

Plug and Process Loads: Roles and Opportunities in Energy Resiliency

10th Anniversary May 10, 2022

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CALPLUG

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CALPLUG Heading Into Next Decade



2021



Energy
Efficiency

*Focused on & addressed
localized problems with
plug loads*



Grid
Interactive
& Flexibility



Onsite
DER & ES



Electrification



Energy
Efficiency



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More Dynamic Grid
Resources & Considerations

More Locally Dispatchable
Renewable Resources

**More New Plug & Process Loads
inside homes, buildings, and
manufacturing facilities**

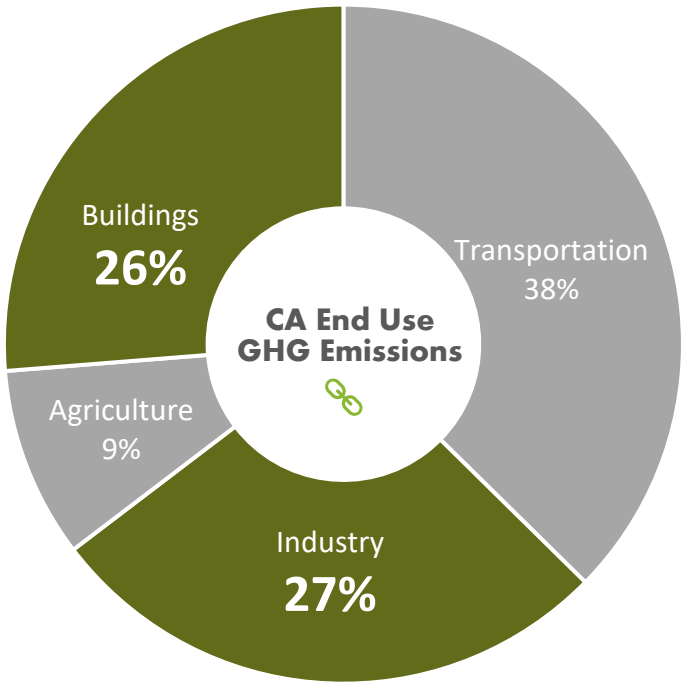
**More Smart Controls &
Smart Loads & Gizmos**



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CalPlug's Holistic Approach & Solution

1 Focus on
Building & Industry
sector Decarbonization

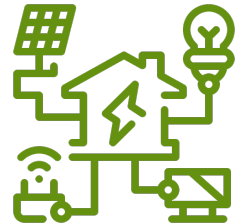


2 Focus on
Small & Medium
Manufacturers and Buildings

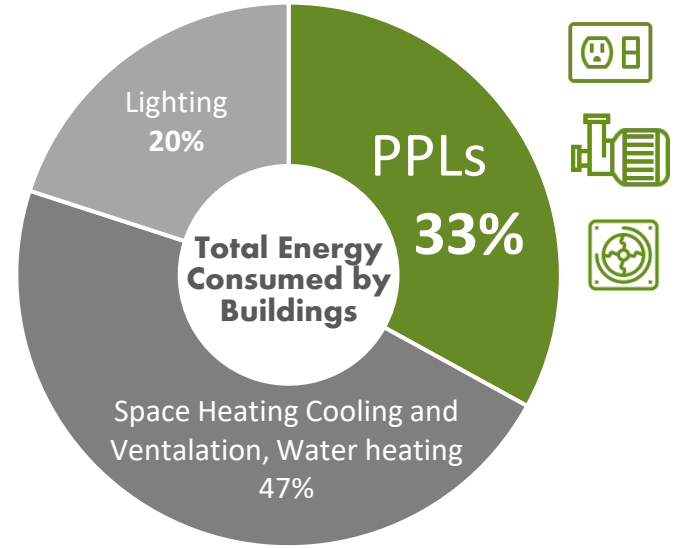
>39,000
small & medium manufacturers in CA
+ their buildings

