Microgrids for a More Sustainable Future

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I. INTRODUCTION TO MICROGRIDS

Microgrids have been implemented to provide dependable, affordable, and efficient energy for customers on a private and industrial scale.[1] Microgrids operate in one of two ways, either on an island (decentralized) or connected to a main grid (centralized) to provide energy to communities or commercial infrastructures.[2] The main problem that microgrid implementation addresses is that unlike their counterpart the macrogrid, microgrids have the ability to break off from the macrogrid, using only its own locally generated power to supply electricity during natural disasters or power outages.[3] Additionally, microgrids can create energy through renewable resources such as wind and solar. This energy may then be held in a battery storage system enabling communities to use the microgrid in a time of crisis.[4]

What has been holding back higher rates of implementation to the use of microgrids rests mainly on municipalities ability to fund these projects.[5] These grids require a substantial amount of time and resources to operate and maintain.[6] Since they are a relatively new way of creating and distributing energy many potential customers do not have the experience or knowledge on

[1] Sam Cramer, *Private, State, and Federal Funding and Financing Options to Enable Resilient, Affordable, and Clean Microgrids*, National Association of Regulatory Utility Commissioners, 9 https://pubs.naruc.org/pub/E1D94D36-155D-0A36-3149-DFEB9D24715D (2021).
[2] Gregory T. Bischoping, *Providing Optimal Value to Energy Consumers Through Microgrids*, 4 U. Pa. J. L. & Pub. Aff. 473 (2019).
[3] Allison Lantero, *How Microgrids Work*, https://www.energy.gov/articles/how-microgrids-work, (June 17, 2014).
[4] *Id.*
[5] Cramer, *supra* note 1, at 8.
[6] *Id.*

how to create a revenue stream to develop these grids.[7] Municipalities and developmental builders have a budget they must consider when developing new communities and infrastructures, so they must be creative in finding funds for their development.[8]

There are currently no known municipalities who have an ordinance specifically addressing microgrid implementation.[9] The municipalities that do have microgrids primarily make references to the microgrid only in their definition sections and relate it to being a way of establishing more clean energy in their districts, rather than having an ordinance specifically addressing the issue.[10] Most municipalities that have enacted microgrids use a bid specification model for the parameters of implementing microgrids in their communities.[11] A bid specification model sets forth the characteristics of services that may be purchased so vendors know what parameters they will be confined to before applying to work on the project.[12]

Every municipalities that implements microgrids does so with the purpose of reducing their environmental footprint on county facilities or residential buildings because they offer zero-emission electricity sources such as solar and wind and increase the reliability of electrical infrastructure to the community by reducing the chance of a prolonged blackout.[13] However, these bid specification models have many similar outlines on how these municipalities have implemented microgrids and their reasons for doing so.

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[7] *Id.*
[8] *Id.*
[9] *Microgrids*, Center for Climate and Energy Solutions https://www.c2es.org/content/microgrids/
[10] See https://library.municode.com/ct/stamford/codes/code_of_ordinances?nodeId=COOR_CH119ENIMDI_S119-2DE . This is an example of how most municipalities reference microgrid in their code but do not lay out parameters for an exact ordinance on this topic.
[11] See Eric Coffman, *Montgomery County, Maryland, Request for Energy Proposal, Microgrids on County Facilities*, Office of Energy and Sustainability https://www.montgomerycountymd.gov/DGS-OES/Resources/Files/MicroGridsRFEP-201404.pdf as an example of Bid Spec model.
[12]University of South Alabama, *Guidelines for Writing Effective Bid Specifications*, https://www.southalabama.edu/departments/financialaffairs/purchasingdepartment/resources/how_to_write_bid_specifications.pdf.
[13] Coffman, supra note 11, at 2.

When municipalities implement microgrids they often partner with a third-party partner for the design, operation and maintenance of a microgrid facility.[14] Municipalities do this using a bid speculation model that lay out the scope of what the municipality would be expecting a third-party partner to accomplish by constructing the microgrid.[15] The scope of the third parties that municipalities wish to partner with are usually to design the project, construct and implement, maintenance of the facility, be able to sell the electricity back to the county, and finance the project.[16] This is a private-public partnership model that is commonly referred to as Energy-as-a-Service (EaaS).[17]

The EaaS model is "a pay-for-performance model that can be used to finance microgrid construction."[18] In the EaaS model, the provider would be responsible for the construction and operation of the microgrid and will keep any revenue it creates as payment.[19] This enables the private sector to profit off the creation of microgrids and leaves little liability on the municipality for funding.[20] These microgrids can be set up in locations for towns or buildings that need them in case of a power outage such as offices for Homeland Security, and police stations.[21]

