Building an Interactive Web Mapping Tool to Support Distributed Energy Resource Planning Using Public Participation GIS

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California Center for Sustainable Communities at UCLA
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CALIFORNIA STRATEGIC GROWTH COUNCIL

CCSC at UCLA

UCLA California Center for Sustainable Communities

Institute of the Environment & Sustainability

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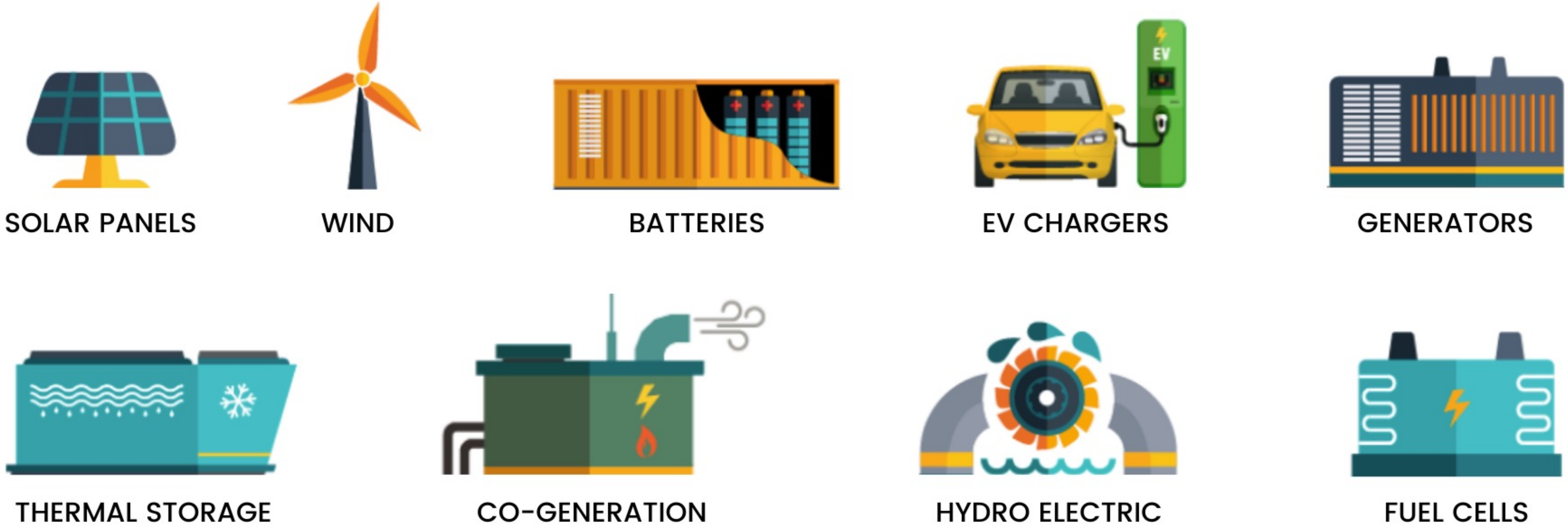
Distributed Energy Resources (DERs)

These are new technologies that facilitate the generation and storage of renewable electricity closer to points of consumption, reducing reliance on the conventional grid for the supply of energy services.



The Problem

Current state and utility programs which have been designed to incentivize the adoption of DERs are very much biased towards implementation models which are only accessible to high-income households that are owners of recently constructed single-family homes.

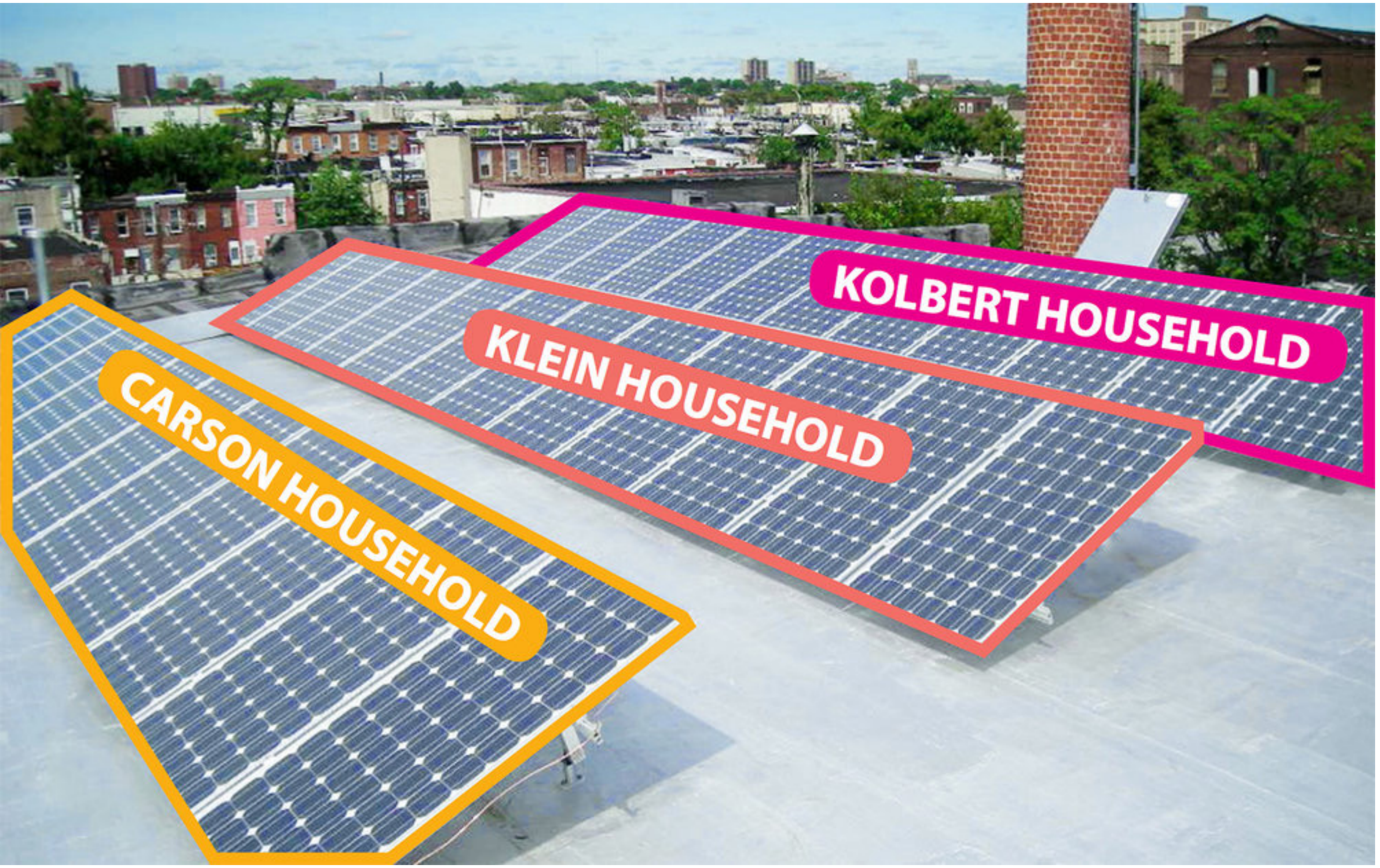
This is a problem of vision in terms of how we currently conceptualize DER systems should be designed, built, owned, and operated.