Account for
50%
CA's Manufacturing GDP

3 Focus on
Holistic
Approach & Solution



4 Start with the rapidly changing
Plug & Process Loads



CalPlug's Holistic Approach

***Starting from “The End-Use”,
the nested and rapidly changing
Plug and Process Loads,***

***By the integration of sensing, measuring,
optimization, analytics, and real-time control,***

***To provide data and insights to enable
optimal orchestration for Grid-interactive
Efficient Buildings,***

***To develop economically and technically
feasible decarbonization pathways for
Small and Medium (SM) sized Commercial
buildings, and SM Manufacturers and their
buildings.***



Energy Resiliency in Small & Medium sized Manufacturers

"the ability to resist being affected by an event or the ability to return to an acceptable level of performance in an acceptable period of time after being affected by an event closing"

--U.S. DOE on Resiliency

Decarbonization Pillars Support the Energy Resiliency

Technically feasible key pillars for End-use Sectors Decarbonization



“The ability of a power system and its components to withstand and adapt to disruptions and rapidly recover from them”

In the Case of SMMs energy resilience the power system comprises the electrical infrastructure behind the electrical meter of the industrial facility.

Decarbonization Pillars Support the Energy Resiliency

In the event of a blackout or extreme event, SMMs designed to be energy efficient and store or produce energy onsite offer a greater level of protection to the continuity of operations and safety ramp down.



Energy
Efficiency

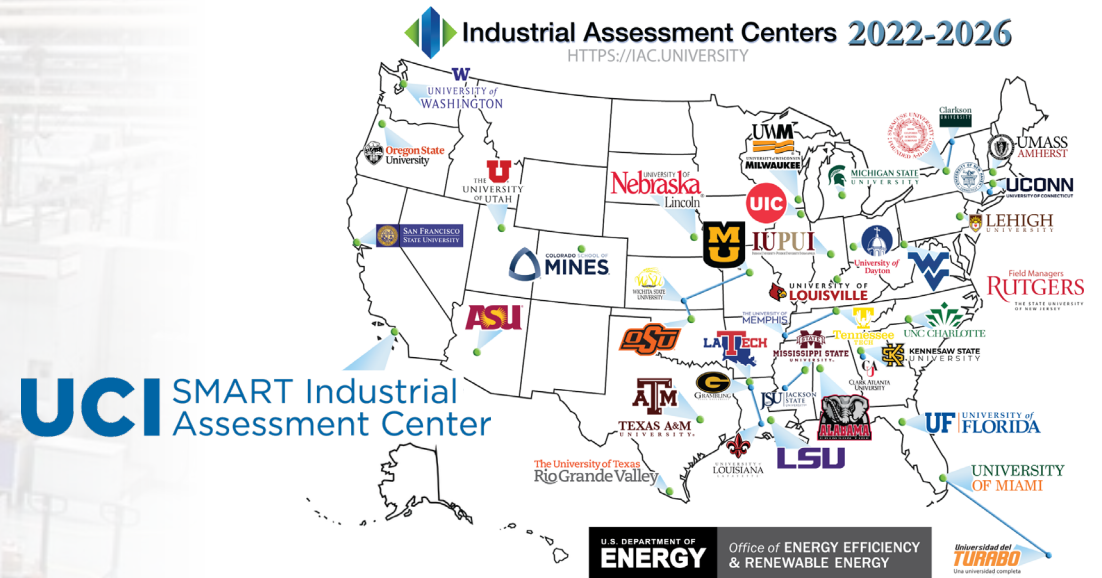
Energy efficiency increases the passive survivability of buildings —maximize the usage of limited resource available.



Onsite
DER & ES

Onsite DER+ES: During a power outage, backup power (e.g., batteries, onsite solar, generators, or combined heat and power [CHP]) allows for continuity of operations and building habitability.

Access to SMMs?



For SMMS, the IAC has done:

19,686 Assessments

147,944 Recommendations

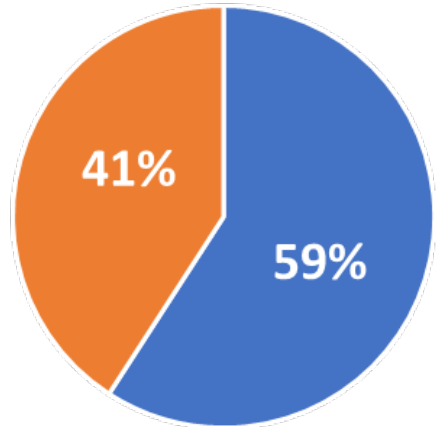
to improve SMMs energy efficiency.

