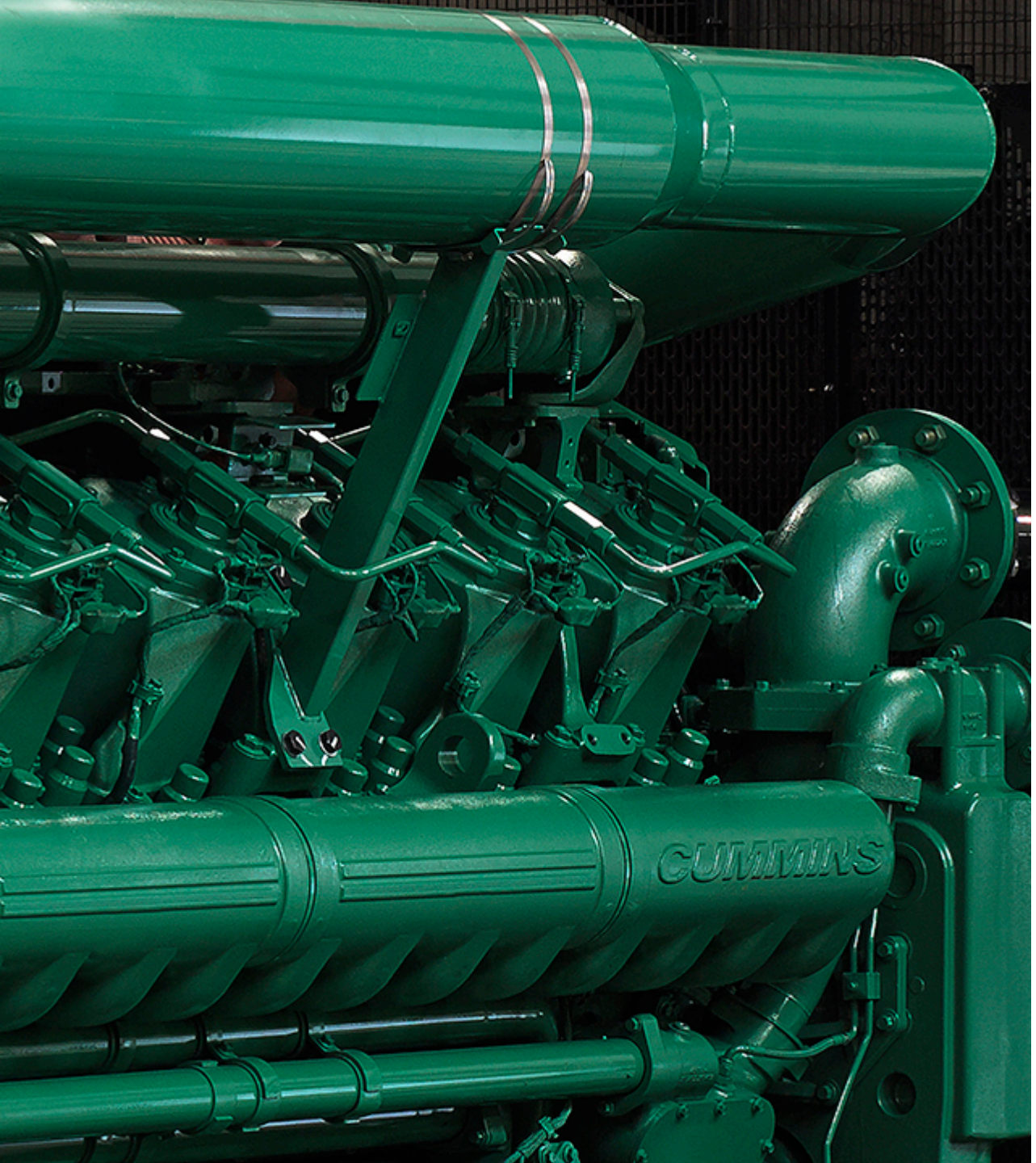

An Introduction to Distributed Generation (DG) Applications

PowerHour webinar series for consulting engineers

Experts you trust. Excellence you count on.

December 17, 2019 11:00 PDT / 13:00 CDT

(1PDH issued by Cummins)

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Product Manager
Cummins Inc.

Dave Matuseski
Customer Engineering Director
Cummins Inc.

Cummins facilitator:

Michael Sanford
Technical Marketing Specialist
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- TX, OK, AR, LA, MS, AL, Western TN: Scott Thomas (m.scott.thomas@cummins.com), Gulf Region
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The views and opinions expressed in this course shall not be considered the official position of any regulatory organization and shall not be considered to be, nor be relied upon as, a Formal Interpretation.

Participants are encouraged to refer to the entire text of all referenced documents. In addition, when in doubt, reach out to the Authority Having Jurisdiction.

Course Objectives

An Introduction to Distributed Generation (DG) Applications

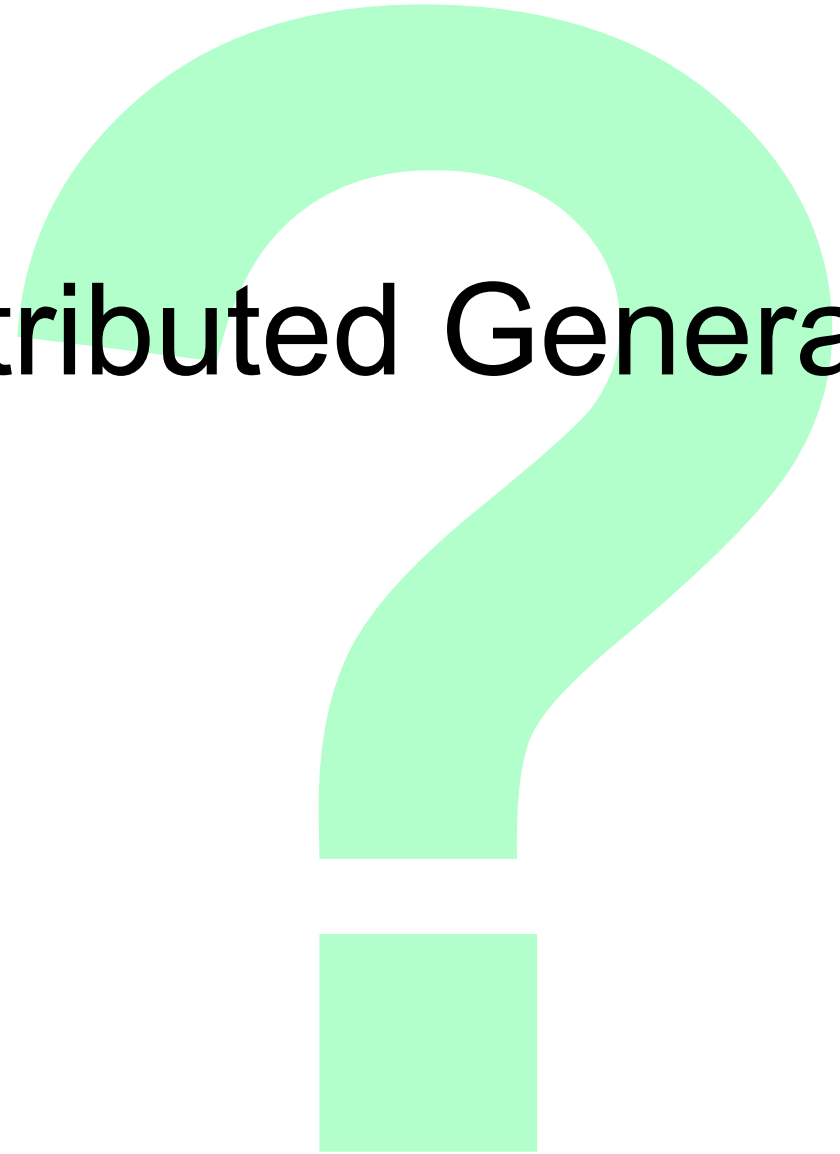
The evolution of the electricity markets has changed….Distributed Generation is a broad category and although there are some more apparent applications of the concept; some applications may not be top of mind when customers are considering their approach to an energy strategy or inquiring about on-site generation.

This course will provide an approach to categorizing these distributed generation (DG) uses and explain a few of these opportunities in greater detail.

After completing this course, participants will be able to:

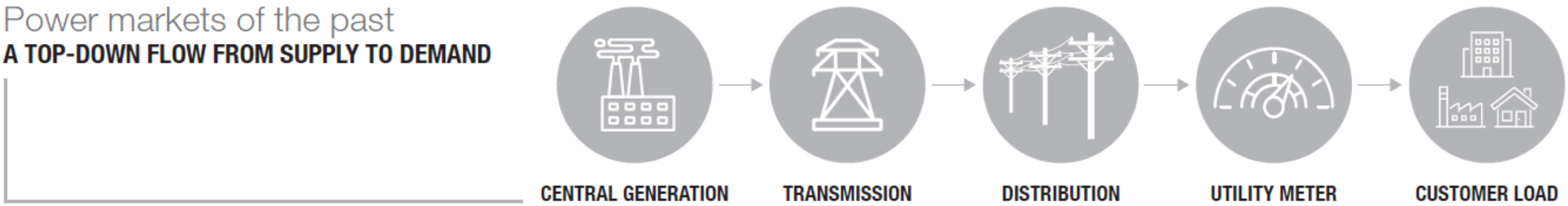
- Describe energy ecosystem trends and the needs driving the evolution of DG
- Identify the categories of DG applications (Use Cases) and components of the system
- Define possible DG approaches to customer energy needs.

What is “Distributed Generation?”



The Evolution of Power Markets

The traditional top-down flow of electricity has been experiencing disruptive forces over the last several years.



Power Markets Evolution

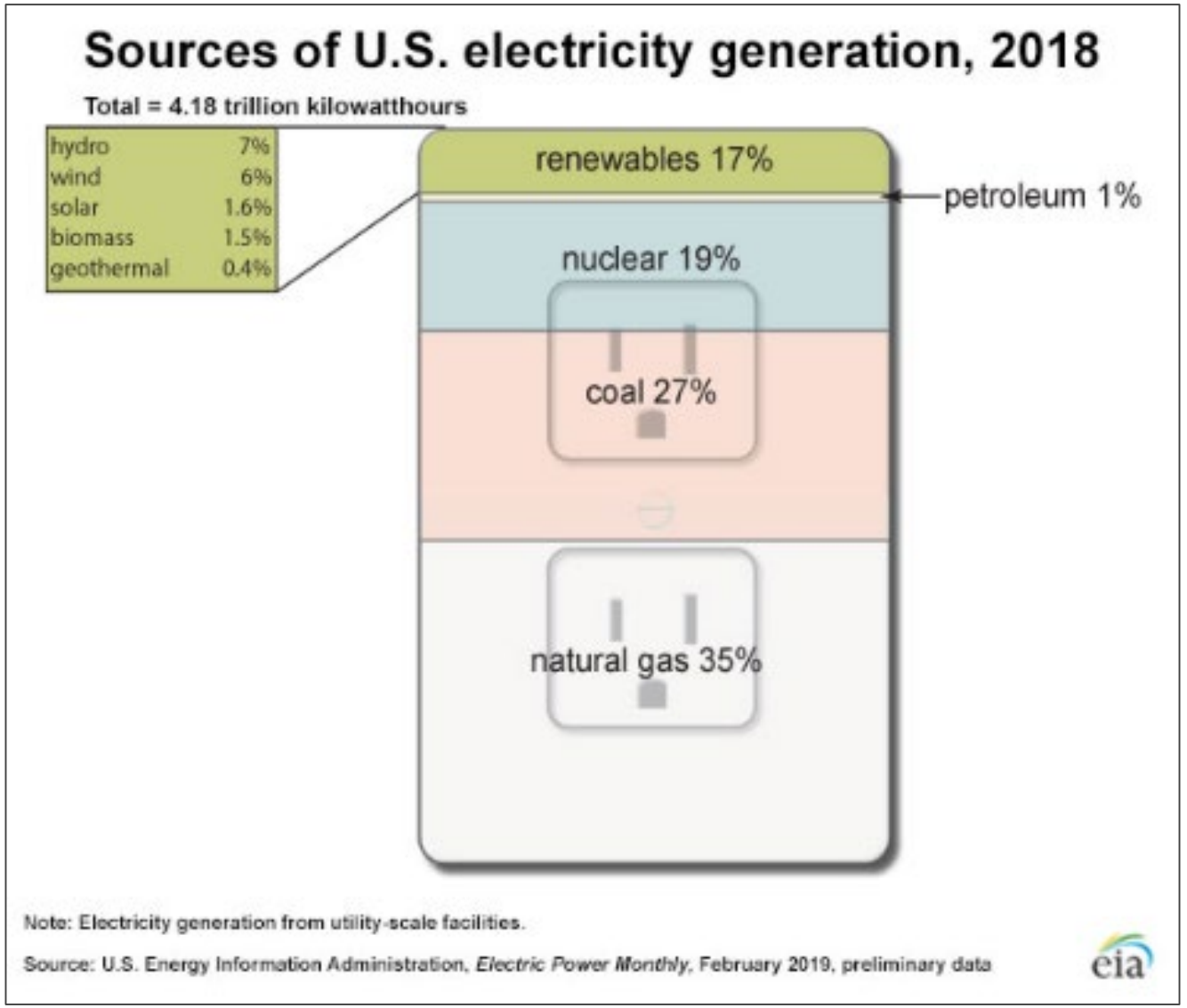
The traditional top-down flow of electricity has been experiencing disruptive forces over the last several years.

