THE EU CAN INCREASE ITS CLIMATE TARGETS TO BE IN LINE WITH A GLOBAL 1.5°C TARGET

THE KEY IS TO APPLY PROVEN BEST PRACTICE POLICIES FROM MEMBER STATES ACROSS THE EU

SUMMARY FOR POLICY MAKERS, APRIL 2018

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KEY MESSAGES

This project analyses best practice policies across Europe and how far extending them to all EU member states could support EU Greenhouse Gases (GHG) and energy targets.

It finds that the EU can go much further than its current commitments in terms of GHG reductions: it has the potential to reach -55% to -62% below 1990 by 2030, consistent with the Paris commitment of staying "well below 2°C, pursuing 1.5°C".

The key to realize these reductions is to apply EU-wide the best practice policies identified in various Member States including The Netherlands, Denmark, UK, Germany and Norway:

- The Power sector has the most potential for additional emission reductions. The first key enabler for this is electrical energy efficiency across the demand side. This could reduce power demand significantly despite the upward pressure from increasing transport and heat electrification. The second key enabling policy is a faster coal exit, which is essential to take away the largest polluting source from the power sector and to make space for additional renewable energy in a demand constrained situation. And finally, due to reductions in technology costs, it is possible to increase investments and deployment rates to the levels required by 2030 by continuing with strong and consistent support policies for RES.
- In Transport the key levers are higher emissions standards and support for the faster penetration of electric vehicles by applying a mix of financial and non-financial support measures.
- In Buildings, the most critical factor is both faster and deeper renovation of existing buildings. Policies in Member States to incentivise energy-related renovations of buildings are diverse, and better coordination of the efforts on the EU level, e.g. through the newly initiated Smart Finance for Smart Buildings Initiative, and roll-out of best practices could significantly increase building renovation.
- For the Industrial sectors, a combination of policies increasing resource efficiency and the circular economy, as well as supporting the shift away from fossil fuel use can lead to much stronger reductions than what current policy can deliver, particularly with a weak Emissions Trading System.

Overall, as a result of the broad application of these best practice policies, energy demand can be reduced by almost -45% below the 2007 baseline, compared to -30% in the Commission's proposal.

Also, renewable energy sources (RES) increase to 45% of total final energy demand, compared to 27% in the commission's proposal.

The conclusion is that technical issues are not the blocking factor to reach ambitious GHG targets. With sufficient political will, far-reaching policies could be implemented and support the relevant reductions. This is not to say that applying best practice policy across all EU member states will be easy to realise. Spreading best practice to such a degree will have massive challenges, and this should be further explored at Member States level. To some extent the replication of best practice policies could also be realised through EU wide measures. The huge policy challenge however has to be faced in light of the dire consequences of not delivering on the Paris Agreement objectives.

These key messages are described in more detail below.

THE CARBON TRANSPARENCY INITIATIVE MODEL

The Carbon Transparency Initiative (CTI) is a project of the ClimateWorks Foundation that helps funders and decision makers within the climate community track and project progress toward a low-carbon economy by analysing the drivers of emissions trends (www.climateworkstracker.org).

It was launched in 2016 and is updated annually. Country models were further developed with partners, and for the EU model this included collaboration with the European Climate Foundation, Climact and the NewClimate Institute.

Building on the original CTI model, the updated EU-CTI module can help answer climate policy questions for Europe. Upgrades to the base tool include: (1) Sector-based policy tools that translate EU and Member State (MS) policies into EU-wide metrics. (2) Adaptation of the model-logic structure in order to reflect these policies. (3) And a user-friendly scenario-feature to convert the tool into a full simulation model, allowing to test the extent of the application of these policies and measures.

Typical questions the tool was built to answer are the following:

- How do current EU policies compare to its 2020 and 2030 targets (GHG, RES, Energy Efficiency)?
- What are key additional policies to reach the 2030 targets and beyond (well below 2°C or 1.5°C)?
- What are the impacts of specific policies (e.g., support for electric vehicles, coal-exit policies)?

In order to compare modelled scenarios to existing ones, the EU Commission's latest reference scenario (REF16) and one of the recent EUCO scenarios have been replicated in the model.[1] The EUCO30 scenario models the achievement of the 2030 climate and energy targets as agreed by the European Council in 2014 with a 30% energy efficiency target.

Reflecting current policies, as well as the potential from best practice ones

This report describes analyses of existing policies in Europe, estimating future trajectories of key drivers based on these, and how the extension of the best policy practices from the best in class to the rest of Europe can increase the speed of deployment of technologies in the market, and increase EU's climate ambitions. 3 cases are modelled for each of the policies in the tool:

1. The **"No policy case"** represents trajectories where diffusion is achieved without the influence of policies.
2. The **"Current policy case"** logically lies between the 2 and is based on analysing these policies at Member State level and to aggregate their impact at the European level.
3. The **"Best practice policy case"** is based on the level reached in countries that have successfully implemented a policy package to incentivize a fast implementation of the policy (e.g., rapid technology diffusion).

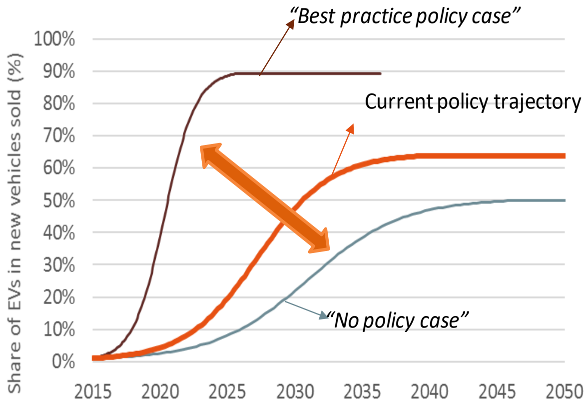
To this end, the S-curve model was introduced to reflect the typical pattern of technology diffusion in the market, driven by a set of technical factors and related policy assumptions (starting date of implementation, pace, and ceiling of the policy ambition, etc.).

A sliding scale allows the user to select intermediary trajectories, including the current policy trajectory reflecting current ambitions of member states. Policy packages were defined around the most important policies in the EU and at member states level. Policy packages around the development of Renewable Energy Sources, the development of electric vehicles and deep buildings renovation were analysed using the S-Curve approach. For each of these policy packages the main policies/aspects determining their success were identified. For instance, for electric vehicle

[1] See the details of both the Reference 2016 and the various EUCO scenarios at the following website https://ec.europa.eu/energy/en/data-analysis/energy-modelling

development this included charging infrastructure density, purchase subsidies and behavioural incentives among other factors. This allowed to transparently link policy assumptions that speak to policy makers to the technology diffusion S-curve and hence translate policy assumptions into energy/emission trajectories.

