

Issues in Focus Analysis from *International Energy Outlook 2020*: Off-Grid Electricity Development in Africa: Uncertainties and Potential Implications for Electric Power Markets



Center for Strategic and International Studies

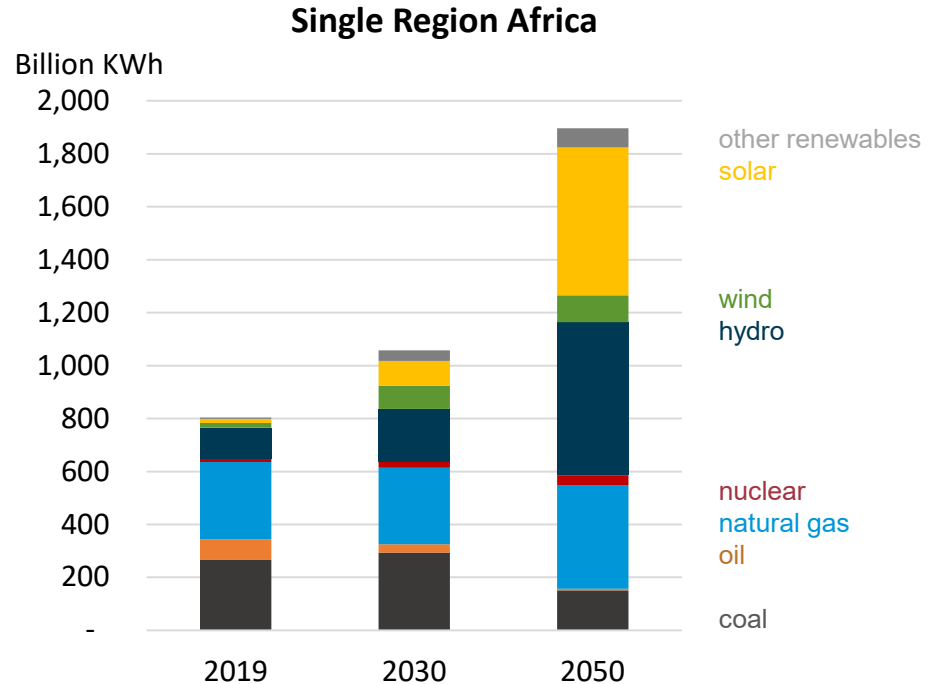
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U.S. Energy Information Administration

Challenges in the *International Energy Outlook 2019* (IEO2019) from a continent-wide, centralized-grid viewpoint of Africa

- Africa generation projection includes major growth and contains uncertainty
 - Expanding urbanization, but large rural population without electricity access
 - Lower pace of transmission development and grid integration
 - New opportunities associated with off-grid generation
- In IEO2019's single region view of Africa, centralized grid-only approach masks these uncertainties
 - Results in *over-optimized* projected generation mix in which hydro and solar dominate



Source: U.S. Energy Information Administration, *International Energy Outlook 2020*

IEO2020 regional differences include greater electricity demand growth potential in the Africa South region

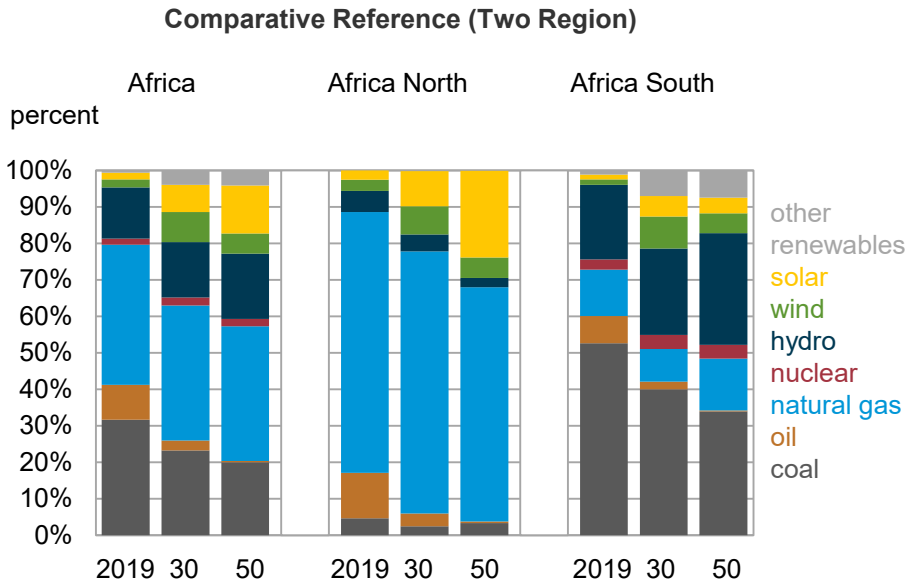
- Africa North
 - Greater electricity access
 - More mature electric sector infrastructure
 - Significant reliance on natural gas
- Africa South
 - Lower electricity access
 - Higher potential for electricity demand growth and investment
 - Significant reliance on coal/hydro, with new offshore gas reserves discovered in Mozambique and Tanzania
- Full electric access by 2030, met by:
 - Maximum Grid Expansion
 - Maximum Off-grid Expansion



