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Identifying the Policy Barriers for a Microgrid System in Ohio

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Abstract

The electric grid may be the most critical and vital component of the United States' infrastructure but is projected to fail more frequently in the future. One solution for improving grid resiliency is through renewable energy and microgrids. However, many cities lack public policies to bring these solutions to fruition. The purpose of this study was to discover the perceived and real challenges to the development of policies necessary for the implementation of a microgrid system for a small city in Ohio. Using a generic qualitative approach and the principles of participatory action research, data were obtained through interviews of elected officials at the local, state, or federal levels and individuals who were familiar with renewable energy policies or microgrid concepts. The theoretical framework used to analyze the data was the multiple streams approach. Data analysis revealed 5 categories that comprise the theme of barriers: apathy, a lack of awareness and education, personal beliefs, expense, and fear as preventing small Ohio cities from developing policies for the creation of microgrids. Also, identified in this study were how the categories of education, incentives, investment, relationships, and systems planning comprised the theme of incentives and solutions for promoting the development of a microgrid. This research contributes to the body of knowledge regarding renewable energy policies by validating existing literature and identifying apathy as a contributing factor not found in the literature. Understanding barriers identified by this research will assist elected officials in the development of policies for microgrids that will protect critical infrastructure, enhance community resiliency, and preserve the quality of life for the community.

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Introduction

Chapter 1 contains an introduction and background of the vulnerability of the United States' electrical grid system while describing a potential solution using renewable energy sources and microgrid technologies. In most cases, renewable energy sources provide power for a microgrid. It can operate connected to the primary grid or independently of the main power grid to relieve the demands on the conventional grid while providing resiliency to communities during a power outage (Center for the Study of the Presidency & Congress, 2014; Choobineh & Mohagheghi, 2015). Additionally, Chapter 1 describes the lack of public policies that would allow the use of these energy sources and technologies as being the precursory problem to solve. Chapter 1 continues with the purpose of my research as identifying the barriers to the creation and adoption of public policies for the implementation of a microgrid system.

Background

The electric grid may be the most critical and vital component of the United States' infrastructure (Center for the Study of the Presidency & Congress, 2014; Canton, 2011; Choobineh & Mohagheghi, 2015; Cook, Volpi, Nobler, & Flanegin, 2018; Gholami, Aminifar, & Shahidehpour, 2016). Western Interconnect, Eastern Interconnect, and Texas Interconnect provides electric power through 640,000 miles of transmission lines and serves more than 300 million people in the United States (American Society of Civil Engineers, 2018; Center for the Study of the Presidency & Congress, 2014). However, the grid has been described "as a patchwork system that is in desperate need of investment" (American Society of Civil Engineers, 2018; Center for the Study of the Presidency & Congress, 2014, p. 74).

The power grid has protection systems designed to react immediately to isolate disturbances and prevent the remaining portions of the network from failing. When an outage occurs, alternative routes and substations re-energize the affected area during the repair phase. Choobineh and Mohagheghi, (2015) asserted this traditional approach may work for typical disturbances but may be incapable of handling a large-scale impact from a natural disaster. Compounding the vulnerability of the U.S. power grid is its age and lack of investment in updating and maintaining its structure. Over the last several decades, the United States' has reduced the amount it allocates for constructing and maintaining its infrastructure.

Short (2016) reported that the United States spent 3% of its Gross Domestic Product (GDP) on infrastructure improvements between 1950 and 1970. The GDP investment has been reduced by 2% since 1980. By comparison, China spends 9% of its GDP, and most Western European countries invest 5% (Short, 2016). The American Society of Civil Engineers (2018) estimated $2.2 trillion over five years should have been spent to ensure an adequate infrastructure; however, the investment had a shortfall of $45.5 billion. Consequently, in 2017 the energy grid was rated D+ and is projected to fail more frequently and impact more extensive areas (American Society of Civil Engineers, 2018; Gholami et al., 2016).

Abedi, Gaudard, & Romerio (2018) reported that the electric grid is susceptible to disruptions from:

- System component failures due to aging, obsolete, and equipment in disrepair;
- Hidden faults made worse from cascading events that remove protection system components;
- Sabotage;
- Imbalances in demand and generation; and
- Human errors.

Baker and Volandt (2018) warned that multiple critical infrastructures would be impacted if a prolonged power outage lasted weeks, months, or a year,

- Water supply and wastewater treatments;
- Telecommunications and the internet;
- Food production and delivery;
- Fuel extraction, refining, and distribution;
- Financial systems;
- Transportation and traffic controls;
- Government, including public works, law enforcement, and emergency services;
- Hospitals and healthcare;
- Supply chains; and
- Other critical societal processes.

Regardless of the cause, because of the interdependent structure of the components of the grid, a simple outage can create a cascading effect “affecting millions of people and impinging enormous costs on the economy” (Center for the Study of the Presidency & Congress, 2014, p. 17).

The cascading effect begins from a specific event and causes a sequence of disconnections and failures that can lead to full area blackout (Abedi et al., 2018). In August of 2003, exacerbated by cascading effects, a massive outage impacted 50 million people throughout the Northeastern United States and the cities of Ontario and Toronto in Canada (Center for the Study of the Presidency & Congress, 2014). The event began when transmission lines became overloaded and shut down from high demands for electricity. Also, a warning alarm system failed and resulted in additional transmission lines becoming overloaded and shutting down. As the grid system was increasingly taxed, cascading failures continued throughout the system and region. Efforts to transfer to a back-up system also failed (American Society of Civil Engineers, 2018).

Natural disasters and severe weather have exposed the weaknesses of the United States' power (Cook, Volpi, Nobler, & Flanegin, 2018). The number of high-impact storms has been increasing and produced seven of the 10 costliest storms in U.S. history (Ton, 2015). Six of the most active storms have occurred since 2008, and by 2017 the cumulative cost from these storms "exceeded $300 billion, surpassing the previous record of $200 billion set in 2005" (Cook et al., 2018, p. 1). Abedi et al. (2018) estimated that weather-related blackouts cost an estimated $20 to $55 billion per year. The combination of aging infrastructure, increased populations, and climate changes have increased the likelihood of storms causing massive devastation (Center for the Study of the Presidency & Congress, 2014).

On June 29, 2012, over 1.4 million lost power in the Washington metro area from the Ohio Valley & Mid-Atlantic Derecho, which traveled 600 miles in less than 10 hours

(Short, 2016). The storm knocked over trees and severed power transmission lines rendering the nation's capital nonfunctioning. Cook et al. (2018) reported Hurricane Sandy left 8.5 million people without power for a week in 2012. Hurricane Maria struck Puerto Rico in 2017, leaving 3.4 million people without power for 90 days (Cook et al., 2018).

All the recent power outages have exposed the ineffectiveness of current measures used for community energy resilience. The most common type of back-up system is a diesel generator. Unfortunately, this method is problematic if the power disturbance is long in duration. Issues such as a lack of refueling options, unreliability, interruptions to fuel supplies, and an aging infrastructure make the diesel generator an antiquated choice (Anderson, 2017). Subsequently, providing resiliency to a community through alternative means is becoming a priority (Hayat, 2016)

One definition of resiliency is the electric grid having the capacity to withstand a low-probability/high impact event by quickly progressing back to a normal operating state through self-healing capabilities (Bahramirad, Khodaei, Svachula, & Aguero, 2015; Chandra & Srivasta, 2016; Choobineh & Mohagheghi, 2015; Panteli & Mancarella, 2015). To make the power grid more resilient, the National Science and Technology Council (NSTC) looked to improve grid technologies with advanced information and grid technologies, advanced metering solutions, and the ability to leverage energy usage information (NSTC, 2011). A primary focus of the suggested improvements was to make the grid more resilient and less vulnerable to weather-related outages (Chandra &

Srivasta, 2016). A community can also complete reinforcing and operational measures to improve grid resiliency.

One way to lessen grid vulnerability is to place high voltage lines and distribution lines underground. However, Short (2016) reported that underground high voltage lines would cost eight to 10 times more, and underground distribution lines would be four to six times more expensive compared to traditional installations. Maintaining power lines above ground is less costly but increases grid vulnerability. Although burying electric lines improves resiliency, the action is not a failsafe solution. Short warned underground installations are subject to damage from tree roots, chemical abrasions, and flooding. Another solution to providing grid resiliency is the utilization of distributed energy systems (DES) and microgrids (Anderson, 2017).

The United States' grid system is centralized and monodirectional. Power is generated, transmitted, and distributed in one direction. Conversely, distributed energy systems are decentralized, bidirectional, and permit electricity to flow in multiple directions. A simple analogy to understand the centralized grid system is a river that has no tributaries. If the river is blocked, everyone downstream receives no water. However, a river with tributaries that is blocked still provides water to everyone downstream; a DES is similar to a river with tributaries, and microgrids are a part of a DES.

Metelista (2017) asserted the use of microgrids is not a new concept and has provided reliable, resilient, and cost-effective power to military installations, industrial facilities, and universities. Gaining in popularity are community microgrids. Community microgrids rely on DES and renewable energy sources "to achieve a more sustainable, secure, and cost-effective energy system while providing indefinite, renewables-driven, back-up power for prioritized loads" (Clean Coalition, 2019, para. 2). In the realm of emergency operations, community microgrids are seeing an increase in use to power critical infrastructure such as schools, police and fire stations, and elderly care centers (Delony, 2018; ICLEI-Local Governments for Sustainability, 2017; Thurston, 2019; Qazi & Young, Jr., 2014).

For the microgrid concept to come to fruition, the goals of all key community stakeholders and the utility providers must align toward creating and connecting the community microgrid into the conventual power grid (Clean Coalition, 2019). For effective use of renewable energy sources and systems, "the right statutory package and appropriate government incentives" are essential elements to be addressed (Ali et al., 2017, p. 24). However, according to Gundlach (2018), recent surveys from stakeholders and subject matter experts consider regulatory barriers, opposition from incumbent utilities, and difficulty accessing financing the significant obstacles to a community for advanced microgrid development. Cook et al. (2018) affirmed Gundlach's assertion of the lack of supportive policy and regulations being a barrier to future microgrid development. Ali et al. (2017) concluded that there are a limited number of studies in the literature on effective policies and incentives for microgrid development and installation. Also, several other scholars and subject matter experts have identified the gap in knowledge as the lack of effective policies for the use and development of renewable energy and microgrids.

The research I conducted fulfills the need of identifying the actual and perceived obstacles that are preventing small northeast Ohio cities from adopting renewable energy policies to achieve the development of a microgrid. In doing so, cities will become more resilient to the impact of power failures. Subsequently, the community will be better protected and safer.

Problem Statement

The loss of electrical power can rapidly change from a burden to a calamity when a network's basic framework is rendered inoperable. The problem is that many cities lack the public policies that would allow the use of microgrid technology to enable operational resiliency during a long-term or widespread power outage. The literature suggested several impediments to creating public policy,

- Opposition by the individuals who are dreadful of job losses in the non-renewable energy source businesses;
- Initial and on-going expenses of progressing to sustainable power sources;
- A government agency is having to manage an electrical grid (Ali et al., 2017; Brown & Hess, 2016; Cohen, 2015; Kester, Moyer, & Song, 2015).

The literature also recommended policies should be created or overhauled for the full advantages (ecological, budgetary, flexibility) of a microgrid to be achieved (Bird & Hotaling, 2017; Freeman & Hancock, 2017; Hayat, 2016; Yang & Zou, 2015)**.** However, the literature does not address the specific challenges or other potential problems a small NE Ohio city may face in developing and enacting microgrid public policies.

Purpose of the Study

The purpose of my study was to discover the perceived and real challenges to the development of policies necessary for the implementation of a microgrid system for a small northeast Ohio city. A small city is one with a population of 200,000 or less (OECD, 2018). I identified and provided meaning to the views and experiences of the study's participants regarding the barriers that are preventing public policies and a microgrid system from becoming a reality. I used a generic qualitative approach that was inspired by the principles of participatory action research (PAR). Finally, my results contribute to the body of knowledge regarding the necessary public policies related to the development and installation of microgrids in northeast Ohio communities.

Research Questions

The study research questions were:

1. What are the perceived and actual factors preventing a small northeast Ohio city from developing renewable energy policies?
2. What policies and incentives are necessary for the active promotion and development of a microgrid?

Theoretical Framework

In 1984, John Kingdon developed the multiple streams approach (MSA) to analyze "ambiguity, time constraints, problematic preferences, unclear technology, fluid participation, and stream independence" in public policy research (Weible & Sabatier, 2018, p. 18). Cairney and Jones (2015) reported the MSA allows users to understand and explain the overall policy process with unparalleled flexibility for testing general policy theories, and the ability to contribute to insights of other approaches. Brought together by focusing events and windows of opportunities, the MSA focuses on three categories of independent and interdependent variables that produce opportunities for agenda setting (Beland, & Howlett, 2016; Mukherjee & Howlett, 2015). The three categories are:

- The problem stream-encompasses issues that deviate from the ideal state and the public's expectation that the government will provide a solution (Beland, & Howlett, 2016; Weible & Sabatier, 2018).
- The policy stream- evaluates the potential policy solutions to problems by identifying, assessing, and reducing the number of promising options to a few (Beland & Howlett, 2016).
- The political stream- analyzes the influences of the executive or legislative turnover, and interest group advocacy campaigns and how it affects the national mood (Beland & Howlett, 2016).

Using the MSA as the research theory was in-line with the research questions and the qualitative methodology. Because the microgrid study looked to explore what the obstacles to creating an energy policy for small northeast Ohio cities were, evaluating through the lens of the MSA facilitated a thorough examination.

Nature of the Study

Qualitative research is used to understand how people perceive and approach the meanings of their experiences with a particular phenomenon (Burkholder, Cox, & Crawford, 2016; Ravitch, & Carl, 2016). The purpose of my research was to identify and describe the real and perceived challenges for small northeast Ohio cities to develop and adopt energy policies that are beneficial to the community. Knowing and understanding the person's awareness of microgrid technology and energy policies will help in policy creation and implementation. Finally, potential policy and incentive recommendations for other communities was shown through my research.

Definitions

Community microgrid: relies on DES and renewable energy sources to provide energy for an entire community as opposed to a single limited number of buildings (Clean Coalition, 2019).

Black start resource: the ability to restart from a partial or total power shutdown independently of external power sources (Cook et al., 2018).

Cascading effect: begins from a specific event and causes a sequence of disconnections and failures that can lead to full area blackout (Abedi et al., 2018; Baker & Volandt, 2018).

Centralized power grid; conventual power grid: delivers power from a few large power plants to users thousands of miles away through a centralized and monodirectional system of transmission and distribution power lines (Cook et al., 2018; Delfino et al., 2018).

Distributed energy systems (DES); distributed energy resources (DER); distributed energy generation (DEG): decentralized, bidirectional electricity-producing resources or controllable loads that are directly connected to a local distribution system or connected to a host facility within the local distribution system. Utilizing existing power distribution lines, a DES, DER, and DEG may use renewable energy sources (RES) or conventional energy sources (CES) to generate and deliver electrical power at or near the location it will be used (Cook et al., 2018; Delfino et al., 2018).

Federal Production Tax Credits (PTC)- were first established as part of the 1992 Energy Policy Act to incentivize wind production (Federal Energy Regulatory Commission [FERC], 2006).

Feed-In-Tariff (FiT): financial compensation to customers who own renewable energy-producing systems that feed the conventual power grid (DSIRE, n.d.).

Grid-Connected: refers to a microgrid system that is connected to the utility grid (Delfino et al., 2018; (Hirsch, Parag, & Guerrero, 2018); Ton, 2015).

Island Mode, *Islanding*: the condition in which a microgrid continues to power a location even though electrical grid power is no longer present (Hirsch et al., 2018; Mahmoud, 2017; Schneider et al., 2017; Thomas & Henning, 2017).

Microgrid: a self-sufficient energy system that serves a discrete geographic footprint, such as a college campus, hospital complex, business center, or neighborhood (Ton, 2015).

*Net metering tariffs***:** enables customers owning renewable systems to use the power produced instead of the power coming from the central electric grid (DSIRE, 2016c).

Renewable Energy Credit (REC)- allows energy producers who produce more than their required of sustainable power to offer or exchange credits to different utility providers (Public Utilities Commission of Ohio [PUCO], 2017).

Renewable energy sources (RES): includes sunlight, wind, ocean, hydropower, biomass, geothermal resources, biofuels, and hydrogen. These natural energy sources are converted into electricity, heat, and appear infinite in their current forms (The American Society of Civil Engineers, 2018).

Renewable Portfolio Standard (RPS): A policy program usually adopted by states to require energy generators/utilities to produce a certain percentage of electricity from renewable energy sources (Public Utilities Commission of Ohio [PUCO], n.d.a).

Resiliency: An advanced approach to preparing communities to threat from climate change and planning for such threats, incorporating various economic and environmental, and emergency preparedness strategies into strategic and sustainability planning (Chandra & Srivasta, 2016; Panteli & Mancarella, 2015).

SMART Grid: digitally based control technologies and field devices that are designed to coordinate multiple grid processes. A SMART-Grid has intelligence capabilities for monitoring and reacting automatically to local changes in power usage through real-time, two-way communication between the users and power suppliers (Campbell, 2018; Center for the Study of the Presidency & Congress, 2014; Willrich, 2017).

Assumptions

My first assumption was that participants selected had the familiarization, knowledge, or experience with renewable energy and microgrids necessary to contribute to the study. The second assumption was that people were interested and willing to participate in the study. Finally, a third assumption was that participants would discuss the subject matter in an honest, sincere fashion without fear of ridicule or repercussions.

Scope & Delimitations

Delimitations state what a particular study does not include (Burkholder et al., 2016). My study was limited to northeast Ohio and to participants who are a local, or a state, government employee with decision-making authority for a small community (population less than 200,000) such as:

- Local government officials
- A county representative(s)
- A state representative(s)
- A representative(s) from utility providers
- Subject matter experts (microgrids, solar, wind, etc.)

Although the findings may apply to other regions in the State of Ohio or throughout the United States, these areas were not be specifically studied.

Limitations

Burkholder et al. (2016) asserted that limitations are the known weaknesses of a design or study. Since the research focused on northeast Ohio, potential limitations for the study are the questions about validity and external generalizability. According to Hacker (2013), validity is how accurate research conclusions apply to the real world. Hacker asserted, "generalizability exists when our conclusions hold for the community, population, or setting we specify" (p. 43). Given the study focused on NORTHEAST, Ohio, it is unclear if, and how much, the findings will also apply to other regions of Ohio.

Using a generic qualitative approach poses several points to be considered by the researcher. Kahlke (2014) reported several critiques or limitations with a generic qualitative approach. The main concern is that this approach lacks the rigor of other qualitative approaches. Specifically, Kahlke reported that critics warn the approach leads to atheoretical research lacking in a sufficiently critical review of the literature. Also, the mixing of multiple methodologies creates contradictions between all elements of the study. Finally, Kahlke offered several counterarguments to the critic's concerns, which will be discussed further in the literature review.

Limitations of using interviews to obtain data for a study also exist. Patton (2015) reported that participant responses could be prone to "personal bias, anger, anxiety, politics, and simple lack of awareness" (p. 389). Interview data is also susceptible to recall error and self-serving responses (Patton, 2015). Finally, Patton warned of the fine line that exists between essential data collection and analysis with not interfering "in the program or burdening participants" (p. 489).

Significance

As researchers have stated, the United States' power grid will continue failing more frequently and affect larger populations of people (American, 2018; Gholami, Aminifar, & Shahidehpour., 2016). A microgrid offers an answer for setting up network versatility amid a power blackout**.** Despite the literature supporting the concept of a microgrid, it additionally referred to the absence of viable policies and incentives vital for the promotion and advancement of microgrids. Therefore, as a part of this study I reviewed Ohio's renewable energy laws, regulations, and identified the policies and incentives that would support the development of a microgrid in a small northeast Ohio city. The development of policies to protect critical infrastructure and enhance community resiliency during a power failure provides a lasting social change.

