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The EU National Energy and Climate Plans: A Survey

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Introduction

With the Clean Energy for All Europeans package,[1] the European Union (EU) has committed to being carbon-neutral by 2050. In order to achieve this goal, the EU Commission and the Member States have agreed upon binding targets to be met by 2030: emissions of greenhouse gases (GHGs) shall be cut by at least 40 per cent below 1990 levels, renewable energies shall cover at least 32 per cent of final energy demand, and energy efficiency shall be improved by at least 32.5 per cent as compared to business-as-usual.[2] These objectives are broadly in line with the Paris Agreement, a multilateral pledge adopted in 2015 which calls the Member States to implement policies ambitious enough to contain the global temperature increase well below 2°C above the pre-industrial levels.[3] Targets might be revised to be even more ambitious in the next few months: the Commission presented a plan to reduce emissions by 55 per cent, rather than 40 per cent, by 2030.[4] For these increased ambitions to become legally binding, several formal steps need to be taken that would require both time and effort. In this paper we will focus on the current goal of -40 per cent, which provides the foundation for several policies that have been adopted, or are in the process of being adopted, both at the EU and national level. Of course, when the 55 per cent target becomes legally binding, the measures and plans described below will have to be updated. Some of the problems of internal consistency and cost-effectiveness that need to be addressed under the current scenario will become even more relevant. In designing the road to -55 per cent, these issues need to be fixed in order to achieve the desired environmental and economic goals.

The Clean Energy for All Europeans package follows up previous initiatives, including the Kyoto Protocol[5] and the 2020 Climate and Energy Package,[6] under which the EU collectively committed to – and pursued – a reduction of GHG emissions by 8 per cent below 1990 levels by 2012, and by 20 per cent below 1990 levels by 2020, respectively. Emissions reductions were achieved through measures at

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1 https://ec.europa.eu/energy/topics/energy-strategy/clean-energy-all-europeans_en

2 EC (2019), "Fourth report on the State of the Energy Union", COM(2019) 175 final.

3 https://unfccc.int/process-and-meetings/the-paris-agreement/the-paris-agreement

4 https://ec.europa.eu/commission/presscorner/detail/en/ip_20_1599

5 https://ec.europa.eu/clima/policies/strategies/progress/kyoto_1_en

6 https://ec.europa.eu/clima/policies/strategies/2020_en

national as well as European level, including the largest carbon market in the world (the Emissions Trading System, or ETS), on top of "natural" technological progress. They were accompanied by further measures to promote the adoption of renewable energy sources (RES) in several fields, including electricity generation (RES-E), transport (RES-T), and heating/cooling, as well as strong support for energy efficiency.

The 2030 targets, hence, are part of a broadly consistent and long-lasting effort to make Europe decarbonized as well as a global leader in clean energies and energy efficiency. Evaluating whether these goals have been, or are likely to be, achieved in a cost-effective way is well beyond the scope of this paper. What ultimately matters is that so far emissions have fallen according to the projections and while many mistakes have been made, occasionally resources have been wasted, and/or unnecessary distortions have been introduced in energy markets, the EU has been learning by (and while) doing. A vigorous effort has been made to reconcile environmental targets with economic growth, particularly during the years of the Great Crisis of 2008-11. While historically carbon emissions have been strictly correlated with GDP per capita, Europe has set an objective of decoupling carbon and economic performance. Much has been done but there is still much to do. The issue of how to make environmental policy complementary, rather than harmful, to economic policy and competitiveness, is to some extent still an open question and is extremely relevant in the aftermath of the coronavirus-induced economic crisis.

Achieving even stricter emission standards by 2030, while not endangering the economy should not be viewed as an easy task. In fact, the low-hanging fruits have already been picked. Opposing strengths are at work: on one hand technological process is making more and cheaper options available to reduce the economy's environmental footprint; on the other hand, marginal costs may be increasing, especially in specific sectors (such as transport) where fossil fuels are still competitive or better performing, and where behavioral obstacles remain (such as in heating or cooling residential buildings). On top of all that, coordination problems may arise both amongst Member States and between the States and the Commission. Some national governments may be tempted to free ride on others' efforts, and opportunistic strategies may be put in place to protect what they believe is their own national interest. Finally, the temptation is strong to achieve the desired results by picking the preferred technologies – rather than relying on the competitive process coupled with technology-neutral policies such as carbon pricing – and might lead to extra costs or missed opportunities. This is the case particularly in the transport sector and electricity generation, where potential developments (such as carbon capture, storage, and utilization) are often overlooked. The latter may increase in the future, as some portion of the largest carbon-free electricity generation fleet (i.e. nuclear power) is likely to be phased out with no clear substitution.

Given the magnitude of the challenge, policies should be closely scrutinized ex ante, monitored as they are implemented, and evaluated ex post. In this respect, the EU Commission is making a valuable effort to make data available to independent researchers, on top of the evaluation exercises conducted by the Commission staff itself. The 2030 Clean Energy for All Europeans Package entails a coordinated effort by the Commission and the Member States. While goals are – in most cases – intended to be achieved at the EU level, national governments are responsible for reducing emissions, promoting renewables, and incentivizing energy efficiency in the sectors where a top-down approach from Brussels is unlikely to work – or where the Treaty on the Functioning of the European Union (TFEU) confers no power to the Commission. In order to do so, Member States were required to submit

