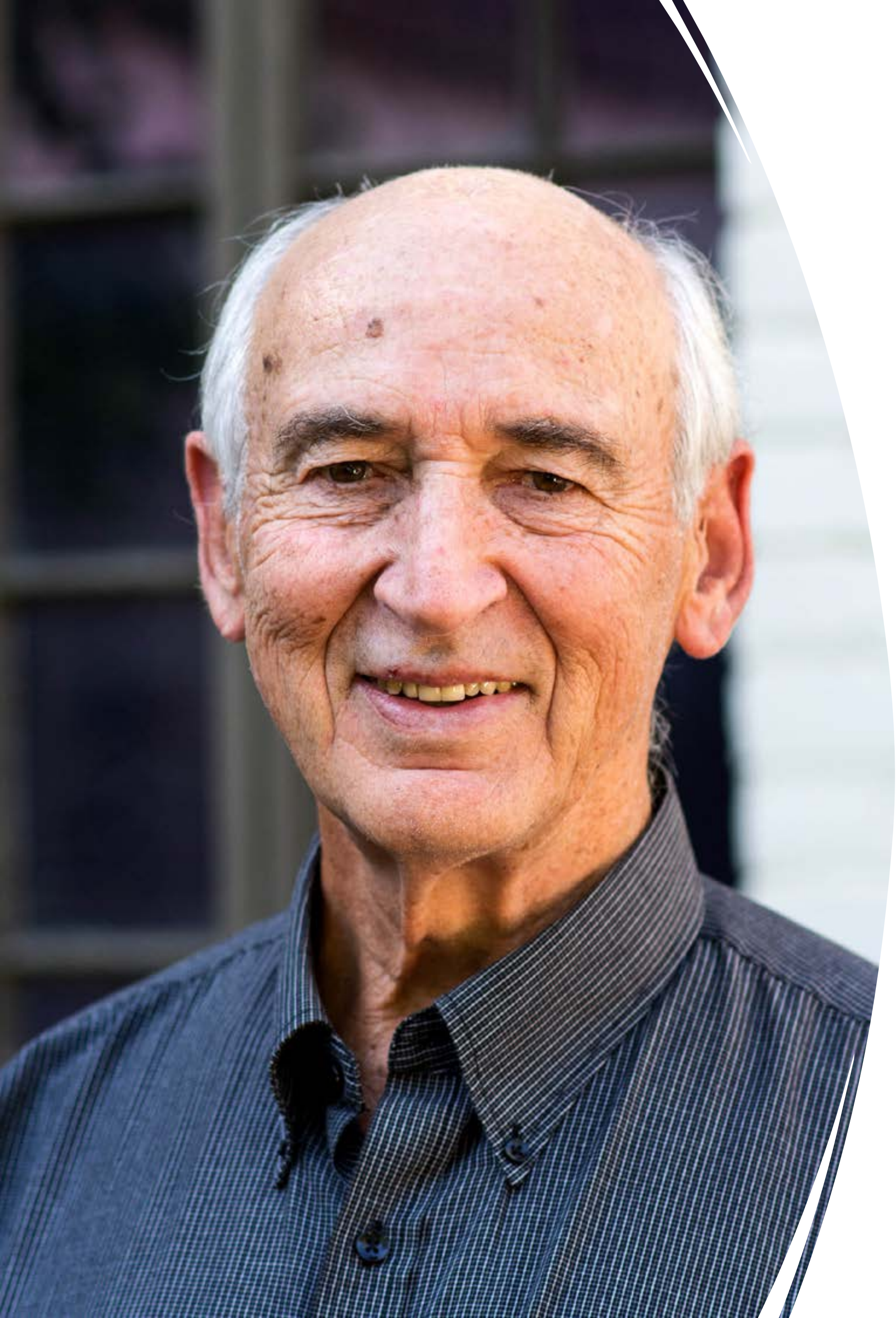

Using Available Local Assets to Achieve Resilient Decarbonization

MSEF Webinar

September 28, 2021

Gerry Braun, IRESN

Outline

- Introduction
- Available Local Assets
- Microgrids
- Economic Benefits
- Energy Resilience Stakeholders
  - Stakes
  - Proven, Pragmatic Actions

Electric utilities transport electricity to communities. Transport disruptions cost cities, counties, and energy users dearly. Local energy resilience implementation teamwork and integration comes at a cost, but community level energy resilience more than pays for the teamwork and integration required to achieve it. Which local governments will step up to the cost? Initially, it will be those who have already paid a price for their vulnerabilities.

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Definitions

Decarbonization is the process of reducing greenhouse gas (GHG) emissions

Energy resilience is the ability to restore energy services quickly when cut off from regional energy supply networks. (Inadequate energy resilience is a local concern because extended outages can disrupt, even cripple, local economies.)

Energy security is the condition of having locally produced renewable energy available 365/24/7.

Resilient decarbonization* results when new zero or negative carbon energy sources are deployed to enable local needs to be met when bulk energy transport to the local area is disrupted.

