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### SNAPSHOT OF THE 2022 ENERGY BALANCE

#### **TOTAL PRIMARY ENERGY SUPPLY (TPES), 2022**



Tanzania's Energy Mix: Traditional Fuels Still Dominate

#### SHARE OF MODERN RENEWABLES IN TOTAL PRIMARY ENERGY SUPPLY, 2022



Modern Renewables: A Modest Share in the Total Primary Energy Supply



#### SECTORAL ENERGY DEMAND (KTOE), 2022



Sector Breakdown: Industry and Transport on the Rise



**SECTORAL ENERGY DEMAND BY SHARES, 2022** 

A Diverse Mix of Sources Powering Key Sectors



#### **ELECTRICITY GENERATION BY SOURCE, 2022**

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**Biofuels:** fuels derived from organic materials, such as plants, agricultural residues, animal waste, and wood that are used for producing energy.



**Energy Mix:** the proportion of energy supplied from various sources like fossil fuels, nuclear power, and renewables (e.g., wind, solar, hydroelectricity, biomass, geothermal) in the total energy production or consumption.



**Solar PV:** a technology that converts sunlight directly into electricity using solar cells.



**CO<sub>2</sub> Emissions:** the release of carbon dioxide (CO<sub>2</sub>) into the atmosphere, primarily as a result of human activities. A greenhouse gas that contributes to global warming and climate change.

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## LIST OF ABBREVIATIONS

- **CO**, Carbon Dioxide
- **EWURA** Energy and Water Utilities Regulatory Authority
- **GDP** Gross Domestic Product
- **GHGs** Greenhouse Gases
- Ktoe Kilotonnes of Oil Equivalent
- **NBS** National Bureau of Statistics
- PBPA Petroleum Bulk Procurement Agency
- PURA Petroleum Upstream Regulatory Authority
- TANESCO Tanzania Electric Supply Company
- TAREA Tanzania Renewable Energy Association
- **TPDC** Tanzania Petroleum Development Corporation
- **TPES**Total Primary Energy Supply
- TWh Terawatt-hour

## **DEFINITIONS OF KEY TERMS**

**Biofuels:** for purposes of this report, we are referring to primary solid biofuels, specifically fuelwood used to make charcoal] fuels derived from organic materials, such as plants, agricultural residues, animal waste, and wood that are used for producing energy.

**Energy Balance:** a comprehensive accounting of all energy inputs, transformations, and outputs within a country over a specified period, usually a year.

**Energy Efficiency:** the ability to use less energy to perform the same task or produce the same amount of output.

**Energy Flows:** movements or transfers of energy products from one entity to another within the energy system.

**Energy Intensity:** a measure of how efficiently energy is used within an economy, industry, or sector.

**Energy Mix:** the proportion of energy supplied from various sources like fossil fuels, nuclear power, and renewables (e.g., wind, solar, hydroelectricity, biomass) in the total energy production or consumption.

**Energy Products:** any source or form of energy that is produced, processed, or converted for consumption in various sectors, including electricity, heat, and fuel.

**Imports and exports:** the physical movements of energy products across national boundaries, regardless of ownership or contractual arrangements.

**Production:** the extraction or capture of energy products from natural sources, such as mining, drilling, harvesting, etc.

**Renewable Energy:** energy derived from natural processes that are replenished constantly.

**Stock changes:** changes in the level of inventories of energy products held by producers, suppliers, or consumers within the national territory.

**Transformation:** the process of changing the form or quality of an energy product, such as refining, power generation, charcoal production, etc.

# FOREWORD

t is with great pleasure that we present the "Key Insights from the United Republic of Tanzania's 2022 Energy Balance." This report provides a comprehensive overview of the energy landscape in Tanzania, offering critical insights into the production, distribution, and consumption of energy across the nation. As we strive toward sustainable development anad energy security, understanding the nuances of our energy balance is essential for informed policy-making and strategic planning.

Tanzania is at a crucial point in its energy journey. With a rapidly growing economy and population, energy demand is soaring. Our abundant natural resources, including hydro, natural gas, and renewable energy, offer significant growth opportunities. To effectively harness these, we must have a clear and accurate understanding of our current energy dynamics.

This report explores Tanzania's energy supply and demand, highlighting the sources powering our industries, homes, and transportation. It analyzes energy use efficiency, identifying areas for improvement to reduce losses and boost productivity. Additionally, it examines the environmental impact of our energy consumption, providing key data on greenhouse gas emissions.

