# Utility-enabled DER Toolkit: Guide for Distribution Companies

This guide is the starting document for DisCos that are interested in using the standardized tools developed under this toolbox for utility-enabled DER project development and implementation. This guide is composed of the following sections:

- Section 1 introduces utility-enabled DERs and describes how they can benefit DisCos and their customers
- Section 2 describes why the toolkit is necessary, the objective of the toolkit, the tools, and how and when to use them during the project implementation process
- Section 3 describes wider initiatives that will help DisCos successfully scale DERs.

The core user of this toolkit is the DisCo's DER department or unit responsible for developing utility-enabled DER projects

# Contents

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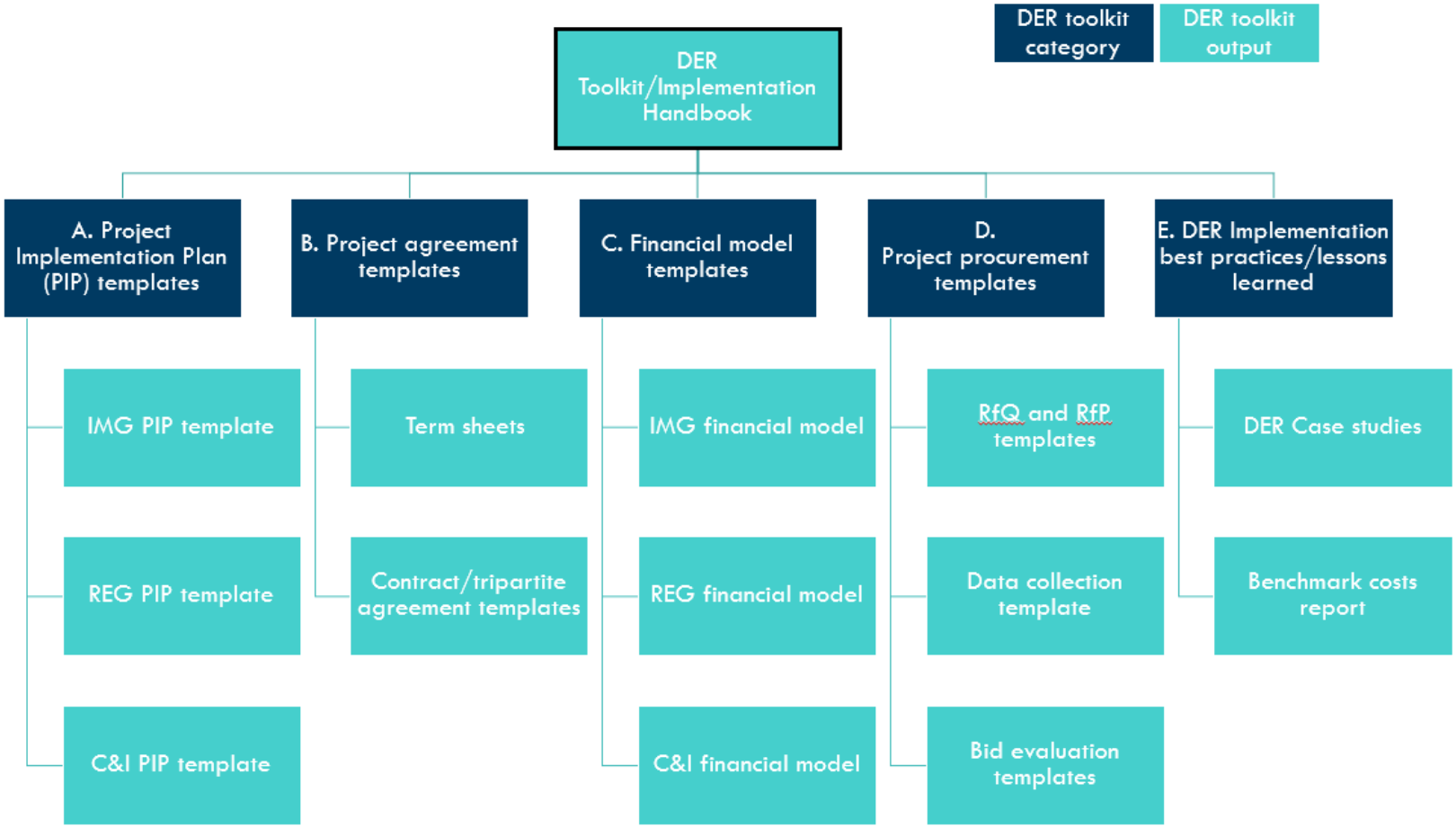
|---|---|
| AEDC | - Abuja Electricity Distribution Company |
| AMI | - Advanced Metering Infrastructure |
| ATC&C | - Aggregated Technical, Commercial and Collection |
| CAPEX | - Capital Expenditure |
| DER | - Distributed Energy Resource |
| DisCo | - Distribution Company |
| EG | - Embedded Generation |
| GEAPP | - Global Energy Alliance for People and Planet |
| GenCo | - Generation company |
| ICA | - Independent Collections Account |
| IEDN | - Independent Electricity Distribution Network |
| IMG | - Interconnected Minigrid |
| M&E | - Monitoring and Evaluation |
| MYTO | - Multi-Year Tariff Order |
| NERC | - Nigeria Electricity Regulatory Commission |
| PV | - Photovoltaics |
| REA | - Rural Electrification Authority |
| REG | - Renewable Embedded Generation |
| RfP | - Request for Proposals |
| RfQ | - Request for Quotations |
| TCN | - Transmission Company of Nigeria |

# The DER Toolkit Diagram



# 1 Why Utility-Enabled DERs are a Win-Win-Win Opportunity

***This section provides an overview of utility-enabled DERs and their benefits. Readers who have a strong understanding of utility-enabled DER business models and their benefits can skip this section.***

## 1.1 Discos Need Innovative Solutions to Their Problems

As a result of difficulties on the national grid such as inadequate generation and transmission capacity, deteriorating infrastructure, and fuel supply constraints, DisCos across Nigeria are unable to reliably supply their customers with electricity. Consequently, some customers, particularly large commercial and industrial (C&I) customers who are the DisCos' most valuable customers, are defecting from the grid to alternative sources. Additionally, due to high aggregate technical, commercial and collection (ATC&C) losses caused by outdated network infrastructure, widespread energy theft, and low metering levels, DisCos do not collect enough revenue to cover their costs.

Given the longstanding nature of these issues, innovative approaches which allow DisCos to improve supply to their customers independently of the national grid while reducing their ATC&C losses are required.

