base year 19
FEC per GDP	Not ambitious	Reasonable	Intermediate (constraining)		Too constraining		

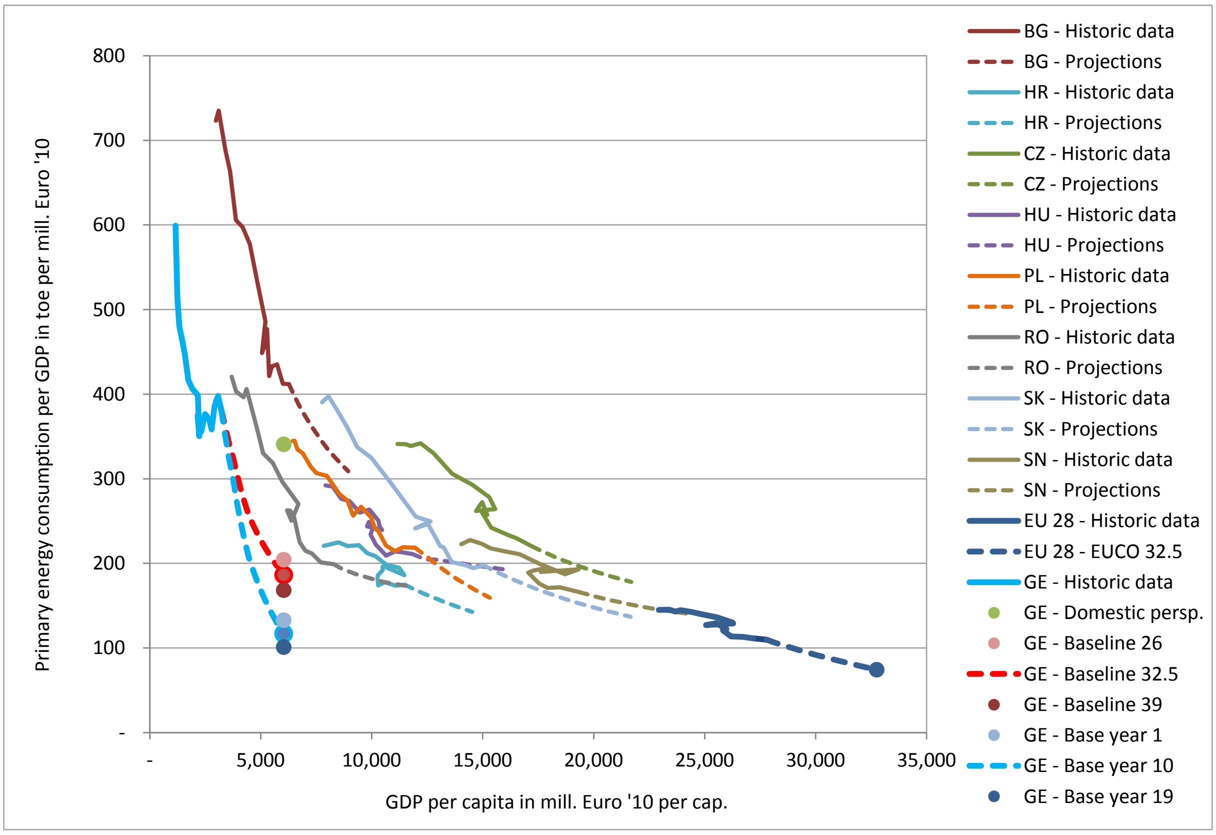


Figure 59: **The development of PEC per GDP related to the GDP per capita showing historical values from 2000 to 2017 and projections from 2018 to 2030 assuming an EE target achievement in Georgia compared to the EU 28 and selected MSs. Source: Eurostat, 2019; IMF, 2019; NTUA, 2012, 2017.**

Table 21: **Qualitative assessment of all EE target setting options concerning PEC per GDP (Georgia)**

Indicator	Domestic	Baseline 26	Baseline 32.5	Baseline 39	Base year 1	Base year 10	Base year 19
PEC per GDP							

Figure 60 and Figure 61 below put final and primary energy consumption per capita in relation to GDP per capita. The graphs include trend data for Georgia, the EU28 and our suite of selected MSs, and, similar to above, we connect therein for a single country the different data points, referring to distinct years, with a coloured line. Again, all seven proposed EE target setting options for 2030 for Georgia are shown by circular dots using different colours – these dots are on a vertical line since all make use of the same GDP per capita projection.

In contrast to the previous figures, the trend pattern expressed in these graphs are much harder to interpret. The overall correlation is lower (compared to energy consumption per GDP) both for the historic development and for projections towards 2030.

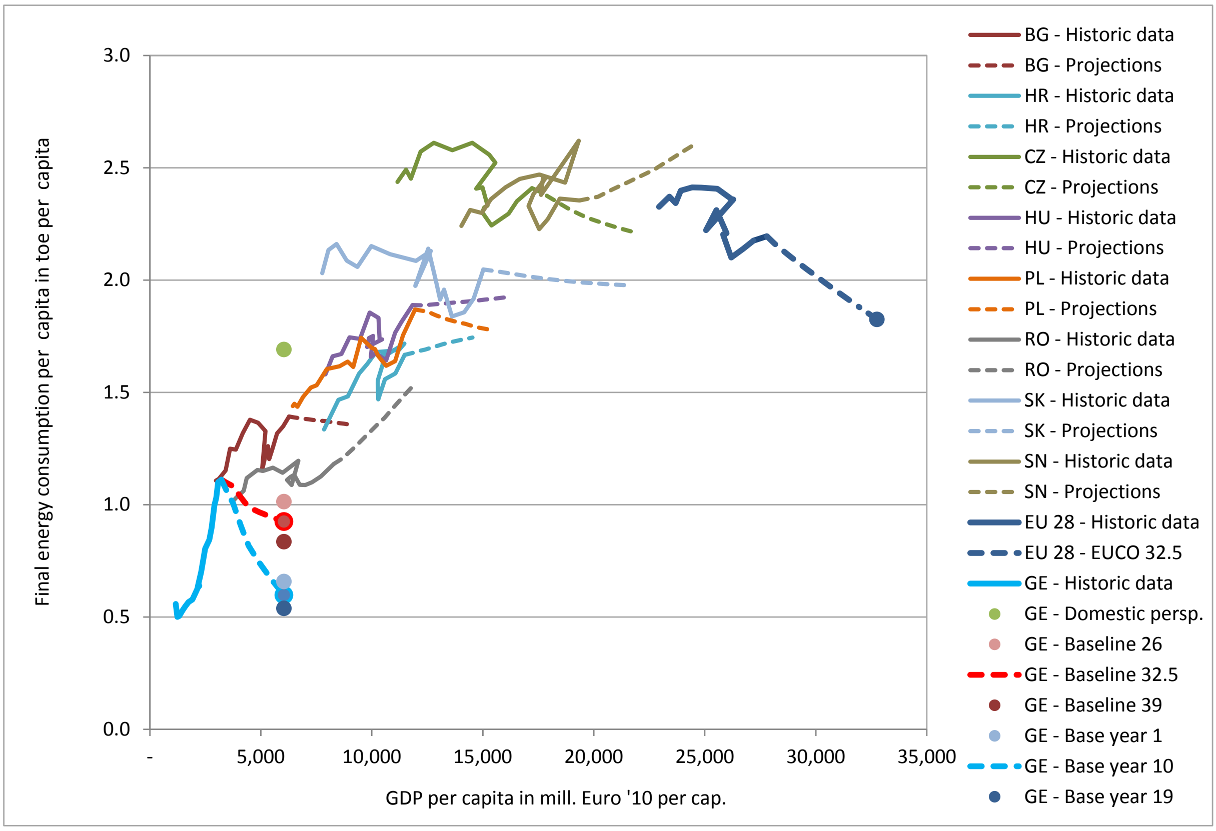


Figure 60: **The development of FEC per capita related to the GDP per capita showing historical values from 2000 to 2017 and projections from 2018 to 2030 assuming an EE target achievement in Georgia compared to the EU 28 and selected MSs. Source: Eurostat, 2019; IMF, 2019; NTUA, 2012, 2017**

Table 22: **Qualitative assessment of all EE target setting options concerning FEC per capita (Georgia)**

Indicator	Domestic	Baseline 26	Baseline 32.5	Baseline 39	Base year 1	Base year 10	Base year 19
FEC per capita							

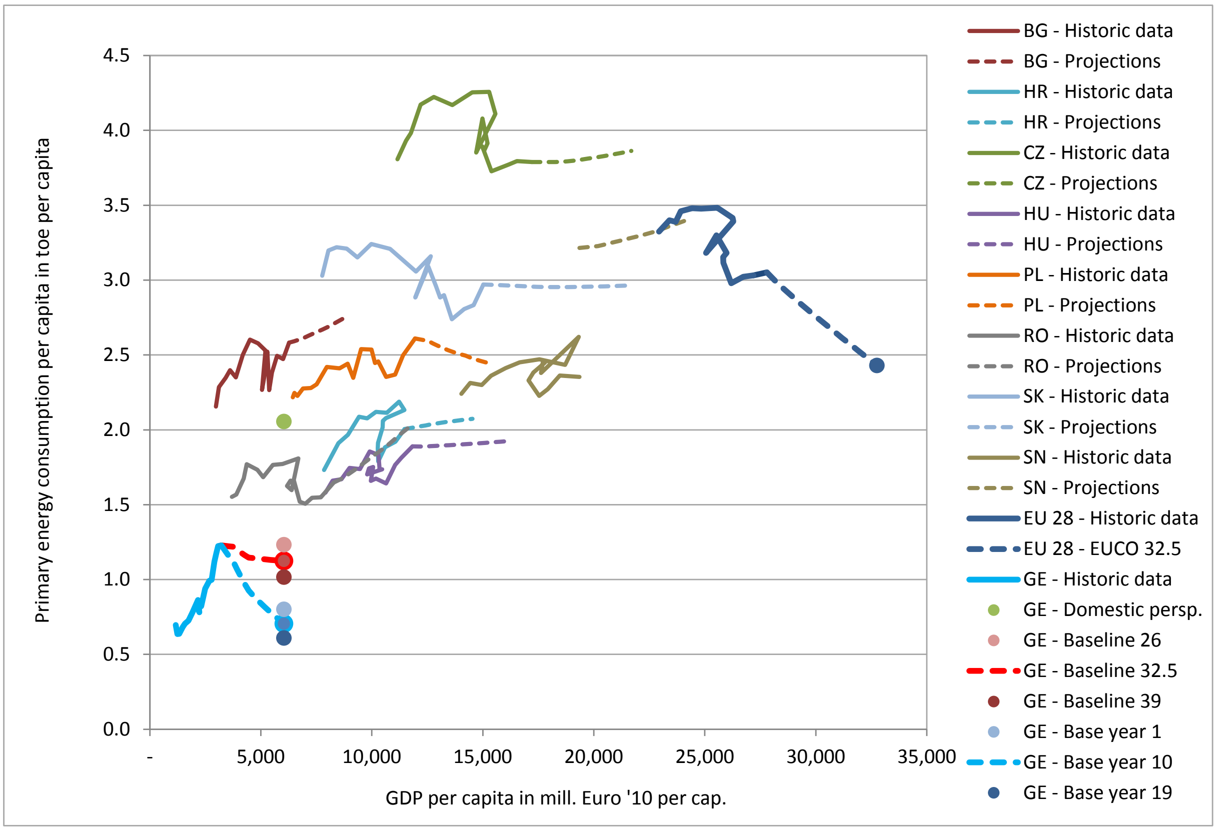


Figure 61: The development of PEC per capita related to the GDP per capita showing historical values from 2000 to 2017 and projections from 2018 to 2030 assuming an EE target achievement in Georgia compared to the EU 28 and selected MSs. Source: Eurostat, 2019; IMF, 2019; NTUA, 2012, 2017.

Table 23: Qualitative assessment of all EE target setting options concerning PEC per capita (Georgia)

Indicator	Domestic	Baseline 26	Baseline 32.5	Baseline 39	Base year 1	Base year 10	Base year 19
PEC per capita							

2.5.3.3 Summary & Conclusions for Energy Efficiency Targets of Georgia

Table 41 summarizes the assessment of all seven EE target setting options done in subchapter 2.5.3.2. It shows that the Baseline 32.5 and Base year 1 approach would lead to the most reasonable EE targets for 2030. These scenarios stay within the range of comparable efforts. This conclusion is drawn from a comparison with EU MSs that show the most similarieties when compared to Georgia in regards with to their economic structure.

Table 24: Summary table for the qualitative assessment of all EE target setting options (Georgia)

Indicator	Domestic	Baseline 26	Baseline 32.5	Baseline 39	Base year 1	Base year 10	Base year 19
FEC per GDP	Not ambitious	Reasonable	Intermediate (constraining)		Too constraining		
PEC per GDP							
FEC per capita							
PEC per capita							

2.5.4 Resulting Energy Efficiency Targets for Kosovo*

The results on calculated EE targets for Kosovo* are presented in Table 25 in terms of final energy demand and in Table 26 for primary energy demand. The absolute consumption caps for 2030 are shown in Figure 62. A closer look at the timely evolution of final energy demand according to the various target setting options is then shown in Figure 63. The corresponding illustration in terms of primary energy is provided by Figure 64.

Table 25: EE targets in terms of final energy for Kosovo* for different scenarios

EE targets for Kosovo* in terms of final energy consumption	Historic data for 2008 [ktoe]	Historic data for 2017 [ktoe]	Baseline III in 2030 [ktoe]	Consumption cap in 2030 [ktoe]	Change compared to 2008	Change compared to 2017	Change compared to Baseline III in 2030
Domestic perspective	1,163	1,522	2,335	1,729	+48.6%	+13.6%	**-25.9%**
Base year 1	1,163	1,522	2,335	1,152	-1%	-24.3%	**-50.7%**
Base year 10	1,163	1,522	2,335	1,047	-10%	-31.2%	**-55.2%**
Base year 19	1,163	1,522	2,335	942	-19%	-38.1%	**-59.6%**
Baseline 26	1,163	1,522	2,335	1,728	+48.5%	+13.5%	**-26%**
Baseline 32.5	1,163	1,522	2,335	1,576	+35.5%	+3.6%	**-32.5%**
Baseline 39	1,163	1,522	2,335	1,424	+22.4%	-6.4%	**-39%**

Table 26: EE targets in terms of primary energy for Kosovo* for different scenarios

EE targets for Kosovo* in terms of primary energy consumption	Historic data for 2008 [ktoe]	Historic data for 2017 [ktoe]	Baseline III in 2030 [ktoe]	Consumption cap in 2030 [ktoe]	Change compared to 2008	Change compared to 2017	Change compared to Baseline III in 2030
Domestic perspective	2,212	2,528	4,066	3,011	+36.1%	+19.1%	**-25.9%**
Base year 1	2,212	2,528	4,066	2,183	-1.3%	-13.7%	**-46.3%**
Base year 10	2,212	2,528	4,066	1,921	-13.1%	-24%	**-52.7%**
Base year 19	2,212	2,528	4,066	1,660	-25%	-34.4%	**-59.2%**
Baseline 26	2,212	2,528	4,066	3,009	+36%	+19%	**-26%**
Baseline 32.5	2,212	2,528	4,066	2,745	+24.1%	+8.6%	**-32.5%**
Baseline 39	2,212	2,528	4,066	2,480	+12.1%	-1.9%	**-39%**

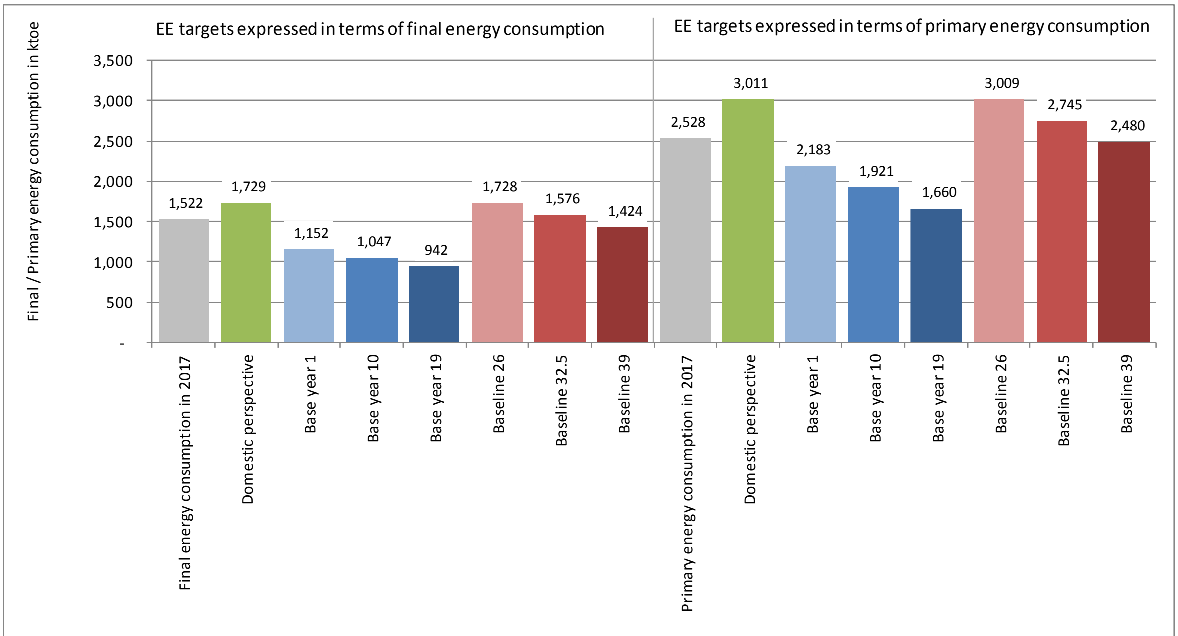


Figure 62: Energy efficiency targets in terms of primary and final energy for different scenarios. Baseline vs. Base year approach vs. Domestic perspective

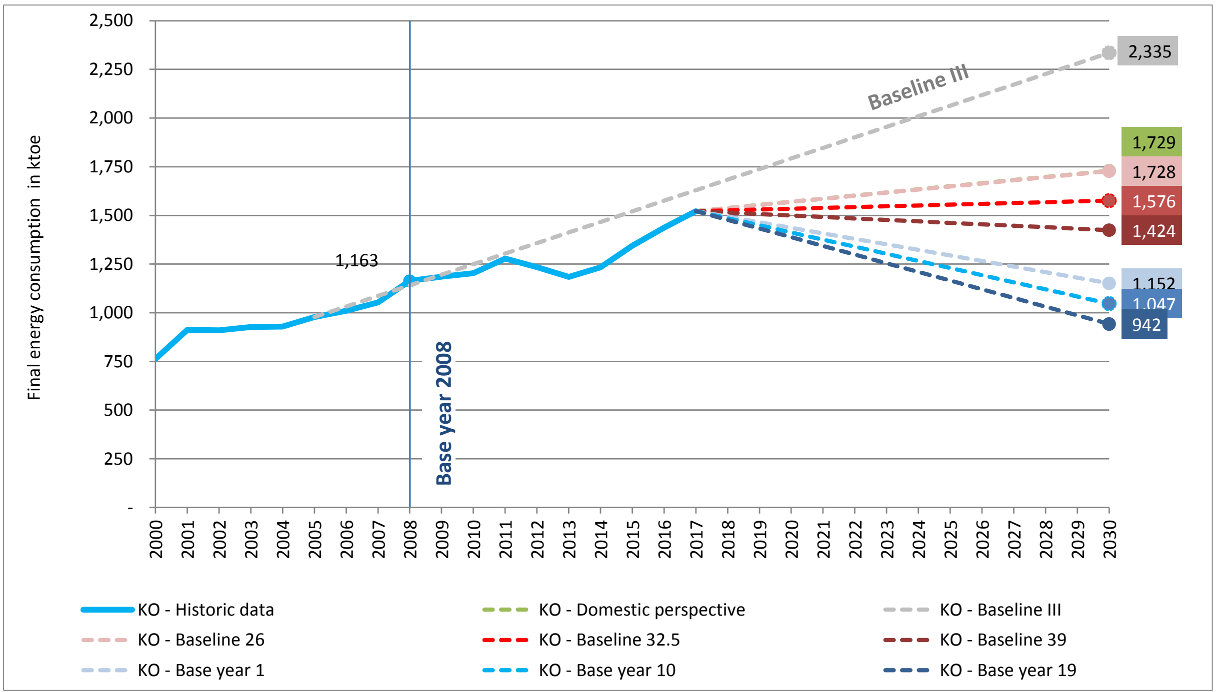


Figure 63: Energy Efficiency targets in terms of final energy for different scenarios. Baseline compared to Base year approach vs. Domestic perspective

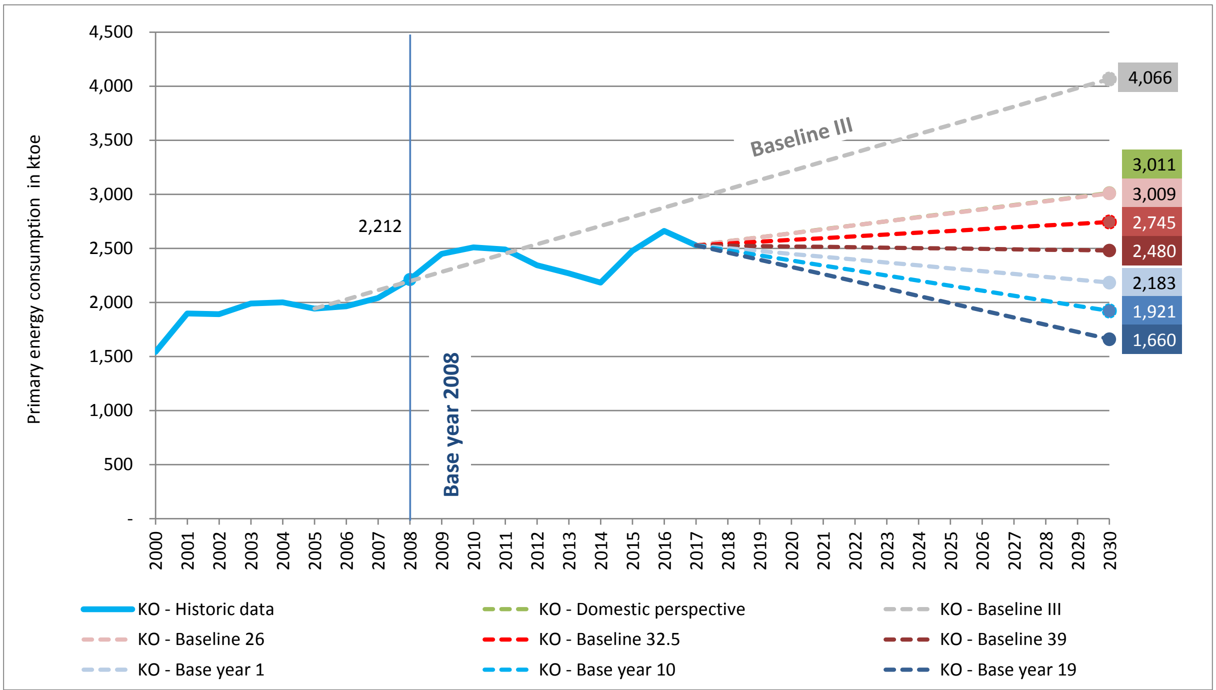


Figure 64: Energy efficiency targets in terms of primary energy for different scenarios. Baseline compared to Base year approach vs. Domestic perspective

2.5.4.1 Indicators for analysing energy performance

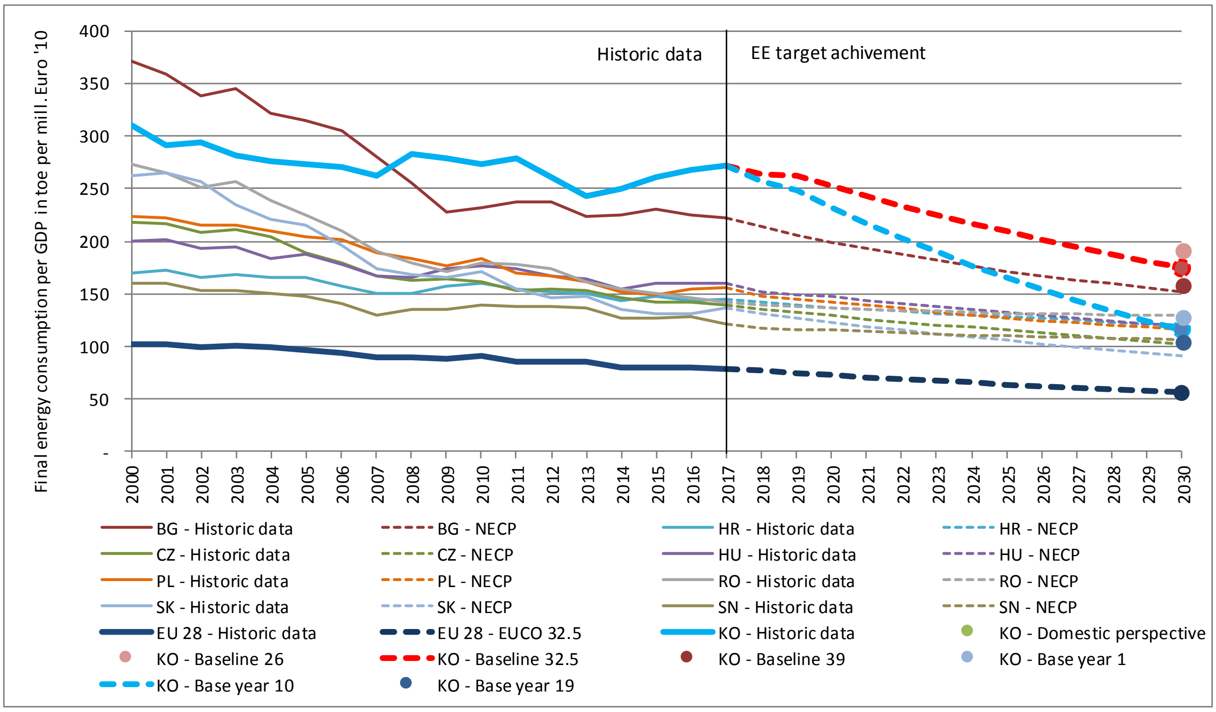


Figure 65: Development of FEC/GDP in Kosovo* compared to the EU 28 and selected MS. Source: Eurostat, 2019; IMF, 2019; NTUA, 2012, 2017.

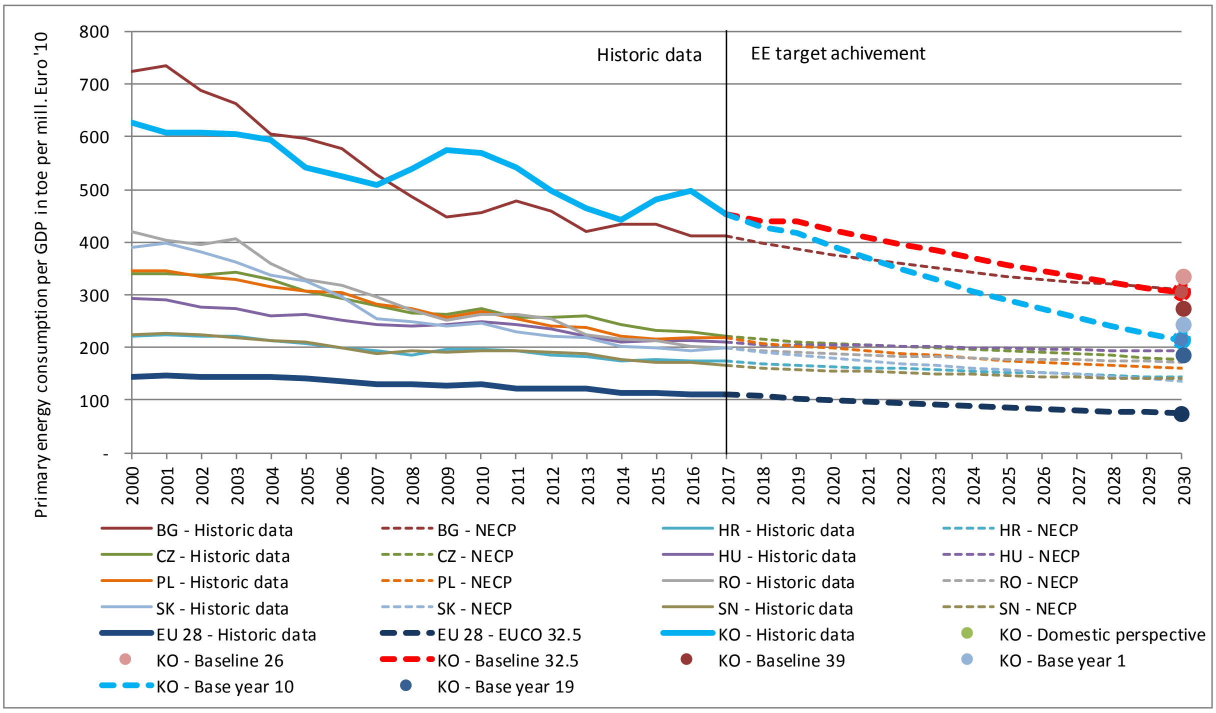


Figure 66: Development of PEC/GDP in Kosovo* compared to the EU 28 and selected MS. Source: Eurostat, 2019; IMF, 2019; NTUA, 2012, 2017.

With this indicator-based analysis we aim for gaining further insights on feasibility and impacts of the (broad) range of identified energy efficiency target setting options into a broader perspective. We consequently illustrate how the EE targets examined match with historic trends and with the EE target setting in other countries or regions. Underlying objective is to identify those EE target setting options that would lead to a comparable effort with the EE target set at EU level, while respecting differences in economic welfare. Complementary to socio-economic indicators like population, GDP and related growth trends for all CPs as introduced and discussed in section 2.3, within this section we aim to incorporate the energy perspective into the analysis.

Thus, the graphs below provide energy-related indicators like Final Energy Consumption per GDP (Figure 65) and Primary Energy Consumption (PEC) per GDP (Figure 66) which both represent the energy intensity of the country. Next to these, Figure 67 and Figure 68 complement with an illustration of trends in PEC/Capita and in FEC/Capita.

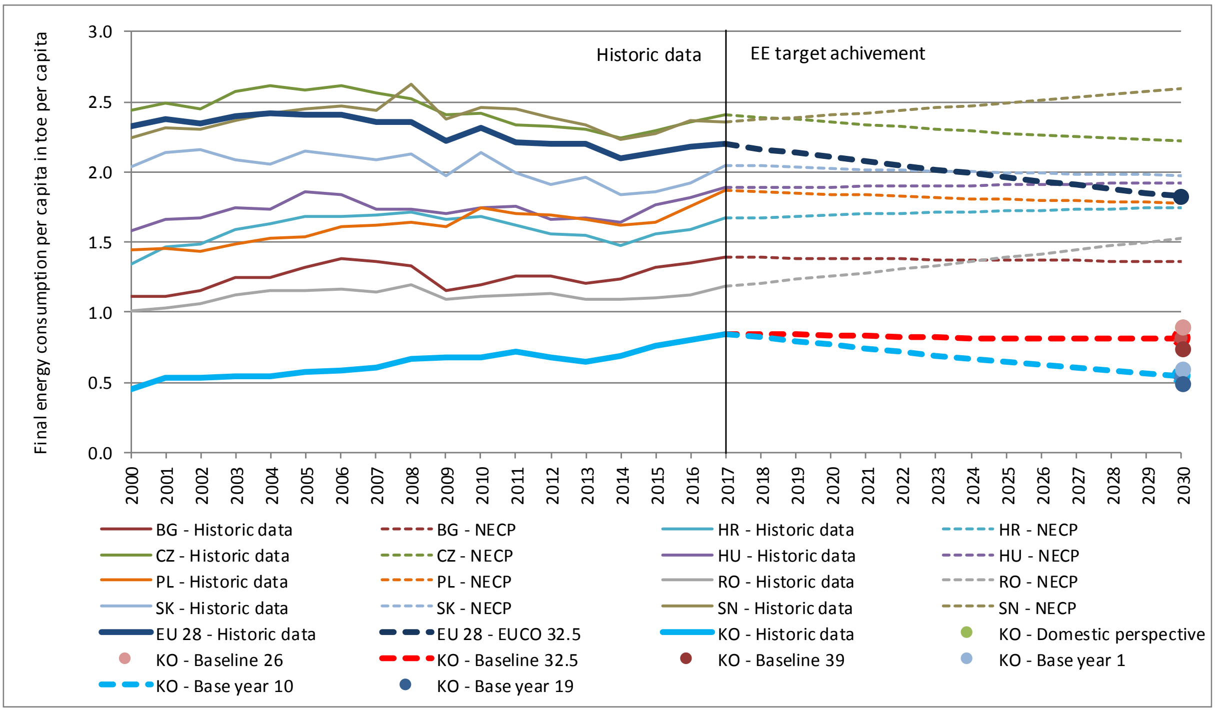


Figure 67: **Development of FEC/Capita in Kosovo* compared to the EU 28 and selected MSs. Source: Euro-stat, 2019; IMF, 2019; NTUA, 2012, 2017.**

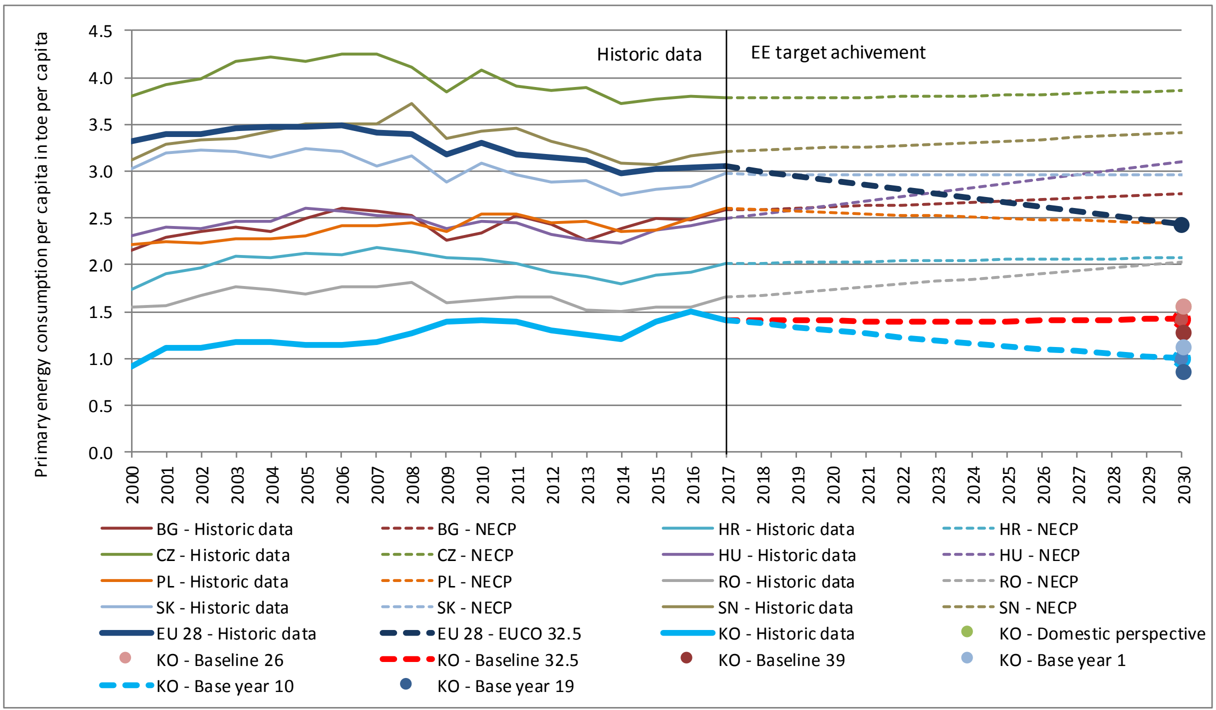


Figure 68: **Development of PEC/Capita in Kosovo* compared to the EU 28 and selected MS. Source: Eurostat, 2019; IMF, 2019; NTUA, 2012, 2017.**

2.5.4.2 Advanced indicators to assess energy efficiency performance

Indicators on economic structure

A closer look at indicators that shed light on the economic structure help to put the economic development in Kosovo* into perspective with selected other countries. Figure 69 to Figure 72 allow for gaining insights on the importance of certain sectors for the country's economy. Thus, these graphs show the development of the share of agriculture, manufacturing (as an important part of the industry sector), industry and services in % of GDP (on the vertical axis) related to the GDP per capita (on the horizontal axis) showing historical values from 2000 to 2017 in Kosovo* compared to the EU28 and selected MSs.

Key results gained from these graphs are:

- In overall terms, latest (2017) figures on GDP per capita show that Kosovo* has reached a level that was achieved in Bulgaria in 2001.
- Manufacturing and the industry sector in general play a less prominent role in Kosovo*'s economy today. The respective share in overall GDP remains at a level comparable to Bulgaria and Croatia.
- Agriculture is of dominance and contributes about 30% to the total GDP in Kosovo*. The share (in total) fluctuates from year to year – but, in general terms, it remains rather constant when looking back in time throughout the last decade.
- The service sector has in comparison to other countries a low share in overall GDP. The respective share in total is still highest among all sectors but in comparison to EU MSs (and also to CPs) comparatively low.

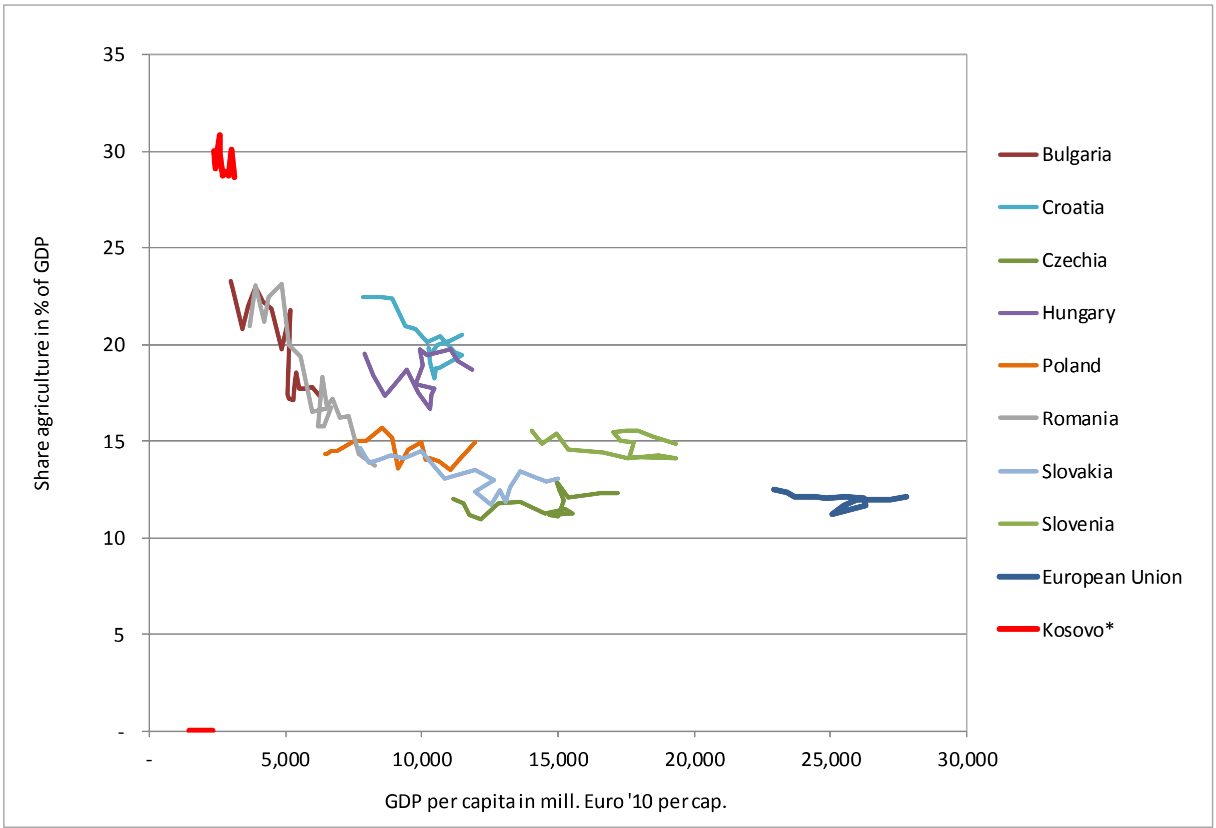


Figure 69: Development of the share of agriculture in % of GDP related to the GDP per capita showing historical values from 2000 to 2017 in Kosovo* compared to the EU 28 and selected MSs. Source: Eurostat, 2019; IMF, 2019; Worldbank, 2019;

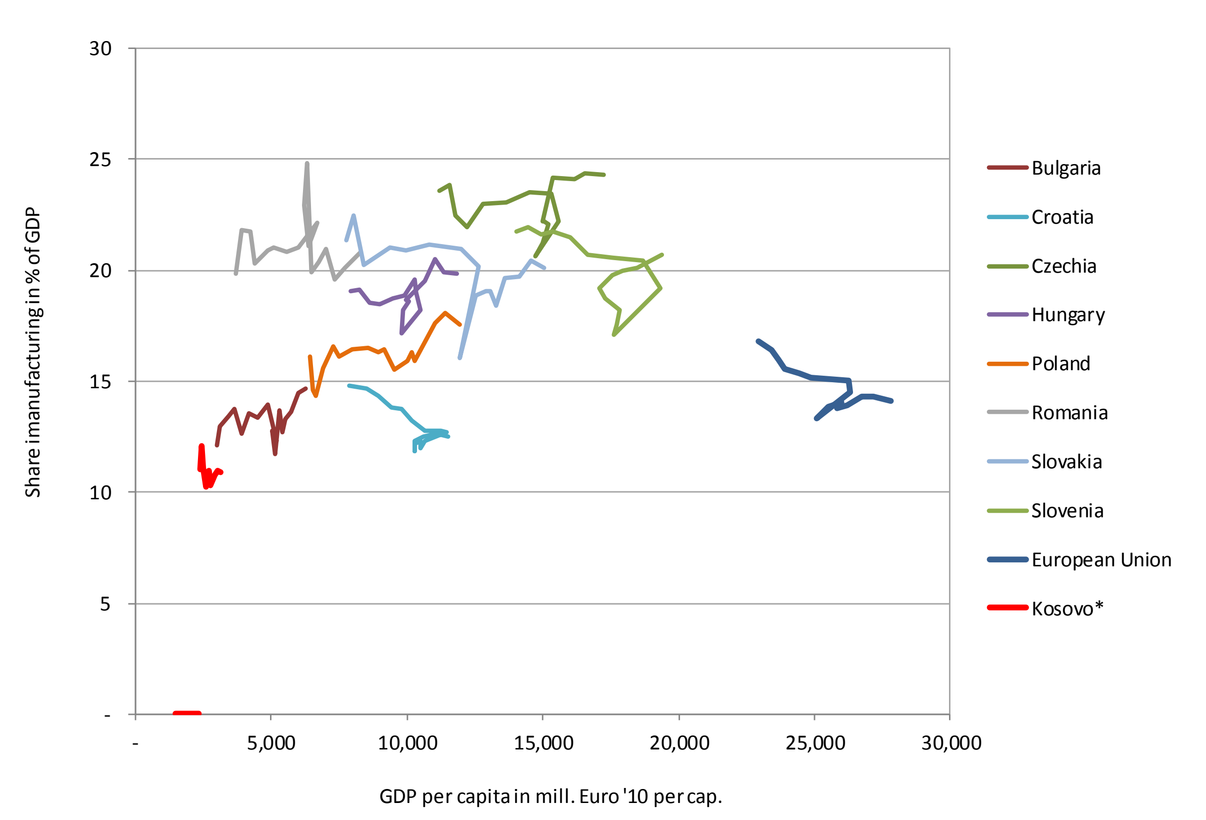


Figure 70: Development of the share of manufacturing in % of GDP related to the GDP per capita showing historical values from 2000 to 2017 in Kosovo* compared to the EU 28 and selected MSs. Source: Eurostat, 2019; IMF, 2019; Worldbank, 2019;

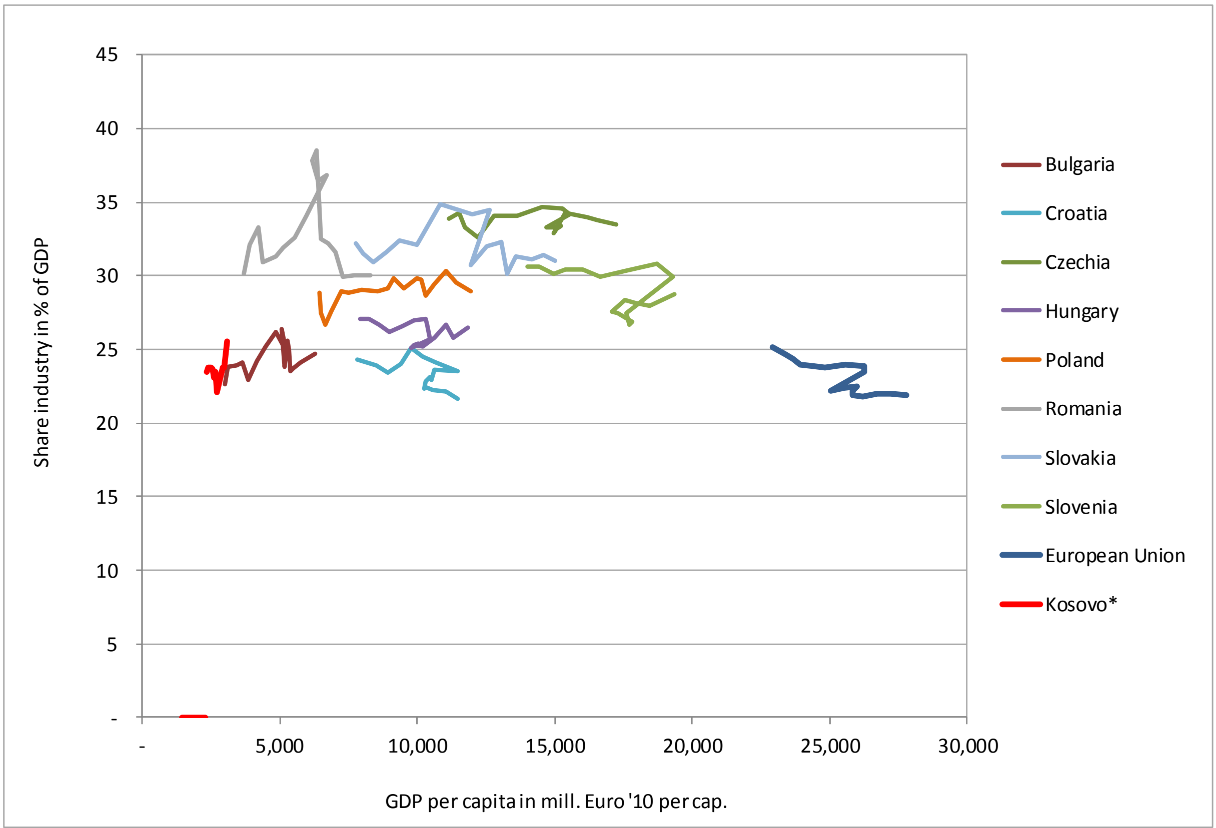


Figure 71: Development of the share of industry in % of GDP related to the GDP per capita showing historical values from 2000 to 2017 in Kosovo* compared to the EU 28 and selected MSs. Source: Eurostat, 2019; IMF, 2019; Worldbank, 2019;

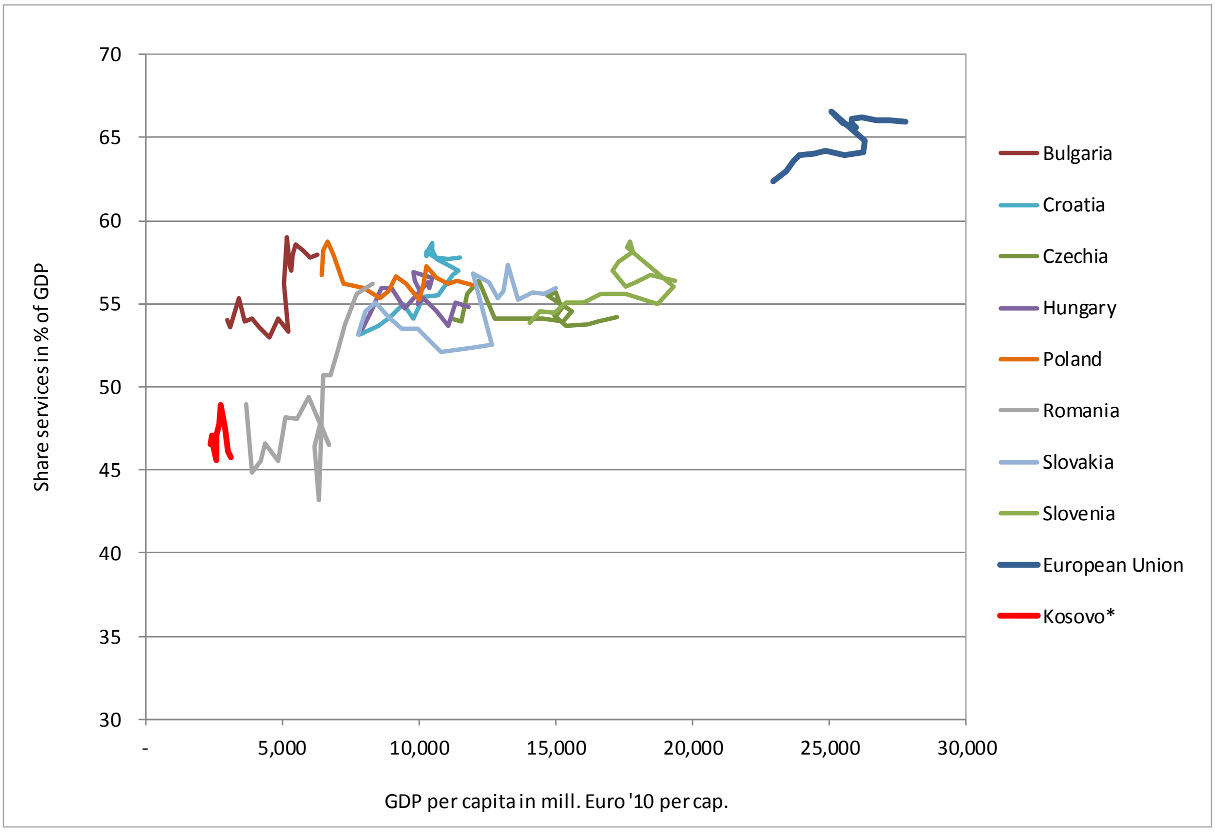


Figure 72: **Development of the share of services in % of GDP related to the GDP per capita showing historical values from 2000 to 2017 in Kosovo* compared to the EU 28 and selected MSs. Source: Eurostat, 2019; IMF, 2019; Worldbank, 2019;**

Indicators on energy system

Advanced indicators as illustrated below set the energy intensity and energy use per capita, both in terms of final energy and primary energy consumption, in correlation to the country's GDP per capita. As outlined previously, energy intensity shall act here as a representative for energy efficiency, measuring how efficient an economy uses energy. Its calculation is done by dividing energy use, in this case either final or primary, by GDP. Consequently, high energy intensities indicate a high price or cost of converting energy into GDP, and vice versa.

Figure 73 and Figure 74 below put final- and respectively primary energy consumption per GDP in relation to GDP per capita. This is shown in both graphs for Kosovo*, the EU28 and our suite of selected MSs. For each country (or region) we connect therein the different data points, referring to distinct years, with a coloured line. All seven proposed EE target setting options for 2030 for Kosovo* are shown by circular dots using different colours – these dots are on a vertical line since all make use of the same GDP/capita projection.

As applicable from these graphs, in accordance with previous statements, GDP per capita in Kosovo* today (2017) is about as high as in Bulgaria more than 15 years ago (2001); and the projected GDP per capita in 2030 for Kosovo* is comparable to Bulgaria about ten years later (i.e. in 2012).

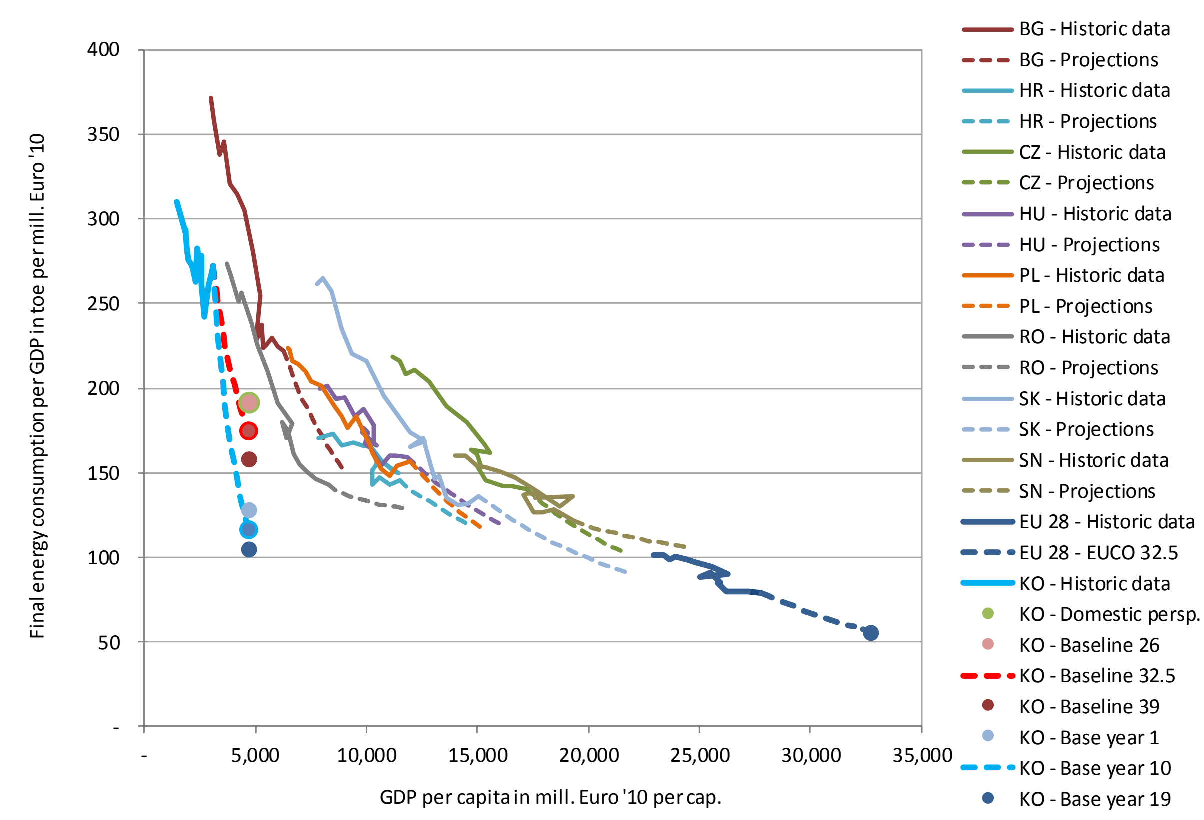


Figure 73: **The development of FEC per GDP related to the GDP per capita showing historical values from 2000 to 2017 and projections from 2018 to 2030 assuming an EE target achievement in Kosovo* compared to the EU 28 and selected MSs. Source: Eurostat, 2019; IMF, 2019; NTUA, 2012, 2017.**

Table 27: **Qualitative assessment of all EE target setting options concerning FEC per GDP (Kosovo*)**

Indicator	Domestic	Baseline 26	Baseline 32.5	Baseline 39	Base year 1	Base year 10	Base year 19
FEC per GDP	Reasonable		Intermediate (constraining)	Too constraining			

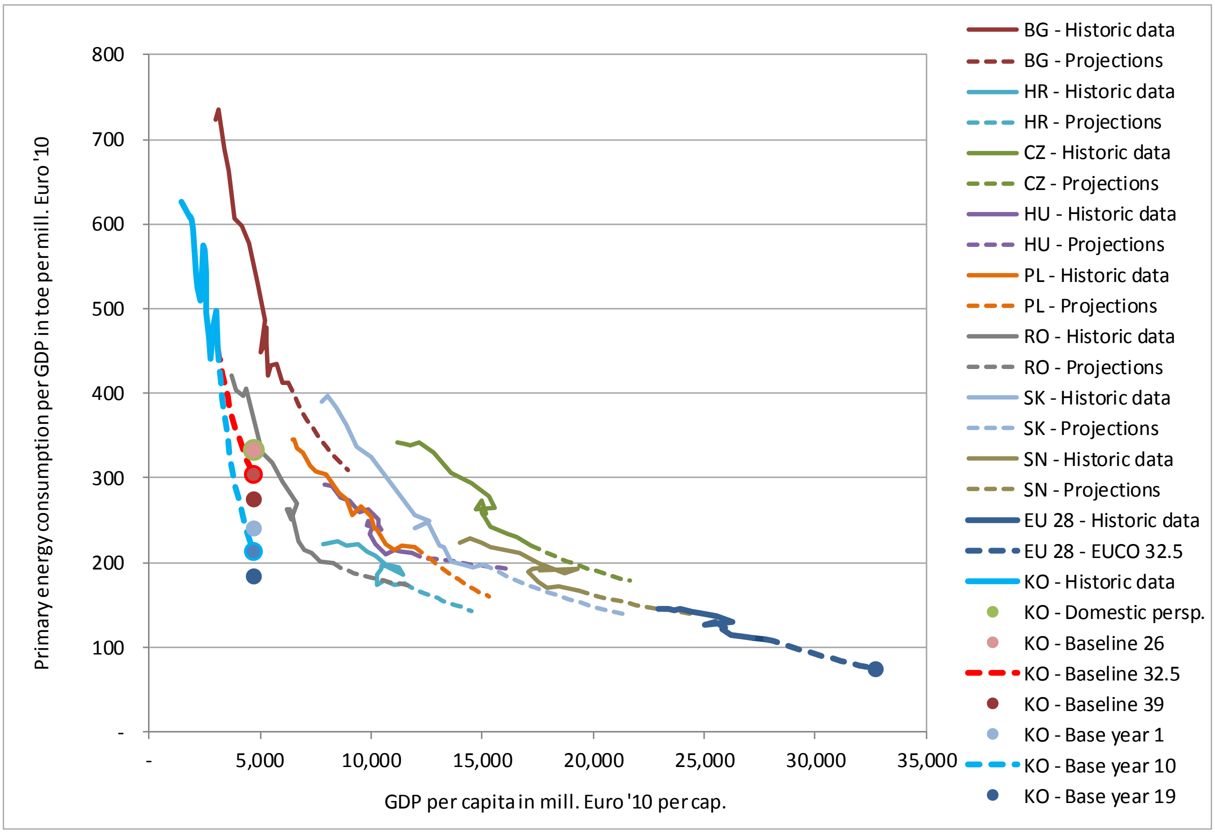


Figure 74: The development of PEC per GDP related to the GDP per capita showing historical values from 2000 to 2017 and projections from 2018 to 2030 assuming an EE target achievement in Kosovo* compared to the EU 28 and selected MSs. Source: Eurostat, 2019; IMF, 2019; NTUA, 2012, 2017.

Table 28: Qualitative assessment of all EE target setting options concerning PEC per GDP (Kosovo*)

Indicator	Domestic	Baseline 26	Baseline 32.5	Baseline 39	Base year 1	Base year 10	Base year 19
PEC per GDP							

A first (indicator-based) comparison of EE target setting options for Kosovo* indicates:

- Among all EE target setting options only the Baseline 26 and the Domestic Perspective appear useful in that sense that imposed 2030 EE targets may lead to comparable efforts to other EU MSs.
- All other target setting options, e.g. all Base year variants or the Baseline options imposing more stricter 2030 targets (Baseline 32.5 and Baseline 39) appear too constraining. Thus, they would lead to very strict EE targets in 2030. Energy consumption would then be by far lower than any observed performance across all EU MSs.

Figure 75 and Figure 76 below put final and primary energy consumption per capita in relation to GDP per capita. The graphs include trend data for Kosovo*, the EU28 and our suite of selected MSs, and, similar to above, we connect therein for a single country the different data points, referring to distinct years, with a coloured line. Again, all seven proposed EE target setting options for 2030 for Kosovo* are shown by circular dots using different colours – these dots are on a vertical line since all make use of the same GDP per capita projection.

In contrast to the previous figures, the trend pattern expressed in these graphs can hardly be interpreted at a glance. The overall correlation is lower (compared to energy consumption per GDP) both for the historic development and for projections towards 2030.

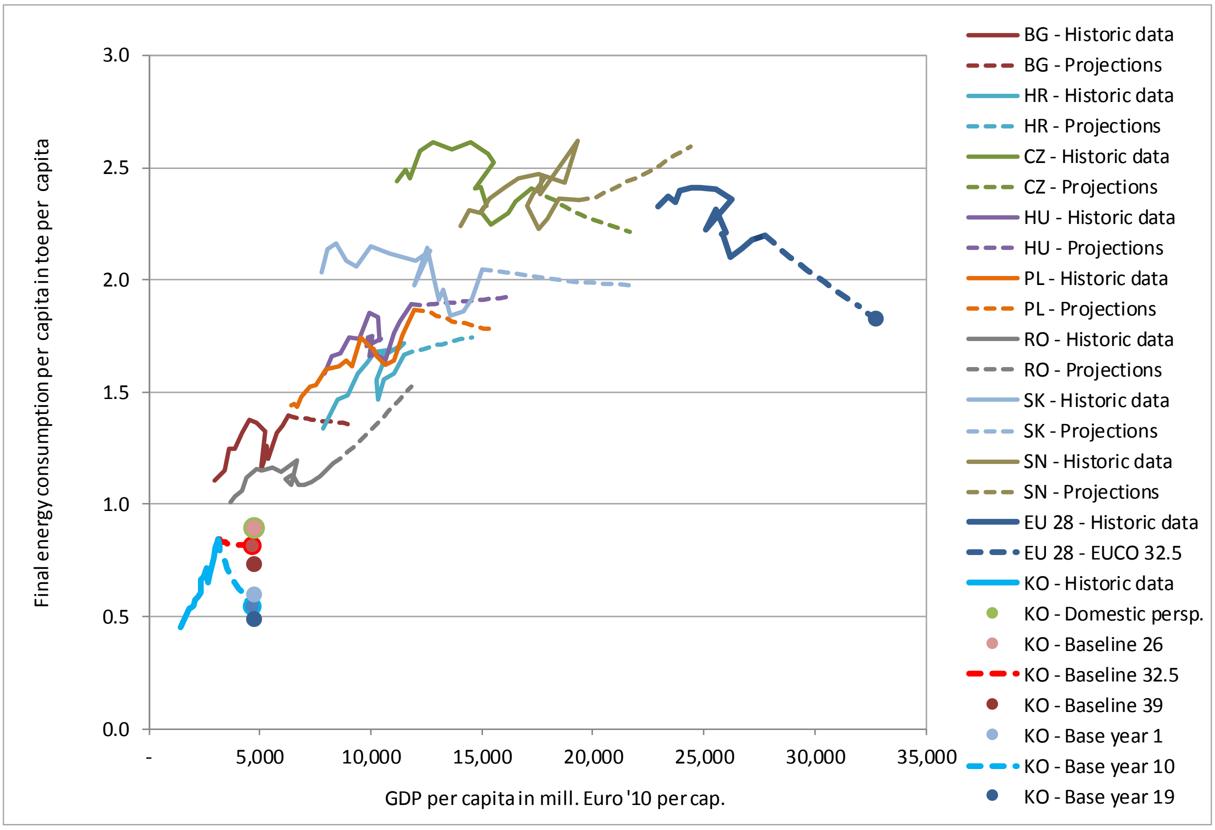


Figure 75: The development of FEC per capita related to the GDP per capita showing historical values from 2000 to 2017 and projections from 2018 to 2030 assuming an EE target achievement in Kosovo* compared to the EU 28 and selected MSs. Source: Eurostat, 2019; IMF, 2019; NTUA, 2012, 2017

Table 29: Qualitative assessment of all EE target setting options concerning FEC per capita (Kosovo*)

Indicator	Domestic	Baseline 26	Baseline 32.5	Baseline 39	Base year 1	Base year 10	Base year 19
FEC per capita							

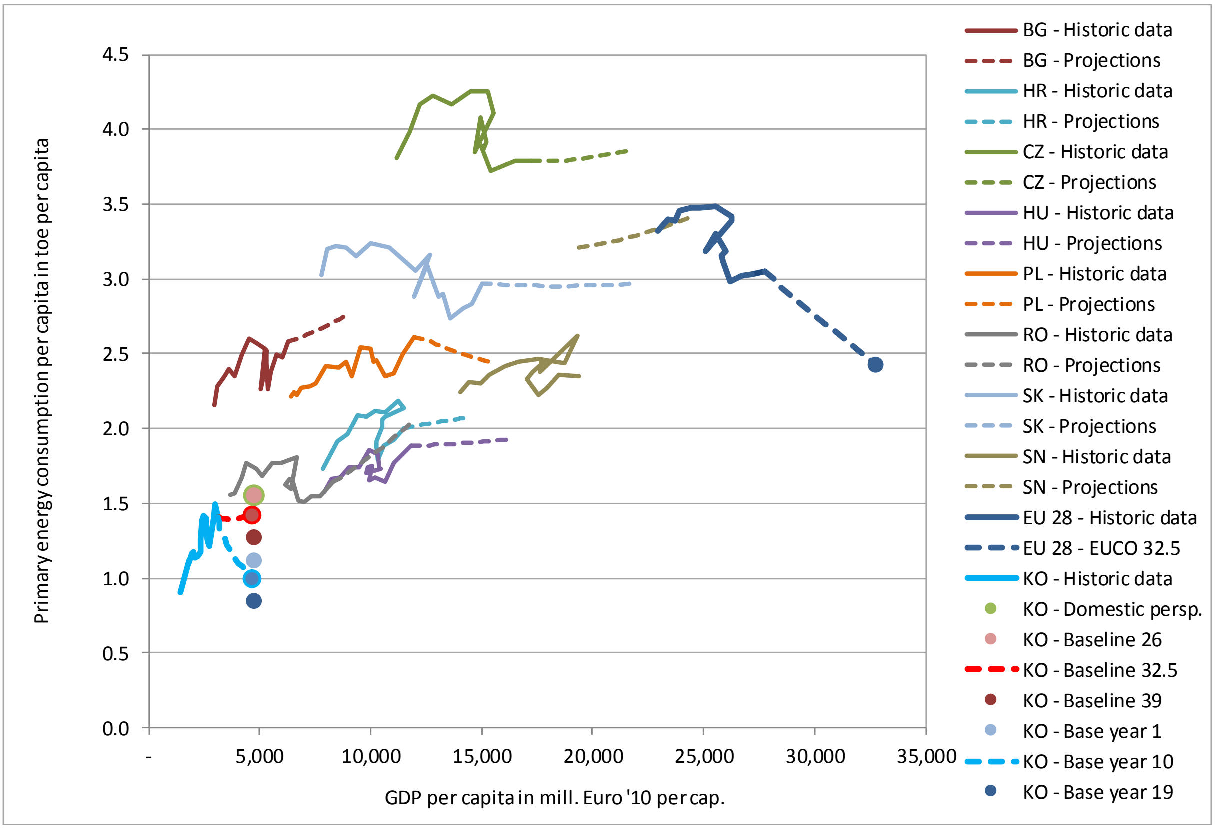


Figure 76: The development of PEC per capita related to the GDP per capita showing historical values from 2000 to 2017 and projections from 2018 to 2030 assuming an EE target achievement in Kosovo* compared to the EU 28 and selected MSs. Source: Eurostat, 2019; IMF, 2019; NTUA, 2012, 2017.

Table 30: Qualitative assessment of all EE target setting options concerning PEC per capita (Kosovo*)

Indicator	Domestic	Baseline 26	Baseline 32.5	Baseline 39	Base year 1	Base year 10	Base year 19
PEC per capita							

2.5.4.3 Summary & Conclusions for Energy Efficiency Targets of Kosovo*

Table 31 summarizes the assessment of all seven EE target setting options done in subchapter 2.5.4.2. It shows that the Baseline 26 and an EE target set in accordance with the Domestic Perspective may lead to reasonable and feasible EE targets for Kosovo* in 2030. Thus, these scenarios stay within the range of comparable efforts. A bit more constraining but still acceptable from certain perspectives (e.g. when looking at PEC per GDP) is the Baseline 32.5 approach.

Table 31: Summary table for the qualitative assessment of all EE target setting options (Kosovo*)

Indicator	Domestic	Baseline 26	Baseline 32.5	Baseline 39	Base year 1	Base year 10	Base year 19
FEC per GDP	Reasonable		Intermediate (constraining)	Too constraining			
PEC per GDP							
FEC per capita							
PEC per capita							

2.5.5 Resulting Energy Efficiency Targets for Moldova

The results on calculated EE targets for Moldova are listed in Table 32 in terms of final energy demand whereas Table 33 provides the corresponding outcomes in primary energy. The absolute consumption caps for 2030 are then illustrated in Figure 77. Complementary to that illustration, a closer look at the timely evolution of final energy demand according to the various target setting options is given in Figure 78, and the corresponding illustration in terms of primary energy is provided by Figure 79.

Table 32: EE targets in terms of final energy for Moldova for different scenarios

EE targets for Moldova in terms of final energy consumption	Historic data for 2008 [ktoe]	Historic data for 2017 [ktoe]	Baseline III in 2030 [ktoe]	Consumption cap in 2030 [ktoe]	Change compared to 2008	Change compared to 2017	Change compared to Baseline III in 2030
Domestic perspective	2,211	2,526	3,692	2,988	+35.1%	+18.3%	**-19.1%**
Base year 1	2,211	2,526	3,692	2,189	-1%	-13.3%	**-40.7%**
Base year 10	2,211	2,526	3,692	1,990	-10%	-21.2%	**-46.1%**
Base year 19	2,211	2,526	3,692	1,791	-19%	-29.1%	**-51.5%**
Baseline 26	2,211	2,526	3,692	2,732	+23.5%	+8.1%	**-26%**
Baseline 32.5	2,211	2,526	3,692	2,492	+12.7%	-1.4%	**-32.5%**
Baseline 39	2,211	2,526	3,692	2,252	+1.8%	-10.9%	**-39%**

Table 33: EE targets in terms of primary energy for Moldova for different scenarios

EE targets for Moldova in terms of primary energy consumption	Historic data for 2008 [ktoe]	Historic data for 2017 [ktoe]	Baseline III in 2030 [ktoe]	Consumption cap in 2030 [ktoe]	Change compared to 2008	Change compared to 2017	Change compared to Baseline III in 2030
Domestic perspective	3,345	3,767	5,355	3,308	-1.1%	-12.2%	**-38.2%**
Base year 1	3,345	3,767	5,355	3,301	-1.3%	-12.4%	**-38.4%**
Base year 10	3,345	3,767	5,355	2,906	-13.1%	-22.9%	**-45.7%**
Base year 19	3,345	3,767	5,355	2,510	-25%	-33.4%	**-53.1%**
Baseline 26	3,345	3,767	5,355	3,963	+18.5%	+5.2%	**-26%**
Baseline 32.5	3,345	3,767	5,355	3,615	+8.1%	-4%	**-32.5%**
Baseline 39	3,345	3,767	5,355	3,267	-2.3%	-13.3%	**-39%**

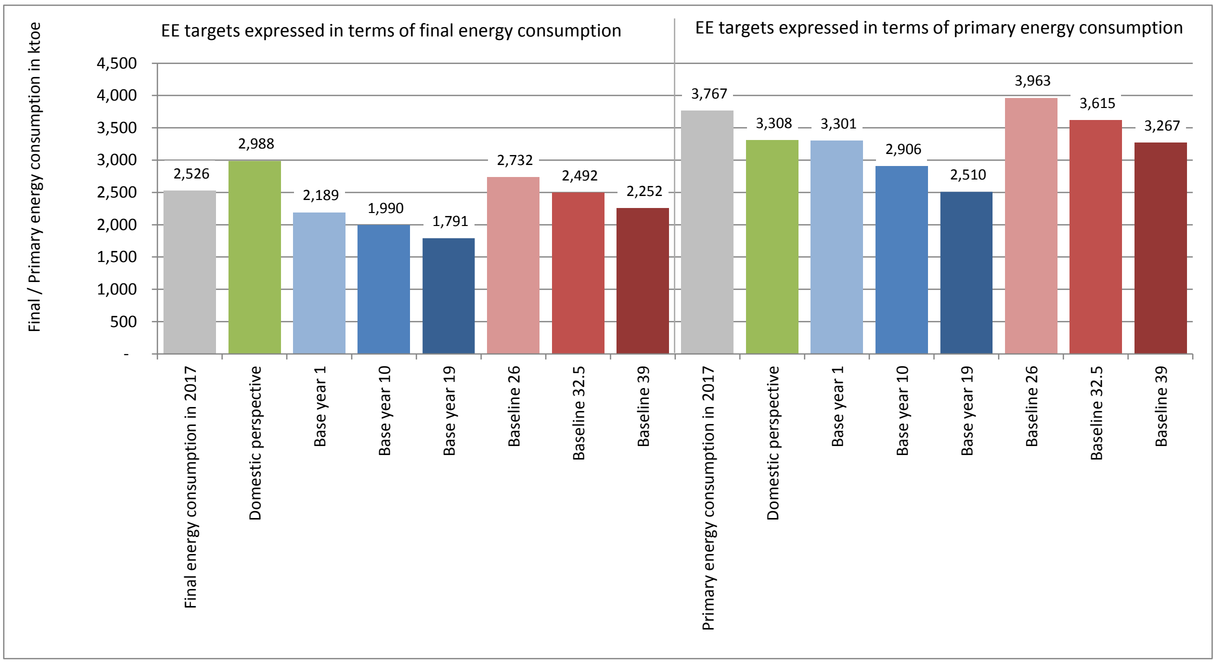


Figure 77: **Energy efficiency targets in terms of primary and final energy for different scenarios. Baseline vs. Base year approach vs. Domestic perspective**

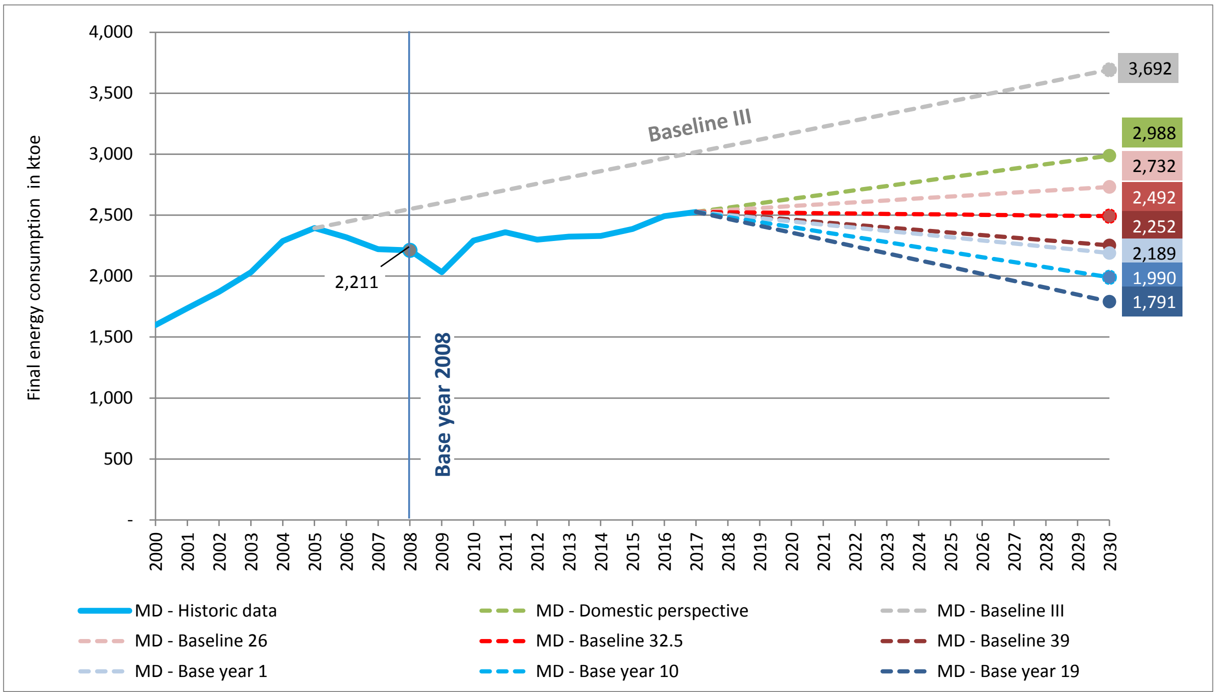


Figure 78: **Energy Efficiency targets in terms of final energy for different scenarios. Baseline compared to Base year approach vs. Domestic perspective**

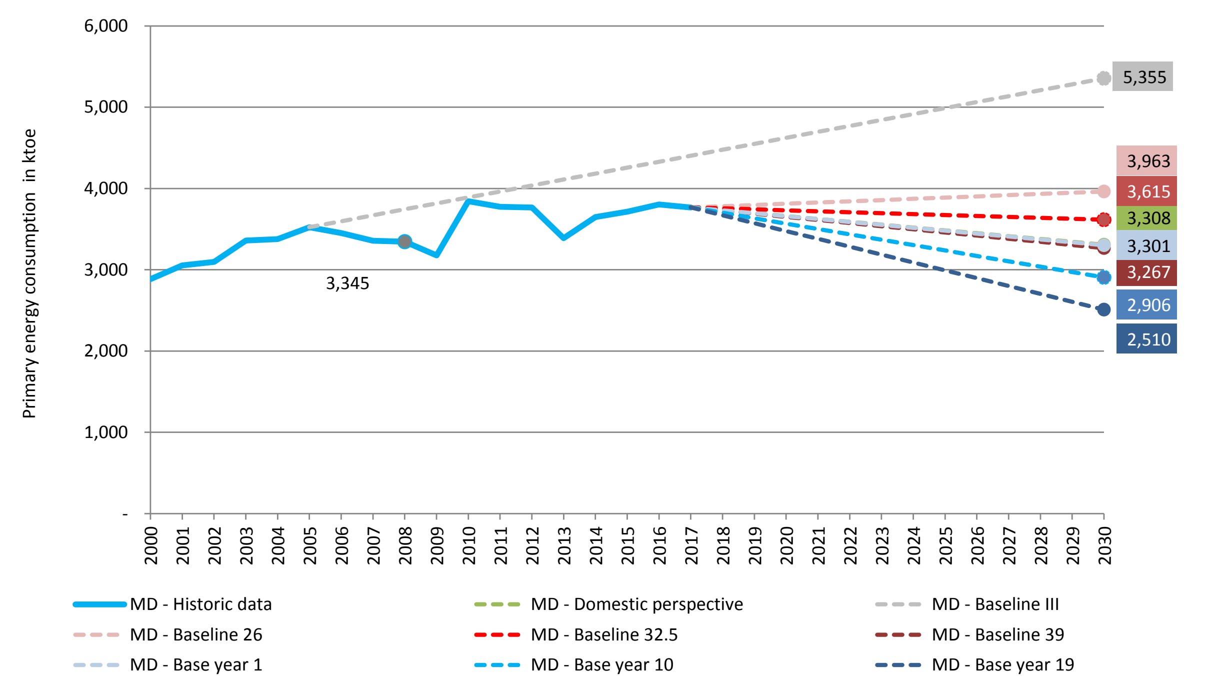


Figure 79: **Energy efficiency targets in terms of primary energy for different scenarios. Baseline compared to Base year approach vs. Domestic perspective**

2.5.5.1 Indicators for analysing energy performance

Our indicator-based assessment shall help to gain further insights on the feasibility and the impacts of the (broad) range of identified energy efficiency target setting options. We thereby illustrate how the EE targets examined match with historic trends and with the EE target setting in other countries or regions. The underlying objective is here to identify those EE target setting options that would lead to a comparable effort with the EE target imposed at EU level, while respecting differences in economic welfare. Complementary to socio-economic indicators like population, GDP and related growth trends for all CPs as introduced and discussed in section 2.3, within this section we aim to incorporate the energy perspective into the analysis.

Thus, the graphs below provide energy-related indicators like Final Energy Consumption per GDP (Figure 80) and Primary Energy Consumption (PEC) per GDP (Figure 81) which both represent the energy intensity of the country. Next to these graphs, Figure 82 and Figure 83 complement with an illustration of trends in PEC/Capita and in FEC/Capita.

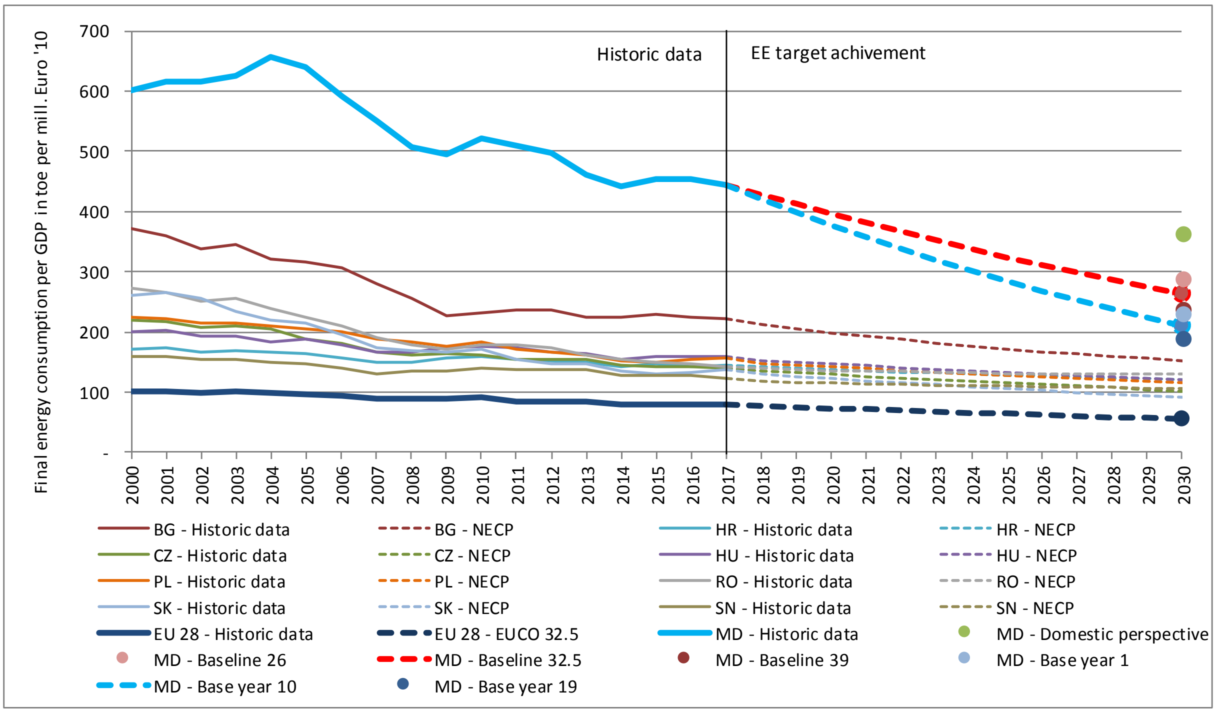


Figure 80: **Development of FEC/GDP in Moldova compared to the EU 28 and selected MS. Source: Eurostat, 2019; IMF, 2019; NTUA, 2012, 2017.**

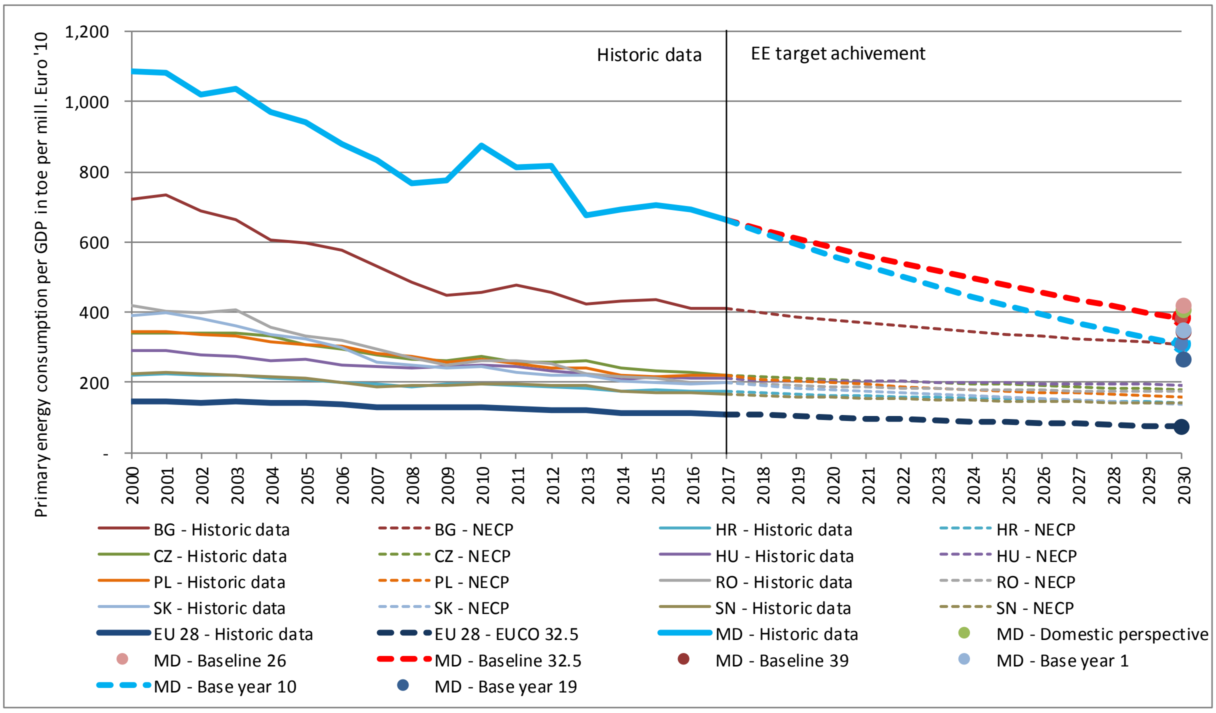


Figure 81: **Development of PEC/GDP in Moldova compared to the EU 28 and selected MS. Source: Eurostat, 2019; IMF, 2019; NTUA, 2012, 2017.**

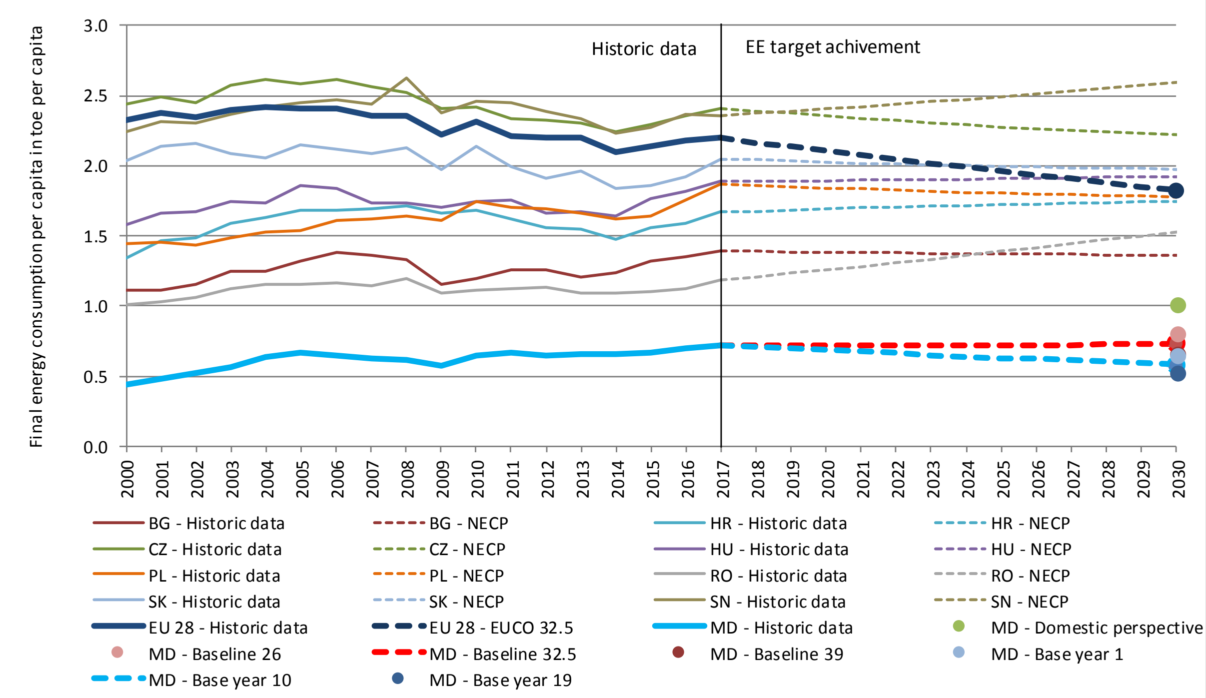


Figure 82: Development of FEC/Capita in Moldova compared to the EU 28 and selected MSs. Source: Euro-stat, 2019; IMF, 2019; NTUA, 2012, 2017.

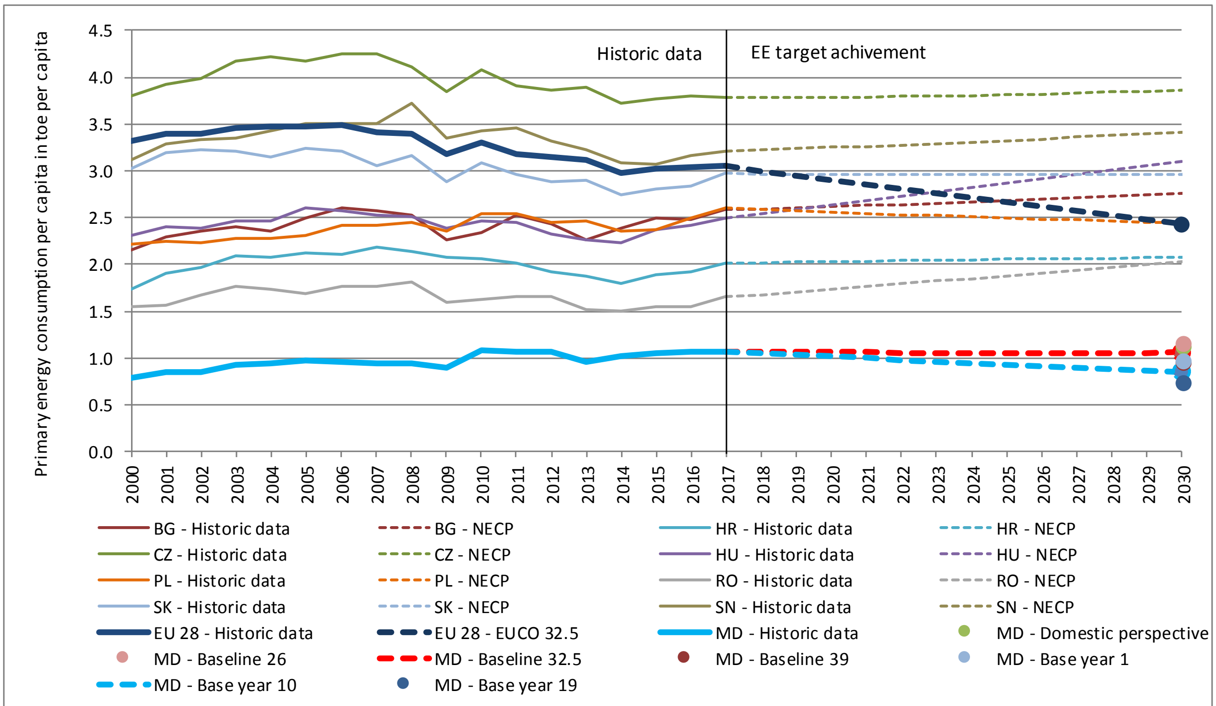


Figure 83: Development of PEC/Capita in Moldova compared to the EU 28 and selected MS. Source: Eurostat, 2019; IMF, 2019; NTUA, 2012, 2017.

2.5.5.2 Advanced indicators to assess energy efficiency performance

Indicators on economic structure

A closer look at indicators that shed light on the economic structure help to put the economic development in Moldova into perspective with selected other countries. Figure 84 to Figure 87 allow for gaining insights on the importance of certain sectors for Moldova's economy. Thus, these graphs show the development of the share of agriculture, manufacturing (as an important part of the industry sector), industry and services in % of GDP (on the vertical axis) related to the GDP per capita (on the horizontal axis) showing historical values from 2000 to 2017 in Moldova compared to the EU28 and selected MSs.

Key results gained from these graphs are:

- In overall terms, latest (2017) figures on GDP per capita show that Moldova has today (and also in the past) the lowest GDP per capita among all assessed countries – i.e. with 1,619 €$_{2010}$ per capita it is today (2017) about 50% as high as the EnC average (2,820 €$_{2010}$ per capita).
- In overall terms, the economic structure is comparable to Croatia – but the economy is less service-based but instead more agriculture-oriented.

With a share in total GDP of 18.5% the industry sector is second lowest compared to all CPs and the selected EU MSs. Only Montenegro, with a share of 15.9% shows a lower contribution towards value added in relative terms (whereas if counted in absolute terms, Montenegro would be ranked last).

