

**A CONCEPT NOTE ON THE
RWANDA NATIONAL ELECTRIFICATION PLAN (NEP) -2023 REVISION**



JULY 2023

I. Background and Objectives

Rwanda's National Strategy for Transformation (NST1) aims for the country to achieve middle-income status by 2035 and high-income status by 2050. As one of its core objectives, the strategy targets universal electricity access by 2024. The Sustainable Development Goals defines universal access to electricity for households as having an electricity connection in their house.

The Energy Sector Strategic Plan (ESSP) to implement the NST1 lays out how to provide electricity to all households in Rwanda by 2024. The ESSP specifies that universal access will be achieved through on-grid and off-grid electrification technologies.

NST1 targets will be achieved through connecting households to the National grid (**52 %**) whereas off-grid solutions -Stand Alone Solar Systems (**SAS**) and **micro-grid** account for **48%**.

By end of June 2023, 65.7 % of Rwandan households have access to electricity. These include 47.6% of households connected to the national grid whereas 18.1% are connected to off-grid systems including Solar home systems and microgrid. The present electricity access rate is lower compared to last year's publication in NEP due to updated number of households as per the recent 5th Population and Housing census that was conducted in August 2022.

To guide investments in electrification and achieve the access targets within the framework defined by the NST1 and ESSP, EDCL/REG has developed a 7-year Electricity Access Development Plan deduced from the NST1 (NEP 2018-2024) subject to revision periodically according to electrification status in the country.

This concept note presents the revised National Electrification Plan (NEP 2023) for Rural and Urban Electrification for the 2-year period 2023 and 2024 using 2022 status as baseline.

II. Key changes compared to previous NEP 2022

With reference to previous NEP 2022, the following were the key changes for the revised NEP 2023:

- Villages in off-grid zone increased the share from 2,601 villages to 5,090 villages.
- The revision of the current NEP was guided by the figures in electricity access as published by the National Institute of Statistics during the recently conducted 5th Population and Housing Census.

III. Methodology/Approach used in the revision of NEP 2022

The previous NEP 2022 was revised based on the following assumptions/scenarios:

- villages in NEP 2022 version under Renewable Energy Financing (REF) remained unchanged except those added to complete Rwanda Universal Energy Access Program (RUEAP)/BADEA II scope in Districts where financing was secured.
- All other villages with funding (RUEAP, BADEA II, District commitments, Ongoing projects by in-house EDCL teams) were also not touched and remain in grid extension scope.
- Villages with households (HHs) relocated due to various reasons (High Risk Zones (HRZ), Expropriation for tea plantations, etc.) were not assigned technology (i.e., unclassified)
- For villages with rural settlement sites under Grid Extension (GE) showing that there is need of power supply to achieve 100% connection but with unconnected HHs and without financing, they were categorized under SAS 2023. This is to allow off-grid companies to work in these areas.
- Villages in GE where funds are to be mobilized yet, were demarcated for GE-Temporarily SAS
- Off grid villages increased due to lack of funding in some districts as well as changes in Mini-grid status after countrywide verification on status of Mini-grid implementation
- HHs numbers per village were not considered. Only NISR data were used up to District/Sector level.

IV. Results for the revised National Electrification Plan 2023

After checking the status of electricity connection in all sectors across the country and after considering the factors/criteria set forth during the revision of the 2022 NEP, it was found out that the situation changed like as follow:

- 65.23% of all villages fall in on-grid zone (Grid Extension and Fill in and) i.e., 9,664 villages out of 14,816 villages.
- 34.35% of all villages fall in off grid zone (GE-Temporarily Solar Home Systems, SAS and Microgrid) i.e., 5,090 villages.
- 0.42% of all villages (62 villages) were not demarcated for any technology factoring in that the residents were relocated. Others are under the process of relocation due to the facts that they remain in areas marked as high-risk zones while others live in areas planned for strategic investments in agriculture such as tea plantation, etc.

The revised NEP summary results are translated in the map below:

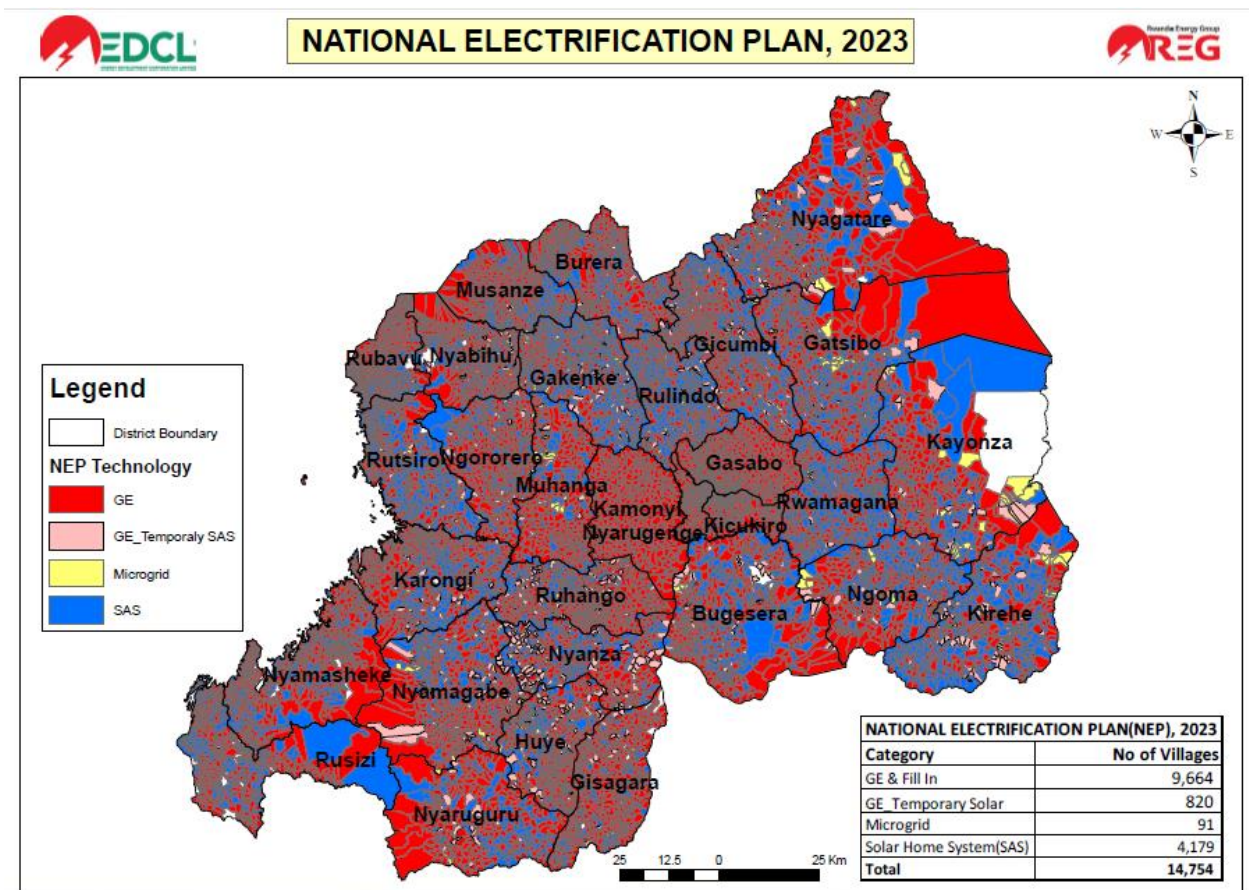


Figure1: Map of revised NEP results 2023

Among the off-grid villages, a share of 91 villages (equivalent to 0.6%) are proposed for microgrid development while 4,999 (equivalent to 33.7%) villages are proposed to be electrified using Standalone Solar Home Systems.

During the revised NEP 2023, the off-grid share increased compared to previous NEP 2022 as per the table below:

S/N	TECHNOLOGY	NUMBER OF VILLAGES 2022	NUMBER OF VILLAGES 2023
1	Solar (SAS)	1,441	1,279
2	Minigrid	199	91



3	GE-Temporarily SAS	961	820
4	Additional Scope	N/A	2,900
	TOTAL	2,601	5,090

Table 1: Table showing the off-grid share in the revised NEP 2023

The additional scope for off grid is 2,900 villages and this came because of various discussions between REG and off grid private developers who persistently manifested the need for increasing the market stock for villages in off grid to achieve as more connections as possible.

These villages will be dispatched into two batches: The first batch of **2,000 villages** will be published for market to off grid developers as **first priority** while the remainder will be published as **2nd priority** depending on the performance of companies in 1st priority.

The villages demarcated for off grid technology under Stand-Alone Solar Home Systems will be assigned for Renewable Energy Fund (REF) to allow residents acquire the technology at a subsidy scheme in the spirit to attract their appetite to use off grid solutions as the Government strives for funds mobilization to put them on the grid.

The additional off grid villages are breakdown in Districts as per the chart below:

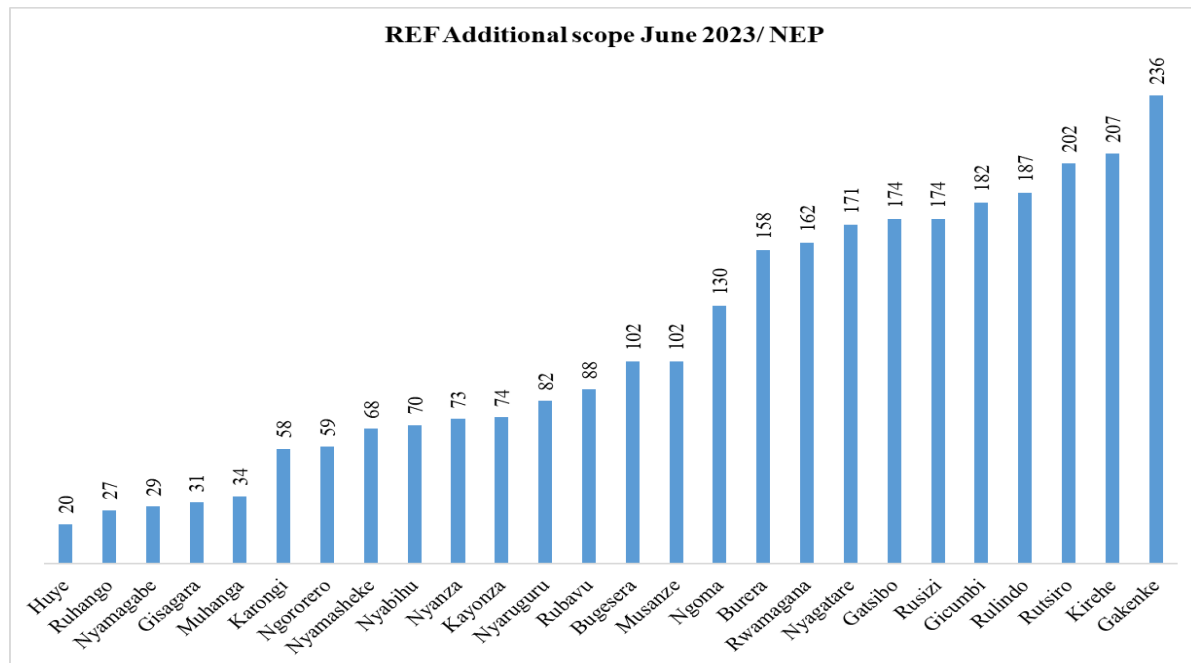


Figure 2: Additional off grid scope to for allocation to private developers.



From figures above, it is observed that the off-grid share increased drastically due to the following reasons:

- Lack of anticipated funds to connect villages that were previously demarcated for Grid Extension
- Persistent requests from off grid developers for additional villages to enlarge the market stock which may in turn engender increase in connections to solar kits.

V. Current Situation of Electricity Sector, Planned developments.

Rwanda's low electrification rate is a barrier to economic development. At the end of June 2023, about 65.7% of the households in Rwanda had been electrified that includes 47.6% of households connected to the grid and 18.1% are connected using off-grid solutions mainly solar home systems.

Increasing access to electricity is a major objective for the government of Rwanda (GoR). By 2023/24, 100% of the population shall have access to electricity, whereby 52% will be connected to the national grid whereas 48% will be connected through Off-Grid technologies including micro-grid and Stand-alone Solar home systems.

Foundations for the ambitious plans are in place. The existence of the Rural Electrification Strategy and Energy Sector Strategic Plan are both in place.

An operational Energy Agency, REG through its subsidiaries EDCL and EUCL which oversee development of energy projects as well as utility operations have been established since 2014.

Electrification projects are implemented by EDCL through a well-coordinated program renamed Rwanda Universal Energy Access Program (RUEAP) with funds coming from Development Partners, the Government's budget, and different donors.

This scheme of electricity projects implementation (RUEAP) replaced the former Electricity Access Roll Out Program (EARP).

Clear regulations provide and enable the environment for the desired participation of private developers in electricity access.

This Plan encompasses urban and rural electrification. It covers electrification by connection to the main grid and by off-grid technologies where isolated mini-grids are supplied by renewable energy sources.

VI. Criteria for NEP revision

- Extensions considering productive customers having strategic importance for the country were identified in each district and given priority in upcoming universal energy access program including schools, health posts, cell offices, mineral processing plants and border villages among others.
- Electrification projects recently completed across the country.
- Availability and funds mobilized so far for grid extension and off grid connections including RUEAP and smart classroom project as well as Mini grid developments.

There are both economic and technical reasons for revising the NEP 2022.

The economic reason is that grid connection is the least-cost electrification technology for settlements which meet the following conditions:

- (i) they are close to the main grid,
- (ii) they have a not-too-small population,
- (iii) the customers to be electrified are not scattered over a large area but concentrated. Rules of thumb for the first two conditions are within 5 km of the national grid.

Economic criteria are not the only criteria determining which settlements should be electrified when and by which technology. In Rwanda, the Government and many donors pursue the policy to connect all settlements in the vicinity of a Medium Voltage (MV) lines. The plan accounts for that policy by electrifying all settlements which are within 5 km of the existing electricity network especially the Medium Voltage line and those living in allowed residential premises according to approved land use plans.

VII. NEP REVISION RESULTS PER PROVINCE

GIS Database and Electrification Programs determined with the Database.

The GIS database contains REG's existing and planned transmission network, the main HV (High Voltage)/MV and associated substations, low voltage networks (LV) and the location of potential sites for small hydro plants.

The GIS database provided the input data for EDCL planning, the software was used to determine the electrification program, the off-grid potential by using small hydro or small Photo-Voltaic (PV)-fueled plants and the "priority" off-grid projects.

