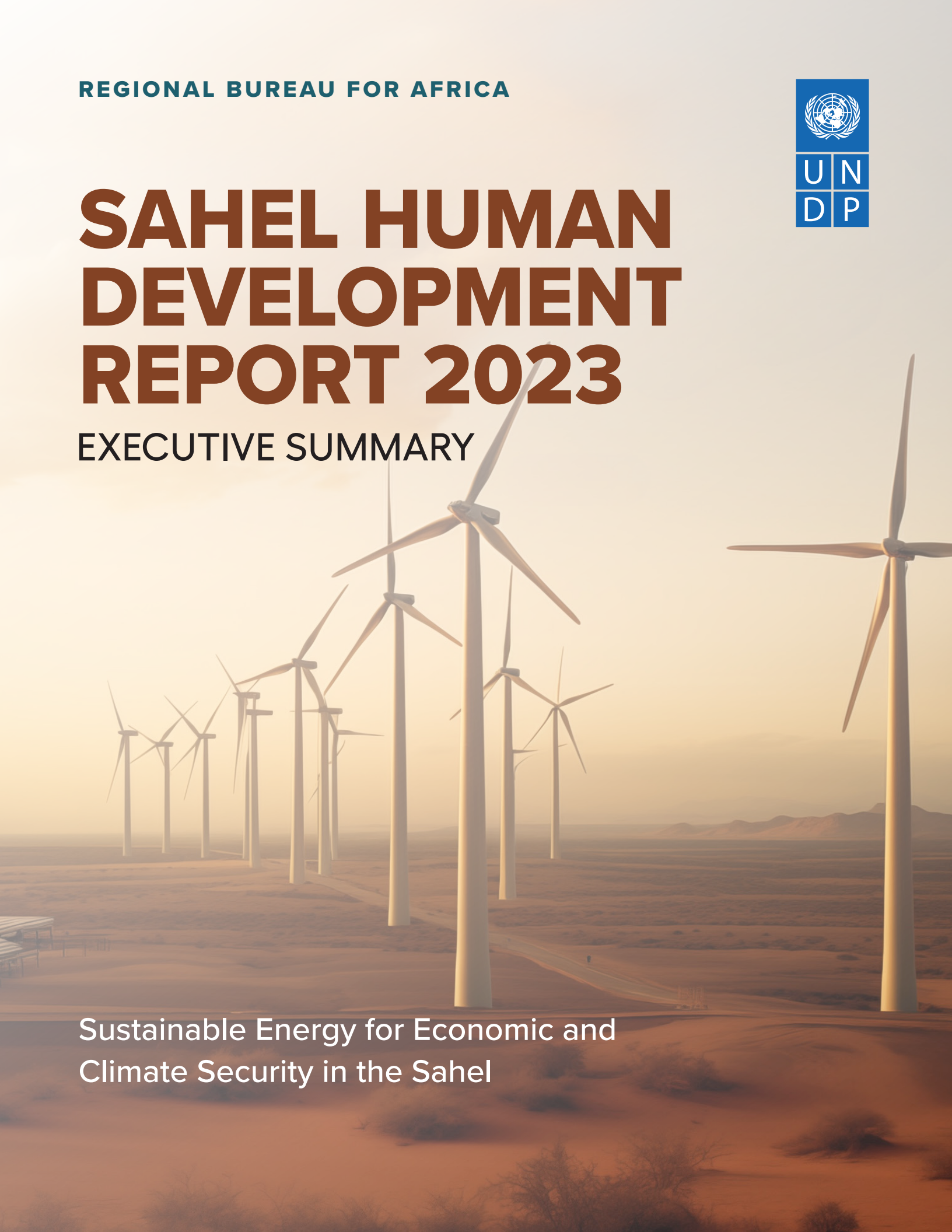
REGIONAL BUREAU FOR AFRICA

SAHEL HUMAN DEVELOPMENT REPORT 2023

EXECUTIVE SUMMARY



Sustainable Energy for Economic and Climate Security in the Sahel

Title: Sahel Human Development Report
Language: English
Sales no: E.24.III.B.1
PRINT ISBN: 9789210030571
PDF ISBN: 9789213588130
EPUB ISBN: N/A
Print ISSN: N/A
Online ISSN: N/A
Bar code: ean-9789210030571

A catalogue record for this book is available from the British Library and Library of Congress

Printed in New York, February 2024.

Acknowledgments

The 2023 Sahel Human Development Report stands as a testament to the collaborative efforts of an extensive network of decision-makers, managers, policy analysts, and researchers from diverse institutions, working alongside the UNDP. We extend our gratitude to all those who contributed significantly to the creation and execution of this impactful report.

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Powering Economic Development Across the Sahel

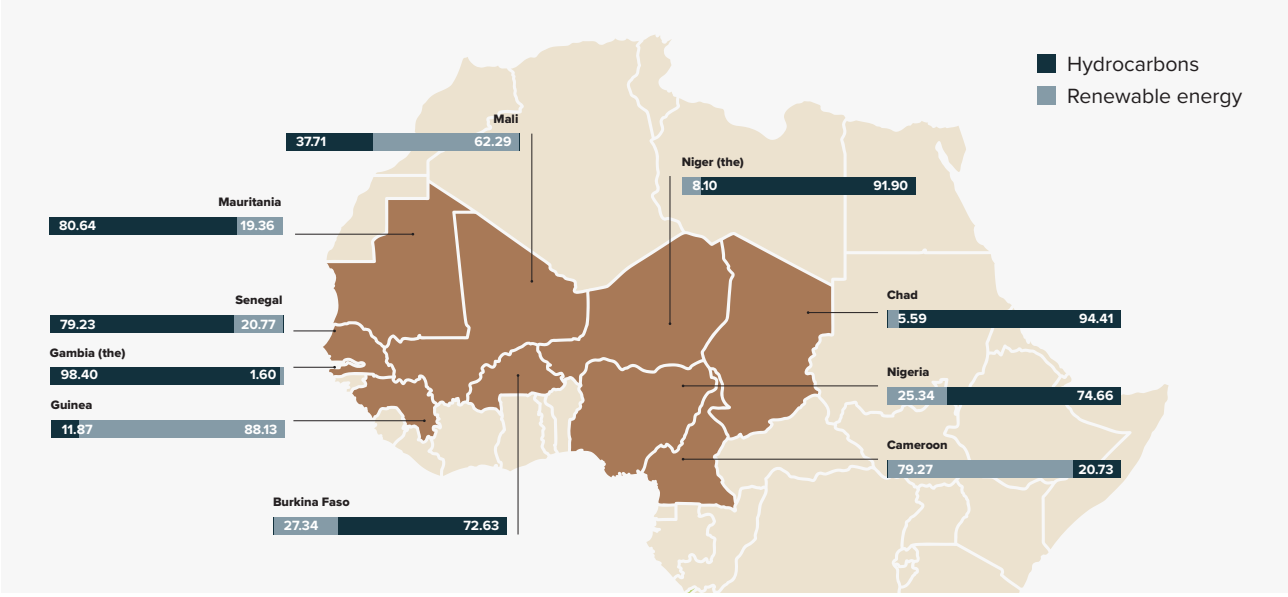
Sustainable energy could regenerate Africa's Sahelian zone by using the region's abundant clean energy potential to transform lives, diversify economies, give hope, and protect the planet. A combination of energy poverty for over half of the population of the Sahel and an over-reliance on expensive and high-polluting hydrocarbons has retarded socioeconomic progress and contributed to environmental degradation. In addition, recent global economic shocks and geostrategic shifts have highlighted the need to move the Sahel away from energy dependency to energy agency that delivers accessible, reliable, and affordable energy for all.

