THE CARBON REALITY BEHIND 100% RENEWABLE CLAIMS

How more transparency around electricity emissions can enhance corporate climate impact.
“Digitalization is reshaping the power sector. Corporate energy procurement can progress toward a more accurate, data-informed approach to decarbonize further and faster.”
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Executive Summary

This report is the first ever to examine energy-related (market-based) emissions of global companies using a more granular Scope 2 accounting metric.

Most of these companies either claim today, or have short-term targets, to be powered by “100% renewable energy” and therefore having zero electricity-related carbon emissions following today’s current guidelines from leading environmental reporting standards (GHG Protocol Scope 2 market-based) and leadership programs (CDP, SBTI, RE100 etc.). Our results indicate that these companies are not reaching zero emissions when analyzing their market-based emissions (i.e. based on the electricity that organizations have chosen to purchase) using requirements that more closely reflect the physical reality of electricity grids. Such criteria are an evolution of the current “market boundaries” and “vintage” Scope 2 guidance, provided by the GHG protocol:

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Current Scope 2 market-based</th>
<th>Granular Scope 2 market-based</th>
</tr>
</thead>
<tbody>
<tr>
<td>Market boundaries (location)</td>
<td>Same continent</td>
<td>Same grid region</td>
</tr>
<tr>
<td>Vintage (time)</td>
<td>Same year</td>
<td>Same hour</td>
</tr>
<tr>
<td>Quality criteria</td>
<td>N/A</td>
<td>N/A</td>
</tr>
</tbody>
</table>

Thanks to our CFE Diagnostic web app, we collected and analyzed 109 different voluntary input/responses about corporate electricity consumption and supply contracts and compared the results of applying the two different methods described above. The key insights we gathered from our sample are:

1. The current structure of supply contracts are a barrier for granular market-based Scope 2 accounting
   a) 67% of respondents have signed RE supply contracts without clear oversight of where their electricity comes from (Insight 1). This prevents these businesses from knowing whether they comply with the market boundaries requirements included in more accurate Scope 2 accounting (ensuring your energy is bought from the same grid you offtake from).
   b) 42% of respondents who can claim zero market-based emissions using the current Scope 2 guidelines have not signed any electricity supply contract that can meet this more granular market boundary requirements (Insight 2).

2. The respondents report less than half of their emissions using the current Scope 2 accounting principles compared to what would be reported using more granular Scope 2 accounting principle (Insight 3).
   a) Just for the sample of respondents included in this analysis, almost 1.5M t CO2 is not being reported.
   b) On average, respondents report 13,000 t CO2 less in each country of operation.
c) Only 2% of the respondents reporting zero market-based emissions following the GHG Protocol's current Scope 2 market-based guidelines could reach the same result considering more granular criteria (stricter geographical and temporal requirements) (Insight 4).

3. Hourly matching decreases the respondents' RE performance score by 45 percentage points on average (Insight 5)

a) The difference between the contracted CFEScore and RE100 is, on average, **74 percentage points** considering all responses.

b) The difference decreases to **45 percentage points** when considering only the respondents that have signed at least one supply contract compliant with the market boundaries requirement of the granular Scope 2 principles. This aims to highlight the bias derived from the vintage requirement.

Whereas the current guidelines have been highly successful in incentivizing and developing a vast community of corporate buyers contracting renewable energy, the report clearly shows that this also creates a false sense of achievement, failing to provide organizations with the right information to understand the real carbon footprint of their energy supply and therefore the right incentives to negotiate supply contracts with suppliers.

Especially the (lack of) clear “provenance” commitments (clearly stating if the electricity comes from the same country of origin as consumption) in today’s supply contracts is failing to allow businesses to account for their emissions using a more granular approach. This shows that the main barrier to more accurate and credible carbon accounting is not data availability, the complexity of hourly matching, or many other criticisms often laid out. Today, our Energy Attribute Certificates systems (RECs, REGOs, GOs, I-REC, etc.) allow for more granular market boundaries requirements and reporting. Buyers simply need the right incentives to request it from their suppliers. If enough companies start doing it, the EAC price will increase wherever the supply is limited, leading to a stronger impact of corporate procurement practices.

