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NATIONAL COMMUNITY SOLAR PARTNERSHIP

Community Solar Model for Water Utilities

By
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INTRODUCTION

Community Solar refers to a solar array located within a community where multiple customers can subscribe and receive a credit on their utility bill for their share of the power that is produced, just as if the panels were on their roof. Residents and small businesses sign up to receive energy from a certain number of panels, which can be purchased up front or as a "pay-as-you-go" subscription.[2] Community solar is expanding in all regions of the US.[3] Community solar can expand access to affordable solar energy, especially for people who live in multifamily housing and rental units, and those who do not have physical space or financial ability to place solar on their property.

Twenty states and Washington, D.C. have established policies to enable or require community solar. Of that group, 16 states and Washington, D.C., have created provisions to address low-income participation in community solar. Incentives provide added funding for projects that subscribe low-income customers; carve-outs require a certain percentage of a community solar project or program to be subscribed by low-income subscribers or low-income serving organizations.

[1] https://www.keyesfox.com/; https://www.keyesfox.com/david-r-wooley/.
[2] Michigan Community Solar Alliance, https://www.micommunitysolaralliance.com/what-community-solar;
Michigan, Office of Climate & Energy, Department of Environment, *Community Solar* website, with links to:
A Guide to Community Shared Solar: Utility, Private, and Nonprofit Project Development
The Solarize Guidebook: A community guide to collective purchasing of residential PV system
U.S. DOE CELICA Toolkit
https://www.michigan.gov/climateandenergy/0,4580,7-364-85453_98214_98271-521093--,00.html
[3] https://solarinyourcommunity.org/market-trends.html.

In the past community solar projects have usually involved partnerships with utilities who provide credits on electric bills for their customers who participate in community solar projects. This paper explores a new model: partnerships with water supply and waste water utilities (here in after "water utilities") that locate solar arrays on water utility property, paid for with funds or subscriptions from their customers, with credits on water supply or water treatment bills.

This paper was developed for Michigan Energy Options[4] who first posed the question whether community solar models could be adapted to drinking water and waste water utilities. This paper was prepared under a Technical Assistance grant from the National Community Solar Partnership program.[5]

Research under this grant supports the following overall conclusions:

- Water and waste water utilities in the US are a large new market for distributed solar investment.
- Community solar models can be adapted to water utilities whose revenues are supported by water or water treatment service bills.
- Water utilities generally appear to have legal authority to provide community solar services to their customers.
- Federal and state agencies should provide a range of research and financial supports to enable water utilities to consider on-site solar generation and community solar services.

This paper is a preliminary review of the potential for community solar for water utility customers. Additional research is needed to test and pilot this concept, however, data for a prototype project suggests that community solar models are viable for water utilities and their customers. See Fact Sheet in the attached Appendix. [6]

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[4] The author of this paper thanks the following people for their ideas and insights that helped guide the development of this paper. John Kinch and Michael Larson of Michigan Energy Options; Laura Wisland, Heising Simons Foundation and formerly Union of Concerned Scientists, and Bonnifer Ballard, Executive Director, Michigan Section, American Water Works.

[5] The National Community Solar Partnership (NCSP) is an inclusive coalition of organizations working to expand access to affordable community solar to every American household by 2025. Partners join to collaborate, learn from each other, set ambitious goals, and gain technical know-how to deliver tangible benefits, like energy bill savings and job creation, to underserved communities. The Partnership builds on the successes of DOE's **Solar in Your Community Challenge**, where more than 175 teams across the country tested and validated dozens of new community solar models serving low income households and nonprofit organizations. https://solarinyourcommunity.org/news-events.html

[6] The author of this paper has many years' experience with electric utility regulation, renewable energy development and policies. He is not, however, water utility law expert. The regulations and laws governing water utility governance and finance differ from state to state. Persons considering a community solar project with a water utility should consult counsel with water utility law experience in their state before proceeding with a community solar service with a water utility.

Water Utility Industry at a Glance

Water utilities operate infrastructure critical to health and well-being of people in almost all urban, suburban and many rural communities.

There are 156,000 “public” drinking water systems in the United States, serving over 306 million people. About 70% of public water systems are privately owned. About 20% are owned by local governments (e.g., cities, counties, towns or villages).[7] There are about 15,000 waste water treatment plants in US.[8] All of these entities use electric power for a range of operations.

Wastewater treatment plants can be a significant consumer of a municipality’s overall electricity consumption.[9] According to the United States EPA (LINK), as much as 4% of all energy use in the United States goes to public drinking water and wastewater services. California Water and Wastewater Special Districts alone spend more than $11 billion per year on electricity. As a controllable operating expenditure, energy use is a sweet spot for cost reduction.[10]

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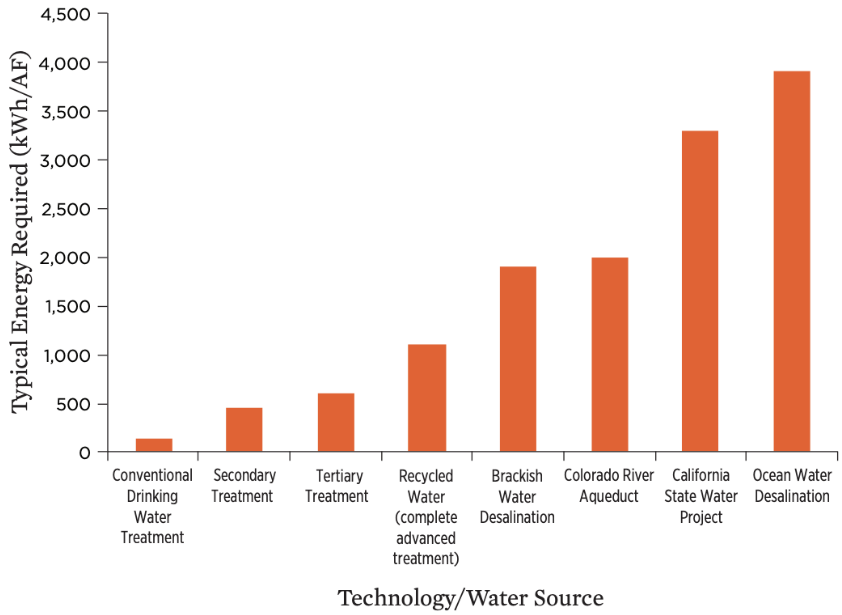
[7] David Denig-Chjakroff, National Regulatory Research Institute, *The Water Industry at a Glance*, April 2008. https://pubs.naruc.org/pub/FA864488-D93A-C11B-0B41-8977DC1C1611 See also, USEPA, https://www.epa.gov/aboutepa/about-office-water.

[8] “Municipal wastewater treatment systems in the U.S. consume a total of approximately 30 billion kWh annually, and their operations are typically the largest energy users in a community. … [That] energy use is expected to increase by up to 20 percent in the coming decades due to more stringent water quality standards and growing water demand based on population growth. Reducing energy usage in these facilities can yield significant environmental, economic, and social benefits for local communities. https://betterbuildingssolutioncenter.energy.gov/sites/default/files/attachments/SWIFt_Results_Sheet_FINAL.pdf

[9] Producing and delivering safe drinking water is a power-intensive operation, involving extensive use of pumps and treatment systems. Generating electricity, in turn uses large quantities of water, primarily for cooling. Consequently, reducing water use reduces demand for electricity, and reducing electric demand in turn reduces use of water. For water utilities operating in drought sensitive regions, solar makes sense from multiple perspectives.

[10] https://solarbuildermag.com/news/benefits-solar-water-plants/ (2015).

FIGURE 1. Electricity Requirements for Different Water Treatment Processes



The energy footprint of water supplies can vary greatly. A key consideration for new water supply alternatives is the amount of energy required to obtain, treat, and deliver potable water. In California, the most energy-intensive water supplies include large interbasin water transfers through the Colorado River Aqueduct and State Water Project and ocean water desalination.

SOURCE: RAUCHER AND TCHOBANOGLOUS 2014.

Water utilities often have significant amount of land,[11] rooftop and reservoir[12] surface space under their control which can be used to site solar generation. Water utilities often provide a wide range of non-water services to their communities. These services can include water and open space conservation services, recreation, community benefit programs and others.

