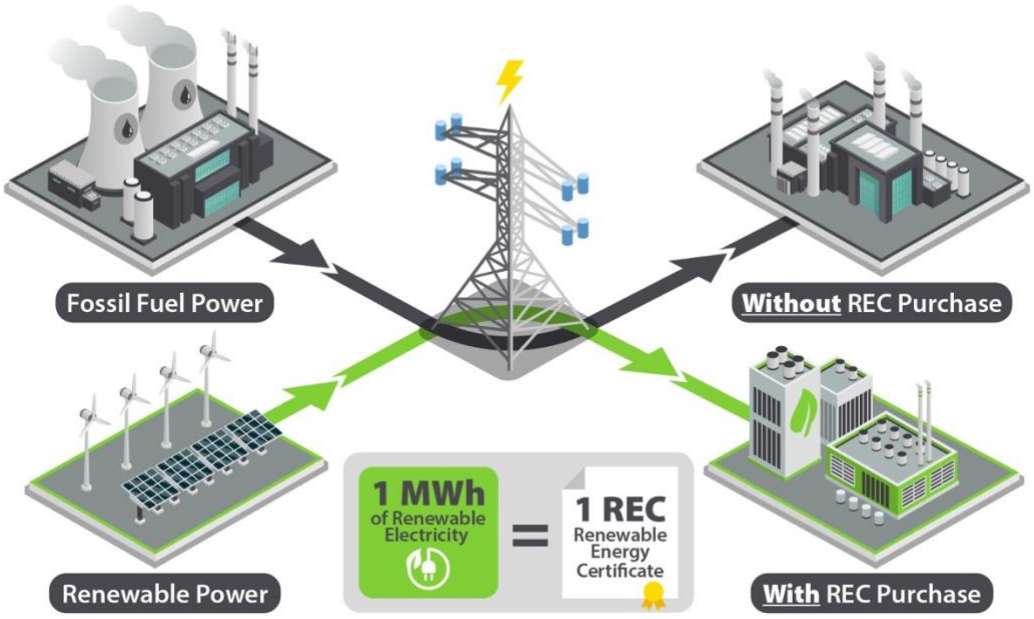
This document is designed as an overview of renewable energy certificates in the US renewable energy market. For more information about renewable energy technologies (e.g., solar energy, wind power, water power) and other renewable electricity supply options (e.g., power purchase agreements, green tariffs), please reference the Renewable Energy Guidance for Industry 2022[1] and the Renewable Energy Guidance for Industry 2022: Supplemental Document.[2]

1. What Are Renewable Energy Certificates?

A renewable energy certificate (REC), also known as a renewable energy credit or a green tag, is a tradable, nonphysical commodity in the US energy market that represents certain attributes associated with 1 MWh of generated renewable energy, including the type of renewable energy, the emissions rate associated with that energy, and the grid to which the energy was delivered.[3,4]



- **How are RECs created and tracked?**
  Renewable power has two key aspects: (1) the generated electricity itself and (2) the environmental attributes of that electricity, which may then be monetized and sold separately on the open market. Generated electricity is sold to the grid or can be delivered directly to consumers. The environmental attributes can be sold as RECs. They may be sold with the electricity as ***bundled*** RECs or sold independently as ***unbundled*** RECs.

[1] Abbas, A., Price, C., Nandy, P., and Wenning, T. 2022. *Renewable Energy Guidance for Industry.* ORNL/SPR-2021/2026. Oak Ridge National Laboratory, Oak Ridge, TN. https://doi.org/10.2172/2251662.
[2] Abbas, A., Price, C., Nandy, P., and Wenning, T. 2022. *Renewable Energy Guidance for Industry: Supplemental Document*. ORNL/SPR-2021/2026. Oak Ridge National Laboratory, Oak Ridge, TN. https://doi.org/10.2172/2251661.
[3] US Environmental Protection Agency. 2024. *Renewable Energy Certificates (RECs)*. Green Power Markets. Retrieved January 29, 2024, from https://www.epa.gov/green-power-markets/renewable-energy-certificates-recs.
[4] National Renewable Energy Laboratory. 2015. *Renewable Electricity: How do you know you are using it?* https://www.nrel.gov/docs/fy15osti/64558.pdf.

