

CenCal Forum

Microgrids are for Everyone

November 7, 2019



01 The History of Microgrids

02 Microgrids 101

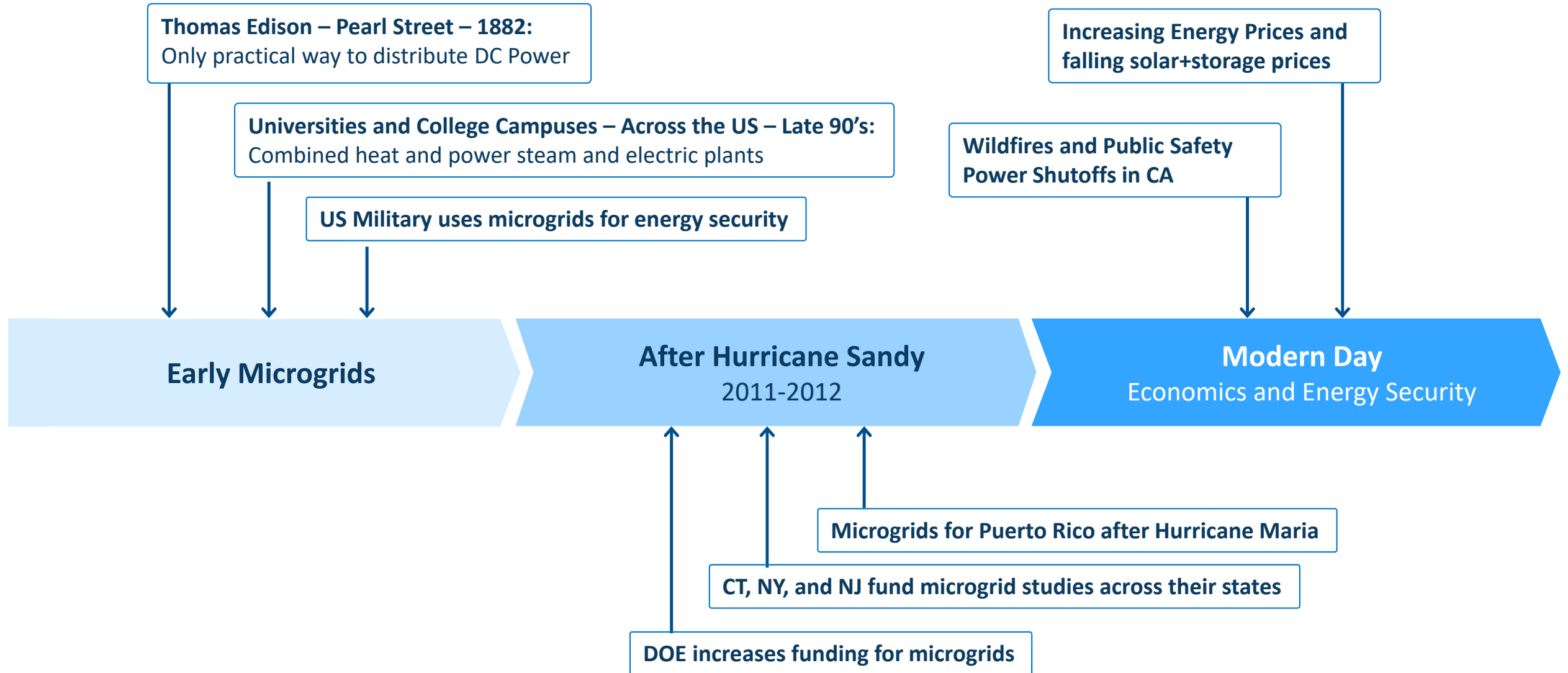
03 Real World Case Study

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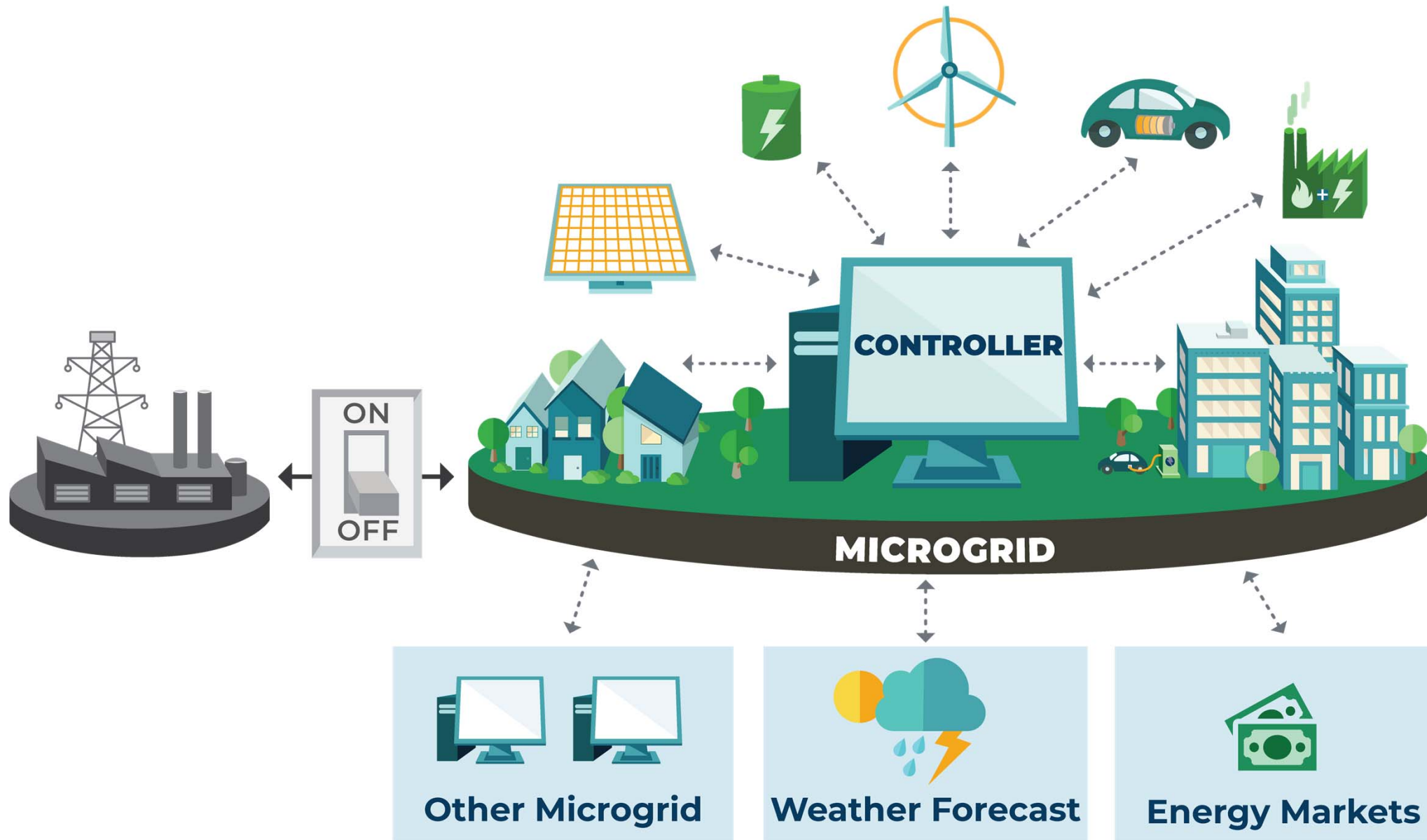
05 Funding Sources

