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MIDDLE EAST AND CENTRAL ASIA DEPARTMENT

A Low-Carbon Future for the Middle East and Central Asia

What Are the Options?

Prepared by Gareth Anderson, Jiayi Ma, Tokhir Mirzoev, Ling Zhu, and Karlygash Zhunussova

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Acronyms and Abbreviations

BAU	Business as Usual
CCA	Caucasus and Central Asia
CH4	Methane
CO2	Carbon Dioxide
CPAT	Climate Policy Assessment Tool
ECR	Effective Carbon Rate
FCS	Fragile and Conflict Affected States
GHG	Greenhouse Gas
IPCC	Intergovernmental Panel on Climate Change
LULUCF	Land use, Land-use change and forestry
ME&CA	Middle East and Central Asia
MENAP	Middle East, North Africa, Afghanistan, and Pakistan
NDC	Nationally Determined Contribution
NZE	Net Zero Emissions
RE	Renewable Energy
UNFCCC	United Nations Framework Convention on Climate Change

Glossary

Effective carbon rate	The net fiscal revenue from fossil fuels per metric-tonne of carbon dioxide
Energy intensity	Energy consumption per unit of real GDP
Emissions intensity	GHG emissions per unit of energy consumption
Kaya identity	An accounting identity of GHG emissions

Executive Summary

This departmental paper is based on the second IMF study devoted to macroeconomic challenges associated with climate change in the Middle East and Central Asia (ME&CA). It follows a departmental paper, released earlier this year, that highlighted the urgency and macro-critical nature of the region's climate adaptation needs and called for embedding adaptation policies in countries' medium-term inclusive growth agendas (Duenwald and others 2022).

In addition to the challenge of climate adaptation, nearly all countries in the Middle East and Central Asia have pledged to contain greenhouse gas (GHG) emissions as part of the Paris Agreement. Collectively, these commitments envisage reducing annual emissions in 2030 by an estimated 13 to 21 percent, depending on the availability of external support, relative to the current trend of their rapid growth. This will require reducing the region's per capita emissions by as much as 7 percent over the next eight years—a feat only a few emerging and developing economies have been able to achieve over a similar period while maintaining economic growth.

Achieving the goals of the Paris Agreement is of paramount importance both globally and for the region, which is among the most vulnerable to the effects of climate change although it accounts for only a tenth of annual global GHG emissions. In the long term, the environmental, health, security, and economic benefits of successful climate mitigation would undoubtedly outweigh its financial cost, including by reducing the price tag of climate adaptation (IMF 2020a, IPCC 2022, OECD 2017). Nevertheless, reaping these benefits could require a potentially sizable initial investment of resources and policy efforts to set off a low-carbon transition.[1] Recognizing and balancing the key macroeconomic trade-offs along the way is the main challenge for economic policymakers.

The purpose of this departmental paper is to identify the menu of fiscal policy options which would allow the region to fulfil its emissions reduction commitment. Specifically, the paper examines and estimates the trade-off between two broad categories of fiscal policies: public investments, for example in renewable sources of energy, and measures that raise the effective price of fossil fuels. Such a dichotomy captures the key medium-term macroeconomic and long-term intergenerational trade-offs that are arguably the most pertinent for the countries in the Middle East and Central Asia, where governments are likely to play a leading role in the low-carbon transition.

At one end of this trade-off, a gradual removal of all fuel subsidies and, in addition, a phased introduction of a carbon tax of $8 per metric-tonne of CO2-equivalent in the Middle East, North Africa, Afghanistan, and Pakistan (MENAP) and $4 in the Caucasus and Central Asia (CCA) over the next eight years could achieve the region's 2030 emissions abatement goals without additional investments in renewables. This approach would set off a potentially challenging transition by the private sector toward a cleaner fuel mix and lower overall energy consumption that could temporarily weigh on economic growth. In the long term, however, such a transition would leave to future generations an economy with a stronger fiscal position, greater energy efficiency, and a more efficient overall allocation of resources.

Alternatively, additional combined public investments of close to $900 billion in renewable sources of energy between 2023 and 2030 would allow achieving the region's emissions reduction targets with fuel subsidies reduced by two-thirds and without any carbon tax. Such a greening strategy implies a smaller increase in

[1] More precisely, a transition toward an economic growth model with low overall greenhouse gas emissions.

energy prices and faster economic growth during the transition. But a smoother low-carbon transition for the current generation could set future generations on a path of lower long-term growth due to higher debt, persistent distortions in the energy sector, and unabated emissions in many parts of the economy.

In practice, most countries are likely to choose a mix of these policies based on their individual circumstances. Importantly, the deployment of non-fiscal mitigation policies—such as tightening of environmental regulations, raising emissions standards, or incentivizing green private investments—could play an important role in reducing the required fiscal efforts and improving the trade-off described above. Global and regional initiatives to provide affordable financial support and technological assistance would be equally important in improving the region's economic options.

Regardless of the chosen strategy, delaying the rollout of mitigation policies would make achieving the emissions reduction targets more difficult and costly. Therefore, an early start will be essential to tread a smoother path toward a low-carbon future in the Middle East and Central Asia.

1. Introduction

Almost all countries in the Middle East and Central Asia (ME&CA) region have joined the rest of the world in what is arguably the most ambitious and consequential global effort—the race to save the planet from the effects of climate change. To date, 31 out of the region's 32 economies have published their nationally determined contributions (NDCs) as envisaged by the 2015 Paris Agreement. Of these, 29 spell out explicit commitments for reducing or containing greenhouse gas (GHG) emissions in the coming years. As part of a broader strategy by the IMF to help member countries address climate change related policy challenges, this paper examines two questions:

- What do ME&CA countries emission reduction commitments amount to?
- What will it take to achieve them?

Answering these questions is important both for the world and for the ME&CA countries themselves. Despite witnessing a rather rapid increase in emissions in recent decades, the ME&CA region is admittedly not the largest overall emitter of GHGs in the world, neither currently nor from a historical perspective (Chapter 2). And reflecting its countries' stage of development—the region is populated by emerging and developing economies (EMDEs) including several low-income and conflict-affected countries—their mitigation objectives can be expected to be more modest than those of the advanced economies (AEs). Nevertheless, for the global effort to succeed, achieving every region's mitigation target is critical. Moreover, ME&CA is one of the most vulnerable regions to the continued rise in global temperatures and achieving the goals of the Paris Agreement is of paramount importance to containing the region's climate adaptation costs and the habitability of many of its countries (Duenwald and others 2022).

The absence of explicit enforcement mechanisms in the Paris Agreement means that whether its goals will be achieved largely depends on the clarity of countries' emission reduction commitments, credibility of their mitigation policy strategy, transparency when it comes to monitoring progress, and periodic revisions of mitigation ambitions to ensure that individual commitments are on aggregate compatible with the overall goal of limiting the rise in global temperatures to no more than 1.5°C–2°C relative to the preindustrial level by 2100. In any global coordinated effort, insufficient ambition or underperformance in some parts of the world would need to be compensated elsewhere for the overall numbers to add up. That is why it is important to understand what is entailed in each region's pledges, what they imply for the future trajectory of emissions, and how they fit into global mitigation efforts.

Aggregation of the ME&CA countries' mitigation commitments is a challenging task. Reflecting individual circumstances and priorities, countries have used a variety of definitions, methodologies, yardsticks, and reference points to specify their pledges. Chapter 3 of the paper attempts to aggregate them by using a common denominator in a unified framework with the help of the IMF-World Bank Climate Policy Assessment Tool (CPAT)—a country-specific climate model that projects fuel usage and emissions across different sectors (see Annex 1). It finds that achieving the region's "conditional" climate mitigation pledges, that is those commitments that require some form of external support, would imply a level of GHG emissions in 2030 that is roughly equal to the volume of emissions expected to be produced by the region in 2022 and constitutes a 21 percent decline relative to the business-as-usual (BAU) baseline projection in 2030. By contrast, unconditional commitments, that is those that rely on countries' own resources, amount to moderating the growth of GHG emissions to 16 percent between 2022 and 2030, relative to 32 percent in the BAU. Within the region, there is also significant variation in the degree of mitigation ambition. Some countries' stated emissions reduction commitments could be met without additional mitigation efforts, while others will need to work hard to fulfil their pledges in the coming years.

Nevertheless, the region as a whole has a mountain to climb, and it would be inaccurate to interpret its collective mitigation commitment as unambitious because of the strong underlying currents. Much of the region's recent growth in emissions owes to rapid expansion of populations which by far outpace the rest of the world, particularly in MENAP. This demographic trend is expected to continue and containing the region's aggregate emissions at their current level would require a reduction in per capita terms by 7 percent over the next eight years. This will be no mean feat given that only a few EMDEs have been able to achieve a similar reduction in emissions while maintaining economic growth over the same period.

Therefore, crafting policies to meet countries' mitigation commitments while carefully balancing the associated socioeconomic consequences will be critical. Chapter 4 discusses how climate mitigation policies can be integrated into the broader macroeconomic policy framework. To do so in a tractable way, it focuses on two broad categories of policies to curb GHG emissions: those that increase public investment in renewable energy and those that raise the effective carbon rate (ECR), defined as emissions-weighted tax revenue from fossil fuels net of subsidies. Such a dichotomy emphasizes substitutability, albeit up to a point, between two alternative fiscal policy approaches to climate change mitigation and captures the key medium-term macroeconomic and long-term intergenerational trade-off that is arguably the most pertinent for the ME&CA region where governments are likely to play a leading role in the low-carbon transition.

At one end of this trade-off, a sizable increase of the ECR could achieve ME&CA's emissions reduction targets without any additional investment in renewables, for example, through a gradual removal of all fuel subsidies and, in addition, a phased introduction of a carbon tax of $8 per metric-tonne of CO2-equivalent in MENAP and $4 in the CCA over the next eight years. Such an approach would prioritize raising the price of energy and amounts to making the current generation bear the brunt of the adjustment burden. Vulnerable households and the economic sectors reliant on cheap sources of energy could be particularly at risk. Though the additional fiscal resources generated by ECR-raising measures could be used to alleviate these side effects, an adverse impact on economic growth—at least in the medium term—would be difficult to avoid, and real GDP per capita in 2030 could decline by 5 percent in both MENAP and CCA relative to the BAU baseline. In the long term, however, such a transition would leave to future generations an economy that is not only cleaner but also more energy efficient and potentially more competitive, with fewer distortions and a more efficient allocation of resources.

An alternative way of reducing emissions is through public investments in renewable sources of energy. For example, additional investments of $770 billion in MENAP (20 percent of 2021 GDP) and 114 billion (27 percent of 2021 GDP) in the CCA between 2023 and 2030 would allow achieving the region's emission reduction targets with fuel subsidies reduced by two-thirds and without any carbon tax. Such a strategy implies a smaller increase in energy prices and would create more jobs and faster growth, raising the 2030 real per capita GDP by 4 percent in MENAP and 7 percent in CCA relative to the BAU baseline. But it would also preserve the distortions in energy prices, limit energy efficiency gains, weaken fiscal positions and macroeconomic stability, and leave fewer resources available to future generations that would see the aggregate government debt in 2030 rise by 12 percent of GDP in MENAP and 15 percent of GDP in the CCA relative to the BAU baseline. Thus, a smoother transition for the current generation could set future generations on a path of slower long-term growth.

In between, other combinations of these fiscal options can be compatible with reaching the ME&CA region's NDC targets. Countries would need to choose a suitable policy mix based on the available fiscal space, socioeconomic fragilities, and political economy constraints. Non-fiscal mitigation policies—such as environmental regulations or private climate finance initiatives—could play an important role in reducing the mitigation burden on fiscal policy, thereby improving the options outlined above. Global and regional initiatives to provide affordable financial support and technological assistance would be equally important in improving the ME&CA region's economic trade-offs. For individual countries, deciding on and rolling out the appropriate policy mix early will be critical. Delays will make achieving the mitigation targets more

difficult, thus worsening the fiscal trade-off over time. On the other hand, an early start will allow an orderly adjustment by the private sector and timely gearing of other regulatory, fiscal, monetary, and financial sector policies and structural reforms to tread a smoother path toward a greener economy in the ME&CA region.

2. GHG Emissions in ME&CA

A. Trends

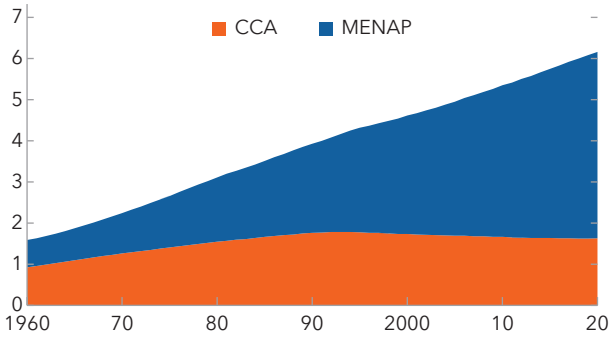
Historically, the ME&CA region's contribution to global emissions has been limited owing to its gradual industrialization. Out of the world's total cumulative carbon dioxide (CO2) emissions associated with human activity since 1960, only 6 percent can be attributed to the ME&CA region (Figure 1). As of 2019, the ME&CA region accounted for about a tenth of annual global emissions, of which more than half can be attributed to its five largest economies: Egypt, Iran, Kazakhstan, Pakistan, and Saudi Arabia.

Within the region, emissions have evolved very differently in MENAP and the CCA in the past several decades:

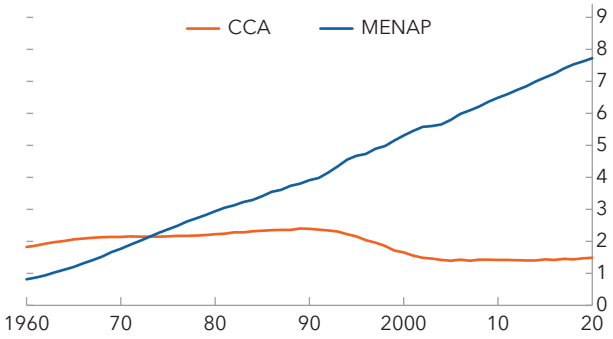
- In the CCA, emissions nearly halved during the 1990s reflecting the collapse of the Soviet Union and a deep economic contraction that followed in its wake. Since 2000, driven by robust transition-related growth, CCA's emissions rose by about 50 percent, slightly faster than in other EMDEs, but remained below their level in 1990.

