Non paper on complementary economic modelling undertaken by DG ENER analysing the impacts of overall energy efficiency target of 13% to 19% in the context of discussions in the European Parliament on the revision of the Energy Efficiency Directive

Modelling analysis

This non-paper contains the results of an update – performed by the European Commission in May 2022 – of the modelling analysis, for the Impact Assessments accompanying the proposal for a Directive of the European Parliament and of the Council on energy efficiency (recast)[1].

This update consists of two energy modelling scenarios which include: a) a revision of the assumptions for international fossil fuel prices reflecting the ongoing rise in energy prices and the assumption that gas prices will remain significantly higher well after 2030; b) the European action proposed in the REPowerEU plan which includes achieving an energy efficiency target of 13%; and c) additional measures needed to reach an energy efficiency target of 19% (compared to the 2030 projections of the Reference Scenario 2020), the latter in accordance with the draft report[2] of the Energy Efficiency Directive (EED) rapporteur in the European Parliament.

This analysis will be shared with the co-legislators.

1. IMPACTS OF HIGHER ENERGY PRICES AND ENERGY SECURITY CONSIDERATIONS ON THE EU ENERGY EFFICIENCY POLICY ARCHITECTURE

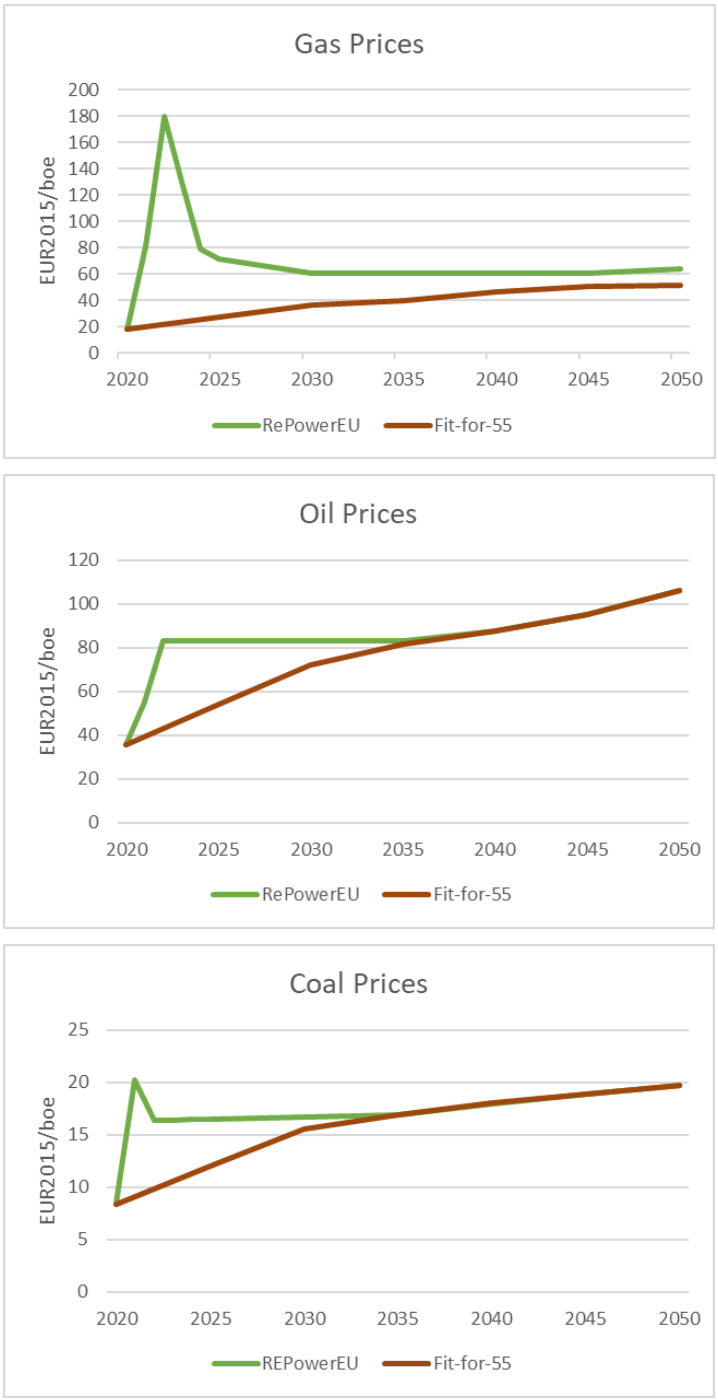
Russia's unprovoked and unjustified military aggression against Ukraine, has massively disrupted the world's energy system. It has caused high energy prices and it has heightened energy security concerns, bringing to the fore the EU's over-dependence on gas, oil and coal imports from Russia.

Although it is hard to accurately model the fuel price trajectories for the next years, the European Commission has quantified possible trajectories to allow to assess its impacts. The purpose of this analysis is to estimate the effect of high fuel prices (compared to the fuel price trajectories proposed in the Fit-for-55 package) on the European energy system, and the impact of the measures and actions it has proposed in its REPowerEU plan.