There is huge diversity among water utilities in size, energy requirements, revenues, customer bases and governance and financial structures.[13] Roughly 85 percent of all water and wastewater systems are publicly owned and operated by municipalities and most are small; more than 80 percent of community water systems and publicly owned treatment works serve populations of less than 3,300.

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[11] Water Resource Foundation, *Opportunities and Barriers for Renewable and DER Development at Water and Wastewater Utilities,*
2019 https://www.waterrf.org/research/projects/opportunities-and-barriers-renewable-and-distributed-energy-resource-development.

[12] See, https://deeply.thenewhumanitarian.org/water/articles/2017/08/17/floating-solar-power-a-new-frontier-for-green-leaning-water-utilities.

[13] In Wisconsin, there are approximately 575 municipally-owned water utilities, 81 electric utilities, 1 gas utility, and 600 wastewater utilities. All public utilities in Wisconsin, except wastewater utilities, are regulated by the Public Service Commission (PSC). In most other states, municipal utilities are regulated by the local unit of government itself, and not by a state commission.

Many water utilities face financial difficulties in meeting capital costs to maintain safe and reliable service.[14] Like other sectors, water has an aging infrastructure that requires massive reinvestment to upgrade pipes, mains, pumps and other equipment. Many assets are nearing or beyond their expected lifespan, leading to roughly 240,000 water main breaks, and between 23,000 and 75,000 sanitary sewage overflows per year in the United States. The estimated investment gap ranges from about $400 billion to nearly $1 trillion, just to maintain current levels of service. For example, a report of the 21st Century Infrastructure Commission (2017), Michigan currently "has an $800 million annual gap in water and sewer infrastructure needs."

This financial stress was intensified in 2020-2021 during the Covid Pandemic which resulted in widespread unemployment and commercial facility closures. These factors tended to reduce revenues and greatly increase bill payment arrearage.[15] This suggests that many water utilities are looking for new ways to pay for infrastructure that can lower operating costs and increase resilience against increasing frequent and severe weather events that interrupt electric power supply.

Uninterrupted power is critical to safely deliver water services. A story in the San Francisco Chronicle provides a glimpse at what happens at a water utility when the power goes out, an increasingly common occurrence due to wildfire, storms and other climate related weather events.

> While most urban areas have enough backup power to cover the huge energy demands of water and sanitation service, some rural communities do not. Many utilities were scrambling to get generators in place as well as stockpile fuel to run their backup power equipment….. The Tuolumne district serves many small, far-flung communities that rely on pump stations to deliver water. Some have no backup power because utility rates would never cover the cost….. "We'll try to bring mobiles in, but we don't have enough mobile generators for all those locations," Pattison said. "Remember, this is a rural area. We have customers that are very remote and all over the place."[16]

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[14] See, https://www.greentechmedia.com/articles/read/water-utility-turns-to-dr-and-efficiency-performance-contract-to-save-500m ("Water utilities spend about 30 percent of their total operating budget on energy, and yet have little to no available capital to upgrade systems in order to save money.")

[15] "A survey by the California state water board earlier this year found at least 1.6 million households were behind on water bill payments due to the pandemic, with debt totaling at least $1bn. At least 25 small and medium-sized water utilities – 1% of the total – were at imminent risk of going under." The Guardian, *California Households owe $1 bn in water bills as affordability crisis worsens,* *https://www.theguardian.com/us-news/2021/jan/19/california-water-bills-affordability-debt-crisis*, January 19, 2021. See also, *A Looming Crisis for Local U.S. Water Systems?* February 19, 2021, https://www.nationalacademies.org/news/2021/02/a-looming-crisis-for-local-u-s-water-systems?utm_source=NASEM+News+and+Publications&utm_campaign=d896705adb-What%27s_New_2021_02_22&utm_medium=email&utm_term=0_96101de015-d896705adb-103955281&goal=0_96101de015-d896705adb-103955281&mc_cid=d896705adb&mc_eid=274d55dba3

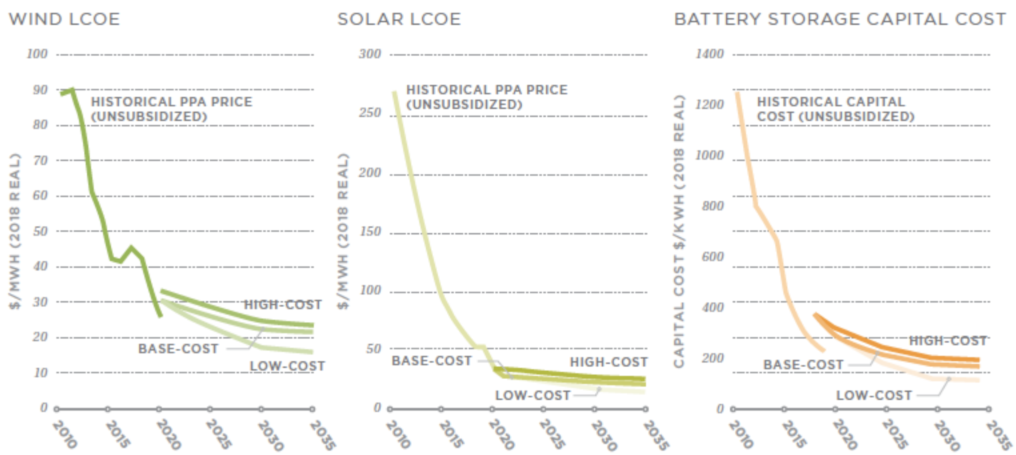
[16] Kurtis Alexander San Francisco Chronicle *When the power goes out, so does the water in some places,* Oct. 9, 2019. See also, *Power Resilience, Guide for water and wastewater utilities,* June 2019 https://www.epa.gov/sites/production/files/2016-03/documents/160212-powerresilienceguide508.pdf

In the NY metropolitan area, Superstorm Sandy in 2012 knocked out electricity over a widespread area and prevented some treatment plants from functioning at all.

There are many examples of successful water utility-based PV systems in the US,[17] but solar power at water utilities remains relatively rare in the US outside of California.[18] We found no examples of water utilities engaging in community solar models.[19]

What Has Changed?

The cost of solar and wind generation and battery shortages has dropped precipitously in recent years.[20]



These radically lower costs mean that renewable generation, including distributed renewables, are economically beneficial across wider and wider parts of the US. For example, successful pairing of solar generation with water utility operations has occurred recently in Michigan and other northern states. See attached Case Studies in Appendix.

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[17] Dozens of water utilities and districts across the United States have embraced the cost-saving benefits of solar power over the past few years. Commissioned installations include the 7.5 MW solar power plant at the Lake Pleasant water treatment plant in Phoenix; a pair of solar systems operating for the Rancho California Water District; the E.M. Johnson plant in Raleigh, N.C.; and a ground-mounted array at the Gresham, Ore., wastewater facility. In each case, the customer expects to offset a sizeable percentage of its annual power usage, enjoy millions of dollars in energy savings over the lifetime of the system and significantly reduce its carbon footprint.

