

Corporate Procurement of Renewable Energy as a Key Driver

in the Decarbonization of the Power Industry

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Abstract

Private companies, motivated by commitments to sustainability, have become important purchasers of utility-scale renewable energy, contracting for over 11 GWs of capacity in the past five years. This paper discusses the history and key drivers of growth in the corporate procurement of wind and solar energy. It provides a view on the potential for continued growth of corporate buyers. The paper identifies two barriers to accelerated growth - the industry's current use of a complicated contracting structure and related limited access to capital markets financing alternatives. Other positive market fundamentals including lower wind and solar costs and structural innovations such as aggregated buyer consortiums are reviewed. A corporate underwriting model is offered as a potential catalyst to simplify contracting structure and financing access. Syndicated debt, commercial paper, green bonds, and securitization are analyzed as potential financing vehicles available in a corporate style underwriting. Google, as the early and consistent buyer in the space was used as a case study. The case study illuminates the challenges, opportunities and benefits Google has experienced in its eight-year journey. Google's unique definition of additionality as a key catalyst to industry growth is discussed.

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List of Key Terms

CFD - Contract for Difference

ESG - Environmental, Social and Governance

GW - Gigawatt

MW - Megawatt

RPS - Renewable Portfolio Standard

REC - Renewable Energy Certificate

PPA - Power Purchase Agreement

PURPA - Public Utility Regulatory Purchasing Act

VPPA - Virtual Power Purchase Agreement

Introduction

Executive Summary

This paper concludes that the corporate procurement of renewable energy in the United States will continue to grow despite the significant and related barriers of contract complexity and limited financing alternatives. Because market leaders are overcoming these barriers, renewable energy procurement is now a proven path of execution on corporate sustainability commitments. The paper confirms that the growth and increasing specificity of corporate sustainability commitments represents a new and robust source of long-term demand for renewable energy. Intensifying sustainability commitments from a broad base of diversified companies, reflected by increased science-based targets, evidence a noteworthy transition in demand for corporate renewable energy. Moreover, buyers are repositioning from purchasing renewable energy certificates to the direct purchase of power through onsite or offsite facilities. The new demand for renewable energy is a private company competitive response and focuses on sustainability differentiation through a claim of additionality. Additionality serves to offset or displace fossil fuel generation sources.¹

While growth in corporate renewable energy is now more predictable, potential market scale and acceleration suffers from developers' limited access to the capital markets. Broader financing access will necessarily dictate less underwriting reliance on the contract complexity of the power purchase agreement ("PPA"). This shift in risk allocation implies a diversification away from use

¹ There is a general consensus on the definition of additionality. It means that incremental or otherwise new renewable energy assets would not have been built without my action. There is less agreement on authentic claims of additionality. It is a valuable attribute and many participants beyond the buyer, seller and financier involved in renewable energy projects will claim additionality.

of the limited non-recourse project finance market. The expertise and financial wherewithal of the early corporate buyers such as Google can be scaled in the development of a new financing paradigm. The idea of an alternative to an exclusive reliance on project finance is possible because of collaboration such as buyer aggregation constructs. Individual corporate actors are naturally partnering in a joint commitment to reduce GHG emissions from the power industry. Corporate leaders have an opportunity to exploit their capacity for innovation and mitigate the industry's financing challenges.

The scale and broader capital market access of these corporate renewable leaders is a tangible example of Michael Porter's shared value theory. Based on his experience with non-profits, Porter's theory posits that corporate profitability is the source of needed scale and speed to tackle society's big challenges. The challenge of decarbonizing power generation, especially in an era of low fossil fuel prices, can only be met with a private market, scaled response. The growth and acceleration of corporate procurement of renewable energy is that private market, scaled response.²

Central Question - Growth

The central question of this paper is whether the corporate procurement of utility scale wind and solar energy will continue to grow. The central question is nuanced. It requires secondary questions of growth components and an analysis of barriers to that growth. The central question also presumes that growth leads to decarbonization in power generation, yet this is obscured by complexities of indirect causation.

² Porter and Kramer, "Creating Shared Value."

Barriers to growth

The paper identifies the structural complexity of contracting for renewable energy and the scarcity of financing alternatives as the two primary suspects in the barriers to growth. These barriers are related, and I provided ideas for mitigating contract complexity and limited financing options. I discussed the feasibility and efficacy of financing innovation referred to herein as the “syndicate model.”³ The syndicate model allows the application of capital markets financing alternatives and new approaches to contracting complexity that currently limit the scale and speed of growing the corporate renewable energy market. The syndicate model might be deemed a radical approach were it not for the application of common and widely used techniques of corporate finance.

Decarbonization Presumption

This paper assumes that growth in the corporate renewable market will contribute to the decarbonization of the power generation market.⁴ This logical presumption is based on a fossil fuel for renewable energy substitution dynamic that is evidenced by renewable energy grid

³ Syndication in corporate finance implies a selling down, or distribution of risk. It is most commonly seen in large loan transactions, where tranches, or pieces of a corporate credit facility are underwritten by three or four lead banks and then sold in syndication at various commitment levels and tiers to larger group of banks. Syndication in a renewable energy underwriting is a similar construct where a lead corporate buyer(s) can syndicate, sell down portions of the financing to participating corporate buyers which can accelerate their renewable energy programs through the expertise and financial wherewithal of larger, lead players.

⁴ Decarbonization is referred to as taking brown, or fossil fuel generation off the market. Decarbonization can take the form of canceling new fossil fuel plants, or hastening the retirement of existing plants. Decarbonization by substituting an intermittent renewable energy source for a base load, or always running base load fossil fuel plant was originally considered difficult, if not impossible. This was prior to modernization and digitalization of the grid which has allowed system operators to maintain grid stability with greater percentages of intermittent renewable energy.

parity. The substitution dynamic leading to decarbonization was briefly discussed and offers the opportunity for additional research.

Audience, Objective and Supporting Case Study

The objective of this paper was answering the central question of growth but in doing so, providing a roadmap for the companies interested in purchasing renewable energy and a prescription for industry stakeholders who would like to see broad and sustained growth in the sector. It provides an optimistic scenario where private market activity can complement and replace public sector efforts to reduce GHG.

The case study on Google's journey provides elements of the roadmap and prescription. As a first mover, and now with substantial experience, Google's case study can be leveraged by many companies committing to new sustainability targets. Google's experience, financial wherewithal, and unique definition of additionality, provided the basis for the syndicate model idea. Google's definition of additionality reflects the company's ethos of positively impacting the world.

Background

A Market Born in 2013

Notable corporate demand for renewable energy started five years ago yet we started to see activity a decade ago. The first transaction in 2008 was not a corporate deal but the University of Oklahoma signed a PPA with Oklahoma Gas and Electric for 101 MWs of the OU Spirit Wind farm. This project featured forty-four 2.3 MW Siemens wind turbines in northwestern Oklahoma.⁵ Google and Walmart got involved with transactions in 2010 yet total industry transaction volume never exceeded 200 MWs until 2013. Legitimacy was established in 2013,

⁵ Office of Sustainability, Univ. of Oklahoma, "Wind Power."

led by deals from Google, Apple, Facebook, Microsoft, Volkswagen, US Delphi, and Becton Dickinson. A total of 789 MWs were contracted in 2013, representing seven-fold increase over 2012. An industry was born.⁶

Corporate buyers represent a completely new source of demand for renewable energy, replacing utilities as primarily the sole offtake source. In early 2017, the corporate procurement exceeded utility demand for renewable energy, indicating that this new demand was materially important and growing⁷. It is important to note that growth is occurring in restructured markets which provide mechanisms for competitive generation.⁸ Regulated markets have provided a different response to corporate demand in the form of green tariffs, riders, or green subscription programs.⁹

Growth was explosive in the first three years of corporate procurement in restructured markets, retrenched in 2016, and has resumed growth in 2017, nearly doubling the GWs contracted the previous year. Figure 1, graphically illustrates these growth dynamics and the source of demand for the U.S and Mexico. Google started the industry and has been a consistent presence in the industry's six-year history. Diversification of buyers is the latest trend.¹⁰ Transactions in Figure 1 were completed in restructured markets only reflecting both a challenge and opportunity for the industry to grow in regulated jurisdictions.

⁶ Powers and Haddon, "The Role of RECs and Additionality."

⁷ Moody's, "Primary Driver of Renewable Energy."

⁸ Restructured markets are also known as wholesale competitive markets.

⁹ A green tariff is also referred to as a "sleeved" transaction where a corporate can buy renewable energy from an offsite project in a regulated utility jurisdiction by sleeving the terms of the PPA through the utility. A modification of this is a green rider where the utility can offer a corporate offsite renewable every by adding a rider to a utility bill, typically at premium. A green subscription program is where multiple corporate buyers can sign up for renewable energy from the utility which offers participation in a renewable energy owned or contracted by the utility.

¹⁰ "BRC Deal Tracker."

Corporate Renewable Deals 2012 – 2017

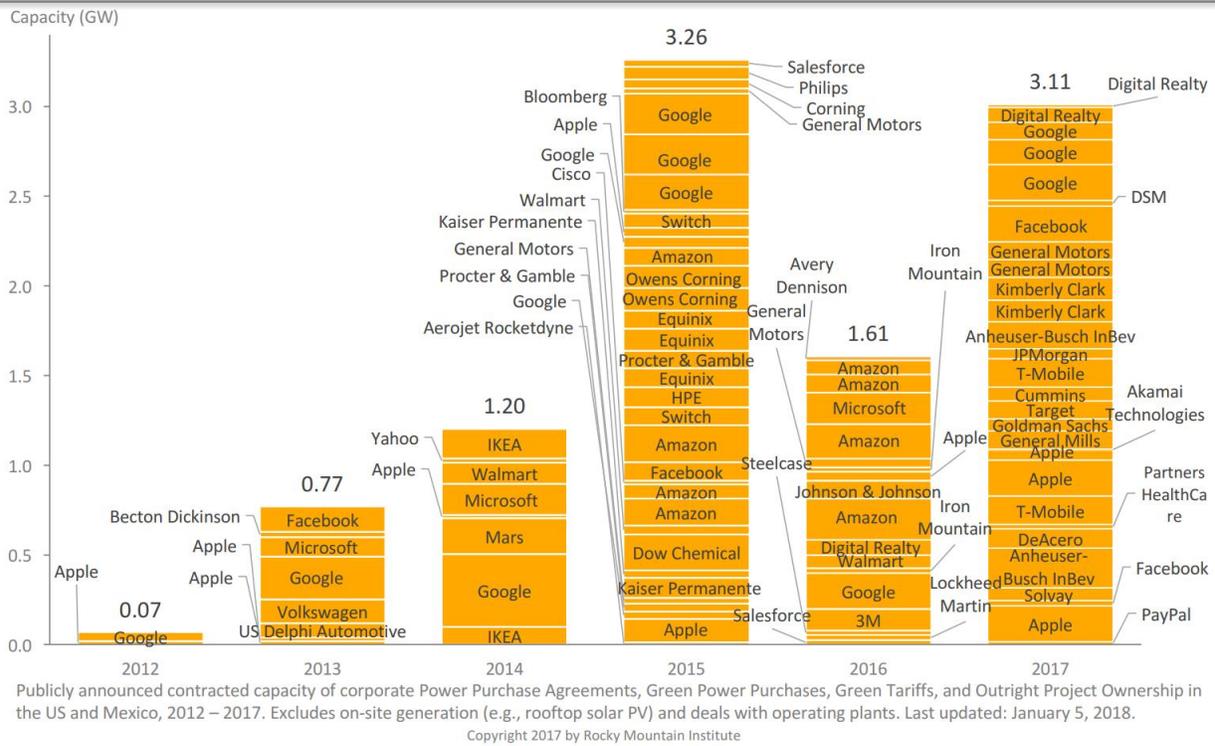


Figure 1: BRC Deal Tracker¹¹

Big Data has a Big Appetite

Data center growth and related energy usage was a key growth driver in the formation of the renewable corporate market. Defining the 4th industrial revolution,¹² super normal growth in computing needs for big data applications, cloud storage and social media traffic in the past decade, created massive energy requirements for new data centers. This energy requirement from the high-tech industry was met initially with grid-mix electricity, including fossil and nuclear

¹¹ “BRC: Business Renewables Center - Rocky Mountain Institute.”