Figure 1. Example of the S-curve policy diffusions model for the sale of Electric Vehicles



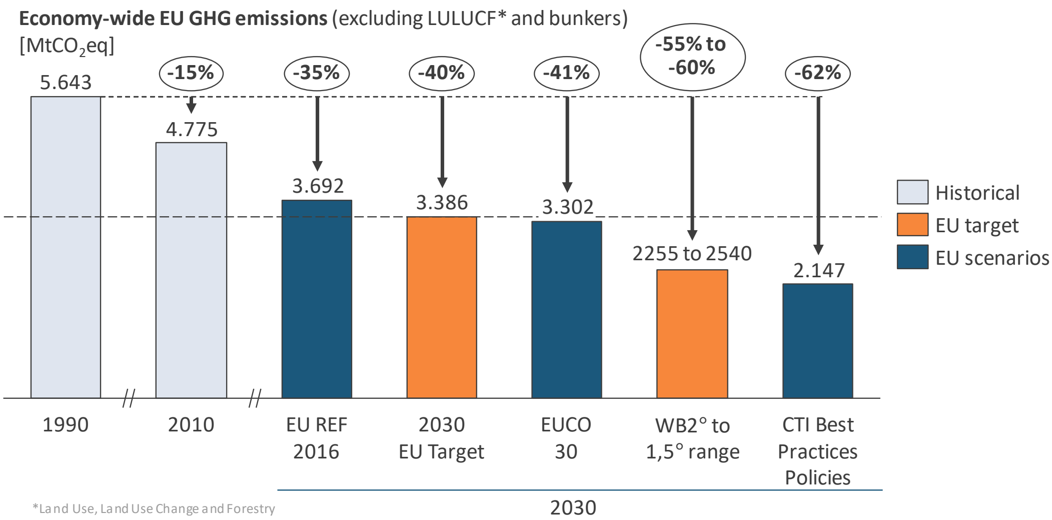
The detailed technical report contains a full description of the model upgrades as well as the analysis of policies: "The EU carbon transparency initiative: an EU deep dive based on scaling sector-based policies. Model methodology."

RESULTS FROM THE WORK

The EU can go much further than its current commitments in terms of GHG reductions: it has the potential to reach -55% to -62% below 1990 by 2030, consistent with the Paris commitment of staying "well below 2°C, pursuing 1.5°C".

While the EU REF16 scenario does not reach the -40% GHG target in 2030, only reaching about -35% reductions compared to 1990, the EUCO30 does (as it was designed to). Our analysis shows that Best practice policies applied EU-wide can lead the EU to -62% GHG reductions, in line with trajectories currently estimated to be required for Europe if the world is to stay well-below 2° or 1.5°C.[2]

Figure 2. Historical and scenarios for EU GHG emissions

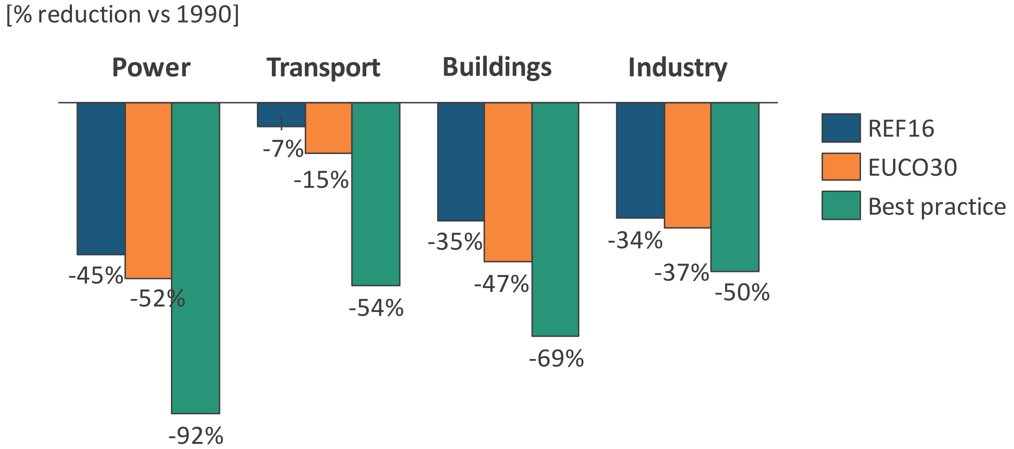


[2] Importantly, these trajectories mostly include overshooting, as the carbon budgets for limiting the temperature increase to "Well below 2°C" or 1.5°C is extremely limited for Europe (latest figures highlight 4 to 8 years of current emissions for a 66% chance). References to these figures include work from PBL (2017, Jan Ros and Bert Daniëls).

THE KEY TO REALIZE THESE REDUCTIONS IS TO APPLY EU-WIDE THE BEST PRACTICE POLICIES IDENTIFIED IN VARIOUS MEMBER STATES.

Increasing the ambition significantly requires pushing policies to best practice, raising ambition across all sectors, and particularly in the power sector which enables decarbonizing the other end-use sectors through electrification. This is illustrated in Figure 3 which shows how the Power sector has the potential to decarbonise almost fully by 2030, reaching beyond 90% reductions compared to 1990.

Figure 3. Resulting EU GHG emission reductions by 2030 by sector for selected scenario

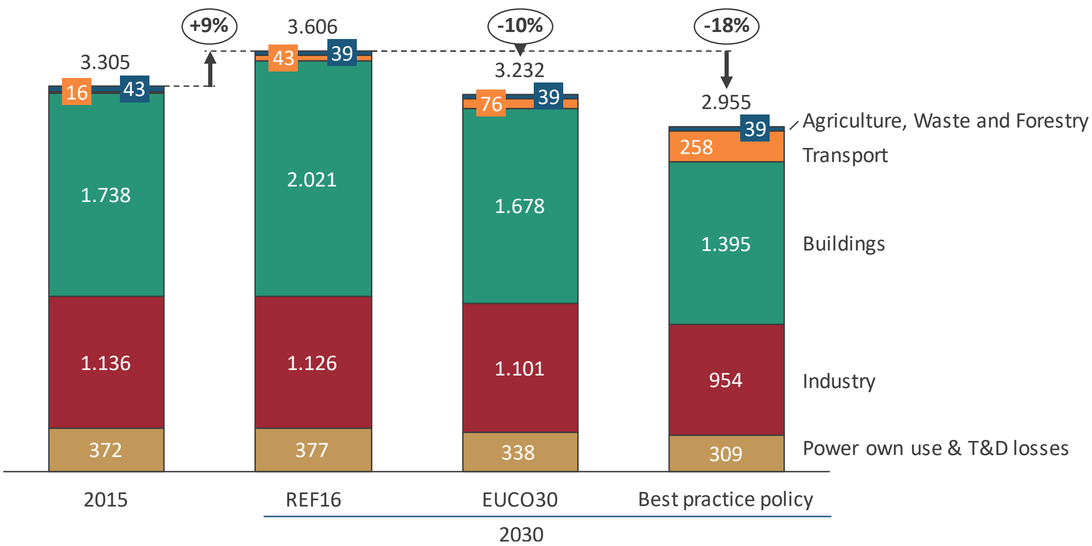


This is ambitious, as it implies applying far-reaching policies across the whole of Europe, but the good news is that the technologies are there and the policies have been tested and were proven effective.

THE POWER SECTOR HAS THE MOST POTENTIAL FOR ADDITIONAL EMISSION REDUCTIONS; THE KEY ENABLING POLICIES ARE DEMAND SIDE ELECTRICAL EFFICIENCY, A FASTER COAL EXIT AND SUPPORT FOR RENEWABLE ENERGY SOURCES (RES).