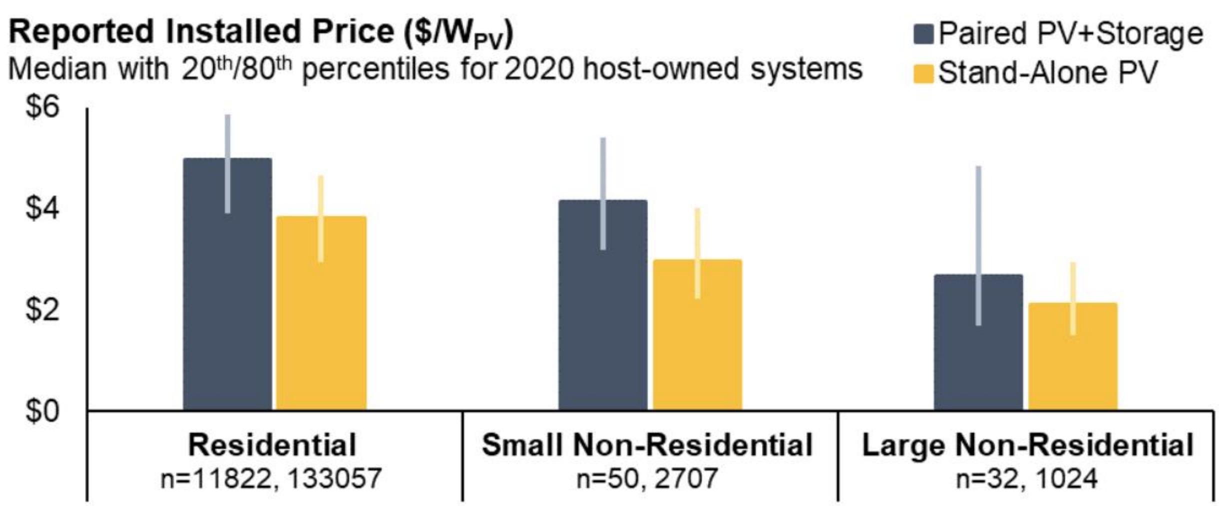
[18] A.Strazzabosco, S.J.Kenway, P.A.Lant, *Solar PV adoption in wastewater treatment plants: A review of practice in California*
https://www.sciencedirect.com/science/article/pii/S0301479719310461,
https://doi.org/10.1016/j.jenvman.2019.109337

[19] One report from 2013 very briefly mentions the potential to use water bill credits to support community solar projects, but none of the case studies in the report include this model. In one case, a solar array was located on waste water utility property, but the bill credits were arranged with customers of an affiliated electric utility. See, *A Guidebook for Community Solar, Programs in Michigan Communities*, 2013
https://www.michigan.gov/documents/mdcd/Michigan_Community_Solar_Guidebook_437888_7.pdf

[20] See, 2035Report, *Plummeting Solar, Wind, And Battery Costs Can Accelerate Our Clean Electricity Future,* page 11-14, available at https://www.2035report.com/electricity/.

Renewable generation is no longer just a resource for in windy Midwest or sunny Southwest regions. In our experience, many people who plan and operate electric utilities are not taking these cost reductions into account in planning and investment decisions. This is likely to be even more true for water utility managers who historically would have had no reason to track such cost trends. Similarly, due to historically high prices, water and waste water utilities will tend to discount potential for solar/battery microgrid applications to provide back-up power and to reduce overall electricity costs. Today the situation is vastly changed. By integrating solar generation into water utility operations managers can significantly reduce the overall energy demand, become energy self-sufficient and, in some cases, energy positive.[21]

Another trend that affects water utility manager attitudes toward renewable generation is the increasingly frequent interruption of electric power supply due to extreme weather events. These events have occurred in all regions of the US in recent years. PV systems can provide resiliency in grid emergencies, providing at least some capacity for operations during the daytime; in combination with storage and demand response systems solar can provide both full resiliency and ability to gain new revenues from demand response / interruptible service, and other grid services in some parts of the US. A report by Lawrence Berkeley laboratory suggests that adding storage to large nonresidential PV systems does not, on average increase cost substantially, but that prices vary widely.[22]



[21] *Solar PV adoption in wastewater treatment plants: A review of practice in California*, Journal of Environmental Management Vol 248, October 2019, https://www.sciencedirect.com/science/article/pii/S0301479719310461; https://www.altenergymag.com/article/2020/01/heres-how-renewable-energy-benefits-the-wastewater-industry/32592. See also, L. Lovely, *Microgrids Power Wasterwater Treatment Plants, WaterWorld,* January 24, 2019, https://www.waterworld.com/home/article/14071013/microgrids-power-wastewater-treatment-plants

[22] Lawrence Berkeley Laboratory*, Behind the Meter Solar+Storage: Market data and trends*, July 2021, https://emp.lbl.gov/publications/behind-meter-solarstorage-market-data

Water utilities typically rely on diesel generators to supply power when the electric grid goes down. But diesel fuel is very expensive, its supply can be interrupted by storms and other emergencies, and diesel generators emit large amounts of toxic air pollution in the community.

Here are some reasons why the time is ripe for water and waste water utilities to adopt on-site solar technology and consider community solar financial models.

- Many water utilities face rising electric power costs and increasingly volatile prices.
- Many water utilities have difficulty raising capital for ordinary system costs.
- Many water utilities, particularly small and mid-sized systems have suffered revenue losses during the Covid-19 epidemic, due to bill arrearages, lower water use in businesses and industry, making it more difficulty to take on new debt.[23]
- Community solar can be structured to put downward pressure on water bills for every customer, including low-income customers (equity issue).
- Solar systems can be added to water utility facilities without up-front capital costs, through 3rd party ownership and PPAs business models, but these models reduce the financial benefit to the water utility and overall community relative to community solar models.
- Drinking water and waste water systems are responsible for 45 million tons of greenhouse gases to the atmosphere annually.[24] Many local governments have adopted GHG reduction goals or are under pressure from consumer and citizen groups to reduce climate impacts. A community solar program is one way to address these concerns at low or zero cost to the water utility budget.

Scope of Authority to Offer Community Solar Services Governance discussion

When considering a proposal to offer Community Solar services, water utility managers will ask, "do we have authority to do this – would we be exceeding our powers as a utility?" Keyes & Fox researched whether the governance structure and powers of water utilities typically would allow it to offer a community solar serviced to its customers and to provide bill credits to their customers who voluntarily contribute capital toward a solar system on water utility property. We did not have resources under this TA grant to do a complete survey of state water utility governance models, to assess whether water utilities have authority to offer community solar services. But we did look at governance structures from two states (MI and CA) to provide a sense of what is typical.

The following are several general observations:

- Water utilities appear to have wide discretion to structure contracting and procurement,

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[23] "… The United States faces a water infrastructure funding gap of hundreds of billions of dollars, which impacts all utilities – but especially small utilities – and can cause compliance challenges that impact the reputation of the sector as a whole." https://www.nacwa.org/docs/default-source/conferences-events/2018-ulc/nacwa-utility-governance-document-(002)v3.pdf?sfvrsn=2

[24]https://www.epa.gov/sites/default/files/2017-04/documents/water_utility_heat_pump_brochure_508.pdf,

- Solar generating facilities and community solar services are similar to a wide range of community benefits that water utilities often provide, including:
    - preferences for local hiring, small businesses, and minority- or woman-owned businesses,[25]
    - provide land or staff to support community recreation
    - preserve land or waters for open space, wildlife protection
    - provide space for a community public art

A community solar service seems consistent with these kinds of activities, particularly where the community solar model provides benefits to the utility customer base.

Statutory Authority

In many states have enacted statutes prescribing the way in which water utilities are formed and governed. Typically, these laws give broad authority to water utilities regarding the scope of activities authorized.[26] For example, The following are excerpts from Michigan law regarding powers of water utilities:

> MUNICIPAL SEWAGE AND WATER SUPPLY SYSTEMS - Act 233 of 1955[27]
>
> § 124.284
> Authority as municipal authority and public body corporate; powers generally.

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[25] See, e.g. San Francisco Public Utilities Commission, Community Benefits Policy, https://sfwater.org/modules/showdocument.aspx?documentid=3676).

[26] See, http://www.waterencyclopedia.com/La-Mi/Legislation-State-and-Local-Water.html#ixzz6suRUS442

> "Legislatures commonly used two different approaches to create these new agencies. One method was to pass general legislation outlining procedures communities had to follow to create and set the boundaries for a specific type of agency, the agencies' duties and powers, and funding mechanisms. Legislatures could create special-purpose, multi-county or regional water agencies. Regardless of how they were created, many of these agencies have overlapping jurisdictions: some possess broad powers, whereas others are limited to a single purpose."

[27] http://www.legislature.mi.gov/(S(lu4ruynwoisuynxd2n5f205v))/mileg.aspx?page=getObject&objectName=mcl-Act-233-of-1955. Other examples include the following from the state of Maryland and Wisconsin:

> PUBLIC UTILITIES
> § 7-105 - Water companies – Powers Universal Citation: MD Pub Util Code § 7-105 (2013)
>
> > (a) A water company incorporated in the State has the powers necessary for the purposes for which it is incorporated and may:
> > (2) The governing body of the municipal corporation or county may adopt reasonable regulations for the …. operations of a water company.