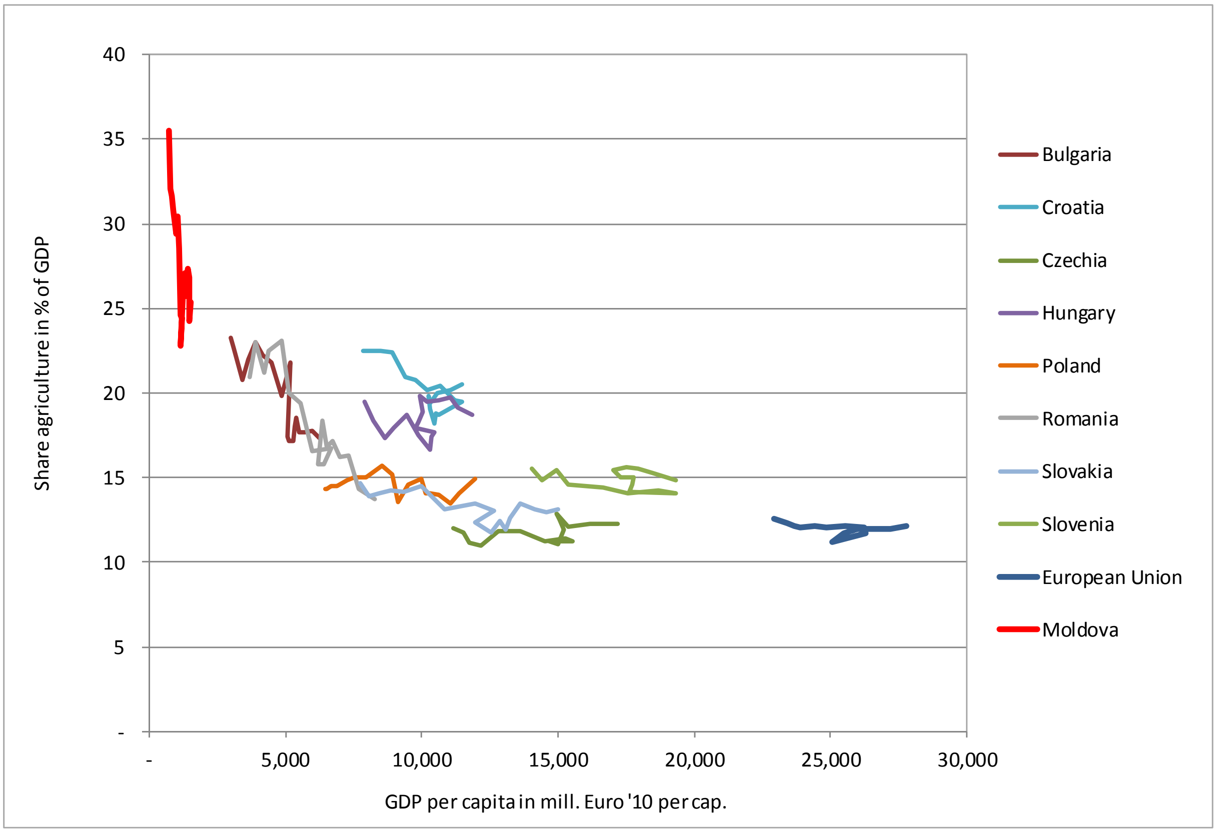


Figure 84: Development of the share of agriculture in % of GDP related to the GDP per capita showing historical values from 2000 to 2017 in Moldova compared to the EU 28 and selected MSs. Source: Eurostat, 2019; IMF, 2019; Worldbank, 2019;

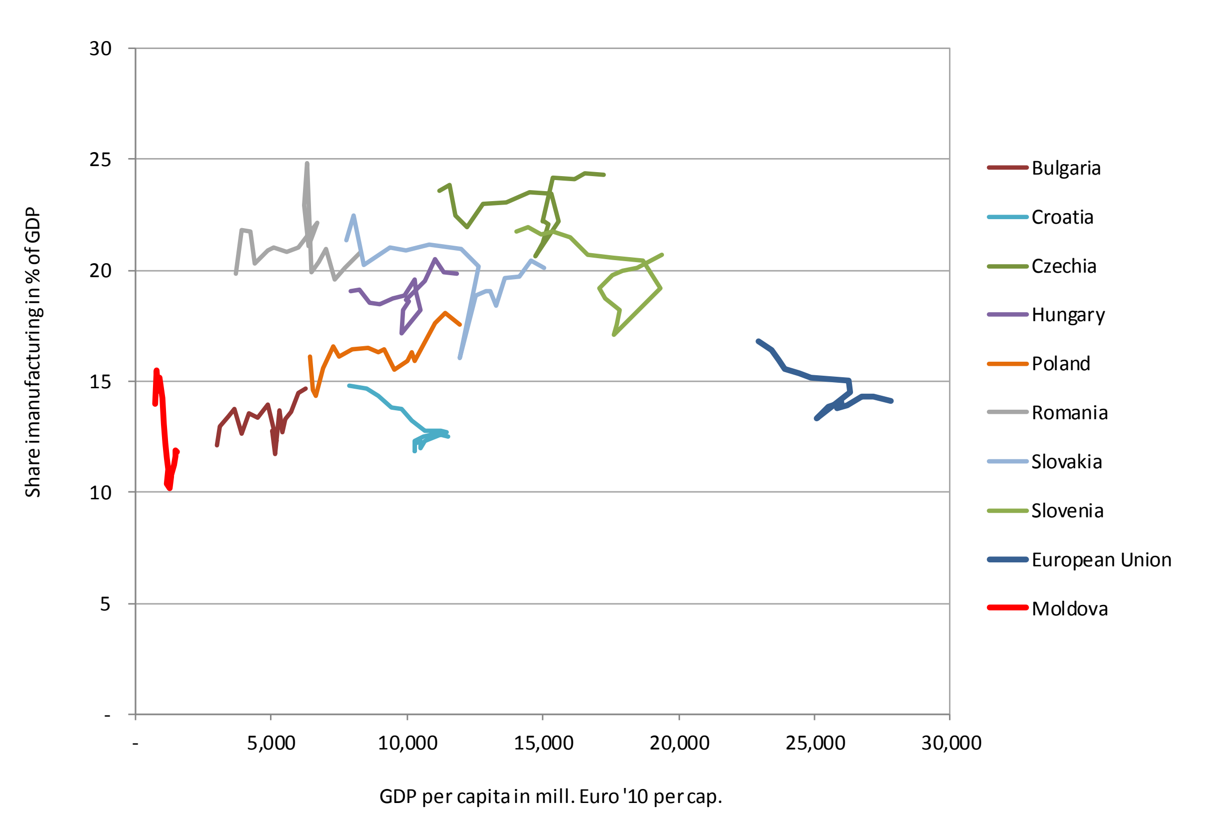


Figure 85: Development of the share of manufacturing in % of GDP related to the GDP per capita showing historical values from 2000 to 2017 in Moldova compared to the EU 28 and selected MSs. Source: Eurostat, 2019; IMF, 2019; Worldbank, 2019;

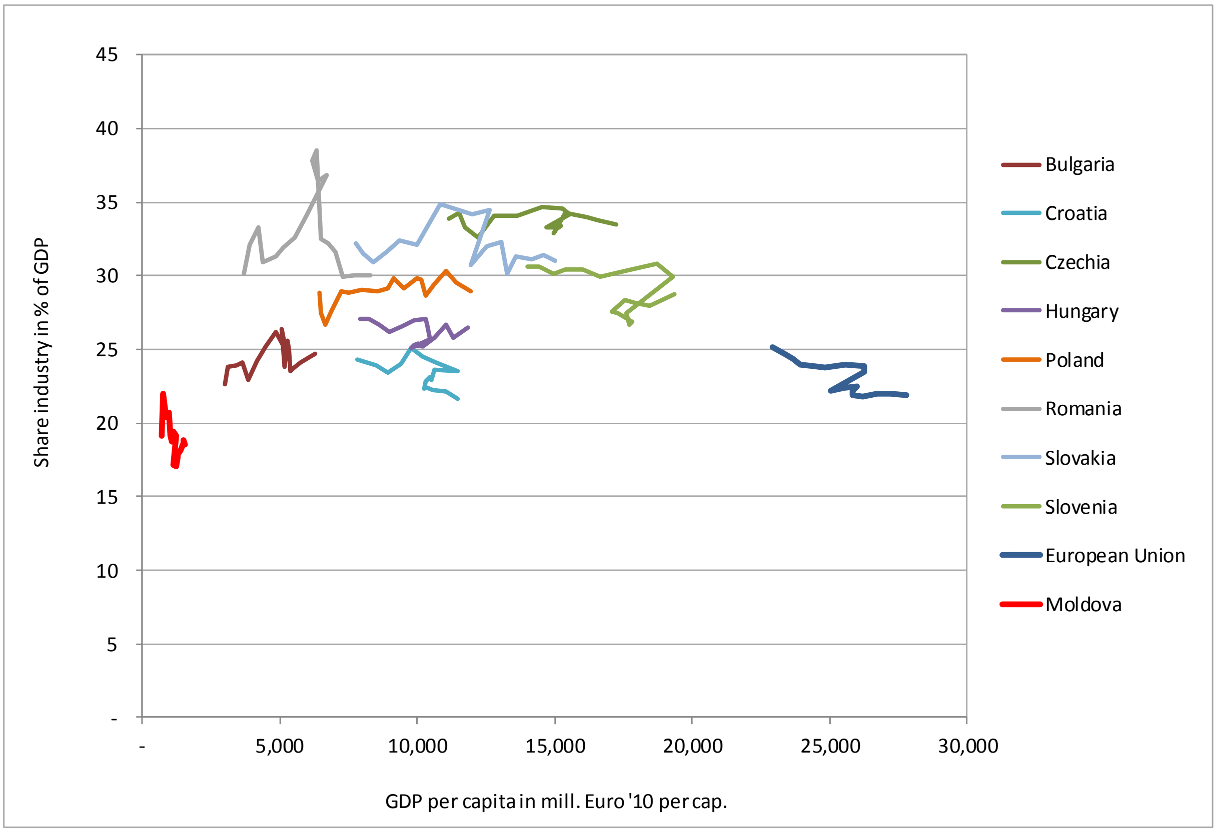


Figure 86: Development of the share of industry in % of GDP related to the GDP per capita showing historical values from 2000 to 2017 in Moldova compared to the EU 28 and selected MSs. Source: Eurostat, 2019; IMF, 2019; Worldbank, 2019;

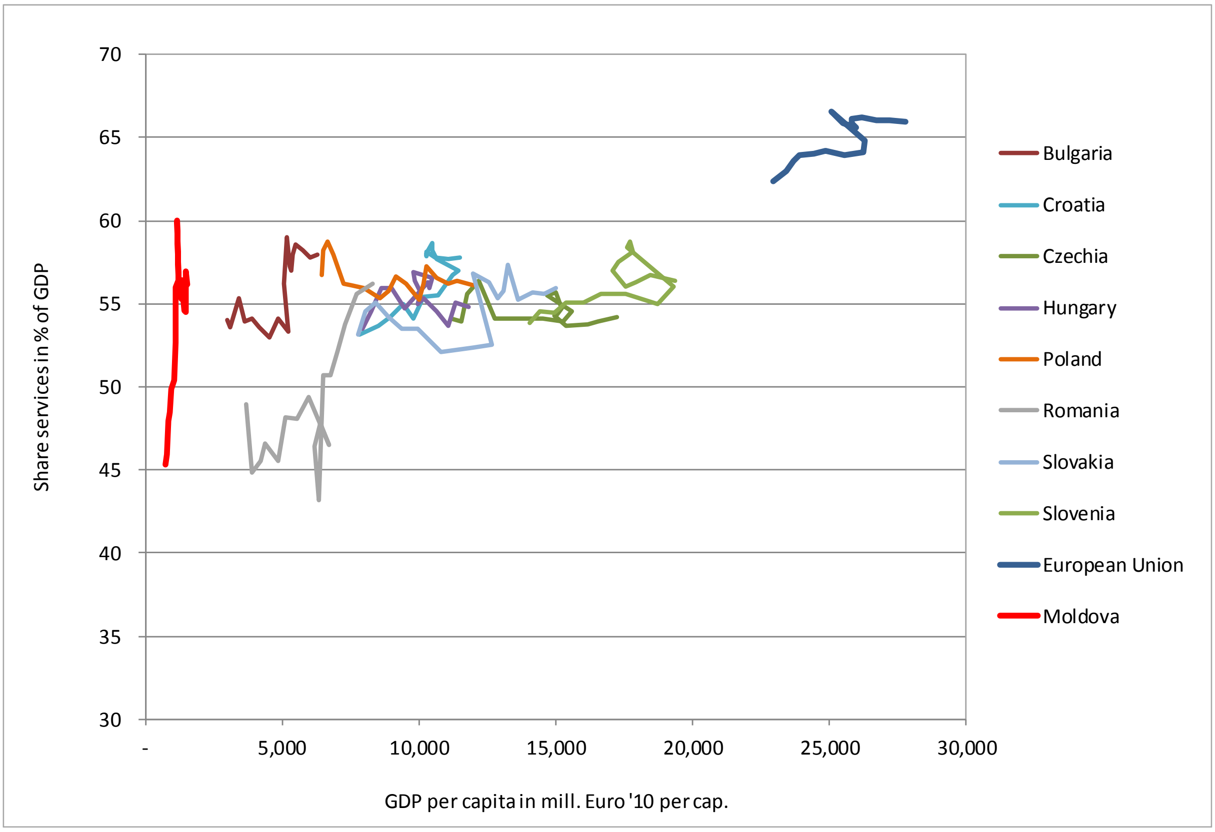


Figure 87: Development of the share of services in % of GDP related to the GDP per capita showing historical values from 2000 to 2017 in Moldova compared to the EU 28 and selected MSs. Source: Eurostat, 2019; IMF, 2019; Worldbank, 2019;

Indicators on energy system

Advanced indicators as illustrated below set the energy intensity and energy use per capita, both in terms of final energy and primary energy consumption, in correlation to Moldova's data on GDP per capita. As outlined previously, energy intensity acts here as a substitute for energy efficiency, measuring how efficient an economy uses energy. In this context, a high energy intensity indicate a high price or cost of converting energy into GDP, and vice versa.

Figure 88 and Figure 89 below put final- and respectively primary energy consumption per GDP in relation to GDP per capita. This is shown in both graphs for Moldova, the EU28 and our suite of selected MSs. For each country (or region) we link therein the different data points, referring to distinct years, with a coloured line. All seven proposed EE target setting options for 2030 for Moldova are shown by circular dots using different colours – these dots are on a vertical line since all make use of the same GDP per capita projection.

As applicable from these graphs, in accordance with previous statements, GDP per capita in Moldova today (2017) is lowest among all assessed CPs and EU MSs; and the projected GDP per capita in 2030 for Moldova is comparable to Bulgaria as of 2001.

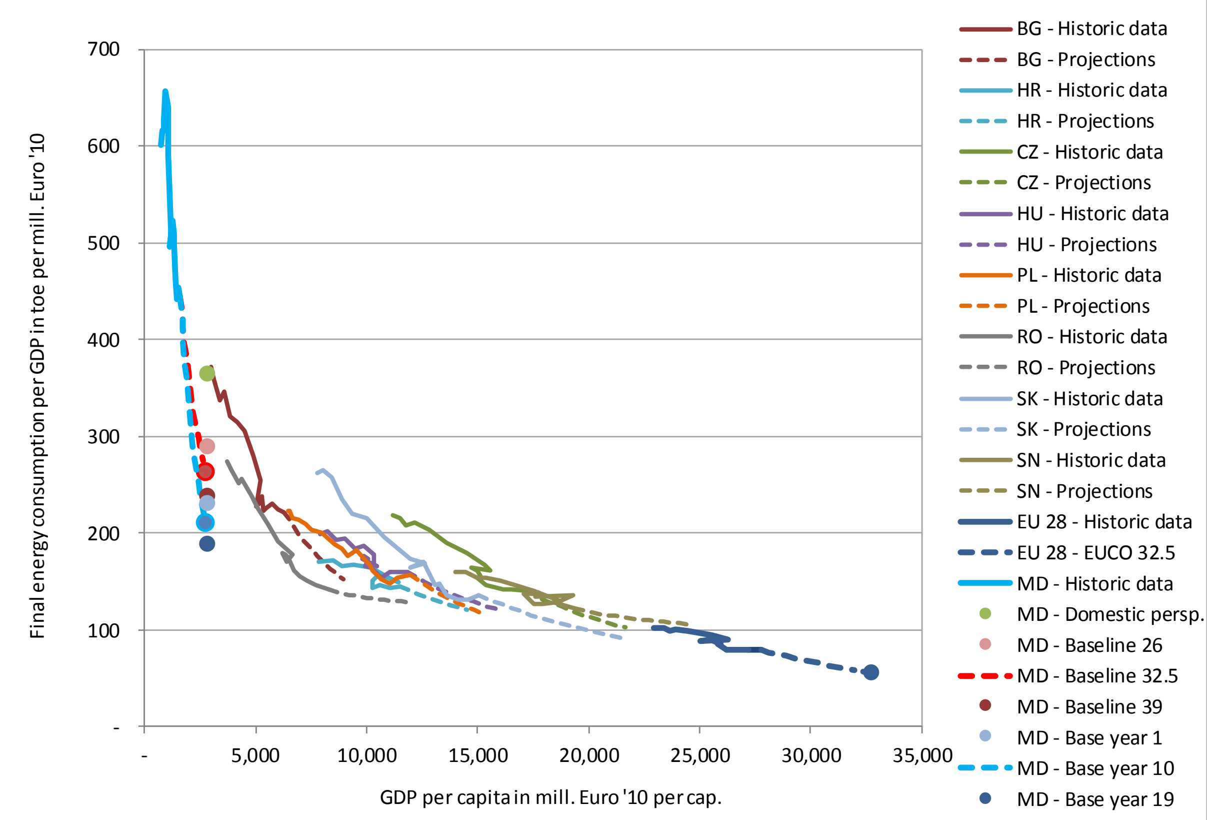


Figure 88: **The development of FEC per GDP related to the GDP per capita showing historical values from 2000 to 2017 and projections from 2018 to 2030 assuming an EE target achievement in Moldova compared to the EU 28 and selected MSs. Source: Eurostat, 2019; IMF, 2019; NTUA, 2012, 2017.**

Table 34: **Qualitative assessment of all EE target setting options concerning FEC per GDP (Moldova)**

Indicator	Domestic	Baseline 26	Baseline 32.5	Baseline 39	Base year 1	Base year 10	Base year 19
FEC per GDP	Not ambitious	Reasonable	Intermediate (constraining)	Too constraining			

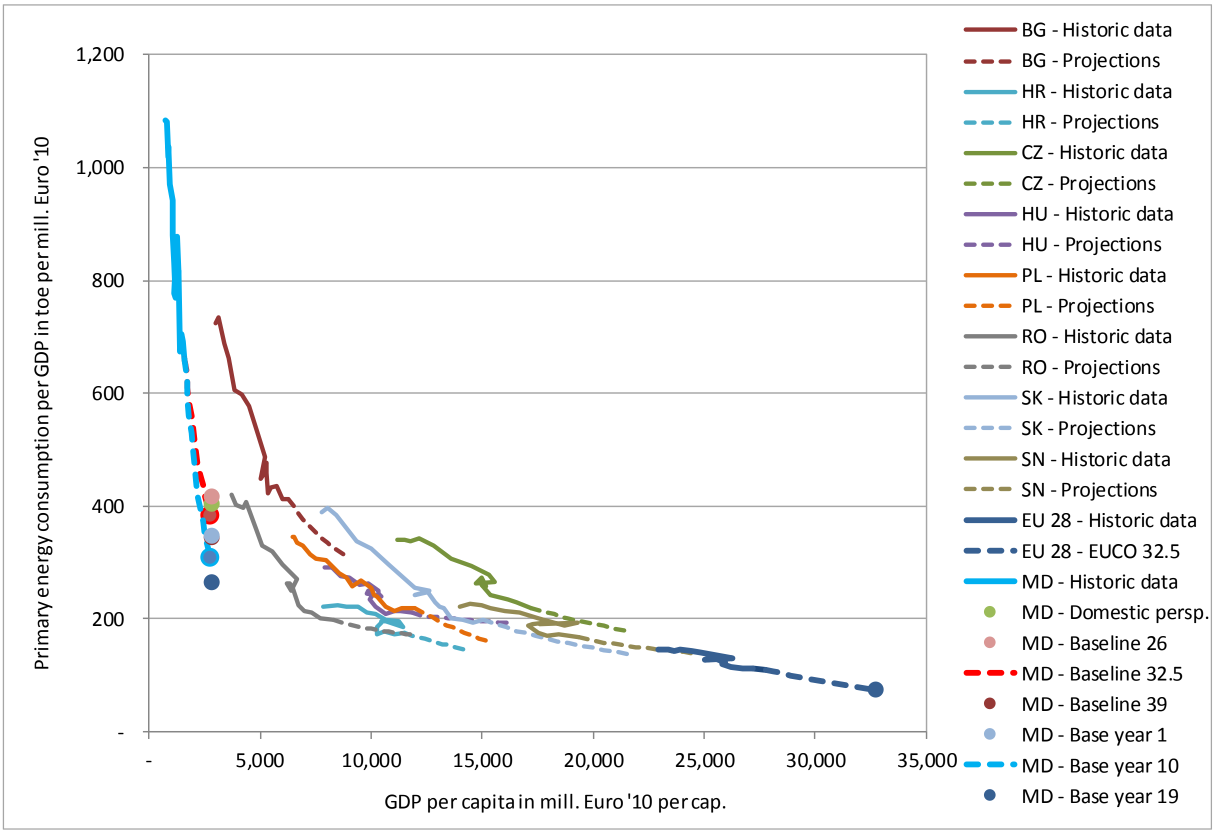


Figure 89: **The development of PEC per GDP related to the GDP per capita showing historical values from 2000 to 2017 and projections from 2018 to 2030 assuming an EE target achievement in Moldova compared to the EU 28 and selected MSs. Source: Eurostat, 2019; IMF, 2019; NTUA, 2012, 2017.**

Table 35: **Qualitative assessment of all EE target setting options concerning PEC per GDP (Moldova)**

Indicator	Domestic	Baseline 26	Baseline 32.5	Baseline 39	Base year 1	Base year 10	Base year 19
PEC per GDP							

Figure 90 and Figure 91 below put final and primary energy consumption per capita in relation to GDP per capita. The graphs include trend data for Moldova, the EU28 and our suite of selected MSs, and, similar to above, we connect therein for a single country the different data points, referring to distinct years, with a coloured line. Again, all seven proposed EE target setting options for 2030 for Moldova are shown by circular dots using different colours – these dots are on a vertical line since all make use of the same GDP per capita projection.

In contrast to the previous figures, the trend pattern expressed in these graphs can hardly be interpreted without further background information and so forth. On general observation is however that the overall correlation is lower (compared to energy consumption per GDP) both for the historic development and for projections towards 2030.

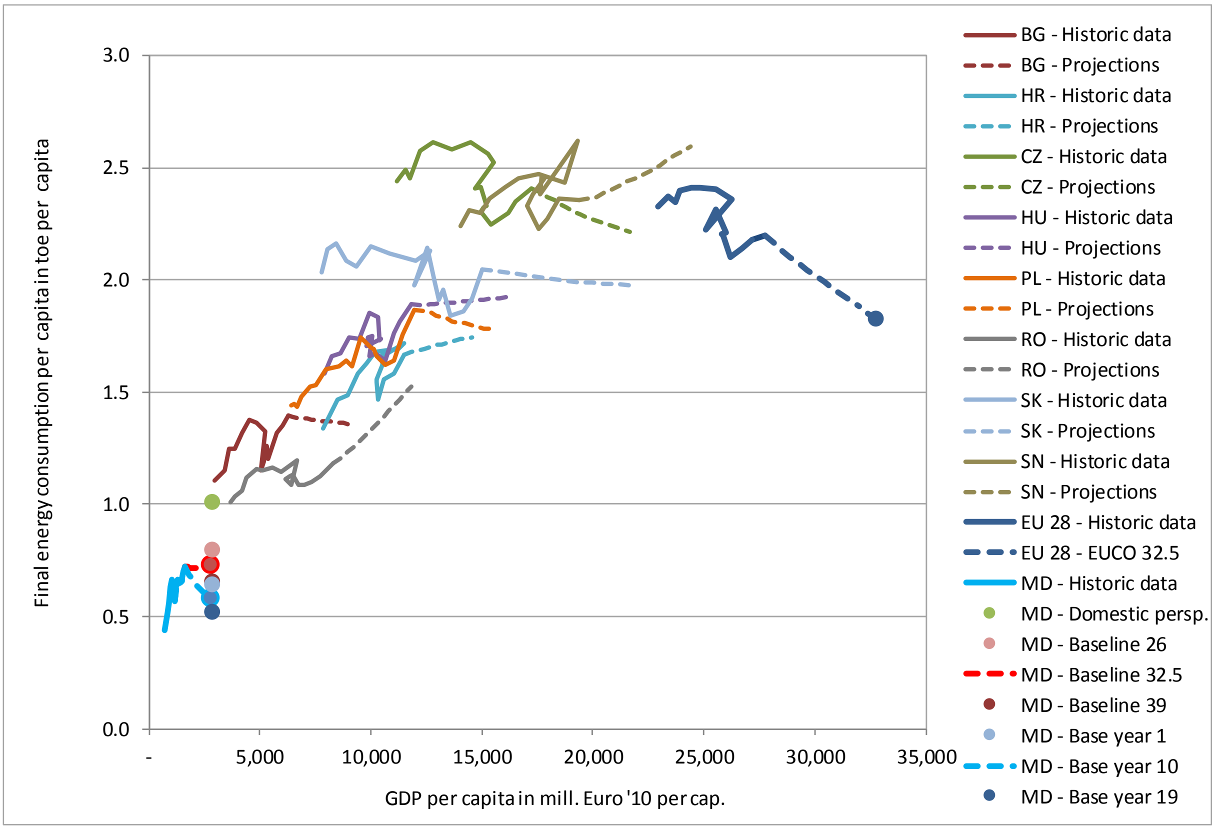


Figure 90: The development of FEC per capita related to the GDP per capita showing historical values from 2000 to 2017 and projections from 2018 to 2030 assuming an EE target achievement in Moldova compared to the EU 28 and selected MSs. Source: Eurostat, 2019; IMF, 2019; NTUA, 2012, 2017

Table 36: Qualitative assessment of all EE target setting options concerning FEC per capita (Moldova)

Indicator	Domestic	Baseline 26	Baseline 32.5	Baseline 39	Base year 1	Base year 10	Base year 19
FEC per capita							

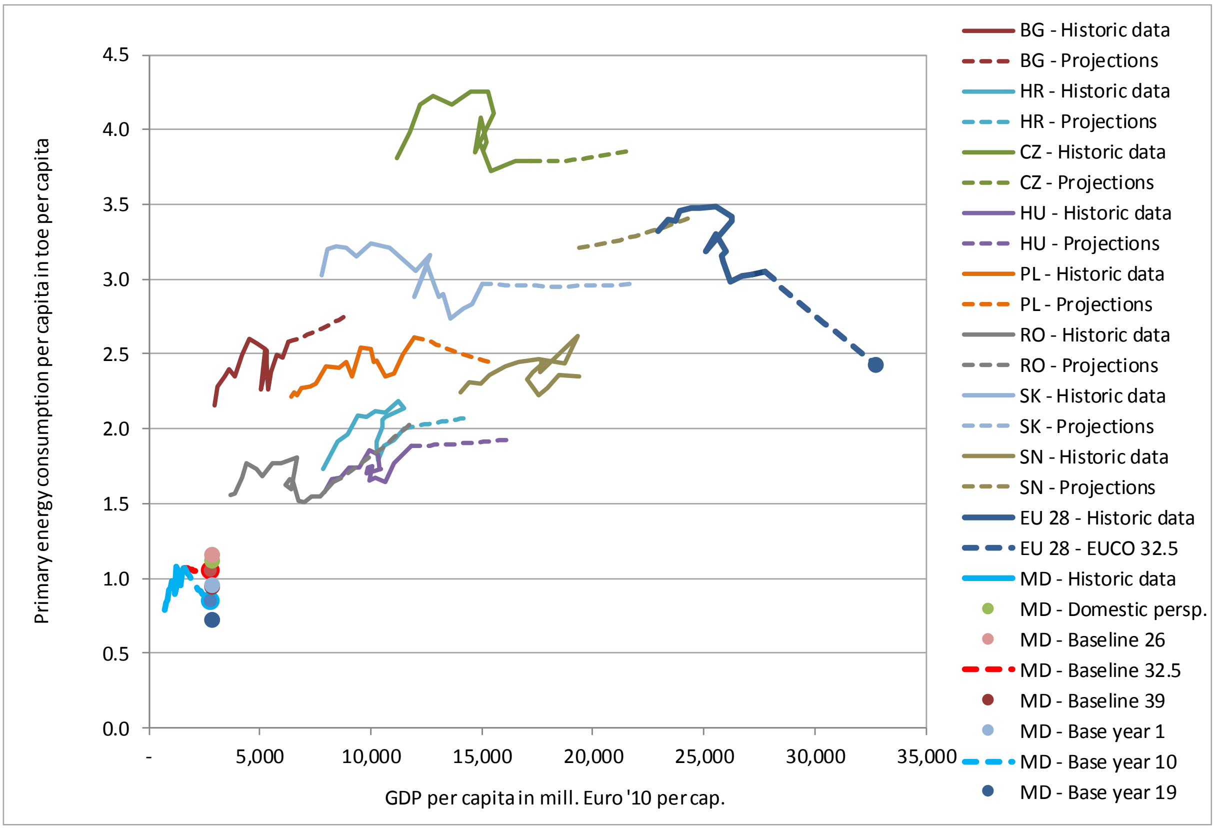


Figure 91: The development of PEC per capita related to the GDP per capita showing historical values from 2000 to 2017 and projections from 2018 to 2030 assuming an EE target achievement in Moldova compared to the EU 28 and selected MSs. Source: Eurostat, 2019; IMF, 2019; NTUA, 2012, 2017.

Table 37: Qualitative assessment of all EE target setting options concerning PEC per capita (Moldova)

Indicator	Domestic	Baseline 26	Baseline 32.5	Baseline 39	Base year 1	Base year 10	Base year 19
PEC per capita							

2.5.5.3 Summary & Conclusions for Energy Efficiency Targets of Moldova

Table 38 summarizes the assessment of all seven EE target setting options done in subchapter 2.5.5.2. Specifically for Moldova one has to keep in mind that today's final energy consumption per capita is very low (as is GDP), and, consequently, an increase until 2030 seems to be reasonable.

A comparison of EE target setting options for Moldova indicates:

- An EE target in accordance with the Domestic Perspective looks not ambitious enough – i.e. there would hardly be any change in energy use imposed by that.
- Targets following the Base year approach, and using 2008 as base year, would lead to very strict EE targets in 2030. Thus, all corresponding EE target setting options – i.e. all variants of the Base year approach – appear all too constraining for Moldova.
- Among the Baseline options the Baseline 26 appears reasonable when compared to trends and performances observed in other countries. In contrast to that, Baseline 32.5 seems to be intermediate constraining, and Baseline 39 far too constraining.

We can consequently conclude that the EE target setting option Baseline 26 lead to the most reasonable EE targets for 2030 in the case of Moldova. This scenario stays within the range of comparable efforts – i.e. here based on a comparison with EU MSs showing the most similarieties when compared to Moldova in regards with their economic structure.

Table 38: Summary table for the qualitative assessment of all EE target setting options (Moldova)

Indicator	Domestic	Baseline 26	Baseline 32.5	Baseline 39	Base year 1	Base year 10	Base year 19
FEC per GDP	Not ambitious	Reasonable	Intermediate (constraining)	Too constraining			
PEC per GDP							
FEC per capita							
PEC per capita							

2.5.6 Resulting Energy Efficiency Targets for Montenegro

The results for calculated EE targets are presented in Table 39 in terms of final energy demand and in Table 40 in Terms of primary energy demand. The absolute consumption caps for 2030 are shown in Figure 92. A closer look at the timely evolution of final energy demand according to the various target setting options is then shown in Figure 93. The corresponding illustration in terms of primary energy is shown in Figure 94.

Table 39: EE targets in terms of final energy for Montenegro for different scenarios

EE targets for Montenegro in terms of final energy consumption	Historic data for 2008 [ktoe]	Historic data for 2017 [ktoe]	Baseline III in 2030 [ktoe]	Consumption cap in 2030 [ktoe]	Change compared to 2008	Change compared to 2017	Change compared to Baseline III in 2030
Domestic perspective	868	743	1,318	1,102	+27%	+48.3%	**-16.4%**
Base year 1	868	743	1,318	859	-1%	+15.6%	**-34.8%**
Base year 10	868	743	1,318	781	-10%	+5.1%	**-40.8%**
Base year 19	868	743	1,318	703	-19%	-5.4%	**-46.7%**
Baseline 26	868	743	1,318	976	+12.4%	+31.3%	**-26%**
Baseline 32.5	868	743	1,318	890	+2.6%	+19.8%	**-32.5%**
Baseline 39	868	743	1,318	804	-7.3%	+8.2%	**-39%**

Table 40: EE targets in terms of primary energy for Montenegro for different scenarios

EE targets for Montenegro in terms of primary energy consumption	Historic data for 2008 [ktoe]	Historic data for 2017 [ktoe]	Baseline III in 2030 [ktoe]	Consumption cap in 2030 [ktoe]	Change compared to 2008	Change compared to 2017	Change compared to Baseline III in 2030
Domestic perspective	1,196	1,002	1,471	1,569	+31.1%	+56.6%	**+6.7%**
Base year 1	1,196	1,002	1,471	1,181	-1.3%	+17.8%	**-19.7%**
Base year 10	1,196	1,002	1,471	1,039	-13.1%	+3.7%	**-29.3%**
Base year 19	1,196	1,002	1,471	898	-25%	-10.4%	**-39%**
Baseline 26	1,196	1,002	1,471	1,088	-9%	+8.6%	**-26%**
Baseline 32.5	1,196	1,002	1,471	993	-17%	-0.9%	**-32.5%**
Baseline 39	1,196	1,002	1,471	897	-25%	-10.5%	**-39%**

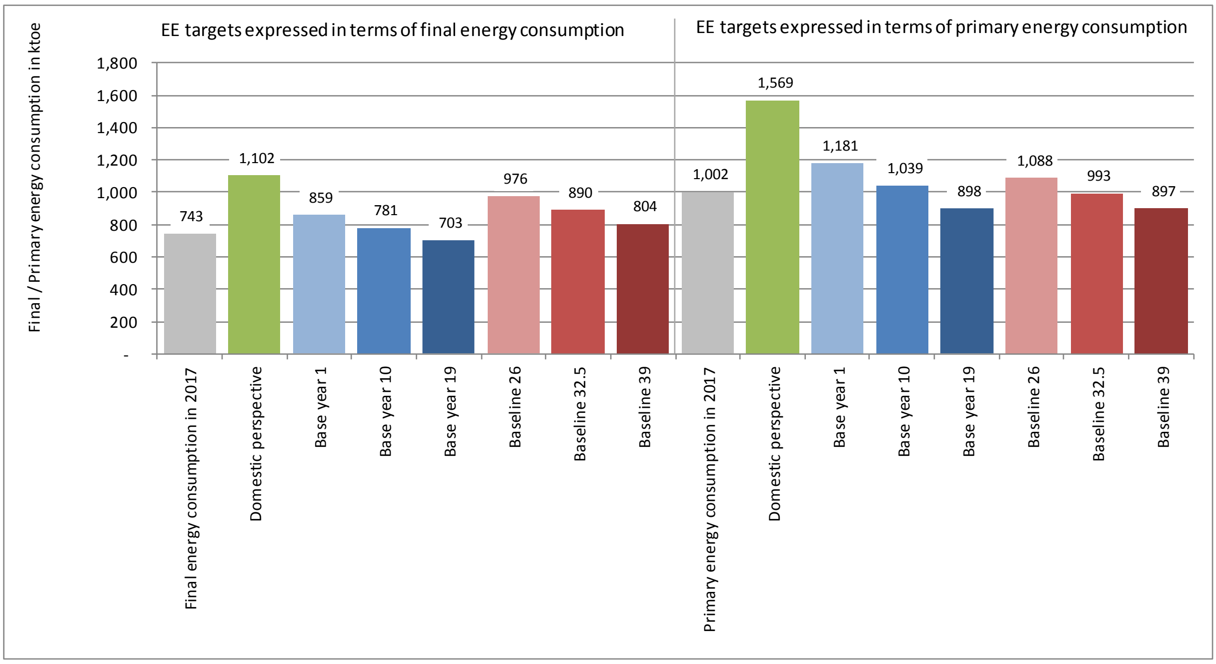


Figure 92: **Energy efficiency targets in terms of primary and final energy for different scenarios. Baseline vs. Base year approach vs. Domestic perspective**

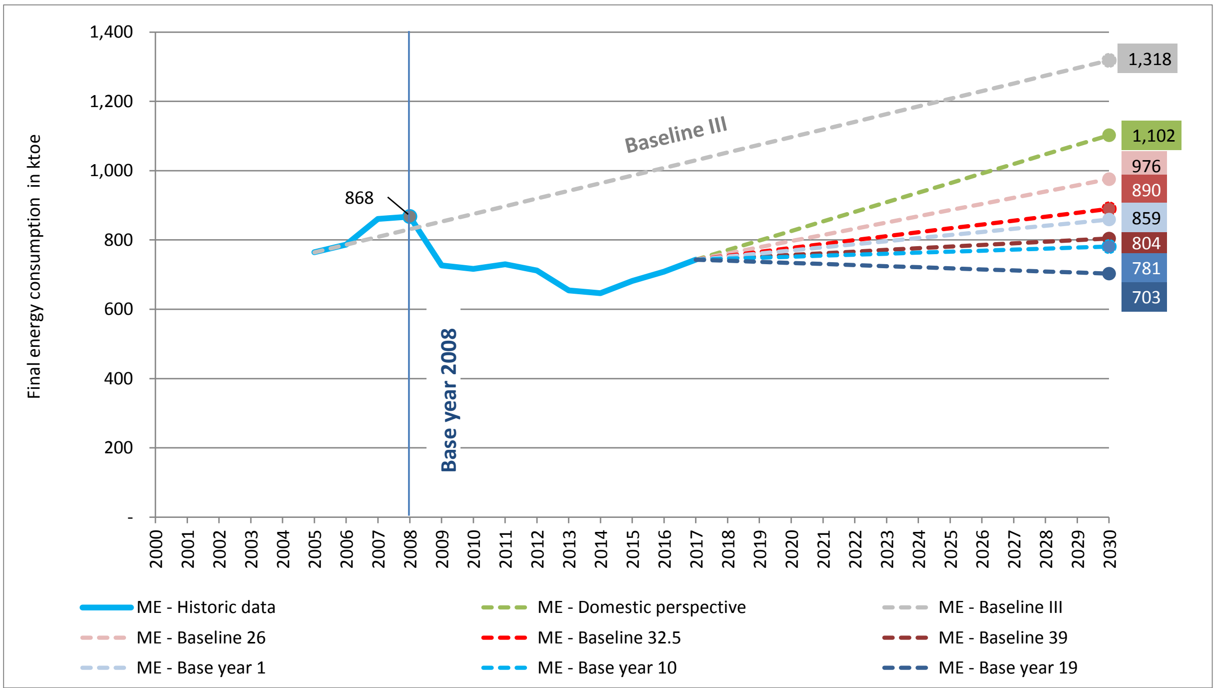


Figure 93: **Energy Efficiency targets in terms of final energy for different scenarios. Baseline compared to Base year approach vs. Domestic perspective**

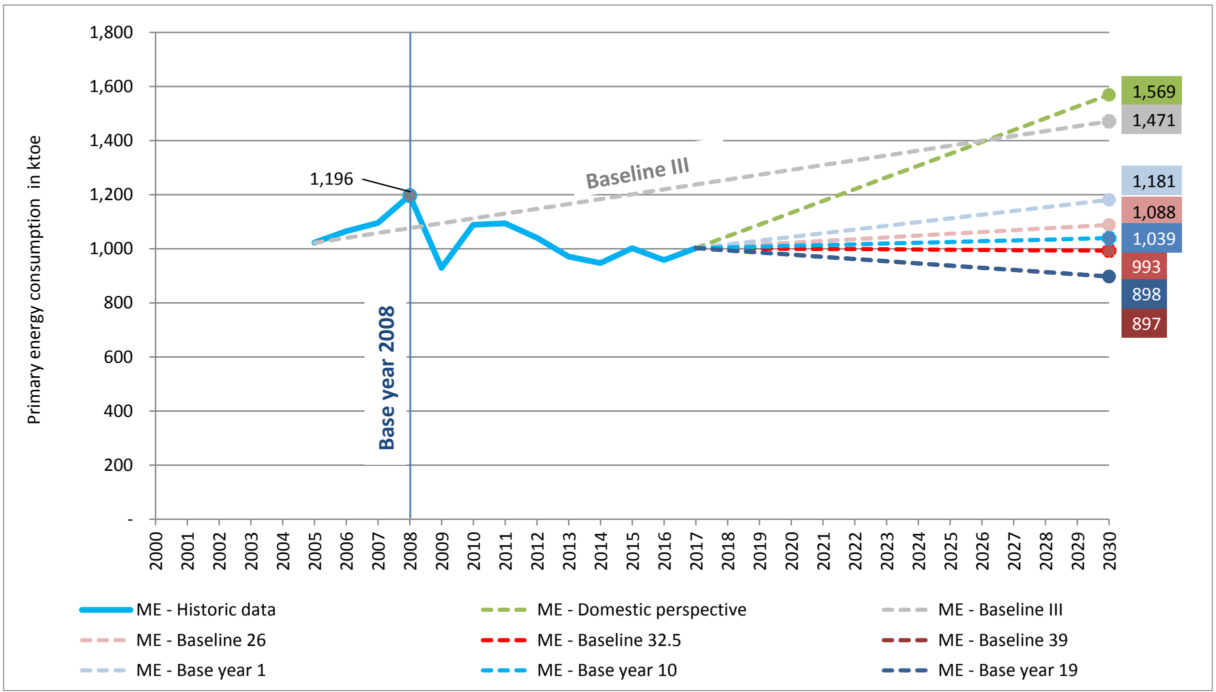


Figure 94: **Energy efficiency targets in terms of primary energy for different scenarios. Baseline compared to Base year approach vs. Domestic perspective**

2.5.6.1 Indicators for analysing energy performance

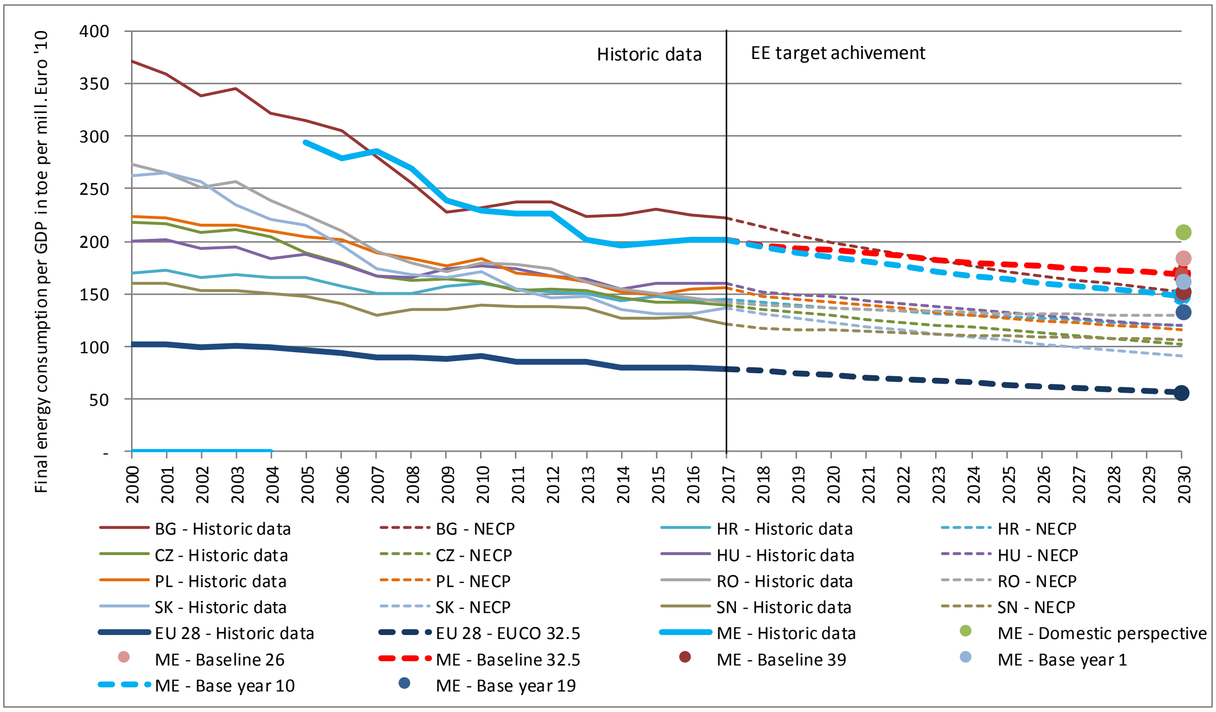


Figure 95: **Development of FEC/GDP in Montenegro compared to the EU 28 and selected MS. Source: Eurostat, 2019; IMF, 2019; NTUA, 2012, 2017.**

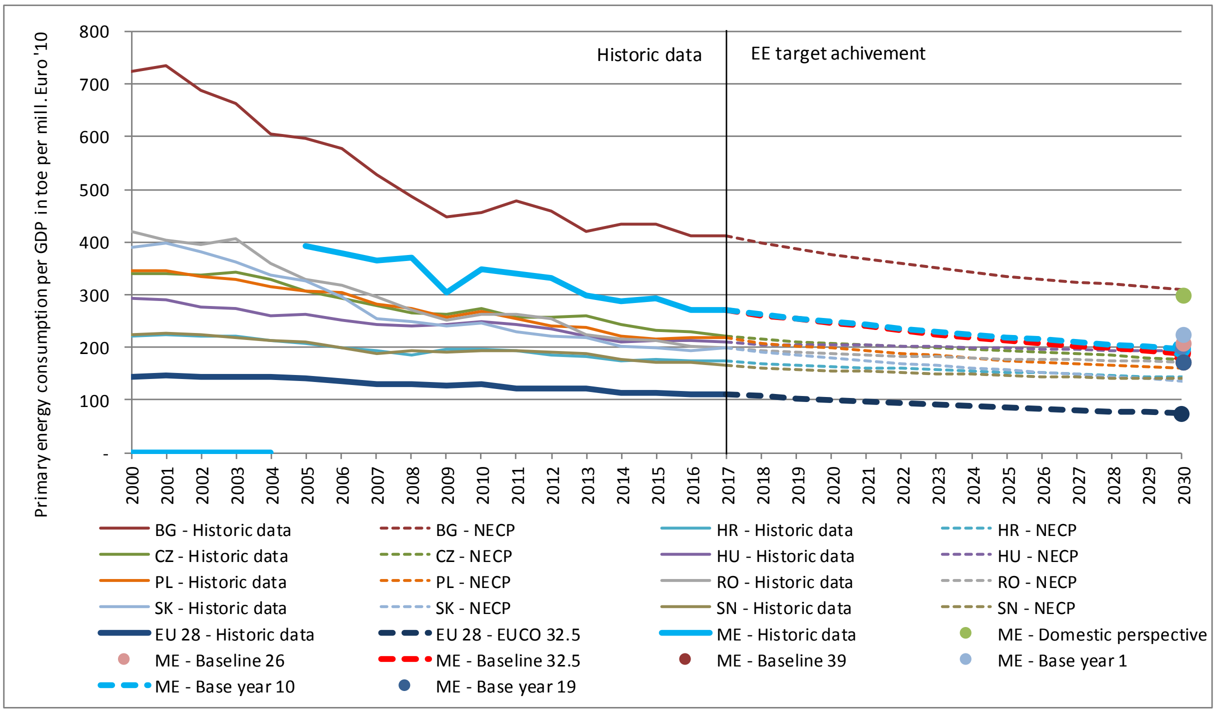


Figure 96: **Development of PEC/GDP in Montenegro compared to the EU 28 and selected MS. Source: Eurostat, 2019; IMF, 2019; NTUA, 2012, 2017.**

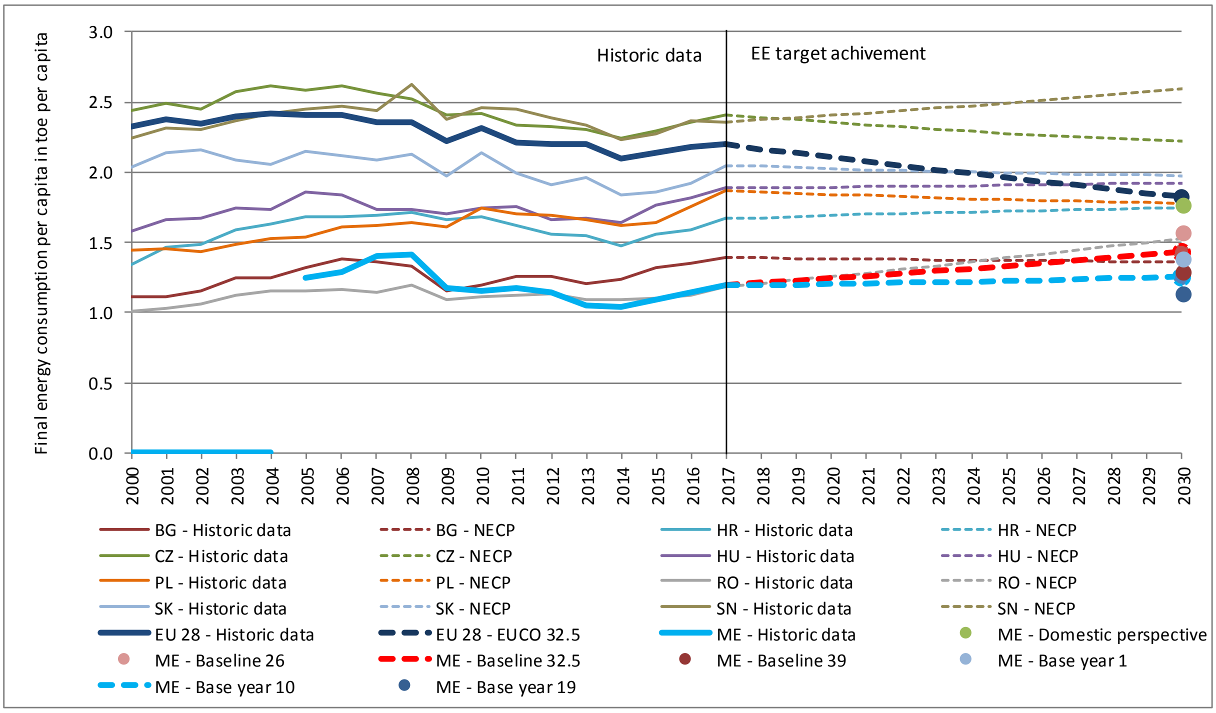


Figure 97: **Development of FEC/Capita in Montenegro compared to the EU 28 and selected MSs. Source: Eurostat, 2019; IMF, 2019; NTUA, 2012, 2017.**

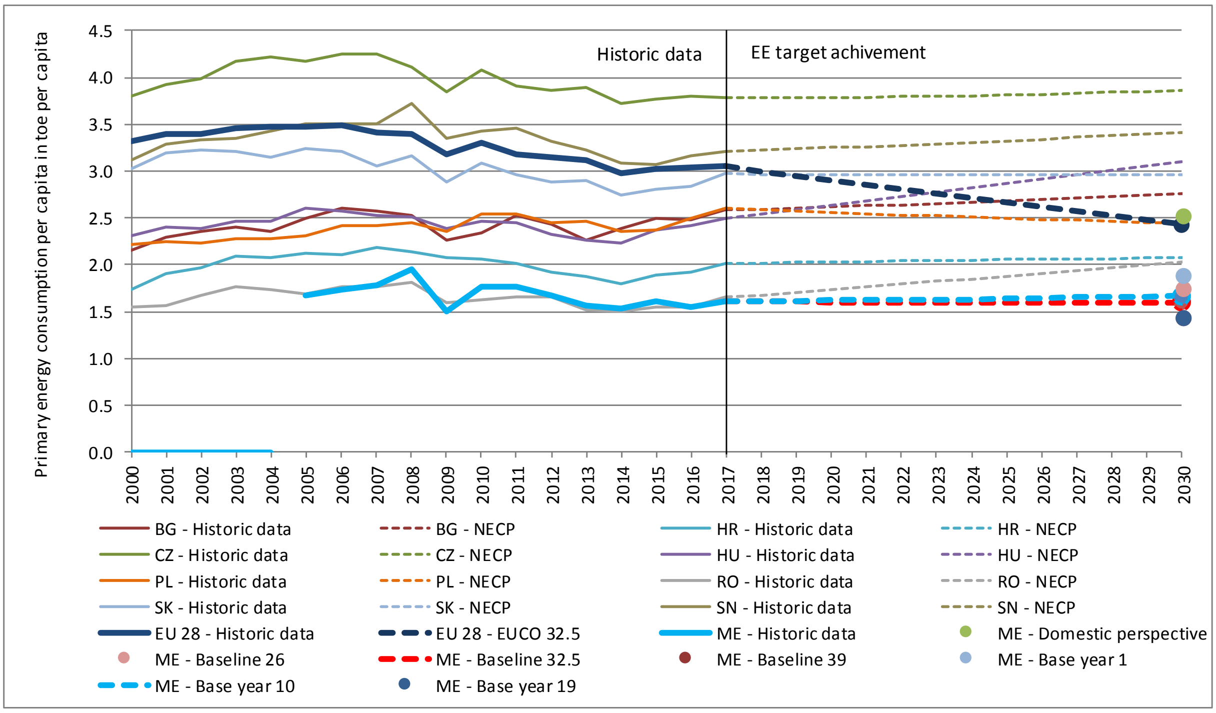


Figure 98: **Development of PEC/Capita in Montenegro compared to the EU 28 and selected MS. Source: Eurostat, 2019; IMF, 2019; NTUA, 2012, 2017.**

2.5.6.2 Advanced indicators to assess energy efficiency performance

Indicators on economic structure

Figure 99 to Figure 102 show the share of different economic sectors of the GDP of Montenegro. These figures describe the economic structure and compare it to EU 28 MSs. The overall structure of the economy in Montenegro has no similarities with any of the included EU MSs. Figure 99 shows a high share of the agriculture sector in Montenegro's GDP. On the other hand, the share of manufacturing and industry is rather low, while the share of services is rather high with 59.1% of the GDP in 2017. The GDP the capita in 2017 is about as high as it was in Bulgaria in 2016. Overall this shows a very service and agriculture oriented economic structure for Montenegro.

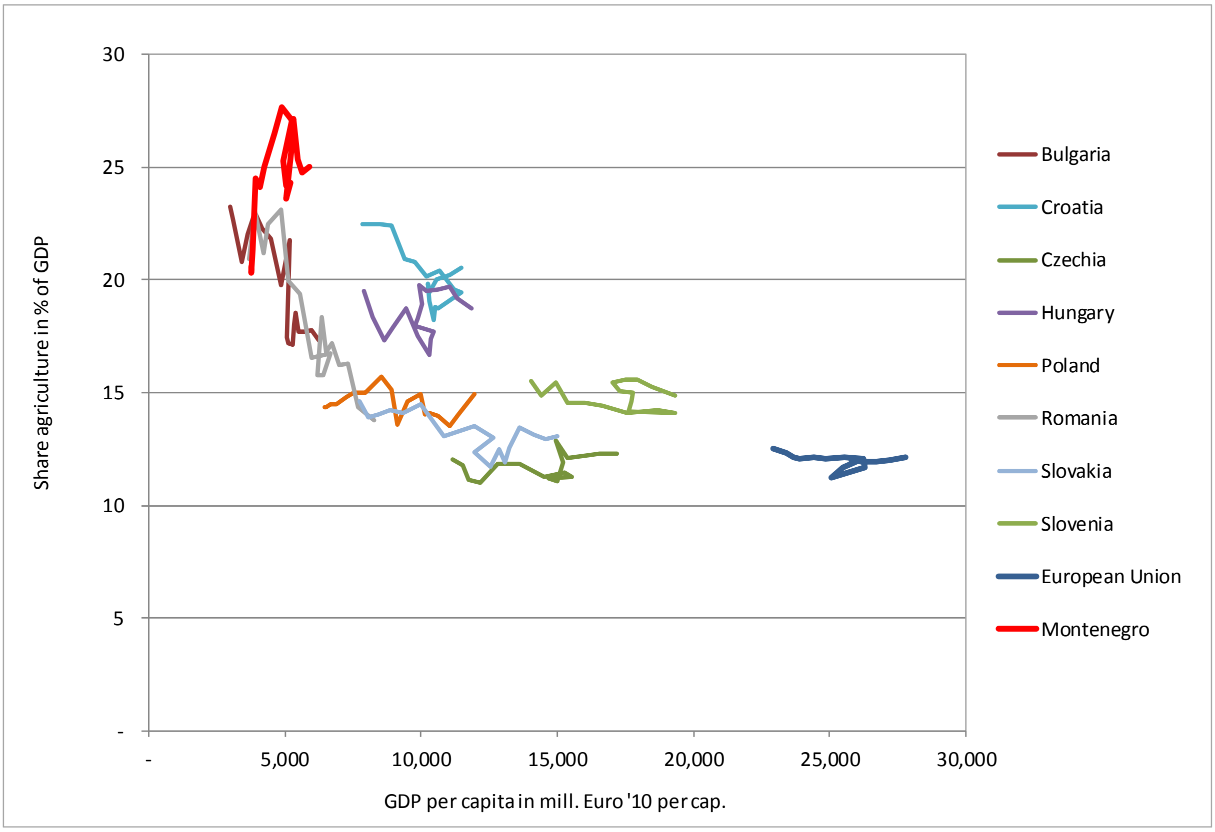


Figure 99: Development of the share of agriculture in % of GDP related to the GDP per capita showing historical values from 2000 to 2017 in Montenegro compared to the EU 28 and selected MSs. Source: Eurostat, 2019; IMF, 2019; Worldbank, 2019;

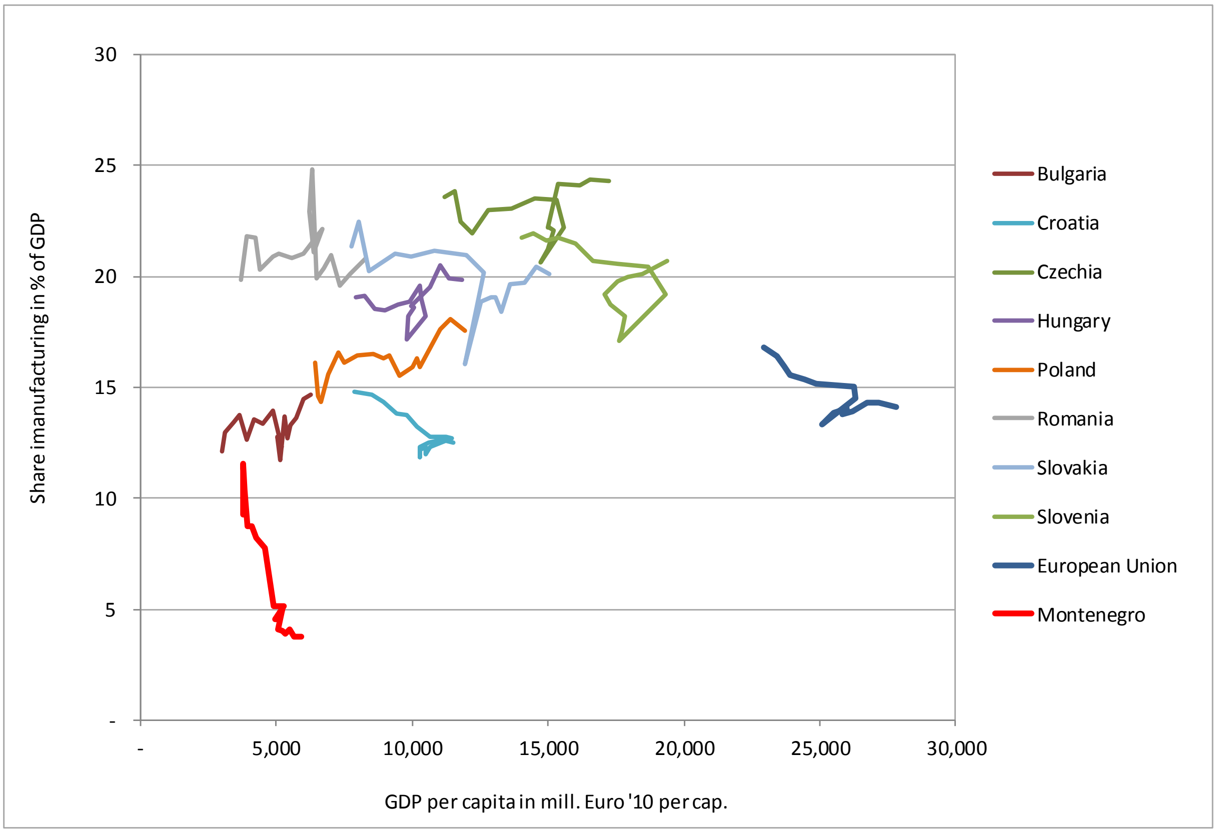


Figure 100: Development of the share of manufacturing in % of GDP related to the GDP per capita showing historical values from 2000 to 2017 in Montenegro compared to the EU 28 and selected MSs. Source: Eurostat, 2019; IMF, 2019; Worldbank, 2019;

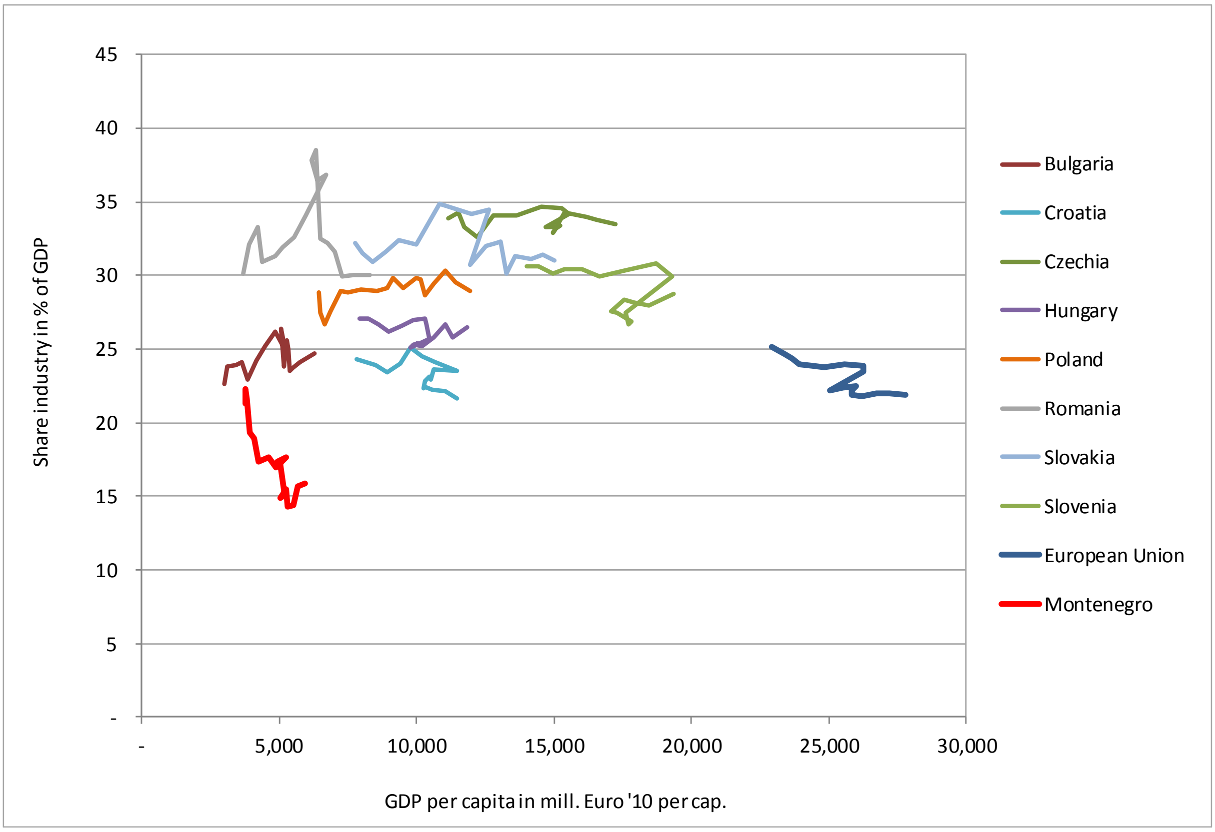


Figure 101: **Development of the share of industry in % of GDP related to the GDP per capita showing historical values from 2000 to 2017 in Montenegro compared to the EU 28 and selected MSs. Source: Eurostat, 2019; IMF, 2019; Worldbank, 2019;**

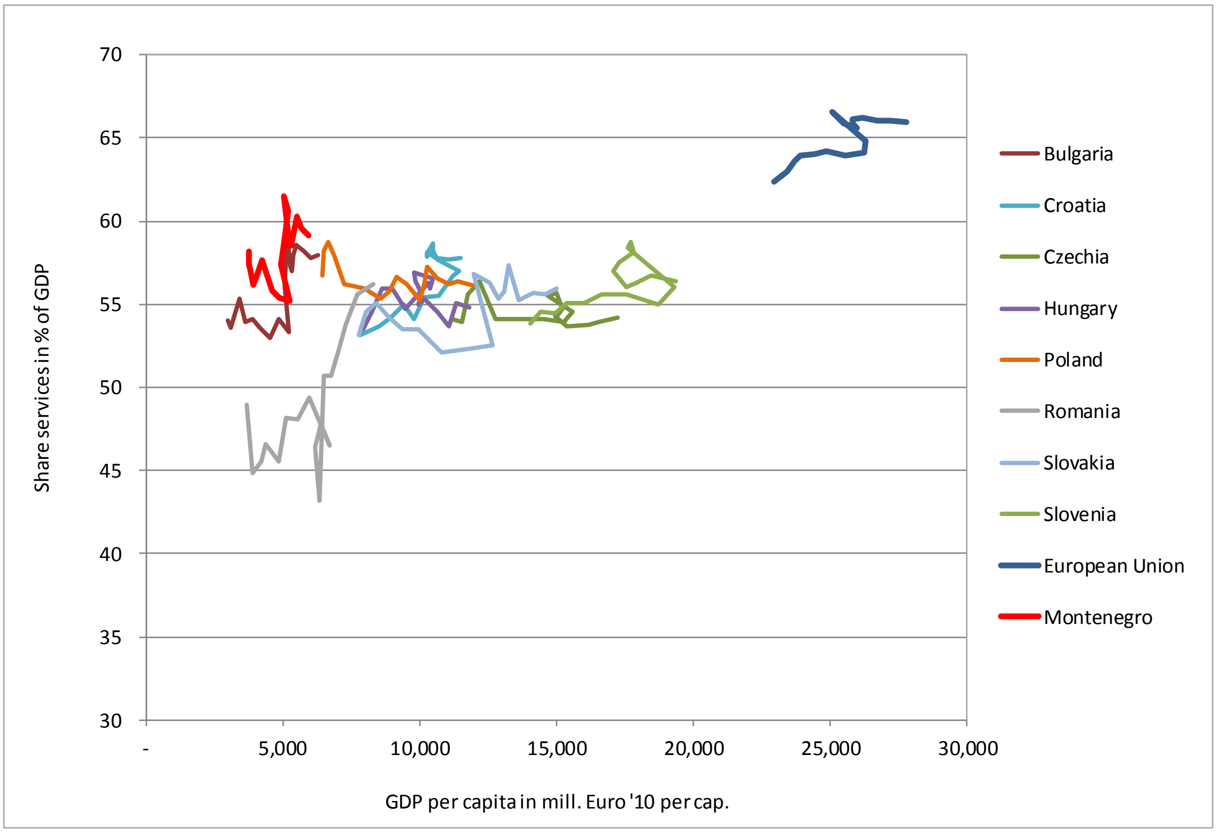


Figure 102: **Development of the share of services in % of GDP related to the GDP per capita showing historical values from 2000 to 2017 in Montenegro compared to the EU 28 and selected MSs. Source: Eurostat, 2019; IMF, 2019; Worldbank, 2019;**

Indicators on energy system

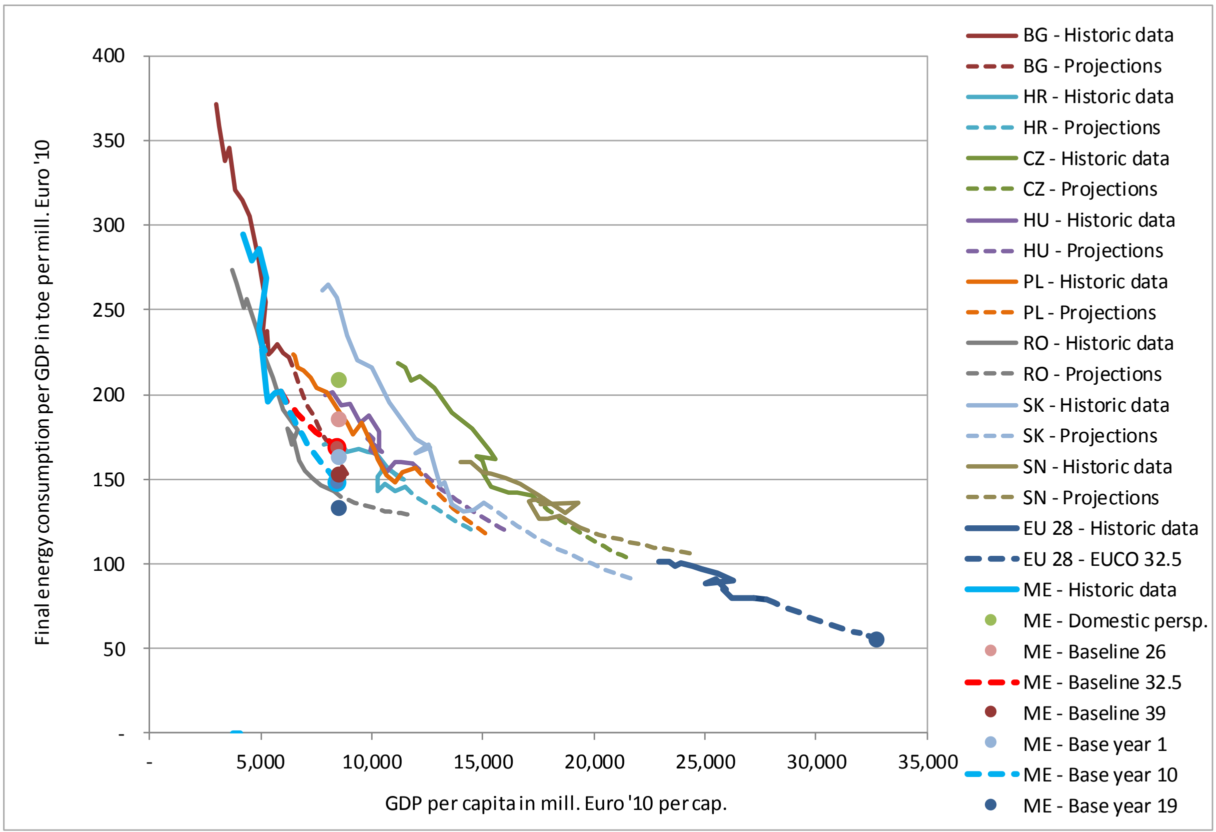


Figure 103: The development of FEC per GDP related to the GDP per capita showing historical values from 2000 to 2017 and projections from 2018 to 2030 assuming an EE target achievement in Montenegro compared to the EU 28 and selected MSs. Source: Eurostat, 2019; IMF, 2019; NTUA, 2012, 2017.

Table 41: Qualitative assessment of all EE target setting options concerning FEC per GDP (Montenegro)

Indicator	Domestic	Baseline 26	Baseline 32.5	Baseline 39	Base year 1	Base year 10	Base year 19
FEC per GDP	Not ambitious	Intermediate (ambition)	Reasonable				Intermediate (constraining)

Most of the calculated EE targets for Montenegro seem reasonable for Montenegro. Figure 103 shows that only the domestic perspective and Baseline 26 scenarios are lacking in ambition, while Base year 19 seems to be too constraining.

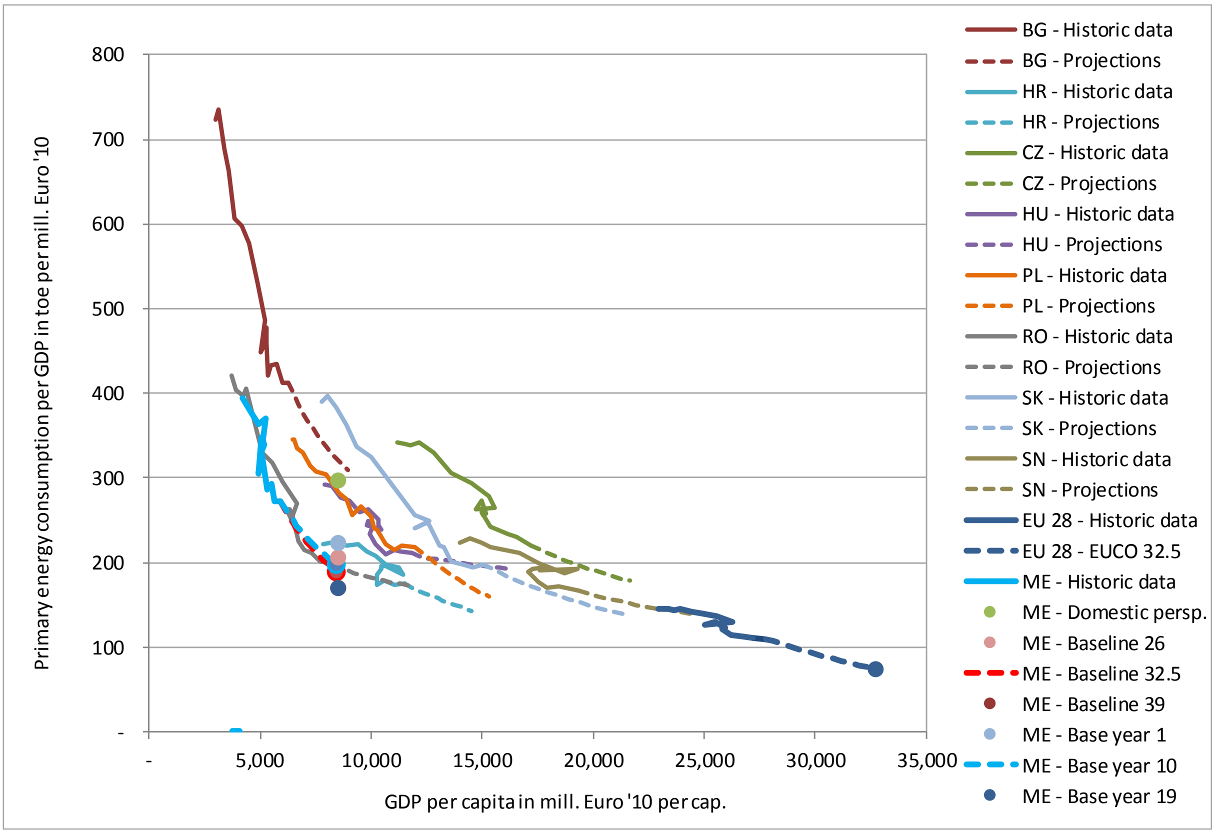


Figure 104: **The development of PEC per GDP related to the GDP per capita showing historical values from 2000 to 2017 and projections from 2018 to 2030 assuming an EE target achievement in Montenegro compared to the EU 28 and selected MSs. Source: Eurostat, 2019; IMF, 2019; NTUA, 2012, 2017.**

Table 42: **Qualitative assessment of all EE target setting options concerning PEC per GDP (Montenegro)**

Indicator	Domestic	Baseline 26	Baseline 32.5	Baseline 39	Base year 1	Base year 10	Base year 19
PEC per GDP							

Switching to the energy intensity of the GDP in terms of primary energy consumption, shown in Figure 104, the domestic perspective and Base year 1 show EE targets which are lacking in ambition, while Baseline 39 and Base year 19 are too restrictive. Baseline 26, 32.5 and Base year 10 show reasonable EE targets.

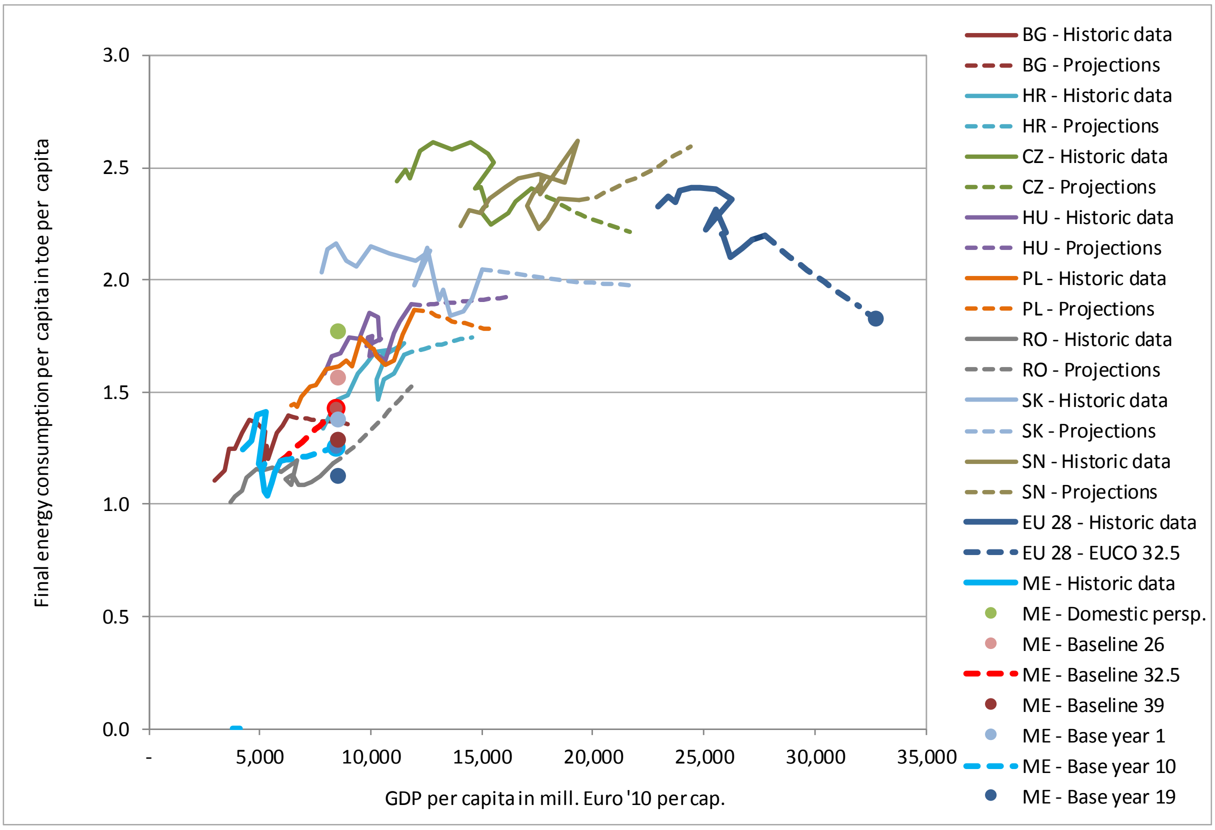


Figure 105: **The development of FEC per capita related to the GDP per capita showing historical values from 2000 to 2017 and projections from 2018 to 2030 assuming an EE target achievement in Montenegro compared to the EU 28 and selected MSs. Source: Eurostat, 2019; IMF, 2019; NTUA, 2012, 2017**

Table 43: **Qualitative assessment of all EE target setting options concerning FEC per capita (Montenegro)**

Indicator	Domestic	Baseline 26	Baseline 32.5	Baseline 39	Base year 1	Base year 10	Base year 19
FEC per capita							

In terms of per capita energy consumption, the Baseline 39 and Base year 10 EE targets seem to be reasonable targets. Most other EE targets allow for a relative drastic growth in the per capita energy consumption until 2030. Except for the Base year 19 target, which would imply a reduction in the per capita consumption in regards to final energy.

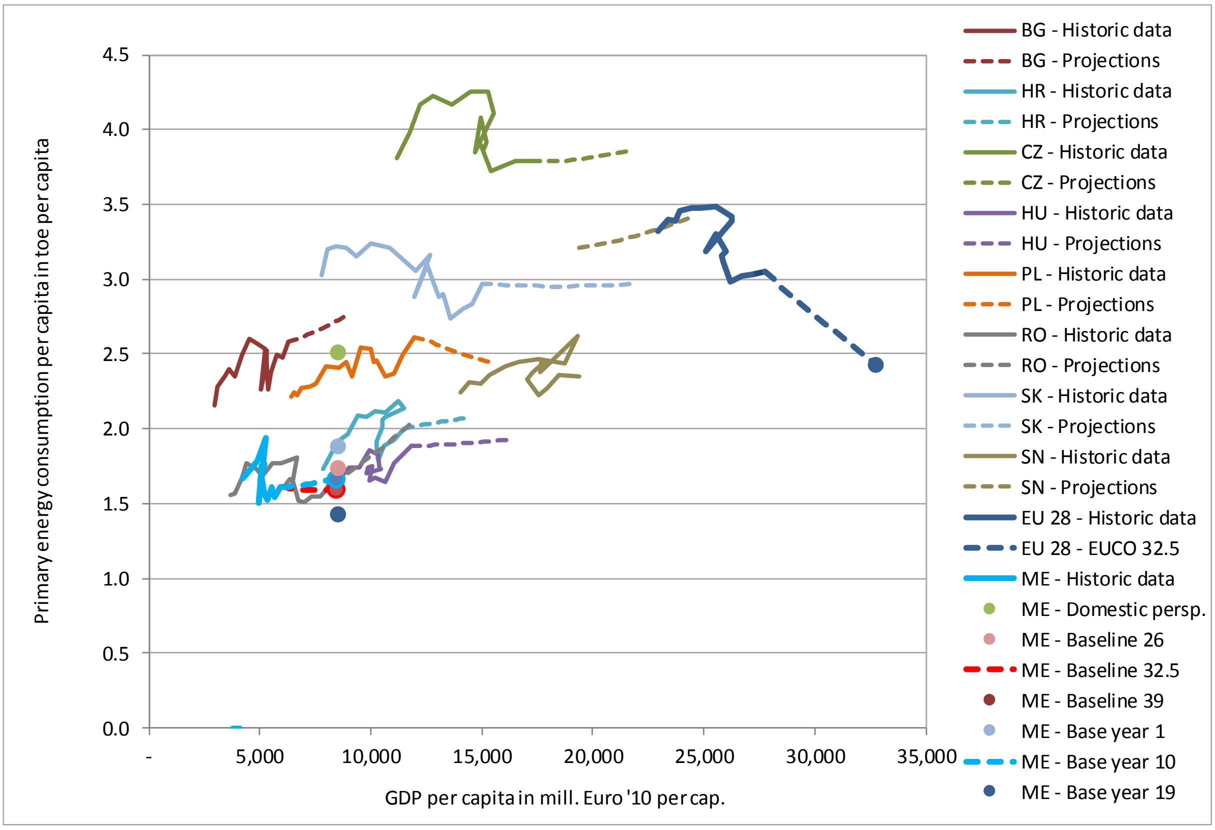


Figure 106: The development of PEC per capita related to the GDP per capita showing historical values from 2000 to 2017 and projections from 2018 to 2030 assuming an EE target achievement in Montenegro compared to the EU 28 and selected MSs. Source: Eurostat, 2019; IMF, 2019; NTUA, 2012, 2017.

Table 44: Qualitative assessment of all EE target setting options concerning PEC per capita (Montenegro)

Indicator	Domestic	Baseline 26	Baseline 32.5	Baseline 39	Base year 1	Base year 10	Base year 19
PEC per capita							

2.5.6.3 Summary & Conclusions for Energy Efficiency Targets of Montenegro

Table 45 summarizes the assessment of all seven EE target setting options done in subchapter 2.5.8.2. It shows that the Base year 10 approach comes to the most reasonable EE targets for 2030. This scenario stays within the range of comparable efforts when compared to EU 28 MSs.

Table 45: Summary table for the qualitative assessment of all EE target setting options (Montenegro)

Indicator	Domestic	Baseline 26	Baseline 32.5	Baseline 39	Base year 1	Base year 10	Base year 19
FEC per GDP	Not ambitious	Intermediate (ambition)	Reasonable				Intermediate (constraining)
PEC per GDP							
FEC per capita							
PEC per capita							

2.5.7 Resulting Energy Efficiency Targets for North Macedonia

The results on for calculated 2030 EE targets for North Macedonia are presented in Table 46 in terms of final energy demand whereas and in Table 47 provides the corresponding data in terms in Terms of primary energy demand. The absolute consumption caps for 2030 are then shown in Figure 107. Complementary to that, A closer look at the timely evolution of final energy demand according to the various target setting options is then shown in Figure 108. The corresponding illustration in terms of primary energy is shown in Figure **109**Figure 79.

Table 46: EE targets in terms of final energy for North Macedonia for different scenarios

EE targets for North Macedonia in terms of final energy consumption	Historic data for 2008 [ktoe]	Historic data for 2017 [ktoe]	Baseline III in 2030 [ktoe]	Consumption cap in 2030 [ktoe]	Change compared to 2008	Change compared to 2017	Change compared to Baseline III in 2030
Domestic perspective	1,803	1,888	2,957	2,030	+12.6%	+7.5%	**-31.3%**
Base year 1	1,803	1,888	2,957	1,785	-1%	-5.4%	**-39.6%**
Base year 10	1,803	1,888	2,957	1,623	-10%	-14%	**-45.1%**
Base year 19	1,803	1,888	2,957	1,461	-19%	-22.6%	**-50.6%**
Baseline 26	1,803	1,888	2,957	2,188	+21.3%	+15.9%	**-26%**
Baseline 32.5	1,803	1,888	2,957	1,996	+10.7%	+5.7%	**-32.5%**
Baseline 39	1,803	1,888	2,957	1,804	+0%	-4.4%	**-39%**

Table 47: EE targets in terms of primary energy for North Macedonia for different scenarios

EE targets for North Macedonia in terms of primary energy consumption	Historic data for 2008 [ktoe]	Historic data for 2017 [ktoe]	Baseline III in 2030 [ktoe]	Consumption cap in 2030 [ktoe]	Change compared to 2008	Change compared to 2017	Change compared to Baseline III in 2030
Domestic perspective	3,001	2,682	4,239	2,300	-23.3%	-14.2%	**-45.7%**
Base year 1	3,001	2,682	4,239	2,961	-1.3%	+10.4%	**-30.2%**
Base year 10	3,001	2,682	4,239	2,606	-13.1%	-2.8%	**-38.5%**
Base year 19	3,001	2,682	4,239	2,251	-25%	-16.1%	**-46.9%**
Baseline 26	3,001	2,682	4,239	3,137	+4.6%	+17%	**-26%**
Baseline 32.5	3,001	2,682	4,239	2,862	-4.6%	+6.7%	**-32.5%**
Baseline 39	3,001	2,682	4,239	2,586	-13.8%	-3.6%	**-39%**

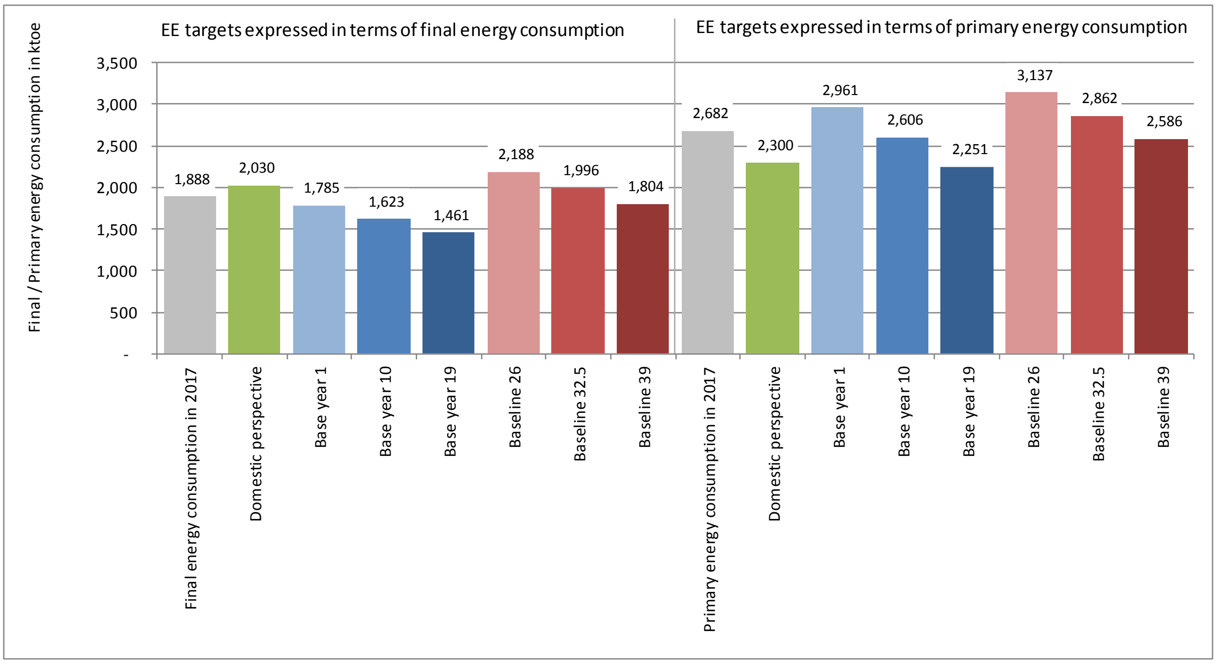


Figure 107: **Energy efficiency targets in terms of primary and final energy for different scenarios. Baseline vs. Base year approach vs. Domestic perspective**

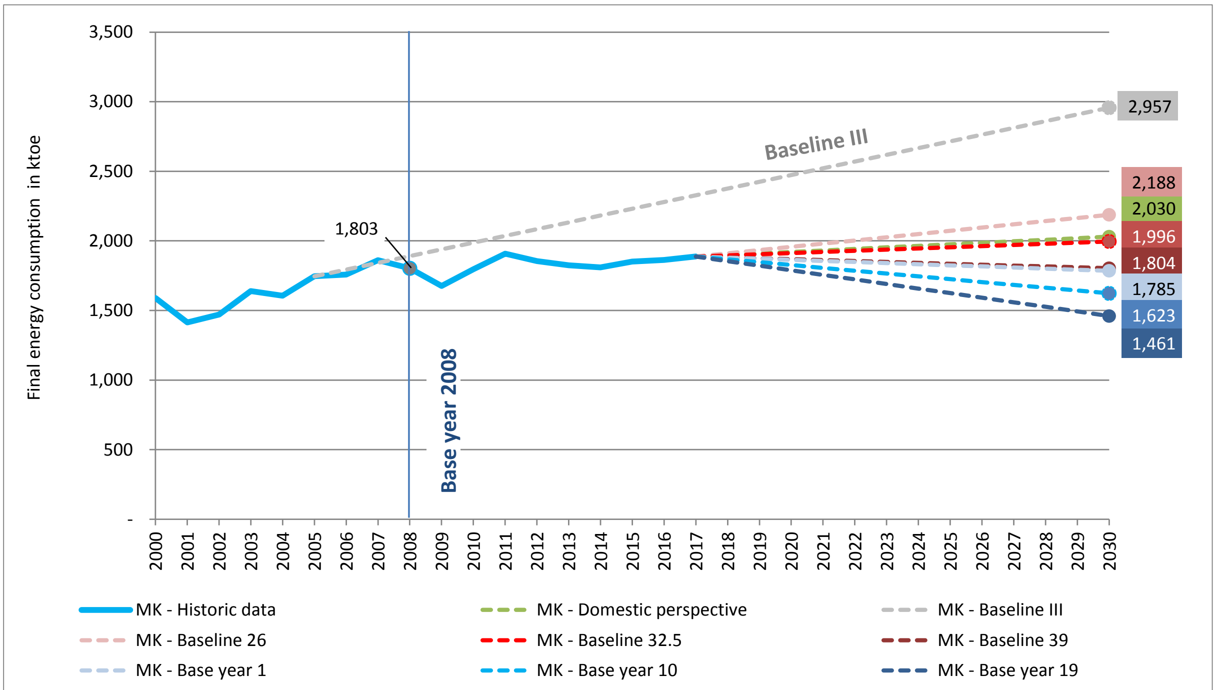


Figure 108: **Energy Efficiency targets in terms of final energy for different scenarios. Baseline compared to Base year approach vs. Domestic perspective**

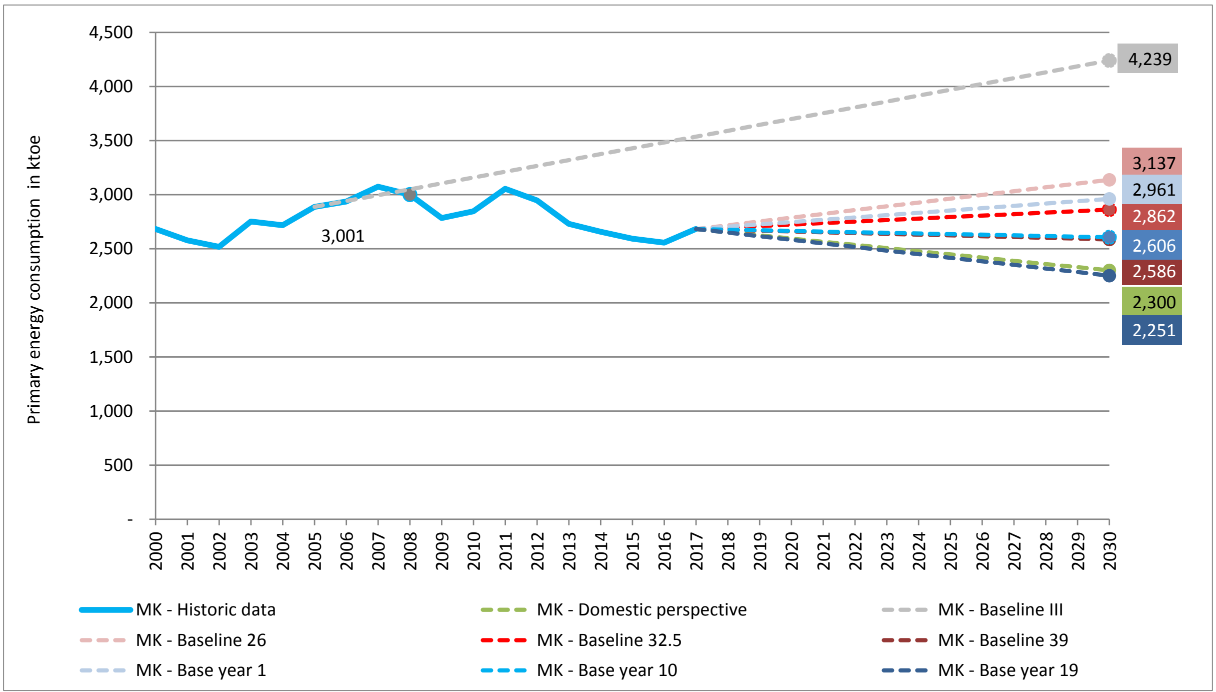


Figure 109: Energy efficiency targets in terms of primary energy for different scenarios. Baseline compared to Base year approach vs. Domestic perspective

2.5.7.1 Indicators for analysing energy performance

With this indicator-based assessment we help on gaining insights on feasibility and impacts of the (broad) range of identified energy efficiency target setting options, by setting these into a broader perspective. We consequently illustrate how the EE targets examined match with historic trends and with the EE target setting in other countries or regions. Underlying objective is to identify those EE target setting options that would lead to a comparable effort with the EE target set at EU level, while respecting differences in economic welfare. Complementary to socio-economic indicators like population, GDP and related growth trends for all CPs as introduced and discussed in section , within this section we aim to incorporate the energy perspective into the analysis.

