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FOREWORD

The Water Research Foundation (WRF) is a nonprofit corporation dedicated to the development and implementation of scientifically sound research designed to help water utilities respond to regulatory requirements and address high-priority concerns. WRF’s research agenda is developed through a process of consultation with WRF subscribers and other water professionals. WRF’s Board of Directors and other professional volunteers help prioritize and select research projects for funding based upon current and future industry needs, applicability, and past work. WRF sponsors research projects through the Focus Area, Emerging Opportunities, Tailored Collaboration, and Facilitated Research programs, as well as various joint research efforts with organizations such as the U.S. Environmental Protection Agency and the U.S. Bureau of Reclamation.

This publication is a result of a research project fully funded or funded in part by WRF subscribers. WRF’s subscription program provides a cost-effective and collaborative method for funding research in the public interest. The research investment that underpins this report will intrinsically increase in value as the findings are applied in communities throughout the world. WRF research projects are managed closely from their inception to the final report by the staff and a large cadre of volunteers who willingly contribute their time and expertise. WRF provides planning, management, and technical oversight and awards contracts to other institutions such as water utilities, universities, and engineering firms to conduct the research.

A broad spectrum of water issues is addressed by WRF's research agenda, including infrastructure and asset management, rates and utility finance, risk communication, green infrastructure, food waste co-digestion, reuse, alternative water supplies, water loss control, and more. The ultimate purpose of the coordinated effort is to help water suppliers provide a reliable supply of safe and affordable water to consumers. The true benefits of WRF’s research are realized when the results are implemented at the utility level. WRF's staff and Board of Directors are pleased to offer this publication as a contribution toward that end.

Charles M. Murray
Chair, Board of Directors
Water Research Foundation

Robert C. Renner, P.E.
Chief Executive Officer
Water Research Foundation
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WATER RESEARCH FOUNDATION RESEARCH MANAGER

Linda Reekie

WATER ENVIRONMENT & REUSE FOUNDATION

Lauren Fillmore

PROJECT ADVISORY COMMITTEE

Alan Roberson
AWWA Government Affairs Office

Shahid Chaudhry
California Energy Commission

Daniel J. Hufton, P.E.
Pennsylvania American Water

Sebastian “Buster” Fichera
Fort Worth Water Department

Robert B. Taylor, P.E., C.E.M.
Washington Suburban Sanitary Commission

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EXECUTIVE SUMMARY

KEY FINDINGS

Critical success factors for W&WRRU P3 energy projects include:

- Identifying a political champion who can maintain the project’s momentum, involve stakeholders, and obtain buy-in and commitment from local government, top managers, the workforce, and the public
- Creating, with stakeholder support, an action plan with concrete goals
- Selecting the right project delivery mechanism using risk tools and value-for-money analysis
- Undertaking a procurement process that leads to a win-win contract with clear terms and flexibility for contingencies
- Monitoring contract performance to address issues as they arise

OVERVIEW

This report reflects an assessment of public-private partnership (P3) opportunities for water and water resource recovery utility (W&WRRU) energy projects. This report is intended to help W&WRRUs identify opportunities and undertake energy projects through P3s.

Consistent with the publication, The Water Resources Utility of the Future: A Blueprint for Action, this report uses the term “water resource recovery utility (WRRU)” instead of “wastewater treatment plant” or similar terms, unless required for clarity when referring to a specific law, policy, or facility. This updated terminology reflects the sector’s achievements in managing household and industrial wastewater as a resource, and protecting the integrity of waterways.

OBJECTIVES

This project’s objectives were to develop and produce a report to assist W&WRRUs in undertaking energy projects through P3s. The scope of the report includes detailed review and discussion of relevant P3 issues, including energy and P3 project drivers, legal matters, allocation of risk, financing options, contractual drafting, and monitoring and oversight, among others.

BACKGROUND

The energy use implications of water and water resource recovery are becoming increasingly salient. Energy use accounts for a significant amount of local governments’ operating budgets, of which water and water resource recovery are often some of the greatest components. Reducing energy costs has become an imperative for W&WRRUs. At the same time, W&WRRUs and local governments have increasingly embraced policies and cultures of sustainability. Energy projects at W&WRRUs thus provide important opportunities for both controlling costs and minimizing environmental impacts.

Energy projects include a wide spectrum of activities, from undertaking efficiency measures to self-generating electricity. P3s offer a promising way to assess and allocate risks, raise
new capital, tap private expertise, and promote innovation while meeting utilities’ obligations to their consumers. Energy projects can be particularly well-suited to the P3 delivery tool because such projects often require expertise outside of W&WRRUs’ capabilities; moreover, such projects involve a number of financing mechanisms that are attractive to private partners.

A number of publications and other resources are available to W&WRRUs on the technical aspects of energy projects and P3 projects generally. However, literature regarding P3 energy projects at W&WRRUs is relatively limited. Moreover, those resources do not collect the legal, political, and business-oriented aspects of such projects all in a single place. This report is a contribution to filling those gaps.

APPROACH

The first phases of the project included a comprehensive literature review and data collection efforts for five case studies. The literature review spanned several topics, including: (1) engineering, legal, and policy drivers of energy projects at W&WRRUs; (2) the variety of energy projects currently in place at W&WRRUs; (3) P3 project drivers; and (4) the variety of P3 mechanisms that are being, or could be, used at W&WRRUs for energy projects. The methodology for the case studies included: (1) in-person interviews and site visits at the participating W&WRRUs; (2) reviews of key documents relevant to the participating W&WRRUs’ P3 energy projects; and (3) written communications with key personnel about their experiences with the projects.

The results of the literature review are presented in Chapters 1 through 4 of the report, and the case studies are presented in Chapter 5. All of the effort from the first phase of the project informed the development of the report.

RESULTS/CONCLUSIONS

As W&WRRUs increasingly adopt cultures of sustainability while seeking to cut costs or develop new revenue streams, the number of P3 energy projects will likely grow. Critical success factors include:

- Understanding the W&WRRU’s energy use, needs, and alignment with strategic and operational priorities
- Identifying a political champion who can maintain the project’s momentum, involve stakeholders, and obtain buy-in and commitment from the local government, top managers, the workforce, and the public
- Creating an action plan with concrete goals that is supported by stakeholders
- Selecting the right project delivery mechanism using risk tools and value-for-money analysis
- Undertaking a procurement process that leads to a win-win contract with clear terms and flexibility for contingencies
- Monitoring contract performance while working collaboratively with the P3 partner to address issues as they arise and ensure a successful outcome
APPLICATIONS/RECOMMENDATIONS

W&WRRUs can put this report to use immediately both to enrich their understanding of P3 energy projects at W&WRRUs, and to begin or enhance an already-in-progress P3 energy project. The first sections of the report will aid in:

- Understanding the engineering, legal, and policy drivers that are spurring new energy projects at W&WRRUs
- Understanding the risk allocation, legal, and policy drivers that make P3s attractive for W&WRRU energy projects
- Providing concrete examples and lessons learned for P3 energy projects at W&WRRUs from start to finish using case studies

The final section of the report presents recommended practices for P3 energy projects at W&WRRUs, and includes:

- Setting utility priorities and selecting the energy project
- Identifying the optimal project delivery tool
- Socializing the P3; that is, tapping a political champion and engaging with both internal and external stakeholders
- Approaching the procurement process, which includes bidding processes, requests for qualifications and proposals, proposal review, partner selection, and contract negotiation
- Ensuring that the final contract is as detailed and comprehensive as possible, including a term-by-term guide to contract provisions

RESEARCH PARTNERS AND PARTICIPANTS

The research team gratefully acknowledges the following W&WRRUs, which participated in the case studies:

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- Ridgewood Water Pollution Control Facility, Village of Ridgewood, New Jersey
- Rockland County Sewer District #1, Rockland County, New York
- Portland Water Bureau, City of Portland, Oregon
- San Antonio Water System, City of San Antonio, Texas

RELATED WRF RESEARCH

- Energy Efficiency Best Practices for North American Drinking Water Utilities, project #4223
- New and Emerging Capital Providers for Infrastructure Funding, project #4617
- Opportunities for Distributed Energy Resource Development at Water and Wastewater Utilities, project #4625
CHAPTER 1
ENERGY AT WATER AND WATER RESOURCE RECOVERY UTILITIES AND THE ROLE OF PUBLIC-PRIVATE PARTNERSHIPS

This report uses the term “water and water resource recovery utility (W&WRRU)” rather than more traditional terms such as “publicly-owned treatment works,” or “water and wastewater treatment,” to signify the value of such facilities in maintaining the overall water resource. With respect to water resource recovery utilities in particular, this usage is consistent with the publication *The Water Resources Utility of the Future: A Blueprint for Action*, which recognizes the sector’s achievements in managing household and industrial wastewaters as a resource and protecting the integrity of waterways. This updated terminology is used throughout this report unless required for clarity when referring to a specific law, policy, or facility.

The energy-use implications of water and water resource recovery are becoming increasingly salient. According to the U.S. Department of Energy (DOE), energy use can account for as much as 10 percent of a local government’s annual operating budget, and a significant amount of this municipal energy use occurs at water and water resource recovery facilities. With their various equipment and machinery, such facilities can be among the largest consumers of electricity in a community—accounting for 30 to 40 percent of the total electricity consumed. Collectively, U.S. W&WRRUs spend about $4 billion annually on energy.

Given that most electricity in the United States is generated from fossil fuels, W&WRRU electricity use contributes to both greenhouse gas (GHG) and other air pollutant emissions. Indeed, according to the U.S. Environmental Project Agency (EPA), drinking water and water resource recovery systems account for approximately 3 to 4 percent of energy use in the United States (U.S.), resulting in the emissions of more than 45 million tons of GHGs annually. Furthermore, certain biological treatment processes at wastewater treatment facilities produce biogas, the primary component of which—methane—is a much more potent GHG than carbon dioxide. Facilities with anaerobic digesters flare the biogas, wasting the energy content and releasing carbon dioxide.

Energy projects at W&WRRUs thus provide significant opportunities both for controlling costs and for minimizing environmental impacts. Depending on a facility’s age, processes, and operations, efficiency measures can reduce costs as much as 25 percent; EPA estimates an average 10 percent reduction in costs through efficiency measures alone, which amounts to a savings of more than $400 million annually. At wastewater treatment plants, the composition of anaerobic digester gas is 60 to 70 percent methane (the rest being mostly carbon dioxide). Although many plant operators flare this biogas, for every million gallons per day (MGD) of treated wastewater, anaerobic digester biogas can produce 26 kW of electric capacity and 2.4 million British thermal units (Btu) per day (Btu/day) of thermal energy. Finally, for suitably sited W&WRRUs, generating electricity from wind or solar power is a meaningful option. Energy measures like these can provide cost savings, introduce new revenue streams, provide tax benefits, improve reliability, and reduce the environmental footprint of the facility. Moreover, many of these attributes of energy projects can be monetized in order to leverage the potential of public-private partnerships (P3s).

P3s have long offered a promising way for W&WRRUs to raise new capital, tap private expertise, and promote innovation while meeting their obligations to consumers. Today, the twin imperatives of upgrading infrastructure and cutting costs have combined with the desire to respond
to energy policies at the federal, state, and local levels. This development offers the opportunity to further leverage P3s so that utilities are ready for the energy future.

The following is a useful working definition of a P3:

A public-private partnership is a contractual, institutional, or other relationship between government and a private sector entity that results in sharing the duties, risks, and rewards of providing a service in which the government has an interest, recognizing that the government retains ultimate responsibility for insuring that social needs and objectives are met.\footnote{13}

This report begins in Chapter 2 with an overview of the engineering, environmental, and legal drivers of energy projects at W&WRRUs. Next, Chapter 3 presents an overview of the variety of energy projects already in place. Chapter 4 returns the focus to using P3s for energy projects at W&WRRUs. With this overview in place, Chapter 5 presents five case studies of P3 energy projects at W&WRRUs: the City of Thousand Oaks, California; the City of Portland, Oregon; Rockland County, New York, the City of Ridgewood, New Jersey; and the City of San Antonio, Texas.

Following the case studies, Chapter 6 presents best practices. This chapter roughly tracks the timeline of a P3 energy project, beginning with identifying utilities’ energy priorities and selecting energy projects. Next, this chapter addresses the political aspects of P3 energy projects, considering how to socialize the project and make the case for pursuing it. This chapter then turns to approaching P3 procurement and selecting a partner, concluding with considerations for developing and implementing a win-win contract.
CHAPTER 2
DRIVERS OF ENERGY PROJECTS AT WATER AND WATER RESOURCE RECOVERY UTILITIES

ENGINEERING DRIVERS

A variety of plant-focused engineering and operational drivers are often at work for energy projects at W&WRRUs, including energy cost savings, facility upgrades, waste stream management and resource recovery, enhanced reliability, and the implementation of energy management plans.

Energy Cost Savings

As described above, energy costs account for a significant portion of W&WRRUs’ operating budgets. Finding ways to reduce such costs can help alleviate budget pressure and minimize the need to seek rate increases for customers.14

Facility Upgrades

Many W&WRRUs undertake energy projects in conjunction with facility upgrades. New equipment typically brings efficiency improvements and may either result in energy audits or be prompted by such audits. Moreover, if a water or WRRU plans to make other facility upgrades, it can minimize construction disruptions by concurrently undertaking other energy projects.15

Waste Stream Management and Resource Recovery

Among the waste streams produced at WRRUs, biosolids and biogas represent opportunities for energy projects. Biogas from wastewater treatment operations, for example, is typically flared – but on average, this waste stream contains 60 to 70 percent methane, which is the primary component of natural gas.16 If the biogas is appropriately processed, it can be used for heating, electricity, or vehicle fuel. Similarly, new technologies are enabling greater use of the energy content of biosolids.17

Enhanced Reliability

With the proper equipment, W&WRUs that self-generate heat and electricity can benefit from reliability even if there are natural gas shortages or grid power outages.18 This greatly reduces the need to rely on back-up diesel generation.19

Implementing Energy Management Plans

Many W&WRRUs have already undertaken energy audits and developed energy management plans. Often, new energy projects are part of that implementation.20
ENVIRONMENTAL/SUSTAINABILITY DRIVERS

In addition to engineering drivers, environmental and sustainability drivers often prompt W&WRU energy projects. These include reducing emissions, building resilience or energy independence, and enhancing corporate social responsibility.21

Emissions Reductions

As climate change becomes increasingly salient across all sectors, reducing emissions grows in importance. A variety of legal and policy measures directly incentivize emissions reductions at W&WRUs, which are discussed later in this chapter.

Resilience and Energy Independence

A reduced reliance on electricity and natural gas promote resilience and energy independence. Particularly where self-generation of electricity is possible, systems are far less susceptible to major weather events, system outages, and natural gas shortages.22

Corporate Social Responsibility and Commitments to Sustainability

A variety of organizations have embraced commitments to social responsibility and sustainability. These commitments often become deeply embedded in the culture of organizations, and customers increasingly value and seek out such organizations. Moreover, the commitment, involvement, and visibility of management in W&WRU energy projects is critical to their success.23

FEDERAL STATUTORY AND REGULATORY DRIVERS

Federal statutes and regulatory programs can add value to energy projects at W&WRUs by creating opportunities to attract investors.24 These drivers typically provide a critical piece of the incentive package for P3 partners.

Tax Incentives and Grant Funding

Federal support for renewable electricity generation is largely achieved through tax policy, and includes: (1) accelerated depreciation rates; (2) investment tax credits for solar power, qualified fuel cell, microturbine, and combined heat and power (CHP) systems;25 and (3) production tax credits for wind power and other qualifying technologies.26 As suggested by this list of tax policies, the investment tax credit is most relevant to projects likely to be undertaken by W&WRUs.27 Typically, renewable project developers monetize their tax credits by bringing in tax equity investors.28 For P3 energy projects, the private partner (rather than the water or WRRU) would be the most likely entity to leverage the tax incentives to attract investors.29

Although no longer available, a cash grant provision in the American Recovery and Reinvestment Act (ARRA) of 2009,30 known as “section 1603” grants, permitted project developers to receive up to 30 percent of their qualifying costs as a grant in lieu of the other tax credits.31 The section 1603 grant program remained in effect for projects that undertook
construction or began operation in 2011,32 and was a notable driver of several W&WRRU energy projects.33 For example, Philadelphia, Pennsylvania’s Northeast Water Pollution Control Plant leveraged a P3 arrangement in conjunction with ARRA funding to install a biogas cogeneration system that came online in 2013.34 The site generates over 134,000 kWh of electricity per day and has reduced the need to purchase electricity by 81 percent;35 combined with the heating provided by this system, the site reports 54 percent energy neutrality.36

Other federal agencies continue to administer grants for renewable energy projects, and several W&WRRU energy projects have benefitted from federal grant funding.37 For example, the U.S. Department of Energy (DOE) maintains a site detailing such funding,38 and the website Grants.gov functions as a clearinghouse. The U.S. Department of Agriculture’s (USDA) Rural Development Utilities Program also provides grants and low-interest loans for rural infrastructure.39

Public Utility Regulatory Policies Act (PURPA)40 Qualifying Facilities

Enacted in 1978, PURPA guarantees grid access to qualified renewable energy project developers (“qualified facilities, or QFs”) and imposes on power utilities a purchase obligation at utilities’ avoided cost.41 Following statutory amendments in 2005, this PURPA provision remains in effect primarily in Southeastern and some Western states.42 Many W&WRRU energy projects are possible QFs, which can be small cogeneration, solar, or wind installations, for example,43 so W&WRRUs could leverage the purchase obligation by interconnecting with an electric utility.44 The authors of this report, however, are unaware of any W&WRRUs that have done so; this is likely because the barriers to becoming QFs and participating in the electric grid are formidable.45

Clean Air Act (CAA) and Climate Change Regulation

The federal government also administers a number of regulatory programs that have a bearing on energy projects. A central statute is the Clean Air Act (CAA), which is administered cooperatively by EPA and the states. Under the CAA’s Clean Power Plan (CPP), which was promulgated during the Obama administration for example, states were required to set emission targets for existing fossil-fuel fired electricity generators, and new renewable and efficiency measures could be credited toward state compliance.46 As of this writing, the CPP has been stayed during litigation and President Trump has directed EPA to reexamine all climate-related rules;47 nevertheless, some states are continuing to develop climate plans48 and many scholars expect climate policies to continue to gain traction in the longer term.49

An additional CAA program, administered by EPA jointly with USDA and DOE, is the Renewable Fuel Standard Program. This program mandates certain amounts of renewable transportation fuel to replace fossil fuels. To comply, refiners or importers of fossil transportation fuels must either blend their fuels with renewable sources, or purchase credits called Renewable Identification Numbers (RINs). Biogas from municipal wastewater treatment facility digesters can qualify as a renewable feedstock for compressed natural gas, liquefied natural gas, or electricity used for electric vehicles.50 The sale of biogas for this purpose, therefore, can generate income from the associated RINs, providing a revenue stream that can be leveraged in a P3 relationship.
Demand Response and Other Market Incentives

For W&WRRUs operating within competitive wholesale electricity markets, a number of incentives for energy projects may be available. The Federal Energy Regulatory Commission (FERC) has issued Order 745, which permits aggregated demand response to be bid into competitive wholesale energy markets at the same price as electricity. Aggregators such as EnerNOC have encouraged W&WRRUs to take part in demand response programs, because W&WRRUs have backup sources of power and can therefore respond to calls to curtail electricity use. Under such programs, the W&WRRUs would receive payments for curtailing electricity usage when called on to do so. Due to stricter air emission requirements, however, W&WRRUs’ backup generators may not be suitable for providing demand response. W&WRRUs may still successfully provide other monetizable grid services like frequency regulation, however, depending on their systems’ flexibility and configuration. In addition, some market operators have rebates and other incentives available to W&WRRUs that undertake efficiency projects.

STATE STATUTORY AND REGULATORY DRIVERS

States have taken significant steps toward incentivizing clean energy within their borders, and these incentives have been important drivers for W&WRRU energy projects. Examples include Renewable Portfolio Standards (RPS), Energy Efficiency Resource Standards (EERS), Feed-In-Tariffs (FITs), net metering, and state tax incentives. In addition, numerous states authorize third-party power purchase agreements (PPAs) and alternative project financing and delivery through P3s.

Renewable Portfolio Standards

RPSs are state mandates that a certain portion of electricity be generated from renewable sources by a certain date. Twenty-nine states plus D.C. currently have some form of RPS, and an additional nine states have renewable portfolio goals. Electricity suppliers can comply with RPS requirements by owning renewable generation resources, purchasing Renewable Energy Credits (RECs), or purchasing both power and RECs from a renewable power source. RECs are typically bought and sold in secondary markets, and their value varies significantly from one market to another. Thus, RPSs create a market for renewable power as well as for the RECs associated with generation. In P3 energy arrangements, the private partner generally retains the RECs associated with any renewable power generation, but as described below this is a term that can be negotiated.

Energy Efficiency Resource Standards

By contrast, EERS are state mandates that electric utilities meet particular energy-savings goals by a given date. Twenty-six states have Energy Efficiency Resource Standards or goals. For example, California has established numerical goals for the largest four investor-owned electric utilities in the state, many of which have funded W&WRRU energy projects. Electric utilities often comply with these mandates by providing consumer incentives for energy efficiency or other demand-side projects.
Net Metering

Unlike Feed-In-Tariffs (described below), net metering permits any excess electricity generated by a customer to be fed back into the distribution grid, essentially allowing the meter to "spin backwards." Forty-one states plus D.C. have mandatory net metering policies, while four states have other distributed generation (i.e., power generated at the point of consumption) policies, and two others permit utilities to decide whether to permit net metering. W&WRRUs should be aware that there is a strong movement, led by incumbent utilities, to roll back or entirely eliminate net metering and impose surcharges on distributed generation. Net metering can benefit a self-generating W&WRRU, but it is important to know that in P3 relationships, it is often the private party, rather than the W&WRRU, that receives the benefit of net metering.

Feed-in-Tariffs

FITs typically guarantee to renewable energy projects interconnection with the grid, and project owners are provided a fixed, above-market rate for a term of years. Unlike net metering, therefore, FITs provide an income structure that can be leveraged in a P3 relationship. Germany has years of experience with FITs, and some states have modeled their own FIT policies on Germany’s experience. Only a few states have FIT policies, but notable among them is California, which hosts several W&WRRU energy projects.

Electric Utility Rate Structures

Electric utility rate structures have a profound impact on the landscape of incentives for W&WRRU projects. This is particularly true given the fluctuations in restructuring status of states’ retail electricity regulation. California, for example, was an early leader in retail electricity restructuring, but its energy crisis and Enron scandal lead the state to reregulate its electricity market. The turbulence in California led to higher energy costs (both for electricity and natural gas) and was a direct driver for many of its W&WRRU projects. By contrast, Pennsylvania’s block rate structure under a traditional rate regulation was so low for W&WRRUs that there was little economic incentive to consider energy projects. As the state’s transition to retail restructuring grew closer, however, Philadelphia’s wastewater treatment plant became concerned about increasing costs associated with the removal of a price cap. The utility specifically pointed to this looming change as an important driver in developing its biogas cogeneration system.

