EVERSOURCE – UCONN PARTNERSHIP RESEARCH PILLARS

UCONN TECH PARK

ENERGY CENTER

1. Grid Resilience in a Warming Climate
2. Grid Reliability in a Changing Demand Environment
3. Renewable Energy Integration
4. Cyber-Physical System Security
5. Workforce training, outreach, and policy

UCONN Eversource Energy Center EVERSOURCE

Pillar 5
Workforce training, outreach, and policy

Eversource Energy Center Pillar 5

Workforce Training, Outreach, and Policy

- Five funded projects, with 11 PIs from across 7 Departments and 5 Colleges/Schools

- **Morzillo, Dobbs, Witharana**: Assess strategies that integrate innovation for grid resilience among carbon and climate resiliency goals and public communication.
- **Scruggs**: Assess the progress in uptake of decarbonization technologies and what factors affect consumer decisions about energy consumption behavior.
- **Cohen:** Evaluate the effect of electric vehicle charging stations and residential solar of real estate values and equity in benefits.
- **Parr and Graziano**: Link the needs of the energy business community to the training and education institutions across the state through an informed, data-driven process
- **Rollins, Carstensen, Towe, McDonnell**: Quantify benefits to customers from resiliency investment costs, as required for a full evaluation of the societal rate of return, net societal benefits of resiliency improvements, and their distribution.

Grid Resilience, Climate Change, and Resiliency to Communities

09 February 2024

Drs. Anita T. Morzillo, Cynnamon Dobbs, and Chandi Witharana
Department of Natural Resources & the Environment, University of Connecticut

Industry Relevance & Need

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Grid resilience is multi-faceted, and includes both powering the grid itself and broader community planning that includes energy needs and infrastructure

Planning decisions of both communities and industry also focus on long-term climate resiliency within the context of entity goals

Disconnect exists between industry and community planning related to resiliency and energy infrastructure

Project Goals and Objectives

Goal: Assess the integration of grid resilience with community climate and resiliency goals

Objectives

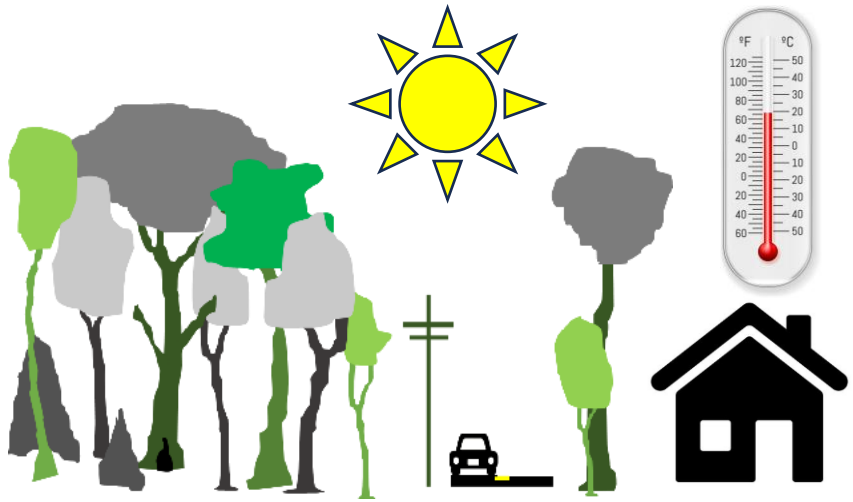
1. Evaluate ecosystem services influenced and enhanced by roadside vegetation management practices

2. Explore town-level strategies for grid resilience among other resiliency and planning goals (e.g., climate, carbon, heat)

Research Approach

Three data components

1. Remote sensing - proximity pixels
2. Ecosystem services: carbon, thermal change
3. Social science



Outcomes and Deliverables

Models of roadside tree metrics for trees removed or those with potential for removal based on proximity pixels

Integrate Lidar and ecosystem services models to develop carbon and thermal change estimation map for proximity pixels

Integrated knowledge for communicating alignment of community resiliency planning and grid resiliency goals

Assessing Connecticut's Energy Transition:
Consumer and Commercial Incentives and Investments

Lyle Scruggs, Political Science
Eleanor Ouimet, Anthropology
Jackson Somers, Agricultural & Resource Economics

Relevance & need

Goal to decarbonize energy in CT requires millions of demand-side investment decisions about transportation and equipment that is carbon-free

Stakeholders lack good information on:

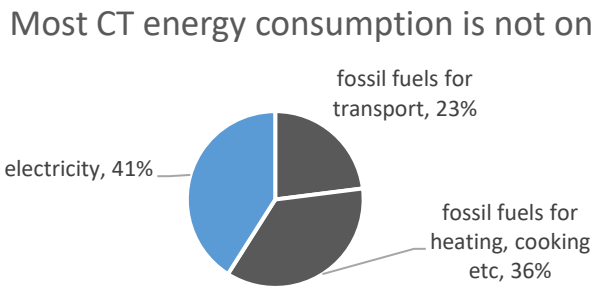
--current energy consumption behavior

--future demand for clean energy technology

- Heat pumps
- Heat pump water heaters
- Alternative fuel Vehicles
- Rooftop PVs
- Energy storage
- Etc.

--how policy incentives affect 10-20 year equipment investments

Full decarbonization will *increase* reliance on electricity and the grid



Demand will vary *geographically* presenting possible challenges to adapting the grid efficiently.

Better forecasts of customer demand and decision-making → better planning

Goals

- Improve estimates of residential energy consumption patterns in Connecticut versus the EIAs Residential Energy Consumption Survey
  - Larger sample size (e.g., 2000 versus 300)
  - Survey more frequently (bi-annually versus every 4-5 years)

- Assess the effectiveness of incentive programs in CT
  - Do citizens know about incentives?
  - Do incentives affect decision-making?
  - Barriers to adoption
  - Validating survey responses with administrative data

Research approach

- Customer survey of CT residents
  - Summer 2024
  - Summer 2026
- Questionnaires modeled on EIAs Residential Energy Consumption Survey (RECS)
- Supplement RECS with survey items on the uptake of clean energy incentives, including plans to replace major equipment
- RCTs of drivers of decision-making
- Extrapolate survey estimates using MRP with census, geolocated parcel housing data, and utility information on historical electricity consumption

Outcomes & Deliverables

- Annual reports on
  - Energy consumption structure
  - Knowledge of existing policy incentives
  - Role of policy and other factors (like information, word-of-mouth, energy bills,
  - affordability, concerns about resiliency), in affecting changes in energy consumption
- Small area forecasts of community energy consumption.
- Micro datafiles and codebook of large two surveys of residential and commercial utility customers regarding intentions to adopt decarbonization technologies

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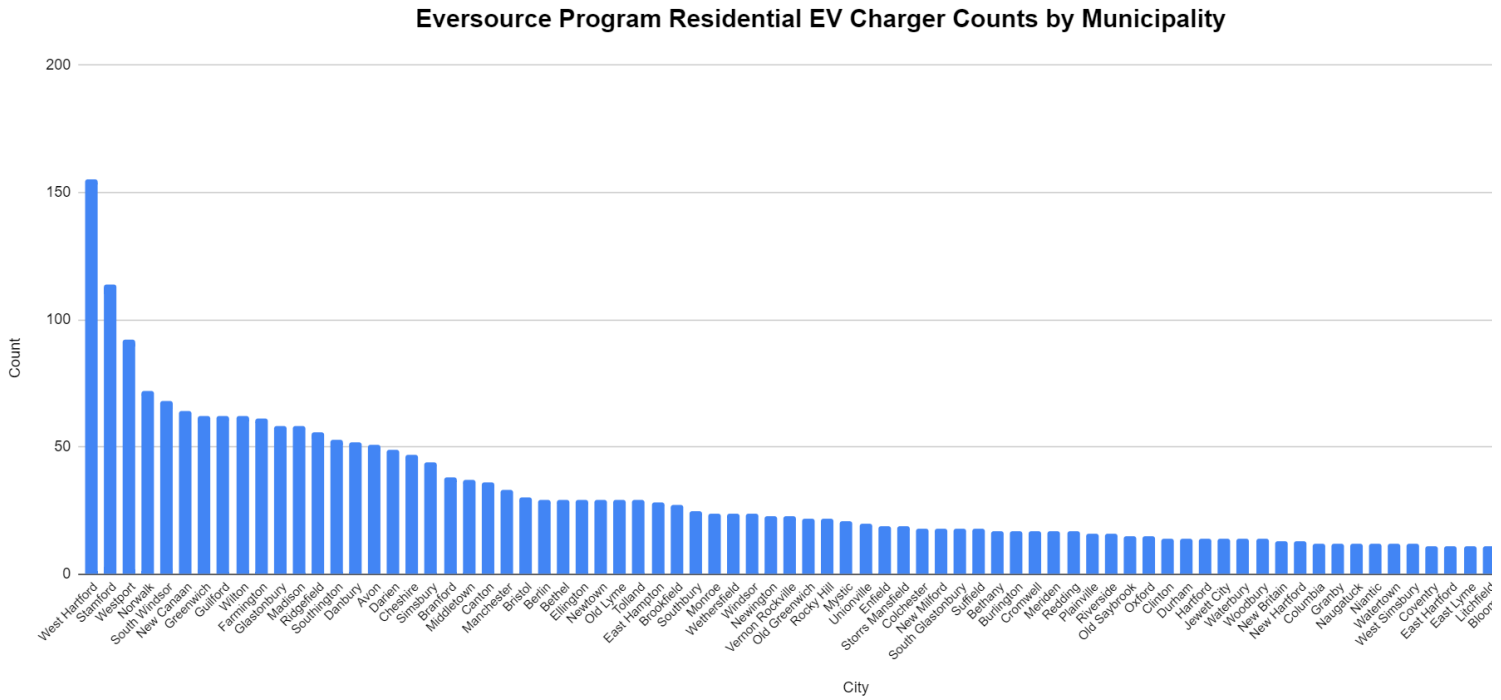
Research impact

