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JRC TECHNICAL REPORT

Global Covenant of Mayors in the Middle East and North Africa (MENA) region: how to set the 2030 emission reduction targets according to the Nationally Determined Contributions

A Business as Usual Emission Scenario Approach

Lo Vullo, E., Palermo V., Rivas, S., Monforti-Ferrario, F., Bertoldi, P.

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Joint Research Centre

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Contact information
Email: JRC-COM-TECHNICAL-HELPDESK@ec.europa.eu

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Authors

Eleonora Lo Vullo, Valentina Palermo, Silvia Rivas, Fabio Monforti-Ferrario and Paolo Bertoldi.

Abstract

The Regional Covenant of Mayors for Mediterranean (CoM Med) is an alliance of local municipalities from the Middle East and North Africa (MENA) region, supporting cities committed to develop a climate resilient society. The CoM Med, supported by the European Commission, is part of the Global Covenant of Mayors (GCoM), the largest coalition of cities fighting against climate change. The JRC provides scientific and technical assistance to eight of the countries signing the CoM Med: Algeria, Egypt, Israel, Jordan, Lebanon, Morocco, Palestine and Tunisia. Based on the GCoM Common Reporting Framework, local governments are invited to develop a Sustainable Energy Access and Climate Action Plan (SEACAP), stating the climate and energy objectives they intend to achieve and the actions they will implement. With respect to the mitigation targets, the GCoM Common Reporting Framework requires the municipalities to set the local GHG emissions reduction objectives according to their Nationally Determined Contributions (NDCs). The present report provides a summary of the NDCs for the MENA countries, including the mitigation sectors, the unconditional and conditional mitigation targets, the target year and the base year. In addition, the report presents a brief overview of the main national energy policies, to give a general picture of the contexts where the local climate plans will be implemented. Finally the report shows a methodology to calculate the local commitments to a reduction of GHG emissions with reference to a national Business As Usual (BAU) emission scenario. Based on the national BAU projection reported in the NDCs, the JRC has developed a methodology to estimate the maximum GHG emissions allowed in the target year 2030.

1 Introduction

The Global Covenant of Mayors for Climate & Energy (GCoM) is the world's largest alliance of cities and local governments supporting voluntary action to fight climate change and promoting a low emission, climate resilient society. In the context of GCoM initiative, the EU-JRC plays an important role providing scientific and technical support to the Regional Covenants[1]. The JRC mission is to ensure an effective implementation of the GCoM vision that is in line with the regionally relevant frameworks and the national priorities.

The Covenant of Mayors Mediterranean (CoM Med) covers nineteen countries in the Middle East and North Africa region: Algeria, Egypt, Israel, Jordan, Lebanon, Libya[2], Morocco, Palestine, Syria and Tunisia, as well as the neighbors of neighbors, namely Bahrain, Iran, Iraq, Kuwait, Oman, Qatar, Saudi Arabia, United Arab Emirates and Yemen. The Middle East and North Africa (MENA) region is likely to face serious social, economic and environmental impacts from global warming deserving special attention as one of the world's most vulnerable regions to climate change (Mahlooji et al. 2020). Since 2012 the JRC has been supporting the MENA region, providing scientific and technical assistance for the implementation of the local climate plans (Rivas et al. 2018; Gabrielaitiene et al. 2014).

According to the GCoM Common Reporting Framework[3] the local governments are required to develop a Sustainable Energy Access and Climate Action Plan (SEACAP), setting the GHG emissions reduction parameters (target type, ambition, target year and base year) in accordance with their Nationally Determined Contributions (NDCs)[4]. The mitigation actions in the MENA region cover essentially the energy and waste sectors, meanwhile Agriculture, Forestry and Other Land Use (AFOLU) is included only for the municipalities with a strong rural character (Communication from CoM Med Office, 2021).

The present report provides (1) a general overview of the NDCs for the MENA countries, (2) a methodology to calculate the commitment to a reduction of GHG emissions with reference to a Business As Usual (BAU) emission scenario.