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[14] Aida Camacho-Welch, *Staff Straw Proposal: BPU Town Center Distributed Energy Resources Microgrid Detailed Design Incentive Program*, New Jersey Board of Public Utilities, https://www.nj.gov/bpu/pdf/publicnotice/Notice%20-%20Phase%20II%20TCDER%20Microgrid%20Incentive%20Program%2011-22-19.pdf (Nov. 22, 2019).
[14] Cramer, *supra* note 1, at 22.
[15] Camacho-Welch, *supra* note 14.
[16] Coffman, *supra* note 11 at 3.
[17] Camacho-Welch, *supra* note 14.
[17] Cramer, *supra* note 1, at 22.
[18] *Id.*
[19] *Id.*
[20] *Id.*
[21] *Id.*

The benefits of using this model is that municipalities are able to incorporate other models to help fund the project such as grant programs where the third-party must apply for grants from the state, when possible, to help in providing capital to construct the microgrid.[22]

For a microgrid ordinance that should be used for boroughs across this state this article will provide key elements of our proposed ordinance. The purpose of microgrid implementation is to promote the use of sustainable energy sources in the production of electricity within the borough through microgrids. These microgrids will be able to operate for the purpose of powering emergency or borough service buildings.[23] Microgrids that are connected to the main macrogrid should be able to operate in an "island" mode in case of an emergency.[24]

The borough should partner with an engineer who will work directly with the third-party to implement the microgrid.[25] The municipal council will select an engineer who will decide which third-party that they wish to partner with.[26] The engineer will make its consideration based on a number of factors that are, included but not limited to, the third-party's expertise in microgrid construction, if the third-party can design, finance, construct, and operate the microgrid, if the proposal is to maintain critical infrastructure, and if the third-party can create a reasonable fee to provide a revenue stream from the microgrid. [27]

The rest of this article will show the problems faced in implementing microgrids in Pennsylvania, with a focus on how to fund these projects. While no direct borough will be targeted, it will be a blanket ordinance and projects that incentivize developing towns and municipalities in this state to start their own microgrid projects. Part II will continue with how

[22] Cramer, *supra* note 1, at 9.
[23] *Id.*
[24] *Id.*
[25] Coffman, *supra* note 11, at 3.
[26] *Id.*
[27] *Id.*

Pennsylvania's current local ordinances do not adequately address microgrid development primary for a lack of having any. Next, Part III will cover how other municipalities across the country have begun addressing microgrid implementation by using their own projects and the benefits that have been created through them as examples of already functioning projects. Lastly, Part IV will address recommendations on how Pennsylvania municipalities may be able to implement more microgrids in their boroughs.

II. PROBLEM WITH IMPLEMENTATION OF MICROGRIDS

Municipalities have been moving toward microgrid implementation. However, the progress has been slowed down by a lack of knowledge or understanding of how microgrids operate and the many benefits associated with them.[28] One of the major issues in the creation of microgrids is that there exist no model ordinances for boroughs to follow in implementing these projects.[29]

A. Why States are Moving Towards Microgrids

Microgrids provide many benefits to the communities that use them.[30] They offer affordable, efficient and reliable energy to customers and infrastructure.[31] The unique aspect of

[28] Stadler, Michael et.al., *Value Streams in Microgrids: A Literature Review*, LAWRENCE BERKELEY NATIONAL LABORATORY, 12, (Oct. 2015) https://eta-publications.lbl.gov/sites/default/files/value_streams_in_microgrids_a_literature.pdf.
[29] *Id.*
[30] Hatziargyriou, N.D. et al., *Quantification of economic, environmental and operational benefits of Microgrids*, 2009 IEEE BUCHAREST POWERTECH., 1-8 (2009) https://ieeexplore.ieee.org/abstract/document/5281860.
[31] *Id.*

microgrids compared to their counterpart, a macrogrid, is that "although they mostly operate interconnected to the macrogrid, they can be automatically transferred to island mode, in case of faults in the upstream network." [32]

This ability of microgrids to operate in a power outage is a critical aspect for communities to consider when developing new towns because it will enable essential buildings, such as hospitals, police stations, fire stations or water treatment facilities, to continue to operate in case of a power outage.[33] Just this last winter in February of 2021, Houston, Texas saw a winter power outage that lasted 4 days affecting 4.5 million citizens, leaving them with no electricity and causing over $19 million in damages.[34] Microgrids would have mitigated the harm done to this community as such infrastructure could have been able to supply electricity to the community and the facilities that truly needed it such as hospitals, water treatment facilities and grocery stores.[35]

B. Problems in Implementing Microgrids Identified by the PSAB

With communities starting to understand the power and usefulness of microgrids the Pennsylvania State Association of Boroughs (PSAB) has begun researching how microgrid implementation can be more thoroughly addressed by boroughs throughout the state and has identified problems with the development of microgrids.[36] The PSAB has identified the main cause impeding the development of microgrids as a lack of funding for such projects both at the

[32] *Id.*
[33] Cramer, *supra* note 1, at 27.
[34] *Id.*
[35] *Id.*
[36] *Conversation with Ed Knittel*, Deputy Executive Director for THE PENNSYLVANIA STATE ASSOCIATION OF BOROUGHS, (Sept. 16, 2021).