Higher energy prices trigger energy savings in the short-term and enable more investments in energy efficiency in the medium- and long-term as they reduce the payback period of these investments. The fuel price trajectories assumed in the REPowerEU plan[3] and the modelling analysis of this paper are significantly higher than the assumptions used in the FF55 package analysis for the whole period until 2030, especially for natural gas. Figure 1 shows the assumed evolution of fossil fuel prices since 2020.

[1] COM/2021/558 final
[2] https://www.europarl.europa.eu/doceo/document/ITRE-PR-703281_EN.pdf
[3] See also the Annex of the SWD(2022) 230 final.

Figure 1: International fuel prices



In 2021, as part of the Fit-for-55 package[4] and with the objective of delivering on the European Green Deal, the Commission proposed to increase the energy efficiency target to a reduction of energy consumption (both primary and final) of 9% by 2030 compared to the projections of the Reference Scenario 2020[5]. While primarily framed to support the decarbonisation of the EU economy, the proposal to further decrease energy consumption also aims at other benefits that energy efficiency brings, such as higher energy security, job creation, lower air pollution, lower natural resources depletion, and decrease of energy poverty.

[4] https://ec.europa.eu/info/strategy/priorities-2019-2024/european-green-deal/delivering-european-green-deal_en
[5] https://energy.ec.europa.eu/data-and-analysis/energy-modelling/eu-reference-scenario-2020_en

Implementation of the full Fit-for-55 package would lower the EU's gas consumption by 30% (equivalent to 116 bcm) by 2030[6] compared to today. More than one third of this would come from meeting the EU energy efficiency target put forward in the Energy Efficiency Directive (EED) recast proposal.

The target, facilitated by the projected higher gas prices, would be delivered by the implementation of the relevant energy efficiency policy proposals, such as the recast EED itself, the recast of the Energy Performance of Buildings Directive (EPBD), Ecodesign and Energy Labelling legislation, as well as other policy instruments with an impact on energy consumption, such as the CO_2 emissions standards for new vehicles supported by the Alternative Fuels Infrastructure Regulation, the EU Emission Trading System (ETS), the proposed new ETS for buildings and road transport, and the Effort Sharing Regulation (ESR).

Following the REPowerEU communication of 8 March, further modelling of the REPowerEU scenario with structurally higher gas prices indicated a cost-effective energy efficiency target of 13% in 2030 which was thus proposed in the REPowerEU plan and the 'EU Save Energy' communication. To support this target, the Commission put forward specific short-, medium- and long-term measures and actions, which would increase the achieved energy efficiency and accelerate the clean energy transition and allow for the phase out of our energy imports from Russia.

More specifically, and regarding energy savings, the Commission suggested for consideration improvements to the Fit-for-55 package that include[7]:

- Increase of the ambition of the national energy savings obligation.
- Introduction of obligations to reduce energy consumption, stop fossil fuel subsidies, and promote renewable energy technologies in transport and industry.
- Strengthening of the implementation of energy audit results.
- Extension of the Minimum Energy Performance Standards in buildings.
- Strengthening of national energy requirements for new buildings.
- Tightening of national heating system requirements for existing buildings.
- Introduction of national bans for boilers based on fossil fuels in existing and new buildings.
- Advancement of the end of Member States subsidies for fossil fuel-based boilers from 2027 to 2025.

Energy system modelling of this measures underpins the following analysis. Some of these measures can be quantified as model parameters in PRIMES model[8] and are presented below. Some other measures cannot be quantified directly in the same way, but they are modelled as enabling conditions or factored in proxy variables used by the PRIMES model. Amongst those, there are the measures that a) affect the effectiveness with which energy efficiency measures are adopted and implemented in the Member States (e.g., strengthening of the implementation of energy audit results), and b) make energy efficiency more attractive (e.g., stop of fossil fuel subsidies enables a behavioural change to energy efficiency in fossil fuel-based sectors and applications).

[6] REPowerEU plan

[7] This list of measures covers measures included or pertinent to, e.g. EED and EPBD, but does not cover all actions assumed in SWD(2022)230, for instance related to increased renewable energy deployment

[8] https://ec.europa.eu/clima/eu-action/climate-strategies-targets/economic-analysis/modelling-tools-eu-analysis_en

More cost-efficient options available, due to the assumed higher energy prices, and more action in energy efficiency means that, together with the other measures mentioned above, higher Article 8 target can be considered. This is also in line with the increase of measures that are eligible under Article 8, mainly measures to support investments on the renovation of the building envelope and the replacement of the heating and cooling equipment in the buildings sector (by renewable alternatives including heat pumps), measures to support higher use of public transport and active mobility, and measures to promote the uptake of direct energy management systems in the industrial sectors.

The modelling analysis shows that achieving more energy efficiency will thus require a further acceleration of renovation of buildings (as high as close to 2.5% per year by 2030 for residential buildings in the 19% energy efficiency case), and notably of deep renovation (resulting in considerable energy saving, which would reach about 1% of the stock annually in the 19% energy efficiency case), combined with an even faster deployment of heat pumps. Policies to end the support to fossil fuels and the very high gas prices reduce considerably the installation of gas boilers.

