

Achieving Corporate Climate Commitments: Risks and Benefits of Using Virtual Power Purchase Agreements and Unbundled Renewable Energy Certificates

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Abstract Energy consumption via electricity purchased by organizations makes up a large part of worldwide greenhouse gas (GHG) emissions. More than two-thirds of electricity used is by commercial and industrial users. Companies with warehouses, offices, data centers, and other facilities, and that engage in industrial processes consume significant amounts of purchased electricity to power their operations. Most organizations do not generate their own electricity or have operational control of their energy generation; rather, they purchase it from public utilities and other providers. Many organizations are making climate commitments in support of the Paris Agreement's net-zero pledge by reducing their indirect "Scope 2" GHG emissions and promoting development of more renewable energy and less dependence on fossil-fuel-generated electricity. Depending on the locations of organizations' facilities, renewable energy infrastructure may or may not be available. However, companies can meet their public climate commitments by obtaining renewable energy certificates in lieu of obtaining renewable energy directly to their operations. Each certificate purchased represents 1 megawatt-hour of renewable energy added to the grid. The two options for obtaining these certificates, which this study will focus on: obtaining renewable energy certificates via a contract, such as a virtual power purchase agreement or purchasing them from a broker or developer without a contract, or association with energy generated known as "unbundled renewable energy certificates." Thus, even when companies do not consume the energy directly, their efforts do not go unnoticed by their stakeholders as they take possession of the environmental attributes via renewable energy certificates. Either option enables companies to secure renewable energy certificates and meet their climate commitments. Companies may purchase certificates equal to their total greenhouse gas emissions emitted or equivalent to the MWh value of fossil-fuel-generated energy consumed as a way to offset their Scope 2 GHG emissions generated from fossil fuels. Both options have potential risks and benefits. The second phase of this research will be to measure and identify these risks around long-term virtual power purchase agreements and unbundled renewable energy certificates. Results of the literature review show that there are substantial benefits and potential risks to organizations that use these instruments to achieve their climate commitments. The significance of this research is to identify, quantify, and measure the potential risks of unbundled renewable energy certificates and virtual power purchase agreements. The results of the research can serve as a baseline framework to be used by corporations and clean energy developers to combat climate change and accelerate their renewable energy portfolios. Understanding the risks will undoubtedly help in developing key mitigating strategies and removing the timeline barriers associated with contract negotiations, signage, or the purchase of unbundled renewable energy certificates.

Keywords: *renewable energy; virtual power purchase agreement; sustainability; environmental, social, and governance (ESG); climate change; renewable energy certificates; fossil fuels; greenhouse gas protocol; stakeholders; net zero; carbon neutrality; decarbonization; science-based targets initiative; Paris Agreement*

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1. Introduction

1.1. Corporate Decarbonization

As the environmental sustainability landscape continues to evolve, companies are increasingly examining their short and long-term climate efforts and developing strategies to help decarbonize their operations to support limiting global warming to 1.5 degrees Celsius. Investors, consumers, and policymakers are increasingly concerned about climate risks, and corporations whose operations have substantial environmental impacts are being asked to take action. Many companies are incorporating environmental, social, and governance (ESG) into their long-term business strategies, and environmental and social issues must be addressed for companies seeking to align with industry standards and remain competitive. [1] Energy consumption is vital to most companies' operations as they manufacture products, provide services, and engage in onsite collaborations [2].

Energy consumed by companies typically comes from purchases from local utilities that operate near their facilities. [3] Most companies disclose their greenhouse gas emissions, categorizing them according to the greenhouse gas protocol. Companies that purchase energy normally classify their emissions under their Scope 2 emissions [3]. According to the greenhouse gas protocol, many corporations obtain large portions of their energy from utilities, as opposed to generating it onsite, where they would have operational control [4].

1.2. Categorizing Corporate Greenhouse Gas Emissions

Many organizations are seeking to quantify and account for their greenhouse gas emissions. Creating a baseline year is important for tracking over time their progress in reducing their carbon footprints. [5] Using the right methodology is imperative as greenhouse gases may not be emitted directly by end users, and accurate tracking requires that double counting not occur, i.e., no two companies should report the same direct emissions. Importantly, one company's direct emissions (Scope 1) may be another's indirect emissions (Scope 2 or 3). The greenhouse gas protocol is used by many companies to quantify their greenhouse gas footprints.