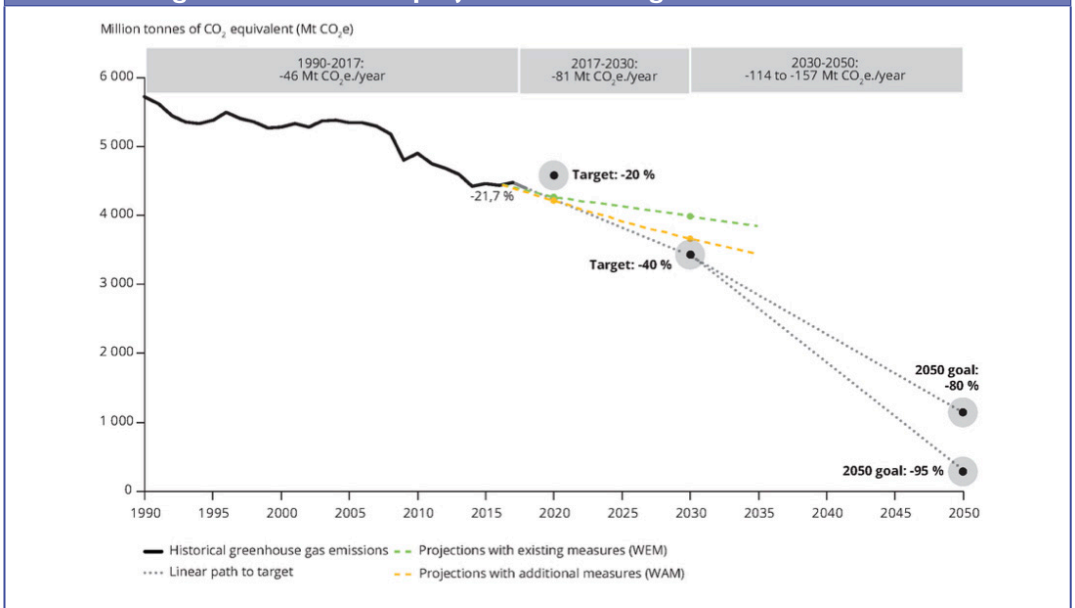
National Energy and Climate Plans (NECPs) with a detailed analysis of their national targets, a thorough description of the proposed policies, and an estimate of the investments needed to meet the goals, as well as their impact on expected economic growth.

This paper performs a survey of the NECPs to provide further elements to improve the effectiveness and cost-efficiency of the proposed policies. The paper is structured as follows. Section 2 describes the process for NECPs and presents them within the long-term perspective of Europe's climate policies. Section 3 provides some stylized facts regarding the NECPs while explaining their structure. Section 4 focuses on the economic data that can be derived from the NECPs, specifically the estimates of the investments needed and, where available, the economic impact of the climate policy in general. It should be emphasized that we will not discuss the estimates of the Plans: we will take them at face value and shall compare them vis-à-vis the underlying environmental and energy goals. Section 5 then summarizes and concludes.

The way forward to 2050: The process

The European Union is on track to meet its 2020 goals regarding emissions reductions, renewable energies, and energy efficiency, even without the dramatic fall in energy demand in 2020 due to the Covid-related economic downturn (Figure 1). But what about the 2030 targets? Will Europe be able to face an increasingly ambitious effort that encompasses several industries and may raise multiple side-effects? Is the governance appropriate to set the incentives right for national governments as well as private parties?

Figure 1
Greenhouse gas emission trend projections and target



Source: European Environment Agency.

Under the Regulation on the governance of the energy union and climate action (EU/2018/1999),[7] EU Member States were required to submit their draft NECPs to the EU Commission by the end of 2018 (which all of them did). Draft NECPs were also subject to public consultation in the individual countries, which in many cases created ad-

7 https://ec.europa.eu/energy/topics/energy-strategy/energy-union_en?redir=1#content-heading-2

hoc websites. Based on the outcomes from the consultation as well as the Commission's assessment and recommendations, Member States were supposed to submit a final Plan by the end of 2019. Although with some delay, most member states did, as summarized in Table 1. All information is available on the EU Commission's website.[8]

Table 1 and any other table or figure from here on, will not consider the UK, which did not submit its NECP because of Brexit.

A few countries submitted their plan and/or an English version late. Our analysis only covers those countries that made their plans available by the late Summer of 2020. In 2018, the surveyed countries accounted for 97.8% of total GHG emissions from the EU.

Member states are expected to deploy the proposed policies according to the schedules contained in the NECPs. Every two years, they shall submit a progress report to document the results, check whether they are on track with their long-term (2030 and 2050) and intermediate goals, and to propose adjustments in their policy strategy if needed. The EU Commission, on the other hand, will monitor the EU-wide and Member States' progress towards the targets as part of the energy union report. The Commission released a comprehensive assessment of the NECPs[9] in late 2020 as well as individual assessments.[10]

In order to meet the targets for carbon emissions, renewable energies, and energy efficiency, large investments need to be undertaken. Many of them require physical capital to be refurbished, phased-out, or built, which in turns relies quite often on lengthy permitting procedures. Even if both public and private parties had already begun to file their request to perform the planned investments – new housing stocks, renewable generators, power and natural gas lines, charging stations for electric vehicles, phase-out of polluting plants or industrial machineries and installation of cleaner ones, etc. – it will be a long time before new technologies replace the older ones.

The challenge to deploy investments is made tougher by two changes that have (or are about to) intervened. On one hand, the Covid-19 crisis, while causing a dramatic fall in the GHGs emissions in 2020, will leave a much-impoverished Continent where financing new investments may be harder. The new financial instruments that are being introduced at the EU level, i.e. the loans and grants embedded in the Next Generation EU package,[11] may help in channeling financial resources, but it is not clear whether this will entirely offset the economic consequences of the pandemic. On the other hand, the -40 per cent emissions target is being revised upwards to -55 per cent by 2030. The NECPs should be revised and the EU relevant legislation updated, a process that will take further time and create further uncertainty. Paradoxically, moving to a more ambitious target now might make decarbonization more costly and even harder to achieve, despite the Commission's own Impact Assessment forecasts a mildly negative to mildly positive impact on GDP[12].