A REC is generated when electricity from a renewable energy generator (e.g., a wind farm) is transmitted to the grid; for every 1 MWh of electricity generation, one REC is created. For example, if an organization owns an on-site solar photovoltaic system that generates 2 MWh in 1 day, they also generate two RECs per day. The organization needs to register the system and retire RECs in a tracking system *(discussed later in this document)* to claim the use of renewable energy. Each registered REC has a unique ID number and is individually tracked by a regional tracking system. If registering an on-site generation system in a tracking system is not financially feasible, organizations can use contractual or attestation documents and meter reports to show that 1 MWh is generated to prove the creation of one REC.

Bundled and unbundled RECs

An energy stream may be considered renewable only if the consumer owns and "retires" the associated RECs *(discussed later in this document)*. When renewable electricity is purchased with the associated RECs, these RECs are called ***bundled*** RECs. However, a company may choose to purchase only the environmental benefits of renewable energy through an ***unbundled*** REC, without purchasing the associated energy stream. For example, an organization that consumes 100 MWh of annual electricity from a fossil-fuel powered grid may choose to purchase 100 unbundled RECs in order to claim (for 1 year) that they have met zero market-based Scope 2 emissions.

Buying unbundled RECs theoretically increases aggregate demand for renewable energy at a system level. However, because unbundled RECs can be purchased from new or existing generation, procuring unbundled RECs does not require the installation of a new renewable energy generation. In other words, it generally does not lead to additional system-level renewable generation. Also, because unbundled RECs purchases are generally short-term contracts and inexpensive in many markets, these alone may not bring enough revenue to justify the cost of constructing a new renewable energy project.

However, when organizations purchase bundled RECs—through a power purchase agreement (PPA), for example—that purchase is more likely (but not guaranteed) to bring additional renewable energy generation to the grid.

*The term "additionality" describes the concept of adding **new** renewable energy generation to the grid when an organization procures a bundled renewable energy contract such as a PPA. Based on that purchase, organizations may claim that increment in renewables generation as an "addition" because it has a direct effect on implementing more renewable energy projects. However, the organization must be involved before construction begins on the project to ensure its financial contribution to the project.*

- **Understanding REC ownership**
  RECs have only one owner at a time. By purchasing and retiring a REC, the owner can claim sole use of the environmental benefit of that green power. Purchased RECs are "retired" by or on behalf of the purchaser in a tracking system to avoid multiple ownership of each REC (i.e., to avoid double counting or claiming the REC's environmental benefit by more than one entity). For example, a solar project generates RECs that are issued to the project owner's account. When the REC is sold, it is transferred to the account of the purchaser, who then may resell or retire the REC, or it is retired by the project owner on the purchaser's behalf. Before the REC is retired, it can be resold multiple times. However, once the REC is retired, it cannot be sold or transferred again.
- **Why do organizations buy RECs?**
  Procuring RECs enables organizations to choose cleaner sources of energy and reduce their carbon footprints by reducing Scope 2 and Scope 3* emissions. RECs also provide organizations with flexibility to invest in renewable energy even if they do not have the ability to generate it themselves (e.g., they have space limitations) or if their local utility does not offer renewable power options.