¹² The 4th industrial revolution is a general term describing the application of digitization to many processes.

generation. Recognizing the GHG emissions impact of this demand, the high-tech industry turned to large scale wind and solar generation as the sustainable alternative.

Data center energy usage has slowed recently because of advances in efficiency deployed after growth earlier this decade. According to a 2016 analysis by Berkeley National Labs, data center energy usage grew by 90% from 2000 – 2005, 24% from 2005 – 2010, and 4% from 2010 – 2014. Data center energy usage accounted for 1.8% of total electricity consumed in the U.S.¹³

These efficiency gains however belie a recent significant ramp-up in data center capex led by industry giants Google, Apple, Microsoft, and Amazon. Data center capex of \$18 Billion in the first half of 2017 reflected a doubling of the entire previous year in 2016. As evidence of accelerating growth, a total of \$45 Billion has been spent on data center expansion in the past five years with 50% of that occurring since 2016.¹⁴ In this arms race Google recently announced 10 new data centers around the world, which represents an additional \$30 Billion in capex and Apple announced an increase of \$10 Billion in data center capex over the next five years.¹⁵

Google, as the early adopter of renewable energy procurement, incorporated the strategy as a key underpinning to its data center growth. This early focus on energy risk management and growth sustainability is essential now in this period of data center growth. Other high-tech firms have incorporated similar strategies, providing the basis for formation of the corporate procurement market. With the overlay of additionality, Google's leadership in its renewable energy procurement strategy is effectively offsetting and displacing fossil fuel generation.

¹³ Shehabi, "2016 Berkeley National Labs Data Center Energy Usage."

¹⁴ Darrow, "Super-Heated Data Center Spending Broke a Record in 2017."

¹⁵ Jeffrey, "Amazon, Microsoft, and Google Want to Own the Cloud."

Google, and other similar high-tech companies, recognize their leverage as significant and incremental consumers of electricity. This leverage is effectively shaping the environmental impact of their business by redefining practices and potential magnitude of renewable energy procurement. Google’s journey is highlighted as the case study below.

Power Markets – A Two Party System

At a high level, the market for the corporate procurement of renewable energy is divided between traditionally regulated markets¹⁶ and competitive electricity markets, known as restructured or deregulated¹⁷ markets. The products and methods to execute a renewable energy purchase vary widely within these two general classifications.¹⁸ Renewable Energy Certificates (“RECs”) are common to both, providing a tradable certification.

With the demand for corporate renewable energy increasing, product offerings in both the regulated and competitive markets have multiplied. In regulated markets, vertically integrated utilities are offering green tariffs and green subscription programs, with a focus on insulating system-wide customers from any cost impacts.

In competitive or restructured markets, corporates are using a Power Purchase Agreement (“PPA”). This is the same PPA construct that was used by utilities to buy renewable energy as a method to meet requirements under respective state renewable portfolio standards (“RPS”).

Historically, renewable energy PPA’s with the utility as offtake counterparty, have been anywhere from 10 to 20 years in length with fixed electricity rates. Naturally, the asset was in the utility’s service territory. RECs are bundled with the PPA, and thus give the utility to legal claim

¹⁶ 19 states have fully regulated electric and gas markets, the remainder of the country is a mix of partially deregulated electric and gas markets, “Map of Deregulated Energy States (Updated 2017).”

¹⁷ Restructured markets can also be referred to as organized markets, leading to confusion.

¹⁸ US EPA, “U.S. Electricity Grid & Markets.”

of renewable energy, which satisfies the RPS. With the assets in the service territory, utilities can physically mix renewable energy into the grid.

RECs, first established in California as a method to prevent double or false claims of renewable energy, have been an invaluable mechanism in the market.¹⁹ Because the REC is tradable, corporates that wanted to establish a claim to buying renewable energy could buy RECs. This REC was separated from the energy but allowed corporates to offset its purchase of utility offered electricity- usually a mixture of fossil fuel generation and nuclear. A REC purchase without taking physical energy added to value of renewable energy through this incentive, albeit indirectly.

Corporations, and in particular financial institutions, could add to their renewable energy claims by purchasing or investing in renewable energy project finance or tax equity transactions. This demand for the investment product is a catalyst in new renewable energy but it is also indirect. Demand for these finance products lead to facilitation of renewable energy projects, not justification, although investors and lenders can claim environmental attributes.

In the new corporate procurement market, an enabling product enhancement to the PPA has been the offsite or synthetic PPA. This solves the physical constraint of electricity, which must be consumed immediately when produced. As such, the consumer must be physically connected to the producing source. Optimal renewable energy, defined as being located near the best wind or solar resource, is often located offsite and thus off grid from the corporate purchaser - not physically connected to a corporate purchaser's operations.

¹⁹ Pinkel and Weinrub, "What the Heck Is a REC.Pdf."

The offsite PPA is made possible through a synthetic or electricity swap arrangement called a Contract for Differences (“CFD”). This swap borrows financial technology from the futures market where differences in settlement are made through cash, versus physical delivery. A CFD in a futures contract provides investors with the benefits and risks of owning a security without taking delivery of it.

In the offsite renewable energy market, where physical delivery is impossible, a CFD embedded in the PPA allows a corporate purchase all the benefits and risks of owning the renewable energy production without taking delivery. A CFD is a straightforward swap, but it has basis risk,²⁰ which can complicate settlement. The CFD futures contract underpins the virtual nature of the offsite PPA and is referred to as a virtual PPA or (“VPPA”).

In the VPPA the corporate buyer is also buying energy twice, with the fixed rate renewable energy purchase offset with a variable price short into a competitive market. It purchases the renewable energy, on a fixed rate, which it immediately shorts in the variable competitive wholesale market at spot or cash.²¹ Buying energy twice can be a difficult paradigm shift for first-time buyers in the corporate renewable space.

The wholesale market, usually physically near the renewable asset, is renewable asset’s dispatch grid, separate from the corporate’s grid. The second purchase is from the corporate’s local utility, for the physical delivery of electricity for company operations. This electricity is called grid-mix,

²⁰ Basis risk is the risk that two financial positions used to hedge or offset each other, do not move in exactly opposite directions, increasing long or short exposure. The two financial positions are in the cash market and the futures market (which is the hedging market) $\text{Basis} = \text{Cash price} - \text{Futures price}$. For renewable energy buyers in an offsite PPA, basis risk has a locational element as settlement of the PPA can either be at the busbar (where energy is produced, not transmitted) or a trading hub, which is average of busbar prices but includes price influenced by transmission congestion or renewable intermittency.

²¹ The spot market, also known as the cash market, is the market where commodities are traded for immediate delivery, whereas the futures market represents trading for delivery at date in the future.

as it is sourced from the entirety of the utility's generation portfolio and the attributes reflect such. The green claim of course is the renewable energy purchase, which mitigates the grid-mix.

A graphical representation of a CFD in Figure 2, illustrates a fixed rate renewable energy purchase, settled against a market rate sale of that renewable in the competitive wholesale market. CFD technology is a financial derivative that has been applied in many markets, as a substitute for exchange-based futures markets. CFD transactions are bespoke, illiquid and have more counterparty risk than exchange-based transactions. Eight years after World Resources Institute ("WRI") identified CFDs in 2004 as a useful tool for offsite PPAs, Google kicked off the industry using CFDs. Currently CFDs in the corporate renewable space are bilateral private transactions. Follow up research to this paper could include an analysis of market scale necessary to consider an exchange-based VPPA CFD. Variables such as transparency, standardization and size are factors that could be developed with an objective of creating investor liquidity as another growth element in the corporate renewable industry.

How a Green Contract for Differences Works

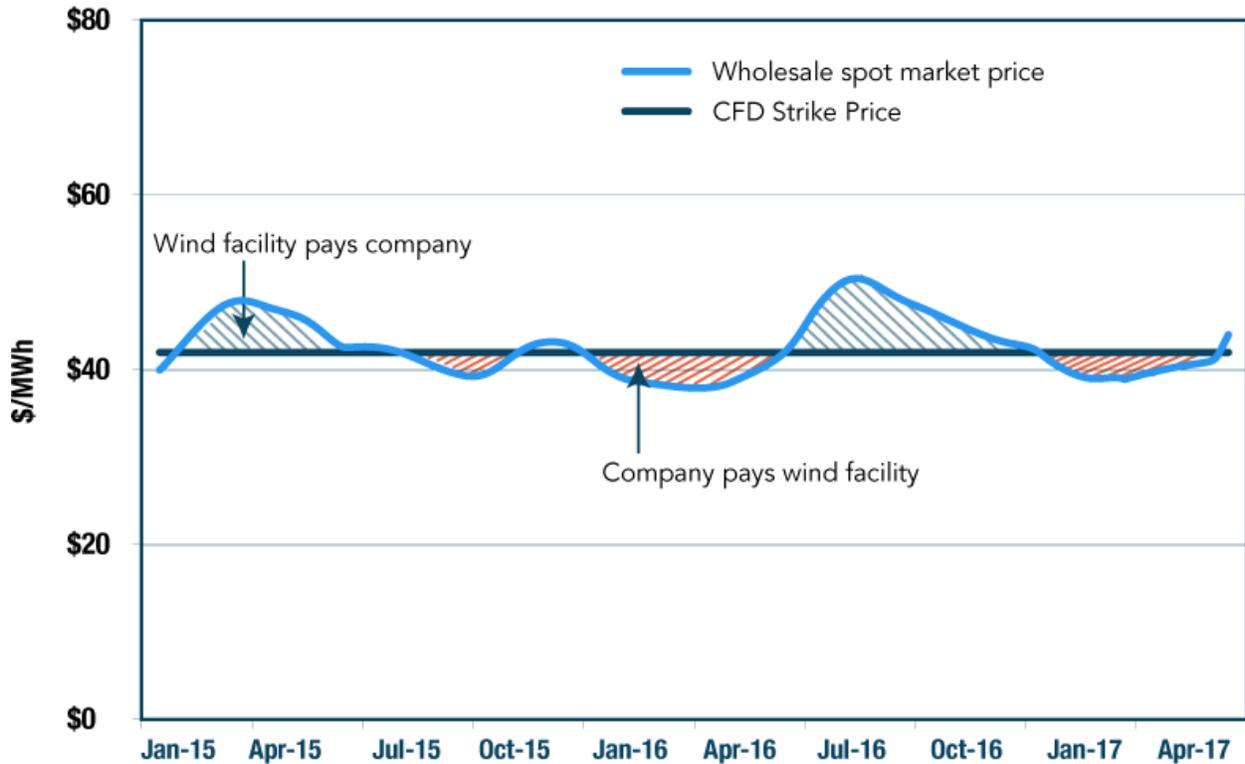


Figure 2: How a Green Contract for Differences Works²²

The following map in Figure 3 illustrates the geographical complexity of contracting financial versus physical PPAs. Most importantly, it shows that the market for the corporate procurement of renewable has grown despite limited jurisdictions. Green tariffs and green subscription programs are growing trends in regulated utility jurisdictions as a competitive response to corporate demand, but still represent a small percentage of transactions. Several utilities in regulated jurisdictions have used green tariffs as an economic development tool. Most notable

²² Aulisi and Hanson, "World Resources Institute Guide to Green Power Markets."