We will perform a benchmarking analysis of the NECPs at face value, which means that we will not discuss whether the proposed targets or the attached economic costs are plau-

8 https://ec.europa.eu/energy/topics/energy-strategy/national-energy-climate-plans_en

9 https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1600339518571&uri=COM%3A2020%3A564%3AFIN

10 https://ec.europa.eu/energy/content/individual-assessments-and-summaries_en

11 https://ec.europa.eu/info/live-work-travel-eu/health/coronavirus-response/recovery-plan-europe_en

12 https://ec.europa.eu/clima/sites/clima/files/eu-climate-action/docs/impact_en.pdf and https://ec.europa.eu/clima/sites/clima/files/eu-climate-action/docs/impact_part2_en.pdf

Table 1
Final NECPs received by the EU Commission (as of 24 June 2020)

	NECP in national language	Courtesy translation	National website	GHGs total emissions (2018) [M ton CO2 eq]*	Share of total GHGs emissions (exl UK) [%]
Austria	√	√	https://www.bmnt.gv.at/umwelt/klimaschutz/klimapolitik_national/nationaler-energie-und-klimaplan.html	73.8	2.1
Belgium	√	√	https://www.plannationalenergieclimat.be/fr https://www.nationaalenergieklimaatplan.be/nl	117.4	3.4
Bulgaria	√	√	X	49.4	1.4
Croatia	√	√	https://mzoe.gov.hr/o-ministarstvu-1065/djelokrug-4925/energetika/energetska-politika-i-planiranje/strategije-planovi-i-programi-2009/2009	18.7	0.5
Cyprus	√	√	http://www.moa.gov.cy/moa/environment/environmentnew.nsf/All/C1AE50C8353E2D35C2257FF00034D1E0?OpenDocument	8.4	0.2
Czech Republic	√	√	X	133.9	3.8
Demark	√	√	X	54.8	1.6
Estonia	√	√	https://www.mkm.ee/et/eesmargid-tegevused/energeetika/eesti-riiklik-energia-ja-kliimakava-aastani-2030	18.0	0,5
Finland	√	√	http://julkaisut.valtioneuvosto.fi/handle/10024/161977	46.1	1.3
France	√	√	X	419.1	12.0
Germany	√	√	https://www.bmwi.de/Redaktion/DE/Textsammlungen/Energie/necp.html	831.4	23.7
Greece	√	√	http://www.ypeka.gr/	89.2	2.5
Hungary	√	√	https://www.kormany.hu/hu/dok?source=11&type=402#!DocumentBrowse	58.6	1.7
Ireland	√	√	X	65.2	1.9
Italy	√	√	https://www.mise.gov.it/index.php/it/	391.3	11.2
Latvia	√	√	X	13.1	0.4
Lithuania	√	√	X	16.4	0.5
Luxembourg	√	√	https://environnement.public.lu/fr/actualites/2020/05/pnec.html	10.3	0.3
Malta	√	√	X	2.2	0.1
Netherlands	√	√	X	193.1	5.5
Poland	√	√	https://www.gov.pl/web/klimat/krajowy-plan-na-rzecz-energii-i-klimatu	376.4	10.8
Portugal	√	√	http://www.dgeg.gov.pt/	61.1	1.7
Romania	√	√	X	91.7	2.6
Slovakia	√	√	https://www.mhsr.sk/energetika/navrh-integrovaneho-narodneho-energetickeho-a-klimatickeho-planu	37.7	1.1
Slovenia	√	√	https://www.energetika-portal.si/dokumenti/strateski-razvojni-dokumenti/nacionalni-energetski-in-podnebni-nacrt/	17.7	0.5
Spain	√	√	X	296.2	8.5
Sweden	√	√	X	9.8	0.3

*Source: European Commission. * Excluding memo items*

sible, nor shall we consider the physical complexities and the potential constraints on the supply or demand side to perform such massive investments all over Europe. We will ignore the economic and social consequences of Covid-19 and will assume that the final targets remain unchanged. While emphasizing this methodological choice, we still note that the current plans were developed under a much milder macroeconomic scenario – nobody would have expected a 7.4 per cent economic contraction in Europe in 2020 (if the most

recent forecasts are true)[13]. Any further change might endanger the targets themselves by creating uncertainty, delays, and extra-costs. This should be taken into account when reading the analysis below.

The National Energy and Climate Plans: an overview

NECPs address the EU-wide and national targets under five dimensions:

- Decarbonization
- Energy efficiency
- Energy security
- Internal energy market
- Research, innovation and competitiveness

We are most concerned with the first two dimensions because most choices made under their labels require investments and impose (or reduce) costs on society. Of course, energy security, internal energy market, research, innovation, and competitiveness matter and may have significant impacts on how energy is produced and consumed in the EU, especially in the long run. However, their consequences are mostly indirect insofar as they affect the behavior of public and private stakeholders, the geopolitical positioning of the EU and Member States, and possibly the probability that disrupting innovation takes place.

NECPs have also a common structure. They are divided in five sections:

1) Overview and process for establishing the Plan
2) National objectives and targets
3) Policies and measures
4) Current situation and projections with existing policies and measures
5) Impact assessment of planned policies and measures

In performing our benchmarking exercise, we take most information from sections 2), 4), and 5). We take the 2030 targets under the relevant dimensions (carbon emissions, energy demand, renewable share, etc.) from section 2; we take the business-as-usual scenario from section 4; and we take the estimate of the amount of investments needed – and, where available, the expected macroeconomic impact from implementing the measures – from section 5.

As we have already said, we will not question whether targets, estimates about the investments needed, or the underlying assumptions concerning time-to-market are plausible; nor will we make any inferences regarding internal consistency of the estimates (i.e., whether NECPs are self-consistent) or their external consistency (i.e. whether estimates in the different NECPs are consistent with each other). Rather, we will provide some descriptive statistics or stylized facts about the content of the plans. Based on the States' own estimated costs, we will also try to show correlations in order to: i) compare the strategies of the Member States from a cost-benefit perspective; and ii) capture the potential patterns (if any). Of course the latter relies on the caveat that correlation does not necessarily imply causation, so we will not attempt to draw any causal inference.

Most NECPs provide the requested information, although not always in an easily usable form. For example, some plans carry graphs but not tables with the precise figures concer-

13 https://ec.europa.eu/info/sites/info/files/economy-finance/ip136_en.pdf

ning each variable (say, primary and final energy consumption, energy demand by branch of economic activity, carbon emissions, etc.). When collecting data, we only rely on tables. If a piece of information is only presented in graphical form, we drop it.

A second caveat is that we rely on three points in time for each variable: i) the expected value in 2020; ii) the expected value in 2030; iii) the target value in 2030. The plans were drafted in 2019, so all 2020 values are likely to be grossly over- or under-estimated (depending on the variable of interest) because of Covid-19. Still, it is useful to take them as a baseline because they reflect where member states presumed they would stay at the beginning of the process compared to where they feel inertial trends would end up, and what targets they believe they can commit to reaching. In doing this, we focus on the expected scenarios and costs, regardless to the current short-term economic downturn (which, however, will have a presumably large impact not just on 2020 emissions, but also on medium-term investments).

