



Status and Trends in the Voluntary Market (2020 data)

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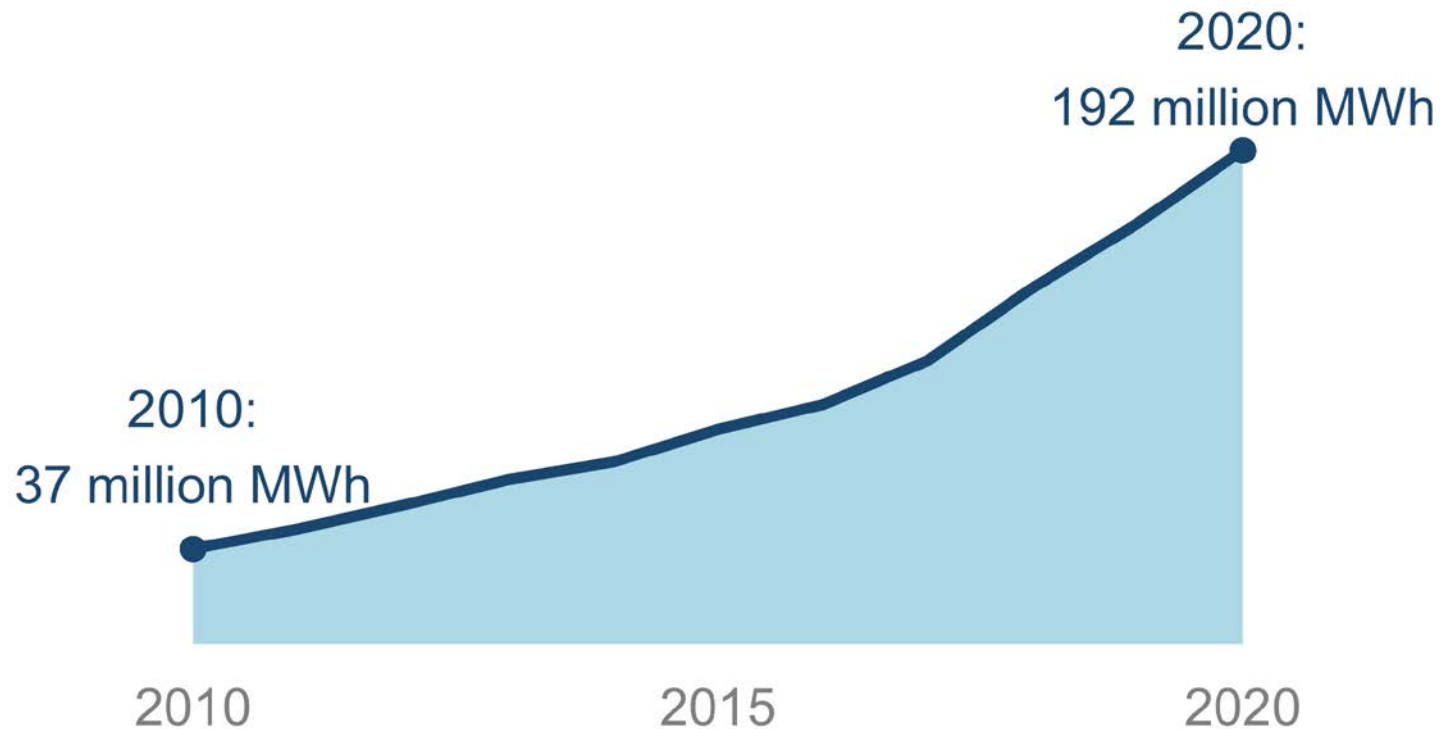
Renewable Energy Markets Conference
September 29, 2021

Voluntary Green Power Markets

- Voluntary green power refers to renewable electricity voluntarily purchased by retail electricity customers. It is a separate market from renewable energy used by load serving entities to fulfill renewable portfolio standards or other mandates.
- The voluntary green power market refers to the suite of products that allow customers to procure green power:
 - Utility green pricing programs
 - Utility renewable contracts
 - Competitive suppliers
 - Unbundled renewable energy certificates (RECs)
 - Community choice aggregation
 - Power purchase agreements

The Big Picture

In 2020, about **7.5 million customers** procured about **192 million MWh** of renewable energy through green power markets.



That represents about:

1 in 20

U.S. retail electricity customers

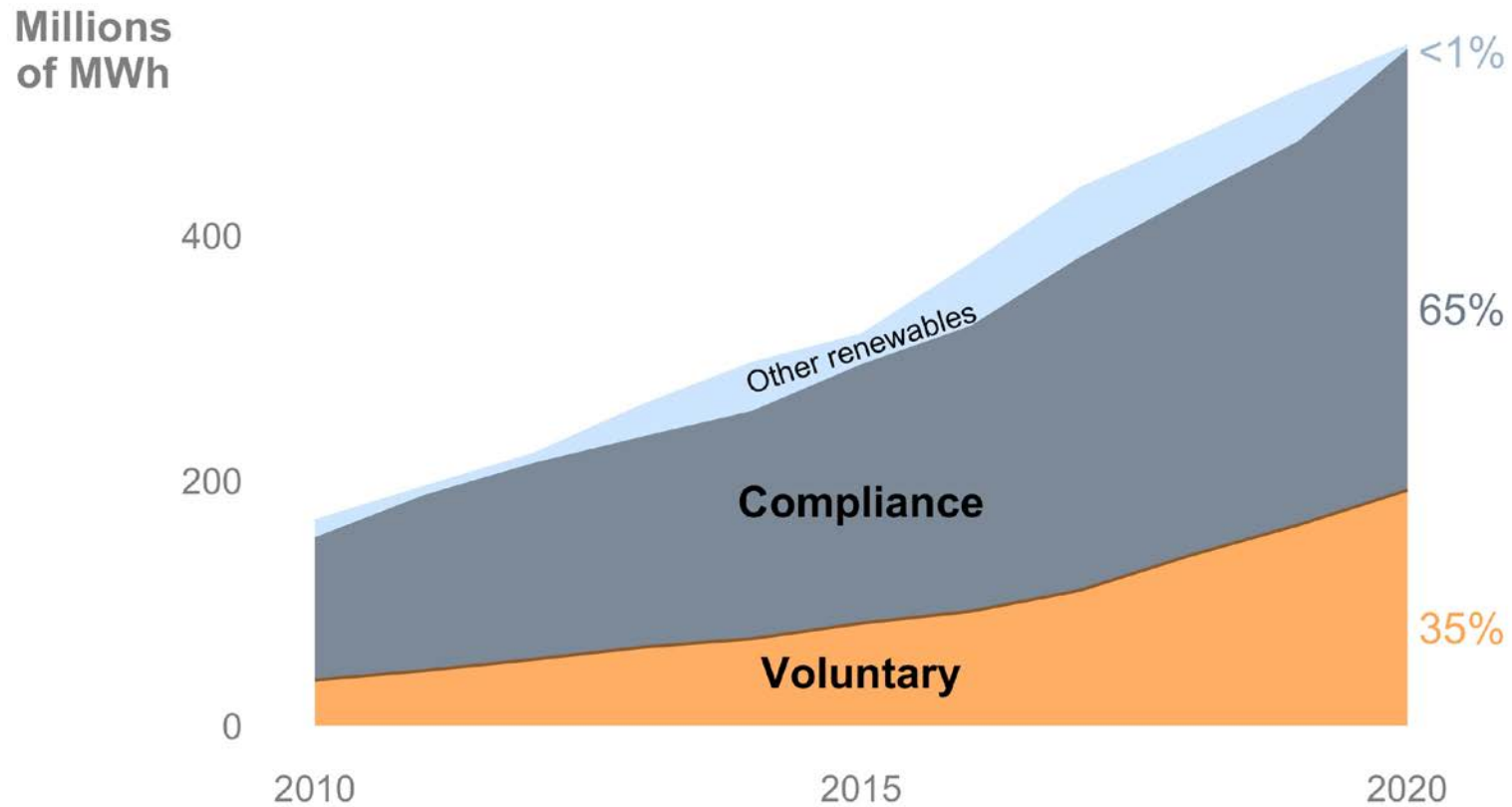
5%

of U.S. retail electricity sales

Total green power sales 2010-2020 (million MWh)