The authority of water utilities in Wisconsin is described as follows:

> "The broadest authority for the management and governance of municipal utility operations derives from statutory home rule. This is an extremely broad grant of authority with respect to the management and control of "the public service" through regulation, license, tax levy, appropriation, and "other necessary or convenient means."

https://www.lwm-info.org/DocumentCenter/View/3824/Public-Utilities-356-Municipal-Utilities-Governance-Options-and-Responsibilities

Sec. 4 (1) An authority shall be a municipal authority and shall be a public body corporate with power to sue and be sued in any court of this state. It shall possess all the powers necessary to carry out the purposes of its incorporation and those incident thereto. Including: Adopt and promulgate rules and regulations for the use of any project constructed by it under the provisions of this act.

(h) Acquire, hold, and dispose of real and personal property in the exercise of its powers and the performance of its duties under this act.
(Emphasis added).

THE GENERAL LAW VILLAGE ACT (EXCERPT)
Act 3 of 1895
71.7 Water works; ordinances.

Sec. 7. The council may enact such ordinances, and adopt such resolutions, as may be necessary for the care, protection, preservation, and control of the water works, and all the fixtures, appurtenances, apparatus, buildings, and machinery connected therewith or belonging thereto, and to carry into effect the provisions of this chapter, and the powers herein conferred in respect to the construction, management and control of such water works. (Emphasis added.)

Michigan State Constitution
§ 22 Charters, resolutions, ordinances; enumeration of powers. Under general laws the electors of each city and village shall have the power and authority to frame, adopt and amend its charter, and to amend an existing charter of the city or village heretofore granted or enacted by the legislature for the government of the city or village. Each such city and village shall have power to adopt resolutions and ordinances relating to its municipal concerns, property and government, subject to the constitution and law. No enumeration of powers granted to cities and villages in this constitution shall limit or restrict the general grant of authority conferred by this section.

§ 34 Construction of constitution and law concerning counties, townships, cities, villages. The provisions of this constitution and law concerning counties, townships, cities and villages shall be liberally construed in their favor. Powers granted to counties and townships by this constitution and by law shall include those fairly implied and not prohibited by this constitution.

In California, the state Legislative Analyst's office discussed water utility powers as follows:[28]

There are hundreds of water special districts in California, with a great diversity of purposes, governance structures, and financing mechanisms. Some districts are responsible for one type of specific duty, while others provide a wide range of public

[28] California Legislative Analyst's Office, Water Special Districts: A Look at Governance and Public Participation, March 2002. https://lao.ca.gov/2002/water_districts/Special_Water_Districts.html.

services. Some are governed by a county board of supervisors or city council while others have their governing boards directly elected by the public.

Water districts in California provide a diverse range of services—using a variety of financing means and governance structures.

Many of these statutory authorizations allow districts to provide more than one of the three designated water services (water delivery, sanitation, or flood control). Lighting, recreation and park, and street services are the most common nonwater activities performed by the state's water districts.

The development of on-site solar to provide power to water utility operations is clearly part of routine operations, just as other means of supplying power are routinely exercised by water utilities (e.g. methane production and recovery for use in producing electric power).

Similarly, solar power has potential, especially in combination with battery storage to ensure reliable service and to respond to weather and grid emergencies. Actions to improve reliability of water service is clearly within the authority of water utilities.

AWWA Policy Statement on Electric Power Reliability For Public Water Supply And Wastewater Utilities

AWWA believes that every water and wastewater utility should set uninterrupted service as a high priority operating goal and include potential service interruptions in its risk assessment and resiliency plan. Avoiding extended interruptions in water service is essential for fire safety, sustaining local economies, maintaining public trust, and protecting public health and the environment.

To provide uninterrupted service, water and wastewater systems require an acceptable level of electric power reliability. Every utility is unique with respect to its vulnerability to electric supply disruption and must undertake a critical assessment of the issue based on specific local conditions. For some utilities, even a small electric service outage can have significant consequences. Redundancy of supply or backup generating capacity tends to mitigate the risk.[29]

For these reasons it seems unlikely that a water utility considering community solar would face challenges that such projects go beyond the utilities' authority under state law. It is possible that local utility articles of incorporation or charter could narrowly prescribe the powers of the entity, narrower than allowed by state law. In this case however, articles of incorporation or charters can be amended to resolve such a constraint.

[29] See: https://www.awwa.org/Policy-Advocacy/AWWA-Policy-Statements/Electric-Power-Reliability-for-Public-Water-Supply-and-Wastewater-Utilities

Nevertheless, a first step in developing a community solar project is to review applicable statues and utility governance documents to ensure there are no specific restrictions to the power of water utilities that might prevent a community solar service.

Community solar as a form of community stewardship
Another strong indicator that community solar is firmly within the scope of water utility authority is the long tradition and role of water utilities in community stewardship. In researching this question, we found several documents that appear to support a broad role for water utilities as community steward.

The AWWA 2019 Guide to Community stewardship appears to recognize the general authority of water utilities to provide a wide range of community services, beyond water supply or waste water treatment. [30] It states:

> Community stewardship is the practice of leveraging the utility's assets and operations to benefit the larger community, lessen negative impacts from utility activities, and provide service equitably across the service area.
>
> Across the country, utilities are looking for creative ways to embody the community stewardship role by helping everyone to have access to clean water, ensuring water service is affordable, investing in local businesses and providing community benefits.
>
> In particular, the [Effective Utility Management] (EUM) framework includes the community stewardship role under community sustainability which promotes the following attributes:
>
> - Efficiently uses water and energy resources, promotes economic vitality, and engenders overall community improvement.
> - Uses operations to enhance natural environment.
> - Maintains and enhances ecological and community sustainability including pollution prevention, watershed and source water protection.
> - Partner with other utilities, agencies, community organizations and philanthropies to leverage utility investments to benefit the community. The utility can leverage its role as an institutional anchor to build local partnerships and programs that benefit the community beyond the utility's water service delivery role

[30] https://www.awwa.org/Portals/0/AWWA/Communications/AWaterUtilityManagersGuidetoCommunityStewardship.pdf

CONCLUSION

Community solar is a viable mechanism for water utilities to raise capital for operations, reduce power costs and to provide a new service to its members. Due to recent price reductions, solar is an economic option for water utilities in all parts of the continental US, Hawaii and parts of Alaska. Community solar business models provide a means to add solar generation to utility operations without incurring new debt, which may be attractive for utilities whose access to capital is weakened by effects of the Covid-19 epidemic. Federal and state agencies can play an important role to educate and train water utilities on community solar.

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Community Solar Model for Water Utilities

APPENDIX A

Fact Sheet

COMMUNITY SOLAR FOR WATER UTILIITES
August, 2021
David Wooley
Keyes & Fox, LLP

Background:

- Solar power generation costs have fallen dramatically in recent years, making solar highly cost effective almost everywhere, including northern tier states.
- Electricity expenses for water and waste water utilities are generally on the rise; on-site solar generation can help stabilize or in some cases reduce water utility electric bills.
- With on-site solar, water utilities may be able to better manage operating expenses to the benefit of customers, who may otherwise see water bills increase less over time.
- Many water and waste water utilities have land and roofs that can be used for solar generation.
- There is growing need for on-site back-up generation to enable water utilities to weather power grid interruptions. On-site solar generation can be a critical part of such a system, especially if paired with on-site battery storage technologies.
- Solar generation systems are highly modular and can be configured to meet a variety of needs including reduction of energy and demand charges.

Basic concept:
Water and waste water utility customers fund and own (e.g. 1 kW shares) a solar generation system connected behind a water utilities meter. The customer contributes up-front capital to fund solar generation – in return for water-bill credits representing, a proxy share of the electric bill savings made possible by the solar system.

The customer gets her initial payment back over time in the form of bill credits (e.g. 15 years) with a 3-5% return on remaining balance of initial investment. The bill credit runs with the account, and can't be sold. This keeps customer ownership rights simple and avoid securities law issues.

