

# **How Geographic Information System (GIS) Data and Application Tools Can Be Used to Inform Renewable Energy Decisions: A Case Study**

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# Background

## Massachusetts Community Energy Strategies Program (2013 – 2015)

- Main objective: develop clean energy roadmap for communities
- Stone was one of two consultants who won the competitive bid to work on the project
- Conducted the GIS inventory of potential clean energy solutions
- Meister Consulting Group was other consultant that facilitated the public meetings, working group progress, and road map development
- Worked closely with MassCEC, towns, and Meister

## Basics:

- Quasi-Public Agency
- Created in 2008 by Governor Deval Patrick's Green Jobs Act
- Funded by the Renewable Energy Trust Fund (systems benefit charge paid by electric ratepayers)

## Mission:

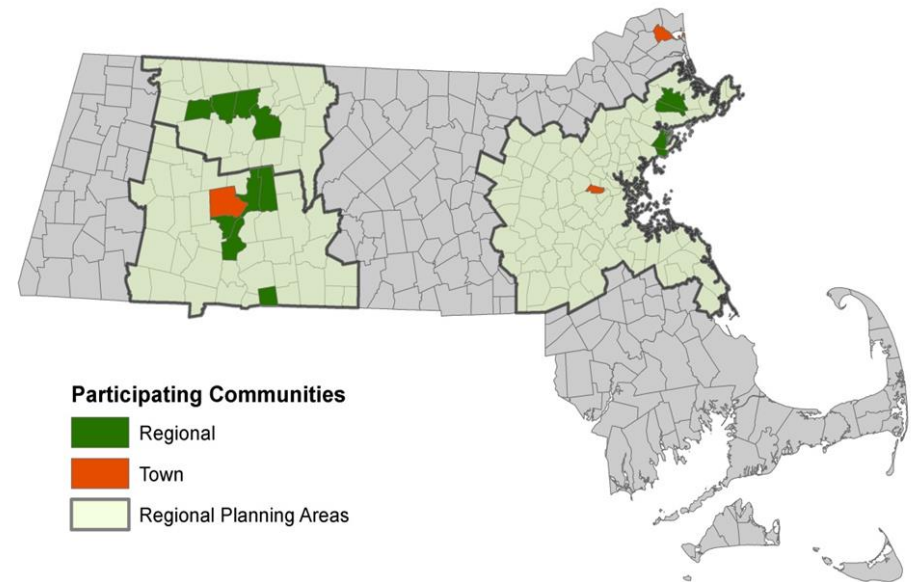
- **Accelerate** clean energy technologies, companies and projects
- **Create** high-quality jobs and long-term economic growth
- **Support** municipal clean energy projects
- **Invest** in residential and commercial renewable energy installations
- **Cultivate** a robust marketplace for innovation

# Community Energy Strategies Pilot Program

A Collaboration of MA CEC, DOER, and Local Government

## GOALS:

- Identify and implement an optimal mix of existing strategies and incentives
- Provide educational opportunities
- Promote ongoing ownership and implementation of clean energy goals.



# Community Energy Strategies Pilot Program

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## Assumptions

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*“Each community is unique. Renewable energy projects that work for one community may not work for another, and this program will help these communities find the best projects to fit their cities and towns,”*

*- MassCEC CEO Alicia Barton.*

# Community Energy Strategies Pilot Program

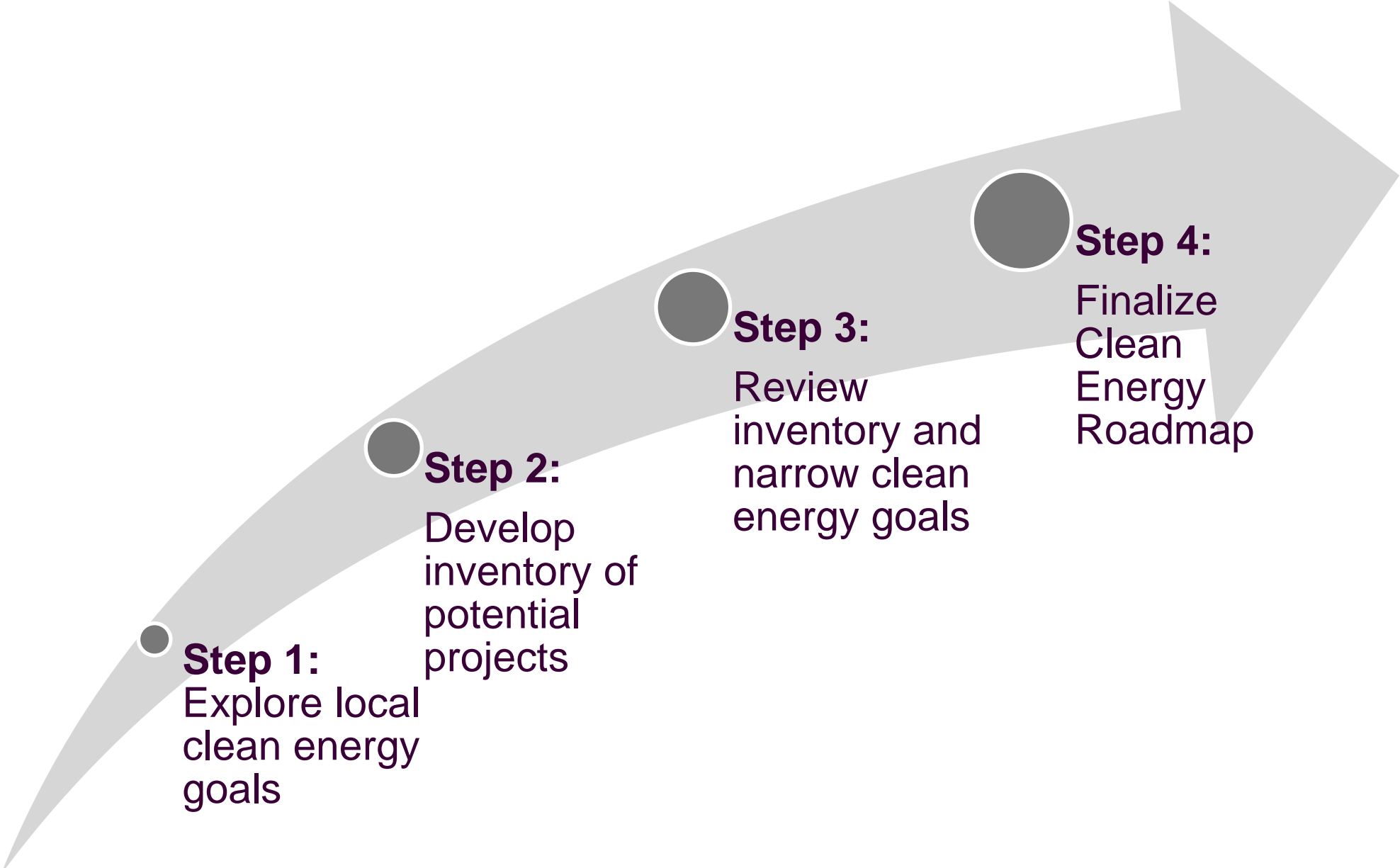
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## Assumptions

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Distribution and extent of clean energy opportunities can be realized through **GIS based spatial analysis** of infrastructure, and siting criteria for various clean energy technologies

