PRE-CONFERENCE WORKSHOP: VOLUNTARY RENEWABLE ELECTRICITY MARKETS 101

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Wednesday, Sep 3 1:30–3:00 PM

Renewable Energy Markets™ 2025

About Center for Resource Solutions

Non Governmental Organization (NGO) creating policy and market solutions to advance sustainable energy since 1997.

- Expert assistance resource for corporate buyers
- Renewable energy and climate policy
  - Clean Energy Accounting Project (CEAP)
- Renewable Energy Markets annual conference
- Green-e® certification for suppliers and users of renewable energy, carbon offsets and biomethane in the voluntary market

The Basics.

Renewable Resource Types

- Solar
- Wind
- Geothermal
- Biomass
- Hydroelectric

Capacity (MW) vs. Output (MWh)

Measuring Energy

1 Megawatt hour = 1000 Kilowatt hours

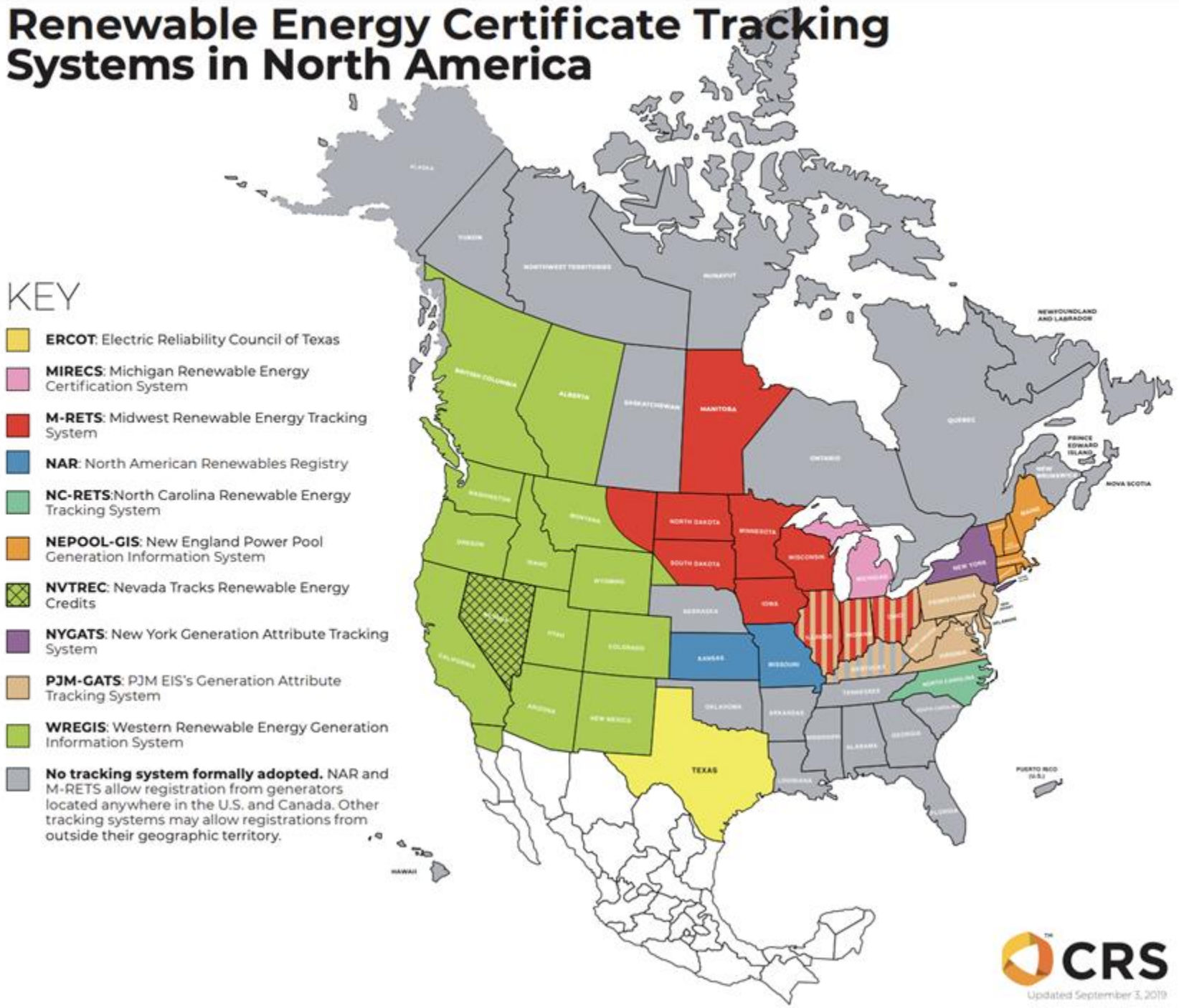
Graphic Source: Climate Council
https://www.climatecouncil.org.au/resources/the-difference-between-installed-capacity-mw-and-energy-generation-mwh/

RECs

are needed to:

1. Allocate and claim use of renewable generation on a shared grid
   — For both the voluntary and regulatory market
2. Avoid double counting and double claiming
3. Create a national market for renewable energy

Renewable Energy Certificate Tracking Systems in North America



Attribute Tracking

- Databases used to track, trade, and "retire" RECs
- Claims are substantiated with retired RECs
- Used for both voluntary and compliance markets

All renewable energy procurement methods involve RECs

Self Generation

(Lease and Own Generation)

- Onsite self-generation or lease
- Offsite self-generation or lease

Direct Purchasing

(Purchase from a Generator)

- Onsite PPA
- Offsite physical PPA
- Virtual PPA
- Direct attribute-only purchase

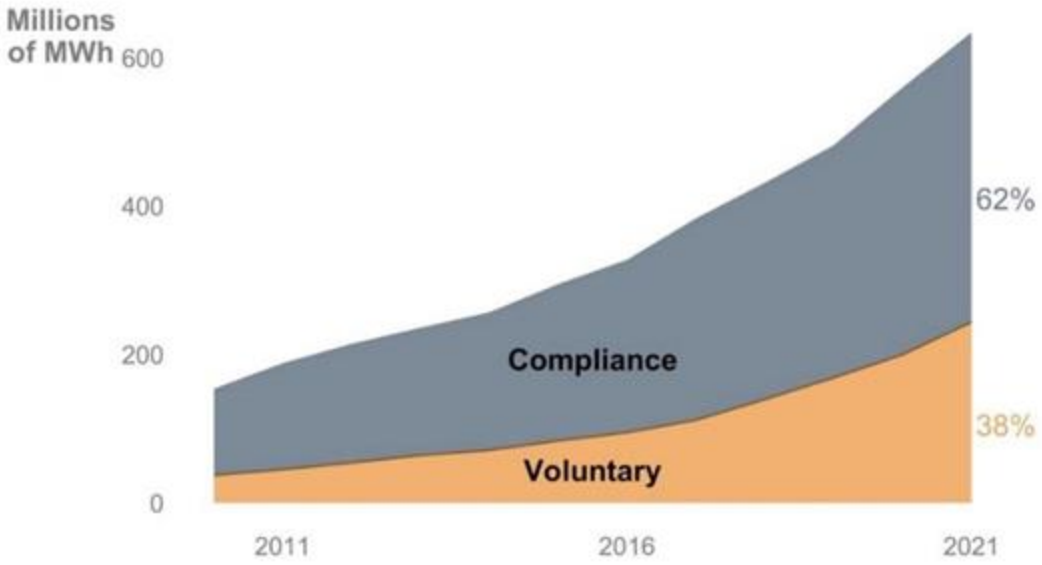
Retail Purchasing

(Purchase from a Supplier or Utility)

- Utility green pricing
- Competitive green power
- Community renewables
- Direct access tariff
- Unbundled certificates

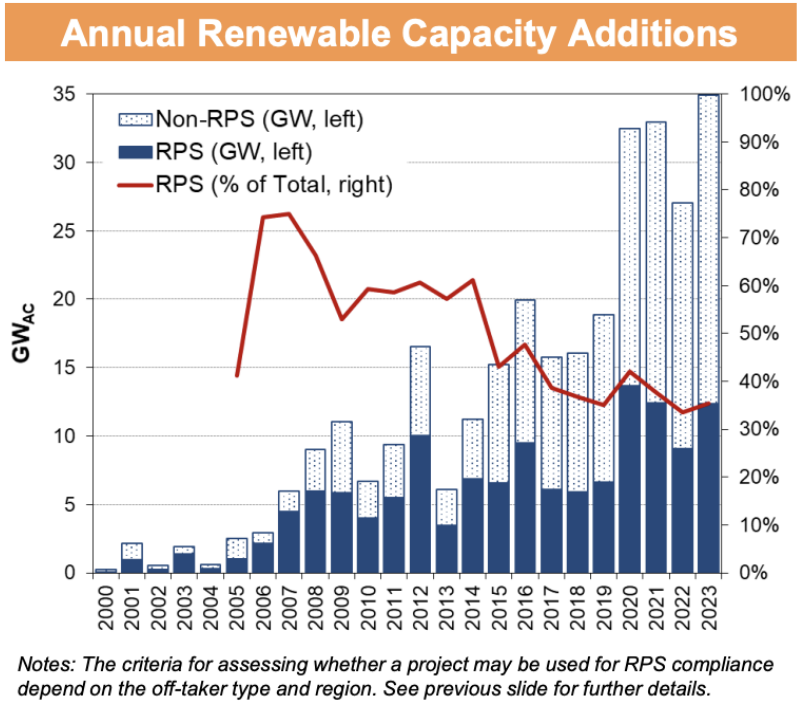
U.S. Voluntary Renewable Energy Market

Renewable energy sales in voluntary, compliance, and other markets, 2011–2021



Source: National Renewable Energy Laboratory
https://www.nrel.gov/docs/fy23osti/86162.pdf