It is possible that an ownership structure could be designed to enable the subscribing customers to be eligible for a federal solar income tax credit for their share of the project investment. But this is likely to be infeasible for small systems, as it is complex to set up (e.g. create and administer an LLC), and may only work for people with significant "passive" income. This might work if the subscribers to a water utility community solar project consisted of a small number of wealthy individuals, rather than a self-selected group of middle-income utility customers. This subject, however, is beyond the scope of the author's expertise. We mention this mainly as a topic for additional research.

- A community solar project voluntarily undertaken by a water utility would not need to be sanctioned by a state community solar law. For states considering new (or revised) community solar legislation, provisions should be considered to make it easier for water utilities to voluntarily participate.[1]

Sample system
- 200kW solar system ($330,000 capital cost)[2];
- 200 water customer investor shares at $1650/share, paid to utility at commencement of construction;[3]
- Customer receives $110/year in bill credits for 15 years (return of initial investment) + 3% on unamortized remaining balance of unpaid initial investment
  - The 3% could be adjusted so that it is better than a comparable return on a long-term CD.
- A customer who has no ability to install solar on home or business receives an opportunity to participate in solar energy market for both economic and social reasons.

[1] See, e.g. *Michigan Municipal League backs community solar, joins statewide alliance* https://www.micommunitysolaralliance.com/news/michigan-municipal-league.
[2]This is based on installed cost of $165/kW, which may be high for a 200Kw system, but it provides some margin to recover water utility administrative costs. See, https://www.infiniteenergy.com.au/commercial-solar-system-size-comparison/100kw
[3] One could develop a monthly subscription system that could mimic these cash flows.

- Certain customers **may** be eligible for $429 federal solar tax credit at the current 26% rate and might qualify for state credits or rebates.[4]
- Water/Wastewater Utility:
  - repays participating customers for capital cost and interest: $22,000 + $9,900 in 1st year, falling to $22,000 in year 15 and $0 in year 16;
  - achieves $42,048 reduction in annual electric bills (commercial rate of .12/kwh x 350,400 kWh) + potential reduction in demand charges;
  - captures all bill savings from final 15 years of 30-year system life;
  - water utility gets an addition to its system that can be used to increase resiliency, and lower operating costs, without increasing or incurring new debt.
  - gains an option to couple solar system with on-site energy storage, enabling back-up power for critical services.
  - gains an option to couple solar system with on-site energy storage to enable load-shifting to avoid expensive demand charges, and supply grid services.
  - responsible for system O&M; this expense needs to be covered in the Utility share of savings.
  - may be eligible for income from sale of renewable energy credits in state with a renewable portfolio standard (subscribing customers need to assign right to Renewable Energy Credits to water utility).

- Nonparticipating water utility customers receive:
  - Lower system electric costs will put downward pressure on rates;
  - On-site generation protects customers against risk of rising commercial electric rates (to the extent of the solar system output);
    - For example, if a municipality could hedge 20% of their electricity costs—knowing what that cost would be for 20 years—they have a powerful planning tool they don't have now. Typically, water utilities plan their services, operations and capital budgets for decades ahead, without a clear idea of how much their electricity costs are going to be—knowing only that costs will likely go up.
  - A partial power back-up system in case of grid failure when accompanied by battery storage;
  - Lower greenhouse gas emissions and power plant pollution.

- Other Advantages:
  - May require no approval or involvement of local electric utility beyond system interconnection (assuming there is no charge for partial departing load, no "all requirements agreement with electric.

- Questions for water utilities to research:

[4] =$1,650* 26%. See, https://www.lawofrenewableenergy.com/2015/09/articles/solar/irs-opens-door-for-community-solar-investors-to-qualify-for-federal-tax-credits/]

- How much will it cost to administer the program? The utility will have to devote some staff to marketing the program, managing customer relations and billing. In some cases this can be done with existing staff, or with volunteers without additional cost to the utility. A key question is whether the utility's billing system will need to be adjusted, but if this is expensive the investor/subscriber payments could be handled (for a small group of customers) outside of the existing billing system.
- Would water utility need to change its bylaws or governance structure to engage in this form of service to its customers?
- Do state laws limit ability of water utilities to offer such a service (unlikely, see Main Report)?
- How does community solar model compare with: 1) water utility owned/financed solar project; 2) third party owned, PPA financed solar project?
- Is a 3rd-party ownership model easier to implement - a third party company or LLC owns the system, taking the tax credit, managed relations with water utility customers and oversees water bill credits.
- What happens if a subscriber moves outside of the water/wastewater utility's service territory? Explore Michigan Energy Options "transferability process used for its community solar park as an example."
- What local permitting is required for additional of a solar system.
- What is typical O&M cost for solar system this size in the home region (cost born by water utility).[5]
- Despite the reduction of operation costs (electricity bills) from onsite solar, a water utility that creates a voluntary community solar service for its customers may need to raise rates significantly for reasons unrelated to the solar system and.

    - Additional research is needed to develop a tool that would easily enable the water utility to show what rates would have been but for the additional of the community solar system. Alternatively, research could provide water utilities generic language that informs the customer base of the likely small but positive impact on near term rates and discloses that other factors are the main drivers for changes in rates.

- For projects designed to capture federal or state tax credits – is the tax credit benefit to subscribers large enough to attract participation as part of a broader system payback + interest on unamortized capital contribution; do middle class people have sufficient tax appetite to benefit?

[5] NREL estimates annual maintenance costs of about $17/ kWDC/yr (excluding lease and property tax elements which would likely not apply to a water utility site system). This suggests an annual cost of about $3400 for a 200kW system. This cost could either be absorbed by the utility, subtracted from subscribers/investor return, or in part handled by volunteers. NREL, *U.S. Solar Photovoltaic System and Energy Storage Cost Benchmark: Q1 2020, page 13-14* https://www.nrel.gov/docs/fy21osti/77324.pdf

- Inquire of local electric utility what if anything it requires for a customer who installs on site generation.
  - For example, most small solar systems have inverters or other equipment designed to shut the PV system down during an interruption of utility service equipment. This is to avoid power from the solar system feeding back into electric system lines during the outage, which can create hazard for electric utility linemen. More sophisticated solar systems, including those paired with battery storage or other onsite power generation have equipment to "island" the water utility during an electric grid failure, to prevent onsite generation from feeding back into the electric utility distribution system.
- For water utilities considering large solar arrays with potential to produce more power at any given time than is being consumed by the water plant – consider whether the host state has a net metering program that could produce additional revenues or bill credits to the water utility for power exported to the electric utility distribution system.
- Water utilities should confirm there are no limitations on self-generation in franchise agreements between the electric utility and the city or water authority. Some states restrict on self-generation in state law utility (e.g. exit fees, liability for utility sales taxes). While this is rare, it is important to ask.

East Lansing Board of Water & Light's 315kW solar array is largely financed by dozens of public and private investors. The Solar Park became operational December 2019.

A 4.8 MW floating PV installation in California has surpassed an array in the metro New York area to become one of the largest floating solar projects in the United States.

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APPENDIX B

Examples – Water Utility Solar Investments

Compiled by
David Wooley, Keyes & Fox LLP
August 2021

During research to support our paper on community solar for waste utilities we came across a number of press reports that describe actions by local authorities to invest in solar to support water services. This is not a comprehensive list and none of these projects involve a community solar structure.

We include this appendix as a way for readers to become aware of the experience of other water utility managers in their regions. Most of the material below are excerpts from new stories on the projects.

Ventura County CA, Public Works Agency

Microgrids Protect Essential Water Services for California Residents During Outages

July 23, 2021 By Lisa Cohn

Ventura County Public Works Agency's water and sanitation department in California is planning a microgrid at its Moorpark Water Reclamation Facility, which serves low-income residents.

Microgrid provider PowerFlex is financing and installing the microgrid, due to be installed during the second quarter of 2022. It also has plans for ensuring a different microgrid keeps water flowing to residents in a nearby community. That microgrid will be installed in Thousand Oaks, California, said Michael Robinson, associate director of microgrids and new markets at PowerFlex, an EDF Renewables company.

The water facilities are subject to public safety power shutoffs (PSPS) from utility Southern California Edison (SCE), which means they must rely on polluting and expensive diesel backup generators during outages.