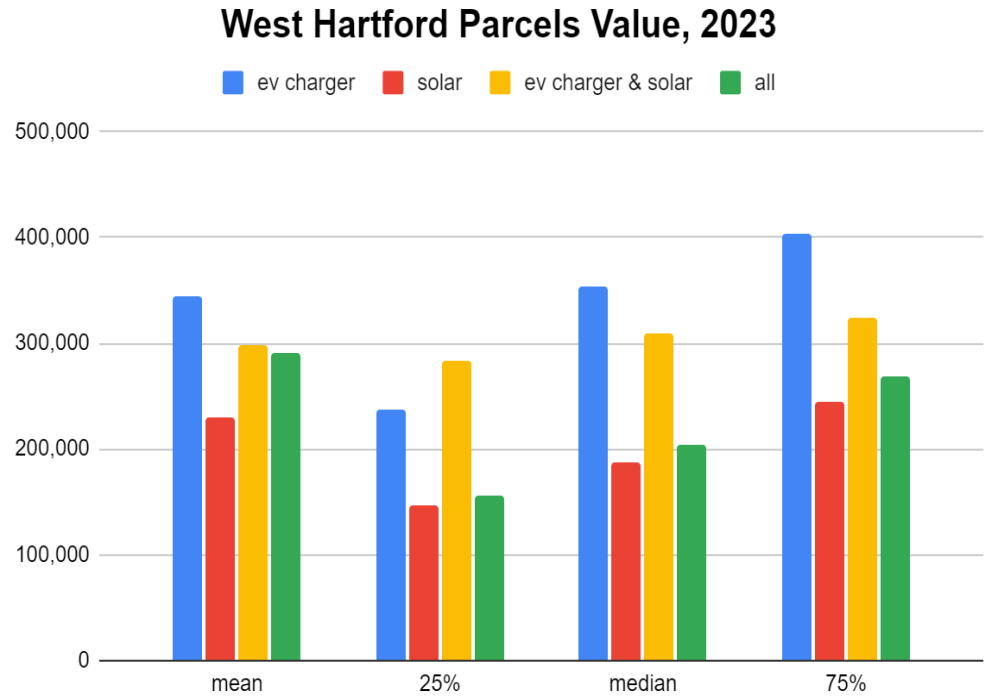
- Behavioral impact of financial incentives on household decision-making to adopt long-range demand side technology
- Informational intervention and investment
- Neighborhood/demonstration effects
- Validation of survey responses (linking answers w administrative data may help gauge survey instrument validity

Long-term energy equipment investments and incentives:

Should I insulation by building?	50+ years
Should I get rooftop solar panels?	25-30 years
Should I get a heat pump to replace my oil furnace?	20 years
Should I get a heat pump water heater	15 years
Should I buy an EV	10 years
Should I get energy storage to stabilize my demand	10 years
Induction stoves	<10 years

Electric Vehicle Charging Stations and Residential Solar: Is There Equality in Connecticut House Price Capitalization?