Figure 1. Greenhouse Gas Emissions in the ME&CA Region

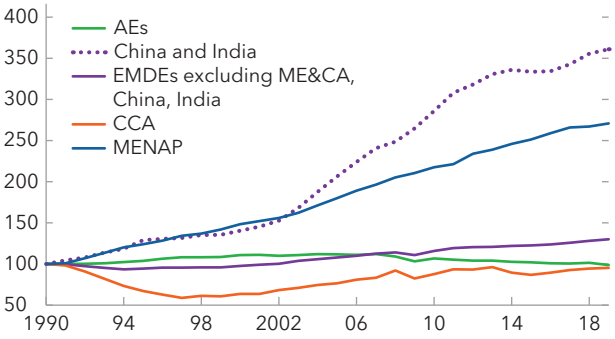
1. Shares in Global CO_2 Emissions: 1960–2020
(Percent, cumulative)



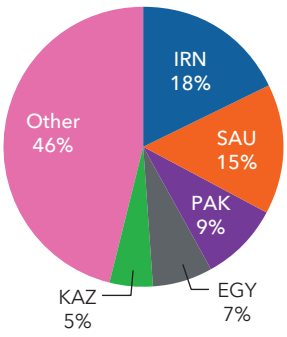
2. Shares in Annual Global CO_2 Emissions
(Percent)



3. GHG Emissions
(Index, 1990 = 100)

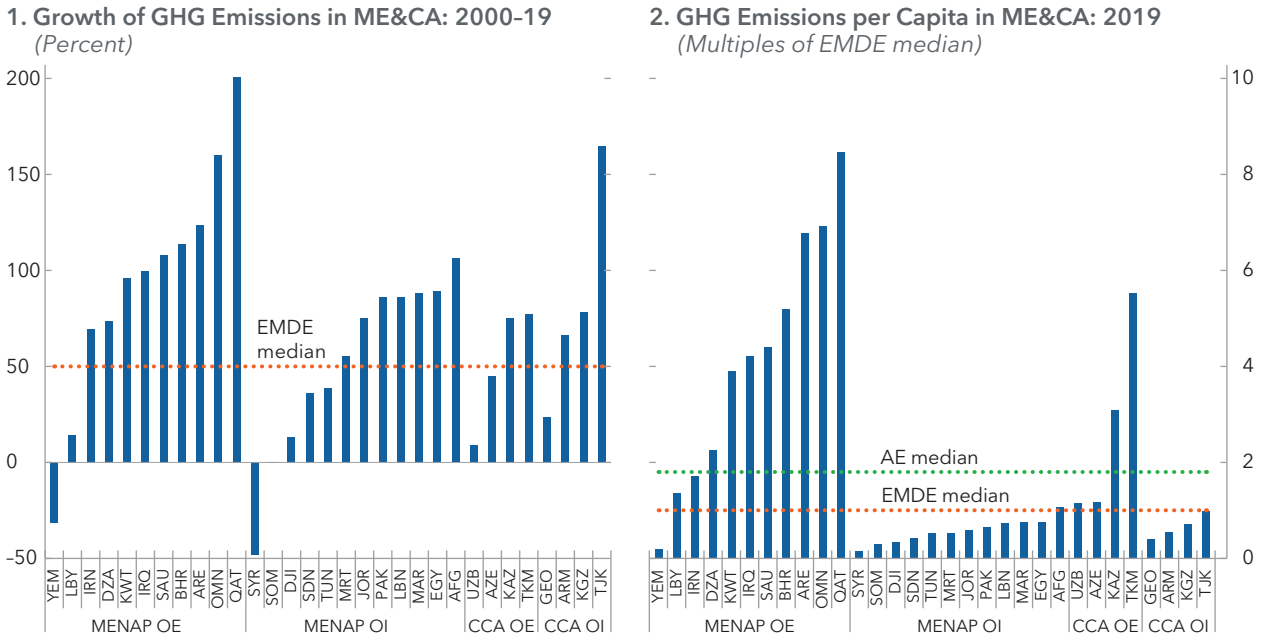


4. Contribution to ME&CA's GHG Emissions, 2019
(Percentage of total)



Sources: Climate Watch Database for the GHG emissions; and IMF staff calculations.
Note: GHG emissions exclude land use, land-use change, and forestry (LULUCF). AEs = Advanced Economies; EMDEs = Emerging and Developing Economies; ME&CA = Middle East, North Africa, and Central Asia.

Figure 2. Growth of Total GHG Emissions and per Capita Emissions in ME&CA



Sources: Climate Watch Database for the GHG emissions; Global Petrol Prices; World Bank; and IMF staff calculations.
Note: OE = Oil exporters; OI = Oil importers; RoW = Rest of the world; EMDE = Emerging and Developing Economies; ME&CA = Middle East and Central Asia.

- By contrast, the MENAP region's low historic share in global emissions veils a trend of a rapid acceleration in recent decades. The region's share in annual global CO2 emissions, for example, increased from 1 to 8 percent over the past 40 years. This increase is particularly striking given that emissions in the rest of the world during this period were growing at their fastest pace since the industrial revolution driven by the rapid economic development of China and, to a significantly lesser extent, India. During 2000–19, cumulative growth of GHG emissions in MENAP reached 88 percent, by far outpacing emissions growth in other EMDEs excluding China and India (33 percent) and AEs where emissions declined by 11 percent.

Fragility and conflict have also played a role in the evolution individual countries' emissions, triggering rapid declines in countries experiencing flareups (Libya, Syria, and Yemen) followed by rapid rebounds during the post-conflict and reconstruction phases (Iraq and Afghanistan before 2020).

Per capita emissions have been rising significantly in most of the region (Figure 2), especially the MENA oil exporting countries where energy is heavily subsidized (Figure 3). At present, MENA oil exporters include five out of the world's top 10 countries in per capita annual emissions.

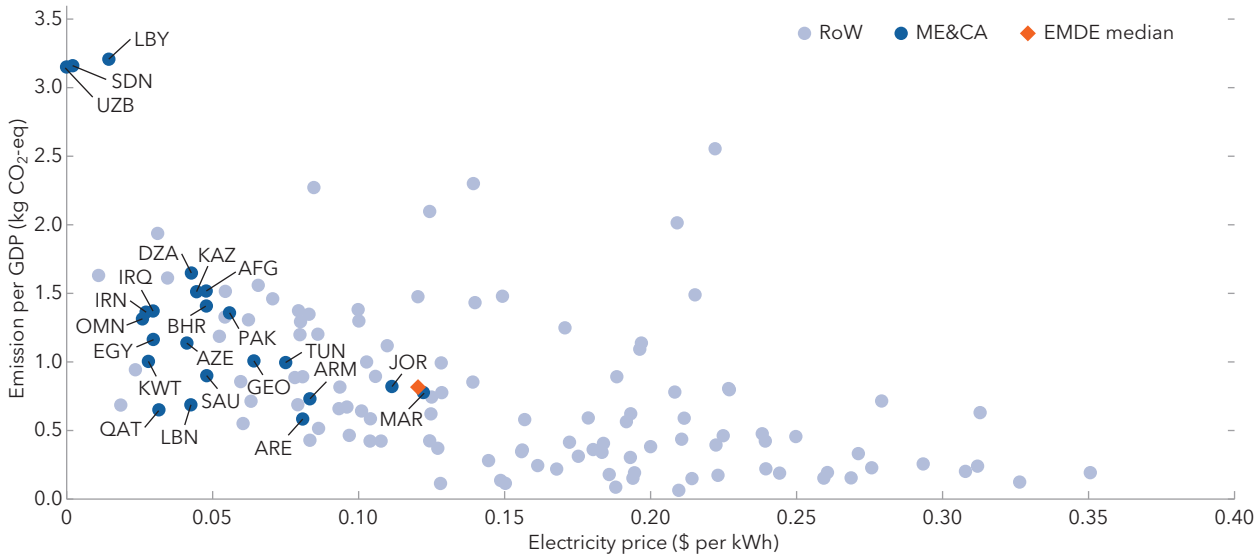
B. Drivers

To understand what is behind the recent trends in ME&CA countries' GHG emissions, it is useful to examine the relative contribution of their key economic and demographic drivers. Specifically, the Kaya identity (Kaya and Yokobori 1997) decomposes GHG emissions as a product of four components: population, GDP per capita, energy per GDP (energy intensity), and GHG emissions per unit of energy (emissions intensity):

$$GHG\ Emissions = Population \times \frac{Real\ GDP}{Population} \times \frac{Energy\ Consumption}{Real\ GDP} \times \frac{GHG\ Emissions}{Energy\ Consumption}$$

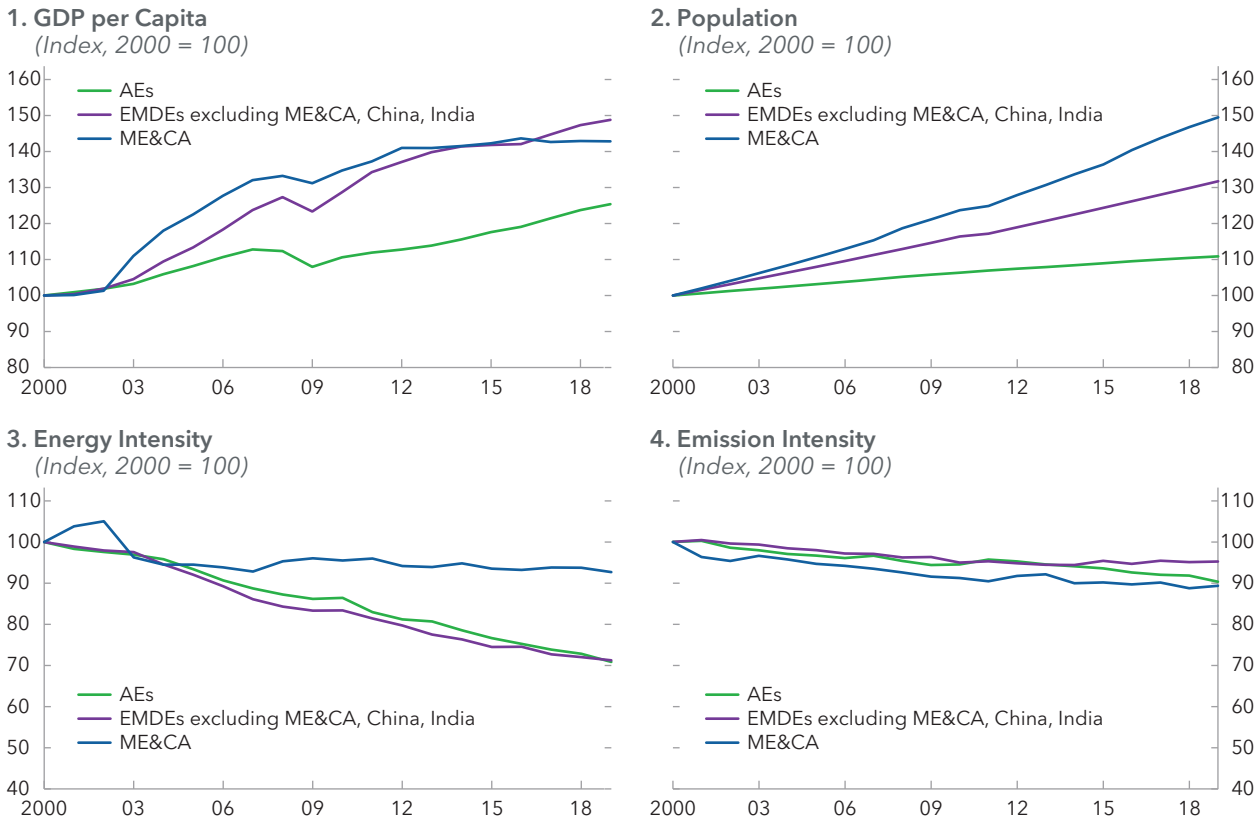
Applied to the ME&CA region, the Kaya decomposition points to faster population growth and limited improvement in energy intensity as the main reasons for the rapid increase in the region's aggregate GHG emissions (Figure 4). Between 2000 and 2019, other EMDEs and AEs have reduced the energy intensity of

Figure 3. Emissions and Energy Prices in ME&CA: 2019



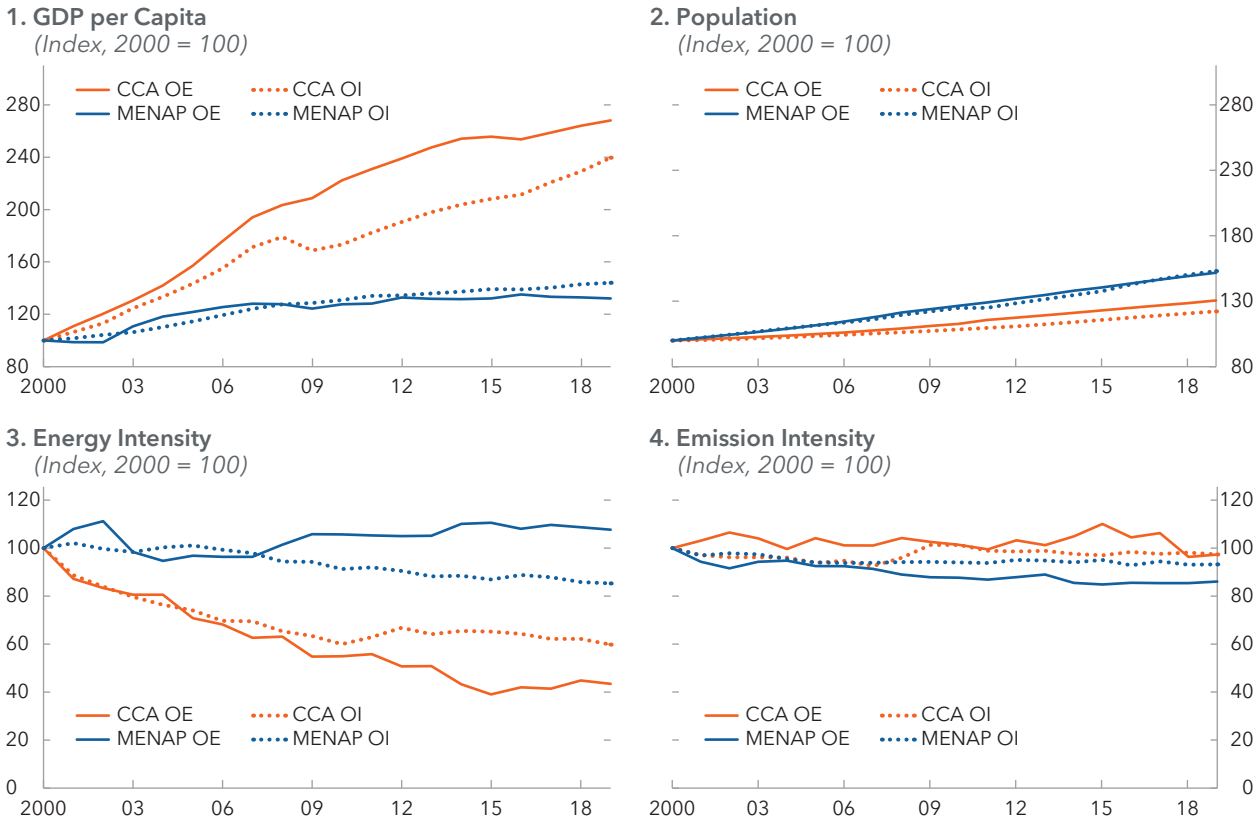
Sources: Climate Watch Database for the GHG emissions; Global Petrol Prices; World Bank; and IMF staff calculations.
Note: EMDE = Emerging and Developing Economies.

Figure 4. Kaya Decomposition of Emissions Growth, 2000–19



Sources: Climate Watch Database for the GHG emissions; IMF WEO; United Nations World Population Prospects; IEA; BP; and IMF staff calculations.
Note: GHG emissions exclude land use, land-use change, and forestry (LULUCF).

Figure 5. Kaya Decomposition of Emissions Growth in the ME&CA Region, 2000–19



Sources: Climate Watch Database for the GHG emissions; IMF WEO; United Nations World Population Prospects; IEA; BP; and IMF staff calculations.
Note: GHG emissions exclude land use, land-use change, and forestry (LULUCF).

their productions by about 29 percent, thereby countering the positive effects of population and real GDP growth. Meanwhile, the ME&CA region recorded only a modest improvement of about 7 percent during this period. This, combined with much faster population growth, resulted in the region outpacing other EMDEs in emissions despite seeing similar growth in real per capita incomes. The role of emissions intensity, which has improved only marginally in all regions, has been small.