Source : [The World Bank: World Bank Electricity Transmission and Distribution data set, 2017](#)

IEO2020 highlights regional differences in generation mix growth

- Highlights transmission limits between regions
- Differing role of natural gas in Africa North and coal in Africa South
- Natural resources availability influences generation fuel-mix
- Expanding investment in LNG facilities for both import/export



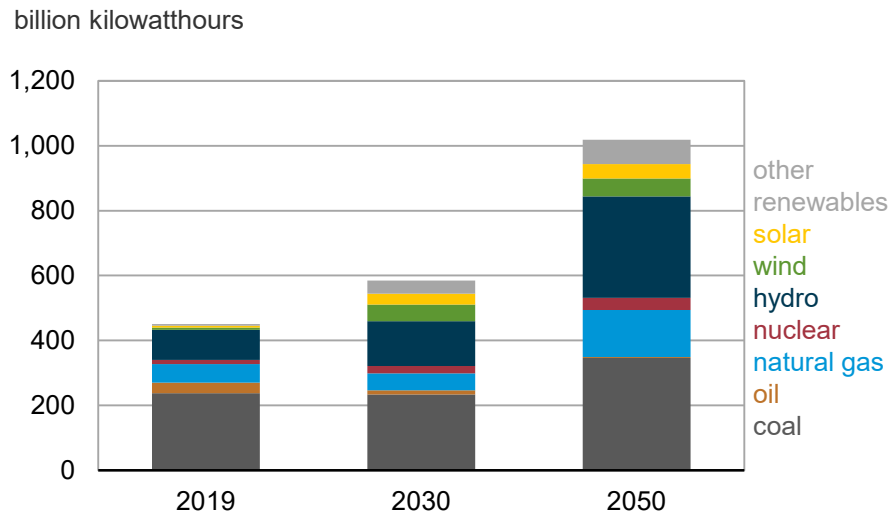
Source: U.S. Energy Information Administration, *International Energy Outlook 2020*

IEO2020 calculates bounds for off-grid generation in Africa South and potential for significant expansion of renewables

- Assumes Africa South reaches full electricity access by 2030 with incremental demand by sector:
 - Residential: unserved urban and rural areas achieve full electricity access by 2030 at average electricity consumption levels
 - Commercial/Industrial: replacement of lost load for commercial and industrial customers attributed to Africa's less reliable power supply and delivery systems
- Maximum Grid Expansion case assumes full incremental demand is met by least cost dispatch of centralized-grid power
- Maximum Off-Grid Expansion case assigns incremental demand to be met by off-grid supply either in mini-grid or stand-alone solar photovoltaic systems
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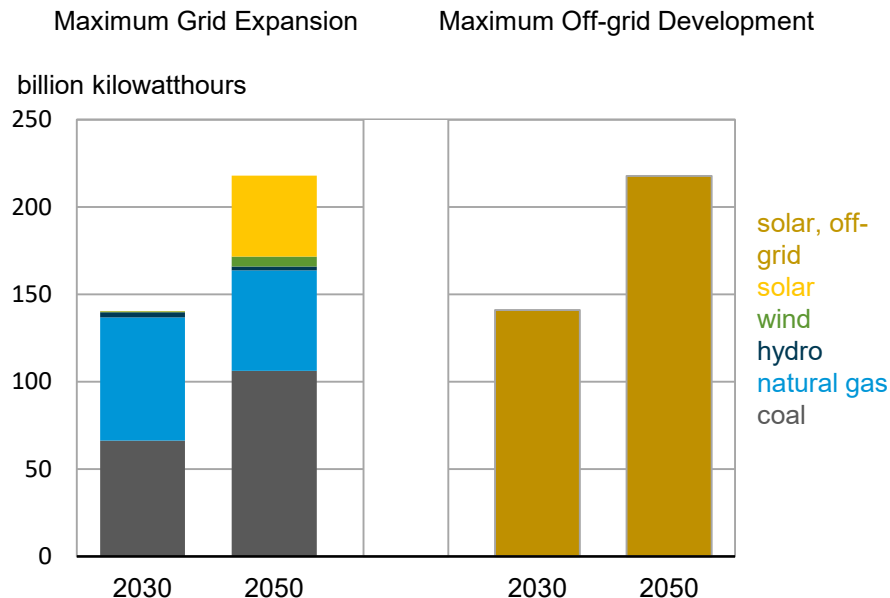
Africa South Maximum Grid Expansion maintains growth in fossil fuel generation versus solar growth in Maximum Off-Grid case