We sought information regarding: primary and final energy consumption; energy demand by branch of economic activity and/or final use (with particular regard to industry, residential demand, transport, electricity); renewable energies (total production, renewable electricity, renewables in the transportation sector); and total carbon emissions (including both ETS and non-ETS sectors). On top of this, we also collected information concerning the expected costs to cover the investments needed.

Some countries estimated the entire investment costs required to achieve the 2030 targets; others estimated the additional investments required to move from the business-as-usual to the 2030 targets; only a few (Italy, Malta, and Portugal) provide estimates for both. Based on this information, we estimate the expected annualized cost of investments (net of operational expenditures) Member States deem necessary in order to achieve the results. While this calculation may have little "physical" meaning (for example, it doesn't take into account the expected technical life of the new equipment, nor does it relate to the actual timeline for investments), it still provides a useful benchmark for comparing the individual countries' strategies and to infer some preliminary conclusions.

A survey on the National Energy and Climate Plans

Data regarding primary and final energy consumption as well as total carbon emissions are readily available in most NECPs, with reference to both the business-as-usual scenario (which the NECPs call "with existing measures", or WEM) and the 2030 policy scenario (which is called "with additional measures", or WAM). More detailed information – for example, regarding energy demand by branch of economic activity or the amount of renewable energy by final use – are not always explicitly provided, although in many cases they can be derived from graphs and figures. When commenting on the expectations and targets of Member States, we will only rely on information that is provided explicitly (i.e. in tables or in the accompanying text).

To begin with, an estimate of primary energy demand in 2020 and 2030 WEM is clearly available for 24 countries, but only 20 provide a precise estimate of the 2030 WAM primary energy demand. More information is available with regards to final energy demand, whose estimate is supplied by 26 countries for 2020 and 2030 WEM, but only by 22 countries for 2030 WAM. On average, EU Member States expect a very modest increase of primary energy demand (+0.15 per cent) in 2030 WEM, that turns into an aggressive -9.2 per cent in the WAM scenario. The expected switch is almost aggressive as far as final

energy demand is concerned: member states expect a 2.7 per cent increase in the WEM scenario vis-à-vis -7.1 per cent in the WAM scenario. This suggests that Member States expect efficiency in transforming energy to be as important as the efficiency in using energy, even though the former appears to be slightly more relevant. On average, the improvement between the WEM scenario and the WAM scenario is around -8.8 per cent for both primary energy demand and final energy demand.

How does this translate in GHGs emission reductions? This is the most important indicator because it is the only one that matters to reduce Europe's environmental footprint. From an environmental perspective, all other indicators or targets are instrumental to achieve emission reductions, and only matter as long as they contribute to this goal. For example, if widespread, competitive carbon capture and usage technologies were available, it would be pointless to set a target for energy efficiency or renewable energy (or, at least, it would be irrelevant from the climate point of view). Luckily most countries provide explicit data regarding their views on the dynamics of emissions: 24 countries provide a precise estimate for 2020 for 2030 WEM, while 23 countries provide an estimate for 2030 WAM. On average, the surveyed member states expect an 8.4 per cent emission reduction in the WEM scenario vis-à-vis a 22.2 per cent reduction in the WAM scenario below (expected) 2020 levels. Hence, the improvement which is attributed to additional measures is as high as -14.6 per cent below the business-as-usual.

Table 2
Primary and final energy demand and GHGs emissions in WEM and WAM scenarios

	WEM vs 2020	WAM vs 2020	WEM vs 2020
Primary energy demand	+0.14% (24 countries)	-9.2% (19 countries)	-8.8% (18 countries)
Final energy demand	2.7% (26 countries)	-7.1% (22 countries)	-8.8% (22 countries)
GHGs emissions	-8.4% (24 countries)	-22.2% (24 countries)	-14.6% (23 countries)

Who are the best and worst (expected) performers? The question is trickier than it seems. However, one should consider that the initial conditions matter a lot, especially when they entail either low GDP per capita (say, Hungary) or very efficient and clean economies (say, Finland – outside the transportation sector). In order to provide some context, we also show two measures of the carbon-efficiency of the economy, i.e. emissions per capita and emission intensity of the GDP (namely the carbon content of one unit of GDP) (the most recent data concern 2018 and 2017, respectively). Table 3 shows the best and worst performers under each dimension.

How do Member States expect to achieve the promised results? Not all NECPs provide analytical data on each of the dimensions that we have reviewed, so our elaborations rely on the data provided by a subset of countries. Still, large Member States such as Germany, France, Italy, and Spain did a reasonably good job in making data available, so we are confident that our survey still adds value.

Table 3
Best and worst (expected) performers according to the NECPs

		Country	Variation	Emissions per capita [ton Ceq 2018]	GDP Carbon intensity [ton Ceq / 1,000 euro 2017]
Primary energy demand					
WEM vs 2020	Best	Germany	-10.9%	10.7	106
	Worst	Hungary	+19.2%	6.6	106.5
WAM vs 2020	Best	Italy	-25.3%	7.3	93
	Worst	Finland	+8%	10.7	110
WAM vs WEM	Best	Italy	-21.9%	7.3	93
	Worst	Greece	0.0%	9.6	150
Final energy demand					
WEM vs 2020	Best	Latvia	-7.2%	6.3	106
	Worst	Denmark	+20.8%	8.9	85
WAM vs 2020	Best	France	-15.4%*	6.9	80
	Worst	Cyprus	+5.3%	11.3	145
WAM vs WEM	Best	Spain	-20.8%*	8.5	112
	Worst	Greece	0.0%	9.6	150
GHGs emissions					
WEM vs 2020	Best	Portugal	-33.1%	7	100
	Worst	Malta	+20.8%	5.5	75
WAM vs 2020	Best	Denmark	-51.2%	8.9	85
	Worst	Romania	-0.8%	6	120
WAM vs WEM	Best	Denmark	-44.7%	8.9	85
	Worst	Finland	+4.1%	10.7	110