State and Municipal Tax Incentives, Grant Funding, and Other Incentives

State and municipal tax incentives are potential drivers in W&WRRU energy projects, though they do not appear to have had a significant impact thus far. (By contrast, such incentives have played roles in driving other distributed generation, such as rooftop solar.) A W&WRRU considering an energy project should evaluate whether such incentives are available, how to qualify, and how to leverage them to attract investors. Conversely, there are numerous examples of state grant funding, often conducted in conjunction with EERS or the Clean Water State Revolving Fund (CWSRF). Under ARRA, the CWSRF operated by each state must dedicate at least a portion of those resources to green projects, which can include energy efficiency and CHP. Finally, a number of nonprofits also provide funding and interact with the state’s environmental
agency or public utility commission. Efficiency Vermont, for example, is a program operated by a nonprofit organization appointed by the Vermont Public Service Board; it provides rebates to W&WRRUs that install new energy-efficient equipment.77

P3 Authorizations

As of January 2017, 37 states including Washington, D.C. and Puerto Rico have state enabling P3 legislation, and in some states may be a prerequisite to entering into P3 arrangements.78 There is significant variation among the authorizing states, however, and the U.S. Department of Treasury reports that about 18 states have broad enabling statutes.79 Fundamental needs for state legislation include authorizing local authorities to enter P3s without a second review by the legislature, providing an open-ended scope of P3 projects, and removing obstacles such as a requirement to accept only the lowest-cost bids.80 Further considerations specific to P3s are discussed in Chapter 4.

Power Purchase Agreement (PPA) Authorizations

PPAs are simply contracts between buyers and sellers of electricity. They have developed a specialized meaning in the context of renewables, however, as a way of financing small renewable projects. Their role in financing is described in more detail below, but first, it is important to note that the availability of PPAs for this purpose is governed by state law. For example, at least twenty-six states, plus D.C. and Puerto Rico, authorize some form of third-party PPA for solar PV.81 At least nine states, however (including Florida), expressly disallow PPAs for solar PV.82 The status of PPA authorization in a W&WRRU’s state should be carefully examined for its coverage of technology and any requirements as to the terms.

LOCAL ORDINANCE DRIVERS

Local governments’ sustainability programs may provide services and support to help W&WRRUs meet their goals. Other local incentives might include property tax incentives, building codes, and financing incentives. Numerous local governments are experimenting with such incentives for rooftop and community solar,83 and this may be a fruitful area for W&WRRU projects in the future.
CHAPTER 3
ENERGY PROJECT LANDSCAPE

A wide variety of W&WRRU energy projects are already in place across the United States and worldwide. Projects include demand-side measures like energy efficiency upgrades, electrical load management, and energy use performance monitoring and benchmarking. In addition, electricity generation technologies at W&WRRUs include: biogas as feedstock for electricity generation (with or without heat for CHP) using technology like fuel cells, microturbines, and reciprocating engines; solar PV; wind; heating using wastewater streams; and in-pipe hydroelectric power generation. At many W&WRRUs, a combination of such projects is in place.

Especially for projects undertaking electricity generation, site-specific variables are an important consideration. Energy projects must be integrated into the project site’s footprint, layout, and existing physical constraints. Further, power generation must be integrated into the site’s electricity system and the local electricity grid. Depending on the project, a natural gas connection and water supply may also be necessary. Finally, monitoring and communications systems may be tied in to the existing site’s system, or operated in parallel. All such projects are specifically tailored to their sites.

DEMAND-SIDE MEASURES (DSM)

Energy Efficiency Upgrades

Numerous W&WRRUs have undertaken energy efficiency upgrades. As EPA reports, the primary opportunities include equipment upgrades, operational modifications, and modifications to facility buildings. Projects include electrical load management, energy efficient treatment processes, energy efficient equipment, energy use performance monitoring and benchmarking. For example, many water resource recovery facilities have replaced their aeration equipment, resulting in energy savings of over 20% per year.

Demand Response and Grid Services

As described above, demand response and other grid services at the wholesale level are governed by FERC and carried out through aggregators. However, similar state-level programs are also in effect. Some such programs combine time-of-use pricing with information to electricity consumers so that they can reduce their demand at times of peak demand (and hence, peak prices). Several W&WRRUs noted a sensitivity to time-of-use pricing. Other programs, such as those that provide grid services to the local distribution grid, may operate irrespective of such pricing schemes.

COMBINED HEAT AND POWER (CHP)

Many water resource recovery facilities have implemented CHP systems that use biogas as a feedstock. The estimated energy potential from water resource recovery biogas sources in the United States is 113 billion cubic feet per year, which amounts to a potential annual electricity production of 5.6 billion kilowatt-hours per year. USDA, EPA, and DOE have established a
biogas opportunities roadmap working group, which is aimed at developing information sharing mechanisms, interagency cooperation, and research and development.89

A number of energy projects use water resource recovery biogas as a feedstock for electricity generation and/or CHP applications.90 This is particularly suited for sites that already have anaerobic digester systems.91 EPA estimates that anaerobic digester gas from WRRUs is typically 60 to 70 percent methane (the remainder is primarily carbon dioxide), with heating values ranging from 550 to 715 British thermal units per cubic foot (Btu/cf).92 Therefore, each MGD of treated resource water can produce enough biogas through an anaerobic digester to yield 26 kW of electric capacity.93

A 2011 EPA study documented 190 MW of CHP capacity across the U.S. at 104 WRRUs. Moreover, the study estimated that the technology was economically viable at between 257 and 662 additional facilities.94 Nationally, the technical potential was estimated at over 400 MW of electric capacity and about 38,000 Btu/day of thermal capacity, with costs ranging from 1.1 to 8.3 cents per kWh.95 The potential benefits of CHP systems include increased efficiency, electric reliability, reduced air emissions, and money savings.96 In addition, such projects may qualify for compliance with state and federal GHG initiatives. Such initiatives include RPSs, carbon trading, and any applicable federal law.97

Among the prevailing biogas technologies are CHP systems using digester gas to generate electricity through reciprocating engines, microturbines, or fuel cells.98 These technologies are scaled to typical WRRU sizes; only the largest WRRUs (greater than 100 mgd) can take advantage of combustion turbines, steam turbines, or combined-cycle electricity generation.99

As noted above, electricity generation systems using biogas are most cost-effective when WRRUs already operate anaerobic digesters.100 Microturbine systems ranged from $3,000 – 5,000 per KW installed capacity, reciprocating engine systems ranged from $2,500 – 4,000 per KW installed capacity, and combustion turbines ranged from $1,800 – 2,800 per KW installed capacity.101 Fuel cell systems were the highest cost options and ranged from $5,000 – 6,000 per KW installed capacity.102 These costs vary depending on the plant size and specific technology used, and WRRUs should carefully evaluate their site-specific data and efficiencies of proposed technologies.

OTHER RENEWABLE ENERGY APPLICATIONS

Some energy-related projects use the wastewater stream itself for heating. For example, the False Creek Energy Center in Vancouver harvests resource water heat and supplies about 70 percent of the thermal energy demand of 1,400 residential units in the city.103 The system, which took three years to build and cost $30 million funded by ratepayers, uses a heat pump system and heat exchanger; raw sewage is fed directly into the heat pump and additional wastewater streams are available to ensure steady supply.104 The system is part of the City of Vancouver’s policy of reducing greenhouse gas emissions.

Biogas itself can be sold for use as a feedstock under the Renewable Fuel Standard described in Chapter 2. The experience of the City of San Antonio, Texas, is detailed in a case study in Chapter 5. This option for biogas has especially attracted attention among WRRUs where electric utilities’ demand charges make it uneconomic to operate a biogas-fueled electric generating system on-site.105
NON-EMITTING RENEWABLE ELECTRICITY GENERATION

Solar Photovoltaic (PV)

W&WRRUs are implementing solar PV projects, most of which were financed using PPAs with either private companies or local utilities. The biggest considerations for solar projects are site-specific physical constraints, including how solar PV would be oriented, buildable areas, and rooftop availability. A survey of the existing electrical system is also necessary, to determine an appropriate interconnection strategy. These variables will impact the projected solar generation, and can be compared to usage data to estimate whether the project would be expected to feed power to the grid (which would in turn enable FIT or net-metering benefits, where available).

Wind

Wind projects at W&WRRUs are much less prominent, and some such projects are not truly onsite, but rather involve the W&WRRU acting as the buyer under a PPA, enabling it to take advantage of RECs. Other W&WRRUs have onsite wind turbines, some funded by PPAs. Similarly to solar PV, installing wind generation requires a number of site-specific considerations.

Hydroelectric Power

An emerging technology is in-pipe hydro, which takes advantage of the flow in water distribution systems to drive turbines. Currently, the City of Portland, Oregon is operating such a system, which is a featured case study in Chapter 5. The City of Halifax, Nova Scotia has also implemented an in-pipe hydro system. Some W&WRRUs operate traditional hydropower systems, such as the city of San Diego, California, which uses wastewater effluent at elevation to generate electricity.
CHAPTER 4
P3 ENERGY PROJECTS AT WATER AND WATER RESOURCE RECOVERY UTILITIES

INTRODUCTION TO P3S

Overview of P3s

Where authorized by law, P3s enable W&WRRUs to capitalize on energy drivers while tapping private sector expertise, attracting investments, and alleviating energy costs. A P3 is a contractual agreement between the public and private sector, sharing skills, assets, risks, and rewards, to jointly deliver a service or a project. Under the P3 agreement, the public sector hires one or more private firms to provide various functions, such as operations and maintenance or new infrastructure construction.

Compared to traditional project procurement models, P3s hold particular advantages and offer an alternative financing and project delivery mechanism for public entities to manage their infrastructure assets. P3s can reduce development risks, provide more cost effective and timely infrastructure delivery, offer the potential for better ongoing maintenance, and leverage limited public sector resources, all while maintaining the appropriate level of public control over the project.

Local governments undertaking traditional approaches are typically required by law to award construction projects to the lowest bidder. P3s, however, enable public entities to evaluate proposed projects based on the overall best value to the public, not solely the lowest cost option. The public entity is thus able to consider factors that optimize quality, such as the experience and track record of a private company and its access to innovative technologies, materials, and management techniques, while also incorporating project life cycle costing, efficiency gains, budgetary certainty, and performance criteria into the evaluation. As a result, public entities that enter into P3s generally do not face many of the quality issues over the long-term that stem from low-bid contract awards, such as contractors using inferior materials or otherwise cutting corners to undermine their competition in order to offer the lowest bid.

Moreover, when the private partner provides design, construction, as well as operational components of a project as in P3s, the public entity can shift greater responsibility and risk to the private sector. The private partner then holds ultimate responsibility for the life cycle costs and performance outcomes, which result in later stages of a project but are tied back to decisions committed during earlier stages of design and construction. Where a single entity manages all phases of a project, the operator cannot blame performance failures on design or construction flaws, and construction firms cannot blame performance failures on design flaws. Where one entity designs, constructs, and operates an infrastructure asset, it must – and generally is more willing to – take responsibility for all aspects of the project. Thus, P3s have the added benefit of decreased litigation, as there is less potential for finger pointing.

W&WRRUs must also consider potential drawbacks to P3s; however, these may be minimized through careful P3 planning, contractual terms, and negotiations. For example, some critics of P3s argue that they require workforce reductions. This is unlikely as an empirical matter, and the norm is to structure P3s to ensure that municipal workforces are protected. Contractor accountability, consumer rate protection, and mechanisms for public oversight can similarly be
incorporated into P3s. More challenging can be political or ideological opposition to P3s; robust stakeholder processes can be effective means of overcoming such concerns.

Access to capital needed to finance infrastructure projects represents one of the most sought out reasons utilities enter into P3s due to the current fiscal budgetary tightening at all levels of government. W&WRU infrastructure is very capital-intensive, and years of deferred maintenance have resulted in significant immediate upgrading needs. Whether governments are unwilling or unable to increase public debt to meet investment needs, the private sector can supply capital through P3 arrangements without impacting municipal balance sheets. This type of alternative financing can come from private capital sources such as infrastructure funds, pension funds, and other institutional investors who seek investment in public infrastructure projects in exchange for its steady long-term, lower-risk returns. Public entities are increasingly examining alternative options to leverage its revenue-generating infrastructure assets in order to fund P3 projects, rather than committing to further indebtedness.

DRIVERS OF P3 ENERGY PROJECTS

As W&WRUs set out to establish or execute their energy management initiatives, the following are common drivers of the P3 approach.

Access to Private-Sector Expertise

Industry-Wide Best Practices

Private companies operating numerous facilities of different sizes and in various geographical settings can provide industry-wide best practices for utility operations, while working alongside local employees knowledgeable about the specific facility or system. Stimulated by competition and supported by multiple customers, private companies can afford to invest in research and development of new technologies, best practices, and workforce training that can be applied across all of its operations. Many of the energy services companies and water sector firms have the ability to tap into their greater pool of technical skill and know-how, with divisions also specializing in areas such as research, equipment manufacturing, and value engineering. The specialized resource of private sector P3 partners provide operational, managerial, technological, as well as regulatory benefits to a community’s water and wastewater assets and energy profiles, bringing expertise that is not available to a single water utility acting alone.

Enhanced Asset Management

P3s frequently use enhanced asset management and preventive maintenance programs, which involves asset identification and evaluation, life cycle cost analysis of replacement components, and repair reprioritization to attain the full useful life from each asset. An asset management strategy helps ensure that the facility or system will remain in good repair, while relying on preventive maintenance to head off costly overhauls. Because emergency repairs are more expensive than preventive maintenance, the private partner has a financial incentive to prevent infrastructure failure. Some experts claim that greater use of asset management at water and wastewater systems could slash as much as 20 percent off the total infrastructure gap, citing
examples such as Australian and New Zealand systems, Seattle Public Utilities, and Orange County, CA, which implemented the tool to more effectively maintain its capital assets.\textsuperscript{130}

\textbf{Advanced Technologies}

Utilities seeking to execute energy initiatives that take advantage of advanced or complex technologies and procedures, such as installing and operating renewable electricity systems or implementing system-scale energy efficiency projects, may not have the core competency in-house to operate new systems or the appetite to take on the risk. P3 partners accept that risk and build a utility’s capacity to deliver long-term energy objectives. P3 energy models such as Energy Savings Performance Contracts (ESPCs) provide utilities with the means to implement a project at fixed price with guaranteed savings tied to performance-based requirement, without the risk.\textsuperscript{131} Moreover, public partners will rely on private sector capacity to stay on top of changing regulatory requirements and the newest technologies that can meet them. In some instances, the private partner is able to eliminate the need for capital expenditures by using advanced technology.\textsuperscript{132}

\textbf{Efficiencies}

Private firms operating on a regional or national basis, also take advantage of economies of scale to further contribute to cost efficiencies and quality of service. A firm spreads the costs of expertise in information technology, energy efficiency, preventive maintenance, and environmental compliance across the entire infrastructure it operates. Through automation, cross-training staff, implementing organizational best practices, investing in time- and labor-saving equipment, and exploiting economies of scale, costs are driven out and efficiency gains are achieved by private sector partners. Public utilities are highly capable of developing efficiencies; however, the non-competitive and non-profit motive environment does not appear to stimulate the same level of efficiency generated by the private sector.\textsuperscript{133}

P3s also benefit from more efficient procurement and faster delivery of projects. When more responsibility and risk is transferred to the P3 private partner, efficiencies are gained through greater latitude in problem solving, and optimization of input resources (e.g., design, construction, operations) through project delivery. For example, the City of Santa Paula, CA, faced tight compliance and budget requirements to replace its existing wastewater treatment plant. Utilizing the design-build-operate-maintain-finance (DBOMF) procurement model, the brand new Santa Paula Water Recycling Facility was fully operational within two-years, in compliance seven-months ahead of its deadline while achieving all budgetary goals, and has earned global recognition.\textsuperscript{134} The City of Seattle, WA, benefited from a design-build-operate (DBO) contract that delivered its Tolt River water filtration facility at an estimated cost savings of 40 percent (or $70 million) over 25 years when compared with a conventional, non-integrated design-bid-build procurement followed by municipal operation and maintenance of the facility.\textsuperscript{135}

\textbf{Risk Transfer}

The chief mechanism for realizing cost savings in a P3 derives from the transfer of multiple project risks from the public to the private sector.\textsuperscript{136} Under conventional procurement, taxpayers bear most of the risks (e.g., design flaws, construction cost overruns, higher maintenance costs, missed demand projections) including those risks that the public sector is not well positioned to
influence. The net benefit from P3 procurement is maximized when: 1) a given controllable risk is allocated, and the related decision-making authority is delegated, to the party that can best influence it; and 2) any risk that no party can control is allocated to the party that is best able to manage or diversify it. In general, as the number of related risks that can be appropriately transferred to the private partner increases, the incentives for cost saving are strengthened.137 The following represent a number of key risk factors that can be addressed through a P3 arrangement.

**Regulatory**

The private partner often bears the risks of complying with regulatory standards. These include compliance with environmental regulations governing W&WRUs’ core operations (for example, in undertaking efficiency upgrades) and compliance with electric grid interconnection rules (for example, in establishing a cogeneration facility). Private partners that specialize in particular arenas have the benefit of experience, skill, and judgment when it comes to regulatory compliance.138

**Financial**

P3s also enable the public partner to shift some of the financial risk to the private partner. As described in the context of private DB, DBO, and other similar P3 arrangements, for example, the risk of cost overruns is transferred to the private partner. Other risks, such as those associated with financing,139 can similarly be shifted to the private partner, particularly where the private partner is responsible for securing investors in the project. Further, PPAs help reduce financial risk uncertainties by locking in an electricity rate for a specified period of time, as described in more detail later in this chapter.

**Managerial**

A benefit of W&WRU P3s is that managerial risk may be shifted to the private partner. This shift can be especially useful for large capital construction, such as CHP or significant wind installations, in which the private party conducts construction management, leaving the public party free to conduct normal operations. Once project construction is completed, if the private partner continues to operate and maintain the project, the ongoing managerial risk remains in the private domain.

**Performance and Technology**

As illustrated by the ESPC example, risks associated with the performance of an energy project may also be shifted to the private sector.140 In ESPCs, the private partner typically guarantees a certain level of performance and assumes the risk of falling short. Likewise, many electricity P3s specify certain expectations – such as how many kW a project will generate – that fall within the private partner’s responsibilities.
Project Delivery

Constructing and completing the project is generally a risk borne by the private partner in a W&WRU P3. This includes early planning and design, necessary permits and approvals, and the large variety of construction risks inherent in any capital-intensive project.

Demand- and Supply-Side Projections

Demand risk refers to the possibility that there will be less demand for the project than initially projected. Traditionally, this risk is associated with users of infrastructure— for example, drivers using a toll road—but it has applications for the W&WRU energy project context as well. A more complex example is that of electricity generation at a W&WRU. Although the generator may be sized in anticipation of the W&WRU’s own demand, there will be times during which the W&WRU generates more electricity than it needs, and times when the project generates less electricity than anticipated. For excess electricity, the private partner can undertake the necessary arrangements to sell the excess power to the local electric utility, a cooperative, or some other end user. For underperformance, the P3 contract can be structured so that the private partner bears this risk, for example, by paying for electricity needed by the W&WRU that was not provided by the project as anticipated.

Value for Money

A key component in making the business case for whether to use a P3 is Value for Money (VfM) analysis. VfM processes have been designed and utilized in many countries to help government officials determine if, when entering into a P3 agreement, they are likely to obtain a better deal compared to conventional approaches to procure the same project. VfM analysis is the process of developing and comparing total project life cycle costs, measured at the same point in time under the following delivery models: 1) Traditional Procurement: The estimated total costs to the public sector of delivering the project (also known as the Public Sector Comparator); and, 2) Alternative Procurement: The estimated total costs to the public sector of delivering the same project to the exact same specifications using an alternative procurement model such as P3.

VfM is a sophisticated analysis conducted by experts that can help communities make better-informed decisions for selecting the most appropriate mode of project delivery. Through this side-by-side comparison, public officials can begin to better comprehend the costs and savings associated with each method. While procurement and financing costs may be higher as part of the P3 arrangement, the full life-cycle analysis considers the savings achieved over the life of the entire project under the P3 arrangement through reduced costs (e.g., efficiency gains, economies of scale) associated with design, construction, operations, maintenance, and risk allocation. Only with a full accounting of costs, risks, and benefits, can public officials establish priorities to optimize the use of limited public funding, including the potential costs of not investing. All project analysis results should be transparently disclosed to the public, both to engender public understanding of and support for infrastructure projects and to encourage greater accountability for investment of public dollars. Additional information on VfM analysis can be found in Chapter 6.
Alternative Financing

Access to available capital needed to finance infrastructure projects represents a primary reason utilities enter into P3s. Local governments increasingly view P3s as a viable way to address pressing infrastructure investment needs, given ongoing fiscal pressures at all levels of government. P3s can be structured to allow the public sector to avoid adding to long-term debt obligations by partnering with the private sector to finance a project, such that costs associated with financing, constructing, operating, and ongoing maintenance of infrastructure are no longer the direct responsibility of the government.151

W&WRRU infrastructure is very capital-intensive, and years of deferred maintenance have resulted in significant immediate upgrading needs. Whether governments are unwilling or unable to increase public debt to meet investment needs, the private sector can supply capital and alternatively finance infrastructure projects through P3 arrangements without impacting municipal balance sheets.152 This type of alternative financing can come from capital sources such as leveraging guaranteed cost savings, private activity bonds, commercial debt financing, and equity investment, which can include private developers, infrastructure funds, pension funds, and institutional investors who seek investment in public infrastructure projects in exchange for its steady long-term, lower-risk returns.153

Accountability

The outcome-based contractual nature of P3 projects inherently establishes a high level of accountability. The private sector partner is bound to performance specifications, allowing the public entity to monitor and enforce as intended.154 Well-structured P3s improve certainty and accountability that serve the long-term operational condition of public infrastructure assets.155 P3s promote transparency, accountability, and in-depth cost/benefit analysis and scrutiny of proponents offering the best value back to taxpayers.156

STRUCTURING P3 ENERGY PROJECTS

Key Contractual Mechanisms

Two key examples illustrate how many W&WRRUs leverage contractual mechanisms to structure P3 energy projects. These mechanisms are often paired with, or function as, a general partnership agreement that specifies the overall P3 project terms.