"The Sahel is a diverse ecosystem, with individual countries at different stages of development and energy use.

Analyzing viable pathways to this goal is the focus of this Human Development Report (HDR), which covers Burkina Faso, Cameroon, Chad, The Gambia, Guinea, Mali, Mauritania, Niger, Nigeria, and Senegal – the 10 countries identified by the United Nations for the establishment of the United Nations Integrated Strategy for the Sahel (UNISS) in 2013. The HDR uses empirical techniques and political economy analyses to consider optimal energy strategies that would be most appropriate for this sub-region. Energy mixes that promote a just energy transition for the Sahel, while delivering tangible socioeconomic gains and diminishing planetary pressures, are prioritized.

The Sahel is a diverse ecosystem, with individual countries at different stages of development and energy use. Thus, even though the HDR identifies an optimal pathway, the recommendations are tailored to suit each country. The HDR also explores regional synergies that allow for scaled-up investments, economies of scale and broader energy markets.

Figure 1 **Sahelian country energy mix**



Source: EMBER, 2021

Rationale for the 2023 Sahel HDR

Over the past decade, energy demand in the Sahel has grown by more than 4% annually,[1] partly on account of population growth and partly due to growing economic activity. Countries in the Sahel have all expressed their desire to transition from high-polluting energy sources in their nationally determined contribution (NDC) documents. Thus, green energy will be central in meeting the estimated 950 petajoules growth in demand.[2] However, it is worth noting that the pathways will differ for Sahelian states that are hydrocarbon exporters as opposed to those that are not. They will also differ for those that are agro-based and those that are more oriented towards service sectors. The energy transition offers an opportunity for the Sahel to do so in a way that boosts economic growth, improves socioeconomic outcomes, builds resilient societies, and protects the environment.

"Switching from coal to natural gas will reduce greenhouse gas emissions by an average of 50% for electricity generation and 33% for heat supply.

Nearly 7,385 MW of new thermal power plant capacity has been developed, alongside renewable energy capacity. Following a transition period, liquid fuel power plant projects gave way to gas-fired power plant projects, either through the conversion of existing plants or through the construction of new plants. To finance these new or converted gas power plants, most of the multilateral and bilateral development institutions present on the continent have played a key role, notably providing concessional funds, capital contributions, or guarantees.

Oil-based power plants account for 75% of total power generation in the Sahel.[3] Switching from coal to natural gas will reduce greenhouse gas emissions by an average of 50% for electricity generation and 33% for heat supply.[4] Replacing oil and diesel with natural gas for convertible power plants will reduce emissions by around 25% to 30%. By adding a steam cycle, the thermal efficiency of the gas-fired power plant increases to nearly 60%, thereby reducing GHG emissions per kWh to approximately half of the quantity generated by a traditional coal-fired power plant.[5]

A just energy transition centered on renewables and energy efficiency is increasingly understood to be not only feasible but essential for a climate-safe future in which sustainable development prerogatives can be met. However, this must be done in a way that prioritizes human welfare-oriented outcomes. This HDR explores the close causal relationship between energy and development. At the most basic level, humans require energy to be able to eat, study, work, socialize, and survive. Energy is therefore a public good that must be guaranteed for all citizens.

"Energy is the driving force of economic growth: It is critical for lighting, cooling, cooking, transportation, and industrial activities as well as powering the digital technologies that are increasingly important to the global economy.

Energy is the driving force of economic growth: It is critical for lighting, cooling, cooking, transportation, and industrial activities as well as powering the digital technologies that are increasingly important to the global economy. Scholars agree that increasing access to modern energy systems, which includes reliable access to electricity and clean cooking facilities, has far-reaching effects that can help communities eradicate poverty, improve health, support business activity, achieve gender equality, address food insecurity, and adapt to climate change effects. Access to electricity has been found to be an important proxy and strong predictor for multidimensional poverty. For example, the Multidimensional Poverty Index shows that 77.5% of the population in sub-Saharan Africa that is poor is also electricity deprived.

Unlocking the Energy Potential in the Sahel

The Sahel is also one of the regions with the highest renewable energy potential in the world, including one of the world's highest solar production capacity – 13.9 billion kWh/y compared to the total global consumption of 20 billion kWh/y – and is abundant in the natural resources that are critical for powering clean energy technologies.[6] These opportunities distinguish the Sahel as a region that can accelerate progress towards the achievement of the Sustainable Development Goals (SDGs) while paving the way for a more prosperous and resilient future.

About half of the 362 million people living in the Sahelian region does not have access to electricity.[7] This is one of the lowest rates of consumption of modern electricity on the planet. The current state is the result of a combination of low levels of generation, volatile or high petroleum prices, and inadequate financing for relevant electricity grids, leading to very poor connectivity.

"The Sahel (has) . . . one of the world's highest solar production potential – 13.9 billion kWh/y compared to the total global consumption of 20 billion kWh/y.

Power generation in the Sahel is about 35 watts per capita, roughly a third of the Sub-Saharan Africa average and close to 4% of the global average. There are, however, high regional disparities. For instance, in Senegal, the level of access is as high as 70%, while in Chad it stands at just 8%.[8] Electricity access in urban areas is increasing faster than in rural areas. In fact, electricity is completely absent in many rural areas in the Sahel, forcing people to use firewood for cooking stoves which leads to health (and deforestation) issues.