Summary

The United States' electric grid, described as a pieced-together system needing investment and updates, maybe the most critical and vital infrastructure. A simple outage can quickly become a blackout due to cascading effects. One solution for improving grid resiliency is through DES and microgrids. However, many cities lack public policies to bring these solutions to fruition. Through research I identified the real and perceived challenges for small northeast Ohio cities to develop and adopt energy policies that are beneficial to the community using qualitative research. Also, my findings revealed incentives and solutions to promote the development of a microgrid system.

Chapter 2: Literature Review

Introduction

This chapter reviews and summarizes the literature regarding the condition of the United States' power grid, the potential solutions renewable energy sources may provide, and the public policies currently in place. The purpose of this literature review is to provide a thorough description of the topic and to establish the understanding necessary to answer the research the following questions:

- What are the perceived and actual factors preventing a small northeast Ohio city from developing renewable energy policies?
- What policies and incentives are necessary for the active promotion and development of a microgrid?

Literature Search Strategy

Conducting a literature review for this dissertation was both extensive and challenging. Because the concepts of distributed energy systems, microgrids, and renewable energy are not familiar subjects, the literature review was structured to introduce the subject matter while also reporting on current research and trends. The literature review focused on:

- Peer-reviewed articles and studies;
- White paper, technical research, and analytical reports about microgrids or renewable energy;
- Textbooks;
- Current or recommended federal, state, and local laws, regulations, and standards.

Multiple databases and the internet were used to locate peer-reviewed articles and resources. The databases were primarily from Walden University's library and included:

Public Policy Databases

- EBSCOhost
- Emerald Insight
- Sage Research Methods
- Sage Stats
- Taylor & Francis Online
- U.S. Government Publishing Office

Energy Databases

- Energy Power Source
- IEEE Xplore
- Science Direct

Emergency Management Databases

- CQ Researcher
- EBSCO Host
- Homeland Security Digital Library
- Sage Journals

Google and Goggle Scholar were also used to located additional peer-reviewed articles and resources. Specific websites researched were:

- American Solar Energy Ohio
- DSIRE
- Green Energy Ohio
- Grow Solar
- ICLEI Publications & Reports
- Microgrid Institute
- Microgrid Knowledge
- National Renewable Energy Laboratory
- ORCID

- Public Utilities Commission of Ohio
- U.S. Environmental Protection Agency

Amazon.com was used to locate textbooks. The references cited in the peer-reviewed articles, technical reports, and white papers were used to find additional resources. Regardless of the medium researched, the same terms were used for searching the databases and the internet. The most common search terms used were:

- Community resiliency
- Community solar
- Disaster management
- Distributed energy
- Electric grid
- Microgrids
- Multiple Streams Framework
- Generic Qualitative Approach
- Renewable energy
- Renewable energy policies
- Solar
- Sustainability
- U.S. power grid

Furthermore, literature regarding the multiple streams theoretical framework was found using the same databases

Research Design: Generic Qualitative Approach

A generic qualitative approach is "not guided by an explicit or established set of philosophic assumptions in the form of one of the known qualitative methodologies" (Caelli, Ray, & Mill, 2003, p. 2; Kahlke, 2014). Patton (2015) further described the approach as using in-depth interviewing, fieldwork observations, and document analysis to answer the research question(s) without being specific to a particular theoretical, epistemological, or ontological belief. Finally, Merriam (2002) posited researchers who conduct generic studies are an epistemologically social constructivist who seeks to understand a phenomenon from the lived experiences of people through observations, interviews, and researcher reflection through theoretically interpretive studies.

Kahlke (2014) reported several critiques or limitations with a generic qualitative approach. The main concern is that this approach lacks the rigor of other qualitative approaches. Specifically, Kahlke reported that critics warn the approach leads to atheoretical research lacking in a sufficiently critical review of the literature. Also, the mixing of multiple methodologies create contradictions between all elements of the study.

Sandelowski (2000) posited because of the required linkages between the research questions, the methodological choices, and the research methods, a generic qualitative approach is not atheoretical. Sandelowski also opinioned the generic qualitative approach is no more susceptible to a non-critical review of the literature than any other approach. Regarding the concerns of mixing multiple methodologies, Kahlke (2014) reported there are no approaches that conform exactly as their textbook depictions suggest. Kahlke also added

> generic studies require researchers to know the methodologies (sometimes more than one) that they draw on well enough to not only apply that methodology to context but also to manipulate and blend methodologies. Also, generic studies must justify the choices made in the relative absence of real arguments (Kahlke, 2014). As a result, individual researchers employing generic qualitative approaches need to read and think broadly about their work (p. 44).

Theoretical Foundation: Multiple-Streams Approach

Anfara, Jr. (2008) described a theoretical framework as a study's foundational structure that has been present in literature, documented, and empirically tested. The theoretical framework defines the viewpoint of the researcher and how data will be analyzed and interpreted (USC Libraries, 2019). John Kingdon’s multiple streams approach (MSA) is a theoretical framework used for analyzing public policies.

Jones et al. (2016) and Zahariadis (1999) stated the MSA is a proven approach in the study of public policy at the systems level to understand specific policy decisions. The MSA evaluates how and why some topics and policy choices become a priority, while others are overlooked (Pessolani, 2016). Rather than examining the policy linearly, the MSA categorizes and assesses the problem, policy, and political streams together (Beland & Howlett, 2016; Pessolani, 2016).

The MSA has faced criticism from scholars over the years. Chow (2014) asserted one criticism is that the framework was never tested outside of the United States in other political ideologies and lacks compatibility with Eastern politics. Chow also cited another problem with MSA is its lack of consideration for the effects the media can bring to bear on public policy. Finally, Chow reported many have questioned whether the three streams are independent of each other. Mucciaroni and Bender, Moe, and Shott shared Chow's question of the streams being genuinely independent and asserted the streams should be viewed as interdependent (Mucciaroni; Bender; Moe, & Shott as cited in Zahariadis, 1999).

The MSA was used recently in the research of solar energy policies in the country of Paraguay. Pessolani (2016) reported, because Paraguay's policies fit into the three primary stream categories, MSA was appropriate for the investigation of solar energy policies. Despite being a different country, Paraguay's solar energy and northeast Ohio's microgrid project have policy similarities.

Paraguay's problem stream did not emerge from a disastrous occasion or perceived crisis; instead, it developed systemically over the years (Pessolani, 2016). By comparison, northeast Ohio's need for a reliable, redundant power supply does not originate from a solitary emergency; instead, it is an issue with its infrastructure that has exacerbated over decades. Similarities among Paraguay and northeast Ohio are also presented in the policy and political streams of the MSA. Paraguay presented their plan with relevant documents published by official entities and had made numerous changes to their laws and regulations to improve the politics of solar energy before policy implementation (Pessolani, 2016).

Literature Review of Key Variables and Concepts

The United States Power Grid Overview

Kwasinski, Weaver, and Balog (2016) described the United States' electrical grid as a centralized system that delivers power from a few large power plants to users thousands of miles away. The electrical network is comprised of more than 640,000 miles of high-voltage transmission lines and serves over 300 million customers (American Society of Civil Engineers, 2018; Center for the Study of the Presidency & Congress, 2014). Kwasinki et al. warned that the existing centralized power system is unreliable, lacks flexibility, and cannot be stabilized by simply mending its many weaknesses. Consequently, the electrical grid will continue to fail more frequently and affect larger populations of people (American Society of Civil Engineers, 2018; Center for the Study of the Presidency & Congress, 2014; Gholami et al., 2016; Kwasinski et al., 2016; Pahl, & Jones, 2012).

It is challenging for power supply companies to meet modern-day load requirements, consumer satisfaction, and environmental considerations associated with the United States' power grid (Mahmoud, 2017). Some of the electric grid predates the 20th century, and most of the transmission and distribution lines were installed in the 1950s and 1960s with a 50-year life expectancy (American Society of Civil Engineers, 2018). Due to the power grid's aging interdependent system, increased usage and demand, and ongoing climate changes, the electric power industry is in a critical era as the electric grid suffers from frequent cascading failures and volatility (Bevrani, Francois, & Ise, 2017)

Baker and Volandt (2018) cautioned that the United States would be unable to effectively respond to a prolonged, nationwide power failure that lasted many weeks or months. It is estimated essential infrastructure to protect life and property would begin failing within three days, and sufficient relief from government agencies and other sources may not be available (Baker & Volandt, 2018; Lasky et al., 2016). Subsequently, grid failure poses a significant threat to public safety and the national economy (American Society of Civil Engineers, 2018).

Grid Resiliency

To limit the threat grid failure poses, making the power grid more resilient is becoming a critical necessity for many cities (Hayat, 2016; Huang, Wang, Chen, Qi, & Guo, 2017)). Panteli and Mancarella, (2015) define reinforcing actions as making the power system less susceptible to extreme events by,

- Moving distribution and transmission lines underground;
- Upgrading poles and structures with stronger, more robust materials;
- Elevating substations;
- Relocating facilities to areas less prone to extreme weather;
- Rerouting transmission lines to areas less affected by weather;
- Redundant transmission routes.

Operational measures are control-based actions focused on allowing resources to remain dynamic and adaptive during an extreme event. A distributed energy system (DES) that utilizes renewable energy resources is one example of an operational measure that can alleviate the stress on the existing grid by supplying localized energy (Mahmoud, 2017; Panteli & Mancarella, 2015).

Distributed Energy Systems

In the early 20th century, distributed energy systems (DES) were widely used for heating, cooling, lighting, mechanical, and other electrical needs before the use of less expensive centralized power generation systems (Delfino et al., 2018). Utilizing existing power distribution lines, a DES can use renewable energy sources (RES) or conventional energy sources (CES) to generate and deliver electrical power at or near the location it will be used. Renewable energy sources include sunlight, wind, ocean, hydropower, biomass, geothermal resources, biofuels, and hydrogen. These natural energy sources are converted into electricity and heat. Given the advancement in technology, DES offers an affordable solution with increased flexibility, efficiency, and reliability over the centralized power system (Delfino et al., 2018; Kwasinski et al., 2016).

Although DES offers many benefits, Mahmoud (2017) described several technical issues that need to be addressed. The high costs for initial implementation, custom engineering, and integration problems are a few challenges of transitioning to a DES. The Department of Energy and other state organizations within the United States are addressing these issues (Mahmoud, 2017). Another potential problem with a DES is the problem of intermittent power flows (Mahmoud, 2017). However, address the intermittent power flows by segmenting the existing power grid into smaller functional units, and add diversity (renewable energy sources), redundancy, and strength to the current power system (Bevrani et al., 2017**;** Defino et al., 2018; Hirsch et al., 2018; Kwasinski et al., 2016; Lin, & Bie, 2016; Mahmoud, 2017; Panteli & Mancarella, 2015).

Microgrids

A microgrid is a small, distributed energy grid powered by renewable energy sources that can provide electrical power independently or in conjunction with the primary electric power grid (Ton, 2015). Microgrids allow the centralized, mono-directional network to transition to a bidirectional distributed energy system (Delfino et al., 2018). When connected to the conventional energy grid's distribution lines (grid-connected), a microgrid can augment the supply and delivery of clean, reliable energy while reducing the user's energy costs (Delfino et al., 2018; Gholami et al., 2016). When operated independently (island mode), a microgrid operates entirely off renewable energy sources to supply and deliver electrical power to a building, multiple buildings, or an entire community (Gholami et al., 2016; Schneider et al., 2017).

The literature cited several benefits to a grid-connected microgrid. (Hirsch et al., 2018) reported fuel and energy cost savings for users, relief on the energy demand placed on the conventual grid, and improved efficiency and quality of power generation and distribution. From an environmental perspective, Wentao et al. (2017) asserted that microgrids provide a reduction in fossil fuel consumption, pollutants, and greenhouse gas emissions while providing a sustainable energy source. In summary, distributed energy systems, renewable energy, and microgrids offer economic, environmental, and community resiliency benefits compared to the traditional fossil fuel powered centralized electric grid.

Because a microgrid can be operated autonomously (island mode), the construction of a microgrid offers community resiliency during a power outage. Schneider et al. (2017) presented three configurations in which a microgrid can be a resiliency resource, (a) locally, (b) community-wide, or (c) as a black start resource (the ability to restart from a partial or total power shutdown independently of external power sources). Because a microgrid is part of a distributed energy system that uses batteries for energy storage and advanced control systems, they offer operational flexibility, self-sustainability, and expedited power grid restoration (Hirsch et al., 2018; Mahmoud, 2017; Thomas & Henning, 2017). Despite the many benefits distributed energy systems and microgrids offer, they are not without technological, economic, legal, and policy challenges.

A lack of technology can pose a barrier to the transformation regarding renewable energy and microgrids (Coen, 2015; Hamilton, 2013). To have a seamless transition between the conventual power grid and distributed energy systems (DES) and microgrid future technologies should be developed to address stability and control challenges (Bevrani, et al., 2017; Cohen, 2015). Campbell (2018) and Willrich (2017) asserted the stability and control issues could be addressed by modernizing the existing power distribution network needs to be upgraded with Smart-Grid technologies.

Smart-Grid

The U.S. Department of Energy (2018) described the Smart-Grid as digitally based control technologies and field devices that can coordinate multiple grid processes. A Smart-Grid has intelligence capabilities for monitoring and reacting automatically to local changes in power usage through real-time, two-way communication between the users and power suppliers (Campbell, 2018; Willrich, 2017). Although efficiency, reliability is improved, and there is a reduction in overall costs are, grid modernization may require significant capital investments that create economic challenges.

Most of the expense of implementing wind or solar power will be the upfront capital costs that may not be as cost-competitive as conventual solutions (Hamilton, 2013; Kwasinski et al., 2016; Willrich, 2017). However, when a microgrid is used to power medium to high power critical loads or used in power isolated locations, they are more cost-effective than conventual power supply sources (Kwasinski et al., 2016). Also, federal tax credits will continue to subsidize wind and solar power, which could further promote its use (Kwasinski et al., 2016; Willrich, 2017). Although there are high initial costs to implementing a microgrid, their promotion through tax incentives may make their use more prominent and less expensive.

There are legal considerations to address with distributed energy systems (DES) and microgrids. The first legitimate question is whether DES and microgrids will be subject to oversight by state regulatory agencies (Hirsch et al., 2018)? Secondly, if DES and microgrids are deemed exempt from regulatory agencies, will they fit into existing energy sales, purchasing, generation, or legal distribution frameworks (Hirsch et al., 2018)? For these questions to be answered and DES and microgrids to be cost-effective, safe, and reliable, policies are necessary that clearly define their identity and uses.

Public Policy Formation

Cook et al. (2018) suggested categorizing policies into three categories: market preparation, creation, and expansion. Cook et al. defined market preparation policies as those policies "designed to identify and address institutional barriers that may limit a technology's market access" (p. 22). Market creation policies catalyze direct investment into renewable energy technologies (i.e., mandating the use of DES or microgrids). Market expansion policies, as described by Cook et al., are designed to reduce investment costs or promote widespread use.

Krasko and Doris (2013) argued that effective policy ordering (policy sequencing or stacking) could have a significant effect on institutionalizing renewable energy, DES, and microgrid policies. Krasko and Doris described policy sequencing as policymakers adopting "market reforms in a step-wise fashion that address barriers incrementally" (p. 22). Cook et al. (2013) reported that the policy sequencing strategy was used in agriculture, financing and economic reforms, and trade markets.

Although there are a plethora of studies regarding the benefits of renewable energy and microgrids, very few studies address the public policies that are necessary for the concept to come to fruition. Examination of the primary form of public policy needs to occur before analyzing renewable energy policies individually. Public policies are typically a result of an issue that the public views appropriate for the government to resolve (Anderson, 2011; Gerston, 2014). Krutz (2016) further described public policies as guides to legislative action that stem from the debate, compromise, and refinement. Although seemingly straight forward, policy formation is a complex process of agenda-setting, the development of alternative solutions, and the subsequent choice of right action (Kingdom, 1995).

According to Gerston (2014), policy issues can be categorized as substantive or symbolic. Gerston defined substantive issues as those items which are controversial or could have a significant impact on a community or society. Furthermore, substantive issues tend to include government resources, and are difficult and time-consuming to solve, if solvable at all. Symbolic issues are problems that are bothersome, uncontroversial, and are generally resolved quickly, according to Gerston. Finally, Gerston added that the resolution of symbolic issues tends to focus on political values and provide more psychological relief than actual changes to the political system.

Kingdom (1995) discussed how an issue becomes an agenda for the policy-making process. Kingdom referred to catalysts for agenda-setting as indicators or focusing events that drive the necessity for public policy. A change in the state of the system is an indicator for policymakers to define a potential problem. Kingdom warned indicators could often cause false interpretations and lead to distorted policymaking. Kingdom defines a focusing event as a crisis or disaster that cannot be ignored and drives the creation of policies.

Gerston (2014) used the term triggering mechanism for the impetus for policy creation. Similar to Kingdon's focusing event, a triggering mechanism is an event that transforms a routine societal problem into a critical incident. Gerston further described a triggering mechanism as having the ability to identify and clarify emerging issues while defining new issues and policy solutions. Finally, Gerston stated the interaction between scope, intensity, time, and resources make triggering mechanisms a powerful stimulant for public policy.

Scope and intensity have potentially powerful synergy. Gerston (2014) described the scope as the number of people who are affected by a triggering mechanism. The demand for policy action will have a higher chance of garnering political attention if a significant amount of people are impacted. However, if the scope only affects a small number of people, the triggering mechanism may lack the momentum to achieve the political support necessary to make policy formation. The public's perceived intensity of the triggering mechanism is also a driver for public policy. Gerston asserted if the incident is of low severity, policy changes may not occur. However, if the intensity of the event invokes enough public fear or anger, policymakers are typically moved to action.

Regarding the element of time, Gerston (2014) asserted that a triggering mechanism could transpire instantly or over a lengthy period. Gerston pointed out that there is not a correlation between time and intensity. Instead, he suggested a triggering mechanism that occurs immediately can be just as influential to policy creation as one that happens over some time.

Gerston (2014) does not use the term resources to mean what is available for use. However, instead, he describes them as the costs associated with coming to terms with a problematic situation. Expenses may be viewed in terms of money, lives, quality of life, or whatever is negatively affected by the event. The higher the potential loss to the resources, the more significant it contributes to the triggering mechanism.

The concepts put forth by Gerston (2014) and Kingdon (1995) come together to create what Kingdon termed a policy window. Indicators, focusing events, and triggering mechanisms create the policy window for the creation and adoption of policies to address a societal problem. However, Kingdon warned policy windows are only open for a short period, and once they close, policymakers will have to wait until the window opens again.

Renewable Energy Policies

Cohen (2015) and Edenhofer et al. (2012) reported that the public sector plays an essential role in the transition from fossil fuel usage to renewable energy. Cohen also opinioned smart; effective public policies can help the United States move away from fossil fuels into sustainable clean energy. The right statutory package combined with government incentives for renewable energy has the potential to become a low-cost alternative to fossil fuels (Ali et al., 2017; Cohen, 2015). If Ali et al. and Cohen are correct, then public policies need to be developed.

However, policymaking is often reactive and shrouded in confusion, contradictions, and fear (Behave, 2016; Gerston, 2014). Subsequently, developing effective policies has been challenging due to there not being a one-size-fits-all policy (Edenhofer et al., 2012). Consequently, the United States' renewable energy policy oversight and regulations lack a coherent vision, coordinated policy guide, or legislation, all of which are required for distributed energy systems and microgrids to become a reality (Willrich, 2017).