06 Conclusions

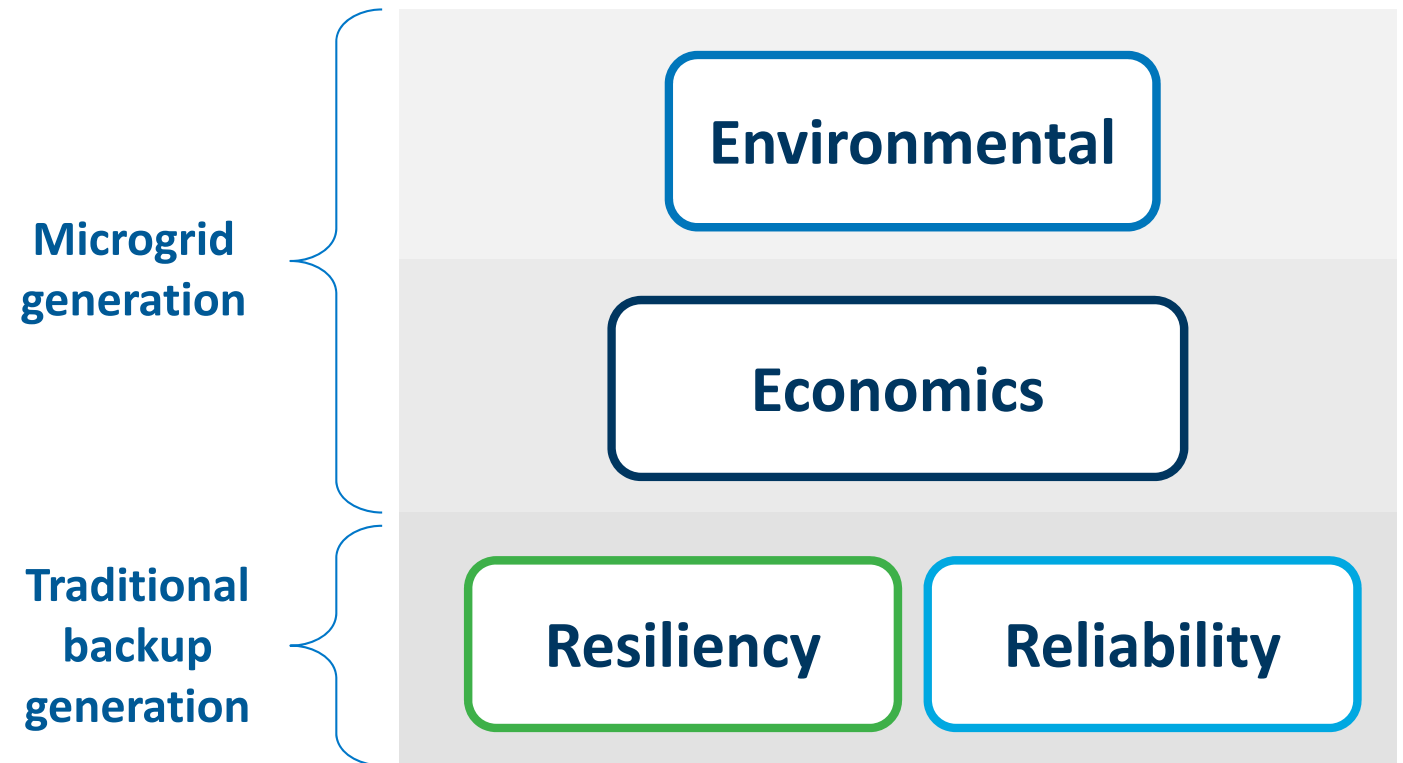
Historical Drivers for Microgrids



Microgrids 101 - Components



- Primary Motivators
 - Resilience, Reliability
- Secondary Motivators
 - Economics, Environmental goals
- Standard most “cost-effective” solution would be diesel generators



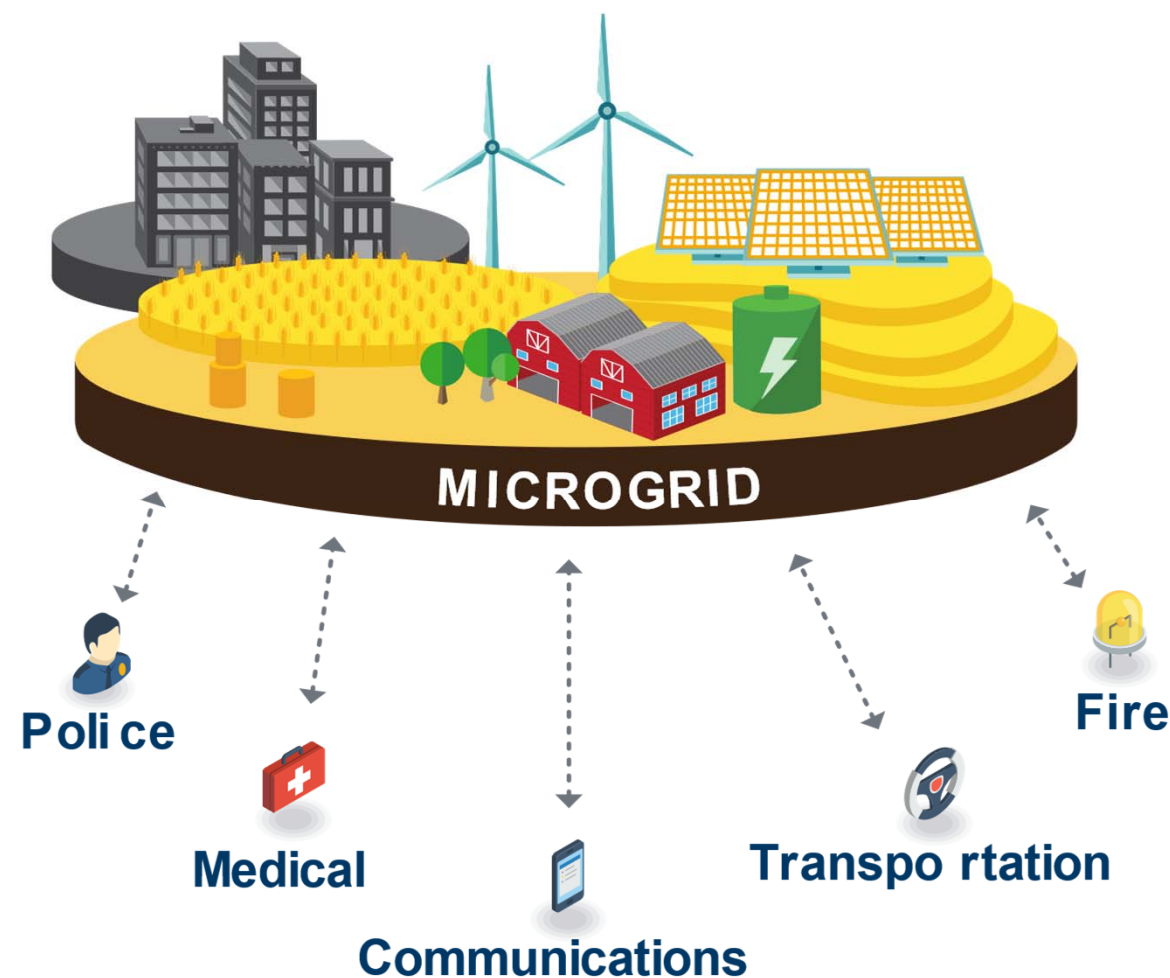
Microgrids incorporate functionality of traditional backup generation and add additional benefits.

