MIDDLE EAST AND
NORTH AFRICA

Morocco

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COUNTRY CLIMATE AND DEVELOPMENT REPORT

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Abbreviations and Acronyms

2030-NCP	2030 National Climate Plan
2050-LEDS	Long-term Low Emission Development Strategy for 2050
AAL	Annual Average Losses
ABH	Agence de Bassin Hydraulique (Water Basin Agency)
AMCDD	Alliance Marocaine pour le Climat et le Développement Durable (Morocco Alliance for Climate and Sustainable Development)
AMMC	Moroccan Capital Market Authority
ANGE	Agence Nationale pour la Gestion de l'Eau (National Water Agency)
APE	Agence Nationale de Gestion Stratégique des Participations de l'État (National Agency for Strategic Management of State Participation)
ARM	Association des Régions du Maroc (Association of Regions in Morocco)
BAM	Bank Al Maghrib (Central Bank of Morocco)
BAU	Business As Usual
CAGR	Compound Annual Growth Rate
CAPEX	Capital Expenditure
CAR	Capital Adequacy Ratio
CAT	Climate Action Tracker
CBAM	Carbon Border Adjustment Mechanism
CBI	Climate Bonds Initiative
CCDR	Country Climate and Development Report
CCGT	Combined Cycle Gas Turbines
CCIA	Climate Change Institutional Assessment
CCKP	Climate Change Knowledge Platform
CCS	Carbon Capture and Storage
CDG	Caisse de Dépôt et de Gestion
CEEAT	Clean Energy Employment Assessment Tool
CESE	Economic, Social and Environmental Council (of Morocco)
CGE	Computable General Equilibrium
CGEM	Confédération Générale des Entreprises du Maroc (General Confederation of Moroccan Enterprises)
COVID-19	Coronavirus disease 2019
CPSD	Country Private Sector Diagnosis
CSO	Civil Society Organization
DEPF	Département des Etudes et des Prévisions Financières (Department of Studies and Forecasts)
DPH	Domaine Public Hydraulique (Public Water Domain)
DRF	Disaster Risk Financing
DRM	Disaster Risk Management
EG	Environmental Goods
EIP	Eco-Industrial Zones
ENVISAGE	Environmental Impact and Sustainability Applied General Equilibrium model

EPM	Electricity Planning Model
ESMAP	Energy Sector Management Assistance Program
EV	Electric Vehicle
FDA	Fonds de Développement Agricole (Agriculture Development Fund)
FDI	Foreign Direct Investment
FLCN	Fonds de Lutte contre les effets des Catastrophes Naturelles (Natural Disasters Resilience Fund)
FLFP	Female Labor Force Participation
FMVI	Mohammed VI Strategic Investment Fund
FSEC	Fonds de Solidarité contre les Evènements Catastrophiques (Solidarity Fund Against Catastrophic Events)
GH	Green Hydrogen
GHG	Greenhouse Gas
GJ	Giga-Joule
GTAP	Global Trade Analysis Project
GW	Giga Watt
GWh	Giga Watt-hour
HCP	Haut Commissariat au Plan (High Planning Commission)
HDI	Human Development Index
ICT	Internal Consumption Tax
I4CE	Institute for Climate Economics
JICA	Japan International Cooperation Agency
LG	Local Government
LPG	Liquid Petroleum Gas
LSI	Large-Scale Irrigation
MAD	Moroccan Dirham
MENA	Middle East and North Africa
MFMod	Macro-Fiscal Model
Mt	Metric ton
Mtons	Million tons
NDC	Nationally Determined Contribution (to Paris Agreement)
NDM	New Development Model
NGF	Network for Greening the Financial System
NGO	Non-Governmental Organization
NPL	Non-Performing Loan
NPV	Net Present Value
NSAP	National Strategic Adaptation Plan
O&M	Operations and Maintenance
OCGT	Open-Cycle Gas Turbines
OCP	Office Chérifien des Phosphates (Morocco Phosphate Office)
OIZ	Organized Industrial Zones
ONEE	Office National de l'Electricité et de l'Eau potable (National Agency for Electricity and Water)

OPEX	Operating Expenditure
ORMVA	Office Régional de Mise en Valeur Agricole (Regional Office for Agriculture Development)
PCT	Plan Climat Territorial (Regional Climate Plan)
PDC	Plan de Développement Communal (Municipal Development Plan)
PDR	Plan de Développement Régional (Regional Development Plan)
PdP	Projet de Performance (Performance Plan)
PEA	Pacte d'Exemplarité de l'Administration (State Examplarity Pact)
PFM	Public Finance Management
PI	Private Irrigation
PMV	Plan Maroc Vert (Green Morocco Plan)
PNE	Plan National de l'Eau (National Water Plan)
PNEEI	Programme National d'Economie d'Eau en Irrigation (National Program for Water Savings in Agriculture)
PNI	Plan National de Protection Contre les Inondations (National Flood Protection Plan)
PPP	Public-Private Partnership
Ppts	Percentage points
PV	Photovoltaic
RE	Renewable Energy
RES	Renewable Energy Sources
RISE	Regulatory Indicators for Sustainable Energy
RLC	Reslient and Low-Carbon
SME	Small and Medium Enterprises
SMI	Small-Scale Irrigation
SNDD	Stratégie Nationale de Développement Durable (Sustainable Development National Strategy)
SOE	State-Owned Enterprise
SRAT	Schéma Régional d'Aménagement du Territoire (Regional Development Plan)
TAC	Tangier Automotive City
TFZ	Tangier Free Zone (TFZ)
TWh	Tera Watt-hour
UNFCCC	United Nations Framework Convention on Climate Change
VAT	Value Added Tax
WDI	World Development Indicators
WUA	Water Users Association
WUE	Water Use Efficiency

Standard currency unit is US dollars noted as simply $

1 $ = 11.0 MAD as of October 31, 2022

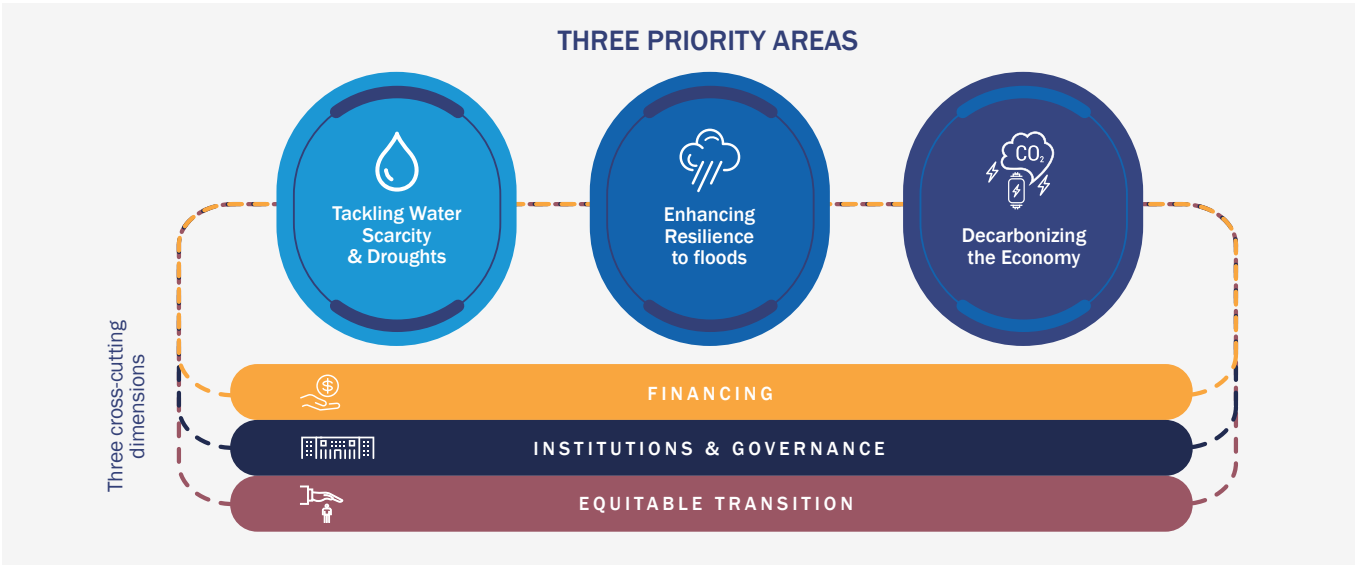
Executive Summary

Morocco is at a critical juncture in its development process. The structural reforms launched two decades ago have given way to a sustained period of economic growth and poverty reduction that is unparalleled in the country's recent history. However, this model began to exhibit increasing signs of exhaustion even before the COVID-19 pandemic hit, prompting an inclusive national reflection on how Morocco's path towards more rapid economic growth and social development can be reinvigorated. This resulted in the New Development Model (NDM), which has set ambitious development targets with a 2035 horizon. The country now faces intertwined and compounded challenges in order to implement this vision: (i) heightened vulnerability to a changing climate, as evidenced by the recent string of severe droughts (three in the last four years); (ii) the urgent need to accelerate structural reforms to put the country's development on a more solid, equitable, and sustainable path; and (iii) achieving all of this within a constrained fiscal space.

This Country Climate and Development Report (CCDR) explores the relationship between Morocco's development goals and climate change, in terms of both risks and opportunities. Building on an extensive body of quantitative and qualitative studies as well as on novel modeling exercises,[1] this CCDR analyzes the interplay between the country's development goals and climate change, and examines the risks that climate change poses to the country's development path, but also the opportunities that can come from the global trend toward decarbonization. And it explores policy and investment options that could achieve both climate and development objectives in a synergistic manner.

Building on a rich body of analytical work, three priority areas were identified for this CCDR. These were considered to capture the most salient nexuses between Morocco's development prospects and its climate commitments, and to hold the greatest potential for putting Morocco on a climate-resilient and low-carbon (RLC) pathway. These areas are: (i) tackling water scarcity and droughts, notably through the lens of the water-agriculture nexus; (ii) enhancing resilience to floods in order to preserve urban and coastal economies and livelihoods; and (iii) decarbonizing the economy, looking at a zero-net emission pathway by the 2050s. In addition, three cross-cutting areas are seen as critical enablers in order for these priority areas to materialize: (i) financing (from both private and public sources); (ii) institutions and governance; and (iii) equitable transition to ensure that no one is left behind.

Figure - Morocco's CCDR Framework for a Resilient and Low Carbon (RLC) Pathway



[1] It should be recognized, however, that the economic and social effects associated with climate change are still uncertain in Morocco, as elsewhere. As such, the quantitative tools presented in this report are not intended to generate predictions of such impacts, but to provide a unified analytical framework with which to identify the tradeoffs between various policy choices.

A key message that emerges from this CCDR is that Morocco can pursue a path that contributes to achieving both climate and development objectives in a synergistic manner. The modeling exercises presented in this report show that embarking on a RLC pathway would not compromise Morocco´s macroeconomic stability. They indicate instead that GDP and growth could be higher than in a scenario of inaction. Fiscal and external balances could also improve with the introduction of the right policies. In other words, climate action can have a positive impact on GDP, and can contribute to accelerating progress towards Morocco's development goals. Such a pathway would, however, be contingent on the private sector playing a central role, with the expectation that it would shoulder a large share of the investments under the mitigation agenda, and potentially on the adaptation front as well, though to a lesser extent. The policies that are needed for these private investments to materialize coincide in many respects with those that would be required to address the structural bottlenecks that have constrained Morocco's economic growth in recent years. The following section summarizes the sectoral and structural reforms that would back a resilient and low carbon pathway.

Sectoral Policies for a Resilient and Low Carbon Transition

Water scarcity could impact almost every aspect of Morocco's future socioeconomic development. Morocco is one of the most water-scarce countries in the world: it is quickly approaching the absolute water scarcity threshold of 500 cubic meters (m3) per person per year. The increasing incidence and severity of droughts is already a major source of macroeconomic volatility, and a threat to food security at the national level. With a longer-term perspective, the reduction in water availability and the drop in crop yields due to climate change could reduce GDP by up to 6.5 percent. Rainfed agriculture (bour) is particularly vulnerable to both droughts and water scarcity. Since rainfed agriculture still represents 80 percent of the country's cultivated area and employs most of the agricultural workforce, climate-induced changes (water availability and crop yield) on rainfed agriculture could result in out-migration to urban areas of up to 1.9 million Moroccans (about 5.4 percent of the total population) by 2050.

The deployment of water infrastructure at a massive scale has been a critical contributor to Morocco's recent development. Since the late 1960s, the kingdom has built more than 120 large dams, leading to a tenfold increase in the total capacity for water mobilization–from 2 to almost 20 billion cubic meters. It also expanded drip irrigation, which resulted in an increase of water productivity in agriculture, by far the most important water-consuming sector in Morocco. This enabled Morocco to shift to more productive crops and to almost double real agricultural value added over the past two decades. However, these large investments have not avoided the increased pressure on water resources and the overexploitation of underground resources. Moreover, the effectiveness of infrastructure as a buffer against the macroeconomic volatility induced by rainfall shocks may be decreasing in the context of climate change and declining trend in water inflows.

Investment in infrastructure is a necessary but not sufficient condition for coping with the challenge of water scarcity; and a change of paradigm is needed. Morocco has put forward an ambitious water investment plan for 2020-2050, the Plan National de l'Eau (PNE) (National Water Plan), which aims to close the water demand-supply gap. This CCDR emphasizes that given the high level of vulnerability of Morocco to both droughts and water scarcity, investing in water infrastructure yields positive returns for the economy and should remain a priority. However, based on international experience and an extensive body of academic research, we also argue that these returns will not fully materialize unless infrastructure development is paired with additional "soft" measures, such as water demand management, water governance, and other actions designed to bring about behavioral changes. This is aligned with the NDM, which recommends "reflecting the true value of the water resource and incentivizing a more efficient and rationale use and management of the resource."

Floods also represent a threat to development. Floods are the most frequent climate-related natural hazards in Morocco, causing average direct losses estimated at $450 million per year, with a disproportionate impact on vulnerable households. In addition, given that more than 65 percent of the population and 90 percent of industry is concentrated on the country´s coastline, sea-level rise constitutes another long-term stressor, especially for low-lying areas that will contribute to exacerbating the risk of floods.

Morocco has developed a sophisticated architecture for disaster risk management (DRM) and disaster risk financing (DRF), but the scale of investment in risk reduction and insurance coverage remains insufficient. The

country has developed a DRM system building on innovative schemes, including the Natural Disasters Resilience Fund (FLCN), initially created to finance post-disaster reconstruction, and then turned into a mechanism that co-finances disaster risk reduction and preparedness investments at the local level. It has also strengthened its financial resilience to natural disasters through the establishment of a dual catastrophic risk insurance regime that involves private insurers, and a public Solidarity Fund Against Catastrophic Events (FSEC). The scale of the protection offered by these mechanisms, however, remains insufficient. The quantitative simulations included in this CCDR conclude that an optimal level of DRM investments would cover the equivalent of 15-20 percent of annual average losses (AAL), corresponding to an average annual investment between $67 and $90 million. The simulations also emphasize that scaling up the DRF scheme is critical in order to adequately cope with extreme events. In addition, given their high returns, nonstructural investments such as early warning systems, nature-based solutions, risk and climate knowledge, and awareness raising should be more systematically integrated into the DRM approach. On the institutional front, Morocco should continue strengthening cross-sectoral and territorial coordination to increase the effectiveness of the DRM system.

Morocco can decarbonize its economy gradually. The CCDR estimates that Morocco could reach a net-zero emissions by the 2050s by taking advantage of its abundant competitive renewable energy resources and implementing its ambitious Reforestation Program. Decarbonizing its economy would also contribute to increase its energy independence and reduce the average cost of electricity generation. The power sector would be the cornerstone of the decarbonization strategy: first of all because it is the major contributor to greenhouse gas (GHG) emissions, but also because it would support the decarbonization of end-use sectors such as road transport and industry, which are also major emitters. While Morocco represents only 0.2 percent of global GHG emissions, it has a carbon intensive power sector. Decarbonizing the power sector would require a gradual phase-out of coal-fired generation through the deployment of renewable energy and energy storage technologies, with natural gas as a transition fuel. To switch from reliance on large thermal power plants towards more dispersed solar and wind power plants and to ensure network stability, large investments in the transmission grid would be required. In the medium to long term, Morocco could develop large-scale production of green hydrogen and its derivatives--which could be used for domestic purposes such as the production of green fertilizer, transport, and as a substitute for natural gas in power generation—but also for export (to the European Union (EU), for example). As the fifth largest exporter of fertilizers, Morocco has already taken decisive steps to reduce the footprint of its highly energy- and water-intensive phosphate industry. In addition, efforts to improve energy efficiency across all sectors should be pursued. Investing in renewables and energy efficiency in line with government targets by 2030 could result in around 28,000 net jobs per year, or about 9 percent of the estimated 300,000 annual jobs shortfall facing the economy. In order to achieve those targets, appropriate higher education and vocational training would need to be in place in order to prepare the workforce for these new jobs.

Decarbonizing the economy would require massive investment but would also equire profound reforms. Reaching a net-zero emission target by the 2050s would have an estimated cost of $52.8 billion[2] . In this CCDR, we estimate that more than 85 percent of the investment needed to decarbonize the economy would be covered by the private sector. However, in order for this to materialize, profound reforms would have to occur, most notably in the power sector. This would include sector unbundling; the creation of wholesale and balancing markets; fully cost-reflective network access and end-user tariffs; and increased market integration with the European Union (EU). Policies and market incentives would also need to be put into place in order to develop e-mobility and green hydrogen.

Decarbonization could bring significant benefits to the Moroccan economy. Morocco is particularly well placed to reap the economic benefits that could emanate from the global decarbonization agenda. Its economy is closely integrated with the EU, which is among the regional blocks that have embraced ambitious climate action targets. In this regard, decarbonization represents an opportunity for the Moroccan industry to not only maintain but even expand its market share in Europe. It would also increase the country's attractiveness for foreign direct investment (FDI), and position Morocco as a hub for green investment and export, with positive spillovers in terms of economic growth and jobs.

[2] This amount is in net present value applying a 6 percent discount rate. It also comprises all costs related to green hydrogen, including exports.

Structural and Macroeconomic Policies for a Resilient and Low Carbon Transition

This CCDR estimates the total investment needed for a resilient and net zero Morocco by 2050s at about $78 billion in net present value (NPV) terms[4] . Ultimately the impact of the transition will depend on how these investments are financed, and more broadly on the macroeconomic policy choices that will be made in the years and decades to come. Therefore, beyond the sectoral interventions discussed above, the CCDR also focuses on various structural and macroeconomic policies that could synergistically pursue both the Kingdom's development objectives and its climate adaptation and mitigation ambitions.

The private sector will be central both in the RLC transition and in rebalancing Morocco's growth model. As mentioned above, it is expected that the investments in decarbonization would, by and large, be shouldered by the private sector. On the adaptation front, while most of the investment needs identified in this report are expected to be covered by public financing, there is room for attracting private operators on specific interventions—for example sea-water desalination, but also climate-smart agriculture and insurance. Maximizing private climate investment would help release pressure on public finances and would also have broader positive impacts on the economy. But in order to achieve this, Morocco would need to relieve the structural constraints that have prevented private firms from entering new markets and growing, which is also critical in order to accelerate productivity growth and job creation going forward.

Greening the financial system could also help channel resources toward climate-friendly activities. As a first step, Morocco should consider adopting a green national taxonomy (i.e., a classification scheme). Moreover, a public guarantee or investment vehicle could be put in place to de-risk and crowd in green commercial investments, a role that could be partly played by the newly created Mohammed VI Strategic Investment Fund. This CCDR also considers the financial stability dimension of climate change. It uses a stress- testing methodology developed together with the central bank that shows that the impacts could be significant; this calls for reinforcing of the coverage of climate risks in financial regulation and supervision.

The fiscal dimension will be central for the RLC transition in Morocco, since a significant part of the investments will inevitably have to be led by the public sector. The COVID-19 shock led to a large increase in public debt and may eventually force the authorities to embark on a fiscal consolidation process that could increase competition for scarce public resources. In this context, this CCDR explores various options that could increase fiscal revenues through environmental tax reforms and water valuation policies, while synergistically pursuing climate objectives.

Environmental tax reform and water valuation policies could generate an important flow of public revenues, and could be less harmful to the economy than conventional tax reform. A few options could be considered, including the elimination of "brown" tax expenditures; the removal of explicit butane gas subsidies; and the introduction of a carbon tax. Overall, these reforms could mobilize more than 2 percent of GDP in the short term. They would also trigger behavioral and economic adjustments that would generate climate co-benefits; as a result, the revenues of such environmental taxes would tend to decline over time. In the longer term, the CCDR modeling analysis show that their macroeconomic impacts would be better than those of an equivalent tax reform". Similarly, increasing water tariffs, which have been maintained at low levels despite the growing scarcity of resources, could also have positive fiscal impacts while also encouraging a more rational use of water.

However, such reforms could have disproportionate impacts on the poor and vulnerable; therefore, compensatory measures should be carefully crafted to ensure an equitable transition. Both the environmental tax and the water valuation reforms could reduce private consumption, channeled through the price increases that these policies would cause. A well-targeted cash transfer program could be the best compensation option to offset the negative impacts on the most disadvantaged households. For that purpose, the government could leverage the Unified Social Registry that is currently being deployed. It should be noted that environmental tax reforms are more likely to succeed when implemented in a context of price stability: as such, the timing of the reform, along with its sequencing with the compensatory measure roll out, need to be carefully handled.

[4] With a discount rate of 6 percent, i.e. representing a total undiscounted amount of $219 billion for the 2022-2050 period.

Principles for Pursuing a Transition to a Resilient and Low Carbon Economy

This CCDR presents a series of principles that could be used to guide the process as Morocco embarks on an ambitious set of policy reforms to synergistically pursue its development objectives and its climate adaptation and mitigation ambitions.

Principle #1: Adopt a "Whole-of-Government" Approach. The level of complexity this challenge represents cannot be tackled through sectoral lenses and under current institutional boundaries. Instead, it requires a "whole of government" approach that will ensure that climate change is recognized as an intrinsic constituent of the development model, at both the macro and sectoral levels, with enhanced articulation between the various levels of jurisdictions. In this context, Morocco needs to strengthen its coordination mechanisms both horizontally and vertically, since local governments will be expected to play an important role in climate actions. In addition, public finance management (PFM) tools, such as a climate-sensitive budget, green procurement, and environmental fiscality have the potential for systematically mainstreaming climate consideration in all public actions and ensuring a full alignment with the Nationally-Determined Contribution (NDC).

Principle #2: Protect the Most Vulnerable. Poor households tend to be systematically more vulnerable to climate events, but also to the impact of climate policies. As Morocco embarks on an overhaul of its social protection system, it has an opportunity to embed climate-responsive features that would allow the system to respond swiftly to protect those who are affected by climate-related events, and to offset their losses in income or assets. In addition, the country could expand its already sophisticated DRF mechanism for flood protection, including the coverage of the risk of floods. Since climate policies could also be harmful to vulnerable households and firms that don't have the adaptative capacity to quickly adjust, compensatory measures need to be carefully crafted to avoid exacerbating social disparities, and to contribute to an equitable and inclusive transition. While the RLC transition holds prospects for the creation of green jobs, there will be a need to prepare workers for these opportunities by putting into place incentives in the educational and vocational training systems to reorient programs toward the shift in skill that is needed. Public policies should also anticipate the migratory flows that could be triggered by climate change, most notably in the areas of urban planning and development.

Principle #3: Strengthen the System of Climate Information and Analysis. A robust information system is the foundation for effective climate action, when it comes to both preparedness and response to shocks and long-term stressors. Generating, compiling, sharing, and analyzing reliable information on climate indicators is a public good that can inform decision-making processes, both public and private, and can foster climate action by reducing the level of uncertainty.

Principle #4: Unleash Innovation. Innovation and clean technologies are core to addressing the challenges of climate change and can also spur gains in productivity and competitiveness. Morocco has demonstrated its capacity to adopt innovative solutions in renewable energy; however, regulatory barriers have constrained their full deployment. On the adaptation side, recurring droughts and water scarcity challenges call for a transformation of the agriculture sector (most notably its rainfed segment); public/private partnerships (PPPs) could be established to foster agricultural R&D and innovative systems to promote the development of climate-smart technologies and practices. The public and private sectors could also join forces to disseminate such innovations to farmers through extension services in order to sustain productivity growth in the face of climate change.

Principle #5: Stakeholder Engagement. Climate action will necessitate the contribution of all actors of the society (public entities, the private sector, and civil society). Creating space for exchanges and coordination can foster dialogue among actors that can help accelerate the deployment of climate action at both the national and local levels.[5] Partnerships between the public sector, private operators, and academia have already shown results in terms of innovation in Morocco.[6] Engaging with all stakeholders and making information on climate change available through a targeted communication campaign will prove essential in order to trigger the behavioral changes that will support the climate transition to a resilient and low carbon Morocco.

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[5] For instance, the 4C Maroc is a platform for dialogue and capacity building on climate change, bringing together public administration, the private sector, civil society, and academia.

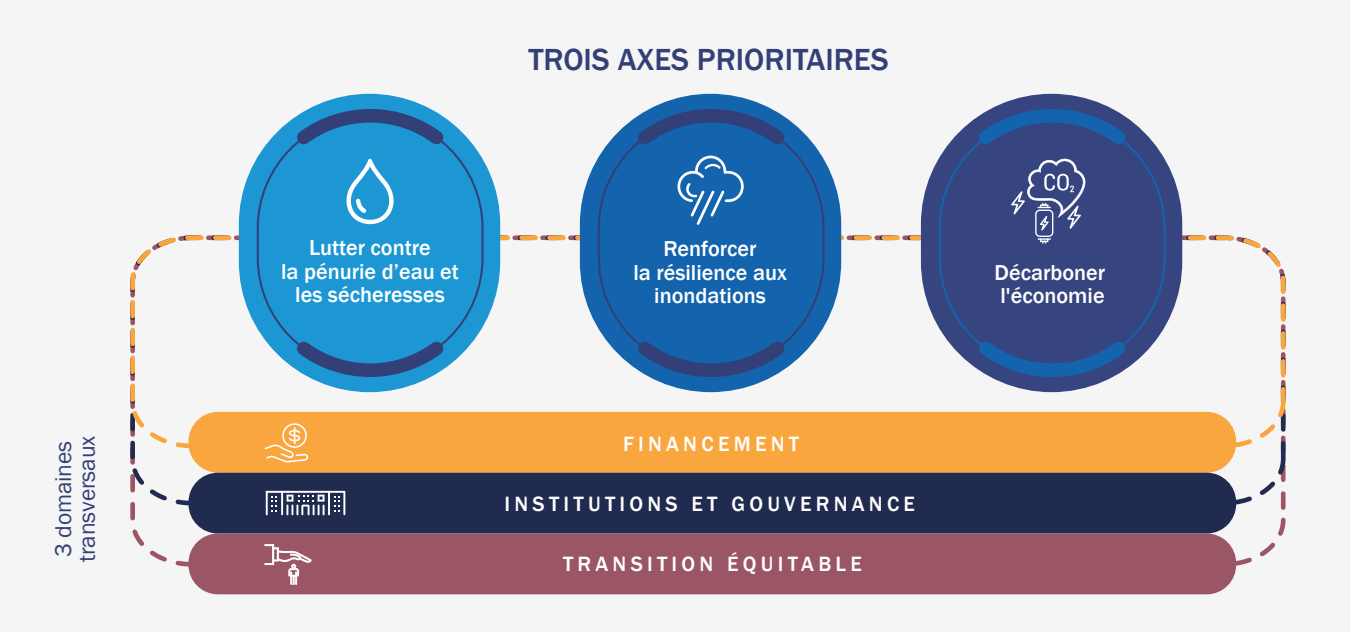
[6] The Euromed University of Fez, the Fez-Meknes Region, the CGEM Fez-Taza, the Alten Maroc Company, the Digital Development Agency, and the Ministry of Industry and Trade have launched the Fez Smart Factory project, which aims to develop an innovation ecosystem for Industry 4.0.

Résumé

Le Maroc se trouve à un moment critique de son processus de développement. Les réformes structurelles lancées il y a deux décennies ont ouvert la voie à une période prolongée de croissance économique et de réduction de la pauvreté, sans équivalent dans l'histoire récente du pays. Cependant, ce modèle a commencé à montrer des signes croissants d'épuisement avant même la pandémie de COVID-19, suscitant une réflexion nationale sur la manière de redynamiser la croissance économique et le développement social au Maroc. Cette réflexion a débouché sur l'élaboration du Nouveau Modèle de Développement (NMD), qui fixe des objectifs ambitieux à l'horizon 2035. Le pays doit aujourd'hui relever des défis inextricablement liés pour mettre en œuvre cette vision : i) une vulnérabilité accrue au changement climatique (comme l'atteste la récente série de graves sécheresses, trois au cours des quatre dernières années) ; ii) un besoin urgent d'accélérer les réformes structurelles pour placer son développement sur une trajectoire plus solide, équitable et durable ; et iii) une marge de manœuvre budgétaire réduite.

Le présent Rapport sur le climat et le développement (Country Climate and Development Report ou CCDR) examine la relation entre les objectifs de développement du Maroc et le changement climatique, tant en termes de risques que d'opportunités. S'appuyant sur un vaste ensemble d'études quantitatives et qualitatives et sur des exercices de modélisation inédits[1] , ce rapport analyse les effets synergiques entre les objectifs de développement du pays et le changement climatique, en examinant les risques que celui-ci fait peser sur sa trajectoire de développement, mais aussi les opportunités susceptibles de découler de la tendance mondiale à la décarbonation. Il examine également les options de politique et d'investissement qui pourraient permettre d'atteindre les objectifs climatiques et de développement de manière synergique.

Figure 1 : Cadre du CCDR pour une trajectoire résiliente et bas-carbone (RBC) au Maroc



[1] Il faut cependant reconnaître que les effets économiques et sociaux associés au changement climatique sont encore incertains au Maroc comme ailleurs. Ainsi, les outils quantitatifs présentés dans ce rapport n'ont pas pour objet de prédire ces effets, mais plutôt de fournir un cadre analytique unifié permettant d'identifier les avantages et les inconvénients de différents moyens d'action.

S'appuyant sur un riche corpus de travaux analytiques, trois axes prioritaires ont été identifiés pour ce CCDR. Ils reflètent les enjeux les plus critiques entre les objectifs de développement du Maroc et ses engagements climatiques et qui ont le plus de chance de placer le Maroc sur une trajectoire résiliente et bas-carbone. Ces enjeux prioritaires sont les suivants : i) lutter contre la pénurie d'eau et les sécheresses, notamment dans le contexte du nexus eau-agriculture ; ii) améliorer la résilience aux inondations, afin de préserver les économies et les moyens de subsistance urbains et côtiers ; et iii) décarboner l'économie en envisageant une trajectoire visant une neutralité carbone d'ici aux années 2050. En outre, trois domaines transversaux ont été considérés comme des catalyseurs essentiels à la mise en œuvre de ces axes prioritaires : i) le financement (privé et public) ; ii) les institutions et la gouvernance ; et iii) la transition équitable, pour que personne ne soit laissé pour compte.

L'un des messages clés du CCDR est que le Maroc peut suivre une trajectoire qui contribue à la réalisation des objectifs en matière de climat et de développement de manière synergétique. Les exercices de modélisation présentés dans ce rapport montrent que le choix d'une trajectoire RBC ne compromettrait pas la stabilité macroéconomique du Maroc. Ils indiquent, au contraire, que le PIB et la croissance seraient plus élevés qu'en cas d'inaction, tandis que les finances publiques et les soldes extérieurs pourraient également s'améliorer si des politiques appropriées sont mises en place. En d'autres termes, l'action climatique peut avoir un effet positif sur le PIB et contribuer à accélérer les progrès vers les objectifs de développement du Maroc. Le succès dans cette trajectoire dépendra toutefois largement du rôle joué par le secteur privé, qui devra financer une grande partie des investissements dans le domaine de l'atténuation et, potentiellement, de l'adaptation, bien que dans une moindre mesure. Les politiques nécessaires à la concrétisation de ces investissements privés coïncident à bien des égards avec celles qui devraient être mises en place pour s'attaquer aux obstacles structurels qui entravent la croissance économique du Maroc depuis quelques années. La section ci-dessous résume les réformes sectorielles et structurelles à même de soutenir cette trajectoire résiliente et bas-carbone.

Politiques sectorielles pour une transition résiliente et bas-carbone

La pénurie d'eau pourrait influer sur presque tous les aspects du développement socioéconomique futur du Maroc. Le Maroc est l'un des pays les plus pauvres en eau au monde et se rapproche rapidement du seuil de pénurie absolue en eau fixé à 500 m3 par personne et par an. L'incidence et la gravité croissantes des sécheresses constituent déjà une source majeure de volatilité macroéconomique et une menace pour la sécurité alimentaire nationale. Dans une perspective à plus long terme, la réduction de la disponibilité en eau et la baisse des rendements agricoles due au changement climatique pourraient réduire le PIB à hauteur de 6,5 %. L'agriculture pluviale (bour) est particulièrement vulnérable aux sécheresses et à la pénurie d'eau : alors qu'elle représente encore 80 % de la superficie cultivée du pays et emploie la majorité des travailleurs agricoles, les changements induits par le climat (disponibilité en eau et rendement des cultures) sur l'agriculture pluviale pourraient entraîner l'exode rural de 1,9 million de Marocains (soit 5,4 % de la population totale) d'ici à 2050.

Le déploiement d'infrastructures hydrauliques à grande échelle a été un facteur essentiel du développement récent du Maroc. Depuis la fin des années 1960, le Royaume a construit plus de 140 grands barrages, ce qui a permis de décupler la capacité totale de mobilisation de l'eau (de 2 à près de 19.1 milliards de m3). Il a également développé l'irrigation au goutte-à-goutte, ce qui a entraîné une augmentation de la productivité de l'eau dans l'agriculture, de loin le secteur le plus gourmand en eau du Maroc. Ces infrastructures ont permis au pays de s'orienter vers des cultures plus productives et de quasiment doubler la valeur ajoutée agricole réelle au cours des deux dernières décennies. Cependant, ces investissements importants n'ont pas permis de réduire la pression sur les ressources en eau, entraînant même une surexploitation des ressources souterraines. En outre, l´efficacité des infrastructures comme mécanisme d´atténuation de la volatilité macroéconomique induite par les chocs pluviométriques pourrait être en train de diminuer dans le contexte du changement climatique et de baisse tendancielle des apports en eau.

L'investissement dans les infrastructures est une condition nécessaire mais non suffisante pour relever le défi de la pénurie d'eau, et un changement de paradigme est nécessaire. Le Maroc a présenté un ambitieux plan d'investissement dans l'eau pour la période 2020-2050 (Plan national de l'eau ou PNE), qui vise à combler l'écart entre l'offre et la demande. Le présent rapport souligne que, compte tenu de la grande vulnérabilité du Royaume aux sécheresses et à la pénurie d'eau, l'investissement dans les infrastructures hydrauliques apporte des bienfaits

économiques et doit rester une priorité. Mais, sur la base de l'expérience internationale et de nombreuses études, il fait également valoir que ces bienfaits ne se manifesteront pleinement que si le développement des infrastructures est associé à des interventions « soft », telles que la gestion de la demande en eau, la gouvernance de l'eau et des actions visant à modifier les comportements. Cette approche est conforme au NMD, qui recommande de « *mettre en place une tarification qui reflète la valeur réelle de la ressource et incite à la rationalisation des usages et à la gestion de sa rareté* ».

Les inondations représentent également une menace pour le développement. Les inondations sont les catastrophes naturelles liées au climat les plus fréquentes au Maroc. Elles causent en moyenne des pertes directes estimées à 450 millions de dollars par an et frappent de manière disproportionnée les ménages vulnérables. En outre, étant donné que le littoral du pays concentre plus de 65 % de la population et 90 % de l'industrie, l'élévation du niveau de la mer constitue un autre facteur de stress à long terme, en particulier pour les zones de faible altitude, où ce phénomène contribue à exacerber les risques d'inondation.

Le Maroc s'est doté d'une architecture sophistiquée de gestion et de financement des risques de catastrophes mais l'ampleur des investissements en matière de réduction des risques et la couverture d'assurance restent insuffisante. Le pays a développé un système de gestion des risques de catastrophe (GRC), s'appuyant sur des dispositifs innovants, notamment le Fonds de lutte contre les effets des catastrophes naturelles (FLCN), initialement créé pour financer la reconstruction post-catastrophe, puis transformé en un mécanisme qui cofinance les investissements de réduction des risques de catastrophe et de préparation au niveau local. Il a également renforcé la résilience financière du pays face à ces risques (ou financement des risques de catastrophe FRC) en mettant en place un régime mixte d'assurance contre les risques catastrophiques qui fait intervenir des assureurs privés et un Fonds de solidarité contre les événements catastrophiques (FSEC). La protection offerte actuellement par ces mécanismes reste toutefois insuffisante. Les simulations quantitatives présentées dans le présent CCDR concluent qu'un niveau optimal d'investissements dans la GRC permettrait de couvrir l'équivalent de 15 à 20 % des pertes moyennes annuelles (PMA), soit un montant annuel d'investissement moyen entre 67 et 90 millions de dollars. Ces simulations soulignent également qu'il est essentiel de renforcer le système de FRC pour faire face aux événements climatiques extrêmes. En outre, étant donnés leurs rendements élevés, les investissements non structurels, comme les systèmes d'alerte précoce, les solutions basées sur la nature, la connaissance des risques et du climat et la sensibilisation, devraient être plus systématiquement intégrés dans l'approche GRC. Sur le plan institutionnel, le Maroc devrait continuer à renforcer la coordination intersectorielle et territoriale pour accroître l'efficacité du système de GRC.

Le Maroc peut progressivement décarboner son économie. Le présent rapport estime que le Maroc pourrait viser la neutralité carbone d'ici les années 2050 en tirant pleinement parti de ses ressources abondantes et compétitives en énergies renouvelables et en mettant en œuvre son ambitieux programme de reboisement. Décarboner l´économie marocaine pourrait aussi contribuer à renforcer son indépendance énergétique et réduire le coût moyen de production de l'électricité. Le secteur de l'électricité est la pierre angulaire de la stratégie de décarbonation : d'abord parce qu'il est le principal émetteur de gaz à effet de serre (GES), mais aussi parce qu'il permet de soutenir la décarbonation de secteurs qui sont également de gros émetteurs (tels que le transport routier et l'industrie). Bien que le Maroc ne représente que 0.2 % des émissions mondiales de GES, l'intensité carbone de son secteur de l´électricité reste élevé. La décarbonation du secteur électrique nécessiterait la fermeture progressive des centrales au charbon grâce au déploiement des énergies renouvelables et des technologies de stockage de l'énergie, tout en recourant au gaz naturel comme combustible de transition. Pour passer de la dépendance à l'égard des grandes centrales thermiques à des centrales solaires et éoliennes plus dispersées et pour assurer la stabilité du réseau, d'importants investissements dans le réseau de transport et transmission électriques seront nécessaires. À moyen et à long terme, le Maroc pourrait développer la production à grande échelle d'hydrogène vert et de ses dérivés, qui pourraient être utilisés sur le territoire national (pour la production d'engrais verts, les transports et la production d'électricité, pour remplacer le gaz naturel), mais aussi exportés (vers l'UE par exemple). En tant que cinquième exportateur d´engrais, le Maroc a déjà pris des mesures décisives pour réduire l´empreinte de son industrie du phosphate, qui consomme beaucoup d´énergie et d´eau. En outre, les efforts doivent être poursuivis pour améliorer l'efficacité énergétique dans tous les secteurs. L'investissement dans les énergies renouvelables et l'efficacité énergétique conformément aux objectifs fixés par le gouvernement pour 2030 pourrait permettre de créer environ

28 000 emplois nets par an, soit 9 % du déficit annuel d'emplois (estimé à 300 000). Pour atteindre ces objectifs, des aménagements dans l'enseignement supérieur et la formation professionnelle devront être mis en place pour préparer la main-d'œuvre à ces nouveaux emplois.

