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A Local Government's Guide to Off-Site Renewable PPA Risk Mitigation





AUTHORS & ACKNOWLEDGMENTS

AUTHORS

Stephen Abbott and Ryan Shea

** Authors listed alphabetically. All authors from Rocky Mountain Institute unless otherwise noted.*

ADDITIONAL CONTRIBUTORS

Eric Carlson, REsurety
Michelle Bowen, REsurety
Lee Taylor, REsurety
Hannah Hunt, REsurety

CONTACTS

Ryan Shea, **rshea@rmi.org**
Stephen Abbott, **sabbott@rmi.org**

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ABOUT RMI

RMI is an independent nonprofit founded in 1982 that transforms global energy systems through market-driven solutions to align with a 1.5°C future and secure a clean, prosperous, zero-carbon future for all. We work in the world's most critical geographies and engage businesses, policymakers, communities, and NGOs to identify and scale energy system interventions that will cut greenhouse gas emissions at least 50 percent by 2030. RMI has offices in Basalt and Boulder, Colorado; New York City; Oakland, California; Washington, D.C.; and Beijing.

TABLE OF CONTENTS

INTRODUCTION 6

VIRTUAL AND PHYSICAL PPAS 8

RISKS 11

Price Risk 12

Basis Risk 14

Non-Energy Market Risk 16

Shape Risk 18

Operational Risk 20

Volume Risk 22

RISK MITIGATION STRATEGIES 24

Floors and Collars 26

Fixed-Volume Price Swap 28

Hub or Load Zone Settlement 30

Good Faith Renegotiation 31

Retailer-Firmed Power 33

Settlement Guarantee Agreement 34

Volume-Firming Agreement 35

Production Guarantees 38

Proxy Generation 40

CONCLUSION 42

ENDNOTES 46

INTRODUCTION

Local governments have become instrumental leaders in the clean energy transition. Nearly 200 US cities and counties and eight states have committed to 100% clean energy to date, covering approximately one in three Americans.[1] Large-scale off-site renewable power purchase agreements (PPAs) have been the primary procurement method used to make progress on these goals, covering nearly 90% of the 9.2 gigawatts (GW) that local governments have procured since 2015.[2] Off-site PPAs will likely continue to be a key strategy given their large scale and ability to act as a financial hedge.

As with any energy procurement, off-site PPAs also come with risks. The wholesale market nature of off-site PPAs produces intricacies and financial risks that are not present in other renewable energy procurement strategies. For local governments without prior experience operating in wholesale markets, these may be new and unfamiliar.

This paper aims to help local governments (hereafter referred to as "cities" for simplicity) understand and mitigate key risks by explaining what they are and the strategies to mitigate them, as shown in Exhibit 1.

- The paper describes six specific risks: price, basis, non-energy market, shape, operational, and volume. While legal and accounting risks are also relevant to PPAs, they are outside of the scope of this paper. However, they are outlined in the American Cities Climate Challenge Renewables Accelerator's *Virtual Power Purchase Agreement Legal Considerations* report.[3]

- The paper then summarizes nine mitigation strategies for virtual PPAs and physical PPAs. Some of these strategies are widely used (e.g., floors and collars, hub-settled contracts, good faith renegotiation, and production guarantees) while others are emerging in the market today (e.g., fixed-volume price swaps, retailer-firmed power, settlement guarantee agreements, volume-firming agreements, and proxy generation).

Portions of this content have been adapted from RMI's *A Corporate Purchaser's Guide to Risk Mitigation* and the Renewable Energy Buyers Alliance's web-based Risk Allocation Primer.[4]

EXHIBIT 1

Overview of Risk Mitigation Strategies for Off-Site PPAs

RISK MITIGATION STRATEGY	RISK MITIGATED					
	Price Risk	Basis Risk	Non-Energy Market Risk	Shape Risk	Operational Risk	Volume Risk
Floors and Collars	✓	✓				
Fixed-Volume Price Swap	✓					
Hub or Load Zone Settlement	✓	✓				
Good Faith Renegotiation	✓		✓			
Retailer-Firmed Power		✓		✓	✓	✓
Settlement Guarantee Agreement	✓			✓		✓
Volume-Firming Agreement	✓			✓		✓
Production Guarantee					✓	
Proxy Generation					✓	

VIRTUAL AND PHYSICAL PPAS

Off-site renewable energy projects are front-of-the-meter systems tied into the grid at the transmission or distribution level. PPAs are the preferred contract mechanism for these systems in which a buyer agrees to purchase the energy produced by the project over a set period of time at a predetermined price per unit of energy, such as a megawatt-hour (MWh). Since these agreements provide the developer with the revenue certainty required to finance the project, the buyer (i.e., a city) can claim that its purchase is instrumental in adding new renewable energy generation to the grid.

There are two primary types of off-site PPAs: virtual PPAs (VPPAs) and physical PPAs (PPPAs).

VIRTUAL POWER PURCHASE AGREEMENTS

A VPPA is a purely financial contract where, for each renewable MWh, the buyer pays the project owner a fixed $/MWh rate and receives the variable hourly market $/MWh rate in return, as shown in Exhibit 2. In most cases, the buyer also takes ownership of the renewable energy certificates (RECs), which are created alongside every MWh of renewable energy generated, to claim the environmental attributes. The project owner sells the renewable electricity into the local wholesale electricity market and passes that revenue onto the buyer.

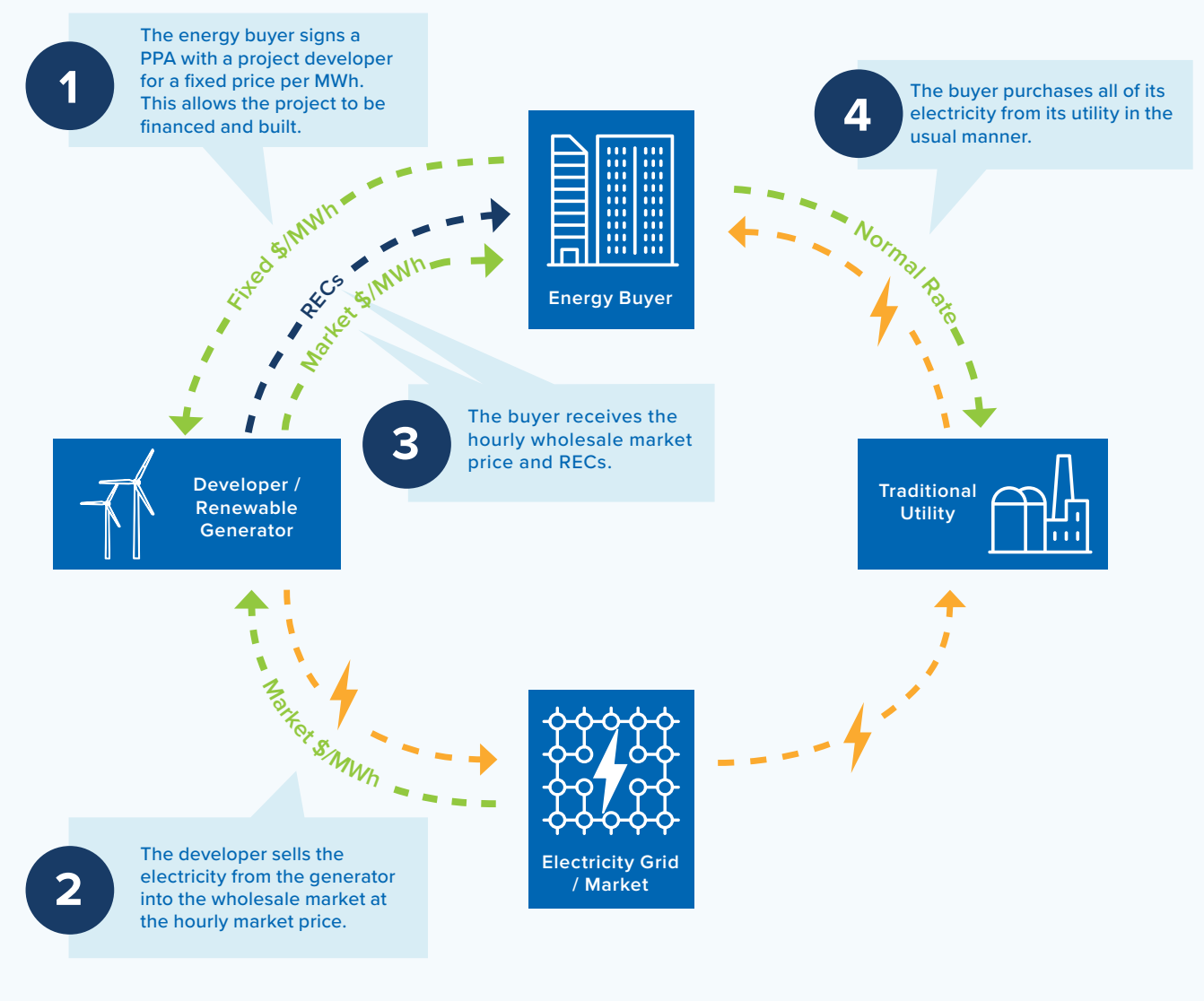
Since the buyer is effectively receiving the financial difference between the PPA price and wholesale market price for each MWh, these deals are also known as "contracts for differences," "fixed-for-floating swaps," or "financial PPAs." Unlike a PPPA, a VPPA is separate from, and does not impact, the buyer's power supply agreements with its local utility or retail provider (unless the VPPA is contracted through the utility).

Corporations pioneered the use of VPPAs to support large-scale renewable energy projects and meet their renewable energy goals. Since VPPAs do not involve physical delivery of the energy, corporations have used them to procure renewable energy to offset the energy usage at sites distributed across multiple geographies, regardless of whether they are located in deregulated or regulated energy markets. A VPPA's purely financial nature has also enabled companies to quickly procure renewable energy at scale without having to create an internal energy management team to deal with physical energy challenges inherent with PPPAs. This has allowed companies such as Fifth Third Bank to meet 100% renewable energy goals through a single VPPA.[5]

Cities are also starting to consider VPPAs due to the structure's geographic and regulatory flexibility. Cities located outside a retail choice market that are not served by a municipal utility or community choice aggregation (CCA) cannot utilize a PPPA without going through their utility due to regulatory restrictions. However, they can still sign a VPPA to support projects located in wholesale markets. For example, Arlington County, Virginia, procured 38 megawatts (MW) of solar through a VPPA with its utility in 2020.[6]

EXHIBIT 2

How an Off-Site Virtual Power Purchase Agreement Works



PHYSICAL POWER PURCHASE AGREEMENTS

In a PPPA, the buyer (i.e., a city) pays the project owner a fixed $/MWh rate for each renewable MWh generated and delivered to a predetermined delivery point within the local electricity market, as shown in Exhibit 3. In this structure, the buyer takes legal title to the electricity and then purchases any additional needed electricity from its utility (or retailer) in the usual manner.

When they have the option to choose between a VPPA and a PPPA, most cities have opted to sign PPPAs to date. For example, the City of Cincinnati considered both deal structures for its 100 MW solar PPA for municipal and community load, but ultimately signed a physical deal.[7] Load-serving branches of local governments, such as municipal utilities and CCA programs, generally want to physically purchase renewable energy to supply their customers.