In Ventura County in 2020, SCE held PSPS 11 times in portions of Moorpark, Santa Susana and the Simi Valley, said a spokesman for Ventura County Public Works.

Right now, Ventura County's Moorpark facility has about 1 MW of solar — plus a diesel generator that's used during outages, said Robinson. Without a microgrid, when there's an outage, the solar goes offline. With the microgrid, the solar will continue to operate, and for a longer time period during outages, thanks in part to the 750-KW, 3,000-KWh battery that's part of the microgrid.

The Thousand Oaks project faces the same challenges, and PowerFlex plans a similar solution.

Both microgrids will receive funding from the equity resilience budget of California's Self-Generation Incentive Program (SGIP), which is available to low-income and disadvantaged communities that need energy resilience.

In the Ventura County case, the microgrid project is eligible for a $1,000/kWh incentive because it's located in a high fire threat district, provides critical facilities infrastructure — sewage treatment — and serves a community that includes low-income residents. The total payment from SGIP will be $1,992,050, said Homer Arredondo, an engineer for Ventura County Public Works' water and sanitation department.

Under a financing arrangement from PowerFlex, the Ventura County and Thousand Oaks projects require no upfront payments. PowerFlex collects the SGIP incentives from the state, leases the microgrid equipment to its customers and is paid back through monthly payments.

"You could call it an energy-as-a-service contract," said Robinson. "We finance it, we are responsible for operations during both grid-connected times and power outages. We generate savings so the savings cover the cost of the customer's lease payments."

The state of California provides 50% of the SGIP payment upfront, and the other 50% is paid out over a 5-year period, based on the number of battery cycles, said Robinson. A battery has completed one cycle when it fully charges and discharges. Generally, a battery cycles about 300 times a year, he said.

The microgrid at the Ventura County Public Works Agency is expected to save the district and its customers $355,400 over the 15-year life of the battery by reducing demand charges as well as energy charges during on-peak, time-of-use tariff periods, said Arredondo.

First, the microgrid will allow the company to use the solar and battery to reduce demand charges. Second, the microgrid will reduce the agency's energy costs by taking advantage of SCE's time-of-use tariff (TOU-PA3E tariff). The solar will charge the battery during less expensive off-peak hours, and the battery will be discharged during expensive peak rate times, which occur between 4 p.m. and 9 p.m., said Arredondo.

Lake Michigan Filtration Plant (LMFP), City of Grand Rapids

- 1 MW ground mounted solar;
- $1.2 million savings over 24 years ($50,000/year);
- 700-1000 metric tons CO2 avoided;
- City goal to supply muni operations with 10% RE by 2025;
- LMFP used 17,236,501 kilowatt-hours of electricity in 2020, which was 23% of all electricity used by city of Grand Rapids municipal operations;
- 67 Acre site;
- Zoning variance granted by Grand Haven zoning Board of Appeals at request of City of Grand Rapids;
- Requires approval from Grans Haven Planning Commission for site pan building and electrical permits

Reference:
Grand Rapids receives approval for filtration plant solar project, Grand Rapids Business Journal
By Ehren Wynder -March 16, 2021https://grbj.com/news/energy/grand-rapids-receives-approval-for-filtration-plant-solar-project/

Narragansett Bay Commission

The Narragansett Bay Commission operates the two largest wastewater treatment facilities (WWTF) in Rhode Island. Its annual energy use is 36,312,890 kilowatt-hours/year. In response to statewide goals for renewable energy, the Narragansett Bay Commission completed several renewable energy projects. In 2012, it installed three 1.5 MW wind turbines at the Field Point WWTF. At Bucklin Point WWTF, there are three anaerobic digesters. The commission has been using about half of the biogas to heat the digesters. In 2018, it built a new combined heat and power (CHP) system to burn the remaining biogas in reciprocating engines to produce power. In addition to these projects, the commission receives net metering allowances for its offsite wind turbines and solar photovoltaic energy farms. The Narragansett Bay Commission now utilizes renewable energy for more than 90 percent of its annual energy demands.

Atlantic County Utilities Authority

The Atlantic County Utilities Authority (ACUA) serves 14 municipalities in Atlantic County, New Jersey and a population of over 230,000 residents. Its wastewater treatment plant has a capacity of 40 million gallons per day (MGD) and currently treats about 26 MGD. The treatment plant has an energy demand of approximately 2.5 MW. The 7.5 MW Jersey Atlantic Windfarm provides about 60 percent of the utility's electricity through a fixed purchase agreement. ACUA also has 500 kW of solar onsite, including ground mount, canopy and rooftop systems. ACUA has a land lease agreement with Viridity Energy, who installed, owns and operates a 1 MW battery energy storage at ACUA. Viridity uses the frequency regulation market to get a return on its investment and shares in the savings ACUA sees from a reduction in peak load charges on its electric bills. The 1 MW battery storage could provide 15 minutes of back-up power to the entire treatment plant. During a longer power outage, the utility would switch from battery storage to back-up generators. ACUA plans to obtain additional batteries so it can operate as an island, independent of the grid.

Santa Clara County Valley Water

In the event of an extended outage, how many days can Valley Water continue water delivery service using back-up power resources?
Several factors are involved in determining how long Valley Water can continue treated water delivery service, including time of year and water demand. In the event of the unlikely possibility of a total power loss throughout Santa Clara County, we have enough fuel on-site to run the generators for approximately four to six days. We also have contracts with fuel suppliers that could supplement our needs if necessary to extend our operations using backup power.
https://www.valleywater.org/flooding-safety/preparation-extended-power-outages

Ullrich Water Treatment Plant, Austin Texas

NPR Story: https://www.npr.org/2021/03/08/973512033/how-giant-batteries-are-protecting-the-most-vulnerable-in-blackouts
Like falling dominos, infrastructure around Texas, dependent on electricity, began failing in the extreme cold. In Austin, the Ullrich Water Treatment Plant shut down due to an electrical failure. That, combined with low water pressure from broken pipes, meant residents had to boil their water. …So, some communities are looking for new ways to ensure that vulnerable people and infrastructure can withstand power outages. They're installing solar panels and large batteries to create tiny "microgrids" that continue working when the larger grid goes dark. Some are being sited at crucial facilities, like water treatment plants, hospitals and emergency response centers…….

Waste Water Treatment Plant, Caldwell NJ

PSE&G installed solar panels at a wastewater treatment plant in Caldwell, New Jersey, as well as a very large battery. The solar panels generate electricity for the local grid, but in the event of a storm, they help keep the plant running by supplying the plant during the day and helping to charge large batteries that can provide electricity when the sun goes down.

Between the battery and the backup generator, the wastewater plant can run for several weeks on its own,

> "It took several weeks for the state to really come back," Powers says. "Generators were destroyed, and they weren't able to get diesel fuel to their generators."

Billions of gallons of raw sewage were released into waterways in New York and New Jersey as a result of the power loss and flooding. In the wake of the storm, the state of New Jersey began looking at how to create a more resilient system.

In the course of rebuilding the grid after Sandy, New Jersey spent $200 million on installing energy systems at critical facilities and looked at how microgrids can play a larger role.

75th Street Wastewater Treatment Facility, City of Boulder, Colorado – Biomethane and SolarPV System

This case study examines the development and operation of biomethane and solar resources for the 75th Street Wastewater Treatment Facility (WWTF) in Boulder, Colorado. The study showcases the collaboration between public and private entities to deploy solar PV (photovoltaic) resources without passing the cost of PV onto municipal customers. Since the start of operation in 2010, the installed PV system has saved customers over $200,000 and reduced carbon dioxide (CO_2) emissions by 10 million pounds of CO_2 (City of Boulder 2018).
The one MW PV system was installed on land owned by the utility in 2010. The developer, EyeOn Energy, leased five acres of city owned land at the treatment facility to install the project (Day 2011).