## 1.2 Utility-Enabled DERs are Part of the Solution

Due to the supply deficit on the national grid, many customers in Nigeria own fossil fuel generators to supplement their grid supply. More recently, an increasing number of customers are installing solar PV and battery solutions to improve supply reliability. Alternative energy sources such as these can be collectively referred to as distributed energy resources (DERs) which are demand- and supply-side resources that can be deployed throughout an electric distribution system to meet the energy and reliability needs of the loads on that system. The most relevant DERs in the Nigerian context are solar PV, battery storage, and petrol, diesel, or gas generators.

Currently, most DERs in Nigeria are installed without the knowledge or the co-operation of DisCos. This is a sub-optimal solution, as these DERs are unable to take advantage of low-cost supply from the grid, making them more expensive for customers than necessary. Additionally, this results in lower revenue for DisCos as their most valuable customers switch to alternative energy sources, thereby creating a sense of competition between DisCos and DER developers.

Rather than losing customers and revenue to DERs, DisCos can collaborate with DER developers to improve supply to their customers and increase their revenues while lowering energy costs for customers and enabling DER developers to implement projects at lower cost – resulting in a "win-win-win" for all parties involved.

Utility-enabled DERs are DERs implemented in collaboration with a DisCo by leveraging the DisCo's existing distribution network and relatively low-cost supply from the national grid to enhance the value proposition of DERs for customers. In addition to improved revenue, DisCos can benefit from DER developers providing funding to improve the DisCo's distribution network and meter customers as this reduces ATC&C losses.

## How Utility-Enabled DERs Create Win-Win-Wins for DisCos, Developers, and Customers

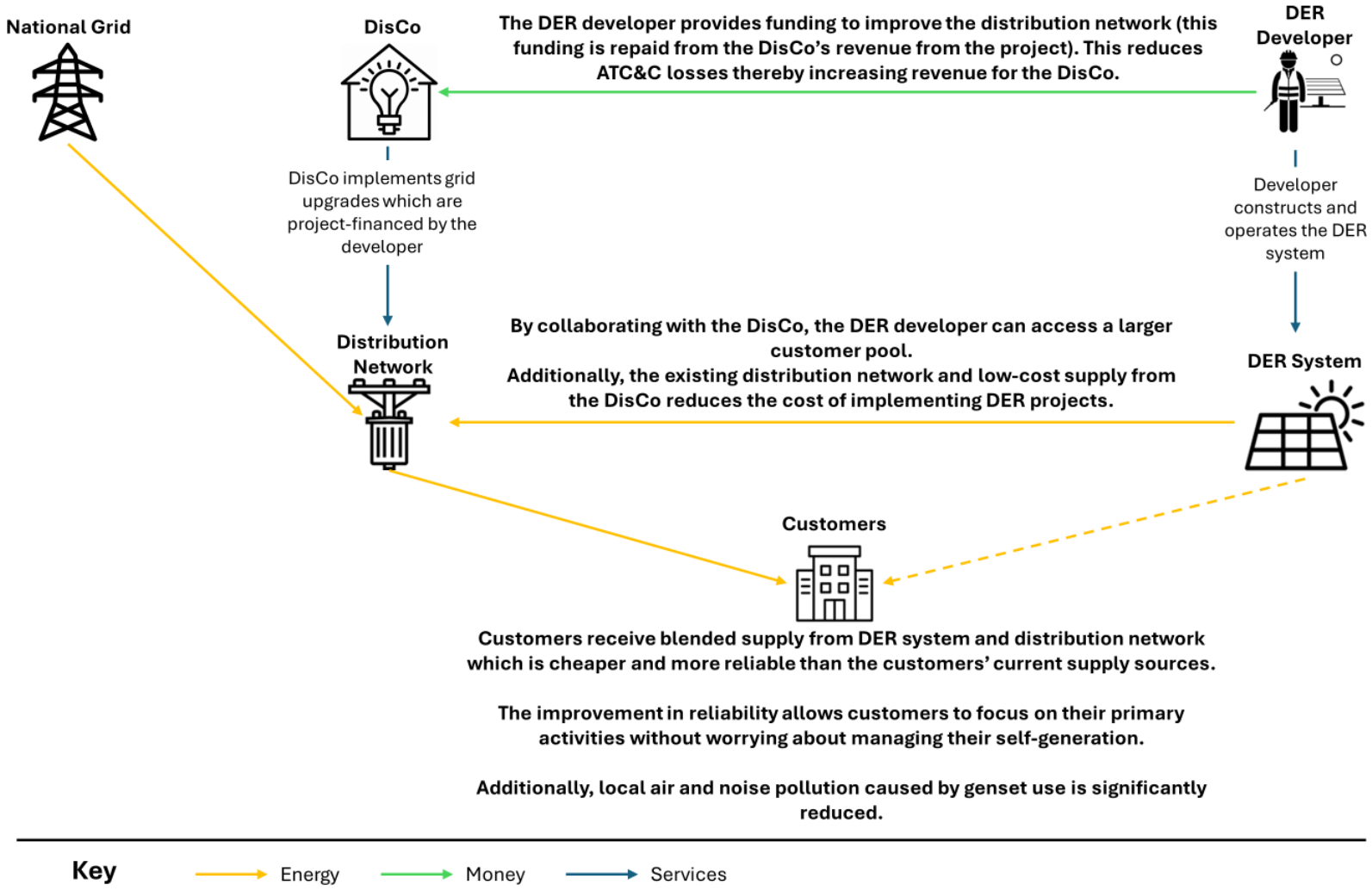



*Figure 1: Diagram illustrating the benefits of utility-enabled DERs*

## 1.3 Utility-Enabled DERs are Suitable for Most Customer Segments

To successfully implement utility-enabled DER projects, it is important that DisCos select an appropriate business model for the customer mix in the location under consideration. A business model refers to how an organization creates and delivers value to its customers, and the processes through which the organization benefits from providing that value. The key components that define a utility-enabled DER business model are:

- **Customer segment(s)**: Who are the customers that will be served by the DER solution?
- **Customer value proposition**: How does the business model improve the situation for these customers compared to other alternatives available to them?
- **Operations**: What must the developer and DisCo do to deliver this value proposition to the customer, how should they do it, and what resources or partners will they need?
- **Customer relationships**: How do the DisCo and DER developer establish a relationship with customers and who is responsible for delivering parts of the value proposition to them?
- **Finances**: What are the costs incurred by the DisCo and the DER developer to deliver the value proposition and what are their revenue streams from the project?

