



Distributed Energy Resource (DER) Developers and Utility Collaboration to Improve Customer Experience

HOMER Microgrid and Hybrid Power Conference

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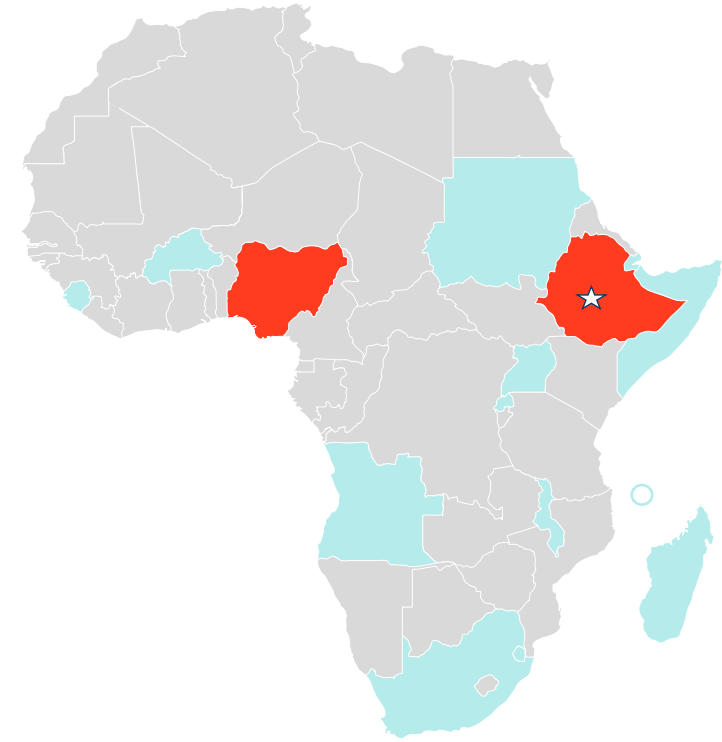


HOMER MICROGRID AND
HYBRID POWER

9TH ANNUAL
INTERNATIONAL

RMI (Rocky Mountain Institute) transforms energy systems to create a clean, prosperous, and secure low-carbon future

- **Impartial NGO** grounded in technical and economic analysis with a whole-systems approach and focus on market-based solutions
- **Staff of 250+** scientists, engineers, business and policy leaders
- **Global operations** collaborating with governments, development partners, utilities, and the private sector – including the US, China, India, sub-Saharan Africa, and the Caribbean
- **38-year history** of transforming energy systems to increase efficiency, sustainability, and resilience (electricity, buildings, transportation, industry)
- **Africa Energy Program** drives **affordable, efficient, and resilient** energy systems that incorporate emerging distributed energy resources to **rapidly provide energy access and increase economic development**



RMI's Africa Energy Program receives generous programmatic support from:

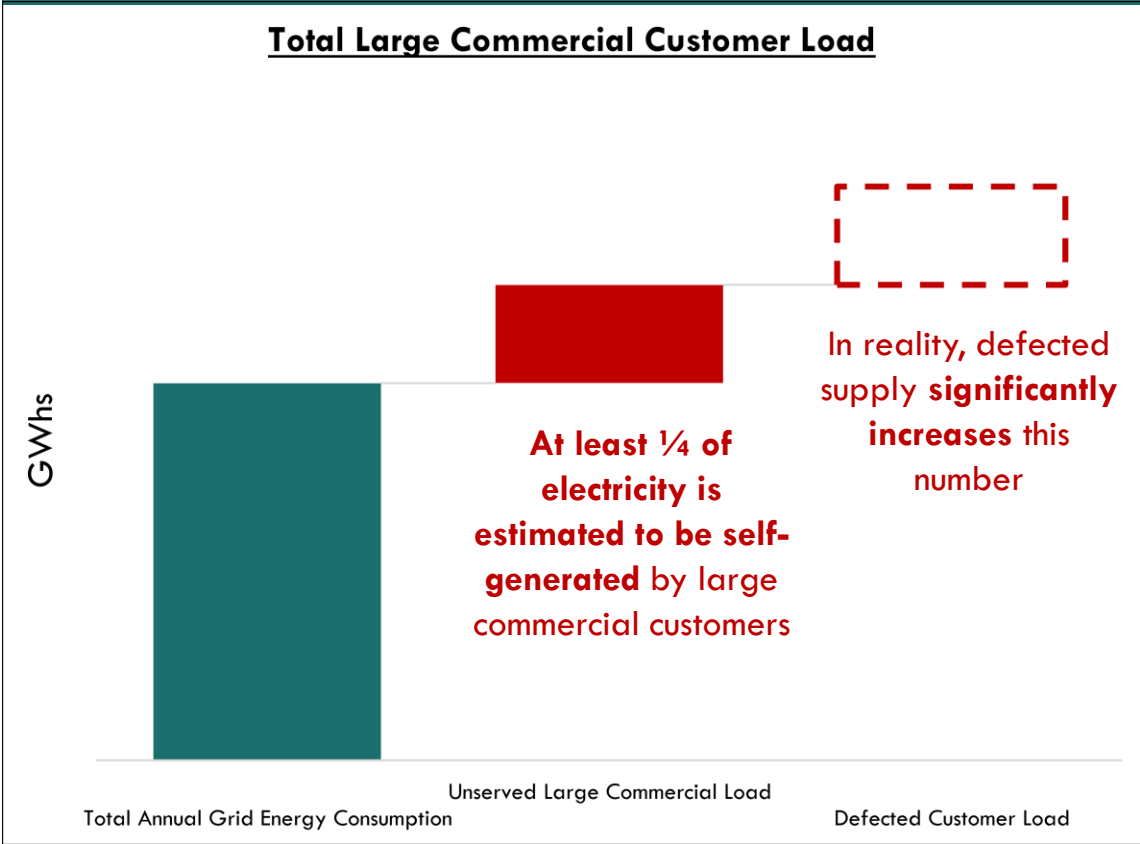


IKEA Foundation



Many large C&I customers complement grid supply with diesel, or are even defecting to and installing their own renewable energy hybrid systems on-site