Reducing power demand is powerful as it limits the incentive for keeping coal plants running or increasing the amount of gas-based production. The largest enabler for this is electrical energy efficiency in buildings, particularly in lighting and appliances. This could reduce power demand despite the upward pressure from transport and heating (heating electrification partly helps shifting away from direct electrical heating).

Figure 4. Final electricity demand by sector and by scenario in 2030 compared to 2015, TWh per year



The second key enabling policy is a faster coal exit, which is essential to take away the largest polluting source from the power sector and to make room for additional RES deployment in a situation of decreasing demand. It is very unlikely that a drastic increase in the price of carbon can be realised in time and therefore it will be national policies to phase out coal that will have to do the job. Announcements of coal phase out by 2030 have already been made by several Member States.

Finally, consistent support for Renewable Energy Sources (RES) deployment can raise historical deployment rates to ensure sufficient clean production by 2030. The EUCO30 scenario does not yet operate a significant shift in power production, while Best practice policy shows it would be technically feasible.

Figure 5. Electricity production by source, TWh

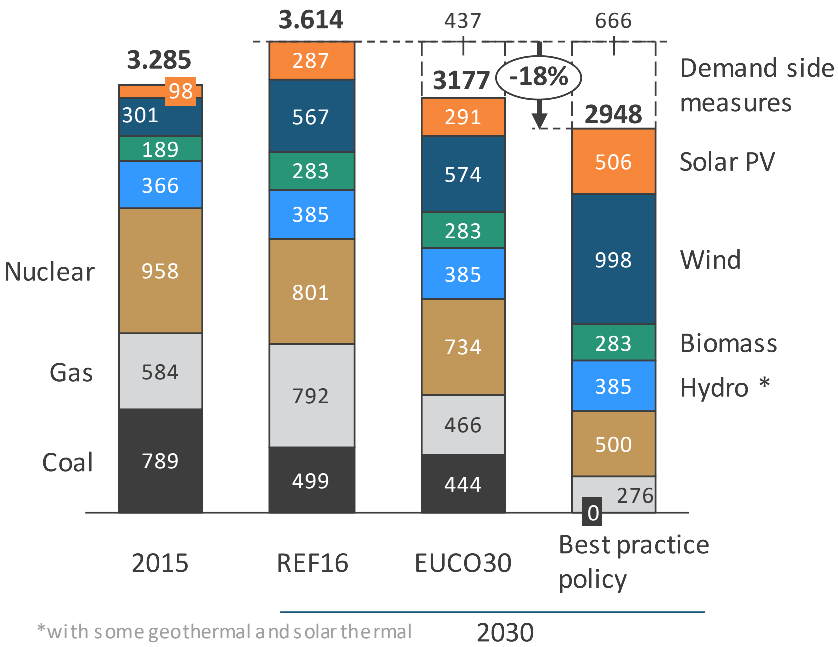
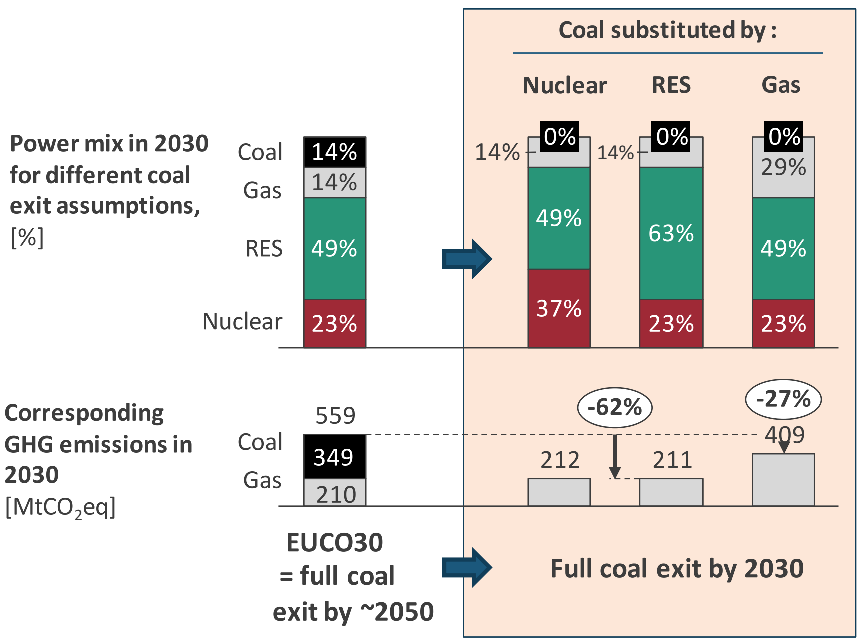


Figure 6. Impact of faster coal exit policies across Europe

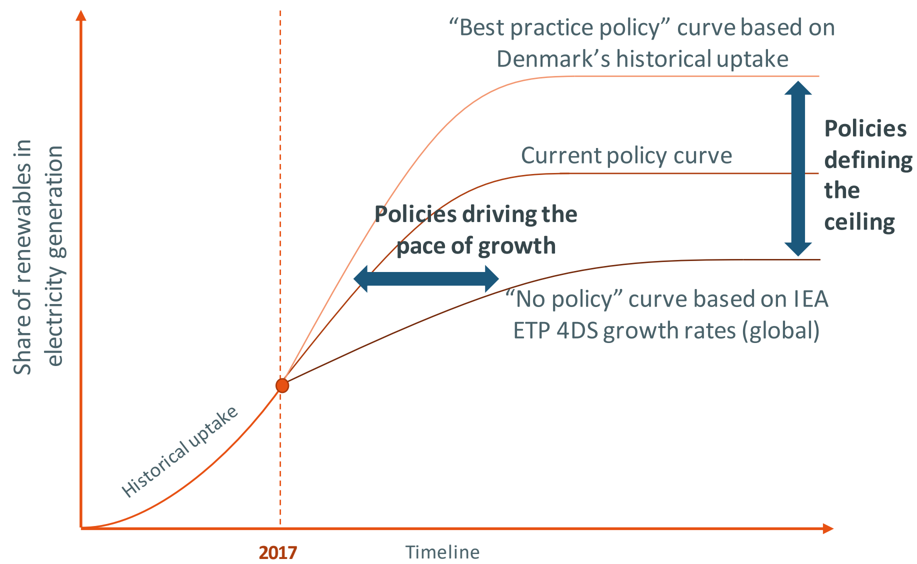


This requires strong political will to ensure that coal makes room for the rest of potential production sources where the pace of deployment can be increased. EUCO30 scenario assumes that a full coal exit will only be realized by roughly 2050, when a complete coal exit by 2030 would further reduce power sector emissions by to between -62% (if substituted by RES or nuclear) or only -27% if substituted with gas, as illustrated in Figure 6.

In replacement of this coal-based electricity production, the largest Renewable Energy Sources (RES) by 2030 are hydro, biomass, solar and wind (on and offshore). Hydro is mostly already exploited close to its maximum potential, and for biomass the same assumption as for the REF16 and EUCO30 scenario is used, as mobilizing larger amounts of sustainable biomass is uncertain.

