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Will the Fit for 55 package deliver on energy efficiency targets?

A high-level assessment

This report is part of the project **'Stronger EED Target Governance'** by Stefan Scheuer Consulting and Fraunhofer ISI, financed by the European Climate Foundation.

The report assesses the Fit for 55 package published by the Commission on 14th July 2021. It provides high-level recommendations for strengthening the target ambition and governance and for increasing the synergies with other pieces of the package.

This analysis builds on the findings of the first phase of our project, which started in March 2021. The findings are presented in Annex 1 (EED target governance options) and 2 (Energy Savings potentials) to this report. In the first phase, we:

- assessed the different governance approaches in EU climate and energy policies;
- developed an energy efficiency target benchmarking and allocation approach; and
- updated the EU's and national economic energy savings potentials.

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Will the Fit for 55 package deliver on energy efficiency targets? A high-level assessment
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List of most common abbreviations

EED – Energy Efficiency Directive

ESR – Effort Sharing Regulation, also called the Climate Action Regulation

FEC – final energy consumption (applying the new Eurostat method, which excludes energy consumption of blast furnaces)[1]

GHG – greenhouse gas

GR – Governance Regulation

IA – impact assessment

NECP – National Energy and Climate Plan

RED – Renewable Energy Directive

REF 2007 – EU reference scenario, European energy and transport: Trends to 2030, update 2007

REF 2020 – EU reference scenario, Energy, transport and GHG emissions: Trends to 2050, update 2020[2]

PEC – primary energy consumption

[1] FEC = final energy consumption - final energy consumption (ambient heat (heat pumps)) + international aviation (all products total). This is different from the current EED indicator for FEC, FEC2020-2030, which includes energy consumed in blast furnaces

[2] COM (July 2021). EU Reference Scenario 2020, Energy, transport and GHG emissions - Trends to 2050.

1 Executive Summary

The European Commission published the Fit for 55 package on 14th July 2021 to align the EU's main energy and climate rules with the EU's new climate target for 2030. The package includes among others proposals for an overhaul of the EED[3]; an expansion of carbon pricing with a new ETS for buildings and road transport[4]; a new Social Climate Fund[5]; and higher RES[6] and ESR[7] targets.

A leap for the credibility of EU energy efficiency policy: The EED recast proposal increases the EU target ambition, makes the EU level target binding, and nearly doubles the national energy savings obligation. Potentially powerful target governance tools are introduced. They could increase compliance, enable enforcement and in effect secure the achievement of the EU target. At the heart sits a target allocation formula to foster a transparent and fair way to determine national contributions and a correction factor to avoid a gap between national contributions and the EU's target. But the legislators still have a substantial task to make this work in practice. It requires an explicit sequence of first applying the formula based on objective criteria, second considering the subjective criteria and third using the correction factor to close any ambition gap. The criteria of the target allocation formula should be reviewed to foster acceptance by Member States and to strengthen the climate and social equity perspectives. In order to improve enforcement and fill target gaps during implementation, national contributions need to be fixed once they are set by Member States.

A step towards cost-effective energy savings levels: The proposed EU 2030 energy efficiency-target levels of 9% below REF 2020 (36% below FEC REF 2007 and 39% below PEC REF 2007) are above the current targets of 32.5%, but remain below the potentials. Latest assessments show that economic energy savings would get the EU two times further: 17% below FEC REF 2020 and 18% below PEC REF 2020 (41% below FEC REF 2007 and 45% below PEC REF 2007). Furthermore, with increased carbon pricing and strengthened revenue recycling conditions, new economic energy savings potentials are created. Member States have to tap these potentials to mitigate negative social impacts of higher energy prices and to get on track towards climate neutrality.

A tailwind for a more ambitious EED implementation from climate policies: Recycling ETS revenues for energy efficiency measures, including new ones from the proposed ETS for buildings and transport, will help to avoid negative social impacts. But more needs to be done in the ETS proposal to secure additional energy efficiency spending on top of existing programmes. Member States can put

[3] COM (2021) 558 final
[4] COM (2021) 551 final, new chapter IVa
[5] COM (2021) 568 final
[6] COM (2021) 557 final
[7] COM (2021) 555 final

forward energy efficiency measures under the Social Climate Fund. The fund has the potential to drive the EED implementation by making payments conditional to achieving national energy efficiency contributions. The increased ESR targets will further drive the EED implementation. But this will not work for all Member States due to the wide spread of ambition levels between low- and high-income countries.

The European Parliament called repeatedly for a reinforced implementation of the EED through binding national targets - latest 2020 in their reaction to the Green Deal. The European Commission has come some way toward this expectation, but was held back by opposition from Member States.

The achievement of the target can be secured, if the EU's legislators manage to clarify and put the right order into the proposed target governance elements and fully deploy the supportive elements of the other pieces of the package. The result will be an effective and credible energy efficiency policy and an increased financial flow to support climate investments: the prerequisites to deliver a fast, fair and attractive energy transition.

2 New potentially powerful tools for the EED target governance

The EED recast proposal presents an overhaul of the EU's energy efficiency framework:

- The underlying goal of the EED will move from the completion of the Energy Union to contributing to climate neutrality (recital 11 EED recast).
- The targets are becoming binding for the EU and most other provisions and requirements for Member States are strengthened and consolidated. The number of exemptions is reduced.
- The EU 2030 target is set at 9% below the REF 2020 for PEC and FEC, which corresponds to an increase of the current target level of 32.5% to 36% for FEC, and 39% for PEC compared to the REF 2007.
- Potentially powerful new governance tools are provided, which could ensure that Member States set adequate and enforceable national contributions so as to secure the achievement of the EU's targets giving effect to their binding character.

The central tools are the introduction of a formula and correction factor for determining national contributions. Member States have to apply this formula, which is based on objective criteria, to determine their target allocation. Furthermore, they have to consider a list of subjective criteria, which may be used to justify changes to the result of the formula. If the resulting national contributions do not add up to the EU target, a common correction factor will be applied to all pledges to close the gap (gap avoider) and determine the final national contributions. Furthermore, Member States have to take additional measures within one year after they are found to be off track of their national indicative trajectories (gap filler).

This system of a gap avoider and a gap filler could secure the achievement of the EU's target. However, there are weaknesses and inconsistencies in the Commission's proposal:

- While the criteria as such in the formula are objective (Eurostat data), the baseline is set by REF 2020, which includes many assumptions and expert judgements made by the Commission or its contractors.
- It is not clear at what moment the correction factor will be applied: before or after Member States have used the subjective criteria to establish their national contribution. If the correction factor is applied before, it will not serve as a gap avoider.
- It is not explained who will establish the correction factor and what form it will take, enshrined in a Commission communication or decision or other.
- National contributions are labelled as 'indicative', which suggests that Member States can change them during implementation. This would result in instability and undermine a meaningful functioning of the gap-avoider and gap-filler mechanisms. The EU target achievement would be at risk and the credibility of the EU target would be undermined.

Table 1: Nature and governance of targets in the EED

	EED recast (2021) proposal	EED (2018)
Nature of the Union target	'Union's target' (Art. 1) 'Binding Union target' (Art. 4.2)	'Union headline target' (Art 1.1)
Nature of national contributions	Self-determined, indicative and based on a mix of subjective and objective criteria. (Art. 1, Art. 4.2 and Annex I) 'Member States shall collectively ensure a reduction of energy consumption of at least 9% compared to the projections of the 2020 Reference Scenario.' (Art. 4.1) National contributions are based on a formula with objective criteria, defined in an Annex to the Directive, and on a set of subjective criteria. (Art 4.2 (a) - (e))	Self-determined, indicative and using subjective criteria. (Art. 3.1)
	The 'indicative trajectory' for the contribution is self-determined. (Art 4.2)	The 'indicative trajectory' for the contribution is self-determined. (Art. 4. (b) (1))
	The formula and the set of criteria are mandatory. (Art. 4.2) The criteria include elements of the formula, but other additional elements as well. 'National contributions calculated based on the indicative formula' (first paragraph, Annex 1)	The criteria are mainly optional and not harmonised for all countries. (Art. 6 GR and Art. 3 EED)
Gap avoider	The main gap-avoider tool could be the correction factor provided in Annex I. It could ensure that any ambition gap towards the EU target will be redistributed equally among all Member States, if the factor of correction is undertaken after Member States applied subjective criteria. The process of determining and applying the correction factor is not explained. GR provisions on the ambition of energy efficiency national contribution should still apply. (Art. 31 GR)	The Commission shall evaluate the relevant circumstances in Art. 6.2 GR and other information provided in NECPs. (Art 31.2 GR) If draft contributions are insufficient for the collective achievement of the Energy Union objectives, the Commission 'may' issue recommendations to Member States whose contributions are deemed insufficient. (Art. 31.1 GR) If final contributions are still not sufficient, the Commission shall propose measures and exercise its powers at Union level. (Art 31.3 GR)
Gap filler	There is also a new gap-filler mechanism. If insufficient progress has been made to reach energy efficiency contributions, Member States which are above their indicative trajectory shall take additional measures. (Art 4.3) If Commission deems the measures insufficient it shall, as appropriate, propose measures and exercise its power at Union level to achieve the EU target. (Art 4.3)	General provision: if aggregate progress is not enough, the Commission may issue recommendations to all Member States. (Art. 32.2 GR) 'The Commission shall, as appropriate, propose measures and exercise its power at Union level in addition to those recommendations.' (Art 32.2 GR) If a Member State doesn't achieve sufficient progress, the Commission issues recommendations. (Art. 32.1 GR)

2.1 Target allocation and gap-avoider tools

On the formula and the objective criteria:

National contributions to the EU's target remain self-determined, but Member States shall apply a formula based on objective criteria (Art. 4.2 and Annex I EED recast).

Nevertheless, Annex I uses the wording 'indicative formula' which may raise confusion: the use of the formula would be mandatory (Art. 4.2 EED recast), but the formula itself could be modified as it is 'indicative' (Annex I EED recast).

The objective criteria used in the Annex I formula are the following:

- *Flat rate contribution*, representing the collective level of ambition necessary to achieve climate objectives. It is calculated by determining the distance between the EU target and REF 2020 (i.e. -9% for all Member States);

- *GDP per capita contribution*, ensuring an equitable contribution of efforts across the Union. This is expressed as real GDP in Purchasing Power Standards (PPS) per capita;

- *Energy intensity contribution*, representing the energy intensity of the economy and calculated as FEC/PEC per real GDP in PPS; and

- *Cost-effective energy savings potential contribution*, which represents the remaining cost-effective potential. It is calculated as the Member State's specific difference in energy consumption between the REF 2020 and the MIX scenario[8].

Each criterion is capped at 0.5 and 1.5 of the EU average and has a weight of 25%.

On the correction factor:

A common correction factor will be applied to the pledged national contributions of all Member States so that their sum achieves the EU target (Annex I EED recast). The value of the correction factor will only be known when all Member States have set and communicated their targets to the Commission. The correction factor would then be determined as the difference between the sum of all national-specific ambitions and the EU target and applied equally to all national-specific ambitions to determine the national contributions.

[8] E3Modelling (July 2021). Fit for 55 MIX scenario, Summary report: Energy, transport and GHG emissions, Primes Version 6 Energy Model.
The MIX scenario reflects the policies proposed on 14th July 2021, introducing carbon pricing for heating and transport and strengthening of efficiency and renewable policies. The scenario delivers GHG emission reductions of 55% compared to 1990, reducing energy demand by around 9% compared to REF 2020 and reaching a RES share of 38.4%.

In our test run (see Table 2), the sum of national contributions calculated based on the Annex I formula is very close to the EU target and the correction factor negligible.

The EED recast proposal does not mention who sets the correction factor and at what moment it is applied in determining the national contributions: before or after Member States used the subjective criteria (see below).

In order to ensure that any resulting target gap is distributed equally among all Member States, the correction factor has to be applied after Member States have considered the subjective criteria.

On the subjective criteria:

Further to the allocation criteria specified in the Annex I formula, the EED recast sets out that Member States must consider further criteria which includes a non-exhaustive list of national circumstances (Art. 4.2 points (a), (b), (c) and (e) EED recast). Member States are obliged to take account of these criteria, as the verb used in the text is 'shall'.

Similar criteria for setting the energy efficiency national contribution are provided in the GR and the current EED, but are accompanied by the verb 'may', meaning that they are optional and not mandatory.[9]

Two of the additional criteria are completely new compared to what is already foreseen in the current EED and the Governance Regulation: 'deployment of new sustainable fuels' and 'decarbonisation of energy-intensive industries'.

The exact formulation of the criteria merits attention. The EED recast proposal introduces the 'developments in energy mix' criterion, while in the GR it is present under a different formulation – 'changes in the energy mix' (GR Art. 6.2 (d)). The word 'changes' points to a situation that already happened, while 'developments' might point to a forecast, which offers more freedom in setting the value for the criterion.

Testing the formula

The national contributions resulting from a test run of the formula in the proposed EED recast are shown in Table 2.

[9] Article 6.2 Governance Regulation states that 'Member States may take into account'; Article 3.1 EED states that 'Member States may also take into account'.