Des investissements massifs seront nécessaires pour décarboner l'économie, ainsi que des réformes profondes. Le coût associé à la décarbonation de l'économie d´ici les années 2050 est estimé à 52.8 milliards en valeur actualisée nette (VAN)[2]. Le présent rapport estime que plus de 85 % des investissements nécessaires pour décarboner l'économie devraient être couverts par le secteur privé. Toutefois, ces investissements privés ne se concrétiseront que si de profondes réformes sont menées, notamment dans le secteur de l'électricité. Ces réformes devraient notamment porter sur la séparation des activités de production, transport et distribution d'électricité, la création de marchés de gros et d'équilibrage, la mise en place d'une tarification pour l'accès au réseau et la consommation qui reflète pleinement les coûts, et une intégration accrue du marché avec l'Union européenne (UE). Des politiques et des incitations devraient également être mises en place pour développer la mobilité électrique (e-mobilité) et l'hydrogène vert.

La décarbonation pourrait avoir d'importantes retombées positives sur l'économie marocaine. Le Maroc est particulièrement bien placé pour profiter des avantages économiques qui pourraient découler de la tendance globale à la décarbonation. Son économie est étroitement intégrée à l'Union européenne, l'un des blocs régionaux ayant adopté des objectifs ambitieux en termes d'action climatique. De fait, la décarbonation représente pour l'industrie marocaine une opportunité de maintenir, voire d'accroître sa part de marché en Europe. Elle augmenterait également l'attractivité du Royaume pour les investissements directs étrangers (IDE) et pourrait faire du Maroc un pôle « hub » pour les investissements et les exportations vertes, avec des retombées positives pour la croissance économique et la création d'emplois.

Politiques structurelles et macroéconomiques pour une transition résiliente et bas-carbone

Les investissements totaux nécessaires pour une transition RBC à l'horizon 2050 sont estimés à un montant total d'environ 78 milliards en valeur actualisée nette (VAN)[3]. À terme, l'impact de cette transition dépendra du mode de financement de ces investissements et, plus généralement, des politiques macroéconomiques adoptées au cours des années et décennies à venir. Par conséquent, au-delà des interventions sectorielles évoquées ci-dessus, ce CCDR s'est également concentré sur diverses politiques structurelles et macroéconomiques susceptibles de servir de manière synergique les objectifs de développement du pays et ses ambitions en matière d'adaptation et d'atténuation face au climat.

Le secteur privé est appelé à jouer un rôle clé dans la transition RBC ainsi que dans le nouveau modèle de croissance marocain. Comme mentionné ci-dessus, il est attendu que les investissements dans la décarbonation soient en grande partie pris en charge par le secteur privé. Dans le domaine de l'adaptation, si le rapport estime qu'une large part des besoins d'investissement identifiés seraient couverts par des financements publics, il est également possible d'attirer des opérateurs privés pour des interventions spécifiques : par exemple, dessalement de l'eau de mer, mais aussi agriculture intelligente face au climat (climate-smart agriculture) et l'assurance. L'optimisation des investissements privés dans le domaine climatique permettrait de soulager la pression sur les finances publiques tout en ayant des effets positifs plus larges sur l'économie. Mais le Maroc devrait pour cela alléger les contraintes structurelles qui ont empêché les entreprises privées de pénétrer de nouveaux marchés et de se développer, ce qui est aussi essentiel pour accélérer la croissance de la productivité et la création d'emplois à l'avenir.

Le verdissement du système financier pourrait également contribuer à canaliser les ressources vers des activités respectueuses du climat. Dans un premier temps, le Maroc pourrait envisager d'adopter une taxonomie nationale verte (c'est-à-dire un système de classification). En outre, une garantie publique ou une structure d'investissement pourrait être mise en place pour réduire les risques et attirer les investissements privés verts. Ce rôle pourrait être en

[2] Ce montant représente les coûts totaux actualisés sur la période 2022-2050, avec un taux d'actualisation de 6%. Il comprend tous les coûts d'investissement, y compris ceux pour l'exportation d'hydrogène vert..

[3] Avec un taux d'actualisation de 6%, soit un montant total non actualisé de 219 milliards de dollars sur la période 2022-2050.

partie joué par le Fonds Mohammed VI récemment créé. Le présent CCDR analyse également l'impact du changement climatique sur la stabilité financière. Il utilise une méthodologie fondée sur des tests de résistance (« stress-test ») et élaborée en collaboration avec la banque centrale, qui montre que les effets pourraient être significatifs, ce qui appelle à un renforcement du suivi des risques climatiques dans la réglementation et la surveillance financières.

L'aspect budgétaire jouera un rôle crucial dans la transition RBC au Maroc, car une part significative des investissements devra inévitablement provenir du secteur public. Le choc de la COVID-19 a entraîné une forte augmentation de la dette publique et pourrait contraindre les autorités à s'engager dans un processus de consolidation budgétaire qui pourrait accroître la concurrence pour les ressources publiques. Dans ce contexte, le présent rapport analyse diverses options susceptibles d'accroître les recettes publiques par le biais de réformes de la fiscalité environnementale et de politique de valorisation de l'eau, tout en poursuivant de manière synergique les objectifs climatiques.

La réforme de la fiscalité environnementale et des politiques de valorisation de l'eau pourraient générer un important flux de recettes publiques, et être moins préjudiciables à l'économie qu'une réforme fiscale classique. Plusieurs options pourraient être envisagées, notamment l'élimination des dépenses fiscales « brunes », la suppression des subventions explicites au butane et l'instauration d'une taxe carbone. Globalement, ces réformes pourraient mobiliser des ressources équivalentes à plus de 2 % du PIB à court terme. Elles pourraient également entraîner des ajustements comportementaux et économiques qui auraient des bénéfices climatiques associés ; par conséquent, les recettes de ces taxes environnementales diminueraient généralement avec le temps. À plus long terme, les modélisations menées dans ce CCDR indiquent que leurs retombées macroéconomiques pourraient être plus positives que celles d'une réforme fiscale classique équivalente. Parallèlement, l'augmentation des tarifs de l'eau, qui sont restés bas malgré la raréfaction de la ressource, pourrait également avoir des répercussions budgétaires positives tout en encourageant une utilisation plus rationnelle de l'eau.

Cependant, ces réformes pourraient avoir des effets disproportionnés sur les populations pauvres et vulnérables; ainsi des mesures compensatoires devraient être élaborées avec soin pour assurer une transition équitable. Les réformes de la fiscalité environnementale et de la valorisation de l'eau pourraient avoir un impact négatif sur consommation privée, sous l'effet des augmentations de prix associées à ces politiques. Un programme de transferts monétaires bien ciblé pourrait être la meilleure option pour compenser ces impacts négatifs sur les ménages les plus défavorisés. À cette fin, le gouvernement pourrait s'appuyer sur le Registre Social Unifié (RSU), en cours de déploiement. Il convient de noter que les réformes de la fiscalité environnementale ont plus de chance d'aboutir lorsqu'elles sont mises en œuvre dans un contexte de stabilité des prix ; il est donc critique d'établir avec soin le calendrier des réformes, ainsi que leur séquençage avec le déploiement des mesures compensatoires.

Principes régissant la transition résiliente et bas-carbone

Le présent rapport formule une série de principes susceptibles d'être utilisés pour orienter le processus de mise en œuvre des réformes qui accompagnerait le Royaume dans une transition lui permettant d'atteindre ses objectifs de développement tout en remplissant ses ambitions en matière d'adaptation et d'atténuation face au climat.

Principe n° 1 : Adopter une approche pangouvernementale. Le défi climatique, du fait de sa complexité, ne peut pas être uniquement abordé dans une perspective sectorielle ni dans le cadre des limites institutionnelles actuelles. Il nécessite l'adoption d'une approche pangouvernementale qui garantira la prise en compte du changement climatique comme une composante intrinsèque du modèle de développement, tant au niveau macroéconomique que sectoriel, avec une meilleure articulation entre les différents niveaux de compétence. Dans ce contexte, le Maroc doit renforcer ses mécanismes de coordination à la fois horizontalement et verticalement, car les collectivités territoriales seront amenées à jouer un rôle important en matière climatique. En outre, les outils de gestion des finances publiques (GFP), tels que le budget sensible au climat, les marchés publics verts et la fiscalité environnementale, peuvent permettre l'intégration systématique de la dimension climatique dans toutes les actions publiques ainsi qu'un alignement complet sur la Contribution Déterminée Nationale (CDN).

Principe n° 2 : Protéger les populations les plus vulnérables. Les ménages pauvres sont généralement plus vulnérables aux événements climatiques, mais aussi aux effets des politiques sur le climat. La refonte en cours

du système de protection sociale au Maroc offre la possibilité d'intégrer des éléments de réponse adaptés qui lui permettraient de réagir rapidement pour protéger les populations touchées par des événements climatiques et compenser leurs pertes de revenus ou d'actifs. En outre, le pays pourrait étendre son mécanisme déjà sophistiqué de FRC en matière d'inondations, notamment pour couvrir les risques de sécheresse. Certaines politiques climatiques pourraient également nuire aux ménages et aux entreprises vulnérables qui n'ont pas la capacité de s'adapter rapidement ; ainsi des mesures compensatoires devront être élaborées avec soin pour éviter d'exacerber les disparités sociales et ainsi contribuer à une transition équitable et inclusive. Si la transition résiliente et à bas-carbone offre des perspectives de création d'emplois verts, il sera nécessaire de préparer les travailleurs à ces opportunités en mettant en place des incitations dans les systèmes d'éducation et de formation professionnelle afin de réorienter les programmes en fonction de l'évolution des besoins en compétences. Les politiques publiques devraient également se préparer aux flux migratoires susceptibles d'être déclenchés par le changement climatique, en particulier dans les domaines de l'aménagement et du développement urbains.

Principe n° 3 : Consolider le système d'information et d'analyse climatiques. Un système robuste d'information constitue le socle d'une action climatique efficace, tant pour la préparation que pour la réponse aux chocs et aux facteurs de stress à long terme. La production, la collecte, le partage et l'analyse d'informations fiables sur les indicateurs climatiques constituent un bien public qui peut éclairer les processus décisionnels, tant publics que privés, et favoriser l'action climatique en réduisant le niveau d'incertitude.

Principe n° 4 : Promouvoir l'innovation. L'innovation et les technologies propres sont essentielles pour relever les défis du changement climatique, et peuvent de surcroît entraîner des gains de productivité et de compétitivité. Le Maroc a démontré sa capacité à adopter des solutions innovantes dans le domaine des énergies renouvelables ; toutefois, des obstacles réglementaires ont entravé leur plein déploiement. En ce qui concerne l'adaptation, les sécheresses récurrentes et les problèmes de pénurie d'eau appellent une transformation du secteur agricole (en particulier de l'agriculture pluviale) ; des partenariats public-privé (PPP) pourraient être établis pour favoriser la R&D agricole et les systèmes innovants afin de promouvoir le développement de technologies et de pratiques intelligentes sur le plan climatique. Les secteurs public et privé pourraient également conjuguer leurs efforts pour diffuser ces innovations auprès des agriculteurs par le biais des services de vulgarisation, afin de soutenir la croissance de la productivité face au changement climatique.

Principe n° 5 : Mobilisation de toutes les parties prenantes. L'action climatique nécessitera la contribution de tous les acteurs de la société (entités publiques, secteur privé et société civile). La création d'un espace d'échange et de coordination peut favoriser le dialogue entre les acteurs, et ainsi contribuer à accélérer le déploiement de l'action climatique aux échelons national et local[4]. Les partenariats entre le secteur public, les opérateurs privés et le monde universitaire ont déjà contribué à l'innovation au Maroc[5]. La mobilisation de toutes les parties prenantes et la diffusion d'informations sur le changement climatique dans le cadre d'une campagne de communication ciblée seront essentielles pour entraîner les changements de comportement qui favoriseront la transition climatique.

[4] Par exemple, le 4C Maroc est une plateforme de dialogue et de renforcement des capacités sur le changement climatique, qui rassemble l'administration publique, le secteur privé, la société civile et le monde universitaire.

[5] L'Université Euromed de Fès, la Région Fès-Meknès, la CGEM Fès-Taza, la société Alten Maroc, l'Agence de développement numérique et le ministère de l'Industrie et du Commerce ont lancé le projet Fez Smart Factory, qui vise à développer un écosystème d'innovation pour l'industrie 4.0.

(أي يصل إلى المستحقين) أفضل خيار للتعويض عن الآثار السلبية على الأسر المعيشية الأكثر حرمانا. ولهذا الغرض، يمكن للحكومة الاستفادة من السجل الاجتماعي الموحد الذي يجري تعميمه حاليا. وتجدر الإشارة إلى أن الإصلاحات الضريبية البيئية من المرجح أن تنجح عند تنفيذها في سياق استقرار الأسعار، وبالتالي، من الضروري مراعاة توقيت الإصلاح، إلى جانب تتابعه مع تطبيق التدابير التعويضية، بعناية تامة.

مبادئ التحول إلى اقتصاد منخفض الانبعاثات الكربونية وقادر على الصمود

يعرض هذا التقرير سلسلة من المبادئ التي يمكن استخدامها لتوجيه هذه العملية في الوقت الذي يشرع فيه المغرب في تنفيذ مجموعة طموحة من الإصلاحات على مستوى السياسات لتحقيق أهدافه الإنمائية وطموحاته في مجال التكيف مع تغير المناخ والتخفيف من آثاره على نحو يتسم بالتعاون وتضافر الجهود.

المبدأ 1: اعتماد نهج „الحكومة بأكملها". من غير الممكن التصدي لمستوى التعقيد الذي يمثله هذا التحدي من منظور القطاعات المعنية وفي ظل الحدود المؤسسية الحالية. لكن الأمر يتطلب نهجا „للحكومة بأكملها" يضمن الاعتراف بتغير المناخ باعتباره مكونا جوهريا للنموذج التنموي، على مستوى الاقتصاد الكلي والمستوى القطاعي، مع تعزيز الصياغة على مستوى جهات الاختصاص المعنية. وفي هذا السياق، يتعين على المغرب تدعيم آليات التنسيق الخاصة به أفقيا ورأسيا، حيث يتوقع أن تلعب أجهزة الحكم المحلي دورا مهما في العمل المناخي. وبالإضافة إلى ذلك، يمكن لأدوات إدارة المالية العامة، مثل الموازنة المراعية للمناخ، والمشتريات الخضراء، وتدابير المالية العامة المراعية للبيئية أن تدمج بشكل منهجي الاعتبارات المناخية في جميع الإجراءات العامة، فضلا عن الاتساق التام مع المساهمة الوطنية لمكافحة تغير المناخ.

المبدأ 2: حماية الشرائح المعرضة للمعاناة والأكثر احتياجا. جرت العادة تكون الأسر المعيشية الفقيرة أكثر تأثرا لمخاطر الوقائع المناخية والسياسات المناخية أيضا، ويحدث ذلك بصورة منهجية. ومع شروع المغرب في إصلاح نظام الحماية الاجتماعية، ستتاح له الفرصة لتضمين سمات وخصائص مراعية للمناخ تسمح للنظام بالاستجابة السريعة لحماية المتضررين من الأحداث والوقائع المرتبطة بالمناخ، وتعويض خسائرهم في الدخل أو الأصول. وبالإضافة إلى ذلك، يمكن أن توسع المملكة آليتها المتطورة بالفعل للحماية من الفيضانات في إطار تمويل التصدي لمخاطر الكوارث، بما في ذلك من خلال توسيع نطاق تغطية موجات الجفاف. ونظرا لأن السياسات المناخية يمكن أن تكون ضارة أيضا بالأسر المعيشية الأكثر احتياجا والشركات التي لا تملك القدرة على التكيف بسرعة، من الضروري صياغة التدابير التعويضية بعناية لتجنب تفاقم التفاوتات الاجتماعية، والإسهام في تحقيق تحول منصف وشامل للجميع. وعلى الرغم من أن التحول نحو مسار قادر على الصمود في وجه الصدمات ومنخفض الانبعاثات الكربونية يحمل آفاقا لخلق فرص عمل خضراء، من الضروري إعداد العمال لهذه الفرص من خلال وضع حوافز في أنظمة التعليم والتدريب (التكوين) المهني لإعادة توجيه البرامج نحو التحول في الاحتياجات من المهارات. وينبغي للسياسات العامة أيضا أن تتوقع تدفقات الهجرة التي يمكن أن يتسبب فيها تغير المناخ، لا سيما في المناطق ذات التخطيط الحضري والتنمية.

المبدأ 3: تعزيز نظام المعلومات والتحليلات المناخية. يمثل وجود نظام معلومات قوي الأساس للعمل المناخي الفعال، عندما يتعلق الأمر بالاستعداد والاستجابة للصدمات والضغوط طويلة الأجل. ويعد توليد وتجميع وتبادل وتحليل معلومات موثوقة عن مؤشرات المناخ من سلع النفع العامة التي يمكن الاسترشاد بها في عمليات اتخاذ القرارات، العامة والخاصة على السواء، ويمكن أن تعزز العمل المناخي من خلال الحد من مستوى عدم اليقين.

المبدأ 4: إطلاق طاقات الابتكار. الابتكار والتكنولوجيات النظيفة عنصران أساسيان في التصدي لتحديات تغير المناخ ويمكنهما أيضا أن يحفزا المكاسب في الإنتاجية والقدرة على المنافسة. وأظهر المغرب قدرته على اعتماد حلول مبتكرة في مجال الطاقة المتجددة؛ غير أن الحواجز التنظيمية أعاقت تعميمها على نحو تام. وعلى جانب التكيف، تدعو التحديات المتكررة المتعلقة بالجفاف وشح المياه إلى إحداث تحول في القطاع الزراعي (القطاع الفلاحي) (لاسيما الزراعة البعلية)؛ ويمكن إقامة شراكات بين القطاعين العام والخاص لتشجيع البحوث والتطوير الخاصة بالزراعة والأنظمة المبتكرة لتشجيع تطوير التكنولوجيات والممارسات المراعية للمناخ. ويمكن للقطاعين العام والخاص أيضا أن يتعاونا لتعميم هذه الابتكارات على المزارعين من خلال خدمات الإرشاد الزراعي من أجل تحقيق استدامة نمو الإنتاجية في مواجهة تغير المناخ.

المبدأ 5: مشاركة أصحاب المصلحة. سيتطلب العمل المناخي مساهمة جميع الأطراف الفاعلة في المجتمع (المؤسسات العامة، والقطاع الخاص، والمجتمع المدني). ويمكن أن يؤدي خلق مجال لتبادل المعارف والمعلومات والتنسيق إلى تعزيز الحوار بين الأطراف الفاعلة التي يمكن أن تساعد على تسريع وتيرة تعميم العمل المناخي على الصعيدين الوطني والمحلي. وقد أظهرت الشراكات بين القطاع العام وشركات القطاع الخاص والأوساط الأكاديمية بالفعل نتائج في مجال الابتكار في المغرب. ومن الضروري للغاية المشاركة مع جميع أصحاب المصلحة وإتاحة المعلومات عن تغير المناخ من خلال حملة مستهدفة للاتصال والتواصل والتوعية لإحداث تغييرات سلوكية من شأنها دعم التحول المناخي إلى مسار قادر على الصمود ومنخفض الانبعاثات.

السياسات الهيكلية وسياسات الاقتصاد الكلي من أجل التحول إلى اقتصاد منخفض الانبعاثات الكربونية وقادر على الصمود في وجه الصدمات

ويقدر هذا التقرير إجمالي الاستثمارات اللازمة لبناء قدرة المغرب على الصمود وتحقيق صافي انبعاثات صفر في خمسينيات هذا القرن بنحو 78 مليار دولار بصافي القيمة الحالية.[3] وفي نهاية المطاف، سيتوقف أثر التحول إلى مسار قادر على الصمود ومنخفض الانبعاثات الكربونية على كيفية تمويل هذه الاستثمارات، وعلى نطاق أوسع على خيارات سياسات الاقتصاد الكلي التي سيتم وضعها في السنوات والعقود القادمة. ولذلك، وبالإضافة إلى الإجراءات والأنشطة التدخلية القطاعية التي نوقشت أعلاه، يركز التقرير أيضا على مختلف السياسات الهيكلية وسياسات الاقتصاد الكلي التي يمكن أن تعمل في إطار من التعاون وتضافر الجهود لتحقيق الأهداف الإنمائية للمملكة وطموحاتها في مجال التكيف مع تغير المناخ والتخفيف من آثاره.

وسيكون للقطاع الخاص دور محوري التحول نحو مسار قادر على الصمود في وجه الصدمات ومنخفض الانبعاثات الكربونية وتحقيق إعادة التوازن لنموذج النمو في المغرب. وكما ذكرنا من قبل، من المتوقع أن يتحمل القطاع الخاص على عاتقه الاستثمارات في الحد من الانبعاثات الكربونية. وعلى صعيد التكيف، وعلى الرغم من أنه من المتوقع أن يغطي التمويل العام معظم الاحتياجات الاستثمارية المحددة في هذا التقرير، فإن هناك مجالا لاجتذاب المشغلين من القطاع الخاص فيما يتعلق بأنشطة وإجراءات تدخلية محددة - مثل تحلية مياه البحر، والزراعة (الفلاحة) الذكية المراعية للمناخ والتغطية التأمينية. ومن شأن تعظيم استثمارات القطاع الخاص في الأنشطة المناخية أن يساعد في تخفيف الضغوط على المالية العامة، وسيكون له أيضا آثار إيجابية أوسع نطاقا على الاقتصاد. ولتحقيق ذلك، سيتعين على المغرب تخفيف القيود الهيكلية التي حالت دون دخول الشركات الخاصة إلى أسواق جديدة وتحقيق النمو المنشود، وهو أمر بالغ الأهمية أيضا من أجل تسريع وتيرة نمو الإنتاجية وخلق فرص العمل في المستقبل.

ويمكن أن يساعد تخضير النظام المالي أيضا في توجيه الموارد نحو الأنشطة الصديقة للمناخ. وكخطوة أولى، ينبغي للمغرب أن ينظر في اعتماد تصنيف وطني أخضر (أي برنامج للتصنيف). وعلاوة على ذلك، يمكن إنشاء شركة/آلية ضمانات أو استثمارات عامة للحد من المخاطر واجتذاب الاستثمارات التجارية الخضراء، وهو دور يمكن أن يلعبه جزئيا صندوق محمد السادس للاستثمار الإستراتيجي الذي أنشئ حديثا. وينظر هذا التقرير أيضا في جوانب الاستقرار المالي في سياق تغير المناخ. ويستخدم منهجية لاختبار القدرة على تحمل الضغوط (اختبار الأوضاع الضاغطة) تم إعدادها بالاشتراك مع البنك المركزي، وتظهر هذه المنهجية أن الآثار يمكن أن تكون كبيرة؛ وهذا يتطلب تعزيز تغطية المخاطر المناخية في إطار أنشطة التنظيم والإشراف الخاصة بالشؤون المالية.

وسيكون جانب المالية العامة محوريا لتحول المغرب نحو مسار قادر على الصمود في وجه الصدمات ومنخفض الانبعاثات الكربونية، حيث يتعين حتما أن يقود القطاع العام جزءا كبيرا من الاستثمارات. وأدت صدمة جائحة كورونا إلى زيادة كبيرة في الدين العام، وقد تجبر السلطات في نهاية المطاف على الشروع في إجراءات لضبط أوضاع المالية العامة، هذه الإجراءات يمكن أن تزيد المنافسة على الموارد العامة الشحيحة. وفي هذا السياق، يستكشف هذا التقرير مختلف الخيارات التي يمكن أن تزيد إيرادات المالية العامة من خلال نظام الضرائب على الأنشطة البيئية وسياسات تقييم المياه، مع السعي لتحقيق الأهداف المناخية في إطار من التعاون وتضافر الجهود.

ويمكن أن يؤدي الإصلاح الضريبي للأنشطة البيئية وسياسات تقييم المياه إلى تدفق هام للإيرادات العامة، وقد يكون أقل ضررا للاقتصاد من الإصلاح الضريبي التقليدي. ويمكن النظر في عدد من الخيارات، منها إلغاء النفقات الضريبية غير المراعية للبيئة „البُنية"؛ وإلغاء الدعم الصريح لغاز البوتان؛ وتطبيق ضريبة الكربون. وبشكل عام، يمكن أن تؤدي هذه الإصلاحات إلى تعبئة أكثر من 2٪ من إجمالي الناتج المحلي على المدى القصير. كما ستؤدي إلى تغييرات سلوكية وتعديلات اقتصادية من شأنها تحقيق منافع مناخية مشتركة؛ ونتيجة لذلك، فإن إيرادات هذه الضرائب البيئية ستنخفض مع الوقت. وعلى المدى الأطول، يظهر تحليل النمذجة الوارد في تقرير المناخ والتنمية أن آثارها على الاقتصاد الكلي ستكون أكثر إيجابية من الإصلاحات الضريبية التقليدية المماثلة. وبالمثل، فإن زيادة تعريفة المياه، التي ظلت عند مستويات منخفضة على الرغم من شحة الموارد المتزايدة، يمكن أن يكون لها أيضا آثار إيجابية على المالية العامة مع التشجيع في الوقت نفسه على زيادة ترشيد استخدام المياه.

وهذه الإصلاحات يمكن أن تكون لها آثار غير متناسبة على الفقراء والضعفاء والأكثر احتياجا؛ ولذلك، ينبغي صياغة تدابير تعويضية بعناية لكفالة تحقيق تحول منصف. ويمكن أن تؤدي إصلاحات الضرائب البيئية وتقييم المياه إلى خفض الاستهلاك الخاص، الذي يتم توجيهه من خلال زيادات الأسعار التي قد تسببها هذه السياسات. ويمكن أن يكون برنامج التحويلات النقدية جيد الاستهداف

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[3] مع معدل خصم قدره 6%، أي ما يمثل مبلغا إجماليا دون خصم قدره 219 مليار دولار لفترة السنوات 2022 -

[4] على سبيل المثال، يعد مركز كفاءات التغير المناخي بالمغرب (4C Maroc) منبرا للحوار وبناء القدرات بشأن تغير المناخ، ويعمل على تجميع مسؤولي الإدارة العامة والقطاع الخاص والمجتمع المدني والأوساط الأكاديمية.

[5] أطلقت جامعة يوروميد في فاس، في منطقة فاس مكناس، والاتحاد العام لمقاولات المغرب فاس-تازا، وشركة ألتن المغرب، ووكالة التنمية الرقمية، ووزارة الصناعة والتجارة ، مشروع مصنع فاس الذكي الذي يهدف إلى تطوير منظومة ابتكار للصناعة 4.0.

في مواجهة الكوارث الطبيعية من خلال إنشاء نظام مزدوج للتأمين ضد مخاطر الكوارث يضم شركات تأمين خاصة، وصندوق التضامن ضد الوقائع الكارثية. ولا يزال نطاق الحماية التي توفرها هذه الآليات غير كاف. وتخلص نماذج المحاكاة الكمية الواردة في هذا التقرير إلى أن المستوى الأمثل لاستثمارات إدارة مخاطر الكوارث سيغطي ما يعادل 20%-15 من متوسط الخسائر السنوية، وهو ما يعادل متوسط استثمار سنوي يتراوح ما بين 67 و90 مليون دولار. وتؤكد نماذج المحاكاة أيضا على أن توسيع نطاق برنامج جهود التصدي لمخاطر الكوارث أمر بالغ الأهمية من أجل مواجهة الوقائع بالغة الخطورة على نحو كاف. وبالإضافة إلى ذلك، ونظرا لارتفاع عائدات الاستثمارات غير الهيكلة ، مثل أنظمة الإنذار المبكر، والحلول المستمدة من الطبيعة، والمعرفة بالمخاطر والمناخ، وزيادة الوعي، فمن الضروري دمج هذه الاستثمارات على نحو أكثر منهجية وتنظيما في أسلوب إدارة مخاطر الكوارث. وعلى الصعيد المؤسسي، على المغرب مواصلة تدعيم التنسيق بين القطاعات والمناطق والأقاليم لزيادة فعالية نظام إدارة مخاطر الكوارث.

وبمقدور المغرب الحد من الانبعاثات الكربونية في اقتصاده تدريجيا، وتشير التقديرات الواردة في هذا التقرير إلى أن المغرب يمكن أن يصل إلى انبعاثات صافية صفرية في خمسينيات هذا القرن من خلال الاستفادة من موارده التنافسية الوفيرة للطاقة المتجددة وتنفيذ برنامجه الطموح لإعادة التحريج (إعادة التشجير). ومن شأن الحد من الانبعاثات الكربونية في اقتصاد المملكة أن يسهم أيضا في زيادة استقلاليتها في مجال الطاقة وتخفيض متوسط تكلفة توليد الكهرباء. وسيكون قطاع الكهرباء حجر الزاوية في إستراتيجية الحد من الانبعاثات الكربونية: أولا وقبل كل شيء لأنه هو المساهم الرئيسي في انبعاثات غازات الدفيئة (غازات الاحتباس الحراري)، فضلا عن الحد من الانبعاثات الكربونية في قطاعات الاستخدام النهائي مثل النقل البري والصناعة، التي تمثل أيضا مصدرا رئيسيا للانبعاثات. وعلى الرغم من أن المغرب لا يمثل سوى 0.2% من انبعاثات غازات الدفيئة على مستوى العالم، فإن لديه قطاع كهرباء كثيف الانبعاثات الكربونية. وسيتطلب الحد من الانبعاثات الكربونية في قطاع الكهرباء الإلغاء التدريجي للتوليد الذي يعمل بالفحم من خلال تعميم تكنولوجيات الطاقة المتجددة وتخزين الطاقة، مع استخدام الغاز الطبيعي كوقود انتقالي. وللتحول من الاعتماد على محطات الطاقة الحرارية الكبيرة إلى محطات الطاقة الشمسية وطاقة الرياح على نحو أكثر انتشارا وضمان استقرار الشبكة، سيلزم القيام باستثمارات كبيرة في شبكة نقل الكهرباء. وعلى المدى المتوسط إلى الطويل، يمكن للمغرب تطوير إنتاج واسع النطاق من الهيدروجين الأخضر ومشتقاته - يمكن استخدامها لأغراض محلية مثل إنتاج الأسمدة الخضراء، والنقل، وكبديل للغاز الطبيعي في توليد الكهرباء - وأيضا للتصدير (إلى الاتحاد الأوروبي، على سبيل المثال). واتخذ المغرب، باعتباره خامس أكبر دولة مصدرة للأسمدة، بالفعل خطوات حاسمة للحد من آثار صناعة الفوسفات كثيفة الاستخدام للطاقة والمياه. وبالإضافة إلى ذلك، ينبغي مواصلة الجهود الرامية إلى تحسين كفاءة استخدام الطاقة في جميع القطاعات. ويمكن أن يؤدي الاستثمار في مصادر الطاقة المتجددة وكفاءة استخدام الطاقة بما يتماشى مع الأهداف الحكومية بحلول عام 2030 إلى خلق نحو 28 ألف فرصة عمل صافية سنويا، أو نحو 9% من فرص العمل السنوية التي تقدر بنحو 300 ألف فرصة عمل التي يحتاج إليها الاقتصاد المغربي. ولتحقيق هذه الأهداف، سيتعين توفير التعليم العالي والتدريب (التكوين) المهني على نحو مناسب من أجل إعداد القوى العاملة لهذه الوظائف الجديدة.

وسيتطلب الحد من الانبعاثات الكربونية في الاقتصاد استثمارات ضخمة، لكنه سيؤدي أيضا إلى إصلاحات عميقة. وستبلغ التكلفة التقديرية لبلوغ هدف خفض الانبعاثات إلى الصفر بحلول خمسينيات هذا القرن 52.8 مليار دولار[2] . وفي هذا التقرير، تشير تقديراتنا إلى أن القطاع الخاص سيغطي أكثر من 85% من الاستثمارات اللازمة للحد من الانبعاثات الكربونية في الاقتصاد. ولكي يتحقق ذلك، سيتعين إجراء إصلاحات عميقة، لا سيما في قطاع الكهرباء. وسيشمل ذلك تفكيك القطاعات؛ وإنشاء أسواق الجملة والأوساق المتوازنة؛ وتوفير الكهرباء من الشبكة للمستخدم النهائي على نحو يغطي إجمالي التكلفة؛ وزيادة تكامل الأسواق مع الاتحاد الأوروبي. وسيتعين أيضا وضع سياسات وحوافز سوقية من لتطوير وسائل النقل باستخدام المركبات الكهربائية والهيدروجين الأخضر.

ومن شأن الحد من الانبعاثات الكربونية أن يحقق منافع كبيرة للاقتصاد المغربي. والمغرب في وضع جيد يمكنه من جني المنافع الاقتصادية التي يمكن أن تتحقق من الأجندة العالمية للحد من الانبعاثات الكربونية. ويتكامل اقتصاد المملكة بشكل وثيق مع الاتحاد الأوروبي، ويعتبر الاتحاد الأوربي من التكتلات الإقليمية التي تبنت أهدافا طموحة للعمل المناخي. وفي هذا الصدد، يمثل الحد من الانبعاثات الكربونية فرصة للصناعة المغربية ليس فقط للحفاظ على حصتها في السوق في أوروبا بل وتوسيعها أيضا. كما سيزيد من جاذبية المملكة للاستثمار الأجنبي المباشر، وسيضع المغرب كمركز للاستثمارات الخضراء والتصدير، فضلا عن تحقيق آثار إيجابية غير مباشرة من حيث النمو الاقتصادي وفرص العمل.

[2] هذا المبلغ بالقيمة الحالية الصافية مع تطبيق معدل خصم بنسبة 6%. ويشمل أيضا جميع التكاليف المتعلقة بالهيدروجين الأخضر، بما في ذلك الصادرات.

وتتمثل إحدى الرسائل الرئيسية التي ظهرت في طيات هذا التقرير في أن المغرب يمكن أن يسلك مسارا يسهم في تحقيق الأهداف المناخية والتنموية في إطار من التعاون وتضافر الجهود. وتظهر النمذجة الواردة في هذا التقرير أن الشروع في مسار قادر على الصمود في وجه الصدمات ومنخفض الانبعاثات الكربونية لن يؤثر سلبا على استقرار الاقتصاد الكلي في المغرب. كما تشير هذه النماذج إلى أن إجمالي الناتج المحلي والنمو يمكن أن يكونا أعلى مقارنة بسيناريو التقاعس عن العمل. ويمكن أيضا أن تتحسن أرصدة المالية العامة وأرصدة المعاملات الخارجية مع تطبيق السياسات الصحيحة. وبعبارة أخرى، يمكن أن يكون للعمل المناخي أثر إيجابي على إجمالي الناتج المحلي، ويمكن أن يسهم في تسريع وتيرة التقدم نحو تحقيق الأهداف الإنمائية للمغرب. وهذا المسار سيتوقف على قيام القطاع الخاص بدور مركزي، مع توقع أن يحمل على عاتقه نسبة كبيرة من الاستثمارات في إطار أجندة التخفيف من مخاطر المناخ، وربما التكيف أيضا، وإن كان ذلك بدرجة أقل. وتتزامن السياسات اللازمة لتنفيذ هذه الاستثمارات الخاصة في العديد من الجوانب مع تلك المطلوبة لمعالجة الاختناقات الهيكلية التي أعاقت النمو الاقتصادي في المغرب في السنوات الأخيرة. ويلخص القسم التالي الإصلاحات القطاعية والهيكلية التي ستساند مسارا منخفض الانبعاثات الكربونية وقادرا على الصمود في وجه صدمات المناخ.

السياسات القطاعية من أجل التحول إلى اقتصاد منخفض الانبعاثات الكربونية وقادر على الصمود في وجه الصدمات

يمكن أن تؤثر شحة المياه على كل جانب تقريبا من جوانب التنمية الاجتماعية والاقتصادية المستقبلية في المغرب. والمغرب هو أحد أكثر البلدان شحة في المياه في العالم: فهو يقترب بسرعة من الحد المطلق لندرة المياه البالغ 500 متر مكعب للفرد سنويا. ويشكل تزايد حالات الجفاف وشدتها بالفعل مصدرا رئيسيا لتقلبات الاقتصاد الكلي، وتهديدا للأمن الغذائي في المملكة. ومن منظور أطول أمدا، يمكن أن يؤدي انخفاض توافر المياه وانخفاض غلة المحاصيل بسبب تغير المناخ إلى خفض إجمالي الناتج المحلي بنسبة تصل إلى 6.5%. وتتأثر الزراعة البعلية سلبا بشكل خاص بالجفاف وشح المياه. ونظرا لأن الزراعة البعلية لا تزال تمثل 80% من المساحة المزروعة في المملكة ويشتغل بها معظم القوى العاملة الزراعية (الفلاحية)، فإن التغيرات الناجمة عن تغير المناخ (توفر المياه وغلة المحاصيل) على الزراعة البعلية قد تؤدي إلى هجرة ما يصل إلى 1.9 مليون مغربي إلى المناطق الحضرية (نحو 5.4% من إجمالي السكان) بحلول عام 2050.

وأسهم توفير البنية التحتية للمياه على نطاق واسع إسهاما بالغ الأهمية في التنمية التي شهدها المغرب في الآونة الأخيرة. ومنذ أواخر الستينيات، قامت المملكة ببناء أكثر من 120 سدا كبيرا، مما أدى إلى زيادة الطاقة الإنتاجية الكلية لتعبئة المياه بواقع عشرة أمثال - من مليارى متر مكعب إلى نحو 20 مليار متر مكعب. وتم توسيع شبكة الري بالتنقيط، مما أدى إلى زيادة إنتاجية المياه في القطاع الفلاحي (القطاع الزراعي)، وهو أهم قطاع مستهلك للمياه في المغرب. وساعد ذلك المغرب على التحول إلى محاصيل أكثر إنتاجية ومضاعفة القيمة الزراعية الحقيقية المضافة تقريبا على مدى العقدين الماضيين. غير أن هذه الاستثمارات الكبيرة لم تتجنب زيادة الضغوط على الموارد المائية، وأدت إلى الاستغلال المفرط لموارد المياه الجوفية. وعلاوة على ذلك، قد تتناقص فعالية البنية التحتية كمصد وقائي ضد تقلب الاقتصاد الكلي الناجم عن صدمات هطول الأمطار في سياق تغير المناخ والاتجاه النزولي في تدفقات المياه.