The focus of the policy analysis is therefore on the contribution from variable RES, and is based on the analysis of a series of policies which are required: policies on the level of support (subsidies, permitting, etc.) define the relevant **pace of deployment**. Other policies are required to ensure the power system has the ability to capture high variable RES: the ambition of these policies defines the **ceiling of their penetration**, which has been set at 50% variable RES. Several reports have shown that 50% variable RES can be absorbed at limited costs.[3]

Figure 7. Illustrating the deployment of variable Renewable Energy Sources (RES)



Denmark is the clear front-runner in terms of RES penetration, with an increase in the share of RES in electricity (both variable and non-variable, so including hydro and biomass) up +42 percentage points[4] from 2010 to 2017, reaching 74% of electricity generation. This is a +6 percentage point increase of penetration per year. But other countries have also shown significant growth: the UK added +22 percentage points, reaching 28% of electricity production in 2017 – a yearly increase of +3 percentage points in penetration – and Germany added yearly about 2.4 percentage points.

Thanks to the impact of energy efficiency described in the previous section, for Europe to reach 74% of RES penetration requires going from about 1000 TWh of RES production in 2015 to 2170 TWh in

[3] See for example the recent report by Artelys for the European Climate Foundation: https://www.artelys.com/news/313/16/Latest-Energy-Union-Choices-report-Cleaner-Smarter-Cheaper

[4] See the recent Agora/Sandbag report on the 2017 electricity market: https://sandbag.org.uk/project/european-energy-transition-power-sector-2017/

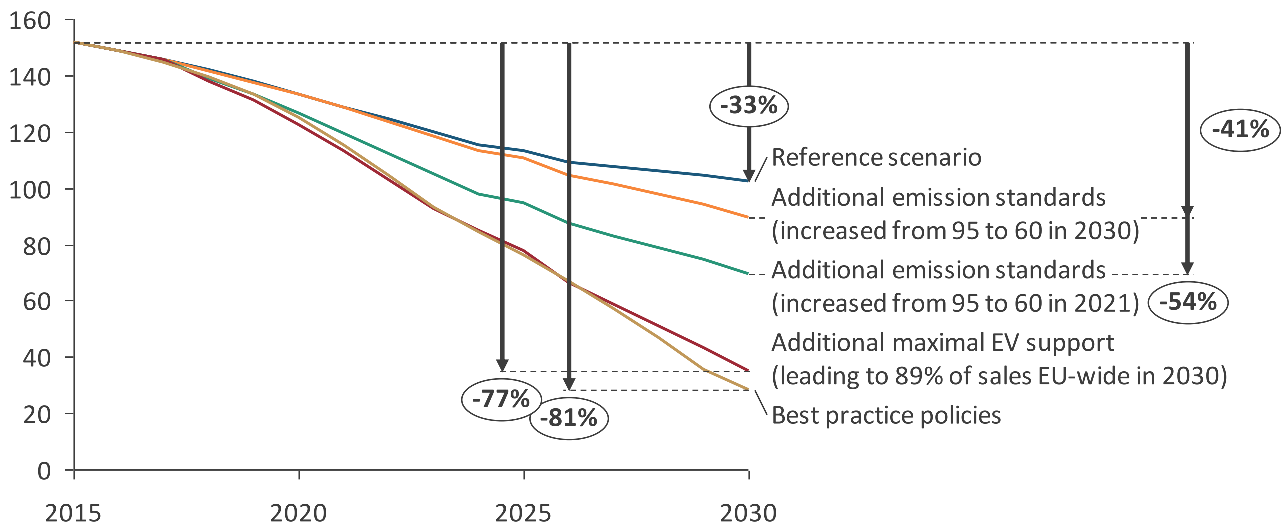
2030. Is that feasible? Growing at the same pace as the average of the UK and Germany over 2010 to 2017 would suffice. It translates to adding 2.7 percentage points of 3244 TWh, or about 90 TWh per year, compared to 70 TWh added in 2015 and 72 TWh in 2017. With the recent cost reductions that solar PV and wind technologies have experienced, this does not seem overly challenging.

IN TRANSPORT THE KEY LEVERS ARE HIGHER EMISSIONS STANDARDS, AND SUPPORT FOR FASTER PENETRATION OF ELECTRIC VEHICLES.

Transport is a sector which has mostly seen an increase in emissions in recent years across Europe, which highlights the difficulty of large scale decarbonization. Electric vehicles have a key role to play in turning this trend around, but the challenges they face in terms of driving range and cost differentials, the related consumer bias, as well as infrastructure requirements may mean that significant growth is unlikely before the early 2020s. This is captured in the model through the application of an S-curve, with only a mild take-off in the first years, followed by steeper growth in later years.

So first and foremost, **the European emissions standards can quickly have a large impact on the market**. This includes the potential for higher vehicle efficiency by improving internal combustion engines but also by increasing hybridisation. The reference scenario includes existing policy which requires new sales to be on average at 95gCO2/vkm as off 2021. Figure 8 shows that this leads to -33% in the average emissions of personal cars. Increased future ambition with standard increased further to 60 by 2030 leads to -44% (and lowering the 2021 target to 60 would even increase to a more than 50% cut). So efficiency can have a massive impact on 2030 emissions. The figure also shows the additional impact a faster EV uptake can then have on the market (additionally to what the emission standard would generate), reaching -77% reductions. Applying the full best practices leads to -80% reductions per vehicle kilometre for the personal car fleet by 2030.

Figure 8. Average emissions of the personal car fleet in gCO2/vkm with higher emission standards and EV support



Zooming in on EV deployment, a series of policies are required to significantly increase their sales. The existing key incentive factors have been analysed by Member State (Figure 9): the density of charging stations; financial incentives in the countries (purchase subsidy and existence of tax rebates); behavioural characteristics (wealth, propensity to buy second car), behavioural incentives put in place (i.e., access to bus lanes, free parking).

Norway is performing outstandingly on these various policies, but other countries are also becoming increasingly ambitious, like France, Austria, as well as The Netherlands where EV sales accounted for 9.7% of the country's total new vehicle sales in 2015, second in the world only to Norway.[5] This is based on a series of action plans leading to concrete measures such as exemptions for registration charges and road taxes, as well as a very extensive public charging network, with 0.8 public charging point per EV at the end of 2015, as well as a series of non-financial incentives (priority for traffic and parking, etc.).

The detailed analysis of these policies can be found in the complete methodology overview.