A. NORTHERN PROVINCE

The National Electrification Plan results as updated in 2023, considering the village level, revealed that the share per electrification technology in Northern province is reflected in the table below:

District Name	NEP2022			NEP2023				
	Grid (Grid Extension & Fill-in)	Solar + GE_Temporary SAS	Microgrid	Grid (Grid Extension & Fill-in)	Solar + GE_Temporary SAS	Microgrid	Unclassified	Total Villages
Burera	336	26	1	403	167	0	1	571
Gakenke	451	162	4	232	376	8	0	617
Gicumbi	544	85	1	359	269	2	0	630
Musanze	404	25	3	308	123	1	0	432
Rulindo	338	148	8	194	299	1	0	494
Northern Province	2,073	446	17	1,496	1,235	12	1	2,744

Table 2: Results of revised NEP 2023 in Northern Province. Source: EDCL

As seen from the above table, the total villages in Northern province were 2,744 and from them 17 were planned to be connected on Microgrid while 446 to SAS and GE-Temporarily SAS while the remaining 2,073 villages were planned for on-grid network (Grid Extension-GE and Fill in).

Given the numbers released by the 5th PHC published by NISR in the fiscal year 2022/2023 and anticipated electrification projects, the assessment has shown that the electricity network will lower to 1,496 villages to be connected on-grid, while the remainder (1,247 villages) is proposed to be connected through off-grid solutions.

MAP OF NEP RESULTS IN NORTHERN PROVINCE

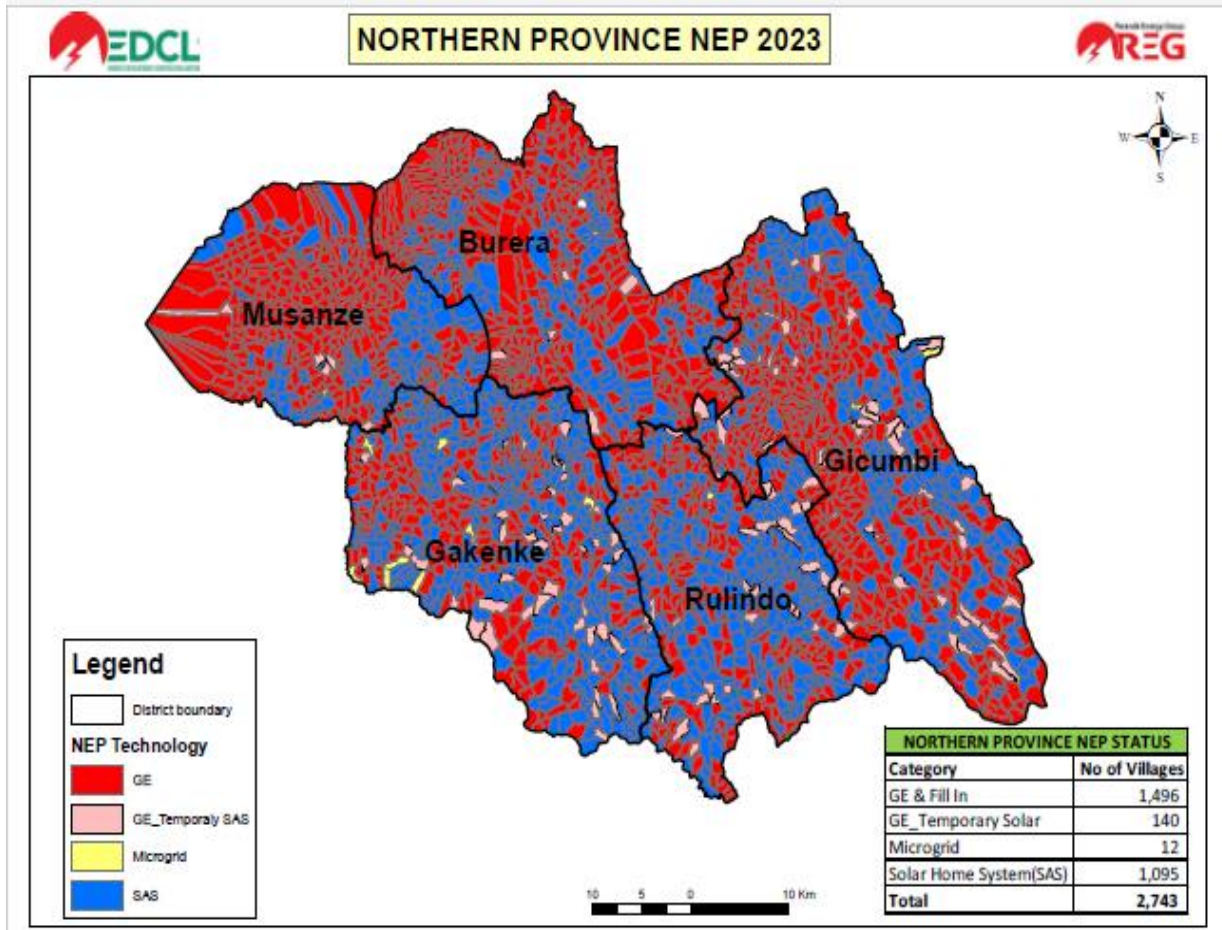


Figure 3: Map of NEP 2023-Northern Province. Source: EDCL

B. SOUTHERN PROVINCE

The National Electrification Plan results as updated in 2023, considering the village level, revealed that the share per electrification technology in Southern province is reflected in the table below:

District Name	NEP2022			NEP2023				
	Grid (Grid Extension & Fill-in)	Solar + GE_Temporary SAS	Microgrid	Grid (Grid Extension & Fill-in)	Solar + GE_Temporary SAS	Microgrid	Unclassified	Total Vilages
Kamonyi	262	43	12	317	0	0	0	317
Muhanga	267	37	27	250	71	10	0	331
Ruhango	419	113	1	395	137	0	0	533
Nyanza	264	156	0	196	224	0	0	420
Huye	349	148	10	337	166	3	2	508
Gisagara	471	43	0	440	75	0	9	524
Nyamagabe	324	202	10	349	181	6	0	536
Nyaruguru	275	55	2	212	119	1	0	332
TOTAL	2631	797	62	2,496	974	20	11	3,501

Table 3: Results of revised NEP 2023 in Southern Province. Source: EDCL

As seen from the above table, the total villages in Southern province were 3,501 and 62 of them were planned to be connected on Microgrid (1.8%) whereas 797 villages were supposed to be connected through SAS and the remaining 2,631 villages on grid network.

Upon recent assessment, it was shown that the electricity network will expand to 2,496 villages using On-grid technologies (GE&Fill in) while the remainder of 974 and 20 villages are proposed to be connected through SAS and Microgrid respectively.

It is important to note that 11 villages in Southern District had no technology assigned to them given the fact that they are no longer populated due to high-risk zones and tea plantations fields in the land use zoning currently approved as per the National Land use and Development Master Plan.