A Business As Usual (BAU) emission scenario is the target type usually recommended for countries that are facing societal and economic challenges, in fact a BAU approach allows the cities to fulfil their aspiration for further development, by including social and economic progress in the calculation of the emissions projections (Cerutti et al. 2017).

The JRC has developed a methodology to estimate the GHG emissions in the target year, based on the national BAU projection reported in the NDCs. A new set of NDC-BAU coefficients ($K_{NDC-BAU}$) has been prepared in order to enable the cities calculating the maximum GHG emissions allowed in the target year. The methodology does not apply to Algeria and Egypt, since, no detailed data are available in their NDCs and a different BAU scenario has been used.

The chapter 2 describes the national mitigation targets for the eight MENA countries as reported in the NDC, in order to give a general picture of the national contexts within which the local climate plans should be embedded.

The chapter 3 presents the methodology adopted to calculate the NDC-BAU coefficients for Israel, Jordan, Lebanon, Morocco, Palestine and Tunisia.

The chapter 4 reports the BAU methodology and BAU coefficients for Egypt and Algeria.

Annex 1 presents the NDC-BAU coefficients.

Annex 2 shows an example of how to use the NDC targets and the NDC-BAU coefficients.

1 A Regional Covenant are locally specific coalitions of cities that have all made a commitment to take action on climate change – through the Global Covenant of Mayors for Climate & Energy

2 Collaboration with Syria and Libya is currently postponed .

3 https://www.globalcovenantofmayors.org/our-initiatives/data4cities/common-global-reporting-framework/

4 See the UNFCCC NDC registry https://www4.unfccc.int/sites/NDCtaging/Pages/All.aspx

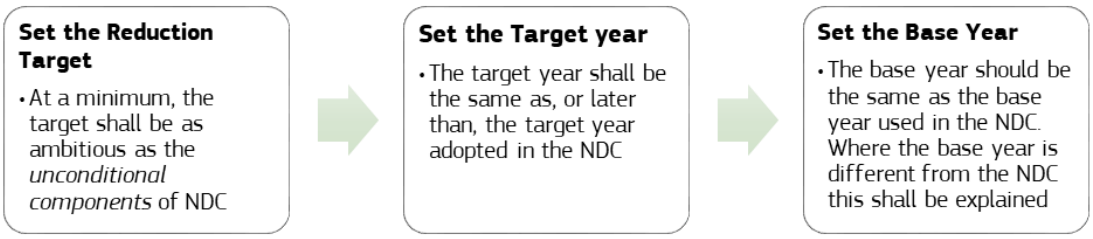
2 Setting the reduction parameters in the MENA region according to the NDC

The MENA region is characterized by an unstainable increase in energy demand, driven by economic development, industrialization, population growth, and increasing needs for water desalination and air conditioning (Gaies et al. 2019). Energy consumption in the region is projected to almost double by 2040, meanwhile the region has to face the challenge of addressing their high vulnerability to climate change, which has a strong social dimension (Waha et al. 2017).

The MENA countries have set ambitious targets for the deployment of renewables and the power sector is set to undergo the most important change in the countries' energy plans. Energy policy goals in these countries are characterized by expanding the deployment of renewable energy technologies in the electricity mix in the medium term (Zelt et al. 2019).

The GCoM Common Reporting Framework (CRF) requires that all local governments and cities in the MENA region set urban/regional emissions reduction parameters according to their Nationally Determined Contributions (NDCs). Figure 1 shows how the municipalities should set the mitigation parameters in the local climate plans to be in line with their national frameworks and to demonstrate their contribution to achieving the NDCs. The reduction targets adopted by local governments should be as ambitious as the unconditional[5] components of the NDCs and in addition also the target year and the base year should be the same as those used in the NDCs. The municipalities are also encouraged to go further beyond the NDCs, providing a higher level of ambitions.