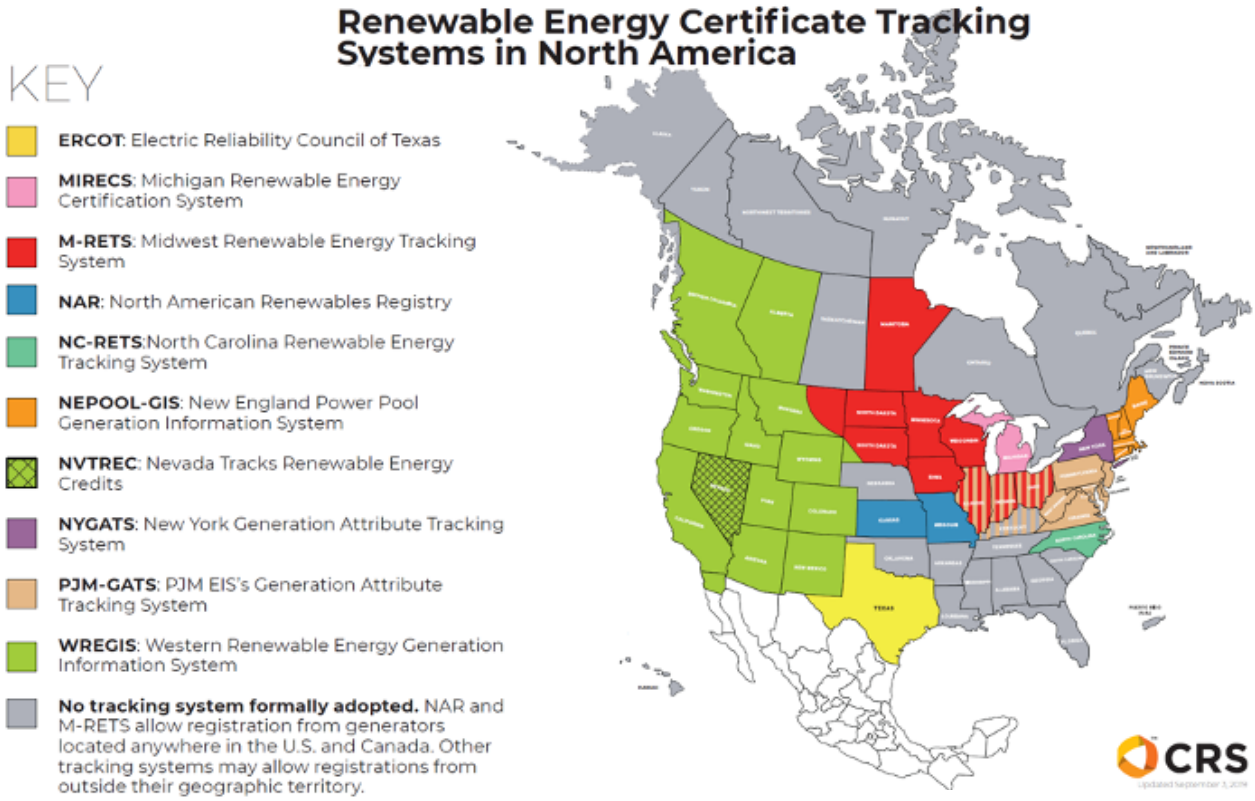
Furthermore, buying RECs helps provide revenue to support more renewable energy projects. When enough organizations buy RECs, these purchases promote growth in the green power marketplace and help to reduce greenhouse gas (GHG) emissions across the country.

**As a growing practice, organizations recently started to reduce their Scope 3 emissions by retiring or allocating RECs on behalf of their value chain partners. For more information, refer to EPA's Renewable Electricity Procurement on Behalf of Others: A Corporate Reporting Guide.*[5]

2. REC Regional Tracking Systems

Tracking systems provide a basis for creating, managing, and retiring RECs, thus ensuring that each REC is counted only once.

RECs are considered the currency of the renewable energy market. Once renewable electricity is delivered to the grid, proving that it came from a clean source (e.g., wind, solar) becomes impossible. Therefore, RECs and their transactions are created at the point of generation and tracked by entities located in different regions of the United States, as shown in the map on the following page. For example, M-RETs[6] covers part of the Midwest, and WREGIS[7] covers the Western Interconnection territory. *(Click map to enlarge.)*