Hamilton (2013) reported there are two ideologies regarding energy policies- those who approach the subject from supply expansion and those who look to suppress the demand for energy. Supply expansion proponents do not see the energy problem as a shortage; instead, they view the issue being the barriers that block the use of other energy sources. Advocates of supply expansion seek to create policies to remove or overcome political, economic, and environmental obstacles. Supporters of demand suppression believe the energy crisis is due to a perpetuating, insatiable desire for an ever-higher standard of living. Therefore, the backers of demand suppression ideology focus on reducing energy consumption through policies.

Cohen (2015) argued that the focus of public policy should be on lowering the price of renewable energy rather than taxing fossil fuel usage. Cohen also recommended that communities, households, and businesses be encouraged to generate power through incentives. Regardless of ideology, the development of energy policies should be based on social, political, and policy preferences focused on the creation of a diverse energy portfolio (Ali et al., 2017; Bevrani et al., 2017).

Edenhofer et al. (2012) asserted that renewable energy policies are regulations or fiscal incentives. Regulations include feed-in-tariffs, quotas, priority grid access, building mandates, biofuel blending requirements, and bioenergy sustainability criteria. Ali et al. (2017) asserted regulations and fiscal incentives encourage the use of renewable energy sources while reducing energy demand. Thus, appealing to both ideologies regarding energy policy formation described by Hamilton (2013).

Federal Policy & Regulations

Federal energy policies have been around since the Colonial era of the United States. To meet the increasing demands for power and to take advantage of newer technologies, the energy policies of the U.S. have evolved. Since 2005, four federal policies expand the use of renewable energy and have driven programs and incentives. The four policies are:

- The Energy Policy Act (EPAct) of 2005;
- The *Energy Independence and Security Act* (EISA) of 2007;
- The American Recovery and Reinvestment Act (ARRA) of 2009**;**
- The Energy Independence Executive Order 13783 signed by President Trump in 2017.

The EPAct of 2005 promoted the production and distribution of reliable, affordable, clean energy (Ali et al., 2017). The EPAct also strengthened the regulatory tools of the Federal Energy Regulatory Commission (FERC), an independent agency that regulates the interstate transmission of electricity, natural gas, and oil (FERC, 2006). Furthermore, the EPAct reestablished a commitment to competition in wholesale energy markets and provided for the development is a stronger infrastructure (FERC, 2006). The 2007s EISA intends to reduce the United States' dependence on fossil fuels by setting a national fuel economy standard, increasing the production of renewable fuels, and enhancing the overall energy efficiencies of products, buildings, and vehicles (Office of the Press Secretary, 2007). The ARRA of 2009 created $17 billion in renewable energy cuts, allocated $5 billion for making homes more energy-efficient, and is the catalyst for starting the alternative energy industry in the United States (Amadeo, 2018). Finally, the Energy Independence Executive Order "established a national policy to promote the clean and safe development of our energy resources while reducing unnecessary regulatory burdens" (Pruitt, 2017, para. 1).

There are several programs and incentives that states can use to meet the intent of federal policies and regulations. Options for the states are:

- Renewable Portfolio Standards (RPS)
- Renewable Energy Credit (REC)
- Feed-In-Tariff (FiT)
- Net Metering Tariffs
- Federal Production Tax Credits (PTC)

- The tax credits for solar and wind producers.

The State of Ohio Regulatory Policies

The State of Ohio has implemented several goals, programs, and incentives to meet the intent of federal policies and regulations. Overall, Ohio's renewable energy policies encourage the implementation of distributed energy systems and generation. Although the State of Ohio has available and offers several financial incentives related to renewable energy, it only has nine regulatory policies (DSIRE, n.d.).

Alternative energy portfolio standard (S.B. 221). In 2008, Ohio adopted the Alternative Energy Portfolio (AEP) that required utility companies to "provide a growing percentage of their annual retail electricity supply from renewable and solar generation sources. Also, the AEP has the end goal of deriving 25% of their annual retail electricity supply from alternative energy" by 2025 (DSIRE, 2018a, para. 2).

Ohio's AEP also included reporting requirements and potential penalties for noncompliance. Electric distribution utilities (EDUs) and electrical services companies must file a status report describing the previous year's activities with the PUCO annually and are subject to compliance payments if the annual benchmarks are not met (PUCO, 2017). However, EDUs and electric services companies may submit a force majeure filing to the PUCO to excuse non-compliance with the minimum benchmarks when there are not sufficient quantities of renewable energy resources (PUCO, 2017).

In 2017, the PUCO initiated the PowerForward workshop by holding two, three-day public sessions where subject matter experts share their insights to modernizing the power grid. The PowerForward "initiative is relevant to the AEP for some reasons, including its consideration of consumer interest in renewable energy and technical issues associated with distributed energy resources and interconnection" (PUCO, 2017, p. 11).

Ohio's AEP "also required utilities to implement energy efficiency and peak demand reduction programs that achieve a cumulative energy savings of 22% by the end of 2025 and reduce peak demand by 1.0% in 2009 and 0.75% annually after that through 2018" (DSIRE, 2018a, para. 13). The PUCO is required by law to submit to Ohio's General Assembly a report describing the electric distribution utilities' and electric services companies' level of compliance with the AEP (PUCO, 2017). Also, the PUCO's report must include the average annual cost of renewable energy credits purchased by utilities and companies and any strategies for encouraging the use of renewable energy resources. Although progressive and similar to other policies across the nation, the AEP would later be temporally suspended and permanently changed.

Energy efficiency portfolio standard (S.B. 310). In May of 2014, Ohio became the first state to suspend its renewable energy schedule (DSIRE, 2018a). The Energy Efficiency Portfolio Standard (S.B. 310) suspended and changed renewable generation levels for two years at the 2014 levels and allowed the utility companies to meet these levels entirely from out of state resources as opposed to half. Instead of achieving the 25% renewable energy goal by 2025, the percentage was reduced to 12.5%. Also, the timeline was extended to 2027 (PUCO, n.d.a); DSIRE, 2018a). Finally, the Energy Efficiency Portfolio Standard allowed utility suppliers to determine their obligation using two statutorily-defined formulas instead of meeting the goals previously set by the Alternative Energy Portfolio (DSIRE, 2016b). The two formulas had the cumulative impact of reducing the required energy savings and peak demand to zero in 2015 and 2016 (DSIRE, 2016b).

DSIRE (2016a) reported that the Energy Efficiency Portfolio Standard also set the goals of a 1% energy efficiency reduction from 2017 to 2020. After 2021, utility suppliers must achieve a 2% annual reduction and realize a cumulative 22% savings by 2027. The Energy Efficiency Portfolio Standard also affected the annual Peak Demand Reduction (PDR) by keeping the 2015's and 2016's requirements at 4.75%. However, by 2020 the PDR will again return to 7.75% as previously set by the Alternative Energy Portfolio (DSIRE, 2016a).

Life cycle analysis and energy conservation standards for state buildings and Executive Order 2007-02S. In 1995, Ohio enacted the Life Cycle Analysis and Energy Conservation Standards for State Buildings. In 2007, the Governor issued Executive Order 2007-02S, which amended the 1995 legislation. Both legislative actions required all state agencies to perform a life-cycle cost analysis and an energy consumption analysis before the construction of new buildings and entering into new leases, respectively (DSIRE, 2014a). Stanford University (2005) defined a life-cycle-analysis as a process of evaluating the economic performance of a building over its entire life. Stanford University further explained a life-cycle-analysis balances the initial investment costs with the long-term expense of owning and operating the building. All state buildings were required to lower their energy use by 5% during 2008 and over the next four fiscal years to achieve a 15% reduction (Energy.gov, n.d.). However, institutions of higher education were given the goal of a 20% reduction by 2014 based on a 2004 baseline (DSIRE, 2014a). Also, universities were required to develop a 15-year plan for phasing in efficiency and conservation improvements and the establishment of a means for reporting periodic progress (Energy.gov, n.d.).

Energy efficiency and sustainable design in new school construction. In 2007 the Ohio School Facilities Commission (OSFC) approved Resolution 07-124, requiring all new school construction and renovations of existing schools to achieve the Leadership in Energy and Environmental Design (LEED) for Schools Silver certification (DSIRE, 2018b). The Alternative Energy Portfolio Standard enacted in 2008 directed the OSFC to adopt solar-ready requirements and guidelines which allow for the installation of roof-top, solar PV energy equipment. Subsequently, the OSFC passed Resolution 08-164 and incorporated the solar-ready standards in the Ohio School Design Manual (DSIRE, 2018b).

Interconnection standards. DSIRE (2016b) reported that Ohio implemented an interconnection standard that provides three levels of review for the interconnection of a 20-megawatt (MW) distributed generator (DG) system into the conventional power grid in 2014. Level 1 is a simplified review procedure that allows the request to be reviewed within 15 days of submission and an agreement within five days of approval. Level 2 provides an expedited process for systems up to 5 MW in capacity. Level 3 applies to systems up to 20 MW, which does not meet the criteria of Levels 1 or 2. The standard also provides provisions for applicants who do not meet the approval criteria. As long as the applicant meets all safety, reliability, and power quality standards, they can be approved. The utility company may also require further study or minor modifications before approving the request. Finally, the utility company and the applicant can agree to evaluate the application under Level 2 or Level 3 criteria.

Net metering. Ohio adopted its net metering law in 1999, and the PUCO revised the law in 2012 (DSIRE, 2016c). Net metering “requires electric distribution utilities to offer net metering to customers who generate electricity using wind energy, solar energy, biomass, landfill gas, hydropower, fuel cells, or microturbines” (DSIRE, 2016c, para. 1). Net metering is a billing mechanism that allows consumers who generate their electricity to receive credits for the excess power fed back into the conventional power grid (Solar Energy Industries Association [SEIA], 2019). Net-metered systems are required to meet the National Electrical Code (NEC), the Institute of Electrical and Electronics Engineers (IEEE), and Underwriters Laboratories (UL) safety standards and utility companies are prohibited from imposing additional requirements (DSIRE, 2016c).

Solar Easements. The State of Ohio has solar access laws that permit property owners to create solar easements. Solar easements are voluntary agreements that individual property owners enter into with their neighbors or governing bodies to protect and maintain access to sunlight to their solar-powered systems and panels (DSIRE, 2014b; Solar United Neighbors of Ohio, n.d.b). Solar easements can be written and address many different facets to protect people's access to sunlight. A typical example would be the requirement of a neighbor to keep their trees trimmed so that the sunlight can reach another neighbor's solar panels.

Financial Incentives

Financial incentives and policies are closely tied together, meaning an entity typically has to have policies in place to be eligible for the funding. Tax measures, rebates, grants, performance-based incentives, and loan programs, guarantees, and credit enhancements “can improve access to capital, reduce the burden of high upfront costs, lower financing costs, support creation of new markets, and address split incentives associated with energy-efficient technologies” (Cox, 2016, p. 1). Yang and Zou (2015) agreed that financial incentives encourage renewable energy use and development; however, they can also be detrimental. Yang and Zou reported Shen et al.'s reporting of China's massive subsidies of large-scale projects have led to criticisms of the inefficient use of public funds and the subsequent diminishing manufacturer profit margins. Instead, Shen et al. (2013) recommended the restructuring of China's subsidies in favor of small-scale projects, which potentially has the benefit of further lowering cost benefits for photovoltaic (solar power) systems). Fortunately, in the United States, there are numerous federal and state financial incentives for renewable energy projects.

Local Government Policies

Blair and Starke (2017) argued that local governments are responsible for providing many essential public services to the community. Subsequently, policies are developed and adapted to meet the community's needs. Although local governments are fertile grounds for policy innovation and social change, several authors concluded there is a limited amount of research regarding local government policies (Ali et al., 2017; Blair & Starke, 2017; Brown & Hess, 2016; Cohen, 2015; Kester et al., 2015). Further complicating the development of renewable energy policies is the tendency for them to become convoluted due to the involvement of multiple "departmental reviews, a permitting fee and a site inspection, as well as interconnection-based reviews by the local utility" (Burkhardt, Wiser, Darghouth, Dong, & Huneycutt, 2014, p. 2). The literature addressed several potential barriers to public policies regarding renewable energy but lacked northeast Ohio specificity.

Summary

The literature described the many issues the United States faces with its aging, obsolete power grid. Scholarly articles and official reports offered several modern enhancements for improving the power resiliency throughout the United States. Although the literature supported the development of a microgrid, it also cited the lack of studies regarding public policies. Admittedly, because of the rapid ever-changing evolution of renewable energy technology, the literature reviewed is not definitively conclusive.

The common themes within the literature are definitions of microgrids, their many benefits toward community resiliency, and the need for policies to be created. A second theme is how federal and state governments are changing and enacting laws and regulations that are placing more priority and incentives for renewable energy. A third theme is the lack of studies regarding local government compliance with federal and state renewable energy goals. A final theme is the generalized reasons people and organizations do not engage in local policy discussions. Therefore, I sought to identify the barriers preventing the development and adoption of renewable energy policies at the local government level.

Chapter 3: Research Method

Introduction

A research design connects theory and concepts within a study (Ravitch & Carl, 2016). The research design creates a framework and addresses the methods of data collection and how it will be analyzed (O'Sullivan, Rassel, Berner, & Taliaferro, 2017). One type of research methodology is qualitative research. Qualitative research assists the researcher to understand how people perceive and approach the meanings of their experiences with a particular phenomenon (Burkholder et al., 2016; Ravitch, & Carl, 2016).

The purpose of my study was to discover the perceived and real challenges to the development of policies necessary for the implementation of a microgrid system for a small N.E Ohio city. A small city is one with a population of 200,000 or less (OECD, 2018). I used qualitative research to identify and provide meaning to the views and experiences of subject matter experts, stakeholders, and decision-makers that may hinder the creation and adoption of public policies for the implementation of a microgrid system. The results of my research also contributed to the body of knowledge regarding the necessary public policies related to the development and installation of microgrids in NE Ohio communities.

Research Design & Rationale

The study research questions were:

1. What are the perceived and actual factors preventing a small NE Ohio city from developing renewable energy policies?

2. What policies and incentives are necessary for the active promotion and development of a microgrid?

Therefore, qualitative research was used to answer to my research questions.

Qualitative research seeks to understand a phenomenon from the lived experiences of people through observations, surveys, focus groups, interviews, and researcher reflection. Ravitch and Carl (2016) asserted that qualitative research is iterative, emergent, and develops from the interrelationships and synergy between the theories, concepts, goals, contexts, beliefs, and relationships of the particular subject.

Rahman (2017) suggested that qualitative research creates a comprehensive interpretation of a participant's experiences and offers more significant insight than what quantitative information regularly introduces. Denzin and Lincoln (1989) referred to qualitative research's other strength is its capacity to incorporate a scope of perspectives comprehensively, inquire about strategies, and procedures for deciphering the information. Because microgrid technology is an emerging concept requiring the input and expertise of government officials, energy companies, and renewable energy experts, the qualitative methodology was well suited to bring the idea to fruition. However, Rahman asserted that the fundamental limitation of qualitative research is the study's conclusions may not have the dimension of assurance as quantitative research. Other limitations reported by Rahman were related to the subjective nature of qualitative research, and the generalization of the study’s results.

The Role of the Researcher

My philosophical orientation aligns closely with social constructivism. Burkholder et al. (2016) described constructivism as the lack of a single actual reality. Specifically, truths are created through the interactions between people. It is through these interactions that knowledge and meaning are derived. Because constructivism lacks a single actual reality, the researcher needs to clearly define the reality by ensuring the ontology's underlying question(s) is an objective, verifiable reality or if the reality is the result of individual interpretation (Burkholder et al., 2016). Regarding epistemology and ontology, validity requires the study of the knowledge (what we know and how we know it) and exploration of its limitations. Reliability applies to epistemology and ontology by ensuring the reality examined with a similar methodology produces results that are in alignment and are reproducible by future research endeavors.

A researcher undertaking a qualitative study becomes the primary data collection instrument through direct observations, participation in interviews, and analysis of documents (Burkholder et al., 2016). Positionality is the role, and the identity the researcher has regarding the connection to the research setting and study context (Ravitch & Carl, 2016). Specifically, the researcher's role could be a practitioner, expert, or member of the community (Ravitch & Carl, 2016).

Creswell (2013) described the researcher as both an observer and participant in varying degrees of a complete participant to complete an observer. An observer-participant is someone who observes a group's activities but does not actively participate. The advantages to the researcher being in this role are the ability to operate recording devices in conjunction with observations, and access to activities they would otherwise need a membership to attend. The disadvantage of being an observer-participant is the loss of data and experience of not being fully engaged with the meeting, activity, or group. During the face-to-face participant interviews, I was able to observe the nonverbal communication of the participant, such as eye contact, facial expressions, gestures, posture and body orientation, voice inflections, silence, personal appearance, and other visual communication cues.

I also used vetting instruments to assist in identifying missing or problematic information, underlying assumptions and biases, issues with clarity, wording, flow, and scope. Ravitch and Carl (2016) described this process as sharing multiple drafts of the data collection instruments with people knowledgeable in the subject matter and making refinements until the research process is vetted and improved. The draft of the results and analysis was shared with a friend for peer-debriefing and with my dissertation Committee.

Methodology

A generic qualitative approach is best defined in the negative as research that is “not guided by an explicit or established set of philosophic assumptions in the form of one of the known qualitative methodologies” (Caelli, Ray, & Mill, 2003, p. 2; Kahlke, 2014). Patton (2015) further described the approach as using in-depth interviewing, fieldwork observations, and document analysis to answer the research question(s) without being specific to a particular theoretical, epistemological, or ontological belief. Finally, Merriam (2002) stated researchers who conduct generic studies are an epistemologically social constructivist who seek to understand a phenomenon from the lived experiences of people through observations, interviews, and researcher reflection through theoretically interpretive. Because microgrid technology is an emerging concept requiring the input of government officials, energy companies, and renewable energy experts to bring the idea to fruition, tenets of participatory action research (PAR) coupled with the chosen generic qualitative approach were used.

Baum et al. (2006) asserted PAR differs from conventual research because the research is focused on enabling action, emphasizes relationships that promote sharing of power between participants and the researcher, and is sensitive to the context of the research. Finally, Gillespie and Gillespie (2006) asserted PAR increases the validity and value of research and increases community application of research results. Collaboration, collectivism, and participation are vital to enacting a public policy that will bring the northeast Ohio microgrid concept to reality. Subsequently, a generic qualitative study inspired by PAR was the best choice for decision-makers, stakeholders, and experts to explore, understand, and address the barriers to public policy.

Participant Selection Logic

Schwandt asserted selection criteria and a strategy for ensuring the participants meet the selection requirements are two critical issues the researcher should address when deciding the composition of the sample's participants (Schwandt, 2015). Based on ethics and methodology, a researcher must establish inclusion and exclusion criteria using valid and reliable means for determining a participant's eligibility (Velasco, 2012).

The inclusion criteria used in my research consisted of participants who were a local, state, or federal government employee with decision-making authority in northeast Ohio, or a representative of a power company, or a subject matter expert in renewable energy (microgrids, solar, wind, etc.). By default, those who did not meet the inclusion criteria were excluded. The target group of interest was local government employees who knew about renewable energy types and local government operations.

Walden University's Institutional Review Board (IRB) was also consulted to assist in addressing any confidentiality concerns and to identify other potential issues to ensure there is compliance with a university's ethical standards and U.S. federal regulations (Walden, n.d.). Walden University's IRB gave its approval to conduct the study on November 15, 2019. Walden University's approval number for my study is 11-15-19-0145931, and it expires on November 14, 2020.

The population for sampling consisted of,

- Local government officials
- A county representative(s)
- A state representative(s)
- A representative(s) from utility providers
- A person who has special skills or knowledge regarding renewable energy policies or microgrid concepts

People who met the inclusion criteria received a formal, written invitation to contribute to the study (Appendix A). Those individuals who held the requisite local government position and who were familiar to me were contacted first. The remaining participants were identified using group characteristic and chain sampling methods until data saturation was achieved.