The Problem

Many households in lower income, disadvantaged communities who rent units within multi-family complexes that were constructed in older vintage years currently find themselves structurally prohibited from participating in popular DER incentive programs.

This has made them far less likely to engage with, and subsequently benefit from, the ongoing renewable energy transition.

A Potential Solution

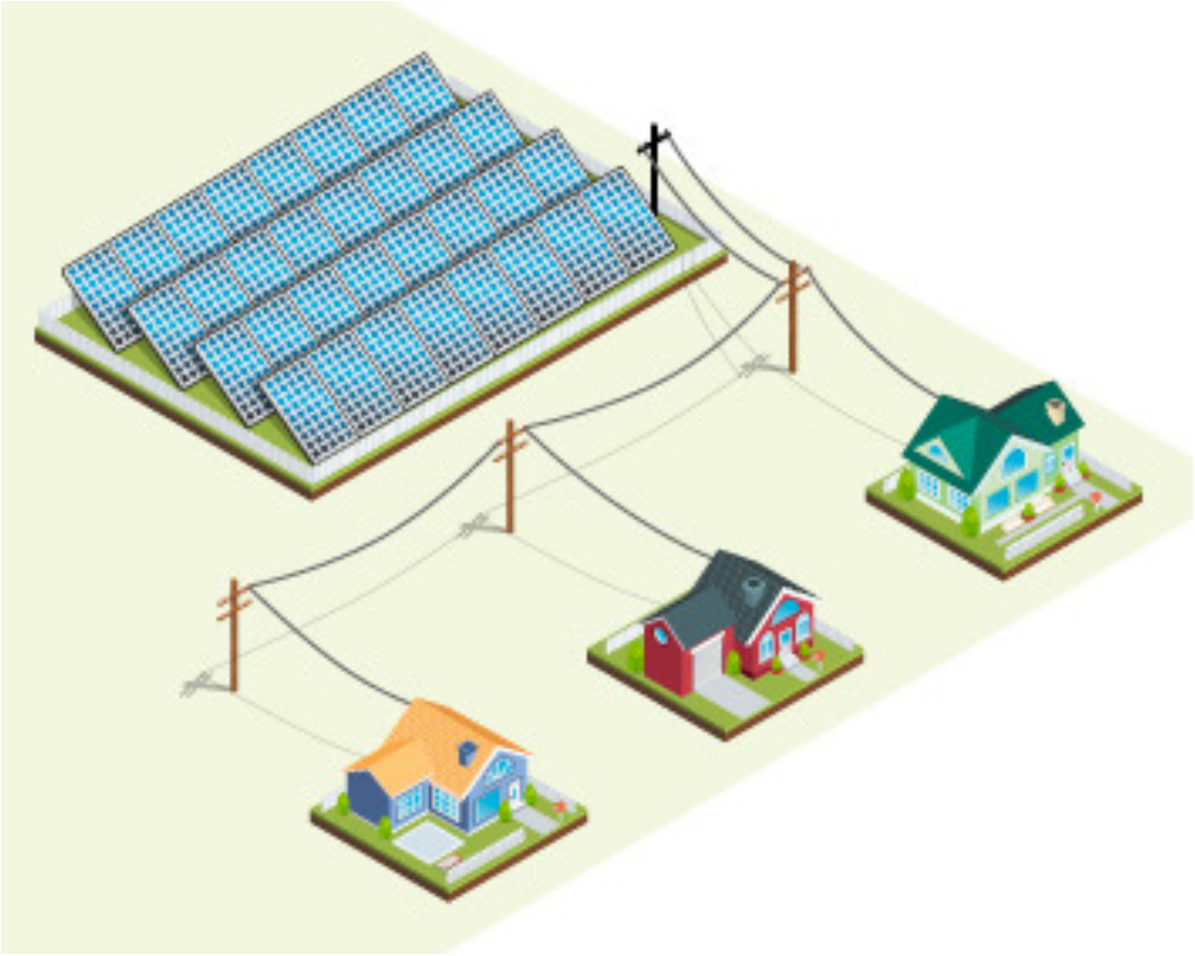


Community Solar + Virtual Net Metering is a fundamentally new DER implementation model that circumvents many of the previously described barriers to adoption which are commonly encountered within low-income and disadvantaged communities.