Table 2: Test calculation for target allocation in the proposed EED recast

Test run of Annex I EED recast proposal for determining national contributions																						
	Point 1.		Point 2.										Point 9.				Point 10.		2020 Reference		MIX Scenario	
	National contribution		F_{Flat}	F_{Wealth}		$F_{Intensity}$				$F_{Potential}$				F_{total}		Target		Correction				
	PEC	FEC				PEC		FEC		PEC		FEC		PEC	FEC	PEC	FEC	PEC	FEC	PEC	FEC	PEC	FEC
	Mtoe		Factor	Factor	capped	Factor	capped	Factor	capped	Factor	capped	Factor	capped	Factor		%		Factor		Mtoe		Mtoe	
Austria	25.8	22.2	1.0	1.3	1.3	0.9	0.9	1.1	1.1	1.0	1.0	0.8	0.8	1.04	1.06	9.4%	9.5%			28.4	24.6	26.0	22.8
Belgium	34.9	29.9	1.0	1.2	1.2	1.2	1.2	1.2	1.2	0.7	0.7	0.9	0.9	1.01	1.06	9.1%	9.6%			38.3	33.1	36.0	30.5
Bulgaria	14.1	9.2	1.0	0.5	0.5	1.7	1.5	1.2	1.2	1.2	1.2	0.9	0.9	1.04	0.91	9.4%	8.2%			15.6	10.0	14.0	9.2
Croatia	7.0	6.0	1.0	0.6	0.6	1.0	1.0	1.2	1.2	1.3	1.3	1.5	1.4	0.99	1.06	8.9%	9.5%			7.6	6.6	6.7	5.7
Cyprus	2.1	1.9	1.0	0.9	0.9	1.1	1.1	1.1	1.1	1.1	1.1	1.0	1.0	1.02	1.01	9.2%	9.1%			2.3	2.0	2.1	1.8
Czechia	29.7	20.9	1.0	0.9	0.9	1.3	1.3	1.2	1.2	0.9	0.9	0.8	0.8	1.04	0.98	9.3%	8.8%			32.8	22.9	30.1	21.2
Denmark	15.9	14.1	1.0	1.3	1.3	0.7	0.7	0.9	0.9	0.5	0.5	0.5	0.5	0.89	0.91	8.0%	8.2%			17.2	15.4	16.4	14.7
Estonia	4.1	2.6	1.0	0.8	0.8	1.7	1.5	1.2	1.2	1.4	1.4	0.5	0.5	1.18	0.88	10.7%	7.9%			4.5	2.9	4.0	2.7
Finland	31.0	21.5	1.0	1.1	1.1	1.7	1.5	1.9	1.5	0.8	0.8	1.2	1.2	1.09	1.20	9.9%	10.8%			34.3	24.1	32.0	21.5
France	163.0	107.0	1.0	1.0	1.0	1.1	1.1	0.9	0.9	0.9	0.9	1.2	1.2	1.01	1.04	9.1%	9.4%			179.2	118.1	164.8	105.5
Germany	200.0	162.0	1.0	1.2	1.2	0.9	0.9	1.0	1.0	1.2	1.2	1.0	1.0	1.08	1.04	9.7%	9.4%			221.4	178.7	198.3	162.8
Greece	17.5	14.9	1.0	0.7	0.7	1.0	1.0	1.0	1.0	0.5	0.5	0.9	0.9	0.80	0.89	7.2%	8.0%			18.8	16.2	18.0	15.0
Hungary	24.1	16.8	1.0	0.7	0.7	1.1	1.1	1.2	1.2	0.6	0.6	0.9	0.9	0.87	0.94	7.8%	8.5%			26.1	18.4	24.6	16.9
Ireland	11.4	10.1	1.0	1.9	1.5	0.5	0.5	0.6	0.6	1.0	1.0	1.0	1.0	1.00	1.03	9.0%	9.3%	1.001	1.000	12.6	11.1	11.4	10.1
Italy	114.0	94.1	1.0	1.0	1.0	0.8	0.8	0.9	0.9	1.3	1.3	0.9	0.9	1.02	0.94	9.2%	8.5%			125.4	102.8	110.9	94.5
Latvia	3.9	3.4	1.0	0.7	0.7	1.1	1.1	1.4	1.4	0.6	0.6	0.4	0.5	0.84	0.89	7.6%	8.0%			4.2	3.7	4.0	3.6
Lithuania	5.2	4.4	1.0	0.8	0.8	0.9	0.9	1.1	1.1	0.7	0.7	0.8	0.8	0.85	0.94	7.6%	8.4%			5.7	4.8	5.3	4.4
Luxembourg	2.9	2.8	1.0	2.6	1.5	0.9	0.9	1.2	1.2	0.8	0.8	0.9	0.9	1.06	1.15	9.6%	10.3%			3.2	3.1	3.0	2.9
Malta	0.8	0.7	1.0	1.0	1.0	0.6	0.6	0.6	0.6	0.5	0.5	0.6	0.6	0.77	0.81	6.9%	7.3%			0.9	0.8	0.9	0.7
Netherlands	47.9	39.4	1.0	1.3	1.3	0.9	0.9	1.0	1.0	0.5	0.5	0.6	0.6	0.94	0.97	8.5%	8.8%			52.3	43.2	49.8	40.9
Poland	80.3	59.9	1.0	0.7	0.7	1.2	1.2	1.2	1.2	1.9	1.5	1.2	1.2	1.10	1.03	9.9%	9.3%			89.1	66.0	73.8	58.7
Portugal	15.7	13.7	1.0	0.8	0.8	0.9	0.9	0.9	0.9	0.7	0.7	0.7	0.7	0.84	0.87	7.6%	7.8%			16.9	14.8	15.9	13.9
Romania	30.6	23.3	1.0	0.7	0.7	0.8	0.8	0.8	0.8	1.1	1.1	1.0	1.0	0.89	0.87	8.0%	7.8%			33.2	25.3	30.0	23.0
Slovakia	14.1	8.8	1.0	0.7	0.7	1.4	1.4	1.3	1.3	0.6	0.6	0.9	0.9	0.92	0.99	8.2%	8.9%			15.4	9.6	14.6	8.8
Slovenia	5.9	4.4	1.0	0.9	0.9	1.2	1.2	1.2	1.2	0.7	0.7	0.7	0.7	0.95	0.94	8.5%	8.5%			6.5	4.8	6.1	4.5
Spain	84.3	66.9	1.0	0.9	0.9	0.9	0.9	0.9	0.9	0.7	0.7	0.6	0.6	0.88	0.85	7.9%	7.7%			91.5	72.4	86.0	68.6
Sweden	36.8	26.2	1.0	1.2	1.2	1.2	1.2	1.2	1.2	1.0	1.0	1.0	1.0	1.11	1.10	10.0%	9.9%			40.8	29.0	37.2	26.4
Sum	1023.0	787.0																		1124.3	864.4	1021.9	791.4

National contributions would range for PEC between 6.9% for Malta and 10.7% for Estonia, and for FEC between 7.3% for Malta and 10.8% for Finland, below their respective REF 2020 figure (see Table 3). The EU target is set at 9% below REF 2020 for FEC and PEC.

Table 3: Comparing test run results with national contribution in NECPs

National contributions, test run of Annex I of the EED recast proposal						
	PEC 2030			**FEC 2030**		
	below REF 2020	PEC	below NECP	below REF 2020	FEC	below NECP*
	%	Mtoe	%	%	Mtoe	%
Austria	9.4%	25.8	16%	9.5%	22.2	7%
Belgium	9.1%	34.9	18%	9.6%	29.9	12%
Bulgaria	9.4%	14.1	19%	8.2%	9.2	10%
Croatia	8.9%	7.0	16%	9.5%	6.0	12%
Cyprus	9.2%	2.1	13%	9.1%	1.9	7%
Czechia	9.3%	29.7	28%	8.8%	20.9	8%
Denmark	8.0%	15.9	13%	8.2%	14.1	11%
Estonia	10.7%	4.1	26%	7.9%	2.6	4%
Finland	9.9%	31.0	11%	10.8%	21.5	12%
France	9.1%	163.0	19%	9.4%	107.0	9%
Germany	9.7%	200.0	7%	9.4%	162.0	10%
Greece	7.2%	17.5	17%	8.0%	14.9	9%
Hungary	7.8%	24.1	22%	8.5%	16.8	9%
Ireland	9.0%	11.4	16%	9.3%	10.1	10%
Italy	9.2%	114.0	9%	8.5%	94.1	8%
Latvia	7.6%	3.9	5%	8.0%	3.4	8%
Lithuania	7.6%	5.2	4%	8.4%	4.4	3%
Luxembourg	9.6%	2.9	17%	10.3%	2.8	8%
Malta	6.9%	0.8	20%	7.3%	0.7	9%
Netherlands	8.5%	47.9	-3%	8.8%	39.4	7%
Poland	9.9%	80.3	12%	9.3%	59.9	10%
Portugal	7.6%	15.7	27%	7.8%	13.7	8%
Romania	8.0%	30.6	5%	7.8%	23.3	8%
Slovakia	8.2%	14.1	13%	8.9%	8.8	5%
Slovenia	8.5%	5.9	7%	8.5%	4.4	7%
Spain	7.9%	84.3	14%	7.7%	66.9	8%
Sweden	10.0%	36.8	7%	9.9%	26.2	8%
Sum		1023.0			787.0	

*2030 national contributions for FEC established in the NECPs are based on the old Eurostat methodology, including energy used in blast furnaces, and are thus not directly comparable to the new FEC methodology. In order to allow for comparison, we subtracted from the NECP contributions the 2005-2019 average energy used in blast furnaces.

The main factors of the formula which lead to a differentiated distribution of national contributions are national wealth and energy intensity of the economy. The lower the wealth and energy intensity, the lower the contribution and vice

versa. The Commission has not covered the formula and the choice of criteria in its impact assessment and further research would be needed to understand the impacts. In the first phase of this project, we developed proposals for target allocation, considering also criteria to address social equity (to ensure benefits for all parts of society, in particular energy poor) and climate integrity (to ensure that all countries are lowering energy demand in line with net-zero pathways)[10].

Also, the Commission's proposed formula heavily depends on the EU energy modelling (REF 2020) as the baseline for all countries and the MIX Scenario to approximate the cost-effective energy savings potentials. It is not clear whether Member State will accept the national outcomes of the modelling as 'objective' criteria. For this reason, we have chosen to use the 2020 targets set by Member States as a baseline for our proposal for a target allocation formula. [11]

The resulting national contributions for PEC would be significantly more ambitious than the current contributions set in the NECPs for most Member States (see Table 3), except for the Netherlands. The comparison of the FEC figures shows for all Member States around 10% additional reduction compared to what is in the NECPs. However, the changed method for establishing FEC makes direct comparison difficult. [12]

2.2 Trajectories and a new gap-filler mechanism

The enforcement mechanism is strengthened, especially at the level of assessing and enforcing national contributions. With the proposed EED recast, the Commission is able to assess progress to achieve the national contributions. Member States found to be above their indicative trajectory are obliged to take measures (Art. 4.3). This provision would enable the Commission to secure not only the achievement of the EU-wide target, but also that each Member State complies with its pledge. This brings convergence among Member States and ensures that all EU citizens benefit from energy efficiency measures.

A problem for the gap-filler mechanism is the nature of the national contributions which is described as 'indicative' by the EED recast proposal. This could imply that Member States can change their contributions and subsequently their trajectory during the target achievement period.[13] If such changes result in 'closing' a progress gap, the gap filler cannot be triggered. In addition, the redistribution done

[10] See Annex 1 to this report
[11] See Annex 1 to this report
[12] They are based on the new Eurostat methodology for FEC, which excludes energy consumption in blast furnaces. In order to allow for a comparison, we have reduced the FEC national contributions in the NECPs by the average annual energy demand in blast furnaces during 2005-2019
[13] In the past, Member States have changed their indicative national targets for 2020 on several occasions, and in many cases without publicly available justifications being provided.

through the correction factor to close the ambition gap (gap avoider) will be invalidated if a national contribution changes.

Indicative national trajectories are the entry point for asking Member States to progress more or faster towards achieving their 2030 energy efficiency targets. But the EED recast does not add any specifications on how Member States should establish their trajectory. In contrast, the RED 2 and ESR provide detailed specifications, includes number of reference points, annual budgets and linearity, which Member States must use to determine their national trajectory (see Annex 1).

2.3 Recommendations to secure the EU target achievement

In order to secure the achievement of the EU target, and thus increase the EU target credibility, we recommend the following:

1. Make it clear upfront that the **Union's targets are binding**: Article 1 should already mention the binding nature of the targets for consistency reasons, and underpin the new character of the Union's targets with a strong governance system to secure its achievement.
2. Establish an **effective, fair and transparent target allocation**:
    - Clarify the role of the formula, the subjective criteria and the correction factor in determining national contributions. The formula must become binding on Member States. In case the subjective criteria are used to facilitate the acceptance of the formula, it is necessary to ensure that the common correction factor is applied as the last step to determine contributions.
    - Consider other criteria for the formula, in particular climate integrity and social equity, and the 2020 national targets as baselines in order to improve political acceptance.
3. Ensure **national contributions are stable** by deleting the word 'indicative' in Article 1. Changing national contributions during the implementation period undermines the application of the gap-avoider and gap-filler mechanisms.
4. Provide **additional criteria for setting national indicative trajectories**, as they will become a key element for triggering the gap-filler mechanism.

3 Untapped energy savings potentials

The Commission proposes an EU 2030 target of 9% FEC and PEC below REF 2020, spelled out in absolute figures in Article 1; the EU's FEC must stay below 787 Mtoe and its PEC below 1023 Mtoe. This represents an increase of ambition compared to the current targets (from -32.5% to -36% for FEC and -39% for PEC, compared to REF 2007), but still below the cost-effective potentials (see Table 4).

The difference in ambition for FEC and PEC is noticeable. It reflects that over the last 20 years efficiency improvements at the end-user level have been lower than the economy-wide primary energy efficiency improvements. FEC and PEC levels are converging. The increasing share of renewable energy, which reduces primary energy demand, plays an important role in this development.

Our assessment has shown that the economic energy savings potential is growing, thanks to an accelerated take-up of energy efficient technologies (e.g. electric vehicles or heat pumps which have higher efficiencies than the competing technologies based on fossil fuels) and an increase of carbon prices, making more energy-efficiency investments cost-effective (see Annex 2).

