



This work has been carried out in the scope of Contract DG-2005-60591 with the **European Climate Foundation** whose financial support is gratefully acknowledged.

Dimitri Lalas, Senior Advisor, FACET³S, S.A.,

Nikos Gakis, FACET³S, S.A.,

contributed to the work described in this report.

This work has also benefited from constructive critique and suggestions from S. Mirasgedis, E. Georgopoulou and Y. Sarafidis of the National Observatory of Athens, Olivie Vardakoulis of WWF-Greece and V. Hondou of FACETS, S.A. for which we are thankful.

Summary

The achievement of the ambitious triple targets of the EU for GHG reduction, RES share in final energy consumption and energy efficiency improvement by 2030 and on to full decarbonization by 2050 requires well thought out, fully documented as well as transparent plans. This role has been given to the National Energy and Climate Plans (NECP) and Long-Term Strategy Roadmaps to 2050 that all MS have submitted to the European Commission in early 2020. The full and timely realization of these plans and the ensuing benefits though also require a robust review mechanism to gage progress over the 10-year period to 2030, identify trouble spots and delays, and devise ways to deal with them.

Provisions for such a review process have already been made in the legislation enacted in late 2018 (Regulation 2018/1999 as amended) and augmented since, with the review entrusted to the European Commission to carry out. Yet, as in many other state activities, the principle of “trust and verify” calls for independent review and in this case by civil societies and external analysts.

To assist in such independent reviews, in this note, the review process of progress inscribed in Regulation 2018/1999 (as amended) in the implementation of the NECPs is briefly presented and analyzed, and advice is offered on important aspects for an independent review. As the implementation of the NECPs rests fully in the implementation of the policies and measures (PaMs) they encompass, the focus of this analysis is on estimating their yield for which quantitative information is required. Sources for such information as submitted by MSs are identified and a number of aspects for gaging their performance are discussed; they include the scope of the PaMs, the timely availability of data and the deviation range between declared and estimated results. For existing PaMs, such information is available from submissions in the scope of the National Plans for energy efficiency (NEEAPs) and renewable energy (NREAPs) that have been required as means to meet the 20-20-20 by 2020 EU targets. Sources for information for additional PaMs are also identified and discussed.

A major aim of an independent review is to gage whether the reductions to be provided by the PaMs match the claims in the NECP quantitative projections and trajectories. To this end, 15 aspects of an analysis of the PaMs in the NECPs are discussed; they include measures for decarbonization of transport, the importance and difficulties of the first checks for the 2020 targets, the ex-post evaluation of existing PaMs, the importance of the NECP Review Boards and the establishment of channels of communication with them, the effect of COVID-19 on trajectories and their review, the financing of PaMs and the investment needs. Overall, as independent reviewers usually have limited resources, it is recommended that emphasis should be given in reviewing the non-ETS sectors as the emissions from the ETS ones are adequately reported and verified.

As an example of a review of the efficacy of PaMs, the Greek NECP is examined. The information provided is judged fair since over 165 separate measures are included but quantitative information for estimating their yield is provided only in aggregated form, and discrepancies are present between various national submissions. These discrepancies are detailed via an analysis of PaMs in the non-ETS residential/tertiary and transport sectors.

In the immediate future, because of the Increase of the EU emission reduction target to 55%, there should be a revision of the NECPs and the PaMs included therein. These revisions should be scrutinized and in this, independent reviews by civil society entities have an important role to play to assure progress to decarbonization at least as set out in the NECPs, to which it is hoped that this work can be of assistance.

Section 1: Introduction

To address the climate change threat, as finally recognized by a large number of political, community and scientific leaders as well as by a majority of the population according to polls in a large number of countries worldwide, all nations agreed in Paris to enhance efforts so as to “hold the increase in the global average temperature to well below 2°C above pre-industrial levels and pursuing efforts to limit the temperature increase to 1.5°C above pre-industrial levels” (Art 2.1 of the Paris Agreement) and tabled Nationally Determined Contributions to meet this target. To this end the European Union (EU) and its Member States (MS) pledged initially to reduce its GHG emissions by 30% with respect to (wrt) those in 1990 by 2030 and declared its willingness to reduce them further if others also increase their contributions.

The EU’s means to live up to its pledge to go further was the European Green Deal (EGD) with its ambitious targets for over 55% GHG emissions reduction wrt 1990, the deep penetration of renewables in energy supply system and serious savings in energy demand. Even though the EGD has as a primary target the amelioration of the climate change existential threat, it will inevitably also lead through decarbonization to a fundamental restructuring of the economy in this decade.

In view of the importance of this endeavor and to ensure the robustness of its pledge, the EU put in place its Energy Union Package which builds on 5 dimensions (energy security, integrated internal energy market, energy efficiency, climate action & decarbonization, and research, innovation & competitiveness) and enacted a basket of relevant legislative acts. Central among those is the so-called Governance Regulation (Regulation 2018/1999)¹ which calls for the MSs to develop and submit National Energy and Climate Plans (NECPs) on how to contribute to the EU pledge in the 2020-2030 horizon, but also for long-term strategies for a Roadmap to a near zero emission economy by 2050. This basic legislative act has been already amended once in 2019 and has now taken added gravitas as part of the 10-11 December 2020 Decision of the European Council and the 17 December 2020 proposed Amendments to Regulation 2018/1999 agreed in the (Environment) Council enshrining the more ambitious target of “at least 55%” net emissions reduction by 2030 and a near carbon-free economy by 2050. This latest proposal² of the so-

called “European Climate Law” tabled on 17 December 2020 is now under debate, with the European Parliament asking for an increase to >60%. Its adoption has been a chief priority of the Portuguese Presidency of the EU. In the 1st Semester of 2021 and a provisional tripartite agreement was reached³ on 21 April 2021 which calls for a 55% target but with a limit (225MtCO₂) to removals and inter alia calls for a target for 2040 to be set within 6 months of the 2023 Global Stocktake.

The efficacy of these plans to meet the targets set for 2030 and to stay in line to the almost full decarbonization target by 2050 but also to monitor progress especially in the first years then becomes a critical issue. It behoofs then not only the EC but also all concerned and, in particular civil society organizations to participate in making sure that adequate progress is made in time and in the contrary case to inform the public and policy makers and propose corrective action.

NECPs are required by Regulation 2018/1999 to include quantitative information on the evolution of a large number of primary energy parameters and emissions reduction over time in the form of trajectories but also the means to achieve them in the form of policies and measures (PaMs). These trajectories are the output of modelling exercises for which PaMs are the inputs after appropriate translation of their nature and design into data, rules or constraints. The careful scrutiny of the PaMs then is a crucial element for deciding on the veracity of the claims of MSs to actually contribute their fair share in the European Green Deal.

The 27 NECPs submitted to the EC in 2020 include thousands of PaMs (only the Greek NECP includes 165) with just the ones that aim at energy efficiency improvements numbering ca 1400 of which 2/3 are existing PaMs i.e. PaMs instituted to meet the EU 2020 targets (the so called 20-20-20 by 2020 targets) and the rest additional to meet the 2030 targets; and as the saying goes, in their details “is the Devil” to be found.

This contribution aims to facility independent reviews by civil society entities and other experts, of progress in the application and results of the PaMs inscribed in the NECPs and to bring out their details and expose possible hidden “Devils”.

In the next Section 2 of this paper, an overview of the reporting and reviewing obligations, mechanisms and timetables already included in the EU Package and especially in Regulation 2019/1999 is described, followed in Section 3 by an

1 <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX-32018R1999&from=EN>

2 <https://data.consilium.europa.eu/doc/document/ST-14171-2020-INIT/en/pdf>

3 <https://www.consilium.europa.eu/en/press/press-releases/2021/04/21/european-climate-law-council-and-parliament-reach-provisional-agreement/>

assessment of this mandated reporting and review process to be carried out at specified intervals by the EC. In Section 4, in view of the crucial role of the PaMs included in the NECPs, an overview of the information submitted this far is given, while in Section 5 a discussion of aspects that are important in reviewing their claimed contribution is provided. In Section

6, recommendations on approaching the review of PaMs are given. Taking into account the considerations presented and analyzed in the previous sections, in Section 7 the PaMs in the Greek NECP are described and analyzed with detailed computations of the analysis laid out in the Annex. Finally in Section 8 some concluding remarks are offered.

Section 2: The reporting and reviewing regime for NECPs

The reporting and review mechanism of the progress in implementing the NECPs is included in Regulation 2018/1999. Besides the enabling Art 13 and 14, in Chapter 4 (Art 17 to Art 28) the reporting requirements for all MSs and the EC are specified while in Chapter 5 (Art 29 to Art 36) the reviewing process is laid out. In addition, reporting systems (per MS and for EU as a whole) for inventories (Art 37) and for PaMs and projections (Art 39) of GHG emissions are to be established for review and registration, with the European Environmental Agency providing support (Art 42). Analytical and extensive lists of the specific data to be reported by MSs are included in the Annexes of the Regulation 2018/1999 as amended. In this Section several aspects of this reporting and reviewing regime that are deemed important are presented and discussed next.

Trajectories

The legislation for meeting 2030 targets, besides the overall ones to be met in the 2020-2030 decade, sets trajectories and milestones for specific components of the NECPs to ensure their achievement. At present, the milestones and absolute values and rates refer to the previous target of >40% reduction of GHG by 2030; these will be changed so as to be in line with the new target of >55% agreed by the EU Council of 10-11 Dec 2020 which also agreed to a carbon neutral EU target by 2050 and the setting of a 2040 target after the UNFCCC Stocktake of 2023. Proposals for the update of the two main components that make up the major part of the GHG emissions, the ETS trajectory and the non-ETS binding national targets are expected to be announced according to the 17 December 2020 EC proposed timetable by 30 June 2021.

