Indicators Used to Track Rwanda's NDC Progress

A summary of BTR –NDC key elements

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Summary of Rwanda's 1st BTR

- **Rwanda's 1st BTR submitted 31st December 2024**

✓ Rwanda's greenhouse gas (GHG) emissions and removals,

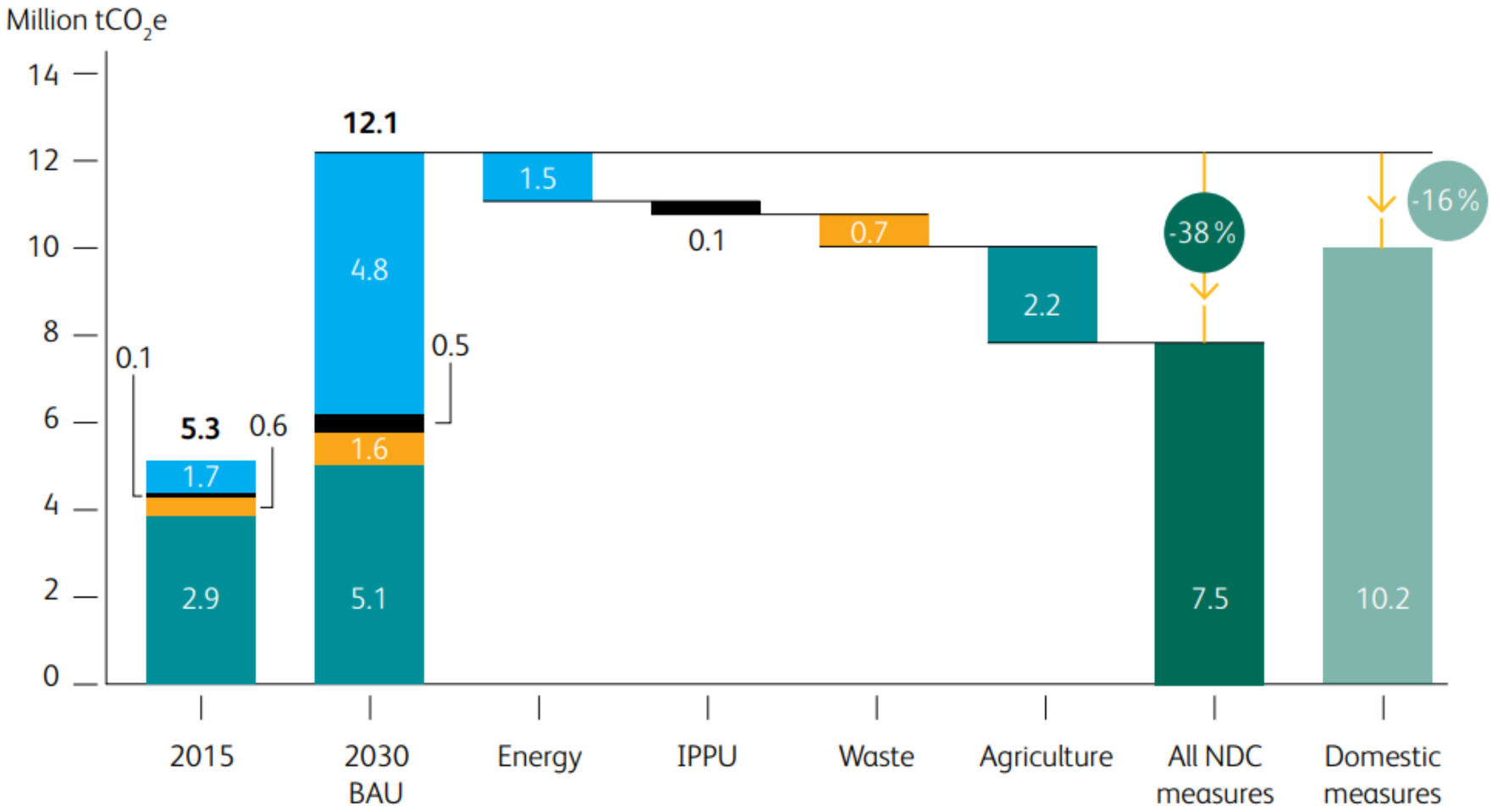
Time series: From 2006 to 2022