The greenhouse gas protocol categorizes emissions based on operational control of assets (World Resources Institute, 1998). According to the protocol, companies categorize their emissions into three Scopes: [6] Scope 1 refers to the direct greenhouse gas emissions over which a company has operational control, such as owned mobile fleets, generators, and boilers that burn fossil fuels. Scope 2 (indirect) emissions are those that come from the purchase of electricity, steam, and heating, from utilities or generating plants whose assets and operations are not under the control of the organization receiving the energy. The corporation purchases the energy (electricity, steam, heat) from the generator. Scope 3 (other indirect) greenhouse gas emissions are those within a company's value chain (supply chain), for example, those generated by the creation of purchased goods and services, business

travel, and waste generated in operations. [4] Organizations should track their energy usage, including any source that burns fossil fuels, thereby reducing environmental impacts as part of their long-term strategy to reduce fossil fuel usage or perhaps remove the source from operations in support of their climate goals.

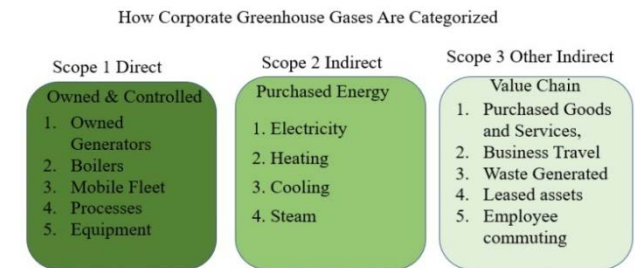


Figure 1. Shows categorize of corporate greenhouse gases [7]

The three Scopes—1, 2, and 3—of greenhouse gases are categorized as shown in Figure 1. [8] They describe the exclusive sources to baseline and inventory in order to reduce them and, ultimately, achieve net zero.

1.3. Greenhouse Gas Accounting Methods for Scope 2 Emissions

The greenhouse gas protocol is one of the most widely used methodologies by which companies account for their GHG emissions. More than 90 percent of top *Fortune* companies [9] use the greenhouse protocol to quantify their Scope 2 greenhouse gas emissions. Many organizations use multiple instruments to reduce their Scope 2 emissions, such as virtual power purchase agreements, green tariffs, and even unbundled Renewable Energy Certificates, which allow reductions to be taken using these instruments. [10]

The Greenhouse Gas Protocol has two Scope 2 accounting methodologies that organizations can follow to quantify and report their greenhouse gas emissions from energy consumption. The first is the location-based method, which uses grid averages from where a company's facilities are geographically located and energy is sourced. These locations could be in proximity to electricity that is generated mostly from fossil fuels, which generate high levels of greenhouse gases.

The second methodology is the market-based approach, which uses emission factors from the markets in which power is generated when a company sources energy under a specific contract, such as a power purchase agreement, virtual power purchase agreement, or green tariff, or even when a company purchases renewable energy certificates from a project that is not located near its operations. [11] In the second approach, the organization normally sources some form of renewable energy in a market outside of its operations. Under the market-based method, the Greenhouse Gas Protocol allows organizations to use zero greenhouse gas emissions in the calculation, which ultimately allows them to report lower levels of greenhouse emissions.

Both location-based and market-based approaches can be utilized in developing the organization's greenhouse gas inventory. Many frameworks or methodologies encourage corporations to disclose Scope 2 greenhouse

gas emissions, using both location-based and market-based methods so that stakeholders can understand a company's energy strategy.

1.4. Corporate Disclosures and Transparency

Increasingly, companies are disclosing information about their greenhouse gases, climate risks, and climate commitments in order to satisfy the needs of investors and stakeholders, and both public and private companies are under pressure to be more transparent. [12] As the landscape of environmental, social, and governance (ESG) continues to evolve, policies and regulations are emerging that are pushing companies to look at their carbon footprint and set reduction goals. Stakeholders and investors have advocated understanding what efforts and progress are being made by companies to reduce their environmental footprints. Nevertheless, companies often publish their metrics via the public domain on their websites, or via annual sustainability reports, corporate responsibility reports, etc. [13] Organizations that disclose their progress in mitigating climate risks and reducing their impact allow investors and stakeholders to evaluate how responsible they are so they can make informed decisions about the financial climate risk impact that a company has.