Power generation across the Sahel is costly. Affordability problems have been exacerbated over the past few years due to global economic and geopolitical shocks, which have caused the prices of all types of energy sources, as well as of energy-related equipment such as solar home systems, to rise. In the absence of policy changes, energy poverty is set to ravage the region for the foreseeable future. The reliability of electricity in the Sahel is also among the lowest in the world, creating a critical roadblock for development.

"About half of the 340 million people living in the Sahelian region does not have access to electricity.

Almost half of Sahel countries experienced a growth of more than 4% in primary energy demand over the last two decades. By 2030, 40% of the population in the Sahel are expected to live in urban areas.[9] If current policies and development patterns continue, around 80 million people will be left without access to electricity and 120 million will not have access to energy that powers clean cooking techniques.[10]

Balanced Green Growth is a Pathway to Success

This HDR uses the International Futures model to evaluate three possible scenario options for just energy transitions in the Sahel. Details of the options are presented in Annex A. The options are: (a) the Current Path (CP), which assumes no change to current and planned energy options; (b) the Renewable Push (RP), which assumes an aggressive transition to renewables; and (c) Balanced Green Growth (BGG), which assumes a more gradual transition with gas as a transition fuel. Table 1 summarizes the results from the model and shows that the Balanced Green Growth scenario would keep the Sahel on track to move away from high-polluting fossil fuels, while eliminating extreme poverty and enhancing the region's Human Development Index (HDI), in the long term. The significant development gains justify the trade-off in preferring the Balanced Green Growth path over the Renewable Push strategy.

The BGG path is based on an energy mix that includes a 30% increase in renewable production and investment, a 30% increase in natural gas production and investment, and a 20% increase in production and investment of other fossil fuel-based sources (primarily oil, coal, and nuclear), by 2030. It also assumes a 100% electrification rate across the Sahel by 2050. In addition, the scenario entails various assumptions related to agricultural yields, governance and spending, gender equality and women's empowerment, caloric variations, conflict/war, water and sanitation access, health, and income inequality. A breakdown of some of the assumptions can be found in Annex A.

"The Balanced Green Growth scenario would keep the Sahel on track to move away from high-polluting fossil fuels, while eliminating extreme poverty and enhancing the region's Human Development Index (HDI), in the long term.

The BGG's investment approach is to leverage fossil fuels, notably natural gas, in the medium term (for the next 10-15 years at least) while concurrently investing in renewable energy for the long term. By 2030, renewables in the Sahel would make up 3.1% of the total energy production but by 2063, this increases to 54%. At a country-specific level, the BGG increases renewable energy production significantly in the long run, especially for countries such as Burkina Faso and Mauritania which will reach over 95% renewable energy by 2063.

Table 1 Summary of results

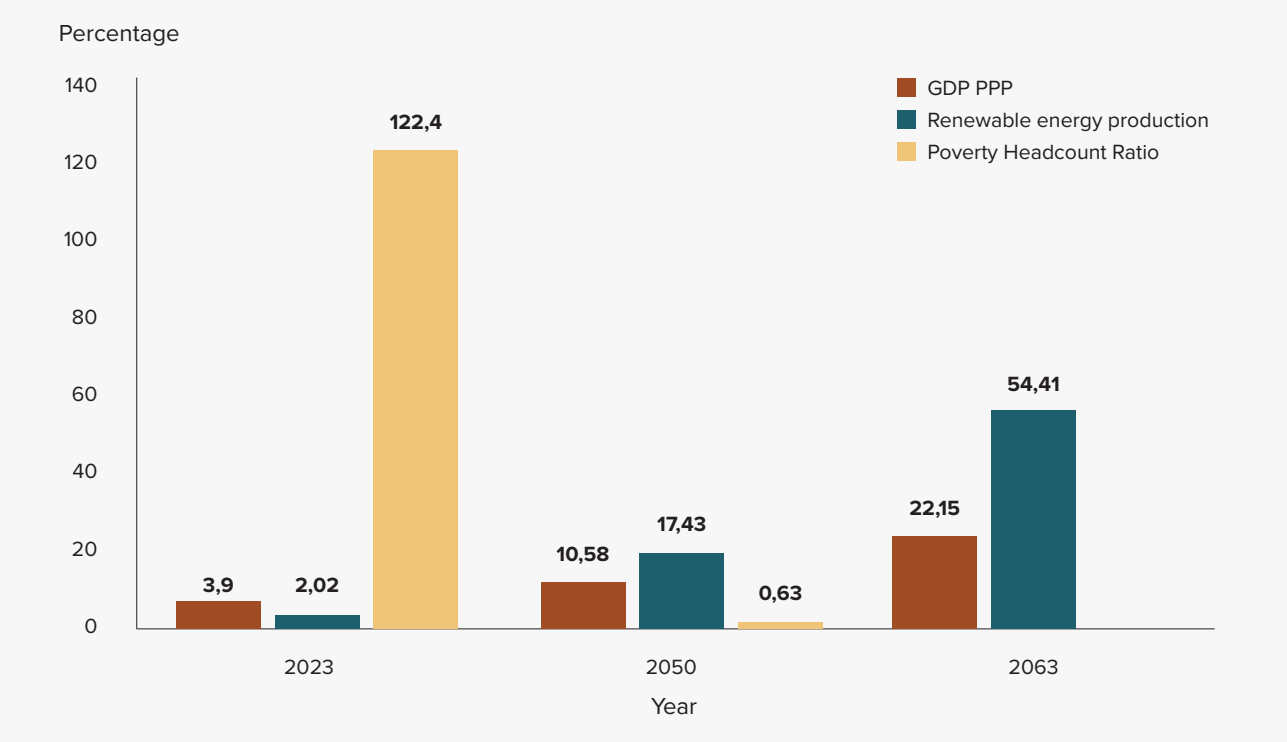
		Current Path 2063		Renewable Push 2063		Balanced Green Growth 2063	
	2030	Value	% change	Value	% change	Value	% change
Oil Production (BBOE)	0.8	1.0	28.2	0.1	-88.5	0.5	-30.8
Natural Gas Production (BBOE)	0.5	0.8	59.6	0.5	-9.6	1.0	90.4
Renewable Production (BBOE)	0.0	1.1	3600.0	2.7	8800.0	1.8	5866.7
GDP per capita (thousand US$)	3.9	12.2	215.2	13.0	234.6	22.2	463.3
Human Development Index	0.6	0.9	41.7	0.9	42.3	0.9	49.0
Extreme Poverty (million people)	142.9	28.8	-79.9	24.5	-82.9	0.0	-100.0
Renewable Energy (% of total)	2.0	37.6	1780.0	82.7	4035.0	54.0	2600.0

According to the projections, the BGG increases economic growth for the region and for each individual country as measured by both gross domestic product (GDP) and GDP per capita. GDP per capita in the region measured by purchasing power parity (PPP) increases from $3.9 thousand in 2024 to $22.2 thousand by 2063 – a significant increase with important implications for government expenditure and development gains. Annual GDP grows exponentially under the BGG, nearly doubling the gains made by the Current Path. The region increases its GDP by over $17,500 billion by 2063 with significant increases for each individual country.