Figure 9. Aggregated incentive factors as the outcome of the various incentives for electric cars

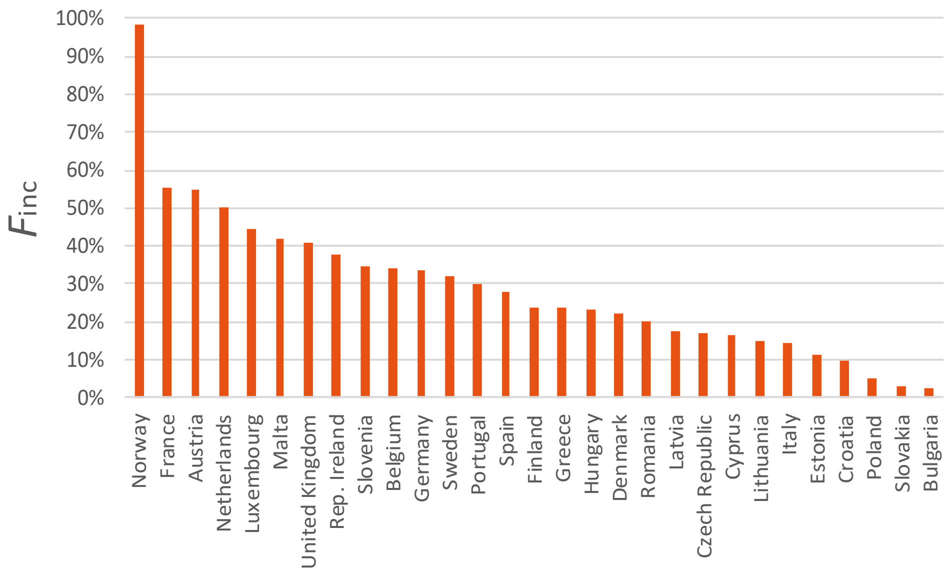
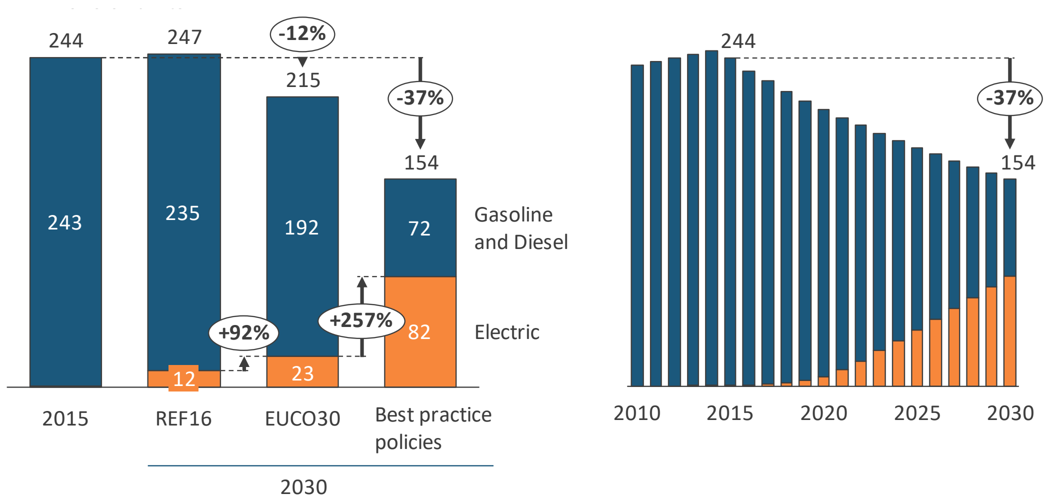


Figure 1 on p4 above shows the resulting shares of sales of electric vehicles over time across the various policy ambitions, and Figure 10 below shows the impact on the number of vehicles for the 3 scenarios.

Figure 10. Number of cars by type and scenario (left) and over time for the best practice one (right). Millions of units.

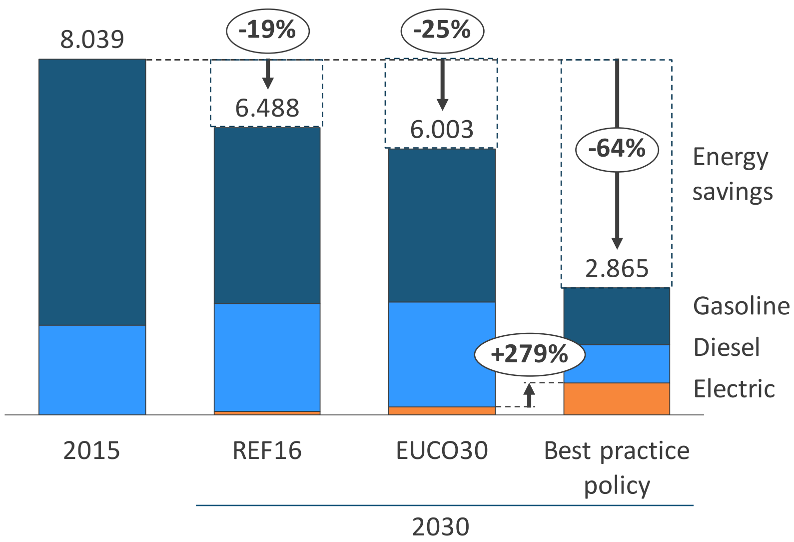


[5] See the ICCT report, "Electric vehicle capitals of the world, Demonstrating the path to electric drive", March 2017

Beyond policies supporting the deployment of electric vehicles, the transport sector will not decarbonize sustainably without other policies to limit the increase in car-based transport demand. Stronger modal shift policies are key to ensure sustainable transport in cities (see the strong reduction in private vehicles in best practice policy in figure 10), and there is potential for both more energy efficiency and alternative fuels than in current ambitions. Together they can lead to more than 60% decrease in energy demand across all transport sectors and modes (including both passenger vehicles and freight).

Altogether extending best practice policies in the next few years across Europe can result in a decrease in the number of cars and a significant increase in electric mobility by 2030, as illustrated in Figure 10, and ultimately this could lead to almost halving transport emissions (Figure 3).

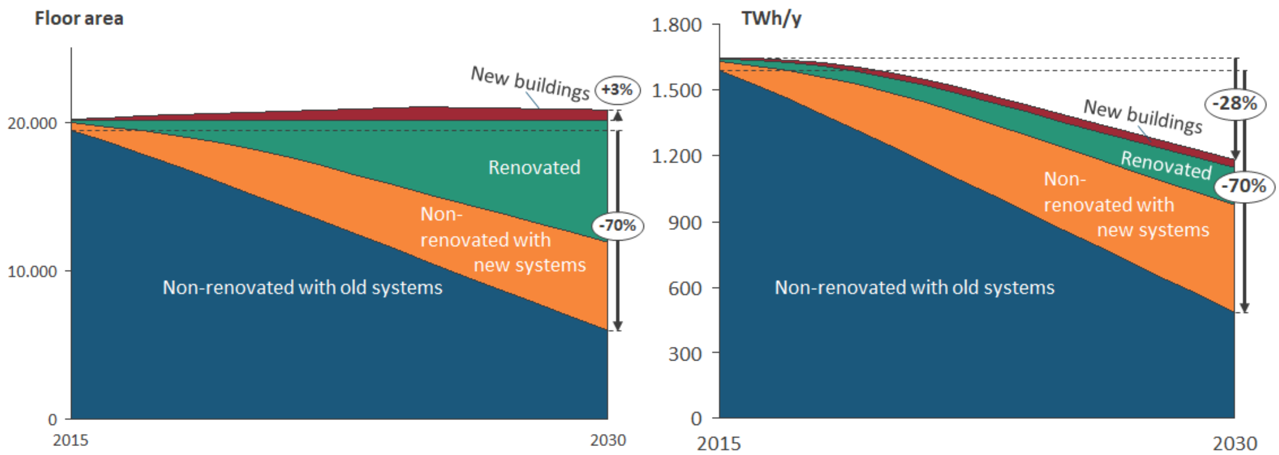
Figure 11. Fuel mix in Passenger transport and impact of energy savings, PJ



IN BUILDINGS, THE MOST CRITICAL FACTOR IS BOTH FASTER AND DEEPER RENOVATION OF EXISTING BUILDINGS.