والاستثمار في البنية التحتية شرط ضروري ولكنه غير كاف لمواجهة التحدي المتمثل في شحة المياه؛ وهناك حاجة تغيير هذا النموذج. وطرح المغرب خطة طموحة للاستثمار في المياه للفترة 2020-2050، وهي المخطط الوطني للماء التي تهدف إلى سد الفجوة في الطلب على المياه. ويؤكد هذا التقرير أنه في إطار ارتفاع مستوى تعرض المغرب لمخاطر موجات الجفاف وشح المياه، فإن الاستثمار في البنية التحتية للمياه يحقق عوائد إيجابية للاقتصاد ويجب أن يظل أولوية. واستنادا إلى التجارب الدولية والبحوث الأكاديمية واسعة النطاق، فإننا نرى أيضا أن هذه العائدات لن تتحقق بالكامل ما لم يقترن تطوير البنية التحتية بتدابير إضافية „لينة"، مثل إدارة الطلب على المياه، وحكامة المياه، وغير ذلك من الإجراءات المصممة لإحداث تغييرات سلوكية. ويتسق ذلك مع نموذج التنمية الجديد الذي يوصي „بتحديد القيمة الحقيقية لموارد المياه وتحفيز استخدام الموارد وإدارتها على نحو أكثر كفاءة وترشيدا".

وتمثل الفيضانات أيضا تهديدا للتنمية. والفيضانات هي أكثر الأخطار الطبيعية المرتبطة بالطقس في المغرب وهي الأكثر حدوثا، وتسبب خسائر مباشرة تقدر بنحو 450 مليون دولار سنويا، ناهيك عن أثرها غير متناسب على الأسر الأكثر احتياجا وضعفا. وبالإضافة إلى ذلك، ونظرا لأن أكثر من 65 % من السكان و90 % من الصناعات تتركز على ساحل المملكة، فإن ارتفاع منسوب سطح البحر يشكل عامل إجهاد آخر طويل الأجل، لاسيما في المناطق المنخفضة التي ستسهم في تفاقم مخاطر الفيضانات.

ووضع المغرب هيكلا متطورا لإدارة مخاطر الكوارث وتمويل جهود التصدي لها، لكن حجم الاستثمارات في الحد من المخاطر والتغطية التأمينية لا يزال غير كاف. ووضعت المملكة نظاما لإدارة مخاطر الكوارث يستند إلى برامج مبتكرة، منها صندوق بناء القدرة على الصمود في وجه الكوارث الطبيعية الذي أنشئ في البداية لتمويل إعادة الإعمار بعد الكوارث، ثم تحول إلى آلية تشارك في تمويل استثمارات الحد من مخاطر الكوارث والتأهب لها على المستوى المحلي. كما عززت المملكة قدرتها المالية على الصمود

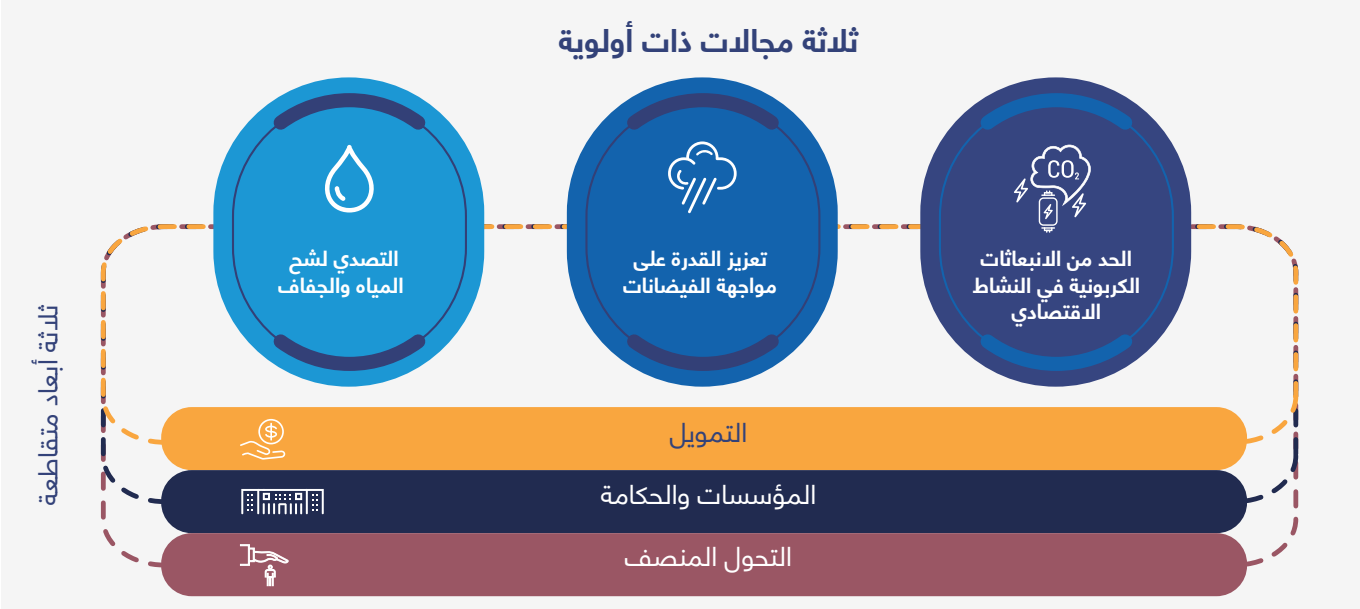
الملخص التنفيذي

تمر المملكة المغربية بمنعطف حرج في مسيرتها من أجل التنمية. وقد أفسحت الإصلاحات الهيكلية التي بدأت قبل عقدين الطريق أمام فترة مستدامة من النمو الاقتصادي والحد من الفقر لم يسبق لها مثيل في التاريخ الحديث للمملكة. وبدأ هذا النموذج يظهر علامات متزايدة على الإنهاك حتى قبل تفشي جائحة كورونا، مما حفز على التفكير الوطني الشامل في كيفية تنشيط مسار المغرب نحو النمو الاقتصادي والتنمية الاجتماعية بوتيرة أسرع. وأسفر ذلك عن نموذج التنمية الجديد الذي حدد أهدافا إنمائية طموحة يُرجى تحقيقها في عام 2035. وتواجه المملكة الآن تحديات متشابكة ومتفاقمة من أجل تنفيذ هذه الرؤية: (1) زيادة قابلية التأثر بتغير المناخ، كما يتضح من سلسلة موجات الجفاف الشديدة التي شهدتها الآونة الأخيرة (ثلاثة في السنوات الأربع الماضية)؛ (2) الحاجة الملحة إلى تسريع وتيرة الإصلاحات الهيكلية لوضع التنمية في المملكة على مسار أكثر صلابة وإنصافا واستدامة؛ (3) تحقيق كل ذلك في إطار حيز مقيد في المالية العامة.

ويكشف هذا التقرير عن المناخ والتنمية في المغرب العلاقة بين الأهداف الإنمائية للمغرب وتغير المناخ من حيث المخاطر والفرص. وبناءً على مجموعة واسعة من الدراسات الكمية والنوعية، والنماذج الجديدة المحددة،[1] يحلل هذا التقرير التداخل بين الأهداف الإنمائية للمملكة وتغير المناخ، ويبحث المخاطر التي يشكلها تغير المناخ على مسار التنمية في المملكة، والفرص التي يمكن أن تأتي من الاتجاه العالمي نحو الحد من الانبعاثات الكربونية. كما يكشف الخيارات على مستوى السياسات والاستثمارات التي يمكن أن تحقق الأهداف المناخية والتنموية في إطار تضافر الجهود.

وبناء على مجموعة كبيرة وثرية من العمل التحليلي، تم تحديد ثلاثة مجالات ذات أولوية في إطار هذا التقرير. وفي إطار ذلك تم تحديد الروابط البارزة بين آفاق التنمية في المغرب والتزاماته المناخية، ومدى إمكانية وضع المغرب على مسار منخفض الانبعاثات الكربونية وقادر على الصمود في وجه تغير المناخ. وهذه المجالات هي: (1) التصدي لشح المياه والجفاف، لا سيما من منظور قطاعي المياه والزراعة والعلاقة بينهما؛ (2) تعزيز القدرة على مواجهة الفيضانات من أجل الحفاظ على النشاط الاقتصادي وسبل كسب العيش في المناطق الحضرية والساحلية؛ (3) الحد من الانبعاثات الكربونية في النشاط الاقتصادي، والتطلع إلى مسار الانبعاثات الصفرية في خمسينيات هذا القرن. وبالإضافة إلى ذلك، هناك 3 مجالات شاملة للعديد من القطاعات تمثل عوامل تمكين بالغة الأهمية كي تتحقق الأهداف المرجوة في إطار هذه المجالات ذات الأولوية: (1) التمويل (من المصادر الخاصة والعامة)؛ (2) المؤسسات والحكامة ؛ (3) التحول المنصف لضمان عدم تخلف أحد عن الركب.

الشكل - إطار تقرير المناخ والتنمية الخاص بالمغرب من أجل مسار قادر على الصمود في وجه الصدمات ومنخفض الانبعاثات الكربونية



[1] ينبغي الاعتراف بأن الآثار الاقتصادية والاجتماعية المرتبطة بتغير المناخ لا تزال غير محددة في المغرب، كما هو الحال في بلدان أخرى. وعلى هذا النحو، فإن الأدوات الكمية الواردة في هذا التقرير لا تهدف إلى تحقيق تنبؤات بمثل هذه الآثار، بل توفير إطار تحليلي موحد لتحديد المفاضلات بين مختلف الخيارات على مستوى السياسات.

Chapter 1: Climate-Related Risks, and Opportunities for Development

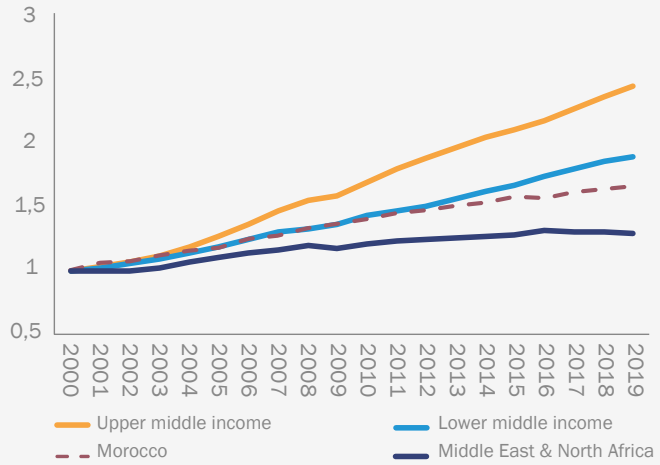
1.1. A Growth Model with Signs of Exhaustion

Morocco has achieved significant socioeconomic progress since the early 2000s. The structural reforms launched in the late 1990s brought about two decades of uninterrupted economic expansion, contrasting with the instability that characterized the 1980s and 1990s. The country's real GDP increased by close to 120 percent between 2000 and 2019; per capita income expanded by 72 percent; and extreme poverty was almost eradicated. Although this was enough to outperform the average for the Middle East and North Africa (MENA) region, per capita GDP growth has been lower in Morocco than in the average for both upper and lower middle-income economy (see Figure 1).

Weakening economic performance in recent years suggests that the country's growth model is overly reliant on public investment. Fixed capital accumulation has surpassed 30 percent of GDP since the early 2000s, explaining more than half of Morocco's GDP growth in recent decades (see Figure 2). However, this public sector-led investment effort has had a comparatively low, and waning, multiplier effect due to the presence of various structural bottlenecks that are constraining productivity growth, including (i) market distortions and rigidities that slow the reallocation of production factors across firms and sectors, and thus the structural transformation of the economy (World Bank 2018a); (ii) a competition framework that limits the capacity of new firms to enter markets and thrive (IFC 2019); and (iii) lags in human development, as evidenced by Morocco's low Human Development Index (HDI) score.[7]

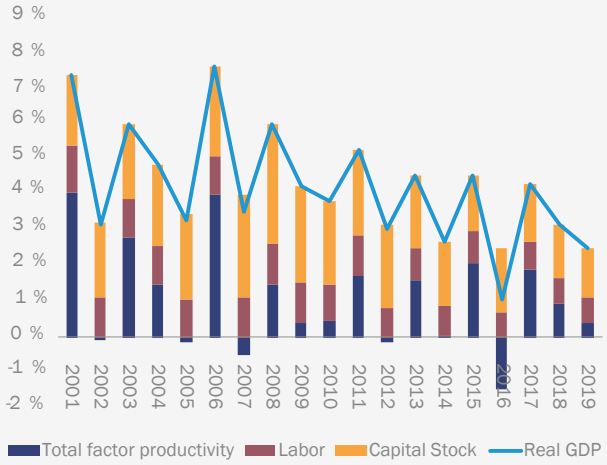
The economy has not been able to generate enough jobs to absorb a growing working-age population. Despite Morocco's continuous economic expansion, the share of active participants in the working-age population has decreased from 53 percent to 46 percent since the turn of the century, a problem that is particularly acute for women and the youth. (At just 22 percent, Morocco's female labor force participation (FLFP) is among the lowest in the world.) The persistence of such a high rate of inactivity implies that Morocco is failing to fully capitalize on its demographic dividend, illustrated by the relatively low (22-24 percent) contribution of labor to GDP growth (see Figure 2).[8] Lack of access to jobs constitutes the most powerful force for social exclusion in contemporary Morocco.

Figure 1: Per Capita GDP (constant US$, Index, 2000=100)



Source: World Development Indicators

Figure 2: Growth Decomposition



Source: World Bank staff calculations

[7] In 2020, Morocco's HDI stood at 0.504, among the lowest in the MENA region.
[8] On average, the rapid expansion of its working-age population has only yielded one additional percentage point of GDP growth between 2000 and 2019.

1.2. Climate-Development Nexus

Morocco is considered a "climate hotspot."[9] Morocco has experienced considerable warming trends since the 1960s, with observed average increases of 0.2 °C per decade, exceeding the global average. Nine of the ten warmest years recorded in the country's history took place during the last two decades. Precipitation levels have followed an overall downward trend, with increasingly erratic patterns. These changes are expected to amplify in the coming decades.

This CCDR explores the interplay between Morocco's development goals and climate change, in terms of both risks and opportunities. This is particularly timely since Morocco currently finds itself at a critical juncture at which it needs to simultaneously tackle several intertwined and compounded challenges: (i) heightened vulnerability to a changing climate (as evidenced by a new drought in 2022, coming after a two-year drought in 2019-20); (ii) an urgent need for structural reforms to put the country's development on a more solid, equitable, and sustainable path; (iii) and a highly constrained fiscal space. This CCDR analyzes ways in which economic development and climate change interface, and examines the risks that climate change poses to the development path; but also the opportunities that can come from the global decarbonization trend. It highlights the importance of the water and energy policy decisions that are at the core of the Climate-Development nexus.

Climate change generates disruptions in the water cycle, with adverse impacts on growth prospects and livelihoods. Changes in temperature and precipitation have had and will continue to have major disruptive impacts on the water cycle. They are manifested through increasingly frequent and intense droughts and floods (shocks) as well as growing water scarcity (a long-term stressor). Given the centrality of water resources in the Moroccan economy as a key production factor for most economic sectors, changes in the availability of water and variability patterns induced by climate change will likely cloud the country's economic prospects, and risk reinforcing inequality and undermining social sustainability.

With a particularly generous endowment in sources of renewable energy, Morocco is well placed to reap the benefits that could emanate from a decarbonization agenda. Gifted with abundant wind and solar resources,[10] the kingdom has been one of the first middle-income countries to forcefully engage in an ambitious renewable energy (RE) program in the latter part of the first decade of the 2000s, increasing by over twofold the RE contribution to power generation, to reach nearly 4 GW.[11] However, even while Morocco was developing its RE potential, it has also continued, and even accelerated, the use of coal for power generation.[12] Further deploying its large and competitive RE potential, and eliminating or greatly reducing the use of coal represents an opportunity for Morocco to contribute to the global decarbonization agenda and reap the economic benefits that could emanate from it.

Managing the water-energy nexus is of central importance for development in Morocco. The interdependencies between the water and energy systems have become a core dimension for Morocco's development. Water is used in all phases of energy production and the generation of electricity, while energy is also required to extract, convey, and deliver water and to treat wastewater prior to its return to the environment (or re-use). As Morocco moves toward new technologies that reinforce the interface between energy and water (for example, unconventional water resources, and green hydrogen), it is important to carefully define the right balance between the aspiration of the country as a "clean energy champion" and the need to manage its scarce water resources in a way that will spur sustained and equitable development. Managing the water-energy nexus is central to the development challenge in Morocco. (See Box 1).

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[9] As per the latest IPCC report on Climate Change 2022: Impacts, Adaptation and Vulnerability.

[10] Morocco has one of the highest rates of solar insolation worldwide, with about 3,000 hours per year of sunshine (and up to 3,600 hours in the desert). The average wind speed is 5.3 meters per second (m/s) in more than 90 percent of the country's territory.

[11] While RE contributes 37 percent in terms of installed capacity, it only contributes about 20 percent of the energy generated.

[12] Coal-fired plants represent 39 percent of total generating capacity.

Box 1: Water-Energy Nexus

In the 1970s, the mobilization of water by dams resulted in an increase in hydropower generation, which represented more than 70 percent of the installed power generation capacity of the country. Dams were most often multipurpose, also delivering water management for distribution and irrigation. The drop in rainfall associated with climate change has negatively affected both the availability of clean water and hydropower generation. As of today, the contribution of hydroelectricity has fallen to 17 percent of total installed generation capacity.[13]

The PNE (National Water Plan) envisions recourse to nonconventional water resources, notably the desalination of seawater,[14] which is based on energy-intensive technologies.[15] In order to be compatible with Morocco's decarbonization targets, these plants will have to receive their energy from renewable energy sources, essentially wind and solar power. There is significant potential for energy savings in the water sector if all of the economically available options for energy efficiency and energy recovery are exploited. Wastewater reuse is energy-demanding, but it also contains significant amounts of embedded energy that, if harnessed, could cover more than half of the electricity needs of municipal wastewater utilities.

On the energy front, Morocco has the ambition to become a large producer of green hydrogen (GH) and its derivatives[16] , such as ammonia, which are an important input to Morocco's large phosphate-to-fertilizer industry. But GH requires clean water and renewable energy. It is worth noting that desalinated water would, however, only represent a small part of the cost of GH production; and that it may be possible to produce GH using treated wastewater in the future.

On both the energy and water fronts, there are significant margins for the improvement of efficiency and loss reduction along the supply chains. Priority should be given to efforts to save water and energy: boosting energy efficiency throughout the water sector value chain, and minimizing water use in the power sector–for example replacing water cooling with air cooling whenever possible--are also important ways of making both sectors more efficient.

Building on a rich body of analytical work, three priority areas were identified for this CCDR: (i) tackling water scarcity and droughts, most notably through the lens of the water-agriculture nexus; (ii) enhancing resilience to floods, to preserve urban and coastal economies and livelihoods; and (iii) decarbonizing the economy, looking at a zero-net carbon pathway by the 2050s. These three areas were considered to capture the most salient nexuses between Morocco's development prospects and its climate commitments, as well to hold the greatest potential for a transition to a climate-resilient and low carbon (RLC) economy.[17] These priority areas constitute the core of the analysis carried out under this CCDR through deep dives and modeling exercises. In addition, three cross-cutting areas have been identified as critical enablers needed in order for the priority areas to materialize: (i) financing (from both private and public sources); (ii) institutions and governance;[18] and (iii) equitable transition (See Figure 3).

The following section provides a snapshot of these three priority areas, and presents the way in which they crystalize the climate-development interface for Morocco. It points to potential tradeoffs and synergies (which will be further analyzed in Chapter 3) by looking at various pathways; combining different sets of interventions (investments and policies); and through modeling exercises as well as other quantitative and qualitative analyses.

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13 The decrease in the share of hydroelectricity is not only the result of the reduction in water supply, but also of the development of thermal power stations since the 1980s, and the constraint of managing dams to meet irrigation demand.

14 The 2050 National Plan for Water (PNE) includes seawater desalination projects that are projected to produce nearly 1 billion cubic meters/year in order to secure drinking water in large cities and, to a lesser extent, to consolidate the water supply in some irrigation perimeters.

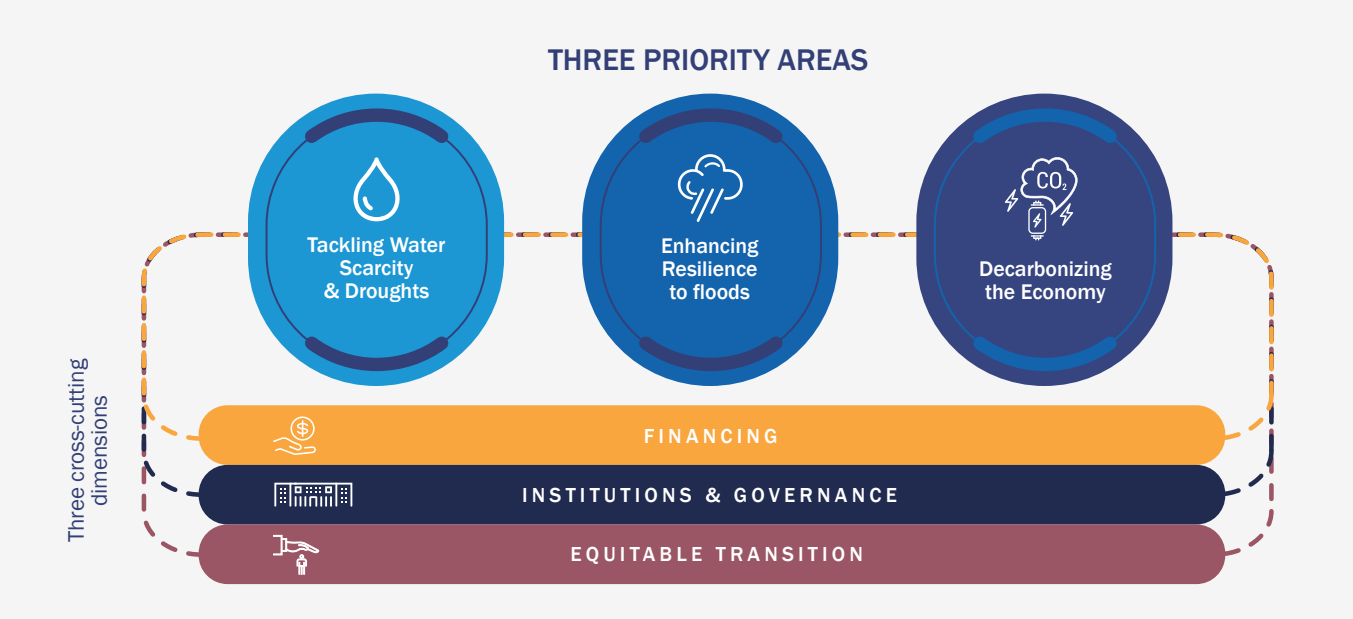
15 The share of energy consumption represents up to 60 percent of the operating cost of desalination plants.

16 The ministry in charge of energy issued a Green Hydrogen Roadmap in 2021,

17 While this CCDR attempts to provide a holistic view on the nexus between development and climate, the three priority areas have been analyzed in greater detail through deep dives and modeling exercises, presented in a series of background notes.

18 A rapid Climate Change Institutional Assessment (CCIA) performed as part of the preparation of the CCDR.

Figure 3: Morocco's CCDR Framework for a Resilient and Low Carbon (RLC) Pathway



1.2.1. Water Scarcity and Drought[19]

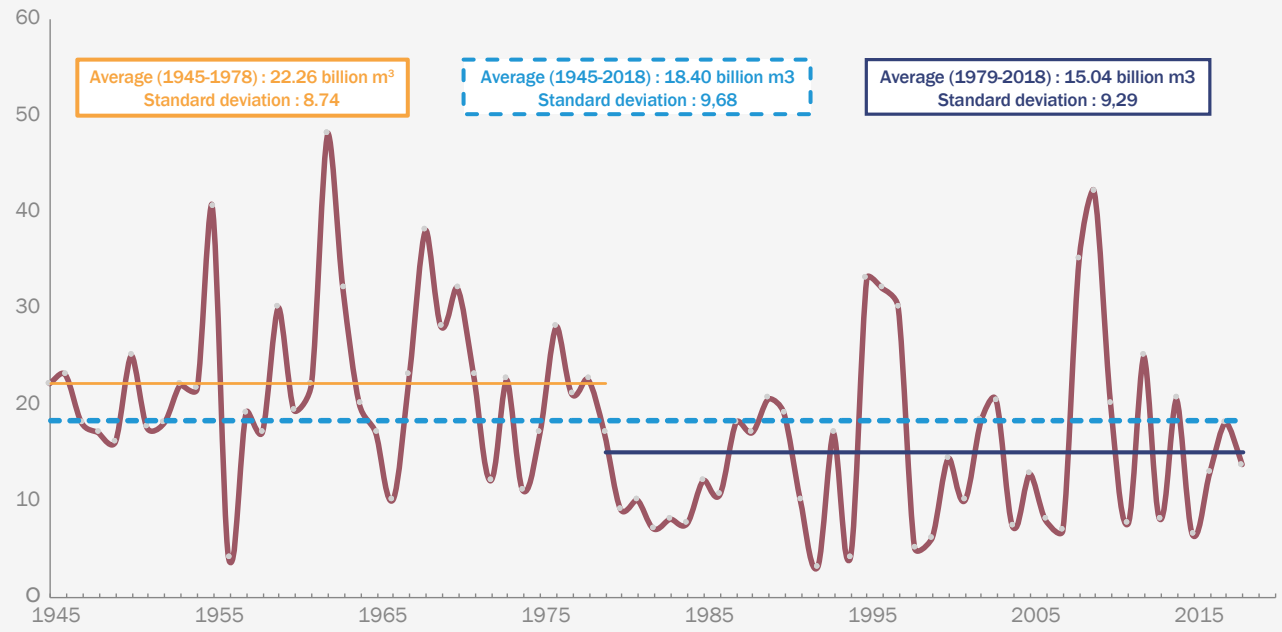
Morocco is among the most water-stressed countries in the world. The country's total water resources are estimated at 22 billion cubic meters (m^3) divided into 18 billion m^3 of surface water (on average for the available historical series), and 4 billion m^3 of groundwater. Since the late 1970s, Morocco has seen its water inflows (from surface water) declining, from an annual average of 22 billion m^3 between 1945 and 1978 (represented by the yellow line) to an annual average of 15 billion m^3 between 1979 and 2018 (represented by the black line) (see Figure 4). These declining inflows, combined with a growing demand pushed by demographic growth and economic development has pushed Morocco into a situation of water stress: between 1960 and 2020 the per capita availability of renewable water resources has decreased from 2,560 m^3 to about 620 m^3 per person per year, placing Morocco in what is considered a situation of structural water stress (below 1,000 m^3), and is quickly approaching the absolute water scarcity threshold of 500 m^3 per person per year. As a result, the pressure on groundwater resources has significantly increased to a level of overexploitation estimated at almost 30 percent,[20] especially in dry years. The challenge of water scarcity is compounded with the deterioration of water quality (surface and underground water)[21].

Morocco has responded to the challenge of water scarcity and droughts with the deployment of large infrastructure, but climate change may jeopardize the efficacy of such infrastructure. Between the late 1960s and 2020 Morocco built 126 dams, increasing its total storage capacity from 2 to 19.1 billion m3.[22] In addition, the country has developed 15 water basin interconnections of about 785 kilometers (km) to secure its municipal water supply and irrigation needs. However, despite these massive investments it is still facing a water demand-supply gap currently estimated at 1.8 billion m3/year at the national level,[23] with structural deficits registered in the Souss-Massa, Tensift, Moulouya and Oum Er Rbia basins. In addition, the variability and decline in rainfall has jeopardized the efficiency

[19] See Background Note "Deep Dive on Water Scarcity and Droughts."
[20] Groundwater withdrawals amount to about 5 billion m3 per year, which exceeds by an estimated 1.1 billion m3 the level of renewable groundwater sources.
[21] While the overall surface water and groundwater quality in Morocco is acceptable or good, one can observe a downward trend. Most industrial sewage is disposed untreated directly into the environment and the agriculture sector also contributes significant amounts of pollution to water sources through uncontrolled use of pesticides and fertilizers.
[22] The Kingdom has also launched water desalination projects and today has an installed capacity of around 147 million m3/year for seawater and 37 million m3/year for brackish water. The desalination program is expected to expand massively in the years to come.
[23] PNE total water demand and water supply amount to 16.249 billion m3/year and 14.473 billion m3/year in 2020, respectively.

of the infrastructure-focused approach, with the actual water volume in reservoirs trending downward over the past decade. This is compounded by a loss in volumes due to a severe problem of siltation caused by erosion from the upstream watershed, estimated at about 100 million tons per year (with about 60 percent of it being deposited in reservoirs)[24]. By the end of February 2022, in the midst of yet another severe drought, the overall filling rate of the main dams had hit a historical low of 32.8 percent of total capacity, with some of the dams at less than 10 percent.

Figure 4: Morocco's Water Inflows (in billion m^3/year)



Source: World Bank team's calculation, based on PNE 2020

Engineering solutions have failed to reduce the pressure on water resources. Although it may improve water productivity, the conversion to modern on-farm irrigation equipment does not systematically lead to a reduction in the consumption of irrigation water at the farm level. This is explained by the fact that, when not constrained in their water use, farmers equipped with drip irrigation tend to intensify production through a shift toward crops with higher added value, which consumes more water and/or increases land use intensity. This phenomenon is referred to as the "Jevon's paradox." In addition, water tariffs have been maintained artificially low and have failed to capture the increasing scarcity of the resource, which, combined with unconstrained water supply, can lead to overconsumption patterns. (See Box 2).

[24] Japan International Cooperation Agency (JICA) study on Dam Sedimentation in Morocco, presented in a workshop in November 2021.

Box 2: Water Tariffs in Irrigated Agriculture

Water pricing in irrigated agriculture is divided into: (i) water use or Domaine Public Hydraulique (DPH) fees[25] ; and (ii) service provision (or irrigation) fees. These two types of fees serve different functions and purposes.

The **DPH fee represents the price for water withdrawal.** It aims to contribute to the operational costs of the water basin agencies (Agences de Bassin Hydraulique, or ABH) to help them carry out their functions (including water policing), as well as contributing to the operating and maintenance (O&M) costs of dams and other hydraulic assets under ABH. Currently it is set at a very low level (MAD 0.02/m^3). It is supposed to be paid by all water users; however, the actual collection level represents only a very small portion of the potential level. Between 2012 and 2017, the fee collection from irrigation users ranged between MAD 26 and MAD 40 million per year, while the potential amount would be about MAD 280 million per year [26]. The amount collected comes mostly from large-scale irrigation schemes (LSIs)[27]. The DPH fee is not collected for small-scale irrigation (SMI) schemes (which is roughly 19 percent of irrigated areas), or for private irrigation (PI), which represents more than 45 percent of irrigated areas and uses mainly underground water or run-off river resources. This situation leaves ABH with very limited resources that do not allow them to fulfill their mandate, most notably their role of water police.

The service provision fee (or irrigation fee) has a very different purpose and relates to irrigation services provided to users. Morocco has progressively put in place a service charge system, allowing a better coverage of irrigation water service costs compared to other major irrigation countries. The purpose of this fee is to cover the O&M and amortization costs of collective irrigation systems. By definition it applies to both LSIs and SMIs, but not to PIs (which rely on individual schemes). In SMIs, where irrigation schemes are usually traditional, the irrigation fees represent low amounts paid by the farmers to the Water User Associations (WUAs). On the contrary, LSI has put into place water pricing systems that aim to reflect the quality and the costs of services according to the schemes: as such, the fee amounts vary widely (between 0.24 and 0.77 MAD/ m^3 in LSIs under Offices Régionaux de Mise en Valeur Agricole (ORMVA, i.e., regional offices for agricultural enhancement), ORMVA's management, and between 1.5 to 5.5 MAD/ m^3 under public/private partnership (PPP) schemes). The collection rate is high for most LSI schemes (in the range of 80 to 95 percent)[28]. However, it is important to note that with these fees, the users' willingness to pay is correlated with the quality of the services delivered. Over the past few years, some collective schemes have been subjected to severe water rationing, therefore to unreliable service —for example in Oum Er Bia, Moulouya, Souss-Massa, and Tensift. This has had an immediate impact on farmers' revenues, which then fuels a vicious circle wherein willingness to pay for the service provision fee is reduced, which further undermines the quality of service.

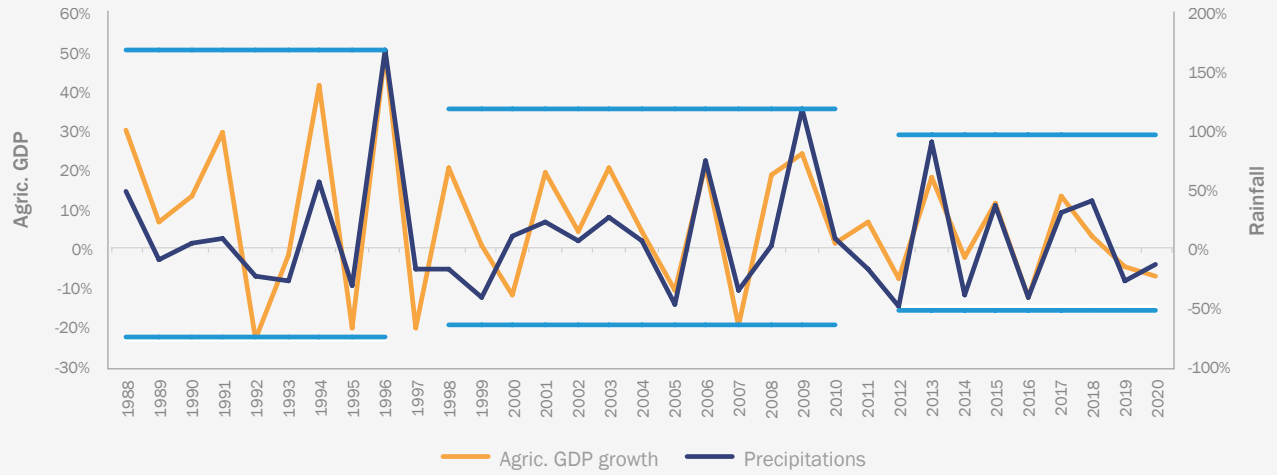
It is also worth noting that the water tariffs do not reflect the high level of public investment in support of irrigation (CAPEX)—both for large water infrastructure, but also for modernization subsidies for irrigation equipment at the farm level (supported at 80 to 100 percent through FDA subsidies).

Despite major advances in water use efficiency in agriculture, the sector remains a source of macro volatility. Since 2010s, public policy has focused on increasing water use efficiency (WUE) in the agriculture sector, which is by far the largest consumer of water resources in Morocco[29]. This was achieved through modernization of the irrigation system and subsidies for investment in on-farm equipment[30]. As a result, between 2008 and 2018, the area under drip irrigation increased 3.5 times, fueling a 92 percent increase in real agricultural value added[31]. And while they

[26] Considering the total average water volume allocated to irrigation by year (14 billion of m3) with a fee of MAD 0.02/m3.
[27] With the ORMVAs (Regional Offices for the Agricultural Valorization) collecting on behalf of the ABH.
[28] This is based on a 2014 survey (which is the latest official data); it is very likely that the collection rate would be lower now given the restrictions applied in terms of water allocation in recent years.
[29] The agricultural sector consumes more than 80 percent of the country's water resources.
[30] Program for Water Savings in Agriculture (PNEEI), under the PMV.
[31] According to the Social Accounting Matrix, irrigated agricultural value added can surpass 70 percent of total agricultural value added in a dry year (source: Haut Commissariat au Plan HCP Matrice de Compabilité Sociale)

represent only 20 percent of agricultural land in the country, irrigated areas contribute more than half of its total agricultural value added. This transformation has contributed to reducing the volatility of agricultural sector growth (see orange lines in Figure 5). However, since crop yields in the rainfed areas (covering 80 percent of agriculture lands) remain strongly correlated to the amount of rainfall, the agricultural sector remains a major source of macro volatility, and rainfall shocks explain close to 37 percent of the variance of Morocco's output over the medium term, even though the agricultural sector represents only 13 percent of GDP (World Bank, 2022b). Droughts can also have fiscal and balance of payment impacts due to the emergency support that is provided to farmers in exceptionally dry years, as well as to the need to import larger volumes of cereals when domestic production falls. These impacts are amplified when droughts coincide with international food price shocks, as is currently the case following the war in Ukraine and its impact on grain trade.

Figure 5: Precipitation vs. Agricultural Value Added (Annual Change in Percentage)



Source: World Bank team's calculation, based on Ministry of Agriculture figures (2021)

Droughts and water scarcity disproportionately affect poor farmers. 79 percent of Morocco's poor live in rural areas, and most of them depend on rainfed agriculture as a source of food and income. In this context, the increasing incidence, severity, and duration of droughts has become a key driver of vulnerability for the rural population. The penetration of agricultural insurance schemes is still marginal for most small producers.[32] The transformation of the Moroccan agricultural sector brought about by the Plan Maroc Vert (PMV) (the Moroccan Green Plan) has not been labor intensive; thus it has failed to provide sufficient opportunities for the rural poor.[33] As a result, migration remains one of the few adaptive responses to climate shocks available to many small farmers, a trend that could gather speed in the decades to come.

1.2.2. Floods

Floods are the most frequent climate-related natural hazard in Morocco. Due to its geographic position, high level of variability in rainfall, and topography, Morocco is particularly prone to floods. Indeed, 20 major events have been

[32] The penetration rate for agricultural insurance in Morocco is estimated at 17 percent, but with large differences: large farmers (> 50 hectares (ha) at 40 percent; medium farmers (between 10 and 50 ha) at 24 percent; and small farmers (<10 ha) less than 3 percent.

[33] Indeed, the jobs diagnostic recently conducted by the World Bank in collaboration with the HCP finds that the significant growth of agricultural value added registered over the past two decades has had a negative jobs multiplier.

registered between 2000 and 2021,[35] causing average direct losses estimated at $450 million per year[36]. In addition, given that more than 65 percent of the population and 90 percent of industry is concentrated along the coastline, sea-level rise constitutes another long-term stressor, especially for low-lying areas that contribute to exacerbating the risk of floods. As such, while acknowledging that in the absence of adaptation measures sea-level rise could cause massive losses,[37] this CCDR focuses on floods and only indirectly (and partially) embeds the dimension of sea-level rise, through the projected increase in flood risk.

Economically vulnerable households are disproportionately exposed to the risk of floods, a trend that climate migration and coastal urbanization are likely to intensify. The hazard and vulnerability maps developed for various cities in Morocco suggest that the riskier areas tend to be concentrated in poorer neighborhoods, poorly connected to transportation networks and less likely to be in proximity of health centers and fire stations. These are also areas in which climate migrants are more likely to relocate in decades to come, which could create an adverse feedback loop between water scarcity and exposure to natural hazards for the poor and vulnerable.