state and local level in Pennsylvania.[37] Microgrids require a sizeable amount of money in-order to design, implement, operate and maintain.[38] It is estimated that the average cost to construct a microgrid is between $4-$2 million depending on the size and voltage output the municipality wishes to produce.[39] The PSAB also expects push back from utility companies such as UGI, or PPL, in implementing microgrids as it would take away the number of customers that rely on their services.[40] As, recent as 2014 there was litigation in Pittsburgh to determine if municipalities in Pennsylvania had the authority to interconnect to public utility company grids.[41] The PSAB would also like to include a greater density incentive while implementing microgrids. Lastly, municipalities do not have a model ordinance to follow to develop microgrids.[42]

III. HOW EXISTING LOCAL ORDINANCES CANNOT ADEQUATELY ADDRESS THE PROBLEM

Currently there is no specific ordinance in the boroughs of Pennsylvania that address microgrid implementation.[43] Rather, local borough codes only offer microgrids in their definition section and often relate them to the purpose a municipality supply clean energy.[44] Therefore, the main issue boroughs in Pennsylvania face is in finding a model ordinance for how to fund, maintain, construct and operate these microgrid projects. Municipalities often use

[37] *Id.*
[38] *Id.*
[39] Ethan Howland, Microgrid Costs, *How to Lower Them and What They Mean for the Sector's Growth*, MICROGRID KNOWLEDGE https://microgridknowledge.com/microgrid-costs-microgrid-2021/.
[40] *Id.*
[41] Hommrich v. Public Utilities Commission, 231 A.3d 1027, (Pa. Commw. Ct.2020).
[42] Microgrids, *supra* note 9.
[43] Elisa Wood, *Five Policies Blocking Microgrids*, Microgrid Knowledge https://microgridknowledge.com/policies-blocking-microgrids/.
[44] City of Pittsburgh, *Climate Action Plan* https://apps.pittsburghpa.gov/redtail/images/7101_Pittsburgh_Climate_Action_Plan_3.0.pdf.

bid specification models to find private third-parties to construct and maintain these microgrids.[45] A model ordinance would give municipalities the tool they need to implement microgrids.

IV. HOW THIS PROBLEM HAS BEEN ADDRESSED BY OTHER ENTITIES

Municipalities across the country take different approaches when implementing microgrids in their communities. Some require municipalities to apply for funding from the state or federal level when applicable or have private partners pay to finance the project.[46] Others choose utility providers to partner with to connect a microgrid to the main macrogrid.[47] A combination of these is most likely the key to successfully implementing microgrids into municipalities.

Boroughs use a bid specification model to create an "energy-as-a-Service" (EaaS) to fund microgrids.[48] This type of financing model uses the private sector and local ordinances to achieve the implementation of these microgrids throughout the state.[49] EaaS would be created through local ordinances. The private sector would have control of the "design[], finance[], construct[], own[ing], and operat[ing] [of] the microgrid, and receives the revenues it generates as compensation as well as a fee from the user of the microgrid."[50] This is especially useful for municipalities with low funding because it enables the private sector to construct microgrids without upfront costs.[51] Additionally, EaaS is an off-balance sheet transaction meaning it would

[45] Coffman, *supra* note 11, at 4.
[46] Cramer, *supra* note 1, at 14.
[47] *Id.*
[48] *Id.*
[49] *Id.*
[50] *Id.*
[51] *Id.*

not appear on the borough's balance sheet, alleviating financial liability from the borough that uses this model.[52]

When municipalities use this model to fund microgrids there are a few key elements that almost all municipalities consider when selecting a third-party partner namely (1) the municipality will have board members (2) their design of the project (3) how to construct and implement (4) maintenance and operations (5) the electric generation and sales (6) how long the service life will be and (7) how to finance the construction of the microgrid.[53]

When using the EaaS model municipalities first select board members to create a selection committee to decide which private third-party they wish to partner with to construct the microgrid however, the board members are normally already in place for the boroughs to give guidance to representatives on environmental impacts during decision making.[54] This selection committee is normally selected by the district representative of the county in which the microgrid will be implemented.[55] The selection committee's duty is to evaluate the proposals of third parties for the criteria they require for their boroughs microgrid.[56]

Next, the selection committee will look at the third-party applicants designs of the project.[57] This includes, but is not limited to, providing all initial and final engineer drawing, conduct any utility interconnection studies, and obtain any necessary federal, state, and local permits necessary to complete the project.[58] When applicable, the applicants should consider if

[52] *Id.*
[53] Coffman, *supra* note 11, at 2.
[54] *Id.*
[55] *Id.*
[56] *Id.*
[57] *Id.*
[58] *Id.*

the state or federal government has a grant based and incentive programs to support the construction and development of microgrids.[59]

The committee is also tasked with determining how the applicant can construct and implement their design.[60] This includes how they would prepare the project site and utility/energy infrastructure needed to support the project and how they would build and commission the project.[61] When considering this the municipality must consider the use of the microgrid in the community. If the microgrid is only for a singular municipal building the microgrid should be smaller and may not have to be able to have a high-power output.[62] But if the microgrid is for multiple buildings or entire neighbor hoods the municipality should consider a larger microgrid that is able to get the correct voltage output.[63]

