A CONCEPT NOTE ON THE

RWANDA NATIONAL ELECTRIFICATION PLAN (NEP) -2022 REVISION

AUGUST 2022

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

NST1 target will be achieved through connecting households to the National grid (52 % as **GE** (Grid Extension) and **Fill in**) as whereas off-grid solutions -Stand Alone Solar Systems **(SAS)** and **micro-grid** (48%) as an interim solution.

By end of the fiscal year 2021/2022, 72 % of Rwandan households have access to electricity. These includes 51% of households connected to the national grid whereas 22% are connected to off-grid systems.

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 National ('NEP 2018-2024') subject to revision periodically according to electrification status in the country.

This concept note presents the revised National Electrification Plan (NEP 2022) for Rural and Urban Electrification for the 3-year period 2022-2024 using 2021 status as baseline.

The revision was developed in a consultative process with central and local Government entities up to village level.

After checking the status of electricity connection in all villages across the country and after considering the factors/criteria set forth during the revision of the 2021 NEP, it was found out that the situation changed like in the following:

- On-Grid zone counts for **13,116 villages** (comprised of Grid Extension and fill in connections) among which **961 villages** of all villages will be temporarily supplied using Solar Home Systems (as 2nd priority).
- Off-Grid zone share is **1,641 villages** countrywide of which:
    - Standalone Solar Home Systems (SHS) are demarcated in **1,442 villages** and considered as 1st priority for investment in off grid.
    - Microgrid technology is demarcated in **199 villages**.

2. Current Situation of Electricity Sector, Planned developments

Rwanda's low electrification rate is a barrier to economic development. At the end of June 2022, about 72% of the households in Rwanda had been electrified that includes 51% of households connected to the grid and 22% 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 interim 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 programs such as Electricity Access Roll Out Program (EARP) and Rwanda Universal Energy Access Program (RUEAP) with funds coming from Development Partners, the Government's budget, and donors.

Clear regulations provide and enable 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.

3. Criteria for NEP revision

- Extensions/villages 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 minigrid 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.

4. National Electrification Plan revision approach and the results

Key information collected from each village:

A field visit was conducted across all districts to validate results published in August last year specifically to physically check and assess the situation in each village in terms of connected Households and productive users therein.

Below is a list of key elements that were collected/questioned in each village:

- Available public infrastructures: Schools, health post, Offices, mineral processing plants, etc.
- The number of households already connected to grid
- The number of households already connected to off-grid technologies
- Total Estimated number of households in the village,

5. 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. Calculations made outside that tool determined the number of customers who would be electrified by densification or fill-in connections even off grid, considering their proximity with the existing/ongoing and planned network.

