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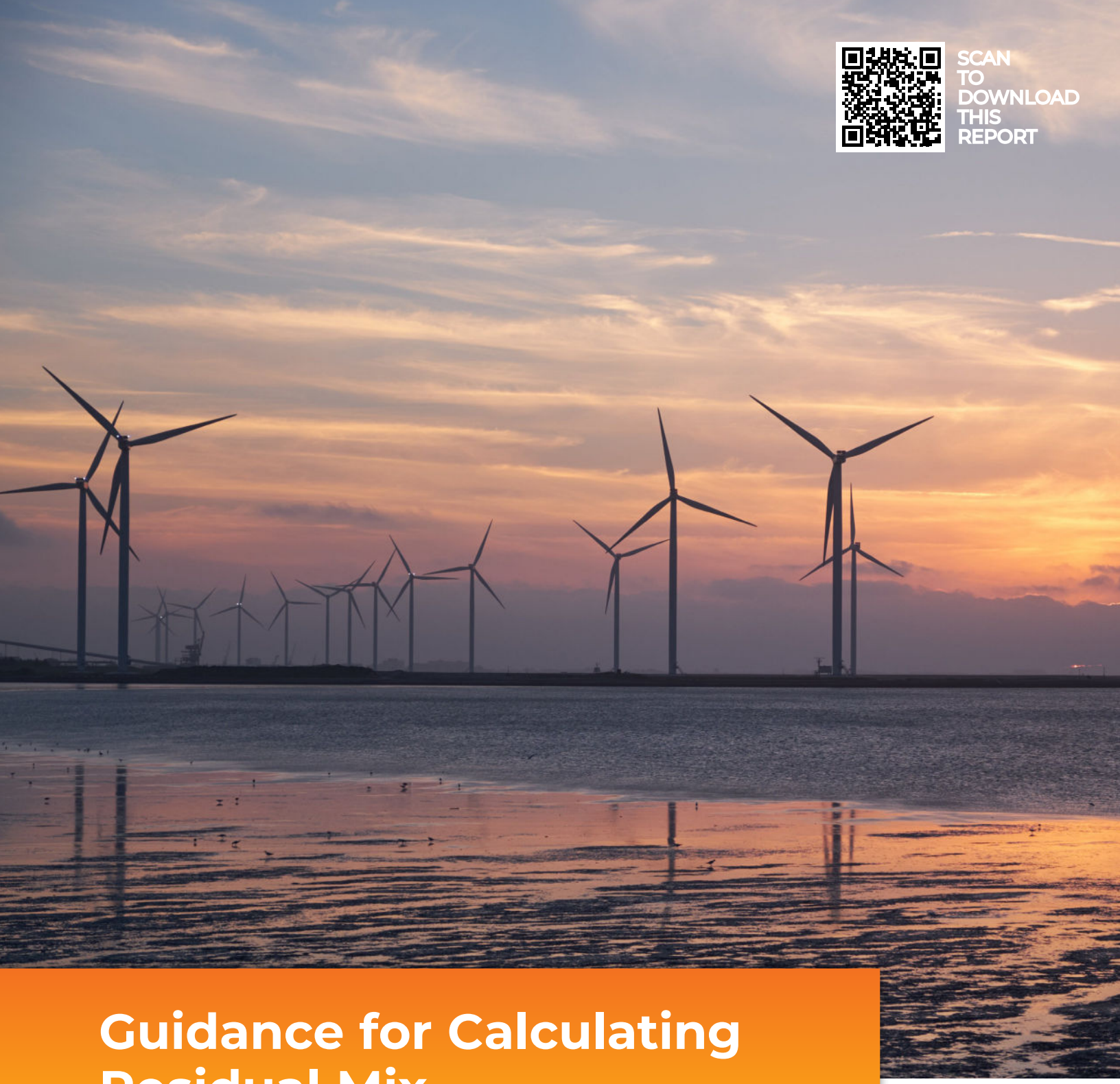

Guidance for Calculating Residual Mix

MARCH 2024

CEAP | CLEAN ENERGY ACCOUNTING PROJECT

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Introduction

"Residual mix" is a term used in energy and greenhouse gas (GHG) emissions accounting to describe the unallocated or unclaimed electricity generation and associated emissions in a certain area over a certain period of time. As the name implies, it represents the generation and emissions that remain after renewable, clean, and other specified power purchases and sales have been allocated. In general, a residual mix is used to characterize the generation and emissions for those not buying specified power, for consumption that is not met by specified purchases, and where resource-specific information is not available. Residual mixes and residual mix emissions factors (EFs) are critical for accurate energy and emissions accounting and reporting. Residual mixes are referenced in generation attribute tracking system operating rules[1], state disclosure and reporting regulations[2], in the 2015 GHG Protocol *Scope 2*

1 See operating rules for all-generation tracking systems: NEPOOL GIS Operating Rules, available at: https://nepoolgis.com/documents, NYGATS Operating Rules, available at: https://www.nyserda.ny.gov/All-Programs/NYGATS/Registration-Documents, PJM-GATS Operating Rules, available at: https://www.pjm-eis.com/documents.

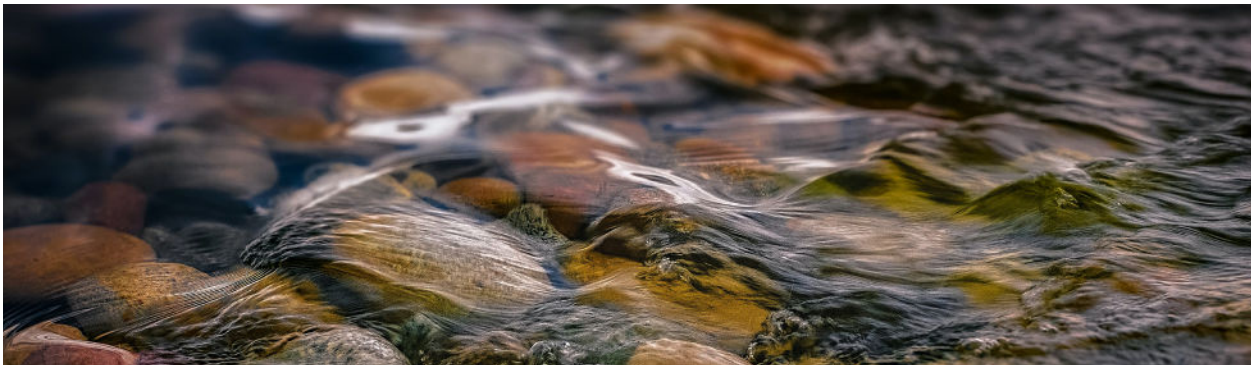
2 For example: New York's Environmental Disclosure Program. NY PSC Opinion 98-19, Case 94-E-0952, available at: https://documents.dps.ny.gov/public/Common/ViewDoc.aspx?DocRefId=%7BF46FEA38-434A-4682-8FC8-797C0F26B2B3%7D. Pg. 4. Referred to as a "residual spot market average."

Guidance[3], and by the White House Council on Environmental Quality (CEQ)[4], among others. However, while the term is common, different applications use different definitions, calculation methodologies, and generation tracking and data, which leads to confusion and inconsistency.