The PV project was financed through a no-upfront cost PPA. During project approval, the City of Boulder identified the lack of capital available for the project

The WWTF signed a PPA with the EyeOn Energy to purchase electricity from the solar site at an average price of $0.032/kWh in 2010 (a savings compared to the average bundled cost of electricity from the grid at $0.065/kWh) (Douville and Macknick 2011). In the agreement, the electricity price increases by 2.75% per year for the first ten years to $0.0417/kWh for the remainder of the agreement (Day 2011). Excess power is sent back into the electrical grid and is under a net-metering agreement with Xcel Energy, the local electrical utility. Power exported to the grid is currently small and only occurs during times of high solar and biogas production coupled with low demand. Excess power is slight enough that the WWTF does not need to schedule exports with Xcel Energy. After installation, SOLON Corporation sold the PV asset to SunEdison Corporation, and then it was sold again to Longroad Energy, who currently operates and maintains the installation.

Blue Plains Advanced Wastewater Treatment Plant, Washington DC

DC Water has recently installed solar panels across its open and flat 153-acre Blue Plains Advanced Wastewater Treatment Plant site: the largest advanced wastewater treatment plant in the world and the largest consumer of electricity in the District.
Deemed Phase 1, solar panels were installed over parking lots, on rooftops, and in-ground mounts as well as a canopy structure on the DC Water pier that sits on the Potomac.
Deemed Phase 1 of the project, the installation began in spring 2020 and by the end of

FY 2020 was generating 5.2 MW of electricity. In total, over 12,000 solar panels were installed, covering around 264,000 square feet.

East Lansing Power and Light Community Solar

https://www.lansingstatejournal.com/story/news/local/2019/01/23/new-community-solar-park-east-lansing-goes-line-clean-energy/2659818002/
https://micommunitysolar.org/new-solar-park-in-east-lansing-goes-on-line/

Fayetteville AR

https://www.nwaonline.com/news/2019/sep/06/fayetteville-flips-on-solar-panels-at-w/
Fayetteville Arkansas. September 2019
Representatives with the city, Ozarks Electric Cooperative and Today's Power Inc. flipped the switch Friday in a showing of the city's solar power system. Three farms and two battery storage facilities cover 87 acres between the city's two wastewater treatment plants.

• The city will lease 87 acres at the wastewater treatment plants
• TPI will build for a capacity of 5 megawatts of solar panels and 12 megawatt hours of battery storage at each wastewater facility and will assume the costs of operating and maintaining the facilities.
• The city will purchase electricity generated by the arrays at a rate that will be $0.0033 less per kilowatt hours.
• The city will own 1% of the solar array, and TPI will own the remaining 99%.
• The city will assume the cost of making electric improvements to both sites to connect the arrays to the power grid. This cost will be paid from the city's water and sewer reserve fund.
• Ozarks Electric will pay the city to manage backup generators at both plants, as well as for HVAC, lighting and storage losses associated with the battery storage.
Read more about the solar array project at bit.ly/faysolararray.

The entire system of 10 megawatts of solar power generation and 24 megawatt hours of storage will save the city about $180,000 annually, said Peter Nierengarten, the city's sustainability director. Work on the $23 million system started in March.
Today's Power put up most of the money for the project. The company is a subsidiary of the Arkansas Electric Cooperatives in Little Rock and offers solar array and energy storage systems, electric cars and charging stations to nonprofit groups, governments and private companies.
The wastewater treatment plants will use the energy generated from the solar panels, and the unused energy will go into storage, Nierengarten said. The plants will be able to draw from the storage units when sunlight is low, he said.
The rate the city will pay to Today's Power is slightly lower than what it paid to Ozarks Electric, and it will make a difference, Nierengarten said.

Today's Power owns 99% of the solar energy systems while the city owns 1% and the land. Construction crews from TPI and Ozarks Electric built the systems.

The city spent $700,000 for site preparation from its water and sewer fund. The city will make back that investment in a few years because of the savings in energy cost, Nierengarten said.

The project will pay for itself in 20 years with the money the city will pay Today's Power, said Michael Henderson, president. The project finished on time and about $3 million under budget, he said.

Ozarks Electric also will be able to draw from the solar energy systems, lessening the cooperative's cost to buy electricity.

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Peterborough NH

With overwhelming support and enthusiasm from the public, the Town of Peterborough has built the largest solar array in the state (944 kW DC). The project was funded by a $1.22 million PUC grant, with the remaining $1.4 million in total project costs being covered through a long-term power-purchase agreement (PPA) with Borrego Solar. The array powers the Town's newly constructed wastewater treatment plant located off of Rt. 202 and helps to offset energy costs for other municipal buildings through a GNM agreement (Group Net Metering).

The project is anticipated the save the town an estimated $250,000.00 to $500,000.00 over the next two decades. This savings will be achieved through a long-term power-purchase agreement with Borrego Solar that enables the town to purchase power at a discounted rate (8 cents/kWh versus 14 cents/kWh) and new state rules regarding "virtual" net metering. "Virtual" net metering allows for the benefits of energy captured at one site (in this case the Peterborough WWTF) to be shared among other buildings not directly attached to the energy capturing site. This model enables a large-scale solar project to help offset the cost of purchasing energy elsewhere, as excess energy is captured and sold back to the larger energy grid.

- Phase 1 of the project, filling of the former lagoon, was completed in the fall of 2014
- Phase 2 construction of the solar array began in mid-November 2014
- The solar array went online in the fall of 2015

The following files may be of assistance as you plan your own sustainable initiative:

- Town of Peterborough/Borrego Solar Power Purchase Agreement
- Town of Peterborough/Borrego Solar Option and Lease Agreement
- NH PUC Grant Application
- Borrego 20-year Cash Flow Analysis
- Information on RECs
- RECs Explained in Simple Terms - Video
- Information on "Net Metering" and "Virtual Net Metering"
- Peterborough Solar Array - General Information Handout

  http://www.peterboroughprojects.info/

Solar Power System at WRCRWA

The Western Riverside County Regional Wastewater Authority (WRCRWA), which is governed via a Joint Powers Authority and managed by Western, has more than 5,000 solar panels at the authority's wastewater treatment plant that will provide up to one megawatt of energy during peak energy use hours. WRCRWA is committed to utilizing renewable energy sources to help lower the amount of greenhouse gases released into the atmosphere.

- The system provides one megawatt of energy, which is enough to power more than 200 homes per year.
- There are more than 5,000 solar panels covering nine acres.
- Solar panels track the sun, increasing sunlight capture by up to 30 percent more than conventional fixed-tilt systems.
- At its peak, the solar panels will provide 25 percent of the power needed to operate the wastewater treatment plant.

Benefits

- Helps reduce the authority's energy costs as the price of electricity increases in the years to come
- Increases the reliability of the plant and protects the region against power outages by relieving the
burden on the California electrical grid during peak demand
- Lowers the amount of greenhouse gases released in the atmosphere by utilizing a renewable energy source

Greater Bayfield Waste Water Treatment Plant, Wisconsin

Array Size: 124.5 kW DC Date Installed: 2019
https://eaglepointsolar.com/portfolio/greater-bayfield-waste-water-treatment-plant/

Seneca Wastewater Treatment Plant in Germantown, Md

Two large fields of several solar panels were unveiled at the., and the Seneca Wastewater Treatment Plant in Germantown, Md., by the Washington Suburban Sanitary Commission (WSSC).The two 2-megawatt (MW) ground-mounted installations, each with nearly 8,500 solar panels spanning several acres, will power the two facilities -- both a result of a public-private partnership (PPP) with Washington Gas Energy Systems and Standard Solar, Inc. Washington Gas Energy Systems will own and operate the solar installations under a 20-year power purchasing agreement.
https://metrocouncil.org/Wastewater-Water/Projects/Sewer-Planning-Construction-Updates/Projects/SenecaWWTP-807520.aspx

Iowa Great Lakes Sanitary District

Solar Project At Waste Water Treatment Plant, September 10, 2020

https://www.iowagreatlakessanitarydistrict.com/2020/09/solar-project-at-waste-water-treatment-plant/

Solar Project will provide up to 0.5 megawatt of power to off set cost power cost for the Wastewater Treatment Plant. The pay back is estimated to be about 7 years. … The plant treats about 2.5 million gallons of wastewater a day the discharges the treated water to Milford Creek.