Morocco has put into place a sophisticated disaster risk management and financing architecture (DRM and DRF). Since the early 2000s, the government has focused on gaining a better understanding of critical risks and on defining the roles and responsibilities of the various institutions that are involved in disaster risk reduction, response, and recovery. A central element of the country's strategy has been the transition from a post-disaster emergency approach to a preparedness approach that prioritizes investment in both structural and nonstructural disaster risk reduction. The National Flood Protection Plan (Plan National de Protection Contre les Inondations or PNI) was launched in 2002 with a programmed amount of 25 billion MAD ($2 billion) for the period 2003-17. In addition, the Natural Disaster Resilience Fund (Fonds de Lutte contre les effets des Catastrophes Naturelles or FLCN), initially created to finance post-disaster reconstruction, was turned into an innovative mechanism for co-financing investment in disaster risk reduction and preparedness at the local level. Morocco has also put in place a sophisticated catastrophic risk insurance regime based on a system that: (i) guarantees coverage for insured households through additional premiums received and managed through private insurers through which at least 8.9 million people were insured in 2021; and (ii) provides basic compensation for uninsured people and households through the creation of the Fonds de Solidarité contre les Evènements Catastrophiques (Solidarity Fund against Catastrophic Events or FSEC).[38] The FSEC is expected to benefit the estimated 95 percent of the people in Morocco who do not have an insurance contract.

The DRM/DRF schemes currently in place remain insufficient to fully cover the needs related to flood risk management. The amount of financial resources mobilized for risk reduction investments remains insufficient.[39] Only one fourth of the investments originally contemplated in the PNI had been carried out or were in progress by the time that strategy was updated in 2017. The updated PNI (2016-2036) targets more than 1,000 flood-prone sites and forecasts $1.5 billion worth of investments. On average, this would amount to a yearly investment amounting to about 16 percent of annual average losses due to floods. Thus far the FLCN has only received a yearly budget of about $20 million. The combined private and public DRF schemes can provide about $100 million in compensations every year with rapid disbursement mechanisms (that is, within weeks of an event). This can, only cover a relatively minor fraction of potential catastrophic damages.

1.2.3. Decarbonization[40]

Despite having increased substantially in recent decades, Morocco's GHG emissions remain comparatively small. The country's total annual GHG emissions doubled between 2000 and 2019 (from 44.6 to 91.2 million tons CO2 eq). However, they still represent just 0.2 percent of global emissions, and the carbon intensity of the Moroccan economy

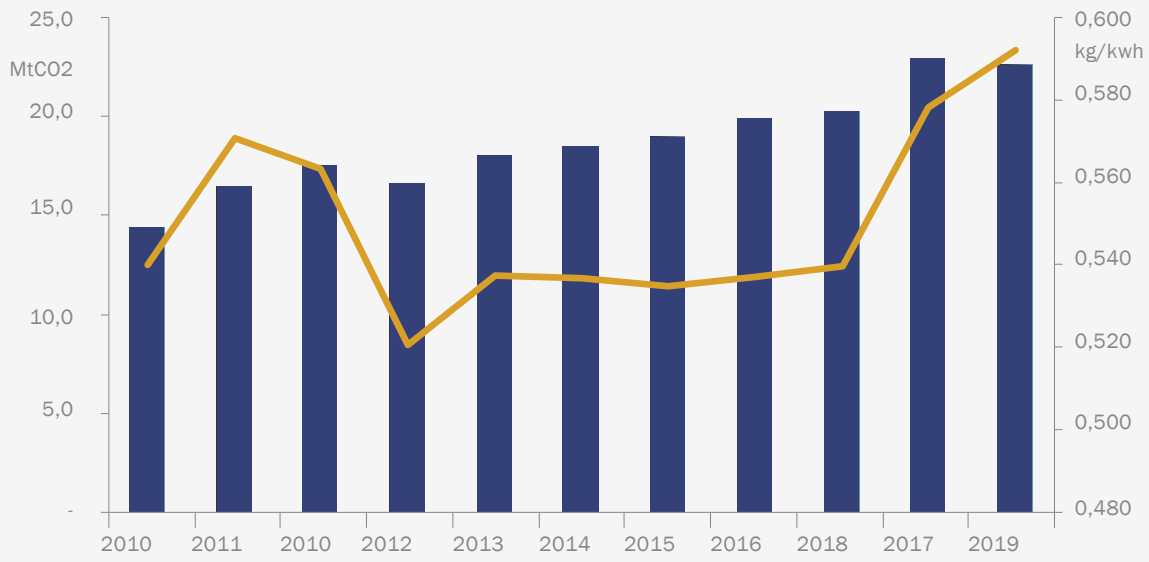
[35] www.emdat.be
[36] Source: World Bank, 2013. Building Morocco's Resilience: Inputs for an Integrated Risk Management Strategy. Washington, DC.
[37] Hallegatte et al. (2013) estimated that a 40-centimeter sea-level rise would result in mean annual losses of up to $1256 million in the city of Casablanca alone. Up to 24 percent of the Tangier Bay would also be at risk of flooding, with particularly large impacts on industrial zones and tourist coastal infrastructure (Snoussi et al., 2009).
[38] Law 110-14 adopted in 2018.
[39] Getting a complete picture of how much is spent annually to reduce the risk of floods is no easy task in Morocco, as it involves several levels of governments and institutions, with no consolidation of figures publicly available.
[40] See Background Note "Deep Dive on Decarbonization of the Moroccan Economy."

is currently 9.2 percent lower than that of the world as a whole, and 30 percent below the MENA region[41]. Moreover, since the early 2010s, Morocco has entered a relative decoupling trend in which real GDP is growing faster than GHG emissions, implying that the carbon intensity of the GDP has begun to decline[42].

The energy sector is by far the largest contributor to Morocco's emissions; thus, the decarbonization agenda has understandably centered on the development of renewable energy sources (RE). The energy sector represents the lion's share, accounting for 65.1 percent of total gross GHG emissions in 2018, followed by agriculture (22.1 percent), industrial processes (6 percent), and waste management (5.4 percent).[43] In terms of energy-related emissions, the power sector dominates with 36.1 percent, followed by the transport sector (29 percent). In this context, as in many other countries, Morocco's mitigation policies have so far prioritized the decarbonization of the power generating sector.[44] Indeed, various flagship solar and wind projects have been developed to tap the country's plentiful RE potential, bringing the share of variable renewables to around 20 percent of the power generation energy mix in 2021, earning Morocco the reputation of an emerging "climate champion".

Nevertheless, Morocco's efforts to decarbonize through RE have been negated by the growing use of coal for power generation. Despite recent progress, wind, solar, and hydropower represent only 20 percent of the country's electricity generation and 3.9 percent of its total energy use in 2019, against 56.5 percent for oil, 29.8 percent for coal, 5.9 for biofuels and waste and 3.9 percent for natural gas.[45] Along with efforts to tap into the country's vast RE potential, three new coal power plants were commissioned in the 2010s, bringing the total coal-fired power generating capacity above 4GW (39 percent of total power generation capacity in 2021). As a result, the carbon intensity of the power sector has continued to increase, placing the power sector in Morocco among the most carbon-intensive in the world, with around 600 tons of CO2 emitted by GWh in 2020 (see Figure 6).[46] This heavy reliance on coal for power generation, which is unusual in the MENA region, can be explained by Morocco's lack of domestic natural gas resources and a reluctance to rely on gas imports from neighboring countries.

Figure 6: Power Sector Emissions (left) and Carbon Intensity (right)



Source: Staff calculation based on ONEE data.

41 Measured as the level of CO2 emissions per PPP$ of GDP. Source: Author's calculations based on the World Development Indicators.
42 Illustrating this point, from 1990-2011, the average growth rate of real GDP and total GHG emissions coincided (4.1 percent). By contrast, from 2012-2018, real GDP expanded at an average rate of 3.3 percent, against 2 percent for GHG emissions.
43 Source: Fourth National Communication to the UNFCCC.
44 Electricity plays a central role in the decarbonization strategy. First, due to its reliance on coal, the power sector represents a major contributor to CO2 emissions, and is the easiest sector to decarbonize. Second, decarbonization of the end-use sectors depends on the level of electricity penetration. Third, green hydrogen, which has great potential in Morocco, is produced by electrolysis, which requires large quantities of electricity.
45 Source: www.iea.org
46 This represents about 2.5 times the average EU level and nearly 1.5 times the world average.

Dependence on fossil fuels has important macroeconomic implications for Morocco. Between 2010 and 2020 energy accounted for 19.4 percent of total imports. In addition, despite the partial liberalization of hydrocarbon prices that took place in 2012-15, liquid petroleum gas (LPG) explicit subsidies still absorb close to 2.4 percent of government expenditure, the equivalent of almost 1 percent of GDP per year.[47] Reliance on imported fossil fuels remains a major source of vulnerability of the Moroccan economy to international price shocks, such as the one recently unleashed by the war in Ukraine.

1.3 Toward a New Development Model[48]

Morocco has recently unveiled a New Development Model (NDM) that envisages deep socioeconomic transformation. The NDM is articulated around four main axes of transformation and lays out high ambitions, including the doubling of per capita GDP by 2035.[49] Placing Morocco on such a trajectory would require sustaining an average annual growth rate of almost 7 percent for the next 12 years, which will only be possible if the country diversifies its sources of growth beyond public capital accumulation. Indeed, recent simulations suggest that in order to grow at such a pace, Morocco would need to prioritize actions to unlock a productivity-enhancing structural transformation process and rebalance investment in favor of the private sector; resolve the bottlenecks that are preventing women and youth from entering the labor force; and raise the levels of human capital through better education and health services (World Bank 2022a).

The NDM highlights opportunities that could be associated with decarbonization and emphasizes the challenge of water scarcity for the country's sustained development. While not singling out climate change as one of its priority areas, the NDM sets the goal of turning Morocco into a regional "green energy champion" by building on and deepening transformation of the energy mix. On the adaptation front, it emphasizes the importance of tackling water scarcity and formulates a series of policy reforms with the objective of improving water resource planning, allocation, and valuation to better reflect the true value of what is set to become an increasingly scarce resource, and implementation of comprehensive institutional reform.[50] On the social policy front, it also mentions the need to address the needs of climate migrants, and to adapt the health system to cope with the foreseeable threats posed by an increase in the frequency of extreme weather events.

However, the NDM could have taken a more systematic approach to climate change, and it may be underestimating the risks that climate change poses to achieving the ambitious development objectives that Morocco has set for itself. Given the magnitude of the transformations that are projected for the coming decades, climate change could impact almost every aspect of Morocco's future socioeconomic development. This means that climate considerations need to be fully embedded in development plans, something that the NDM has partially achieved. In addition, the NDM does not consider the fiscal implications that climate change could have: while it contemplates a large fiscal expansion to finance the policies that it envisages for meeting the country's development ambitions, it does not address the significant pressure climate change could exert on public revenues and expenditures. At some point, Morocco is likely to be forced to engage in a fiscal consolidation process that will increase competition for public resources. In this context, prioritizing investments that have strong development and climate synergies becomes even more relevant. Table 14 in the Appendix constitutes a first attempt to streamline the climate-related risks and opportunities that could affect the national priorities outlined in the NDM.

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[47] The IMF estimates that the implicit fuel subsidies could represent as much as around 5 percent of GDP annually. (Implicit subsidies are calculated as total fuel consumption multiplied by the difference between the existing and efficient prices, the latter internalizing environmental and health externalities.)

[48] The New Development Model, Kingdom of Morocco, April 2021, General Report and Thematic.

[49] The four axes presented in the NDM report are: (i) a productive and diversified economy; (ii) reinforced human capital; (iii) inclusion and opportunities for all; and (iv) sustainable and resilient territories.

[50] The NDM suggests considering the creation of a new agency to oversee the sector, Agence Nationale de Gestion de l'Eau (ANGE).

Chapter 2: Morocco's Climate Commitments, Policies and Capacities

2.1. An Ambitious Set of Policies and Strategies

Morocco has taken some decisive steps to combat climate change over the past 15 years. In the late 2000s, it notably launched two emblematic programs to tackle climate challenges at the sectoral level: the Plan Maroc Vert (PMV), designed to support climate-smart agriculture, and the Moroccan Solar plan (which was then transformed into the National Energy Strategy), to deploy renewable energy.[51] In 2017, it adopted the 2030 National Sustainable Development Strategy, and two years later, it launched the 2030 National Climate Plan (2030-NCP), which is organized around five main pillars: (i) Establish strengthened climate governance; (ii) Strengthen resilience to climate risks; (iii) Accelerate the transition to a low-carbon economy; (iv) Include territories in climate dynamics; and (v) Strengthen human, technological, and financial capacities.

Ahead of COP-26 in Glasgow in November 2021, Morocco put forward a revised Nationally Determined Contribution (NDC) with an enhanced mitigation target. The revised NDC aims to achieve 45.5 percent reduction of its greenhouse gas emissions by 2030 compared to a business-as-usual scenario;[52] this represents an increase of 3.5 percentage points in the mitigation objective from the 2016 NDC. Most notably, Morocco's updated NDC includes for the first time the cement and phosphates sectors: the inclusion of the latter sector is important, since Morocco is estimated to hold approximately 75 percent of the world's phosphate reserves and has become the fifth largest exporter of fertilizers. According to the Climate Action Tracker (CAT), Morocco's climate targets and policies are "almost sufficient,"[53] and the targets set under its unconditional commitment meet its fair-share contribution to the Paris Agreement. However, it is worth noting that the Moroccan electricity mix continues to rely heavily on coal, with over 40 percent of the power generation currently relying on coal;[54] and Morocco has not provided a clear signal on its plans to phase out its relatively-young coal plants. In addition to the NDC, Morocco has initiated the preparation of a long-term low emission development strategy for 2050 (2050-LEDS):[55] this work will determine the modalities for Morocco to achieve climate neutrality over the course of this century.

Adaptation and resilience remain a high priority for Morocco: as such, the updated NDC has expanded its scope, with a more comprehensive approach. The revised NDC strengthens the interventions in the four sectors already covered by the 2015 NDC (agriculture, water, fisheries and aquaculture, and forestry) with enhanced objectives, and includes several additional sectors: meteorology, sensitive environments (coastline, mountains, and oases), urban and rural planning, and health. The adaptation objectives defined in the NDC are further developed in the National Strategic Adaptation Plan (NSAP), which was adopted in January 2022. NSAP sets a roadmap for 2020-2030, with a concerted and inclusive framework to support adaptation planning and priority actions to strengthen the resilience of the population and the territory to climate change. In February 2021, Morocco also launched a National Disaster Risk Management Strategy (2020-2030), which builds on the extensive work on DRM spearheaded by the Ministry of Interior over the past decade. The DRM strategy lays out a comprehensive approach to managing disaster and climate-related risks, with a focus on promoting ex ante risk reduction and preparedness to complement ex post recovery activities.[56] Building on this strategy, two action plans have been developed: the first one focuses on priority actions (2021-2023), while the second one provides a framework for operationalizing the strategy.

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[51] The Government has recently launched the revision of the Strategy that should be finalized by mid-2023. This revised version will notably include concept of carbon neutrality and the deployment of green finance.

[52] Under the revised NDC, 18.3 percent of this target is unconditional, and the remaining 27.2 percent is conditional upon international assistance.

[53] This indicates that Morocco's climate policies and commitments are almost consistent with the Paris Agreement's 1.5°Celsius temperature limit and could reach consistency with moderate improvements.

[54] It is estimated that compliance with the Paris Agreement requires that all coal-based electricity needs be phased out globally by 2040, and much earlier for many regions. For the Middle East and Africa region, coal-based electricity would need to be reduced by 80 percent in 2030 (compared to 2010), and phased out by 2034.

[55] In June 2021, Morocco presented the vision for 2050-LEDS. It is now embarked on the second phase of preparation of 2050-LEDS, which will conduct a modeling work on development trajectories and emissions, complemented by an analysis of sector dynamics.

[56] The DRM Strategy also puts into place a strengthened framework for horizontal and vertical coordination among the multiple institutions with responsibilities related to the DRM agenda.

Financing for climate action remains limited and by and large is focused on mitigation measures. The total cost of the revised NDC amounts to a total of $78,8 billion for the 2020-2030 period, ie an average amount of about $7.2 billion per year.[57] A recent evaluation[58] conducted for the period 2011-18 estimates that Morocco invested an average of $1.5 billion per year on climate action (equivalent to 14 billion dirhams per year, or around 1.3 percent of GDP).[59] A large part of the investments went to support the energy and transport sectors (38 and 32 percent, respectively), and to a lesser extent the agriculture sector (20 percent), through the Plan Maroc Vert (PMV), for the expansion of drip irrigation. While there has been an upward trend[60] from 2011-18, total climate financing falls short in terms of the ambitions described in the NDC: it represents less than one fifth of the annual financial needs estimated.[61] The financing for adaptation in particular is falling behind.

2.2. Remaining Institutional Coordination Limitations

Recent institutional assessment on climate change[62] reveals that a large majority of the ministries at the central level are in one way or another involved in climate action. The Ministry in charge of the environment is designated as the national focal point for coordinating the climate change agenda in Morocco. The Department of Climate Change within this ministry assumes the coordination role on climate issues and leads on the preparation of national plans and strategies related to it (such as the 2030 National Climate Plan; the National Adaptation Plan; and the NDC; low-carbon strategy). It also prepares the national communication to the United Nations Framework Convention on Climate Change (UNFCCC). Most of the line ministries have embedded climate change actions into their mandate, and some ministries (as well as some state-owned enterprises (SOEs)) have prepared sectoral climate plans (Ministry in charge of Agriculture, Ministry in charge of Energy, Ministry in charge of Transport…).

Building a fully-coherent climate action requires a strong institutional coordination. While the sector-specific approach to climate change has certainly yielded an impact over the past 15 years (most notably with the PMV for agriculture and the National Energy Strategy), it will not be enough to put forward a comprehensive and forceful response to climate challenges in Morocco, which call for an integrated approach. The existing sectoral plans and strategies are indeed not always fully articulated, which creates limitations in their implementation; this can in turn lead to fragmentation and lack of coherence. This is particularly challenging when it comes to the critical "energy-water nexus." For example, while Morocco has put together an ambitious plan to deploy green hydrogen, the National Water Plan does not include the water needs associated with such a plan. Similarly, the development of water desalination solutions should be carefully aligned with the deployment of renewable energy, while also taking into account the demand that will come from other sectors (such as transport and industry).

Vertical coordination also needs to be strengthened. Local governments (LGs) play a key role in climate action, and both regional and municipal governments have de jure competencies in sectors that are highly relevant to climate change mitigation and adaptation.[63] LGs develop planning tools, informing pluriannual budgeting of priority investment projects.[64] In addition, with the support of the Ministry of Environment, the regional governments have started to develop their Regional Climate Plans (PCTs).[65] The newly elected regional and municipal councils are

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[57] The total costs associated to mitigation commitments amount to $38.8 billion (out of which $21.5 billion under conditional commitment) while the costs associated to adaptation actions amount to $40 billion.

[58] Source: "Panorama of the Financing of Climate Action in Morocco 2011-2018", carried out by the Caisse de Dépôt et de Gestion (CDG) and the Institute for Climate Economics (I4CE).

[59] It is worth noting that, given the absence of climate-sensitive tagging on the public side and the lack of a green taxonomy on the private side, computing Morocco's total mitigation and adaptation investments is not an easy task; the reported numbers likely underestimate the overall effort.

[60] About 5.3 percent annual increase.

[61] The annual financing needs in order to fulfill the 2015 NDC ambitions is estimated at around 74 billion dirhams (about $7.9 billion).

[62] This section builds on the rapid Climate Change Institutional Assessment (CCIA), which was conducted as part of the preparation of the CCDR. See the Background Note on "Institutions and Governance for Climate Action in Morocco."

[63] Regional government competencies cover intermunicipal transport and natural resource management, which are all relevant to climate change. Municipal governments are responsible inter alia for waste and sanitation, urban transport, water/electricity distribution, and green public spaces.

[64] Regional governments have developed Territorial Development Strategies (SRATs), with a 15-year horizon and Regional Development Plans (PDRs), once per election mandate of five years: the PDRs are then translated into a "Contrat Etat-Region" (pluriannual investment project plan). Municipalities have pluriannual municipal development plans (PDCs) and annual action plans (PACs), including a list of annual investment projects.

[65] Two regions have PCTs (Souss Massa and Marrakech Safi), and seven others are being developed.

in the process of preparing their new five-year plans, which will be adopted during the last quarter of 2022. The engagement with the LG stakeholders, as part of the preparation of the CCDR, shows that the climate agenda has gained momentum and that it should be more highly featured (adaptation but also mitigation) in the upcoming PDRs and PDCs. Nonetheless, the coordination and complementarities between LG investment projects and central government investment projects remains limited due to the lack of an integrated database and limited involvement of the Ministry of Finance in reviewing LG investment planning. In addition, the LGs still lack the financial and human resources needed to scale up climate action.

The country's climate ambitions are yet to be reflected in the public finance management (PFM) system. Currently, there are neither legal nor regulatory requirements for the government to mainstream climate change objectives into the PFM instruments. There is also no tool in place to monitor climate-related programs and expenditures. As a result, it is difficult to assess to what extent the unconditional commitments made to UNFCCC are reflected in the national budget.[66] Second, there are no climate-related filters or climate risk screening tools in place to prioritize public resources either toward climate-smart investments or interventions (rather than toward stranded assets). Also, while the Moroccan public procurement regulation includes a provision on sustainable/green public procurement principles,[67] the government has not yet turned those principles into actions. The newly adopted pact on "State exemplarity"[68] put forward by the Commission for Sustainable Development could serve as a vehicle for mainstreaming climate considerations in the PFM system.

Morocco now needs to transition to a "whole-of-government" approach. Grasping the complexity that climate change poses to the Moroccan development agenda cannot be tackled through sectoral lenses: it requires a "whole of government" approach that can help clarify the long-term tradeoffs associated with short-term policy choices and can guide decision making. A new Commission on Climate Change and Biodiversity was established in April 2020[69] with the objective of fostering consultation and coordination among various governmental entities on their respective climate actions and ensuring overall coherence. However, it is still unclear whether this Commission can act as a mediator and can manage the trade-offs that could arise from climate policy choices.

2.3. The Private Sector and Civil Society: Upping their Games But Still Facing Barriers

According to the World Bank's Enterprise Survey for Morocco, the private sector's level of engagement on climate issues remains uneven, and overall is at a low level.[70] Around one third of Moroccan firms have internalized climate change considerations in their strategic decision-making processes or daily operations,[71] with a large heterogeneity across firms: foreign-owned firms and innovative companies[72] display the highest level on this indicator (47 and 52 percent respectively). Only around 17 percent of businesses said that they have a manager responsible for environmental or climate change issues: this is less than the number of businesses that have adopted strategic objectives related to climate and may indicate that firms have not yet acted upon their stated ambitions or objectives. Surprisingly, exporters[73] do not exhibit a stronger performance in this field, despite the fact that they may have to adhere to sustainability standards required by export destinations – particularly the European Union (EU). Overall, corporations indicate that climate change tends not to be prioritized over other considerations when it comes to investment decisions. It is worth noting, however, that firms that have experienced monetary losses due to extreme weather events are not only more aware of climate change issues, but also tend to have implemented more adaptation or mitigation measures compared to those that have not had such losses.[74]

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66 This is even more true for regional and municipal budgets.

67 As set forth in Art. 1 of the Moroccan Public Procurement Decree No. 2-12-349 „La passation des marchés publics prend en considération le respect de l'environnement et les objectifs du développement durable."

68 Pacte d'Exemplarité de l'Administration (PEA)

69 Décret n° 2-19-721 du 3 ramadan 1441 (27 avril 2020).

70 See Background Note "How Aware Are Moroccan Firms of Climate Change Issues?" based on the 2019 World Bank's Enterprise Survey for Morocco, for a detailed analysis of climate perception and the climate actions of Moroccan firms.

71 This is measured by the number of companies that have strategic objectives that mention climate change or environmental issues. It is worth noting that the levels observed in Morocco are higher than those in other markets, such as Egypt (where less than 5 percent of Egyptian firms indicate strategic objectives mentioning these issues).

72 Innovative firms are firms that have spent internally on R&D over the past three fiscal years. Foreign-owned businesses are those in which at least 10 percent of the company is owned by private foreign individuals, companies, or organizations.

73 Exporters are firms that indicate that they directly export at least 10 percent of their sales.

74 For example, 52 percent of firms with monetary losses are said to have adopted water management measures, whereas this figure only stands at 16 percent for firms that did not experience losses.

However, the private sector has played and will continue to play a major role in climate action. Overall, the private sector has contributed to about 60 percent of the financing for climate action over the period 2011-18,[77] and has proven particularly instrumental in the deployment of renewable energy over the past decade through large public-private partnership (PPP) schemes. In October 2021, the Confédération Générale des Entreprises du Maroc (CGEM), the main union group for private operators published its "White Book Towards a Sustained, Responsible and Green Economic Growth" in which it reiterated its strong engagement to support the decarbonization of the economy and called for liberalization of the electricity market to unleash the participation of private operators--notably through the amendment to Law 13-09 to open access for renewable energy to medium-voltage consumers--but also through the decentralization of renewable energy generation. While this role has been limited so far, the private sector could also play a key role in climate adaptation action, particularly in regard to desalination and resilient building programs, but also in the climate insurance market.

Morocco's private sector still faces several structural constraints that are hampering green investments from materializing. As emphasized by the World Bank Group's Country Private-Sector Diagnosis for Morocco (CPSD), among the factors that have constrained the emergence of a more dynamic private sector in Morocco are the country's weak competition framework and the privileges enjoyed by existing market operators, in particular state-owned enterprises (SOEs) (IFC 2019). As a result, the business environment is not fully conducive to young firms entering markets and growing, thus driving innovation for sustainability, and helping to accelerate the green transition (UNEP 2017).

Civil society organizations (CSOs) have also become increasingly active on the climate agenda at both the local and national levels. A large number of CSOs are involved in the areas of sustainable development and the climate change agenda. They cover a broad range of activities at the local level, from resilient rural development to energy efficiency and solid waste management in urban spaces. They are particularly involved in awareness raising and information sharing on climate-related issues. Alliances and networks of CSOs also contribute to advancing the climate agenda at the national level. Last August, the Alliance Marocaine pour le Climat et le Développement Durable (AMCDD), one of the largest networks of environmental CSOs, published its " White Paper for an Alignment Between Post-COVID Public Policies and the Paris Agreement," which calls for a better alignment of public policy with national climate ambitions, particularly in the context of the post-COVID recovery.

The current framework, however, still provides only limited space for participation and exchange between the various groups of stakeholders. There is a recognition that climate action will necessitate the contribution of all actors of the society (public entities, private sector, and civil society). The government usually reaches out to stakeholders during the preparation of strategies or plans, but they are not fully integrated into the decision-making and implementation processes. The New Development Model (NDM) report highlights the need for convergence and synergy among stakeholders through an open mobilization of partnerships: this is particularly true in the context of climate action, which calls for strong coordination and collaboration among the groups of actors who are involved.

[77] Source: "Panorama of the Financing of Climate Action in Morocco 2011-2018," conducted by the Caisse de Dépôt et de Gestion (CDG) and the Institute for Climate Economics (I4CE). The other 40 percent of the financing for climate action was mobilized through public actors (central and subnational governments as well as SOEs).

Chapter 3: Sectoral Policies for a Resilient and Low-Carbon Morocco

This chapter presents an in-depth analysis of the three pathway areas prioritized under this Country Climate and Development Report (CCDR), namely: (i) tackling water scarcity and droughts, notably through the lens of the water-agriculture nexus; (ii) enhancing resilience to floods, to preserve urban and coastal economies and livelihoods; and (iii) decarbonizing the economy, with a view toward a zero-net carbon pathway by the 2050s. It analyzes how these three pathways connect development prospects and climate commitments in Morocco (both the trade-offs and synergies). And it suggests the interventions (investments and public policies) that could put Morocco on a resilient and low carbon (RLC) track.

3.1. Tackling Water Scarcity and Droughts

3.1.1. A Threat to Long-Term Development

Water scarcity could have an impact on almost every aspect of Morocco's future socioeconomic development. Morocco could reach the absolute water scarcity threshold of 500 cubic meters (m^3) per person per year before the end of this decade. However, the development path that the country has followed in recent decades has created an increase in water consumption in most sectors of the economy—especially in potable water, agriculture, industry, and tourism. The section below sheds light on the multifaceted impacts of water scarcity and their cascading effects throughout the entire economy, notably on areas such as growth, jobs, trade, and domestic migration.[76] It compiles the results of analytical work carried out over the past two years, including three modeling exercises: (i) the GTAP-BIO-Water, a computable general equilibrium (CGE) model (Taheripour, 2020); (ii) the MFMod macrostructural model; and (iii) the Morocco-dedicated analysis included in the 2021 Groundswell Report 2.0.

Impacts on GDP

The channels through which droughts (shocks) and water scarcity (a long-term stressor) impact the economy are different, but they could reinforce each other. As discussed in Chapter 1, droughts are a major source of macroeconomic volatility in Morocco. The historical pattern has been that agricultural output (and thus GDP) tends to rebound after a drought, with limited impact on long-term trends, as evidenced by the robust agricultural growth in output registered in recent decades. However, with the structural decline in water resources, the Moroccan economy could find it harder to rebound from droughts than has previously been observed. In other words, in the long term, Morocco could struggle to recover agricultural output losses suffered in dry years.

Increasing water scarcity could result in large GDP losses.[77] A reduction in water availability to all sectors of the economy (without any yield changes) could reduce GDP by up to 5.3 percent (see Table 1). These negative impacts would be amplified if crop yields were to change due to climate change, with a drop in real GDP that could reach 6.5 percent.[78] The introduction of water use efficiency (WUE) practices in agriculture would only partially offset the negative impacts of water scarcity and climate change on GDP, although the benefits of incorporating such practices are larger in the more severe water scarcity scenarios. Under all scenarios, the agricultural sector is projected to suffer the most, thus reducing its participation in GDP.[79] However, the nonagricultural sectors would also be significantly affected, and most of the overall GDP losses would be explained by the negative impacts in these sectors, given their greater role in the economy.[80]

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[76] The impacts of droughts on the financial system are presented in Chapter 4.

[77] Water resources also represent a critical production factor for the manufacturing and service sectors. These results are generated using the Global Trade Analysis Project (GTAP-BIO-Water) model, a static computable general equilibrium (CGE) model that incorporates water into the production function of all economic activities, including crops, livestock, industries, and utility services. The model also distinguishes between rainfed and irrigated crops to better capture the links between the demand for irrigation and food supply. The GTAP-Bio-Water model squarely focuses on the long-term stressor of water scarcity, not on droughts. These results are based on the modeling exercise presented in the "Water Scarcity in Morocco" report.

[78] Interestingly, the changes in crop yields would also increase the negative impacts on non-agricultural sectors given the forward and backward links between agricultural and nonagricultural sectors in the Moroccan economy.

[79] Water resources also represent a critical production factor for the manufacturing and service sectors. These results are deviations from a baseline scenario in which water is not rationed in the economy. The GTAP-BIO is a static model, implying that the result does not correspond to any particular year. However, it should be assumed that such a scenario could materialize toward the middle of the Century, based on the continuation of the trends observed over the past decades (see Figure 4).

[80] Under the model, the reduction in water availability is applied across all sectors.

Table 1: Changes in GDP Under Various Water Scarcity Scenarios (GTAP-BIO-Water Model)

		Reduction in Water Supply (percentage)			
Examined Variable	**Examined Case**	**10**	**15**	**20**	**25**
Change in Agriculture GDP (percentage)	S1 to S4	-2,9	-4,5	-6,2	-7,9
	SC1 to SC4	-7,1	-7,5	-8,2	-9,3
	SC1-W20 to SC4-W20	-7,8	-7,6	-7,6	-7,8
Change in Non-Agriculture GDP (percentage)	S1 to S4	-1,9	-2,9	-4,0	-5,2
	SC1 to SC4	-4,0	-4,5	-5,2	-6,2
	SC1-W20 to SC4-W20	-3,5	-3,7	-4,0	-4,5
Change in Real GDP (percentage)	S1 to S4	-1,9	-3,0	-4,1	-5,3
	SC1 to SC4	-4,3	-4,8	-5,5	-6,5
	SC1-W20 to SC4-W20	-3,8	-4,0	-4,3	-4,8

Source: GTAP-Bio-Water modeling exercise, extracted from "Water Scarcity in Morocco" report

Notes: The scenarios that are simulated in this exercise are:

(i) Reduction in water supply from 10 to 25 percent, with 5 percent increments across various sectors of the economy (Simulations S1 to S4)
(ii) Reduction in water supply from 10 to 25 percent with 5 percent increments, plus yield changes induced by climate change: yields for rainfed crops are projected to drop by 15 percent on average while yields for irrigated crops are projected to increase by 5 percent on average until 2050 (Simulations SC1 to SC4). The assumption on the change on yields induced by climate change on irrigated and non-irrigated crops is based on the modeling work conducted by Ouraich (2010).
(i) Reduction in water supply from 10 to 25 percent, with 5 percent increments, plus yield changes induced by climate change; and a 20 percent improvement in water productivity in irrigated crop sectors[81] (Simulations SC1-W20 to SC4-W20).

Distributional Impacts

Rural livelihoods are particularly vulnerable to droughts and water scarcity. Poverty in Morocco remains largely rural: about 79 percent of the poor live in rural areas. The agricultural sector employs nearly 30 percent of the national workforce, and more than 80 percent of the rural population.[82] Rural livelihood is intrinsically linked to agriculture, with a large majority of the rural population relying on agriculture, mostly rainfed, for their income and food. As shown in Figure 7, the behavior of the rural labor market has followed two clear patterns in recent years: (i) an overall downward trend in levels;[83] and (ii) large fluctuations correlated with climatic conditions (proxied by cereal production), with employment levels below the trendline when rainfed crops are poor (because of drought), and vice versa. In this context, increasingly frequent droughts and structural water stress can be expected to continue to shrink rural job opportunities in the decades to come.

The simulations conducted with the GTAP-Bio model suggest that a decline in water resources would negatively impact the demand for labor across sectors, with larger impacts for the agricultural sector and for unskilled workers. A reduction in water supply would reduce this demand by a considerable rate across the entire economy (6 percent for unskilled labor, and 5.4 percent for skilled). Together with the changes in crop yields induced by climate change, the drop in the demand for unskilled agricultural labor could reach almost 10 percent. Other sectors would also be adversely impacted, but to a lesser extent (see Table 2). Labor intensity in irrigated schemes tends to be lower than in rainfed areas, which means that water use efficiency (WUE) practices would have a limited capacity to mitigate the drop in the labor demand for in agricultural activities, and on the whole would provide more job opportunities for skilled workers. Since Morocco is already struggling to absorb the growing working-age population, water scarcity combined with climate change could further exacerbate its labor market challenges, which are characterized by high levels of inactivity, particularly among women and youth, who tend to be particularly vulnerable (see Box 3).[84]

[81] These scenarios examine the extent to which improvements in WUE could mitigate the adverse impacts of water scarcity, using the target of 20 percent as set forth in the National Program for Water Savings in Agriculture (PNEEI).
[82] About 70 percent of Morocco's farms are smaller than 5 hectares.
[83] This downward trend is reflected in the negative jobs multiplier that has characterized agricultural value-added growth in recent decades (Source: "Job Diagnosis in Morocco," prepared jointly by the World Bank and the Haut Commissariat au Plan (HCP).
[84] In the primary sector, both women and youth are exposed to vulnerable conditions, with about 73 percent and 60 percent of unpaid labor respectively.

Figure 7: Rural Labor Markets and Cereal Production

Source: World Bank staff with data from FAO-Stat and HCP

Table 2: Changes in Demand for Labor Under Various Water Scarcity Scenarios

Examined variable		Scenarios	Reduction in water supply (percentage)			
			10	15	20	25
Agriculture Activities	Changes in demand for unskilled labor (percentage)	S1 to S4	-3.1	-4.8	-6.6	-8.4
		SC1 to SC4	-7.3	-7.8	-8.6	-9.7
		SC1-W20 to SC4-W20	-7.4	-7.3	-7.4	-7.7
	Changes in demand for skilled labor (percentage)	S1 to S4	-2.2	-3.4	-4.6	-6.0
		SC1 to SC4	-4.5	-5.0	-5.8	-6.8
		SC1-W20 to SC4-W20	-4.2	-4.3	-4.5	-5.0
Non Agricultural Activities	Changes in demand for unskilled labor (percentage)	S1 to S4	-1.9	-3.0	-4.1	-5.3
		SC1 to SC4	-4.0	-4.6	-5.3	-6.3
		SC1-W20 to SC4-W20	-3.5	-3.7	-4.0	-4.5
	Changes in demand for skilled labor (percentage)	S1 to S4	-2.0	-3.0	-4.2	-5.4
		SC1 to SC4	-4.1	-4.7	-5.5	-6.4
		SC1-W20 to SC4-W20	-3.6	-3.8	-4.2	-4.7
All economic activities	Changes in demand for unskilled labor (percentage)	S1 to S4	-2.2	-3.4	-4.6	-6.0
		SC1 to SC4	4.7	-5.2	-6.0	-7.0
		SC1-W20 to SC4-W20	-4.3	-4.4	-4.7	-5.2
	Changes in demand for skilled labor (per-centage)	S1 to S4	-2.0	-3.0	-4.2	-5.4
		SC1 to SC4	-4.2	-4.7	-5.5	-6.5
		SC1-W20 to SC4-W20	-3.6	-3.8	-4.2	-4.7

Source: GTAP-Bio-Water modeling exercise, extracted from the "Water Scarcity in Morocco" report.
Note: The scenarios that are simulated in this exercise are the same as for Table 1 above.

Fewer agricultural jobs could intensify migration to urban centers. Unless job losses in agriculture are compensated for by alternative opportunities in rural areas, either along the agriculture value chains or through other sectors such as tourism, rural working-age workers will face challenging conditions, which may well push some of them to migrate to urban areas, or abroad. The Groundswell 2.0 report projects that up to 1.9 million Moroccans (5.4 percent of the total population) could migrate out of rural areas by 2050 (see Box 4). Rural areas with a predominance of rainfed agriculture and large declines in water availability (which could be combined with a decline in crop productivity) would witness the most out-migration, with hotspots concentrated in the central foothills, including around Marrakech, and on the west and southwest coast around Casablanca, Safi, and south of Agadir to Tiznit.[85]

Box 3: Gender-Differentiated Impacts of Climate Change: A Review of the Literature[86]

While climate change and shocks are gender-neutral, their impacts are not. Due to existing gender disparities in Morocco, women suffer greater exposure and greater vulnerability, and have a more limited level of preparedness and coping capacity compared to men in case of disaster. These limitations emerge, among other factors, from Moroccan women's limited access to information such as early warning systems, as well as from post-disaster interventions.

A 2013 review in the commune of Boudinar shows that (i) women are more likely than men to lose their jobs during dry events (the main driver being that they work predominantly in the informal sector, which makes them more vulnerable to labor adjustments in response to shocks); (ii) during periods of drought, women's workload rises (mainly to ensure access to water); and (iii) during and after flood events, women are mobilized to evacuate rainwater from their homes while men are repairing and fitting out roofs and furniture (Khattabi, 2013).