One of the critical insights from this report is the composition of our energy mix and the trends that have emerged in 2022. Future reports and work on the country's first historical time series will allow us to look at these trends over recent years and into the future. The data reveals a strong potential for the increase in the adoption of renewable energy sources, a positive move toward sustainability efforts.

Energy security remains a top priority for Tanzania. This report assesses our dependence on energy imports and the resilience of our energy infrastructure, which can be used to inform recommendations to enhance our energy security in the future. The insights derived from this analysis will be instrumental in guiding our policies and strategies to ensure a stable and reliable energy supply for all Tanzanians.

As we look to the future and conduct future energy balances, future reports will offer valuable projections and scenarios so we may navigate the challenges and opportunities ahead. By understanding the trajectories of our energy demand and supply, we can better prepare for the future and make strategic decisions that align with our national development goals.

In conclusion, this report is a vital resource for policymakers, industry leaders, and stakeholders across the energy sector. We hope that the insights presented here will contribute to the advancement of our energy policies and the sustainable development of Tanzania.

We extend our gratitude to all the experts, analysts, and contributors who have worked tirelessly to compile the data necessary for this comprehensive report. Their dedication and expertise have been instrumental in providing a clear and accurate picture of Tanzania's energy landscape.

Together, let us continue to work toward a brighter and more sustainable energy future for the United Republic of Tanzania.



Dr. Amina S. Msengwa Statistician General National Bureau of Statistics

## **EXECUTIVE SUMMARY**

he 2022 Energy Balance of Tanzania provides a comprehensive review of the country's energy landscape, highlighting key trends in energy production and consumption. Compiled by the National Bureau of Statistics (NBS) with contributions from various stakeholders, this report captures data across different sectors, emphasizing the critical role of energy in Tanzania's economic and social development.

In 2022, Tanzania's Total Primary Energy Supply (TPES) reached 36,119.4 kilotonnes of oil equivalent (ktoe). Biofuels, primarily wood and charcoal, dominated the energy mix, accounting for 82% of the TPES. Oil products made up 10.7%, while natural gas, coal, and hydro contributed smaller shares. These figures underscore the country's reliance on traditional biomass and the growing need for energy diversification, particularly through renewable sources.

Electricity generation remains concentrated in a few key sources, with natural gas leading at 77%, followed by hydropower (11%) and oil (9.7%). Renewable sources like solar and wind have shown minimal contributions, highlighting the potential for greater investment in clean energy technologies.

**Total energy demand for 2022 was 22,337.55 ktoe**. The residential sector was the largest consumer, accounting for 64% of total final energy consumption, primarily driven by the use of biofuels. Industry, transport, and agriculture also contributed to energy demand, with a clear dependence on biofuels and oil products across sectors.

**Renewables made up less than 1% of the energy mix in 2022**, though hydropower plays a crucial role in electricity generation. The country has significant untapped potential for solar, wind, and other modern renewable sources, which could alleviate reliance on traditional biomass and reduce greenhouse gas emissions.

**Tanzania's energy-related CO<sub>2</sub> emissions totaled 18.08 million tonnes in 2022**, with power generation, transport and industry sectors being the primary contributors. While per capita emissions remain low compared to global averages, the growing reliance on fossil fuels poses environmental challenges. The report highlights the need

for policies to mitigate emissions as the economy grows. Going forward, the 2023 Energy Balance and future historical time series will offer deeper insights into Tanzania's evolving energy landscape, providing a foundation for informed decision-making and long-term planning.

This executive summary serves as a vital resource for policymakers, industry stakeholders, and development partners, guiding Tanzania's transition to a more sustainable and resilient energy future.

## INTRODUCTION

he energy balance is compiled annually by the National Bureau of Statistics (NBS) in collaboration with the Ministry of Energy, the Tanzania Petroleum Development Corporation (TPDC), the Petroleum Upstream Regulatory Authority (PURA), the Tanzania Electric Supply Company (TANESCO), the Energy and Water Utilities Regulatory Authority (EWURA), the Rural Energy Agency (REA), the Petroleum Bulk Procurement Agency (PBPA), The Mining Commission, the Tanzania Renewable Energy Association (TAREA), and other relevant stakeholders. The data sources include administrative records, surveys, reports, and publications from various energy producers, suppliers, and consumers.

The energy balance is an annual statistical report that shows the supply, transformation, and final consumption of different energy products and flows in the country. An energy balance is constructed as a matrix showing both energy products (columns) and energy flows (rows). It is prepared for a given calendar year and expressed in a common energy unit ktoe (kilotonnes of oil equivalent). An energy balance provides a comprehensive and consistent picture of the energy situation and trends in Tanzania.