Large commercial customers do not have enough grid power to meet their needs, substituting with diesel or other sources



In addition, many customers across sub-Saharan Africa are taking advantage of falling renewables prices to install their own DER systems on-site

Afrik 21
NIGERIA: Empower finances a solar system (700 kWp) for the Premium Poultry Farm

THIS DAY
Power Ministry Goes Off Grid With \$2.5m Hybrid Solar Power System

The Guardian
Jabi Lake Mall, CBE consider offgrid solution with 600KW solar plant

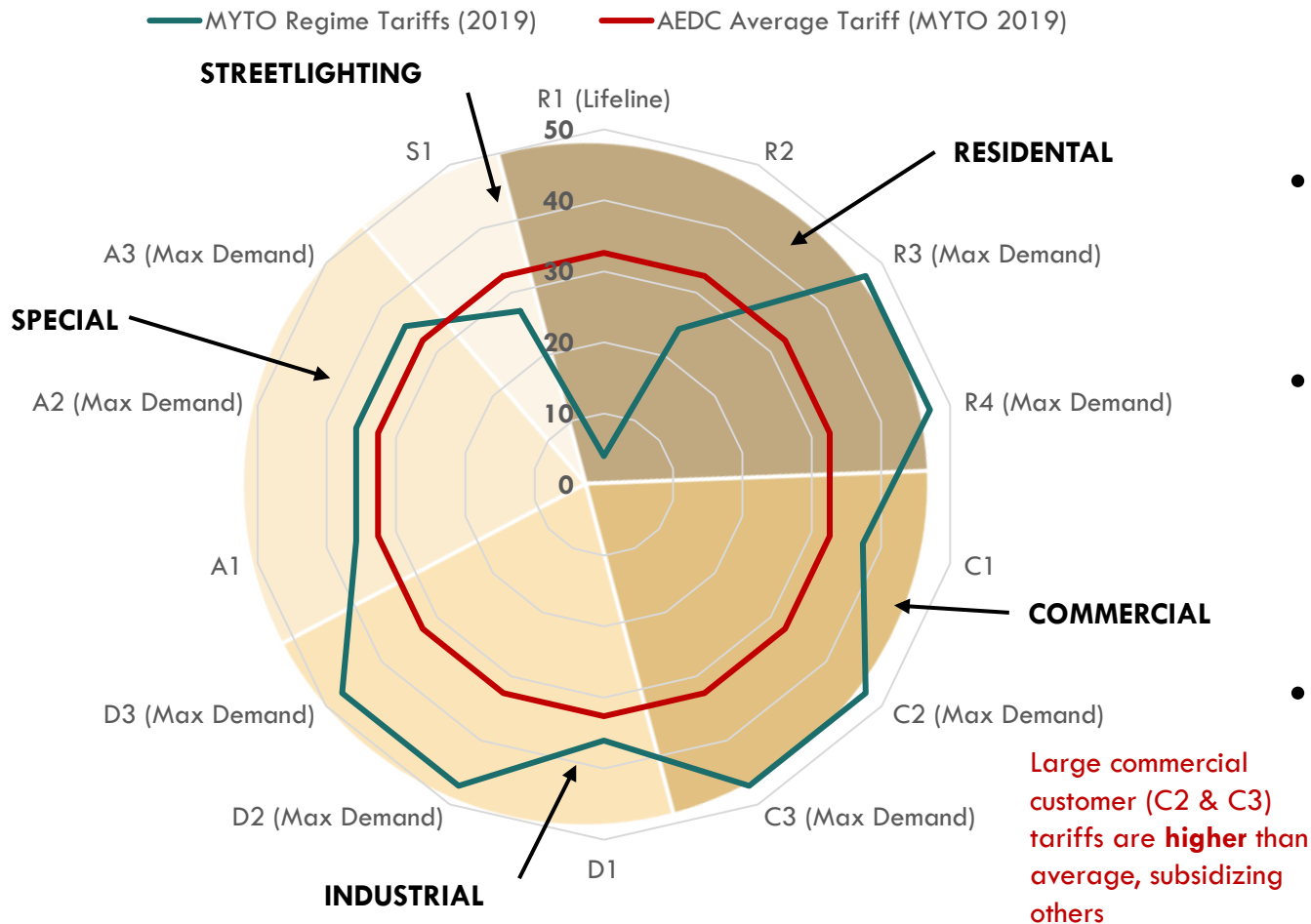
CREAMER MEDIA'S ENGINEERING NEWS
Imperial Wanderers Stadium adds solar as an energy source

HUB
Nigerian Manufacturers Self-Generate 13,223MW of Power

THE NATION
Manufacturers spend N378b on power generation

When large commercial customers defect, it drives up grid costs for other customers and creates a battleground between utilities and DER developers

Comparison of AEDC Customer Tariffs (in 2019)