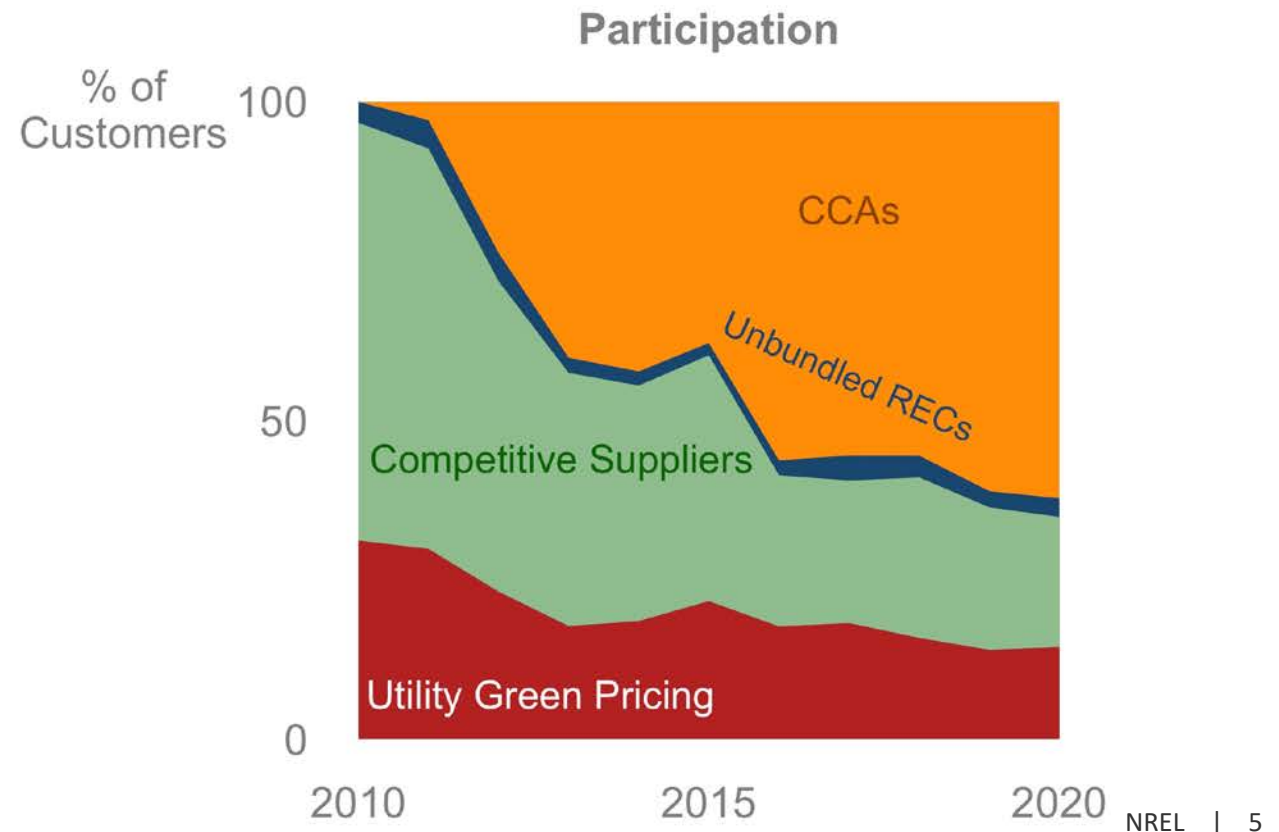
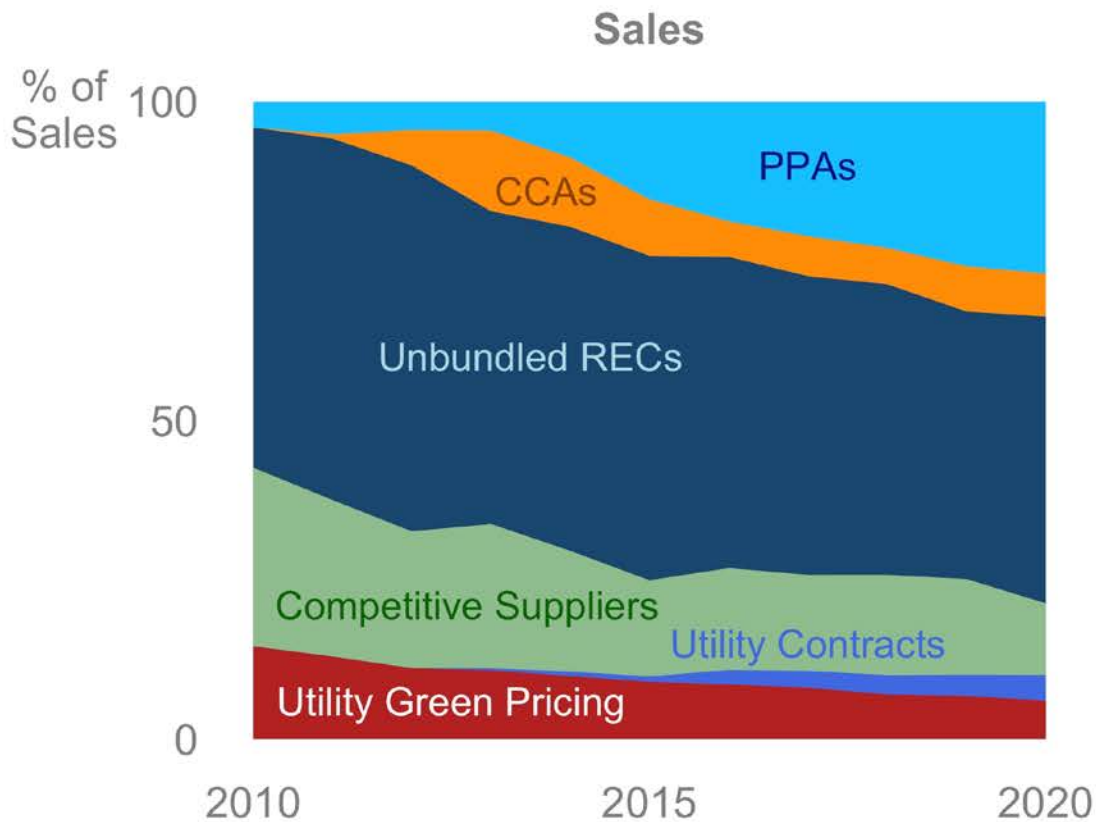
The Voluntary Market in Context

In 2020, voluntary buyers procured about **35%** of all non-hydro renewable energy generated in the United States.



Green Power Sales and Customers by Mechanism

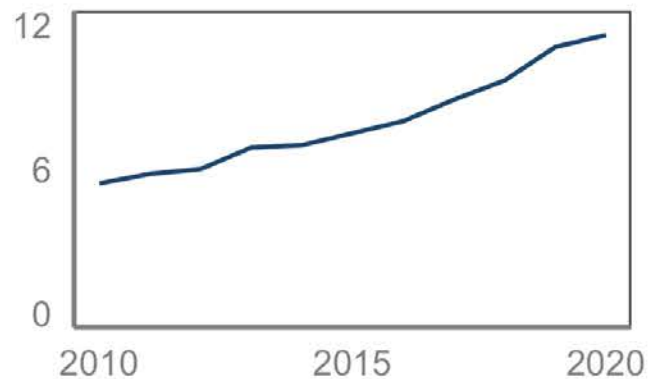
In 2020, the most voluntary sales were via unbundled RECs, while the most customers were via community choice aggregation (CCA) programs. Unbundled RECs purchases are dominated by C&I customers who purchase large volumes, while CCA customers are typically residential customers purchasing low volumes.



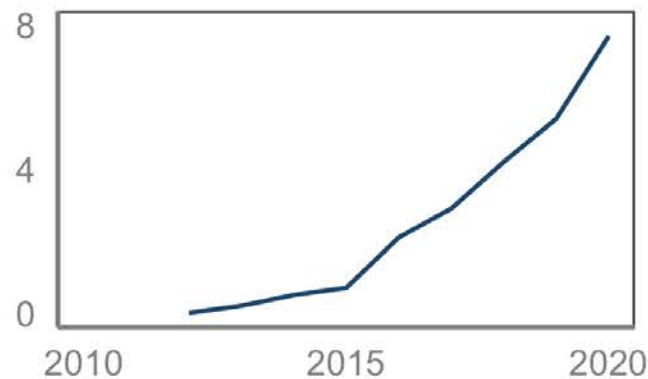
Voluntary Sales Continue to Increase

Sales
(million MWh)

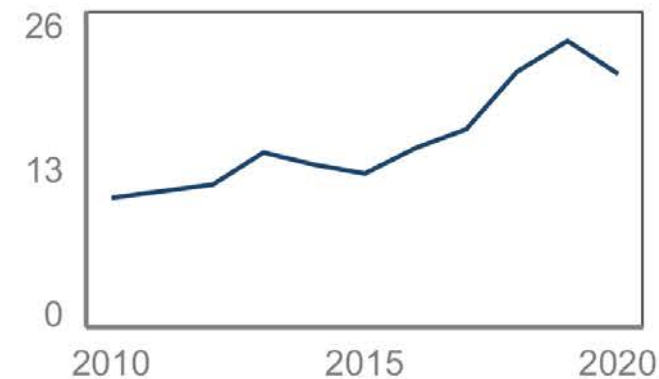
Utility Green Pricing



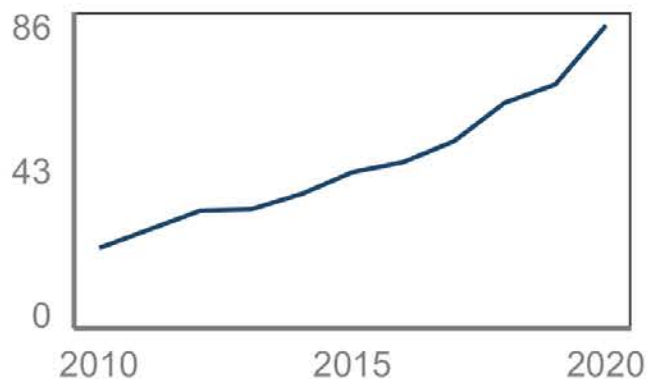
Utility Contracts



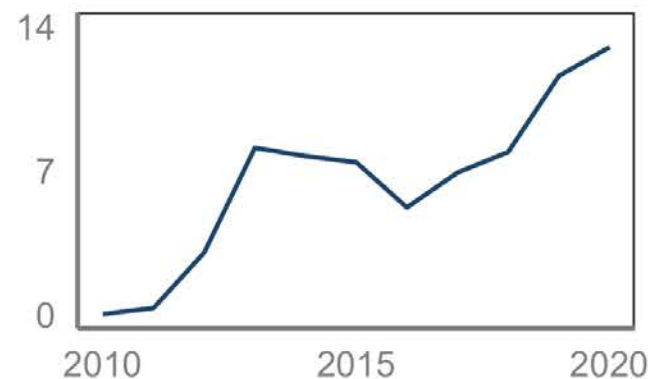
Competitive Suppliers



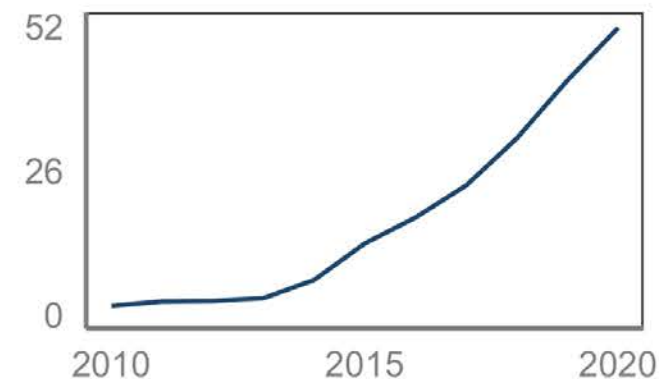
Unbundled RECs



CCAs



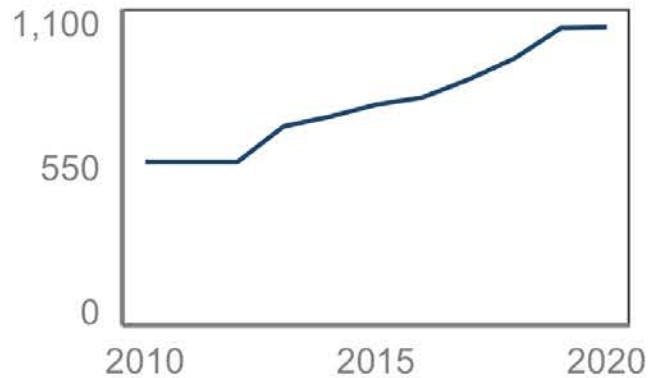
PPAs



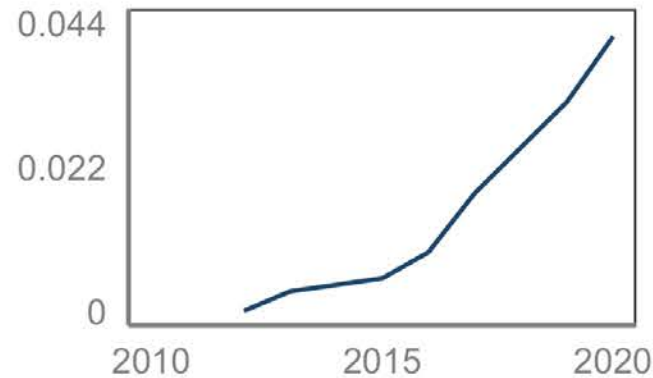
Participation Leveled Off in 2020

Customers
(x1,000)

