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Allianz Research

Africa´s journey to net zero: USD7trn just for energy

Summary

Markus.Zimmer
Senior Economist ESG
markus.zimmer@allianz.com

Arne Holzhausen
Head of Insurance, Wealth and Trend Research
arne.holzhausen@allianz.com

Stefan Landau
Research Assistant
stefan.landau@allianz.com

Patrick Hoffmann
Research Fellow

- The green energy transition is a once-in-a-lifetime opportunity for African development, a chance to reduce poverty and lift growth potential. To reap this opportunity, there are three levers to pull: strengthening political stability and the rule of law, reducing project risks by adopting blended finance, and formulating clear green-energy strategies backed by economy-wide transition plans with sector-specific pathways. This paper aims at the last point, providing guidance for governments and investors alike.
- Limiting global warming to the Paris target of 1.5°C will require USD200bn of investments in the African energy system per year, by 2030, followed by USD370bn per year, by 2050. In total, the investment opportunity adds up to just over USD7trn between 2020-2050.
- On that journey to net zero, two subsectors are pivotal. First, Africa's electricity-production capacities will have to increase tenfold by 2050, requiring USD110bn of investment per annum as early as 2030, which then would need to increase to USD190bn in 2050 to meet the goal of limiting the global temperature increase to 1.5°C. Second, yearly investment needs in the African hydrogen market will have to reach USD2-3bn per year in 2030 and USD4-9bn in 2050. African countries feature a promising combination of resources, coastal access and favorable location, positioning the continent as a potential central hub for the hydrogen-based global economy. Note that hydrogen investments in Nigeria are set to be significantly higher than in most other major African economies and will already reach USD2bn in 2040.

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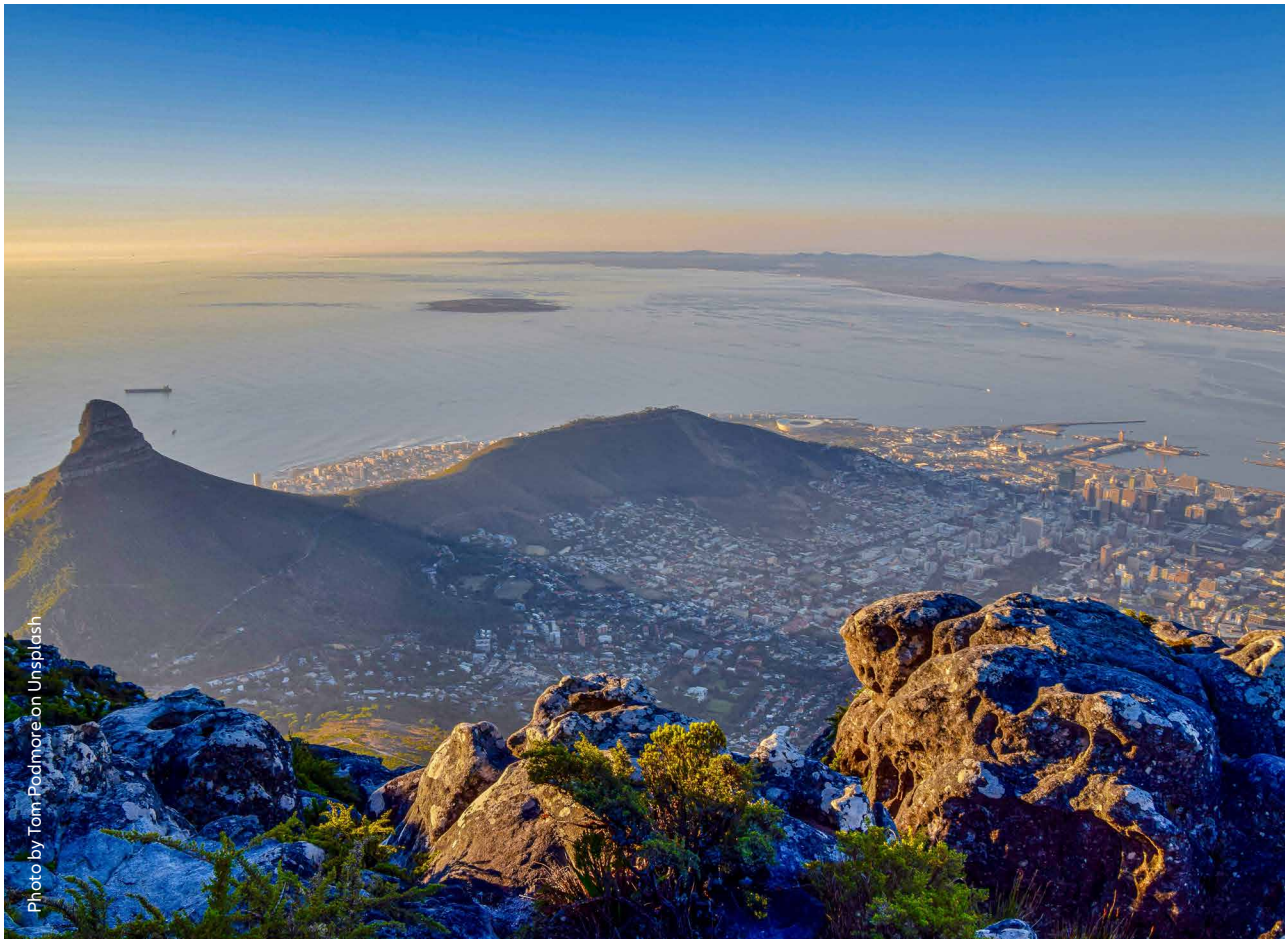
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Private investment for a clean African future

Global warming is the largest threat to humanity and a major driver of poverty and inequality, conflicts and violence. Nowhere is this more true than in Africa, which is at the epicenter of the climate crisis: Although the continent contributed the least to global warming, it is burdened with the highest impacts and losses.
An African energy transition would not only mitigate climate change but also reduce poverty by increasing labor productivity, agricultural yields, water availability, food security and human health. Moreover, while mainly low-skilled jobs in "brown" sectors would be lost, higher-skilled jobs in "green" sectors would be gained, potentially leading to much higher human capital levels. In a nutshell, the energy transition provides tremendous development prospects for African countries.

Climate scenarios

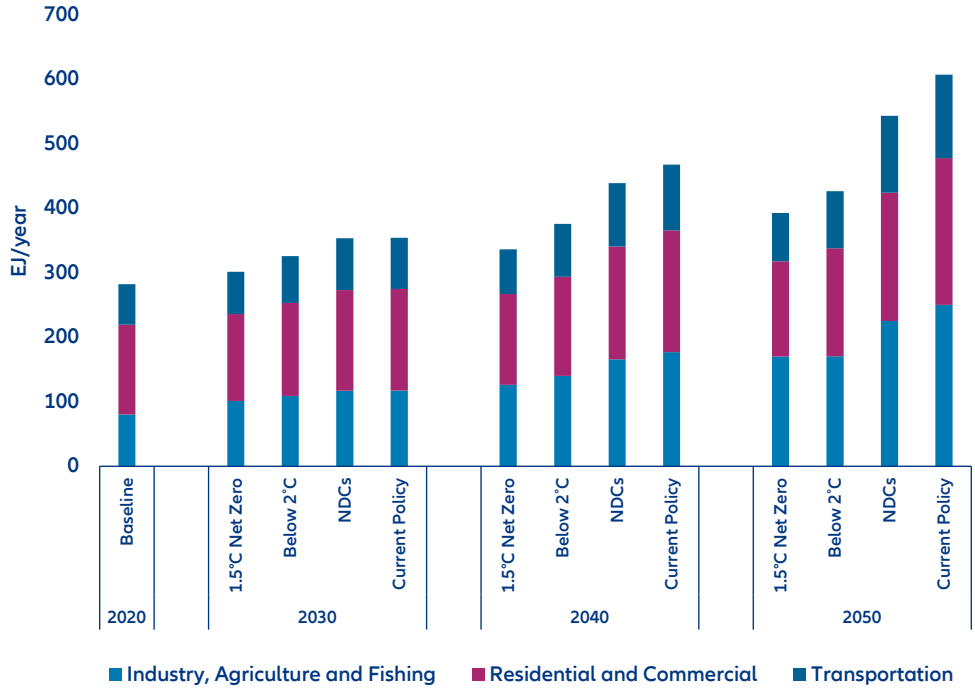
This report features four different climate scenarios. These are not forecasts, but projections in which the economic development and activity is consistent with a certain global warming level. For the scenarios with higher temperature increases, the period after 2050 that is not featured is of particular importance as well:

- 1.5°C Net Zero is a scenario in which global warming is kept below 1.5°C with a 50% probability. The carbon budget for additional CO2 emissions past 2020 is limited to 500Gt and net-zero emissions (the state in which "negative emissions" through carbon capture and storage (CCS) activities offset the remaining residual emissions) are globally reached in 2050 at the latest. This scenario represents the necessary ambition level to avoid thresholds that might trigger tipping points that induce cascade effects, and as a result lead to the materialization of the uncertainties in the "fat-tails" of the distribution that that are associated with catastrophic damages.
- Below 2˚C is a scenario in which global warming is kept below 1.8°C with a 50% probability, and below 1.9°C with a 67% probability. The carbon budget for additional CO2 emissions past 2020 is limited to 1000Gt. This is the global warming level in which climate-change-induced damages are higher than the mitigation costs even without triggering any tipping points for global catastrophic events.
- NDCs relates to the 'Nationally Determined Contributions', which are the climate commitments that have been submitted by countries in the process related to the international climate negotiations. It represents the current policy announcements. In this scenario, global warming is kept below 2.6°C with a 50% probability, and below 2.9°C with a 67% probability. The carbon budget for additional CO2 emissions past 2020 is limited to around 2500Gt.
- Current Policy is a scenario in which no additional climate policy is enforced compared to the 2020 state of climate policy. It is thus not a representation of the policies that are likely to be seen, but a step back from the current policy path. In this scenario, global warming is kept below 3.0°C with a 50% probability, and below 4.1°C with a 67% probability. The carbon budget for additional CO2 emissions past 2020 is limited to around 4300Gt.