RMI has worked with DisCos to develop utility-enabled DER business models that are applicable for a wide range of DisCo customer segments. The following utility-enabled DER business models are described in this document and more broadly in the DER toolkit:

- The commercial and industrial (C&I) customer business model
- The interconnected minigrid (IMG) business model
- The renewable embedded generation business model

To determine which of these business models is most appropriate for a given utility-enabled DER project, identify the key customer segment to be served by the project and determine which of the business model customer segments described in Sections 1.3.1, 1.3.2, and 1.3.3 most closely matches that customer segment.

| | Customer Segment | Operations | Customer Relationships | Finances |
|---|---|---|---|---|
| **Utility-enabled C&I Customer Business Model** | Large individual urban or peri-urban customers with high reliability needs | DER provides supply during daytime hours while DisCo provides power during evening or night-time hours, with DER backup | DisCo and developer share responsibility for electricity supply; Developer is responsible for billing and collections;<br>DisCo operates distribution network | DER developer funds capital costs of DER solution and can provide funding for grid upgrades;<br>Customer pays a blended tariff for grid and DER electricity |
| **Interconnected Minigrid Business Model** | Rural and peri-urban mixed communities<br>Dense commercial districts or enclosed markets<br>Residential estates | Minigrid provides improved supply through additional generation and improvement of distribution network to facilitate reliable supply | Minigrid developer has sole responsibility for electricity supply, billing and collections, and distribution network operation | Minigrid developer funds minigrid and grid upgrades, and pays distribution network usage fee to DisCo;<br>Customers pay tariffs to developer for electricity consumed |
| **Renewable Embedded Generation Business Model** | Urban and peri-urban areas with a high concentration of commercial customers | DER solution comprises solar PV, battery, and gas genset; solar PV improves supply for all customers while battery and gas genset guarantee 24/7 supply for premium customers | DisCo has sole responsibility for electricity supply to customers, billing and collections, and network operations;<br>DER developer supplies DisCo with electricity from embedded generation solution | DER developer funds capital costs of embedded generation solution and can provide funding for grid upgrades<br>Customers pay into independent collections account |

*Figure 2: Diagram summarizing the features of the three utility-enabled DER business models discussed in this document*

### 1.3.1 The Utility-Enabled Commercial and Industrial (C&I) Customer Business Model

**Customer Segment**

The utility-enabled C&I customer business model focuses on large commercial and industrial customers with high reliability requirements and significant purchasing power. Examples of these customers include large malls and large-scale manufacturers. For more information on technical criteria to select appropriate customers for this model, please visit the *C&I Project Implementation Plan*.

**Customer Value Proposition**

In this business model, the C&I customer receives an uninterrupted supply of electricity that is cheaper than either using diesel generators as a backup or grid supplement or installing a stand-alone captive DER solution.

**Operations**

A DER comprising solar PV, battery storage, and a backup diesel or gas generator is installed on the customer's premises. The customer is supplied by the DER during the day while the grid (with backup provided by the DER) supplies the customers during the evening and at night. The combination of the DER and the grid optimizes the cost-effective dispatch of each resource:

- To take advantage of zero marginal cost solar PV production, the DER solution provides electricity during daytime hours.
- The DisCo provides power during evening and night-time hours, where increased reliability can be facilitated by local grid upgrades which are project-financed by the DER developer and repaid by the DisCo over time.
- The DER solution backs up power supply when needed to guarantee an uninterrupted supply, using a combination of dispatchable resources (e.g., batteries, diesel, or gas generator, etc.).

**Customer Relationships**

***Electricity Supply***. The DisCo and the developer both have responsibility for supplying customers with electricity during their supply periods. However, the developer supports the DisCo by providing backup during the DisCo's supply period.

***Billing and Collections***. The developer is responsible for billing the customer and collecting payment for electricity consumed.

***Distribution Network Operation***. The DisCo maintains responsibility for all distribution network operations up to the customer connection point while the developer takes responsibility for operating and managing any local customer connections.

**Finances**

***Costs***. The DER developer funds all the capital costs of the DER solution and can provide funding for any required grid upgrades. Typically, neither the DisCo nor the customer have any upfront costs in this model.
The customer pays a blended tariff for electricity consumed which combines the cost of grid electricity and the cost of DER electricity.

***Revenue***. The DER developer receives revenue for the electricity sold and the grid upgrades through the blended tariff while the DisCo receives revenue for the grid electricity (with the cost of grid upgrades subtracted from its revenue).

| Additional resources: Utility-enabled C&I customer business model |
|---|

https://rmi.org/insight/improving-electricity-supply-for-large-customers-in-nigeria/
https://www.daystar-power.com/news-post/daystar-power-unveils-tripartite-agreement-to-deliver-nigerias-first-solar-grid-hybrid-system-for-the-wood-factory

### 1.3.2 The Interconnected Minigrid Business Model

**Customer Segment**

The interconnected minigrid (IMG) business model can either be implemented in rural, peri-urban and urban residential communities, in clusters of small and medium-sized commercial customers such as commercial districts or markets, or in residential estates. For more information on technical criteria to select appropriate communities for this model, please visit the IMG *Project Implementation Plan*.

**Customer Value Proposition**

The IMG business model provides customers with an improved electricity supply by adding new supply from the minigrid resources and improving the distribution network. Additionally, customers will have a lower cost of electricity compared to the combined cost of grid electricity and their backup generators.

**Operation**

A minigrid is interconnected with the distribution grid and supplies reliable electricity to customers in a ringfenced section of the DisCo's network using existing grid assets. The minigrid which comprises a solar PV plant, battery storage, and a fossil fuel backup generator supplies electricity to customers and due to its interconnection to the DisCo's network, can also receive supply from the grid to supply to customers.

To optimize cost-effective dispatch from each energy source, the solar PV plant will be the primary source of supply during the day while the grid will be prioritized at night when it is available. The developer will typically carry out distribution network upgrades to facilitate reliable supply of electricity to customers.

**Customer Relationships**

***Electricity Supply***. The developer has sole responsibility for supplying customers with electricity.

***Billing and Collections***. The developer is responsible for billing customers and collecting payment for electricity consumed.

***Distribution Network Operation***. The developer takes responsibility for all distribution network operations within the area covered by the minigrid.

**Finances**

***Costs.*** The developer provides all the capital funding for the minigrid and the grid upgrades. The developer also pays the DisCo a fee for usage of the distribution network; this can either be a fixed annual fee or a fee charged per unit of electricity the developer sells on the network. Finally, the developer also pays for electricity purchased from the DisCo.
Customers pay a tariff to the developer for the electricity they consume.

***Revenue.*** The developer receives revenue from electricity sold to customers while the DisCo receives revenue from the developer for grid electricity purchased and for the distribution network usage fee.