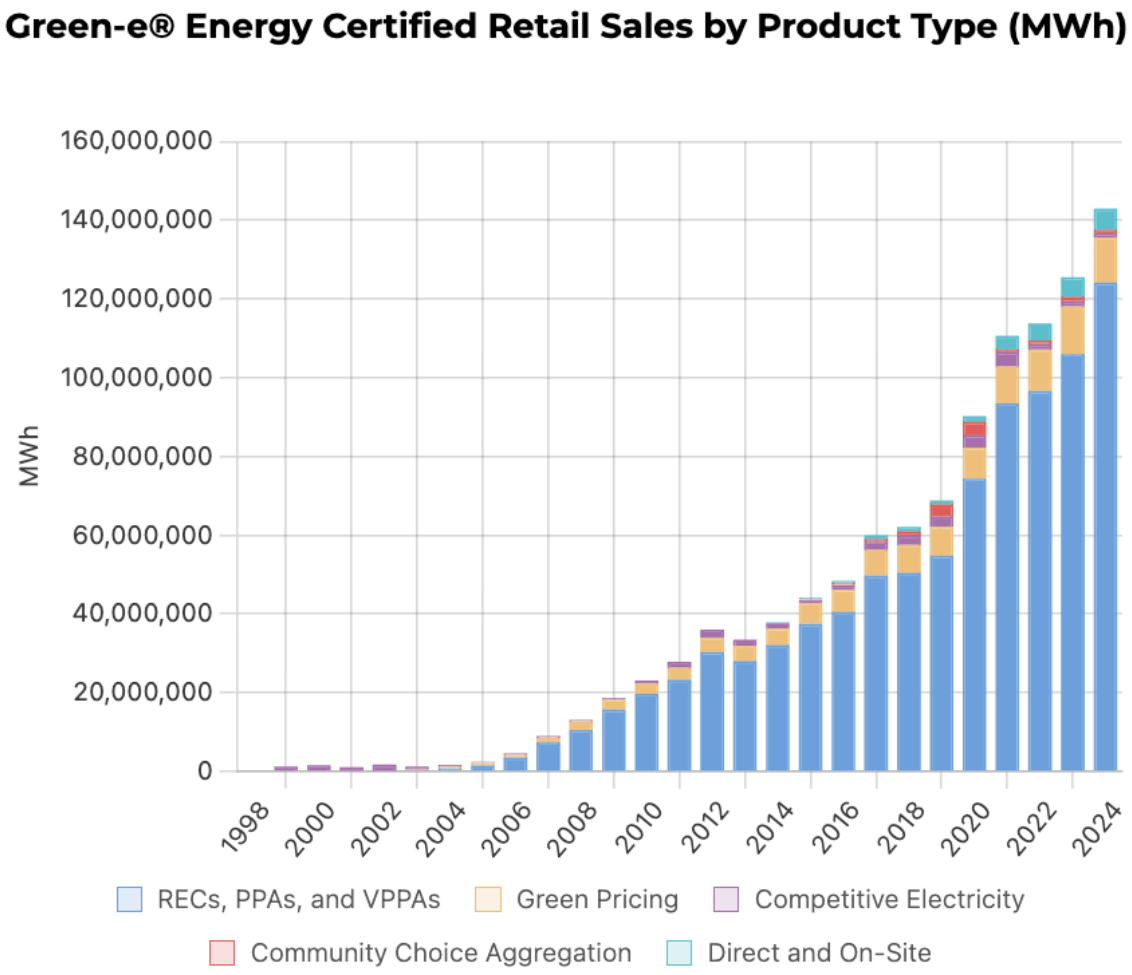
Renewable Capacity Additions, 2000–2023



Source: Lawrence Berkeley National Laboratory
https://eta-publications.lbl.gov/sites/default/files/lbnl_rps_ces_status_report_2024_edition.pdf

Green-e® Certification

Green-e® Certified Renewable Energy



Full Verification Report Data: www.resource-solutions.org/g2024/

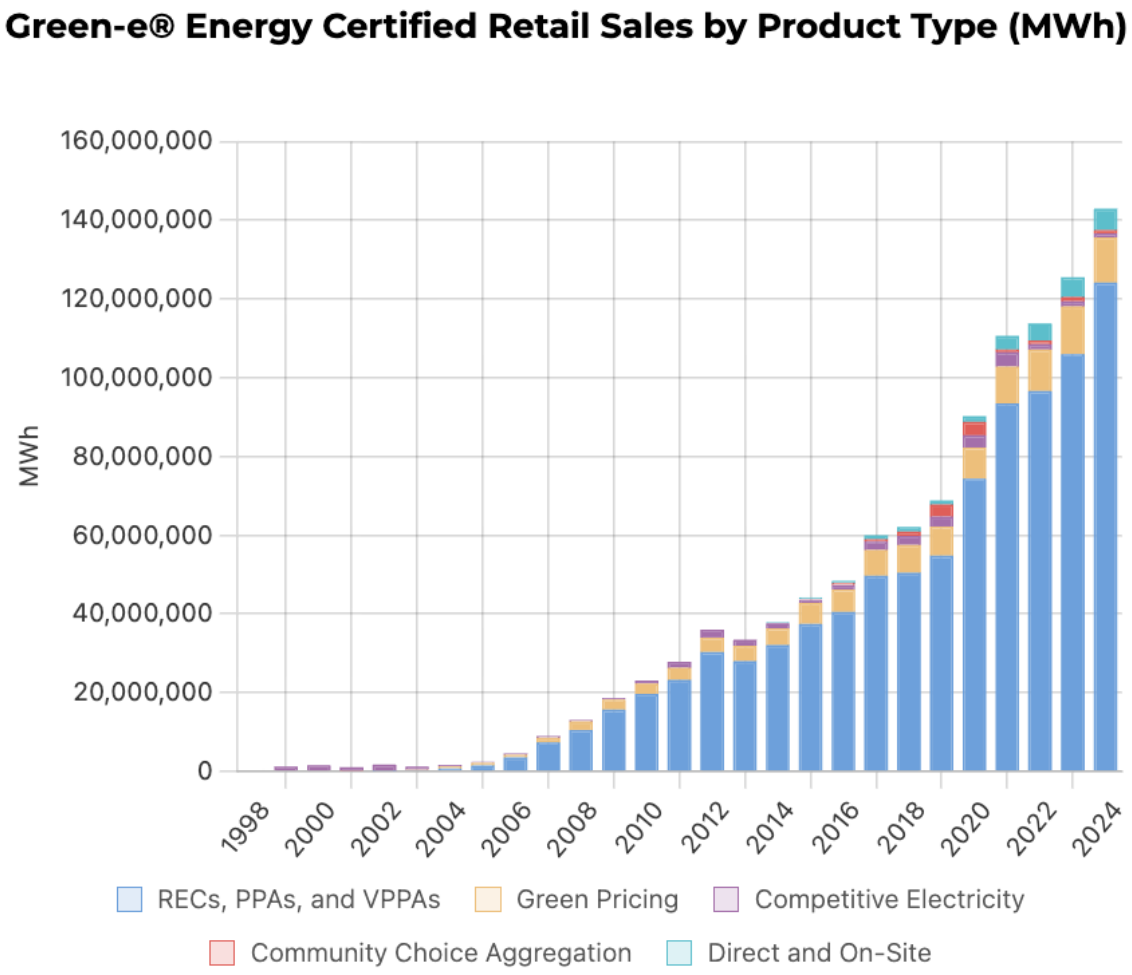
Buyer protections for voluntary renewable electricity purchases

- Green-e® Energy Standard and Code of Conduct
- Independent Governance Board
- From newer generators meeting environmental requirements
- Third-party Audit of:
  - REC retirements
  - Seller disclosures

Green-e®

CRS

Green-e® Certified Renewable Energy



Full Verification Report Data: www.resource-solutions.org/g2024/

Buyer protections for voluntary renewable electricity purchases

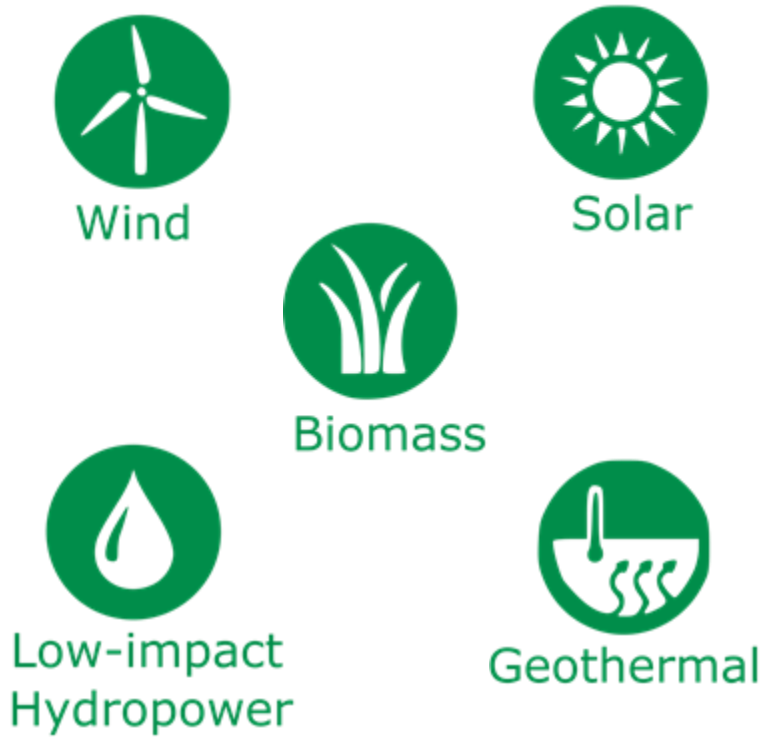
By the Numbers

- More than **143 million** MWh
- **~1 million** retail purchasers, of those, 78,000 were businesses
- New renewables

Green-e®

Supply Must Meet the Green-e® Standard

- 15-year “New Date”
- Must be surplus to regulation
- No double counting, selling or claiming
- GHG reduction benefits must be included
- State-specific requirements and restrictions
- Vintage requirements



6 MONTHS

12 MONTHS

3 MONTHS

Q&A

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NREL
NATIONAL RENEWABLE ENERGY LABORATORY

Voluntary Renewable Energy Markets 101 Workshop

Sushmita Jena
National Renewable Energy Laboratory
03 September 2025

Renewable Energy Markets Conference 2025
Houston, Texas

NREL at a Glance

4,026 Workforce, including:

- 2,968 regular/limited term
- 508 contingent workers
- 228 postdoctoral researchers
- 155 graduate student interns
- 167 undergraduate student interns

—as of 6/9/2025

World-class research expertise in:

- Energy Systems Integration
- Transportation and Fuels
- Buildings and Industry

Partnerships with:

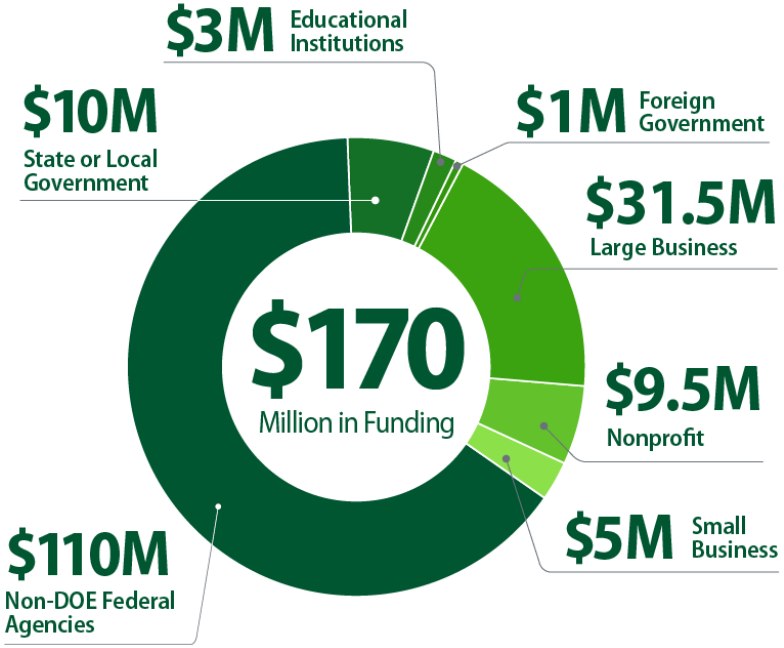
- Industry
- Academia
- Government

4 Campuses operate as living laboratories

Photo by Joe DeNero, NREL 89116

More Than 1,100 Active Partnerships in FY 2024

Agreements by Business Type



Funding by Business Type

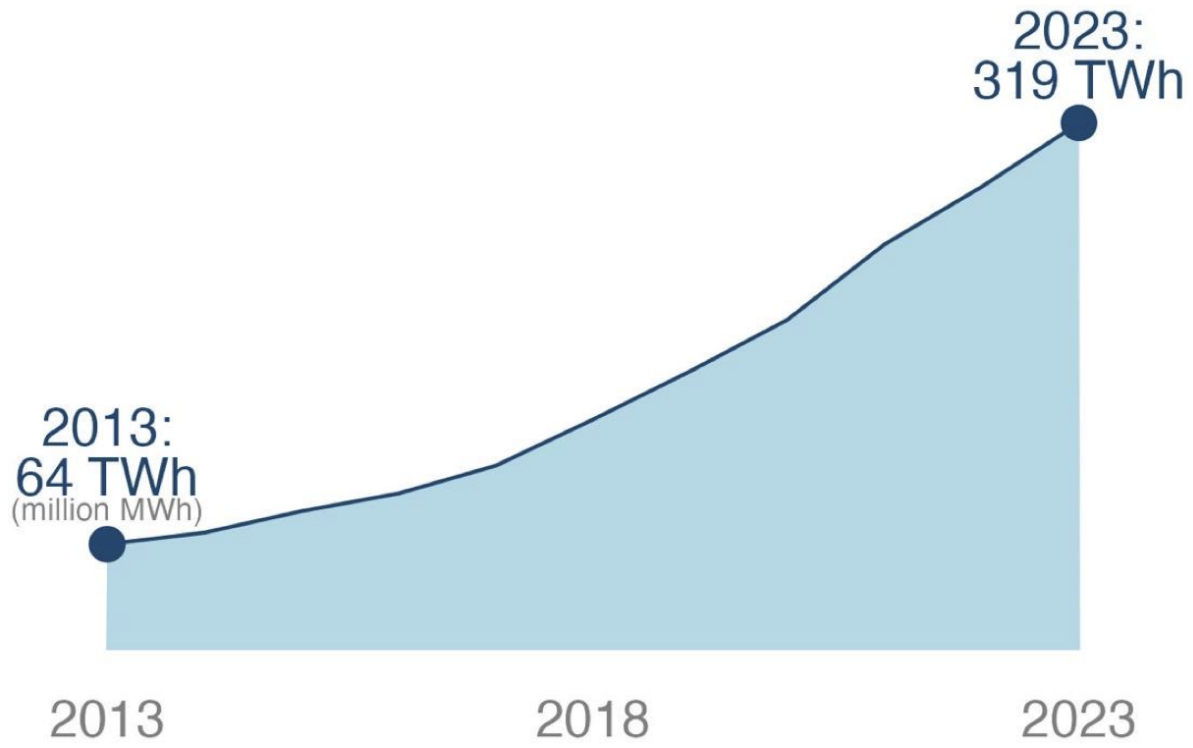
*Due to agreements involving multiple partners, the number of partners exceeds the 365 new agreements executed in FY24.

Voluntary Green Power Markets

- Voluntary green power refers to renewable electricity **voluntarily** purchased by **retail** electricity customers
- 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 RECs
  - Community choice aggregation
  - Power purchase agreements

The Big Picture

In 2023, about **9.7 million customers** procured about **319 million MWh** of renewable energy through green power markets.



Total green power sales 2013-2023

That represents about:

1 in 16
U.S. retail electricity customers

8%
of U.S. retail electricity sales

44%
of U.S. non-hydro renewable energy generation

Note: Estimates compiled from survey data and various data providers including the Energy Information Administration, Center for Resource Solutions, and Bloomberg New Energy Finance

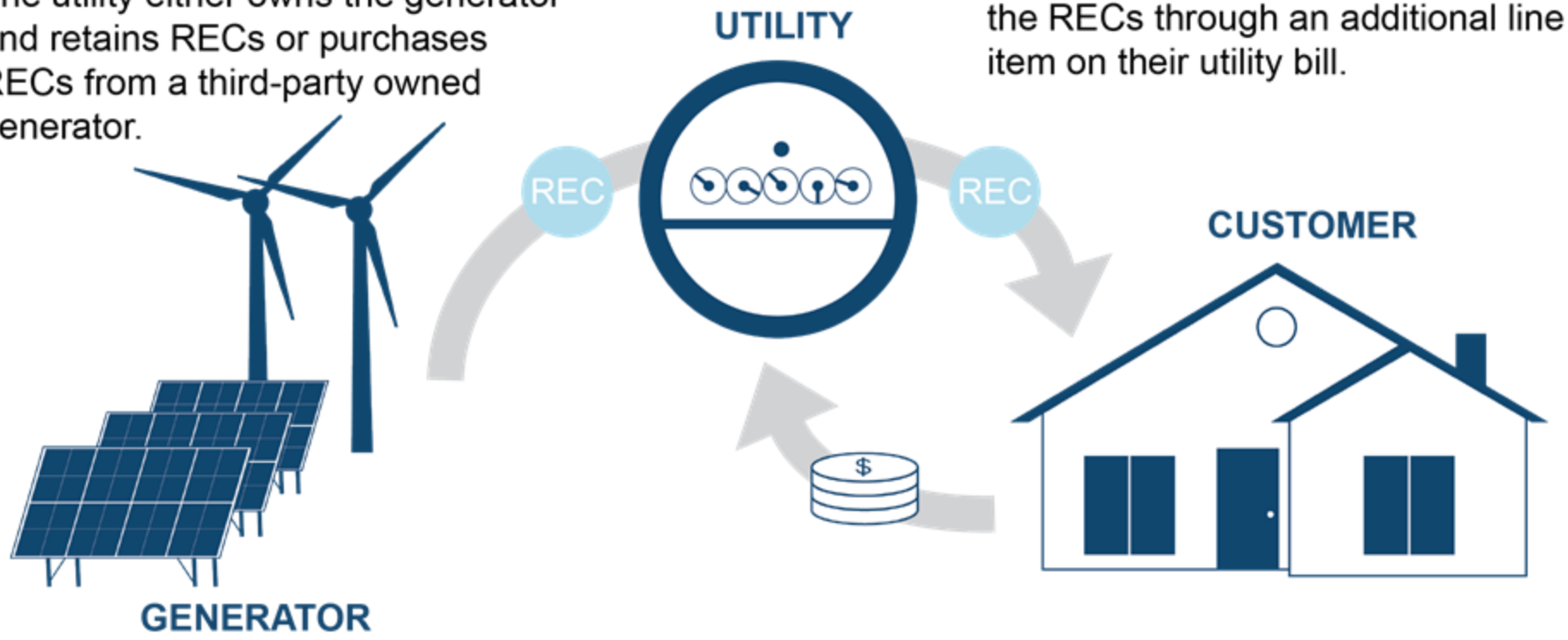
Source: Status and Trends in the U.S. Voluntary Power Market: 2023 Data
https://www.nrel.gov/docs/fy25osti/92289.pdf

The Procurement Options

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

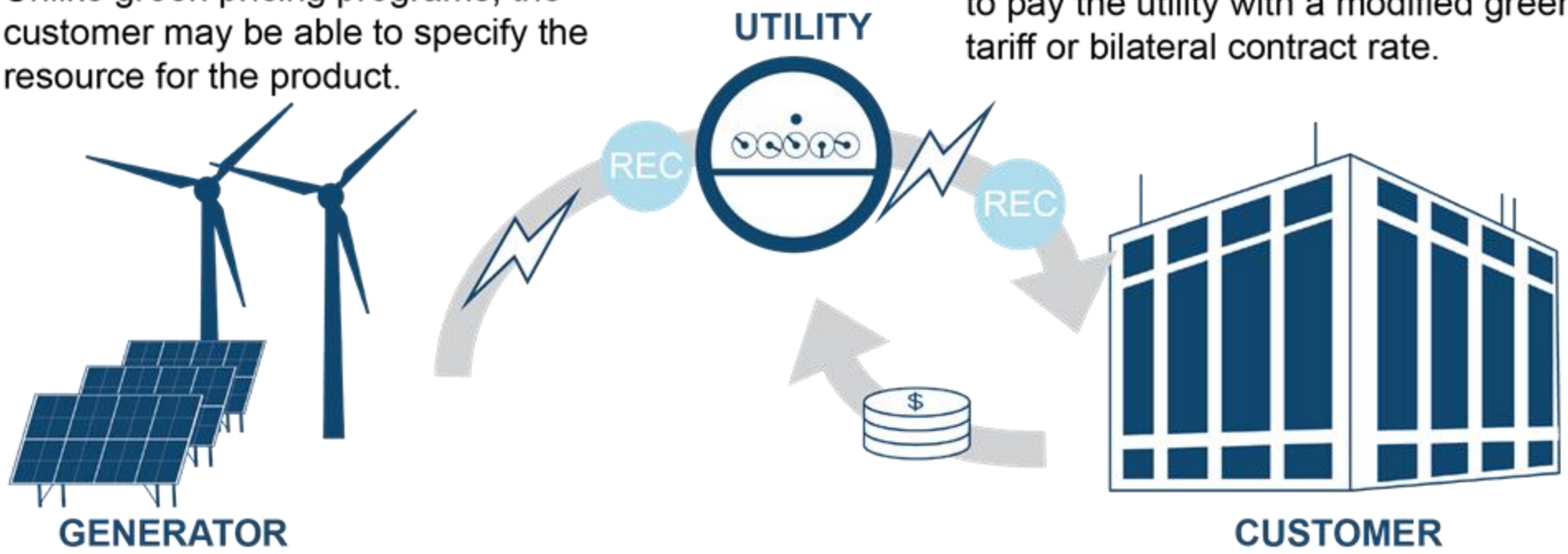
Specific program structures vary

Source: Status and Trends in the U.S. Voluntary Power Market: 2017 Data
https://docs.nrel.gov/docs/fy19osti/72204.pdf

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

Source: Status and Trends in the U.S. Voluntary Power Market: 2017 Data
https://docs.nrel.gov/docs/fy19osti/72204.pdf

Comparing Green Pricing & Renewable Contracts/Green Tariffs

Comparison of Green Pricing vs. Green Tariffs

- Green tariff products have a longer contract term and potential utility cost savings, while green pricing products involve a premium and shorter contract term.
- Some convergence of products is occurring (e.g. green tariffs that have some attributes of green pricing, like shorter contract lengths).