Energy Savings Performance Contract

As described above, an ESPC is a key contractual arrangement for W&WRRUs to achieve their energy goals. Under an ESPC, an energy service company guarantees that infrastructure improvements, replacements, or upgrades will deliver a specified amount of energy, water, and operational savings over a period of time. The W&WRRU offsets the costs of the retrofits by these savings, thereby helping maintain its cash flow, debt service, and stable customer rates. In other words, an ESPC represents a combination of project financing-design-upgrading that permits a utility to modify and renovate existing buildings, equipment, and practices funded by a guaranteed pool of economic savings or costs avoided.
Typically, the W&WRRU will engage the private sector to conduct a preliminary audit to determine feasibility prior to contractually funding an investment grade audit, creating the foundation for project development, design, and execution under an ESPC. The W&WRRU will require the private partner to source any available grants or rebates as well as arrange for the necessary financing. Post installation monitoring, evaluation, and service support will carry through contract performance period (e.g., 20 years).

PPAs

The PPA is often paired with, or functions as, a general partnership agreement that specifies the overall P3 project terms. As described earlier in this chapter, a PPA is a contract between an electricity generator and an electricity consumer. PPAs have been used in the electricity industry for decades, but they have become an important means of financing smaller-scale energy generation projects involving (for example) solar PV. In such contexts, the buyer is the onsite host of the power generation equipment, which the seller (typically, a private partner) owns and operates. The PPA defines the price of the power generated, and rates are typically flat or escalated over time. The availability of a guaranteed revenue stream permits the seller to attract financing, while the buyer can take advantage of predictable power prices generated from clean electricity. Indeed, the most important terms of a PPA are the length of the agreement and the price the buyer pays during that time. Further, a seller is unlikely to enter into an agreement that does not commit the host buyer to purchase the electricity and services for the full term.

The terms of retail PPAs are typically subject to regulation by state Public Utility Commissions (PUCs). PPAs include all of the contract terms defining the relationship between the buyer and seller. A variable of particular importance for utilities undertaking renewable projects in states with RPSs is the decision of which entity will retain the RECs.

RECs are like vouchers, representing proof that 1MWh of electricity was generated by a qualifying renewable resource. The PPA should explicitly state which party will have ownership of the REC – the host buyer or the seller. RECs have independent value for trading and are usually kept by the owner/seller. A host buyer that retains the RECs might expect to pay a slightly higher electricity purchase price under the PPA because of the added value. Tax benefits would belong to the owner/generator (and are often channeled to investors), but the host/buyer would normally want the PPA crafted to enable it to take advantage of state net metering laws.

Various P3 Energy Project Models

P3s are used around the world to build new and upgrade existing public infrastructure as well as operate and maintain public facilities including schools, hospitals, roads, and water and wastewater systems. A variety of P3 models exist, with alternative ways to organize and structure P3 projects, providing communities a spectrum of options to consider. In the application of improved energy efficiency and renewable energy generation at W&WRRUs, P3 energy projects take particular advantage of the models listed below; however, this is not an all-inclusive list. W&WRRUs can be creative and structure arrangements that best suit the capacity, responsibility, and needed allocation of risk for each partner. Appendix A provides a table summarizing the most common P3 models and providing examples from W&WRRU energy projects.
Servicing and Consulting Arrangements

The most limited type of contractual arrangement involves the public sector contracting with a private entity to provide ancillary, non-core functions. A service contract is usually a short-term agreement where the private firm takes responsibility for one or more specific tasks (e.g., billing, meter reading, and leak detection); whereas a consulting contract can involve project-specific evaluation and advisory services (e.g., energy audits, site assessments, and benchmarking analysis).170

Operations and Maintenance (O&M) Agreements

An O&M agreement differs from a servicing arrangement in that the private entity is responsible for all aspects of operations and maintenance of the facility under contract.171 O&M agreements range from short-term (e.g., 2-5 years) to long-term (e.g., up to 20 years) with potential provision for renewal.172

Design-Build (DB)

This is a basic form of P3 in which the public entity transfers project design and construction responsibilities to a private partner, which has the incentive to make the project design as robust as possible because it assumes the risk of design flaws and cost overruns.173

Design-Build-Operate-Maintain-Finance (DBOMF)

Further along the P3 spectrum, the DBOM contract adds operations and maintenance responsibilities to the private partner, which provides the added incentive to employ high quality construction methods and materials to reduce future maintenance expenses.174 Moreover, DBOMF adds financing responsibility for the life of the P3 project to be assumed by the private partner, which maximizes the incentive to be cost- and schedule-efficient so that cash flows begin as quickly as possible for servicing debt and providing adequate returns to equity investors.175

Design-Build-Own-Operate-Transfer (DBOOT)

Under a DBOOT, the private partner will finance, design, build, own, and operate a project for a specified contract period, whereby ownership of the infrastructure assets is optionally transferred from the private partner to the public sector entity at the end of the P3 contract.176

Lease Agreements

The private sector leases infrastructure assets, or facility premises, from a public entity, and is compensated with the revenue stream that the assets generate, rather than on a fee-for-service basis. The risk of future revenue generation is held by the private sector, incentivizing cost control and performance outcomes.177 Asset ownership remains with the public sector.
**Concession Agreements**

Although concessions will inherently contribute to improved W&WRRU energy performance, such an arrangement would not be utilized by a W&WRRU for this purpose alone. Concessions are similar to leases, with longer-term contractual arrangements (e.g., 30-50 years) along with significant transfer of risks and responsibility to the P3 private partner, including full and complete responsibility for investing in its renewal and expansion as needed to maintain the integrity of the infrastructure. Concessions are the point in the P3 spectrum where the full scope of commercial discipline of the private sector is harnessed.\(^{178}\)

**Special Purpose Vehicle (SPV)**

Depending on the P3 arrangement, P3 private partners commonly form a project company, or limited liability corporation, generally organized as an SPV, to contract with the public partner and to provide some combination of the infrastructure asset’s design, construction, financing, operations, and maintenance.\(^{179}\)

**Funding and Financing Mechanisms**

U.S. infrastructure is funded by a combination of tax revenue and user fees, whereas the majority of publicly owned infrastructure assets are currently financed by either: 1) federal grants and loans, state and local expenditures, and municipal tax-exempt bonds, and are therefore ultimately funded by tax revenues; and 2) revenue bonds backed by user fees (i.e., tolls, fees, and charges) generated by enterprise systems such as toll roads, water and sewer systems, airports and public power utilities. Generally, financing is shared across levels of government, with the relative size of the federal, state, and local governments’ role varying by infrastructure sector. With greater reliance on innovative financing through P3s, the funding burden is expected to shift more from taxpayers to users of infrastructure services.\(^{180}\)

**Dedicated Revenue Streams**

As public entities examine ways to leverage their revenue-generating infrastructure assets in order to take advantage of P3 alternatives, a financially viable P3 requires a dedicated revenue stream, whether from user fees (e.g., water service bills), sale of electricity (e.g., renewable power generation under a PPA), or directly from the government in the form of availability payments (i.e., periodic payments if the provided service meets contracted quality standards).\(^{181}\) State legislatures, city councils, and other authorizing agencies are examining options to enable new or increase existing user fees, rates, or taxes, to allocate sufficient revenue in support of their infrastructure investment objectives. While politically challenging, these measures are a straightforward way to generate the recurring revenue necessary for a successful P3. However, using predictable formula-based rate setting can also temper political resistance, keep the rate setting process transparent, and also protect consumers from rate shocks.\(^{182}\)
Alternative Financing Options

The cost of capital and availability of financing play a critical role in determining the appropriate P3 structure for projects in the W&WRRU sector. Accessing external financing is often necessary for implementation of capital-intensive facility upgrades, energy optimization projects, or projects with relatively long payback periods.\textsuperscript{183} While traditional financing options still exist – including tax-exempt government bonds, low-interest state revolving loans, commercial loans, and grant funding\textsuperscript{184} – increasing fiscal pressures at all levels of government have led to reduced commitments for infrastructure, whereas partnering with a private entity can offer alternative financing structures and new sources of capital.\textsuperscript{185}

Local governments increasingly view P3s as a viable way to address pressing infrastructure investment needs, given ongoing fiscal pressures at all levels of government.\textsuperscript{186} P3s can be structured to allow the public sector to avoid adding to their long-term debt obligations by partnering with the private sector to finance a project, whereas costs with financing, constructing, operating, and long-term maintenance of infrastructure are no longer the direct responsibility of the government.\textsuperscript{187} The P3 private partner will bring the investment expertise to take full advantage of available financial incentives, including tax incentives, rebates, grants, and market-based credits for renewable energy generation and energy efficient improvements as discussed above in Chapter 2, and also will leverage some combination of alternative financing mechanisms, such as the following examples:

\textbf{Self-Funded through Guaranteed Cost Savings.} As previously discussed, under an ESPC, the private P3 partner guarantees that infrastructure improvements, replacements, or upgrades will deliver a specified amount of energy, water, and operational savings over a period of time. Guaranteed cost savings through proven measures are leveraged to secure financing, such as bonds, for the capital improvements.\textsuperscript{188}

\textbf{Private Activity Bonds (PABs).} PABs are tax-exempt bonds issued by state or local governments on behalf of private developers of a project. To be eligible for tax-exempt status, 95 percent or more of the bond’s net proceeds must be used for a qualified purpose, such as transportation (highways, airports, and ports), public works (sewage, solid waste, and water), health (hospitals), and education (universities and private schools). Depending on the qualified purpose, state-level caps may limit the volume of PABs, which can be issued any given year.\textsuperscript{189} The water and wastewater industry has advocated for the removal of state-level volume caps of PABS, claiming that a lower cost of borrowing could provide greater leverage of private equity than is currently available, and thus bring more capital (whether fully private, or in the form of P3s) into the market for water and wastewater projects.\textsuperscript{190}

\textbf{Equity Investment.} Alternative financing through equity investment can come from capital sources such as infrastructure funds, pension funds, and institutional investors who seek investment in public infrastructure projects in exchange for its steady, long-term, lower-risk returns. In many instances, the P3 private partner responsible for execution of the project invests its own company’s capital in the P3 project.\textsuperscript{191} Figure 4.1 captures the shares of equity investment committed by various investor categories in U.S. P3 projects from 2007-2016.

Within the figure, Infra Funds (i.e., infrastructure funds) represent a fundraising mandate where capital is raised from diverse sources, such as pension funds and institutional investors, and then invested across various P3 infrastructure projects. Corporates are predominately represented by construction firms, which include builders and operators, as well as P3 project developers. Pension Funds represent direct investment in individual P3 projects, rather than through diversified
infrastructure funds also known as an indirect investment. Over the 9-year history, in excess of $4.6 billion in equity has been invested in U.S. P3 projects with 2012 and 2016 marking the highest years at approximately $856 million and $883 million, respectively.¹⁹²

**Figure 4.1 U.S. P3 equity investor type 2007-2016**

**Credit Enhancements.** Credit enhancements can make project debt more attractive to investors by reducing their risk exposure. Credit enhancements may take several forms such as loan guarantees, bond insurance, cash reserves on the project company’s balance sheet to insulate investors in the case of lower-than-expected project cash flows, and public project sponsor guarantees for debt issued by the project company.¹⁹³

**Emerging Options.** Two new financing tools merit discussion. First, enacted in 2014 as part of the Water Resources Reform and Development Act, the Water Infrastructure Finance and Innovation Act (WIFIA), a new EPA-administered program, will provide low-interest federal loans for up to 49 percent of projects costs for large drinking water, wastewater, stormwater, and water reuse projects. WIFIA is expected to accelerate alternative infrastructure financing solutions, and in particular P3 projects, as modeled after the Transportation Infrastructure Finance and Innovation Act of 1998 (TIFIA), which has provided over $16 billion in assistance since 1999 to transportation projects costing nearly $60 billion. To be eligible for assistance, projects must be determined to be creditworthy with a dedicated revenue stream for repayment, thus limiting the federal government’s exposure to default and also encouraging private capital investment. The low-interest loan combined with the remaining 51 percent project financing will reduce the total cost of capital, enhancing the bankability of projects, especially when compared to debt-equity financing that blends higher cost debt contributions such as commercial loans.¹⁹⁴

Second, socially responsible investors represent an evolving source of capital. For example, an emerging market in green bonds, which enable capital-raising and investment to specifically finance climate change resilient projects or other environmentally beneficial projects,
such as renewable energy and energy efficiency, biodiversity conservation, sustainable water management, and clean and drinking water projects to name a few, were introduced initially in 2008 and have since experienced a rapid increase in issuances. The Climate Bond Initiative reported that $41.8 billion (U.S.) in labeled green bonds were issued globally in 2015, with the U.S. comprising $10.5 billion of the total, an increase from $36.6 billion (U.S.) in 2014. Amid the rapid growth, investors continue to increase scrutiny on ongoing reporting and external assessment of invested capital, project evaluation, and environmental outcomes. For the green bond market to have long-term credibility, investors and other stakeholders are requiring evidence that the projects funded have in fact delivered the intended environmental benefits. Robust disclosure frameworks, second party opinions, and third-party independent assurance are further satisfying the market demand for increased transparency, while also increasing the marketability of bonds.

P3 PROCUREMENT OVERVIEW

In many cases, a state’s P3 authorizing legislation outlines a generic process for agencies to procure a P3. However, the actual procurement will require the development of a wide variety of internal rules and processes. A well-planned and effectively executed procurement is central to a successful P3 and in return will prevent unnecessary expenditures of time and resources for both the public and private sectors.

An overview of common P3 procurement and contract management practices is outlined below. Chapter 6 provides recommended approaches, guidance, and best practices on these topics.

Competitive Bidding

The most common approach to the competitive bidding process is a two-step request for qualifications/request for proposal (RFQ/RFP) procurement.

RFQ

The RFQ sets out to identify the best-qualified bidders to be invited to prepare proposals for the P3 project. Serving several purposes, the RFQ formally advertises the project, communicates key project information, and confirms market interest in the project while providing an opportunity for interested bidders to comment on the proposed project structure. Typically, the RFQ is used to shortlist three qualified bidders, with the selection based on: 1) financial capacity; 2) financial capability; and 3) experience, resources, and track record.

RFP

During the RFP phase, an initial interactive exchange between the public partner and its advisors and shortlisted bidders provides an opportunity to discuss design development, obtain feedback, and provide clarification, while influencing the ongoing development of a formal RFP release, and eventual P3 project agreement. Upon proposal submission by bidders, typically separate design, technical, and financial evaluation teams review and assess response sections specific to their focus and grade against the predetermined evaluation criteria. Subsequently, the RFP process commonly allows for negotiation after the preferred proponent is selected.
Contract Negotiations

Once a preferred bidder has been identified, the municipality and the private partner will negotiate final project agreement terms, which typically includes final adjustments to reflect the financing structure of the preferred bidder. The preferred bidder will also finalize contractual agreements with its major subcontractors and close on all necessary financing arrangements. Commercial contract closure occurs when the public and private partners execute the partnership agreement. 203

P3 Oversight and Contract Management

Regardless of the contract scope and the continued public partner’s role and responsibilities, a successful P3 rests on consistent, ongoing, diligent oversight and monitoring of the agreement and the private sector’s performance under the contract. 204 In some instances, funding can be built into the P3 agreement to provide sufficient administrative resources to the public sector for oversight, monitoring, and contractual management. 205 Effective contract administration begins with a well-grounded understanding of the contract and its provisions. The contract will establish the ongoing information required from the private partner, its frequency and timing. For example, once the private partner has satisfactorily delivered a leased asset and started to perform the requisite services, the public partner will need to initiate processes to monitor the delivery of the services in accordance with the contract. The private partner typically will prepare a commissioning plan that describes the steps needed to integrate completion of the asset, the commencement of its services, and the installation of any equipment (if applicable). The public partner will approve the plan and monitor the private partner’s progress. Moreover, the contract management process will evolve throughout the life cycle of the P3 contract and should be reviewed on an ongoing basis to ensure all emerging risks and issues are appropriately considered. 206
METHODOLOGY

This chapter presents five case studies of P3 energy projects at participating W&WRRUs. The research team sought the following information using interviews and available documentation:

- Background information on the utility;
- The utility’s organizational structure, including team or individual roles;
- The identity, role, and responsibilities of key players in the case study project;
- Background on the proposed project, including its timeline, and where applicable, completion and performance;
- Applicable local, state, and federal laws;
- Factors relevant to the choice of the P3 project delivery approach;
- The procurement process and the resulting contract negotiations and terms;
- Performance standards;
- Risk allocation among P3 partners;
- Barriers encountered;
- Success factors; and
- Lessons learned.

Whenever possible, interviews and facility tours were conducted in person. Other materials reviewed in connection with each case study were drawn from the participating W&WRRU, industry and agency publications, and media outlets and included (as available):

- Pre-project studies;
- Requests for Proposals and responses of potential private sector partners;
- Utility staff evaluations of proposals and recommendations for contract award;
- Minutes of governing body records regarding such staff recommendations;
- Contract documents;
- Reports regarding design, construction, and performance of the procured assets; and
- Industry, agency, and media publications regarding any and all aspects of the project’s consideration, execution, and performance.

Staff from each participating utility had the opportunity to review and comment on each draft case study, and the research team conducted additional research and follow-up as indicated. Each of the following case studies begins with a table presenting key facts about each study, including:

- Utility name, location, and size;
- Project type;
- Time frame;
- P3 highlights;
• Drivers;
• Success factors;
• Power generation and use impacts; and
• Financial impacts.

Thereafter, the details of each case study are presented in narrative format.
CASE STUDIES

City of Thousand Oaks, California: Hill Canyon Wastewater Treatment Plant

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Introduction

The City of Thousand Oaks, California (the City) is located between Los Angeles and Santa Barbara and lies alongside the Santa Monica Mountains. The City has grown quickly since its beginnings in the early 1900s and is now home to nearly 130,000 people. With a fifty-six square mile footprint featuring over 15,000 acres of public space and 75 miles of trails, the City cultivates a spirit of environmental stewardship as a matter of longstanding municipal policy.

Thousand Oaks is a General Law City with a Council/Manager form of government. Under this type of government, the City Council is the policy-making body, appointing the City Manager who is responsible for carrying out Council policy. The Council consists of five at-large members who serve four-year staggered terms. Municipal elections are held in November of even-numbered years, and the Council annually selects a Mayor who serves as presiding officer during City Council meetings.
The City’s Hill Canyon Wastewater Treatment Plant (HCTP) provides wastewater treatment for its domestic, commercial, and industrial customers with a treatment capacity of 14 MGD and an average daily flow of 8.5 MGD. Incoming wastewater is treated to an advanced tertiary level, rendering it suitable for unrestricted reuse. As a result, HCTP effluent is recycled for agricultural irrigation and local landscaping projects, generating about $600,000 annually. In addition, the HCTP accepts restaurant grease and other high-organic liquid wastes from the region’s haulers, generating about $400,000 annually and enhancing energy production. These incomes are dedicated to keeping user rates steady and affordable.

**Project Drivers and Success Factors**

In 2005, the City set an ambitious policy for developing renewable electricity generation from alternative sources at HCTP. The development of financial incentives, such as the creation of marketplaces for the sale of renewable energy credits and substantial state grant programs including a self-generation incentive program, encouraged efforts to hit those targets. The availability of those incentives and the desire to avoid the expenditure of ratepayer monies drove HCTP to use the P3 tool to begin its pursuit of greater freedom from reliance on traditional fossil fuels.

Additional drivers included the record of rising electrical costs at HCTP. During the decade leading up to 2006, electrical costs at HCTP rose at an average of 6.9% per year. In 2006 alone, the facility’s rate rose more than 20% to tiered rates averaging $0.0639/kWh. Furthermore, after the initial RFP for a biogas project in 2005, the City Council in 2010 encouraged HCTP’s efforts to promote process optimization, energy management, and sustainability efforts by setting a goal that HCTP be 100% energy self-sufficient by 2014. The City Council and HCTP understood that P3s would be useful in achieving that ambitious goal.

Several factors contributed to the viability of the P3 program. First was HCTP’s entrepreneurial culture. Because it was run like a business, the City’s wastewater operation was widely known as HCTP Inc. It offered a variety of value-added services, including the grease acceptance program referenced above. Second, the plant was sited in a way that left significant space available for solar panels. Finally, the facility’s anaerobic digesters produced substantial amounts of biogas, which had always been disposed of by flaring.

It was against this background that the City and HCTP pursued two projects:

- The development of a biogas project that would either generate electricity and heat through a cogeneration facility or would process biogas into compressed natural gas; and
- The development of a cost-effective solar PV electric generating system.

**The Biogas Project**

HCTP issued an RFP for the biogas project in September 2005. The RFP sought to make greater use of biogas being produced at HCTP at that time and contemplated two possible approaches for energy recovery:
- A cogeneration facility which the chosen proposer would design, build, own, and operate using any technology it identified, with HCTP buying the generated electricity through a Power Purchase Agreement; or
- A biogas processing facility that would produce compressed gas and which the chosen proposer would design, build, own, and operate using any technology it identified.

The RFP required the chosen contractor to:

- Provide an energy recovery system that would use digester gas as its primary fuel source;
- Provide any and all needed interconnections so the system’s electricity production could meet HCTP’s needs, as supplemented by either SCE electricity or Southern California Gas Company (SCGC) natural gas if required;
- Meet all SCE interconnection requirements;
- Provide all necessary piping so the proposed system’s waste heat could be used to meet HCTP’s thermal energy needs, supplemented by SCGC natural gas as required;
- Complete and submit in a timely manner all documentation required to qualify for available power provider rebates and incentives; and
- Obtain all needed permits and approvals.

The RFP, while guaranteeing no grant funding availability but reciting several potential grants being sought by HCTP, identified five selection criteria:

- Specialized experience and technical competence relevant to the proposed work;
- Records of performance from past and current clients;
- Timely staffing and capability under then-current workload;
- Adequacy of proposed performance measures to meet the project’s goals; and
- Cost of each unit of electricity or heat, which would be sold to HCTP during the contract’s proposed ten-year term.

The City and HCTP sent the RFP to eight vendors, six of whom provided proposals and four of whom the City and HCTP interviewed. Among the finalists, two vendors proposed fuel cell technology, one proposed internal combustion engines, and the last proposed microturbines.

Based on an in-depth review of the proposals, City and HCTP staff made numerous findings on each of the technologies and their unit prices, which accounted for California’s Self Generation Incentive Program:

**Fuel Cells.** The proposed capacities of the fuel cells ranged from 450 kW to 475 kW. This low-emission technology was certified by the California Air Resources Board. However, the fuel cells required additional natural gas to produce thermal energy to heat the digesters, and would thus impose additional costs on the City and HCTP. Staff concluded that the system was very sensitive to the quality of biogas and that a minor outage would require a startup time ranging from eight hours to four days. The unit prices submitted by the two vendors were $0.108/kWh and $0.10/kWh.