**Undergrid minigrids: what is the difference between undergrid and interconnected minigrids?**

Section 1.3.2 discusses ***interconnected minigrids*** i.e., minigrids which are in areas covered by the DisCo's distribution network, are connected to the network and can receive supply or supply power to the DisCo.

However, minigrids can also be located within the DisCo's network without being electrically connected to the network. This model – sometimes referred to as the undergrid minigrid business model – is most useful in areas where the DisCo has network infrastructure but is unable to supply electricity. This model enables minigrid developers to construct and operate an independent minigrid which improves supply in those areas while reducing costs for customers.

However, these minigrids tend to have higher costs than interconnected minigrids due to the need for expensive backup supply either from a diesel generator or a battery. The benefits of these minigrids can be enhanced by fully interconnecting these locations when the network conditions make this possible.

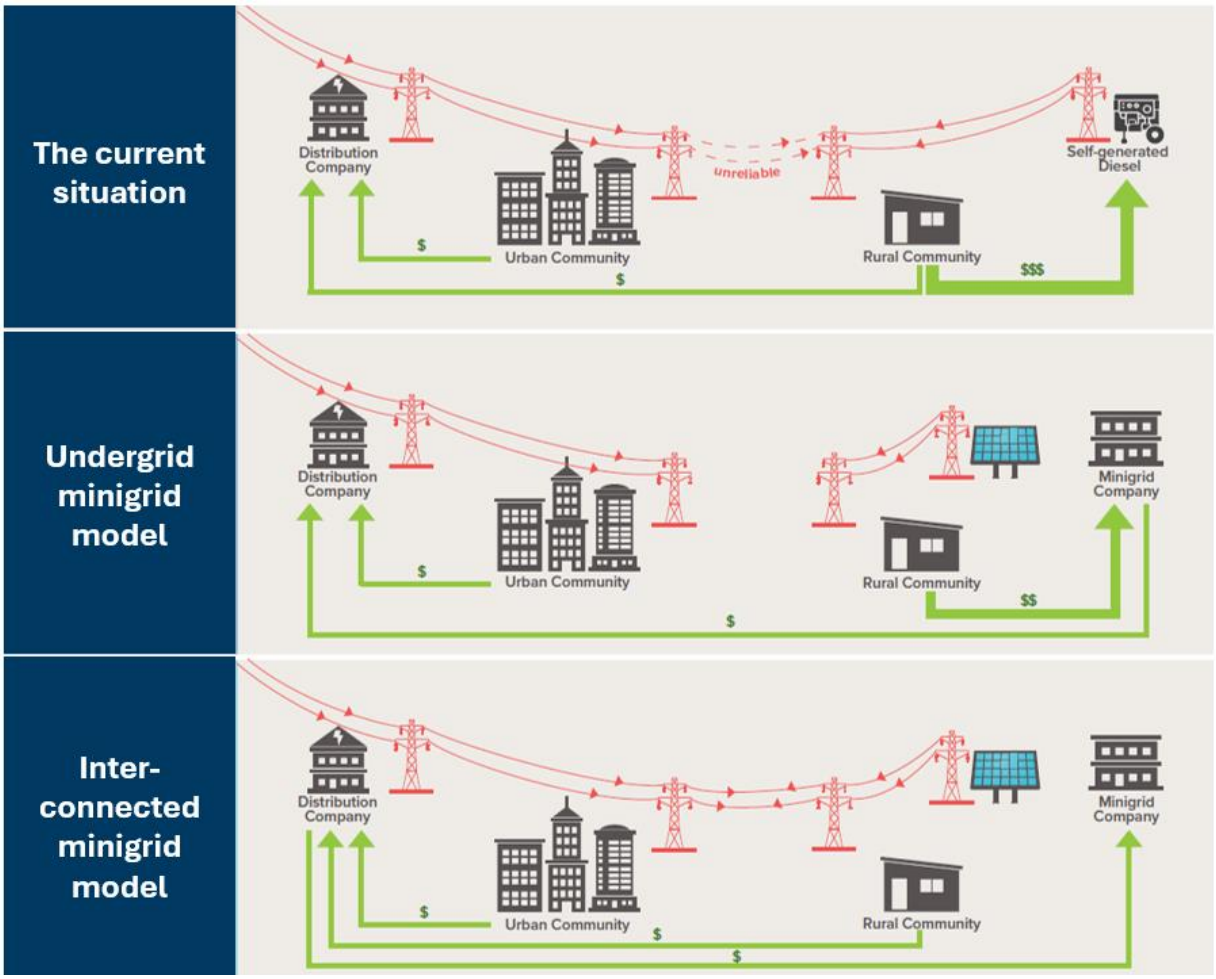



*Figure 3: This diagram illustrates the difference between an undergrid minigrid and an interconnected minigrid*

### 1.3.3 The Renewable Embedded Generation Business Model

**Customer Segment**: The renewable embedded generation (REG) business model is designed for mixed customer clusters or feeders with a significant concentration of commercial or industrial electricity consumption. In this model, C&I customers with significant reliability needs are referred to as premium customers while residential customers or C&I customers with less stringent reliability requirements are referred to as non-premium customers. For more information on technical criteria to identify the most suitable areas for this model, please visit the REG *Project Implementation Plan*.

**Customer Value Proposition**: Premium customers within the customer cluster receive 24/7 reliability at a lower cost than their current cost of electricity while non-premium customers receive increased hours of supply due to reduced load shedding.

**Operation**: The developer builds a REG power plant typically combining solar PV, battery storage, and thermal generation, and supplies electricity to the DisCo through this plant. The DisCo integrates the electricity supplied from the REG plant with supply from the main grid to increase supply for all customers within the selected customer cluster. By including battery storage and thermal generation, the embedded generation installation enables the DisCo to provide 24/7 reliability for premium customers, while the solar PV generation increases daytime supply for all customers, including nonpremium customers.

The REG developer will also fund distribution network upgrades and metering in the customer cluster to minimize distribution network outages. These upgrades will be carried out by the DisCo (or a chosen contractor) and be repaid from the DisCo's share of the REG project's revenue over an agreed-upon timeline between the DisCo and the developer.

Supply-level differentiation between premium and non-premium customers is implemented by installing smart controls on the distribution network that can respond to commands from the network operator to disconnect supply to specific sections of the network.

To address concerns about Nigerian DisCos' liquidity issues, the REG model directs customer payments from REG-served feeders into an independent collections account (ICA). The ICA is a payment mechanism that separates REG customer payments from the DisCo's existing collections accounts, providing revenue assurance for developers without requiring DisCos to enter escrow arrangements that tie up scarce capital.