This scenario also reduces energy import dependency over time. At the same time, because investment is balanced and traditional sources of energy are leveraged in the short term, energy exports increase for the BGG until around 2045 which can provide important economic benefits, such as an improved balance of payments, enhanced terms of trade, and a lower need for foreign reserves. Over time, energy exports start to decrease. These initial gains are concentrated in Nigeria (28.9 billion by 2063), Chad (13.5 billion by 2063), and Cameroon (.8 billion in 2063) who are the largest producers of oil which can be scaled in the short term to increase export values and drive economic growth.

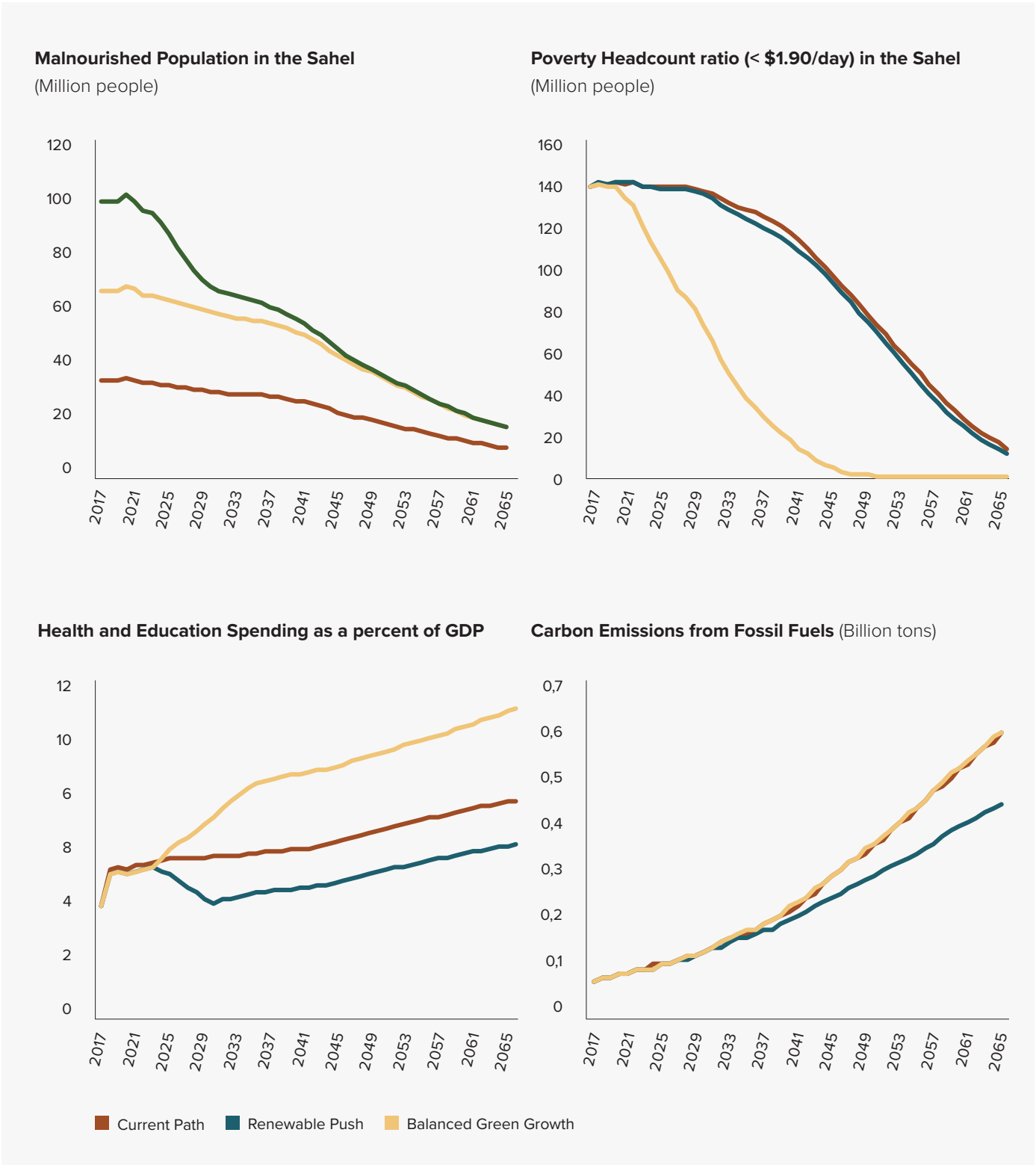
Some of the development gains from the BGG path are illustrated in Chart 1 below.

Figure 2 **Balanced Green Growth projections**



Source: International Futures (IFs) v8.01.

Figure 3 **Socioeconomic and environmental gains from the BGG path**



Source: International Futures (IFs) v8.01.

Accelerating Economic Development in the Sahel

The BGG takes a more gradual path towards net-zero in the Sahel but is more sensitive to the region's diversity and ensures much-needed space for socio-economic development. This is true at both the national and regional levels.

Aligning National Targets with Regional Priorities

The preferred pathway is consistent with the African Union's Common Position on Just Energy Transitions in Africa and supports national renewable targets in many countries – as shown in Table 2. This bodes well for national ownership and would make it easier to garner political will. The Just Energy Transition aspects of the BGG will work better for some countries than others. For example, Senegal and Nigeria have an abundance of natural gas resources and infrastructure in place that can and should be used to create opportunities for local companies and international partners to drive economic growth. In countries without such endowments, much more should be done to support the transition both technically and financially.