**Microturbines.** The proposed capacity of the microturbines was 320 kW from two units. This low-emission technology, also certified by the California Air Resources Board, was not as efficient as fuel cells or internal combustion engines. Staff concluded that the system was very
sensitive to high ambient temperatures, which could reduce generation to 220 kW during hot summer days. The unit price submitted by the vendor was $0.075/kWh.

**Internal Combustion Engines.** The proposed capacity of the internal combustion engines was 440 kW from two engines. The emissions of this technology were within acceptable limits of the Ventura County Air Pollution Control District and were considered a clean-air technology. The nitrogen oxide emissions from this technology were estimated at approximately one ton per year, significantly less than the 13.82 tons/year allowed by the District. Staff found the system to be very efficient in generating thermal energy. The technology did not require any additional natural gas for heating the digesters. Staff also favorably observed that the system would respond well to variations in biogas quality and would restart within a short time in the event of any outage. The unit price submitted by the vendor was $0.0639/kWh.

In March 2006, staff recommended that the City Council award a contract to U.S. Energy Services, the vendor that had proposed the use of internal combustion engine technology. This recommendation was based on the technology’s efficiency in generating electrical and thermal energy, its emissions performance, its superior reliability, and the low cost of the power it generated. That low cost would enable significant savings for the ten-year term of the contract while leaving the utility’s options open in the future. Indeed, the low energy cost could help offset the higher energy cost expected from a pending solar power project, described below. Staff also committed to monitor improvements in fuel cell and other technologies so that replacing the engines might be considered at the end of the contract term.

The City Council adopted this recommendation, and the contract was immediately executed. The Council also authorized a PPA involving the expenditure of $425,000 per year and the purchase of 450 kW of electricity annually for ten years, at an initial rate of $0.0639/kWh with a two percent escalation every year. The City and HCTP anticipated the following measurable results:

- The offset of power generation emissions totaling more than 318 tons of carbon dioxide per year that would have otherwise been released into the atmosphere, which would be equivalent to taking more than 600 cars off the road per month;
- The production of electricity equivalent to that typically used by 148 homes; and
- A projected saving to HCTP of more than $130,000 every year (in excess of $1.3 million over the ten-year contract) on utility costs.

**The Solar Project**

HCTP released an RFP seeking a solar PV contractor in January 2006. It stated its project goal clearly: to enter into a PPA for a negotiated term between HCTP and the chosen solar PV contractor whereby the contractor would design, build, own, and operate the required solar system infrastructure. The RFP identified the treatment plant’s drying beds as the site for the PV system’s installation, which it estimated had “the potential of accommodating solar PV systems ranging in size up to 1 megawatt.”

The RFP required the chosen contractor to:

- Obtain all needed permits and approvals;
- Provide all labor, taxes, services and equipment which the project required to succeed;
- Design the system to maximize its output;
• Place the PV systems as required by the RFP to avoid interference with the treatment plant’s operational needs, including siting the solar array ten feet above the ground so vehicles could drive beneath it;
• Ensure connections with other power sources and the SCE distribution system;
• Provide specified warranties and guarantees; and
• Complete and submit in a timely manner all documentation required to qualify for available rebates and incentives.

The RFP identified four selection criteria:

• Contractor qualification and experience in “developing, owning, operating and maintaining solar PV projects that meet power production specifications over significant terms;”
• The merit of the technical proposal and the implementation schedule;
• Project team and organizational approach; and
• Cost-effectiveness of the project, measured by the proposed cost per unit of electricity and the proposed duration of the term.

Two vendors submitted responses to the RFP, and a review panel representing the Public Works Department, the Finance Department, and the City Attorney’s office interviewed each vendor team. Following evaluation of the proposals and interviews, the review panel concluded that although both vendors were qualified, Powerlight Corporation, through its subsidiary, Solar Star TO, LLC (Solar Star), was best qualified to provide the required services. This decision was based in part on the system that Solar Star proposed, which would use rotating, high-efficiency solar panels to track the sunlight throughout the day, resulting in the greater power generation of the two proposals.

During negotiations, the selection committee and Solar Star explored a variety of potential project variations. These variations included reducing the height of the solar array structure from ten feet to four feet to reduce construction costs, using a higher flat rate fee as compared to a lower rate with an escalation factor, and the possibility that the City might eventually purchase the system. Based on its evaluation, staff recommended in June 2006 that the City Council authorize execution of a contract with Solar Star containing the following provisions:

• A requirement that Solar Star would design, build, own, and operate the required power system infrastructure, proceeding with a four-foot high solar array structure;
• A commitment that HCTP would buy the power this system would produce, which was estimated to be approximately 1,031,256 kWh of electricity per year, at a PPA flat rate of $.165/kWh; and
• A twenty-year PPA term with the opportunity for early termination and HCTP purchase options starting at year seven.

City staff noted two very specific considerations in supporting this recommendation. First, in January 2007, the City would be subject to revised SCE rates, which included high summer peak rates of up to $.42/kWh. Staff shared an analysis, depicted in Figure 5.1 below, that compared the City’s power rates based on SCE’s historical and projected rates against projected rates for the biogas and solar projects: the resulting chart, reprinted below, showed substantial savings by
reduced reliance on SCE power even though the cost of solar power would not be less than that of SCE power until year 10 of the PPA. Thus, the City could obtain certainty in its power rates and protect against market volatility.

Source: Hill Canyon Wastewater Treatment Plant.

Figure 5.1 Hill Canyon Wastewater Treatment Plant energy rate projections

Second, in January 2005, staff applied for grants under the Self-Generating Incentive Program administered by SCE. The incentive program, which SCE conditionally approved on March 15, 2006 with the requirement of execution of a signed contract with a solar power vendor within 120 days, would provide $3 per watt for a total of $1.5 million for this project. The deadline for a fully executed contract with a solar power vendor was July 13, 2006. Under the proposed contract, the grant would be assigned to Solar Star to underwrite the project. Staff concluded that the availability of this grant made this project feasible.

In light of these considerations and the tight timeline for action, the Council approved the contract in late June 2006, and it was executed right away. Additionally, the Council authorized the PPA to include expenditure of available funds of $170,157 per year for a term of twenty years for the purchase of 1,031,256 kWh of electricity annually at the rate of $0.165/kWh. Construction began in November 2006 and energy production began in April 2007.

Performance of the 2006 Biogas and Solar Projects

With biogas and solar contracts in place, HCTP had high hopes for the 2006 projects. The internal combustion engines were expected to supply 50 percent of HCTP’s electricity needs, with
the solar project supplying another 15 percent of the facility’s needs during the peak period of the day when electricity was most expensive.

Because each project was owned and operated by a third-party private sector owner, HCTP expected each owner to possess the technical skill necessary to operate and maintain each system. In both cases, HCTP’s expectations were met. The solar PV system proceeded as expected, following a few minor initial adjustments, with electricity generation meeting expected levels and operations proceeding as planned. Figure 5.2 presents an image of the solar PV system.

Early in the design phase of the internal combustion engines for the biogas project, during the summer of 2006, HCTP’s contractor recognized that the engines would produce more heat energy than would be needed to heat the HCTP digesters: an additional 1,000,000 BTUs of surplus heat would be available. The contractor recognized a valuable engineering opportunity, and it recommended utilizing this extra heat to supplement HCTP’s Operations Building heating system.

The biogas RFP had not required upgrading the heat exchange system for the Operations Building, but after reviewing the option of utilizing the surplus heat, City and HCTP staff recommended an upgrade of the existing heat exchange infrastructure so this opportunity could be seized. On one hand, the transfer of this surplus heat from the internal combustion engines to the existing Operations Building would involve over $167,000 of modifications and upgrades, including:

- Mechanical and electrical design;
- Additional hot water supply and return piping;
- Additional electrical conduits and wiring;
- Installation of heat exchanger;
- Installation of new pumps; and
- Instrumentation and controls.

But the use of this surplus heat would result in cost savings of approximately $40,000 per year as compared to buying natural gas for heating the Operations Building. Given that the cost for these upgrades would be recovered in fewer than five years, the City approved Amendment No. 1 to the biogas contract in November 2006.

Construction was complete in 2007, and, as permitted by the contract with the City, U.S. Energy assigned the contract to Municipal Energy Systems, Inc. (MES) (a local energy services
As mentioned above, HCTP had also launched a new program to receive restaurant grease. The higher organic content gave rise to additional biogas generation, which could support a third internal combustion engine for an additional capacity of 360 kW. If this opportunity were realized, HCTP could produce 100% of its electricity needs on-site and thereby meet the City Council’s 2010 challenge.

There was a further incentive to proceed expeditiously: MES had secured a $420,000 Self-Generating Incentive Program grant for an additional 420 kW of onsite electric generation. This grant came with a deadline of November 30, 2010 for the new third cogeneration unit to be operational. As a result, staff requested and the City Council granted authority to execute Amendment No. 2 to the biogas contract on June 20, 2010. The Council simultaneously approved expenditures to buy the increased amount of power this expanded contract would produce and reset the clock on the term of the PPA, so that it would proceed for a period of ten years from the date of Amendment No. 2.

**Confronting Challenges and Capturing Success**

The new internal combustion engine came online in late 2010. By the end of 2012, however, the three engines and solar system were providing only 86% percent of HCTP’s electricity needs. In a December 2012 report to City Council, HCTP staff made the following observations and recommendation:

The current contractors, MES and MFC, have been challenged with technical issues involving engine cooling and gas conditioning, resulting in less than optimal renewable energy production. Accordingly, MES and MFC desire to assign the contract to CHP Clean Energy, LLC. (CHPCE). City staff support this assignment.²⁰⁹

HCTP staff offered this support based on its own review of CHPCE’s successful work in the biogas-to-energy field, which featured numerous successful California projects, one of which the City-HCTP team visited. As a result, staff were confident that CHPCE would be able to meet the Council goal of 100% renewable self-generation and overcome some of the technical issues that had affected past energy generation efforts. An additional incentive for Council approval of the CHPCE assignment was that the firm had already secured a $1.7 million Self-Generation Incentive Program grant from SCE. This grant was critical: it would allow CHPCE to replace two
of the original engines with a new 650kW unit, improve engine cooling, and replace the gas conditioning system.

This new arrangement, which the Council approved, also yielded a new contract between the City-HCTP team and CHPCE. Although that new contract tracked the key points of the original 2006 biogas cogeneration contract, it added critical performance guarantees and other provisions, including:

- A 15-year term commencing when the new 650 kW engine went online;
- A City guarantee of minimum gas production coupled with a CHPCE guarantee for annual electrical output;
- A CHPCE guarantee that the engines would perform at least 90% of time, inclusive of scheduled downtime for maintenance;
- An engine buy-out option exercisable by the City and HCTP after five years based on fair market value;
- Quarterly reconciliation of accounts as necessary based on SCE billing practices;
- CHPCE’s commitment to create a separate LLC for the project at HCTP to allow for better management of specific contract requirements.
- A continuation of previous PPA pricing terms.

After installation of the new unit, power production commenced in accordance with the contract requirements. The combined biogas cogeneration and solar power production have enabled HCTP to meet the City Council’s goal of 100% energy self-sufficiency. With the right partner and the right technology, retired HCTP Superintendent Chuck Rogers sees the HCTP energy P3 in very simple terms: “It’s a good deal for everyone.”

Conclusions

Ultimately, Rogers reports that the utility’s use of PPA contracts has worked well and saved significant money for the utility. The numbers say it all: cogeneration savings since the inception of the project have exceeded $1,000,000 over purchasing grid produced electricity, and annual electric purchase savings going forward are expected to be $400,000, with only a minimal amount of electricity being purchased from the grid on an episodic basis.

Rogers is grateful to have had very supportive city leadership in both the city manager’s office and the City Council. But he is careful to note that he and his team worked hard to gain the trust with which his proposal was greeted, having invested years of effort into turning the wastewater treatment plant into its now well-run status.

Furthermore, he notes that project advocacy “was accompanied by a good business plan,” and the project delivered on that plan’s projections. Rogers shared the performance reports on the project as it proceeded, providing, for example, annual reports demonstrating that cogeneration was a money-maker for ratepayers.

Rogers is quick to credit engineer Mark Capron, the treatment plant’s part-time employee who continues to bring enormous creativity and a strongly adaptive attitude to a one-man “Ideas and Engineering” unit. He characterizes Capron as a critical resource throughout the lengthy effort to “optimize and make things more efficient” at the HCTP, with one of those important efforts being the accomplishment of the successful PPAs.
But Rogers carefully notes that a PPA contract needs to be both well-crafted and stringently enforced. Moreover, he sees two elements that a PPA contract absolutely must address:

- The need for well-defined operational and power output performance measurements; and
- The requirement that the relationship include carefully defined maintenance standards, backed up by readily available contractor maintenance staff.

With these concerns addressed, Rogers regards the PPA tool as useful because it gives a public utility the capacity to undertake a venture in a way that is less risky than doing it in-house. As he sees it, the reality is that the operation of a cogeneration facility is not generally a core competency of the staff of a wastewater treatment plant, where the primary focus cannot shift from permit compliance. Additionally, Rogers notes the importance of taking things a step at a time, with a contractor showing, for example, mastery of the basics of cogeneration operation before moving on to expanding waste receiving (with increased tipping fees) for the creation of more methane gas and the generation of more power.

In conclusion, the HCTP effort to achieve energy self-sufficiency through the production of power through biogas cogeneration and solar PV has made Rogers a supporter of the PPA tool. It was especially useful in an institutional setting where political support was strong, capital was scarce, core competencies did not favor the activity being conducted in-house, and an entrepreneurial commitment to excellence prevailed. The record reflects that all those elements were in place in the City of Thousand Oaks.
Village of Ridgewood, New Jersey: Ridgewood Water Pollution Control Facility

**Ridgewood Water Pollution Control Facility At-A-Glance**

<table>
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<th>Utility Size</th>
<th>Average daily flow: 2.5 MGD; daily design capacity: 5.0 MGD</th>
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<td><strong>Project Type</strong></td>
<td>PPA/DBOOT for CHP (internal combustion engine, biogas feedstock) and solar PV</td>
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<td><strong>Time Frame</strong></td>
<td>2011 to present</td>
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<td><strong>P3 Highlights</strong></td>
<td>An operationally and financially successful P3 based on community consensus, sound risk allocation decisions, leveraging of incentives, and sharing of revenues.</td>
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<td><strong>Drivers</strong></td>
<td>Village-wide commitment to sustainability; desire to reduce facility’s peak electricity demand and lower electricity costs; availability of tax incentive.</td>
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<td><strong>Success Factors</strong></td>
<td>Local government structure simplifies project approval process; champion within organization undertook pilot studies; P3 contract viewed as fair by all parties.</td>
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<tr>
<td><strong>Power Generation and Use Impacts</strong></td>
<td>Generation of over 2.6 million kWh of biogas-fueled electricity and almost 600,000 kWh of solar power during the first thirty-three months of operation. Excess power is delivered to distribution grid pursuant to arrangement with electric utility. Offset 2200 tons per year of carbon emissions.</td>
</tr>
<tr>
<td><strong>Financial Impacts</strong></td>
<td>Electricity savings of $33,000 over initial eighteen-month period. Receipt of 20% of FOG tipping fees; revenue from sale of RECs.</td>
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</tbody>
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**Introduction**

The Village of Ridgewood (Village) is located in Bergen County, New Jersey, approximately 20 miles northwest of midtown Manhattan. It is slightly more than 5.8 square miles in size with a population of 24,958. As a suburb to New York City, the Village is a consistently ranked as one of the highest-earning towns in the nation with its 2013 median family income of $198,122 and median home price of $611,000.213

The Village Council is Ridgewood’s governing body, exercising legislative authority, awarding contracts, and adopting an annual budget. The five part-time councilors are elected to staggered four-year terms and every two years select one of their own Council colleagues to serve a two-year term as mayor. The Council selects a Village Manager who exercises day-to-day executive authority and to whom all Village department heads report. Within this framework is the public works department, which operates the Water Pollution Control Facility (WPCF) to collect and treat the community’s wastewater.
The WPCF is neither a Municipal Utility Authority nor a regulated utility under the provisions of New Jersey law. As a result, it is a relatively simple process to seek local approval, study, and proceed with a capital improvement project. If the Village Manager concurs with the Director of Public Works’ recommendation to proceed with a project and forwards the matter on to the Village Council, a favorable council vote is the only approval required.214

The Village Council is committed to promoting environmental innovation and problem-solving as a matter of longstanding municipal policy. For example, the Council created the Ridgewood Environmental Advisory Committee (REAC), which was charged to “assist … Ridgewood and its residents in addressing environmental concerns by advocating ‘best use’ practices which protect the environment, respect the ecosystem, promote sustainability and reduce climate change.”215 A community Sustainable Energy Project program featuring many practical and productive actions was the result of this commitment, and its goals include:

- Promotion of recycling;
- Environmental education;
- Adoption of sustainable policies and practices regarding public fields and private yards; and
- Engagement of opportunities to reduce the Village’s carbon footprint.

Among related goals was to institute a combined heat and power and solar PV program that would help ease the WPCF’s peak power demand, which often coincides with the supplying electric utility’s periods of peak power demand and corresponding higher prices.

**The WPCF, Its Energy Needs, and Its Power-Generation Potential**

The WPCF, located across the Village line in the Borough of Glen Rock, had been built in the 1960s and thereafter periodically upgraded to a capacity of 5.0 MGD, with average daily flows of approximately 2.5 MGD. The WPCF treats to anaerobic sludge digestion using two digesters for the reduction of primary and secondary sludge. Resulting biogas was used to heat digester sludge; excess biogas was flared. The plant, which is located in a residential neighborhood and is adjacent to a busy county park, serves the residents and businesses of the Village as well as several hundred homes in nearby municipalities.

With average daily electricity use ranging from 4,100 to 4,400 kWh, the power-intensive operation of the WPCF made it one of the Village’s largest consumers of electricity. As mentioned above, the plant’s periods of peak flow corresponded with the electric utility’s periods of more-costly peak power demands. These considerations led the plant’s director, Christopher Rutishauser, to view the six-foot flame of the biogas flare as a symbol of lost opportunity: he saw it as a waste of fuel that might be used to reduce power costs and generate carbon savings.

But Rutishauser recognized the need to investigate whether Ridgewood’s WPCF could be a meaningful generator of fuel and power. Larger wastewater treatment plants could produce enough biogas to generate meaningful amounts of the electricity required for operational needs. Rutishauser launched two pilot projects to investigate whether supplemental feed sources and process additives would enable WPCF to similarly self-generate notwithstanding its smaller size.

The first pilot project, which required approval from both the Village government and the New Jersey Department of Environmental Protection (NJDEP), tested the impact of a limited liquid waste acceptance program from local septage haulers. This program added grey water and
septage water to incoming flows from the WPCF collection system; ultimately, the pilot study demonstrated that those feed sources supplied enough additional carbon-source material to make a biogas project viable, notwithstanding that the program did not accept fat, oil, and grease (FOG).

The second pilot project involved a year-long study of the use of a bio-organic catalyst additive, EcoSystem Plus®\textsuperscript{216}, which was provided to the WPCF at no cost for purposes of demonstrating its value.\textsuperscript{217} The goal of this effort was to test whether the product would increase biogas production and reduce energy consumption. Among the results of the study were the following:

- Ridgewood increased the amount of methane produced by 62%, which reduced the consumption of natural gas by 70%;
- The volume and weight of sludge was reduced by 29%, lowering the cost of off-site disposal by over $18,000; and
- Electricity costs were reduced for wastewater aeration in an amount projected at $48,000 annually.

With these technical considerations satisfied, Rutishauser and Village leaders considered financing a biogas energy project either through a twenty-year bond issue or through a P3. Desiring to avoid new debt and shed project risk, the Village decided to pursue a DBOF P3, under which it would buy back electricity at an agreed-upon price and would ultimately take ownership of the system.

\textit{The Village’s RFP Process}

The Village released the RFP in June 2011.\textsuperscript{218} Noting that the WPCF “is striving to be an environmental leader in the community by reducing its greenhouse gas emissions from the plant,” the RFP recited two very specific energy goals for the project.

The first goal was to “[m]aximize production of electricity and heat at the WPCF so as to minimize the requirement to purchase from the utilities, thereby recovering energy from the waste and improving the WPCF’s carbon footprint.” This goal would be achieved through the installation and use of an engine-generator, with the contractor also providing maintenance services and operating assistance throughout the term of the contract.\textsuperscript{219}

Second, the RFP sought additional electricity generation through solar PV. The RFP contemplated that the contractor would maximize solar energy recovery by installing solar panel arrays on the grounds of the WPCF and on the roofs of the Village Hall, the main firehouse, the community library,\textsuperscript{220} and the emergency medical services headquarters.\textsuperscript{221} The contractor would also provide maintenance services for the solar arrays throughout the contract term.

The Village’s RFP anticipated that the selected contractor would pay all project costs and finance them over the life of the contract with an expected term of up to twenty years. Moreover, the contractor would provide all design, engineering, construction management, component construction, and ongoing operations assistance support “to maximize the ultimate energy production from the project.” The Village would take ownership of the project assets at the end of the contract term.

As stated in the RFP, the transaction’s value to the Village would be realized through its ability to “purchase electricity for its needs at a cost less than the current suppliers charge from sustainable sources and reducing its use of natural gas over the term of the contract.” The RFP
contemplated a PPA whereby the Village would purchase all available heat and power at the WPCF as well as all electricity generated from the solar power panel arrays. Its payment for this purchase would provide a revenue stream through which the contractor would begin to pay down its debt and receive a return on its investment. The RFP also contemplated the possibility of further revenue to the contractor from such potential sources as grants and renewable energy and carbon credits.

Among other things, the RFP required that each respondent supply both a proposed PPA and detailed information relating to the electricity-generation components of the RFP, including:

- Identification, quantification, and quality assessment of existing and potential biogas production;
- Identification of an appropriate CHP technology for the WPCF retrofit;
- Consideration of CHP waste heat reuse;
- Value estimating of power and heat to be produced by the recommended CHP technology;
- Consideration of solar panel placement issues;
- Assessment of solar power transmission equipment requirements;
- Determination of the quantity of solar power to be supplied; and
- Presentation of recommended CHP and solar panel array designs.

The proposed cost of the project was also to be stated. The RFP envisioned that the selected proposer would meet with the Village council in a workshop session to make a presentation that provided greater detail on a variety of project concerns, including:

- Regulatory requirements and permitting;
- Construction plan and schedule;
- An operating plan and explanation of cost savings to the Village; and
- An explanation of the payment plan for the proposer as well as a discussion of project terms and guarantees and its proposed term.