If all the energy efficiency measures, which are economic or near economic, are deployed across sectors, the EU's FEC could be reduced to 718 Mtoe in 2030 (41% below REF 2007). This is up from the latest available research[14] carried out in 2018, which found that the EU's cost-effective energy savings potential stood at around 40%. This is due to higher energy prices and faster uptake of certain energy efficient technologies, like electric vehicles (see Annex 2.2). The EU's PEC could be reduced to at least 928 Mtoe (44.5% below REF 2007). This is a conservative estimate (Annex 2.3).

If the technical potential[15] would be realised, the EU's FEC could be reduced to 667 Mtoe in 2030 (45.4% below REF 2007). The EU's PEC would be reduced to at least 861 Mtoe (48.5% below REF 2007). This is a conservative estimate.

[14] Fraunhofer Institute for Systems and Innovation Research ISI (2019). Study on Energy Savings Scenarios 2050

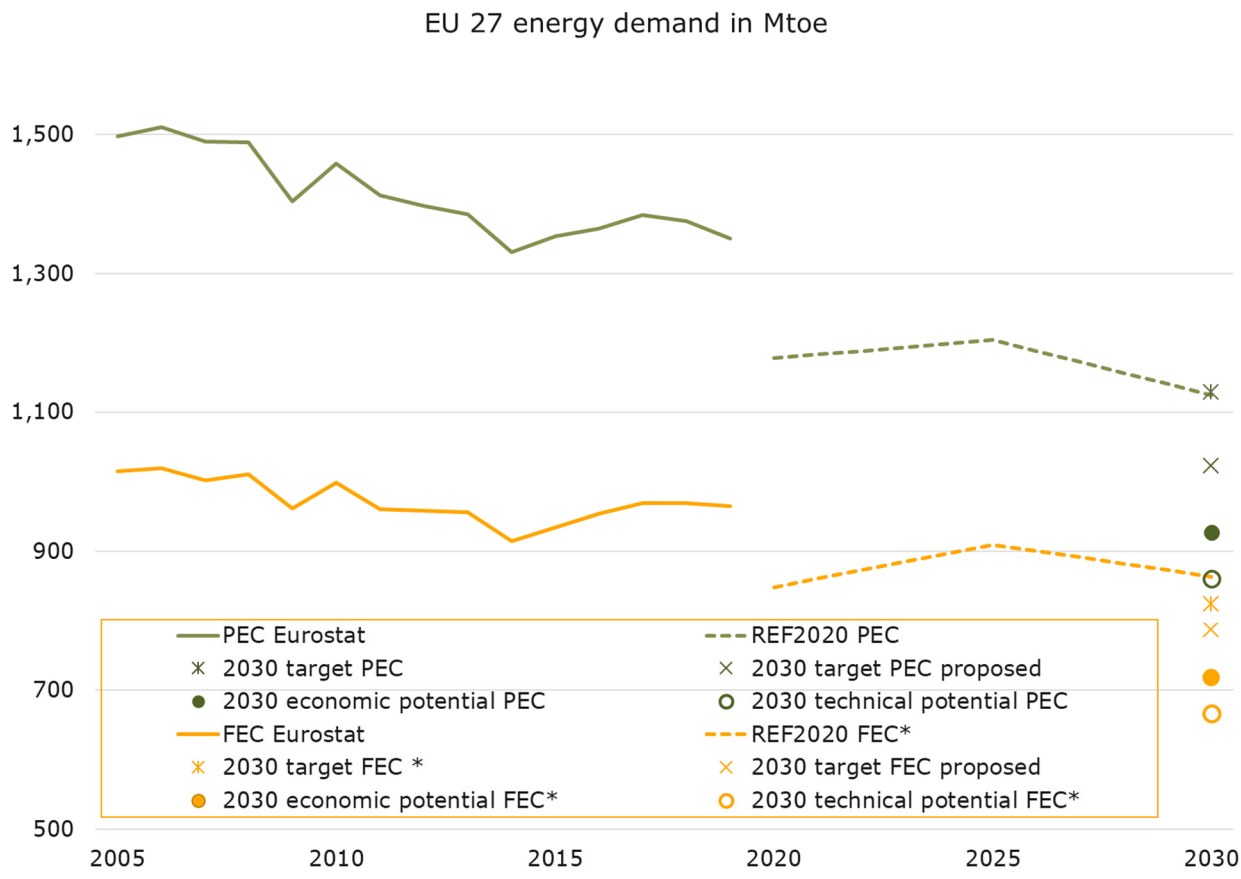
[15] The technical potential estimates the energy savings potential that could be achieved if all processes, equipment and related infrastructure are upgraded with technically feasible solutions, regardless of any economic constraints.

Table 4: EU's 2030 energy efficiency targets and potentials

EU's 2030 current and proposed energy efficiency targets and potentials								
	FEC 2030				PEC 2030			
		% compared to				% compared to		
	Mtoe	2005	REF2007	REF2020	Mtoe	2005	REF2007	REF2020
2030 targets (current)*	825	-18.7%	**-32.5%**	-4.5%	1,128	-24.7%	**-32.5%**	0.3%
2030 targets (proposed)	787	-22.5%	-35.6%	**-9.0%**	1,023	-31.7%	-38.8%	**-9.0%**
2030 economic potentials*	718	-29.2%	-41.2%	-16.9%	928	-38.0%	-44.5%	-17.5%
2030 technical potentials*	667	-34.3%	-45.4%	-22.9%	861	-42.5%	-48.5%	-23.4%

* The current 2030 target, the cost-effective potentials and REF 2007 are using the old Eurostat methodology for FEC including energy used in blast furnaces. In order to allow for comparison, we subtracted the 2005-2019 average energy used in blast furnaces.

Figure 1: EU primary and final energy targets and potentials compared to historical demand and projections.



* The current 2030 target and the cost-effective potentials are using the old Eurostat methodology for FEC including energy used in blast furnaces. In order to allow for comparison, we subtracted the 2005-2019 average energy used in blast furnaces.

The specific national energy savings potentials are well above national contributions set in the NECPs, and in most cases above the national contributions derived from our results of a test run applying the formula proposed by the Commission in the EED recast (see Table 5).

Table 5: Difference between energy savings potentials and national contributions

National contributions compared to savings potentials			
	National contributions based on test run of EED recast proposal	**Economic potentials (see Annex 2)**	**Difference economic potentials to national contributions**
	FEC in Mtoe	FEC in Mtoe	
Austria	22.2	19.7	-11%
Belgium	29.9	26.6	-11%
Bulgaria	9.2	8.6	-6%
Croatia	6.0	5.8	-4%
Cyprus	1.9	1.9	0%
Czechia	20.9	20.1	-4%
Denmark	14.1	12.4	-12%
Estonia	2.6	2.5	-4%
Finland	21.5	20.3	-6%
France	107.0	98.8	-8%
Germany	162.0	142.7	-12%
Greece	14.9	13.9	-7%
Hungary	16.8	15.7	-7%
Ireland	10.1	8.9	-12%
Italy	94.1	84.9	-10%
Latvia	3.4	3.3	-3%
Lithuania	4.4	4.2	-4%
Luxembourg	2.8	2.4	-14%
Malta	0.7	0.7	-5%
Netherlands	39.4	34.7	-12%
Poland	59.9	59.3	-1%
Portugal	13.7	12.5	-9%
Romania	23.3	22.1	-5%
Slovakia	8.8	8.2	-7%
Slovenia	4.4	4.1	-7%
Spain	66.9	61.0	-9%
Sweden	26.2	23.5	-10%
EU27	**787.0**	**718.5**	**-8.7%**

* The cost-effective potentials are based on the old Eurostat methodology for FEC including energy used in blast furnaces. In order to allow for comparison, we subtracted from the NECP contributions the 2005-2019 average energy used in blast furnaces.

4 A push from climate and renewable policy proposals

The EU's climate and energy efficiency policies are closely interrelated. The Fit for 55 package is an opportunity to improve their coherence and strengthen synergies.[16]

The main energy and climate targets and tools, except for the EPBD, are now on the table at the same time. The EU's energy system modelling can be used to assess the target and policy coherence. The Commission has made available the MIX scenario[17] introducing a policy mix of pricing and regulation as proposed by the package. The MIX scenario delivers GHG emission reductions of 55% compared to 1990, a reduction of energy demand of around 9% compared to REF 2020 and it reaches a share of renewable energy of 38.4%, slightly under the 40% target proposed in the RED revision.

Ahead of the publication of the package, there have been concerns that an extension of carbon pricing could crowd out other policies. It was feared that regulatory interventions, like energy savings obligations, car standards or the national climate targets, would be put on the backburner. But the Commission proposed to strengthen the EU regulatory tools in the package and the recycling of revenues from carbon pricing to increase the funding of social and climate policies.

4.1 Carbon pricing and revenue recycling

Carbon prices are set to grow. The EU-ETS carbon price has doubled compared to 2018-2019 following reforms and new political commitments. As part of the Fit for 55 package, the European Commission has proposed a revision of the EU ETS, including a new separate ETS covering buildings and road transport emissions[18] starting in 2026. As the number of emitters covered by the new ETS is very large, it will operate 'upstream' and regulate the 'activity of releasing for consumption of fuels which are used for combustion in the sectors of buildings and road transport' (Annex III of the ETS revision).

The IA estimates that the carbon price would lead to an increase of consumer prices of 10-18% for heating oil, 9-33% for natural gas, 9-14% for diesel and 7-

[16] Jakob Graichen, Stefan Scheuer, Samuel Thomas (February 2021). Strengthening synergies between climate effort sharing & energy savings obligations, an input to the Fit for 55 package.
[17] Fit for 55 MIX scenario, Summary report: Energy, transport and GHG emissions, Primes Version 6 Energy Model, E3Modelling, July 2021
[18] COM(2021) 551 final, new chapter IVa to be introduced in Directive 2003/87/EC

12% for petrol[19]. The impact on energy demand will be limited; the IA estimates a reduction of 1-3% of fuel demand in transport due to the price increase[20].

The potential consequences of higher carbon prices across sectors for energy efficiency policies are:

1. An increase of the overall economic energy efficiency potentials: more technical potentials are becoming economic, and market penetration of energy efficient technologies increases, leading to a further decrease in costs through scale effects (see Annex 2).
2. An increase in energy savings among energy end-users: yet, the impact is limited as the demand for heating and transport fuels is not elastic to increase in prices, especially in low-income households[21].
3. Need to further energy efficiency policies and measures: they address market barriers which cannot be tackled by pricing, like the landlord-tenant dilemma.
4. Need to develop a smart redistribution of carbon revenues: they help vulnerable parts of society and business to experience long-lasting improvements.

The additional auctioning revenues from the new ETS will be substantial, reaching €47bn/ year during 2026 and 2030[22]. Revenues will be available to Member States depending on their share of emissions in the covered sectors.

The way how carbon revenues are redistributed has a major impact on the effectiveness of carbon pricing[23].

- In case of cash payments to citizens and businesses, the impact on energy efficiency improvements will be limited. It could even lead to a slowing of energy efficiency improvements if it delays investment decisions or if governments reduce regulatory efforts assuming that the new ETS will by default deliver the expected climate outcome.
- In case that revenues are recycled in energy efficiency support programmes and target vulnerable households, additional energy savings are achievable, while also helping energy users to structurally lower their energy bills and increase their quality of life (better air quality and higher comfort levels).

The Commission proposes to strengthen the general rules for using carbon revenues. Member States have to use all revenues (currently only 50%) for

[19] SWD (2021) 601 final, page 125 and 128.
[20] SWD (2021) 601 final, page 114
[21] Cambridge econometrics (2020). Decarbonising European transport and heating fuels - Is the EU ETS the right tool?
[22] SWD (2021) 601 final, Annex 13
[23] RAP (2018). Carbon leverage: Investing Europe's carbon revenues in energy efficiency.

measures that address climate mitigation and adaptation, including *'measures intended to improve energy efficiency, district heating systems and insulation, or to provide financial support in order to address social aspects in lower- and middle-income households, including by reducing distortive taxes'* (Article 10.3 (h)).

The list of eligible national measures to make use of the revenues has been extended for the new ETS for buildings and transport to '*contribute to the decarbonisation of heating and cooling of buildings or to the reduction of the energy needs of buildings*'; '*accelerate the uptake of zero-emission vehicles*'; '*provide financial support for low-income households in worst-performing buildings*'; or '*provide financial support in order to address social aspects concerning low and middle-income transport users*' (Article 30d 5.(a) and (b)).

But the proposals fall short of strict conditions and governance to secure a minimum level of recycling revenues for energy efficiency investments. Member States would still have the possibility to count in existing national climate or social policies[24], which means that the new revenues might not always lead to additional climate financing.

A new Social Climate Fund[25] is put in place to mitigate the impact of carbon pricing on vulnerable households, micro-enterprises and transport users. It should have an envelope corresponding to 25% of the revenues from the new ETS for buildings and transport[26]. Member States have to submit to the Commission a Social Climate Plan which shall include national projects to finance measures and investments to '*increase energy efficiency of buildings'* and *'to increase the uptake of zero- and low-emission mobility and transport'* (Article 3.3). The new Fund would make the payment conditional to '*achieving milestones and targets […] compatible with the Union's climate targets and cover in particular: a) energy efficiency; b) building renovation; c) zero- and low-emission mobility and transport…'* (Article 5.2).

This means that the Fund could secure a certain, but not specified, level of revenue recycling for energy efficiency and could provide a significant leverage to implement the EED.