Sample Size

Mason (2010) suggested the sample size should find a balance between assuring essential perceptions are revealed yet not so large it becomes repetitive and unwieldy. Patton (2015) reported the overall size of a sample is dependent on (a) the information being sought, (b) the purpose of the research, (c) the risks involved, (d) what will be useful and have credibility, and (e) what can be done within the researcher's time and resources. Patton further expounded upon sample size by stating the researcher should initially set a minimum sample size that will represent the topic and bring forth information that is rich and addresses stakeholder interests. Another deciding factor for the size of a sample is data saturation. However, whether data saturation is achievable is often debated.

Burkholder et al. (2016) asserted that data saturation occurs when new themes and patterns no longer emerge. Mason (2010) argued that if saturation is determined solely by the lack of further information, then saturation may never be achieved because new data will always add new themes or patterns. Ravitch and Carl (2016) opinioned that data saturation occurs when the researcher can answer the research question and achieve a comprehensive, multi-viewpoint understanding of the research problem.

Based on the information and the multiple considerations presented for determining sample size and data saturation, I began with a sample size goal of 12-14 people with the intention of expanding or contracting its size as necessary to answer the research questions. The participants were selected through purposeful sampling based on their relevance to the research question (Burkholder et al., 2016; Ravitch & Carl, 2016).

Identifying, Contacting and Recruiting Participants

Purposeful Sampling

O'Sullivan et al. (2017) stated that the primary reason for using purposeful sampling is the researcher's belief that the people chosen will be illustrative of the populace. Two potential sampling methods for the microgrid study are Group Characteristics Sampling and Chain Sampling. Ravitch and Carl (2016) and Patton (2015) described Group Characteristics Sampling as the creation of a group of cases that can provide rich data and reveals essential group patterns. O'Sullivan et al. characterized Chain Sampling as a technique utilized with existing participants to uncover or recommend other potential individuals who cannot be readily found by different methods. Both strategies are fitting for choosing members for the microgrid study.

Using purposeful sampling, the initial participants contacted were those individuals who knew me and who had the requisite decision-making authority or were someone with special skills or knowledge regarding renewable energy policies or microgrid concepts. I used group characteristic and chain sampling methods from this initial selection to contact and recruit additional individuals until data saturation was achieved. Potential participants were approached by email to eliminate any pressure to participate (Appendix A).

Instrumentation

Ravitch and Carl (2016) expressed that information gathering is cyclical, emergent, and recursive. Accordingly, the researcher should adopt an iterative strategy for data gathering. In a qualitative study, the researcher does not just gather information, yet preferably, they interface with the participants to produce and co-develop discoveries (Ravitch and Carl, 2016). Rubin and Rubin (2012) declared that interviews are one method for gathering information for collecting data for the qualitative study.

Interviewing can reveal rich, in-depth information; for this reason, I used this data collection method. Although a structured interview format could be used, Patton (2015) stated the process restricts the interviewer from exploring unanticipated topics or issues and reduces the ability to query individual differences and circumstances. The semi-structured interview allows the interviewer to formulate additional questions as the interview progresses (Rubin & Rubin, 2012). The semistructured interview offered flexibility in obtaining the research data. The concepts I wanted to explore were identifying misconceptions and fears of decision-makers and stakeholders, preventing the creation and adoption of renewable energy policies at the local level and incentives or solutions for creating a microgrid.

Before conducting an interview, a checklist or interview guide should be developed by the researcher (Ravitch & Carl, 2016; Rubin & Rubin, 2012). Burkholder et al. (2016) recommended that the researcher should prepare for the event by considering the site, the participants, and the date and time of the interview. To organize and achieve the most benefit from an interview Burkholder et al. recommended using an interview protocol form to record relevant details that will guide the interviewer in conducting an interview.

Rubin and Rubin (2012) suggested the interviewer should develop main questions, probing questions, and follow-up questions when structuring the interview. Rubin and Rubin described the main questions as a focused inquiry designed to answer parts of the research question. Probing questions are meant to encourage the participant to continue talking and providing examples and descriptions (Rubin & Rubin, 2012). Rubin and Rubin stated that the purpose of follow-up questions is to encourage the participant to expand on the principal concepts, themes, ideas, or events.

Burkholder et al., (2016) posited interviewing can produce rich, in-depth data for a qualitative study. Ravitch and Carl (2016) stated that the purpose of individual interviews is to reveal the deeper meaning of the subject matter. Responsive interviewing using a semi-structured format allows flexibility for the interviewer to collect data from a multitude of sources and weave the information into a description of the phenomena (Burkholder et al., 2016; Rubin & Rubin, 2012). I considered and followed the suggestions from Burkholder et al., and Ravitch and Carl when my study's interview process was developed (Appendix B).

Qualitative interviews are semistructured or unstructured and occur as a scheduled conversation between the researcher and the interviewee (Rubin & Rubin, 2012). The contrast between the two types of interviews is the dimension of control the interviewer maintains over the discussion. Rubin and Rubin (2012) described a semi-structured interview as the interviewer asking specific questions with the intent to ask follow-up questions; by comparison, an unstructured interview has an overall topic to discuss and allows for many of the questions to develop during the interview.

The conceptual/theoretical framework for my study was the multiple streams approach (MSA). Kingdon and Zahariadis asserted policy adoption considers five elements (a) the problem being brought to light, (b) proposal of acceptable and achievable policies, (c) political and advocacy group influence, (d) windows of opportunity, and (e) policy entrepreneurs who connect solutions with solutions (Kingdon, 2003; Zahariadis, 1995). The MSA analyzes the problem, the policy, and the politics and served as a template for developing the semistructured interview questions. The questions were categorized as main questions, probing questions, and follow-up questions, as suggested by Rubin and Rubin (2012).

An interview guide "serves as a checklist during the interview to make sure that all relevant topics are covered" (Patton, 2014, p. 439). Based on the literature, theory, and personal experience, questions, or issues were listed and organized into the interview guide. The guide ensured I used the same inquiry with each participant while providing the flexibility of adapting the interview as needed to gain the data. The interview guide used in my research is in Appendix B.

Completed interviews were transcribed, and a copy was be given back to the participant. The interviewee was encouraged to ensure the transcription was correct and to offer any additional insights or clarifications. All participants were asked if they would also participate in any follow-up interviews that may be necessary based on the data collected (Appendix A).

Data Analysis Plan

Qualitative Data Analysis (QDA) Software & Coding

There were several options available for qualitative data analysis (QDA) software programs. However, because I have a Mac computer, my search was limited to those programs that would operate with the OS operating system. The NVivo software is compatible with the OS operating system, designed for qualitative analysis, and received high ratings in several reviews and blogs.

NVivo (n.d.) described their software as useful for qualitative and mixed-methods research. The software has the capability for the researcher to categorize, classify, retrieve, query, transcribe, and import data., NVivo can work with several types of text, audio, video, emails, images, spreadsheets, online surveys, social and web content. Finally, NVivo can ask complex questions and identify new meaning in the data. Overall, the NVivo software brought out in-depth insights into the data I collected.

Qualitative analysis transforms massive amounts of data into findings the researcher can use (Patton, 2015). The specific method used for analyzing the data is coding. Babbie (2017) and Saldana (2016) reported that coding is classifying or categorizing the individual pieces of data based on a word or short phrase that captures the essence and researcher's interpretation of the information. Coding occurs in cycles known as the first cycle and second cycle.

Saldana (2016) described first-cycle coding as occurring during the initial coding of data. Saldana stated that the coding of information could be limited to a single word or encompass a phrase that captures the essence of the various data derived from interviews, and transcripts. Saldana posited values coding is the preferred method for coding an interview transcript. Values coding is "a method of attuning yourself to participant perspectives and actions" and is appropriate for exploring a participant's cultural values and personal perceptions of society (Saldana, 2016, p. 73). Pattern coding is a second-cycle method used to group the summaries obtained through the first-cycle coding "into a smaller number of categories, themes, or concepts" (Saldana, 2016, p. 236). Second-Cycle coding types that applied to my study are evaluation coding and pattern coding.

Issues of Trustworthiness

Content validity occurs through the concepts of dependability, credibility, transferability, and confirmability. Burkholder et al. (2016) and Ravitch and Carl (2016) opinioned for qualitative research to be considered trustworthy; researchers rely on the concepts of dependability, credibility, transferability, and confirmability. Dependability is the presence of consistency in data collection, analysis, and reporting of the results. The two most common methods of establishing dependability are inquiry audits and triangulation. Credibility refers to the believability of the results given the data presented and often uses the strategies of prolonged engagement, persistent observation, peer debriefing, negative case analysis, progressive subjectivity, member checking, triangulation, and reflexivity. Burkholder et al. referred to transferability as findings having the maximum variation and the capability of being applied to other situations. Confirmability in qualitative research implies the strategies used to obtain the study's findings happen with verifiable procedures, analyses, and conclusions to the extent that others would conclude comparable outcomes given similar information. Guba and

Lincoln (1989) suggested a confirmability audit be used to establish confirmability in qualitative research.

I used an inquiry audit trail to describe in detail how and what data was collected and how decisions were derived and made to establish dependability. Peer debriefing ensured credibility. Specifically, I used a retired Fire Chief with 30 years of public service experience and was familiar with renewable energy, public policy, and microgrids for peer debriefing. By keeping my inquiry jurisdictionally nonspecific and asking broad interview questions, transferability was enhanced and applicable to other small communities. Finally, confirmability was achieved by using a confirmability audit that detailed how the study was conducted and the collected data analyzed.

Ethical Procedures

A potential ethical issue in qualitative research is respect for persons. The Belmont Report stated, "participation must be completely voluntary and based on full understanding of what is involved" (Babbie, 2017, p. 64). Respect for persons will influence the design methodology if the researcher is to ensure voluntary, informed participation by the participants. However, this can also result in participants consciously or unconsciously altering their behavior. Burkholder et al. (2016) defined this as observer effects. To address this potential, Burkholder et al. recommended listing the possible consequences and obtaining a second opinion concerning their impact. Secondly, the researcher can inquire with the participants if anything unusual occurred during the research process. Both of these recommendations for addressing observer effects influenced the research design.

Burkholder et al. (2016) suggested that risks should be assessed early in the research planning process. Maintaining confidentiality is an ethical consideration. However, confidentiality differs from anonymity. Babbie (2017) defined confidentiality as when the identity of a respondent is protected for public disclosure and is known only to the researcher. Whereas, Babbie defined anonymity as being achieved when a participant's response cannot be associated to a particular respondent.

In researching the policy barriers for implementing a microgrid system in northeast Ohio participants may be negatively affected by the information they provide. If the participant's confidentiality is unprotected, they may not participate in the study or provide factual, accurate information, especially if it conflicts with their employer's position on the subject. Therefore, all identifying information from the interviews was replaced with an identification number to ensure the IRB of the participant's confidentiality. Babbie (2016) recommended the creation of an identification file that links numbers to names in case future corrections to the data need to occur. In my study, each participant was assigned a number (depending on when they were interviewed and were referred to as Participant 1 (P1) throughout the interview and subsequent reporting found in this document. Also, to further address confidentiality concerns, I provided confidentiality assurances to the participants in the written invitation to include the following:

- Their participation was entirely voluntary, and there would not be ramifications for declining the invitation.

- Their comments would not be anonymous but would be kept confidential. Instead, the participants were identified using the moniker Participant 1.
- Finally, any notes, transcripts, correspondences, or other data which could identify the person is secure in a locked safe only I have access where it will remain for 5-years.

Summary

Qualitative research assists the understanding of how people perceive and approach the meanings of their experiences with a particular phenomenon (Burkholder et al., 2016; Ravitch, & Carl, 2016). The literature reviewed reported several barriers to a public policy being revised or developed. However, the literature does not address the specific challenges or other potential problems a small northeast Ohio city may face in developing and enacting microgrid public policies. Understanding the decision maker's perception of microgrid technology and energy policies will ultimately assist in policy creation and implementation. Subsequently, qualitative was appropriate for my study.

The purpose of my research was to discover the perceived and real challenges to the development of policies necessary for the implementation of a microgrid system for a small northeast Ohio city. Distributed energy and microgrid technologies are an emerging concept that requires the input of government officials, energy companies, and renewable energy experts. Therefore, a generic qualitative approach inspired by participatory action research (PAR) was used to obtain data through semi-structured interviews. Finally, because policy creation has several interdependent influences, the MSA was my choice for the theoretical framework to analyze the problem, policy, and politics of my study.

Chapter 4: Results

Introduction

The purpose of my study was to discover the perceived and real challenges to the development of policies necessary for the implementation of a microgrid system for a small northeast Ohio city. A small city is one with a population of 200,000 or less (OECD, 2018). Through my research I identified and provided meaning to the views and experiences of the people who have decision-making authority in northeast Ohio or who have special skills or knowledge regarding renewable energy policies or microgrid concepts. I analyzed the causes that hinder the creation and adoption of public policies that would ultimately lead to the implementation of a microgrid system. I used a generic qualitative approach that was inspired by the principles of participatory action research (PAR). Finally, my findings contribute to the body of knowledge regarding the barriers to public policies related to the development and installation of microgrids in communities throughout northeast Ohio.

Setting of Study

The semi-structured interviews occurred in settings that were selected by the participant. Interviews occurred over the phone and face-to-face in various places (a church, personal office, and a municipal building). The participants were not influenced by any personal or organizational conditions that affected the study's results. None of the people interviewed stated or indicated dissatisfaction with the process or subject matter. The majority of participants expressed that the process was enlightening, and they were happy to have been asked to contribute.

Demographics

Thirty-nine potential participants who worked or had experience in the categories of local government, county government, state government, power generation, or a subject matter expert were invited to participate. From the 39 people who were invited, 10 accepted and participated in my study, as illustrated in Figure 1.

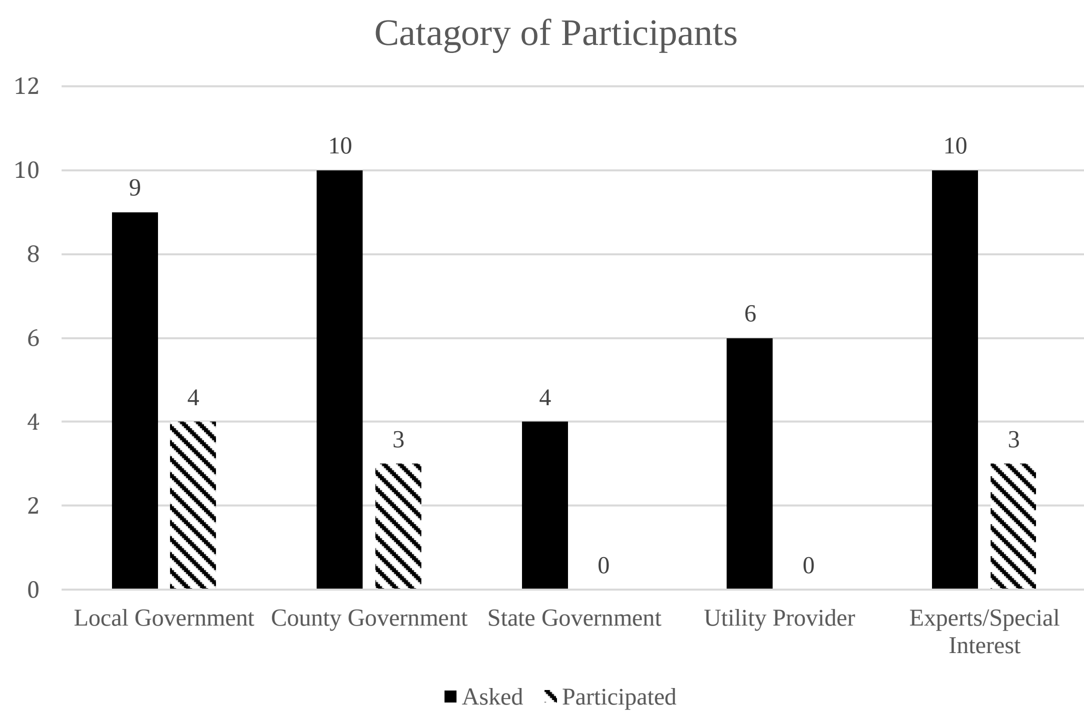

Figure 1. Comparison of total invitations sent versus the number of participants per category.

The experiences of the 10 participants were professionally diverse, with several having held positions in multiple categories throughout their careers with Table 1 detailing the diversity among the participants.

Table 1

Table illustrating the diversity in professional credentials among the 10 participants (P1-P10)

P1	P2	P3	P4	P5	P6	P7	P8	P9	P10
Trustee	Dept. Head (County)	Dept. Head (Local)	Council (Local)	Council (Local)	Special Liaison (State)	Council (Local)	Director of Sustainability (Private Sector)	Dept. Head (Local)	Council (County)
Dept. Head (Local)	State Legislator		Mayor	Campaign Mgr. (Federal)	State Agency	Mayor			
			Dept. Head (County)	Outreach Education (Renew. Energy Org.)	Gov. & Community Affairs (Utility)				
					Director (Renew. Energy Org.)				

Data Collection

Over 11 weeks, 39 people were invited by email to participate in my study. Along with the invitational email, the IRB approved consent form was also provided to the participants. One person expressed concern and confusion regarding the consent form. However, after explaining the purpose of the consent form, the person agreed to be interviewed. Another person initially agreed verbally to be interviewed, but later declined after receiving the consent form. This person did not explain, and the matter was not pursued further. Two other invitees who had previously agreed to participate later declined after receiving the consent form, citing personal reasons and not wanting to be interviewed in an official capacity. Several others declined to interviews because of their belief they could not offer any meaningful insight into the study. The remaining 20 invitees either did not respond to the request or declined without an explanation.

Ten participants were interviewed either in person or by phone. When the interviews occurred face-to-face, the location was of the participant's choosing. Locations included personal homes, public places, and private business offices. Phone interviews were conducted from my home office using my cell phone and wherever location the participant chose to be. Although the duration of 60-90 minutes was allotted for the interviews, the average length for interviews was 42 minutes with the shortest lasting 23 minutes and the longest being 70 minutes in duration (See Table 2).

Table 2

Date, type, duration, and pages of transcript for each interview

Participant	Date	Type	Duration	Pages of Transcript
1	December 11, 2019	Face-to-Face	23 min.	7
2	December 17, 2019	Phone	38 min.	11
3	December 19, 2019	Face-to-Face	27 min.	7
4	January 2, 2020	Face-to-Face	32 min.	12
5	January 4, 2020	Phone	60 min.	15
6	January 9, 2020	Phone	55 min.	15
7	January 11, 2020	Face-to-Face	35 min.	12
8	January 17, 2020	Face-to-Face	70 min.	19
9	January 22, 2020	Face-to-Face	23 min.	7
10	February 3, 2020	Face-to-Face	53 min.	16

Both face-to-face and phone interviews were recorded on my cell phone using a recording app. My phone is password-protected, and the recordings were deleted from the phone after being transferred to the more secure, password-protected location on my personal computer. After the interview, the audio recording was transcribed using the transcription service Rev.

Confidentiality was addressed and ensured in two ways. First, Rev stated in their work agreement that all of their transcribers have signed non-disclosure agreements

(NDA) and strict confidentiality agreements (Appendix C). Secondly, before recording the interview, the participant was reminded to not reveal their name or the names of their employers and affiliations. Throughout the interview, the person would only be referred to by their code identifier (i.e., Participant 1). Upon receiving the transcribed interview, the signed consent form, audio recording, and the transcript were all placed in an electronic folder bearing the person's code identifier and kept on my password-protected personal computer during the collection and analysis phase of the study.