Methodology: 2006 IPCC Guidelines and the 2019 Refinements

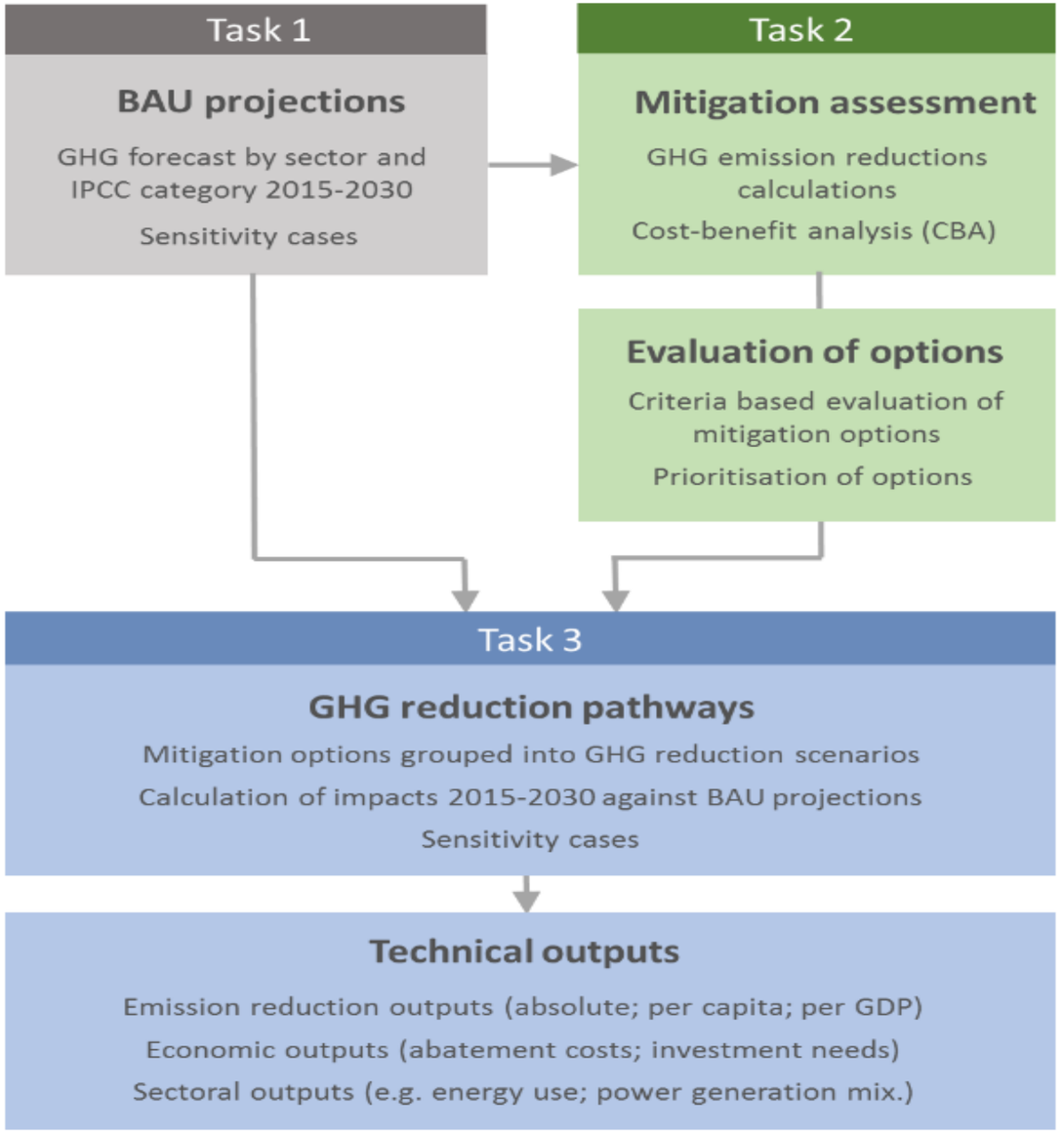
Covered Sector: Energy, IPPU, LULUCF and Agriculture and Waste

✓ Progress in implementing Nationally Determined Contributions (NDCs),
✓ Adaptation strategies and Financial
✓ Technical, and capacity-building needs and support,
✓ As well as other relevant BTR information.