Thus, the case for the green energy transformation in Africa is overwhelming. But so are the obstacles. In general, investment needs relative to local GDP are larger than in advanced markets. At the same time, most countries lack the financial capacities to implement the necessary investment paths for the energy transition as local funding resources are insufficient. International capital could be the solution but access to foreign financing is limited: factors such as political instability and weak rule of law frequently act as red flags.

However, the time for action is now. Investments in clean energy have declined in recent years in many emerging markets, not least due the Covid-19 pandemic. If this path continues in the next decades, we will see expansive growth of emissions and Africa might follow the high-carbon pathways that today's developed economies took in the past, particularly as its final energy demand is set to grow in all scenarios (Figure 1). This would not only undermine global efforts to reduce emissions but would also be a great missed opportunity: The costs of clean-energy technologies have come down tremendously in recent years, offering new opportunities for jumping ahead and transitioning to clean energy sources at grand scale without jeopardizing economic aspirations. The future of the African energy sector has to be shaped today.

Figure 1: Final energy demand by sector in Africa's 10 largest economies



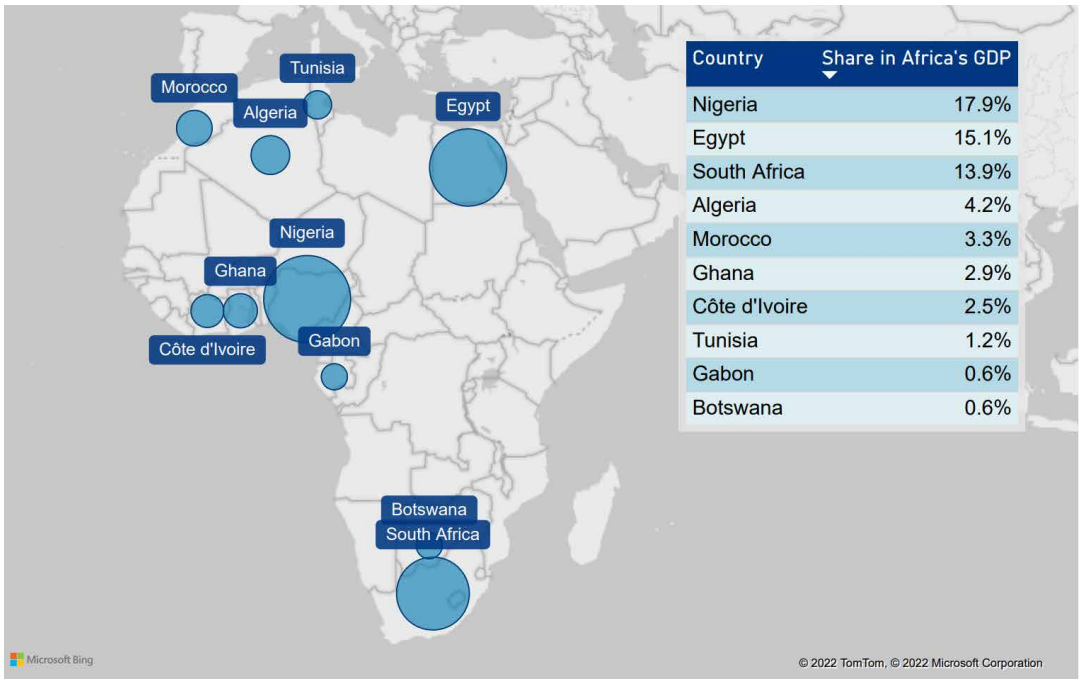
Sources: NGFS, Allianz Research. Climate scenarios described on page 5.

So what needs to be done to reap this once-in-a-lifetime opportunity for African development? It boils down to one crucial question: How can the private capital of advanced economies – which is plentiful at more than EUR200trn – be mobilized for investing into the green transition in Africa? Naturally there is no silver bullet and most of the required actions have to be done by the countries themselves, i.e. strengthening institutions and political governance and changing policies and regulations to provide a suitable investment climate.

But even these actions might not be sufficient. From the perspective of private investors, risk-adjusted returns might still be too low. There is solution to this dilemma: Multilateral lenders and developing finance institutions could lower risks by taking mezzanine positions in blended finance vehicles; this would make a multitude of transition projects more viable for private investors.

Thus, what is really needed is that developing economies in Africa, advanced economies and private investors join forces: Public-private partnerships are the name of the game to foster the African energy transition.

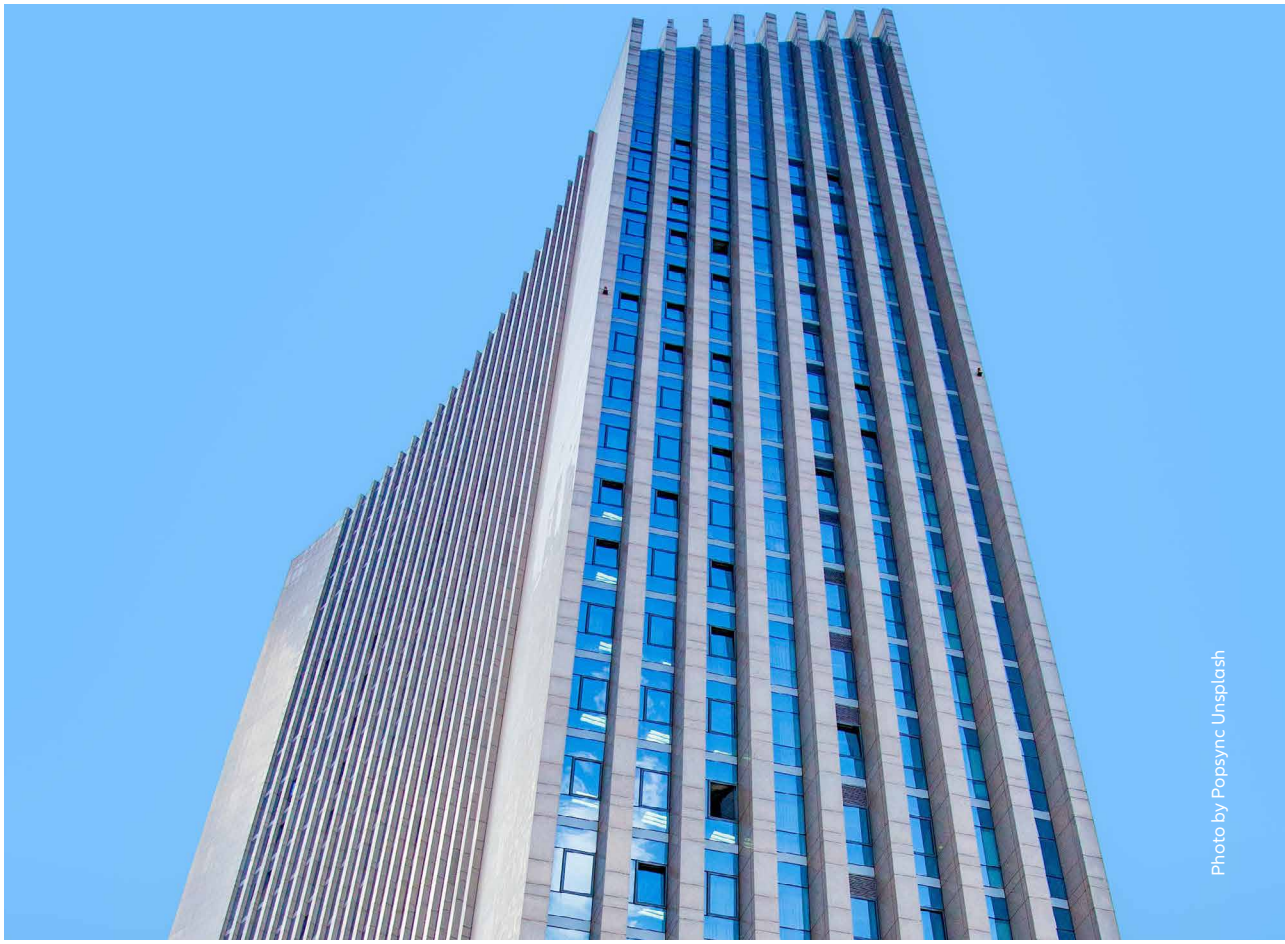
Figure 2: The ten largest African economies by their share of GDP (in %)



Country	Share in Africa's GDP
Nigeria	17.9%
Egypt	15.1%
South Africa	13.9%
Algeria	4.2%
Morocco	3.3%
Ghana	2.9%
Côte d'Ivoire	2.5%
Tunisia	1.2%
Gabon	0.6%
Botswana	0.6%

Source: Allianz Research. 2020 GDP in current USD.