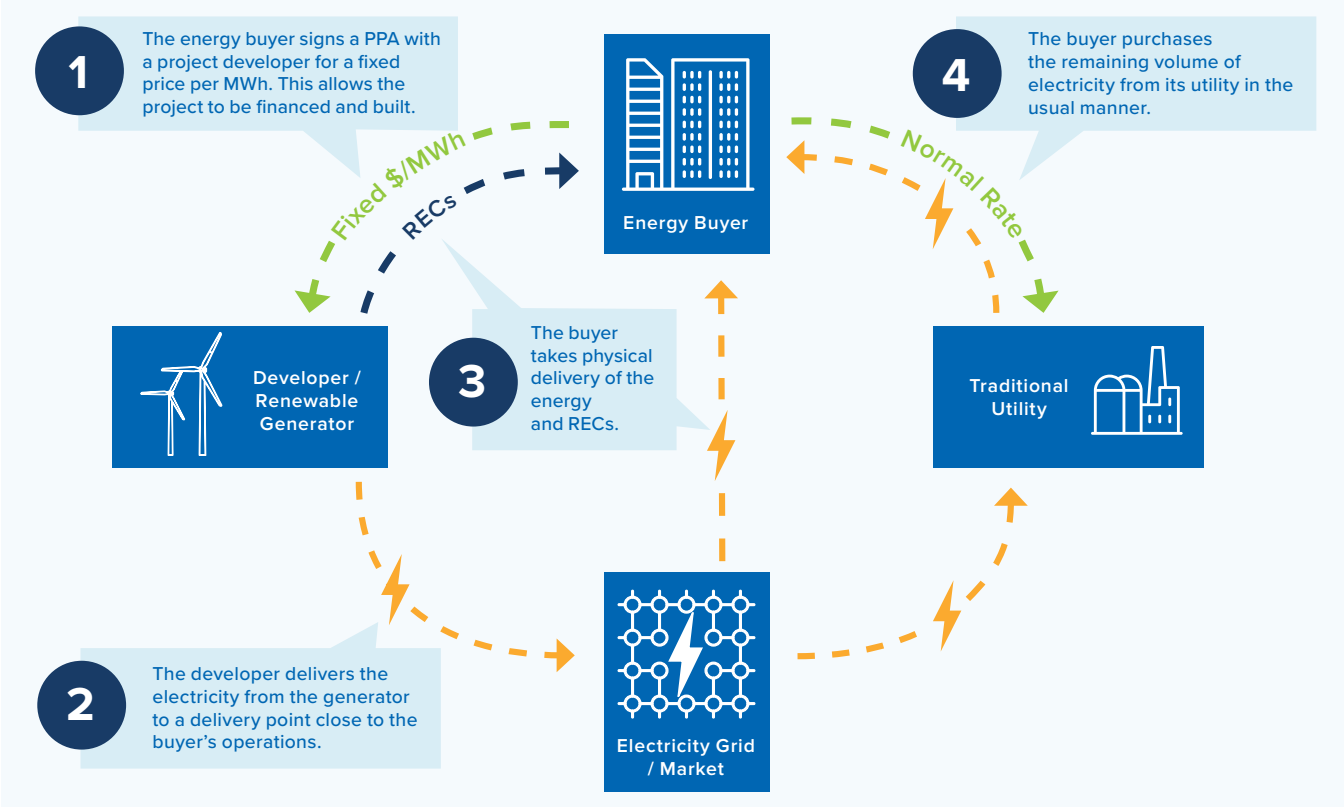
Physical transactions are also easier to conceptualize and explain. And since they must be executed with a project in the same independent system operator (ISO) or region as the city, they have the clear potential to produce local economic, workforce, and health benefits for their residents (although VPPAs can also provide these local benefits if located within the city's region. Additionally, cities have preferred PPPAs due to the lower perceived risk in physical deals as compared with VPPAs. The VPPA structure more explicitly exposes a city to wholesale market prices, which can be challenging to cities that are used to paying flat utility or retail rates for their energy.

While VPPAs and PPPAs are fundamentally different contract structures, it is also important to note that they can result in similar financial outcomes in cases where the city is already purchasing wholesale power. For example, consider the following hypothetical situation: a city enters into a PPA for a 25 MW solar project that generates 50,000 MWh per year, and future weighted wholesale prices in the city's electricity market are, on average, $2/MWh higher than its PPA rate over the 10-year contract.

If the city entered into a PPPA, it would have saved $1 million on its wholesale market purchases. Similarly, if the city instead entered into a VPPA with that same project, it would have received $1 million in revenue (separate from its business-as-usual electricity purchases). However, if the VPPA is signed with a project in a different market not correlated to the city's load zone prices, this relationship will no longer hold.[i]

EXHIBIT 3

How an Off-Site Physical Power Purchase Agreement Works



[i] While cities may be able to access wholesale hub prices for their facilities, this paper refers to their load zone price for simplicity.

RISKS

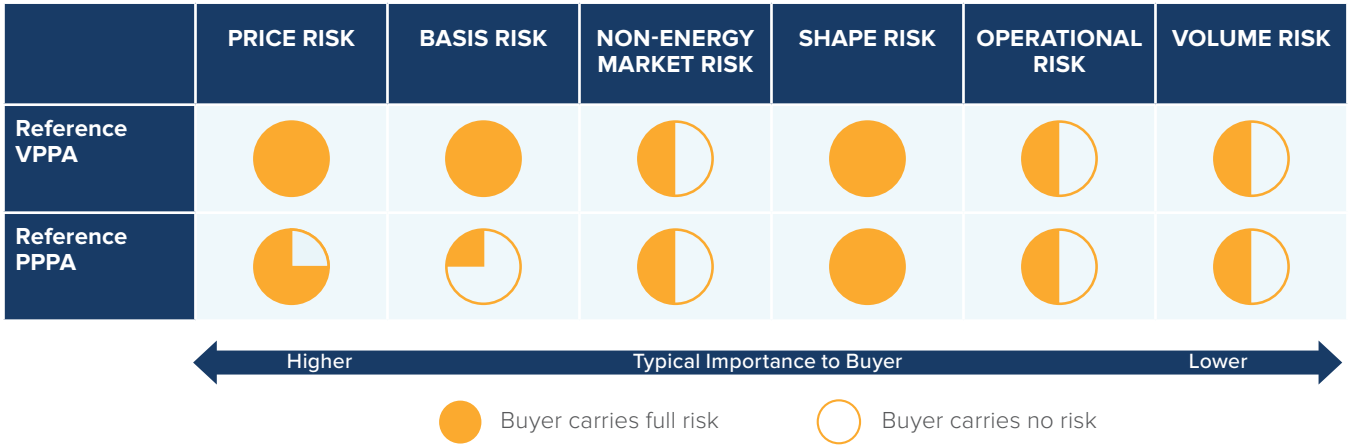
Any strategy to purchase electricity will come with a mixture of benefits, costs, and risks. Thus, when considering off-site PPA risks, they should not be considered in a vacuum but weighed against the risks of alternative strategies (e.g., purchasing unbundled RECs at a cost premium without adding new renewables to the grid) or simply maintaining the status quo (e.g., exposing the city to the potential of future electricity price variability and/or carbon pricing impacts).

Off-site PPAs provide cities with a powerful tool to purchase renewable energy at a large scale, but they also bring costs or risks which should be understood and mitigated where necessary. Understanding these potential risks is the first step in evaluating the costs and benefits of different risk mitigation strategies (see *Risk Mitigation Strategies* section).

This section explores basis, price, non-energy market, shape, volume, and operational risk. While basis, price, and non-energy market risks stem from uncertainty in the variable wholesale electricity market, shape, volume, and operational risks stem from uncertainty in the renewable energy generator's production. Exhibit 4 lists the degree to which buyers may be exposed to each of these risks in "reference" VPPAs and PPAs which do not include potential mitigation strategies.

EXHIBIT 4

Reference Virtual and Physical PPAs without Risk Mitigation Strategies



PRICE RISK

What It Is

For VPPAs and PPPAs, this is the risk associated with the movement and volatility of wholesale electricity prices.

How It Affects Cities

If market prices are above the PPA price, cities with PPAs can benefit by paying below-market rates for each MWh. However, if wholesale prices fall below the PPA price:

- Cities with VPPAs will pay a premium to the project owner for the difference between the VPPA and market price for each MWh generated.
- Cities with PPPAs will pay more for each MWh generated than they would have if they had purchased from the wholesale market.

Further Detail

Price risk stems from hourly and long-term fluctuations in wholesale prices arising from shifts in supply and demand, fuel prices, and transmission constraints. For example, an unexpected surge in wind generation due to a weather front might cause regional market prices to decrease. If the market prices fall below the PPA price, cities will be forced to pay above-market rates for the generated electricity. While the fundamental economics are similar, this above-market payment impacts cities differently depending on whether they have signed a VPPA or a PPPA.

For VPPAs, price risk impacts the revenue received from or loss paid to the renewable energy asset's owner. Exhibit 5 illustrates that when the wholesale price is higher than the VPPA price, the city makes money (i.e., the area shaded in green). Conversely, when the market price is lower than the VPPA price, the city loses money (area shaded in red). Over time, if the cumulative area shaded in green is more than the cumulative area shaded in red, the deal is profitable (and vice versa for a loss). In a VPPA, these fluctuations can also cause day-to-day, month-to-month, and year-to-year shifts in the profits and losses generated by the transaction, which should be considered when structuring the transaction and setting annual budgets.

From an economic payoff perspective, price risk impacts a PPPA in much the same manner. While the cost of the energy in a PPPA is fixed, the rise or fall of energy market prices will dictate whether signing a PPPA saves or loses money as compared with purchasing energy from the market or via a retail provider. However, for PPPAs this economic profit or loss represents an opportunity cost rather than actual payments the buyer will have to make, so the price risk volatility does not directly impact the city's budget or operations.

Price risk is often the most critical issue to buyers, as wholesale power prices dictate the deal's profitability yet are volatile over time (see Exhibit 6 for annual average prices in the PJM Interconnection region) and difficult to predict many years into the future. Since most PPAs last for 10–20 years, cities should evaluate a deal's potential economic upside and downside using a variety of future pricing scenarios, and not solely rely on forecasts provided by project developers. Tools like the American Cities Climate Challenge Renewables Accelerator's Solar and Wind Off-Site PPA Economic Calculator can be useful for this.[8]