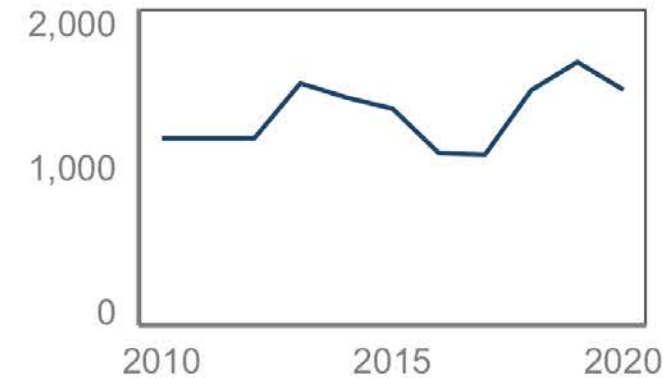
Utility Green Pricing



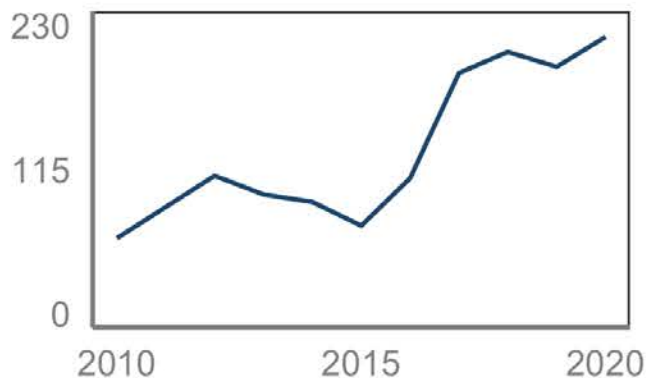
Utility Contracts



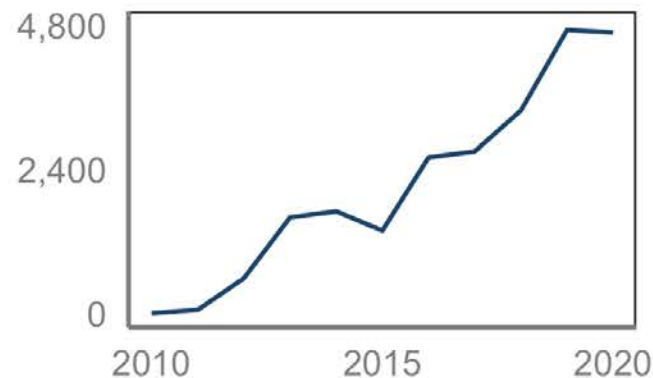
Competitive Suppliers



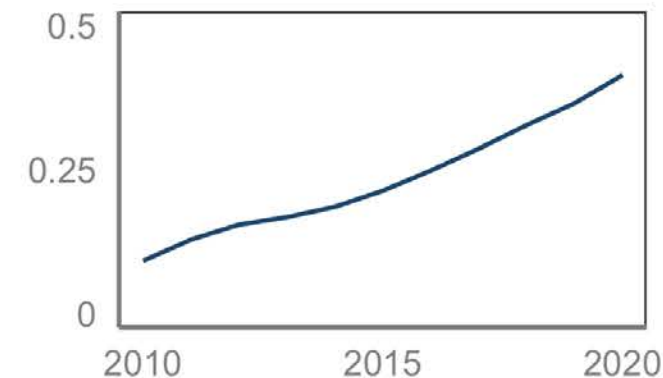
Unbundled RECs



CCAs



PPAs



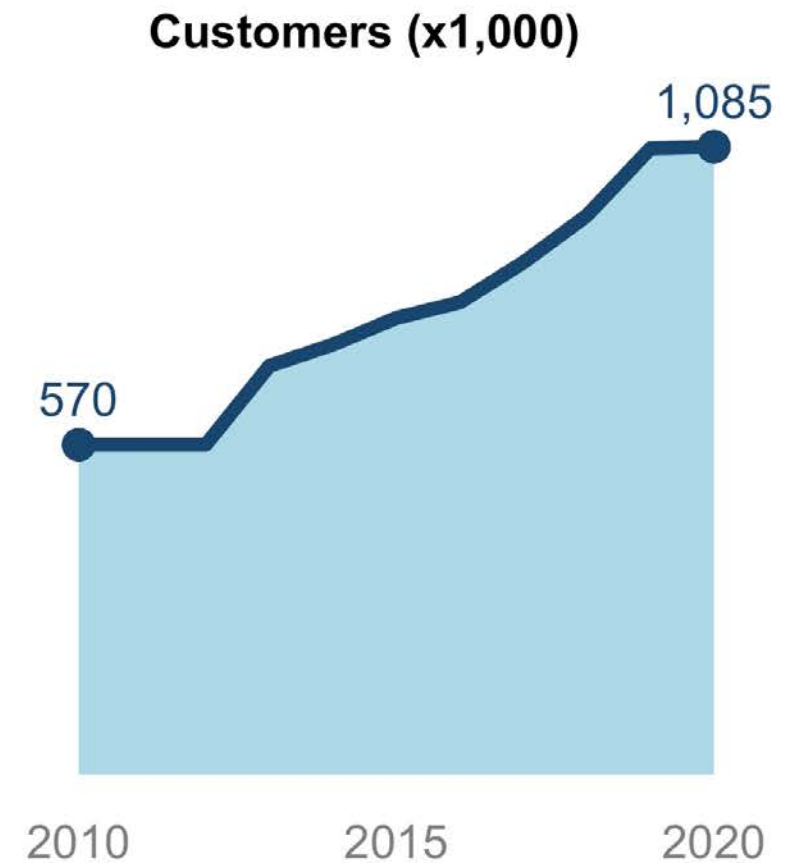
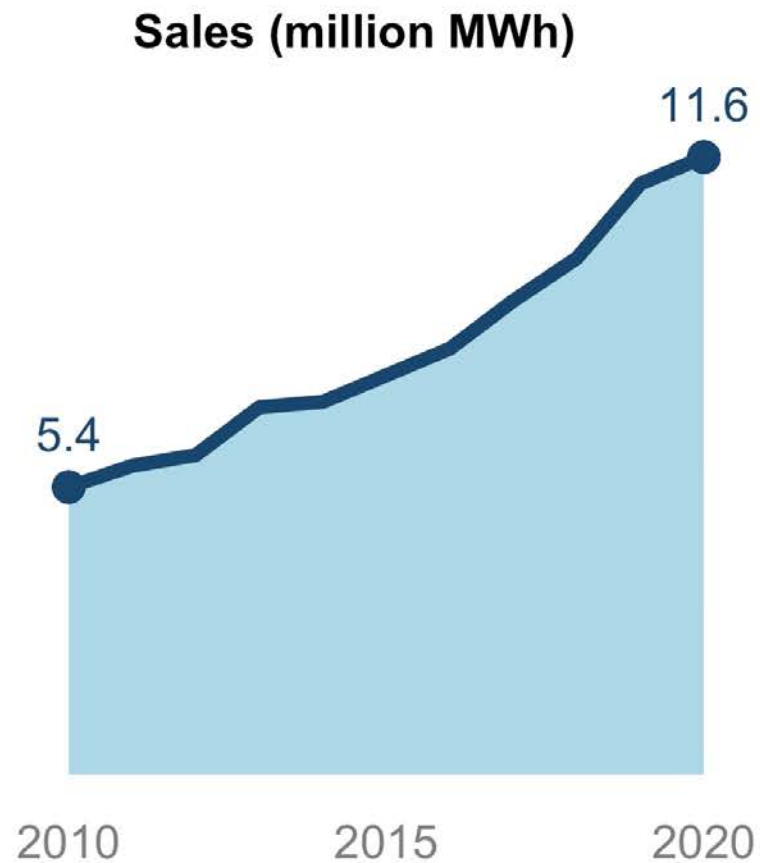
2020 Green Power Sales and Participation

Segment	Sales (million MWh)	Participation
Utility green pricing	11.6	1,085,000
Utility renewable contracts	7.7	42
Competitive suppliers	21.6	1,537,000
Unbundled RECs	86.4	221,000
Community choice aggregation	13.0	4,684,000
Power purchase agreements	51.8	414
Total	192.1	7,527,000

Voluntary Market Trends by Market Segment

Utility Green Pricing Trends

About **1,085,000 customers** procured about **11.6 million MWh** of voluntary green power through utility green pricing programs in 2020. The relatively slow growth in 2020 may reflect program marketing challenges related to the Covid-19 pandemic.



Utility Green Pricing Programs Challenged by COVID

Impacts on Marketing Strategies

- We asked utility survey participants about the impacts of the pandemics on their programs
- Most programs that responded reported slight reductions in sales and participation from expected levels, typically around a 5% decrease.
- Survey participants attributed reduced participation to the reduced ability of utilities to actively market their programs, particularly through in-person marketing (e.g., door-to-door, in-person events).
 - Some utilities noted that other extreme events such as wildfires have caused similar disruptions to program marketing in recent years
- At the same time, some utilities reported increased interest from proactive customers, perhaps because more time at home led to more interest in residential green power.

Top 10 Rankings Published

- NREL has [published](#) its annual “Top 10” rankings of utility green pricing programs

Green Power Sales Rate (as of December 2020)

Rank	Utility	Green Power Sales Rate
1	Portland General Electric (Green Future Choice)	21.39%
2	Silicon Valley Power	11.40%
3	PacifiCorp (Blue Sky Usage & Habitat)	7.50%
4	Portland General Electric (Green Future Enterprise)	7.49%
5	River Falls Municipal Utilities	6.55%
6	Waterloo Utilities	5.86%
7	Alameda Municipal Power	5.43%
8	Grand Marais Public Utility Commission	4.85%
9	Farmers Electric Cooperative	3.83%
10	Puget Sound Energy	3.38%

Green Power Sales (as of December 2020)

Rank	Utility	Green Power Sales (MWh)
1	Portland General Electric	2,593,869
2	PacifiCorp	1,519,326
3	Xcel Energy	950,674
4	Austin Energy	727,711
5	Puget Sound Energy	638,855
6	Silicon Valley Power	426,316
7	Dominion Energy Virginia	389,413
8	Tennessee Valley Authority (TVA)	335,524
9	AES Indiana	218,278
10	Consumers Energy	200,430

Green Power Participation Rate (as of December 2020)