This guidance focuses on U.S. markets and provides best practices for calculating annual residual mixes and residual mix EFs for a variety of uses in both voluntary and compliance electricity and emissions reporting contexts. It describes the applications and use cases for residual mix and identifies the methodology and geographic boundary relevant to each. Finally, it evaluates the availability of generation and transaction data to support calculation methodologies and recommends data hierarchies when preferred data is not available.

This guidance also explains what information is needed for different uses and what challenges and options there are in different regions of the U.S. including the impacts of different regulatory and market structures, tracking and transaction infrastructure and data availability. Emphasis is placed on regions without comprehensive all-generation tracking in order to define and determine unclaimed generation and establish appropriate geographic boundaries. The guidance also identifies the proper uses of existing annual regional residual mix information. By defining these methods and data sets, this guidance can be used by voluntary customers, wholesale market operators, load-serving entities (LSEs), and other relevant policy makers to work towards increasing data availability that supports these calculations.

It is important to note that utility-specific emissions factors, though sometimes also referred to as utility "residual mixes" and "residual mix emission factors," since they exclude the utility's voluntary and other specified product sales, must be distinguished from regional or market residual mixes, which are discussed in this guidance. Utility-specific factors, better understood as utility default product or standard mixes/rates, themselves rely on residual mixes to accurately account for emissions associated with null power or unspecified purchases. Use cases for utility-specific mixes and EFs are not discussed in this guidance.



3 Sotos, M. Jan 2015. *GHG Protocol Scope 2 Guidance: An Amendment to the GHG Protocol Corporate Standard.* World Resources Institute. Pg. 8, 9, 56, 101. Available at: https://ghgprotocol.org/scope-2-guidance.

4 Council on Environmental Quality: clarification of grid-supplied carbon pollution-free electricity calculation methodology. Available at: https://www.sustainability.gov/pdfs/grid-supplied-cfe-memo.pdf.

1. Applications

The intended application of a residual mix helps determine the generation that should be included and the appropriate geographic boundary. Residual mix uses can be categorized into three applications:

- Consumer market-based scope 2 emissions accounting,
- State GHG reporting by LSEs at the company level, and
- State GHG reporting by LSEs at the electricity product level.

1.1 Consumer Market-Based Scope 2 Accounting

The GHG Protocol's *Scope 2 Guidance* includes a data hierarchy[5] for the market-based method for measuring and reporting GHG emissions from purchased electricity (scope 2 emissions calculations). The preferred approach is to obtain transaction-specific or supplier-specific EFs directly from electricity suppliers. But the guidance recognizes that complete supplier data may not always be available. In such cases, a residual mix becomes essential. While these mixes introduce some level of uncertainty, they serve as a crucial alternative for organizations to report scope 2 emissions in the absence of comprehensive supplier-specific data. Residual mixes help to avoid the inherent double counting of using grid-average emissions factors.

1.2 State GHG Reporting by LSEs (Company Level)

State GHG reporting programs for LSEs involve the systematic monitoring and disclosure of emissions data from entities responsible for providing electricity to consumers. LSEs, which encompass utilities and energy providers, are required to regularly report emissions data to state regulatory authorities, contributing to transparency and accountability. Understanding which residual mix EFs to apply to different megawatt-hours (MWh), particularly for unspecified transactions, plays a crucial role in assessing the environmental impact of energy consumption and informing state-level climate policies.

1.3 State GHG Reporting by LSEs (Electricity Product Level)

State-level GHG reporting programs for LSEs extend to the electricity product level (e.g., default or standard offer product, voluntary green power products, etc.) through power source disclosure and environmental labeling requirements. These programs require LSEs to disclose the composition of energy sources and associated emissions associated with product sales to different customers (i.e., different generation portfolios). They are intended to provide transparency for customers regarding the nature and impact of the electricity they use and empower consumers to make informed choices based on the environmental footprint of their energy consumption.

5 Sotos, M. Jan 2015. *GHG Protocol Scope 2 Guidance: An Amendment to the GHG Protocol Corporate Standard.* World Resources Institute. Pg. 48. Table 6. 3. Available at: https://ghgprotocol.org/scope-2-guidance.

2. Use Cases

This document introduces key residual mix use cases within the applications described above. The use cases are the specific instances or numbers for which a residual mix could be used within a broader application. Residual mix use cases determine the geographic boundary and methodologies that are needed for distinct purposes associated within each of the three applications.

2.1 Consumer Market-Based Scope 2 Accounting Use Cases

There are three use cases for the application of residual mixes in consumer market-based scope 2 accounting:

- Load not covered by specified purchases where utility-specific mixes are not available
- Default-delivered or standard delivery/ non-voluntary specified energy where utility-specific mixes are not available
- Null Power

Load Not Covered by Specified Purchases Where Utility-Specific Mixes Are Not Available

A residual mix may be used for electricity consumption not met with specified power purchases where utility-specific information is unavailable. In this case, a residual mix represents the best available information for what is used to serve this consumption. For example, an electricity consumer may contract for a specified percentage of their consumption from clean or renewable resources, which requires purchasing the Energy Attribute Certificates (EACs). The remaining portion of their consumption may be assigned the residual mix where utility-specific information for this portion is not available.

Default-Delivered or Standard Delivery/Non-voluntary Specified Energy Where Utility-Specific Mixes Are Not Available

A residual mix may be used to estimate a customer's default or baseline resource mix (and emissions), including renewable and clean energy called Standard Delivery Renewable Energy (SDRE). This use case applies to regions that have a Renewable Portfolio Standard (RPS) or Clean Energy Standard (CES) that uses certificates, as that generation is intended to be claimable by all customers. The standard delivery mix and EF should only be claimed/reported where the retirement of that generation on behalf of customers receiving a standard offer product is substantiated EACs, utility-specific information is not available, and the specified energy is publicly shared and allocated equally among consumers in the boundary. Load that is met with direct contracts with generators or that has opted out of standard utility service, e.g., through a power purchase agreement (PPA), does not receive a utility's standard delivery mix and EF.

Null Power

Null power refers to the electricity that remains after EACs have been separated or unbundled and subsequently sold. For organizations that own generation assets or procure bundled specific power and sell the attributes separately, null power enables a transparent representation of attribute ownership, sale, and use. By removing the EACs, null power represents a generic

Unbundled EACs

When unbundled EACs are applied to a customer's consumption, the attributes of the generation that customer would have otherwise claimed should be reallocated to other customers unless those attributes have also been transacted on a specified basis. Where both the EAC generator and EAC consumer are located in the same region, this reallocation is facilitated via the regional residual mix. Likewise, where the EAC generator and consumer are located in different regions and all regions are served by all-generation tracking, inter-regional reallocation happens automatically as a result of coordination across regional tracking systems. However, in the absence of nationwide all-generation tracking, regional residual mixes may not properly reflect inter-regional EAC transactions because the generation attributes no longer claimed by the EAC consumer will stay in the region where that consumer is located, instead of the region where the EAC generator and null power are located. While no generation is lost between the two regions, depending on the difference between resource mixes, this may result in an underestimation of the null power residual mix EF in the region of the generator. For example, if a customer in Wyoming buys RECs from Texas, the underlying generation in Wyoming will be included in the Wyoming system mix, not the Texas residual mix where the null power is being reported and claimed. As a result, the Texas null power may be underestimated if the resource mix in Wyoming is dirtier than Texas. It is unclear if the degree of error resulting from inter-regional EAC transactions is material at this time. As such, we are not currently recommending inter-regional allocation of generation to account for inter-regional EAC transactions in regional residual mix calculations for null power. It is a key consideration however as consumer demand and generation resource mixes continue to evolve.

electricity commodity which cannot be attributed to a particular fuel source or set of environmental characteristics. A residual mix EF should be used to characterize the emissions associated with null power to prevent double counting.