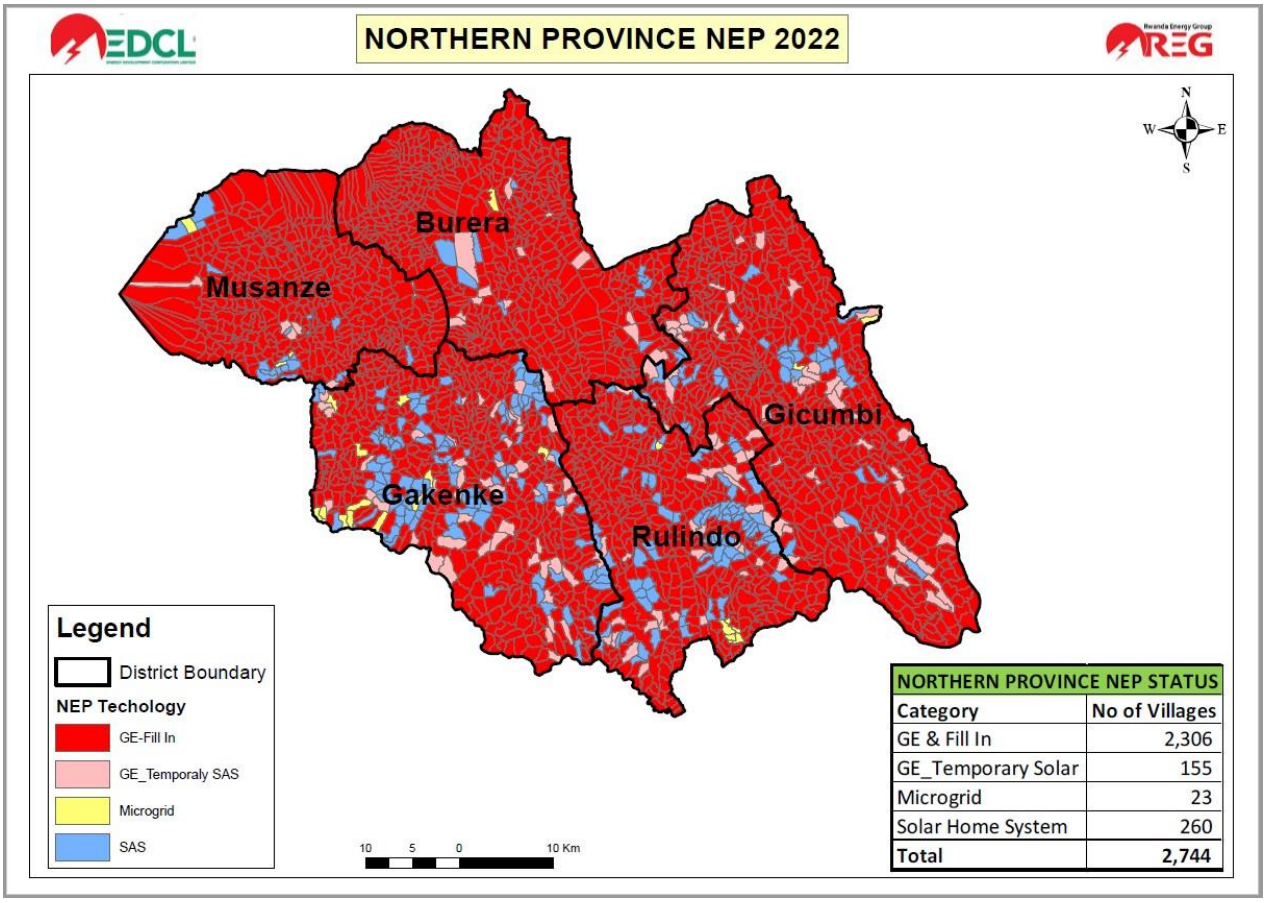
A. NORTHERN PROVINCE

The National Electrification Plan results as updated in 2021, considering the village level, revealed that the share per electrification technology in Northern province is reflected in the table below:

NEP NORTH 2021 (No.villages)			**NEP NORTH 2022 (No.villages)**		
GE & Fill in	2439	88.9%	**GE & Fill in**	2461	89.68%
Microgrid	24	0.9%	**Microgrid**	23	0.84%
SAS	281	10.2%	**SAS**	260	9.48%
Grand Total	**2744**	**100%**	**Grand Total**	**2744**	**100%**

As seen from the above table, the total villages in Northern province were 2,744 and from them 24 were planned to be connected on Microgrid (0.9%) while 281 to SAS (10.2%) and remaining 2439 meaning 88.9% was planned for on-grid network (Grid Extension-GE, Fill-in &GE Temporarily Solar Home Systems). Given the electrification speed that has happened during the year 2021/2022, the assessment has shown that the electricity network has expanded rapidly and reached even some villages that initially were demarcated as off grid villages. Therefore, the share changed to 89.68% of villages to be connected on-grid electricity, while the remainder (9.48%) is proposed to be connected through SAS and 0.84% of villages will be connected through Microgrid.

MAP OF NEP RESULTS IN NORTHERN PROVINCE



B. SOUTHERN PROVINCE

The National Electrification Plan results as updated in 2022, considering the village level, revealed that the share per electrification technology in Southern province is reflected in the table below:

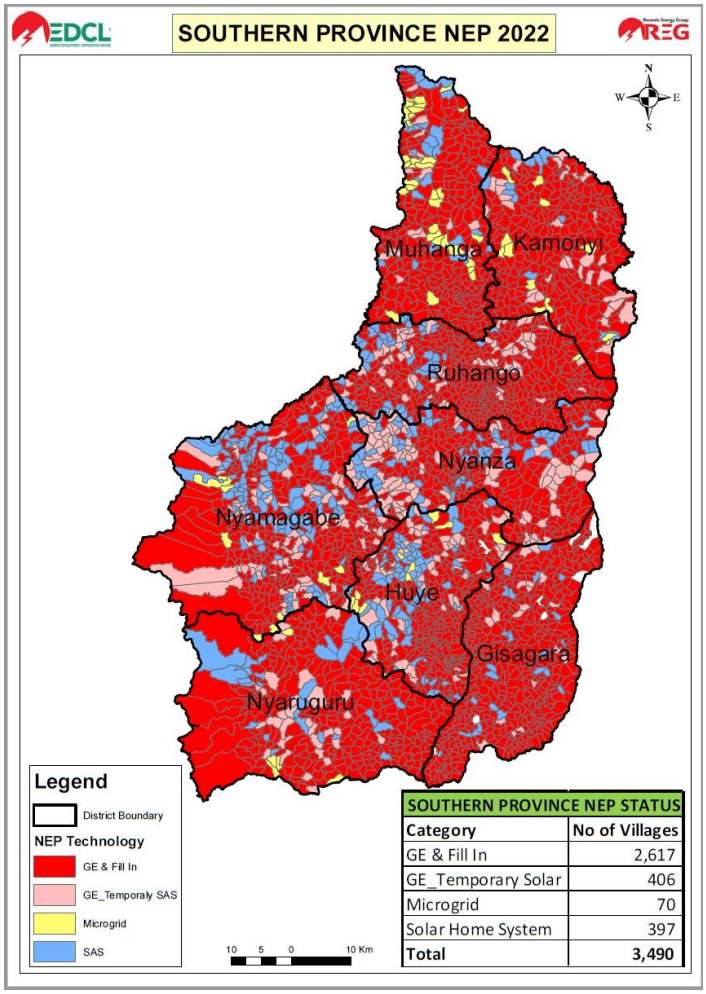
NEP SOUTH 2021 (No.villages)			**NEP SOUTH 2021 (No.villages)**		
GE & Fill in	2,993	85.5%	**GE & Fill in**	3,023	86.62%
Microgrid	62	1.8%	**Microgrid**	70	2%
SAS	446	12.7%	**SAS**	397	11.38%
Grand Total	**3,501**	**100%**	**Grand Total**	**3,490**	**100%**

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 446 were supposed to be connected through SAS (12.7%) and remaining 85.5% on grid network.

Given the electrification speed that has happened in the last fiscal year, the assessment has shown that the electricity network has expanded rapidly and reached even some villages that initially were demarcated as off grid villages. Therefore, the share changed to 86.62% of villages to be connected on-grid electricity, while the remainder (11.38%) is proposed to be connected through SAS and 2% of villages will be connected through Microgrid.

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



C. WESTERN PROVINCE

The National Electrification Plan results as updated in 2022, considering the village level, revealed that the share per electrification technology in Western province is reflected in the table below:

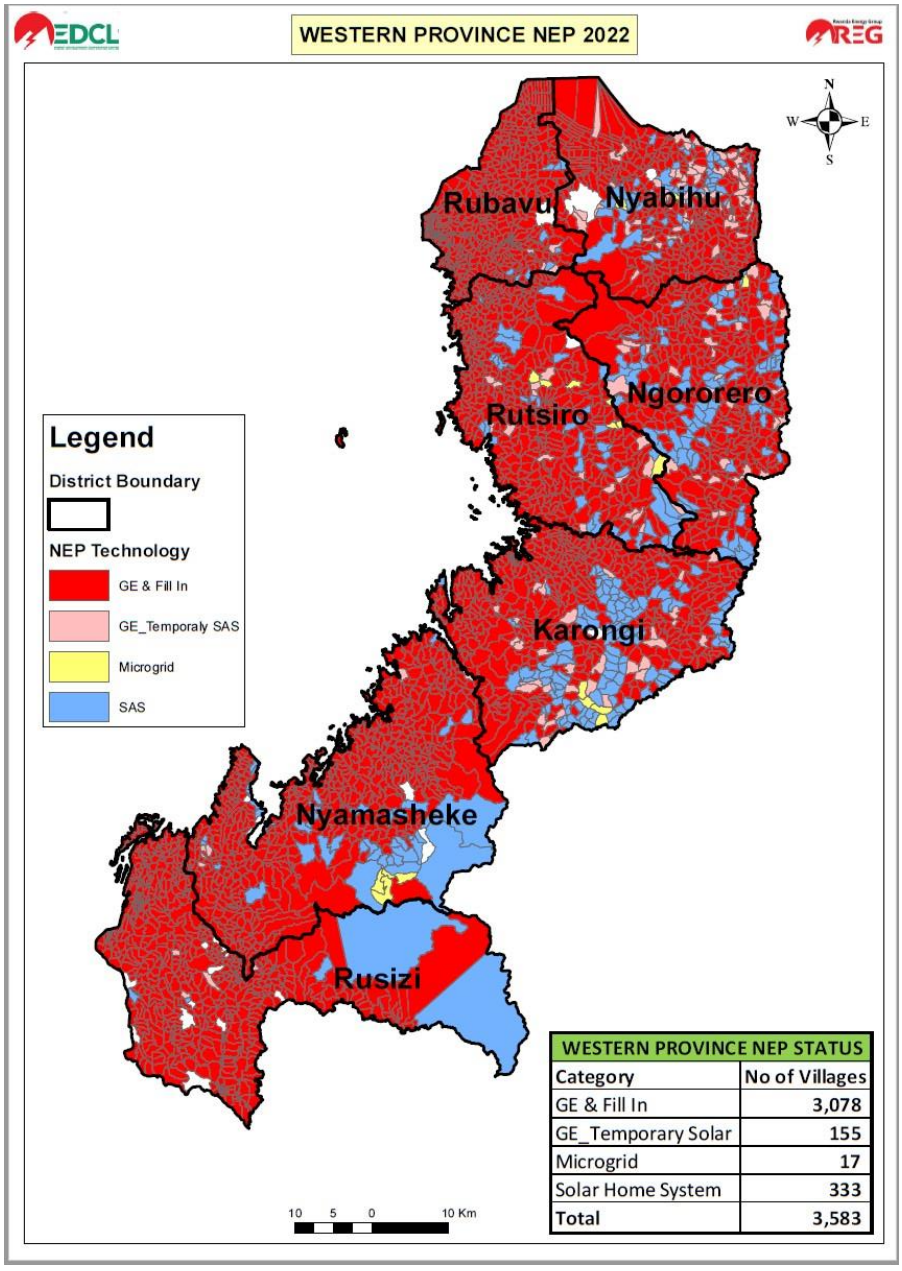
NEP West 2021 (No of Villages)			**NEP West 2022 (No of Villages)**		
GE & Fill in	3,309	91.5%	**GE & Fill in**	3233	90.23%
Microgrid	16	0.4%	**Microgrid**	17	0.47%
SAS	292	8.1%	**SAS**	333	9.3%
Grand Total	**3,617**	**100%**	**Grand Total**	**3583**	**100%**