Studies have shown that companies that are responsible and incorporate environmental stewardship into their long-term business strategies tend to be more financially stable and have higher stakeholder satisfaction. Nevertheless, publicly traded companies are subject to the ESG ratings which often use public information to score and rate companies according to their peers or industry standards. [14] Rating agencies routinely score public companies against environmental, social, and governance criteria. Many of these ratings, such as MSCI and Sustainalytics, require public information for companies to receive credit for their efforts and thus maximize their scores. Hence, companies' strategies evolve as policy changes, stakeholder expectations increase, and ESG rating agencies raise their standards. Importantly, companies that develop resilient long-term strategies to reduce their environmental impact and share information with its stakeholders are better prepared for evolving ESG policies and foreseeable trends.

1.5. Emerging Policy and Regulations

Policies in the United States and internationally that require companies to set net zero commitments and science-based targets are on the rise. [15] Sustainability efforts are moving from voluntary to required directives as the policy is put in place. Scope 2 emissions have a drastic impact on achieving net zero. Scope 2 emissions are a relevant metric as they are related to energy consumption. Policy and governmental involvement to ensure that commitments such as net zero are met will increase over the next decade. Many companies use frameworks as guidance and methodology to determine how to disclose their efforts consistently around environmental stewardship. Policy frameworks such as the Global Reporting Initiative (GRI), Task Force on Climate-Related Financial Disclosures (TCFD), Corporate

Sustainability Reporting Directive (CSRD), and Sustainability Accounting Standards Board (SASB), all recommend or require companies to disclose their Scope 2 emissions. [16,17]

Many frameworks have been endorsed by existing and draft policies, such as the United States Security and Exchange Commission's draft, "Enhancement and Standardization of Climate-Related Disclosures. The draft rule only applies to publicly traded companies, but private companies are still being scrutinized by their stakeholders, and suppliers to be more transparent as to their carbon footprints and climate commitments. (Securities and Exchange Commission, 2022). Moreover, publicly traded companies are also subject to many ESG ratings, such as CDP, MSCI, Sustainalytics, and Bloomberg. [14] These ratings agencies use public information to assess companies according to ESG trends, their peers, global initiatives, etc. They score companies based on how transparent they are and how much they disclose publicly to their stakeholders. Most of the agencies require disclosure of Scope 2 greenhouse gas emissions and other metrics to receive the maximum scoring points. Therefore, it is in companies' best interests to develop long-term strategies to reduce their carbon footprints and disclose their reduction targets and progress [1].

1.6. Sourcing Renewable Energy

Many organizations have made commitments to achieve 100 percent renewable energy within specific timeframes under the RE100 initiative. Limited renewable energy infrastructure has made it difficult for organizations that want to reduce their Scope 2 Greenhouse Gas Emissions from purchased electricity. Globally, renewable energy accounts for less than 20 percent of total energy generation. [18] Many national and global companies may experience difficulty supporting their decarbonization efforts for Scope 2 emissions. As part of companies' long-term strategies, they may consider available options to decarbonize their operations and reduce purchased electricity consumption, especially if it is generated using fossil fuels. They may consider options such as onsite renewable energy generation, which can be expensive and may not be scalable at the capacity needed to meet their energy needs.

Also, large organizations that have offices and operations in multiple locations may find that their local utility providers do not yet offer renewable energy. Their utility or provider may be planning or transitioning to renewable energy, while their portfolio is still comprised of fossil-fuel-based generation, partially or exclusively. Hence, they may need to employ a mixed strategy and be creative in reducing their Scope 2 emissions, and thereby meet their climate commitments. Companies with net zero and science-based targets are required to reduce not only their direct greenhouse gas emissions but their indirect Scope 2 emissions. [19] Prior to development commitments, companies need to evaluate their best options for meeting their commitments. Options such as onsite solar, wind generation via a power purchase agreement, green energy tariff, and other instruments such as virtual power purchase agreements or renewable energy certificates should also be considered. [20] Incorporation

of renewable energy into the grid globally will help companies meet their climate commitments and provide additional options. Reducing Scope 2 emissions from purchased energy will require companies to baseline their emissions and consider the many options for reducing their Scope 2 emissions [9] (Table 1).