The basic idea is that larger scale ”Community Solar” arrays can be built at one physical location with their output then virtually allocated to a group of customers located other physical locations.

This virtual allocation is performed using a special net-metering tariff which allows for customers to sign on as part of a community solar program which is tied to an anchor generator location.

Challenges



Community Solar (CS) projects benefit from economies of scale and thus favor larger host sites – most typically roofs or parking lot canopy structures. These sites require buy-in from the property owner/manager to function as the anchor location for a community solar project.

Because of the larger size of CS systems, the capacity of grid circuits and other grid infrastructure components to support their interconnection, without degrading their performance or incurring elevated risks of failure, must be evaluated during the screening of candidate host sites.

Finally, the physical relationship between a CS generator site and the community members which sign up to participate in the program is also important to consider. To reduce the demands being placed upon the local distribution grid it is ideal if the CS participant households are physically connected to the same distribution circuit/sub-station as the host CS array.

Project Overview

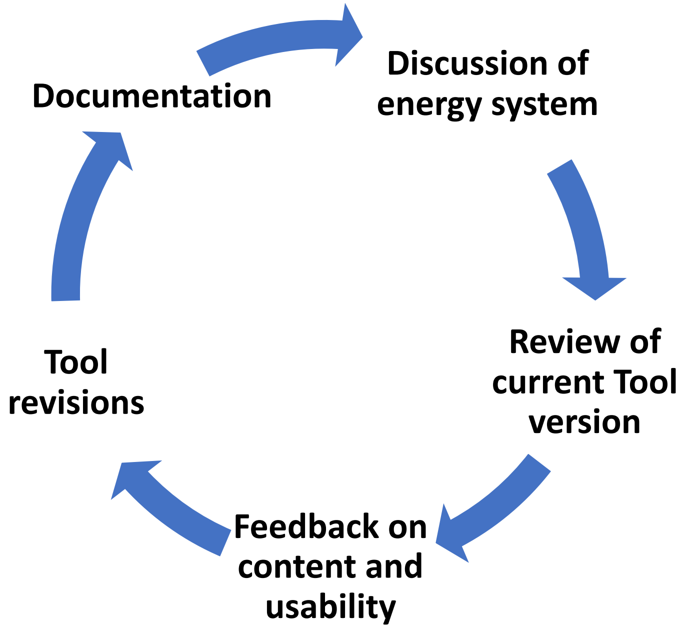
Develop an interactive web-mapping tool to help local community-based organizations identify promising sites for CS (and resilience centers) to increase access to the benefits of renewable energy within their communities.

Include information developed by Los Angeles County about parcel level rooftop and carport canopy solar PV generation potential for candidate sites

Include information provided by the electric local utility about the capacity of the distribution circuits to support solar PV interconnections

Include information about local renter household characteristics, including average annual energy usage intensities, to better understand the potential number of CS program participants that a given site could support

Design, build, and test the tool in conjunction with paid project partners representing local CBOs actively working on energy justice issues in lower-income and disadvantaged communities using a formal PPGIS stakeholder engagement process



Advancing the State's Climate Goals

CALIFORNIA CLIMATE INVESTMENTS
Cap and Trade Dollars at Work

Reduction of greenhouse gas emissions by facilitating the siting of Community Solar and Resilience Centers

- Generate clean energy without additional transmission line investments
- Reduce the need for ecologically destructive utility-scale solar
- Resilience Centers **could** replace diesel back-up generators

Community Solar overcomes barriers to rooftop solar prevalent in **underserved / low-income communities**

Resilience Centers **could** offer energy services in the event of grid outages for these same communities, the most vulnerable to increased numbers of high heat days

Project Partners

Liberty Hill Foundation | Active San Gabriel Valley | Asian Pacific Islander Forward Movement | East Yard Communities for Environmental Justice | Pacoima Beautiful | T.R.U.S.T. South LA | Social Justice Learning Institute. Support was also provided by GRID Alternatives.