Plug and Process Loads in SMMs

The general area of application of the recommendations, can be dividing into **Process related** and **non-process related**.



Total 113,562
Recommendations



Manufacturing Process and Process Support

Process Heat, Process Equipment, Air Compressor, Steam, Motor, etc.



Building and Administrative

Lights, HVAC, Taxes, Inventory control, etc.



Opportunities in improving
Process Load energy
efficiency in Small & Medium
sized Manufacturers.

Plug and Process Loads in SMMs

! “Better” savings in adopting Process Load energy efficiency recommendations in Small & Medium sized Manufacturers.

\$ Implementation Cost



\$35,672



\$21,505

Average Payback Years



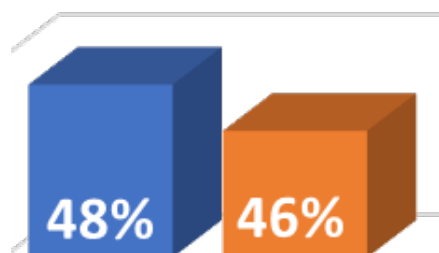
1.34yr



1.69yr



Process related recommendations have higher implementation cost, but saving are more significant therefore shorter payback period.



Implementation Rate



Higher adoption rate for SMMs to improve their process load and process support.



Process related



Non-Process related

Onsite DER & ES in SMMs

- During normal operation
Reduce demand charge and energy cost, if sized properly
- During blackout or fuel shortage event
Provide resiliency and continuity of operation
- Onsite generation and energy storage type of recommendation is under the category of Reduction of downtime recommendations in IAC program
NOT “popular” among SMMs, recommended **41** times over the decades (148,887 total recommendation), very low adoption rate **24%**
- High cost and long payback period; require high resolution data to make sense the dispatch strategy for selected PPLs

A photograph of two utility workers in high-visibility yellow vests. One worker is standing and writing on a clipboard, while the other is kneeling and using a tool on a piece of industrial equipment. The background shows a complex network of pipes and valves.

Planning for Resiliency with PPLs for SMMs

More PPLs with improved Energy efficiency

- During normal grid/fuel supply
 - Reduced likelihood of demand surge that led to service disruptions
 - Lower energy cost
- During outage or shortage
 - Passive survivability
 - Utilize limited resources for longer duration

Planning for Resiliency with PPLs for SMMs

Critical PPLs connected with Onsite DER & ES

- Identify critical PPLs in SMMs
- During normal grid/fuel supply
 - Reduced demand charges
 - Support sustainability goals
- During outage or shortage
 - Uninterrupted operation of critical PPLs

SMMs Planning Resiliency with PPLs



SMMs are

- In variety of industry sub-sectors
 - Have their own process power/heating requirements
 - Various product specs and production cycles
 - Have a high degree of process integration
 - Higher cost of onsite energy source and storage systems in small scale
-
- Identify control strategies and critical Plug and Process Loads, to pair and size with the energy storage system for optimal dispatch during blackout
 - Seek alternative fuel for Process loads to diversify the fuel supply to improve resiliency over supply shortage

SMMs Planning Resiliency with PPLs

- **Estimating loads to identify energy resiliency needs**
 - Timeframe of energy resiliency desired
 - Remain minimum operation
 - Safely shut down or ramp down
 - Prioritize of the loads and circuit control design
 - Know your loads! PPLs + processes
 - ES SOC and DER ramping rate and dynamics
- **Planning for different type of events**
 - Unpredictable events
 - Planned PSPS (Public Safety Power Shutoffs)
 - PSPS outages and resiliency plan with notifications from utility
 - Generator and battery rebate program
 - If NOT a Critical facility/infrastructure

We Welcome Opportunities for Collaboration!

Please contact Dr. Li Zhao
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THANK YOU!



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