Table 1. How Corporations Can Reduce Scope 2 Purchased Energy Emissions

| | |
|---|---|
| 1 | Onsite renewable energy generation via Power Purchase Agreement (PPA) |
| 2 | Virtual Power Purchase Agreement (VPPA) |
| 3 | Utility Green Tariff |
| 4 | Purchase unbundled renewable energy certificates |
| 5 | Companywide energy efficiency program |
| 6 | Asset consolidation to reduce energy usage |

1.7. Organizations Commitments to Renewable Energy

Increasingly, initiatives such as RE100 are inspiring organizations to set long-term renewable energy goals and reduce their Scope 2 greenhouse gas emissions. The program was developed by CDP and the climate group. The RE100 initiative was developed to encourage organizations to commit to 100 percent renewable energy. Organizations that adopt the initiative must commit to and achieve a source of 100 percent renewable energy. [21] The program sets deadlines and other requirements for compliance with the program. RE100 companies must set targets of 60 percent renewable electricity by 2030, 90 percent by 2040, and 100 percent by 2050. The program allows companies to demonstrate to their stakeholders that they have made a firm plead to support the energy transition, reduce their Scope 2 emissions, and source renewable energy. As of the beginning of 2023, approximately 3,980 member organizations globally were participating [22].

2. Benefits of Virtual Power Purchase Agreements

Corporations that opt to use a virtual power purchase agreement in their long-term decarbonization strategy are able to benefit from the many attributes that these

contracts possess. A virtual power purchase agreement (VPPA) is a long-term contract with a utility, developer, or entity that develops renewable energy generating facilities. The contract is the normal length of approximately 15 to 20 years and has a fixed price for the energy/renewable energy certificates being acquired by the buyer (corporation) from the seller (developer) (RECS Energy Certificate Association, 2023). [23] The physical energy is sold into the energy market by the seller. The buyer obtains renewable energy certificates for each MWh of power they have contracted in the agreement (virtual power purchase agreements, 2023). The buyer and seller agree to a fixed price for the length of the contract. The buyer normally requires renewable energy certificates equal to the amount of MWh that they consume or greenhouse gases that they emit within their operations due to consumption of fossil fuels energy generation. The VPPA has been a way for companies with widely dispersed operations that otherwise have difficulty achieving at scale a strategy that would counterbalance their energy environmental impacts. [23] This allows a corporation that has set a target to reduce its Scope 2 greenhouse gas emissions within a specific time period to enter a contract and achieve its reduction commitment by supporting development of renewable energy and obtaining green certificates. When these contracts are signed, the developer can use the contract commitment to obtain financing to build the project.

Oftentimes, a corporation will secure the entire project capacity in the event it expands its operations or just the amount it will need to meet its climate commitments. It is critical that corporations that want to use the VPPA as a mechanism to meet its climate commitments start early because supply and demand can be an issue, and project delays due to technology, weather, etc., can delay a project.

Fortunately, many of the instruments and initiatives that corporations use to reduce their Scope 2 emissions, such as a VPPA, are aligned with net zero, science-based target initiatives, and the Greenhouse Gas Protocol. [11] The Greenhouse Gas Protocol allocation market-based approach allows organizations to take reductions in Scope 2 emissions from purchased electricity using instruments such as VPPA. Therefore, since many organizations' operations are within areas where the local utility provider may not be able to offer green energy, they can meet their long-term Scope 2 commitments by using renewable energy certificates.