Table 1: Selected policy drivers by scenario (in 2030 unless stated otherwise)

	Modelling analysis for the EED recast	**New modelling analysis**	
	Full Package Scenario 9%EE/40%RES	**REPowerEU 13%EE/45%RES**	**REPowerEU 19%EE/45%RES**
Energy efficiency measures			
Annual target for Article 8 of EED recast	**1.5%**	**1.8%**	**2.2%**
Renovation rate for residential buildings	**2%**	**2.25%**	**2.46%**
Renovation rate for non-residential buildings	**1.2%**	**1.4%**	**1.9%**
Average rate of deep renovations[9] (% of housing stock)	0.8%	0.9%	1%
Number of households with heat pumps in 2030[10] (mio)	37.20	38.68	58.04
Number of services buildings with heat pumps in 2030 (mio)	2.85	3.17	4.08

2. RESULTS OF MODELLING ANALYSIS

The two new scenarios of this additional modelling analysis examine two possibilities. The first one (REPowerEU 13% energy efficiency[11]/ 45% renewables) follows the increased targets proposed by the Commission in the REPowerEU plan and accounts to an increase by 13% of the energy efficiency ambition by 2030, compared to the projections of the 2020 reference scenario and 45% of renewables in the European energy mix by 2030. The second one (REPowerEU 19% energy efficiency/ 45% renewables) keeps the target of renewables to

[9] Residential buildings. The average 2021-2030 is presented since deep renovations are frontloaded in some scenarios.
[10] Numbers include only the air- and ground-source heat pumps.
[11] Compared to the 2030 projections of the Reference Scenario 2020.

the increased 45% by 2030 and further increases the energy efficiency ambition to 19% by 2030, in accordance with the target proposed in the draft report of the EED Rapporteur in the European Parliament.

These two scenarios are complemented by the results of an updated Full Package Scenario that uses the targets adopted by the Commission in the Fit-for-55 package, namely 9% for energy efficiency and 40% for renewables. The Full Package Scenario is very close to the modelling performed for the Impact Assessments of the Fit-for-55 package. However, combining the final legislative proposals of the package, as these were further formulated by the end of 2021[12], results in small differences in the main targets compared to the MIX scenario presented in July 2021 (generally less than one percentage point). Larger differences exist in hydrogen generation by 2030, where the results of increased ambition for hydrogen penetration where captured in the MIX-H2 scenario, as included in the impact assessment supporting the review of the Renewable Energy Directive and the exact shares of some power generation technologies (that now better reflect Member States' policies and trends, e.g., an increased deployment of solar PV). These changes do not affect the results presented in the Fit-for-55 package (in particular, do not significantly affect the targets and cost).

It should be underlined that the Full Package Scenario included in this non-paper uses the (lower) energy prices of the Fit-for-55 package. This scenario is used as a baseline scenario for the conditions for which the Commission responded with the Fit-for-55 package in 2021.

Higher energy prices stimulate and enable more action in energy efficiency. Modelling a Full Package Scenario that uses higher energy prices indicates higher energy savings of 10% with lower import dependency and gas imports than in the projections used for the Fit-for-55 package. However, both fall short of the REPowerEU plan objectives (reducing our dependency on Russian fossil fuels and accelerating the energy transition).

This justifies the higher energy efficiency target put forward by REPowerEU. In addition, should energy prices be lower than in the aforementioned projections, the objectives of the plan should still be fulfilled. Thus, a strong regulatory framework (energy efficiency target of 13%) is needed to ensure this, independently of of the level of energy prices.

Finally, the energy system costs[13] in the Full Package Scenario that uses higher energy prices are slightly higher than the ones for the REPowerEU scenario. Without additional energy efficiency measures, consumers will bear similar (or even slightly higher) costs and this will most likely affect vulnerable consumer more (as they are less likely to react to high prices with investments and energy saving measures).

Table 2: Main modelling results for 2030

	Modelling analysis for the EED recast	**New modelling analysis**	
	Full Package Scenario 9%EE/40%RES	**REPowerEU 13%EE/45%RES**	**REPowerEU 19%EE/45%RES**
Energy consumption			
EU FEC target (wrt. REF2020 scenario)	**9%**	**13%**	**19%**

[12] For example by the proposal for a revision of EPBD and the proposed EU framework to decarbonise gas markets, promote hydrogen and reduce methane emissions.
[13] Total system costs, without disutility and auction payment.