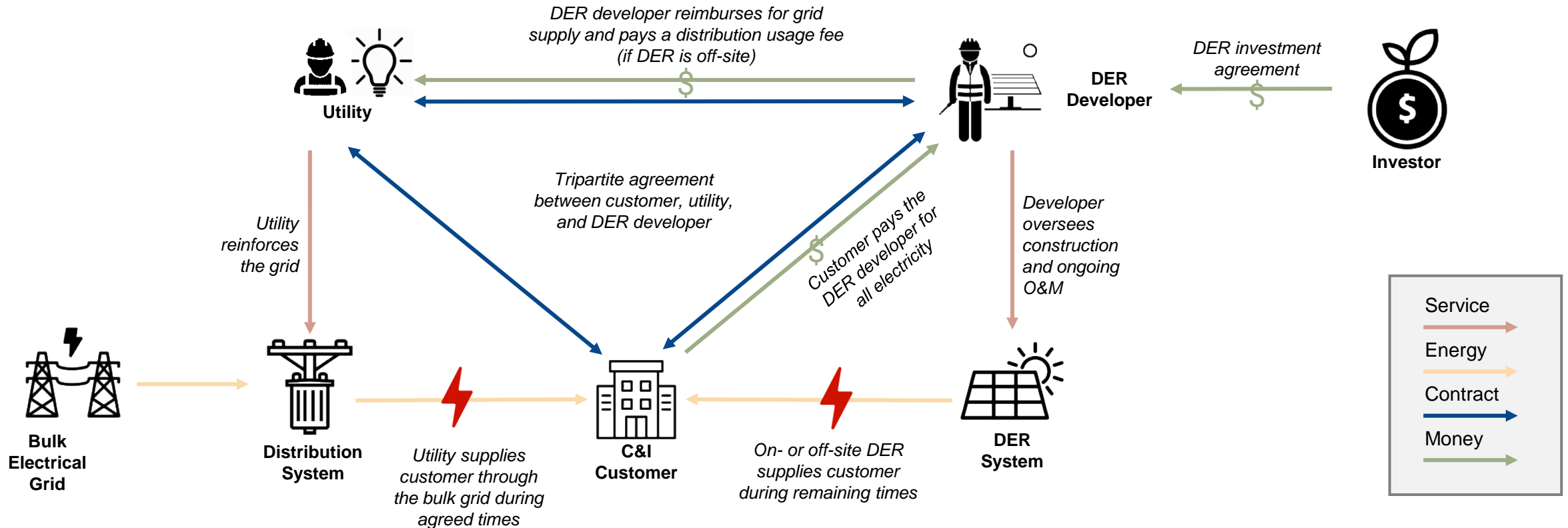


- When C&I customers defect, it decreases cross-subsidization of other customers' tariffs (e.g., small, rural customers), **driving up average grid tariffs**.
- This creates **tension between DER developers** (and customers wanting cheap, reliable power now) **and utilities** (whose customers are being poached).
- Some utilities and regulators respond with **protectionist policies**. For example, Kenya's Energy and Petroleum Regulatory Authority is proposing rules for further regulation of solar systems that could dampen the growing industry in Kenya.
- Despite Nigeria's enabling regulation, tension between utilities protecting their customer base and DER developers providing customers with power still exists - as it does **across sub-Saharan Africa**.

Instead, utilities and DER developers can collaborate to mutually benefit by sharing power supply using the below “Utility-Enabled DER Business Model”

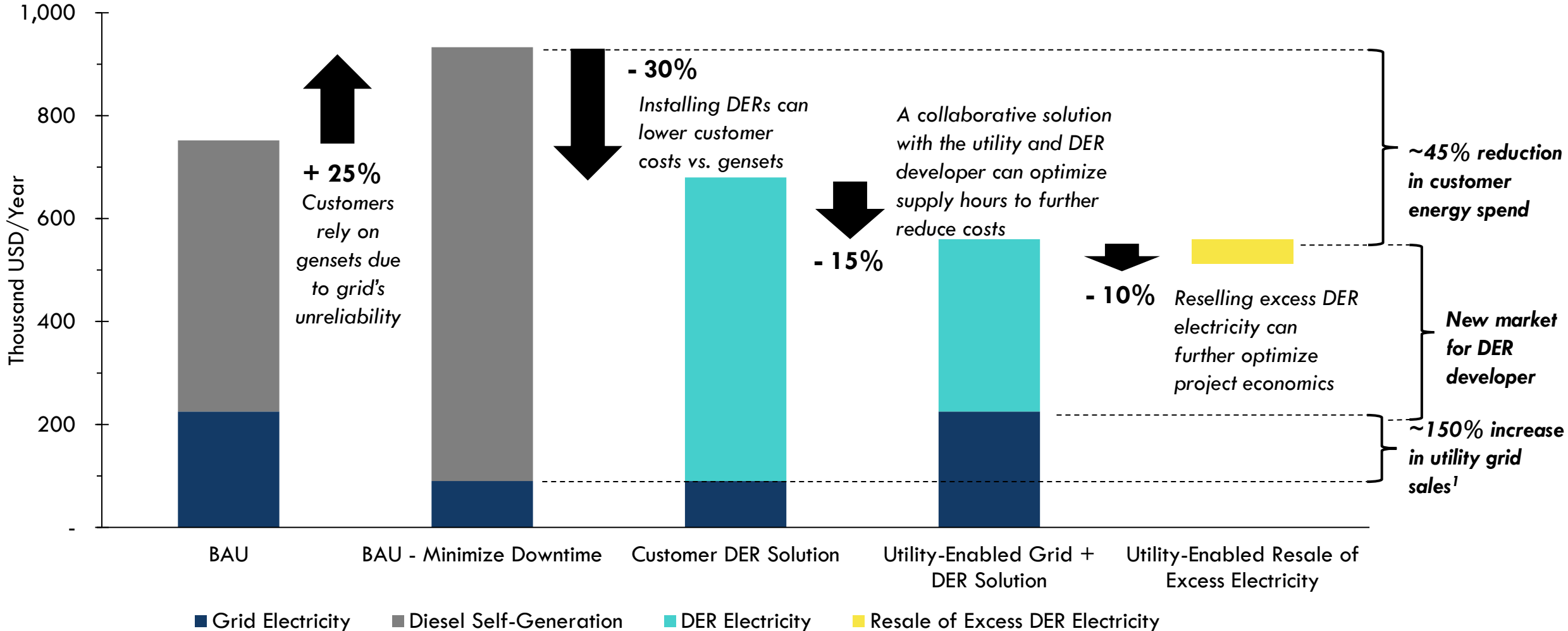
Utility-enabled DER solutions for commercial and industrial customers can optimize costs while providing for reliability and utility revenue