Private sector players should engage in public-private partnerships to co-create enabling environments that support scaling mini grids and other renewable energy technologies. For example, the Africa Mini Grid Developers Association (AMDA) could work together with governments and donors to ensure that mini grids are effectively used as a key component in ending energy poverty through reliable, affordable, and sustainable energy.

To succeed, Sahel governments should prioritize strong engagement in enacting enabling policies to support the localization of energy technologies. Several policy options to do so and attract private sector participation are urgently required. Off-grid providers should be incentivized and regulated, for instance, through clean energy targets, tax breaks, net metering, and carbon pricing. For off-grid solar, countries should use technological, digital, and business model innovations that could increase energy access in rural areas.

Table 2 National renewable energy targets in the Sahel

Country	Renewable energy target
Burkina Faso	To increase the share of renewable energy in total electricity production to 50% by 2030.
Chad	To reach a 20% share of renewable energy in national electricity production by 2030.
Mali	To increase the share of renewable energy in the energy mix to 59% by 2025, 64% by 2030, and 70% by 2036.
Mauritania	To increase the share of renewables in the energy mix to 60% by 2030.
Niger	To reach at least 30% of the energy balance from renewable energies by 2030.

Source: IEA, 2021

Leveraging Regional Synergies to Enhance Green Energy Initiatives

The BGG could create new regional green energy solutions, while also expanding and deepening existing regional arrangements. For example, the West African Power Pool (an agency of ECOWAS that is working toward integrating 14 of its 15 members into a unified regional electricity market) is committed to strengthening regional integration which will lead to lower import costs and cleaner energy generation while significantly expanding the grid beyond major cities. The FREXUS program is another regional initiative that has been successful in achieving its objectives of using a water-energy-food nexus to address a wide range of challenges in fragile contexts. The nexus approach allows the initiative to avoid unintended consequences and impacts on other sectors and to improve the efficiency of natural resources in a climate-conscious way. The project is based in Mali, Niger, and Chad led by the Lake Chad Basin Commission and Niger Basin Authority and includes capacity building for country stakeholders to address conflict and climate change in an integrated way.

Financing Green Energy Transitions in the Sahel

For the BGG, across all 10 Sahel countries, the cumulative investment towards energy needed is $186 billion by 2030 – see Table 3 and Table 4. By 2050, this increases to $797 billion and by 2063 the total is $1.9 trillion. Investment levels differ by country, ranging from $1,571 billion in Nigeria to $3.1 billion in Mauritania. The overall cumulative investment toward energy is lower for the BGG than the Current Path and Renewable Path up until 2050, meaning these transformative impacts on energy and development could be achieved under similar or lower investment levels than the other pathways. This level of investment is still a heavy burden and will require bold action by key financing players.

To facilitate and expedite requisite financing, Sahelian countries must take steps to strengthen their domestic financial systems. National governments can play a key role in addressing financing bottlenecks by promoting and supporting local financial institutions to identify projects and accredit implementing entities that meet investors' requirements. They can also enhance the capacity of local finance actors such as commercial banks and institutional investors to improve energy finance. Since local finance channels eliminate currency risks, reduce exposure and vulnerability to external shocks, and effectively, reduce price risks due to their proximity to communities and markets, they have great potential as sources of energy investment.

In addition, Sahelian countries should embrace innovative financial strategies, including greenhouse gas trading systems, green bonds, green swaps, sustainability-linked bonds, efficient carbon marks, debt swaps, and forward-looking domestic resource mobilization instruments. Greenhouse gas trading systems could establish a market for buying and selling emission allowances and provide an opportunity for Sahel countries to generate revenue that can be reinvested in BGG priorities.

Table 3 Anticipated annual energy investments in the Sahel across scenarios (billion US$)

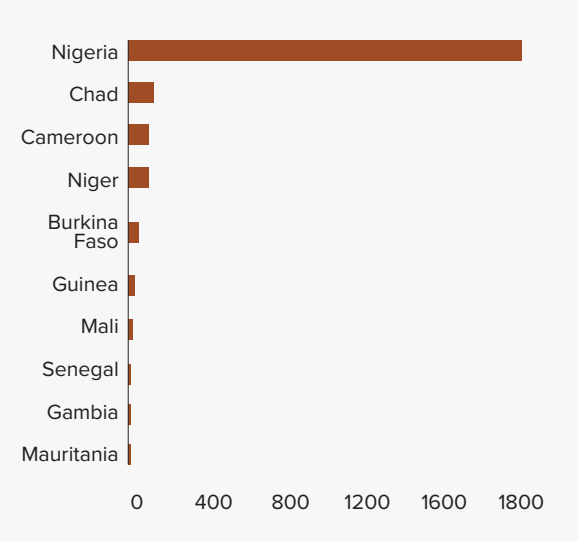
	Current Path	Renewable Push	Balanced Green Growth
2030	18.89	19.3	17.25
2050	46.80	59.1	50.3
2063	97.92	117.1	124.1

Table 4 Anticipated cumulative energy investments in the Sahel across scenarios (billion US$)

	Current Path	Renewable Push	Balanced Green Growth
2030	195	196.2	186.1
2050	795.6	921.9	797
2063	1,735	2,062	1,898

Source: IFs v8.01.

Figure 4 Cumulative investment in energy under BGG scenario across Sahel countries by 2063



Source: International Futures (IFs) v8.01.

Recommendations

Sustainable energy can unlock the Sahel's immense potential. As UN Secretary General António Guterres has stated, "With their innovation, their climate leadership and commitment to inclusive and sustainable development, African countries can provide solutions not just for Africa, but for the world." This sentiment was echoed by UNDP Administrator Achim Steiner who pointed out that "Africa has abundant renewable energy sources with the potential to ensure access to affordable, reliable, sustainable and modern energy for all." This HDR unpacks the relationship between energy, economic development, and societal stability in the Sahel and identifies eight broad recommendations.

1. The Sahel can lead a green industrialization in Africa. Given its significant renewable energy resource potential, the Sahel can become the first region in Africa to pioneer and champion an industrial revolution based on, and fueled by, renewable energy. Investments in renewable energy would go beyond transforming domestic use (the transition from biomass) to focus on establishing green regional value chains that create jobs, leverage global value chains, and accelerate the attainment of the SDGs. Industries like the manufacture of photovoltaic cells/batteries, textiles, and agro-processing are potential candidates. Countries in the Sahel should adopt targeted green industrial policies, use the African Continental Free Trade Area (AfCFTA) to widen market access, and work with the private sector to ensure (and expedite) necessary technology transfers and financing – including with the diaspora.