Upon concluding the study's collection and analysis, all of the data was transferred to an encrypted memory stick and secured in a locked safe where it will remain for the next five years. After five years, the memory stick will be destroyed and discarded. There were no variations, or unusual circumstances encountered regarding data collection from what was presented in Chapter 3.

Data Analysis

The collected data was studied using NVivo 12 for Mac. Before analyzing the data, NVivo 12's *Mind Map* feature was used to develop the first-cycle codes. This feature allows a user to brainstorm ideas from a central theme or idea. Trede and Higgs (2009) asserted the values, world view, and the direction of the inquiry are embedded within the research questions and thus influence the type of data that is obtained. Therefore, the research questions formed the central idea from which the initial coding terms were developed.

Saldana (2016) asserted that values coding is the preferred method for coding an interview transcript. Additionally, the values coding method was chosen because of how it would "reflect a participant's values, attitudes, and beliefs, representing his or her perspectives or worldview" (Saldana, 2016, p. 131). Figure 2 and Figure 3 illustrate the initial codes used for each research question.

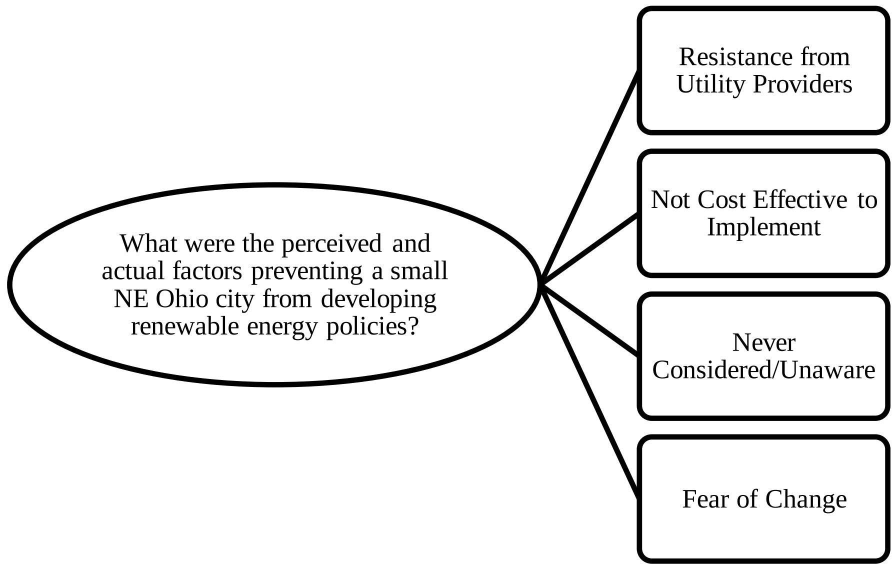

Figure 2. The initial codes developed for RQ-1 using NVivo 12 Mind Map feature.

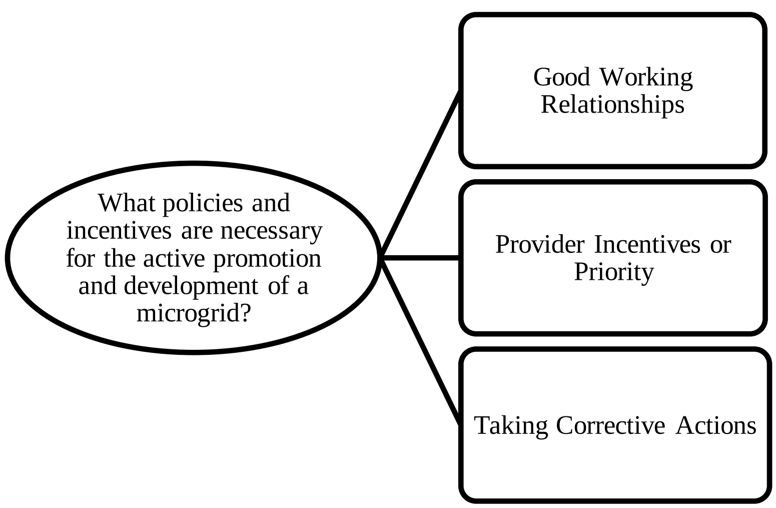

Figure 3. The initial codes developed for RQ-2 using NVivo 12 Mind Map feature.

As the interviews began to be coded and more codes developed, it became necessary to define what each code meant so their application would be more consistent across all interviews. A total of 37 initial codes came from the first-cycle coding of the interviews, which were later reduced to 27 after combining similar codes. Table 3 illustrates a sample of the code words and definitions. Appendix D contains all first-cycle codes, definitions, number of participants where the code was used (file column), and how many times the code was used for all interviews (reference column). Once the first-cycle coding was completed, code mapping was used to develop the second-cycle codes.

Table 3

First-cycle codes and definitions that were applied to all interviews

Name	Description
Acceptance to Change	The person or organization will not accept changes to the system.
Advantages	Socio-economic advantages to transitioning to renewable energy sources.
Adversity to Change	A person or organization is opposed to change.

Saldana (2016) described code mapping as the refinement and categorization of first-cycle codes into similar groups. The pattern coding method was used to reveal emergent themes found in the first-cycle analysis. Using NVivo 12 for Mac, sets of similar codes were created that were categorized as Apathy, Awareness & Education, Belief, Cost, and Fear. Appendix E details the similar individual codes that were grouped into all of the categories. Figure 4, Figure 5, Figure 6, and Figure 7 show the relationships between codes, themes and RQ1 and RQ2.

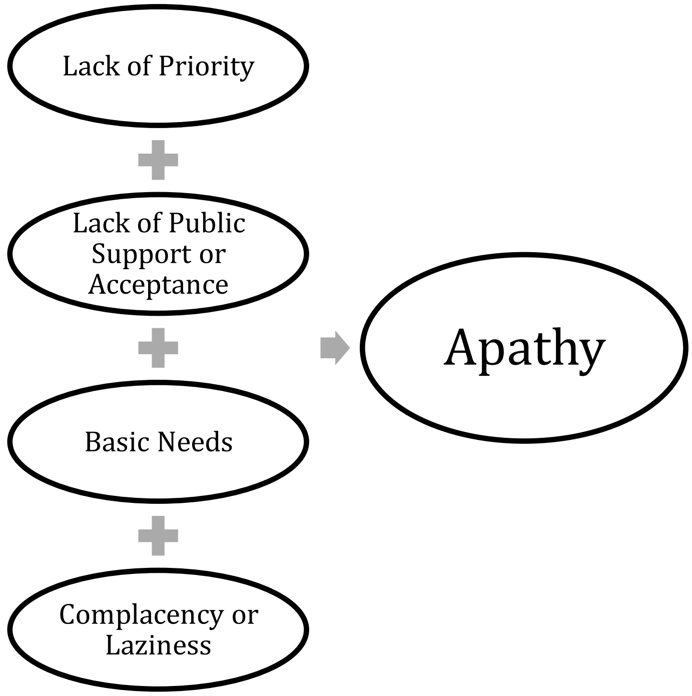

Figure 4. Example of first-cycle codes grouped into the category Apathy.

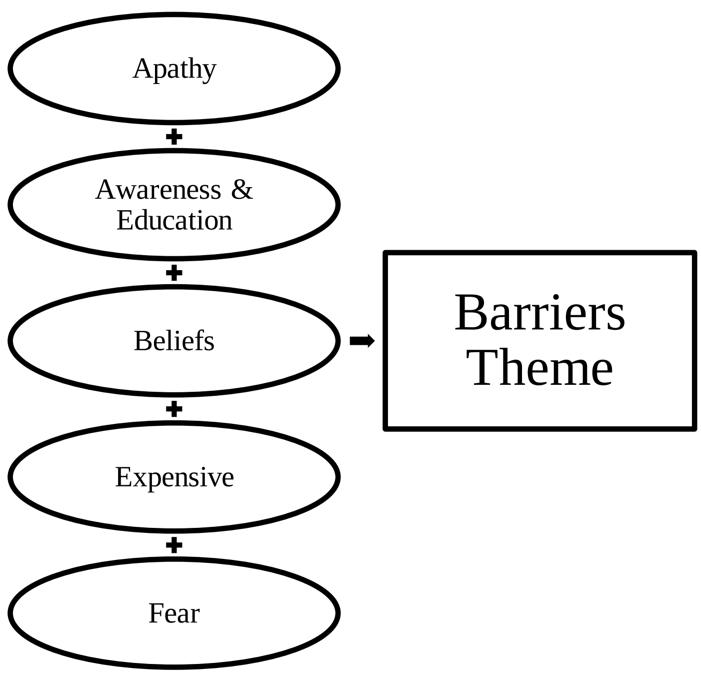

Figure 5. Pattern coded categories comprising the theme of Barriers.

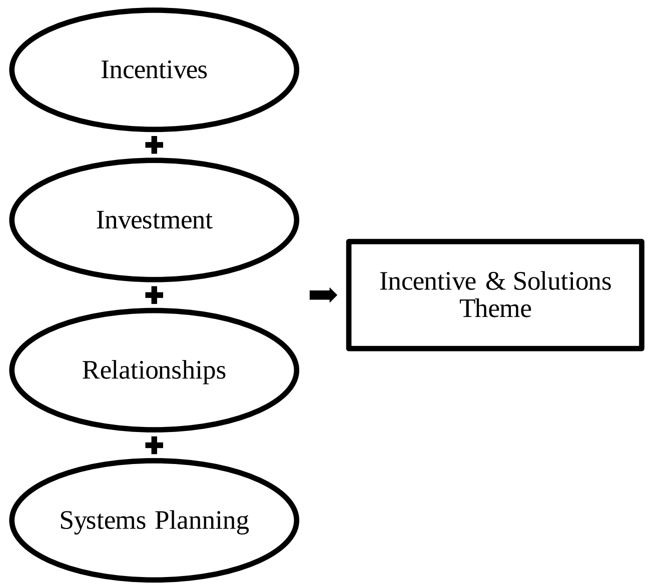

Figure 6. Pattern coded categories comprising the theme of Incentives and Solutions.

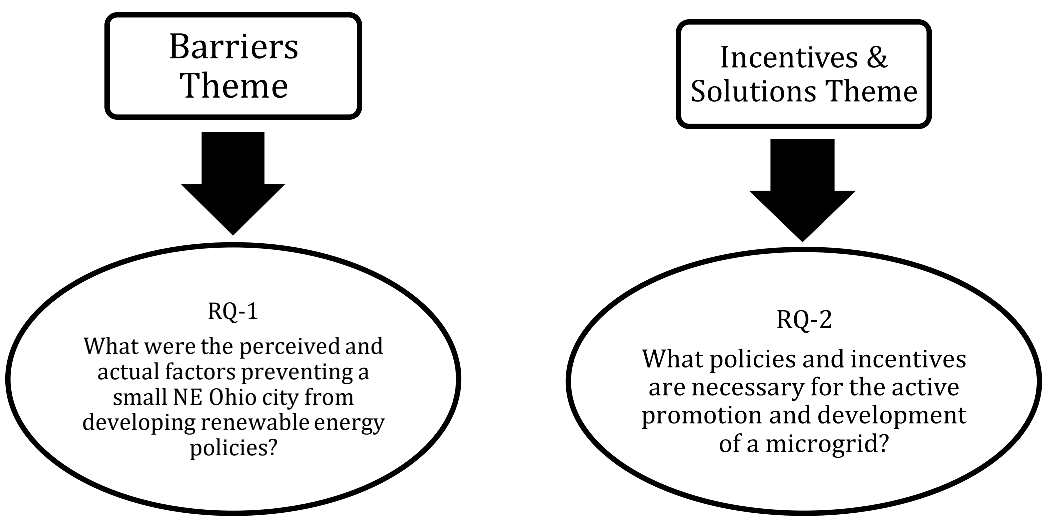

Figure 7. Relationship of themes to research questions.

Evidence of Trustworthiness

The credibility of my research was confirmed in three ways. First, the interviewees were chosen based on the study's inclusion criteria and their added individual credentials and experiences. As reported earlier, many of the participants held positions in multiple inclusion categories throughout their careers. Therefore, the information they provided was multifaceted and very comprehensive. The second way credibility was ensured was by returning the transcribed interviews to the participant to confirm the accuracy of the transcription and to allow additional insights to be added. Of the 10 participants, three submitted corrections and additional clarifications. Finally, peer debriefing was used to ensure credibility. Specifically, a retired fire chief with 30 years of public service experience and who was familiar with renewable energy, public policy, and microgrids was used for peer debriefing.

By keeping the study's inquiry jurisdictionally nonspecific and asking broad interview questions, transferability was enhanced and applicable to other small communities. The use of thick description was another means of ensuring transferability. Guba (1981) described thick description as detailed descriptions of the data and the context which allow the study's reader to make comparisons to other contexts based on as much information as possible. Definitions of the first-cycle codes and the subsequent description of the context of the data and findings increased transferability of my results.

I used an inquiry/confirmability audit to describe in detail how and what data was collected and how decisions were derived and made to establish dependability and confirmability. On November 15, 2019, I was approved for data collection by the IRB. Beginning November 18, 2019, an inquiry audit tracked the data collection, analysis, and how the reporting was kept. The actual document was created in Excel and included the columns found in Table 4.

Table 4

Inquiry audit sample created in Excel

Date	Action	Local	County	State	Experts	Utility
11/18/19	Sent two email invitations. Received one decline.					**X**
11/20/19	I sent three email invitations.	**X**	**X**	**X**		
11/21/19	Sent two email invitations.		**X**		**X**	

The columns of local, county, state, experts, and utility allowed me to track the total number of invitations, the particular positions that met the inclusion criteria, and the outcome of the invitation. Figure 1 also details the comparison of the total number of invitations and the number of participants within each inclusion criteria category.

Results of Study

All of the participants agreed that most communities were unprepared for the impacts of a long-term power outage. Most of the participants were nonspecific with how their communities were unprepared for a massive power failure. However, P1, P3, and P9 did offer specific areas of concern. All had work experiences within emergency services and positions within the local government. Each offered specific insights from an emergency response perspective. P1 stated:

> Speaking from an emergency response perspective, we lose communications ability; we lose water supply. Certainly, long-term health and medical issues would be a concern. The loss of revenue from all the businesses that have to shut

> down; they can't continue to function. It would be catastrophic. Long-term, long term loss of power would have far-reaching effects on everything, from emergency preparedness to response to the economy.

P3 asserted, “our ability to respond to emergencies and mitigate those emergencies are going to be negatively impacted."

Finally, P9 felt a massive outage would be:

> catastrophic to certain degrees just because of the fact of the communication aspect. Everything would be okay in a short-term environment. But when it went long-term, anytime you start talking about long-term, any of the infrastructure, we're not prepared at the local levels in general for long-term sustainability past that, once those initial resources are depleted.

All the participants felt both renewable energy and the concept of a microgrid were viable solutions toward achieving community resiliency. However, opinions on the effectiveness of renewable energy usage and microgrids varied depending on their knowledge of the subject matter. The opinions of both P1 and P5 represent opposite ends of the spectrum, with the remaining participants' assertions falling between the two extremes. P1 opinioned:

> but I don't see that as a long-term solution to maintaining the same level of power use that we have right now. I don't know that that's.... I don't know that's something we would want to hang our hat on to recover from a situation. If the grid goes down, solar is going to be a nice supplement. Used correctly, it could, again, power some of those locations. But I don't see it as a wide range option.

Whereas P5 felt a stronger conviction toward renewable energy and microgrids by asserting:

> Look at Germany. I mean, they're on a latitude that's above ours, with crappy weather like ours or Ohio. And not to dis Germany, but they have cloudy weather and lots of rain like we do, and their economy is based on solar power. I mean, solar power is their number one, more so than wind even. They're relying on solar and battery. And we're seeing giant installations going in in California, not too far off our latitude, and battery backup. People think that oh the sun's only out during the day, or in the winter we only get so many, or this time of year we only get so many hours of sun. But deployment of batteries is becoming more and more widespread as a means to even out those peaks and get power through the night from solar. So, it's happening. It's happened other places similar to ours; there's no reason.

All the participants had doubts about their community's resiliency during a long-term outage and viewed renewable energy and microgrids as a potential solution to some degree. Several even named and described areas where both are functioning within the United States. Nevertheless, neither is being widely used or even discussed in northeast Ohio. The pattern-coded categories of apathy, awareness, and education, beliefs, expense, and fear are barriers preventing the development of renewable energy policies.

Barrier Theme

Each category and code will be discussed as they relate to RQ1- what are the perceived and actual factors (barriers) preventing a small NE Ohio city from developing renewable energy policies?

Apathy Category

Merriam-Webster (2020) defined apathy as a lack of feeling, emotion, interest, or concern. Several reasons were revealed through the interviews as to why apathy exists as a factor preventing the development of renewable energy policies. The reasons included basic needs not being met, a lack of support, lack of priority, and complacency or laziness.

Basic needs code. This researcher defined the code of the basic need as when a person's basic needs according to Maslow's Hierarchy of Needs are not being met. In all of the literature reviewed, this was not mentioned. However, P8 described this form of apathy as:

> if I'm having trouble putting food on the table, I'm not going to give a crap about solar power 20 years from now. So, a rising tide raises all ships, so how do I get everybody to a position where they can care more?

P6 further expanded on the relationship between basic needs not being met and the use of renewable energy technologies:

> And this is one of the real issues, is that the people who need relief the most from their energy bills are often the people who can't afford to install residential solar or geothermal, or any of the other cost-saving systems. And so, it's very

> disproportionate. So, we need to look at communities that.... I mean, right now, the houses with solar panels are pretty much the ones that cost the most, and they're in the neighborhoods that are the most affluent.

The insight provided by P8 and P6 was very profound. The association between poverty and renewable energy is so apparent yet overlooked in the literature as a barrier to public policy. Although the struggle to meet one's basic human needs is one factor, a lack of support for the concepts of renewable energy is another barrier to achieving public policies.

Lack of support code. Despite the fact that the social and environmental good renewable energy can bring to a community, people may still oppose it being located in their neighborhood. Kinder (2019) described this as the *Not in My Backyard Phenomenon* (NIMBY) in which the public is opposed to something considered undesirable being located in one’s neighborhood. P4 alluded to this phenomenon by stating:

> Nobody wants to see the windmills, and we're a very urbanized the community, very urbanized county. So not only is it the site of the windmills, then you get the flicker effect and everything else too if it gets too close to buildings, you know?

P6 also asserted the opposition to a microgrid was not political, but rather it came from the neighbors to the property:

> And [organization name]’s problem wasn’t the village council. They managed to figure it out. [Organization name]’s problem were property owners that bordered the bio reserves.

Also, P6 inferred the problem of NIMBY might even worsen due to proposed legislation in Ohio:

> And then on the larger level, you have this bill pending in the legislature right now that would allow a local referendum to stop a wind farm at any point in the process, even after all the approvals have been received, even after they've started to turn dirt.

A lack of support is an obvious hurdle that is preventing renewable energy policies and microgrid technologies from coming to fruition. A lack of support from the public can also attribute to a lack of priority.

Lack of priority code. A lack of priority can simply be because, as P1 stated, "it's not a priority, only because we've never even considered it." However, a lack of priority towards renewable energy can also be the result of trying to balance needed resources with available revenue. P8 expanded on this concept with the following insight:

> Well, one definition of politics is the process of deciding where your resources go. So, a community has a finite amount of resources; of course, the community always has the list of needs that outstrips the list of resources. So that's the trade-off, so it's really about decision-making prioritization schemes and behind that moral principle guidance.

P5 also shared a similar view as P8:

> So, it's all about priorities and resources, and trying to figure out where to get those resources from, but on the other side of that, how you address that is you really task people within the administration with handling it.

What P1, P5, and P8 are saying is a lack of priority does not necessarily imply nefarious behavior, but rather only a lack of knowledge and the challenge of balancing needs with revenue.