Final energy consumption (Mtoe)	787	751	701
EU PEC target (wrt. REF2020 scenario)	8%	10%	13%
Primary energy consumption (Mtoe)	1,033	1,006	979
Renewable energy			
RES share	**40%**	**45%**	**46%**
Energy system			
Total system costs[14] (bn €'22, average 2021-2030)	1,802	1,963	1,982
Import dependency (as % of GIC)	51%	46%	44%
Net natural gas imports (bcm)	233	117	104
Net electricity Generation (TWh)	3,355	3,450	3,638
Renewable energy share in electricity generation	69%	72%	70%

The main additional modelling results in Table 2 indicate that increased energy efficiency, combined with increased renewables, can deliver significant results in the directions of the clean energy transition and the reduced dependency of Europe from energy imports. Compared to the Fit-for-55 projections, high gas prices combined with ambitious policy drive at the same time a fuel substitution (both in the power sector and in final consumption sector) and additional energy conservation measures. This affects both primary energy consumption (PEC) and final energy consumption (FEC) and further promotes electrification and penetration of renewable energy. Though additional benefits in terms of import dependence and reduced natural gas imports are limited beyond the REPowerEU 13%EE/45%RES scenario.

The results of the additional modelling show that the reduction in primary energy consumption trails behind the reduction in final energy consumption. This can be interpreted as a result of the high energy prices, which are driving a return to less efficient technologies in electricity generation, for example the prolongation of the use of coal instead of natural gas, the use of nuclear instead of high-efficiency CHP, etc. To a lesser extent, the increased deployment of hydrogen and Renewable Fuels of Non Biological Origin (RFNBOs) limits further reductions in PEC.

For both additional scenarios a considerable decrease in the use of fossil fuels is projected.

The synergies between energy efficiency and renewables can be better seen in the results of the REPowerEU 19% energy efficiency/ 45% renewables scenario, in which the RES share slightly increases to 46%, even without additional measures taken for the deployment of renewables compared to the REPowerEU 13% energy efficiency/ 45% renewables scenario. Targeting a reduction in the use of fossil fuels via energy efficiency, increases the relative share of renewables in the energy mix. In addition, the intensification of the energy efficiency efforts benefits the penetration of renewables as it favours the greener and more efficient technologies of heating and electricity generation (e.g., more heat pumps in the place of gas boilers).

[14] Excluding disutility costs and deductible auction payments

In absolute terms, the scenario with 19% energy efficiency is reducing both PEC and FEC at a level that a reduction in renewable deployment compared to the scenario with 13% energy efficiency is projected.

The results show that, in an environment of high energy prices, Europe can reap the benefits of an accelerated green transition at a reasonable cost. The additional measures and actions in the REPowerEU 13% energy efficiency/ 45% renewables and REPowerEU 19% energy efficiency/ 45% renewables scenarios result in total annual energy system costs of 9% and 10% more, respectively, than the Full Package Scenario 9% energy efficiency/ 40% renewables. The implementation of the REPowerEU 19% energy efficiency/ 45% renewables scenario would need extra investments of more than an extra 0.5% of the European GDP annually, while Full Package 9% energy efficiency/ 40% renewables and REPowerEU 13% energy efficiency/ 45% renewables scenarios result in comparable investment expenditure.

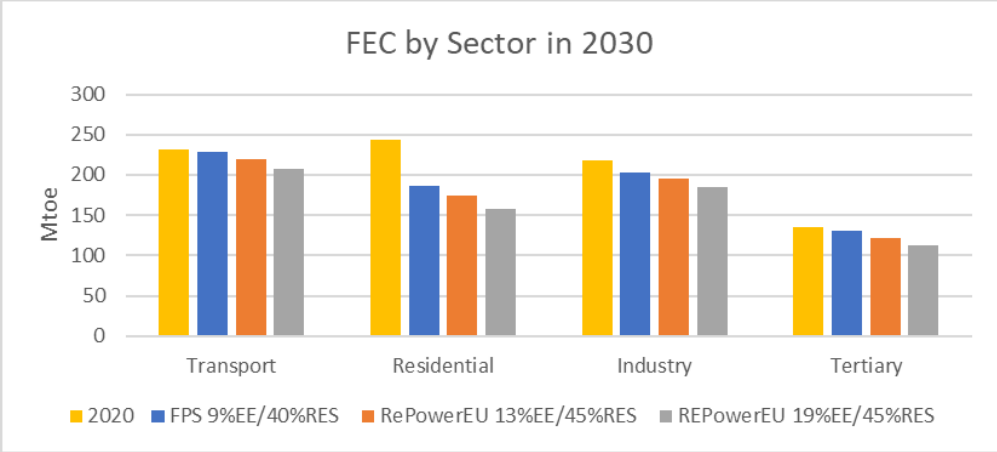
The additional modelling supports the assumption that the increased targets can reduce Europe's import dependency. Starting from a 56% import dependency in 2020, the Full Package Scenario could bring down this figure to 51%. The two additional scenarios improve further this figure, down to 46% in the REPowerEU 13% energy efficiency/ 45% renewables scenario and down to 44% in the REPowerEU 19% energy efficiency/ 45% renewables scenario.

More importantly in the context of the energy crisis caused by Russia's invasion of Ukraine, the two additional scenarios result in a decrease of 60-65% in the imports of natural gas compared to 2020 and 50-55% compared to the Full Package Scenario, allowing to achieve the objective of phasing out, well before 2030, gas imports from Russia which accounts currently to 40% of the EU gas imports.