MAP OF NEP RESULTS IN SOUTHERN PROVINCE

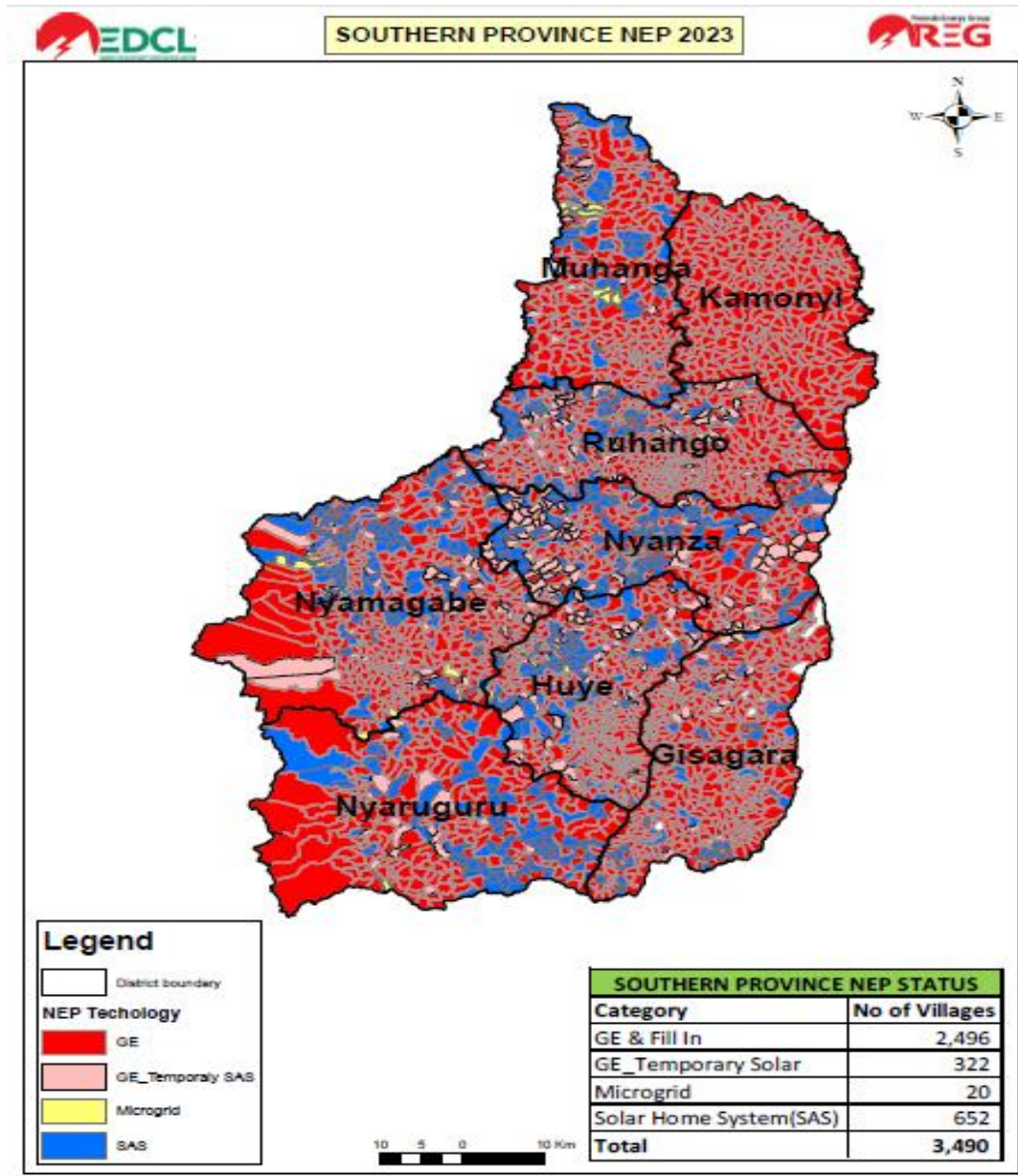


Figure 4: Map of NEP 2023-Southern Province. Source: EDCL

C. WESTERN PROVINCE

The National Electrification Plan results as updated in 2023, considering the village level, revealed that the share per electrification technology in Western province is reflected in the table below:

Districts Name	NEP 2022			NEP2023				
	Grid (Grid Extension & Fill-in)	Solar + GE_Temporary SAS	Microgrid	Grid (Grid Extension & Fill-in)	Solar + GE_Temporary SAS	Microgrid	Unclassified	Total Villages
Karongi	393	140	4	337	200	0	1	538
Ngororero	307	111	1	311	108	0	0	419
Nyabihu	356	111	2	332	133	0	8	473
Nyamasheke				486	96	0	6	588
Rubavu	502	13	0	414	101	0	4	519
Rusizi	575	10	0	398	182	0	16	596
Rutsiro	418	58	7	222	260	1	1	484
Western Province	3,089	492	14	2,500	1,080	1	36	3,617

Table 4: Results of revised NEP 2023 in Western Province. Source: EDCL

In Western Province, considering the table above, 14 villages were planned to be connected on Microgrid while 492 to SAS and GE-Temporarily SAS. On the other hand, 3,089 villages were demarcated for on-grid electricity.

The NEP 2023 had brought up many changes whereby villages planned for GE and fill in changed to 2,500 villages from 3,089 villages that were proposed last year while the remainder (1,080 villages) are proposed to be connected through SAS and Micro-grid.

36 villages in total were unclassified due to the fact that residents have been/are under relocation.