2.2 State GHG Reporting by LSEs (Company Level) Use Cases

There are four use cases for the application of residual mix in state GHG reporting by LSEs at the company level:

- Unspecified purchases (from within the same market)
- Unspecified imported electricity (purchase from a different market)
- Default emissions rate for electricity delivery where utility-specific mixes are not available or not used
- Null power

Unspecified Purchases (From Within the Same Market):

Unspecified purchases within the same market pertain to purchases of electricity where the resource-type is unknown or not specified (i.e., unspecified power) by an LSE from within the LSE's local organized wholesale electricity market, e.g., Independent System Operator (ISO) or Regional Transmission Organization (RTO). In this context, "unspecified" denotes that the specific attributes or origins of the procured electricity are not known or provided. This use case applies to unspecified purchases through bilateral contracts, as well as organized markets.

Unspecified Imported Electricity (Purchase from a Different Market):

Unspecified imported electricity pertains to unspecified purchases made by an LSE from outside the LSE's own market and where more precise information about the import (e.g., a specified resource type or mix, or seller's mix) is not available. This type of procurement involves obtaining power from an external market without precise identification or categorization of the energy sources involved. Recognizing and accounting for unspecified imported electricity is essential in comprehensive energy assessments, as it enables a more accurate understanding of the energy mix, sourcing dynamics, and potential environmental implications associated with cross-market electricity transactions.

Default Emissions Rate for Electricity Delivery Where Utility-Specific Mixes Are Not Available or Not Used

A state default emissions rate is a constant, predetermined rate, usually taken from the average emissions rate of a marginal fossil unit. For example, the California Low Carbon Fuels Standard (LCFS)[6] uses the "California Average Grid Electricity" emissions factor for electricity delivered as a transportation fuel that is not a specified purchase. A residual mix EF may be a more accurate representation of electricity generation used when utility-specific mixes are not available or used. Where default emissions rates are assigned to unspecified power when setting emissions targets for LSEs, a residual mix may also facilitate greater market participation by LSEs subject to emissions targets since the residual mix may change over time.

Null Power

Null power is generally the same for LSEs in this application as it is for customers in scope 2 reporting—electricity that has been stripped of its generation attributes, for which the attributes have been sold off. In the context of state GHG reporting programs, understanding null power is essential as it helps identify the portion of electricity generation that lacks a defined emissions profile. By quantifying null power, LSEs and regulatory bodies gain insight into the potential emissions associated with this undefined portion of electricity.

The null power and unspecified power use cases in this application are similar, as they both refer to power where the generation attributes or EACs are not owned by the reporting entity. This guidance distinguishes between them to highlight when and by whom the attributes are unbundled relative to the retail transaction being reported (e.g., not included in the retail transaction being reported vs. sold by the reporting entity) and to ensure a complete understanding of how unspecified power can be delivered. As a result, they are both assigned a residual mix to prevent double counting and the recommended geographic boundary for the residual mix depends on the location of the generator and reporting entity.

6 California LCFS § 95488.5. Lookup Table Fuel Pathway Application Requirements and Certification Process. Available at: https://ww2.arb.ca.gov/our-work/programs/low-carbon-fuel-standard/lcfs-regulation.

2.3 State GHG Reporting by LSEs (Electricity Product Level) Use Cases

There are three use cases for the application of residual mixes in State GHG reporting by LSEs at the company level:

- Unspecified purchases or wholesale market purchases
- Unfulfilled LSE load
- Null power

Unspecified Purchases or Wholesale Market Purchases

This refers to unspecified power reported on an LSE's electricity product content or environmental disclosure label—reporting electricity procured for retail sales where the resource type is unknown or not specified.

Unfulfilled LSE Load

In regions with all-generation tracking, unfulfilled load refers to portion of an LSE's electricity demand that has not been procured/matched with specified generation and attributes (e.g., certificates) during a specified trading or reporting period. This load would be assigned the average mix of unallocated generation in the market to accurately assess total emissions to all load and prevent double counting.

Null Power

Null power in this application is generally the same as the previous application. In the context of electricity product level GHG reporting, it is important to assign the appropriate rate to energy for which renewable/clean attributes have been sold off. This allows LSEs to more accurately disclose the emissions associated with individual products and enable consumers to make more educated decisions and better differentiate between products offered by LSEs. As noted above, the null power and unspecified purchase use cases both refer to power without generation attributes or EACs.

3. Residual Mix Types

Identification of the use cases for residual mix in the previous section revealed two distinct "types" of residual mix. In this guidance these are identified as Type A and Type B.

Type A

Type A is a mix of only all unclaimed or unsold electricity generation attributes in a given time period, or from which all transacted attributes and specified sales during that time period have been removed. The geographic boundary for Type A depends on the use case, either being the same market as the reporting entity or the market from which electricity is imported.

Certain regions of the country are served by all-generation certificate tracking systems, such as New England Power Pool Generation Information System (NEPOOL-GIS), PJM Generation Attribute Tracking System (PJM-GATS), and New York Generation Attribute Tracking System (NYGATS). These systems play a pivotal role in facilitating compliance with renewable and clean energy standards, power source disclosure programs, and voluntary sales. They issue certificates for all electricity generation and resource types within their regions.

Among other things, they calculate Type A residual mixes representing the unsold certificates during a defined trading or settlement period, which are assigned to LSE unfulfilled load (load not met with retired certificates, i.e., specified power).

Type B

Type B is a mix that includes Type A plus RPS generation—attributes delivered to consumers as part of compliance with a state mandate—and other potentially shared specified attributes but does not include voluntary specified sales. Including shared specified energy (e.g., renewables) in a residual mix may be appropriate when all of the following conditions are met:

- The retirement of that generation on behalf of customers receiving a standard offer product is substantiated by EACs;
- When utility-specific information is not available, and
- When that specified energy is publicly shared and allocated equally among consumers in the boundary.

This extends to customers without access to utility-specific information. Furthermore, as organizations proactively choose to conduct business in states that support clean energy, the

Residual Mix Vintage and Retirement Requirements

In following market best practices, EACs used in annual residual mix calculations should be generated, at most, within six months prior to or three months after the calculation year. EACs and specified transactions used for calculations should be retired or otherwise "settled" prior to the time that the calculation is done. Vintage and retirement can be limited to smaller timeframes for more granular residual mixes if desired. For example, for NEPOOL-GIS the residual mix is calculated quarterly, and PJM-GATS is moving to monthly reporting. The data is all specific to the respective wholesale market for each tracking system. Certificates that have been transacted into specified accounts to be banked for transaction or retirement at a later date should be treated as settled, meaning they are subtracted from system residual mixes.

incorporation of RPS and CES generation in relevant Type B residual mixes reflects their choice.