A study conducted in the regions of Tangier and Tinghir finds that farm households rely on internal migration to mitigate the consequences of climate change (Van Praag, 2021). Specifically, this study shows that men are more likely to migrate first to other localities to seek work in times of drought, often leaving the women at home even though the women also want to migrate. A qualitative study focusing on these regions finds that a high prevalence of women relative to men in the agricultural sector makes them more vulnerable to the effects of climate change, such as drought and land degradation (Van Praag, 2022). In these regions, the decrease in agricultural productivity due to climate change leads to a reduction in their income and a decrease in their decision-making power in the household.

Overall, climate change is expected to heighten existing gender-equality gaps in employment and income levels; women's access to and control over productive assets and natural resources; their access to services, skills, and capacity; and their mobility, as well as agency and decision-making power.

Box 4: A Looming Crisis of Climate Migration: Groundswell 2.0 Report[87]

The Groundswell Report, published in September 2021, projects trends in domestic migration driven by climate change. It uses three different scenarios for development pathways (Shared Socioeconomic Pathways: SSP2 as moderate development, and SSP4 as unequal development) and GHG emission pathways (RCP 2.6 as low emissions and RCP 8.5 as high emissions): (i) a pessimistic reference scenario (unequal development and high emissions); (ii) more inclusive development (moderate development and high emissions); and (iii) a more climate-friendly scenario (unequal development and low emissions).

Climate change is projected to spur out-migration from rural areas as water availability declines. In Morocco (one of the three country cases) climate migration is projected to increase during the next three decades, across the three scenarios, albeit with considerable differences, as shown in Figure 11 and Figure 12. The number of climate migrants could be as high as 1.9 million (5.4 percent of the total population) under the pessimistic reference scenario; in the more inclusive development scenario, the projection is 1.5 million (4.0 percent of the total population); and in the more climate-friendly scenario, it is 0.5 million (1.3 percent of the total population).

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[85] Morocco has put into place various programs, including small-scale public works for water management, to retain population in rural areas, by offering job opportunities while supporting local water management solutions.

[86] See Background Note on "Gender and Climate Change in Morocco," under finalization.

[87] See "Groundswell: Acting on Internal Climate Migration" report.

Figure 8: Projected Number of Internal Climate Migrants in Morocco Under Three Scenarios, 2020-2050

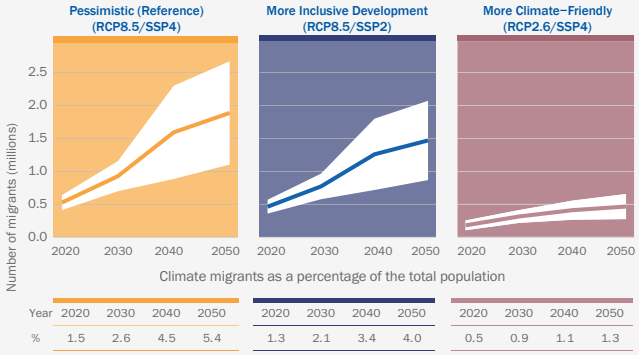
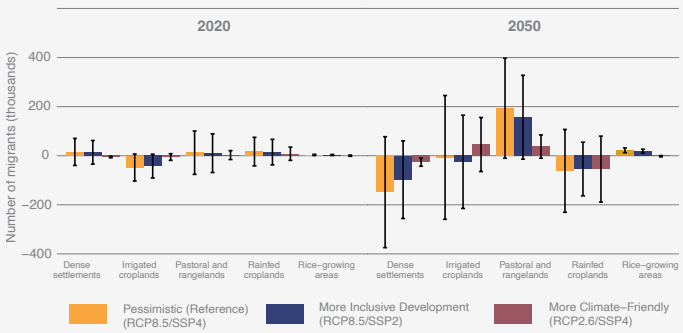


Figure 9: Projected Net Climate Migration In and Out of Livelihood Zones in Morocco Under Three Scenarios, 2020-2050



Source: World Bank, Groundswell 2:0, 2021

Note: The scenarios are based on combinations of two Shared Socioeconomic Pathways—SSP2 (moderate development) and SSP4 (unequal development)—and two Representative Concentration Pathways —RCP 2.6 (low emissions) and RCP 8.5 (high emissions).

Impacts on Food Product Trade

Increased pressure on the water supply could put Morocco's agricultural trade at risk. Such impacts could be felt on both the import and export sides by: (i) increasing the dependency on imported cereals to compensate for the shortage of domestic production (a potential threat to national food security),[88] and (ii) affecting Morocco's ability to export the irrigated agricultural products in which it has specialized. The simulations run with the GTAP-BIO-Water demonstrate that a drop in water supply by 25 percent combined with climate change impacts could make net exports drop by $891 million per year (at 2016 prices), or about 24.7 percent of agricultural exports, and 3.5 percent of total merchandise exports (see Table 3).[89] Improvements in WUE would cushion only a small portion of this reduction in net food exports. In short, with the decline in water resources, Morocco is expected to export less, and import more from other countries. Although water scarcity and yield changes jointly decrease the net exports of all agricultural and food products of Morocco, a large portion of this reduction (more than half of the impacts simulated under the different scenarios) would fall on higher value-added crops such as vegetables and fruits, since they jointly consume the largest portion of water for irrigation.

Table 3: Changes in the Trade Balance of Food Items Under Various Water Scarcity Scenarios

		Reduction in water supply (percentage)			
Examined variable	Scenarios	10	15	20	25
Changes in trade balance of food (US$, millions)	S1 to S4	-223	-345	-475	-611
	SC1 to SC4	-679	-728	-797	-891
	SC1-W20 to SC4-W20	-612	-627	-651	-692

Source: GTAP-Bio-Water modeling exercise, extracted from the "Water Scarcity in Morocco" report.
Note: Food items include crops, livestock, and processed food.

[88] Morocco is a net importer of grains, and the volume of grain imported is negatively correlated to rainfall and domestic production. For example, when Morocco's wheat production plummeted to 2.7 million tons in 2016 from 8.1 million tons in 2015, the country's wheat imports doubled, from 3.2 million tons in 2015 to 6.3 million tons in 2016. Barley production and imports in Morocco show a similar pattern, but to a lesser extent.

[89] Based on $3.9 billion and $27.7 billion of Morocco's agricultural and total exports in 2020.

3.1.2. Policy Options for Tackling Water Scarcity and Droughts

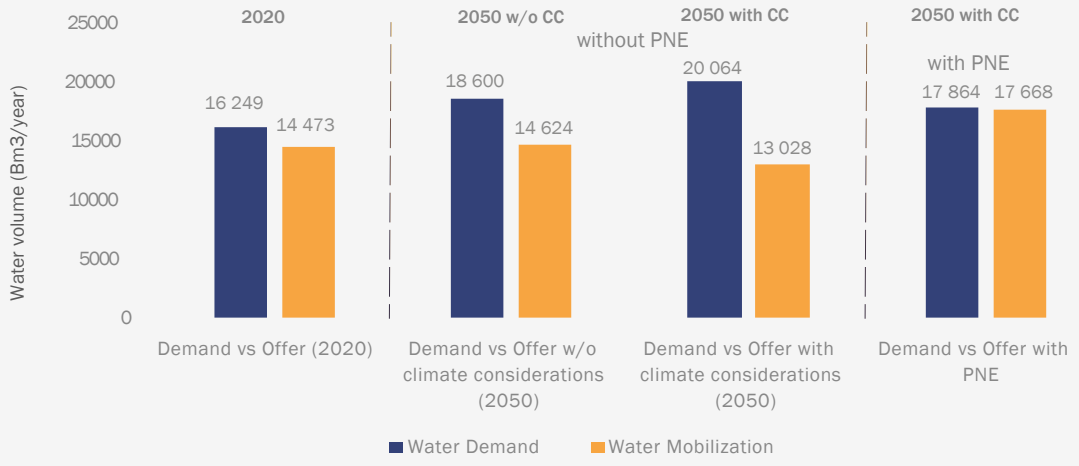
Investments in Water Infrastructure

Investing in water infrastructure can reduce the adverse impacts of both droughts and water scarcity. Morocco has traditionally managed its water scarcity challenge through infrastructure solutions (notably, dams and modernized irrigation systems). In its 2022 report "Feeling the Heat: Adapting to Climate Change in the Middle East and Central Asia," the IMF estimated that investing in climate adaptation infrastructure would improve the resilience of the Moroccan economy to droughts, and reduce GDP losses by almost 60 percent compared to an equal-sized investment in standard infrastructure. It also shows that a more muted decline in GDP would in turn be beneficial for the debt-to-GDP ratio trajectory in the aftermath of events. In that sense, the 2050 National Water Plan is headed in the right direction since it represents an ambitious infrastructure plan, mostly relying on "engineering" actions[90] to increase water mobilization and improve water productivity (see Box 5).

Box 5: The 2050 National Water Plan

The 2050 National Water Plan (PNE) is an ambitious infrastructure plan that has been designed to tackle the water demand-supply gap in coming decades. The gap is currently estimated at 1.8 billion cubic meters (m^3) per year at the national level. In the absence of any new water infrastructure construction, and taking into account the effects of climate change (with the increase in demand for irrigation estimated at 10 percent and the decline in precipitation and underground water resources), the gap is projected to reach 7 billion m^3 a year by 2050. The 2050 PNE lists a series of mostly engineering solutions to close this deficit. On the one hand, the PNE aims to reduce the water demand[91] by 2.2 billion m^3/year by 2050, by (i) reducing water losses in transport and the distribution of potable water (up to 0.4 billion m^3/year); and (ii) saving 1.8 billion m^3/year of water in the agriculture sector through modernized irrigation. On the other hand, the PNE plans to increase water mobilization by 4.6 billion m^3/year by 2050 through: (i) dam construction and interconnections (3 billion m^3/year); (ii) desalination (1 billion m^3/year); (iii) wastewater use (0.3 billion m^3/year); and (iv) rainwater harvesting (0.3 billion m^3/year). Thus, even if the PNE actions are fully implemented, leading to the expected results by 2050, the increased supply level of sustainable water would be 17.6 billion m^3/year,[92] while the demand would be 17.8 billion m^3/year, leaving a residual water deficit of about 0.2 billion m^3/year (see Figure 10).

Figure 10: Projected Water Deficit 2020-2050, with and without climate issues, and with and without PNE Interventions (in millions cubic meters/year)



Source: Authors' calculations (based on the PNE, 2021)

[90] The expression "engineering supply and demand actions" refers to these supply actions: reservoirs, desalination, treated wastewater reuse, and rainwater harvesting; and these demand actions: reduction of leakages, and localized irrigation.

[91] The soon-to-be-published report "The New Normal of Allocating Water Scarcity" from the World Bank points out the "counterintuitive effect" of the pitfalls of engineering solutions in terms of water demand management that can end up leading to a greater demand for water.

[92] The PNE projects that sustainable water resource supply levels will decrease from 14.473 to 13.028 billion m3/year by 2050 due to reduced dam storage capacity caused by sedimentation, decreased run-off, and declined groundwater recharge due to climate change.

However, the PNE will also absorb a large volume of public resources; and given Morocco's fiscally constrained environment this warrants a careful cost-benefit analysis of its various components. The overall PNE is estimated to mobilize about $41 billion over the 2020-2050 period, which would be mostly covered by public resources. Given the constrained fiscal space that Morocco has inherited due to the COVID-19 pandemic, and the ambitious plans set in the New Development Model (NDM), an important policy question is whether there might be more economically beneficial alternatives uses for a portion of the public resources expected to be committed to the PNE.

In this CCDR, we use the MFMod model to address this question by simulating the impact of repurposing part of the investments contemplated by the PNE. The objective of this exercise is to determine whether downscaling the PNE would elicit better macroeconomic responses than implementing it in its entirety. Four scenarios were simulated in this exercise: two in which the resources freed by an incremental reduction in investments planned for PNE to increase water supply are used instead to reduce debt; and two in which these resources are used to finance other productive investments. These macroeconomic simulations assume that the reduction in infrastructure investment (the new water mobilization infrastructure planned under PNE) would result in water rationing only for irrigated agriculture, since the authorities are fully committed to ensuring that water demanded by other sectors of the economy always be met first.[93] These scenarios contemplate a 10 and 25 percent reduction in the water flows made available to irrigated agriculture. For the sake of simplicity, it is assumed that the investment is proportionally related to the increase or reduction in water supply.[94]

The simulations we conducted suggest that redeploying water infrastructure investments to other uses would not elicit positive macroeconomic responses. In all four scenarios, GDP, consumption, and investment would fall below the baseline, indicating that full completion of the PNE investments is the pathway that would have the most positive aggregate impacts in terms of growth, consumption, and investment (see Table 4). Unsurprisingly, the one macro variable that would evolve positively is the level of debt under the two scenarios where freed investment would be used to reduce the budget deficit (S1-debt and S2 debt). However, given the adverse impacts that this option would have on GDP, investment, and consumption, it does not appear to be the most appropriate way to create fiscal space (see Chapter 4 for a discussion of fiscal policy and some alternative revenue-generating reforms).

Table 4: Macroeconomic Simulations - PNE Partial Redeployment

	GDP Deviation from baseline (*)			Consumption Deviation from baseline (*)			Investment Deviation from baseline (*)			Debt Deviation from baseline (*)		
	2030	2040	2050	2030	2040	2050	2030	2040	2050	2030	2040	2050
S1 Debt	-0.04%	-0.19%	-0.48%	-0.07%	-0.28%	-0.56%	-0.49%	-0.54%	-0.73%	-2.46%	-3.48%	-2.90%
S1 Investment	0.01%	-0.09%	-0.38%	0.01%	-0.12%	-0.40%	0.04%	-1.44%	-0.64%	0.12%	0.16%	0.16%
S2 Debt	-0.12%	-0.55%	-1.32%	-0.20%	-0.78%	-1.51%	-1.28%	-0.19%	-1.99%	-6.14%	-8.67%	-7.25%
S2 Investment	0.00%	-0.31%	-1.07%	0.00%	-0.39%	-1.14%	0.05%	-0.60%	-1.79%	0.30%	0.42%	0.43%

Source: Authors' calculations using intermediate results of the GTAP-Bio model and the MFMod model.
Notes: (*) The baseline corresponds to the full implementation of the National Water Plan (PNE).
S1 Debt: Reduction in PNE investments on additional water mobilization infrastructure corresponding to a 10 percent reduction in water supply for irrigation; freed resources used for debt reduction (fiscal consolidation).
S1 Investment: Reduction in PNE investments on additional water mobilization infrastructure, corresponding to a 10 percent reduction in water supply for irrigation; freed resources used for alternative productive investment.
S2 Debt: Reduction in PNE investments on additional water mobilization infrastructure corresponding to a 25 percent reduction in water supply for irrigation; freed resources used for debt reduction (fiscal consolidation).
S2 Investment: Reduction in PNE investments on additional water mobilization infrastructure corresponding to a 25 percent reduction in water supply for irrigation; freed resources used for alternative productive investment.

[93] A such, this modeling exercise differs from the simulations presented in Section 3.1.1 (GTAP-BIO-W model), which analyzes the impact of rationing water supply to all sectors of the Moroccan economy.
[94] See Background Note "Deep Dive on Water Scarcity and Droughts" for a detailed presentation of the modeling approach.

Maximizing the participation of the private sector in this effort is still desirable. The modeling exercise presented above suggests that investing in water infrastructure is a good use of scarce public resources given the significant impact that water rationing would have on the economy. That said, it would still be desirable to attract some private financing to support such an effort. Morocco was one of the pioneer countries to set up PPPs in the irrigation sector (e.g. Guerdane, Chtouka,...). The PNE also provides for private sector participation in certain investments (desalination and wastewater treatment, as well as certain irrigation programs). However, it does not set a clear roadmap for attracting private financing, nor does it discuss the incentives that would be required for this financing to materialize.[95] Additionally, and beyond the CAPEX financing, the private sector could play a key role in the operation and maintenance (O&M) of the infrastructure, bringing about innovation and increasing efficiency of the water systems.[96]

Water Demand Management Policies

If not paired with policy measures on water demand management, the investments contemplated under the PNE are unlikely to meet the objective of closing the supply-demand gap. As highlighted in Chapter 1, the massive investments in water infrastructure (dams and irrigation schemes) in past decades have not succeeded in alleviating the pressure on water resources; the result has been continuous groundwater overmining. There is indeed a growing literature arguing that "engineering" solutions,[97] when they are not paired with adequate water demand management measures, may not succeed at reducing the pressure on water resources, but could actually lead instead to an increase in water consumption. These counterintuitive impacts can be explained by various phenomena: supply-demand cycles;[98] the reservoir effect;[99] and the water efficiency paradox (or Jevons Paradox).[100] [101] This means that "engineering supply and demand actions"[102] alone are unlikely to achieve the expected results if they are not accompanied with climate smart policies that keep water demand growth under control and induce efficient water use. Given its almost exclusive focus on engineering solutions, there is a great risk that the PNE may not fully close the demand-supply gap by 2050.

The NDM report formulates a series of policy reforms, and highlights the need to "reflect the true value of the water resource and incentivize a more efficient and rationale use and management of the resource".[103] A 2017 regional benchmark shows that Morocco is lagging behind in terms of water productivity (World Bank, 2017). Despite growing water scarcity, water systems are still plagued with losses in the transport and distribution networks.[104] The price signal is considered to be a powerful tool for incentivizing more rational and efficient use of resources that could also contribute to improving the financial sustainability of the sector. However, as mentioned in Chapter 1, water tariffs have been held artificially low, and remain largely insufficient to cover the O&M costs. In line with the NDM recommendations, an adjustment of water tariffs could be an appropriate tool to help incentivize a more rationale use of water resources, especially the use of groundwaters, which are quickly depleting. In that sense, private irrigation should be the priority target for enforcement of the DPH fee[105] ; the pricing modalities (amount, with the possibility of using different tranches, etc.) could be reconsidered, to produce the desired effects towards a more rational use

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95 The PPP Law 86-12 issued in 2014, revised by Law 46-18 in 2020, could be used for desalination projects. However, it should be noted that Law 86-12 is not specific to desalination. A decree laying down the procedures and terms for granting the authorization and establishing the concession contract and the related specifications, relating to the desalination of seawater, for the benefit of natural and legal persons private is therefore under development. The regulation of effluent discharges to the ocean foreseen under Coastal Law 81-12, including the conditions under which brine discharge permits renewals can be denied.

96 As Morocco embarks on a large infrastructure plan under PNE, it needs to devote the necessary level of financial resources to O&M in order to fully use their potential during their entire lifetime, and to reduce losses along the distribution network.

97 Only a very small fraction of the PNE intervention (about 1.3 percent of the total budget) corresponds to soft measures, ranging from communication to groundwater resource management and ecosystem preservation.

08 An increasing water supply can generate higher demand, which can then aggravate water scarcity.

99 The reservoir effect results in overreliance on water infrastructure (dams, desalination, wastewater treatment), and is associated with the expansion of water supply, and a belief that water will always be available; this can lead to reduced incentives for adaptive actions at the individual or community level to periods of water shortages or droughts.

100 As referred to in Chapter 1.

101 See Background Note "Deep Dive on Water Scarcity and Droughts" for a detailed presentation of the counterintuitive impacts of engineering solutions.

102 The expression "engineering supply and demand actions" in this report refers to these supply actions: reservoirs, desalination, treated wastewater reuse, and rainwater harvesting; and these demand actions: reduction of leakages, and localized irrigation.

103 The NDM report also put forward the need for more transparency on the costs all along the water chain (from mobilization to consumption and treatment), and a new governance of the sector with the creation of a Water Agency (ANGE), while promoting the deployment of nonconventional water resources.

104 According to the 2021 version of the PNE, the physical water loss in the distribution networks is estimated at around 24 percent (ranging from 17 percent in the city of Salé to 38 percent in the city of Essaouira). In addition to these losses, there are also losses in the transport of treated water (5 to 10 percent); treatment (5 percent); and in some cases, losses in the transport of raw water as well (10 to 20 percent).

105 As mentioned in Box 2 /Chapter 1, private irrigation using groundwater does not pay a DPH fee.

106 Private irrigation using groundwater covers around 620,000 hectares (ha), with estimated water withdrawals estimated to be around 4 to 4.5 billion cubic meters per year.

of the resource.[106] The combination of the DPH fee increase with a system of tradable quotas could provide the level of flexibility needed to ensure optimal water allocation among users. Increasing revenues from DPH fees would also provide the ABHs with additional resources, which would allow them to fully perform their responsibilities, most notably the ones related to water policing. They could also more carefully monitor the use of groundwater, proactively address issues of overexploitation, as well as monitor the quality of water and address the risks of water pollution.

Water Governance

Setting the right governance model in the water sector is critical to help manage competing demands from many sectors. There is no clear blueprint or off-the-shelf solution for managing trade-offs in the allocation of scarce water resources across sectors; each country has to pave its own reform policy path. Morocco's Economic, Social and Environmental Council (CESE) has published a report on water governance[107] that calls for a governance model that would ensure that decisions about water resource management are made in a way that optimizes the overall socioeconomic outcomes of the country, and that aligns with the development model set for Morocco.[108] In particular, it highlights the need for a strong national entity that is able to arbitrage trade-offs that could arise from the various actors (and sectors) that have competing demands. The governance model should also provide for a level of flexibility with a clear set of principles that will be helpful in navigating evolving situations and adapting to them. Recent research from the World Bank[109] shows that besides having a strong central entity that can set the principles for water resource planning and allocation (using a science-based approach and robust information), it is important to empower local entities and foster a decentralized approach. Decentralizing the decision-making process related to water resource management allows for better capturing local specificities, but also generating trust among stakeholders, which in turn increases their adherence to new rules. The aquifer contracts/participatory management contracts, launched in several regions (Souss-Massa (Chtouka), Errachidia (Boudnbib), Settat (Berrechid) and Fez-Meknes (Saiss)), represent a key tool to stimulate such an approach. The Water Basin Agencies (or ABHs) are well positioned to support a decentralized approach to water resource management, but in order for this to materialize, they will have to be reinforced. Also, for increases in tariffs to be acceptable to users, it is crucial to ensure that the increase also comes with an adequate level of service delivery. In Morocco, some of the experiences in decentralizing the operation and maintenance of irrigation water schemes to water users' associations (WUAs) have proven to be a particularly efficient way to help users define appropriate service levels, water charges, and water allocation.

Communication and awareness-raising are of paramount importance. Any water reform process, and particularly any changes in water allocation and pricing, needs to be accompanied by a communication campaign that allows the various stakeholders to understand the rationale behind the proposed changes and to gain their acceptance of the reform process. There are many positive examples from around the globe—from Brazil, Cambodia, Israel, and South Africa, for example—where reforms were accompanied by well-sequenced communication and awareness-raising campaigns: these countries have shown impactful results in terms of behavior changes. The current version of the PNE includes only a very shallow budget for communication and awareness-raising; about $5 million for the period 2020-50, corresponding to less than 0.13 percent of the entire PNE budget, which seems not adequate for the task at hand.

Transformation of the Agricultural Sector

While public investments have been mainly devoted to irrigation, more attention is now being given to rainfed agriculture. While irrigated areas contribute on average to more than half of the total agricultural value added,[110] rainfed agriculture (bour) still represents 80 percent of the country's cultivated area, employs the largest portion of the agricultural workforce, and is essential for the nation's food security. However, rainfed agriculture (in particular

[107] CESE 2014. « La gouvernance par la gestion intégrée des ressources en eau au Maroc : Levier fondamental de développement durable ».
[108] To that effect, the NDM report also highlights the need to adjust the governance of the water sector and mentions the creation of a National Water Agency (Agence Nationale pour la Gestion de l'Eau (ANGE).
[109] World Bank, soon to be published: "The Economics of Water Scarcity in the Middle East and North Africa: Institutional Solutions"
[110] The contribution oscillates with the rainfall patterns.

cereal production) remains strongly correlated to fluctuations in precipitation, with a particularly high coefficient of yield variability.[111] In this context, enhancing the resilience of rainfed agriculture should be a priority for Morocco. The new Green Generation Strategy, through its Axis 2, places particular emphasis on this dimension, capitalizing on the PMV achievements. Promoting the adoption of climate-smart practices, notably no-tillage cereal-based systems, has recently gained momentum since it provides a solution for simultaneously enhancing resilience to climate change and increasing productivity.[112] Training and extension programs would have to be deployed in order to ensure that farmers can acquire the skills needed to adopt these new practices. Adaptative measures (physical investments and nature-based solutions) can also bring a source of green jobs to rural areas.

The penetration rate of agricultural insurance should be increased. While Morocco has made progress in the agricultural insurance, the penetration rate is still low; only 17 percent of agricultural areas are insured against climate risks, and there is limited access for small farmers (less than 3 percent). Increasing the penetration rate, particularly for small farmers, who are the most vulnerable to shocks (they are less equipped to promptly recover from shocks) should be a core priority. This could be facilitated through gathering robust data and exploring digital solutions such as index-based agricultural insurance systems that could significantly reduce the administrative costs of insurance, which would in turn unlock the potential for new insurance products to emerge (both private- and public-led).[113] Macro-insurance coverage against drought should also be considered.

Morocco has initiated a structural transformation of its agricultural sector, with a decline in agricultural employment and a rise in employment in the agri-food value chains (agribusiness). Agricultural employment declined in absolute terms by almost 1 million jobs over the past 20 years.[114] In contrast, nonagricultural rural activities have created around 440,000 jobs over the same period, with an inflection point in 2012-13. This structural transformation of the agricultural sector has been observed in many countries.[115] With the new Green Generation strategy, the government of Morocco intends to accelerate this structural transformation by unleashing the potential of job creation all along the agricultural value chains (both upstream and downstream). In addition, overhauling the social protection system will accompany this transformation by delivering much-needed assistance to smallholder farmers and informal workers in agriculture, thus redressing the divergence observed between agricultural labor and employment in other sectors. It would also constitute a buffer and would accompany the foreseeable adjustments in the labor market structure in the long run (for example, the predicted migration from rural areas to urban centers).

Private investment in adaptation and innovation should be incentivized. As mentioned in Chapter 2, while private investment has been instrumental in deploying climate mitigation actions in Morocco, most notably in regard to renewable energy, it has been very limited when it comes to adaptation and resilience. This can be explained by the fact that such investments usually embed a much higher level of uncertainty.[116] However, the transformation of the agricultural sector promoted under the Green Generation strategy has the potential for opening new opportunities for the private sector through the development of innovative technologies and digital climate services. Unlocking the participation of the private sector in the adaptation agenda would require specific measures to address market failures (especially regarding access to finance and data), and to unleash innovation.[117] Promoting innovative approaches and technologies through dynamic research and development, and promoting stronger partnerships between the private and public parts of the agricultural sector, would allow for improved productivity of rainfed agriculture and would strengthen its competitiveness while reducing its vulnerability to climate shocks. As mentioned earlier, encouraging the participation of private operators in the agricultural insurance market could have a multiplier effect, and could increase coverage (as well as the cost-efficiency) of insurance mechanisms.

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111 The coefficient of yield variation is defined as the standard deviation of a given crop expressed in volume divided by its mean. The coefficient of yield variation for wheat reached 0.34 between 2000 and 2020 in Morocco, against 0.23 in Tunisia, 0.18 in Algeria and Spain, 0.11 in France, and 0.06 in Turkey (calculations based on FAOSTAT data). Such fluctuations are primarily linked to the level and temporal distribution of precipitation across the agricultural season.

112 These practices have been piloted in Morocco for the last decade and have systematically shown positive outcomes in terms of yield increase, as well as reduction in production costs and time saving. In November 2021, the Ministry of Agriculture launched a national no-tillage program with the objective of increasing the area using no-tillage practices from 30,000 hectares (ha) to 1 million ha by 2030.

113 Only one insurance company currently offers agricultural insurance products in Morocco.

114 It should be acknowledged that part of this decline in agricultural employment has also been due to an improvement in education enrolment rates in rural areas, which has reduced the participation of young people (15-24 years old) in the agriculture labor market.

115 In middle-income countries, farming accounts for almost half of the food system jobs, while off-farm jobs in food manufacturing and services account for the other half. In high-income countries, farming accounts for a smaller share of food system jobs, while food services account for most jobs.

116 Since they take the form of risk avoidance, and only generate a return if and when an extreme event occurs.

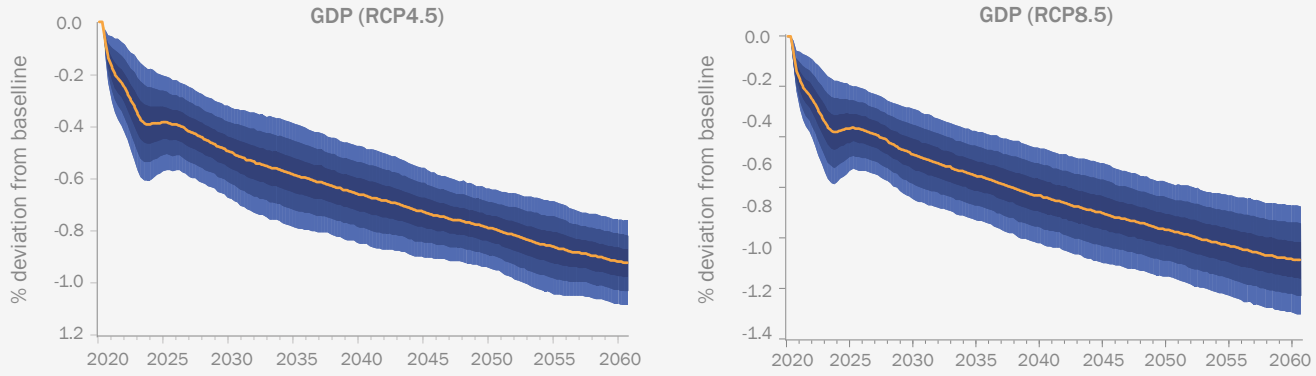
117 Morocco has only 1.7 agricultural researchers per 100,000 inhabitants—too low a number to allow it to become a leader in agri-food innovation (the number is 4.2 in France, 5 in Tunisia, and 4 in Turkey). Morocco needs to increase investment in agricultural research and strengthen the capacity of farmers and enterprises to innovate.

3.2 Enhancing Resilience to Floods

For this CCDR report, we have analyzed the macroeconomic impact of floods under various policy configurations. As discussed in Chapter 1, flooding is the most relevant climate-related natural hazard in Morocco. Various macro modelling tools are used to assess which levels and types of risk reduction investments are more likely to increase the resilience of the economy against various types of shocks.

In the absence of public action, floods could cause significant and increasing output losses in coming decades. The World Bank's macrostructural model (MFMod) is used to generate a probability distribution of GDP outcomes based on historical data. Without incorporating public interventions to reduce damages or mitigate impacts, the projected median impact of floods gradually increases, from 0.2 percent of GDP in 2025 to surpass 0.5 percent of GDP by the 2030s and almost 1 percent in 2050, with only minor differences shown between the two climatic scenarios that are considered in this exercise (see Figure 11).

Figure 11: GDP Responses to Flood Damages Without Policy (Under RCP 4.5 and RCP 8.5[118] Climate Projections)



Source: World Bank staff

Note: The baseline under the two climatic scenarios is no flooding. These graphs capture only the impacts of damages to physical capital, and not the ancillary impacts on economic activity that could be caused by floods. The yellow line represents the median result; the 10th to 90th percentile areas are shown by the edges of the lighter areas.

There are two key policy levers through which the Moroccan authorities could reduce the long-term impact of future floods: (i) Disaster Risk Management (DRM) investment; and (ii) scaling up of existing financial protection schemes (Disaster Risk Financing, or DRF). In recent years, Morocco has established a sophisticated and innovative system to manage natural disasters, combining these two levers. The key question addressed in the following section is whether there are elements in that system that could be reinforced.

3.2.1. Disaster Risk Management (DRM) Investment Options

DRM investments reduce the damages caused by floods but require payments that need to be mobilized ex ante, and which carry an implicit cost for the economy. Converging toward an optimal level of investment in risk reduction therefore implies the need to weigh the benefits of lower future damages against the cost of financing upfront payments, either through taking on additional public debt or by reallocating other productive investments to flood prevention. We used MFMod to conduct probabilistic and deterministic macro-simulations[119] to capture this trade-off, and compared the impacts of various DRM investment pathways defined in terms of their scale, as a percentage

[118] While long-term GHG emissions in the RCP8.5 are considered overly pessimistic, the CMIP5 climate change scenarios with RCP8.5 provide a useful (and not implausible) high-warming scenario, which would be consistent with continued GHG emissions and high sensitivity to climate change, or positive feedback from the carbon cycle.

[119] The stochastic simulations use a probability distribution of flood damage that is derived from Morocco's historical data. The deterministic simulations are used to obtain the outcomes of various levels of adaptation investment to cope with relatively small but frequent floods, and with large, infrequent events.

of annual average loss (AAL) and the financing sources (debt vs. investment substitution). As mentioned in Chapter 1, Morocco has put into place an ambitious program to reduce flood-related disasters, notably with its National Flood Protection Plan (PNI) and its Natural Disasters Resilience Fund (FLCN). However, the resources mobilized under both instruments are likely to fall below the optimal level of DRM investment that Morocco needs.

Moderate levels of debt-financed DRM investment have positive macroeconomic impacts.[120] According to our probabilistic simulations, investing 10 percent of AAL annually can increase GDP by 0.1 percent in 2030 and 0.2 percent in 2050 if compared with a baseline of no DRM investments (See Figure 12, left panel). This would reduce the GDP losses caused by floods by about a quarter. The positive macroeconomic effects of moderate DRM investments are confirmed in the deterministic simulations (see Table 5). the GDP gains generated by this level of investment can reach 0.1 percent of discounted GDP, A 6 percent discount rate is applied. with positive impacts also on consumption and private investment. Financing choices, however, appear to have significant macroeconomic implications. When they are moderate in scale (10 percent of AAL), debt-financed DRM generates larger NPV GDP and consumption gains than investment-financed risk reduction. However, it also carries a significant accumulation of additional public debt (2 percent of GDP by 2030; 4 percent by 2040; and 5 percent by 2050), which may be especially relevant for Morocco given its constrained fiscal space.

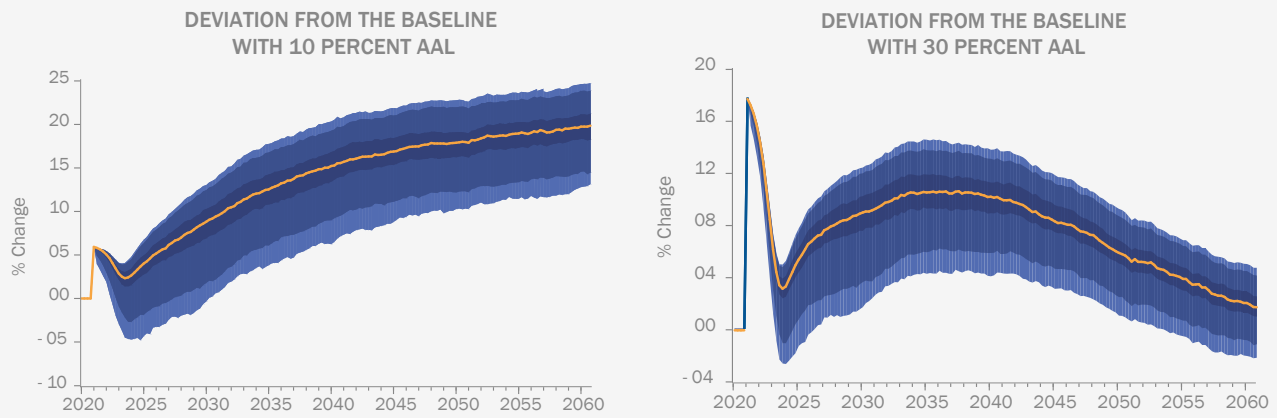
Beyond a certain level, additional DRM investments begin to have detrimental effects on the economy. At some point, the marginal costs associated with the mobilization of additional public resources for DRM investment purposes may come to surpass the marginal benefits of reducing future damages. Illustrating this point, in the long term, annual DRM investments (amounting to 30 percent of AAL) will elicit a weaker positive GDP response than investing just 10 percent of AAL. (See Figure 12, right panel). The same message emerges from the deterministic simulations. Large-scale DRM investment (30 percent of AAL) does not yield better GDP, consumption, or investment responses than the more moderate DRM investment scenario, and the impacts turn negative when the investment is financed by substituting other productive investments. Moreover, large debt-financed DRM investment scenarios would lead to an excessive accumulation of public debt (6 percent of GDP by 2030; 12 percent by 2040; and 16 percent by 2050). This is further illustrated in Figure 13, which suggests that GDP gains or losses in present value terms are optimized when annual investment reaches 15-20 percent of the AAL range (corresponding to an annual investment comprised between $67 and $90 million[121]), and can turn negative when more than 30 percent of AAL is financed through the reallocation of other productive investments.

Nonstructural investments should be more systematically integrated into the DRM approach. Improvement can be made to the prioritization methods for DRM investments, notably by striking the most efficient and cost-effective balance between structural and nonstructural risk reduction measures. This effort should consider the high cost-benefit and return on investment ratios of nonstructural measures like early warning systems, nature-based solutions, risk and climate knowledge, and disaster risk awareness-raising.

[120] The modeled results presented in this section are sensitive to the parameter used as the multiplier of risk-reduction adaptation investment. Based on a review of the literature, a 1.4 multiplier was used in this exercise. A higher multiplier would yield higher optimal levels of DRM investments, and vice versa.

[121] This estimate aligns with the level of average annual investments planned under the ongoing National Flood Protection Plan (total investments of $1.5 billion over a 20 year-period). However, as mentioned in Chapter 1, it is worth noting that the level of execution of the previous National Flood Protection Plan (2003-17) only reached a low 25 percent.

Figure 12: Stochastic Simulation - GDP Responses with Various Levels of DRM Investment



Source: World Bank staff

Note: The baseline is a median GDP projection, with floods under the RCP4.5 scenario (as shown in the left panel of Figure 11). In these simulations DRM investment is financed by debt. The yellow line represents the median result; the 10th to 90th percentile areas are shown by the edges of the lighter areas.