Solar electrification* results when solar electricity is used to power electric appliances and vehicles that have replaced fossil fueled appliances and vehicles.

*Resilient decarbonization and solar electrification require technical and economic integration

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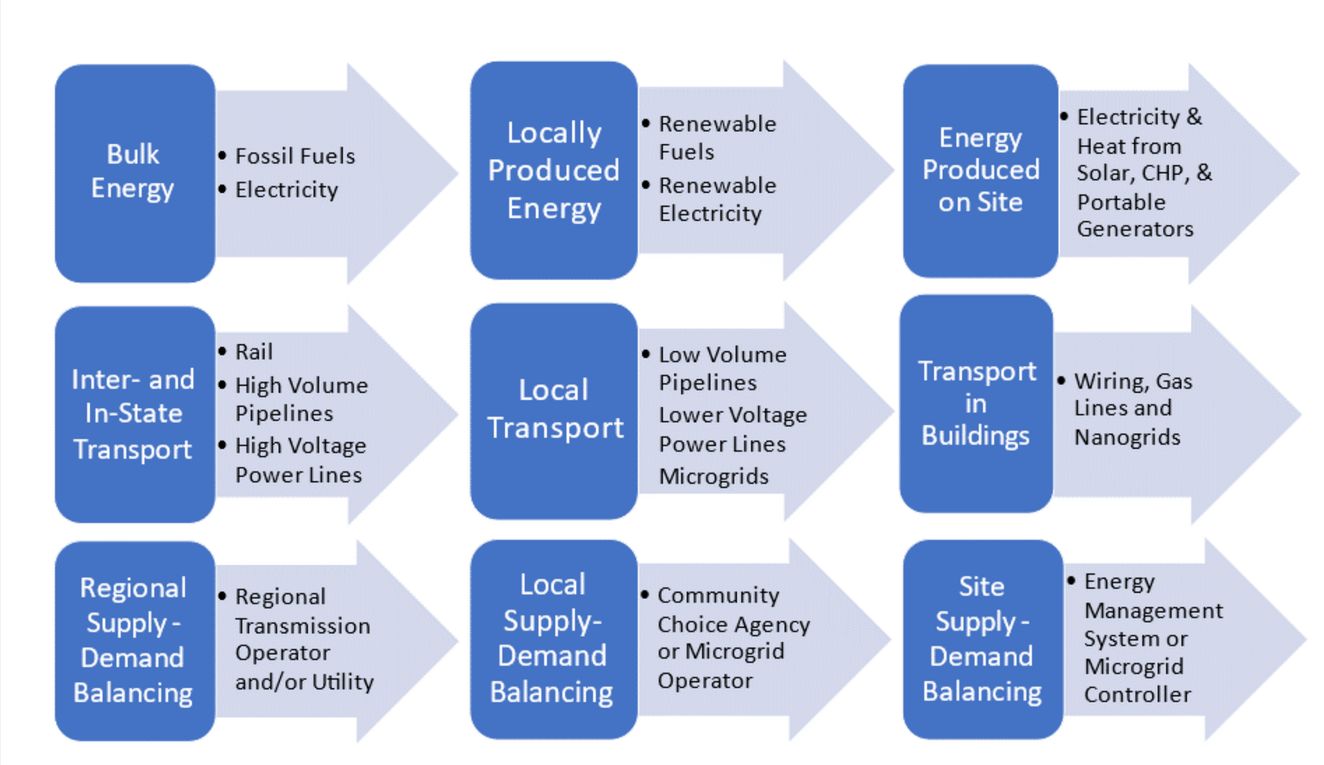
Local Energy Resilience Enablers



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Prompted by wildfire experience and anticipating further major wildfires, an energy resilience conversation is beginning in California. Robust energy resilience minimizes costs and economic dislocation in the wake of natural disasters. It is made possible by energy produced locally and on-site, by local energy grids and building circuits, and by supply/demand balancing by local authorities, microgrid controllers and energy management systems.

Available Local Assets

California's Energy Resilience Assets	
Resilience Asset	**2020 Capacity (est.) (GW)**
	Operational Assets
Combined Heat and Power	**8.6**
Standby Power	**10.4**
	Additional Available Assets
Solar PV	**9.3**
Electric Vehicles	**41.4**
	Enabling Assets
Campus Microgrids	**0.2**
Community Microgrids	**No est.**
Total - all major elements	**69.8**

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Local energy resilience in California is currently financed by individual energy users. Local assets can deliver energy resilience benefits to communities as well as to asset owners. This will require:

- Full economic integration of existing and new on-site energy resilience assets with existing and new energy grid assets.
- Broader and more active stakeholder engagement necessary to empower local economic integration.