Thus, the graphs below provide energy-related indicators like Final Energy Consumption per GDP () and Primary Energy Consumption (PEC) per GDP () which both represent the energy intensity of the country. Next to these, and complement with an illustration of trends in PEC/Capita and in FEC/Capita.

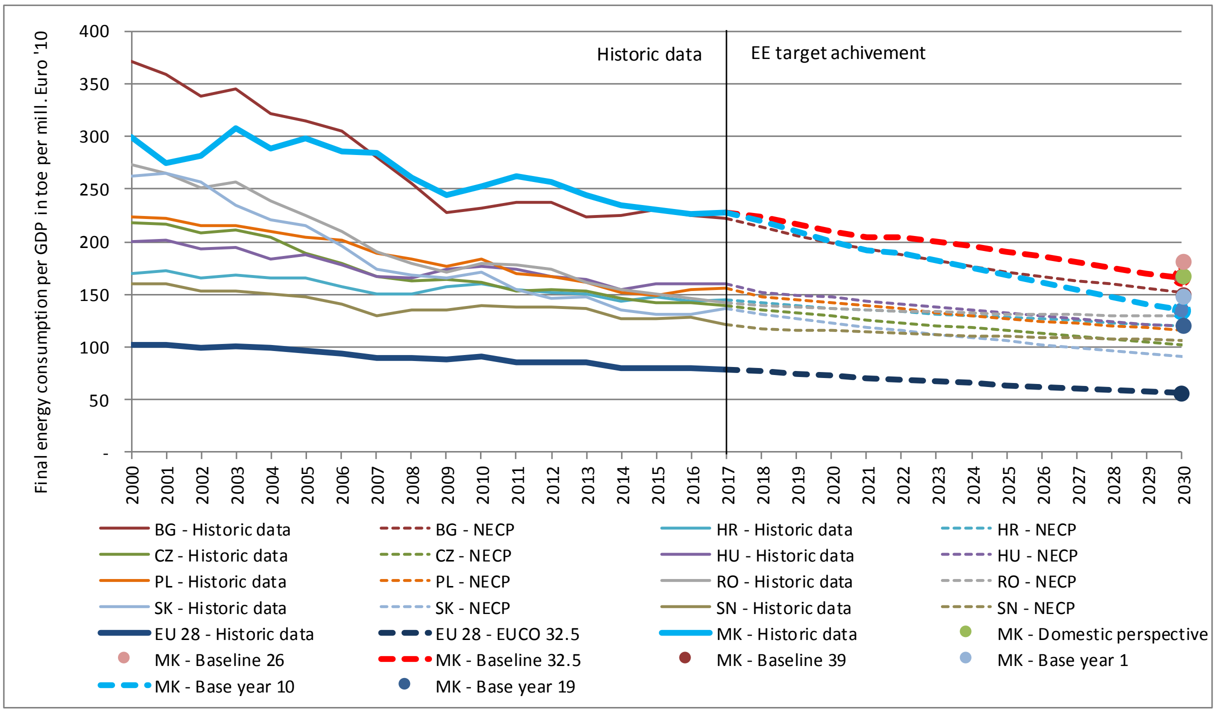


Figure 110: Development of FEC/GDP in North Macedonia compared to the EU 28 and selected MS. Source: Eurostat, 2019; IMF, 2019; NTUA, 2012, 2017.

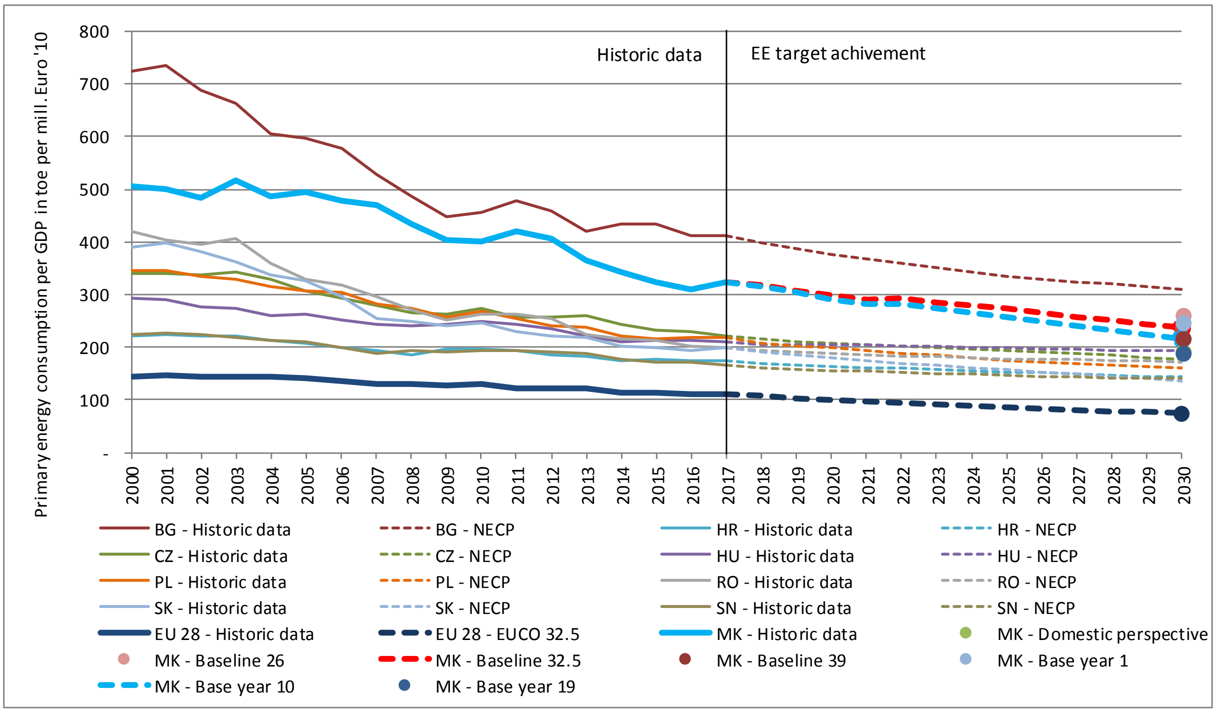


Figure 111: Development of PEC/GDP in North Macedonia compared to the EU 28 and selected MS. Source: Eurostat, 2019; IMF, 2019; NTUA, 2012, 2017.

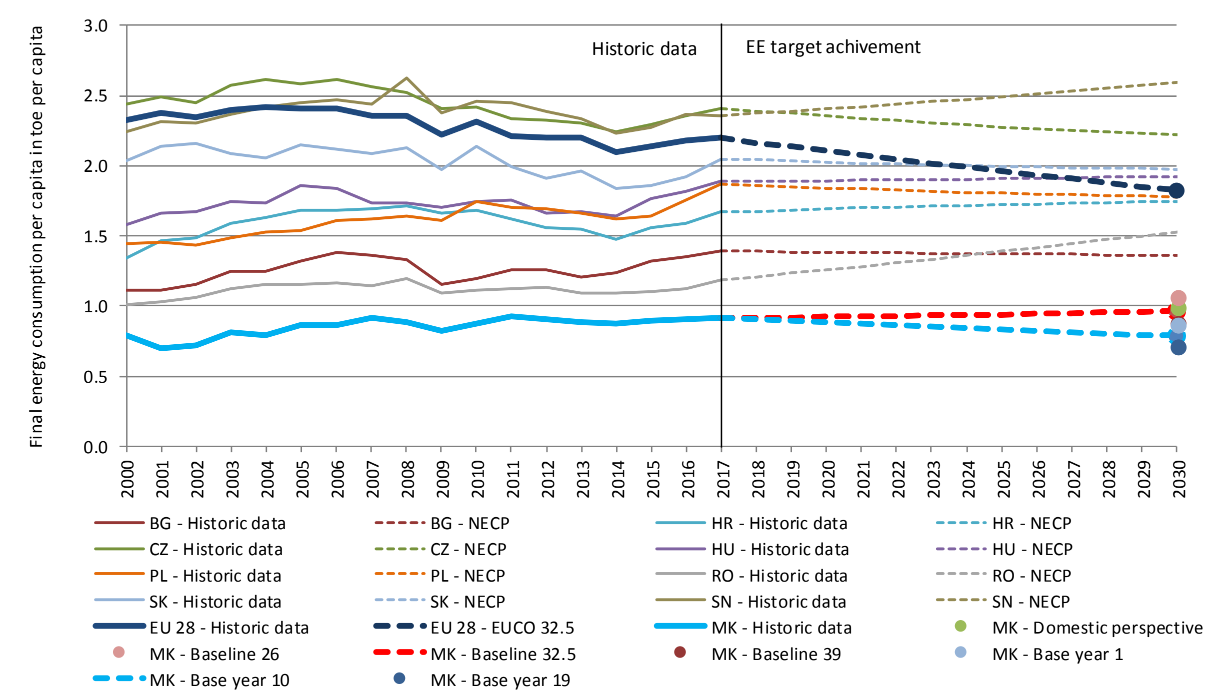


Figure 112: Development of FEC/Capita in North Macedonia compared to the EU 28 and selected MSs. Source: Euro-stat, 2019; IMF, 2019; NTUA, 2012, 2017.

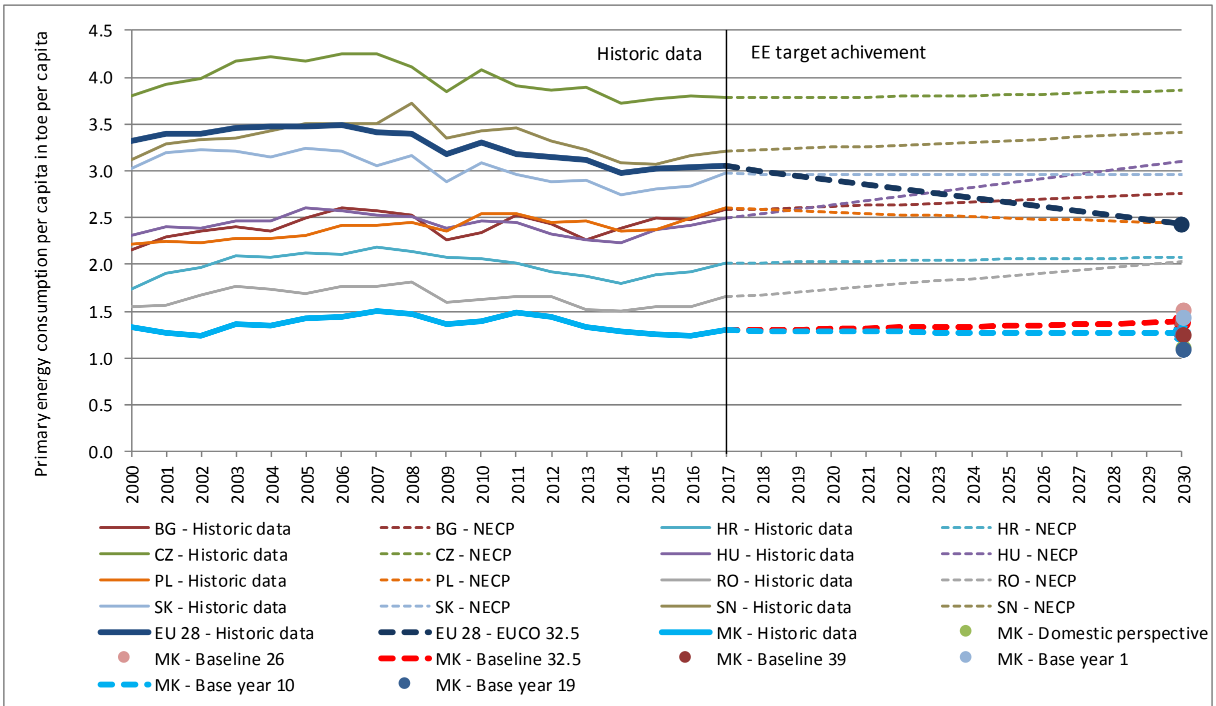


Figure 113: Development of PEC/Capita in North Macedonia compared to the EU 28 and selected MS. Source: Eurostat, 2019; IMF, 2019; NTUA, 2012, 2017.

2.5.7.2 Advanced indicators to assess energy efficiency performance

Indicators on economic structure

Our indicators below shed light on the economic structure of North Macedonia and put the domestic trends into perspective with selected other countries. Thus, to allow for gaining insights on the importance of certain sectors for the country's economy. Thus, these graphs show the development of the share of agriculture, manufacturing (as an important part of the industry sector), industry and services in % of GDP (on the vertical axis) related to the GDP per capita (on the horizontal axis) showing historical values from 2000 to 2017 in North Macedonia compared to the EU28 and selected MSs.

Key results gained from these graphs are:

- In overall terms, latest (2017) figures on GDP per capita show that North Macedonia has reached a level that was achieved in Bulgaria ten years ago.
- Manufacturing and the industry sector in general play a less prominent role in North Macedonia's economy today. The respective share in overall GDP remains at a level comparable but still below the ones in Bulgaria and Croatia.
- Agriculture is of relevance, contributing about 22% to the total GDP in North Macedonia today (2017). The share (in total) is however declining throughout the last decade.

The service sector plays an important role, contributing around 55% to overall GDP. This is in line with trends observed in EU MSs like Bulgaria or Croatia.

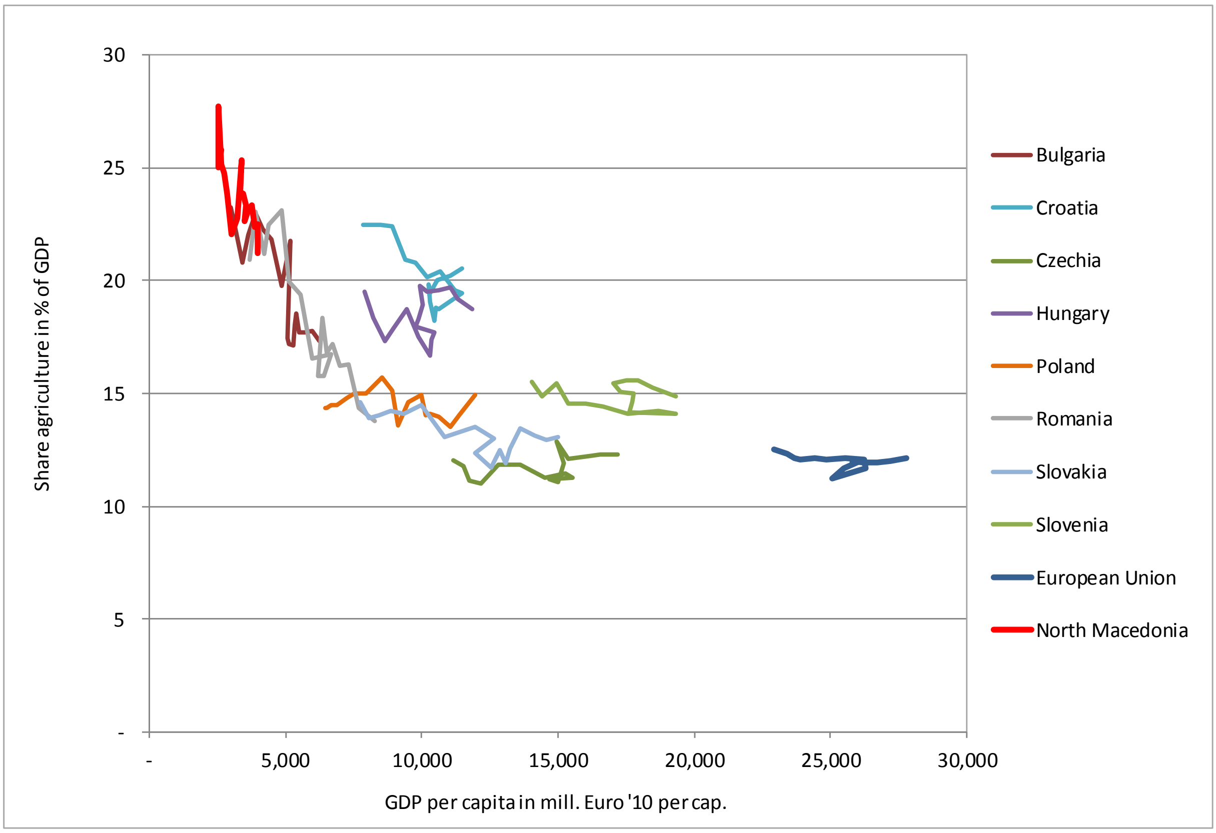


Figure 114: Development of the share of agriculture in % of GDP related to the GDP per capita showing historical values from 2000 to 2017 in North Macedonia compared to the EU 28 and selected MSs. Source: Eurostat, 2019; IMF, 2019; Worldbank, 2019;

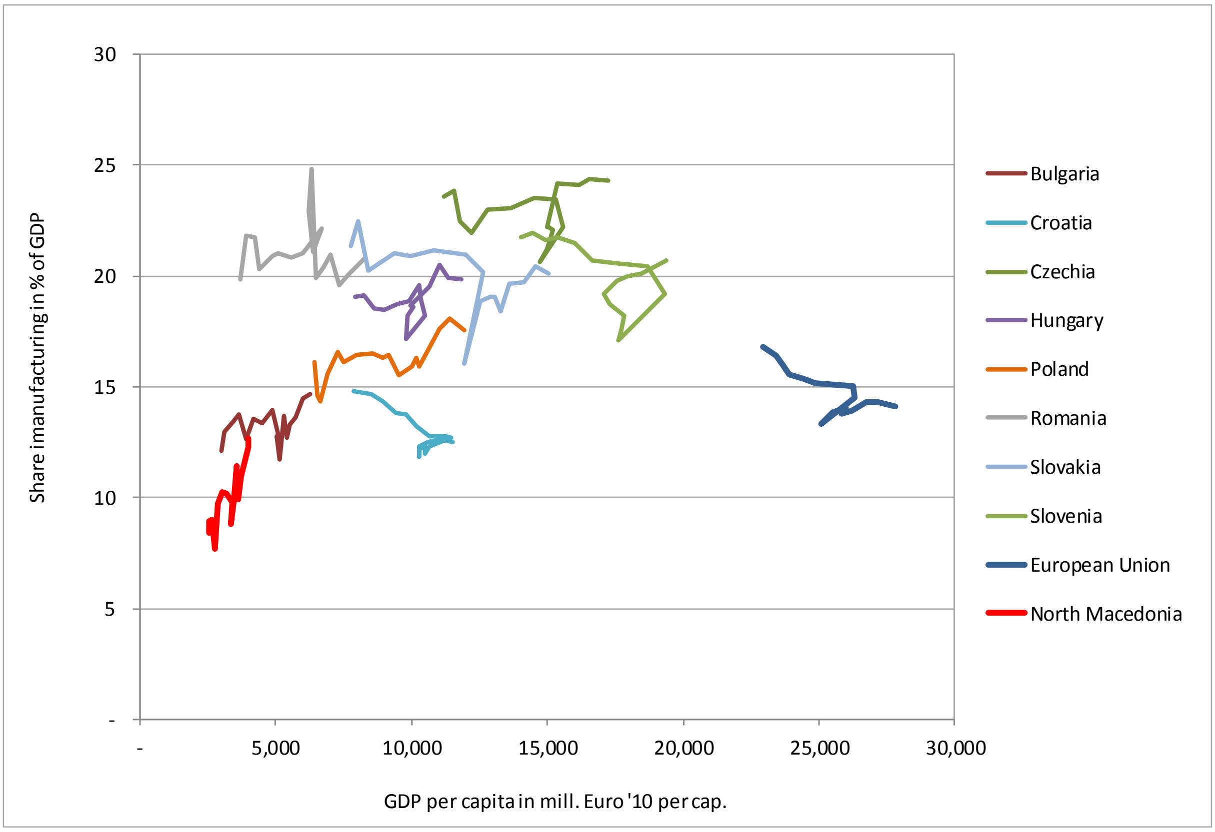


Figure 115: Development of the share of manufacturing in % of GDP related to the GDP per capita showing historical values from 2000 to 2017 in North Macedonia compared to the EU 28 and selected MSs. Source: Eurostat, 2019; IMF, 2019; Worldbank, 2019;

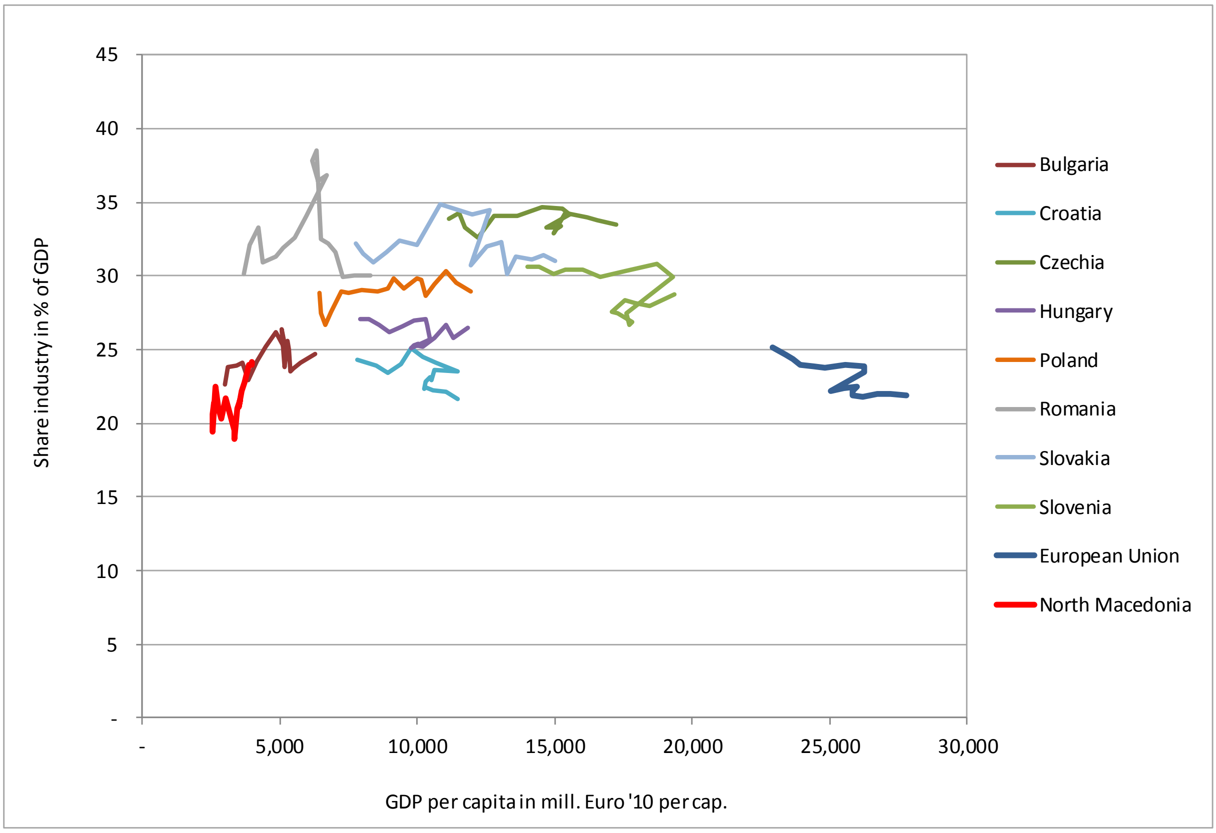


Figure 116: Development of the share of industry in % of GDP related to the GDP per capita showing historical values from 2000 to 2017 in North Macedonia compared to the EU 28 and selected MSs. Source: Eurostat, 2019; IMF, 2019; Worldbank, 2019;

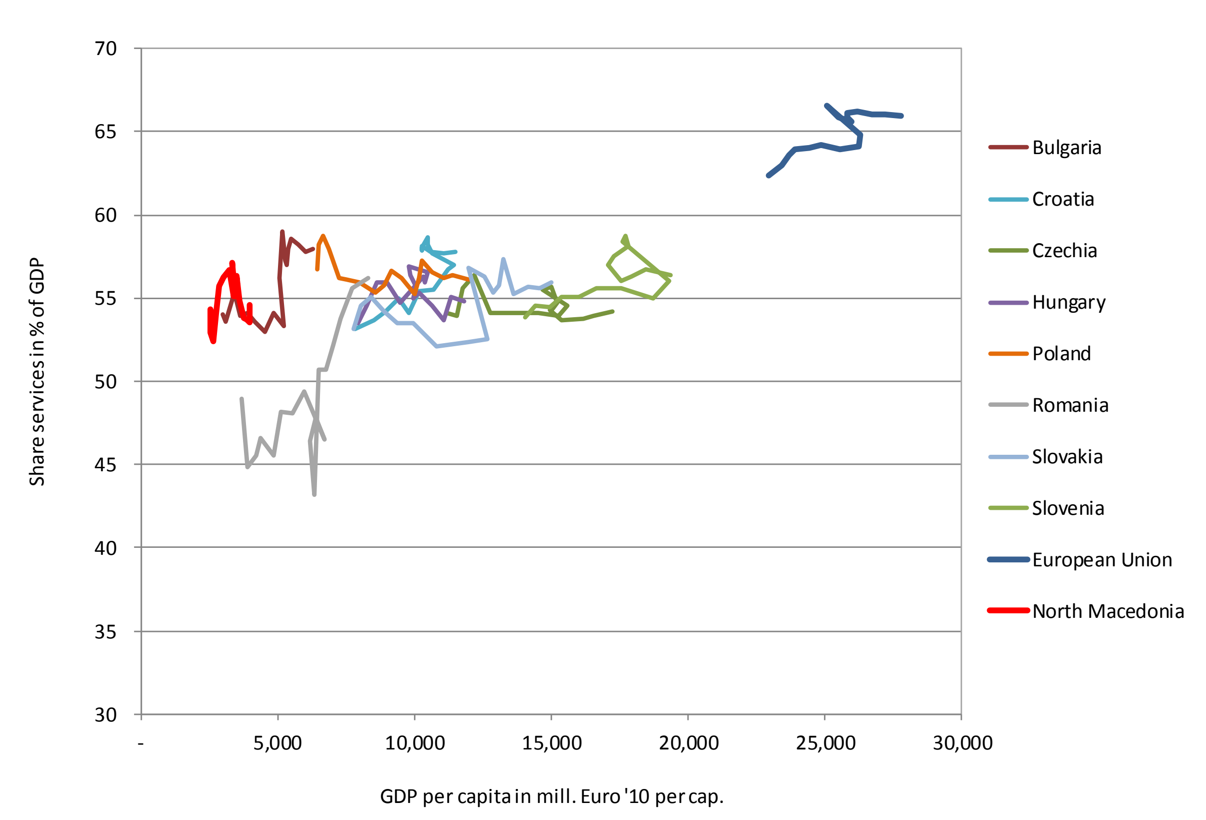


Figure 117: Development of the share of services in % of GDP related to the GDP per capita showing historical values from 2000 to 2017 in North Macedonia compared to the EU 28 and selected MSs. Source: Eurostat, 2019; IMF, 2019; Worldbank, 2019;

Indicators on energy system

Advanced indicators on the energy system as illustrated below set the energy intensity and energy use per capita, both in terms of final energy and primary energy consumption, in correlation to the country's GDP per capita. As outlined previously, energy intensity acts here as a representative for energy efficiency, measuring how efficient an economy uses energy. Its calculation is done by dividing energy use, in this case either final or primary, by GDP. Consequently, high energy intensities indicate a high price or cost of converting energy into GDP, and vice versa.

Thus, and below put final- and respectively primary energy consumption per GDP in relation to GDP per capita. This is shown in both graphs for North Macedonia, the EU28 and our suite of selected MSs. For each country (or region) we connect therein the different data points, referring to distinct years, with a coloured line. All seven proposed EE target setting options for 2030 for North Macedonia are shown by circular dots using different colours – these dots are on a vertical line since all make use of the same GDP/capita projection.

As applicable from these graphs, in accordance with previous statements, GDP per capita in North Macedonia today (2017) is about as high as in Bulgaria about 10 years ago; and the projected GDP per capita in 2030 for North Macedonia is comparable to that in Bulgaria in the year 2015.

The advanced indicators shown below …

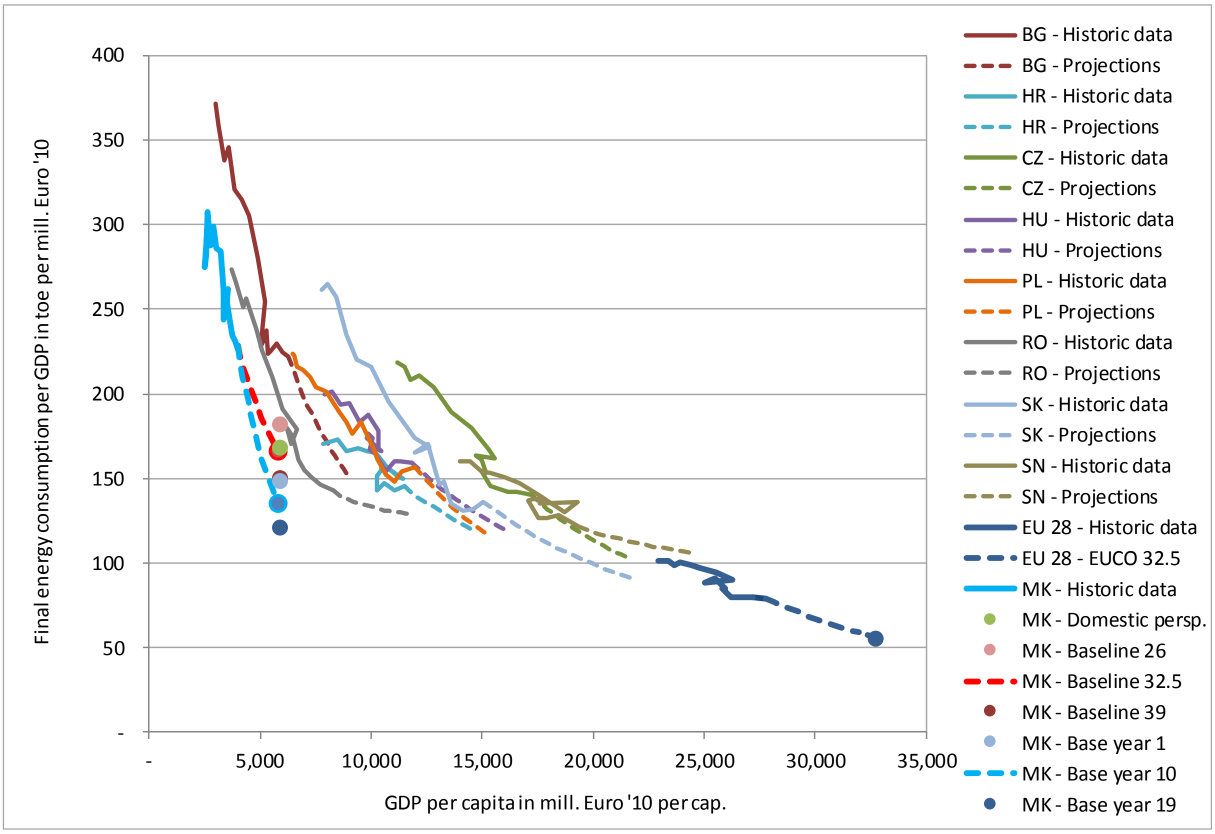


Figure 118: **The development of FEC per GDP related to the GDP per capita showing historical values from 2000 to 2017 and projections from 2018 to 2030 assuming an EE target achievement in North Macedonia compared to the EU 28 and selected MSs. Source: Eurostat, 2019; IMF, 2019; NTUA, 2012, 2017.**

Table 48: **Qualitative assessment of all EE target setting options concerning FEC per GDP (North Macedonia)**

Indicator	Domestic	Baseline 26	Baseline 32.5	Baseline 39	Base year 1	Base year 10	Base year 19
FEC per GDP		Reasonable		Intermediate (constraining)		Too constraining	

A closer look at the latest statistical data for the historic record (2017) …

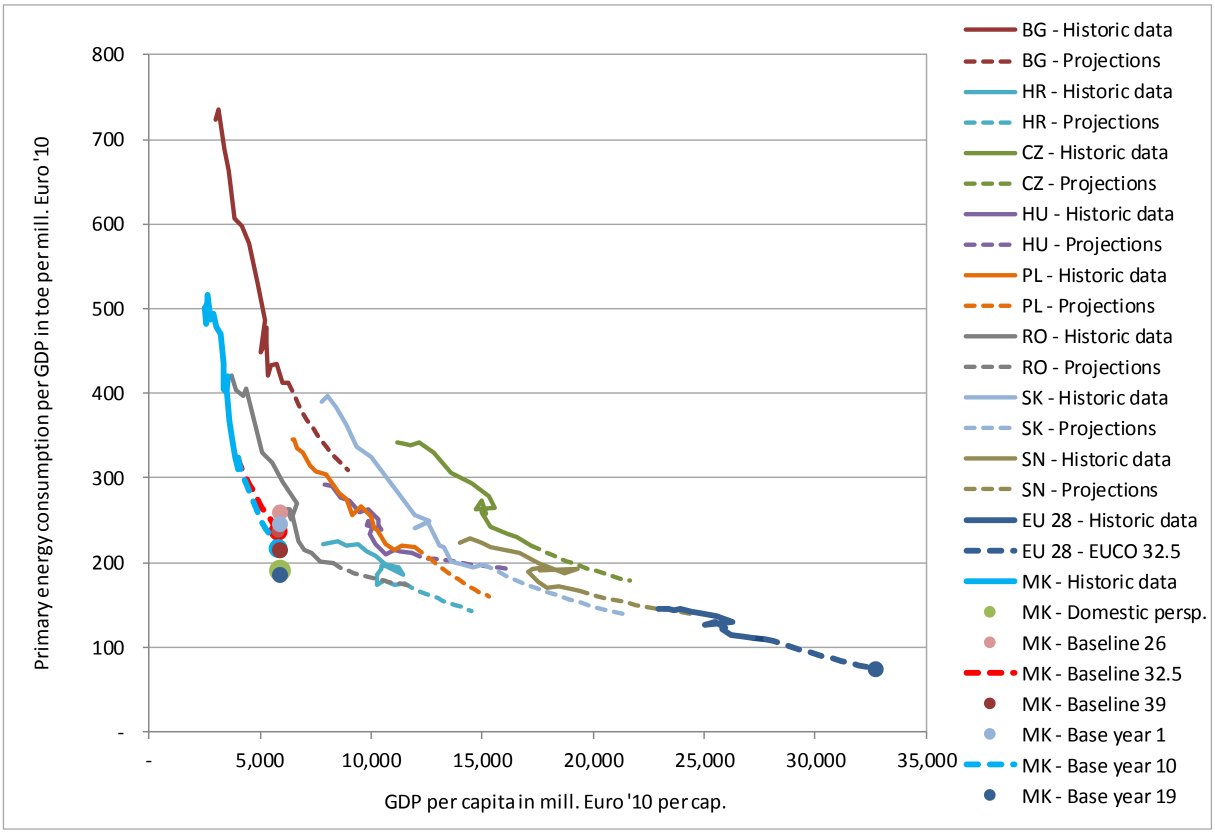


Figure 119: The development of PEC per GDP related to the GDP per capita showing historical values from 2000 to 2017 and projections from 2018 to 2030 assuming an EE target achievement in North Macedonia compared to the EU 28 and selected MSs. Source: Eurostat, 2019; IMF, 2019; NTUA, 2012, 2017.

Table 49: Qualitative assessment of all EE target setting options concerning PEC per GDP (North Macedonia)

Indicator	Domestic	Baseline 26	Baseline 32.5	Baseline 39	Base year 1	Base year 10	Base year 19
PEC per GDP							

and below set final and primary energy consumption per capita in relation to GDP per capita. The graphs include trend data for North Macedonia, the EU28 and our suite of selected MSs, and, similar to above, we connect therein for a single country the different data points, referring to distinct years, with a coloured line. Again, all seven proposed EE target setting options for 2030 for North Macedonia are shown by circular dots using different colours – these dots are on a vertical line since all make use of the same GDP per capita projection.

In contrast to the previous figures, the trend pattern expressed in these graphs can hardly be interpreted without further background information and so forth. On general observation is however that the overall correlation is lower (compared to energy consumption per GDP) both for the historic development and for projections towards 2030.

Concerning …

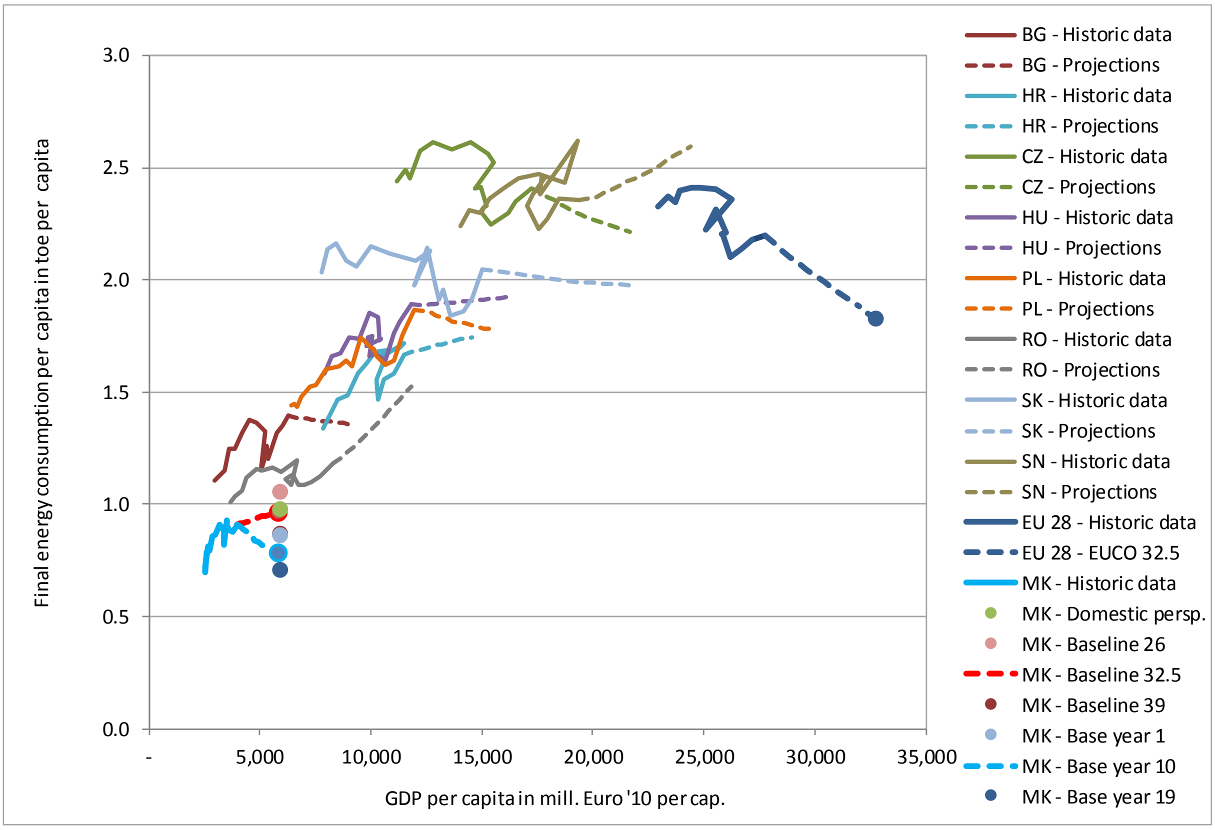


Figure 120: **The development of FEC per capita related to the GDP per capita showing historical values from 2000 to 2017 and projections from 2018 to 2030 assuming an EE target achievement in North Macedonia compared to the EU 28 and selected MSs. Source: Eurostat, 2019; IMF, 2019; NTUA, 2012, 2017**

Table 50: **Qualitative assessment of all EE target setting options concerning FEC per capita (North Macedonia)**

Indicator	Domestic	Baseline 26	Baseline 32.5	Baseline 39	Base year 1	Base year 10	Base year 19
FEC per capita							

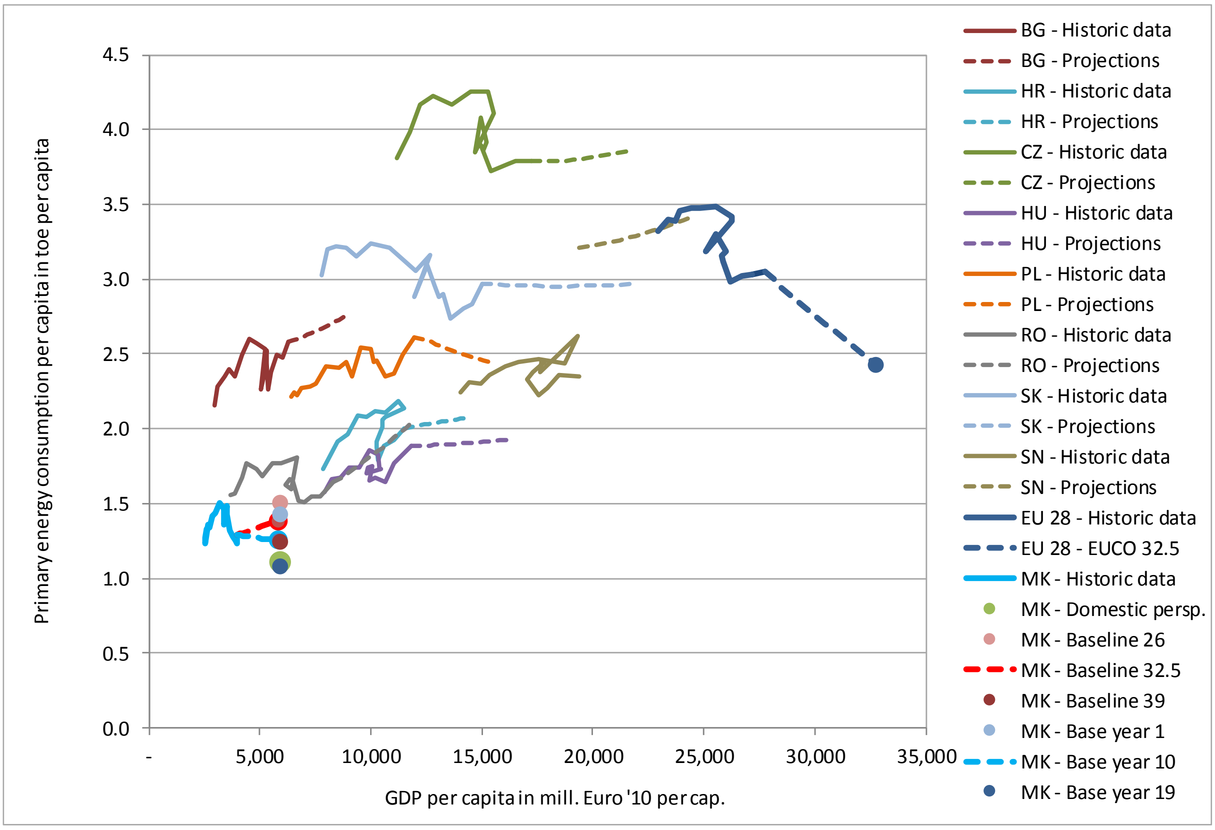


Figure 121: The development of PEC per capita related to the GDP per capita showing historical values from 2000 to 2017 and projections from 2018 to 2030 assuming an EE target achievement in North Macedonia compared to the EU 28 and selected MSs. Source: Eurostat, 2019; IMF, 2019; NTUA, 2012, 2017.

Table 51: Qualitative assessment of all EE target setting options concerning PEC per capita (North Macedonia)

Indicator	Domestic	Baseline 26	Baseline 32.5	Baseline 39	Base year 1	Base year 10	Base year 19
PEC per capita							

2.5.7.3 ...Summary & Conclusions for Energy Efficiency Targets of North Macedonia

Table 52 summarizes the assessment of all seven EE target setting options done in subchapter 2.5.7.2. A comparison of EE target setting options for Moldova indicates:

- An EE target in accordance with the Domestic Perspective looks for certain aspects, specifically when assessing final energy consumption trends, not ambitious enough. In other words, there would hardly be any change in energy use imposed by that.
- Targets following the Base year approach, and using 2008 as base year, would lead to very strict EE targets in 2030. Thus, all corresponding EE target setting options – i.e. all variants of the Base year approach – appear all too constraining for North Macedonia. An exception from that is the Base year 1 variant where imposed targets in terms of primary energy appear reasonable (but not in terms of final energy)
- Among the Baseline options both Baseline 26 and Baseline 32.5 lead to reasonable outcomes, specifically when compared to trends and performances observed in other countries. In contrast to that, Baseline 39 seems to be too constraining.

We can consequently conclude that the EE target setting options Baseline 26 and Baseline 32.5 lead to the most reasonable EE targets for 2030 in the case of North Macedonia. These scenarios stay within the range of comparable efforts – i.e. here based on a comparison with EU MSs showing the most similarieties when compared to North Macedonia in regards with their economic structure.

It shows that the Baseline 26 and 32.5 approaches come to the most reasonable EE targets for 2030. These scenarios stay within the range of comparable efforts. This is based on a comparison with EU MSs which show the most similarieties when compared to North Macedonia in regards with to their economic structure.

Table 52: Summary table for the qualitative assessment of all EE target setting options (North Macedonia)

Indicator	Domestic	Baseline 26	Baseline 32.5	Baseline 39	Base year 1	Base year 10	Base year 19
FEC per GDP	Reasonable			Intermediate (constraining)			Too constraining
PEC per GDP							
FEC per capita							
PEC per capita							

2.5.8 Resulting Energy Efficiency Targets for Serbia

The results for calculated EE targets are presented in Table 53 in terms of final energy demand and in Table 54 in Terms of primary energy demand. The absolute consumption caps for 2030 are shown in Figure 122. A closer look at the timely evolution of final energy demand according to the various target setting options is then shown in Figure 123. The corresponding illustration in terms of primary energy is shown in Figure **124**.

Table 53: EE targets in terms of final energy for Serbia for different scenarios

EE targets for Serbia in terms of final energy consumption	Historic data for 2008 [ktoe]	Historic data for 2017 [ktoe]	Baseline III in 2030 [ktoe]	Consumption cap in 2030 [ktoe]	Change compared to 2008	Change compared to 2017	Change compared to Baseline III in 2030
Domestic perspective	9,465	8,831	13,652	11,078	+17%	+25.4%	**-18.9%**
Base year 1	9,465	8,831	13,652	9,371	-1%	+6.1%	**-31.4%**
Base year 10	9,465	8,831	13,652	8,519	-10%	-3.5%	**-37.6%**
Base year 19	9,465	8,831	13,652	7,667	-19%	-13.2%	**-43.8%**
Baseline 26	9,465	8,831	13,652	10,102	+6.7%	+14.4%	**-26%**
Baseline 32.5	9,465	8,831	13,652	9,215	-2.6%	+4.3%	**-32.5%**
Baseline 39	9,465	8,831	13,652	8,328	-12%	-5.7%	**-39%**

Table 54: EE targets in terms of primary energy for Serbia for different scenarios

EE targets for Serbia in terms of primary energy consumption	Historic data for 2008 [ktoe]	Historic data for 2017 [ktoe]	Baseline III in 2030 [ktoe]	Consumption cap in 2030 [ktoe]	Change compared to 2008	Change compared to 2017	Change compared to Baseline III in 2030
Domestic perspective	15,931	14,893	23,025	17,629	+10.7%	+18.4%	**-23.4%**
Base year 1	15,931	14,893	23,025	15,721	-1.3%	+5.6%	**-31.7%**
Base year 10	15,931	14,893	23,025	13,837	-13.1%	-7.1%	**-39.9%**
Base year 19	15,931	14,893	23,025	11,952	-25%	-19.7%	**-48.1%**
Baseline 26	15,931	14,893	23,025	17,039	+7%	+14.4%	**-26%**
Baseline 32.5	15,931	14,893	23,025	15,542	-2.4%	+4.4%	**-32.5%**
Baseline 39	15,931	14,893	23,025	14,045	-11.8%	-5.7%	**-39%**

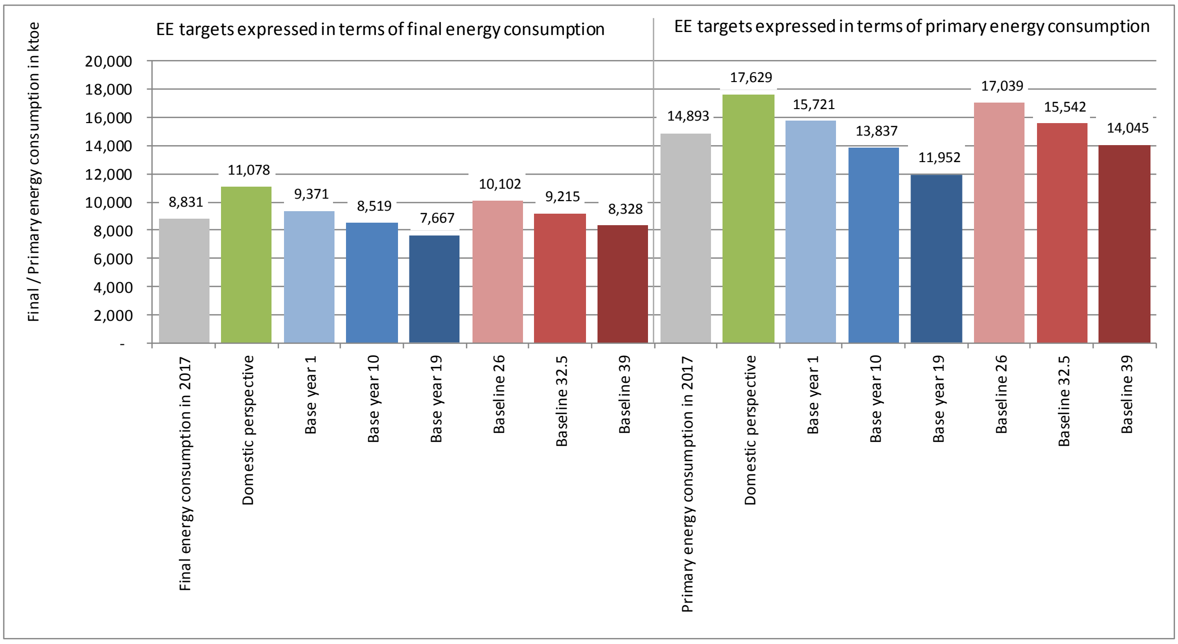


Figure 122: Energy efficiency targets in terms of primary and final energy for different scenarios. Baseline vs. Base year approach vs. Domestic perspective

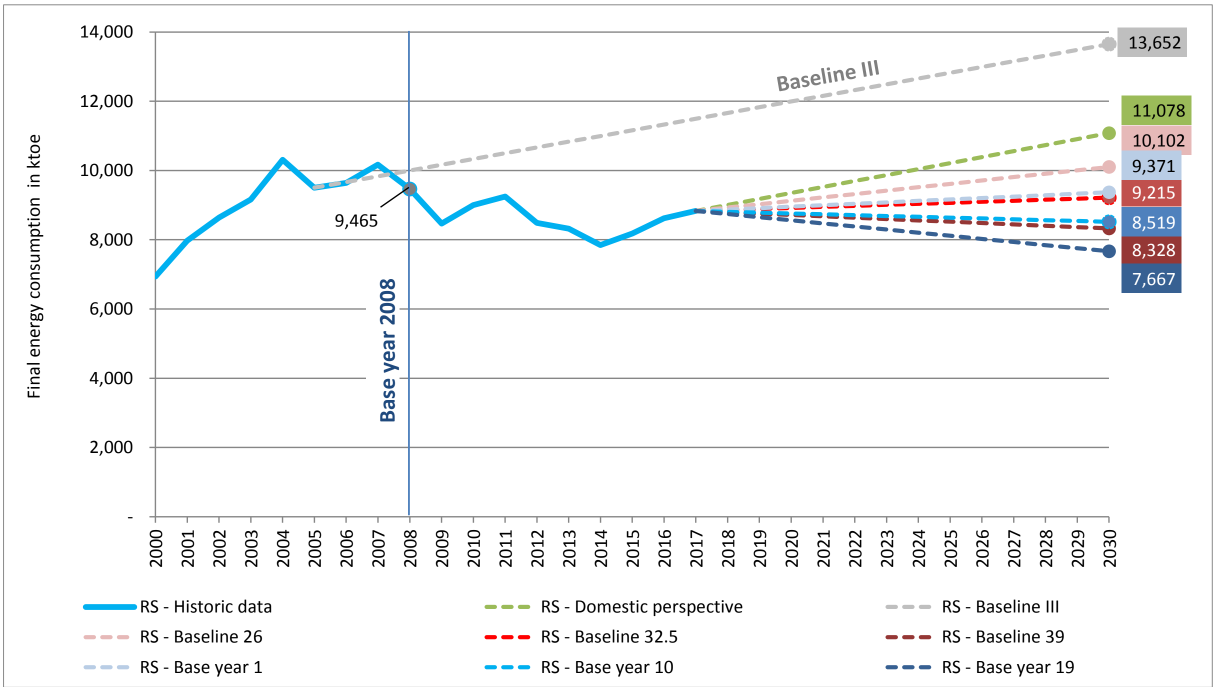


Figure 123: Energy Efficiency targets in terms of final energy for different scenarios. Baseline compared to Base year approach vs. Domestic perspective

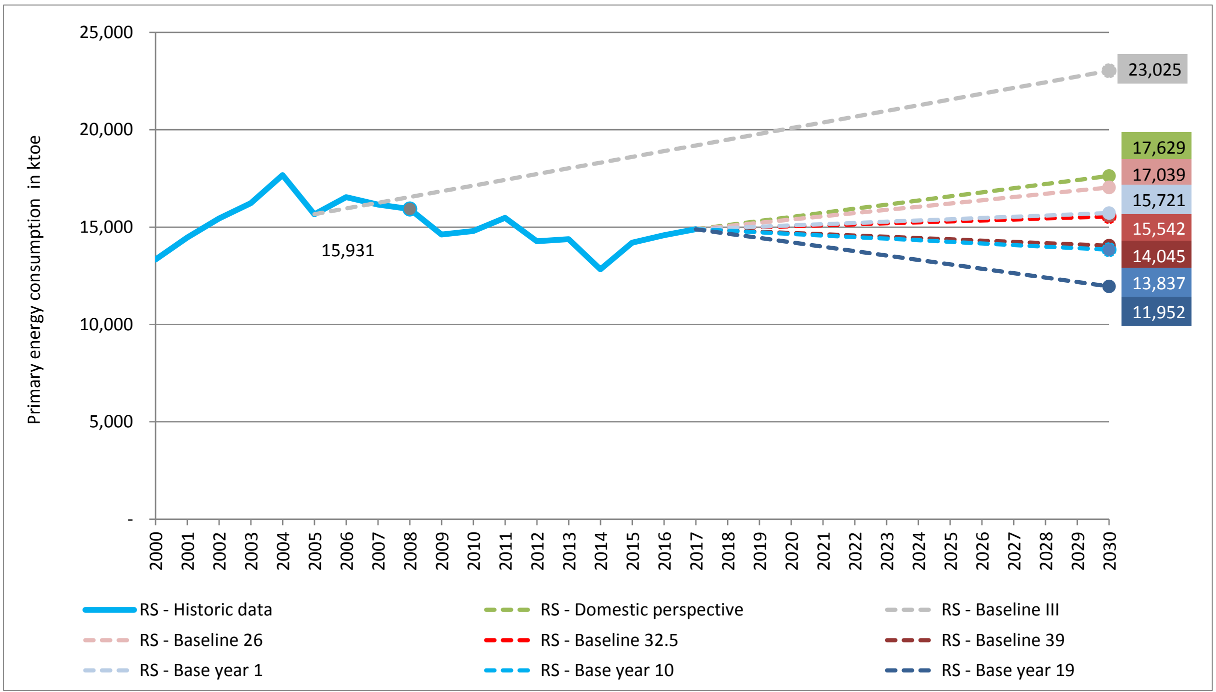


Figure 124: Energy efficiency targets in terms of primary energy for different scenarios. Baseline compared to Base year approach vs. Domestic perspective

2.5.8.1 Indicators for analysing energy performance

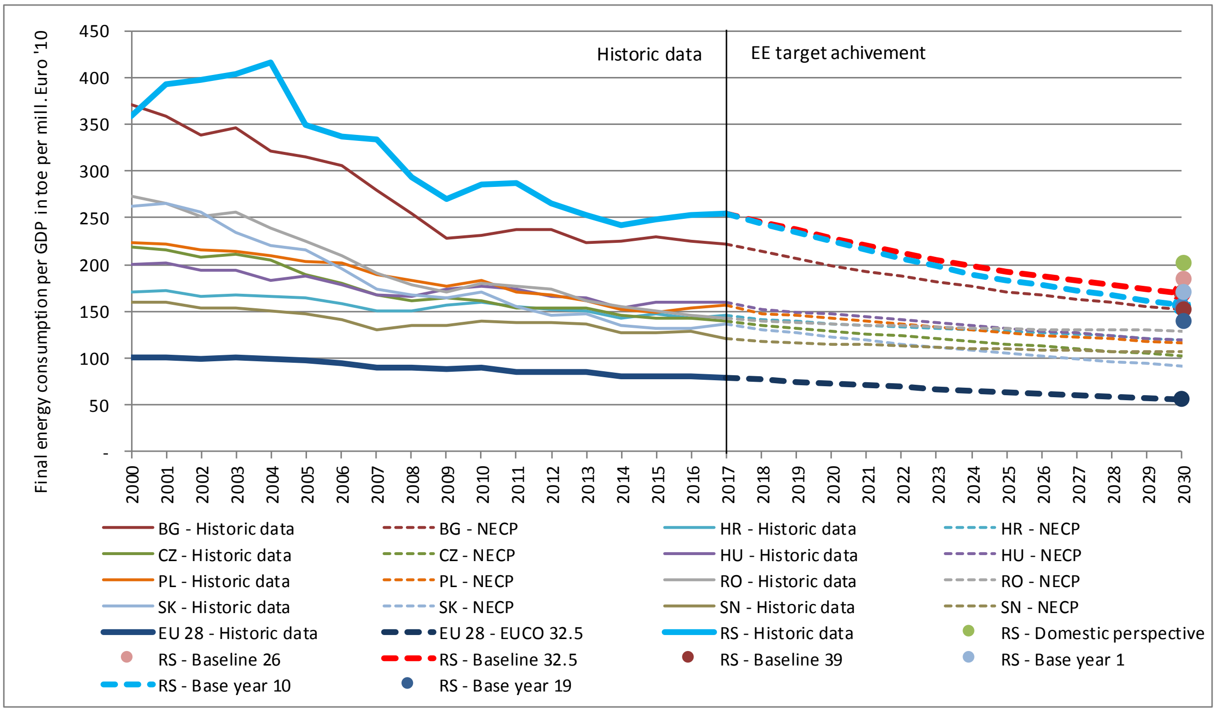


Figure 125: Development of FEC/GDP in Serbia compared to the EU 28 and selected MS. Source: Eurostat, 2019; IMF, 2019; NTUA, 2012, 2017.

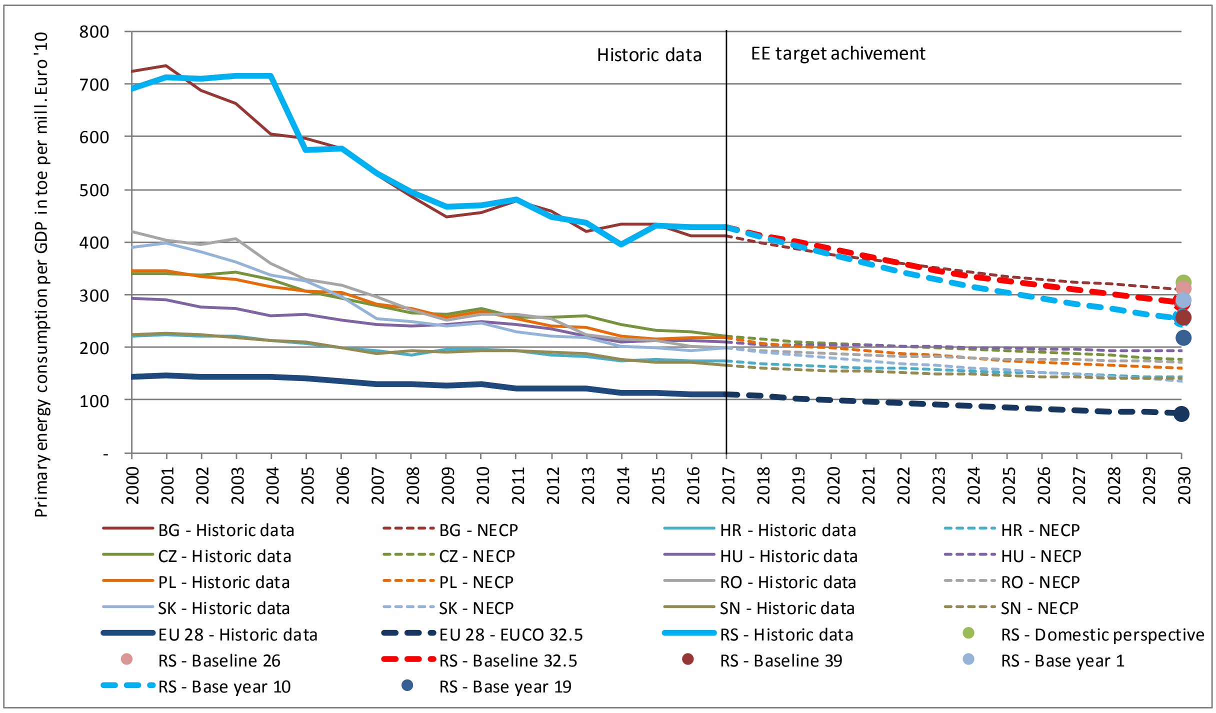


Figure 126: Development of PEC/GDP in Serbia compared to the EU 28 and selected MS. Source: Eurostat, 2019; IMF, 2019; NTUA, 2012, 2017.

If one considers primary energy per GDP in absolute values, it can be seen that Serbia and Bulgaria have a comparatively similar present level and historic record. If a baseline approach is followed for Serbia and a moderate EE target of 32.5% is introduced therein, then also a similar future trend can be expected in both countries.

In 2017, primary energy consumption per GDP was about 420 toe/mill. Euro '10 in Serbia. Under both considered EE target setting options, energy consumption per GDP will drop significantly until 2030 – i.e. to about 300 toe/mill. Euro '10 under the expressed Baseline variant (i.e. Baseline 32.5) and to about 250 toe/mill. Euro '10 according to the indicated base year option (i.e. Base year 10). Compared to other EU MSs Serbia has a significantly higher primary energy consumption per GDP, cf. Figure 126.

Figure 128 indicates the development of primary energy per capita in absolute terms. A comparison between EU MSs and Serbia shows that in absolute terms Serbia has comparatively low per capita primary energy consumption. In the considered Base year scenario (Base year 10), energy consumption per capita would have to remain relatively constant until 2030 whereas in the expressed Baseline scenario (Baseline 32.5), energy consumption per capita may even slightly increase until 2030. A likewise increasing trend can be observed also for other selected MS. In contrast, at EU level a clear downward trend is getting apparent.

The base year scenario (base year 10) leads to a slight decrease until 2030, whereas the Baseline option (i.e. Baseline 32.5) leads to a slight increase, which can also be seen for most of the MS considered. Looking at the EU 28, however, a clear downward trend can be observed. Similar to the discussed future trend in absolute terms, the strongest increase between 2017 and 2030 can be observed in Hungary.

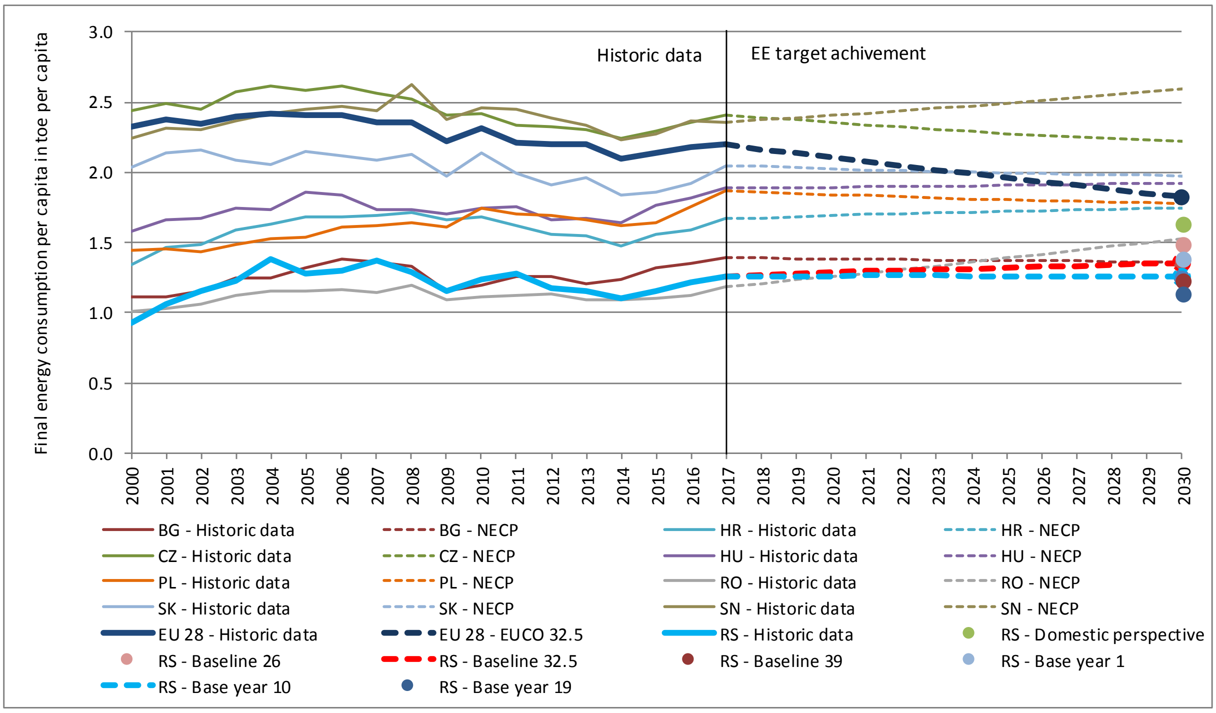


Figure 127: Development of FEC/Capita in Serbia compared to the EU 28 and selected MSs. Source: Euro-stat, 2019; IMF, 2019; NTUA, 2012, 2017.

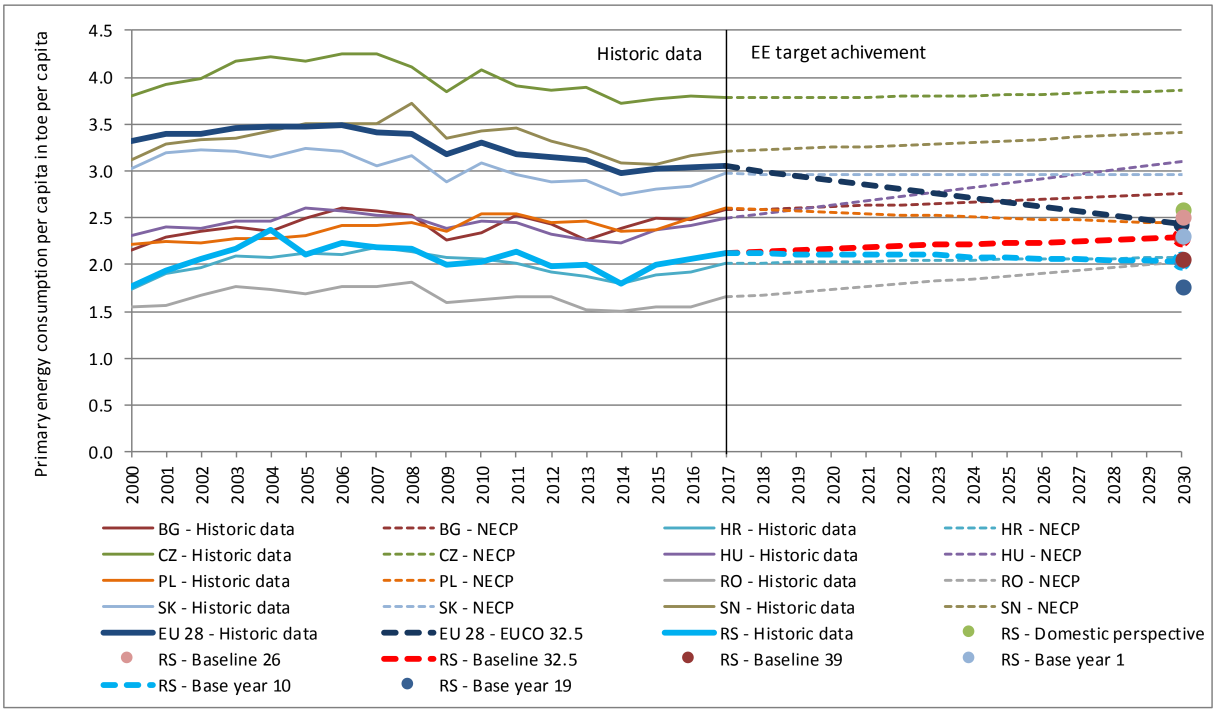


Figure 128: Development of PEC/Capita in Serbia compared to the EU 28 and selected MS. Source: Eurostat, 2019; IMF, 2019; NTUA, 2012, 2017.

2.5.8.2 Advanced indicators to assess energy efficiency performance

Indicators on economic structure

In a first step, indicators on the economic structure should put the Serbian economic development in context to selected EU MSs. Figure 129 to Figure 132 show the development of the share of agriculture, manufacturing (as an important part of the industry sector), industry and services in % of GDP related to the GDP per capita showing historical values from 2000 to 2017 in Serbia compared to the EU 28 and selected MSs.

Figure 129 depicts that the share of agriculture sector is as high as 23.6 expressed in % of GDP in 2017. This share is about as high as it was in Bulgaria in the year 2000 and Rumania in 2004. Similar trends can be observed for the contribution of manufacturing (cf. Figure 130), the overall industry (cf. Figure 131) and the service sector (see Figure 132) to GDP – also here Bulgaria and Romania show comparative developments to Serbia in the last decade(s).

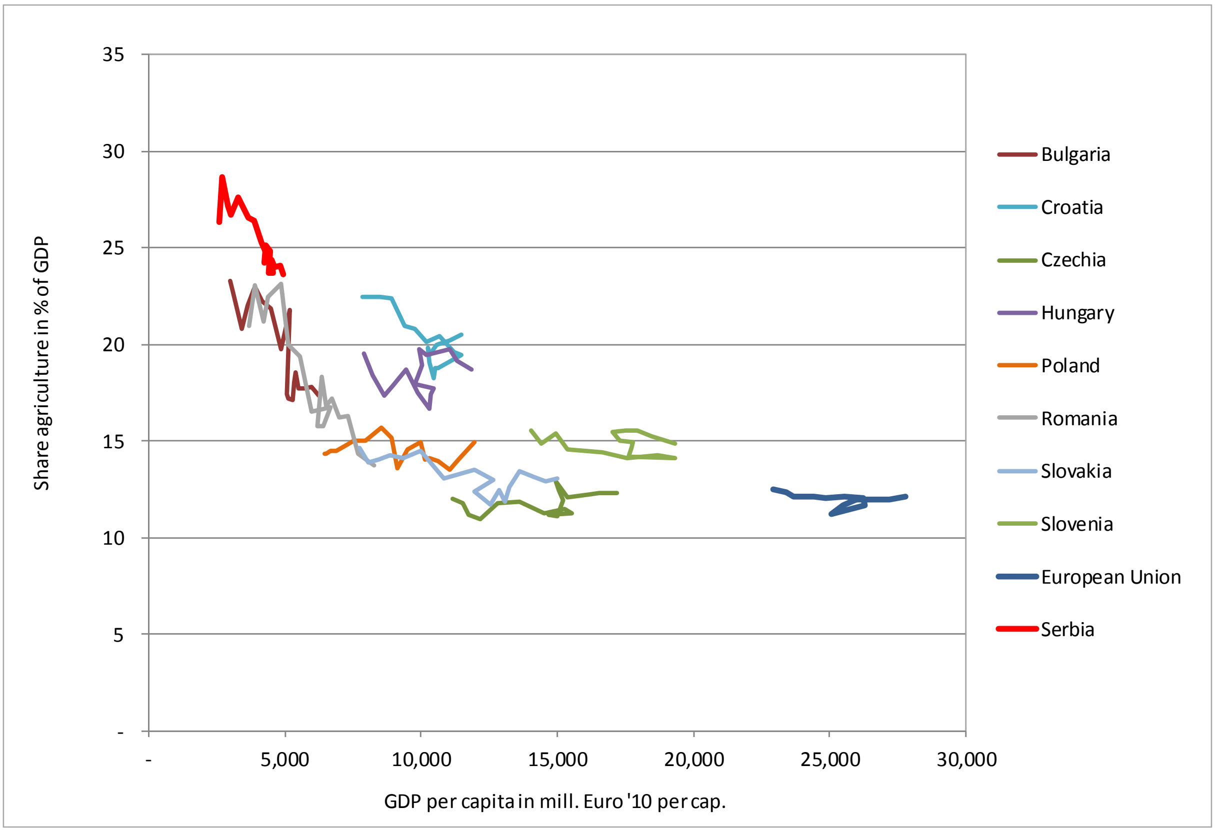


Figure 129: Development of the share of agriculture in % of GDP related to the GDP per capita showing historical values from 2000 to 2017 in Serbia compared to the EU 28 and selected MSs. Source: Eurostat, 2019; IMF, 2019; Worldbank, 2019;

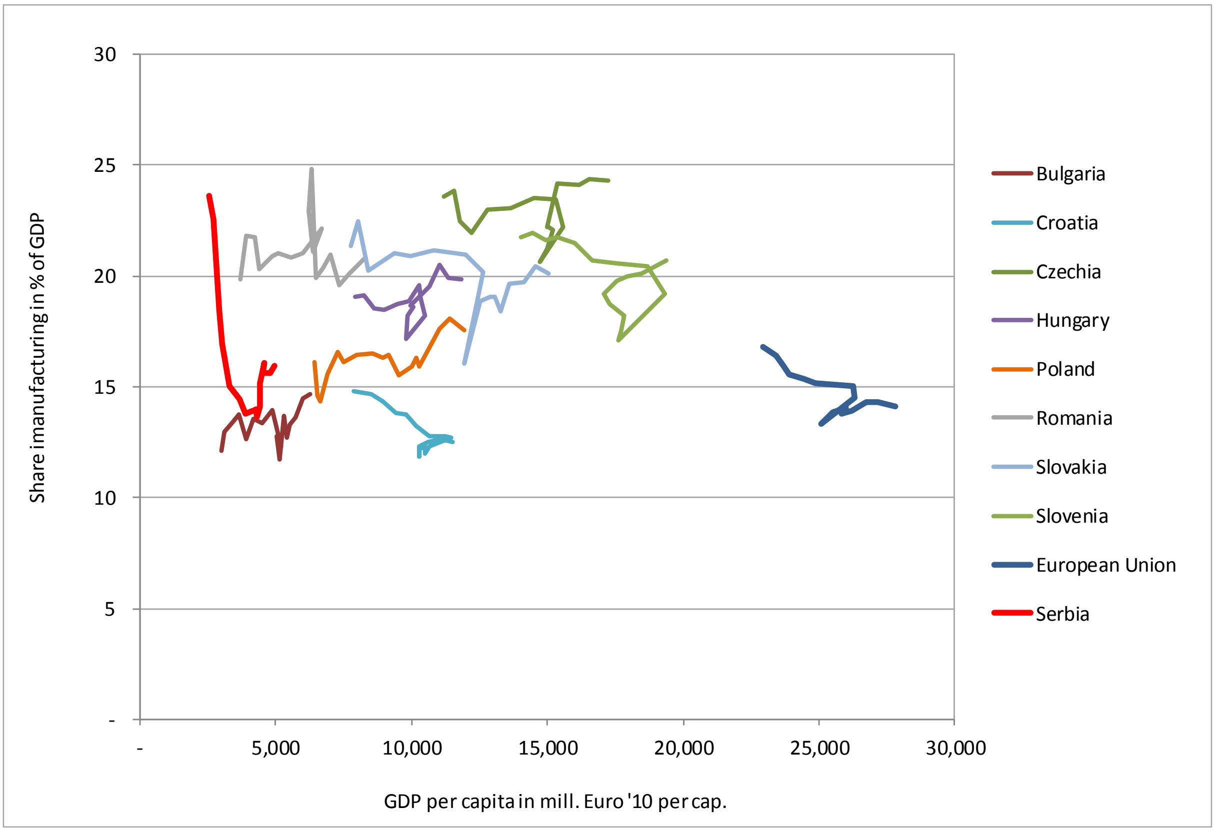


Figure 130: **Development of the share of manufacturing in % of GDP related to the GDP per capita showing historical values from 2000 to 2017 in Serbia compared to the EU 28 and selected MSs. Source: Eurostat, 2019; IMF, 2019; Worldbank, 2019;**

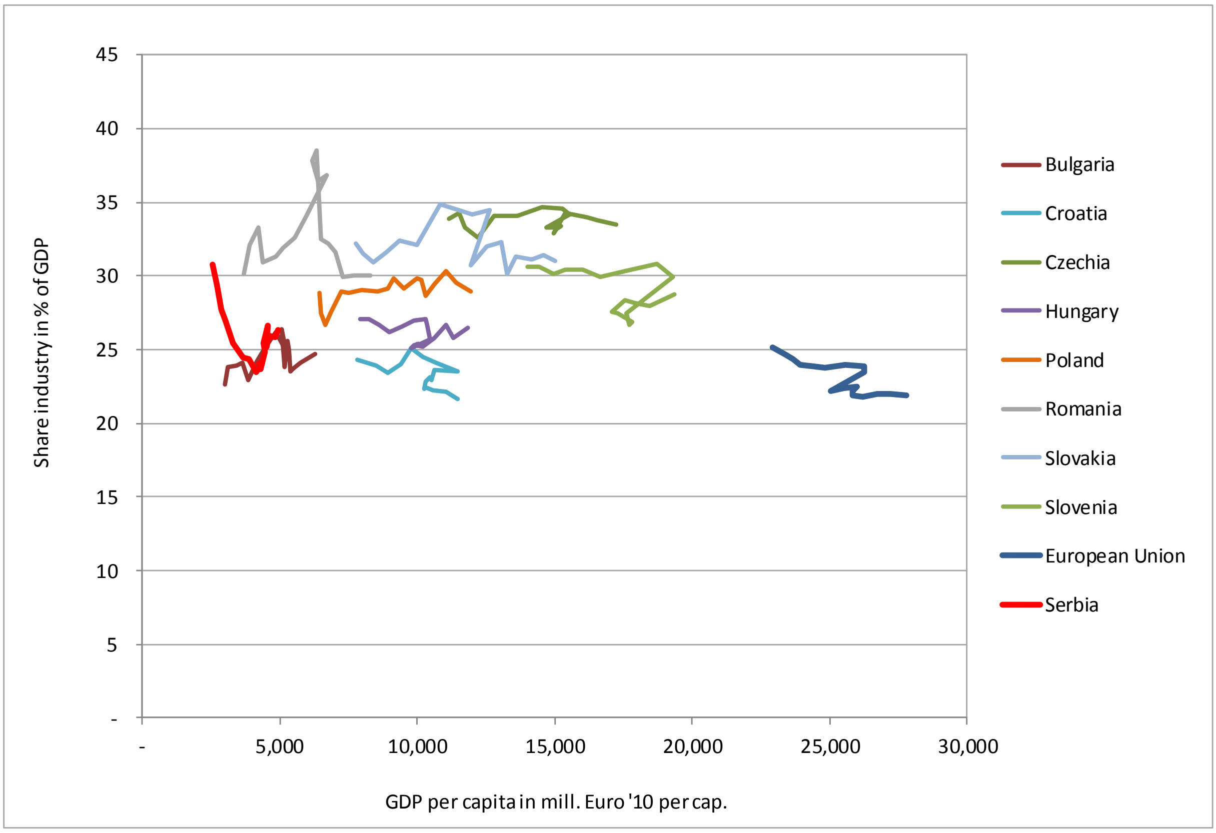


Figure 131: **Development of the share of industry in % of GDP related to the GDP per capita showing historical values from 2000 to 2017 in Serbia compared to the EU 28 and selected MSs. Source: Eurostat, 2019; IMF, 2019; Worldbank, 2019;**

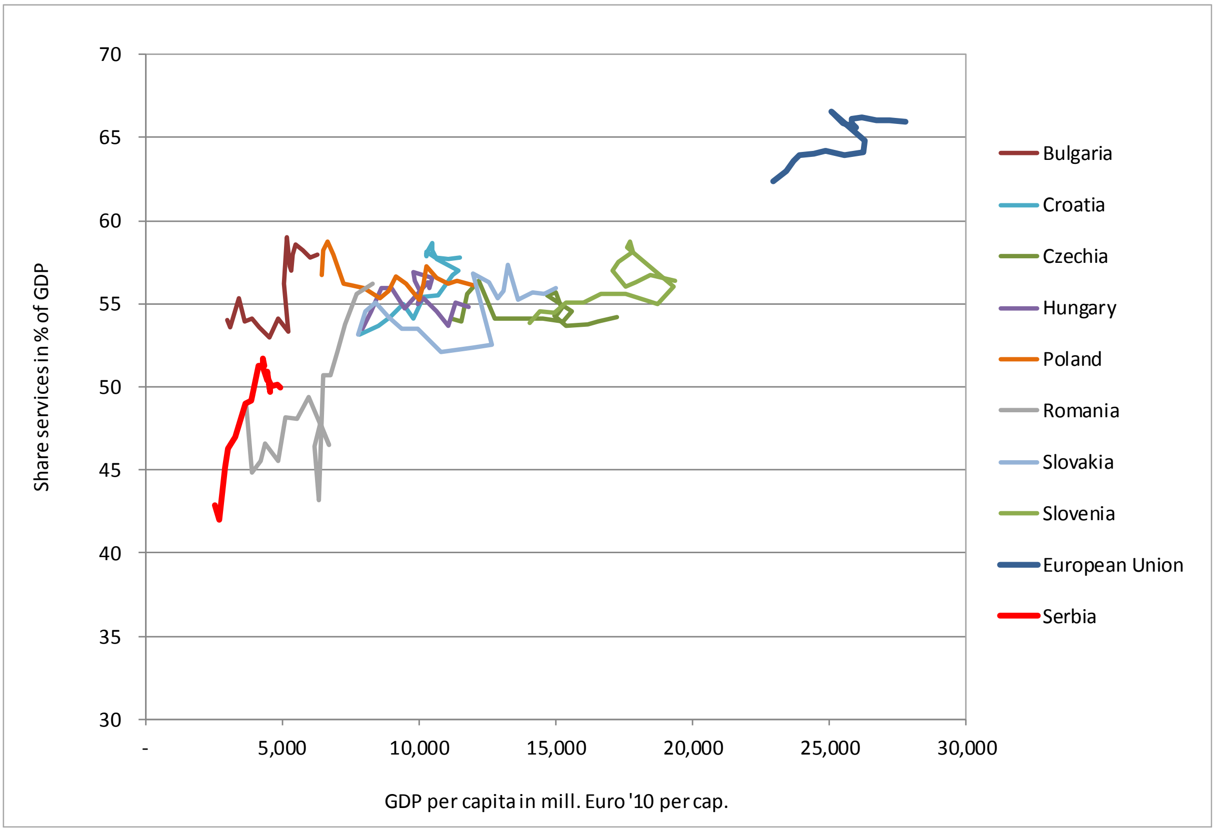


Figure 132: Development of the share of services in % of GDP related to the GDP per capita showing historical values from 2000 to 2017 in Serbia compared to the EU 28 and selected MSs. Source: Eurostat, 2019; IMF, 2019; Worldbank, 2019;

Indicators on energy system

Figure 133 and Figure 134 below put final and respectively primary energy consumption per GDP in relation to GDP per capita. This is shown in both figures for Serbia, the EU28 and our suite of selected MSs, and by country we connect therein the different data points, referring to distinct years, with a coloured line. All seven proposed EE target setting options for 2030 for Serbia are shown by circular dots using different colours – these dots are on a vertical line since all make use of the same GDP per capita projection.

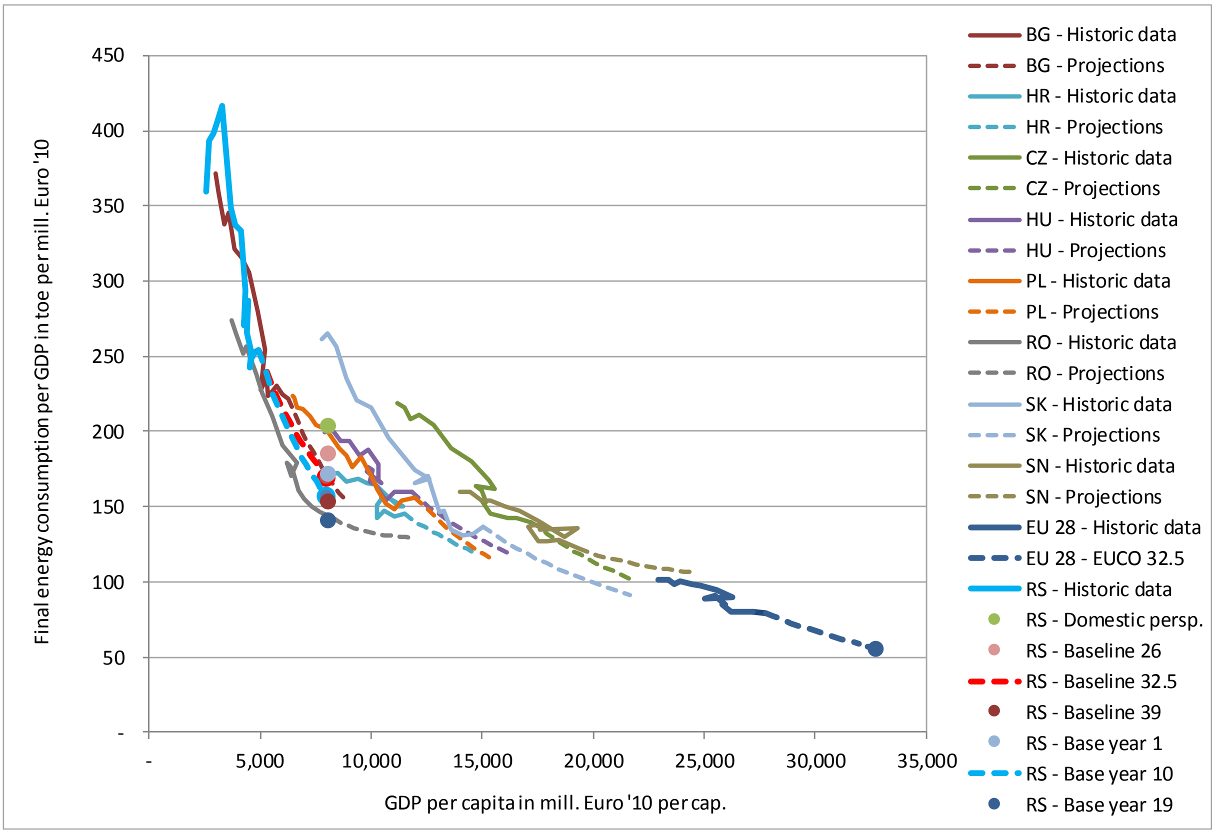


Figure 133: **The development of FEC per GDP related to the GDP per capita showing historical values from 2000 to 2017 and projections from 2018 to 2030 assuming an EE target achievement in Serbia compared to the EU 28 and selected MSs. Source: Eurostat, 2019; IMF, 2019; NTUA, 2012, 2017.**

Table 55: **Qualitative assessment of all EE target setting options concerning FEC per GDP (Serbia)**

Indicator	Domestic	Baseline 26	Baseline 32.5	Baseline 39	Base year 1	Base year 10	Base year 19
FEC per GDP	Not ambitious	Intermediate (ambition)	Reasonable			Intermediate (constraing)	Too constraining

A closer look at the latest statistical data for the historic record (2017) in Figure 133 shows that Serbia and Bulgaria are by far the most energy intensive countries with more than 200 toe of energy use per million Euro of GDP. Remarkably, these two countries have the lowest GDP per capita in 2017 – but that is by no means “accidental”. Figure 133 and Figure 134 show a very high correlation between, on the one hand, energy use per GDP and, on the other hand, GDP per capita. When moving to the right on the horizontal axis a reduction in energy intensity is observable among all assessed countries. This is however not only true for a cross-country comparison – the same trend pattern can be observed when comparing different points in time for a single country: Figure 133 and Figure 134 show here in general terms a clear downward trend, meaning a decline of energy intensity that goes hand in hand with an increase of economic welfare. The development over time contains some irregularities for the historic record from 2000 to 2017. These irregularities are mostly caused by the economic recession during the years 2008 to 2010. This recession hit different MSs and Serbia with different severity. The projected future trend from 2017 to 2030, assuming a 2030 EE target achievement for all assessed countries, shows again a strict downward-looking trend. This trend has a steeper slope for countries with higher energy intensities at present as they have a higher potential for EE measures, and also a higher potential for a structural shift to a more service-orientated economy.

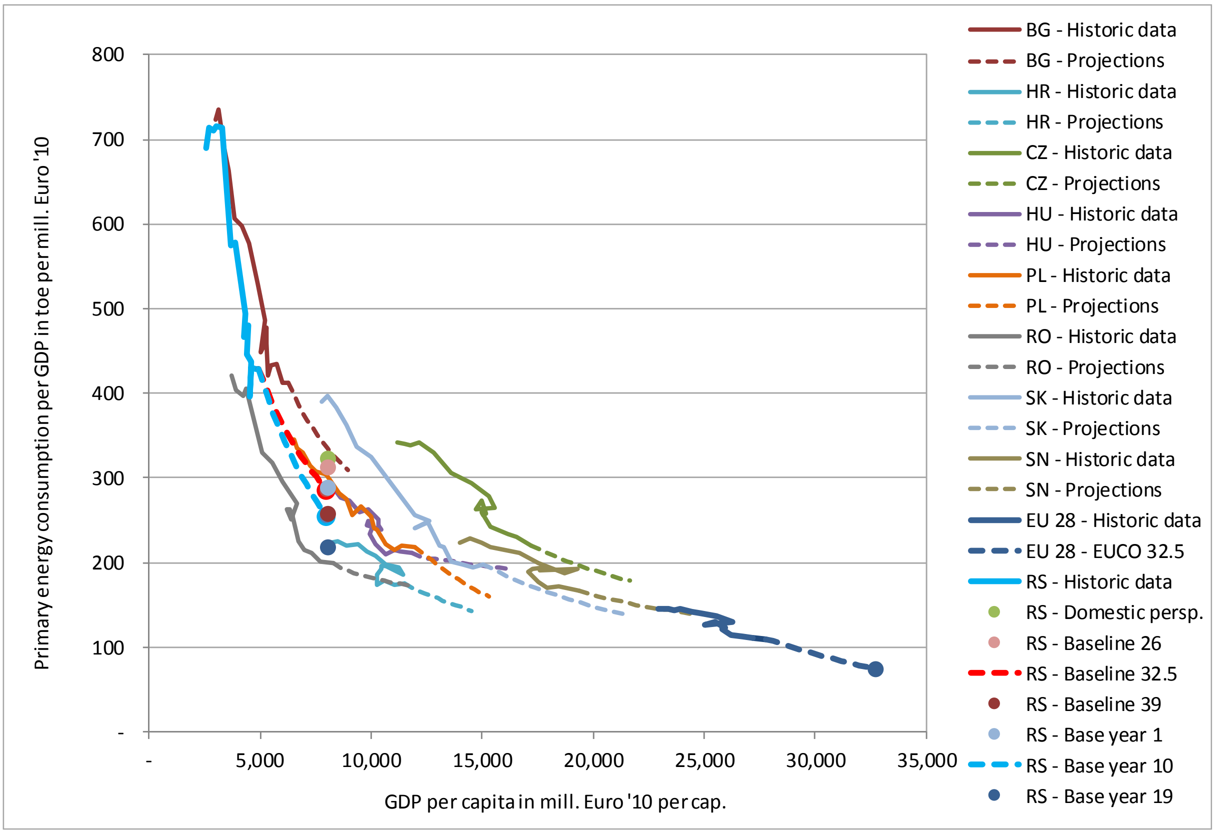


Figure 134: The development of PEC per GDP related to the GDP per capita showing historical values from 2000 to 2017 and projections from 2018 to 2030 assuming an EE target achievement in Serbia compared to the EU 28 and selected MSs. Source: Eurostat, 2019; IMF, 2019; NTUA, 2012, 2017.