Regardless, the requirements of obligatory or indicative trajectories and milestones in all three areas to meet the marquee targets, i.e. GHG emissions, RES utilization and Energy efficiency improvements remain those set in Regulation 2018/1999, as the proposed amendments of 17 December 2020 do not affect them. Although specific values and percentages may need to be adjusted in view of the new >55% target, these requirements are as follows:

a. For the GHG emissions

- An ETS⁴ trajectory leading to a 43% reduction by 2030: An overall reduction rate of ETS emissions of 2.2% (from 1.7% until 2020) per year starting from the nominal val-

ue in 2020 till 2030 with Market Stability Reserve (MSR) enhanced intakes of 24% till 2024 and 12% afterwards, and a review in 2021 but with no individual MS targets or milestones

- Mandatory reduction targets for the non-ETS sector of each MS⁵ (-16% for GR) and year by year values in Decision 2020/2126 under Regulation 2018/842. This also covers other GHG beside CO₂. Yet as mentioned in the 11 Dec 2020 Conclusions (Para 19) of the European Council⁶ "the European Council will return to the matter and adopt additional guidance" to amend the Effort Sharing Regulation, and the MS shares.
- LULUCF⁷ no debit rule to all land change by 2025 and 2030 for the two 5-year periods.

b. Renewable Energy Sources (Art 4 (a) 2 Directive 2018/1999)

- A trajectory leading to the increased target of RES percentage to Gross Final Energy Consumption (GFEC) by 2030 inscribed in the NECPs with a 18% increase to target by 2023, a 43% by 2025 and a 65% by 2027.
- Also, indicative trajectories to be included but without interim targets for RES sectors
 - electricity generated
 - RES heating & cooling
 - RES in transport
 - By RES technology
 - Biomass specifics including imports

c. Beside the overall target for the 2020-30-decade, specific annual milestones are asked for in the Energy Efficiency Directive 2012/27/EU as amended by Directive 2018/2002, namely:

- Primary and Final Energy Consumption (Art 3) with further annual requirements for
 - 0,8% reduction per year of PEC and FEC from 2021 till 2030 wrt the 3-yr average before 1.1.2019 (Art 7a)
 - 3% of public buildings/yr upgraded (Art 5)
- Milestones of the long-term strategy for the renovation (LTRS) of the national stock of residential and non-resi-

5 Decision 2020/2126

6 <https://www.consilium.europa.eu/media/47296/1011-12-20-euco-conclusions-en.pdf>

7 Directive 2018/841

4 ETS recast

Table 1: Trajectories and milestones from Regulation (EU) 2018/1999

	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2040	2050
Emissions													
Total emissions Art 4 and Annex I,												Annex I	LTS
non-ETS R842 yearly Art 4((a)-1		Check	Check	Check	Check	Check	Check	Check	Check	Check	Check		
LULUCF R841 yearly Art 4((a)-1						0% net					0% net		
RES													
To meet the prescribed intermediate targets 18%, 43%, 65% Art 4(A)-2 / GFEC Art 20(a)1				18%		43%		65%			100%	Annex I	LTS
Electricity, heating/cooling, transport Art20(a)2				Check		Check		Check					
By technology Art 20(a)3				Check		Check		Check					
Bioenergy Art20(a)4				Check		Check		Check					
Other Art20(a)5				Check		Check		Check					
Energy Efficiency													
Indicative trajectory Art 4(b)-1 / PEC&FEC Art 21(a)				Check		Check		Check				Annex I	Annex I
LTSR Art21(a)2				Check		Check		Check					
Internal Market													
Interconnection progress Art 32(8)						Check							
Energy Security (trajectory)												Annex I	
Research, Innov. & Comp. (indicative target)													Annex I

dential buildings, both public and private, and the contributions to the Union's energy efficiency targets pursuant to Directive 2012/27/EU in accordance with Article 2a of Directive 2010/31/EU

- Energy poverty eradication

An overview of the trajectories and milestones that are included in the NECPs which MSs are called to adhere to is given in Table 1.

Reporting and review

A key part of this, and any other legislative act, are the provisions for its full implementation that include, in view of the 30-year horizon for decarbonization efforts, full reporting and assessing progress. A full but tentative schedule in view of Art 6 and Recital para 18 of the 17 December 2020 Council Decision is given in Table 2 below.

As NECPs, which should be in line with EU-wide measures (ETS Directive, Effort Sharing and LULUCF Regulations) are the main tactical means to achieve the marquee >55%

emissions reduction target by 2030 but also those for RES contribution to GFEC and energy efficiency which need to be redefined, the focus should be on the provisions and timetable for assessing progress in their implementation. This is laid out chiefly in Art 29 of the Governance Regulation 2018/1999 as amended.

Article 29 calls for a two-year assessment cycle (with the first assessment at present in 2021) of progress made by each Member State in meeting its "objectives, targets and contributions and implementing the PAMs set in its NECP" so as to meet the EU overall trajectory towards the target, while Art 17 calls also for yearly reports on PAMs for reduction of GHG, starting in 2021. This is further elaborated wrt RES in Art 29(2), for energy efficiency in Art 29(3), and for the integration of internal market in Art 29(4).

In addition, every year the EC is tasked (Art29 para 5) to assess progress of MSs in meeting their obligations wrt to non-ETS sectors (Regulation EU-2018/842) and LULUCF (Regulation EU-2018/841).

Table 2: Timetable of reporting submissions by MSs from Regulation (EU) 2018/1999 and UNFCCC

	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
NECP @ LTS 10YR																
NECP Submission - Draft Art 9										31/12						
NECP Submission - Final Art 3	31/12										1/01					
Updates-NECP - Draft Art14(1)					30/06										30/06	
Updates-NECP - Final Art14(2)						30/06										30/06
LTS - 10 YR cycle		1/01									1/01					
NECP Report 2YR																
Progress NECP 2 YR cycle Art 17			15/03		15/03		15/03		15/03		15/03		15/03		15/03	
PaMs @ projections re GHG Art 18			15/03		15/03		15/03		15/03		15/03		15/03		15/03	
PaMs changes re GHG Art 19				15/03		15/03		15/03		15/03		15/03		15/03		15/03
EC Assessment																
Assess and Report All NECP 29(1) / Art29(1) / This will change earlier <30Sept, pursuant to 17Dec Decision Art 18			31/10		31/10		31/10		31/10		31/10		31/10		31/10	
Assess and Report nonETS @ LULUCF 29(5) / State of the Energy Union Report			31/10	31/10	31/10	31/10	31/10	31/10	31/10	31/10	31/10	31/10	31/10	31/10	31/10	31/10
Assess Progress to 2050 target (Art5 Dec2020)					30/09					30/09					30/09	
20-20-20 Targets RES @ EE Art27				30 Apr												
Inventories Art 26																
PAMs @ Projections on GHG 2 YR			15/03		15/03		15/03		15/03		15/03		15/03		15/03	
GHG Emissions 1 YR																
CRF Tables			15/01	15/01	15/01	15/01	15/01	15/01	15/01	15/01	15/01	15/01	15/01	15/01	15/01	15/01
Final Inventory			15/03	15/03	15/03	15/03	15/03	15/03	15/03	15/03	15/03	15/03	15/03	15/03	15/03	15/03
Inventory to UNFCCC			15/04	15/04	15/04	15/04	15/04	15/04	15/04	15/04	15/04	15/04	15/04	15/04	15/04	15/04
n-1 YR Projections			31/07	31/07	31/07	31/07	31/07	31/07	31/07	31/07	31/07	31/07	31/07	31/07	31/07	31/07
LULUCF preliminary Art 26(5)									15/01					15/01		
LULUCF Final Art 26(5)									15/03		15/03			15/03		15/03
Adaptation Art 19(1)																
Adapt strategy implement			15/03		15/03		15/03		15/03		15/03		15/03		15/03	
Financial Art 19																
Use of EUA auction proceeds (2)			31/07		31/07		31/07		31/07		31/07		31/07		31/07	
Support Developing Countries Art 19(3)			30/09		30/09		30/09		30/09		30/09		30/09		30/09	
UNFCCC (besides Inventory)																
Biennial National Report		1/01		1/01		1/01		1/01		1/01		1/01		1/01		1/01
Paris Agreement Art 14 Stocktake Art19(2)																
EC Assessment 2030 (and 2050)					30/09					30/09					30/09	
EC Proposal for 2040 target (Art2a @ 5)						Set					Revisit					Revisit

A 5-year cycle is set out for the LULUCF target of ensuring that cumulatively GHG sinks are larger than sources as well as for a review of the overall NECP progress and coherence, with the LTS 2050 plans including an intermediate 2040 target and with the NECPs themselves to be resubmitted in a 10-year cycle.

Finally, the timetable includes (Art 37 and 38) all the yearly inventory submissions to meet UNFCCC obligations and the 5-year Stocktake reviews to remain in line with the Paris Agreement decision for keeping mean global temperature rise to much less than 2°C.

To facilitate the reporting process, the EC is instructed (Art 28) to develop and put into operation by 1 January 2020 an electronic platform for submissions.

Regulation 2018/1999 also includes in Art 39 and 42 reporting and review requirements for PaMs, existing and planned,

to meet the targets. The European Environment Agency (EEA) is entrusted (Art 42) with compiling relevant information, assuring quality and reporting on PaMs, as well as on projections, to be carried out by systems at EU and MS level that should be set up by 1 Jan 2021.

Lately (April 2021), under the provisional agreement between the EU Council, the European Parliament and the EC, a 15-member independent European Scientific Advisory Board on Climate Change, is to be established. Its task is to provide scientific advice and reporting on EU measures, climate targets and indicative greenhouse gas budgets and their coherence with the European climate law and the EU's international commitments under the Paris Agreement. It is not clear yet how it will carry out its responsibilities as regards reporting on EU measures and how it will interact with the EC in reviewing progress.

Section 3: Assessment of the Reporting and Review process

The process as set out in Regulation 2018/1999 is deemed to be comprehensive as to its coverage and well timed to ensure, for the EU as a whole and its MSs individually, their staying on a path to meet the 2030 and 2050 targets. The dual frequency of 2-year and 5-year cycles provides for both early warning of delays or ineffectiveness of PaMs, and adequate depth of time to design and implement corrective actions.

The quantitative data to be submitted in NECP as set out in Annex I (part 2) of Regulation 2018/1999 cover adequately the sectors that are responsible for most GHG emissions and thus can provide a good picture of the ways that are planned to meet the targets while the periodic updates especially of the 2-year cycle can describe adequately the progress made.

The EC is tasked to report annually (Art 35) on progress made in its Energy Union report and the European Parliament and Council are asked to “address” progress (Art 36).

In case the conclusion of the reviews carried out by the EC is that there is insufficient progress either in individual targets or overall, the EC is to communicate its findings to MSs and issue, and make public, recommendations for them to take corrective action, with deficits to be made up in the next period. MSs are to submit information on actions to do so.

The EC is authorized to “exercise its powers” but without further specification, whenever the overall targets are judged to be inadequate (Art31(3)) and progress wrt the RES and Energy Efficiency targets is insufficient (Art32(2) and 32(6)) but under the terms of Regulation 2011/182.

As in a number of other legislative acts that aim to protect the environment, it is not clear when MSs do not live up to their obligation, what the consequences will be nor whether they are adequate to encourage MSs to be in compliance, as was the case for example with the €100/tCO₂ penalty for enterprises that did not surrender yearly the appropriate amount of ETS allowances.

Further to the issue of enforcement and proposing an appropriate balance between clear consequences and remissions, an additional aspect that needs to be pointed out is the possibility of backloading actions. One or more MSs may postpone action toward the end of the period, by not complying fully with the recommendations of the EC and by transferring the actual realization of emission reduction and meeting the overall targets from biennial-to- biennial periods, i.e. in plain terms kicking the can down the road, resulting in a crowding in the last years of the 2020-30 period. This might lead to the EU not meeting its overall targets at the end of the period, without adequate time to react thus itself passing the buck to the next period and endangering reaching full decarbonization by 2050.

In this respect, it is encouraging that deviations from the 20-20-20 targets are not ignored but are addressed in Regulation 2018/1999. Besides the reporting required in Art 26 by MSs on their meeting their 20-20-20 by 2020 obligations, the 2020 amounts of non-ETS emissions, of RES in GFEC and of energy conservation are taken into account in determining 2030 MSs targets (Annex II Art 1a) and for specifying the starting points of trajectories to 2030 (Decision 2020/2126 and Art1(3) of Directive 2018/2002).