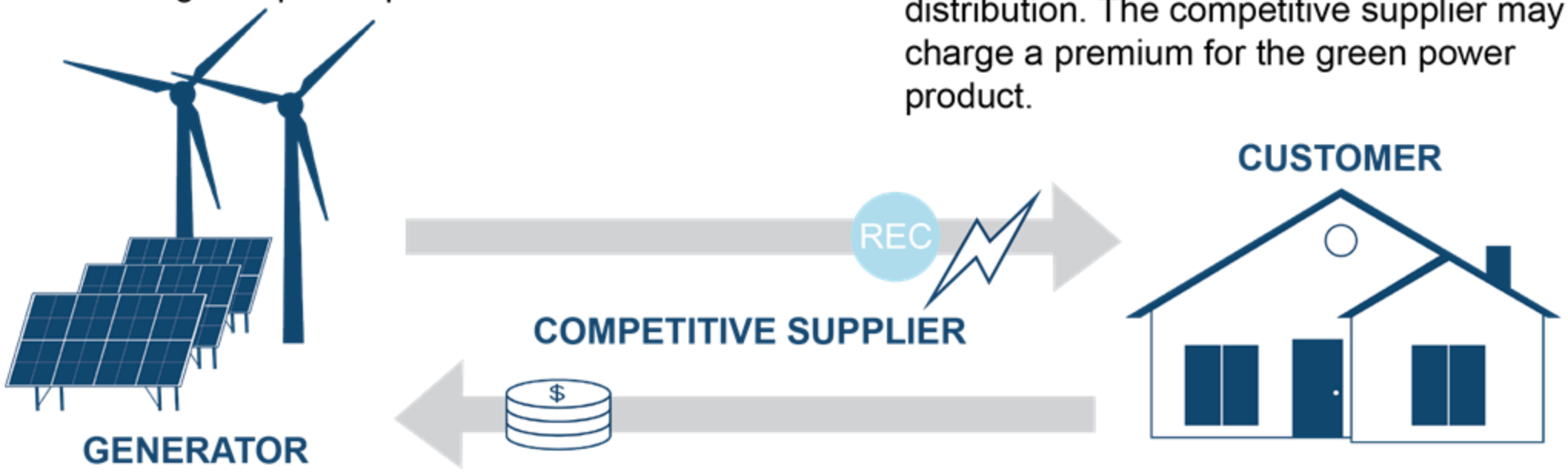
Program Characteristics	Green Pricing	Green Tariff
Cost savings potential	No, products average around 1.5 cents/kWh premium	May be cost-competitive, depending on structure and term
Price stability	No, continue to pay utility rate that is subject to change	Possible under certain program structures
Contract length	Shorter contract terms (typically month-to-month)	Longer agreements possible (10-20 years)
Ease of joining	Typically a simple sign-up process	Often limited availability, longer contract is potential barrier
Choice of RE resource	Utility determines	Customer may have input

Source: Utility Green Tariff Programs in the U.S.: Overview and Opportunities for Cost Savings
https://docs.nrel.gov/docs/fy19osti/74211.pdf

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

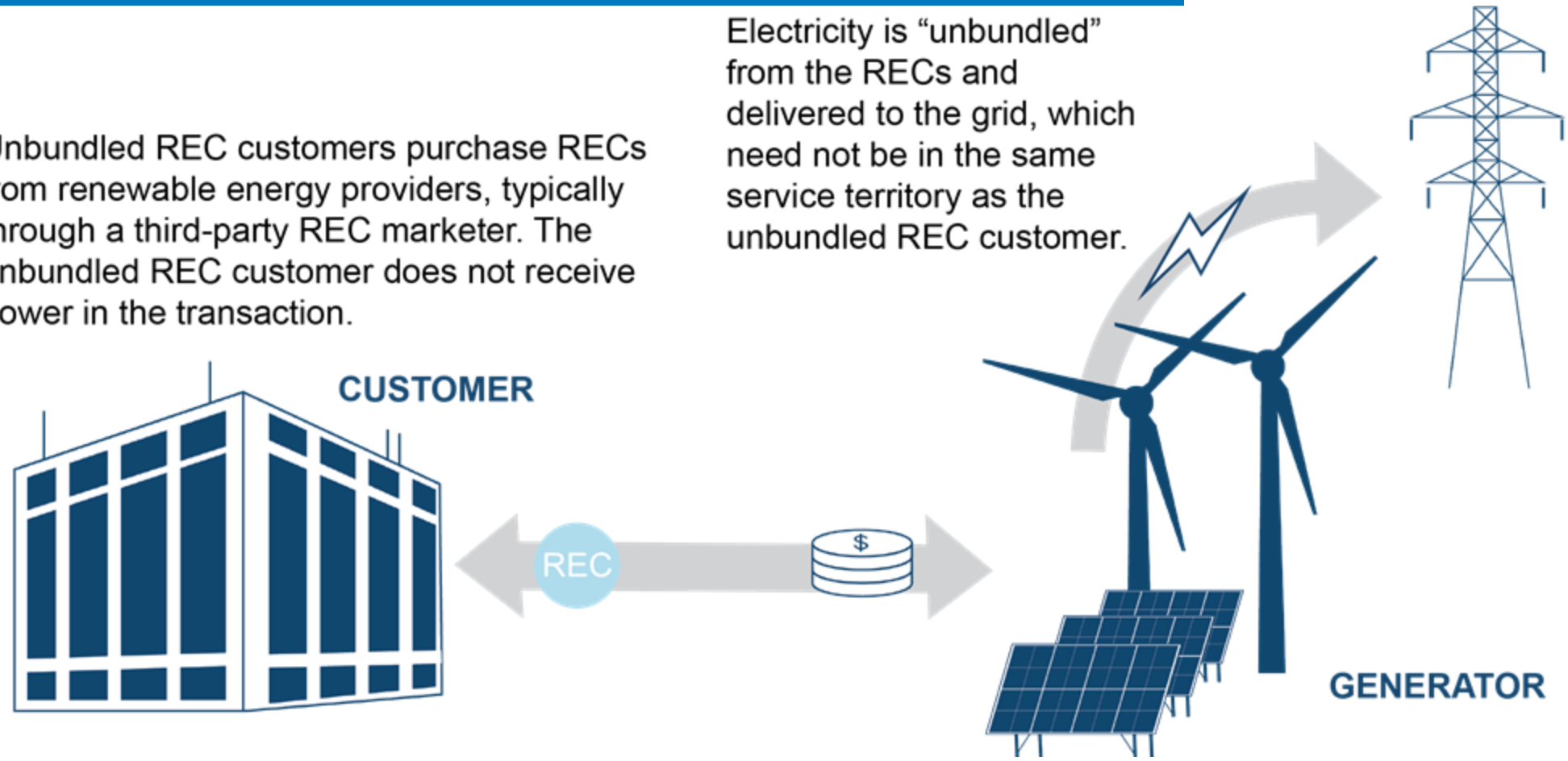
Specific program structures vary

Source: Status and Trends in the U.S. Voluntary Power Market: 2017 Data
https://docs.nrel.gov/docs/fy19osti/72204.pdf

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

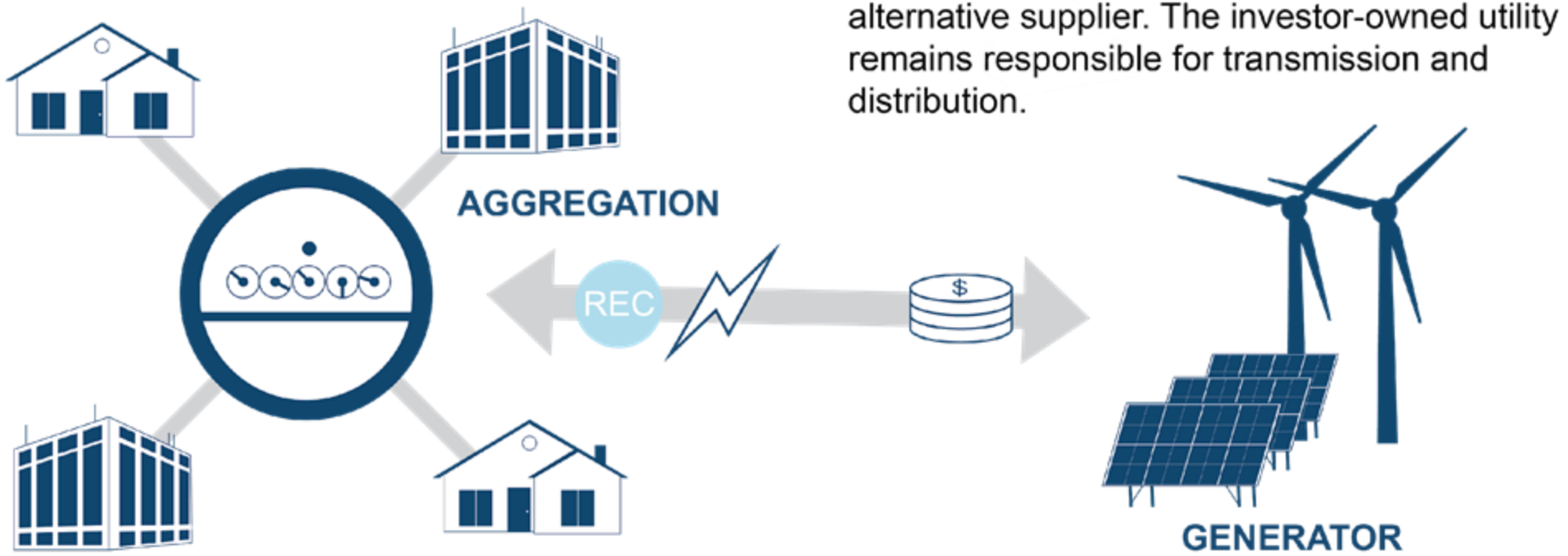
Specific program structures vary

Source: Status and Trends in the U.S. Voluntary Power Market: 2017 Data
https://docs.nrel.gov/docs/fy19osti/72204.pdf

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.