Therefore, any business **can start today with a more accurate accounting of their emissions inventory** and assess how to adapt their procurement strategy to achieve zero (market-based) emissions hourly, using local renewable energy. This can protect businesses against upcoming carbon regulation changes and empower them to **communicate decarbonization progress with more confidence and transparency.**
We want to highlight the need for an evolution of the norm, a shift towards a **true and fair** carbon accounting landscape"
We started FlexiDAO back in 2017 in response to a systemic challenge we saw in the market.

Many global companies were making bold claims about being powered by “100% renewable energy”, and the number of energy retailers offering “100% renewable electricity” contracts was growing daily. How did these companies solve the challenge of the intermittent availability of wind and solar energy? How did they achieve the dream of being powered by 100% renewables on grids that suffer from a physical bottleneck of electricity flow or where energy storage is still scarce and expensive? Well, they didn't because they were not required to do so.

Fast-forward 5 years, this systemic challenge is now widely recognized and debated (by bodies like Princeton, Bloomberg, Berlin Institute of Technology). The lax requirements that allow retailers and companies to claim “100% renewable energy” are becoming a threat to market-based carbon accounting principles. The tipping point was reached a few months ago when WRI and WBSCD opened a public consultation requesting businesses, regulators, NGOs, activists, and other stakeholders to respond on whether market-based carbon accounting could ever have a material impact on the world’s decarbonization (we have recently published an article on this ongoing process and its potential outcomes). FlexiDAO’s answer is definitely yes. However, updates are urgently needed to improve accuracy and safeguard credibility and actionability. This is even more important considering the recent EU and US regulatory frameworks on mandatory Scope 1 and Scope 2 reporting for large-size businesses.

This report highlights the existing gap between electricity-related carbon accounting practices and emissions that could be reported using a reviewed market-based carbon accounting standard that adopts stricter temporal and geographical requirements. We intend not to point fingers at mainstream renewable energy metrics or criticize companies for how they currently purchase and account for renewable energy. It is, after all, the norm to account for emissions on an annual basis with lax geographical requirements, and the current system has played a crucial role in deploying all the renewable energy projects we have today. Instead, we want to highlight the need for an evolution of the norm, a shift towards a true and fair carbon accounting landscape that can propel us into a cleaner, greener world.

We look forward to bringing you on this journey with us.

Simone Accornero
CEO & Co-founder of FlexiDAO
In 2022, WRI and WBSCD announced a public consultation requesting businesses, regulators, NGOs, activists, and other relevant stakeholders to respond on:

1. Whether Scope 2 market-based carbon accounting could ever have a material impact on the global decarbonization effort;
2. If not, what changes are required to ensure Scope 2 achieves the above objective?

Following this announcement, we have decided to look at the data we collect as part of our business operations to assess the potential changes’ impact on today’s corporate sustainability and decarbonization claims.

In this first report, we have decided to focus on more granular Scope 2 accounting, see The 24/7 CFE approach section (granular Scope 2 accounting) for more information - and how it might impact the emissions that companies report to disclosure programs such as CDP, RE100, and SBTi.

Therefore, whereas several critical reports have been released in recent years which explore the projected system-level benefits of businesses adopting 24/7 strategies (Princeton, TU Berlin, IEA), this report goes in a different direction: it is the first to hone in on the current state of play for companies in the market today. The insights presented here illustrate how the emissions currently reported by large international companies using well-established annual reporting metrics like RE100 and SBTi differ significantly from those reported using a location-sensitive, hourly metric. By accounting for emissions using a more accurate accounting method, businesses can have more accurate oversight of their carbon footprint.