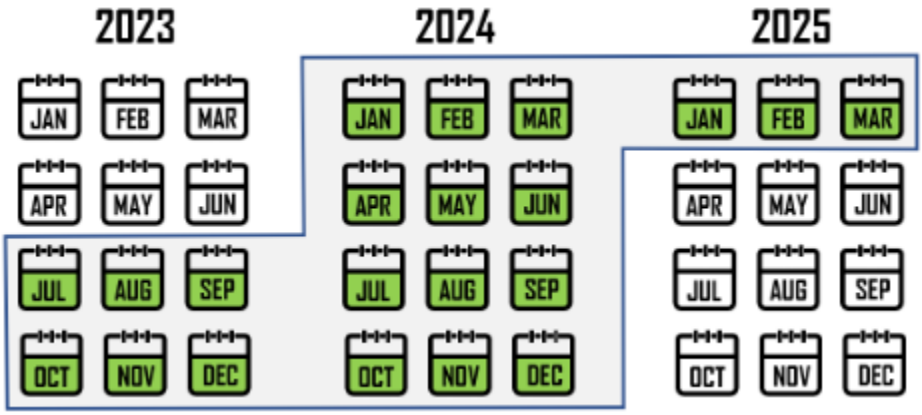


Credit: Center for Resource Solutions, September 2019.[8]

[5] Green Power Partnership Program. 2022. *Renewable Electricity Procurement on Behalf of Others: A Corporate Reporting Guide*. US Environmental Protection Agency. . https://www.epa.gov/system/files/documents/2022-05/renewable_electricity_procurement.pdf.
[6] The Midwest Renewable Energy Tracking System (M-RETS): https://www.mrets.org/.
[7] The Western Renewable Energy Generation Information System (WREGIS): https://www.wecc.org/WREGIS/Pages/Default.aspx.
[8] Center for Resource Solutions. 2019. *Renewable Energy Certificate Tracking Systems in North America*. https://resource-solutions.org/wp-content/uploads/2018/02/Tracking-System-Map.pdf.

Each REC is assigned a serial number that consists of the tracking system's ID, location and date of generation, and type of renewable energy source. Tracking systems may charge small fees when RECs are issued or retired in the system.

States have different limits on the time between when a REC is generated and when it is retired. For example, Wisconsin and Nevada allow up to 4 years before a REC is retired, whereas New England allows only 3 months.[9] RECs certified by Green-e have a 21-month window—12 months of the calendar year when the REC is sold, 6 months before that year starts, and 3 months after that year ends. If a REC is sold in January or even in December of 2024, that REC must not be generated before July 2023 and then it must be retired by March 2025 (as shown in the graphic below).



3. REC Procurement

- **Voluntary and compliance renewable energy markets**
  Many consumers can purchase renewable energy through their existing electric utility company because numerous states require utility companies to supply a certain share of their energy from renewable sources, a policy called a renewable portfolio standard (RPS). RECs purchased for the sake of meeting the requirements of an RPS are said to have been purchased in a ***compliance market***.

*A **renewable portfolio standard** is a regulatory policy adopted by 38 states and the District of Columbia[10] in which electricity companies must generate a certain percentage of their electricity from renewable energy sources. Utilities that do not generate a high enough percentage themselves must purchase RECs to make up the difference.*

In a ***voluntary market***, consumers can choose to purchase RECs not because of a legal obligation to comply with an RPS but for other reasons. For example, companies might purchase RECs to claim that a certain percentage of their electricity consumption was met by renewable sources. If utilities in compliance markets purchase more renewable energy than required, this is also considered participation in the voluntary market.

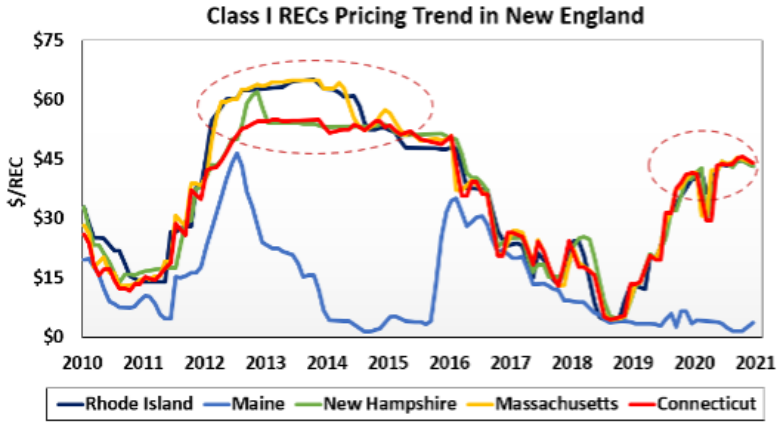
[9] EPA Clean Energy-Environment Technical Forum. 2008. *Renewable Energy Certificates: Background and Resources.* US Environmental Protection Agency. https://www.epa.gov/sites/default/files/2016-03/documents/background_paper_3.pdf.
[10] National Conference of State Legislatures. 2021. *State Renewable Portfolio Standards and Goals*. Retrieved January 29, 2024, from https://www.ncsl.org/energy/state-renewable-portfolio-standards-and-goals.