Still, one challenge remains: reaching the aspired implementation speed. Often high ambitions are confronted with a lack of knowledge on the very basics of what has to be done where and when. Only clear green-energy strategies and goals backed by economy-wide transition plans with sector-specific pathways, coupled with clear implementation policies, can provide the necessary guidance and unlock private capital. This report tries to shed some light on this issue by providing initial transition plans for the energy sector in the 10 biggest African economies (Figure 2), which together represent well over 60% of Africa's total GDP. Starting an informed discussion from the required scope and scale, governments and investors are welcome to adjust and improve these transition plans, and to then walk the talk with actual projects and investments.



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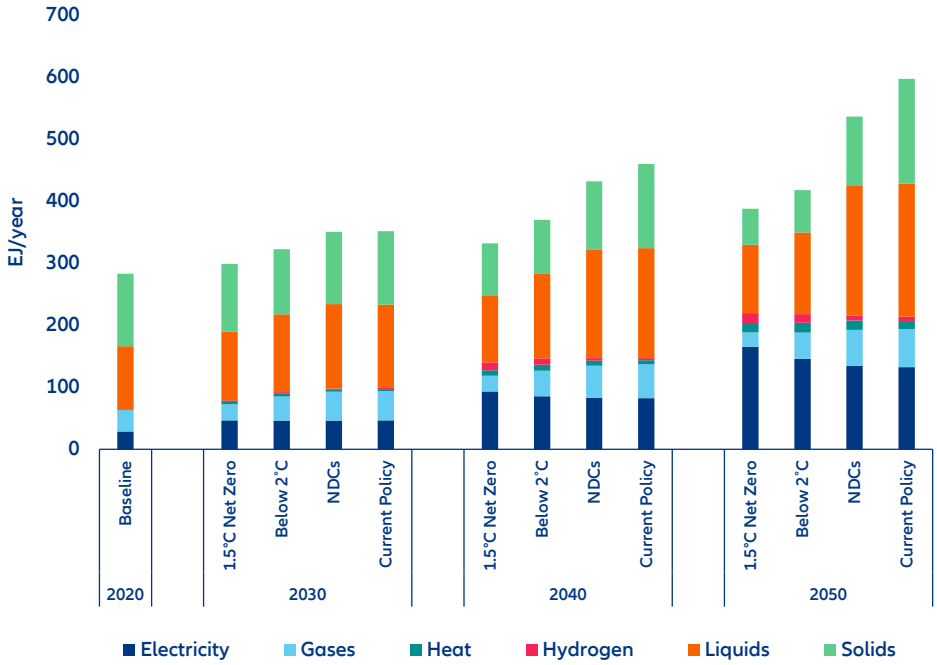
No development without energy

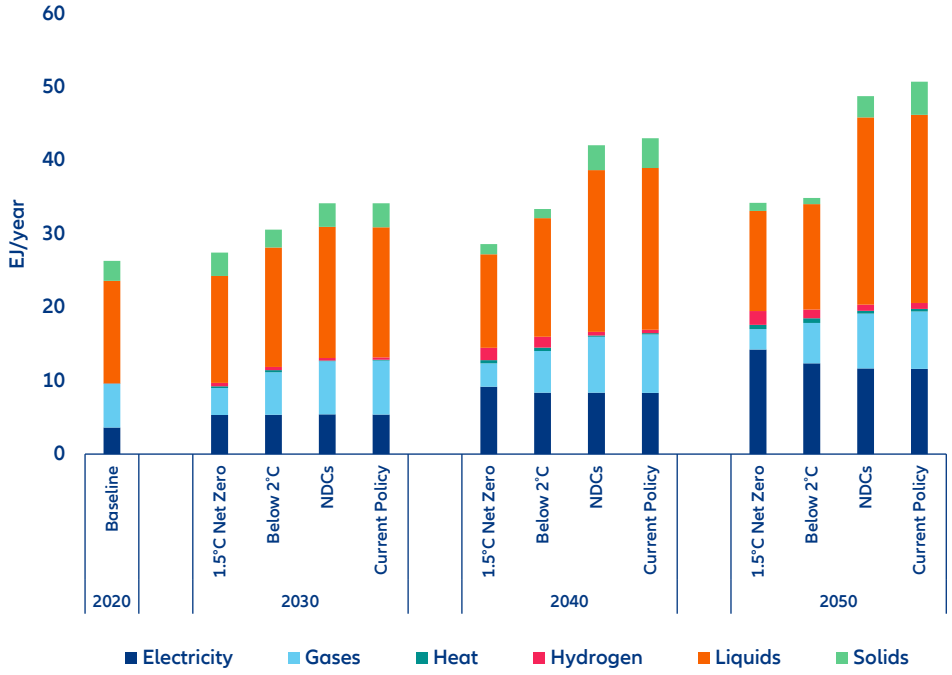
A particular challenge for developing economies is presented in the transformation of the energy sector. As economic catch-up dynamics and the potential continuation of population growth in Africa set the stage for increasing energy demand, investment needs are also rising. At the same time, African economies are facing considerable impacts from climate change. Hence, any investment path under consideration requires a thorough assessment for a sustainable energy transition. Achieving these targets hinges on swift action and the extent of financing available from both the public and private sectors.

Figure 3: Final energy demand by energy source in Africa's 10 largest economies



Sources: NGFS, Allianz Research. Climate scenarios described on page 5.

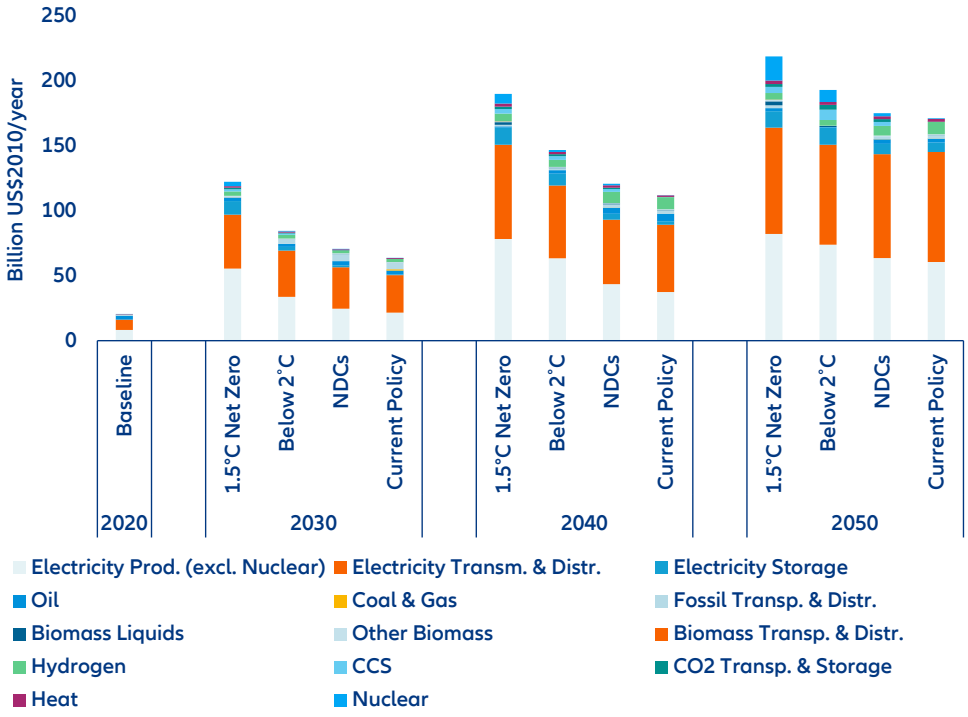
Figure 4: Final energy demand by energy source, Egypt



Sources: NGFS, Allianz Research. Climate scenarios described on page 5.

On the demand side, expectations differ in the four climate scenarios (Figure 3, previous page). As in high-income economies, electrification plays a dominant role in the African energy transition. Electricity demand in the 10 largest African economies (African 10) will increase in all scenarios, reaching more than 100 EJ/year, or more than five times the 2020 baseline. However, aggregate demand shows larger differences between the pathways. Along the 1.5°C energy-transition path, the selected African countries would experience an increase in overall final energy demand, but at the same time reduce their fossil dependence, leading, for instance, to a lower use of solid energy sources such as coal. In the case of Egypt (Figure 4), overall lower demand for energy from coal would decline, but relative demand for liquid energy sources such as oil would increase. If Egypt follows a path consistent with the 1.5°C climate target, energy demand from hydrogen would need to increase as well. The disparities between the developments of gross final energy demand in the scenarios mainly originates from differences in the effort to improve energy efficiency. The 1.5°C and 2°C scenarios assume a significant push in energy conservation, with more efficient industrial processes, means of transport and savings in both commercial and residential sectors. This separation of final energy demand by sector is depicted in Figure 1 for the aggregate of the 10 African economies. In 2020, the highest energy consumption could be assigned to the residential and commercial sectors. Until 2050, energy demand in these sectors is expected to stay almost constant in the low-emission scenarios, while the energy demand in industry, agriculture and fishing will increase. In the transport sector, there are noticeable differences in final energy demand when comparing the different pathways. With efforts to conserve energy in transport via the electrification of the current vehicle fleet and switching towards less energy-intensive modes of transport such as rail, energy demand does not substantially increase even with an increase in population.