The Match Makers

Seeing the potential to scale decarbonization of the power generation sector by growing corporate renewable energy, several NGOs and energy-based think tanks have committed substantial resources to facilitate market growth. They have proven to be critical enablers of this new market for renewable energy. Most importantly, I found these catalysts committed to collaborating, and leveraging each other toward a common goal of accelerated procurement.

These catalysts in growing the corporate procurement market are described below:

1. The Business Renewable Center (“BRC”) (part of the Rocky Mountain Institute)

The BRC was launched in February 2015 after recognizing that the nascent corporate renewable market needed a platform for the exchange of information and a matching of sellers (developers) and corporate buyers. It attacked this market inefficiency by creating a BRC membership where renewable buyers and sellers can meet each other, learn from each other, and negate an otherwise private and bespoke transaction market. It currently has 200 members and has acted as a catalyst in 94% of the corporate renewable energy transactions to date. It is staffed by 12 professionals in offices in Wash, DC., Colorado and New York. This staff includes two MEM alumni of the Nicholas School. The BRC is becoming well-known as the “go to” resource for any company considering procurement of renewable energy as well as developers which previously only sold to utilities.²⁵

2. The Renewable Buyers Alliance (“REBA”)

REBA is led by four non-profit groups including the BRC. The three other groups are the World Research Institute’s (“WRI”) Energy Initiative, Business for Social Responsibility (“BSR’s)

²⁵ Rocky Mountain Institute, “BRC: Business Renewables Center - Rocky Mountain Institute.”

Future of Internet Power, and The Renewable Energy Buyer’s Principles (co-founded by WRI and the World Wildlife Fund (“WWF”). REBA is a true catalyst, working across NGOS and industry to collaborate on the acceleration of the corporate procurement of renewable. The organization won the C.K. Prahalad Award for Global Business Sustainability Leadership in 2017, which recognized its collaboration to grow new corporate renewable energy in the U.S. and leadership in educating stakeholders on the benefits of sustainability in business.²⁶

3. The RE100

The RE100 is an initiative sponsored by The Climate Group in partnership with CDP. Both organizations are part of the broader coalition called We Mean Business, which brings together seven international non-profit organizations focused on climate change through the intersection of policy advocacy and business partnerships. The RE100 is a global collaborative, bringing together companies which have committed to purchasing 100 percent renewable energy. The collaborative helps corporate buyers navigate going 100 percent renewable through direct purchases of energy or RECs. It currently has 125 members and according to the group’s January 2018 annual report, 25 of its companies had achieved 100% renewable energy by the end of 2016 and on average RE100 members are sourcing 32% of their energy from renewables.²⁷

Corporate Sustainability

We are now seeing significant growth in the number of companies committing to renewable energy goals. This is a direct result of early leadership coming from the high-tech space with companies like Google, Amazon, Facebook, Microsoft which are fully engaged and reporting success. Growth is also the result of the catalyst organizations and platforms described earlier.

²⁶ “REBA CK Prahalad 2017.”

²⁷ “RE100 Progress Report.”

The market is now broadening to other sectors, driven by success and an opportunity to achieve new corporate sustainability goals. Several surveys and analysis have been published recently which illuminate trends in market potential.

In June of 2016, the consulting firm Price Waterhouse Coopers (“PwC”) conducted a survey of U.S.-based companies, attempting to further understand the key facets of the recent growth in corporate procurement of renewable energy. Their survey found 72% of respondents are actively pursuing additional renewables purchases, 63% are more inclined to purchase in the last six months, and 85% intend to make additional purchases in the next 18 months. According to the survey, corporate goals are driving this interest to reduce greenhouse gas emissions, generate an attractive return on investment (“ROI”), and limit exposure to energy price variability. Wind and solar were the predominant renewable energy targets.

Of the 28% that were not actively pursuing purchases, the top three reasons cited were lack of a mandate, unattractive ROI, and the length of contracts. Most of the purchasing companies (81%) were planning to engage a third party to help with their procurement strategy while listing tracking the savings and telling the story as the biggest challenges.²⁸

World Wildlife Fund, Calvert Investments, CDP, and Ceres have collaborated on series of reports titled “Power Forward” which reflects on the trend of corporations committing to sustainability energy targets. Corporate commitments to sustainability and clean energy are growing in number and precision. The latest report in 2017 reports nearly half of the Fortune 500 companies now have at least one climate or clean energy target. Most of the gains are coming from smallest 100 companies in the Fortune 500, reflecting the momentum of the private market

²⁸ “PwC Corporate Renewable Energy Survey.”

response to climate challenges. Reflecting the seriousness of commitments, 72 companies in the Fortune 500 have committed to having science-based goals within the next two years.^{29 30}

Membership in the RE100, companies committed to achieving 100% renewable energy procurement, grew by 40% in 2017. Offsite PPA growth from the 74 global companies in RE100 from 2015 to 2016 grew from 3% to 13%. In the United States, the growth in offsite PPAs from RE100 in the surveyed period of 2015 to 2016 was noteworthy. It went from less than 1% to 20%, providing a clear indication that offsite PPAs have become the instrument of choice for companies committing to renewable energy. Marrying wind and solar resource rich areas of the country with distant and physically disconnected buyers is a logical, albeit difficult path.³¹

Two Barriers to Growth

Structural Complexity of the PPA – A Tough Hurdle for First-Time Buyer

The PPA as the underlying contract to purchase renewable energy is both an enabler and barrier in the market. It has facilitated private market development of renewable generation projects in restructured markets, outside a cost-of-service regulated model. This is a noteworthy achievement. Yet the PPA is structurally complex, as the contract must identify and allocate a myriad of technical, construction, operating and market risks between two counterparties. It is necessarily bespoke, highly negotiated, time consuming, and expensive to close.³² The PPA in a

²⁹ “Power Forward 3.0.”

³⁰ A science-based target is defined as a reduction in company specific greenhouse gas emissions that would keep global temperatures below 2 degrees Celsius compared to pre-industrial temperatures as described in Intergovernmental Panel on Climate Change report, 5th edition.

³¹ “RE100 Progress Report.”

³² Fletcher and Pendleton, “Milbank Project Finance Risks.”

project finance structure is series of complex agreements as illustrated in Figure 4. None of these agreements are standard.

Typical Project Finance Structure

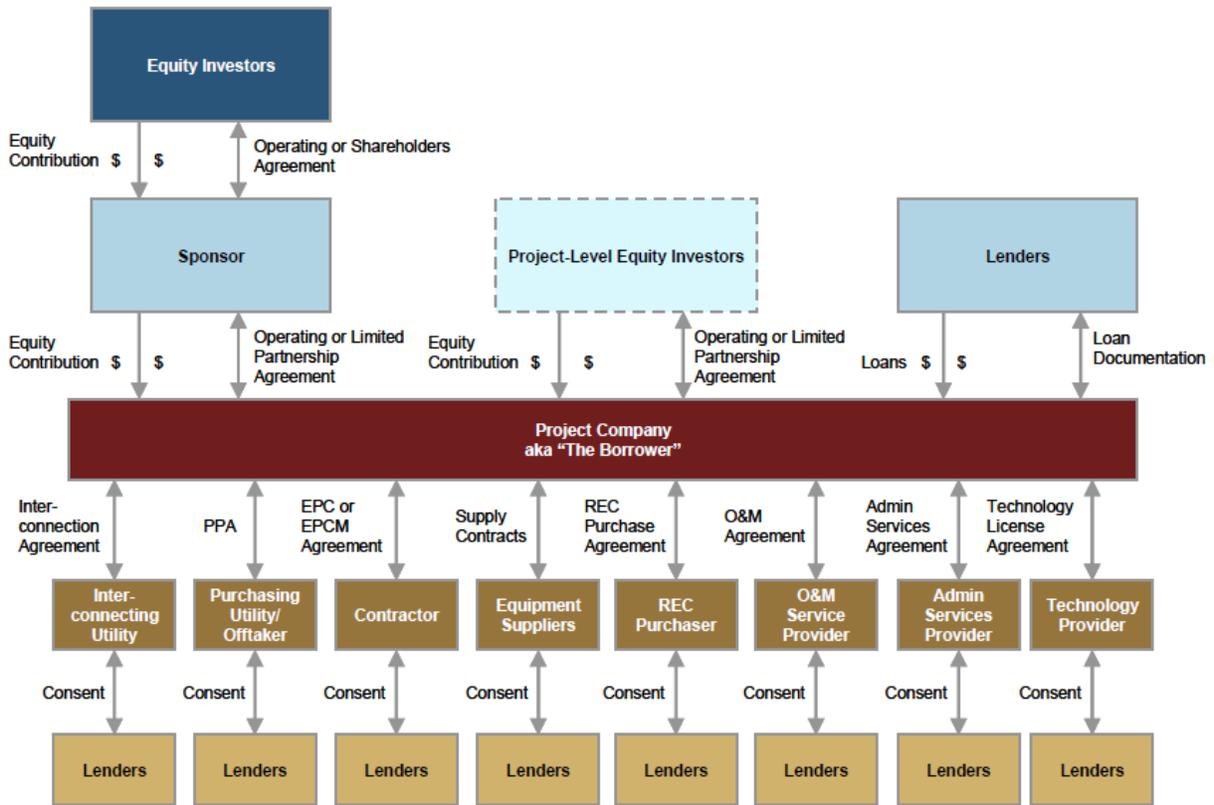


Figure 4: Typical Project Finance Structure³³

As a financial contract with embedded hedging and cash flow waterfall mechanics, it is highly illiquid. Historically the PPA has only had access to the non-recourse project finance market, which requires highly-rated buyers willing to sign up for long tenors and fixed rates. The PPA is subject to specific laws, regulations, and market rules. Its performance and energy production are dictated by the availability and intensity of natural fuel sources such as wind and solar.

³³ Groobey et al., "Project Finance Primer for Renewable Energy."

Understanding how to negotiate, structure and close such an agreement is also only suited for experts well-versed in the byzantine world of renewable production and transmission.³⁴

The original buyers of renewable energy via a PPA were regulated utilities. Utilities were expert by design, as the PPA merely extends its core business. Understanding the PPA and structuring its risks is undemanding to the natural utility buyer. As such, this utility buyer, motivated by a mandate to purchase renewable energy under state RPS was more than willing to deliver a long-term, e.g., 20-year, fixed rate commitment, backed by its credit profile. Moreover, utility regulators prefer longer fixed rate commitments as provides less variability in rate making.