Third, the board will consider how the applicant will maintain and operate the microgrid facility.[64] This includes the ability of the applicant to be able to repair possible damages to the grid and ensure seamless disconnect and reconnect with grid power when desired.[65]

Fourth, the board will consider how the third-party can generate electricity sales.[66] This includes being able to support all the facilities connected to the grid.[67] Additionally, they must adhere to any state or local law.[68]

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[59] *Id.*
[60] *Id.*
[61] *Id.*
[62] Hatziargyriou, N.D. et al., *Quantification of economic, environmental and operational benefits of Microgrids*, 2009 IEEE Bucharest PowerTech., 1-8 (2009) https://ieeexplore.ieee.org/abstract/document/5281860.
[63] *Id.*
[64] Camacho-Welch, *supra* note 14, at 5.
[65] *Id.*
[66] Coffman, *supra* note 11.
[67] *Id.*
[68] *Id.*

Fifth, the board considers how long the third-party contract will be accepted for. This tends to be around 25 years.[69] At the end of the contract the third party must offer the system to the municipality at an independently assessed value or decommission the system at the end of the contract term.[70]

Lastly, the board must consider how to finance the grid. The local government can present regulations on how the EaaS and contractors can operate to maximize the potential revenue streams these microgrid opportunities present.[71] Such policies and regulation encouraged by other EaaS are appropriately valuing microgrid revenue streams by encouraging the use of contracts for microgrid development.[72] A recent court holding Hommrich v. Pennsylvania Public Utilities Commission has shown that boroughs have this ability through ordinances. [73]

Montgomery County, Maryland installed a microgrid in its Public Safety Headquarters and used EaaS to fund the project.[74] This Microgrid connects to the main grid but supplies solar energy to the counties Office of Emergency Management, Homeland Security, and police station.[75] The county contracted with a third-party contractor to build and maintain the solar panels and microgrid.[76] To help create a maintainable revenue stream the county entered into a purchase agreement to buy the excess energy created by the microgrid.[77] This project has an expected life of 25 years.[78] The microgrid is expected to reduce greenhouse gas emissions by

[69] *Id.*
[70] *Id.*
[71] *Id.*
[72] *Id.* at 15.
[73] Hommrich v. Public Utilities Commission, 231 A.3d 1027, (Pa. Commw. Ct.2020).
[74] Coffman, *supra* note 13 at 2.
[75] Cramer, *supra* note 1, at 15.
[76] *Id.*
[77] *Id.*
[78] City of Pittsburgh, *supra* note 44.

over 5,900 metric tons per year.[79] It will also keep the above-mentioned facilities operable in case of a power outage.

This type of model shows how the private sector can become involved in the creation and operation of microgrids while limiting liability on the local boroughs. Additionally, it is a workable model for boroughs to implement other funding techniques by considering if the third-party they wish to partner with has applied to all applicable grants or if they are able to connect to the main macrogrid.

This solves the problem of what would happen in case of a widespread borough blackout and how to fund these projects.[80] By having a microgrid that is able to keep borough facilities running in the event of blackouts of the macrogrid it could potentially save lives and structural damage to buildings. Additionally, these ordinances give guidance of how to fund these projects whether it be through a third-party that supply's the capita like the EaaS model or if boroughs/ third-parties can apply for grants or connect to the macrogrid to save expenses in implementing microgrids.

These also provide social, environmental, and economic benefits to residents and businesses of boroughs. They provide social benefits by being able to keep facilities or residential buildings open in the case of widespread power outage.[81] These could potentially save lives such as the example given from Houston, Texas by keeping the heat on in residential buildings or by supplying energy to facilities where people in the community can gather to stay warm.

[79] *Id.*
[80] *Id.*
[81] *Id.*

Microgrids also offer zero-emission electricity sources which reduce greenhouse gas emissions.[82] By switching to renewable power sources such as solar or wind the environmental impact of implementing microgrids is limitless depending on what facilities they choose to connect to the grid.[83] Microgrids also offer on-site energy that would otherwise be lost from transmission lines that must travel a long distance to supply energy to certain facility. It is estimated that 8-15% of energy is lost when macrogrids supply energy to facilities. This energy loss increases the further away the facility is from the macrogrid.[84]

Economic impacts would be expected for boroughs, residents and business. If a microgrid is connected to the macrogrid the consumers of energy would be able to select when they wish to use the microgrid. This would enable consumers to switch back and furth between the two grids when macrogrid energy consumption has a higher cost than the microgrid.[85] Since they are local they also decrease the energy that is lost from a macrogrid that is far away and provide a local energy plant that keeps jobs within the community.[86] Lastly, just a 30-minute loss of power could cost a medium to large business more than $15,000.[87] A microgrid would eliminate this risk of loss during a power outage of the macrogrid.[88]

V. Recommendations

Throughout this article we have described how other municipalities have implemented microgrids and how they funded these projects. Here, we will describe how we have taken key

[82] Microgrids, *supra* note 9.
[83] *Id.*
[84] *Id.*
[85] Wood, *supra* note 43.
[86] *Id.*
[87] *Id.*
[88] *Id.*

elements from other projects and have created an ordinance for boroughs throughout Pennsylvania to adopt and how they will help fund the creation of microgrids.