- **Where to buy RECs**

  State law underpins the legal basis for RECs; thus, there may be slight variations in how different states define RECs. Certain states may have an RPS that only allows for RECs generated within the local grid region to be used for compliance. However, many organizations, including the US Department of Energy, accept the use of RECs for voluntary demonstration of renewable energy consumption.[11] This means organizations can buy RECs from anywhere in the United States, and generation does not necessarily need to be in the state where the organization is located. In 2021, for example, a large capacity of wind energy was generated in Texas,[12] but a facility in any other state could buy RECs from that generation and claim the use of wind power. However, RECs should not be purchased in the United States for facilities in other countries.[11]

  Because some states with a compliance market have higher REC prices owing to higher demand, an organization located in a state where REC prices are high—such as Massachusetts—may save some money by buying RECs from a state where RECs prices are much lower—such as Texas. Ultimately, the decision of where to buy RECs is up to the organization. Various factors must be considered; buying RECs in Massachusetts in the previous example, for instance, would encourage more local development of renewable energy generation. Organizations are increasingly focusing their renewable energy purchases as close as possible to where they are physically located, thus encouraging the development of renewables in all parts of the country.

  The price of RECs varies depending on market dynamics, such as supply and demand, and market policies such as RPSs. If a significant discrepancy exists between REC prices in the voluntary and compliance markets, an organization may be able to leverage these differences to its financial advantage by selling its eligible renewable energy project's RECs at a high price in a compliance market and purchasing replacement RECs from another renewable project at a lower price. This is commonly referred to as ***REC arbitrage*** (i.e., ***REC swap***). The following examples show the trend of REC prices in the New England states between 2010 and 2021. Areas in red-dotted circles indicate possible opportunities for arbitrage.



Data source: Barbose, G. L. 2021. *U.S. Renewables Portfolio Standards 2021 Status Update: Early Release*. [13]

[11] Jones, T., et al. 2023. *The Legal Basis for Renewable Energy Certificates*. Center for Resource Solutions. https://resource-solutions.org/wp-content/uploads/2015/07/The-Legal-Basis-for-RECs.pdf.

[12] US Energy Information Administration. 2021. "Texas likely to add record utility-scale solar capacity in the next two years." *Today in Energy*. Retrieved January 30, 2024, from https://www.eia.gov/todayinenergy/detail.php?id=47636.

[13] International Tracking Standard Foundation. 2023. *I-REC for Electricity*. Retrieved January 31, 2024, from https://www.trackingstandard.org/product-code/electricity/.

Classes and Tiers of RECs

In different states, RECs are classified based on the generation resource and the year generated. For example, in many states, ***Tier 1*** *or* ***Class I*** *RECs were generated based on solar or wind projects and in the past 5–7 years. These RECs have a higher demand and are thus more expensive than Class II, Class III, or Tier 2. For example, in Connecticut, Class II RECs are for electricity generated from a trash-to-energy facility, whereas Class III RECs are generated from combined heat and power systems with a minimum efficiency of 50% and built on or after 2006.[14] Likewise, the RPS of the District of Columbia classifies electricity generated from hydropower (other than pumped-storage generation) as Tier 2.[15]*

- **How to buy RECs**

  In the United States, roughly 850 electric utility companies—including municipal, investor-owned, and cooperative utility companies—offer programs (e.g., utility green power products, green pricing) to allow customers to pay an additional premium rate per kilowatt-hour to be supplied by renewable electricity bundled with RECs. Some utilities in certain states[16] offer optional programs (e.g., utility green tariffs) that allow commercial and industrial customers to buy bundled renewable electricity from a specific project. In both cases, customers need to make sure that purchased RECs are retired on their behalf by the utility company. Organizations should check with their utility company for the availability of bundled or unbundled RECs in their area.