De-carbonization driving regs & policy

Power markets of the past

A TOP-DOWN FLOW FROM SUPPLY TO DEMAND

Electricity Generation in the US



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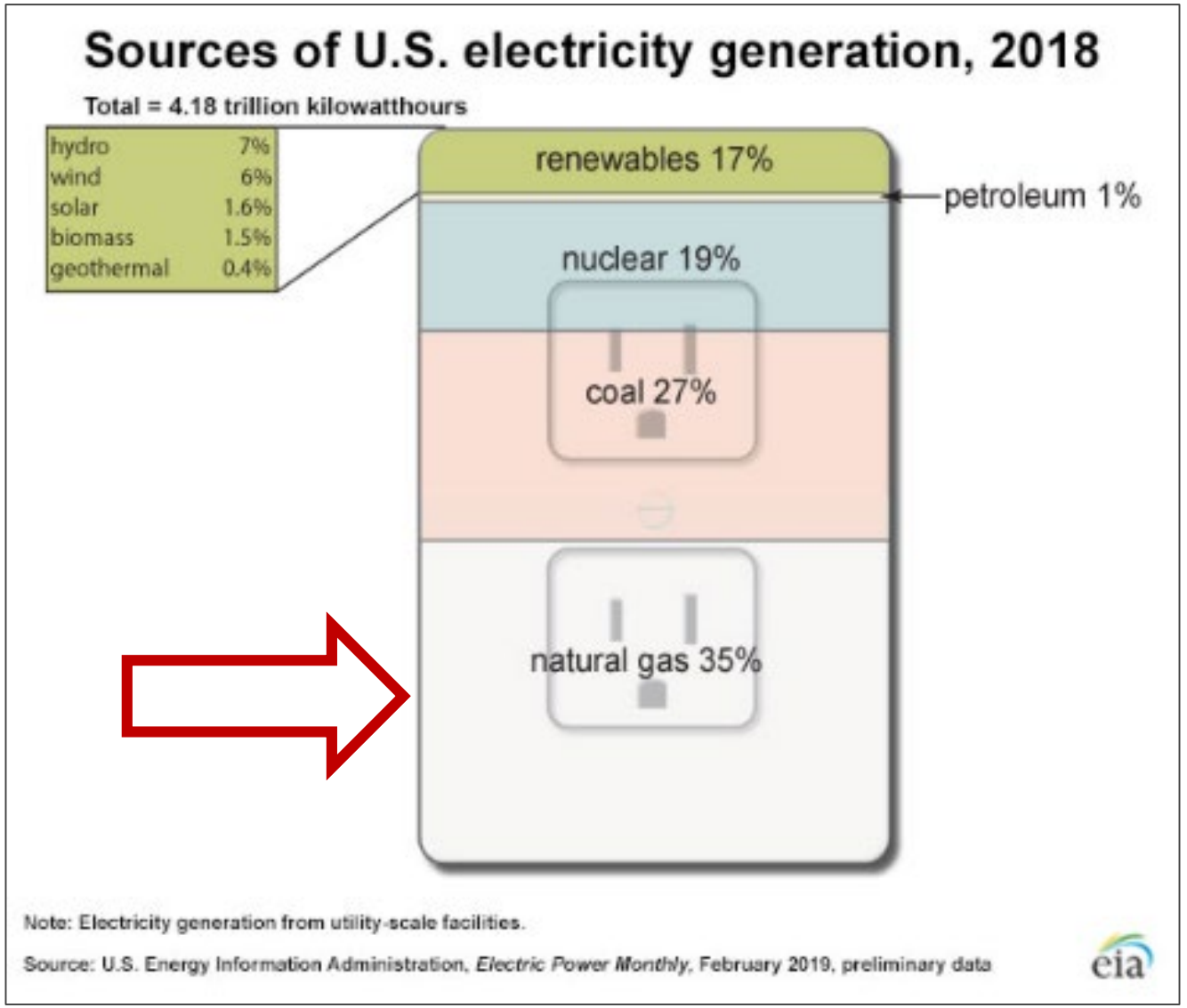

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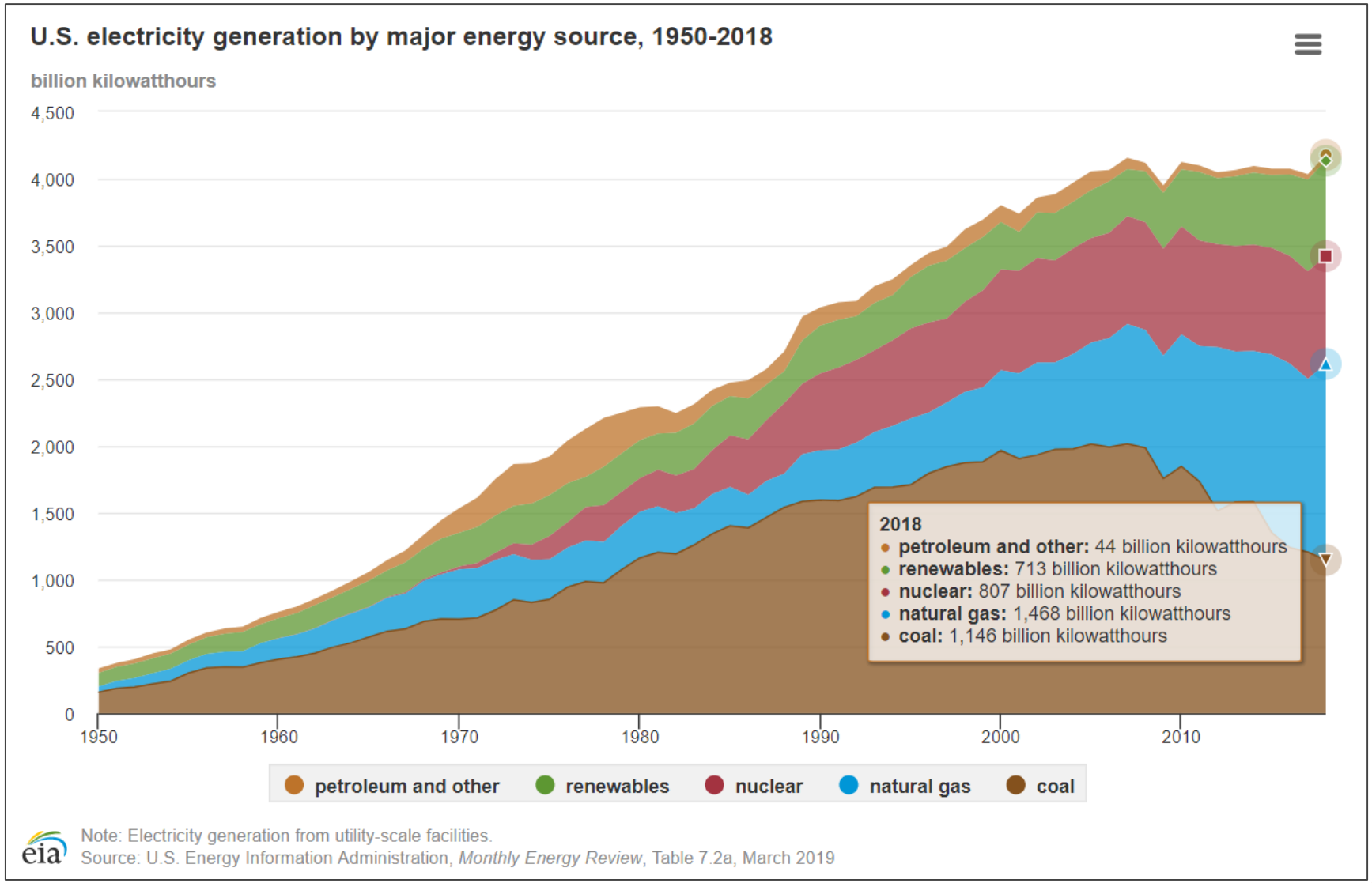

Power Markets Evolution

The traditional top-down flow of electricity has been experiencing disruptive forces over the last several years.

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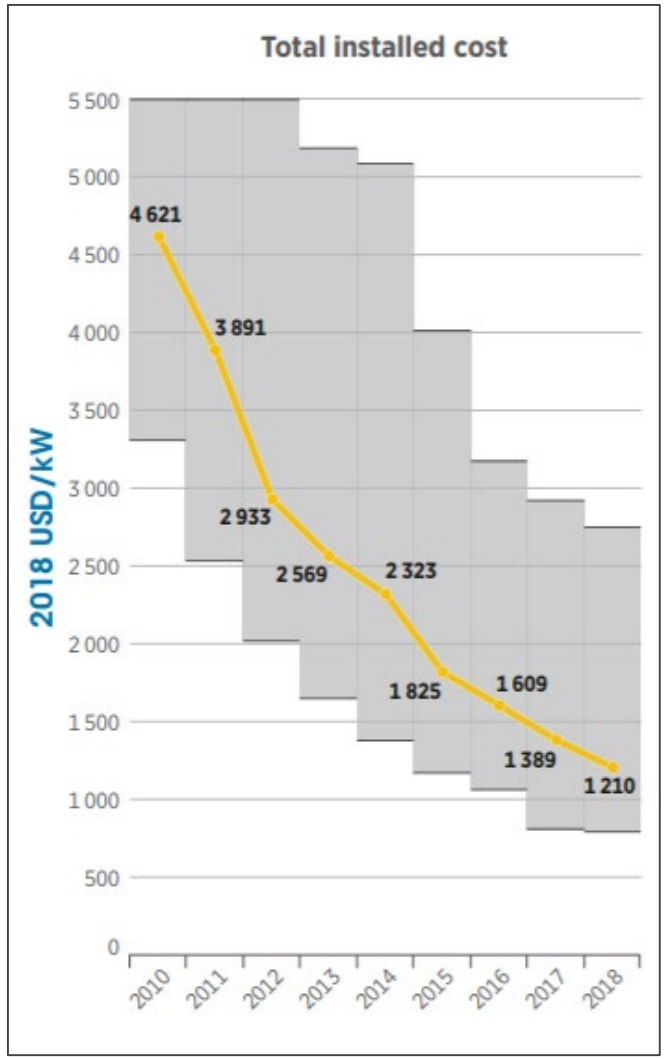
Technology availability & cost decline

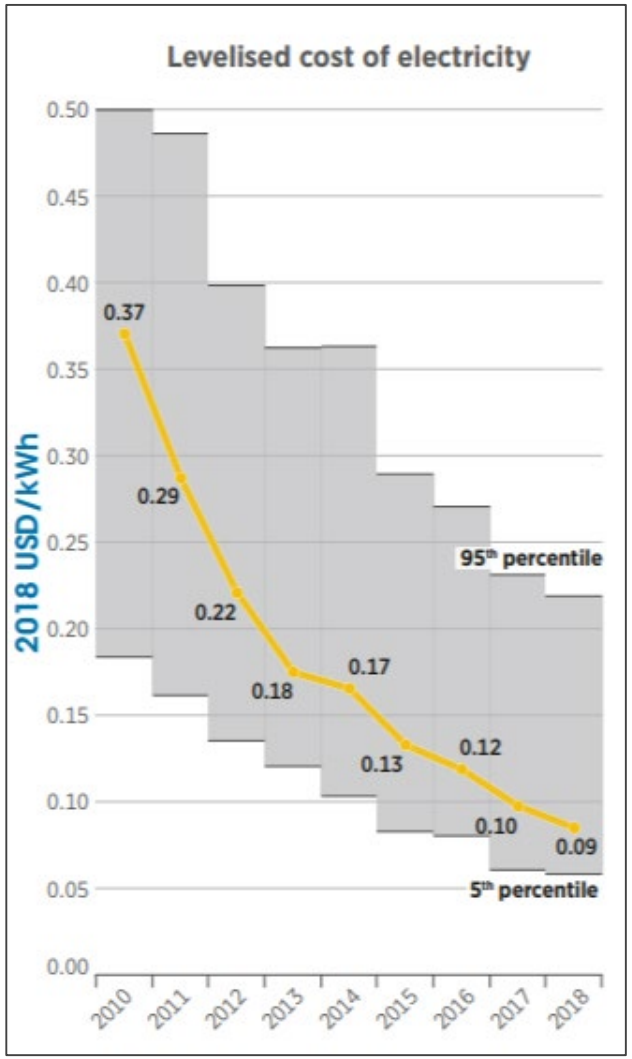
Power markets of the past

A TOP-DOWN FLOW FROM SUPPLY TO DEMAND

Power Markets Evolution

Solar (PV) Cost Decline





IRENA
International Renewable Energy Agency

Source: IRENA.org

Power Markets Evolution

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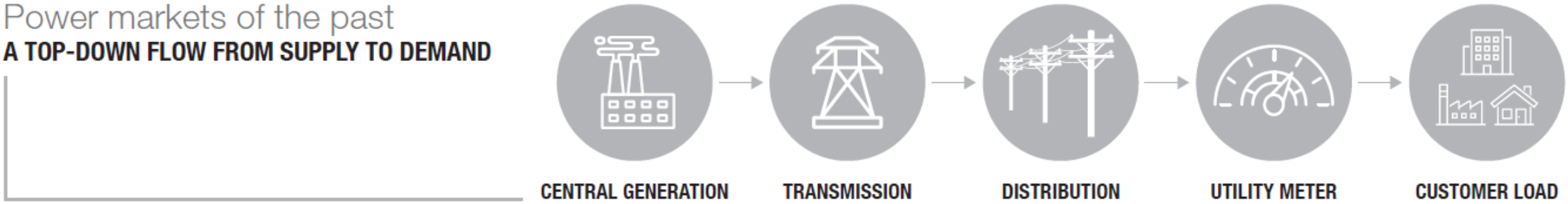
Customer expectations / demand



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A TOP-DOWN FLOW FROM SUPPLY TO DEMAND

Utilities deferring large transmission investments

Power Markets Evolution

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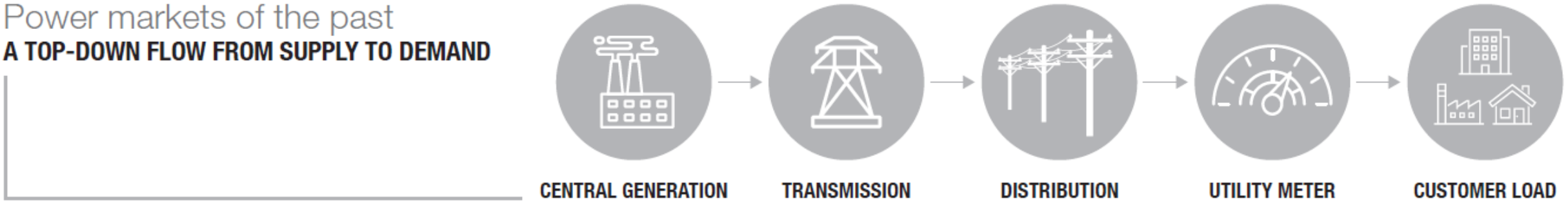
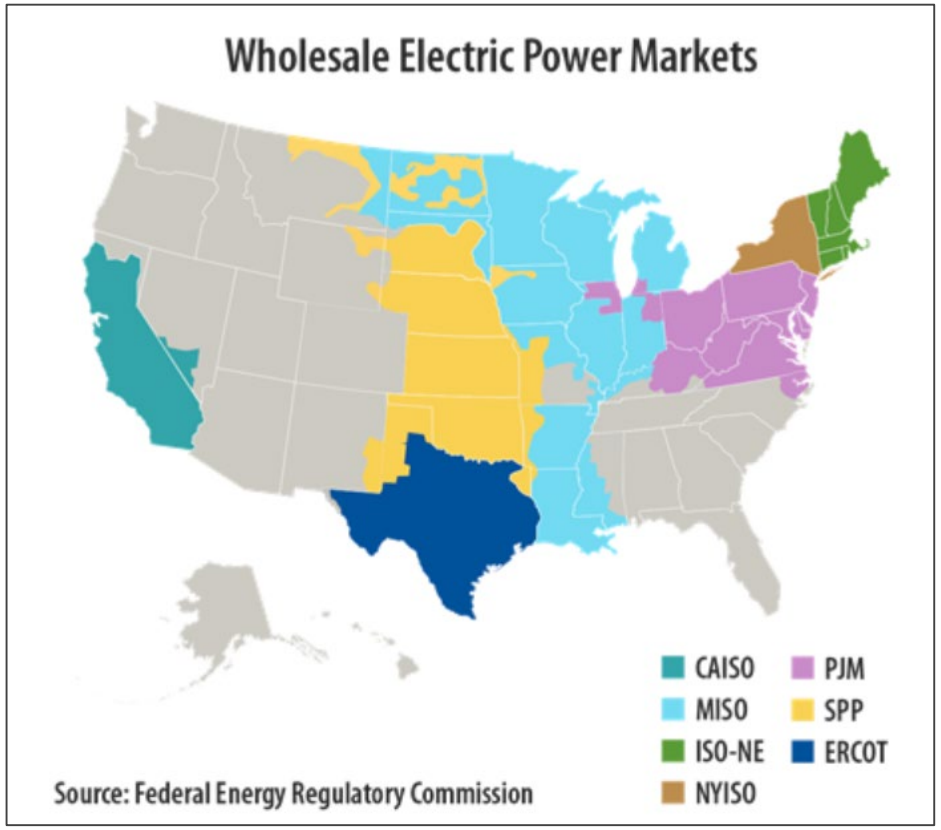