# Community Energy Strategies Pilot Program: Four Steps



**Step 1:**  
Explore local  
clean energy  
goals

**Step 2:**  
Develop  
inventory of  
potential  
projects

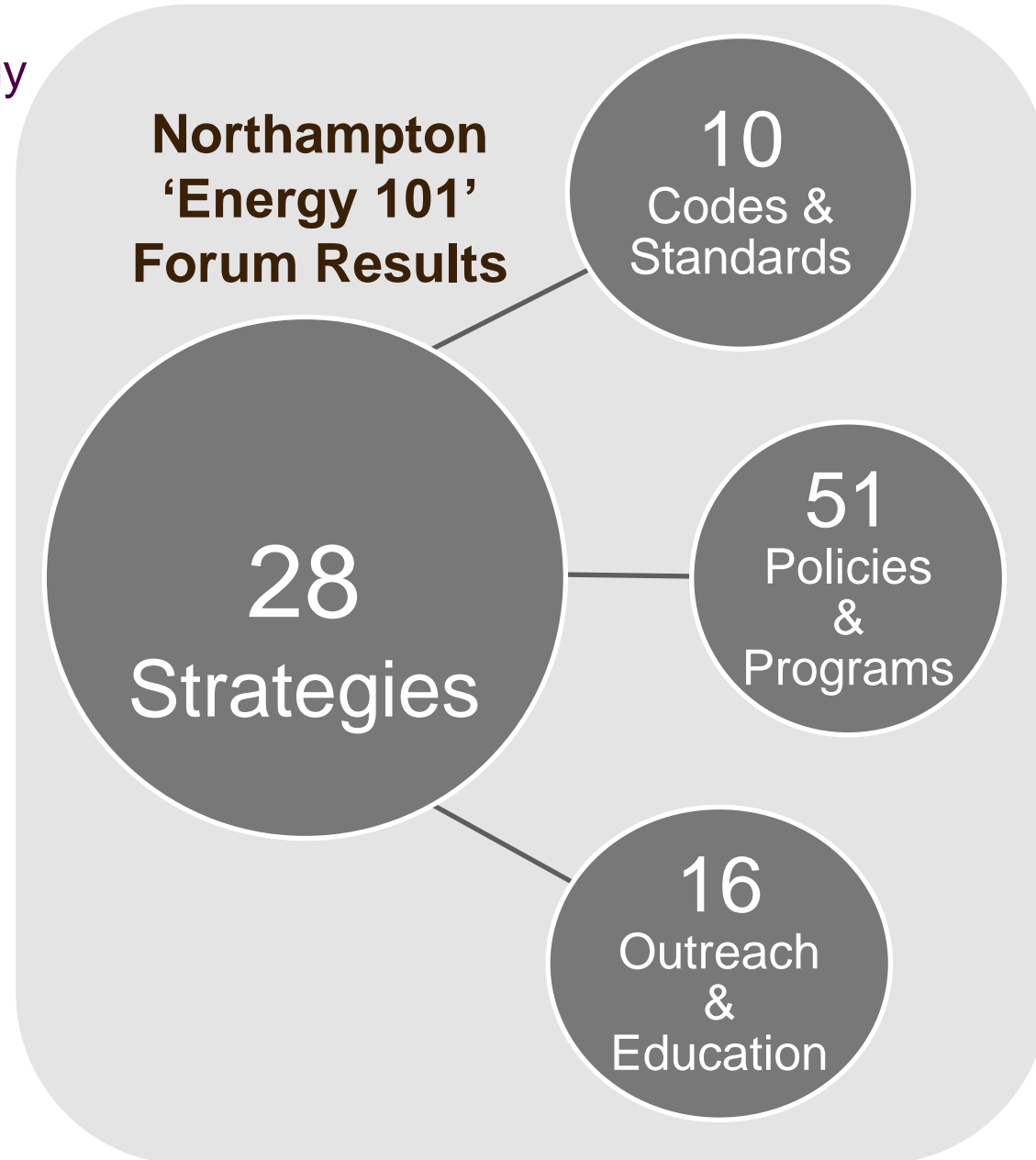
**Step 3:**  
Review  
inventory and  
narrow clean  
energy goals

**Step 4:**  
Finalize  
Clean  
Energy  
Roadmap

# Community Energy Strategies Pilot Program: Step 1

## Step 1: Explore Local Clean Energy Goals

- 'Energy 101' public forum
- Brainstorm to develop full listing of potential strategies, codes & standards, policies & programs
- Clean Energy Working Group helps guide process and narrow goals





# Community Energy Strategies Pilot Program: Step 2

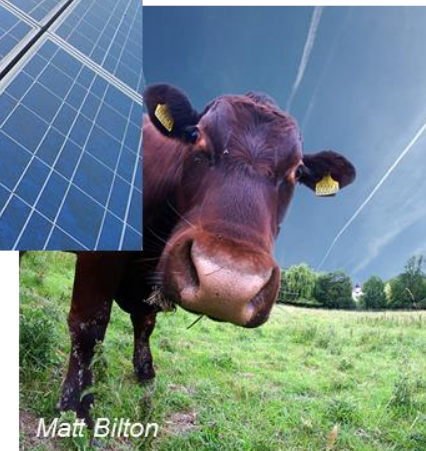
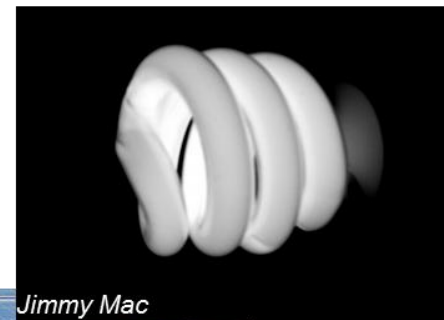
## Step 2. Develop inventory of potential clean energy projects

### GIS-based Evaluation:

- Energy Efficiency
- EV Charging Stations
- Other Community Specific Analyses...