In Western Province, considering the table above, the total villages were 3,617 and from them 16 were planned to be connected on Microgrid (0.40%) while 292 to SAS (8.1%) and remaining 91.5% on grid network.

Given the electrification speed that has happened in the last fiscal year 2021/2022 especially in the off-grid technology due to the high-risk areas identified, the assessment has shown that the solar home system sites have expanded rapidly. Therefore, the share of villages planned for GE changed to 90.23%, while the remainder (9.3%) are proposed to be connected through SAS and 0.47% of villages will be connected to Microgrid.

The villages in the Western District reduced due to 34 villages in which population was relocated due to risky zone. This activity to relocate them reduced the percentage of connection in the whole province.

MAP OF NEP RESULTS IN WESTERN PROVINCE



WESTERN PROVINCE NEP STATUS	
Category	No of Villages
GE & Fill In	3,078
GE_Temporary Solar	155
Microgrid	17
Solar Home System	333
Total	3,583

D. EASTERN PROVINCE

The National Electrification Plan results as updated in 2021, considering the village level, revealed that the share per electrification technology in Eastern province is reflected in the table below:

NEP West 2021 (No of Villages)			**NEP West 2022 (No of Villages)**		
GE & Fill in	3,410	89.9%	**GE & Fill in**	3236	85.7
Micro-grid	80	2.1%	**Microgrid**	89	2.3
SAS	301	8%	**SAS**	452	12
Grand Total	**3,791**	**100%**	**Grand Total**	**3777**	**100%**