The energy balance covers the following energy products: coal, crude oil, petroleum products, natural gas, biofuels, electricity, and renewable energy sources. It also covers the following energy flows: production, imports, exports, international bunkers, stock changes, transfers, transformation, energy sector own use, transmission and distribution losses, and final consumption by sector and subsector.

## **UNITED REPUBLIC OF TANZANIA'S ENERGY MIX**

#### **1.1 TOTAL PRIMARY ENERGY SUPPLY**

Total Primary Energy Supply (TPES) refers to the total amount of energy available to a country from various sources, including fossil fuels, nuclear, and renewable energy.

In 2022, the total primary energy supply in Tanzania amounted to 36,119.4 kilotonne of oil equivalent (ktoe). biofuels, encompassing primarily wood and charcoal, played a significant role in Tanzania's energy mix accounting for 82% of the total energy mix followed by oil 10.7 %, 5.1% natural gas, 1.5% coal, and 0.6% hydro. These figures reflect the country's reliance on traditional biomass and emphasize the need to diversify the energy mix by promoting renewable sources.

#### FIGURE 1: SHARE OF THE TOTAL PRIMARY ENERGY SUPPLY IN TANZANIA, 2022



#### **1.2 ELECTRICITY GENERATION**

Electricity generation in Tanzania is derived from a mix of sources, reflecting the country's ongoing efforts to diversify its energy portfolio. The key components of Tanzania's electricity generation included natural gas, hydro power and other renewables such as wind, solar and biomass.

In 2022, the country's electricity was mostly generated from natural gas (77%), hydro (11%), oil (9.7%), coal (0.8%), and biofuels and waste (1.3%). Solar PV is negligible, followed by some wind.

#### FIGURE 2: SHARE OF ELECTRICITY GENERATION BY SOURCE IN TANZANIA, 2022



#### **1.3 TOTAL FINAL CONSUMPTION**

Final energy consumption is calculated as the energy consumed by end users such as individuals and businesses to heat and cool buildings, to run lights, devices, and appliances, and to power vehicles, machines, and factories. It also includes non-energy uses of energy products, such as fossil fuels to make chemicals. It's important to remember that the energy found in primary sources is lost when converting to a usable final product, especially electricity. Therefore, the breakdown of final consumption may look very different from the primary energy supply. In Tanzania, the largest source of energy in final consumption in 2022 was biofuels and waste at nearly 77% of total final consumption. This was followed by oil at 16.5%, electricity at 2.9%, coal at 2.4%, and natural gas at 1.5%.

#### FIGURE 3: SHARE OF TOTAL FINAL CONSUMPTION OF ENERGY BY SOURCE IN TANZANIA, 2022



# **2.** ENERGY DEMAND

Tanzania's energy demand in 2022 was 22,337.55 kilotonnes of oil equivalent (ktoe) or 259.77 TWh. The sectoral breakdown of Tanzania's energy demand shows that the residential sector is the largest consuming sector, comprising nearly 64% of total final consumption. This is followed by industry (16.4%), transport (12.2%), and agriculture, forestry and fishing (4.4%). Commercial and public services account for only 2% of total final consumption, while 1.3% is non-specified and 0.2% is non-energy use. Due to a lack of available data on the consumption side in Tanzania at the time of reporting the 2022 Energy Balance, this sectoral breakdown could look somewhat different.

#### FIGURE 4: SHARE OF THE TOTAL FINAL CONSUMPTION BY SECTORAL BREAKDOWN IN TANZANIA, 2022



## 2.1 TOTAL FINAL CONSUMPTION BY FUEL SOURCE AND SECTOR

Demand was fueled by a variety of energy sources depending on the sector being served. In 2022, Tanzania, industry primarily consumed biofuels and waste (53.7%), followed by oil products (22.7%), coal (15.5%), and electricity (8.1%). The transport sector consumed only oil products in 2022, primarily diesel and gasoline for road transport. In the residential sector, the largest fuel source for consumption came from biofuels and waste (97%), while oil products and electricity (a secondary energy source being powered by natural gas or hydro) followed at 0.7% and 2.2%, respectively. Commercial and public services primarily consumed biofuels and waste (64.7%), followed by oil products (20.3%) and electricity (15.1%). Finally, agriculture, forestry and fishing consumed only biofuels and waste to power their operations, though 2022 data on this sector was lacking at the time of reporting.

#### FIGURE 5: SHARE OF TOTAL FINAL CONSUMPTION BY FUEL SOURCE AND SECTOR IN TANZANIA, 2022



The energy sector in Tanzania continues to be characterized by low electricity access rates and reliance on biomass use for residential consumption. As seen above, traditional biomass remains a dominant source of energy, particularly in rural areas where access to modern energy services is limited. Fuelwood and charcoal account for some 77% of total energy use, used extensively for cooking and heating. Residential demand for biomass accounted for 13,761.90 ktoe, followed by industry at 1,822.85 ktoe.