Products

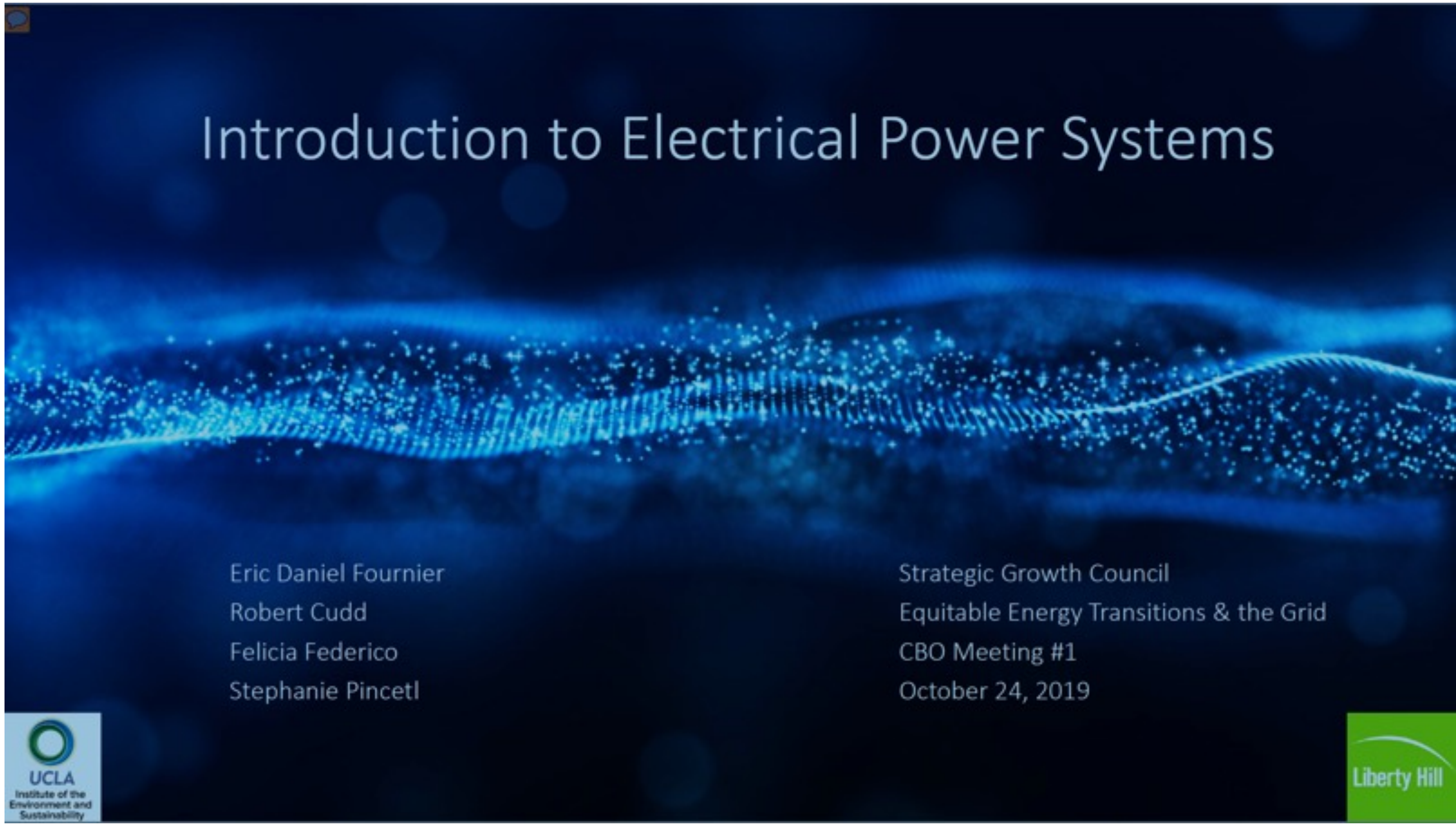
An “Energy 101” Training Curriculum

8-10 hours of teaching materials

Designed for a non-specialist audience

Covers fundamental information on the structure and governance of the energy system within the context of California.

Enhanced the ability of our CBO project partners to provide input to co-develop the Tool, as well as engage on energy policy discussions



Products

The Community Solar Opportunities Mapping Tool
https://solar.energyatlas.ucla.edu/

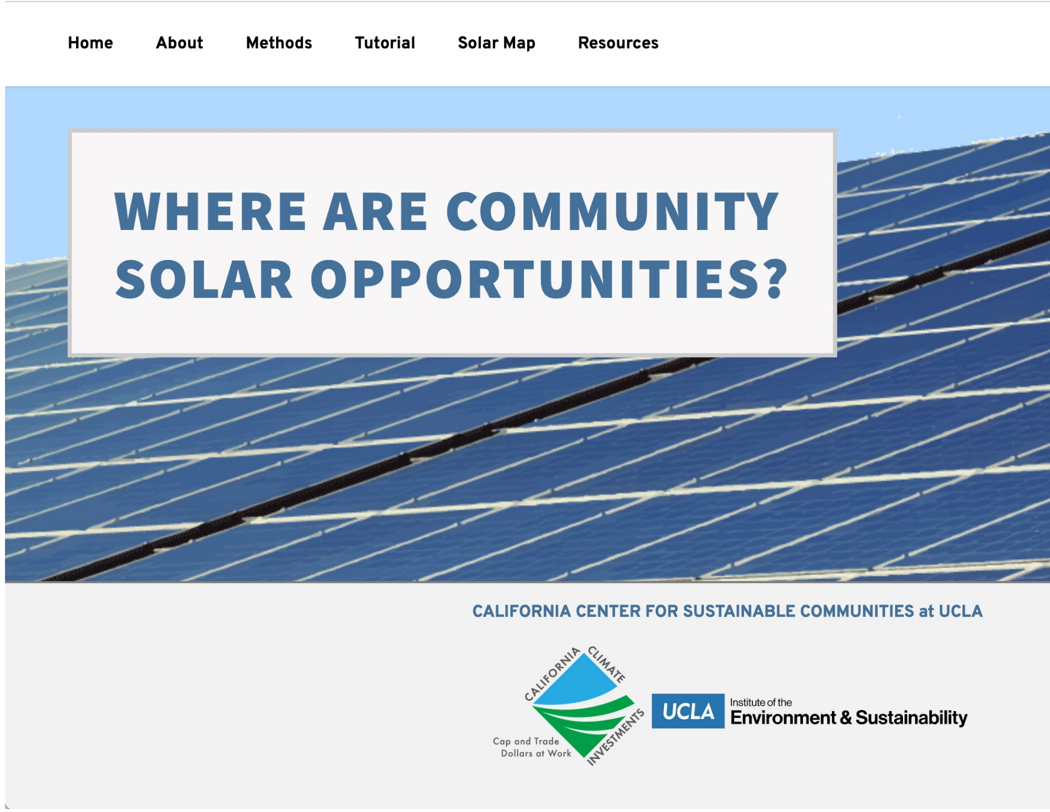
Builds upon another long-term research initiative which has been led by our center called the UCLA Energy Atlas