CHP* and CCHP - 1

Resilience Asset	Est. 2020 Capacity (GW)
CHP	8.6
Industrial	4.1
Commercial	4.5
Micro CHP	0.3

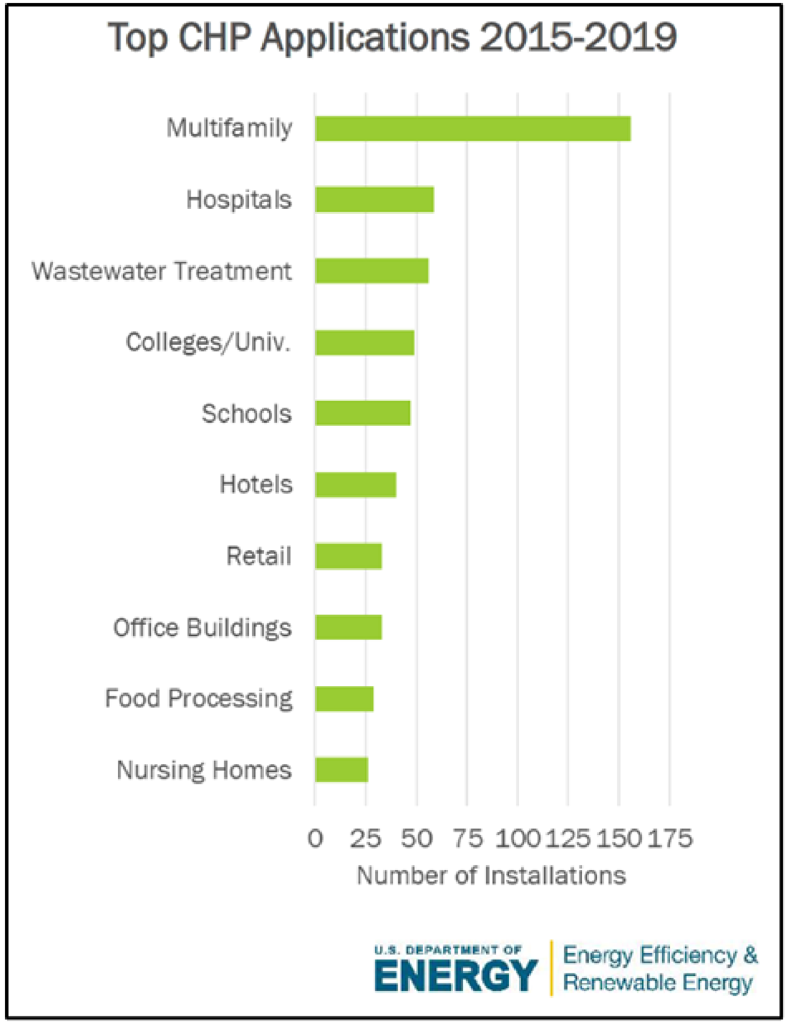
Primary early source of "distributed generation"

Efficiency, decarbonization and energy resilience benefits

Refocusing from:

- Industrial to commercial
- CHP to Micro CHP
- Fossil gas to renewable fuels

*aka cogeneration



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CHP* and CCHP - 2

Resilience Asset	Est. 2020 Capacity (GW)
CHP	8.6
Industrial	4.1
Commercial	4.5
Micro CHP	0.3

Primary early source of "distributed generation"

Efficiency, decarbonization and energy resilience benefits

Refocusing from:

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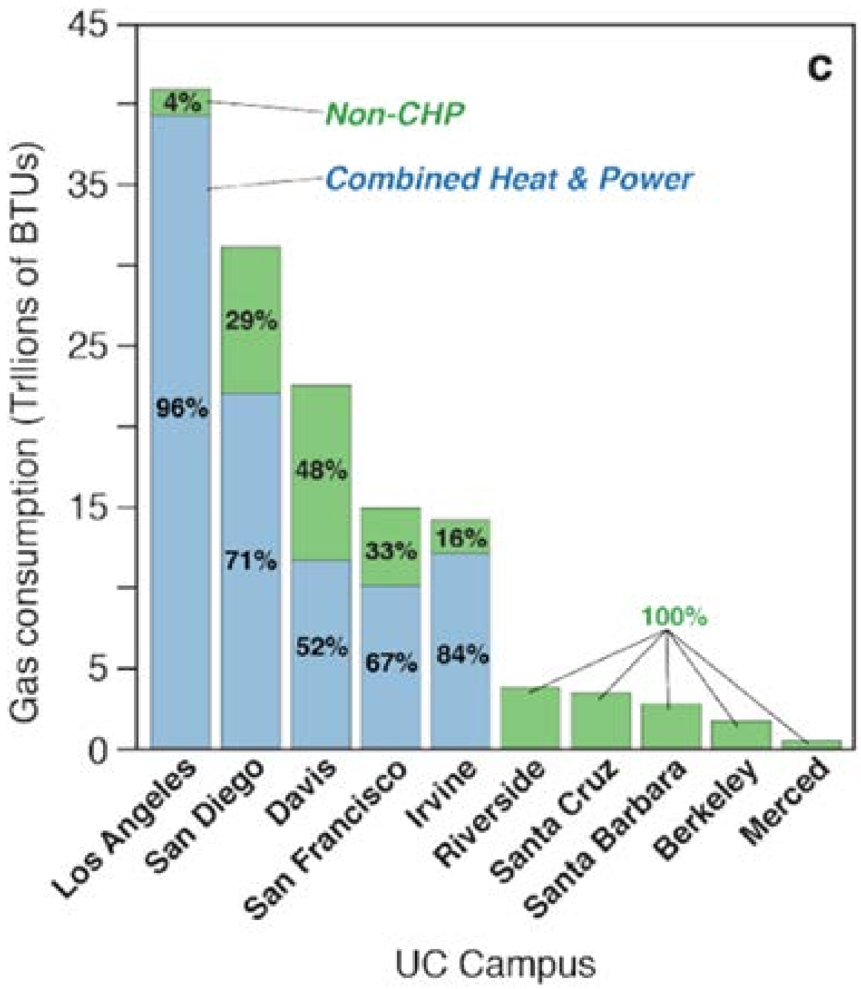