### GIS-based Site Suitability Analyses:

- Large Ground Mounted Solar PV
- Wind
- Solar Canopies
- Anaerobic Digestion

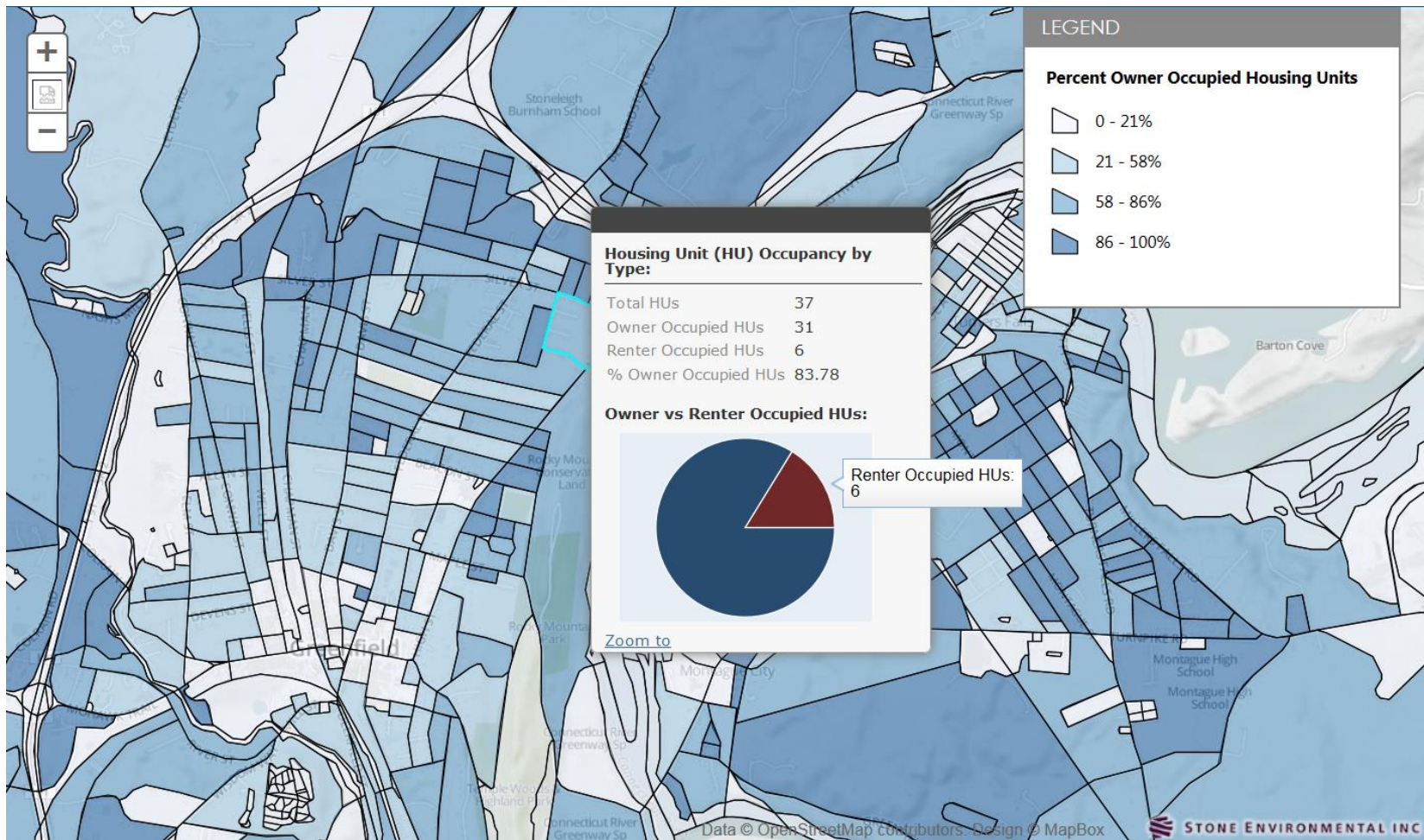


# Community Energy Strategies Pilot Program: Step 2

## GIS-Based Evaluation

Use GIS data to qualitatively understand clean energy opportunities

- Renter vs. Owner Occupied Housing: US Census



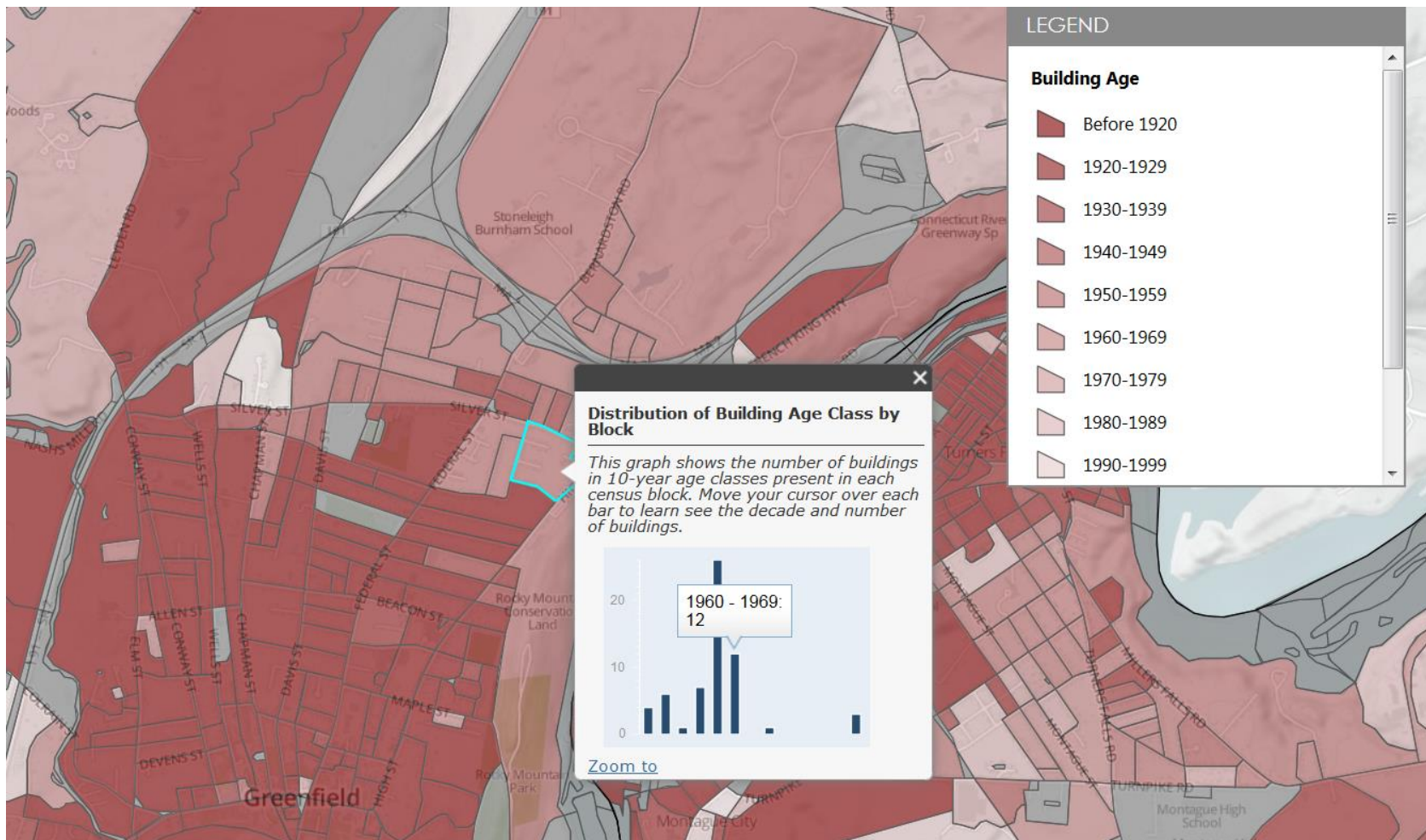


# Community Energy Strategies Pilot Program: Step 2

## GIS-Based Evaluation

Use GIS data to qualitatively understand clean energy opportunities

- Distribution of building age: Assessor Data



# Community Energy Strategies Pilot Program: Step 2

## GIS-Based Evaluation

Use GIS data to qualitatively understand clean energy opportunities

- Distribution of building age and land use class: Assessor Data

Time Period	Commercial	Industrial	Municipal	Open Space	Other	Residential	State	Grand Total
Before 1920	87	3	2	163	321	2,632		<b>3,208</b>
1930-1939	11				19	146		<b>176</b>
1940-1949	10	2		1	40	256		<b>309</b>
1950-1959	15	1	1		20	508		<b>545</b>
1960-1969	17	2			51	630		<b>700</b>
1970-1979	28	8			41	274		<b>351</b>
1980-1989	16	17		15	69	454		<b>571</b>
1990-1999	12	11		19	44	406		<b>492</b>
2000-2009	12	6		12	77	245		<b>352</b>
2010-present				1		6		<b>7</b>
Unknown	21		17	37	16	16	5	<b>112</b>
<b>Grand Total</b>	<b>241</b>	<b>55</b>	<b>21</b>	<b>252</b>	<b>716</b>	<b>5,850</b>	<b>5</b>	<b>7,140</b>