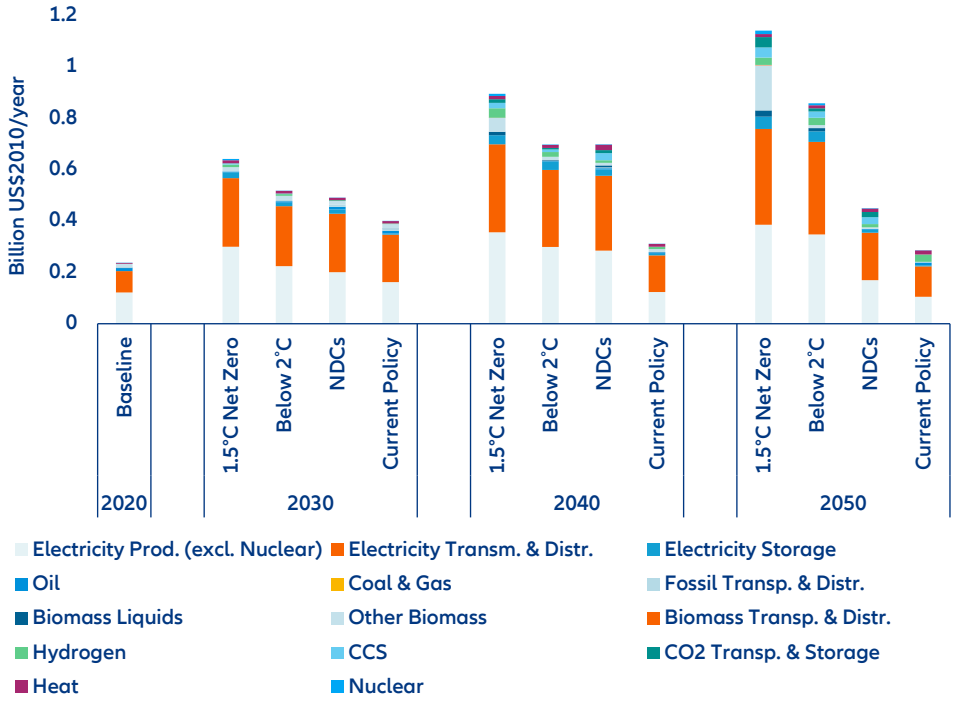
Figure 5: Investment in energy supply in Africa's 10 largest economies



Sources: NGFS, Allianz Research. Climate scenarios described on page 5.
Note: Investment opportunities have been linearly interpolated between time steps. The rest of Africa has been estimated as a compound region that in the analysis featured investment needs of 38% of total African investments. Investment proportions in Africa as a whole are similar to the largest 10 economies.

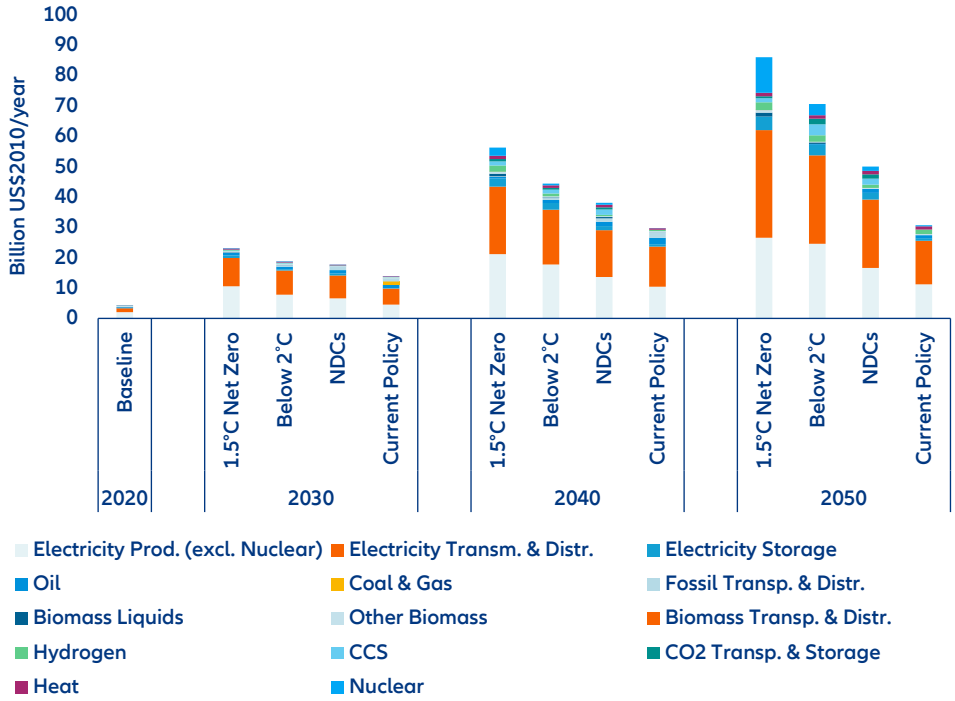
For the largest 10 economies, Figure 5 (previous page) shows the aggregated investment needs for differing energy sources and supply-chain steps by scenario. At USD120bn in 2030, the investment needs in the 1.5°C scenario are sixfold the 2020 baseline. They are also 80% higher than in the 2030 current policy scenario, with the difference being driven by large additional investments in the electricity sector. By 2050, investment needs will increase to USD220bn, given the 1.5°C target. For this target and Africa as a whole, investment opportunities will surpass USD200bn by 2030 and reach USD370bn per year by 2050, adding up to a total of just over USD7trn between 2020 and 2050 (see also note under Figure 5).

Figure 6: Investment in energy supply, Gabon



Sources: NGFS, Allianz Research. Climate scenarios described on page 5.

Figure 7: Investment in energy supply, Nigeria



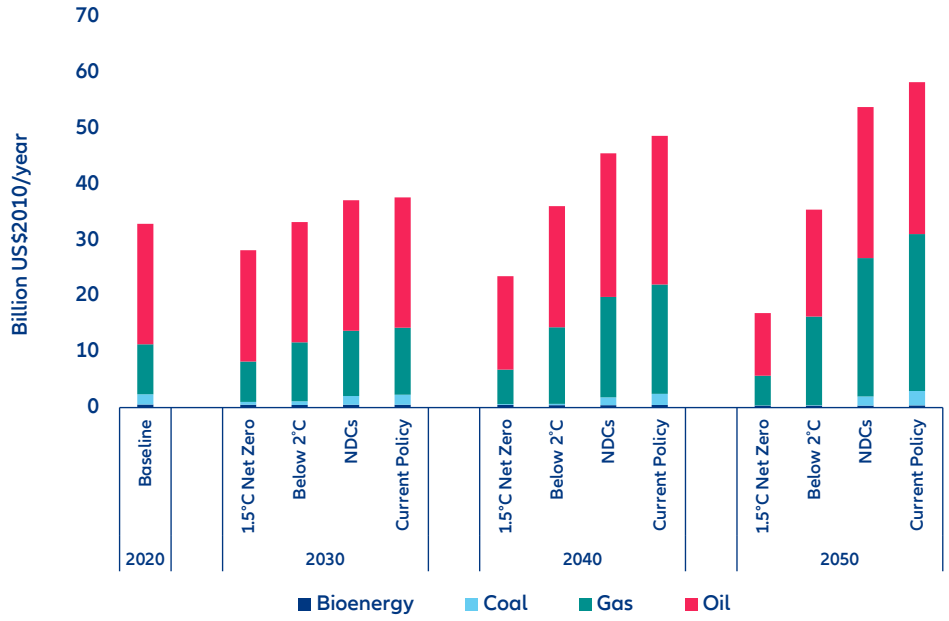
Sources: NGFS, Allianz Research. Climate scenarios described on page 5.

For the supply side, Figure 6 and 7 depict investment efforts in energy supply for Gabon and Nigeria along each of the different climate pathways. In line with the aggregated view in Figure 5, the graphs again show how potential investment strategies are dependent not only on a substantial increase in overall expenditures, particularly for electricity generation, but also on the timing of investments. Yet, the developments in individual countries vary significantly, an observation which will become even more apparent with the further country examples throughout this report.

Scan the QR code and access the app to look at the relevant data for any of the 10 countries analyzed in this report.

A transition in line with the prospect of limiting global warming to below 1.5°C calls for action not only way into the future, but also in the upcoming years. While a path consistent with a backloading of investments is possible, albeit at the expanse of increasing overall costs, the general level of annual investment efforts compared to the 2020 baseline has to increase significantly (more than threefold depending on the scenario). Comparing the investment differences for the four climate scenarios shows sizeable discrepancies between planned and required investment efforts. The annual investment gap between the scenario following current policy commitments and the 1.5°C consistent pathway in Nigeria (Figure 7) amounts to more than double the initial current policy investment in 2040, and three times the size in 2050. For the aggregate of countries (Figure 5), differences between the scenarios are smaller, which indicates that some countries experience a lower investment gap compared to the Paris consistent scenarios than others. Apart from the expansion of electricity-generation capacities, a sustainable energy transition should also include major investments in the provision of the necessary infrastructure for energy transmission and storage. The governments of the selected economies are facing a great challenge as they are required to significantly increase their investment commitments in expanding national power grids, together with additional efforts needed for growing power-storage capacities. For each of the given pathways, infrastructure expansions account for 40-50% of total investments in the electricity sector. This electricity infrastructure is central to any plan for transforming the energy sector. If not in place, it will be difficult to attract the capital needed for investments in renewable energy projects. When looking at both of the depicted countries, there are similar developments required in terms of electricity generation and storage expansions. Differences are observable for the remaining investments, which concentrate on biomass and hydrogen in the case of Gabon and on nuclear power in Nigeria (the investments in the different categories will be further explored and decomposed in the following sections). This demonstrates that while both countries have to increase their investment efforts considerably to catch up with the requirements of the 1.5°C or even 2°C targets, the way in which each country manages their energy transition can vary.