The release of the RFP prompted thirteen firms to register as plan holders, four of which ultimately submitted proposals to the Village. Rutishauser and his team reviewed the proposals and consulted with REAC, and determined that the most complete and detailed proposal was that submitted by the team headed by Natural Systems Utilities, LLC (NSU) of Hillsborough, NJ.

The NSU Proposal

NSU’s proposal was geared toward greater optimization of the anaerobic digestion process at the WPCF and suggested that the WPCF could be powered entirely by renewable energy by expanding the liquid waste program to include FOG. The plan also included the following elements:

- The use of a CHP generator with estimated capacity of 180 kW of power;
- An array of solar panels at the WPCF with a capacity of 268.8 kW; and
- Solar panels at other locations throughout the Village, for a cumulative capacity of 181.92 kW.
The NSU team would provide the services through a new business organization known as Ridgewood Green Responsible Management Entity, LLC (RME), consisting of NSU, Middlesex Water Company, and American Refining and Biochemical. These three entities would provide the entire investment required for the project. Proposed supporting members of the project team were:

- HDR Inc. and its affiliate, Hydroqual, Inc., which would design the facility in conjunction with Bio-Organic Catalyst, Inc., a wholly-owned subsidiary of the pilot study’s additive manufacturer;
- Advanced Solar Products, Inc., which would provide turnkey installation of the required solar energy equipment; and
- NSU’s construction group, which would provide construction services.

The proposal contemplated a twenty-year contract, with a first-year PPA price of $0.12 per kWh; that price would be subject to an annual 3% escalator.

Given all these considerations, Rutishauser concluded that the NSU proposal provided what he and the Village sought through the RFP: a partner that would create, at no capital cost to the Village, a biogas-solar power project centered on the WPCF that would enable the WPCF to meet its energy needs at lower prices. The Village Council unanimously gave its assent in September 2011.

With these approvals in hand, contract negotiations were promptly undertaken and expeditiously concluded, resulting in the execution of a “Water Services and Power Purchase Agreement” between the Village and RME in December 2011.

**Project Development, Launch, and Performance**

Contract execution in December 2011 enabled RME to take a critically important first step before the end of that calendar year: ordering the project’s engine generator before the expiration of a 30% tax credit program, thereby capturing its benefit for financing the project. According to RME President Donald Rogers, securing this tax credit was a critical ingredient for the private sector partner’s financial success in undertaking this green energy initiative.

Thereafter, the RME team undertook the final design of the Ridgewood energy project and its FOG waste receiving and storage station, biogas conditioning system, biogas engine-generator set, and solar arrays at four Village facilities. During this period, the team secured all needed permits and ordered equipment and system components. An especially long lead time was required for the electrical switch gear needed for net metering operations at the WPCF.

RME’s contractor then began construction of the biogas component of the project, first installing the FOG receiving and storage tank and its controls at head of plant. Next came installing the streaming and waste distribution system whereby FOG would be fed into the digester. Installation of the CHP generator engine and associated equipment and controls then followed. This work was completed by the end of 2012, as was the installation of the projects four solar arrays.

Power generation began on July 1, 2013, and the team engaged the most challenging aspect of the project: tuning the engine generator and shaking down the FOG streaming and waste receiving system. Ultimately, as operating experience grew, RME identified and successfully tackled three issues:
• The need to modify the valves to the waste receiving control and FOG pumping system to ensure they functioned well in cold weather;
• The need to upgrade the screening system to remove rags, plastic cutlery, straws, and other foreign objects from incoming FOG loads, received in batches of up to 7,000 gallons in under 15 minutes, before they were pumped to the digester; and
• The need to double FOG holding capacity given the challenge encountered in managing variations in flow and maintaining a consistent supply of material during winter months when weather impacts haulers operations.

As designed and built, the project employs state-of-the-art technology and processes to optimize performance. Patented technology developed by Natural Systems Utilities provides online real-time monitoring of digester alkalinity so the FOG feed rate can be proactively managed to achieve maximum biogas production without posing a risk to the digester biology. Biogas composition is also monitored online to provide early warning of a potential digester overload. The captured biogas is cleaned through a series of reactive filters to remove hydrogen sulfide and siloxanes that would otherwise be detrimental to engine life. The biogas conditioning system also removes moisture and particulate matter from the biogas to improve combustion performance.

RME’s Rodgers emphasizes the importance of the project’s FOG acceptance program to the viability and success of Ridgewood WPCF energy generation initiative, noting that the combined biogas from the co-digestion of FOG and wastewater sludge (approximately 4,000 cubic feet per hour) is sufficient to produce 240 kW of electricity in an internal combustion engine modified to use biogas. The co-generation system can also provide up to 1.2 Million BTU/hr of heat for digester and facility space heating.

Since the start of commercial operation in July 2013 through March 2016, the project had generated over 2.6 million kWh of power from biogas, as well as almost 600,000 kWh of solar power. Over 5 million gallons of FOG had been received, thereby diverting this material from non-beneficial disposal. Rodgers notes that tipping fees, 20% of which go to the Village, with 80% flowing to RME, are variable and depend on volume, timing, consistency, and nature of waste for FOG. Figure 5.4 presents an image of the project.

The carbon offset associated with renewable energy production is over 2,200 tons thus far, equivalent to removing approximately 200 cars from the road (there is no revenue associated with this offset). Finally, all of the project’s power producing facilities are set up to shed excess load to the grid when electricity production exceeds demand. RME uses brokers to sell the solar and biogas-generated RECs, the revenue from which accrues to the benefit of the investors.
Conclusions

Given its results, the Ridgewood project represents a compelling example of the success that a well-structured P3 can provide in meeting the energy needs of a wastewater treatment facility. Both RME’s CEO Rodgers and Ridgewood Director Rutishauser speak of the project in very positive terms and hold it up as an example to others. Rodgers is emphatic – he would urge any utility to give serious attention to the Ridgewood model, commending its RFP and contract. Three key considerations support that point of view:

- Ridgewood allowed the private partner to take full advantage of available tax incentives, especially the 30% tax credit for the CHP component: “without this ingredient, we could not have made this project work,” Rodgers says.226
- Ridgewood crafted a contract that works for both parties: “it is not one-sided and instead created a win-win scenario,” notes Rodgers.227
- Ridgewood has realized economic value from this venture; for example, from July 2014 through December 2015, the Village saved $33,000 in the cost of the power it purchased and received $58,703 as its share of FOG tipping fees.

Rutishauser is equally emphatic in his belief that any wastewater treatment plant with anaerobic digester “should certainly consider harvesting its biogas for reuse as we have done.” And he hails its financing approach, whereby private financing produces a “positive-energy, environmental and economic program” without “taxpayers getting a greater debt they have to worry about paying.”228

Source: Courtesy of Natural Systems Utilities, LLC.

Figure 5.4 Biogas fueled engine generator at Ridgewood WPCF
Rockland County, New York: Rockland County Sewer District #1

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**Introduction**

Rockland County, New York is located on the west bank of the Hudson River thirty-three miles north of New York City. Part of the multi-county New York Metropolitan Area, the County is 176 square miles with a population of over 286,000. An elected County Executive and a seventeen-member elected legislature oversee critical county functions such as consumer protection, special education, elections, health and social services, highway and public transportation systems, park services, and wastewater collection and treatment. One county agency through which this wastewater management obligation is fulfilled is the Rockland County Sewer District #1 (RCSD).

RCSD’s service area includes the Towns of Ramapo and Clarkstown and several parcels in the Town of Orangetown. Within that region, RCSD operates and maintains a collection system consisting of major interceptors, twenty-seven pumping stations, and a screening facility; it is also responsible for the operation and maintenance of sanitary sewers in the Villages of Spring Valley and New Square. RCSD provides most of its treatment services through a wastewater treatment plant (WWTP) located on Route 340 in Orangetown which it owns and operates.229

**RCSD’s WWTP and Energy Profiles**

The WWTP’s treatment process relies on the use of mechanical bar screens, a pump station, aerated grit chambers, primary settling tanks, rotating biological contactors, secondary settling
tanks, gravity thickeners, two digesters, and dewatering. After grit removal, the process line splits into two main treatment trains – Train A and Train B.

- Train A, with a capacity of approximately 10 MGD, was the original WWTP, which included primary clarification and an activated sludge plant that was constructed in the 1960s. The biological process for Train A was retrofitted to a Rotating Biological Contactor (RBC) treatment process in the 1980s.
- Train B includes primary clarification and was built in the 1980s as a RBC process with a design capacity of 18.9 MGD.

The operation of RCSD’s WWTP requires the use of substantial energy at a substantial cost. During the 2010-11 operating year, for example, RCSD used 10 million kWh at a cost of approximately $900,000 and 190,000 hundred cubic feet (ccf) of natural gas at a cost of approximately $180,000. The WWTP was designed to allow biogas to fuel each of three heat exchangers that heat the sludge to maintain anaerobic digestion temperatures. The WWTP is equipped with two internal combustion engines, rated at 250 kW each and intended to generate energy from the biogas produced by WWTP operations; however, those engines are not operational. As a result, RCSD flares its biogas.

Realizing the potential to use this flared gas to reduce the power burden carried by RCSD’s ratepayers, its Executive Director, Dianne Philipps, P.E., began to consider an Energy Performance Contract (EPC) after learning that the nearby Town of Orangetown had successfully used the EPC tool.

Initial Efforts

Director Philipps undertook a due diligence exercise, beginning with a review of EPA and state guidance documents. She concluded:

- If done the right way, RCSD’s use of an EPC would likely quickly produce useful improvements and savings; and
- The value of energy savings alone was not likely to be enough to cover the costs and measure the value of an EPC project: some degree of grant support and the use of a life-cycle analysis of the value of facility improvements would likely also be needed.

The Director’s next step was to meet with Siemens—the P3 partner for the Orangetown facility—which agreed to prepare a free Preliminary Energy Assessment Report to determine if an EPC contract was feasible. The report, issued early in 2012, was encouraging: it found potential for significant energy and operational cost savings, with a focus that included the replacement of the co-generation units, increased use of variable speed drives, and heating system improvements.

Philipps therefore resolved to proceed with a procurement to select a qualified provider, but she first decided to retain expert consultant services. With the approval of her board, Philipps engaged Malcolm Pirnie/Arcadis (Arcadis) to provide Energy Performance Contracting Owner’s Agent Services. Those services included assisting in preparation of an EPC RFP, proposal evaluation, and EPC negotiation and preparation.
The New York Energy Law permits EPCs to be procured through an RFP process and exempts them from the state’s otherwise applicable low-bid requirements. Its provisions provided the legal benchmarks that Arcadis and RCSD’s outside counsel used as they prepared procurement documents for the selection of an energy services company (ESCO).

As they proceeded with their work on this project, RCSD’s advisors also considered supplemental sources of legal and policy guidance, including:

- A New York State Comptroller (“Comptroller”) report pointing out that “the ESCO typically performs the capital improvements to the buildings…”; and
- Recognized industry standards surrounding the workings of an EPC and validating the use of life cycle valuations in determining the calculation of total savings.

In keeping with the state’s energy law, however, the RFP provided that the initial task of a selected ESCO would be to perform an energy audit of the facility and determine the feasibility of an EPC. The parties could then, if warranted, negotiate all the terms and conditions of an agreement to implement energy savings measures in the facility.

RCSD released the RFP in December 2012. It opened with a broadly-stated goal:

The objective of this RFP is to solicit proposals for energy services for RCSD. The selected Energy Services Company (ESCO) will assist the RCSD in becoming as energy efficient as possible through the installation of energy conservation measures (ECMs) and optimization of operation and maintenance procedures, resulting in reduced net energy costs in the short-term and long-term, through an Energy Performance Contract (EPC).

RCSD’s intent was clearly stated: “… that projects [shall] be financed by the ESCO or a third party.”

Annual repayment by RCSD shall be less than the guaranteed costs savings resulting from the ECMs. ECMs shall be financed throughout the performance contract duration, with ownership and long-term operation and maintenance turned over to RCSD at the end of the contract, unless an alternative ownership or maintenance arrangement is proposed and agreed to by RCSD.

The RFP provided a detailed and lengthy list of tasks that the selected ESCO would be expected to perform, ranging from design, permitting, construction, and start-up testing services to securing funding, incentives, and rate reductions, to guaranteeing, measuring, and reporting on performance.

The RFP contained a noteworthy provision that served the purpose of imposing an important prequalification requirement on any potential respondent: accreditation by the National Association of Energy Services Companies (NAESCO) as either an ESCO or an Energy Service Provider. The effect of this limitation was to narrow the field of potential competitors to twenty-two companies, each of which had gained NAESCO accreditation following a stringent review process.
The RFP response period closed in March 2013. RCSD staff and project advisors reviewed four submitted responses, and recommended that Siemens be selected to perform an energy audit. With the approval of the RCSD and the County Executive, Director Philipps and the advisory team negotiated an Investment Grade Energy Audit and Project Development Agreement with Siemens. Siemens issued a draft Investment Grade Energy Audit (IGEA) in July 2014, which prompted a period of review, comment, and negotiations, with RCSD’s advisors playing a central role. These efforts led to the production of a finalized list of proposed Facility Improvement Measures (FIMs), which were seen as the basis for proceeding with a RCSD-Siemens EPC. The FIMs included upgrading the CHP, replacing outdated pumps, centrifuges, motors, boiler controllers, and other equipment, and hardening buildings.

Arcadis prepared an analysis of these proposed FIMs and concluded that RCSD could implement the proposed EPC in compliance with the state’s energy law. It further concluded that RCSD’s projected energy and cost savings were likely to be achieved. Several findings supported this conclusion:

- First, the analysis validated the technical feasibility of the proposed measures, the estimate of construction costs, and the capacity of each FIM to generate energy savings. Arcadis highlighted the primary importance of the CHP upgrade, which it found had the greatest potential for electricity savings through its anticipated generation of 3,576,628 kWh/year.
- Second, the Arcadis report confirmed that the proposed project would generate net financial savings to RCSD. This flowed from the assumption that RCSD would pay for the $21,705,094 project through bonding, which would be more than offset by the EPC’s Total Guaranteed Savings of $36,977,516 over a twenty-year timeframe. Arcadis noted that twenty-eight percent ($8,872,075) of the EPC’s savings would be directly attributable to Energy/Utility and Operational savings, while seventy-two percent ($28,105,440) of the savings would be from life-cycle savings flowing from avoided capital costs due to project replacement for equipment reaching the end of its useful life during the EPC’s term.

Further concluding that proceeding with a Siemens ESCO agreement would provide RCSD with cost-effective and much-needed facility improvements within a quick eighteen-month timeline, Director Philipps sought the approvals she needed to move ahead:

- In January 2015, she obtained board approval for an amendment of the Arcadis contract, thereby ensuring that project oversight, measurement, and verification services were in place; and
- In March 2015, she obtained approval from her board for execution of the ESCO agreement, whereupon needed RCSD signatures and that of the County Executive were to be affixed.

Because a twenty-year bond was to pay for the project, one last step remained: referral by the County Executive of the matter to the County Legislature, which alone has the authority to approve RCSD borrowing.
Project Roadblocks

Ultimately, the County Executive did not refer the matter to the County Legislature. The local newspaper published four articles questioning Siemen’s role in unrelated EPC projects in nearby counties. Although no charges resulted from the matters discussed in the paper, the articles detailed concerns about fraud, ethics violations, and financial losses in Siemens’ other projects.

This unfavorable press coverage caused political backlash and brought the RCSD-Siemens project to a halt despite the following advantages:

- Improvements that fall within the scope of the state’s energy law;
- Technical proposals and financial benefit estimates based on allowable and reasonable considerations reviewed and confirmed by an independent consultant team whose only loyalty was to RCSD; and
- The prospect that construction and project performance, on both technical and financial bases, will be similarly objectively overseen, measured, and verified.

With her only regret being that she might have earlier begun her effort to educate the County’s elected leadership on the merits of an ESCO and the quality of RCSD’s procurement process and the contract it yielded, Director Philipps continues to seek a path forward for RCSD’s WWTP to achieve its energy goals.
City of Portland, Oregon: Portland Water Bureau

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Introduction

The City of Portland, Oregon has a population of 628,830. Its elected officials include a Mayor, four commissioners, and a City Auditor. The mayor and the commissioners, who collectively serve as the City Council, set legislative policy and oversee the various departments that provide day-to-day operation of the city. The Portland Water Bureau (PWB), which provides drinking water supply and services, is one of those departments that the council oversees.

The residents of Portland are not the only beneficiaries of the PWB’s service: nearly one-quarter of the residents of Oregon receive their drinking water supply from the PWB. Working
within parts of nearby Multnomah, Washington, and Clackamas Counties, the PWB provides drinking water on both a wholesale and a retail basis to a population of more than 980,000 people spread over a service area of approximately 225 square miles.

The City has promulgated a Green Building Policy, and the PWB’s operations fall under the umbrella of its requirements. The policy mandates the incorporation of on-site renewable energy systems into the design and construction of all new City-owned facilities, either as practicable or as the State might otherwise require.

**PWB’s Initial Renewable Energy Projects**

The PWB met an initial 400 kW electricity capacity goal with two projects completed using traditional procurement approaches. The first was a solar PV project using conventional procurement approaches. The second project was a 2012 in-line micro hydro-turbine generator in one of the City’s many open-space community resources, the Sabin HydroPark. By converting the thrust of water into electrical energy, this micro hydro-turbine generator produced an estimated 150,000 kWh per year, the balance required for the PWB to meet its renewable energy goal. It also provided experience leading to the PWB’s acceptance of an additional in-line power generation offer through the use of a public-private partnership project with Portland-based Lucid Energy, Inc.

**The Project’s Genesis and Framework**

Lucid had initially approached PWB in 2010 after determining that PWB’s pressurized water delivery pipes would be suitable sites for Lucid water turbines. Although that initial meeting did not give rise to a project at the time, in 2012 PWB had a pending pipe retrofit project for the installation of a pressure reduction valve (PRV) in a pipeline that was over-pressurized due to flow from a new reservoir, and PWB personnel recalled the potential of in-line hydro.

The resulting 2012 meeting focused on an associated new water pipe that would be placed in a residential neighborhood where there might be room to install Lucid Turbines upstream of the PRV. Three concerns were paramount:

**Sufficiency of Water Flow.** The identified water line, Conduit 3, was one of PWB’s three primary transmission mains. Although this was PWB’s preferred line, PWB would provide no guarantees on flow volumes. Nevertheless, Lucid found a sufficient basis for proceeding.

**Financing.** There was not sufficient public sector financing available to support this project. PWB had no money to pay for the turbine system, federal tax credit financing mechanisms were not as favorable for in-line hydropower projects as for solar projects, and there was no time to apply for state or government grants. As a result, a private funding solution was needed, which Lucid provided by committing to find private investment to support the turbine installation project.

**Technology.** The intent of the Lucid Energy private funding was to build a small-scale LucidPipe technology to demonstrate and evaluate the turbines in a real-world environment, at higher pressures and flows than a prior pilot facility in a different jurisdiction. Thus, this approach was unproven and would provide additional lessons learned.

In October 2012, PWB and Lucid executed a project terms sheet, and in November 2012 the City Council enacted an ordinance authorizing the project to proceed. In May 2013, with investors and a PWB conduit contractor in place, Lucid and PWB executed a lease that captured the provisions of the terms sheet, and the project was authorized to proceed.
The Lease Terms

The lease provided that, subject to permitting (which included obtaining project licensing from the Federal Energy Regulatory Commission), Lucid was to install four 50 kW capacity sealed vertical turbines in Conduit 3 in the vicinity of Powell Boulevard and SE 147th Avenue. These turbines would be collectively capable of generating an average of 1,100 MWh per year, which would meet the equivalent of up to 150 homes’ annual power needs. The project would also consist of external generators and ancillary equipment, including the necessary equipment for interconnecting with the local utility, Portland General Electric (PGE).

The initial term of the lease was to be for either twenty years or the duration of Lucid’s PPA, whichever was longer; it also allowed for a single ten-year extension. The City was to assume ownership of the project assets at the end of the lease, and the lease also gave the City a variety of option rights should Lucid contemplate a sale of the assets before the end of the lease.

The lease specified the financial terms of the transaction, which included:

- A commitment by Lucid to pay the costs PWB had incurred in negotiating the terms sheet and the lease as well as those they would incur during the permitting and construction phases of the project;
- A requirement that Lucid cover any expenses its project would cause PWB’s contractor as it undertook its construction of Conduit 3; and
- A provision for Lucid to make quarterly rental payments to PWB pursuant to the following formula, which was based on annual gross revenues received by Lucid as a result of its sales of power:
  - $0 - $100,000 – 4%
  - Any increments of revenue ranging from $101,000 - $200,000 – 5%
  - Any increments of revenue greater than $200,000 – 6%

Lucid’s obligation to finance and assume all the costs of the project, estimated at $1.6 million, was clearly stated, with cost items specified as including permitting, licensing, designing, and constructing and operating the Project and its assets.

Responsibility for operating and maintaining the water system and meeting water quality standards was clearly vested in the PWB, which also agreed it would neither obstruct nor diminish the volume and flow of water either upstream or downstream of the project. PWB retained, however, the right to require movement or removal of any of the project facilities if water supply concerns warranted any such changes.

Construction, Launch, and Performance

Lucid’s construction challenge was to complete the project in compliance with the deadline set by its PPA: Lucid was be producing power by the end of December 2014. But the path to project completion did not proceed free of challenges, and two issues needed to be resolved:

- Lucid was able to deliver and install the required four modular, in-pipe turbines on schedule. But due to private financing issues, the installation of the necessary power electronics occurred only one month before the December 2014 deadline. Although
production started on time, this compressed schedule meant that it took several additional months for optimum power generation to be achieved.

- Additionally, the siting of project electronics hit an unexpected obstacle: a 1909 county ordinance prohibition on the siting of any hydropower project on private land. The original plan had been to install all power electronics above ground, leasing a small piece of private property from a neighbor. Instead, Lucid had to site the electronics in the public way in a larger underground vault than had been planned, which added considerable expense to the project.

Dr. French, Lucid’s CEO, reports that the project produced electricity at rated capacity when flows were as designed. Dr. French is careful to note that actual water flows have been lower than estimated, so total power produced is in turn lower than expected. As result of this situation, the rate of return for the project investor is long; moreover, the revenue that PWB is realizing from its Lucid partnership does not constitute a significant amount.\textsuperscript{237}

Nevertheless, Dr. French sees value in the project: it has provided important lessons-learned from design and construction perspectives, with an operating commercial system in place that proves the value of the in-line power generation concept. In addition, the PWB-Lucid project has provided a significant platform for spreading the word of the value of the in-line generation model, with Dr. French reporting that it has generated the publication of more than 600 articles since January 2015. Figures 5.5 and 5.6 present views of the project’s installation.
Conclusions

Although it is easy to conclude that Lucid’s PWB project demonstrates the technical merit of the in-line power generation model when properly placed in a water distribution system, it remains to be seen whether the P3 tool is as useful in this sector as in others. As of now, there are only a handful of P3-driven in-line hydro projects. The research team explored this question further in an interview with Matt Swindle, CEO and Founder of NLine Energy Services, Inc., a renewable energy development company focused on conduit hydroelectric projects. He offered the following considerations:

- Very few public utilities want a third party to be operating within their infrastructure. In Swindle’s experience, since the average cost of an in-line power project is $1.8 million, utilities would rather pay for the project themselves and thereby avoid the presence of that third party.
- Currently, there is an absence of state or federal financing assistance needed to entice private investors’ interest in P3 participation; low-cost loans are rare, though tax credits are available.
- There is a risk arising from uncertainties in the amount of flow through distribution lines, making it difficult to provide any guarantee to an in-line turbine P3 party.