4.2 Renewable energy sources

The share of renewable energy and energy efficiency improvements are intertwined. In most cases, the relation is mutual reinforcing: many renewable

[24] Article 30d.5 paragraph 3: '*Member States shall be deemed to have fulfilled the provisions of this paragraph if they have in place and implement fiscal or financial support policies or regulatory policies, which leverage financial support, established for the purposes set out in the first subparagraph and which have a value equivalent to the revenues generated from the auctioning of allowances referred to in this Chapter*.'
[25] COM (2021) 568 final
[26] COM (2021) 568 final, Explanatory Memorandum Point 4.

technologies are more energy efficient, and energy efficiency measures lower energy demand thus enabling and accelerating renewable energy growth (in shares and absolute). The Commission proposal for the revision of the RED[27] increases the RES target to 40% from 32%. Furthermore, Member States would have to set indicative targets for the use of renewables in buildings in order to achieve an EU-wide share of 49% in 2030 (new Article 15a).

But not all renewable and efficiency measures are supporting each other. For example, biomass-based heat production is not necessarily more efficient than fossil fuel combustion; hydrogen can be less efficient than direct electrification[28]. The RED revision includes new targets to promote hydrogen[29].

4.3 National climate targets

The ESR is the EU's main climate policy instrument. It covers 58% of total GHG emissions of which around 2/3 are from energy use in buildings and transport and 1/3 from agriculture and land-use practices.

The ESR target governance is strong and the level of compliance is high (see Annex 1). It drives the implementation of the EED. Most countries with a higher ESR ambition report that they meet their EED requirements (like the energy savings obligation 2014-2020 under Article 7 EED), while many countries with lower ESR ambitions are failing to do so[30].

The proposed ESR revision[31] increases the GHG emission reduction target to 40% from 30% compared to 2005, which will require further national energy efficiency efforts; this will drive the EED implementation.

Nevertheless, the 40% spread of national ESR targets between low- and high-income countries is kept. This means that this positive interaction does not work well for lower-income countries.

The MIX scenario, which models the Fit for 55 Package, exposes this potential problem. Bulgaria, for example, would reduce its ESR emission by 27% according to the model, while the ESR revision proposal would set it at only 10%. For a high-income country like Finland, the model results in a 45% reduction while the ESR proposal stands at 50%.

[27] COM (2021) 557 final
[28] IEA (2019). The Future of Hydrogen.
[29] According to the Commission proposal, by 2030, 50% of hydrogen used in industry will be renewable fuel of non-biological origin (RFONBO) (Article 22a), and has to achieve a minimum share of RFNOBO in transport of 2.6% (Article 25). RFONBO is mainly renewable hydrogen or hydrogen based on synthetic fuels with at least 70% less GHG emissions.
[30] Eceee summer study (2021), paper by Graichen, Scheuer and Thomas
[31] COM (2021) 555 final

This suggests that the ESR targets are not aligned with modelled cost-effective GHG reduction pathways. In addition, lower-income countries would remain far from a net-zero GHG emission pathway. Higher-income countries are likely to need to buy greenhouse gas emission allocations from lower-income countries. The ESR would thus become a tool for climate finance transfers. Nevertheless, there is no organised market for ESR emission allocations.

Table 6: Interactions between main elements of the Fit for 55 package, from an energy efficiency perspective

Impact on energy efficiency	ETS and revenue recycling	RES 40%	ESR 40%
Positive	Overall pricing signal and allocation of all revenues for climate purposes: Increases energy savings potential. Supports energy efficiency policies. Social Climate Fund: Secures a certain, but not specified level, of revenue recycling. Potential leverage to achieve the EED target.	A higher target is increasing energy efficiency.	A higher target is driving the EED implementation.
Unclear	Revenue recycling: Overall conditions and governance tools are too weak to secure additional financing for energy efficiency across the EU.		Could become an important tool for financial transfers between high- and low-income Member States, but these transfers need to be organised.
Negative		Targets for hydrogen may increase primary energy demand.	Wide spread (40%) of national targets is not in line with energy savings potentials and climate neutrality goal.

Annex 1

EED target governance options

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1 Introduction

Reducing energy demand plays a major role in achieving net-zero GHG emissions. By 2050, final energy demand needs to be halved[32] in order to enable a fair and attractive energy transition.

This requires a substantial acceleration of energy savings policies and measures. So far, the EU's main energy efficiency policies have only helped to slightly decrease final energy demand, which in 2019 is 5% down from 2005 levels. Energy demand reduction will need to accelerate by three to four times to achieve a lowering of energy demand by 50% to be in line with net-zero GHG emissions pathways.

Energy efficiency targets could play an important role in this acceleration, but only if their level of ambition[33] and governance is strengthened.

There have been problems with the current framework: The EU could not secure its 2020 energy efficiency target achievement. The national targets set by governments in 2013 did leave a substantial target gap. And indeed, the 2019 energy consumption remained off target by 3% (PEC and FEC)[34]. The EU could still achieve by chance its 2020 target – not because of an acceleration of energy efficiency measures on the ground, but due to the exceptional decline in economic activity during the 2020 pandemic year. Hence, the EC sees a risk of a rebound of energy demand post-Covid.[35] Also, the IEA expects that investments in energy efficiency fell by around 9% in 2020.[36]

The picture for the 2030 targets does not look better. The national contributions as set in the National Energy and Climate Plans (NECPs) leave a gap of around 4% off target.[37]

While increasing the level of ambition does not require substantial legislative changes and it is rather straightforward, the establishment of an effective governance framework that secures delivery is more complicated.

[32] According to the in-depth analysis of the Commission COM(2018) 773, supporting the A Clean Planet for All communication, final energy demand needs to drop by 43 to 48% compared to 2005. According to the 2050 Vision of the Coalition for Energy Savings, the energy savings potential is actually higher, achieving a reduction of at least 56% compared to 2005.
[33] The EU's 2020 target is equivalent to only 9% and the 2030 target to only 19% reduction of FEC compared to 2005.
[34] Eurostat FEC and PEC, 2020-2030 indicators.
[35] IEA, Energy efficiency 2020 report
[36] Idem
[37] The sum of indicative national contributions is 1176 Mtoe for primary and 885 Mtoe for final energy consumption. The EU's targets are 1128 Mtoe and 846 Mtoe respectively.

The European Parliament has several times called for a binding EU target for energy efficiency and stronger governance, latest in 2020[38], but this has been rejected by the European Council[39].

First, we are providing an assessment of background and options applied in the EU's main climate and energy target laws to allocate the national contributions to the EU wide targets. RED and ESR have a more robust target allocation mechanism as the following assessment will show.

Second, we will use the mechanism and criteria for target allocation from RED and ESR to suggest a specific target allocation approach for energy efficiency.

We then use current Eurostat data to run a test with the developed target allocation approach in order to illustrate a possible outcome and to reflect the findings.

2 Policy screening and criteria assessment

For our assessment, we are looking at the EU's main energy and climate policies which set EU level targets and require specific national actions for their achievement (legislation on energy efficiency, renewables and GHG emissions reduction).

The nature of the EU targets, the rules how Member States have to contribute to the target achievement, as well as enforcement mechanisms differ significantly under the respective piece of legislation.

These are our findings from assessing and comparing these three aspects in the Energy Efficiency Directive (EED), Renewable Energy Directive 2009 (RED 1), Renewable Energy Directive 2018 (RED 2) and Effort Sharing Regulation (ESR).

EED – indicative national contributions to achieve a EU headline target

The EED[40] has the weakest nature and governance of targets, though stronger requirements for putting in place national policies and measures (the mandatory annual energy savings obligation under Article 7 EED). It is the result of a compromise between the European Parliament, which wanted binding targets, and Member States objecting to it. The Energy Efficiency First Principle, which is

[38] European Parliament (January 2020). Resolution Towards a European Energy Union (December 2015) and Resolution on the European Green Deal

[39] European Council (23 and 24 October 2014). Conclusions on 2030 climate and energy policy framework for the EU

[40] The EED has been revised in 2018, which included setting a new 2030 target and new target governance. In particular, through the Governance Regulation, Member States are required to provide an indicative trajectory between the 2020 and the 2030 targets and the Commission may issue recommendations in case national contributions or national progress are deemed insufficient.

anchored in the Governance Regulation does give energy efficiency policies a high priority, but this has not had a visible impact yet.

The EU energy efficiency target is a 'headline target', with 'indicative' national contributions determined by Member States through their National Energy and Climate Plan (NECP).

In determining their contributions, Member States have to consider the overall EU target as well as national efficiency measures. However, they can base their contributions on different national target metrics (PEC, FEC, savings or intensity) and on national circumstances, using a non-exhaustive list of general elements, such as economic development or energy mix.

The European Commission has been given the opportunity to comment on the draft national contributions and issue country-specific recommendations (Art 9.3 GR). Member States have to explain themselves in case they do not follow Commission's recommendations. The vast majority of Commission's recommendations on the 2030 national contributions have not been internalised by Member States.[41] In the absence of agreed criteria, explanations for not following the recommendations risk being very general and their credibility and plausibility is difficult to judge.[42] In addition, these arguments are not always easy to identify within the text of National Energy end Climate Plans.

RED 1 and RED 2 – from EU-determined national targets to self-determined contributions

The RED has undergone significant changes concerning the nature and governance of targets during the 2016 revision leading to RED 2 in 2018.

The RED 1 (time horizon 2020) foresaw EU-determined and legally binding targets for Member States, based on the European Council support for a 'binding EU target' and 'overall national targets'[43]. The main enforcement mechanism was the infringement procedure. The EU's 2020 target is on track to being achieved.

The RED 2, like the EED, is based on Member state's self-determined contributions, but with a binding EU target. It has a strong governance mechanism which ensures that the national contributions secure the EU level target achievement. Passing from EU-determined and binding contributions to self-determined contributions

[41] The Commission asked all but few Member States to increase their energy efficiency target. Not one Member State has fully addressed this ask. Nine countries have ignored it, while four of them have even lowered their target ambition in the final plan. Around 10 countries have partially addressed the recommendations by slightly increasing their ambition, but the Commission considered it was not enough. (The Coalition for Energy Savings, news update 16 October 2020)
[42] For example, Malta justified the increase of energy consumption because of growing population, while Denmark and Ireland mentioned its plans to construct new data centres.
[43] European Council (2007). Conclusions

backed by a gap-filler and -avoidance mechanism[44] is the result of a political compromise. The governance of RED 2 is based on two pillars:

i) An agreed formula for the Commission to assess the adequacy of the national contributions (Annex II GR) and mostly mandatory criteria to be used by Member States in determining their national contributions (Art. 5 GR). The formula and criteria are largely the same, meaning the Commission and Member States are on the same page and use the same elements to calculate and assess national contributions; and

ii) An obligation to take measures to achieve the reference points on the trajectory between the 2020 target and the 2030 contribution (Art. 32.3 GR[45]). In addition, the European Commission has adopted a RES financing mechanism to which Member States can make voluntary financial contributions which can be counted towards reaching the reference points.[46]

The 2030 national contributions add up to the EU's 2030 target and even overachieve it. Nevertheless, nine contributions are below the level resulting from the RED's formula.[47]

The European Commission is obliged to issue country-specific recommendations in case national contributions do not add up to the Union target (Art. 9.2 and 31.1 GR). As mentioned above, if one or more reference points of the Union target are missed, the European Commission shall ask those Member States that missed their reference points to implement additional measures (Art 32.3 GR).

ESR – distributes national efforts in order to meet a binding EU target

The ESR provides the strongest nature and governance among the targets in our comparison. It is based on European Council conclusions which call for a binding

[44] Gap avoidance is action taken to minimise the ambition gap, while gap filler is action taken to minimise the progress gap.
[45] '*Where, in the area of renewable energy the Commission concludes, based on its assessment (…) that one or more of the reference points of the indicative Union trajectory in 2022, 2025 and 2027 (…) were not met, Member States that have fallen below one or more of their national reference points in 2022, 2025 and 2027 (…) shall ensure that additional measures are implemented within one year following the date of reception of the Commission's assessment in order to cover the gap compared to their national reference point.*'
[46] The financing mechanism has been established by the European Commission '*to better support renewable energy projects and encourage greater uptake of renewable energy sources across the EU. The mechanism links countries that voluntarily pay into the mechanism (contributing countries) with countries that agree to have new projects built on their soil (hosting countries).*' More information on Commission's website here.
[47] According to the European Commission's individual assessment of National Energy and Climate Plans.

GHG emissions reduction target at EU level and national efforts being distributed on the basis of GDP per capita.

The ESR thus determines the national contributions, the linear trajectory (2021-2029) and the Commission establishes annual allocations (Art 4.2 ESR). All these three are legally binding on Member States.

The enforcement is ensured through compliance checks and sanctions (Art. 8 and 9 ESR), though Member States have some flexibilities, including transfers, banking, borrowing and purchase of allocations (Art. 5 ESR).

Table 1: Comparison between the nature and governance of targets in the EED, RED 1 and 2 and ESR

	EED (2018)	**RED 2 (2018)**	**RED 1 (2009)**	**ESR (2018)**
Nature of Union target	'Union headline target' 'There are no binding targets at Member State level' Compromise between the Parliament and Council.	'Binding Union target' Compromise between the Parliament and Council.	'Binding target' Endorsed by European Council 2007.	'Binding Target' & 'All MS should participate in this effort (…) with efforts distributed on the basis of GDP per capita' Endorsed by European Council 2014 and 2016.
Nature of national contributions (target for RED 1)	Self-determined, indicative and with no benchmark.	Self-determined, considering the agreed benchmark.[48]	EU-determined and binding.	EU-determined and binding.
	The 'indicative trajectory' for the contribution is self-determined.	The 'indicative trajectory' has to meet three reference points set in the law (linear path).	The 'indicative trajectory' has to meet four reference points set in the law (exponential path).	The linear trajectory is binding. Annual binding allocations established by Commission.
	The criteria for setting the target are mainly optional and not harmonized for all countries.	The criteria for setting the contribution are mainly mandatory. They cover the same elements in the benchmark formula used for the assessment of the contributions.	The contributions are based on the same formula for all MS.	The contributions are based on the same formula for all MS.

