Neighborhood Microgrids: Replicability and Revitalization

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Executive Summary

This document presents "Neighborhood Microgrids: Replicability and Revitalization," a study conducted in 2015-2016 with support from Syracuse Center of Excellence for Energy and Environmental Systems, at Syracuse University. Study products include development of an analysis process for use with any model neighborhood, as well as findings specific to the replication of the Near Westside microgrid in Syracuse, New York, a proposed installation assessed for feasibility under Phase I of the NY Prize Community Grid Competition (www.nyserda.ny.gov/All-Programs/Programs/NY-Prize). As a proposal linking a microgrid to economic revitalization of a disadvantaged urban neighborhood, the Near Westside NY Prize award is unusual, contrasting with more common goals such as elimination of power outages or storm resilience. This anomaly created an opportunity to explore the promise of microgrids for revitalization, through a year-long study. This report of its findings begins with a background section, details the process for identifying candidate neighborhoods, presents findings from the process specific to the Near Westside, discusses the study's outcomes, and concludes with limitations and directions for further work.

This process identifies sets of selected neighborhoods as likely candidates for replicating a microgrid designed for the model neighborhood, at a level of specificity comparable to that of a casual in-person assessment of a potential neighborhood by an expert. S/he might visit such a neighborhood and note that it contains a school, a police station, a hospital, a street full of storefronts, and areas of single-family homes. Such an expert might form the initial conclusion that this neighborhood could be feasible for a community microgrid, before investigating existing energy use data. The process presented in this document may be thought of as similar to this kind of casual assessment, done for the entire region or state at once, instead of one neighborhood at a time.

Background

This section provides context for readers from the various constituencies concerned with microgrids, neighborhood revitalization, and the Near Westside in Syracuse, New York. Topics covered include an introduction to microgrids and community microgrids, the NY Prize competition, the goal of economic revitalization in contrast to gentrification and other similar processes, and the sustainability of community microgrids for revitalization. This section also introduces the Near Westside, the model neighborhood around which this study was constructed.

Process for Identifying Candidate Neighborhoods

The major product of this study is a process for identifying suitable neighborhoods for implementation of similar microgrids, from within a larger geographic area. This process is not tied to the Near Westside, but rather can be adjusted to replicate any given model neighborhood for which a community microgrid is being developed. The process identifies neighborhoods that are similar to the model neighborhood in two respects: 1) similar enough to replicate the same microgrid and make it technically and financially

feasible, and 2) similar in suitability for economic revitalization. These goals are intertwined in this process as presented here; the suitability of this process for other goals is discussed below in Limitations and Directions for Further Work.

A series of steps applies different characteristics of the model neighborhood to a larger geographic area, beginning with the assumption that every neighborhood in the larger geographic area is similar to the model, then narrowing the set of similar neighborhoods with each characteristic added. The process's findings therefore include not merely a set of neighborhoods, but a list of objective data-based reasons **why** they are similar to the model neighborhood. This paper walks the reader through this process step-by-step, with illustrative diagrams. The steps are:

1. Existing electrical rates
2. Urban status
3. Socioeconomic and demographic characteristics
4. HUD Community Block Development Grant eligibility
5. Age and scale of urban fabric
6. Percentage of vacant land
7. Energy load estimation and proportion of different types of load

Findings: Replicating the New Westside Microgrid

This section applies the process outlined above, using Syracuse's Near Westside as the model neighborhood. The Near Westside is an ideal candidate for serving as a model, because it has been assessed as at the margin of financial feasibility for a community microgrid. Thus the Near Westside's values for each variable in the process form natural thresholds: the Near Westside may be thought of as the "worst" case for financial feasibility, so all neighborhoods that are "better" cases are more feasible financially. This section again walks the reader through the process step-by-step, this time including existing values for the Near Westside to identify a set of similar neighborhoods across Upstate New York. Each step includes interim results, such as cities remaining in the analysis or number of neighborhoods deselected. This process results in the identification of 59 neighborhoods across ten Upstate cities: Albany, Binghamton, Buffalo, Elmira, Jamestown, Niagara Falls, Rochester, Schenectady, Troy, and Utica. Syracuse was not included in this study because it is the site of the model neighborhood. Buffalo and Rochester had the most neighborhoods within this final set, with 24 and thirteen neighborhoods, respectively. The remaining eight cities had just a few selected neighborhoods each, in keeping with the cities' smaller overall size. The paper includes a map of each city, showing the location and Census tract number of each of the final selected neighborhoods.

Discussion

This section evaluates the study's success and products. Topics explored include whether community microgrids appear to be a worthwhile tool for encouraging urban revitalization, and important considerations for that goal that lie beyond the scope of this study, such as the perceptions of residents and outsiders, the distribution of energy savings among different ratepayers, and the relationship with declining public infrastructure. The significance of the findings specific to the Near Westside are also briefly discussed, as are the merits of the process developed relative to the original goals of this study.

Limitations and Directions for Further Work

As an exploratory study chiefly focused on methods creation, this study's limitations are interwoven with notes about further work. Most limitations concern the characteristics of available data that is suitable for this kind of large-scale remote analysis. Chief among them is the use of property class (from tax parcel data) as a proxy for energy use and load type. Several ideas for additional refinements to address this limitation are discussed. The merit of selective groundtruthing of the results, or spot checking a random selection of the final set of neighborhoods, is also discussed.

The document concludes with a short bibliography of sources cited and an acknowledgements section listing the project staff as well as the many professionals that provided expert assistance in developing this study.

Introduction

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Background

This section provides context for readers from the various constituencies concerned with microgrids, neighborhood revitalization, and the Near Westside in Syracuse, New York. Topics covered include an introduction to microgrids, the NY Prize competition, the goal of economic revitalization, and ecological sustainability. This section also introduces the Near Westside, the model neighborhood around which this study was constructed.

Microgrids

A microgrid is a miniature version of the larger electrical grid, incorporating its different components – energy generation, use, and sometimes storage – in a relatively compact space. Microgrids typically connect several related buildings or facilities, such as a campus or military base. They may be tied to the larger electrical grid or operate independently. Microgrids are most commonly used to lower electricity costs, to incorporate renewable energy generation, or to provide power during outages. By linking the energy systems of several facilities, microgrids provide greater flexibility in how technologies are incorporated, allowing for more efficient and broader use. Microgrids may also allow demand, or energy use, to be managed more effectively [1].

Microgrids are not new, nor do they necessarily incorporate renewable energy generation. To date, they have been constructed primarily to serve sites with a single property owner or energy user, such as universities or hospital campuses. In contrast, community microgrids connect facilities managed or owned by different energy users, such as adjacent buildings in a neighborhood [2]. Community microgrids offer a way to extend the benefits of microgrids to smaller energy users.

NY Prize

The study here reported is an outgrowth of an award made to Syracuse University for feasibility assessment of a community microgrid in the Near Westside [3], as part of the NY Prize Community Grid Competition. NY Prize is a groundbreaking program by New York State Energy Research and Development Agency (NYSERDA) to spur the development of community microgrids, primarily to increase resilience to power outages in the wake of Superstorm Sandy. NY Prize is a three-stage competition, with 83 awards made for feasibility assessments in Stage 1. Stage 2 proposals were due in early October 2016, and Stage 3 will be awarded in 2018 [4].