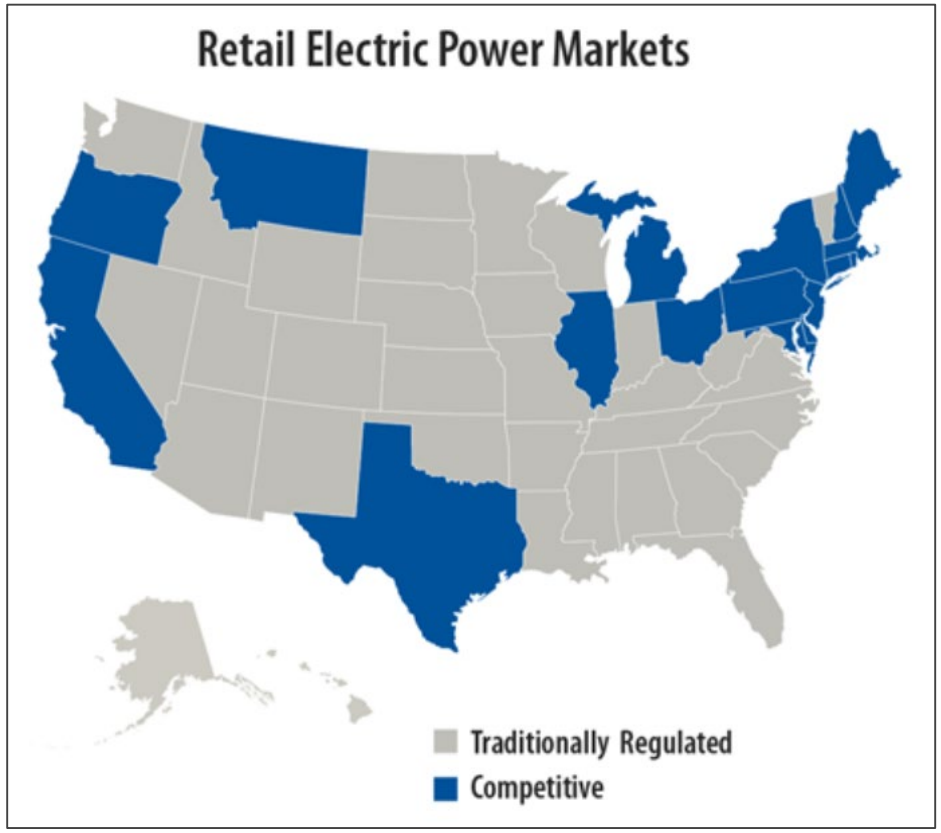
Utilities deferring large transmission investments

De-Regulation of markets

Power Markets Evolution

Regulated and De-Regulated Markets



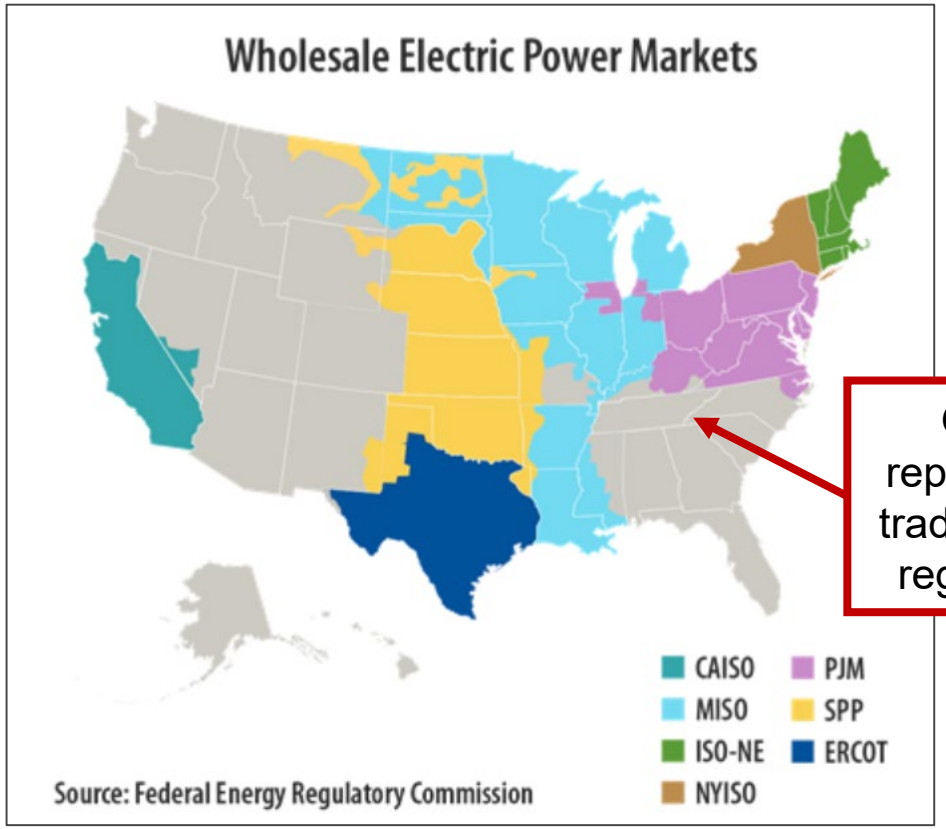


Wholesale Market – Sale of electricity among utilities and electricity traders

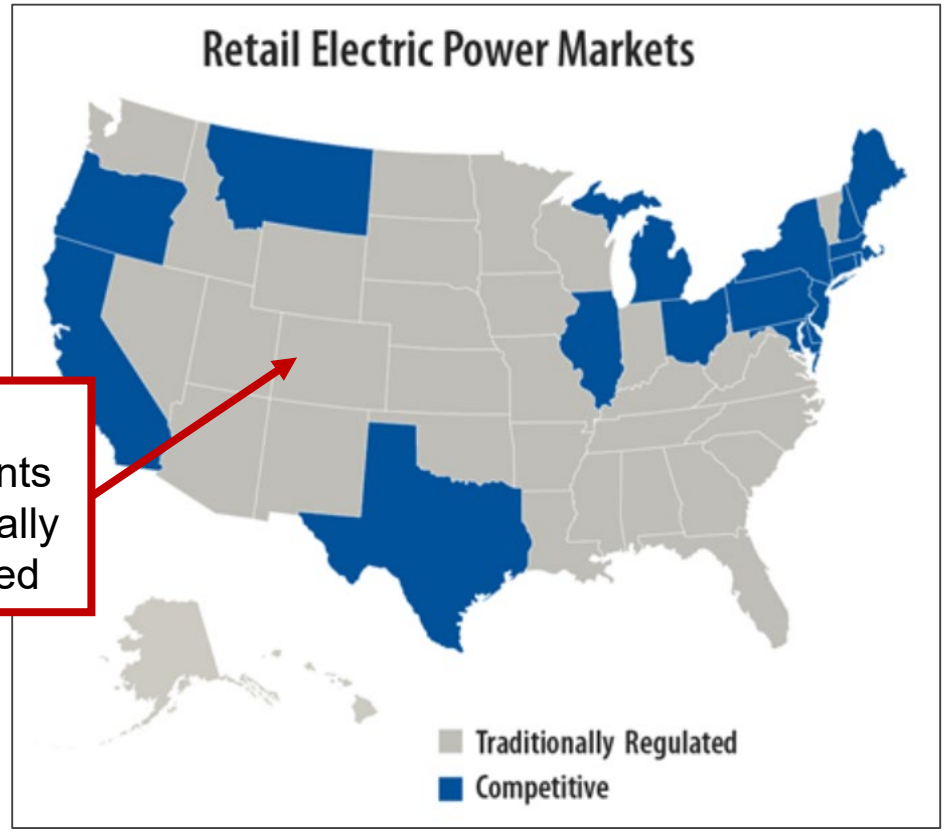
Retail Market – Sale of electricity to the end consumer

Power Markets Evolution

Regulated and De-Regulated Markets



Grey represents traditionally regulated



Wholesale Market – Sale of electricity among utilities and electricity traders

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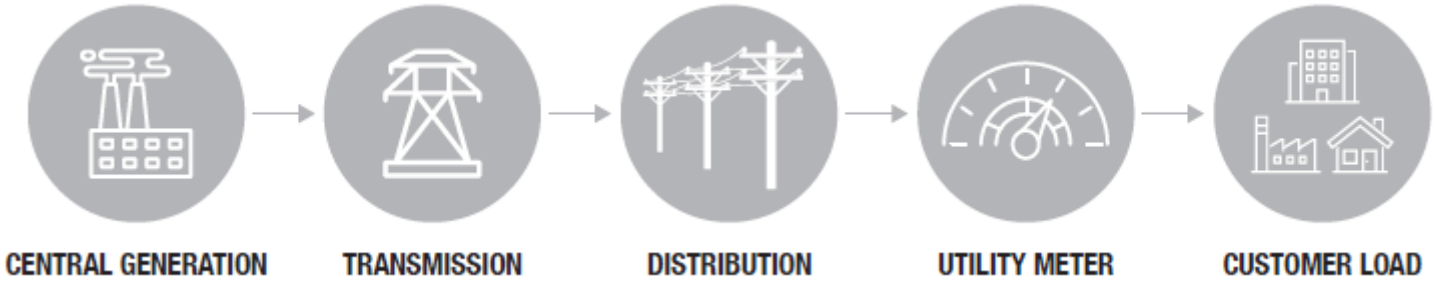
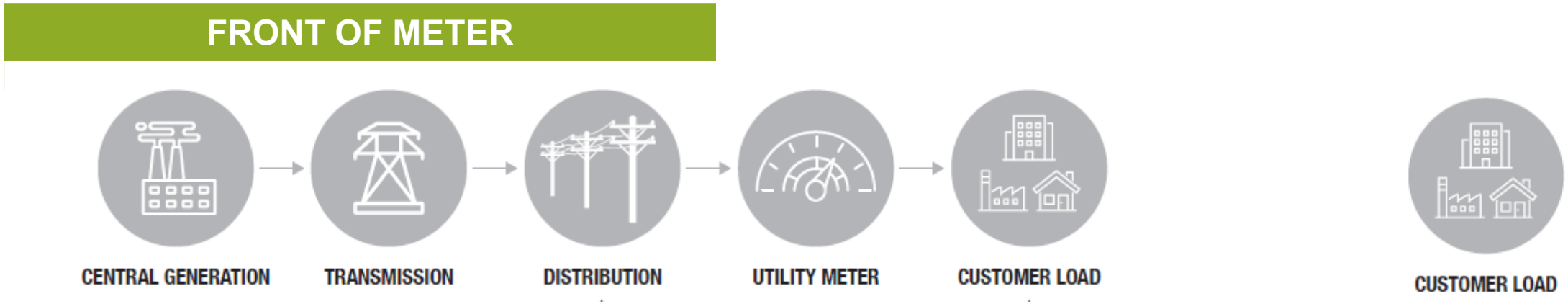
Power Markets Today