EXHIBIT 5

Hourly Profit and Loss in a VPPA

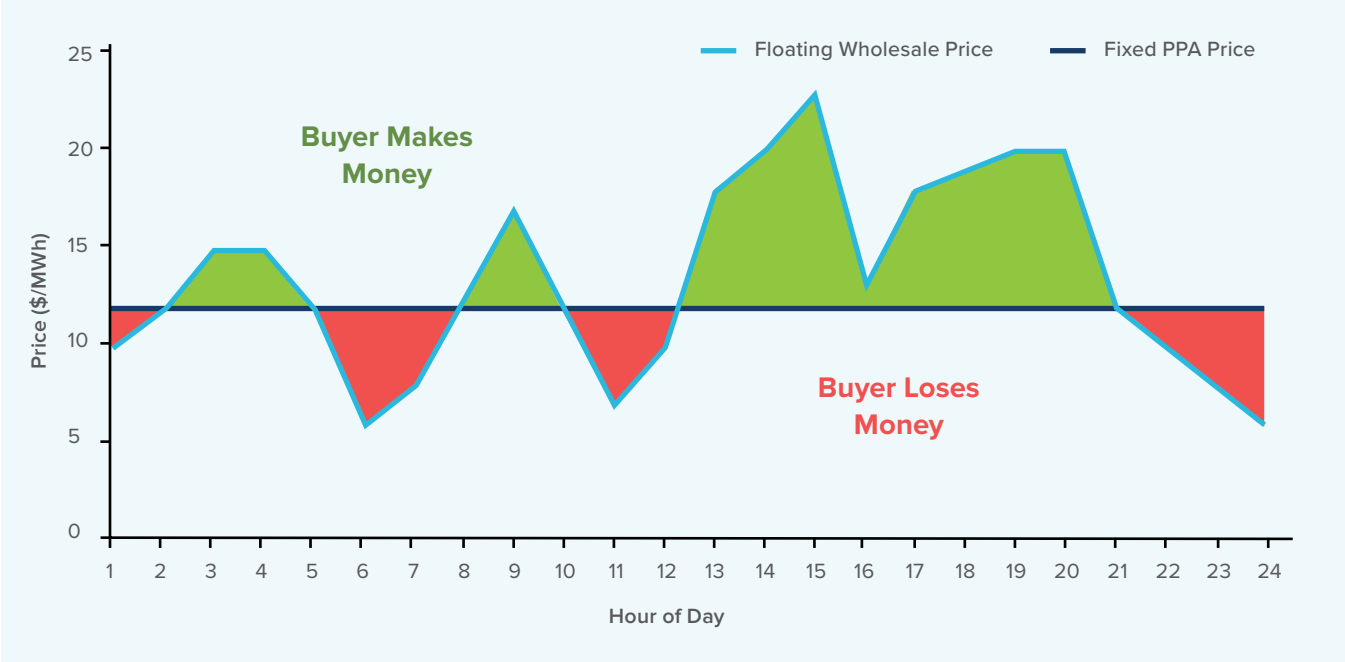
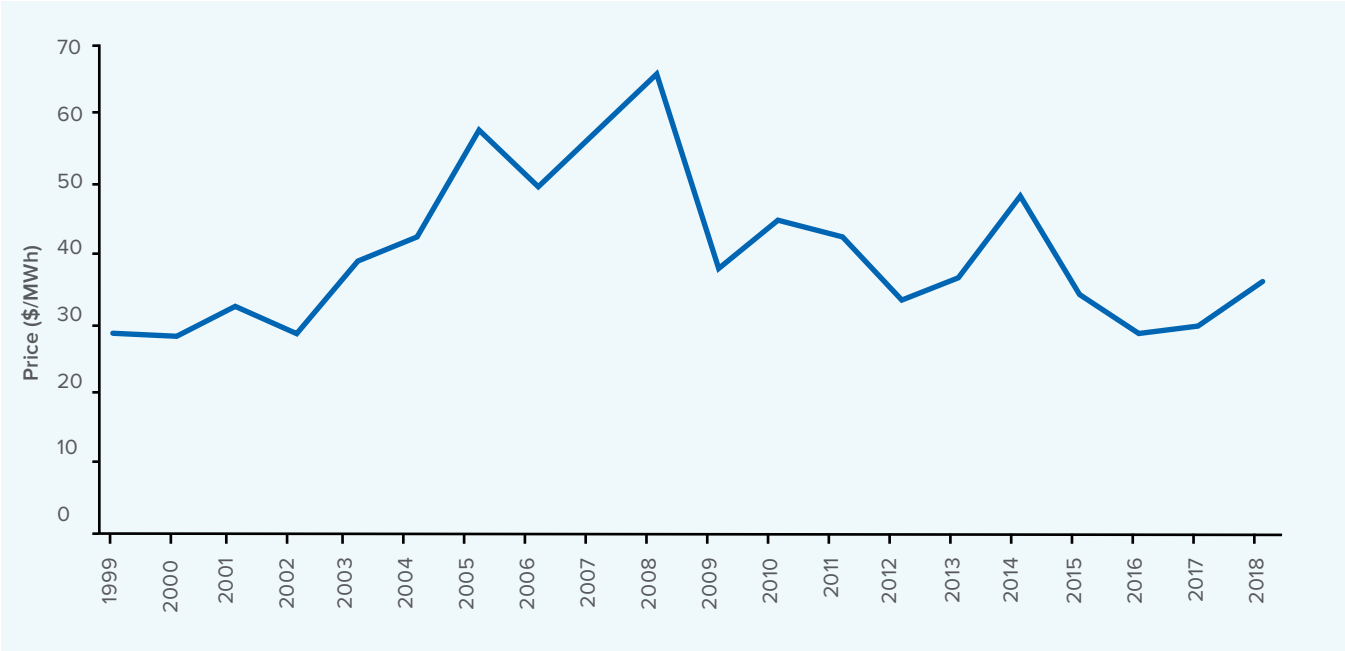


EXHIBIT 6

Variability of Historical Average Annual Wholesale Prices in PJM



Source: 2018 State of the Market Report for PJM, Monitoring Analytics.

BASIS RISK

What It Is

This is the risk, primarily in VPPAs, that the relationship between the market price at the renewable generator's location and the price the city pays for its electricity may change due to locational price differences.

How It Affects Cities

Basis risk can reduce a city's ability to use PPAs to hedge against future electricity price changes.

Further Detail

One potential benefit of signing a PPA is hedging against future increases in energy prices. While cities that sign PPPAs clearly protect themselves from escalating prices by locking in a set price for the length of the contract, VPPAs can also provide a similar protection. For example, if energy prices rise uniformly by $5, a city that has signed a VPPA will both pay $5 more for the energy to power its facilities and receive $5 more from its VPPA revenues.

This type of hedge is only applicable to cities that already purchase energy from their local wholesale market since retail prices do not reflect day-to-day or hour-to-hour variability of wholesale prices. Moreover, the effectiveness of this hedge can be eroded if the relationship between prices at different locations in the market changes over time.

PPAs have three relevant price settlement points: the node (the generator's interconnection point price), the hub (the simple average of node prices within the hub's geographic region), and the buyer's load zone (the load-weighted average of node prices within the load zone). Basis risk exists between the price at the generator's location (i.e., the generation node) and the price the city pays for its own consumption at its load zone.

Consider an example in which a city in Virginia signs a VPPA with a wind farm in West Texas. The wind farm delivers its power to Node 1 in the ERCOT West Hub within the Texas power market, as shown in Exhibit 7, and in return receives the nodal market price. The nodal prices from Nodes 1–6 are then averaged to generate the ERCOT West Hub prices.

But while the VPPA revenues are linked to ERCOT West Node 1, the buyer's energy expenses are linked to the PJM Dominion Load Zone prices in Virginia. Exhibit 8 indicates that ERCOT West Node 1 and PJM Dominion Load Zone average monthly prices are well correlated during most months, but in April, September, and October the higher prices the city experiences in Virginia are not fully offset by the prices at ERCOT West Node 1 that remain low or decrease. This change in the relationship between prices in Texas and Virginia is an example of basis risk eroding the VPPA's financial hedge.

Basis risk is typically less relevant to PPPAs, as the power is usually generated within or close to the city's load zone or local hub. As a result, the prices at the point of generation and the point of consumption will likely be very similar. While project owners usually absorb any differences in these prices in a PPPA, that is not always the case. For example, the City of Houston agreed to pay the basis difference between its load zone and the project's node in West Texas in its 50 MW PPA signed in 2017.

EXHIBIT 7

Illustrative Example of Basis Risk Between a Generator (ERCOT West Node 1) and Load Zone (PJM Dominion)

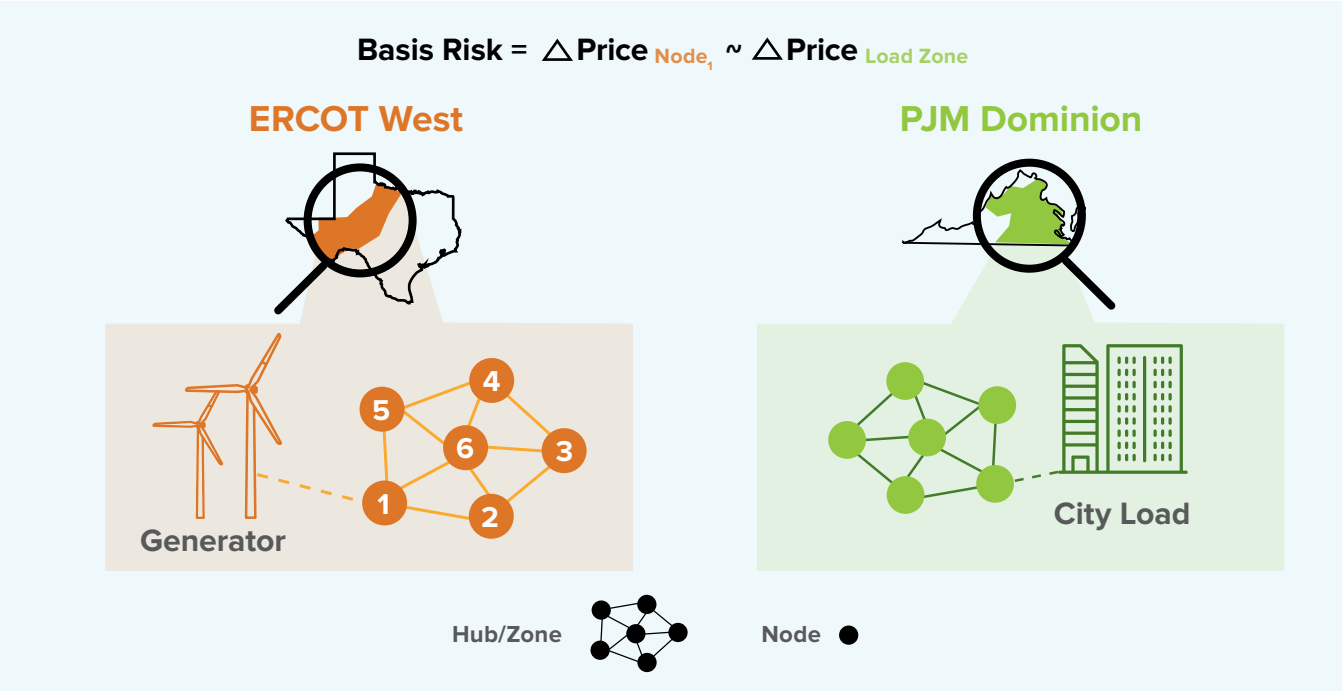
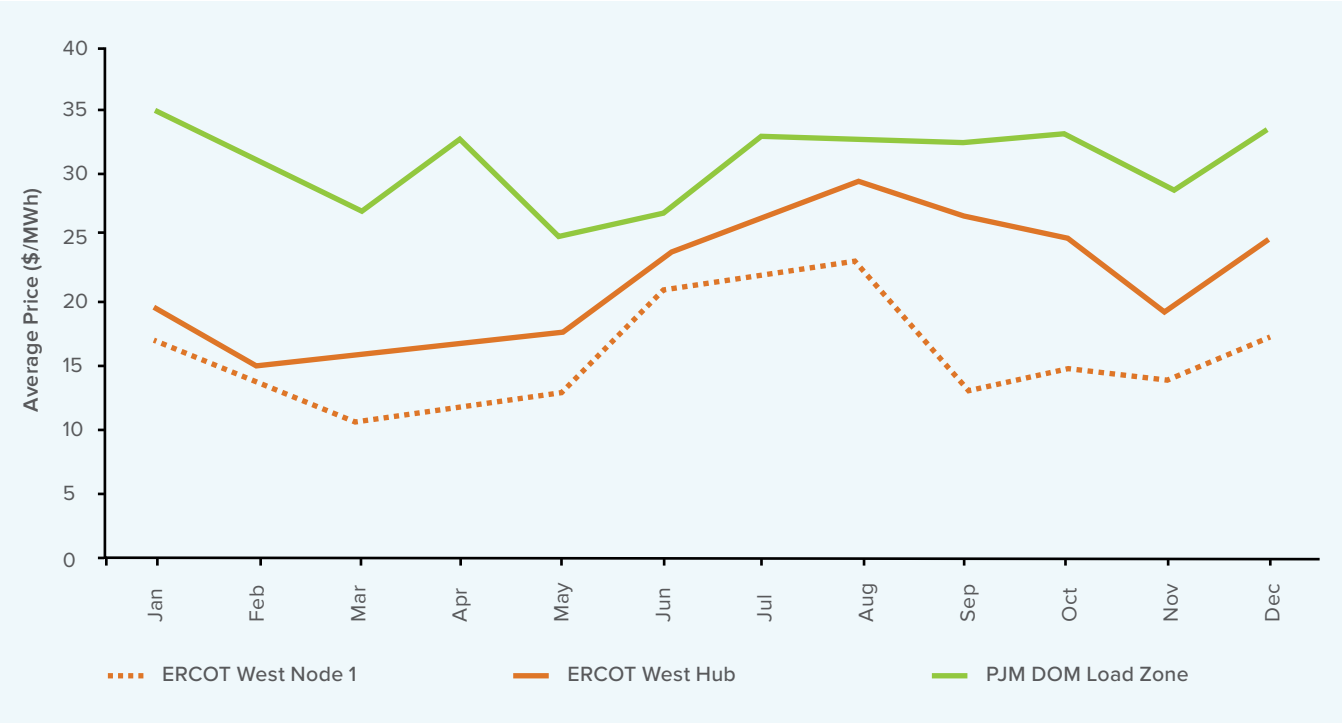


EXHIBIT 8

Historic Market Prices in ERCOT West and PJM Dominion in 2016



NON-ENERGY MARKET RISK

What It Is

This is the risk associated with unforeseen, non-energy market changes occurring after a VPPA or PPPA is signed.

