

Assessing the energy system impacts of Morocco's NDC and low-emission pathways

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Key Messages

- Morocco has set ambitious NDC targets for 2030, but current climate policies need strengthening to meet NDCs and long-term low-emission strategies
- The energy system needs to be transformed by expansion of RE investment, higher levels of electricity use in transport, industry, and buildings, and a drive to use energy more efficiently
- The low-carbon transition can boost Morocco's economy, attract investment, create new jobs, and reduce energy imports



Introduction

In the last decade, Morocco has positioned itself at the forefront of the clean energy transition, through the ambitious emission pledges presented in COP21 as part of Morocco NDC (Nationally Determined Contribution), the announcement of a 52% renewable energy target in 2030 and the launching of the world's largest concentrating solar power (CSP) plant. Under the NDC, submitted in 2016, Morocco committed to unconditionally reduce its GHG emissions by 17% and conditionally by 42%, below business as usual emissions by 2030. The NDC strategy covers all sectors of the economy and relies heavily on energy sector transformation towards more sustainable energy sources.

There is strong support of climate policy at a high level. Morocco has hosted the UNFCCC Conference of Parties twice, in 2001 and 2016, leading to a

higher commitment to climate policy in the country. The NDC ambition levels are ranked by the international community as among the highest globally and are aligned with the mitigation objectives of the Paris Agreement [1]. Moroccan institutions have also built significant knowledge of innovative renewable energy financing instruments, especially for solar and wind projects. Despite recent policy developments, Morocco's energy consumption is dominated by fossil fuels (which are imported due to the lack of domestic hydrocarbon resources), while the expansion of coal-fired generation raises new concerns for rapidly increasing emissions.

The briefing provides a quantitative model-based analysis of the energy system and socio-technical and financial implications of implementing the Morocco NDC targets by 2030 and low-emission transition by 2050. The NDC implementation is based on electricity sector

transformation with rapid up-scaling of renewable technologies combined with elimination of coal-fired plants. Implementing the Moroccan NDC can pave the way towards the structural transformations required to ensure compatibility with the Paris Agreement. Morocco has vast renewable energy resources that can be exploited to replace fossil fuel use in and beyond the power sector, and thus the policy ambition can further increase focus on expansion of renewable energy combined with storage, acceleration of energy efficiency, and electrification of energy services. As Morocco's economy depends heavily on hydrocarbon imports, opportunities abound to reduce its energy import bill by developing domestic renewable energy and reducing fossil fuel consumption. Our research highlights the key challenges and opportunities for Morocco's transition and provides key policy-relevant messages and recommendations on how to im-

plement its NDC for 2030 and even raise its climate ambition towards a long-term low-emission development.

Study Design

As the energy and transport sectors represent more than 90% of Morocco's CO₂ emissions and Morocco's mitigation goals rely in large part on the energy sector transformation [2], the policy brief analyses future energy system development under alternative climate policy scenarios. In line with Morocco's NDC, the study considers a business-as-usual (BAU) scenario that includes only currently implemented policies and does not consider the measures included in country's NDC. The study analyses the impacts, costs, and benefits for Morocco to achieve its (conditional and unconditional) NDC targets for 2030, and also quantifies long-term low-emission pathways for Morocco, in line with mitigation pathways of the IPCC Special Report on 1.5°C [3].

The climate policy scenarios are developed with the comprehensive Middle East and North Africa Energy Demand and Supply (MENA-EDS) model [4–5]. MENA-EDS is a technologically rich energy system model capturing in detail the complex interactions between energy demand and supply. It provides future projections on energy consumption by sector and fuel, power generation mix by technology, energy price formation, policy instruments, required investment, and CO₂ emissions from energy combustion by sector [5].

With currently implemented policy measures, CO₂ emissions from energy use in BAU scenario are projected to constantly increase as a result of high GDP and energy demand growth, ris-

ing standards of living, and limited climate action [1, 6]. Transport and electricity production remain the highest carbon emitting sectors, accounting for 75% of total CO₂ emissions by 2050.

Key Results

Current policies and plans as included in BAU need strengthening to ensure that Morocco meets its NDC targets for 2030 (**Figure 1**). Our analysis shows that the policy ambition can be raised in Morocco, facilitating the uptake of renewable energy and energy efficiency and the phase out of coal-fired power plants.

The cost-efficient implementation of Moroccan NDC targets is based on electricity sector transformation with rapid up-scaling of renewable technologies (solar PV, CSP, and wind power) combined with elimination of coal and oil-fired power plants. Gas-fired Combined Cycles support the large-scale deployment of variable renewables and provide an important flexibility option to the system. Accelerated energy efficiency improvements resulting directly in lower emissions are also a major pillar to meet NDC targets; this is facilitated by the

uptake of more efficient energy carriers in end-use sectors, the removal of fossil fuel subsidies, energy savings in buildings (energy labelling, energy efficiency cook-stove program, low-consumption lamps, efficient building envelopes), transport improvements (uptake of EVs, taxi renewal programme, public infrastructure in urban centres), efficiency standards in industries, and the uptake of efficient appliances, equipment, and cars.