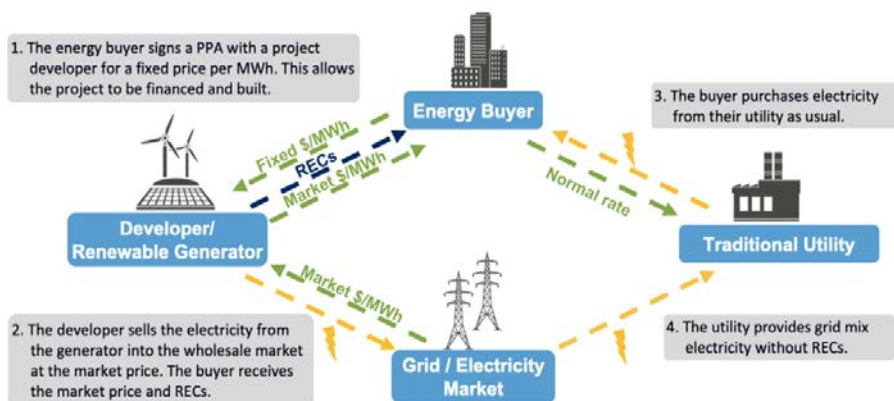


Figure 2. Shows virtual power purchase agreement cycle [24]

Potential benefits of virtual power purchase agreements, as shown in Table 2, and types of renewable energy resources which are feasible for VPPAs are shown in Table 3.

Table 2. Achieving Scope 2 Reductions Via VPPA [20]

| No. | VPPA benefits |
|-----|---------------------------------------|
| 1 | Support energy transition |
| 2 | Meet climate commitments |
| 3 | Potential for profit |
| 4 | Achieve net zero or carbon neutrality |
| 5 | Renewable energy additionality |

Table 3. Types Of Renewable Energy Sourced for VPPA [24,25]

| Renewable energy type | Description |
|-----------------------|--|
| Solar | Energy generated from the sun converted into electric power |
| Wind energy | Electrical energy produced from wind source using wind turbine |
| Hydro-electric | Electrical energy produced from wind source using wind turbine |
| Geothermal | Energy produced under the earth from fluids to produce steam to run the turbines |

2.1. Companies Accelerating Renewable Energy with VPPAs

There are top Fortune 500 organizations that are leading the way to energy decarbonization and using one or both instruments that this study focuses on. Many organizations use diverse strategies to reduce their Scope 2 emissions. We expect to see organizations worldwide use both virtual power purchase agreements and unbundled renewable energy certificates as there are many benefits for not only organizations and developers, but also the energy transition. Companies such as McDonald’s, Starbucks, Amazon, and Walmart have entered into virtual power purchase agreements. [26,27,28,29] These agreements will

support the companies’ energy decarbonization and help them achieve their climate comments.

3. Benefits of Unbundled Renewable Energy Certificates

Like VPPA, there are many benefits to purchasing unbundled renewable energy certificates. First, purchasing unbundled certificates do not require organizations to sign long-term contracts. Unbundled renewable energy certificates are purchased from brokers, developers, or entities. They are referred to as “unbundled” because the buyer is not purchasing any energy with the certificates and no contract commitment is required, as shown in Figure 3.

[24] This option allows the buyer to secure the number of certificates needed and an equal balance of their energy consumption from fossil-fuels-based generation. The certificates may come from various renewable energy projects; hence, there is no guarantee that the buyer will be able to acquire all certificates from the same project. The buyer has no affiliation with the project from which the certificates are generated. Similar to VPPA, unbundled certificates are acceptable to achieve Scope 2 reductions by net zero, science-based-targets initiative, and the Greenhouse Gas Protocol market-based method. Companies may choose to buy renewable energy certificates without the energy and contract, due to fear of the financial risks of long-term contracts. It can also be difficult to sign a VPPA and acquire the exact number of RECs needed to offset an organization’s energy consumption as there may be a shortage due to a merger or acquisition as a company expands. Nevertheless, because it is difficult to determine the exact number of RECS needed under a VPPA, many organizations will purchase unbundled renewable energy certificates to fill a gap if they are short of what is provided via the VPPA by considering the potential benefits as shown in Table 4.