Figure 8: Investment in mining, extracting and processing primary energy in Africa's 10 largest economies



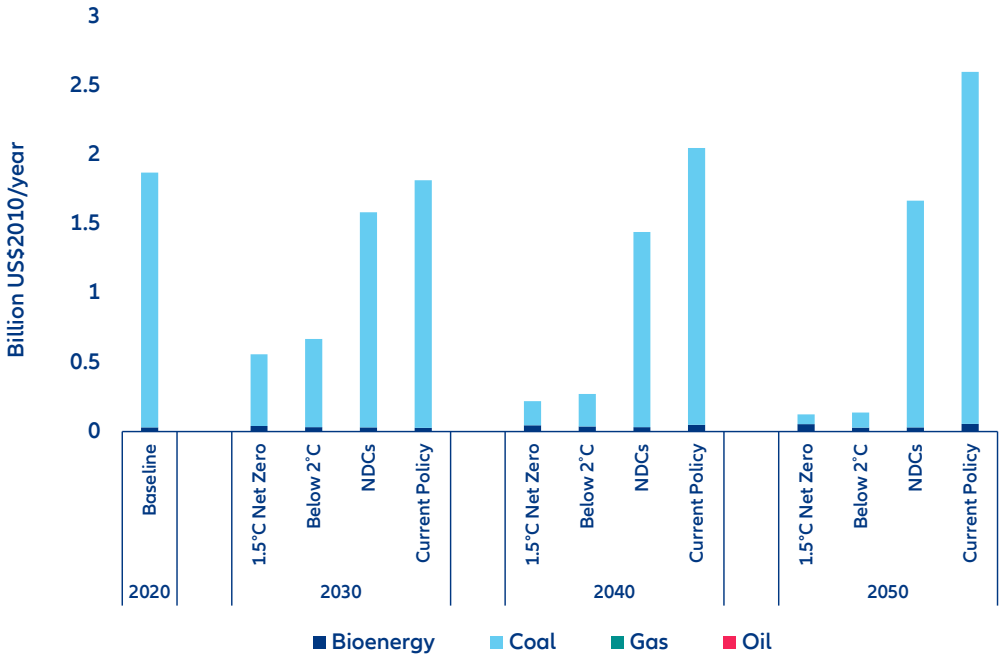
Sources: NGFS, Allianz Research. Climate scenarios described on page 5.

Photo by Chris LeBoutiller Unsplash

Fossil energy, there is life in the old dog yet

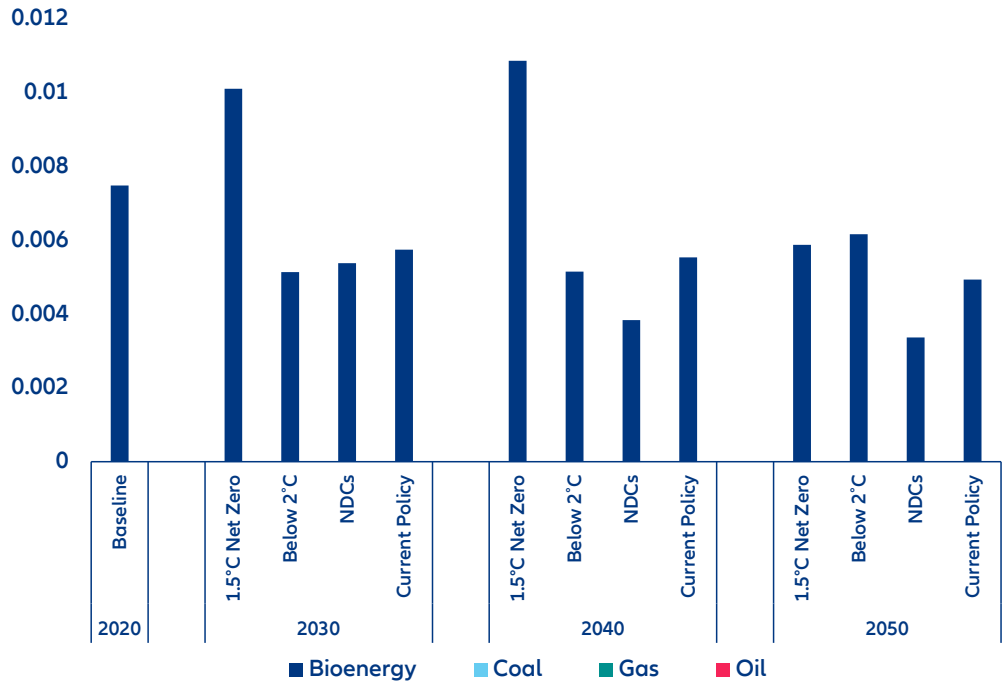
With the immense challenges accompanying the transformation of the African energy sector, the fossil industry will be subject to significant change. A shift towards renewable energy sources and the increasing cost of carbon emissions will put pressure on the profitability of fossil-resource extraction. On the other hand, renewable energy cannot always guarantee a sufficient supply of energy without the necessary means of storage. This will lead to lower, but persistent extraction figures even in climate scenarios aiming for 1.5°C. A look at the joint projected investments in primary energy for the largest African economies in Figure 8 reveals that the majority of investments into fossil-resource extraction is directed at oil and gas. There is some remaining investment projected in the extraction of coal, which stems from the heavily coal-dependent South African economy (Figure 9), but overall investments are concentrated on the other two conventional energy sources.

Figure 9: Investment in mining, extracting and processing primary energy, South Africa



Sources: NGFS, Allianz Research. Climate scenarios described on page 5.

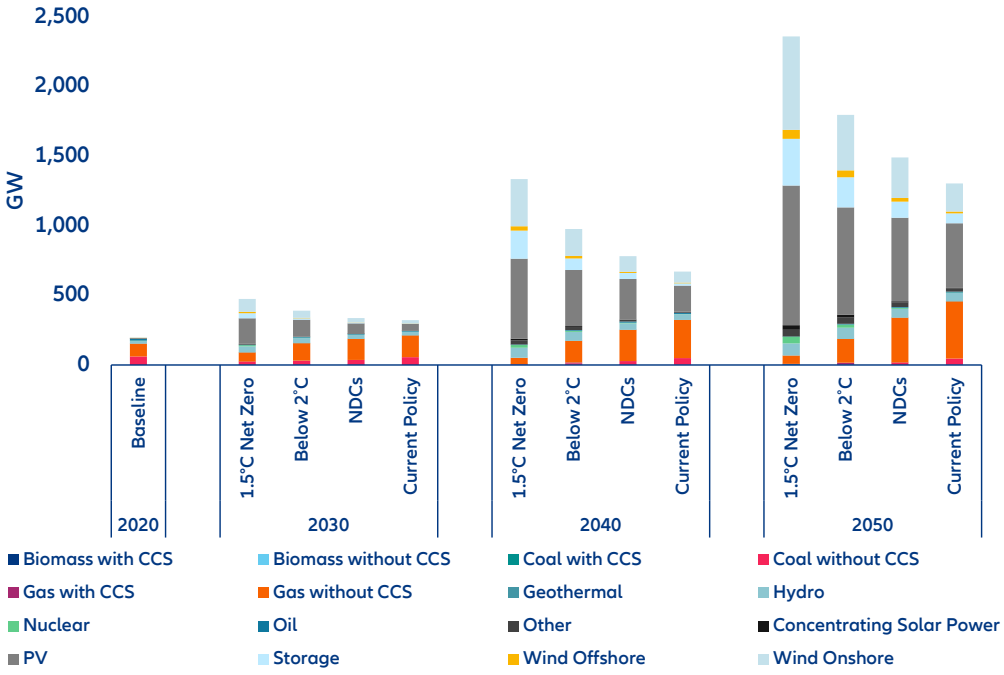
Figure 10: Investment in mining, extracting and processing primary energy, Morocco



Sources: NGFS, Allianz Research. Climate scenarios described on page 5.

Figure 8 depicts that the only scenario for which investments into fossil energy extraction are distinctly decreasing is the 1.5°C consistent pathway. In all other scenarios, investments are either constant (below 2°C) or increasing (NDC and current policy). This could support the notion that replacing all fossil energy might prove difficult in the near future as renewables are not yet sufficient to cover the increase in demand due to their volatile energy yields. In this case, investments into fossil-resource extraction can be partly understood as replacement investments for maintaining the extraction capacities without an increase in overall extraction levels. Besides the investments into coal, oil and gas extraction, there are some comparatively low expenditures directed at the production of bioenergy, which can in many cases act as a direct substitute to fossil alternatives. However, it provokes conflicts with another development goal of upmost importance: the sufficient and affordable supply of food. One country associated with a focus on bioenergy investment in the observed scenarios is Morocco (Figure 10, previous page).

