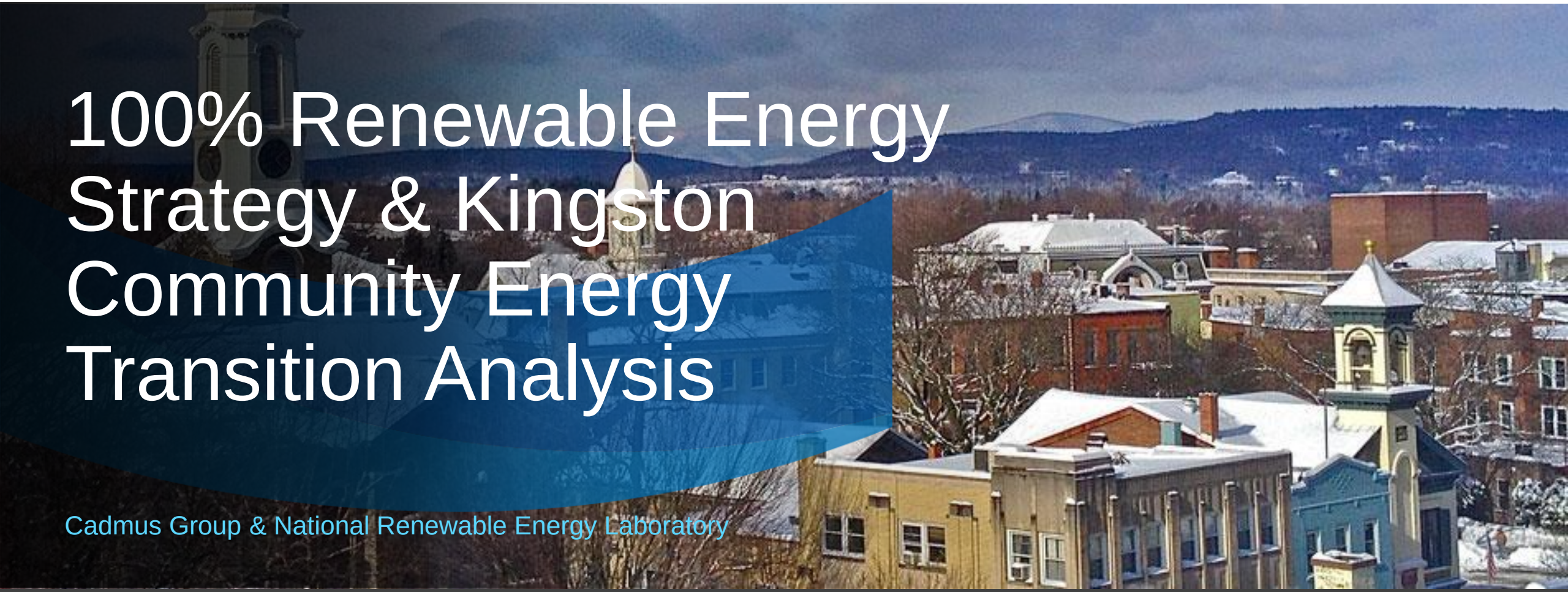
CADMUS

NREL Transforming ENERGY



100% Renewable Energy Strategy & Kingston Community Energy Transition Analysis

Cadmus Group & National Renewable Energy Laboratory

CADMUS

Project Team

CADMUS

NREL Transforming ENERGY

Our combined team brings:

City 100% Renewable Energy Planning Experience and Thought Leadership

New York State Clean Energy Expertise

Strong Technical Skills on Building, District, and Community-wide RE/EE Analysis

A Stakeholder and Equity Focus in Energy Planning

Project Goals

Supporting the City of Kingston in its climate planning efforts

- **Developing a Renewable Energy Roadmap** that will identify a **suite of local policies, programs, and strategy options** to help The City of Kingston and its residents plot the right path to **achieve 100% renewable electricity supply** and quantify the potential greenhouse gas mitigation impacts.