Table 56: Qualitative assessment of all EE target setting options concerning PEC per GDP (Serbia)

Indicator	Domestic	Baseline 26	Baseline 32.5	Baseline 39	Base year 1	Base year 10	Base year 19
PEC per GDP							

Concerning the assessed EE target setting options the following observations appear of relevance:

- Base year 19 is too strict as the data point for 2030 would be out of, or more precisely, below the EU28 spectrum.
- Both the Base year 10 and the Baseline 39 appear also very ambitious in terms of imposed EE ambition.
- Base year 1 or Baseline 32.5 ends exactly where Croatia was located in its historic development in the year 2000 in terms of final energy.
- When comparing primary energy consumption trends a similar statement can be made for Serbia and Hungary in the case of a Baseline 32.5 target for 2030.
- The projection to reach the Baseline 26 correlates very well with 2030 obligation for Bulgaria.

Figure 135 and Figure 136 below put final and respectively primary energy consumption per capita in relation to GDP per capita. The graphs include trend data for Serbia, the EU28 and our suite of selected MSs, and, similar to above, we connect therein for a single country the different data points, referring to distinct years, with a coloured line. Again, all seven proposed EE target setting options for 2030 for Serbia are shown by circular dots using different colours – these dots are on a vertical line since all make use of the same GDP per capita projection.

In contrast to above, the trend pattern expressed in these graphs are much harder to interpret. The overall correlation is lower (compared to energy consumption per GDP) both for the historic development and for projections towards 2030.

Bulgaria, Romania and Poland show an upward looking trend for the energy per capita indicator when looking at the historic values. Bulgaria and Romania are allowed to continue this trend in future years when assuming a reduction of 32.5% in comparison to their baseline trend in 2030. All other MSs show however the requirement to reduce energy use per capita for reaching the 2030 EE targets or for contributing to the overall EU target achievement.

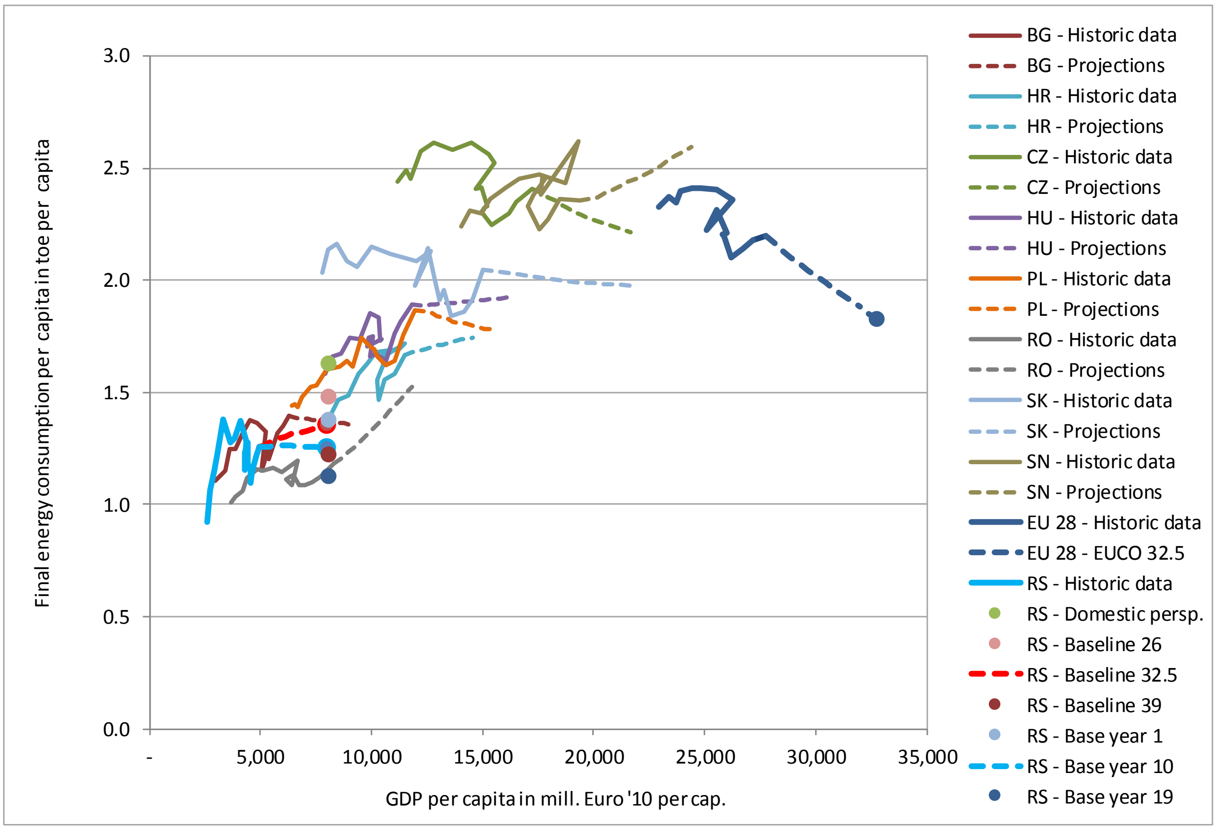


Figure 135: The development of FEC per capita related to the GDP per capita showing historical values from 2000 to 2017 and projections from 2018 to 2030 assuming an EE target achievement in Serbia compared to the EU 28 and selected MSs. Source: Eurostat, 2019; IMF, 2019; NTUA, 2012, 2017

Table 57: Qualitative assessment of all EE target setting options concerning FEC per capita (Serbia)

Indicator	Domestic	Baseline 26	Baseline 32.5	Baseline 39	Base year 1	Base year 10	Base year 19
FEC per capita							

The following observations appear of relevance with respect to the analysed EE target setting options:

- Base year 19 appears too strict since the 2030 data point for Serbia would be located out of the EU 28 spectrum
- Base year 1 or Baseline 32.5 ends exactly where Croatia was located in its historic record in 2000 in terms of final energy.
- The same statement is true when comparing trends in Serbia and Hungary, here in terms of primary energy, under the Baseline 32.5 target setting option.

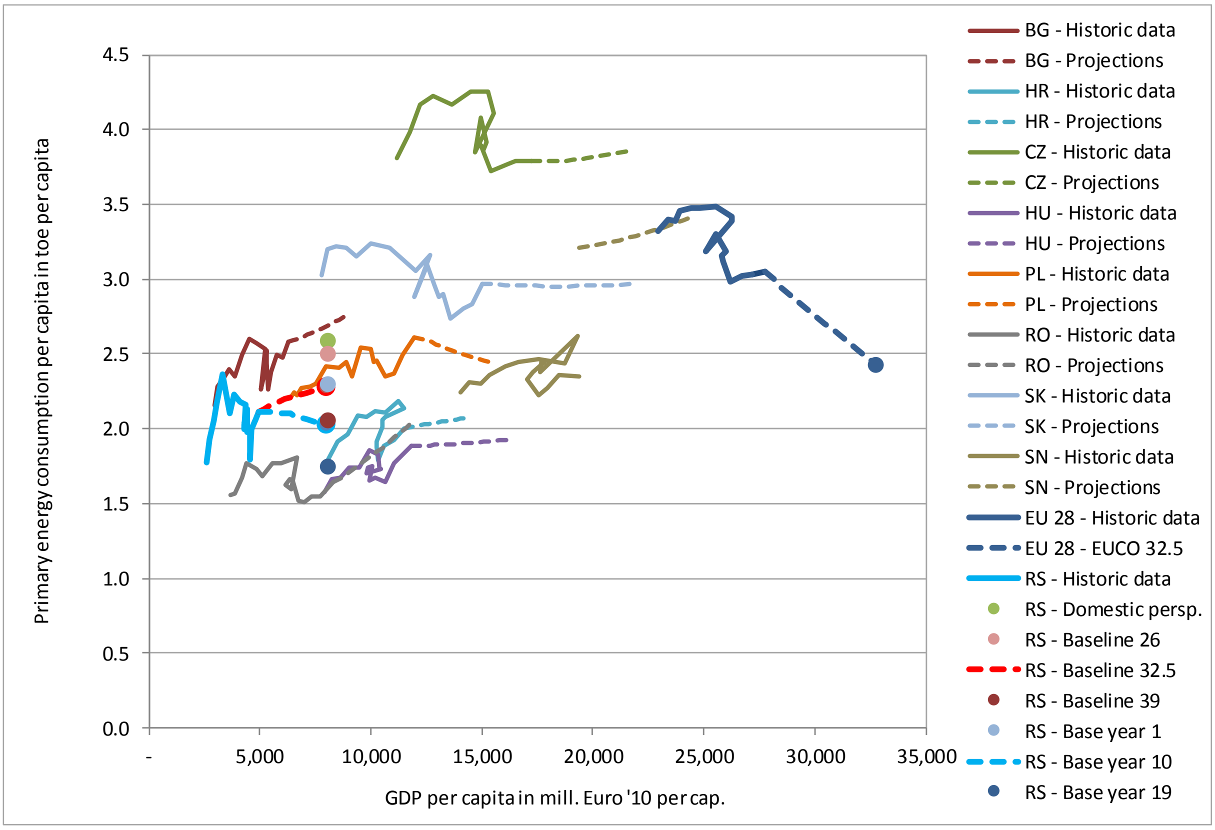


Figure 136: The development of PEC per capita related to the GDP per capita showing historical values from 2000 to 2017 and projections from 2018 to 2030 assuming an EE target achievement in Serbia compared to the EU 28 and selected MSs. Source: Eurostat, 2019; IMF, 2019; NTUA, 2012, 2017.

Table 58: Qualitative assessment of all EE target setting options concerning PEC per capita (Serbia)

Indicator	Domestic	Baseline 26	Baseline 32.5	Baseline 39	Base year 1	Base year 10	Base year 19
PEC per capita							

2.5.8.3 Summary & Conclusions for Energy Efficiency Targets of Serbia

Table 59 summarizes the assessment of all seven EE target setting options done in subchapter 2.5.8.2. It shows that the Baseline 32.5 and Base year 1 approach come to the most reasonable EE targets for 2030. These scenarios stay within the range of comparable efforts. This is based on a comparison with EU MSs which show the most similarieties when compared to Serbia in regards with to their economic structure.

Table 59: Summary table for the qualitative assessment of all EE target setting options (Serbia)

Indicator	Domestic	Baseline 26	Baseline 32.5	Baseline 39	Base year 1	Base year 10	Base year 19
FEC per GDP	Not ambitious	Intermediate (ambition)	Reasonable			Intermediate (constraining)	Too constraining
PEC per GDP							
FEC per capita							
PEC per capita							

2.5.9 Resulting Energy Efficiency Targets for Ukraine

The results for calculated EE targets are presented in Table 60 in terms of final energy demand and in Table 61 in Terms of primary energy demand. The absolute consumption caps for 2030 are shown in Figure 137. A closer look at the evolution over time of final energy demand according to the various target setting options is then shown in Figure 138. The corresponding illustration in terms of primary energy is shown in Figure 139.

Table 60: EE targets in terms of final energy for Ukraine for different scenarios

EE targets for Ukraine in terms of final energy consumption	Historic data for 2008 [ktoe]	Historic data for 2017 [ktoe]	Baseline III in 2030 [ktoe]	Consumption cap in 2030 [ktoe]	Change compared to 2008	Change compared to 2017	Change compared to Baseline III in 2030
Domestic perspective	80,744	53,195	81,713	57,199	-29.2%	+7.5%	**-30%**
Base year 1	80,744	53,195	81,713	79,936	-1%	+50.3%	**-2.2%**
Base year 10	80,744	53,195	81,713	72,670	-10%	+36.6%	**-11.1%**
Base year 19	80,744	53,195	81,713	65,403	-19%	+22.9%	**-20%**
Baseline 26	80,744	53,195	81,713	60,468	-25.1%	+13.7%	**-26%**
Baseline 32.5	80,744	53,195	81,713	55,156	-31.7%	+3.7%	**-32.5%**
Baseline 39	80,744	53,195	81,713	49,845	-38.3%	-6.3%	**-39%**

Table 61: EE targets in terms of primary energy for Ukraine for different scenarios

EE targets for Ukraine in terms of primary energy consumption	Historic data for 2008 [ktoe]	Historic data for 2017 [ktoe]	Baseline III in 2030 [ktoe]	Consumption cap in 2030 [ktoe]	Change compared to 2008	Change compared to 2017	Change compared to Baseline III in 2030
Domestic perspective	127,682	92,147	164,929	109,124	-14.5%	+18.4%	**-33.8%**
Base year 1	127,682	92,147	164,929	126,004	-1.3%	+36.7%	**-23.6%**
Base year 10	127,682	92,147	164,929	110,898	-13.1%	+20.3%	**-32.8%**
Base year 19	127,682	92,147	164,929	95,792	-25%	+4%	**-41.9%**
Baseline 26	127,682	92,147	164,929	122,047	-4.4%	+32.4%	**-26%**
Baseline 32.5	127,682	92,147	164,929	111,327	-12.8%	+20.8%	**-32.5%**
Baseline 39	127,682	92,147	164,929	100,607	-21.2%	+9.2%	**-39%**

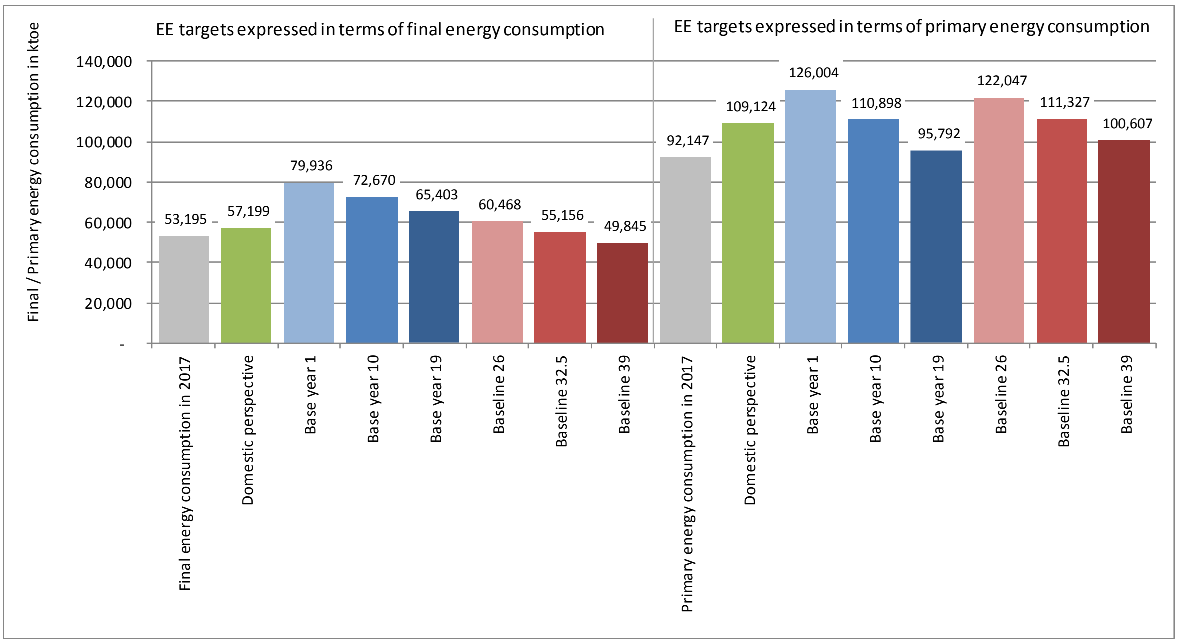


Figure 137: Energy efficiency targets in terms of primary and final energy for different scenarios. Baseline vs. Base year approach vs. Domestic perspective

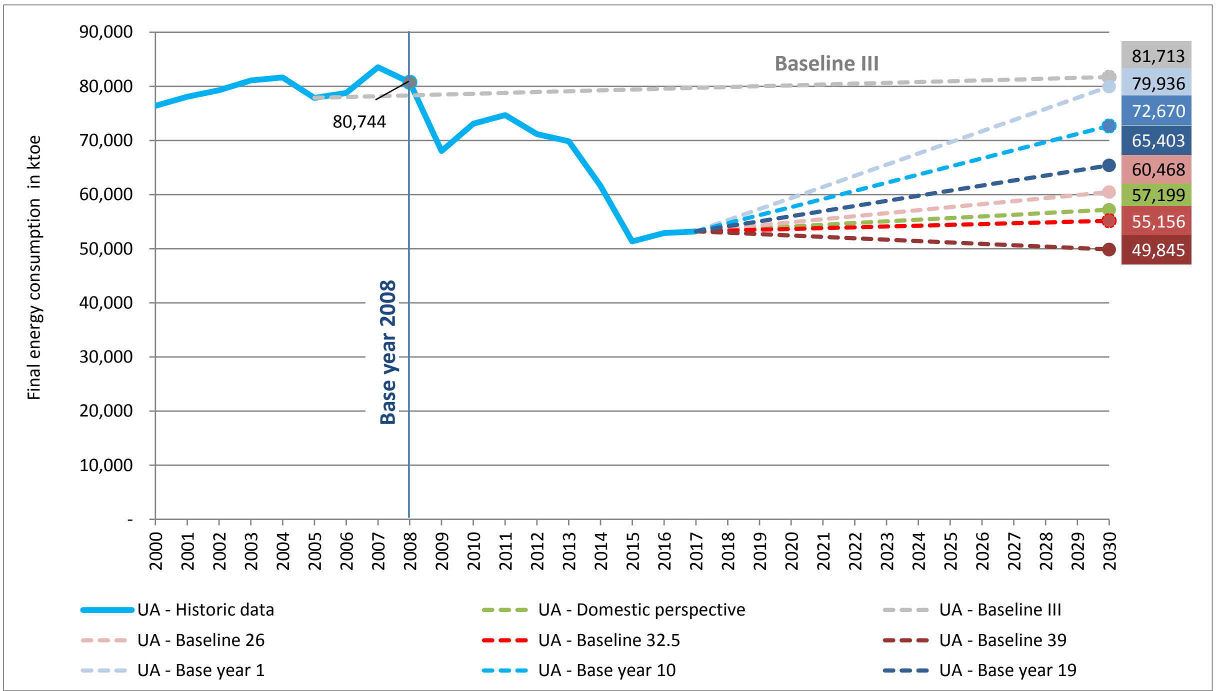


Figure 138: Energy Efficiency targets in terms of final energy for different scenarios. Baseline compared to Base year approach vs. Domestic perspective

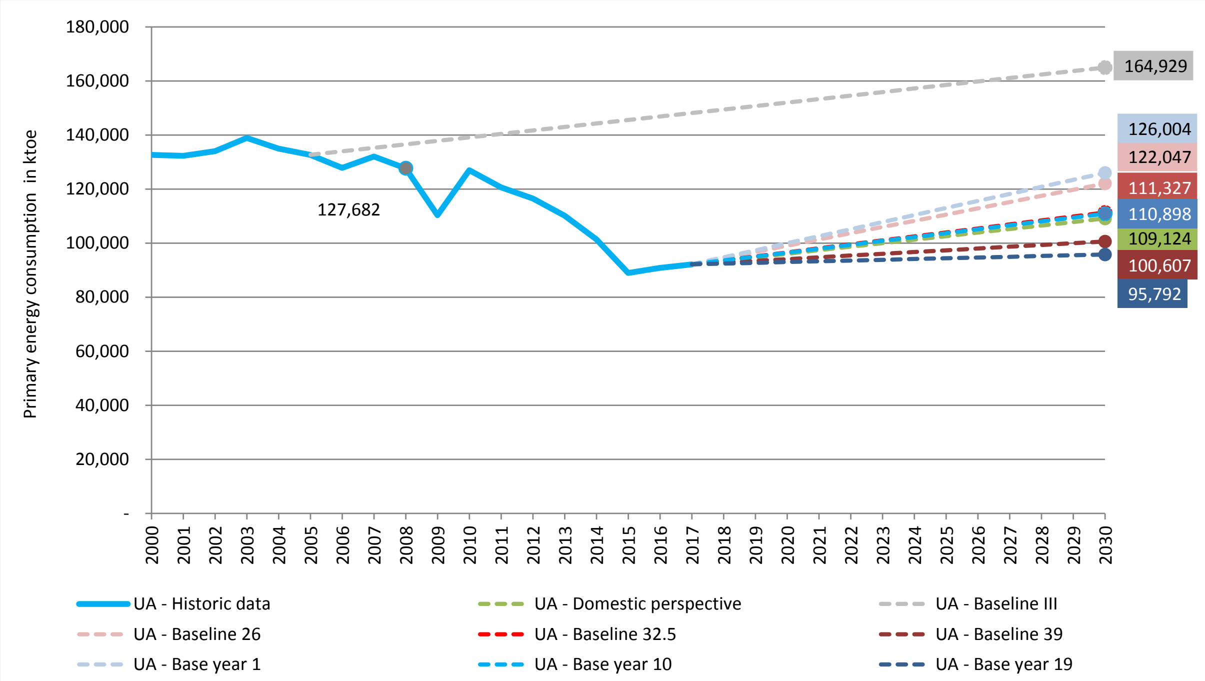


Figure 139: Energy efficiency targets in terms of primary energy for different scenarios. Baseline compared to Base year approach vs. Domestic perspective

2.5.9.1 Indicators for analysing energy performance

The results for calculated EE targets are presented in Table 60 in terms of final energy demand and in Table 61

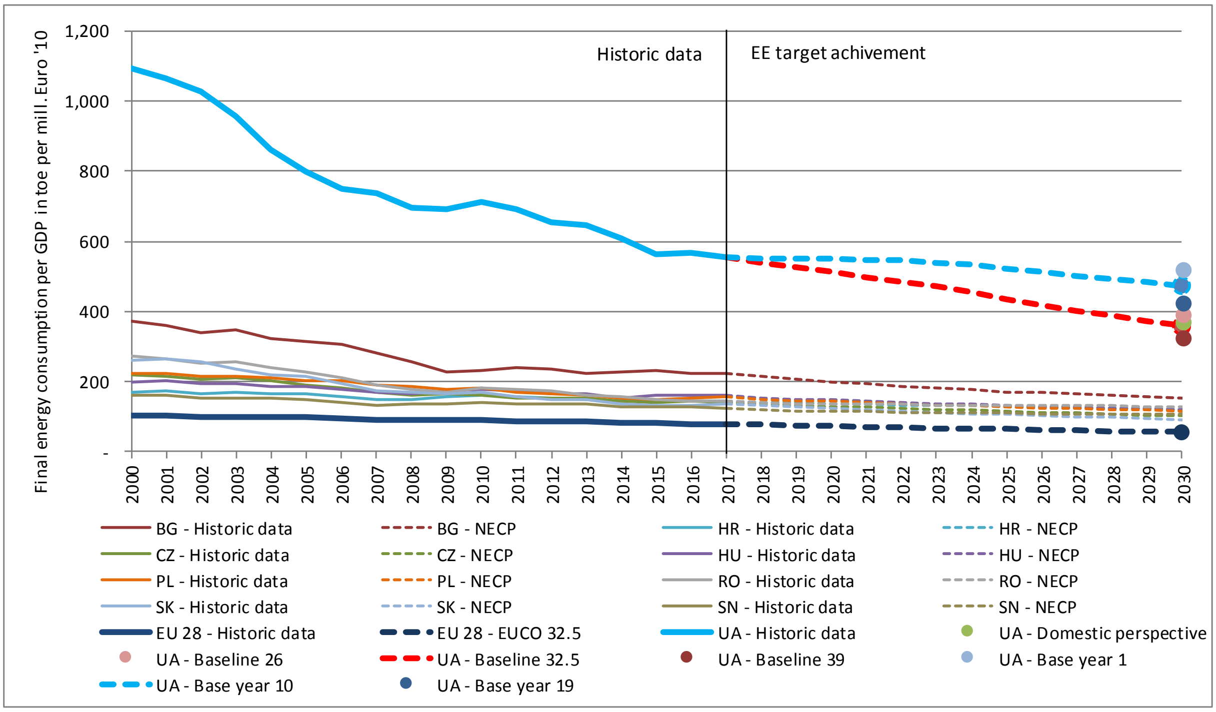


Figure 140: Development of FEC/GDP in Ukraine compared to the EU 28 and selected MS. Source: Eurostat, 2019; IMF, 2019; NTUA, 2012, 2017.

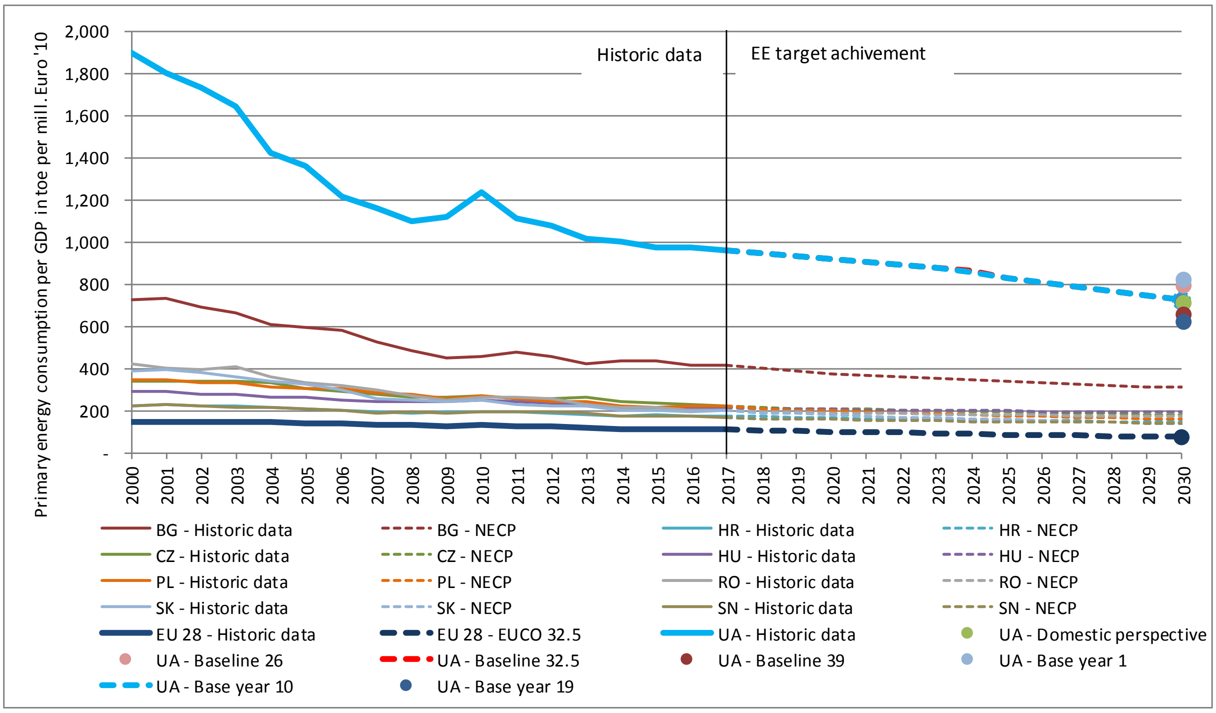


Figure 141: **Development of PEC/GDP in Ukraine compared to the EU 28 and selected MS. Source: Eurostat, 2019; IMF, 2019; NTUA, 2012, 2017.**

In 2017, final energy consumption per GDP was about 555 toe/mill. Euro '10 in Ukraine (see Figure 140). This is the highest value of any CP, and more than twice as high when compared to EU MSs. Primary energy consumption per GDP was about 960 toe/mill. Euro '10 in Ukraine in 2017 (see Figure 141). Contrary, the final energy intensity in per capita terms in 2017 is as high as 1.25 toe per capita and on the level of Romania with an per capita final energy consumption of 1.18 in 2017. This number is lower than of any other EU MSs in this comparison (see Figure 142). In comparison to other CPs, Figure 13 and Figure 14 in the beginning of this subchapter already showed, that Ukraine has the highest energy intensity in GDP.

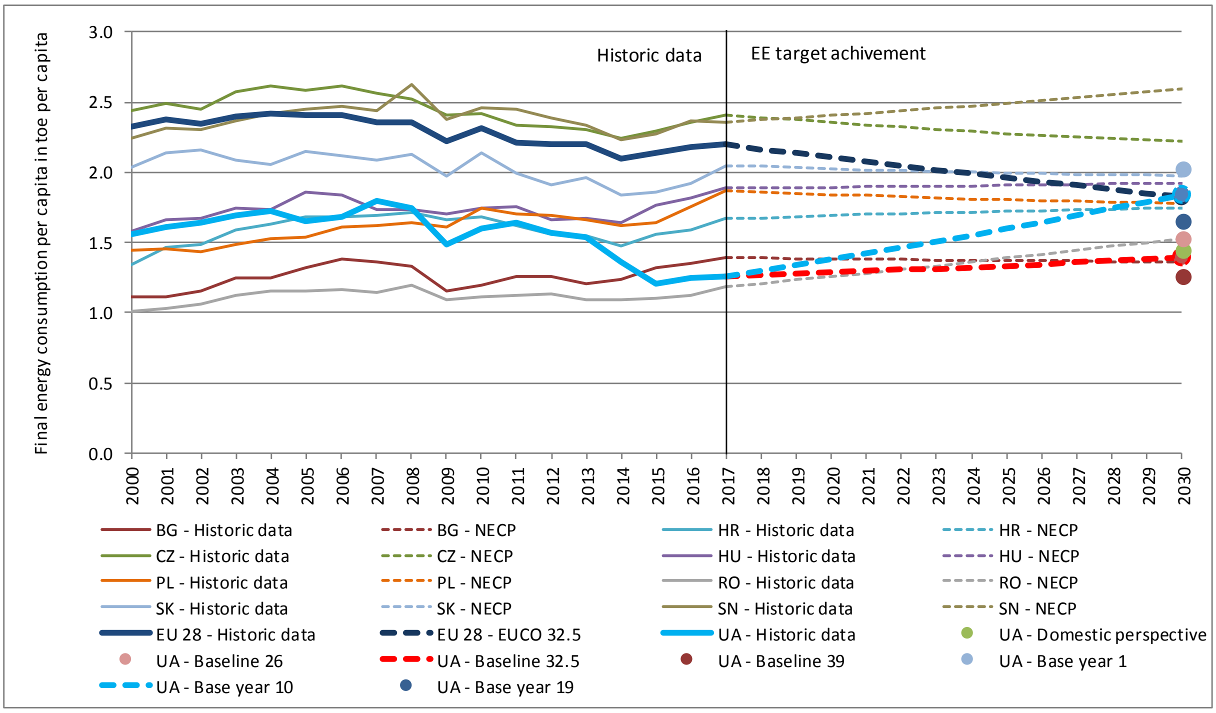


Figure 142: **Development of FEC/Capita in Ukraine compared to the EU 28 and selected MSs. Source: Euro-stat, 2019; IMF, 2019; NTUA, 2012, 2017.**

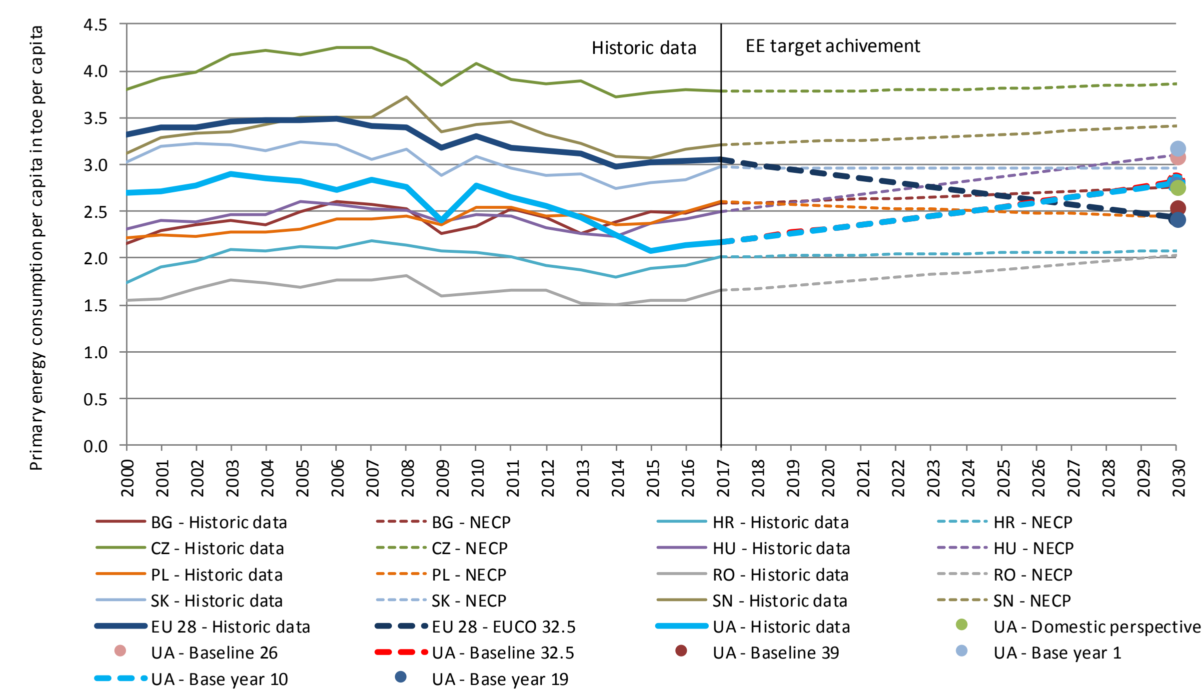


Figure 143: **Development of PEC/Capita in Ukraine compared to the EU 28 and selected MS. Source: Eurostat, 2019; IMF, 2019; NTUA, 2012, 2017.**

2.5.9.2 Advanced indicators to assess energy efficiency performance

Indicators on economic structure

Figure 144 to Figure 147 show the share of different economic sectors of the GDP of Ukraine. These figures describe the economic structure and compare it to EU 28 MSs. The overall structure of the economy in the Ukraine is showing similarities compared to Croatia. But its share of the agriculture in GDP is higher while the share of services is lower. Overall the development in the last century was very dynamic. The highest share of manufacturing and Industry was reached in 2007, showing a clear downward trend until 2013 and a small recovery until 2017. The service sector peaked in its share in GDP in 2013 at 56.2%. The agricultural sector had its lowest share with 18.4% in 2007, followed by a steady phase of recovery until it hits a share of 26.9% in 2016.

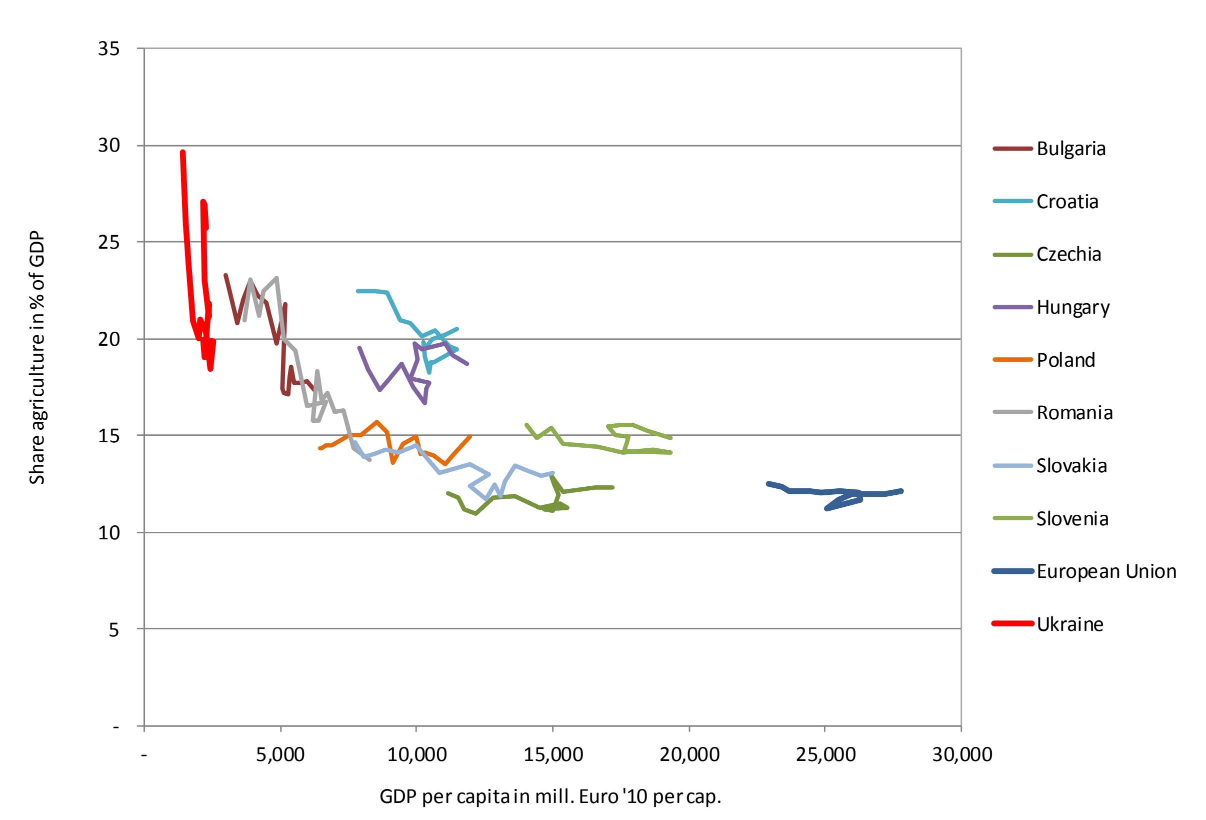


Figure 144: **Development of the share of agriculture in % of GDP related to the GDP per capita showing historical values from 2000 to 2017 in Ukraine compared to the EU 28 and selected MSs. Source: Eurostat, 2019; IMF, 2019; Worldbank, 2019;**

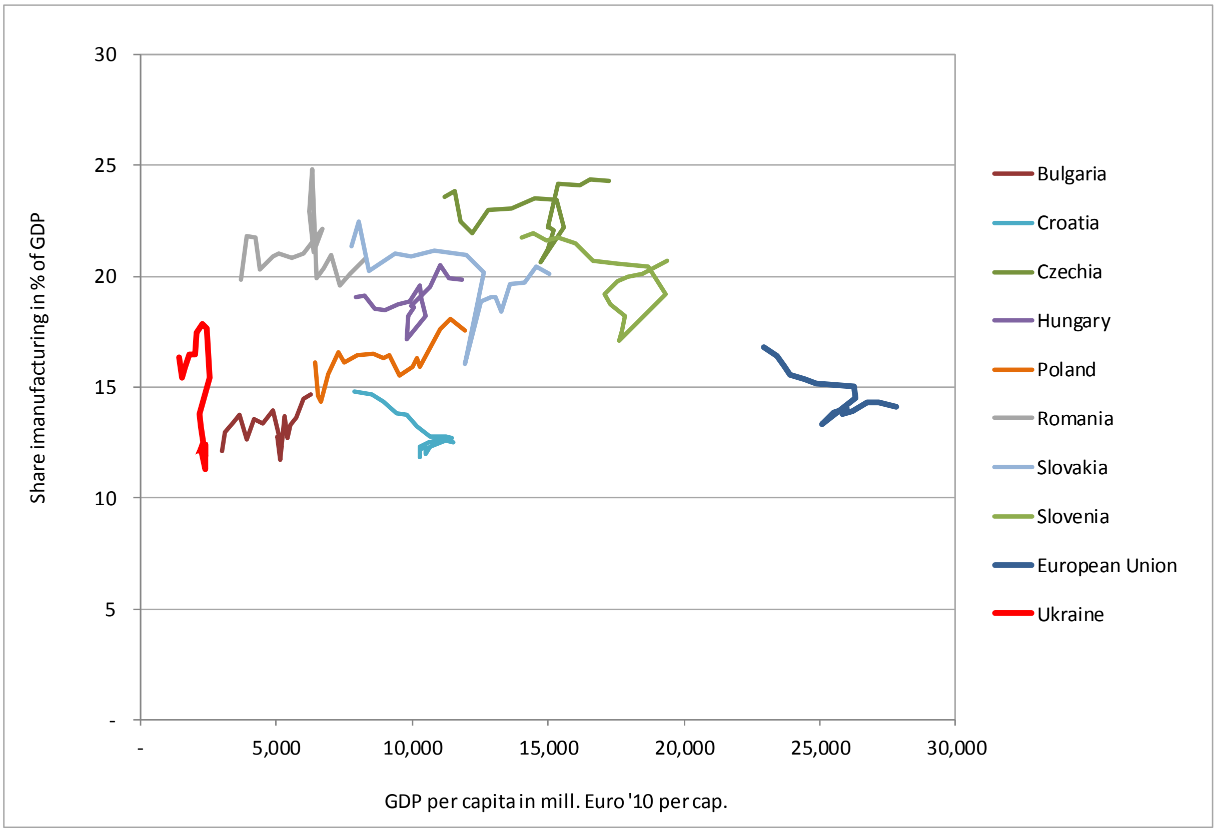


Figure 145: **Development of the share of manufacturing in % of GDP related to the GDP per capita showing historical values from 2000 to 2017 in Ukraine compared to the EU 28 and selected MSs. Source: Eurostat, 2019; IMF, 2019; Worldbank, 2019;**

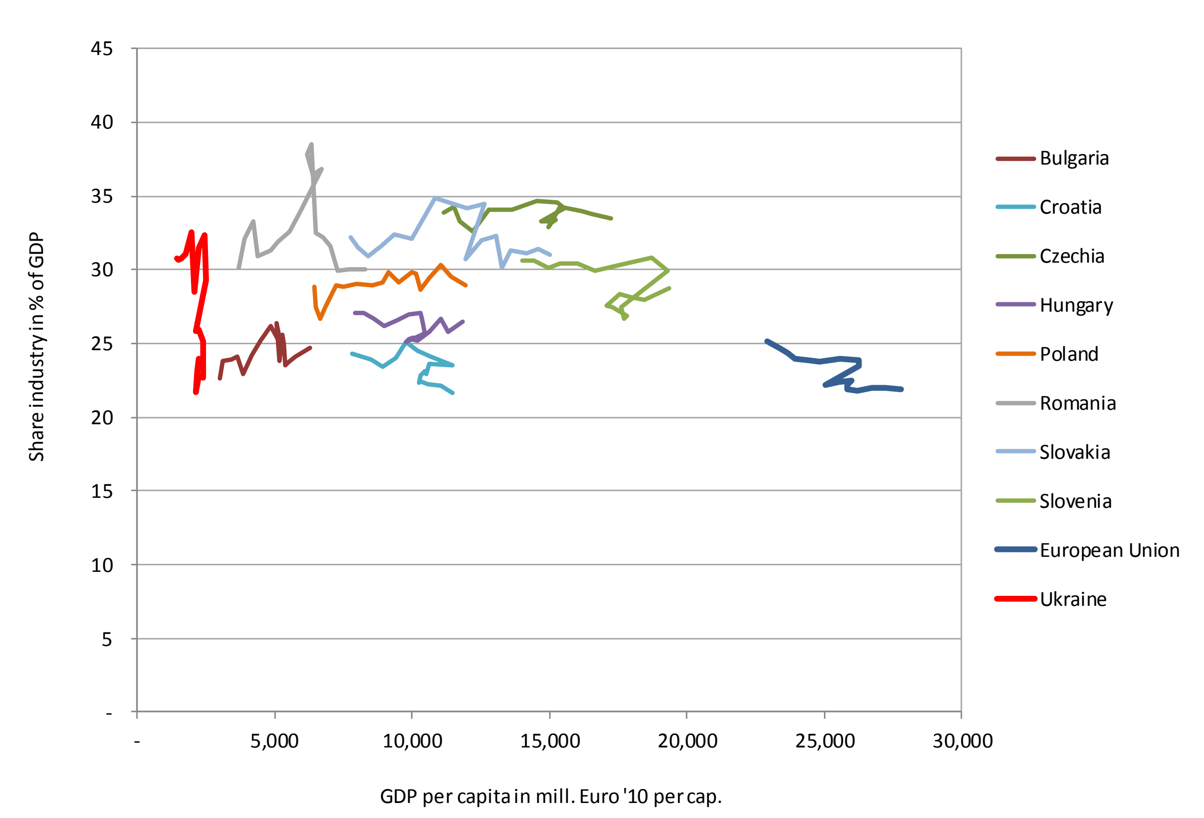


Figure 146: Development of the share of industry in % of GDP related to the GDP per capita showing historical values from 2000 to 2017 in Ukraine compared to the EU 28 and selected MSs. Source: Eurostat, 2019; IMF, 2019; Worldbank, 2019;

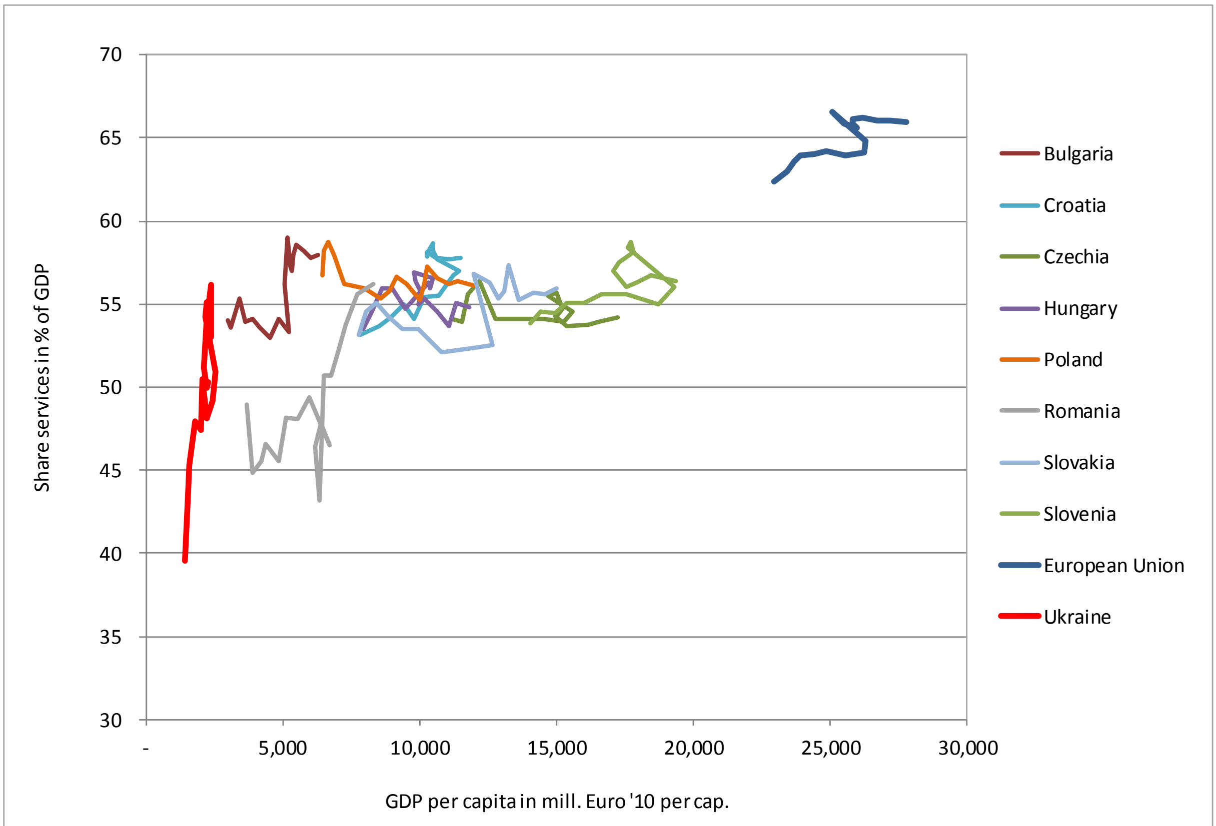


Figure 147: Development of the share of services in % of GDP related to the GDP per capita showing historical values from 2000 to 2017 in Ukraine compared to the EU 28 and selected MSs. Source: Eurostat, 2019; IMF, 2019; Worldbank, 2019;

Indicators on energy system

Ukraine shows clear differences in the development of its energy consumption from 2008 to 2017. Figure 138 and Figure 139 show the energy intensity of the GDP for Ukraine in terms of final and primary energy consumption. A fast and consistent drop in its energy intensity during a slow economic growth and recession is visible. These drastic developments especially after the Base year of 2008 puts Ukraine in a different situation compared to all other CPs. All Base year scenarios seem not ambitious enough in this case. Looking at Figure 148, only the domestic perspective, Baseline 32.5 and Baseline 39 scenario seem to be reasonable as possible EE targets for the Ukraine.

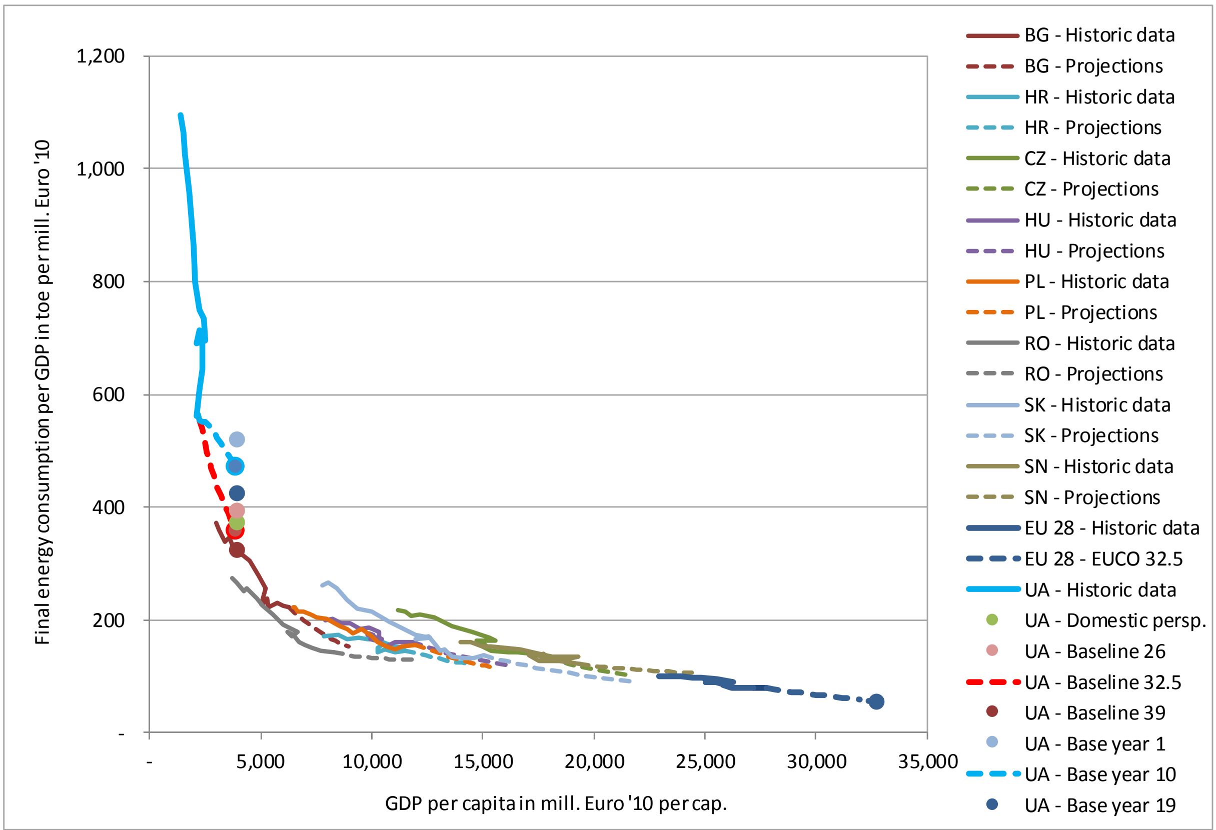


Figure 148: **The development of FEC per GDP related to the GDP per capita showing historical values from 2000 to 2017 and projections from 2018 to 2030 assuming an EE target achievement in Ukraine compared to the EU 28 and selected MSs. Source: Eurostat, 2019; IMF, 2019; NTUA, 2012, 2017.**

Table 62: **Qualitative assessment of all EE target setting options concerning FEC per GDP (Ukraine)**

Indicator	Domestic	Baseline 26	Baseline 32.5	Baseline 39	Base year 1	Base year 10	Base year 19
FEC per GDP	Reasonable	Intermediate (ambition)			Not ambitious		

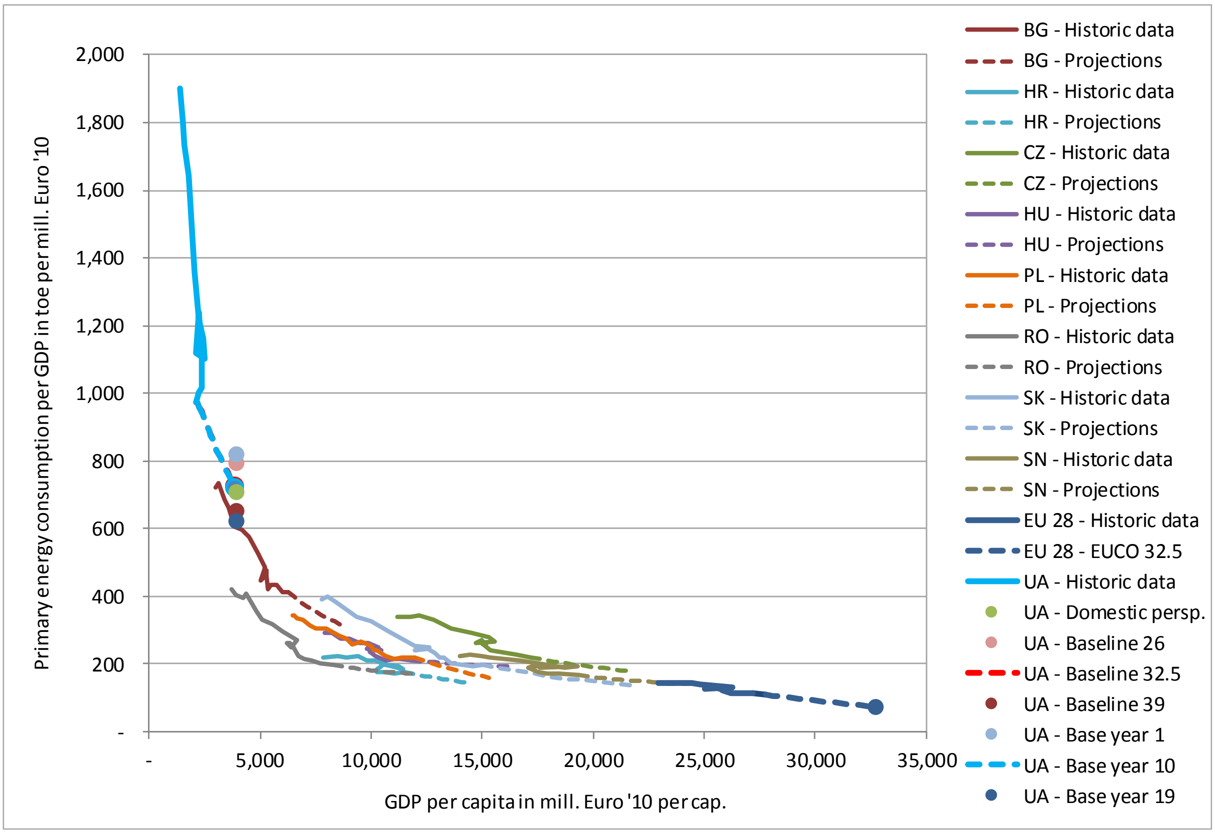


Figure 149: **The development of PEC per GDP related to the GDP per capita showing historical values from 2000 to 2017 and projections from 2018 to 2030 assuming an EE target achievement in Ukraine compared to the EU 28 and selected MSs. Source: Eurostat, 2019; IMF, 2019; NTUA, 2012, 2017.**

Table 63: **Qualitative assessment of all EE target setting options concerning PEC per GDP (Ukraine)**

Indicator	Domestic	Baseline 26	Baseline 32.5	Baseline 39	Base year 1	Base year 10	Base year 19
PEC per GDP							

The set of viable option for EE targets changes if the primary energy intensity of GDP is used as an indicator. In this case the Base year 19 as well as the Baseline 39 scenarios seem to be ambitious enough.

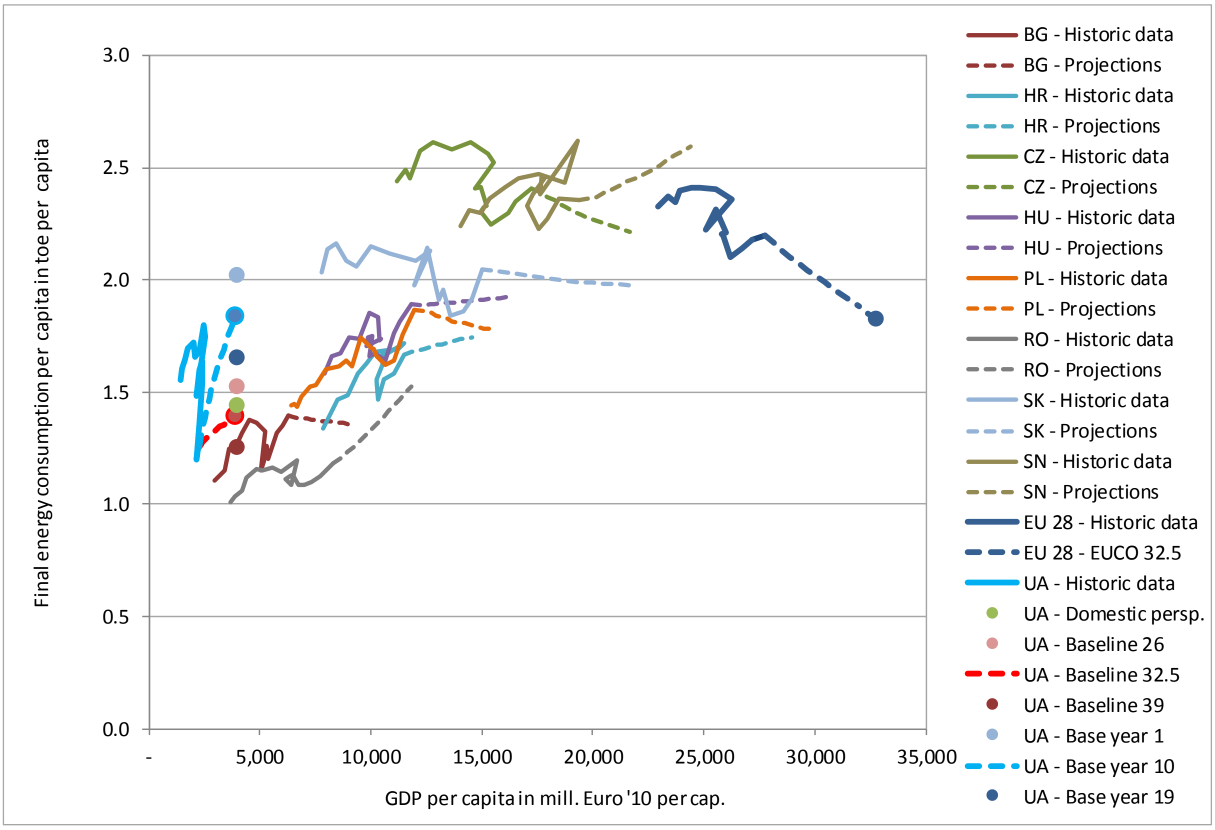


Figure 150: **The development of FEC per capita related to the GDP per capita showing historical values from 2000 to 2017 and projections from 2018 to 2030 assuming an EE target achievement in Ukraine compared to the EU 28 and selected MSs. Source: Eurostat, 2019; IMF, 2019; NTUA, 2012, 2017**

Table 64: **Qualitative assessment of all EE target setting options concerning FEC per capita (Ukraine)**

Indicator	Domestic	Baseline 26	Baseline 32.5	Baseline 39	Base year 1	Base year 10	Base year 19
FEC per capita							

Switching to the energy demand per capita (Figure 150and Figure 151) the same scenarios seem reasonable in terms of final and primary energy consumption.

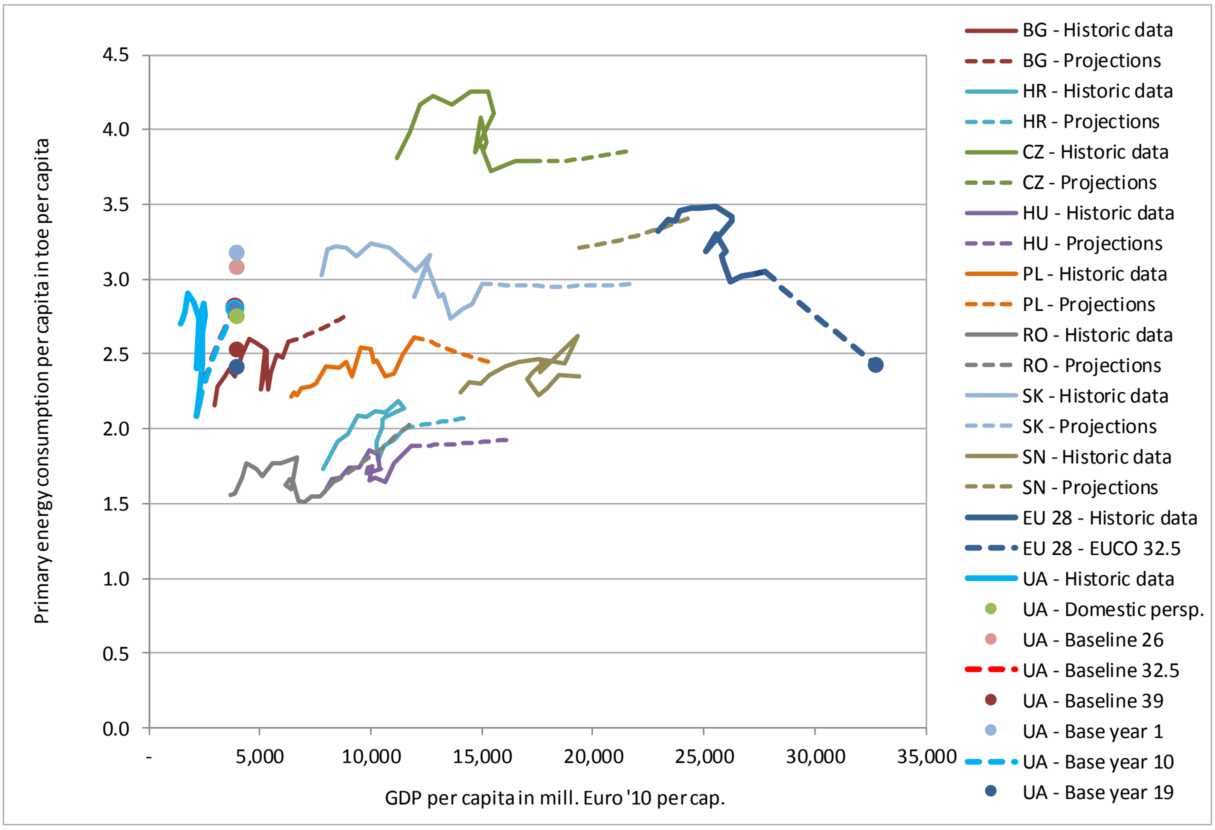


Figure 151: The development of PEC per capita related to the GDP per capita showing historical values from 2000 to 2017 and projections from 2018 to 2030 assuming an EE target achievement in Ukraine compared to the EU 28 and selected MSs. Source: Eurostat, 2019; IMF, 2019; NTUA, 2012, 2017.

Table 65: Qualitative assessment of all EE target setting options concerning PEC per capita

Indicator	Domestic	Baseline 26	Baseline 32.5	Baseline 39	Base year 1	Base year 10	Base year 19
PEC per capita							

2.5.9.3 Summary & Conclusions for Energy Efficiency Targets of Ukraine

Table 66 summarizes the assessment of all seven EE target setting options done in subchapter 2.5.9.2. It shows that the Baseline 39 approach comes to the most reasonable EE targets for 2030. This scenario stays within the range of comparable efforts using the four included indicators.

Table 66: Summary table for the qualitative assessment of all EE target setting options (Ukraine)

Indicator	Domestic	Baseline 26	Baseline 32.5	Baseline 39	Base year 1	Base year 10	Base year 19
FEC per GDP	Reasonable	Intermediate (ambition)			Not ambitious		
PEC per GDP							
FEC per capita							
PEC per capita							

2.5.10 Summary on options for Energy Efficiency target setting

Several approaches exist to define an **Energy Efficiency** target for the Energy Community in 2030 as well as at the level of individual CPs. As starting point, a closer look has been taken at the approach followed at EU level. At EU level, a 20% reduction of energy demand compared to baseline projection is targeted for 2020 as outlined in Directive 2012/27/EU on energy efficiency. For 2030 a political agreement has been achieved on the overall ambition level – i.e. a 32.5% reduction of energy demand compared to projected baseline conditions shall be achieved by 2030 at EU level. This corresponds to a net increase of the EE effort by 12.5 percentage points at EU level and to a reduction of -20% and -26% to historical consumption levels observed in 2005 for FEC and PEC, respectively. The Commission proposal for the 2030 target for the EU28 built on a comprehensive impact assessment exercise, which took also into account the macro-economic impacts on GDP and employment.

As indicated within this chapter, there is however no single way how to translate this exercise for the EnC, and the analysis should start from an assessment of the data and projections available, both on the energy system and on the economic fundamentals. Following the same ambition at EnC level implies for example to strive for an increase at EnC level from 20% by 2020 (i.e. the expected EE target at EnC level) to also 32.5% by 2030. A severe challenge in applying this approach to the EnC arises from the following issue: a suitable baseline scenario is not so easy to determine for the EnC as whole as well as for selected CPs, due to data limitations. As illustrated for example in Figure 2, there is a substantial gap between (previously derived) energy scenarios and actual energy consumption at CP as well as at EnC level. At the same time, however, the economic development of the countries must be taken into account when setting the ambition level for energy efficiency targets. Here, similar to energy consumption, actual figures are far below previously projected ones. A second limitation is that such methodology might not be well suited to take into account the differences in economic development of the EnC compared to the EU28.

The following three principal methodological options for EE target setting were analysed:

- Baseline approach
- Base year approach
- Domestic perspective.

It is shortly described how reasonable, lacking in ambition or too constraining the assessed EE targets seem from the perspective of each CP.

For the case of Albania only the Baseline 26 approach seems reasonable. The corresponding EE target seems to be ambitious since Albania has an economic structure which is more agriculture-orientated than most other CPs and EU MSs. This leads to a less energy intensive economy when compared to other cases. In comparison to above, all Base year targets are too constraining for Albania.

Baseline 26 and Baseline 32.5 are a good fit as an EE target for Bosnia and Herzegovina. Depending on the indicator (final- or primary energy consumption), Baseline 26 is a bit lacking in regards to final energy. All Base year targets are too constraining for Albania.

For Georgia only Baseline 26 seems reasonable as a 2030 EE target. Especially all Base year targets seem too constraining, as the growth in energy demand after the year 2008 was much higher than in any other CP. Baseline 26 is also the only reasonable EE target for Kosovo* and Moldova.

For the case of Montenegro both central EE scenarios and their targets represent a good fit (Baseline 32.5 and Base year 10). When comparing these targets, Baseline 32.5 seems a bit less ambitious in regards to its final energy target. Baseline 10 may constitute the better balanced EE target for Montenegro.

North Macedonia is in a similar situation as Bosnia and Herzegovina, and Baseline 26 and 32.5 represent a good fit as an EE target. The difference is that overall Baseline 26 seems to be fine when looking at both indicators and Baseline 32.5 may constitute a bit too constraining EE target for final energy consumption.

For the case of Serbia the Baseline 32.5 and Base year 1 approach lead to the most reasonable EE targets for 2030, leading to a required cap consumption that stays within the range of comparable efforts. This conclusion builds on a comparison with EU MSs which show the most similarieties when compared to Serbia in regards with to their economic structure.

Ukraine is a special case compared to all other CPs, as it has a strong decline in demand for energy over the last 10 years, that was not foreseen in reagrds to its Baseline scenario. For this reason only the most ambitious Basline EE tragte, Baseline 39, seems reasonable for the Ukraine.

Table 67: Summary table for the qualitative assessment of all EE target setting options for all CPs

Indicator	Domestic	Baseline 26	Baseline 32.5	Baseline 39	Base year 1	Base year 10	Base year 19
Albania	Intermediate (ambition)	Reasonable	Intermediate (constraining)				Too constraining
Bosnia and Herzegovina							
Georgia	Not ambitious						
Kosovo*							
Moldova							
Montenegro							
North Macedonia							
Serbia							
Ukraine							

3 Renewable energies

For setting 2030 RE targets in the Energy Community and its CPs, we propose to follow the principles sketched in Resch et al. (2018). That implies as a first step to take a closer look at the approach taken at EU level.

Subsequently we provide a brief recap of the approach taken at EU level and describe options on how to apply the underlying principles for RE target setting at EnC level and/or for its CPs. Then we inform on the outcomes, i.e. the country- and region-specific RE targets for 2030 that would occur if identified options are applied. Next to that, we assess related impacts in terms of deployment, costs and benefits for the Energy Community and for each Contracting Party. Since RE targets are defined in percentage terms, i.e. expressed as share in gross final energy demand, the ambition related to the proposed RE target depends also on the future development of energy demand. Here we build on the analysis of EE target setting options (cf. chapter 2) and select three illustrative examples to indicate consequences of that on the RE ambition.

3.1 Introduction

Renewable energies have become mainstream for supplying our demand for energy – at EU level and at global scale. Similar to energy efficiency, barriers and constraints exist that need to be overcome or at least respected. For establishing reasonable targets for the uptake of renewables within the Energy Community and/or its Contracting Parties, various options exist. Before shedding light on these, we take a closer look at the approach taken at EU level.

3.1.1 Target setting at EU level

Two steps were taken at EU level concerning 2030 RE targets: Firstly, the 2030 RE target at EU level was agreed upon, and, subsequently, an approach was discussed for a fair sharing of the efforts across national entities. Both steps are discussed subsequently.

Step 1: Agreement on RE ambition at EU level

On 30 November 2016 the European Commission published a package of proposals for legislative measures for the time horizon from 2020 to 2030 called "Clean Energy for all Europeans" commonly referred to as the *winter package*. It aimed at further promoting the clean energy transition while developing the internal market for electricity and thus fostering the Energy Union. Concerning renewable energies this package included a proposal for a recast of the (2020) RE Directive (COM(2016) 767 final/2).

Apart from intensive discussions on the regulation and governance, the winter package also triggered the discussion on the overall RE ambition to be taken at EU level. After a period of intensive negotiations within and between the EU Parliament and Council final agreements could be taken throughout 2018. The recast of the RE Directive aims at establishing a stable framework for the promotion of energy from renewable energy sources and mainly includes an EU-wide binding target of (at least) 32% RE share in gross final consumption by 2030.[7] This shall allow Europe to keep its leadership role in the fight against climate change, in the clean energy transition and in meeting the goals set by the Paris Agreement. Such a share in turn translates into a share of roughly 50-60% of renewables in the electricity sector and, together with the energy efficiency targets to a minimum reduction in GHG of 40% compared to 1990. Unlike for the 2020 energy and climate targets, the recast does not include a breakdown of the EU-wide target into binding national targets. Instead, the new governance regulation (EU) 2018/1999 shall provide adequate measures to ensure that the European bloc hits its targets. MSs are supposed to commit themselves through free pledging, stipulated in "integrated national energy and climate plans

[7] That implies a strong increase of the RE ambition compared to an early agreement taken in 2014: In October 2014 the Council agreed on a 2030 RE target for the EU in size of (at least) 27%, cf. EUCO 169/14.

(INECPS)". While MSs dispose of considerable legislative scope in designing policies to achieve their national pledges, falling below the binding 2020 targets shall be directly sanctioned with penalty payments into a fund.

Step 2: Benchmarks for distributing the RE effort across MSs

The questions arises how to distribute the overall RE effort at EU level across individual MSs. For that purpose **Annex II** of Regulation (EU) 2018/1999 on the Governance of the Energy Union and Climate Action introduces a methodology for establishing benchmarks concerning the national contributions for the share of energy from renewable sources in gross final energy consumption in the 2030 context at EU level. This approach follows **an integrated concept that takes into account the differences in economic development, the potential for cost-effective RE deployment and the interconnection level in the European Network of Transmission System Operators for Electricity (ENTSO-E) across the EU and its Member States**, respectively. This approach strictly follows the formula set out in Annex II, and distributes the efforts across all EU Member States while maintaining the RE ambition at EU level of (at least) 32% RE as share in gross final energy demand.

Below we provide a recap of the formula described in Annex II of the Governance Regulation (EU) 2018/1999. Subsequently we then introduce different options on how this approach (or alternatives to that) can be used for RE target setting in the Energy Community and/or its Contracting Parties.

Annex II of the Governance Regulation: National contributions for the share of energy from renewable sources in gross final consumption of energy in 2030

1. The following indicative formula represents the objective criteria listed in […] Article 5(1), each expressed in percentage points:

   (a) the Member State's national binding target for 2020 as set out in the third column of the table Annex I to Directive COM(2018)2001 ("$RE\%_{2020}$")

   (b) a flat rate contribution ("C_{Flat}");

   (c) a GDP-per-capita based contribution ("C_{GDP}");

   (d) a potential-based contribution ("$C_{Potential}$");

   (e) a contribution reflecting the interconnection level of the Member State ("$C_{Interco}$").

   Remark: The resulting RE target for 2030 ("$RE\%_{2030}$") is consequently the sum of the different contributions listed above and explained in further detail below, cf. formula (1). The 2030 RE target prescribes the minimum share of energy from renewable sources in gross final consumption of energy in 2030.

$$RE\%_{2030} = RE\%_{2020} + C_{Flat} + C_{GDP} + C_{Potential} + C_{Interco} \qquad (1)$$

2. C_{Flat} shall be the same for each Member State. All Member States' C_{Flat} shall together contribute 30 % of the difference between the Union's targets for 2030 and 2020.

3. C_{GDP} shall be allocated between Member States based on Eurostat's GDP per capita index to the Union average, over the 2013 to 2017 period, expressed in purchasing power standard, where for each Member State individually the index is capped at 150 % of the Union average. All Member States' C_{GDP} shall together contribute 30 % of the difference between the Union targets for 2030 and 2020.

4. $C_{Potential}$ shall be allocated between Member States based on the difference between a Member State's RE share in 2030 as shown in PRIMES scenario and its national binding target for 2020. All Member States' $C_{Potential}$ shall together contribute 30 % of the difference between the Union's targets for 2030 and 2020.

5. $C_{Interco}$ shall be allocated between Member States based on an electricity interconnection share index to Union average in 2017, measured by the net transfer capacity over total installed generation capacity, where for each Member State individually the interconnection share index is capped at 150% of the Union average. All Member States' $C_{Interco}$ shall together contribute 10% of the difference between the Union's targets for 2030 and 2020.

Critical reflection and applicability for the EnC and/or its CPs

It appears wise to mimic here the EU approach taken, following two steps for determining RE targets in the 2030 context. In a first step, the RE ambition at the aggregated level, here at the level of the Energy Community has to be agreed upon, and, in a second step, the EnC target needs to be distributed across CPs.

For determining the RE ambition at EU level (cf. step 1 as described above) comprehensive modelling activities and complementary analyses were undertaken throughout last years, accompanied by intensive policy discussions at various levels. This resource and time intensive procedure can hardly be mimicked at EnC level – but a move into the right direction was already taken within our previous analysis as described in Resch et al. (2018).

The benchmarking approach used within step 2, i.e. for distributing the RE effort across CPs, considers country-specific differences in economic strength (measured in terms of GDP), the potential for RE, the interconnection level in the ENTSO-E, as well as efforts/commitments taken in the past. As opposed to the 2020 RE target setting, no first mover bonuses appear useful to consider: Since there is a legally binding support framework in place in the period prior 2030, first mover bonuses are deemed to be unfair. Neither we suggest to include any caps on overall RE shares (as used for MSs with comparatively high RE shares in the 2020 context).

The practical application of this approach to the EnC and its CPs can be characterised as follows. The idea is to treat the EnC and its CPs similar to EU MSs, meaning to follow and reapply the principles described above – i.e. in accordance with the benchmarking formula described in Annex II of the Government regulation. That procedure may consequently involve the following steps:

1. **Data gathering (for "C_{GDP}" and "$C_{Interco}$"):** In a first step, all data has to be gathered as required for calculating specifically the GDP-component ("C_{GDP}") and the component referring to the interconnectivity of the power system ("$C_{Interco}$"), involving data on NTC and on overall electricity generation capacity.
2. **Least-cost allocation of the additional RE effort among all involved national entities (for "$C_{Potential}$"):** For determining the potential-based contribution ("$C_{Potential}$") at EU level a PRIMES scenario comes into play. That scenario provides a least-cost allocation across the whole EU of the in comparison to 2020 additional RE effort required for meeting the targeted RE share by 2030 at EU level. More precisely, the comparison of the modelled 2030 RE share with the given 2020 RE target at country level allows to derive the potential-based domestic contribution at national level.

   Since no suitable PRIMES scenario was applicable for the CPs of the EnC we had to derive our own least-cost allocation of required additional RE deployment. In this context, TU Wien's Green-X model, a specialised energy system model that offers a detailed representation of RE technologies across the whole EU and the EnC, including their potentials[8], costs as well as the corresponding framework conditions (incl. the policy and financing framework) (cf. Box 2), has been applied.

   The Green-X modelling incorporates the following aspects:

   - As described in further detail in Box 1, Green-X derives a least-cost allocation of RE deployment across all sectors, technologies and countries in accordance with the given overall 2030 EU RE target

[8] Potentials for RE technologies are specifically for the CPs of the EnC the outcome of a consolidation process undertaken in the course of various (past) studies, including for example the SEERMAP project (Szabo et al., 2017) or various other studies conducted by TU Wien on behalf of the ECS. Concerns do however prevail specifically on hydropower, questioning the practical availability and the adequate reflection of environmental constraints.

- It incorporates differences in financing conditions for (renewable) energy technologies in modelling, in accordance with a detailed analysis of that undertaken in the course of the SEERMAP study (Szabo et al., 2017).

Box 1. A least-cost approach to allocate investments in RE technologies post 2020

The selection of RE technologies across all involved countries follows a least-cost approach in the period post 2020, meaning that all additionally required future RE technology options are ranked in a merit-order, and it is left to the economic viability which options are chosen for meeting the presumed 2030 RE target (as presumed at EU and EnC level). In other words, a least-cost approach is used to determine investments in RE technologies post 2020 across both the EU and the EnC. This allows for a full reflection of competition across technologies and countries (incorporating well also differences in financing conditions etc.) from a European perspective.

Figure 152 and Figure 153 inform on the outcomes of our brief assessment done for the Energy Community. More precisely, Figure 152 shows the 2030 RE share by CP derived from our model-based least cost allocation of RE investments across the CPs of the EnC as prescribed above (i.e. in accordance with an assumed overall 2030 RE target for the EnC and the EU). This graph indicates the given 2020 target as well as the resulting uptake of the RE share in the period up to 2030. As applicable from this graph, among all assessed CPs Montenegro and Georgia, followed by Albania and North Macedonia may offer most promising RE potentials that can be exploited in a cost effective manner. In contrast to above, according to our assessment Serbia, Ukraine and Moldova may offer comparatively limited RE potentials – specifically for the Ukraine this is however also a consequence of the fact that the given 2020 RE target is out of reach thanks to the low current RE share.

Insights on the (least-cost) technology options according to our analysis can be gained from Figure 153. This graph shows a technology breakdown of 2030 RE deployment by CP under a least cost allocation of RE investments across the CPs of the EnC. It is getting apparent that at Energy Community level bioenergy, specifically for the heating and cooling, is a key least cost option for CPs. Among all energy sectors it is however the electricity sector that allows to contribute most to 2030 RE target achievement under a least cost allocation. Here hydropower is a key RE source at present, and in several of the CPs also in forthcoming years. Most promising for the future RE uptake until 2030 is however wind energy, specifically in the Ukraine, Montenegro and Serbia, and solar PV (in all of the CPs).

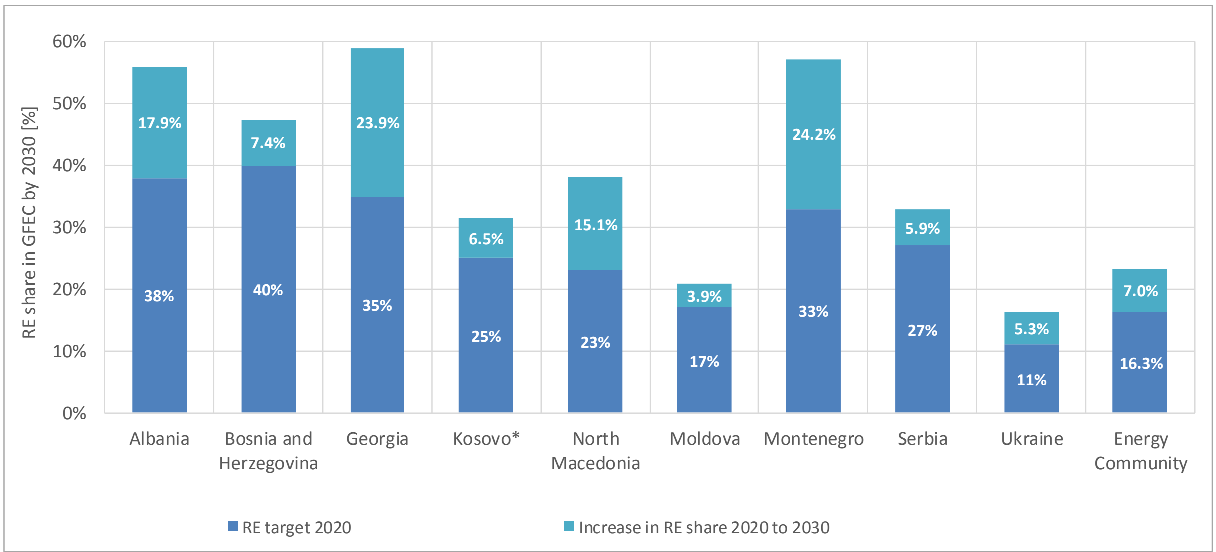


Figure 152. Resulting 2030 RE share by CP under a least cost allocation of RE investments across the CPs of the EnC (in accordance with an overall 2030 RE target for the EnC and the EU) (Source: Green-X modelling)

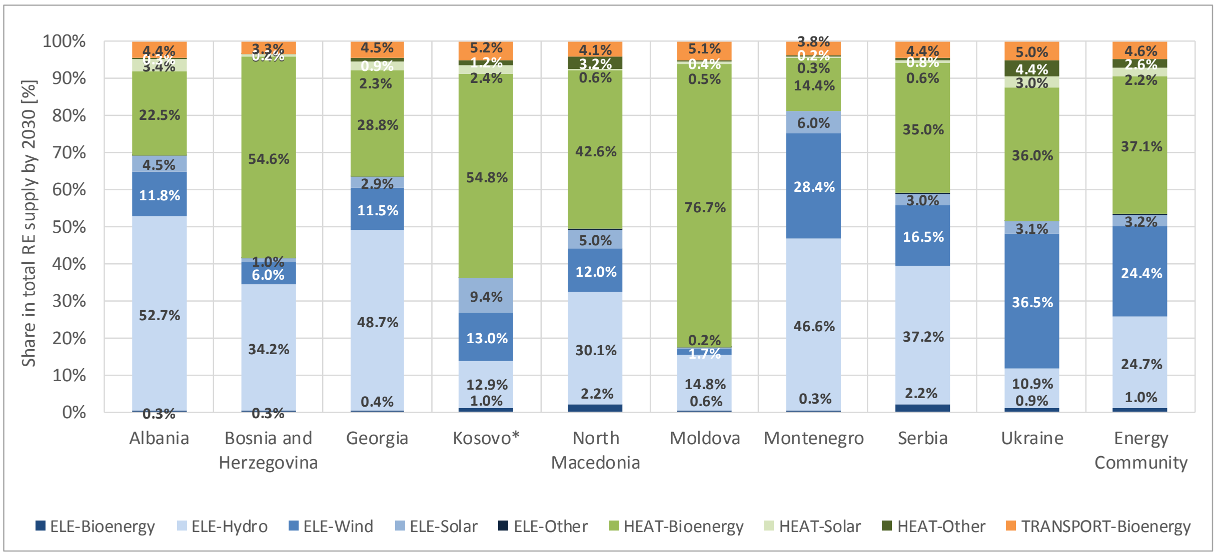


Figure 153. Technology breakdown of 2030 RE deployment by CP under a least cost allocation of RE investments across the CPs of the EnC (in accordance with an overall 2030 RE target for the EnC and the EU) (Source: Green-X modelling)

3. **Application of the benchmark formula to the EnC and its Contracting Parties:** In a final step, after all input data has been derived, the benchmark formula can be applied to distribute the RE ambition as determined within step 1 at EnC level across all CPs. Here distinct options are assessed, either strictly following the approach (and calculation procedure) taken at EU level, or striving for alternative concepts that aim for a suitable reflection of country- and region-specific circumstances.

Following that procedure allows to provide a sound indication on how the RE ambition as predetermined at EnC level can be allocated to individual CPs in accordance with the principles established at EU level for the allocation of the overall RE effort across national entities.

3.2 Options for RE target setting

On the basis of previous analyses, i.e. the findings gained in Resch et al. (2018) and our follow-up elaboration as discussed above, we follow the two-step approach and, furthermore, introduce and compare in total six distinct options for setting RE targets for Serbia and all other CPs of the EnC. We start with two options that aim for mimicking the ambition and principles applied within the EU, and then introduce alternative options for RE target setting.

3.2.1 Mimicking the EU approach: Options in accordance with the principles followed at EU level

In accordance with above, we take two steps:

- As starting point (**step 1**) for establishing a methodology for 2030 RE target setting we take a closer look at the overall Energy Community and elaborate on the ambition level concerning future RE deployment. When aiming for a mimic of the EU approach taken, two options appear suitable to **determine the ambition in increasing the deployment of renewable energies at Energy Community level**:

Option 1a (RE): ABSOLUTE - same absolute increase of RE share at EnC and at EU level

On the one hand, the overall RE effort may be fully aligned to the European Union. At EU level, according to previous agreements taken at the European Council and Parliament it is planned to increase the RE share from 20% by 2020 to (at least) 32% by 2030. This corresponds to a net increase by 12 percentage points at EU level. Consequently, if the same ambition would be followed at EnC level, an increase of the RE share at EnC level from 16.3% by 2020 (i.e. the expected RE share at EnC level if all CPs would reach their binding 2020 RE targets) to 28.3% by 2030.

Option 1b (RE): RELATIVE - same relative increase of RE share at EnC and at EU level

As alternative to above, the required increase in renewables energies might be set at a lower level compared to the EU, respecting difference in the starting point, and imposing that, in accordance with diffusion theory, the same relative increase (compared to the EU) might be more adequate for determining the RE ambition at EnC level. At EU level an increase of the RE share from 20% by 2020 to 32% by 2030 implies a relative increase of the RE share by 60%, leading to a 2030 RE target at EnC level of 26.1%.[9]

- For **distributing the RE effort across the individual Contracting Parties** (**step 2**) we then make use of the benchmarking formula stated in Annex II of the Governance Regulation (EU) 2018/1999, i.e. the 4 component approach as described above (*Option 2a (RE): 4 COMPONENT*).

Summing up, when aiming for a mimicking of the approach taken at EU level in determining the 2030 RE ambition, two options occur:

- **EU mimic 1: ABSOLUTE with 4 components:** same absolute increase of RE ambition (at EnC level, step 1), combined with "4 component" benchmarking approach for distributing the effort across CPs (step 2).
- **EU mimic 2: RELATIVE with 4 components**: same relative increase of RE ambition (at EnC level, step 1), combined with "4 component" benchmarking approach for distributing the effort across CPs (step 2).

3.2.2 Alternative options for RE target setting

Next we open up the basket of options that can be used for RE target setting for determining both the RE ambition at EnC level (step 1) and how that is distributed across CPs (step 2).

All options still aim for respecting the principles followed at EU level but differ in the detailed application of these principles, for example concerning the benchmark formula (e.g. when ignoring certain components). Thus, the following four alternative options for RE target setting are analysed:

- **ALTERNATIVE 1: RELATIVE with 3 components: (i.e. Potential-component excluded)**
  In order to reflect on concerns and uncertainties in establishing the realisable 2030 potential for renewables within the Energy Community and its CPs, we exclude under this option the potential-based contribution ("$C_{Potential}$") from the calculation procedure for distributing the EnC RE effort across CPs. Thus, the remaining components (i.e. C_{Flat}, C_{GDP}, $C_{Interco}$) are used and corresponding weighting factors are adapted accordingly for calculating the aggregated RE target for 2030.[10] Please note that for determining the RE ambition at EnC level we exemplarily follow here the relative approach as described and used under the central option "EU mimic 2".

[9] Here the following calculations are made: First, the relative increase is determined by dividing the required increase in the RE share between 2020 and 2030 by the RE share at the starting point. At EU level that means to divide 12% (2030 RE target minus 2020 RE target) by 20% (2020 RE target at EU level) and the result is 60%. Second, we multiply 16.3%, the 2020 RE share at EnC level, supposing that all CPs meet their 2020 RE target, by 60% and add to that the RE share by 2020 (16.3%). As a result, the 2030 RE target at EnC level is set at 26.1%.

[10] Please note that all weighting factors used in RE target calculations are listed in **Error! Reference source not found.**.

- **<u>ALTERNATIVE 2: WEIGHTING with 4 components:</u>**
  Here we follow an alternative concept for determining the RE ambition at EnC level. Conceptually, we apply here the benchmarking formula, i.e. the weighting approach, to determine the RE ambition not only at country but also at the level of the EnC. More precisely, the EnC as a whole is here treated similar to a MS of the EU. Thus, within the calculation procedure the same flat rate increase is imposed to the EnC as to individual MSs, and the same principle is followed in calculating the other components, meaning that we set here the EnC in comparison to the EU (average) when determining the GPD-based contribution etc. This can be seen as an attempt to explicitly incorporate principles of economic welfare in the overall determination of the RE ambition at EnC level (under step 1) and not only for the distribution of that (under step 2).

- **<u>ALTERNATIVE 3: WEIGHTING with 3 components:</u> (i.e. Potential-component excluded)**
  This alternative option represents a combination of the two principles sketched above (i.e. of alternative 1 and 2). Thus, a “3 component” weighting approach is followed for determining the RE ambition at EnC level (step 1) and for distributing the RE effort across CPs (step 2).

- **<u>ALTERNATIVE 4: (Full) flat rate:</u>**
  This option deviates most from the principles laid down at EU level. This option stitches however because of its simplicity and transparency. Thus, following this option means that only a flat rate contribution (“C_{Flat}”), set similar to the overall increase in the RE share required between 2020 and 2030 at EU level, is used for determining the additional RE effort for each CP as well as at aggregated EnC level.

Below we indicate the outcomes of applying all above sketched options to the EnC and its CPs.

3.3 Target Calculation

Approaches and assumptions

This section is dedicated to present the outcomes of the RE target calculation done at EnC and at CP level. As starting point, we take a closer look at the assessed RE target setting options, providing a brief recap of the approaches taken and on the parameter used.

Table 68: Comparison of RE target setting options: Approaches and Parameter setting

Comparison of RE target setting options: Approaches and Parameter setting (weighting factor)	RE target 2030 - target setting options:					
	EU mimic 1: Absolute with 4 Components	EU mimic 2: Relative with 4 Components	Alternative 1: Relative with 3 components	Alternative 2: Weighting with 4 components	Alternative 3: Weighting with 3 components	Alternative 4: (Full) Flat rate
Step 1: Determining the RE ambition at EnC level						
Target setting approach:	Absolute	Relative	Relative	Weighting	Weighting	Weighting
Step 2: Distributing the RE effort across CPs						
Target setting approach	Weighting	Weighting	Weighting	Weighting	Weighting	Weighting
Weighting factors:						
Flat rate component	30%	30%	45%	30%	45%	100%
GDP component	30%	30%	45%	30%	45%	0%
Potential component	30%	30%	0%	30%	0%	0%
Interconnector component	10%	10%	10%	10%	10%	0%

Table 68 summarises the approaches used for both steps in RE target setting, i.e. for setting the overall RE ambition at EnC level (step 1) and for distributing the RE effort across CPs (step2). The table also informs on the parameter setting for step 2 – i.e. when distributing the RE effort across individual CPs. Here the above described benchmarking formula is applied, considering all four components, only three of them (i.e. excluding the potential component and as such differences in resource availability and in respective cost) or, as in the case of a full flat rate approach (cf. “Alternative 4”), only one of them. Table 68 lists the weighting factor used for the individual components within the target setting procedure.

As explained above, the weighting approach is used in all RE target setting options within step 2 of the overall procedure, i.e. for distributing the RE effort across CPs. Within several of the alternative approaches the weighting concept is however also applied within step 1, so, for determining the overall RE ambition at Energy Community level. Thereby, the same weighting factors are applied within step 1 and step 2 of the calculation procedure. In step 1 the EnC as a whole is then treated similar to an EU MS. That means for example that within the calculation procedure the same flat rate increase is imposed to the EnC as to individual EU MSs, and the same principle is followed in calculating the other components. That implies that we set here the EnC in comparison to the EU (average) when determining the GDP-based contribution etc. As highlighted above, this can be seen as an attempt to explicitly incorporate principles of economic welfare in the overall determination of the RE ambition at EnC level (under step 1) and not only for the distribution of that (under step 2).