Adopting a 24/7 CFE procurement strategy can directly benefit business operations and performance while reducing carbon-related risks. Please visit our CFE Academy to deepen your knowledge of these crucial topics.
The data used in this report

In this report, we analyze the procurement practices of 22 companies with operations in multiple countries, 18 of which have either a public SBTi target or are a RE100 member. Each company has responded by providing data (details below) for some of their countries of operations. This has provided 109 survey responses (one response is one country for one business) about corporate energy procurement across 27 countries and 4 US states. The responses we received sum up to 5.87 TWh of reported consumption and 1244036.01 MWh of procured Carbon-free Electricity (CFE).

The data input by the companies in our sample includes

- Country of operation
- Annual electricity consumption in MWh
- The type of electricity contracts used to cover their consumption
- Whether the buyer’s electricity contracts specify the country of provenance.
- Whether the buyer’s electricity contracts specify known generation plant(s) or not (in the contractual phase).
- The generating technology of the clean energy they buy, if known (e.g., wind, solar, hydro).

The companies involved in this study provided us with information by voluntarily inputting into our CFE Diagnostic Calculator or voluntarily having data input on their behalf.

CFE Diagnostic Calculator is an online tool that provides an estimation of how much a company's electricity load is served with local carbon-free electricity on an hourly basis. (See section The 24/7 CFE approach and more technical details of the methodology at the end of this report).

The companies involved will remain anonymous.

We use yearly and hourly grid-mix averages provided by our partners at Electricity Maps to calculate emissions. Check out their amazing open-source grid mix map to compare historical and live grid mixes across multiple countries.
Current Scope 2 reporting guidelines

In 2015, market-based accounting was introduced into the GHG Protocol's Scope 2 guidelines, encouraging companies to procure renewable electricity and reduce their energy-related emissions to zero. You can read more about the introduction of market-based accounting in our previous blog post. These guidelines include two key principles regarding which electricity supply contracts are eligible to be accounted for in reducing market-based emissions:

- **Market boundaries.** Chapter 7 criteria 5 (*location*):
  All contractual instruments shall “be sourced from the same market in which the reporting entity’s electricity-consuming operations are located and to which the instrument is applied.

- **Vintage.** Chapter 7 criteria 4 (*time*):
  All contractual instruments shall “be sourced as close as possible to the period of energy consumption to which the instrument is applied.

Following the current Scope 2 guidelines (referred to throughout the rest of the report as current Scope 2), the accepted market interpretation of these guidelines is the following:

- **Market boundaries:** All contractual instruments shall be sourced from the same continent as where the reporting entity’s electricity-consuming operations are located.

- **Vintage:** All contractual instruments shall be sourced within the last 12 months from when the energy consumption took place.

This results in the following reporting metrics (mathematical formulas included in Annex):

- **Annual location-based (tCO2e):** physical emissions calculated multiplying the annual electricity load in a given country and the average annual grid mix of the same country.

- **Annual market-based (tCO2e):** Emissions calculated based on the electricity that organizations have chosen to purchase as the difference between the annual electricity load and the annual contracted renewable energy, multiplied by the average grid mix. Contracted renewable energy must meet the vintage and market boundaries requirements specified above.

- **RE100 score (%):** The proportion of your total load that is made up of contracted renewable energy that complies with RE100 technical criteria.

Therefore, following the current Scope 2 accounting guidelines, companies can report to disclosure and leadership programs like RE100 and SBTI to have zero energy-related carbon emissions (the same as claiming “100% renewable energy”) by matching their annual electricity consumption with the same volume of EACs procured within the same continent in the 12 months.
The 24/7 CFE approach
Granular Scope 2 accounting

24/7 Carbon-free Energy (CFE) is the movement towards a more true and fair accounting of carbon emissions from electricity usage and purchase, building on today’s Scope 2 market-based guidelines.