Figure 11: Electricity generation capacities by technology in Africa's 10 largest economies



Sources: NGFS, Allianz Research. Climate scenarios described on page 5.

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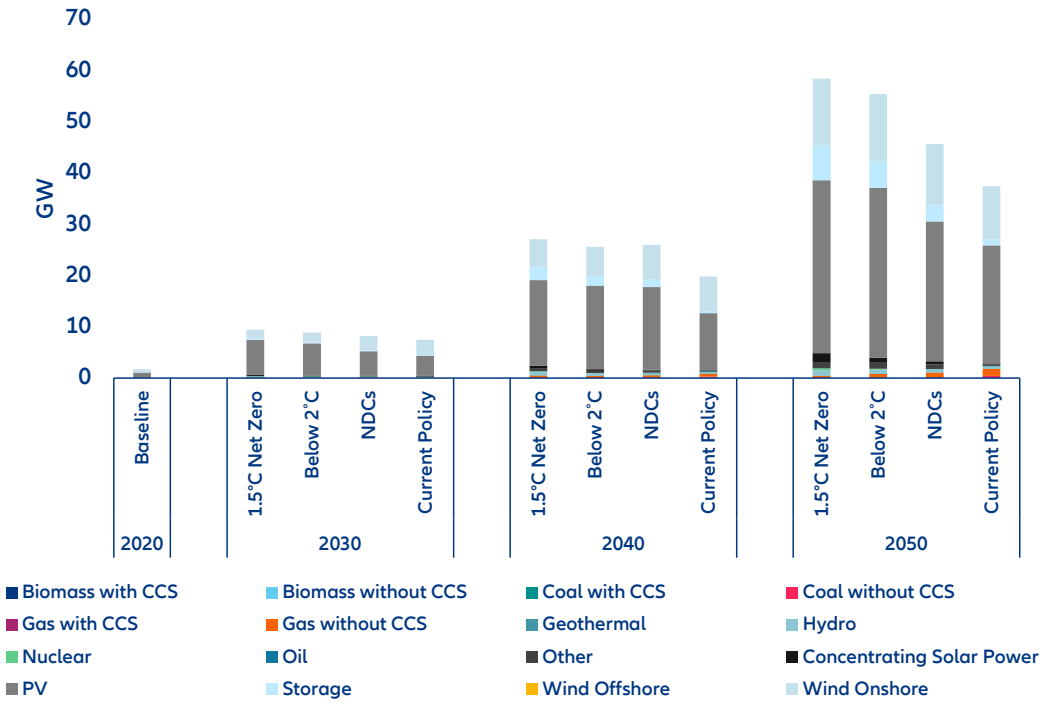
The future is electric

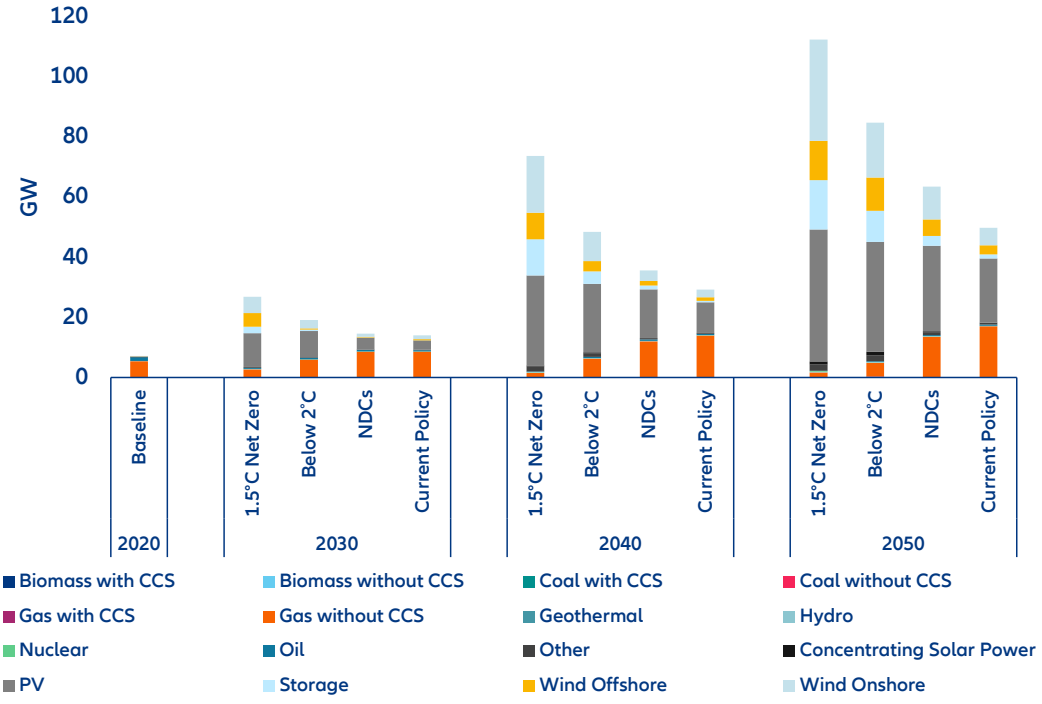
With renewables being among the most cost-efficient options for electricity production, it is not surprising that in all scenarios – even in the current policy scenario – wind and photovoltaic dominate the capacity additions in the 10 largest African economies (Figure 11). This holds true for the country-specific transition pathways as well, though the importance of other power sources – particularly for other renewables – varies significantly, as Figures 14 and 15 show for the case of Côte d'Ivoire and Tunisia. The capacity stock would increase significantly over the years, fostered by decreasing costs for renewable energy and, depending on the scenario, substantial investments in the previous years.

Figure 12: Electricity generation capacities by technology, Côte d'Ivoire



Sources: NGFS, Allianz Research. Climate scenarios described on page 5.

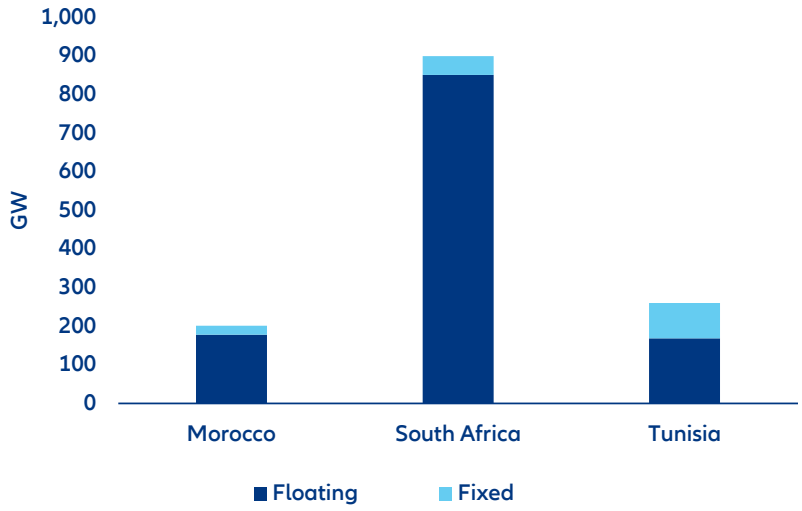
Figure 13: Electricity generation capacities by technology, Tunisia



Sources: NGFS, Allianz Research. Climate scenarios described on page 5.

For the composition of the energy mix, there are some differences between the two portrayed countries, in particular for power generation from offshore wind and the remaining usage of natural gas capacities. The expected capacities for electricity generation in Côte d'Ivoire are dominated by a mix of onshore wind and solar power stemming from photovoltaic power stations. For Tunisia, even when following the 1.5°C consistent pathway, there will be some remaining fossil dependence regarding the usage of natural gas. Another difference for the case of Tunisia concerns the increase in wind power capacities, which includes turbine additions not only for wind onshore but also offshore wind-power generation. This is in line with estimations of existing offshore potential for Tunisia, observed in Figure 13. For the country aggregate we find similar patterns, with strong expansions of renewable-energy capacities specifically along the pathways consistent with the Paris target of limiting global warming to well below 2°C. Importantly, currently planned and promised changes in the electricity sector will leave African countries dependent on fossil energy, with conventional energy capacities accounting for 20-40% of the overall stock even up until 2050.