Revitalization

This study focuses on the goal of economic revitalization of disadvantaged urban neighborhoods. At first glance, revitalization seems like a straightforward and universally appreciated goal: to promote new investment by businesses and residents in neighborhoods affected by urban blight. However, revitalization and renewal initiatives have a long problematic history in cities in the US and elsewhere, including programs that intentionally destroyed or displaced African-American, Latina/o, and other minority communities [5, 6]. These programs, particularly the urban renewal programs of the postwar era, are now widely viewed as leaving legacies destructive to both communities [7] and urban environments [8]. More recently, efforts to promote new investment in challenged urban neighborhoods have been seen as displacing residents through gentrification, although there is not expert consensus on this relationship. Revitalization efforts may also be seen as overstepping in their social goals, either overpromising and not delivering or being too much characterized by (usually non-Hispanic white and affluent) outsiders dictating to (usually non-white and impoverished) residents.

Nonetheless, reversing the trend of disinvestment in urban neighborhoods remains a necessary and worthy goal, especially in the postindustrial cities of the Eastern and Midwestern US. These cities, including Syracuse, are characterized by the loss of manufacturing, public and private investment, and population in their urban cores. This creates a suite of problems and common conditions that defy easy solutions, in part because they are linked to national and global changes in economics and demographics. Part of these conditions is the growth of suburban and exurban areas as their associated urban cores shrink, a hollowing out of the city that results in large amounts of underused or vacant buildings and land. Many dynamics present in the postindustrial city reinforce themselves, creating feedback loops that continue to weaken the social and economic health of the city.

It's therefore important to explicitly define the goal of revitalization as used in this study. Economic revitalization here means providing financial incentives to those already living and working in disadvantaged neighborhoods to remain in place and to invest their own resources in maintaining and improving their surroundings. These incentives may also be extended to new residents or businesses arriving to fill the space left vacant by previous disinvestment and population loss. At the same time, improving the perception of the neighborhood by residents and by outsiders is a priority, encouraging the view of the neighborhood as a safe, authentic and desirable place to be. These perceptions are important to both long-term residents and to those looking for a new place to establish a home or business; in many ways, a "good" neighborhood is more about reputation than actual crime statistics, and reputation may lag behind the changing fortunes of an area. Specific to concerns about displacement of residents is the acknowledgement that Upstate cities are characterized by decades of economic challenges, thus creating a much less competitive and much more affordable housing market than those seen in New York City. This study therefore assumes the presence of abundant housing of comparable affordability and quality within these cities. The study also recognizes the severity of disinvestment in these cities relative to the best case of success of these efforts, making gentrification pressures unlikely.

Sustainability

Discussions about revitalization and gentrification involve social and economic sustainability, but what about ecological sustainability? Microgrids do not necessarily result in a greener energy system, but they do tend to result in greater energy efficiency, can allow greater use of renewables, and can avoid expansion of grid components, thus avoiding their ecological cost. Significant ecological benefit stands to be derived from encouraging reinvestment in urban core neighborhoods over distant suburban ones, due to the ecological costs of transportation and new construction, compared to the reuse of existing buildings and infrastructure. Redensification, or the movement of people back into central urban cores, is a key trend in reducing the greenhouse gas emissions of the US [9]. Initiatives encouraging urban revitalization such as this one are vital to that redensification trend.

Syracuse's Near Westside

The Near Westside is an older neighborhood adjacent to the downtown of Syracuse, New York, with a long industrial history dating to the founding of the nearby Erie Canal. Like many urban industrial neighborhoods, it experienced economic decline and population loss in the decades following World War II. Today, the Near Westside is a mixed-use area of businesses, some remaining industry, and residences that has been heavily impacted by the economic challenges of the last several decades. It is an area characterized by high poverty rates and high property vacancy [10], yet also several revitalization efforts such as the Salt District, an emerging arts and culture area [11].

As the area just beyond the revitalized Armory Square neighborhood and Syracuse's revitalizing downtown, the Near Westside lies at the so-called "frontier" of revitalization, where the positive cycle of reinvestment meets surrounding areas of vacancy and impoverishment. This physical proximity and visibility makes the Near Westside a next best candidate for revitalization in the city, a conclusion reflected in the many revitalization efforts already in place within the neighborhood, including several associated with Syracuse University through the affiliated Near Westside Initiative [12]. The Near Westside faces many of the common challenges of urban neighborhoods: poverty, crime and perception of crime, weak public schools, aging building stock. Of special note are Syracuse's status as the city with the highest concentration of African-American and Hispanic poverty within the US [13] and the city's pervasive problem of failing water mains and other public infrastructure [14]. These issues add extra urgency to revitalization and infrastructure improvement within the city.

In contrast, the Near Westside is a non-traditional choice for a microgrid. As mentioned above, community microgrids, or those tying together properties owned by multiple ratepayers, are less common than single-owner microgrids. The goal of neighborhood revitalization means that many, if not all, of the neighborhood's buildings must benefit from the microgrid, not merely a few institutions or businesses. This presents a substantial challenge in designing a financially feasible microgrid, one of the main hurdles in positioning the establishment of community microgrids as tools for urban revitalization.

A Process for Identifying Candidate Neighborhoods for Replicating Microgrids

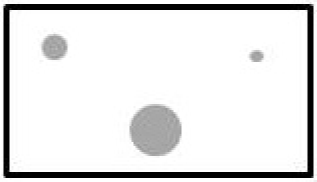
A major product of this research is the creation of a method for identifying suitable neighborhoods for implementation of similar microgrids within other geographies. Although this study focused on the Near Westside of Syracuse and replicating its community microgrid, it is important to realize that the process depicted here is not tied to the Near Westside. This same process could work for many different neighborhoods, simply by using a different one as the model neighborhood at the beginning of the process and by adjusting various thresholds and parameters in the process accordingly. This flexibility makes the process created here the main product of this study. Also of note is that this process focuses on identifying neighborhoods that are similar to the model neighborhood in two respects: 1) similar enough to replicate the same microgrid and make it technically and financially feasible, and 2) similar in suitability for economic revitalization. These goals are intertwined in this process as presented here.

At heart, this process is a series of steps that apply different characteristics of the model neighborhood to a larger geographic area to identify a set of neighborhoods that are similar to the model neighborhood. The process begins with the assumption that every neighborhood in the larger geographic area is similar to the model, then narrows the set of similar neighborhoods with every characteristic that's added. At the end of the process, there's not just a set of neighborhoods, but a list of objective, data-based reasons **why** they are similar to the model neighborhood. This process also readily allows multiple adjustments to make the final set of neighborhoods broader or narrower. The process proceeds from largest to smallest geographic scale of analysis, placing the variables with datasets of potentially problematic size at the end of the sequence, to minimize the size of the datasets needed.