A possible means to encourage MSs to meet in a timely fashion their obligations is for the EC to exercise its powers in proposing a scheme that delinquent MSs are required to contribute, not on a voluntary basis as now included in Art 32 (3d), to the RES Mechanism to be established by 1 January 2021 (Art33), especially as how funding of this new Mechanism is not addressed in the Regulation. This payment to the RES Mechanism could also come from a diversion of the proceeds of the MSs from the EUA auctions.

Section 4: Existing Policies and Measures Information and Review

As PaMs are the means to meet the targets, requirements for their reporting are included in Regulation 2018/1999. Of the five chapters of the template for NECPs in Annex I, three involve PaMs: Chapter 3 of the NECP to include overall descriptions of all PaMs, Chapter 4 those already existing defined to be those already implemented or adopted by end of 2019 or when the biennial reports are submitted (Art2(3 and 4)), and Chapter 5 the planned PaMs, i.e., those being under discussion and have a realistic chance to be implemented in 2020 or later (see Art 2(5) of Regulation 2018/1999).

In Chapter 4, in which reporting requirements in the biennial cycle are set out in Arts 17 to 25 inclusive, MSs are called upon to report on progress made in implementing existing PaMs and inform on planned ones. These PaMs refer to all 5 dimensions with lists further expanded in Annex VI. Of note are the requirements for reporting set out in Art 39(2) that “the Member States and the Commission shall aim to ensure the timeliness, transparency, accuracy, consistency, comparability and completeness of the information reported on policies and measures”. These requirements are capable, if met, to provide the necessary information for meaningful review of both ambition and progress made or to be made in implementing NECPs.

The increase of the EU GHG emission reduction target from >40% to >55% as already pointed out, would require revising NECPs accordingly. This provides an opportunity to revisit all the relevant information on PaMs included in the NECPs and in particular as regards two aspects:

1. The trajectory and other quantitative information
2. Their reflection in modelling projections

One should recall that to meet the 20-20-20 Information, MSs had to compile and submit National Plans, in 2007 for energy efficiency actions (NEEAPs) and in 2010 for meeting the RES MS specific target (NREAPs), and henceforth reports on their progress every 2 (NREAPs) or 3 (NEEAPs) years. These plans which in reality have been amalgamated in the NECP for the 2021-2030 period similarly included information for the PaMs, which were reviewed periodically. The Joint Research Center (JRC) of the EU and the EEA reviewed the NEEAPs and GHG reductions, respectively. To facilitate this, the EC developed a template and guidelines (EEA, 2018) for reporting PaMs, which MSs are encouraged to use on a vol-

untary basis. The main information to be collected included:

- PaM number, name of policy or measure
- Information of the mandatory NECP template of Annex I Regulation 2018/1999
- Main objective, quantified objective, scenario (WEM/WAM) in which the PaM is included
- Short description of sectors affected, type of policy instrument, planned budget
- Relevant Energy Union dimension, relevant Union policy
- Implementation status, implementation period, entities responsible for implementation
- Indicators to monitor progress
- Reference to assessments and underpinning technical reports

In 2020, a review of the PaMs for the Energy Efficiency dimension of the NECPs has been carried out by the JRC (Economidou et al., 2020). This follows a companion report (Tsemekidi-Tzeirananki et al.,2020) which examined the latest progress (2018 final data) toward the 2020 energy efficiency target and concluded that after 2018, the reduction wrt 2005 consumption is 17.1% (1536.8 Mtoe) and 20.4% (1090.4 Mtoe) for Primary (PEC) and Final Energy Consumption (FEC) respectively vs. the 20% targets (1483 Mtoe and 1086 Mtoe) set for 2020.

The JRC review of the PaMs in NECPs (Economidou et al., 2020) analyzed 1394 PaMs (of which 90 Greek) of various kinds covering all 4 sectors (Buildings, Industry, Transport and Agriculture) plus cross-sectional aspects and energy poverty. The results of the analysis point out that: (i) the sum of the savings of MSs by 2030 as inscribed in their NECPs amounts to a 29.6% and 29.4% reduction for PEC and FEC respectively, short of the target of 32.5%, with meeting the individual targets set in Art 5 and 7 of Directive 2012/29/EU as amended and LTRSs also in doubt, (ii) transparency of additional PaMs to be implemented after 2020 is lacking, (iii) submissions do not include enough data/granularity to assess accurately their ability to deliver the targets and (iv) COVID-19 impacts would need to be taken into account.

Similarly, for progress in meeting the RES target, the EC with external assistance has been reviewing the NREAP submissions. In the latest report (Navigant, 2020), progress is assessed on the main target of RES in covering 20% of GFEC and

on the individual sectoral targets for electricity, heating and cooling and transport (10%). The findings indicate that the EU-27, having reached by 2018 18.9% of RES on GFEC, are on a path to surpassing the 20% nominal target (20.6% actual) and reaching somewhere between 22.8% and 23.1% with only 3 MSs in danger of not meeting their individual targets. Similarly, overachievement of 2% is estimated, including COVID-19 impacts, for the 10% of biofuels in transport but with only 16 MSs reaching or overachieving their individual targets.

The recast RES Directive 2018/2001 updated the targets for 2030 to >32% RES in GFEC (Art 4(1)), >14% biofuels in transport (Art 25(1)) and a 1.3% annual improvement of RES in heating & cooling (Art 23(1)) from the 2020 use. Individual targets for 2030 per MS have not been specified.

Turning to GHG emission reduction, progress to meeting the 20% target wrt 1990 was reviewed by EEA in 2019 (EEA 2019) in line with the 2-year reporting cycle of Art 13(1) on PaMs to mitigate emissions (in-between annual significant update is also offered). The findings of the review based on the 2019 submissions indicate that the EU will meet its 20% target and

even exceed it as by 2019 reduction had already reached 22%.

The EEA review, besides progress toward the 2020 target, included a discussion of the indicators used to assess it (Section 3.4) and an analysis of the quality of information submitted (Section 5) and in particular its ability to cover the requirements set out in Art 39(2) that “the Member States and the Commission shall aim to ensure the timeliness, transparency, accuracy, consistency, comparability and completeness of the information reported on policies and measures” mentioned previously. As regards indicators, the EEA report finds that there is inconsistency between MSs reporting. This is attributed basically to lack of clear general monitoring concepts or guidelines for the ex-ante and ex-post progress assessment of PaMs leading to confusion whether the ex-ante values are targets or projections. This inconsistency is also evident in the labeling of “implemented in response to an Energy Union policy”, the start of the year and most importantly the methods used to estimate the impact of PaMs. A further problem area identified is the inadequate information provided as regards costs and sources of funding.

Section 5: Evaluating progress and the review of PaMs

Part of the reporting requirements (inscribed in the Annexes of Regulation 2018/1999) of all 5 dimensions of the NECPs and in particular GHG emissions mitigation, RES use and energy efficiency, is the communication of trajectories of a number of key parameters to 2030 (for example PEC and FEC, GHG emissions, RES installations etc.) and for some even to 2040 (see Table 2). These trajectories are estimates from the results of modelling with the use of appropriate tools (for example PRIMES, TIMES, and other models) in which PaMs need to be introduced and represented in a quantitative fashion so that their impacts can influence the future evolution of the parameters including that of the amount of emission reductions. This is particularly important and challenging if not enough information is provided on the PaMs when the models used are either bottom-up or hybrid (as the majority are) especially for PaMs that are soft, that is of an educational or informational or even regulatory nature.

For example, to properly incorporate the PaM of energy renovation of buildings into the modelling package, one would need information on the number of the buildings to be refurbished and the energy upgrading per building which would also need to be commensurate with the budget allocated and the years that it covers. This information is not usually provided in the description of the PaMs as reported. If the number of buildings, their energy use status and the budget is provided, the degree of savings can then be estimated as can the amount of GHG emissions to be attributed to that PaM and thus one can check the accuracy of the ex-ante projections and the ex-post estimates to gauge progress of implementation.

On the other hand, for a PaM that calls for a public campaign urging citizens to use electricity for washing and water heating during off-peak hours, say at night, to include it in the modelling, assumptions must be made on how many citizens will be convinced and switch habits, a figure that would be difficult to estimate ex-ante as would the PaM impact to be attributed ex-post.

As mentioned above, Regulation 2018/1999 provides for a well-designed and robust reviewing mechanism which is based on the large number of mandatory information reported in the initial NECP submission and in the following progress reports in the 2-year cycle. Never-the-less, it is important that external and independent reviews from interested civil society organizations and individual citizens check and supplement the EC review, and recommendations at MS level are carried out with a view to encouraging the Governments

to improve the performance of the PaMs and remain on track to meeting their targets for 2030 and beyond. In this, civil society organizations and other interested parties are often in a better position to carry out a critical review as they can bring to the task a better knowledge of the local situation. Such a review needs to take into consideration a number of important aspects that are presented next.

Scope of an independent review

A first approach to a review is to look at the indicators of the overarching target of >55% GHG emissions reduction which is actually serviced by the targets and PaMs of the other 4 dimensions. Such indicators are included in the yearly GHG inventories which are based on the activity data and in the breakdowns of the national energy balances both of which are reviewed closely by teams of international experts from the United Nation Framework Convention on Climate Change (UNFCCC) Secretariat.

In taking this approach and essentially in reviewing progress toward decarbonization, one should keep in mind the ETS – non ETS breakdown. The ETS emissions are not allocated on a MS basis and need only to meet an EU-wide trajectory and overall target, whereas for the non-ETS, mandatory targets per MS have been agreed (to be updated in view of the >55% new ambitious reduction target). It is thus important to decide whether, at the national level, one should concentrate resources for review of both or of only the non-ETS sector PaMs.

For the ETS sector emissions reduction, the major tool remains the price of allowances for which at EU level, decisions are made after review of the ETS Directive and by making use of the MSR mechanism. At MS level, PaMs for increasing RES share mostly in electricity and to a lesser extent for increasing energy efficiency of major industrial installations are of interest. These PaMs, which in view of State Aid limitations, are mostly of regulatory nature, that is of the kinds of streamlining permitting, of ensuring correct operation of the market, of enhancing infrastructure and of providing support mostly in tax relief form for upgrading energy efficiency of industrial installations.

By their nature then, results of the implementation of the relevant PaMs cannot be reflected directly to either emission reductions or energy conservation as other factors also play a significant if not the major role. Such external factors, most of which are not determined at MS level, include among others

the price of fuel, the availability of capital at favorable terms, and the production capacity and prices for equipment.

Even though energy use related emissions are the majority, ETS emissions also include industrial process emissions especially from the cement, ceramics, and lime sectors, which, although reported in the annual enterprise submissions to the authorities, are not separated in the public information available in the EC ETS Registry. Again, for these emissions, the impact of PaMs cannot be directly correlated to reductions as external factors, mostly commercial, may be as important.

In any case, the ETS mechanism by itself constitutes a PaM which is already tested and there is confidence that it will meet its target.

The non-ETS sector includes emissions from final energy consumption in the main economic sectors namely residential, tertiary, industrial, transport and agriculture, plus additional non-energy emissions from product use such as F-gases and waste. Non-ETS emission reductions may more easily be attributed to specific PaMs although here as well external factors also play a role including those of the local economic conditions and the disposable income, as the effectiveness of PaMs often depends on consumer choices and behavior.