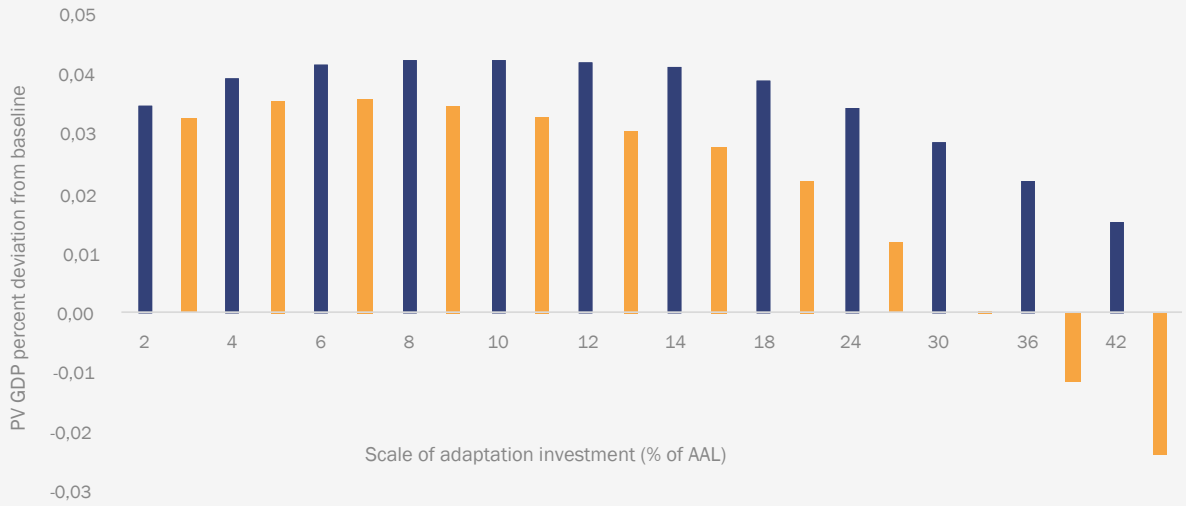
Table 5: Deterministic Simulations - Main Results

		Floods, with low adaptation investment (1)				Floods, with high adaptation investment(2)			
		Small frequent shocks (3)		Large infrequent shocks (4)		Small frequent shocks (3)		Large infrequent shocks(4)	
		Debt financed	Investment financed	Debt financed	Investment financed	Debt financed	Investment financed	Debt financed	Investment financed
GDP	**2030**	0.05	0.02	0.01	-0.02	0.07	-0.02	0.01	-0.08
	2040	0.07	0.05	0.07	0.04	0.07	-0.01	0.06	-0.02
	2050	0.09	0.07	0.10	0.08	0.07	0.01	0.08	0.01
Household consumption	**2030**	0.04	0.02	0.00	-0.02	0.04	-0.03	-0.02	-0.09
	2040	0.07	0.05	0.06	0.04	0.06	-0.01	0.04	-0.03
	2050	0.08	0.06	0.09	0.07	0.06	0.00	0.06	0.00
Private investment	**2030**	0.01	-0.15	-0.07	-0.23	-0.11	-0.60	-0.22	-0.71
	2040	0.05	-0.13	0.03	-0.15	-0.08	-0.62	-0.11	-0.66
	2050	0.07	-0.11	0.08	-0.10	-0.09	-0.63	-0.09	-0.63
Public debt	**2030**	2.00	-0.22	2.06	-0.17	6.13	-0.54	6.17 1	-0.50
	2040	3.92	-0.25	3.97	-0.20	11.79	-0.74	1.82	-0.72
	2050	5.27	-0.26	5.31	-0.22	15.72	-0.87	15.73	-0.86

(1) DRM investment equal to 10% of expected damages (RCP 4.5), deviation from baseline with no adaptation
(2) DRM investment equal to 30% of expected damages (RCP 4.5), deviation from baseline with no adaptation
(3) Shock every two years, twice the AAL size
(4) Shock every ten years, ten times the AAL size

On the institutional front, to increase the effectiveness of the DRM system Morocco should pursue strengthening its cross-sectoral and territorial coordination. The Moroccan authorities have taken decisive steps to improve institutional capacity for the management of natural disasters and climate-related risks, an effort that has been centered around the directorate for disaster risk management established at the Ministry of the Interior. Moving ahead, and in line with the new DRM strategy, the coordination mechanism between the vast array of actors involved in the management of climate risks (including at the subnational levels) should be strengthened.[122]

Figure 13: GDP Gains/Losses by Level of DRM Investment (in present net value)



Note: Blue = debt-financed; Yellow = investment-financed
Discount rate of 6 percent

3.2.2. Alternative Disaster Risk Financing (DRF) Schemes

Morocco has developed a sophisticated disaster risk financing (DRF) system to alleviate the financial impact of natural disasters on households and reduce the State's financial exposure to catastrophic risk. As mentioned in Chapter 1, Morocco has developed a sophisticated dual DRF system, combining a private scheme that makes catastrophic insurance compulsory for households and firms with payment capacity, and a public compensation scheme that provides partial compensation through a Solidarity Fund. However, the financing schemes currently in place can only cover a relatively minor fraction of potential catastrophic damages. The combined private and public schemes would provide between 5 and 10 percent of the direct economic damages associated with average catastrophic scenarios, with rapid disbursement mechanisms paid within weeks of the event. In the case of an extreme scenario, this amount would increase to about 25 percent of losses on covered assets.

This CCDR explores the potential costs and benefits of reinforcing the DRF scheme so that it could better cope with extreme events. A scenario-based approach is used to compare the value for money of DRF investments to cope with shocks of various magnitudes (see Table 6). The "benefits" associated with each of these scenarios are the direct losses covered by public DRF instruments as well as the risks transferred to the insurance market, to which a multiplying factor is applied depending on the severity of the event. The multiplying factor is derived from the fact that the quick injection of preplanned financial flows after such events will limit the spillover effects and the transmission of the shock to other sectors or economic agents, while a delayed response will generate additional costs. The "costs" are the estimated pricing of DRF instruments, including opportunity costs.[123]

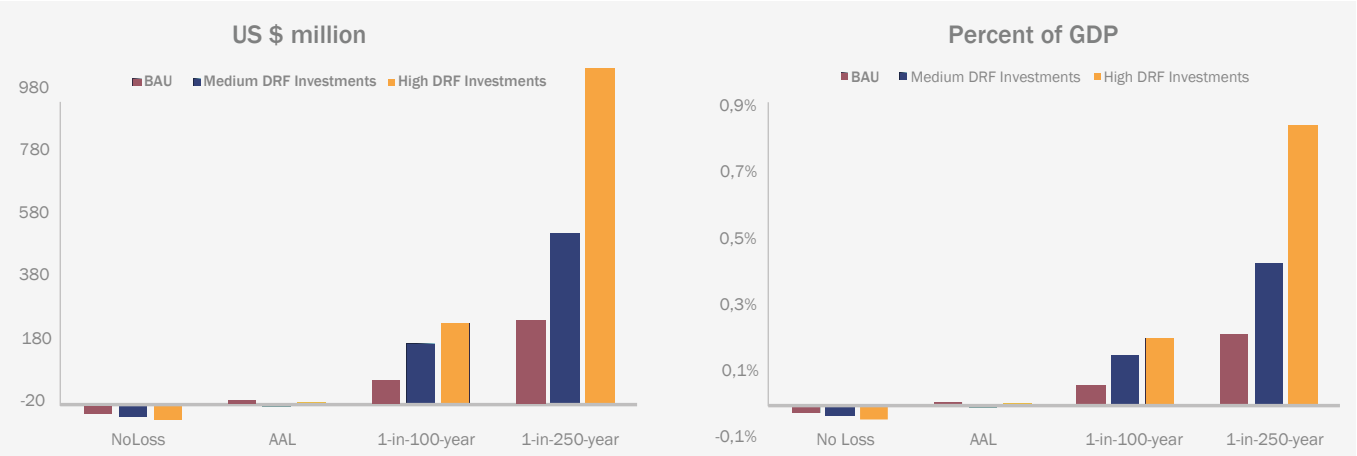
[122] Various measures are planned for that purpose in the years ahead. For instance, the authorities have discussed the creation of an Inter-ministerial Commission for Natural Risk Management, and are planning to appoint close to 90 "risk officers" across the territory by 2025.
[123] This refers, for instance, to the set-up costs of the contingent credit, the claim management of the FSEC payouts, the commercial loading of the insurance, or the premiums paid to the reinsurance markets.

Table 6: Scenarios and Assumptions for the Cost–Benefit Analysis of DRF Schemes

2030 Scenarios	Assumptions
Scenario 1 Business as Usual (BAU)	No additional DRF investments are made until 2030. FSEC reserves at 240 million dirhams.
Scenario 2 Moderate investment	Targeted public policies lead to a 3 percent annual increase in the insurance penetration rate. In addition, the government invests additional DRF resources to increase the reserves of the FSEC (to 327 million dirham) and to contract a contingent credit of 750 million dirhams that can be triggered to cope with medium and high severity events (1-in-100 or 1-in-250-year flood)
Scenario 3 High investment	Targeted public policies lead to a 5 percent annual increase in the insurance penetration rate. In addition, the government increases the FSEC resources up to 396 million dirhams, and contracts both a contingent credit of MAD 1 billion and a parametric flood insurance of an additional billion which can be triggered for extreme events (1-in-100-year flood)

The net benefits of scaling up the DRF scheme increase exponentially with the severity of the event. Unsurprisingly, the three scenarios yield a relatively low net cost if no adverse event materializes. The differences between the three scenarios are minor in "normal" years, ranging from a net benefit of $10 million in the business-as-usual scenario and a negative net benefit of $1 million in the moderate DRF investment scenario. However, the difference between the three scenarios increases markedly if more severe events materialize, reaching $257 million following a 1-in-100-year event, and as much as $1,066 million (0.85 percent of GDP) in the 1-in-250-year event, against $74 and $268 million respectively in the business-as usual investment scenario (see Figure 14). These results suggest that scaling up the DRF framework is a cost-effective option for increasing Morocco's resilience against extreme events.

Figure 14: Net Benefits of DRF Investment Scenarios



Source: World Bank staff calculations

Some aspects of the DRF and the insurance could be further strengthened. Beyond the regular revenues received from a newly created parafiscal tax (approximately MAD200 million per year), given the potential severity of the disaster-related losses it faces, the FSEC financing base could be reinforced with a combination of instruments.[124] For example, additional capacity-strengthening efforts are needed in order to refine flood and other climate risk

[124] For example, the FSEC has successfully subscribed to parametric coverage for seismic risk over the period 2020-23 and is preparing to subscribe to a similar scheme for flood risk. The authorities are also reviewing the opportunity to implement a risk transfer product (Cat Bond or reinsurance) and for the revision and expansion of its DRF strategy to cover: i) businesses; ii) drought risk for farmers; and iii) public assets (including critical infrastructure). Additional contingent credit lines to further strengthen the FSEC financing base could also be explored. In parallel, insurance companies need to continue building up reserves to strengthen their financial capacity against catastrophic events.

modeling, and to improve the national claim management system. Finally, the authorities may want to explore whether extending the current DRF system to provide some coverage for drought risks would be feasible. Also, developing a DRF and insurance program for public assets, including for critical infrastructure, could leverage private capital that might better manage the associated contingent liabilities and their impact on the budget, and ensure access to rapid, reliable, effective, and cost-efficient financing for recovery and reconstruction. Finally, targeted policies to boost the insurance penetration rate in Morocco could be considered.

3.3. Decarbonizing the Economy[125]

3.3.1 Identification of the Decarbonization Pathway[126]

Given the centrality of the electricity sector in decarbonizing the economy, the Electricity Planning Model (EPM)[127] was used to simulate this decarbonization by 2050. Two scenarios are envisioned in this chapter[128] : (i) a baseline scenario in which the capacity expansion plan is developed with no CO2 emission constraints (this is tagged as the reference, or unconstrained least cost); and (ii) a decarbonization scenario that models the decarbonization reduction of GHG emissions of power generation; the penetration of e-mobility in road transport; the electrification in the industrial sector; and the production of green hydrogen to further decarbonize the industrial and transport sectors, and lower the average cost of power generation, as well as the prices of goods exports[129]. In addition, the decarbonization scenario includes increases in power interconnector capacity with the Iberian Peninsula that would keep such capacity at or above 7.5 percent of peak demand in Morocco, thus enabling increased electricity trade with the EU. It also models improvements in energy efficiency through the decreasing correlation coefficient between demand for electricity and GDP growth[130]. In both scenarios (baseline and decarbonization), the model is used to project the optimal mix of power generation until 2050. Table 7 summarizes the assumptions in terms of the growth in demand for electricity, and the sources as well as constraints that would be imposed under the decarbonization scenario.

Table 7: Summary Assumptions of the Baseline and Decarbonization Scenarios [131]

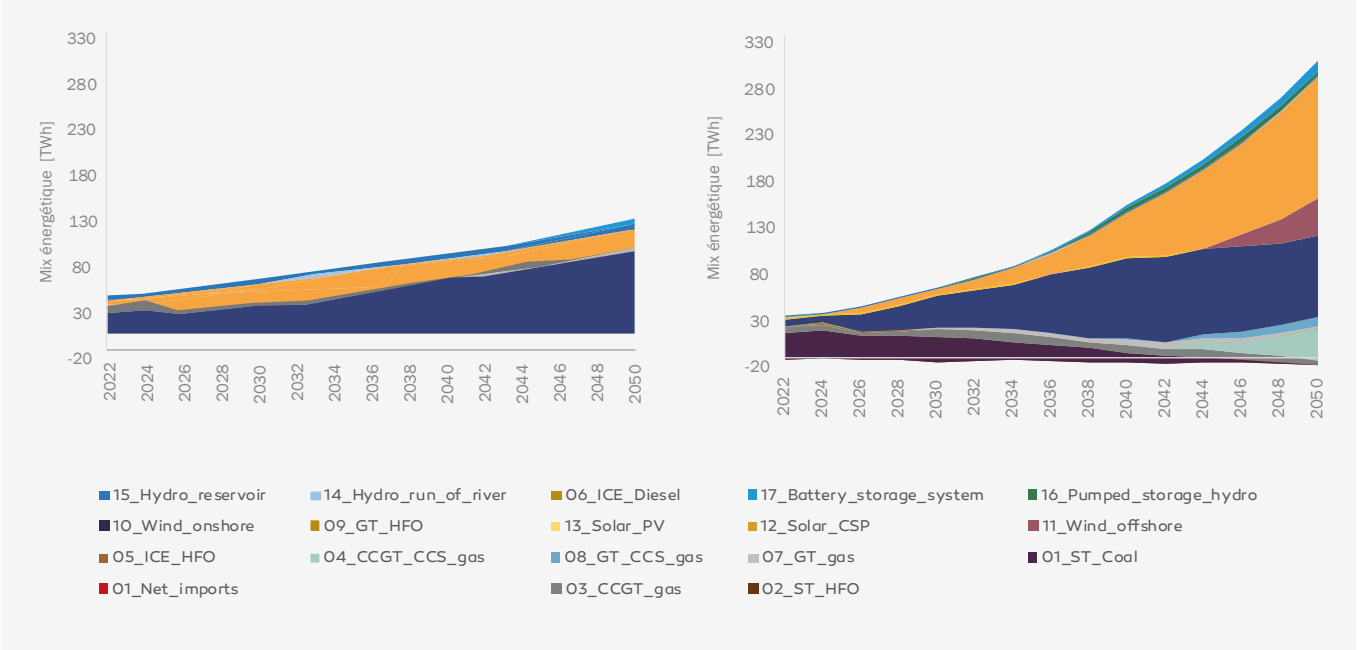
	Reference	Decarbonization
Demand growth	In both scenarios, the demand growth is exogenous and projected using correlation coefficients with GDP, (assumed as 1.00 in 2022, decreasing to 0.95 by 2030 and 0.9 by 2040 to account for energy efficiency improvements)	
Demand sources	BAU demand from end-use sectors	In addition to BAU demand in Reference scenario, additional demand from the following end-use sectors: Industry: Electrification of the industrial sector, from 33 percent currently to 80 percent in 2050, and replacement of standard ammonia imports with domestic ammonia produced using green hydrogen as feedstock to the fertilizer industry. e-Mobility: Penetration of electricity and green hydrogen Passenger motor vehicles: electrification from close to 0 percent currently to 11 percent in 2035 and 50 percent in 2050 - Freight road transport: Electrification from close to 0 percent (currently) to 20 percent by 2050; use of green hydrogen for long-distance transport (30 percent), and heavy-duty vehicles for mining. Green hydrogen (GH) (including for desalination of the water used in electrolyzers): demand grows from zero currently to 14 TWh by 2030, 68 TWh by 2040 and 154 TWh by 2050, and split equally between on-grid and off-grid production
Constraints	**None**	Carbon emission target: 95% decarbonization of power generation compared to Reference Scenario. Technological constraints: - No new coal power plants - No new non-abated fossil fuel thermal power plants after 2030, i.e. all new thermal plants are fitted with Carbon Capture and Storage (CCS)

[125] The modeling exercise related to decarbonization is focused on decarbonization of the power sector and the electrification of some key sectors (for example transport and industry). Assumptions for GHG emission reductions in other sectors (agriculture, solid waste management) derive from the 2021 NDC prepared by Morocco ahead of the COP 26 conference in Glasgow.
[126] See Background Note "Deep Dive on Decarbonization of the Moroccan Economy."
[131] For more information, see Background Note on "Electric Mobility in Morocco" and "Green Hydrogen in Morocco."

Power Sector: The Cornerstone of Decarbonization

Decarbonization of the power system and decarbonizing the end-use sectors through electrification would require massive deployment of solar and wind power. The decarbonization scenario implies that there would be an on-grid demand of 292 TWh in 2050; that is, an increase in demand of 182 TWh (or +165 percent) from the baseline scenario (see Figure 15). Of this, 46 TWh comes from transport, 28 TWh from industry, and 107 TWh from GH (including the use of electricity for water desalination for electrolyzers' input). This additional demand is met by the deployment of: (i) wind (onshore and offshore) and solar PV as the main zero-emission sources; (ii) gas-fired generation–including open-cycle gas turbines (OCGT) and combined cycle gas turbines (CCGT) with or without Carbon Capture and Storage (CCS), depending on the year of commissioning, and the storage technologies used to provide needed flexibility to the power system.

Figure 15: Left: Power Generation by Type of Plant in Baseline Scenario Right: Decarbonization Scenarios, in TWh



Under the decarbonization scenario, the capacity of installed power generation in 2050 would increase by almost five times compared to the baseline scenario, and the installed capacity would reach 147 GW (compared to 30 GW in the baseline scenario). This represents a much larger increase than that of peak electricity demand, which would be due to a higher level of participation in the generation of renewable energy, with low utilization factors (see Table 8). The results of this model suggest that the retirement of coal plants, which are predominantly privately owned, would mostly occur after 2044; before that, the load factor of coal plants would be gradually reduced and, if they could be used more flexibly than they are currently, they could provide cold or spinning reserves instead of being shut down[132]. Natural gas would be needed as a bridge fuel in the transition to decarbonization, both as a less carbon-intensive alternative to coal, and as a source of flexibility for the power system. Introducing natural gas into the Moroccan energy mix would require significant investments in natural gas transport infrastructure[133]. Alternative solutions for providing firm and flexible power would be increasingly available, particularly beyond 2030, including through the use of green hydrogen (GH) instead of natural gas in thermal plants;[134] battery storage; demand-side response; and power market integration with Europe.

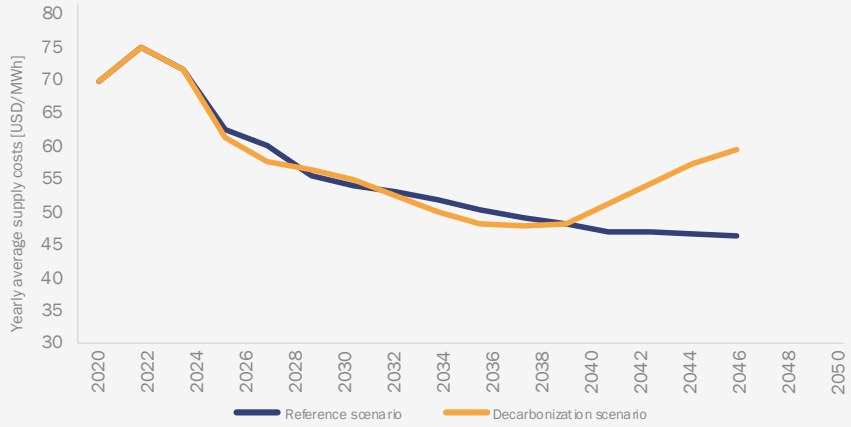
[132] Even if all of the remaining coal-fired plants were shut down by 2040, earlier than the end of their 30-year contracts, compensation to private investors for the remaining debt and equity would be quite limited (about $330 million in nominal terms).
[133] In the EPM, the cost of natural gas infrastructure is accounted for through a price premium for domestic transport of natural gas.
[134] Due to limitations of the model, this option could not be modeled using EPM.

Table 8: Summary of the Main Results Under the Baseline and Decarbonization Scenarios by 2050

	Reference	Decarbonization
Installed capacity (GW)	Coal: 11.7	Coal: 0
	Gas: 2.1	Gas unabated: 7.1
		Gas with CCS: 21.3
	Wind: 6.2	Wind: 39
	Solar: 4	Solar: 67.2
	Battery storage: 2.9	Battery storage: 10.9
	Hydro & pumped storage: 3.6	WHydro & pumped storage: 6.5
Total installed capacity (GW)	30	147
Retirements of coal plants @ end of useful life (GW)	1.5	1.5
Economic retirements of coal plants by 2050 because of carbon emission constraints (GW)	0	2.2
Emissions in 2050 (MtCO2/year)	80	4
Marginal abatement costs (US$/tCO2e)	0	201 in 2050 (increasing first slowly to 50 in 2040 then more rapidly in the 2040s)
NPV of total system costs minus revenues (US$ billion)	46	74
NPV annualized CAPEX (US$ Billion)	15	32
Note: using a 6 percent discount rate		

Under both scenarios, the average cost of generation would be reduced compared to the currently high average cost. As shown in Figure 16, the average cost would decline until the early 2040s under both scenarios, as the structure of the power system becomes optimized. While the higher rate of intermittent renewable energy (RE) brings up the need for investment in power storage, the additional cost would be optimized by the fact that on-grid GH production could then be allocated to the hours of lowest cost (for example, when there are surpluses of renewable generation), thus reducing RE curtailment.[135] Under the decarbonization scenario, the average cost of the supply would start increasing after 2040, reflecting the need for gas-fired thermal generation with CCS. This implies that cost-reflective consumer prices may not have to increase as a result of decarbonization until the latter part of the forecast period. Similarly, the marginal abatement cost of carbon[136] only rises sharply above $50 per ton of CO2 after 2040 to reach about $200 in 2050.

Figure 16: Average Electricity Generation Costs in Baseline and Decarbonization Scenarios



Source: EPM modeling

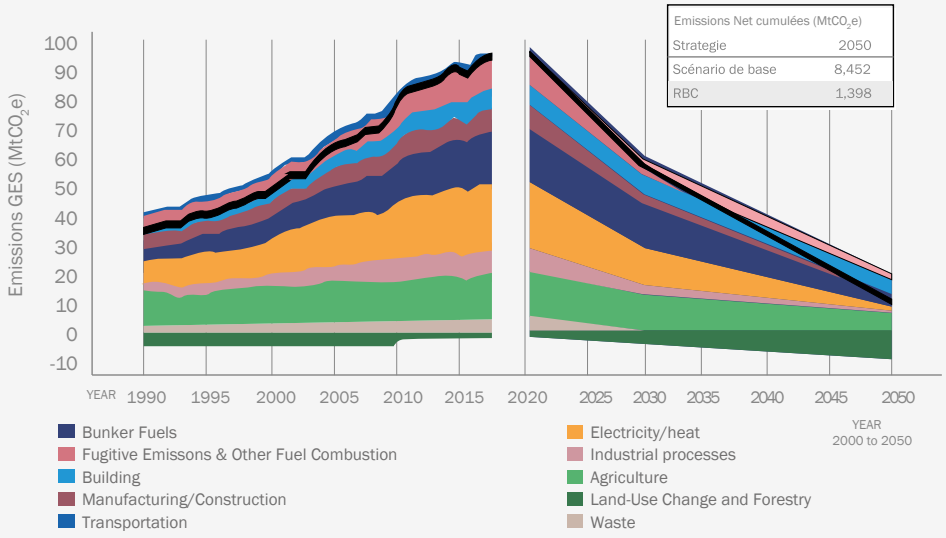
[135] An intermediate scenario, the results of which are presented in the Decarbonization Background Note but not in this summary report, indicate that scaling up renewables without developing green hydrogen production would not only increase costs but would also induce curtailments of renewable energy generation.

[136] The marginal abatement cost can be interpreted as being equivalent to a shadow carbon price that would incentivize economic agents to decarbonize their sectors in line with the decarbonization scenario.

Reduction in GHG Emissions by 2050

Morocco could reach a zero-net emission economy in the 2050s. Figure 17 shows the overall trend of GHG emissions over the period 2020-2050, under the decarbonization scenario. Most of the assumptions are coming directly from the ones used in the EPM model (that is, for the power sector, industries, and transportation). In addition, we use the conditional and unconditional targets set for 2030 under the NDC for the other sectors (buildings, forest, agriculture, and waste management). It is worth noting that Morocco has launched an ambitious Reforestation Program (Forêts du Maroc 2020-2030), with an objective of involving 600,000 hectares of forests and arboriculture by 2030. Under these assumptions, and as presented in Figure 17 below, the kingdom would bring its overall GHG emissions down to about 9.9 Mtons CO2eq in 2050, representing a 90 percent reduction from the 2020 emission levels.[137] The decarbonization scenario also projects that Morocco could become a net exporter of green electricity, GH, and derived products. However, the displacement of GHG emissions in importing countries is not captured in Figure 17[138].

Figure 17: Morocco GHG Emission Profile Under the Decarbonization Scenario (2020-2050)



Source: World Bank

3.3.2. Policy Options for the Decarbonization Pathway

Investment Needs

Decarbonizing the economy would require large investments, particularly during the last decade of the forecast period (2040-50). Compared with the baseline scenario, the simulations indicate that the decarbonization scenario presented above would imply an additional total investment of $46.3 billion over the 2022-2050 period, from 6.7 billion over the first period (2022-2030), growing to $13.8 billion from 2030-2040, and to $25.8 billion during the last decade 2040-2050[139]. These cumulative figures illustrate the fact that investment in decarbonizing will grow over time as the size of the economy increases, but also as full decarbonization becomes more expensive, and as reliance on energy storage and carbon capture and storage technologies goes up, particularly from 2040-2050.

To switch from reliance on large thermal power plants towards more dispersed solar and wind power plants in the decarbonization scenario and to ensure network stability, large investments in the transmission grid would be required. The geographical disparity between the concentration of renewable energy resources and electricity demand would call for transmission over long distances, requiring investing in costly direct current transmission lines.

[137] This simulation was done using an in-house World Bank tool. While it does not allow projection beyond 2050, based on the projected trends net-zero emissions would be reached in the 2050s.
[138] Figure 17 only reflects the domestic GHG profile
[139] These amounts are presented in discounted net value, applying a 6 percent discount rate. These estimates only cover the share of investments in green hydrogen that would be needed for domestic consumption. If green hydrogen exports are included, total investment in decarbonization from 2022-2050 would reach $52.8 billion in discounted terms and $175 billion in undiscounted terms. Note that the chapter 4 takes the total investments in green hydrogen (incl for exports) into account.

These large costs would be justified by the benefits that decarbonization would bring to the economy. The costs of decarbonization would be compensated for by numerous benefits, including: less need for fossil fuels and importation of ammonia; increased energy security; reduced air pollution and GHG emissions; and less vulnerability to international hydrocarbon price shocks. Decarbonization will also open the door for Morocco to become a net exporter of green energy and GH, and to position itself as a hub for green industrial investment and exports, most notably to the EU. When accounting for the reduction in fuel imports, air pollution, and carbon emissions, the net economic impact is positive. The costs and benefits of decarbonization are summarized in Table 9. [140]

Table 9: Additional Investment Needs and Economic Costs (NPV in billion USD) in the Decarbonization vs. Baseline Scenarios

	2022–2030	2022–2040 [141]
POWER		
Investment needs: generation	$4.79	$11.84
Investment needs: transmission and distribution	$1.34	$5.01
Other economic costs: operational and fuel costs	$0.28	$3.31
Other economic costs: air pollution externality costs from coal [a]	-$0.99	-$9.40
Other economic costs: air pollution externality costs from gas [b]	$0.01	$0.04
Other economic costs: CO2 emission reduction [142]	-$1.16	-$9.56
TRANSPORT		
Investment needs: charging infrastructure and green hydrogen [d]	$0.10	$2.32
Other economic costs: fuel import	-$0.04	-$3.50
Other economic costs: air pollution	-$0.00	-$0.37
Other economic costs: CO_2 emission reduction from electrification and green hydrogen	-$0.05	-$0.85
INDUSTRY AND MANUFACTURING		
Investment needs: green hydrogen for feedstock [c,d]	$0.49	$1.32
Other economic costs: ammonia import	-$0.45	-$2.18
Other economic costs: fuel import (excluding feedstock)	-$3.60	-$6.66
Other economic costs: CO2 emission reduction from electrification and green hydrogen	-$2.20	-$6.05
EXPORT		
Investment needs: green hydrogen for export	$1.62	$4.33
TOTAL INVESTMENTS AND ECONOMIC COSTS IN THESE SECTORS		
Net economic costs (excluding exports)	-$1.48	-$14.74
includes: investment needs (excluding exports)	$6.71	$20.49

Notes: All amounts are discounted using a 6 percent discount rate.

(a) This estimate applies a cost of $4.1/GJ in 2022, rising to $8.2/GJ by 2040. This is based on the only available unit emission factors for Morocco and is an upper bound. In reality three major coal power plants are in well-ventilated coastal locations that have much less contribution to air pollution. Furthermore, they could be equipped with highly effective filters and scrubbers, thus eliminating almost all harm to air quality. (b) This estimate applies a cost of $0/GJ in 2022 rising to $0.1/GJ by 2040. (c) Estimating the investment required for electrification of the industrial sector requires a detailed knowledge of industrial energy use by industrial processes, which is not currently available. (d) These investments only include electrolyzers, water desalination plants, and conversion plants. They do not include investments for renewables (which are already included under Power) and additional investments in infrastructure, such as strengthening the electrical networks, and building dedicated pipelines and GH refueling stations; adapting port infrastructure for exports; and developing storage facilities for GH and derivatives, since these require more detailed analyses on the locations of the demand and supply centers.

[140] wMore detailed information can be found in the Background Note "Deep Dive on Decarbonization of the Moroccan Economy."
[141] Economic analysis here only runs until 2040 because with a 6% annual discount rate, cost and benefits beyond 2040 are heavily discounted in NPV terms.
[142] Guidance note on shadow price of carbon in economic analysis (English). Washington, D.C. : World Bank Group. http://documents.worldbank.org/curated/en/621721519940107694/Guidance-note-on-shadow-price-of-carbon-in-economic-analysis

Underlying Policy Reforms

In addition to the massive investment needed, in order for decarbonization to fully materialize, Morocco will need to engage in an ambitious set of reforms, particularly in the power sector. Meeting the country's decarbonization objectives in a holistic manner would require the Ministry of Energy to start by defining a strategy that accounts for the interplay between electricity, natural gas, and GH systems. This would in turn call for a more integrated and coordinated planning of the power and gas infrastructure to ensure reliability and security of supply, while giving clear signals to private investors in the competitive segments of the markets.

The market design would need a radical shift in order to establish institutional and market arrangements that facilitate massive scaling up of renewable energy. This could start with allowing for third-party access to the transmission and distribution networks at regulated tariffs so that private investors in RE can sell directly to eligible customers without discrimination--and eventually creating open wholesale and balancing markets that will make investment market-driven rather than government-driven. ONEE, the vertically integrated public utility, as already envisaged, would need to be unbundled into generation, transmission, and distribution to avoid conflicts of interest, with priority given to the creation of a transmission system operator to manage network access for both public and private actors fairly. The regulator would also have to be strengthened so that it could enforce the unbundling of ONEE; calculate fair access tariffs for the transmission and distribution networks; and calculate full cost-recovery tariffs for end users. The legal and regulatory framework of the electricity market will need to be enhanced in preparation for alignment with the EU electricity market structure in view of market coupling. A clear roadmap for such transition, combined with early implementation of the appropriate policy and legal framework, would contribute to lowering the risk for private sector investors, thus reducing the investment costs.

In the transition away from coal, the government would need to prepare a roadmap. In due time, this may involve holding consultations and negotiations with the owners of coal power plants and agreeing on a retirement or mothballing schedule for plants that have not yet reached the end of their useful life, as well as assessing the legal risks of various pathways in the transition. Natural gas is likely to be needed as a bridge solution to provide the system with firmness and flexibility at least until 2030. Beyond that, the use of GH and derivatives for thermal power generation may become viable, along with other solutions such as batteries, pumped hydro storage, and more interconnectors, to bring flexibility to the power generation system, thus managing the intermittency of renewables.

Morocco has the potential to take a leading role in the hydrogen industry, but it will have to create a conducive market environment in order for this potential to materialize. The deployment of the GH market will require large investments in production and transport infrastructure,[144] which ought to be mostly financed by the private sector. To facilitate such investment, the government would need to finalize its gas policy and regulatory framework and extend it to green hydrogen; prepare an implementation plan for the GH strategy (including the needed transport infrastructure); develop cooperative partnerships with potential importers of Moroccan GH; and prepare certifications, norms, and standards. The nascent nature of this market also means that some key risks will need to be mitigated in order to attract the private sector through optimized conditions. These risks include revenue uncertainty, since the markets will be developing from scratch,[145] and large investment needs in transport and storage infrastructure are not yet clearly defined. The crucial underlying condition for the development of GH for both domestic use and exports is how quickly it will become competitive with the alternatives. Morocco is well placed to become an important producer of GH because of its endowment with renewable energy resources (the most important cost component of GH) and because of its local demand in the large fertilizer industry, which currently imports ammonia (and which could be produced domestically using GH in the future). Another potential source of large energy demand is the maritime sector, where using GH would facilitate decarbonization, as in some other transport sectors. There are, however, risks and uncertainties associated with such a nascent industry.

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[144] According to the Moroccan Hydrogen Roadmap, the development of the GH industry in Morocco would require a total investment of $76 billion between 2020 and 2050, including renewable energy generation, electrolyzers, and conversion plants, but excluding investment in associated infrastructure such as dedicated pipelines, GH refueling stations, adaptation of port infrastructure for exports, and development of storage facilities for GH and derivatives.

[145] The European Green Deal may provide financial resources, particularly to develop GH production for export to the EU.

The industrial sector in Morocco is already quite advanced in its decarbonization efforts, but it could go further by electrifying processes in smaller plants and greening the industrial parks. The industrial sector in Morocco is already largely electrified at 33 percent (above the European average of 31 percent). Industrial energy consumption is dominated by non-metallic minerals[146] and mining/quarrying, which together account for 65 percent of final energy use in industry. Within those subsectors the major CO2- emitting industrial sector is the cement industry. This sector has already been successful at reducing its direct and indirect CO2 emissions per ton of cement produced, performing better than both the world and the European averages.[147] The phosphate industry is also leading the way, with an ambitious climate strategy. The state-owned enterprise OCP, the world leader in the phosphate industry, has already reduced its carbon footprint considerably[148] and has set the objective of reaching carbon neutrality by 2040. Since the most energy-intensive sectors are already on track to decarbonize by 2050 or even earlier, efforts should now focus on the sectors that are more fragmented and have less access to technology and know-how: ceramics, textiles, and food processing. In addition, transforming existing industrial zones into eco-industrial parks (EIPs),[149] or developing new ones as green industrial zones (for example Nador West Med) could reduce the carbon intensity of the exported products and contribute to sustaining and increasing the competitiveness of Moroccan manufacturing[150]. To do so, the government could develop a policy framework to incentivize and accelerate the deployment of EIP model green zones.

The projected penetration of electric vehicles (EVs) as road passenger vehicles can only materialize if an adequate regulatory framework is put in place. The penetration of EVs in passenger vehicles projected under the decarbonization scenario is based on four main parameters for the country: (i) population growth; (ii) the motorization rate; (iii) the vehicle decommissioning and aging rate; and (iv) vehicle ownership. Despite the financial incentives already in place, the cost of EVs remains uncompetitive for most passengers but it is rapidly falling and could become competitive by 2030, particularly if environmental taxes are raised for diesel and gasoline. By 2030 when the numbers of EVs are expected to pick up (although still below 5 percent of total vehicle stock), the carbon intensity of the electricity grid would have declined, significantly lowering carbon footprint from EVs.[151] There is also potential for Morocco to develop its domestic EV industry and to manufacture charging stations. To facilitate this, it would need to adopt a regulatory framework on electric mobility in general and electric vehicles in particular (including EV standards, charging tariffs, etc.), as well as build the necessary recharging infrastructure[152].

Overall, Morocco needs to accelerate its efforts in energy efficiency. The cheapest energy remains the one that is not consumed. However, as per the most recent Regulatory Indicators for Sustainable Energy (RISE) benchmark, while Morocco ranks relatively high (with an overall score of 77), it underperforms when it comes to energy efficiency (with a score of only 60), and stagnant energy intensity for the last 10 years (ESMAP, 2020).[153] Morocco should give priority to energy-saving programs that would combine the use of economic instruments (including a carbon tax) as well as the adoption of performance standards (for buildings, vehicles, equipment…). Such instruments are deemed efficient in triggering behavioral changes and incentivizing energy users to conserve energy.

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[146] Nonmetallic minerals include the production of cement, ceramics, glass, and lime products. The transformation of nonmetallic minerals into these products is often an energy-intensive process, which can include several steps (heating, grinding, mixing, cutting, shaping, and honing).

[147] Direct and indirect CO2 emissions per ton of cement produced by Morocco are estimated at 592 kg CO2, while they stand at 634 and 632 kg CO2 for the world and European averages respectively.

[148] The phosphate sector is already highly electrified, with a share of electricity in final energy use of 55 percent presently; it is expected to reach 75 percent by 2030.

[149] A recent World Bank assessment shows that two of the main industrial zones in Morocco--the Tangier Free Zone (TFZ) and Tangier Automotive City (TAC)--have a carbon intensity of 0.76 and 0.75 ton CO2eq./MWh, which is significantly higher than the average intensity of 0.54 ton CO2eq./MWh of 18 organized industrial zones (OIZs) in Turkey.

[150] Through EIPs, Morocco can implement solutions to measure and certify the carbon footprint of its products, and at the same time improve its resiliency through a better use of resources (water, material, and energy).

[151] In addition, there is a growing body of evidence from literature showing, even with an existing grid relying heavily on fossil fuels, switching ICE vehicles to EVs tends to yield GHG emission reduction (and pollution reduction) benefits, given the much higher energy efficiency (instead of burning fossil fuel across millions of ICE vehicles, burning fossil fuel in power plants is much more efficient and more easily treated with mitigation measures). Source: Knobloch, 2020

[152] Policy recommendations in this chapter focus on the electrification of the road vehicle fleet. However, it is important to note that decarbonizing the transport sector would require a much broader approach, from more compact city planning, to shifting to public transport, nonmotorized mobility, intelligent transport systems, and freight improvements. Further analytical work is required to assess the comprehensive policy reforms that will be needed in the transport sector.

[153] RISE is a set of 31 indicators distributed among three pillars: access to electricity; renewable energy; and energy efficiency. It is intended to monitor the policy and regulatory frameworks that countries have put in place to support the achievement of the UN's Sustainable Development Goal 7 (Universal Access to Clean and Modern Energy). The third edition of the RISE report was released in December 2020. Morocco ranks relatively high, with an overall score of 77-- 100 for access to electricity and 71 for renewable energy, but only 60 for energy efficiency.