For example:

- The Nigerian Energy Masterplan outlines approaches to bolster domestic solar panel manufacturing and skills for green industries, targeting job creation in a market of 206 million people.
- Senegal is hosting Africa's first utility-scale wind farm, the 158 MW Taiba N'Diaye facility, and is positioning itself for associated industrial growth.

2. Only a balanced and coordinated approach utilizing some natural gas and fossil fuels in the short term while scaling up renewables long term will succeed in transitioning the region's energy system. A balanced and coordinated strategy also provides a realistic transition timeline that is sensitive to each country's resources, avoids energy shortfalls as renewable capacity scales up, and keeps the lights on for Sahel communities. Sahelian governments must enact clear legal and regulatory frameworks that attract investments to facilitate a just green transition. Development partners and investors can provide funding and technical expertise to help update grids, build gas infrastructure where viable, pilot new technologies, and craft localized transition roadmaps rooted in data and community needs.

For example:

- Nigeria boasts extensive infrastructure and more than 200 trillion cubic feet of proven gas reserves, currently fueling 43% of its power generation. Rather than abandoning operational gas plants, Nigeria can attract investment to capture flared gas, utilizing existing pipelines to expand electricity access and support industries.

3. Consistent long-term engagements between governments, development partners, and communities will deliver tangible results on the ground and build trust in the process. This is critical because trust-building between citizens, officials, and development partners could help establish a more conducive political economy that will support and promote green transitions. Sahelian governments should institutionalize inclusive energy and development planning processes that empower communities in shaping priorities. Civil society and private

sector partners can provide capacity building and participatory monitoring support while financiers must commit to multi-year funding tranches tied to locally defined energy access and usage metrics.

For example:

- The EU-funded FREXUS project in Niger facilitates engagement between the government, Lake Chad Basin Commission, civil society, and local communities to co-develop context-specific solutions addressing the water-energy-food nexus in the Diffa region facing conflict and environmental pressures.
- Burkina Faso's Bottom-Up Energy Planning methodology ensures citizen feedback for the formulation of an energy policy targeting 26% electrification by 2030, in collaboration with development partners.

4. Technology should play a central role both in delivering energy access solutions and informing data-driven policy to maximize socioeconomic impacts. Technology is at the core of expanding energy access and affordability in the Sahel, underpinning off-grid solar solutions, mini-grid connections, battery storage innovations and efficiency improvements. Granular geospatial and user data layered with machine learning can support dynamic, evidence-based policy targeting for subsidies, grid expansions, and renewable micro-financing so investments maximize impact. Sahelian governments should invest in nationwide energy user and market datasets while crafting interoperability standards. Private sector and development partners should develop customer-centric pay-as-you-go solutions, provide analytics to model least-cost electrification scenarios, and finance pilot innovations aligned to socioeconomic development metrics.

For example:

- Orange Mali introduced three Solar Electricity Villages, supplying decentralized solar power to sustain critical telecom infrastructure. Additionally, they have extended pay-as-you-go home solar systems to more households in these villages, utilizing mobile payment solutions.
- Niger's government aims to leverage GIS data strategically to target electrification investments and subsidies, maximizing socioeconomic benefits.

5. Patient capital must underpin the Sahel's renewable energy revolution. The Sahel requires patient, long-term capital to fund its renewable energy revolution because transforming distributed energy ecosystems requires sustained investments before commercial viability. Without concessionary and risk-tolerant financing that adopts a long-term lens, bankable projects will remain scarce, deal flows limited, and energy poverty entrenched across the region. Sahelian governments should explore mechanisms to attract and retain long-term capital that will improve investor returns over the medium term. Furthermore, just as development banks and impact funds provide credit enhancements and subordinate debt to catalyze private capital inflows, corporate partners can also embrace social responsibility mandates supporting early-stage ventures.

For example:

- Nigeria has initiated various financial incentives to encourage renewable energy adoption. These include freezing import duties on renewable energy technologies, tax credits, capital incentives, and favorable loans to foster continuous growth in renewable energy projects.
- In Mali, the government's Segou Solar PV project champions initial private sector investments in a large-scale solar photovoltaic facility. This endeavor not only lowers overall power generation costs but also encourages increased private sector involvement in funding renewable energy ventures amid evolving regulatory frameworks.

6. Scaling up the Sahel's energy ambition means prioritizing cross-border initiatives to boost affordability and reliability. Scaling up the Sahel's energy ambition requires prioritizing cross-border interconnectivity and regional power pools because no country has sufficient resources to independently achieve universal access. Regional approaches protect against climate vulnerabilities as countries facing droughts or fuel shortages can import clean

electrons from neighbors with surpluses. Such initiatives can build on existing regional arrangements like the Economic Community of West African States (ECOWAS) and the West African Power Pool (WAPP). Sahelian governments should harmonize power sector regulations, lower duty barriers for equipment imports, and jointly plan least-cost generation additions with WAPP support. Development partners can provide technical assistance to negotiate and broker agreements while the private sector finances interconnections through transparent public-private deals.

For example:

- Guinea's Kaleta dam kickstarted a broader strategy, revamping its electricity sector and establishing new power lines to connect with neighboring countries. The addition of the 450 MW Souapiti dam has substantially increased the country's power capacity. Despite ongoing distribution and transmission challenges, resolving these issues could enable Guinea to export electricity to neighboring nations, aligning with the government's goals.

7. Leaving no one behind requires incentives, not just subsidies. Achieving universal access in the Sahel requires incentives that spur commercial investments, not just temporary subsidies that could distort markets. With the right mix of smart incentives tied to milestones like new connections or kilowatt hours of renewable energy delivered, companies can profitably expand pay-as-you-go solar and mini-grids to rural villages while subsidies focus on those in most need. This approach will help close the gender energy gap and bridge the rural-urban divide in energy access and affordability. Sahelian governments should set up investment facilities that de-risk lending to decentralized players while streamlining licensing. Development partners can provide working capital loans via local financial institutions to support inventory and receivables, and impact-focused investors must structure innovative instruments like enterprise challenge funds.

For example:

- Mali is prioritizing gender inclusion in renewable energy programs by integrating gender expertise throughout project activities, aiming to reduce disparities in resource access, decision-making, and autonomy.
- Niger's government aims to establish financial support programs that strike a balance between ensuring commercial sustainability for service providers and protecting customers from high tariffs. Solar home systems play a pivotal role in Niger's National Electrification Strategy, especially in rural areas.