Within the ME&CA region, the lack of improvement in energy intensity is confined to MENAP countries, where it declined by only 15 percent in oil importers and increased slightly in oil exporters (Figure 5). This can in part be attributed to energy and fuel subsidies which are among the highest in the world (Parry, Black, and Vernon 2021) and have been found to lead to excessive energy consumption and subpar energy efficiency (Hahn and Metcalfe 2022). The slight increase in energy intensity in MENAP oil exporters has been offset by a similar improvement in emissions intensity possibly reflecting a shift toward greater use of natural gas. In the CCA, real GDP expanded much faster than in most other EMDEs between 2000 and 2019, reflecting catch-up transition growth. Nevertheless, compared to MENAP, growth of GHG emissions was less pronounced due to slower population growth and a significant reduction in energy intensity (more than 40 percent), likely driven by phasing out of the Soviet-era production methods.

3. Climate Mitigation Pledges

A. Mitigation Plans in Nationally Determined Contributions

As part of the Paris Agreement (Box 1), all ME&CA countries except Libya have published NDCs that outline their plans to reduce national GHG emissions and adapt to the impact of climate change. NDCs are expected to be updated every five years, and most NDCs of ME&CA countries have been revised during 2020–21. As of August 2022, 29 ME&CA countries have specified some quantifiable mitigation targets for 2030 or beyond.[1] In addition to the 2030 climate mitigation targets stated in their NDCs, 12 ME&CA countries have also declared commitments to reach net zero emissions (NZE) by either 2050 or 2060 (Table 1).[2]

Since the Paris Agreement does not specify a common methodology for setting climate mitigation targets, countries in ME&CA, as in other regions, have used a wide range of approaches in specifying their commitments. They generally differ in several ways:

- Coverage. Most countries directly target the level of emissions, although coverage of GHGs is not uniform: the majority of NDCs include CO2, CH4, and N2O, and very few include F-gases. Some countries instead target the carbon intensity of output at a future date, as measured by GHG emissions per unit of GDP. Several NDCs set sectoral emission levels as their targets as opposed to more commonly used economy-wide emissions.

- Reference point. Most MENAP countries have specified their emission reduction targets as percent reductions relative to BAU scenarios. Exceptions include Egypt and Saudi Arabia, which target annual emission reductions relative to BAU in absolute (volume) terms. The methodology for computing the BAU scenarios in these NDCs is often unclear and the BAU scenarios themselves are not always disclosed. By contrast, most CCA countries' emission reduction goals are relative to the level of emissions at a specific point in the past (reference year).

- Conditionality. Most countries have set two mitigation targets: (1) an "unconditional" commitment, which is not dependent on external support, and (2) a more ambitious "conditional" commitment, which typically requires external technology transfer and/or financial support.[3] Only about half of these specify the type and amount of the required external support underlying the conditional targets.[4]

These differences complicate both the interpretation of individual countries' goals—for the purposes of economic policy analysis—and aggregation of individual countries' targets to understand their global implications and what socio-economic consequences they involve at the regional level.

[1] Countries that have not yet provided a quantifiable mitigation target are Libya, Sudan, and Syria.

[2] While the obligation to publish NDCs is legally binding under the Paris Agreement, the mitigation targets are not.

[3] Some unconditional targets also depend on external conditions. For example, Iran's unconditional target is subject to the removal of sanctions, and Saudi Arabia's target is conditional on the continued ability to export fossil fuels.

[4] To date, 13 ME&CA countries have specified their estimated financing needs to reach conditional targets, totaling $512 billion. Because many NDCs are not explicit about the financial needs, this figure cannot be interpreted as the total financing need of the region.

Box 1. Paris Agreement and Nationally Determined Contributions

In a global effort to fight climate change, 196 parties signed the Paris Agreement, a legally binding international treaty on climate change, following the 2015 United Nations Climate Change Conference. The main goal is to limit the global rise in temperature to well below 2, preferably to 1.5 degrees Celsius, compared to preindustrial levels. According to IPCC (2018), to achieve this long-term temperature goal, global GHG emissions will need to peak as soon as possible and reach net-zero by mid-century.

In pursuance of coordinating this global endeavor, parties are required to submit their plans for climate action, also known as the nationally determined contributions (NDCs), every five years to the UNFCCC secretariat reflecting the highest possible ambition pursuant to Article 4 of the Paris Agreement. In the NDCs, parties communicate their medium- and long-term strategies of reducing GHG emissions (mitigation strategies) and building resilience to adapt (adaptation strategies).

The Paris Agreement includes the principle of common but differentiated responsibilities and respective capabilities. Regarding mitigation strategies, developed countries should make economywide absolute emission reduction targets while developing country parties are encouraged to move over time toward economywide emission reduction based on different national circumstances. On the other hand, the least developed countries and small island developing states may communicate strategies, plans, and actions for low GHG emissions development.

Article 4.8 of the Paris Agreement mandates countries to provide clarity, transparency, and understanding of NDCs, as to cover quantifiable information on the reference point, time frames, scope and coverage, planning processes, assumptions, methodological approaches, and how the countries consider their NDC as fair or ambitious in light of their national circumstances.

In the Copenhagen Accord (2009), advanced economies promised to channel $100 billion per year by 2020 to help developing countries with mitigation and adaptation. Moreover, in Article 9 of the Paris Agreement, advanced economies are also expected to provide financing resources to assist developing countries. Hence, it is common for developing countries to set conditional mitigation targets subject to external support.

B. What Do ME&CA Mitigation Commitments Amount To?

Understanding the overall implications of ME&CA countries' mitigation pledges requires bringing the various definitions used by countries to a common denominator to enable their aggregation. The biggest challenge in doing so is agreeing on BAU projections—that is the level of projected emissions assuming that no additional mitigation policy measures will be implemented beyond those already in force (IPCC 2018)—since most NDC targets in MENAP are defined relative to them.[5]

To date, only 12 out of 21 MENAP countries with quantifiable targets have made available their own BAU estimates in NDCs. However, all of them were derived using country-specific methodologies which are not always published.

[5] In the CCA, two countries' NDC targets are set relative to BAU, and only the Kyrgyz Republic's BAU scenario has been published.

Table 1. Climate Mitigation Pledges in ME&CA Countries' Latest NDCs[1]

NDC type: BAU				
Country	**Latest NDC**	**Unconditional Targets (% reduction from 2030 BAU level)**	**Conditional Targets (% reduction of 2030 BAU level)**	**Net-Zero Targets**
Afghanistan	2015	0.0	13.6	2050
United Arab Emirates	2022	31.0	n.a	2050
Djibouti	2015	40.0	60.0	
Algeria	2015	7.0	22.0	
Iran	2015	4.0	12.0	
Iraq	2021	1.5	15.0	
Jordan	2021	5.0	31.0	
Kyrgyz Republic	2015	12.6	29.9	
Kuwait	2021	7.4	n.a.	
Lebanon	2021	20.0	31.0	2050
Morocco	2021	18.3	45.5	
Qatar	2021	25.0	n.a.	
Mauritania	2021	11.0	92.0	2050
Oman	2021	4.0	7.0	
Pakistan	2021	15.0	50.0	2050
Turkmenistan	2016	n.a.	0.0	
West Bank and Gaza	2021	17.5	26.6	
Yemen	2015	1.0	13.0	2050
Somalia	2021	n.a.	30.0	2050
Saudi Arabia	2021	278 Mt CO2-eq annually		2060
Egypt	2022		79 Mt CO2-eq annually	
NDC type: Historical				
Country	**Latest NDC**	**Unconditional Targets (% reduction from 1990 level)**	**Conditional Targets (% reduction from 1990 level)**	**Net-Zero Targets**
Armenia	2021	40.0	n.a.	2050
Azerbaijan	2017	35.0	n.a.	
Georgia	2021	35.0	53.5	
Kazakhstan	2016	15.0	25.0	2060
Tajikistan	2021	35.0	45.0	

Table 1. ***(continued)***

Country	Latest NDC	Unconditional Targets (% of 2010 level)	Conditional Targets (% of 2010 level)	Net-Zero Targets
Tunisia	2021	27.0	45.0	
Uzbekistan	2021	n.a.	35.0	
NDC type: Others				
Country name	**Latest NDC**	**Unconditional targets (2030)**	**Conditional Targets**	**Net-Zero**
Syria	2019			
Bahrain[2]	2021	1.9 Mt CO2 annually[2]		2060
Sudan	2021			2050

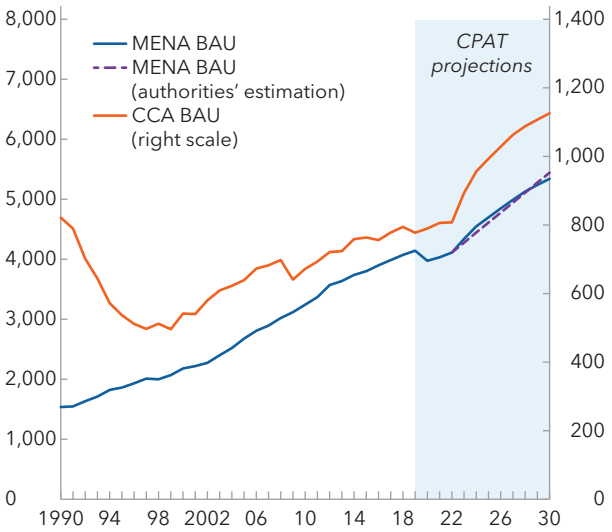
Sources: UNFCCC; and IMF staff summarizes.

Notes: [1]Based on information available as of September 2022;

[2]Bahrain's NDC does not specify an explicit emissions reduction target and sets reducing energy use as the main goal. The country's Third National Communication to UNFCCC provides an estimate of what this goal implies for emissions reduction.

The CPAT tool can be used to project BAU emissions for each country through a model-based (calibrated to recent trends) forecast of fuel use and emissions based on a common set of assumptions and country-specific policy configurations (Annex 1).[6] The aggregate BAU projection for the MENA region derived using this common methodology is broadly consistent with the sum of the countries' own estimates (Figure 6).[7] That said, for several countries, there are notable differences between the CPAT-based BAU and the authorities' forecasts, putting a premium on continued work—as part of future revisions of NDCs—to explain underlying BAU assumptions and possibly refine BAU projections to ensure consistency of methodologies and realism (Annex 2).

Figure 6. ME&CA Emissions: 1990–2030
(Metric-ton CO_2-equivalent)



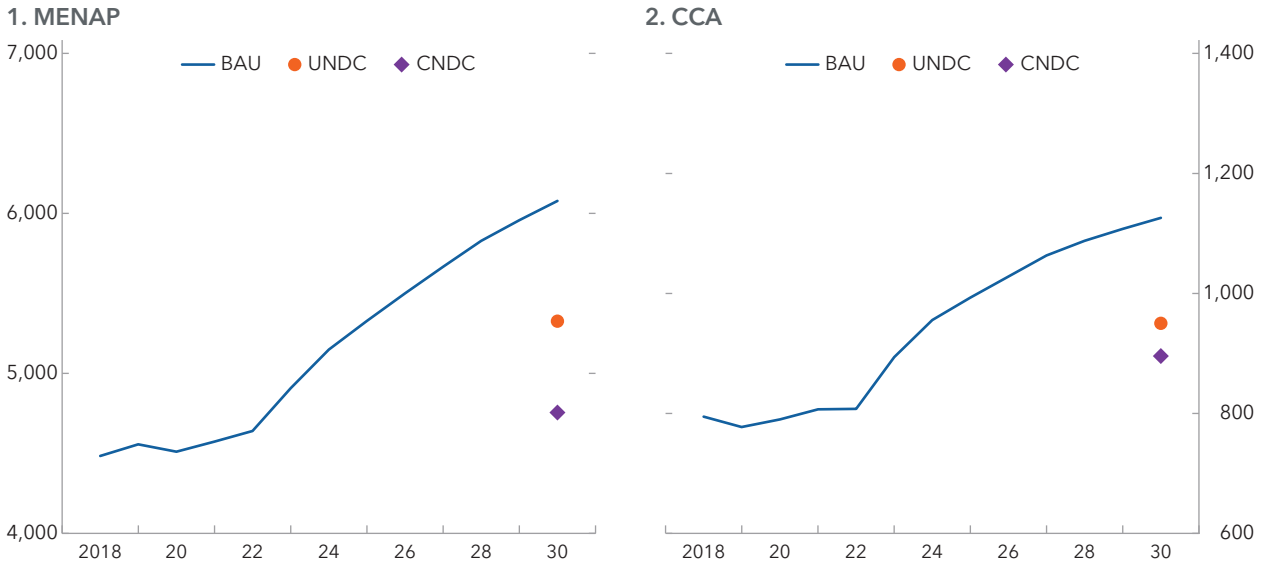
Sources: Edgar; UNFCCC; and IMF staff calculations.

The estimated BAU scenarios suggest the continuation of a trend of rapidly increasing emissions driven by robust population and real GDP growth amid, as in the past, limited improvements in energy and emission intensities. By 2030, GHG emissions would rise by 32 percent in the MENAP region and—owing to higher average real GDP growth—40 percent in the CCA region relative to the projected levels in 2022. Reflecting a variety of country-specific factors, trend emissions vary significantly across countries with the BAU increases between 2022 and 2030 ranging from 0.02 percent in Bahrain to 81 percent in Armenia.

[6] Syria and West Bank and Gaza were not included due to data limitations. The starting point of the CPAT projection is 2019.

[7] For countries that do not disclose a BAU level in NDCs, the CPAT BAU is used to calculate total of authorities' estimation. Pakistan is a notable outlier: the authorities' own BAU projection is significantly higher than what is implied by past trends (Annex 2).

Figure 7. BAU Emissions Projections and NDC Targets
(Metric-ton CO_2-equivalent)



Sources: UNFCCC; and IMF staff calculations.
Note: Whenever authorities' BAUs are not published, CPAT BAUs are used. CNDC = conditional mitigation targets defined in countries' NDCs; UNDC = unconditional mitigation targets defined in countries' NDCs.