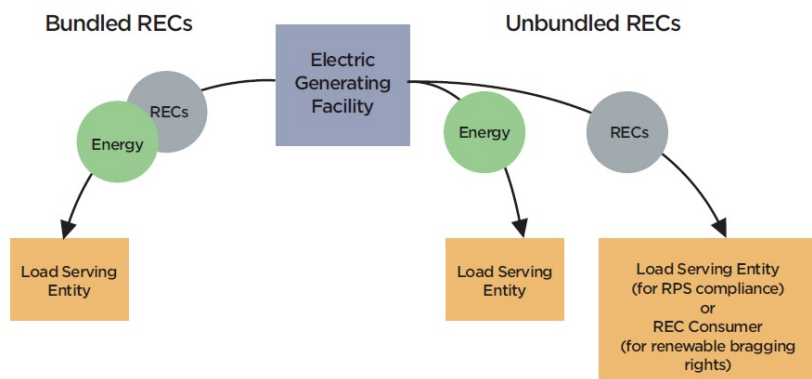


Figure 3. Shows unbundled renewable energy certificates vs bundled renewable energy certificates [30]

Table 4. Potential Benefits of Unbundled Renewable Energy Certificates [31]

| No. | Benefits |
|-----|---|
| 1 | No contract required |
| 2 | Purchase only what is needed |
| 3 | Accepted by Net Zero, Science-Based Targets initiative and the GHG protocol |
| 4 | Potential for less financial risk |

4. Potential Risks of Virtual Power Purchase Agreements

As the energy transition will continue to evolve in support of the Paris Agreement and net zero to meet climate commitments, organizations may need to rely on VPPA over the next two decades to achieve their Scope 2 commitments and accelerate the use of renewables in their energy portfolios. Nevertheless, there are also risks that organizations should consider when negotiating a VPPA. Like other contracts, the VPPA is a financial contract, and, like any long-term contract, it carries risks. Navigating the execution of a contract can be timely, requiring input from accounting, engineering, and legal, along with capital commitment. Potential risks, such as contract execution, project delay, counterparty risks, technology issues, change in law, etc, should also be considered [32].

Table 5. Types Of Potential Risks for VPPA and Unbundled Renewable Energy Certificates [32,33]

| VPPA Potential Risks | Unbundled Renewable Energy Certificates Potential Risks |
|--|--|
| Financial Risks | Additionality |
| Contract Execution | Market Price Risk |
| Change in Law | Supply Risks |
| Counterparty Risks | Change in Law |
| Operations Risks | Stakeholder perception |
| Renewable energy certificates compliance and certification | Renewable energy certificates compliance and certification |

As noted, VPPAs have many benefits and potential risks that must be considered by both buyer and developer before contracts are signed.

The list of potential risks in Table 5 is not inclusive of all potential risks.

5. Potential Risks of Unbundled Renewable Energy Certificates

Like VPPAs, unbundled renewable energy certificates are invaluable for organizations that need to meet their Scope 2 climate commitments or bridge the gap when their VPPA does not deliver the generation or certificates needed. Even though the unbundled certificates can be sourced without a contract, they are still subject to risks that need to be taken into account when purchasing them as part of an organization’s climate strategy. Though both VPPAs and purchasing unbundled RECS from a third-party support for the renewable energy portfolio, there are unique risks associated with both instruments. The potential risk associated with unbundled renewable energy certificates should examine risks such as additionality, the perspective of how they are viewed by stakeholders, and the market price risks, as supply and demand related to the certificates could become an issue as more organizations make climate commitments and need these instruments to support their strategies [33].

6. Forming Partnerships & Energy Resiliency

Historically, corporations and clean energy developers have worked independently with little collaboration in pursuit of sourcing renewable energy. The objective of this forwarding-looking examination is not to present a negative impact on either Virtual Power Purchase Agreements or unbundled renewable energy certificates, but rather to identify the instruments as viable options that organizations can use to achieve their climate commitments and support renewable energy development. With the impact of greenhouse gas emissions on climate change, the environment, and the desire to limit global warming to 1.5 degrees Celsius by 2050, industries such as power generation and large energy consumers such as corporations have a vital role to play in increasing renewable energy usage.

The goal is to understand the risks and benefits of both instruments and break down barriers, as it takes significant time, resources, and capital for organizations to research and understand the potential risks of both instruments prior to contract signing. Hence, the benefit of risk identification will not only build synergies and eliminate silos between corporations and clean energy developers, but also allow increased usage of both instruments, expedite contract preparation time, and include essential cross-functional leaders to support the process, as both developers and organizations will understand and mitigate the risks that each transaction subjects them to. Hence, these partnerships and risk management efforts will support the energy transition, promote net zero, and allow organizations to achieve their climate commitments.