Figure 1: How to set the reduction parameters in the climate plans according with the NDCs



Source: JRC elaboration, 2021

Table 1 provides a brief overview of MENA countries 'NDCs including the mitigation sectors, the unconditional and conditional mitigation target, the target year and base year. Almost of all the countries set 2030 as target year, except Palestine which adopted the 2040. The sectors targeted are mainly the electricity production, the industrial and waste activities, and the residential and transport sectors. In Box 1 are reported the main energy policies for some of the MENA countries.

5 An "unconditional contribution" is what countries could implement based on their own resources. A "conditional contribution" is one that countries would undertake if international means of support are provided

Box 1. National Energy Policies

Morocco under the National Energy Strategy of 2009 (updated version of 2015) set to install renewables-based capacity in the electricity sector with an increase from 34% in 2015 to 52% by 2030 (20% wind, 20% solar, 12% hydro).

Jordan under the National Master Strategy of the Energy Sector (2007–2020) as well as the National Strategy for the Development of Renewable Resources has established that 20% of electricity generation is to be based on renewable energy technologies (solar and wind) by 2025.

Tunisia under Tunisian Renewable Energy Action Plan 2030 set renewables as part of the installed capacity for electricity generation to increase from 2% to 30% by 2030 (15% wind, 10% Photovoltaic (PV) and 5% Concentrating Solar Power

Egypt under the Integrated Sustainable Energy Strategy to 2035, released in 2015, has established that renewable energy capacity should contribute 42% of power capacity by 2035

Lebanon set out a national action plans to scale up renewables and improve energy efficiency in 2016-2020 with an initial target of 12% of primary energy consumption. More recent plans have raised the target to 30% renewable energy consumption, spanning both electricity and heat demand, by 2030.

Israel set out the National Plan for Implementation of the Greenhouse Gas Emissions Reduction Targets and for Energy Efficiency with the goal to achieve a 10 % target for electricity generation from renewables by 2020. Lately the Israeli cabinet has approved the proposal of the Ministry of Energy to set a new 30% renewable energy goal to be achieved by 2030.

Table 1. Mitigation Target parameters reported in the National Determined Contribution for the eight countries in the MENA region

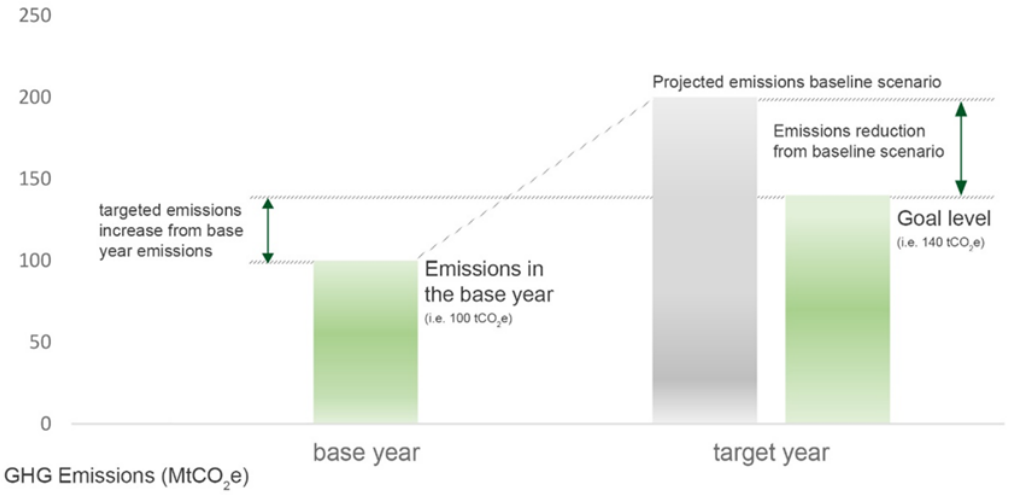
Mitigation Target NDC	Tunisia	Morocco	Lebanon	Jordan	Palestine	Israel	Algeria	Egypt
Unconditional Reduction Target	13%	13% without AFOLU, 17% with AFOLU	15%	1.5%	12.8%	26%	7%	not reported
Conditional Reduction Target	41%	34% without AFOLU; 42% with AFOLU	30%	12.5%	24.4%	not reported	22%	not reported
Target Year	2030	2030	2030	2030	2040	2030	2030	2030
Base Year	2010	2010	2011	2006	2010	2005	2013	not reported
Target Type	% decrease in carbon intensity compared to the base year	BAU	BAU	BAU	BAU	% decrease in GHG per capita	BAU	not reported
Gas covered	CO_2, CH_4 and N_2O	CO_2, CH_4 and N_2O	CO_2, CH_4 and N_2O	CO_2; CH_4; N_2O; SF_6; PFCs; HFCs.	CO_2, CH_4 and N_2O	CO_2, CH_4, (N_2O), HFCs, PFCs, SF_6	CO_2, CH_4 and N_2O	not reported
Sectors covered	Energy; industrial processes; agriculture, forestry and other land use (AFOLU); waste	Electricity production Housing (residential and tertiary) Agriculture Industry Transportation Waste Forestry	Energy, industrial processes and other product use, agriculture, land-use, land-use change and forestry, and waste	Energy (including transport), waste, industrial processes, agriculture and land-use, land-use change and forestry (LULUCF) and solvents.	Energy; industrial processes and product use; agriculture, forestry and other land use; waste.	Electricity generation, other energy sources, transportation, industrial processes, buildings, waste and agriculture	Energy (Generation, Transport, Building and Industry); Industrial processes; Agriculture, Forests, Land use and Waste.	not reported