Overview of Rwanda's Nationally Determined Contribution



Technical Analysis of selecting Mitigation measures



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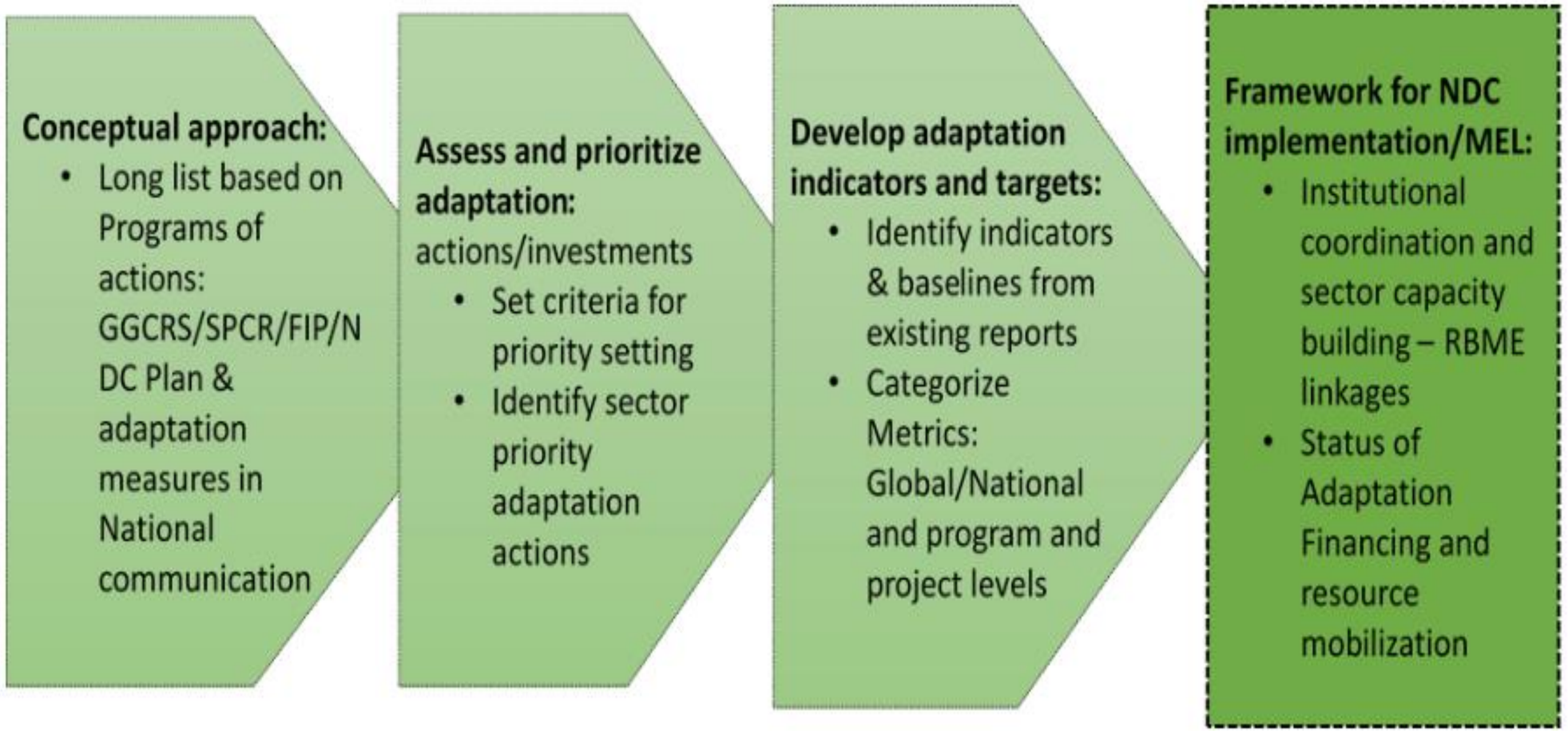


NDC Tracking

TOP DOWN

Emission reductions are calculated as the difference between a reference emissions level (e.g., base year, baseline, or business-as-usual [BAU]) and the actual emissions observed in the most recent inventory.