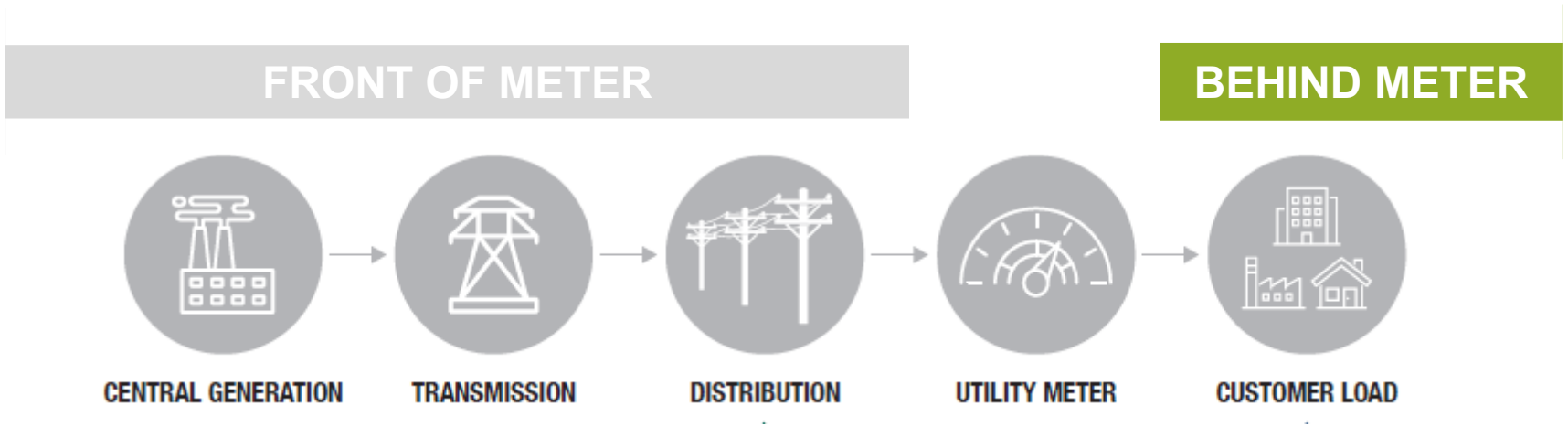
Power Markets Today

Defining the Customers



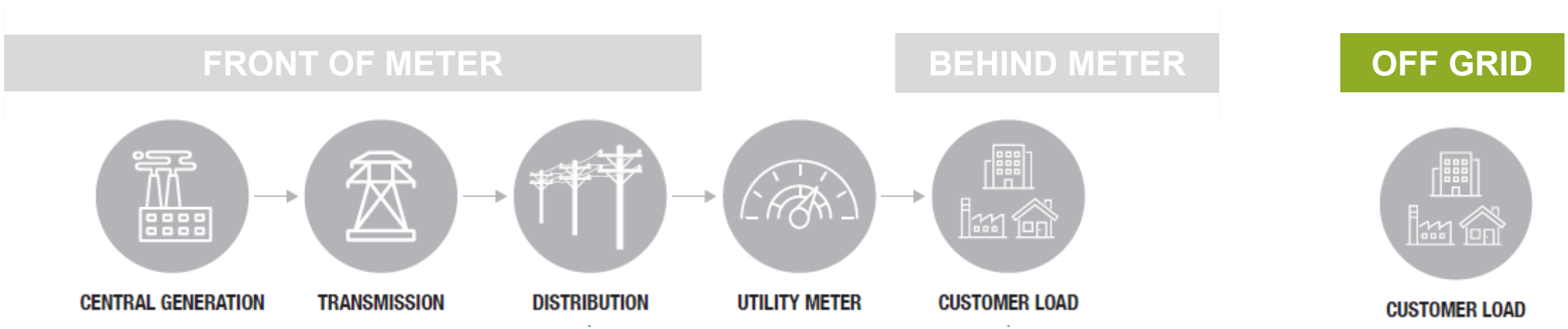
Power Markets Today

Defining the Customers



Power Markets Today

Defining the Customers

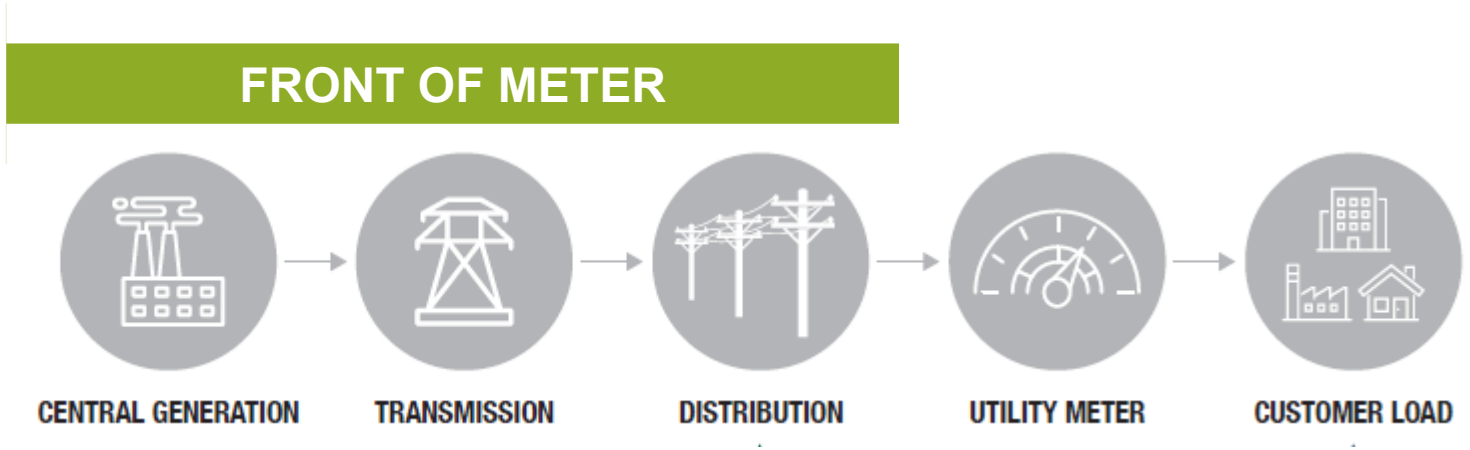


Power Markets Today

Defining the Customers

Power market today

BI-DIRECTIONAL ENERGY NETWORKS WITH ACTORS ACROSS THE VALUE CHAIN SHAPING PLANNING, INVESTMENT AND OPERATION



Power Markets Today

Defining the Customers

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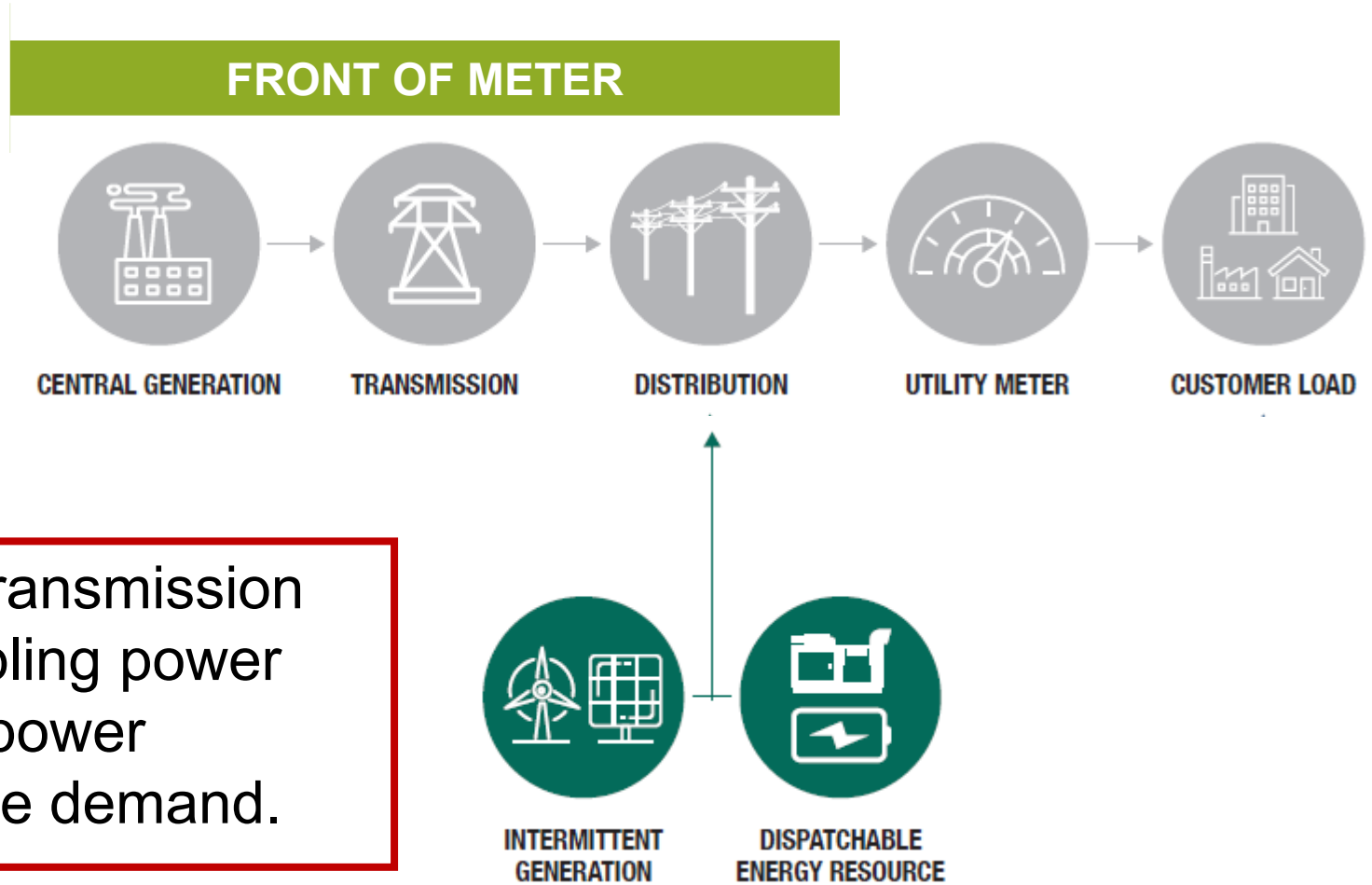


Alternatives to major transmission infrastructure are enabling power providers to leverage power generation closer to the demand.

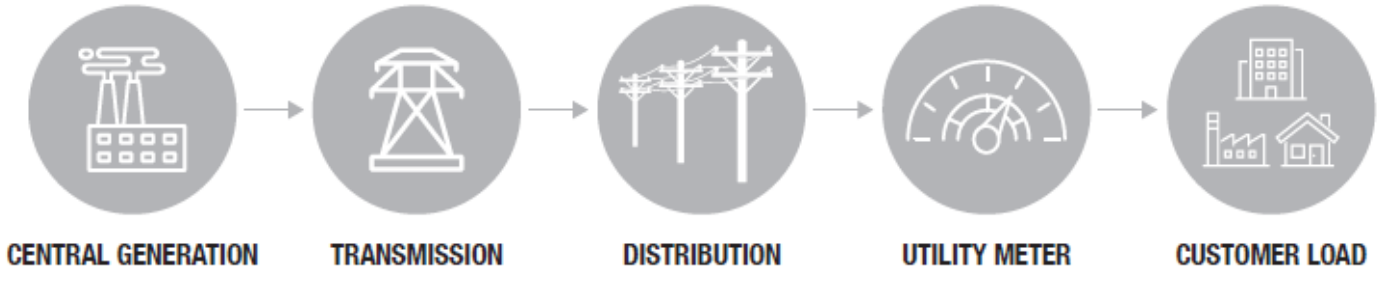
Power Markets Today

Defining the Customers

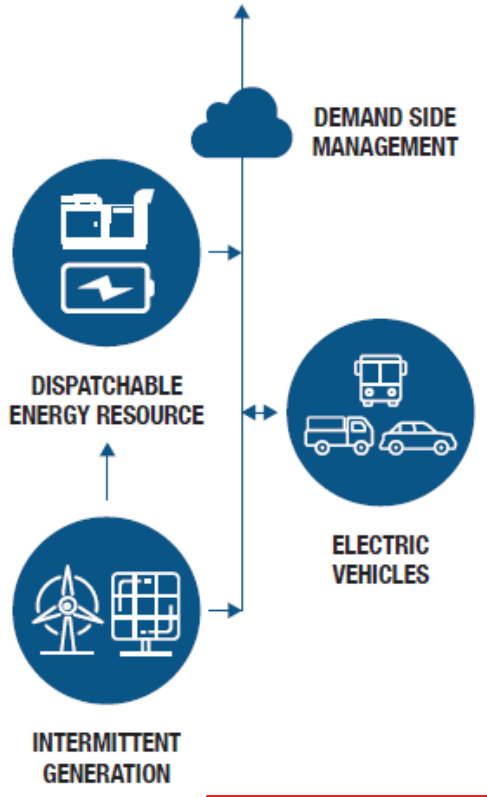
BEHIND METER

Power market today

BI-DIRECTIONAL ENERGY NETWORKS WITH ACTORS ACROSS THE VALUE CHAIN SHAPING PLANNING, INVESTMENT AND OPERATION



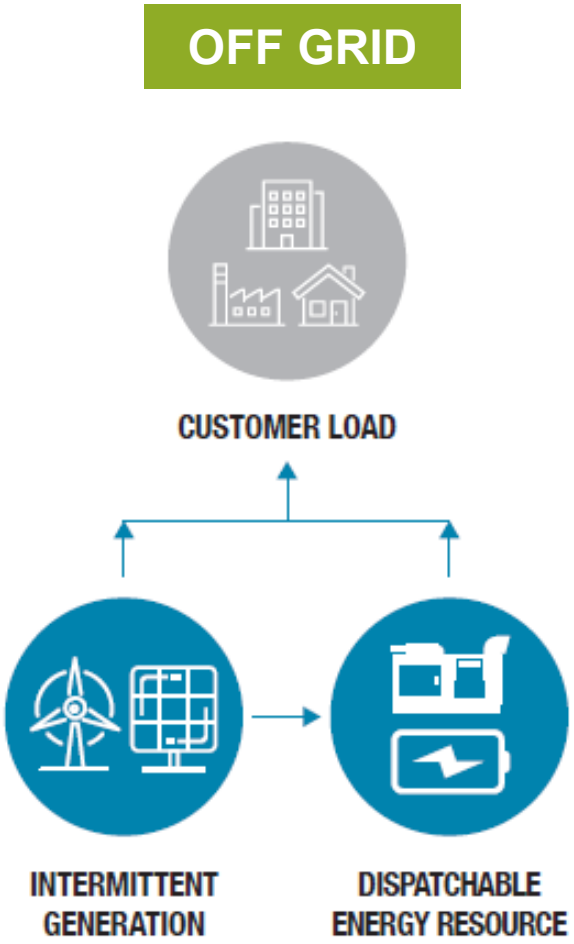
Energy consumers have the option to be in control of the source and cost of their power.



Power Markets Today

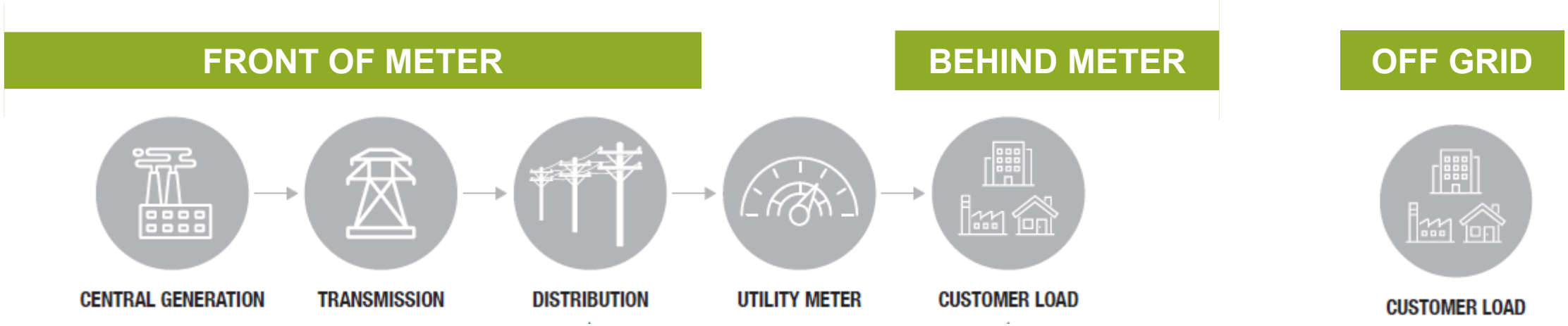
Defining the Customers

Customers with weak or no grid infrastructure have options to produce their own reliable power.



Power Markets Today

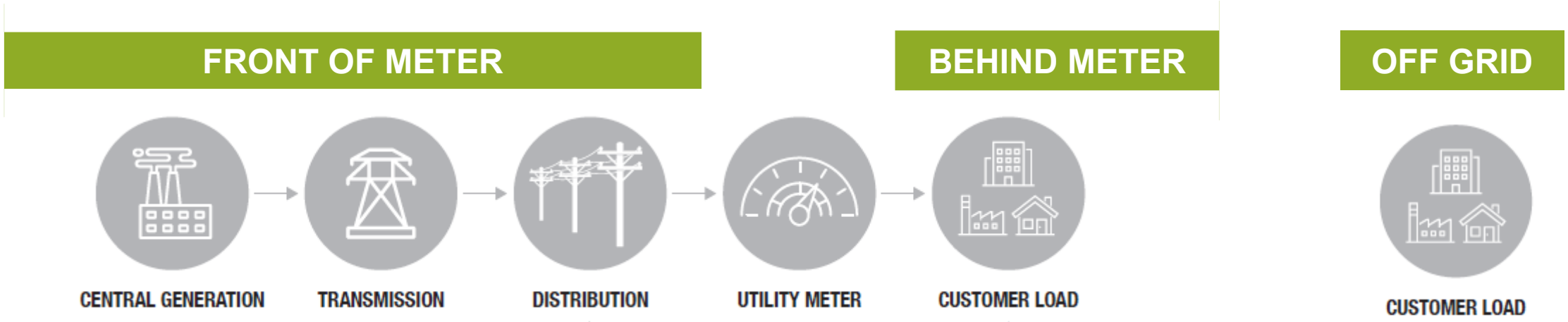
Customer Profiles



Power Providers
- Utilities

Power Markets Today

Customer Profiles

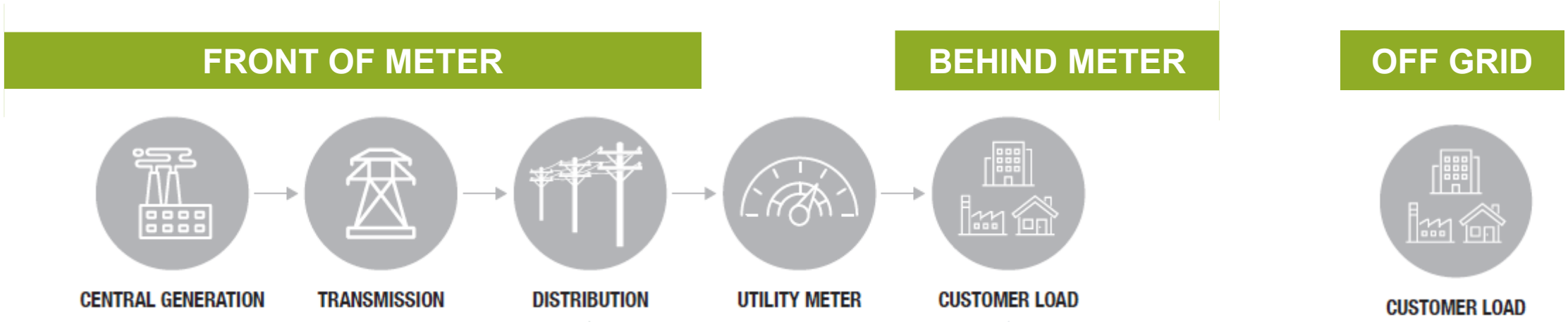


Power Providers
- Utilities

Power Consumers
- Larger C&I
- Hospitals
- Hotels
- Data Centers
- Also residential scale

Power Markets Today

Customer Profiles



Power Providers
- Utilities

Power Consumers
- Larger C&I
- Hospitals
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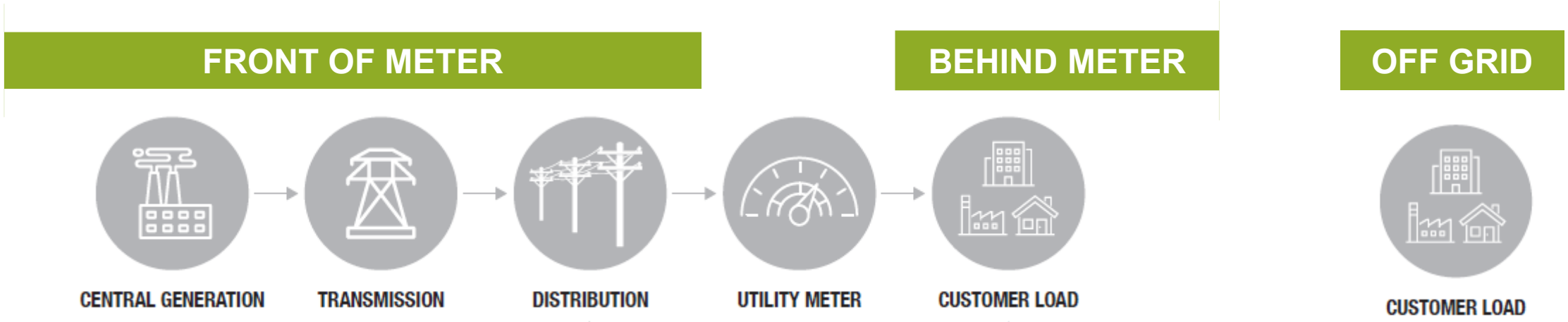
- Also residential scale