Overview on resulting 2030 RE targets

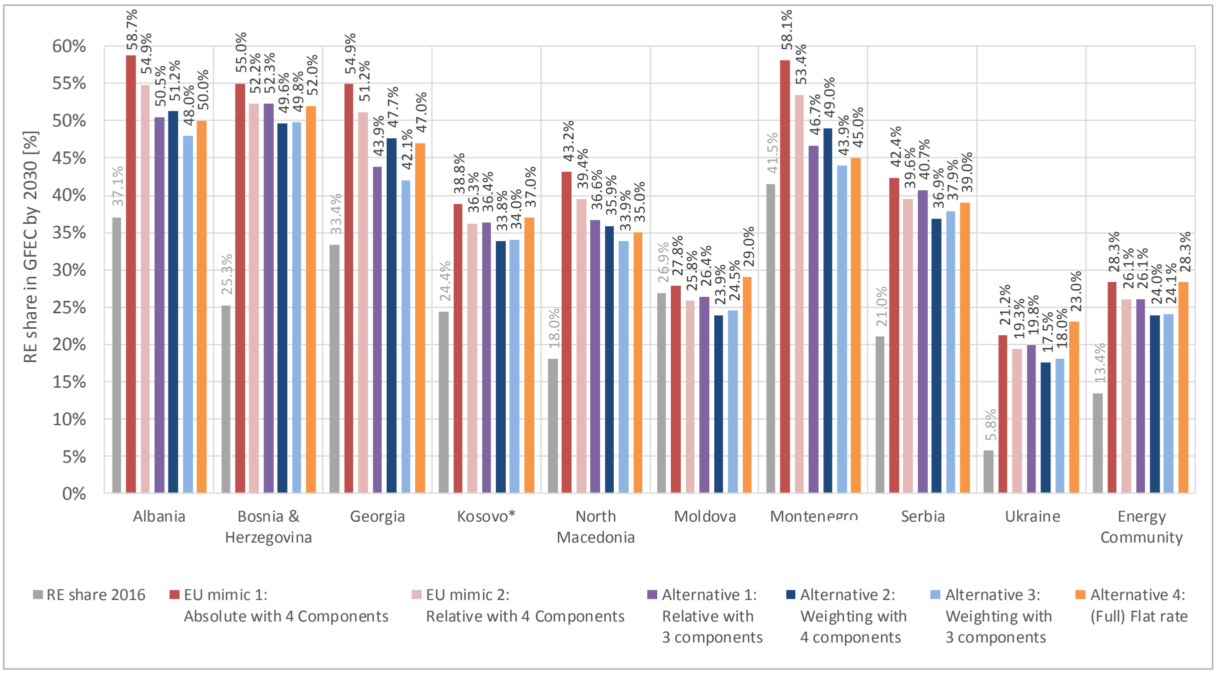


Figure 154. **2030 RE targets for all CPs and the EnC region according to proposed target setting options. (Source: EUROSTAT, 2018; IEA, 2018; IMF, 2019; NTUA, 2012; own calculations)**

Table 69: **Historic (2015, 2016) and planned (2020) RE shares and 2030 RE targets according to proposed options by CP and for the EnC. (Source: EUROSTAT, 2018; IEA, 2018; NTUA, 2012; own calculations)**

RE target setting options by CP and/or the Energy Community	Status Quo and 2020 perspective			RE target 2030 - target setting options:					
	RE share 2015	RE share 2016	RE target 2020	EU mimic 1: Absolute with 4 Components	EU mimic 2: Relative with 4 Components	Alternative 1: Relative with 3 components	Alternative 2: Weighting with 4 components	Alternative 3: Weighting with 3 components	Alternative 4: (Full) Flat rate
[Unit]	%	%	%	%	%	%	%	%	%
Albania	34.4%	37.1%	38.0%	58.7%	54.9%	50.5%	51.2%	48.0%	50.0%
Bosnia & Herzegovina	26.7%	25.3%	40.0%	55.0%	52.2%	52.3%	49.6%	49.8%	52.0%
Georgia	33.0%	33.4%	35.0%	54.9%	51.2%	43.9%	47.7%	42.1%	47.0%
Kosovo*	18.5%	24.4%	25.0%	38.8%	36.3%	36.4%	33.8%	34.0%	37.0%
North Macedonia	19.5%	18.0%	23.0%	43.2%	39.4%	36.6%	35.9%	33.9%	35.0%
Moldova	26.2%	26.9%	17.0%	27.8%	25.8%	26.4%	23.9%	24.5%	29.0%
Montenegro	43.1%	41.5%	33.0%	58.1%	53.4%	46.7%	49.0%	43.9%	45.0%
Serbia	21.9%	21.0%	27.0%	42.4%	39.6%	40.7%	36.9%	37.9%	39.0%
Ukraine	4.9%	5.8%	11.0%	21.2%	19.3%	19.8%	17.5%	18.0%	23.0%
Energy Community	**12.8%**	**13.4%**	**16.3%**	**28.3%**	**26.1%**	**26.1%**	**24.0%**	**24.1%**	**28.3%**

Note: The RE share for Georgia for the years 2015 and 2016 is an approximate value, as the available data is not as detailed as needed to calculate the exact RE share.

The resulting RE targets (expressed as RE shares in gross final energy demand) for all CPs as well as at EnC level are presented in Table 69 whereas Figure 154 provides a graphical illustration of the outcomes. Here we consider all six options as sketched above that can be used for RE target setting within the EnC.

Below we dig deeper into the subject, indicating details on RE target setting options for the Energy Community as a whole and by CP. For each CP we thereby inform in table format and via graphs on the contributions of individual components to the overall 2030 RE targets for each assessed RE target setting option. Please note that at the bottom of each table we illustrate the impact of EE target setting on the RE ambition, indicating the re-newable energy volumes required to meet the given 2030 RE target in dependence of energy demand.[11]

[11] As default, in order to reflect a moderate energy demand development and EE target setting, respectively, we have taken the Baseline 32.5 EE target setting option, named as moderate demand trend. The lower and upper boundary of feasible demand trends in accordance with analysed EE target setting options is then taken to illustrate the consequences of that on the RE ambition, subsequently named as low and high demand trend.

3.3.1 RE targets at Energy Community level

Table 70 provides at Energy Community level details on the resulting 2030 RE targets according to the assessed target setting options for renewables. On the one hand, this table informs on the role of renewable today, indicating latest statistics on the achieved RE share in gross final energy demand by 2015, 2016 and on the given 2020 RE target. On the other hand, Table 70 (as well as Figure 158) compares the required RE increase in relative terms, listing the necessary percentage point increase of the RE share from 2020 to 2030. Additionally, this table shows the RE volumes required to meet the given 2030 RE target in absolute terms, depending on how stringent 2030 EE targets are set and met. A graphical illustration of the ambition associated with the uptake of renewables in accordance with proposed RE target setting options is given in , indicating the necessary increase in the RE share (in GFEC) over time for all assessed RE target setting options.

Table 70: Historic (2015, 2016) and planned (2020) RE shares and 2030 RE targets according to proposed options – details for the Energy Community. (Source: EUROSTAT, 2018; IEA, 2018; NTUA, 2012; own calculations)

RE target setting options for the Energy Community and its CPs	Target setting options:	EU mimic 1: Absolute with 4 Components	EU mimic 2: Relative with 4 Components	Alternative 1: Relative with 3 components	Alternative 2: Weighting with 4 components	Alternative 3: Weighting with 3 components	Alternative 4: (Full) Flat rate
Energy Community	[Unit]						
RE share 2015	%	12.8%					
RE share 2016	%	13.4%					
RE target 2020	%	16.3%					
RE target 2030							
Approach used for determing the RE ambition at EnC level		Absolute	Relative	Relative	Weighting	Weighting	Weighting
Default share (in Base Year)	%	16.3%	16.3%	16.3%	16.3%	16.3%	16.3%
Increase of RE share from 2020 to 2030	%	12.0%	9.8%	9.8%	7.7%	7.8%	12.0%
RE target 2030 (total)	%	28.3%	26.1%	26.1%	24.0%	24.1%	28.3%
RE amount required by 2030:							
... moderate energy demand (default)	Mtoe	53.5	49.3	49.4	45.3	45.6	53.7
... high energy demand (low EE ambition)	Mtoe	64.5	59.5	59.0	54.8	54.6	63.9
... low energy demand (high EE ambition)	Mtoe	36.6	33.8	33.7	31.1	31.2	36.4

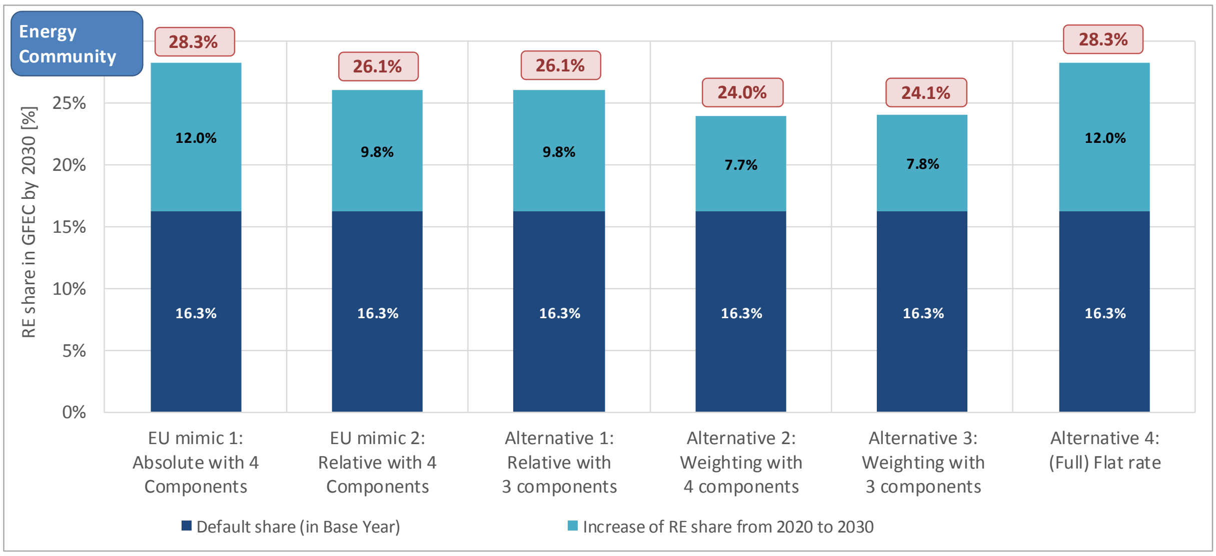


Figure 155. Comparison of the required increase in the RE share (in the period 2020 to 2030) for meeting 2030 RE targets for the Energy Community according to proposed target setting options. (Source: EUROSTAT, 2018; IEA, 2018; IMF, 2019; NTUA, 2012; own calculations)

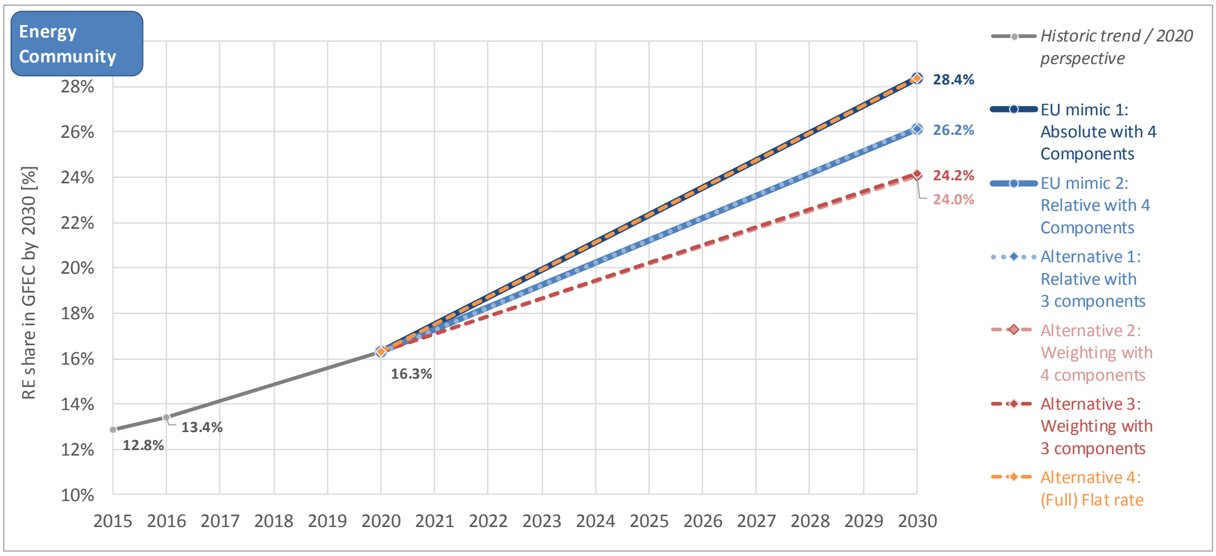


Figure 156. Comparison of the required RE uptake over time for meeting 2030 RE targets for the Energy Community according to proposed target setting options. (Source: EUROSTAT, 2018; IEA, 2018; IMF, 2019; NTUA, 2012; own calculations)

The results gained from applying the RE target setting concepts introduced before allow for a first comparison of the consequences and pin-point on some specifics and peculiarities, here exemplified at the aggregated level, i.e. the Energy Community as a whole:

- The strongest increases in renewable energies are observable in target setting options “EU mimic 1” and “Alternative 4”: in both cases an increase of the RE share (in gross final energy demand) by 12 percentage points is presumed, i.e. from 16.3% in 2020 to 28.3% in 2030 at EnC level. The increase of the RE share in percentage points is here kept similar to the target setting at EU level (here from 20% to 32%). This reflects a flat rate concept and as such mimics the EU approach taken by postulating the same increase in RE ambition in absolute terms. Compared to today where renewables stand at 13.4% (2016) at EnC level this implies, however, to (more than) double the RE share until 2030.
- A comparatively lower increase occurs under target setting option “EU mimic 2” and “Alternative 1”: here an increase of the RE share by 9.8 percentage is required in the period 2020 to 2030. Similar to above, the aim is here to mimic the approach taken at EU level but to also respect differences between the EU and the EnC in the starting point for RE. In practical terms, under these target setting options the same relative increase (compared to the EU) of the RE share is postulated at EnC level. At EU level an increase of the RE share from 20% by 2020 to 32% by 2030 implies a relative increase of the RE share by 60%, leading to a 2030 RE target at EnC level of 26.1%.
- Under a weighting approach as followed in option “Alternative 2” and “Alternative 3” the comparatively lowest increases of the RE share are required, ranging from 7.7 (4 component approach) to 7.8 percentage points (3 component approach). In accordance with the benchmark formula (described in Annex II of the Governance Regulation (EU) 2018/1999) four distinct components are considered and each has a dedicated weight in overall RE target calculation, cf. Table 68. Since GDP per capita and the availability of least-cost RE potentials are both lower at EnC level compared to the EU average (cf. Figure 157), a low to moderate RE increase is needed according to these components. Generally, the underlying weighting approach can be seen as an attempt to explicitly incorporate principles of economic welfare in the overall determination of the RE ambition at EnC level (under step 1) and not only for the distribution of that (under step 2)

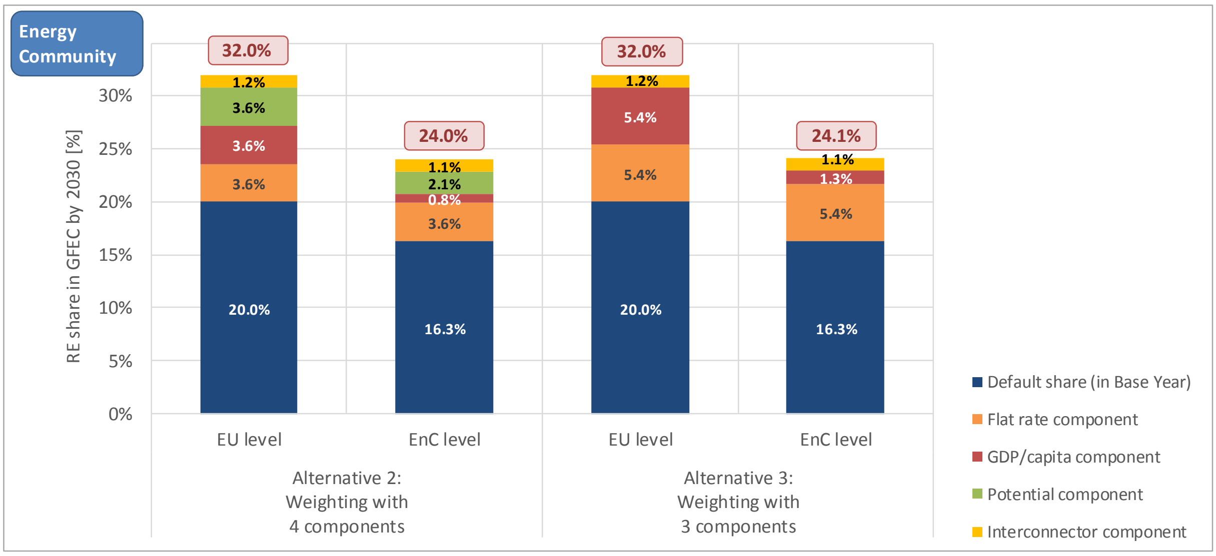


Figure 157. Breakdown by component of the overall 2030 RE targets for the EU and the Energy Community according to selected target setting options (with a weighting approach used for determining the RE ambition at EnC level). (Source: EUROSTAT, 2018; IEA, 2018; IMF, 2019; NTUA, 2012; own calculations)

3.3.2 RE targets for Albania

Both Table 71 and Figure 158 show the decomposition of the resulting 2030 RE targets according to the assessed target setting options for renewables in Albania. More precisely, they illustrate how the different components, that reflect relevant criteria for RE target setting, contribute to the overall target calculation. As explained above, there are strong differences among the target setting options. For example according to option "Alternative 4: (Full) Flat rate" only the flat rate component is taken into account. More complex target setting options take also other criteria into account for distributing the RE effort at EnC level across CPs. Furthermore, at the bottom of Table 71 the impact of EE target setting on the RE ambition is illustrated, indicating the renewable energy volumes required to meet the given 2030 RE target in dependence of energy demand.[12]

[12] As default, in order to reflect a moderate energy demand development and EE target setting, respectively, we have taken the Baseline 32.5 EE target setting option, named as moderate demand trend. A lower and upper boundary of feasible demand trends in accordance with analysed EE target setting options is then added for illustrating the consequences of that on the RE ambition, subsequently named as low and high demand trend.

Table 71: Historic (2015, 2016) and planned (2020) RE shares and 2030 RE targets according to proposed options – details for Albania. (Source: EUROSTAT, 2018; IEA, 2018; NTUA, 2012; own calculations)

RE target setting options for the Energy Community and its CPs	Target setting options:	EU mimic 1: Absolute with 4 Components	EU mimic 2: Relative with 4 Components	Alternative 1: Relative with 3 components	Alternative 2: Weighting with 4 components	Alternative 3: Weighting with 3 components	Alternative 4: (Full) Flat rate
Albania	[Unit]						
RE share 2015	%	34.4%					
RE share 2016	%	37.1%					
RE target 2020	%	38.0%					
RE target 2030 - breakdown by component							
Default share (in Base Year)	%	38.0%	38.0%	38.0%	38.0%	38.0%	38.0%
Flat rate component	%	3.6%	2.9%	4.4%	2.3%	3.5%	12.0%
GDP/capita component	%	4.5%	3.6%	5.5%	2.9%	4.4%	0.0%
Potential component	%	9.4%	7.7%	0.0%	6.0%	0.0%	0.0%
Interconnector component	%	3.2%	2.6%	2.6%	2.1%	2.1%	0.0%
RE target 2030 (total)	%	58.7%	54.9%	50.5%	51.2%	48.0%	50.0%
RE amount required by 2030:							
... moderate energy demand (default)	Mtoe	1.30	1.22	1.12	1.14	1.06	1.11
... high energy demand (low EE ambition)	Mtoe	1.94	1.81	1.67	1.69	1.58	1.65
... low energy demand (high EE ambition)	Mtoe	0.98	0.91	0.84	0.85	0.80	0.83

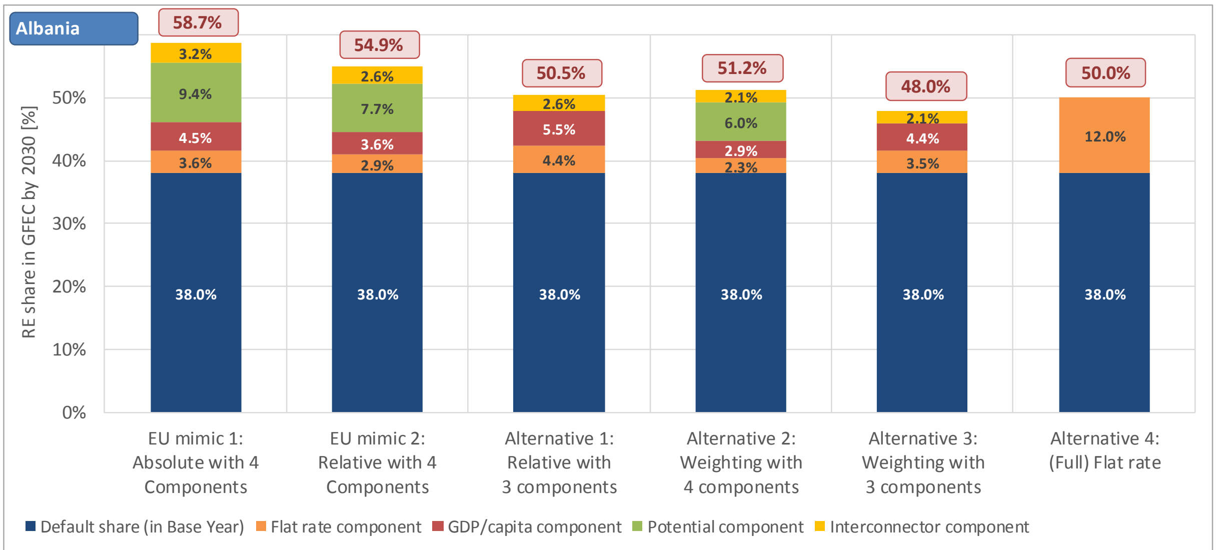


Figure 158. Breakdown by component of the overall 2030 RE targets for Albania according to proposed target setting options. (Source: EUROSTAT, 2018; IEA, 2018; IMF, 2019; NTUA, 2012; own calculations)

For Albania the results show a wide range of 2030 RE targets. A comparatively moderate increase of the RE share by 10 percentage points is for example required according to option “Alternative 3”, where a 3-component weighting is applied for determining the RE ambition at EnC and at CP level. Next follows (in contrast to many other CPs) the full flat rate approach as postulated under option “Alternative 4” (with a +12 pp. increase). A slightly higher increase is required under option “Alternative 1” (+12.5 pp.) and under option “Alternative 2” (thanks to the overall lower RE ambition at EnC level). With an increase of 17 pp. and more the most ambitious variants concerning RE deployment are option “EU mimic 1” and “EU mimic 2” – here Albania’s comparatively cheap and large RE potentials play a decisive role, coupled with the fact that Albania’s economic welfare (measured as GDP/capita) is above the average of the region.

3.3.3 RE targets for Bosnia and Herzegovina

Table 72: Historic (2015, 2016) and planned (2020) RE shares and 2030 RE targets according to proposed options – details for Bosnia and Herzegovina. (Source: EUROSTAT, 2018; IEA, 2018; NTUA, 2012; own calculations)

RE target setting options for the Energy Community and its CPs	Target setting options:	EU mimic 1: Absolute with 4 Components	EU mimic 2: Relative with 4 Components	Alternative 1: Relative with 3 components	Alternative 2: Weighting with 4 components	Alternative 3: Weighting with 3 components	Alternative 4: (Full) Flat rate
Bosnia and Herzegovina	[Unit]						
RE share 2015	%	26.7%					
RE share 2016	%	25.3%					
RE target 2020	%	40.0%					
RE target 2030 - breakdown by component							
Default share (in Base Year)	%	40.0%	40.0%	40.0%	40.0%	40.0%	40.0%
Flat rate component	%	3.6%	2.9%	4.4%	2.3%	3.5%	12.0%
GDP/capita component	%	4.3%	3.5%	5.2%	2.7%	4.2%	0.0%
Potential component	%	3.9%	3.2%	0.0%	2.5%	0.0%	0.0%
Interconnector component	%	3.2%	2.6%	2.6%	2.1%	2.1%	0.0%
RE target 2030 (total)	%	55.0%	52.2%	52.3%	49.6%	49.8%	52.0%
RE amount required by 2030:							
... moderate energy demand (default)	Mtoe	2.64	2.50	2.50	2.38	2.38	2.49
... high energy demand (low EE ambition)	Mtoe	3.21	3.05	3.05	2.89	2.90	3.03
... low energy demand (high EE ambition)	Mtoe	2.15	2.04	2.04	1.94	1.94	2.03

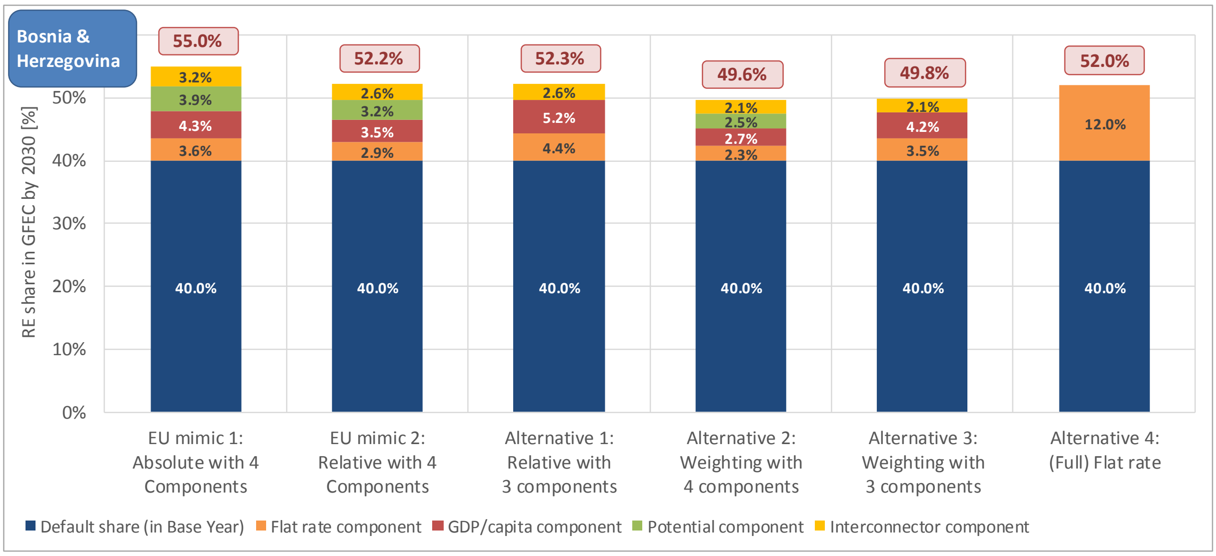


Figure 159. Breakdown by component of the overall 2030 RE targets for Bosnia and Herzegovina according to proposed target setting options. (Source: EUROSTAT, 2018; IEA, 2018; IMF, 2019; NTUA, 2012; own calculations)

For all assessed target setting options Figure 159 and Table 72 indicate the decomposition of the resulting 2030 RE targets in Bosnia and Herzegovina. Thus, both illustrate how the different components, that reflect relevant criteria for RE target setting, contribute to the overall RE target calculation. In the case of Bosnia and Herzegovina strong differences among the distinct target setting options are applicable:

- A comparatively weak to moderate increase of the RE share by ca. 10 percentage points is required according to option “Alternative 2” and “Alternative 3”, where either a 4-component or a 3-component weighting is applied for determining the RE ambition at EnC and at CP level.
- With an increase by around 12.0 to 12.3 pp a comparatively stronger RE uptake is required under the full flat rate approach as postulated under option “Alternative 4”, or according to option “EU mimic 2” and “Alternative 1”. In the two latter options a in relative terms similar RE ambition is imposed at EnC

level compared to the EU, and a 4- or 3-component weighting approach is then used to distribute the RE effort across CPs.

- A strong increase of the RE share in size of 15 pp is prescribed under option "EU mimic 1". Here the combination of a strong overall RE ambition at EnC level, coupled with the fact that Bosnia and Herzegovina has an economic welfare (measured as GDP/capita) above the average of the region, plays a decisive role.

3.3.4 RE targets for Georgia

Table 73: Historic (2015, 2016) and planned (2020) RE shares and 2030 RE targets according to proposed options – details for Georgia. (Source: EUROSTAT, 2018; IEA, 2018; NTUA, 2012; own calculations)

RE target setting options for the Energy Community and its CPs	Target setting options:	EU mimic 1: Absolute with 4 Components	EU mimic 2: Relative with 4 Components	Alternative 1: Relative with 3 components	Alternative 2: Weighting with 4 components	Alternative 3: Weighting with 3 components	Alternative 4: (Full) Flat rate
Georgia	[Unit]						
RE share 2015	%	33.0%					
RE share 2016	%	33.4%					
RE target 2020	%	35.0%					
RE target 2030 - breakdown by component							
Default share (in Base Year)	%	35.0%	35.0%	35.0%	35.0%	35.0%	35.0%
Flat rate component	%	3.6%	2.9%	4.4%	2.3%	3.5%	12.0%
GDP/capita component	%	3.7%	3.0%	4.5%	2.3%	3.6%	0.0%
Potential component	%	12.6%	10.3%	0.0%	8.1%	0.0%	0.0%
Interconnector component	%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
RE target 2030 (total)	%	**54.9%**	**51.2%**	**43.9%**	**47.7%**	**42.1%**	**47.0%**
RE amount required by 2030:							
... moderate energy demand (default)	Mtoe	1.97	1.84	1.57	1.71	1.51	1.69
... high energy demand (low EE ambition)	Mtoe	4.14	3.87	3.31	3.60	3.18	3.55
... low energy demand (high EE ambition)	Mtoe	1.62	1.52	1.30	1.41	1.25	1.39

Table 73 and Figure 160 indicate the decomposition of the resulting 2030 RE targets for all assessed target setting options in the case of Georgia. Similar to other CPs, also for Georgia one can see strong differences among the different target setting options:

- A comparatively weak to moderate increase of the RE share by 7.1 percentage points is required according to option "Alternative 3", applying a 3-component weighting that considers a flat rate, a GDP/capita component and an interconnector component for determining the RE ambition at EnC and at CP level. While economic welfare is comparatively similar to the EnC average, it is the missing interlinkage of the high voltage power grid with its European neighbours that leads to a comparatively low overall increase of the RE ambition.
- We can confirm that hypothesis by moving on to the next option ranked in terms of RE ambition: "Alternative 1" makes also use of a 3-component approach to distribute the RE effort at EnC across CPs. Since here the aggregated RE ambition is higher compared to "Alternative 3" Georgia would end up with a higher overall RE target – i.e. a 2030 RE target of 43.9%, corresponding to an increase by 8.9 pp compared to 2020. That is however still low compared to the RE ambition imposed by other target setting options.
- With an increase by around 12.0 to 12.7 pp a comparatively stronger RE uptake is required under the full flat rate approach as postulated under option "Alternative 4", or according to option "Alternative 2".
- The strong increases of the RE share in range of 16.2 to 19.9 pp occur under those options where mimicking the EU approach deserves key attention. Under "EU mimic 1" Georgia would face a RE target of 54.9% by 2030 – here it is the combination of a strong overall RE ambition at EnC level, coupled with the fact that Georgia may offer according to our assessment comparatively sound (least-cost) RE potentials, that plays a decisive role. Under "EU mimic 2" it is the slightly lower overall RE ambition at EnC level that causes a slightly less ambitious target for Georgia (51.2%)

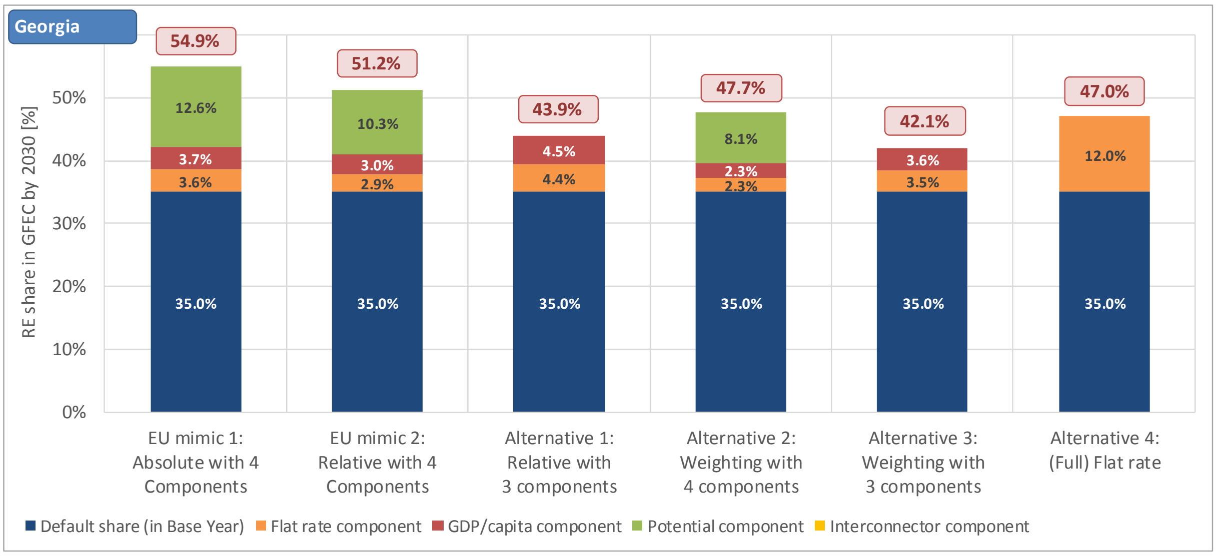


Figure 160. **Breakdown by component of the overall 2030 RE targets for Georgia according to proposed target setting options. (Source: EUROSTAT, 2018; IEA, 2018; IMF, 2019; NTUA, 2012; own calculations)**

3.3.5 RE targets for Kosovo*

Table 74: **Historic (2015, 2016) and planned (2020) RE shares and 2030 RE targets according to proposed options – details for Kosovo*. (Source: EUROSTAT, 2018; IEA, 2018; NTUA, 2012; own calculations)**

RE target setting options for the Energy Community and its CPs	Target setting options:	EU mimic 1: Absolute with 4 Components	EU mimic 2: Relative with 4 Components	Alternative 1: Relative with 3 components	Alternative 2: Weighting with 4 components	Alternative 3: Weighting with 3 components	Alternative 4: (Full) Flat rate
Kosovo*	[Unit]						
RE share 2015	%	18.5%					
RE share 2016	%	24.4%					
RE target 2020	%	25.0%					
RE target 2030 - breakdown by component							
Default share (in Base Year)	%	25.0%	25.0%	25.0%	25.0%	25.0%	25.0%
Flat rate component	%	3.6%	2.9%	4.4%	2.3%	3.5%	12.0%
GDP/capita component	%	3.5%	2.9%	4.3%	2.3%	3.4%	0.0%
Potential component	%	3.4%	2.8%	0.0%	2.2%	0.0%	0.0%
Interconnector component	%	3.2%	2.6%	2.6%	2.1%	2.1%	0.0%
RE target 2030 (total)	%	38.8%	36.3%	36.4%	33.8%	34.0%	37.0%
RE amount required by 2030:							
... moderate energy demand (default)	Mtoe	0.62	0.58	0.58	0.54	0.54	0.59
... high energy demand (low EE ambition)	Mtoe	0.68	0.64	0.64	0.59	0.60	0.65
... low energy demand (high EE ambition)	Mtoe	0.43	0.40	0.40	0.37	0.38	0.41

Table 74 and Figure 161 allow for a closer look at the decomposition of the resulting 2030 RE targets for Kosovo*. Both provide insights on how the different components, that reflect relevant criteria for RE target setting, contribute to the overall RE target calculation. Generally, for Kosovo* we can observe only small differences among the distinct target setting options:

- The least ambitious RE targets occur under option “Alternative 2” and “Alternative 3”, where either a 4-component or a 3-component weighting is applied for determining the RE ambition at EnC and at CP level. Here the necessary increase in the RE share from 2020 to 2030 is in the range of 8.8 to 9.0 pp.
- Next in ranking follow option “EU mimic 2” and “Alternative 1”: here the increase lies in the range from 11.3 to 11.4 pp. Under both options it is the overall RE ambition at EnC that determines the result for Kosovo* since the approach used to distribute the effort across CPs hardly makes a change for Kosovo*.
- A slightly stronger increase in the RE ambition is applicable under option “Alternative 4”. Here the simplistic flat rate approach prescribes the increase by 12 pp for Kosovo*.

- The strongest RE target for Kosovo* would occur under option “EU mimic 1”: 38.8% as 2030 RE target which implies an increase of the RE share by 13.8 pp. Here the combination of a strong overall RE ambition at EnC level, coupled with the fact that Kosovo* performs well in all other criteria like economic welfare (measured as GDP/capita), power grid interconnectivity and applicable (least-cost) RE potentials, plays a decisive role.

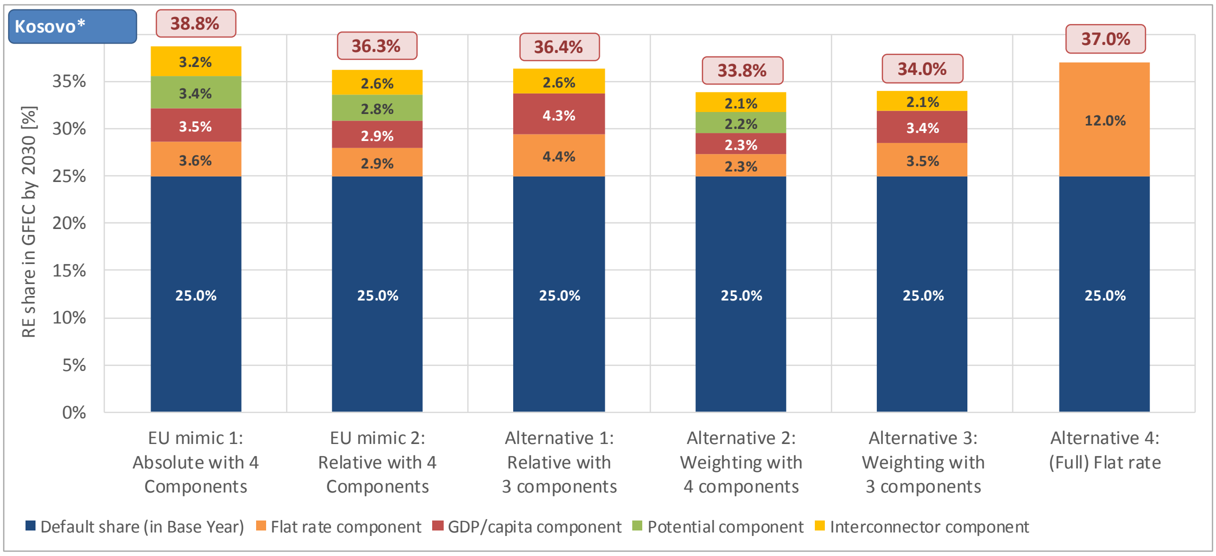


Figure 161. Breakdown by component of the overall 2030 RE targets for Kosovo* according to proposed target setting options. (Source: EUROSTAT, 2018; IEA, 2018; IMF, 2019; NTUA, 2012; own calculations)

3.3.6 RE targets for North Macedonia

Details on determining factors concerning RE targets for North Macedonia according to assessed target setting options are applicable in Figure 162 and Table 75. Both inform on the decomposition of the resulting 2030 RE targets for all assessed target setting options in the case of North Macedonia.

Similar to other CPs, strong differences among the different target setting options are also applicable for North Macedonia:

- A comparatively moderate increase of the RE share by 10.9 percentage points is required according to option “Alternative 3”, applying a 3-component weighting that considers a flat rate, a GDP/capita component and an interconnector component for determining the RE ambition at EnC and at CP level. Generally, North Macedonia faces in comparison to other CPs strong increases in the RE ambition even under this target setting option. Reasons for that are the comparatively high economic welfare (in comparison to the EnC average) and the fact that the high voltage power grid in North Macedonia is well interconnected with its European neighbours.
- The comparatively high RE ambition that would results for North Macedonia under all target setting options is confirmed by the fact that the full flat rate approach as postulated under option “Alternative 4” ranks second (in reverse order of the RE ambition). Thus, an increase by 12 pp can be classified as moderate in the case of North Macedonia.
- Next in ranking follow the option “Alternative 2” where a 4-component weighting is applied for determining the RE ambition at EnC and at CP level. Thanks to comparatively promising (least-cost) RE potentials (according to the underlying Green-X modelling), North Macedonia would face here an increase of the RE share by 12.9 pp from 2020 to 2030. This increase is 2 pp stronger than under “Alternative 3” where applicable RE potentials are not taken into consideration for distributing the effort across CPs.
- “Alternative 1” comes next in ranking, imposing an increase of the RE share by 13.6 pp. Under this target setting option the overall RE ambition at EnC level is set by mimicking the EU ambition in relative terms

("Relative" approach in step 1 of target setting procedure), and by distributing the RE effort across CPs according to the 3-component concept.

- The strongest increases of the RE share in range of 16.4 to 20.2 pp occur under those options where mimicking the EU approach deserves key attention. Under "EU mimic 1" North Macedonia would face a RE target of 43.2% by 2030. The strong increase is caused by the combination of a strong overall RE ambition at EnC level, coupled with the fact that North Macedonia may offer according to our assessment comparatively sound (least-cost) RE potentials, and that it performs comparatively well also in other criteria (like economic welfare and interconnectivity). Under "EU mimic 2" it is the slightly lower overall RE ambition at EnC level that causes a slightly less ambitious target for North Macedonia (39.4%).

Table 75: Historic (2015, 2016) and planned (2020) RE shares and 2030 RE targets according to proposed options – details for North Macedonia. (Source: EUROSTAT, 2018; IEA, 2018; NTUA, 2012; own calculations)

RE target setting options for the Energy Community and its CPs	Target setting options:	EU mimic 1: Absolute with 4 Components	EU mimic 2: Relative with 4 Components	Alternative 1: Relative with 3 components	Alternative 2: Weighting with 4 components	Alternative 3: Weighting with 3 components	Alternative 4: (Full) Flat rate
North Macedonia	[Unit]						
RE share 2015	%	19.5%					
RE share 2016	%	18.0%					
RE target 2020	%	23.0%					
RE target 2030 - breakdown by component							
Default share (in Base Year)	%	23.0%	23.0%	23.0%	23.0%	23.0%	23.0%
Flat rate component	%	3.6%	2.9%	4.4%	2.3%	3.5%	12.0%
GDP/capita component	%	5.4%	4.4%	6.6%	3.5%	5.3%	0.0%
Potential component	%	7.9%	6.5%	0.0%	5.1%	0.0%	0.0%
Interconnector component	%	3.2%	2.6%	2.6%	2.1%	2.1%	0.0%
RE target 2030 (total)	%	43.2%	39.4%	36.6%	35.9%	33.9%	35.0%
RE amount required by 2030:							
... moderate energy demand (default)	Mtoe	0.99	0.90	0.84	0.82	0.77	0.80
... high energy demand (low EE ambition)	Mtoe	1.08	0.99	0.92	0.90	0.85	0.88
... low energy demand (high EE ambition)	Mtoe	0.69	0.63	0.59	0.58	0.54	0.56

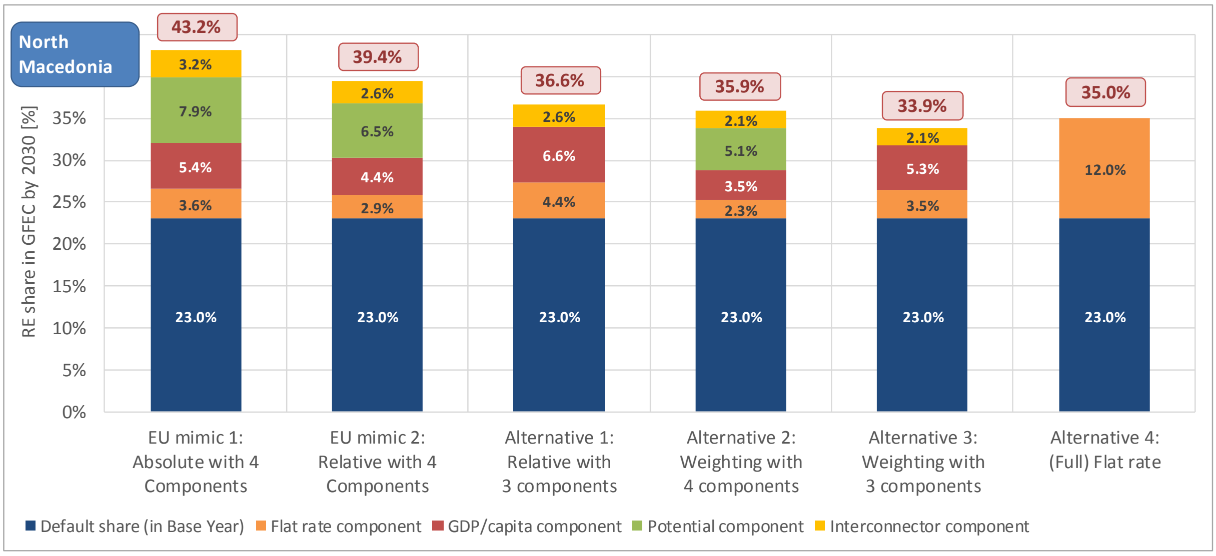


Figure 162. Breakdown by component of the overall 2030 RE targets for North Macedonia according to proposed target setting options. (Source: EUROSTAT, 2018; IEA, 2018; IMF, 2019; NTUA, 2012; own calculations)

3.3.7 RE targets for Moldova

Table 76: Historic (2015, 2016) and planned (2020) RE shares and 2030 RE targets according to proposed options – details for Moldova. (Source: EUROSTAT, 2018; IEA, 2018; NTUA, 2012; own calculations)

RE target setting options for the Energy Community and its CPs	Target setting options:	EU mimic 1: Absolute with 4 Components	EU mimic 2: Relative with 4 Components	Alternative 1: Relative with 3 components	Alternative 2: Weighting with 4 components	Alternative 3: Weighting with 3 components	Alternative 4: (Full) Flat rate
Moldova	[Unit]						
RE share 2015	%	26.2%					
RE share 2016	%	26.9%					
RE target 2020	%	17.0%					
RE target 2030 - breakdown by component							
Default share (in Base Year)	%	17.0%	17.0%	17.0%	17.0%	17.0%	17.0%
Flat rate component	%	3.6%	2.9%	4.4%	2.3%	3.5%	12.0%
GDP/capita component	%	2.0%	1.6%	2.4%	1.3%	1.9%	0.0%
Potential component	%	2.0%	1.7%	0.0%	1.3%	0.0%	0.0%
Interconnector component	%	3.2%	2.6%	2.6%	2.1%	2.1%	0.0%
RE target 2030 (total)	%	27.8%	25.8%	26.4%	23.9%	24.5%	29.0%
RE amount required by 2030:							
... moderate energy demand (default)	Mtoe	0.76	0.71	0.72	0.65	0.67	0.79
... high energy demand (low EE ambition)	Mtoe	0.83	0.77	0.79	0.72	0.73	0.87
... low energy demand (high EE ambition)	Mtoe	0.60	0.56	0.57	0.52	0.53	0.63

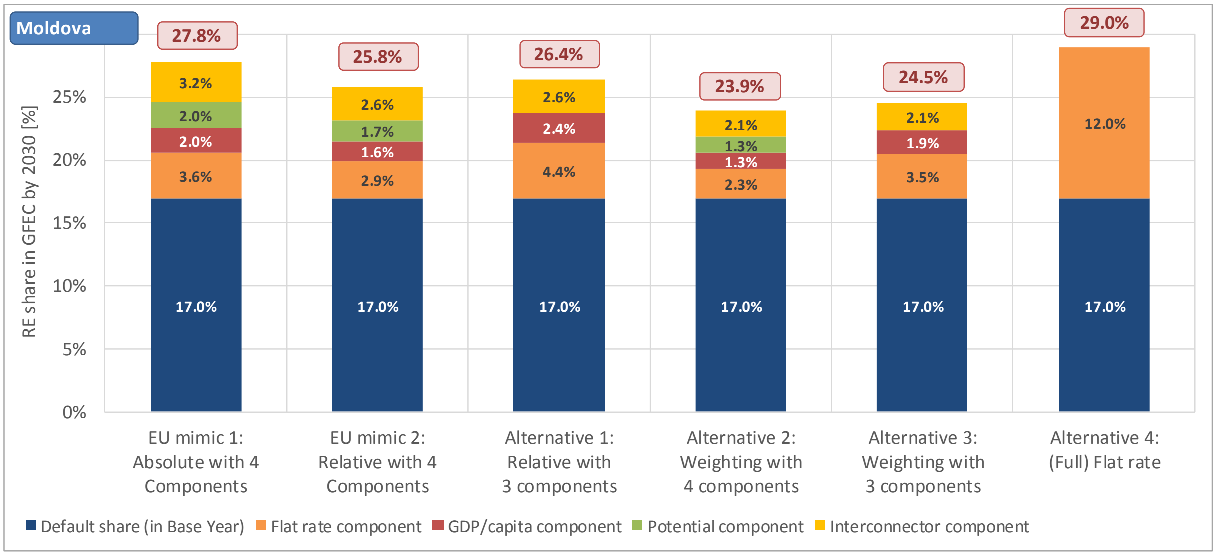


Figure 163. Breakdown by component of the overall 2030 RE targets for Moldova according to proposed target setting options. (Source: EUROSTAT, 2018; IEA, 2018; IMF, 2019; NTUA, 2012; own calculations)

and allow for gaining insights on the decomposition of the resulting 2030 RE targets for Moldova. Both clarify how the different components, that reflect relevant criteria for RE target setting, contribute to the overall RE target calculation. Generally, for Moldova we can observe only small differences among the different target setting options:

- The least ambitious RE targets occur under option “Alternative 2” and “Alternative 3”, where either a 4-component or a 3-component weighting is applied for determining the RE ambition at EnC and at CP level. Here the necessary increase in the RE share from 2020 to 2030 is in the range of 6.9 to 7.5 pp.
- Next in ranking follow option “EU mimic 2” and “Alternative 1”: here the increase lies in the range from 8.8 to 9.4 pp. Under both options it is the overall RE ambition at EnC that determines the result for Moldova since the approach used to distribute the effort across CPs hardly makes a change for Moldova.
- A slightly stronger increase in the RE ambition is applicable under option “EU mimic 1”: 27.8% as 2030 RE target which implies an increase of the RE share by 10.8 pp. Here the combination of a strong overall RE ambition at EnC level, coupled with the fact that Moldova performs comparatively well in power grid

interconnectivity, and moderate in all other criteria like economic welfare (measured as GDP/capita) and applicable (least-cost) RE potentials, determine the outcome.

- The strongest RE target for Moldova would occur under option “Alternative 4”. Here the simplistic flat rate approach prescribes the increase by 12 pp for Moldova.

3.3.8 RE targets for Montenegro

Details on relevant factors for RE targets in Montenegro according to our assessed target setting options are applicable in Figure 164 and Table 77. Both indicate the decomposition of the resulting 2030 RE targets for all assessed target setting options for Montenegro.

Table 77: Historic (2015, 2016) and planned (2020) RE shares and 2030 RE targets according to proposed options – details for Montenegro. (Source: EUROSTAT, 2018; IEA, 2018; NTUA, 2012; own calculations)

RE target setting options for the Energy Community and its CPs	Target setting options:	EU mimic 1: Absolute with 4 Components	EU mimic 2: Relative with 4 Components	Alternative 1: Relative with 3 components	Alternative 2: Weighting with 4 components	Alternative 3: Weighting with 3 components	Alternative 4: (Full) Flat rate
Montenegro	[Unit]						
RE share 2015	%	43.1%					
RE share 2016	%	41.5%					
RE target 2020	%	33.0%					
RE target 2030 - breakdown by component							
Default share (in Base Year)	%	33.0%	33.0%	33.0%	33.0%	33.0%	33.0%
Flat rate component	%	3.6%	2.9%	4.4%	2.3%	3.5%	12.0%
GDP/capita component	%	5.5%	4.5%	6.7%	3.5%	5.3%	0.0%
Potential component	%	12.8%	10.4%	0.0%	8.2%	0.0%	0.0%
Interconnector component	%	3.2%	2.6%	2.6%	2.1%	2.1%	0.0%
RE target 2030 (total)	%	58.1%	53.4%	46.7%	49.0%	43.9%	45.0%
RE amount required by 2030:							
... moderate energy demand (default)	Mtoe	0.44	0.41	0.35	0.37	0.33	0.34
... high energy demand (low EE ambition)	Mtoe	0.70	0.64	0.56	0.59	0.53	0.54
... low energy demand (high EE ambition)	Mtoe	0.33	0.31	0.27	0.28	0.25	0.26

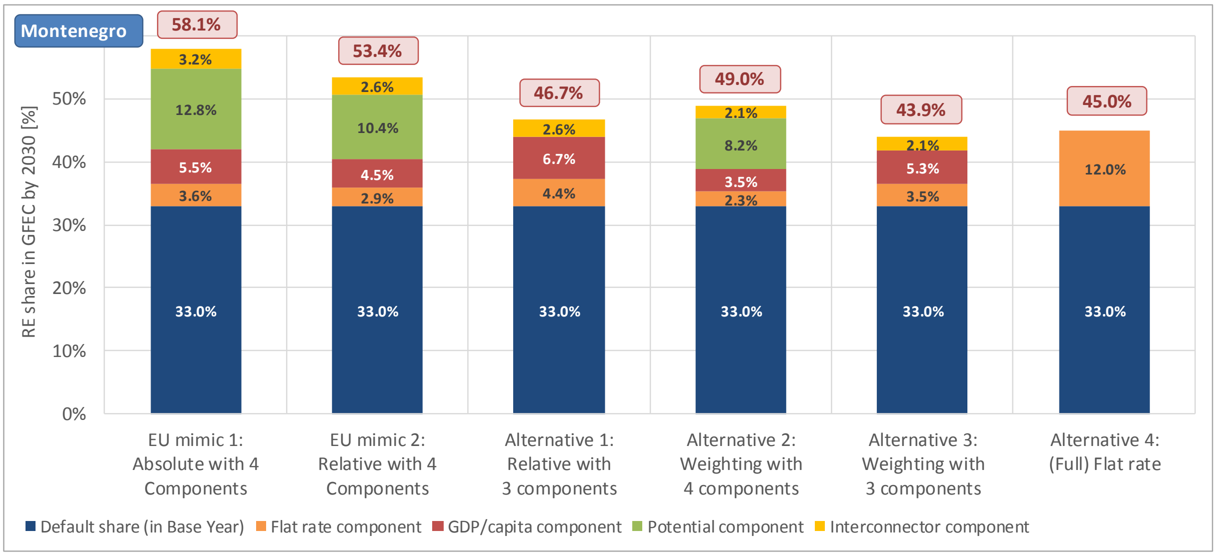


Figure 164. Breakdown by component of the overall 2030 RE targets for Montenegro according to proposed target setting options. (Source: EUROSTAT, 2018; IEA, 2018; IMF, 2019; NTUA, 2012; own calculations)

Similar to other CPs, strong differences among the different target setting options are also applicable for Montenegro:

- A comparatively moderate increase of the RE share by 10.9 percentage points is required according to option "Alternative 3", applying a 3-component weighting that considers a flat rate, a GDP/capita component and an interconnector component for determining the RE ambition at EnC and at CP level. Generally, Montenegro would face in comparison to other CPs strong increases in the RE ambition even under this target setting option. This is a consequence of the comparatively high economic welfare (in comparison to the EnC average) and the fact that the high voltage power grid in Montenegro is well interconnected with its European neighbours.

- The comparatively high RE ambition that can be seen for Montenegro under all target setting options is getting apparent since the full flat rate approach as postulated under option "Alternative 4" ranks second (in reverse order of the RE ambition). Thus, an increase by 12 pp can be classified as moderate in the case of Montenegro.
- "Alternative 1" comes next in ranking, imposing an increase of the RE share by 13.7 pp. Under this target setting option the overall RE ambition at EnC level is set by mimicking the EU ambition in relative terms (i.e. a "relative" approach is taken in step 1 of the target setting procedure), and by distributing the RE effort across CPs according to the 3-component concept.
- Next in ranking follow the option "Alternative 2" where a 4-component weighting is applied for determining the RE ambition at EnC and at CP level. Thanks to comparatively favourable (least-cost) RE potentials (according to the underlying Green-X modelling), Montenegro would face here an increase of the RE share by 16.0 pp from 2020 to 2030. Remarkably, this increase is more than 5 pp stronger than under "Alternative 3" where applicable RE potentials are not taken into consideration for distributing the effort across CPs.
- The strongest increases of the RE share in range of 20.4 to 25.1 pp occur under those options where mimicking the EU approach deserves key attention. Under "EU mimic 1" Montenegro would face a RE target of 58.1% by 2030. The strong increase is caused by the combination of a strong overall RE ambition at EnC level, coupled with the fact that Montenegro may offer according to our assessment comparatively favourable (least-cost) RE potentials, and that it performs comparatively well also in other criteria (like economic welfare and interconnectivity). Under "EU mimic 2" it is the slightly lower overall RE ambition at EnC level that causes a slightly less ambitious target for Montenegro (53.4%).

3.3.9 RE targets for Serbia

Table 78: Historic (2015, 2016) and planned (2020) RE shares and 2030 RE targets according to proposed options – details for Serbia. (Source: EUROSTAT, 2018; IEA, 2018; NTUA, 2012; own calculations)

RE target setting options for the Energy Community and its CPs	Target setting options:	EU mimic 1: Absolute with 4 Components	EU mimic 2: Relative with 4 Components	Alternative 1: Relative with 3 components	Alternative 2: Weighting with 4 components	Alternative 3: Weighting with 3 components	Alternative 4: (Full) Flat rate
Serbia	[Unit]						
RE share 2015	%	21.9%					
RE share 2016	%	21.0%					
RE target 2020	%	27.0%					
RE target 2030 - breakdown by component							
Default share (in Base Year)	%	27.0%	27.0%	27.0%	27.0%	27.0%	27.0%
Flat rate component	%	3.6%	2.9%	4.4%	2.3%	3.5%	12.0%
GDP/capita component	%	5.5%	4.5%	6.7%	3.5%	5.3%	0.0%
Potential component	%	3.1%	2.5%	0.0%	2.0%	0.0%	0.0%
Interconnector component	%	3.2%	2.6%	2.6%	2.1%	2.1%	0.0%
RE target 2030 (total)	%	42.4%	39.6%	40.7%	36.9%	37.9%	39.0%
RE amount required by 2030:							
... moderate energy demand (default)	Mtoe	4.0	3.7	3.8	3.5	3.6	3.7
... high energy demand (low EE ambition)	Mtoe	4.5	4.2	4.4	3.9	4.1	4.2
... low energy demand (high EE ambition)	Mtoe	2.9	2.7	2.8	2.5	2.6	2.6

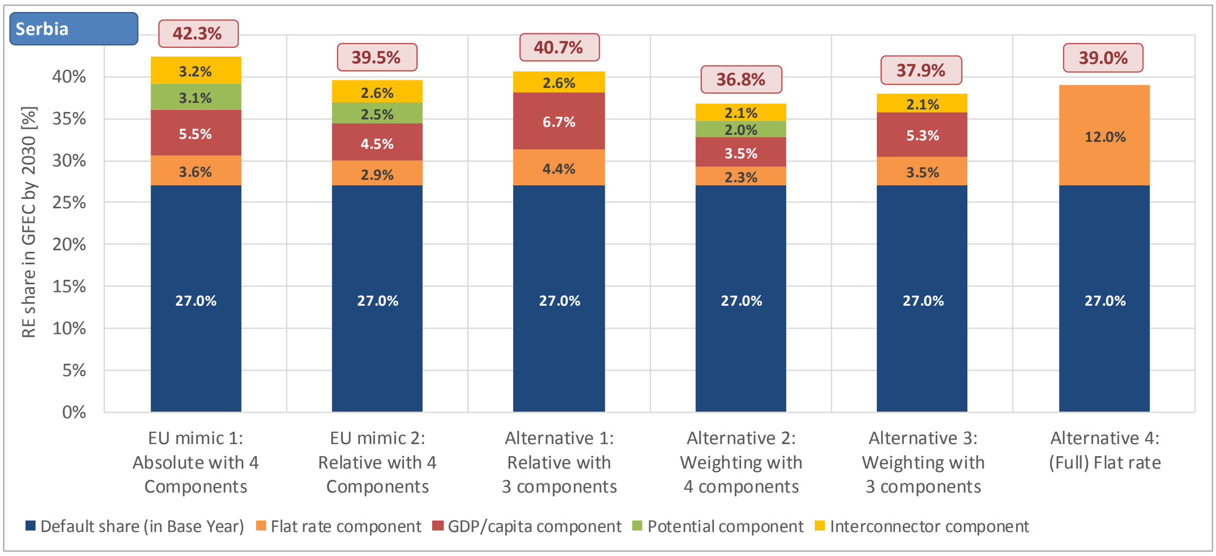


Figure 165. Breakdown by component of the overall 2030 RE targets for Serbia according to proposed target setting options. (Source: EUROSTAT, 2018; IEA, 2018; IMF, 2019; NTUA, 2012; own calculations)

Table 78 and Figure 165 indicate the decomposition of the resulting 2030 RE targets for Serbia according to assessed target setting options. Both clearly show how the different components, that reflect relevant criteria for RE target setting, contribute to the overall RE target calculation. Generally, strong differences among the distinct target setting options are applicable for Serbia:

- A comparatively weak to moderate increase of the RE share by 9.9 to 10.9 percentage points is required according to option “Alternative 2” and “Alternative 3”, where either a 4-component or a 3-component weighting is applied for determining the RE ambition at EnC and at CP level.
- With an increase by around 12.0 to 12.6 pp a comparatively stronger RE uptake is required under the full flat rate approach as postulated under option “Alternative 4”, or according to option “EU mimic 2”. In the latter option a in relative terms similar RE ambition is imposed at EnC level in comparison to the EU, and a 4-component weighting approach is then used to distribute the RE effort across CPs. A slightly stronger increase in RE ambition is applicable if only a 3-component approach is chosen to distribute the RE effort at EnC level across CPs. Thus, under option “Alternative 1” the applicable RE potentials are ignored for the effort sharing, and we can conclude that this does not appear beneficial for Serbia.
- The strongest increase of the RE share, here in size of 15.4 pp is prescribed under option “EU mimic 1”. Here the combination of a strong overall RE ambition at EnC level, coupled with the fact that Serbia has an economic welfare (measured as GDP/capita) above the average of the region, plays a decisive role.

3.3.10 RE targets for Ukraine

Figure 166 and Table 79 help to gain insights on the decomposition of the resulting 2030 RE targets for the Ukraine. Both illustrate how the different components, that reflect relevant criteria for RE target setting, contribute to the overall RE target calculation. Generally, for Ukraine we can observe only small differences among the different target setting options:

- The least ambitious RE targets occur under option “Alternative 2” and “Alternative 3”, where either a 4-component or a 3-component weighting is applied for determining the RE ambition at EnC and at CP level. Here the necessary increase in the RE share from 2020 to 2030 is in the range of 6.5 to 7.0 pp.
- Next in ranking follow option “EU mimic 2” and “Alternative 1”: here the increase lies in the range from 8.3 to 8.8 pp. Under both options it is the overall RE ambition at EnC that determines the result for the Ukraine since the approach used to distribute the effort across CPs hardly makes a change for this country.

- A slightly stronger increase in the RE ambition is applicable under option "EU mimic 1": 21.2% as 2030 RE target, implying an increase of the RE share by 10.2 pp. Here the combination of a strong overall RE ambition at EnC level, coupled with the fact that Ukraine performs comparatively moderate to weak in all distribution criteria like economic welfare (measured as GDP/capita), interconnectivity of the power grid and the applicable (least-cost) RE potentials, determine the outcome.
- The strongest RE target for the Ukraine would occur under option "Alternative 4". Here the simplistic flat rate approach prescribes the increase of the RE share by 12 pp.

Table 79: Historic (2015, 2016) and planned (2020) RE shares and 2030 RE targets according to proposed options – details for Moldova. (Source: EUROSTAT, 2018; IEA, 2018; NTUA, 2012; own calculations)

RE target setting options for the Energy Community and its CPs	Target setting options:	EU mimic 1: Absolute with 4 Components	EU mimic 2: Relative with 4 Components	Alternative 1: Relative with 3 components	Alternative 2: Weighting with 4 components	Alternative 3: Weighting with 3 components	Alternative 4: (Full) Flat rate
Ukraine	[Unit]						
RE share 2015	%	4.9%					
RE share 2016	%	5.8%					
RE target 2020	%	11.0%					
RE target 2030 - breakdown by component							
Default share (in Base Year)	%	11.0%	11.0%	11.0%	11.0%	11.0%	11.0%
Flat rate component	%	3.6%	2.9%	4.4%	2.3%	3.5%	12.0%
GDP/capita component	%	3.3%	2.7%	4.0%	2.1%	3.2%	0.0%
Potential component	%	2.8%	2.3%	0.0%	1.8%	0.0%	0.0%
Interconnector component	%	0.6%	0.5%	0.5%	0.4%	0.4%	0.0%
RE target 2030 (total)	%	**21.2%**	**19.3%**	**19.8%**	**17.5%**	**18.0%**	**23.0%**
RE amount required by 2030:							
... moderate energy demand (default)	Mtoe	14.7	13.4	13.7	12.1	12.5	15.9
... high energy demand (low EE ambition)	Mtoe	16.1	14.7	15.0	13.3	13.7	17.4
... low energy demand (high EE ambition)	Mtoe	9.1	8.3	8.5	7.5	7.7	9.9

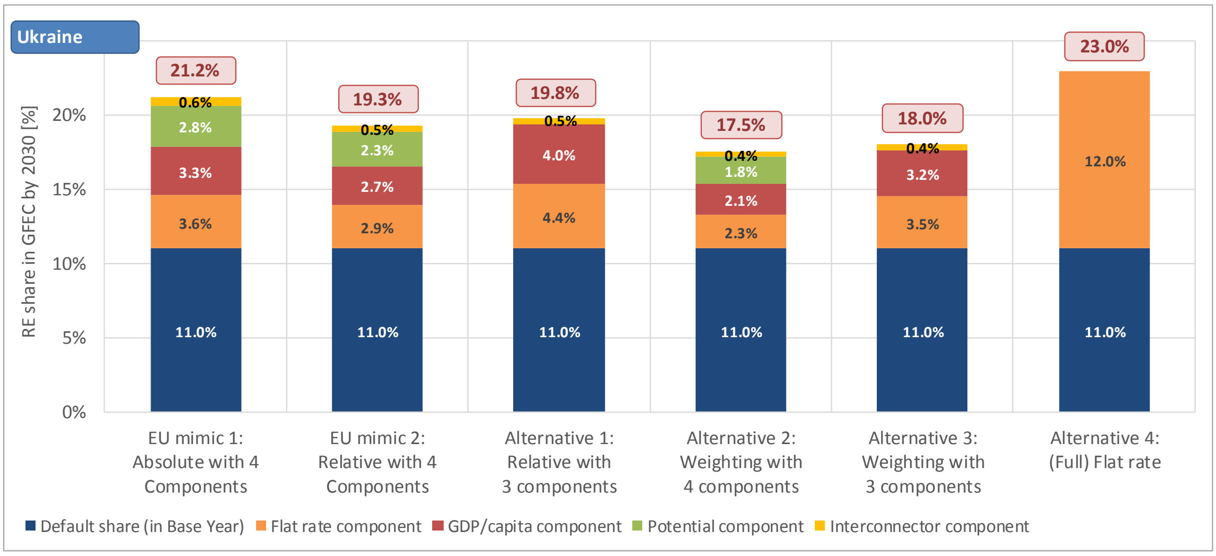


Figure 166. Breakdown by component of the overall 2030 RE targets for Moldova according to proposed target setting options. (Source: EUROSTAT, 2018; IEA, 2018; IMF, 2019; NTUA, 2012; own calculations)

3.4 Assessment of related impacts

This section is dedicated to the brief analysis of impacts of proposed 2030 RE targetsachieving specific shares of renewables by 2030. A model-based analysis of the feasibility of achieving 2030 RE targetsthese shares is undertaken, indicating the necessary RE deployment at sectorial level by CP as well as related direct economic impacts.

Before digging into details on derived results we provide a brief recap of the approach and key assumptions taken.

This illustrative section applies the analytical method to the RE target setting option "EU mimic 2", which represents an intermediate level of renewables at EnC level among the six options described above. Moreover, we shed light on (indirect) changes in the RE ambition within a brief sensitivity analysis. That assessment is targeted on the impact of changes in future energy demand developments, which, in turn, leads to changes in the required uptake of RE that correspond to achieving given RE shares (in demand).

3.4.1 Approach used for the brief analysis of impacts

Modelling framework

This analysis builds on modelling works undertaken by the use of TU Wien's Green-X model (cf. Box 2). More precisely, the outcomes of a quantitative RE policy analysis of distinct scenarios on future RE deployment within the Energy Community are used to indicate impacts that can be expected while aiming for achieving proposed 2030 RE targets. The impacts assessed in this brief analysis include the following aspects:

- Feasibility of RE target achievement, indicating the necessary RE deployment and its sectorial decomposition;
- Assessment of direct economic impacts, estimating the necessary investments and the required support dedicated to renewable energies.

Box 2. Brief characterization of the Green-X model

Green-X is an energy system model that offers a detailed representation of RE potentials and related technologies in Europe and in neighbouring countries. It aims at indicating consequences of RE policy choices in a real-world energy policy context. The model simulates technology-specific RES deployment by country on a yearly basis, in the time span up to 2050[13], taking into account the impact of dedicated support schemes as well as economic and non-economic framework conditions (e.g. regulatory and societal constraints). Moreover, the model allows for an appropriate representation of financing conditions and of the related impact on investor's risk. This, in turn, allows conducting in-depth analyses of future RE deployment and corresponding costs, expenditures and benefits arising from the preconditioned policy choices on country, sector and technology level.

For specific purposes, e.g. for assessing the interplay between RE and future electricity market design that involves an analysis of the merit order effect and related market values of the produced electricity for variable and dispatchable renewables, Green-X was complemented by its regional power-system companion – i.e. the EEMM model, developed and applied by REKK – to shed further light on the interplay between supply, demand and storage in the electricity sector thanks to a higher intertemporal resolution than in the RE investment model Green-X.

gives an overview on the interplay of both models. Both models apply the same set of general input parameters, however in different spatial and temporal resolution. Green-X delivers a first picture of renewables deployment and related costs, expenditures and benefits by country on a yearly basis (2010 to 2030. The output of Green-X in terms of country- and technology-specific RE capacities and generation in the electricity sector for selected years (2020, 2030) serves as input for the power-system analysis done with EEMM. Subsequently, the EEMM model analyses the interplay between supply, demand and storage in the electricity sector on an hourly basis for the given years. The output of EEMM is then fed back into the RE investment model Green-X. In particular the

[13] For this exercise model calculations are however limited to the period up to 2030.

feedback comprises the amount of RES that can be integrated into the grids, the electricity prices and corresponding market revenues (i.e. market values of the produced electricity of variable and dispatchable RE-E) of all assessed RE-E technologies for each assessed country.

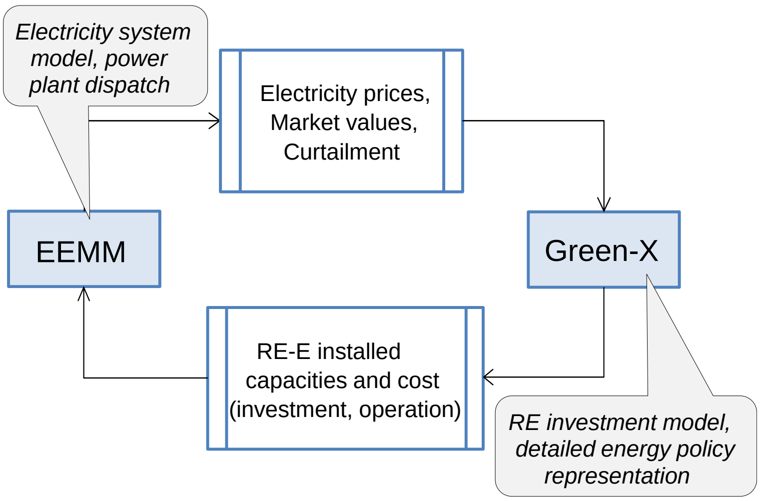


Figure 167. Model coupling between the Green-X and the EMM model for an assessment of RE developments in the electricity sector

Key parameter

In order to ensure maximum consistency with existing EU scenarios and projections the key input parameters of the scenarios presented in this report are derived from PRIMES modelling and from the Green-X database with respect to the potentials and cost of RE technologies. Table 80 shows which parameters are based on PRIMES, on the Green-X database and which have been defined for this study. The PRIMES scenarios used for are the latest publicly available reference scenario (European Commission, 2016f) for the EU 28 concerning energy price trends, and its previous edition (as of 2013) for the conventional supply portfolio and carbon intensities for selected CPs of the EnC due to the extended geographical coverage (i.e. include parts of the EnC) at that point in time.

Energy demand trends are derived from an own assessment – i.e. EE targets as derived from option Baseline 32, and the same holds for electricity price trends and market values of variable RE technologies where REKK'S EEMM model comes into play.

Table 80. Main input sources for scenario parameters

Based on PRIMES	Based on Green-X database	Defined for this assessment
Primary energy prices	Renewable energy technology cost (investment, fuel, O&M)	Renewable energy policy framework
Conventional supply portfolio and conversion efficiencies	Renewable energy potentials	Reference prices for electricity (EEMM modelling) and other sectors
CO_2 intensity of sectors	Learning rates	Energy demand by sector (in accordance with EE target setting)
	Technology diffusion / Non-economic barriers	Market values for variable renewables (EEMM modelling)

Scenario definition – overview on assessed cases

For indicating the feasibility of 2030 RE targets at EnC and at CP level three distinct scenarios are derived. They can be classified as follows:

A "No Policy" scenario indicates the expected RE developments in the period up to 2030 in the case of no policy intervention in the forthcoming decade. More precisely, the assumption is taken that post 2020 currently implemented RE policy measures are phased out and not replaced by any other dedicated support scheme. This scenario is then used as benchmark for the other cases where 2030 RE target achieved is preconditioned.

Two scenarios are then derived to assess the feasibility and impacts of 2030 RE target achievement. RE targets for 2030 at EnC as well as at CP level stem from the **RE target setting option "EU mimic 2"** where a in relative terms similar RE ambition is imposed at EnC level in comparison to the EU, and a 4-component weighting approach is then used to distribute the RE effort across CPs. In both cases 2030 RE target fulfilment is assumed, using either strictly at national level, or – assuming a higher degree of flexibility – at EnC level. More precisely, the target scenarios can be characterised as:

- Scenario "RE target fulfilment – without RE cooperation": here a "national perspective" is taken where CPs primarily aim for a pure domestic RE target fulfilment and, consequently, no (or only limited cooperation arising from that,
- Scenario "RE target fulfilment – with RE cooperation": in this case a "Community perspective" is taken where – thanks to intensified RE cooperation – an efficient and effective RE target achievement is envisaged at EnC level rather than a fulfilment of each national RE target.

All scenarios assume a baseline trend in the period up to 2020 where currently implemented RE policy initiatives are continued. Please note further that concerning energy efficiency all scenarios build on the default EE target setting option where according to the previously derived methodology a Harmonized Reduction (from the Baseline III scenario) has been applied to define the EE effort for Serbia.

As a **sensitivity assessment** **we analyse the impact of EE target setting options on the RE ambition**. We thus add to the default approach a corridor of possible demand trends in accordance with EE target setting options as derived and assessed in chapter 2 of this report. Thereby, the following variants are taken into consideration:

- **High demand**: For each CP we compared all assessed EE target setting options and made use here of the least ambitious approach – in most cases this reflects the "Domestic Perspective", cf. chapter 2 of this report
- **Low demand**: Complementary to above, we made use here of the most stringent EE target setting option for each CP. In most cases that is the EE target setting option "Base Year 19".

Please note that all scenario reflect here a "national perspective" concerning the RE uptake where RE cooperation comes only into play if domestic achievement appears not feasible.

3.4.2 Results at Energy Community level

Assessment of future RE deployment

The 2030 RE target calculation constitutes for the overall Energy Community a RE share of ca. 26.1% in 2030, compared to a 2020 RE target of about 16.3%. Achieving the proposed target can be classified as challenging but feasible to undertake under the given circumstances. Past and expected future RE deployment at EnC level is depicted in Figure 168 in relative terms (as RE share in GFED) (left) and in absolute terms (right) according to statistics and assessed RE scenarios. It is getting apparent that the given target can be achieved – with and without intensified RE cooperation between individual CPs. This requires however an increase of the RE policy ambition across the EnC and the provision of dedicated support for renewables in the years to come (cf. scenarios with RE target fulfilment with the "No Policy" case)

Complementary to above, Figure 169 shows the sectorial decomposition of expected 2030 RE deployment for the scenarios assessed within the underlying modelling exercise. More precisely, Figure 169 (left) indicates the expected RE share in corresponding demand by energy sector whereas on the right hand side of Figure 169 the contribution is shown in absolute terms. It can be seen that both the electricity sector and the sector of heating and cooling contribute in the two target scenarios around equally as much whereas biofuels in transport are expected to provide only a negligible addition. Without dedicated policies, renewable energies will disappear in the transport sector until 2030, while target fulfilment scenarios indicate a stable share of ca. 6 to 8% in 2030.

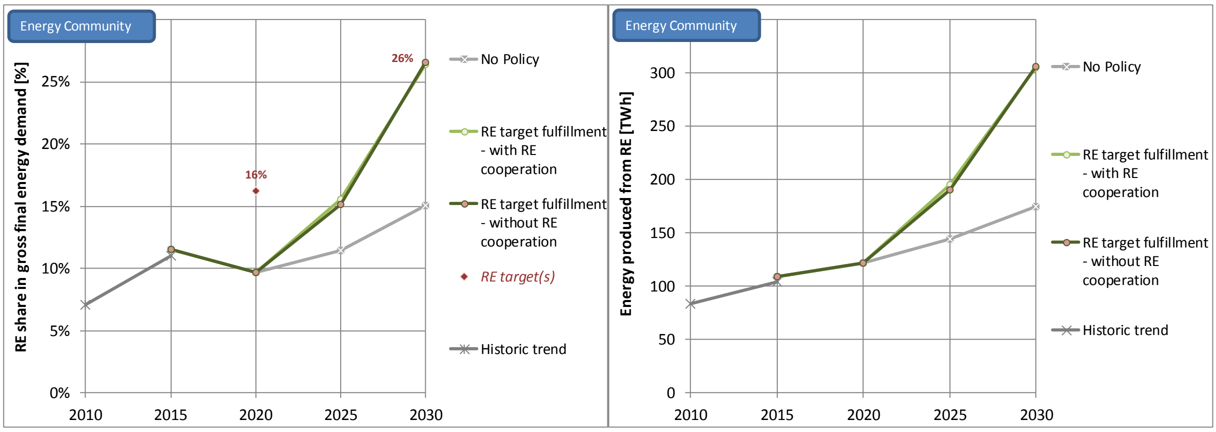


Figure 168: **Past and expected future RE deployment in the Energy Community in relative terms (RE share in GFED) (left) and in absolute terms (right) according to statistics and assessed RE scenarios**

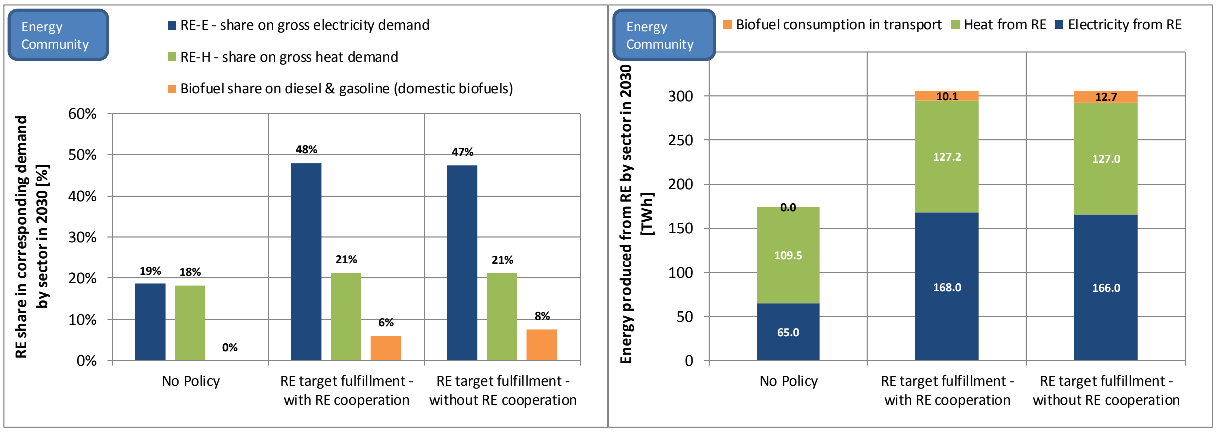


Figure 169: **Sectorial breakdown of 2030 RE deployment in the Energy Community according to the assessed RE scenarios – in relative terms as share in corresponding demand (left) and in absolute terms (right)**

A cross-country comparison of expected 2030 RE deployment is finally shown in , both in relative (as RE share in GFED – top) and in absolute terms (TWh – bottom). In relative terms, Albania, Bosnia and Herzegovina, Georgia and Montenegro are in the lead, all achieving a RE share above 45% in the RE target scenarios by 2030. Despite the expected large share of renewables in overall energy supply, in absolute terms their contributions appear less impressive – here Ukraine outperforms and accounts for about half of the required RE effort by 2030. On second place follows Serbia, adding however only a quarter of the expected contribution of Ukraine.

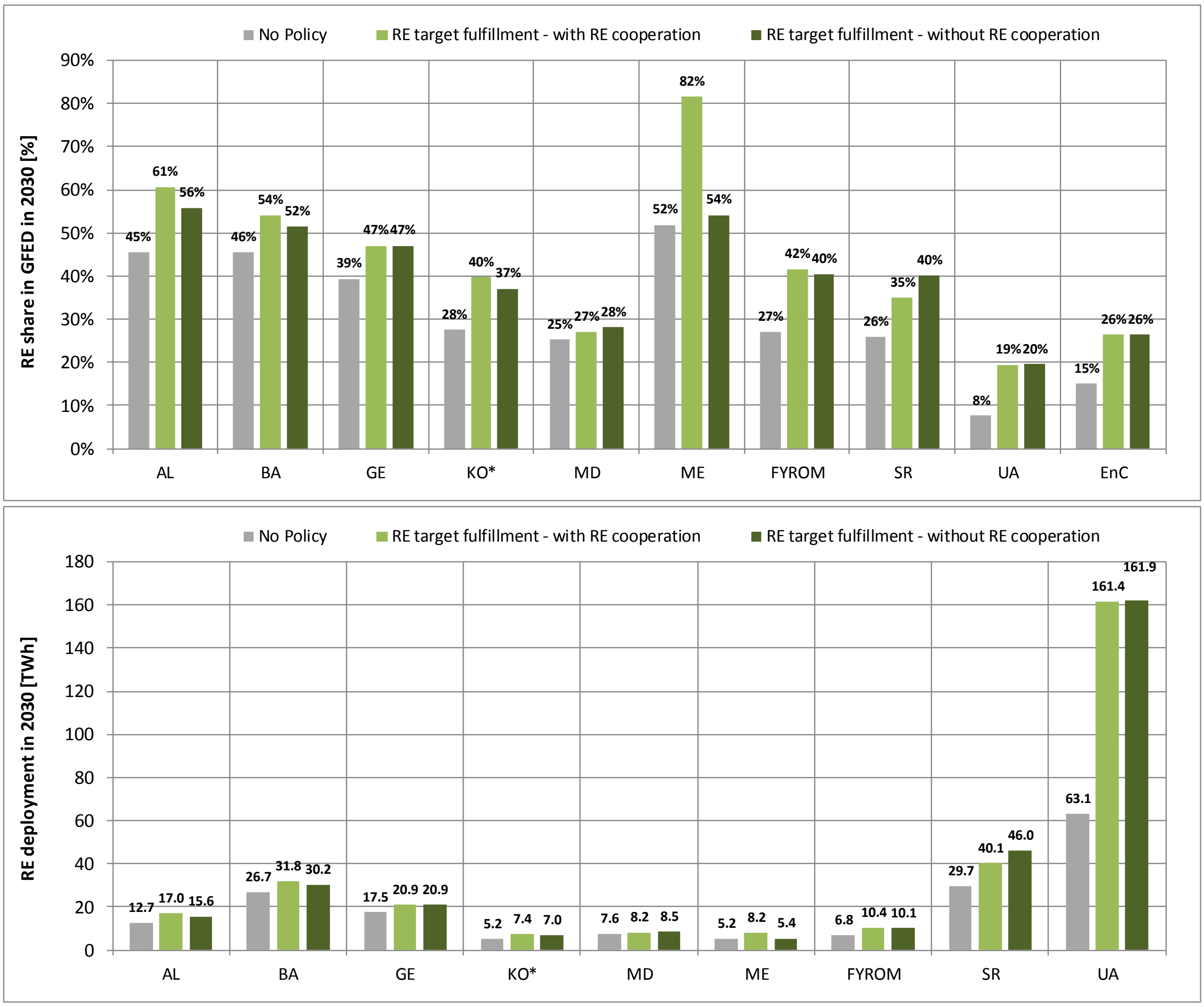


Figure 170: Comparison of country-specific RE deployment in 2030 in relative terms (as share in GFED – top) and in absolute terms (TWh – bottom) according to assessed RE scenarios

Assessment of direct economic impacts

Next we provide a brief outlook on direct economic impacts that may come along with future RE deployment. A closer look is taken at the required investments in RE installations and on the financial support that appear necessary for stipulating the RE expansion. In this context, required investments provide however per se not an indication on societal cost impacts – they rather indicate the level of economic activity associated with RE developments. A closer look at cost impacts is consequently provided through another indicator: the required support. For a better cross-country comparison, due to the large differences between CPs in terms of size and welfare, these economic indicators are shown in relation to GDP in Figure 171. In general terms, it is applicable that required public financial support for renewables is around a fifth of the investments taken by the private sector: Whereas average (2021 to 20203) annual investments are generally in a range between 1.5 and 4% in all target scenarios, required financial support varies typically in a corridor between 0.2 and 0.7% of GDP. Moreover, slight benefits that come along with RE cooperation are observable – compared to the pure national target fulfilment case RE cooperation may lead to a cost decline by (at least) 1%.

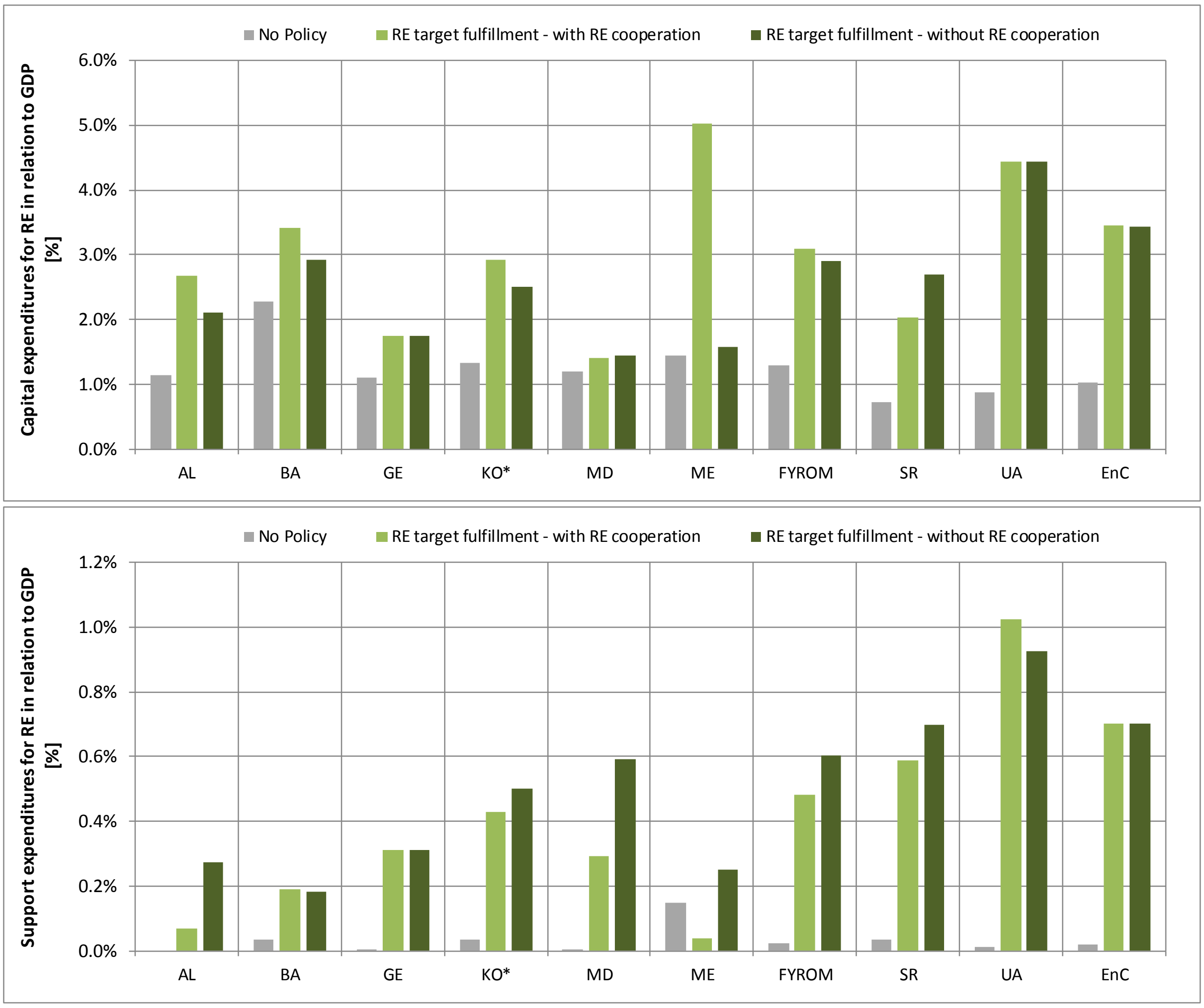


Figure 171: Comparison of country-specific investments in new RE installations (top) and of RE-related support expenditures in the period 2021 to 2030according to assessed RE scenarios

Sensitivity assessment on the impact of EE target setting options for the RE ambition

As discussed previously, a sensitivity assessment has been performed to analyse the impact of EE target setting options on the RE ambition. We thus add to the default trend (that stems from the EE target setting option Baseline 32) a corridor of possible energy demand trends, in accordance with the EE options derived in chapter 2 of this report:

- High demand trend, reflecting an unambitious EE target for 2030 as in most case prescribed under the option "Domestic Perspective"
- Low demand, reflecting stringent EE targets for 2030, as for example assumed under Base Year 19.

All scenarios reflect here a "national perspective" concerning the RE uptake where RE cooperation comes only into play if domestic achievement appears not feasible.

As illustrated in Figure 172 the results on RE deployment indicate that the expected high demand requires a significantly stronger uptake of renewables. Apart from that, according to our assessment, at aggregated level the overall RE target for 2030 would not be met – a gap in the RE share in size of 0.2% would remain by 2030. Contrarily, a strong EE target as proclaimed under the Low Demand case would simplify RE target achievement, reducing domestic deployment needs for renewables as well as corresponding costs. Here, modelling shows that at EnC level the minimum RE target for 2030 would be over succeeded by 0.8 pp.

Thus, it can be seen that the EE target has a strong impact on the RE ambition – i.e. for example an unambitious EE target challenges the achievement of RE targets and endangers the feasibility of GHG limits.

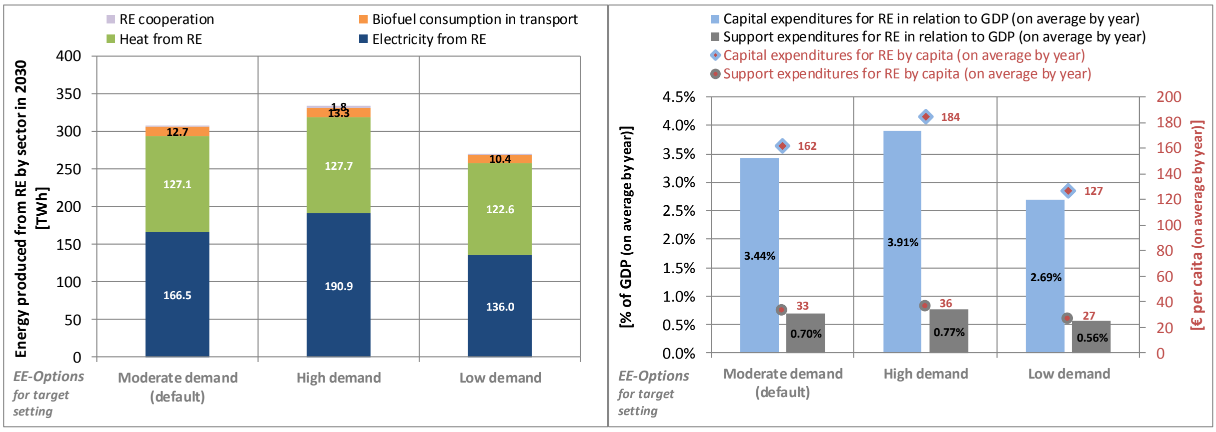


Figure 172. **Sensitivity assessment on EE target setting options: Sectorial breakdown of 2030 RE deployment (left) and indicators on capital and support expenditures in relation to GDP and population (right) according to assessed scenarios for the Energy Community**

3.4.3 Results at Contracting Party level

This section provides further details on the results of the model-based assessment of feasibility and impacts that come along with postulated 2030 RE targets.

3.4.3.1 Albania

Albania represents a country with a high deployment of renewables already – but this is largely limited to the electricity sector where hydropower dominates the scene: today (2016) RE electricity generation – in the case of Albania limited to hydropower – holds a share of 86% in gross electricity consumption. Apart from that RE in heating and cooling adds a significant contribution: here biomass is of dominance and contributes to meet one third of the Albanian heating demand. In total, a RE share in GFED of 37.1% is achieved today (2016). For meeting the given 2020 RE target (38%) a moderate increase is needed.

Assessment of future RE deployment

The 2030 RE target calculation constitutes for Albania a RE share of 50% in 2030. Similar to other CPs this can be classified as challenging but feasible to achieve under the given circumstances. There is a vast potential of renewables waiting to be exploited, specifically in the electricity sector but also in heating and cooling. If no dedicated support for renewables is provided post 2020 this may however hardly be mobilised, cf. the projected RE deployment according to the "No Policy" scenario in Figure 173. In such case, a target gap of over 8pp is likely to manifest in Albania. In this context, Figure 28 shows past and expected future RE deployment in Albania in relative terms (as RE share in GFED) (left) and in absolute terms (right) according to statistics and assessed RE scenarios. Please note that for details on the scenario definition as well as the general approach and assumptions underlying this modelling exercise section 0 of this report provides further insights.

