POLICY BRIEF

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MINISTRY OF ENERGY AND MINERAL DEVELOPMENT

Harnessing Uganda's Industrialisation Strategy: Macroeconomic Impacts of Renewable Energy Expansion

Abstract

Uganda's development strategy encompasses industrialisation—progression from low-value production to an innovation-based and high-skilled economy through technological progress and increased production of economic goods and services. Achieving this economic transformation is dependent on the availability of reliable and affordable energy supply. This policy brief utilizes the e3.ug model and simulates the potential macroeconomic impacts on the economy and environment when renewable energy investments are considered. By modelling the impact of renewable energy expansion and a reduction in electricity tariffs for the industrial sector, an increase in electricity consumption by the industrial sector translates into an increase in the production of goods and services. This is illustrated by the positive effects on real GDP. Besides GDP growth, there are associated positive impacts on household consumption, government expenditure, and employment. In terms of environmental quality, results indicate that CO2 emissions would significantly reduce by 2050 as industries gradually replace biomass energy demand with electricity use. For policy, investments that simultaneously increase electricity generation while making it affordable would spur industrialization and economic growth for Uganda in the medium term and long term.

Introduction

Industrialisation is a vital strategy for sustainable economic growth and social inclusion. For Uganda, the industrial sector contributes 27.4% to GDP, and has been earmarked as a strategic sector in the creation of clean and decent jobs (MITC, 2021). In the medium-term strategy, eight (8) industrial value chains have been prioritized, and these include: iron and steel, engineering, mobility, agro-industry, beauty and apparel, pathogens, digitalization, and oil and gas (UIA, 2021). These priorities imply that Uganda's primary policy challenge is the transformation from low-value production into high-value manufacturing.

To facilitate this goal, and achieve Government of Uganda's industrialisation strategy, the industrial sector requires adequate, reliable, and affordable supply of energy. Renewable energy resources, particularly hydro and solar, provides a huge potential in the generation of electricity to power the industrial sector. In this context, models that simultaneously evaluate options that increase reliable electricity supply while accounting for sector-wide contributions in terms of economic growth, energy consumption, employment, and environmental sustainability are critical for policy targeting and implementation. Consistent with Uganda's development plans (NDP III) on industrialisation, this policy brief assesses the macroeconomic impacts of increasing renewable electricity generation in Uganda by 2050.

Methodology

The analysis employed a scenario-based simulation using the e3.ug model (Fig.1). The e3.ug model is an integrated modelling tool that assesses the macroeconomic impacts of policy changes or interventions on Uganda's energy, environment, and economic system.

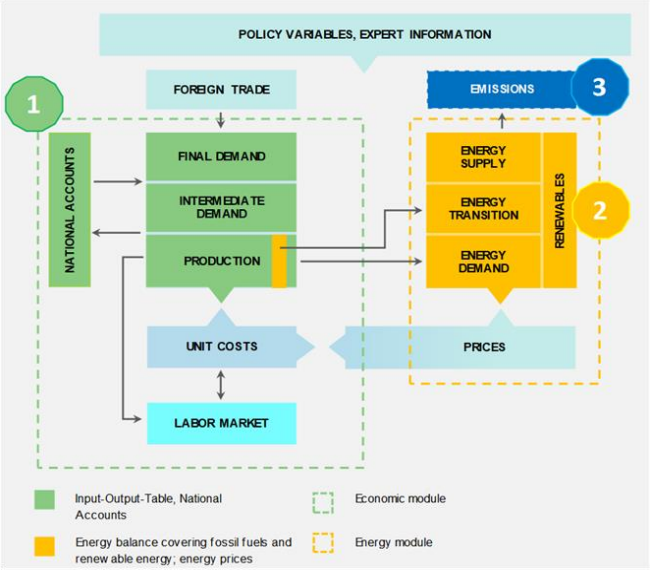

Figure 1: Structure of the e3.ug model. Source: GWS, 2022

The e3.ug model covers the structure of the Ugandan economy and its main connections to the environment, i. e. the use of energy resources and the contribution of greenhouse gas (GHG) emissions into the environment. Impacts on the whole economy, single economic sectors, and social balance and environment can be quantified using this model.

For the assessed scenario in this brief, the assumptions are based on the evidence that industrial electricity consumers in Uganda make the largest share of electricity consumption, accounting for 67% of the energy sales in 2021 (ERA, 2022). This implies that any surplus electricity generated will be utilised by the industrial sector to produce additional goods and services for domestic consumption and export.