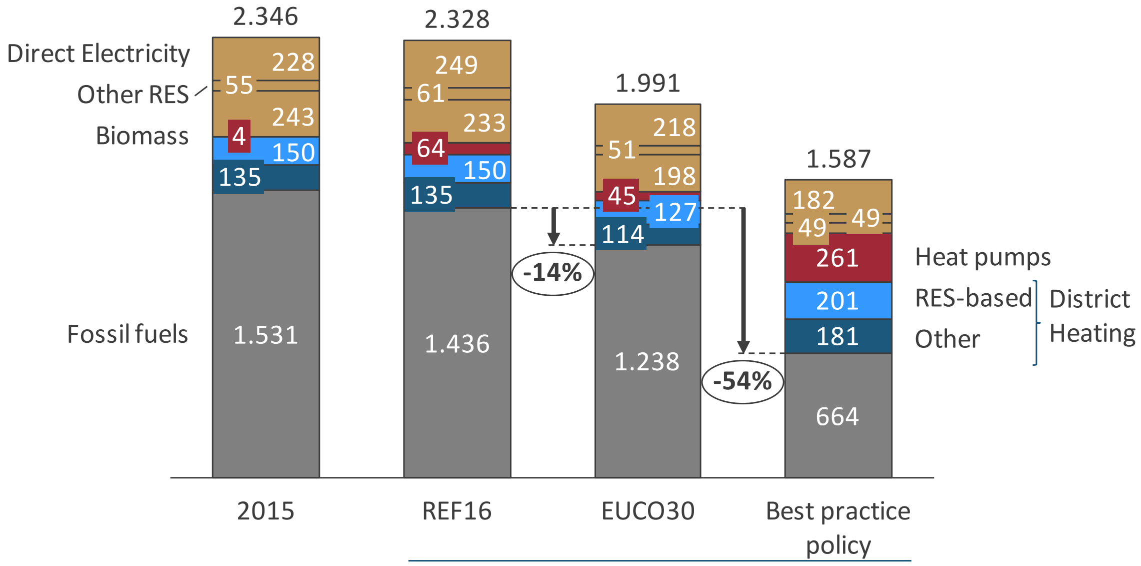
For buildings, the key is to increase the ambition of policies on renovation of existing buildings, both on the pace (>3% per annum) and the depth (>80% energy reduction after renovation). This leads to much fewer buildings being non-renovated buildings or with old heating systems, and a 70% reduction in their energy requirements by 2030.

Figure 12. Floor area and Heating energy consumption by building segments for the Best Practice Policy scenario



This leads to lower heating demand, but still requires shifting heating systems towards electricity-based heat pumps. District heating can also play a role to shift to more efficient heat production. Altogether this leads to a significant reduction of -70% in GHG emissions by 2030 compared to 1990.

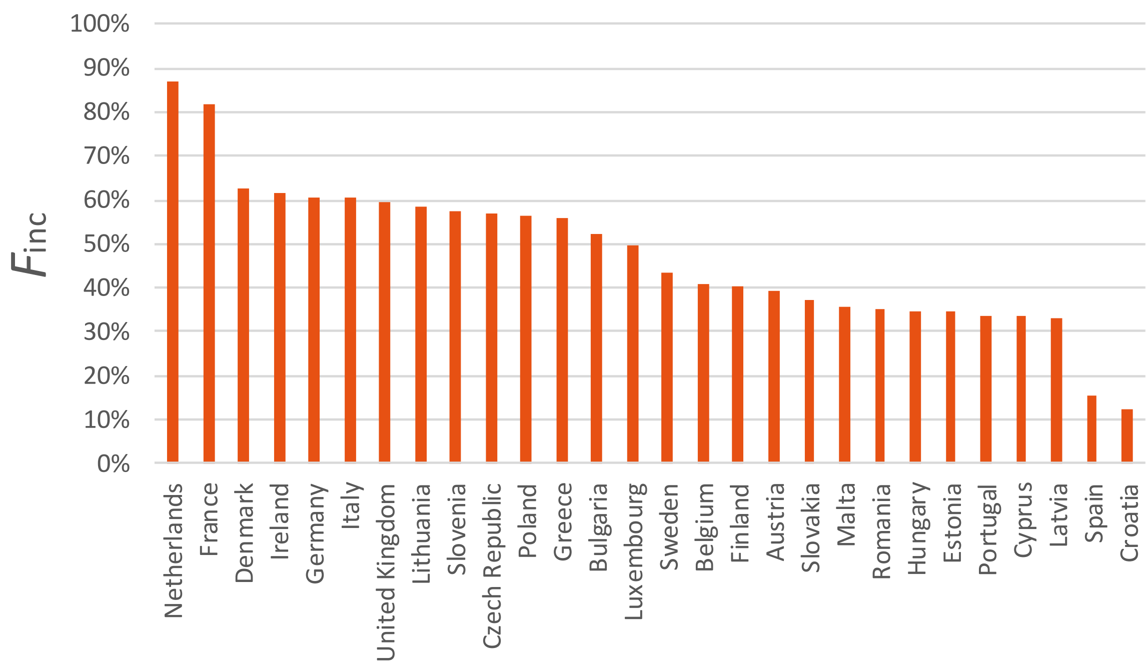
Figure 13. Heating production by type of system by scenario, TWh per year



Policies in Member States to incentivise energy-related renovations of buildings are diverse, including provisions of grant/subsidies or tax exceptions. As a result, the aggregated incentives calculated here vary between Member States (Figure 14). The Netherlands has the highest score, which reflects a significant ambition to reach a net zero carbon building stock by 2050. Policies in place effectively mean they need to reach a minimum of 3% renovation rate, although they will need to prove this in their future implementation.

Coordination of the efforts on the EU level, e.g. through the newly initiated Smart Finance for Smart Buildings Initiative, and roll-out of best practices can significantly increase building renovation.

Figure 14. Aggregated incentive factors from analysis of policies to increase energy-related renovation of buildings

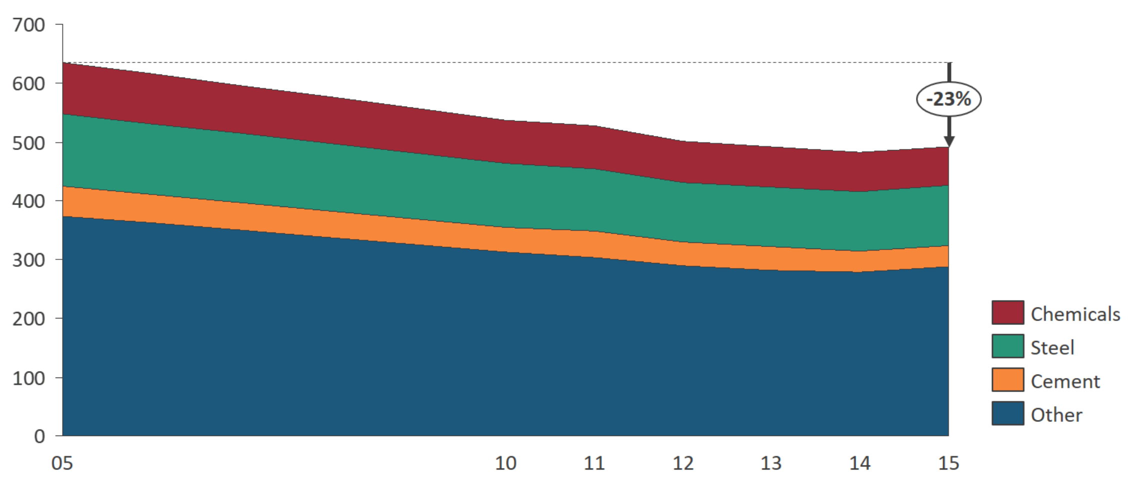


FOR THE INDUSTRIAL SECTORS, A COMBINATION OF POLICIES INCREASING RESOURCE EFFICIENCY AND SUPPORTING THE SHIFT AWAY FROM FOSSIL FUEL USE CAN LEAD TO MUCH STRONGER REDUCTIONS THAN WHAT CURRENT POLICY CAN DELIVER.