Conversely, the corporate buyer, motivated by a sustainability or renewable energy target, does not have a utility's purchasing expertise. The corporation must acquire a new skill set, and comprehend complex nuances and risks associated with the PPA. Committing to a long-term and fixed rate energy purchase, after a history of buying energy at spot as offered by the local grid is a paradigm shift. Consequently, initiating a proactive and strategic renewable energy purchasing program can be a daunting, resource intensive and time-consuming process. The requirement for program start-up is the primary explanation for the market pause in 2016, discussed below.

Program Depth and Scale

Initiating a renewable energy program for a corporation is a progression of intensity and environmental efficacy. The easiest and most logical start is the purchase of RECs. This can be an invaluable tool for companies that want to demonstrate commitment to renewable energy procurement but have not assembled the resources necessary to understand and manage the next layer of complexity.

³⁴ Groobey et al.

That next layer of progression is developing renewable resources onsite, building renewable capacity (typically solar) on corporate property. This can be executed through a direct purchase of the asset or a PPA, where a developer builds the project on corporate property and contracts through a PPA to sell the offtake to the corporation. Onsite renewable energy, whether purchased directly or through a PPA is a clear delivery of additionality and should be claimed as such.

The third step in the layer of complexity is to contract through the local utility. This occurs in regulated markets as a green tariff. The tariff acts as a sleeve where the utility contracts via a PPA for production from a renewable energy project in its service territory. That production is then allocated to the corporation and thus is not mixed into the other grid resources available to existing ratepayers.

Utilities, motivated to find ways to meet corporate demand for renewable energy, are starting to incorporate green tariffs as a defensive measure to preclude losing corporations. Conversely green tariffs are being used as an economic development tool, bringing new corporations to the service territory and tax base.

However, locating renewable energy onsite may be limited or not available, and the local utility may be constrained in what type of tariff or sleeve it can offer. The remaining option, buying renewable energy offsite, dramatically increases decision complexity and risk. Yet this is structure of choice as it allows corporations the flexibility to purchase renewable energy in markets and locations where renewable projects are most productive.

The purchase of offsite renewable energy is the fourth and final step in the evolution of buyer sophistication. The purchase is transacted through a virtual power purchase agreement (“VPPA”) which includes an electricity swap called a contract for differences (“CFD”). It is virtual or

synthetic arrangement as the renewable energy project is not grid connected to the buyer. Offsite renewable energy procurement through a VPPA requires knowledge of wholesale markets, renewable energy technology and resource capacity. The CFD requires a skill set and comfort with basis risk and an ability to manage this risk effectively on a project and portfolio basis.

In summary, the VPPA is a complex yet powerful enabler of the burgeoning corporate renewable energy market. It is unlikely however that the VPPA will ever achieve standardization necessary for a public or exchange-listed financing that would provide trading, liquidity, and market depth. It will rely solely on the project finance market for financing, where an optimal execution is both long-term and fixed rate. Without a long tenor and ability to fix the rate, developers will be challenged to access the traditional project finance market.

Financing Constraints – Project Finance is the only option

Developers rely exclusively on the non-recourse project finance market for funding renewable energy projects. This funding mechanism efficiently separates the project sponsor from project risks, providing a path for optimal leverage at the project level. Underwriting centers on the underlying PPA and the credit quality and security commitment of the off taker. A utility, with an investment grade profile, under a long-term PPA, provides ample credit support to lenders and equity investors at the project level.

However, relying on one market for funding can be problematic if there are any changes in structure or external market disruptions. The corporate buyer of renewable energy is one such disorder. Corporations are generally not comfortable committing to a long-term, fixed rate purchase of energy. Long-term is defined as anything greater than five years. Corporations considering a long-term renewable energy purchase via a PPA readily acknowledge the value of hedging against commodity price risk and supply disruptions. However, they also understand

that renewable energy cost curves are still bending quite dramatically. Thus, any long-term fixed rate commitment would preclude taking advantage of cheaper energy going forward.

Consequently, there is currently a significant imbalance in the market between demand and supply. Supply, as an artifact from the time when the only buyer of renewable energy was a utility, requires a long-term fixed rate commitment from buyers. Some corporate buyers, with financial wherewithal and an underlying commitment to make the market work, have been willing to contract via a 10 to 20-year PPA. Many corporate buyers have not been willing to commit longer than five years, and thus we are observing a major barrier to the accelerated growth of the corporate renewable market. Developers have a backlog of potential projects but have intently steered away from the five-year corporate buyer as project finance funding is not available for this non-market, short tenor.

This constraint is manifest even though corporate demand is growing and assistance from market catalysts such as the BRC and RE100 has been exceptional. There must be an adjustment in traditional project finance criteria or corporate buyers must start to consider alternative and broader capital markets alternatives.

The 2016 Market Pause – Temporary or chronic?

In 2016 the corporate renewable market collapsed. It declined by over half, going from 3.3 GWs contracted in 2015, to 1.6 GWs the following year. This downdraft in volume reflected the full effects of structural complexity and related financing constraints of the market, but also a rush to complete deals in 2015 before the expiration of the production tax credit. While these flaws are a

cause for concern over long-term sustainable market growth, the market illustrated its resilience in 2017, resuming a growth trajectory.³⁵

The market also broadened in 2017 with new buyers entering. This breadth reflected the strength of the market's core driver, increasing science-based sustainability and renewable corporate commitments. The new corporate buyers in 2017, mostly major multi-national firms with substantial resources, were able to overcome the structural complexities and financing constraints present in the market. This demand phenomenon is consistent with the PwC, RE100 and Power Forward Surveys indicating robust growth going forward. It appears that the market will continue to grow despite inherent structural flaws.

Market Response to Barriers – Expertise to the rescue

The primary strategy deployed by corporate purchasers to mitigate purchasing complexity has been to hire a consultant or alternatively, add significantly to internal staff. The staff addition option - dedicated groups with energy expertise, is a major resource commitment by a company. For example, Amazon and Google have invested significant resources in establishing internal teams for understanding and actively managing the complexity, risk and returns associated with the electric generation, transmission, and renewable markets. The skill sets necessary to purchase offsite renewable energy are more expansive and complex than purchasing renewable energy certificates "RECs" as an avenue for meeting clean energy goals.

Microsoft's team to attack its transition from RECs to the purchase of offsite renewable power included hiring 14 experts in electricity markets, renewable energy, battery storage and distributed generation. (Winston, Favalro, & Healy, 2017) To get serious about purchasing

³⁵ "BRC Deal Tracker."

renewable energy, the large high-tech companies have been uniquely positioned with a combination of financial wherewithal and senior management commitment. Most firms do not have this advantage.

Another market response has been an acknowledgement from committed and well-resourced corporate buyers that developers must have a long-dated PPA, say 15 years and longer, to access financing. This financing reality has prompted corporate buyers to execute longer-dated transactions, understanding that fixed-rate renewable generation could be an effective hedge against price and/or supply volatility. The downside is that the renewable cost curve continues to decline because of advances in technology and manufacturing efficiencies. Under a fixed long-dated contract, buyers would be locked out of benefitting from those declines.

These market responses to the barriers of structural complexity and financing constraints have been effective. However, accelerated growth, through increased participation by corporations with less expertise and financial wherewithal, remains in doubt.

Growth resumes in 2017 and diversified buyers appear

As indicated in 2017's resumption of growth and increased participation by new buyers, demand in the market illustrates several strong underlying fundamentals. This is the result of confidence provided by over five years of successful transactions. Institutional investors have responded, and the market has transitioned to execution accountability. The accountability transition is evidenced by the January 2018 BlackRock letter to CEOs, and research being produced supporting the business case and valuation differentials provided by sustainability and renewable energy procurement.

The Letter heard round the world

On January 12, 2018, the CEO of BlackRock, Inc., the world's largest investment manager, wrote a letter to CEOs of public companies with an admonishment to serve all stakeholders. He warned that long-term valuation would suffer without an explicit strategy on social issues such as climate change and the environment. In effect, he indicated that BlackRock would work with companies to understand this social purpose but also cautioned that BlackRock and society would hold companies accountable for this broader social and environmental responsibility. This letter, and BlackRock's follow-up, will be a significant support to corporations that are engaged or contemplating engagement in the procurement of renewable energy. It is possible that BlackRock, and other institutional shareholders may start asking not only about a company's commitment to renewable energy but also the additionality of that commitment.^{36 37}

Business Case – Economics matter

Akin to what occurred in green certification of buildings, operating economics are now becoming a key driver for growth in renewable energy corporate procurement. The environmental benefit, as an important driver, is a significant complementary consequence.

The chart below, contained in the January 2018 RE100 Insight and Progress Report, reflects that economics of renewable energy were ranked a close third in importance based on this 2016 survey with its 74 members.

³⁶ Fink, "BlackRock CEO Letter."

³⁷ There is no common definition of additionality in the renewable procurement, yet it is becoming a highly desired attribute and point of differentiation for sustainability commitments.

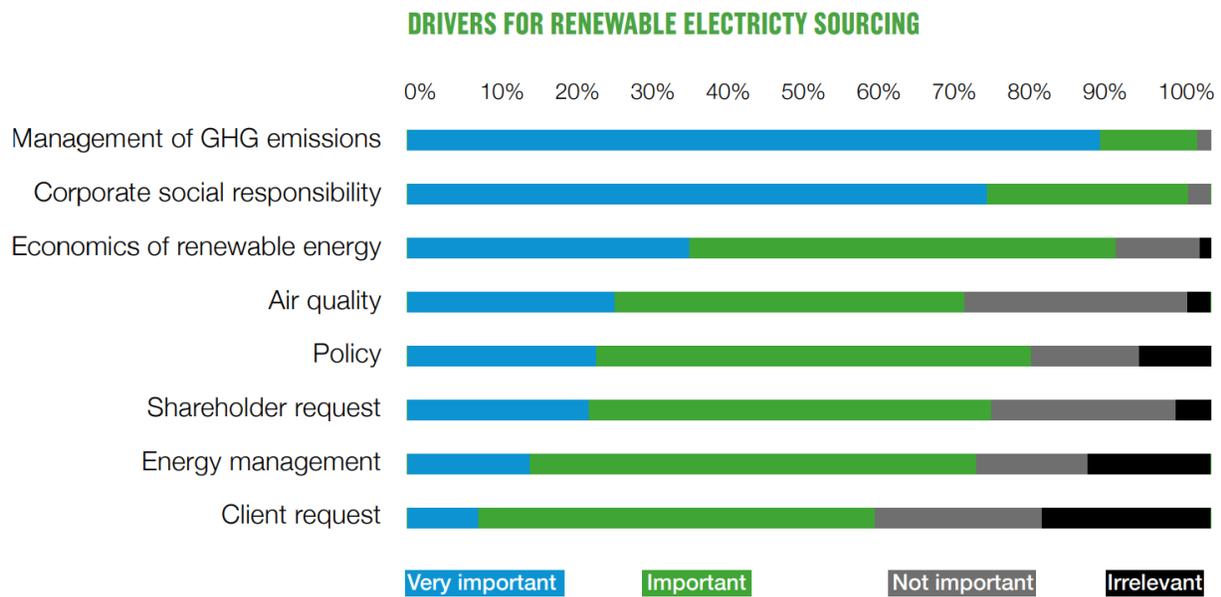


Figure 5: Drivers for Renewable Electricity Sourcing³⁸

Dramatic declines in utility scale wind and solar cost curves now make the business case for renewables a discussion of grid parity with conventional generation. Since the corporate procurement market got underway in 2012, the unsubsidized levelized cost of utility scale solar has dropped 60.4% for the five years ended in 2017, and the unsubsidized levelized cost of utility wind has dropped 37.1% for the same period. This remarkable cost decline stems from improvements in technology, manufacturing efficiency and capacity.³⁹

The following quotes from members of the RE100 sum up the experience of two large multi-national corporations of using renewable energy to lower operating expenses.