Against the backdrop of these trends, on aggregate, ME&CA countries' conditional and unconditional NDC commitments envisage a 22 and 13 percent reduction of GHG emissions by 2030, respectively, relative to the BAU level (Figure 7).[8] Put differently, even if all the required external support materializes and countries succeed in achieving their conditional targets, overall GHG emissions in the region would rise by an estimated 2.4 percent in MENAP and 11 percent in the CCA between 2022 and 2030.[9]

How do the ME&CA countries' pledges fit into the global mitigation effort? According to the latest IPCC's Sixth Assessment Report, worldwide GHG emissions need to halve by 2030 for net emissions to reach zero by mid-century, which will help achieve the Paris Agreement's goal of limiting the rise in global temperature to well below 2 degrees Celsius relative to the preindustrial levels by 2100. Since the combined pledges made by ME&CA countries do not yet envisage any decline in the level of regional emissions, reaching this global benchmark will require either a larger reduction in GHG emissions by the rest of the world or raising the ambition of ME&CA region's mitigation efforts in the coming years.[10]

Nevertheless, achieving the ME&CA region's conditional targets will be no mean feat given strong underlying currents, notably robust population growth. About 112 million people are expected to be born in the region between 2022 and 2030, and ME&CA countries' conditional commitments also mean that emissions in per capita terms would need to decline by 7 percent between 2022 and 2030. Moreover, close to a third of

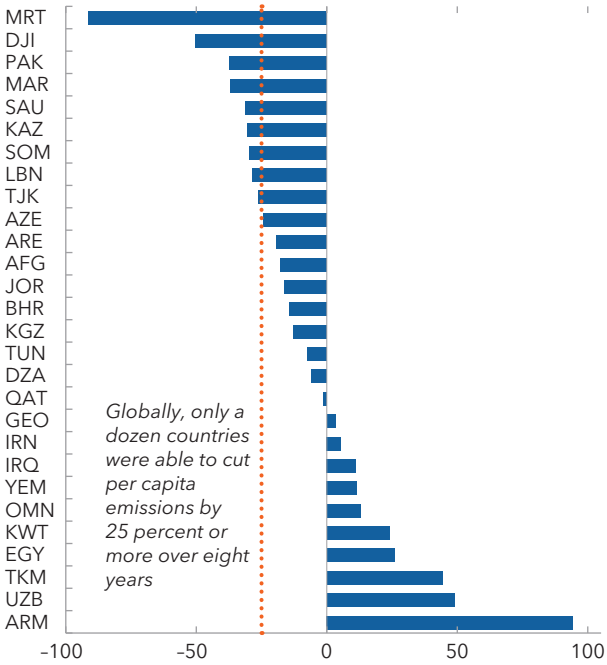
[8] The regional aggregate targets are computed from a sample including countries without quantifiable targets (Bahrain, Libya, and Sudan) as well as those with only unconditional targets—their unconditional targets are used when computing regional aggregate conditional targets. In cases where emissions targets are below BAU levels (for example, Armenia and Georgia where historical benchmarks are used), BAU levels were used to compute the regional aggregate mitigation targets. See Annex 2 for details.

[9] Using an alternative BAU projection approach by extrapolating forward the elements of the Kaya identity based on recent trends (emissions intensity and energy intensity), IMF WEO projections (GDP), and UN projections (population) produces qualitatively similar results: achieving the conditional commitments would imply a level of emissions in 2030 broadly similar to the current level.

[10] The latest IPCC report warns that the existing global emission reduction commitments fall short of what is needed to reach the goals of the Paris Agreement and calls on all countries to scale up the ambition of their mitigation efforts.

the region's countries would need to reduce their per capita emissions by more than 25 percent (Figure 8).[11] To put this in context, globally, only a dozen countries have been able to achieve such a reduction in emissions within a similar timeframe while continuing to grow. While there is hope that technological innovation will facilitate faster progress, these considerations call for a significant acceleration of mitigation efforts—and the required external support—for the region's emissions reduction commitments to be fulfilled.

Figure 8. Conditional NDCs: Implied Changes in per Capita Emissions by 2030
(Percent, relative to the 2022 levels)

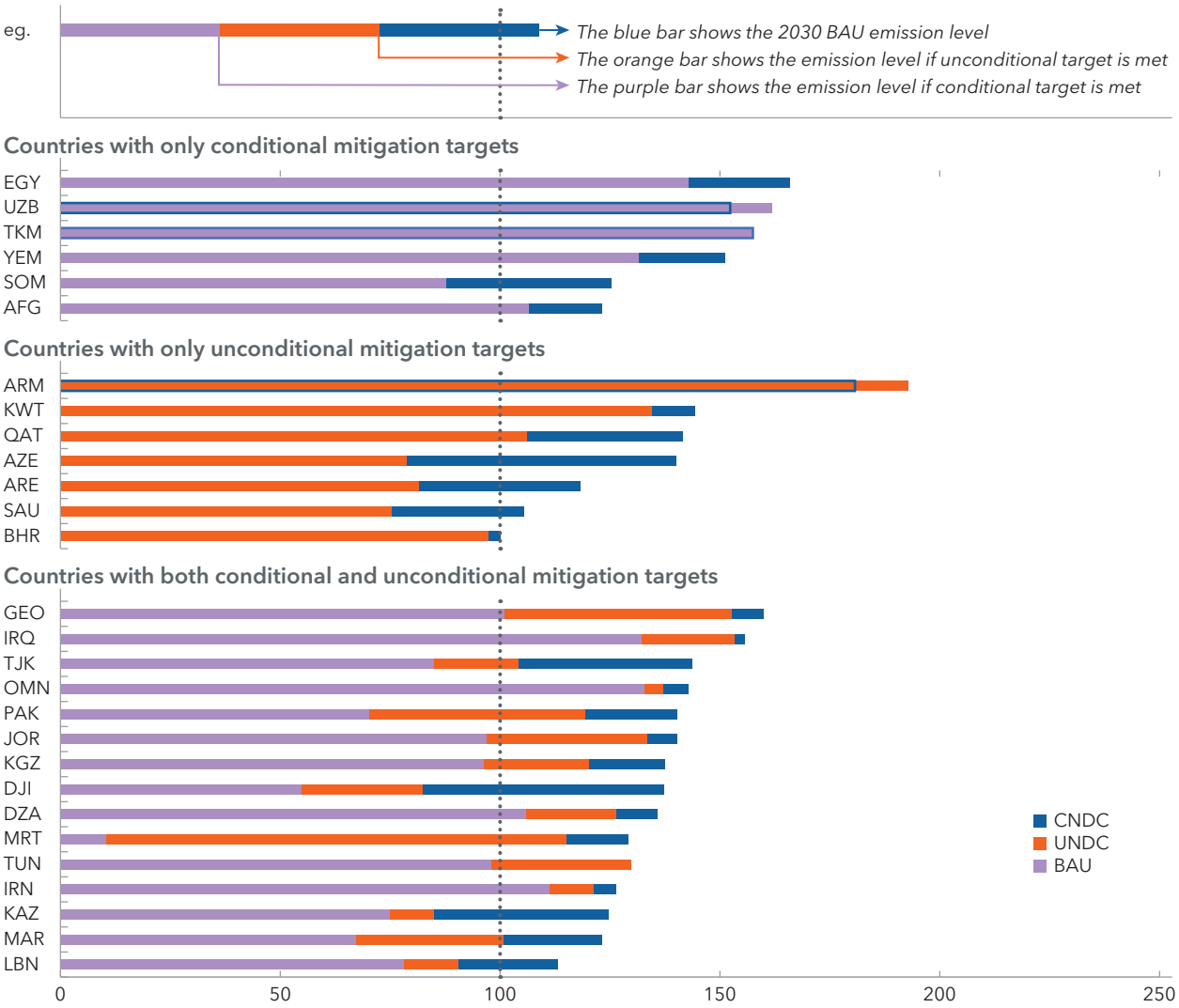


Sources: UNFCCC; World Bank; and IMF staff calculations.

It is noteworthy that the degree of mitigation ambition, as captured by countries' NDCs, varies greatly across countries (Figure 9). For example, 15 countries' mitigation pledges imply a reduction in the level of emissions in 2030 relative to their present level. At the other end of the spectrum, some countries' unconditional (Armenia) or conditional (Uzbekistan) 2030 emission targets appear to be above their estimated BAU levels, requiring no additional mitigation policy measures. This can be explained by these countries' NDCs targeting emissions reductions relative to their level in 1990 when their industrial base was dominated by highly energy-intensive Soviet-era plants. That said, such targets do not necessarily signify a lack of overall long-term ambition—for example, Armenia has also committed to reach net zero by 2050—but suggests a need for further clarification of these countries' medium-term emission plans in the upcoming revisions of NDC documents.

[11] The implied per capita emissions in some countries are projected to be above their present level in 2030. This is either because the baseline increase in per capita emissions is not fully offset by the mitigation target or because the target is defined relative to a historical point of when per capita emissions were very high, as discussed in the next paragraph.

Figure 9. ME&CA BAU Emissions and NDC Targets
(Index, 2022=100)



Sources: UNFCCC; World Bank; and IMF staff calculations.
Note: Armenia and Uzbekistan's BAU levels are lower than their mitigation targets. CNDC = conditional mitigation targets defined in countries' NDCs; UNDC = unconditional mitigation targets defined in countries' NDCs.

4. The Macroeconomics of Climate Mitigation in the ME&CA Region

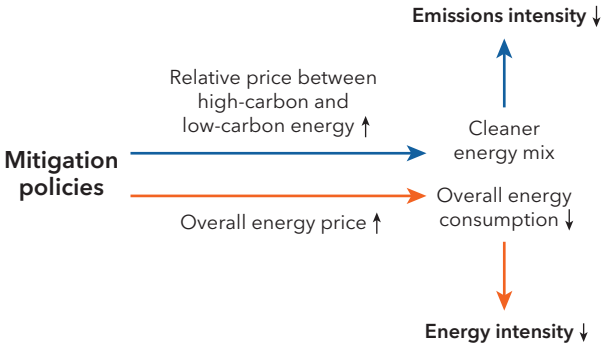
A. Challenges

Mitigation of climate change is one of the many socioeconomic challenges faced by the ME&CA region. Growing populations imply mounting social development spending needs. For example, the World Bank estimates that, to help reach its Sustainable Development Goals (SDGs), the MENA region needs to invest 7 percent of GDP annually on basic infrastructure between 2015 and 2030 (Rozenberg and Fay 2019). In addition, being one of the most vulnerable regions to climate change, ME&CA will need to devote significant resources to adapting and building resilience of its economies to the changing environment (Duenwald and others 2022, IMF 2020b). Meanwhile, the region produces more than a third of global oil supply and more than a quarter of natural gas, and many countries' economic systems and public finances will need to prepare for the effects of the global energy transition, which is set to accelerate in the coming years. Amid these competing priorities, a key challenge for countries' policymakers is how to fit climate mitigation into their broader economic strategy within the available fiscal space.

Many countries are particularly concerned about the potential impact of climate mitigation policies on growth. The discussion of the Kaya decomposition (Figure 4) suggests that countering the impact of strong population growth on emissions while preserving economic growth will require significant reductions in countries' energy and emission intensities—in other words, economic growth will need to be decoupled from emissions. Should energy and emission intensities not improve, for example, the ME&CA region's conditional mitigation targets can only be achieved through slower economic growth, notably a 7 percent decline in real GDP per capita between 2022 and 2030. By contrast, a 19-percent combined improvement in energy and emissions intensities over the same period would allow countries to fulfill their mitigation commitments while raising real per capita GDP by 15 percent over the next eight years, as in the BAU baseline.

Decoupling growth and GHG emissions, in turn, requires implementing policies targeted at either increasing the relative price of high-carbon fuels or raising the overall price of energy. The former induces a transition away from high-carbon energy sources through demand substitution and investment, thereby improving the overall energy mix. Higher overall energy prices may not necessarily change the energy mix but would induce a transition toward less energy-intensive production and consumption, improving the overall energy intensity of output (Figure 10).

Figure 10. Mitigation Policy Transmission Mechanism



Source: IMF staff.

There is by now a plethora of economic studies and cross-country experiences outlining many possible climate mitigation measures for ME&CA countries to choose from, using either direct government intervention (the so-called "command-and-control" measures) or market-based incentives (Box 2). What is less clear is how to choose among the myriad of options and, specifically, how to balance their efficacy in reducing emissions with potential economic

consequences. This puts a premium on developing a tractable framework to embed climate mitigation policies into countries' macroeconomic frameworks to help economic policymakers ensure consistency and compatibility across their many objectives and resource constraints.

Box 2. Climate Mitigation Policy Options

A wide range of domestic energy and environmental policy actions can help mitigate emissions by improving energy and emissions intensities (see for example, IPCC, WGIII, AR6, Chapter 13). They can be grouped into two broad categories:

- "Command-and-control" instruments. These instruments aim to directly reduce the carbon content of production and consumption through direct government regulations or investments. Examples include direct public investment in renewable energy (RE), energy efficiency standards, renewable portfolio standards, vehicle emissions standards, methane regulations, biofuel content mandates, and bans on coal-fired power plants.
- Market-based instruments. These instruments alter price signals to incentivize behavioral change toward low-carbon production and consumption. Examples include carbon taxes, fossil fuel subsidy reductions, fuel surcharges, GHG emissions trading, tax credits, feebates, RE subsidies, and research and development subsidies (for example, clean technologies).

Some market-based instruments can, in principle, be the most efficient way to mitigate emissions (Stavins 1997, Borenstein and Kellogg 2022). Carbon pricing, for example, has the effect of inducing households and firms to choose the level and mix of their energy consumption and/or production at which their marginal abatement costs are the same. Particularly, when the measures are broad-based, such as an economywide carbon tax, the marginal cost of emissions reduction can be equated across all sectors and fuel types. This way, the overall mitigation abatement costs will, in theory, be minimized—for example, if the marginal cost of emissions reduction is higher for gasoline than for diesel, the total cost of achieving a fixed emission target can be reduced by increasing gasoline usage and decreasing diesel usage until their marginal costs are equated

In practice, the effects of mitigation policies can be expected to be multidimensional (see for example, Chateau, Jaumotte, and Schwerhoff 2022) and including fiscal, distributional, and real output costs among others. Therefore, efficiency is just one of several applicable criteria to guide countries' policy choices. Other competing priorities, such as achieving the SDG goals, need to be considered. Moreover, achieving economic efficiency does not guarantee that policies are equitable, the latter requires additional distributional measures and strengthening of social safety nets. Therefore, a comprehensive approach with a combination of "command-and-control" and market-based instruments, together with measures to soften their distributional impact, is likely to be more compatible with countries' socioeconomic goals.

B. Fiscal Policy Framework

Mitigation Policy Mix

The fiscal aspect of climate mitigation is of particular importance for policymakers, and it is likely to be central in the ME&CA region where the role of the state in countries' economies has traditionally been significant.[12] This does not mean that fiscal policy alone will or should bear the full burden of climate mitigation. This will depend on the extent to which non-fiscal mitigation policies, such as environmental regulations and private sector's participation in greening the economy can reduce emissions. Nevertheless, for economic policymakers, it is useful to gauge the size of the baseline fiscal challenge under current trends and policies.

The construction of a tractable macroeconomic framework underpinning countries' climate mitigation strategies could start with a conceptual summary of the broad fiscal options available to governments and how these options are expected to affect both emissions and broader macroeconomic outcomes.

The fiscal measures in support of climate mitigation can be generally categorized as either primarily affecting net government revenues (that is, revenues net of subsidies) or expenditures—a dichotomy that captures two competing, albeit complementary, fiscal approaches to climate mitigation with very different macroeconomic and intergenerational implications. Within each category, policies can be summarized as follows:

- Revenue-based mitigation policies can be measured by their impact on the effective carbon rate (ECR), defined as the net fiscal revenue from domestic fossil fuel consumption—that is revenue from taxation and emission permits net of subsidies—per metric-tonne of CO2 emissions:[13]

$$ECR = \frac{\text{Fuel taxes} + \text{carbon taxes} + \text{tradable emissions permits} - \textit{fuel subsidies}}{\textit{Total CO2 emissions}}$$

- Expenditure-based mitigation policies are typically gauged by the additional public investment which countries direct toward emissions reduction efforts. A prominent example is developing renewable sources of energy (RE investment).

The substitutability between these two approaches, albeit up to a point, points to an important fiscal policy trade-off between revenue- and expenditure-based measures. Policymakers would need to calibrate their optimal combination to balance the attendant side effects and ensure consistency with domestic socioeconomic realities and constraints as well as with reaching the emissions reduction target.