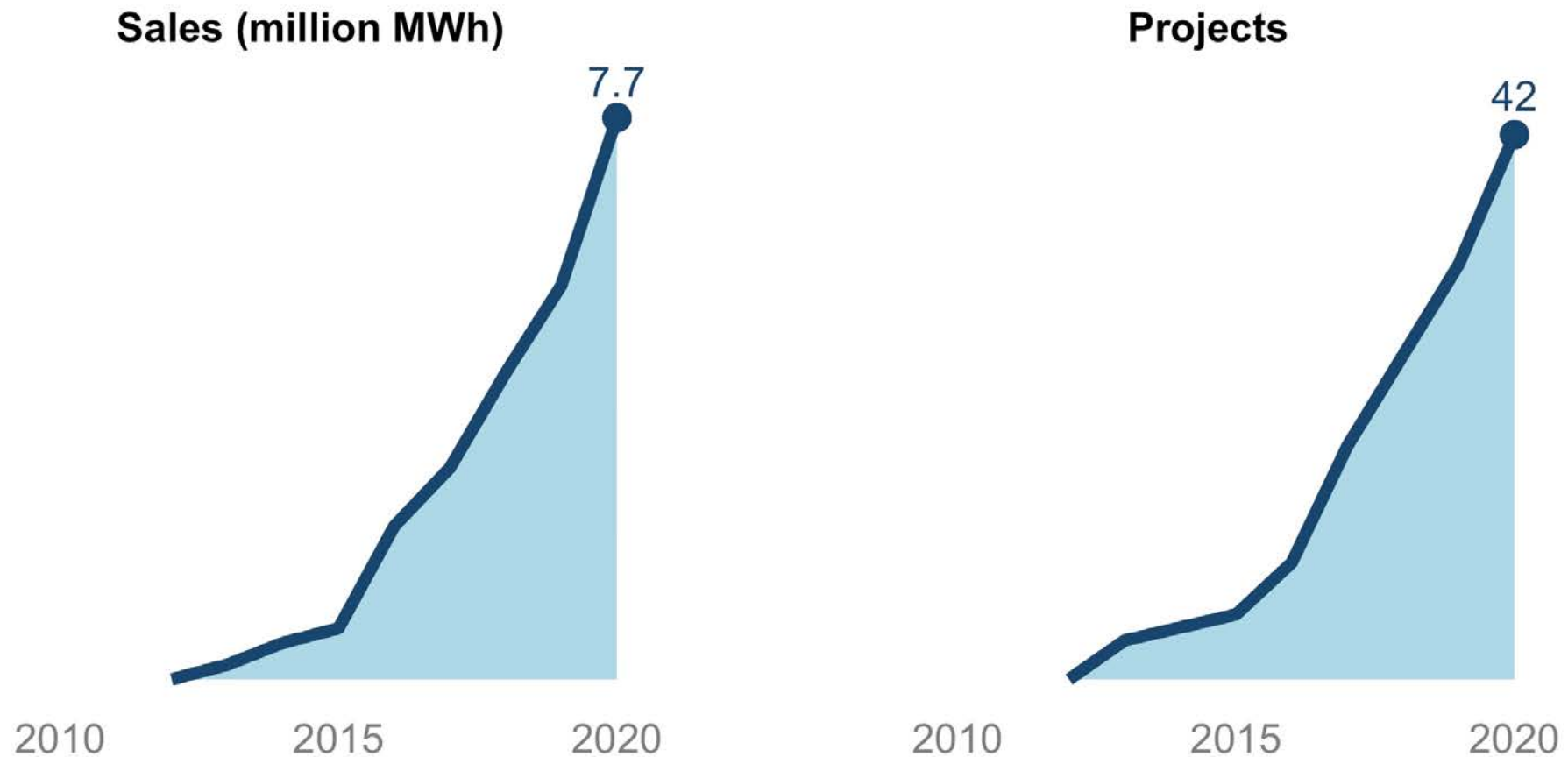
Rank	Utility	Green Power Sales (MWh)
1	Portland General Electric	26%
2	Farmers Electric Cooperative	19.21%
3	River Falls Municipal Utilities	11.93%
4	Alameda Municipal Power	10.29%
5	PacifiCorp (Blue Sky Usage & Habitat)	9.13%
6	Silicon Valley Power	6.76%
7	Puget Sound Energy	6.12%
8	Muscoda Utilities	5.38%
9	Naperville Public Utilities - Electric	4.83%
10	Stoughton Utilities	4.57%

Green Power Customers (as of December 2020)

Rank	Utility	Green Power Customers
1	Portland General Electric	232,129
2	Xcel Energy	151,783
3	PacifiCorp	142,879
4	Puget Sound Energy	72,131
5	Dominion Energy Virginia	36,655
6	Austin Energy	24,835
7	DTE Energy	23,647
8	Consumers Energy	18,476
9	National Grid	14,511
10	We Energies	12,455

Utility Renewable Contract Trends

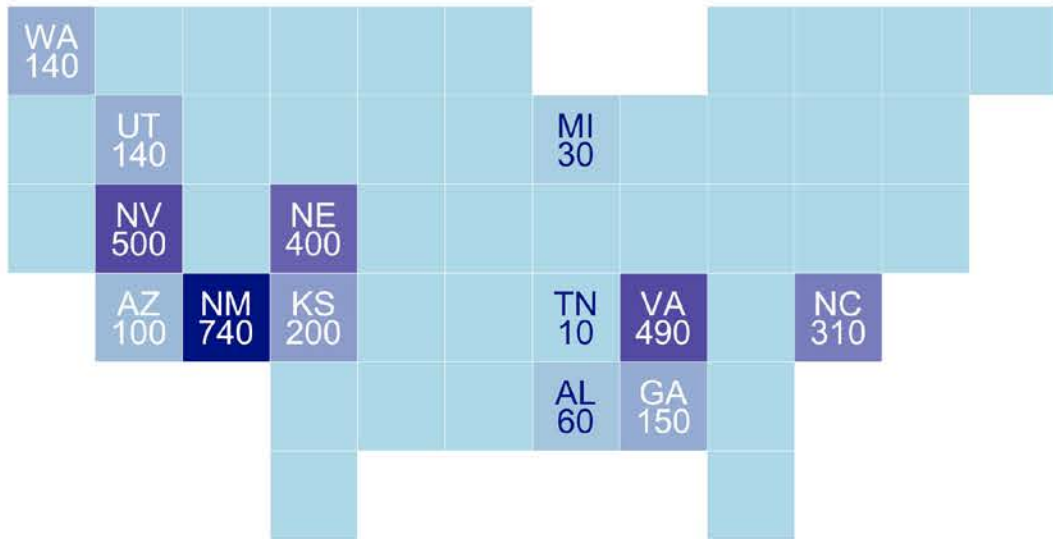
About **7.7 million MWh** of renewable energy was procured through **42 utility renewable contracts** through utility green pricing programs in 2020.



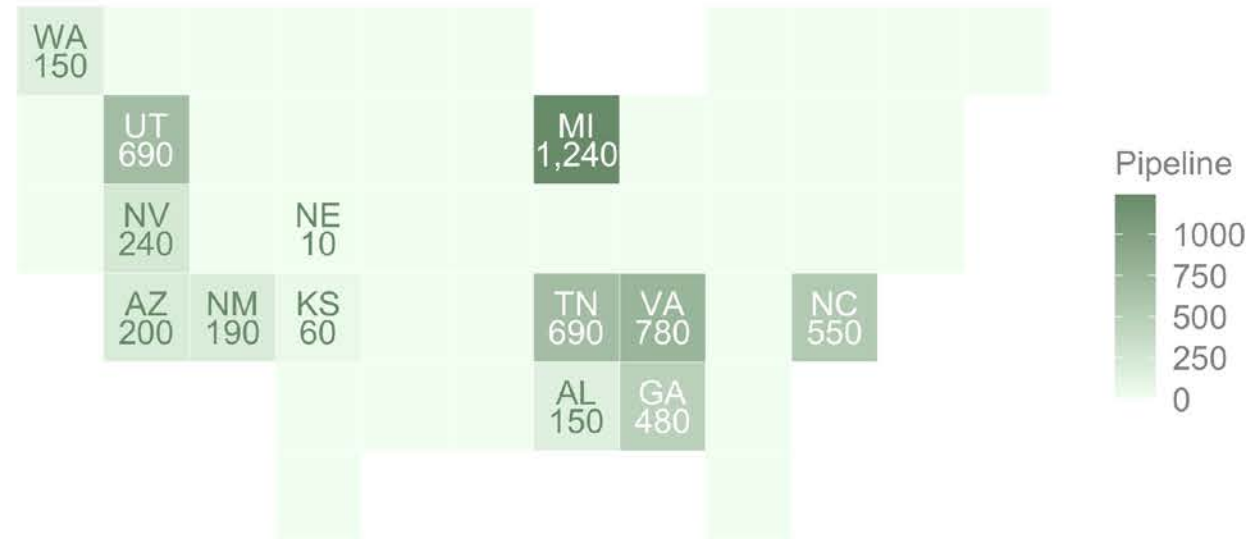
Large Pipelines of Utility Contracts Exist Across the Country

There is about twice as much capacity in the utility contract pipeline as currently operational capacity. Utility renewable contracts are poised for significant growth, especially in Michigan, Virginia, Tennessee, and Utah.

Operating Capacity

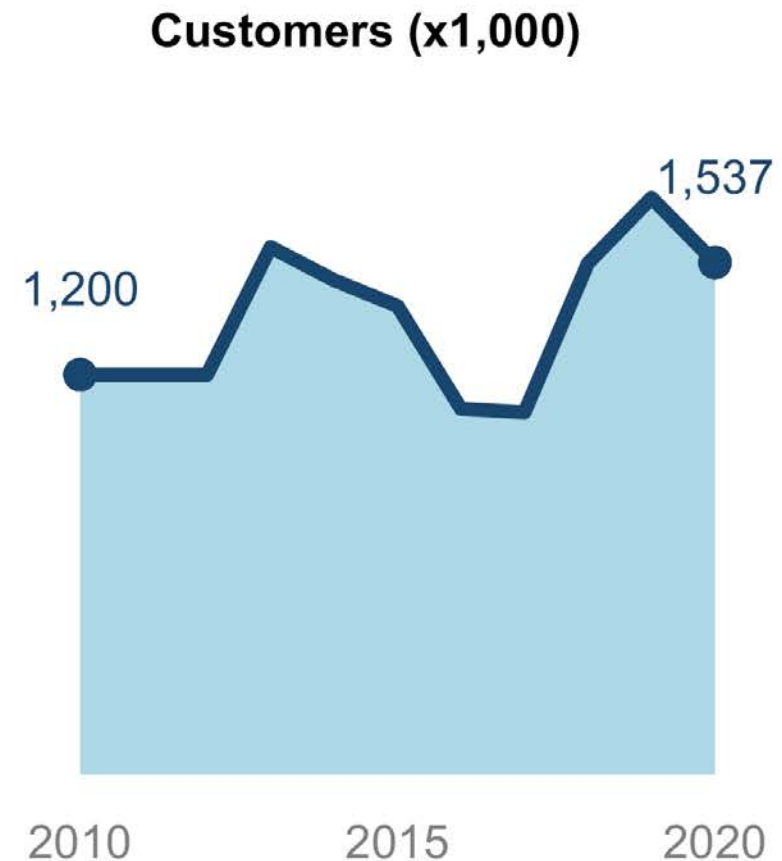
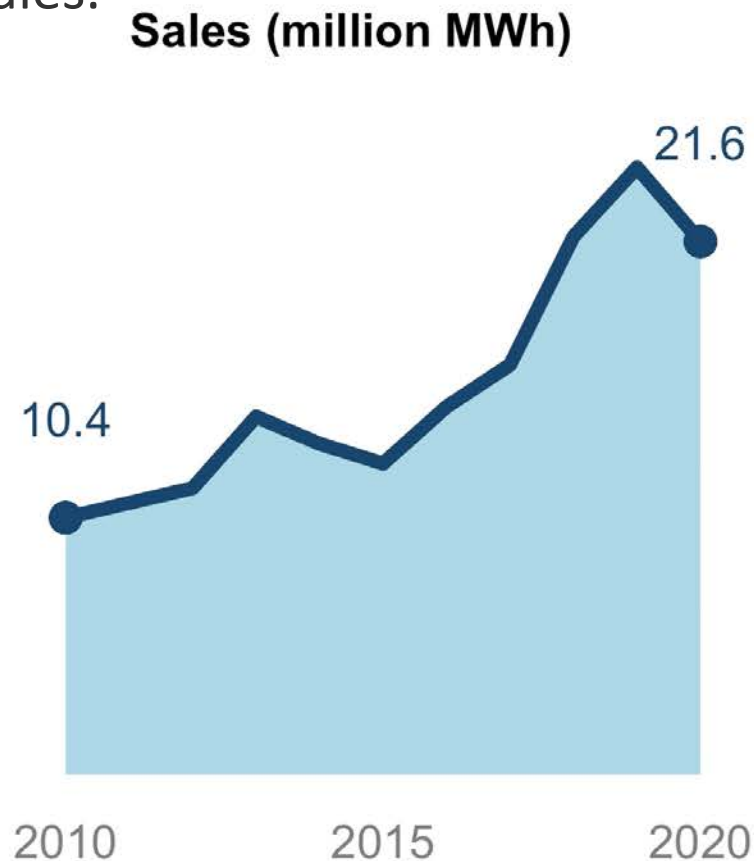


Pipeline Capacity



Competitive Supplier Trends

About **1.5 million customers** procured about **21.6 million MWh** of voluntary green power through competitive suppliers in 2020. The year-over-year fall in sales likely reflects two trends: 1) a drop in electricity sales overall in 2020 due to the Covid-19 pandemic; and 2) ongoing increases in RPS requirements that reduced the green power portion of competitive supplier sales.