Producers / Consumers
- Islands
- Rural growth areas
- Mining Operations

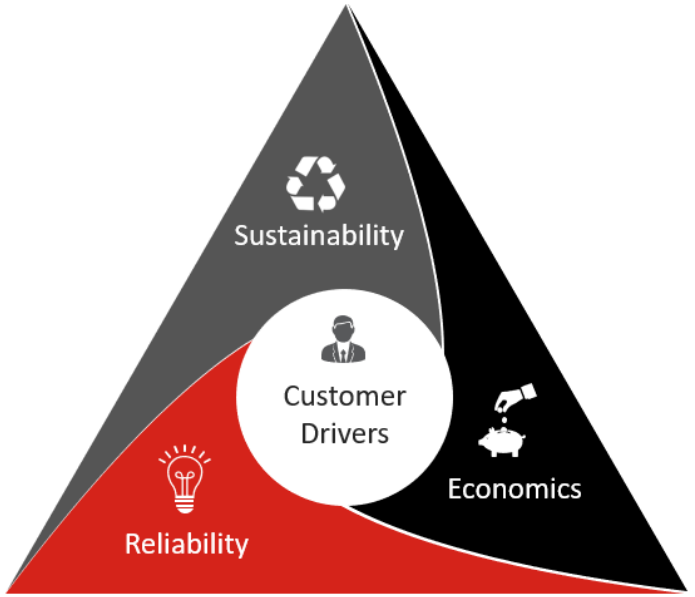
Power Markets Today

Customer Profiles



VARYING PURCHASE MOTIVATORS

- Capital Expense
- Operating Expense
- Resiliency / Reliability
- Carbon Footprint / Renewable Integration
- Regulatory Pressures



Concept Check

The evolution of power markets is all driven by the transition from coal and nuclear central generation.

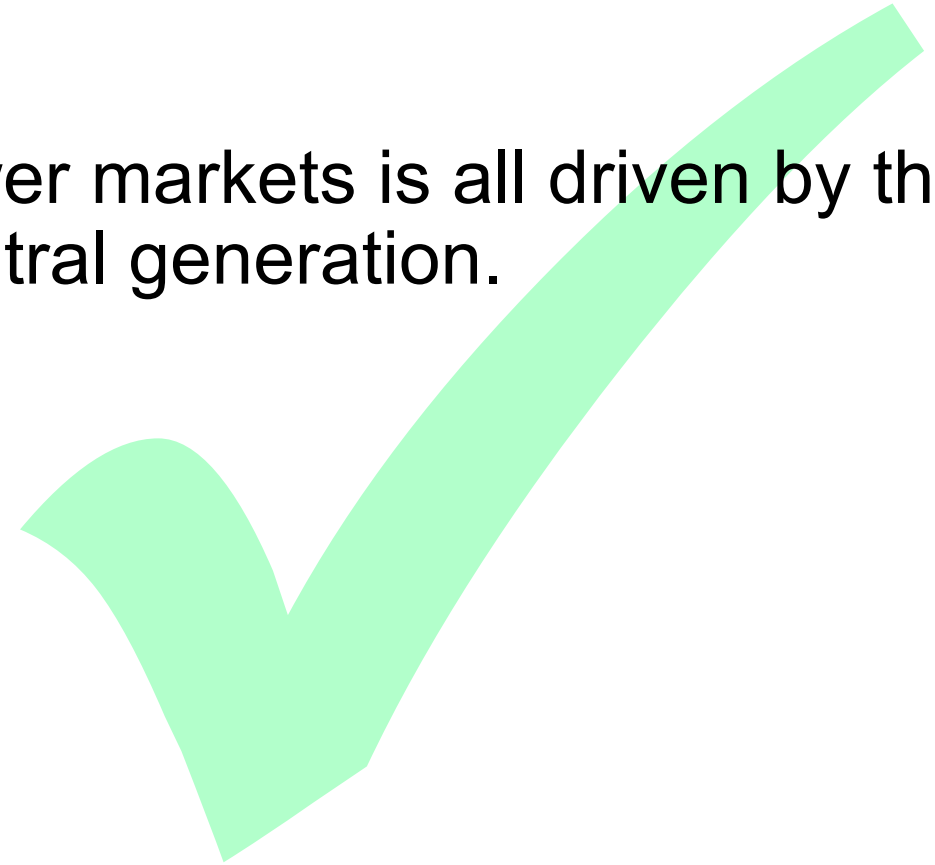
a) True
b) False

Concept Check

The evolution of power markets is all driven by the transition from coal and nuclear central generation.

a) True

b) False



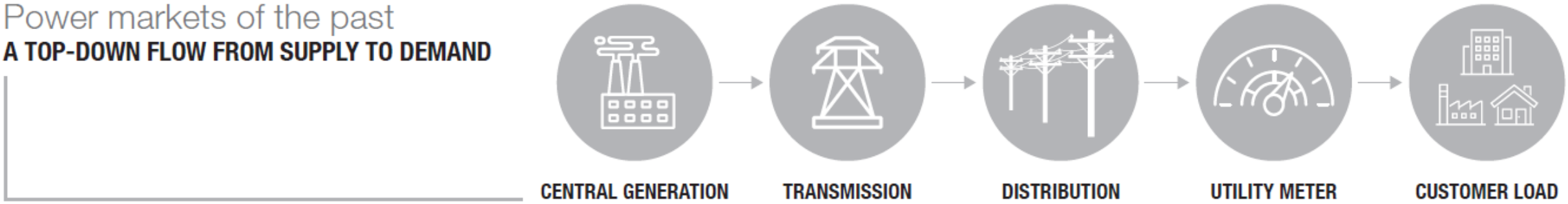
Power Markets Evolution

The traditional top-down flow of electricity has been experiencing disruptive forces over the last several years.

De-carbonization driving regs & policy

Technology availability & cost decline

Customer expectations / demand

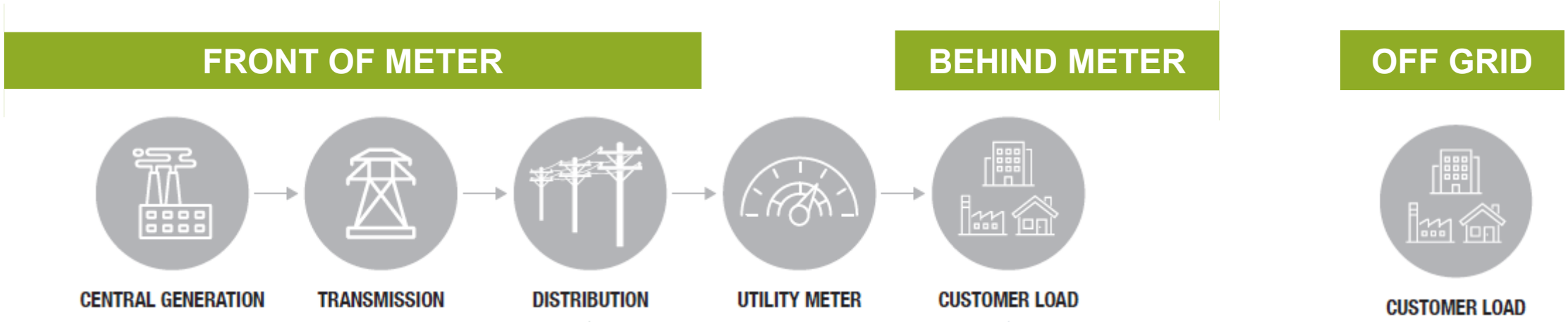


Utilities deferring large transmission investments

De-Regulation of markets

Power Markets Today

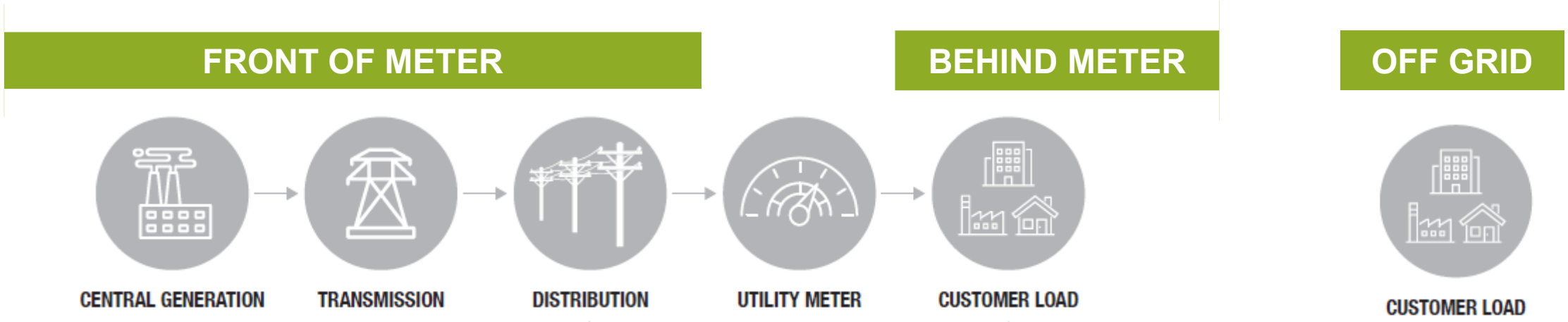
Customer Use Cases



How is DG used by these customers?

Power Markets Today

Customer Use Cases

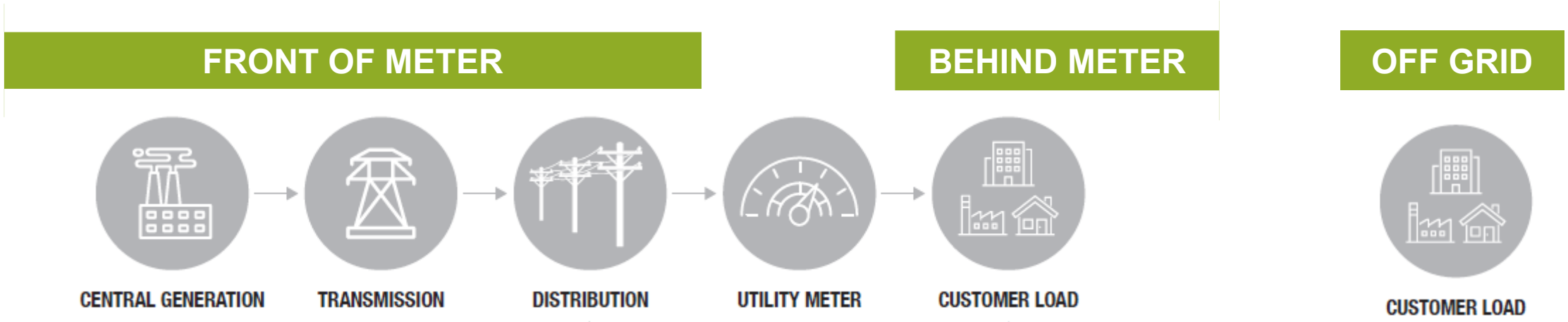


GRID FIRMING

- Frequency and Voltage Regulation
- Balancing the intermittency of Renewable Sources
- Additional Capacity

Power Markets Today

Customer Use Cases



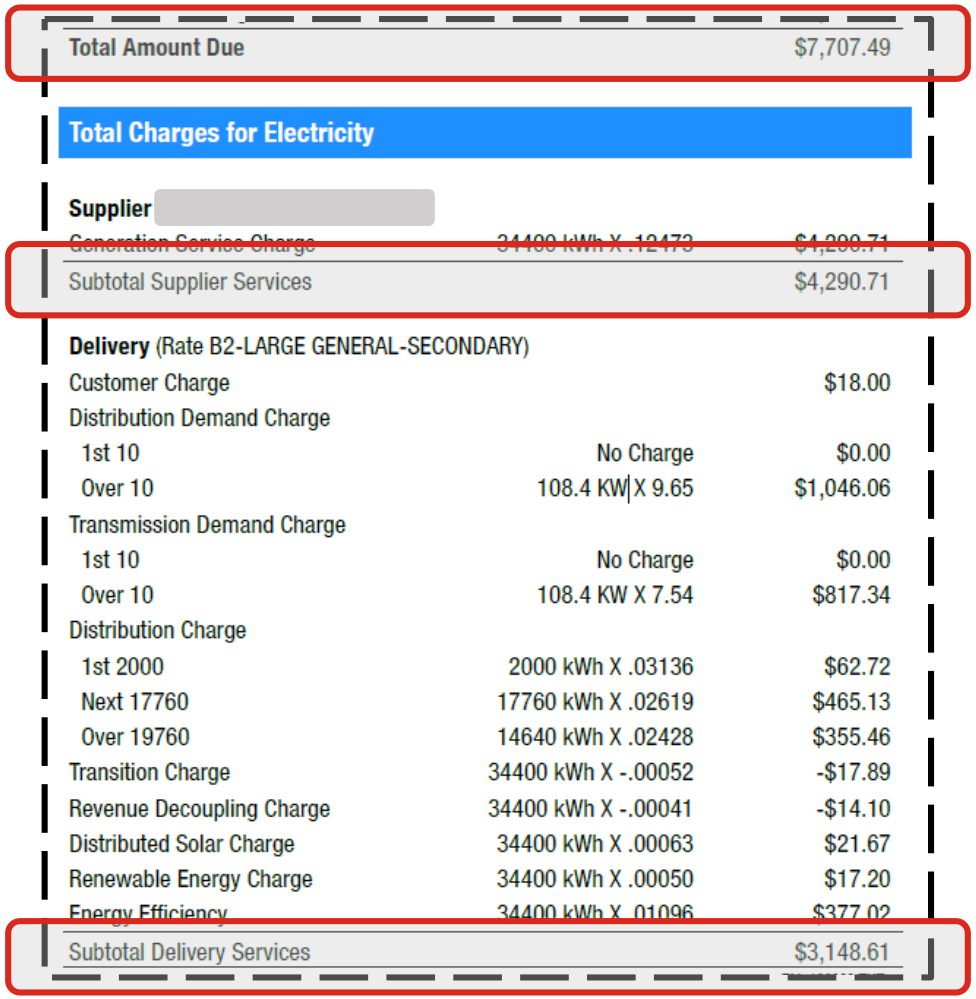
ENERGY MANAGEMENT

- Demand Response

- Balancing the intermittency of Renewable Sources
- Leverage multiple right-sized assets in a system (microgrid)
- Energy Resiliency

Power Markets Today

Customer Use Cases



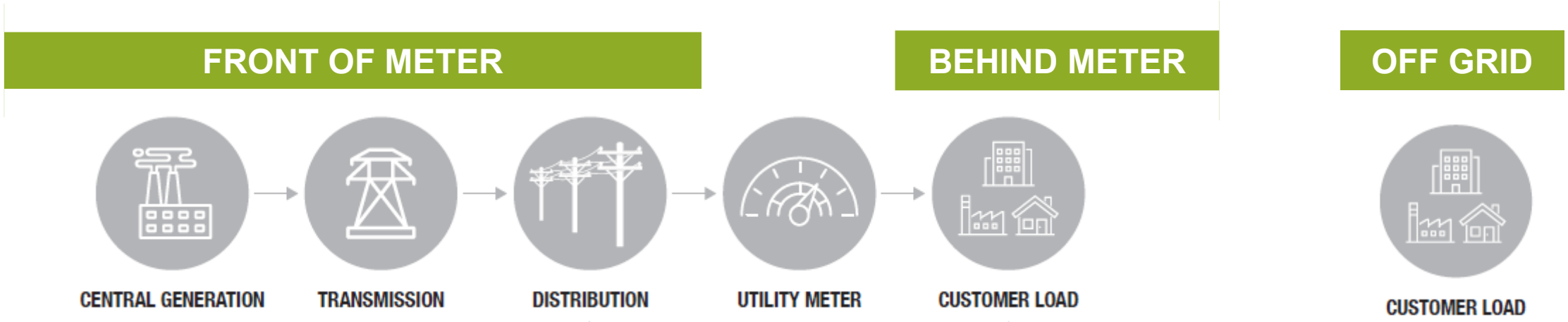
Total Amount Due		$7,707.49
Total Charges for Electricity		
Supplier		
Generation Service Charge	34400 kWh X .12473	$4,290.71
Subtotal Supplier Services		$4,290.71
Delivery (Rate B2-LARGE GENERAL-SECONDARY)		
Customer Charge		$18.00
Distribution Demand Charge		
1st 10	No Charge	$0.00
Over 10	108.4 KW X 9.65	$1,046.06
Transmission Demand Charge		
1st 10	No Charge	$0.00
Over 10	108.4 KW X 7.54	$817.34
Distribution Charge		
1st 2000	2000 kWh X .03136	$62.72
Next 17760	17760 kWh X .02619	$465.13
Over 19760	14640 kWh X .02428	$355.46
Transition Charge	34400 kWh X -.00052	-$17.89
Revenue Decoupling Charge	34400 kWh X -.00041	-$14.10
Distributed Solar Charge	34400 kWh X .00063	$21.67
Renewable Energy Charge	34400 kWh X .00050	$17.20
Energy Efficiency	34400 kWh X .01096	$377.02
Subtotal Delivery Services		$3,148.61

Customers are billed for their energy in numerous ways, sometimes a mix of different charges.