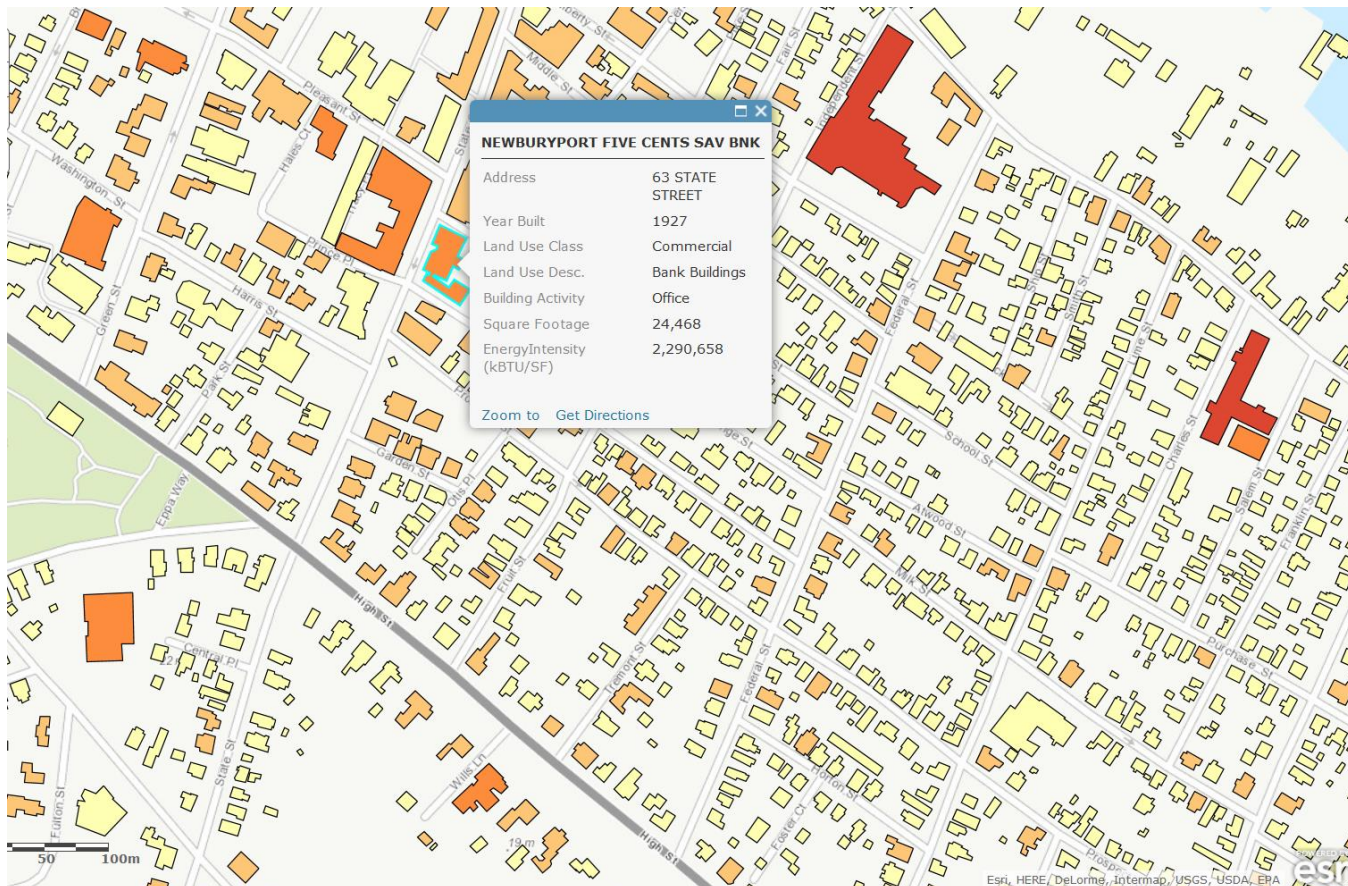


# Community Energy Strategies Pilot Program: Step 2

## GIS-Based Evaluation

### Use GIS data to qualitatively understand clean energy opportunities

- Estimate of Energy Intensity: Assessor data (building use, age, sq.ft) and US Energy Information Admin

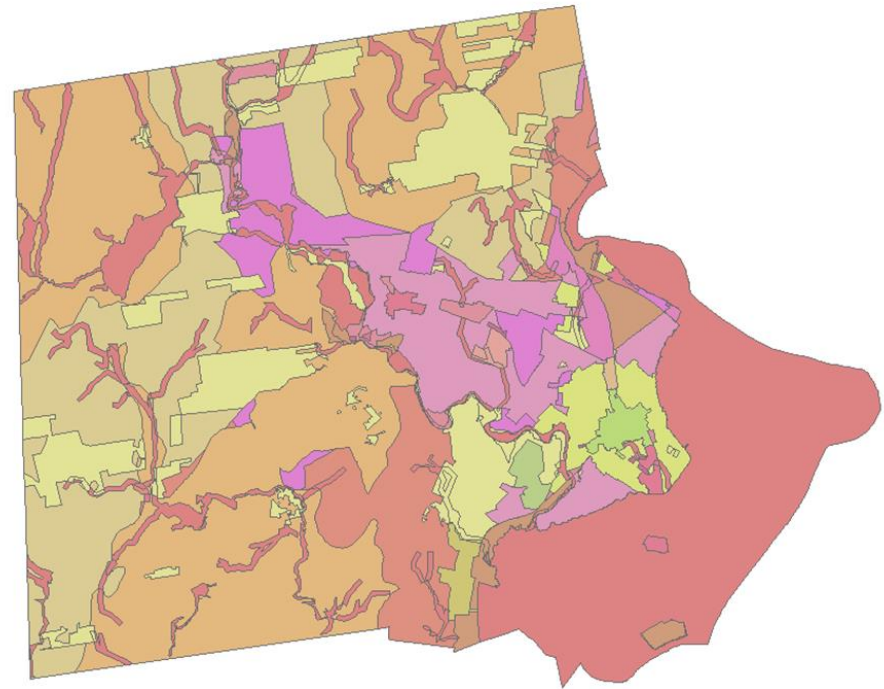


# Community Energy Strategies Pilot Program: Step 2

## GIS-Based Suitability Analyses

Identify and characterize areas that meet minimum threshold criteria

- Exclusion layers
- Concern layers
- Community-specific setbacks for the exclusion layers, concern layers, parcel boundaries and buildings
- Add additional zoning or conserved land restrictions
- Identify minimum parcel size requirements