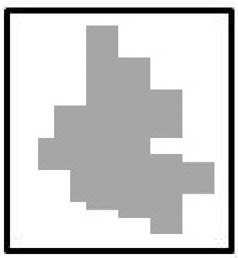
This process and the sets of selected neighborhoods it produces are intended as likely, but not guaranteed, candidates for replicating a microgrid designed for the model neighborhood. The level of specificity and confidence of this recommendation are comparable to that of a casual in-person assessment of a potential neighborhood by an expert. S/he might drive around such a neighborhood and note that it contains a school, a police station, a hospital, a street full of storefronts, and areas of single-family homes. Such an expert might form the initial conclusion that this neighborhood might be feasible for a community microgrid, but that it will depend on the balance between long-term uses such as the school with constant uses such as the hospital. This expert might then proceed to investigating existing energy use data to confirm whether this neighborhood is indeed a good candidate. The process presented in this document may be thought of as similar to this kind of casual assessment – except that it looks at the entire state (or other large geographic region) at once, instead of just at an individual neighborhood.

To employ this process, one initially selects the **larger geographic area** from which the final set of neighborhoods should be selected. For example, this process was developed with Upstate New York as the larger geographic area, but would work for smaller regions such as Central or Western New York. This process should also work for other states and their regions, particularly within the eastern part of the US, although this assumption remains untested.

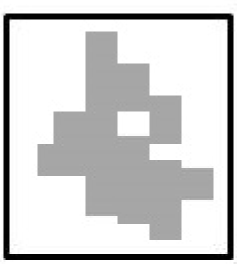
Step 1 incorporates existing **electrical rate information** by any geographical unit smaller than state level and over some unit of time (ie: not real time). These data can be quite coarse in granularity, at the level of average/below average/above average compared to the state as a whole, and can be broken down by any geographical unit smaller than the state, such as region, county, or municipality. The actual price paid by individual ratepayers is not needed, which makes confidentiality and privacy less of a concern. Areas that differ on this basis from the model neighborhood's region are deselected before Step 2.



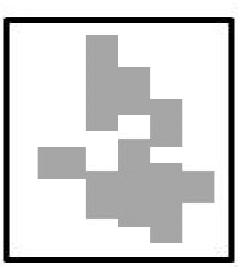
Step 2 identifies neighborhoods in **urban areas** from those selected in the previous step. The process incorporates U.S. Census data designating metropolitan areas as Census Urbanized Areas, data publicly available without charge from www.census.gov. Census Urbanized Areas, commonly abbreviated either UA or UZA, are densely settled areas of at least 50,000 residents [15]. UAs typically include both central city and suburban areas, making them roughly synonymous with "metropolitan areas." These data are available for the entire United States at the tract level, which is used as a surrogate for neighborhoods in this study (a very common practice). This process focuses on urban neighborhoods, so those falling outside any Census Urbanized Area are deselected before Step 3, leaving us with only those neighborhoods in urban areas.



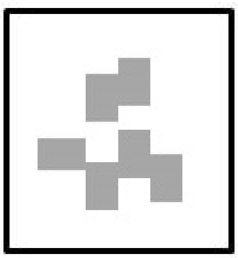
Step 3 adds a variety of **socioeconomic and demographic variables** to the process. This is done using the Social Vulnerability Index (SVI), a widely used index that incorporates a variety of characteristics into a single number, well suited to quantitative processes like this one. SVI incorporates many indicators of vulnerability, including household income, racial and ethnic status, employment status, educational attainment, and age [16]. SVI eliminates the need for other demographic data within this analysis, enabling a simpler and more elegant process. Since it is widely used by government and nonprofit agencies, its use here also creates an opportunity for coordination between these findings and various other plans and reports, a likely concern in discussions about urban economic revitalization. SVI is often discussed in terms of quartiles, with the highest quartile corresponding to most vulnerability, and the lowest quartile corresponding to least vulnerability. In identifying neighborhoods for economic revitalization efforts, it is therefore likely that the quartile of interest will be the highest one, but this process will work to match any SVI quartile the model neighborhood has. Neighborhoods with other SVI quartiles are deselected before Step 4, narrowing the selected neighborhoods to urban ones with similar socioeconomic profiles to the model neighborhood's.



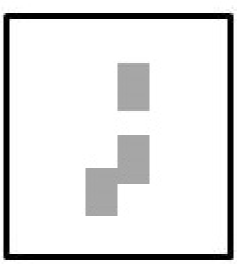
Step 4 tests the selected neighborhoods for eligibility according to the Housing and Urban Development **(HUD) Community Block Development Grant**. Eligibility for this program is an important consideration for economic revitalization efforts [17]. Eligibility is determined by HUD, which makes the determination publicly available through their website. Again, in identifying a set of target neighborhoods for economic revitalization, it's very likely that the model neighborhood will meet requirements for the HUD Community Block Development Grant, but this process will work with either eligible or noneligible status. Neighborhoods within the selected set that do not match the model neighborhood's status for block development grants are deselected before moving on to Step 5.



Step 5 adds the crucial variable of the **age and scale of the urban fabric** within the neighborhood. This includes the age of housing stock, but by implication also includes the era in which the neighborhood was initially developed. Age of neighborhood generally is associated with a variety of characteristics and dimensions of streets, sidewalks, rights-of-way, and land parcel size and orientation. To a lesser extent, it also implies condition of existing utility infrastructure, with older neighborhoods typically having older infrastructure. Data used for this step are average age of housing stock (median year structure built), publicly available without charge from the US Census for all neighborhoods [18]. While the term *age* implies that these data are accurate to the nearest year of construction, data on the year in which a structure was original constructed are less reliable than many data from the Census, because they rely on the current occupant's knowledge of the age of the building when s/he fills out the long form questionnaire. Naturally, this uncertainty grows with the age of the building. While the occupant is quite likely to know the year built and be correct for newer buildings, for older buildings, this is often an estimate on the part of the resident. Accordingly, therefore, the Census aggregates these years together for older dates. Neighborhoods that are candidates for economic revitalization are likely to be those with older housing stock, but this process will work for any age neighborhood. Those neighborhoods within the selected set that have an average building stock age that is too different from the model neighborhood are deselected before moving on to Step 6.



Step 6 concerns the amount of **vacant land** available within the selected neighborhoods. Vacant land is that not currently used for any other purpose, and may be thought of as "extra" land, including vacant lots and brownfields. New York State Property Type Classification Codes include several specific subtypes of vacant land, all assigned numeric codes between 300 and 400 [19]. This database includes every land parcel in the state, providing a wealth of information. This process makes extensive use of the property class codes included within the Real Property Database to indicate current land use and, by extension, the locations of various types of energy users. The presence of vacant land classification within the database provides greater reassurance of the accuracy of the other classification types, by providing a "none of the above" option to assessors. The amount of vacant land within a neighborhood reflects its economic health, but also indicates opportunity for redevelopment as revitalization occurs [17]. This process uses vacant land as a percentage of the overall number of land parcels within a neighborhood. Although vacant land by acreage could arguably be a more reliable measure, since it allows for parcels of widely varying size, parcel acreage data within the Real Property Database appear far less complete and therefore not the best choice for this process. Neighborhoods within the selected set that are too different from the model neighborhood in terms of percentage of vacant parcels are deselected before proceeding to Step 7.