**Customer Relationships**

***Electricity Supply***. The DisCo has sole responsibility for supplying customers with electricity. The developer has responsibility to supply the DisCo with electricity as outlined in the agreement between both parties.

***Billing and Collections***. The DisCo is responsible for billing customers and collecting payment for electricity consumed, however, all REG customer payments are automatically paid into the ICA.

***Distribution Network Operation***. The DisCo maintains responsibility for all distribution network operations within the REG cluster.

**Finances**

***Costs***. The developer provides funding for all capital costs including the cost of the REG solution and grid upgrade costs. However, the DisCo repays the grid upgrade funding over the project lifetime.

The DisCo pays the developer for REG electricity it purchases from the developer and repays the grid upgrade funding.

Premium customers receive a higher level of service than nonpremium customers, so they pay a premium tariff. Nonpremium customers continue to pay the regulated service-based tariff for the number of hours of supply they receive. All customer payments are made into the ICA.

***Revenue***. The developer receives revenue from the sale of electricity to the DisCo from the REG solution and from the repayment of the grid upgrade funding. To ensure revenue certainty for the developer, these payments are deducted directly from customer payments into the ICA rather than being paid by the DisCo.

The DisCo receives revenue from the sale of electricity to the customers.

| Additional resources REG business model |
| --- |
| https://rmi.org/insight/unlocking-renewable-embedded-generation-in-nigeria/ |

# 2 How the DER Toolkit can Empower DisCos to Take this Opportunity

This section lays out the major phases and steps to take to successfully implement a utility-enabled DER project, the importance of DisCos playing a larger role in the project implementation process, and the DER toolkit that has been developed to support DisCos in each of these steps.

Utility-enabled DER implementation phases can be categorized into three: initiation, preparation, and execution.

| Phase | Description |
|---|---|
| **Initiation Phase** | ▪ Identify the customer group that needs reliable power and initiate engagement to determine interest and business model fit. |
| **Preparation Phase** | ▪ Conduct technical assessment, design a DER solution, select a developer, and finalize the DER solution design alongside the selected developer. |
| **Execution Phase** | ▪ Sign final agreement between all parties; Solution is constructed and distribution network upgrades are implemented; Services to the customer are initiated based on the terms of the signed agreement. |

These three phases can be broken down into the following eleven steps:

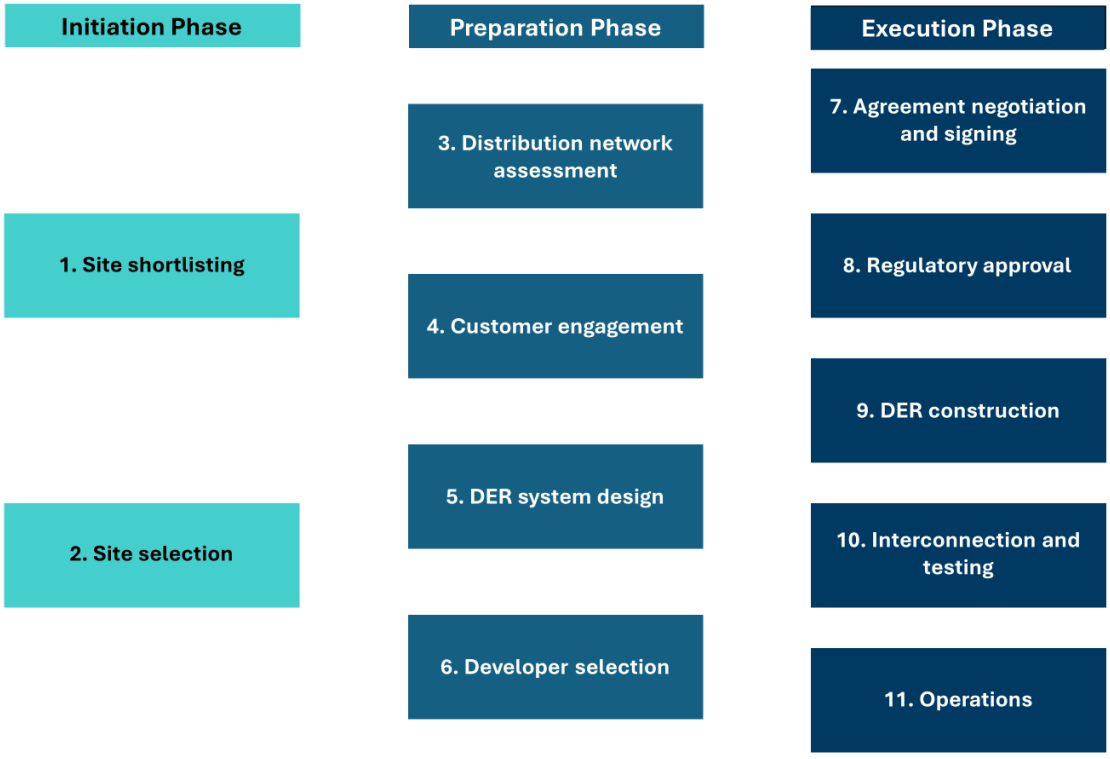



*Figure 4: Diagram summarizing the DER implementation phases and the steps in each phase*

## 2.1 Why the DER Toolkit is Necessary

Currently, due to capacity and resource constraints, DisCos typically select a DER developer to prepare and execute DER projects immediately after the project initiation phase. While this reduces the effort and resources that DisCos expend on a project, it can be suboptimal as it hands the initiative for driving project implementation to the DER developer and limits the level of oversight that DisCos can exercise on the implementation process.

It is important that DisCos are eventually able to lead both the initiation and preparation phases of the DER implementation process because[1]:

- **Alignment with broader DisCo objectives and plans**. A DisCo-led implementation process allows DisCos to ensure that projects are developed in accordance with their broader objectives and plans. By leading project implementation, DisCos can fully integrate their DER projects into their overall performance improvement strategy.
- **Capacity Development**. Although in the short term, a developer-led DER project implementation process might seem less resource intense for DisCos, this limits the experience that DisCos gain from the projects and increases dependence on developers for implementing DER projects. By driving the procurement process by themselves, DisCos can develop the capabilities to initiate and prepare DER projects internally.
- **Least-Cost solutions through competitive procurement**. A DisCo-led process allows DisCos to competitively procure developers to execute the projects as DisCos will have the required information to properly assess competitive bids. This is important because DisCos can achieve significant cost-savings, faster implementation timelines, and value for money through competitive bidding. Competitive procurement forces potential DER developers to transparently bid against one another thereby, driving down project costs. By creating a competitive environment among DER developers with a clear and consistent set of rules and criteria, DisCos can benefit from better contract terms.