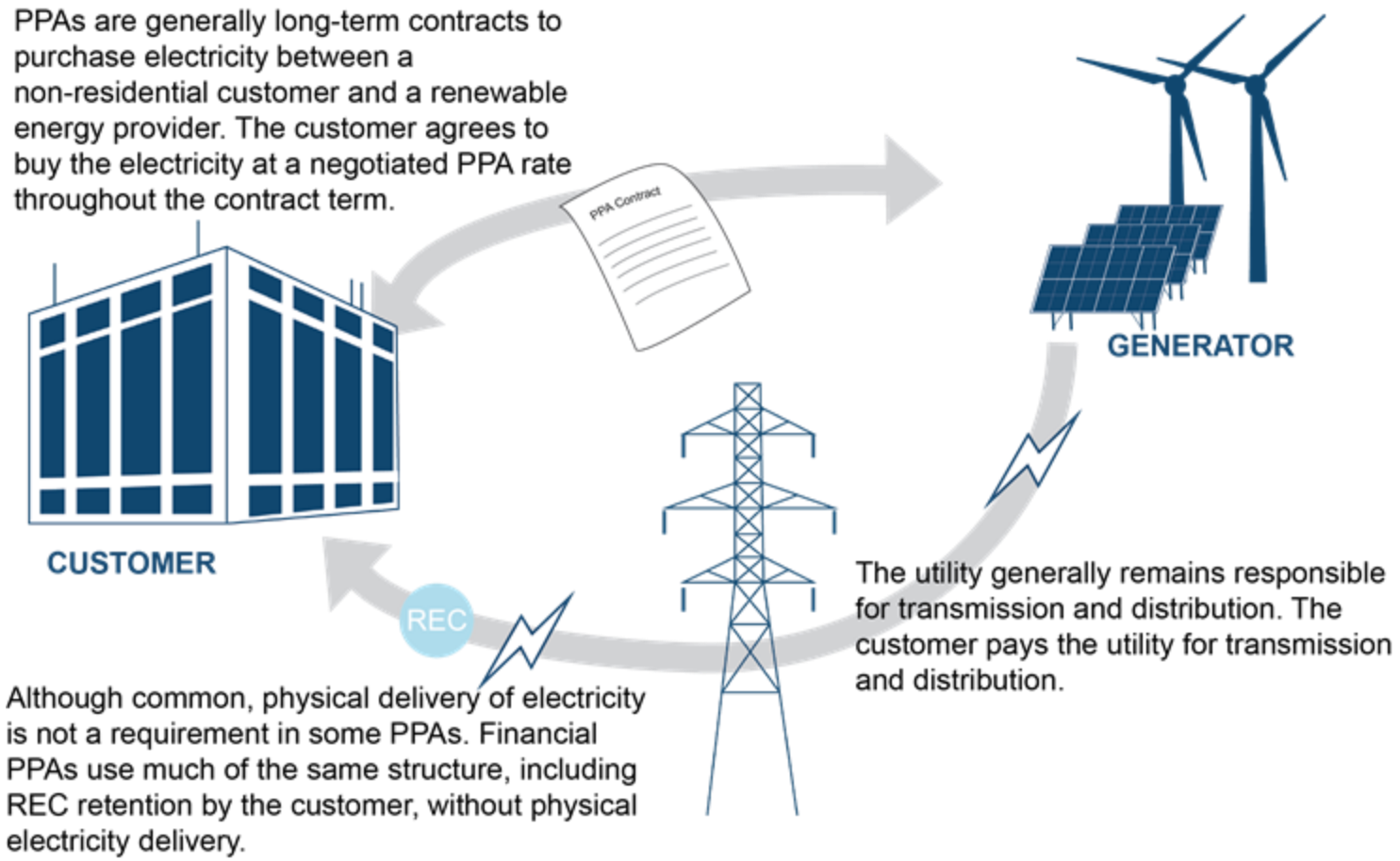


Basic CCA structure

Specific program structures vary

Source: Status and Trends in the U.S. Voluntary Power Market: 2017 Data
https://docs.nrel.gov/docs/fy19osti/72204.pdf

Power Purchase Agreements

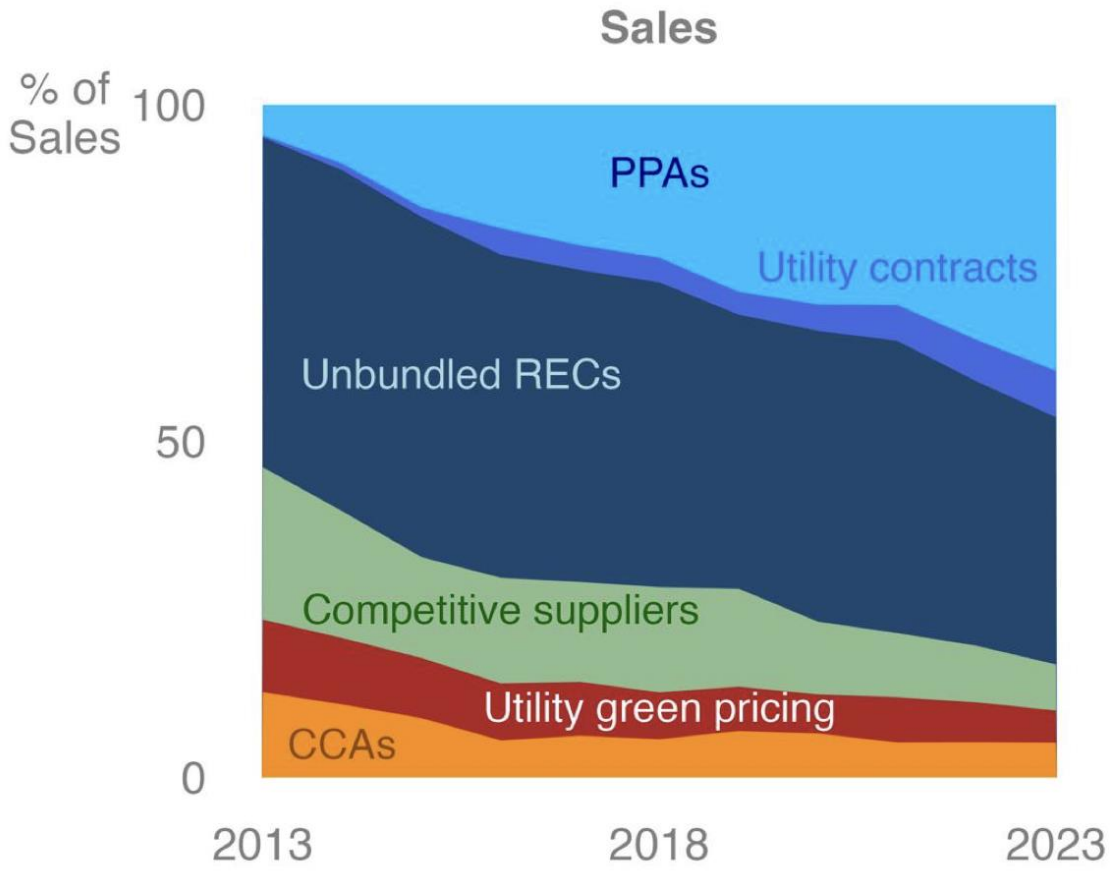


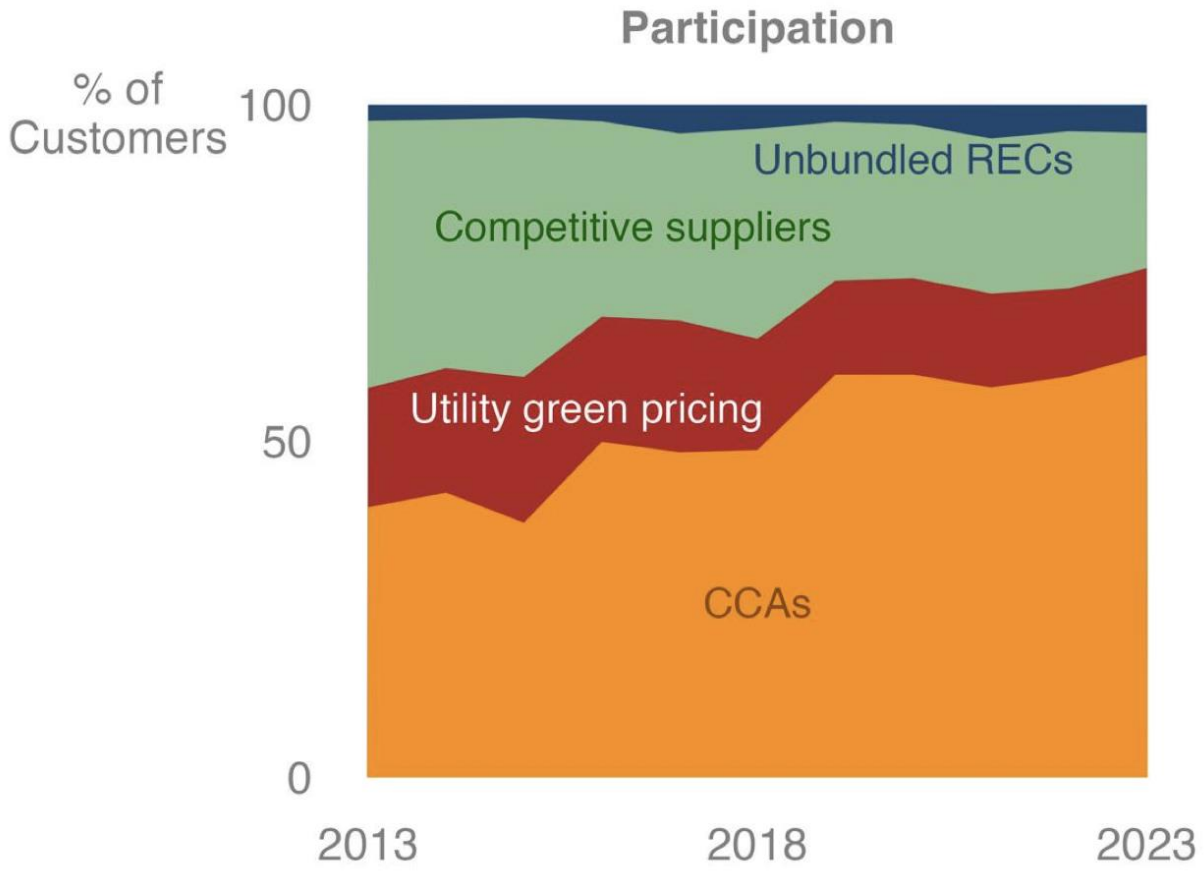
Basic PPA structure

Specific program structures vary

Source: Status and Trends in the U.S. Voluntary Power Market: 2017 Data
https://docs.nrel.gov/docs/fy19osti/72204.pdf

Green Power Sales and Customers by Procurement Options





Additional NREL Resources

Find additional resources at the NREL Voluntary Green Power Procurement landing page:

www.nrel.gov/analysis/green-power.html

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RENEWABLE ELECTRICITY CLAIMS WORKSHOP