[48] Article 31.2 GR: '*Where a gap between the Union's 2030 target and the collective contributions of Member States occurs in the area of renewable energy, the Commission shall base its assessment on the formula set out in Annex II which is based on the objective criteria listed in point (e)(i) to (v) of the first subparagraph of Article 5(1).*'

	EED (2018)	RED 2 (2018)	RED 1 (2009)	ESR (2018)
Enforcement mechanism	Commission issues recommendations. Member States have to take due account and provide reasons in case of not following the recommendations.	Commission assesses national contributions against the agreed benchmark and issues recommendations. Member States have to take due account and provide reasons in case of not following the recommendations. MS are obliged to submit additional measures in case they fall under their national trajectory reference points.	Infringement is possible, but has never been used despite non-compliance. MS are obliged to submit a reasonable timetable and additional measures to re-join the reference points on the national trajectory, in case they fall behind it.	Infringement is possible. MS are obliged to submit additional actions and a strict timetable in case they exceed their annual allocation, the limit of linear trajectory or national contribution. Additional compliance checks in 2027 and 2032, which can lead to sanctions.

3 Criteria for benchmarking and setting national contributions

Particularly in case of self-determined targets, the criteria for benchmarking and setting national contributions play an important role in determining the strength of the target and its governance. In the case of EU-determined contributions, like with the ESR, the criteria may have been important for preparing the legislative proposal, but once the legislative text adopted, they are no longer used in the implementation. Nevertheless, they help in understanding the considerations that enabled a political agreement.

The **ESR** criteria for determining national contributions were developed using two main elements:

- GDP/capita to ensure fairness, thus reflecting the different economic capacities of Member States; and
- mitigation potentials to ensure cost-effectiveness across Member States.

In addition, the criterium of environmental integrity was applied to prevent the flexibility mechanisms[49] from jeopardising the delivery of the EU's climate objectives and targets.

The **RED 1** criteria for determining national targets were based on two elements: half of the effort was shared equally between Member States based on GDP/capita and the other half based on a flat-rate. The indicative trajectory has to reach four references point set by the Directive following an exponential path. A cap was introduced to prevent any Member States from having to deliver over 50% of its energy mix from renewable sources.

Under the **RED 2**, Member States may use the formula provided in Annex II GR in determining their contributions. MSs shall take into account:

- national and EU measures (under RED, EED or other measures promoting renewable energy within Member States or at Union level);
- its binding 2020 national target (Annex I, RED2); and
- other relevant circumstances such as economic conditions (including GDP), potential for cost-effective deployment, level of interconnection, geographical and environmental constraints, equitable distribution of deployment across the Union.

The RED 2 establishes three reference points that Member States have to achieve in their linear national trajectory.

[49] A series of flexibility mechanisms are available to Member States to achieve their national contributions, such as borrowing, banking and transfers.

In assessing Member States' contributions, the Commission shall use the formula set in Annex II GR, which takes as a starting point the 2020 target and adds four weighted components:

- flat rate (30%);
- GDP per capita (30%);
- Renewables potential (30%); and
- Level of interconnection (10%).

The **EED** self-determined national contributions must be based on PEC, FEC or energy intensity. Member States shall express it in terms of absolute level of PEC and FEC in 2030, with an indicative trajectory (Art 4 (b)(1) GR). In setting the contribution, Member States shall take into account (Art 6.1 GR):

- the Union target in absolute level; and
- EED measures and other national and Union efficiency measures[50].

In setting the contribution, Member States may take into account: cost-effective potential, GDP evolution and forecast, changes of imports and exports, changes in the energy mix and the development of carbon capture and storage etc. (Art 6.2 GR).

These criteria that Member States shall or may take into account when setting the contributions are identical to those foreseen in the Energy Efficiency Directive (Art. 3) before the revision in 2018.

In assessing Member States' contributions, the Commission used the following benchmark: distance to the 2020 target and to 2017 consumption.[51]

Summary of main findings:

=> The ESR target allocation approach is politically motivated, providing three criteria which allow to balance between political, economic and environmental aspects.

=> The RED 1 had a binding national target, opening the way to use infringement procedures in case targets were missed. However, the European Commission did not initiate any infringement procedures until now, even though several Member States have failed to meet the reference points and are off track to achieve their target.[52], The RED 2 provides a target benchmarking approach. It uses four

[50] For example, energy savings measures implemented at the national level to comply with Art. 7 EED, energy efficiency measures at Union level such as Ecodesign.
[51] The formula was presented in the Commission staff working document accompanying the communication on draft National Energy and Climate Plans.
[52] EEA (2020), Report No 13/2020

parameters, which can ensure a certain predictability for the sector, while considering national potentials and economic capacities.

=> The EED provides few indications on how to allocate or benchmark contribution. The wide list of elements Member States can use to justify target calculation gives some ideas on what are the major concerns of Member States: cost-effectiveness, the energy mix and external factors influencing energy demand.

4 Developing target allocation criteria for energy efficiency

The RED and ESR show that target allocation criteria play an important role to foster acceptance for stronger target governance.

The above analysis has shown that the weak target allocation in the field of energy efficiency and the resulting weak enforcement mechanisms has led to missing the targets – a failure that is jeopardising the credibility of the EU energy efficiency policy and a successful energy transition.

The aim of this study is to propose a solid method for target allocation in the field of energy efficiency in order to fix this problem. We therefore use the mechanisms from the two other legislations working with energy and climate targets. Both, ESR and RED, have different but equally successful approaches to target allocation that will be used as a basis for our reflections on how to allocate national contributions, appropriate to meet political objectives and based on quantifiable criteria.

We first look at the objectives and criteria used in the ESR and RED legislation in order to integrate these experiences into a method that takes into account the specifics of energy efficiency. On this basis we identified the parameters and the data availability according to these parameters. We performed a test run with these data with illustrative purpose and in order to comment on the outcome of these illustration of a target allocation based on quantifiable criteria (chapter 5).

Learning from ESR and RED experiences

For the ESR, the objectives are outlined in the Commission's impact assessment:

- Economic fairness, addressing lower-income countries concerns;
- Cost-effectiveness, addressing higher-income countries concerns; and
- Environmental integrity, addressing concerns that flexibilities in target achievement would jeopardise climate protection.

For the RED 1 and 2, the objectives are less clear, but from the impact assessment of RED 2, we have identified three specific objectives for the target allocation:

- Investment certainty, addressing concerns of the renewable energy industry;

- Cost-effectiveness, addressing concerns about RES potentials and the effectiveness of the internal energy market; and
- Functioning markets, addressing concerns that deployment of renewable energy sources in heating & cooling and transport are less developed.

For the EED, the situation is not clear, as target allocation was not discussed during the 2018 revision. But from the EED text, one can identify the following objectives:

- Economic fairness, addressing Member States' concerns that absolute reduction of energy consumption could constrain economic development and competitiveness; and
- Cost-effectiveness, addressing Member States' concerns that their specific remaining potentials are smaller than in other Member States, because of having already undertaken energy efficiency efforts.

These EED considerations are similar to the ones applied by the ESR and RED 1 and 2 to agree a target allocation or benchmarking. But in the case of the EED, it lead to a different outcome: maximising flexibility in setting national contributions, even allowing Member States to change their contributions during the implementation period or to provide only ranges for their contribution, for example by making the contribution dependent on economic or energy mix scenarios.

This situation does not fit well with the recognition that reducing energy demand through energy efficiency measures across sectors needs to be the first consideration for the energy transition, to maximise the societal, economic and environmental benefits. The Energy Efficiency First Principle has been enshrined in the 2019 Clean Energy for all Europeans package, defined by the Governance Regulation.

The Energy Efficiency First Principle does provide a strong argument to move towards an allocation approach and to complement the current set of Member States equity considerations with societal, environmental and climate considerations.[53] In particular, reducing energy poverty, increasing energy performance of buildings and access to healthy and affordable homes for vulnerable groups has moved up the political agenda and are important objectives of energy efficiency policies and targets. Reducing energy demand across the economy by around 50% is a cornerstone for all pathways towards net-zero GHG emissions.

For both the ESR and the RED 1 and 2, the allocation criteria are supported by objective and quantifiable parameters. They are based on public data, target data

[53] Guidelines C(2021) 7014 final say *inter alia*: '*Recognise the role of energy efficiency in addressing other objectives, such as reduction of GHG emissions, pollutants and use of non-energy resources, improvement of health and comfort, reduction of energy poverty.*'

to calculate a flat rate, Eurostat data to calculate a GDP rate, ENTSO-E data for interconnectivity, or EU reference projections (PRIMES) to approximate potentials.

Recommendations

The criteria of an energy efficiency target allocation can be informed by current political and economic considerations, which need to be further elaborated and be complemented by:

- Social equity, ensuring that all parts of society will benefit from the energy transition, in particular the energy poor and vulnerable groups, by providing high performing and healthy homes;
- Climate integrity, ensuring that all countries are lowering energy demand in line with net-zero pathways;
- Economic fairness, ensuring that the economic capacity to undertake investments and to manage short-term costs across the economy and end users are addressed; and
- Cost-effectiveness, realising the cost-effective potentials to achieve an economical allocation, and to address the different starting points of Member States.

The parameters selected for the allocation criteria must be objective and quantifiable

Identifying parameters for the criteria

For our selection of the energy efficiency target allocation criteria, we identified parameters which are objective and quantifiable (see Table 2 for the parameters and their values). This list is non-exhaustive and used to demonstrate feasibility with allocation scenario in the following chapter.

- Social equity

  Energy poverty: up to one in four households in the EU are affected by energy poverty.[54] One of the main tools to alleviate this is through energy efficiency measures. Also, the European Union has a duty to address energy poverty, as all its actions have to entail an equal treatment of all European

[54] Data by the Right to Energy Coalition

citizens.[55] The EU energy poverty observatory[56] provides a list of primary and secondary indicators.

We have looked at the primary indictors and identified one which is closely linked to buildings: *inability to keep home adequately warm* - the share of (sub)population not able to keep their home adequately warm. The data are based on surveys and available on Eurostat for all EU Member States. For 2019, the values range from 30% in Bulgaria to 2% in Finland, with 7% for the EU average.

For our illustrative allocation scenario, we use as parameter each country's share of the EU's total number of citizens that are not able to keep their home adequately warm. This means that the lower the number of people not able to keep their home adequately warm, the lower the allocation is and vice versa. Given the large spread of the indicator, we decided to apply a lower and upper cap per country as follows:

- the reference is the EU average share of citizens that are not able to keep their home adequately warm;
- if in a Member State the share of citizens that are not able to keep their home adequately warm is less than 50% of the EU average share, the value is set at 50%;
- if in a Member State the share of citizens that are not able to keep their home adequately warm is above 150% of the EU average share, the value is set at 150%.

- Climate integrity

  Reducing energy demand plays a major role in achieving net-zero GHG emissions. By 2050, final energy demand needs to be roughly halved in order to enable a fair and attractive energy transition. In 2019, the EU has lowered its demand by 5% PEC and 3% FEC compared to 2005. But the picture is very diverse at national level: some countries have increased demand (i.e. 5% PEC and 9% FEC in Poland) while others have reduced their demand substantially (i.e. 15% PEC and 18% FEC in Greece).

  For our illustrative allocation scenario we use as parameter each country's share in the EU's total distance to halving consumption. This means the smaller a country's distance to halving consumption, the lower its allocation would be and vice versa.

[55] '*In all its activities, the Union shall observe the principle of equality of its citizens, who shall receive equal attention from its institutions, bodies, offices and agencies.*' (Art. 9 Treaty on the European Union).
[56] Indicators and data by the EU Energy Poverty Observatory

- Economic fairness

  Similar to the ESR and RED target allocation, the rationale is to consider the close relation between economic output and energy demand, and the economic capacity, i.e. to undertake investments, as well as to manage short-term costs across the economy and end users. A broad range of factors could be considered, including national GDP, GDP/capita, access to EU financing and investment support.

  In the interest of simplicity and to achieve broad coverage, we have chosen the national GDP expressed as Purchasing Power Standard, which also ensures comparability.

  For our illustrative allocation scenario we use as parameter each country's share in the EU's total GDP. This means the smaller a country's GDP, the lower its allocation would be and vice versa.

- Cost-effectiveness

  The objective is to realise the cost-effective potentials to achieve an economical allocation, and to address concerns that Member States have different starting points, due to early actions, higher costs to access capital or specifics of the key sectors, such as buildings, transport and industry.

  This means that a variety of parameters are involved, which are subject of intensive debates, like discount rates and impact of energy efficiency policies.

  We are looking at two approaches to identify quantifiable and objective values:

  - Fraunhofer ISI model[57], a bottom-up modelling of energy savings potentials assuming market barriers are removed by policies; and
  - PRIMES model, an EU energy system model which simulates energy consumption and the energy supply system[58].

  The advantage of the first option is that it uses a large database to describe the different end-use sectors and their specific discount rates, and delivers overall potentials for each country.

[57] Fraunhofer ISI (2019). Study on Energy Savings Scenarios 2050. And more recent the ICF potentials

[58] PRIMES developed by E3MLab/ICCS of NTUA is a partial equilibrium modelling system that simulates an energy market equilibrium. See more here.

The advantage of the second is that it is updated in consultation with Member States experts and available for the current 2030 energy efficiency and renewable targets[59].

For our illustrative allocation scenario, we use as parameter for each country the distance between the 2020 target and ECO32325 modelling result, which reflects the achievement of the EU's 2030 targets for energy efficiency and renewable energy. This means that the smaller a country's distance between its 2020 target and the 2030 modelling result, the lower its allocation would be and vice versa.