Source: UNFCCC NDC registry, 2021

3 NDC-BAU Methodology

The recommended methodology to be applied for municipalities experiencing or expecting economic and population growth, like the countries in the MENA region, is to set a final GHG emissions reduction target assuming a Business As Usual (BAU) emission scenario. A BAU scenario, also indicated as baseline scenario, is a reference case that represents future events or conditions most likely to occur in the absence of measures and policies to influence or control the GHG emissions. The municipalities will estimate the emissions in their base year and then could set a GHG emissions reduction against the projected emissions in the target year (Figure 2).

Figure 2: The BAU scenario describes future emissions levels in the absence of future additional mitigation policies



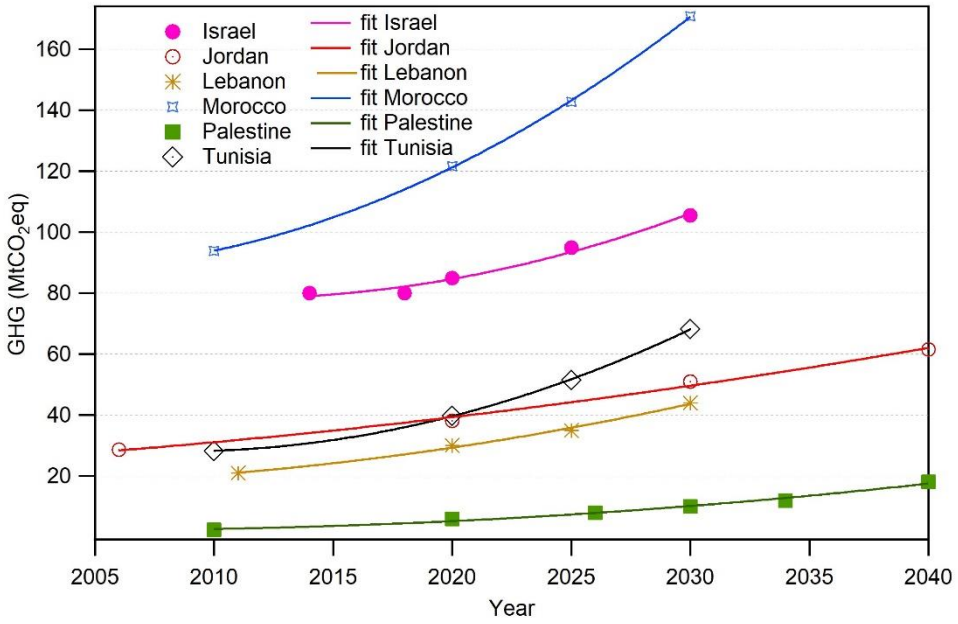
Source: JRC elaboration, 2021

Figure 3 reports the GHG emissions ($MtCO_2eq$) determined in the NDCs and the estimated fitting curves for Tunisia, Morocco, Lebanon, Palestine, Jordan and Israel, meanwhile no data were found for Egypt and Algeria. For those last countries a different approach has been used (see Chapter 4).

When using a baseline scenario targets, local governments should develop BAU scenarios using local-specific parameters, such as growth rates of local population, economy, sector-specific factors that drive emissions to change. The municipalities in the MENA region, in the absence of local specific parameters, decided to adopt a simplified approach using national coefficients derived from national NDC BAU scenarios. In this way the mitigation target will also adequately reflect the city's contribution to the climate goals committed at national level.

- The National BAU scenarios reported in the NDCs have been used for calculating the maximum GHG emissions allowed in the target year respect to the base year.
- The NDC-BAU coefficients (KN_{DC-BAU}) and an example on how to use them, are respectively reported in the Annex 1 and Annex 2.
- The methodology does not apply to Algeria and Egypt, since no detailed data are available in their NDC and a different BAU scenario has been utilized (see Chapter 4).