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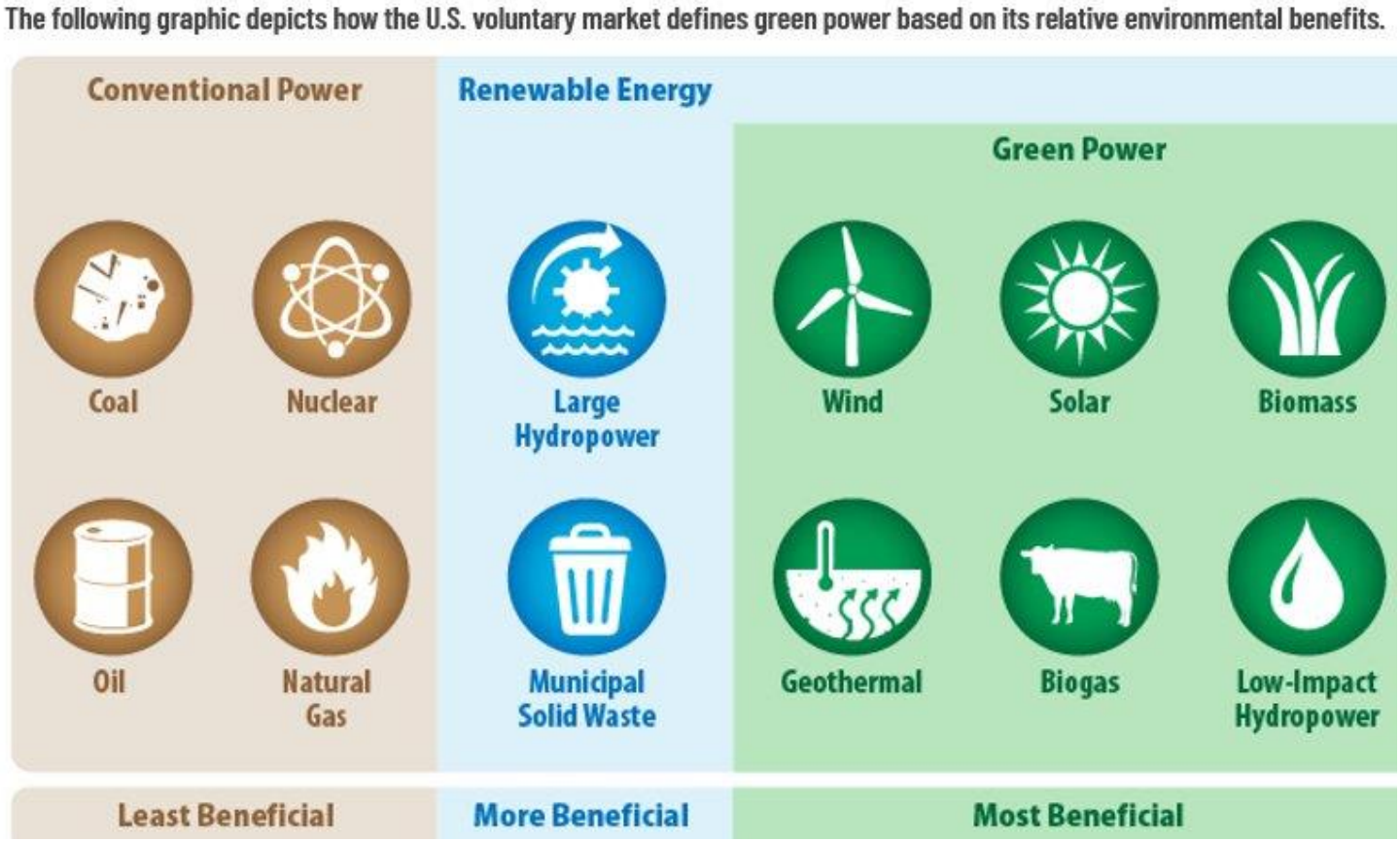
Agenda

01. Renewable Electricity Claims
02. Interactive Activity
03. Review Quiz
04. Q&A

Renewable Electricity Claims.

Energy Sources & Emissions

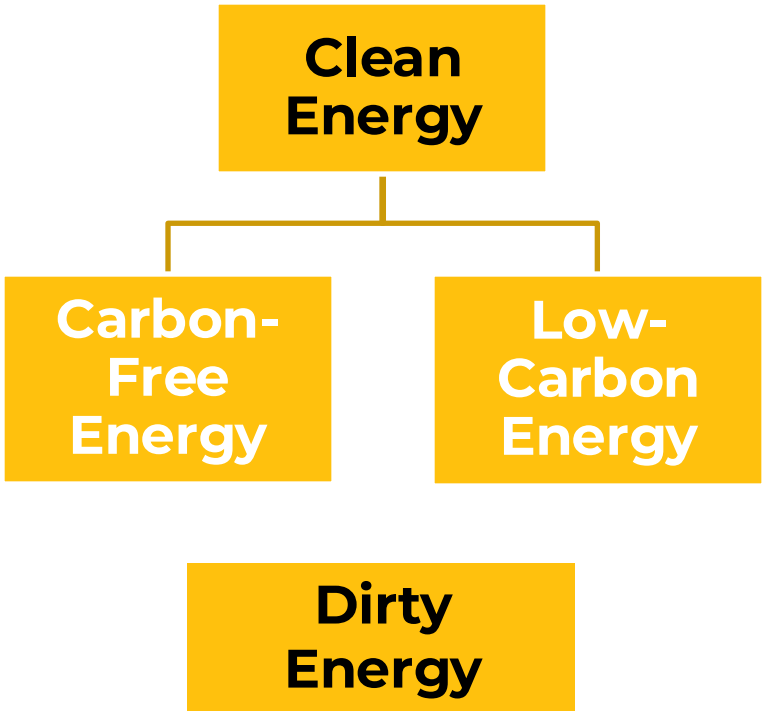
Sources



(U.S. Environmental Protection Agency, 2025a)

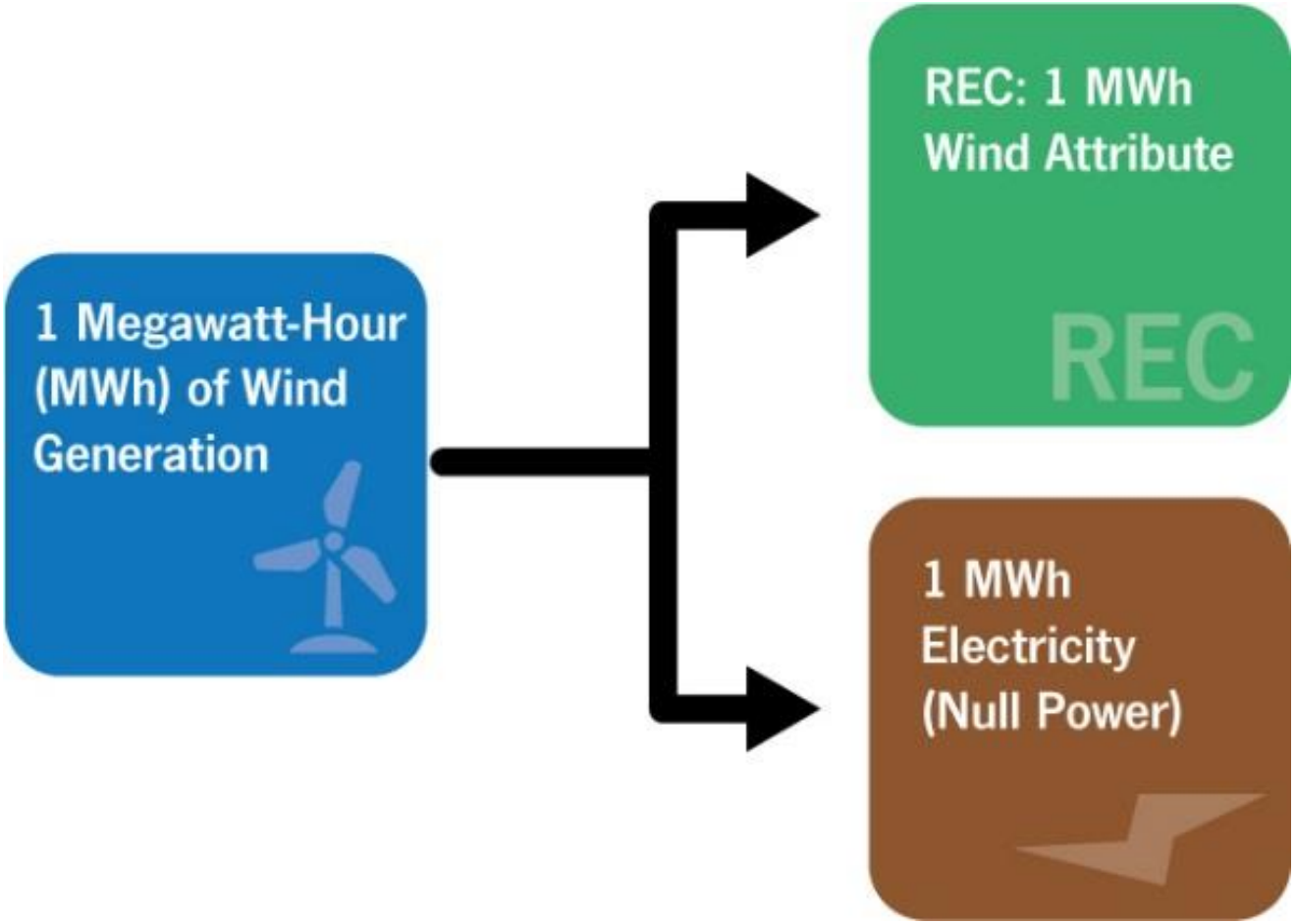
Emissions

Carbon Intensity:



(Morris, 2024)

Renewable Energy Certificates (RECs)



RECs are valuable for they are…

1. The currency of renewable energy markets (compliance & voluntary).
2. Backed by metering (Registries) and mutual trust (Certification).
3. Environmental attributes from RE generation.
4. The only instrument for RE delivery and usage/consumption **claims.**

Modified from Rosen (2024)

REC Ownership

- Contracts determine ownership
- If you don't own it, you can't claim it!

Environmental Attributes and Environmental Incentives.

Unless otherwise specified on **Exhibit 1**, Seller is the owner of all Environmental Attributes and Environmental Incentives and is entitled to the benefit of all Tax Credits, and Purchaser's purchase of electricity under this Agreement does not include Environmental Attributes, Environmental Incentives or the right to Tax Credits or any other attributes of ownership and operation of the System, all of which shall be retained by Seller. Purchaser shall cooperate with Seller in obtaining, securing and transferring all Environmental Attributes and Environmental Incentives and the benefit of all Tax Credits, including by using the electric energy generated by the System in a manner necessary to qualify for such available Environmental Attributes, Environmental Incentives and Tax Credits. Purchaser shall not be obligated to incur any out–of–pocket costs or expenses in connection with such actions unless reimbursed by Seller. If any Environmental Incentives are paid directly to Purchaser, Purchaser shall immediately pay such amounts over to Seller. To avoid any conflicts with fair trade rules regarding claims of solar or renewable energy use, Purchaser, if engaged in commerce and/or trade, shall submit to Seller for approval any press releases regarding Purchaser's use of solar or renewable energy and shall not submit for publication any such releases without the written approval of Seller. Approval shall not be unreasonably withheld, and Seller's review and approval shall be made in a timely manner to permit Purchaser's timely publication.

"**Environmental Attributes**" means any and all credits, benefits, emissions reductions, offsets, and allowances, howsoever entitled, attributable to the System, the production of electrical energy from the System and its displacement of conventional energy generation, including (a) any avoided emissions of pollutants to the air, soil or water such as sulfur oxides (SOx), nitrogen oxides (NOx), carbon monoxide (CO) and other pollutants; (b) any avoided emissions of carbon dioxide (CO_2), methane (CH_4), nitrous oxide, hydrofluorocarbons, perfluorocarbons, sulfur hexafluoride and other greenhouse gases (GHGs) that have been determined by the United Nations Intergovernmental Panel on Climate Change, or otherwise by law, to contribute to the actual or potential threat of altering the Earth's climate by trapping heat in the atmosphere; and (c) the reporting rights related to these avoided emissions, such as Green Tag Reporting Rights and Renewable Energy Credits. Green Tag Reporting Rights are the right of a party to report the ownership of accumulated Green Tags in compliance with federal or state law, if applicable, and to a federal or state agency or any other party, and include Green Tag Reporting Rights accruing under Section 1605(b) of The Energy Policy Act of 1992 and any present or future federal, state, or local law, regulation or bill, and international or foreign emissions trading program. Environmental Attributes do not include Environmental Incentives and Tax Credits. Purchaser and Seller shall file all tax returns in a manner consistent with this Section 5. Without limiting the generality of the foregoing, Environmental Attributes include carbon trading credits, renewable energy credits or certificates, emissions reduction credits, emissions allowances, green tags tradable renewable credits and Green-e® products.