09 February 2024

Professor Jeffrey P. Cohen, *University of Connecticut, School of Business*

Industry Relevance & Need

- EV charging stations: important for EV planning
- Reliable energy sources and strain on the grid: important considerations in locating EV charging
- Convenience of Level 2 home charging for EV owners
- Equity issue 1: what demographic groups have EV and/or level 2 EV charging stations in homes?
- Equity issue 2: what groups see higher property values from having EVs and/or level 2 EV charging stations in homes?

Project Goals and Objectives

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For a Subset of Locations In Connecticut:

1. Determine how real estate sales prices (for 1 to 4 family homes) may be different for those with solar panels onsite, opposed to those without, based on the actual locations of residential solar installations in CT.

2. Determine how real estate sales prices (for 1 to 4 family homes) may be different for those with EV charging stations, and/or that are “close” to EV charging stations.

3. Estimate how real estate sales prices (for 1 to 4 family homes) may be different for those with **both** EV charging stations and solar panels onsite (CONTINGENT ON DATA AVAILABILITY).

4. Examine whether there is equality in who receives these benefits of solar and EV charging stations among residents in a subset of locations in Connecticut, and who gains and loses the most.

5. Forecast how adding EV charging stations and/or solar panels in a subset of some CT locations would be expected to impact real estate value and equality of who receives the benefits.

Research Approach

Data Sources:

- Eversource Energy level 2 EV charging residential locations by zip code (proprietary)
- grand list data on EV locations by town (some proprietary data)
- Single-family Level 2 EV charging stations locations in West Hartford and Westport (town permits data)
- Resident demographics - various sources (some proprietary data)
- property values (town assessors and other sources)
- locations of residential solar - CT Green Bank (proprietary)

Data analysis:

- Regressions (statistical analysis)
- How are house prices affected by having Level 2 EV chargers and/or residential solar panels, controlling for demographics?

- GIS mapping

- Lorenz Curves/Gini Coefficients

Advisory Panel:

- Yale, UCONN, Eversource Energy, AVANGRID/UI, CT DEEP, CT DOT, CT Green Bank

Outcomes and Deliverables

1. A database of the data to be used in the statistical analysis, including a set of summary statistics and description of the variables and sources. NOTE: Some of the raw data may be proprietary and subject to nondisclosure agreements; therefore it is possible that not all of the raw data used in the analysis can be shared with EEC and/or all of the project's partners.

2. A literature review of how residential solar impacts house prices; and how EV charging stations impact house prices.

3. A preliminary set of GIS maps.

4. One or more follow-up funding applications. A summary of these follow-up funding applications will be submitted as a deliverable; in Year 1, this will likely be limited to a follow-up EEC funding application.

5. Monthly virtual meetings of the project's advisory panel.

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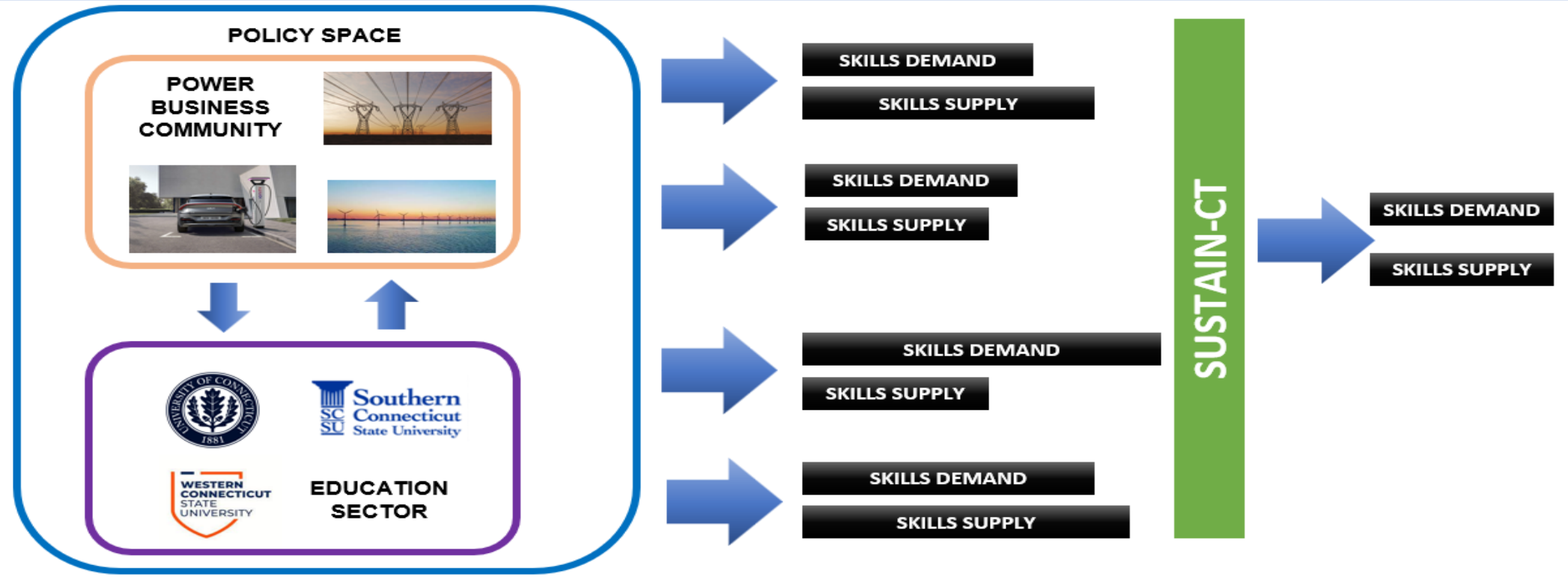
Research Impact