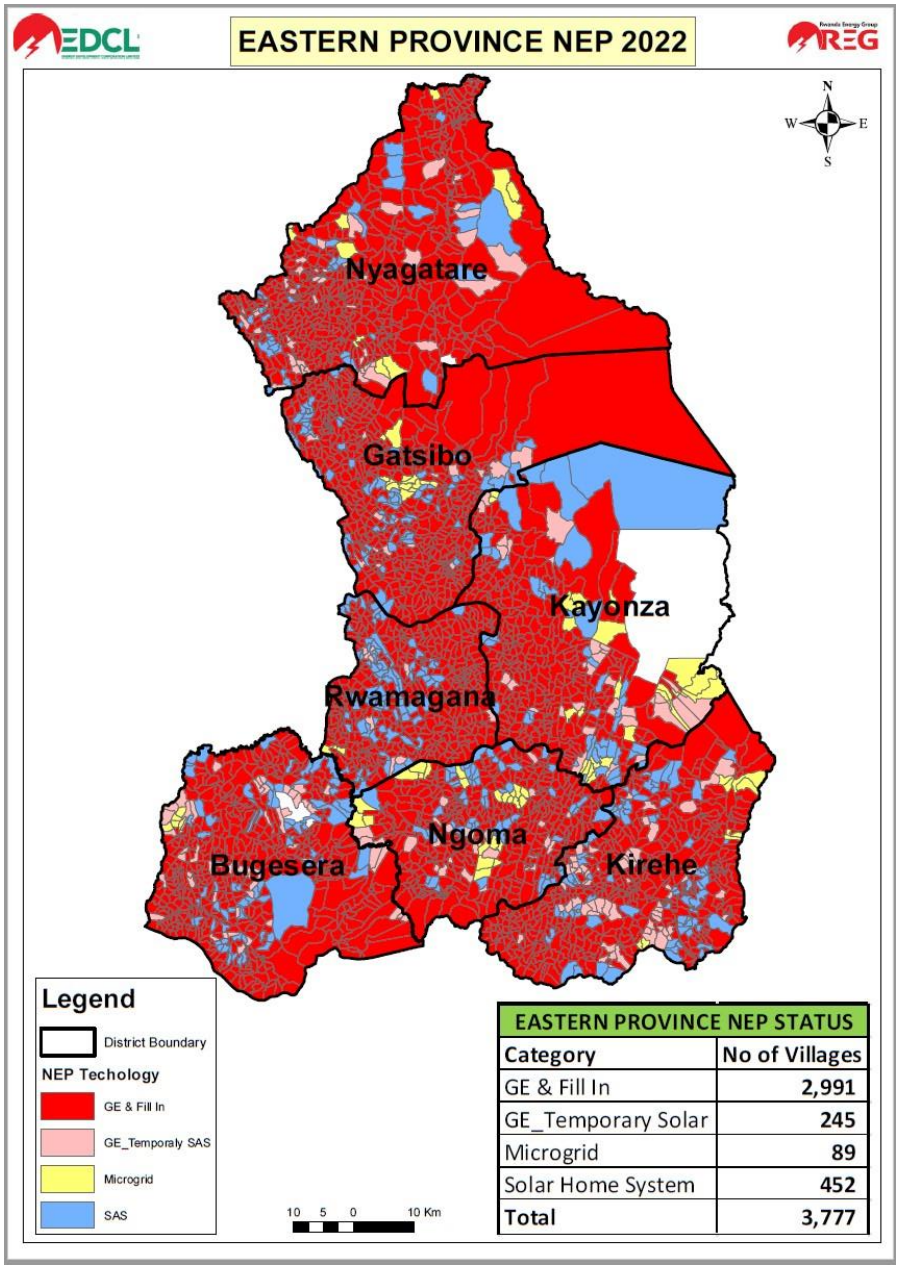
From the table above, the total villages in Eastern province were 3,791 and from them 80 villages counting 2.1% were planned to be connected on Microgrid while 301 villages to SAS (8%) and remaining 3410 villages (89.9%) planned to be connected to the national grid.

During the 2022 revision, the share changed to 85.7% of villages to be connected to on-grid network, while the remainder (12%) is proposed to be connected through SAS and 2.3% of villages will be connected through Microgrid. The whole of BUGESERA district was planned to be electrified using on-grid technology being an airport city.

The reason for the changes in on-grid and off-grid numbers is because in Eastern Province, during validation, it was found out that most Households were connected to the national grid but with much more scattered homesteads within the same village that were not yet connected, and this pushed the whole village to be planned for off-grid.

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



EASTERN PROVINCE NEP STATUS	
Category	No of Villages
GE & Fill In	2,991
GE_Temporary Solar	245
Microgrid	89
Solar Home System	452
Total	3,777