This approach (referred to throughout the rest of this report as granular Scope 2 accounting) proposes adopting more stringent requirements for the vintage and market boundaries guidelines already present in the GHG protocol. More specifically:

- **“Market boundaries”:** All contractual instruments must be sourced from the same power grid region where the reporting entity’s electricity-consuming operations are located and to which the instrument is applied. In this report, we define a power grid region as a country in EMEA or a grid managed by the same independent operator in NA, LATAM, and APAC.

- **“Vintage”:** All contractual instruments must be sourced within the same hour as the energy consumption to which the instrument is applied (i.e., hourly matching between production and consumption)

It is important to highlight that these requirements follow (and are less stringent than) the design of power markets in liberalized electricity markets all around the world. For this reason, this methodology is described as a “true and fair” representation of the physical reality of the power grid. Since this analysis focuses on reported emissions and not impact (additionality, natural environments preservations, etc.) in the more general sense, additional quality criterias to be applied as requirements to contractual instruments have not been included.

This results in the following reporting metrics:

- **Granular location-based (tCO2e):** physical emissions calculated summing the product of hourly electricity load and average hourly grid mix for every hour of the year

- **Granular market-based (tCO2e):** Emissions calculated based on the electricity that organizations have chosen to purchase as the difference between the hourly electricity load and the contracted renewable energy, multiplied by the hourly grid mix and summed for every hour of the year. Contracted renewable energy must meet the vintage and market boundaries requirements specified above

Prof. Tom Brown (TU Berlin) explains the economics behind 24/7 CFE in his peer-reviewed scientific article, where he uses a capacity expansion model. This report won’t be addressing this particular aspect.

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1 Actually power markets have even more stringent requirements since the “vintage” for trading power is usually 15 minutes and the market boundary is the bidding zone, which in many cases is a smaller area than a country or a grid region.
1. The electricity supply contract (i.e. contractual instrument) must specify the “provenance” to assess the compliance with the more granular “market boundaries” requirement.
   a) This means that in the contractual phase, the business is made explicitly aware that the Energy Attribute Certificates (EACs, the umbrella term for RECs, GOs, I-RECs, REGOs, etc.) they are purchasing come from an asset on the same grid/zone they source their electricity from.

2. The electricity supply contract (i.e., contractual instrument) must specify the generation technology from which the power and/or the EACs are sourced. Carbon-free sources include technology types like wind, solar, hydro, and nuclear (which we include as a CFE source, in line with the EU Taxonomy)

To perform the accounting calculations following the more granular Scope 2 methodology, businesses must be able to provide the following information:

- **Contracted CFEscore (%):** The weighted average for every hour of the year of the proportion of your total load made up of carbon-free electricity you have contracted on the same power grid region and within the same hour as consumption.

- **CFEscore (%):** The weighted average for every hour of the year of the proportion of your total load of carbon-free electricity you have contracted (on the same power grid region and within the same hour as consumption) and carbon-free electricity present in the hourly local grid mix of your provenance.
Our results

Insight 1
67% of respondents have signed RE contracts without clear oversight of where the electricity comes from.

This means they did not request and/or receive explicit information in the contractual phase about where the EACs claimed against their electricity consumption came from, and if the assets they are buying from are in the same grid region/bidding zone as their consumption.

This lack of oversight prevents these companies from assessing whether their contract meets the market boundaries requirements needed to account for their emissions on a granular Scope 2 basis.

For this 67% of respondents, their contracted CFEScore will be zero as they have yet to sign any RE supply contracts that meet the minimum requirement of CFE. This means their granular market-based emissions will be the same as granular location-based emissions (you can read the disclaimers at the end of the report to understand the current limitations on the residual mix).

Energy consumption distribution by contract type

Graph 1. Findings based on data inputs from our sample
When filling out FlexiDAO’s [CFE Diagnostic calculator](#), respondents specified which energy contracts they currently use to procure their electricity. The most common renewable energy contracts are:

**PPA contracts:** Long-term contracts (usually 10-15 years) between an energy buyer and a renewable energy developer. The buyer directly purchases the EACs related to a specific asset, along with the underlying electricity, at a predetermined price. In virtue of the contract structure, off-takers (buyers) usually know where their electricity is coming from.