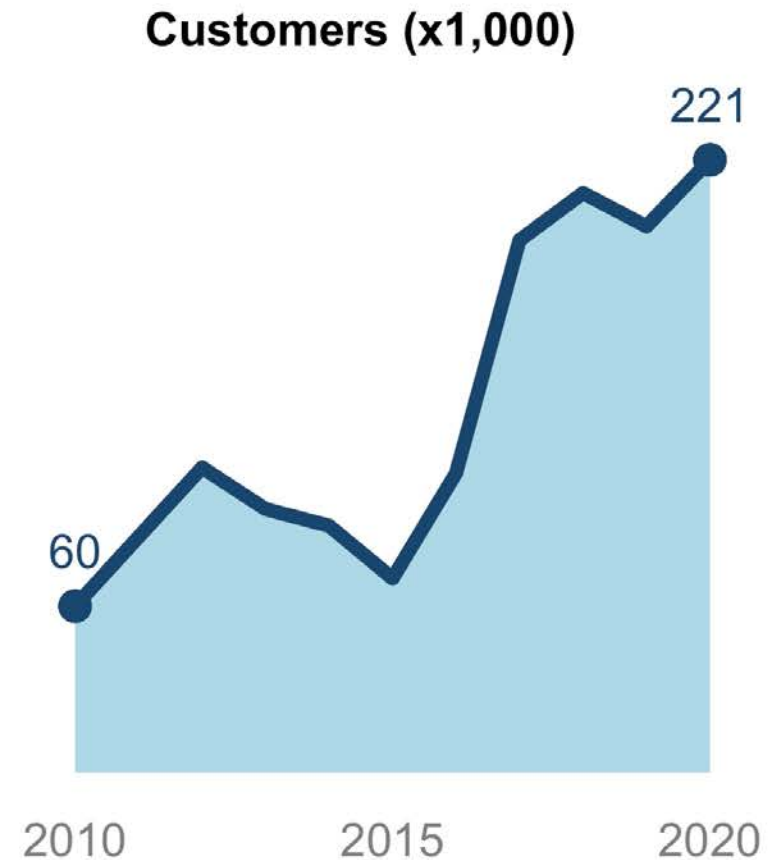
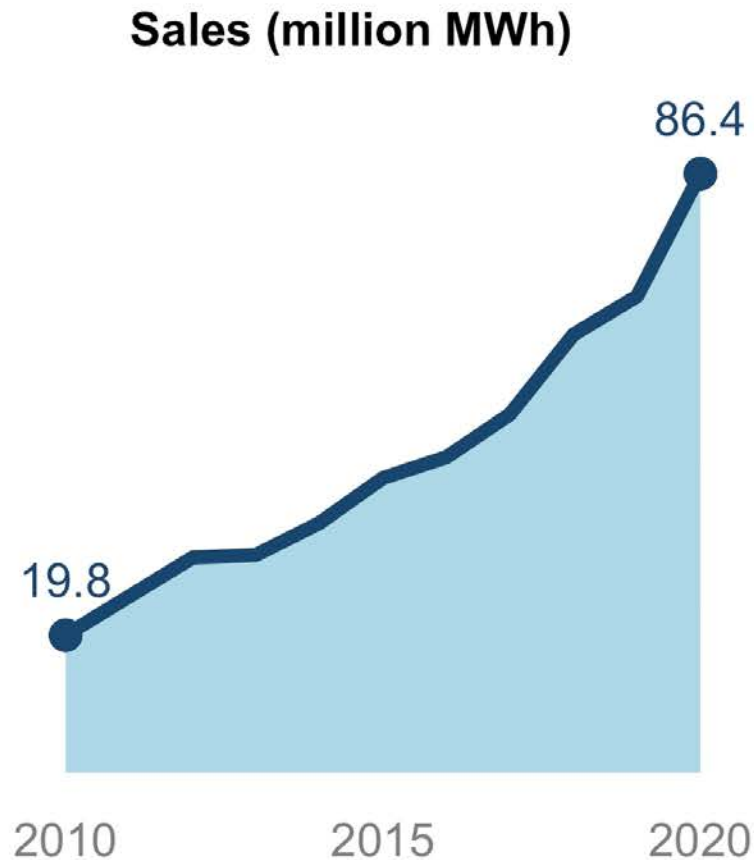


Competitive Suppliers are Providing New Options

- Some suppliers have begun to offer **long-term green power contracts** similar to utility green tariffs. The supplier procures green power from a specific resource (e.g., through a PPA) on behalf of their customers, minimizing expenses and time that the customer would need to spend to make their own power purchase.
 - For instance, NRG has created the Renewable Select program, a retail contract that makes it easier for business customers to obtain off-site green power from specific resources. Currently, the program includes 36 large commercial and industrial customers, providing renewable electricity to more than 345 offices, financial centers, and ATMs in Texas. It has an output of 3 TWh annually, and a collective 600 MW peak load. NRG plans to expand this program in the future to include smaller customers as well.
- Competitive suppliers have also begun to offer **community solar with RECs retired on behalf of subscribers**.
 - For instance, MP2 Energy has a community solar program partnership with Local Sun, a 1.5 MW solar project, which will power 300 homes and eliminate the need for long-term contracts. If customers need more power than can be supplied by the array, MP2 buys 100% renewable energy from other Texas sustainability projects.

Unbundled RECs

About **221,000 customers** procured about **86.4 million MWh** of voluntary green power through unbundled RECs in 2020.

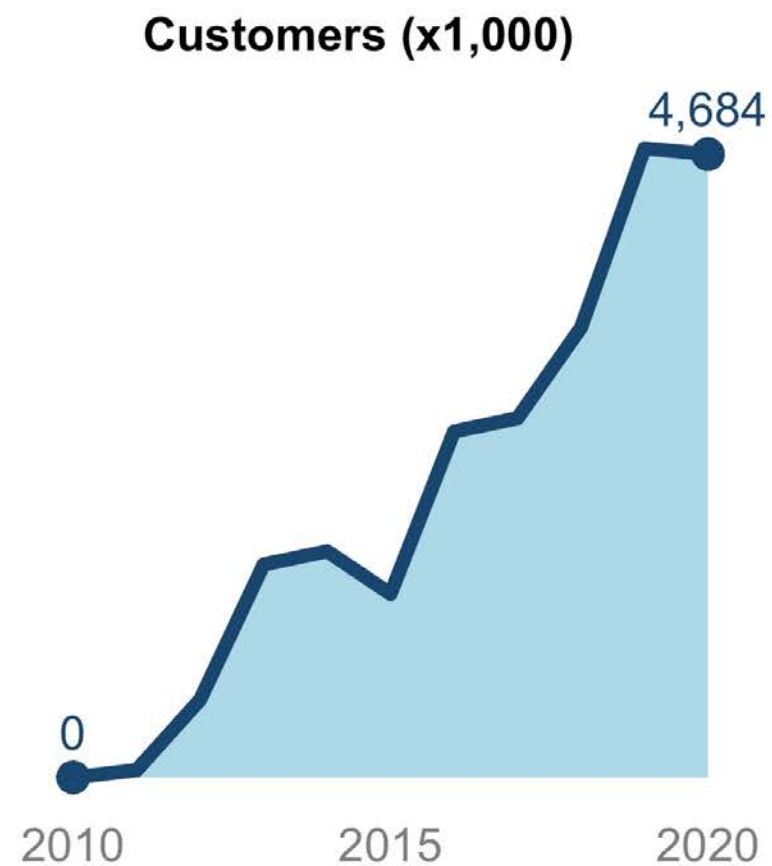
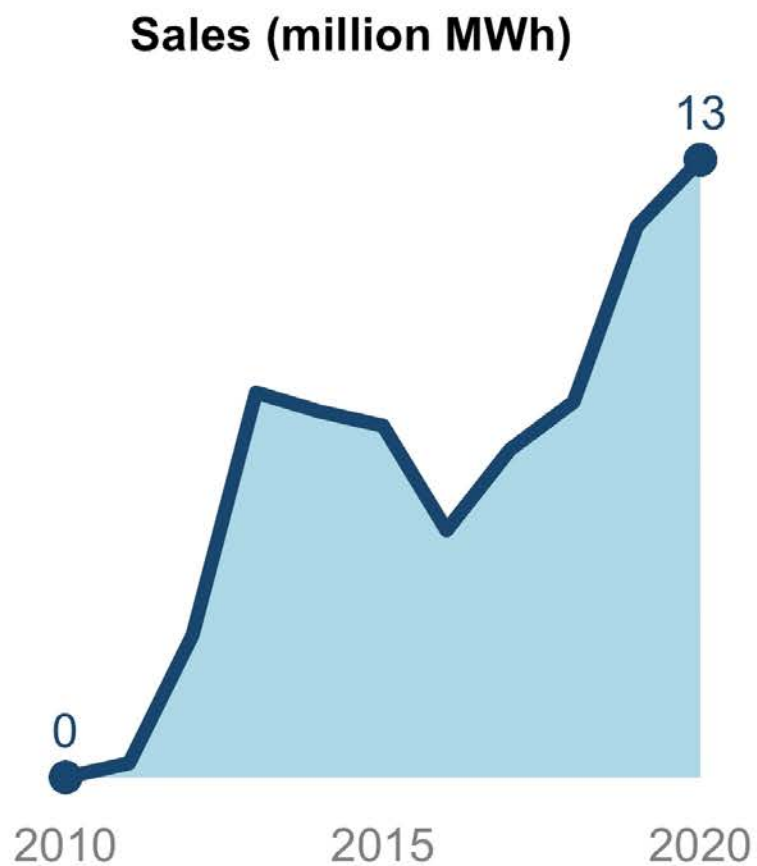


Unbundled REC Prices Continue to Climb

- From December 2020 to August 2021, REC prices (nationally sourced, Green-e Eligible) increased from \$1.50/MWh to \$6.60/MWh.
 - Previously, these RECs were <\$1/MWh since ~2015
- Market players have many questions about what is causing the increase in price and how purchasers might respond
 - Is the increase due to market tightening? ERCOT factors? Other issues?
 - Will purchasers look for other options? Will they purchase smaller quantities of unbundled RECs?

CCA Trends

About **4.7 million customers** procured about **13 million MWh** of voluntary green power through CCAs in 2020.