Chapter 1 of the ordinance deals with the preliminary provisions of the ordinance. This includes the legal authority pursuant to Chapter 13 Section 1315(a)(3) and Chapter 14 Section 1402(d)(6) of the Pennsylvania Borough Code,[89] which gives the boroughs the ability to enter into contracts and authorize the receipt of incentives for the creation of microgrids.

It also includes the purpose. This is consistent with nearly every municipality that has implemented microgrids which is to promote the use of sustainable clean energy to those connected to the microgrid.[90] Additionally, to have a microgrid that can be severed from the macrogrid to provide electricity to essential services of the borough in the event of an emergency.[91]

Lastly, section one includes the definitions of funding models the ordinance implements. These are consistent with the bid speculation models addressed throughout this article such as the definition of microgrid, EaaS, and Sustainable Energy Sources.

These sections were included to give the boroughs legal authority showing they have the ability to implement microgrids. Additionally, by including a definition section it shows boroughs how to reference different funding models that are addressed in the ordinance.

Section 2 of the ordinance deals with "Council Authorizations and Restrictions". This gives the rules boroughs must follow when a board of councilors are deciding whether to implement a microgrid. This is consistent with other borough that have implemented microgrids and is included because the ordinance was created to provide boroughs the ability to implement

[89] 8 PA. CONS. STAT. § 1315(a)(3), 1402(d)(6).
[90] P.A. CONST. art. I, § 27.
[91] Cramer, *supra* note 1, at 27.

microgrids and shows they must be powered by sustainable energy sources.[92] It also restricts the council to not create microgrids that would generate electricity for entire communities. While other municipalities have this option, it was important for the ordinance to focus narrowly on borough facility buildings because these are critical infratructures that cannot fail in-case of power outages.[93]

Section 3 is titled "Appointed Engineer Requirements and Authorizations". This section list the duties of the appointed engineer who may or may not be an employee of the borough. There main task is to oversee any microgrid projects. It also list the discretion of the appointed engineer. This is similar to every EaaS model that has been used as borough board members are not experts in microgrid construction, so it is important to designate an expert in the field to oversee the project.[94]

Chapter 4 is titled "Incentivization of Microgrid Projects". This list has funding ways that the engineer may pursue to construct the microgrid. Either Private-Public Partnership Projects or Solely Private Microgrid and the distinction between the two.[95] The only difference is Private-Public Partnerships offer Borough Contributions since the borough may elect to designate funds from their own budget.[96] This is important and consistent with other municipalities who have implemented microgrids as every board wants to see how the engineer plans to fund the microgrid and what incentives it will have to do so.[97]

Lastly, Chapter 5 deals with severability of the ordinance and repeals. This is consistent with ordinances generally which is if one part is found invalid it will not affect the other

[92] Coffman, supra note 11.
[93] *Id.*
[94] *Id.*
[95] Cramer, supra note 1.
[96] *Id.*
[97] Coffman, supra note 11.

provisions that are found valid. It also gives an effective date of 30 days after enactment and approval. This is consistent with all ordinance as they must give an effective date and 30 days is a reasonable time to prepare for microgrid construction.

VI. CONCLUSION

This model will solve many of the problems the PSAB has identified. By applying to grants and having private investors, the boroughs in this state would be able to fund the development of these projects.

Microgrid not only create a sustainable future by reducing the carbon footprint of the boroughs that use them, but they help save lives by quite literally keeping the lights on in case of an emergency. By helping municipalities switch to one or a combination of the models presented, being Grant/Incentive based, or creating an EaaS, boroughs are taking a step in the right direction to fight climate change and create a safer community for the people they serve.

Microgrid Incentivization Ordinance of ___ [Borough] ___.

Ordinance Lead: Sean Peterson and Narrative Lead: Hunter Shreffler

ORDINANCE NO. _____

AN ORDINANCE OF ____ [BOROUGH] ____ OF _____ COUNTY, PENNSYLVANIA, TO ESTABLISH INCENTIVES AND GUIDELINES RELATED TO THE CULTIVATION AND PROSPERITY OF MICROGRID PROJECTS USED TO PROVIDE EMERGENCY ELECTRICITY FOR VITAL INFRASTRUCTURE

Be it enacted and ordained by the authority of the Council of ___[Borough]___ of _____ County, Pennsylvania:

Chapter 1

Preliminary Provisions

Section 101. **Short Title.**

This act shall be known and may be cited as the "Microgrid Incentivization Act of ___[Borough]___."