Step 7 is the estimation of a neighborhood's **energy load**. Community microgrids may be very straightforward from a technical point of view, so the determination of feasibility is typically due to financial analysis [20]. In this process, properties (or ratepayers) may be thought of as falling into three categories: 1) critical **constant** usage (eg: stores, hospitals), or properties that have more need of maintaining electrical service during outages, pay market rates for energy, and that have a relatively constant energy demand on a daily, weekly, and annual basis, 2) critical **long-term** uses (eg: schools, universities), or properties that have more need of maintaining electrical service during outages and that are expected to retain their property and its use for many years, thus contributing stability to the microgrid even if they receive their electricity at lower public (NYPA) rates, and 3) **noncritical** uses (eg: private homes), which have less need of maintaining electrical service during outages. To be financially feasible, a microgrid must have more critical long-term usage than critical constant usage; ideally at least 70% of energy usage will come from critical long-term uses. Many microgrids include only these critical uses, or the first two types described above. The goal of economic revitalization dictates the inclusion of other properties within the neighborhood in the microgrid, to distribute benefits across the neighborhood rather than providing them only to a handful of public or commercial properties. This is a substantial challenge for financial feasibility [20].

This process again uses property classes from the Real Property Database to estimate these loads. Since this is the final step in the process, the overall load of the neighborhood (including critical and noncritical loads) is assumed to be comparable to the model neighborhood, since the neighborhoods still selected at this point have passed all the previous tests. The task therefore is to estimate critical constant usage and critical long-term uses, and their relative proportions. Table 1 indicates the property classes assigned to each of these use types. To pass this final test, selected neighborhoods must contain at least one parcel of critical constant usage and at least one parcel of critical long-term uses, recognizing that the latter type often has much higher use per parcel. The relative proportion of these two load types is then compared for all neighborhoods to that of the model neighborhood. Neighborhoods are deselected that have more parcels of constant load per parcel of long-term load than the model neighborhood.

All neighborhoods remaining within the selection at this point comprise the final set of selected neighborhoods, those considered similar enough to the chosen model neighborhood to be candidates for replication of the original community microgrid for economic revitalization.

Table 1: Property Classes Assigned to Load Types

Property Type Classification Code	*Property Class name*	*Critical Long-term use*	*Critical Constant use*	*Noncritical use*
100-199	Agricultural classes			x
200-299	Residential classes			x
300-399	Vacant classes*			x
400-499	Commercial classes		x	
500-589	(Private) Recreation and Entertainment classes			x
590-593	Parks and playgrounds	x		
600-615	Educational institutions	x		
620-633	Churches and charitable institutions	x		
640-642	Hospitals and health facilities	x		
650-670	Other government facilities	x		
671-681	Museums and cultural facilities	x		
682-693	Recreational trails, roads, etc.			x
694	Animal shelters		x	
695	Cemeteries			x
700-799	Industrial classes			x
800-827	Public water and flood control facilities	x		
830-837	Communications and media facilities		x	
840-853	Transportation and Waste Facilities	x		
860	Special Franchise Property			x
861-885	Utility Facilities	x		
900-950	Wild, Forested or Conservation Land*			x
960-963	Public recreation land*	x		
970-994	Other wild land			x

*Property type likely to use little electricity.

Findings: Replicating the Near West Side Microgrid

The process presented in the previous section is designed to use a single model neighborhood to select a set of similar neighborhoods for replicating a community microgrid to encourage economic revitalization. In this study, the model neighborhood was Syracuse's Near Westside. This section presents the process as applied to the Near Westside.

The Near Westside also forms a particularly useful model neighborhood, because in a financial sense, its microgrid is on the margins of feasibility [20]. That means that all neighborhoods identified by this process can be thought of as being at worst a similar case to the Near Westside, with most of them being a better case. The Near Westside values on the series of variables serve as thresholds for the process, meaning that at minimum each selected neighborhood meets the Near Westside's value on that variable – but could be much better as well.

The larger geographic area of interest regarding the Near Westside is all counties in Upstate New York, so we begin with every neighborhood in every Upstate county as part of our working set of selected neighborhoods. For Step 1, the Near Westside value for existing electrical rate is below the state average, as calculated for zip code 13204 from www.chooseenergy.com and statewide average energy prices as reported by NYSERDA at www.nyserda.ny.gov. It's important to note that as statewide data, these figures include both the New York City metro area and Upstate New York, which may make the Near Westside rate appear artificially low. Since below average existing electricity costs are the worst case for microgrid feasibility, no neighborhoods are removed from the selected set.

Step 2 removes all rural neighborhoods from the selected set, as well as smaller cities and towns. This leaves us with a working selected set of all neighborhoods within the larger cities of Upstate. This step uses Census Urbanized Areas, so only metropolitan areas of 50,000 residents or more were included beyond this point. Syracuse was eliminated from the study at this point, since it is the location of the model neighborhood.

Step 3 adds the Social Vulnerability Index (SVI), using the Near Westside value of highest (most vulnerable) quartile. In this case, the SVI used incorporated poverty, unemployment, age of residents, disability, race and Latina/o ethnicity, English fluency, and vehicle access. All neighborhoods within the selected cities that are not rated most vulnerable using SVI are deselected. The remaining analysis focuses on ten cities remaining within the analysis at this point: Albany, Binghamton, Buffalo, Elmira, Jamestown, Niagara Falls, Rochester, Schenectady, Troy, and Utica (See Figure 1).

Step 4 adds a second measure of the neighborhood's economic challenges and related suitability for revitalization efforts: eligibility for the HUD Community Block Development Grant. The Near Westside meets the threshold for this grant, determined through the neighborhood's median income. As might be expected, nearly all of the selected neighborhoods also met this threshold. It is nonetheless a valuable variable to include in the process because it allows easy coordination with public and nonprofit revitalization efforts.

Step 5 compares the age of a neighborhood's housing stock, and by extension, the age and scale of its streets, lots, and other urban fabric, to the Near Westside. The US Census lists the median year structure (housing unit) built of the Near Westside as 1925. As noted above, these data tend to be less reliable than most Census data, and are aggregated into decades or larger groups of years for older buildings. For these data for New York cities, an average year structure built of 1925 appears to be the earliest date used for any neighborhood. This 1925 date should therefore be interpreted as meaning housing stock from before World War II, including that from the nineteenth century. Fortunately, for our purposes this lack of precision is irrelevant, because there's not much difference in urban fabric (street layout and profile, right-of-way width, etc.) between neighborhoods dating from the 1800s and those built between 1900 and 1929 (when the advent of the Great Depression brought housing construction to a crawl). All neighborhoods with newer average years of construction are removed from the selected set, leaving us with a set of disadvantaged urban neighborhoods with the oldest housing stock, distributed across ten cities.