- This 1-year project: demonstrate the feasibility of using the techniques described, in a smaller setting.
- Pursue a larger, multi-year grant from EEC that would consider a broader geographic area than considered in this pilot project.
- After Year 1, explore relevant funding opportunities with the National Science Foundation (NSF); U.S. Department of Energy (DOE).
- Follow-up funding possibility for graduate students: National Academies of Science, Engineering and Medicine's National Research Council (NRC) Research Associate Program (RAP)
- Work with advisory panel members to develop ideas for follow-up research

SUSTAIN-CT: Sustainable Up-Skilling for Transitioning and Achieving Inclusive and Just Energy in Connecticut.



Dr. Kathryn Parr, *University of Connecticut*
Dr. Marcello Graziano, FeRSA, Ruralis
Zhengxuan Wu, *University of Connecticut*

09 February 2024

Industry Relevance & Need

- Electrification of the State's economy has accelerated post-2020.
- Utilities, including electric ones and generators set to lose 60,000 workers by 2035.
- Connecticut is 3rd highest emigration rate for skilled graduates in the nation.
- State dual role: as a generating hub and a transmission hub.

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Project Goals and Objectives

GOAL: SUSTAIN-CT aims to link the needs of the energy business community to the training and education institutions across the state through an informed, data-driven process.

SUSTAIN-CT will achieve this overarching goal by meeting the following objectives:

1) *Project the skills needed by the energy business community for operationalizing the sustainable transition within Connecticut.*

2) *Investigate the skills available in Connecticut through formal and informal training programs, public information from the web; and the demographic and regional profile of these skill holders.*

3) *Identify mismatches between the skills-demand and skills-supply in the region.*

4) *Coordinate with formal and informal training programs to bridge the identified gaps.*

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Research Approach

WP1: Analysis of industry skills based on literature

WP3: Business community skills needs.

WP2: Analysis of skills and demographic profile

WP4: Identification of regional skill gaps and mismatches.

WP5: Development of skill-building programs.

Inputs

Outcomes and Deliverables

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Regional policymakers: Policy brief, which will be circulated to commissioners of PURA, the Connecticut Green Bank, CT DECD, and through the 2Gen initiative.

Eversource: The results of sustain-CT will be synthesized in a comprehensive report to Eversource, highlighting existing in-state resources, short-term impactful changes to education programs, and medium-term opportunities for training talent in the state.

Scientific: A total of two peer-reviewed articles will be published in high impact factor journals.

Eversource Center Community: all the final data will be shared with the Eversource Center in digital format.

Education institutions: visual skill map policy brief and summary video informing of the existing gaps.

Continuing research: 2025 International Joint Initiative for Research in Climate Change Adaptation and Mitigation Competition AND Erasmus+ for implementing skill gap filling practices with selected educational partners.

Research Impact

1. First skill gap analysis driven by demand and supply based on real-world sources.
2. Responsive to public policies related to investment in sustainability and equity.
3. Provides basis for strengthening state policies for more robust support of the green economy.
4. Suggests comprehensive strategies for skill development including vocational training, internships and other continuous learning opportunities for existing and future green workers.