Identifies opportunities for **community solar** and **resilience centers** on institutional, government-owned, and community-oriented properties parcels in Los Angeles County, IOU territory (SCE).

Provides a range of spatial analysis capabilities, from highly granular explorations at a local scale, to county- or city-scale assessments.

Incorporates contextual information to enable equitable siting of solar installations.

Reveals where institutional solar capacity cannot currently be realized due to grid infrastructure limitations as defined by SCE, either in front of the meter (community solar) or behind the meter (resilience centers) applications



Products

Previously Published Article

Fournier, E.D., Cudd, R., Federico, F., and Pincetl, S. (2020). On Energy Sufficiency and the Need for New Policies to Combat Growing Inequities in the Residential Energy Sector. *Elementa, Science of the Anthropocene* 8: 24. DOI: https://doi.org/10.1525/elementa.419

ELEMENTA
Science of the Anthropocene

Fournier, ED, et al. 2020. On energy sufficiency and the need for new policies to combat growing inequities in the residential energy sector. *Elem Sci Anth,* 8: 24. DOI: https://doi.org/10.1525/elementa.419

RESEARCH ARTICLE

On energy sufficiency and the need for new policies to combat growing inequities in the residential energy sector

Eric Daniel Fournier, Robert Cudd, Felicia Federico and Stephanie Pincetl

The decreasing cost and increasing availability of new technologies capable of improving household energy efficiency, generating and storing renewable energy, and decarbonizing major end use appliances have begun to significantly transform many residential communities across the U.S. Despite these positive developments however, the degree to which disadvantaged communities (DACs) have been able to participate in and benefit from these transformations remains far from equal. Using historical time series data at the zipcode level within Los Angeles County, we document the scale and extent to which DACs continue to be left behind. These data show per-capita levels of electricity and natural gas consumption within DACs that are, on average, about half of those seen within their more affluent counterparts. We argue that the magnitude of these differences reflect a fundamental departure in the use of energy from purposes of sufficiency to those of excess. We introduce a set of forecasts that show the extent to which current inequities in per-capita energy consumption, rates of vehicle electrification, and adoption of rooftop solar PV are likely to persist under the status quo. In conclusion, we suggest that the redistributive investment of public funds for the purpose of accelerating DAC participation in energy system transformations constitutes a socially optimal investment strategy – one which reflects the dramatically higher marginal utility of units of energy consumed at levels of sufficiency rather than excess.

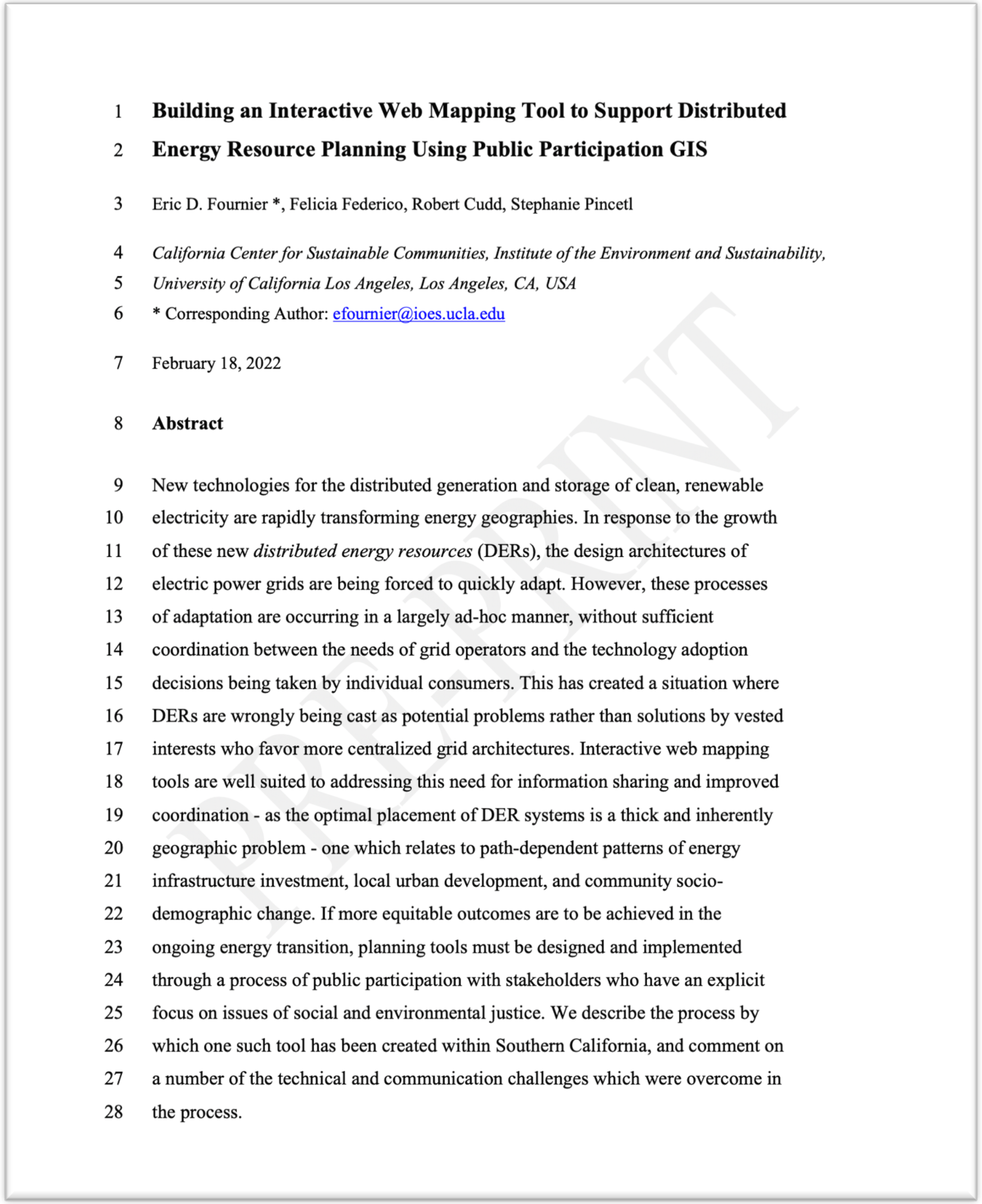
Keywords: Energy sufficiency; Residential electricity; Energy efficiency; Income; Housing size; Equity