Section 102. **Legal Authority.**

This ordinance is authorized under Chapter 10 Section 1005(1), Chapter 13 Section 1315(a)(3), Chapter 14 Section 1402(d)(6), and Chapter 33 Section 3301.1(a) of the Pennsylvania Borough Code.[98]

[98] 8 PA. CONS. STAT. § 1005(1), 1315(a)(3), 1402(d)(6), 3301.1(a) (2012).

Section 103. **Purpose.**

The purposes of this act are as follows:

(1) To promote the creation and proliferation of microgrids within and throughout the boroughs of Pennsylvania;

(2) To incentivize boroughs to work with private parties to create microgrids;

(3) To incentivize the creation of microgrids that can be severed from the macrogrid and designed to provide electricity to essential services of the borough in the event of emergency;[99]

(4) To decrease reliance on the macrogrid for electricity and promote sustainable electricity generation that can be sold to the utility company that operates the macrogrid in that area in the event of surplus electricity generation;[100]

(5) To promote the use of sustainable energy sources in the production of electricity within the microgrids;[101] and

(6) To promote the creation of microgrids which supply electricity to neighborhoods, small developments, or emergency service infrastructure.[102]

[99] Sam Cramer, *Private, State, and Federal Funding and Financing Options to Enable Resilient, Affordable, and Clean Microgrids*, NATIONAL ASSOCIATION OF REGULATORY UTILITY COMMISSIONERS, 27 https://pubs.naruc.org/pub/E1D94D36-155D-0A36-3149-DFEB9D24715D (2021).
[100] Allison Lantero, *How Microgrids Work*, https://www.energy.gov/articles/how-microgrids-work (June 17, 2014).
[101] P.A. CONST. art. I, § 27.
[102] Cramer, *supra* note 2, at 8.

Section 104. **Definitions.**

The following words and phrases, when used in this ordinance, shall have the meaning given to them in this section unless the context clearly indicates otherwise:

"Appointed engineer" is the engineer approved by the council of the borough enacting this ordinance. This person will be in charge of overseeing the creation of the microgrid and recommending incentives for the microgrid project to the council for their approval.

"Borough contribution" is an incentive where the enacting borough will contribute an amount approved by the Council to the project and recovers the investment through a share of the proceeds from energy distribution by the facilitating third-party.

"Council" refers to the elected council of the borough which enacts this ordinance.

"Energy-as-a-Service," or "Eaas," is a type of incentive allowing a borough to construct microgrids without upfront costs by employing a third-party facilitator to construct, operate, and own the microgrid for the benefit of the borough, and sell excess electricity to the utility company which operates the macrogrid.[103]

"Greater Density Incentive" is a type of incentive which allows developers to increase maximum development density of a property or development in exchange for creating a microgrid within that property or development which advances the energy resiliency of the borough.[104]

[103] Cramer, *supra* note 2, at 14-15.
[104] As requested by Ed Knittel.

"Macrogrid" is a larger electric grid which provides electricity to entire boroughs, states, or larger regions, as opposed to a microgrid which concerns smaller areas and takes on a smaller electrical load.[105]

"Microgrid" consists of a facility or group of facilities and power sources on a single property or adjacent properties that are electrically connected to each other and can connect or disconnect from the larger electric grid to function independently in case of electrical grid service interruptions.[106]

"Public-private partnership microgrid projects" are those that are facilitated by a private third-party and financially supported and sponsored by the enacting local government.[107]

"Solely private microgrid projects" are those that are solely facilitated by a private third-party but given the ability by the local government to receive benefits for their work due to their public policy advancement.

"Sustainable Energy Sources" are those included under the Alternative Energy Portfolio Standards Act that are in no way fossil fuel based, such as, solar photovoltaic or other solar electric energy, solar thermal energy, wind power, large-scale hydropower, low-impact hydropower, geothermal energy, biomass energy, biologically derived methane gas, and fuel cells. This does not include waste coal or coal mine methane.[108]

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[105] Cramer, *supra* note 2, at 4.
[106] Cramer, *supra* note 2, at 4.
[107] *See* Eric Coffman, Montgomery County, Maryland, Request for Energy Proposal, Microgrids on County Facilities, Office of Energy and Sustainability https://www.montgomerycountymd.gov/DGS-OES/Resources/Files/MicroGridsRFEP-201404.pdf as an example of Bid Spec model.
[108] 73 PA. CONS. STAT. § 1648.2.

"Third-party facilitator" is a private entity that takes up the facilitating role in the creation of a microgrid project and takes advantage of the incentives laid out in this ordinance. This is also the person or entity who will own the microgrid.

Chapter 2

Council and Appointed Engineer Requirements and Authorizations

Section 201. **Restrictions on the Council.**

(a) Pursuant to Chapter 24A Section 24A03(a)(7) of the Pennsylvania Burrough Code,[109] the Council shall either borrow money or issue revenue bonds to fund any projects for the creation of microgrids within their borough.[110]

(b) All contracts for the creation of microgrids are to be made pursuant to the requirements of Chapter 14 of the Pennsylvania Borough Code.[111]

(c) The Council shall only enter into contracts for the creation of microgrids which are powered by sustainable energy sources.