How It Affects Cities

Non-energy market changes could impact the financial performance of the PPA for the city or the project owner, which might trigger requests to renegotiate key terms.

Further Detail

While price risk involves the wholesale energy market, non-energy market risk encompasses risks related to other potential revenue streams. Renewable energy projects could be impacted by a range of non-energy market changes, such as retroactive changes to federal incentives, the creation of new markets, or adjustments to policies relating to environmental attributes. However, this paper focuses on two common non-energy markets: capacity markets and REC markets created by renewable portfolio standards (RPS).

Capacity markets aim to provide grid reliability by paying power producers, on a $/MW basis, for the capacity they can supply the grid during a specified future timeframe. For cities entering into a PPA for a project in an ISO that operates a capacity market,[ii] this capacity revenue is either secured by the city, or, more frequently, by the project owner and indirectly passed on to the city through a lower PPA price. Thus, cities that directly secure this revenue are more susceptible to the risk of capacity market changes.

In 2019, the Federal Energy Regulatory Commission issued its Minimum Offer Price Rule that ordered PJM to impose a price floor for nearly all "state-subsidized" resources that participate in its capacity auctions. This serves as an example of how new market regulations can impact the value of wind or solar plants, as this ruling may significantly reduce the capacity market revenues for some renewable energy projects.

Furthermore, if the project is located in a state with a high RPS, the future value of its RECs could have a large impact on the project's overall revenue. These markets can shift dramatically, making their future value hard to predict. For example, Exhibit 9 illustrates how Ohio's REC prices declined compared to prices in other PJM states when the state reduced its RPS ambitions in 2014. Cities that choose to sell their project's RECs and buy low-cost national RECs in hopes of increasing the project's financial outlook are especially susceptible to this market risk.

[ii] PJM, ISONE, and NYISO operate mandatory capacity markets, MISO operates a voluntary capacity market, and CAISO operates a similar resource adequacy market.

EXHIBIT 9

Ohio's REC Price Drop Illustrates the Risk of State Regulatory Shifts[iii, iv]



[iii] REC prices vary by class, location, and index year. These prices are for locally produced Tier 1 or Class 1 RECs created in the indicated year.

[iv] SB 310 of 2014 froze the multiyear renewable ramp-up schedule for two years, removed the in-state requirement for renewable energy procurement, and pushed back the final renewable goal of 12.5% from 2024 to 2026 (DSIRE, 2018).

SHAPE RISK

What It Is

For VPPAs and PPPAs, the source of shape risk is the uncertainty regarding the timing of the renewable generation.

How It Affects Cities

Shape risk impacts the financial performance and hedge value of VPPAs and PPPAs differently.

- For a VPPA, shape risk coupled with price risk creates uncertainty regarding the revenues the buyer receives.
- For a PPPA, shape risk requires the buyer to purchase or sell energy to manage over- or underproduction, while also impacting the deal's opportunity cost.

Further Detail

The intersection of uncertain generation with uncertain market prices increases the uncertainty around the project's revenue with a VPPA and avoided costs with a PPPA.

For a VPPA, the uncertain generation shape impacts wholesale revenues received at the project's settlement point. Exhibit 10 illustrates how the generation profile from a solar plant and the corresponding market prices impact the VPPA's revenue.

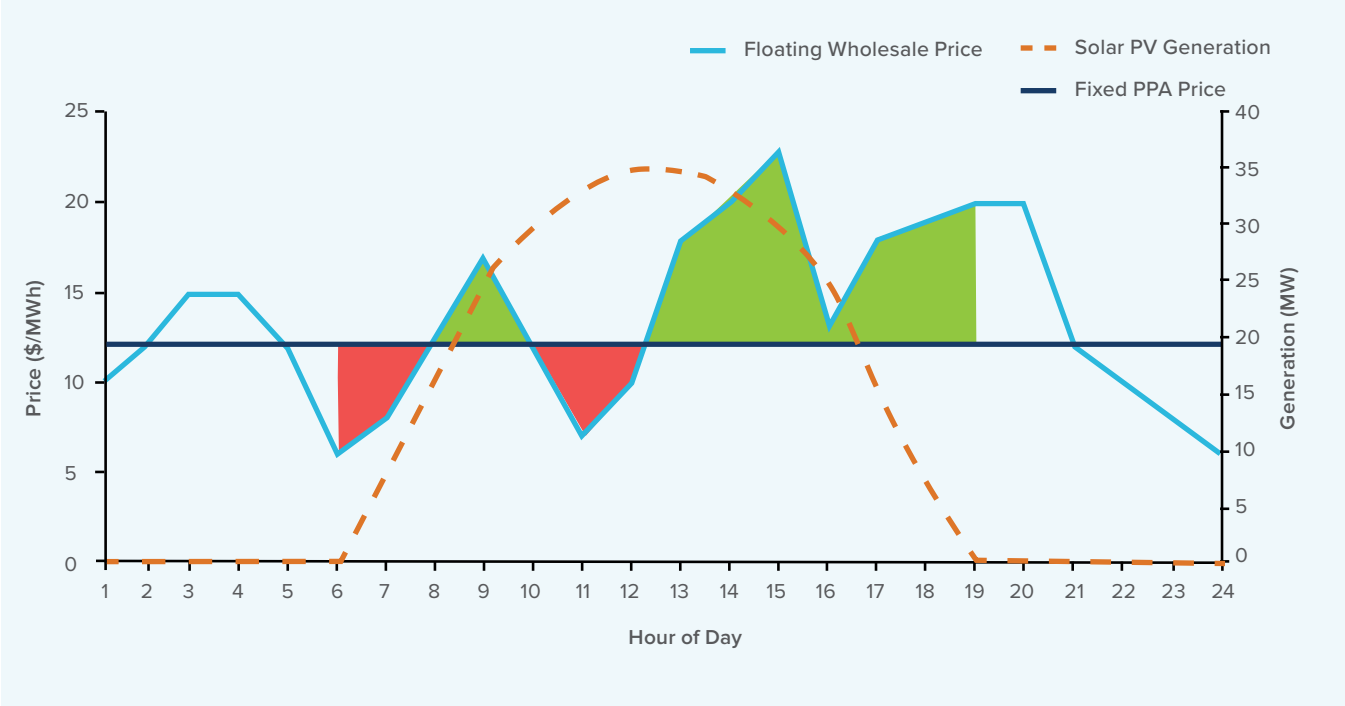
For a PPPA, uncertain generation impacts the avoided cost from not purchasing the energy at the market's load zone price. Additionally, in a PPPA, when the renewable generator produces more power than the city needs, the city is exposed to the generator's node price since it must sell the excess power into the wholesale market.

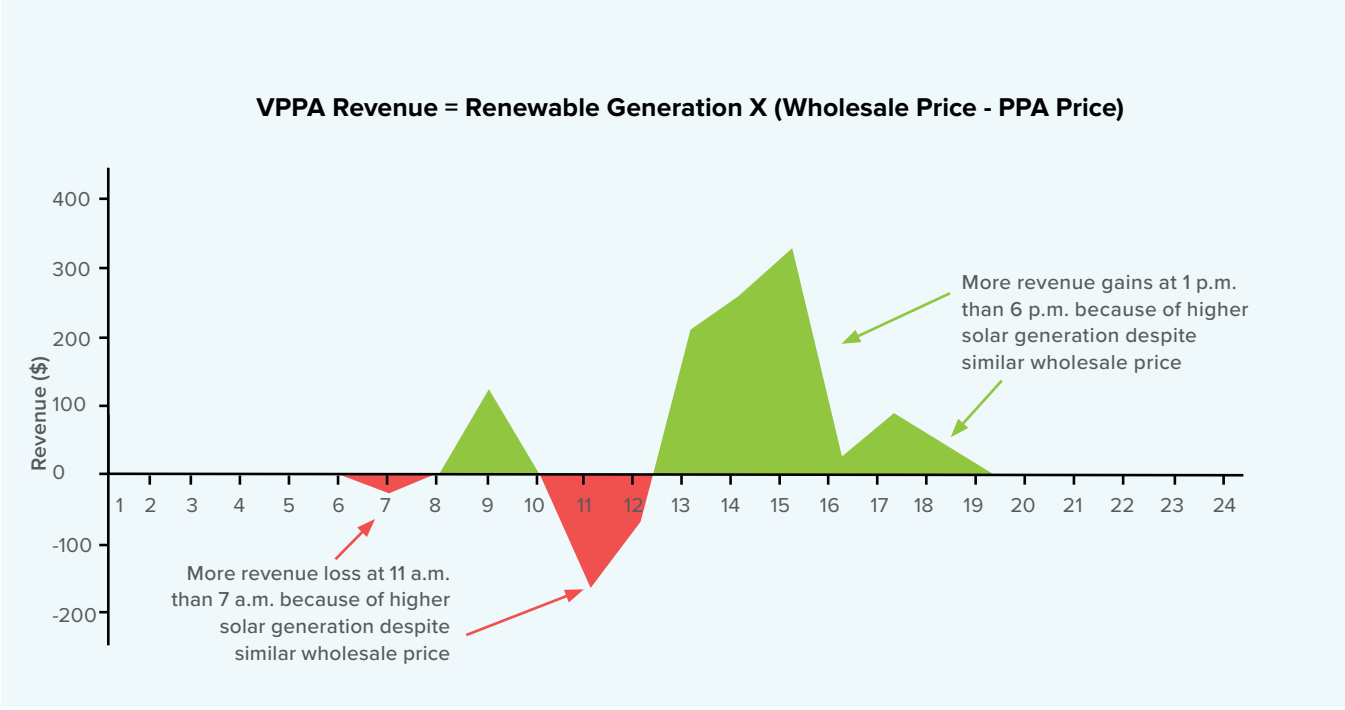
When evaluating the financial impacts between pursuing a VPPA and PPPA for a project, the impacts on a PPPA's avoided costs are equivalent to those on a VPPA's revenue if the city is purchasing energy on the wholesale market.

Shape risk also impacts a PPA's hedge effectiveness. In a PPPA, over- or underproduction from the project would typically force the city to transact in the wholesale market, reducing its price certainty. Meanwhile, in a VPPA, if generation and consumption are not coincident (and they rarely are), changing wholesale energy prices throughout the day may lead to the VPPA revenues not fully offsetting the city's energy costs.

EXHIBIT 10

A VPPA's Revenue (bottom) Is Impacted by the Shape of the Renewable Generation and Wholesale Prices (top)





OPERATIONAL RISK

What It Is

This is the risk associated with a renewable generator's performance being compromised due to inadequate or failed processes, people, equipment, or systems, or from external events.

How It Affects Cities

Decreased generation could lead to decreased profit (or loss) and RECs for the city.

Further Detail

Operational risk is, for the purposes of this paper, uncertainty in renewable generator performance due to factors other than weather. Project underperformance can occur due to important equipment being taken off-line for maintenance or degrading due to wear and tear, operational errors, force majeure events, or intentional curtailment of generation.

System operators may require generators to curtail, or limit, their generation when suppliers are unexpectedly providing more power than the grid demands at a system-wide level. System operators may also order curtailments at a local level if the transmission lines have insufficient capacity to carry the renewable electricity to where it is needed in the system. Exhibit 11 illustrates how transmission constraints can vary over time; transmission upgrades in West Texas allowed ERCOT to decrease curtailment from 2012 to 2014 despite increasing wind penetration.