In this first approach then, one should start by looking at the reported progress in the major indicators in the GHG inventories as computed from overall activity data at national level vs their projected trajectories in the NECPs and then if gaps appear, to try to identify which PaMs are laggard and ask for corrective actions. In a sense this constitutes a “top-down” approach.

A second approach is to examine progress in each individual PaM, compare it to its milestones if available and try to estimate whether their contributions add up to the overall values reported especially those in the GHG national inventories and energy balances.

In this second approach, a base year needs to be picked (for example the latest year that an inventory is published or 2020 for which a full review will be available) and utilizing the ex-post reported estimates of the existing PaMs reductions, estimating those of the current period under review and adding the contribution of the additional PaMs from their implementation year on, one can construct the overall reduction and compare it with those projected in the NECPs.

This approach, as it constitutes a “bottom-up” approach, requires that the information reported individually for the large majority of the PaMs is of sufficient detail for a reasonable estimate of their impact to be made, something that does not appear to be the case as of now.

In analyzing the results of PaMs and the possible reasons for

inadequate outputs, one should try to differentiate between delay or partial implementation, and reduced efficacy, as this would need different kinds of corrective action.

In either of the two approaches, when comparing reported values in the inventories or energy balances with their projections in the NECPs, one should also consider that the difference may possibly be due not only to delay in implementation or reduced efficacy of PaMs but also to the possibility of their being inadequately or inaccurately inputted in the models used which generate the projections of overall parameters. Some PaMs might be of facilitative only nature and this cannot be assigned easily quantitative results. Such measures include streamlining permitting for RES and soft measures such as educational/public informational and promotional campaigns, community engagement programs etc.

It is crucial then to identify sources and analyze all available information regarding the PaMs, existing or additional. Some sources are included in the information uploaded in the EEA PaM portal⁸.

Timing of data to be used.

The review process of progress to meeting the EU and MSs targets to 2030 by necessity is based on data submitted by MSs directly to EC and EUROSTAT but also to other international organizations such as the UNFCCC Secretariat, IEA, IMF and OECD. The time lag in submissions of these data ranges from less than 2 months for the monthly energy data to EUROSTAT, to less than 4 months for the annual emissions of ETS installations and to more than a year for the national energy balances and GHG inventories with spatial granularity at that of the MSs.

In addition, most electricity Transmission System Operators (TSOs) report daily production data, by production technology and imports, to ENTSO-E that are available on-line as do the NG grid operators. Monthly summary data are also made public from the energy exchanges and the TSOs, often broken down by customer category. These data in conjunction with the energy use data of EUROSTAT can provide the necessary information to estimate the energy component of the national emissions and the final energy use within the first semester of the next year from that in question.

The evolution of the rest of emissions can still be reviewed annually in the first semester of year X but for the X-2 year. Thus, for the first period of review of progress in the NECPs in 2023, as the submission deadline is 15th of March 2023, it

⁸ https://cdr.eionet.europa.eu/Converters/run_conversion?file=/gr/eu/mmr/art04-13-14_lcds_pams_projections/pams/pams/envx0xsow/gr_mmr-pam_report.xml&conv=524&source=remote#pam2

would include information to be reviewed for the year 2021 and before. As noted above, estimates of progress in 2022 can still be made at least for the energy emissions which in most MSs comprise the major part of national emissions. As the majority of PaMs already notified involve the energy sector, this gives a useful tool for gaging progress in their implementation at an annual basis so that timely pressure can be applied to Governments for corrective action in those PaMs that are not performing.

Acceptable deviations

All the previous aspects notwithstanding, one should bear in mind that the trajectories of the output of PaMs are estimates usually derived by models with some exogenous input based of expert opinion. As such, they should be considered as trajectory bands with a reasonable width within which their performance in the intermediate reviews should be judged as acceptable.

In deciding on the uncertainty bandwidth of estimates, a hint

is provided by the Greek NECP where two widely used models (PRIMES and TIMES-MARKAL) have been utilized simultaneously. The differences between the results with the same basic assumptions and PaM description is ca 4% in total emissions by 2030, ca 2% in FEC and ca 2.5% in RES in GFEC, but with larger differences in 2025 and in some subsectors. For example, in the transport section, the derived (on the basis of GDP and population trajectories) amounts of the road commercial transport in 2030 differ by over 7% between the two models (30,549 Mil ton-km vs 28,300Mil ton-km) and they differ by the same percentage in their respective passenger-miles. This difference is present even in the 2015 values which should have been near zero⁹. This difference would result in a similar difference in emissions.

⁹ Tables 30 and 31 of the Greek NECP

Section 6: Recommendations for independent reviews of progress

Taking all the above into account, it would be useful to try to formulate a plan for independent reviews of progress in the impact of existing PaMs and in the application of additional ones that have been included in the NECPs always bearing in mind (a) the possible limitations in access to specific data either because the mandatory submissions under Regulation 2018/1999 are incomplete or because the information provided is not adequate for quantitative estimates and (b) that civil society organizations may have limited resources including of specialized expertise needed in some sectors. The following 15 suggestions may be of value.

1. The main rule should be that priority for deployment of available resources of civil society and independent reviewers should be given to reviewing the non-ETS sectors, as ETS installations are reviewed adequately by the appointed authorities annually on the basis of verified reports with the results made public without delay.
2. As verified ETS emissions in the ETS sector are available yearly within 6 months of the end of the year in question, comparisons for electricity generation can be made in the in-between years to the submissions (i.e., 2024, 2026, 2028). Comparison in 2021 for the 2020 amounts with those given in the NECP trajectories (note that modelling for the NECPs used statistics for the years up to 2016 or 2017 at best with the 2020 values computed) unfortunately is biased by the effects of COVID-19. Examination of progress toward the decommissioning of coal/lignite plants is crucial, but such review is easily carried out, even by non-specialists. An important item that needs monitoring is the use of proceeds from MS ETS allowances more than 50% of which should be earmarked for "specified climate and energy related purposes". Even though overall this seems to be the case (77% according to the latest report of the EC¹⁰), still a review at MS level of these actions and their classification as climate related is worth the effort.
3. Meeting the RES targets is dependent on both the penetration of RES (numerator) but also the decrease of GFEC (denominator). The penetration is a function of market prices, the cost of money and appropriate infrastructure with regulation barriers also playing a role. As equipment costs continue to decrease, one needs to differentiate between EU-wide and MS factors. At EU level, in view of this period of very low cost of money, the price of ETS allowances is the major factor to monitor while at MS level the infrastructure strengthening and the progress in the streamlining of permitting are the parameters to keep track of. Here, the penetration of RES to electricity generation is obviously an important metric. As to the GFEC, the denominator, the review of energy efficiency in hard PaMs, such as energy upgrading of buildings and specific consumption of vehicles and appliances is required but so is the promotion of soft measures of "sufficiency". In any case, the RES target at present does not seem to be a difficult one to meet.
4. Transport is the largest contributor in terms of emissions in the non-ETS sector¹¹ and emission reductions expected from additional measures in this sector amount to over 12% by 2030 (see Tables 5-1 and 5-2 of the 4th Biennial Report (BR4) of the EU¹²), with electric vehicle penetration playing a major role. It is important to scrutinize progress there especially in the construction of electric vehicle charging stations and the expansion and promotion of public transport.
5. The second largest component of the non-ETS sector, the energy use in buildings, has clear and quantitative targets to be met. Estimating actual progress here on an annual basis is possible through national sources such as building renovation permits, and annual reports of public funds spent in supporting private dwelling and public building refurbishment.
6. Attention should be paid to the other parts of the non-ETS sectors for which emissions are not from energy use, namely agriculture and industrial processes and product use (11% and 9% respectively of total EU-wide emissions in 2019) which with waste (3%) are responsible for 23% of EU-wide emissions in 2019 (last year available)¹³. This is because whereas in the last ten years (2010-2019) energy sector emissions (77% of total EU emissions in 2019) declined by 24%, in the Industrial Processes and Product

¹⁰ https://ec.europa.eu/clima/sites/clima/files/strategies/progress/docs/com_2020_777_en.pdf

¹¹ <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX-52020DC0564&from=EN>

¹² https://unfccc.int/documents/273463European%20UnionBR4_C_2019_8832_and_SWD_2019_432_2.pdf

¹³ EU Inventory Table ES-5, <https://unfccc.int/documents/228021>

Use (IPPU) sector they declined by only 6% (the non-ETS part accounts for ca 25% and refers to HFC use in refrigeration) and in agriculture sector (mostly CH₄ from enteric fermentation and N₂O from managed soils) they even increased by 1%.

7. PaMs are the instruments to accelerate decarbonization and moving to near zero emissions by 2050. This calls for a close examination of their design and the estimation of expected results that are included in the NECPs. At the same time, it also calls for an estimate of their effectiveness - ex-post if they are existing and ex-ante if additional - to be able to gauge deviations and to propose corrections to enhance their output. With the decision to reach for >55% GHG reductions by 2030, the evaluation of the effectiveness of PaMs already inscribed becomes even more crucial, if they are called, as looks likely, to provide after upgrading the additional reductions. This poses a question of timing. Existing PaMs, some running for a few years already, can be evaluated in 2021 but with results for 2019, as this is the year that both the latest energy balances and inventories issued in the first semester of 2021, cover. Based on this record, it is important to analyze whether the added reductions that they are called to deliver (if any) are realistically estimated. In this, the submissions and assessments in 2022 of meeting the original 20-20-20 targets should provide the means to gauge existing PaMs performance. Additional PaMs already announced, i.e., to be implemented in or after 2020, clearly cannot be reviewed in a quantitative fashion until data for at least one year of their operation become available which means 2023 at the earliest. As a result, a stronger scrutiny will be required to gauge whether they are likely to deliver.

Finally, new additional PaMs may be proposed to meet the new target of >55% for which the only scrutiny possible initially (i.e., before 2023) is as regards their design. Here, as with the ones already included in the NECP, it is important to examine the quantitative information provided to gauge whether computation of expected results is possible, and the reductions claimed are realistic.

8. In view of the importance of energy savings in the residential/tertiary sectors, reviewing progress in two particular activities, namely the 3% annual energy upgrades of public buildings (Art 5 of Directive 2012/27/EU) and the annual publication of savings from obligated parties (Art 7a(7) of Directive 2012/27/EU as amended) is of high importance, as the annual data availability provides a better indication of results and trends. Both these items constitute part of the 0.8% overall annual reduction of

PEC and FEC obligation which also must be reported annually (Art 7a of Directive 2012/27/EU as amended). The need for monitoring of MS obligations regarding reporting is evidenced by the submissions pursuant to Art 2a of Directive 2010/31/EU as amended (LTRS Directive) that should have been communicated to EC by 10 March 2020¹⁴. By 4 February 2021 only 19 of the 27 MSs had submitted plans.¹⁵ The evaluation of 15 of them submitted by 15 November 2020 by the EC noted lack of detailed quantitative information and varying levels of ambition as well as targets of different nature.