RMI and Abuja Electricity Distribution Company (AEDC) are working to develop and pilot this first-of-its-kind business model in Nigeria

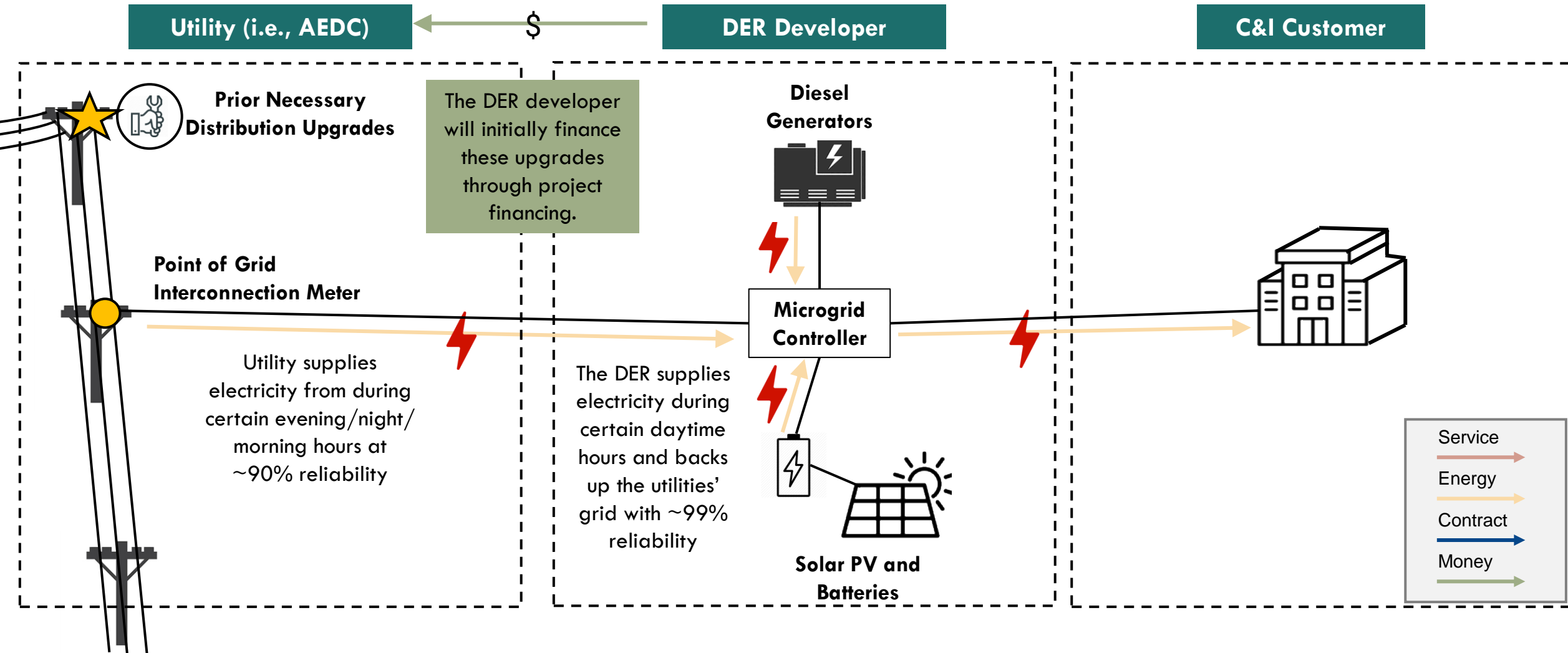


This collaboration between utilities and DER developers can create a “win-win-win” that lowers large C&I customer costs