Understanding the rate structure of the utility bill can uncover opportunities for cost savings through self-generation.

Power Markets Today

Customer Use Cases



GRID FIRMING

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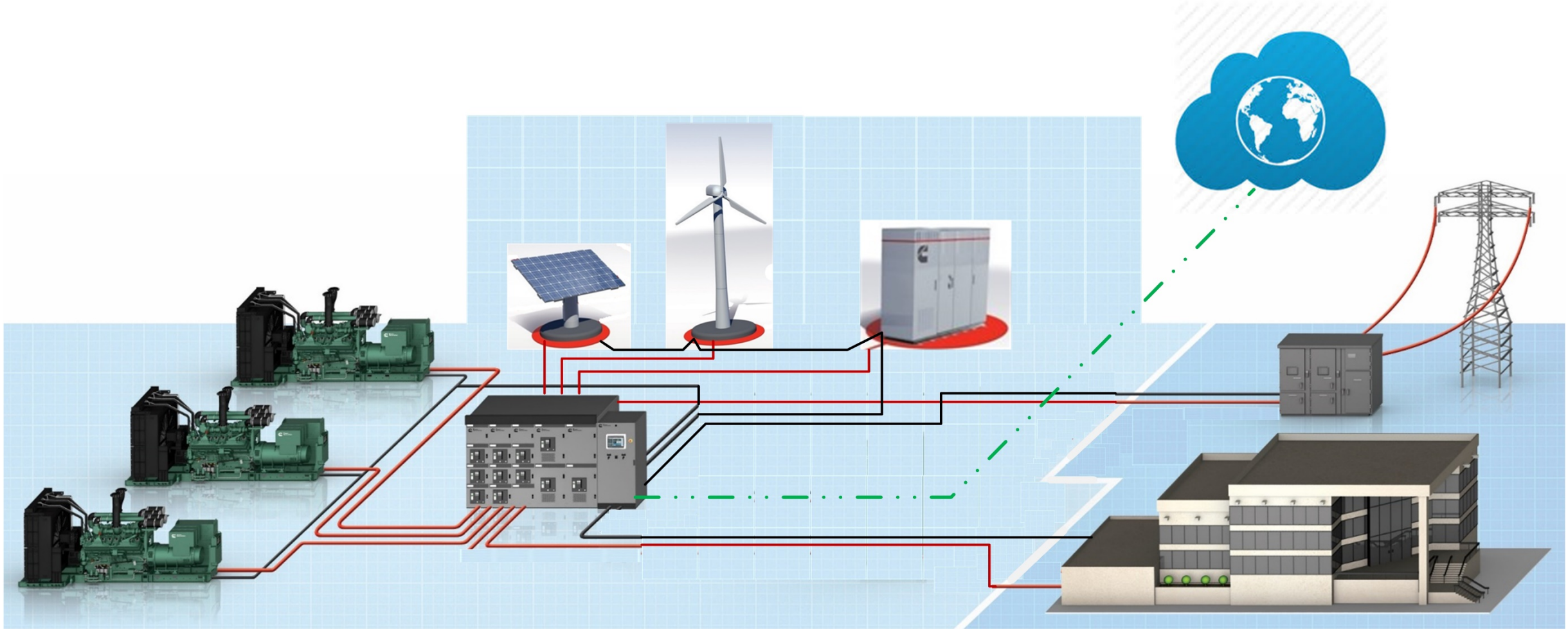
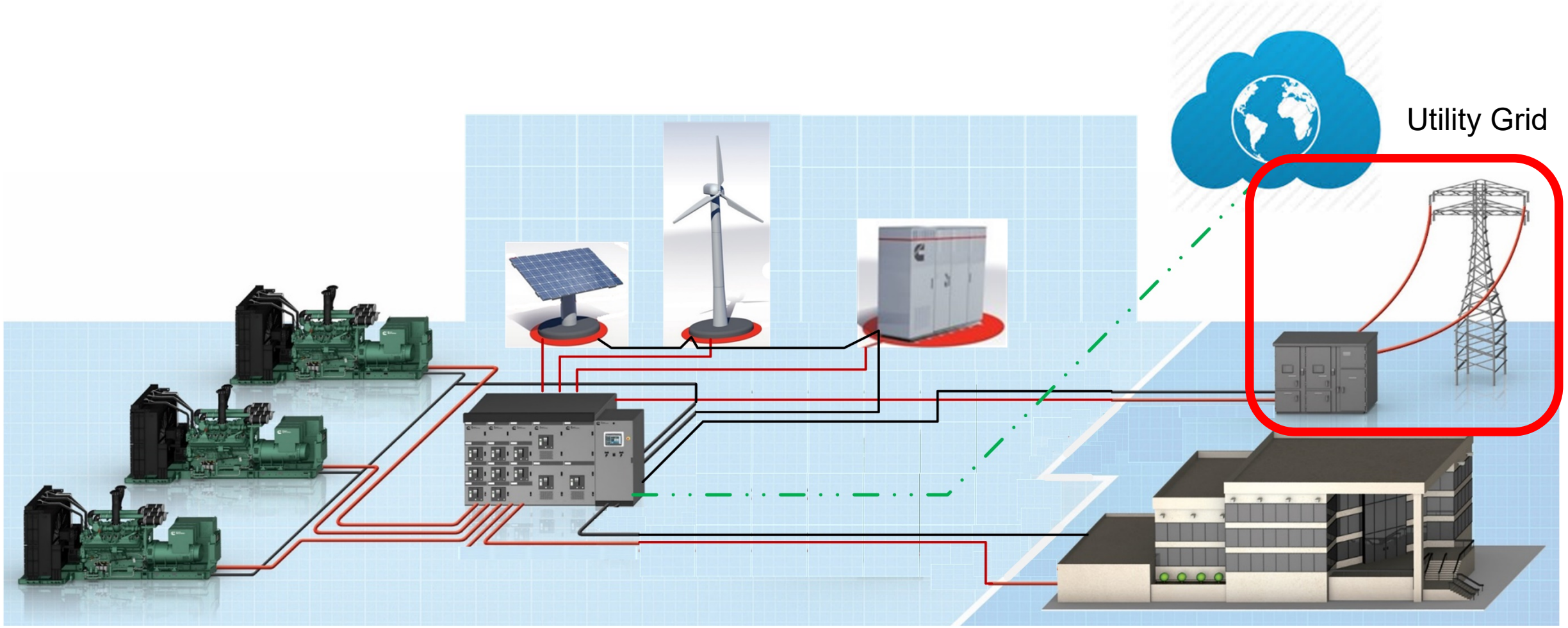
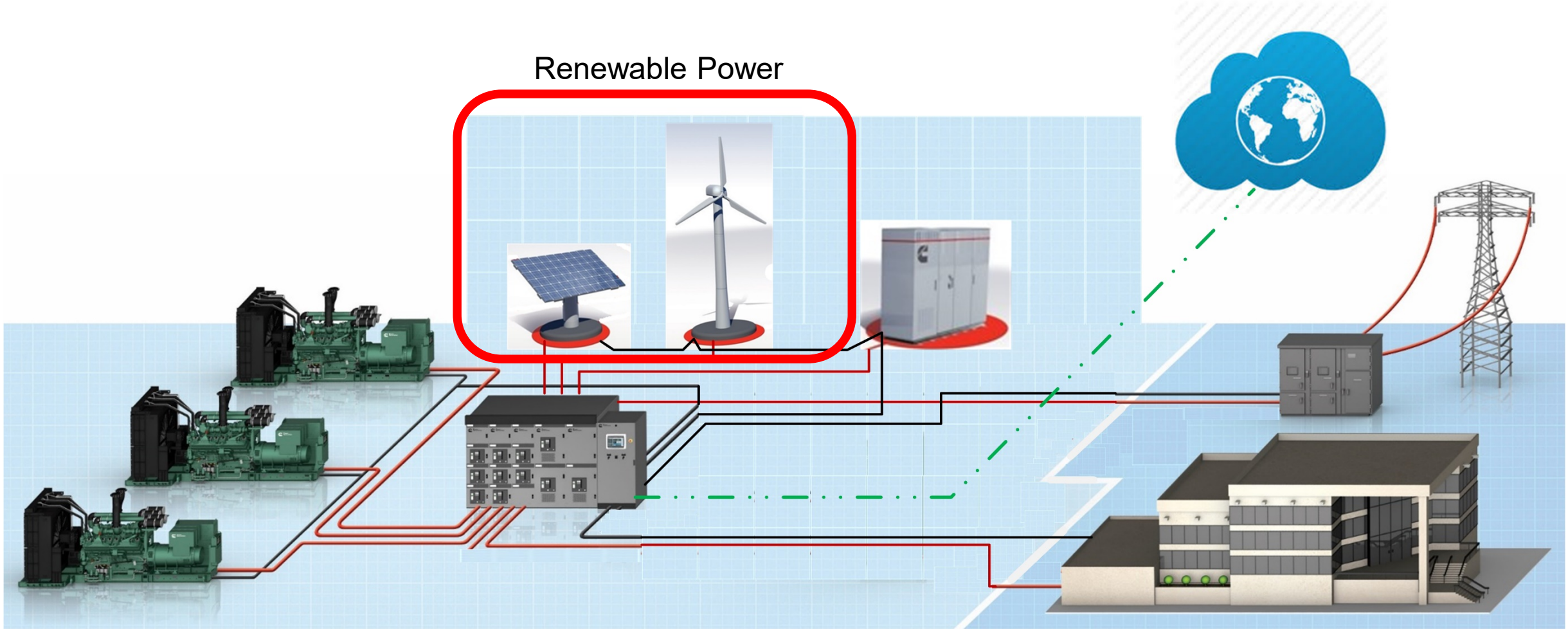
Multi-Asset Power System