The DER Toolkit has been developed to empower DisCos to drive the DER project implementation process.

## 2.2 Objective of the DER Toolkit

Recognizing the need for DisCos to develop the capacity to lead DER project implementation, this DER Toolkit has been developed to support and guide DisCos through the DER project implementation process. The toolkit includes several resources and templates (henceforth referred to as ***tools***) that DisCos can modify for use in their own utility-enabled-DER projects.

This DER toolkit is designed to support the scaling of utility-enabled DERs in Nigeria by:

- Improving understanding of utility-enabled DER business models among DisCos and developers, thereby increasing their ability to implement these business models.
- Providing useful guides and templates that simplify and accelerate the project implementation process for DisCos and developers.

[1] All references to DisCos leading the DER implementation process refer specifically to the initiation and preparation phases of the process as due to NERC regulations, DisCos are unable to lead the execution phase.

- Standardizing and harmonizing documentation between DisCos and developers, thereby reducing misalignment during the project identification, negotiation, and execution process and accelerating overall implementation. This also enhances data sharing between developers and DisCos as the document standardization ensures that both parties are processing information in the same format.

The diagram below summarizes the tools that are in the current version of the DER Toolkit. As more projects are implemented, RMI will update the tools in the toolkit and develop additional tools to support more utility-enabled DER project implementation steps.

## 2.3 The Tools

| Tool | Link to File | Description |
|---|---|---|
| **Implementation Plans** | | The implementation plan outlines the steps, processes, and recommendations for the timely identification, development and execution of a DER project.<br>There are specific implementation plans for each business model that account for the nuances of the business models.<br>The implementation plans are designed to guide DisCos through the DER implementation process by outlining each of the key DER implementation steps, describing the DisCo's responsibilities with each step, and referencing the other tools in the DER toolkit where appropriate to guide users on where and how to use each of these tools. |
| **Term Sheets** | | The term sheets are legally non-binding documents in which the parties provisionally spell out the key transaction parameters of DER project agreements.<br>The term sheets are designed to allow all parties (the DisCo, the developer, and customers/communities) to understand and agree on the terms of the key DER project agreements before the beginning full negotiations of the contracts and proceeding towards signing a binding agreement. |
| **Agreement Templates** | | These are templates of the key contract agreements for each of the business models e.g., tripartite agreements for the C&I model or the IMG model.<br>These templates have been designed to be modified for use in specific projects. By using |

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| | | these templates, DisCos can reduce the time required to draft contract agreements, as these will not have to be developed from scratch. |
| **Financial Model Templates** | | These are financial model templates in Microsoft Excel that take in user-defined inputs and use these to calculate the revenues, costs, profits and cashflows for DER projects.<br>There are individual financial model templates for each business model and these have been designed to accommodate the inputs pertaining to the business model.<br>The financial model templates are designed to help DisCos evaluate the financial viability of DER projects and estimate investment returns from these projects for project developers, distribution companies (DisCos), and customers.<br>This will help DisCos assess the viability of proposed projects and properly compare proposals received from developers. |
| **Data Collection Template** | | The data collection template identifies the data that stakeholders implementing DER projects need to collect, outlines how the collected data can be used to make improved project decisions, discusses potential data sources, and provides recommendations for improving data availability. |
| **Request for Qualifications Template** | | This is a template for Request for Qualifications (RFQ) documents to be used in a two-stage process for selecting developers to execute DER projects. The RFQ outlines the qualifications that a developer is expected to have to be shortlisted as eligible to submit a full proposal.<br><br>Additionally, a Microsoft Excel scoring matrix template for the RFQ is provided. This is a tool which allows the DisCo to record if a developer's qualifications match the outlined criteria and determine which developers will be selected as pre-qualified developers. |
| **Request for Proposals Template** | | The Request for Proposals (RFP) template provides an example of an RFP including how the project should be described, the key requirements to include, and proposed process for submitting a proposal including how the proposal will be evaluated and the timelines for submission and evaluation. |

| | | |
|---|---|---|
| **DER Case Studies** | | The DER Case Studies review examples of projects which have been implemented and highlight key aspects of these projects that can guide DisCos and developers during the implementation of future projects. |
| **Technology Cost Benchmarks** | | The technology cost benchmarks list out the capital expenditure (CAPEX) for each of the key components of a DER project (e.g., solar PV modules, battery storage, diesel generator, customer meters etc.).<br>These cost benchmarks have been developed to help DisCos evaluate the CAPEX costs included in DER proposals/bids from developers. |

## 2.4 Using the DER Toolkit

The table below describes each major step in the DER project implementation process and the tools that support implementation of that step. Note that the table includes tools which have not yet been finalized and, as a result, are not part of this version of the toolkit. Tools that are still under development are marked with asterisks in the table.

| Implementation Step | Description | Relevant Tools |
|---|---|---|
| **Initiation Phase** | | |
| **Site shortlisting** | In this step, the project team identifies locations that possess the desired characteristics for DERs and shortlists them for further analysis | • ***Data collection methodology*** |
| **Site Selection** | From the initial shortlist developed in Step 1, the project team selects the preferred site(s) to develop DER projects. The project team will need to visit the shortlisted sites and collect additional data on the sites to aid the selection process | • ***Stakeholder Engagement Plan**** <br>• ***Data Collection Template*** |
| **Preparation Phase** | | |
| **Distribution Network Assessment** | After selecting the preferred site(s) for the DER project(s), the project team should assess the distribution network to understand the issues affecting reliability, catalogue existing infrastructure, understand how customers are arranged across the network, and determine the most cost-effective way to upgrade the | • ***Distribution Network Assessment Template*** |