9. Art 39 of Regulation 2018/1999 calls for the establishment of NECP Review Boards at national level. The role of these Review Boards is crucial to the success of the NECP as a guide and check to meeting the ambitious targets for 2030 and progress toward decarbonization by 2050. It is thus imperative that these Review Boards have both the staff and the means to carry out their mission. The means should include resources, authority to request the necessary information and access to policy makers for their findings to be brought to their attention for remedial action. This needs to be ascertained in an independent review by examining the legal basis of the Review Board, the qualifications of its staff and the finances provided as to their amount and rules for their use.
10. Reporting under Regulation 2018/1999 is comprehensive and voluminous which calls for a State Agency (most likely the Review Board) to collect, review and collate all necessary activity data and compile the report. Such agencies are already required and in place for the annual compilation of the GHG inventories but also for the energy balances. It is important for independent entities to establish contact with the staff of these agencies to be able to request clarification or additional information when reviewing the official submission.
11. In trying to replicate estimates of energy use/emissions parameters, it is important to make use of official statistics. The most important such data are those of EUROSTAT and/or of the National Statistical Services, the JRC's IDEES energy data base, the submissions to the UNFCCC and especially the so-called CRF tables, and the verified emissions in the EU ETS Registry.
12. In reviewing progress to the near zero emissions target by 2050, the 30-year period from the present can be separated in to 3 parts: the near term

14 https://ec.europa.eu/energy/sites/ener/files/eu_renovation_wave_strategy.pdf

15 https://ec.europa.eu/energy/sites/default/files/swd_commission_preliminary_analysis_of_member_state_ltrss.pdf

of 2021-2023, the mid-term 2023-2030 and the long-term 2030-2050. In each of these periods, reviewing and monitoring priorities will clearly differ. Short term: the review should concentrate on: (a) the assessment of fulfilling the 20-20-20 commitments by 2020 based on data submitted in March 2022, which the ex-post performance of the existing PaMs will give a clear indication of the possibility of fulfilling their role in the next period to 2030, (b) the re-evaluation of the NECPs and their projections to 2030 to achieve the >55% target including the revisiting of the PaMs to re-assess their individual contribution, (c) the results achieved in the 2-year period 2020-2021 in the scope of the NECPs as reported in March 2023 which basically show the start (or not) of the implementation of the additional PaMs announced in the NECPs and possibly some first estimates of their output from 2020 to 2023 and (d) the consistency of the new PaMs with the trajectories to near zero emissions by 2050. Medium term: The main concern in this period is adherence to the trajectories to 2030 as documented in the biennial reviews, and corrective measures if needed. In addition, the UFCCC Stocktake may point out the need for possible increase of the ambition level of the voluntary pledges, which may require the consideration of corrective action also by the EU. Here as well, the need for consistency of the new PaMs with the trajectories to near zero emissions by 2050 needs to be checked. Long term: Too early for recommendations of review focus yet, beyond that of the revised Long-term Strategy to 2050 submissions. The determination of the 2040 target and the 2030-2050 GHG budget is of primary importance.

13. All NECPs were compiled in 2019 at which time COVID-19 was not in the horizon. Yet, its effect has made 2020 an extraordinary year as regards energy use and its corresponding GHG emissions, with these effects possibly to continue to be present in 2022 and even longer. This will affect the trajectories in the NECPs both in the planning and at the technical level of modelling especially in view of

the >55% target recalculations. It is important, for transparency and reality-check purposes then that the way in which the COVID impact is accounted for in EC and MSs new projections be clearly described and taken into account, with particular emphasis in the transport and residential/tertiary sectors. The COVID-19 impact will be felt primarily in 2020. This will clearly affect the evaluation of the 20-20-20 targets that is scheduled to take place in 2022. As hopefully the COVID-19 will be brought under control in 2021 and its influence in coming years will be limited, a fair evaluation of the achievement of the 20-20-20 targets should take into consideration the COVID effect in 2020 in the estimation of future progress.

14. The MSs will be called upon to update their NECPs to bring them in line with the 55% target and the revised ESD obligatory targets for the non-ETS sectors. In doing so, they need to take into account not only the effect of COVID-19 discussed previously but also all new information that has become available in the almost 3 years since the original compilation of the NECPs and the more than a year period since their final submission. It thus important to check that use of most up-to-date data has been made for the revision.

15. Finally, a crucial aspect in the green transition is the Investments that would be required to implement all the PaMs. This is a factor that would influence the progress of implementation and thus it is important to be able to gauge the availability and the probability of attracting them. Unfortunately, financial information in NECPs is not detailed enough, not to say mostly superficial, and for the PaMs individually often non-existent. This is a major shortcoming of almost all NECPs as is the lack of any discussion of the cost effectiveness of the particular PaMs chosen based on either economic or environmental criteria or better yet on a combination of both. It is still worthwhile to attempt to estimate where possible the investment needs as a check on the expected final contribution from the PaMs.

Section 7: The Case of Greece

After the adoption of Regulation 2018/1999 in December 2018, the Greek Government appointed on 21 May 2019 a committee chaired by the Secretary-General for Energy of the Ministry for the Environment and Energy and comprising 10 members and 5 alternates to:

- follow, review and assess the implementation of the PaMs in the Greek NECP
- compile and approve the national progress reports
- compile proposals for upgrading the NECP in accordance with the review schedule of R2018/1999.

With the change of Government in July 2019, a new structure was put in place¹⁶ with changes in the Committee membership to include representatives of most ministries and with a Working Group (WG) appointed¹⁷ on 29 July 2020 to carry out the technical work. Starting in September 2020, the WG with 6 members from the Ministry staff, the Regulatory Agency for Energy (RAE) and the Greek Center for Renewables and Energy Conservation (CRES) plus 3 external experts has met in an almost monthly basis to debate and decide on a bottom-up approach for collecting and filtering raw data and calculating contributions and costs per PaM aiming at providing, starting in March 2023, all the information and accompanying documentation called upon by Regulation 2018/1999.

According to the Greek NECP (section 3.1.1), the monitoring of progress will be carried out by defining and making use of indices which will be along the lines of those used by the EC for the Community Funds, and possibly those of OECD.

The deliberations of the WG have not been made public until now. Never-the-less, a first assessment of the adequacy of information available can be made by utilizing the information in both the NECP itself and that in the PaMs platform at EEA.

In the case of Greece, the PaMs that have been uploaded in the EEA platform are 22 of which 17 existing, and 5 additional to be implemented in or after 2020. All are composite as evidenced by the fact that the NECP itself lists over 165 different individual PaMs but without providing details for many of them.

In Table 3, a list of the composite PaMs and the resulting emission reductions, compiled from the EEA portal disaggregated into ETS and non-ETS sectors¹⁸, is shown.

Reduction in the ETS sector is predominant (68% of total) in both the pre-2020 and post 2020 periods. This, as previously mentioned, is due to the decommissioning with an aggressive schedule of all lignite plants by 2028, forced by the EU ETS allowance price increase rather than as a direct impact of other PaMs such as enhancing infrastructure (i.e., grids and terminals for electricity and NG) and streamlining permitting procedures. This installed fossil fuel capacity reduction is in turn partially covered by more RES resulting in the large reduction of GHG emissions but also by new NG power plants.

The delignitization schedule seems to be adhered to with the remaining 2 units of the Kardias lignite power station which provided district heating to Ptolemais municipality closing on schedule on 17 April 2021.

One should note that the results of PaM #6 (Promotion of RES for electricity generation) which was predicted to lead to a reduction of 11,000 ktCO₂eq in 2020, have already exceeded (14,700 MtCO₂eq already achieved in 2015) its target.

In the non-ETS sector, reduction by 2030 is seen to be much smaller (32%, i.e., 15.73MtCO₂eq) of which 2/3 from existing and 1/3 from additional PaMs. The split between existing and additional is interesting, as the additional PaMs reduction is mostly (88%) from measures to increase NG use in all sectors while the existing ones (11.79 MtCO₂eq in total) are evenly divided between F-gas use reduction (2.3MtCO₂eq), energy efficiency measures in the residential and tertiary sectors (2.4MtCO₂eq), recovery of waste and biogas (2.0MtCO₂eq), agriculture (1.3MtCO₂eq) and transport (1.35 MtCO₂eq).

The 22 composite PaMs are also included in the latest (submitted on 1 February 2020, late by one month) Biennial National Report (BNR4)¹⁹ to the UNFCCC Secretariat. In this report some additional information is provided which is helpful in analyzing the PaMs. In BNR4, three scenarios, Reference (WM), with Existing Measures (WEM) and with Additional Measures (WAM) are presented. The modelling tool used (TIMES-MARKAL plus complementary ones for electricity, i.e., WASP and PropSim) computes the projections for the evolution of the energy sector with the emissions calculated separately using the GHG Inventory methodology. The model does not allow specification of particular PaMs but is driven by demand and available technology and equipment. As a result, unless there is a specific input of equipment deployment in the final consumption sectors at competitive prices to be chosen, it

16 Decision of the Ministerial Council 31/30.9.2019

17 Ministerial Decree ΥΠΕΝ/ΕΠΕΑ/73714/424 (27/07/2020)

18 https://cdr.eionet.europa.eu/Converters/run_conversion?file=/gr/eu/mmr/art04-13-14_lcds_pams_projections/pams/pams/envx0xsow/gr_mmr-pam_report.xml&conv=524&source=remote#pam2

19 https://unfccc.int/sites/default/files/resource/BR4_Greece.pdf

Table 3: GHG emissions reductions due to Policies and Measures

	Reduction from "if they did not exist" level (ktCO ₂ e/yr)	Implementation date	2005	2010	2015	2020			2025			2030		
			Total	Total	Total	ETS	ESD	Total	ETS	ESD	Total	ETS	ESD	Total
1	Improvements/ conventional power generation system	1996	6017	1171	7400	15000		15000	13300		13300	10400		10400
2	NG Promotion residential sector	1998	53	187	260		320	320		390	390		475	475
3	NG Promotion in tertiary sector	1998	54	102	120		140	140		170	170		210	210
4	NG Promotion in industry	1996	378	388	638	433	381	814	394	438	832		572	572
5	NG Promotion in transportation	1999	8	9	11		18	18		22	22		44	44
6	Promotion of RES for electricity generation	1994	1019	12221	14700	11000		11000	14500		14500	19000		19000
7	Biofuel use in transportation	2005		392	490		650	650		680	680		700	700
8	Implementation of EE PaMs in Industry (NECP)	2008					200	200		200	200		200	200
9	Implementation of EE PaMs in Res. & Tert. Sector (NECP)	2008			180		2200	2200		2300	2300		2400	2400
10	Road transport measures	1983			300		560	560		600	600		650	650
11	Recovery of organic waste	2002			480		500	500		900	900		1300	1300
12	Recovery of biogas	2002			700		500	500		600	600		700	700
13	Reduction of emissions of fluorinated gases	2004					460	460		1400	1400		2300	2300
14	CAP Green Direct Payments: reduction of the intensity of agricultural land use; improvement management of animal waste.	2007			300		375	375		550	550		750	750
15	Rural Development Programme: Increase of organic farming.	2007			160		220	220		300	300		350	350
16	CAP Green Direct Payments: Reduction in fertilizers use	2007			100		120	120		150	150		200	200
17	Measures in the LULUCF sector	2000			NE		NE	NE		NE	NE		NE	NE
18	Further promotion of RES for electricity generation	2020					0	8323		8323	11792		11792	
19	Further biofuel use in transportation	2020					0			100	100		429	429
20	Further promotion of NG and EE in industry	2020					0			764	764		1276	1276
21	Further promotion of NG in Res. & Tert. sectors and Additional PaMs (NECP)	2020					0			2270	2270		2990	2990
22	Road transport measures (additional measures as included in NECP and NTSP)	2020					0			46	46		190	190
		Existing	7529	14470	25739	26433	6524	32957	28194	8700	36744	29400	10651	40251
		New							8323	3180	11503	11792	4885	16677
		Total	7529	14470	25839	26433	6644	33077	36517	11880	48397	41192	15736	56928