Absent further technical and legal developments, therefore, drinking water utilities with an interest in exploring in-line power generation opportunities seem likely to do so on their own and with their own resources rather than through the application of the P3 tool.
City of San Antonio, Texas: San Antonio Water System

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**Introduction**

The San Antonio Water System (SAWS) is a public utility owned by the City of San Antonio, Texas. Created in 1992 through the consolidation of three predecessor agencies, SAWS has grown to serve a 930-square-mile area of more than 1.8 million people in Bexar County and in parts of Medina and Atascosa counties.

SAWS is charged with responsibility to operate, maintain, sustain, and modernize the facilities and infrastructure that support water supply and delivery, wastewater collection and treatment, and chilled water requirements in its service area. Besides treatment facilities, that infrastructure includes drinking water distribution and wastewater collection systems measuring more than 10,700 miles.

A Board of Trustees consisting of the Mayor of the City and six members appointed by the City Council governs SAWS. Trustees must reside within the corporate limits of the City or the SAWS service area, and each member is appointed for a four-year term with a two-term limit. Led
by its President/CEO, the SAWS management team leads agency staff in seeking improvement and growth, operational efficiencies, work culture enhancement, and the promotion of customer and community wellbeing. Indeed, in 2004 the SAWS Dos Rios Water Recycling Center received EPA’s prestigious Operations and Maintenance Excellence Award.

The SAWS Biogas Opportunity

In 2005, SAWS energy manager Dan Titerle observed that natural gas prices were rising significantly. A geologist by training and a veteran of the oil and gas industry when he joined SAWS in 2001, his entrepreneurial instincts saw a potential business opportunity in the biogas which sewage treatment operations at the Dos Rios Water Recycling Center produced and flared, as shown in Figure 5.7, rather than used. Titerle determined to investigate whether there might be any income-producing opportunities for the Center’s biogas.

Titerle first explored whether there were any opportunities with San Antonio’s power provider and SAWS’s sister agency, CPS Energy (CPSE), but CPSE did not wish to pursue the matter. Given his mandate to realize energy efficiencies and develop new power sources and the “just do it” approach that the mandate encouraged, Titerle reached out to the private sector for possible solutions. In 2006, assisted by SAWS consultant Camp Dresser McKee, Titerle drafted and issued an RFP.

The RFP and Proposals

Having investigated on-site generation and not finding cost-justified examples, the RFP charted a middle-of-the-road course in its approach; it did not dictate a desired means for capturing or using the facility’s gas output, and in fact did not provide any directives at all. Instead, it sought proposals that answered the question “what is the best way to use the gas,” measured by income generation and risk avoidance. The RFP created a great deal of interest in the vendor community, resulting in twenty-five letters of interest and, ultimately, eleven responses.

Nine of the proposals contemplated some form of on-site cost-avoiding use of the biogas that generated power to meet the operating needs of Dos Rios, but SAWS was attracted to an approach advanced by two other proposers: selling the biogas at market and compensating SAWS through royalty payments. This was an attractive approach given the evaluation criteria SAWS had set. Royalty payments, frequently seen by Titerle during his years in the oil and gas industry,
had the potential to provide a meaningful revenue stream to his agency while placing all project risk on the private sector partner.

SAWS ultimately chose Ameresco to undertake the project. With unanimous approval from the SAWS Board of Trustees, the agency contracted with Ameresco in September 2008 to proceed with the project as a P3. Ameresco committed to the following:

- Develop on a design-build-operate basis the facilities needed to collect, clean, compress and transport the Dos Rios biogas output for sale to market;
- Finance the project;
- Provide operations and maintenance services for an initial term of twenty years, with the possibility of a single five-year extension, at the end of which SAWS would decide whether to continue the Ameresco P3 arrangement, take possession of and responsibility for the facilities itself, or have Ameresco dismantle them; and
- Make both a fixed-lease and a royalty payment to SAWS based on a complex formula negotiated by the parties to the contract.

The Design, Construction, and Operation of the Project

The facility Ameresco was to build needed to have the capacity to produce up to 1.5 million cubic feet (MMCF) of methane per day and to purify the Dos Rios biogas to meet the specifications of the natural gas pipeline into which the processed gas would be injected. The biogas was approximately 60% methane, with the balance being mostly carbon dioxide, but gas injected into the pipeline had to be about 98% or more methane. This meant that the carbon dioxide, along with other trace constituents (including water vapor, hydrogen sulfide, siloxanes), had to be removed from the digester gas.

To accomplish this level of purification, Ameresco designed a facility with the following key components: (1) a feed compressor; (2) a pressure swing adsorber to filter the biogas; (3) a compressor for the purified gas; (4) a metering station; and (5) a thermal oxidizer for unwanted gas constituents. Work on the project proceeded smoothly, and by March 2009 the Ameresco team had completed plant design and preparation of construction documents, and long lead-time equipment components were released for factory fabrication. One month later, the necessary state air emissions permit was granted.

Ameresco realized another key milestone in February 2010 when it successfully completed the negotiation of a natural gas pipeline interconnection agreement with pipeline owner Enterprise Products Partners L.P. (Enterprise). In March 2010, with long lead-time equipment fabrication nearing completion, Ameresco’s construction subcontractor commenced on-site construction of the plant, and by November, plant operations began. Figure 5.8 presents an image of the system.
The results for the first several years of plant operation were strong, with Ameresco transporting produced gas through the Enterprise pipeline to a Houston-based renewable natural gas marketer, Elements Markets LLC. For SAWS, the results were two-fold:

- Realizing the beneficial reuse of the biogas output of the Dos Rios digesters; and

In 2014, problems arose from a change in federal regulatory standards governing the level of oxygen in natural gas transported through pipelines subject to FERC jurisdiction. This change required a one-year shutdown while Ameresco undertook necessary upgrade work, which required removing oxygen from the biogas.238

Ameresco worked for several months with SAWS, testing modifications to SAWS sludge handling systems and practices to see if the amount of oxygen being introduced through the gas handling system could be reduced. When these efforts were unable to reduce digester gas oxygen levels low enough to meet the new pipeline standard, Ameresco designed and installed an active oxygen removal system. The costs for this upgrade work were carried fully by Ameresco, and shipping resumed in July 2015. The result to SAWS was the receipt of an additional $48,878 of lost royalty by year’s end and a continuation of beneficial reuse and environmental protection through the cessation of biogas flaring. Operations continued to proceed smoothly through 2016.

Conclusions

Both SAWS and Ameresco richly praise the results of their P3 biogas collaboration. SAWS President/CEO Robert R. Puente describes the project as “a sound investment for our environment and our community. By reusing biogas rather than burning it off, we are helping protect the City’s air quality and developing a renewable energy source.”239

Ameresco also points proudly to the project’s success in helping to reduce the need for traditional fossil fuels, and points to the carbon footprint reduction equivalencies it annually produces, including:

- The removal of 31,261 cars from the road;
- The planting of 38,736 acres of trees;
- The reduction of 19,739 tons of carbon dioxide per year;
- Displacing 396,369 barrels of oil; or
- The heating of more than 4,689 average-sized homes.240

Titerle believes that the agreement has performed well for both parties. Titerle notes that the royalty calculations were surprisingly complex because they tried to make allowances for many contingencies, but overall, he sees the success of the project stemming from the decision to treat the SAWS biogas opportunity as a “gas well.” By taking a royalty instead of a fee, SAWS could generate several positive outcomes. Those included enabling the use of tax credits by a taxable third party and reducing SAWS’s risk and liability through the use of “an across-the-fence lease agreement” with its contractor-partner.

But Titerle highlights the important benefit of a successful P3: mixing and matching the skillsets of the private and public sectors. He describes it as:
Letting the parties to the agreement each do what it does best. Letting Ameresco do the energy part, including compressing and cleaning the gas, and monitoring the futures and renewables markets for bio-gas; and letting SAWS do the water part by generating the biogas through its wastewater operations.241

Titerle therefore views the SAWS biogas collaboration with Ameresco as a solid success.

**KEY CONSIDERATIONS FOR A W&WRRU**

The case studies, informed by the prior parts of this report, suggest four key questions that a W&WRRU needs to evaluate when considering a P3 energy project:

1. What are the utility’s overall priorities and how do energy projects fit within that assessment?
2. How should the utility select the right project delivery tool, and if a P3 is selected, how should the utility socialize and make the case for the P3 energy project?
3. How should the utility approach P3 procurement and selecting a private partner?
4. What does a utility need to do execute a win-win partnership agreement and have a successful P3 relationship?

Chapter 6 presents best practices to address these questions.
CHAPTER 6
BEST PRACTICES FOR WATER AND WATER RESOURCE RECOVERY
UTILITY P3 ENERGY PROJECTS

This chapter presents best practices for undertaking P3 energy projects at W&WRRUs. As indicated by the preceding discussion, a number of drivers may provide the impetus for such an undertaking. Assuming sufficient drivers are in place, involving outside parties in a system’s operation is still a complex issue.

The material below is presented step-by-step, but in reality, many of the steps take place simultaneously and adaptively as further information becomes available. Indeed, an overarching best practice is adaptive management. The ability to remain flexible throughout the process and update expectations and approaches as needed is critical to a successful outcome. Furthermore, critical keys to success are a longstanding commitment to sustainability by the W&WRRUs’ management, the ability to tap advocates from within the W&WRRU who can be champions of the projects both internally and externally, and a demonstrated willingness to innovate and be a first-mover.

The first part of this chapter describes setting utility priorities and selecting the energy project. The second part is aimed at identifying the optimal project delivery tool, with considerations relevant to risk allocation and Value-for-Money (VfM) analysis. The third part focuses on socializing the P3; that is, tapping a political champion and engaging with both internal and external stakeholders. The fourth part focuses on the procurement process, which covers bidding processes, requests for qualifications and proposals, proposal review, partner selection, and contract negotiation. The final part provides a term-by-term guide to contract provisions to assist W&WRRUs in ensuring that their final contract is as detailed and comprehensive as possible.

UTILITY PRIORITIES AND ENERGY PROJECT SELECTION

Long before beginning construction, a W&WRRU interested in an energy project must understand its priorities and operations sufficiently to identify projects that will bring value to the facility, local government, and/or citizens. Often, the local government or the W&WRRU itself has established sustainability or cost-savings priorities that are important drivers for ultimately undertaking a discrete P3 project. As is evident from the case studies, of course, there is considerable variety in how W&WRRUs approach energy projects. Some begin with a specific goal in mind—such as self-generation—while others are more generally interested in energy management on a plant-wide basis. This section can therefore assist the W&WRRU in ensuring that its early steps are sufficiently comprehensive to establish a solid foundation for moving forward.

Developing the W&WRRU’s Energy Priorities and Creating an Action Plan

Comprehensive energy management planning starts with an evaluation of the W&WRRU’s facility to identify energy use and costs. Armed with that information, W&WRRUs can establish their goals and align those goals with their operational needs. This process enables the W&WRRU
to develop an action plan, which must have the buy-in of management and a leadership team before proceeding to next steps.242

Assessing Energy Use and Costs

Options for assessing energy use and costs are as follow.243

**Low- or No-Cost Assessment Options.** Many systems conduct initial in-house energy use and cost assessments. In addition, many electric and natural gas utilities have on-staff personnel who can perform high quality, objective energy efficiency studies at nominal or no cost. Some states offer other energy efficiency and assessment programs that the W&WRRU may be able to access.

**Consultant Assessment Options.** A system may engage a consultant not only to assess its energy use and costs but also to identify priorities and set energy improvement goals and targets. One approach is to engage an energy service company (ESCO), which can perform a range of services, including various types of energy audits, and possibly, develop an infrastructure retrofit project proposal designed to deliver energy, water, and operational savings over a period of time.244

Other ESCO services include construction management (including project design and commissioning), project financing, asset maintenance and servicing, project monitoring, and project guarantees. Most ESCOs allow a system to choose from among the services offered. A few may insist on a set package of services; this approach is not recommended for W&WRRUs because it limits flexibility and does not necessarily allow for course corrections as the energy project unfolds. Note that ESCO relationships are themselves a form of P3, so the best practices for P3 selection, contracting, and performance should be attended to in connection with ESCOs.

Establishing Goals and Aligning Them with Operational Needs

The W&WRRU’s goals should be clearly defined and easily articulated, for example:

- improve the facility’s energy efficiency by 15%;
- find a useful and profitable way to leverage excess biogas;
- self-generate up to 65% of the facility’s heat and power needs; and/or
- conduct a pilot test of a new energy technology by a particular date.

Once the goals are defined, W&WRRUs should align the goals with their operational needs, including current or planned upgrades and construction. This exercise will help refine the goals and situate them within overall plant priorities.

Developing an Action Plan

Select the operations or processes that will serve as the focus for the system’s energy goals, and develop a concrete set of specific identifiable actions and dates by which those actions should be accomplished.

The action plan should include assignments of in-house tasks and responsibilities. This exercise will help identify whether there are sufficient resources—both financial and in staff time—to devote to the project, and in particular helps show whether external funding is needed to implement the project.
At this point, the identity of a project champion should be clear. As is discussed in detail below, a champion is a critical success factor for P3 energy projects. Ideally, this person already has the respect of the community served by the utility, political leaders, superiors, peers, and those under his or her supervision. A strong knowledge of the W&WRRU’s operations and processes is essential, as is the ability to bring both vision and pragmatism to a project.

**Seek Early Buy-in and Approval**

The champion and any other involved personnel should seek top management’s approval, commitment, and involvement even at the early stages of goal setting and action plan development. Top managers must understand the proposed implementation strategy and schedule contained in the action plan, the direct workforce commitment involved, and how the proposed energy program aligns with management’s priorities.

After top management confirms the goals and the action plan, communicate the plan and targets to the utility’s middle managers, supervisors, union stewards, and all types of employees. Time spent on promoting awareness, understanding, and buy-in will save time later. Also, communicate the action plan to external stakeholders, including: local citizen groups, regulatory agencies, local officials, and energy-providing utilities. Further information on communication and outreach is presented later in this chapter.

**Establish a Leadership Team**

Establish an energy improvement leadership team, including selecting an energy program manager (this is often the project champion), who will take responsibility and be trusted with the authority to develop, implement, and maintain the specific energy improvement program. Assuming that person already has a level of management authority, he or she must receive the designated authority from top management to get the work done. In most cases, the energy program manager will take on these new responsibilities in addition to his or her existing ones. The energy program manager must regularly meet and communicate with top management on implementation status.

**IDENTIFYING THE IDEAL PROJECT DELIVERY MODEL**

W&WRRUs considering energy projects must decide both whether to engage the P3 tool, and if so, what kind of P3 tool to use. By using risk tools, W&WRRUs can clarify their understanding of which risks can be borne in-house, and which risks may merit being transferred to an outside party. W&WRRUs should next conduct a Value-for-Money (VfM) analysis to determine the ideal project delivery model.

**Thinking in Terms of Risk Allocation**

As is evident from the discussion in Chapter 4, P3 tools help public partners transfer risk. Before engaging in a Value for Money analysis, W&WRRUs should engage in three sets of analysis regarding risk:
- Risk identification, including design (design flaws), construction (cost overruns, delays to completion), environmental, permitting, other regulatory barriers, operations and maintenance (high costs), performance (service unavailability, lower service quality);
- Risk assessment (the likelihood and severity of adverse outcomes); and
- Risk management and allocation, including reducing the likelihood, severity, or both, of adverse outcomes, determining the W&WRU’s ability to bear the risks, and considering whether some risks are better allocated to an outside party.

Of these, risk allocation is an important lens from which to assess project delivery models. In general, as the number of risks transferred to a private partner increase, the private partner’s incentives for risk minimization (and accompanying cost savings) also increase. For example, a design-build contract transfers the design and construction risks to the private partner, thereby providing incentives for that party to minimize design flaws and construction costs. A DBOM shifts risks further by encouraging the private partner to select construction methods and materials to minimize operations and maintenance costs. Performance risk can also be transferred when the contract sets quality standards for the infrastructure and ongoing services.

In considering how to manage risks, controllable and non-controllable risks must be distinguished. A controllable risk is typically allocated to the party that can best influence it. A risk that no party can control is typically allocated to the party best able to manage or diversify it. Some risks can be quantified through engineering or actuarial methods, and can be represented in the quantitative VfM analysis. Other risks are difficult to quantify (often due to uncertainty) and are more appropriate for the qualitative VfM analysis. The important point is that thinking in terms of risk helps W&WRUs assemble information and develop clarity of thought that can be integrated into the VfM process.

Project Delivery Evaluation and Value-for-Money Analysis

VfM analysis enables a W&WRU to determine whether a P3 delivery option is financially preferable to a traditional approach to implement a project. VfM evaluates and quantifies the benefits, risks, and cost savings of a P3 compared to public sector provision alone. A sophisticated VfM analysis also considers a variety of P3 arrangements, such that if a P3 tool is preferable, the analysis can help identify which model(s) offer the best value. Key components of VfM analysis include the following.245

VfM Comparison

VfM begins with defining the project and identifying the various delivery options to be evaluated. Then, a side-by-side comparison of two or more project delivery options allows decision makers to better comprehend the costs and benefits associated with each method. The VfM comparison will evaluate the:

- Traditional procurement referred to as the “public sector comparator” (PSC); against the
- Alternative P3 option(s) referred to as the “shadow bid,” which represents a proxy for the potential P3 proposal(s).
There may be multiple P3 alternative options under consideration, for example, ranging from DB to DBOMF. The P3 shadow bid assumptions should be updated with the proposal determined to offer the best value to the public sector.

**Qualitative Analysis**

The purpose of the qualitative analysis is to highlight key differences between the project delivery options and to address issues that are relevant to the overall VfM determination but are difficult to quantify in monetary terms. Qualitative factors may include reliability, service quality, flexibility, and innovation, and the evaluation can receive equal or even more importance relative to the cost factors, particularly when the difference between the quantitative results between the PSC and alternative P3 options are marginal. Thus, it is critical that qualitative analysis be approached as objectively as possible to minimize bias toward one or another option. A matrix or table can be an effective tool for evaluation with the project’s strategic objectives listed vertically along the left and a qualitative assessment of each delivery option compared to the right.

**Quantitative Analysis**

VfM requires comprehensive quantitative analysis, and public entities should consider engaging financial consultants and outside experts to assist with these activities. Primary activities of the VfM quantitative analysis include:

- **Develop Life-Cycle Cost Estimates** – VfM is based on estimates of all costs expected over the entire full life cycle of the project. These direct and indirect costs include the project delivery and capital costs (e.g., consultants, labor, materials, and financing), operating costs (e.g., core functions, supporting services, personnel, and routine maintenance), and rehabilitation expenditures, as well as costs associated with the project’s oversight, handover, and risk-adjusted costs.

- **Create Financial Models** – Spreadsheet-based project finance models will incorporate inputs such as the life cycle cost estimates and forecasted revenue components of the project. The primary output of the financial models is a cash flow schedule for each project delivery option that shows how the various funding sources will be used over time to pay the project costs, debt service, distributions to investors (if application) and cash flows back to the public sector partner.

- **Identify and Monetize Project Risks** – It is necessary to identify and calculate the monetary value of major risks that may be assumed, transferred, or shared by the public entity under the PSC and P3 options. The cost estimates for a PSC must be adjusted to include the potential value of the transferable risks retained by the public partner, known as the “risk-adjusted” costs, allowing for a fair comparison of the delivery options. The amount of the risk adjustment is typically based on a financial calculation that reflects the potential cost and schedule impact of the identified risk and the likelihood that the risk will occur over the defined period of time.

- **Compare the Net Present Value of Risk-Adjusted Costs** – The final step is to compare the estimated costs and revenue to the public entity under the PSC and P3 option by discounting the future cash flows developed for each option, known as Net Present Value (NPV) analysis, so that the amounts can be expressed in dollars at the same point
in time. The NPV analysis relies on a discount rate that should be comparable to the weighted average cost of capital of available financing structures reflecting conditions in the capital markets and the risk premiums required by investors. The public entity should use a sensitivity analysis showing the impact of using different discount rate assumptions for a better assessment of potential outcomes. Figure 6.1 is an example illustration depicting VfM quantitative results. If the cost of the P3 option is lower than the risk-adjusted cost of the PSC, the P3 option provides “value for money” to the public entity.

![Figure 6.1 Illustration of VfM Quantitative Results](image)


Figure 6.1 Illustration of VfM Quantitative Results

VfM analysis is a key component of making the business case for whether to use a P3. A sound VfM analysis requires a sophisticated understanding of quantitative and qualitative factors, taken together. The analysis is time- and resource-intensive. Unless the W&WRRU has the dedicated skill sets in-house to perform this analysis in a comprehensive way, a W&WRRU should look to consultants who have significant professional experience with VfM work.

SOCIALIZING THE P3 PROJECT AND MAKING THE CASE: POLITICAL CHAMPIONS AND STAKEHOLDER ENGAGEMENT

The public sector can be a place where risk-aversion and inertia rule. There are well-established patterns governing what tasks are to be performed, their relative priorities, and the ways they are to be accomplished. New approaches that are different from the established norms have only a small chance of success unless a political champion steps forward to socialize the project and pave the way for its accomplishment. The fundamental importance of the political champion to a P3 project’s success cannot be overstated. Indeed, all of the successful projects in the case studies in Chapter 5 included effective political champions.

Becoming a political champion requires careful and time-consuming work, establishing and sustaining a consensus-based political foundation upon which a project can then be built. Be
it a mayor, a county or city manager, a town administrator, or a utility director, the political champion must step forward, take the lead, and begin by engaging and educating all stakeholders (internal and external) who are vital to the operation of a utility and critical to a community’s success of a P3 venture.

Stakeholders include:

- Utility representatives, such as operational managers, planners, engineers, executives, and governing board members, and representatives of the work force (whether or not unionized);
- Business group representatives, with likely examples including the local chamber of commerce as well as specific businesses or industries that are important utility customers;
- Community representatives, such as environmental advocacy groups with demonstrated concerns about utility operations, neighborhood organizations from areas where project operations have an impact;
- Local media, which can enhance the public’s understanding of the project and its objectives, and influence public support; and
- Local government representatives, which should include both the executive and legislative branches of government, and any appointed board with a role in the subject matter of the P3, such as a local sustainable energy advisory committee.