3. IMPACTS OF HIGHER ENERGY EFFICIENCY TARGETS

3.1. Energy supply and demand

The higher energy efficiency targets in the final energy consumption are achieved by efforts in all sectors (transport, residential, industry and tertiary).



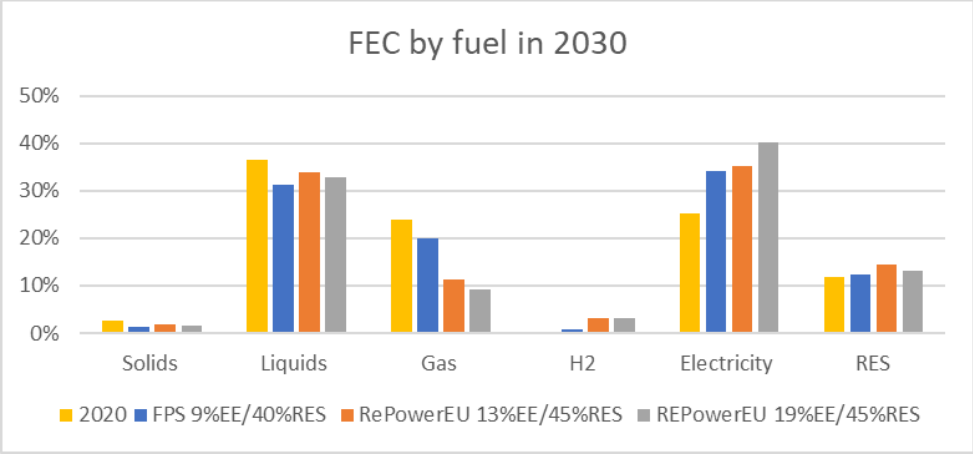
In both additional scenarios, the final energy consumption in the residential sector is projected to have the largest decrease compared to the Full Package Scenario and the historical data of 2020. This is driven by a higher renovation rate in buildings, with a significant share of deep renovations and an increased electrification in space heating, water heating and cooking. The uptake of heat pumps contributes to this result.

In the transport sector, the two additional scenarios result in a decrease of final energy consumption of 3% and 9% by 2030 respectively compared to the Full Package Scenario.

While the higher oil price contributes to reducing energy consumption in both additional scenarios compared to the Full Package scenario, further reductions, in different degrees for the two scenarios, are driven by an increase in vehicle efficiency, higher use of public transport and transport electrification. In addition, new fuels as bio kerosene and RFNBOs are introduced in the sector, nevertheless by 2030 they still represent a share of less than 5%.

On the industry side, energy consumption is reduced mainly in the iron and steel, chemical and paper, and printing industries. The share of electricity is increased and new fuels are introduced in the energy mix of the sector, with hydrogen representing approximately 5% of the final energy mix of the sector by 2030.

If the final energy consumption is broken down by fuel, a significant decrease in the use of fossil fuels (more for gas and less for solids and liquids), an increase in electricity and RES[15], and an increase in the use of hydrogen are observed.

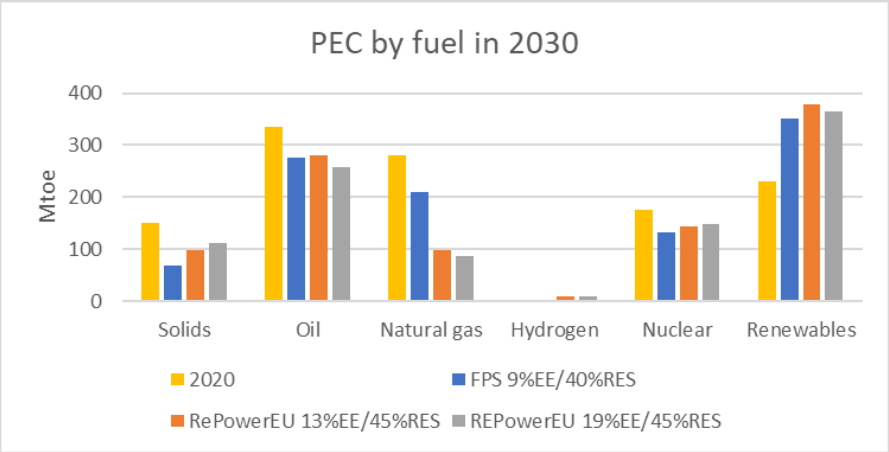


In both additional scenarios, the consumption of gas is significantly reduced, fulfilling the objective of REPowerEU of phasing out Russian gas imports which accounts currently to 40% of the EU gas imports. Hydrogen enters the energy mix with a share of approximately 3%. Hydrogen in FEC is projected to be used mainly in the industry sector.

Electrification is intensified and the relative use of electricity is significantly higher. In both cases, the share of renewable energy in the electricity mix increases, with wind representing the highest share. The use of other RES, notably biomass, is reduced, but in a slower pace than the whole final energy consumption, thus resulting in a small increase in the relative importance of biomass. The same can be told about oil and oil products, since the decrease of their use is slower than the decrease of the total final energy consumption.