Complacency or laziness code. Complacency or laziness also is another form of apathy that hinders the development of renewable energy policies. P5 and P6 discussed this form of apathy in the context of performing the actual work by saying:

> P5- This is work, and if it's not part of your vision, it's nothing that you're passionate about, if it's not motivated by real concerns about climate change and resiliency, then it's really easy to throw your hands up and say, well, I don't know where to start. I wish I knew where, but I don't know where to start. Once everyone else gets their act together, then we'll think about it. That's not the way to approach it.
>
> P6- I think part of it is that people assume that someone else is doing it, maybe on a higher level, and we all react to crises, and it's very hard, especially in public policy, to look ahead.

P8 had a different view and discussed apathy from the perspective of a person being unmotivated to research and discern fact from fiction:

> they can't tell what's opinion and what's not or let's dig down to see what the factual basis is or what the things they don't know are.…people tend to try and oversimplify things to try and understand them…So, they think it's nighttime; I guess I can't have light at night. Well, no, it's in all of the above solution. It's hard for people to think in complexities in systems, they kind of default to the most

reasonable assumptions to make sense of things, people are sense, sense makers, and will fill in blanks with often bad assumptions.

Awareness & Education Category

Unaware code. Having a lack of awareness regarding renewable energy and what technologies are available is a natural barrier to policy development and implementation. Not knowing what is not known can stifle progress regarding renewable energy and microgrids. P1, P3, P6, and P7 discussed being unaware. P3 and P7 each had a more detailed response:

> P3- but the lack of renewable energy, in my opinion, is based on ignorance…. People just don't know. I don't know. And, I think that there's a lot of people out there that know more, but I think there's a whole lot of people that know less, and they just don't think about it, they don't know whether or not it is economically viable.
>
> P7- I can tell you there's not a mayor in the last 100 years in my town who has thought about that. And I can promise you that not any one of the six councilpersons in office right now have ever, ever thought about a microgrid in our town.

Belief Category

Skepticism code. P1, P3, P4, P7, and P9 expressed varying degrees of doubt as to the long-term effectiveness of renewable energy. Interestingly, P1, P3, and P7 also expressed being unaware of renewable energy potential and current technologies. P1 described his belief in the limitations of renewable energy by stating:

> I don’t see that as a long-term solution to maintaining the same level of power use that we have right now…. Again, I would say while it could function as a supplement, I don’t see it replacing the current power grid…. That’s great. I like the concept. But… until you can get the energy to charge that battery from a renewable source, I don’t want to say it’s irrelevant, but you’re still using fossil fuels. And also, then what do you do with the battery when it’s spent?

Expensive Category

Expensive code. Systematic changes and technological upgrades are expensive. In the public sector, these costs can often be an insurmountable challenge. The concerns for the transition and ongoing maintenance expenses were expressed by P1, P3, P4, P5, P6, and P8. P3 stated the following concerning start-up costs:

> I think that it's just going to be pure economics. Until renewable energy is at the forefront of the most economical solution for energy problems, it will remain in the back seat compared to traditional energy sources… What I would say a hurdle would be convincing either our legislators, local legislators, and or our community of the benefit to front a significant amount of money to save money long term. It's price tag, price tag, price tag.

P6 also viewed the start-up costs as a challenge, but added the problem of funding the ongoing maintenance costs with local taxes by stating:

> But they are not cheap, and for an outage of, I don’t know, four or five, even 12 hours, to me that’s almost not worth the cost…. These things are not cheap….

> And local funds are always tight and there’s not an appetite for raising local taxes or bond issues or whatever. And so being truly resilient isn’t necessarily cheap.

Fear Category

Adversity to change code. Many of the participants provided excellent insight regarding adversity to change on a personal, organizational, or systematic level. P7 generalized the resistance to change as, “it would be nice if change was readily welcomed, but people don’t typically like change anyway.” P6 looked at change as an inevitability that society needs to accept:

> So, our lives are changing in many, many ways. And those changes have consequences, and unfortunately they have economic consequences for individuals. And that is something that we as a society have to look at. But it’s not a reason not to do these things.

P10 also echoed society’s resistance to change and offered a way for change to be successful by making small incremental changes over time:

> Ultimately, I believe that the public and voters don't react well to radical and so the longer ramp you have to introduce positive practices and changes, the better off you'll be and the more of a cultural norm it becomes. It's because small practice is introduced over time. There's all these different behavior patterns you can change with folks, but you can't do it all at once. People rebel. They don't want that much change.

Looking at many of the systems in the United States, P8 felt systems are:

> built to be really hard to change things on purpose because if you can change things too easily, you got instability and you've got other problems… It's the whole school of thought around systems thinking, and the larger and more complex the system is, the more resilient it is to change….people look at the past as a way to predict the future when things don't track the way they think they do, they get very fearful and they resist change.

P8 also stated a key to changing a system is through the evaluation of its resilient and weaker components and determining how to "break the system in a positive way to get the change I want faster than the system is designed to change."

P10 was not positive changes will occur in time "to make the dramatic changes we need to, particularly in our region." P10 referred to the current climate management model as basically managing our decline rather than having proactive thinking and making ardent changes.

Selfish agenda code. P4, P5, P6, P7, P9, and P10 had concerns decision-making by people and organizations would be based on self-interest and not the greater good. Conducting oneself or governing in a way that does not consider the greater good. Participant 7 was very passionate regarding a selfish agenda that has played out in multiple areas throughout time:

> That's why you always have to govern and make decisions based on the greater good, regardless of special interests…Special interest, big money, pharma, whatever, big, big energy. This is not what's right, fair and just for the masses. People just are not aware of what is controlling decision making. And it's not this

altruistic sense of what's right, and we're not answering to a greater good or greater God who wants what's best for us. We're answering to the almighty dollar.… And yet the profits are made on the backs of the sick and the needy. And it's not fair. And life's not fair….You're going to have a small group of people controlling the purse strings, controlling the distribution and access to the benefits, all based on profit. And that's inevitable.

P4, P6, P9 and P10 all felt the power generation companies were uncooperative in the realm of providing or allowing renewable energy:

P6- And traditionally, utilities resist change. They spent years fighting the clean air act, and yet, sort of the sky is falling mentality has never proven to be true.

P9- I would agree that in concept, it sounds like it would work. I just think that energy, overall, in the state that we live in, is politically motivated too many times by dollars and cents from the major suppliers… So, we have, I think, a great relationship with the local providers, as long as we play by their rules. Once we try to overstep those rules, or if an issue or challenge comes into place where there's a need of the community, it's offset in a way, that's when we realize that our relationships aren't quite as solid as we think.

P4 and P10 felt the power generation companies were greatly aided in perpetuating their resistance by lobbyists and lawmakers:

P4- They make a lot of money on the generation…. I don't know all their whole portfolio, but I think I can go out on a limb and I don't believe a lot of it is with renewable energy…. And who are the lobbyists representing? The generation companies.

P10- Power companies that are still rooted ultimately 90% in fossil fuel, and particularly in coal burning, are going to be the biggest impediments to making solar power accessible, particularly at large scale consumption rate like the county would have. Here, …. is one of the largest employers in the county…. The barriers to solar energy in Ohio have nothing to do with science. It has everything to do with the politics, particularly a couple of different businesses and their role in electing people and making law in the state house.

So as not to paint the power generation companies as a nefarious overlord, P6 felt:

I think it's very idiosyncratic…. And I think it's in large part who you deal with. I mean, who you get…. Is that person going to facilitate what you want to do and make it easy? I don't think you can make broad generalizations about any specific utility or about the co-op. I, I really think it's a very individual kind of a thing and the relationship just depends on factors that aren't necessarily institutional. They aren't necessarily systemic factors.

P4 and P10 pointed out the responsibilities the local political entities generation companies have toward the large population that are employed with the various companies. P4 stated “the largest electrical provider in this region has a lot of employees in this region.” P10 discussed finding balancing political and corporate responsibilities with environmental responsibilities:

That's a political struggle for us. Because while I may not agree with some of

> their corporate practices, a lot of them, I definitely don't agree with some of their public policy practices and our political policy practices, not for nothing, they're a union employer who employs 200 and some union lineman who provide a living wage and healthcare to many of our residents. So how do you balance that conflict? That's really difficult and ultimately at least for me that's the barrier to solar.

Incentives & Solutions Theme

The categories and codes related to RQ2- what policies and incentives are necessary for the active promotion and development of a microgrid, will be discussed in detail. Several codes were grouped into the category of Incentives and Solutions, which also became the theme title. The codes are education, incentives, investment, relationships, and systems planning.

Incentives & Solutions Category

Education code. Many of the participants suggested there should be a more concerted effort to educate elected officials and the general public regarding renewable energy and technological changes. To combat the lack of awareness and misperceptions, P1, P5, P6, and P8 all commented about educating the elected officials and members of the community. P1 suggested:

> if you can get involved with the Ohio Township Association, the Ohio Municipal League, get involved at the state level on the government, in the government spectrum, and be an advocate or share the information and get that back out to

everybody. All the government organizations have their publications, and their email trees and their newsletters, I think that would be a good place to start.

P5 stated that most elected officials want to do what is best for the community and education "… starts to reshape and reframe how they're thinking. So, it is important to engage people and help them think through some of the what-ifs…." P8 related how he and his employer created a training session for the employees regarding renewable energy and sustainability:

> So, we basically created a display and invited our employees to come in and kind of see what we're doing, talk about how this could apply to their home lives, and we did one on solar panel power… And it was amazing to see how just kind of a simple engagement and basic education was a powerful motivator and make people to go from, 'I heard about that, I'm not sure to, I could actually do that on my home'. And yeah, that's a big important hindrance is, 'I've kind of heard about it. I don't know about it.' To, 'Okay my employer did it, I see how they did it. I know what the costs look like they gave me a pamphlet to how I could go to various NGOs and the companies and make it happen in my home, I think I'm going to try this and make it work.

Incentives code. Incentives were another suggestion for the active promotion and development of a microgrid. P2, P3, and P8 each gave separate incentive ideas. P2 relayed their jurisdiction is placing solar panels on several of their buildings and "allowing local governments to piggyback off the contract we had." P3 felt more incentives should be offered and communicated from the utility providers to the elected officials. Specifically, they described the following scenario:

> Those utilities have to come to municipalities and say, hey, we know that you are doing this, and we've got this program that can help, and this is how it works. If you put up solar panels and you generate X number of kilowatts of power, then this is how much money you're going to save. We'll also give you a rebate of X amount of dollars, or we'll help you with the frontend costs, whatever it might be.

P8 discussed how the country of Germany saw a "a massive growth in renewable energy, in solar in particular, and it was the incentive package." However, P8 also warned tax incentives might be less than successful if the public does not understand the process or taxes, in general, they may say, " I don't want to deal with it."

Investment code. All of the participants understood and agreed on the condition of the United States' power grid is weak and will continue to pose problems. P6-" conveyed there has to be "an investment in infrastructure, particularly transmission, we have an old grid, and we need to upgrade that so that if you do have a problem."

Relationships code. According to all of the participants having working relationships are imperative for a successful transition into renewable energy and microgrid age. P5 emphasized the importance of good relationships by stating:

> in order to get anything done, we have to work out deals. That requires community involvement, and it requires organizing…. Part of having that plan is having the resources and options, to get there… They need people in positions of power that have the vision to set that goal, then having the will and work within

> the community to organize people around keeping their elected's accountable, and continuing to build towards that goal and plan, not the stage we're in.

Systems planning code. P8 was the only participant to mention taking the approach of addressing renewable energy and microgrid development from a systems perspective. P8s view on systems was profound enough to include it as a code. P8 asserted that the systems approach:

> takes someone who can kind of project themselves into the future or care about future generations in a different way to understand the immediacy and the connection. …then to take the leap that I have a responsibility for those impacts as part of the system and not as an observer of the system…. And that's a personal responsibility flip that people have to kind of take on when they start to realize that they're part of the problem and not watching the problem on television.

P8 concluded as a leader:

> You got to communicate that this is the plan. And you got to figure out who's against this and why? It's likely that you've got a small group that are passionate about it, a small group that are against it and a large group that just don't care.

Summary

Thirty-nine people were invited to participate in my study, and ten people agreed to be interviewed. As most of the participants conveyed, our communities are unprepared for the impacts of a long-term power outage. First and second cycle coding was completed to reveal the themes which answer the two research questions.

RQ1 asked, what were the perceived and actual factors preventing a small NE Ohio city from developing renewable energy policies? Several factors hindering the creation of renewable energy policies in northeast Ohio are apathy, a lack of awareness and education, beliefs, costs, and fears. RQ2 asked what policies and incentives are necessary for the active promotion and development of a microgrid? Although there was not a specific policy discussed in any of the interviews, all participant data pointed to positive ways to incentivize and promote the development of a microgrid. The suggestions were the education of elected officials and the general public, incentives, investments into the existing power grid, organizational and public interrelationships, and systems planning.

In Chapter 5, I will synthesize what the literature has stated with the findings of my study. Additionally, a review will discuss why my research was conducted, the implications of the findings within the theoretical framework, and any limitations of the current study. Finally, recommendations will be provided for further research and probable implications for social change regarding renewable energy policies and microgrid technologies.

Chapter 5: Discussion, Conclusions, and Recommendations

Introduction

The purpose of my study was to discover the perceived and real challenges to the development of policies necessary for the implementation of a microgrid system for a small northeast Ohio city. I identified and interviewed people who had special skills or knowledge regarding renewable energy policies or microgrid concepts to reveal the barriers to the creation and adoption of public policies for the implementation of a microgrid system. The research showed the five perceived and actual barriers of apathy, a lack of awareness and education, beliefs, costs, and fears are preventing the development of renewable energy policies. Although there was not a specific policy discussed in any of the interviews, all participant data pointed to positive ways to incentivize and promote the development of a microgrid. The suggestions were the education of elected officials and the general public, incentives, investments into the existing power grid, organizational and public interrelationships, and systems planning.

Interpretation of the Findings

The multiple streams approach (MSA) evaluates how and why some topics and policy choices are made a priority, while others are neglected and overlooked (Pessolani, 2016). Cairney and Jones (2015) reported the MSA allows users to understand and explain the overall policy process with unparalleled flexibility for testing general policy theories, and the ability to contribute to insights of other approaches. Brought together by focusing events and windows of opportunities, the MSA focuses on three categories of independent and interdependent variables (problem stream, policy stream, and political stream) that produce opportunities for agenda setting (Beland, & Howlett, 2016; Mukherjee & Howlett, 2015).

Because the MSA analyzes the problem, the policy, and the politics, the framework served as a template for developing the semi-structured interview questions. The questions were categorized as problem stream questions, policy stream questions, and political stream questions (See Appendix B). Also, the codes and categories applied to multiple MSA streams (Figures 8, 9, & 10). Therefore, in the following section, the data will be organized, discussed, and analyzed by the MSA stream in which they apply.

The Problem Stream

The problem stream-encompasses issues that deviate from the ideal state and the public's expectation that the government will provide a solution (Beland, & Howlett, 2016; Weible & Sabatier, 2018). Figure 8 illustrates the codes and categories applicable to the problem stream.

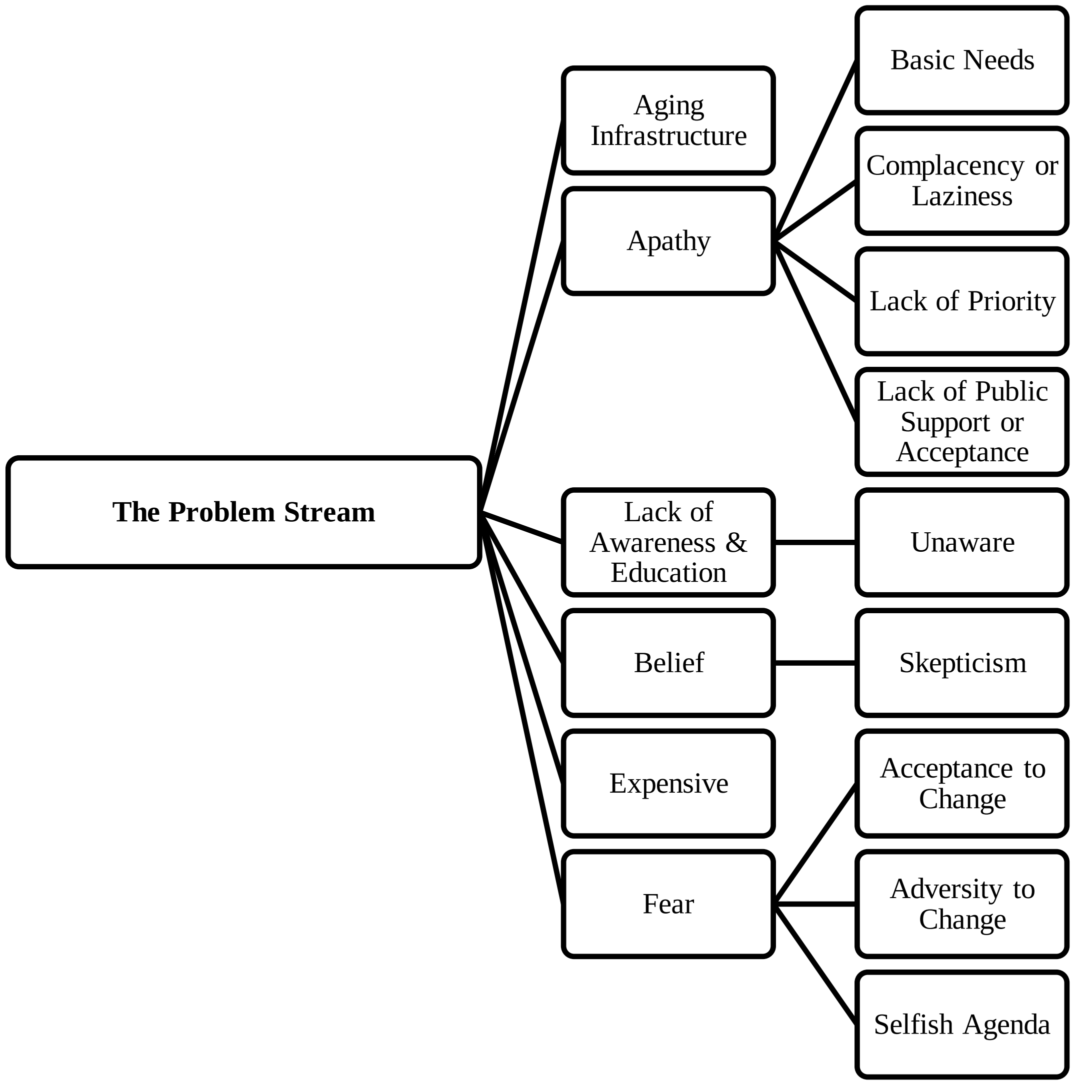

Figure 8. The codes and categories about the MSA Problem Stream

Aging infrastructure category. The participants agree the problem was a combination of aging infrastructure, depleting fossil fuel resources, and inadequate community preparedness in a long-term or massive power failure; thus, contributing to a deviation from an ideal state. All of the participants are currently working or had worked in the public sectors of government. The participants feel the public would, and is, relying on the government to find a solution. Finally, the participants support the use of renewable energy sources and microgrid technologies. However, several problems exist preventing the adoption of renewable energy policies and the implementation of a microgrid.

Apathy category. A barrier identified in my research but not mentioned in the literature is apathy. When a person lacks basic human needs, they seldom can focus on much else. Although outside the scope of my study, poverty is an indicator of where a person's basic needs are. Currently, there is a need to redefine how poverty levels are assessed by including adjustments to the federal poverty line (H.R. 5069, 2019). The specific adjustments are to account for geographic cost variation, costs related to health insurance, work expenses for the family, childcare needs, and new necessities, like internet access (H.R. 5069, 2019). Although Table 5 illustrates the current poverty levels of the 22 counties commonly referred to as in northeast Ohio, because of the need to redefine poverty indicators, these percentages could be higher under the proposed new adjustments. Table 5 also details the average of all 22 poverty rates combined and the comparison of the average with the national poverty level.