Table 4: Total emissions with WEMs and WAMs

(MtCO ₂ eq)	National emissions excl LULUCF		EU ETS		non-ETS	
	WEM	WAM	WEM	WAM	WEM	WAM
2005	118,44	118,44				
2010	118,44	118,44	54,92	54,92	63,52	63,52
2015	95,33	95,33	50,24	50,24	45,09	45,09
2019	85,61	85,61	40,48	40,48	45,13	45,13
2020	87,90	80,31	41,01	35,20	46,89	45,11
2025	81,05	69,08	34,40	26,03	46,66	43,05
2030	78,14	60,86	31,29	19,38	46,85	41,48
2035	73,08	58,17	25,95	17,58	47,13	40,59
2040	70,84	56,43	23,54	16,85	47,30	39,59

NB: From Table 35 of UNFCCC BNR4

Table 5: Energy Sector emission projections with Existing (WEM) and Additional (WAM) measures

(MtCO ₂ eq)	2020		2025		2030		2035		2040	
	WEM	WAM	WEM	WAM	WEM	WAM	WEM	WAM	WEM	WAM
Energy Industries	32,909	27,004	26,406	17,764	23,279	11,065	17,628	9,195	15,211	8,952
Industry	5,588	5,159	5,564	4,8	5,704	4,428	5,949	4,292	6,014	3,861
Transport	17,731	17,806	17,918	17,869	17,444	16,866	16,978	15,814	16,697	14,941
Tertiary	1,075	0,842	1,084	0,905	1,107	0,824	1,158	0,782	1,293	0,733
Residential	5,961	5,098	5,873	3,781	5,914	3,209	6,135	3,118	6,128	2,755
Agriculture	0,869	0,631	0,852	0,62	0,858	0,614	0,84	0,577	0,837	0,538
Other	0,253	0,253	0,253	0,253	0,253	0,253	0,253	0,253	0,253	0,253
Total	64385	56793	57950	45993	54560	37259	48940	34032	46435	32032

NB: From Tables 39 and 40 of BNR4

does not account for individual PaM contribution. Examples of the latter case of specifying exogenously technology, are the electric vehicles penetration and the energy upgrading of dwellings, for which the measure applied includes specific number of buildings upgraded per year and electric vehicles registered per year.

To clarify this further, the emission reduction from the application of measures for penetration of RES in electricity generation, i.e., PaM #6 (existing) and PaM#18 (additional), can only be inferred from the electricity RES generation that the model decided that is economically preferable to conventional pro-

duction because of the drop of RES prices and the increase of allowance prices. The measures that are included in the PaM description simply facilitate administratively the additional penetration but as mentioned earlier are but one of the parameters investors consider in deciding to finance and install RES plants.

Furthermore, projections of emissions in BNR4 for non-energy sectors have been carried out separately but no details for the methodology used or the way incorporation of specific PaMs has been taken into account, is provided.

Of interest is to look at the total emissions with existing and

additional measures, and also disaggregated between ETS and non-ETS sectors as shown in BNR4. These are presented in Table 4 in which projections are extended to 2040. The differences in Table 4 between WEM and WAM scenarios (3.60MtCO₂eq and 5.35MtCO₂eq in 2025 and 2030 respectively) are in line with the similar reductions in Table 3 (3.18MtCO₂eq and 4.88MtCO₂eq in 2025 and 2030 respectively) but with a deficit of ca 0.45MtCO₂eq that may be due to definitions and/or statistical differences.

The difference between the reductions in the ETS and the non-ETS sectors is striking and almost identical to that shown in Table 35 of the NECP.

To examine this further, in Table 5, information is presented for the Energy Sector emissions also from the BNR4 for the UNFCCC, which goes to 2040. Here, focusing in the Transport and the Residential and Tertiary sectors, the additional PaMs for the transport sector are given as 0.05MtCO₂eq and 0.58MtCO₂eq for 2025 and 2030 vs 0.15MtCO₂eq and 0.62MtCO₂eq respectively in Table 3. The difference in 2025 is due to the contribution of the enhanced use of biofuel (PaM #18) which though is included in 2030. Similarly, in the Residential and Tertiary sectors the equivalent values are 2.09MtCO₂eq and 2.71MtCO₂eq in 2025 and 2030 vs. 2.27 MtCO₂eq and 2.99MtCO₂eq in Table 3. This points out the need for consistency in reporting in the National Submissions which is a sine-qua-non for the accurate review of progress. It should be pointed out in this respect, that as of February 2021 Greece has not submitted its Long-Term Building Renovation Strategy Report²⁰.

As mentioned earlier, it is crucial to examine whether there is enough information in the PaM description to be able to carry out an estimate of the expected reductions so as to compare with the values reported in the NECP. In Table 6, all quantitative information that would enable an independent estimation, at least to a reasonable level, has been garnered from the submission in the EEA template and the NECP as published. In this Table 6, quantitative information for Research and Innovation and Energy Security is also included. What is surprising is that the information provided in BNR4 on the PaMs including the clear differentiation between WEM and WAM is much more detailed and enables better review of the NECP structure and evolution.

Examination of the additional PaMs should be given priority because of the concern in evaluating a further enhancement that should be specified in view of the increase in ambition to the >55% target.

Even for PaMs as those in Table 6 for which some quantitative information has been provided, one should also bear in mind in evaluating their yield, the economic and administrative resources required. If such information is known, it should be utilized in conjunction with the technical means that need to be deployed. For example, the NECP PaM for increasing energy efficiency in the residential sector, calls for the upgrading of 60,000 per year every year for the 10-year period to 2030 buildings (to be upped to 80,000 for 2021 to 2026 with RRF funding). At the same time, the NECP states an expenditure of €11Billion i.e., €1.1Billion/yr for energy efficiency. Assuming that of that amount the majority, say €0.9Billion/yr goes for upgrading of buildings, the average amount per building comes out to €15,000. Previous programs funded by the 2011-2017 MFF financed the upgrading of 51,732 buildings with a budget of €530Million, i.e., a lower amount of €10,245/building, with a saving of 893GWh/yr. More recent programs such as “Exiconomo & Autonomo” of the Ministry of Environment and Energy announced in 2020²¹ allocate over €16,000/building on average.

An example of the use of all available information to evaluate the effectiveness in energy saving and emission reduction in the residential and tertiary but also in the transport sector is provided in the Annex. As a general observation, substantial quantitative information should be provided for all the PaMs listed in the NECP, or at least a reference to it, if NECPs are to be fully transparent.

In summary, in the case of Greece, a mixed picture emerges as regards information available to carry out an assessment of the likelihood of reaching the admittedly ambitious targets set out in the NECP and to review progress. The major contributions in the energy sector that involve installations in the ETS including power stations are well policed and assessed annually as is the RES penetration, and do not require close review. This calls for concentration on the non-ETS sectors, especially residential/tertiary and transport where progress is slow (see Tables 5 and 6) and most importantly contingent on PaM implementation. Here, quantitative information provided for PaMs is small which calls for resorting to other sources, official such as IPCC submissions and the National Statistical Services and from academia and the private sector, and for cross-checking to gauge effectiveness and progress. Discrepancies have been found that need to be analyzed and explained. Also, the way that these PaMs are incorporated in the modelling to estimate trajectories should be requested and analyzed to gauge confidence in the projections taking care not to take at face value frequent announcements from

20 https://ec.europa.eu/energy/sites/default/files/swd_commission_preliminary_analysis_of_member_state_ltrss.pdf

21 <https://exikonomo2020.gov.gr/welcome>

Table 6: Quantitative information and trajectories of PaMs

PaM Number	Comprehensive PaM	Quant information if available	Comments
PaM#11, PaM#12	Waste management strategy plans	60% by 2030 recycling, and 10% < to landfills	National Waste Management Plan published in 2020
PaM#1	lignite phase-out, promoting RES in Greece's energy mix	Lignite PP decommissioning schedule by 2028, (Table 14 in NECP)	Master Plan for JT submitted in 2020
PaM#9, PaM#21	Energy efficiency of public buildings and exemplary role of public sector	(1) 3%/yr pursuant to Directive i.e. 5400m2 upgrading yearly, (2) by 31/12/2023 all public buildings to Energy Efficiency Grade B, (3) from 1/1/2021 all purchased/leased public buildings to be NZEB	
PaM#9, PaM#21	Upgrading of Buildings	60000/yr in NECP but In March 2021, a raise to 80000/yr was announced by the Ministry	Taking account of the funds mentioned in the NECP to be allocated for this task, the upgrading is not going to be substantial.
PaM#22	Replacement of polluting passenger vehicles and goods vehicles	(1) Construction of 8 LNG stations and 55 CNG vehicle depot supply stations, (2) BEV/PHEV registrations by year to 2030 given	(1) Construction of 1500 charging stations has been announced (2020) (2) financial incentives for BEVs and electric bicycles given in 2020 (200Mil from RRF)
PaM#6, PaM#18	Promoting electricity transmission, distribution and storage projects	Electricity DSO Grid 10-year rolling plan / Connection of all islands to the mainland grid by 2030 (schedule provided) including Crete by 2023	Progress of Cyclades islands Phases 1,2,3 completed, Phase 4 by 2023) and Crete (2023) on schedule
PaM#4, PaM#20	Promoting gas transmission, distribution and storage infrastructure projects	NG TSO Grid 10-year rolling plan	East Med NG pipeline, Alexandroupolis FSRU,
PaM#6, PaM#18	Promoting electricity transmission, distribution and storage projects	Island connection schedule - Electricity TSO Grid 10-year rolling plan	
PaM#4	Promoting infrastructure for the use of natural gas	New pier to supply (for their use) ships with LNG by end 2023	New facility to supply tanker trucks with LNG by end 2021
PaM#10, PaM#22	Transport - Electric vehicle	30% by 2030 = 9% of the fleet and 4% by 2027	
PaM#7, PaM#19	Transport - Biofuels	From 3% 2020 to 5% in 2030 For private vehicles / From 3% in 2020 to 7% use of biodiesel	
PaM#4, PaM#20	Industry	Decrease of use by 4% due to more NG +24% and biofuel +31%	
	Transport	Rail fully electric by 2030	
	Electricity and NG interconnectivity with neighbouring countries	Grid connection to BG -Maritsa operation by 2023	Israel-Cyprus-GR interconnection plan
	Research and Innovation	From 0.06% of GDP 2017 to 0.13% in 2030 for energy/env R&I	
	Energy Security	dependence to reach 75% from 78% and aim for 70% by 2030	

ministers that are either exaggerated in numbers or overoptimistic as regards the timetable.