Flexibilities to account for external factors

Member States will require a certain level of flexibility in achieving their national contributions. Energy saving polices and measures can reduce energy demand, but the result is not fully predictable. In addition, there are external factors, like changes in the economy, weather or population size, which can have significant impacts. The ESR for example provides a set of tools, including banking, borrowing transferring and purchasing of allocations, which Member States may use. However, to secure the integrity of the objectives and targets, their use needs to be controlled and be limited.

5 Illustrative allocation scenario

We applied the four criteria and their specific parameters as identified in chapter 4 for a test run, in order to illustrate the impact of each criterion for each Member State.

Based on these results, a target allocation or benchmarking formula could be developed by combining the different criteria with a specific weighting. This has not been done within the scope of our project.

The baseline for the test run is the current level of national contributions to the 2030 target as set in the NECPs.

The four criteria are applied one by one, each with a weight of 1. All input and output data are provided in Table 2 to 4, which show if Member States would be required to do more or less effort compared to their 2030 national contributions as set in their NECPs.

Main findings for PEC target allocation (Figure 1 below, Table 4):

[59] EUCO32325

- For ten Member States, all four criteria lead to a significant increase in their 2030 contributions, suggesting that the current 2030 national contributions lack ambition. In four countries among them the poverty allocator dominates (MT, CY, BG and PT). In three countries the climate allocator dominates (BE, AT and PL).
- In five countries, three criteria lead to a significant increase in their 2030 contributions; the climate allocator dominates in three (FI, FR and SE).
- In two countries, two criteria lead to a significant increase in their 2030 contributions, dominated by the poverty allocator (GR and RO).
- In six countries, only one criterium leads to a significant increase in their 2030 contributions, dominated by the poverty allocator in three cases (LT, IT and ES).
- In four countries all criteria lead to a decrease in their 2030 contributions (LV, DE, NL and LU).

Main findings for FEC target allocation (Figure 2 below, Table 4):

- For ten Member States, all four criteria lead to a significant increase in their 2030 contributions, suggesting that the current 2030 national contributions lack ambition. In three countries among them the poverty allocator dominates (MT, LT, BG and CY). In three countries the climate allocator dominates (HU, DK and HR).
- In four countries, three criteria lead to a significant increase in their 2030 contributions; the climate allocator dominates in three (ET, DE and SE).
- In five countries, two criteria lead to a significant increase in their 2030 contributions. The potential allocator dominates in two (FI and RO), the climate in two (PL and CZ).
- In four countries, only one criterion leads to a significant increase in their 2030 contributions (SL, PT, IT and NL).
- In four countries, no criterion leads to a significant increase in their 2030 contributions (ES, FR, LV and LU).

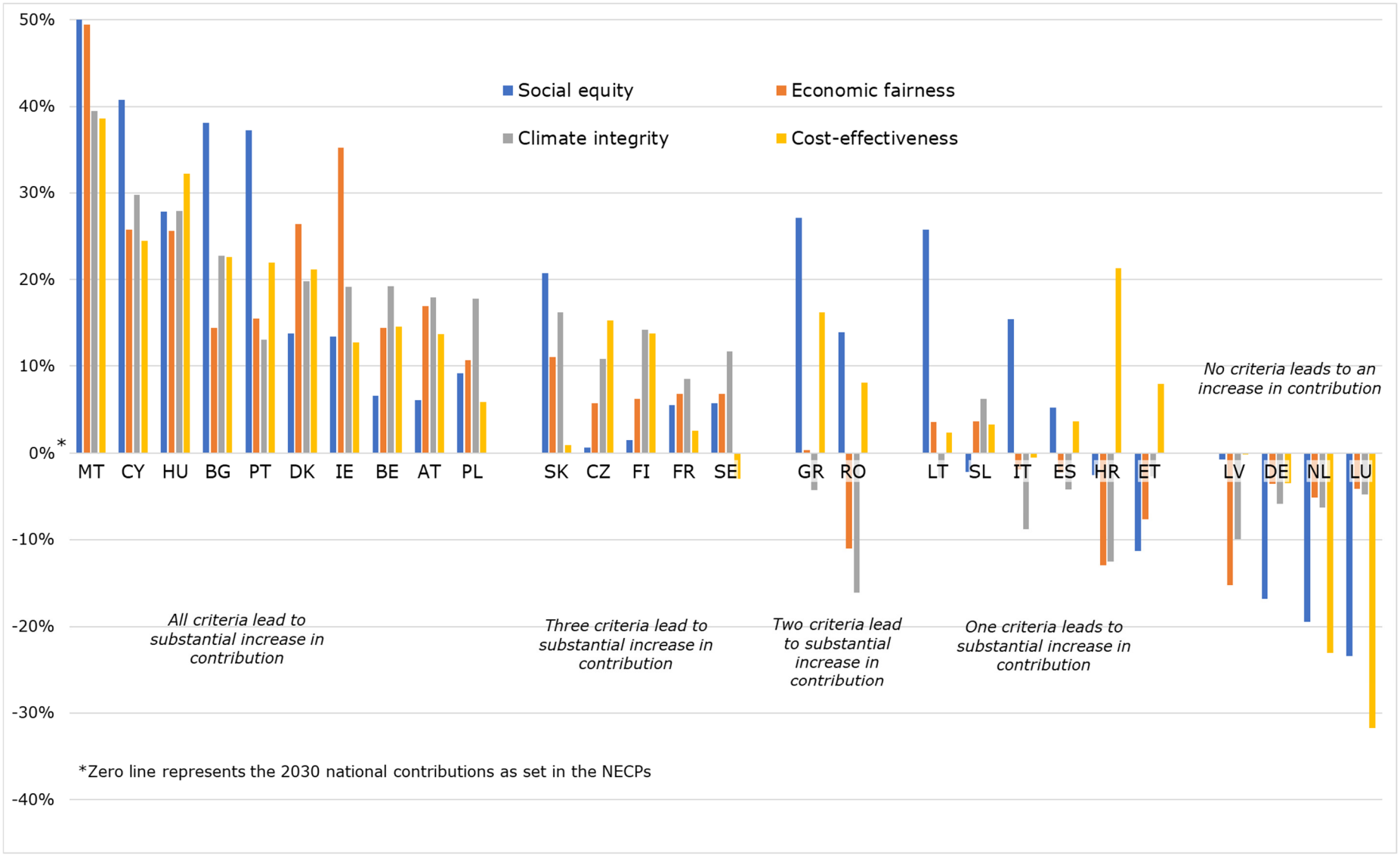

Figure 1: Impact of different allocation criteria, shown as changes to the national contributions to the EU's 2030 PEC target

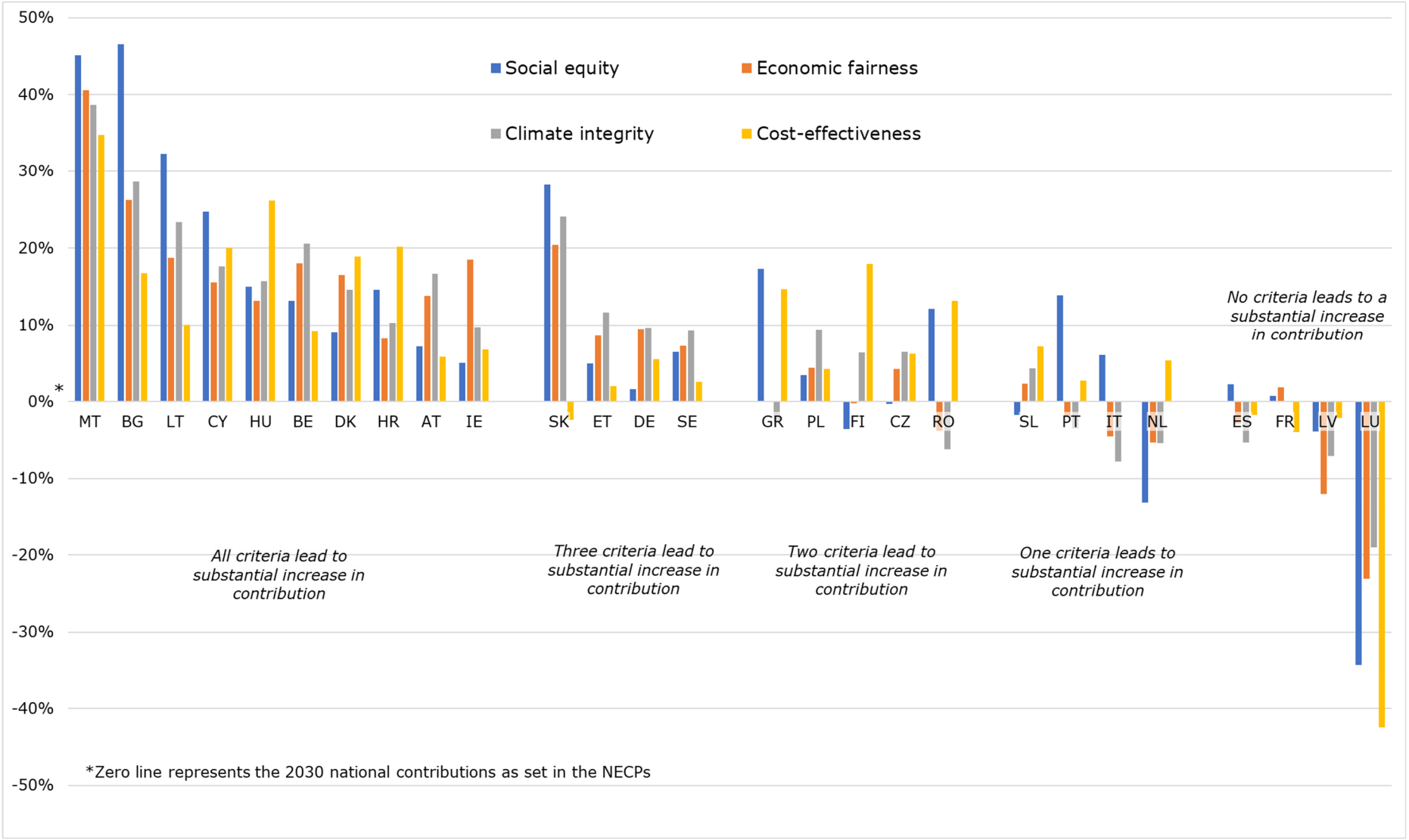

Figure 2: impact of different allocation criteria, shown as changes to the national contributions to the EU's 2030 FEC target

6 Conclusions

- Our review of climate and energy legislation finds that binding national contributions are effective to secure delivering the EU's targets if complemented by strong governance, including:
    - interim targets or trajectories;
    - obligations to take national measures; and
    - penalties, with infringement procedures being the last resort.
- The ESR and RED provide for a strong target governance. National contributions are allocated using a comprehensive set of criteria with quantifiable parameters.
- In the field of energy efficiency, a target allocation is absent and the governance is weak. Member States have large flexibilities to set and change their contributions. Progress on the ground has been insufficient to achieve the EU's 2020 target. National contributions leave a large gap to the EU's 2030 target.
- The EED and Governance Regulation address Member States' concerns about an equitable target allocation. But important benefits of energy efficiency policies, like social equity and climate protection, are missing from the considerations.
- We have identified four criteria which can be used to design an energy efficiency target allocation method:
    - Social equity: ensuring that all parts of society will benefit from the energy transition, in particular the energy poor and vulnerable groups, by providing high performing and healthy homes;
    - Climate integrity: ensuring that all countries are lowering energy demand in line with net-zero pathways;
    - Economic fairness: ensuring that the economic capacity to undertake investments and to manage short-term costs across the economy and end users are addressed; and
    - Cost-effectiveness: realising the cost-effective potentials to achieve an economical allocation, and to address the different starting points of Member States.
- Quantifiable parameters are available for these four criteria and were used to carry out allocation test runs. The outcome shows that those criteria allow to accommodate a broad range of Member States' and stakeholders' interests for a negotiated allocation or benchmarking.
- A transparent setting of criteria for allocating or benchmarking national contributions will help to strengthen the legal nature of the energy efficiency target and its governance in the context of the EED revision within the Fit for 55 package.