Both residual mix Types A and B serve distinct purposes, tailored to specific use cases. The application of the appropriate residual mix type to a given use case dictates that use case's residual mix calculation methodology. Table 1 shows how these Types correspond to use cases and applications.

Table 1: Use Cases, Residual Mix Types, and Geographic Boundaries

APPLICATION	USE CASE	RESIDUAL MIX TYPE	GEOGRAPHIC BOUNDARY
Consumer's market-based scope 2 accounting	Load not covered by specified purchases where utility-specific mixes are not available	B	Consumer's state
	Default-delivered or standard delivery/non-voluntary specified energy where utility-specific mixes are not available	B	Consumer's state
	Null power	A	Consumer's ISO/RTO, or consumer's eGRID subregion in traditionally regulated markets
State GHG reporting by LSEs (Company level)	Unspecified purchases (from within the same market)	A	LSE's organized wholesale market (e.g., ISO/RTO), or LSE's eGRID subregion in traditionally regulated markets
	Imported unspecified electricity (purchase from a different market)	A	Organized wholesale market (e.g., ISO/RTO) from which the electricity is imported, or eGRID subregion from which electricity is imported in traditionally regulated markets
	Default emissions rate for electricity delivery where utility-specific mixes are not available or not used (e.g., clean fuels/transportation programs)	B	State
	Null power	A	Organized wholesale market (e.g., ISO/RTO) in which generator participates, or eGRID subregion where generator is located in traditionally regulated markets
State power source or environmental disclosure labeling by LSEs (electricity product level)	Unspecified purchases or wholesale market purchases	A	Organized wholesale market from which purchase is made, or eGRID subregion of wholesale seller (e.g., LSE or generator) in traditionally regulated markets
	Unfulfilled LSE load	A	LSE's organized wholesale market (e.g., ISO/RTO), or LSE's eGRID subregion in traditionally regulated markets
	Null power	A	Organized wholesale market (e.g., ISO/RTO) in which generator participates, or eGRID subregion where generator is located in traditionally regulated markets

From this we identify four distinct emissions factors or use case categories with the same residual mix type and geographic boundary across applications: state default, null power, unspecified out-of-market purchases, and unspecified in-market purchases. These are shown in Table 2.

Table 2. Use Case Category by Residual Mix Type and Geographic Boundary

USE CASE CATEGORY	RESIDUAL MIX TYPE	GEOGRAPHIC BOUNDARY
State Default EFs	B	Consumer's State
Null Power	A	Organized wholesale market or eGRID subregion where generator is located, or Consumer's RTO/ISO or eGRID subregion
Unspecified out-of-market purchases	A	Organized wholesale market or eGRID subregion from which electricity is imported or from which purchase is made
Unspecified in-market purchases	A	LSE's organized wholesale market or eGRID subregion

4. Geographic Boundaries

The geographic boundaries for residual mix calculations are a crucial aspect of ensuring data quality, consistency, and accuracy in energy and emissions reporting. These boundaries can differ from and may often be smaller than boundaries for voluntary purchasing or sourcing of renewable energy certificates (RECs). This distinction serves to enhance the precision of data while addressing the challenges posed by the lack of perfect information about attributes for residual MWh across the country.

4.1 Prioritizing Data Quality and Consistency

When determining geographic boundaries for residual mix calculations, data quality is a primary concern. In the absence of perfect data about attributes for residual MWh across the country, geographic boundaries should be narrowed where it improves the quality of data about unclaimed attributes. By doing so, the risk of combining data sources of varying quality is minimized. This approach ensures that the data used in residual mix calculations represents the highest quality data available for the specific region in question.

Where data quality is equal, geographic boundaries should be set as large as possible to enable larger markets for scaling benefits, provide greater accessibility to data, and help lower associated costs.

4.2 Applying Geographic Boundaries to Each Use Case

Geographic boundaries for different use cases, shown in the last column of Table 1, were set based on the requirements of individual applications and use cases and by applying the principles of data quality, conservativeness, and scalability. The resulting geographic boundaries align with the specific goals of each use case while maintaining overall data accuracy and transparency. For example, for residual mix Type B, the geographic boundary is the state where the shared-renewables or clean energy policies are effective, encompassing resources that align with that policy.

By understanding and applying the appropriate geographic boundaries to each use case, we can enhance the precision of residual mix calculations, improve data quality, and promote greater consistency in energy and emissions reporting.

5. Methodology by Type

Methodologies for Type A and B residual mixes hinge on the presence of all-generation tracking systems, regional policies, and the availability of EACs for substantiating renewable and clean energy claims.

Type A

Under the Type A methodology, if a region has an all-generation tracking system, the residual mix rate provided by that system is used. If not, emissions from specified transactions are

simply subtracted from regional total emissions and that difference is divided by the remaining unspecified MWh to obtain the residual annual emissions rate for the region. Specified transactions are the sum of transacted and tracked attributes (certificates), locally consumed generation, market attributions, and other non-tracked generation included in a specified transaction.

Type A Residual Mix Equation

For a given region and time period:

$$\text{Type A Residual Mix} = (E_T - E_S)/(MWh_T - MWh_S)$$

Type B

The Type B methodology evaluates whether a state has an RPS or CES. In states with RPS or CES, state-level RPS emissions and generation are added to the numerator and denominator, respectively, of the Type A equation, resulting in an adjusted regional residual mix for the state. In regions without these standards or for consumer load that is not subject to the RPS/CES,[7] the Type A residual mix methodology is used.

Although RPS compliance is utility-specific, and not shared equally across the state, this is a reasonable approximation for Type B residual mix calculations.

Note that although non-RPS SDRE is included in the definition of Type B residual mixes, it is not currently feasible to estimate this utility-specific data at the state level where utility-specific information is not available.

Type B Residual Mix Equation

For a given region and time period:

$$\text{Type B Residual Mix} = (E_T - E_S + E_{RPS})/(MWh_T - MWh_S + MWh_{RPS})$$

$$E = \Sigma\ MWh \times EF$$

$$E_S = E_{TA} + E_{RDG} + E_{MA} + E_{NTS}$$

$$MWh_S = MWh_{TA} + MWh_{RDG} + MWh_{MA} + MWh_{NTS}$$

Key to Variables:

- E_S = Emissions of specified transactions
- E_T = Total emissions
- MWh_T = Total MWh
- MWh_S = MWh of specified transactions
- E_{TA} = Emissions of transacted attributes (certificates)
- E_{RDG} = Emissions of retained distributed generation
- E_{MA} = Emissions of market attributions
- E_{NTS} = Emissions of non-tracked specified transactions
- E_{RPS} = Emissions of RPS transactions
- MWh_{TA} = MWh of transacted attributes (certificates)
- MWh_{RDG} = MWh of retained distributed generation
- MWh_{MA} = MWh of market attributions
- MWh_{NTS} = MWh of non-tracked specified transactions
- MWh_{RPS} = MWh of attributes from RPS generation.