(d) The Council may not enter into contracts for the creation of large scale microgrids. Such microgrids that are not covered under this ordinance are ones that would supply energy to the entirety of the borough or larger entity.

(e) Pursuant to Chapter 24A Section 24A03(a)(3) the Council shall obtain insurance for any microgrid projects that involve public funds.[112]

[109] *Id.* at § 2403(a)(7).
[110] *Id.* at § 1315(a)(3)
[111] *Id.* at § 1401-11.
[112] *Id.* at § 24A03(a)(3).

Section 202. **Duties of the Council Appointed Engineer.**

(a) The Council shall appoint an engineer, who is to report to the Borough Manager, who will report to the Council, to oversee any microgrid projects created or contracted into by the Council.[113]

(1) If there is no Borough Manager, the appointed engineer will report directly to the Council.

(2) The appointed engineer [is the engineer of record for the borough and] will [not] be a borough employee.[114]

(b) The appointed engineer is responsible for overseeing the creation of any microgrids contracted into or created by the Council. Oversight of such microgrids will include:[115]

(1) Creation of a reasonable timeline, that is consistent with any present contract details for the project;

(2) Assurance that such deadlines within that timeline are met;

(3) Reporting to the Borough Manager, or Council if there is no Borough Manager, on the progress of the project in relation to the project timeline;

(4) Providing written reports to the Borough Manager, who will then report to the Council, on their recommendation of incentives for certain microgrid projects to be later approved or denied by the Council;[116]

(5) Assurance that proper safety precautions are met;

[113] This is an option, as requested by Ed Knittel and authorized under Chapter 10 of the Pennsylvania Borough Code. *Id*. at § 1005(1).
[114] This was made into an option at the request of Ed Knittel.
[115] The Council may allocate any non-legislative or non-judicial power to the borough manager. *Id.* at § 1142(b)(5).
[116] *Id.*

(6) Having knowledge of available state and federal grants and incentives for the construction of microgrids;

(7) Assurance that all possible federal and state monies, from grants, other incentive programs, or otherwise, are applied for; and

(8) Assurance that specifications of the project are met including maximum capacity of the microgrid, proper connectivity and severability the macrogrid, and proper construction of the microgrid.

(c) In the event that the above requirements are not met, the Council shall have the ability to replace the appointed engineer.[117]

Section 203. **Recommendations of the Council Appointed Engineer.**

So long as the above requirements are met for each microgrid project, regardless of the third-party facilitator, the appointed engineer has discretion to recommend which incentives should be granted to each microgrid project. Recommendations are then submitted to the Council for final approval. The appointed engineer's recommendation must take into account:

(a) The requirements to complete the project, including design, construction, implementation, maintenance and operation, electric generation and sales, and total foreseeable service life,;[118]

(b) The feasibility of the project as a whole in relation to those incentives;[119]

(c) The economic benefit to the borough;

(d) The environmental impact of the project;

[117] 8 PA. CONS. STAT. § 1142(b)(5).
[118] Coffman, *supra* note 10.
[119] Coffman, *supra* note 10.

(e) The availability of state and federal monies in microgrid incentive programs that the third-party microgrid facilitator has not applied for; and

(f) The need for the microgrid within the borough.

Section 204. **Approval of Microgrid Projects.**[120]

(a) Microgrid projects under this ordinance are subject to the approval of the Council. Approval of a microgrid project will be decided along with the approval or denial of the recommendation of incentives by the appointed engineer for that particular microgrid project.

(b) The Council may not approve a microgrid project or coinciding incentives for that project if that project does not conform to the following minimum requirements:

(1) The microgrid must be a complete proposal that includes a feasibility study that is created either by the facilitating third-party or the appointed engineer, depending on the microgrid that is proposed.

(2) Electricity from the microgrid must be generated from only sustainable energy sources, as defined by this ordinance;

(3) The microgrid must be resilient enough to withstand weather conditions that may result in macrogrid power outages and contribute to the overall resiliency of the borough's electricity distribution system;

(4) The microgrid project must include energy storage capability with the ability to provide energy to emergency services in the event the macrogrid fails;

[120] Ed Knittel requested that the process for approval be left to the borough for determination, as each may want something different in terms of procedure.

(5) The microgrid must generate enough electricity to power all emergency service providers within the borough in the event the macrogrid fails; and

(6) The microgrid must be capable of being connected to but severable from the macrogrid.[121]

(c) If one of the incentives recommended by the appointed engineer is Energy-as-a-Service, the following requirements shall be met in order for the Council to grant approval:

(1) The third-party facilitator shall have expertise in microgrid construction;

(2) The third-party facilitator shall be responsible for the design, financing, construction, ownership, and operation of the microgrid;[122]

(3) The microgrid must comply with Institute of Electrical and Electronic Engineers Standard 1547.4 and the third-party facilitator shall document that either the primary or secondary purpose of the project is in maintaining critical infrastructure;[123]

(4) The third-party facilitator shall obtain approval from the Public Utility Commission to net meter their energy production against the macrogrid;[124] and

(5) The microgrid shall be capable of generating more electricity than will be consumed by the microgrid.