Figure 3. GHGs Emissions (Mt CO_2eq) and fitting curves for CoM South Countries



Source: JRC elaboration, 2021

Based on the fitting curves, it is possible to calculate the 2030 NDC-BAU coefficients as the ratio of GHG emissions expected in 2030 and the GHG emissions in each specific year. As an example of the applied methodology, Table 3 shows the estimated NDC-BAU coefficients for Jordan in the period 2019-2030.

Table 2. Fitting data and NDC-BAU coefficients for Jordan in the period 2019-2030

Base Year	Estimated NDC BAU GHG (MtCO2eq)	NDC BAU Coefficients 2030
2019	38.41	1.26
2020	39.19	1.24
2021	40.14	1.21
2022	41.12	1.18
2023	42.12	1.15
2024	42.29	1.14
2025	43.15	1.12
2026	44.19	1.10
2027	45.26	1.07
2028	46.17	1.05
2029	47.27	1.02
2030	48.40	1.00

Source: JRC Elaboration, 2021

In Jordan, some of the municipalities will use 2019 as base year in their local plan and 2030 as target year (Table 2). In order to determine the 2030 NDC-BAU coefficients, the ratio between the GHG emissions forecast in 2030 (48.40 $MtCO_2$eq) and the GHG emissions in 2018 (38.41 $MtCO_2$eq) has been calculated.

At national level, in Jordan the GHGs emissions in 2030 are projected to be around 1.3 times higher than in 2019 and the same ratio will be applied at local level using the Equation 1. Among the six countries studied and taken 2019 as base year, Palestine shows the largest GHG increase in 2030, with a coefficients of 2.07. On the other side, Israel and Jordan present the lowest values with 1.25 and 1.26 respectively.

The NDC-BAU coefficients ($K_{NDC-BAU}$) indicate the relative projected increase in GHG emissions between the base year and the target year.

In operative terms, in order to obtain the GHG emissions foreseen for the target year, the emission in the base year has to be multiplied by the national coefficients $K_{NDC-BAU}$ according to the following the Equation 1:

(Eq.1) **GHG Emissions (target year) = GHG Emissions (base year) * $K_{NDC-BAU}$**

Before using the BAU national coefficient, the signatories should check that the target year chosen in their Sustainable Energy Access and Climate Action Plans (SEACAPs) is consistent with the year reported in the NDCs.