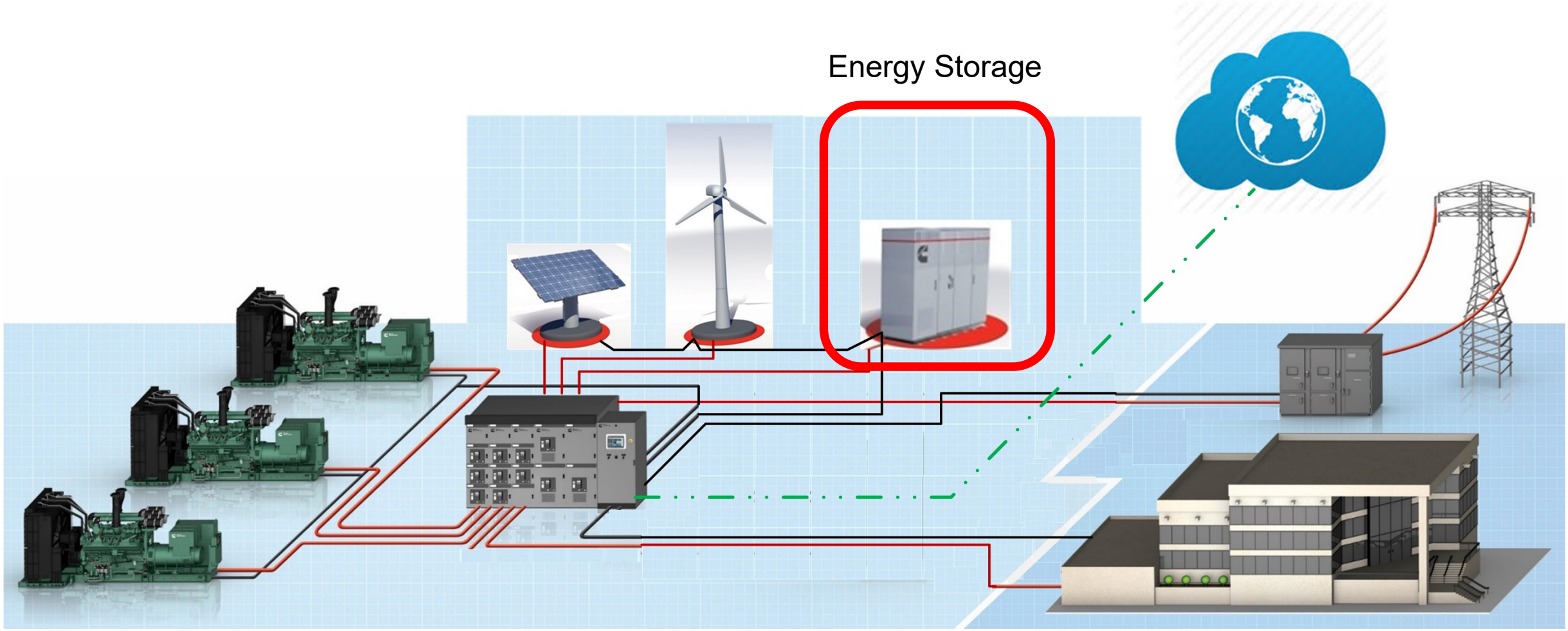
Multi-Asset Power System



Multi-Asset Power System

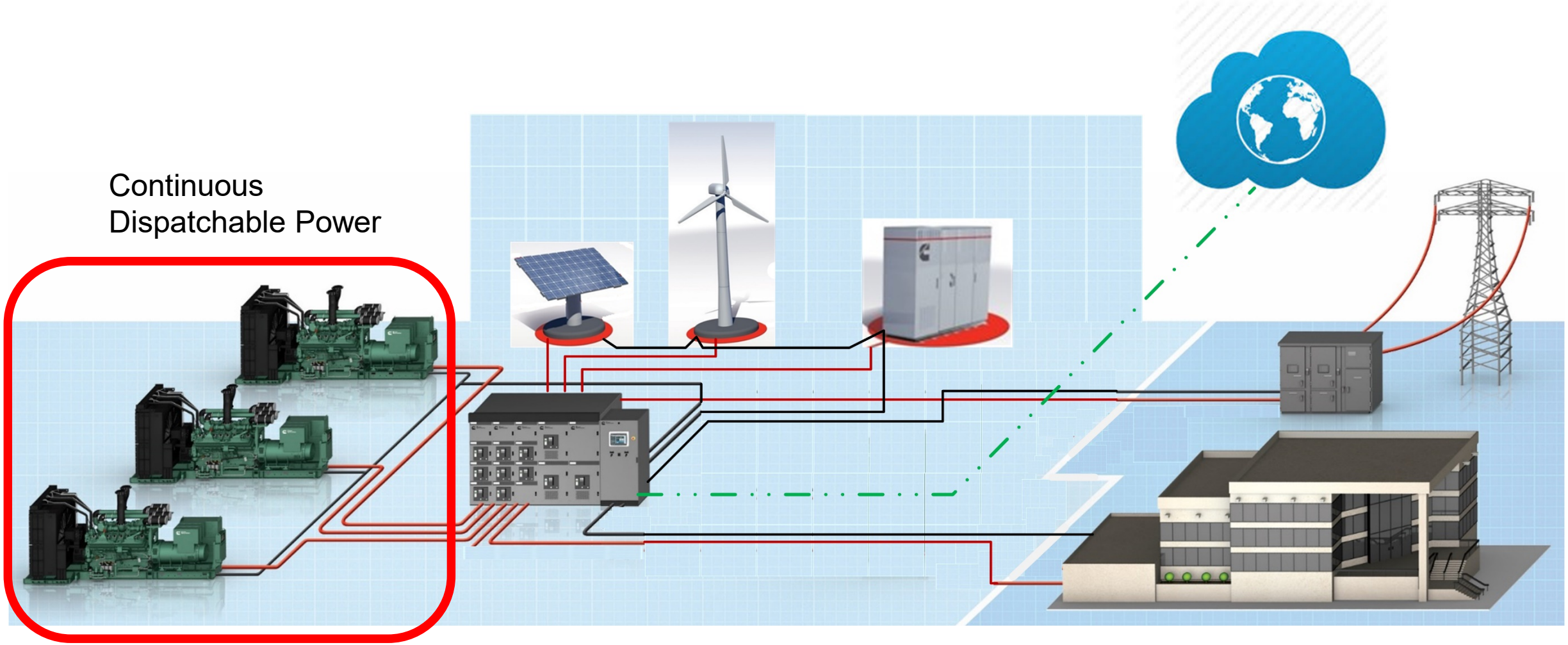


Multi-Asset Power System



Multi-Asset Power System

Continuous
Dispatchable Power



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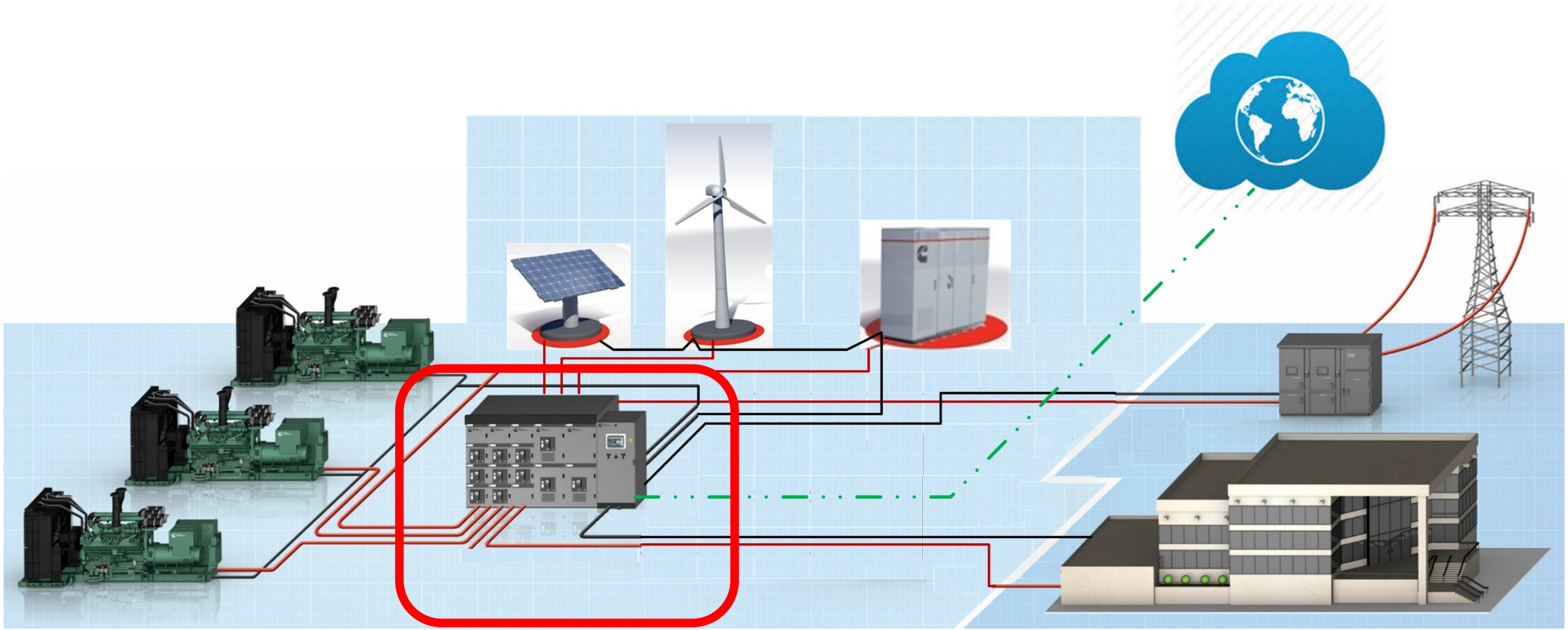
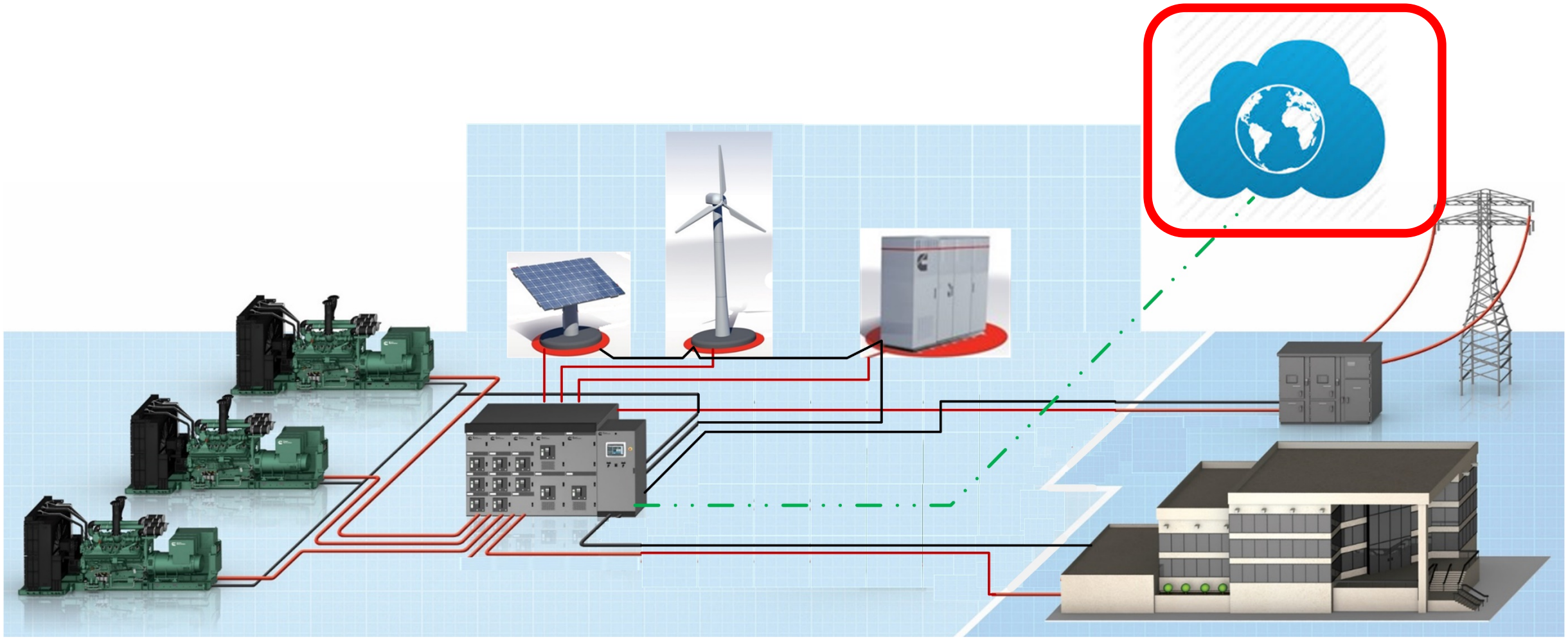


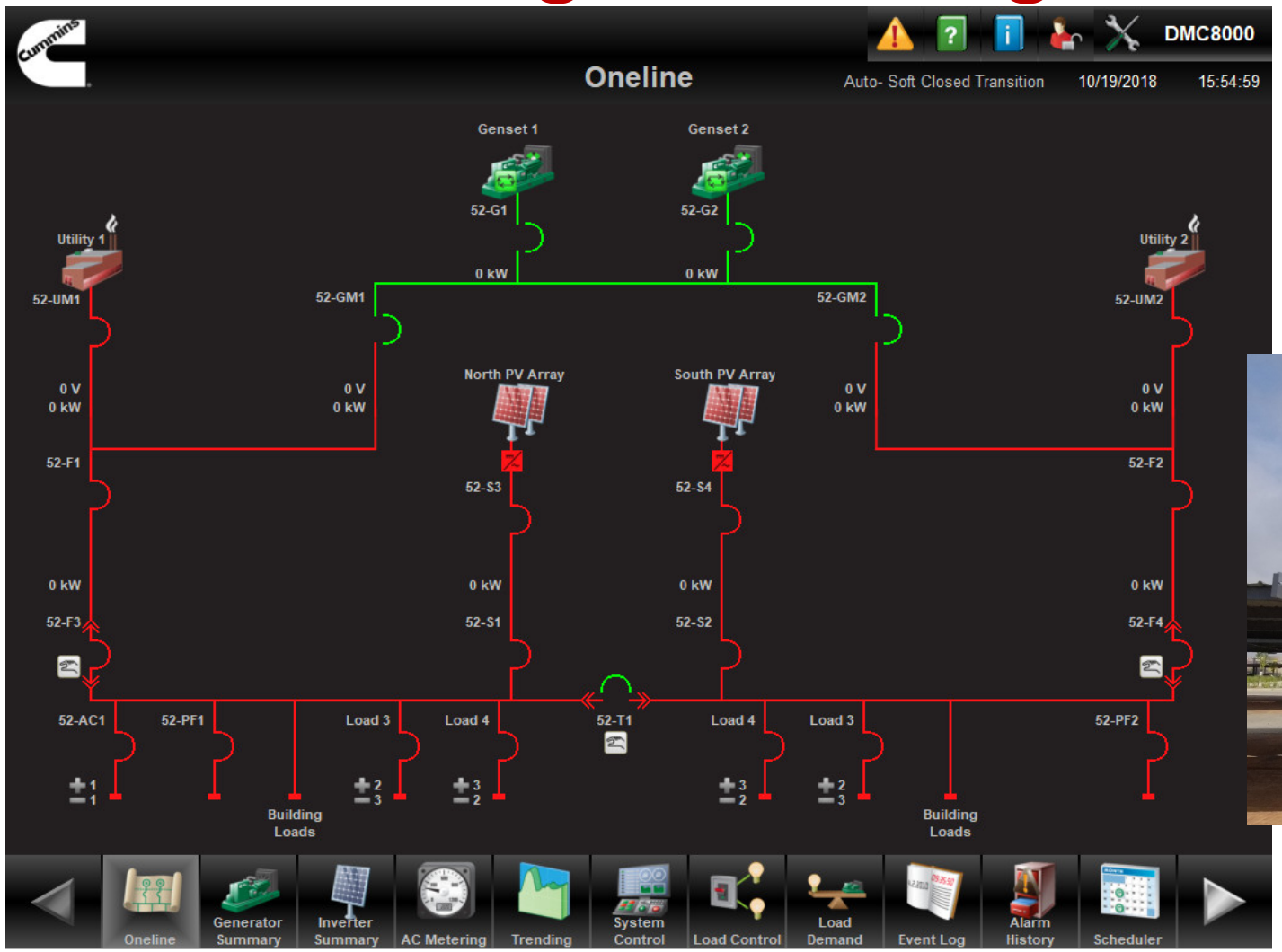
Switchgear and
Controls

Multi-Asset Power System



Power System Case Study

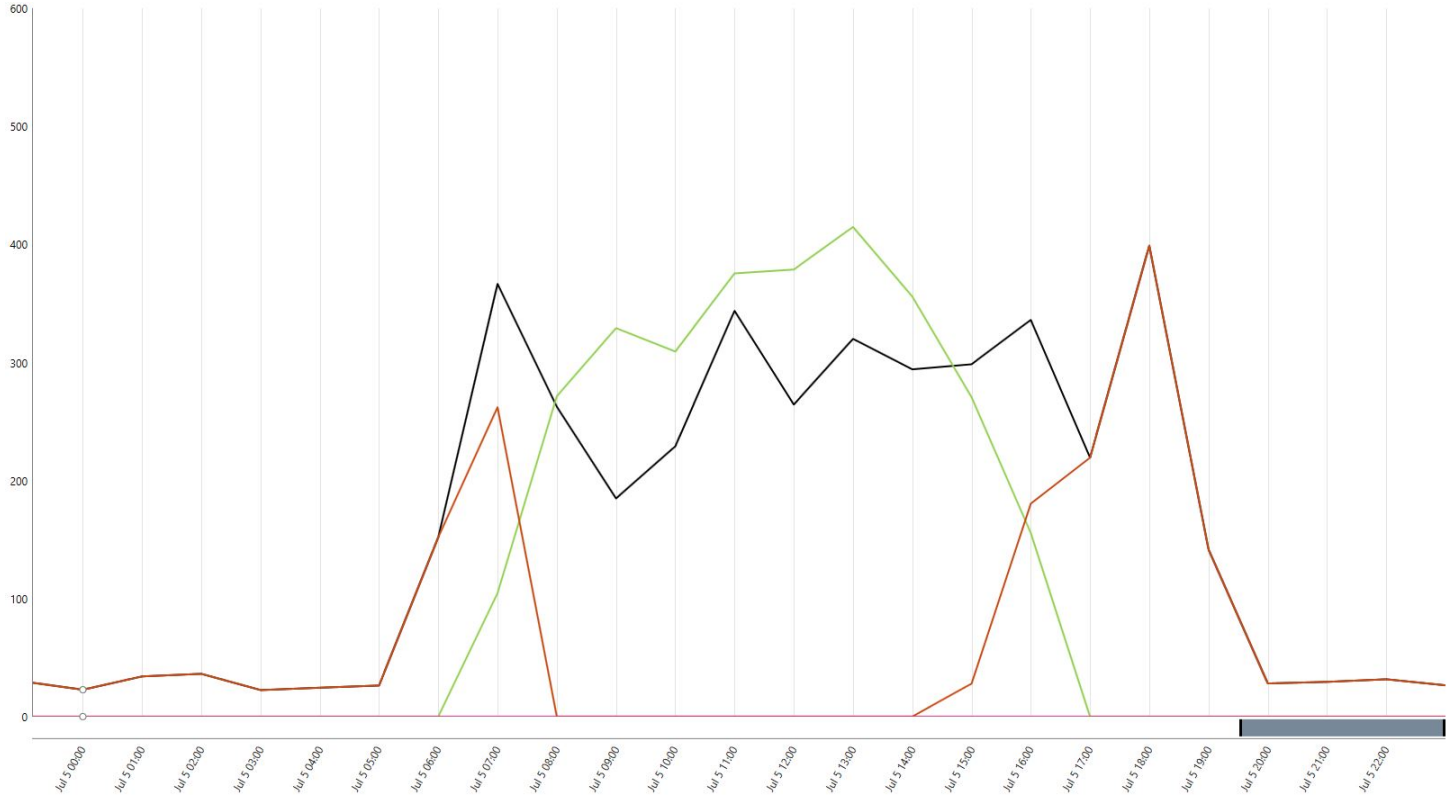
Johannesburg Solar Integration



Power System Case Study

Johannesburg Solar Integration

- Total annual PV output is estimated to be 1,065 MWH
- This results in 1,081 metric tons of reduction in green house gas per year



Black – Load
Green – PV output
Brown – Utility import

Help customers understand their energy system needs by asking leading questions…

Many customers might not come to you specifically looking for a distributed generation system.