| | | |
|---|---|---|
| | distribution network to improve reliability. | |
| **Customer/Community Engagement** | The project team should also engage customers to enumerate customers, re-confirm customer interest in the solution, and collect key information on the characteristics of the customers in the location. | • ***Customer Engagement Templates**** |
| **DER Solution Design** | This step involves designing an optimal DER solution for the site. To do this, the project team should:<br>• Develop a load profile for the site;<br>• Model the load to design a least-cost and high-reliability DER solution for the site;<br>• And finally, estimate project costs, revenue and tariffs through financial modeling. | • ***HOMER Resources for DER Solution Design****<br><br>***Financial Models***<br>• ***IMG Financial Model Template***<br>• ***REG Financial Model Template***<br>• ***C&I Financial Model Template***<br><br>• ***Benchmark Costs Document*** |
| **Developer Selection** | To select a developer to execute the project, the project team should initially identify a pool of pre-qualified developers through a **Request for Qualification (RFQ),** conduct site visits to the site(s) under consideration with the pre-qualified developers, and finally, select a developer from the pool through a **Request for Proposals (RFP)** | • ***RFQ Template***<br><br>• ***RFQ Scoring matrix***<br><br>• ***RFP Template***<br><br>• ***RFP Scoring matrix*** |
| **Execution Phase** | | |
| **Agreement Negotiation & Signing** | Once a developer is selected, the project team will negotiate and agree upon the terms of an appropriate agreement with the developer and (if required) with the customer(s)/community. | ***Term Sheets***<br>• ***IMG Model Term Sheet***<br>• ***REG Model Term Sheet***<br>• ***C&I Model Term Sheet***<br><br>***Agreements***<br>• ***IMG Tripartite Agreement Template***<br>• ***REG Agreement Template*** |

| | | |
|---|---|---|
| | | • ***REG Connection Agreement***<br>• ***REG Premium Customer PPA Template***<br>• ***C&I Tripartite Agreement Template*** |
| **Regulatory Approval** | The project team will coordinate with the developer to submit all required documents to the Nigerian Electricity Regulation Commission (NERC) | ***Implementation Plans***<br>• ***IMG Implementation Plan***<br>• ***REG Implementation Plan***<br>• ***C&I Implementation Plan*** |
| **System Construction & Network Upgrades** | The project team will work alongside the project developer to source financing and procure DER components including generation equipment, distribution network equipment needed for upgrades, and meters. | ***Implementation Plans***<br>• ***IMG Implementation Plan***<br>• ***REG Implementation Plan C&I Implementation Plan*** |
| **Interconnection** | The DisCo's technical team and the developer will work closely to ensure successful interconnection based on agreed-upon designs and standards. To ensure smooth operations, key issues such as retrofitting or installing transformers, poles, distribution cables, and meters, as well as implementing appropriate control, switching, and protection systems between the grid and DER solution must be addressed effectively and tested before going live. | ***Interconnection Guidelines**** |
| **Operations** | The project team will work with the project developer to ensure the project runs smoothly and the terms of all agreements are fulfilled. | ***Monitoring and Evaluation Template**** |

# 3 Wider Initiatives to Scale Utility-Enabled DERs and Maximize their Benefits

The DER toolkit provides DisCos with the tools needed to lead the implementation of DERs within their franchise areas. However, to fully grasp the opportunities that utility-enabled DERs offer, DisCos will need to undertake certain initiatives to support successful DER implementation across the DisCo. None of these initiatives are disruptive or expensive for DisCos to implement, but it is important that DisCos are aware of the need for them as it is important that they are included in utility-enabled DER adoption plans and they will require some changes to current operational processes.

This section discusses five key initiatives that will enable DisCos to maximize the benefits of utility-enabled DERs for them and their customers.

## 3.1 Develop a DER Strategy

To successfully initiate and implement utility-enabled DER projects, DisCos must first develop comprehensive DER strategies that outline critical points such as:

- The customer segments and business models that the DisCo's DER program will focus on
- How DER initiatives will be coordinated with other efforts to improve service delivery
- The DisCo's targets for DER implementation and timelines for these targets.[2] Particularly how the DER strategy helps the DisCo meet NERC's embedded generation targets and fill in the supply gap
- The personnel within the DisCo who will be responsible for delivering those targets
- The metrics for measuring the DER strategy's success.

This is critical as it will enable DisCos to ensure that their DER programs are complementary to their other service improvement initiatives, help them identify the required resource allocations for successful DER project deployment, and allow for accurate measurement of the impact of the DERs implemented in their territory.

Additionally, NERC's request on 18th March 2024 for DisCos to submit workplans for reaching the prescribed targets of at least 5% of load allocation coming from renewable embedded generation sources adds further impetus to this as DisCos are required to factor in tasks, milestones, resources, financial requirements, and a timeline. DisCos can use this as an opportunity to develop comprehensive strategies that clearly outline how DERs will be leveraged – in combination with other initiatives – to meet their performance improvement targets.

## *3.2* Deploy Technology to Collect and Manage Data for Project Development

Designing a DER solution that is properly sized for the electrical load it is intended to serve requires the availability of accurate data on the number of customers to be served, their electric load profile,

[2] RMI's DER Roadmap has estimated the DER capacity that five Nigerian DisCos (AEDC, BEDC, EKEDC, Ikeja Electric, and KEDCO).

and their current level of supply from the DisCo. Preferably, this data should be available at the distribution transformer level for at least a year.

Currently, most DisCos do not have this data at the required level of granularity. As a result, the project preparation typically includes customer enumeration, customer load data logging exercises or similar exercises. While these activities are necessary due to the data gap, they lengthen the timeline for project preparation and increase the cost of project implementation. Additionally, due to time and cost constraints, the period over which the data is collected is typically shorter than is ideal, with negative impacts on system sizing and financial modeling.

To scale DERs in line with what is required to close the supply gap, these data items must be collected on an ongoing basis. Given the difficulty and cost of collecting this data manually, where possible, DisCos should use technologies such as advanced metering infrastructure (AMI) and smart meters to collect customer load data continuously and remotely.

Beyond data collection, it is important that DisCos have systems for organizing, managing, and analyzing the data they collect. This will enable DisCos to identify the locations that are most suitable for DERs and begin the process of preparing DER projects for these locations.

This DER toolkit includes a data collection template that will assist DisCos with data collection and management.

## 3.3 Establish a DER Department or Unit

RMI'S DER Roadmap estimates that up to 11GW of DERs will be required by 2033 to close the supply gap in the areas served by AEDC, BEDC, EKEDC, IE, and KEDCO. For DisCos to expand utility-enabled DERs to these levels, internal resources will have to be committed to the identification and development of utility-enabled DER projects. DisCo staff will be required to gather and analyze data to identify locations that can benefit from utility-enabled DERs, engage customers/communities, conduct distribution network assessments, design DER solution, build financial models, select developers and negotiate agreements with them.

While it is possible to assemble teams to work on these projects on an ad hoc basis, to build the internal capacity required to properly implement it is preferrable for DisCos to identify staff members with interest in DERs and some expertise in an area of DER implementation. Building a permanent DER department or team will enable the members of the department to rapidly improve their skills through repeatedly working on DER projects. Additionally, this will help DisCos to complete projects quicker as the members of the team will be able to focus on DER implementation with minimal distraction from other activities.