³⁸ "RE100 Progress and Insights Report: Approaching a Tipping Point."

³⁹ "Lazard Levelized Cost of Electricity V11.0."

From Stephen Badger, Chairman of Mars, Inc., the global manufacturer of candy and pet food products with an estimated \$35 billion in 2017 revenue:

“Mars is already capitalizing on the falling prices of renewable energy and the long-term cost savings of clean technology. We now purchase enough renewable energy in to fuel our entire operations in five countries and plan to make that 11 countries in 2018. All of this is delivered at the same cost or lower, than fossil fuel.”⁴⁰

From Urs Holze, Senior Vice President, Technical Infrastructure, Google:

“Renewables are increasingly becoming the lowest cost option. Electricity costs are one of the largest components of our operating expenses at our data centers, and having a long-term stable cost of renewable power provides protection against price swings in energy.”⁴¹

Valuation – Wall Street has noticed

Corporate procurement of renewable energy is often referenced as an attribute of corporations that are executing on environmental, social and governance (“ESG”) commitments. ESG performance is growing criteria of the investment community, driven by new millennial investors who desire to find companies that do well by doing good. Calvert Investments, an investment firm focused on the ESG sector, collaborated with Barron’s recently, analyzing financial returns against the top 100 ESG firms. The study found that the top 100 ESG firms outperformed the S&P 500 by 5% in 2017, providing an indication that value is positively correlated to ESG and renewable energy execution.⁴²

⁴⁰ “RE100 Progress and Insights Report: Approaching a Tipping Point.”

⁴¹ “RE100 Progress and Insights Report: Approaching a Tipping Point.”

⁴² Norton, “The Top 100 Sustainable Companies.”

A research note published by the research team at Bank of America Merrill Lynch in 2016 provided an analysis that ESG investments should be viewed as a portfolio risk reduction strategy. The study found that ESG investments lower future volatility through lower earnings risk, price declines and avoidance of bankruptcies. Portfolio risk reduction is a value that can be quantified, which reinforces the value of ESG and renewable energy focused companies.⁴³

The purchase of renewable energy provides evidence and fact-based metrics that investors are demanding when reviewing ESG disclosures. These disclosures, which help identify risks as well as profit opportunities, are a board level issue, as approximately 33 percent of S&P companies now have at least one board member with CSR experience. For Institutional Shareholder Services as a proxy advisory firm, the issue of ESG strategy has become a question of negative valuation - those companies without an ESG imperative are subject to a lower valuation, irrespective of other financial metrics.⁴⁴

Case Studies

Google – A Values-Driven Market Leader

Google was selected as a case study not only because of its market leadership, but also its focus on additionality as a core value of its renewable energy program. Its definition of additionality has two components. The first test is whether Google's involvement caused additional renewable energy generation to be built. The second test is unique to Google and has broad implications. It asks whether their involvement had the highest impact on the renewable energy industry.

⁴³ Subramanian et al., "BOAML ESG Equity Strategy."

⁴⁴ Skroupa, "Company Valuation -- How ESG Integration Is The Future Standard."

As an example of its view on additionality, the company will not buy an existing renewable energy project or one that is under construction. Again, without Google, no new renewable energy generation would have been created. Google's second test of additionality would test whether its action enhanced the efforts of market participants, such as developers or investors.⁴⁵

This second Google additionality test provides the company with the flexibility to play different roles and implicitly, have a longer-term view. This involvement test is an indirect but powerful force. In my view it can and should be used as a key support mechanism for a new and radical review of the traditional financing equation, the syndicate model. This model would enable scale and scope of the corporate procurement market. It is discussed in the new paradigm for the underwriting model portion of this paper.

Additionality directly relates to the issue of decarbonization. Additionality is a one-to-one offset, or replacement, of carbon-based power generation. It is a higher and more difficult standard of going green than purchasing Renewable Energy Certifications ("RECs"). RECs remain an important component of efforts to meet environmentally sustainable energy procurement. RECs are often the only execution option. However, RECs are viewed as early stage alternative of buying renewable energy, and do not directly lead to decarbonization. The competitive process of attempting to differentiate and improve sustainability effectiveness is prompting companies to look at additionality transactions.⁴⁶

⁴⁵ "Google Green PPAs: What, How and Why."

⁴⁶ Powers and Haddon, "The Role of RECs and Additionality in Green Power Markets."

Results of Case Study

The following questions were presented to Will Fadrhonc, who is a Commercial Lead in the Energy Markets and Policy Group at Google. Mr. Fadrhonc has been with Google for three and half years, following his graduation from Duke University with a joint MEM/MBA in May 2012.

- What is the history of Google's renewable energy program?
- What was the motivation to get started?
- What is Google's definition of additionality?
- How do you get brown power off the grid?
- What was the internal socialization of the program?
- What anticipated barriers did you experience?
- What unexpected barriers did you experience?
- What anticipated opportunities did you experience?
- What did you learn from the Dutch Wind consortium transaction?
- How big is your team?
- Is managing basis risk one of your top priorities?
- How much have you done?

The following is a summary of results from the questions:

Initial Program

- Getting the program started involved a series of smaller, experimental transactions. Incorporating experience from smaller and diverse deals, with a focus on understanding structure allowed acceleration of the program. This experimental and learnings phase lasted about four years.

Initial Objectives

- The motivation to get started was a sustainability goal to become carbon neutral. That strategy shifted into supply chain management, with a focus on hedging commodity price volatility through fixed price contracts.

Additionality

- Google's definition of additionality is to make sure that power consumption is carbon free, and secondly to impact and drive change in the market such that renewable and carbon free energy increases for the entire market.

Decarbonization

- It is a challenge to get brown power off the grid, but renewable energy's modularity and dramatically lower construction risk is more competitive than fossil fuel generation. Modularity is defined by the ability to build smaller and incremental renewable projects. Lower construction risk is defined by renewable energy's shorter construction periods and lower operational/construction risks.

Socialization

- Google is very much a bottoms-up organization in terms of idea generation. It is a disciplined process, but if you can support your hypothesis with data, provide a credible way to test it, and present your results, you can get new ideas and programs initiated and funded. This was the scenario with renewable energy procurement.

Expectations

- Google expected project costs to be higher but was pleasantly surprised by significantly lower costs which created additional momentum. Google expected deal complexity, but developers struggled a bit early on with Google's different corporate profile from a utility buyer. Google's reputation and financial wherewithal helped most developers mitigate this challenge.

Disappointments

- Google expected regulated markets and utilities to be more flexible. This was not the case and Google found green tariffs and similar programs to be less neutral and utilities in general less willing to accommodate Google's needs. As such, Google focuses almost entirely on deregulated wholesale markets.

Surprises

- Google expected costs to decline but missed the rate of decline. This has been a pleasant surprise but also surprising in that the company was not able to predict this with more accuracy.

Leadership

- The Dutch Wind deal was a good example of partnership, with Google using its experience and credibility to help three other companies to do their first utility scale renewable energy transaction. It allowed Google to show others how to execute on a tactical perspective and navigate negotiations of a complex contract in a multi-party transaction. Google's expertise provided valuable air cover to legal departments and risk managers of its consortium partners.

Staffing

- Google has twelve members on its energy team and contracting for renewable energy represents 25 percent of their activities. Other duties include retail relationships with utilities, data center site selection, sub-station and transmission expansions.

Deals done

- Google has done about 3000 MWs, mostly wind. The top three states are Oklahoma, Kansas, and Iowa. They have done one solar farm in NC

Differentiator

- A key differentiating factor for getting deals done is that the team sits in the operations division, not sustainability. It has the pressure and constraint of delivering required power to keep Google running.

Projections

- Lastly, Google sees market design changes coming as we get saturation of renewable energy, zero marginal cost resources. Wholesale markets will be under pressure, from a pricing and design perspective.

Discussion

Like many companies exploring new and risky activities, Google took an incremental approach by learning through several smaller transactions. This process took several years but paid off in confidence to transact larger deals, and on an accelerated pace. Now its institutional knowledge and expertise is shaping the market and helping first-time buyers as illustrated by the Dutch Wind transaction which brought in AkzoNobel, Philips, and Royal DSM.⁴⁷

Google benefitted from a declining cost curve in renewables, but lower costs did not predicate its participation and eventual leadership. Its unique definition of additionality has defined its market leadership not by market share, but by expanding the market, acknowledging that a larger corporate renewables market is good for the broader world. Yet it maintains a financial focus

⁴⁷ Dutch Wind consortium involved two wind PPAs, direct supply, in the Netherlands, for 136 MWs.

through the lens of traditional supply chain management and the burden of responsibility for the corporate line item of energy expense. It has hedged commodity price risk through the fixed price hedging of PPAs, and it has mitigated supply and regulatory risk through renewable power. Google has taken a potential risk exposure from a growing energy appetite and transformed this potential liability into a differentiated asset, that uniquely benefits the overall market. Google's experience is providing potential new entrants to renewable energy procurement with a roadmap and confidence to commit resources to what will increasingly be a mandatory component of supply chain risk management. Just "google it" may have a new meaning in the renewable energy space.

Disruptive Decisions as Harbingers

The following examples illustrate the dynamics within the market for renewable energy.

Corporate demand can be a game changer for broader installation and use of renewable energy. It is making a meaningful contribution to a reduction in carbon emissions from the power industry, yet regulated utilities and renewable developers have significant new challenges ahead.

1. Cutting the Cord

In September of 2016, MGM Resorts, owner of 16 properties on the Las Vegas strip, and representing 5% of the local utility NV Energy's load, elected to pay a \$86mm exit fee to leave the regulated utility and procure power from renewable developers as well as onsite rooftop solar arrays. This arrangement, approved by the Nevada regulatory commission, sent shock waves through the regulated utility industry, acknowledging that the demand and economics of renewable energy can tangibly disrupt a regulated utility's protected monopoly.⁴⁸

⁴⁸ Spector, "How MGM Prepared Itself to Leave Nevada's Biggest Utility."

2. Industrials in the Game

In March, Anheuser-Busch InBev, the maker of Budweiser, Stella Artois, and Corona, committed to purchasing 100% renewable energy by 2025, representing \$400mm of an annual electricity bill. The primary motivation for this commitment was to reduce operating expense. Providing tangible evidence of its commitment, the company executed a PPA with renewable developer Iberdrola to buy 490,000 megawatts of wind to be built in Mexico. This PPA will meet all of AB InBev's power needs in Mexico, home of one of its global brands: Corona.⁴⁹ This is a good example of renewable energy procurement occurring outside the tech space.