- Microgrids help balance customer priorities in the following areas:



Microgrids are for Everyone!

- Public Safety Power Shutoffs affect everyone!
 - Hours, days and potentially weeks without reliable grid access are the new reality
- Public Safety Benefits:
 - Keeps critical infrastructure up and running during an outage
 - Complements and integrates with existing backup now
- Bolsters Community Resiliency:
 - Powers emergency shelters / high density living areas
- Resiliency now has value.



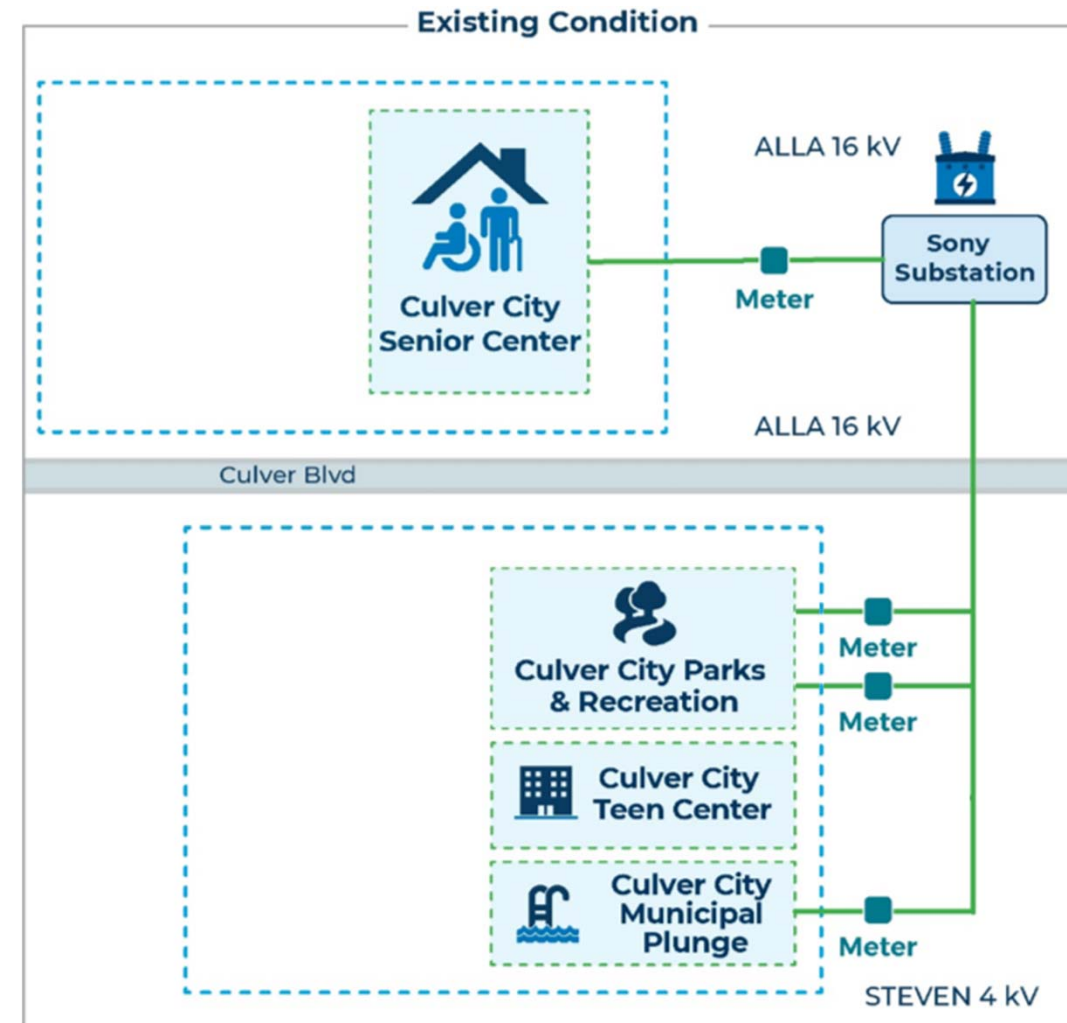
Microgrids can provide solutions to urban and rural areas alike.