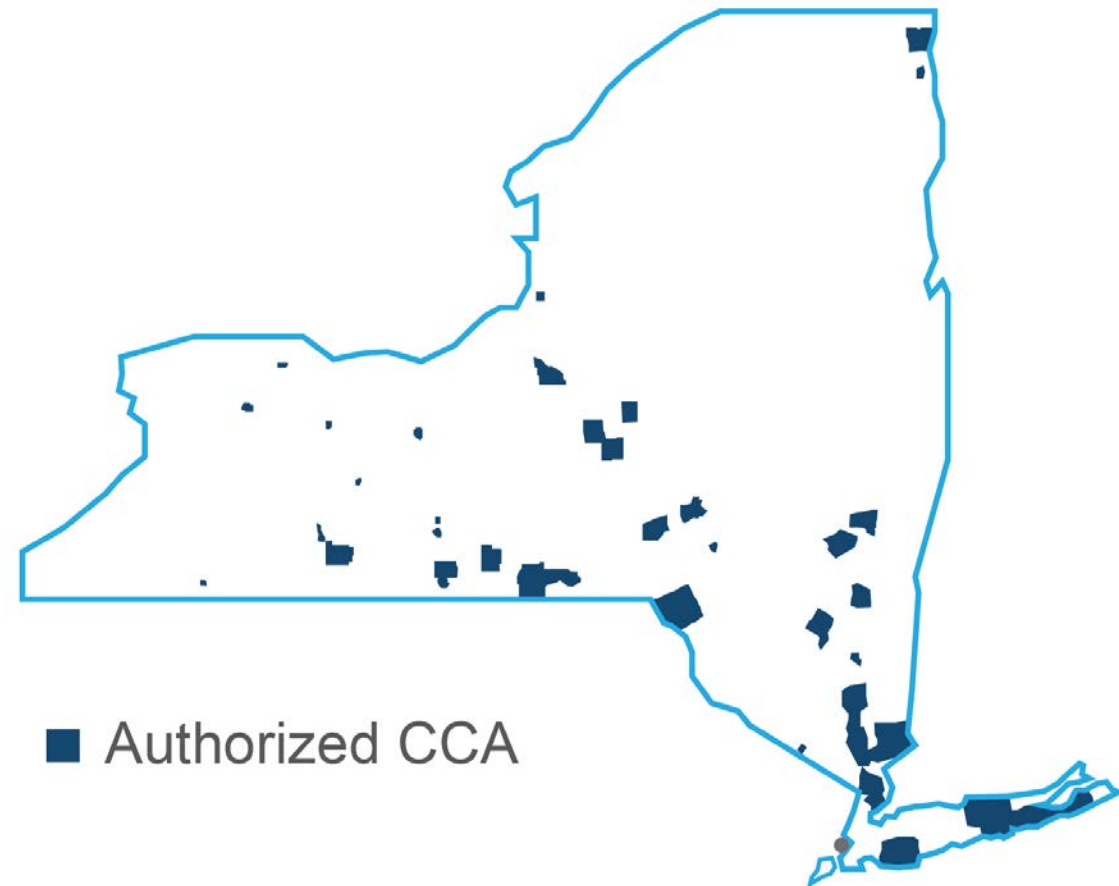
California Continues to Dominate CCA Green Power Sales and Customers

State	Green Power Sales (MWh)	Green Power Customers
California	9,632,000	3,888,000
Illinois*	336,000	45,000
Massachusetts	1,580,000	507,000
Ohio	693,000	111,000
New York	745,000	133,000
TOTAL	12,986,000	4,684,000

* Methodology for Illinois CCA estimation changed from 2019 to 2020, see data book for updated historical estimates for previous years.

CCAs in New York

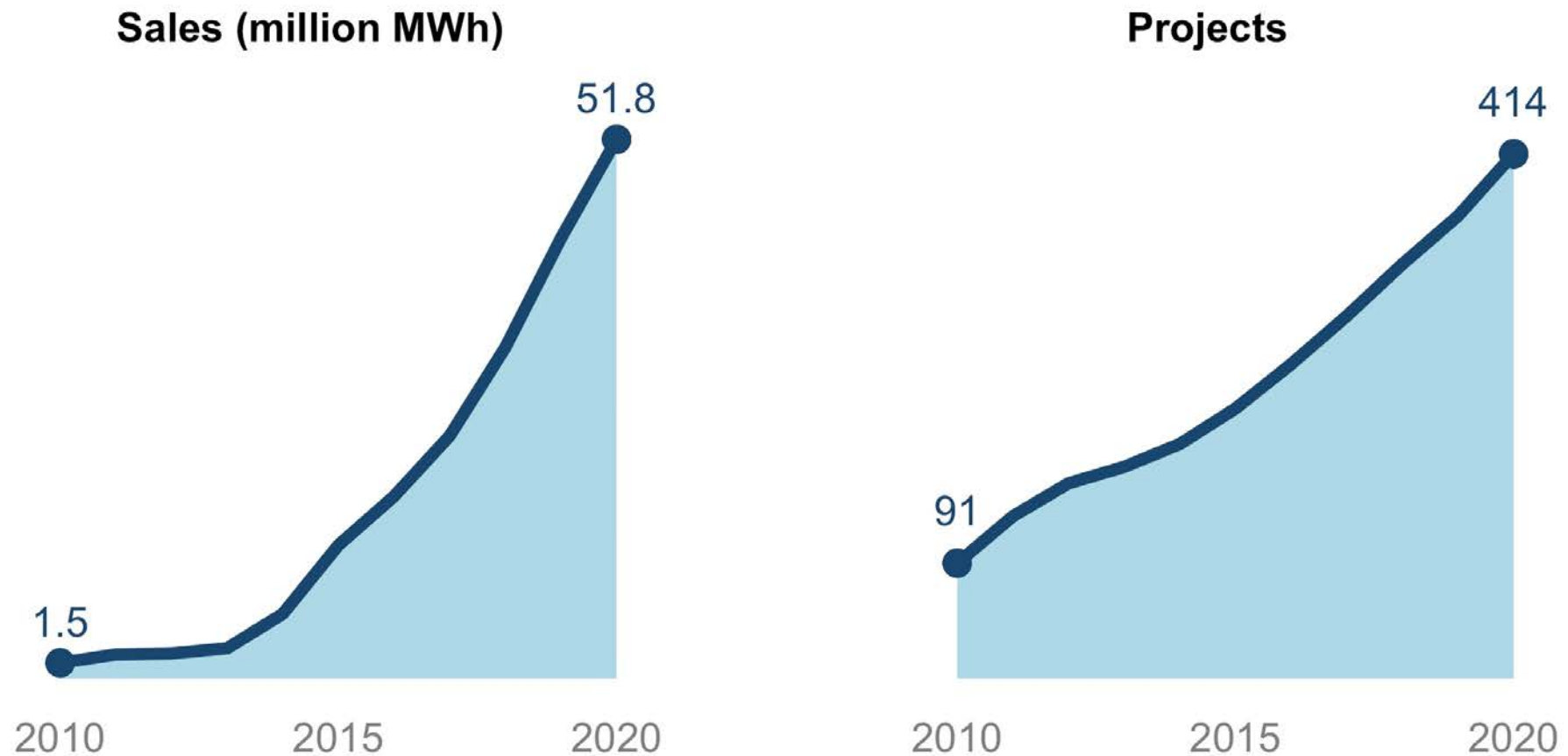
- In 2014, Westchester County formed New York's first CCA. Since then, three other aggregators have emerged forming CCAs throughout the state.
- Many New York communities have chosen to provide 100% renewable energy by default (opt out), and all aggregators offer opt-in green power products.
- New York CCAs are also innovating. Several CCAs offer their own community solar programs, and one aggregator (Joule Assets) offers a unique opt-out community solar product to eligible CCA customers.



Map modified from New York Department of Public Service “Community Choice Aggregations” map, accessed 8/23/2021.

PPA Trends

About **414 oftakers** procured about **51.8 million MWh** of voluntary green power through PPAs in 2020. These figures include only PPA sales where we estimate that the purchaser has retained the RECs.



Grid Impacts of Voluntary Market Purchasing

Impacts of Voluntary RE on the Grid

- How might the grid operate differently with an increasing penetration of *voluntary* renewable energy?
- Voluntary buyers are different from load-serving entities (LSEs)
 - Corporate buyers are not subject to the same constraints as LSEs
 - Corporate buyers have no mandate and less incentive to invest in project operational flexibility, at least in the near term
- Impacts on grid operations, planning, and cost attribution

Engaging Corporates to Increase the Grid Value of Corporate Procurement

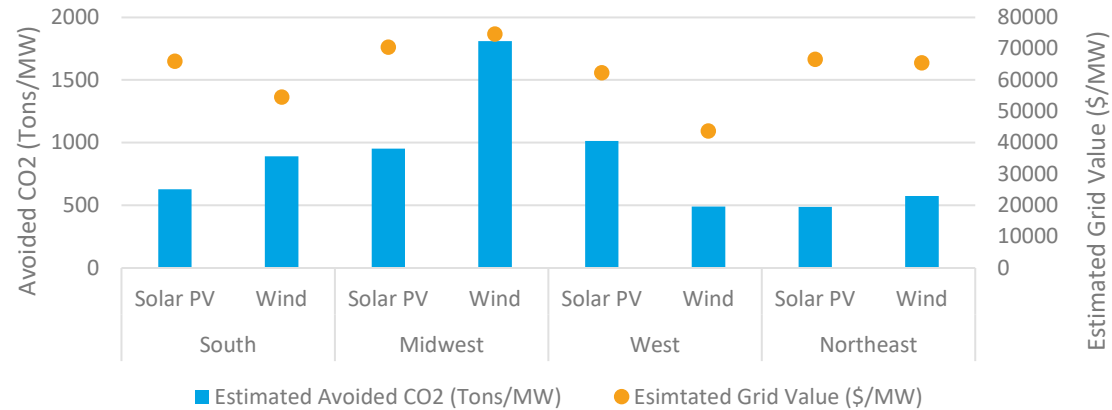
- Integrate corporate procurement into resource and transmission planning
- Aligning corporate grid values through:
 - Market reforms, alternative contracts, and data transparency
- Updating guidance on corporate greenhouse gas and renewable energy claims
 - For time-based claims and energy storage claims

What is “Grid Value”?

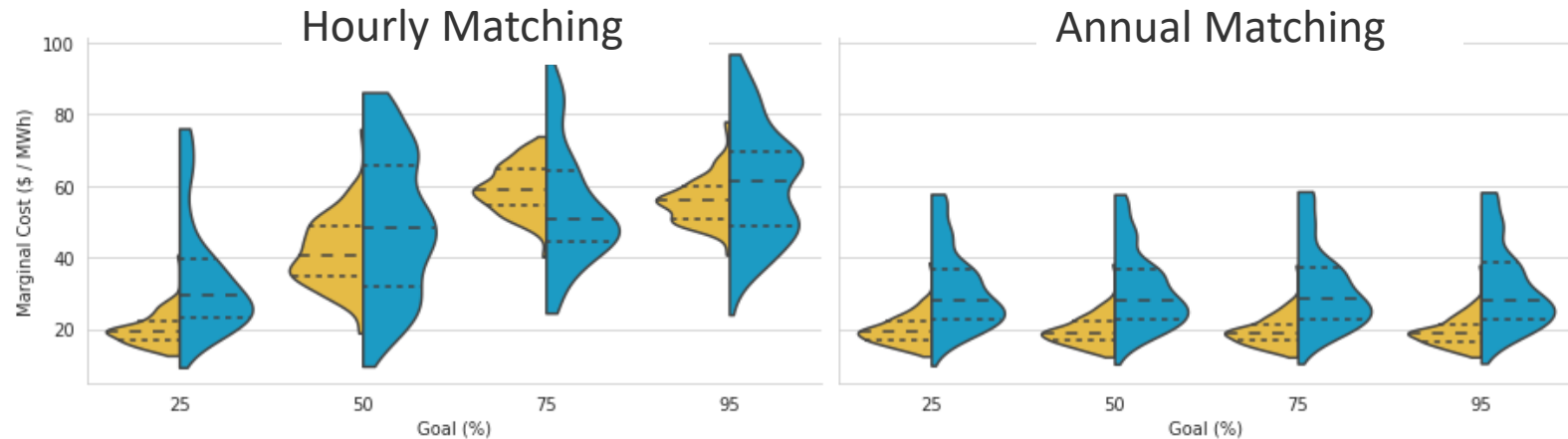
- We estimate the impacts of off-site power purchase agreements on:
 - Avoided CO2 emissions, defined as the long-run avoided emissions metric)
 - “Grid value”, defined as the energy and capacity contributions of the projects to the grid.
- We use BNEF’s Corporate PPA database and NREL’s Cambium data.