8. Garnering sustained political commitment requires an alignment between national policy objectives and programmatic initiatives being implemented. Garnering ongoing high-level political commitment requires closing gaps between ambitious national policies and actual initiatives implemented on-ground. Without visible demonstrations that policy priorities like expanding off-grid solar or funding hydro plants translate into households getting connections, trust in government commitment erodes. Sahelian governments need to task relevant ministries, departments, and agencies with tracking policy priorities against spending allocations and community-level energy access data while providing public dashboards. Civil society should conduct citizen surveys and budget expenditure analyses feeding into oversight, and development partners can fund independent evaluators assessing rural connectivity against national electrification targets.

For example:

- Mauritania's commitments in its updated Nationally Determined Contributions (NDCs) focus on assessing renewable energy accessibility and promoting clean energy production through legislation revisions. The revised NDC aims for an 11% reduction in greenhouse gas emissions by 2030, emphasizing clean energy projects like green hydrogen, solar, and wind energy, with an estimated cost of US$34.25 billion.

ANNEXES

ANNEX A

Summary Details of International Futures Model Scenarios

		Model Parameterization	
Scenario	**Impact**	***Assumption***	***Underlying change***
Current Path (CP)	No Change	Dynamic unfolding of current development patterns.	Assuming the current trends and policies continue unchanged into the future, this involves no additional parameterization of variables in the model.
	Renewable production	Accounts for upcoming hydropower developments in Sahel.	Hydro-based energy in Senegal, Guinea, and Gambia increased by 10% over original CP forecasts.
Renewable Push (RP)	Renewable production	A 60% increase in renewable production (primarily solar, tidal, geothermal and wind sources) by 2030, with additional monetary investments of over 200% the value of CP estimates.	Increased energy production and investment parameters for solar, geothermal, tidal and wind sources by 30% and 200%, respectively, over CP projections by 2030.
	Electricity use, access, and generation	A 100% increase in electrification rates by 2030. A 30% increase in electricity as a percentage of energy use at country-level by 2030.	The model parameterizes electricity access % to a value of 100% and target year of 2030. The proportion of electricity use in overall energy use is increased by 30% by 2030 over CP forecasts.
	Capital-output costs of renewables	Higher capital-output costs for hydro and other renewables are inherent to the model. Additional government spending to boost renewable energy production.	Capital costs to output ratio for energy associated with renewables is assumed constant, and higher than other energy sources. The model assumes additional fiscal expenditure to incentivize up-take of renewables.
Balanced Green Growth (BGG)	Renewable energy production and investment	A 30% increase in renewable production and investment by 2030.	The model increases energy production and investment by 30% over CP forecasts by 2030.
	Conventional (or non-renewable) energy production and investment	A 30% increase in natural gas production and investment by 2030. A 20% increase in production and investment in other conventional sources of energy in Sahel.	The model increases parameters associated with natural gas production and investment by 30% over CP forecasts by 2030. For other conventional sources of energy, primarily oil, coal, nuclear, it includes an increase of 20% by 2030.
	Electricity use, access, and generation	An increase in electrification rates to 100% by 2050 across Sahel – a more realistic target. An increase in electricity share in energy use of over 20% by 2030 applied at the country level in Sahel.	The parameter value is adjusted to 33 (to reflect universal electrification in 33 years from IFs base year and adjusted to 100% for universal access value pertinent to electricity. Proportion of electricity use in overall energy use is increased by an additional 20% over CP forecasts by 2030.
	Governance and spending	A 30% increase in government effectiveness by 2030, with an additional 20% increase by 2050. A global 50% increase in government spending towards household welfare transfers to skilled and unskilled labor force by 2040, but 100% increase for low-income countries by 2040. A 75% increase in fiscal expenditures towards health, education, and research and development sectors by 2050. A 30% increase in the level of democracy by 2030, followed by an additional 20% increase by 2050 for Sahelian countries.	The government effectiveness parameter is increased by 30% by 2030 with an additional 20% improvement by 2050 over CP projections. Government spending towards household welfare transfers is increased by 50% globally over CP forecasts by 2040, excluding low-income countries where it is simulated to increase by 100% by 2040. Education, health, and R&D is simulated to increase by an additional 75% over CP projections by 2050. The democracy multiplier is increased by 30% over CP projections by 2030 globally, with a further 30% increment for Sahelian countries by 2050.

ANNEX B:

Regional energy initiatives across the Sahel

Initiative	Countries Involved	Objective	Energy Levers	Partners
Desert to Power	Burkina Faso, Ethiopia, Eritrea, Djibouti, Mali, Mauritania, Niger, Nigeria, Senegal, Sudan and Chad	Connect 250 million people to electricity by making Sahel the world's largest solar production zone.	Infrastructure, financing, sustainability	AfDB Green Climate Fund, Africa 50
DESFERS	Senegal, Mali and Niger	Support the development of over 4,000 women-led renewable energy businesses in the Sahel.	Inclusivity	EU-Plan International
Zagtouli village solar plant	Burkina Faso	Construct a 33 megawatts solar power plant (largest in the Sahel region).	Infrastructure, sustainability	EU (grant), French Development Agency (loan)
The Gambia River Basin Development Organization (OMVG) Energy Project	The Gambia, Guinea, Guinea-Bissau and Senegal	To reach at least 30% of the energy balance from renewable energies by 2030.	To reach at least 30% of the energy balance from renewable energies by 2030.	To reach at least 30% of the energy balance from renewable energies by 2030.
The Regional Electricity Access and Battery-Energy Storage Technologies (BEST) project	Mauritania, Mali, Niger, Côte d'Ivoire, Senegal	To reach at least 30% of the energy balance from renewable energies by 2030.	To reach at least 30% of the energy balance from renewable energies by 2030.	To reach at least 30% of the energy balance from renewable energies by 2030.
Sahel Renewable Energy	Mali, Niger and Burkina Faso	Boost the supply of renewable energy and contribute to socioeconomic development of targeted communities.	Inclusivity, infrastructure	Swedish International Development Cooperation Agency, UNOPS, UNDP and ALG (Integrated Development Authority of the Liptako-Gourma Region)
West Africa Energy Program (WAEP)	G5 countries	To provide technical assistance, financial advisory services, and targeted use of grant funding to support new transmission lines and facilitate new on-grid connections.	Finance, infrastructure	USAID, ECOWAS
Energy4Sahel	Burkina Faso, Cameroon, Chad, The Gambia, Guinea, Mali, Mauritania, Niger, Nigeria and Senegal	To provide technical assistance and investment through regional and national level interventions aimed at off-grid renewable electrification and clean cooking.	Finance, infrastructure, inclusivity	UNDP
Regional Off-Grid Electrification Project (ROGEP)	Benin, Burkina Faso, Cabo Verde, Cameroon, Central African Republic, Chad, Cote d'Ivoire, The Gambia, Ghana, Guinea, Guinea-Bissau, Liberia, Mali, Mauritania, Niger, Nigeria, Senegal, Sierra Leone and Togo.	Expand off-grid access to electricity using stand-alone solar systems.	Adopt regional standards and regulations to establish a regional market, crowding in private investments to deploy innovative technologies	Credit and grant from IDA, recovery grant from the Clean Technology Fund (World Bank)
The West African Power Pool North Dorsal Project	Niger, Benin, Burkina Faso	Increase integration of regional energy systems and enable the transport of electricity at a lower cost from Nigeria to Niger, Benin, and Burkina Faso.	Affordability	World Bank, African Development Bank, EU, France