Assumptions

Tracing and quantifying the combinations of revenue- and expenditure-based measures that are compatible with meeting the ME&CA region's emission reduction commitments can be implemented with the help of the CPAT model, adapted to enable the simulation of alternative mitigation policies (Annex 1). The simulations assume that the ECR is initially raised by reducing fuel subsidies and, once they are fully removed, complemented by the introduction of a carbon tax.[14] This assumption reflects the prominence of fuel subsidies in ME&CA countries and the general view that their removal should be a prerequisite for the introduction of more involved measures, such as carbon taxation, to minimize potential distortions (UNDP 2021). In addition, subsidy savings and tax revenues generated by measures to raise the ECR are assumed to be fully re-channeled as tax expenditures to support growth (85 percent) and targeted social transfers to protect the vulnerable (15 percent). By contrast, public investments in renewable energy are assumed to

[12] For example, public sectors (governments and state-owned enterprises) are estimated to account for more than two-thirds of energy investment in MENA (Al-Ashmawy and Shatila 2022).

[13] The emphasis on carbon price owes to the importance of carbon emissions. In principle, GHG emissions from all sources could be taxed.

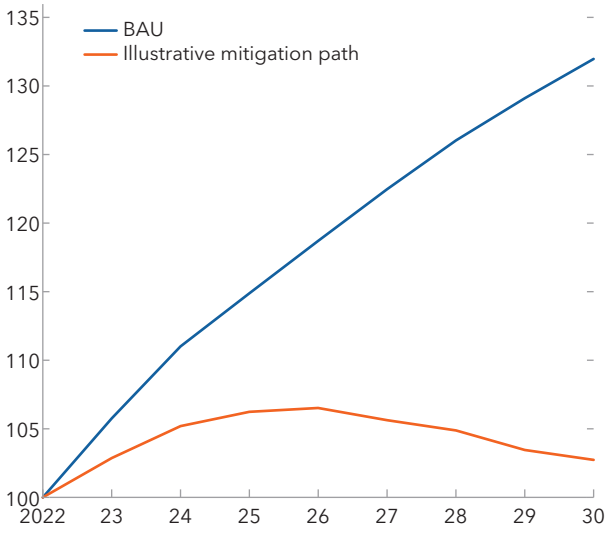
[14] A carbon tax can be applied to economic activities beyond fossil fuel consumption and GHG emissions other than CO2, including livestock emissions (a major source of CH4 emissions), and therefore could help contain emissions beyond raising the ECR. Increases in the ECR could also be achieved through other fuel taxes.

widen the budget deficit and are simulated as being financed through additional government borrowing. This assumption reflects the strategy outlined in countries' NDC documents, most of which count on significant external financing to meet their conditional mitigation targets. That said, it should be mentioned that, in principle, green public investments can also be fiscally neutral if they were paid for by fiscal revenues (for example, from additional direct or indirect taxes) or reprioritization of existing expenditures.[15]

The starting point for the simulations is the BAU baseline, which provides the ECR and other mitigation efforts embedded in countries' current policies. Specifically, the baseline includes the following initial conditions:

- *Effective carbon rate*. The current level of the ECR in MENAP is estimated at about $ –11 per metric-tonne of CO2 reflecting the prevalence of fossil fuel subsidies whose level is lower in the CCA, where the ECR is estimated at about $11 per metric-tonne of CO2.[16]
- *RE investment*. In the MENAP region, the declining costs of renewables is expected to help raise the estimated share of electricity generated from renewable sources from 10 to 23 percent between 2022 and 2030, with a cumulative investment of $249 billion. In the CCA, the baseline share of electricity generated from renewable sources is projected to increase from 30 to 37 percent during 2022–30, supported by cumulative public investment of $35 billion. In both regions, RE investments represent more than 60 percent of the total projected power sector investments in this period.

Figure 11. Illustrative Mitigation Path: Total GHG Emissions in MENAP
(Index, 2022 = 100)



Source: IMF staff calculations.

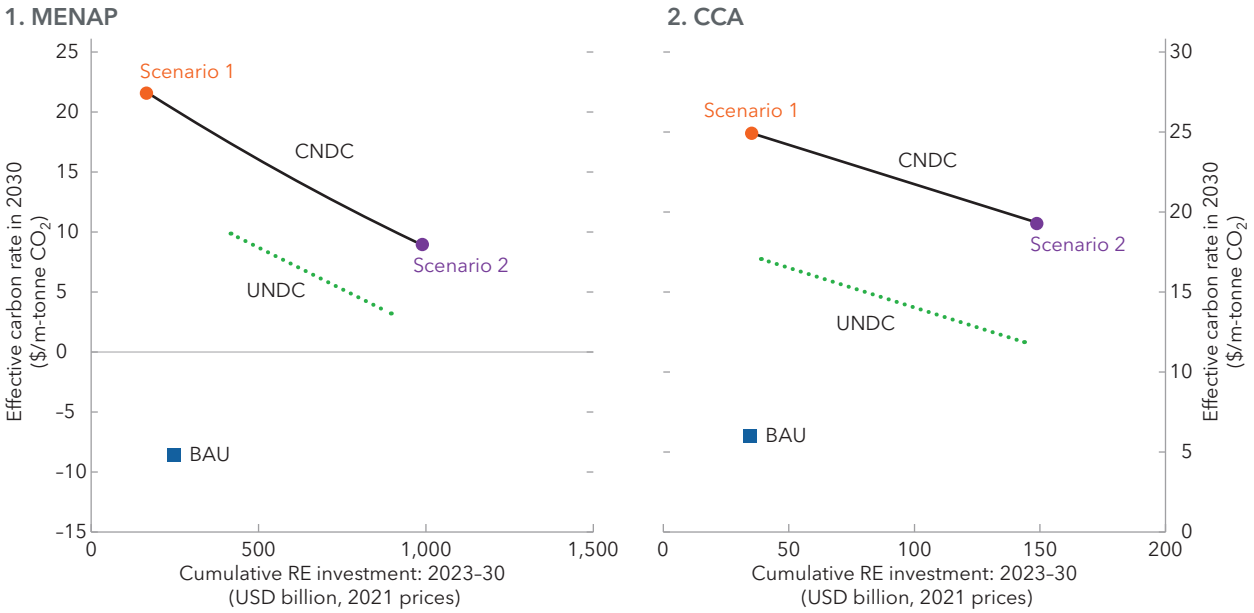
The fiscal effort required to achieve the emissions reduction targets in 2030 also depends on how quickly the policy measures are implemented. Since policies take time to phase in, policies introduced today, for example, would have a larger impact on emissions in 2030 than those introduced in 2029. The simulations discussed below assume a gradual phasing in of mitigation policies over the eight-year period. Consequently, the resulting path of annual emissions toward the NDC target envisages an initial slowdown in emissions growth, followed by a peak around 2025–26, and gradual reduction in the outer years as emissions increasingly decouple from economic growth (Figure 11). A different rollout speed would affect both the path of emissions and the trade-off itself, meaning the needed increases in ECR and/or RE investment. Importantly, a significant delay would reduce the efficacy of RE investments (which require time to be implemented) or even make the mitigation targets unattainable.

The framework does not model a potentially positive impact of raising the ECR on private green investment and other similar externalities which are not yet well understood and are difficult to quantify for the ME&CA region. Finally, it should be noted that the range of possible emissions-reducing public investments modeled in the CPAT tool is limited to those that alter the sources of power supply by adding new capacity to meet additional demand, as well as the gradual retirement of conventional power plants based on fossil

[15] Unlike the intergenerational trade-off discussed in the rest of the paper, countries seeking fiscally neutral combinations of revenue- and expenditure-based measures would face an intragenerational choice of where to place the adjustment burden.

[16] Additional reasons for a higher ECR in the CCA include higher taxation of fuel consumption and the emissions trading scheme in Kazakhstan (introduced in 2013).

Figure 12. Fiscal Policy Trade-off in the ME&CA Region



Source: IMF staff calculations.
Note: CNDC = conditional mitigation targets defined in countries' NDCs; UNDC = unconditional mitigation targets defined in countries' NDCs.

fuels. However, even if all of the region's power supply are to be transitioned to renewable sources, this will not be sufficient to achieve the region's emissions reduction targets if fossil fuels continue to be used extensively outside of the power sector, for example, by households and other economic sectors such as transportation or manufacturing, and fugitive emissions such as gas flaring from fossil fuel extraction remain unaddressed. This limitation means that only a part of the broader fiscal trade-off can be estimated using the CPAT tool.[17]

Fiscal Policy Trade-Off

The estimated fiscal policy trade-off for the ME&CA region is presented in Figure 12. Two scenarios marked on the figure illustrate the magnitude of the fiscal challenge associated with reaching the emissions reduction commitments in MENAP and the CCA.

In MENAP

- Reaching the conditional NDC targets without any additional RE investments would require raising the ECR from $–11 at present to $22 per metric tonne of CO2 by 2030. This can be achieved, for example, by removing all existing fuel subsidies and introducing a carbon tax of $8 per metric-tonne of CO2-equivalent over the next eight years (Scenario 1).

- However, if fuel subsidies were reduced by two-thirds and no carbon tax was introduced, this would raise the ECR to $9 per tonne of CO2 by 2030 and require additional RE investments of $770 billion (20 percent of 2021 GDP or 2 percent of GDP per year on average during the eight-year period) over the BAU baseline (Scenario 2).

[17] Public investments not captured by the CPAT tool, for example, those targeting electrification of the rest of the economy or the still nascent large-scale carbon capture initiatives, would extend the trade-off curve (Figure 12) opening the possibilities of reaching the NDC targets with larger investments and smaller increases in the ECR.

In the CCA

- Reaching the conditional NDC targets without any additional RE investments would require raising the ECR from $11 at present to $25 per metric-tonne of CO2 by 2030. This can be achieved, for example, by removing all existing fuel subsidies and introducing a carbon tax of $4 per metric-tonne of CO2 over the next eight years (Scenario 1).

- Reducing fuel subsidies by two-thirds would raise the ECR to $20 per metric-tonne of CO2 in 2030, requiring additional public investments of $114 billion (27 percent of 2021 GDP or 3 percent of GDP per year on average during the eight-year period) over the BAU baseline (Scenario 2).

Accounting for Non-Fiscal Mitigation Efforts

The fiscal framework in Figure 12 summarizes key fiscal alternatives to achieve the region's mitigation targets *holding other mitigation policies constant*. In their NDC strategies, countries in the ME&CA region, as in other parts of the world, generally count on a much wider range of both fiscal and non-fiscal policies to meet their emissions reduction objectives (Annex 3). These include tightening of environmental regulations and building codes, mandating a transition to cleaner fuels and processes in manufacturing, raising emissions standards in transportation, conducting public awareness campaigns, and mobilizing private investments in greening the economy, including through government subsidies.

To the extent that such policies can induce a change in the volume or composition of energy consumption, they would generally work to lessen the residual mitigation burden on fiscal policy and, therefore, improve the fiscal trade-off. For example, increased private investment in renewable energy would reduce the need for such investments by the state for any given level of ECR. This would shift the trade-off curve in Figure 12 to the left, closer to the BAU point. A tightening of the emissions standards in transportation would reduce emissions without fiscal action thus shifting the trade-off curve inward. Thus, while focusing on the fiscal perspective, the framework presented above can be used to study broader mitigation efforts if their impact can be quantified. In other words, the framework is informative about how the fiscal position—summarized by the levels of ECR and RE investment—can be aligned with the emissions-reduction frontier and *how the frontier itself* can be made more consistent with the existing fiscal position with the help of other policies.

C. Macroeconomic Implications

Ultimately, for climate-related policies to be a part of broader economic policymaking, the associated fiscal options need to be examined through the prism of their macroeconomic consequences. It is also important to distinguish the horizon of these consequences, which can be different in the medium term, that is, when policies are being rolled out and the economy is adapting and adjusting to their effects, and in the long term.

Medium Term

Raising the ECR—for example, through taxation of fossil fuels or phasing out subsidies—generally improves fiscal positions thanks to additional revenues. Numerous studies argue that such measures, especially when they are broad-based, are "efficient" in the sense that they allow the carbon price to be equated to the marginal social cost of GHG emissions, thereby penalizing high emitters more (Box 2). In addition, such measures usually result in higher retail fuel and electricity prices, providing an extra incentive for households to reduce their energy consumption. At the same time, by imposing the cost of reducing emissions and energy intensity on the private sector, such policies could have a detrimental economic impact, particularly on vulnerable households and energy-dependent firms (see for example, Kat, Paltsev, and Yuan 2018;

Nong and others 2020; Ojha, Pohit, and Ghosh 2020).[18] These concerns are highly pertinent for the ME&CA region's low-income countries and oil exporters whose non-oil sectors are often highly dependent on the availability of inexpensive fossil fuels and could be at risk of a disorderly transition. Even if the additional fiscal space could be used to soften the impact, overall private consumption and growth are likely to be weighed down by the burden of adjustment and increased inflation, at least for some time, while relief for the vulnerable may be constrained by the limitations of existing social safety nets in many ME&CA countries (Machado and others 2021).

By contrast, RE investment is often thought of as one of the most growth- and jobs-friendly ways of greening the economy both because of higher potential growth multipliers compared to investments in fossil fuels (Batini and others 2021) and because of the expansionary effect it—as any other fiscal stimulus of this magnitude—would have on economic activity. Public-led RE investment could be particularly beneficial in countries where markets are otherwise unable to exploit the "learning by doing" benefits that can come from increased renewables production or where scope for revenue-based instruments is constrained (Kalkuhl and Brecha 2013, Rezai and van der Ploeg, 2017). These considerations are important for ME&CA countries whose young and rapidly growing populations will require significant job creation in the coming years. At the same time, RE investment is less efficient in reducing emissions because it does not penalize sources of high emissions and, in fact, can raise the overall demand for energy. In addition, RE investments need to be financed by either drawing down fiscal savings or additional public borrowing. The financial burden associated with climate mitigation would thus be shifted to future generations. Some have argued that the growth dividend might help such investments pay for themselves in the future, but this is not guaranteed (Buffie and others 2012). And for countries with limited fiscal space, the payoff horizon, even of the most profitable projects, could prove to be too long compared to the associated fiscal risks.