7. Conclusion

As noted, there are many benefits to both the VPPA and unbundled renewable energy certificates. Both of these instruments will be vital in achieving net zero and combating climate change. Many more organizations may use these instruments over the next decade to meet their climate goals. Bringing a level of awareness of both the risks and benefits of these instruments supports corporations and developers in accelerating the use of both instruments to help achieve the global initiative set under the Paris Agreement and the United Nations Sustainable Development clean energy and climate change goals. As highlighted in this paper, both instruments have risks that should be considered and incorporated into organizations’ long-term climate strategies. Companies looking to use a VPPA should conduct market analyses for their projects and locations, consider historical energy patterns in the markets, and be forward-looking to mitigate risks. Also, companies that want to employ both instruments as part of their decarbonization efforts should develop long-term energy plans to consider the timeline of their climate commitments, options, and risks with both instruments.

8. Future Research

Sourcing renewable energy takes time, effort, and expertise to ensure that organizations make the best investments and are able to achieve their near and long-term climate goals. Organizations that are not part of the energy sector may find themselves in an area with which they are unfamiliar when embarking on a VPPA or even purchasing unbundled renewable energy certificates. A quantifiable framework to aid organizations and developers in mitigating risks with both instruments would be useful and support adding renewables to their energy portfolios.

Additional research should be undertaken to further identify and quantify the potential risks with both instruments. In determining the perspective of risks associated with VPPA and unbundled renewable energy certificates, surveying a population that has engaged with one or both instruments would add great value to promoting the usage of both instruments. Doing so would help identify and mitigate these potential risks before executing a contract agreement and implementing a robust strategy that both organizations and developers can use as a roadmap. The risk framework analysis, in addition to surveying experienced users of the instruments, can improve the decision-making process and compare both instruments to determine the feasibility, benefits, and risks. These actions will undoubtedly support energy transition and protect both organizations and developers. The next phase of the research will allow the potential risk for both instruments to be quantified, and the results can serve as a framework for both corporations and clean-energy developers.