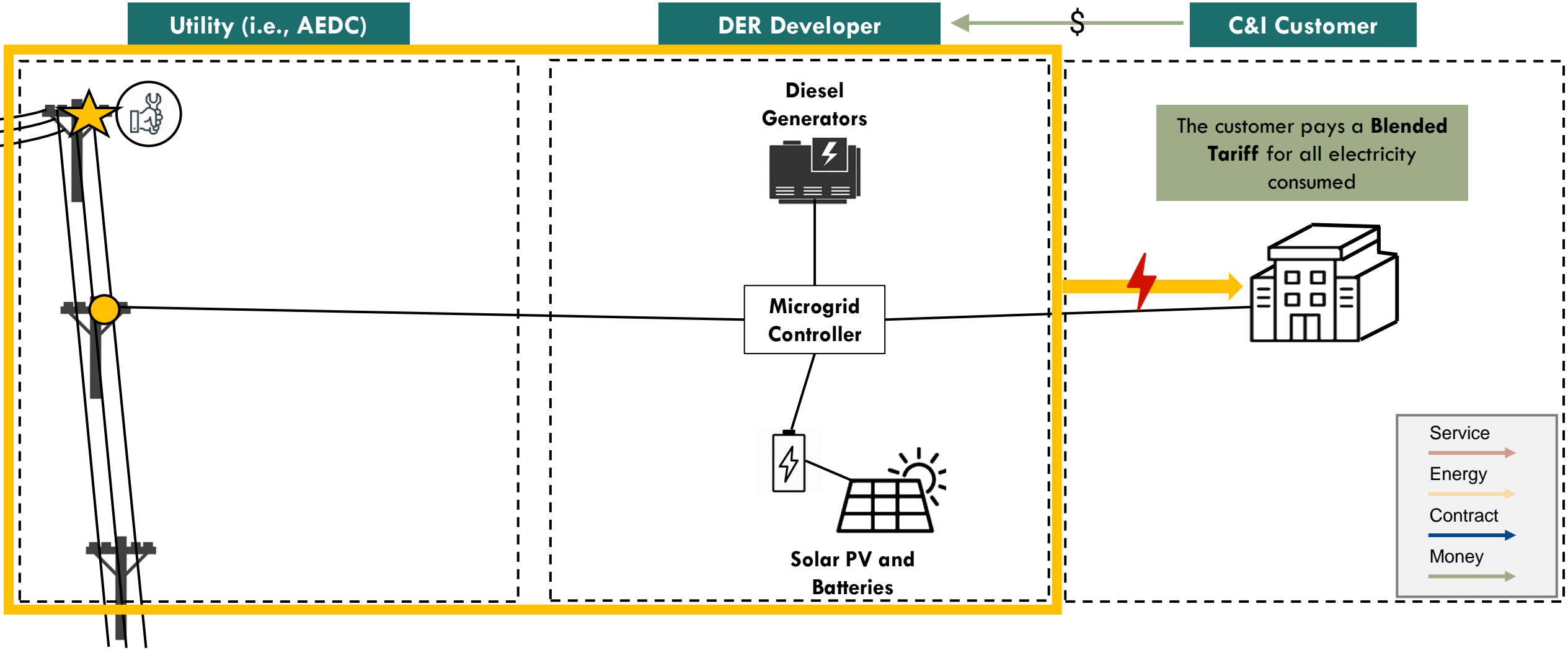
Illustrative Large Commercial/Industrial Customer Costs



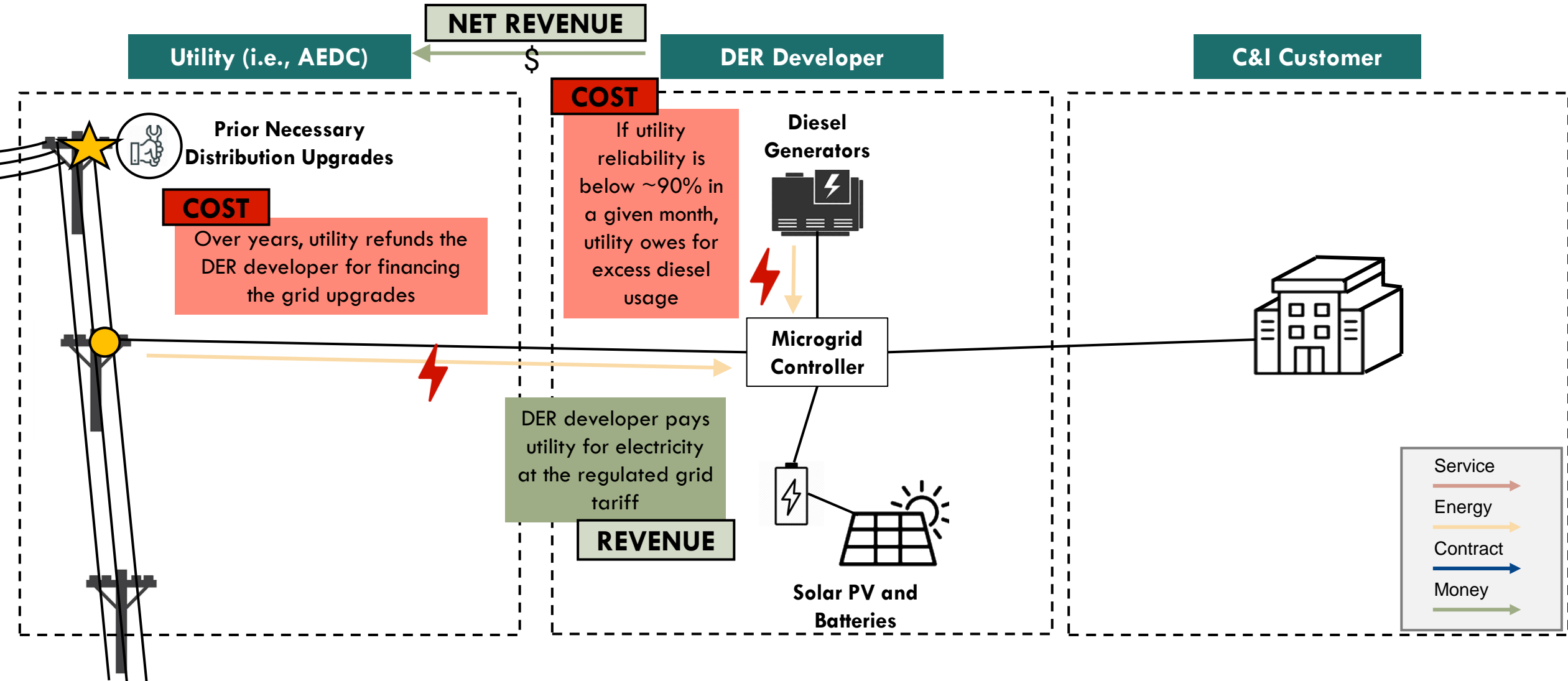
On the technical side, electricity is supplied both from the utility's grid and from the DER (owned and operated by the DER developer)



The customer's experience is simplified: the customer pays the DER developer for all electricity received