** Luxembourg has the best performance but we didn't consider it because it is a very small country that provided fragmented and partial data.*

One important indicator to look at is the progress of renewable energy sources (RES). Increasing the share of RES is a target within the EU broader 2030 and 2050 plans. We have data for 22 countries regarding the total (expected) RES production in 2020, 17 countries in 2030 under WEM and 18 countries in 2030 under WAM. On average, total RES are bound to increase by 28.2 per cent in 2020-2030 if no additional measure is taken, and by 53.4 per cent if EU targets are to be met. Hence, moving from WEM to WAM would result in a 23.8 per cent improvement. A key role will be played by an increase in renewable electricity generation (RES-E) and green transportation (RES-T), but only a handful of

Table 4
Increase in RES-E generation in a sample of countries

	2030 WEM vs 2020	2030 WAM vs 2020	2030 WAM vs 2030 WEM
Austria	+7.1%	+39.3%	+30.0%
Bulgaria	+59.9%	+64.2%	+2.7%
Germany	+21.3%	+46.1%	+20.4%
Hungary	+31.8%	+141.5%	+83.2%
Italy	+11.4%	+57.6%	+41.5%
Luxembourg	+130.2%	+199.3%	+30.0%
Poland	+47.8%	+139.1%	+61.8%
Spain	+32.8%	+114.5%	+61.4%
Sweden*	+20.0%	+18.0%	-1.7%
Average	+54.6%	+8.6%	+36.6%

** Note: Sweden expects electricity demand to decline by 2030 in the WAM scenario.*

countries provide the estimates needed to analyse the improvement attributable to policy choices. Estimates for a few countries, including some large ones, are shown in Table 4.

We have shown that Member States believe they can implement a wide array of policies to incentivise renewable energies, introduce stricter standards for energy efficiency, promote sustainable mobility, etc. Member states may be over-optimistic (or pessimistic) regarding the environmental impact if their economies were left unchecked, and they may be over-optimistic (or pessimistic) regarding the ability to change their economic trajectories by implementing additional policies. They all agree that targets cannot be met without adequate investments. They also agree that the markets alone, even under the current policy constraints and incentives, would not be able to finance the sheer volume and the kinds of investments deemed necessary to achieve the targets. This results in the obvious consequence that costly investments should be either subsidized or made mandatory by policy measures. At what cost will the necessary change be achieved? And what will the impact on economic growth be?

Costs and Benefits Are in the Eye of the Beholder

Section 5 of the NECPs is dedicated to the economic impacts of the proposed measures. Even though Member States were supposed to provide an estimate of the investments needed and a forecast of the impact on GDP, not all of them provided precise data. Moreover, we have little information regarding the methodologies employed for calculating them, so we are not sure the figures can be confidently compared with each other. Still, this is what we have.

We start from the estimates of the investments that are needed to achieve the 2030 targets according to the Member States. Not all NECPs contain precise estimates; moreover, a large majority supplies an estimate of the total amount of investments required to reach the targets, but only a small sample distinguishes between investments that would happen anyway, from those that are a consequence of additional policies. Still, the bits of information derived from the few states that make the distinction are telling.

To perform a meaningful benchmark, we calculate the ratio between total (or additional) investments expected to happen in the decade 2021-2030, and the emissions cut as a consequence (i.e., total emission cuts in 2020-2030 WAM or additional cuts in 2030 WEM-2030 WAM, respectively). Since these investments should be deployed between 2021-2030, we divide the result by ten to have an annualized capital expenditure per unit of emissions avoided. Hence, where we do have an estimate of total investments, we divide it by the expected reduction between 2021-2030 WAM, whilst we divide estimates of additional investments by the expected reduction between 2030 WEM and 2030 WAM. In principle, this should provide a proxy for average Capex and marginal Capex, respectively (of course these estimates reflect expectations, not ex-post evaluations).

Let's start from total costs, which are supplied by 17 Member States. On average, the expected total investment cost to cut one ton of CO2 in 2030 is 522 euros per annum. The highest-cost countries are Portugal (1,645 euros / ton CO2), Italy (1,312 euros / ton CO2), and Bulgaria (1,174 euros / ton CO2). The least-cost countries are Estonia (47 euros / ton CO2), Lithuania (67 euros / ton CO2), and Denmark (82 euros / ton CO2). These averages do not consider Malta, whose estimate is an outlier (almost 12,000 euros / ton CO2).

Nine countries provide detailed information on what they believe the additional costs will be to achieve the goals (Germany, Italy, Latvia, Luxembourg, Malta, Poland, Portugal, Slo-

Table 5
Expected and programmed emission cuts, estimates on the investments needed, and unit average and marginal abatement capex according to the NECPs

	Emissions 2020 (est.)	Emissions 2030 WEM	Emissions 2030 WAM	Total emission reduction	% emission reduction	Total expected capex	Annualized average total cost of abatement	Additional emission reduction	% additional emission reduction	Additional expected capex	Annualized marginal cost of abatement
	Mtons CO2	Mtons CO2	Mtons CO2	2030 Mtons CO2	%	bn euro	euro / ton CO2 per annum	2030 Mtons CO2	%	bn euro	euro / ton CO2 per annum
Austria	80	74	61	-19	-24	169	889	-13	-18		
Belgium	113	128	109	-4	-4			-19	-15		
Bulgaria	62	57	56	-6	-10	70	1174	-1	-2		
Croatia	24	23	21	-3	-12	19	679	-2	-8		
Cyprus	9	8	5	-4	-43			-3	-35		
Czech Republic	127	108	105	-22	-17	63	289	-3	-3		
Denmark	43	38	21	-22	-51	18	82	-17	-45		
Estonia	16	12	12	-4	-27	2	47	-1	-6		
Finland	52	41	43	-9	-18	11	118	2	4		
France	461	416	328	-133	-29	674	507	-88	-21		
Germany	830	731	562	-268	-32			-169	-23	279	165
Greece	82	61	61	-21	-26	44	206	0	-1		
Hungary	70	62	56	-14	-20			-6	-10		
Ireland								0			
Italy	419	384	328	-91	-22	1194	1312	-56	-15	186	332
Latvia	12		9	-3	-24			9		190	
Lithuania	21	20		-21	-100	14	67	-20	-100		
Luxembourg											
Malta	2	3	2	0	-2			-1	-19	6	1020
Netherland	177	151	113	-64	-36	65	102	-38	-25		
Poland	398	405	336	-62	-15	196	318	-69	-17	45	65
Portugal	63	42	38	-25	-40	419	1645	-5	-11	13	282
Romania											
Slovakia	42	41	37	-5	-13	20	377	-4	-11	1	23
Slovenia	17	17	13	-4	-24	22	550	-4	-23		
Spain	324	293	222	-102	-31			-71	-24	241	339
Sweden	50	46	43	-6	-13			-3	-6		
UK											
EU Average	**146**	**137**	**112**	**-38**	**-26**	**187**	**522**	**-23**	**-19**	**120**	**318**