References

- [1] "2023 energy, resources, and Industrials Industry Outlooks." *Deloitte United States*, no. 02-Dec-2022, 2023.
- [2] "9 best ESG Rating Agencies - who gets to grade?" *Impact Invest. / ESG Invest. Blog*, no. 18-Feb-2023.
- [3] Akella, S. R. "Walmart signs VPPAs with Engie for 366MW wind energy." *NS Energy*, no. Oct. 23, 2019, 2019, [Online]. Available: <https://www.nsenenergybusiness.com/news/walmart-engie-wind-energy-supply/>
- [4] Alqaseer, M. M. F., et al. "The State of U.S. Sustainability Reporting," *Harvard Law Sch. Forum Corp. Gov.*, no. 02-Nov-2021, [Online]. Available: <https://corpgov.law.harvard.edu/2021/11/02/the-state-of-u-s-sustainability-reporting/>.
- [5] Bell, D., and R. Llewellyn, "Best practices for establishing ESG Disclosure Controls and Oversight." *Harvard Law Sch. Forum Corp. Gov.*, no. 03-Feb-2022.
- [6] Brenden, N. "12 Ways to Reduce Your Scope 1, 2, and 3 Emissions," *WatchWire*, no. Sep. 2022, [Online]. Available: <https://watchwire.ai/reduce-your-scope-1-2-and-3-emissions/>.
- [7] CDP, "CDP Technical Note: Accounting of Scope 2 emissions. CDP Climate Change Questionnaire," 2021.
- [8] "World Resources 1998-99." *World Resour. Inst.*, no. 05-Jan-1998, 1998.
- [9] Clean Energy Buyers Association, "Renewable Energy Procurement - CEBA," *CEBA*, no. May 10, 2022, 2022, [Online]. Available: <https://cebayers.org/programs/education-engagement/renewable-energy-procurement/>.
- [10] Corporate, S. and N. S. Version. "SBTi CORPORATE NET-," no. April, pp. 1-63, 2023.
- [11] "Corporate value chain (Scope 3) standard: GHG protocol." *Corp. Value Chain (Scope 3) Stand. / GHG Protoc.*
- [12] Davis, L. "RE100: renewable electricity demand initiative growing in reach and impact – We Mean Business Coalition." *We Mean Bus. Coalit.*, no. Feb. 06, 2023, 2023, [Online]. Available: <https://www.wemeanbusinesscoalition.org/blog/re100-renewable-electricity-demand-initiative-growing-in-reach-and-impact/>.
- [13] Dokso, A. "McDonald's in three new renewable energy VPPAs," *Green Hydrot. News*, no. Apr. 2021, 2021, [Online]. Available: <https://energynews.biz/mcdonalds-in-three-new-renewable-energy-vppas/>.
- [14] Edie Newsroom, "Amazon reveals plans for 26 new large-scale renewable energy projects," *Edie*, no. Dec. 10, 2020, [Online]. Available: <https://www.edie.net/amazon-reveals-plans-for-26-new-large-scale-renewable-energy-projects/>
- [15] *EnergySage*. "Benefits of renewable energy certificates."
- [16] Environmental Protection Agency. "Environmental Protection Agency 2019 in Review." 2020, [Online]. Available: https://www.epa.ie/pubs/reports/other/corporate/EPA_AnnualHighlights2019_web.pdf.
- [17] Favaloro & Healy. "Energy Strategy for the C-Suite." *Harv. Bus. Rev.*, no. January-February 2017, pp. 138-146, 2017.
- [18] Greenhouse Gas Protocol. "The Greenhouse Gas Protocol." *Greenh. Gas Protoc.*, p. Al-Homoud, M. S. (2001). Computer-aided building e, 2013, [Online]. Available: <http://www.ghgprotocol.org/standards/corporate-standard>.
- [19] Goldman, S. "Scope 2 Emissions: Location-Based vs. Market-Based Carbon Accounting Methods." *Cleartrace*, 2022, [Online]. Available: <https://cleartrace.io/scope-2-emissions-location-based-vs-market-based-carbon-accounting-methods/>.
- [20] IEA. "CO₂ Emissions in 2022." *Glob. Energy*, vol. 62, no. 10, pp. 20-21, 2022, [Online]. Available: <https://www.iea.org/news/global-co2-emissions-rebounded-to-their-highest-level-in-history-in-2021>.
- [21] K. Llp. "Decarbonizing with virtual power purchase agreements."
- [22] "Steps corporations can take to reduce greenhouse gas emissions," *LevelTen Energy*.
- [23] Pinkel, B. Dan et al. "What the Heck is a REC? And Why It Matters?" no. October, 2013, [Online]. Available: www.localcleanenergy.org.
- [24] Protocol, G. "GHG Protocol Scope 2 Guidance." *Greenh. Gas Protoc.*, no. March, p. 118, 2014, [Online]. Available: https://ghgprotocol.org/sites/default/files/standards/Scope 2 Guidance_Final_Sept26.pdf.
- [25] Re 100, Climate Group, and CDP. "RE100 Reporting Guidance 2022." *Guidance*, vol. 6, pp. 1-19, 2022.
- [26] "Renewable energy certificates or credits." *ElectricRate*, no. 02-Jun-2022, 2022. <https://stories.starbucks.com/stories/2020/starbucks-solidifies-pathway-to-a-planet-positive-future/>.
- [27] Ritchie, H., et al. "CO₂ and Greenhouse Gas Emissions." *Our World Data*, 2020.
- [28] Staff, M. "Investors demanding public companies come clean on ESG performance." *Montieth Co.*, no. January 26 2023, 2023, [Online]. Available: <https://montiethco.com/news/investors-demanding-public-companies-come-clean-on-esg-performance/>.
- [29] Starbucks Corporation. "Starbucks solidifies pathway to a planet positive future." *Starbucks Stories*, no. Sep. 15, 2021, 2021, [Online].
- [30] TCFD, "Task Force on Climate-Related Financial Disclosures: 2020 Status Report," *Task Force Clim. Fiancial Discl.*, no. October, pp. 1-114, 2020.
- [31] "Unbundled renewable energy certificates (recs)." *EPA*, no. 13-Aug-2018, 2018.
- [32] "Virtual PPA," *Am. Cities Clim. Chall.*, no. 13-Jan-2022, 2022.
- [33] Wallace, K. "Top ten risks of virtual power purchase agreements." *Sustain. Roundtable Inc*, no. 27-Nov-2018.