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Standby Power

Resilience Asset	Est. 2020 Capacity (GW)
Standby Power	10.4
>25 hp Rental	3.7
>25 hp Other	2.4
<25 hp	4.3

Pervasive on-site deployment

- Commercial, agricultural and industrial service continuity
- Important in areas of poor grid service reliability

Transitioning from:

- Diesel to gas
- Engines to fuel cells
- Fossil gas to renewable gas
- Backup role to microgrid supply portfolio role

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Solar Plus Batteries

Resilience Asset	Est. 2020 Capacity (GW)
Solar PV	9.3
Residential	6.1
Non-res.	3.2

Both power plant and on-site applications

Transfer switches enable on-site solar arrays, batteries, and portable generators to provide service continuity for specific uses.

Transitioning from:

- Grid electricity to solar electricity
- Smaller to larger solar arrays
- Stationary batteries to vehicle batteries
- Partial decarbonization to net zero carbon

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Electric Vehicles

Resilience Asset	Est. 2020 Capacity (GW)
EVs	41.4
BEV cars	30.0
PHEV cars	11.0
FCEV cars	0.4
FCEV buses & trucks	0.01

Technically feasible value-added uses:

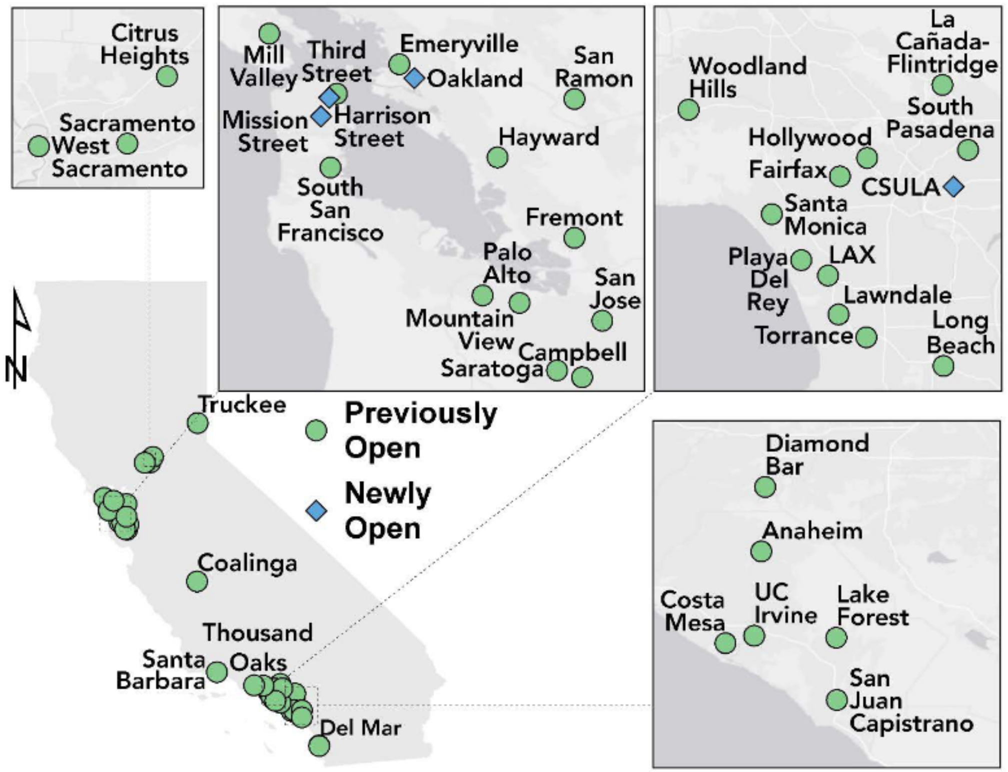
- Energy resilience (in situ and mobile)
- Grid support

On-site, commercial and public charging infrastructure options

Transitioning from:

- BEVs to mix of BEVs and FCEVs
- No value-added uses to major value-added uses

California's H2 Fueling Station Network - July 2020



Microgrids

Resilience Asset	Est. 2020 Capacity (GW)
Microgrids	0.2
CHP, NG, Diesel	0.1
Solar, Battery, Other	0.1