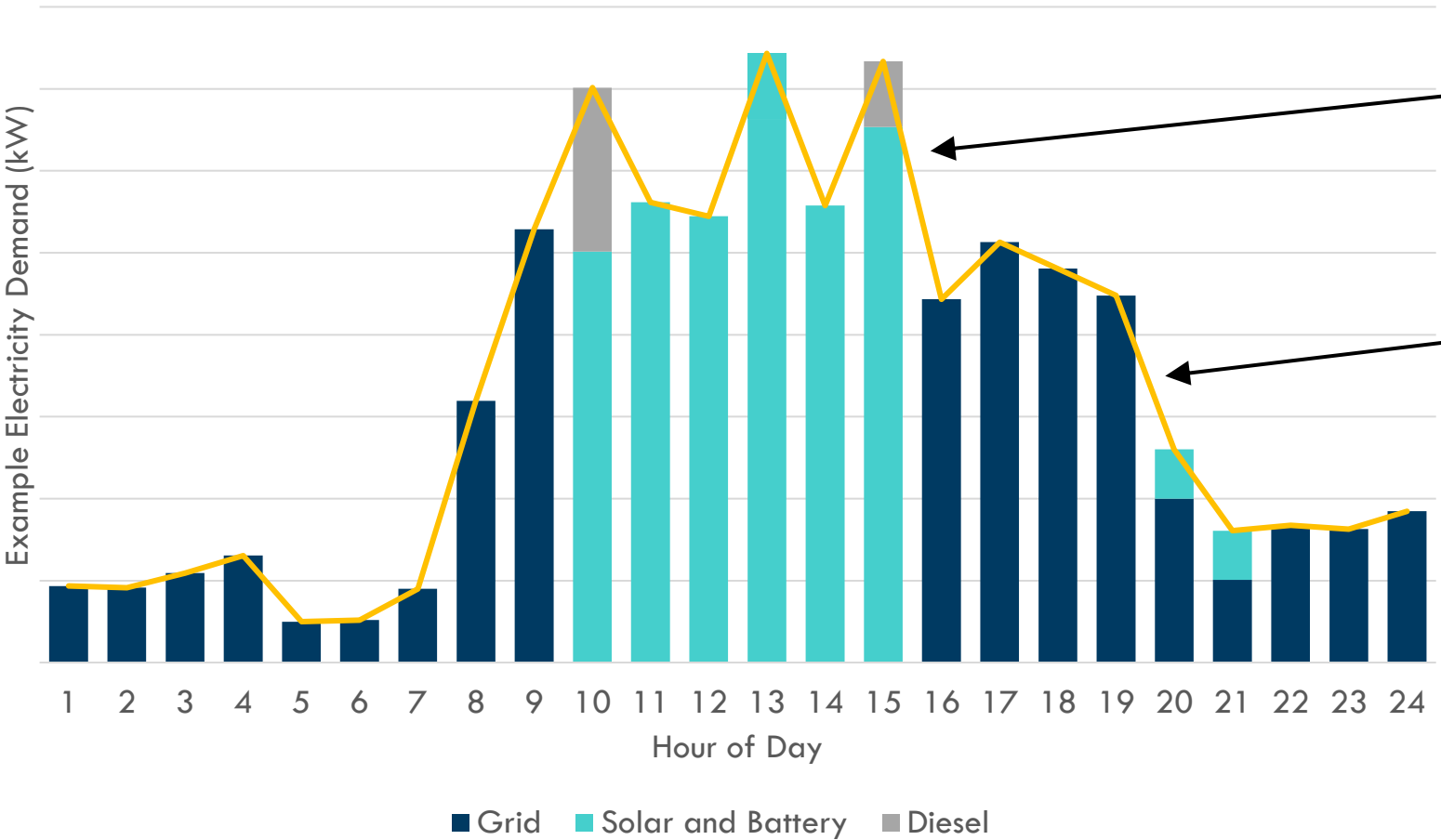


Contractually, performance incentives ensure reliable electricity supply and provides the utility the opportunity to earn revenue



The customer receives electricity from the DER system during daytime to maximize solar PV output and from the grid during the rest of the time

Power Sources Supplying Customer with Electricity
(An Illustrative Day)