7 RPS and CES requirements are not always applied to all LSEs or load in a state.

RPS Geographic Consideration

For the Type B methodology, simply subtracting voluntary specified generation out of the regional generation totals (leaving compliance and standard-delivery specified renewable generation) potentially misallocates state-specific RPS generation—specifically, by aggregating all RPS generation regionally and applying it to all regional customers. In other words, the result would be that all customers in a region receive an equal share of all RPS generation in a region. This would over-count the RPS for some customers and under-count it for others, which would not be a reasonable assumption for Type B residual mix calculations, since there may be significant differences between RPS programs within a region and RPS data can be disaggregated by state.

6. Required Data

The accurate calculation of Types A and B residual mixes in accordance with the methodologies relies on specific categories of data to provide insights into untracked or unclaimed electricity generation attributes.

6.1 Data for Type A Residual Mix Calculations

- **Regional Total Generation Data:** Accurate data on total electricity generation and associated emissions or emissions factors within a specific region provides the foundation for understanding the energy mix (E_T and MWh_T from equations above).

- **Tracked Specified Transaction Data:** Data regarding the retirement of EACs within tracking systems is essential for tracking unclaimed generation (E_{TA} and MWh_{TA} from equations above).

- **Untracked Specified Transaction Data:** This category encompasses several subcategories of data, including:
  - **Locally-Consumed Distributed and Behind-the-meter Generation and Off-grid Generation Data:** Off-grid generation and attributes retained by local customers who have consumed distributed generation (E_{RDG} and MWh_{RDG} from equations above).
  - **In-Market Settlement and Resource-Specific Attribution Data:** Data regarding untracked generation that has been attributed or transacted on a resource-specific basis in wholesale markets (E_{MA} and MWh_{MA} from equations above).
  - **Out-of-Market Transaction Data:** Information on bilateral specified transactions of untracked generation (E_{NTS} and MWh_{NTS} from equations above).

Regional Total Generation Data (E_T and MWh_T) may account for imported and exported electricity. If not (and it only represents in-region generation), or if Regional Total Generation data includes imports but does not account for exports, then specified exported electricity generation should also be removed from the regional residual mix to account for specified transactions out-of-region and "wheel throughs."

Specified Transaction Data (E_S and MWh_S) must be a subset of the Regional Total Generation Data (E_T and MWh_T) used, i.e., all generation

Generation Emissions Data Consideration

Where directly measured emissions data for generation in different categories is not available, emissions factor (e.g., tons/MWh) data for different resources or resource types must be used to calculate emissions in the numerator of the equation. In that case, sources of emissions factor data of varying quality and completeness will also affect residual mix calculations. This guidance does not address different sources of emissions factor data. However, in general, it is recommended that emissions factor data, where used, be sourced from the same sources of generation data used for other variables, that it come from an authoritative source, that it be as recent as possible, and that it be as specific to the actual resource or generation accounted for as possible.

Specified Transactions without Attributes

When calculating residual mix, transactions where the resource type is specified (resource-specific transactions) and where EACs are not issued for generation (e.g., those that may be included in MWhMA) should be removed in order to avoid double counting. Resource-specific transactions that do not include EACs issued for the generation, or where attributes have otherwise been transacted, should not be removed since the attributes will be claimed and accounted for separately. When reporting emissions, LSEs, consumers and other reporting entities should report all resource-specific transactions without EACs as unspecified generation and assign the residual mix to those transactions in accordance with this guidance, unless EACs have not been issued for generation and generation attributes cannot otherwise be transacted.

included in the Specified Transactions (and subsequently excluded from the residual mix) must be included in the Total Generation in order for the residual mix to be accurate. For example, if distributed, off-grid, or regionally exported generation is not included in the Total Generation Data used, it should not be subtracted from Total Generation as a part of Specified Transactions.

6.2 Additional Data for Type B Residual Mix Calculations

- **RPS/CES Compliance Data:** Data related to compliance is essential for Type B calculations, which incorporate RPS/CES and other shared specified renewable energy attributes (E_{RPS} and MWh_{RPS} from equations above).

6.3 General Data Sources

In pursuit of the data required for accurate residual mix calculations, stakeholders can turn to a variety of sources, each serving as a critical piece of the data puzzle. Table 3 outlines the general sources for each data type, providing an overview of where stakeholders can typically access or request the required data. For each value or variable, it is recommended that the most recent and highest quality data available be used, even if this creates discrepancies between variables regarding the data year or timeframe. This approach prevents the oldest or least frequent data from limiting residual mix calculations and ensures that accuracy is prioritized

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Table 3: General Data Sources

DATA TYPE	GENERAL DATA SOURCE
Regional Total Generation	Federal databases (eGRID, EIA), Organized wholesale markets (e.g., ISOs/RTOs)
Tracked Specified Transaction Data	Regional Generation Attribute Tracking Systems, Green-e® program[8]
Untracked Specified Transaction Data	ISOs/RTOs, voluntary organized wholesale electricity markets, vertically integrated utilities, other LSEs, distributed generation databases
RPS Compliance	States, Tracking Systems, Lawrence Berkeley National Laboratory (LBNL)[9]

- **Regional Total Generation Data[10]**
  - **Federal Databases (eGRID, EIA):** The U.S. Environmental Protection Agency's (EPA's) Emissions and Generation Resource Integrated Database (eGRID)[11] and the U.S. Energy Information Administration (EIA) provide comprehensive data on electricity generation across various regions in the United States. Both offer detailed information on emissions and generation at the balancing authority, eGRID region, and state and national levels. These federal databases serve as valuable sources for acquiring total generation data, a fundamental component in understanding the energy landscape.
  - **Organized wholesale electricity markets (e.g., ISOs/RTOs):** Wholesale market operators play a central role in managing and overseeing electricity markets, grid operations, and reliability. They provide regional data on electricity generation and transactions, offering valuable insights into the generation mix within their respective territories. Organized wholesale markets are reliable sources for understanding regional total generation, often with a focus on specific market areas. They contribute to a comprehensive overview of electricity production within their jurisdictions, allowing stakeholders to assess energy mixes and emissions within distinct regions.

8 More information on regional generation attribute tracking system data and Green-e® residual mix data can be found in the CEAP backgrounder *Residual Mix Applications and Existing Data*. Available at: https://resource-solutions.org/document/091323/.

9 LBNL Renewables Portfolio Standards Resources. Available at: https://emp.lbl.gov/projects/renewables-portfolio.

10 In addition to federal databases such as eGRID and EIA, other public and open-source datasets, such as the Open Grid Emissions dataset provide regional and plant-level generation and emissions data at the monthly and hourly resolutions: https://oge.singularity.energy/.