Cities in the MENA region report the GHG emissions in the energy and waste sectors but they do not cover the industrial and agriculture sectors (Table 2). Emissions from AFOLU could be included only in municipalities with a strong rural character, where the agricultural component is relevant. Finally, only CO_2 and CH_4 are reported and N_2O is not included.

To verify that the NDC-BAU coefficients can still adequately fit the local level, the JRC EDGAR[6] dataset was used (Crippa et al. 2019). Based on temporal profiles in EDGAR and referring to the base year reported in the NDCs (Table 1), it has been estimated that for all the MENA countries in this study, the energy and waste sectors account for more than 80% of the total nationally GHG emissions. Furthermore, the contribution of N_2O in the energy and waste sectors is negligible, representing around the 1% of the total emissions.

For the purpose of this study, it is reasonable to affirm that the NDC-BAU coefficients can still represent a valid tool for calculating the GHG value emitted locally in the target year.

Table 3. Local mitigation targets, gas and sectors covered in the Sustainable Energy Access and Climate Action Plans for the MENA countries

	Tunisia	**Morocco**	**Lebanon**	**Jordan**	**Palestine**	**Israel**	**Algeria**	**Egypt**
Target year	2030	2030	2030	2030	2030	2030	2030	2030
Target Type	BAU	BAU	BAU	BAU	BAU	BAU	BAU	BAU
Base year	2010, 2019	2010, 2019	2015, 2018, 2019	2018, 2019	2018, 2019	2017, 2018, 2019	Not reported	2018, 2019
Gas covered	CO_2, CH_4	CO_2, CH_4	CO_2, CH_4	CO_2, CH_4	CO_2, CH_4	CO_2, CH_4,	CO_2, CH_4,	CO_2, CH_4
Sectors covered	Energy and waste	Energy and waste	Energy and waste	Energy and waste	Energy and waste	Energy and waste	Energy and waste	Energy waste and agriculture

Source: Communication from CoM Med Office, 2021

6 EDGAR - EDGAR v5.0 Global Greenhouse Gas Emissions - European Commission (europa.eu)

4 Egypt and Algeria BAU coefficients

Egypt and Algeria did not provide their NDCs the necessary data for using the methodology described in the previous paragraph. Instead, the 2020 GECO Reference scenario named "New Normal"(Keramidas et al. 2021) has been used to calculate the national BAU coefficients.

This reference scenario represents a perspective on energy supply and demand in a baseline case. Provided no supportive action is taken, the baseline scenario is the case that potentially would occur given current market and policy developments.

The 2020 GECO reference scenario corresponds to a world where currently existing policies for GHG emissions, renewables deployment and energy efficiency are carried out and where no additional policies are implemented compared to what had been legislated as of June 2019.

For the MENA region the GECO Reference scenario[7] singles out only the large economies like Egypt, meanwhile Algeria and Libya are reported as aggregated. For Algeria as gross proxy to projections, EDGAR historical emissions have been used, assuming that the share of a country within the MENA region would be the same in the future.

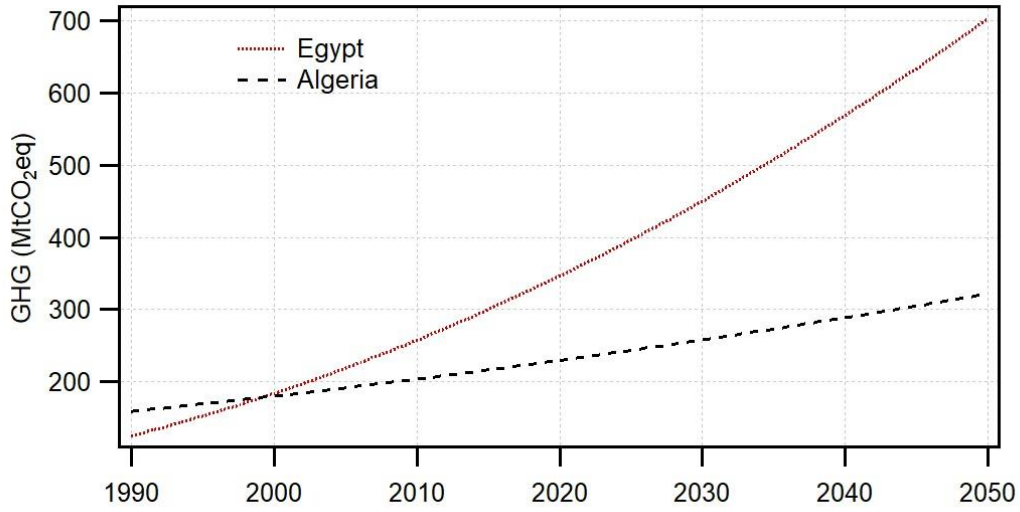
The GHG emissions (CO_2 and CH_4) have been estimated using the 2020 GECO reference scenario under the assumptions that:

- no additional policies are implemented compared to what was legislated as of the end of 2019;
- energy and emissions projections are driven by market forces and technological learning;
- it does not pursue the policies put forward in the NDCs.

Figure 4 shows the CO_2 and CH_4 emissions under the 2020 GECO reference scenario for Egypt (in red) and for Algeria (in black). According to the 2020 GECO reference scenario, Egypt and Algeria will increase their emissions respectively by 37% and by 23% in 2030 compared to 2020.

After computing the trajectories shown in Figure 4, K_{BAU} coefficients have been computed for Algeria and Egypt in strict analogy with the coefficients for other MENA countries as explained in Paragraph 3.2

Figure 4: 1990-2050 GHG emissions ($MtCO_2eq$) for Egypt (red line) and Algeria (black line) under the 2020 GECO reference scenario



Source: JRC elaboration, 2021

7 JRC Data Catalogue - European Commission (europa.eu)

5 Conclusions

The Covenant of Mayors for the Mediterranean is a voluntary based initiative that under the EU umbrella, brings together and supports cities from MENA region in their fight against climate change. The local governments are requested to define in their climate plans the GHG reduction targets in line with the Global Covenant of Mayors (GCoM) requirements and their National Determined Contributions (NDCs).

The current report has presented and discussed the NDCs for Algeria, Egypt, Israel, Jordan, Lebanon, Morocco, Palestine and Tunisia, explaining how to set the reduction parameters in the local climate plans according with the NDCs (Chapter 2). Almost of all the countries set 2030 as target year, except Palestine which adopted the 2040. The sectors targeted at national level are mainly the electricity production, the industrial and waste activities, and the residential and transport sectors. The MENA countries have set ambitious mitigation targets in their climate plans, where the power sector plays a key role. A general overview of the main national energy policies has been reported to give a general picture of the national contexts within which the local climate plans will be implemented (Box 1).

Municipalities in the MENA region set a GHG emissions reduction target assuming a Business As Usual (BAU) emission scenario, a reference case that represents future conditions most likely to occur in the absence of measures to control the GHG emissions. The municipalities have to estimate the emissions in their base year and then set a GHG emissions reduction against the projected emissions in the target year. The National BAU scenarios reported in the NDCs have been used to enable the municipalities to estimate the maximum GHG emissions allowed in the target year 2030 respect to the base year (Chapter 3). For each countries NDC-BAU coefficients have been reported (Annex 1) and it has been explained how to apply them (Eq.1). Among all the countries studied and taken 2019 as base year, Palestine shows the largest GHG increase in 2030, with a coefficient equal to 2.07, meanwhile Algeria presents the lowest value with a coefficient of 1.13.

At local level the municipalities report the GHG emissions in the energy and waste sectors but they do not cover the industrial and agriculture sectors, meanwhile Agriculture, Forestry and Other Land Use (AFOLU) is included only for the municipalities with a strong rural character. In order to verify the consistency between the local plans and the NDCs, the JRC EDGAR dataset has been used. It has been estimated that for all the MENA countries in this study the energy and waste sectors account for more than 80% of the total nationally GHG emissions.