Microgrid Case Study: Culver City



Microgrid Case Study: Culver City

- Four separate facilities
 - Event spaces
 - Performance space
 - Municipal Pool
- Separated by main road
- Separate utility circuits
- Served by 4 different meters
- Collective usage:
 - 1.25M kWh/yr
 - 60k therms/yr



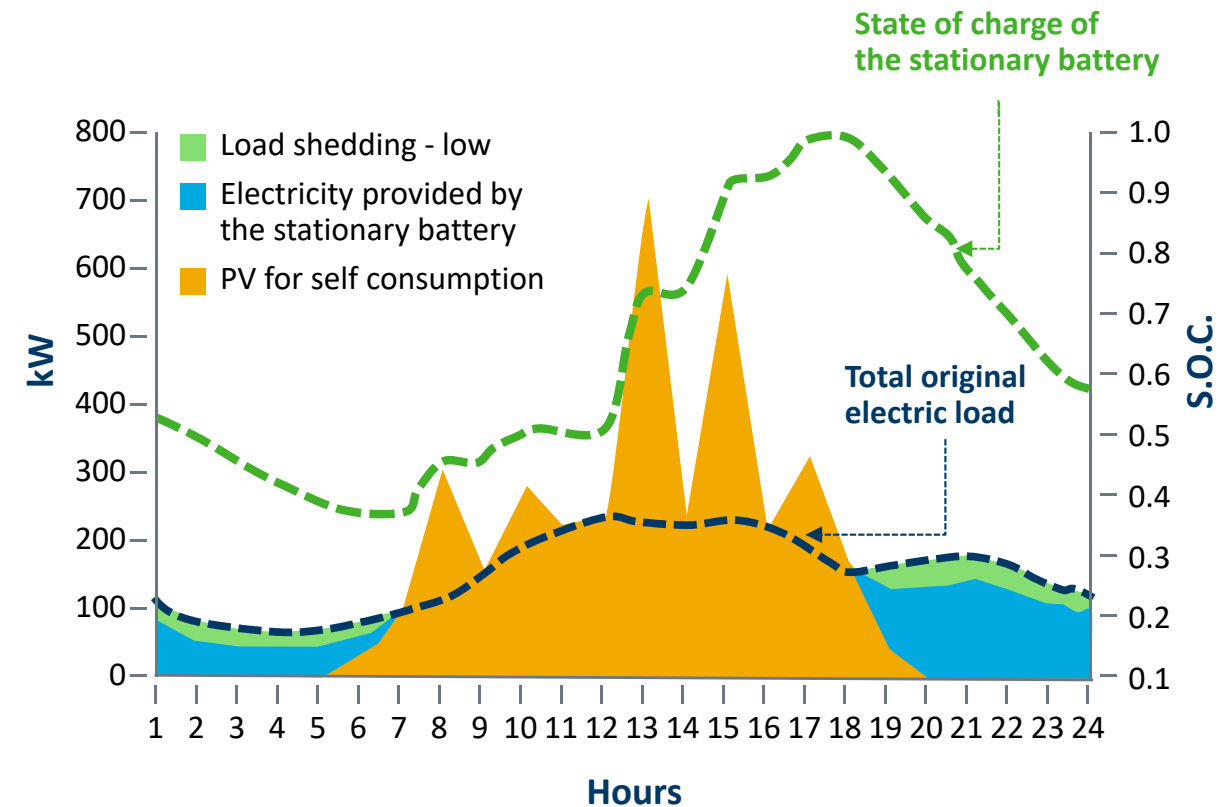
Microgrid Case Study: Culver City – Tools and Analysis

- SCE Circuit Analysis using DERiM



- 8760 Load, Solar+Storage, and Islanding for Resilience Analysis – DER-CAM

Optimal Dispatch for Electricity Technologies (July-emergency-week)





Option A – Economic Scenario

Provides enough Solar PV and storage capacity to maintain critical loads at Senior Center and Veterans Memorial Building during sustained outages

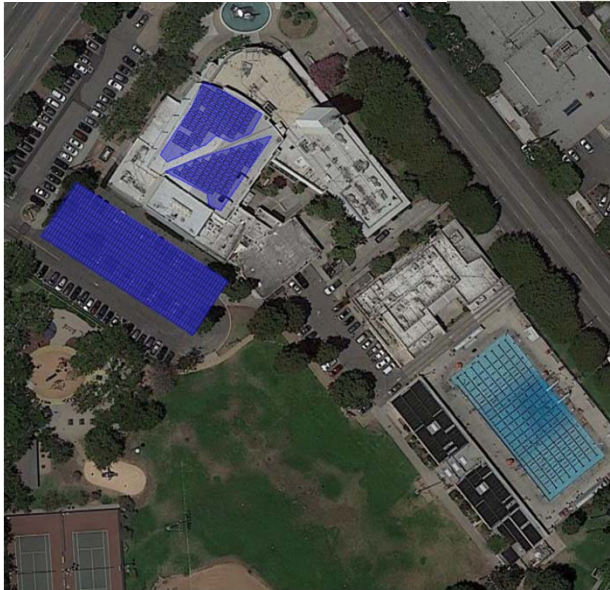
- Does not interconnect any meters
- Only offsets Municipal Plunge load (and Teen Center) via NEM-A
- Not a true microgrid





Senior Center



	187 kW Solar
	150 kW/ 150 kWh Energy Storage

Veterans Memorial



	155 kW Solar		140 kW/ 128 kWh Energy Storage
	127 kW Solar		114 kW/ 154 kWh Energy Storage

Cost	\$2.6M
Annual Savings	\$150k
Simple Payback	17 years
Standalone Resiliency	4 hours


Option B – Resilient Scenario


Flexibility to share solar generation and storage at Veterans Memorial site

- Physically interconnection of three Veteran’s meters into one meter
- Increased storage at Senior Center compared to Option A
- Allows for more solar and storage, adding resiliency to the site
- Not a true Microgrid for both sites

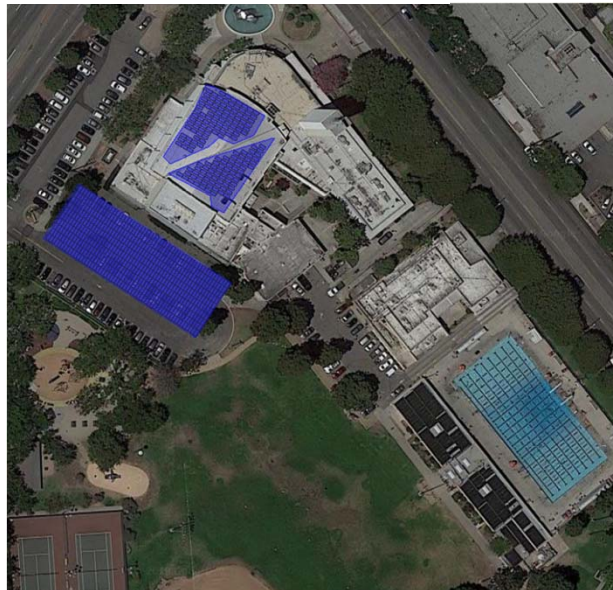
Senior Center





 187 kW Solar

 168 kW/
301 kWh Energy Storage

Veterans Memorial



 351 kW Solar

 316 kW/
1,412 kWh Energy Storage

Upfront Cost	\$4.2M
Annual Savings	\$200k
Simple Payback	21 years
Standalone Resiliency	7 hours