11 See https://www.epa.gov/egrid.

- **Tracked Specified Transaction Data**
  - **Regional Generation Attribute Tracking Systems:**[12] These tracking systems are instrumental in recording and monitoring the retirement EACs. They serve as databases that track the attributes of electricity generation. By recording the issuance, transfer, and retirement of certificates, these systems offer information related to retail end uses and claims being made on tracked (e.g., clean and renewable energy) generation, which is essential for calculating residual mixes. It is important to note that tracking systems vary based on the region and the types of generation they cover.

  - **Green-e® Program:** The Green-e® program, administered by Center for Resource Solutions (CRS), certifies voluntary renewable energy products and verifies voluntary sales. Data from the Green-e® Energy program tracks REC retirements for a significant portion of the voluntary market. This data is used to calculate the Green-e® Residual Mix[13] and can potentially be used for other residual mix calculations as well.

- **Untracked Specified Transaction Data**
  - **ISOs/RTOs:** Wholesale market operators ISOs/RTOs maintain data on market settlements and in certain cases resource-specific attributions, which are an essential component of residual mix calculations. By capturing this information and making it publicly available, properly aggregated, ISOs/RTOs can contribute to more accurate residual mix calculations, ensuring that untracked specified transactions are properly accounted for in energy attribute accounting.

  - **Voluntary Organized Wholesale Markets:** Voluntary wholesale markets include the California ISO's Western Energy Imbalance Market (WEIM) and future Extended Day-Ahead Market (EDAM)[14]. These markets often encompass transactions that may not be subject to long-term contracts and can involve untracked generation. Both WEIM and EDAM include GHG attribution on a resource-specific basis to GHG compliance areas in California and Washington. Attribution data from these markets, properly aggregated, provides insights into transactions of the untracked portion of electricity procurement.

  - **Vertically Integrated Utilities:** Vertically integrated utilities are responsible for various aspects of electricity generation, transmission, and

12 See operating rules for all-generation tracking systems: NEPOOL GIS Operating Rules, available at: https://nepoolgis.com/documents/, NYGATS Operating Rules, available at: https://www.nyserda.ny.gov/All-Programs/NYGATS/Registration-Documents, PJM-GATS Operating Rules, available at: https://www.pjm-eis.com/documents.

13 Green-e® Residual Mix Emissions Rates are available at: https://www.green-e.org/residual-mix.

14 More information is available at: https://www.caiso.com/Documents/extended-day-ahead-market-edam-fact-sheet.pdf.

distribution. They often have access to data on energy procurement outside of organized markets, including specified bilateral transactions of untracked generation. These utilities may be a source of valuable data, particularly for regions where they are the predominant energy providers.

- **Other LSEs:** LSEs, which provide electricity to consumers, may engage in untracked specified transactions. Data from other LSEs participating in these transactions can offer insights into the procurement of untracked generation.

- **Distributed Generation Databases:**[15] Distributed generation, such as rooftop solar panels, wind turbines, or other small-scale renewable energy installations, may not always be fully tracked within existing systems or participate in organized wholesale markets. Databases that focus on distributed generation can provide information on locally-consumed generation (where the attributes are retained onsite) that may not be captured by broader tracking systems. This data source helps complete the picture of untracked specified transactions.

- **RPS Compliance Data**
  - **States:** State RPS and CES regulatory authorities maintain compliance data, including compliance achieved and verified with REC retirements (representing generation that may be claimed by retail customers). These data sources are essential for understanding the extent of compliance with state-driven clean energy policies.

  - **Tracking Systems:** As part of the compliance process for RPS and CES, tracking systems are used to monitor the acquisition and retirement of RECs for RPS compliance. These systems help ensure that LSE adhere to state-mandated renewable energy requirements. Tracking systems provide a comprehensive view of RPS compliance and are therefore essential data sources for Type B calculations.

  - **Lawrence Berkeley National Laboratory:** LBNL is involved in research and analysis related to state energy policy and regulation. They compile and maintain data related to RPS compliance[16]. LBNL's expertise in energy and environmental policy makes it a valuable source for understanding RPS compliance data.

These general data sources serve as valuable starting points for stakeholders seeking the essential data required for accurate residual mix calculations. However, the accessibility and comprehensiveness of these sources may vary by region and may require further efforts to enhance data granularity and accessibility, particularly in areas where gaps in data coverage exist.

15 There are no known regional databases of retained distributed generation attributes, but utilities may have information about distributed generation over a certain size.

16 LBNL Renewables Portfolio Standards Resources. Available at: https://emp.lbl.gov/projects/renewables-portfolio.

Accurate and transparent energy and emissions reporting depend on the availability and quality of these essential data types. Recommendations for regional sources of residual mix data are provided in Table 4, though this data may not currently be available from these sources.

Table 4: Type A Residual Mix Recommended Data Sources by Region

REGION	REGIONAL TOTAL GENERATION AND EMISSIONS DATA	REGIONAL SPECIFIED TRANSACTION GENERATION AND EMISSIONS DATA	
		TRACKED	UNTRACKED
CA	eGRID (CAMX); CAISO voluntary wholesale markets – attributions (imports) to CA	WREGIS – retired certificates	CAISO – non-WREGIS specified transactions
Midwest	eGRID (MROW, MROE, RFCM, SPNO, SPSO, SRMW)	MIRECs – retired certificates; MRETS – retired certificates	SPP – non-MRETS/MIRECs specified transactions and attributions to out-of-region GHG compliance areas; MISO – non-MRETS/MIRECs specified transactions
NEPOOL	NEPOOL-GIS Residual Mix		
Non-CA West	eGRID (AZNM, NWPP, RMPA)	WREGIS – retired certificates	CAISO and SPP voluntary markets – non-WREGIS specified transactions and attributions to GHG compliance areas; LSEs – non-WREGIS and non-market (bilateral) specified transactions
NY	NYGATS Residual Mix		
PJM	PJM-GATS Residual Mix		
Southeast	eGRID (SRTV, SRVC, SRSO, SRMV, FRCC)	NAR – retired certificates	MISO – non-NAR specified transactions; SEEM – non-NAR specified transactions; LSEs – non-NAR bilateral specified transactions
TX	eGRID (ERCT)	ERCOT (tracking system) – retired certificates	ERCOT (RTO) – untracked specified transactions; MISO – untracked specified transactions; SPP – untracked specified transactions

7. Data Constraints

7.1 Challenges, Constraints, and Gaps in Necessary Data

Residual mix calculations depend on the availability and quality of data. The challenges and constraints associated with obtaining the requisite data vary across different regions, particularly in areas lacking comprehensive tracking systems or robust data sources. This section describes data availability, regional variation, and data improvements relevant to the key residual mix data categories.

Generation Data

In comparison to specified transaction data and RPS data, generation data tends to be more readily available in the United States. Stakeholders can often access this information through sources such as the EIA and EPA. These agencies offer datasets that provide insights into energy production, consumption, fuel types, and emissions. The EIA's data, including the EIA Forms 923[17] (Power Plant Operations Report), 860[18] (Annual Electric Generator Report), and 930[19] (Hourly and Daily Balancing Authority Operations Report) can be particularly valuable for understanding electricity generation and emissions at national, state, and regional levels. Similarly, the EPA's eGRID contains a wealth of information on emissions and generation resources, helping to discern the emissions associated with different power generation sources.