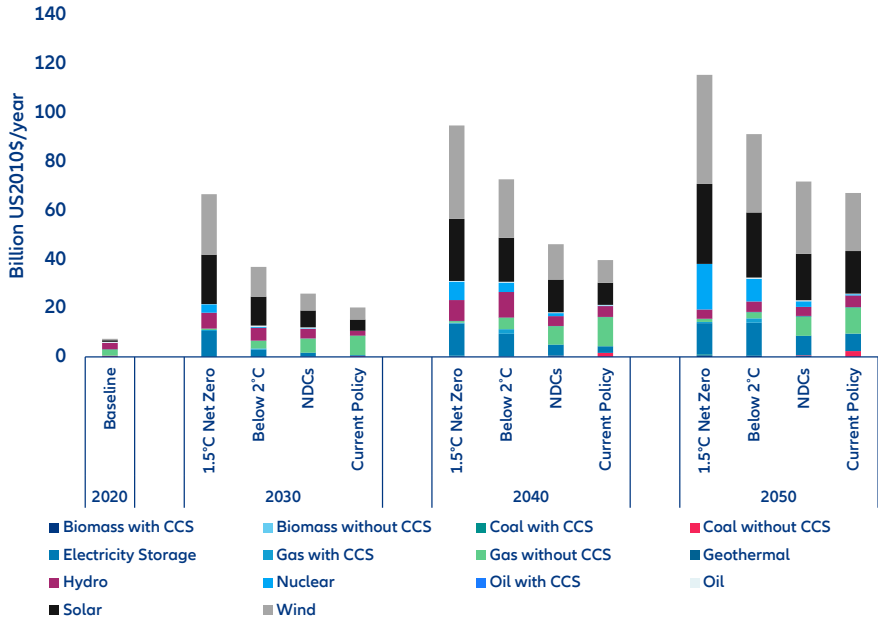
Figure 14: Main offshore-wind potentials, African Economies



Sources: NGFS, Allianz Research. Climate scenarios described on page 5.

Three examples of how the power capacity figures translate into investments are displayed in Figures 16 and 17 in the case of Algeria and Botswana, and in Figure 15 for the aggregate of the 10 largest African economies. Figures 11 and 12 give a detailed view of investments into capacity expansions for power generation, the biggest component of energy sector investment, as well as electricity storage for Algeria and Botswana. In the 1.5°C and below 2°C consistent pathways, there is a clear shift in investments towards renewable energy sources such as wind, hydro or solar power. In both countries, key investments should be conducted towards an expansion of renewable capacities in order to be consistent with the Paris goals. However, there are notable differences between the countries in terms of how to achieve these goals. Algeria is projected to invest relatively more in wind power while Botswana should favor investments in solar energy. This shift towards renewables is to some extent reflected in the countries' NDC targets, but barely visible for the current policy investments in the upcoming years.

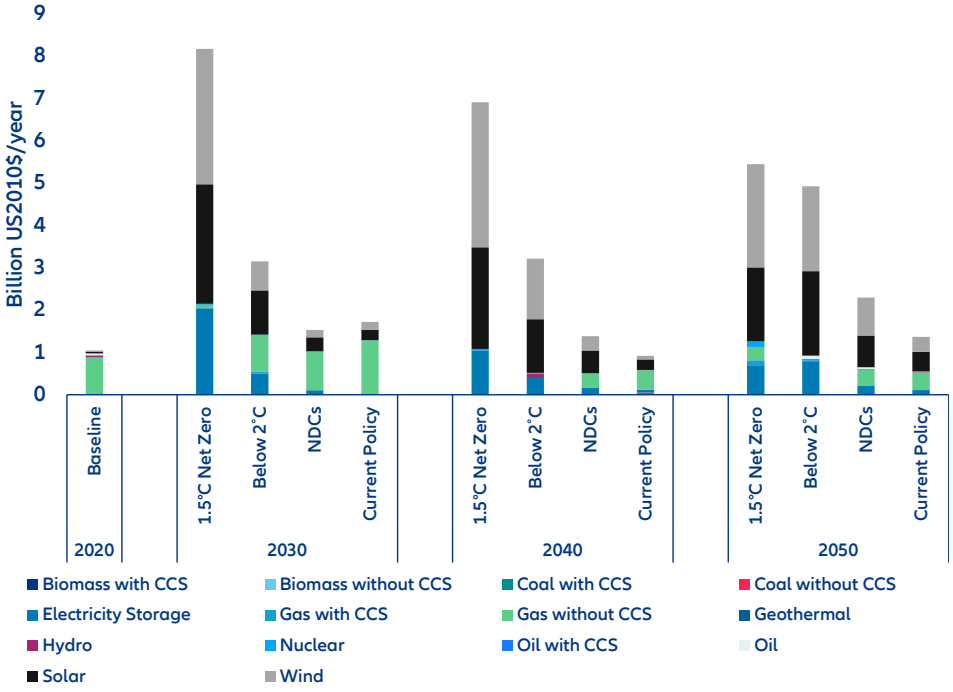
Figure 15: Investment in electricity supply in Africa's 10 largest economies



Sources: NGFS, Allianz Research. Climate scenarios described on page 5.

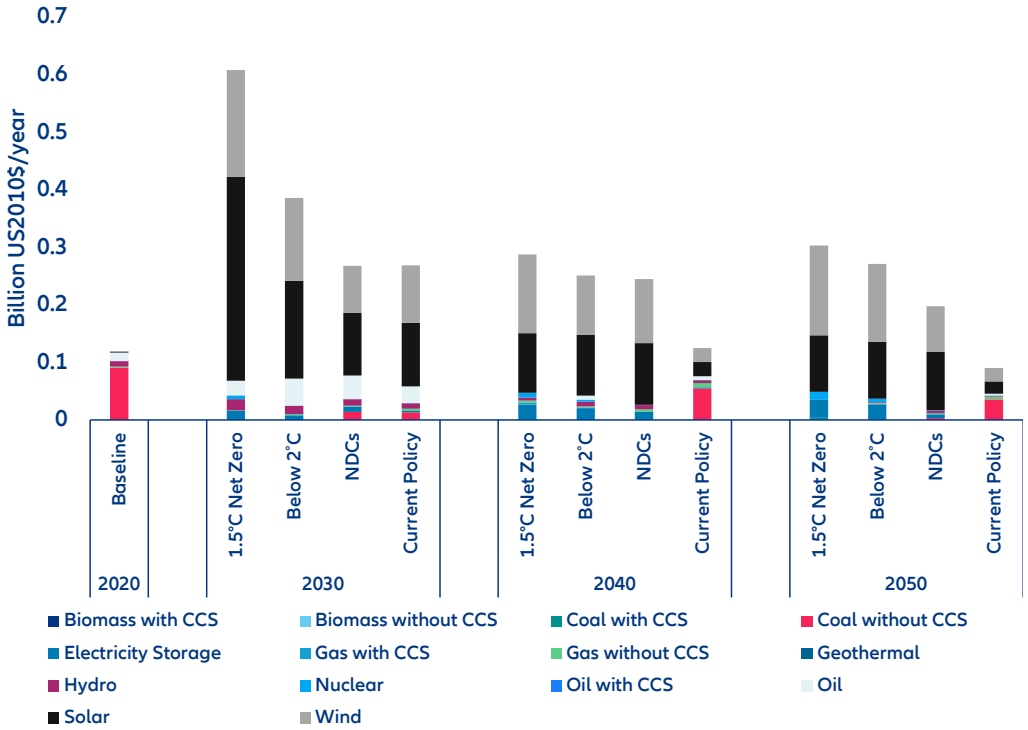
Overall, investment levels targeted in both current policy and NDCs pathways are well below the level necessary to meet the goals of the Paris agreement. We observe a similar picture in all African economies considered in our analysis (Figure 13). Considerable investments are required in wind and solar energy generation, with additional funding directed to hydro and nuclear power in some of the countries. However, the investment gap between planned and needed capacity investments differs from country to country, with sometimes large discrepancies between what is targeted and what should be reached, as in the case of Algeria. A central task for African economies will lie in securing the necessary funds, both private and public, to finance the transition towards renewable electricity. In their Sustainable Development Scenario, the IEA projects that the private sector will play a key role in increasing power-generation capacities, with investments projected to rise by +400%. This essentially requires renewable investment projects to become more attractive for private investors. To entice investors, governments should prioritize the provision of a reliable financing infrastructure, well-designed competitive procurement programs for power-generation projects and a comprehensible and credible strategy to increase clean-energy deployment.

Figure 16: Investment in electricity supply, Algeria



Sources: NGFS, Allianz Research. Climate scenarios described on page 5.

Figure 17: Investment in electricity supply, Botswana



Sources: NGFS, Allianz Research. Climate scenarios described on page 5.

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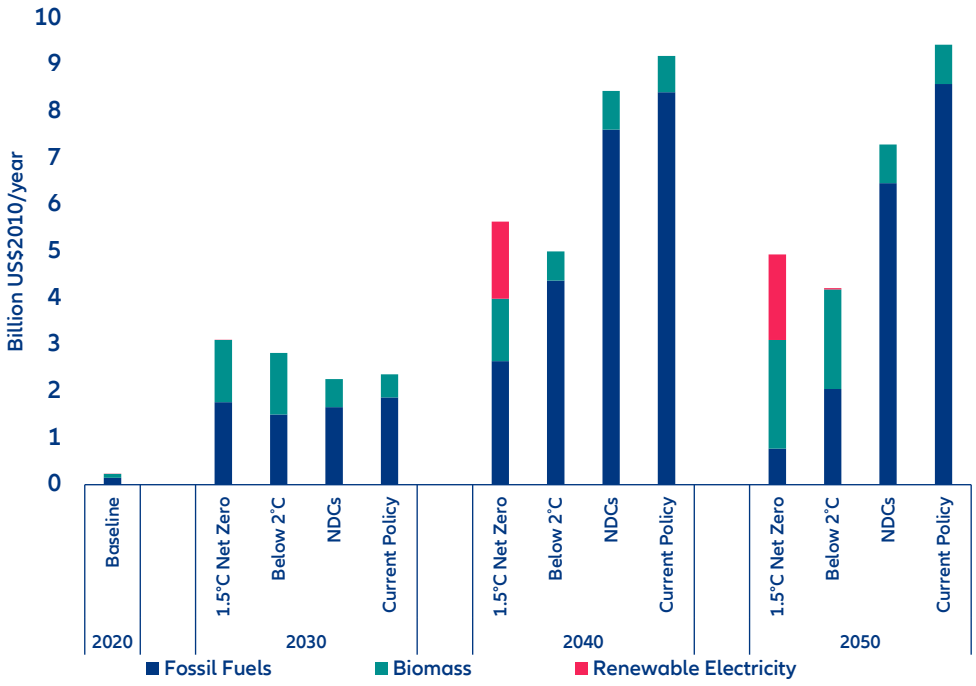
Naturally!