Option C – True Microgrid


Creates an actual microgrid between the two sites

- All four meters are combined into a microgrid
- Maximizes total solar and storage capacity
- Greatest resiliency option, and most aligned with City’s goals and needs

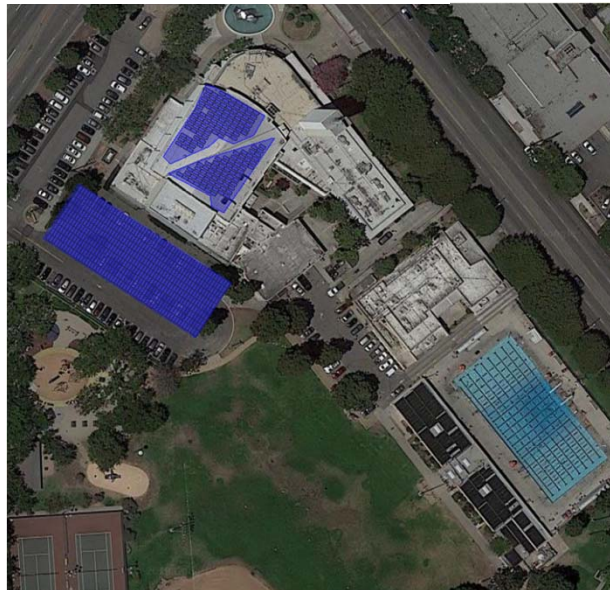
Senior Center





 428 kW Solar

 168 kW / 301 kWh Energy Storage

Veterans Memorial



 323 kW Solar

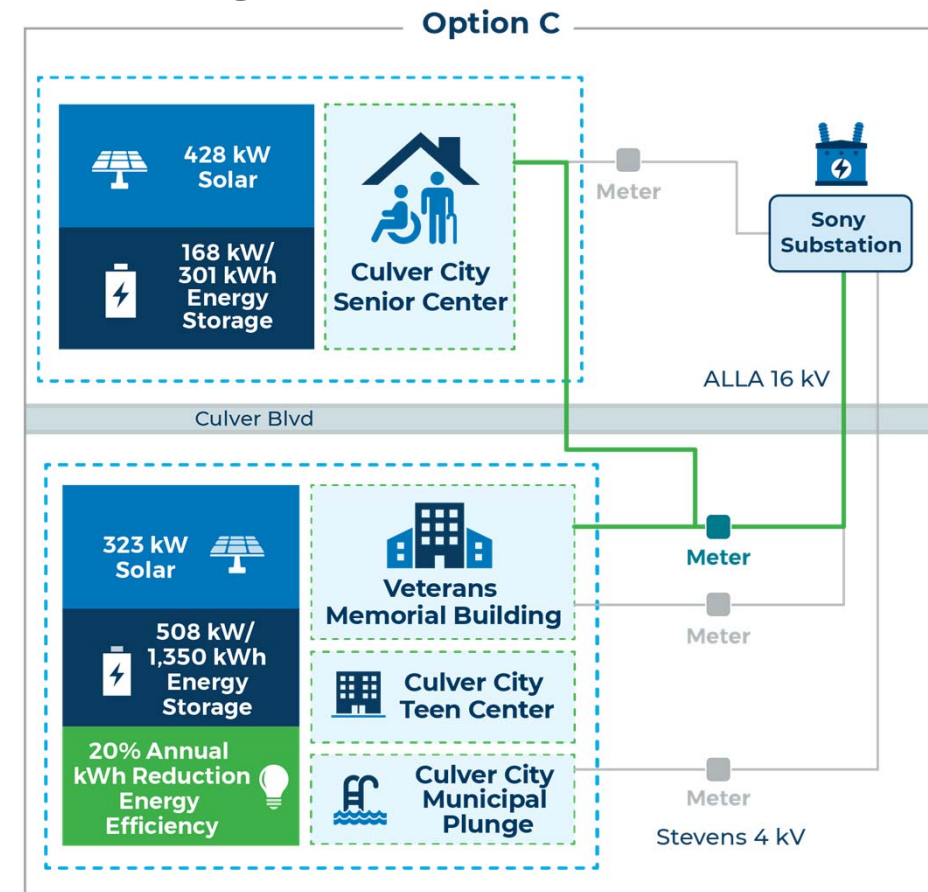
 508 kW / 1,350 kWh Energy Storage

Upfront Cost	\$5.0M
Annual Savings	\$214k
Simple Payback	23 years
Standalone Resiliency	10+ hours

Microgrid Case Study: Culver City - Results

- Meter Consolidation and Islanding to create a microgrid behind a single meter – New Lines in Blue

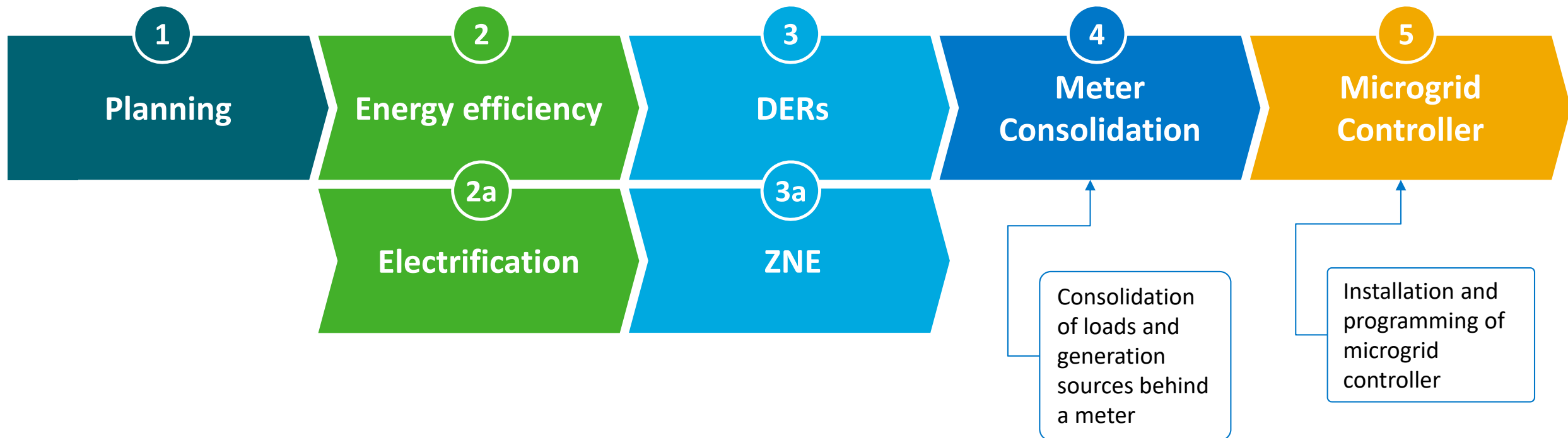
- Optimal Technical and Financial Microgrid Solution