Ideas for Overcoming Structural and Financial Barriers

Access to the capital markets is a critical element of the long-term health and success of companies and industries. It is the key to industry scale, flexibility, durability, and innovation. The corporate procurement of renewable energy is no different.

Because of its reliance on one capital market, the corporate procurement industry is subject to single market disruption or volatility. Moreover, the absence of availability to broader and deeper capital markets is an opportunity cost of optimal growth. Fortunately, innovation born of frustration is being introduced. The architects of these innovations attack various parts of the financing equation and value chain. The two most noteworthy contributions are the idea of buyer aggregation and secondly, external contracted expertise through consulting arrangements. The buyer aggregation model allows smaller corporates to participate in the market, and third-party

⁴⁹ Helman, "A Green Energy Push For Anheuser-Busch."

consultants are being resourced to provide critical expertise in the navigation of PPA and electricity market complexity.

Aggregation – A Scaled Buyer

Aggregation is a construct that has potential to expand the number of smaller corporate buyers in the market that do not have the expertise or load demand to initiate transactions on their own. Aggregation renewable energy deals, assembled by intermediaries, brings together multiple buyers with similar needs and profiles. The buyer consortium provides the leverage and scale necessary for negotiating a PPA and provides a diversified risk profile to the seller and its financing sources. This diversification or blended buyer credit profile enhances the seller's transaction risk profile presented to the credit market.

LevelTen Energy, a start-up intermediary with an aggregation model, claims that aggregation also greatly increases transaction efficiency by reducing complexity. Seeking to take advantage of the growth in renewable energy, LevelTen was founded by developers frustrated with bilateral bespoke PPAs that could take up to two years to close. LevelTen's model is based on a standardized PPA contract that replaces bilateral negotiation with a pre-packaged deal.⁵¹

If aggregation is successful at scale, then standardization, particularly of the CFD, is a first step to enhanced liquidity. This commoditization and liquidity could provide a path to trading markets. The historical model is financial derivatives, which started out as an inefficient and bespoke market. Industry worked with regulators and other stakeholders to create standardization and transparency. Liquidity, standardization, and transparency were critical to the growth of the financial derivatives market. This market started out as a private, illiquid, and inefficient market.

⁵¹ "LevelTen Energy Raises \$6.8M to Make It Easier for Big Companies to Buy Renewable Energy."

An example of buyer aggregation is the four-party consortium put together in 2016 to purchase two wind energy projects in the Netherlands. The four buyers were three Dutch companies, AkzoNobel, DSM and Philips, plus Google. The partnership is known as the “Dutch Wind Consortium”. This buyer aggregation demonstrated the power of scale both in time and cost efficiencies. The consortium has executed two wind PPAs with the first taking three years to complete, and the second transaction, which was a replica of the first, took just a year from start to finish. It was still a complex undertaking and required negotiating a 15-year PPA while structuring transmission and market risks. Yet it proved that buyer aggregation is a powerful construct for companies focused on additionality.⁵²

Third-party consultants – A Critical Expert and Advocate

Because of contract complexity, third-party consultants become a necessity to corporations that have not or cannot commit the resources necessary for staffing expertise internally. Consultants serve as an addition to the non-profit catalysts described earlier and are vital in aggregation transactions.⁵³ Deloitte, PwC, and McKinsey are noteworthy large firms in the space, competing for this growing consulting business with a host of specialty firms such as RenewableChoice Energy (now owned by Schneider Electric), Level10, 3 Degrees, Renewable Power Direct and APX Renewables. All these consultants have a variety of programs and services aimed at educating buyers on how to structure a power purchase agreement (“PPA”). This bespoke transaction market includes variables such as purchase size, targeted savings, contract length, potential aggregation, portfolio diversity and follow-up monitoring.⁵⁴ Consultant advocacy is a valuable component of a renewable energy buyer’s confidence as the multi-party PPA is

⁵² Zanchi, Porter, and Miller, “Dutch Wind Consortium.”

⁵³ Zanchi, Porter, and Miller.

⁵⁴ Renewable Energy Choice, “Renewable Choice Energy.”

negotiated. Lastly, a consultants' network of tax experts, attorneys, engineers, and other stakeholders is an essential piece of a successful and efficient transaction process.

Underwriting Model – Need for a new paradigm

While the project finance market has served developers and utilities well, the new corporate buyer often has requirements that are not conducive to a long-term non-recourse model. The corporate buyer is currently pressing for a significantly shorter contract term than what is readily financeable in the project market. Additionally, the new corporate buyer is using its bargaining power to allocate more settlement risk to the project company, which further limits the developer's ability to obtain project financing effectively. The corporate buyer is acting rationally, using its wherewithal to structure optimal flexibility for changing energy and financial market conditions. Yet the corporate buyer indirectly limits potential project proposals as developers elect to stand down on bids that will not allow effective project financing. Moreover, the corporate buyer, by completely relying on the traditional project-style financing, limits its ability to weigh financing a broader array of financing alternatives in the capital markets.

A common tenet of the most effective finance division of corporations is the ability to source capital where and when capital is the cheapest. Currently the corporate renewable energy market has only one market – the project market. The financing or credit node⁵⁵ is at the non-recourse project company, usually a limited liability subsidiary of a larger development company or sponsor. The project financing market can become illiquid, expensive or suffer other disruptions – for reasons completely beyond the control of the corporate buyer or developer. The project

⁵⁵ A financing node is synonymous with obligor, borrower. Corporations can have numerous financing nodes, points at which individual business units are financed within corporations. Nodes can have support agreements from parts of the organization to enhance access to financing.

financing market can also be the cheapest and most flexible, but the corporation won't be able to accurately judge optimization without the ability to compare additional options in the broad capital markets. These capital markets are available to a corporate buyer in structures where the corporation is the creditor, and underwriter's look first to corporate cash flows as repayment and secondarily to the integrity of the PPA.

Acceleration of the market will only occur if the corporate buyer is able to weigh various financing alternatives. The options should include project finance, but increased financing optionality and accessibility is only possible through changing the borrower or credit node, from the project to the corporate buyer. In this new paradigm the corporate buyer is structured as an owner versus being a contracted offtaker. This is a corporate finance model.

Corporate Finance – Is Renewable Energy a project market or asset acquisition?

The corporate finance or “syndicate” model simply moves the node of financing to the corporate buyer. It would look like any other corporate financing and thus it could be sold, or syndicated, and in various tenors in different markets. Corporate or syndicate style finance can be structured secured or unsecured as the obligation is direct to the corporate buyer as owner of the renewable project. Structurally it could eliminate the need for a PPA, and thus negate the expensive and protracted underwriting of that contract.

Corporate financing provides simplicity through collapsing the buyer and owner roles. It involves no change in the buyer obligation under a PPA. This financing simplification has noteworthy implications for differences in pricing, ease, and speed of closing, and importantly, access to broader corporate finance markets. It is a simplification that acknowledges and addresses the different profile and needs of the corporate buyer compared to a regulated utility. It

is a radical idea in that it has not been used in renewable energy procurement. Yet it is the primary method of finance for a corporation.

A corporate financing model also applies to the buyer aggregation construct. Buyer scale and diversity through additional partners creates an enhanced credit profile. PPA underwriters in a project financing certainly benefit from buyer aggregation. An enhanced credit profile provides the option for buyers to consider a corporate financing as an alternative. Providing smaller buyers with additional financing wherewithal would accelerate growth in the market.

By switching the financing node to the corporate buyer and creating larger transactions through aggregation, buyer consortiums can now consider syndicating the transaction. Syndication is a tried and true concept borrowed from the capital markets where financing transactions are divided by selling commitments to underwriters. Underwriters in this case would be additional corporate buyers in larger syndicated transactions.

Syndication is akin to the reinsurance market where risk is allocated by a lead or lead underwriters to multiple secondary underwriters. Syndication in the capital markets spreads risk and facilitates larger transactions. Capital markets mechanisms like this must be considered and applied to scale and accelerate the market.

Syndication in the corporate procurement market could be defined as additionality plus. It has the potential for a tangible contribution to acceleration. For example, with Google as a lead on larger than needed projects, could syndicate, or sell down parts of that larger transaction to other corporations. The buyer could be a corporate transitioning in expertise from purely buying RECs to purchasing renewable energy offsite and thus creating additionality.

This participation in Google's syndication would be an authentic claim of purchasing renewable energy leading to decarbonization and GHG reduction. The participant would diligence Google's structure and underwriting but could accelerate its move into renewable energy. Potential syndicate participants are either not large enough or have the staff or expertise to transaction renewable procurement. Expertise is gained through underwriting and diligence on a large syndication, originated by a market leader such as Google. The market accelerates via participations and smaller participants eventually gain enough expertise to step out on their own.

Most importantly this model would appeal to Google as it is consistent with the company's commitment to additionality to an entirely new and higher level. This idea would deliver unprecedented scale for accelerated decarbonization through corporate renewable procurement. This would truly differentiate Google's definition of additionality as a syndicate transaction would not be possible without Google.

Capital markets syndications make scale possible through risk allocation and leveraging lead underwriter's expertise and financial wherewithal. With larger transactions possible, the demand for scale of renewable projects will increase. Syndications of corporate renewable truly tap the demand of smaller corporate buyer. Corporate and syndicate transactions would also create product for several capital markets that are open and hungry for green transactions.

Green Bonds – A Real Deal?

Once the financing node has switched to the corporate buyer, capital markets alternatives increase. A logical avenue is to do a green bond, which is effectively a corporate bond with a green use of proceeds. The green bond market has grown significantly in the past few years as institutional investors with their own sustainability commitments have an appetite for environmentally oriented investments.

Green bond issuance totaled \$155 billion in 2017, up 80% over 2016. Renewable energy proceeds accounted for 51 Billion, or 1/3rd of issuance in 2017. The market is expected to grow another 60 to 80% in 2018, being fueled by pressure on investors and lenders to deliver on corporate sustainability commitments.⁵⁶

A skeptic would call this double counting of the renewable project, with both the buyer and investor getting credit. However, if it accelerates the growth and scale of the corporate renewable market, credit for the transaction matters not. Credit for funding the transaction is an accelerator and thus matters a lot.

Related to the issue of getting credit for the bonds is the definition of green bonds. While rating agencies are attempting to define what qualifies, the green bond label is applied liberally by underwriters. It can look like a new variant of greenwashing, with little quality control. Often the bonds don't offer any additionality and critics argue that this is merely a corporate bond with no yield advantage for being green.⁵⁷ As volume increases, investor demand for definition clarity will create more differentiation in this growing sector.

Commercial Paper

Commercial paper is the cheapest and shortest financing possible in the corporate market. It is also a deep capital market. As a security that has a maturity of less than 270 days commercial paper has rollover risk which is mitigated by bank lines of credit. The commercial paper market would be open to the corporate purchase of renewable energy projects if the contract was structured as a corporate financing. Current pricing for second tier commercial paper is 2.25%

⁵⁶ Climate Bonds Initiative, "Green Bond Highlights 2017."