Grid ownership by energy user or utility

Municipalization option

Transitioning from:

- Campus to campus/community
- Microgrids to nanogrids*
- Single to multiple supply/storage sources
- Grid electricity cost avoidance to resilient decarbonization
- Grid as backup to mutual grid/microgrid backup

*microgrids comprised of building electricity circuits, energy management systems and on-site generation and storage

Montgomery County Maryland Correctional Facility Powered by a Campus Microgrid

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Resilient Decarbonization Outlook

- Transitions from:
  - Site resilience to resilient decarbonization
  - Site resilience to community resilience

Change enablers:
  - Scale-driven and learning-driven cost shifts
  - Life cycle thinking

Resilience Asset	2020 Capacity (est.) (GW)	Annual Market Growth (%)	Projected Capacity in 2025 (GW)
Currently Operational Assets			
CHP	8.6	5	11.0
Standby Power	10.4	4	12.6
Additional Assets Available for Use			
Solar PV	9.3	14.5	19.5
Electric Vehicles	41.4	22	108
Enabling Assets			
Campus Microgrids	0.2	19	0.5
Community Microgrids	No est.	No est.	0.5

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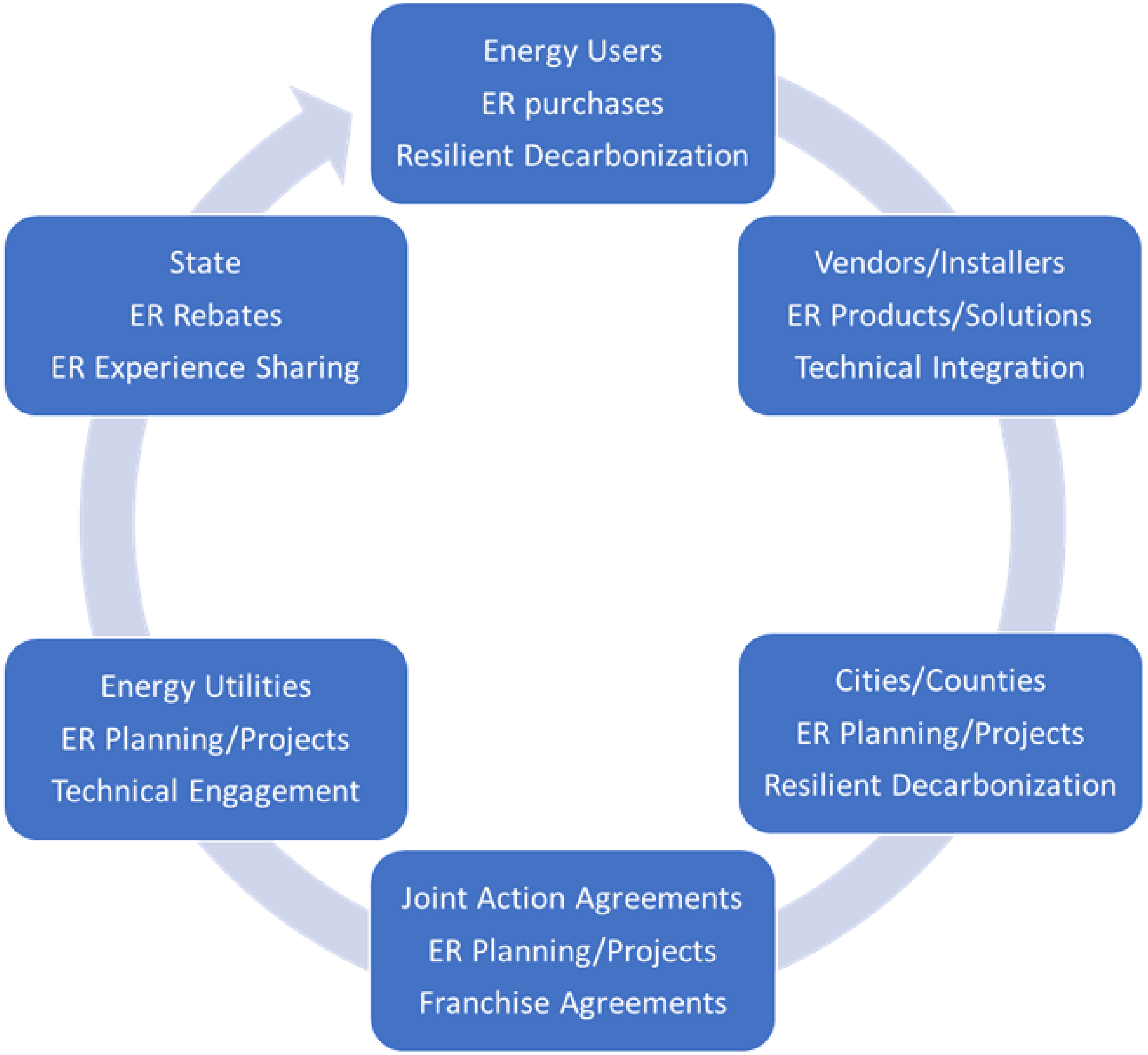
Resilient Decarbonization Eco-systems

Change agents:

- Private capital and retailers - nothing happens until it saves someone money.
- Local governments – no beneficial integration without local programs

Stakeholders:

- Energy users
- Equipment vendors and installers
- Energy service providers
- Cities and counties
- States



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Energy Users

Energy users invest in resilient decarbonization.