The modelling for primary energy consumption offers valuable insights on how the energy system reacts to the projected high energy prices.

[15] In FEC, the category RES includes the direct use of biomass, heat from solar and geothermal systems, and biofuels



In all scenarios (including the Full Package Scenario) consumption of all fossil fuels in 2030 is significantly lower compared to 2020. However, by 2030, the fuel shift prompted by high prices and security of supply policies is significant.

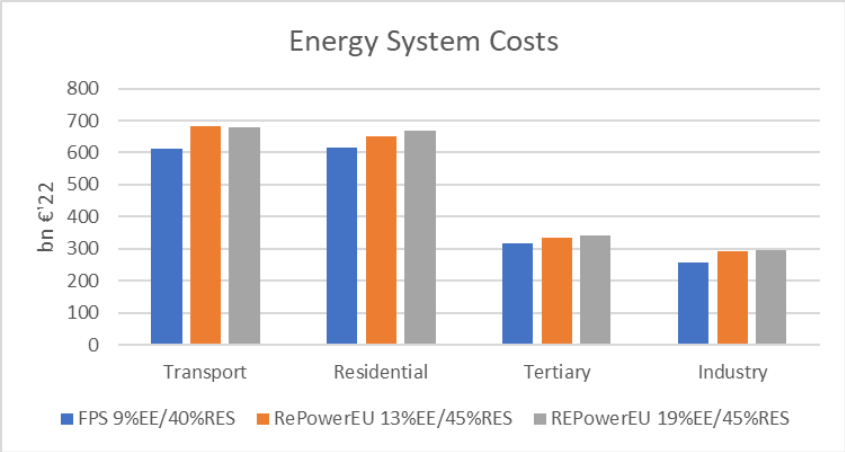
The price increase is particularly high for natural gas prompting a shift towards fuels with lower conversion efficiency (e.g., coal). Whereas overall coal still sees a strong reduction by 2030 compared to 2020, this relative shift from gas to coal tends to decrease the rate with which primary energy consumption is reduced. Thus, while in the two additional scenarios final energy consumption is reduced by 13% and 19%, the primary energy consumption is reduced by only 10% and 13%.

Compared to the Full Package Scenario, in the REPowerEU 13% energy efficiency/ 45% renewables scenario consumption of natural gas in 2030 is 47% lower while consumption of coal is 30% higher and consumption of oil and oil products is 3% higher. Then, in the REPowerEU 19% energy efficiency/ 45% renewables scenario consumption of natural gas in 2030 is 59% lower while consumption of coal is 10% lower and consumption of oil and oil products 7% lower, a result that reflects the significant overall decrease of the primary energy consumption.

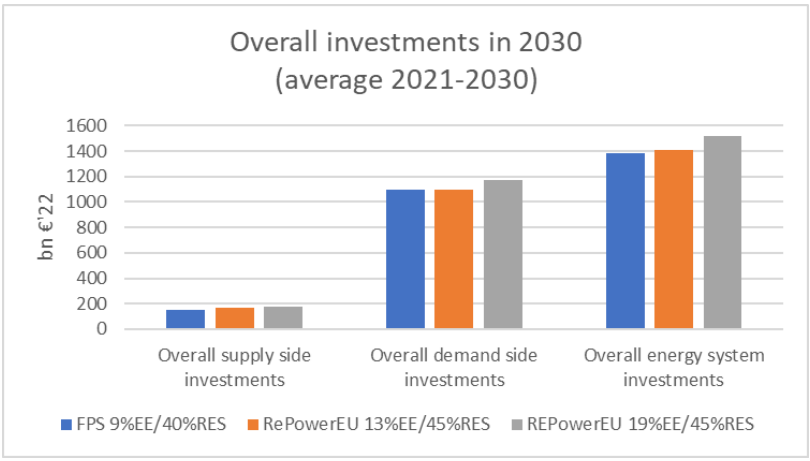
3.2. Energy system costs

The total costs of the energy system are projected to increase with a higher energy efficiency target, however, this would generate additional co-benefits in terms of security of supply.

For the two additional scenarios, the total energy system costs will increase by 9% and 11%, respectively, compared to the Full Package Scenario. This increase will be more significant in the industry sector, at 14% for the two additional scenarios. For the transport sector, the increase is projected at 12% for both scenarios in part due to the further penetration of RFNBOs and further investments in new electric vehicles and ensuring charging infrastructure. The increase for the two additional scenarios is projected at 6% and 8% in the residential sector and at 6% and 7% in the tertiary sector respectively.



The overall[16] investments by 2030 are projected to be moderately higher for the REPowerEU 13% energy efficiency/ 45% renewables scenario and considerably higher for the REPowerEU 19% energy efficiency/ 45% renewables scenario when compared to the Full Package Scenario.