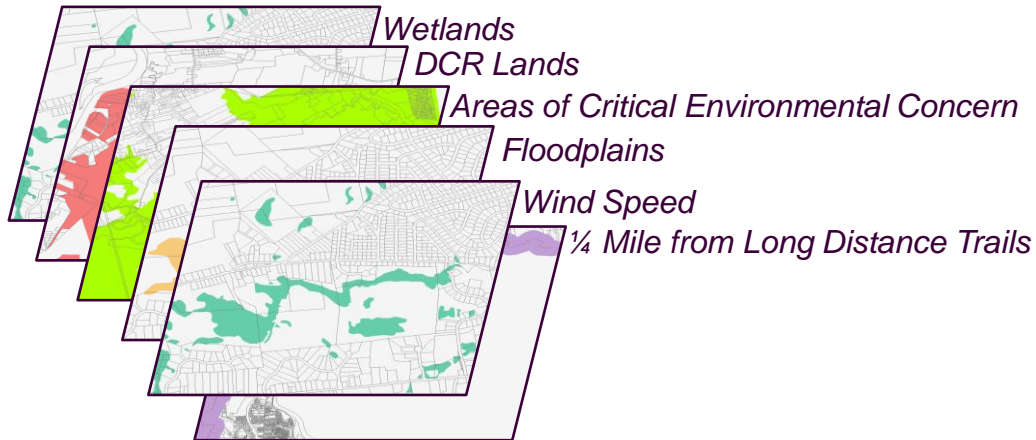


# Community Energy Strategies Pilot Program: Step 2

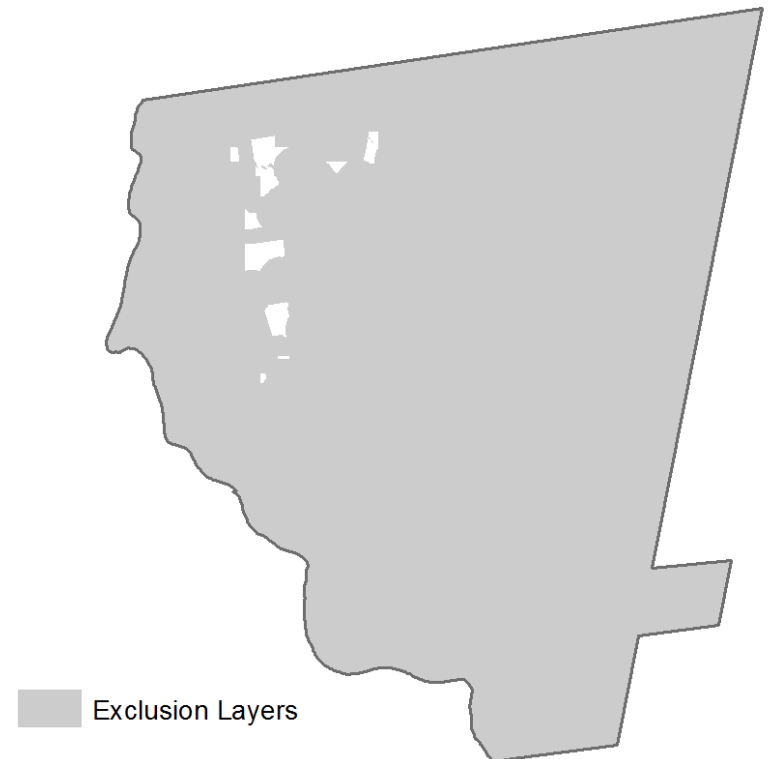
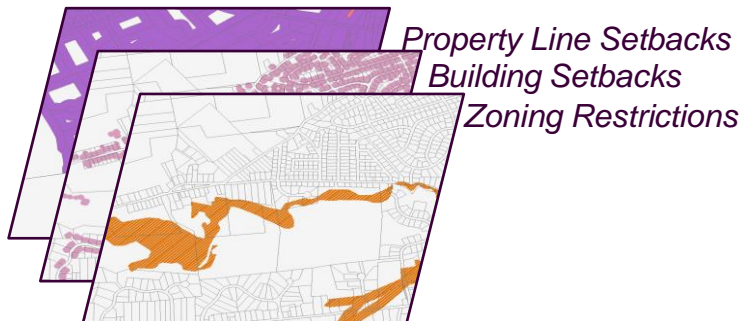
## GIS-Based Suitability Analyses: Wind Site Selection Example

Exclusions: *Layers that clearly indicate incompatibility based on minimum technical requirements or regulatory status*

### Statewide Datasets



### Local Datasets



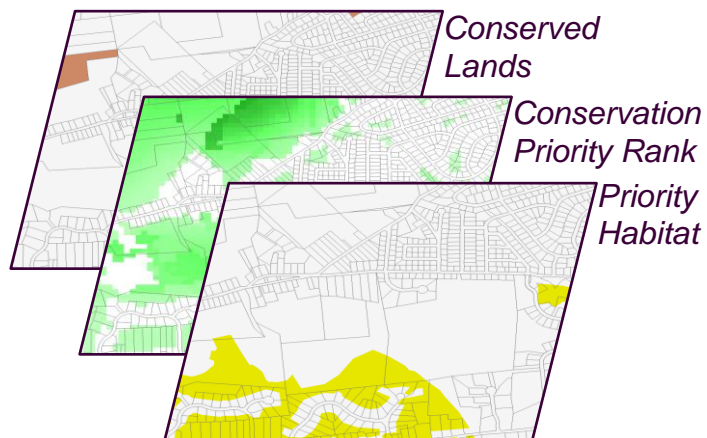


# Community Energy Strategies Pilot Program: Step 2

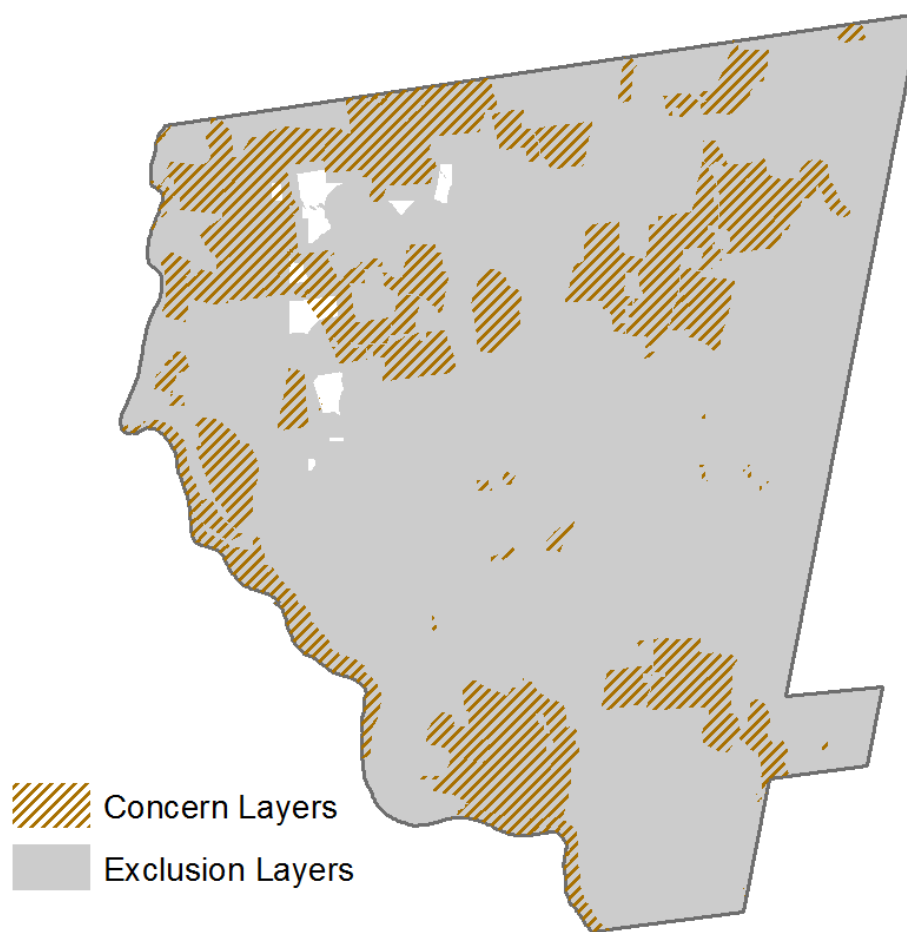
## Solar Site Selection Example

Concerns: *Layers that do not clearly indicate incompatibility but whose presence and selected attributes will inform decisions.*