Products

New Article in Development

Fournier, E.D., Federico, F., Cudd, R., and Pincetl, S. (2022). Building an Interactive Web Mapping Tool to Support Distributed Energy Resource Planning Using Public Participation GIS.

Pre-print available via the conference document hosting service.



Building an Interactive Web Mapping Tool to Support Distributed Energy Resource Planning Using Public Participation GIS

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February 18, 2022

Abstract

New technologies for the distributed generation and storage of clean, renewable electricity are rapidly transforming energy geographies. In response to the growth of these new *distributed energy resources* (DERs), the design architectures of electric power grids are being forced to quickly adapt. However, these processes of adaptation are occurring in a largely ad-hoc manner, without sufficient coordination between the needs of grid operators and the technology adoption decisions being taken by individual consumers. This has created a situation where DERs are wrongly being cast as potential problems rather than solutions by vested interests who favor more centralized grid architectures. Interactive web mapping tools are well suited to addressing this need for information sharing and improved coordination - as the optimal placement of DER systems is a thick and inherently geographic problem - one which relates to path-dependent patterns of energy infrastructure investment, local urban development, and community socio-demographic change. If more equitable outcomes are to be achieved in the ongoing energy transition, planning tools must be designed and implemented through a process of public participation with stakeholders who have an explicit focus on issues of social and environmental justice. We describe the process by which one such tool has been created within Southern California, and comment on a number of the technical and communication challenges which were overcome in the process.

Questions & Discussion

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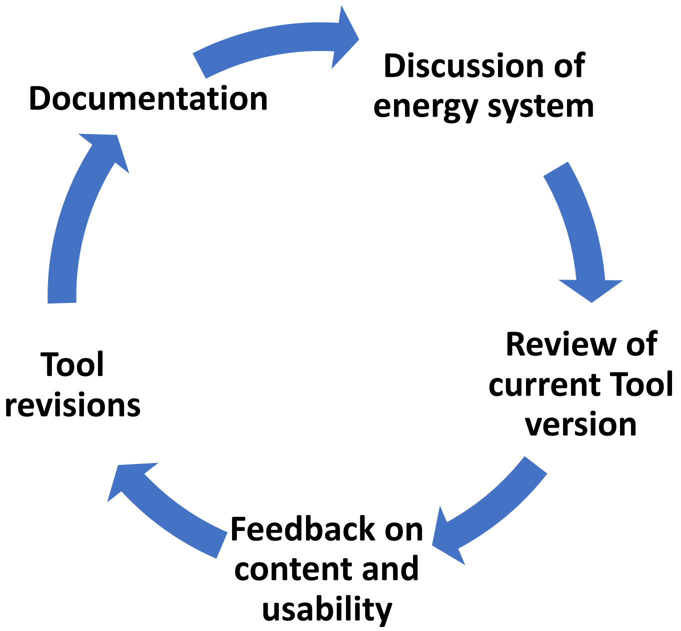
Live Tool Demo