Step 6 examines the percentage of vacant land present in these neighborhoods. The Near Westside contains 19% vacant parcels, quite a high percentage – nearly one in every five parcels. While this certainly provides ample space for the redevelopment associated with economic revitalization to occur, it is an unnecessarily high bar. A less severe vacant land threshold of one vacant parcel out of every ten, or 10% vacant, still guarantees plenty of room for new development projects while eliminating fewer good candidates. This 10% threshold resulted in the elimination of a few neighborhoods each in Binghamton, Elmira, Niagara Falls, Utica, and Schenectady, and the elimination of 13 neighborhoods in Buffalo and 17 in Rochester. Overall 82 neighborhoods had a high enough percentage of vacant land to remain in the selection, out of 119 selected previous to this step. Lowering the vacant land threshold from 19% to 10% nearly doubled the number of neighborhoods remaining in the selection, from 44 neighborhoods to 82 neighborhoods.

Step 7 estimates a neighborhood's energy load and the different types of energy users within the neighborhood. Application of this same analysis process to the Near Westside (Census tracts 30, 39, and 40) indicates that the Near Westside contains seven parcels of constant load for every one parcel of long-term load. When looked at by individual tract, the Near Westside tracts' ratios range from six to eight. The threshold for this proportion is therefore set at 8:1, and neighborhoods are deselected that have more than eight parcels of constant load for every parcel of long-term load. Overall, 41 tracts were rejected in the load analysis, out of a total of 119 tracts (not considering those tracts rejected in the vacancy analysis). Analysis by parcel is a rough measure of load, but one readily made using only data publicly available and suitable for relatively fast analysis of large geographic areas. See "Limitations and Directions for Further Work" below for more discussion of this issue.

When combined with the vacancy analysis results, 59 total tracts comprise the final selected set of neighborhoods. Of these, Buffalo had by far the most at 24 tracts, and Rochester was second with 13 tracts. The remaining tracts are scattered over the other eight cities. Interestingly, all of the ten cities included since Step 3 of the analysis had at least one tract in the final selected set. See Table 2 and Figures 2-11 for details.

Table 2: Steps 6, 7, and final results for all cities

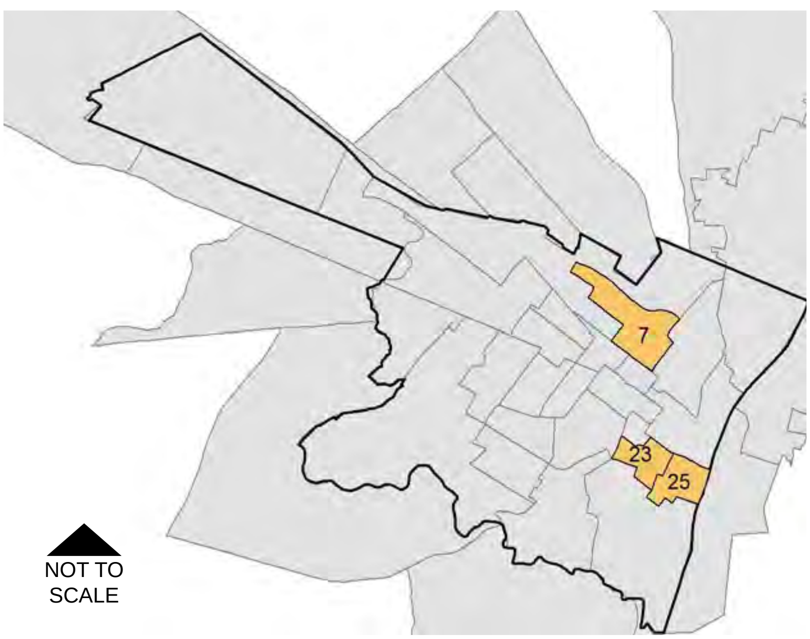
City	County	Tracts remaining after Step 5	Tracts rejected in Step 6 - vacant land analysis	Tracts rejected in Step 7 - load analysis*	Tracts in final selection
Albany	Albany	5	0	2	3
Binghamton	Broome	3	1	2	1
Buffalo	Erie	41	13	6	24
Elmira	Chemung	4	1	1	2
Jamestown	Chautauqua	2	0	1	1
Niagara Falls	Niagara	7	1	4	3
Rochester	Monroe	38	17	21	13
Schenectady	Schenectady	6	2	0	4
Troy	Rensselaer	3	0	0	3
Utica	Oneida	10	2	4	5

*Note: For expediency, Step 7 analysis included tracts rejected in Step 6.

Final selection reflects tracts removed in both Steps 6 and 7.

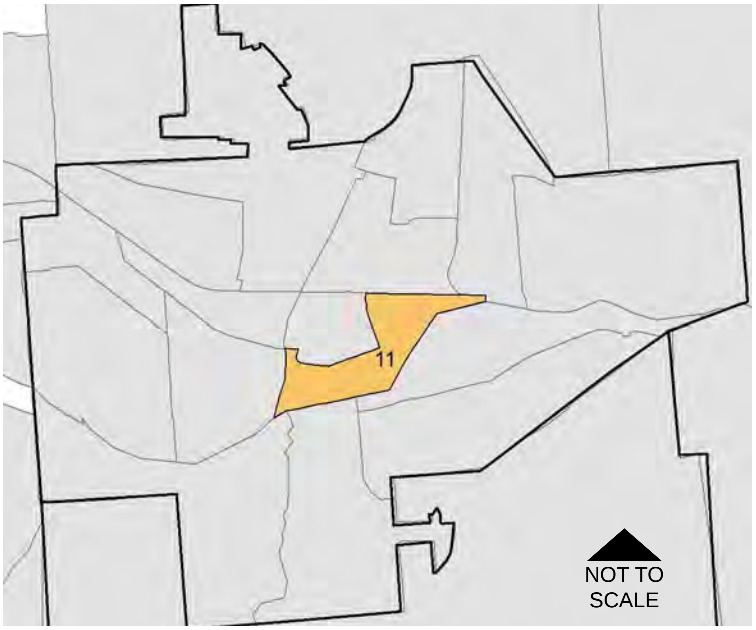
Figure 1: Map of Cities remaining after Step 3

Figure 2: Final selected neighborhoods, Albany, New York



Final selected neighborhoods labeled with Census tract numbers, shown within city boundary. Additional Census tracts within city shown for context.

Figure 3: Final selected neighborhoods, Binghamton, New York



All figures on this page: Final selected neighborhoods labeled with Census tract numbers, shown within city boundary. Additional Census tracts within city shown for context.