Benefits of their investments are limited or maximized by other stakeholders.

Strategies:

1. Start by minimizing bulk energy purchases.
2. Secure compensation for making on-site generation and electric vehicle assets available to support improved community energy resilience or more efficient grid operations.

UC Davis Net Zero Carbon Student Housing

In the local energy transition, it is the incomplete and imperfect thing you do and then learn from that clears the way, because you learn and gain confidence and experience to take additional necessary steps.

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Retailers and Installers - 1

Retailers and installers advise and implement energy user decisions.

Benefits of their work are limited or maximized by specialization, local experience, innovation and local teaming.

Strategies:

1. Team up to offer resilient net zero retrofits.
2. Progress to offering services beyond equipment installation, including technical integration of energy resilience assets and smart controls for resilient decarbonization.

Solar and electrification retrofits are most cost-beneficial to both user and community where there is competition to sell and install them.

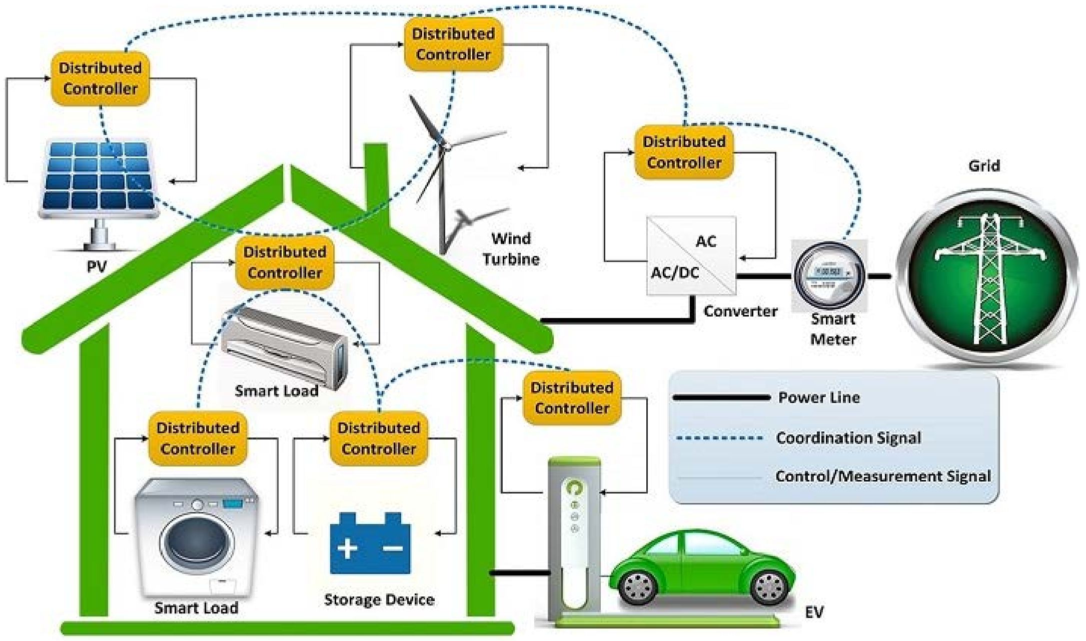
Retailers and Installers - 2

Retailers and installers advise and implement energy user decisions.

Benefits of their work are limited or maximized by specialization, local experience, innovation and local teaming.

Strategies:

1. Team up to offer resilient net zero retrofits.
2. Progress to offering services beyond equipment installation, including technical integration of energy resilience assets and smart controls for resilient decarbonization.



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Resilient Decarbonization Economic Benefits

California per capita local annual investment:

- Decarbonization assets
- Collateral assets enabling resilience

Economic benefits:

- Decarbonization
  - Jobs
  - Avoided electricity import cost
  - Tax revenues
- Resilience
  - Avoided interruption of economic activity

Estimated Economic Benefits of On-site Solar Deployment – Yolo County, CA through 2020

County Electricity Usage (GWh)	1750
On-site Solar Share of Supply (%)	12
Number of On-site Solar Electricity Systems	11800
Combined Capacity (MW)	117
Annual Production (GWh) (est.)	211
Avoided Grid Electricity Generation Cost ($M/yr.) (est.)	21
Number of Direct, Indirect and Induced Jobs (est.)	361
Property Value Increase ($M/yr.) (est.)	88
Avoided Electricity Import Cost ($M/yr.)	**53**
Job Creation Benefit to Local Economy ($M/yr.)	**37**
Sales Tax Revenue Benefit to Local Economy ($M/yr.)	**3**
Combined Benefit - Jobs, Sales Tax and Avoided Imports ($M/yr.)	**92**