vakia, and Spain). Unfortunately, an estimate of emissions in 2020, 2030 WEM and 2030 WAM is not available for Latvia, so we have to drop it. The remaining eight countries display an average annualized marginal abatement capex of 318 euros / ton CO2. Malta has a very high cost of 1,020 euros / ton CO2 per annum, whereas the other countries range between Germany's 165 euros / ton CO2 per annum and Spain's 339 euros / ton CO2 per annum. Four of these – namely Italy, Poland, Portugal, and Slovakia – provide both an estimate for total costs and for additional investments, which allows us to compare average and marginal abatement capex: marginal capex is much lower than average capex (332 vs 1,312 euros / ton CO2 for Italy, 65.4 vs 317.8 euros / ton CO2 for Poland, and 282 vs 1,645 euros / ton CO2 for Portugal, 23 vs 377 euros / ton CO2 for Slovakia). This raises a serious

concern about the reliability of these estimates.

Member States were also required to run a model of their economies in order to assess the expected impact of the proposed investments on the GDP growth. Many of them did not provide explicit figures, and among those who did, none supplied a confidence interval. Table 6 shows the data we were able to obtain from the NECPs. Out of 14 countries that provide an estimate, 8 expect the proposed investments to boost the economy, while 5 expect a contraction of the GDP (as compared to the baseline), and one (Austria) expects no relevant impact on the GDP. Macroeconomic estimates seem to suffer from an optimism bias: the optimistic countries, i.e. those who expect a positive macroeconomic impact from the proposed policies, forecast an average increase of the GDP by 1.33 per cent in 2030, whereas the pessimistic one believe their GDP will be, on average, 0.51 per cent below the baseline the same year. All in all, the 14 countries that provided an explicit estimate for the macroeconomic impacts from the proposed measures expect the GDP in 2030 to be 0.58 per cent higher than in the business-as-usual. Incidentally, this estimate is neither significantly different from zero, nor far from what the EU Commission finds in its Impact Assessment of the proposed increase of the emissions reduction target from -40 per cent to -55 per cent in 2030.[14]

Table 6
Expected macroeconomic impact in 2030 of the proposed investments by country (deviation from the baseline

Country	Expected GDP in 2030 under WAM as compared to expected GDP in 2030 under WEM [%]
Austria	0%
Croatia	+2.25%
Cyprus	+0.29%
Finland	-0.59%
France	+1.5%
Italy	-0.17%
Lithuania	+1.72%
Luxembourg	+0.08%
Netherlands	-0.5%
Poland	+0,7%
Slovakia	-0.5%
Slovenia	+2.12%
Spain	+2%
Sweden	-0.8%

We conclude our survey by showing a few correlations we find interesting. Correlations should never be confused with causations; this caveat should be taken particularly seriously in this circumstance, since we are not reviewing data ex-post, but the expectations of the member states.

Figure 2 shows the correlation between the expected annual average capex and carbon intensity in 2017 and per capita carbon emissions in 2018. There seems to be a weak, negative correlation between emissions per capita and the expected average annualized capex to achieve the desired decarbonization target (r2 = -0.23). Somehow contrary to our expectations, there seems to be little (if any) correlation between the carbon intensity of GDP (which is a measure of the carbon-efficiency of the entire economy), and the

14 https://ec.europa.eu/clima/sites/clima/files/eu-climate-action/docs/impact_en.pdf

Figure 2
Correlation between the expected annual average capex and carbon intensity and per capita emissions.

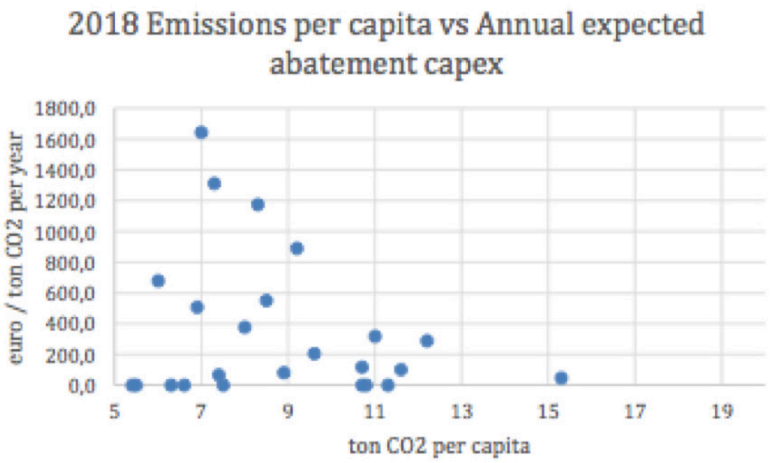
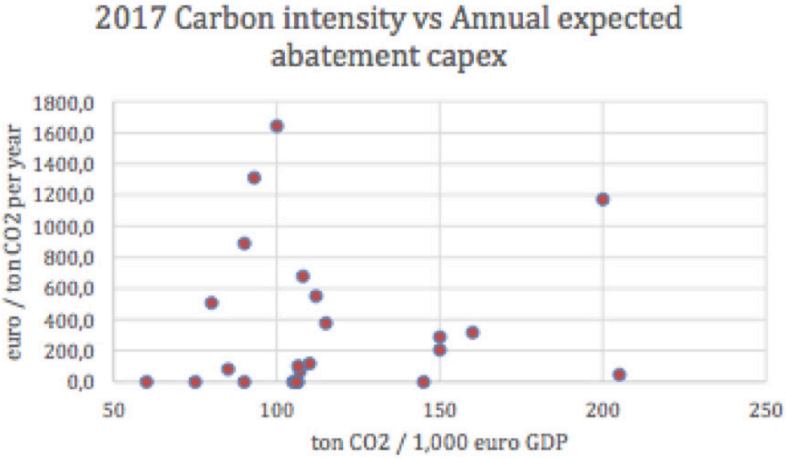


Figure 3
Correlation between the expected annual average capex and primary and final energy demand.