- **Identifying building, district, and community-wide renewable energy and energy efficiency options** that could enable Kingston to rapidly transition to high levels of energy efficiency in the built environment, 100% renewable electricity supply, and resilient energy infrastructure.

- **Quantifying the potential local job impacts** of the recommended renewable energy and energy efficiency measures.

Project Approach

CADMUS

- Project Manager
- Policy and strategy lead
- Developing a policy pathways analysis to identify the suite of local policies, programs, and strategies best able to drive rapid progress toward 100% renewable energy.

NREL

- Technical lead
- Identifying optimal pathways for buildings, district, and community-wide renewable energy and energy efficiency opportunities.

Cadmus SOW

Developing a Renewable Energy Roadmap that will identify a suite of local policies, programs, and strategy options

Tasks	Description
Renewable Energy Program Strategy Framework	• Strategy document that will articulate the values and principles that should guide the selection of RE policies and programs
Renewable Energy Policy and Strategy Pathway Analysis	• Assessment of past and active policies, programs, and projects • Compilation of Potential Policy Options • Barriers and Opportunities Assessment • Policy and Strategy Analysis Matrix
Scenario Analysis	• Baseline Power Mix Projection and Model • Develop Four High RE Power Mix Projections • Quantify GHG and Cost Reduction Impacts
Roadmap Development	• Identify a specific mix of strategies for reaching 100% RE • Identify major implementation steps

NREL SOW

NREL City Energy Core Knowledge Areas

- Policy
- Planning
- Economic Analysis

- Resiliency
- Micro Grids
- Battery Storage

- Grid Integration
- Transportation
- Alternative Fuel Vehicles

- Buildings
- Energy Efficiency
- District Energy

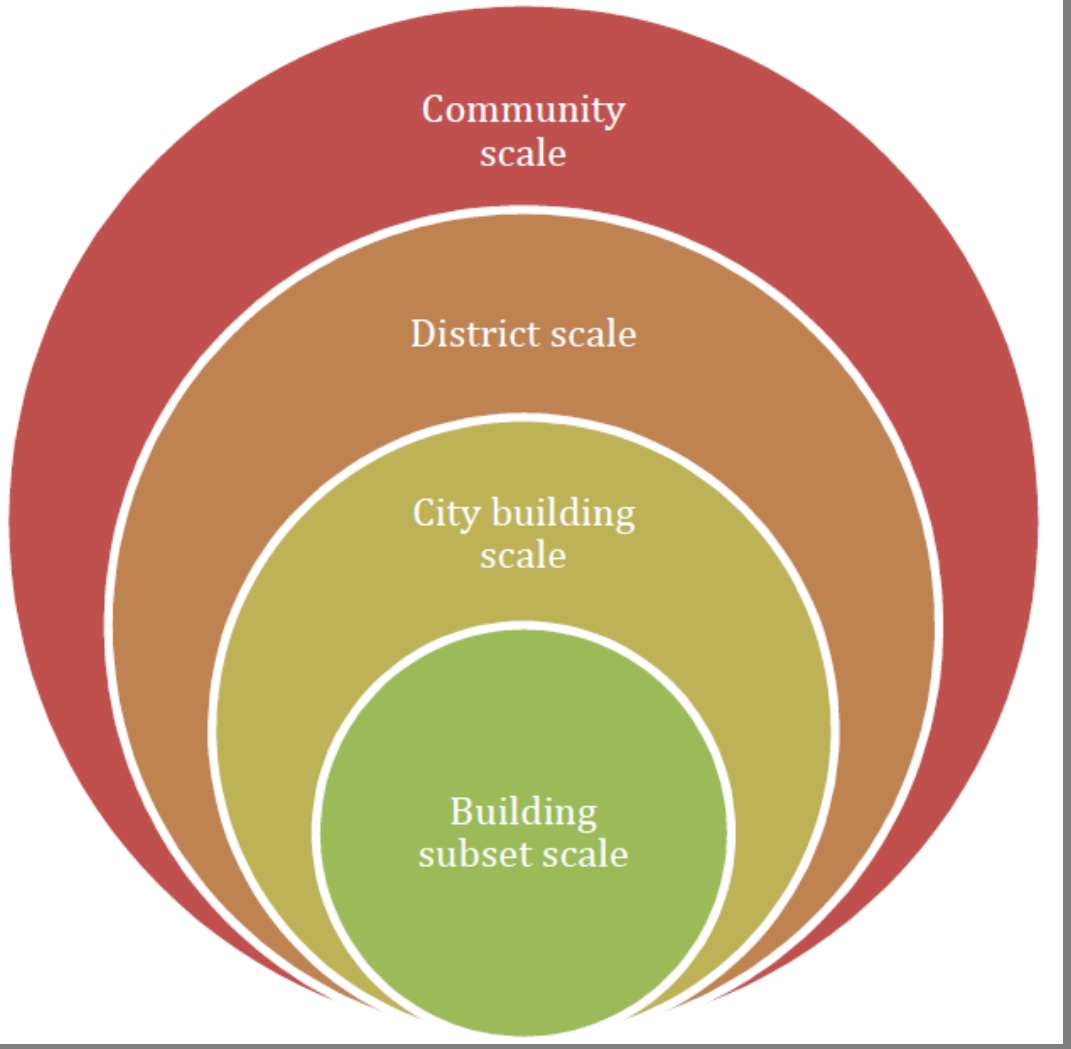
- Solar
- Wind
- Geothermal
- Bio Energy