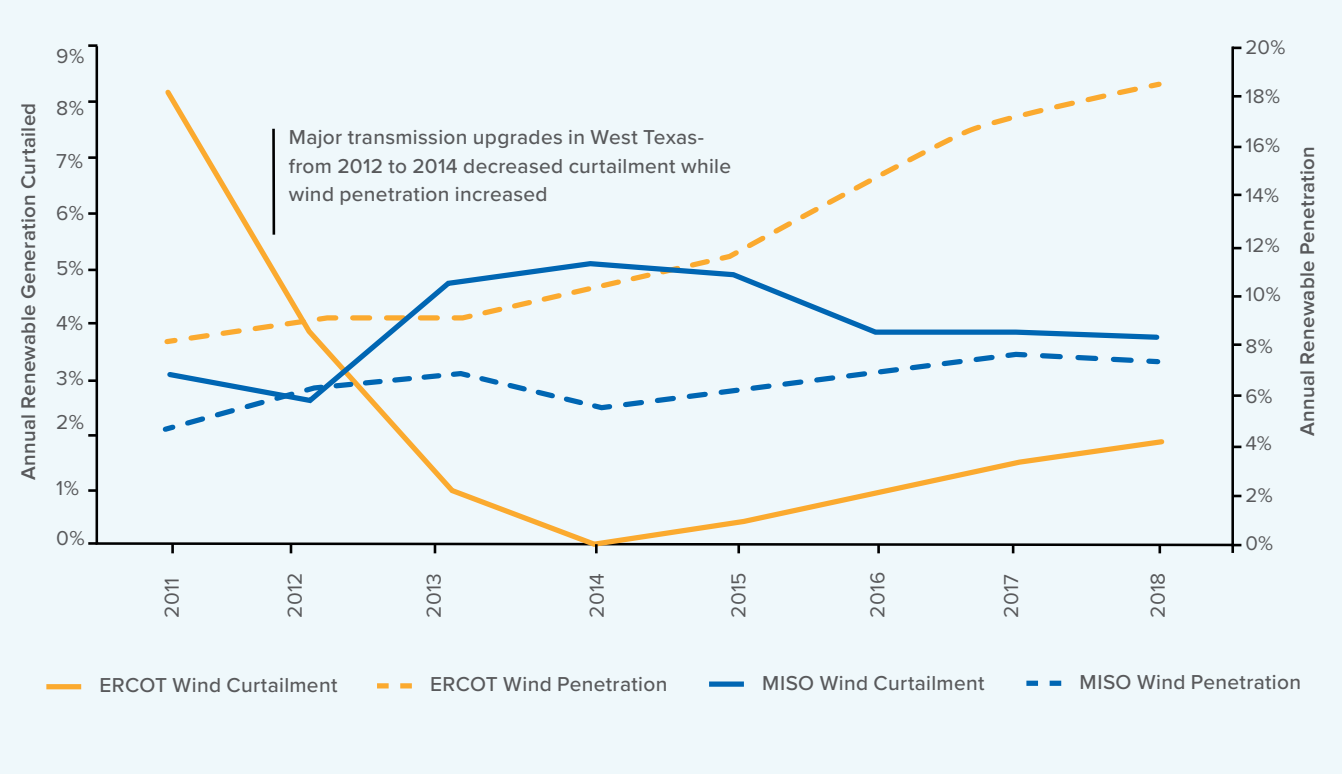
Market averages, however, may differ from project specific curtailment. For example, the average curtailment within ERCOT was 2.5% in 2018, but four wind projects totaling nearly 600 MW experienced curtailment of 18%–25%.[9] Project owners may also curtail their plants intentionally to avoid financial losses for themselves and/or a buyer if market prices fall below a certain threshold (e.g., $0/MWh).

Another type of operational risk is a force majeure event: an unforeseen event causing disruption to the generator, such as a natural disaster. These types of events could damage the asset and reduce its generation potential.

As with volume risk, decreased output will impact the project's economic performance and decrease REC production for both VPPAs and PPPAs, which can impact a city's ability to meet its sustainability goals.

EXHIBIT 11

ERCOT and MISO Wind Curtailment Over Time Illustrates How the Operational Risk of Curtailment Depends on Renewable Penetration and Transmission Capacity



Source: 2018 Wind Technologies Market Report, Lawrence Berkeley National Laboratory.

VOLUME RISK

What It Is

This is the risk of uncertainty in the overall amount of renewable energy generation.

How It Affects Cities

For both VPPAs and PPPAs, varying weather patterns create uncertainty regarding the amount of renewable generation, which impacts the project's value and number of RECs created. In PPPAs, this also creates uncertainty regarding the amount of additional balancing energy required.

Further Detail

While the uncertainty in the amount of renewable energy generated associated with volume risk could be due to various factors, this paper defines volume risk as weather-driven to differentiate it from operational risk. Furthermore, while the timing of renewable generation inherent in shape risk can also be weather-driven, volume risk is distinctly associated with the uncertainty in the overall amount of renewable generation.

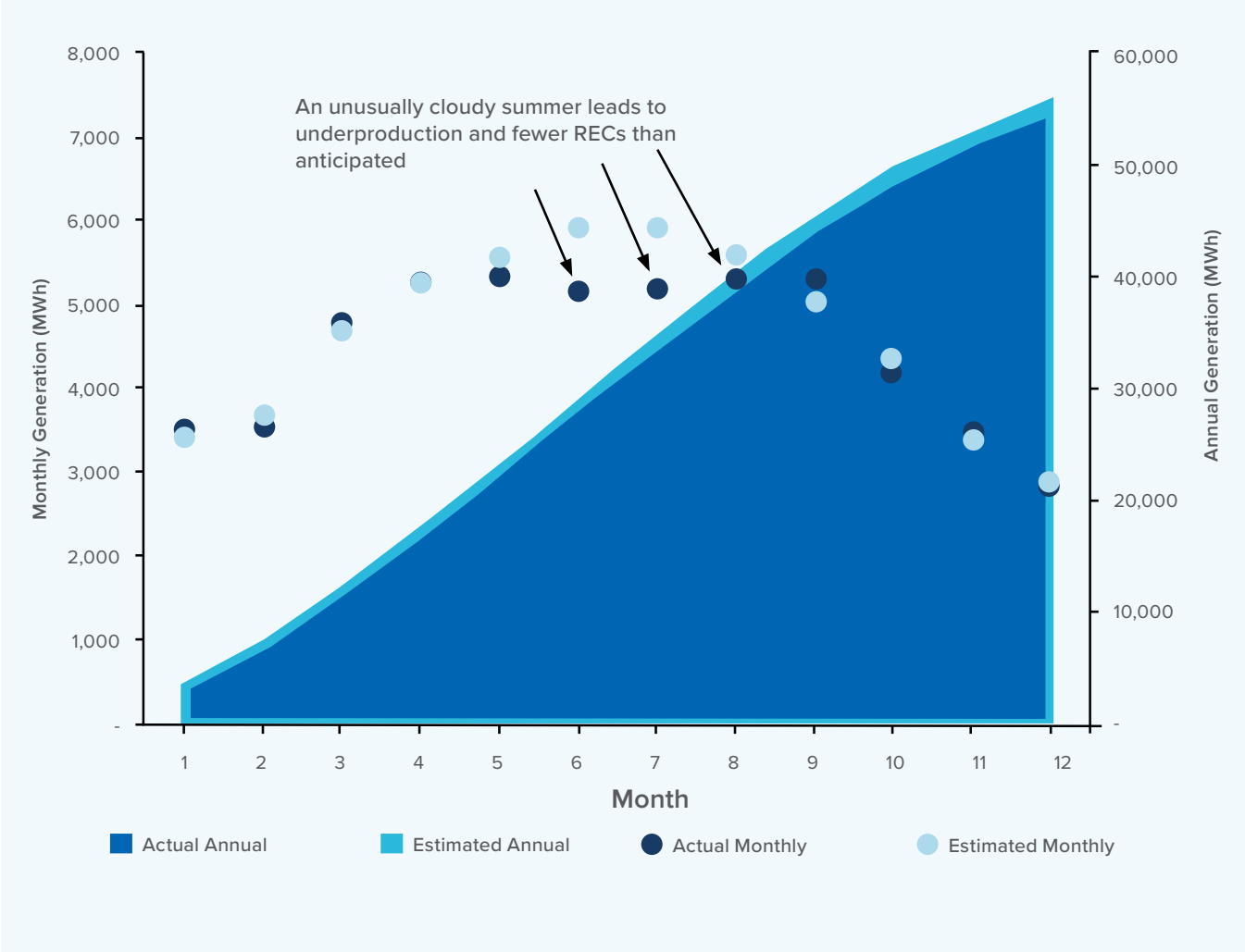
Since the value of a VPPA to a city in any given period is the product of the energy generated and the difference between the market and VPPA prices, any variability in the former causes uncertainty to the project's value. This could lead to cash flows being higher or lower than expected, exposing the city to upside and downside risk.

For PPPAs, volume risk similarly impacts the opportunity cost of the deal, translating to uncertainty in the balancing energy required to meet the city's load. Depending on the city's electricity purchasing structure, this translates to either purchasing more or less energy on the wholesale market or from the city's utility or retailer.

Uncertainty in renewable energy generation also impacts a project's total creation of RECs. In both VPPAs and PPPAs, this could lead to the city receiving too few or too many RECs to meet its renewable energy goals in a given year. Exhibit 12 illustrates how a lower-than-expected solar resource in the summer could lead to underproduction and a shortfall in RECs.

EXHIBIT 12

Weather-Related Impacts on the Actual Amount of Renewable Energy and RECs Generated



RISK MITIGATION STRATEGIES

Having explored the associated risks inherent with VPPAs and PPPAs, this section will introduce strategies to mitigate those risks. Exhibit 13 provides an overview of the key risk mitigation strategies and the specific risks that each one addresses. The risks are sorted horizontally based upon typical importance to a buyer, while the risk mitigation strategies are ordered based upon the primary risk(s) that each one mitigates.

It is important to bear in mind that no risk management strategy comes for free. Choosing the right strategy requires finding the right balance between your city's risk tolerance and, typically, a higher PPA price. The preferred risk mitigation strategies should be noted early on in the request for proposal (RFP) as they will likely impact the proposed PPA price.

To illustrate the effectiveness of each strategy, this section will assess how a buyer's exposure to key risks changes when a risk mitigation approach is added onto the "reference" VPPA and PPPA (Exhibit 13).

The reference VPPA assumes settlement at a node outside of the city's ISO and does not include any of the following risk mitigation strategies. The reference PPPA assumes settlement at a node within the city's ISO and outside of its load zone and does not include any of the following risk mitigation strategies. The reference PPA is not meant to represent the most common structure, rather one simply without any risk mitigation strategies.

Each risk mitigation strategy covered will note whether the strategy in question was utilized by Cincinnati, Ohio; Houston, Texas; Philadelphia, Pennsylvania; and Arlington County, Virginia, in their PPAs.



EXHIBIT 13

Overview of Risk Mitigation Strategies for Physical and Virtual PPAs

RISK MITIGATION STRATEGY	CONTRACT TYPE		RISK MITIGATED					
	VPPA	PPPA	Price Risk	Basis Risk	Non-Energy Market Risk	Shape Risk	Operational Risk	Volume Risk
Floors and Collars	✓		✓	✓				
Fixed-Volume Price Swap	✓		✓					
Hub or Load Zone Settlement	✓	✓	✓	✓				
Good Faith Renegotiation	✓	✓	✓		✓			
Retailer-Firmed Power		✓		✓		✓	✓	✓
Settlement Guarantee Agreement	✓		✓			✓		✓
Volume-Firming Agreement	✓		✓			✓		✓
Production Guarantee	✓	✓					✓	
Proxy Generation	✓						✓	

FLOORS AND COLLARS

What It Is

Floors and collars are agreements within the VPPA contract between the city and project developer that reduce the city's exposure to prices below and/or above a certain threshold. A floor is a minimum limit for the market price, and thus revenue, that a city can receive from the sale of the electricity. A collar consists of minimum and maximum limits within which a city can receive market prices. These structures are not typically used in PPPAs since the buyer in physical contracts is not directly exposed to floating market prices.

As an example, consider a contract that has a collar with a maximum limit of $30/MWh and a minimum limit of $10/MWh. If the market price falls to $8/MWh, the city will still receive $10/MWh in revenue with the extra $2/MWh being supplemented by the project owner. If, however, the price rises to $34/MWh, the city will receive only $30/MWh and the additional $4/MWh would pass on to the project owner.

Negative pricing protections have become a fairly common form of floor protection in VPPAs. These are essentially $0 floors which protect the buyer from having to pay the PPA price and receiving a negative market price in return. Negative pricing can occur when a sufficient number of generators are willing to pay (rather than receive) money to continue operating (e.g., to capture the production tax credit or avoid facility shut down and start-up expenses).