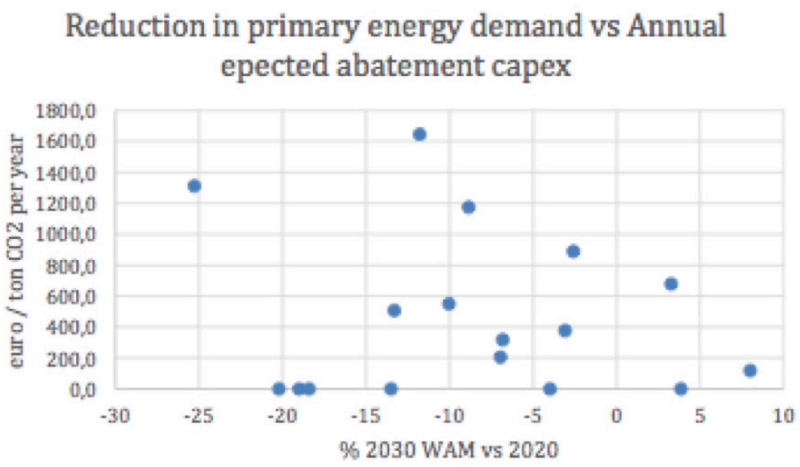
expected investment costs to achieve decarbonization (r2 = -0.07). The correlation somewhat increases (r2 = -0.14) if we drop an outlier (Bulgaria), which seems to have both high carbon intensity and high abatement costs.

Figure 3 shows the correlation between the expected annual average capex and the total reduction of primary and final energy demand, while Figure 4 shows the correlation between the expected annual average capex and the increase in total and electric RES.

Figure 4 (next page) shows the lack of any meaningful correlation.

The correlations between expected capex and renewable support seem mild. In fact, countries with more ambitious targets for RES expect to face lower capex. This is true both for total RES and for RES-E, although we should warn that we have a small number of observations on RES-E, which makes this relation weaker. There seem to be greater correlations between the marginal expected capex and all the above-mentioned variables, but

Figure 4
Correlation between the expected annual average capex and the increase in total renewable energies and electric renewables



the correlation coefficients are still relatively small and, the number of countries providing enough data is limited.

Conclusive remarks: Time is Money (but not viceversa)

As we have seen in this benchmarking exercise, the NECPs provide a useful basis to develop a thorough examination of the potential consequences of the EU's climate and energy targets. They also show how the Member States design their own strategies to achieve their national and EU-wide goals. Notwithstanding, many NECPs fail to supply precise information regarding some key areas. Despite the uniform structure presumably intended to simplify the understanding and comparison of their content, the standards adopted by national governments vary widely.

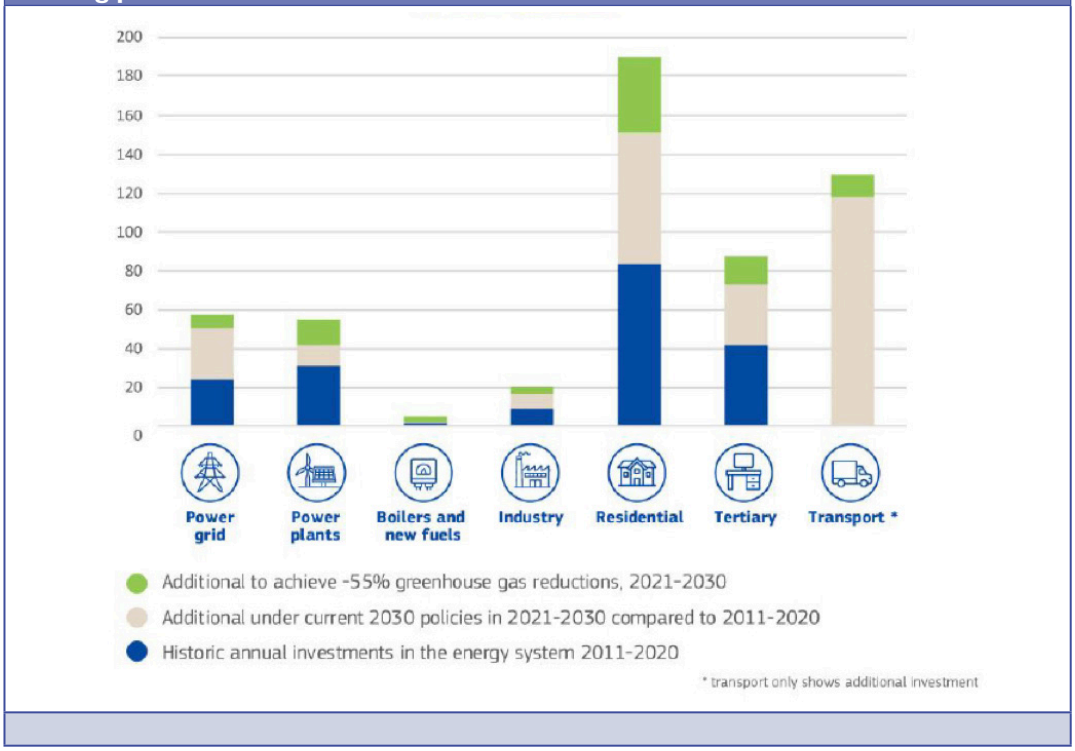
As far as the expected macroeconomic impacts and investment needs, several NECPs lack transparency regarding their methodologies. The information provided by the Member States – which reflects their own expectations – does not always seem consistent between countries.