Estimation of the macroeconomic effects in the illustrative scenarios laid out above using the CPAT model (Annex 1) is consistent with these observations (Figure 13):[19]

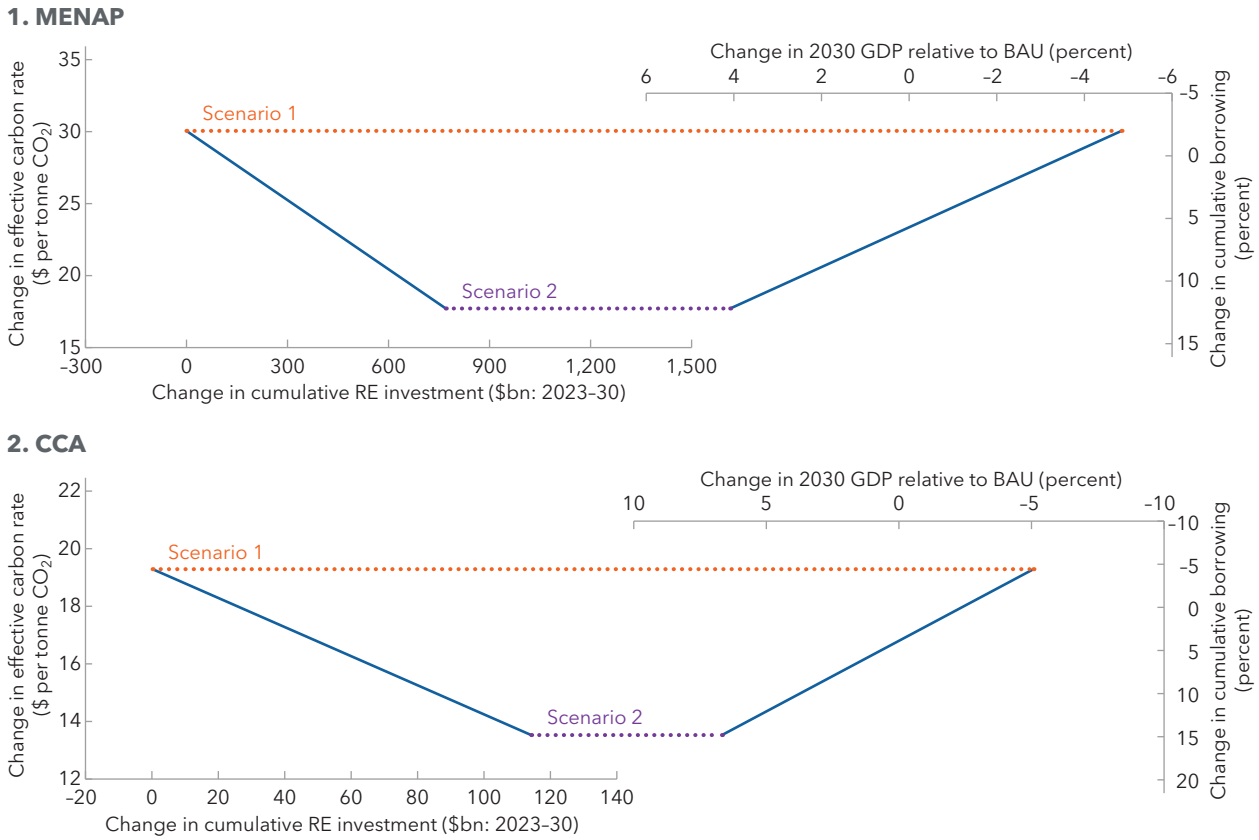
- A mitigation strategy based on removing fuel subsidies and imposing a carbon tax (Scenario 1) does not require additional fiscal financing. However, it would produce a sizable increase in energy prices, and, as a result, the 2030 real GDP per capita is projected at 5 percent below the BAU baseline in both MENAP and CCA.[20] Even when subsidy savings and carbon tax revenues are re-channeled to support the economy, fiscal savings remain positive, as manifested in lower additional borrowing of 2 percent of GDP in MENAP and 4 percent of GDP in the CCA. These savings arise from lower overall energy demand which requires less public investment in nonrenewable energy. Depending on the initial level of debt, these savings would at least partially offset the effect of lower GDP on the overall debt-to-GDP ratio.
- In the simulation of the illustrative scenario 2, significant RE investments and a smaller subsidy reduction provide a fiscal stimulus that leads to temporary acceleration of growth and raises real per capita incomes in 2030 by 4 and 7 percent in MENAP and the CCA, respectively, relative to the BAU baseline. At the same time, it squeezes countries' fiscal space and requires significant government borrowing which would raise government debt in 2030 by 12 percent of GDP in MENAP and 15 percent of GDP in the CCA.

[18] Studies focusing on advanced economy (AE) samples usually find that output loss is either negligible or slightly positive (see, for example, Metcalf and Stock forthcoming). The opposite growth impacts likely reflect differences in market structure and frictions between AEs and EMDEs, including smaller private sectors and less efficient revenue recycling policies in EMDEs.

[19] The estimates provided below depend crucially on the assumed links between fuel prices, energy consumption, and real GDP, which are subject to considerable uncertainty (see for example, Hansen and Brock 2019). The CPAT model relies on price elasticities obtained in various cross-country studies based on countries' characteristics (such as income level). The magnitude of the growth impact is similar to the results in IMF (2022a).

[20] In MENAP, for example, the median electricity tariff would need to rise from 8 cents per kilowatt hour in 2022 to 13 cents by 2030 (more than 60 percent).

Figure 13. Mitigation Policy Mix and Medium-Term Macroeconomic Trade-Offs
(All changes are defined relative to BAU scenario)



Source: IMF staff calculations.
Note: This is a simplified version of Annex Figure 1.1. For more detailed explanations of this chart and its derivation, please see Annex 1.

Beyond significant financing needs, the ability to reduce emissions through RE investments faces several other constraints. First, such investments take longer to implement—especially in settings with less developed renewable energy sectors and public financial management systems—and their volume is subject to countries' implementation capacity. The intermittent nature of renewables also creates challenges as renewable capacity is scaled up. Second, to have a meaningful long-term impact on reducing emissions, RE investments need to be directed both toward meeting new energy demand and replacing existing sources of energy from nonrenewable sources, which considerably raises the cost. For example, even if all MENAP countries' additional electricity demand during 2023–30 are to be met from renewable sources, their share in total electricity generation in 2030 would reach 30 percent in 2030—just 7 percentage points higher than in the BAU scenario—reducing emissions by only 2 percent relative to the BAU level. Finally, even if countries succeed in replacing all conventional power plants used for electricity generation with renewable sources, energy consumption and emissions from industry, transportation, and other sectors could increase—what is known as the rebound effect—unless economies undergo significant electrification. The latter potentially involves even larger fiscal costs if implemented by the government.

Long Term

Apart from varying medium-term outcomes, alternative combinations of ECR-raising measures and RE investments would, over time, also reshape economies in very different ways, with long-term ramifications for economic structures, growth potential, and future mitigation options.

A strategy that relies heavily on raising the ECR would have welfare advantages over strategies that hinge on RE investment in producing an economy with fewer energy price distortions, a more efficient allocation of resources, and greater energy efficiency. Raising the ECR would move the price of carbon toward its marginal social cost, promoting emissions cuts across all sectors in an efficient manner. Alongside, preserving countries' fiscal space would put governments in a strong position to support growth in the long term.

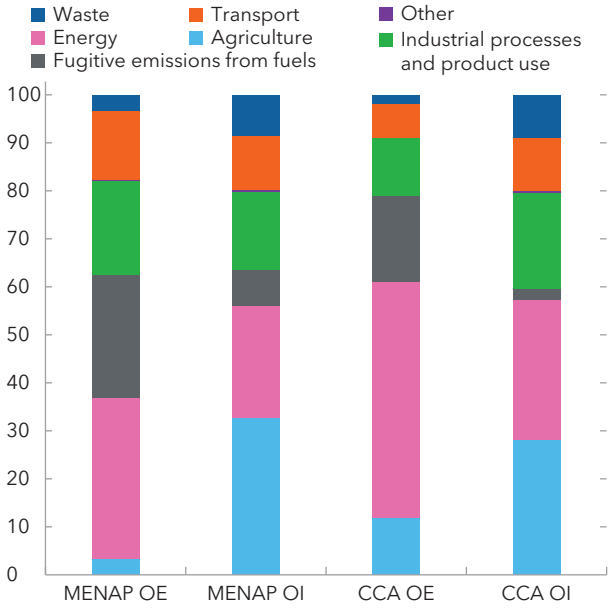
By contrast, a strategy that hinges on RE investment would concentrate mitigation efforts in specific sectors, such as power generation, leaving emissions from other sectors largely unabated. A sizeable share of economic activity, such as transport and residential heating, would continue to rely on fossil fuels, while the energy price distortions and attendant inefficiencies would remain to be addressed. While this could leave countries more energy-intensive and less competitive than the strategies that rely on raising the ECR, such a strategy would contribute to strengthening energy security and the external balances of oil-importing countries and make them less exposed to the inflationary impact of volatile commodity prices (Abdallah and Kpodar 2020). Nevertheless, a smaller fiscal space caused by the additional debt burden could further weigh down future growth prospects, especially in countries with already elevated debt levels (Reinhart and Rogoff 2010) or weak institutions (Vinokurov, Lavrova, and Petrenko 2020). A broad range of studies have documented empirical evidence of a negative effect of public debt on long-term GDP growth. For example, (Kumar and Woo 2010) estimate that additional public debt of 10 percent of GDP is associated with 0.2 percent lower real annual GDP growth rate in the long term. These estimates imply that, while facilitating a smoother medium-term low-carbon transition for the current generation, the illustrative scenario 2 could also set the ME&CA region on a path of lower long-term growth—by 0.2 percent in MENAP and 0.3 percent in the CCA relative to the BAU baseline—with larger risks to macroeconomic stability.

For many countries, achieving the 2030 emissions reduction targets is an intermediate step on the path toward reaching net zero or significantly reducing emissions in the following period. The costs of mitigation efforts beyond 2030 will depend on the strategies adopted now and the trade-off outlined above is likely to change over time. For example, prioritizing RE investments in the initial stages of climate mitigation could leave fewer high-impact investment opportunities available in the future, thus raising the marginal cost of emissions abatement using this instrument. At the same time, it would increase the attractiveness of pivoting toward raising the ECR because its impact on the overall price of energy would become increasingly muted as the share of electricity generated from renewable sources grows and technological advancements reduce the cost of electrification. By contrast, an initial greening strategy based on raising the ECR is expected to trigger economy-wide improvements in energy efficiency and switching to cleaner fuels. However, the presence of market failures, insufficient private initiatives, or regulatory roadblocks could hold back such adjustment in some sectors, particularly those involving large financing requirements. Such constraints could be addressed more directly with targeted public investment.

More generally, achieving net zero in the long term will require reducing emissions in both state-dominated sectors, such as the power sector, and parts of the economy which are more responsive to market signals such as manufacturing and transportation. This will likely require an array of mitigation measures involving both RE investments and ECR-raising measures as well as regulations and other sector-specific measures (Annex 3). This means that the medium-term fiscal trade-off associated with reaching the 2030 targets can be interpreted as the choice of where to start en route to net zero in the long term.

For individual countries, the question of where to start their mitigation efforts could be guided by examining the current sources of emissions (Figure 14). For example, in oil exporting countries, which tend to have larger fiscal space, over a half of GHG emissions originate from the power sector, including the use of fossil fuels in electricity generation and gas flaring, thus pointing to high potential efficacy of RE investments either from public or private sources. In oil importing countries, the contribution of the power sector to overall emissions is significantly smaller and budget constraints are generally tighter. This puts a premium on measures to

Figure 14. ME&CA Sectoral Emissions, 2019
(Percent of total emissions)



Sources: Edgar; and IMF staff calculations.

reduce the use of fossil fuels by households and other economic sectors, such as transportation and manufacturing, as well as addressing non-fossil fuel sources of emissions, particularly CH4, in the agriculture sector which accounts for a large share of overall GHG emissions.

The Role of Non-Fiscal Mitigation Policies

When planning their mitigation strategies, it will be important for countries to consider how much of a burden should be placed on fiscal policy, how this burden can be reduced, and what macroeconomic effects can be expected from non-fiscal mitigation efforts. In this context, incentivizing private initiatives in greening the economy and reducing emissions through regulatory intervention could be of particular importance.

Mobilizing private climate financing can be achieved through a variety of tools from leveraging public–private partnerships to incentivization of green loans and bonds (Prasad and others 2022). In this context, putting in place climate-friendly financial sector policies and developing financial market architecture to complement countries' mitigation strategies could help promote private sector participation (IMF 2022a). Tapping into this potential will allow countries to pursue RE investments with less fiscal resources and attendant debt sustainability risks, although such risks could be transferred onto the financial sector. To support this effort, it will be critical to also accelerate work by central banks to strengthen regulatory frameworks in the financial sector and enhance financial markets to make them more climate friendly. Many countries in ME&CA have begun working toward these ends. However, it is difficult at this stage to assess how much private climate financing can be mobilized toward emissions reduction by 2030, not least because private sector involvement depends on the relative price of carbon and thus hinges on the supportive role of fiscal policy. Therefore, while pursuing the goals of greater green investment by the private sector, it would be also important for policymakers to hold realistic expectations of their potential size.

Regulatory reforms, such as tightening of environmental standards and building codes or mandating a cleaner fuel mix in specific sectors, are a potent instrument in reducing emissions. Such measures would effectively raise the shadow price of carbon emissions and, therefore, could have a similar impact on the economy as raising the price of fossil fuels through taxation but without directly impacting government revenues. Like ECR-raising measures, such policies would place the burden of adjustment on economic agents and—depending on how they are introduced—could potentially weigh on growth and raise inflation during the transition, requiring fiscal and monetary policy responses (IMF 2022b). One difference from ECR-raising measures is that regulations can be easier to tailor to target specific sectors. While advantageous in some settings, such tailoring could also introduce unintended distortions in the economy and reduce overall efficiency of resource allocation.

5. Practical Considerations

The framework outlined above presents a broad way of embedding climate mitigation strategies in macroeconomic policies and quantifies the associated medium-term economic trade-offs for the ME&CA region.

At the global level, closer international cooperation could focus on improving these trade-offs. For example, increased external financial support, particularly in the form of grants or concessional financing, and technology sharing would ease the fiscal and growth constraints associated with climate mitigation policies in ME&CA countries. Alongside, coordinated mitigation actions, particularly across the region, could have sizable positive spillovers. Regional climate initiatives, for example the Middle East Green Initiative, could help diffuse domestic political sensitivity and allow ratcheting up overall ambition, while also facilitating knowledge sharing and limiting cross-border carbon leakage and arbitrage.

At the individual country level, the application of the proposed framework could start with a national policy dialogue over non-fiscal mitigation policies that would gauge the scope for reducing emissions through other measures and clarify the residual burden on fiscal policy to achieve climate mitigation goals. On this basis, the fiscal trade-off and the attendant macroeconomic implications can be quantified (and revised in the future as needed) to guide economic policies.

Given the quantified trade-off, policymakers would need to make a potentially difficult choice of the fiscal strategy, given the available fiscal space, and the various pros and cons of alternative approaches, including intergenerational considerations. Some studies have explored the use of cost-benefit or cost-effectiveness analyses to inform mitigation policy making (Köberle and others 2021). The former, also known as welfare analysis, typically assumes substitutability between all costs and benefits and hence the objectives, while the latter allows an evaluation of potential trade-offs between different objectives (Schneider and others 2007).

In practice, climate mitigation brings both global and local benefits, many of which are difficult to quantify in economic terms. Most mitigation policy packages, independent of the mix, are likely to be welfare-improving once the sizeable environmental, health, and other co-benefits are factored in. For example, consuming less fossil fuels helps reduce local air pollution which, in addition to entailing an economic cost of around $141 billion per year in MENA (2 percent of GDP) due to lower labor productivity, is also estimated to cause about 270,000 deaths a year (Heger and others 2022). By encouraging the use of public transportation over individual transportation, climate policy can also reduce congestion (IMF 2021). The benefits from containing temperature rise, including reduced adaptation costs, through global mitigation efforts could be even more significant.