Looking ahead, for Greece and most likely for several other MSs, the way the additional impressively large amounts of the RRF Green Transition Pillar are utilized is crucial as they are to be spent by 2026 well on the way to 2030. It is important for the Government to provide detailed information on the expectations of the investments to be made in reducing GHG emissions and conserving energy so as to provide the means for independent analysis and input. This goes hand-in-hand with the need to also provide detailed information on the enhancement of PaMs to meet the higher targets of the

European Green Deal. For both, it is crucial to consider the effect of COVID-19 to the economy and the large, temporary recession of 2020 of at least 8.4% in Greece by the latest (April 2021) estimates of the Bank of Greece²² and the rather weaker than previously thought recovery of 4.2% in 2022, or even lower to 3.5-4.0% or lower according to independent estimates.²³

²² <https://www.bankofgreece.gr/Publications/ekthdkth2020.pdf>

²³ http://iobe.gr/docs/economy/ECO_Q1_2021_REP_GR.pdf

Section 8: Some concluding remarks

The achievement of the ambitious triple targets of the EU by 2030 and on to full decarbonization by 2050 requires well thought out, fully documented as well as transparent plans together with a robust review mechanism to gauge progress, identify trouble spots and delays, and propose ways to deal with them. This dual task is covered by the NECPs and the review provisions of Regulation 2018/1999. The quantitative information to be provided includes the majority of parameters and KPIs for review of progress.

Although the review process of the Green Deal as laid out in Regulation 2018/1999 is deemed adequate provided that MSs meet fully and on time their reporting obligations, especially as regards the full quantitative information in its Annexes, in a spirit of “trust but verify” it is important that independent entities from the civil society including NGOs review both the NECPs themselves, but also the progress in their implementation and the functioning of the review process as laid out in Regulation 2018/1999.

As independent reviewers have usually limited resources, they should be spent mostly in reviewing the non-ETS sectors as the emissions from the ETS ones are adequately reported and verified. In particular, attention should be paid to those sectors or subsectors that will provide the major part of reductions but also to those that seem to contribute very small reductions or even increases. The latter sectors need to be scrutinized harder as they will be the ones that would need to have major reductions after 2030 to be brought to near zero by 2050.

For any in-depth evaluation, it is important that the information for the PaMs included in the NECP and submitted to the EEA portal should be further enriched especially as they are called upon to contribute more, in view of the increase of GHG reduction from >43% to 55%. In this respect, as Regulation 2018/1999 asks those agencies at MS level in charge of overseeing the realization of PaMs and the reporting to the EC be in place, that a working contact is made with these agencies. Through this contact, it is hoped that information requests will be facilitated but also areas identified in the independent review that need attention are brought up to assist the agencies in improving the results of PaMs.

In reviewing the actual progress as well as the projected trajectories, all available sources of data including the National Energy Balances and the GHG Inventories, the European Semester National Reforms Reports, EUROSTAT and other more specialized reports for the evolution of technologies and their cost should be used to facilitate the review of the efficacy of PaMs.

The first scheduled reviews at EU level include the assessment, in 2022, of the degree that the 20-20-20 by 2020 targets have

been met followed by the first review in 2023 of progress to 2030. Both reviews will be affected by the COVID-19 pandemic as the extraordinary circumstances in 2020 were responsible for reductions in energy consumption and overall economic output, effects that might extend into 2022 and possibly longer. This, together with the increased marquee targets, would require a revision of trajectories in the NECPs including new modelling runs. These should be based on updated inputs, especially those for RES technology costs, fuel and EUA allowance prices.

Looking further down the line, it is understood that, even though the NECPs for most parameters and their PAMs refer to the period to 2030, additionally they have to be compatible with the near zero target for 2050. This brings up the question of EU-wide convergence between MSs in several KPIs keeping in mind national circumstances including geography, climate, and the structure of the economy. How this has been taken into account in the NECPs and used in their projections should be examined especially for indices that refer to quality of life such as average dwelling area, average size of household and energy use, mass transit use and recycling.

The experience from both the submissions of NECPs and recently of the National Recovery and Resilience Plans has clearly shown a reluctance by some MSs and more surprisingly by the EC to release them despite numerous requests by NGOs. One wonders what has prevented the full release of these submissions despite insistent requests from NGOs based on the provisions of the Aarhus Convention. The EC should be encouraged to reverse its practice and provide prompt on-line access to the submissions.

A final point that should be made refers to the interrelations and cross-effects between PaMs in the NECPs and projects to be financed by all Community Funds of the Multiannual Finance Facility (i.e., Cohesion, ERDF, EAGF, EAFRD, REACT, LIFE, HORIZON, etc.) and in particular the Resilience and Recovery and the Just Transition Facilities. A significant portion of these funds is constrained to be used to contribute toward the Green Transition and in accord with “do no significant harm” to the environment. It is important to examine first that there is no double counting and second that the rest of the projects to be financed, do not support investments that would result in facilities that would lock-in technologies difficult to green on the road to 2050.

In closing, it is worth underlining once more, the importance of the independent review by civil society entities to assure progress to decarbonization at least as set out in the NECPs, to which it is hoped that this work will be of value.

References

- Braun, A. and W. Rid, 2017: "Energy consumption of an electric and an internal combustion passenger car. A comparative case study from real world data on the Erfurt circuit in Germany", *Transportation Research Procedia*, 27, 468-47, <https://doi.org/10.1016/j.trpro.2017.12.044>
- Brown, D., S. Sorrell and P. Kivimaa, 2019: "Worth the risk? An evaluation of alternative finance mechanisms for residential retrofit", *Energy Policy*, 128, 418-430.
- Economidou, M., Ringel, M., Valentova, M., Zancanella, P., Tsemekidi-Tzeiranaki, S., Zangheri, P., Paci, D., Serrenho, T., Palermo, V., and P. Bertoldi, 2020: "National Energy and Climate Plans for 2021-2030 under the EU Energy Union: Assessment of the Energy Efficiency Dimension", EUR 30487 EN, Publications Office of the European Union, Luxembourg, 2020, 978-92-76-27013-3, doi:10.2760/678371, JRC122862.
- EEA, 2018: "Guidelines for reporting PAMs EEA report under the MMR Directive 525 2013 Art 20", [https://cdr.eionet.europa.eu/help/mmr/MMR%20Article%2013%20Reporting%20Manual%20PaMs%20\(2018\).pdf](https://cdr.eionet.europa.eu/help/mmr/MMR%20Article%2013%20Reporting%20Manual%20PaMs%20(2018).pdf)
- EEA, 2019: "Overview of reported national policies and measures on climate change mitigation in Europe in 2019", Eionet Report - ETC/CME 5/2019 November 2019
https://cdr.eionet.europa.eu/Converters/run_conversion?file=/gr/eu/mmr/art04-13-14_lcds_pams_projections/pams/pams/envx0xsow/gr_mmr-pam_report.xml&conv=524&source=remote#pam2
- Georgopoulou, E., S. Mirasgedis, Y. Sarafidis, D. Lalas and N. Gakis, 2021: "Policy Brief #3: Mass improvements of energy efficiency in the Greek buildings", National Observatory of Athens Report (in Greek).
- IOBE, 2018: "The upgrading of the building stock as a fulcrum to improve the Greek economy", Institute of Economic and Industrial Research Report (in Greek), Athens http://iobe.gr/docs/research/RES_05_C_04122018_REP_GR.pdf
- LBRS, 2020: "Long-term Building Renovation Strategy of Cyprus", National Report (in Greek)
https://ec.europa.eu/energy/sites/ener/files/documents/cy_2020_ltrs.pdf
- Navigant, 2020: "Technical assistance in realisation of the 5th report on progress of renewable energy in the EU - Task 1-2". Service contract: ENER/C1/ 2019-478 [DOI 10.2833/325152]
- Tsemekidi-Tzeiranaki, S. Paci D., Cuniberti, B., Economidou M., and P. Bertoldi, 2020: "Analysis of the annual reports 2020 under the Energy Efficiency Directive", EUR 30517 EN, Publications Office of the European Union, Luxembourg, 2020, ISBN 978-92-76-27416-2 (online), doi:10.2760/180952 (online), JRC122742.

Annex: Deep dive in the Residential, Tertiary and Transport PaM of the Greek NCEP

Greece, in its NECP as mentioned in the main part of this paper lists under its 6 pillars of Emissions reduction, RES, Energy Efficiency, Energy Security, Internal Market, Research and Innovation plus a Pillar of particular importance for Greece covering the Tourism, Agriculture and Shipping sectors, over 55 Policy Priorities to be addressed by 169 Measures. In particular, in the Energy Efficiency pillar, 12 Policy Priorities with 47 Measures are listed of which 15 refer to building energy use upgrading and 8 to transport.

As an example of carrying out quantitative reviews of NECPs we focus on two aspects, those of building energy upgrades and of electrification of transport and investigate whether the respective outputs of PaMs as stated in the NECP, in the EEA platform and in other National submissions are consistent and accurate to the degree possible, with claimed reductions of GHG emissions.

Energy use and emissions in the Residential and Tertiary sectors

As the EU emblematic targets include, besides GHG reduction, also actual energy conservation, it is interesting to examine the claimed effectiveness of the relevant PaMs as reported in the NECP as well as in the EEA website.

In Table A-1 the final energy consumption in the residential and tertiary sectors from the NECP (Tables 39 and 40) is shown. Utilizing the emission factors from the National GHG Inventory as submitted annually to the UNFCCC Secretariat, the emissions by fuel used are also shown. In both sectors but especially in the residential, a large decrease in oil use is seen accompanied by an increase in NG and ambient energy (high efficiency heat pumps) utilization. The decrease in energy consumption in the residential sector is ca 5% but the reduction in emissions is much larger reaching 40%. Similarly, in the tertiary sector consumption increases by 12% but the emissions decrease by 25%.

The first point to be noted from the information in Table A.1 is the considerable difference of ca 14% in the residential sector FEC between the 2019 Energy Balance values and those for 2020 from the NECP which translates into a 9% difference in emissions. The major deviations are in Ambient energy (74%) and Bioenergy (31%) and in electricity use (15% but the largest in absolute terms of 2,624 GWh). In the tertiary sector, the difference is still there by much smaller (2%) for FEC and larg-

er (13%) for emissions amounts due to the different percentages of solar, biofuel and ambient which do not contribute to emissions.

A second look at Table A-1 reveals that the major contribution to the GHG reduction in both sectors is the switch from oil to other energy carriers (2,528ktCO₂ in residential and 133ktCO₂ in tertiary). It is of interest then to see whether this is consistent with the reductions claimed for PaMs in the NECP and the EEA portal that refer to these sectors, namely:

- 155 ktCO₂ from existing P#2 in Table 3, NG in the Residential sector
- 70 ktCO₂ from existing P#3 in Table 3, NG in the Tertiary sector
- 200 ktCO₂ from existing P#9 Table 3, Energy conservation in Residential/Tertiary sector
- 2,990 ktCO₂ from additional P#21 in Table 3, Further NG in Residential and Tertiary sectors (One should note that despite its title, NG is not even mentioned in the detailed description of planned interventions which are actually envisioned to include the upgrading of private and public buildings).

for a total of 3,315 ktCO₂. It is useful to try to reconcile this figure of 3,315 ktCO₂ with the much smaller reduction of 2,661 ktCO₂ shown in the NECP (Table A-1) as an example of checking the veracity of the claims in the scope of the NECP.