Table 2: Values for the allocation criteria

	Social equity		Economic fairness		Climate integrity				Cost-effectiveness			
	People unable to heat		2019 GDP		2019 distance to halving consumption compared to 2005				Distance bteween 2020 target and EUCO32325 for 2030			
	Number in Mill	% of EU, capped	MPPS	% of EU	PEC Mtoe	% of EU	FEC Mtoe	% of EU	PEC Mtoe	% of EU	FEC Mtoe	% of EU
Austria	0,16	1,1%	349.790	2,5%	15,8	2,6%	14,4	3,1%	5,1	2,1%	1,0	0,8%
Belgium	0,45	1,6%	422.159	3,0%	23,3	3,9%	17,5	3,8%	7,5	3,0%	0,6	0,5%
Bulgaria	2,09	2,6%	115.157	0,8%	8,6	1,4%	4,8	1,0%	3,5	1,4%	0,0	0,0%
Croatia	0,27	1,0%	82.582	0,6%	3,6	0,6%	3,3	0,7%	4,4	1,8%	1,6	1,3%
Cyprus	0,19	0,3%	24.591	0,2%	1,3	0,2%	1,0	0,2%	0,4	0,2%	0,3	0,2%
Czechia	0,30	1,3%	308.245	2,2%	18,5	3,1%	12,2	2,6%	9,5	3,9%	3,2	2,6%
Denmark	0,16	0,7%	235.617	1,7%	7,1	1,2%	6,6	1,4%	3,2	1,3%	2,5	2,0%
Estonia	0,03	0,2%	34.595	0,2%	2,2	0,4%	1,5	0,3%	1,5	0,6%	0,1	0,1%
Finland	0,10	0,7%	191.196	1,4%	15,3	2,5%	12,7	2,7%	6,1	2,5%	6,3	5,1%
France	4,17	14,9%	2.230.188	16,0%	104,8	17,4%	65,4	14,1%	30,4	12,4%	12,5	10,2%
Germany	2,08	10,2%	3.119.167	22,3%	121,9	20,3%	104,7	22,6%	54,9	22,4%	19,8	16,2%
Greece	1,92	4,0%	222.288	1,6%	7,1	1,2%	5,7	1,2%	7,3	3,0%	4,4	3,6%
Hungary	0,53	1,9%	222.845	1,6%	11,4	1,9%	9,2	2,0%	6,0	2,4%	4,4	3,6%
Ireland	0,24	0,9%	296.381	2,1%	7,2	1,2%	6,1	1,3%	2,0	0,8%	1,3	1,0%
Italy	6,62	22,0%	1.799.240	12,9%	55,5	9,2%	46,7	10,1%	33,3	13,6%	20,5	16,7%
Latvia	0,15	0,5%	41.136	0,3%	2,3	0,4%	2,1	0,4%	1,4	0,6%	0,7	0,6%
Lithuania	0,75	1,0%	72.731	0,5%	2,3	0,4%	3,2	0,7%	1,2	0,5%	0,2	0,2%
Luxembourg	0,02	0,1%	50.370	0,4%	2,1	0,4%	2,1	0,5%	-0,1	0,0%	-0,2	-0,1%
Malta	0,04	0,1%	15.833	0,1%	0,4	0,1%	0,5	0,1%	0,2	0,1%	0,1	0,1%
Netherlands	0,52	2,1%	692.779	5,0%	28,4	4,7%	22,9	4,9%	3,5	1,4%	10,9	8,9%
Poland	1,59	5,7%	872.911	6,3%	54,2	9,0%	41,7	9,0%	10,8	4,4%	7,5	6,2%
Portugal	1,95	3,8%	254.733	1,8%	9,7	1,6%	7,6	1,6%	5,9	2,4%	3,0	2,4%
Romania	1,80	6,4%	420.244	3,0%	13,9	2,3%	11,6	2,5%	13,7	5,6%	8,1	6,6%
Slovakia	0,43	1,5%	119.218	0,9%	7,3	1,2%	5,4	1,2%	0,4	0,2%	-1,3	-1,1%
Slovenia	0,05	0,3%	57.780	0,4%	2,9	0,5%	2,3	0,5%	1,0	0,4%	0,7	0,6%
Spain	3,55	12,7%	1.335.443	9,6%	52,7	8,8%	37,2	8,0%	29,4	12,0%	12,5	10,2%
Sweden	0,71	2,5%	380.174	2,7%	21,3	3,5%	14,9	3,2%	2,7	1,1%	1,9	1,6%
EU27	30,87		13.965.441		601,2		463,1		245,1		122,7	

Table 3: Values for the baseline

	Targets and contributions [Mtoe]				Eurostat [Mtoe]			
	2020 PEC	2030 PEC	2020 FEC	2030 FEC	2005 PEC	2019 PEC	2005 FEC	2019 FEC
Austria	31,5	30,8	25,1	25,6	32,7	32,2	28,3	28,3
Belgium	43,7	42,7	32,5	35,2	51,6	49,1	35,8	35,8
Bulgaria	16,9	17,5	8,6	10,3	19,2	18,2	9,8	9,8
Croatia	10,7	8,2	7,0	6,9	9,1	8,2	6,9	6,9
Cyprus	2,2	2,4	1,9	2,0	2,5	2,5	1,9	1,9
Czechia	44,3	41,4	25,3	23,7	42,5	39,8	25,3	25,3
Denmark	17,5	18,3	15,2	15,8	19,4	16,8	14,4	14,4
Estonia	6,5	5,5	2,8	2,7	5,0	4,7	2,9	2,9
Finland	35,9	34,8	26,7	25,0	33,6	32,1	25,3	25,3
France	226,4	202,2	137,9	120,9	260,9	235,3	145,4	145,4
Germany	276,6	216,0	194,3	185,0	321,6	282,7	214,5	214,5
Greece	24,7	21,0	18,4	16,5	30,3	22,3	16,2	16,2
Hungary	26,6	30,7	18,2	18,8	26,3	24,6	18,6	18,6
Ireland	13,9	13,7	11,7	11,2	14,9	14,7	12,4	12,4
Italy	158,0	125,1	124,0	103,8	180,8	145,9	115,4	115,4
Latvia	5,4	4,1	4,5	3,7	4,5	4,6	4,1	4,1
Lithuania	6,5	5,5	4,3	4,5	8,0	6,3	5,6	5,6
Luxembourg	4,5	3,5	4,2	3,1	4,8	4,5	4,4	4,4
Malta	0,8	1,1	0,6	0,8	0,9	0,9	0,7	0,7
Netherlands	60,7	46,6	52,2	43,9	70,1	63,5	49,9	49,9
Poland	96,4	91,3	71,6	67,1	88,0	98,1	71,0	71,0
Portugal	22,5	21,5	17,4	14,9	24,9	22,1	17,1	17,1
Romania	43,0	32,3	30,3	25,7	36,1	32,0	23,9	23,9
Slovakia	16,4	16,2	9,2	10,3	17,4	16,0	11,2	11,2
Slovenia	7,1	6,4	5,1	4,7	7,2	6,5	4,8	4,8
Spain	123,4	98,5	87,2	73,6	136,0	120,8	86,3	86,3
Sweden	43,4	39,6	30,3	29,1	49,0	45,8	31,5	31,5

Table 4: Results of the test run for each allocation criteria [Mtoe]

	PEC					FEC					
	Social equity	**Economic fairness**	**Climate integrity**	**Cost-effectiveness**	**NECP**	**Social equity**	**Economic fairness**	**Climate integrity**	**Cost-effectiveness**	**NECP**	
Austria	28,9	25,6	25,2	26,5	**30,8**	23,8	22,1	21,4	24,1	**25,6**	**AT**
Belgium	39,9	36,5	34,5	36,5	**42,7**	30,6	28,9	28,0	31,9	**35,2**	**BE**
Bulgaria	10,8	14,9	13,5	13,5	**17,5**	5,5	7,6	7,4	8,6	**10,3**	**BG**
Croatia	8,4	9,3	9,3	6,5	**8,2**	5,8	6,3	6,1	5,5	**6,9**	**HR**
Cyprus	1,4	1,8	1,7	1,8	**2,4**	1,5	1,7	1,6	1,6	**2,0**	**CY**
Czechia	41,2	39,1	37,0	35,1	**41,4**	23,7	22,6	22,1	22,2	**23,7**	**CZ**
Denmark	15,8	13,5	14,7	14,4	**18,3**	14,3	13,2	13,5	12,8	**15,8**	**DK**
Estonia	6,1	5,9	5,6	5,1	**5,5**	2,6	2,5	2,4	2,7	**2,7**	**ET**
Finland	34,3	32,6	29,9	30,0	**34,8**	25,9	25,1	23,4	20,5	**25,0**	**FI**
France	191,1	188,5	185,0	196,9	**202,2**	120,0	118,7	120,9	125,6	**120,9**	**FR**
Germany	252,3	223,6	228,4	223,4	**216,0**	182,0	167,4	167,1	174,8	**185,0**	**DE**
Greece	15,3	20,9	21,9	17,6	**21,0**	13,6	16,5	16,9	14,1	**16,5**	**GR**
Hungary	22,1	22,8	22,1	20,8	**30,7**	15,9	16,3	15,8	13,8	**18,8**	**HU**
Ireland	11,8	8,9	11,1	11,9	**13,7**	10,7	9,1	10,1	10,5	**11,2**	**IE**
Italy	105,8	127,4	136,1	125,7	**125,1**	97,5	108,5	111,8	103,9	**103,8**	**IT**
Latvia	4,1	4,7	4,5	4,1	**4,1**	3,8	4,1	4,0	3,8	**3,7**	**LV**
Lithuania	4,1	5,3	5,6	5,3	**5,5**	3,1	3,7	3,5	4,1	**4,5**	**LT**
Luxembourg	4,3	3,6	3,7	4,6	**3,5**	4,1	3,8	3,6	4,4	**3,1**	**LU**
Malta	0,5	0,5	0,6	0,6	**1,1**	0,4	0,5	0,5	0,5	**0,8**	**MT**
Netherlands	55,6	48,9	49,5	57,3	**46,6**	49,6	46,2	46,3	41,5	**43,9**	**NL**
Poland	82,9	81,6	75,0	85,9	**91,3**	64,8	64,1	60,7	64,2	**67,1**	**PL**
Portugal	13,5	18,2	18,7	16,8	**21,5**	12,8	15,2	15,4	14,5	**14,9**	**PT**
Romania	27,8	35,9	37,5	29,7	**32,3**	22,6	26,7	27,3	22,3	**25,7**	**RO**
Slovakia	12,8	14,4	13,5	16,0	**16,2**	7,4	8,2	7,8	10,5	**10,3**	**SK**
Slovenia	6,5	6,1	6,0	6,1	**6,4**	4,8	4,6	4,5	4,4	**4,7**	**SL**
Spain	93,4	100,7	102,6	94,9	**98,5**	72,0	75,7	77,5	74,9	**73,6**	**ES**
Sweden	37,4	36,9	35,0	40,8	**39,6**	27,2	27,0	26,4	28,4	**29,1**	**SE**
EU27	**1128,0**	**1128,0**	**1128,0**	**1128,0**	**1176,7**	**846,0**	**846,0**	**846,0**	**846,0**	**884,7**	**EU27**

Annex 2

Cost-effective energy saving potentials 2030

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1 Introduction

As part of the Green Deal, the European Commission proposed a plan to reduce EU greenhouse gas emissions by at least 55% by 2030, compared to 1990 levels. The scenarios achieving this 55% GHG ambition (including intra EU aviation and navigation emissions in the target scope) derive corresponding energy efficiency levels for 2030 of around 36% and between 39% to 40%[60] for final energy and primary energy, respectively, in the frame set by the proposed GHG target.

From the modelling in the frame of the Commission's Impacts Assessment of the EED, different ranges of reduction of primary and final energy consumption were derived, which will be the basis of a more ambitious 2030 target set. Thus, the proposed increase of ambition regarding energy efficiency will further increase to the need of ambition regarding the reduction of final and primary energy consumption in the European Union and its Member States.

In this chapter, the general feasibility of these new energy efficiency levels is compared to the energy savings potential in the EU and national energy savings potentials are compared to the national contributions set out by Member States in the NECPs under the current EU energy efficiency target of 32.5%.

2 Approach for assessing the target options

For the identification of possible options for the final and primary energy reduction targets in the EU, we compare the PRIMES reference projections (REF 2007 for the current 2030 targets and REF 2016 as a baseline for the inclusion of saving potentials for deriving the options for possible reduction targets) to the economic and technical potentials assessed by ICF in 2021 (ICF 2021[61]). These targets are translated to the REF 2007 to allow for a comparison with the current 32.5% reduction target.

This is done for both primary and final energy and for each MS and the EU27 as a whole. Due to limited data availability this assessment framework is not yet adjusted to the latest reference scenario REF 2020.

The technical saving potential estimates the level of energy saving potential that would occur if all processes, equipment and related infrastructure are upgraded with Energy Saving Opportunities (ESOs) that are technically feasible, regardless of any economic constraints.

[60] COM SWD(2020) 176 final (2020). Impact assessment: 'Stepping up Europe's 2030 climate ambition Investing in a climate-neutral future for the benefit of our people'
[61] ICF, CE Delft and eclareon (2021). Technical assistance services to assess the energy savings potentials at national and European level, published by the European Commission DG Energy

For estimating the economic saving potential in a MS, each ESO under the technical saving potential was assessed regarding its cost-effectiveness using the Cost of Conserved Energy (CCE) methodology. The CCE represents the lifetime cost of providing an energy service using an efficient technology measure possibly substituting a more inefficient baseline technology. It represents the cost per energy saved specific to a technology and usage pattern. The lower the CCE, the more economically attractive the specific ESO.

An ESO is deemed cost effective if CCE is smaller than the applicable fuel (e.g., electricity, gas, coal, etc.) price for the given ESO. Therefore, the energy prices applied in the assessment of economic potentials can strongly influence their magnitude.

Table 1 shows a summary of the EU27 technical and economical final energy saving potential by sector between 2020 and 2030 (in Mtoe and %) with reference to the final energy consumption as projected by ICF under Business as usual (BAU)[62]. The ICF's BAU is a further development of the EU Reference Scenario 2016 considering the latest Eurostat energy balances available at the time (2018). This new BAU would get the EU to 29.2% energy efficiency closer to the EU target of 32.5%, compared to the 2016 reference, which only achieved 24%.

Table 1: Summary of original EU27 technical and economic saving potential by 2030 (ICF 2021)

Sector	**BAU projected consumption by 2030**	**Technical reduction potential by 2030**		**Economic reduction potential by 2030**	
	Mtoe	Mtoe	%	Mtoe	%
Total	887	191	21.5%	135	15.2%

Table 2 gives an overview of the discount rates assumed in the ICF study. The same discount rates are applied for all sectors. Most of these values have been derived from the 'EU countries' 2018 cost-optimal reports'[63].