Including a floor in a VPPA contract significantly reduces downside risk for the city. Therefore, project owners may either ask for a collar or to increase the VPPA price in exchange for taking on this risk.

Which City Risks Are Mitigated

Utilizing a floor or collar in a VPPA primarily reduces price risk, while also indirectly reducing basis risk, as shown in Exhibit 14.

- Price risk: Constraints on the lowest and highest market prices the city can receive significantly reduce price risk for cities by limiting the potential range of revenues per MWh.[v]
- Basis risk: In cases where the generator's locational price experiences localized disruptions (e.g., an isolated large weather event increases wind

[v] Reducing price risk also indirectly reduces the impact of shape risk since shape risk involves the intersection of variable generation and market prices. However, since floors and collars do not reduce the source of shape risk (i.e., uncertainty in the generation profile), shape risk was not listed as a risk mitigated.

production in West Texas and drives local prices down), a floor or collar can somewhat insulate the city from the resulting disruption in the correlation between the project's locational prices and the city's load zone prices.

Where It Has Been Done Before

While there are no known cities that have used floors or collars, they are common in corporate VPPAs. As an alternative to a price floor, Arlington County chose to include in their VPPA a unique rate-changing mechanism at annual true-up to alleviate short-term price risk in their budget planning.[vi]

EXHIBIT 14

Distribution of Risks with Price Floors/Collars versus the Reference VPPA

	PRICE RISK	BASIS RISK	NON-ENERGY MARKET RISK	SHAPE RISK	OPERATIONAL RISK	VOLUME RISK
Reference VPPA						
VPPA with a Floor/Collar						

Buyer carries full risk Buyer carries no risk

[vi] This mechanism used a modified annual, instead of monthly, true-up mechanism that alters the next year's PPA rate instead of the typical true-up of owing or receiving a lump sum. For example, when the County is owed a credit at the end of the year, the next year's PPA rate is lower. If the County owes money, the next year's rate is higher.

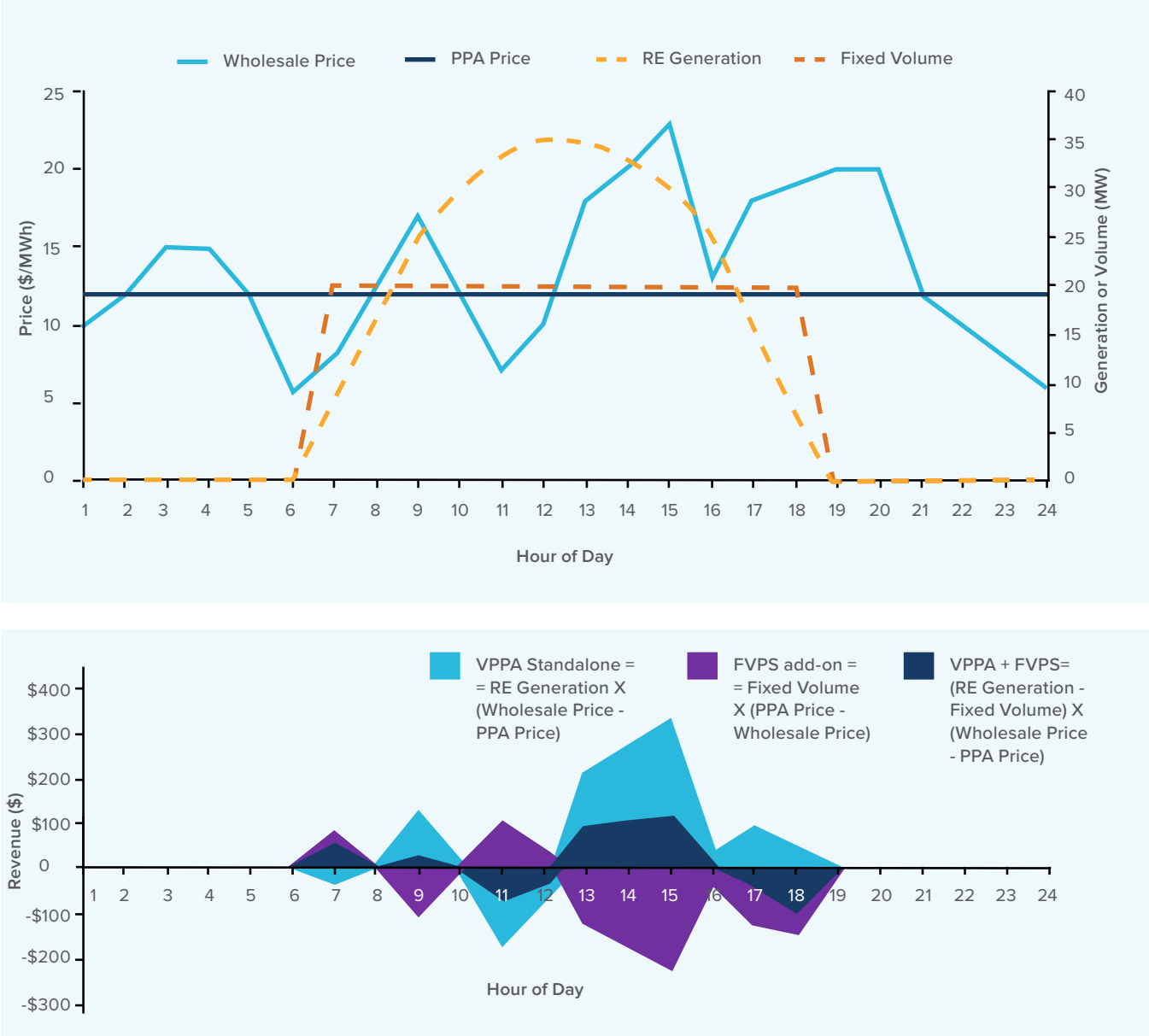
FIXED-VOLUME PRICE SWAP

What It Is

A fixed-volume price swap (FVPS) is a purely financial transaction, separate from a standard VPPA contract, between the city and a hedge provider to mitigate price risk. The city passes on the floating market price it receives from a fixed number of megawatts to a hedge provider (e.g., a large bank or commodity trading firm) and receives a fixed price in return. This structure effectively allows a buyer to "unwind" a portion of the VPPA.

EXHIBIT 15

An FVPS Decreases Revenue Fluctuations in a Standalone VPPA



This structure removes the impact of market prices, and thus financial risk, for the amount of fixed volume in the FVPS during generating hours. For simplicity, this example assumes that the FVPS price is the same as the PPA price, although it can be higher or lower.

Since fixed-volume price swaps include a third party, there are additional transaction costs, fees, and credit risks involved in executing them. Also, a fixed-volume guarantee may require derivative accounting treatment, particularly in the case of companies utilizing Financial Accounting Standards Board accounting standards.

Which City Risks Are Mitigated

The FVPS primarily reduces price risk while increasing volume and shape risk, as shown in Exhibit 16. The degree to which each risk is impacted is dependent on the volume covered in the swap.

- Price risk: By swapping the floating market prices for the specified megawatts for a fixed price, the FVPS structure eliminates price risk for the megawatts included in the swap.[vii] However, price risk remains for any generation which exceeds the FVPS fixed-volume threshold.
- Volume risk: An FVPS increases volume risk for the city because the city is responsible for providing a set amount of "power" to the hedge provider. This means that if the project underproduces, the city will have to "financially backfill" that missing volume for the hedge provider.
- Shape risk: An FVPS increases shape risk for the city because by having to provide a set amount of "power" at certain times they are more susceptible to the timing of renewable generation.

Where It Has Been Done Before

While there are no known cities that have used an FVPS, many commercial and industrial (C&I) buyers have used an FVPS in their VPPA.

EXHIBIT 16

Distribution of Risks with an FVPS versus the Reference VPPA

	PRICE RISK	BASIS RISK	NON-ENERGY MARKET RISK	SHAPE RISK	OPERATIONAL RISK	VOLUME RISK
Reference VPPA						
VPPA WITH A FVPS						



[vii] By decoupling a VPPA's revenues from wholesale market prices, an FVPS may decrease a VPPA's hedge value for cities that purchase their energy at variable wholesale market prices. That said, an FVPS may increase the hedge value for cities that purchase their energy at a fixed retail rate from a utility or retail provider.

HUB OR LOAD ZONE SETTLEMENT

What It Is

In a VPPA, a city may choose to settle at the hub to receive the generator's hub pricing (instead of node pricing) as its floating market price. The project owner will still sell the project's power at the node, meaning that the owner will have to accept the basis risk between the project's node and its hub. Similarly, with a PPPA, the city may choose to take delivery at its load zone, in which case the project owner manages differences between the project and load zone prices.

Which City Risks Are Mitigated

Settling at the hub or load zone primarily reduces basis risk while slightly reducing price risk for VPPAs, as shown in Exhibit 17.

- Basis risk: Compared with nodal prices, hub or load zone prices should generally be less volatile and more correlated with the prices that a city pays to its energy supplier for delivered electricity. To the extent that this is true, settling at a hub or load zone will reduce the basis risk to which the city is exposed.

- Price risk: Hub and load zone prices are, on average, less volatile than node prices. Thus, settling at the hub typically reduces the volatility in market prices the city receives from a VPPA and, therefore, reduces price risk.

Where It Has Been Done Before

The cities of Philadelphia and Cincinnati took electricity delivery within their load zone in their PPPAs signed in 2019.

EXHIBIT 17

Distribution of Risks for Hub-Settled VPPA and Load Zone-Delivered PPPA versus the Reference VPPA and PPPA

	PRICE RISK	BASIS RISK	NON-ENERGY MARKET RISK	SHAPE RISK	OPERATIONAL RISK	VOLUME RISK
Reference VPPA						
Hub-Settled VPPA						
Reference PPPA						
Load Zone-Delivered PPPA						



GOOD FAITH RENEGOTIATION

What It Is

A "good faith renegotiation" clause in a VPPA or PPPA states that if an impactful regulatory change occurs, the city and project owner are required to meet and attempt in good faith to negotiate amendments that as far as possible restore to both parties the original balance of burdens and benefits. The rationale is that neither party knows what changes might occur, and neither party can control them, so the two parties should share this risk and renegotiate terms as needed.

These clauses can incorporate changes to both energy and non-energy markets to mitigate the risk that the city and/or project owner would be financially impacted. Financial thresholds may be specified to determine when these negotiations should be pursued.

PPAs can also include backstop clauses that specify a PPA rate change corresponding to specific market rule changes if parties cannot in good faith agree to a reasonable amendment (e.g., if an RPS change impacts average annual project REC prices by at least +/-75% and parties cannot agree to a price amendment within one year from the rule change date, the new PPA rate will change by +/- $2/MWh). Backstop clauses are most suitable for non-energy (e.g., capacity) market rule changes.

Which City Risks Are Mitigated

A good faith renegotiation clause in a VPPA or PPPA can reduce non-energy market risk and/or price risk, as shown in Exhibit 18.

- Non-energy market risk: Including non-energy market changes within the good faith negotiation clause can reduce the risk that future regulatory changes will disproportionately impact the city and/or project owner. Parties may also want to include renegotiation triggers in the case of unexpected upside (e.g., the state strengthens its RPS and REC prices significantly increase).
- Price risk: If this clause incorporates energy market changes, this strategy may help protect the city from systemic electricity market price changes that arise from fundamental market shifts over the life of the contract (e.g., changes to ISO policies or pricing methodologies).

Where It Has Been Done Before

In Arlington County's VPPA, the good faith renegotiation clause focused on changes to the utility program that would impose additional costs on the seller above a specified threshold. The City of Cincinnati's PPPA included a good faith renegotiation clause to address capacity market changes. Finally, the City of Philadelphia's PPPA included capacity market changes, market price availability changes, and a backstop $/MWh PPA price reduction related to capacity market changes if the parties could not agree upon an alternative.