If the RE policy ambition is increased in accordance with the postulated 2030 RE target, Albania may achieve this solely by relying on domestic RE sources (see scenario "RE target fulfilment – without RE cooperation"). RE potentials available in Albania indicate that even a higher RE deployment appears feasible. If for example regional cooperation comes into play as postulated in the scenario "RE target fulfilment – with RE cooperation", the outcomes of the modelling exercise indicate a stronger RE deployment than if solely a national perspective is taken. The surplus in RE generation may then be (virtually) exported to other CPs that may fall short in meeting the given 2030 RE target.

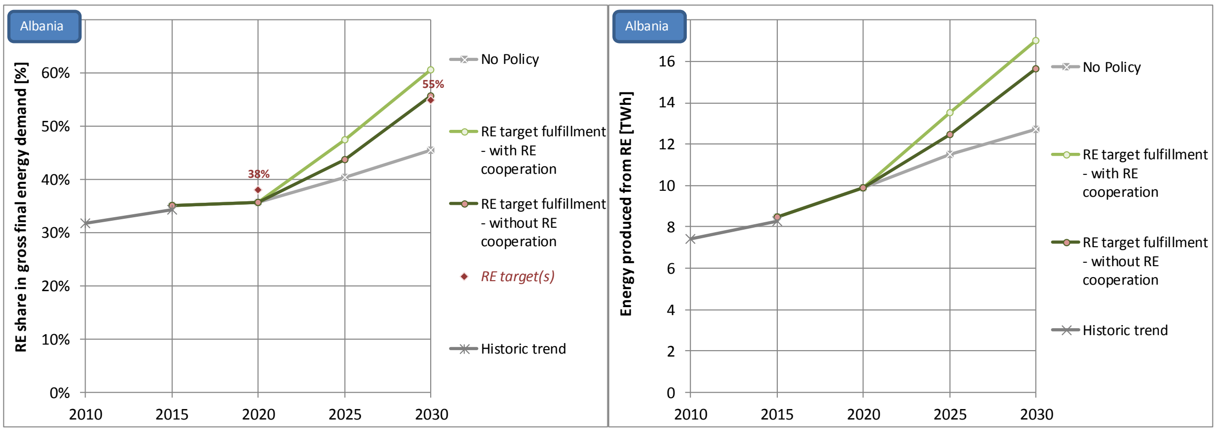


Figure 173: Past and expected future RE deployment in Albania in relative terms (RE share in GFED) (left) and in absolute terms (right) according to statistics and assessed RE scenarios

Complementary to above, Figure 174 provides further insights on the sectorial decomposition of expected 2030 RE deployment for the scenarios assessed within the underlying modelling exercise. More precisely, Figure 174 (left) indicates the expected RE share in corresponding demand by energy sector whereas on the right hand side of Figure 174 the contribution in absolute terms is indicated. It can be seen that the electricity sector outperforms compared to other energy sectors – here hydropower, solar PV and wind energy offer promising potentials. Renewables in heating and cooling add also a significant contribution to the required increase in RE deployment. Here biomass is of dominance, followed by solar thermal (used for hot water supply) and heat pumps.

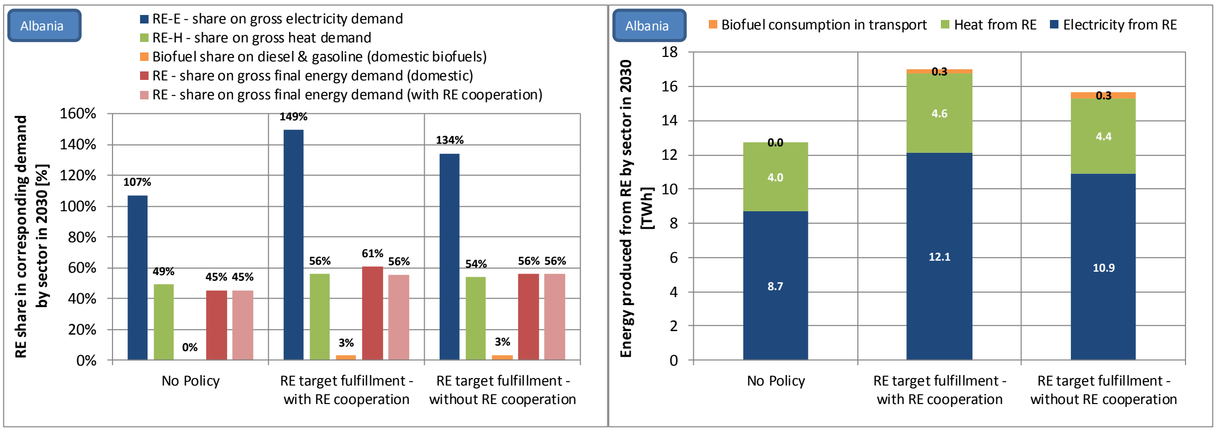


Figure 174: Sectorial breakdown of 2030 RE deployment in Albania according to the assessed RE scenarios – in relative terms as share in corresponding demand (left) and in absolute terms (right)

Assessment of direct economic impacts

Next we provide a brief indication of resulting direct economic impacts that come along with future RE deployment. A closer look is taken at the required investments in RE installations and on the financial support that may be needed to stipulate the RE expansion. As a starting point, on the left hand side of Figure 175 the development of capital expenditures for renewables is shown for the period up to 2030. It can be seen that compared to past trends a strong increase in investments is needed for achieving the given RE targets – both in the 2030 but also in the 2020 context. Specifically in the period 2020 to 2030 capital expenditures are strongest in the case "RE target fulfilment – with RE cooperation" since here the strongest RE deployment is achieved. They are then roughly twice as high compared to the "No Policy" scenario that serves as lower boundary of expected RE developments.

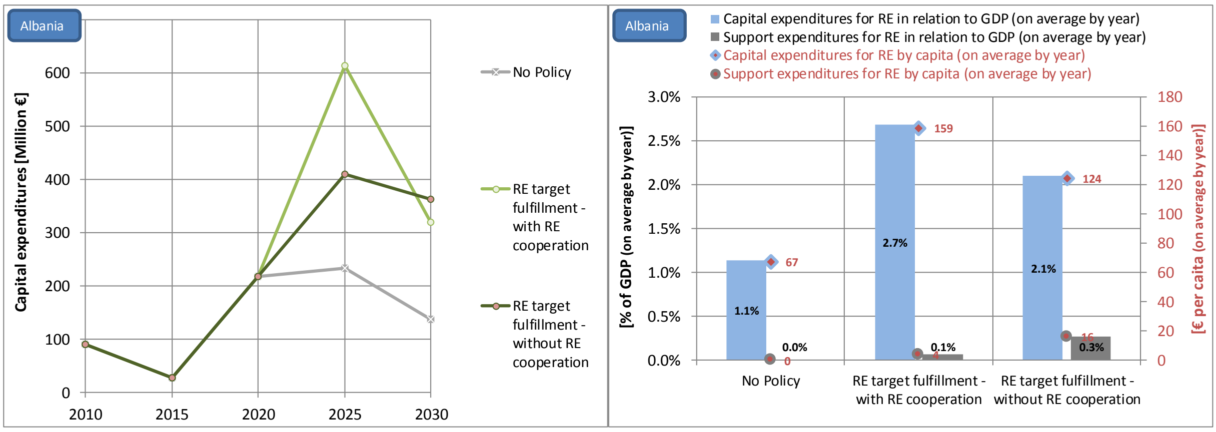


Figure 175: **Direct economic impacts: development of required capital expenditures in new RE installations (left) and indicators on capital and support expenditures in relation to GDP and population (right) in Albania**

Required investments are however per se not an indication on societal cost impacts – they rather indicate the level of economic activity associated with RE developments. A closer look at cost impacts is consequently provided through another set of indicators: Figure 175 (right) shows indicators on both capital and support expenditures – here put in relation to GDP and population. In general terms, it is getting apparent that public financial support for renewables is by far smaller in magnitude than the required investments taken by the private sector. There is a factor of 4 to 12 between both. Per capita cost for providing financial support for renewables are in size of 4 to 14 € per year on average in the period 2020 to 2030. Compared to other CPs this can be classified as comparatively low. Of note, support expenditures in the "RE target fulfilment – with RE cooperation" are lower than in the "RE target fulfilment – without RE cooperation" although total the total amount of generated renewable energy is significantly higher (cf. Figure 173). This can be attributed to the demand for renewable energy from CPs with more costly RE sources and their respective willingness to (virtually) import RE from Albania. In consequence, investment opportunities occur mainly into renewable electricity generating capacities that require very little support expenditures.

Sensitivity assessment on the impact of EE target setting options for the RE ambition

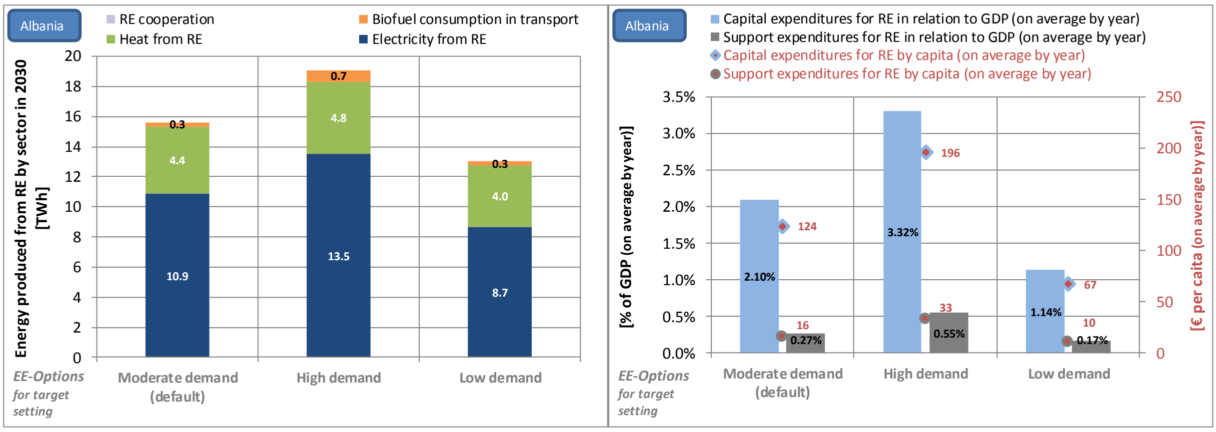


Figure 176. **Sensitivity assessment on EE target setting options: Sectorial breakdown of 2030 RE deployment (left) and indicators on capital and support expenditures in relation to GDP and population (right) according to assessed scenarios for Albania**

As discussed previously, a sensitivity assessment has been performed to analyse the impact of EE target setting options on the RE ambition. We thus add to the default trend (that stems from the EE target setting option Baseline 32) a corridor of possible energy demand trends (i.e. a low and a high demand scenario), in accordance with the EE options derived in chapter 2 of this report. As illustrated in Figure 176, the results on RE deployment indicate that the expected high demand requires a significantly stronger uptake of renewables. In contrast to above, a strong EE target as proclaimed under the Low Demand case would simplify RE target achievement, reducing domestic deployment needs for renewables as well as corresponding costs. For Albania it can be seen that the EE target has a strong impact on the RE ambition – i.e. for example an unambitious EE target challenges the achievement of RE targets and endangers the feasibility of GHG limits, and it leads to higher RE support cost for consumer in Albania.

3.4.3.2 Bosnia and Herzegovina

Bosnia and Herzegovina currently (2016) has an overall RE share in GFED of 41.525.3%. Therefore, the given 2020 RE target (40%) has been already achievedappears challenging given the short time left towards 2020. The RE share of electricity generation is entirely made of hydropower and sums up to more than 41.1% in gross electricity consumption. Apart from that renewables in heating and cooling add a significant contribution, but uncertainty remains on their exact contribution. Previous assessments indicate a range from about one third up to more than half of corresponding overall demand, depending on the approach used in the underlying statistical accounting of biomass.The RE share in transportation is virtually non-existing (0.5%).

Assessment of future RE deployment

The 2030 RE target calculation constitutes for Bosnia and Herzegovina a RE share of 52% in 2030. This That target can be classified as challenging but feasible to achieve under the given circumstances. By solely relying on domestic RE sources as well as without any additional policy initiative post 2020, the 2030 RE target seems to be already well achievable. In this context, Figure 31 shows past and expected future RE deployment in Bosnia and Herzegovina in relative terms (as RE share in GFED) (left) and in absolute terms (right) according to statistics and assessed RE scenarios. Please note that for details on the scenario definition as well as the general approach and assumptions underlying this modelling exercise section 0 of this report provides further insights.

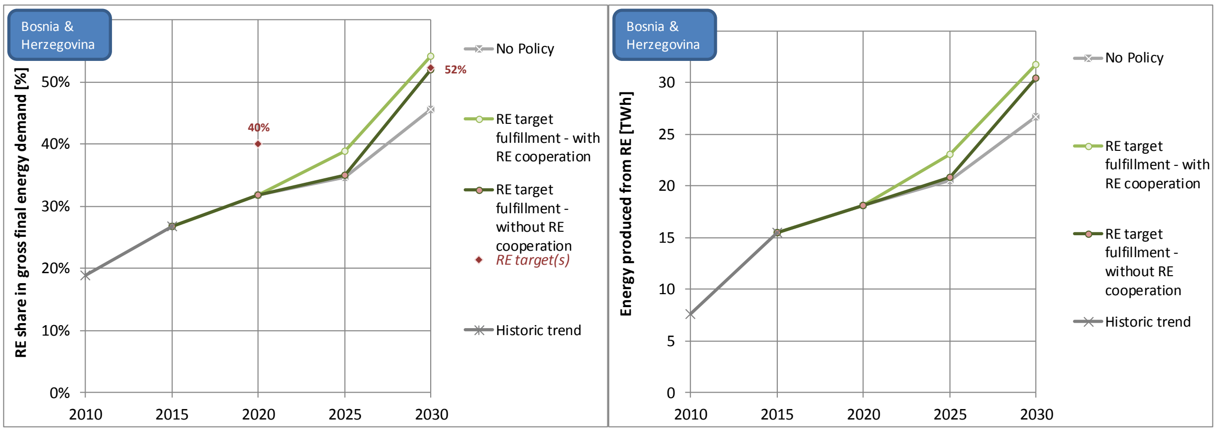


Figure 177: Past and expected future RE deployment in Bosnia and Herzegovina in relative terms (RE share in GFED) (left) and in absolute terms (right) according to statistics and assessed RE scenarios

Bosnia and Herzegovina may achieve the postulated 2030 RE target solely by relying on domestic RE sources (see scenario "RE target fulfilment – without RE cooperation") and even in the "No Policy" scenario that serves as lower boundary of expected RE developments. However, RE potentials available in Bosnia and Herzegovina indicate that even a higher RE deployment appears feasible. If for example, regional cooperation comes into play as postulated in the scenario "RE target fulfilment – with RE cooperation", the outcomes of the modelling exercise indicate a stronger RE deployment than if solely a national perspective is taken. The surplus in RE generation may then be (virtually) exported to other CPs that may fall short in meeting the given 2030 RE target.

Figure 178 provides subsequently further insights on the sectorial decomposition of expected 2030 RE deployment for the scenarios assessed within the underlying modelling exercise. More precisely, Figure 178 (left) indicates the expected RE share in corresponding demand by energy sector whereas on the right hand side of Figure 178, the contribution in absolute terms is indicated. It can be seen that the heating and cooling sector outperforms compared to other energy sectors – here, solid biomass makes up the significant part of the renewable share in heating. In later years, solar thermal heating followed by heat pumps (in the "RE target fulfilment – with

RE cooperation" scenario) gain importance. Renewables in electricity add also a significant contribution to the required increase in RE deployment. Here, hydropower (in all scenarios) and wind power (especially in the "RE target fulfilment – with RE cooperation" scenario) are most important.

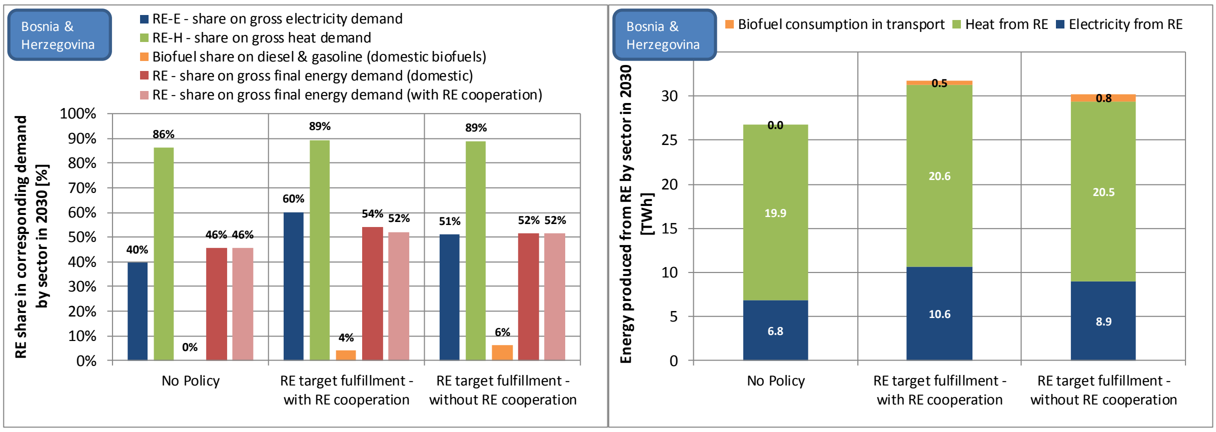


Figure 178: **Sectorial breakdown of 2030 RE deployment in Bosnia and Herzegovina according to the assessed RE scenarios – in relative terms as share in corresponding demand (left) and in absolute terms (right)**

Assessment of direct economic impacts

Next we provide a brief indication of resulting direct economic impacts that come along with future RE deployment. A closer look is taken at the required investments in RE installations and on the financial support that may be needed to stipulate the RE expansion. As a starting point, on the left hand side of Figure 33, the development of capital expenditures for renewables is shown for the period up to 2030. It can be seen that stable expenditures after 2020 are sufficient to achieve the given RE targets.

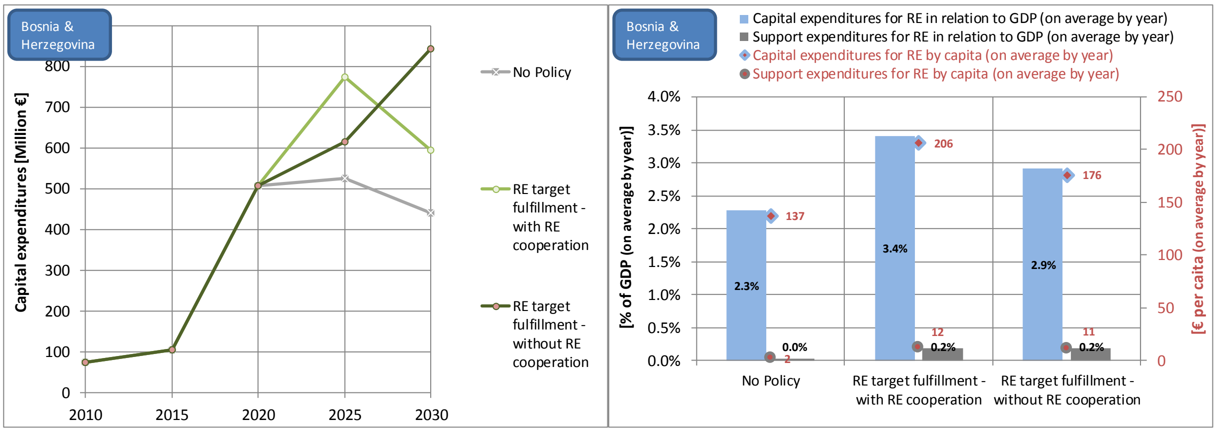


Figure 179: **Direct economic impacts: development of required capital expenditures in new RE installations (left) and indicators on capital and support expenditures in relation to GDP and population (right) in Bosnia and Herzegovina**

Required investments are however per se not an indication of societal cost impacts – they rather indicate the level of economic activity associated with RE developments. A closer look at cost impacts is consequently provided through another set of indicators: Figure 179 (right) shows indicators on both capital and support expenditures – here put in relation to GDP and population. In general terms, it is getting apparent that public financial support for renewables is smaller in magnitude than the required investments taken by the private sector. While public support expenditures are at ca. 0.2% of GDP, the required investments are in a range from 2.9% to 3.4% of GDP. Also while the "RE target fulfilment – with RE cooperation" scenario imposes additional capital costs on Bosnia and Herzegovina compared to the "RE target fulfilment – without RE cooperation", most of the increase is covered by the private sector, implying lucrative investment opportunities.

Sensitivity assessment on the impact of EE target setting options for the RE ambition

Complementary to above, a sensitivity assessment has been performed to analyse the impact of EE target setting options on the RE ambition. The default demand trend (that stems from the EE target setting option Baseline 32) has been complemented by a corridor of possible energy demand trends (i.e. a low and a high demand scenario), in accordance with the EE options derived in chapter 2 of this report. As illustrated in Figure 180, the results on RE deployment indicate that the expected high demand requires a significantly stronger uptake of renewables. In contrast to above, a strong EE target as proclaimed under the Low Demand case would simplify RE target achievement, reducing domestic deployment needs for renewables as well as corresponding costs. For Bosnia and Herzegovina it can be seen that the EE target has a strong impact on the RE ambition – i.e. for example an ambitious EE target would simplify the achievement of RE targets and would also contribute to GHG target achievement. Moreover, it would help to lower the cost burden for consumer that corresponds to public RE support.

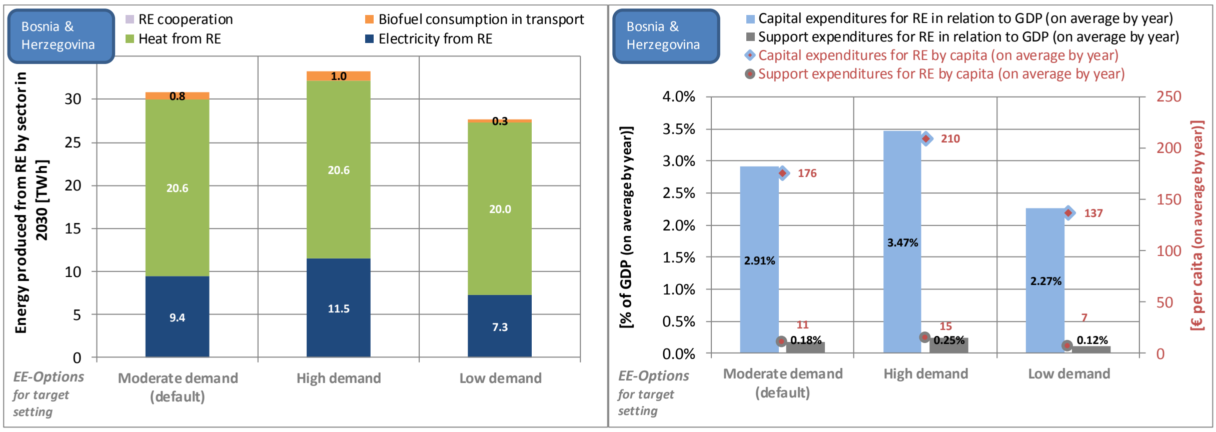


Figure 180. Sensitivity assessment on EE target setting options: Sectorial breakdown of 2030 RE deployment (left) and indicators on capital and support expenditures in relation to GDP and population (right) according to assessed scenarios for Bosnia and Herzegovina

3.4.3.3 Georgia

Assessment of future RE deployment

The 2030 RE target calculation constitutes for Georgia a RE share of 51% in 2030. Similar to other CPs this can be classified as challenging but feasible to achieve under the given circumstances. If no dedicated support for renewables is provided post 2020 this may however hardly be mobilised, cf. the projected RE deployment according to the “No Policy” scenario in Figure 181. In such case, a target gap of over 7pp is likely to manifest in Georgia. In this context, Figure 34 shows past and expected future RE deployment in Georgia in relative terms (as RE share in GFED) (left) and in absolute terms (right) according to statistics and assessed RE scenarios. Please note that for details on the scenario definition as well as the general approach and assumptions underlying this modelling exercise section 0 of this report provides further insights.

If the RE policy ambition is increased in accordance with the postulated 2030 RE target, Georgia may achieve this solely by relying on domestic RE sources (see scenario “RE target fulfilment – without RE cooperation”). Renewable energy generation capacities shall not be installed beyond this level in the cooperation scenario. Thus, deployment of renewable energy is virtually identical in both target fulfilment scenarios.

Complementary to above, Figure 182 provides further insights on the sectorial decomposition of expected 2030 RE deployment for the scenarios assessed within the underlying modelling exercise. More precisely, Figure 182 (left) indicates the expected RE share in corresponding demand by energy sector whereas on the right hand side of Figure 182 the contribution in absolute terms is indicated. It can be seen that the electricity sector contributes the most compared to other energy sectors – here hydropower followed by and wind energy and solar PV offers promising potentials. Renewables in heating and cooling add also a significant contribution to the required increase in RE deployment. Here biomass is most important, followed by solar thermal (used for hot water supply) and geothermal heat.

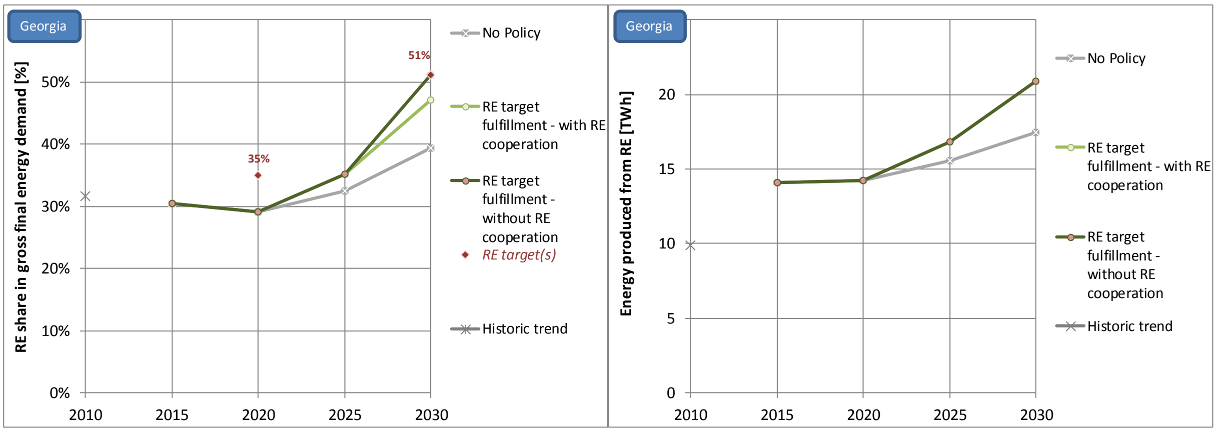


Figure 181: **Past and expected future RE deployment in Georgia in relative terms (RE share in GFED) (left) and in absolute terms (right) according to statistics and assessed RE scenarios**

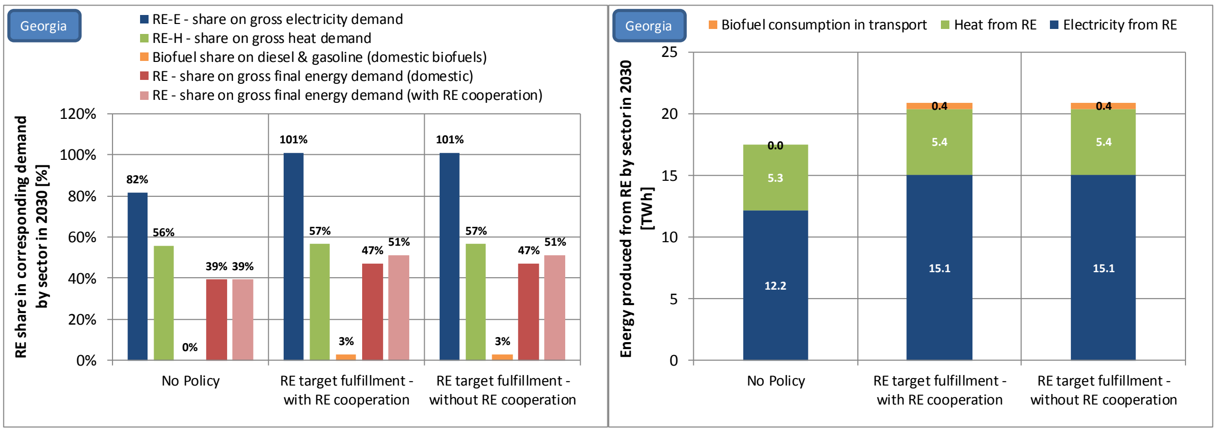


Figure 182: **Sectorial breakdown of 2030 RE deployment in Georgia according to the assessed RE scenarios – in relative terms as share in corresponding demand (left) and in absolute terms (right)**

Assessment of direct economic impacts

Next, we provide a brief indication of resulting direct economic impacts that come along with future RE deployment. A closer look is taken at the required investments in RE installations and on the financial support that may be needed to stipulate the RE expansion. In this context, Figure 183 shows the development of capital expenditures for renewables for the period up to 2030. It can be seen that compared to past trends a strong increase in investments is needed for achieving the given RE targets, especially between 2025 and 2030. During this period, capital expenditures have to increase continuously until reaching twice the amount from the “No Policy” scenario. Just as regards RE deployment, capital expenditures are identical in both “RE target fulfilment” scenarios.

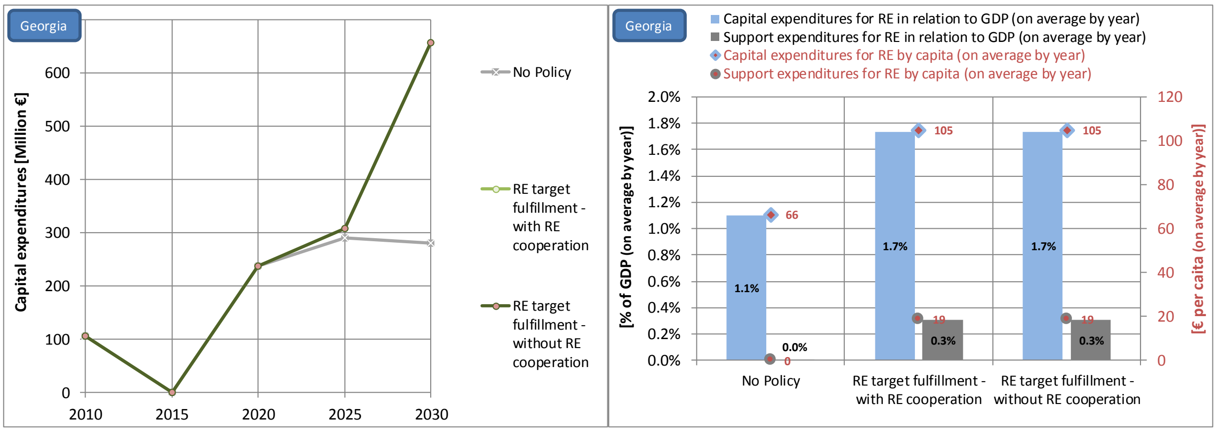


Figure 183: Direct economic impacts: development of required capital expenditures in new RE installations (left) and indicators on capital and support expenditures in relation to GDP & population (right) in Georgia

Required investments are however per se not an indication of societal cost impacts – they rather indicate the level of economic activity associated with RE developments. A closer look at cost impacts is consequently provided through another set of indicators: Figure 183 (right) shows indicators on both capital and support expenditures – here put in relation to GDP and population. In general terms, it is getting apparent that public financial support for renewables is by far smaller in magnitude than the required investments taken by the private sector. There is a factor of 10 between both. Per capita cost for providing financial support for renewables are in size of 10 € per year on average in the period 2020 to 2030. Compared to other CPs this can be classified as low.

3.4.3.4 Kosovo*

Kosovo* currently (2016) has an overall RE share in GFED of 18.524.4%. This is largely limited to the heating and cooling sector where RE heat generation holds a share of 47generation covers about half of total demand.. The renewable share of electricity is entirely made of hydropower but only amounts to 1.8about 2%. There is no RE share in transportation in Kosovo. For meeting the given 2020 RE target (25%) according to latest (2016) statistical data only a minor a strong increase in the RE share is neededappears necessary.

Assessment of future RE deployment

The 2030 RE target calculation constitutes for Kosovo* a RE share of 36% in 2030. Similar to other CPs this can be classified as challenging but feasible to achieve under the given circumstances. If no dedicated support for renewables is provided post 2020 this may however hardly be mobilised, cf. the projected RE deployment according to the “No Policy” scenario in Figure 184. In such case, a target gap of over 9 pppp is likely to manifest in Kosovo. In this context, Figure 184 shows past and expected future RE deployment in Kosovo in relative terms (as RE share in GFED) (left) and in absolute terms (right) according to statistics and assessed RE scenarios. Please note that for details on the scenario definition as well as the general approach and assumptions underlying this modelling exercise section 0 of this report provides further insights.

If the RE policy ambition is increased in accordance with the postulated 2030 RE target, Kosovo* may achieve this solely by relying on domestic RE sources (see scenario “RE target fulfilment – without RE cooperation”). If regional cooperation comes into play as postulated in the scenario “RE target fulfilment – with RE cooperation”, the outcomes of the modelling exercise indicate a lower RE deployment than if solely a national perspective is taken. It can be seen that there is a significant difference in RE share in GFED in 2030 if there are no policy measures taken post 2020 compared to the two other scenarios - “RE target fulfilment – without RE cooperation” and “RE target fulfilment – with RE cooperation”.

Complementary to above, Figure 185 depicts further insights on the sectorial decomposition of expected 2030 RE deployment for the scenarios assessed within the underlying modelling exercise. More precisely, Figure 185 (left) indicates the expected RE share in corresponding demand by energy sector whereas on the right hand side of Figure 185 the contribution in absolute terms is indicated. It can be seen that the heating and cooling sector contributes four times more to an increased RE share compared to other energy sectors – here, biomass is of dominance, but solar thermal heating and heat pumps show also promising potentials. Renewables in electricity also add a significant contribution to the required increase in RE deployment. In the electricity sector, solar PV, hydropower and wind technology almost evenly contribute to the increased RE share.

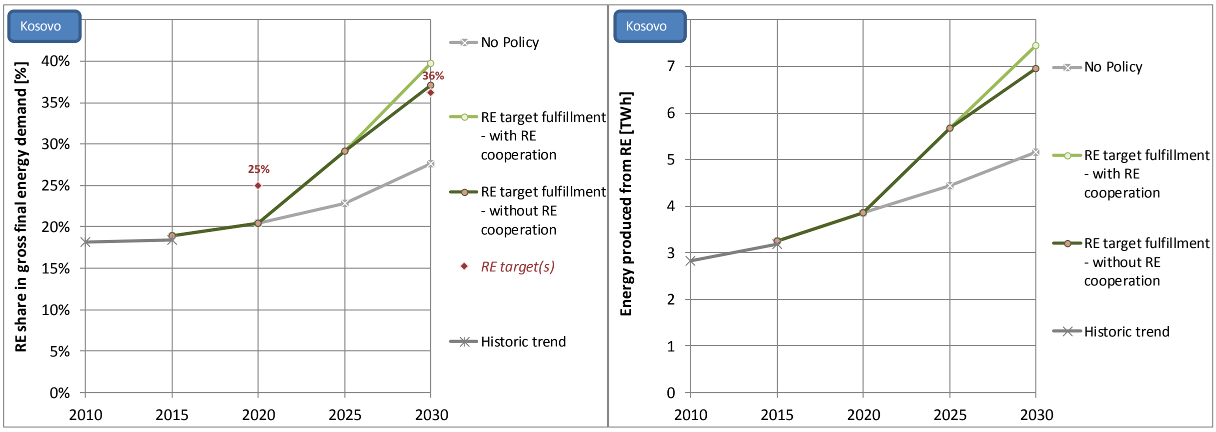


Figure 184: Past and expected future RE deployment in Kosovo* in relative terms (RE share in GFED) (left) and in absolute terms (right) according to statistics and assessed RE scenarios

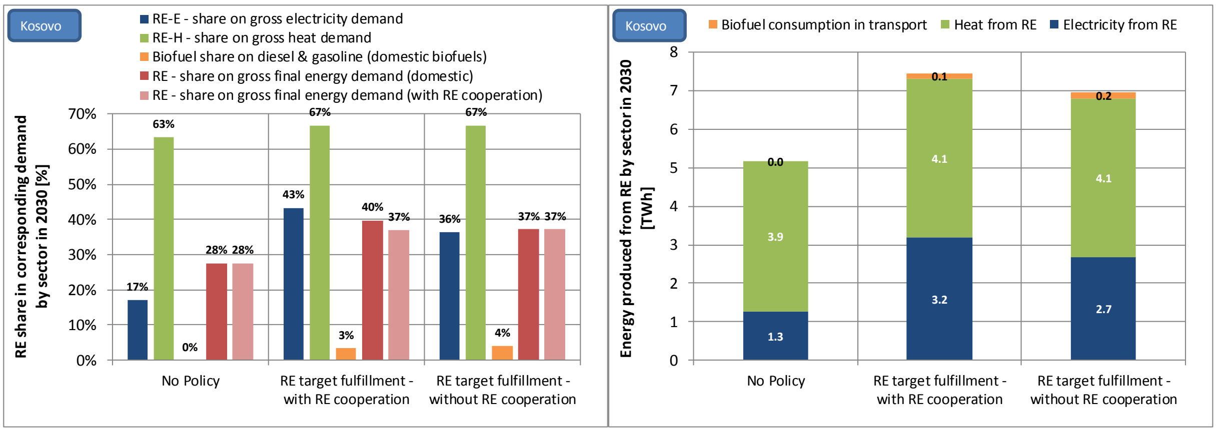


Figure 185: Sectorial breakdown of 2030 RE deployment in Kosovo* according to the assessed RE scenarios – in relative terms as share in corresponding demand (left) and in absolute terms (right)

Assessment of direct economic impacts

Next, we provide a brief indication of resulting direct economic impacts that come along with future RE deployment. A closer look is taken at the required investments in RE installations and on the financial support that may be needed to stipulate the RE expansion. The development of capital expenditures for renewables is consequently shown in Figure 186 for the period up to 2030. In the period 2020 to 2025, capital expenditures are in the same range for "RE target fulfilment – with RE cooperation" and "RE target fulfilment – without RE cooperation". After 2025, expenditures for the scenario without cooperation are higher but also the strongest RE deployment is achieved in this scenario.

Required investments are however per se not an indication of societal cost impacts – they rather indicate the level of economic activity associated with RE developments. A closer look at cost impacts is consequently provided through another set of indicators: Figure 186 (right) provides indicators on both capital and support expenditures – here put in relation to GDP and population. In general terms, it is getting apparent that public financial support for renewables is about a fifth of the required investments taken by the private sector. Per capita cost for providing financial support for renewables are in size of 20-23 € per year on average in the period 2020 to 2030. Compared to other CPs this can be classified as an average cost level.

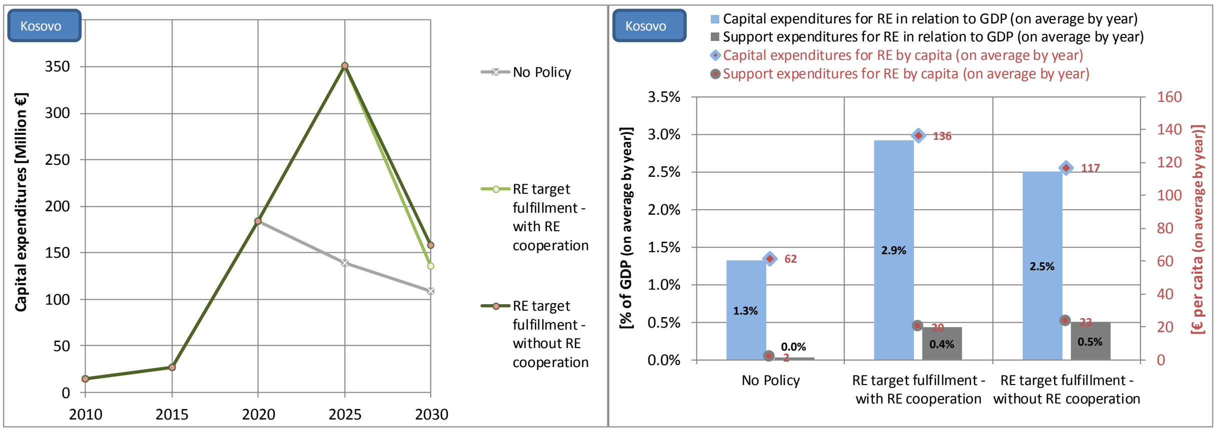


Figure 186: Direct economic impacts: development of required capital expenditures in new RE installations (left) and indicators on capital and support expenditures in relation to GDP & population (right) in Kosovo*

Sensitivity assessment on the impact of EE target setting options for the RE ambition

Complementary to above, a sensitivity assessment has been performed to analyse the impact of EE target setting options on the RE ambition. Thus, the default demand trend (that stems from the EE target setting option Baseline 32) has been complemented by a corridor of possible energy demand trends (i.e. a low and a high demand scenario), in accordance with the EE options derived in chapter 2 of this report. As illustrated in Figure 187, the results on RE deployment indicate that the expected high demand requires a significantly stronger uptake of renewables. In contrast to above, a strong EE target as proclaimed under the Low Demand case would simplify RE target achievement for Kosovo*, reducing domestic deployment needs for renewables as well as corresponding costs. For Kosovo* it can be seen that the EE target has a strong impact on the RE ambition – i.e. for example an ambitious EE target would simplify the achievement of RE targets and would also contribute to GHG target achievement. Moreover, it would help to lower the cost burden for consumer that corresponds to public RE support in significant terms.

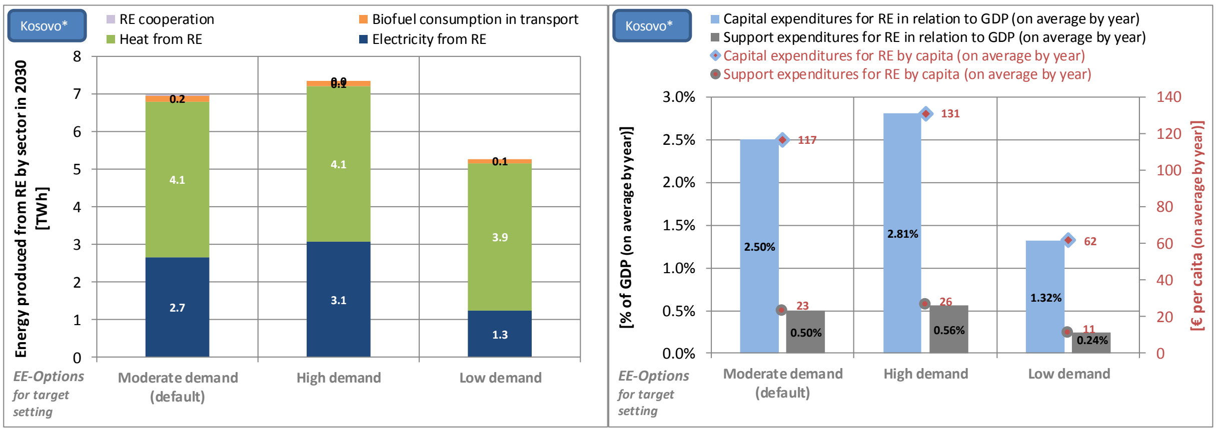


Figure 187. Sensitivity assessment on EE target setting options: Sectorial breakdown of 2030 RE deployment (left) and indicators on capital and support expenditures in relation to GDP and population (right) according to assessed scenarios for Kosovo*

3.4.3.5 North Macedonia

North Macedonia represents a country with a currently moderate deployment of renewables. Renewable energy deployment is limited to the electricity sector and the heating and cooling sector, whereas renewables are virtually inexistent in the transport sector. Today (2016) RE electricity generation in the case of the North Macedonia is majorly provided by hydropower and to a lesser extent by wind power. It holds a share of 24% in gross electricity consumption. RE in heating and cooling adds a considerable contribution: here off grid solid biomass is of dominance and contributes to meet roughly one third of the North Macedonian heating demand. In total, a RE share in GFED of 18.23% is achieved today (2016). Meeting the given short term 2020 RE target (2823%) seems not practically feasibleappears challenging, in particular when considering the projected increase in energy demand until 2020.

Assessment of future RE deployment

The 2030 RE target calculation constitutes for North Macedonia a RE share of 39% in 2030. Similar to other CPs this can be classified as challenging but still feasible to achieve under the given circumstances. There is a vast potential of renewables waiting to be exploited, specifically in the electricity sector but also in heating and cooling. If no dedicated support for renewables is provided post 2020 this may however hardly be mobilised, cf. the projected RE deployment according to the "No Policy" scenario in Figure 188. In such case a target gap of over 10pp is likely to manifest in North Macedonia. In this context, Figure 188 shows past and expected future RE deployment in North Macedonia in relative terms (as RE share in GFED) (left) and in absolute terms (right) according to statistics and assessed RE scenarios. Please note that for details on the scenario definition as well as the general approach and assumptions underlying this modelling exercise section 0 of this report provides further insights.

If the RE policy ambition is increased in accordance with the postulated 2030 RE target, North Macedonia may achieve this solely by relying on domestic RE sources (see scenario "RE target fulfilment – without RE cooperation"). Renewable energy generation capacities shall not be installed beyond this level in the cooperation scenario. Thus, deployment of renewable energy is virtually identical in both target fulfilment scenarios.

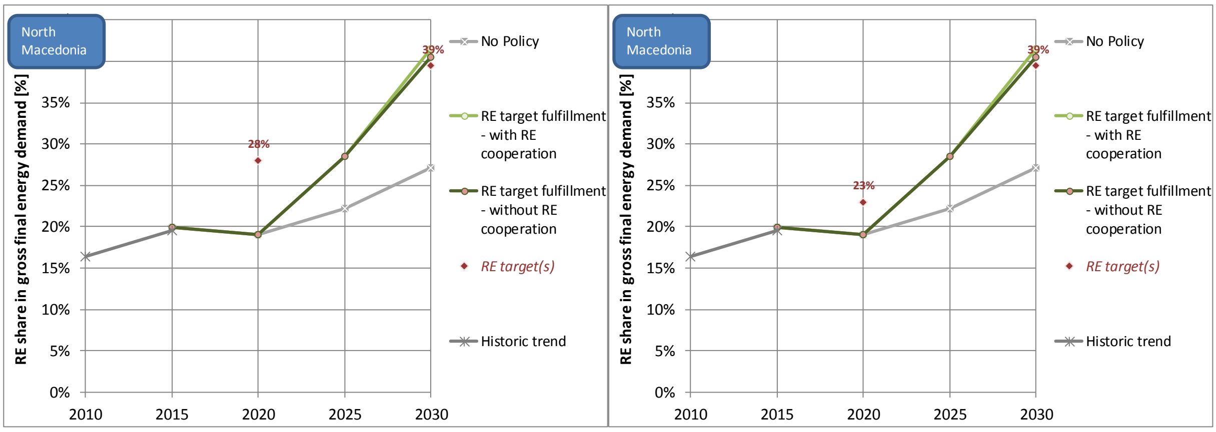


Figure 188: Past and expected future RE deployment in North Macedonia in relative terms (RE share in GFED) (left) and in absolute terms (right) according to statistics and assessed RE scenarios

The sectorial decomposition of expected 2030 RE deployment for the scenarios assessed within the underlying modelling exercise is shown in Figure 189. More precisely, Figure 189 (left) indicates the expected RE share in corresponding demand by energy sector whereas on the right hand side of Figure 41 the contribution in absolute terms is indicated. In the "No Policy" scenario, the largest part of RE stems from so lid biomass in the heating sector. Yet to actually reach the 2030 target, a considerable increase in total RE deployment is required. These energy quantities can be provided cost-efficiently in the electricity sector by hydropower, wind and solar PV, technologies of which the FYROM offers promising potentials. Renewables in heating and cooling only barely add a contribution to the required increase in RE deployment. Thus to increase the total deployment of renewable energy beyond the market driven development, North Macedonia shall recur to the electricity generation capacities.

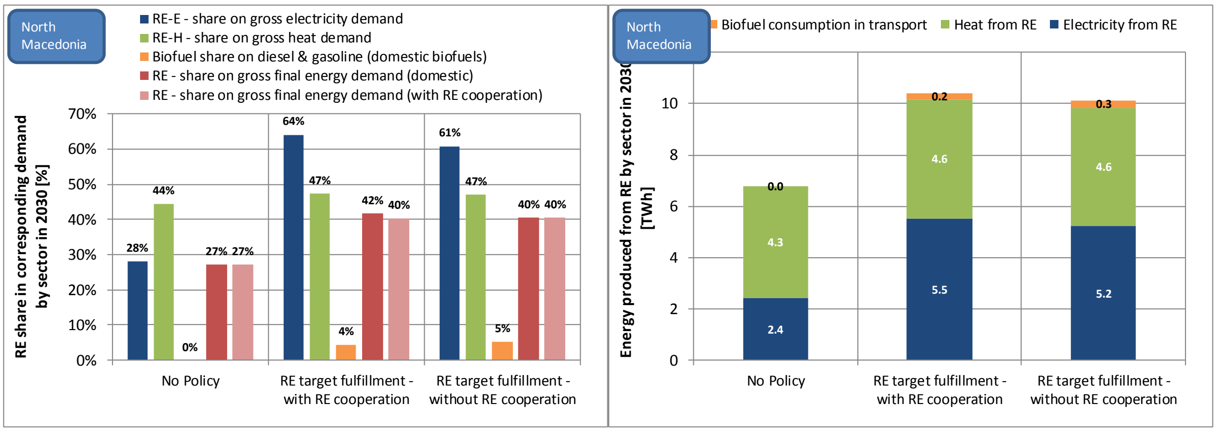


Figure 189: **Sectorial breakdown of 2030 RE deployment in North Macedonia according to the assessed RE scenarios – in relative terms as share in corresponding demand (left) and in absolute terms (right)**

Assessment of direct economic impacts

Next we provide a brief indication of resulting direct economic impacts that come along with future RE deployment. A closer look is taken at the required investments in RE installations and on the financial support that may be needed to stipulate the RE expansion. As a starting point, on the left hand side of Figure 190 the development of capital expenditures for renewables is shown for the period up to 2030. It can be seen that compared to past trends a strong increase in investments is needed for achieving the given RE targets – both in the 2030 but also in the 2020 context. Capital expenditures are nearly identical in the "RE target fulfilment" scenarios. To fulfil the 2030 targets, the largest part of the investments have to be raised in the mid-twenties, and then decrease to an even lower level than in the "No-Policy" scenario.

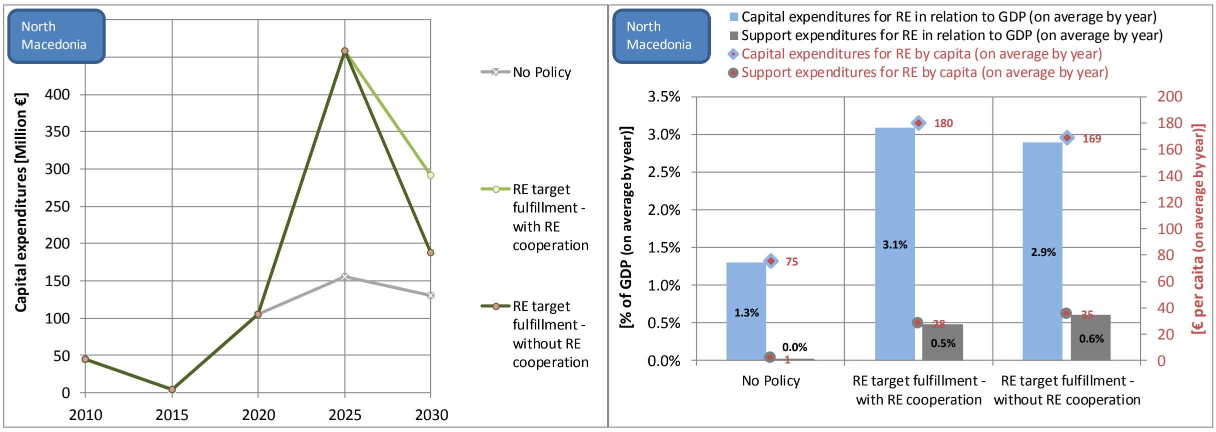


Figure 190: **Direct economic impacts: development of required capital expenditures in new RE installations (left) and indicators on capital and support expenditures in relation to GDP and population (right) in North Macedonia**

Required investments are however per se not an indication on societal cost impacts – they rather indicate the level of economic activity associated with RE developments. A closer look at cost impacts is consequently provided through another set of indicators: Indicators on both capital and support expenditures are illustrated by Figure 190 – here put in relation to GDP and population. In general terms, it is getting apparent that public financial support for renewables is by far smaller in magnitude than the required investments taken by the private sector. In numbers, private capital expenditures are roughly five times as high as the required public support. Per capita cost for providing financial support for renewables are in size of 28 to 35 € per year on average in the period 2020 to 2030. Compared to other CPs this can be classified as average. In case of the "No Policy" scenario, the entirety of the expenditures is covered by the private sector.

Sensitivity assessment on the impact of EE target setting options for the RE ambition

Complementary to above, a sensitivity assessment has been performed to analyse the impact of EE target setting options on the RE ambition for North Macedonia. Thus, the default demand trend (that stems from the EE target setting option Baseline 32) has been complemented by a corridor of possible energy demand trends (i.e. a low and a high demand scenario), in accordance with the EE options derived in chapter 2 of this report. As illustrated in Figure 191, the results on RE deployment indicate that the expected low demand requires a significantly smaller uptake of renewables. Thus, a strong EE target as proclaimed under the Low Demand case would simplify RE target achievement for North Macedonia, reducing domestic deployment needs for renewables as well as corresponding costs. It can be seen that the EE target has a strong impact on the RE ambition – i.e. for example an ambitious EE target would simplify the achievement of RE targets and would also contribute to GHG target achievement. Moreover, it would help to lower the cost burden for consumer that corresponds to public RE support.

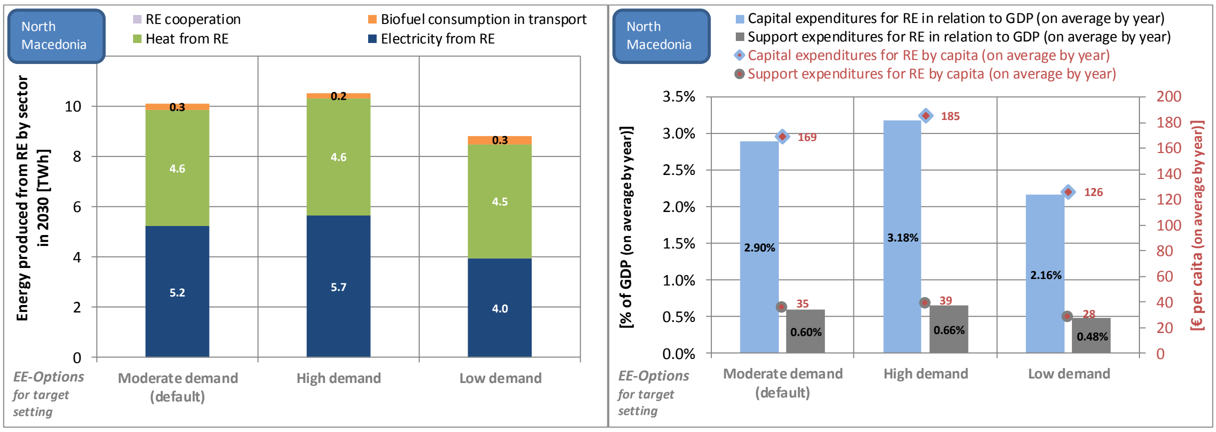


Figure 191. Sensitivity assessment on EE target setting options: Sectorial breakdown of 2030 RE deployment (left) and indicators on capital and support expenditures in relation to GDP and population (right) according to assessed scenarios for North Macedonia

3.4.3.6 Moldova

In Moldova, according to latest statistical data a renewables account for a share of 26.9%RE share in GFED of 15.8% is achieved today (20152016). For meeting the givenThat implies that Moldova has already achieved its 2020 RE target (17%) a moderate increase is neededfour years in advance. RE electricity generation holds a share of 35.3%more than one third in gross electricity consumption – with 0.1% generated by wind, hydropower contributes the vast majority of this share. Apart from that RE in heating and cooling adds a significant contribution which adds up to meet 27.7%about one quarter of the Moldovan heating demand.

Assessment of future RE deployment

The 2030 RE target calculation constitutes for Moldova a RE share of 26% in 2030. Similar to other CPs this can be classified as challenging but feasible to achieve under the given circumstances. If no dedicated support for renewables is provided post 2020 the RE share in 2030 will stay slightly below the presumed RE target of 2526%, this is visualized in the projected RE deployment according to the "No Policy" scenario in . Past and expected future RE deployment in Moldova are shown in Figure 192 in relative terms (as RE share in GFED) (left) and in absolute terms (right) according to statistics and assessed RE scenarios. Please note that for details on the scenario definition as well as the general approach and assumptions underlying this modelling exercise section 0 of this report provides further insights.

If the RE policy ambition is increased in accordance with the postulated 2030 RE target, Moldova may achieve this solely by relying on domestic RE sources (see scenario "RE target fulfilment – without RE cooperation"). If regional cooperation comes into play as postulated in the scenario "RE target fulfilment – with RE cooperation", the outcomes of the modelling exercise indicate a weaker RE deployment than if solely a national perspective is taken.

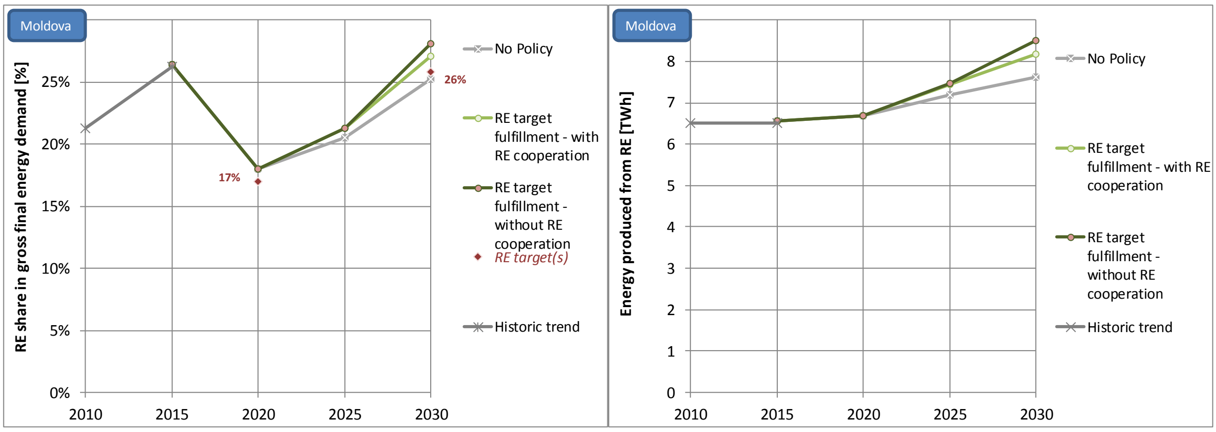


Figure 192: Past and expected future RE deployment in Moldova in relative terms (RE share in GFED) (left) and in absolute terms (right) according to statistics and assessed RE scenarios

Complementary to above, Figure 193 provides further insights on the sectorial decomposition of expected 2030 RE deployment for the scenarios assessed within the underlying modelling exercise. More precisely, Figure 193 (left) indicates the expected RE share in corresponding demand by energy sector whereas on the right hand side of Figure 193 the contribution in absolute terms is indicated. It can be seen that the heating and cooling sector contributes more than the electricity sector. In the heating sector, biomass is in dominance whereas in the electricity sector, hydropower and wind power take the lead.

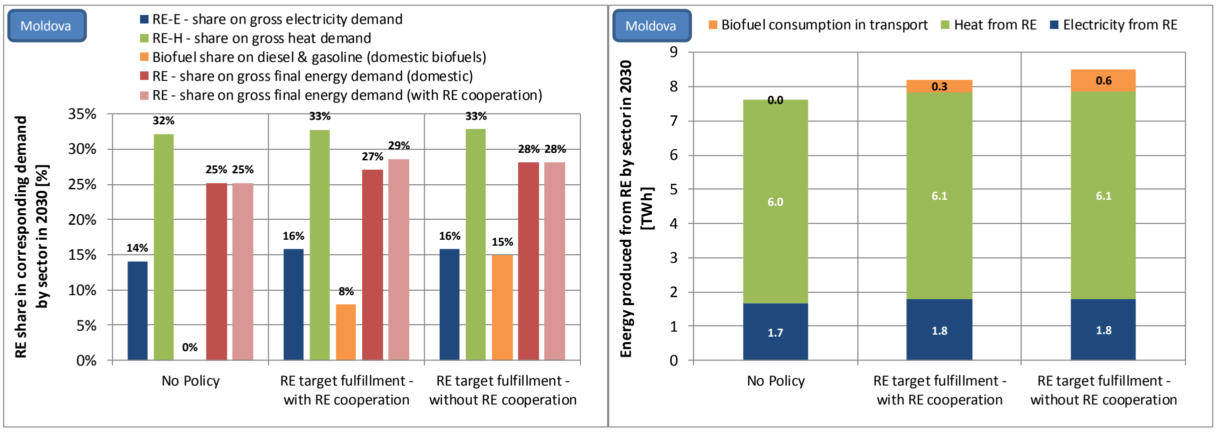


Figure 193: Sectorial breakdown of 2030 RE deployment in Moldova according to the assessed RE scenarios – in relative terms as share in corresponding demand (left) and in absolute terms (right)

Assessment of direct economic impacts

Next, we provide a brief indication of resulting direct economic impacts that come along with future RE deployment. A closer look is taken at the required investments in RE installations and on the financial support that may be needed to stipulate the RE expansion. As a starting point, on the left hand side of Figure 194, the development of capital expenditures for renewables is shown for the period up to 2030. It can be seen that compared to past trends stable or slightly increased investments are sufficient for achieving the given RE targets – both in the 2030 but also in the 2020 context. Capital expenditures are around 20% higher in the case of both “RE target fulfilment” scenarios as in the “No Policy” scenario that serves as lower boundary of expected RE developments.

Required investments are however per se not an indication on societal cost impacts – they rather indicate the level of economic activity associated with RE developments. A closer look at cost impacts is consequently provided through another set of indicators: Figure 194 (right) shows indicators on both capital and support expenditures – here put in relation to GDP and population. In general terms, it is getting apparent that the required public financial support is about a factor 3-5 times lower than investments taken by the private sector. Per capita cost for providing financial support for renewables are in size of 8 to 16 € per year on average in the period 2020 to 2030. Compared to other CPs this can be classified as comparatively low.

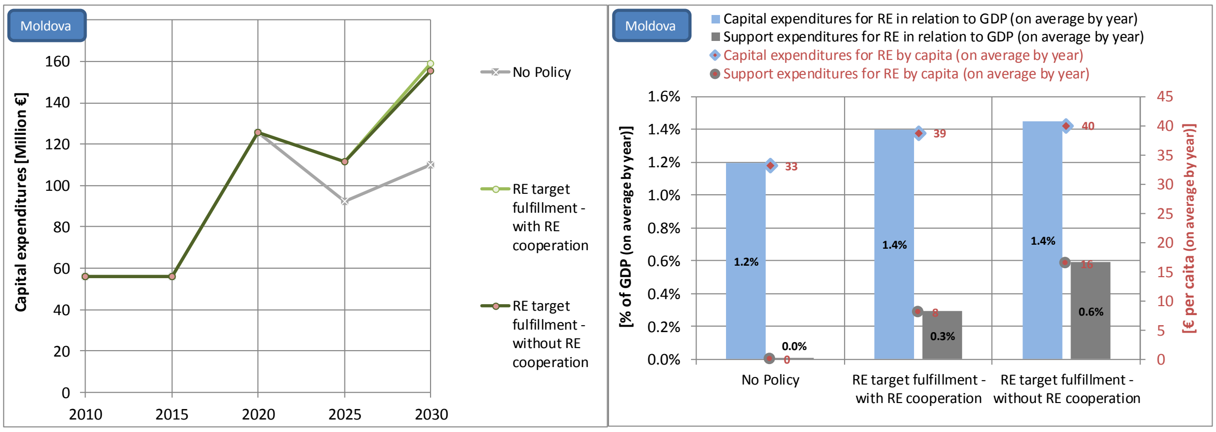


Figure 194: **Direct economic impacts: development of required capital expenditures in new RE installations (left) and indicators on capital and support expenditures in relation to GDP and population (right) in Moldova**

Sensitivity assessment on the impact of EE target setting options for the RE ambition

Complementary to above, a sensitivity assessment has been performed to analyse the impact of EE target setting options on the RE ambition for Moldova. Thus, the default demand trend (that stems from the EE target setting option Baseline 32) has been complemented by a corridor of possible energy demand trends (i.e. a low and a high demand scenario), in accordance with the EE options derived in chapter 2 of this report. As illustrated in Figure 195, the results on RE deployment indicate that the expected low demand requires a significantly smaller uptake of renewables. Thus, a strong EE target as proclaimed under the Low Demand case would simplify RE target achievement for Moldova, reducing domestic deployment needs for renewables as well as corresponding costs. It can be seen that the EE target has a strong impact on the RE ambition – i.e. for example an ambitious EE target would simplify the achievement of RE targets and would also contribute to GHG target achievement. Moreover, it would help to lower the cost burden for consumer related to public RE support.

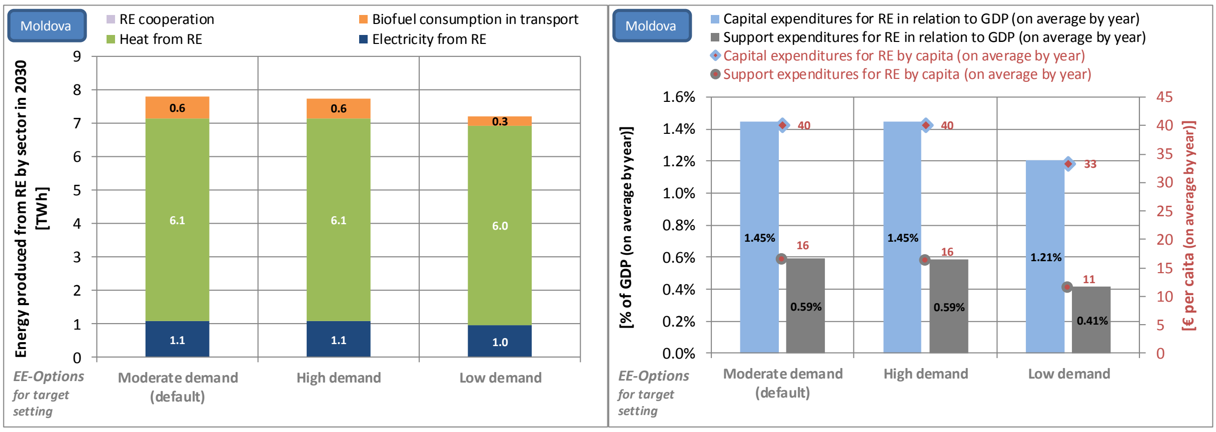


Figure 195. **Sensitivity assessment on EE target setting options: Sectorial breakdown of 2030 RE deployment (left) and indicators on capital and support expenditures in relation to GDP and population (right) according to assessed scenarios for Moldova**

3.4.3.7 Montenegro

Montenegro represents a country with a historically already significant deployment of renewables. Yet, the presence of renewables is currently limited to the electricity sector and heating sector, while the transport is nearly exclusively fuelled by fossil sources. As of today (2016) RE electricity generation – in the case of Montenegro virtually entirely provided by hydropower – holds a share of 51% in gross electricity consumption. Renewable energy in heating and cooling also adds a significant contribution: here solid off grid biomass is of dominance and contributes to meet 69% of the Montenegrin heating demand. In total, a RE share in GFED of 42% is achieved today (2016). In consequence the given 2020 RE target (38%) are already reached as of today and only a moderate relative increase in RES deployment is required to reach the 2030 RE target.

Assessment of future RE deployment

The 2030 RE target calculation constitutes for Montenegro a RE share of 53% in 2030. Reaching this target seems feasible under the given circumstances. There is a vast potential of renewables waiting to be exploited, specifically in the electricity sector (hydro and wind) but also in heating and cooling (solid biomass). If no dedicated support for renewables is provided post 2020, the target for 2030 will slightly be missed, cf. the projected RE deployment according to the "No Policy" scenario in Figure 196. In such case, a target gap of over 3pp is likely to manifest in Montenegro. In this context, Figure 196 shows past and expected future RE deployment in Montenegro in relative terms (as RE share in GFED) (left) and in absolute terms (right) according to statistics and assessed RE scenarios. Until 2020, we expect a slight drop in the relative RE share, although the absolute amount of deployed renewables increase during this period. This is due to increasing due to increasing energy demand related to the growth of economic activity combined with only moderately ambitious energy efficiency targets until 2020. Please note that for details on the scenario definition as well as the general approach and assumptions underlying this modelling exercise section 0 of this report provides further insights.

If the RE policy ambition is increased in accordance with the postulated 2030 RE target, Albania may achieve this solely by relying on domestic RE sources (see scenario "RE target fulfilment – without RE cooperation"). RE potentials available in Montenegro indicate that even a higher RE deployment appears feasible. If for example regional cooperation comes into play as postulated in the scenario "RE target fulfilment – with RE cooperation", the outcomes of the modelling exercise indicate a much stronger RE deployment than if solely a national perspective is taken. The surplus in RE generation may then be (virtually) exported to other CPs that may fall short in meeting the given 2030 RE target.

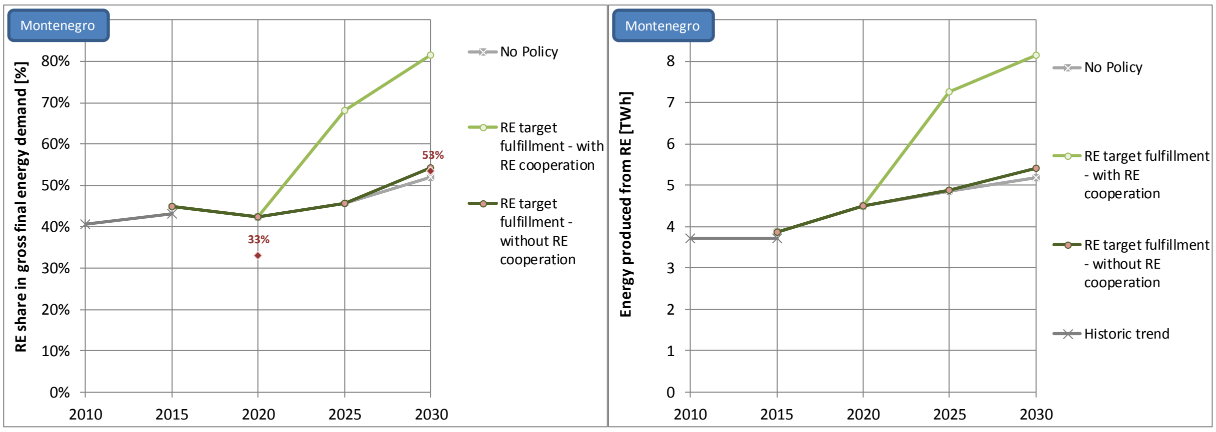


Figure 196: Past and expected future RE deployment in Montenegro in relative terms (RE share in GFED) (left) and in absolute terms (right) according to statistics and assessed RE scenarios

Complementary to above, Figure 197 provides further insights on the sectorial decomposition of expected 2030 RE deployment for the scenarios assessed within the underlying modelling exercise. More precisely, Figure 197 (left) indicates the expected RE share in corresponding demand by energy sector whereas on the right hand side of Figure 197 the contribution in absolute terms is indicated. It can be seen that the electricity sector outperforms compared to other energy sectors – here wind energy and hydropower offer promising potentials. Renewables in heating and cooling add also a significant contribution to the required increase in RE deployment. Here biomass is of dominance, followed by solar thermal (used for hot water supply) and heat pumps. While a small additional amount of renewable energy shall be deployed in all sectors to reach the 2030 target, the least cost modelling exercise would impose a major increase in the RE share in the electricity sector. The modelled RE share of 150% in the scenario "Target fulfilment - with RE cooperation" directly indicates that a large part of generated electricity would be exported to other CPs.

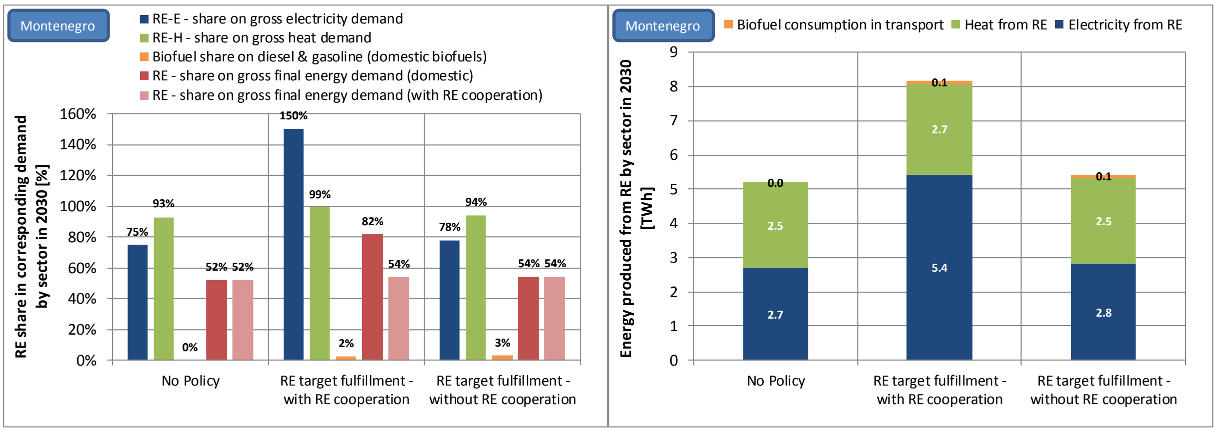


Figure 197: Sectorial breakdown of 2030 RE deployment in Montenegro according to the assessed RE scenarios – in relative terms as share in corresponding demand (left) and in absolute terms (right)

Assessment of direct economic impacts

Next we provide a brief indication of resulting direct economic impacts that come along with future RE deployment. A closer look is taken at the required investments in RE installations and on the financial support that may be needed to stipulate the RE expansion. As a starting point, on the left hand side of Figure 198 the development of capital expenditures for renewables is shown for the period up to 2030. It can be seen that compared to past trends a slight increase in investments is needed for achieving the given RE targets – both in the 2030 but also in the 2020 context. Specifically in the period 2020 to 2030 capital expenditures are strongest in the case "RE target fulfilment – with RE cooperation" since here the strongest RE deployment is achieved. They are then roughly two to three times as high compared to the "No Policy" scenario that serves as lower boundary of expected RE developments. A significant difference in capital expenditures between the two target fulfilment scenarios is striking. Due to the abundant amount of available RES-E potentials, in a cooperation scenario, large of amounts of additional capacities – not directly required for reaching the own target – would be installed in Montenegro.

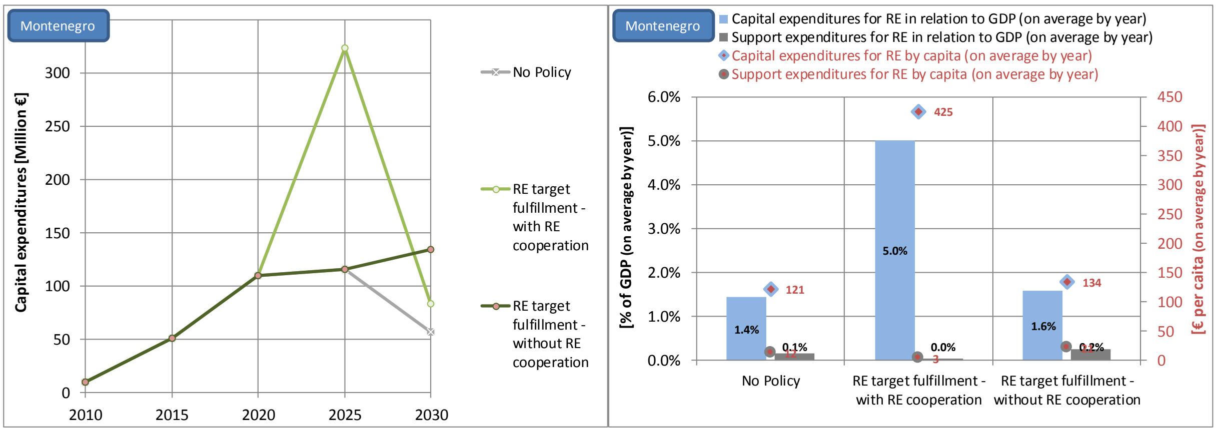


Figure 198: Direct economic impacts: development of required capital expenditures in new RE installations (left) and indicators on capital and support expenditures in relation to GDP and population (right) in Montenegro

Required investments are however per se not an indication on societal cost impacts – they rather indicate the level of economic activity associated with RE developments. A closer look at cost impacts is consequently provided through another set of indicators: Figure 198 (right) shows indicators on both capital and support expenditures – here put in relation to GDP and population. In general terms, it is getting apparent that public financial support for renewables is by far smaller in magnitude than the required investments taken by the private sector. There is a factor of 5 to 7 between both. Per capita cost for providing financial support for renewables are in size of 3 to 21 € per year on average in the period 2020 to 2030.

Sensitivity assessment on the impact of EE target setting options for the RE ambition

Complementary to above, a sensitivity assessment has been performed to analyse the impact of EE target setting options on the RE ambition for Montenegro. Thus, the default demand trend (that stems from the EE target setting option Baseline 32) has been complemented by a corridor of possible energy demand trends (i.e. a low and a high demand scenario), in accordance with the EE options derived in chapter 2 of this report. As illustrated in Figure 199, the results on RE deployment indicate that the expected low demand requires a significantly smaller uptake of renewables. Thus, a strong EE target as proclaimed under the Low Demand case would simplify RE target achievement for Montenegro, reducing domestic deployment needs for renewables as well as corresponding costs. It can be seen that the EE target has a strong impact on the RE ambition – i.e. for example an ambitious EE target would simplify the achievement of RE targets and would also contribute to GHG target achievement. Moreover, it would help to lower the cost burden for consumer related to public RE support in large amounts.

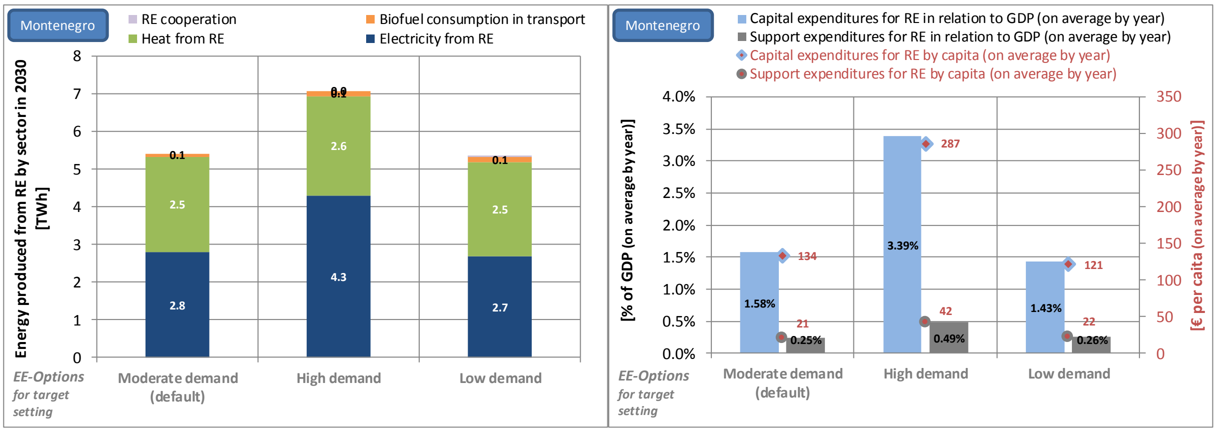


Figure 199. **Sensitivity assessment on EE target setting options: Sectorial breakdown of 2030 RE deployment (left) and indicators on capital and support expenditures in relation to GDP and population (right) according to assessed scenarios for Montenegro**

3.4.3.8 Serbia

Serbia represents a country with a currently moderate deployment of renewables. Renewable energy deployment is limited to the electricity sector and the heating and cooling sector, whereas renewables are virtually inexistent in the transport sector. Today (2016) RE electricity generation in the case of Serbia is majorly provided by hydropower and to a lesser extent by wind power. It holds a share of 29% in gross electricity consumption. RE in heating and cooling also adds a considerable contribution: here off grid solid biomass is of dominance and contributes to meet roughly one quarter of the Macedonian heating demand. In total, a RE share in GFED of 21% is achieved today (2016). In total, a RE share in GFED of 21% is achieved today (2016). For meeting the given 2020 RE target (27%) a considerable increase is needed.

Assessment of future RE deployment

The 2030 RE target calculation constitutes for Serbia a RE share of 40% in 2030. Similar to other CPs this can be classified as challenging but feasible to achieve under the given circumstances. There is a vast potential of renewables waiting to be exploited, specifically in the electricity sector but also in heating and cooling. If no dedicated support for renewables is provided post 2020 this may however hardly be mobilised, cf. the projected RE deployment according to the “No Policy” scenario in Figure 200. In such case, a target gap of over 10pp is likely to manifest in Serbia. More precisely, Figure 200 shows past and expected future RE deployment in Serbia in relative terms (as RE share in GFED) (left) and in absolute terms (right) according to statistics and assessed RE scenarios. Please note that for details on the scenario definition as well as the general approach and assumptions underlying this modelling exercise section 0 of this report provides further insights.

If the RE policy ambition is increased in accordance with the postulated 2030 RE target, Serbia may achieve this solely by relying on domestic RE sources (see scenario "RE target fulfilment – without RE cooperation"). If however example regional cooperation comes into play as postulated in the scenario "RE target fulfilment – with RE cooperation", the outcomes of the modelling exercise indicate a lower RE deployment than if solely a national perspective is taken. The difference in RE generation may then be (virtually) imported from other CPs that may exceed in meeting the given 2030 RE target.

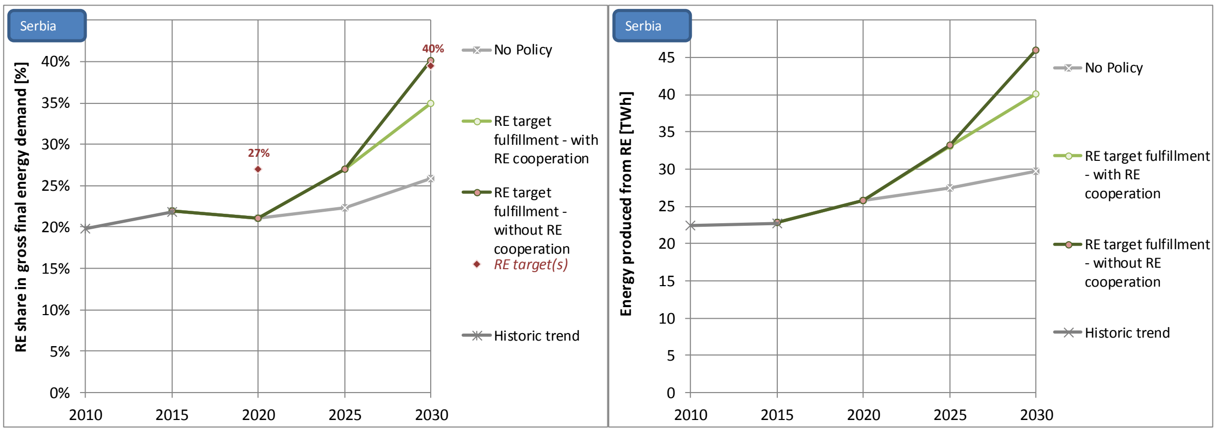


Figure 200: Past and expected future RE deployment in Serbia in relative terms (RE share in GFED) (left) and in absolute terms (right) according to statistics and assessed RE scenarios

Complementary to above, Figure 194 provides further insights on the sectorial decomposition of expected 2030 RE deployment for the scenarios assessed within the underlying modelling exercise. More precisely, Figure 194 (left) indicates the expected RE share in corresponding demand by energy sector whereas on the right hand side of Figure 194 the contribution in absolute terms is indicated. In the "No Policy scenario" the electricity and heating sector provide a roughly equal amount of RE. Yet, if the 2030 target shall be reached, the electricity sector clearly outperforms when compared to other energy sectors – here hydropower, solar PV and wind energy offer the most promising potentials. Renewables in heating and cooling only barely adds a contribution to the required increase in RE deployment. Here biomass is of dominance, followed by solar thermal (used for hot water supply) and heat pumps. Of note, in the no cooperation target fulfilment scenario, also the transport sector, contributes a significant amount to the overall target. That indicates that biomass potentials from forestry for production of renewable heat are largely exhausted.

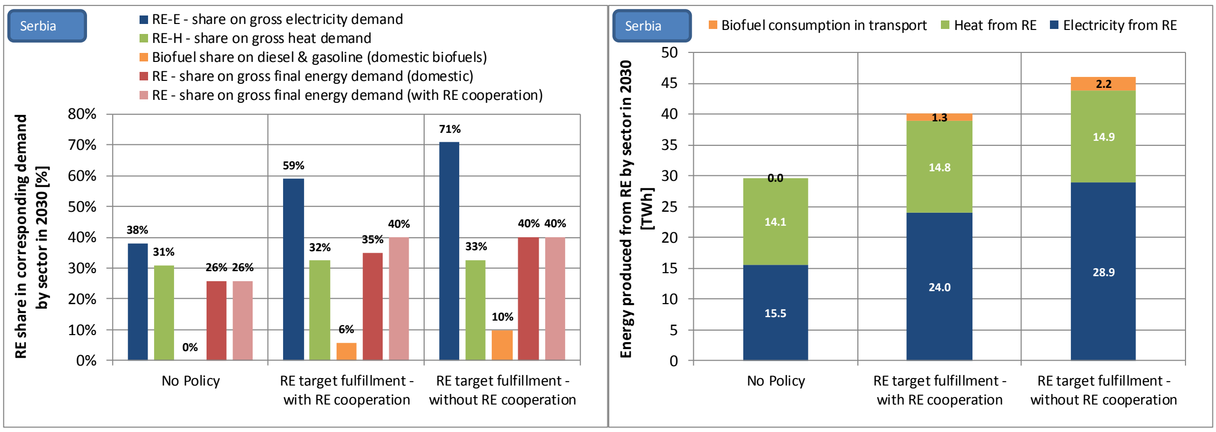


Figure 201: Sectorial breakdown of 2030 RE deployment in Serbia according to the assessed RE scenarios – in relative terms as share in corresponding demand (left) and in absolute terms (right)

Assessment of direct economic impacts

Next we provide a brief indication of resulting direct economic impacts that come along with future RE deployment. A closer look is taken at the required investments in RE installations and on the financial support that may be needed to stipulate the RE expansion. As a starting point, on the left hand side of Figure 202 the development of capital expenditures for renewables is shown for the period up to 2030. It can be seen that compared to past trends a strong increase in investments is needed for achieving the given 2030 RE target. Specifically in the period 2020 to 2030 capital expenditures are strongest in the case "RE target fulfilment – without RE cooperation" since here the strongest RE deployment is achieved. They are then roughly two to three times as high compared to the "No Policy" scenario that serves as lower boundary of expected RE developments.

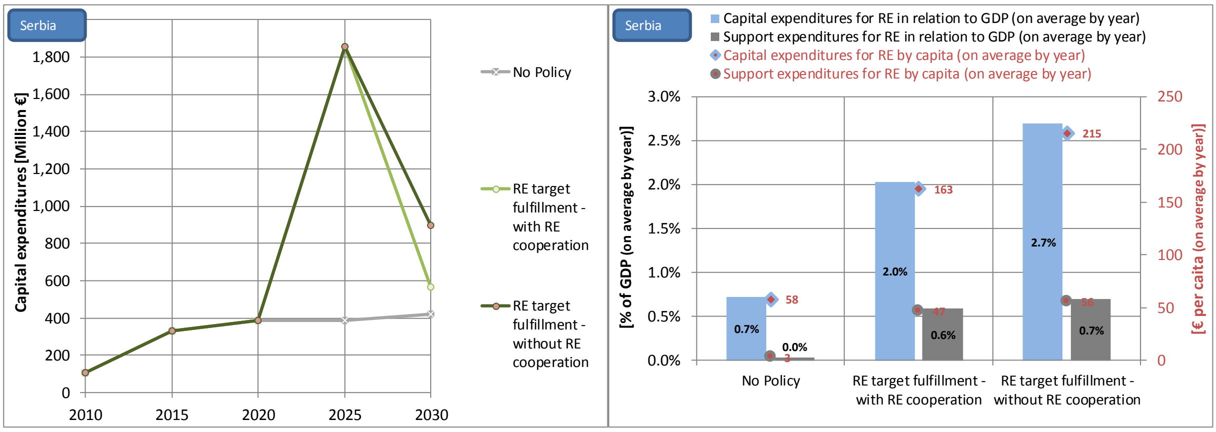


Figure 202: Direct economic impacts: development of required capital expenditures in new RE installations (left) and indicators on capital and support expenditures in relation to GDP and population (right) in Serbia

Required investments are however per se not an indication on societal cost impacts – they rather indicate the level of economic activity associated with RE developments. A closer look at cost impacts is consequently provided through another set of indicators: Figure 202 (right) shows indicators on both capital and support expenditures – here put in relation to GDP and population. In general terms, it is getting apparent that public financial support for renewables is smaller in magnitude than the required investments taken by the private sector. There is a factor of four between both. Per capita cost for providing financial support for renewables are in size of 47 to 56 € per year on average in the period 2020 to 2030. Compared to other CPs this can be classified as comparatively high.

Sensitivity assessment on the impact of EE target setting options for the RE ambition

Complementary to above, a sensitivity assessment has been performed to analyse the impact of EE target setting options on the RE ambition for Serbia. Thus, the default demand trend (that stems from the EE target setting option Baseline 32) has been complemented by a corridor of possible energy demand trends (i.e. a low and a high demand scenario), in accordance with the EE options derived in chapter 2 of this report. As illustrated in Figure 203, the results on RE deployment indicate that the expected low demand requires a significantly smaller uptake of renewables. Thus, a strong EE target as proclaimed under the Low Demand case would simplify RE target achievement for Serbia, reducing domestic deployment needs for renewables as well as corresponding costs. It can be seen that the EE target has a strong impact on the RE ambition – i.e. for example an ambitious EE target would simplify the achievement of RE targets and would also contribute to GHG target achievement. Moreover, it would help to lower the cost burden for consumer related to public RE support in large amounts.

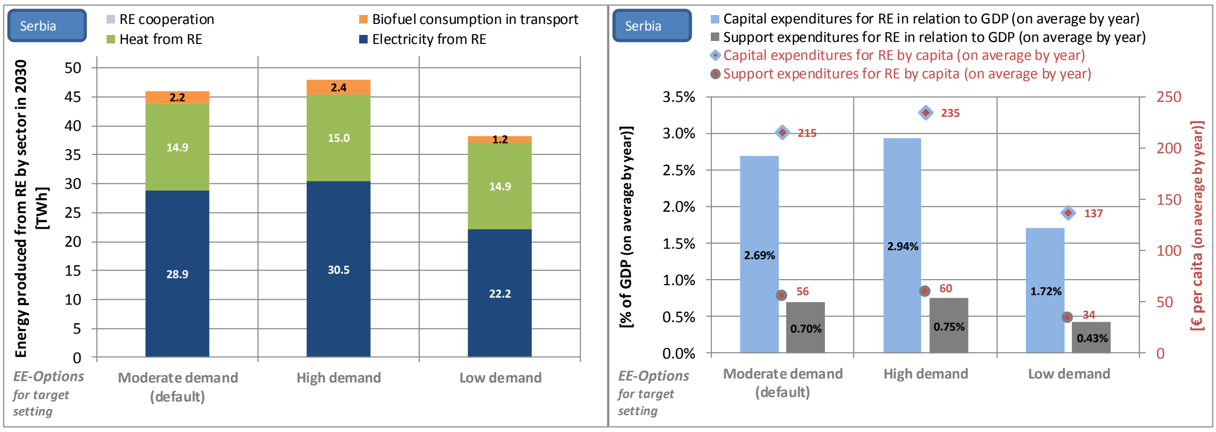


Figure 203. Sensitivity assessment on EE target setting options: Sectorial breakdown of 2030 RE deployment (left) and indicators on capital and support expenditures in relation to GDP and population (right) according to assessed scenarios for Serbia

3.4.3.9 Ukraine

Ukraine represents a country with a historically low deployment of renewables. Today (2015), compared to other CPs, Ukraine has a high RE share in transport (5.3%), which is in the same range as the ones in heating and cooling (4.6%) and electricity (5.8%). Currently (2015), Ukraine has an overall RE share in GFED of 4.3%. For meeting the given 2020 RE target (11%) a strong increase would be needed.

Assessment of future RE deployment

The 2030 RE target calculation constitutes for Ukraine a RE share of 19% in 2030. Similar to other CPs this can be classified as challenging but feasible to achieve under the given circumstances. Next, Figure 204 illustrates past and expected future RE deployment in Ukraine in relative terms (as RE share in GFED) (left) and in absolute terms (right) according to statistics and assessed RE scenarios. Please note that for details on the scenario definition as well as the general approach and assumptions underlying this modelling exercise section 0 of this report provides further insights.

If the RE policy ambition is increased in accordance with the postulated 2030 RE target, Ukraine may achieve this solely by relying on domestic RE sources (see scenario "RE target fulfilment – without RE cooperation"). If regional cooperation is applied as postulated in the scenario "RE target fulfilment – with RE cooperation", the outcomes of the modelling exercise indicate a slightly lower RE deployment than if solely a national perspective is taken.