Industrial demand followed that of the residential sector but only accounting for 16.36% of total energy demand. The most energy-demanding industries remained non-metallic mineral industries, or primarily cement or ceramic industries, and mining and quarrying industries.

Transport accounted for 12.23% of total energy demand in 2022, over 95% of which came from road transport – private cars, heavy and light goods vehicles, busses, taxis, etc. The rest went to rail transport which uses some diesel, while domestic aviation only accounted for 1.3% of total energy demand in the transport sector. International aviation bunkers, though estimated, consumed roughly four times more energy than domestic aviation.

Understanding Tanzania's energy intensity is crucial for evaluating its energy efficiency and identifying opportunities for improvement in its energy sector as it is only one aspect of measuring energy efficiency. However, energy intensity can help identify how much energy is used to produce one unit of economic output. In Tanzania, total energy supply per unit of GDP in 2022 was 2,949.68 MJ/thousand 2015 USD, compared to the international average intensity of 4,715 MJ/thousand 2015 USD in 2019 alone, according to the International Energy Agency. While below international averages, Tanzania's relatively high energy intensity indicates the country's economy relies significantly on energy-intensive sectors such as heavy industry, mining and perhaps even agriculture as these sectors typically consume large amounts of energy relative to their economic output.

# **3.** ENERGY-RELATED EMISSIONS

Energy-related emissions refer to the greenhouse gases (GHGs) and pollutants released into the atmosphere due to the production, conversion, distribution, and consumption of energy. The primary sources of these emissions include the burning of fossil fuels (coal, oil, and natural gas) for electricity generation, transportation, industrial processes, and residential heating. Carbon dioxide (CO<sub>2</sub>) is the largest contributor to energy-related emissions, primarily from the combustion of fossil fuels. Other emissions include methane (CH<sub>4</sub>), especially from natural gas systems, and nitrous oxide (N<sub>2</sub>O), which can result from both fuel combustion and industrial activities. The following sectors in Tanzania contribute to the country's emissions:

**Electricity and Heat Generation** from power plants are a significant source of emissions, especially in countries relying heavily on coal and oil.

**Transportation**, including emissions from cars, trucks, ships, and airplanes, with petroleum products as the main fuel source.

Various industries emit GHGs from direct combustion of fuels.

Tanzania's total CO<sub>2</sub> emissions from energy consumption in 2022 were 13.81 Mt CO<sub>2</sub> (Million tons of carbon dioxide) with the transport and industrial sectors being the primary contributors, accounting for 59% and 37% of the total emissions, respectively. These emissions represent only 0.04% of the share of total global CO<sub>2</sub> emissions from combustible fuels in 2022, according to reports by the International Energy Agency (IEA).

In addition, emissions from power generation and the energy sector reached 4.27 Mt  $\mbox{CO}_2$  in 2022.

Total GHG emissions from combustion in Tanzania therefore stand at 18.08 Mt CO<sub>2</sub>: 23.6% from power

#### FIGURE 6: SHARE OF CO<sub>2</sub> EMISSIONS FROM FUEL COMBUSTION BY END-USE SECTOR (MTCO<sub>2</sub>) IN TANZANIA, 2022



 $CO_2$  emissions per capita were low at 225 tCO<sub>2</sub>, an indication of both the current developmental stage of the country and the potential for sustainable growth in the future. This is compared to the average  $CO_2$  emissions per capita of over roughly 5 tCO<sub>2</sub>.

Overall, most  $CO_2$  emissions in the energy sector come from the burning of fossil fuels such as coal, oil and natural gas for power generation or to fuel vehicles and machines. In 2022, the four most significant sources of energy-related emissions were diesel oil and gasoline used for road transport or to power industrial operations. Oil products accounted for 80% of  $CO_2$  emissions, or 11.11 Mt  $CO_2$ .

#### FIGURE 7: SHARE OF $\rm CO_2$ EMISSIONS IN END-USE SECTORS BY FUEL SOURCE IN TANZANIA, 2022



## **4.** RENEWABLE ENERGY

Renewables, excluding the traditional use of biomass and focusing on modern renewables, in the Tanzania are an increasing important source of energy and are primarily used to generate electricity. Renewables accounted for almost 1% of the total energy mix in 2022. Hydropower remains the largest renewable energy source, contributing almost 99% of total renewables through its use in electricity generation, while solar has shown small growth overall, but only contributes slightly over 1%, primarily used as power in the off-grid residential sector. Wind is negligible to-date in Tanzania.