**Green tariffs:** A short-term contract (usually 2-3 years or less) between an energy buyer and a supplier. The buyer purchases a volume of electricity from the supplier, and the supplier ensures the same volume of EACs are canceled for the buyer, which can be “bundled” (i.e. the supplier sources the EACs from the same assets as it sources the power from) or “unbundled” (i.e. the EACs are sold separately from the underlying energy, so the power is not being directly consumed by the purchaser). Some suppliers offer tariffs with explicit information about where the EACs they procure are coming from (which grid or renewable asset) in the contractual stage, but this is not common or a requirement.

**Unbundled EACs:** Buyers purchase electricity on the wholesale market and purchase the same volume of EACs from a supplier or broker. Similarly to green tariffs, some brokers and suppliers offer EACs explicit information about where the EACs they procure are coming from (which grid or renewable asset) in the contractual stage, but this is not common or a requirement.

**Figure 1.** [Figure 10: Procurement reported by RE100 members since 2016](#)
Our results show that a higher proportion of buyers with green tariffs and unbundled EACs don't have oversight on the provenance of their renewable energy procurement. This is enforced by the fact 67% of our sample confirmed not being clear on not knowing if their electricity is from the same provenance as they source electricity from when using these contracts (unbundled EACs or green tariffs), whereas only 6% confirmed knowing their asset with these contracts. This is, of course, not the case for PPAs, for which, due to the nature of the contract, the provenance is always known.

Our findings partially align with the latest 2022 annual RE100 report published by CDP (see figure 1). The difference may derive from the dataset used in this report compared to RE100 members (22 companies vs. 334) and because only 19 out of 22 companies that responded to our study are RE100 members.

Nevertheless, the importance of market boundaries is clearly laid out also in the latest 2022 annual RE100 report published by CDP. The report explains (page 12) that as of 2022 reporting companies are asked to “report a country breakdown of their electricity consumption and corresponding procurement of renewable electricity. They also report on the procurement types they use, and in which countries or areas the projects they are purchasing from are located”.

The report mentions that, in Europe, around 17% of procurement is crossborder. However the report goes on acknowledging that “[reported] number is distorted by RE100 members' varying footprints in different countries” (page 19). This sentence corroborates our finding that, today, companies are not ready to clearly and accurately report market-based emissions including clear market boundaries analysis. Nevertheless, as FlexiDAO, we are delighted to see CDP and RE100 encouraging their members to move in this direction.
Insight 2

42% of respondents that can claim zero market-based emissions using current Scope 2 guidelines haven't signed any electricity supply contracts that meet a more granular “market boundaries” requirement.

Respondents that have an RE100 score (see description in section 5 of this report) of a hundred in the specific reported grid region (not globally as a company) can also claim zero market-based emissions. The graph below shows the comparison of respondents RE100 scores compared to their contracted CFEScore (see The 24/7 CFE approach - granular Scope 2 accounting for definitions). A large proportion of our sample have RE100 scores of 100 or above (over procurement in the grid region), yet CFEScores of zero, which means they haven’t signed contracts which meet the granular “market boundaries” requirement needed for granular Scope 2 reporting.

Graph 2. Findings based on data inputs from our sample

At the same time, 4% of the respondents in our sample are currently performing way above average even when applying granular Scope 2 principles. These respondents could leverage their performances and communicate through a robust, transparent environmental leadership campaign. This strong show of climate leadership can provide an advantage when attracting new ESG investments or climate-conscious customers to their business.
**Insight 3**
Respondents report less than half of their emissions using the current Scope 2 accounting approach if we compare this to more granular Scope 2 accounting principles.