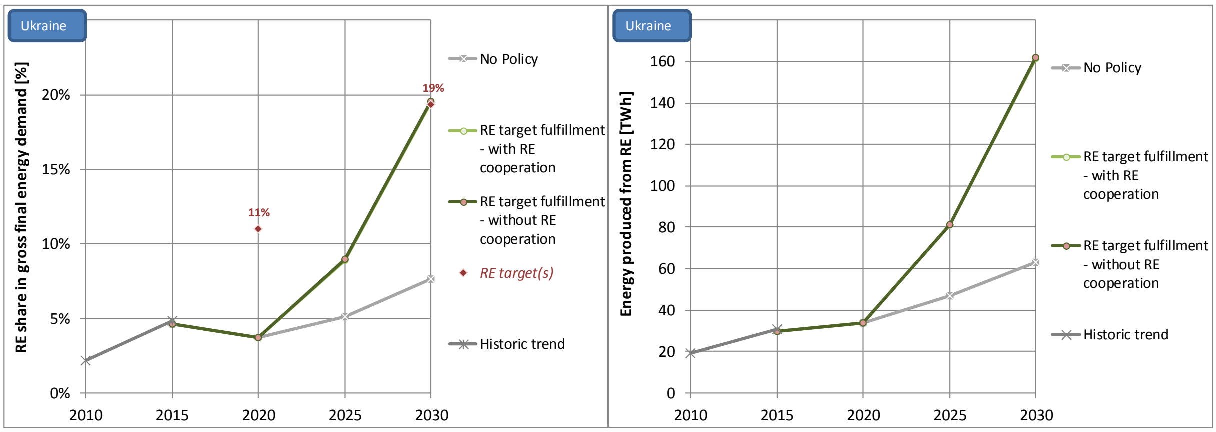


Figure 204: Past and expected future RE deployment in Ukraine in relative terms (RE share in GFED) (left) and in absolute terms (right) according to statistics and assessed RE scenarios

Below Figure 205 provides further insights on the sectorial decomposition of expected 2030 RE deployment for the scenarios assessed within the underlying modelling exercise. More precisely, Figure 205 (left) indicates the expected RE share in corresponding demand by energy sector whereas on the right hand side of Figure 205 the contribution in absolute terms is indicated. It can be seen that the electricity sector contributes in the two scenarios including policy initiatives around equally as much as the heating and cooling sector. Without dedicated policies, renewable energies will disappear from the transport sector until 2030, while target fulfilment scenarios indicate a stable share roughly 5% in 2030.

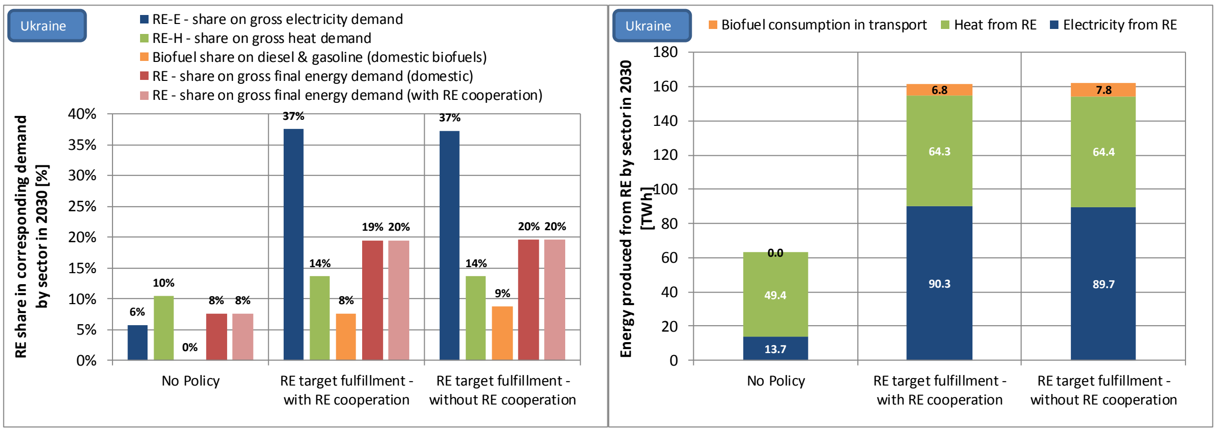


Figure 205: Sectorial breakdown of 2030 RE deployment in Ukraine according to the assessed RE scenarios – in relative terms as share in corresponding demand (left) and in absolute terms (right)

Assessment of direct economic impacts

Next we provide a brief indication of resulting direct economic impacts that come along with future RE deployment. A closer look is taken at the required investments in RE installations and on the financial support that may be needed to stipulate the RE expansion. As a starting point, on the left hand side of Figure 206, the development of capital expenditures for renewables is shown for the period up to 2030. It can be seen that compared to past trends a strong increase in investments is needed for achieving the given RE targets – both in the 2030 but also in the 2020 context. Since here the strongest RE deployment is achieved, both scenarios "RE target fulfilment – with RE cooperation" and "RE target fulfilment – without RE cooperation" require significantly higher capital expenditures than in the "No Policy" scenario that serves as lower boundary of expected RE developments.

Required investments are however per se not an indication on societal cost impacts – they rather indicate the level of economic activity associated with RE developments. A closer look at cost impacts is consequently provided through another set of indicators: Figure 206 (right) shows indicators on both capital and support expenditures – here put in relation to GDP and population. In general terms, it is getting apparent that required public financial support for renewables is around a fifth of the investments taken by the private sector. Per capita cost for providing financial support for renewables are in size of 36 to 40 € per year on average in the period 2020 to 2030. Compared to other CPs this can be classified as a moderate to high cost level.

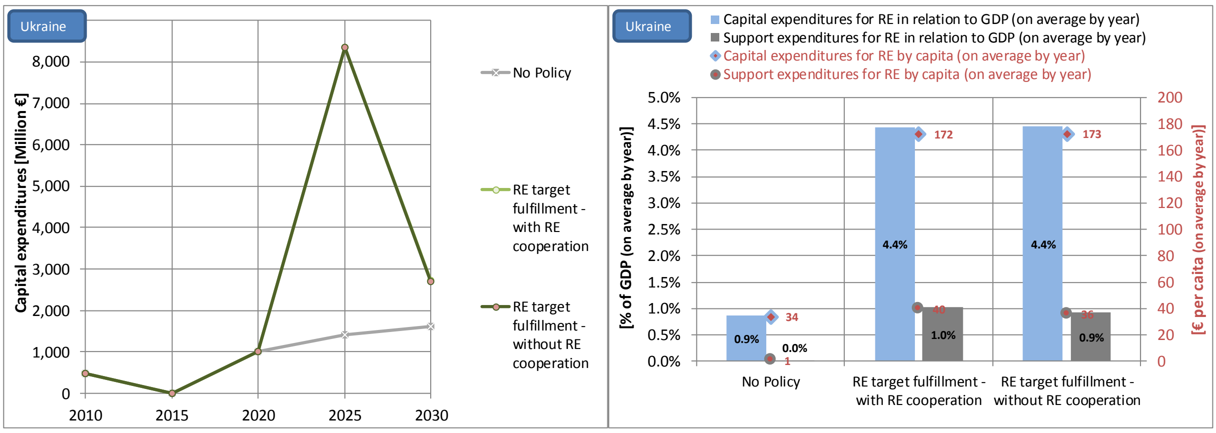


Figure 206: **Direct economic impacts: development of required capital expenditures in new RE installations (left) and indicators on capital and support expenditures in relation to GDP and population (right) in Ukraine**

Sensitivity assessment on the impact of EE target setting options for the RE ambition

Complementary to above, a sensitivity assessment has been performed to analyse the impact of EE target setting options on the RE ambition for Ukraine. Thus, the default demand trend (that stems from the EE target setting option Baseline 32) has been complemented by a corridor of possible energy demand trends (i.e. a low and a high demand scenario), in accordance with the EE options derived in chapter 2 of this report. As illustrated in Figure 207, the results on RE deployment indicate that the expected low demand requires a significantly smaller uptake of renewables. Thus, a strong EE target as proclaimed under the Low Demand case would simplify RE target achievement for Ukraine, reducing domestic deployment needs for renewables as well as corresponding costs. It can be seen that the EE target has a strong impact on the RE ambition – i.e. for example an ambitious EE target would simplify the achievement of RE targets and would also contribute to GHG target achievement. Moreover, it would help to lower the cost burden for consumer related to public RE support in large amounts.

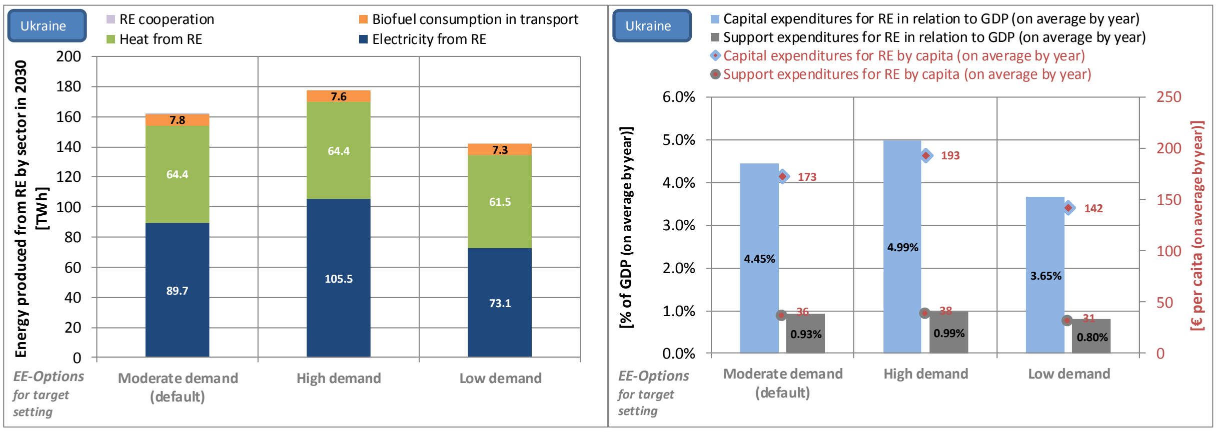


Figure 207. **Sensitivity assessment on EE target setting options: Sectorial breakdown of 2030 RE deployment (left) and indicators on capital and support expenditures in relation to GDP and population (right) according to assessed scenarios for Ukraine**

4 GHG emission reduction

4.1 Target setting at EU level

The greenhouse gas targets for the EU were set at a 20% reduction by 2020 and a 40% reduction by 2030 compared to 1990 emission levels for the EU as a whole. There have been several stages in sharing the EU emission reduction effort across sectors and the EU Member States. Specifically, GHG emission reduction targets for the EU Emissions Trading System (EU ETS) as well as for the non-ETS sectors on a national level were defined. For the non-ETS sectors, the first effort sharing for the 2008-2012 period emerged from political agreements of Member States. The second and third effort sharing for 2013-2020 and 2021-2030 were established in Decision No 406/2009/EC[14] ("Effort Sharing Decision", ESD) and Regulation (EU) 2018/842[15] ("Effort sharing regulation"). Both documents rely on a target setting approach based on modelling and GDP related formulas, which are described below (EC, 2009, EC 2016c). The ETS is established by Directive 2003/87/EC[16] ("ETS Directive"). In general terms, the EU targets are part of a trajectory to reach a GHG reduction of up to 80% by 2050 (cf. Figure 208).

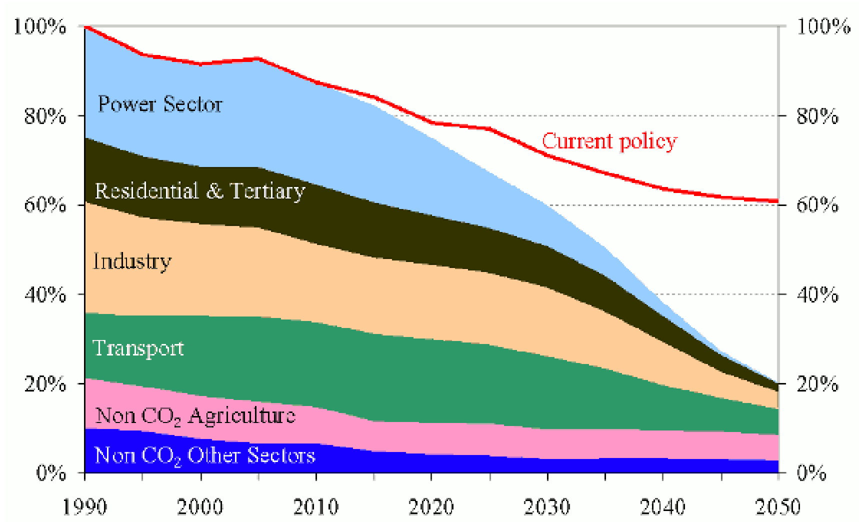


Figure 208: Long term GHG reduction pathway of the EU[17]

4.1.1 2020 GHG targets

Under the EU climate and energy package, a 20% overall GHG emission reduction target as compared to 1990 was set for 2020. The reduction effort is shared between countries and sectors. In contrast to the overall GHG emission reduction target (based on 1990), targets of individual Member States are based on 2005 emission levels because it was the only year with reliable verified emission data for both the EU ETS and the overall GHG emissions as reported to the UNFCCC (European Commission, 2008).

[14] Decision No 406/2009/EC of the European Parliament and of the Council of 23 April 2009 on the effort of Member States to reduce their greenhouse gas emissions to meet the Community's greenhouse gas emission reduction commitments up to 2020

[15] REGULATION (EU) 2018/842 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 30 May 2018 on binding annual greenhouse gas emission reductions by Member States from 2021 to 2030 contributing to climate action to meet commitments under the Paris Agreement and amending Regulation (EU) No 525/2013

[16] Directive 2003/87/EC of the European Parliament and of the Council of 13 October 2003 establishing a scheme for greenhouse gas emission allowance trading within the Community and amending Council Directive 96/61/EC

[17] https://ec.europa.eu/clima/policies/strategies/2050_de

In general, the sectoral breakdown was carried out as follows:

- Emissions not covered under the European ETS – i.e. the so-called Non-ETS sectors, including housing, transport (w/o aviation), agriculture and waste – have to be reduced by 10% on average below 2005 levels by 2020;
- Emissions related to sectors covered by the EU ETS (i.e. large-scale power and energy-intensive industry facilities, aviation) have to fall 21% below 2005 levels by 2020.

The split between the non-ETS and ETS sectors was done in a way to minimize costs according to the cost-efficient reference option described in the Commission Staff Working Document SEC(2008) 85.[18] Because emission reductions in the ETS sectors had a higher cost-efficient potential as compared to the Non-ETS sectors, a higher share of total reductions was attributed to the ETS. Combining the ETS target and national non-ETS targets results in an overall EU wide target of a 14% GHG emission reduction as compared to 2005 (equivalent to the above stated 20% reduction compared to 1990). The timeframe for target achievement was set to 2013-2020.

Non-ETS sector

-10% compared to 2005 levels

The overall non-ETS emission reduction target for the EU is 10%. National emission reduction targets for 2020 in the non-ETS sectors are regulated under the EU Effort Sharing Decision (ESD, Decision No 406/2009/EC). Under this decision, six greenhouse gases are covered: carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF_6). The non-ETS sectors cover emissions from housing, transport (except aviation), agriculture and waste. Emissions from land-use, land-use change and forestry (LULUCF) are excluded.

The national reduction targets of Member States were determined as a function of their 2005 GDP per capita. Member States with a GDP per capita above the EU average were obliged to reduce non-ETS emissions to an extent exceeding the EU average, those with a GDP per capita below the EU average are obliged to limit non-ETS emissions to an extent below the EU average reduction. In some cases, individual Member States with a very low GDP per capita and thus a strong need for economic growth in a longer term obtained the permission to increase emissions to a defined extent. These allowed emission increases are capped to a maximum of +20% compared to 2005 levels for the lowest income country but still represent an emission reduction effort compared to 1990. At the other end, emission reductions were capped with a maximum of -20% for the wealthiest country. The emission targets of the other Member States were set according to the relative position of their GDP per capita using a function between the EU average and the minimum and maximum reductions (see Figure 209). Thus, individual Member State targets range from -20% to +20%. On average, the EU reduction targets sum up to the above stated reduction target of -10% compared to 2005 levels for the non-ETS sectors.

In order to meet their emission targets, each Member State committed to binding annual GHG emission limits (capped by the annual emission allocations, AEAs) following a linear path from 2013 to 2020. In the Member States that are required to reduce their GHG emissions by 2020, 2013 emissions were not allowed to exceed the average annual emissions of the 2008-2010 period. In Member States that must keep emission growth within a boundary, 2013 emissions were not allowed to exceed the level arising from a linear path calculated from 2009 to 2020 (according to the business as usual scenario).

To ensure a fair and cost-effective achievement of annual GHG levels, the effort sharing decision provides various flexibilities:

- Up to 5% of AEAs are allowed to be traded between Member States (buying and selling)
- Until 2019 Member States are allowed to access up to 5% of AEAs allocated to the subsequent year in advance (borrowing)

[18] SEC(2008) 85, COMMISSION STAFF WORKING DOCUMENT, IMPACT ASSESSMENT Document accompanying the Package of Implementation measures for the EU's objectives on climate change and renewable energy for 2020

- When annual emissions are lower than binding annual GHG emission limits, Member States are allowed to use any surplus in later years (banking)
- In 2013-2014 Member States could apply for a 5% increase in AEAs for increased emissions resulting from extreme weather conditions
- Member States may use credits from project activities undertaken in countries outside the EU (Kyoto protocol mechanisms CDM & JI). Generally, these credits are not allowed to exceed 3% of Member States GHG emissions in 2005. For certain Member States this percentage is increased by 1% for projects carried out in least developed countries and small island developing states.

ETS sector

In the third phase of the EU ETS applying to the period 2013-2020, an overall EU ETS target replaced national target settings. Three greenhouse gases are covered: carbon dioxide (CO_2), nitrous oxide (N_20) and perfluorocarbons (PFCs).

The EU ETS thus sets an overall cap on the total amount of GHG emissions from all installations covered by the system (more than 11,000 heavy energy-using power and industry facilities & airlines). Each year, the cap is reduced by 1.74% representing an emission reduction of approx. 21% by 2020 compared to 2005. Thereby, about 60% of the EU's emission reductions are to be achieved within the EU ETS. [19]

Generally, emission allowances are allocated by auctioning and can be traded between covered installations. CO_2 emissions from aviation have been included in the EU ETS since 2012.

4.1.2 2030 GHG targets

For 2030, a 40% GHG emission reduction target as compared to 1990 was endorsed in the European Council conclusions of 23 and 24 October 2014[20] and reaffirmed in the European Council conclusions of 17- 18 March 2016[21]. Using 2005 as a base year, a GHG reduction of 30% in the non-ETS sectors and of 43% in the ETS sectors needs to be achieved. The timeline for target achievement is 2021-2030.

Non-ETS sectors

-30% compared to 2005 levels

Limits for emissions from the non-ETS sectors in the period 2021-2030 are regulated by the Effort Sharing Regulation (ESR, Regulation (EU) 2018/842[22]). The ESR covers the same sectors as the ESD, but the greenhouse gas nitrogen trifluoride (NF_3) is included in addition.

Generally, to calculate effort sharing targets, the ESR uses the same methodology as the ESD. Differentiation in efforts is based on relative differences of the respective GDP per capita of Member States. However, the methodology has been expanded, and benchmark values and limits were adjusted.

First, GDPs per capita of 2013 are used for target calculation and the EU average target for the non-ETS sectors changes from -10% to -30%.

[19] SEC(2008) 85, COMMISSION STAFF WORKING DOCUMENT, IMPACT ASSESSMENT Document accompanying the Package of Implementation measures for the EU's objectives on climate change and renewable energy for 2020

[20] EUCO 169/14, European Council (23 and 24 October 2014) – Conclusions

[21] https://www.consilium.europa.eu/en/press/press-releases/2016/03/18/european-council-conclusions/

[22] REGULATION (EU) 2018/842 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 30 May 2018 on binding annual greenhouse gas emission reductions by Member States from 2021 to 2030 contributing to climate action to meet commitments under the Paris Agreement and amending Regulation (EU) No 525/2013

Second, the upper and lower emission limits are set at 0% and -40% compared to 2005 levels (instead of the range +20% to -20% in the period 2013-2020). Thus, the ESR bans further emission increases for all Member States (see Figure 209 for comparison with the 2020 targets).

Third, in order to reflect cost-effectiveness for all Member States, adjustments to targets for high-income Member States (Member States with a GDP per capita above the EU average) are made. For high income Member States, a target setting based on GDP per capita solely results in reduction requirements exceeding their cost-effective reduction potential. This gap between the cost-effective and the more ambitious target varies quite significantly between high-income Member States (from -5% to +30%). Required ambitions for Member States with a high gap between the cost-effective potential and the calculated target based on GDP per capita are therefore lowered. To ensure the overall EU target achievement of -30%, this reduction is compensated by required higher ambitions of Member States with a low or even a negative gap between the cost-effective potential and their target based on GDP per capita. For the exact quantification of the adjustment different options were proposed (Impact assessment accompanying the proposal for an Effort Sharing Regulation 2021-2030, p. 46[23]).

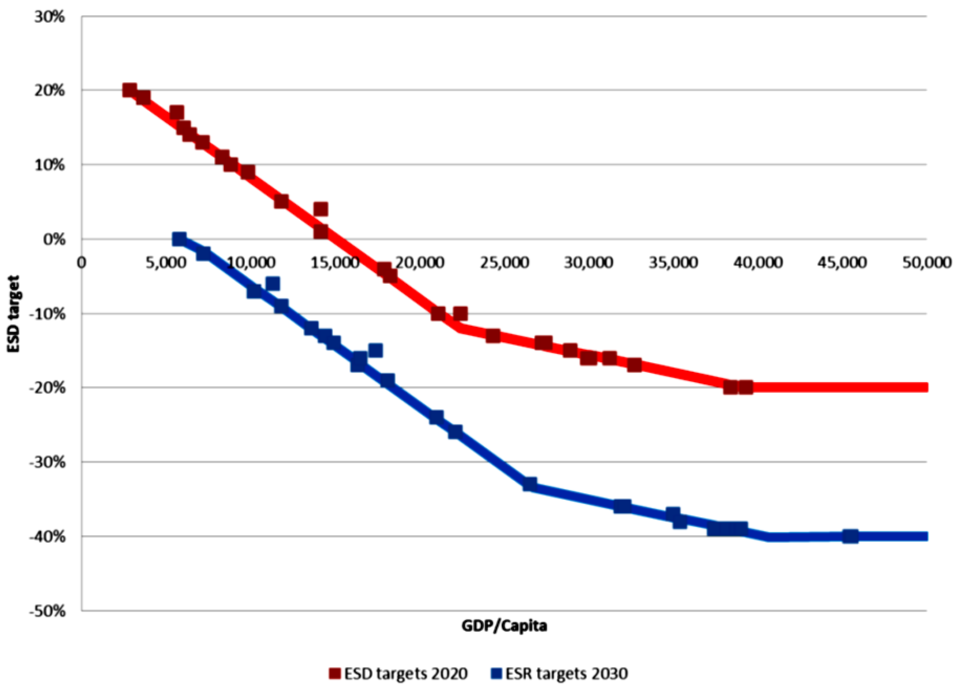


Figure 209: National effort sharing targets for 2020 and 2030 (Source: European Commission, 2016[24])

Similarly to the approach for the 2020 targets annual GHG emission limits were determined as linear trajectory up to 2030. However, the starting point for the trajectory should be set using average emissions of the most recent inventory years available in 2020. In 2020, emission data will be available up to 2018. Thus, as a starting point, the average of 2016-2018 emissions should be used. Finally, new flexibilities for target achievement were introduced and existing flexibilities were adjusted. The following major changes to the flexibility options were introduced:

- Some Member States are allowed to use EU ETS allowances, which would normally have been auctioned, for target achievement in the non-ETS sector. However, the total transfer between EU ETS and non-ETS is limited to a total amount on EU level of 100 million tonnes CO_2-equivalent (CO_{2eq}) over the

[23] COMMISSION STAFF WORKING DOCUMENT - IMPACT ASSESSMENT Accompanying the document: Proposal for a REGULATION OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL on binding annual greenhouse gas emission reductions by Member States from 2021 to 2030 for a resilient Energy Union and to meet commitments under the Paris Agreement and amending Regulation No 525/2013 of the European Parliament and the Council on a mechanism for monitoring and reporting greenhouse gas emissions and other information relevant to climate change SWD(2016) 247 final

[24] ibid

whole period. Eligible Member States have to announce their foreseen use of this flexibility before 2020. Eligible Member States are countries with reduction targets significantly above the EU average as well as countries not having free allocations for industrial installations in 2013 ("one-off flexibility between ETS and non-ETS").

- In the whole period, up to 2030, Member States are allowed to use emission reduction credits from the land use sector equalling 280 million tonnes CO_{2eq}. While all Member States are allowed to fall back on this flexibility option, access is higher for Member States with a high share of emissions from agriculture.
- Further banking, borrowing, buying and selling of emission allowances as stated in the ESD are maintained. However, as the EU has set a domestic 2030 target, the use of credits from project activities undertaken in countries outside the EU (e.g. CDM & JI projects) will be no longer valid and are planned to be eliminated from flexibility options. Any surplus of annual emission allowances from the period 2013-2020 expires, i.e. a carry over to the period 2021-2030 is not allowed.

ETS sectors

The new framework for the ETS is defined in the revised directive on the EU emissions trading scheme ((EU) 2018/410[25]). From 2021 to 2030 the annually allocated amount of emission allowances will decrease by 2.2% as compared to 1.74% up to 2020. This corresponds to a reduction of 556 million tonnes of CO_{2eq} emissions in the ETS sectors over the period 2012 to 2030. An additional instrument, the Market Stability Reserve was introduced, in order to keep the ETS emission units in a more balanced trajectory. This reserve will allow withdrawing excess allowances from the ETS market.

The directive further develops some rules to address the risk of carbon leakage. This includes free allocation to focus on the sectors at the highest risk of relocating their production outside the European Union.

Prerequisites for target setting according to the EU methodology

The following prerequisites in terms of data and frame conditions would be required in order to carry out a target setting and achievement approach similar to the EU:

- GHG data: For national target setting, 2005 emissions data is required as the reference.
- GDP data: GDP per capita data for 2005 (2020 target) and 2013 (2030 target) is required.
- Individual industrial plant level emissions data is required in order to allow for the split between ETS and non-ETS sectors.
- Regional economic modelling is required for the cost-efficient optimization of the target split between the ETS and non-ETS sectors (compare EC, 2008).
- In order to achieve ETS targets in the same way as in the EU, a functioning ETS would be required to allow for actual trade and cost-efficient target achievement. In addition, an ETS would require robust governance including the introduction of reliable registries. Alternatively, other mechanisms such as carbon prices may be implemented for the achievement of sectoral emission targets.
- Described flexibilities for the non-ETS sectors and between ETS and non-ETS sectors would need to be designed.

Critical reflection and applicability for the EnC and/or its CPs

Generally, in order to allow consistency with EU targets, the methodology for GHG target setting for the CPs should aim to stay as close to the structure and approach used in the EU as possible, with deviations only where needed and appropriate. Therefore, as a first step, some general considerations on the transferability of the EU approach are discussed based on the above described preconditions. In the subsequent chapters, the actual methodological options and proposals, as well as the available data in the CPs, are presented.

[25] DIRECTIVE (EU) 2018/410 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 14 March 2018 amending Directive 2003/87/EC to enhance cost-effective emission reductions and low-carbon investments, and Decision (EU) 2015/1814

- GHG data: data is available for the same years as in the EU, only for Kosovo*[26] 2005 data is lacking and therefore 2008, the first year with available data, is used as a base year. However, the accuracy of data is low in some countries. Land-use data is too uncertain in the CPs to be considered for the 2030 target.
- GDP data: data is available for the same years as in the EU.
- Individual industrial plant level emissions: data availability and quality are very limited. Even though a sectoral split may be undertaken, the proof of target achievement and the (potential) allocation/auctioning and use of emission allowances requires detailed installation level data. In addition, lack of data hinders national level decisions on the potential exclusion of installations as foreseen in the EU ETS (e.g. installations emitting less than 2 500 tonnes of carbon dioxide equivalent in each of the three years preceding the beginning of each allocation period).
- Regional economic modelling: a similar analysis as for the EU (EC, 2008) is not available for CPs. Thus, an overall cost-efficient target distribution between the ETS and non-ETS sectors in the CPs cannot be addressed in this study. However, costs of potential measures can be covered to some extent in order to provide insights into relative, cost-related efforts required for national target achievement. Assuming that the national bottom-up mitigation strategies are based on cost-efficient measures, these strategies provide implicit information on cost-efficient emission reduction pathways.
- ETS: the current absence of the EU-ETS in the EnC region is a fundamental difference to the EU. However, countries could implement national or regional trading systems. Alternatively (or in addition), in absence of an ETS, for instance a carbon price via a CO2 tax could be implemented in the ETS sectors. Also, in order to achieve “EU ETS readiness”, the split of the non-ETS and ETS sectors can be considered a value added.
- Flexibilities: the flexibility options available to Member States in the non-ETS sectors could currently only partially be translated on CP level. Specifically, the use of EU ETS allowances for the non-ETS sectors would first require the introduction of an ETS. Similarly, AEA trading between countries would require an introduction of a regional trade system. The use of the land use flexibility is strongly constrained by the data quality in this sector.

Major additional questions are whether the EnC’s overall targets (total, ETS, non-ETS) should correspond to the EU 2020 or 2030 top-down regional reduction targets and whether the same methodology for effort-sharing in the non-ETS sectors should be applied to CPs. In the latter case, the effort sharing distribution shown in Figure 209 would need to be applied to the range of per capita GDPs in the EnC in a reasonable way. Full application of the EU 2030 rules applicable to the non-ETS sector would exclude emission increases for any CP over the period 2021-2030 compared to 2005. Given that the GDP/capita levels of the CPs are much lower as compared to EU MS, this may result in a disproportionally high burden for the CPs (see presentation of GDP data and further elaboration in the options for target setting below).

Choice of base years

Accounting for past emission trends has been part of effort sharing discussions. Hungary, in 2008, proposed to use the base year 1990 instead of 2005 as the basis for EU effort sharing. This would have allowed the new MS to count the emissions reductions due to the economic recession during the 1990s towards their targets, reducing the need for targeted emission reduction measures. While also improved efficiencies of their economies may have led to more permanent emission reductions, a separation of the economic recession from efficiency restructuring was not feasible (Novikova et al. 2008). Finally, the use of 1990 as a base year was rejected on European level and 2005 emissions levels are applied instead. Thus, for the CPs, a 1990 base year would not be in line with the EU framework. Also, the database for 1990 is weak; all CPs were non-Annex-1 parties under the UNFCCC with lower requirements regarding their emissions inventories than Annex-1 counties.

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

***Example:** Croatia's EU accession and the EU effort sharing*

Croatia joined the European Union in 2013. Croatia's Accession Treaty stipulated that the Effort Sharing Decision (ESD) shall be amended to include Croatia's target. According to the EU non-ETS methodology, by 2020, Croatia can increase its emissions not covered by the EU ETS by 11% compared to 2005. For the ETS sectors defined in Article 9 of the EU ETS directive it was laid down that "The Community-wide quantity of allowances will be increased as a result of Croatia's accession only by the quantity of allowances that Croatia shall auction pursuant to Article 10(1) (see Ohlendorf et al 2017)." Thus, due to the relatively low impact of Croatia's accession, the overall EU approach could be maintained, and no modification of EU internal effort sharing was made. Already before its EU accession, Croatia introduced a national ETS to prepare ETS installations for EU-ETS entry. Even though the system was small and had very limited liquidity, the system allowed the involved companies to gain experience with an ETS. Comparable approaches may be thought of for the EnC region as well in order to facilitate ETS accession. Alternatively, carbon pricing may be simpler to implement especially in the short-term.

4.2 Options for GHG target setting for the CPs

The following options are based on the paradigm of consistency with the EU methodological approach to target setting and take into account the economic situation of the EnC countries (following the "GDP fairness" approach of the EU for burden sharing). Although the present assessment focuses on the 2030 GHG targets, CPs should extend their vision to the 2050 EU decarbonisation goal, and regard the 2030 target as an intermediate step on this pathway. In the longer term, however, and in light of potential EU accession, they will need to converge to the common EU GHG reduction efforts. As Figure 208 above shows, the envisaged emission reduction trajectory becomes steeper after 2030, and more effort would then be required also from the CPs.

In the following, the potential and proposed methodological options for target setting in the EnC region are presented.

4.2.1 Top-down target setting

As top-down target setting we understand the definition of a regional target (either for the entire economy or, separately, for the ETS and non-ETS sectors) in a first step, potentially followed by a breakdown to national targets. In this section we focus on the potential adoption of a top-down regional target for the entire economy, i.e. a target corresponding to the 20% (2020) or 40% (2030) in the EU (compared to 1990). As indicated above, the question of whether to adopt the EU 2020 or 2030 GHG reduction target is the starting point of our analysis. A prime consideration, also reflected in the EU burden-sharing, is the economic situation of countries in terms of GDP per capita indicating the economic capability for emissions reduction. On the level of the entire region, a comparison of the regional average EU and EnC GDP per capita and, for deeper analysis, national level GDPs per capita provides an indication of the relative economic situation. Table 81 and Figure 210 provide an overview of the EU and EnC GDP per capita for both 2005 and 2013 in line with the years chosen for the EU burden-sharing approach. On national level, Bulgaria's GDP per capita is shown for comparison because it represents the lowest value for the EU and thereby is closest to the EnC countries. The table shows that most EnC countries in 2005 and all EnC countries in 2013 have a GDP per capita below that of Bulgaria. Especially, Ukraine, Georgia and Moldova have a significantly lower GDP/cap. These countries and Kosovo* are even below the 2005 GDP/capita level of Bulgaria. Albania and Bosnia and Herzegovina are only slightly above the 2005 values of Bulgaria. The average of the EnC region is significantly below the values for Bulgaria (in particular in 2013) and represents about only one-tenth of the EU average (23 400 in 2005 and 26 800 in 2013) for both years. Therefore, adopting the 2030 EU regional target for the entire economy 1:1 would not reflect economic realities and would lead to significantly higher efforts as compared to Bulgaria.

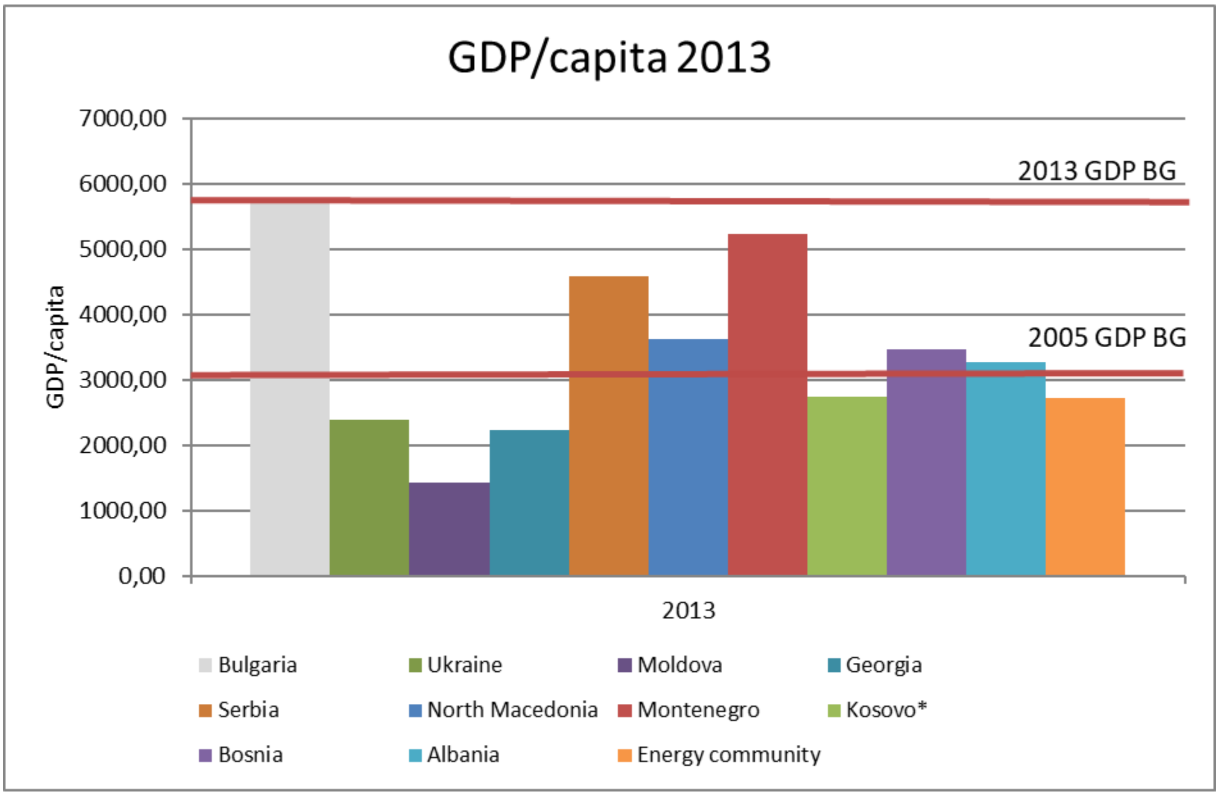


Figure 210 2013 GDP/capita of CPs in comparison to the EU average and Bulgaria for the years 2005 and 2013

Table 81 GDP/capita of CPs in comparison to the EU average and Bulgaria for the years 2005 and 2013

	GDP/capita [€]		Source
	2005	**2013**	
EU average	23,400	26,800	Eurostat (and IMF for EnC average)
EnC average (entire region)	2,285	2,717	
EU lowest GDP/capita (Bulgaria)	3,100	5,800	
Montenegro	4,105	5,234	
Serbia	3,653	4,276	
North Macedonia	2,872	3,614	
BIH	2,932	3,424	
Albania	2,304	3,264	
Kosovo*	1,724	2,737	
Moldova	1,040	1,430	IMF
Georgia	1,575	2,737	
Ukraine	2,150	2,397	

An alternative approach could be to define a less stringent, GDP per capita weighted, regional target. This could be defined based on the average GDP/capita in the EnC region as compared to the EU GDP per capita with the EU target as a basis. Following the discussion on the base year above, 2005 should be taken as the base year.

An advantage of this approach would be the direct comparability with the overall EU target. The down-scaling of the EU target to the EnC region and, subsequently, a burden sharing between the CPs would require a suitable GDP-related methodology. In the easiest case, a proportional correlation between the EU and the CPs regional targets and, subsequently, for the target sharing between the CPs could be applied (with or without differentiation of ETS and non-ETS sectors). On regional level, given that the overall GDP per capita of the CPs is only about 10% of the EU, this would equally result in a reduction target of one tenth of the EU target (comparison with the results in section 4.4.10 on a regional target shows that this would be much lower as compared to the other options). Correspondingly, on country level, a country with half the GDP per capita of another country would also have to achieve only half the reduction effort in relative terms or have the right to twice the emissions increase (e.g. a reduction of -5% versus -10% or an increase of +20% vs. +10%). This approach may be too simplistic and would also not be in line with the EU methodology; burden sharing in the EU non-ETS sectors was the result of negotiations and substantial analysis leading to the application of maximum and minimum emission increase/reduction ceilings, and different correlations between GDP and national targets. This effort cannot be replicated in the context of this study. Thus, we do not attempt to apply "GDP fairness" in the framework of a top-down approach, in particular for the overall regional target.

For a potential split between the ETS and the non-ETS sectors, the encompassing economic modelling as applied in the EU is lacking for the EnC (in contrast to renewable energy and energy efficiency). Therefore, as an alternative approach, the use of bottom-up data provided by national studies is of high relevance for insights on economically efficient measures (see further below). This, however, is not compatible with the application of a top-down target setting. Our preferred approach, therefore, is a bottom-up approach building on the EU methodology that would establish comparability of efforts on country level as a starting point (see explanations in the following). For comparison, we however apply the full adoption of the overall EU target in the section on a regional target (section 4.4.10).

4.2.2 *Bottom-up GDP related target setting*

As compared to the above explained top-down approach, the bottom-up approach would consist in defining national targets first which can then be aggregated to a regional target. Two different options exist: defining national targets for the entire economy or defining separate targets for the ETS sectors and the non-ETS sectors separately.

Option 1 national target based on separate targets for ETS and non-ETS sectors

The split between ETS and non-ETS sectors would correspond to the EU approach. As discussed above, limitations apply because no ETS is in place and the data basis on installation level is strongly limited. At the same time, national studies indicate potential emission reductions in the power and industry sectors, which could be used. Calculating targets separately, independently from their enforcement, allow for better comparability with the EU effort undertaken in the ETS and non-ETS sectors, and would be a basis for the introduction of suitable sectoral policy instruments (e.g. carbon tax, national/regional ETS). An ETS/non-ETS split can be done indicatively based on the national communications, in which some sectors are clearly non-ETS (waste, agriculture, buildings, transport), while other sectors are clearly ETS (power sector, industry) according to UNFCCC classification as presented in Table 82. Manufacturing industries are added to the ETS in our approach, however, there may be companies that fall below the ETS emissions threshold.

Table 82 ETS/non-ETS split based on UNFCCC classification

Sector	Sub-sector	ETS/non-ETS
Energy	Energy industries	ETS

	Manufacturing industries	ETS
	Transport	Non-ETS
	Other sectors	Non-ETS
	Fugitive Emissions from Fuels	ETS
	Oil and natural gas	ETS
Industry		ETS
Agriculture		Non-ETS
Waste		Non-ETS

For the ETS sectors, as the consortium has no models available to cover all sectors in all CPs, the approximation will be limited to assessing available modelling estimates (based on literature review mainly from national sources) and studies covering the electricity sector, which is one of the most important ETS sectors and, as far as possible, the industry sector. For most countries, national projections are available for a BAU Scenario and a mitigation scenario. For the purpose of this study, the estimations for the ETS sector are based on the mitigation scenario. If more than one mitigation scenario is available the most reasonable and likely scenario is used. For the electricity sector, models and recent studies (e.g. SEERMAP, SLED) will be used. This assessment provides an indication of ranges of reduction efforts in the CPs power generation under various ETS assumptions (e.g. on carbon price ranges). In addition, this model assessment can provide indications on the impact of emissions of the power sector in case new fossil-based generation units are operationalised during the period 2018- 2030. Depending on data quality and sectoral differences between countries, this may result in different sectoral splits of the contracting parties, and the assessment is limited to the CPs where data availability is sufficient.

For the non-ETS sectors, in order to reach consistency with the EU approach, we apply a GDP related method based on EU burden sharing. However, as discussed above and shown in Table 81, most CP's GDP per capita is significantly below the lowest EU value (Bulgaria). Montenegro, representing the highest GDP per capita in the region, is relatively close to Bulgaria's values. Thus, for Montenegro, we assume that defining a target on the same ground as for Bulgaria may be appropriate. For this reason, we suggest using the 2030 burden-sharing approach presented above for Montenegro (implicitly adopting the EU 2030 overall target). This would lead to the minimum effort according to this approach representing a zero emissions increase compared to 2005. For the other countries, in contrast, following this approach would equally lead to this same target (no increase) which does not seem to be appropriate given their low GDP per capita. Due to the need for economic recovery that was embedded in the 2020 methodology by allowing emission increases we consider this approach more appropriate for the CPs with a lower GDP per capita. All CPs would be at the lowest end of the EU GDP per capita scale on the presented effort sharing graph. Therefore, and in order to represent both the 2020 and 2030 approach, we suggest merging these approaches by establishing a gradient between the "zero increase" target for 2030 (applicable for Montenegro that has the closed GDP to Bulgaria in 2013) and the +20% target for 2020 applicable for CPs with a GDP/capita below Bulgaria in 2005 (Kosovo, Georgia, Ukraine and Moldova). The least ambitious targets from the 2030 non-ETS framework and the 2020 non-ETS methodology thus set the basis as a start and end point for establishing a linear GDP-target correlation (Figure 211). This would result in a gradient in national ambition levels moving from the stricter 2030 methodology based targets to the less ambitious 2020 methodology based targets. We refer to this approach as Option 1a or (20%-0% range target setting. In addition, we introduce an Option 1b with an intermediate lower target. For Option 1b, the same methodology is applied, however, instead of a 20% increase for the least ambitious target, only +10% is allowed in this option. Therefore, in Option 1b a gradient between 0% and +10% is created (further referred to as 10%-0% range). The calculation method for the ETS sector remains the same as in Option 1a.

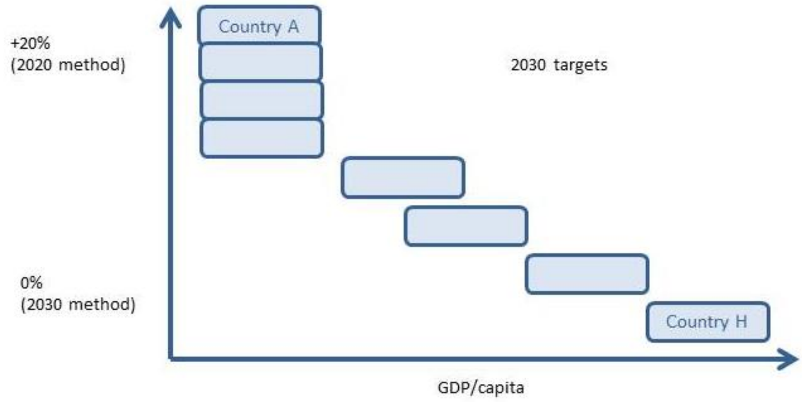


Figure 211: GDP based target differentiation among CPs

Overall, our target setting approach would not require emission reductions from CPs in the non-ETS sectors up to 2030 compared to 2005 levels but still represent emission reductions compared to 1990 (see presentation of results below). This is due to the strong economic decline in the 1990s from which the region has only partly recovered so far. For GHG emissions 2005, and for GDP/capita 2013 is used as the base year in accordance with the base years of the EU methodology. For Kosovo*, 2005 emissions data was not available to us. For that reason, we base our target calculation on the first year with officially available data, namely 2008.

Option 2 One economy-wide target for all sectors

The starting point would be national GDP-related targets for the entire economy adopting a methodological approach comparable to the one used for the determination of EU Member State non-ETS efforts (see explanation above). Option 2a would, therefore, refer to the non-ETS Option 1a approach (gradient between 0% and 20%) and Option 2b to the Option 1b non-ETS methodology (gradient between 0% and +10%), with the difference that the resulting target is applied to the entire economy. As opposed to Option 1 and the EU approach, a split between ETS and non-ETS sectors would not be required. This method would thus be simple to apply and assume that all sectors of the economy are "non-ETS". On the flip side, "EU ETS readiness" as discussed above would be more difficult to achieve. In addition, national studies of relevance for the ETS sectors are available which provide valuable insights into the potential (economically feasible) emission reductions. These would not be considered in a generic economy-wide target setting.

4.2.3 Hybrid top-down (ETS) and bottom-up (non-ETS) target setting (Option 3)

As discussed above, we suggest not breaking down a top-down target to the national level. Also, under the assumption that a regional system would be in place (or that countries join the EU), such break down is not required for the ETS sectors. A regional ETS target would correspond to the situation in the EU and thus would be most consistent with the EU approach. Therefore, we consider a top-down target for the ETS sectors in combination with a bottom-up approach for the non-ETS sectors as discussed above (Option 1a).

In order to provide insights into comparability with the EU 2030 target, we apply the target of -43% emission reduction as compared to 2005 to all analysed (sub-)regions (all CPs, CPs without Ukraine, WB6).

4.2.4 Consistency with EE and RES targets

Setting RE and EE targets/benchmarks importantly impacts GHG emissions as well. The corresponding CO_2 reduction can be quantitatively assessed with the Green-X model providing an important methodological basis for GHG target setting next to GDP fairness considerations. With the help of Green-X, the GHG reductions resulting from RE/EE target setting were calculated and help to assess the feasibility of our GHG target setting approaches (see Table 95).

4.3 Available data and trends in the Contracting Parties

This section gives an overview of the data available in the CPs that is required to follow the above presented methodological options. For the GDP-based national target setting comparable to the EU approach, historical trends of GHG emissions and GDP per capita of CPs are required. GDP per capita was already presented above.

4.3.1 Historical trends of GHG emissions and carbon intensities of CPs and EU member states

The analysis of the historical trends is based on the GHG emission data reported under the UNFCCC framework (based on the latest National Communications),. Kosovo* is not a member of the UNFCCC and therefore historic GHG emission data is based on the Kosovo* Climate change strategy 2014 and the governmental document ”Greenhouse Gas Emissions in Kosovo* 2014-2015”. For comparison with the EU, GHG emissions data was taken from the Eurostat database. GDP data is based on EUROSTAT for most countries. GDP data for Georgia, Moldova, and Ukraine are retrieved from the IMF database (see overview of data sources in Table 83).

Table 83. Data sources

	Country	Source
GDP	AL, BO, KO, MD, MK, RS	Eurostat (constant 2010 €)
	GE, MD, UK	IMF
	EU	Eurostat (chain-linked volumes, 2010)
GHG	AL, BO, MD, MK, GE, MD, UA	UNFCCC
	RS	Second National Communication (SNC)
	KO	Kosovo* Climate change strategy 2014
	EU	Eurostat (EEA)

Figure 212 and Figure 213 show the emission profiles for the CPs.

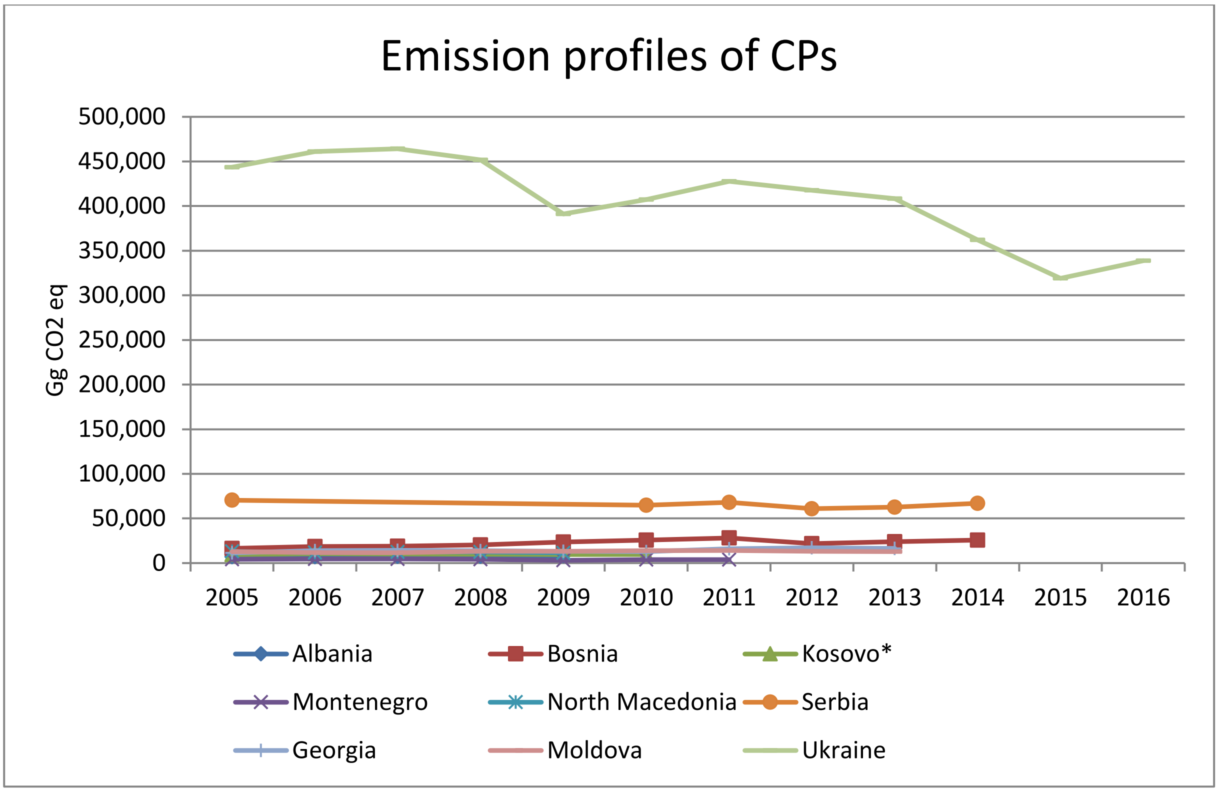


Figure 212 Emission profiles of CPs

Based on this data, the indicator GHG/GDP (carbon intensity) is derived representing an important basis in analyzing and comparing historic trends of CPs and EU Member States. Figure 214 show the development of carbon intensities in the region, including a comparison with the EU. Ukraine, followed by Moldova, have by far the highest GHG/GDP indicator, Albania shows the lowest value for the EnC region. The comparison with the EU trend shows that most Contracting Parties are far from reaching a comparably low level of carbon intensity (Figure 214).

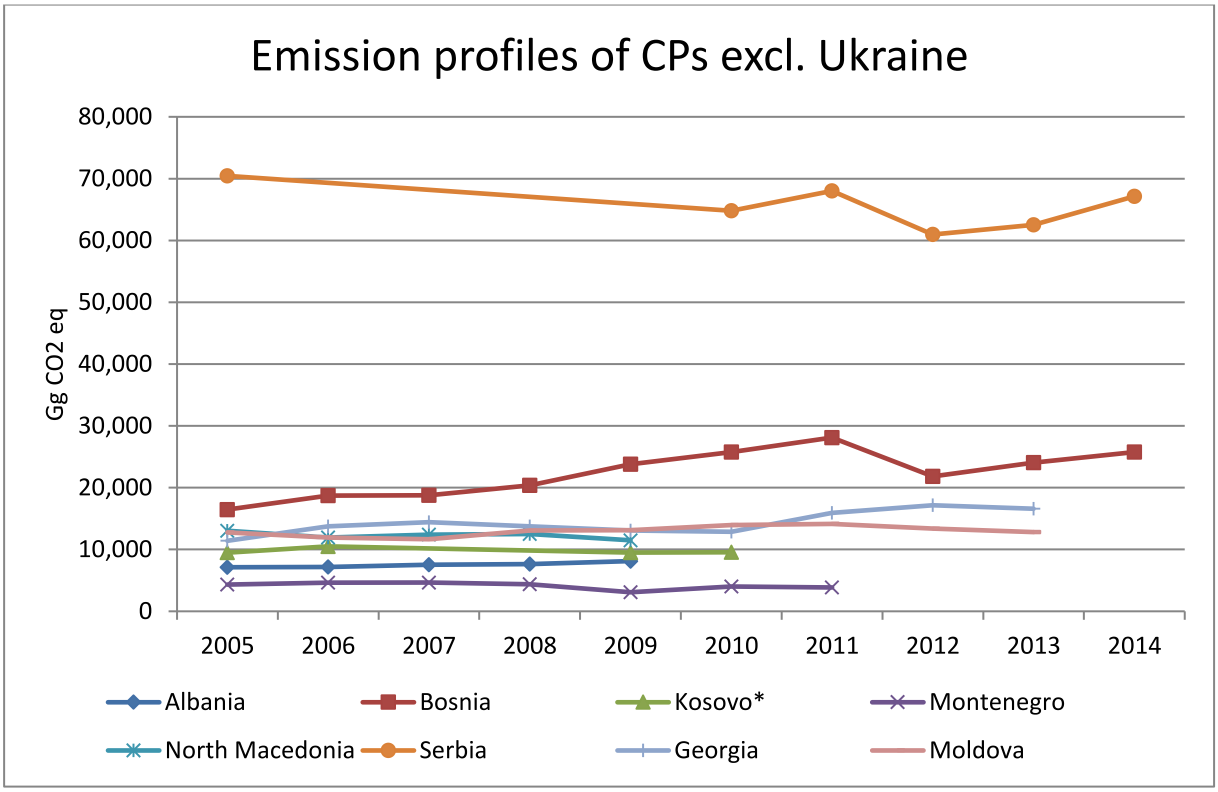


Figure 213 Emission profiles of CPs without Ukraine

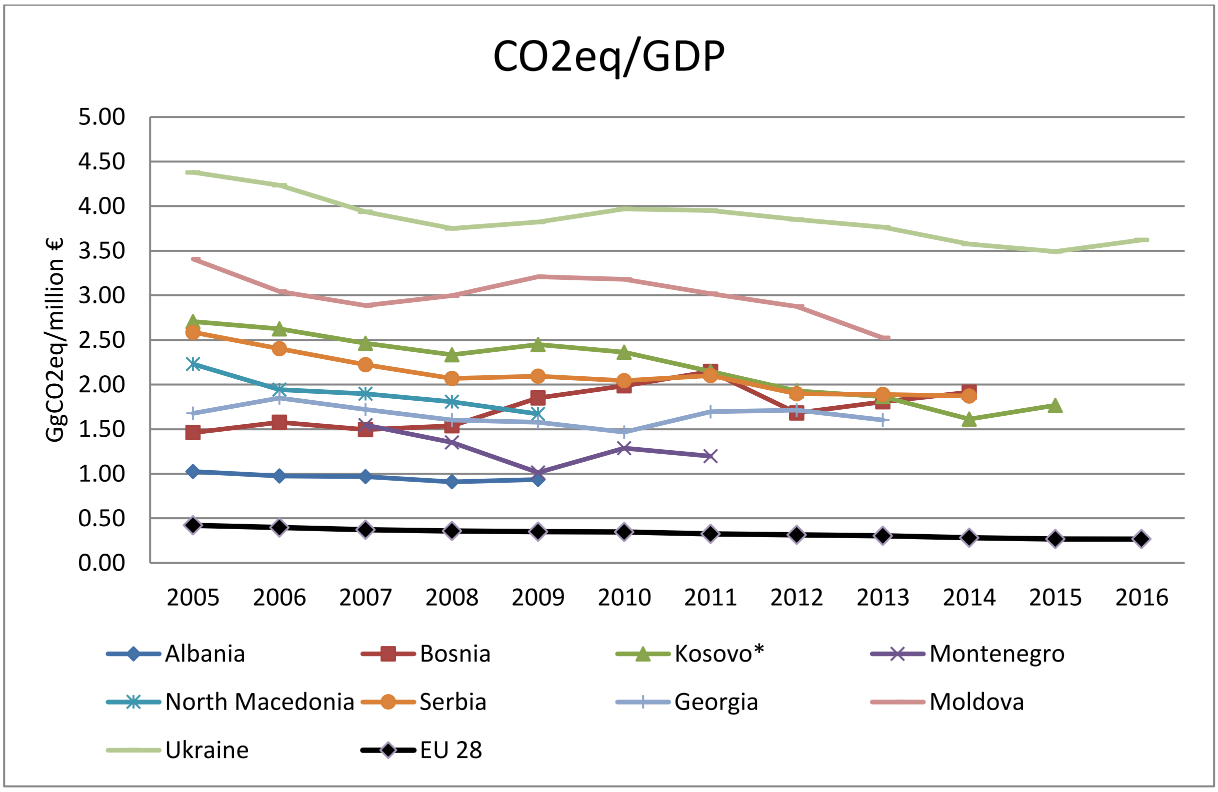


Figure 214: CO_2eq/GDP of CPs compared to the EU average

4.4 2030 GHG targets for the CPs

4.4.1 Albania

The total 2030 target emissions are 8 087 GgCO2eq for Option 1a, 7674 GgCO2eq for Option 1b, 8 258 GgCO2eq for Option 2a and 7 695 GgCo2eq for Option 2b. For the ETS sector, we assume industrial emissions of 2032 GgCO2eq in 2030 based on the INDC background document, while we expect that the power generating sector remains CO2 free. Total emissions increase in between +8% and +16% compared to 2005, with the non-ETS sector increasing its emissions by 16% and the ETS sector by +7% in Option 1a and quite evenly in Option 1b. Compared to 2009 emissions are decreased by -6% to -0,5% for all options besides option 2a, where emissions are increased by +2%.

Table 84 2030 target emissions for Albania

	Option 1a: separate ETS/non-ETS target (20-0%)		Option 1b: separate ETS/non-ETS target (10-0%)		Option 2a: single target (0-20%)		Option 2b: single target (0-10%)	
2030 Emis-sion	**Total (Gg CO2 eq) (% change to 2005)**	**% change to 2009**[27]	Total (Gg CO2 eq) (% change to 2005)	% change to 2009	Total (Gg CO2 eq) (% change to 2005)	% change to 2009	Total (Gg CO2 eq) (% change to 2005)	% change to 2009
2030 Target	**8 087 (+13%)**	**-0,5%**	7 674 (+8%)	-6%	8 258 (+16%)	+2%	7 694 (+8%)	-5%
Indica-tive ETS	**2 032 (+7)**		2 032 (+7%)					
Indica-tive non-ETS	**6 055 (+16%)**		5 642 (8%)					

[27] Next to the base year 2005, Option 1 is also compared to the most recent year with available GHG data for the respective country.

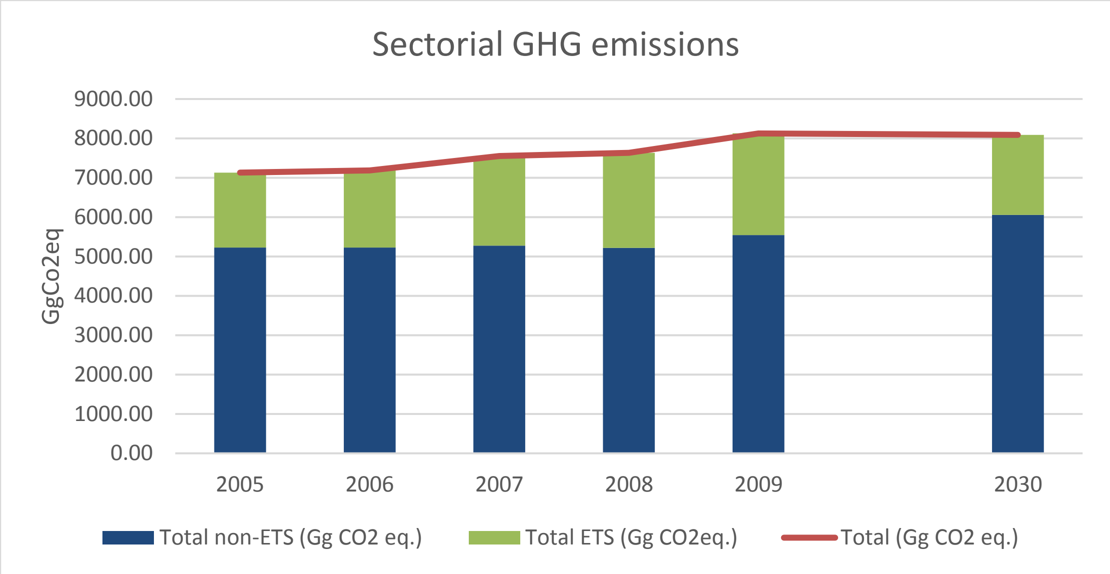


Figure 215 Historic GHG emissions under an indicative ETS, non-ETS split (Option 1a) for Albania

Figure 215 shows a slight increase in emissions since 2005 and the targeted stabilisation until 2030. The non-ETS sector is responsible for almost ¾ of the overall emissions in 2030. This split doesn't vary significantly compared to historic GHG emissions and is caused by the carbon-free power sector. Figure 216 compares the baseline scenario (BAU - forecasted emissions of the TNC of Albania) to the results of all four options.

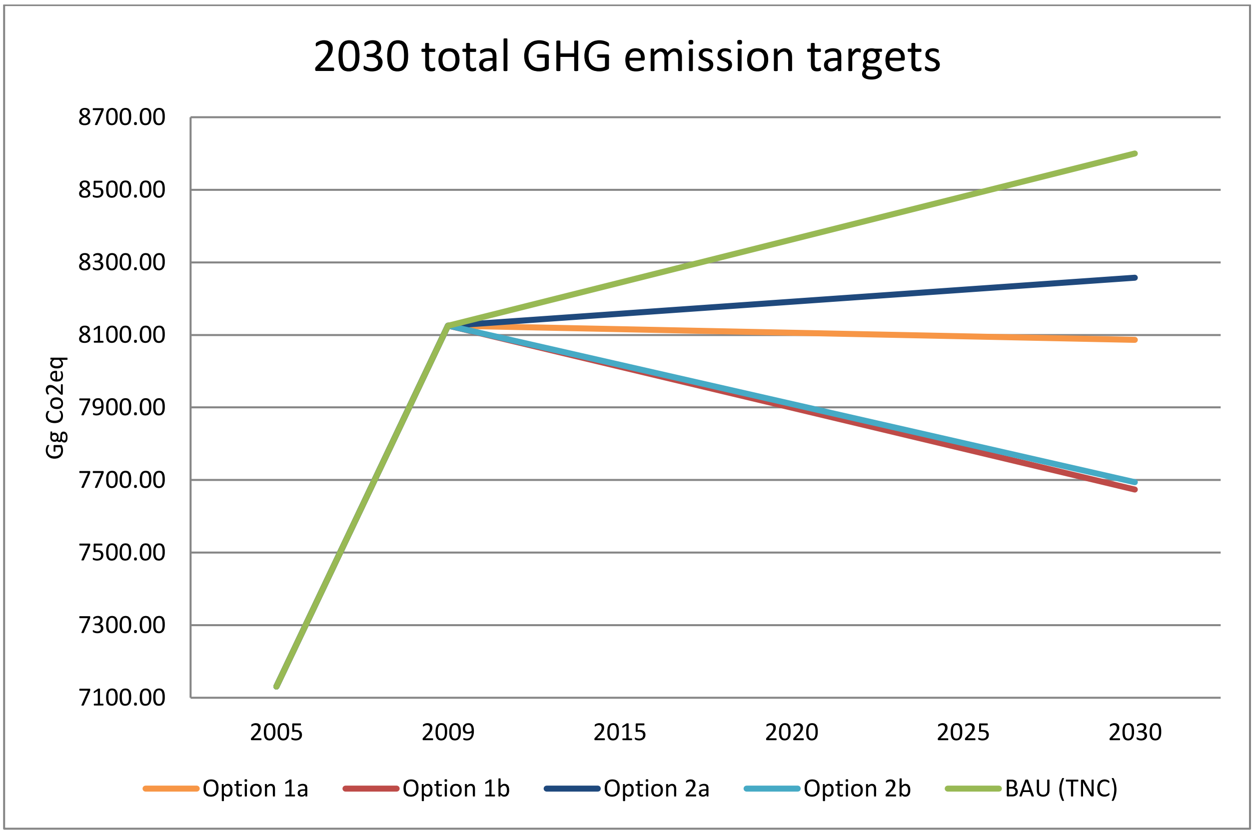


Figure 216 Comparison of 2030 GHG emissions of Albania

4.4.2 Bosnia and Herzegovina

The 2030 emission targets for Bosnia and Herzegovina are in the range of 17 628 GgCo2eq (Option 2b) and 22 747 GgCO2eq (Option 1a) corresponding to an increase of +7% to +38% compared to 2005 values. The ETS sector development is based on the assumptions made for the power and heating sector in the TNC under the SII (WM) scenario and updated with recent emission data from the EEMM modelling results, amounting to 11 735 GgCO2 eq. There are no national projections available regarding the emissions from the industrial sector. For that reason, the PRIMES trend regarding the CO2 emissions from 2015 to 2030 for the industry sector was used as an indicator for 2030 industrial emission (3284 GgCo2q). In comparison to 2013 (latest year with available GHG data) emission levels are reduced by about 30% for Option 2 and by 12%/13% for Option 1.

Table 85 2030 target emissions for Bosnia and Herzegovina

	Option 1a: separate ETS/non-ETS target (20-0%)		**Option 1b:** separate ETS/non-ETS target (10-0%)		**Option 2a:** single target (0-20%)		**Option 2b:** single target (0-10%)	
2030 Emission	**Total (Gg CO2 eq) (% change to 2005)**	**% change to 2014**	Total (Gg CO2 eq) (% change to 2005)	% change to 2014	Total (Gg CO2 eq) (% change to 2005)	% change to 2014	Total (Gg CO2 eq) (% change to 2005)	% change to 2014
2030 Target	**22 747 (+38%)**	**-12%**	22 267 (+35%)	-13%	18 794 (+14%)	-27%	17 628 (+7%)	-32%
Indicative ETS	**15 019 (+55%)**		15 019 (+55%)					
Indicative non-ETS	**7 727 (+14%)**		7 248 (+7%)					

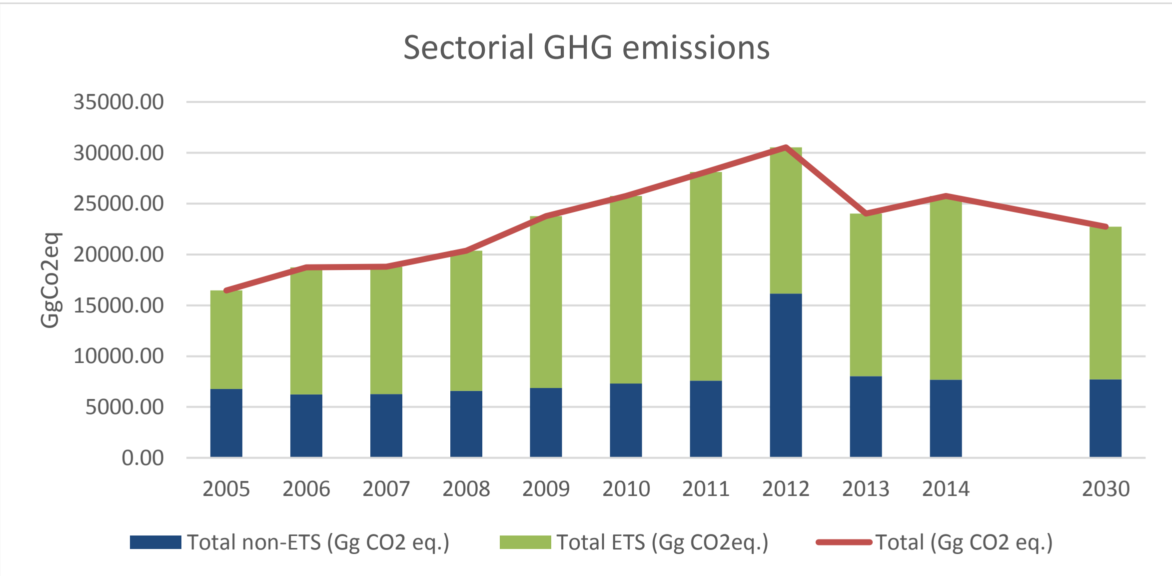


Figure 217 Historic GHG emissions under an indicative ETS, non-ETS split (Option 1a) for Bosnia and Herzegovina

Figure 217 shows a strong emissions increase until 2012. Option 1a target emissions in 2030 are 38% above 2005 emissions but 12% below 2014 emissions levels.

Three targets are presented in the TNC, where the S1 Scenario (business as usual) is just below 30 000 Gg CO2 eq, while the with measures scenario S2 (~19 000 Gg Co2 eq) is in line with our Option 2a.

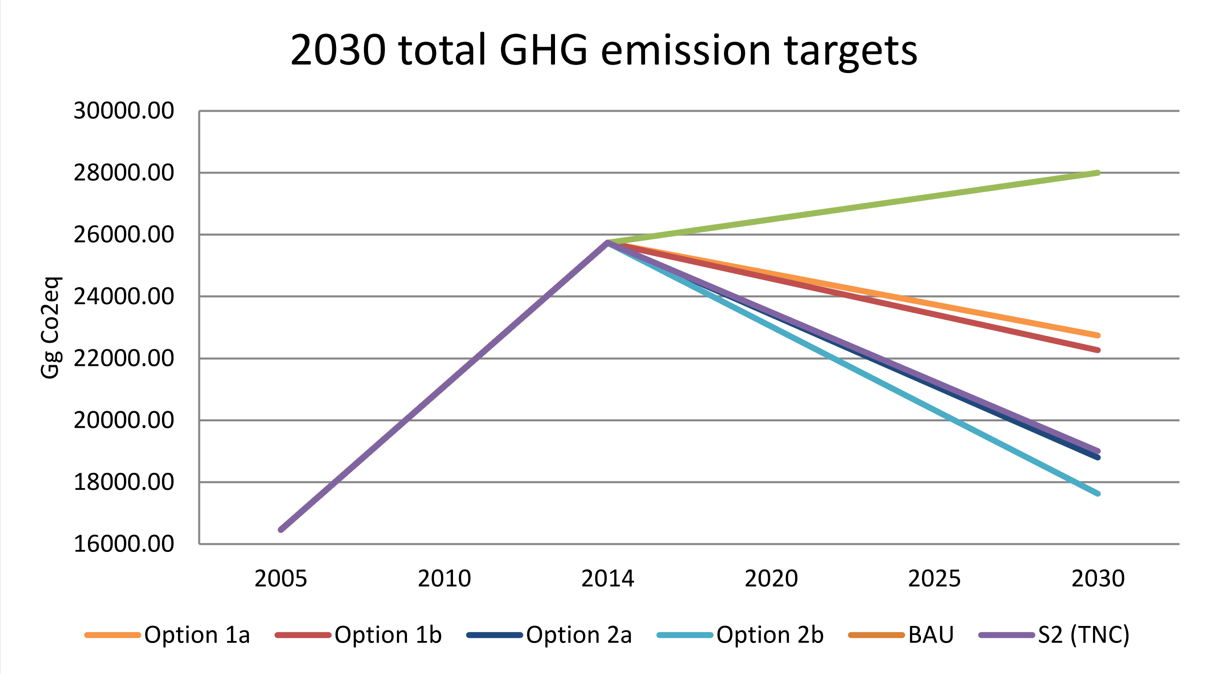


Figure 218 Comparison of 2030 GHG emissions of Bosnia and Herzegovina

4.4.3 Kosovo*

There are no national studies available on the potential development of the ETS sectors (except the power sector). Therefore, only the second option is applied, amounting to 11 388 GgCo2 CO2 eq for Option 2a and 10 439 GgCo2eq for Option 2b. There is no official data for the year 2005, so 2008, the first year with available data was used as a base year.

Table 86 2030 target emissions for Kosovo*

	Option 1a: separate ETS/non-ETS target (20-0%)		Option 1b: separate ETS/non-ETS target (10-0%)		Option 2a: single target (0-20%)		Option 2b: single target (0-10%)	
2030 Emission	**Total (Gg CO2 eq) (% change to 2008)**	**% change to 2013**	Total (Gg CO2 eq) (% change to 2008)	% change to 2013	Total (Gg CO2 eq) (% change to 2008)	% change to 2013	Total (Gg CO2 eq) (% change to 2008)	% change to 2013
2030 Target					11 388 (+20%)	+17%	10 439 (10%)	+7%
Indicative ETS								
Indicative non-ETS								

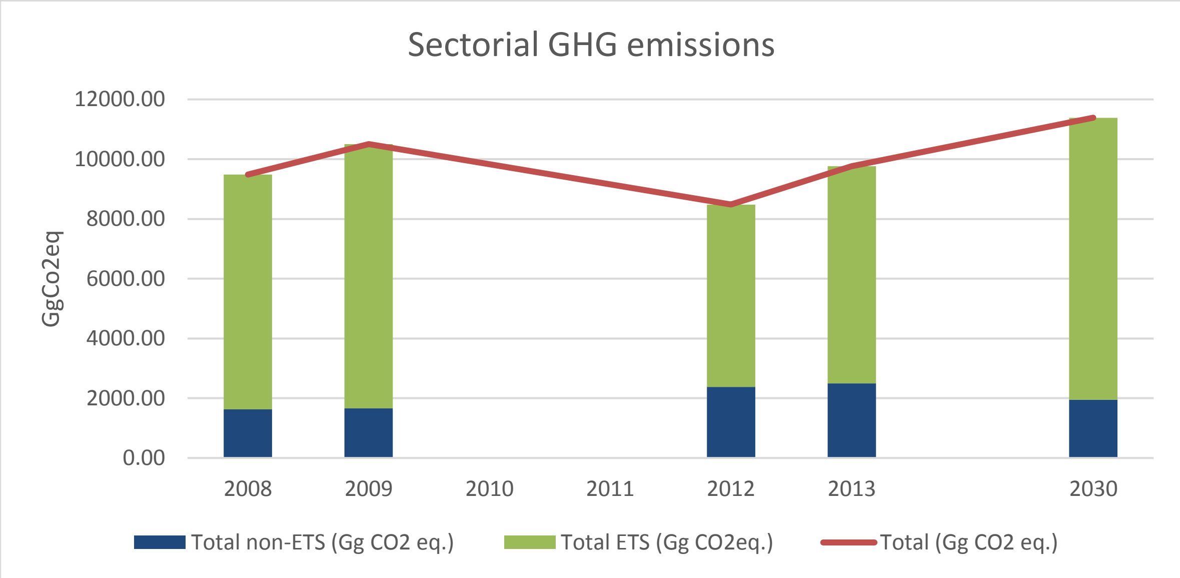


Figure 219 Historic GHG emissions under an indicative ETS, non-ETS split (Option 2a) for Kosovo*

In the last 10 years, the GHG emissions in Kosovo* have been between 9.5 and 10 Mt $CO_{2\,eq}$ with the value being heavily dependent on the amount of energy produced from a major coal-based power plant. The figure above illustrates that Kosovo*'s ETS sector contributes significantly to the total emissions, if the same relative split into ETS/non-ETS sectors of 2005 is applied.

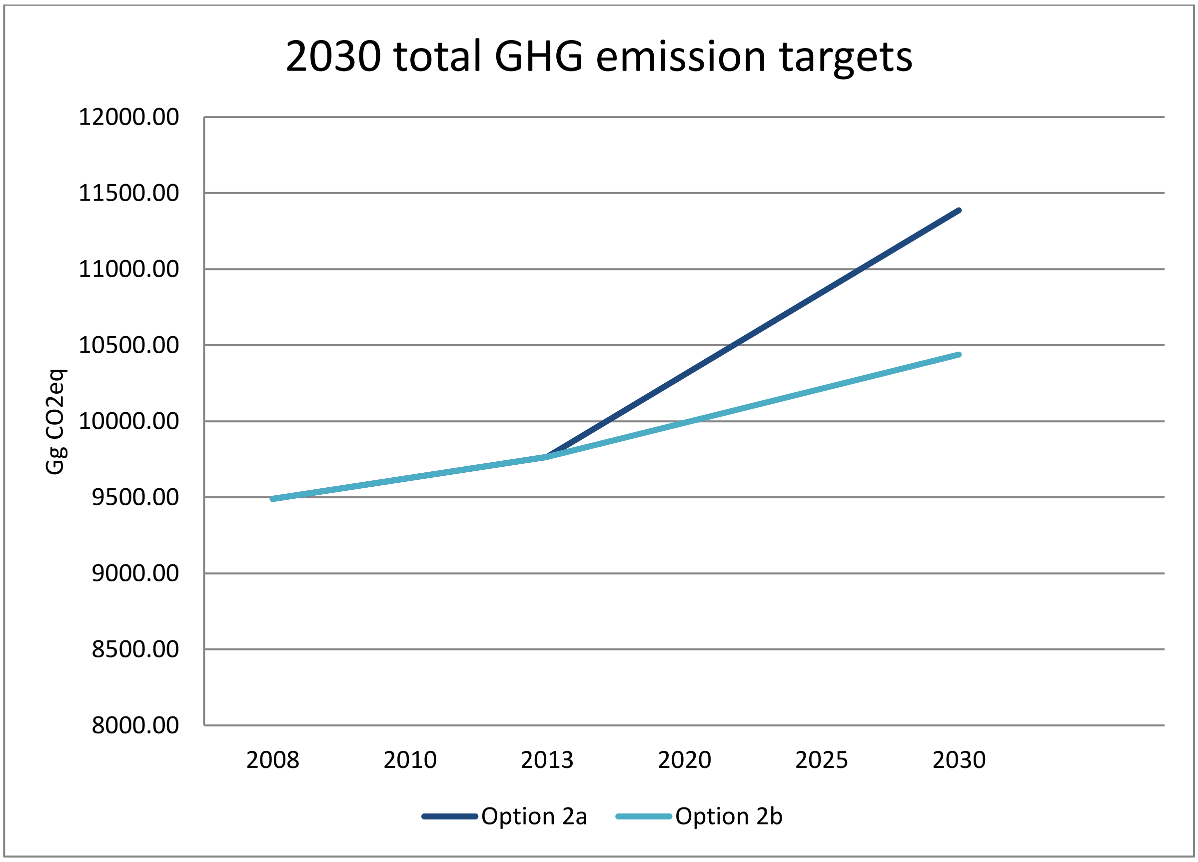


Figure 220 Comparison of 2030 GHG emissions of Kosovo*

4.4.4 Montenegro

The 2030 target emissions for Montenegro are 3 106 Gg CO2eq under Option1a and 1b, as in both scenarios a 0% increase for the non-ETS sector is the basis, and 4 411 GgCO2eq for Option 2a and 2b for the same reason. As the country with the highest GDP/capita, the % change to 2005 is 0% for Option 2, while in Option 1 emissions are decreased by 30% compared to 2005 levels due to a 40% reduction in the ETS sector. Importantly the production in the aluminium plan KAP strongly slowed down and is not expected to reach past levels again. Option 2 with 2005 as the base year doesn't consider this decrease after 2005. For Option 1 assumptions for the ETS sector for the elec. production is based on EEMM modelling results and for the industrial sector on the INDC document and adds up to 1 983 GgCO2eq compared to 1 123 GgCO2eq for the non-ETS sector. Compared to the most recent year available (2011), Options 1 equals a reduction of 20% and Option 2 an increase of 14%.

Table 87 2030 target emissions for Montenegro

	Option 1a: separate ETS/non-ETS target (20-0%)		Option 1b: separate ETS/non-ETS target (10-0%)		Option 2a: single target (0-20%)		Option 2b: single target (0-10%)	
2030 Emis-sion	**Total (Gg CO2 eq) (% change to 2005)**	**% change to 2011**	Total (Gg CO2 eq) (% change to 2005)	% change to 2011	Total (Gg CO2 eq) (% change to 2005)	% change to 2011	Total (Gg CO2 eq) (% change to 2005)	% change to 2011
2030 Target	**3 105 (-30%)**	**-20%**	3 105 (-30%)	-20%	4 411 (0%)	+14%	4 411 (0%)	+14%
Indica-tive ETS	**1 983 (-40%)**		1 983 (-40%)					
Indica-tive non-ETS	**1 123 0%**		1 123 0%					

The figure below shows the emission levels from 2005 to 2011 and further on to 2030 for Option 1a. The ETS sector covers approximately 3/5 of total emissions in Montenegro.

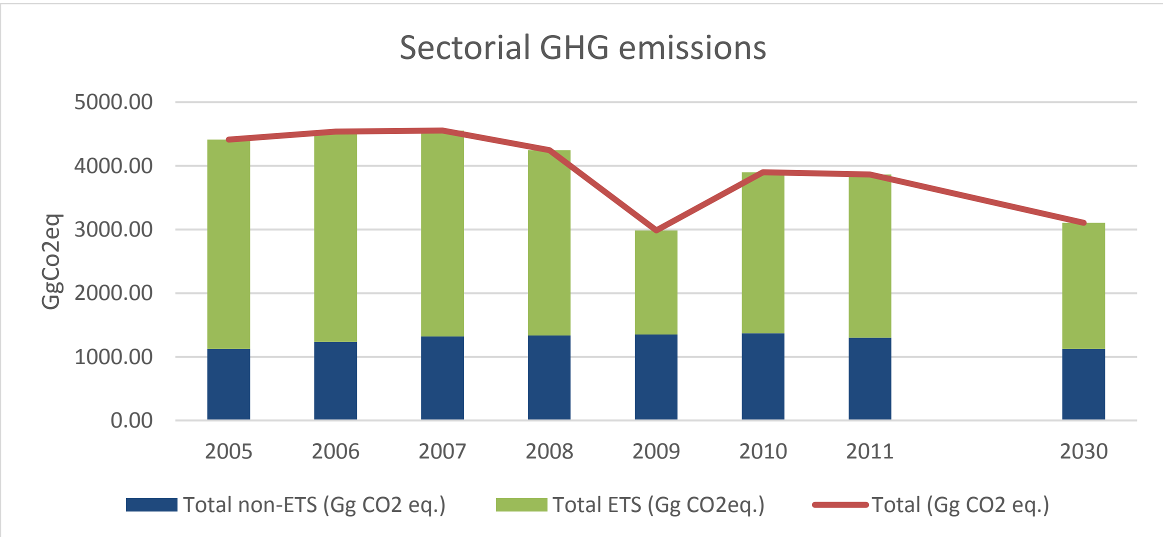


Figure 221 Historic GHG emissions under an indicative ETS, non-ETS split (Option 1) for Montenegro

Figure 222 presents the targets for the different approaches. In the INDC background document, several different targets are mentioned ranging from 3 256 to 3741 GgCo2 eq. Option 1 is below all of their proposed options.

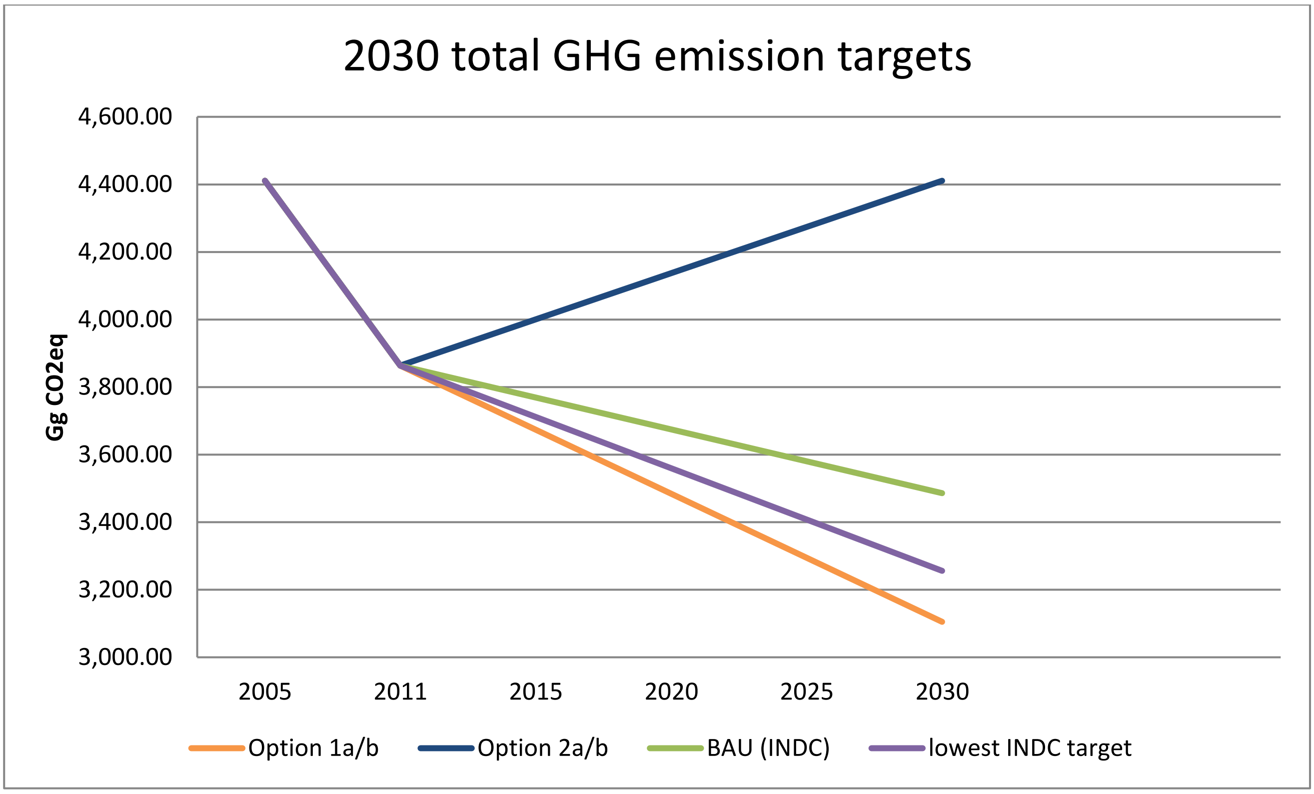


Figure 222 Comparison of 2030 GHG emissions of Montenegro

4.4.5 North Macedonia

The target emissions for North Macedonia in 2030 are 9 010 GgCO2eq for Option 1a and 8 734 GgCO2eq for Option 1b, due to a steep expected reduction of 52% compared to 2005 in the ETS sector. The target of Option 2a is 14 726 GgCO2eq and 13 881 GgCo2 eq for Option 2b. The underlying assumptions for the ETS sector (electricity and industry) are based on the mitigation scenario of the TNC and amount to 4 201 GgCo2eq, which is in line with the EEMM modelling results, compared to 4 809 GgCO2 for the non-ETS sector.

Table 88 2030 target emissions for North Macedonia

	Option 1a: separate ETS/non-ETS target (20-0%)		**Option 1b:** separate ETS/non-ETS target (10-0%)		**Option 2a:** single target (0-20%)		**Option 2b:** single target (0-10%)	
2030 Emission	**Total (Gg CO2 eq) (% change to 2005)**	**% change to 2009**	Total (Gg CO2 eq) (% change to 2005)	% change to 2009	Total (Gg CO2 eq) (% change to 2005)	% change to 2009	Total (Gg CO2 eq) (% change to 2005)	% change to 2009
2030 Target	**9 010 (-31%)**	-22%	8 734 (-33%)	-24%	14 726 (+13%)	28%	13 881 (6%)	21%
Indicative ETS	**4 201 (-52%)**		4 201 (-52%)					
Indicative non-ETS	**4 809 (+13%)**		4 533 (6%)					

Figure 223 illustrates the emissions reduction for North Macedonia under Option 1a. It is visible that especially the ETS sector reduces emissions drastically (-52%).

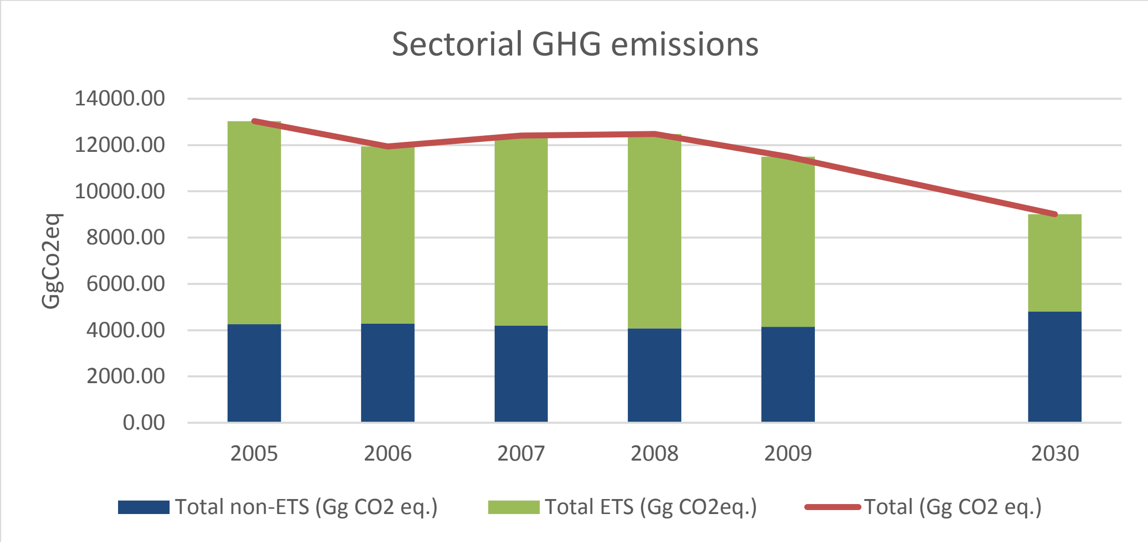


Figure 223 Historic GHG emissions under an indicative ETS, non-ETS split (Option 1a) for North Macedonia

Option 1 targets follow the reduction trend from 2005-2009 with a reduction of 22%/24% compared to 2009. Option 2a/b show an increase in emissions until 2030. In the Third National Communication of North Macedonia, the mitigation scenario target is slightly below Option 1a/b.

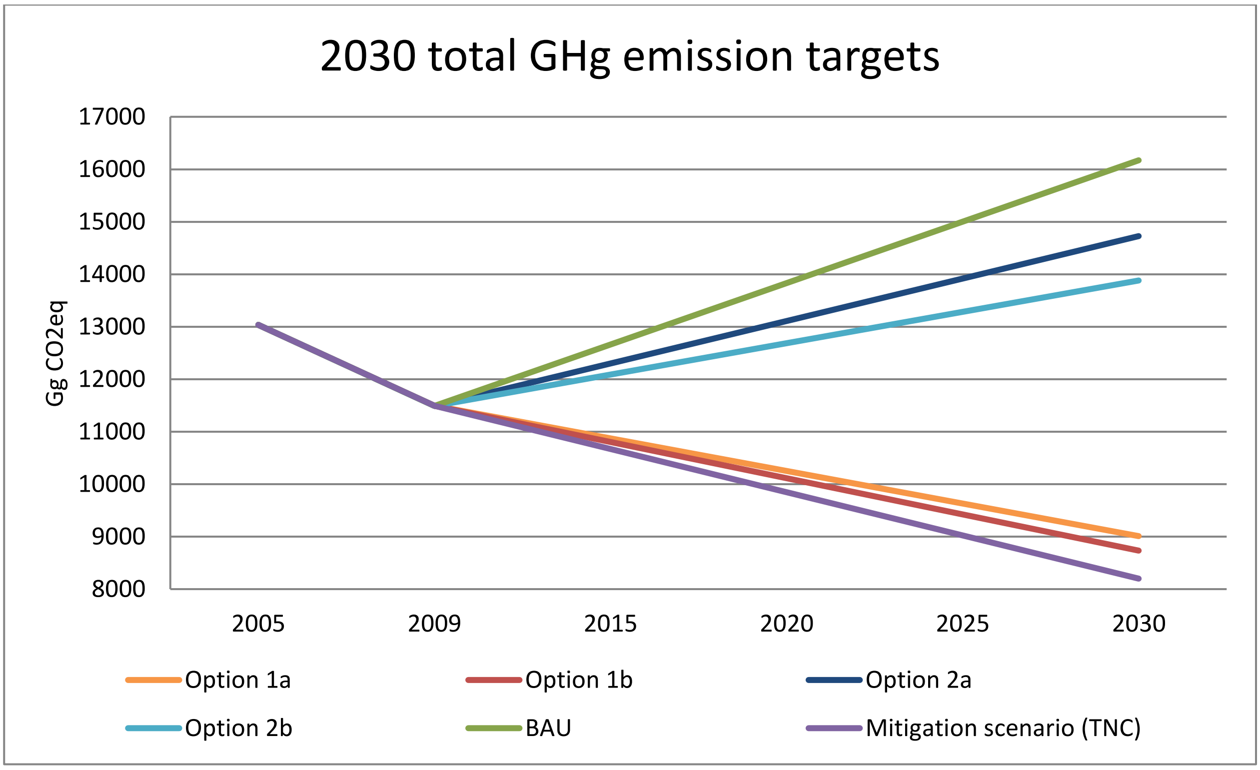


Figure 224 Comparison of 2030 GHG targets of North Macedonia

4.4.6 Serbia

The targets face uncertainties related to the 2005 emissions (e.g. the share of emissions from Serbia and Kosovo*). Based on Option 1a the target is 59 868 GgCo2eq and for 1b it is 59 339 GgCo2eq. For Option 2a it is 74

131 GgCo2eq and 72 288 GgCo2eq for Option 2b. In the Option 1 target scenarios, Serbia reduces emissions until 2030 by % 15%/16% compared to Options 2 where overall emissions increase by 5%/3%. Assumptions for the ETS sector development are based on the EEMM modelling results for the electricity sector, and the WAM projections for elec. for the manufacturing industry and industry emissions from the SNC, leading to a total of 38 611 GgCO2eq for the ETS sector compared to 21 256 GgCO2eq for the non-ETS sector for Option 1a.