⁵⁷ McCrone, "McCrone."

for 60 days.⁵⁸ As a proxy, a project financing would be priced below investment grade pricing. Current BB bond pricing is in the 5.25%.⁵⁹ This estimate of a 300-basis point differential in financing costs would positively impact project economics of a renewable project, making developers the sellers of projects, as opposed to owners with a PPA to be financed. Commercial paper is often used by corporations as temporary bridge financing to the longer-term capital markets. This financing optionality, flexibility and pricing is currently untapped in the renewable energy procurement market because of the singular focus on PPA and project-style underwriting.

Securitization – Wall Street’s alchemy for liquidity

Green securitization, which is a small but emerging asset class, would represent another financing alternative, particularly for pooling smaller corporate funding’s. There has only been \$5 billion of issuance in this market as 2017, which has been hampered by the lack of standardized contracts. That inefficiency could be corrected if the debt was at the corporate level, eliminating a need to review loans based on bespoke PPAs with smaller counterparties.

Securitization in other asset classes is an example of scaling capital market access by pooling, which is only possible with homogenous contracts such as a straight corporate borrowing. S&P, one of the most recognized rating agencies, initiated a global ratings evaluation service in 2017, noting that sustainable finance is now a legitimate and growing investment sector.⁶⁰

Policy

The corporate purchase of renewable energy, either onsite or offsite, is antithetical to how our power markets were built and now regulated. As such, there is much work to do on the policy front to enable this mega trend. To date, the corporate procurement of renewable energy is

⁵⁸ “The Fed - Commercial Paper Rates and Outstanding Summary.”

⁵⁹ “Bonds - NYTimes.Com.”

⁶⁰ Wilkins, “Beyond Green Bonds.”

occurring in restructured states that have gone through partial or full electric market restructuring. Texas, being a restructured state with a competitive generation market in addition to be wind rich resource state, benefits greatly.⁶¹

The response from fully regulated utilities has been limited but encouraging. Market demand, lower costs, and increasingly, the value of resilience, is forcing change. Regulated utilities are now offering additional renewable energy purchasing options. The effort to satisfy growing demand from existing corporate customers for renewable generation is now viewed as an economic development tool to attract corporate relocations.

The options from regulated utilities are in the form of separate tariffs or riders. There were ten green tariff options in 2016 compared with five the previous year. Two notable new programs were in New Mexico where the tariff was used to attract a new Facebook data center to the state, and in Virginia, where Dominion Resources put together a tariff with market-based rates at the request of Amazon.⁶²

World Resources Institute (“WRI”) and the World Wildlife Fund (“WWF”) have worked to catalyze the development of green tariff programs through collaboration with policy makers and industry. Through its energy division, WRI and WWF have produced a framework of six guiding principles for buyers as the market continues to evolve. This transparency has provided policy makers with a road map for policy design. The principles, briefly summarized, seek to inform the concepts of greater choice, lower cost, greater access, new projects, new alternatives of financing, and increased collaboration.⁶³

⁶¹ Advanced Energy Economy, “VA-2017-Market-Brief-Corporate-Renewable-Energy-Procurement.Pdf.”

⁶² Tawney, Barua, and Bonugli, “Emerging Green Tariffs in U.S. Regulated Electricity Markets.”

⁶³ WWF and WRI, “Corporate Renewable Energy Buyers Principles.”

Advanced Energy Economy (“AEE”), another corporate renewable advocacy group, has published extensively on the policy topic and has put forth a similar framework, with a focus on needed policy changes at the regulated utility level. Specifically, AEE is recommending that utilities begin to include corporate renewable energy in integrated resource planning, which is the nexus between utility and regulator in terms of long-range planning for revenue requirements.⁶⁴

Public Governance – Time to Modernize

To date, the existence and growth in utility scale renewable energy industry has been policy-driven. One state policy - - a RPS by state⁶⁵, and two federal policies - - the production tax credit (“PTC”)/investment tax credit (“ITC”), and the Public Utility Regulatory Policies Act of 1978 (“PURPA”), combined to drive the industry forward in the last three decades.

Today growth is a function of private market dynamics. Dramatically lower costs, increased operating efficiency, plus price risk mitigation and sustainability commitments are the key drivers. As such, much work is being done on the policy front to reflect these new private market dynamics. The PTC and ITCs are being phased down finally after 20 years of short-term extensions, state RPS are being revised and late last year, legislation was introduced in the U.S. House with an intent to modernize PURPA.⁶⁶

Policy formed the industry and is now overdue for modernization. Policy makers will need to incorporate flexibility for new technologies and increased competition while maintaining the benefits of existing policy focused on reliability and lower costs. This will require collaboration

⁶⁴ Advanced Energy Economy, “Expanding Corporate Access to Advanced Energy.”

⁶⁵ Durkay, “State Renewable Portfolio Standards and Goals.” 29 states have a RPS

⁶⁶ “The PURPA Modernization Act of 2017.”

with all stakeholders, including the new corporate buyer, which has an altruistic motivation as a key part of its strategy. The social purpose element in renewable energy demand was not present in earlier laws and regulations and must be incorporated by policy makers if we are to harness the power of the free market in provided scaled solutions to GHG challenges. Without the explicit cost of carbon emissions in regulation, policy must remember a key tenet of demand is reduction of GHG, understanding that policy roadblocks to additionality should be removed.⁶⁷

Conclusion

Growth Projected

The corporate procurement of renewable energy will continue to grow, as evidenced by additional industry sectors participating and strong indicators from new and detailed corporate sustainability commitments. If the 125 companies in the RE100 executed on their pledges to 100 percent renewable energy by 2030, investment and contracted volume in utility scale renewable energy would total 87 GWs estimated at a cost of \$94 billion.⁶⁸ We are currently at approximately 11 GWs cumulative over the past six years, with Google at 3 GWs, representing 3 to 4x the next three buyers of Amazon, Microsoft and Apple. The 2030 RE100 committed goal of 87 GWs over the next 12 years represents an 18.8 percent CAGR.⁶⁹ This compares to 32 percent CAGR over the last four years illustrated in Figure 1, which reflects the initial period of rapid growth for this new buyer segment.⁷⁰ These initial and projected growth rates are

⁶⁷ Vandenbergh and Gilligan, *Beyond Politics: The Private Governance Response to Climate Change*.pp.120-121

⁶⁸ Eckhouse, “It’ll Take \$94 Billion for These Companies to Go 100% Green.”

⁶⁹ Compound Annual Growth Rate (CAGR) = $\left(\frac{87}{11}\right)^{1/12} - 1 = 18.8\%$

⁷⁰ CAGR from 2013 to 2017 = $\left(\frac{3.11}{.77}\right)^{1/4} - 1 = 32\%$

noteworthy compared to flat-to-declining overall load growth for the utility industry occurring over the past decade.⁷¹

If RE100 commitments were the only indicator, the answer to this MP's central question would be affirmative with a high probability of double digit growth. Yet the industry remains constrained by its structural complexity and limited financing alternatives. The pressure from corporate buyers' desire for shorter tenors and less basis risk will make this growth scenario unrealistic. All that pressure is currently allocated to developers, which have healthy backlogs of potential projects, but carry the financing burden of accessing the project finance market. In the short history of the corporate renewables market, developers face increased difficulties in accessing a project finance market that is more comfortable with a long-term offtake contract from a regulated utility.

Google's market leadership is critical to growth of the industry. Their approach is multi-faceted and provides a powerful encouragement and incentive for new corporate buyers of renewable energy. Google defines additionality broadly, with an intention to impact healthy growth in the overall market. In the Dutch Wind transaction, they brought three new renewable buyers together in a consortium that reflects the benefits and power of the aggregated buyer model. This deal would not have happened without Google and as such provides a tangible example of the company's influence.

Aggregation is a trend that will enable accelerated growth. The corporate buyer, particularly when aggregated, presents a strong and diversified credit profile. Moreover, it is a credit profile that is amenable to a corporate financing, precluding a reliance on a project financing. The

⁷¹ U.S. Energy Information Administration, "In 2017, U.S. Electricity Sales Fell by the Greatest Amount since the Recession - Today in Energy - U.S. Energy Information Administration (EIA)."

aggregated corporate profile that would provide efficient access to a number of capital markets, beyond the project finance market. Switching the financing node, or borrower from a developer's non-recourse limited liability corporation to an aggregated buyer, would allow access to unsecured and more flexible financing options than the narrowly defined project finance market. Market catalysts such as the BRC, REBA and the RE100 have been essential accelerators, advocates, and assistance as the industry has formed. They will continue to play a critical role for innovation and collaboration as the challenges of contract complexity and limited financing alternatives evolve.

Time Urgency – The Future is Now

The 2016 climate change agreement signed in Paris had a stated goal of keeping the global temperature rise of less than 2⁰ Celsius by the year 2100. It was an aspirational goal that is often debated on whether it is realistically achievable. One study published in 2017 from the International Journal of Science predicted that there was just a 5% chance of staying under 2 percent, and the range was 2 to 4.9⁰ C, with a median of 3.2⁰C. This was based on the existing trajectory of emission mitigation.⁷²

Consequently, to say that time is urgent is an understatement. A logical conclusion is that the world needs radical change, discovery of new technologies, and practices that unleash the power of scale on an unprecedented basis.

⁷² Raftery et al., "Less than 2 °C Warming by 2100 Unlikely."

The Road Map

The road map in Figure 6 below is a high-level description of the steps that are recommended for a first-time corporate buyer of renewable energy. The first step is merely a collection of existing data within the firm, to be used as input for decisions down the road. This data exists throughout the firm but in most cases is not collectively actively. If a corporation proceeds with renewable energy procurement, information systems will need to collect this data constantly for accurate benchmarking and comparative analysis of objectives.

Road Map

Dive	Deep dive on your energy usage, sources, prices, variability, history, GHG emissions
Use	Use case studies to get C-suite approval for project analysis
Join	Join the Business Renewable Center or similar organization
Consider	Consider hiring a firm specializing in aggregation
Win	Win project approval for small initial transaction
Learn	Learn from participation
Report	Report results and analysis to project approvers.

Figure 6: The Road Map

The second step is getting approval for the project. In Google’s case, senior executive approval was obtained by execution of the first step of data collection which supported scenario analysis. Because Google was an early adopter, there were no case studies. I would recommend selecting

the best and most comparable case studies as renewable energy purchasing is quickly becoming a competitive differentiator, in addition to data-driven scenario analysis.⁷³

The third step, joining the Business Renewable Center (“BRC”) makes sense as currently 96% of all corporate transactions have come through the BRC.⁷⁴ As discussed earlier, the non-profit BRC has only one motive, to do whatever is needed to help buyers and sellers of utility scale renewable energy. The BRC has built an impressive collection of educational channels, analytical tools and network frameworks that are intended to help BRC members bridge any gap in knowledge, information, or confidence in renewable energy transactions. This is the network to have for a serious and comprehensive analysis of whether the purchase of renewable energy makes sense.

It is at this point when a firm might consider connecting with a consulting firm that is active in the space. If the company is smaller and thus has limited resources, I would recommend considering one of the consulting firms that specializes in aggregation. They are set up for smaller buyers and first-time buyers that would like to understand the market more through participation in a larger deal.

Winning approval for a smaller transaction is only recommended from a perspective of risk management. At this step a company may be ready to engage in a larger transaction or non-aggregated deal. It will all depend on the commitment of senior management and the time horizon for execution.