  Alternatively, organizations may choose to procure unbundled RECs from an outside supplier. In this case, purchasing verified and certified RECs from a supplier that is Green-e certified (or I-REC[17] certified for international markets) is recommended. This helps to avoid double counting the RECs and to guarantee that RECs come from new renewable energy generation (i.e., operation that began within the last 15 years) to support the development of new renewable energy projects. For more information about the Green-e certification program criteria, please refer to the Green-e Framework for Renewable Energy Certification.[18]

  In general, if a utility company is supplying all customers with a certain percentage of renewable electricity as a part of its standard mix, the customers have the right to claim that percentage of renewable electricity where the utility is responsible for retiring the RECs for that generation on behalf of its customers.

  In deregulated electricity markets where customers are allowed to purchase energy from retail energy suppliers other than their local utility, customers can buy bundled RECs through PPAs or competitive green power products. However, in regulated electricity markets where customers do not have the choice to select the utility or energy provider, customers may seek the aforementioned options through their local utility company. Whether an organization is in a deregulated or a regulated electricity market, the option of procuring a virtual or financial PPA is always available, commonly in the form of bundled RECs. For more information on renewable electricity supply options and electricity markets, please see the Renewable Energy Guidance for Industry 2022.[1]

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[14] Connecticut's Department of Energy and Environmental Protection: Public Utilities Regulatory Authority. 2023. *Connecticut Renewable Portfolio Standard*. Retrieved January 30, 2024, from https://portal.ct.gov/PURA/RPS/Renewable-Portfolio-Standards-Overview.

[15] NC Clean Energy Technology Center. 2023. *Renewable Portfolio Standard. Database of State Incentives for Renewables & Efficiency*. Retrieved January 30, 2024, from https://programs.dsireusa.org/system/program/detail/303.

[16] Clean Energy Buyers Association. 2023. *Availability of Utility Green Tariff Programs. Green Tariffs*. Retrieved January 30, 2024, from https://cebuyers.org/solutions/procure-clean-energy/green-tariffs/.

[17] International Tracking Standard Foundation. 2023. *I-REC for Electricity*. Retrieved January 31, 2024, from https://www.trackingstandard.org/product-code/electricity/.

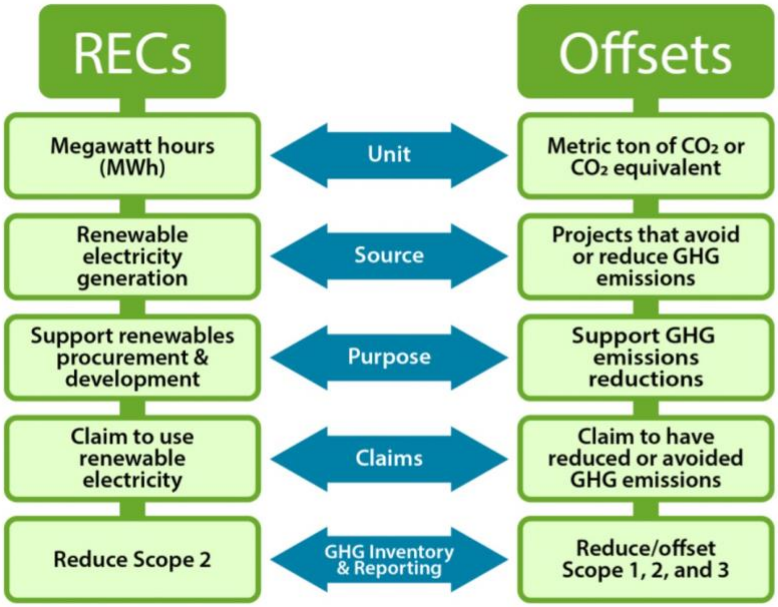
[18] Green-e Energy. 2017. *Green-e Framework for Renewable Energy Certification.* Center for Resource Solutions https://www.green-e.org/docs/energy/framework/Green-e Framework for Renewable Energy Certification.pdf.