The methodology NDC-based does not apply to Algeria and Egypt and for those last countries the 2020 GECO Reference scenario has been used to calculate the national BAU coefficients (Chapter 4). The 2020 GECO reference scenario corresponds to a world where currently existing policies for GHG emissions, renewables deployment and energy efficiency are carried out and where no additional policies are implemented compared to what had been legislated as of June 2019.

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List of abbreviations and definitions

AFOLU Agriculture, Forestry and Other Land Use

BAU Business As Usual

CoM Med Covenant of Mayors for Mediterranean

CRF Common Reporting Framework

EDGAR Emission Database for Global Atmospheric Research

EU European Union

GCoM Global Covenant of Mayors for Climate & Energy

HFCs Hydrofluorocarbons

NDCs Nationally Determined Contributions

MENA Middle East and North Africa

PFCs Perfluorocarbons

SEACAPs Sustainable Energy Access and Climate Action Plans

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Annex 1. BAU coefficients for estimating GHGs (CO_2-eq) in the target year

BAU Coefficients 2030								
Base Year	**Israel**	**Jordan**	**Lebanon**	**Morocco**	**Tunisia**	**Palestine**	**Algeria**	**Egypt**
2010		1.56		1.82	2.41	4.02	1.26	1.73
2011		1.52	2.07	1.75	2.34	3.60	1.25	1.69
2012		1.49	1.94	1.71	2.28	3.40	1.23	1.62
2013		1.46	1.87	1.67	2.22	3.17	1.22	1.58
2014		1.42	1.81	1.63	2.14	2.95	1.21	1.54
2015	1.32	1.39	1.74	1.59	2.07	2.77	1.19	1.49
2016	1.31	1.35	1.68	1.54	1.98	2.57	1.18	1.45
2017	1.29	1.32	1.61	1.50	1.90	2.38	1.16	1.41
2018	1.27	1.29	1.55	1.45	1.81	2.23	1.15	1.36
2019	1.25	1.26	1.49	1.41	1.72	2.07	1.13	1.33
2020	1.23	1.24	1.43	1.36	1.64	1.94	1.12	1.30
2021	1.21	1.21	1.38	1.32	1.55	1.80	1.11	1.25
2022	1.19	1.18	1.32	1.28	1.47	1.67	1.10	1.22
2023	1.16	1.15	1.27	1.23	1.39	1.57	1.08	1.19
2024	1.14	1.14	1.22	1.19	1.32	1.46	1.08	1.16
2025	1.11	1.12	1.17	1.15	1.25	1.36	1.06	1.13
2026	1.08	1.10	1.13	1.11	1.18	1.29	1.05	1.10
2027	1.06	1.07	1.08	1.07	1.12	1.20	1.03	1.07
2028	1.03	1.05	1.04	1.04	1.06	1.13	1.02	1.05
2029	1.00	1.02	1.00	1.00	1.01	1.07	1.01	1.02

Annex 2. How to use the NDC-BAU coefficients in the local climate plans

Reduction Parameters	Tunisia	Lebanon
Reduction Target	At least 13%	At least 15%
Target Year	2030	2030
Base Year	2016	2016
Gas covered	CO_2, CH_4	CO_2, CH_4
Sectors covered	Energy and waste	Energy and waste
GHG emissions in the base year	100 $MtCO_2eq$(*)	100 $MtCO_2eq$ (*)
BAU National Coefficients	1.98	1.68
Emissions foreseen in the target year	(100*1.98.)=198 $MtCO_2eq$	(100*1.68)=168 Mt CO2eq
Minimum amount of GHG reduction requested	13% (198) = 25.74 $MtCO_2eq$	15% (168) = 25.20 $MtCO_2eq$
Maximum GHG (Mt CO2eq) emissions in the target year	172.26 $MtCO_2eq$	142.80 $MtCO_2eq$

(*) The GHG emissions in the base year have been set at 100 $MtCO_2eq$ by way of example

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