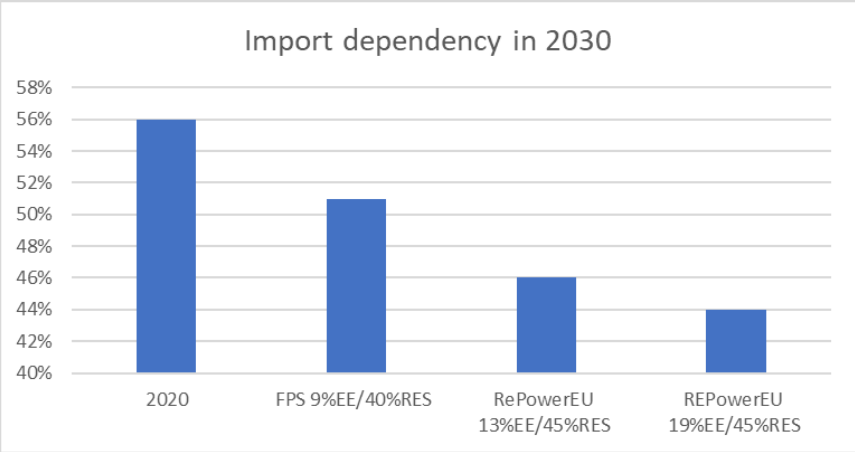


For the first additional scenario, the increase in the annual overall supply side investments by 2030 is projected to reach 10.5% and the increase in the annual overall demand side investments by 2030 is projected to reach 0.6%, thus an increase of 1.8% in the annual overall energy system investments by 2030, all figures compared to the Full Package Scenario. For the second additional scenario, the increase in the annual overall supply side investments by 2030 is projected to reach 17.2% and the increase in the annual overall demand side investments by 2030 is projected to reach 7.5%, thus an increase of 8.6% in the annual overall energy system investments by 2030, again all figures compared to the Full Package Scenario.

3.3. Energy security and imports

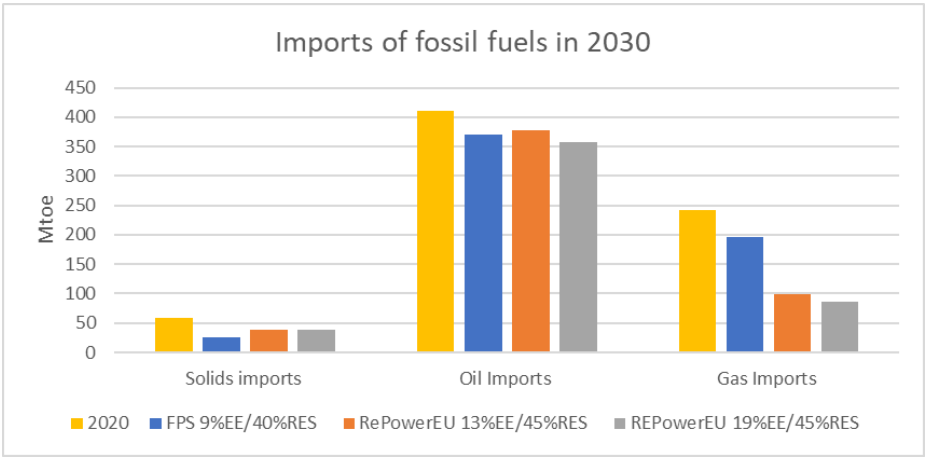
Import dependency is projected to decrease by 2030 with the increase of the energy efficiency targets, thus leading to a higher security of supply and a lower dependence in imports of fossil fuels.

[16] Supply and demand side of the energy system. Some measures of the REPowerEU Plan as reported in the SWD of May 2022 (SWD(2022) 230) such as gas infrastructures (*e.g.* LNG terminals and pipeline corridors) are not covered by the investment figures from modelling projections reported here.



It is more relevant to look at the relative import changes. An important reduction is projected notably for gas imports, with a significant decrease of 50% in the REPowerEU 13% energy efficiency/ 45% renewables scenario and a more limited additional decrease to 55% in the REPowerEU 19% energy efficiency/ 45% renewables scenario compared to the Full Package Scenario.

Compared to the Full Package Scenario, imports of solid fuels are projected to slightly increase in both additional scenarios following the analysis of the effect that high energy prices have to the primary energy consumption and the European energy mix. Imports of oil are projected to slightly decrease between 2020 and 2030 in both additional scenarios. The reason for the moderate decrease in oil imports should be sought in the fact that in the first place focus was put on natural gas substitution which is more used in heating applications than in transport and in the fact that around 23% of the total oil consumption relates to non-energy uses.



4. OVERALL REMARKS ON THE ADDITIONAL MODELLING

The analysis presented in this paper referred to three scenarios: (a) an updated *Full Package Scenario* that uses the targets adopted by the Commission in the Fit-for-55 package, namely 9% for energy efficiency and 40% for renewables, and the (lower) fossil fuel prices of the Fit-for-55 package, (b) a *REPowerEU 13% energy efficiency/ 45% renewables* scenario that follows the increased targets proposed by the Commission in the REPowerEU plan and accounts to 13% of more energy efficiency by 2030, and 45% of renewables in the European energy mix by 2030, and (c) a *REPowerEU 19% energy efficiency/ 45% renewables* scenario that keeps the target of renewables to the increased 45% by 2030 and further increases the energy efficiency target to 19% by 2030, in accordance with the draft report of the EED

rapporteur in the European Parliament. Both additional scenarios use the higher fossil fuel prices presented in chapter 1.