### Statewide Datasets



### Local Datasets

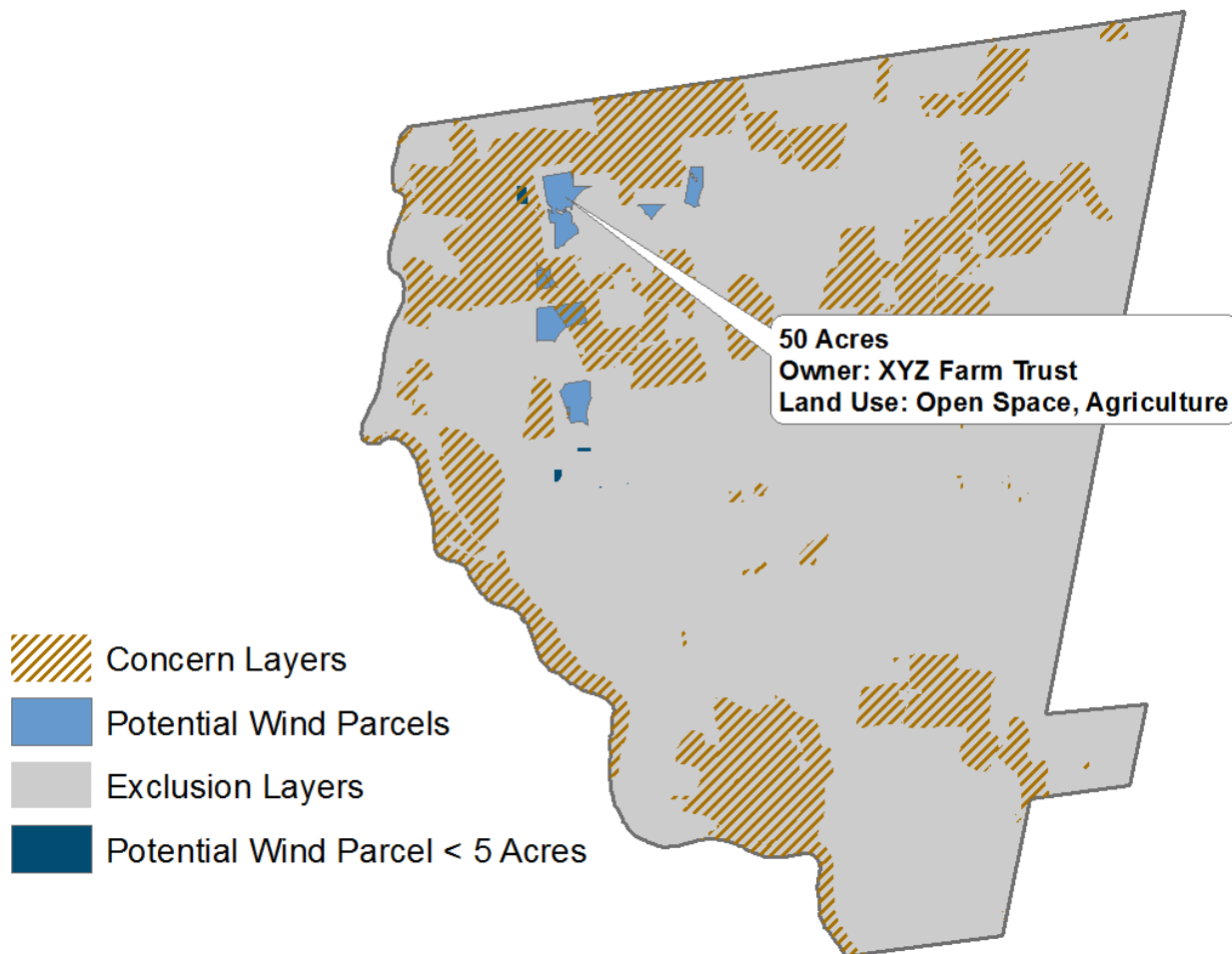




# Community Energy Strategies Pilot Program: Step 2

## Solar Site Selection Example

***Combine Exclusions, Concerns, and Minimum Parcel Cut-off***



# Community Energy Strategies Pilot Program: Step 2

Using **GIS tools** for Clean Energy Site Evaluation and Suitability allows for:

- Repeatability
- Flexibility
  - Use local data input
  - Alter setback distances
- Iterative analyses
  - Test multiple scenarios