The industry sectors involve many complex processes, but there are examples where energy efficiency, electrification and further innovation have led to significant energy savings and emission reductions.

In the EU, the following policy instruments explain part of the historical emission reductions: the Energy Efficiency Directive (EED [6]), the EU Emission Trading System (EU ETS [7]), and the Industrial Emissions Directive (IED [8]). We also assume these policies will continue to enable emissions mitigation. While there are few studies that isolate the effect of one of these policies on the industry emissions mitigation, the EED is considered to have stimulated the execution of audits, the ETS has limited impact but could have a high impact from the end of the next decade with a high allowance price, and the IED is expected to have a medium to high impact by increasing the adoption of best available technologies as described in the Best Available Techniques reference documents (BREFs), which are developed under the IED.

Figure 15. Historical evolution of Industry direct combustion emissions, MtCO2e/year



To go further with deep emission cuts, we will require far-reaching policies, with resource efficiency policies that ensure a longer lifetime, a better design of products through better product standards and process changes to increase resource efficiency [9], and more generally a shift to circular processes, providing more services with long lasting products[10]. This can lead to massive reductions in production.

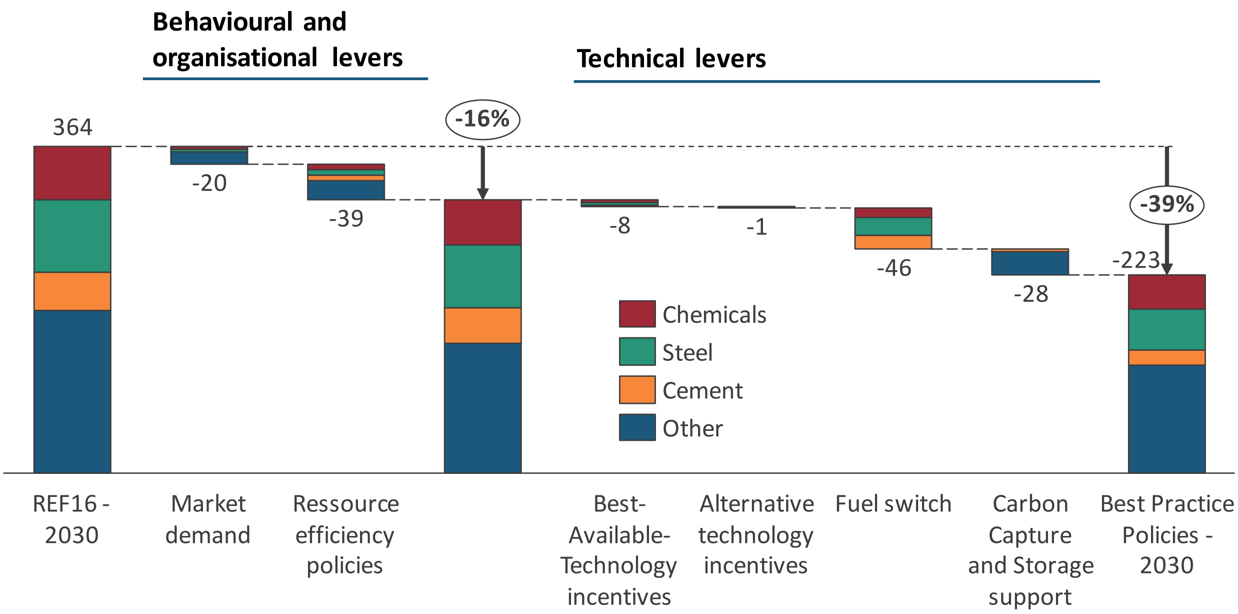
Next, policies encouraging the shift from fossil to cleaner fuels and electrification are having most impact. Higher ETS allowance prices are expected to have a medium to high impact, including on fuel

[6] Energy efficiency (EU EED) Directive 2012/27/EU on Energy efficiency, amending Directives 2009/125/EC and 2010/30/EU and repealing Directives 2004/8/EC and 2006/32/EC)
[7] EU Emission Trading System (EU ETS) Directive 2009/29/EC amending Directive 2003/87/EC
[8] Industrial Emissions Directive (IED) 2010/75/EU
[9] Eco-design (Directive 2009/125/EC)
[10] EU Action Plan for the Circular Economy (COM (2015)614)

switches and electrification (and need to be combined with the decarbonisation of the power sector described above).

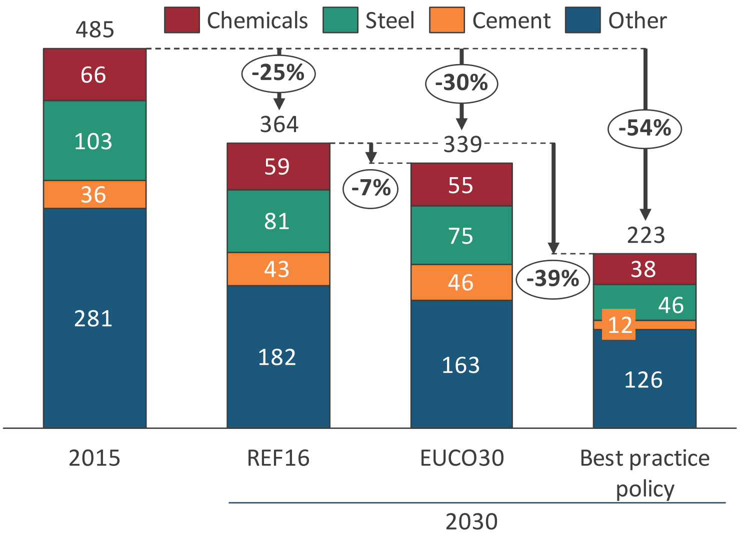
Finally, CCS could be applied to reduce the remaining emissions, such as process emissions from cement production, through an EU-wide carbon capture and storage policy. The current CCS Directive[11] provides a framework, but legal obligations to implement CCS, combined with carbon pricing policies would encourage its implementation.

Figure 16. Direct Energy Emissions in the industry sectors [$MtCO_2e$]



Applying these best practice policies across the European industries would allow increasing from a -25% reduction in GHG emissions in the REF16, to reach beyond -50% by 2030 in the Best practice policy scenario.