NREL approach

Progressive scales of analysis, representing concentric circles of opportunity and stages of energy transition to meet city energy and renewable goals, including:

- 20% energy use reduction by 2020
- 20% renewable energy by 2020
- 100% renewable energy by 2050

NREL
Transforming ENERGY



NREL technical and applied energy modeling is designed to complement and provide foundational data for Cadmus policy pathways analysis

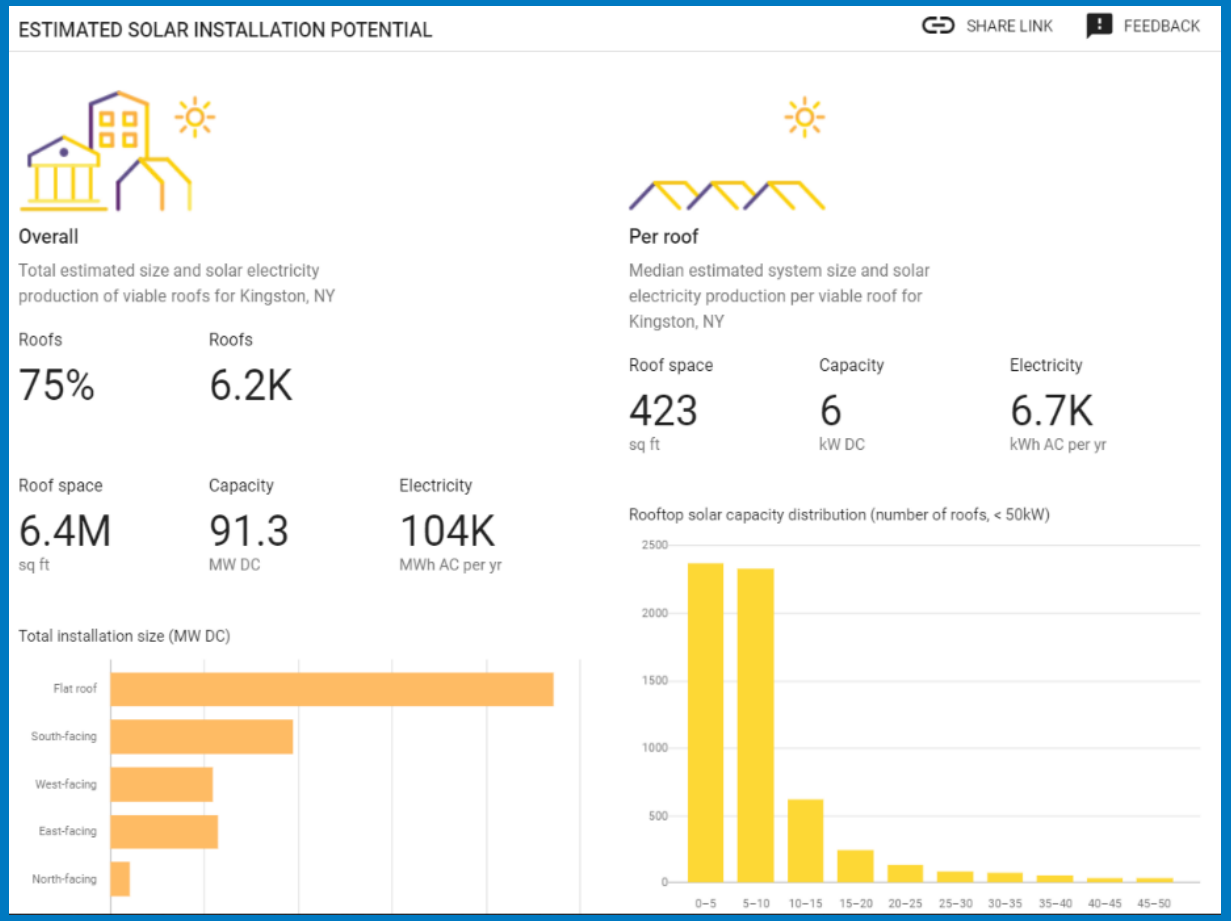
NREL
Transforming ENERGY

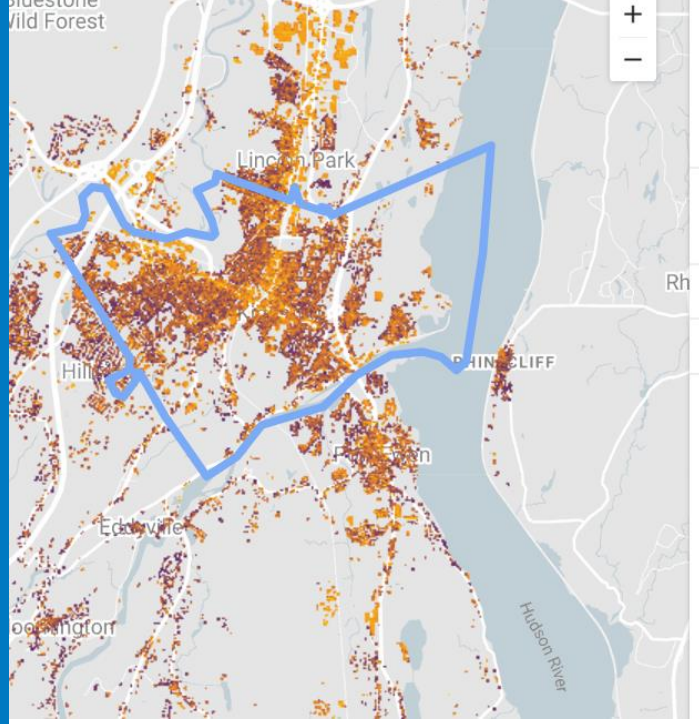
Tasks	Activities	Deliverables
1. Residential and commercial building subset analysis	Detailed, building-specific analyses of Land Bank residential buildings, two commercial buildings (Metro building and TBD)	Optimized energy efficiency and renewable interventions that can support net-zero energy buildings
2. City building analysis	• Review past efficiency recommendations • Model building efficiency and on-site renewable and renewable plus battery storage potential • Estimation of aggregated labor and materials for the building and city scales	• Optimized energy solutions and cost savings opportunities tailored to each building's load profile, for four to seven city-owned buildings • Workforce development potential analysis • Standard Work Specifications for Home Energy Upgrades aligned with optimized building interventions
3. District analysis	Franklin Street Revitalization Project area energy modeling, using Renewable Energy Optimization (REopt) model or UrbanOpt, for a subset of buildings to match modeled building energy load with optimized, cost-effective renewable energy solutions	• Analysis of feasibility of district-wide on-site renewable energy and energy efficiency opportunities • Net present value of energy resilience aspects of modeled solutions