Despite the relatively greater accessibility of generation data, it is essential to acknowledge that even in this category, granular and specific details required for precise residual mix calculations may not always be readily available. While existing generation data sets offer a promising starting point for calculations, these data sets do have limitations. For example, the EIA data sets do not represent generators with a nameplate capacity of less that one megawatt (MW).

Specified Transaction Data

Obtaining reliable specified transaction data presents several challenges, often stemming from the diversity of sources, transaction types, markets, and data accessibility. In some regions and for certain resource types, data related to specified transactions might not be tracked or publicly available, leading to data gaps that hinder comprehensive residual mix calculations. For instance, organized wholesale markets (e.g., ISOs and RTOs), while crucial sources of data, may not disclose the specifics of specified transactions. As an example, the PJM Interconnection provides extensive data on market operations[20], but this might not be the case in all regions, complicating uniform data collection. In the case of bilateral contracts or transactions, data can be proprietary or confidential, limiting transparency. Data accessibility and reporting practices vary among vertically integrated utilities and other LSEs, potentially affecting data quality and consistency. Similarly, short-term voluntary

17 See https://www.eia.gov/electricity/data/eia923/.

18 See https://www.eia.gov/electricity/data/eia860/.

19 See https://www.eia.gov/electricity/gridmonitor/about.

20 https://www.pjm.com/markets-and-operations/etools/dataviewer.aspx.

wholesale markets in the West are new and are not yet operational or fully transparent.

These data constraints highlight the need for standardized data reporting practices and enhanced transparency, particularly in regions with diverse and fragmented data sources. They also highlight the benefits of nationwide all-generation tracking, which should be a common goal for all consumers and programs. Data quality and consistency are pivotal for accurate residual mix calculations, and addressing these constraints is essential for achieving comprehensive and precise reporting.

RPS/CES Data

RPS compliance data plays a vital role in shaping residual mix calculations, offering insights into the extent of clean and renewable energy usage within a region. However, several challenges are associated with RPS compliance data, which can impact the accuracy and reliability of residual mix calculations[21].

Obtaining reliable RPS and CES data can be challenging due to several potential data constraints. First, RPS and CES programs can vary significantly from state to state in terms of their requirements, compliance timeframes, reporting structures, and data availability. Most state RPS programs also involve multi-year compliance periods, complicating annual RPS compliance data for annual Type B residual mixes. Furthermore, some RPS states have multipliers to incentivize specific technologies.[22] These multipliers are a part of RPS policies that count towards compliance and vary by state, illustrating that an LSE's compliance with RPS may not accurately reflect the MWh of renewables being procured and delivered. The presence of RPS compliance data does not necessarily guarantee that RECs have been retired for compliance. RECs are often banked for future compliance years. For calculating a residual mix, RECs that are banked for compliance should be treated as transacted and used in the year of issuance.

Moreover, the accuracy and completeness of RPS compliance data can vary significantly. The reporting processes and verification mechanisms associated with RPS compliance can be complex, and discrepancies or inaccuracies in the data can occur. These variations and inaccuracies in RPS compliance data can impact the calculation of residual mixes, as they rely on precise and reliable data to provide accurate insights into the clean energy landscape.

To address these challenges, it is essential to conduct a rigorous examination of RPS compliance data, ensuring that it aligns with actual REC transactions used for compliance in the residual mix timeframe. Verification and validation processes are critical to confirming the accuracy of reported data. By addressing these challenges associated with RPS compliance data, stakeholders can enhance the precision and transparency of residual mix calculations, ultimately contributing to more accurate energy and emissions reporting.

21 These challenges are highlighted in Center for Resource Solutions' publication Sources: *Accounting for Standard Delivery Renewable Energy.* Available at: https://resource-solutions.org/document/03152101/.

22 See *Credit Multipliers in Renewable Portfolio Standards*. Prepared for The RPS Collaborative by Brian Lips, Senior Project Manager for Policy North Carolina Clean Energy Technology Center. July 2018. Available at: https://www.cesa.org/wp-content/uploads/RPS-Multipliers.pdf.

7.2 Data Improvements

Importance of Public REC/ EAC Tracking Systems

The availability of public REC/EAC tracking system data is crucial to residual mix calculations. By leveraging public REC/EAC generating asset inventories, stakeholders can establish a clearer and more accurate connection between attributes and their sources. This transparency helps avoid double counting and ensures that residual mix calculations reflect the true contribution of various generating assets.

Consistency in Data Collection and Reporting

Consistency in data collection and reporting practices across regions is crucial for ensuring the overall quality of residual mix calculations. When data collection methodologies and reporting standards align, it becomes easier to aggregate and compare data from various sources. This consistency enhances data reliability and simplifies the process of creating comprehensive residual mixes. Standardized practices and protocols for data collection and reporting contribute to a higher level of accuracy and transparency in energy and emissions reporting.

By understanding the hierarchy of data sources, recognizing the significance of public REC/EAC generating asset inventories, and prioritizing consistency in data collection and reporting, stakeholders can improve the precision and reliability of residual mix calculations, regardless of the region in question.

Entities Suited for Residual Mix Calculations and Data Publication

Organizations with experience in energy and attribute accounting, such as wholesale market operators, regional tracking systems, organizations that monitor RPS compliance (e.g., State public utilities commissions), and EPA and EIA are well-suited to calculate and publish residual mixes. These entities possess the necessary expertise and infrastructure to ensure the accuracy and transparency of residual mix data. It is recommended that entities responsible for generating, trading, or retiring RECs also play a pivotal role in data publication. By providing clear and accessible data on certificate retirements and transactions, these entities contribute to more reliable residual mix calculations. The entity that performs the residual mix calculation and provides residual mix data may be different from the sources of data required for residual mix calculations (see Section 6).

Future Sources of Data

To improve data availability and quality, potential future sources of data include survey information collected by entities like the EIA, organized wholesale markets (e.g., ISOs/RTOs), and utilities. Surveys can help capture additional data on energy generation, certificate transactions, and compliance with renewable and/or clean energy standards.

Collaboration with organized wholesale markets can lead to more extensive and standardized data collection practices, enhancing the quality of data available for residual mix calculations. Utilities also play a key role in providing data on regional energy generation and transactions, especially for areas without comprehensive tracking systems.

A nationwide all-generation tracking system would also greatly facilitate residual mix calculations. This system would offer broad view of all energy generation sources and transactions, allowing for precise attribution. With such a

system in place, the accuracy and granularity of residual mix calculations would significantly improve. It would streamline the process by providing a unified platform to capture and record all energy generation data, ensuring a more precise and comprehensive assessment of renewable and clean energy attributes across regions and markets.

As residual mix calculations evolve and data sources improve, a collaborative effort among relevant entities is crucial to ensure the accuracy and transparency of residual mix data. This not only benefits energy attribute accounting but also empowers consumers and businesses to make informed choices about their energy consumption and environmental impact.