Figure 17. Direct Energy Emissions in the industry sectors [$MtCO_2e$]



[11] CCS Directive (2009/31/EC)

The policy ambition of the different scenarios is summarized in the table below:

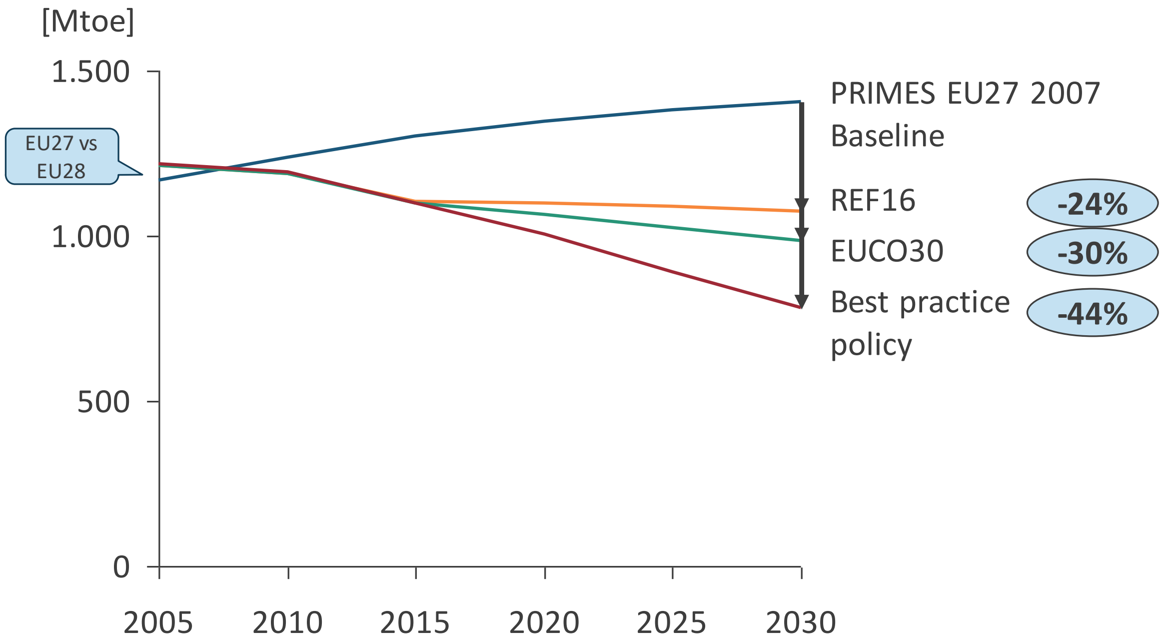
	Reference scenario	EUCO30 scenario	Best practice policy scenario
Market demand	High	High	Medium to high
Resource policies	Low	Low	High
Other policies	Medium to low	Medium to high	High
ETS	Medium to low	Medium	High
CCS	Medium to low	Medium	High

The paper sector has set out a strong example with the publication of a low carbon roadmap to 2050 to reach -80% reductions, with a view on at least 50% higher value-added in the sector. This is already the 2nd version of their roadmap (accessible through this link) and builds on significant innovation and research over the past few years. It includes a bold investment strategy (+40% investments) to make it happen.

OVERALL, AS A RESULT OF THE BROAD APPLICATION OF THESE BEST PRACTICE POLICIES, ENERGY DEMAND CAN BE REDUCED BY -45% BELOW THE 2007 BASELINE, COMPARED TO -30% IN THE COMMISSION'S PROPOSAL.

The EU REF16 does not reach the -30% energy efficiency target in 2030. The EUCO30 scenario shows it is still feasible to reach the target, but our analysis shows that applying existing best practice policies EU-wide can help reaching much beyond even a -40% reduction in energy consumption. This shows the strength of coordinated action from all Member States.

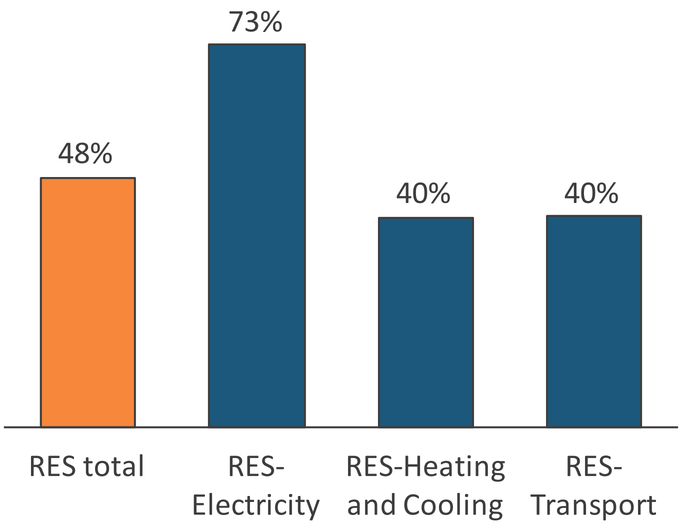
Figure 18. Final energy demand (excluding bunkers)



ALSO, RENEWABLE ENERGY SOURCES (RES) INCREASE TO 45% OF TOTAL FINAL ENERGY DEMAND, COMPARED TO 27% IN THE COMMISSION'S PROPOSAL.

Much can be done across all sectors to include higher shares of Renewable Energy Sources (RES). This goes from increasing the use of biofuels and electricity in transport (once the production of electricity is decarbonized), to biomass in industry or buildings, as well as increased wind and solar in electricity production. With the higher ambitions described above, the RES share can be significantly increased compared to the EUCO30 scenario, reaching up to 45% of final energy demand. This is made easier with the higher energy efficiency reached in all sectors.

Figure 19. RES share in final energy consumption



CONCLUSIONS

This report shows that technical issues are not the blocking factor to reach ambitious greenhouse gas (GHG) emissions targets. If all Member States act seriously across the main GHG emitting sectors, Europe has the potential to reduce its greenhouse gas emissions much more and be in line with the long-term goals of the Paris climate Agreement. The good news is that there is no need to reinvent the wheel for this. There are policies in Europe that already prove effective. Instead of adopting policies that accommodate the least ambitious Member States, aiming for the highest common denominator would lead to significant cuts. Taking the best of what is being done in Member States and applying it EU wide would allow Europe potential to reach -55% to -62% below 1990 by 2030 in line with trajectories staying "well below 2°C, pursuing 1.5°C".

This is not to say that applying best practice policy across all EU member states is easy to realize. Spreading best practice to such a degree will have a series of challenges, a.o., ensuring sufficient and coordinated infrastructure deployments, therefore mobilising significant amounts of investment capital, managing a just transition across Europe, ensuring countries that are particularly far from best practice can join the movement.

More detailed analysis at the national level will help support the concrete implementation of these best practice policies, to ensure that they are adapted to national circumstances and that actual emissions reductions result from their proper application. To some extent the EU wide application of best practice policies can also be realised through EU wide measures. A powerful enabler for the deployment of these policies across Europe would be to ensure the appropriate provisions are made in the EU Governance regulations to make it a requirement for member states in developing their National Energy and Climate Plans (NECPs) to implement best practice policies found elsewhere in Europe.

It is worth considering that the huge challenges of delivering on a Paris compatible policy package are a direct consequences of the decisions in Paris to further limit climate change in the interest of avoiding the big risks of climate change for people, the economy and our supporting natural systems.