City of San Juan, Puerto Rico

The solar panel array, which is a 100 kW (DC) Solar Photovoltaic System, is located on a quarter acre of Town property behind the Wastewater Treatment Plant. The project is guaranteed to produce 95,000-plus kW hours of electricity per year using solar panels and electrical inverters made in Washington State. Apollo Solution Group, through a Washington State Department of Commerce grant, installed the array.

https://www.sanjuanjournal.com/news/friday-harbor-wastewater-treatment-plant-solar-project/

APPENDIX C

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USEPA, *Power Resilience, Guide for Water and Waste water Utilities*, EPA 800–R–19–001, June 2019, https://www.epa.gov/sites/production/files/2016-03/documents/160212-powerresilienceguide508.pdf -- (mostly about how to choose a generator, with some discussion of solar, batteries and microgrids).

> Power loss can have devastating impacts on drinking water and wastewater utilities and the communities they serve. Inoperable pumps at a drinking water utility can make firefighting difficult and cause local health care facilities and restaurants to close. Pressure loss can allow contaminants to enter the drinking water distribution system from surrounding soil and groundwater. For wastewater utilities, pump failure may lead to direct discharge of untreated sewage to rivers and streams or sewage backup into homes and businesses. Power loss can also impact water utilities through cascading infrastructure failures. For example, a chemical plant without power could discharge contaminants into source water supplies.

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> "Energy is the highest operational cost for a water and wastewater utility. Water is extremely heavy to move through pipes and many treatment processes are energy intensive thus conveyance and treatment requires an enormous amount of power — and money. According to our survey, two-thirds of respondents say energy management is "extremely or very important," while one-quarter prioritized it as "moderately important."
>
> 'The solar alternative was far and away the popular energy choice among respondents to the poll, not surprisingly, given the shrinking cost of solar equipment and advances in the efficiency and lifespan of the panels. Solar is a logical, credible option because it's a passive, sunshine-collecting system without a lot of operations and maintenance (O&M) demands, which can be handled by outside contractors as needed.
>
> "It is no surprise that after labor costs, energy is the next highest operational cost for water and wastewater utilities. Water is an extremely heavy resource, requiring enormous amounts of energy to move and treat it. As energy costs continue to rise and more states adopt regulatory incentives and disincentives that drive large-scale sustainability and

efficiency efforts, it is expected that utilities will become more aggressive in their approach to managing energy"

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Water Research Foundation, *Opportunities and Barriers for Renewable and DER Development at Water and Wastewater Utilities,*
2019 https://www.waterrf.org/research/projects/opportunities-and-barriers-renewable-and-distributed-energy-resource-development

Community Solar Model for Water Utilities

APPENDIX D

Author's Background

DAVID ROBERT WOOLEY

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SUMMARY

Strategic leader on energy market and regulatory issues; project/program innovator; public speaker and author; experienced negotiator; government relations and legal counselor.

http://www.linkedin.com/in/david-wooley-a0a8486
http:/www.kfwlaw.com

PROFESSIONAL EXPERIENCE

Lecturer & Director Center for Environmental Public Policy, Goldman School of Public Policy, University of California, Berkeley

Berkeley, California — September 2017 to Present

Manage public policy research projects affecting transportation, energy, environment and climate; convene stakeholder dialogues to address air quality problems associated with shipping and transport; manage executive training for electric power executives and staff from India; and teach courses on environment, energy and climate topics.

Principal, Wooley Energy & Environment

Berkeley, California — January 2012 to Present

Consultant to private foundations, NGOs and clean energy industry – providing advice on regulatory compliance, policy advocacy, fundraising and grant making strategy in the areas of renewable energy, energy efficiency, air quality, carbon pollution control, natural gas, combined heat and power, and transmission policy. Clients have included: Energy Foundation; Future 500, Institute for Industrial Productivity; National Parks & Conservation Association; Regulatory Assistance Project; and Natural Resources Defense Council.

Vice President for Domestic Policy Initiatives, The Energy Foundation

San Francisco, California March 2003- December 2011

Managed a $22 million/year domestic grant making program; responsible for strategy development on climate, renewable energy, energy efficiency, transmission, building codes, appliance standards, power generation and air quality. David launched new grant operations on industrial efficiency, CHP, coal, carbon capture and sequestration and natural gas. David led a team that helped design a greenhouse gas emission target for California (June 1, 2005). During his tenure at EF, energy efficiency investment by regulated electric and gas utilizes quadrupled, and spread from the coasts to Midwest, Intermountain West and Southern Regions.

Founding Partner, *Young, Sommer . . . LLC*

Albany, New York 1999-2003

A private law practice specializing in environmental and energy law, government relations, renewable energy development, utility law and compliance counseling. Helped initiate NY's role in the Regional Greenhouse Gas Initiative (RGGI).

Counsel, *Clean Air Task Force*

Boston, Massachusetts & Albany, New York October 1996 - February 2003

Counsel to air quality advocacy and education project. Represented citizen groups in environmental-related rulemakings and litigation over federal and state power plant emission controls, New Source Review enforcement, and ambient air quality standards. Appointed by U.S. State Department as an NGO Member of US Negotiating Team in talks on the US-Canada Air Quality Agreement, Ozone Annex (2000). Member, Governor Pataki's Greenhouse Gas Taskforce, whose recommendations led to the NY Renewable Portfolio Standard and the Regional Greenhouse Gas Initiative (RGGI).

Director, Northeast State Policy Project, American Wind Energy Association

Albany, New York and Washington, DC 1999-2003

Represented wind industry on utility procurement, transmission rules, and state policy developments in Northeast States. Appointed to NJ Governor's Renewable Energy Task Force. Convinced Pataki Administration to implement a renewable portfolio standard in NY.

Professor for Environmental & Energy Law, Executive Director, Pace Energy Project

Pace University School of Law, White Plains, New York January 1990 – August 1999

Led an energy policy advocacy project active in NY, NJ, PA, MI and FL on energy efficiency investment, renewable energy policy, state energy planning, and electric power regulation. Lead counsel for environmental and consumer groups in the NY Public Service Commission case that restructured the electric utility industry. Convinced officials to establish a fund (initially $87 million/year) to support energy efficiency services and renewable energy development. Taught courses on energy and environmental law, managed student interns in the Energy Project and served as a full member of the law school faculty***Assistant***

***Assistant Attorney General, New York State Department of Law*, Environmental Protection Bureau,**
Albany, New York 1980 - 1989
Lead counsel in acid rain litigation for coalition of northeastern states and national environmental groups. Organized lobbying efforts, public information meetings, press statements and speeches for Attorney General on air quality issues. Represented NY in court actions under Clean Water Act, State Environmental Quality Review Act, and Clean Air Act, involving solid waste incineration, gasoline vapor control, power plant emissions, smog control, enforcement and federal grants.

EDUCATION

Juris Doctor, Rutgers University, School of Law, Newark, N.J.,
Bachelor of Arts, Rutgers College, New Brunswick, N.J. (Departmental Honors in History).

SELECTED PUBLICATIONS

Books & Chapters

Clean Air Act Handbook, 3rd through 27th Editions, West Group, (1993-2020).

Articles & Reports

Climate Policy, *Environmental Justice*, *and Local Air Pollution*, Brookings Institute, November 2020 https://www.brookings.edu/research/climate-policy-environmental-justice-and-local-air-pollution/

2035 Report, *Plummeting Solar, Wind and Battery Costs Can Accelerate Our Clean Energy Future*, June 2020, http://www.2035report.com/wp-content/uploads/2020/06/2035-Report.pdf?hsCtaTracking=8a85e9ea-4ed3-4ec0-b4c6-906934306ddb%7Cc68c2ac2-1db0-4d1c-82a1-65ef4daaf6c1

A New State Regulatory Framework to Abate Community-Level Air Pollution Hotspots and Improve Health Outcomes, August 2017, Goldman School of Public Policy, UC Berkeley *https://gspp.berkeley.edu/centers/cepp/environmental-justice-and-climate-policy-solutions-dialogue/executive-summary*.

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The truth about the future of gas: We don't need to build any more, Utility Dive, Opinion, June 22, 2020. https://www.utilitydive.com/news/the-truth-about-the-future-of-gas-we-dont-need-to-build-anymore/580200/