Estimating potential costs of mitigation policies is equally challenging, especially in countries with significant fragilities, large development needs, and political economy constraints. In MENA, for example, fuel subsidies are usually described as being at the center of the broader social compact. Not surprisingly, past attempts at their reduction were, at times, met with widespread protests or even social unrest (Yemen and Tunisia in 2014, Iran in 2020, and Kazakhstan in 2022), reflecting the negative impact on the vulnerable and the broader economy. Similarly, a salient feature of many oil-exporting economies in the ME&CA region is the dominant position of state-owned enterprises in highly energy-intensive sectors such as petrochemicals, aluminum casting, steel production, and glass works. What effects higher energy prices would have on their viability and profitability—and what additional fiscal costs would they imply should governments

be forced to keep them afloat—is difficult to estimate.[21] A stylized welfare function is therefore unlikely to capture these multidimensional considerations and, consequently, countries' choice of the fiscal strategy is likely to be highly subjective and guided by their individual circumstances.

The design of future reforms will be critical for their success. For example, the region's own experience with subsidy reforms during the past decade provides clues about ingredients of future success. Reforms driven by government determination, supported by extensive public awareness campaigns and dialogue, and accompanied by significant boosting of targeted cash transfers (Jordan in 2012, Morocco during 2013–14, Egypt during 2014–19) tended to have bigger and longer lasting effects on reducing the level of subsidies. Improving targeting of social safety nets and developing new delivery mechanisms (Saudi Arabia in 2018) also helped contain the distributional impact of the reform and facilitate acceptance by the population. On the other hand, reforms introduced under significant economic stress (for example, by exporters during periods of large oil price declines) and/or political instability (Tunisia, 2012–13) tended to slow or even reverse over time due to waning public support.

[21] On the other hand, energy price reforms could foster innovation and adoption of more competitive technologies and business practices—what is known as the Porter hypothesis—which, for example, was found to be important in Oman (see Amman and others 2021).

6. Conclusion

This paper estimates that, under the Paris Agreement, countries in the ME&CA region have collectively committed to reduce annual GHG emissions in 2030 by 13 to 21 percent, depending on the availability of external support, relative to current trends. This means that the region's per capita emissions would need to be reduced by 7 percent over the next eight years.

Fulfilling this commitment entails a significant economic challenge that is likely to grow over time as the deadline nears, while many other competing needs, such as meeting the SDGs and adapting to climate change, become more acute. Therefore, balancing the region's priorities while ensuring an adequate contribution to the global climate mitigation effort requires full integration of emissions reduction policies into countries' economic strategies.

The discussion above lays out a framework to help countries do so and outlines the magnitude of the required policy efforts at the regional level. It focuses on the choice between two broad categories of fiscal policies to curb GHG emissions: public investments in renewable sources of energy and measures that raise the effective carbon rate. Such a choice involves important medium-term macroeconomic and long-term intergenerational trade-offs that are arguably the most pertinent for the countries in the Middle East and Central Asia where governments are expected to play a key role in the low-carbon transition.

On the one hand, the region's 2030 emissions reduction goals can be achieved through a gradual removal of all fuel subsidies and, in addition, a phased introduction of a carbon tax of $8 per metric-tonne of CO2-equivalent in MENAP and $4 in the CCA over the next eight years. Such an approach would set off a potentially challenging transition by the private sector toward a cleaner fuel mix and lower overall energy consumption that could temporarily weigh on economic growth. In the long term, however, such a transition would leave to future generations an economy with a stronger fiscal position, greater energy efficiency, and a more efficient overall allocation of resources.

Alternatively, additional public investments of close to $900 billion in renewable sources of energy between 2023 and 2030 would allow achieving the region's emission reduction targets with fuel subsidies reduced by two-thirds and without any carbon tax. Such a greening strategy implies a smaller increase in energy prices, improved energy independence, and faster economic growth during the transition. But a smoother low-carbon transition for the current generation could set future generations on a path of lower long-term growth due to higher debt, persistent distortions in the energy sector, and unabated emissions in many parts of the economy.

In between, many other combinations of these fiscal options can be compatible with reaching the ME&CA region's climate mitigation commitment, combined with other measures including regulations and sector-specific policies. How to share the economic burden of climate mitigation between current and future generations is arguably the most difficult and important decision that each government will need to make. Other mitigation policies could play an important role in alleviating the burden on fiscal policy and the trade-off outlined above. Examples of such policies include tightening building codes, mandating a transition to cleaner fuels and processes in manufacturing, reducing gas flaring from fossil fuel extraction, raising emissions standards in transportation, and mobilizing private investments in greening the economy.

A key takeaway from the discussion presented above is that, regardless of the choice, identifying the implied fiscal strategy and rolling it out early can help countries meet their mitigation pledges in time while minimizing potential economic dislocations. If action is delayed, the measures required to achieve a given commitment would become larger and the trade-off less favorable. This is especially pertinent for countries

which, in addition to their 2030 commitments, also pledged to reach net zero in the following decades and would therefore need to progressively raise their policy ambition. Increased external financial support, particularly concessional financing, could be used to ease the fiscal and growth trade-offs associated with climate mitigation policies.

There are other benefits to early identification of the fiscal strategy in support of climate mitigation. It would help countries arrive at credible estimates of potential external financing needs to inform both their own economic planning and the international dialogue on the needed external financial support. It would also provide sufficient time for domestic public discourse to take place, for the private sector to adjust to the expected policy changes, and for the authorities to implement other policies toward addressing the potential side effects—for example, by introducing measures to soften the distributional impact of mitigation policies, improving social safety nets, accelerating structural reforms to support the energy transition and offset potential growth effects, and strengthening financial sector regulations (IMF 2022). Finally, an early start will allow timely gearing up of other regulatory, fiscal, monetary, and financial sector policies and reforms, helping countries in the ME&CA region tread a smoother path toward greener economies.

Annex 1. Climate Policy Assessment Tool

The Climate Policy Assessment Tool (CPAT) is an Excel-based model jointly developed by the IMF and the World Bank. It provides, on a country-by-country basis, projections of fuel use and CO2 emissions by major energy sectors. CPAT is used to model baseline business-as-usual (BAU) scenarios as well mitigation policy scenarios.

Modeling the Business-as-Usual Scenarios

The CPAT tool starts with current use of fossil and other fuels by the power, industrial, transport, and residential sectors and projects fuel use forward in a baseline BAU scenario starting in 2019 using:

- GDP projections from the IMF *World Economic Outlook*
- Assumptions about the income elasticity of demand and own-price elasticity of demand for electricity and other fuel products, calibrated based on empirical findings in the literature
- Assumptions about the rate of technological change that affects energy efficiency and the productivity of different energy sources, calibrated to recent trends
- IMF and World Bank projections of future international energy prices.

In the BAU projections, current fuel taxes/subsidies and carbon pricing are held constant in real terms.

The impact of any given mitigation policy measure on fuel use and emissions depends on (1) its proportionate impact on future fuel prices in different sectors, (2) modeled fuel switching and electricity dispatch within the power generation sector, and (3) various own-price elasticities for electricity use and fuel use in other sectors.

The basic model is parameterized using data compiled by the International Energy Agency (IEA) on recent fuel use by country and sector. GDP projections are from the IMF forecasts reflected in the April 2022 World Economic Outlook. Data on energy taxes, subsidies, and prices by energy product and country are compiled from publicly available and IMF sources, with inputs from proprietary and third-party sources (see below). International energy (coal, oil, and natural gas) price projections are by the IMF and the World Bank. Assumptions for fuel price responsiveness are chosen to be broadly consistent with empirical evidence and results from energy models (fuel price elasticities are typically between about –0.5 and –0.8).

Carbon emissions factors by fuel product are from IEA. Non-carbon externalities per unit of fuel use in different sectors are based on methodologies described in Parry and others (2014, 2021).

Two modifications are made to tailor the CPAT model to the ME&CA region, including:

- To ensure the projected levels of emissions and energy consumption in 2020–22 are comparable to the estimates and forecasts from the IEA and other international agencies, one-time adjusters are applied to the model-estimated overall energy consumption to account for the large COVID-shock in 2020 and the bounce-back in 2021-22.

- Consistent with historical trends, annual efficiency gains of fuel uses are assumed to be muted in the MENAP countries compared to the rest of the world. In CCA countries, there is an assumed annual efficiency gain of 1 percent, consistent with the global trend observed in most countries in recent decades (CPAT model default).

One caveat is that, while the assumed fuel price responses are plausible for modest fuel price changes, they may not be for dramatic price changes which could accompany major technological advances, or nonlinear adoption of technologies like carbon capture and storage. In addition, the modeled fuel price responsiveness is approximately similar across countries; however, in practice, price responsiveness may differ across countries depending on the structure of the energy system and regulations on energy prices or emission rates. The model also does not explicitly account for the possibility of upward sloping fuel supply curves, general equilibrium effects (for example, changes in relative factor prices that might have feedback effects on the energy sector), and changes in international fuel prices that might result from simultaneous climate or energy price reform in large countries. Parameter values in the model are, however, chosen so that the results are broadly consistent with those from more detailed energy models.

Modeling Mitigation Scenarios

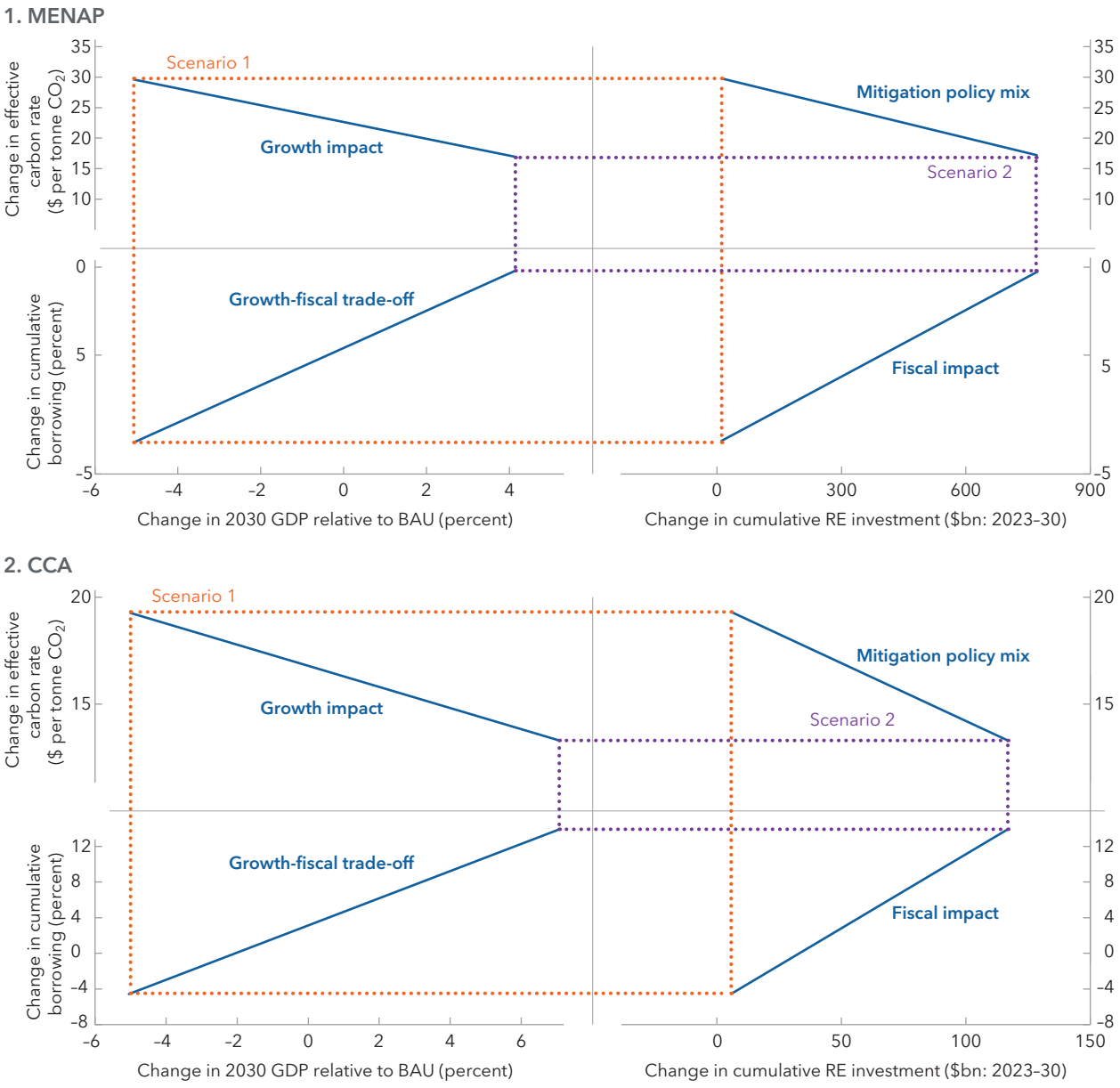
Mitigation scenarios differ from the BAU scenarios by assuming additional mitigation policy actions over the projection horizon. Except for mitigation policy actions and GDP (the latter becomes endogenous and varies depending on the mitigation policy actions), all other assumptions are identical across the different scenarios. The additional mitigation policy actions in this paper are fossil fuel subsidy removal, carbon taxation, and renewable energy investment in the power sector. The paths of fuel and electricity prices and consumption, the power sector's fuel mix, levels of emissions, and real GDP differ across different scenarios. They are modelled as follows:

- Fossil fuel subsidies reductions and carbon taxation are assumed to be fully passed on to end-users through increases in energy prices, which in turn affects the level of energy consumption and emissions. Both policy actions are assumed to be implemented gradually with annual increases in equal increments to reach the policy target in 2030. For example, fossil fuel subsidy removal is modelled as a fossil fuel subsidy reduction of 1/8 removal in 2023, 2/8 in 2024, 3/8 in 2025, 4/8 in 2026, 5/8 in 2027, 6/8 in 2028, 7/8 in 2029, and 100 percent removal in 2030. Both policy actions are expected to have an adverse growth impact, which is modeled through fiscal multiplier effects from higher excise taxes. 85 percent of the fiscal savings are channeled back to the economy through tax cuts on labor and corporate income, and their growth effects are also modeled as multiplier effects from lower income taxes. 15 percent of the fiscal savings are transferred to the vulnerable to preserve their BAU consumption levels.

- Renewable energy investment in the power sector is assumed to first meet the gap between the next year's expected electricity demand and the end-of-this-year's effective capacity. Beyond this level, investments are assumed to replace existing nonrenewable power plants (assuming they are being retired early). The electricity prices are expected to fall first because renewable energy has lower operational costs, before they start to rise as more expensive electricity storage facilities are needed (due to intermittency of renewable energy and insufficient storage capacity of power grids). For implementation, additional investments are assumed to be evenly spaced during eight years to gradually increase the renewable energy mix in the power sector at equal annual increments. Investment in renewable energy is expected to have a positive growth impact, which is modeled as fiscal multiplier effects from higher public investment.

Five nodes of different combinations of the two the types of mitigation policies that can help the region achieve its conditional NDC targets are solved. With the two end points representing the policy mix that leans heavily on raising the ECR (scenario 1) or on RE investment (scenario 2). The rest of the combinations

Annex Figure 1.1. Mitigation Policy Mix and Medium-Term Macroeconomic Trade-Offs
(All changes are defined relative to BAU scenario)



Source: IMF staff calculations.

are linearly interpolated. The curve that captures the possible combinations of the fiscal mitigation policy mix that achieve the region's conditional emissions targets can be found in the northeast quadrant of Annex Figure 1.1.

For any fiscal mitigation policy mix on the curve in the northeast quadrant, its economic impacts could be traced out by drawing a rectangle whose corners intersect with the curves in the other quadrants: the curve in northwest quadrant captures the economic growth impact of each corresponding policy mix in the northeast quadrant, while the curve in southeast quadrant shows the corresponding debt impact. As a result, the curve in the southwest quadrant shows the growth-debt trade-off, corresponding to the mitigation policy trade-off in the northeast quadrant.