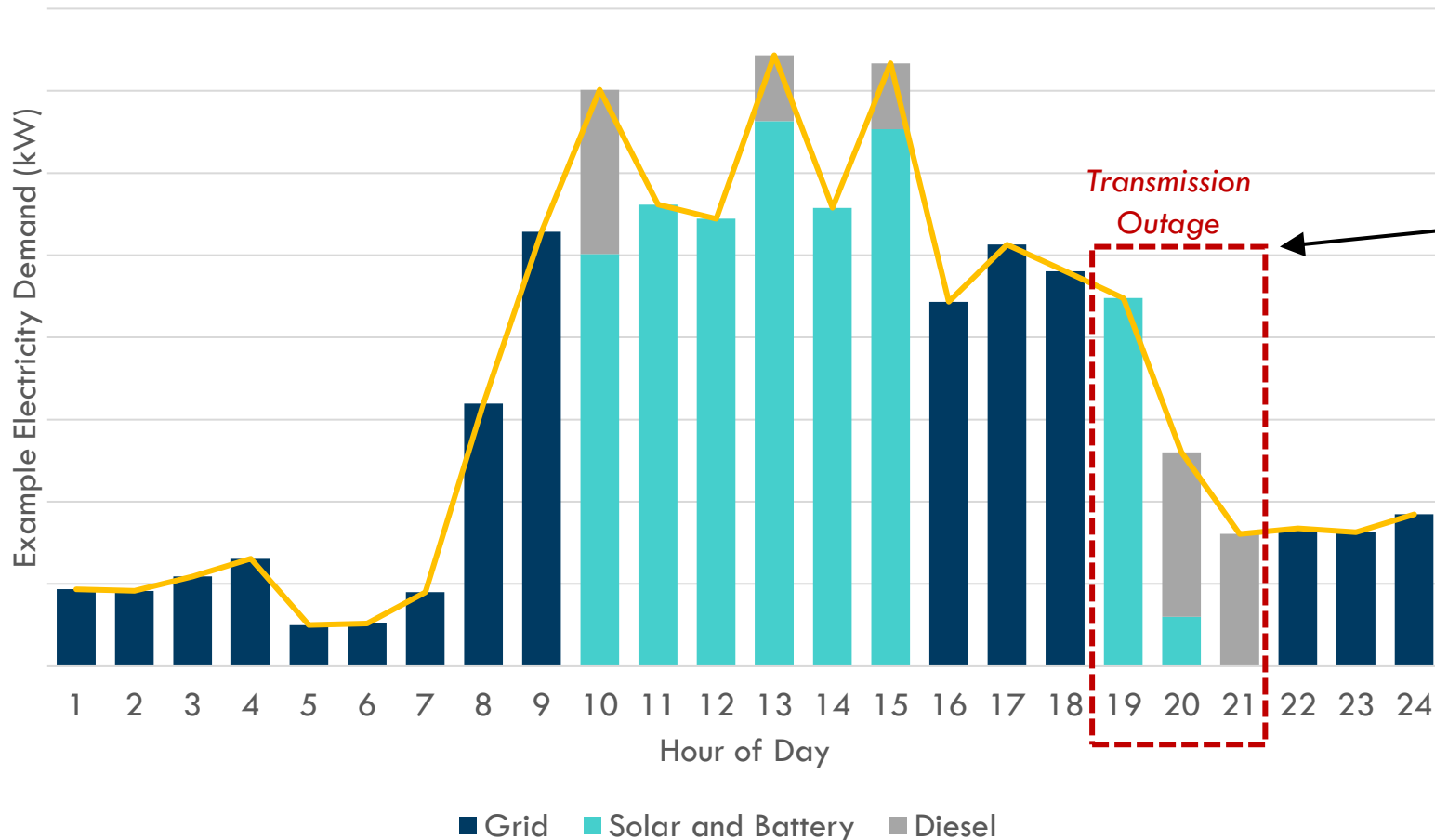
Customer would receive electricity from the **DER system – including from solar photovoltaics, battery, and diesel** – from 9am to 3pm which are the peak producing hours of solar photovoltaics.

Customer would use electricity from **utility's grid** from 3pm to 9am to reduce costs.

According to RMI's analysis, **aided by HOMER**, this division of supply from DERs and the grid is the **lowest-cost option** for an example customer.

There may be instances where, outside of the utility's control, Nigeria's transmission system has a blackout — the DER system would provide backup

Power Sources Supplying Customer with Electricity
(Illustrative Day)

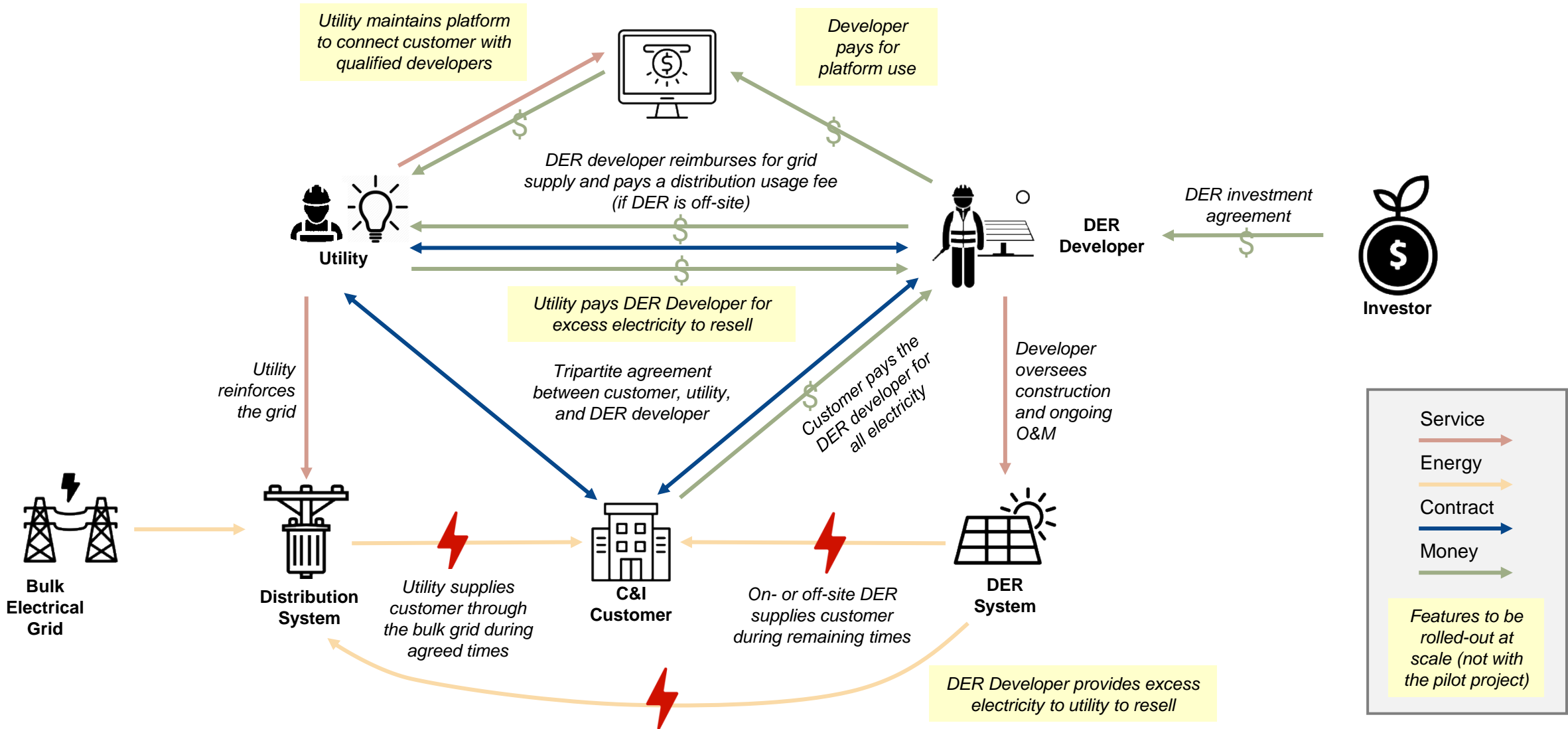


If the utility's grid goes down or the quality of power is not acceptable, the DER system automatically engages **with zero downtime** switching between sources.