3.3.3. Macroeconomic Impacts of the Decarbonization Pathway

Decarbonizing the Moroccan economy would by and large be supported by private-sector-led investments, with overall positive impacts on GDP and fiscal space. Using inputs from the EPM model and other sector studies on e-mobility and green hydrogen, the World Bank's macrostructural model (MFMod) was used to simulate the macroeconomic impacts that an ambitious decarbonization pathway would have for Morocco. A key assumption in this exercise is that the private sector would lead the investment effort, deploying close to 75 percent of the investments required in the power sector and all of the investments needed to push the e-mobility and green hydrogen agendas forward.[154] The decarbonization scenario would have moderately positive impacts on GDP, resulting in a 0.2 percent deviation from the baseline that materializes early on and remains rather stable throughout the projection period 2022-50 (see Table 10). The impact on consumption would also be positive, but would unfold more gradually (from 0.15 percent deviation from the baseline in 2030, to 0.3 percent in 2050). The decarbonization pathway would also help to create fiscal space and would be consistent with a lower level of debt (2.5 percentage points negative deviation from the debt-to-GDP baseline by 2030). This scenario does not incorporate the additional revenues that could be collected by the introduction of a carbon tax, or another form of environmental tax reform; this is discussed further in Chapter 4.

Table 10: Decarbonization Macro-Simulations

	Baseline				Decarbonization scenario Deviation from Baseline			
	2022	2030	2040	2050	2022	2030	2040	2050
Average growth, % (1)								
Real GDP	1.09	3.55	3.65	3.65	0.39	0.17	0.23	0.25
Real GDP per capita	-0.05	2.16	2.26	2.26	0.39	0.17	0.23	0.25
Per Capita Income and Consumption (1)								
Real GDP Per Capita (Constant 2020 USD)	3 296.78	3 549.36	4 436.88	5 546.32	0.39	0.17	0.23	0.25
Real Household Consumption Per Capita (Constant 2020 USD)	1 997.45	2 005.85	2 507.42	3 134.40	-0.02	0.15	0.26	0.31
Real Expenditure Shares in Real GDP (2)								
Private Consumption (% of GDP)	60.69	56.24	56.24	56.24	-0.23	-0.01	0.01	0.02
Government Consumption (% of GDP)	19.57	20.76	20.76	20.76	-0.04	-0.02	-0.03	-0.03
Private Investment (% of GDP)	26.65	26.66	26.66	26.66	-0.29	-0.20	-0.09	-0.05
Government Investment (% of GDP)	2.32	2.34	2.34	2.34	-0.02	0.01	0.07	0.05
Net Exports (% of GDP)	-16.47	-6.00	-6.00	-6.00	0.58	0.23	0.03	0.00
Sectoral Shares in Real GDP (2)								
Agriculture (% of GDP)	13.23	10.96	11.52	12.11	0.00	0.00	0.00	0.01
Industry (% of GDP)	26.64	17.72	18.48	19.25	0.01	0.04	0.03	0.03
Services (% of GDP)	59.92	71.32	70.00	68.63	-0.01	-0.04	-0.04	-0.03
External Balance (2)								
Current Account Balance (% of GDP)	-5.55	-6.00	-6.00	-6.00	0.39	-0.05	-0.18	-0.15
Fiscal Aggregates (2)								
Fiscal revenues (% of GDP)	25.72	24.00	24.00	24.00	-0.06	-0.02	0.00	0.00
Fiscal expenditure (% of GDP)	31.97	29.45	26.64	24.09	-0.11	-0.07	-0.01	0.00
Budget deficit (% of GDP)	-6.25	-5.45	-2.64	-0.09	0.05	0.05	0.01	0.01
Debt to GDP	79.80	87.79	74.54	47.39	-1.58	-2.50	-2.26	-1.26

Source: MFMod modeling
Note: (1) Deviations from the baseline are expressed as a percentage of the baseline level
(2) Deviations from the baseline as expressed in percentage of GDP in the simulated scenarios, minus the percentage of GDP in the baseline

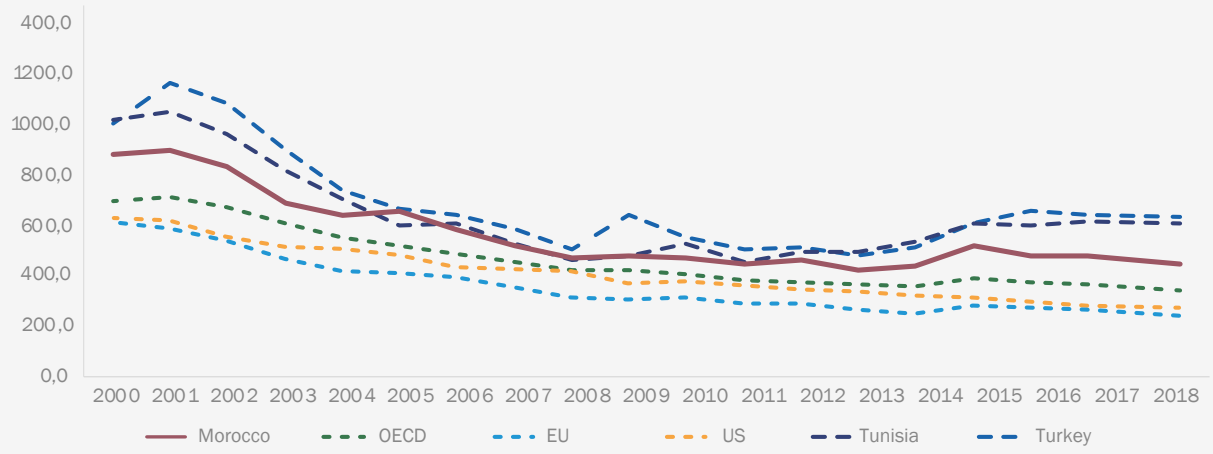
[154] In this scenario, transmission and distribution investments continue to be led by the public sector, but the private sector mobilizes all of the investments required to increase the power sector's generating capacity, and to shift to renewable sources of energy.

Although the decarbonization pathway may only temporarily reduce the current account deficit, it would help reduce exposure to international shocks. The simulated scenario initially leads to an improvement in the current account balance (mostly due to a reduction in coal and other energy imports), but the sizeable investments associated with decarbonization do eventually lead to rising imports, cancelling out this effect . This macrosimulation, however, does not factor in other important aspects of decarbonization, such as (i) the reduction of Morocco's exposure to shocks in international energy prices, which would contribute to a more resilient balance of payments; but also (ii) the comparative advantage a low carbon intensity may represent for Morocco's exports.

The aggregate impact of a carbon border adjustment mechanism (CBAM) is likely to be limited. Based on the information available to date, the levies generated by the EU's CBAM will only reach EUR 67 million in 2026, the equivalent of a mere 0.06 percent of GDP. This suggests that Morocco is barely exposed to the transition risks associated with European climate policies. However, there is a possibility that the CBAM may be gradually expanded to other sectors, and for other key markets to prevent carbon leakages. To anticipate the potential impacts that such a change in the international trade architecture would have, various simulations were conducted using the ENVISAGE computable general equilibrium (CGE) model (van der Mensbrugghe, 2019).[155] These simulations suggest that the macroeconomic impacts would be moderate even under an expanded CBAM.[156]

However, some sectors could be significantly impacted, most notably the chemical industry. With about 75 percent of the world's phosphate reserves, Morocco has become the fifth-largest exporter of fertilizers.[157] According to the ENVISAGE simulations, under an expanded CBAM, chemical exports to the EU (mostly fertilizers) could fall by 2-3 percent. Morocco has already taken decisive steps to green the highly energy- and water-intensive phosphate industry. To do so, the state-owned enterprise OCP has lowered its carbon emissions by boosting its consumption of clean energy, and has deployed the unconventional water resources that now cover 31 percent of its water needs. Moving ahead, the OCP group is committed to reaching carbon neutrality by 2040 and to supplying 100 percent of its water needs from nonconventional sources by 2030. Substituting conventional ammonia imports with ammonia produced with local GH would enable OCP to market its green fertilizers, while improving its current account. Given the OCP's global footprint on the phosphate trade, reducing the carbon content of its products is expected to have significant mitigation spillovers at the global level.

Figure 18: Intensity of CO2 Emissions Embedded in Gross Exports (tons per US$ million)



Source: OECD, 2022

[155] In the first scenario (as currently announced by the EU), the CBAM covers Scope 1 emissions from chemicals, metals, and electricity, and takes effect in 2024. In the second (expanded) scenario, the CBAM is applied to Scope 1 and 2 emissions for all products in the EU ETS sectors by EU, EUFTA countries and the USE, starting from 2026.

[156] The expanded CBAM covers all ETS sectors and scope 1 and 2.

[157] Morocco supplies about 6 percent of the world's fertilizers trade, which account for about 13 percent of its merchandise exports.

Morocco would be well-placed to reap the benefits of changing consumer preferences toward low-carbon products. The intensity of CO2 emissions embedded in Morocco's exports is already substantially lower than that of other countries located in the vicinity of European markets, such as Tunisia and Turkey; however, it was still 70 percent higher than that of the EU, 65 percent above that of the US, and 31 percent higher than the average for OECD members in 2018 (see Figure 18). The decarbonization agenda would allow Morocco to further improve the carbon intensity of its industrial products and strengthen their competitiveness on the markets that are embracing a decarbonization trend (notably the EU), thus improving the trade balance and feeding a strong and diversified economy. For instance, Morocco's automotive industry, one of the key engines of industrial development and export performance over the past decade,[158] emerges as being carbon competitive.[159]

In addition, Morocco's environmental goods (EGs) are gaining competitiveness in the EU market.[160] Morocco has exported EG products to Europe worth $90.5 million in 2020 (an 18.1 percent increase in the compound annual growth rate (CAGR) since 2016).[161] Again, the example of EVs is quite telling: Morocco has seen its attractiveness for EV producers, particularly European ones, growing over the past years. With the announced phase-out of all vehicles with internal combustion engines in the EU by 2035, European automakers are being pressed into investing in EV production in places where it has a lower cost of production. Morocco has already benefitted from this trend in recent years and has deployed a few EV production plants.[162] An additional advantage is that Morocco's EV industry could benefit from the recent investments in semiconductor manufacturing in Morocco.[163]

3.3.4. Impacts on Jobs

The energy transition would bring net job creation on a substantial scale. The Clean Energy Employment Assessment Tool (CEEAT)[164] was used to simulate the economy-wide job creation that could be associated with the energy transition investment under the Decarbonization scenario above until 2030, particularly for four technologies (utility-scale solar; distributed solar; utility-scale wind; and increasing energy efficiency). The CEEAT tracks the flow of expenditures when investments in the four above technologies take place and during the lifetime of the assets through four channels: (i) the Investment Impact refers to the expenditures spent to set up the project (policy planning, financing, installation, manufacturing, etc.); (ii) the Investment Shift Impact is the opposite of the Investment Impact whereby the expenditures spent on clean energy technologies take away resources from future conventional (fossil fuel) energy projects, which negatively impact the associated sectors;[166] (iii) the Substitution Impact is the result of energy expenditures saved by consumers either through energy efficiency or the introduction of clean energy as well as the spending on operation and maintenance (O&M) throughout the project lifetime; and (iv) the Revenue Impact is the opposite of the Substitution Impact.[167]

For each impact, the CEEAT computes the direct, indirect, and induced jobs[168] by multiplying the changes in expenditures in each sector with employment multipliers derived from an input-output framework . According to this assessment, the energy transition (investments up to 2030) will yield around 28,000 net jobs across the economy

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158 In 2019, the Moroccan automotive industry was comprised of over 250 companies: production exceeded 400,000 vehicles, with a local integration rate of 60 percent. Morocco exported an equivalent of $8.5 billion that year, mostly to the EU (83 percent of auto exports). The automotive industry created about 150,000 jobs between 2014 and 2019.

159 Morocco ranks 22nd out of 66 countries, with a carbon emission intensity in motor vehicle exports of 365 tons/US$ million in 2018, which is a much lower record than that of India (1,608 tons/US$ million), South Africa (1,511 tons/US$ million), China (676 tons/US$ million), and Tunisia (469 tons/US$ million).

160 Environmental goods and services are defined as products manufactured or services rendered for the main purpose of preventing or minimizing pollution, degradation, or the depletion of natural resources; repairing damage to air, water, waste, noise, biodiversity, and landscapes; and/or reducing, eliminating, treating, and managing pollution.

162 In 2021, a German auto manufacturing firm announced that it would begin EV production in Kénitra, Morocco. Earlier, in 2017, a Chinese electric car manufacturer, BYD, had signed to open an EV factory in Morocco.

163 The company STMicroelectronics recently started a microchip production line for EVs in its Bouskoura plant on the outskirts of Casablanca, which has put Morocco on the fast track to lead in EV production.

164 The CEEAT was developed under the World Bank's umbrella project Disruptive Energy Transition and Opportunities for Job Creation in the Middle East and North Africa, financed by the Energy Sector Management Assistance Program (ESMAP). It is an Excel-based input-output model that can simulate the net economy-wide direct, indirect, and induced employment impacts of clean energy technology pathways.

166 This is the counterfactual considered for the job simulation and is different from the Baseline scenario above which still include some clean energy investments

167 The energy expenditure savings are beneficial for consumers but create a loss of income for the conventional energy provider (e.g., the utility and the fossil fuel sector value chain).

168 Direct jobs are on-site jobs created by an investment. In the case of building a renewable energy system, the direct jobs include engineers, construction workers, as well as others who might be carrying out related tasks to ensure the successful completion of the project (e.g. installation workers, O&M staff throughout the lifetime of the system). Indirect jobs are the employment in upstream industries that supply the equipment (e.g., manufacturing) and support the core activities of clean energy deployment (e.g. finance). Induced jobs are jobs created as people who are directly and indirectly employed by clean energy systems spending their earnings in the economy.

per year, about 9 percent of the 300,000 annual jobs shortfall currently estimated in Morocco.[169] It is worth noting that the results presented in Table 11 only capture a portion of the potential impact of the decarbonization agenda in terms of job creation. As a matter of fact, they do not account for the potential reservoirs of new jobs that could be generated by other clean energy technologies (for example, energy storage), but also transformation of the end-user sectors, such as industry and e-mobility.

A Just Transition Framework is needed to mitigate the negative impacts that the deployment of green energy will have for workers currently employed in carbon intensive sectors. As emphasized above, the jobs created by the transition would more than make up for the jobs displaced by decreased investment in the fossil fuel sectors and decreased revenues for the utilities. However, some workers will unavoidably be displaced, need to change sectors/locations, or change their job profiles, and such shifts need to be facilitated through policies that encourage the movement of labor across sectors and regions, training/reskilling for workers, as well as protection for those who lose their jobs. Most of the jobs potentially induced by the transition could be created by small and medium enterprises (SMEs), with a wide territorial spread.[171] However, for this potential to materialize, it is important to create a more favorable environment for these enterprises and remove the bottlenecks preventing them from entering the market and growing (see Chapter 4).

Table 11: Distribution of Net Job Impact Per Year by Mechanism and Technology (up to 2030)

	Drivers	Utility Scale Wind	Industry auto-generation PV	Utility Scale Wind	Energy Efficiency
Investment Impact Investments to support clean energy expansion	Stimulates employment: Moving expenditures from capital-intensive to labor-intensive sectors; Building up local supply chains	2050	315	8670	1625
Investment Shift Impact Redirecting funds from other projects/spending to support clean energy investments	Displaces jobs in other sectors (e.g., fossil fuels).	--4540	--805	- 21800	- 525
Substitution Impact Energy savings from efficiency/ renewables spent locally and O&M jobs	Stimulates employment as consumers (residential, commercial, industrial) spend their savings in economy and O&M jobs during the project lifetime.	7260	1325	36250	1450
Revenue Impact Lost energy company revenues	Displaces jobs in the utility sector.	--460	- 80	--2210	- 300
Subtotal by technology	-	4310	755	20910	2250

Along the clean energy value chain, new skills would be needed in order for this potential to materialize. While many of the jobs created will be across the economy in non-energy sectors, many jobs along the energy value chain (in energy, construction, manufacturing, and services sectors) will have different skill profiles to meet the need of clean energy technologies. A qualitative review of the skill demand in the energy value chain reveals that jobs needed for the energy transition are mostly in project management, installation, construction, and operations and maintenance (O&M), all of which require relatively high skills in terms of consulting, engineering, and technical services. In addition, transversal and soft skills such as complex problem solving, negotiation, coordination, and communication would be essential in the energy transition professions. Moroccan firms involved in clean energy reported that skilled technical jobs (those requiring an engineering degree) are the hardest to fill, and that even those having completed higher education often lack practical experience, partly due to the low rates of available professional training (and its limited geographic distribution). Lack of awareness of the importance of energy transition among the local population also limits the attractiveness of these jobs.

[169] World Bank, 2021b.
[171] The renewable energy business is by nature regionalized and represents an opportunity for territorial development.

Chapter 4: Structural, Macroeconomic, and Financial Policies for a Resilient and Low-Carbon Morocco

Chapter 3 quantified some of the key mitigation and adaptation investments that would support the transition toward a resilient and low carbon (RLC) Morocco. In undiscounted terms, these investments could amount to a total of $219 billion for the period 2022-2050, with a first tranche estimated at $32 billion between 2022 and 2030; $60 billion between 2031 and 2040; and $127 billion between 2041 and 2050.[173] Table 12 summarizes these investments in net present value (NPV) terms, and as a share of discounted GDP. A 6 percent discount rate is applied.

Table 12: Total Investments for a Resilient and Low-Carbon Morocco

	Present Value in USD Billion (*)				En proportion du PIB (**)			
	2022-2050	2022-2030	2031-2040	2041-2050	2022-2050	2022-2030	2031-2040	2041-2050
Mitigation	52.8	8.3	16.7	27.8	2.4%	1.0%	2.2%	4.6%
Power sector (***)	10.8	6.1	10.7	15.9	1.5%	0.7%	1.4%	2.6%
E-mobility	32.8	0.0	1.9	8.9	0.5%	0.0%	0.3%	1.5%
Green hydrogen	9.2	2.2	4.0	3.0	0.4%	0.3%	0.5%	0.5%
Adaptation	24.9	14.9	8.3	1.6	1.1%	1.8%	1.1%	0.3%
National Water Plan	23.4	14.2	7.8	1.4	1.1%	1.7%	1.0%	0.2%
DRM & DRF (15 percent AAL)	1.4	0.7	0.5	0.3	0.1%	2.7%	0.1%	0.0%
Total	77.7	23.3	25.0	29.5	3.5%	0.1%	3.3%	4.9%

Notes: (*) Real US dollars in 2022 terms. Uses a 6 percent discount rate.
(**) Net present value (NPV) of investments divided by the present value of baseline GDP
(***) Difference between decarbonization and business as usual (BAU). Includes transmission and distribution.

Ultimately, the impact of the RLC transition will depend on how these investments are financed, and more broadly on the macroeconomic policy choices that will be made in the years and decades to come. This chapter focuses on some of the policy levers that could synergistically pursue the climate ambitions discussed in Chapter 3 as well as broader development objectives such as increasing private investment and accelerating growth; ensuring fiscal sustainability while promoting shared prosperity; and safeguarding financial stability. It provides macrosimulations on scenarios that combine the policy choices affecting the share of public versus private financing and the use of environmental tax instruments and water valuation reforms. The results of the simulations are summarized in Table 13 at the end of this chapter.

4.1. Maximizing Private-Sector Participation

This report assumes that a large share of the financing for a RLC Morocco would come from the private sector. Unlocking the potential of the private sector will be critical in order for Morocco to meet its development and climate aspirations. Maximizing private climate investment would also help to release some of the pressure on public finance, which is under strain after the COVID-19 pandemic. In this report, we assume that more than 85 percent of the investment needed to decarbonize the economy would be covered by the private sector[174]. On the adaptation side, it is expected that the investments would primarily be financed with public resources, but there is a growing

[173] This amount, however, does not include adaptation spending related to the protection of natural habitats, support to rainfed agriculture, or preparedness for coastal erosion; these were not quantified under the CCDR exercise. In contrast with section 3.3.2, it includes investments for the export of green hydrogen.
[174] All investments for the ambitious decarbonization strategy would be privately financed, except for transmission and distribution CAPEX and OPEX.

recognition that the private sector could also beef up its participation in the deployment of resilient solutions.[175] The following section presents policy options that could contribute to maximizing the participation of the private sector in climate action, focusing on (i) the need for structural reforms to foster the participation of the private sector in the RLC transition (reforms that align with those presented in the New Development Model (NDM)); and (ii) the greening of the financial system to maximize the financial resources needed to support the transition.

4.1.1. Private Sector Development Policies

The Moroccan private sector faces structural constraints that have slowed productivity growth and job creation; this could also hamper green transition going forward. As emphasized in the Country Private- Sector Diagnosis (CPSD) for Morocco the emergence of a more dynamic private sector has been constrained by a combination of regulatory constraints, unequal treatment of operators, and a weak competition policy enforcement (IFC 2019). As a result, the business environment is not conducive for young firms to enter markets and grow. This may constitute a missed development opportunity for Morocco, as there is solid evidence about the central role played by such firms as an engine for productivity growth and job creation in other economies (Goswami, Medvedev, and Olafsen 2019). One by-product of these constraints is limited private investment in climate-friendly sectors. Beyond the mobilization of private climate investment, there is growing international awareness about the role that a dynamic small and medium enterprise (SME) ecosystem can play as a driver of innovation for sustainability (UNEP 2017).

To effectively transition toward a climate-friendly, private-sector-led model of development, Morocco needs to accelerate the structural reform process that it has already begun. The New Development Model (NDM) sets a clear roadmap for unleashing the potential of the Moroccan private sector. It calls for a level playing field for market players; limiting the protection that certain public and private market operators still enjoy; and sanctioning anticompetitive practices. Some important steps have already been taken in this direction, including the reactivation of the Competition Council in 2018, and the launch of ambitious state-owned enterprise (SOE) reform that could streamline the role of the public sector in the economy, thus strengthening private sector development and competitiveness.[176] However, multiple regulatory constraints that still protect incumbents in key sectors--including those central to climate change mitigation and adaptation--remain to be addressed.

Scaling up private investment in renewable energy is central to the decarbonization agenda, but the private sector can also play an important role on the adaptation side. The reforms that could enable the private sector to lead the decarbonization of the Moroccan economy were discussed in Chapter 3. Public investment is likely to retain a prominent role in adaptation, but there are additional reforms that could open space for more active private involvement in that effort too. In the water sector, the authorities intend to use public-private partnership (PPP) schemes to leverage private sector financing and technical and managerial skills in the desalination program. While some PPP projects are already underway,[177] this trend could be accelerated if a clear roadmap to attracting private financing were to be developed. Also, given the centrality of the energy and water sectors in the RLC pathway, the reform of ONEE should be prioritized in order to create an enabling environment that allows private operators to enter and grow in the commercial segments of the water and electricity sectors.

Greening SMEs can be challenging and may require tailored government support. While some SMEs are in a position to lead on the climate innovation agenda, a large majority of them may find it difficult to adapt to the policies and regulations that will be adopted in Morocco and elsewhere to sustain the green transition. Moreover, SMEs often have less access to information on such regulations, and more broadly on the benefits of greening their practices. They may also have less leeway with which to absorb the higher cost of environmentally friendly technologies (OECD 2021). Overall, these market failures could justify well-tailored government interventions; in the absence of such interventions, the green transition could create additional entry barriers and thus lead to higher market concentration.

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[175] We have thus included a scenario where 10 percent financing of the PNE could be led by private sector (see Scenario 5 under Water Valuation Options).

[176] A framework law defining the state ownership policy was adopted, clarifying the role of the public entities, their governance, and their management principles. The Agence Nationale de Gestion Stratégique des Participations de l'État (APE), a new state holding agency in charge of driving overall SOE reform is, however, still pending creation.

[177] Several projects to be developed as PPPs are under consideration, including the 300 million m3 seawater desalination plant in the Casablanca-Settat region, with an overall cost of around $1.2 billion, the commissioning of which is scheduled for 2027. Added to this are the Safi desalination station, the Mokhtar Soussi dam elevation project, and the wastewater reuse project in Marrakech.

4.1.2. Greening the Financial System[178]

Morocco has taken decisive steps to establish a broad framework for greening the financial system, but a fully-fledged climate finance strategy has yet to be developed. Since 2016, Bank Al Maghrib (BAM), the Moroccan Capital Market Authority (AMMC) and the Ministry of Economy and Finance (MEF) have built foundations geared toward greening the financial system. The most relevant achievements have been the development of a broad roadmap to align financial institutions and capital markets with sustainable development goals; the introduction of disclosure and reporting standards; and adoption of key reforms to stimulate the creation of a corporate green bond market. However, unlike other countries, Morocco still lacks a comprehensive national strategy on green climate finance.[179]

Adopting a national "green taxonomy" could help to attract green financing. One of the key barriers that still hamper the development of a sustainable financial market is the lack of a national green taxonomy that provides a classification of the economic activities that can and should be considered environmentally sustainable and are aligned with Morocco's climate ambitions. Such taxonomies are being adopted in an increasing number of jurisdictions as an important tool to help issuers and investors identify green financial assets and projects. Moroccan authorities are aware of this gap and are scaling up their efforts to build the required institutional and market capacity in order to advance in this area.

The green bond market is still incipient. Between 2016 and 2018, AMMC produced guidelines describing the principles and actions needed to issue a green bond, including the use of proceeds, and the evaluation and selection of eligible projects. However, only five green bonds have been issued in Morocco. The total outstanding value of green bonds in Morocco as of 2020 amounted to around $400 million[180] issued by banks, corporates, and SOEs, to which the recent MAD1 billion emissions by the national rail company (Office national des chemins de fer, ONCF) should be added; and no sovereign green bond has yet been issued by the central government.[181] It is worth noting that, with the exception of that of ONCF, all of these issuances took place between 2016 and 2018, right after the green bond market was created. This weak activity may indicate the presence of obstacles in the way of mobilizing capital for these products (demand side) and/or constraints against making projects bankable (supply side).[182]

Blended finance instruments could be further used to raise capital for climate action. Few public financial institutions have a formal green mandate, although certain entities (such as Crédit Agricole, CDG capital and the Fonds d´Equipement Communal) have taken steps to green their practices. In addition, Tawilcom (the former Central Guarantee Fund) has launched various programs to provide guarantees and co-financing specifically targeted at climate-sensitive sectors, including Green Invest and the Green Value Chain initiatives. However, existing vehicles in place to de-risk and crowd in commercial green investments could be further reinforced. Whether the new Mohammed VI Strategic Investment Fund (FMVI) recently created in Morocco could contribute to fill that gap is still unclear[183].

4.2. Fiscal Policies

The fiscal dimension will be central for the RLC transition in Morocco. A substantial part of the investments discussed in the previous chapter would inevitably have to be led by the public sector, especially on the adaptation front. However, as discussed in Chapter 1, the COVID-19 shock led to a large increase in public debt, which may eventually force the authorities to embark on a fiscal consolidation process that could increase competition for scarce public

[178] See more detailed information in the Background Note on "Greening the Financial System in Morocco." Applying the World Bank Toolkits for Policymakers to Green the Financial System, this note assesses the progress made by Morocco; identifies the gaps that still need to be filled; and produces a preliminary policy benchmarking assessment informed by exchanges with key policy makers and stakeholders.

[179] A National Strategy on Climate Finance is under preparation and will support the implementation of the revised NDC.

[180] This is still a relatively low figure, especially if it is compared with the total volume of outstanding Moroccan corporate debt, which stood at more than $33.4 billion at the end of October 2020.

[181] This figure only encompass bonds that are "climate-green" as defined by the Climate Bonds Initiative (CBI), and that are in compliance with the regulator's guidelines; therefore it excludes self-labeled green bonds or other types of sustainable bonds from corporations.

[182] The fact that the last green bond issuance that took place Morocco was in 2018 (by the Al Omrane Holding group) and was eight times oversubscribed suggests that the main constraint lies on the supply side.

[183] The FMVI was established to complement the government of Morocco's COVID-19 recovery package. It aims to provide equity and quasi- equity instruments to strengthen the solvency of companies and contribute to the rebounding of investments in priority areas for economic growth (infrastructure, innovation, enterprises). The target size has been set at MAD 45 billion, of which MAD 15 billion is provided by the State; MAD 30 billion is to be raised from domestic and foreign public and private investors.

resources. This section focuses on (i) options for increasing fiscal revenues while synergistically pursuing climate objectives (such as environmental tax reforms and water valuation); and (ii) public financial management (PFM) tools that could increase the efficiency and effectiveness of public climate spending.

4.2.1. Fiscal Revenue Mobilization

Environmental Tax Reform

Despite recent progress, Morocco still has substantial implicit "brown" subsidies stemming from the underpricing of fuels. Successful reform implemented between 2013 and 2015 eliminated most explicit fuel subsidies, the only exception being the butane gas subsidy. However, Morocco still foregoes a substantial amount of the public revenues that it could collect from fuel imports and consumption due to various exemptions and reduced rates (see Box 6). Moreover, the current tax regime is still far from internalizing the environmental and health externalities associated with fossil fuels. As such, the IMF estimates that fuel subsidies still surpass 5 percent of GDP even after the elimination of most of the explicit subsidies (IMF 2021).[184]

Box 6: "Brown" Tax Expenditures in Morocco

Fuels are subject to two main taxes in Morocco: an excise tax collected upstream by the customs authority (the Internal Consumption Tax (ICT); and a value-added tax (VAT) on consumption. The ICT is not applied uniformly and rates vary significantly across fuels. In addition, a reduced VAT rate of 10 percent is applied on all fuels (the normal rate is 20 percent). Given that the VAT is imposed on the product price on top of the ICT, reduced ICT rates cause further VAT revenue losses. Importantly, some strategic sectors benefit from VAT and ICT exemptions, most notably fuels used for water and electricity generation (through ONEE), but also by ships refueling in high waters, planes in transit, and Moroccan fishing boats.

These exemptions generate a significant volume of tax foregone revenues. According to the Ministry of Finance, the foregone revenues generated by the reduced VAT rate alone have reached 0.34 percent of GDP on average between 2018 and 2021. Perhaps even more relevant is the fact that these tax expenditures are also contributing to shaping agents' decision-making processes in ways that are environmentally harmful, further encouraging the use of coal in the power sector, or the consumption of more polluting products such as diesel, which has an ICT rate that is 36 percent lower than that of gasoline.

A reform of environmental taxation could support climate action while helping to achieve the broader goals of Morocco's fiscal policy. Environmental tax policy is a crucial instrument that can contribute to fiscal sustainability while promoting behavioral changes aligned with climate objectives. It can also reduce pollution in a cost-effective way, and in so doing avoid premature deaths. In addition, revenues raised (from taxes) or saved (from subsidies) could make an important contribution to reducing Morocco's budget deficit and placing debt on a downward path. Such revenues could also be equitably funneled into social transfer, investment in adaptation, or reduced labor and capital taxes, thus enhancing economic efficiency.

Morocco could consider introducing an environmental tax reform around three pillars, to be completed independently or complementarily. A first pillar could target the removal of existing tax expenditures. A second pillar could be to remove the last remaining explicit price subsidy in Morocco (for butane gas).[185] A third pillar could be the introduction of a carbon tax on producers, which could be designed in such a way as to have the additional benefit of being compatible with CBAM.[186] Depending on their level of ambition, these reforms could have significant macroeconomic and distributional effects that need to be carefully assessed ex ante.

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[184] Implicit subsidies are calculated as total fuel consumption times the difference between existing and efficient prices, the latter internalizing environmental and health externalities.

[185] It is important to note, however, that higher butane gas subsidies could encourage rural households to revert back to wood and charcoal for cooking, both of which have harmful effects on human health and could also increase deforestation. The elimination of the butane gas subsidy, therefore, should be complemented by the promotion of less harmful substitutes, such as electricity or solar water heaters.

[186] The directive on CBAM issued on July 14, 2021 includes a provision related to the "crediting of foreign policies." This provision would recognize carbon pricing mechanisms put into place in exporting countries, and accordingly adjust the CBAM fees.

Environmental tax reform could generate an important flow of public revenues that would tend to decline over time. Ceteris paribus, the elimination of current tax expenditures could raise additional revenues for an amount of at least 0.3 percent of GDP (see Box 6). The removal of butane gas subsidies would generate savings amounting to 0.9 percent of GDP (the average for 2015-2020). Finally, in the short term the introduction of a carbon tax of $20 per ton of CO2-equivalent would raise fiscal revenues by close to 1 percent of GDP. This first static approximation, however, does not factor in the behavioral and economic adjustments that higher environmental taxes would trigger. As economic agents adjust to the new relative prices induced by the reform the intended climate co-benefits would materialize, which would gradually reduce the base of the environmental taxes, thus progressively reducing the public revenues collected by the State.

The initially adverse macroeconomic impacts of the environmental tax reforms simulated in this exercise would fade away with time and turn positive in the longer term. As shown in Table 13, both the elimination of the butane gas subsidy (Scenario 2) and the introduction of a carbon tax (Scenario 3) would result in GDP losses around the time of the reform; but the output response would turn positive afterward (0.1 and 0.3 ppt positive deviation from the baseline by year 2030 in Scenarios 2 and 3). In addition, the simulation suggests that these reforms would be an effective tool for creating fiscal space: the elimination of the butane gas subsidy (without compensation) would yield a 2.5 ppt reduction in the debt to GDP ratio by 2030, and the introduction of a carbon tax would reduce this same ratio by 6.5 ppt with respect to the baseline. This exercise also compares the macroeconomic effects of the simulated environmental tax reforms with those of a more conventional reform implemented through indirect taxes (Scenario 4). It shows that while the adverse effects of the environmental tax reforms on GDP could be larger in the short term, conventional tax reform would elicit weaker positive GDP responses in the longer term. In other words, even without factoring in their climate co-benefits, environmental tax reform would be preferable to conventional tax reform from a macro perspective.

Water Valuation Policies

Morocco foregoes a substantial amount of revenue due to the current structure of water charges. There is limited publicly available information on the fiscal impact and distribution of implicit water subsidies in Morocco. But it is clear that current water use fees are insufficient to cover operation and maintenance (O&M) costs, let alone the capital expenditure mobilized by the State for large water infrastructure and irrigation projects. (See Box 2 in Chapter 1.) This suggests that the fiscal cost associated with subsidies may be large, even though some users (in particular large-scale irrigators) may have the ability to pay higher charges.

On top of raising additional revenues to finance the transition, revisiting current water valuation policies could have other co-benefits. First, it could encourage more rational use and improve the allocation of a scarce resource, thus helping to balance supply and demand. Second, it could increase the private sector's willingness to invest in the water sector, thus reducing the share of the total climate capital expenditure effort being shouldered by the State. Third, it would contribute to mobilizing additional funds for maintenance, thus avoiding the accelerated depreciation of existing hydraulic assets and hence the need to replace or rehabilitate them at higher costs.

Increasing water tariffs could have significant fiscal impacts. To illustrate these effects, two water policy scenarios were included in the macrosimulations presented in Table 13. In the first one (Scenario 5), the participation of the private sector in water mobilization is encouraged through increasing the water tariff to a level that would enable private operators to cover about 10 percent of the investments contemplated in the National Water Plan (PNE).[187] In the second one (Scenario 6), the value-added price of water is increased by 20 percent, and the additional resources that this generates are used to reduce debt.[188] Both scenarios would lead to an improved fiscal outcome, reducing the debt-to-GDP ratio by 3.4 percent and 2.4 percent respectively, by 2030. Moreover, according to the macrosimulations, these reforms would not hurt economic growth: after a relatively mild short-term negative response, by 2030 real GDP would surpass the baseline in both scenarios.

[187] These include 50 percent of the desalination and large-scale irrigation projects, as envisioned under the PNE.
[188] The value-added price of water is the price deflator of the water sector obtained from the national accounts, i.e. the ratio between the nominal and the real value-added of the water sector.

Compensatory Policies

The simulated reforms discussed above could reduce private consumption, warranting caution. The results presented in Table 13 suggest that both the environmental tax reforms (Scenarios 2 and 3) and the water reforms (Scenarios 5 and 6) could lead to a negative deviation of private consumption from the baseline, channeled through the price increases that these policies would originate. In the case of the environmental tax reforms, these impacts would tend to be concentrated in the short term and then gradually fade away with time, whereas the water reforms would have more persistent impacts.

Recycling a portion of the additional revenues mobilized by the reform would partially offset adverse impacts on private consumption, but not prevent them entirely. Three untargeted compensatory policies are simulated in this exercise. In the first one (Scenario 7), the proceeds from the butane gas subsidy reform are fully recycled to households. In the second one (Scenario 8), on top of the proceeds from the butane gas subsidy reform, the government recycles 50 percent of the revenues generated by the carbon tax. In the third one (Scenario 9), the government recycles 50 percent of the revenues generated by the increase in water tariffs. Given that in the first of these scenarios the full amount of the revenues mobilized by the reform is recycled, it is unsurprising that no effects are found on the fiscal outcome. However, the other two scenarios do still result in a reduction of the debt ratio. They also moderate but do not fully eliminate the negative impacts of the reforms on private consumption. An important limitation of this exercise, however, is that these simulations cannot address the critical question of how such consumption losses would be distributed across the income distribution.[189]

For the RLC transition to be equitable, the potential impact of the reforms on the poor and vulnerable need to be carefully anticipated and addressed. A microsimulation was conducted to analyze the potential distributional impact of the butane gas subsidy reform.[190] It shows that an increase in butane gas prices would have a stronger impact on the consumption baskets of poorer households (+3.7 percent increase for households in the first decile, against an increase of only 0.7 percent for households in the tenth decile of the income distribution). As a result, it would increase the poverty headcount by 0.5 percent and the consumption Gini index by 0.002; therefore, it would collide with broader developmental objectives.

Targeted compensatory measures are critical in order to mitigate the adverse impacts of climate policies. The simulations run under this exercise provide a strong justification for the adoption of compensatory measures to mitigate the adverse impacts on household welfare. The distributional impacts of any environmental and water pricing reform need to be carefully assessed ex ante to design appropriate compensatory mechanisms to support the poor and vulnerable. A well-targeted cash transfer program could be the best option for channeling such compensation. For that purpose, the government could leverage the Unified Social Registry that is currently being deployed; this could be an important tool for targeting support mechanisms aimed at disadvantaged households. The timing of the reform is also crucial since environmental tax reforms are more likely to succeed when implemented in a context of price stability, when households are not already undergoing the effects of inflationary pressures on their cost of living and consumption capacity. This condition does not hold in the current context; hens the authorities' caution on the timing of butane gas subsidy reform and the alignment with the social protection reform, is justified.

4.2.2. Public Financial Management

In a fiscally constrained environment, the public financial management (PFM) system can offer tools to optimize the use of scarce public resources for climate action. Morocco has recently joined the Coalition of Finance Ministers for Climate Change, and as such is committed to adhering to the "Helsinki Principles" and to using fiscal planning, budgeting, public investment management, and procurement practices to accelerate the transition to a RLC economy. However, although Morocco's PFM framework has evolved substantially following the adoption of a new Organic Finance Law in 2015, its institutional arrangements and practices have not yet been adapted to support climate-sensitive policies.[191]

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[189] Indeed, the macroeconomic model that is used does not capture the distributional dimension of the simulated reforms, and hence cannot be used to analyze the effects of different targeting options for the cash transfer program. This is why the macro analysis needs to be complemented by microsimulations in order to generate a more accurate picture of the potential outcomes of the reforms.

[190] Data from the 2019 panel household survey (ONDH).