Annex 2. Aggregation of ME&CA Region's Emissions Reduction Targets

Since 2016, 31 ME&CA countries (all except Libya) have outlined and communicated their plans to reduce national emissions in their nationally determined contributions (NDCs), submitted to the UNFCCC, and 22 provided updates to their NDCs between 2020 and 2022. In the latest NDCs, 29 include quantitative mitigation targets for 2030,[1] and all NDCs specify national-level or sector-level plans to reduce GHG emissions. The numerical mitigation targets are defined using different approaches and their aggregation requires a uniform methodology. The regional estimates reported in this paper are based on several assumptions which were used to bring countries' targets to a common denominator.

Business-as-usual (BAU) emissions projections. In IPCC AR6 report, BAU is defined as "a scenario that assumes no additional policies beyond those currently in place and that patterns of socio-economic development are consistent with recent trends." In the ME&CA region, 20 out of 29 ME&CA countries' mitigation targets are defined as a percentage reduction from a reference year (usually 2030) BAU emissions level. The emissions level in a BAU scenario can vary significantly depending on the assumptions and modeling framework used to project emissions. To date, only 10 countries have published their BAU emission level and very few reported the underlying assumptions used to project them. The coverage of sectors and GHGs within BAU scenarios also varies across countries.

The BAU scenarios in this paper were estimated for each country using a consistent approach based on the CPAT model (Annex 1). Excluding Pakistan, the aggregate BAU level of emissions implied by the CPAT model for the ME&CA region is 2 percent lower than that implied by the authorities' projected BAU levels. Pakistan is a notable outlier due to the assumption of "historically unprecedented and unmatched" economic growth underpinning the authorities' BAU emissions projection in 2030. The latter is 1.5 times higher than what is implied by the CPAT model. For other countries, the difference between the authorities' BAU and the CPAT BAU varies from 57 percent (Somalia) to –17 percent (Oman). These deviations can be explained by different growth assumptions and sectoral coverage. In Oman's case, its NDC target and BAU emission projection only covers the power sector while the CPAT model includes projections of other sectoral emissions. Due to data limitations, Syria and West Bank and Gaza are excluded from the exercise.

Calculation and aggregation of emissions reduction targets relies on several additional assumptions. First, for countries with mitigation targets expressed as a percent reduction from the BAU level, the CPAT model BAUs were used to quantify these targets for the purpose of aggregation. Thus, in absolute terms, individual country targets do not always coincide with the authorities' estimates, although the aggregate numbers are similar. Second, NDC targets expressed relative to a base year (historical approach) were recalculated in percent deviation from BAU.[2] In the few cases when such targets are higher than the BAU projection, the latter was used in place of a target (that is, countries were assumed not to seek raising emissions beyond the BAU level). Finally, in cases when the emissions reduction is targeted beyond 2030 (for example, Kuwait has a target for 2035), a linear interpolation is used to obtain an implied target for 2030.

[1] Emissions targets in Kuwait and West Bank and Gaza have a longer time horizon.

[2] Six countries in ME&CA region set their mitigation targets as a percentage reduction from the 1990 level, including most CCA countries.

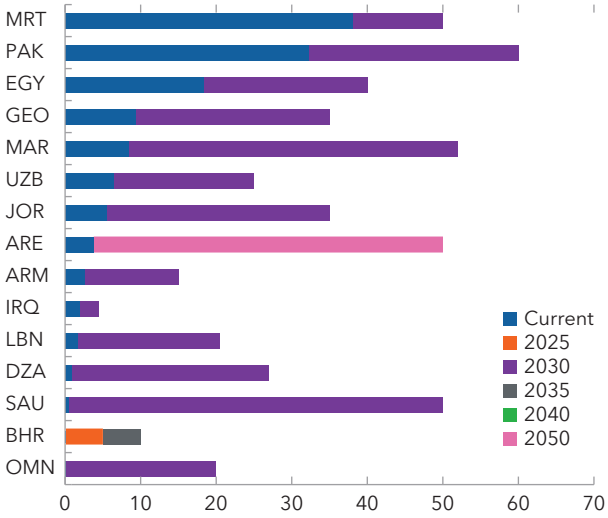
Annex 3. ME&CA Countries' Mitigation Policy Plans

ME&CA countries have laid out diverse strategies on how they intend to reach their mitigation targets. Some countries have provided broader economy-level strategies on the transformation to a low-carbon economy, while others disaggregate national-level mitigation targets by sectors, sometimes with detailed project-level costing and implementation plans. Some of the sectoral targets, such as the share of renewable energy in the power sector and the electric vehicle penetration rate, are specified and their contribution to emissions reduction could be estimated. However, other mitigation policies, especially those in the agriculture, waste, and industrial sectors, are discussed in less detail in the NDCs and are harder to quantify. More information on these commitments would help to better translate them into potential emissions reduction.

Power Sector

The power sector dominates the region's GHG emissions. In 2019, the energy sector and fugitive emissions from fuels together accounted for 59 percent of MENAP oil exporters' and 68 percent of CCA oil exporters' total GHG emissions. For the regions' oil importers, these two sectors are responsible for more than 30 percent of the emissions. As a result, power sector mitigation policies are a key part of ME&CA countries' mitigation strategies.

Annex Figure 3.1. ME&CA Renewable Energy Targets
(Percent of total energy mix/installed power capacity/ peak installed power)



Sources: UNFCCC; and IEA policies database.

Boosting renewable energy is a common policy proposed for power sector mitigation. In the coming decades, at least 24 countries in the ME&CA region are planning to increase the renewable or clean energy share in the power mix. Among them, 16 countries have set clear targets for the renewable energy share, varying from 5 percent in Iraq to 60 percent in Pakistan by 2030. Depending on their geographic characteristics, countries are planning to invest in hydropower, solar power, and offshore wind plants, while also developing nonrenewable clean energies such as nuclear.

However, investing in renewables alone would have limited impact if existing dirty energy sources continue to operate unabated. For example, reaching these renewable targets stated in the NDCs without other mitigation measures will likely allow countries to reduce their emissions by 1–10 percent relative to the BAU. Very few policies in the NDCs directly aim to retire high-emissions power sources, and they are usually replaced with less polluting fossil fuels such as natural gas-fired power plants (for example, Algeria, Iran, Saudi Arabia, and Yemen). However, investing in new gas-fired power plants might have a lock-in effect as they take several decades to retire, which may become a hurdle on the path to reaching net-zero emissions beyond 2030.

Annex Table 3.1. Selected Policies on Increasing Energy Efficiency and Reducing Energy Consumption

United Arab Emirates	Increase the efficiency of energy consumption through regulatory measures, pricing signals, as well as technology deployment. The country has set a federal target to reduce energy consumption by 40% by the year 2050.
Egypt	More efficient use of energy, especially by end users; use of advanced, locally appropriate, and more-efficient fossil fuel technologies, in addition to new generation of nuclear power; Reform energy subsidies; Improve energy efficiency in the electricity sector; Improve energy efficiency in petroleum.
Kuwait	The State of Kuwait has initiated formal producers to study the law of removal of subsidies for gasoline from the beginning of 2016 and gradually remove subsidies for electricity and water in commercial and industrial sectors.
Uzbekistan	Halve the energy intensity of GDP.
Bahrain	The National Energy Efficiency Action Plan (NEEAP) lays out a comprehensive set of 22 initiatives across all sectors and targeting efficiency improvements in both energy supply and demand, including improving efficiency in energy production, transmission and distribution, and implementing building energy efficiency code and labeling.

Other policies aim to reduce energy consumption and increase energy efficiency, including through energy subsidy reforms and technological improvements. Some refer to their ongoing energy subsidies reforms (for example, Egypt and Kuwait). Others plan to use awareness campaigns to incentivize behavioral changes in energy usage. Some countries are also planning to modernize the power sector to minimize the generation and transmission loss.

Some countries have also pledged to reduce fugitive emissions by reducing or banning gas flaring. In their latest NDCs, Algeria, Iran, Iraq, and Oman plan to reduce gas flaring, while Saudi Arabia commits to reaching zero flaring in the oil and gas industry. Fugitive emissions make up another big part of emissions for oil exporters, accounting for, on average, 25 percent of MENAP oil exporters' emissions and 18 percent of CCA oil exporters' emissions. According to the World Bank Global Gas Flaring Database, half of the world's top 20 largest gas flaring and venting countries are from the region, and more than $7 billion can be generated in revenue annually if the flared gas is captured instead. However, capturing gas flaring and commercializing it will require significant upfront capital investment (Emam 2015).

Annex Table 3.2. Selected Policies on Reducing Fugitive Emissions

Algeria	Reduce gas flaring to less than 1% by 2030.
Iran	Reduction of gas flaring emissions.
Saudi Arabia	Zero flaring in the oil and gas industry.
Oman	Reduce gas flaring and reduce methane and fugitive emissions.
Iraq	Reduce levels of associated gas flaring and its involvement in oil and natural gas extraction processes.

Quantifying all power sector policies is challenging. Some power sector policies are straightforward to translate to emission reduction, such as renewable energy targets, banning gas flaring, and numerical goals on energy consumption reduction or energy efficiency improvement. Others require more detailed implementation plans to calculate the potential outcomes.

Annex Table 3.3. Selected Policies in Transportation Sector

United Arab Emirates	The Dubai Green Mobility Strategy targets a 2% share of electric and hybrid cars in Dubai's road fleet by 2030, and a 30% share in Dubai's government-procured vehicles by the same year.
Jordan	Promoting hybrid and electric cars at the national level, including through targeting 50% of the public fleet to be EVs.
Azerbaijan	Use of environmentally friendly forms of transport; Enhancement of the use of EVs and public transportation; Electrification of railway lines; Improvement of the transport management system; Development of metro transport; Reducing congestion.
Sudan	Promoting public transportation; Blending fossil fuel with biofuel and promoting fuel efficiency.
Somalia	Improvement of road conditions through investment in road infrastructure; Improve vehicle stock efficiency including for the three wheeled tuk-tuks.

Transport Sector

The transport sector accounts for about 12 percent of total GHG emissions in the ME&CA region. With rapid population growth and urbanization, emissions from transportation in the region have almost doubled since 2000, led by a 31-fold increase in Tajikistan.

Transport sector mitigation policies differ by countries' income level and degree of urbanization. Promoting electric vehicles (EVs) is a common policy among countries with a larger middle class and private vehicle ownership. These countries are also investing in greening public transportation, for example through electrifying metro systems and railroads, and are embedding intelligent transportation management systems in the urban planning process. Meanwhile, lower-income countries rely on policies that focus on improving road efficiency, including upgrading road infrastructure, reducing traffic jams, and increasing vehicle fuel efficiency. Like the power sector, reducing emissions in the transport sector also relies on the early retirement of high-emissions vehicles. In this regard, several countries are planning to implement policies such as banning imports of fuel-inefficient used vehicles and adopting stricter vehicle emissions standards such as EURO 6.[3]

Agriculture Sector

The agriculture sector contributes a significant portion of emissions for oil importers, accounting for around 33 percent in MENAP oil-importing countries and 28 percent of CCA oil-importing countries, and a much smaller share in oil exporters: 3 and 13 percent in MENAP and the CCA, respectively. Agriculture sector emissions increased by over 30 percent in the ME&CA region over the past two decades following economic and population growth. That said, reporting agricultural emissions is complex, and estimates are often subject to a lot of ambiguity. It is also difficult to quantify the mitigation measures in this sector since policies are often not described in detail and lack numerical targets. Current policies can be summarized as follows:

- *Managing emissions from crop and livestock productions*. Agricultural activities release mainly non-CO2 GHGs such as methane (CH4) released by cattle and nitrous oxide (N2O) from the use of synthetic fertilizers. Countries in the region are considering measures to tackle emissions in farming, including manure management, improving the cropping system, fertilizer management, improving irrigation infrastructure, and promoting digital agriculture and technological innovation in farming.
- *Afforestation and reforestation*. Policies in this area focus on reducing emissions from deforestation that is driven by agriculture land usage.

[3] The latest European Emission Standards for light-duty vehicles.

Annex Table 3.4. Selected Policies in Agriculture Sector

Egypt	Enteric fermentation; Manure management; Rice cultivation; Field burning of agricultural residues; Ammonia not used in urea; Nitrogenous fertilizer and nitric acid management.
Tajikistan	Promoting efficient irrigation technologies; Optimizing the use of fertilizers; Introduction of technologies and equipment for collecting of anaerobic systems; Manure storage.
Morocco	Promote renewable energies in the field of irrigation by promoting the use of pumping solar in water efficient irrigation projects.
Armenia	Improve nitrogen fertilizer management and the development of organic farming; Improve irrigation systems; Promote digital agriculture and technological innovation.

Industrial Sector

Emissions in the industrial sector have outpaced growth in other sectors in the ME&CA region, more than doubling over the past two decades. They now account for 20 percent of total emissions in MENAP oil exporters and CCA oil importers, and about 15 percent in MENAP oil importers and CCA oil exporters. The share of emissions from the industrial sector is highest in the UAE (38 percent), Saudi Arabia (29 percent), and Egypt (25 percent). Countries' mitigation plans aim to reduce emissions from both the production process and the final consumption stage. Most of them focus on the latter through measures such as rehabilitation of buildings and promoting energy-efficient household appliances, and a few countries are considering industry-specific measures to contain emissions from production processes.

Annex Table 3.5. Selected Policies in Industrial Sector

Jordan	Use of steel slag and/or fly ash to substitute the raw materials needed to produce clinker; Increase the percentage of Pozzolana in CEM II; Produce new cement product CEM IV with 45% of Pozzolana; Implementing pilot interventions to scale-up the sustainable use of cooling technologies with climate-friendly gases.
Somalia	Promotion of clean and energy efficient cooking; Promotion of distributed renewable lamps; Promotion of use of energy efficient light bulbs.
United Arab Emirates	Dubai has set a target to retrofit 30,000 buildings in the Emirate by 2030; Ras Al Khaimah's Retrofit Program aims to retrofit 3,000 buildings by 2040.

Waste Sector

The waste sector accounted for less than 10 percent of emissions in the ME&CA region in 2019. Countries' policies in the waste sector are a combination of encouraging recycling to reduce waste and improving waste management to reduce emissions via both legislation and market measures. For example, seven countries plan to improve both solid waste and wastewater management through adopting various technologies, and five countries' NDCs include recycling policies. Two countries are planning to explore power generation using biogas from waste treatment.

Annex Table 3.6. Selected Policies in Waste Sector

Sudan	Composting 60% of organic and recycling 15% of the total waste; Establishment of landfills in all large urban areas of Sudan; Integrated solid waste management; Waste-water treatment, Sludge to biogas for electricity generation
Morocco	Reduce the waste to be disposed of in controlled landfills and improve the recycling-recovery rate by 2030, including: 20% recycling of household and similar waste (DMA); 20% recovery of organic matter from DMA; 10% energy recovery from waste; 25% recycling of industrial waste; 70% recycling of end-of-life vehicles; Achieve a volume of treated wastewater of 50% in 2016, 60% in 2020 and 100% in 2030; Treat wastewater to the tertiary sector and reuse it at 50% for inland cities in 2020.
United Arab Emirates	Increase waste management through regulation, technology, and consumer awareness

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