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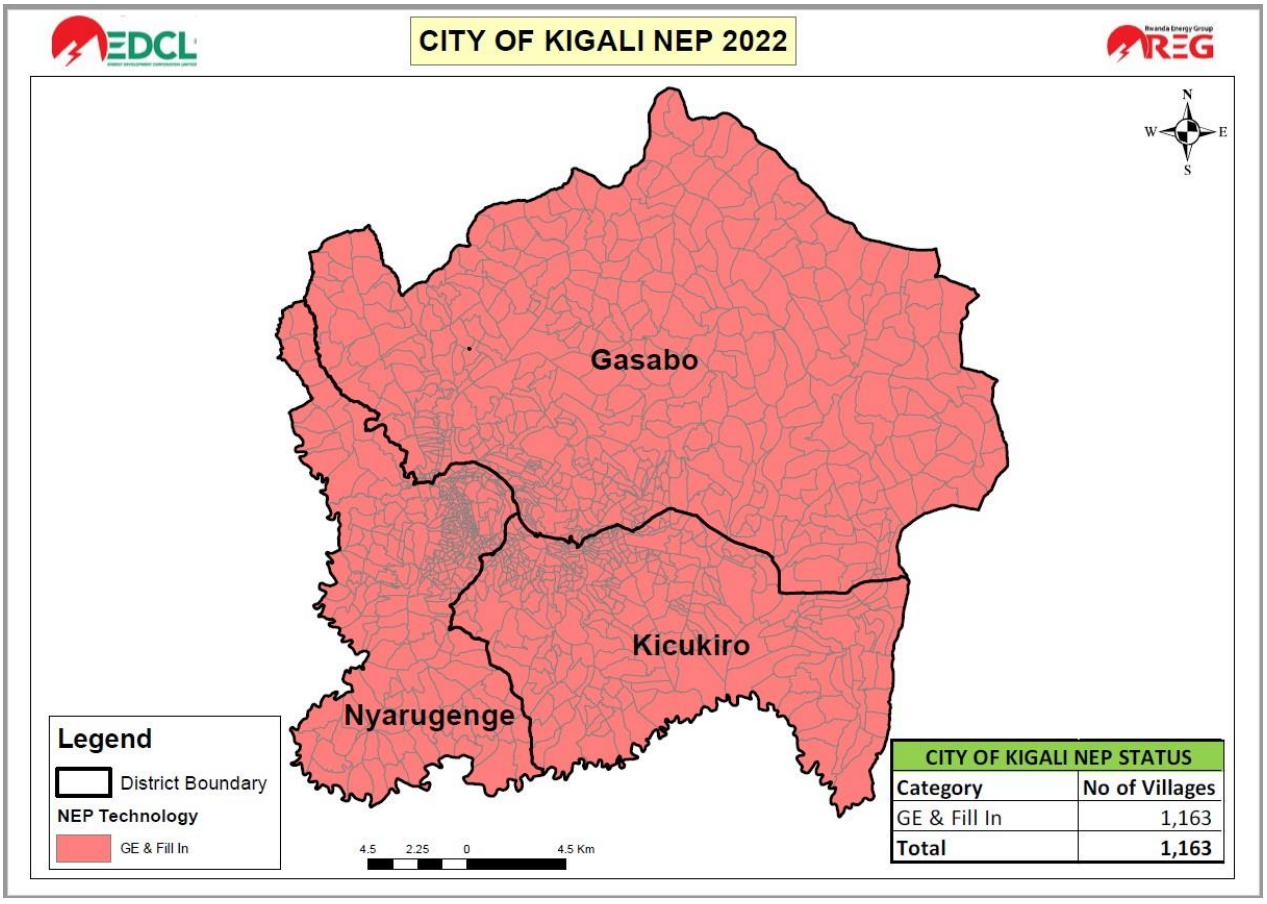
E. KIGALI CITY

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



F. SUMMARY

The results of the NEP 2022 are summarized as follow: **13,116** villages representing 88.9% of all villages are demarcated for the Grid zone while **199** villages representing 1.3% are zoned for Microgrid and **1,442** villages representing 9.7% are planned to be connected to off-grid share.

Province	Electrification Technology per villages						Grand Total
	GE & Fill-In	%	Microgrid	%	SAS	%	
North	2461	89.7	23	0.8	260	9.5	2744
South	3023	86.6	70	2	397	11.4	3490
East	3236	85.7	89	2.3	452	12	3777
West	3233	90.2	17	0.5	333	9.3	3583
Kigali City	1163	100.0	0	0.0	0	0.0	1163
Grand Total	**13116**	**88.9**	**199**	**1.3**	**1442**	**9.7**	**14757**

Among 13,116 villages demarcated for Grid Extension and Fill-in connections, some of them have got funding while for others, the funding is not yet secured.

Therefore, 961 (6.5%) villages zoned for on-grid are suggested to be temporarily connected through Standalone Solar Home Systems due to their proximity to the national grid (located at more than 3Km).

In addition, 59 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.

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 connection status (EXCEL FILE)