Table 89 2030 target emissions for Serbia

	Option 1a: separate ETS/non-ETS target (20-0%)		Option 1b: separate ETS/non-ETS target (10-0%)		Option 2a: single target (0-20%)		Option 2b: single target (0-10%)	
2030 Emission	**Total (Gg CO2 eq) (% change to 2005)**	**% change to 2014**	Total (Gg CO2 eq) (% change to 2005)	% change to 2014	Total (Gg CO2 eq) (% change to 2005)	% change to 2014	Total (Gg CO2 eq) (% change to 2005)	% change to 2014
2030 Target	**59 868 -15%**	**-4%**	59 339 -16%	-12%	74 131 +5%	10%	72 288 3%	8%
Indicative ETS	**38 611 -23%**		38 611 -23%					
Indicative non-ETS	**21 256 5%**		20 728 (3%)					

Figure 225 illustrates that ETS emissions in Serbia make up about 2/3 of total emissions for the past years and this split is also expected to stay similar until 2030.

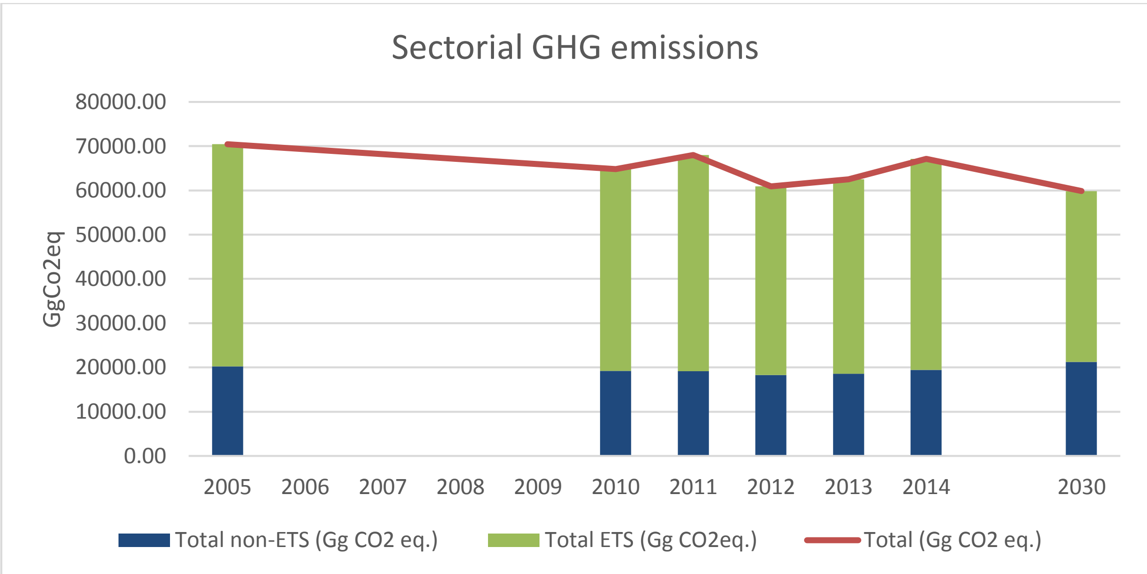


Figure 225 Historic GHG emissions under an indicative ETS, non-ETS split (Option 1a) for Serbia

Figure 226 presents the 2030 GHG emissions of the BAU and the WAM Scenario of the SNC, and the targets for Option 1a/b and 2a/b. The Option 1 targets are more stringent than the "with additional measures" of the national projections of Serbia (SNC). It should here be noted that a first draft on potential ETS installation has been prepared, however, this list does include GHG emissions of the installations.

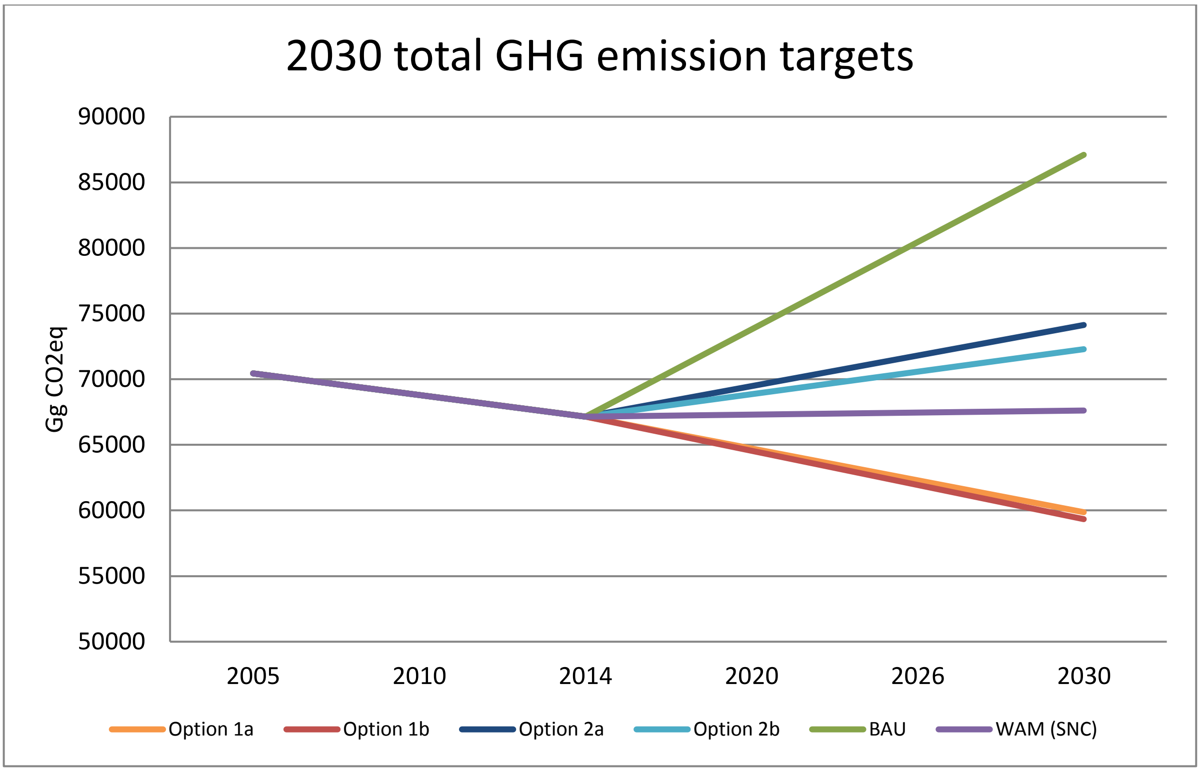


Figure 226 Comparison of 2030 GHG emissions targets of Serbia

4.4.7 Georgia

The target emissions for Georgia are 14 858 Gg CO2eq for Option 1a, 14 125 GgCo2eq for Option 1b, 13 683 Gg CO2eq for Option 2a and 12 542 GgCo2 eq for Option 2b. Emissions are increased by between 10% and 30% compared 2005 levels and reduced by 11% - 24% compared to 2013. The assumptions for the ETS sector are based on the LEDS scenario of Georgia's low emission development strategy: "Enhancing capacity for low emission development strategies (EC-LEDS) clean energy program" and add up to 6 189 GgCO2eq compared to 8 669 GgCO2eq for the non-ETS sector.

Table 90 target emissions for Georgia

	Option 1a: separate ETS/non-ETS target (20-0%)		Option 1b: separate ETS/non-ETS target (10-0%)		Option 2a: single target (0-20%)		Option 2b: single target (0-10%)	
2030 Emis-sion	**Total (Gg CO2 eq) (% change to 2005)**	**% change to 2013**	Total (Gg CO2 eq) (% change to 2005)	% change to 2013	Total (Gg CO2 eq) (% change to 2005)	% change to 2013	Total (Gg CO2 eq) (% change to 2005)	% change to 2013
2030 Target	**14 858 (+30%)**	-11%	14 135 (24%)	-15%	13 683 (+20%)	-18%	12 542 (10%)	-24%
Indica-tive ETS	**6 189 (+48%)**		6 189 (+48%)					
Indica-tive non-ETS	**8 669 (+20%)**		7 946 (+10%)					

The figure below shows that especially emissions from the ETS sector have been increasing from 2005 to 2013 in Georgia, but will have to decrease until 2030 to reach the Option 1a target.

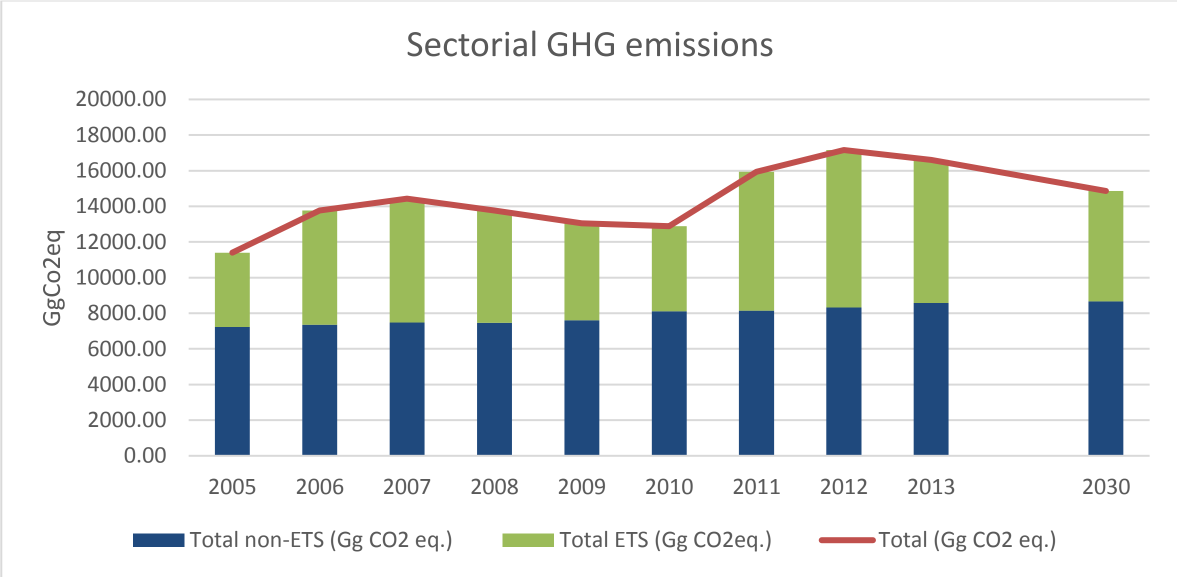
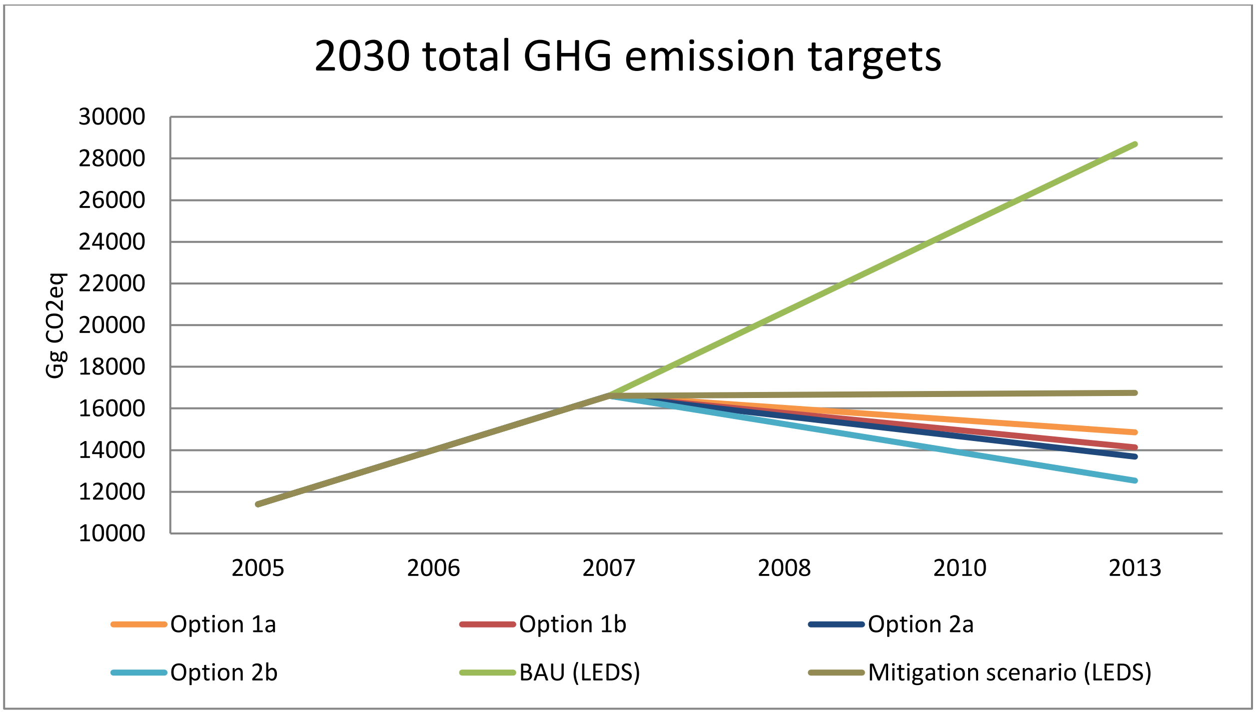


Figure 227 Historic GHG emissions under an indicative ETS, non-ETS split (Option 1a) for Georgia

Within the EC-LEDS study, a BAU and a mitigation scenario are created. While the BAU scenario is significantly higher than our targets the mitigation scenario is more in line with our 4 options. Economic recovery, in Georgia, started only after 2005 and therefore base year 2005 emissions are really low for Georgia. If we assume 2013 as a base year for GHG emissions, total emissions for Option 1a are 16 480 GgCO2eq and for Option 2a are 19 932 GgCO2eq, which would make them slightly less ambitious than the mitigation scenario.



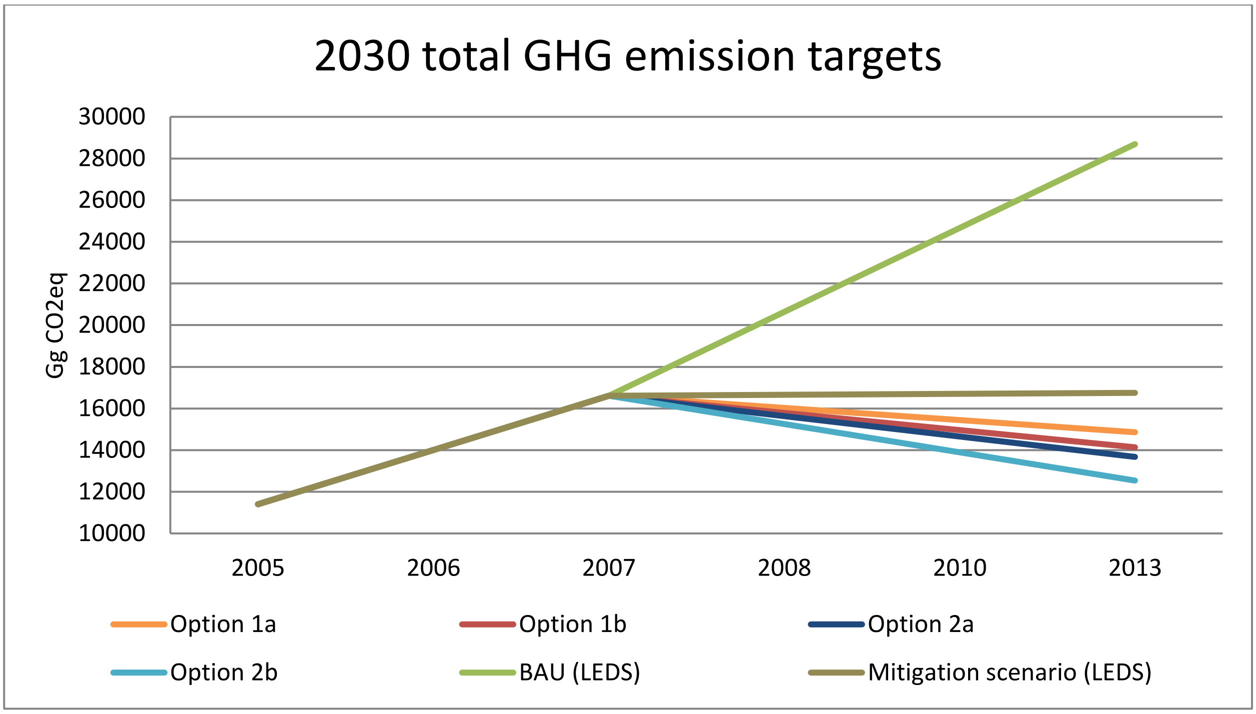


Figure 228 Comparison of GHG emissions targets in Georgia

4.4.8 Republic of Moldova

The 2030 target emissions for the Republic of Moldova are between 13 286 GgCO2eq for Option 1b and 15 223 GgCO2eq for Option 2a. The ETS sector target of 4886 Gg CO2eq is based on the WAM scenarios of the Second Biennial Update Report, which is a 3% decrease compared to 2005. The non-ETS sector emissions are 9 164 GgCo2eq for Option 1a and 8400 GgCo2eq for Option 1b.

Table 91 Target emissions for the Republic of Moldova

	Option 1a: separate ETS/non-ETS target (20-0%)		Option 1b: separate ETS/non-ETS target (10-0%)		Option 2a: single target (0-20%)		Option 2b: single target (0-10%)	
2030 Emis-sion	**Total (Gg CO2 eq) (% change to 2005)**	**% change to 2013**	Total (Gg CO2 eq) (% change to 2005)	% change to 2013	Total (Gg CO2 eq) (% change to 2005)	% change to 2013	Total (Gg CO2 eq) (% change to 2005)	% change to 2013
2030 Target	**14 050 (+19%)**	**(+10%)**	13 286 (5%)	(+4%)	15 223 (+20%)	(+19%)	13 954 (+10%)	(+9%)
Indica-tive ETS	**4886 (-3%)**		4886 (-3%)					
Indica-tive non-ETS	**9 164 (+20%)**		8 400 (10%)					

Figure 229 presents the emissions levels for the ETS and non-ETS sector for Moldova. Emissions stay quite constant with a reduction in the ETS sector in 2030 in Option 1a, representing only slightly above 1/3 of total emissions.

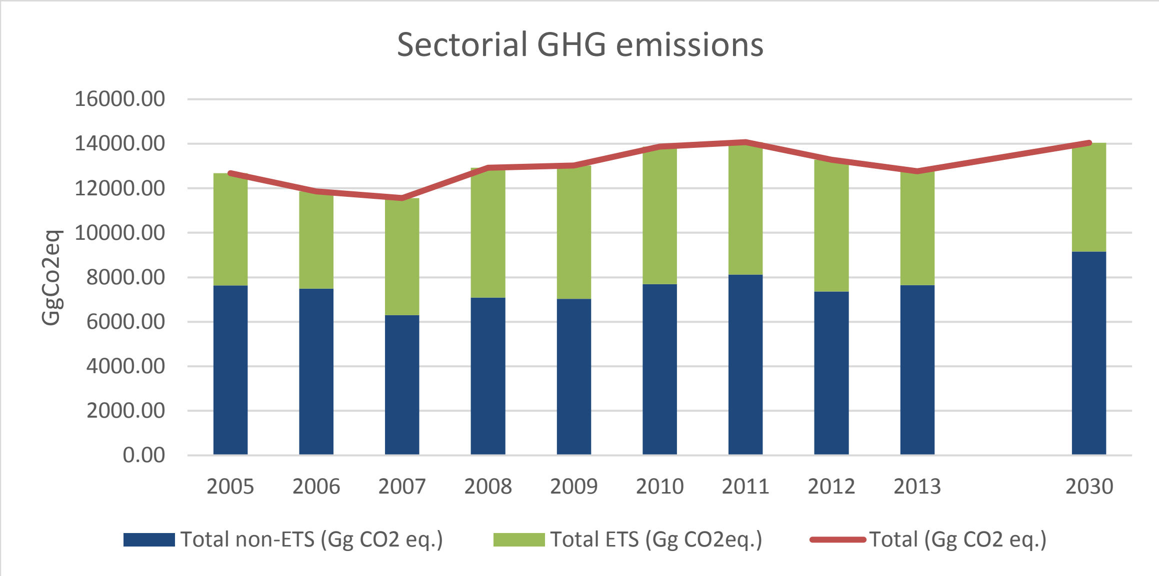


Figure 229 Historic GHG emissions under an indicative ETS, non-ETS split (Option 1a) for Moldova

Compared to the BAU scenario of the Fourth National Communication of Moldova all 4 Options are significantly more ambitious. Option 1a/b and Option 2b are in between the with measures and with additional measures scenario of the Second Biennale Update report.

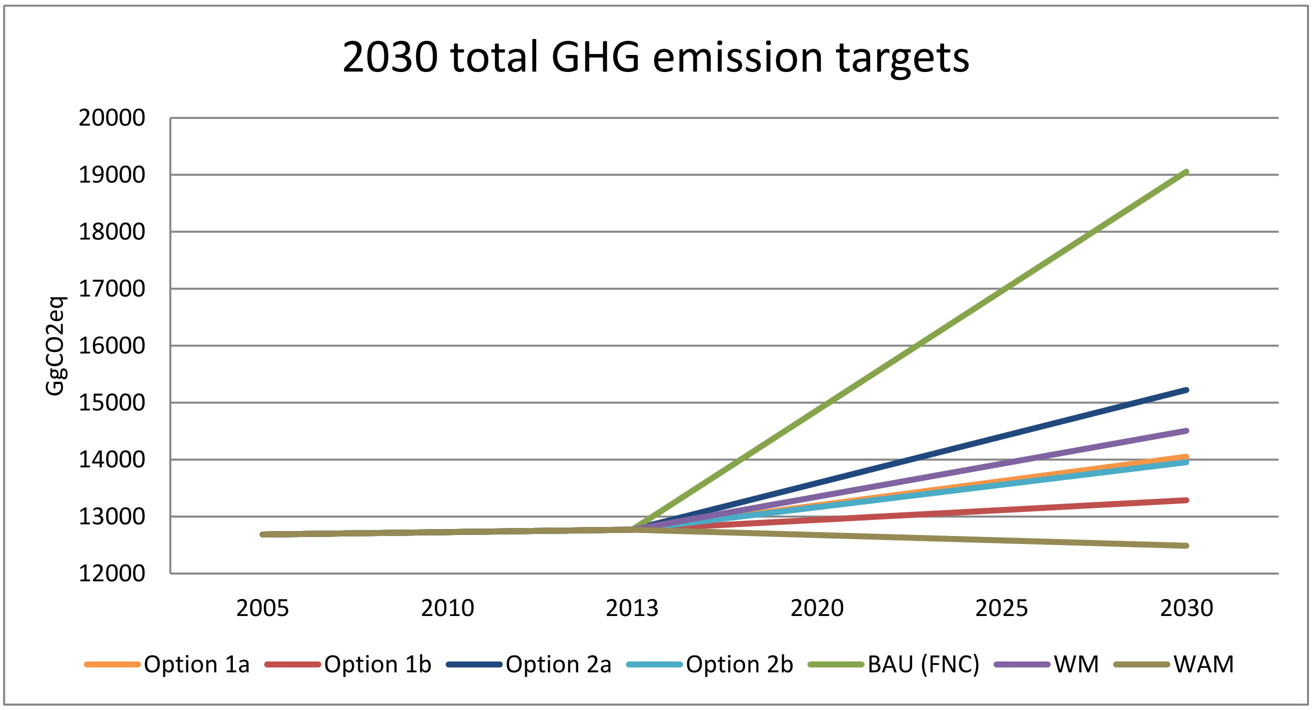


Figure 230 Comparison of 2030 GHG emission targets for the Republic of Moldova

4.4.9 Ukraine

The emissions for Ukraine vary significantly between the two approaches. For Option 1a emissions are 329 784 Gg CO2 eq and 316 957 GgCo2 eq for Option 1b while for Option 2a emissions are 532 176 GgCo2eq and 487 828

GgCo2eq for Option 2b. The emissions of the ETS sectors were assumed to reach 175 852, which is a decrease of 44% compared to 2005 and are based on the revolutionary scenario of Ukraine from the transition to renewable energy by 2050 study. In the non-ETS sector, emissions are 153 932 GgCO2eq, which is an increase of 20% compared to 2005 emissions levels for Option 1a. Compared to the most recent year available (2016), Option 1a/b represents a change of +3% and -1%. Option 2a/b come with an increase of 67%/53% compared to 2016.

Table 92 Target emissions for Ukraine

	Option 1a: separate ETS/non-ETS target (20-0%)		Option 1b: separate ETS/non-ETS target (10-0%)		Option 2a: single target (0-20%)		Option 2b: single target (0-10%)	
2030 Emission	**Total (Gg CO2 eq) (% change to 2005)**	**% change to 2016**	Total (Gg CO2 eq) (% change to 2005)	% change to 2016	Total (Gg CO2 eq) (% change to 2005)	% change to 2016	Total (Gg CO2 eq) (% change to 2005)	% change to 2016
2030 Target	**329 784 (-26%)**	**+3%**	316 957 (-29%)	-1%	532 176 +20%	+67%	*487 828* +10%	+53%
Indicative ETS	**175 852 (-44%)**		175 852 (-44%)					
Indicative non-ETS	**153 932 (+20%)**		141 105 (10%)					

The figure below illustrates the emissions of Ukraine split into the ETS and non-ETS sector. It shows that the ETS sector reduces emissions in 2030 (-44%), according to Option 1a, while the non-ETS sector increases emissions by 20% compared to 2005.

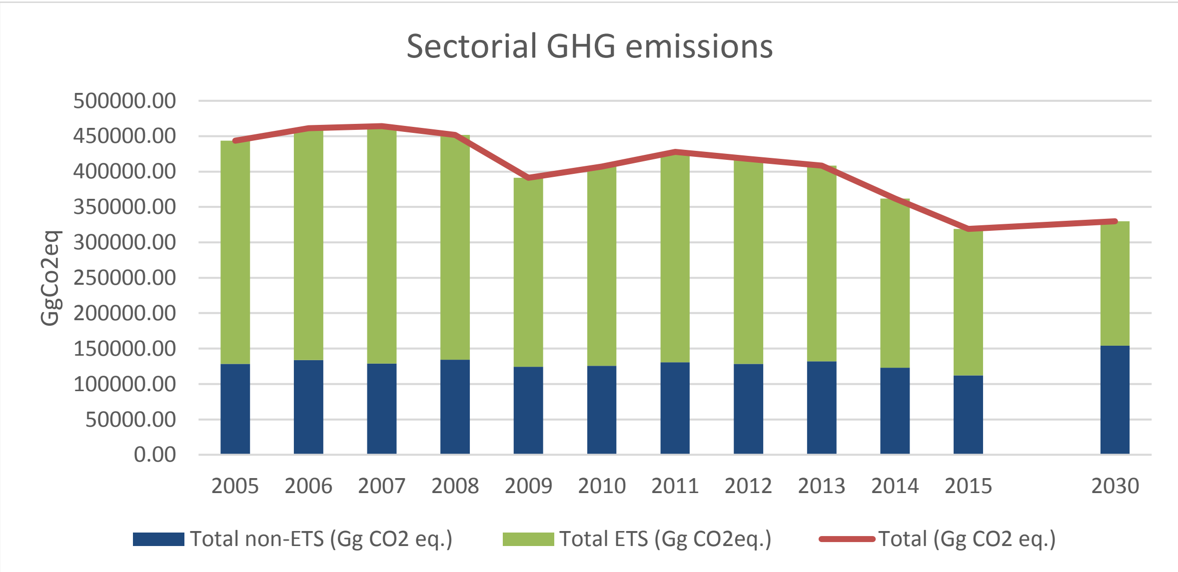


Figure 231 Historic GHG emissions under an indicative ETS, non-ETS split (Option 1a) for Ukraine

The BAU and the Option 2a come with a comparable target. Two scenarios, the liberal and the revolutionary, are proposed in the Transition of Ukraine to the Renewable Energy by 2050. The liberal target is a bit more ambitious than our Options 1 targets. [28]

[28] Diachuk et al. (2017) Transition of Ukraine to the Renewable Energy by 2050.

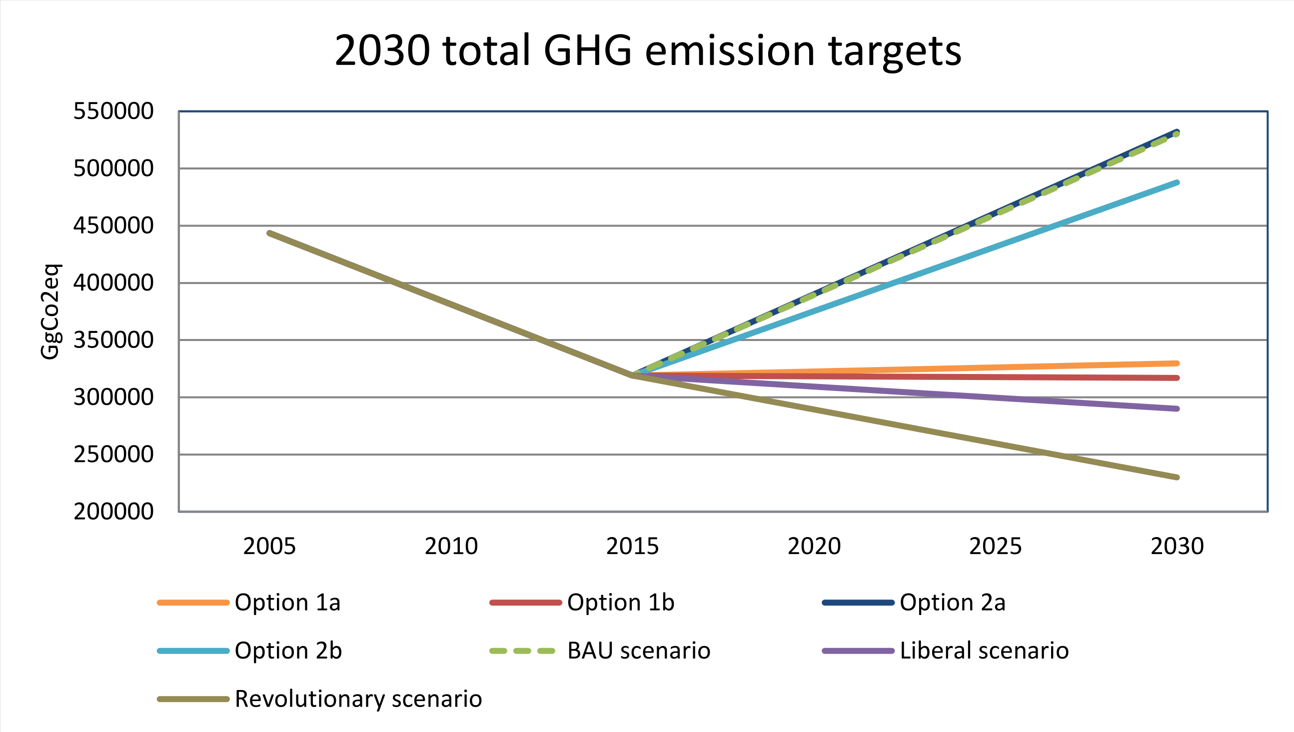


Figure 232 Comparison of 2030 GHG emission targets for Ukraine

4.4.10 Calculation of a regional target

Table 93 presents the regional targets aggregating the national bottom up-targets presented above and adding a top-down target for the ETS sectors in Option 3. Targets are presented as a total for all CPs, but also without Ukraine and for WB6 countries as Ukraine has a significant impact on the overall target. The targets represent an overall emissions reduction compared to 2005 for Option 1a/b and Option 3 and an emission increase for Options 2 and b. Thus, in comparison, Option 1 is more ambitious than Option 2.

For comparison with the EU ambition, we also calculated the regional targets using a top-down approach (Table 94, Figure 233) assuming the same overall targets as for the EU (2020 -20% compared to 1990, 2030 -40% compared to 1990). However, as discussed above, 1990 is not a reasonable base year for CPs. Therefore, a comparison to 2005 (2020 target, 14% overall emission reduction, 2030 target, 30% overall emission reduction) is more meaningful. The --30% compared to 2005 is used according to Meyer-Ohlendorf (Meyer-Ohlendorf, 2018) excluding potential flexibilities of LULUCF. Due to lack of reliable data this flexibility cannot be applied in the CPs. Moreover, Option 3, applying a 20%-0% range for the non-ETS sectors and an overall -43% emission reduction target compared to 2005 for the ETS sectors is presented.

For the EnC, the Option 3 target is most ambitious for the entire region with a 24% reduction. Interestingly, Option 1b leads to a quite similar target for the entire region, however following a top-down approach for the ETS sector. This is mainly due to the strong expected emission decreased in the ETS sectors of Ukraine. In comparison only the EU 2030 target (30%/2005) leads to lower total emissions. In general, regional reduction targets for Options 3 are more ambitious than the EU 2020 target of 14% reduction compared to 2005 for all CPs. This emphasizes that these targets come with a more ambitious or comparable effort compared to the 2020 framework, but to be achieved by a group of countries that have lower GDPs than all EU members. However, if Ukraine is excluded, targets for Option 1a/b are less ambitious than the 2020 target. This is also reflected in the absolute values in Table 94 and Figure 233 (comparison between the column “Option 1” and “EU 2020 target 14% /2005 reduction”). The difference in level of effort is less pronounced for WB 6 countries.

Table 94 and Figure 233 reveal that Option 2 leads to less ambitious targets as compared to Option 1, and also to less ambitious targets than the EU 2020 target. The comparison with the calculations based on 1990 as reference year shows that the targets would be much less ambitious than in Option 1, even if the EU 2030 target would be adopted.

Overall, the analysis shows that the Option 1 approach is importantly more ambitious than the Option 2 approach. This is due to the separate treatment of the ETS sectors based on national studies and model-based results better reflecting cost-effective mitigation options and mitigation needs in these sectors. In particular, in the power sector, the large combustion plant directive will lead to strong emission decreases.

Depending on the group of countries, Option 3, i.e. application of the EU 2030 ETS target of -43%, leads to comparable targets as compared to Option 1: As shown in section Table 93, the -43% emission reduction is close to the ETS target calculated with a bottom-up approach for the entire region. This bottom-up target for all CPs would correspond to a -37% emission reduction, while the WB6 (-10%) and in particular the CPs without Ukraine (-14%) show significantly lower ETS targets. Correspondingly, application of the EU ETS 2030 target would tighten in particular the overall targets excluding Ukraine (-23% instead of -2%) and for WB6 (-26% instead of -6%) while the target for the entire region would show a relatively low increase of 4% (-24% instead of -20%).

Table 93 Comparison of regional targets in absolute terms and compared to 2005 emissions[29]

	Option 1a[30] **separate ETS/non-ETS target (range 20-0%)**	**Option 1b** **separate ETS/non-ETS target (range 10-0%)**	**Option 2a** **single target (range 0-20%)**	**Option 2b** **single target (range 0-20%)**	**Option 3** **20-0% non-ETS** **-43%/ 2005 ETS cap**
	2030 emissions (% to 2005)	2030 emissions (% to 2005)	2030 emissions (% to 2005)	2030 emissions (% to 2005)	2030 emissions (% to 2005)
All CPs (Gg CO2 eq)	472 896 (-20%)	455 936 (-23%)	692 788 (+18%)	640 664 (+9%)	446 780 (-24%)
Non-ETS	214 687 (+18%)	198 513 (9%)	-	-	214 687 (+18%)
ETS	258 209 (-37%)	258 209 (-37%)	-	-	232 093 (-43%)
CPs without Ukraine (Gg CO2 eq)	143 112 (-2%)	138 979 (-5%)	160 612 (+10%)	152 836 (+5%)	113 182 (-23%)
Non-ETS	60 754 (+12%)	57 408 (6%)	-	-	68 591 (+12%)
ETS	82 357 (-10%)	82 357 (-10%)	-	-	52 427 (-43%)
WB 6 (Gg CO2 eq)	114 204 (-6%)	111 557 (-9%)	131 707 (+8%)	126 340 (+4%)	90 089 (-26%)
Non-ETS	42 922	41 062	-	-	42 922

[29] 2005 was chosen for comparison according to the EU framework where specific ETS/non-ETS targets are set as relative reduction compared to 2005.

[30] For the calculation of the regional target for Option 1a/b, 2030 emissions for Kosovo* from the Option 2a/b are used.

	(+9%)	(5%)			(+9%)
ETS	71 282 (-14%)	71 282 (-14%)	-	-	47 168 (-43%)

Table 94 shows the emission levels of the different options presented above compared to applying the EU 2020 and 2030 reduction efforts to the CPs for the entire economy. Except for an application of the EU 2030 target of -30% (2005), Option 3 is the most stringent one. However, for all CPs, Option 3 emissions levels are close to the bottom up Option 1b, due to strong assumed emission reductions in Ukraine in Option 1.

Table 94 Top-down regional target calculations in comparison to Option 1 and 2

	Option 1a	Option 1b	Option 2a	Option 2b	Option 3	EU 2020 target 14% /2005 reduction	EU 2020 target 20% /1990 reduction	EU 2030 target 30%/2005 reduction	EU 2030 target 40% /1990 reduction
All CPs (Gg CO2 eq)	472 896 (-20%)	455 936 (-23%)	692 788 (+18%)	640 664 (9%)	**446 780** (-24%)	507 019	935 947	412 690	701 960
CPs without Ukraine (Gg CO2 eq)	143 112 (-2%)	138 979 (-5%)	160 612 (+10%)	152 836 (5%)	**113 182** (-23%)	125 627	178 144	102 254	133 608
WB 6 (Gg CO2 eq)	114 204 (-6%)	111 557 (-9%)	131 707 (+8%)	126 340 (4%)	**90 089** (-26%)	104 911	150 909	85 393	113 182

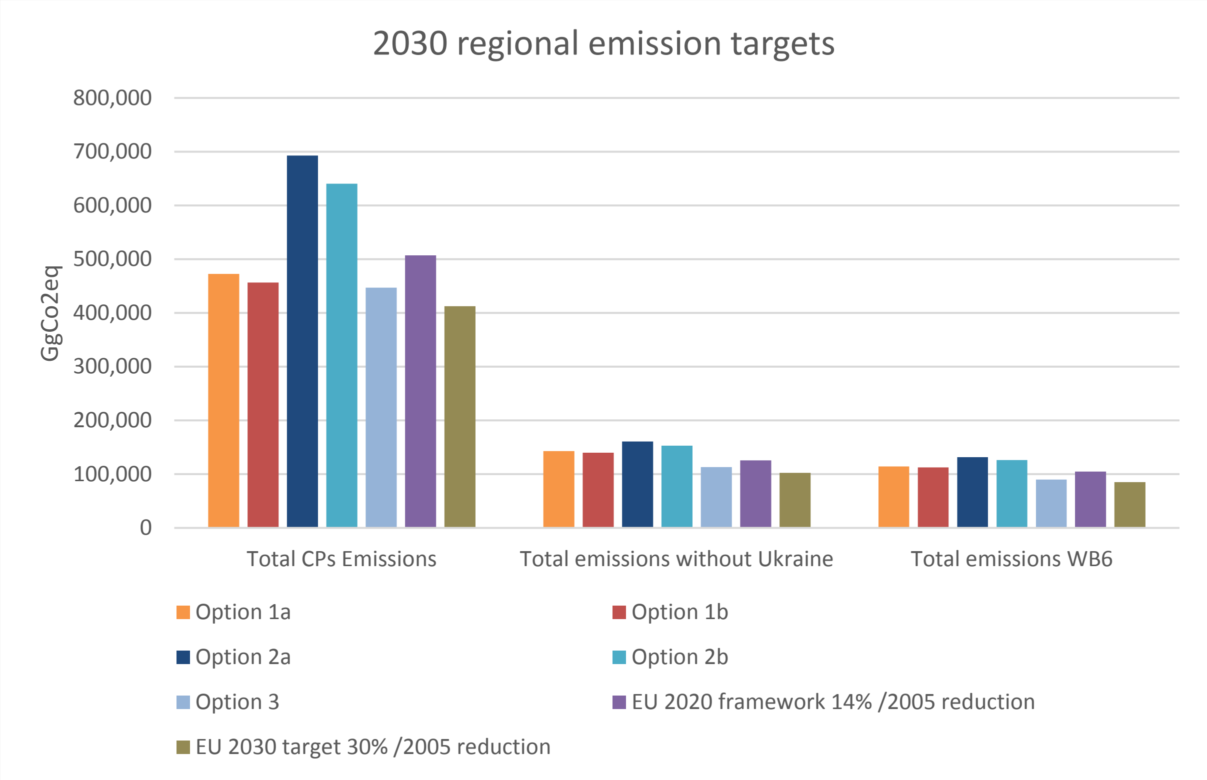


Figure 233: 2030 regional emission targets

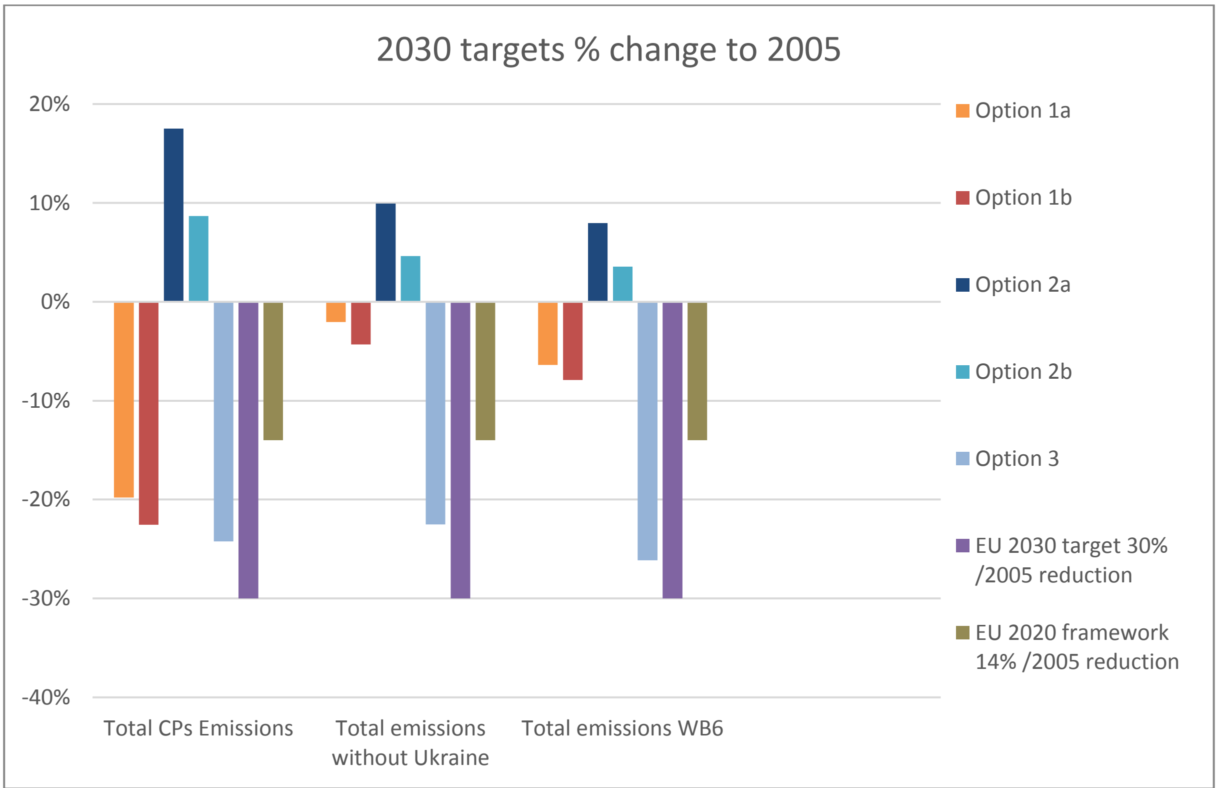


Figure 234: relative change of 2030 targets to 2005

A sensitivity for the use of different GDP per capita years was undertaken. As Figure 235 shows, the base year (2013, 2015 or 2017) of the GDP/cap. calculation does not influence the results significantly for the three different regions as shown for Option 1a. This also holds true for Option 1b and Option 2, and also on country level, where the base year for GDP/cap. influences the target by less than 2% for all individual countries in all options.

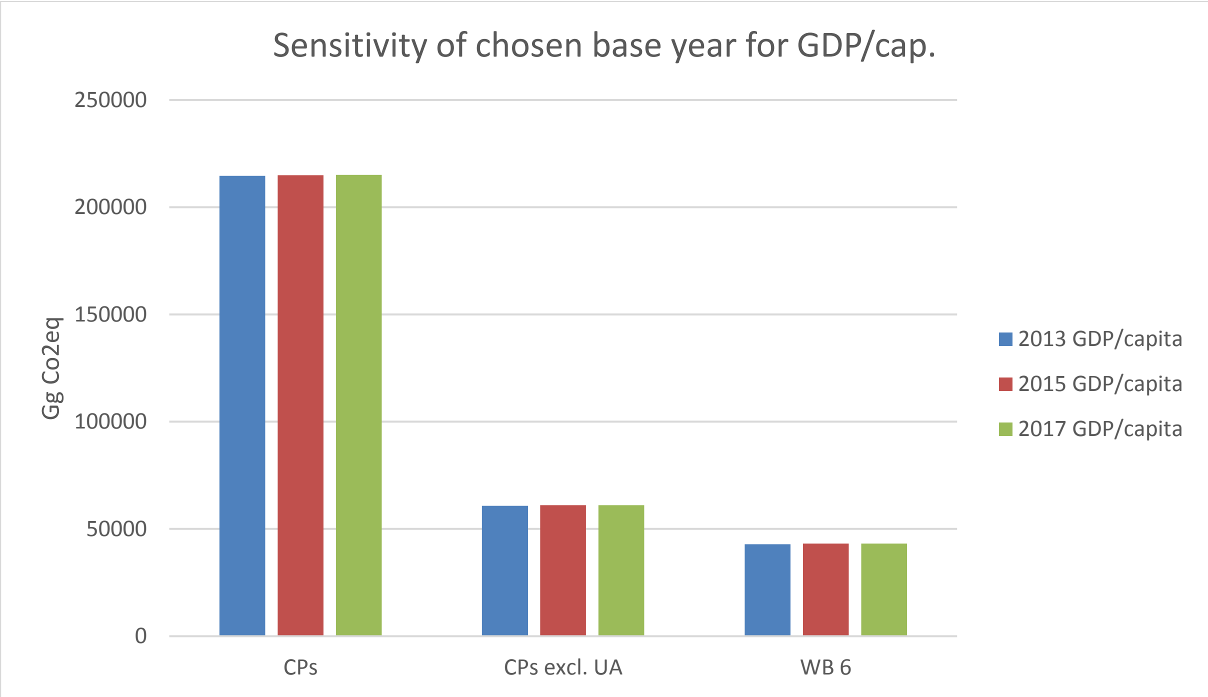


Figure 235: Sensitivity of chosen base year for GDP/cap.

4.5 Alignment with EU ETS

Several of the CPs may enter the European Union before 2030. This comes along with full compliance with the EU Acquis including the EU ETS Directive. For instance, the benchmark for aluminium production is 1,514 tonnes of CO_2/tonne aluminium. From 2021 onwards, the benchmarks will be reduced by a certain factor that represents efficiency improvements[31] (reduction of benchmarks is set in a range of between 0,2% and 1,6% annually).

Therefore, in counties that will accede the EU in the near future, the industry needs to be prepared and has to reduce carbon intensity fast; either by energy efficiency measures in industry, by reduction of GHGs that are by products of industrial processes such as PFC in case of aluminium production or by a switch from coal to less carbon-intense fuels including natural gas for those industrial processes where it is possible. In Croatia, the EU accession was no major issue for Croatian companies that entered the EU-ETS as carbon prices were low at that time. Currently, we see a strong rise in carbon prices with even higher prices predicted in the next years, that companies entering the EU-ETS will have to face.

While there may be cheap reduction potentials that will be exploited by the EU ETS, there are also expensive reduction options that will require early reduction measures in order to prevent high carbon costs after EU accession.

The carbon intensity in industry of most countries decreases until 2009 but follows a stagnating trend afterwards. In Bosnia and Herzegovina, the carbon intensity increased after 2008 as a result of technology change: a lower carbon-emitting steel making process (electric arc furnace) was substituted by a far higher emitting technology (coal-based blast furnace). Also in other CPs, the use of coal instead of gas in the industrial sector has increased over time. This switch has also led to an increase in industrial emissions in Serbia and Ukraine (Shatoka, 2014).

[31] DIRECTIVE (EU) 2018/410 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 14 March 2018 amending Directive 2003/87/EC to enhance cost-effective emission reductions and low-carbon investments, and Decision (EU) 2015/1814

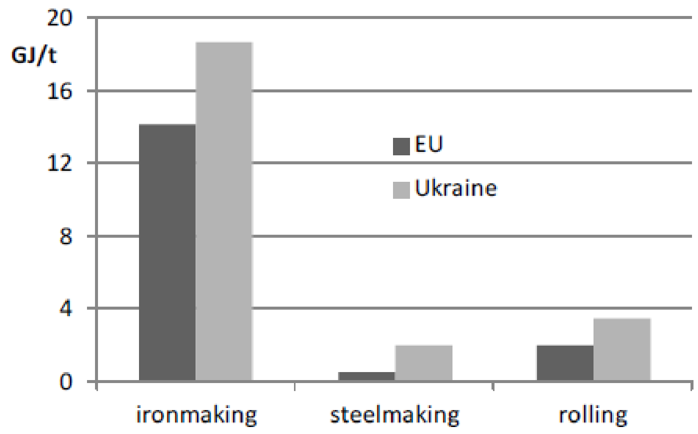


Figure 236: Energy consumption in iron and steelmaking in Ukraine (Shatoka, 2014)

The energy intensity for certain industrial sectors is very low compared to the EU level in some of the CPs as shown in the figure above for Ukraine.

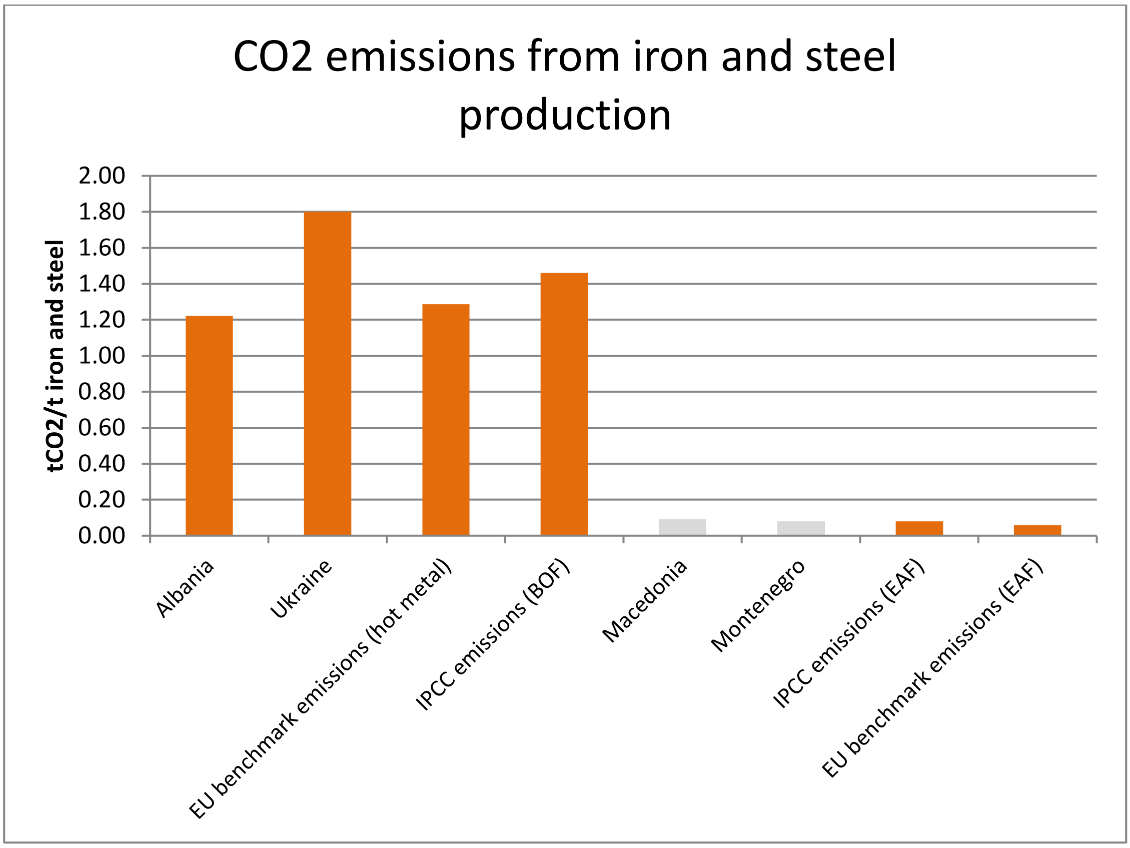


Figure 237 Carbon intensity of iron and steel production

Figure 237 above shows the emissions of the iron and steel making industries in several CPs. Most CPs predominantly use the carbon-intensive coal-based blast furnace process, fewer countries use the low emission electric arc process.

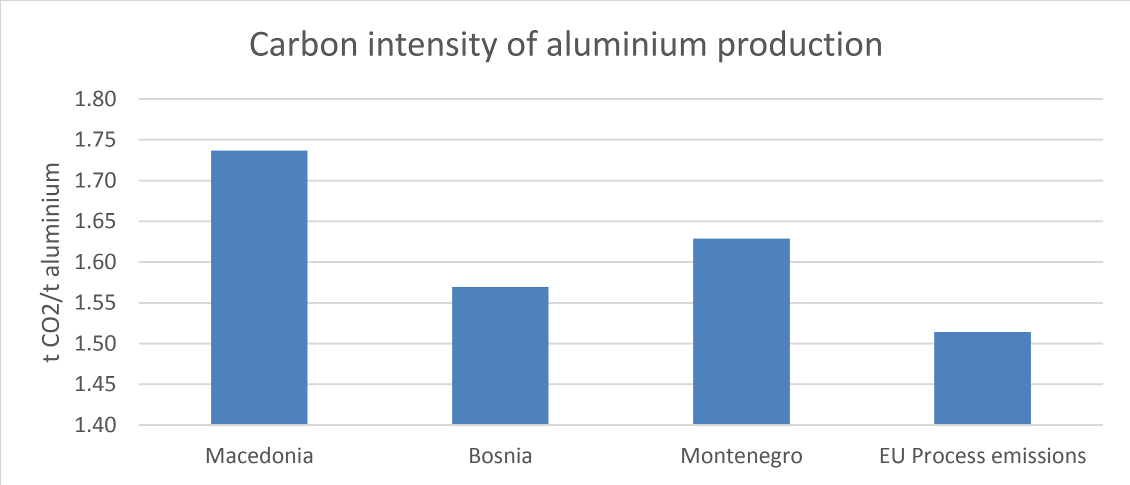


Figure 238 Carbon intensity of aluminium production

4.6 Policy options for the ETS sectors

As explained above, carbon intensities will have to be addressed in the CPs. Also, the process of carbon leakage from EU countries, which are facing increasing carbon prices and therefore locate production processes in the CPs has already started. While an ETS is a significant policy instrument in particular in the power sector which can potentially address both of these issues, establishing an ETS is not easy regarding data requirements and operation. Therefore, depending on the country, the introduction of an ETS may not be the first available policy solution to the stated issues. A carbon tax can provide an effective 'preparatory period' for entities which will ultimately participate in an ETS (EBRD, 2015). For instance, in 2011 Ukraine implemented a tax on greenhouse gas emissions which has proved ineffective so far in reducing emissions and therefore needs improvements. In a short-term perspective, Ukraine has committed to create a domestic emissions trading scheme with gradual approximation of relevant European Union legislation as part of its Association Agreement with the EU (EBRD, 2015). Also Croatia had a trial ETS before joining the EU. While it did not achieve a liquid market, ETS companies got familiar with the concept and avoided high investments for emission reductions. Such a preparatory phase could allow for a gradual convergence to EU ETS carbon prices. Also, a regional ETS including all CPs is a possible policy approach and could operationalize the Option 3 for GHG target setting as presented in this report.

4.7 The contribution of EE and RE to GHG emission reduction

In this section, we summarise the outcomes of a brief analysis on how the assessed options for EE and RES targets affect GHG emission reduction in the Energy Community and its CPs. Please be aware that this shall only serve to illustrate interlinkages and trends rather than deriving solid numbers.

The approach used can be described as follows:

- Firstly, based on 2030 energy consumption (imposed by EE target setting), the "fossil fuel remainder" has been calculated, indicating all energy required to meet demand that is not covered by renewables supply (which is set in accordance with the RE target). This calculation is done by energy sector and then figures are cumulated to derive an overall trend.
- Secondly, a similar calculation is done for 2015 using historic data, serving as benchmark for the expressed carbon reduction.
- Thirdly, for a simplified translation of energy figures (concerning fossil fuel use) into CO_2 emissions sectorial carbon intensities are taken from PRIMES modelling for the heating & cooling sector and for

transport. For the electricity sector carbon intensities are derived endogenously (by REKK's EEMM electricity market model).

- A final step implies to compare estimated CO_2 emissions for 2030 with the estimation done for the status quo (2015). The change in calculated CO_2 emissions between today (2015) and 2030 indicates the combined contribution of energy efficiency and of renewables towards GHG emission reduction. Moreover, this also includes changes that might come up from changes in the fossil mix in the power sector as derived by own modelling.

Table 95 summaries the outcomes of this brief assessment, indicating the contribution of EE and RE toward CO_2 emission reduction for the same set of RE and EE scenarios used within the impact assessment as part of the RE analysis (see section 3.4). This rough indication shows that the approaches used for EE and RE target setting will have a strong impact on the RE uptake (as outlined in section 3.3 and 3.4) and on the complementary resulting GHG emissions.

Table 95: Approximation of GHG savings from RE and EE by 2030 by CP and the EnC

Approximation of GHG savings from RE and EE by 2030 by CP and/or the Energy Community	2030 GHG targets vs. status quo			Contribution of RE and EE to GHG savings: Savings in GHG emissions by 2030 compared to status quo (2015)									
	GHG target 2030 (according to Option 1)	GHG emissions status quo (2013)	Required TOTAL change in GHG emissions (2030 vs status quo)	No Policy		RE target fulfillment - with RE cooperation		RE target fulfillment - without RE cooperation		RE target fulfillment - EE-Option: High demand		RE target fulfillment - EE-Option: Low demand	
[Unit]	Mt CO2	Mt CO2	Mt CO2	Mt CO2	%*	Mt CO2	%*	Mt CO2	%*	Mt CO2	%*	Mt CO2	%*
Albania	8.09	8.13	-0.04	-0.49	1255%	-2.17	5609%	-1.61	4155%	-0.74	1906%	-2.58	6671%
Bosnia & Herzegovina	18.32	24.03	-5.71	1.57	n.a.	-2.75	48%	-1.01	18%	1.00	n.a.	-6.44	113%
Georgia	11.53	16.61	-5.08	-0.72	14%	-3.19	63%	-3.19	63%	-3.31	65%	-3.31	65%
Kosovo*	13.67	11.00	2.67	-0.97	n.a.	-3.11	n.a.	-2.57	n.a.	-2.27	n.a.	-4.36	n.a.
North Macedonia	9.01	32.37	-23.36	0.31	n.a.	-3.47	15%	-3.14	13%	-2.88	12%	-3.87	17%
Moldova	12.76	12.84	-0.08	1.02	n.a.	0.85	n.a.	0.77	n.a.	1.58	n.a.	-1.97	2582%
Montenegro	3.11	3.87	-0.76	-0.91	120%	-3.66	481%	-1.05	139%	-0.83	109%	-1.33	175%
Serbia	59.87	62.52	-2.65	-2.01	76%	-11.79	444%	-17.35	654%	-13.33	502%	-21.51	811%
Ukraine	329.78	408.27	-78.48	23.80	n.a.	-34.52	44%	-34.42	44%	-12.76	16%	-65.95	84%
Energy Community	**466.13**	**579.63**	**-113.50**	**21.60**	**n.a.**	**-63.81**	**56%**	**-63.57**	**56%**	**-33.54**	**30%**	**-111.34**	**98%**

Remarks:
* … share of total GHG savings compared to status quo (as required for meeting the 2030 GHG target)
n.a. … not applicable

The "No Policy" scenario concerning renewables makes clear that in the absence of dedicated support for RE an increase of CO_2 emissions appears indispensable, despite comparatively strong measures taken on energy efficiency. At EnC level CO_2 emissions would then increase by about 22 Mt CO_2 by 2030 compared to today (2013/2015). That appears remarkable, since as default this scenario still builds on the assumption that a comparatively strong EE target is imposed as presumed for the EE target setting option "Baseline 32".

In contrast to above, dedicated policies for RE in combination with RE targets set according to the RE target setting option "EU mimic 2" (where at EnC level a strong uptake of RE is assumed until 2030, leading to a RE share above 26% in GFED) would allow for comparatively strong GHG savings. Here about 64 Mt CO_2 can be saved by 2030 (in comparison to today). That corresponds to about 56% of the overall savings required for meeting 2030 GHG targets (set in accordance with GHG target setting option 1).

Stronger savings appear feasible if either the RE ambition or the EE ambition would be strengthened. This is exemplified in Table 95 for the case of strengthening the EE target (i.e. low demand case): under this variant about 98% of the required CO_2 savings could be achieved by the combined contribution of EE and RE. The latter option would help CPs to achieve most of their GHG targets, in some cased CPs can even go beyond the proposed GHG targets of Option 1a, such as in Albania. In the case of Kosovo the planned 500 MW coal power plant could be significantly downsized.

Summing up, one can see that the EE target has a strong impact on the feasibility of target achievement in RE and in GHG mitigation. Thus, an unambitious EE target challenges the achievement of RE targets and endangers the feasibility of GHG limits. In the same way, an unambitious RE target would also limit the contribution of renewables towards GHG emission reduction. Vice-versa, the GHG targets as defined in option 1a could be expected to provide a significant trigger for the improvement of EE and/or RE expansion.

4.8 Conclusions

Setting 2030 GHG targets for CPs is the beginning of a convergence process towards the EU long term (i.e. 2050) target that needs to take into account countries' current and historic emissions profiles and the strong need for economic recovery. Relating mitigation efforts to the country's' economic situation expressed in GDP/capita is a main principle of our approach and in line with the effort sharing approach of the EU. Our approach includes elements of both the EU 2020 and 2030 non-ETS effort sharing methodology in order to acknowledge the different economic situation of the CPs. We apply two options: For option 1, we use this approach for the non-ETS sector only, while for Option 2 this approach is used for the entire economy. For Option 1, national projections and model-based results were used for the ETS sectors. This approach better reflects national circumstances and realities. However, the separation of the ETS and non-ETS sectors and their corresponding emissions can only be made indicatively given the data basis available. Option 2 is simple to apply, however, this approach strongly deviates from the EU framework and tends to set emission targets for the ETS sectors below the ones taking into account national studies. In order to take into account the fact that 2020 targets, allowing for a maximum emissions increase of 20%, were set a significant time ago, we apply an option "b" to both approaches. Options 1b and 2b consist of ceiling potential emission increases with a maximum 0f 10%, representing the average between the EU 2020 and 2030 ceiling. In addition, we propose an Option 3 which applies the EU target to the entire ETS sectors.

The proposed 2030 GHG targets have, depending on the groups of countries, a higher or similar level of ambition as compared to the EU 2020 framework. While adopting the 2030 target also for the EnC countries would be importantly over-ambitious, the proposed Option 1 may well reflect their current economic situation.

Setting GHG targets in the EnC region is strongly needed. In CPs there are several highly GHG emitting industrial processes and the risk of Carbon leakage from EU countries that face increasing carbon prices could lead to an increase of these processes, which has already started to a certain extent. In several CPs, the ETS sectors have a far higher share of total emission than the non-ETS sectors. In this context, a further alignment with the EU acquis may importantly contribute to future emission profiles. Besides the Large Combustion Plants and Industrial Emissions Directives that were already adopted in the Energy Community, EU-ETS benchmarks would apply upon EU ETS accession. While an ETS is a significant policy instrument in particular in the power sector by incentivizing a fuel switch, establishing an ETS is not easy regarding data requirements and operation. The separate treatment of ETS and non-ETS sectors even before becoming part of an ETS would support the preparation of a future ETS participation. Preliminary instruments such as a carbon tax can offer a solution for an effective 'preparatory period'.

5 Concluding remarks

Several approaches exist to define an *Energy Efficiency* target for the Energy Community in 2030 as well as at the level of individual CPs. As starting point, a closer look has been taken at the approach followed at EU level. At EU level, a 20% reduction of energy demand compared to baseline projection is targeted for 2020 as outlined in Directive 2012/27/EU on energy efficiency. For 2030 a political agreement has been achieved on the overall ambition level – i.e. a 32.5% reduction of energy demand compared to projected baseline conditions shall be achieved by 2030 at EU level. This corresponds to a net increase of the EE effort by 12.5 percentage points at EU level and to a reduction of -20% and -26% to historical consumption levels observed in 2005 for FEC and PEC, respectively. The Commission proposal for the 2030 target for the EU28 built on a comprehensive impact assessment exercise, which took also into account the macro-economic impacts on GDP and employment.

As indicated within this chapter, there is however no single way how to translate this exercise for the EnC, and the analysis should start from an assessment of the data and projections available, both on the energy system and on the economic fundamentals. Following the same ambition at EnC level implies for example to strive for an increase at EnC level from 20% by 2020 (i.e. the expected EE target at EnC level) to also 32.5% by 2030. A severe challenge in applying this approach to the EnC arises from the following issue: a suitable baseline scenario is not so easy to determine for the EnC as whole as well as for selected CPs, due to data limitations. As illustrated for example in Figure 2, there is a substantial gap between (previously derived) energy scenarios and actual energy consumption at CP as well as at EnC level. At the same time, however, the economic development of the countries must be taken into account when setting the ambition level for energy efficiency targets. Here, similar to energy consumption, actual figures are far below previously projected ones. A second limitation is that such methodology might not be well suited to take into account the differences in economic development of the EnC compared to the EU28.

On the basis of previous analyses, i.e. the findings gained in Resch et al. (2018) and our follow-up elaborations within this study, as well as on the basis of calculations done by national authorities, we introduced and compared three different approaches for setting an EE target: These options differ in the underlying methodology for target setting, and for two of them we vary the ambition level, i.e. showing various options how quantitative targets can be set. For each option we then calculated the corresponding primary and final energy consumption for 2030 and undertook a comparison of related impacts. By use of indicators, i.e. socio-economic, on energy performance and advanced indicators that combine both aspects, we illustrated how proposed targets match with historic trends and with EE target setting in other countries or regions. Aim here was to assist in the identification of a suitable target setting option that would lead to a comparable effort with the EE target set at EU level, while respecting difference in economic welfare.

Thus, the following three principal methodological options for EE target setting were analysed:

- Baseline approach
- Base year approach
- Domestic perspective.

The central element of the ***baseline approach*** is to first derive or make use of a projection of future primary and/or final energy consumption under baseline conditions, i.e. in the absence of proactive energy efficiency measures that limit demand growth. In a second step, an energy efficiency target is then determined on the basis of this energy consumption for the year under consideration, in our case 2030. This energy efficiency target can then be calculated or expressed as a relative reduction, but also as an absolute reduction compared to this baseline scenario in 2030. For our assessment of EE target setting we made use of the Baseline III scenario for the EnC and its CPs since this baseline trends appeared most balanced across the EnC and aimed to incorporate all relevant caveats and characteristics of the different CPs. On the basis of this baseline trend we then defined three different ambition levels for the 2030 EE target:

- As default, in accordance with the EE ambition imposed at EU level numerically, we assumed a (moderate) reduction of 32.5% compared to baseline,
- Then we added a corridor of +/- 20% to that, leading to a (high) EE target of 39% and a (comparatively low) EE target of 26%.

Under the ***base year approach*** an absolute or relative reduction target for primary and/or final energy consumption is defined in comparison to a base year in the past. The advantage of this methodology is that for target setting there is no need for modelling the development of energy consumption under baseline conditions in future years. However, it is important to agree on a representative base year that allows for describing the energy system adequately for all involved countries. Consequently, also here it is important to have a common and consistent data basis among all involved countries, in particular for the base year, so that energy supply and demand are accounted according to agreed principles and methods, and that the underlying statistical data is of reasonably good quality. Here 2008 has been identified as suitable for the EnC and its CPs. Similar to the baseline approach we have chosen the default ambition level of 19%, here compared to the final energy consumption in 2008, in accordance with the EE ambition imposed in the 2030 context at EU level. We then added two more variants and consequently introduced a corridor for the EE ambition level. Within the follow-up analysis it became however clear that the 19% target can already be classified as ambitious. We were therefore setting a corridor between 1% and 19% in relation to final energy consumption in 2008.

Where available, as a third principle option the *domestic perspective* is considered. Here country-specific baseline- and energy efficiency scenarios, developed by the CPs themselves, are used. In contrast to the scenarios outlined above, this means that each CP performs its own calculations regarding the development of energy consumption with or without energy efficiency measures up to 2030 and also presents these scenarios in their NEEAPs in order to define its own energy efficiency targets on this basis. These scenarios are of interest as the CPs themselves often are in the best position regarding data to develop these scenarios. However on the one hand, the problem is that not all CPs have published an energy strategy including an energy efficiency perspective for 2030. On the other hand, the challenge lies in, that data and approaches used by the CPs have not been harmonised and that, consequently, the correspondingly projected developments in energy consumption within the CPs are difficult to compare.

Socio-economic, energy performance and advanced indicators that combine both aspects were then derived to assess the consequences of derived EE target setting options. Thus, the indicator-based analysis aimed for putting the range of energy efficiency target setting options into a broader perspective. By use of these indicators, we illustrated how proposed targets match with historic trends and with EE target setting in other countries or regions. Aim here was to assist in the identification of a target setting option that would lead to a comparable effort with the EE target set at EU level, while respecting difference in economic welfare and development.

In the following it is shortly described how reasonable, lacking in ambition or too constraining the assessed EE targets seem from the perspective of each CP.

For the case of Albania only the Baseline 26 approach seems reasonable. The corresponding EE target seems to be ambitious since Albania has an economic structure which is more agriculture-orientated than most other CPs and EU MSs. This leads to a less energy intensive economy when compared to other cases. In comparison to above, all Base year targets are too constraining for Albania.

Baseline 26 and Baseline 32.5 are a good fit as an EE target for Bosnia and Herzegovina. Depending on the indicator (final- or primary energy consumption), Baseline 26 is a bit lacking in regards to final energy. All Base year targets are too constraining for Albania.

For Georgia only Baseline 26 seems reasonable as a 2030 EE target. Especially all Base year targets seem too constraining, as the growth in energy demand after the year 2008 was much higher than in any other CP. Baseline 26 is also the only reasonable EE target for Kosovo* and Moldova.

For the case of Montenegro both central EE scenarios and their targets represent a good fit (Baseline 32.5 and Base year 10). When comparing these targets, Baseline 32.5 seems a bit less ambitious in regards to its final energy target. Baseline 10 may constitute the better balanced EE target for Montenegro.

North Macedonia is in a similar situation as Bosnia and Herzegovina, and Baseline 26 and 32.5 represent a good fit as an EE target. The difference is that overall Baseline 26 seems to be fine when looking at both indicators and Baseline 32.5 may constitute a bit too constraining EE target for final energy consumption.

For the case of Serbia the Baseline 32.5 and Base year 1 approach lead to the most reasonable EE targets for 2030, leading to a required cap consumption that stays within the range of comparable efforts. This conclusion builds on a comparison with EU MSs which show the most similarieties when compared to Serbia in regards with to their economic structure.

Ukraine is a special case compared to all other CPs, as it has a strong decline in demand for energy over the last 10 years, that was not foreseen in reagrds to its Baseline scenario. For this reason only the most ambitious Basline EE tragte, Baseline 39, seems reasonable for the Ukraine.

Overall, ther is no single EE target definition that fits for all CPs. A possible solution to overcome that deficit is to undertake further research in this respect. On the one hand, more Base years and other corridors could be tested. On the other hand, the Baseline III scenario, to substract 32.5% from a Baseline trend as done at EU level, could be further fine-tuned so that this logic would fit for all CPs.

Table 96: Summary table for the qualitative assessment of all EE target setting options for all CPs

Indicator	Domestic	Baseline 26	Baseline 32.5	Baseline 39	Base year 1	Base year 10	Base year 19
Albania	Intermediate (ambition)	Reasonable	Intermediate (constraining)				Too constraining
Bosnia and Herzegovina							
Georgia	Not ambitious						
Kosovo*							
Moldova							
Montenegro							
North Macedonia							
Serbia							
Ukraine							

Different approaches compared to Energy Efficiency are proposed for establishing 2030 targets for *Renewable Energies*. Here it appears wise to mimic the EU approach taken, following two steps for determining RE targets in the 2030 context. *In a first step, the RE ambition at the aggregated level, here at the level of the Energy Community has to be agreed upon*, and, in a second step, the EnC target needs to be distributed across CPs.

For determining the RE ambition at EU level (cf. step 1 as described above) comprehensive modelling activities and complementary analyses were undertaken throughout last years, accompanied by intensive policy discussions at various levels. This resource and time intensive procedure can hardly be mimicked at EnC level – but a move into the right direction was already taken within our previous analysis as described in Resch et al. (2018).

The benchmarking approach used within *step 2, i.e. for distributing the RE effort across CPs*, considers country-specific differences in economic strength (measured in terms of GDP), the potential for RE, the interconnection level in the ENTSO-E, as well as efforts/commitments taken in the past. As opposed to the 2020 RE target setting, no first mover bonuses appear useful to consider: Since there is a legally binding support framework in place in the period prior 2030, first mover bonuses are deemed to be unfair. Neither we suggest to include any caps on overall RE shares (as used for MSs with comparatively high RE shares in the 2020 context).

On the basis of previous analyses, i.e. the findings gained in Resch et al. (2018) and our follow-up elaboration as discussed above, the two-step approach has been followed and, furthermore, we have introduced and compared in total six distinct options for setting RE targets for the EnC and its CPs:

When aiming for a *mimicking of the approach taken at EU level* in determining the 2030 RE ambition, two options occur:

- EU mimic 1: ABSOLUTE with 4 components: same absolute increase of RE ambition (i.e. +12 pp RE share increase at EnC level, step 1), combined with “4 component” benchmarking approach (incl. a flat rate, a GDP/capita, a potential and an interconnectivity-component) for distributing the effort across CPs (step 2).
- EU mimic 2: RELATIVE with 4 components: same relative increase of RE ambition (i.e. + 9.8 pp RE share increase at EnC level, step 1), combined with “4 component” benchmarking approach for distributing the effort across CPs (step 2).

Next we opened up the basket of options that can be used for RE target setting for determining both the RE ambition at EnC level (step 1) and how that is distributed across CPs (step 2). All *alternative options* still aim for respecting the principles followed at EU level but differ in the detailed application of these principles, for example concerning the benchmark formula (e.g. when ignoring certain components). Thus, the following four alternative options for RE target setting were analysed:

- Alternative 1: RELATIVE with 3 components, excluding the RE potential-based component (due to data uncertainty related to that)
- Alternative 2: WEIGHTING with 4 components: Here we follow an alternative concept for determining the RE ambition at EnC level. Conceptually, we apply here the benchmarking formula, i.e. the weighting approach, to determine the RE ambition not only at country but also at the level of the EnC. Consequently, the EnC as a whole is here treated similar to a MS of the EU within step 1.
- Alternative 3: WEIGHTING with 3 components, similar to alternative 2 but with only 3-components to distribute the RE effort across CPs.
- Alternative 4: (Full) flat rate, imposing a 12 pp increase of the RE share for the EnC and its CPs

The resulting RE targets (expressed as RE shares in gross final energy demand) for all CPs as well as at EnC level, **gained from applying the RE target setting concepts** introduced above, are shown Figure 239.

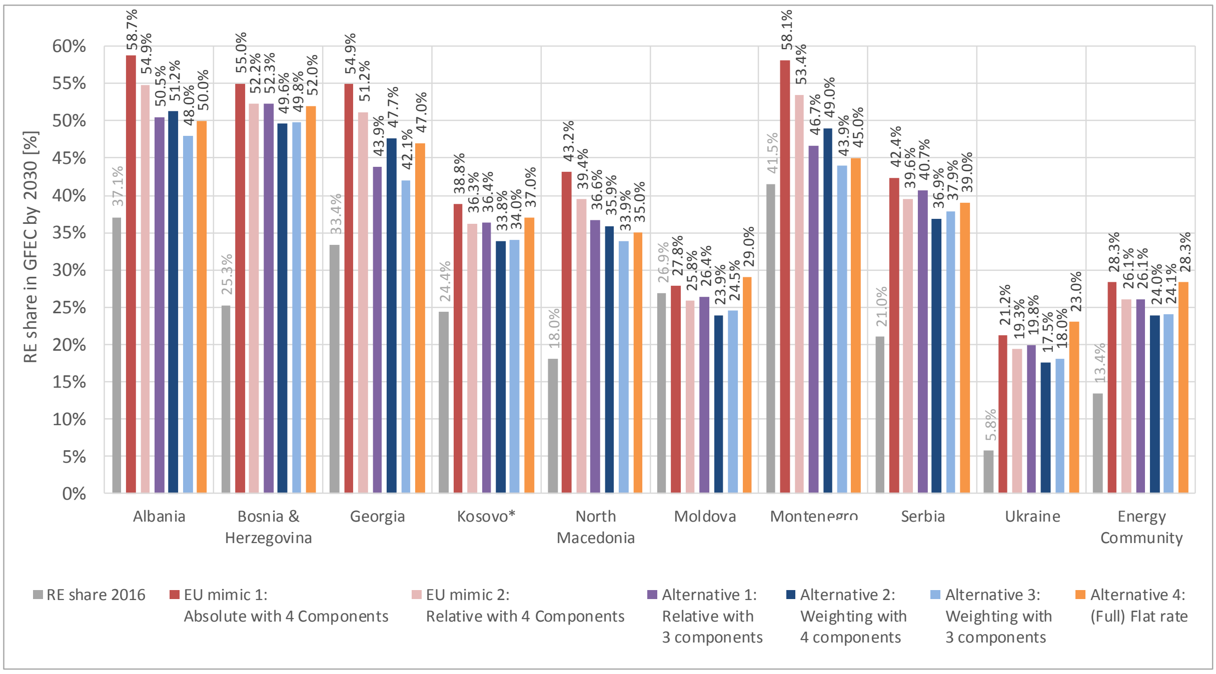


Figure 239. **2030 RE targets for all CPs and the EnC region according to proposed target setting options. (Source: EUROSTAT, 2018; IEA, 2018; IMF, 2019; NTUA, 2012; own calculations)**

This illustration allowed for a first comparison of the consequences, here exemplified at the aggregated level, i.e. the Energy Community as a whole:

- The strongest increases in renewable energies are observable in target setting options “EU mimic 1” and “Alternative 4”: in both cases an increase of the RE share (in gross final energy demand) by 12 percentage points is presumed, i.e. from 16.3% in 2020 to 28.3% in 2030 at EnC level. The increase of the RE share in percentage points is here kept similar to the target setting at EU level (here from 20% to 32%). This reflects a flat rate concept and as such mimics the EU approach taken by postulating the same increase in RE ambition in absolute terms. Compared to today where renewables stand at 13.4% (2016) at EnC level this implies, however, to (more than) double the RE share until 2030.
- A comparatively lower increase occurs under target setting option “EU mimic 2” and “Alternative 1”: here an increase of the RE share by 9.8 percentage is required in the period 2020 to 2030. Similar to above, the aim is here to mimic the approach taken at EU level but to also respect differences between the EU and the EnC in the starting point for RE. In practical terms, under these target setting options the same relative increase (compared to the EU) of the RE share is postulated at EnC level. At EU level an increase of the RE share from 20% by 2020 to 32% by 2030 implies a relative increase of the RE share by 60%, leading to a 2030 RE target at EnC level of 26.1%.
- Under a weighting approach as followed in option “Alternative 2” and “Alternative 3” the comparatively lowest increases of the RE share are required, ranging from 7.7 (4 component approach) to 7.8 percentage points (3 component approach). In accordance with the benchmark formula (described in Annex II of the Governance Regulation (EU) 2018/1999) four distinct components are considered and each has a dedicated weight in overall RE target calculation, cf. Table 68. Since GDP per capita and the availability of least-cost RE potentials are both lower at EnC level compared to the EU average (cf. Figure 157), a low to moderate RE increase is needed according to these components. Generally, the underlying weighting approach can be seen as an attempt to explicitly incorporate principles of economic welfare in the overall determination of the RE ambition at EnC level (under step 1) and not only for the distribution of that (under step 2)

Complementary to the RE target calculation, a brief analysis of related impacts has been undertaken as described in section 3.4 of this report. A model-based analysis provides first insights on the feasibility of achieving postulated 2030 RE targets, indicating the necessary RE deployment at sectorial level by CP as well as related direct economic impacts on required investments and financial support. In brief, achieving the proposed RE targets can be classified as challenging but feasible to undertake under the given circumstances. It requires an increase of the RE policy ambition across the EnC and the provision of dedicated support for renewables in the years to come. A cross-country comparison of expected 2030 RE deployment in accordance with the given RE targets indicates that in relative terms, Albania, Bosnia and Herzegovina, Georgia and Montenegro are in the lead, all achieving a RE share above 45% in the RE target scenarios by 2030. Despite the expected large share of renewables in overall energy supply, in absolute terms their contributions appear less impressive – here Ukraine outperforms and accounts for about half of the required RE effort by 2030. On second place follows Serbia, adding however only a quarter of the expected contribution of Ukraine.

The analysis provides also first insights on (direct) economic impacts. Required public financial support for renewables accounts for around one fifth of the investments taken by the private sector: whereas average (2021 to 20203) annual investments are generally in a range between 1.5 and 4% in all target scenarios, required financial support varies typically in a corridor between 0.2 and 0.7% of GDP. Moreover, slight benefits that come along with RE cooperation are observable compared to a pure national perspective where each country aims to meet the given target strictly with domestic resources.

Setting 2030 *Greenhouse Gas emission* targets for CPs is the beginning of a convergence process towards the EU long term (i.e. 2050) target that needs to take into account countries current and historic emissions profiles and the strong need for economic recovery. Relating mitigation efforts to the country's economic situation expressed in GDP/capita is a main principle of our approach and in line with effort sharing approach of the EU. Our approach includes the application of both the EU 2020 and 2030 non-ETS effort sharing methodology in order to acknowledge the different economic situation of the CPs. We apply two options: For option 1, we use this approach to the non-ETS sector only, while for Option 2 this approach is used for the entire economy. For Option 1, national projections and model-based results were used for the ETS sectors. This approach better reflects national circumstances and realities. However, the separation between ETS and non-ETS can only be made indicatively given the data basis available. Option 2 is simple to apply, however, this approach strongly deviates from the EU framework and tends to set emission targets for the ETS sectors below the ones taking into account national studies.

While adopting the 2030 target also for the EnC countries would be importantly over-ambitious, the chosen approach may well reflect their current economic situation. Adopting a RE and EE target in the EnC region would lead for most CPs to a GHG target achievement, for some even to an overachievement, such as in Albania, a few such as Ukraine or Georgia also need to focus on non-energy related mitigation options. Setting GHG targets in the EnC region is strongly needed. In CPs there are several highly GHG emitting industrial processes and the risk of Carbon leakage from EU countries that face increasing carbon prices could lead to an increase of these processes, which has already started to a certain extent. In several CPs, the ETS sectors have a far higher share of total emission than the non-ETS sectors. Alignment with EU acquis will determine future emission profiles. This includes the Large Combustion Plants and Industrial Emissions Directives, which were adopted in the Energy Community, but also EU-ETS benchmarks, that will be relevant upon EU ETS accession. While an ETS is a significant policy instrument in particular in the power sector by incentivizing a fuel switch, establishing an ETS is not easy regarding data requirements and operation. The separate treatment of ETS and non-ETS sectors even before becoming part of an ETS would support the preparation of a future ETS participation. For instance, a carbon tax can offer a solution for an effective 'preparatory period'.

The *interlinkage between EE, RE and GHG emission reduction*

A brief quantitative analysis that builds on our modelling works concerning the RE impact assessment aims to indicate the contribution of EE and RE towards GHG emission reduction. Via a set of distinct scenarios we showcase how assessed options for establishing EE targets, combined with the required uptake of renewables in accordance with targets proposed in that field, affect GHG emission reduction in the Energy Community and its CPs. Below we provide a brief recap of key results and findings:

- A “No Policy” scenario concerning renewables makes clear that in the absence of dedicated support for RE an increase of CO_2 emissions appears indispensable, despite comparatively strong measures taken on energy efficiency. At EnC level CO_2 emissions would then increase by about 22 Mt CO_2 by 2030 compared to today (2013/2015). That appears remarkable, since as default this scenarios still builds on the assumption that a comparatively strong EE target is imposed as presumed for the EE target setting option “Baseline 32”.
- In contrast to above, dedicated policies for RE in combination with RE targets set according to the RE target setting option “EU mimic 2” (where at EnC level a strong uptake of RE is assumed until 2030, leading to a RE share above 26% in GFED) would allow for comparatively strong GHG savings. Here about 64 Mt CO_2 can be saved by 2030 (in comparison to today). That corresponds to about 56% of the overall savings required for meeting 2030 GHG targets (set in accordance with GHG target setting option 1).
- Stronger savings appear feasible if either the RE ambition or the EE ambition would be strengthened. This is exemplified in Table 95 for the case of strengthening the EE target (i.e. low demand case): under this variant about 98% of the required CO_2 savings could be achieved by the combined contribution of EE and RE.

Summing up, one can see that the EE target has a strong impact on the feasibility of target achievement in RE and in GHG mitigation. Thus, an unambitious EE target challenges the achievement of RE targets and endangers the feasibility of GHG limits. In the same way, an unambitious RE target would also limit the contribution of renewables towards GHG emission reduction.

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7 Annex I - Development of a baseline scenario – recap of the Baseline III approach

The most appropriate methodology for baseline setting was recommended after a corresponding analysis of the pros and cons of a total of four different baseline scenarios: Reference 2012, Baseline 2007, Baseline II and Baseline III.

The methodology of calculating the individual scenarios is briefly summarized below.

- **Reference 2012:** Primes Reference 2012 was used for WB6, national baseline scenarios were taken from NEEAP'S and national energy strategies (Georgia, Moldova, Ukraine).
- **Baseline 2007:** Primes Baseline 2007 and the targets for 2020 were extended to include Georgia and the growth rates of Primes Reference 2012 as well as national calculated growth rate scenarios up to 2030 were used.
- **Baseline II:** Primes Baseline 2007 and the 2020 targets were extended to Georgia and the same methodology as used to calculate the 2020 targets was applied to 2030.
- **Baseline III:** Based on the Baseline II methodology, the 2020 targets of Albania were revised downwards and the Old BAU Scenario of the NEEAP was used for Ukraine.

The Baseline III approach and scenario was indicated as the most homogeneous one among all demand scenarios under past consideration, and has proven to be the most suitable starting point baseline trend for the follow-up processing within this study (i.e. on assessing impacts related to RE and GHG target setting). It is based on the methodology of calculating the 2020 targets scenario and was further adapted and redeveloped. 2020 targets were checked for plausibility and the most recent figures of economic development up to 2030 were also incorporated into the analysis. Compared to other scenarios, in the Baseline III scenario there are considerably fewer outliers upwards, but also fewer outliers downwards with respect to the PEC/GDP and FEC/GDP indicators within CPs. Since not all CPs were modelled in PRIMES, alternative energy scenarios had to be used for Georgia, Ukraine and Moldova, which also caused these outliers.

Aim of the baseline scenario was also to make use of the same procedure as followed at EU level for EE target setting – i.e. defining the EE target as a reduction of final and primary energy consumption compared to this baseline trend. Since the derived Baseline III scenario will serve also within this study as one (among in total three) options for EE target setting, we provide *below a brief recap of the considerations and reflections that led to this baseline scenario*.

Based on the Baseline 2007 approach for CP's, the 2020 values were extended to include Georgia and growth rates in terms of primary energy and final energy, derived from the PRIMES Reference Scenario 2012 (NTUA, 2012), were applied to calculate the baseline scenario for 2030. As Ukraine, Moldova and Georgia are not modelled in PRIMES, the National Energy Strategy for Moldova (Energy Strategy, 2012) and the presented BAU scenarios in the National Energy Efficiency Action Plans (NEEAP's) for Georgia (NEEAP, 2018) and Ukraine (NEEAP, 2017) had to be taken into account. The problem with this first baseline approach was the very high growth rates from 2015 to 2020 for Albania. This high increase is due to the fact that the calculated energy consumption for the 2020 targets for Albania is already relatively high, and in this respect an energy efficiency target based on this scenario would be relatively unambitious compared to other CPs. Moreover, applying the growth rates of the PRIMES reference scenario 2012 to 2030 also leads to a relatively high energy consumption for Albania in 2030. In addition, the strong increase in energy consumption of Georgia and Moldova is also noticeable. This led us to develop the Baseline II approach.

The Baseline II scenario builds on the same approach as the Baseline 2007 scenario. The difference lies in the calculation of EE targets for Ukraine, Moldova and Georgia. Instead of growth rates from the national scenarios until 2030, the share of WB 6 in total consumption in 2030 was simply assumed to be the same as in 2012, and starting from this point, scenarios for Ukraine, Moldova and Georgia were calculated. The problem of this approach was then the overly high energy consumption scenario of Ukraine and, as already previously mentioned, the problem of the overly high energy consumption of Albania in 2020 also remained, so that Baseline II can only be seen as an intermediate step to the Baseline III scenario.

The most suitable baseline scenario is Baseline III. The Baseline III scenario builds on the Baseline II scenario with the difference that for Ukraine the Old BAU scenario from the NEEAP was used. Since the previously calculated Baseline scenarios for Ukraine would be significantly higher than the Ukrainian scenarios and thus the targets would also be less ambitious than Ukraine itself would have assumed, there are clear arguments to use the Old BAU scenario of Ukraine in this case. Additionally, in the calculated Baseline III scenario the primary energy consumption of Albania in 2020, as projected by the PRIMES Baseline scenario was lowered by 45%. This can be seen as a reasonable approach, as the primary energy consumption in 2020 as projected in the PRIMES Baseline scenario appeared comparatively high. The primary energy consumption growth rates between 2020 and 2030 were kept the same (corresponding to the PRIMES Reference trends).

Table 97 shows both primary and final energy consumption in 2030 based on the Baseline III approach and for 2015 as derived in (Resch et al., 2018).

Table 97: The Baseline III scenario for all CPs. These demand scenarios serve as a basis for the subsequent sections. Source: Eurostat, 2019; IEA, 2019; own calculations.

Energy demand scenarios used for this impact assessment	PEC Historical 2015	PEC Baseline III 2030	FEC Historical 2015	FEC Baseline III 2030
Contracting Party	[ktoe]	[ktoe]	[ktoe]	[ktoe]
Albania	2,118	3,444	1,966	3,070
Bosnia and Herzegovina	6,114	9,126	3,497	5,578
Georgia	4,371	6,167	3,837	5,070
Kosovo*	2,476	4,066	1,344	2,335
Moldova	3,710	5,355	2,386	3,692
Montenegro	1,002	1,471	682	1,318
North Macedonia	2,593	4,239	1,852	2,957
Serbia	2,593	23,025	8,180	13,652
Ukraine	88,929	164,929	51,329	81,713
Energy Community	125,521	221,822	75,072	119,385

On the basis of previous analyses, i.e. the findings gained in Resch et al (2018) and our follow-up elaboration as discussed above, as well as on the basis of national calculations, we introduce and compare three different approaches for setting an EE target for all CPs:

These options differ in the underlying methodology for target setting, and for two of them we vary the ambition level, i.e. showing various options how quantitative targets can be set. For each option we then calculate the corresponding primary and final energy consumption for 2030 and undertake a comparison of related impacts. By use of indicators, i.e. socio-economic, on energy performance and advanced indicators that combine both aspects, we illustrate how proposed targets match with historic trends and with EE target setting in other countries or regions. Aim here is to assist in the identification of a target setting option that would lead to a comparable effort with the EE target set at EU level, while respecting difference in economic welfare.