By adding up the total reported emissions from respondents in this study, we find that almost 1.5Mt CO2 is not being reported using the current Scope 2 accounting approach compared to a more granular Scope 2 accounting approach. To explain this point with an analogy, consider how an annual weather forecast across Europe would not be accurate enough to represent the physical reality of what the skies are doing in one European city at a given moment. In the same way, annual accounting with lax requirements regarding the time and place of electricity production struggles to accurately represent the reality of local electricity grids considering factors such as the fluctuating carbon intensity and existing interconnections. This low data resolution can lead to false confidence in companies’ decarbonization progress. Several articles and scientific papers have begun to pick up on and discuss this.

Graph 3 highlights the difference in the sum of the reported market-based emissions inventory for the respondents in our sample when calculated following the current Scope 2 principles versus the granular Scope 2 accounting principles.

**Graph 3. Findings based on data inputs from our sample**
“...consider how an annual weather forecast across Europe would not be accurate enough to represent the physical reality of what the skies are doing in one European city...”
**Insight 4**

Just **2% of the respondents** that can report zero market-based emissions following the current Scope 2 accounting approach can do the same following a granular Scope 2 accounting principle.

Complementing the previous insight, the graph below shows the percentage of survey respondents that can claim zero market-based emissions using the current Scope 2 approach, and how this compares if we look at market-based emissions using granular Scope 2 accounting principles.

**Achieving zero market-based emissions with current vs granular Scope 2 principles**

![Graph 5. Findings based on data inputs from our sample](image)

As you can see, the difference is stark. Whereas 61% of respondents in our sample can claim to have zero emissions via the current Scope 2 approach, only 2% can report the same on an hourly metric when using a granular Scope 2 accounting principle.
**Insight 5**
The difference between the average contracted CFEscore and RE100 Score is:

- **74 percentage points** considering all the responses
- **45 percentage points** when considering only the respondents that have signed at least one supply contract compliant with the market boundaries requirement of granular Scope 2 principles.

**Average contracted CFE Score & Average RE100 Score**

![Graph 6](image)

*Graph 6. Findings based on data inputs from our sample*

**Average contracted CFE (inputs with CFE contracts) & Average RE100 Score**

![Graph 7](image)

*Graph 7. Findings based on data inputs from our sample*

In this graph, the difference is considerably lower, although it remains very high in terms of absolute numbers. The difference between the two metrics aims to show the impact that the vintage requirement (hourly matching) has on the emissions calculation. We can see that on its own.
Conclusions

From the insights in this report, we can see the considerable gap that exists between companies’ emissions inventory when using the current Scope 2 reporting standards compared to a more granular accounting approach, with hourly accounting and limitations on the geographical origin.

This can foster false confidence in the business's progress toward carbon reduction targets, especially when buyers are members of leadership programs like CDP, RE100 or SBTi. As the market evolves, buyers should be aware that today’s “100% renewable energy” claims often do not equal zero emissions. Businesses do not want to find themselves on the back foot if carbon accounting standards change (revision of the GHG protocol is underway) and potentially start to demand a more granular and data-informed reporting approach to Scope 2 emissions.

This report does not intend to disregard the effectiveness of disclosure programs like CDP, the RE100 and SBTi. After all, market-based emission reporting and these global initiatives have helped develop a community of corporate energy buyers, enabling direct contracting of over 76.9 GW of clean energy capacity worldwide between 2010 and 2020, which continues to grow. These programs also continuously review and refine their reporting standards; they recently included the production asset age as quality criteria, as well as the requirement to report the country’s breakdown of electricity consumption and corresponding procurement of renewable electricity.

Instead, the results highlight how businesses can continue to evolve their energy procurement approach, driving their energy-related emissions down to zero once and for all. Our results show how the current renewable energy market does not appear to incentivize buyers to favor contracts with key data about where and when the electricity they buy is being generated. Without this data, it is difficult for businesses to genuinely quantify their energy-related emissions and act in response to this. All buyers can start on the right foot today by switching to a CFE strategy regardless of their current CFE progress, having better oversight over where their electricity comes from, and beginning working towards zero emissions on a more accurate and data-informed metric that better reflects the reality of the electricity market.