Figure 4: Final selected neighborhoods, Elmira, New York

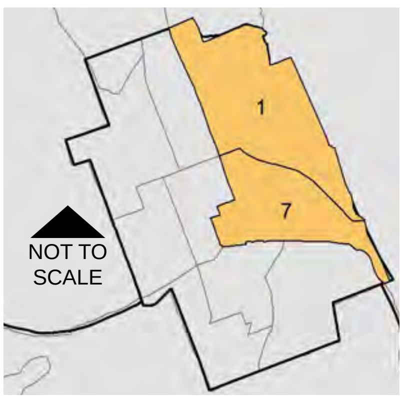


Figure 5: Final selected neighborhoods, Jamestown, New York

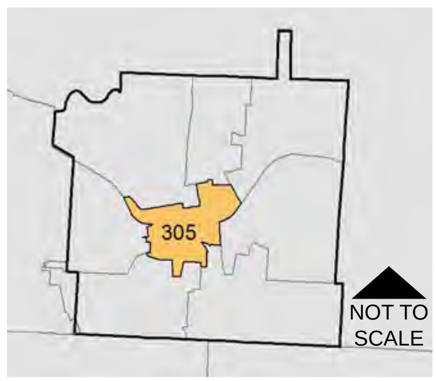
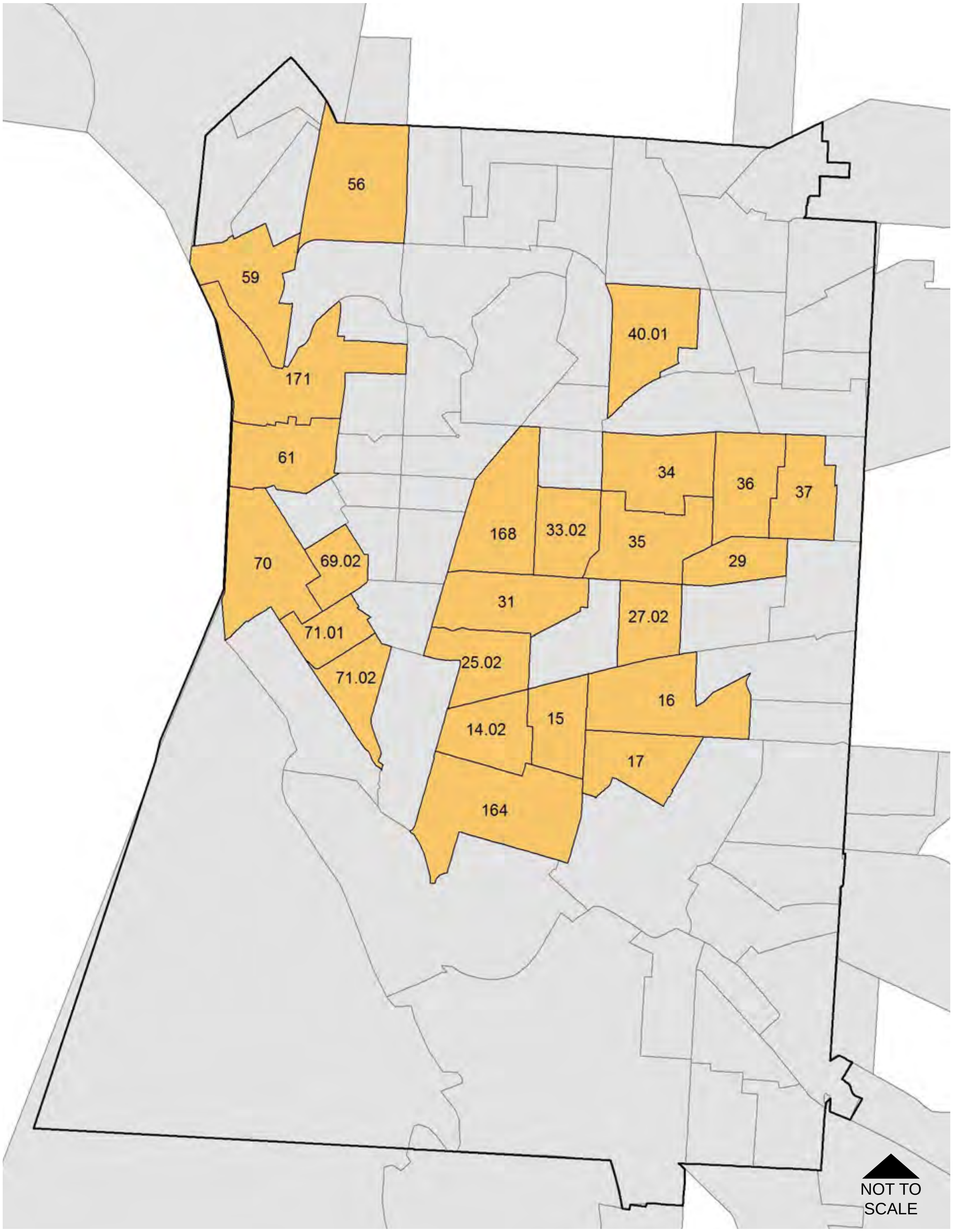


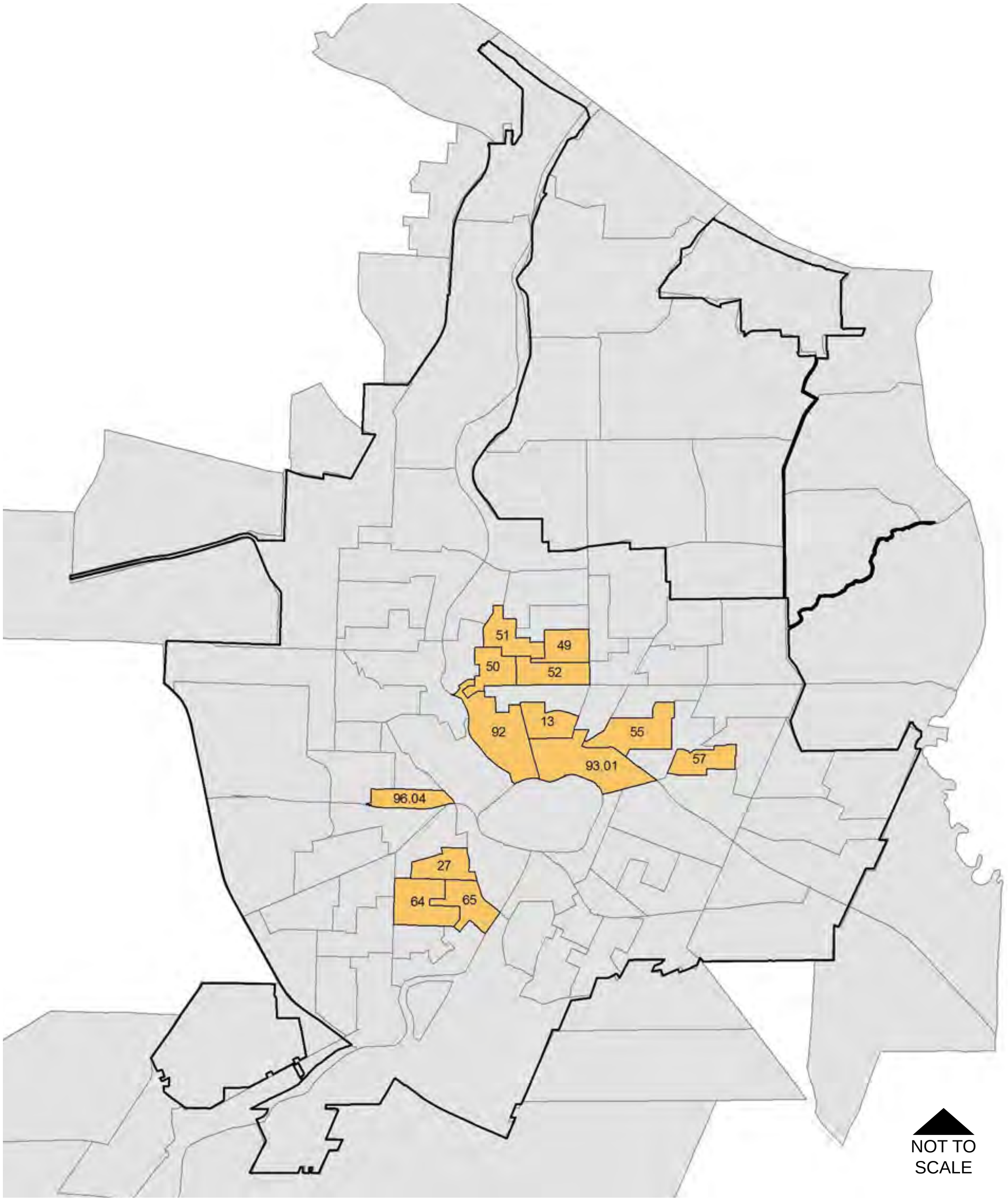
Figure 6: Final selected neighborhoods, Niagara Falls, New York