MAP OF NEP RESULTS IN WESTERN PROVINCE

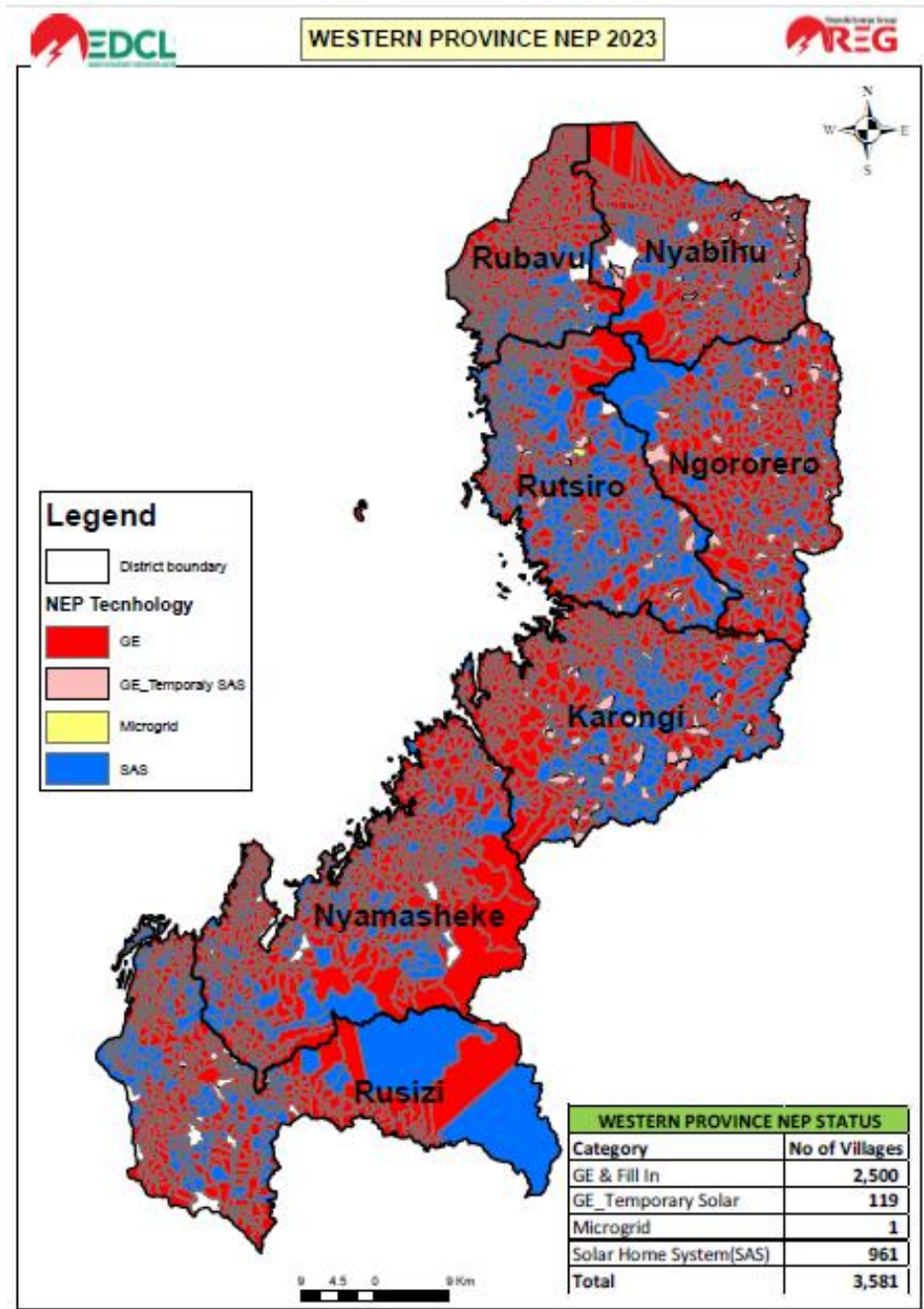


Figure 5: Map of NEP 2023-Western Province. Source: EDCL

D. EASTERN PROVINCE

The National Electrification Plan results as updated in 2023, considering the village level, revealed that the share per electrification technology in Eastern province is reflected in the table below:

District Name	NEP 2022			NEP2023				
	Grid (Grid Extension & Fill-in)	Solar + GE_Temporary SAS	Microgrid	Grid (Grid Extension & Fill-in)	Solar + GE_Temporary SAS	Microgrid	Unclassified	Total Villages
Bugesera	452	124	5	340	226	3	12	581
Gatsibo	509	85	8	324	265	13	0	602
Kayonza	321	73	27	258	141	21	1	421
Kirehe	461	142	9	256	349	7	0	612
Rwamagana	379	92	2	220	254	0	0	474
Ngoma	365	85	23	252	215	6	0	473
Nyagatare	516	101	11	359	260	8	1	628
Eastern Province	3,003	702	85	2,009	1,710	58	14	3,791

Table 5: Results of revised NEP 2023 in Eastern Province. Source: EDCL

From this table, the total villages in Eastern province were 3,791 and from them 85 villages were planned to be connected on Microgrid while 702 villages to SAS and remaining 3,003 villages planned to be connected to the national grid.

During the 2023 revision, the share changed to 2,009 villages to be connected to on-grid network, while the remainder 1,768 villages are proposed to be connected through SAS and Microgrid.

In addition, 14 villages were not considered for this revision given the fact that some of them were recently planned for touristic destinations, others designated as agriculture hub and airport infrastructure, hence citizens were expropriated and relocated.