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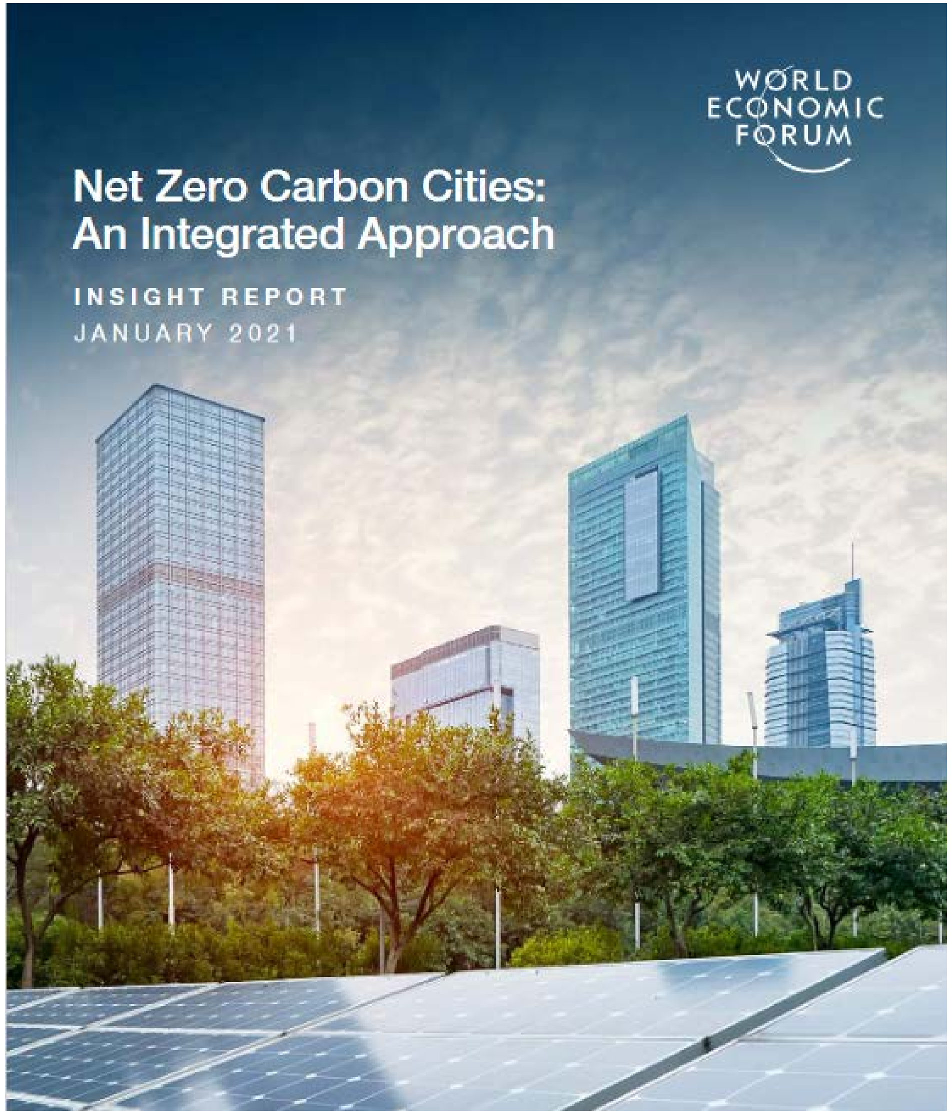
Cities and Counties

Cities and counties are the keystone species in 21st century energy eco-systems. They have rights and authorities that enable effective leadership and partnering but smaller jurisdictions may lack critical staff expertise.

Strategies:

1. Re-invest decarbonization economic benefits in energy management and analysis capacity.
2. Community renewable site identification and valuation.
3. Mandate carbon neutral microgrids for new neighborhoods and government operations.



http://www3.weforum.org/docs/WEF_Net_Zero_Carbon_Cities_An_Integrated_Approach_2021.pdf

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Utilities and Local Energy Service Providers

Energy utilities and community choice providers have data that is critical to assessing resilient decarbonization trends and progress.

They can actively partner with cities and counties to share data and drive projects forward, enabling:

1. more resilient back-up for schools and critical local facilities,
2. net negative carbon management of local organic waste streams, and
3. equitable access to resilient on-site solar electricity for community members unable to take advantage of net energy metering or on-site energy.