Consistent with this expectation, a reduction in electricity tariffs for industrial sector is considered, and is modelled as the industrialisation (INDU) scenario. The associated assumptions of the "INDU" scenario are presented in Table 1. To model this scenario, results are reported as deviations from the "Business As Usual" (BAU) scenario to assess the potential macroeconomic impacts of this policy intervention.

Scenario Assumptions

Table 1: Key Scenario Assumptions

Scenario	Scenario Description	Key Assumptions
Industrialization	To support government industrialisation strategy, simulations in line with government's plan to increase renewable electricity generation in total 4,574 MW by 2040 were effected. Also, industrial electricity prices gradually reduce between 2023 and 2050.	• Reduce electricity price for industrial sector by 10% between 2022 and 2030, and then by 5% between 2031 and 2050. • Affordable electricity triggers increased production in manufacturing sectors (food, chemical, basic metals) between 2023 to 2050. • Additional production and value addition from the manufacturing sector will be absorbed by increase in exports of food, chemicals, and basic metals by 10% compared to BAU by 2050. • Increase in electricity demand by industries is matched by reduction in biomass energy demand by the same economic sector • Industrial energy savings of 10% between 2023 and 2025, and then 35% between 2026 and 2050.

Key Findings

1. An increase in renewable electricity generation is associated with positive impacts on economic growth.

Findings reveal that expansion of the renewable energy in the electricity generation mix translates into surplus electricity supplied that can be utilized by the industrial sector for production of goods and services. In particular, the stated scenarios between 2022 and 2030 contribute to approximately 0.5% increase in real GDP by 2027 (Fig 2). This effect is largely driven by renewable energy investments and increase in the exports of industrial outputs for food, chemicals, and basic metals over the same period.

While imports reveal an upward trend, their contribution as a share of GDP is lower than the growth in exports. Similarly, positive impacts on real GDP are observed through increase in investment (gross fixed capital formation) by 1.3% in 2030. Further, there is a positive impact on real GDP through increased household consumption between 2023 and 2030. These observations infer that investments in renewable electricity generation propels economic growth as business enterprises and households utilize electricity for productive and income generating activities.

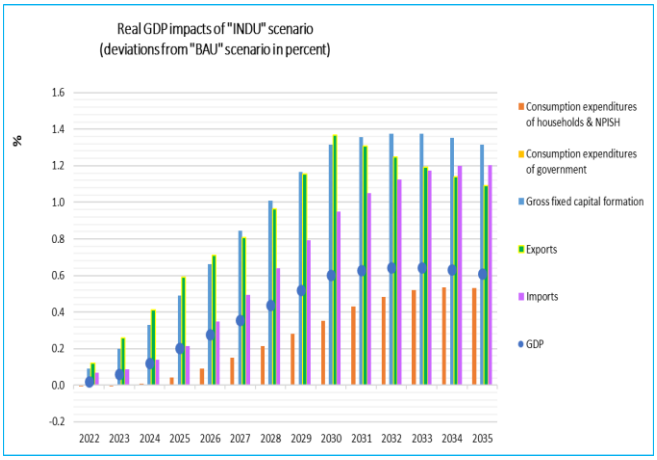

Figure 2: Real GDP impacts as deviations from the BAU scenario

2. Renewable electricity carries considerable positive long-term impacts on employment.

Results depict an increase in total employment starting in 2026, recording a 0.17% increase in 2030 (Fig.3). A direct implication is that an expansion of renewable electricity is associated with positive medium-term and long-term effects on employment (Arvanitopoulos & Agnolucci, 2020).

The transmission mechanisms of renewable electricity on employment are in two ways: First, there are direct jobs created in the operation and maintenance of renewable electricity generation (IRENA, 2023).

Second, electricity is associated with increased economies of scale for the industrial sector because electricity enhances the productivity of existing production capacities and facilitates value addition chains especially in the manufacturing sector. These two channels, combined, contribute to total employment in the economy.

Findings, however, show relatively small reductions in total employment between 2022 and 2025. This implies that implementing such policy interventions may arrive with short-term job losses as enterprises have to switch to, and or invest in new equipment to utilize the electricity. Overall, these small reductions are offset by the higher gains in employment in the medium term and long term.