Overall, the performed additional modelling proves that both scenarios are in principle feasible and, as explained in the previous paragraphs, will deliver important benefits for EU. However, as expected, the second scenario requires increased investments and commitment (e.g., annual rate for Article 8 of EED recast), sub-targets (e.g., renovation rates), and effort (e.g., number of heat pumps installed) to be implemented. Table 1 includes some key quantifiable measures that exhibit how much additional effort should be pursued for each additional scenario.

The extra benefits that the second scenario brings over the first scenario are relatively less as its implementation would not, for example, result in significantly more RES in the energy system, or significantly increased energy independence (Table 2). Even more, for this scenario, the required rate of electrification surpasses the feasible rate of RES deployment, resulting not just in a postponement of the phasing out of coal and nuclear in the energy mix but even in the increased use of these two sources of energy. Also, the extra benefits of the second scenario would come with a considerably higher price tag, compared to the first scenario. According to the results in Table 3, a target of energy efficiency of 19% would result in extra investments that could be over an extra 0.5% of the European GDP annually. In addition to the investments challenge, the higher energy efficiency target would also face more significant bottlenecks in skilled workforce, supply chains issues and cash flow constraints. The latter, alongside with high inflation across the economy, are likely to translate to higher overall costs, including via increased cost of capital.

5. DETAILED RESULTS OF THE ADDITIONAL MODELLING ANALYSIS

Table 3: Detailed table of comparative benefits and costs of different scenarios

		Modelling in EED impact assessments	**New modelling analysis**	
Key indicators	**Unit**	**Full Package Scenario 9%EE/ 40%RES**	**REPowerEU 13%EE/ 45%RES**	**REPowerEU 19%EE/ 45%RES**
Year		**2030**	**2030**	**2030**
EE PEC target[17]	%	8	10	13
Primary Energy Consumption	Mtoe	1,033	1,006	979
EE FEC target[18]	%	9	13	19
Final energy consumption	Mtoe	787	751	701
Import dependency (% of GIC)	%	51	46	44
Net natural gas imports	bcm	233	117	104
Gross Inland Consumption	Mtoe	1,135	1,096	1,068
Solids share	%	6	9	11
Oil share	%	31	33	32
Natural Gas share	%	20	11	10
Nuclear share	%	12	13	14
Renewable share	%	31	34	34
Overall RES share	%	40	45	46

[17] REF2020 baseline: 1124 Mtoe of PEC in 2030
[18] REF2020 baseline: 864 Mtoe of FEC in 2030

RES-E share	%	66	69	66
RES-H&C share	%	38	47	50
RES-T share	%	29	32	38
Final Energy Consumption by fuel				
Solids	Mtoe	10	13	9
Liquids	Mtoe	220	226	205
Gas	Mtoe	141	75	58
H2	Mtoe	5	21	19
Electricity	Mtoe	240	236	252
RES and biofuels	Mtoe	87	97	82
Final Energy Consumption by sector				
Transport	Mtoe	229	220	208
Residential	Mtoe	186	175	157
Industry	Mtoe	203	196	185
Tertiary	Mtoe	130	121	112
Net Electricity generation	TWh	3,355	3,450	3,638
Solids	%	5	7	10
Oil	%	0	0	0
Natural Gas	%	10	3	4
Nuclear	%	15	15	15
RES	%	70	73	71
Net imports of fossil fuels (Mtoe)	Mtoe	593	515	484
Solids imports (average annual 2020-2030)	Mtoe	46	54	54
Oil Imports (average annual 2020-2030)	Mtoe	409	407	399
Gas Imports (average annual 2020-2030)	Mtoe	232	173	167
International oil prices (compared to MIX; average 2020-2030)	%	+0	+54	+54
International gas prices (compared to MIX; average 2020-2030)	%	+0	+126	+126
International coal prices (compared to MIX; average 2020-2030)	%	+0	+39	+39
Net Electricity Generation	TWh	3,638	3,355	3,450
Average Electricity prices for final consumers	€'22/kWh	195	207	206
Total System Costs (average 2021-2030)[19]	bn €'22	1,802	1,963	1,982
Transport	bn €'22	613	684	678
Residential	bn €'22	615	651	669
Tertiary	bn €'22	317	335	340
Industry	bn €'22	256	292	294
Total System Costs (average 2021-2030)	% of GDP	11.6	12.7	12.8

[19] Excluding disutility costs and deductible auction payments

Investment expenditure (average 2021-2030)	bn €'22	1,241	1,263	1,348
Transport	bn €'22	754	750	764
Industry	bn €'22	34	38	47
Residential	bn €'22	202	207	246
Tertiary	bn €'22	103	105	119
Power grid investment	bn €'22	55	58	67
Power plants	bn €'22	78	88	91
Investment expenditure (average 2021-2030)	% of GDP	7.7	7.8	8.4