Implementing the Moroccan NDC can pave the way towards the structural systemic transformations required to ensure compatibility with Paris Agreement goals. As Morocco has vast renewable resources that can be exploited to replace fossil fuel use in and beyond the power sector, the climate policy ambition can further increase, focusing on electricity sector restructuring with high expansion of renewable energy and acceleration of efficiency improvements in all demand sectors (**Figure 2**). As power generation decarbonizes well before 2050, the increased electrification of energy services becomes an increasingly important strategy to reduce emissions, e.g., through uptake of electric vehicles that account for 50% of

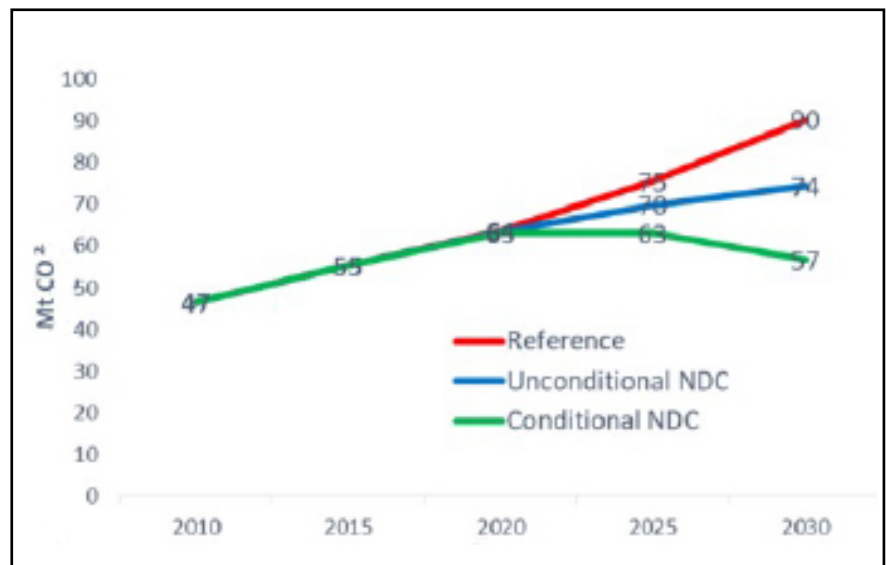


Figure 1: CO₂ energy-related emissions over 2010–2030 in Morocco in BAU and NDC scenarios

passenger cars in 2050. The rapid upscaling of mature, market-ready technologies (i.e., solar PV, wind) to more than with the deployment of new options, (i.e., storage batteries, electric vehicles, carbon capture and storage, advanced biofuels) can significantly reduce CO₂ emissions close to net zero by 2050. But this requires an up-scaling of the NDC effort and ambitious climate policy. Renewable energy deployment can contribute to economic development in Morocco, attract investment, and boost the industrial sector.

As Morocco’s economy depends heavily on hydrocarbon imports, opportunities abound to improve its energy import dependence and enhance energy supply security by developing domestic renewable energy and reducing hydrocarbon consumption. Morocco can benefit from reducing GHG emissions as production facilities of green industrial products (e.g., solar panels, wind turbines) are already in place in Morocco and their contribution in Moroccan GDP would increase creating new employment opportunities.

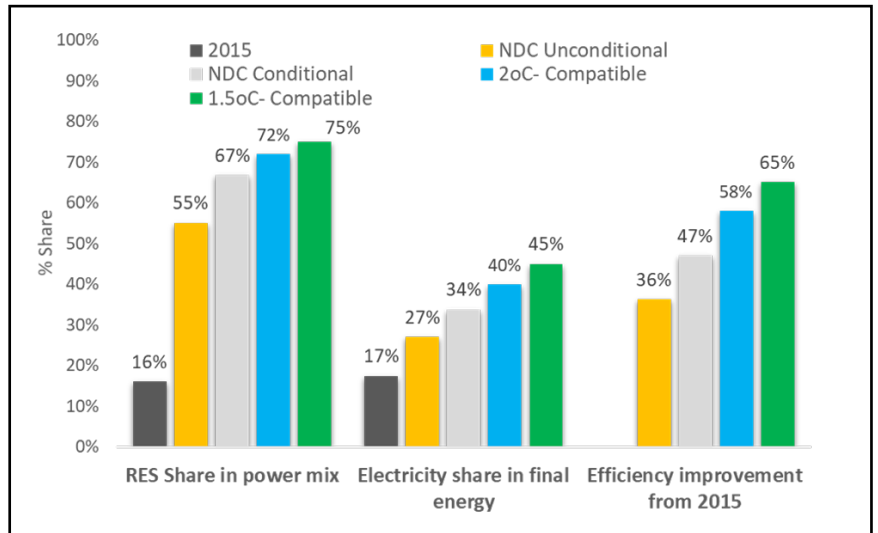


Figure 2: Energy system indicators in alternative climate policy scenarios in Morocco in 2050

Conclusions and Policy Recommendations

With a young and growing population and plans to continue developing and diversifying the economy, a committed low-carbon energy strategy for the medium and long-term can be developed largely based on renewable energy, electrification, and energy efficiency. Climate policy and renewable energy deployment contribute to the development of the economy, create new, quality jobs, and boost investment and the industrial sector of Morocco. The domestic manufacturing of clean energy technologies, the

exports of RE-based electricity and the reduced fossil fuel imports bring important growth opportunities for Morocco.

Morocco has only renewable energy targets for the electricity sector. With a view to meeting SDG7 and increasing the share of renewable energy in primary energy mix, Morocco is encouraged to set targets and policy measures for the use of modern renewables in residential and transport sectors. This will strongly promote the reduction of fossil fuel use and emissions across the economy, which comes with co-benefits in terms of reduced air pollution and energy imports and stimulating investment.

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Notes

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