MAP OF NEP RESULTS IN EASTERN PROVINCE

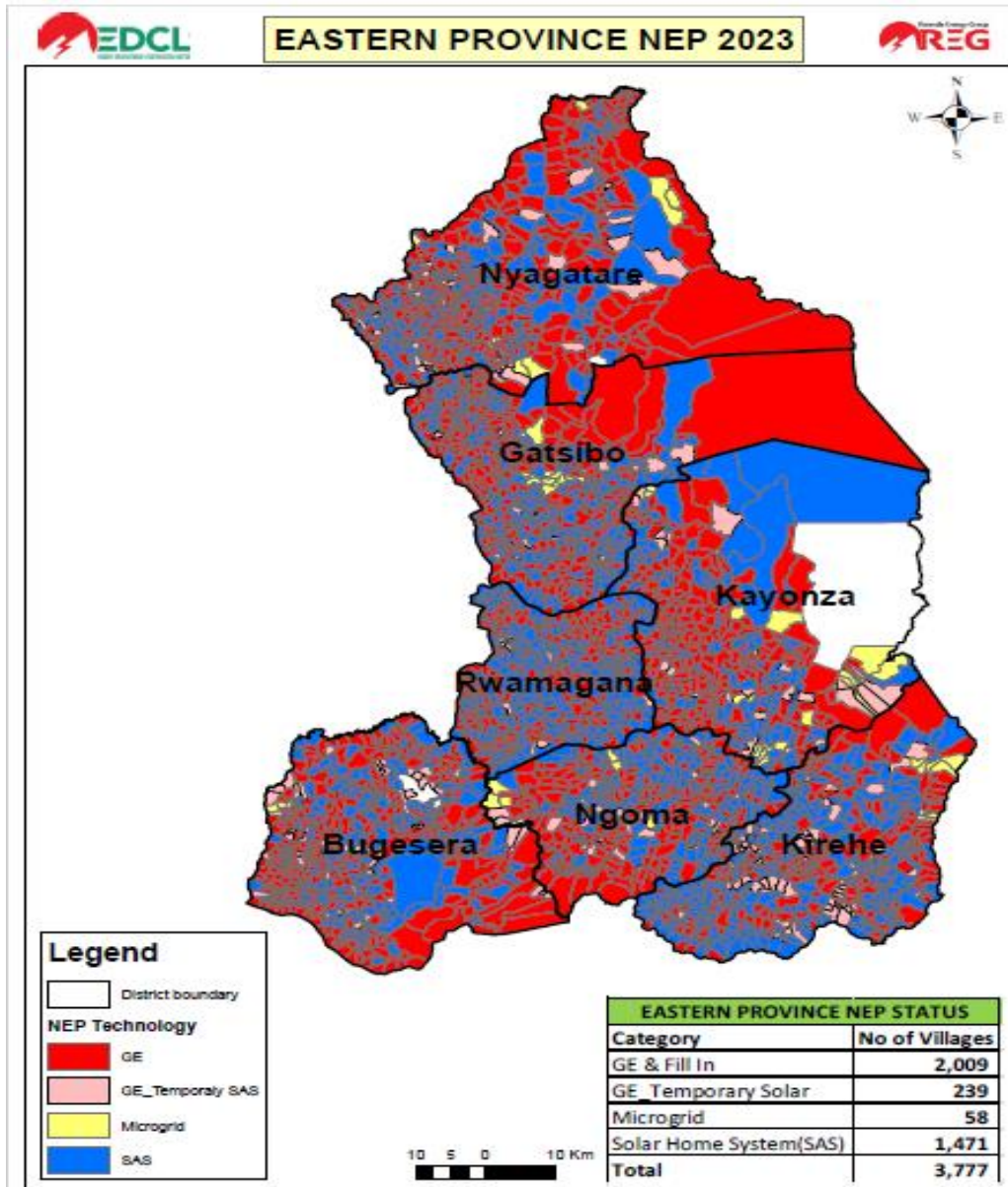


Figure 6: Map of NEP 2023-Eastern Province. Source: EDCL

E. KIGALI CITY

During this revision, the whole Kigali City was proposed to be connected 100% on grid since it is the Capital City as it was the situation in 2022 as per the figure below:



Figure 7: Map of NEP 2023-Kigali City. Source: EDCL

VIII. SUMMARY

The results of the NEP 2023 are summarized as follow:

- **9,664** villages representing **65.23%** of all villages are demarcated for the Grid zone.
- **5,090** villages representing **34.35%** are planned to be connected to off grid systems (Standalone solar home systems (SAS) and GE-Temporally SAS and Microgrid).
- **91** villages representing 0.6% are zoned for Microgrid. The numbers on mini-grid sites decreased drastically compared to previous NEP due to expansion of the grid network to villages crossed by grid lines heading to various productive users especially in Eastern Province during power supply to available farming units. The exercise to physically visit and validate all those mini-grid sites was done across the country.
- In this revision, additional **2,900 villages** were added to the share of off grid companies.

Province Name	NEP 2022			NEP2023				
	Grid (Grid Extension & Fill-in)	Solar + GE_Temporary SAS	Microgrid	Grid (Grid Extension & Fill-in)	Solar + GE_Temporary SAS	Microgrid	Unclassified	Total Villages
East	2,991	697	89	2,009	1,710	58	14	3,791
North	2,306	415	23	1,496	1,235	12	1	2,744
South	2,617	803	70	2,496	974	20	11	3,501
West	3,078	488	17	2,500	1,080	1	36	3,617
City of Kigali	1,163	0	0	1,163	0	0	0	1,163
Total (National)	12,155	2,403	199	9,664	4,999	91	62	14,816



Table 6: Results of revised NEP 2023-National Level. Source: EDCL

Among all villages demarcated for Grid Extension and Fill-in connections and GE-Temporarily SAS, some of them have got funding while for others, the funding is not yet secured.

Therefore, 2,900 (19.6%) villages were temporarily opened to offgrid operators to allow them to boost the electrification rate by disseminating Standalone Solar Home Systems.

62 villages were not assigned to any technology since National Land Use Master Plan has not designated them as residential areas.

Discussions are still ongoing with all stakeholders to brainstorm on the funding possibilities to ensure that the unconnected villages and respective productive users are electrified before end of June 2024.

IX. Recommendation:

It is recommended that the revised NEP be considered by all stakeholders and development partners to fast track the implementation of NST1 targets.

Annexes:

1. Overall list of NEP Villages per Technology type (EXCEL FILE)