[62] The final report shows different figures for the EU27 as a whole. However, the sum of potentials by MS is different. The table here shows the sum of potentials by MS.
[63] COM EU countries' 2018 cost-optimal reports

Table 2: Discount rates applied in the ICF study

Country	Discount rate
Austria	3.9%
Belgium	1.0%
Bulgaria	4.0%
Cyprus	11.0%
Czechia	4.0%
Germany	0.0%
Denmark	4.0%
Estonia	3.5%
Greece	7.0%
Spain	7.8%
Finland	6.0%
France	5.5%
Croatia	3.0%
Hungary	3.0%
Ireland	4.0%
Italy	5.0%
Lithuania	3.0%
Luxembourg	4.0%
Latvia	3.0%
Malta	5.0%
Netherlands	3.0%
Poland	6.0%
Portugal	3.0%
Romania	5.5%
Sweden	4.5%
Slovenia	3.0%
Slovakia	2.0%

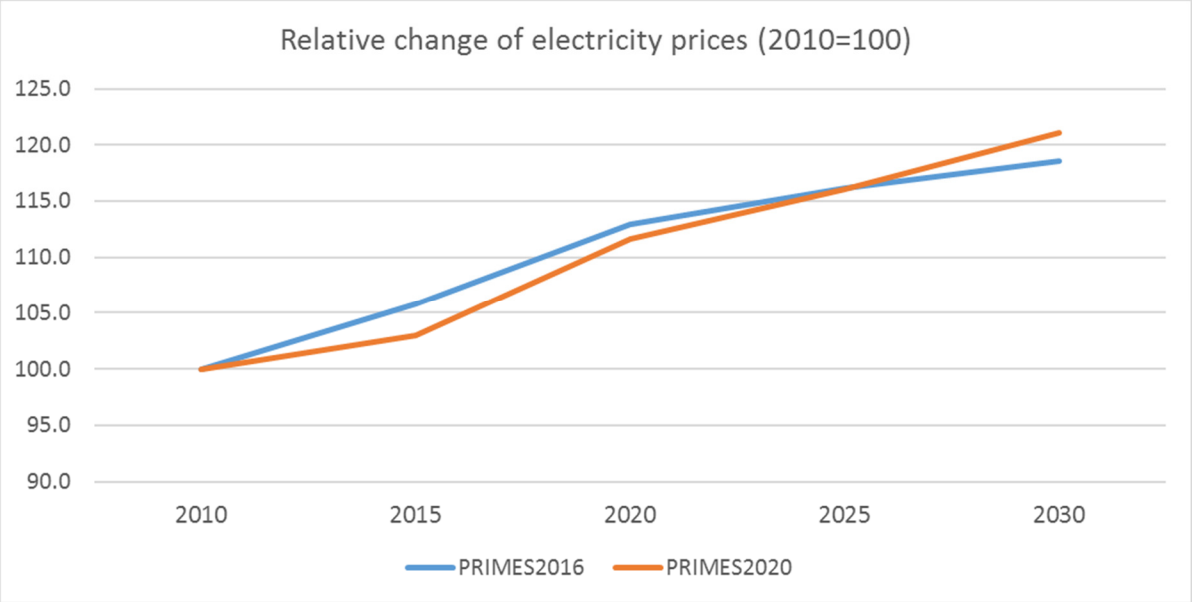
The developments of fuel tariff prices applied by ICF in the assessment of the saving potential were derived from REF 2016 Scenario based on Eurostat data of 2018. The primary fuel mix for each Member State was assumed to be constant throughout to 2050 in the ICF study.

However, due to rising carbon prices (from both the EU ETS and national carbon pricing instruments, such as recently implemented in Germany), energy prices substantially increased beyond what was assumed in the assessment of savings potentials by ICF. An increase in energy prices results in a larger share of technical potentials deemed as economic, thus resulting in an increase of the economic potential.

This share of technical potential, assuming to be a share of the difference between originally economic and technical potential, based on the relative difference in electricity price trajectories between REF2016 and REF2020 (see Figure 1 for the

EU as a whole) for each MS, can be considered economically viable because of the increase in energy prices.

Figure 1: Relative change of electricity prices REF 2016 and REF 2020



Furthermore, an additional share of the technical potentials can be considered achievable at low additional cost (near-economic potentials), so that the share of the technical potentials that can be used to achieve the targets continues to grow provided that appropriate financial support measures are introduced to allow these potentials to be leveraged. Combined with expected future cost reductions of the ESOs, this share can increase further.

The ICF study considered several different ESOs in its assessment. For the sector industry, ESOs from ICF's internal Industrial Energy Efficiency Database (IEED)[64] were applied. For residential and tertiary, ICF's Demand Side Management (DSM) database was used. The database contains information on the implementation of 150 DSM programmes for more than 50 utilities and program administrators.

ESOs in transport were selected based on the review of Member State NECPs and through consultation of experts. The main measures in this sector include increasing technical vehicle energy efficiency, electrification of transport, modal shift to environmental friendlier modes and a measure related to driving behaviour (lower speed on motorways).

The ESOs considered under the assessment of economic and technical potentials also exclude novel or emerging technologies, renewable energy sources (except solar heating for buildings), possible fuel switch between energy carriers (e.g.

[64] ICF (2016). The gold mine of energy efficiency program data

electrification of heat, etc.) and modal shift in road transport. These limitations harbour further increases in potential (economic as well as technical).

To account for a gap in possible measures like behavioural changes (e.g. modal shift) in transport excluded from the set of ESOs, we include potentials from the FhG potential study[65] of 2014 in addition to the ICF potentials in the transport sector. Furthermore, we adjusted the economic potentials to account for the accelerated uptake of electric vehicles in the market. The REF 2016 projection assumed a share of electricity consumption in road transport of 0.9% in 2030, while the REF 2020 assumed a share of 2.7% in 2030. To account for this higher penetration of electric vehicles in the market and its decreasing effect on vehicle prices, we conservatively assumed twenty percent higher economic savings potential in the transport sector.

3 Results

The calculations based on the original potentials derived by ICF (2021), *including* the adjustments mentioned, show a possible reduction by 2030 of the European Union's final energy demand by 41.2% compared to the REF 2007[66] (adjusted for new FEC definition used) or 9% reduction compared to the EED recast proposed target of 787 Mtoe if the economic potentials only are considered. This does not yet include near-economic potentials.

Assuming that the entire technical potential could be realised in the European Union, a maximum reduction of 45.4% in final energy consumption could be achieved compared to the adjusted REF 2007 (see Table 3 for results on Member State level compared to the MS contributions resulting from EED recast test run and Figure 2 for EU27) or a 15% reduction compared to the EED recast proposed target of 787 Mtoe.

The EU's PEC could be reduced to at least 928 Mtoe (44.5% below the EU reference projections from 2007 and 9.3% below the proposed PEC target) if the economic FEC savings potential is tapped. If the full technical potential can be tapped, a reduction by 48.5% compared to the 2007 reference could be achieved (or 15.8% below the proposed PEC target).

This is a conservative estimate, based on the MIX scenario which covers some additional factors which reduce PEC. The PEC potential is determined by the FEC potential and efficiency improvements in the energy conversion sector, notably the increasing share of solar and wind. With the proposed RED revision the renewable

[65] Fraunhofer ISI, TU Vienna, PwC (2014). Study evaluating the current energy efficiency policy framework in the EU and providing orientation on policy options for realising the cost-effective energy-efficiency/saving potential until 2020 and beyond. Report on behalf of DG ENER

[66] Adjusted for new Eurostat methodology for FEC excluding energy used in blast furnaces. In order to allow for comparison, we subtracted the 2005-2019 average energy used in blast furnaces.

energy target increases from 32% to 40%, resulting in additional PEC savings. Further to that, a reduced FEC supports an increase of the share of renewable energies and enables a higher penetration of intermittent energy sources, like solar and wind. This will further reduce PEC beyond the direct reductions resulting from end-use energy savings.

Table 3: MS contributions from EED recast test run compared to economic and technical potentials for FEC

	MS contributions in FEC from EED recast test run	**ICF potentials, adjusted**		**Difference of ICF adjusted to MS contribution in FEC**	
		economic	technical	economic	technical
Country	Mtoe	Mtoe	Mtoe	%	%
Austria	22.2	19.7	18.4	-11%	-17%
Belgium	29.9	26.6	25.3	-11%	-15%
Bulgaria	9.2	8.6	7.8	-6%	-15%
Croatia	6.0	5.8	5.1	-4%	-14%
Cyprus	1.9	1.9	1.7	0%	-8%
Czechia	20.9	20.1	17.8	-4%	-15%
Denmark	14.1	12.4	11.9	-12%	-16%
Estonia	2.6	2.5	2.3	-4%	-12%
Finland	21.5	20.3	19.5	-6%	-9%
France	107.0	98.8	91.0	-8%	-15%
Germany	162.0	142.7	137.2	-12%	-15%
Greece	14.9	13.9	12.6	-7%	-16%
Hungary	16.8	15.7	14.3	-7%	-15%
Ireland	10.1	8.9	8.3	-12%	-18%
Italy	94.1	84.9	76.5	-10%	-19%
Latvia	3.4	3.3	3.1	-3%	-10%
Lithuania	4.4	4.2	3.9	-4%	-11%
Luxembourg	2.8	2.4	2.3	-14%	-17%
Malta	0.7	0.7	0.6	-5%	-12%
Netherlands	39.4	34.7	32.4	-12%	-18%
Poland	59.9	59.3	53.3	-1%	-11%
Portugal	13.7	12.5	11.7	-9%	-14%
Romania	23.3	22.1	19.0	-5%	-18%
Slovakia	8.8	8.2	7.5	-7%	-14%
Slovenia	4.4	4.1	3.8	-7%	-13%
Spain	66.9	61.0	56.5	-9%	-16%
Sweden	26.2	23.5	22.9	-10%	-13%
EU27	787.0	718.5	666.8	-9%	-15%

Figure 2: Comparison of REF 2016 and REF 2020 projection with economic and technical potentials for final and primary energy consumption in the EU27.

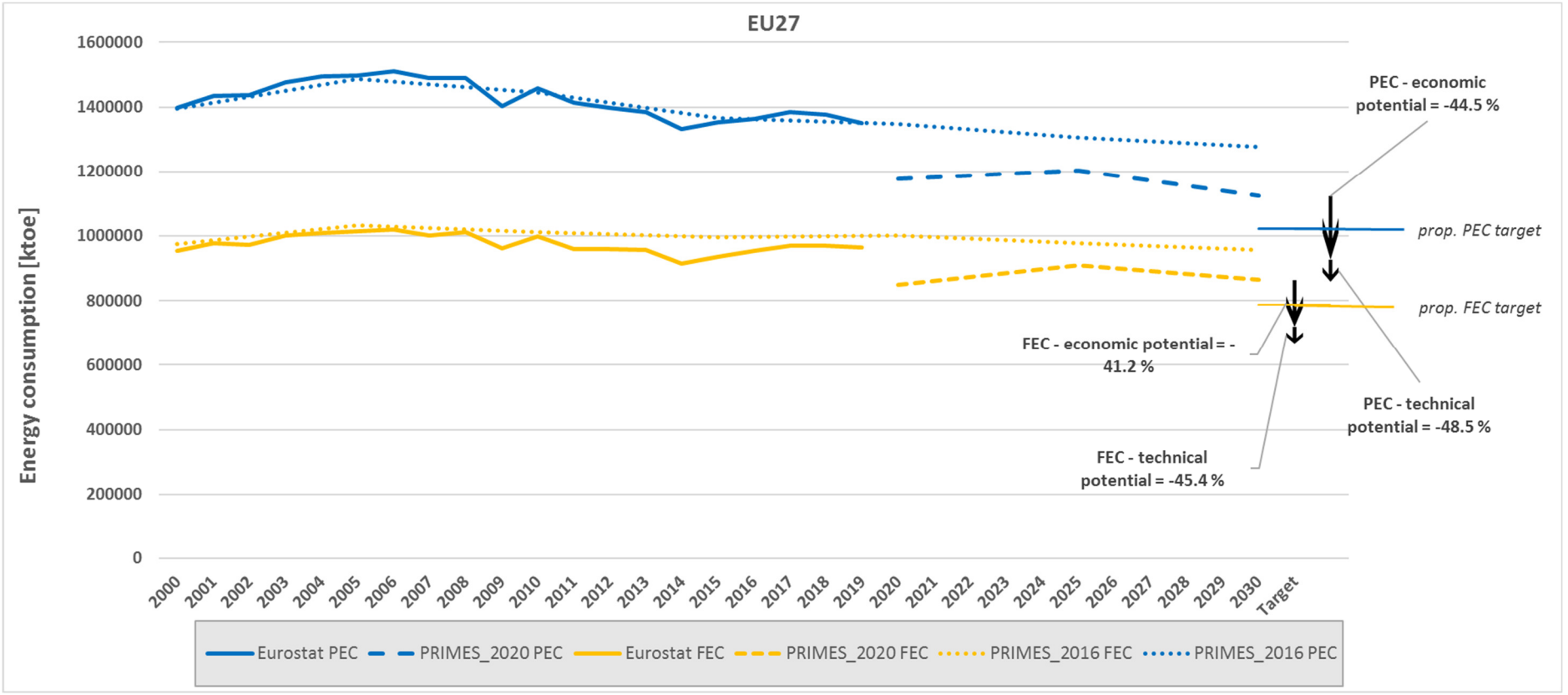


Table 4: Energy savings potentials derived from ICF 2021 adjusted to REF 2020

Country	FEC in ktoe	
	economic	technical
Austria	4,837	6,130
Belgium	6,501	7,718
Bulgaria	1,356	2,197
Cyprus	190	338
Czechia	2,786	5,157
Denmark	2,978	3,479
Estonia	337	533
Finland	3,844	4,567
France	19,302	27,097
Germany	36,020	41,500
Greece	2,379	3,678
Croatia	845	1,497
Hungary	2,657	4,023
Ireland	2,248	2,849
Italy	17,874	26,312
Latvia	405	642
Lithuania	600	898
Luxembourg	722	812
Malta	92	139
Netherlands	8,481	10,759
Poland	6,754	12,745
Portugal	2,388	3,101
Romania	3,187	6,226
Slovakia	1,423	2,073
Slovenia	728	991
Spain	11,417	15,953
Sweden	5,561	6,160
EU27	145,911	197,574