(Solar Energy Finance Association, 2013)

RE Claims

What is a RE claim?

It is a statement that expresses or implies RE ownership.

Types of RE claims

1. Direct Emissions
2. Avoided Grid Emissions

Clear & Precise Claims

- Accurate amounts and equivalencies | **RECs ≠ Offsets**
- *”We purchase our electricity from a solar facility.”*

Direct or Express Claims

Example

A toy manufacturer places solar panels on the roof of its plant to generate power and advertises that its plant is “100% solar-powered.” The manufacturer, however, sells renewable energy certificates based on the renewable attributes of all the power it generates.

(U.S. Federal Trade Commission, 2025)

Direct or Express Claims

Example

A toy manufacturer places solar panels on the roof of its plant to generate power and advertises that its plant is “100% solar-powered.” The manufacturer, however, **sells renewable energy certificates** based on the renewable attributes of all the power it generates.

Even if the manufacturer uses the electricity generated by the solar panels, it has, by selling renewable energy certificates, transferred the right to characterize that electricity as renewable.

(U.S. Federal Trade Commission, 2025)

Implied Claims

Example 1

A toy manufacturer places solar panels on the roof of its plant to generate power and advertises that it hosts a renewable power facility.

(U.S. Federal Trade Commission, 2025)

Implied Claims

Example 1

A toy manufacturer places solar panels on the roof of its plant to generate power and advertises that it **hosts** a renewable power facility.

It's deceptive for this manufacturer to advertise that it "hosts" a renewable power facility because reasonable consumers likely interpret this claim to mean that the manufacturer uses renewable energy.

(U.S. Federal Trade Commission, 2025)

Implied Claims

Example 2

A university issues a press release about its recent electricity power purchase agreement for a on-campus, 1 MW solar array.

Press release highlights:

- University's goal of achieving carbon neutrality by 2030.
- University's new purchase of fixed price electricity from the on-campus solar facility.

Modified from Kent & Pasinella, (2016)

Implied Claims

Example 2

A university issues a press release about its recent **electricity power purchase agreement** for a on-campus, 1 MW solar array.

Press release highlights:

- University's goal of achieving carbon neutrality by 2030.
- University's new purchase of fixed price electricity from the on-campus solar facility.

Both claims are technically accurate, but a reasonable consumer would interpret as the university is using solar to reduce its carbon footprint.

Modified from Kent & Pasinella, (2016)

Deceptive Claim Risks

- **Legal:** Federal or State level scrutiny
- **Contractual & Financial:** Breach of contract
- **Brand & Reputation:** Increase in PR costs
- **RE Market:** Hinder RE market development

Modified from Rosen (2024)

Best Practices

Refer to industry experts, such as

- U.S. FTC Green Guides
- U.S. EPA Green Power Markets
- World Resources Institute's GHG Accounting Standards

Certification

- Ensures that REC product meets consumer and environmental standards

Verification

- Buyer protection against deception or fraud

Interactive Activity.

Instructions

1. Break up into small groups
2. Introduce yourselves to your group
3. Select a spokesperson
4. Select all appropriate answers for your scenario
5. Report back on which are the correct claims and why

Scenario 1. Company A has onsite solar system and owns associated RECs.

What claims can this company make about their use and generation of renewable electricity and associated greenhouse gas emissions? Select all that apply.

- We are using solar power
- Our solar panels are reducing our carbon footprint
- Our solar panels are helping to reduce our energy costs and generate revenue through the sale of the RECs
- Apply the zero-emissions rate conveyed by the REC to the purchased electricity consumption under Scope 2
- Apply grid average emissions rate or grid residual mix

(Kent & Pasinella, 2016)

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- **Apply the zero-emissions rate conveyed by the REC to the purchased electricity consumption under Scope 2**
- Apply grid average emissions rate or grid residual mix

(Kent & Pasinella, 2016)

Scenario 2. Company B has onsite solar system but does not own associated RECs.

What claims can this company make about their use and generation of renewable electricity and associated greenhouse gas emissions? Select all that apply.

- We are using solar power
- We are not using solar power, but our solar system is helping to green the grid
- Our solar panels are helping to reduce our energy costs and generate revenue through the sale of the RECs
- Apply the zero-emissions rate conveyed by the REC to your purchased electricity consumption
- Apply grid average emissions rate or grid residual mix

(Kent & Pasinella, 2016)

Scenario 2. Company B has onsite solar system but does not own associated RECs.

What claims can this company make about their use and generation of renewable electricity and associated greenhouse gas emissions? Select all that apply.

- We are using solar power
- **We are not using solar power, but our solar system is helping to green the grid**
- **Our solar panels are helping to reduce our energy costs and generate revenue through the sale of the RECs**
- Apply the zero-emissions rate conveyed by the REC to your purchased electricity consumption
- **Apply grid average emissions rate or grid residual mix**

(Kent & Pasinella, 2016)

Scenario 3. Company C has onsite solar and does not own associated Solar RECs, but purchases wind RECs equal to 100% of power needs.

What claims can this company make about their use and generation of renewable electricity and associated greenhouse gas emissions? Select all that apply.

- We are not using solar power, but our solar system is helping to green the grid
- Our solar panels are reducing our carbon footprint
- Our solar panels are helping to reduce our energy costs and generate revenue through the sale of the RECs
- Apply grid average emissions rate or grid residual mix
- Apply zero-emissions rate from the replacement wind RECs but not claim it to be of solar origin

(Kent & Pasinella, 2016)

Scenario 3. Company C has onsite solar and does not own associated Solar RECs, but purchases wind RECs equal to 100% of power needs.

What claims can this company make about their use and generation of renewable electricity and associated greenhouse gas emissions? Select all that apply.

- **We are not using solar power, but our solar system is helping to green the grid**
- Our solar panels are reducing our carbon footprint
- **Our solar panels are helping to reduce our energy costs and generate revenue through the sale of the RECs**
- Apply grid average emissions rate or grid residual mix
- **Apply zero-emissions rate from the replacement wind RECs but not claim it to be of solar origin**

(Kent & Pasinella, 2016)

Scenario 4. University D signs a 10 MW physical PPA of wind power (and associated RECs) with a yet-to-be developed off-site 100 MW system. Nine other institutions have similar 10 MW agreements and because of this, the project is now being built.

What claims can this company make about their use and generation of renewable electricity and associated greenhouse gas emissions? Select all that apply.

- We are using wind power
- We helped develop new renewable energy supply
- We are not using wind power, but our wind turbine system is helping to green the grid
- Apply the zero-emissions rate conveyed by the REC to your purchased electricity consumption
- Apply grid average emissions rate or grid residual mix

(Rosen, 2024)

Scenario 4. University D signs a 10 MW physical PPA of wind power (and associated RECs) with a yet-to-be developed off-site 100 MW system. Nine other institutions have similar 10 MW agreements and because of this, the project is now being built.

What claims can this company make about their use and generation of renewable electricity and associated greenhouse gas emissions? Select all that apply.

- **We are using wind power**
- **We helped develop new renewable energy supply**
- We are not using wind power, but our wind turbine system is helping to green the grid
- **Apply the zero-emissions rate conveyed by the REC to your purchased electricity consumption**
- Apply grid average emissions rate or grid residual mix

(Rosen, 2024)

Scenario 5. Company E signs a 20-year physical PPA with a new off-site solar system, but per agreement the developer owns RECs for the first 5 years, and Company E will purchase replacement nationally sourced wind RECs. For years 5-20 Company E will own the RECs.

What claims can Company E claim about their use and generation of renewable energy and associated greenhouse gas emissions for years 1-5 AND years 5-20? Select all that apply.

- We are using solar power/powered by solar energy
- We are not using solar power, but our solar PPA is helping to green the grid
- The solar panels reduce our carbon footprint
- Apply zero emissions rate from the replacement wind RECs but not claim it to be of solar origin
- Apply the zero-emissions rate conveyed by the solar RECs to your purchased electricity consumption

(Rosen, 2024)

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(Rosen, 2024)

Additional Resources

- **EPA Green Power Market Claims** https://www.epa.gov/green-power-markets/environmental-claims
- **Center for Resource Solutions (CRS) REC Claims and Ownership** http://resource-solutions.org/learn/rec-claims-and-ownership
- **National Association of Attorneys General (NAAG) Environmental Marketing Guidelines for Electricity** https://19january2021snapshot.epa.gov/greenpower/national-association-attorneys-general-environmental-marketing-guidelines-electricity_.html
- **Vermont Attorney General's Office Guidance for Third-Party Solar Projects** https://ago.vermont.gov/wp-content/uploads/2018/01/Guidance-on-Solar-Marketing.pdf
- **RE100 Making Credible Renewable Energy Usage Claims** https://www.there100.org/sites/re100/files/2024-12/RE100%20Making%20Credible%20Claims.pdf
- **Solar Energy Industries Association Solar Business Code** https://seia.org/wp-content/uploads/2024/07/SEIA-Solar-Business-Code_Sep2015.pdf

Review Quiz.

Question 1

What is a REC?

1. Something, like a vehicle or a building, that is badly damaged
2. A solid collection of mineral grains that have cemented together
3. A tradeable, market-based instrument that represents the legal property rights to the “renewable-ness”—or non-power (i.e., environmental) attributes—of renewable electricity generation.

(Rosen, 2024)

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(Rosen, 2024)

Question 2

What is a RE claim?

1. It is a statement that expresses or implies RE ownership.
2. A statement that can be made by all parties in the supply chain.
3. A statement implying emissions reduction.

(Rosen, 2024)

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Question 3

How does a buyer get protection against deception or fraud?

1. By buying RECs
2. By third-party verification
3. By mutual trust

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Question 4

What consumer best-practice ensures that the RECs purchased meet industry standards?