City Council Approval 3/18/19 to proceed and pursue funding with Willdan as Project Manager

Microgrid Roadmap

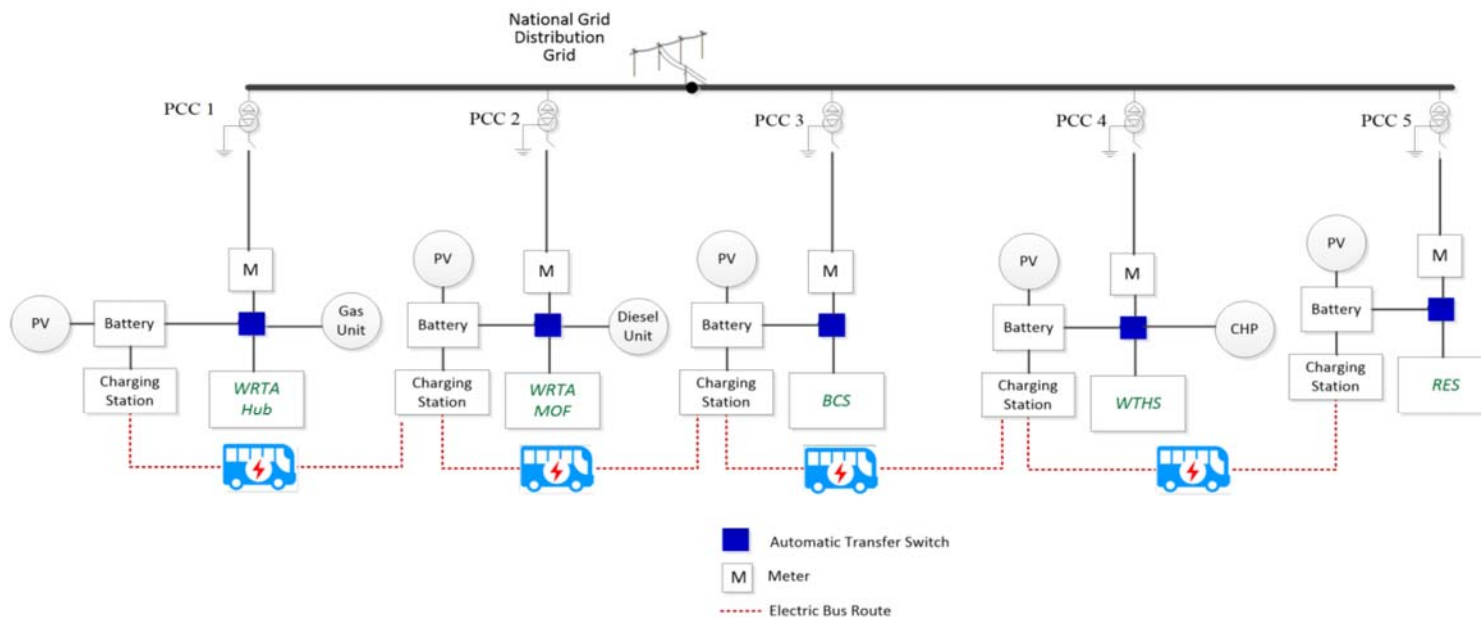
- High level overview of steps from beginning to end:



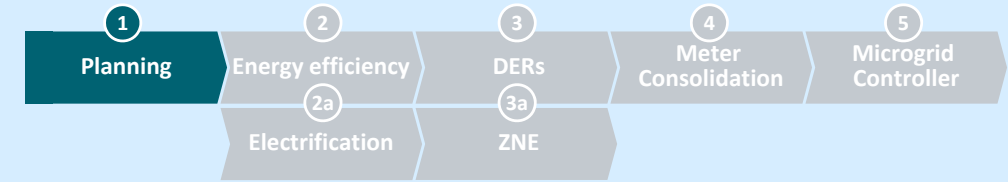
What Step Is Your City On In Their Journey?

Step 1: Planning

- Activities include:
 - Feasibility Studies
 - Energy Audits
 - Strategic Plans
- Real-world example
 - Culver City Microgrid Feasibility
 - Worcester MA Community Microgrid



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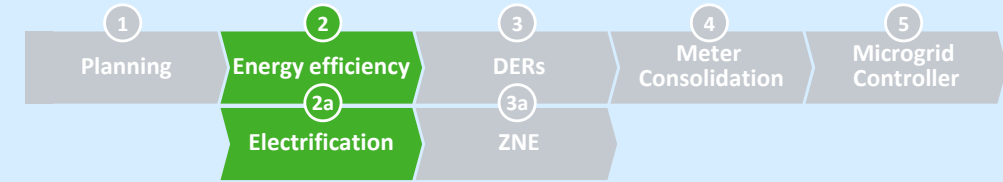


- **Funding Opportunities:**
 - State and Federal Grants – especially related to resiliency
 - Utility Programs and Incentives
 - Local Government Partnerships
 - SoCal REN – Pathway to ZNE

Pro Tip : The planning process allows you to engage and seek input from various stakeholders to make sure needs are understood and met!

Step 2: Energy Efficiency

- Activities include:
 - Energy Audits
 - Retrofits / RCx
- Real-world Examples
 - Culver City Microgrid began with EE:
 - 213,617 kWh, 120 kW, 3,100 therms
 - 17% upfront savings (17% less DERs)



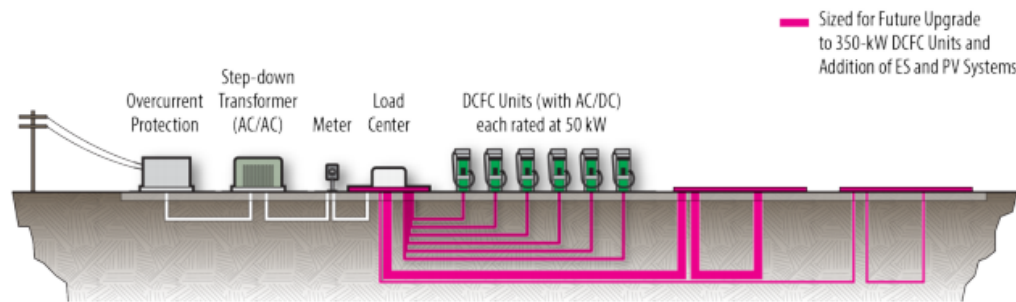
■ Funding Opportunities:

- State and Federal Grants
- Utility Programs and Incentives
- Local Government Partnerships
- SoCal REN
- Turnkey Project Delivery Mechanisms

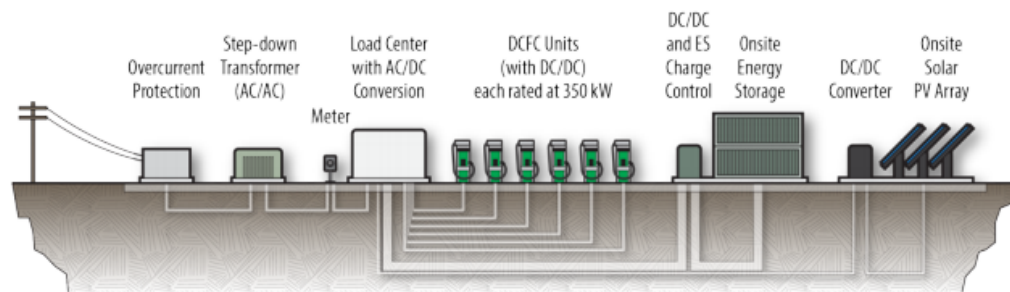
Step 2a - Electrification : If you're looking to go fully ZNE/ zero carbon, replacing gas consuming equipment as it reaches EUL can set you up for future success

Step 3: Distributed Energy Resources

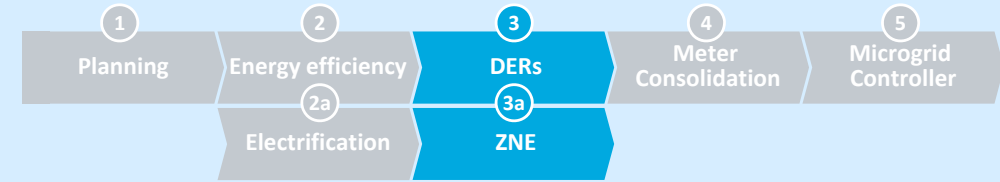
- Activities include:
 - Solar PV
 - Wind
 - Stationary Battery Storage
 - Geothermal
 - EVs
- Real-world Examples
 - Illinois Institute of Technology (IIT)



A) DCFC complex with 50-kW chargers and no ES and PV systems at initial installation



B) DCFC complex with 350-kW chargers and ES and PV systems



- **Funding Opportunities:**
 - State and Federal Grants
 - Utility Programs and Incentives – SGIP
 - System Lease Opportunities – PPA, etc.

Step 3a - Zero Net Energy: If you're looking to go fully ZNE/ zero carbon, this will affect DER system sizing. Careful planning from step 1 will help inform choices of type and size of systems.

IIT DER Photos

Real World Example

IIT Pilot Projects

1  **Campus Microgrid Smart Controller Smart Home**

2  **DC/AC Nanogrid at Gym**

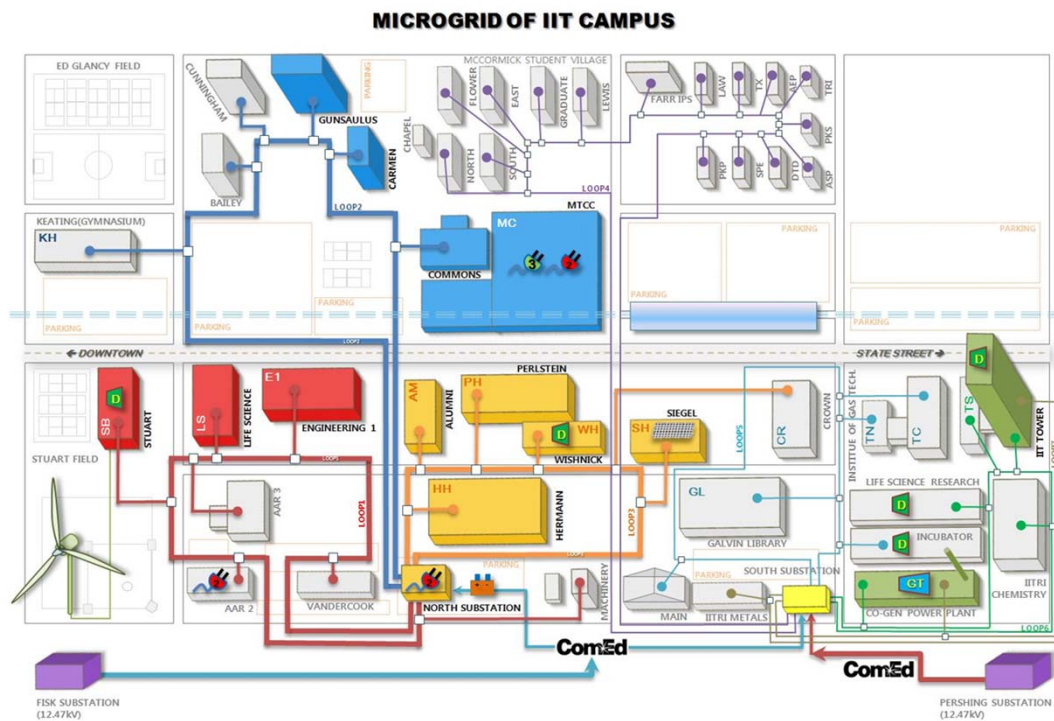
3  **CSMART (Utility, City of Chicago, Industry Partnership)**

4  **Hybrid Charging Station**

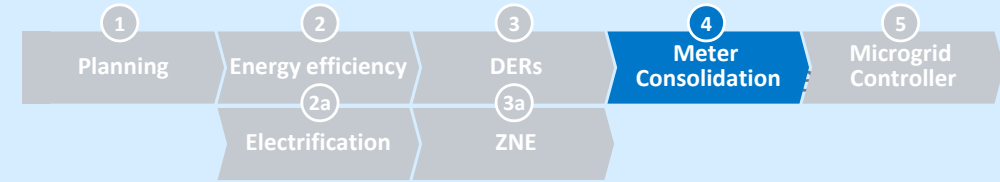


Step 4: Meter Consolidation

- Activities potentially include:
 - Behind-the-meter infrastructure upgrades
 - New Meter
 - New Utility Service
 - In-front-of-the-meter infrastructure upgrades
- Real-world Examples
 - Grid reconfiguration at IIT – Loop based system