The political champion, working with staff or consultant resources providing subject matter expertise on legal, financial, and technical issues surrounding the potential task, must work then to build an environment of trust and transparency. Doing so promotes strategic coordination and consensus on whether and how to proceed with a project. The fruit of this labor is the production of the political will required to proceed successfully with a P3 project.

The political champion should seek strategic partnerships with the stakeholders so that a variety of vital project predevelopment objectives can be evaluated and engaged; central among these are:

- Explaining the project need: is action required by a court decree or an administrative order, or is it a discretionary initiative that would address a matter of public policy or future concern?
- Anticipating and overcoming barriers: what are the political, financial, engineering, operational, environmental, legal, public relations or other matters that need to be considered, prioritized, and resolved?
- Design of communications and outreach strategy: what is the content of the message to be disseminated that will describe the project and the choice to pursue it through P3 procurement, and who are the key audiences?
- Building and maintaining the project’s support: with what means, in what forums, and through which spokespersons will stakeholders be engaged and the message be spread to build community understanding and advocacy for the project?

In assuming this leadership role, the political champion must proceed with sensitivity and patience. The champion must draw stakeholders out with diplomacy and transparency, and must avoid dictating a preferred outcome. By sharing his or her knowledge base fully and transparently
with the stakeholders, the political champion can ensure the discussions and deliberations necessary to proceed. In particular, assuming the ViM analysis was favorable to the P3 procurement option, the political champion can use those findings as an educational tool, ensuring that any and all project analysis is transparently disclosed to the public as part of the communications effort, thereby engendering public understanding of and support for the project and encouraging greater accountability for investment of public dollars.

**APPROACHING P3 PROCUREMENT AND SELECTING A PARTNER**

If the W&WRRU has not done so already, it should consult legal counsel to ensure that it complies with applicable law during the procurement process. The local government’s attorney should be able to advise the W&WRRU on the proper procurement methods and procedures that the W&WRRU must follow. If P3 energy projects are new to the W&WRRU and/or local government, it is strongly encouraged to also retain outside counsel with expertise in such projects.

**Bidding Process**

There are two basic project procurement methods available to local governments: sole source direct negotiation and competitive bidding. Often, the choice of method is dictated by governing law. Nevertheless, considerations relevant to each method are provided below.

**Sole Source Direct Negotiation**

Sole source direct negotiation offers benefits and disadvantages. Benefits include faster project completion, avoidance of the possible loss of incentives, and elimination of costs associated with retaining a consultant to run a competitive bidding process. However, the lack of competition and the inability to compare multiple proposals makes it more difficult for a system-buyer to ensure it is obtaining a competitive price and the optimal technical solution. Moreover, other risk factors, such as a vendor’s financial stability, can be difficult to assess outside of a competitive process.

**Competitive Bidding**

A competitive bidding process typically consists of two parts: a request for qualifications (RFQ) and a request for proposals (RFP). A W&WRRU must carefully design the bidding process, often pre-qualifying potential bidders to ensure their financial, managerial, and technical capabilities. Using an RFQ, presumably tied to a specific project, generates a shortlist of qualified vendors, often followed up with a request for additional information from and an interview with each private party. Although time-consuming, the RFQ phase is recommended for its ability to lay the foundation for an effective competitive process. Thereafter, the RFP phase enables detailed comparisons for selecting a winning bidder.

**The RFQ Phase.** Key steps in the RFQ phase include:

- Developing and finalizing the request document. Assuming it is tied to a specific project, the main elements of the document include a description of the project’s purpose and objectives, a project schedule, identification of the desired services, and
an explanation of how the proposals will be evaluated. If not tied to a specific project, the document will focus on the last two items.

- Obtaining approval for the release of the request.
- Releasing the request.
- Holding a bidder’s conference to answer questions from prospective bidders.
- Evaluating the responses, involving members of a system’s administrative, technical, and facility staffs.
- Shortlisting the bidders meeting minimum qualifications.

Typically, the RFQ is used to shortlist three to five qualified bidders, with the selection based on three parameters:

- **Financial capacity** examines whether a private party has the financial capacity to undertake its responsibilities over the requisite term. A system must analyze historical financial statements, credit ratings, and current as well as future commitments on other projects.
- **Financing capability** focuses on the private party’s ability to raise the necessary funding, including letters of commitment provided by prospective lenders and experience in raising financing for similar projects. When in doubt, a performance bond, which becomes part of the project’s cost, may be required.
- **Organizational Stability and Experience** assess whether the bidder’s organization is soundly managed and has successfully engaged in comparable past projects. Bidders should provide references and these references should be contacted.

**The RFP Phase.** Thereafter, qualified bidders are invited to submit proposals. Key steps in the RFP phase include:

- Developing and finalizing the RFP. The document includes key project information, such as timelines, output specifications, performance requirements, and payment provisions as well as evaluation criteria and schedules. The technical aspects include the bidder’s approach to design, engineering, construction, services, and maintenance, as appropriate. If the project did not use an RFQ, the RFP will require bidders to provide information on their experience and qualifications as well as their financial and funding capacities.
- Obtaining approval for the release of the RFP.
- Releasing the RFP. If a project-specific RFQ was used, the RFP document is typically issued only to the shortlisted bidders.
- Participation in interactive project development meetings.
- Conducting oral interviews and reference checks.
- Evaluation of the responses.
- Selecting the preferred vendor.

During the RFP phase, bidders will develop detailed proposals and arrange financing for the project. This phase should include an interactive process that permits the W&WRU and prospective P3 partner to exchange feedback and provide clarifications.
The benefits of the RFP process include an expansive competitive search, allowing for the evaluation of multiple proposals, and the ability to assess many potential vendors’ qualifications. However, a traditional RFP pre-defines the solution. To overcome this disadvantage, the system may want to consider an open-ended invitation to negotiation. The RFP process also engenders upfront costs and lengthens the time to implement a solution to a system’s needs. Despite these downsides, a system may be mandated to award a contract using competitive bidding.

**Awarding a Contract**

RFP responses are subject to qualitative and quantitative evaluations. Evaluation of the submitted proposals must follow the criteria set out in the RFP. To be considered, a bid must be materially compliant. Evaluators must follow the evaluation process established at the outset and be free from any conflicts of interest.

Unless required by law, a system need not award a contract on a low-bid (or cost savings) basis. A low-bid selection may compromise quality. Rather, a system ought to award a contract on a best-value basis, not on price alone, selecting the winning bidder on the combination of lowest life-cycle cost and value, including meeting quality standards, among the key selection criteria. The best value approach includes an analysis of a private partner’s past successes in performing its assigned tasks and its financial strength and technical expertise. Indeed, a W&WRRU must select a contractor or developer with a proven record of success as well as the ability to meet the utility’s specific needs. Because of the managerial and technical skills requisite for success on the project, the low bidder may not be the most advantageous contractor or developer.

**Final Negotiations**

Once the preferred bidder has been identified, the public and private partners will enter into negotiations to develop a short memorandum of understanding and then finalize the project contract. Because some of the elements of an energy service contract, an infrastructure construction contract, or a PPA may remain open, the negotiations may be lengthy. This process typically includes making final adjustments to reflect the preferred bidder’s financing structure.

As is true with any negotiation, the parties should aim at achieving a win-win situation, which satisfies each side’s major objectives and achieves a mutually beneficial arrangement. The public sector must provide a contractor with adequate incentives for efficient, effective performance. As noted above, the W&WRRU should engage an attorney with experience in P3 energy projects during the contract negotiating and drafting phase. Expect the private partner’s counsel to similarly be active in this phase of the process.

**DEVELOPING AND IMPLEMENTING A WIN-WIN PARTNERSHIP AGREEMENT**

The parties’ lawyers will draft the P3 contract to reflect the parties’ intentions; key personnel from the W&WRRU will also be deeply involved in this process. This section provides guidance for lay energy project managers and others, including top management, involved in overseeing the contract drafting process. The first section provides a high-level view of important considerations. The second section provides descriptions of a variety of contract terms, many of which a W&WRRU should expect its attorney to include in the final contract.
High-Level Considerations

Be Detailed

A detailed contract helps ensure accountability and decreases the risk of future conflicts. To these ends, a contract should strive to avoid vague, ambiguous language. Thus, it is important for a contract to be definite as to the work scope as well as the performance standards and the private party’s responsibilities with respect to the tasks it will perform.

Performance Criteria

A well-drafted contract must clearly state objective performance standards with respect to costs, quality, and reliability, among other goals. Objective measures of performance (for example, a certain level of electricity generation or efficiency improvement) are preferable to subjective standards that may be open to individuals’ interpretations.

Division of Responsibilities

A contract must clearly delineate each party’s responsibilities. For each component of the contract, from obtaining permits to recordkeeping, these details are critical.

Ongoing Accountability and Oversight

Many P3 contracts establish an ongoing relationship, making accountability and continual oversight key. These types of contracts should contain periodic reporting and monitoring provisions designed to assess whether the private partner has met the contractual performance standards. And penalties for nonperformance should be specified, including provisions for terminating the contract.

Provide a Dispute Resolution Mechanism

A contract should include a mechanism for resolving disputes before turning to litigation. Common methods are mediation and arbitration.

Provide for Renegotiation and Readjustment

Even well-designed contracts may require renegotiation and readjustment at some point, as many of the case studies above demonstrate. Thus, a contract should provide mechanisms for making these adjustments that maintain the parties’ relationship and are aimed at fair results for all concerned.

Typical Contractual Terms

A well-written contract is the “operation manual” for the W&WRUU-P3 relationship. It should address all of the parties’ obligations as well as how any contingencies will be handled.
Thus, the contract should be drafted so that it can answer questions that might arise in the future—even after the original personnel involved in developing the agreement are no longer there.

If a W&WRRU is entering into a P3 energy contract either for the first time or for a technology that is new to the W&WRRU, the best practice is to enlist the assistance of outside counsel—a lawyer who specializes in such agreements. Many of the provisions are unique to this context and an experienced attorney can help avoid future problems by carefully accounting for them in the contract language.

In addition, state or local government law may impose particular requirements to some of the contractual provisions. The provisions below are examples of the most common contractual terms in W&WRRU-P3 energy projects, but they may not include all the necessary terms, or they may provide more terms than necessary. Rather, the provisions are meant to help guide a best-practices approach to developing a contract that will endure for the life of the project.

Note: the terms “contract,” “agreement,” and “bargain” are used interchangeably throughout the material that follows. The term “P3 party” refers to the private party, not the W&WRRU.

**Introductory and Preliminary Contract Provisions**

The following terms are often found at the beginning of a contract.

*Table of Contents.* A table of contents helps the contract operate like a user’s manual for the agreement.

*The Parties.* Specify who are the parties to the contract, and any shorthand names that will be used in the rest of the document. For example, the Ridgewood Case Study references: “the Village of Ridgewood, NJ (hereinafter, the “Host Customer”).” Be sure any shorthand names are used consistently throughout the document.

*Definitions.* Definitions of important terms can play an important role in understanding the contract if issues arise. Be sure the list of definitions is as comprehensive and accurate as possible.

*Recitals.* Recitals are usually statements of the W&WRRU’s motivations for entering into the P3. They are not enforceable contract terms, but are desirable for communicating the W&WRRU’s motivations to the public and other stakeholders. These terms can also provide a quick overview of the most important parts of the contract. Drawing from the SAWS case study, for example, recitals might reference the W&WRRU’s intention to “convert an otherwise waste resource whose release has negative environmental consequences” into a “beneficial resource” or “useful commodity” that will also “generate revenue” for the W&WRRU. Or, as in the Ridgewood example, the recitals can provide a purpose like “to install and generate for the W&WRRU’s purchase solar power” or “to provide system upgrades and install the necessary equipment for a biogas electricity generation system.”

*Conditions Precedent.* Conditions precedent are events that must take place before the contract can become effective. For local government entities, conditions precedent might include receipt of grant or matching funding, any necessary post-contract approvals, and the like. For P3 parties, conditions precedent might include obtaining any government approvals, like permits, that are necessary to the project.
The Contract’s Core—The Parties’ Key Obligations

The following terms are at the heart of the contract.

**Term.** Be sure the contract explains how long the parties’ obligations will last. This provision may include a time period after which the contract can be renewed, either automatically or on agreement of the parties. It may also specify any conditions that must be met prior to renewal. This provision should also describe when the contract would terminate if renewal were not an option.

**Key Obligations.** These terms describe the most important parts of what the parties have agreed to do. A DBO P3, for example, will describe all aspects of the P3 party’s commitment to design, build, and operate the new system or equipment. These terms will also address matters necessary for each party to perform its obligations. For example, they will specify who is responsible for obtaining the necessary permits, prioritize the W&WRRU’s ability to conduct its operations unhindered, ensure the P3 contractor’s access to the site, detail the P3 contractor’s obligation not to damage the site or equipment or interfere with operations except as necessary to perform the contract; and describe which party is responsible for ensuring proper utility connections and paying the cost of utility services.

**Design.** The project’s design should be specified, including any particular equipment for which specification is important to the parties. As noted earlier, the design should account for site-specific characteristics.

**Construction Provisions.** Like any capital-intensive P3, the contract must specify the parties’ obligations with respect to construction. When the P3 party has agreed to undertake construction, accompanying contract provisions specify that construction will proceed in conformity with applicable laws and contractual requirements. The W&WRRU typically promises to make the premises reasonably available, and otherwise cooperate with construction consistent with providing its core services. Among other things, P3 parties are responsible for providing updates during construction, and as-builts and operational manuals following construction.

**Operation.** The contract should specify which party will operate the project. When the P3 party is the operator, the W&WRRU should provide reasonable access to the site, and the P3 party should not unreasonably interfere with W&WRRU operations.

**System Ownership.** This provision specifies which party owns the system, if one is installed, and how ownership may be transferred from the P3 party to the W&WRRU, if permitted by the contract (note that transfer of system ownership by the P3 party to a new P3 party should be handled by the Assignment provisions of the contract, detailed below). Ownership of the system may have tax implications (whether benefits or burdens) that can be specified here as well.

**Buy-Out/Purchase Option.** For P3 projects under which the P3 party owns the equipment or system, most contracts include a buy-out or purchase option provision, which entitles the W&WRRU to purchase the equipment and take over its operation at the end of a fixed period of time. The contract will either specify a price or, more commonly, how a price will be determined.

**Delivery of Electricity.** For P3 projects that will generate electricity, pay careful attention to which party is responsible for ensuring that the electricity generated can be used by the W&WRRU. The parties can agree that it is either the P3 party’s or the W&WRRU’s responsibility to ensure that the necessary equipment is in place so that the W&WRRU can accept and use the electricity, depending on the optimal allocation of risk and VfM. A delivery point should be specified at which the electricity is transferred from the P3 party to the W&WRRU; typically, the risk of loss of electricity is also transferred at this delivery point.
**Payments/Income/Revenue**

The following terms relate to the financial aspects of the contract.

**Financial Commitments.** Most parties view financial commitments as among the most important of all the contractual provisions, so these should be detailed as carefully as possible. The W&WRRU should evaluate its financial commitments as part of the VfM analysis, described above, prior to reaching an agreement.

For example, in solar PPAs, the P3 party typically assumes all financial obligations for installing, operating, and maintaining the equipment, and the W&WRRU agrees to pay the P3 party a fixed rate for all of the electricity that the solar panels produce, for a set term. The cost of power might be fixed for the entire term of the contract, it might increase at a set rate every few years, or it might be set at some price tied to retail market rates (for example, just under the prevailing retail market rate). All of these components of the agreement will be part of the contract’s core obligations.

**Invoicing and Payment.** State law may require particular terms for how the W&WRRU is to be invoiced and how payments will be made. Otherwise, the parties should consider such matters as how often the payor will be invoiced, what the invoices should include, and how long thereafter and by what method payment will be made. Procedures for resolving any invoice disputes should also be included. In addition, the parties should specify how long any invoicing and payment records should be retained.

**Environmental Benefits.** Energy projects often generate environmental benefits, so this section of the contract should also specify which party owns those benefits. It is common that the private P3 party retains the benefits of any RECs, tax incentives, net metering, feed-in-tariffs, or other incentives, but the specifics should be put in writing. In addition, there should be a provision specifying that the parties will execute any documents necessary to ensure that the environmental benefits are transferred as contemplated by the contract.

**Contract Monitoring and Enforcement**

The following terms relate to how the parties’ performance under the contract is monitored and enforced.

**Metering and Measurements.** Monitoring performance and enforcing contract obligations require means of measuring outcomes. For example, if electricity is to be generated, the contract should specify which party is responsible for providing metering equipment, equipment testing, and equipment maintenance. Other measures that may be necessary are biogas production and/or treatment, biogas shipments, acceptance of additional wastes like FOG, and the like. This portion of the contract should specify any dispute resolution processes and what measurements will ultimately control.

**Performance Measures.** This provision will specify how the P3 party’s performance will be measured. This might be, for example, a yearly average power or heat output. Ensure that performance measures are as detailed as possible. As described in the case studies, W&WRRUs report that clear performance measures are critical to successful P3 energy projects.

**Right to Inspect Records.** This provision obligates each party to keep adequate records relating to the contract and gives each party the right to inspect the other’s records. Details include specifics as to what records must be kept, how records must be kept, how long they must be kept,
how requests for record reviews must be made, when records must be produced, and how records will be reviewed.

**Contingencies**

Contracts try to anticipate changed circumstances. Some of the commonly used terms for contingencies follow.

**Assignment.** May either of the parties assign the contract? Under what circumstances? A W&WRU may prefer to have a right to participate in the selection of, or veto, a prospective assignee (that is, a new P3 party). However, some P3 agreements prohibit assignments altogether. At the very least, any party contemplating an assignment should be required to notify the other party.

**Notifications.** The parties should notify one another of major events that could impact their ability to perform their contract. These might include (1) any proceeding with respect to the real property (that is, the W&WRU site); (2) any major operational changes at the site that would impact the P3 project; (3) any major changes impacting the financial status of the P3, such as a bankruptcy filing, major adverse judgment in litigation, or change of ownership or governance.

**Default.** These provisions will specify what constitutes default, and how default can be remedied. Examples of default are (1) failure to pay; (2) failure to provide a good or service; (3) failure to perform obligations in the contract; (4) failure to adhere to covenants in the contract; (5) assignment of the contract without consent; (6) bankruptcy of either party; (7) failure to maintain insurance; (8) consolidations and mergers of either party; and the like. It is advisable to include as many specific terms as possible, as well as a more general catch-all term that can cover important defaults that the parties did not think to specify.

**Remedies.** If a party is in default, contracts typically specify how notice of the default will be given and the conditions under which the defaulting party may remedy the default. Failure to correct a default typically can result in contract termination and/or damages.

**Termination.** This provision specifies the circumstances under which a party may terminate the agreement. Termination is often a remedy for breach of contract or failure of one of the contract’s terms (like obtaining the necessary permits, for example), but it does not necessarily have to be for cause. A W&WRU should be wary of a termination provision that allows a P3 party to unilaterally terminate the contract.

**Misconduct.** If the system is lost or the contract cannot be performed due to the misconduct of one of the parties, that party is usually fully responsible for the loss. Other provisions involving misconduct may expressly preserve the harmed party’s right to seek legal remedies. If the system remains operational or the contract capable of being performed despite partial loss due to misconduct, the contract should specify the conditions under which performance must continue.

**Force Majeure.** This provision temporarily excuses parties from performing their contract obligations for extraordinary, unforeseeable events beyond their control, like war, riots, extraordinary flooding, earthquakes, and volcanic eruptions.

**Damage or Destruction of Facility or Equipment Related to the P3 Project.** If the facility or equipment is damaged or destroyed (for example, by fire or an extreme weather event), this term would explain the circumstances under which the parties would terminate, delay, or continue with the contract.
Other Common Contract Terms

Additional terms common to such contracts are as follow.

**Indemnification.** It is typical for the P3 party to indemnify (compensation for harm or loss) the W&WRU for any claims arising out of the P3’s conduct, and vice versa. Consult an attorney for any required indemnity provisions arising under state or local law.

**Insurance.** Consider who will insure the P3 project’s equipment, and for whose benefit the insurance will be procured. Other insurance matters may include premises liability, personal injury, products liability, independent contractor liability, and so on. Required insurance is typically a matter of state law, and state law or local ordinance may specify the precise terms of any insurance provisions to be included in the contract.

**Allocation of Tax Liability.** The new equipment may be taxable at the federal, state, or local level; even if this is unlikely, the parties should detail which party is responsible for any such taxes.

**Allocation of Environmental Liability.** This provision sets forth which party is responsible for environmental liabilities arising out of the project.

**Representations and Warranties.** The parties will often represent that they have the power to undertake the contractual obligations. Express warranties may also be included.

**Governing Law.** This term specifies what state’s law applies in the event of a dispute. The W&WRU should choose the law of the state within which it operates (and it may be required to do so under state or local procurement law).

**Dispute Resolution.** The parties may wish to resolve disputes first through good-faith negotiation, and thereafter, through mediation or arbitration prior to, or in lieu of, resort to the courts. State law requirements may apply.

**Confidentiality.** The parties may specify that information that becomes known to them through contract performance will remain confidential and will not be used except in furtherance of performing the contract, to the extent permitted by law.

**Public Relations.** Both the P3 party and the W&WRU will likely want to generate favorable publicity regarding the project and their P3, so a contract should describe each party’s rights to do so. For example, a W&WRU may prefer to be able to issue press releases, create advertising and promotional materials, and the like, without prior approval of the P3 party.

**Financing.** If the equipment owner may pledge the equipment that is subject to the P3 as collateral for obtaining financing, the terms of so doing should be specified in the contract.

**Entire Agreement; Amendments.** The contract should specify that it (plus any specified attachments) reflects the parties’ entire agreement (that is, there are no additional agreements that are not written in the four corners of the contract document). In addition, the contract should specify that amendments, modifications, or other changes to the contract must be in writing and signed by both parties.

**Non-Waiver.** Contracts commonly provide that a party’s failure to exercise a right under the contract does not operate as a waiver of that right.

**Severability.** If a court were to hold a portion of the contract unenforceable, a severability clause can ensure that the rest of the contract will remain in effect.

**Third-Party Beneficiaries.** The parties will likely want to specify that there are no third-party beneficiaries to the contract.

**Attorneys’ Fees.** The parties may choose to specify that if one of them prevails in a dispute, the other must pay reasonable attorneys’ fees and costs.
**Attachments.** Attachments to the contract should include the technical details of the project to be undertaken. The contract should reference and itemize the attachments as included as part of the parties’ agreement.