[191] See Background Note on Institutions and Governance for Climate Action in Morocco.

Adopting a climate-sensitive budget would be helpful in translating climate ambitions into budgeting and track-related public expenditure. Morocco has transitioned to program budgeting--in which line ministries produce three-year programs with objective performance indicators and costing in line with their sectoral priorities and strategies--since 2015. However, as indicated in Chapter 2, there is no tool in place to ensure that the climate ambitions, as described in the NDC, are fully reflected in these programs. Climate Budget Tagging is a budgeting tool that identifies, classifies, weights, and marks climate-relevant expenditures in a government's budget system, enabling the estimation, monitoring, and tracking of those expenditures. Morocco has launched the process for moving ahead with a climate-sensitive budget, which would help decision makers identify gaps in terms of the funding needed to achieve climate goals and opportunities, and potentially mobilize additional resources (for instance through the issuance of sovereign green bonds). It already has some of the key technical prerequisites needed to introduce it, including a Treasury single account; budget classification by functions of government; and an integrated financial management information system. Moreover, Morocco already has some experience in cross-cutting budget analysis on gender issues. It could also benefit from the experience and lessons learned from the 19 national and subnational governments that have adopted budget tagging methodologies across the world.[192]

Morocco's public procurement processes have yet to be adapted to the climate change challenge. At close to 20 percent of GDP, Morocco's public procurement is significantly above the 12 percent global average.[193] The decree on public procurement embeds a provision on sustainable/green public procurement,[194] but it still has to be turned into actions, so that the State can exploit its sizeable purchasing power to foster climate change mitigation and adaptation measures. Mainstreaming climate considerations into the procurement process, and reporting in relevant sectors would offer strong leverage in bringing new solutions to the market.[195]

4.3. Ensuring Financial Stability

There is growing international awareness of the potential impacts of climate change on financial stability. Climate-related risks can be broadly grouped into two categories: (i) physical risks, that is, financial risks stemming from the gradual and abrupt impacts of climate change (primarily droughts and floods in the case of Morocco); and (ii) transition risks, that is the financial risks that can result from the transition to a low-carbon economy, for example due to changes in climate policy, technology, or market sentiment. Based on the results of a vulnerability assessment conducted jointly between the Central Bank of Morocco (BAM) and the World Bank, this section discusses the exposure of the Moroccan financial sector to both physical and transition risks, and presents a quantification of the impacts that the materialization of various scenarios could have on banks' balance sheets.[196] It should be noted that this remains an exploratory exercise intended to provide an idea on orders of magnitude.[197]

The physical risks related to droughts and floods can have both direct and indirect impacts on bank balance sheets. Beyond their direct impacts on crop producers and livestock farmers, droughts can also affect other economic activities through supply chain linkages, most notably in the food processing industry. Floods can disrupt key infrastructure, generating revenue losses for sectors such as transport, tourism, and agriculture. Such shocks directly affect property and corporate assets, household wealth, profits, and incomes, and can thus reduce the ability of borrowers to service their debt, hence increasing the stock of nonperforming loans (NPLs), which in the post-COVID environment is already relatively large (around 8.5 percent of credit). In addition, weather-related hazards can have indirect cascading effects on banks through their socioeconomic and macroeconomic impacts, which can lead to a further tightening of financial conditions. For instance, a surge in government spending linked to a reconstruction effort could result in a deterioration of sovereign risk, eventually leading to an increase in interest rates and to losses on bank holdings of public debt.

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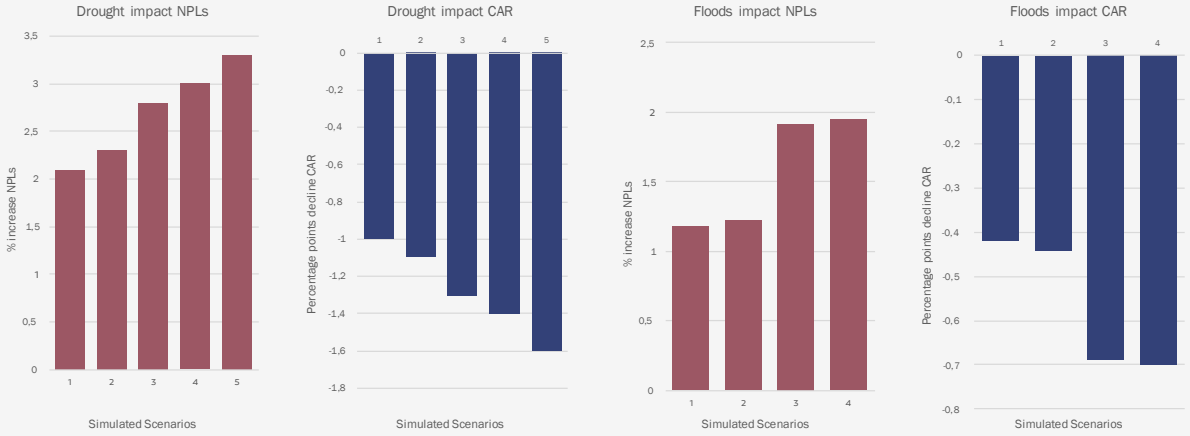
[192] These include Australia, Chile, Colombia, France, Indonesia, Ireland, Kenya, Nepal, and the Philippines.
[193] See World Bank blog "How Large is Public Procurement?".
[194] As set forth in Art. 1 of Decree No. 2-12-349 (General Conditions for Works Contract) and Objective #5 of the National Strategy for Sustainable Development.
[195] This could be achieved through including sustainable/green procurement priorities such as new requirements concerning, for example, construction materials; or life-cycle costing in value-for-money assessments by including the cost of externalities such as CO2 in the design of the procurement process.
[196] Refer to the Background Note "Benchmarking Financial Sector Policies for Climate Risk Management and Green Finance."
[197] To get a more precise assessment on climate risks for the financial sector, further methodological refinements and more granular data will be required

The direct and indirect exposure of Moroccan banks to physical risks is estimated at around 35 percent of total assets. Direct exposure reaches 8 percent of assets, and covers loans to the agriculture, agro-industrial and food processing sectors. In addition, the tourism sector and household mortgages are indirectly exposed to physical risks, reaching an additional 27 percent of assets.

The catastrophic scenarios simulated in this exercise would lead to an increase in NPLs and a decline in the capital adequacy ratio (CAR). As shown in Figure 1, different drought scenarios could result in a system-wide increase in NPLs, ranging between 2.1 ppts (3 years long historical drought) and 3.3 ppts (2050 time horizon, RCP 8.5), and in a decline in the CAR that would range from 1.0 ppts to 1.6 ppts. In turn, the flood scenarios result in a system-wide increase in NPLs ranging from 1.2 ppts to 1.7 ppts, and a decline in the CAR ranging from 0.4 to 0.6 ppts.

Figure 19: Physical Risk Stress-Testing



SD1: 3-year long historical drought
SD2: RCP 4.5 drought scenario occurring in 2030
SD3: RCP 4.5 scenario occurring in 2050
SD4: RCP 8.5 scenario occurring in 2030
SD5: RCP 8.5 scenario occurring in 2050

SF1: RCP 4.5 fluvial flood occurring in 2030
SF2: RCP 8.5 fluvial flood occurring in 2030
SF3: RCP 4.5 pluvial flood occurring in 2030
SF4: RCP 8.5 pluvial flood occurring in 2030

Note: this assessment incorporates a macro-modelling exercise to simulate the impact of the simulated catastrophic scenarios on the capital stock and jobs. The underlying assumption is that the destruction of capital stock in the agricultural sector results in a proportional share of agricultural loans turning non-performing, and that the job losses associated with each scenario result in a proportional share of consumer and mortgage loans turning non-performing. Recognizing that the impact of floods tends to be concentrated geographically, the assessment for SF1 to SF4 is conducted at the municipal level for each individual bank, and then aggregated for the entire system. The results presented above are just a subset of the scenarios that were simulated in these exercise, which also included floods with a 2050 time horizon.

Transition risks can affect financial institutions primarily through losses in their credit and investment portfolios. Especially if they are unanticipated by the market, changes in policy, technological disruptions, and consumer preferences linked with the decarbonization effort could increase NPLs by reducing the profitability and debt-servicing capacity of firms. The transition to a green economy can also affect banks' investment portfolios through a lower value of bank equity and the bond holdings of affected firms. Since investments are usually priced mark-to-market, a reduction in the market price of the underlying asset would require banks to adjust the value on their balance sheet and record a loss on the investment holding. These transition risks could be further amplified through macroeconomic feedback loops; however, these are not captured in the vulnerability assessment presented below.

Overall credit exposure to industries that are defined as highly or moderately transition-sensitive amounts to 11 and 13.3 percent of total loans respectively [198]. Exposures are highest in the manufacturing sector (9 percent of total loans); electricity (5 percent of total loans); and agriculture (4 percent of total loans).

The introduction of a carbon tax could increase the share of corporate loans that are at increased credit risk. This assessment assumes that higher carbon prices will directly reduce firms' earning potential proportional to their level of emissions. According to this static exercise, a carbon tax of $25/tCO2 and $75/tCO2 would increase the total share of firms at risk of debt distress by 1.1 ppts and 3.2 ppts respectively[199]. As a result, 1.9 percent of total corporate loans (0.7 percent of banking sector assets) would be estimated to be at increased credit risk following the introduction of a $25/tCO2 carbon tax, a share that would reach 8.4 percent (3.1 percent of banking sector assets) in the $75/tCO2 scenario[200].

The assessment presented above suggests that the materialization of climate-related physical and transition risks could have considerable–but manageable–impacts on the Moroccan banking system; and a solid regulatory and supervisory framework could help mitigate those risks. The Central Bank of Morocco (BAM) has already identified climate risk management as a key priority[201] and is working to fully integrate climate risks into its supervisory practice. Indeed, a directive has already been issued on the management of climate and environmental financial risks; the micro-prudential framework continues however to be constrained by the limited amount of data and information that is available to monitor and track financial risk exposures. Moreover, Moroccan banks have emphasized that data limitations present a key challenge for facilitating climate disclosure, and to reporting and assessing climate risk internally.

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[198] Highly transition-sensitive sectors are defined as those that have an emission intensity above 300 tons of CO2 per US$ million produced, while moderately transition-sensitive sectors are those with an emission intensity between 100 and 300 tons of CO2 per US$ million.

[199] Firms that are debt-distressed are those that have an interest coverage ratio (earnings divided by interest expenditure) less than 1. Given the absence of firm-level data in Morocco, the calculations presented here are computed at the sectoral level.

[200] Estimates for the increase in credit risk are obtained by multiplying the increase in debt-at-risk at the sectoral level with each bank's lending exposure to these sectors.

[201] BAM joined the Network of Central Banks and Supervisors for Greening the Financial System (NGFS) in 2018 to share and build knowledge on climate risk integration in supervision and central bank operations. An internal unit dedicated to climate risk and green finance was established in 2019. BAM's 2020 annual report has included as one of its key goals the integration of climate change adaptation and mitigation into its mission. During COP26 in November 2021, BAM also announced a series of ambitious plans to address climate risks, including issuing guidelines to the banking sector regarding stress tests and reporting on climate risks, conducting climate risk assessments, and capacity building.

Table 13: Macro-Fiscal Simulations of Various Financing Options for RZN Investments

	Baseline (1) Low carbon and resilient Morocco				Subsidy reform (2) Deviation from baseline				Plus introduction of a carbon tax (3) Deviation from baseline			
Average growth (*)	2022	2030	2040	2050	2022	2030	2040	2050	2022	2030	2040	2050
Real GDP	3.68	3.61	3.65	3.65	3.68	0.10	0.02	0.00	3.68	0.28	0.08	0.01
Per Capa Income and Consumption												
Real GDP Per Capita (Constant USD)	3,297	3,549	4,437	5,546	-0.75	0.00	0.12	0.13	-2.26	-0.14	0.37	0.52
Real Household Consumption Per Capita (Constant USD)	1,997	2,006	2,507	3,134	-2.50	-1.11	-0.75	-0.46	-7.26	-3.12	-2.52	-1.98
Real Expenditure Shares in Real GDP												
Private Consumption (% of GDP)	60.69	56.24	56.24	56.24	-0.98	-0.51	-0.35	-0.21	-2.84	-1.38	-1.17	-0.88
Government Consumption (% of GDP)	19.57	20.76	20.76	20.76	0.08	0.00	-0.01	-0.01	0.24	0.01	-0.02	-0.03
Total Investment (% of GDP)	26.65	26.66	26.66	26.66	-0.43	-0.39	-0.14	-0.08	-1.21	-1.09	-0.43	-0.30
Net Exports (% of GDP)	-16.47	-6.00	-6.00	-6.00	1.10	0.73	0.42	0.23	3.12	2.05	1.41	1.03
Sectoral Shares in Real GDP												
Agriculture (% of GDP)	13.23	10.96	11.52	12.11	-0.16	-0.07	-0.07	-0.04	-0.46	-0.22	-0.23	-0.19
Industry (% of GDP)	26.64	17.72	18.48	19.25	-0.18	-0.06	-0.06	-0.04	-0.54	-0.16	-0.22	-0.19
Services (% of GDP)	59.92	71.32	70.00	68.63	0.34	0.13	0.13	0.08	1.00	0.38	0.45	0.38
External balance												
Current Account Balance (% of GDP)	-5.55	-6.00	-6.00	-6.00	-0.24	-0.20	0.14	0.10	-0.88	-0.52	0.46	0.33
Fiscal Aggregates												
Fiscal revenues (% of GDP)	25.72	24.00	24.00	24.00	0.51	0.33	0.15	0.09	1.57	0.84	0.41	0.29
Fiscal expenditure (% of GDP)	31.97	29.45	26.64	24.09	0.05	0.00	-0.02	-0.03	0.19	-0.02	-0.07	-0.10
Budget deficit (% of GDP)	-6.25	-5.45	-2.64	-0.09	0.46	0.33	0.17	0.12	1.37	0.86	0.48	0.39
Debt to GDP	78.20	87.79	74.54	47.39	-0.78	-2.54	-3.04	-2.99	-2.23	-6.47	-7.97	-8.30

Notes: (*) Average annual growth since preceding period (2020 for first column)
Scenario 1: Full deployment of the ambitious decarbonization strategy (all investments by the private sector, except for transmission and distribution CAPEX and OPEX) and of the National Water Plan (investments fully shouldered by public sector). Public debt financed risk reduction adaptation investments amounting to 15 percent of Annual Average Losses (AAL)
Scenario 2: Elimination of the butane gas subsidy without compensatory transfers to households
Scenario 3: Elimination of the butane gas subsidy and introduction of a carbon tax (US$20 per ton of CO2) without compensatory transfer to households
Scenario 4: No environmental reform, tax reform generating revenues equivalent to scenario 4.
Scenario 5: 10 percent of the National Water Plan deployed through the private sector, with an increase in water tariffs sufficient to cover those investments´ CAPEX plus 15 percent.
Scenario 6: 20 percent increase in the value-added price of water.
Scenario 7: butane gas subsidy reform (scenario 2) with proceeds channeled towards low-income households through a cash transfer.
Scenario 8: butane gas subsidy reform and introduction of a carbon tax (scenario 3), with all proceeds from the subsidy reform and 20 percent of revenues collected from the carbon tax channeled towards low-income households through a cash transfer.
Scenario 9: 20 percent increase in the value-added price of water (scenario 6), with 20 percent of revenues collected channeled towards low-income households through a cash transfer.

	Equivanet tax reform (4) Deviation from baseline				Private sector participation (5) Deviation from baseline				Water valuation –(6) Deviation from baseline			
Average growth (*)	2022	2030	2040	2050	2022	2030	2040	2050	2022	2030	2040	2050
Real GDP	3.68	0.09	0.02	0.00	3.68	0.06	0.07	-0.01	3.68	0.05	0.07	0.00
Per Capa Income and Consumption												
Real GDP Per Capita (Constant USD)	-0.53	0.13	0.32	0.36	-0.12	0.33	0.98	0.99	-0.19	0.15	0.85	0.91
Real Household Consumption Per Capita (Constant USD)	-1.45	-0.25	-0.04	0.07	-0.30	-1.38	-2.20	-2.77	-0.37	-1.86	-2.97	-3.57
Real Expenditure Shares in Real GDP												
Private Consumption (% of GDP)	-0.51	-0.17	-0.15	-0.10	-0.10	-0.79	-1.28	-1.32	-0.10	-0.93	-1.54	-1.58
Government Consumption (% of GDP)	0.06	-0.01	-0.02	-0.02	-0.02	-0.16	-0.03	0.00	-0.02	-0.15	-0.02	0.00
Total Investment (% of GDP)	-0.20	-0.13	-0.06	-0.04	0.54	1.57	1.09	0.51	0.55	1.63	1.14	0.54
Net Exports (% of GDP)	0.06	-0.12	-0.10	-0.11	0.00	-0.31	0.39	0.94	0.05	-0.15	0.65	1.20
Sectoral Shares in Real GDP												
Agriculture (% of GDP)	-0.09	-0.03	-0.03	-0.02	-0.02	-0.18	-0.30	-0.32	-0.03	-0.21	-0.36	-0.38
Industry (% of GDP)	-0.11	-0.03	-0.04	-0.03	-0.03	-0.19	-0.37	-0.42	-0.03	-0.23	-0.45	-0.50
Services (% of GDP)	0.20	0.06	0.07	0.05	0.05	0.36	0.68	0.75	0.06	0.44	0.81	0.89
External balance												
Current Account Balance (% of GDP)	-0.28	-0.32	0.05	0.09	0.00	-0.59	0.45	0.93	0.05	-0.46	0.66	1.11
Fiscal Aggregates												
Fiscal revenues (% of GDP)	1.65	0.95	0.58	0.41	0.24	0.02	-0.25	-0.31	0.02	-0.16	-0.35	-0.37
Fiscal expenditure (% of GDP)	0.31	0.13	0.01	-0.05	-0.35	-0.34	-0.22	-0.15	-0.40	-0.37	-0.21	-0.14
Budget deficit (% of GDP)	1.33	0.82	0.57	0.45	0.58	0.36	-0.04	-0.16	0.42	0.22	-0.13	-0.23
Debt to GDP	-1.30	-6.39	-9.31	-9.73	-0.47	-3.38	-3.56	-1.58	-0.37	-2.36	-1.77	0.20

Notes: (*) Average annual growth since preceding period (2020 for first column)

Scenario 1: Full deployment of the ambitious decarbonization strategy (all investments by the private sector, except for transmission and distribution CAPEX and OPEX) and of the National Water Plan (investments fully shouldered by public sector). Public debt financed risk reduction adaptation investments amounting to 15 percent of Annual Average Losses (AAL)

Scenario 2: Elimination of the butane gas subsidy without compensatory transfers to households

Scenario 3: Elimination of the butane gas subsidy and introduction of a carbon tax (US$20 per ton of CO2) without compensatory transfer to households

Scenario 4: No environmental reform, tax reform generating revenues equivalent to scenario 4.

Scenario 5: 10 percent of the National Water Plan deployed through the private sector, with an increase in water tariffs sufficient to cover those investments´ CAPEX plus 15 percent.

Scenario 6: 20 percent increase in the value-added price of water.

Scenario 7: butane gas subsidy reform (scenario 2) with proceeds channeled towards low-income households through a cash transfer.

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Scenario 9: 20 percent increase in the value-added price of water (scenario 6), with 20 percent of revenues collected channeled towards low-income households through a cash transfer.

	Butane gaz reform/household transfer (7) Deviation from baseline				Env. Tax reform household transfer (8) Deviation from baseline				Water val. Reform household transfer (9) Deviation from baseline			
Average growth (*)	2022	2030	2040	2050	2022	2030	2040	2050	2022	2030	2040	2050
Real GDP	3.68	0.08	0.02	0.00	3.68	0.27	0.10	-0.01	3.68	0.04	0.07	0.00
Per Capa Income and Consumption												
Real GDP Per Capita (Constant USD)	-0.72	-0.11	0.09	0.08	-2.51	-0.51	0.39	0.40	-0.13	0.16	0.82	0.89
Real Household Consumption Per Capita (Constant USD)	-1.21	-0.20	-0.25	-0.17	-4.74	-1.27	-1.13	-0.63	0.00	-1.59	-2.93	-3.61
Real Expenditure Shares in Real GDP												
Private Consumption (% of GDP)	-0.27	-0.04	-0.14	-0.09	-1.27	-0.36	-0.61	-0.36	0.07	-0.81	-1.52	-1.58
Government Consumption (% of GDP)	-0.27	-0.20	-0.04	-0.02	-0.79	-0.58	-0.13	-0.09	-0.03	-0.17	-0.02	0.00
Total Investment (% of GDP)	-0.44	-0.44	-0.18	-0.11	-1.19	-1.28	-0.52	-0.33	0.52	1.59	1.14	0.54
Net Exports (% of GDP)	0.73	0.51	0.30	0.19	2.44	1.75	1.09	0.69	-0.07	-0.21	0.64	1.22
Sectoral Shares in Real GDP												
Agriculture (% of GDP)	-0.16	-0.08	-0.08	-0.05	-0.50	-0.25	-0.25	-0.17	-0.03	-0.21	-0.37	-0.39
Industry (% of GDP)	-0.19	-0.07	-0.08	-0.05	-0.59	-0.20	-0.25	-0.17	-0.03	-0.23	-0.45	-0.50
Services (% of GDP)	0.35	0.15	0.15	0.10	1.09	0.45	0.50	0.34	0.06	0.44	0.81	0.89
External balance												
Current Account Balance (% of GDP)	-0.63	-0.54	-0.12	-0.08	-1.90	-1.34	-0.09	-0.13	-0.09	-0.59	0.61	1.09
Fiscal Aggregates												
Fiscal revenues (% of GDP)	0.56	0.39	0.19	0.11	1.83	1.08	0.49	0.30	-0.02	-0.17	-0.35	-0.36
Fiscal expenditure (% of GDP)	0.62	0.42	0.25	0.14	1.62	0.96	0.58	0.36	-0.25	-0.27	-0.17	-0.12
Budget deficit (% of GDP)	-0.06	-0.02	-0.06	-0.03	0.21	0.13	-0.10	-0.06	0.23	0.10	-0.18	-0.24
Debt to GDP	-0.59	0.39	1.15	1.02	-1.58	-0.44	1.31	1.30	-0.27	-1.43	-0.37	1.37

Notes: (*) Average annual growth since preceding period (2020 for first column)

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Chapter 5: Principles for Pursuing a Resilient and Low-Carbon Pathway

This Country Climate and Development Report (CCDR) explores how Morocco can align its development objectives with climate action and embark on a resilient and low-carbon (RLC) pathway, with the objective of reaching carbon neutrality toward the 2050s. For such a transition to materialize, the country would need to carry out a series of investments and ambitious policy reforms, as described in Chapters 3 and 4. This final chapter presents principles that are intended to inform and support the Moroccan authorities in their policy-making processes to synergistically pursue climate and development objectives. These principles have emerged from exchanges carried out with a wide range of stakeholders during the preparation of the CCDR.

Principle #1: Adopt a "Whole-of-Government" Approach

Both climate action and development policies are multisectoral in nature and thus require a "whole-of-government" approach. This CCDR has touched upon a wide array of interlinked sectoral policies, including for energy and water, agriculture, disaster risk management (DRM) and disaster risk financing (DRF), and macroeconomic policy. The actions that are needed for Morocco to engage in the RLC pathway do not only involve central ministries: they will also require concerted action by subnational governments, state-owned enterprises (SOEs), regulators, and the central bank. The level of complexity this challenge represents cannot be tackled through sectoral lenses and under current institutional boundaries. It requires a whole-of-government approach that ensures that climate change is recognized as an intrinsic constituent of the development model, both at the macro and sectoral levels, with enhanced articulation between the different levels of jurisdictions. A case in point are the actions needed to simultaneously address the challenge of water scarcity and the decarbonization of the economy, as emphasized in this CCDR. Managing the water-energy nexus will prove crucial in putting the country on a sustainable and inclusive development pathway: and the current institutional set-up may not yet be well suited for this. In this context, Morocco needs to strengthen its coordination mechanisms both horizontally and vertically.

Multisectoral coordination could be strengthened. As emphasized in the New Development Model (NDM), Morocco needs to put into place mechanisms to break the silos between sectoral and cross-cutting ministries, and facilitate the coordination of planning and policies across multiple sectors. The following measures could contribute to this objective on the climate front: (i) adoption of a single climate policy that is coherent with existing relevant strategies and nationally determined contribution (NDC) commitments, to which line ministries would align their future sector strategies and pluriannual programs (PdPs); (ii) ensuring a review of the strategies and PdPs of key ministries relevant to the implementation of the climate policy, perhaps by the newly created Ministry of Investment, Convergence, and Evaluation of Public Policies; (iii) fostering inter-ministerial collaboration on cross-cutting challenges (energy, transport, and education for electric transport; water, agriculture, and energy for decarbonized rural productivity), and possibly using leadership and behavioral change management tools to foster collaboration, at both the planning and implementation phases.

Local governments (LGs) – both regional and municipal governments – should be empowered to deliver on climate action. LGs have a de jure mandate on key sectors that are highly relevant to climate change mitigation and adaptation.[201] The "Régionalisation Avancée" reform provides an opportunity to promote climate actions by LGs and strengthen the vertical coordination between the different jurisdictional levels (central, regional, and municipal) in terms of planning and investment.[202] However, LGs often lack sufficient financial and human resources to fully take on climate action. Ensuring sufficient and predictable transfers to LGs could reinforce climate action at the local level. Rolling out a comprehensive capacity-building program has been identified as a priority by the LGs.[203]

[201] Regional government competencies cover intermunicipal transport, natural resource management, and the environment, all relevant to climate change. Municipal governments are responsible for waste and sanitation, urban transport, and the distribution of water and electricity, all of which are directly relevant to climate change.
[202] As mentioned by the NDM report, territories represent a spatially coherent platform for climate action to promote intersectoral coordination; better integrate risk considerations into land-use and urban planning processes; and promote data and knowledge sharing.
[203] Conference on « Les Régions du Maroc: Acteurs-Clés du Développement Résilient et Bas-Carbone des Territoires » organized on May 12, 2022 in Ben Guérir.

The public finance management (PFM) system can bring climate action to scale. Through a climate-sensitive budget, green procurement, and environmental fiscality, the PFM system has the potential to systematically mainstream climate consideration into all public actions, and to ensure full alignment of public action with the NDC.

Principle #2: Protect the Most Vulnerable

Poor households tend to be systematically more vulnerable to climate events, but also to climate policies. As shown in Chapter 3, poor households are disproportionately exposed to climate shocks, including droughts and floods, but also to climate stressors such as water scarcity and sea-level rise. They are also the ones that face the greatest challenges in recovering from shocks. Given their relatively low endowment in human capital, these groups may also be the ones that would struggle the most to adjust to climate interventions such as carbon pricing, restriction in water access, and the like.

As Morocco embarks on an overhaul of its social protection system, it has an opportunity to embed climate-responsive features that would allow swift response to people affected by climate-related events and to offset losses in income or assets that could threaten their livelihoods and their wider economic activity. Morocco could identify those groups that are most exposed/vulnerable to different climate events in order to inform the targeting of social protection programs. In addition, it could expand its already sophisticated DRF mechanism for flood protection by including schemes for addressing droughts. This could involve accelerating the penetration of agricultural insurance for small farmers, notably through innovative digital solutions.[204] This could be complemented by a solidarity fund for the uninsured.

The transition to an RLC economy should be inclusive and supported by accompanying measures designed to help those who may lose in the process. This transition may be particularly harmful to vulnerable households and firms that don't have the adaptative capacities to quickly adjust to the changes. Climate interventions on both the adaptation and mitigation fronts need to be carefully crafted to ensure that they properly take into account the specific vulnerabilities of certain groups; that they avoid exacerbating social disparities; and that they contribute to an inclusive transition. For instance, small farmers in rainfed agriculture, who have limited coping options, will be the most exposed to the impacts of water scarcity: training them to adopt climate-resilient practices (including no-tillage) or to transition to new labor opportunities would reduce their vulnerability. On the mitigation side, there will be a need to prepare workers for the green jobs of the future through skilling, upskilling, and reskilling, by putting into place incentives in the educational and vocational systems to reorient programs toward the shift in skills needs.

Climate migration should be embedded in public policies. Climate change will likely trigger domestic migration (up to 1.9 million migrants estimated by 2050). Climate in-migration hotspots will coincide with major coastal urban centers (including Agadir, Rabat, and Tangier) which will also be facing the challenge of sea-level rise. Expanding coastal cities will need to consider climate-resilient and inclusive urban planning, while accounting for scenarios that place urban infrastructure and key economic activities under increasing strain, with more people at risk. While adaptive measures can help to limit the number of climate migrants from rural areas, Morocco will also need to continue to pursue economic diversification and transformation.

Principle #3: Strengthen the System of Climate Information and Analysis

To best inform its decisions on climate actions, Morocco should develop a robust information system. A robust information system is the foundation for effective climate action when it comes to preparedness as well as responses to shocks and long-term stressors. Generating, compiling, sharing, and analyzing reliable information on climate indicators represents a public good that informs effective decision-making processes, both public and private, and therefore fosters climate action by reducing the level of uncertainty.

Reliable climate information is key to properly preparing and responding to climate change. Preparedness and timely response to climate shocks and stressors depends heavily on the availability and quality of information related

[204] Notably the index-based agricultural insurance systems using new digital technologies (earth observation, Big Data, etc.).

to risks and exposure. Having a data system that can be shared across stakeholders can support a more holistic and coordinated approach to risk management and response to disasters. It can also help further understanding of the many facets of various risks and their potential interlinkages. For example, climate risks have the potential to occur in parallel, or in combination with other external shocks (economic recession, pandemics) which can have a compound effect, exacerbating the socioeconomic and financial impacts in nonlinear ways, and disproportionately affecting the poor and the most vulnerable.

Reliable climate information can unlock investments in adaptation. One of the key barriers to investment in adaptation relates to the lack of availability of robust information on climate trends at the local level, and the associated level of uncertainty. Generating and sharing information and knowledge on climate risks could help private operators take informed risks and thus unleash a financing flow to the adaptation agenda that represents a global public good that could lower risk.

It is important for Morocco to build up a national water accounting system, in a participatory manner. Given the centrality of water resources to the Kingdom's economic and social development, Morocco could develop a robust and reliable data system to monitor the availability of water resources (surface, groundwater, and non-conventional) as well as water uses of different sectors. This would help decision-making in the field of water resources management, particularly with regard to the allocation system but also of investment planning.

Climate policies can have complex long-term impacts that need to be analyzed ex ante in order to inform decision-making processes. Governments across the world are increasingly relying on sectoral, macroeconomic, microeconomic, and financial models to anticipate the impacts of climate policies. Various modeling approaches have already been developed in coordination with the authorities in the context of this CCDR, but this remains a preliminary effort; more work is needed to reinforce the analytical architecture currently in place and to inform the decision-making processes to adequately address the climate challenge.

Principle #4: Unleash Innovation

Transitioning toward an RLC pathway will require embracing innovative solutions and technologies. Innovation and clean technologies are core to addressing the challenges of climate change; and they can also spur productivity and competitiveness gains. The private sector is particularly well-placed to deliver on this agenda but in order for them to do it, Morocco will need to put into place a conducive policy and regulatory framework for clean technology development and dissemination. On the mitigation front, Morocco has demonstrated its capacity to adopt innovative solutions in the renewable energy fields; however, regulatory barriers have constrained their full deployment. On the adaptation side, the recurring droughts and water scarcity challenges call for a transformation of the agricultural sector (most notably its rainfed segment): public and private partnerships could be established to foster agricultural R&D and innovation systems to promote the development of climate-smart technologies and practices. The public and private sectors could also join forces to disseminate such innovations to farmers through extension services in order to sustain productivity growth in the face of climate change.

Principle #5: Stakeholder Engagement

Climate action needs the engagement of all stakeholders. All actors of the society (public entities, the private sector, and civil society) are expected to contribute to climate action. Creating space for exchanges and coordination between these entities can foster dialogue that will help to accelerate the deployment of climate action at both the national and local levels.[205] Partnerships between the public sector, private operators, and academia have already shown results in innovation in Morocco.[206] Engaging with all stakeholders and making information on climate change widely available through targeted communication campaigns will prove essential to triggering the behavioral changes that will support the transition to an RLC path.

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[205] For instance, 4C Maroc is a platform for dialogue and capacity building on climate change, bringing together public administration, the private sector, civil society, and academia.

[206] The Euromed University of Fez, the Fez-Meknes Region, the CGEM Fez-Taza, the Alten Maroc Company, the Digital Development Agency, and the Ministry of Industry and Trade have launched the Fez Smart Factory Project, which aims to develop an innovation ecosystem for Industry 4.0.

Conclusions

This CCDR shows that Morocco can pursue a path that could contribute to achieving climate and development objectives in a synergistic manner. Climate change is already impacting Morocco, and in the absence of reforms the economic and social costs associated with climate-related events are likely to increase over time. Nevertheless, this CCDR overall shows that climate action can have a positive impact on GDP and can contribute to accelerating progress toward Morocco's development goals. Embarking on a resilient and low-carbon (RLC) path could help Morocco achieve its climate goals while also addressing the structural bottlenecks and boosting its economy and the well-being of its population. Doing so will require massive investments, but also sectoral and structural reforms in line with those put forward in the New Development Model (NDM) report. The government will need to set clear strategies and put into place an enabling environment so that the private sector can fully participate in the RLC transition. It will also be important to ensure an equitable and just transition by putting into place compensatory measures for those households and firms that may be adversely impacted.

Beyond the domestic benefits, a resilient and low-carbon path could contribute to positioning Morocco as a global climate champion. The RLC pathway, as described in this CCDR, could indeed have positive spillovers to Morocco's trading partners. On the decarbonization side, Morocco could become a regional exporter of clean energy; it is also well positioned to respond to the global demand for low carbon products such as fertilizers, and other environmental goods, for example electric vehicles. Innovation in water management, and disaster risk solutions are also seen as good practices with great potential for replication, both regionally and globally.

Annex

Table 14: Streamlining Climate Change in Morocco's New Development Model (NDM)

Axes	NDM Priorities	Climate-related risks	Climate-related opportunities
Axis 1: Towards a productive and diversified economy	Foster entrepreneurship Direct economic actors towards productive activities Realize a competitiveness shock Establish a macroeconomic framework to the service of growth Foster the emergence of social economy	Fiscal burden and debt: The rising frequency and severity of weather-related disasters could place additional pressures on public finances, both through the revenue and the expenditure side, and erode fiscal space, thus affecting the future evolution of the already high levels of public debt inherited from the COVID-19 crisis. The resulting need to finance larger deficits could intensify crowding out effects. Macro-volatility: Erratic rainfalls have become a major source of macroeconomic volatility and despite massive investment, GDP remains highly correlated to ag performance, being largely correlated to rainfall patterns. Physical risks: Coastal erosion and floods put critical infrastructure at risk and will challenge critical sectors such as industry and tourism. Transition risks: The materialization of transition and adaptation risks could deteriorate the quality of banks´ assets, which already have inherited a high rate of non-performing loans from the COVID-19 crisis. Energy costs: The NDM expects green energy to lower production costs and bring about competitiveness gains. This is possible (see chapter 3) but depends on the evolution of investment costs of low carbon technologies, including for power generation.	Competitiveness: Helped by a good quality infrastructure, the decarbonization of the economy could fuel Morocco´s integration into global value chains and support the emergence of regional and international hubs. Balance of payment: Decarbonization could reduce Morocco´s exposure to international shocks (through international energy prices). It will also reduce commodity imports and could potentially turn Morocco into an energy exporter. Private Investments: Morocco could position itself as a green champion, which could help attract FDI A relatively large stock of internal savings and the introduction of de-risking tools (such as the Mohammed VI fund) could help channel domestic investment toward green activities. Climate-friendly entrepreneurship: Promoting and incentivizing entrepreneurship and small business ventures in key areas of climate-friendly/neutral industries could spur economic growth and innovation. Water tariffs: A water tariff reform, as preconized by the NDM, could rationalize the usage of scarce water resources, while alleviating pressures on public finances (for operation & maintenance of, and potentially investments in water infrastructure).

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Axis 2: Towards a reinforced human capital	An education of good quality for all Performance-based superior education, vocational training, and research systems Good quality health systems	Food security: Agriculture production is heavily correlated to rainfalls and food security can be challenged during dry years Health: Climate change could intensify existing health threats and create new ones, including infectious diseases and water-borne illnesses (such as dengue fever, malaria, or schistosomiasis). Climate related natural disasters could cause more injuries and premature deaths. Health systems and infrastructure are vulnerable to extreme climate events. Education: Climate events can cause potential damage to school infrastructure and/or roads to schools thereby affecting access to education. Some pupils may have difficulty returning to their studies. Productivity: the increasing number of “hot days” could adversely impact the labor productivity (in addition to the associated health issues they could pose), thus affecting long-term economic growth.	Education: Building and changing school curriculum at relevant levels helps with the opportunity to educate school kids and broader community on climate change which can lead to adaptation to climate change and a resilient/well-prepared community. Skills: The reform of the various levels of the education system could help the youth gain the skills that are required to work for the sectors that could be boosted by the decarbonization effort. Innovation: The reform of the scientific research system, envisioned by the NDM, could be prioritized towards climate innovation, both on mitigation and adaptation fronts. Notably the reinforcement of agricultural R&D proposed by the NDM could facilitate the adoption of adaptive practices. Reform of the Social Protection system: Morocco has engaged in the universalization of the national health insurance scheme, which could provide a better coverage for climate-induced health risks.

Axes	NDM Priorities	Climate-related risks	Climate-related opportunities
Axis 3: Towards inclusion and opportunities for all	Foster gender equality Youth inclusion Mobilize cultural diversity as a lever for openness, dialogue, and cohesion Ensure a minimum social protection floor	Distributional impacts: droughts floods tend to disproportionally impact the most vulnerable (households and firms) as they lack safeguard mechanisms (incl. insurance) and they may also face the most challenges to recover once shock is over. Women, youth, elderly and disable people groups are particularly exposed. Climate Migration: climate change can undermine the livelihoods in some rural and urban areas, fueling internal migration and exacerbating issues of social exclusion.	Green Jobs: The development of new green sectors of the economy could generate new formal jobs, facilitating the inclusion of women and the youth in the labor market.
Axis 4: Towards sustainable and resilient territories	Foster the emergence of a prosperous and dynamic Morocco of regions Innovative reorganization of subnational governance Foster an integrated land use planning to improve habitat and connectivity Preserve natural resources and reinforce climate change resilience Preserve water resources	Spatial inequalities: Asymmetric trends in water scarcity could exacerbate spatial inequities in Morocco, as well as the urban-rural divide. Sea-Level Rise: Coastal economies, hosting more than 65 percent of the population and 90 percent of industry, are threatened by sea-level.	Advanced Regionalization: The deepening of the decentralization and de-concentration process (régionalisation avancée) could strengthen local capabilities to preserve natural resources and combat the effects of climate change. Local governments: Local Governments are better placed to decide on (i) water resource management, (ii) territorial (and urban) planning, (iii) prioritization of investments to reduce climate-induced risks, (iv) urban transport and housing policies, as well as (v) service delivery for climate migrants

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