Potential Data Applications

- Understanding where to get the biggest “bang for your buck”
 - For example, we estimate that wind energy in the Midwest has the greatest avoided CO₂ benefit.



- Analyzing costs of hourly vs. annual RE matching to load
 - We modeled a flat load shape and source solar PV (yellow) or wind (blue) to meet the load on an hourly or annual basis. Marginal costs for hourly matching increased as the hourly matching goal increased.



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www.nrel.gov

NREL/PR-6A20-81141

This work was authored by the National Renewable Energy Laboratory, operated by Alliance for Sustainable Energy, LLC, for the U.S. Department of Energy (DOE) under Contract No. DE-AC36-08GO28308. Funding provided by the U.S. Department of Energy Office of Energy Efficiency and Renewable Energy. The views expressed in the article do not necessarily represent the views of the DOE or the U.S. Government. The U.S. Government retains and the publisher, by accepting the article for publication, acknowledges that the U.S. Government retains a nonexclusive, paid-up, irrevocable, worldwide license to publish or reproduce the published form of this work, or allow others to do so, for U.S. Government purposes.

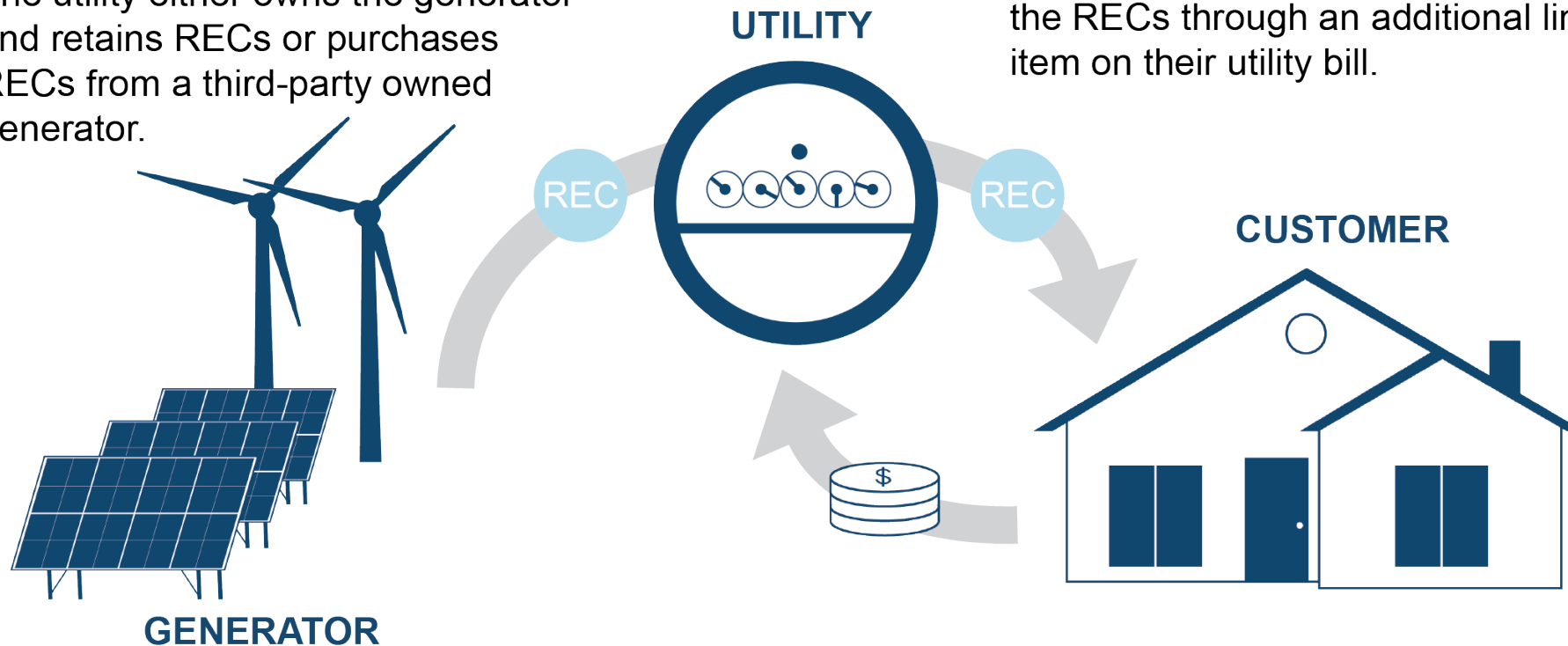


Appendix: Voluntary Market Product Descriptions

Utility Green Pricing

Utility green pricing programs begin with a renewable energy generator. The utility either owns the generator and retains RECs or purchases RECs from a third-party owned generator.

The utility retires the RECs on behalf of green pricing customers, who pay for the RECs through an additional line item on their utility bill.



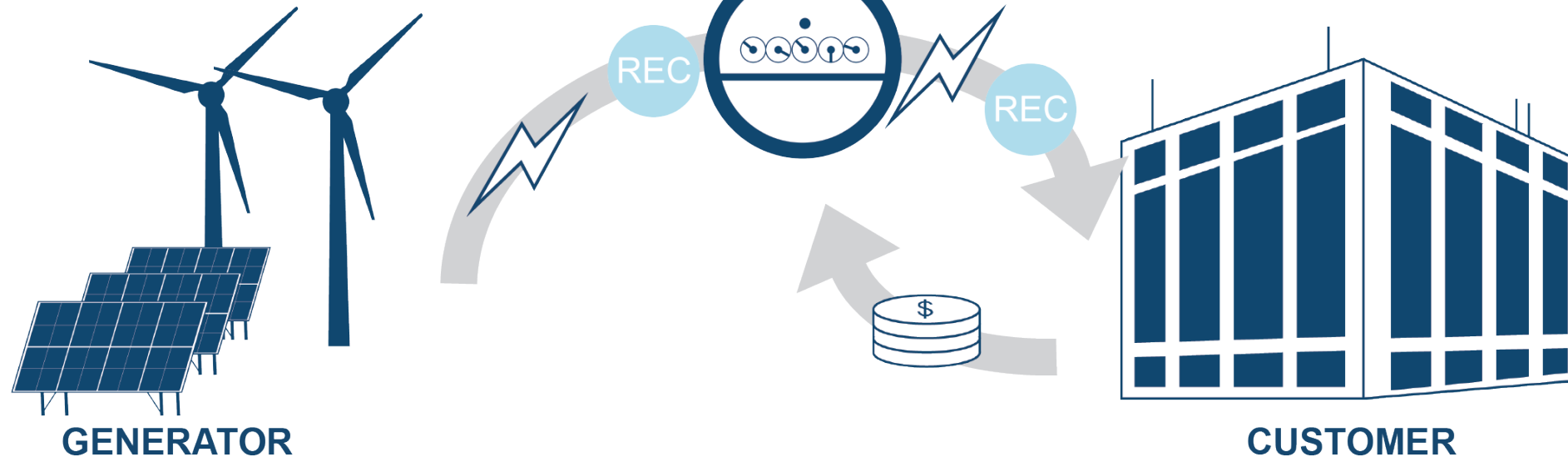
Basic utility green pricing program structure

Specific program structures vary

Utility Renewable Contracts

In a utility renewable contract, the customer enters into a contract with the utility to procure power and RECs from a renewable energy provider. Unlike green pricing programs, the customer may be able to specify the resource for the product.

The utility provides the power and RECs to the customer. The customer continues to pay the utility with a modified green tariff or bilateral contract rate.



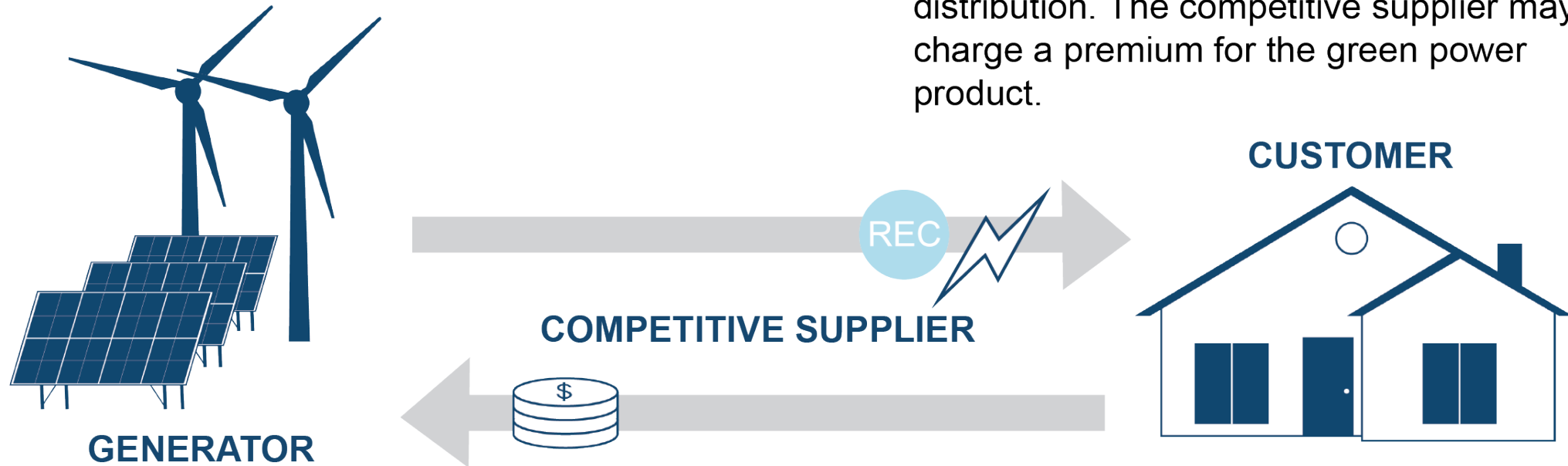
Basic utility renewable contract structure

Specific program structures vary

Competitive Suppliers

In restructured electricity markets, customers may choose a competitive electricity supplier that offers a green power product.

The competitive supplier provides the customer with power and RECs. The utility remains responsible for transmission and distribution. The competitive supplier may charge a premium for the green power product.