Extra Slides

Stakeholder Engagement

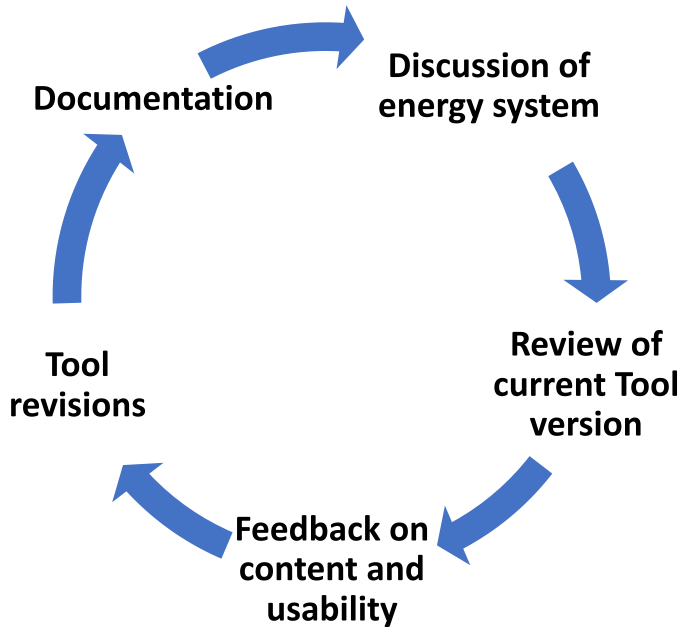


A three-phased engagement approach

- Phase I: solicited interest and identified partners
- Phase II: 4 workshops
  - Energy 101 training
  - Discussion of consecutive versions of the Tool
  - Feedback was iteratively incorporated into subsequent tool updates
  - Feedback, tool changes, and explanations are documented
  - The focus on community solar and resilience centers was adopted in this phase, reflecting CBO partner priorities.
- Phase III:
  - 6 core CBO partners worked with the Tool to identify and prioritize potential sites for community solar and resilience centers in their neighborhoods.
  - Presentations by SCE and the Clean Power Alliance on their relevant programs.

Stakeholder Engagement

- Partnership with community-based organizations was fundamental to the project
- Principles:
  - Fairness (budgeted project partners)
  - Reciprocity (Energy 101)
  - Accountability (documentation of, and response to, feedback)



Tool Development and Features

- The **Community Solar Opportunities Mapping Tool**: https://solar.energyatlas.ucla.edu/
- CARTO web mapping platform
- Interactive CARTO map pane embedded within a UCLA-hosted website
- Numerous underlying spatial data layers power the map
- Source layers were acquired, screened, and pre-processed using a combination of Postgre-SQL and Python scripts
- Raw input data sets include, among others:
    - SCE DPREP grid infrastructure maps
    - Aggregated and privacy protected electricity usage data from the Energy Atlas
    - Feature layers from the Los Angeles Regional Imagery Acquisition Consortium
    - LA County Solar Map
    - Assessor's parcel data
    - CalEnviroScreen scores