Section 205. **Exception.**

In the event that a microgrid already exists within the enacting borough which has energy storage and generation capabilities to provide emergency service providers with sufficient energy

[121] Cramer, *supra* note 2, at 15.
[122] Cramer, *supra* note 2, at 14.
[123] Under the Public Utility Commission regulations, in order to be an operational customer-generator and therefore be able to sell their energy back to the macrogrid operator, those two requirements must be met. *See* Hommerich v. Commonwealth, 231 A.3d 1027, 1041 (Pa. Commw. Crt. 2020) (citing 52 PA. CODE § 75.16).
[124] *See Hommerich*, 231 A.3d at 1041 (citing 52 PA. CODE § 75.13(a)(5), 75.17).

during a macrogrid power outage, subsections (4) and (5) of Section 204(b) of this chapter can be waived as minimum requirements.

Section 206. **Appeal of Council Decisions.**

Upon the approval of the microgrid project and granting of certain incentives and omission of others by the Council, the third-party facilitator may appeal to the Council for approval of additional incentives authorized under Chapter 3 of this ordinance. Appeals for such omitted incentives will be voted on by the Council.

Chapter 3

Available Incentives/Financing for Microgrid Projects

Section 301. **Authorized Microgrid Projects.**

(a) Under this act, the Council appointed engineer may recommend incentivizes for the following types of microgrid projects:
    (1) Private-public partnership microgrid projects, as defined by this act; and
    (2) Solely private microgrid projects, as defined by this act.

Section 302. **Private-Public Partnership Microgrid Projects.**

At the recommendation of the appointed engineer, those facilitating a private-public partnership microgrid project may be granted a borough contribution incentive, as defined in this ordinance. Investment recoupment for the borough's contribution will be done by giving the

enacting borough a percentage of the profits form energy distribution, decided by contractual agreement.[125]

Section 303. **Solely Private Microgrid Projects.**

(a) At the recommendation of the appointed engineer, those facilitating a solely private microgrid project may be granted the following incentives by the Council:

(1) Energy-as-a-Service, as defined by this act. After creation of the microgrid, the third-party facilitator can then sell excess energy back to the primary utility company as a utility provider themselves. Under this incentive the third-party facilitator shall have the ability to contract with sub-contractors for the construction of the microgrid.[126]

(2) Greater Density Incentive, as defined by this act. The exact amount of increased density of a development is to be determined based on the borough's current density restrictions and the increase authorized by the Council.[127]

[125] Boroughs are authorized under Chapter 14 of the Pennsylvania Borough Code to enter contracts. *See* 8 PA. CONS. STAT. § 1401-11. Additionally, the Council is not authorized to give away its legislative authority, so they must be the ones to approve any variance from set density requirements. *See Id.* at § 1142(b)(5).
[126] Cramer, *supra* note 2, at 14.
[127] As requested by Ed Knittel. John Icaza and Connor Behrend, An Addition to the Zoning Ordinance of the Township of Susquehanna, Dauphin County, Pennsylvania to Establish Regulations Related to the Adaptation of Commercial Properties for Reuse as Residential and Mixed Use Properties, 24, 33 (December 2020) (unpublished Sustainability Seminar Ordinance, Widener University Commonwealth Law School) (on file with the Environmental Law and Sustainability Center, Widener University Commonwealth Law School).

Chapter 4

Publication of Contracts, Severability, Repeals, and Effective Date

Section 401. **Severability.**

All provisions of this ordinance are severable. If any provision of this ordinance or its application is held invalid, such invalidity shall not affect any other provision of application of this act which can be given effect without the invalid provision or application.[128]

Section 402. **Repeals.**

No other sections of the ordinances of the [Borough] shall be repealed. All parts of the ordinance of the [Borough] are to be read together. To the extent that there are inconsistencies that cannot be read together, this ordinance shall be construed as to supersede other ordinances for purposes relevant to the provisions and purposes of this ordinance.[129]

Section 403. **Effective Date.**

This ordinance shall be effective in 90 days after enactment and approval. [130]

ENACTED this ____ day of ____, _____.

[128] Chris Williams and Austin Grace, An Ordinance of the ___[Township/Borough] of _____ County, Pennsylvania, To Establish Regulations Related to the Amount of Non-Family Members Residing in a Household in a Single-Family Residential Zoning District, 30 (December 2020) (unpublished Sustainability Seminar Ordinance, Widener University Commonwealth Law School) (on file with the Environmental Law and Sustainability Center, Widener University Commonwealth Law School).
[129] Williams, *supra* note 26, at 30.
[130] Williams, *supra* note 26, at 30.