**Contract Management**

With a well-drafted contract in place and after commercial and financial closings have been achieved, the W&WRRU will have ongoing monitoring and oversight responsibilities. Assuming the W&WRRU must provide (and pay for) ongoing monitoring, the facility should establish an in-house contract administration arrangement. This mechanism sets out the utility’s contract management plan and allocates internal resources, specifically staff, to various tasks.

Effective contract administration begins with a well-grounded understanding of the contract and its provisions. The contract will establish the ongoing information required from the private partner, including its frequency and timing. The W&WRRU’s contract administrator should work closely with on-the-ground personnel and management to ensure that monitoring is effective and that any issues can be quickly resolved. Regular, ongoing communication between the W&WRRU and private party helps build trust and the ability to quickly resolve any unforeseen issues.

Furthermore, the project’s champion and other W&WRRU should continue to engage stakeholders, keeping them up-to-date on the project’s progress and announcing major milestones and successes as they occur.

**CONCLUSION**

W&WRRUs can successfully leverage the P3 tool to implement energy projects that promote sustainability, enhance operations, and provide a revenue stream or cost savings. This report has described best practices for identifying energy needs, choosing a project, determining the best delivery model, negotiating and drafting a contract, and ensuring a successful outcome. In addition, this report provides a resource for understanding the drivers of such projects, the variety of forms they may take, and lessons learned from five case studies. P3 energy projects are likely to increase in number over the coming years, and this report aims to be a resource along the way.
## APPENDIX A
### P3 MODELS, FUNCTIONS, AND WATER AND WATER RESOURCE RECOVERY UTILITY ENERGY PROJECT EXAMPLES

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<tr>
<th>P3 Model</th>
<th>Function</th>
<th>Energy Project Example</th>
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<tbody>
<tr>
<td><strong>Energy Saving Performance Contract (ESPC)</strong></td>
<td>Represents a combination of project financing-design-upgrading. Private partner guarantees that infrastructure improvements, replacements, or upgrades will deliver a specified amount of energy, water, and operational savings over a period of time. Costs of retrofits are offset by guaranteed savings, thereby helping maintain cash flow, debt service, and stable customer rates. Post-installation monitoring, evaluation, and service support will carry through contract performance period (e.g., 20 years).</td>
<td>City of Riverbank, CA, Wastewater Treatment Plant enters into an ESPC to upgrade its equipment and operational controls and transfer significant risk to a private partner. Facility improvements were fully funded through guaranteed cost savings with reductions in energy consumption. The city estimates that it saves 65% on its electric bill, resulting in $4.8 million avoided energy costs over the 20-year contract.²⁴⁷</td>
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<tr>
<td><strong>Power Purchase Agreement (PPA)</strong></td>
<td>Contract between buyers and sellers of electricity. For P3 projects at W&amp;WRUs, is often part of a general partnership agreement that specifies the overall P3 project terms. An important means of financing smaller-scale energy generation projects (e.g., solar PV). In such contexts, the buyer is the onsite host of the power generation equipment, which the seller (typically, a private partner) owns and operates. PPA defines the price of the power generated and other terms. Availability of a guaranteed revenue stream permits the seller to attract financing, while the buyer can take advantage of predictable power prices generated from clean electricity over contract period (e.g., 20 years).</td>
<td>Village of Ridgewood, NJ, Ridgewood Water Pollution Control Facility (buyer and onsite host) uses the PPA tool to secure a long-term price for electricity, incentivizing the private partner (seller) to construct and operate biogas-to-energy and solar power generating systems resulting in energy cost savings.</td>
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<tr>
<td>P3 Model</td>
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<td>Energy Project Example</td>
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<td><strong>Servicing and Consulting</strong></td>
<td>Private sector provides ancillary, non-core functions. A service contract is usually a short-term agreement where the private firm takes responsibility for one or more specific tasks (e.g., billing, meter reading, and leak detection); whereas a consulting contract can involve project-specific evaluation and advisory services (e.g., energy audits, site assessments, and benchmarking analysis).</td>
<td>Rockland County, NY, Sewer District #1 partnered with Siemens to conduct an Investment Grade Energy Audit, which identified facility improvement measures with a total guaranteed savings of nearly $37 million over a 20-year timeframe, providing the basis to proceed with an ESPC.</td>
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<tr>
<td><strong>Design-Build (DB)</strong></td>
<td>Private partner is responsible for design and construction while bearing the risk of design flaws and cost overruns.</td>
<td>Each Chapter 5 W&amp;WRUU case study involved DB responsibilities and risks being shifted to the P3 private partner for energy project delivery.</td>
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<tr>
<td><strong>Design-Build-Operate-Maintain-Finance (DBOMF)</strong></td>
<td>Private partner is responsible for project design, construction, operations and maintenance (O&amp;M), and financing. O&amp;M responsibilities incentivize employing high quality construction methods and materials to reduce future maintenance expenses, while financing responsibility for the life of the P3 project maximizes the incentive to be cost- and schedule-efficient so that cash flows begin as quickly as possible for servicing debt and providing adequate returns to equity investors. Asset ownership remains with the public sector.</td>
<td>District of Columbia Water and Sewer Authority (DC Water) partnered with Pepco Energy Services through a 15-year DBOM P3 for a CHP project producing at least 14 MW of electric power and supplying DC Water’s Blue Plains facility with nearly 30% of its average power demand.</td>
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<tr>
<td><strong>Design-Build-Own-Operate-Transfer (DBOOT)</strong></td>
<td>Private partner finances, designs, builds, owns, and operates a project for a specified contract period, whereby ownership of the infrastructure assets are optionally transferred from the private partner to the W&amp;WRUU at the end of the P3 contract.</td>
<td>City of Thousand Oaks, CA, Hill Canyon Wastewater Treatment benefits from two such P3 arrangements for biogas cogeneration and solar power systems, which generate more than 100% of the facility’s electricity needs.</td>
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<tr>
<td><strong>Lease</strong></td>
<td>Private sector leases infrastructure assets, or facility premises, from a public entity, and is compensated with the revenue stream that the assets generate, rather than on a fee-for-service basis. Asset ownership remains with the public sector. The risk of future revenue generation is also held by the private sector, incentivizing cost control and performance outcomes.</td>
<td>City of Portland, OR, Portland Water Bureau (PWB) uses P3 lease for Lucid Energy, Inc. to pilot an in-pipe turbine hydroelectric generating system within PWB’s water delivery lines with production up to 1,100 MWh per year.</td>
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ABBREVIATIONS

Btu   British Thermal Units
CAA   Clean Air Act
CHP   Combined Heat and Power
CPP   Clean Power Plan
CWA   Clean Water Act
DB    Design-Build
DBO   Design-Build-Operate
DBOMF Design-Build-Operate-Maintain-Finance
DBOOT Design-Build-Owen-Operate-Transfer
DOE   U.S. Department of Energy
DR    Demand Response
DSM   Demand-Side Measures
EPA   U.S. Environmental Protection Agency
ESCO  Energy Services Company
ESPC  Energy Savings Performance Contract
KW    Kilowatt
KWh   Kilowatt Hour
MGD   Million Gallons Per Day
MW    Megawatt
MWh   Megawatt Hour
NAESCO National Association of Energy Services Companies
O&M   Operations and Maintenance
P3    Public-Private Partnership
PAB   Private Activity Bond
PPA   Power Purchase Agreement
PSC   Public Sector Comparator
PURPA Public Utilities Regulatory Policy Act
REC   Renewable Energy Credit
RFP   Request for Proposals
RFQ   Request for Qualifications
RIN   Renewable Identification Number
RPS   Renewable Portfolio Standard
SPV  Special Purpose Vehicle

TIFIA  Transportation Infrastructure Finance and Innovation Act of 1998

USDA  U.S. Department of Agriculture

VfM  Value-for-Money

W&WRRU  Water and Water Resource Recovery Utility

WIFIA  Water Infrastructure Finance and Innovation Act

WWTP  Wastewater Treatment Plant
ENDNOTES

7 EPA, Sustainable Future, supra note 3, at 4.
10 Id. at v.
11 See infra Chapter 3 (describing wind and solar projects).
14 Opportunities for CHP, supra note 9, at 30; Leiby and Burke, supra note 8, at 1-3.
15 Opportunities for CHP, supra note 9, at 30.
16 Eisen et al., supra note 4, at ch.4.
17 E.g., supra note 1, at 14.
Our case studies have demonstrated this driver. See infra Part III.

Opportunities for CHP, supra note 9; Leiby and Burke, supra note 8, at 1-3.


See also EPA, Sustainable Future, supra note 3, at 13.

Michelle D. Layser, Improving Tax Incentives for Wind Energy Production: The Case for a Refundable Production Tax Credit, 81 Mo. L. Rev. 453, 459 (2016) (“The wind energy industry is highly sensitive to the availability of subsidies like the production tax credit, and observers have collected significant data that correlates slowed growth in the wind industry with periods of uncertainty about the future availability of the credits.”).


The project team identified fewer than five onsite wind projects, but of course these projects may qualify for the wind production tax credit.

Mormann, supra note 25, at 309.

It seems likely that projects financed under tax equity investment schemes cost more than those financed through grant funding. Mormann, supra note 25. The tax implications of P3 energy projects for local governments are beyond the scope of this project. W&WRRUs should seek qualified tax advice in connection with considering P3 energy projects.


Mormann, supra note 25, at 316.

Id. at 317.


Tarallo et al., supra note 6, at 2-1.

Id. at ES-1.

E.g., Final Report, King County Fuel Cell Demonstration Project (Apr. 2009) [hereinafter “King County”].


For details, see 18 C.F.R. § 292.204 (small power production facilities); id. § 292.205 (small cogeneration facilities). One report notes that early CHP sales from California wastewater treatment plants under PURPA contracts were productive, but today, because of gas production uncertainties and fluctuating power needs, biogas-powered CHP is considered an intermittent resource and is not eligible for the same (higher) prices paid to generators that supply firm resources. Pramod Kulkarni, Electricity Analysis Office, Calif. Energy Commission, *Combined Heat and Power Potential at California Wastewater Treatment Plants*, CEC-200-2009-014-SF, at 23, (July 23, 2009).


*See* Tarallo et al., *supra* note 6, at 2-7 (describing difficulty of exporting power).

Carbon Pollution Emission Guidelines for Existing Stationary Sources: Electric Utility Generating Units, 80 Fed. Reg. 64,662, 64,855 (Oct. 23, 2015) [hereinafter Clean Power Plan]; *id.* at 64,901 (noting properly documented and verified efficiency measures at water and wastewater treatment plants count toward compliance).


Regulation of Fuels and Fuel Additives: RFS Pathways II, and Technical Amendments to the RFS Standards and E15 Misfueling Mitigation Requirements, 79 Fed. Reg. 42,128 (July 18, 2014). For a full history of biogas and the ways in which it can qualify for a variety of RINs, see generally *id.*

The wholesale electricity markets are under the jurisdiction of the U.S. Federal Energy Regulatory Commission. Two-thirds of U.S. electricity wholesale sales are conducted in these markets, which are operated by Regional Transmission Operators (RTOs) or Independent System Operators (ISOs). These entities operate the regional grids and associated markets, conduct planning, and have key responsibilities for grid reliability.


See Delaware Department of Natural Resources and Environmental Control v. EPA, No. 13-1093 (D.C. Cir. May 4, 2016) (vacating EPA rule that exempted from Clean Air Act requirements back-up generators used for demand response emergencies).

For further explanation and case studies, see Bethany Sparn and Randolph Hunsberger, National Renewable Energy Lab., *Opportunities and Challenges for Water and Wastewater Industries to Provide Exchangeable Services* (Nov. 2015).

E.g., Eisen et al., *supra* note 4 at ch. 11.

Id. at 759. Some states use Clean Energy Credits, which extend to non-renewable forms of zero-emission power like nuclear. E.g., N.Y. Public Service Commission, CASE 15-E-0302 & 16-E-0270, Order Adopting a Clean Energy Standard (Aug. 1, 2016).

Id. at 751. FITs are also called “renewable energy payments.”


Net Metering, dsireusa.org (July 2016).
Up-to-date, state-by-state information is available by National Council for Public-Private Partnerships at ncppp.org. In states where there is no express authorizing statute, local governments’ authority to engage in P3s is a function of each state’s general local government law. For further information, see generally Allen and Overy LLP, *PPPs and Municipal Home Rule* (Spring 2009), at http://clientlink.allenovery.com/images/0912-homeRule_SP09.pdf (providing state-by-state guide to local governments’ authority to undertake P3s, even in the absence of authorizing legislation).


Up-to-date, state-by-state information is available at dsireusa.org. See *Third Party Solar PV Power Purchase Agreement*, dsireusa.org (July 2016).

Eisen et al., * supra* note 4, at 784-86.


See *infra* Part III (providing case studies).


Id. at 24.

E.g., id. at 8 (Janesville, WI; Arlington, TX).


Id. at v.

Id. at vi (assuming a payback period of seven years of less).

Id. at v. The economic potential is estimated at 43-63 percent of the technical potential. Id.

Id. at 3.

See * supra* Parts II.B.3, .4.

EPA, *Opportunities for CHP*, * supra* note 9, at 3 (listing additional CHP technologies including sludge incinerator heat recovery and mechanical power systems). Furthermore, other digester biogas applications include sale to industrial users or power generators, vehicle fuel, treatment to pipeline quality for sale to natural gas companies, and as boiler feedstock for heat generation. Id. at 3-4.

Id. at 6-7.

Id. at 9.

Id. at 19-20.

Id. at 20.
This number has increased since the utility began operations in 2010. See City of Vancouver, Southeast False Creek Neighbourhood Energy Utility: in depth, at http://vancouver.ca/home-property-development/utility-facts-and-presentations-in-depth.aspx (2016).


These variables include whether the panels are on a traditional fixed-tilt design, single-axis tracking, or tilted tracking. National Renewable Energy Lab., Land-Use Requirements for Solar Power Plants in the United States (June 2013); see also National Renewable Energy Lab., Utility-Scale Energy Technology Capacity Factors (last updated Mar. 22, 2016).

Such areas can include both open space and areas suitable for carport-like structures; the latter was chosen for Camden County facility in New Jersey. AECOM, Technical Feasibility Study for Photovoltaic Systems, DC Water Blue Plains Advanced Waste Water Treatment Plans, 15-16, (Jan. 2014).


A thorough description is provided in Solomon, supra note 12, and The Horinko Group, The Role of Public-Private Partnerships in Meeting a Community’s Water and Wastewater Needs—A Primer for Public Officials (Jan. 2015). See also Hearing on Overview of Public-Private Partnerships for Water and Wastewater Projects Before the H. Comm. on Transp. and Infrastructure, at 4-6, (Mar. 25, 2014) (statement of Bruce Tobey, Partner, PLDW) (describing infrastructure needs and providing overview of P3s) [hereinafter Tobey Testimony].


Solomon, supra note 12, at 151-56.

Sabol and Puentes, supra note 80.

Solomon, supra note 12, at 151-56.

Id.
122 Id. at 157.
123 See also The Horinko Group, Proposed Public-Private Partnership Projects for U.S. Inland Waterways Infrastructure Financing, Operations, and Governance, 37, (Dec. 2013) (discussing advantages and possible disadvantages of P3s).
126 U.S. Department of Treasury, supra note 78, at 8-12.
127 The Horinko Group, supra note 115, at 5-8.
129 The Horinko Group, supra note 115, at 7.
131 Ben Johnson, Case Study: City of Riverbank, CA, 3-4, (Schneider Electric Mar. 2016).
133 The Canadian Council for Public-Private Partnerships, supra note 116, at 12.
137 U.S. Department of the Treasury, supra note 78, at 8-9.
139 Sabol and Puentes, supra note 80, at 7.
140 See also U.S. Department of Treasury, supra note 78, at 6-10.
142 Governing, supra note 141, at 18.
143 Sabol and Puentes, supra note 80, at 7.
144 See, e.g., infra Part III (describing case studies).
146 The Canadian Council for Public-Private Partnerships, supra note 116, at 27.
147 The National Council for Public-Private Partnerships, supra note 117, at 8-12.
148 The Horinko Group, supra note 115 at 15-16.
149 Bipartisan Policy Center, Bringing the Gap Together: A New Model to Modernize U.S. Infrastructure, 21, (May 2016).
151 Sabol and Puentes, supra note 80, at 8.
153 U.S. Department of Treasury, supra note 78, at 8-12.
155 Sabol and Puentes, supra note 80, at 14.
157 Nicholas Cattaneo, Alternative Funding for W/WW Improvement Projects, Schneider Electric, Presentation (July 2013).
158 Although the industry frequently uses the term “solar power purchase agreement,” this financing mechanism is not limited to solar power. Cf. EPA, Solar Power Purchase Agreements, at www3.epa.gov/greenpower/buygp/solarpower.htm. (last updated Apr. 15, 2014).
159 Eisen et al., supra note 4, at 841.
160 Id. at 841.
161 That is, sales of power that are not for resale. Wholesale sales in interstate commerce are subject to the jurisdiction of FERC and are generally outside the scope of this report. Cf. Federal Power Act § 201(a), 16 U.S.C. § 824(a) (2012).
162 Some states may define would-be system owners as utilities, which can cause barriers to distributed generation PPAs in traditionally regulated states. E.g., PW Ventures v. Nichols, 533 So.2d 281 (Fla. 1988) (upholding PSC determination that would-be solar PPA provider would be public utility even if selling to a single customer). Compare SZ Enters., LLC v. Iowa Utilities Bd., 850 N.W.2d 441 (Iowa 2014) (reaching opposite result). California, by contrast, has exempted third-party providers from the scope of its “public utility” definition.
163 Which sources qualify for RECs is a matter of state law. DSIRE maintains a database and website of state incentives for renewables and efficiency at www.dsireusa.org.
164 That is not to say that all PPAs work this way. For example, the Santa Rosa Water Reclamation Facility in Murrieta CA has a solar PV installation and uses a PPA under which the installer gets the state incentive payments, but the facility retains the RECs. AECOM, supra note 107, at 19.
165 Eisen et al., supra note 4, at 866.
166 Id. at 866-67.
168 U.S. Department of Treasury, supra note 78, at 11.
169 For examples, see Tarallo et al., supra note 6, at 5.
171 Eggers and Startup, supra note 167, at 5.
172 See The Horinko Group, supra note 14 at 6-9.
173 U.S. Department of Treasury, supra note 78, at 11.
174 Id.
175 Id. Technically, some PPAs may be considered a variant of DBOMF and DBOOT.
176 Eggers and Startup, supra note 167, at 5.
177 The Canadian Council for Public-Private Partnerships, supra note 116, at 5-6.
178 Id.

Id. at 5-6.

Id. at 12; Sam D. Bolstad, Your Local Solar Panel Store: Developing State Laws to Encourage Third-Party Power Purchase Agreements, 99 Minn. L. Rev. 705 (2014).

Sabol and Puentes, supra note 80, at 17.


Sabol and Puentes, supra note 80, at 8.

Cattaneo, supra note 157.

U.S. Department of Treasury, supra note 78, at 10.


U.S. Department of Treasury, supra note 78, at 8-12.


Sabol and Puentes, supra note 80, at 18.


Id.


Id. at 30.

Id.

The Horinko Group, supra note 123, at 60.

Id. at 56.


Spurgin, J. T., *Staff Report: Cogeneration at Hill Canyon Wastewater Treatment Plant*, (City of Thousand Oaks Public Works Department, December 18, 2012).

Chuck Rogers, personal communication, March 22, 2016.

*Id.*

*Id.*


Of course, the matter of complying with requirements for obtaining required construction permits and environmental and other regulatory approvals from various bodies with relevant jurisdiction still remains.

Chris Rutishauser, personal communication, March 9, 2016.

Neozyme International Inc. hold U.S. Patent no. 5,879,928 for EcoSystem Plus®. Its New Jersey product distributor had represented to Director Rutishauser that the additive would, among other things, enhance “biological processes and anaerobic digestion, thus increasing Biogas quantity to generate electricity production....” Letter from Bio-Organic Catalyst to Chris Rutishauser (Jan. 9, 2013).

The monthly cost associated with the use of this additive is $2,000.


The RFP also stated a specific requirement regarding the identified CHP technology: “Selected technology must be commercially available with demonstrated success at a minimum of five separate installations in tristate area (New Jersey, New York, and Pennsylvania) or along the eastern seaboard of the United States....”

The library’s directors did not approve installation of the solar panels on the library roof, so the panels were not installed in that location.

The RFP also stated a third goal: to discontinue the use of chemical disinfection of the WPCF’s effluent discharge and replacing it with ultraviolet (UV) light disinfection. As that goal is not related to the P3 energy focus of this study, it will not be further discussed in this case study; in any event, as of this writing a UV system has not been installed.

The RFP alerted potential proposers to the oversight jurisdiction of at least five agencies, listing NJDEP, The New Jersey Department of Health Codes, EPA, the Borough of Glen Rock Land Use and Building Departments, and agencies of the Village itself.

Three declined to respond inasmuch as their skill sets did not align with the requirements of the RFP; another declined because it thought the WPCF too small to produce enough biogas for the project’s demands. Others joined other proposers as members of proposing teams.

As it proceeded with the project, NSU estimated a greater amount of outside waste and accordingly increased the size of the generator to 240 kW.

The proposal recommended the development of these solar arrays in two phases; the first would produce solar power systems on the roofs of the Village Hall, the fire station, and the EMS facility, with a second phase yielding solar units on the library roof (where no installation ultimately occurred) and on the WPCF grounds.

Don Rodgers, personal communication, April 29, 2016.

*Id.*
RCSD had previous pioneering experience with the P3 tool: it also owns and operates an advanced wastewater treatment plant serving the Villages of Hillburn and Sloatsburg as well as portions of the unincorporated Town of Ramapo, which it built on a DBO basis. It was the first municipal wastewater DBO project in New York.

NYSERDA contributed 50% of the cost ($34,900) of Arcadis’s total proposed fee ($69,800).

Pannone Lopes Devereaux and West LLC, predecessor to Pannone Lopes Devereaux and O’Gara LLC, served as outside counsel. One of the authors of this report, Bruce Tobey, is a partner with the firm.


Rockland County Sewer District No. 1. RFP RC-2013-001: Energy Performance Contracting for Rockland County Sewer District No. 1. (County of Rockland, December 2012).

Because neither this agreement nor a subsequent amendment to it gave rise to an expenditure of $100,000 or more, there was no requirement for County Legislature approval.


As of June 30, 2016, PWB had earned and received lease payments totaling only $1,469.44.

SAWS resumed the flaring of methane during the one-year shutdown period.


Id.

Dan Titerle, personal communication, April 16, 2016.


Ben Johnson, *Case Study: City of Riverbank, CA*, 3-4, (Schneider Electric Mar. 2016).