- Covers the entire economy and all sectors simultaneously, providing a holistic view of national emissions trends.
- Can be easier to implement for countries with limited data on specific policies and measures.
- Directly linked to the national greenhouse gas (GHG) inventory, which uses standardized IPCC methodologies, ensuring consistency.
- Observed emissions may be influenced by factors unrelated to NDC policies, such as economic downturns, technological advances, or natural phenomena (e.g., droughts or pandemics)

BOTTOM UP

Emission reductions are calculated separately for each policy or measure, and the results are aggregated to estimate the total reduction.

- Provides a clear understanding of the impact of specific PaMs, enabling better evaluation of their effectiveness.
- Helps identify underperforming measures and opportunities for improvement.
- Enables tracking of co-benefits such as job creation, energy savings, or health improvements from individual measures.
- Requires detailed data and technical capacity for each policy and measure.

Energy

GRID CONNECTED HYDROPOWER

ADOPTED

DESCRIPTION

- Development of MW large hydro capacity, small and mini hydro projects
- Low carbon energy supply
- MININFRA/REG/EDCL

INDICATORS

- Installed hydropower capacity (MW) in NDC
- Installed hydropower capacity (MW) in GACMO

PROGRESS

- Installed hydropower capacity (MW): **353.40**
- Expected Emissions Reduction: **475 kt CO2 eq**
- Achieved Emissions Reduction: **304.95 kt CO2 eq**

Methodology and Assumption

Grid connected hydropower

Data Available

The installed capacity of Hydropower
Country Specific grid emission factor

Assumption

1. The model assumes that the hydropower plant operates at its projected capacity and displaces electricity from the grid.
2. The grid emission factor remains constant during the analysis period unless otherwise specified.
3. The Hydropower plant is estimated to produce 752,590 MWh/year

Baseline Emissions (Reference Option)

1

The baseline typically assumes that the electricity would be generated by fossil fuel-based power plants with no hydropower plant (e.g., diesel).

Baseline Emissions (Reference Option)

2

Baseline Emissions=Electricity Generated by Hydropower (MWh)×Grid Emission Factor (tCO_2/MWh)

Mitigation Scenario Emissions

3

In the mitigation scenario, the electricity is assumed to be produced by the hydropower plant, which generates electricity without direct CO_2 emissions.

Emission Reductions Option

4

The emission reduction is calculated as the difference between the baseline emissions (Reference Option) and the mitigation scenario emissions.

Energy

SOLAR MINIGRIDS

ADOPTED

DESCRIPTION

- 68 MW of solar mini-grids are planned to be installed in off-grid rural areas by 2030
- Low carbon energy supply
- MININFRA/REG/EDCL

INDICATORS

- Share of renewables in total electricity supply (%) in NDC
- Installed solar capacity (MW) in GACMO

PROGRESS

- Installed solar capacity (MWp): **0.26**
- Expected Emissions Reduction: **146 kt CO2 eq**
- Achieved Emissions Reduction: **0.3 kt CO2 eq**

Methodology and Assumption

Solar minigrids

Data Available

The installed capacity of Solar
Country Specific grid emission factor
Definition of Solar Minigrid--

Assumption

- The system is assumed to be 100% solar, meaning all energy is generated from solar PV panels
- The capacity factor is assumed to be 1642.5 Full Time Hours. This translates to a capacity factor of approximately 45.02% (1642.5 hours / 8760 hours/year). This value is crucial for estimating annual energy production.
- The electricity production per kW of installed capacity is assumed to be 1642.5 kWh/year, consistent with the capacity factor.

Baseline Emissions (Reference Option) — 1

This scenario assumes that the electricity would be generated by fossil fuel-based power plants with no solar PV plant

Baseline Emissions (Reference Option) — 2

Baseline Emissions=Electricity production (kWh) / 1000 * CO2-eq Emission Coefficient * Size of PV * 1000

Mitigation Scenario Emissions — 3

In the mitigation scenario, the electricity is assumed to be produced by the Solar PV plant, which generates electricity without direct CO_2 emissions.