Figure 7: Final selected neighborhoods, Buffalo, New York



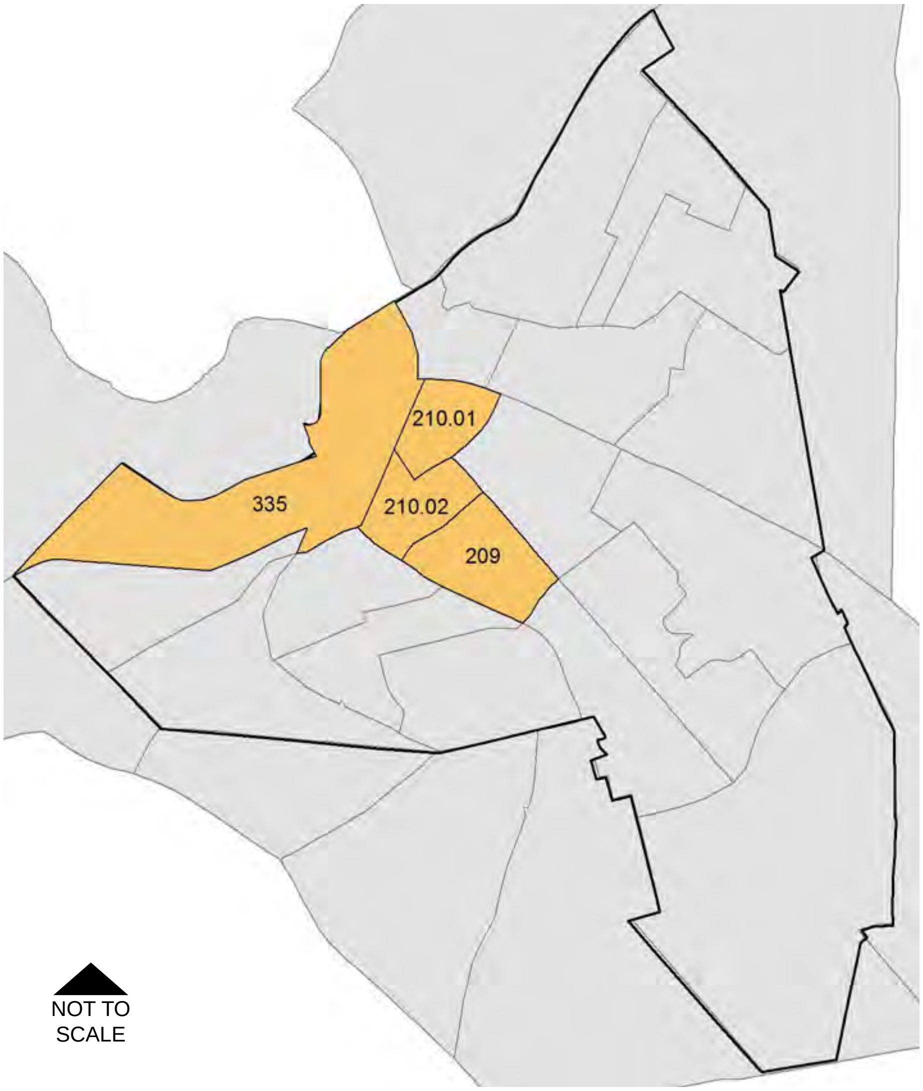
Final selected neighborhoods labeled with Census tract numbers, shown within city boundary. Additional Census tracts within city shown for context.

Figure 8: Final selected neighborhoods, Rochester, New York



Final selected neighborhoods labeled with Census tract numbers, shown within city boundary. Additional Census tracts within city shown for context.

Figure 9: Final selected neighborhoods, Schenectady, New York



Final selected neighborhoods labeled with Census tract numbers, shown within city boundary. Additional Census tracts within city shown for context.