8. Data Hierarchies

The recommended calculation methodologies for residual mixes are designed to be adaptable to regions with diverse levels of data availability and quality. In regions where comprehensive data is accessible, such as those with well-established tracking systems and robust federal databases (e.g., eGRID, EIA), the Type A and B residual mixes provide the most accurate representation. However, recognizing the variability in data infrastructure across regions, Tables 5 and 6 provide hierarchies of data that should be used instead of residual mix, for Types A and B, respectively, in scenarios where the required data for residual mix calculations (in Section 6) is not available or faces considerable constraints (see Section 7).

The priority order reflects a balance between accuracy and conservatism. For instance, regional fossil-only resource mixes and emissions factors allow for a conservative estimation by assuming all non-fossil generation has been transacted and therefore removed. This approach, although less accurate, ensures a more cautious representation of generation used in the absence of residual mix data. The use of regional voluntary-only residual mixes, such as those provided by programs like Green-e®, is less accurate and also less conservative as it allows for renewable and clean generation that has not been included in a Green-e® certified transaction to be claimed. The objective is to maintain consistency in reporting across regions, acknowledging the trade-offs inherent in the availability and quality of different data sources.

Table 5: Type A Residual Mix Data Hierarchy

DATA	SOURCE	DESCRIPTION
Type A Residual Mix	Regional generation attribute tracking systems, federal databases (e.g., eGRID, EIA)	Most accurate, all specified transactions removed
Regional fossil-only resource mixes and emissions factors	Federal databases (e.g., eGRID, EIA)	Most conservative, all renewables and other clean energy assumed to be transacted and removed
Regional voluntary-only residual mixes (e.g., Green-e® Residual Mixes)	Green-e® program	Incomplete, only removes voluntary specified transactions, double counts non-voluntary specified transactions
Regional generation adjusted for imports and exports	Federal databases (e.g., eGRID, EIA)	Double counts specified transactions, reflects regional imports and exports to approximate areas of consumption
Regional grid average	Federal databases (e.g., eGRID, EIA)	Double counts specified transactions, does not represent consumption

Table 6: Type B Residual Mix Data Hierarchy

DATA	SOURCE	DESCRIPTION
Type B Residual Mix	Not yet available	Most accurate, Type A + RPS generation
Regional voluntary-only residual mixes (e.g., Green-e® Residual Mixes)	Green-e® program	Less accurate, aggregates all RPS generation regionally
Regional fossil-only resource mixes and emissions factors	Federal databases (e.g., eGRID, EIA)	Most conservative, all renewables and other clean energy assumed to be transacted and removed
Regional generation adjusted for imports and exports	Federal databases (e.g., eGRID, EIA)	Double counts specified transactions, reflects regional imports and exports to approximate areas of consumption
Regional grid average	Federal databases (e.g., eGRID, EIA)	Double counts specified transactions, does not represent consumption

9. Example Use of This Guidance for Residual Mix Calculation

This section provides an example of residual mix use for the consumer market-based scope 2 application. In this example, the customer's annual electricity consumption is 100 MWh and the customer has multiple electricity procurement strategies which require different residual mix EFs (use cases).

- For 20 MWh, they participate in a utility green tariff for solar generation.
- For 20 MWh, they use rooftop solar but they sell off the associated RECs.
- For 60 MWh, they rely on the utility's default service, but utility-specific information for the default product is not available.

The emissions factor for the 20 MWh procured through the utility green tariff is known. However, both the 20 MWh on onsite solar that has been stripped of attributes (null power) and the 60 MWh of default service without utility-specific information require use of residual mix emissions factors.

A Type A residual mix for the consumer's ISO/RTO, or eGRID subregion if located in a traditionally regulated market, should be used for the 20 MWh of null power. If the consumer is located in a region with all-generation tracking, the all-generation tracking system can provide this residual mix. If not, and it is not otherwise provided by a different entity, Table 4 should be used to identify sources of data needed for the Type A residual mix calculation, or the data hierarchy in Table 5 may be used to identify alternatives to a Type A residual mix for this EF.

A Type B residual mix for the consumer's state should be used for the 60 MWh of load not covered by specified purchases where utility-specific mixes are not available. If the state does not provide this Type B residual mix as the state default EF, for example, then the Type B residual mix can be calculated using Type A residual mix data and state RPS compliance data. If the consumer is located in a region with all-generation tracking, the all-generation tracking system can provide a Type A residual mix. If not, and it is not otherwise provided by a different entity, Table 4 should be used to identify sources of data needed for the Type A residual mix calculation. To this Type A residual mix, the consumer should add RPS compliance data obtained from the state, tracking system, or other source to calculate a Type B residual mix for the state. Alternatively, the data hierarchy in Table 6 may be used to identify alternatives to a Type B residual mix for this EF.

Conclusion

This paper has provided comprehensive guidance for calculating annual regional residual grid mixes and residual emissions factors, addressing the significance and applications of residual mixes in various contexts, including consumer market-based scope 2 accounting, state GHG reporting by LSE, and power source disclosure. The guidance has outlined methodologies, data requirements, and geographic boundaries for different mixes and showcased the importance of these mixes in ensuring accurate emissions reporting, especially in regions lacking comprehensive tracking systems. Furthermore, the guidance has detailed the use cases and appropriate methodologies for each scenario, highlighting the relevance of residual mixes in promoting sustainable energy practices and environmental stewardship. Finally, the paper has recommended regional residual mix data sources, showcasing the flexibility of residual mixes in addressing various reporting needs based on regional policies and data availability.

Consistent use of this guidance will foster standardization, consistency, and comparability across diverse use cases and regions, empower entities to calculate residual mixes accurately, and encourage the improvement of data, reporting, and decision-making in the pursuit of sustainable energy practices.

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Appendix A: Glossary

TERM	DEFINITION
Non-voluntary	Electricity that is delivered as part of a standard offer product or for compliance purposes with an RPS/CES.
Null Power	Energy stripped of all of the environmental and renewable attributes of generation or EACs.
Specified purchases/ transactions	Agreements or contracts in which the resource type or generation source of energy is specified, and/or that include EACs. Transactions of power without the associated generation attributes or EACs, where issued or otherwise transacted, are de facto transactions of unspecified power.
Unclaimed Power	Electricity generation that has not been included in a specified transaction at the end of a defined trading or control period.
Unspecified Power	Electricity that is generated but not tied to a particular source or origin. It is often aggregated with other sources and does not have a direct traceable path from generation to consumption.
Utility-specific Mix	A breakdown of the energy resources used or procured by a utility or retail electricity supplier on behalf of its retail sales. It provides insight into the composition of a supplier's energy portfolio, including the proportion of renewables and other clean energy resources.
Standard Delivery Renewable Energy[23]	SDRE is energy that is not actively procured by customers, but delivered to them through a default product and may be credibly reported by a customer as consumed renewable energy and by a provider as delivered renewable energy when the attributes of the renewable energy are retained or retired on behalf of the customer.
Voluntary generation	Electricity generation that is purchased on a voluntary and specified basis and not used for RPS/CES compliance or included as part of standard offer service.
Wheel-through electricity	Electricity that is imported into a region but is then exported out of the region and has a final point of delivery in a location outside of the region.

23 Accounting for Standard Delivery Renewable Energy (CRS) 2021. Available at: https://resource-solutions.org/document/030921/.

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