Emission Reductions Option — 4

Emission Reduction=Baseline Emissions−Mitigation Scenario Emissions

Energy

SOLAR LED STREETLIGHTS

ADOPTED

DESCRIPTION

- Solar LED Streetlights
- Energy efficiency measures
- MININFRA/REG/EDCL

INDICATORS

- Number of Solar LED streetlights and Number of Solar traffic lights in NDC
- Number of Solar LED streetlights in GACMO

PROGRESS

- Number of Solar LED streetlights: **25**
- Expected Emissions Reduction: **8 kt CO2 eq**
- Achieved Emissions Reduction: **2 kt CO2 eq**

Methodology and Assumption

Solar LED streetlights

Data Available

Number of Solar LED streetlights
Annual Kerosene Consumption

Assumption

• The analysis assumes that all kerosene lamps are replaced with solar LED lamps.
• The CO2-eq emission coefficient for kerosene combustion remains constant.

Baseline Emissions (Reference Option)

1

The baseline typically assumes that the lamps are powered by kerosene

Baseline Emissions (Reference Option)

2

Baseline Emissions=Annual Energy Consumption from Kerosene (GJ)*Emission Factor

Mitigation Scenario Emissions

3

In the mitigation scenario, the LED lamps are powered by solar, which generates electricity without direct CO_2 emissions

Emission Reductions Option

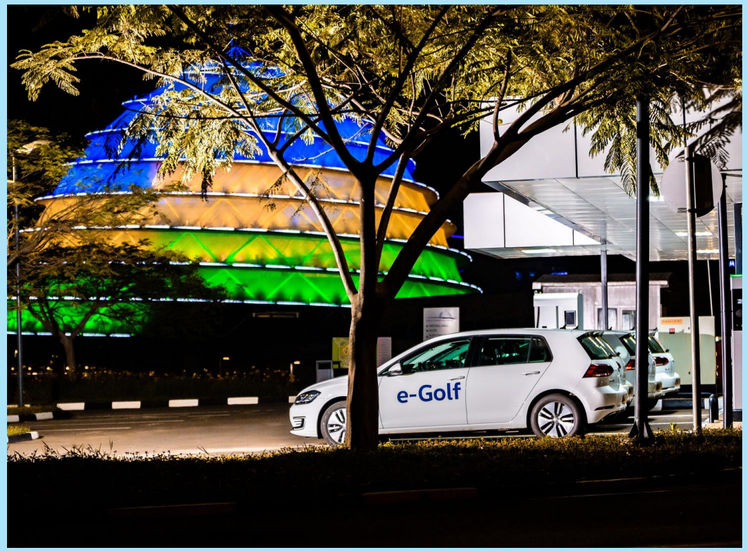
4

Emission Reduction=Baseline Emissions−Mitigation Scenario Emissions

Energy

ELECTRIC VEHICLES (PASSENGER CARS)

ADOPTED



DESCRIPTION

- Electric Vehicles (Passenger cars)
- An efficient resilient transport system
- MININFRA/RTDA/RURA

INDICATORS

- Number of EV LDVs in NDC
- Number of EV LDVs in GACMO

PROGRESS

- Number of EV LDVs: **369**
- Expected Emissions Reduction: **1 kt CO2 eq**
- Achieved Emissions Reduction: **0.3 kt CO2 eq**

Methodology and Assumption

Electric vehicles (passenger cars)

Data Available

Number of EV LDVs
Annual distance traveled per car
Total Fuel Consumption
Total Electricity Consumption

Assumption

• The analysis assumes that all gasoline cars are replaced with electric cars.
• The CO2-eq emission coefficients for electricity and gasoline remain constant.
• The annual distance traveled by each car remains the same after the switch to electric vehicles.
•Annual distance traveled per car is 12,000 km
•The analysis considers only emissions from fuel combustion and does not include other potential environmental impacts such as battery manufacturing, end-of-life disposal,

Baseline Emissions (Reference Option) — 1

The baseline typically assumes that the gasoline cars are replaced with electric cars.