The battery enables an **uninterrupted supply of electricity**. In an extended grid outage or solar power severely limited due to rains, the diesel generators would turn on as a backup source of electricity.

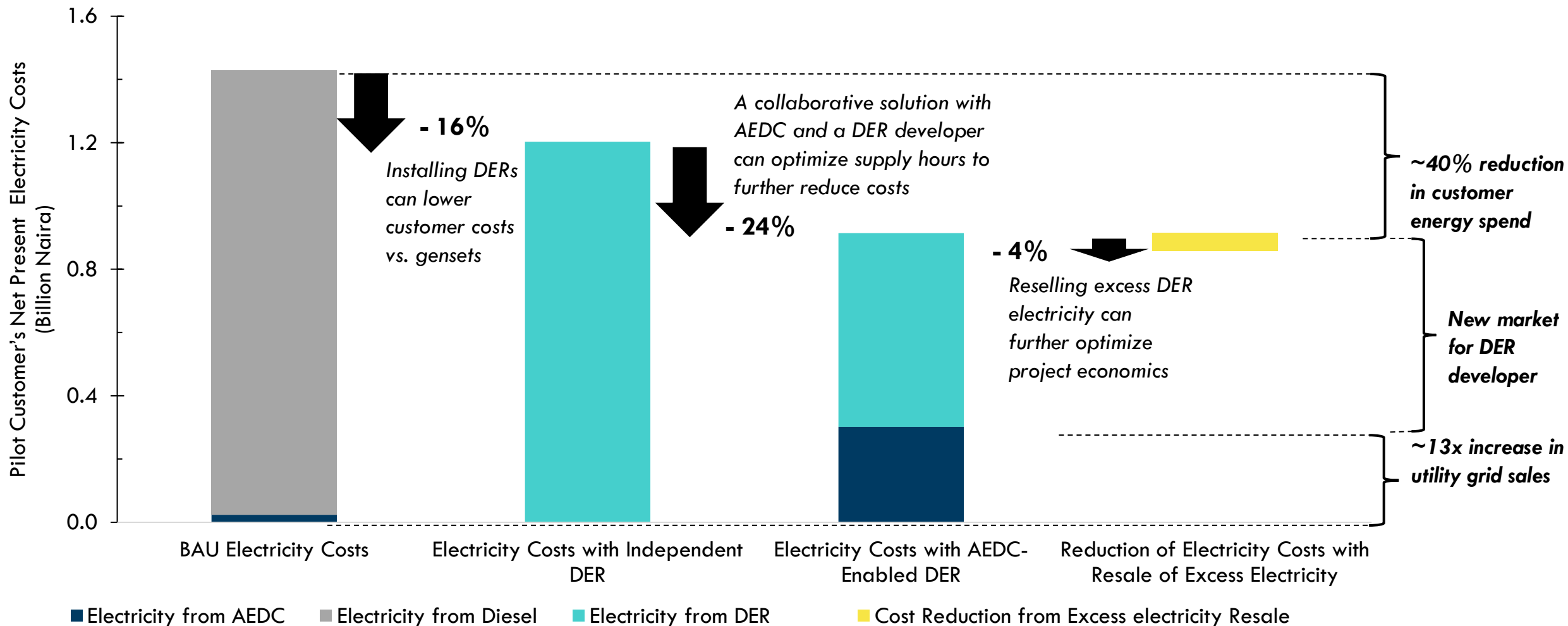
The DER developer would be **responsible for ensuring the customer has uninterrupted power**.

Add-on's, such as a platform and resale of excess electricity, can provide the utility with additional revenue streams and improve project economics



A pilot project customer in AEDC's territory, for example, would save ~40% of its net present electricity costs with the Utility-Enabled DER Business Model

Pilot Customer's Estimated Electricity Costs (20 Years)



The Utility-Enable DER Business Model addresses existing challenges and provides benefits to each stakeholder

Status Quo Challenges

- Customers **do not have reliable electricity** supply from the grid
- Customers **pay high costs** for diesel to complement grid supply, or **defect from the grid**
- Defection **drives tariffs up for all customers** and **reduces utility revenue**
- Developers **oversize DER** to compensate for non-DER optimal hours (i.e., evening / night), increasing customer costs
- **Fosters competition** between DER developers and utilities

Utility-Enable DER Business Model Solution

- DER developers and utilities **can work together** to supply customers
- Customer receives electricity from **both** cheap grid power and DER solution
- **DER provides power during daytime hours** to maximize solar output; grid provides power during less optimal solar hours

Stakeholder Benefits

- **Customer**
 - Improved service delivery
 - 24/7 reliable power
 - Cost savings vs. self-generation
 - Cheaper than standalone DER
- **Utility**
 - Retention of customer base with improved generation supply hours, increasing revenue stream
 - Capital expenditure to improve distribution network
- **DER Developer**
 - Attractive standalone DER economics
 - Blended economics open up larger pipeline of customers
 - Reduces customer acquisition costs and utilities can provide pipeline of projects



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