4. RECs Accounting and Reporting

- **RECs versus carbon offsets**

  DOE's Better Climate Challenge does not allow the use of carbon equivalent emissions offsets to achieve a portfolio-wide emissions reduction target; it does, however, allow for the use of RECs to reduce Scope 2 emissions from purchased electricity.

  An offset represents 1 metric ton of avoided emissions; a REC represents 1 MWh of renewable energy. RECs are associated only with renewable energy generation, whereas offsets can be created from any project that avoids or removes the release of GHG (i.e., carbon capture, efficiency upgrades, green energy). Unlike RECs, an offset reduces only a carbon footprint and has no effect on the renewable character of the energy streams being used by a facility.[19] The figure below illustrates the differences between RECs and offsets.



  RECs and offsets can be important tools in a company's energy portfolio but are not included in energy baselines for the Better Buildings and Better Plants programs. For more information on energy baselining and accounting for renewables, please see DOE's Energy Intensity Baselining and Tracking Guidance[20] and DOE's Better Climate Challenge Resources for Achieving Science Based Targets.[21]

[19] Green Power Partnership Program. 2018. *Offsets and RECs: What's the Difference*. US Environmental Protection Agency. https://www.epa.gov/sites/default/files/2018-03/documents/gpp_guide_recs_offsets.pdf.
[20] Price, C. R., Nimbalkar, S. U., and Wenning, T. J. 2020. *Energy Intensity Baselining and Tracking Guidance*. ORNL/SPR-2020/1566. Oak Ridge National Laboratory, Oak Ridge, TN. https://doi.org/10.2172/1649123.
[21] Nandy, P., Wenning, T., Price, C., Nimbalkar, S. U., Levine, E., and Lung, B. 2020. *Better Plants Resources for Achieving Science Based Targets*. ORNL/SPR-2020/1757. Oak Ridge National Laboratory, Oak Ridge, TN. https://doi.org/10.2172/1694372.

- **RECs Reporting Under Scope 2 Emissions**
  Two methods are available for reporting Scope 2 emissions from grid-purchased electricity: market-based and location-based. The ***market-based*** method considers all of the contractual arrangements a company uses to procure electricity from specific sources, including RECs and PPAs. Information on purchased RECs or emissions factors from the utility provider can be used to calculate the market-based Scope 2 emissions. The ***location-based*** method considers only the average emissions intensity of the local electric grid excluding other purchasing arrangements, unless there is a direct connection between the generation source and the site (e.g., on-site solar, on-site wind). Subregion emissions data in the EPA eGRID database[22] can be used to calculate location-based Scope 2 emissions.

  DOE's Better Climate Challenge partners are required to use both methods when reporting Scope 2 emissions from electricity. Many organizations already track emissions through a market-based method to account for green power purchases. Reporting location-based emissions provides a complete picture of how partners are reducing Scope 2 emissions through both purchasing practices and energy efficiency.

- **GHG Protocol Scope 2 Quality Criteria**
  Based on an amendment[23] to the GHG Protocol Corporate Standard,[24] organizations considering the market-based method to convey emissions information about purchased power such as RECs shall comply with eight Scope 2 Quality Criteria (shown in the following list) that all contractual instruments should meet to be a credible data source for a GHG inventory. If instruments do not comply with the criteria, companies should use other data when reporting by the market-based method. For more information about Scope 2 reporting and accounting, please refer to the GHG Protocol Scope 2 Guidance.[23]