1. Purchasing Green-e certified products
2. That they are purchased via cryptocurrency
3. That they are the prettiest REC in the market

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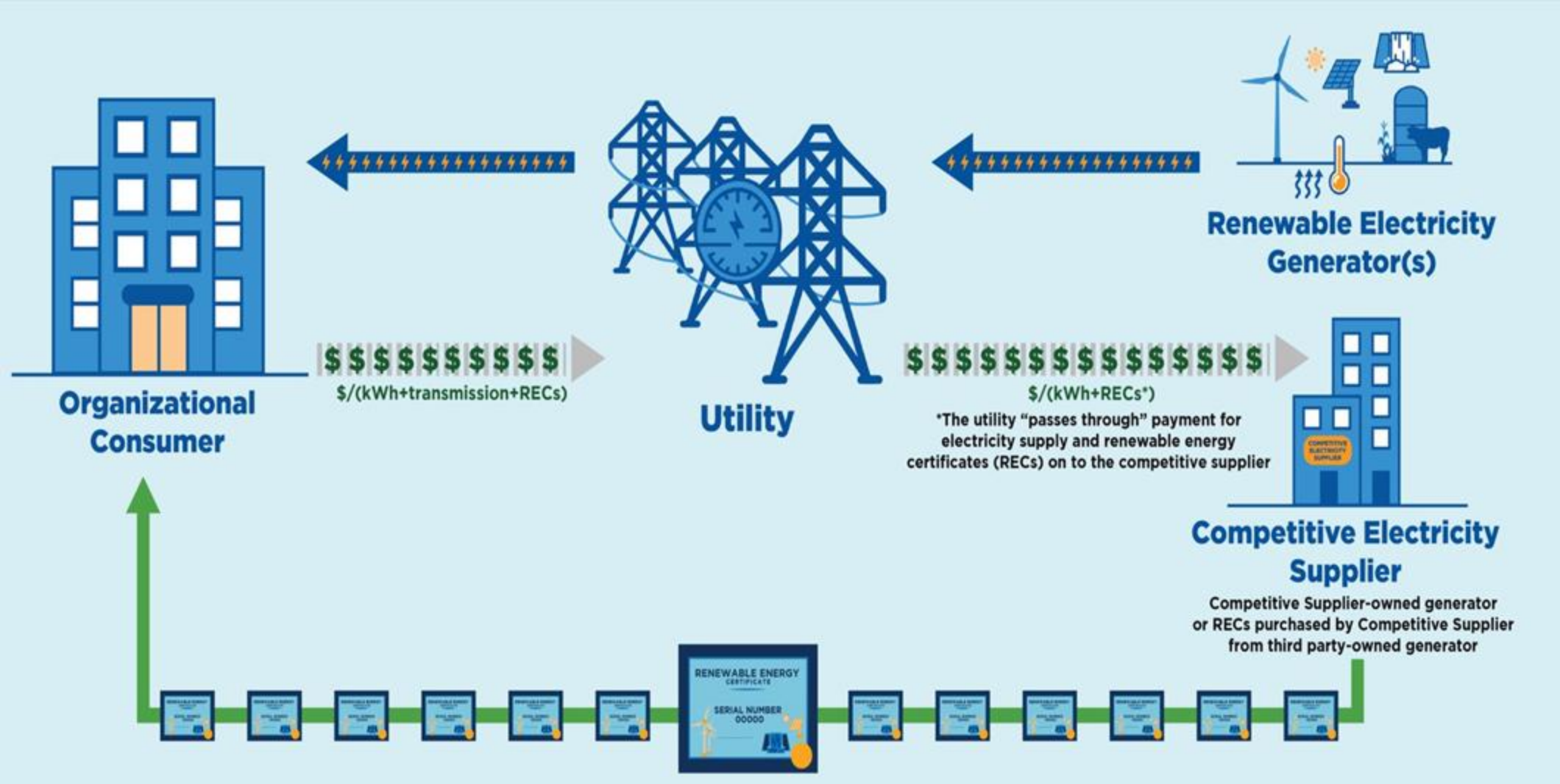
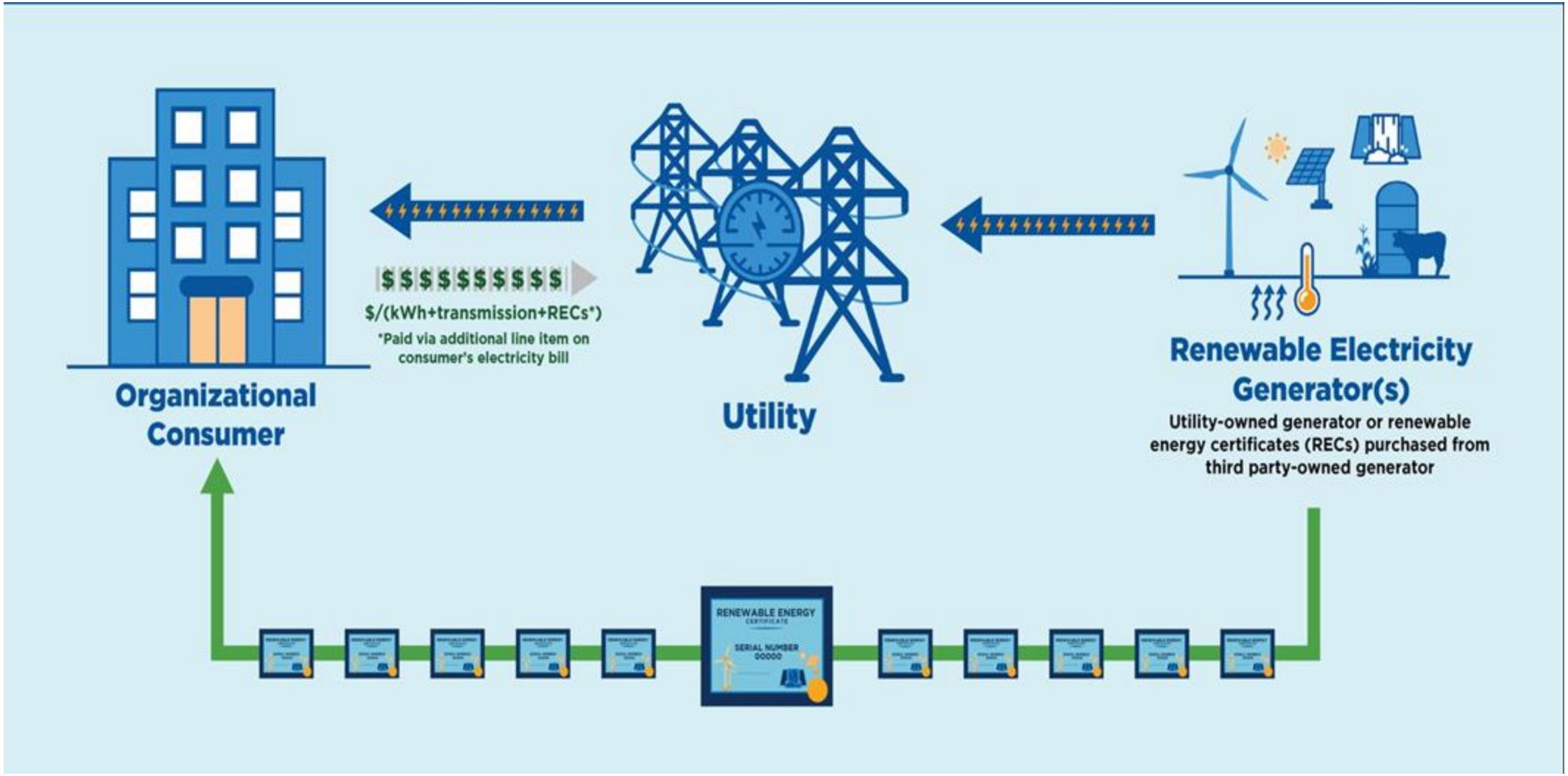
Question 5



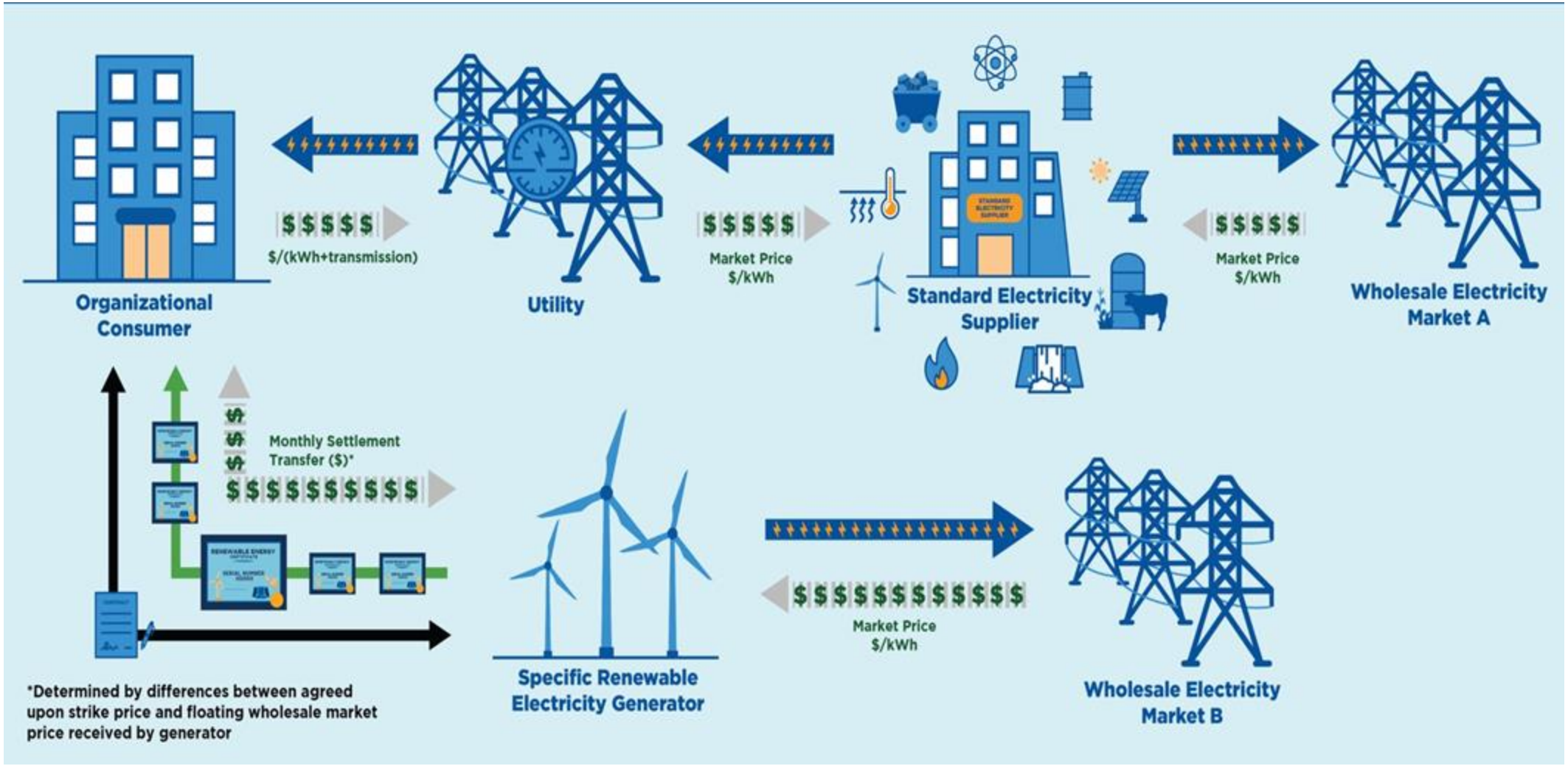
(U.S. Environmental Protection Agency, 2025b)

Question 6



(U.S. Environmental Protection Agency, 2025b)

Bonus Question



(U.S. Environmental Protection Agency, 2025b)

Disclaimer

Parties should consult their attorneys concerning compliance with laws regarding marketing, advertising, and consumer protection. The examples here are for illustration purposes only.

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Q&A

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