Baseline Emissions (Reference Option) — 2

Baseline Emissions=Energy Content of Gasoline * CO2-eq emission coefficient for gasoline

Mitigation Scenario Emissions — 3

In the mitigation scenario, the Gasoline Cars are replaced with Electric cars, where the CO2-eq emission coefficient for electricity is 0.49 tCO2/MWh

Emission Reductions Option — 4

Emission Reduction=Baseline Emissions−Mitigation Scenario Emissions

Energy

ELECTRIC VEHICLES (BUSES)

ADOPTED

DESCRIPTION

- Electric Vehicles (Buses)
- An efficient resilient transport system
- MININFRA/RTDA/RURA

INDICATORS

- Number of EV buses in NDC
- Number of EV buses in GACMO

PROGRESS

- Number of EV buses: **8**
- Expected Emissions Reduction: **3 kt CO2 eq**
- Achieved Emissions Reduction: **0.3 kt CO2 eq**

Methodology and Assumption

Electric vehicles (buses)

Data Available

Number of EV buses
Annual distance traveled per bus
Total Fuel Consumption
Calculate Total Electricity Consumption

Assumption

- Annual distance traveled per bus (100,000 km)
- The analysis considers only emissions from fuel combustion and does not include other potential environmental impacts such as battery manufacturing, end-of-life disposal,

Baseline Emissions (Reference Option) — 1

The baseline typically assumes that the diesel bus are replaced with electric bus

Baseline Emissions (Reference Option) — 2

Baseline Emissions=Energy Content of Diesel * CO2-eq emission coefficient for diesel

Mitigation Scenario Emissions — 3

In the mitigation scenario, the diesel buses are replaced with Electric cars, where the CO2-eq emission coefficient for electricity is 0.49 tCO2/MWh

Emission Reductions Option — 4

Emission Reduction=Baseline Emissions−Mitigation Scenario Emissions

Energy

ELECTRIC MOTORCYCLES

ADOPTED

DESCRIPTION

- It aims at a phased adoption of electric motorcycles from 2020 with the following targets: 2.3% by 2023/24 and 33% by 2029/30
- An efficient resilient transport system
- MININFRA/RTDA/RURA

INDICATORS

- Number of EV motorcycles in NDC
- Number of EV motorcycles in GACMO

PROGRESS

- Number of EV Motorcycle: **4,823**
- Expected Emissions Reduction: **136 kt CO2 eq**
- Achieved Emissions Reduction: **0.9 kt CO2 eq**

Methodology and Assumption

Electric vehicles (buses)

Data Available

Number of EV motorcycle
Annual distance traveled per motorcycle
Total Fuel Consumption
Total Electricity Consumption

Assumption

- The calculation assumes that the electricity used to power the electric motorcycle comes from the grid with the specified CO2 emission factor.
- The actual emission reduction may vary depending on the specific characteristics of the motorcycle, driving patterns, and the source of electricity.

Baseline Emissions (Reference Option) 1

The baseline typically assumes that the gasoline motorcycle are replaced with electric motorcycle

Baseline Emissions (Reference Option) 2

Baseline Emissions=Energy Content of Diesel * CO2-eq emission coefficient for gasoline

Mitigation Scenario Emissions 3

In the mitigation scenario, the gasoline motorcycle are replaced with Electric motorcycle, where the CO2-eq emission coefficient for electricity is 0.49 tCO2/MWh

Emission Reductions Option 4

Emission Reduction=Baseline Emissions−Mitigation Scenario Emissions

Energy

ROOFTOP SOLAR IN COMMERCIAL BUILDINGS

ADOPTED

DESCRIPTION

- The project aims at installing cumulative 10 MWp in three years and is aligned with the Rwanda rural electrification strategy
- Replacement of diesel generators by rooftop solar in commercial and institutional buildings
- MININFRA/REG/EDCL

INDICATORS

- Number of commercial/institutions with rooftop solar/Rooftop solar in NDC
- Installed capacity in W in GACMO

PROGRESS

- Installed capacity in W: **36,595,000**
- Expected Emissions Reduction: **29 kt CO2 eq**
- Achieved Emissions Reduction: **NE**