⁷³ Winston, Favaloro, and Healy, “Your Company Needs an Energy Strategy.”

⁷⁴ Rocky Mountain Institute, “BRC: Business Renewables Center - Rocky Mountain Institute.”

The roadmap, prescription and growth dynamics discussed herein offer a hope of scale and the promise of decarbonization. The ideas presented for reducing structural complexity and enhancing financing alternatives have the potential to accelerate growth. These ideas merely exploit the power of the capital markets. The ideas can enhance existing positive fundamentals of cheaper costs, increasing demand, and greater institutional shareholder pressure. The industry benefits from a growing number of qualified and experienced consultants and non-profit catalysts. Aspirational sustainability commitments and targets will drive change, innovation, and a private market, scaled response to the challenges of growing the corporate renewable market and its intended consequence of lowering GHG through power generation decarbonization.

References

- Advanced Energy Economy. “Expanding Corporate Access to Advanced Energy,” September 7, 2017. <https://info.aee.net/hubfs/PDF/AEE-Policies-to-Expand-Corporate-Access-to-Advanced-Energy.pdf>.
- . “VA-2017-Market-Brief-Corporate-Renewable-Energy-Procurement.Pdf,” 2017. <http://info.aee.net/hubfs/PDF/VA-2017-Market-Brief-Corporate-Renewable-Energy-Procurement.pdf>.
- Aulisi, Andrew, and Craig Hanson. “World Resources Institute Guide to Green Power Markets,” December 2004. http://pdf.wri.org/corporate_guide_6.pdf.
- “Bonds - NYTimes.Com.” Accessed April 17, 2018. <https://markets.on.nytimes.com/research/markets/bonds/bonds.asp>.
- “BRC Deal Tracker.” Business Renewables Center, 2017. <http://businessrenewables.org/corporate-transactions/>.
- Climate Bonds Initiative. “Green Bond Highlights 2017,” 2018. <https://www.climatebonds.net/files/reports/cbi-green-bonds-highlights-2017.pdf>.
- Darrow, Barb. “Super-Heated Data Center Spending Broke a Record in 2017.” *Fortune*, September 29, 2017. <http://fortune.com/2017/09/29/data-center-spending-soars/>.
- Durkay, Jocelyn. “State Renewable Portfolio Standards and Goals,” August 1, 2017. <http://www.ncsl.org/research/energy/renewable-portfolio-standards.aspx>.
- Eckhouse, Brian. “It’ll Take \$94 Billion for These Companies to Go 100% Green.” *Bloomberg.Com*, March 1, 2018. <https://www.bloomberg.com/news/articles/2018-03-01/it-ll-take-94-billion-for-these-companies-to-go-100-green>.
- “Facebook Investment in New Mexico Data Center Tops \$1B.” *US News & World Report*. Accessed March 12, 2018. <https://www.greenbiz.com/article/green-tariffs-secret-state-attraction-corporate-business>.
- Fink, Laurence. “BlackRock CEO Letter.” BlackRock, January 12, 2018. <https://www.blackrock.com/corporate/en-us/investor-relations/larry-fink-ceo-letter>.
- Fletcher, Phillip, and Andrew Pendleton. “Milbank Project Finance Risks,” 2014. <https://www.milbank.com/images/content/1/6/16376/5-564-5045-pl-milbank-updated.pdf>.
- “Google Green PPAs: What, How and Why,” September 13, 2011. <https://static.googleusercontent.com/media/www.google.com/en//green/pdfs/renewable-energy.pdf>.
- Groobey, Chris, John Pierce, Michael Faber, and Greg Broom. “Project Finance Primer for Renewable Energy,” August 2010. https://www.wsgr.com/PDFSearch/ctp_guide.pdf.
- Helman, Christopher. “A Green Energy Push For Anheuser-Busch.” *Forbes*, April 6, 2017. <https://www.forbes.com/sites/christopherhelman/2017/04/06/bud-boss-promises-green-beer-in-big-shift-to-renewable-energy/>.
- Jeffrey, Cal. “Amazon, Microsoft, and Google Want to Own the Cloud.” *TechSpot*, April 10, 2017. <https://www.techspot.com/news/68878-amazon-microsoft-google-want-own-cloud.html>.
- “Lazard Levelized Cost of Electricity V11.0,” 2017. <https://www.lazard.com/media/450337/lazard-levelized-cost-of-energy-version-110.pdf>.

- “LevelTen Energy Raises \$6.8M to Make It Easier for Big Companies to Buy Renewable Energy.” GeekWire, October 16, 2017. <https://www.geekwire.com/2017/levelten-energy-raises-6-8m-make-easier-big-companies-buy-renewable-energy/>.
- “Map of Deregulated Energy States (Updated 2017).” Electric Choice. Accessed April 24, 2018. <https://www.electricchoice.com/map-deregulated-energy-markets/>.
- McCrone, Angus. “Green Bonds - Where’s the Beef?” Bloomberg New Energy Finance, September 29, 2014. <https://about.bnef.com/blog/mccrone-green-bonds-wheres-beef/>.
- Moody’s. “Moody’s: Primary Driver of Renewable Energy Demand Has Shifted to Corporates, Other New Entrants,” March 10, 2017. <http://www.smartenergydecisions.com/news/2017/03/10/moodys-primary-driver-of-renewable-energy-demand-has-shifted-to-corporates-other-new-entrants>.
- Norton, Leslie. “The Top 100 Sustainable Companies,” February 2, 2018. <http://webreprints.djreprints.com/54547.pdf>.
- Office of Sustainability, Univ. of Oklahoma. “Wind Power.” Accessed March 12, 2018. <http://www.ou.edu/sustainability/currentpractices/windpower.html>.
- Pinkel, Dan, and Al Weinrub. “What the Heck Is a REC.Pdf,” October 2013. <http://www.localcleanenergy.org/files/What%20the%20Heck%20is%20a%20REC.pdf>.
- Porter, Michael E., and Mark R. Kramer. “Creating Shared Value,” February 2011. <https://hbr.org/2011/01/the-big-idea-creating-shared-value>.
- “Power Forward 3.0.” World Wildlife Fund, April 25, 2017. <https://www.worldwildlife.org/publications/power-forward-3-0-how-the-largest-us-companies-are-capturing-business-value-while-addressing-climate-change>.
- Powers, John, and Amy Haddon. “The Role of RECs and Additionality,” June 2017. <https://www.renewablechoice.com/wp-content/uploads/2017/07/Additionality-White-Paper.pdf>.
- . “The Role of RECs and Additionality in Green Power Markets,” June 2017. <https://www.renewablechoice.com/wp-content/uploads/2017/07/Additionality-White-Paper.pdf>.
- “Pwc Corporate Renewable Energy Survey,” June 2016. <https://www.pwc.com/us/en/sustainability-services/publications/assets/pwc-corporate-renewable-energy-procurement-survey-insights.pdf>.
- Raftery, Adrian E., Alec Zimmer, Dargan M. W. Frierson, Richard Startz, and Peiran Liu. “Less than 2 °C Warming by 2100 Unlikely.” *Nature Climate Change* 7 (July 31, 2017): 637.
- “RE100 Progress and Insights Report: Approaching a Tipping Point,” January 2018. <http://media.virbcdn.com/files/97/8b2d4ee2c961f080-RE100ProgressandInsightsReport2018.pdf>.
- “RE100 Progress Report,” January 2018. <http://media.virbcdn.com/files/97/8b2d4ee2c961f080-RE100ProgressandInsightsReport2018.pdf>.
- “REBA CKPrahald 2017,” June 2017. http://rebuyers.org/wp-content/uploads/2017/06/REBA_CKPrahald_Press_Release_Final.pdf.
- Renewable Energy Choice. “Renewable Choice Energy.” Renewable Choice Energy. Accessed April 18, 2018. <https://www.renewablechoice.com/>.
- Rocky Mountain Institute. “BRC: Business Renewables Center - Rocky Mountain Institute,” 2018. <https://www.rmi.org/our-work/electricity/brc-business-renewables-center/>.
- Shehabi, Arman. “2016 Berkeley National Labs Data Center Energy Usage,” June 2016. http://eta-publications.lbl.gov/sites/default/files/lbnl-1005775_v2.pdf.

- Skroupa, Christopher P. “Company Valuation -- How ESG Integration Is The Future Standard.” *Forbes*, July 12, 2017. <https://www.forbes.com/sites/christopherskroupa/2017/07/12/company-valuation-how-esg-integration-is-the-future-standard/>.
- Spector, Julian. “How MGM Prepared Itself to Leave Nevada’s Biggest Utility,” September 16, 2016. <https://www.greentechmedia.com/articles/read/how-mgm-prepared-itself-to-leave-nevadas-biggest-utility>.
- Subramanian, Savita, Dan Suziki, Alex Makedon, Marc Pouey, and Jimmy Bonilla. “BOAML ESG Equity Strategy,” December 18, 2016. https://www.bofaml.com/content/dam/boamlimages/documents/articles/ID17_0028/equitystrategyfocuspoint_esg.pdf?pw=1263.
- Tawney, Letha, Priya Barua, and Celina Bonugli. “Emerging Green Tariffs in U.S. Regulated Electricity Markets,” February 2018. <http://www.wri.org/sites/default/files/emerging-green-tariffs-in-us-regulated-electricity-markets-feb2018.pdf>.
- “The Fed - Commercial Paper Rates and Outstanding Summary.” Accessed April 17, 2018. <https://www.federalreserve.gov/releases/cp/>.
- “The PURPA Modernization Act of 2017: Proposed Reforms and Potential Implications.” Akin Gump Strauss Hauer & Feld LLP. Accessed March 19, 2018. <https://www.akingump.com/en/experience/industries/energy/speaking-energy/the-purpa-modernization-act-of-2017-proposed-reforms-and.html>.
- U.S Energy Information Administration. “In 2017, U.S. Electricity Sales Fell by the Greatest Amount since the Recession - Today in Energy - U.S. Energy Information Administration (EIA),” April 3, 2018. <https://www.eia.gov/todayinenergy/detail.php?id=35612>.
- US EPA, OAR. “U.S. Electricity Grid & Markets.” Overviews and Factsheets. US EPA, August 30, 2017. <https://www.epa.gov/greenpower/us-electricity-grid-markets>.
- Vandenbergh, Michael P., and Jonathan M. Gilligan. *Beyond Politics: The Private Governance Response to Climate Change*. Cambridge University Press, 2017.
- Wilkins, Michael. “Beyond Green Bonds: Sustainable Finance Comes of Age,” April 26, 2017. <http://www.spglobal.com>.
- Winston, Andrew, George Favaloro, and Tim Healy. “Your Company Needs an Energy Strategy.” *Harvard Business Review*, January 2017. <https://hbr.org/2017/01/energy-strategy-for-the-c-suite>.
- WWF, and WRI. “Corporate Renewable Energy Buyers Principles,” September 2017. http://buyersprinciples.org/wp-content/uploads/Corporate_RE_buyers_principles_2017_September-1.pdf.
- Zanchi, Roberto, Mark Porter, and Nicolle Miller. “Dutch Wind Consortium,” October 2017. http://businessrenewables.org/wp-content/uploads/2017/12/BRC_DutchCaseStudy.pdf.