Now, in the NECP, a major measure is the energy upgrading of the building stock. Almost a quarter of the €43Billion investments by 2030 identified in the NECP are earmarked for energy efficiency projects (Table 44 of the NECP). In particular, the NECP calls for the upgrading of 60,000 buildings per year for all the 10 years to 2030 with an average expenditure of €15,000/dwelling.

According to the NECP (Annex) a previous building upgrading program (2011-2017) with a budget of €530Million of which €430Mill were grants, resulted in 8,93GWh annual savings from the 51,732 dwellings upgraded with a total floor area of 5.2Mm². This corresponds to €10,259/dwelling and annual savings of 172 kWh/m² or 1.68 kWh per euro invested. Recently (March 2021), the number has been upped by another 20,000 to be financed by the Greek Recovery and Resilience Fund to the tune of €1,081Million in grants which might reach

Table A.1: Consumption and emissions in the Residential and Tertiary sectors

NECP	Final Energy Consumption (GWh)							GHG Emissions (ktCO ₂)						
	2019	2020	2023	2025	2027	2030	Δ30-20	2019	2020	2023	2025	2027	2030	Δ30-20
Residential														
Oil	13415	14654	11142	7862	6641	5036	-9618	3549	3852	2928	2066	1745	1324	-2528
NG	4471	5024	5466	7187	7606	7827	2803	897	1008	1096	1441	1525	1570	562
Electricity	17378	19992	20073	20283	20108	20329	337		0	0	0	0	0	0
District heating	612	500	500	477	465	454	-47		0	0	0	0	0	0
Bioenergy	7378	9653	9711	9804	9781	10002	349	2860	3734	3756	3792	3783	3869	135
Solar	3184	3268	3303	3349	3466	4385	1116							0
Ambient & geoth	841	1465	2780	3140	3454	3908	2442							0
Solid	66	4					-4	16	0	0	0	0	0	0
Total	47871	54556	52975	52102	51521	51940	-2617	4461	4859	4025	3508	3271	2893	-1966
Tertiary														
Oil	1463	1849	1791	1593	1465	1303	-547	361	449	449	434	386	355	-133
NG	1778	1896	2326	2535	2512	2489	593	373	380	380	467	508	504	119
Electricity	17915	17922	17747	17689	17771	17899	-23		0	0	0	0	0	0
District heating	0	0	0	0	0	0	0		0	0	0	0	0	0
Bioenergy	297	105	105	93	93	128	23	60	22	22	22	20	20	5
Solar	123	174	221	279	326	395	221		0	0	0	0	0	0
Ambient & geoth	3247	3373	3873	4919	5454	6292	2919		0	0	0	0	0	0
Solid	0	0	0	0	0	0	0		0	0	0	0	0	0
Total	24836	25319	26063	27110	27621	28505	3187	734	829	829	901	895	859	-14

€1,650Million to €1,890Million if a private contribution of 35-50% is included. The funding mentioned translates to ca €13,500 to 15,000/dwelling.

As the early upgrades could be viewed as picking the low hanging fruit, the Ministry of Environment and Energy (MoEE) commissioned a study in 2017 (IOBE, 2018) which found lower numbers of annual savings per unit (euro) invested namely ca 1kWh/euro for residential, 1.2kWh/euro for commercial and 1.5kWh/euro for public buildings. Deep renovation (i.e., over 60% reduction of energy use) might call for higher expenditures per dwelling, that is of the order of 260-580euro/m² (Brown et al., 2019, LBRS; 2020) which is to be compared to 174euro/m² that the current amount of 15,000/dwelling represents.

In view of the above, the 60,000 buildings per year at

€15,000/dwelling would result at 1.05kWh/euro (to account for upgrading of mixed residential-tertiary use buildings) into a 9,450 GWh annual energy savings in 2030. This would imply an estimated FEC without PaMs of at least 61,400GWh which would bring the annual consumption per household from 1.15toe/hh to 1.3toe/hh, a value close to the current EU average. It should be noted though that the actual energy demand, even for the upgraded buildings, might be higher as recent analyses point out (Georgopoulou et al., 2021), due to the combination of high levels of energy poverty in Greece and the rebound effect.

As the energy conservation from the building upgrades has been estimated at 9.450GWh, the consumption in 2030 without energy conservation and additional measures would have been 61,390GWh (54.556GWh plus 9.450GWh), thus:

Table A.2: Consumption and emissions in the Transport sector

NECP	Final Energy Consumption (GWh)							GHG Emissions (ktCO ₂)						
	2019	2020	2023	2025	2027	2030	Δ30-20	2019	2020	2023	2025	2027	2030	Δ30-20
Oil	67756	78188	79200	78851	77816	74886	-3303	17879,55	20632	20899	20807	20534	19761	-872
Bioenergy	2148	2652	2768	3291	3338	4315	1663	532,81	658	687	816	828	1070	413
NG	209	326	372	488	663	1186	861	42	65	75	98	133	238	173
Electricity	198	209	326	675	1000	1791	1582	0	0	0	0	0	0	0
Total	70311	81375	82666	83306	82817	82178	802	17921	20698	20974	20905	20667	19999	-699

- Without energy conservation or fuel switching or enhanced ambient energy the resulting emissions would have been 5,473 ktCO₂
- With the reduction due to energy conservation resulting in FEC of 51,940 GWh, but with no fuel switching or enhanced ambient energy use, the emissions would have been 4,630 ktCO₂ (i.e., a reduction of 843 ktCO₂)
- With energy conservation and fuel switching but no enhanced ambient use, the emissions would have been 3,419ktCO₂ (i.e., an additional reduction of 1,490 ktCO₂)
- With energy conservation and with both fuel switching and enhanced ambient use added the emissions would have been 2,895 ktCO₂ (i.e., a further reduction of 793 ktCO₂).

for a total reduction of 2,578 ktCO₂.

Similarly, in the tertiary sector the NECP includes (Table 40) a 15% increase in the energy consumption of 3,186 GWh leading to 28,505 GWh, thus:

- Without fuel switching or enhanced ambient energy the resulting emissions would have been 933 ktCO₂
- With fuel switching but no enhanced ambient use, the emissions would have been 898 ktCO₂ (i.e., a reduction of 35 ktCO₂)
- With energy conservation and with both fuel switching and enhanced ambient use added the emissions would have been 815 ktCO₂ (i.e., a further reduction of 83 ktCO₂).

for a total reduction of 118 ktCO₂.

This reduction of 118 ktCO₂ added to the 2,578 ktCO₂ reduction from the residential sector would still not match the 3,315 ktCO₂ claimed reduction, which indicates that the reductions claimed in the EEA submission are overestimated by ca 20%.

The previous considerations point out the importance of mon-

itoring progress in both ambient energy use and switching from oil to NG (via sales of equipment) as well as the number of buildings upgraded (by requesting from the funding agencies the publication of inductions to the program, the number of buildings upgraded, the amount expended and the results of ex-post energy savings including the new energy consumption audit and thus the estimated GHG reduction).

Electrification of transport

The FEC and the GHG emissions from the Transport sector taken from the NECP are shown in Table A-2. Before looking at the PaMs addressed to this sector, it is interesting to note that the total FEC in transport, remains almost constant in the 2020-2030 decade despite a stated increase in passenger-kms of over 9% (Figure 44 of NECP). It is dominated by oil use (over 96% in 2020 down to 91% in 2030). The 5% difference is covered by increases in all three other carriers (NG, Biofuel and NG). Table A-2 also shows a large discrepancy in FEC between the 2020 NECP values of 81,375 GWh and the 2019 actual National Energy Balance value of 70,333 GWh (6046ktoe) which is too large a difference to be ignored. The overall GHG reduction is ca 3% despite the 1% increase in energy use and is due to a two-fold increase of biofuel, and a nine-fold increase in electricity use.

The GHG reduction claimed from the PaMs aimed at the Transport sector in the EEA portal are:

- 25 ktCO₂ from existing P#5 (NG promotion)
- 429 ktCO₂ from additional P#19 (further Biofuel use)
- 190 ktCO₂ from additional P#22 (Road transport measures)

In the NECP itself a number of PaMs are laid out in the Energy Efficiency Pillar (Measures #41 to #45 addressing Priorities PP1.1, PP1.3, PP1.9, PP3.7 and PP3.8). Of those, M#41, M#43 and M#45 are regulatory in nature, M#42 aims at increas-

ing the use of alternative fuels and the number of BEVs and PHEVs and M#44 at replacing older passenger and light duty vehicles with newer, low emissions ones.

Focusing on the PaM to increase the percentage of BEVs in the vehicle fleet (M#44), in Table 17 of the NECP a year-by-year list of the new registrations with a target of 30% of registrations in 2030 to be BEV-PHEV is given which would lead to a disappointing ca 9% of the total fleet in 2030. This makes it easy to monitor progress in BEV-PHEV registration but also the tabling of legislative measures for tax incentives to do so.

The difference in electricity use in road vehicles between 2020 and 2030 is 1,582 GWh. As this would replace oil and NG use, and in view of the 3-fold higher efficiency of BEVs compared to internal combustion vehicles (22kWh/100km vs 68kWh/100km, see Braun and Rid, 2017), it would have resulted in a net reduction of 985 ktCO₂ (1,289 ktCO₂ generated from the additional oil use minus 304 ktCO₂ from emissions saved from electricity used if generated with the 2030 production mix, namely 0.192ktCO₂/GWh). This is much higher than the 190 ktCO₂ claimed for P#22 in Table 3, where though to be fair in P#22 it is mentioned that additional PaMs are included in the NECP.

It should also be noted that there is a discrepancy between the amount in total FEC of 6,997ktoe in 2020 in the NECP and

the 6,046ktoe in the 2019 Energy Balance. This is more worrisome since the amount for road transport shown in Figure 43 in the NECP (5,150 ktoe) matches the amount in the 2019 Energy Balance (5,177 ktoe).

To accelerate the introduction of BEVs and PHEVs, a necessary condition, besides more generous tax incentives, is the installation of sufficient public charging points which is a main target of M#43. Greece currently has ca 6500 fueling stations (1 per 1,690 inhabitants, more than double the EU average of 1 per 3,800). It is then important to monitor the installation rate of the electric charging stations in the near term rather than progress in registrations although registrations of especially PHEVs may be of higher importance as they are already making inroads in Greece.

Turning to the increase in biofuel use, from Table A-2 the additional amount by 2030 is seen to be 1,663GWh. If this were to replace oil and NG use, it would result in a reduction of 430ktCO₂ which matches the one claimed in P#19. Here, the parameter to check is the biofuel used which is included explicitly in the annual Energy Balances and monthly in the EUROSTAT data base.

Finally, it is unfortunate that no targets are included for the softer PaMs of mode switching and passenger-km/ton-km reduction and consequently no data are available to review.



Agiou Isidorou 1, 11471 AThens, Greece • T.: +30 210 3613135, +30 2103613137
F: +30 210 3613136 • E: info@facets.gr, lalas@facets.gr