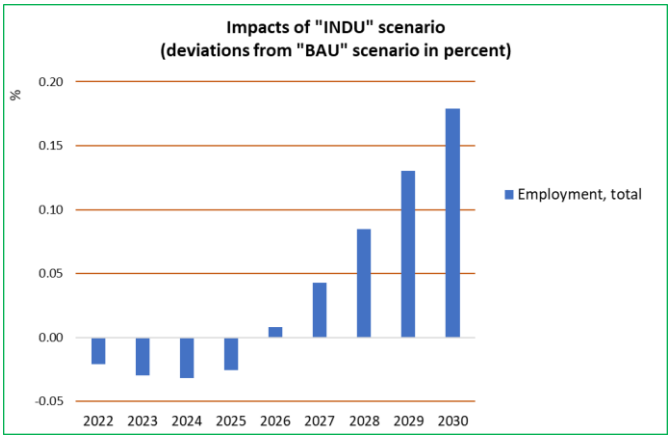

Figure 3: Employment impacts as deviations from the BAU scenario

3. Expansion of renewable electricity generation contributes to reductions in GHG emissions

Results show that renewable electricity generation is associated with a reduction in GHG emissions especially by the energy industries. CO2 emissions reveals the highest reduction up to approximately 10.5% in energy industries (Fig 4). This result is consistent with the expectation that industries are likely to increase electricity consumption when electricity supply is reliable and affordable.

However, results indicate an increase in the GHG emissions in the transport sector and manufacturing industries. This observation is attributed to two occurrences in Uganda: First, the transport sector is nearly 100% reliant on fossil fuels for energy. Second, some manufacturing industries still use fossil fuels and biomass instead of electricity. In general, this analysis infers that an expansion of the renewable electricity generation would increase electricity supply and potentially induce a policy shift to reduce electricity tariffs. Under these circumstances, the overall impact is a reduction in GHG emissions.

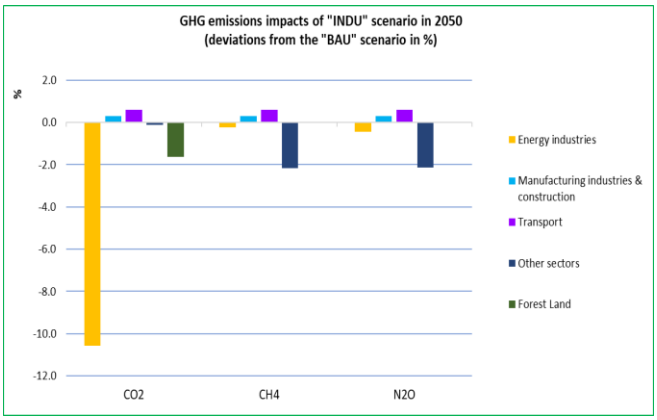

Figure 4: GHG emissions impacts as deviations from the BAU scenario

Policy Recommendations

Per the results, expansion of renewable electricity generation would increase electricity supply. Importantly, adequate and reliable electricity supply supports the implementation of fiscal incentives to the industrial sector, including reduction in industrial electricity tariffs. To harness Uganda's industrialization strategy, economic policies should:

1. Prioritize renewable energy in electricity generation

(i) Undertake and assessment of the national renewable energy potential for hydropower, solar, wind, geothermal, biomass, and green hydrogen resources.
(ii) Increase investment in power generation capacity to ensure that future electricity demand requirements from the industrial sector are adequately met.
(iii) Increase investment in the transmission and distribution networks to ensure the uptake and use of generated electricity.

2. Incentivise electricity use in the industrial sector

(i) Reduce electricity tariffs for the industrial sector especially manufacturing and construction to encourage consumption of generated electricity.
(ii) Encourage value addition and productive use of electricity across all sectors to promote industrial growth. This will induce electricity demand of the generated electricity.
(iii) Enhance grid reliability to encourage industrial customers to invest in electricity use.
(iv) Provide rebates to investors in electricity infrastructure.

3. Increase public awareness and social acceptance of renewable energy technologies

(i) Sensitisation about the economic benefits of using renewable energy technologies.
(ii) Undertake training programmes in the environmental values, including health and safety gains of using electricity from renewable energy resources.

4. Implement the National Industrial Policy (NIP)

(i) Ring-fence planned financial resources to enable the implementation of the NIP targets and strategies.
(ii) Foster domestic and external markets for the industrial commodities produced.
(iii) Support local and private investors to promote the industrialisation agenda.

Conclusion

Leaning on the aspirations of Uganda's industrialisation strategy, this brief assessed the macroeconomic impacts of renewable energy expansion on the economy. Using the e3.ug model, a simultaneous policy intervention that increases renewable electricity generation while gradually reducing industrial electricity prices between 2023 and 2050 was considered. Results show that there are positive impacts on real GDP, observed through increase in household consumption, government expenditure, and export of industrial commodities. Further, there are positive impacts on employment in terms of creation of direct jobs as well as value-addition chains. Also, this policy consideration would translate into reduction of GHG emissions, particularly CO2 emissions by the energy industries in Uganda.

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