EXHIBIT 18

Distribution of Risks with Good Faith Renegotiation Clauses versus the Reference VPPA and PPPA

	PRICE RISK	BASIS RISK	NON-ENERGY MARKET RISK	SHAPE RISK	OPERATIONAL RISK	VOLUME RISK
Reference VPPA						
VPPA with Good Faith Renegotiation						
Reference PPPA						
PPPA with Good Faith Renegotiation						

Buyer carries full risk

Buyer carries no risk

RETAILER-FIRMED POWER

What It Is

A city can sign a PPPA contract with a retail electricity provider (REP) that incorporates renewable generation into the city's retail service and manages any over- or underproduction from the assets.[viii]

In the United States, 17 states and the District of Columbia have enacted some level of retail choice, allowing energy consumers the flexibility to choose their electricity supplier. In these areas, cities may have the option to arrange for a REP to incorporate a PPPA into their retail service or ask the retailer to sign PPAs on the city's behalf. The retailer would then be responsible for managing any variation in hourly generation, as well as any long-term over- or underproduction, to ensure that the city receives the power it needs at any given moment.

In the fairly common scenario where the PPA term exceeds the life of the retail contract, the contract could either stay with the retail provider or the city could retain the PPPA. As the retail provider would be managing a variety of risks, the city would have to pay a premium above a PPPA price for these services.

Which City Risks Are Mitigated

Retailer-firmed power eliminates or reduces shape, volume, basis, and operational risk, as shown in Exhibit 19.

- Shape risk: By managing the variation in production and ensuring that the city receives shaped power to meet its hourly demand, a retail solution would eliminate shape risk.[ix]
- Volume risk: By managing the day-to-day fluctuations in generation, the REP would absorb much of the volume risk. Cities may need to separately handle the risk of REC over- or underproduction or include requirements regarding REC purchases and sales within the retail contract.
- Basis risk: The retailer will likely take on the basis risk, thus eliminating basis risk for the city.
- Operational risk: The retailer takes on the operational risk by guaranteeing shaped power. However, REC shortfalls are still possible from underproduction.

Where It Has Been Done Before

The City of Houston's 2020 retail contract with NRG Energy specified that the city's load would be served with 100% renewable energy, to be sourced from newly developed solar projects. NRG will retain ownership of the solar assets at the end of the contract.

EXHIBIT 19

Distribution of Risks with Retailer-Firmed Power versus the Reference PPPA

	PRICE RISK	BASIS RISK	NON-ENERGY MARKET RISK	SHAPE RISK	OPERATIONAL RISK	VOLUME RISK
Reference PPPA						
Retailer-Firmed Power						

 Buyer carries full risk

 Buyer carries no risk

[viii] While a retailer could be open to managing a VPPA as part of a contract, this is not common and thus the impacts on VPPAs are not included.

[ix] Reducing shape risk also indirectly reduces exposure to wholesale market prices. However, since retailer-firmed power does not reduce the source of price risk (i.e., volatility in the wholesale market price the city could have paid otherwise), price risk was not listed as a risk mitigated.

SETTLEMENT GUARANTEE AGREEMENT

What It Is

A settlement guarantee agreement (SGA) is a financial transaction contracted in parallel with or after the execution of a VPPA that locks in the value of future variable VPPA settlements for a premium or payment, depending on the expected future value of the VPPA (as illustrated in Exhibit 20). An SGA transfers price, shape, and volume risk from a city to an insurer, providing financial certainty on the future value of the VPPA.

EXHIBIT 20

The Total Costs with a Standalone VPPA and with an SGA Add-On

Total City Costs with VPPA	=	BAU costs + Variable VPPA Settlement Amount
SGA Costs	=	Fixed SGA Amount - Variable VPPA Settlement Amount
Total City Costs with VPPA + SGA	=	BAU costs + Fixed SGA Amount

Which City Risks Are Mitigated

An SGA mitigates price, shape, and volume risk, as shown in Exhibit 21, but only for the duration of the SGA contract.[x]

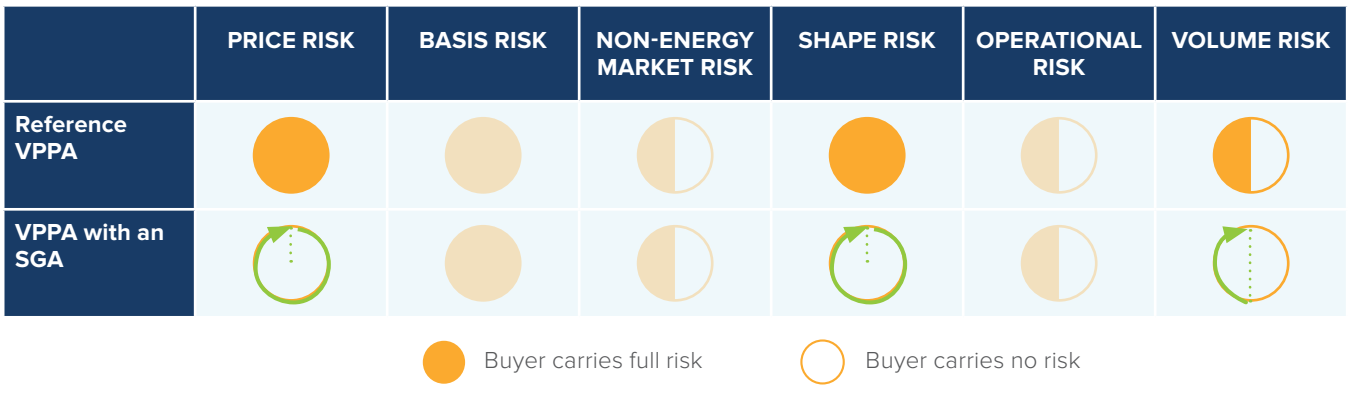
- Price risk: Since the variable future value of VPPA settlements have been transferred to an insurer, the city is no longer financially impacted by future power price variability.
- Shape risk: Since the variable future value of VPPA settlements have been transferred to an insurer, the city is no longer financially impacted by the variability in future timing of generation.
- Volume risk: Since the variable future value of VPPA settlements have been transferred to an insurer, the city is no longer financially impacted by future volume of generation variability. However, cities still face the risk of underproduction leading to less REC creation and not meeting their renewable energy goals.

Where It Has Been Done Before

While no known cities have used SGAs yet, some corporations have recently utilized SGAs. For example, in 2020, Iron Mountain added an SGA onto VPPAs signed in 2016 and 2017.[10]

EXHIBIT 21

Distribution of Risks with a Settlement Guarantee Agreement versus the Reference VPPA



[x] SGAs typically settle using proxy generation, which is described later in this report, rather than actual generation. As such, SGAs do not reduce operational risk. Additionally, SGAs often do not mitigate basis risk because they are typically settled at a project's node rather than at the hub, where most VPPAs are settled.

VOLUME-FIRMING AGREEMENT

What It Is

A volume-firming agreement (VFA) is a financial transaction added onto VPPAs to eliminate shape and volume risk. It is also designed to improve a VPPA's hedge effectiveness for cities purchasing wholesale power with flat or otherwise consistent and predicable electricity demand (e.g., a water treatment plant).

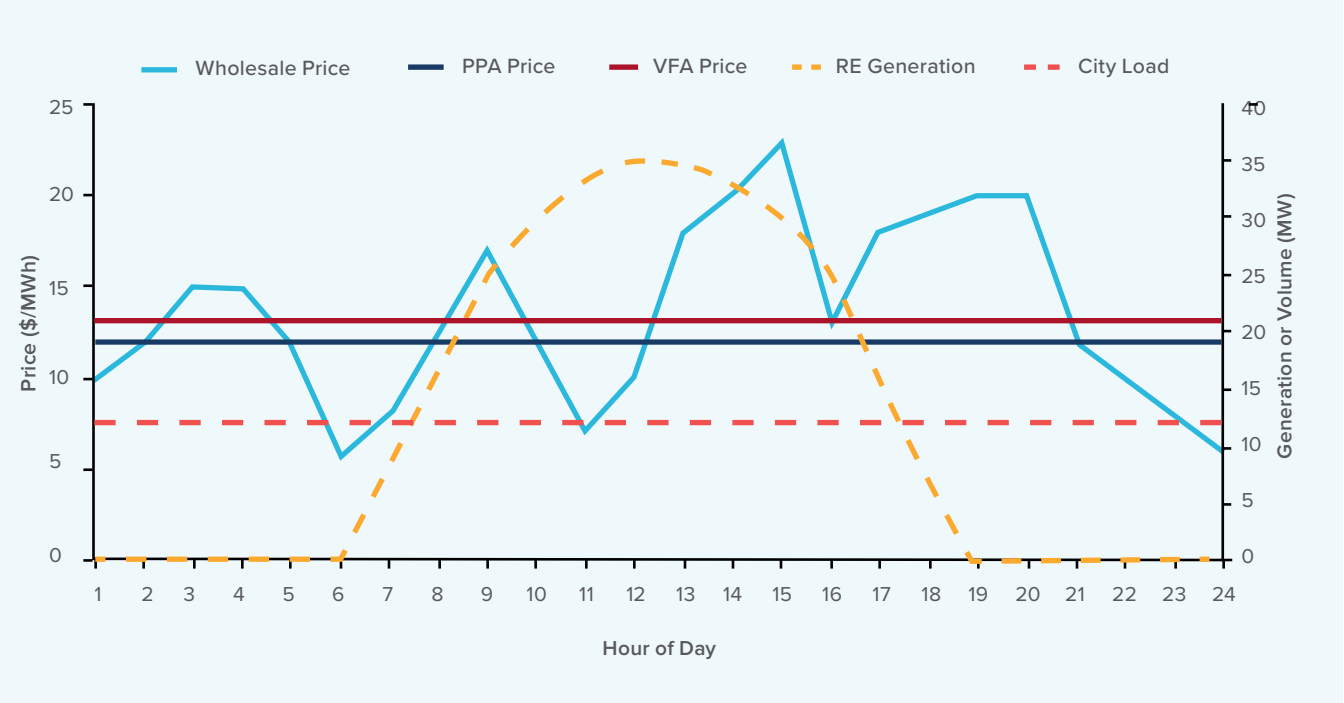
Exhibit 22 shows how, in a normal VPPA, the timing of renewable energy generation does not match the city's consistent load. This disconnect undermines the VPPA's effectiveness as a hedge against its unpredictable business-as-usual (BAU) hourly electricity costs (i.e., a VPPA is a perfect hedge that results in fixed costs only during the hours when the renewable energy project generates exactly the same amount of electricity that the city physically consumes). VFAs directly resolve this discrepancy by allowing cities to exchange their VPPA revenues for what would have been earned if the project had produced energy at fixed volumes throughout the course of a day (i.e., the financial equivalent of firmed power).

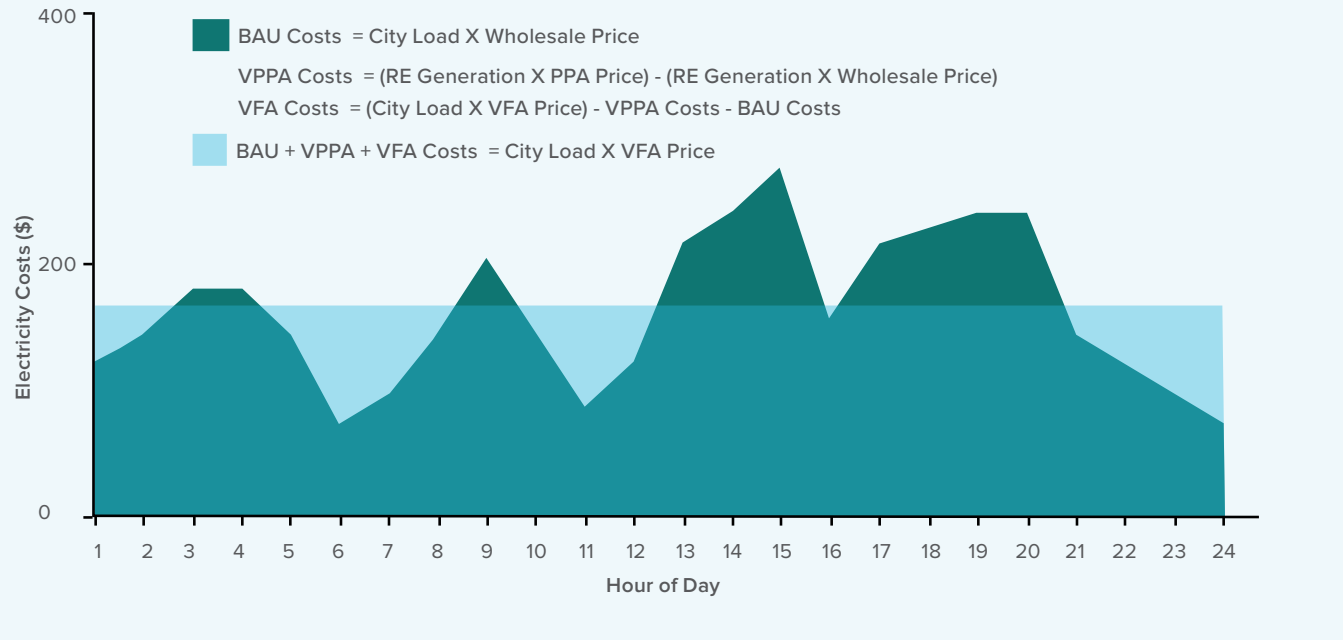
As a result, a VFA transfers the financial risks of over- or underproduction by a renewable energy project to an insurer, enabling a city to source renewable energy and lock in its electricity consumption costs at the same time (see Exhibit 22). Since VFAs involve a third counterparty and transfer a significant amount of risk away from the city, they will involve transaction costs.