Energy

EFFICIENT COOK STOVES

ADOPTED

DESCRIPTION

- Private sector led efforts are also distributing cook stoves that are up to three times more efficient than the traditional 3- stone stove and can reduce biomass consumption by anywhere between 68-94%.
- Halve the number of HH using traditional cooking technologies to achieve a sustainable balance between supply and demand of biomass
- MININFRA/REG/EDCL

INDICATORS

- Efficient stoves (Number of HH) in NDC
- Number of Efficient stoves in GACMO

PROGRESS

- Number of Efficient stoves: **1,345,828**
- Expected Emissions Reduction: **195 kt CO2 eq**
- Achieved Emissions Reduction: **1,097 kt CO2 eq**

Methodology and Assumption

Efficient cook stoves

Data Available

Number of Efficient cookstove
Annual wood/charcoal Consumption
Non-renewable Fraction of Wood

Assumption

•The analysis assumes that all traditional fireplaces are replaced with efficient wood stoves.
•The analysis does not consider other potential environmental impacts such as air pollution and deforestation.
•The analysis assumes that all traditional fireplaces are replaced with efficient charcoal stoves.
•The analysis does not consider other potential environmental impacts such as air pollution and deforestation

Baseline Emissions (Reference Option)

1

The "Reference Option" is "Old charcoal stove." by comparing the efficient stove scenario

Baseline Emissions (Reference Option)

2

Baseline Emissions=Number of stove*Non renewable fraction of wood*Annual Carbon Consumption*44/12 (Carbon content of the charcoal)

Mitigation Scenario Emissions

3

Mitigation Scenario Emissions=Number of stove*Non renewable fraction of wood*Annual Carbon Consumption*44/12 (Carbon content of the charcoal)

Emission Reductions Option

4

Emission Reduction=Baseline Emissions−Mitigation Scenario Emissions

Energy

SOLAR WATER HEATERS IN THE RESIDENTIAL SECTOR

IMPLEMENTED

DESCRIPTION

- Promotes the use of solar water heaters, with the aim of reducing the use of electricity from the grid for water heating
- Installation of solar thermal water heaters within urban residential buildings
- MININFRA/REG/EDCL

INDICATORS

- Number of SWH installations in NDC
- Number of Locations in GACMO

PROGRESS

- Number of Locations: **3,336**
- Expected Emissions Reduction: **41 kt CO2 eq**
- Achieved Emissions Reduction: **2.4 kt CO2 eq**

Methodology and Assumption

Solar water heaters in the residential sector

Data Available

Number of Locations
Annual Electricity Consumption

Assumption

•The analysis assumes that the solar water heater offsets the entire electricity consumption for water heating.
•The CO2-eq emission coefficient for grid electricity remains constant.
•The analysis does not consider other potential environmental impacts such as the manufacturing and disposal of the solar water heater.

Baseline Emissions (Reference Option) 1

The "Reference Option" is "Electrical water heater." by comparing the solar water heater scenario to a scenario where an electric water heater is used.

Baseline Emissions (Reference Option) 2

Baseline Emissions=Annual Electricity Consumption (5.84 MWh/year) * CO2-eq Emission Coefficient (0.486 ton CO2-eq./MWh)

Mitigation Scenario Emissions 3

Since the solar water heater is assumed to offset the entire electricity consumption, the CO2-eq emissions from the solar water heater are considered to be zero.

Emission Reductions Option 4

Emission Reduction=Baseline Emissions−Mitigation Scenario Emissions

Energy

OFF-GRID SOLAR ELECTRIFICATION (SHS AND MINI-GRIDS)

ADOPTED

DESCRIPTION

- Rwanda considers the access to off-grid electricity as the primary mean through which the electricity access could be expanded through the country.
- Installation of solar thermal water heaters within urban residential buildings
- MININFRA/REG/EDCL

INDICATORS

- Share of Rwanda households with off-grid solutions (%) in NDC
- Installed capacity in W in GACMO

PROGRESS

- Installed capacity in W: **1,096,788**
- Expected Emissions Reduction: **10 kt CO2 eq**
- Achieved Emissions Reduction: **8 kt CO2 eq**

Methodology and Assumption

Off-grid solar electrification (SHS and mini-grids)

Data Available

Installed capacity in W
Annual Electricity Consumption

Assumption

•The analysis assumes that the solar PV system offsets the entire electricity consumption of the cottage.
•The CO2-eq emission coefficient for grid electricity remains constant.
•The analysis does not consider other potential environmental impacts such as the manufacturing and disposal of solar panels.