Figure 10: Final selected neighborhoods, Utica, New York

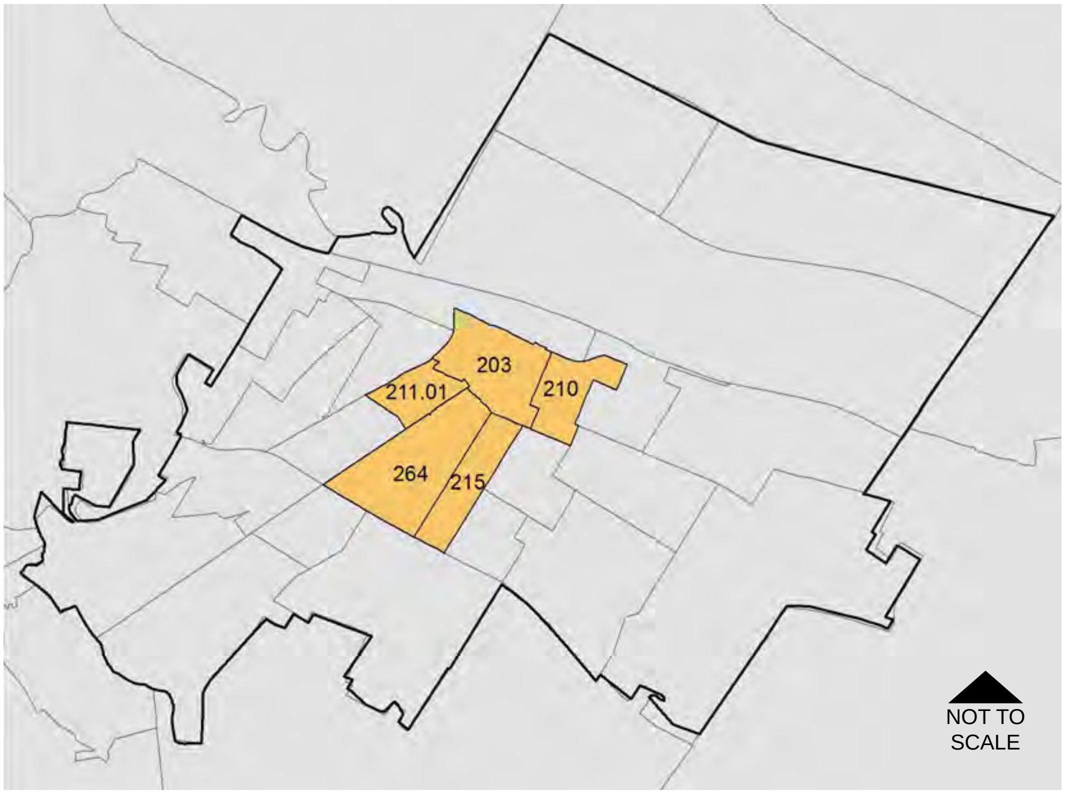
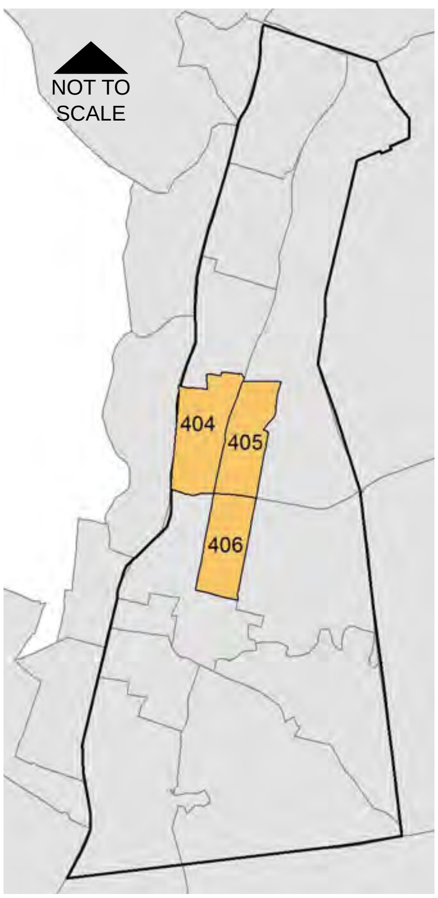


Figure 11: Final selected neighborhoods, Troy, New York



All figures on this page: Final selected neighborhoods labeled with Census tract numbers, shown within city boundary. Additional Census tracts within city shown for context.

Discussion

This study began with the assertion that the Near Westside was representative of many similar neighborhoods across Upstate New York: urban, with aging building stock and economic challenges, ripe for revitalization. The findings presented here indicate that this assertion is true, and that those neighborhoods span ten cities other than Syracuse. This identification supports the evaluation of the process created as a successful one, in that the findings have surface validity. Not every neighborhood was identified as a candidate, just a set of them, and the number of neighborhoods per city is reasonably correlated with the overall size and age of the city.

A larger question is that of the promise of community microgrids for bolstering economic revitalization in urban neighborhoods. The findings of this study are generally supportive of this notion, in that there were a considerable number of candidate neighborhoods identified that are similar to the Near Westside, and therefore as suitable for revitalization as the Near Westside. Community microgrids are a promising tool for encouraging urban revitalization, because they serve a number of functions in addition to providing real improvements in often faulty infrastructure. They enhance the reliability of power and can lower energy rates, a boon to existing residents and businesses and a lure to new ones. They can provide tangible investment in a neighborhood, important to residents who may feel neglected by outside authorities as well as demonstrating commitment to the neighborhood's future to new arrivals. As an innovative technique, community microgrids can provide a neighborhood with cachet, an ephemeral yet crucial quality in attracting new residents and businesses.

To realize these benefits, it's critical also to wisely design and implement two other components. A microgrid should produce cost savings on energy; who gets the benefit of these savings is fundamental to revitalization impact. Perception or reputation of the neighborhood, among residents and among outsiders, are also critical, because this is what truly stimulates investment. Utility improvements like microgrids are often completely invisible to the layperson, which misses the opportunity to depict a struggling neighborhood as a place where new investments are being made and the future is about to happen. Microgrid improvements can be installed in such a way that they are visible and attractive to passers-by and to people who live beside them. Skillful design can coordinate these improvements with other desirable neighborhood goals, such as year-round walkability or stormwater management, to provide maximum benefit with minimum cost.

Limitations and Directions for Further Work

Many of these limitations point the way to further refinements of this process, appropriate to the exploratory nature of this study. The availability of pre-existing data in a format feasible for inclusion in this study was a substantial limitation. Some of these data do exist, but were not available for this study due to security concerns, while others are simply unavailable at this geographic scale or in quantitative form. This includes consideration of the condition of existing energy infrastructure and the amount of new infrastructure required to install a microgrid within a given neighborhood, and evaluation of the similarity of a given neighborhood's existing electrical distribution system (ie: wiring diagram) to that of Near Westside. Proximity to employment center is important for gauging a neighborhood's suitability for revitalization, but this variable was eliminated from this study due to the team's inability to develop a reliable measurement for this that used data readily available for all Upstate locations and was feasible for use in a quantitative, GIS-based analysis process of a large geographic area. This variable could readily be added at a single-city scale, so it might be included in further investigation of the selected neighborhoods, along with their energy usage.

This process is limited to places above 50,000 residents by the Census definitions used, but smaller cities and towns may also have neighborhoods similar enough to the Near Westside to be good candidates for microgrid replication. The process could be refined to use a total population size in place of these designations if a more specific population range was desired. A final limitation is the assumption that electricity usage is relatively similar throughout each property class, and that electricity usage per long-term parcel is far higher than electricity usage per constant parcel.

Directions for Further Work

As a newly developed method, this process invites refinement, enhancing the process for broader use. The estimation of energy usage by numbers of parcels of particular property classes creates a rough estimate, as noted above. A more refined process could identify major energy users and include them in the balance of constant and long-term users. Attempts to incorporate this level of refinement in the process presented in this document were foiled by the lack of compatibility of general data on energy use by property type with the input of the NY Prize team, leading to the conclusion that the general energy use data was not specific enough to New York state or to cities like Syracuse. Another obstacle was some incompatibility between the categories with highest use, such as data centers, and the real property database property classes, which aggregates data centers with other office buildings.

The division of energy usage into constant/long-term/non-critical categories could likely be developed further through additional consultation with the Near Westside NY Prize team. The feasibility of the unusual Near Westside microgrid seems likely to depend primarily upon a handful of facilities, perhaps the supermarket and the public housing complex, and the energy rates they currently pay. These could be added in a final layer to the process, selecting only those neighborhoods that match the model neighborhood in this critical way. If a level of specificity is required that's greater than that provided by property class, important facilities might still be identified at the scale of an individual city or county.

A final refinement would add a check of the findings through groundtruthing. This involves a random selection of a few neighborhoods from the final selection, which are then investigated using maps, aerial photos, and other online resources, to verify that they are indeed similar enough to the model neighborhood. This could be used to either confirm the findings or to iteratively improve the process, as has been done elsewhere [21].

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