The Commission itself expects the amount of investment needed to increase substantially, as the 2030 target will be raised from -40 per cent to -55 per cent. Power plants, residential sector, tertiary, and transports are the fields with the need for the largest investments (Figure 5).[15] Given the massive amount of resources required, climate-driven investments might crowd out private investments elsewhere in the economy, with non-obvious outcomes on the growth rates and income redistribution.

With all these caveats, NECPs help to understand where Europe is headed and where potential obstacles lie. Beyond the specific issues embedded in the plans, three major caveats emerge – partly as a consequence of all the major events that have happened in the meantime, including the global pandemic – that should somehow be dealt with. The revision of the 2030 targets provide a useful opportunity to fix them in due time.

15 https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1600339518571&uri=COM:2020:564:FIN

Figure 5
Average annual investments 2011-2020 and additional investments 2021-2030 under existing policies and to achieve -55% GHGs emissions reduction.



First of all, as we have warned, we have taken the NECPs (including the underlying macro-economic assumptions and simulations) at face value. But the Covid-19 pandemic makes an enormous difference, if not in the medium-run, at least in the short-term: economic growth throughout Europe in 2020-21 will fall way short of the expectations. This will result in lower emissions, but possibly also lower the ability of Europe's economies to sustain and finance new investments in energy and non-energy technologies. Months have been lost, as the lockdown measures and the corona outbreak prevented investments to be deployed. On the other hand, the EU Council of 17-21 July 2020 kicked off the future 2021-27 Multiannual Financial Framework (MFF) and a new relief package to sustain the economic recovery, also known as Next Generation EU (NGEU).[16] Both the MFF and NGEU will devote large financial resources to investments connected with the European Green Deal which may partly or fully offset the consequences of the 2020 economic downturn.

This leads to a second issue: the more ambitious the targets, the larger and more intertwined in the economic system the investments needed. But investments take time to take off: even a relatively simple investment, such as deploying a solar PV or a wind field, requires time to find the exact place, manufacture and transport the equipment, and pursue the administrative permits. Large and widespread investments, for example in the power system, also rely on upgrades of the upstream industry, such as power networks, that take time. Small, distributed investments –to make residential buildings more energy-efficient or to switch from conventional to sustainable mobility for example – presuppose complex efforts to convey information, remove financial and regulatory barriers or behavioural bias, and coordinate the consumption and investment choices of millions people.

16 https://www.consilium.europa.eu/media/45109/210720-euco-final-conclusions-en.pdf

The increase of the emissions reduction target to -55 per cent in 2030 will mean that the current NECPs fall short of the new targets and the process will need to be re-booted. To be fair, not all past efforts will be wasted, insofar as the updated NECPs will build upon the proposals that are embedded in the old ones; but more time will be spent in drafting and assessing the new NECPs. This may create uncertainties that ironically slow-down energy transitions.

All NECPs suffer from an ineliminable limit in which lies their very intellectual foundation: in order to devise the required policies and set the sectoral targets, the national governments rely on assumptions regarding the GDP dynamic in the next decade, the changes in the economic structure, the relative prices of fossil and non-fossil fuels, and technological progress. Most or even all these assumptions cannot be taken for granted: after the coronavirus, not even the 2020 forecasts (cast less than one year ago) fall anywhere close to reality. Hence, policies that will mobilize an unprecedented amount of investments in virtually any aspect of the economic activity are founded upon a fragile ground.

We would like to close by mentioning a figure that we haven't explicitly shown until now: if we focus on the 9 (out of 27) member states that provided a precise estimate of the additional investments needed to meet the 2030 targets, the aggregate estimate of the investments needed exceeds 961 billion euros. If, instead, we look at the 17 countries that provide an estimate of the total investments needed, the total is as high as 3 trillion euros. The former amount is well above the Next Generation EU package, the latter is more than four times as much and roughly equivalent to the total gross fixed capital formation in the entire European Union in 2019. For any meaningful consideration to be made, estimates regarding costs and benefits from the planned investments should be made under the same assumptions and models. Unfortunately, the heterogeneity amongst Member States' estimates is as large as it can be. The EU Commission estimates that in order to meet the -55 per cent target by 2030, EU-wide annual investments should grow by approximately 350 billion euros, as seen in Figure 5[17] that amount is lower than what Italy and Latvia alone believe will be needed to meet the -40 per cent target (Table 5). These figures are clearly inconsistent with each other which makes it virtually impossible to perform any reasonable comparison or draw any reasonable implication from the NECPs. This also means that no best practice can be inferred by the Member States' own documents. The EU Commission should provide assistance to the Member States in the revision process and strive to make the national estimates consistent and transparent.

Mobilizing enough resources, coordinating investments in so many different areas, and making sure that time-to-market does not exceed the 2030 deadline is an unprecedented challenge for the European Union.

17 https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1600339518571&uri=COM:2020:564:FIN

Istituto Bruno Leoni
idee per il libero mercato

IBL Special Report

Chi Siamo

L'Istituto Bruno Leoni (IBL), intitolato al grande giurista e filosofo torinese, nasce con l'ambizione di stimolare il dibattito pubblico, in Italia, promuovendo in modo puntuale e rigoroso un punto di vista autenticamente liberale. L'IBL intende studiare, promuovere e diffondere gli ideali del mercato, della proprietà privata, e della libertà di scambio. Attraverso la pubblicazione di libri (sia di taglio accademico, sia divulgativi), l'organizzazione di convegni, la diffusione di articoli sulla stampa nazionale e internazionale, l'elaborazione di brevi studi e briefing papers, l'IBL mira ad orientare il processo decisionale, ad informare al meglio la pubblica opinione, a crescere una nuova generazione di intellettuali e studiosi sensibili alle ragioni della libertà.

Cosa Vogliamo

La nostra filosofia è conosciuta sotto molte etichette: "liberale", "liberista", "individualista", "libertaria". I nomi non contano. Ciò che importa è che a orientare la nostra azione è la fedeltà a quello che Lord Acton ha definito "il fine politico supremo": la libertà individuale. In un'epoca nella quale i nemici della libertà sembrano acquistare nuovo vigore, l'IBL vuole promuovere le ragioni della libertà attraverso studi e ricerche puntuali e rigorosi, ma al contempo scevri da ogni tecnicismo.

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