Baseline Emissions (Reference Option) — 1

The "Reference Option" is "No solar PVs." by comparing the solar PV scenario to a scenario where no solar PV system is installed

Baseline Emissions (Reference Option) — 2

Baseline Emissions=Electricity Consumption * CO2-eq emission coefficient for electricity (No Solar PV)

Mitigation Scenario Emissions — 3

Since the solar PV system is assumed to offset the entire electricity consumption, the CO2-eq emissions from solar PV are considered to be zero.

Emission Reductions Option — 4

Emission Reduction=Baseline Emissions−Mitigation Scenario Emissions

IPPU

CLINKER SUBSTITUTION: INCREASED USE OF POZZOLANAS IN CEMENT

ADOPTED

DESCRIPTION

- Clinker substitution recognise the need to lower the carbon in cement production industry. A rational 5% substitution of clinker with pozzolanas from the current 70% (cement-to-clinker ratio) has started to be implemented
- Alternative to reduce the GHG emission while at the same time reducing the cost of cement production
- MINICOM, NIRDA

INDICATORS

- Pozzolana use (t) Clinker/cement ratio (%) in NDC
- Tonnes cement/day in GACMO

PROGRESS

- Pozzolana use (t): **2021 (208,038T); 2022 (212,583T) and 2023 (122,495T)**
- Expected Emissions Reduction: **104.0 kt CO2 eq**
- Achieved Emissions Reduction: **NE**

IPPU

GRADUAL SUBSTITUTION OF F-GASES BY LESS POLLUTING SUBSTITUTES

ADOPTED

DESCRIPTION

- The aim is for the gradual replacement of the ODS alternatives that were surveyed in Rwanda on the list of controlled substances as per Annex F of the Montreal Protocol
- MINICOM, NIRDA, REMA

INDICATORS

- Imported HFC (kg) F-gas use in NDC
- Not included in GACMO

PROGRESS

- Imported HFC (t): **2020 (121.7T); 2021 (117.4T) and 2022 (109.24T)**
- Expected Emissions Reduction: **29 kt CO2 eq**
- Achieved Emissions Reduction: **40.048 kt CO2 eq**

Methodology and Assumption

Gradual substitution of F-gases by less polluting substitutes

Data Available: Imported HFCs

Refrigerant	GWP	Consumption (Metric tons and CO2-eq tons)						Average mt	Average CO2
		2020		2021		2022			
		Metric tons	CO2-eq tons	Metric tons	CO2-eq tons	Metric tons	CO2-eq tons		
HFC-32	675	0	0	0	0	0	0	0	0
HFC-134a	1,430.00	58.9	84227	56.3	80509	60.74	86858.2	58.65	83864.73
R-404A	3,921.60	32.1	125883.4	33	129413	22.1	86667.36	29.07	113987.8
R-407C	1,773.85	18.3	32461.46	12.6	22350.5	12.48	22137.65	14.46	25647.54
R-410A	2,087.50	12.4	25885	13.8	28807.5	11.7	24423.75	12.63	26372.08
R-407A	2,107.00	0	0	0.6	1264.2	1.2	2528.4	0.6	1264.2
R-507A	3,985.00	0.04	159.4	1.1	4383.5	1.02	4064.7	0.72	2869.2
TOTAL		**121.7**	**268,616**	**117.4**	**266,728**	**109.2**	**226,680**	**116.1**	**254,008**

The emission reduction is 40.048 Kt Co2-eq

Challenges

Other parameters are required to estimate the emissions reduction

The data for tracking are not progressively by year, they are accumulated, while other are not in line with GACMO

Emissions target for each PaMs, some are not proportionally with the achievement under the project

GACMO doesn’t cover all of the PaMs, mainly those from agriculture are not included

Rwanda Energy Balance is not detailed

Thank You