**Large Ground Mounted Solar PV Site Identification**

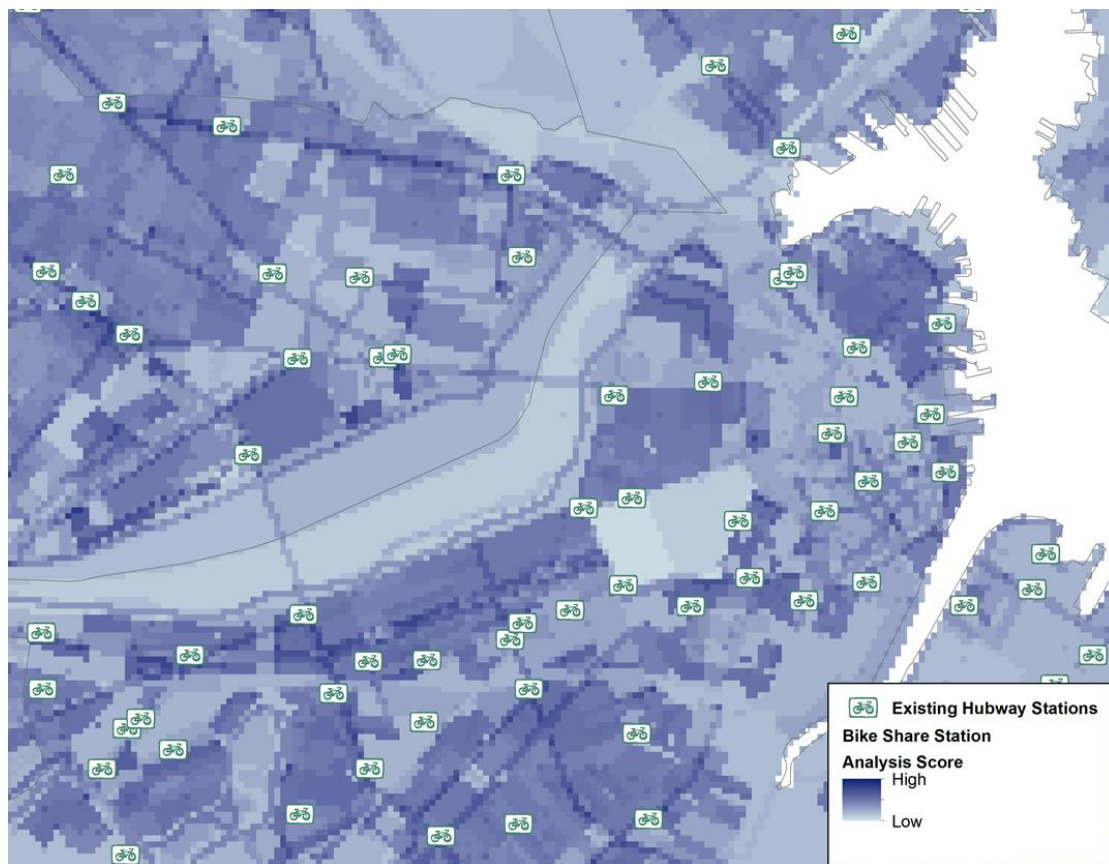
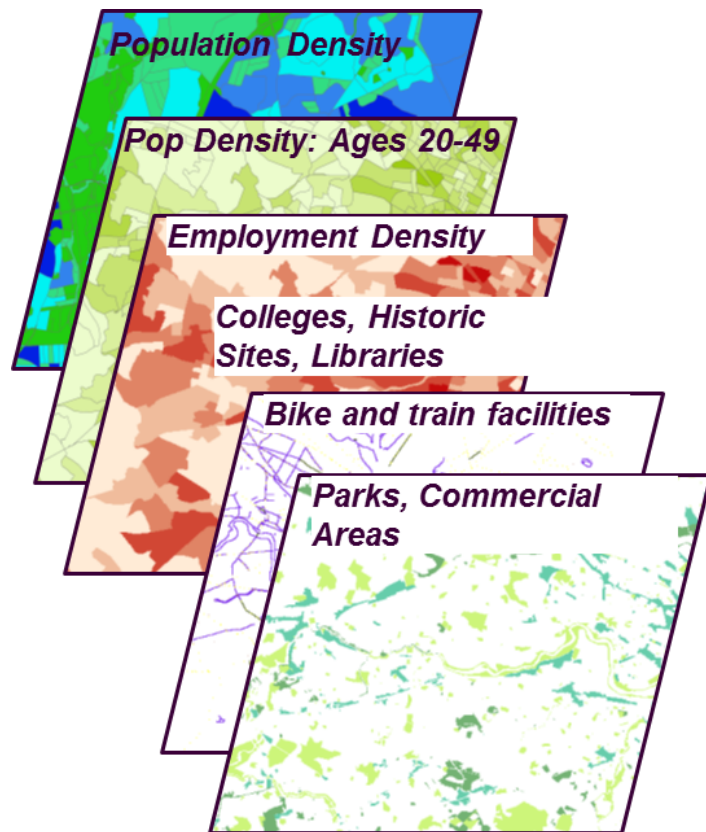
The 'Large Ground Mounted Solar PV Identification' tool identifies and characterizes sites for potential large ground mounted solar PV development projects and evaluates the effects of different setback distances from property lines and structures. The polygons contain summary data for basic characteristics such as average solar potential (if available), land ownership, and land use as well as the presence/absence and selected attributes of data layers which will inform stakeholder decisions.

The tool uses exclusion and concern layers developed using the 'Exclusion and Concern Layer Processing' tool and the 'Optional Exclusion and Concern Layer Processing' tool. Exclusion layers are layers that clearly indicate incompatibility based on minimum technical requirement or regulatory status. Concern layers are layers that do not clearly indicate incompatibility but whose presence and selected attributes will inform decisions. For each polygon that meets the concern criteria, a binary field will be populated which indicates presence or absence of these layers.

The output of this tool results in a file geodatabase including several feature classes. The final output is a polygon feature class called 'PotentialSolarParcels' of suitable solar sites within the selected area of interest. Results are processed at the parcel level. Where available, the parcel

# Community Energy Strategies Pilot Program: Step 2

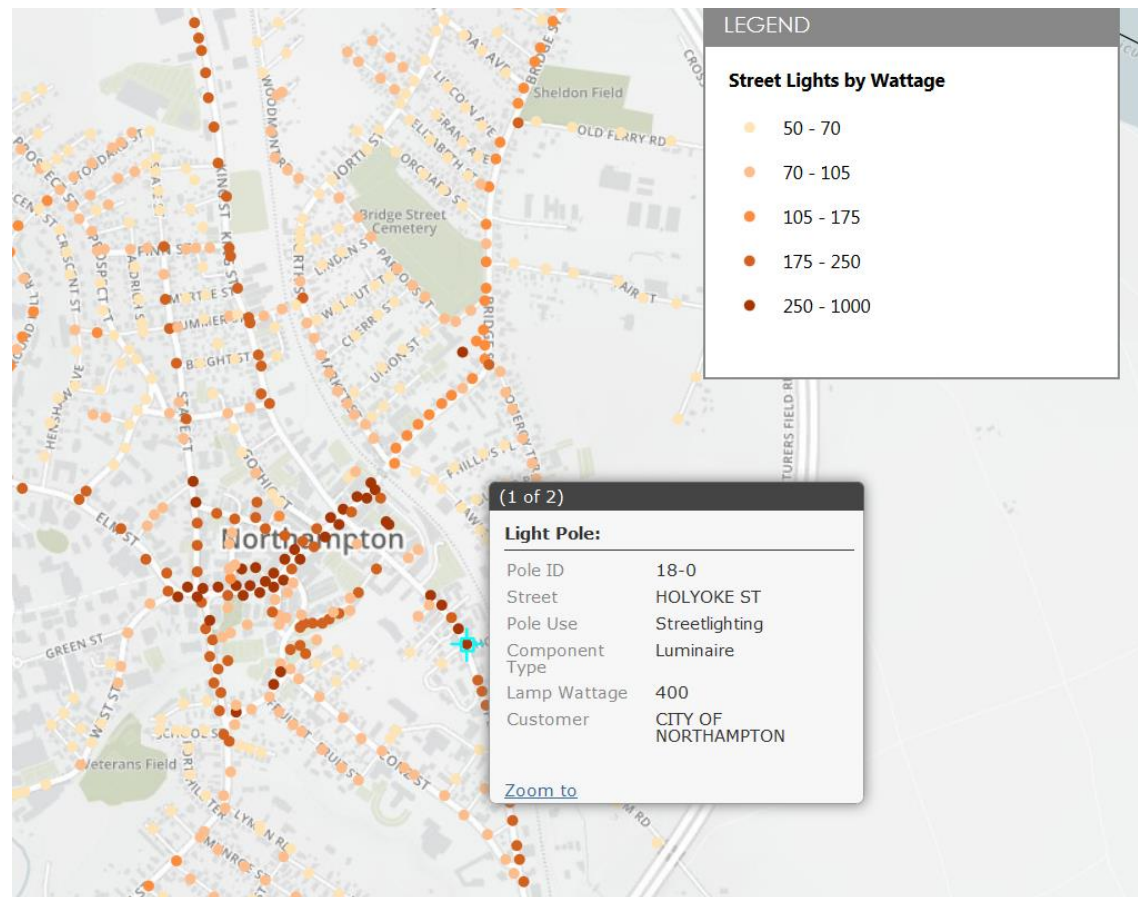
## Additional GIS Analyses: Statewide Bike Share Station Suitability



# Community Energy Strategies Pilot Program: Step 2

## Additional GIS Analyses: Northampton Street Light Retrofit Program

- Connected spreadsheet inventory to pole locations
- Display Current Wattage
- Target LED Upgrade Locations





# Community Energy Strategies Pilot Program: Step 3

## Step 3: Review Inventory and Narrow Clean Energy Goals

- Clean Energy Working Group reviews inventory
- ‘Energy 201’ public forum to narrow goals and establish priorities
- ‘Energy 201’ public forum provides education about technologies of interest
- Revise analyses, where needed