v1 - California Energy Commission (CEC) Funded Research Grant

v2 - California Strategic Growth Council (SGC) Funded Research Grant

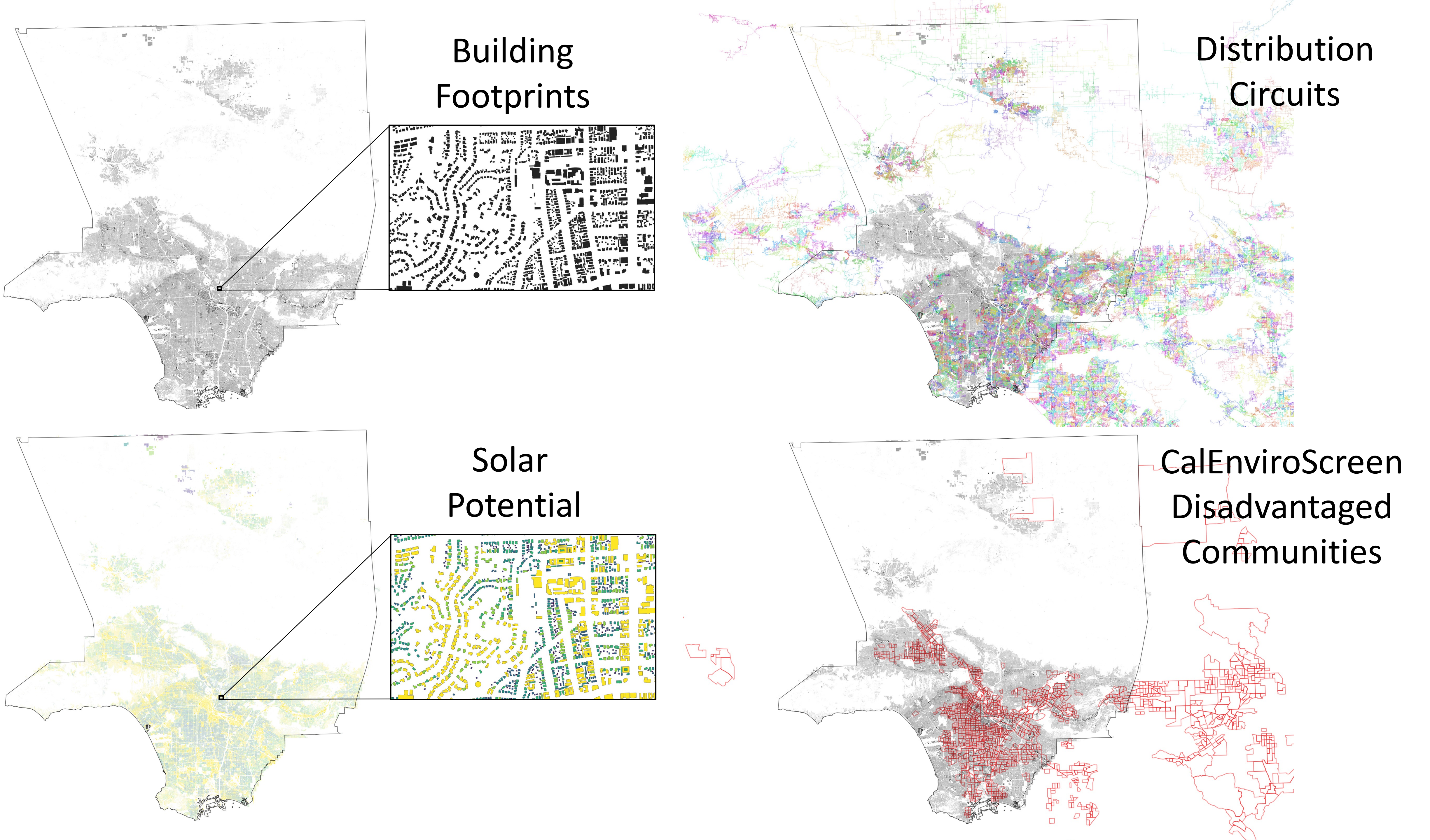
Parcel Use-type Information

Rooftop & Carport Solar Potentials

Grid Infrastructure Capacity

Building Energy Usage

Cal-Enviro-Screen Percentile Scores



Building Footprints
Distribution Circuits
Solar Potential
CalEnviroScreen Disadvantaged Communities

Key Findings and Recommendations

Based on:

- Feedback and priorities expressed by our CBO project partners
- Assessment of regulatory and policy challenges
- Analysis of solar potential and grid limitations identified using the Tool

- Caveats:
  - Analysis findings are based on a snapshot in time
  - While our methodology reflects the best data available, there are still unavoidable uncertainties
  - However, we have made conservative assumptions wherever possible
  - This work represents the most logical and supportable approach to assessing current conditions and identifying needed policy changes

Key Findings

1. **The Community Solar Opportunities Mapping Tool fills an essential need for CBOs and local governments**
    - Community Solar and Resilience Centers are essential to achieving the State’s GHG reduction goals and realizing its equity commitments
    - No other tool provides this functionality

Key Findings

2. **Approximately 3.5GW of technical solar potential is available on institutional, government-owned, and community-oriented properties in LA County SCE territory...**

    - The cumulative production of this 3.5 GW is sufficient to offset the electricity use of <u>all</u> 362K renter households in DAC census tracts within that same territory on an annualized basis

Key Findings

3. …but buildout will be substantially constrained by current grid capacity and Rule 21 protocols as defined by SCE

Community Solar (installed in front of the meter - IFOM)

- **33% of total solar potential for Community Solar would be constrained from development based on Circuit ICA* capacities**

Resilience Centers (installed behind the meter - BTM)

- **86% of total solar potential for Resilience Centers would be constrained from development based on Rule 21 limitations**

***Integrated Capacity Analysis**

Key Findings

4. **Additional constraints:**
   - **PUC rules do not permit a single solar installation to function as both community solar and a resilience center**
   - **PUC rules do not permit storage to be installed as part of solar PV systems developed under community solar programs**

Key Findings

5. **Utility programs are insufficient to meet community needs, and their complexity is a substantial barrier to solar development**.
6. **Planning for Community Solar and Resilience Centers is detailed and time-consuming. There is a dearth of resources available at the local level for this work.**

Recommendations

1. Expand the Community Solar Opportunities Mapping Tool statewide
2. Prioritize the buildout of the enormous resource of institutional, government-owned and community-oriented solar potential
3. PUC should direct the utilities to allow a single solar installation to function as Community Solar during normal grid operations, and an island-able Resilience Center during grid outages
4. Community Solar tariffs must be allowed to include batteries, to support the overwhelming need for energy storage
5. Community Solar programs should be greatly expanded, and rules should be simplified

Recommendations

6. PUC should require utilities to offer programs facilitating Resilience Centers
7. PUC should revise regulations and make financing available, through rate payer funds, to facilitate the creation of such facilities
8. OPR / SGC should use cap-and-trade funding to support local governments and CBOs
9. Grid capacity for distributed solar should be re-evaluated through a public process, to ensure that its interpretation by SCE is consistent and defensible

Future Work

- Tool enhancements to provide improved filtering capabilities and incorporate more current data
- Journal article on the Tool is in preparation
- Webinars to local governments and agencies, upon request, on how to use the Tool
- With appropriate funding, expand the tool beyond the LA County IOU geography
- Potential build out of Energy 101 curriculum for broader application
- White paper on policy findings and recommendations

Community Solar

Community Solar is installed in front of the meter (IFOM)

- The wholesale distribution access tariff (WDAT) applies
- Capacity is determined by the Integrated Capacity Analysis (ICA) value at the circuit segment level
- Our analysis categorized solar potential that exceeded ICA circuit capacity as “Circuit ICA Unrealized”
- **33% of total solar potential for Community Solar was identified as Circuit ICA Unrealized**

Resilience Centers

<u>Resilience Centers</u> are behind the meter (BTM) installations under NEM tariffs

- Rule 21 applies to grid interconnection
  - SCE's Rule 21 defines circuit-level thresholds (15% penetration capacity) that differentiate "fast track" from "detailed study" applications
  - Installations which exceed the 15% capacity and require "detailed study" are unlikely to be advanced, especially by CBOs, due to higher application fees, longer processing time, and greater uncertainty of outcome.
  - Our analysis categorized solar potential that exceeded remaining 15% circuit capacity as "Rule 21 Unrealized"
- **86% of total solar potential for Resilience Centers was identified as Rule 21 Unrealized**