Babcock Ranch Solar Micro Community North of Ft. Myers, Florida

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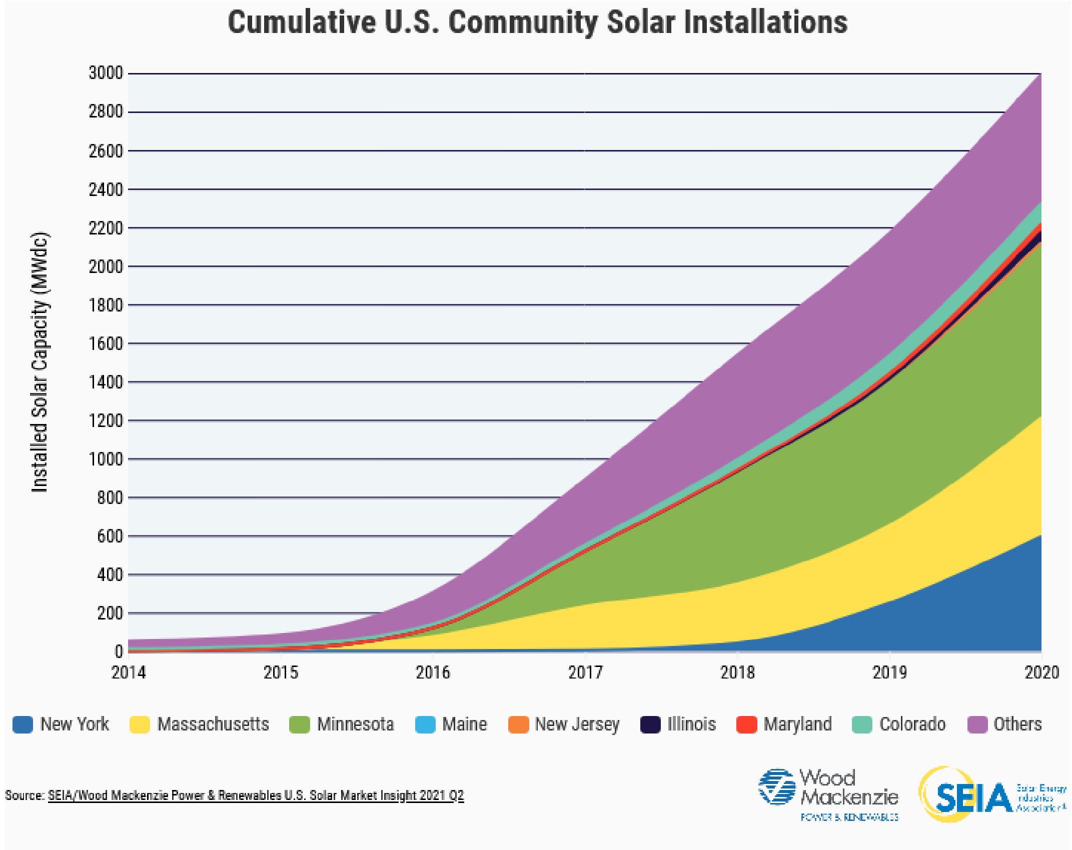
States

State governments can use proven strategies to empower energy user and local government energy resilience actions:

1. Reform net metering to allow net positive on-site solar power generation.
2. Rebate a portion of city and county investment in community renewable energy production.*
3. Convene local energy resilience project sponsors and implementers to share project experience and lessons learned.



*Buy down early higher costs to drive experience-based cost reduction

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Summary

Energy resilience underpins local economic resilience. It's an investment.

There are five important and currently available but under-utilized energy resilience assets:
- CHP and standby generators (site level resilience);
- Solar PV systems and EVs (energy cost minimization and site level decarbonization); and
- Microgrids (campus energy cost minimization and decarbonization)

Community renewable energy is an emerging opportunity for equitable access to energy resilience.

Multi-purpose (cost, carbon and resilience) asset utilization will be empowered by:
- Local technical and economic integration;
- Healthy eco-systems of energy users, installers, retailers, cities, counties, states and energy utilities; and
- City and county leadership, plus community energy resilience goals and implementation budgets.

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Thank you!

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For additional more detailed information:

https://www.researchgate.net/publication/353957607_INVENTORY_AND_INTEGRATION_OF_CALIFORNIA'S_LOCAL_ENERGY_RESILIENCE_ASSETS

https://www.iresn.org/news/2021/7/29/resilient-decarbonization-requires-state-and-local-leadership

For related information and articles:

www.iresn.org

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Post-script

The climate crisis is a “crowded greenhouse” and “hyper-capitalism” problem, to which there are no simple, equitable solutions. We are out of time and need to use every tool in our excellent and expanding tool kit to confront it and save lives.

Key Success Factors:

- All Hands On-Deck. Decarbonize everything. Equitable energy resilience for all.
- Now, not later.
- Unleash the most impactful trends.

Local Strategic Response Options:

- Local non-industrial energy use can be decarbonized by adoption of net zero integration of vehicles and buildings
- Gas fueled resilience assets can be integrated with solar and EV assets to provide community level as well as site level resilience.
- Substitution of carbon free and carbon negative fuels can decarbonize gas and oil fueled resilience assets to enable economically viable microgrids
- Life cycle thinking about zero carbon building and vehicle investments can be encouraged.
- GHG emissions from major sources can be taxed.

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