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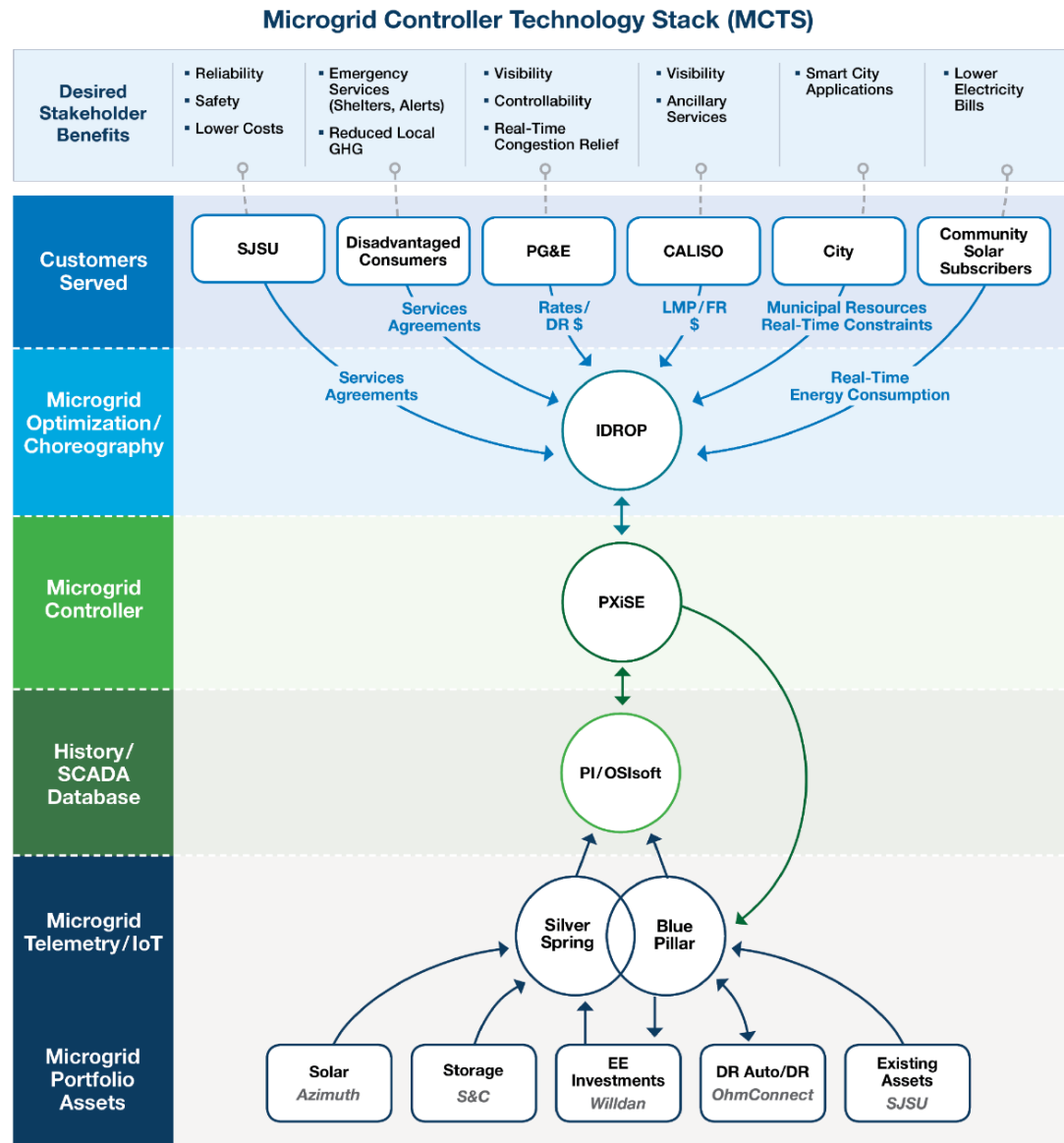


- **Funding Opportunities:**
 - State and Federal Grants
 - Utility Programs and Incentives – EV programs
 - System Lease Opportunities – PPA, etc.

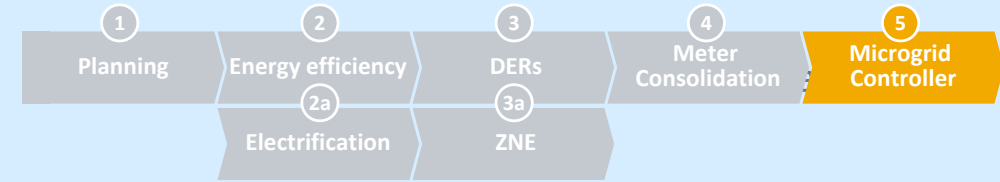
Pro Tip:
 With significant activity in the EV sector, utility programs which fund make-ready EV charger infrastructure installations can also potentially incorporate behind the meter DERs

Step 5: Microgrid Controller

Real-world Examples



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Activities potentially include:

- Installation of physical hardware to strategically deploy DERs
- Setup and ranking of microgrid priorities
- Testing and Tuning

Funding Opportunities:

- State and Federal Grants
- FEMA / Emergency Planning Funding
- Utility Programs and Incentives – Microgrid Conversion Funding
- System Lease Opportunities – PPA, etc.

Big Picture Funding Opportunities/ Next steps

- Assess current progress towards microgrids / resilient operation
- Align Funding with needs

Source	Planning	EE	DERs	Microgrids	Resiliency / PSPS	EVs	ZNE
IOU Incentive		✓				✓	
SoCal REN	✓	✓	✓				✓
FEMA					✓		
SGIP			✓	✓*	✓*		
State / Federal Grants	✓	✓	✓	✓	✓	✓	✓
Cap and Trade						✓	
AQMD		✓				✓	
CARB		✓				✓	



Free

Grants & Utility Incentives

- Grant (FEMA or CAL OES)
- Utility Rebates & Incentives
- Philanthropic Grants



Low Cost

Muni Debt & Subsidized Debt

- CEC Loans
- Muni Bonds & Leases (Tax-Exempt & Taxable)
- CA Infrastructure Bank



Moderate Cost

Private Debt or Equity

- Debt from energy/infrastructure investors
- Third-party ownership of energy assets

Microgrid-as-a-Service: PPA style arrangement where assets are owned and operated by a 3rd party. Offtaker makes a per-kWh and capacity payment.

- Microgrids are for everyone!
- Deployment can be incremental and strategic based on priorities
 - Reliability
 - Environmental
 - Resiliency
 - Economic
- Falling DER prices make more projects economical (alternative is diesel)
- Funding sources are catching up to technology and are expected to continue to increase
- A good plan / roadmap sets up successful project implementation with a vision for future growth and interoperability.
- Use the work of others who have gone before...

Where Are You On Your Journey? Assess and get started!

Questions?

Presenters

Thank you!

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