EXHIBIT 22

A VFA Added onto a VPPA Increases the Predictability of City Energy Costs[xi]





[xi] For simplicity, the BAU, VPPA, and VFA equations assume that there are no geographic disparities in wholesale market prices between the city's load zone and the project's hub.

Which City Risks Are Mitigated

A VFA mitigates price, shape, and volume risk, as shown in Exhibit 23.[xii]

- Price risk: A VFA is designed to simplify a buyer's future energy expenditures per MWh to a single, fixed VFA price. By largely eliminating direct, regular exposure to wholesale prices, VFAs significantly enhance annual budget certainty, making a buyer's price risk comparable to that of a PPPA.
- Shape risk: Guaranteeing a fixed "volume" for each hour eliminates shape risk.
- Volume risk: Guaranteeing a fixed "volume" eliminates the financial risks associated with over- or underproduction. However, since REC creation is based on actual generation, cities still face the risk of underproduction leading to not meeting their renewable energy goals.

Where It Has Been Done Before

While no known cities have used VFAs yet, multiple C&I buyers have utilized this risk management tool to improve the hedge efficacy of their VPPAs. Microsoft publicly announced their use of this tool for various VPPAs starting in 2018.[11]

EXHIBIT 23

Distribution of Risks with a Volume-Firming Agreement versus the Reference VPPA

	PRICE RISK	BASIS RISK	NON-ENERGY MARKET RISK	SHAPE RISK	OPERATIONAL RISK	VOLUME RISK
Reference VPPA						
VPPA with a VFA						

 Buyer carries full risk

 Buyer carries no risk

[xii] A VFA does not mitigate operational risk since it does not impact operational-related processes. Additionally, a VFA will not mitigate basis risk unless the VFA, VPPA, and load zone settlements are all settled at the same price point.

PRODUCTION GUARANTEES

What It Is

Production guarantees include requirements for when the developer will commence production, how much will be produced, or when generation will be available (all subject to the PPA's force majeure clause).

- Commercial operation date (COD) guarantees require that the plant begin feeding electricity into the transmission system by a specified date. COD deadlines are quite common and typically specify both an expected COD and guaranteed COD as well as the repercussions for failing to comply. The period between expected and guaranteed COD typically ranges from 90 to 360 days.
- Availability guarantees require that the plant be mechanically able to generate for a specified percentage of the year (e.g., all plant equipment must be fully operational for 99.5% of the year). An availability guarantee is, in effect, a promise that the project owner will perform necessary maintenance to ensure that the plant is mechanically able to perform.
- Output guarantees require the plant to generate a minimum amount of electricity over the course of a year or some other timeframe (e.g., two-year rolling, weather-adjusted, 90% guarantee of the P50). An output guarantee is, in effect, a promise by the project developer that the plant will actually output some amount of electricity (and therefore RECs) over a period of time. Output guarantees are possible but less common in VPPAs.

It is important to consider what rights the city will have if the project owner fails to deliver on its guarantees. In particular, the city may want to specify whether the project owner will be required to purchase replacement RECs to make up for production shortfalls. The city may even consider a REC replacement clause even in situations where the project owner did not fail to meet its obligations (e.g., a wind project meets its mechanical availability requirements but still does not generate the required number of RECs due to poor weather conditions).

Which City Risks Are Mitigated

Production guarantees specifically address operational risk, as shown in Exhibit 24, by providing some level of protection to the city against project underperformance.

Where It Has Been Done Before

The City of Cincinnati and City of Philadelphia utilized an output guarantee with shortfall payment clauses and economic curtailment specifications in their PPPAs. The cities of Cincinnati and Philadelphia and Arlington County specified a required COD.

EXHIBIT 24

Distribution of Risks with Production Guarantees versus the Reference VPPA and PPPA

	PRICE RISK	BASIS RISK	NON-ENERGY MARKET RISK	SHAPE RISK	OPERATIONAL RISK	VOLUME RISK
Reference VPPA						
VPPA with Production Guarantee						
Reference PPPA						
PPPA with Production Guarantee						

 Buyer carries full risk

 Buyer carries no risk

PROXY GENERATION

What It Is

Proxy generation is a weather resource-based methodology for calculating the hourly volume of energy that a given renewable energy project would have generated had it achieved its planned operational efficiency. A third-party calculation agent typically determines proxy generation, translating hourly measured wind or solar resource data into expected energy generation.[xiii]

The buyer is then compensated based on the amount of proxy generation (a modeled value) as opposed to metered generation (an observed quantity) from the renewable energy project. This shields the city from a range of mechanical and operational risks, including over- or underperformance of the panels or turbines, plant or substation failures, maintenance downtime, or curtailment that could decrease production.

For example, if a 100 MW solar project generates only 75 MW at noon due to a technical fault, but the calculated proxy generation was 95 MW, the city's VPPA revenue or loss will be based on the 95 MW [(Market $/MWh price – PPA $/MWh price) X 95 MW]. Similarly, if the project generates more than the proxy generation, the city's revenue or loss is still based on the proxy generation.

Proxy generation provides the added benefit of simplifying VPPA contract terms. VPPAs based on actual generation typically attempt to mitigate the buyer's exposure to mechanical risk and operational decisions through availability guarantees, production minimums, maintenance schedule restrictions, and so forth. These terms are typically complex, time-consuming to negotiate, and difficult to monitor and enforce.

Additionally, these availability projections typically focus on annual or seasonal limits, which can have little impact on exposures created at the hourly level (e.g., mechanical shutdowns during an extreme weather event when power prices tend to be very high). Similar to production guarantees, REC shortfall concerns can be alleviated by requiring project owners to deliver the number of RECs that would have been created according to the proxy generation calculations.



[xiii] For more detail on Proxy Generation calculations, see **https://orrick.blob.core.windows.net/orrick-cdn/Proxy_Generation_PPAs.pdf**

Which City Risks Are Mitigated

Proxy generation specifically addresses operational risk, as shown in Exhibit 25. Because proxy generation guarantees that the city is compensated even when the generator is unavailable, underperforming, or curtailed, it eliminates operational risk.

Where It Has Been Done Before

While no known cities have utilized proxy generation, more than 5,000 MW of offtake contracts have been signed by insurers and C&I buyers utilizing proxy generation.

EXHIBIT 25

Distribution of Risks with Proxy Generation versus the Reference VPPA

	PRICE RISK	BASIS RISK	NON-ENERGY MARKET RISK	SHAPE RISK	OPERATIONAL RISK	VOLUME RISK
Reference VPPA						
VPPA with Proxy Generation						

 Buyer carries full risk

 Buyer carries no risk

CONCLUSION

Cities are increasingly looking to large off-site PPAs to achieve their renewable energy goals due to their benefits in scale, geographic flexibility, and financial hedge potential. When utilizing these procurement structures it is important that they understand their inherent risks and the available strategies to mitigate those risks. Virtual PPA and physical PPA contracts expose buyers to price, basis, non-energy market, shape, operational, and volume risk, in order of typical importance to buyers.

For VPPAs, Exhibit 26 illustrates the degree to which various market strategies can mitigate those risks.

- Price risk can be limited with floors and collars that set limits on extreme price fluctuations—or mitigated even further with financial add-ons like a fixed-volume price swap or settlement guarantee agreement.
- Settling at the project's hub can reduce basis risk between the project's market price and city's load zone price.
- Non-energy market rule changes can be mitigated with good faith renegotiation clauses.
- Shape and volume risks caused by uncertainty in the timing and overall amount of renewable generation, respectively, can be mitigated with settlement guarantee agreement or volume-firming agreement financial add-ons.
- Operational risk can be mitigated with production guarantees and eliminated with proxy generation by using a calculated production profile based on weather conditions instead of actual production.



EXHIBIT 26

The Risk Reduction of Risk Mitigation Strategies for a VPPA

	PRICE RISK	BASIS RISK	NON-ENERGY MARKET RISK	SHAPE RISK	OPERATIONAL RISK	VOLUME RISK
Reference VPPA						
Floors & Collars						
Fixed-Volume Price Swap						
Hub Settlement						
Good Faith Renegotiation						
Settlement Guarantee Agreement						
Volume-Firming Agreement						
Production Guarantee						
Proxy Generation						

Buyer carries full risk

Buyer carries no risk

PPPAs largely include the same risks as VPPAs but are viewed through a slightly different lens. In VPPAs, financial risks directly impact the regular settlements between the city and the project owner, and therefore represent real costs or revenues that the city will face. On the other hand, in PPPAs, price risk, and its interconnection with non-energy market, shape, operational, and volume risks, primarily impact the opportunity cost of the deal (i.e., a PPPA's cost-effectiveness compared with what the city would have paid for the energy if it had not entered into a PPA). Meanwhile, shape, volume, and operational risk all impact the plant's operations and therefore the degree to which the city must purchase energy outside the PPA to meet its demand or sell off excess generation.

PPPA risk mitigation solutions include those exclusive to PPPAs (retailer-firmed power) and found in VPPAs (load zone delivery, good faith renegotiation, and production guarantees). However, they do not include those that address price risk and/or are financial add-ons in VPPAs (price floors/collars, FVPS, SGA, and VFA), as shown in Exhibit 27.

- Since PPPAs more commonly deliver renewable energy to the city's load zone, cities will more likely be able to eliminate basis risk with load zone delivery.
- As in VPPAs, good faith renegotiations can mitigate the financial impacts of non-energy market rule changes.
- PPPA buyers in retail choice states can partner with retail electricity providers to purchase firm power and eliminate both shape and volume risk.
- PPPAs typically include production guarantees to reduce operational risk by specifying when and how much the generator should produce.

Ultimately, the decision of which type of PPA to pursue and which risks to mitigate will depend on each individual city's particular circumstances and preferences. While perceived to be more complex, VPPAs can provide beneficial geographic flexibility, which may be of particular value to cities facing regulatory constraints or unattractive local market dynamics. PPPAs, meanwhile, provide a conceptually straightforward mechanism that reduces a city's uncertainty regarding its long-term energy expenditures. Yet both structures will change a city's overall energy strategy and can reduce some existing risks while simultaneously introducing new ones.

The strategies outlined in this paper provide a range of options for cities to mitigate these new risks, some of which may come at a cost premium depending on the degree of risk off-loaded. These risk mitigation strategies can allow cities to overcome internal roadblocks and, through PPAs, unlock a range of financial, sustainability, economic development, health, and other benefits for their communities.

EXHIBIT 27

The Risk Reduction of Risk Mitigation Strategies for a PPPA

	PRICE RISK	BASIS RISK	NON-ENERGY MARKET RISK	SHAPE RISK	OPERATIONAL RISK	VOLUME RISK
Reference PPPA						
Load Zone Delivered						
Good Faith Renegotiation						
Retailer-Firmed Power						
Production Guarantee						

Buyer carries full risk

Buyer carries no risk

ENDNOTES

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22830 Two Rivers Road
Basalt, CO, 81621 USA
www.rmi.org

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