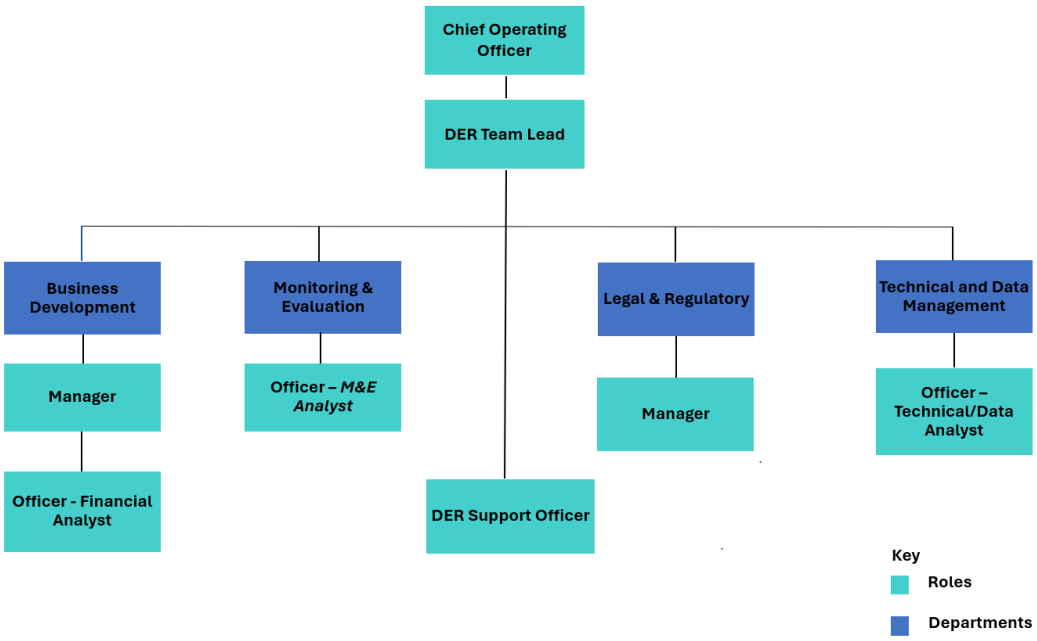
It is important to note that while the DER department will have final responsibility for executing the DER strategy, all DisCo departments/units will be required to support the execution of DER projects. For example, the legal department will be required to review contracts with developers or customers while the technical department will have to work with developers on interconnecting DER plants to the DisCo's network. To ensure that the DER department receives the support that it requires from other departments, DisCos should specify standard timelines for these departments to respond to requests from the DER department and incentivize these other departments to meet these timelines. For example, time to meet these timelines could be included as a key performance indicator (KPI) for the relevant department.

**DER department example: The case of Abuja Electricity Distribution Company (AEDC)**

Supported by the Global Energy Alliance for People and Planet (GEAPP), RMI embedded a DER expert to serve as a DER Team Leader within AEDC. Commencing the role in November 2022, the DER Team Leader has facilitated the execution of DER pilot projects in AEDC's territory, including the Toto Interconnected Minigrid in Nasarawa – Nigeria's first interconnected minigrid while identifying a pipeline of high potential projects for future implementation.

Recognizing the DER Team Leader's positive impact, AEDC has established a three-person DER Unit which is currently working to expand AEDC's DER program. Crucially, although the DER Team Leader position is funded by GEAPP, the other members of the DER Unit are funded by AEDC, demonstrating internal recognition of the DER department's importance at AEDC.

The proposed organogram for AEDC's DER team is shown below.




## 3.4 Empower Regional Staff to Identify Potential Projects

Beyond building a DER department or team, DisCos should develop a process for receiving information from business districts or area offices for DER project identification. Since the business districts are closer to the customers than the head office and interact with them more frequently, they have a stronger grasp of which areas have the desired characteristics for DER projects and can provide additional context on potential sites that may not be apparent from the data at the head office level.

To improve understanding of utility-enabled DERs among business district managers and enable them to select appropriate project locations for DER projects, the DisCo's DER program should be explained to them in detail, including:

- What DERs are and the main DER business models
- How DERs can improve the situation for the DisCo, and more specifically, for their districts
- The objective and targets of the DisCo's DER program
- The preferred characteristics for DER sites
- How to collect, manage, and analyze data that can support DER project development.

This can be done through in-person and/or virtual workshops organized by the DisCo's central DER department.

With this knowledge, business district managers should be encouraged to share potential DER sites with the DisCo's DER department and if projects within their district are selected for implementation, the business district staff should be included in the implementation process to ensure their local knowledge is utilized.

## 3.5 Monitor and Evaluate Implemented Projects

It is critical for DisCos to assess the impact that the DER projects they have implemented are having on their performance. This is important because it enables DisCos to determine if their DER projects are achieving their objectives and to carry out a cost-benefit analysis of the DER projects. Additionally, proper monitoring and evaluation (M&E) can help DisCos to identify developers who are not operating the projects according to the project agreement and provide the necessary information to help the DisCo take decisions on the existing project(s) as well as future projects with that developer.

These assessments should consider both commercial and technical impacts and should be conducted at regular intervals to ensure that the project continues delivering the value expected from the project. Key metrics that should be monitored include:

- **ATC&C loss level**. Since the DER business models include investments to improve the distribution network and to increase customer metering, it is important to evaluate the impact of these investments on ATC&C losses.
- **Revenue and operating income from customer(s).** To determine if the DER project is positively impacting DisCos' revenue and operating income from the customers affected by the DER project, DisCos should assess this metric. This is an important metric that will help DisCos decide if it makes financial sense to extend their DER programs.
- **Customer supply levels**. Given that the primary reason for implementing DER projects is to improve supply for customers, DisCos should monitor customer supply levels to determine if the DER is delivering the expected supply improvements. Additionally, since some DER agreements require the DisCo and/or developer to guarantee a certain level of supply to customers, this will help DisCos to ensure that they are meeting their supply obligations and make adjustments if they are not.

The process starts even before a project is implemented. Firstly, DisCos need to establish a baseline on all key metrics that will be monitored ***before*** the project is implemented. Section 5.2 has already discussed the importance of data collection and management to proper project implementation and M&E requirements should be accounted for in the data collection process. This will enable DisCos to properly assess the impact of their projects compared to business as usual and avoid over- or under-estimating project impacts.

Additionally, it is important for DisCos to properly define the boundaries of impact measurement to ensure that comparisons are accurate. For example, if a DER project supplies customers who were previously connected on a different feeder, the impact assessment should account for this when comparing revenue before and after the DER project.