Table 5

Poverty percentages of each county of northeast *Ohio*

Northeast Ohio	
County	Poverty Rate
Ashland	10.4%
Ashtabula	17.4%
Carroll	12.9%
Columbiana	15.1%
Cuyahoga	17.9%
Erie	10.6%
Geauga	5.7%
Holmes	9.4%
Huron	11.1%
Lake	7.5%
Lorain	14.2%
Mahoning	16.5%
Medina	6.5%
Portage	11.3%
Richland	14.4%
Stark	14.4%
Summit	12.0%
Trumbull	17.6%
Tuscarawas	12.3%
Wayne	9.4%

Note. Table showing the average poverty rate of 12.3% of all counties within northeast

Ohio compared to the national poverty rate of 11.8% (QuickFacts, 2019).

With northeast Ohio's poverty level higher than the national average, P8s assertion of, "if I'm having trouble putting food on the table, I'm not going to give a crap about solar power 20 years from now" is both profound and possibly prophetic. Also, P6s question of "how can we help less affluent neighborhoods and people who really need the relief from the cost of energy" supports the ideation that poverty is a cause of the apathy toward the transition to renewable energy and microgrid use in northeast Ohio.

The literature discussed the lack of public and political support and my research did not reveal any contrary findings (Behave, 2016; Edenhofer et al., 2012; Gerston, 2014; Willrich, 2017). However, the literature did not address public and political complacency. P5, P6, P7, and P8 all felt compliancy, and laziness occurs with public and elected officials. P7 and P8 stated people are comfortable doing things the way they have always been done while lacking the motivation to learn what they do not know. P5 and P6 feel elected officials are intimidated by the amount of work there is to transition to renewable energy and may assume someone else is doing the work.

Although the literature reviewed did not specifically discuss elected official compliancy and laziness, nether was surprising to hear. In my thirty-two years of experience in public service, complacency and laziness have always been problematic. Unfortunately, it is often easier to push the problem onto the next administration. In local government there are many day-to-day issues to contend with, that leaves little time or resources to explore new concepts. Again, complacency and laziness are not discussed in the literature; however, this was not a revelation.

Apathy related to poverty was an unexpected factor. The literature did not address poverty, nor did I fully contemplate how it would contribute to the problem stream regarding renewable energy. Based on the poverty levels in northeast Ohio, the problem is not power failures, pollution, or the lack of community resiliency. The problem is maintaining basic needs. Although the aging infrastructure, increasing power failures, dependence on fossil fuels, and pollution are issues needing addressing, they do not outweigh the problems associated with poverty. Until we as scholar-practitioners address the essential needs within our communities, we will be increasingly challenged to transition from fossil fuels to renewable energy.

Lack of awareness and education category. Ali et al. (2017) warned there is a lack of awareness and sufficient knowledge about the availability and the adequate performance of renewable energies. P1 and P3 confirmed Ali et al.'s assertion. P3s statements described this problem very well:

> People just don't know. I don't know. And, I think that there's a lot of people out there that know more, but I think there's a whole lot of people that know less, and they just don't think about it, they don't know whether or not it is economically viable.

A lack of awareness and education was mentioned throughout the literature (Ali et al., 2017). Also, both the literature and the participants emphasized the importance of improving awareness and education for renewable energy policies and microgrids to become a reality. A lack of awareness or education being part of the problem was an anticipated finding.

Beliefs category. Although the literature reviewed did not explicitly describe the belief renewable energy was not possible, P1 held this belief:

> I don’t see that as a long-term solution to maintaining the same level of power use that we have right now…. Again, I would say while it could function as a supplement, I don’t see it replacing the current power grid…. I like the concept. But just with renewable energy in this, as we're talking about, until you can get the energy to charge that battery from a renewable source, I don't want to say it's irrelevant, but you're still using fossil fuels. And also, then what do you do with the battery when it's spent?

It is unlikely P1 is alone in the belief renewable energy is not a practical solution as I have heard this argument from several people and various organizations.

Expensive category. Hamilton (2013), Kwasinski et al. (2016), and Willrich (2017) asserted grid modernization might require significant capital investments that create economic challenges. P1, P4, P6, and P10 all expressed concerns over the costs of transitioning to renewable energy, especially for the public sector, who usually would not have the capital revenue to undertake a project of this magnitude. P6 and P10 warned of the public's opposition to raising taxes and the limited effectiveness of using grant monies to fund renewable energy projects. P10 discussed the grant process generally followed by local government and the inevitable problem when funding runs out:

> Ultimately, then what happens for public entities often is you find yourselves writing grants for other stuff in order to free up money to use that money on projects like this. But that gets really slippery because then when this grant money runs out. Inevitably, someone's got to go and it's hard.

Funding in any organization is always a challenge. This challenge is often exacerbated by competing interests and the fear of funding an unproven concept. Prioritizing and allocating funding for new ideas is often viewed as a difficult expense to justify.

Fear category. Cohen (2015) discussed the fear of the fossil fuel industry and the aggressive efforts they have gone to discredit climate science through conservative think tanks, funding opposing scientific opinions, economic reports, and public relations campaigns. P5 confirmed the disingenuous information the oil and gas companies are spreading is complicating the transition to renewable energy. P6 discussed the fear people have due to the possibility of losing their employment within the fossil fuel industry.

The problem stream revealed several issues that need addressing regarding renewable energy policies and microgrid technologies. The aging infrastructure is the primary problem driving the need for alternative energy solutions. However, apathy, a lack of awareness and education, beliefs, expense, and fear are what is preventing the creation and adoption of renewable energy policies and microgrids in northeast Ohio.

The Policy Stream

The policy stream evaluates the potential policy solutions to problems by identifying, assessing, and reducing the number of promising options to a few (Beland &

Howlett, 2016). Figure 9 illustrates the codes and categories applicable to the policy stream.

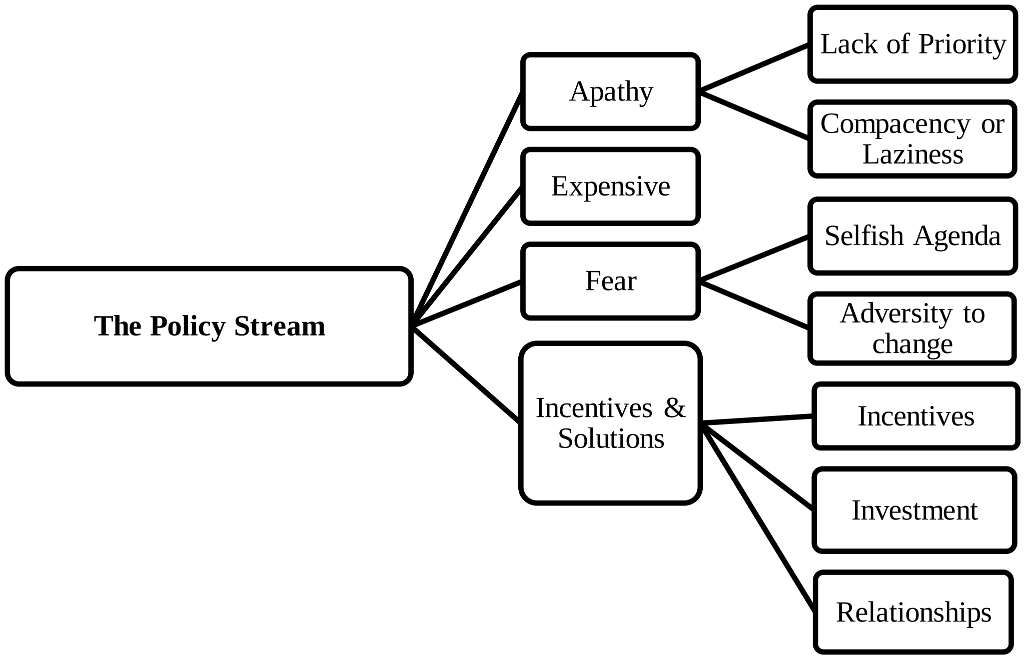

Figure 9. The codes and categories about the MSA Policy Stream.

Apathy category. Cook et al. (2018) affirmed Gundlach's assertion of the lack of supportive policy and regulations being a barrier to future microgrid development. Ali et al. (2017) concluded that there are a limited number of studies in the literature on effective policies and incentives for microgrid development and installation. P5 and P6 both confirmed Cook et al.'s and Ali et al.'s assertions while offering additional insights as to why there may be a lack of policies:

> P5- This is work, and if it's not part of your vision, it's nothing that you're passionate about, if it's not motivated by real concerns about climate change and resiliency, then it's really easy to throw your hands up and say, 'Well, I don't know

where to start. I wish I knew where, but I don’t know where to start. Once everyone else gets their act together, then we’ll think about it.’ That’s not the way to approach it.

P6- I think part of it is that people assume that someone else is doing it, maybe on a higher level, and we all react to crises, and it's very hard, especially in public policy, to look ahead.

Similar to how it affected the problem stream, apathy impacts the policy stream by limiting the development of renewable energy policies due to the complacency and laziness of decisionmakers.

Expensive category. Ali et al. (2017) stated there are financial barriers associated with the absence of adequate funding opportunities and financing products for renewable energy. P3, P5, P8, and P10 all confirmed Ali et al.’s assertion of financing as a hurdle to overcome. The financial component is a challenge for the policy stream to overcome. Policies need to create funding opportunities and develop financing products that reduce the expense of transitioning to renewable energy for local government.

Fear category. Krasko and Doris (2013) described policy sequencing as policymakers adopting "market reforms in a step-wise fashion that address barriers incrementally" (p. 22). Cook et al. (2013) reported the policy sequencing strategy had been successfully used in agriculture, financing and economic reforms, and trade markets. P10s opinion concerning systematic changes supports Krasko and Doris' assertion that the public and voters do not react well to radical changes. P10 confirmed my pre-conceived notion with the statement, “There's all these different behavior patterns you can change with folks, but you can't do it all at once. People rebel. They don't want that much change”.

Policymaking is often reactive and shrouded in confusion, contradictions, and fear (Behave, 2016; Gerston, 2014). Subsequently, developing effective policies has been challenging due to there not being a one-size-fits-all policy (Edenhofer et al., 2012). I agree with the two opinions expressed in the literature. P8 confirmed Behave (2016), Gerston (2014), Edenhofer et al. (2012) and my beliefs by stating, it has “to be really hard to change things on purpose because if you can change things too easily, you got instability, and you've got other problems."

Willrich (2017) asserted the United States' renewable energy policy oversight and regulations lack a coherent vision, coordinated policy guide, or legislation, all of which are required for distributed energy systems and microgrids to become a reality. P6 and P10 also discussed an incoherent vision and coordination described originally by Willrich (2017). When asked the interview question, do you feel it is essential for a municipality to have renewable energy policies, P6 and P10 responded with a question of their own- What do you mean by renewable energy policies?

It is clear from the literature, and the responses from the participants without a shared vision and conceptualization of what a renewable energy policy would be, confusion, contradictions, and fear are likely to be the results of renewable energy policy creation.

Incentives and solutions category. All of the participants concurred that renewable energy policies were necessary at the local level, which supported the claim

Cohen (2015), and Edenhofer et al. (2012) made that the public sector plays an essential role regarding the transition from fossil fuel usage to renewable energy. Cohen asserted the focus of public policy should be on lowering the price of renewable energy rather than taxing fossil fuel usage.

Ali et al. (2017) stated for renewable energy sources and systems to be used effectively, "the right statutory package and appropriate government incentives" are essential elements to be addressed. Several of the participants confirmed the costs associated with transitioning to renewable energy; in most cases, it is cost-prohibitive for their community. P3 captured this factor by stating, "until renewable energy is at the forefront of the most economical solution for energy problems, it will remain in the back seat compared to traditional energy sources."

Cox (2016) suggested tax measures, rebates, grants, performance-based incentives, and loan programs, guarantees, and credit enhancements would all be beneficial incentives. Fortunately, in the United States, there are numerous federal and state financial incentives for renewable energy projects. However, P8 warned tax incentives might not work as effectively as other types of incentives due to their complexities confusing a person.

Investing in the current power grid and various infrastructures were discussed both in the literature and by the participants. Campbell (2018) and Willrich (2017) asserted the stability and control issues could be addressed by modernizing the existing power distribution network needs to be upgraded with Smart-Grid technologies. The policy stream analysis validated the importance of having a good public policy. Wise policies will address many of the problems identified in the problem stream. Unfortunately, the policy stream revealed apathy, expense, and fear still play a negative role in policy creation. However, the policy stream analysis also outlined potential incentives and solutions that are promising options for decisionmakers to consider.

The Political Stream

The political stream- analyzes the influences of the executive or legislative turnover, and interest group advocacy campaigns and how it affects the national mood (Beland & Howlett, 2016). Figure 10. illustrates the codes and categories applicable to the political stream.

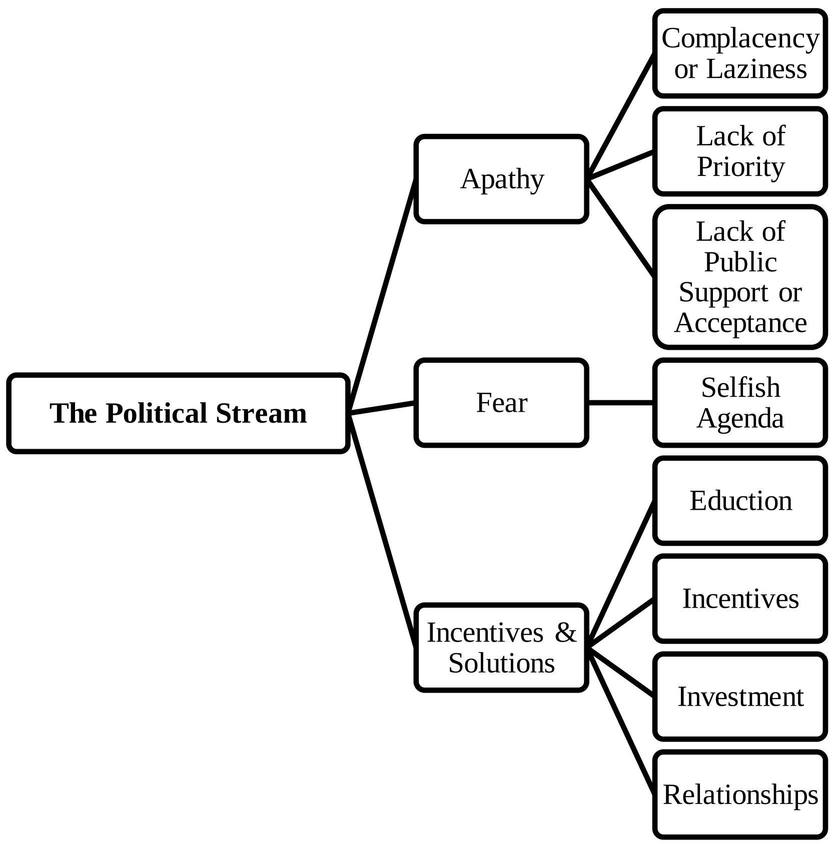

Figure 10. The codes and categories about the MSA Political Stream.

Apathy category. Blair and Starke (2017) argued local governments are responsible for providing many essential public services to the community. Subsequently, policies are developed and adapted to meet the community's needs. Further complicating the development of renewable energy policies is the tendency for them to become convoluted due to the involvement of multiple departmental reviews (Burkhardt et al., 2014). P4 confirmed policy development is not the primary problem, but instead what happens to the policy once it is created, "I think creating a policy, I don't think it would be as problematic. But I'm afraid it would just be a policy to be put on a shelf."

Ali et al. (2017) asserted barriers to public policy include the lack of reliable, dedicated institutions, lack of clear responsibilities, and complicated, slow, or non-transparent permitting procedures. P5 alluded to this being a problem when stating people need to elect those that have renewable energy "as one of their top priorities." P6 offered a slightly different view of Ali et al.'s assertion. P6 stated, "I think part of it is that people assume that someone else is doing it, maybe on a higher level, and we all react to crises, and it's very hard, especially in public policy, to look ahead." Finally, P7 felt the apathy Ali et al. described was because "people are comfortable and successful doing the things we've always done the way we've always done them."

Fear category. Rosenthal (2010, p 698) reported, "fossil fuel companies and their allies have considerable economic and political power and have projected that power with a propaganda war against renewable energy". P8 also felt:

> that there are people, who are motivated to try and keep it unclear and keep it foggy and keep people in the dark because it means they can continue to profit

from the current system. And so, we saw that with the tobacco industry and the whole cancer thing, it's sort of a problem that also keeps people from moving forward.

Incentives and solutions category. Cohen (2015) suggested energy efficiency is not controversial, but accelerating the use of renewable energy requires concerted government action, which requires political support. Renewable energy projects are typically smaller, more complex, and riskier than traditional energy investments— and therefore often require government-supplied incentives.

The political stream analysis validated the literature and revealed politics is affected by many of the same issues of apathy and fear. However, the analysis also showed how politics could be the driving force that positively influences the incentive and solutions that are brought forth.

Summary

The MSA was used to compare what is within the literature and the problem, policies, and politics of renewable energy and microgrid technologies in northeast Ohio. The research findings supported and added to much of the literature because of the study's specificity to northeast Ohio. However, what is absent in the MSA analysis is what will act as the window of opportunity or triggering mechanism that will propel renewable energy and microgrids to the forefront in northeast Ohio.

Limitations of the Study

One of the more significant limitations of my research was the overall lack of participation from the people who were invited to be interviewed. A total of 39 invitations were sent out, and only 10 agreed to be interviewed. The original sample size goal was to have 12-15 participants. Fortunately, data saturation was reached, and the sample size could be reduced to 10. Overall the 10 participants had much diversity regarding their credentials and experiences.

However, two areas not represented in the sample are state government and the electric power companies. Four people were approached from state government and either declined or did not respond at all — six people from the three power companies that service northeast Ohio were contacted, four declined to be interviewed, and two did not respond. Therefore, the second limitation of my research is these two groups are not represented.

The interview questions in the interview guide created for my study were sometimes nonapplicable to the participant. Subsequently, not all participants received the same questions. As an example, if the person was involved in renewable energy, questions 4, 4a, and 4b were omitted. Those questions asked (a) How do you define renewable energy?; (b) Do you think using solar energy is possible in northeast Ohio?; and (c) Do you think using wind energy is possible in northeast Ohio?

Also, Question 8: “Are you familiar with Ohio's Renewable Energy Portfolio Standard?,” was eliminated after the first few interviews. The reason for this elimination was because the question was designed to reveal the person's breadth of knowledge regarding renewable energy and had no other significant value for the data. In all cases, the participant's level of knowledge was assessed with earlier questions.

Finally, since the research focused on northeast, Ohio, it is unclear if, and how much, the findings will also apply to other regions of Ohio. However, several of the participants were members of organizations that serviced and educated all of Ohio. Therefore, it is probable the data will apply to other regions in the state.

Recommendations

Recommendations for future research focus on the limitations of my research and new findings not discussed in the literature.

Recommendation 1

Representatives from the state and power generation companies should be included in future studies to gain an even more in-depth understanding of the barriers and potential incentives for renewable energy policies and microgrid development. Achieving their participation may still be just as problematic for the next researcher. However, the next researcher may be successful in using a different data collection method and sample strategy.