These customers may have…

- reliable grid power
- no expertise to figure out the cost/benefit of self generation
- initial interest in backup generation only

Distributed Generation Applications

Customer Application Considerations

Site Location

Are they in a deregulated Utility Market?

Monetization opportunities

Can they monetize their onsite power generation source now or in the future?

Renewable Integration

Do they have (or want to have) renewables as part of their energy system?

Sustainability Drivers

Are there company carbon or sustainability goals in play?

Financing Options

Did you know that there are investors willing to carry the capital costs of the onsite generation?

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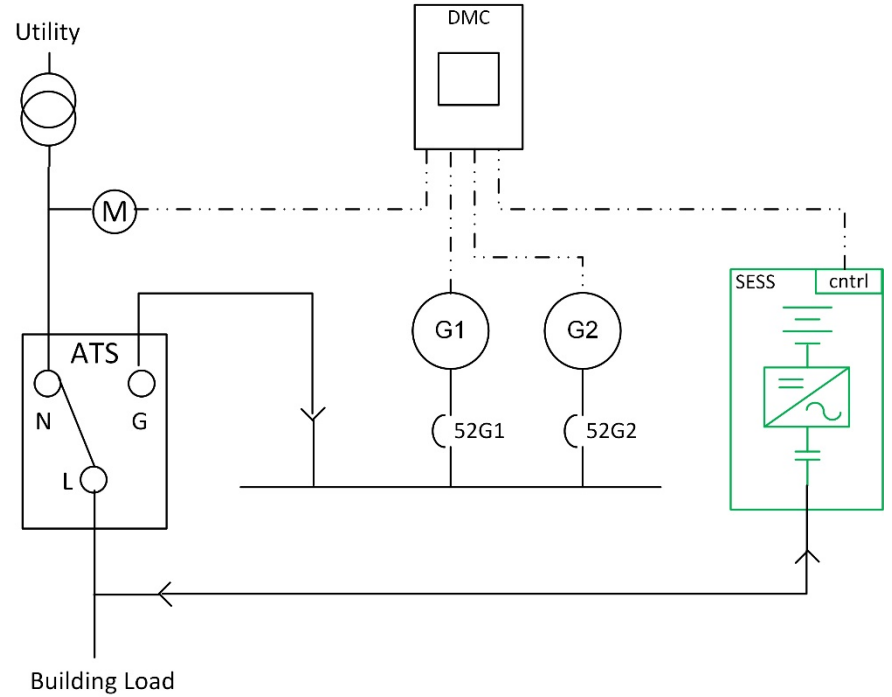

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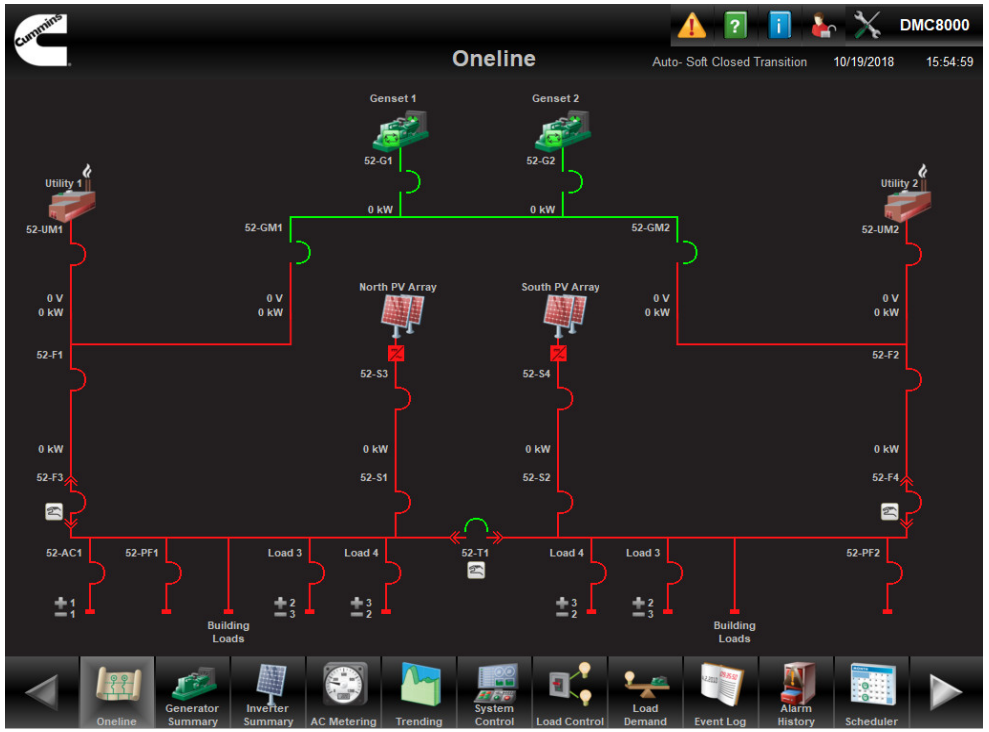

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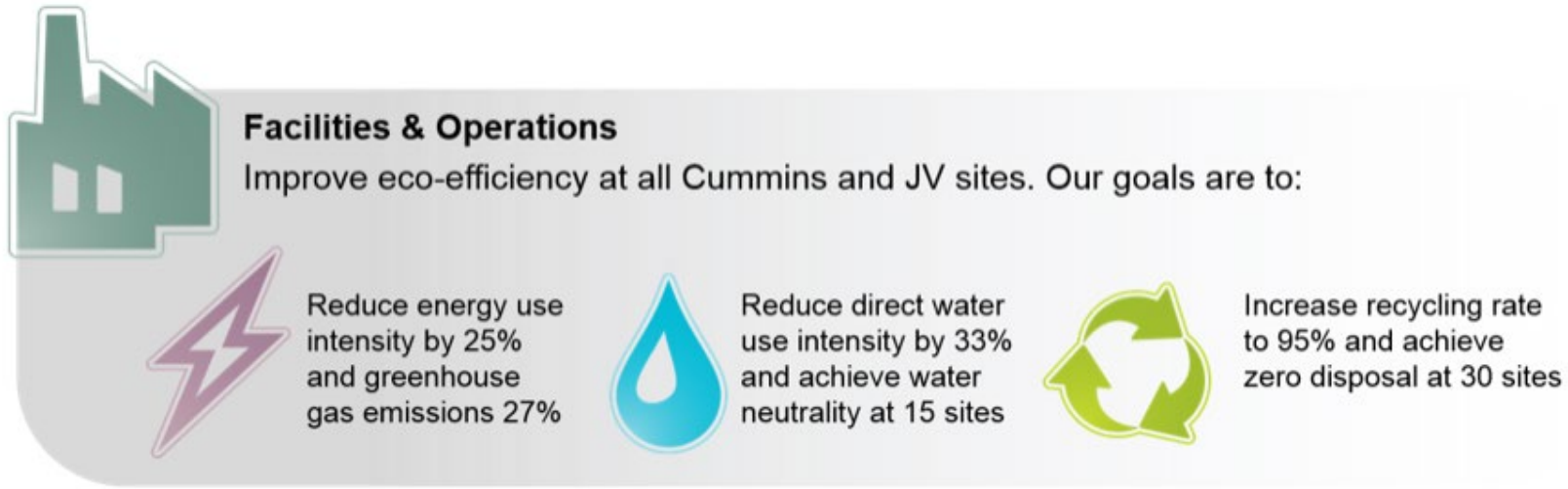

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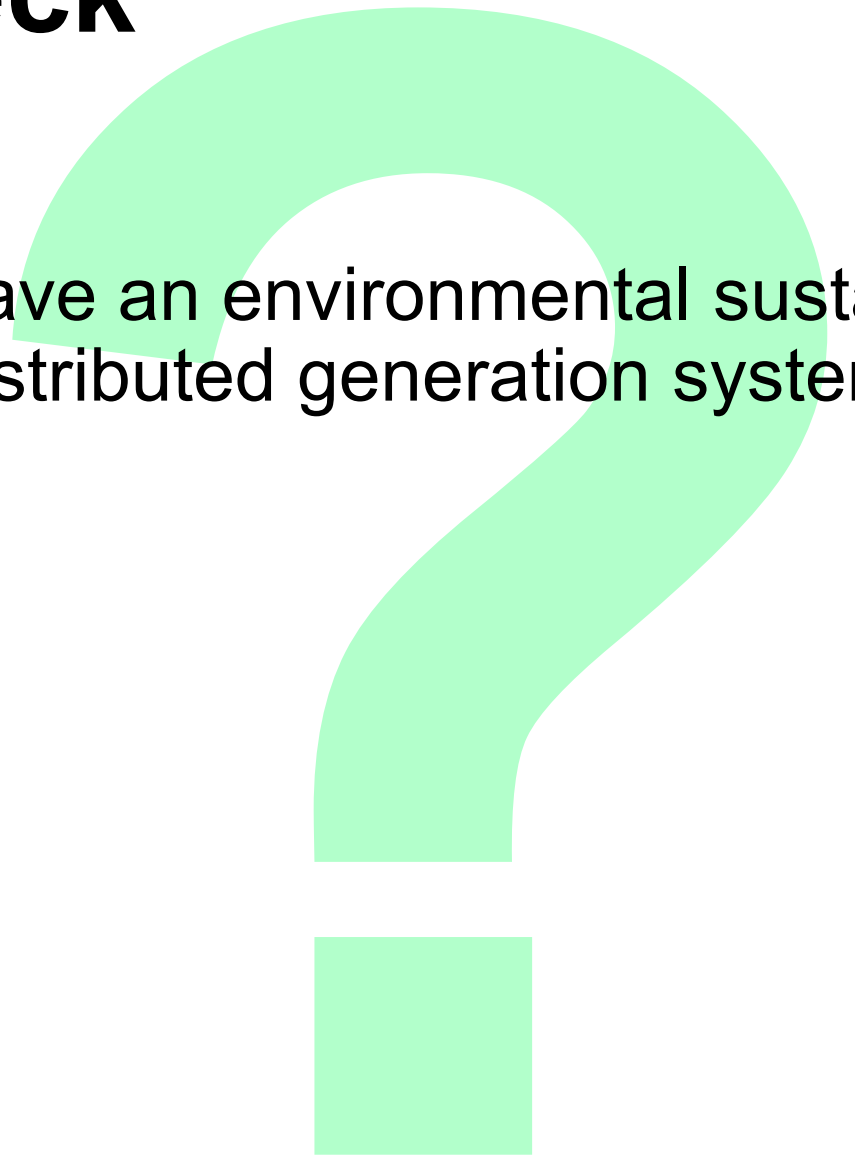
Concept Check

Customers need to have an environmental sustainability goal in order to leverage a distributed generation system.

a) TRUE
b) FALSE



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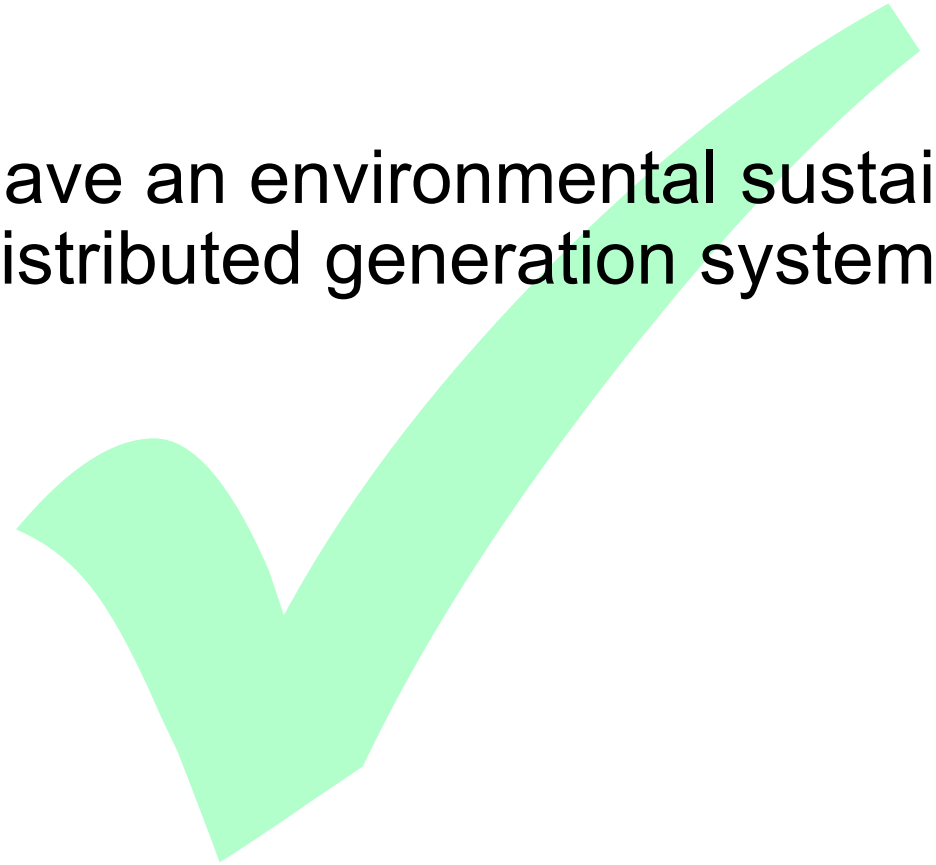

Course Summary

An Introduction to Distributed Generation (DG) Applications

- Describe energy ecosystem trends and the needs driving the evolution of DG
- Identify the categories of DG applications (Use Cases) and components of the system
- Define possible DG approaches to customer energy needs.

Additional Resources

Cummins White Papers

- The Latest Evolution Of Distributed Energy Resources: Opportunity For Business Within The PJM
- An introduction to the Smart Grid
- Utilizing Flare Gas to Generate Power for the Oil and Gas Sector
- Evaluating cogeneration for your facility: A look at the potential energy-efficiency, economic and environmental benefits

Cummins On-Demand Webinars

- Functions and Features of Generator Set Control Based Paralleling
- Specifying Gaseous Generator Sets
- Paralleling Power System Design Considerations and System Level Control

Q&A

Type your questions, comments, feedback in the **WebEx Q&A box**. We will get to as many questions as we can

We will publish consolidated FAQ along with presentation and webinar recording on powersuite.cummins.com

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- For other states and territories, email powergenchannel@cummins.com or visit http://power.cummins.com/sales-service-locator

Closing

Cummins Distributed Generation Informational Contact:

DGinfo@cummins.com

Watch out for a follow-up email including:

- A Link to webinar recording and presentation
- A PDH Certificate

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- Other Cummins Continuing Education programs
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Upcoming PowerHour Webinars:

- January 2020 – Key Considerations When Selecting a Generator Set Fuel Source
- February 2020 – Systems Design Advantages of a Right-Sized Automatic Transfer Switch

Please contact Mohammed Gulam if you have any questions related to the PowerHour webinar (mohammed.gulam@cummins.com)


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