Africa South electricity generation by fuel source in Comparative Reference (Two-Region) case (CRC)



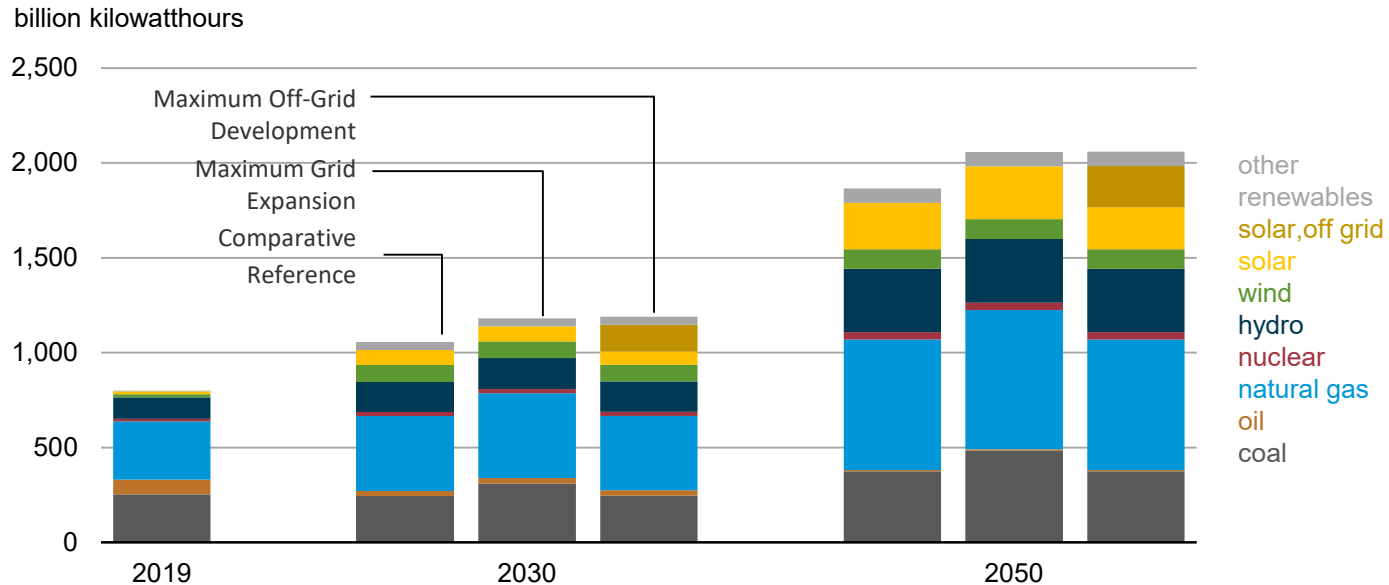
Source: U.S. Energy Information Administration, *International Energy Outlook 2020*

Change in Africa South generation from CRC by fuel source: Maximum Grid Expansion/ Maximum Off-grid cases



Source: U.S. Energy Information Administration, *International Energy Outlook 2020*

IEO2020 projects opportunities for growth in renewables and fossil generation in Africa North and South



Source: U.S. Energy Information Administration, *International Energy Outlook 2020*

Conclusion: Off-grid development could increase solar generation, but bypass of centralized grid is unlikely

- Lack of interconnection and slow transmission infrastructure development reinforces reliance on regional fuels
- Greater off-grid development boosts solar share, but limited interregional transmission and grid cost-competitiveness at higher demand levels make bypass of the grid less likely
- Demand growth for fossil fuels in Africa projected to increase demand for imports, including LNG