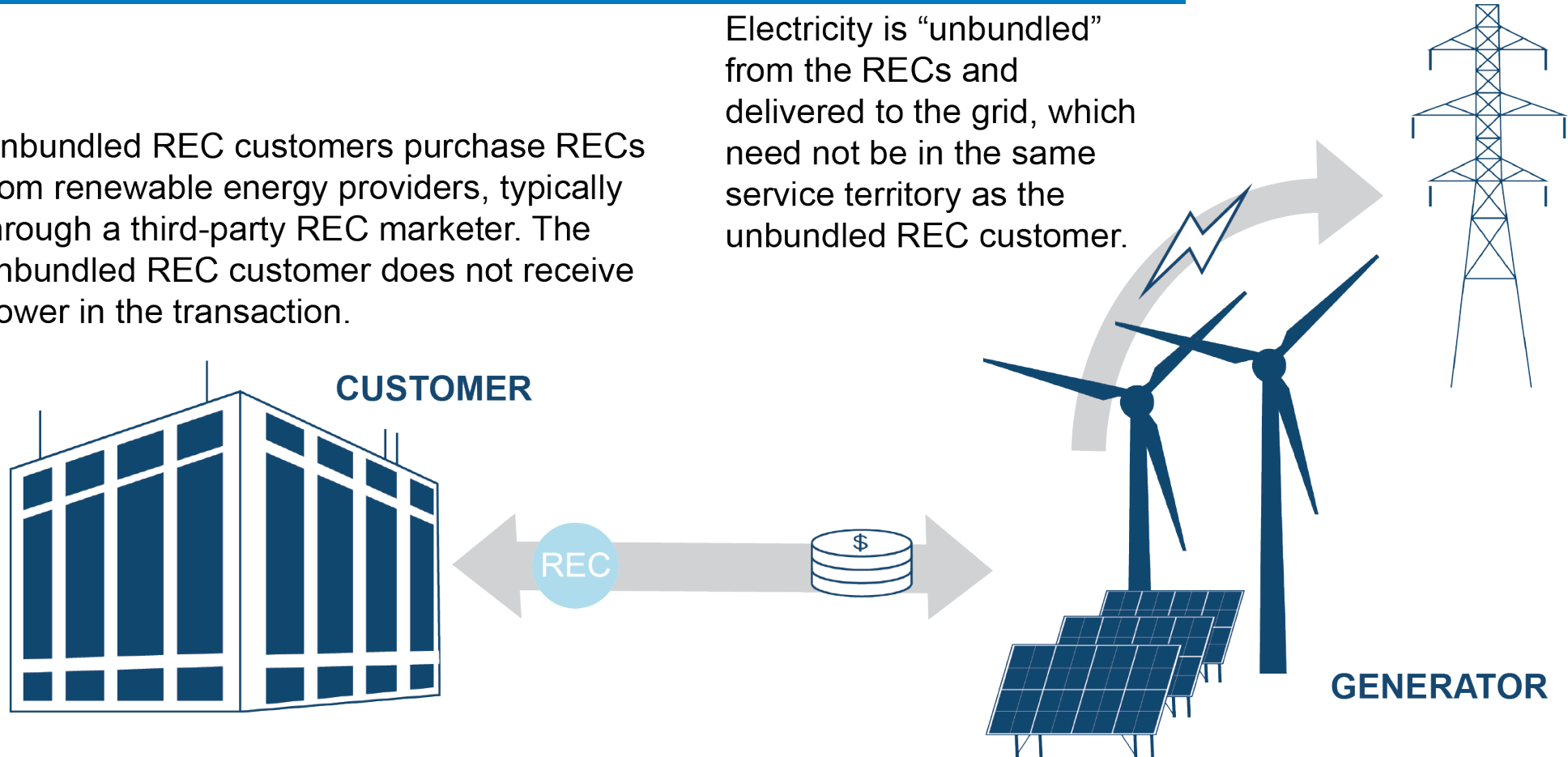
Basic competitive supplier sales structure

Specific program structures vary

Unbundled RECs

Unbundled REC customers purchase RECs from renewable energy providers, typically through a third-party REC marketer. The unbundled REC customer does not receive power in the transaction.

Electricity is “unbundled” from the RECs and delivered to the grid, which need not be in the same service territory as the unbundled REC customer.



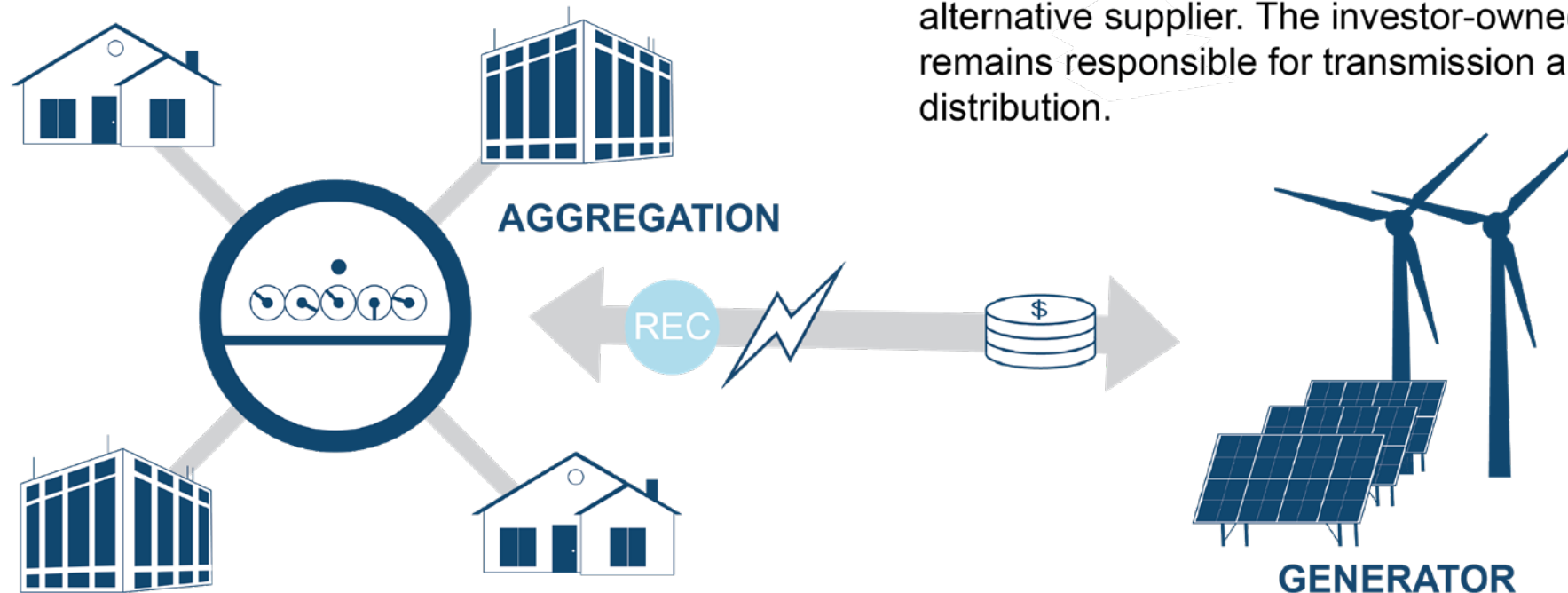
Basic unbundled RECs sales structure

Specific program structures vary

Community Choice Aggregation

A CCA effectively “aggregates” the electricity demand of many customers (residential and non-residential) in order to procure electricity from an alternative supplier.

CCA customers “switch” from an incumbent investor-owned utility to a local government supplier with a green power product. The CCA purchases electricity and RECs from an alternative supplier. The investor-owned utility remains responsible for transmission and distribution.

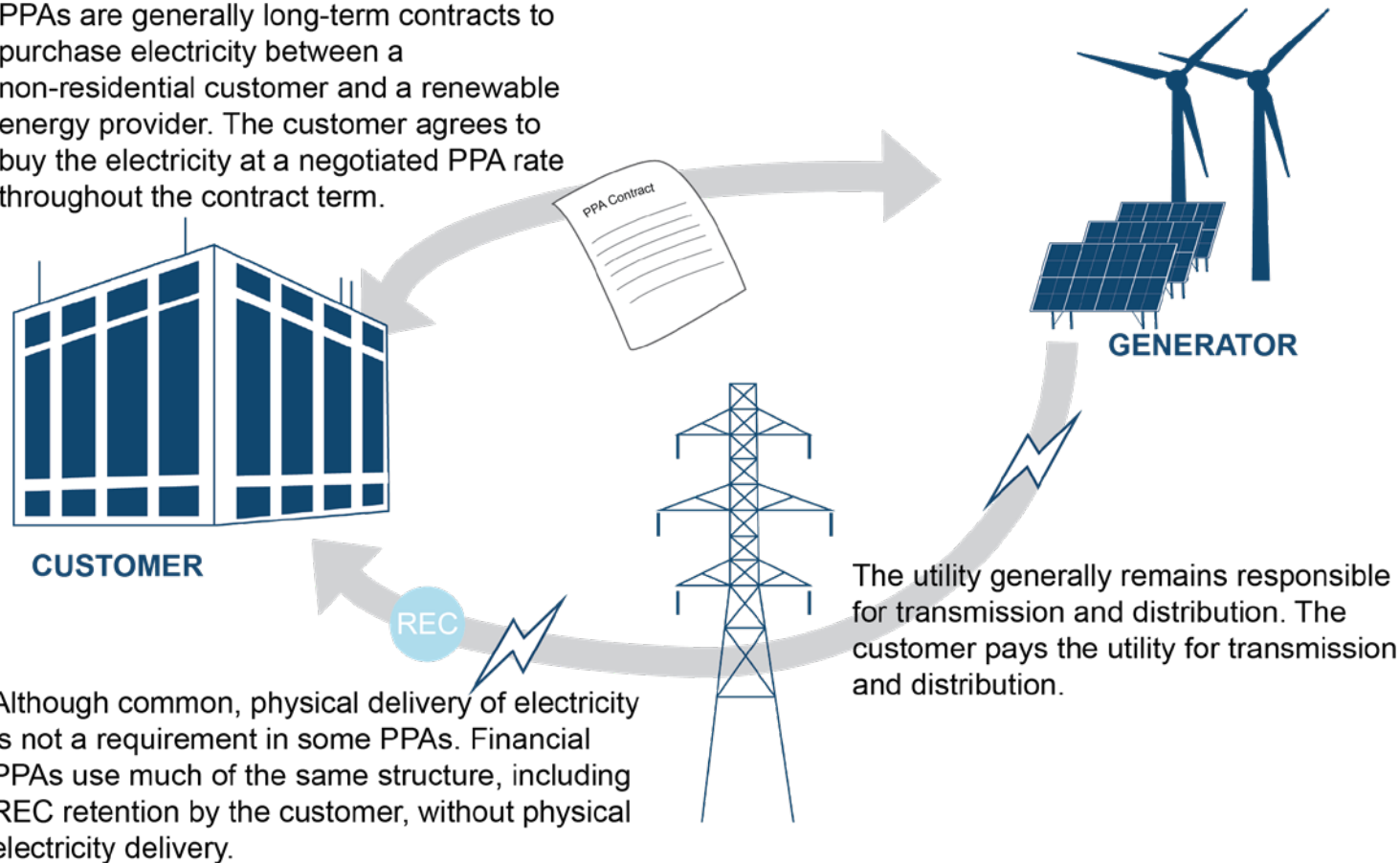


Basic CCA structure

Specific program structures vary

Power Purchase Agreements

PPAs are generally long-term contracts to purchase electricity between a non-residential customer and a renewable energy provider. The customer agrees to buy the electricity at a negotiated PPA rate throughout the contract term.



Basic PPA structure

Specific program structures vary