With its vast amounts of low-cost renewable resources, the African continent naturally has the potential to become one of the main exporters of low-carbon hydrogen, and at the same time build the world's first hydrogen-based economies and societies. The realization of this future is envisioned in the African Hydrogen Partnership's (AHP) operational plans for green hydrogen in Africa. Building on Africa's large potential for solar and onshore wind energy and striving to become an early mover in a quickly growing hydrogen market offers attractive and profitable mid- and long-term business opportunities.

Figure 18: Investment in hydrogen infrastructure in Africa's 10 largest economies



Sources: NGFS, Allianz Research. Climate scenarios described on page 5.

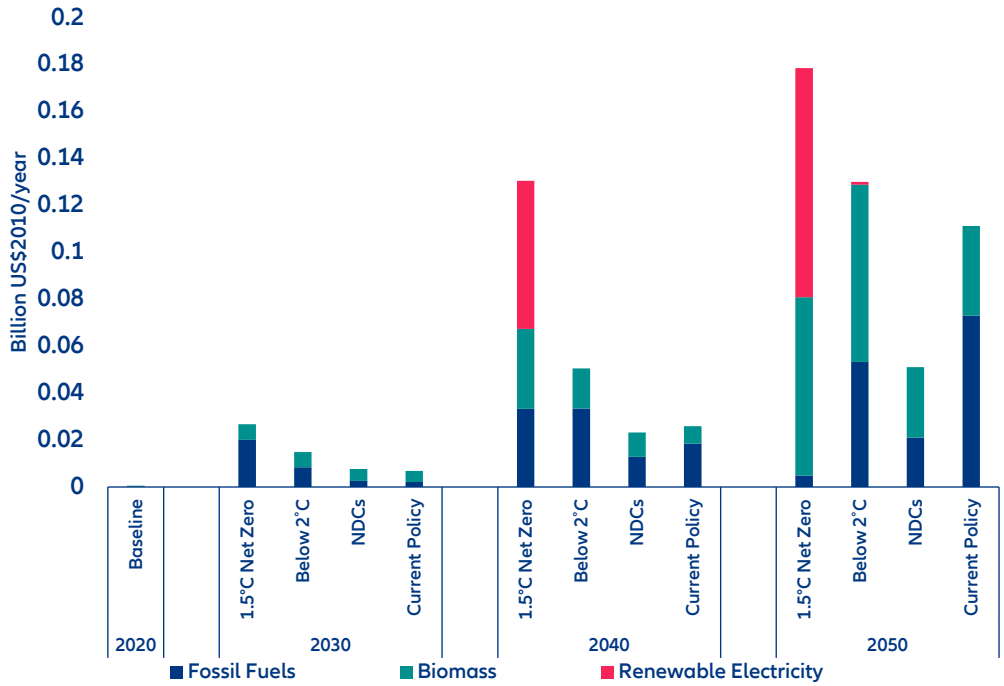
Figure 18 depicts investment in hydrogen-based energy supplies for the 10 largest African economies. It is evident that hydrogen plays an important role in any climate scenario, with investment needs growing from USD2-3bn in 2030 to USD4-9bn in 2050. In less ambitious climate scenarios, hydrogen might even see higher investment levels in the long run as hydrogen-based energy supplies are set to play a specific but important role within the African energy-supply mix (See also Figure 3). The production process varies decisively in the scenarios though as the 1.5°C scenario shifts towards processes that produce hydrogen from renewable sources while in the NDC or current policy scenarios, production continues to rely on fossil energy carriers.

In addition to using hydrogen in the domestic energy-mix, favorable production conditions enable African producers to establish long-term supply relations with the competitive European and Asian markets.

The announced African hydrogen strategies include the establishment of so-called "landing-zones". These are regions with favorable conditions for large-scale hydrogen projects that will serve as the basis for an expansion of such projects across other regions in Africa, and especially central Africa. One of these landing zones is Nigeria, which is already a major producer of fossil fuels. Due to its favorable location and coastal connections, the country is well positioned to act as a central hub for pipelines, as well as port and road traffic. At the moment, Nigeria already uses hydrogen that is extracted from natural gas and coal, mainly for the refining of oil. Moving towards the production of green hydrogen would be an important part of the country's transition to clean energy and provides an attractive opportunity to employ resources from a shrinking oil and gas sector.

The future investments in hydrogen-based energy sources attributed to Nigeria are set to be significantly higher than in most other major African economies. Especially in the 1.5°C net zero scenario, there is no way around extensive investments in Nigerian hydrogen, especially from renewable electricity sources, and the associated investment demand will already reach USD2bn in 2040.

Figure 19: Investment in hydrogen infrastructure, Ghana



Sources: NGFS, Allianz Research. Climate scenarios described on page 5.

Ghana has been identified as another designated landing zone, and set to act as one of the main hubs for clean hydrogen in Western Africa. The country is rich in renewable energy potential from solar, wind, biomass and hydropower. Demand for electricity is increasing by around +10% every single year, with domestic supply struggling to keep pace. This trend leaves the door wide open for renewables to step in and dominate the energy mix. At present, Ghana covers the largest parts of its primary energy supply with imported oil and local biomass resources. According to the International Energy Agency (IEA), it is on track to reach universal access to electricity for its citizens by 2030. To fulfill an ambitious climate mandate, the country needs to utilize its abundance of renewable energy resources and include green hydrogen in its energy supply mix. This creates a need for substantial financial investment and local policy support. In fact, investment patterns in Ghana will need to be very similar to those of Nigeria, though projected on a much smaller total level (Figure 19).


Our
team

Chief Economist Allianz SE

Ludovic Subran
ludovic.subran@allianz.com

Head of Economic Research Allianz Trade

Ana Boata
ana.boata@allianz-trade.com

Head of Macro & Capital Markets Research Allianz SE

Andreas Jobst
andreas.jobst@allianz.com

Head of Insurance, Wealth & Trend Research Allianz SE

Arne Holzhausen
arne.holzhausen@allianz.com

Macroeconomic Research

Maxime Darmet-Cucchiarini
Senior Economist for US & France
maxime.darmet@allianz-trade.com

Roberta Fortes
Economist for Ibero-Latam & Africa
roberta.fortes@allianz-trade.com

Françoise Huang
Senior Economist for Asia Pacific
francoise.huang@allianz-trade.com

Maddalena Martini
Economist for Italy & Greece
maddalena.martini@allianz.com

Manfred Stamer
Senior Economist for Middle East & Emerging Europe
manfred.stamer@allianz-trade.com

Katharina Utermöhl
Senior Economist for Europe
katharina.utermoehl@allianz.com

Corporate Research

Ano Kuhanathan
Head of Corporate Research
ano.kuhanathan@allianz-trade.com

Aurélien Duthoit
Senior Sector Advisor, B2C
aurelien.duthopit@allianz-trade.com

Maria Latorre
Sector Advisor, B2B
maria.latorre@allianz-trade.com

Maxime Lemerle
Lead advisor, Insolvency Research
maxime.lemrle@allianz-trade.com

Capital Markets Research

Eric Barthalon
Head of Capital Markets Research
eric.barthalon@allianz.com

Jordi Basco-Carrera
Lead Investment Strategist
jordi.basco_carrera@allianz.com

Pablo Espinosa Uriel
Investment Strategist, Emerging Markets & Alternative Assets
pablo.espinosa-uriel@allianz.com

Patrick Krizan
Senior Investment Strategist
patrick.krizan@allianz.com

Insurance, Wealth and Trends Research

Michaela Grimm
Senior Economist,
Demography & Social Protection
michaela.grimm@allianz.com

Patricia Pelayo-Romero
Economist, Insurance & ESG
patricia.pelayo-romero@allianz.com

Kathrin Stoffel
Economist, Insurance & Wealth
kathrin.stoffel@allianz.com

Markus Zimmer
Senior Economist, ESG
markus.zimmer@allianz.com

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Director of Publication
Ludovic Subran, Chief Economist
Allianz SE
Phone +49 89 3800 7859

Allianz Group Economic Research
https://www.allianz.com/en/economic_research
Königinstraße 28 | 80802 Munich | Germany
allianz.research@allianz.com

@allianz
allianz

Allianz Trade Economic Research
http://www.allianz-trade.com/economic-research
1 Place des Saisons | 92048 Paris-La-Défense Cedex | France
research@allianz-trade.com

@allianz-trade
allianz-trade

About Allianz Research
Allianz Research comprises Allianz Group Economic Research and the Economic Research department of Allianz Trade.

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