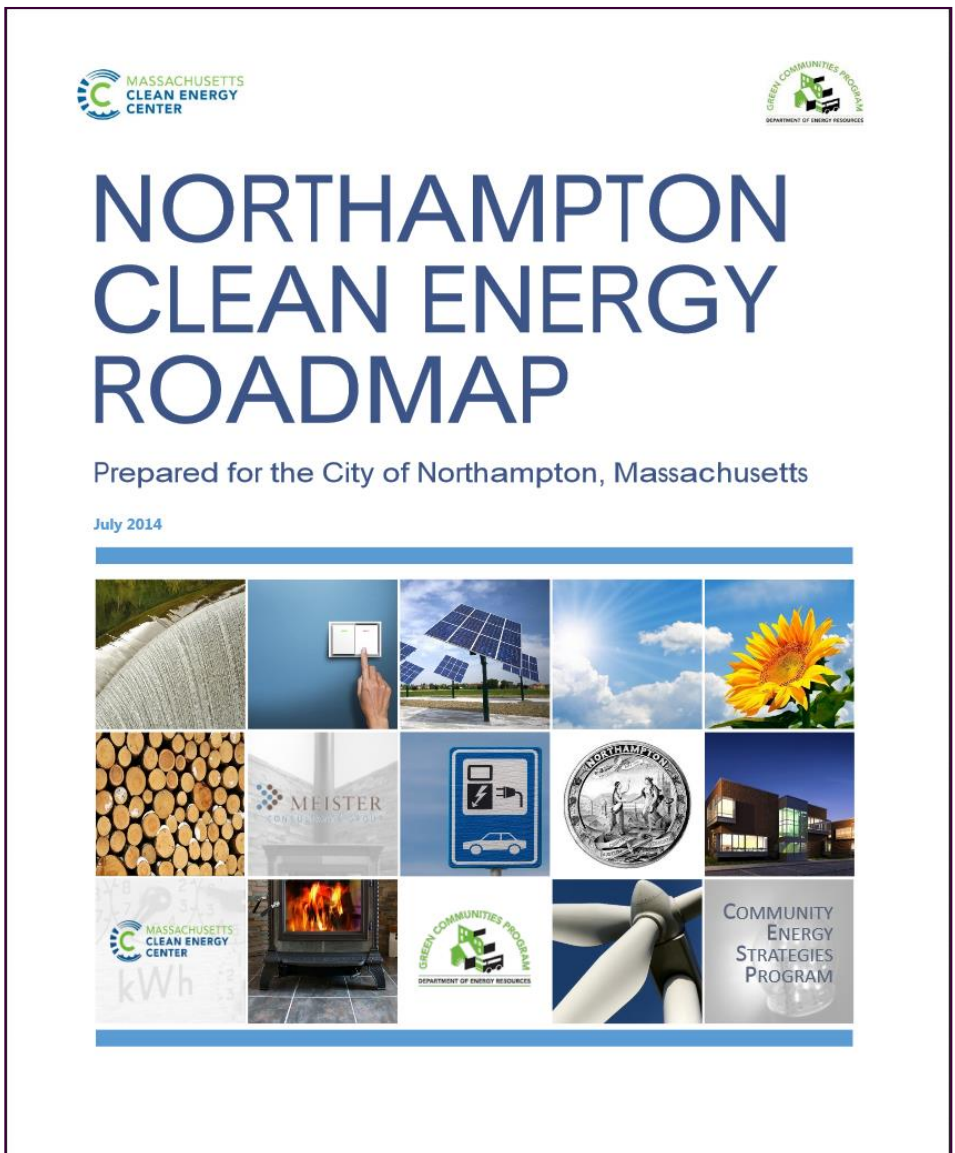


# Community Energy Strategies Pilot Program: Step 4

## Step 4: Finalize Clean Energy Roadmap

- Final site suitability analyses compiled and presented
- Actual project options developed
- Interactive web maps of results to share with public

<http://mapping.masscec.com.s3.amazonaws.com/CESP/ROADMAPS/Northampton.pdf>



# Community Energy Strategies Pilot Program: Step 4

## Actual Project Options

### Strategies

- Objectives
- Description
- Benefits & Risks
- Financial Costs & Benefits
- Next Steps
- Resources

#### STRATEGY 1. DEVELOP COMMUNITY SOLAR PROJECT

A Northampton community solar project will allow residents that are unable to own their own solar installations to purchase locally produced solar electricity, saving them money and contributing to community renewable energy goals.

##### OBJECTIVES

- |   |   |
|---|---|
| ★ | Coordinate the development of a community solar project for Northampton residents.          |
| ★ | Save participating residents money on their electricity bills.                              |
| ★ | Reduce community greenhouse gas emissions and promote the development of large-scale solar. |

##### BACKGROUND AND STRATEGY DESCRIPTION

Many Northampton residents are unable to take advantage of the growing Massachusetts solar market because they either rent their residences or because their homes are unsuitable for solar. Community solar initiatives are one way to allow these residents to take advantage of low-cost solar power. Under the community solar model, a developer builds a PV system at an off-site location and participating residents agree to purchase energy from that system, typically at a discount compared to electricity from traditional electricity sources. There are a range of business models, such as direct ownership by local investors or development and financing by a third-party entity. Current Massachusetts net metering regulations are some of the most favorable in the nation for community solar projects and several municipalities have already established programs with the support of private developers.

As part of this strategy, Northampton staff will work with local volunteers to develop a community solar program, which will:

- Evaluate potential community solar ownership models.
- Identify potential city-owned or privately-owned sites within Northampton to support a community solar installation.
- Recruit potential community solar program participants.
- Assist with the procurement of a community solar program vendor.

With prices for solar installations at all-time lows and new state incentive programs that will favor community solar installations, a coordinated effort to develop a community solar initiative could significantly benefit the Northampton community.


# Community Energy Strategies Pilot Program: Step 4

## Step 4: Finalize Clean Energy Roadmap


### Northampton Clean Energy Map Gallery

[Back to Roadmap](#)


#### Map Categories




Start Here




Community Information



Buildings and Efficiency



Renewable Energy ...



Transportation

#### About the Maps

These maps were created as companions to the Clean Energy Roadmap. Each map features multiple layers that correspond to specific strategies to increase local renewable energy generation, renewable heating and cooling, building energy efficiency, and sustainable transportation. Each map layer has a brief description with links to the corresponding sections of the Clean Energy Roadmap. Simply select a map to open!



#### Additional Resources

[CESP Northampton Website](#)  
[DOER Green Communities Division](#)  
[Sustainable Northampton](#)

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#### About the Community Energy Strategies Pilot Program

The Community Energy Strategies Pilot Program (CESP) is an initiative developed by the Massachusetts Clean Energy Center in collaboration with the Department of Energy Resources Green Communities Division. The program, delivered in partnership with local officials and community volunteers, helps communities identify and develop strategies for implementing the mix of clean energy projects and incentives best suited to address local interests, needs, and opportunities for clean energy development across all sectors.

[energyplanning@masscec.com](mailto:energyplanning@masscec.com)



# Community Energy Strategies Pilot Program: Conclusions

- Community focus
- Opportunities for public involvement
- Develop statewide datasets for communities
- Tools give communities flexibility to use their own data



STONE ENVIRONMENTAL

## Questions

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