#### FIGURE 8: SHARE OF MODERN RENEWABLES IN FINAL ENERGY CONSUMPTION IN TANZANIA, 2022



#### FIGURE 9: RENEWABLES SHARE OF ELECTRICITY GENERATION AND RENEWABLE ENERGY GENERATION BY SOURCE (NON-COMBUSTIBLE), 2022



This report underscores the importance of continued investment and policy support to further increase the share of modern renewable energy in the country's electricity mix, while lessening reliance on traditional biomass in the whole of the energy mix.

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# **5.** CONCLUSION

In conclusion, the 2022 Energy Balance of the United Republic of Tanzania offers profound insights into the country's evolving energy landscape. The data shows the level of energy demand, which we know to be driven primarily by robust economic growth and a rapidly expanding population. This trend highlights the urgent need for scalable and sustainable energy solutions to meet increasing consumption needs. The report also points to substantial progress in the adoption of renewable energy sources, primarily hydroelectric power and the need for the increased adoption of other modern renewables, especially solar.

The analysis also reveals persistent challenges around carbon emitting sectors and fuel sources. While the country is not a leading global emitter, it is important to implement measures to limit the growth of carbon emissions in line with the continued economic growth we expect to see. Addressing this is also crucial for optimizing energy use and enhancing the overall productivity of the energy sector.

Moreover, the report emphasizes the importance of continuous monitoring and strategic planning. By regularly updating the energy balance and incorporating realtime data, Tanzania can better anticipate and respond to changes in energy demand and supply dynamics. This proactive approach will be essential in ensuring that the energy sector can support the nation's economic development goals while also adhering to environmental sustainability commitments.

In the 2023 Energy Balance, we can expect a more refined and comprehensive analysis building on the foundations laid by the 2022 report. This next iteration will likely provide deeper insights into the patterns and trends observed, offering more detailed data on energy production, consumption, and efficiency improvements. The introduction of a historical time series in this next iteration will be particularly significant, as it will enable the tracking of energy trends over multiple years. This longitudinal data will help identify long-term patterns and shifts in energy dynamics, allowing for a better understanding of how economic growth, population changes, and policy reforms impact the energy sector. Historical data will also facilitate more accurate forecasting and planning, helping policymakers and stakeholders to make informed decisions. By comparing year-on-year changes, it will be possible to pinpoint the effectiveness of interventions and strategies, leading to more targeted and impactful energy policies and initiatives in the future.

## **ANNEX** 2022 ENERGY BALANCE UNITED REPUBLIC OF TANZANIA

Thousand Tonnes of Oil Equivalent (ktoe)	Coal and Coal Products	Crude oil	Oil products	
Production	1,701.4	3.2		
Imports (+)			4,014.3	
Exports (-)	-1,160.3			
International Aviation Bunkers (-)			-150.0	
TOTAL PRIMARY ENERGY SUPPLY	541.1	3.2	3,865.0	
Transfers : Origin (-) and Destination (+)				
Statistical Difference			-14.8	
TRANSFORMATION Inputs (-) and Outputs (+)	-16.1		-192.5	
Electricity plants	-16.1		-192.5	
Charcoal production plants				
Energy Sector Own Use				
Losses				
FINAL CONSUMPTION	525.0	3.3	3,687.2	
Industry	525.0		771.0	
Transport			2,674.9	
Households			101.5	
Commercial and public services			90.4	
Agriculture, Forestry and Fishing				
Non-specified (HH, Com. & PS., Agri.)				
Non-Energy Use		3.3	49.4	

Natural Gas	Biofuels and waste	Hydro	Solar	Wind	Electricity	Total of all energy sources
1 858.4	29 615.8	219.7	2.4	0.4		33,401.2
					13.5	4,027.7
						-1,160.3
						-150.0
1,858.4	29,615.8	219.7	2.4	0.4	13.5	36,119.4
-6.3					129.6	108.4
-1,532.2	-12,479.1	-219.7	-2.4	-0.4	902.2	-13,540.2
-1,532.2	-26.1	-219.7	-2.4	-0.4	902.2	-1,087.1
	-12,453.0					-12,453.0
3.7					9.0	12.7
					120.5	120.5
328.9	17,136.7				656.5	22,337.5
260.0	1,822.9				276.6	3,655.4
56.1						2,731.0
3.2	13,763.4				312.8	14,180.9
9.6	288.5				67.2	455.6
	981.5					981.5
	280.4					280.4
						52.7