Kingston Rooftop Solar Energy Potential

Google Project Sunroof Data Explorer total rooftop PV potential (99% city area covered):

104k MWh/yr. = 59% of 2010 consumption (177,229 MWh)





Estimated rooftop solar potential of Kingston, NY

Last updated: 11/2018

Sunlight on rooftops

Shady Sunny

Existing solar arrays

Median household income

Buildings

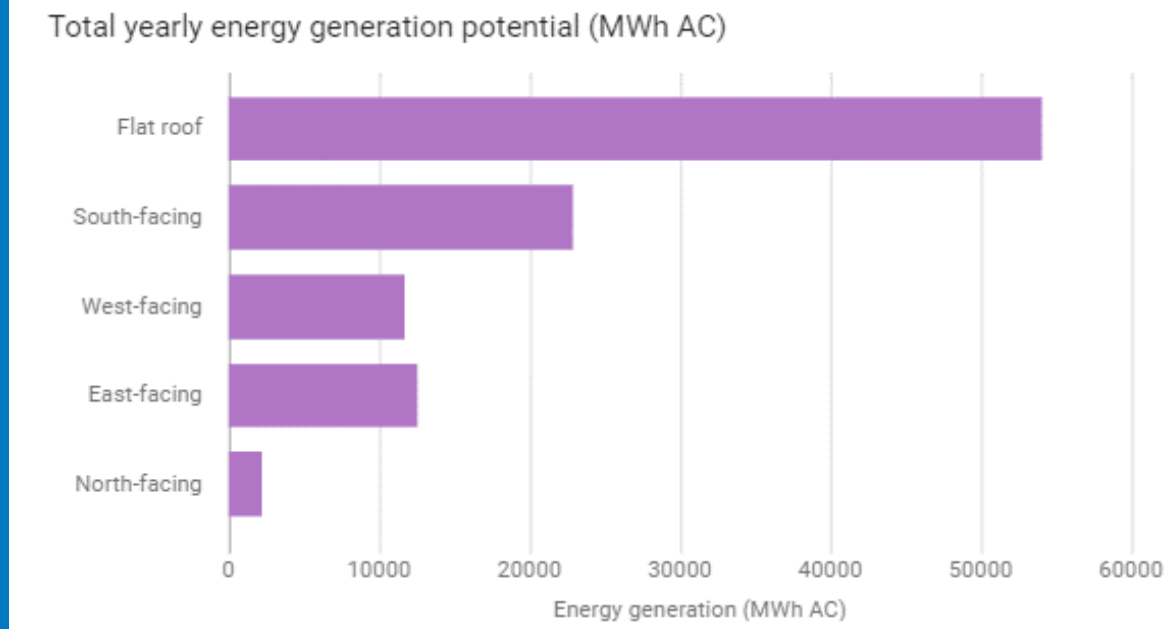
75%

solar-viable

9

existing solar installations

Based on 99% data coverage over buildings in this geographic area. All estimates are based on buildings viable for solar panels. Included panels receive at least 75% of the maximum annual sun in the county. For Kingston, the threshold is 975 kWh/kW. Read about Project Sunroof's methodology for defining solar



https://www.google.com/get/sunroof/data-explorer/place/ChIJJ4HJLQEP3YkRE8kyWFqJ10E/

Alignment of Cadmus & NREL SOW

Task Area	Cadmus	NREL
Strategy Framework	• Draft strategic framework aligning priorities for renewable energy with parallel Kingston objectives	• Review/advise on framework
Renewable Energy (site and citywide)	• Renewable energy policy and strategy selection, scenario modeling, and roadmap	• Technical and market potential analysis (building-specific, district, and city-wide) • Siting recommendations
Energy Efficiency	• Review	• Deep energy retrofit specifications for a subset of buildings, options analyses at district and city-wide scales
Clean Energy Economy	• Review	• Estimate workforce development potential

CADMUS

Thank You

Megan Day

NREL

Megan.Day@nrel.org

Chad Laurent

CADMUS

Chad.Laurent@cadmusgroup.com