Sahel Country Factsheets

Burkina Faso

HDI: 0.449
184th globally; 46th in Africa

EXTREME POVERTY **6.9M; 30.5%** of population

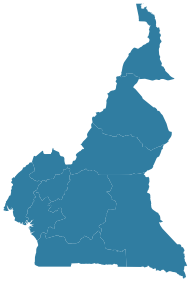
ELECTRICITY ACCESS
of population **19%**

ELECTRICITY CONSUMPTION PER CAPITA
10 *(Watts , year)*

CURRENT ENERGY MIX

Hydro 15.8% | Solar 11.4% | Oil 72.6%

Cameroon



HDI: 0.576
151th globally; 19th in Africa

EXTREME POVERTY **7.2M; 25.7%** of population

ELECTRICITY ACCESS
of population **65.4%**

ELECTRICITY CONSUMPTION PER CAPITA
30 *(Watts , year)*

CURRENT ENERGY MIX

Hydro 79.0% | Solar 0.3% | Oil 5.0% | Natural Gas 15.8%

Chad

HDI: 0.394
190th globally; 52th in Africa

EXTREME POVERTY **5.5M; 30.9%** of population

ELECTRICITY ACCESS
of population **11.3%**

ELECTRICITY CONSUMPTION PER CAPITA
2 *(Watts , year)*

CURRENT ENERGY MIX

Natural Gas 65.4% | Oil 29.0% | Solid biofuels 2.6% | Wind 2.6%

Gambia (the)

HDI: 0.5
174th globally; 38th in Africa

EXTREME POVERTY **0.5M; 17.2%** of population

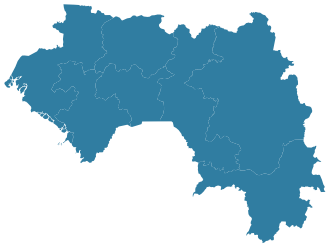
ELECTRICITY ACCESS
of population **63.7%**

ELECTRICITY CONSUMPTION PER CAPITA
14 *(Watts , year)*

CURRENT ENERGY MIX

Wind 0.5% | Solar 1.1% | Oil 98.4%

Guinea



HDI: 0.465
182th globally; 45th in Africa

EXTREME POVERTY **1.9M; 13.8%** of population

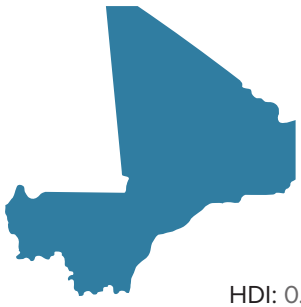
ELECTRICITY ACCESS
of population **46.8%**

ELECTRICITY CONSUMPTION PER CAPITA
18 *(Watts , year)*

CURRENT ENERGY MIX

Hydro 87.4% | Solar 0.7% | Oil 11.9%

Mali



HDI: 0.428
186th globally; 48th in Africa

EXTREME POVERTY **3.3M; 14.8%** of population

ELECTRICITY ACCESS
of population **53.4%**

ELECTRICITY CONSUMPTION PER CAPITA
18 *(Watts , year)*

CURRENT ENERGY MIX

Hydro 56.6% | Oil 37.7% | Solar 3.1% | Solid biofuels 2.6%

Mauritania

HDI: 0.556
158th globally; 24th in Africa

EXTREME POVERTY **0.3M; 6.5%** of population

ELECTRICITY ACCESS
of population **47.7%**

ELECTRICITY CONSUMPTION PER CAPITA
22 *(Watts , year)*

CURRENT ENERGY MIX

Oil 80.6% | Solar 10.0% | Wind 9.4%

Niger

HDI: 0.400
189th globally; 51th in Africa

EXTREME POVERTY **13.3M; 50.6%** of population

ELECTRICITY ACCESS
of population **18.6%**

ELECTRICITY CONSUMPTION PER CAPITA
8 *(Watts , year)*

CURRENT ENERGY MIX

Coal 33.0% | Natural gas 7.8% | Oil 51.1% | Solar 8.1%

Nigeria

HDI: 0.535
163th globally; 28th in Africa

EXTREME POVERTY **67.5M; 30.9%** of population

ELECTRICITY ACCESS
of population **59.5%**

ELECTRICITY CONSUMPTION PER CAPITA
16 *(Watts , year)*

CURRENT ENERGY MIX

Hydro 24.9% | Natural gas 74.6% | Solar 0.3% | Solid biofuels 0.2%

Senegal

HDI: 0.511

170th globally; 34th in Africa

EXTREME POVERTY **1.6M; 9.3%** of population

ELECTRICITY ACCESS

of population **68%**

ELECTRICITY CONSUMPTION PER CAPITA

27 *(Watts , year)*

CURRENT ENERGY MIX

Coal	Natural gas	Solar	Oil	Wind
2.7%	0.2%	9.3%	76.4%	9.8%

Endnotes

POWERING ECONOMIC DEVELOPMENT ACROSS THE SAHEL

RATIONALE FOR THE 2023 SAHEL HDR

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BALANCED GREEN GROWTH IS A PATHWAY TO SUCCESS

ACCELERATING ECONOMIC DEVELOPMENT IN THE SAHEL

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FINANCING GREEN ENERGY TRANSITIONS IN THE SAHEL

RECOMMENDATIONS

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