Recommendation 2

An unexpected finding in my research was how much poverty could affect the implementation of renewable energy. Given northeast Ohio's poverty rate, the next study should focus on how renewable energy could improve the quality of life and provide relief to those less fortunate. As an example, could renewable energy provide financial relief by lowering the cost of electricity in impoverished areas? Could the manufacturing of renewable energy components (solar panels, wind turbines, etc.) provide employment opportunities that could bring people out of poverty?

Implications

The development of policies to protect critical infrastructure and enhance community resiliency during a power failure provides a lasting social change. I identified several areas for lawmakers and community members to focus on who are beginning the transition to renewable energy practices. With this focus, changes can improve the overall quality of life by improving the environment, lowering utility costs, and strengthening the aging power grid. The MSA analyzed the topic from a problem, policy, and political perspective. In doing so, the interconnectedness of all three regarding renewable energy was revealed.

There are several implications to discuss. The literature discussed the current grid, distributed energy systems, microgrids, and smart grids. My results showed apathy, fear, and expense are preventing factors to these items becoming updated or a reality.

Apathy causes energy policies to remain a low priority for meeting basic human needs. Subsequently, this results in a lack of concern for developing renewable energy technologies and policies. My study also revealed the lack of knowledge of many regarding what technologies are available. Pubic energy policies and the technologies available need to be understandable, or they will not be used. The implication is public and local leaders do not realize they have the means to generate their own power through renewable energy sources, renewable energy systems provide value to the community in multiple ways, and are even more unfamiliar with technologies available. Therefore an apathy among the public and local leadership is preventing the development of policies that will create microgrids and DES.

Fear also is a barrier to renewable energy technologies and policy development. Fear creates the Not in My Backyard (NIMBY) syndrome among residents who then resist having a microgrid, wind turbine, or solar panels near their homes. My results also showed there is a fear of the unknown and a lack of understanding of renewable energy technologies. Also, fear made many of the participants skeptical of transitioning from fossil fuels to renewable energy, a realistic solution. The implication of all of the fears is the increased challenge to educate the public and local leaders of the benefits of renewable energy and the potential for increased resiliency and stability to the power grid.

Expense is another barrier to developing microgrids, DES, and public policies. Our more impoverished populations could greatly benefit from these technologies but unfortunately cannot afford to transition to renewable energy. Cities who are operating on reduced funding have difficulty in prioritizing and funding renewable energy products and endeavors over their typical operating costs. One implication is private investment may be the only solution to funding the start-up expenses associated with microgrids and DES. The other implication is public energy policies need to serve as a catalyst to assist in attracting incentives and a means of overcoming the financial challenges to renewable energy projects.

In analyzing public energy policies, my results showed apathy, fear, and expense again are problematic. Companies that control the current electric power supply are not receptive to change, especially without customers demanding a transition to renewable energy. Subsequently, the power companies are apathetic regarding public energy policies. The implication is the power companies are resistant to changing their business practices.

Fear impacts public energy policies because of the potential political battles that may be caused by upsetting the power suppliers who may also be a city's more significant employer. The implication is renewable energy concepts are not discussed at the local level, nor are the consumers pushing for change. Therefore, no progress is being made toward bringing new energy technologies to fruition.

Depending on how renewable energy and microgrids are valued, they may be deemed too expensive. Helgenberger (2016) stated,

> Renewable energy has emerged as a true multi-benefit system, combining ecological necessities like climate change mitigation with society's visions and economic opportunities. Local value creation based on technology development, production, installation, and maintenance, increasing energy access promptly, reducing resource conflicts in a water-constrained world, and improving air quality for a healthy environment is among these opportunities (para. 12).

If the cost-benefit analysis were to include the value of stability and resiliency of the power grid and the improvement to the environment, the expense might prove to be acceptable. The implication is the community, local decisionmakers, and the power suppliers should revise their cost-benefit analysis to include the many benefits Helgenberger mentioned, as well as a reduction in our dependence on foreign oil.

A recommendation for practice is for the community or region to create a task force comprised of citizens, power company representatives, and elected officials from various levels of government. In essence, bringing everyone together so the problem can be discussed outside of the personal and organizational silos, the concepts are currently being kept. The task force would work to determine the needs, weaknesses, potential technologies (solar, wind microgrids), and funding opportunities to transition to renewable energy. The result would be to overcome an adaptive challenge to improve the quality of life, reduce pollution, and enhance community resilience to the effects of a power failure.

Conclusion

The purpose of my study was to discover the perceived and real challenges to the development of policies necessary for the implementation of a microgrid system for a small northeast Ohio. I identified several barriers (apathy, lack of awareness, beliefs, expense, and fear) preventing public policies regarding renewable energy. Also, my research revealed several solutions for overcoming these challenges- education, incentives, investment into the power grid, cultivating relationships, and systems planning. In the process, I also revealed how poverty could affect the creation of renewable energy policies and technologies. However, it also presents an even more excellent opportunity for social change by using renewable energy to improve the quality of life of our impoverished communities.

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Appendix A: Invitational Letter

Dear (Person's name),

My name is Robert L. Pursley, Jr. and I am completing my PhD dissertation at Walden University. You are invited to take part in this research study to assist in identifying the perceived and actual factors preventing a small NE Ohio city from developing renewable energy policies. Also, this study seeks to identify the policies and incentives necessary for the active promotion and development of a microgrid.

I am inviting a local, state, or federal government employee who have decision-making authority in NE Ohio, or a representative of a power company, or a person who has special skills or knowledge regarding renewable energy policies or microgrid concepts to participate in this study. **This study is voluntary, and you are free to accept or turn down the invitation. If you decide to be in the study now, you can still change your mind later. You may stop your participation at any time.**

If you agree to be in this study, you will be asked to:

- Read and sign an informed consent form;
- Participate in a 60 to 90-minute audio-recorded interview;
- Review a transcribed copy of the interview for clarifications, concerns, or questions you have regarding the documentation content accuracy. This review may be in duration of 60-90 minutes;
- Possibly participate in a single follow-up interview.

I thank you for your consideration and look forward to hearing from you. My contact information is:

Appendix B: Interview Guide

Introduction & Purpose of the Study

The aging, over-burdened United States' power grid is projected to continue failing more frequently and affect larger populations of people. Being more resilient to the impacts of a power failure is vital for maintaining critical infrastructure during such events. The creation of a microgrid offers a solution towards establishing community resiliency to a power outage. Powered by renewable energy sources, a microgrid is a small, advanced electric grid that produces electrical power independently or in conjunction with the primary electric power grid. The purpose of this study is to discover the perceived and actual challenges for a municipality to develop renewable energy policies that will allow the creation of a microgrid.

Research Questions

1. What are the perceived and actual factors preventing a small NE Ohio city from developing renewable energy policies?
2. What policies and incentives are necessary for the active promotion and development of a microgrid?

Confidentiality Assurances

- Your participation is entirely voluntary, and there will not be ramifications for declining the invitation.
- Your comments will not be anonymous but will be kept confidential by not using your name, title or position unless written consent is granted to do so. Instead, you

will be identified using other types of identifiers (codenames, numbers, letters, etc.).

- Any notes, transcripts, correspondences, or other data which could identify you will be secured in a file cabinet or safe only I have access too.
- A copy of the transcription will be provided to you for review before publication to ensure it was correctly transcribed.

Question Key:

MQ= Main Question

PQ= Probing Question

FQ= Follow-up Question

Warm Up Questions

- MQ-What is your name and title?
- MQ-Can you briefly describe your background (education, work experience)?

Problem Stream Questions

- MQ-Please describe what you think would happen to critical infrastructure during a massive or long-term power failure.
- MQ-What is meant by the term community resiliency?
    a. PQ- Do you believe your community as resiliency regarding a power failure?
- MQ- How do you define renewable energy?
    a. PQ- Do you think using solar energy is possible in NE Ohio?
        i. PQ- Why or why not?

   b. PQ- Do you think using wind energy is possible in NE Ohio? W

      i. PQ- Why or why not?

- MQ- What is your definition of a microgrid?
- MQ- What are your concerns with developing a microgrid?

   a. PQ- Please elaborate

Policy Stream Questions

- MQ- Do you feel it is important for a municipality to have renewable energy policies?

   a. PQ- Why or why not?

- MQ- Are you familiar Ohio's Renewable Energy Portfolio Standard?
- MQ-Do you see renewable energy and microgrids as a problem or solution for addressing the community's needs?

   a. PQ- Why or why not?

- MQ- Do you feel local government is able to develop renewable energy policies that will support Ohio's Renewable Energy Portfolio Standard?
- MQ- Please elaborate on the challenges for local government to develop renewable energy policies and partnerships with local electric companies?

   a. PQ- What solutions do you suggest for overcoming these challenges?

Political Stream Questions

- MQ- How does your administration prioritize the use of renewable energy?
- MQ- How would you describe your relationship with county, state and energy company representatives?

- MQ- What socio-economic advantages for the city and community do you see in transitioning into renewable energy?
    a. Please elaborate
- MQ- What socio-economic disadvantages for the city and community do you see in transitioning into renewable energy?
    a. Please elaborate

Follow-Up Questions

- Will be developed based on the interviewer's responses.

Closing Question

- MQ- Do you have any questions for me?

Closing Remarks

Thank you for taking the time to share your thoughts. This interview will be transcribed, and a copy will be sent to you for review. After the transcription is reviewed, please share with me any clarifications, concerns, or questions you have regarding the documentation. Do you have any questions for me?

Appendix C: Rev Transcription Privacy & Confidentiality

Rev Information Security & Privacy Program Overview

Introduction

The following document provides an overview of Rev's Information Security & Privacy program. We advise reviewing this document in its entirety as an overview and seeking any additional details in the appropriate attached documents.

Rev.com's advanced platform is a multi-tenant, multi-user, on-demand service providing unbeatable quality, speed, and value to clients and freelancers alike. Rev.com may be securely accessed 24x7 through any Internet-connected computer with a standard browser, an application program interface (API), or mobile applications.

Objectives

Security is a critical part of our business. With our security & privacy program, we strive to achieve the following goals:

1. Ensure that customer data is encrypted and inaccessible to other customers and the public.
2. Ensure that customer data is accessible to staff only to the extent necessary to perform the required work.
3. Prevent loss or corruption of customer data.
4. Maintain a redundant infrastructure with 99.9% uptime.
5. Provide timely notifications in the unlikely event of a downtime, data corruption or loss.

6. Provide continuous training for our staff on proper operation of our systems and best practices for security and privacy.

Our security policies and procedures are reviewed on an ongoing basis by the Rev security committee, which is also responsible for enforcement. All our staff have signed confidentiality agreements.

Information Security

Rev.com uses appropriate technical, organizational and administrative security measures to protect any information in its records from loss, misuse, and unauthorized access, disclosure, alteration and destruction. Rev.com uses NIST guidelines and Center for Internet Security Cybersecurity Best Practices as a foundation for its information security program including information security policies and incident response.

Privacy

Please see the Rev.com Privacy Policy (https://.rev.com/about/privacy) for details of how Rev.com treats personal information and complies with privacy regulations.

Secure Infrastructure

All Rev.com services are hosted by Amazon Web Services (AWS). AWS maintains strict physical access policies that utilize sophisticated physical access control mechanisms. Environmental controls such as uninterruptable power and non-destructive fire suppression are integrated elements of all data centers. Rev.com uses multiple geographically distributed data centers as part of a comprehensive disaster recovery strategy, and uses the CIS Amazon Web Services Benchmarks (https://aws.amazon.com/quickstart/architecture/compliance-cis-benchmark/) as a guide for best practices. AWS provides DDOS services.

Software Development Lifecycle

As a cloud service company, Rev.com releases software frequently and regularly so that clients may benefit from on-going development of new service and security capabilities

Rev.com follows a defined SDLC (Software Development Lifecycle) that includes the application of security-by-design principles. Rev operates using an agile development methodology under which software development teams and management are tasked with ensuring that the SDLC method and design principles are followed.

Secure Service Operations

Access to production infrastructure is managed on a least privileges basis and is limited to the Rev.com operations team. Background checks are performed and security training is provided to ensure the background and skills of the operations staff are consistent with the information security policy and work instructions. Sensitive product service data stored in service databases never leaves the production system and access is controlled according to least privilege principles.

Firewalls rules are maintained so that production systems can only be accessed for maintenance from defined Rev.com locations using secured access mechanisms. Systems are maintained in a hardened state with defined baselines for all host and network equipment.

All changes to systems are tracked and managed according to well-established change management policies and procedures. The patch level of third-party software on systems in regularly updated to eliminate potential vulnerabilities.

Breach Detection and Response

Rev.com utilizes network intrusion detection and host integrity management tools to continuously monitor the state of the system. Availability of the system is also continuously monitored using external monitoring tools. System logs are aggregated and archived centrally, facilitating both continuous analysis for suspicious access patterns and future forensic analysis. Regular external vulnerability scanning is also performed. In the event of a breach, Rev.com has the ability to isolate components of the system to contain the breach and maintain ongoing operations. Rev.com's incident response team is at the ready to notify customers of security or service impacting events according to defined notification policies in the Incident Response Plan.

Security Package Contents

The attached Information Security package includes:

1. Rev Information Security Overview (this document)
2. Rev Privacy Policy
3. Rev Terms of Service
4. Rev GDPR Overview
5. Rev Policies
    a. Encryption Policy
    b. Third-Party Connection Policy

c. Retention Policy
d. Network Security Policy
e. Incident Response Policy
f. Wireless Access Policy
g. Password Policy
h. Network Access and Authentication Policy
i. Mobile Device Policy
j. Email Policy
k. Acceptable Use Policy
l. Physical Security Policy
m. Backup Policy
n. VPN Policy
o. Remote Access Policy
p. Outsourcing Policy
q. Guest Access Policy
r. Data Classification Policy
s. Confidential Data Policy
t. Web Application Security Policy
u. Remote Access Policy

6. Rev Procedures (select examples, Rev retains additional confidential procedures)
    a. Incident Activity Log Template
    b. Incident Tracking Form

c. Rev Data Handling 3rd party request procedure

d. Privacy & Information Security Policy training (high-level example, Rev also requires completion of a 3rd party training platform)

7. Rev Data & Security Architecture

a. Rev Data Flow diagram

b. Rev Data Subprocessors

c. Rev Data Flow folder – supporting details

8. Rev Qualifications, Certifications and Tests

a. National Institute of Standards and Technology - Cybersecurity Guidelines b. PCI Compliance certificate

c. Rev PCI Scan Report

Available on request (our standard legal documents):

1. Rev Master Service Agreement (MSA)
2. Rev Service Level Agreement (SLA)
3. Rev Non-Disclosure Agreement (NDA)
4. Rev Data Protection Addendum (DPA)
5. Rev Service Agreement

Appendix D: First-Cycle Codes & Descriptions

Name of Code	**Description**	**Files**	**References**
Acceptance to Change	The person or organization will not accept changes to the system.	1	3
Advantages	Socio-economic advantages to transitioning to renewable energy sources	3	7
Adversity to Change	Person or organization is opposed to change.	8	25
Aware	Aware of the existence of microgrids or renewable energy technologies	4	14
Basic Needs	If a person's basic needs according to Maslow's Hierarchy of Needs.	1	1
Complacency or Laziness	Energy providers and consumers are so used to the current system they do not want to change because of the work involved.	4	5
Education	Educating oneself or a group of individuals	7	14
Expensive	Includes start-up and ongoing costs to transition to renewable energy and maintenance of equipment.	7	18
Importance of Policy and Procedures	The person or organization agrees there must be policy and procedures that promote and govern the use and supply of renewable energy.	8	13
Incentives	Utility providers make it a priority to educate	4	6

Name of Code	Description	Files	References
	and provide incentives to the public and municipalities. Other NGO or government incentives		
Infrastructure or System Ready	The organization’s system and infrastructure are ready for microgrid implementation and operations.	1	1
Investment	Infrastructure improvements or needs necessary for renewable energy solutions to be advantageous.	2	2
Lack of Priority	Subject has not been a priority for a person or group to look at or achieve.	5	12
Lack of Public Support or Acceptance	The public does not support the use of renewable energy possibly due to: unsightly solar panels, wind turbines, etc.	4	7
Managing Decline		1	2
Maximizing System Changes	The ability to change a system faster than it is designed to change	1	1
Potential Solution	Potential solution to achieving renewable energy and microgrid policies.	6	14
Prepared	The person’s community is prepared to endure a long-term power outage.	3	10

Name of Code	Description	Files	References
Relationships	To recover in timely and effective manner, organizations need to have relationships with providers and contractors prior to event.	8	16
Resiliency	The ability of the community to withstand a power outage	9	23
Selfish Agenda	Conducting oneself or governing in a way that does not consider the greater good.	4	21
Skepticism	Person doubts renewable energy is a solution.	2	5
Systems Planning	The proactive planning for implementation to transition to renewable energy.	1	5
Taking Corrective Action	People in power being willing and capable of initiating the change to renewable energy.	2	3
Unaware	Person is unaware of microgrids or renewable energy technologies	7	31
Understands Potential Threat	Person understands the potential threat a long-term power outage would have on the community and critical infrastructure.	6	11
Unprepared	The person's community is unprepared to endure a long-term power outage.	9	23

Appendix E: Code Mapping

Barrier Theme

Apathy Category

Type	Name	In Folder	Created On	Created By	Modified On	Modified By
Node	Basic Needs	Nodes	Jan 21, 2020 at 14:22:35	RP	Jan 24, 2020 at 11:06:41	RP
Node	Complacency or Laziness	Nodes	Jan 12, 2020 at 10:33:01	RP	Jan 24, 2020 at 11:13:44	RP
Node	Lack of Priority	Nodes	Dec 15, 2019 at 10:54:42	RP	Jan 21, 2020 at 14:13:07	RP
Node	Lack of Public Support or Acceptance	Nodes	Dec 20, 2019 at 10:40:33	RP	Jan 24, 2020 at 11:22:56	RP

Awareness Category

Type	Name	In Folder	Created On	Created By	Modified On	Modified By
Node	Unaware	Nodes	Dec 15, 2019 at 10:47:54	RP	Jan 21, 2020 at 14:33:10	RP

Belief Category

Type	Name	In Folder	Created On	Created By	Modified On	Modified By
Node	Skepticism	Nodes	Dec 15, 2019 at 10:46:45	RP	Jan 23, 2020 at 13:58:35	RP

Expensive Category

Type	Name	In Folder	Created On	Created By	Modified On	Modified By
Node	Expensive	Nodes	Feb 4, 2020 at 09:11:18	RP	Feb 4, 2020 at 09:12:04	RP

Fear Category

Type	Name	In Folder	Created On	Created By	Modified On	Modified By
Node	Acceptance to Change	Nodes	Jan 21, 2020 at 14:06:49	RP	Jan 24, 2020 at 11:04:13	RP
Node	Adversity to Change	Nodes	Jan 12, 2020 at 10:42:33	RP	Feb 4, 2020 at 10:01:43	RP
Node	Selfish Agenda	Nodes	Jan 12, 2020 at 10:26:01	RP	Feb 4, 2020 at 09:51:23	RP

Incentives & Solutions Theme

Incentives & Solutions Category

Type	Name	In Folder	Created On	Created By	Modified On	Modified By
Node	Education	Nodes	Dec 15, 2019 at 10:52:57	RP	Jan 23, 2020 at 13:52:27	RP
Node	Incentives	Nodes	Dec 20, 2019 at 10:41:44	RP	Feb 4, 2020 at 09:54:15	RP
Node	Investment	Nodes	Dec 20, 2019 at 10:28:45	RP	Feb 4, 2020 at 09:27:28	RP

Node	Relationships	Nodes	Dec 20, 2019 at 10:19:11	RP	Feb 4, 2020 at 09:20:44	RP
Node	Systems Planning	Nodes	Jan 21, 2020 at 14:11:54	RP	Jan 24, 2020 at 11:39:50	RP