[22] US Environmental Protection Agency. 2024. *Download Data: eGRID with 2022 Data*. eGRID. Retrieved January 31, 2024, from https://www.epa.gov/egrid/download-data.
[23] Sotos, M. E. 2015. *GHG Protocol Scope 2 Guidance: An amendment to the GHG Protocol Corporate Standard*. Greenhouse Gas Protocol. World Resource Institute. https://ghgprotocol.org/sites/default/files/standards/Scope%202%20Guidance_Final_Sept26.pdf.
[24] World Resources Institute and World Business Council for Sustainable Development. 2004. *The Greenhouse Gas Protocol: A Corporate Accounting and Reporting Standard, Revised Version*. https://ghgprotocol.org/sites/default/files/standards/ghg-protocol-revised.pdf.

All contractual instruments used in the market-based method for scope 2 accounting shall:

1. Convey the direct GHG emission rate attribute associated with the unit of electricity produced.
2. Be the only instruments that carry the GHG emission rate attribute claim associated with that quantity of electricity generation.
3. Be tracked and redeemed, retired, or canceled by or on behalf of the reporting entity.
4. Be issued and redeemed as close as possible to the period of energy consumption to which the instrument is applied.
5. Be sourced from the same market in which the reporting entity's electricity-consuming operations are located and to which the instrument is applied.

In addition, utility-specific emission factors shall:

6. Be calculated based on delivered electricity, incorporating certificates sourced and retired on behalf of its customers. Electricity from renewable facilities for which the attributes have been sold off (via contracts or certificates) shall be characterized as having the GHG attributes of the residual mix in the utility or supplier-specific emission factor.

In addition, companies purchasing electricity directly from generators or consuming on-site generation shall:

7. Ensure all contractual instruments conveying emissions claims be transferred to the reporting entity only. No other instruments that convey this claim to another end user shall be issued for the contracted electricity. The electricity from the facility **shall not** carry the GHG emission rate claim for use by a utility, for example, for the purpose of delivery and use claims.

Finally, to use any contractual instrument in the market-based method requires that:

8. An adjusted, residual mix characterizing the GHG intensity of unclaimed or publicly shared electricity shall be made available for consumer scope 2 calculations, or its absence shall be disclosed by the reporting entity.

Credit: GHG Protocol Scope 2 Guidance, World Resource Institute, Table 7.1: Scope 2 Quality Criteria, page 60.[23]

- **Calculating Scope 2 Emissions**
  The following example shows how to calculate Scope 2 emissions using both location-based and market-based methods for "company A" with operations in the United States:

Total electricity consumption	Breakdown of electricity	Type of contractual instrument	Location-based emission factor (MT CO_2e/MWh)	Location-based emissions (MT CO_2e)	Market-based emission factor (MT CO_2e/MWh)	Market-based emissions (MT CO_2e)
1,000 MWh	200 MWh	Green tariffs with RECs	0	0	0	0
	200 MWh	PPA with RECs	0	0	0	0
	600 MWh*	300 MWh of unbundled RECs	0.551**	165.3	0	0
		300 MWh grid average (eGRID subregion RFC Michigan[25])	0.551	165.3	0.54***	162

* Assuming all 600 MWh of electricity were consumed in Michigan from a local utility provider.

** Emission factor obtained from the EPA's eGRID 2022 data[22] for subregion RFC Michigan.

*** Emission factor obtained from the 2021 Green-e Residual Mix Emission Rates (2019 Data)[26] for subregion RFC Michigan.

[25] US Environmental Protection Agency. 2024. *Power Profiler. RFCM Emission Rates*. Retrieved January 31, 2024, from https://www.epa.gov/egrid/power-profiler#/RFCM.

[26] Center for Resource Solutions. 2021. *2021 Green-E Residual Mix Emissions Rates (2019 Data).* Retrieved January 31, 2024, from https://www.green-e.org/2021-residual-mix.

5. Helpful Resources

- EPA's Green Power Partnership
- Center for Resource Solutions
- Green-e Energy and Green-e Marketplace
- Green-e approved Regional Tracking Systems
- GHG Protocol Scope 2 Guidance

6. Authors and Acknowledgements

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