If you want to understand more about your decarbonization progress using a more granular Scope 2 accounting metric, you can run your own CFE diagnostic here.

The results from this diagnostic are your first step towards stronger emissions oversight and data-led climate leadership.
About FlexiDAO

At FlexiDAO, we envisage a world that runs on carbon-free energy every hour of every day. We are co-creating the global standard for the next generation of energy procurement that can completely decarbonize the grid while providing the right tools for businesses to take action.

We believe existing energy reporting frameworks need to evolve. Data is the key to achieving this our solutions allow corporate buyers and suppliers to accurately track the carbon intensity of their energy usage. We help businesses pursuing both Emissions First and 24/7 CFE strategies to achieve their goals.

FlexiDAO is collaborating with other early movers in the carbon-aware energy space, like the United Nations 24/7 Carbon Free Energy Compact, Eurelectric with its EU 24/7 Hub, CEBA/CIBI, Linux Foundation Energy, and Energy Tag.

If you want to hear more about our work or discuss your own CFE Diagnostic results, you get in touch.
Methodology

The results in this study have come from data input by or on behalf of businesses into our CFEDiagnostic calculator. The data insights we have drawn are only as good as the data that has been provided, and we are aware that businesses may not have had complete information about all of their electricity contracts when inputting data.

We are also aware of the limitations in this study in regards to sample size, scope, and estimations based on industry averages that can only provide projected rather than completely granular results. We intend to continue gathering and measuring data on the decarbonization progress of businesses as we continue to grow, producing updated and increasingly more granular reports in the future.

The calculations used for our reporting metrics are:

<table>
<thead>
<tr>
<th>Metric</th>
<th>Calculation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Annual location-based (tonCO2)</td>
<td>load [year=i] * average_grid_mix [year=i]</td>
</tr>
<tr>
<td>Annual market-based (tonCO2)</td>
<td>(load [year=i] - contracted_RE [year=i]) * average_grid_mix [year=i], where contracted_RE must meet the vintage and market boundaries requirements of the current Scope 2 principles</td>
</tr>
<tr>
<td>RE100 score (%)</td>
<td>(contracted_RE [year=i] / load[year=i] )×100</td>
</tr>
<tr>
<td>Granular location-based (tonCO2)</td>
<td>sum(load [hour=i] * average_grid_mix [hour=i])</td>
</tr>
<tr>
<td>Granular market-based (tonCO2)</td>
<td>sum([load [hour=i] - contracted_CFE [hour=i]] * grid_mix [hour=i]), where contracted_CFE must meet the vintage and market boundaries requirements of the granular Scope 2 principles</td>
</tr>
<tr>
<td>Contracted_CFEscore (%)</td>
<td>weighted_average(contracted_CFE [hour=i] / load [hour=i])×100</td>
</tr>
<tr>
<td>CFEscore</td>
<td>weighted_average(load [hour=i] - contracted_CFE [hour=i] - grid_CFE[hour=i]) / 100</td>
</tr>
</tbody>
</table>
The methodology we use to calculate CFEDiagnostic is as follows, in line with how Google measures their CFE progress.

**Businesses input:**

- The industry type
- Electricity consumption for each country/region
- Contracts type and expected electricity coverage

**We provide:**

- Based on industry type we plot an estimated average daily curve for the entire year. These curves vary in data accuracy based on industry (due to the nature of the business. Data centers have a very predictable consumption curve for example, whereas manufacturing businesses do not).

- Each country/region has its own daily estimate production curve (with hourly granularity) per energy source (hydro, wind, solar, nuclear). We use this data to analyze how businesses’ estimated hourly consumption profile matches with local carbon-free energy production.

- Each country/region has its own hourly grid mix based on the latest completed year. We use this data to analyze how businesses’ estimated hourly consumption profile matches with local carbon-free energy production.