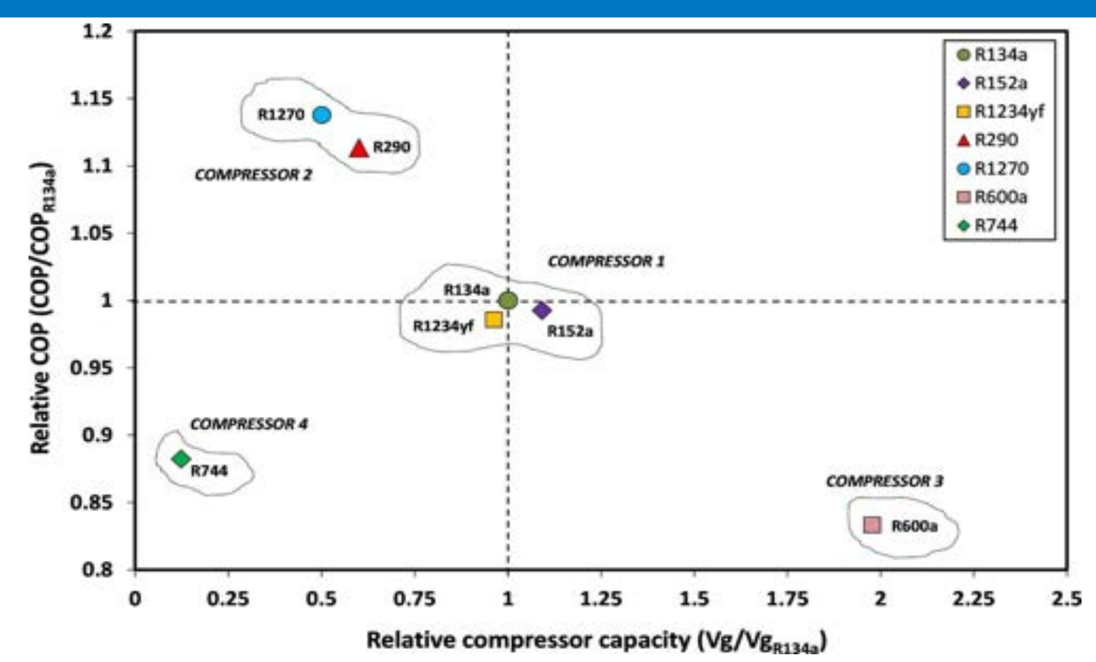
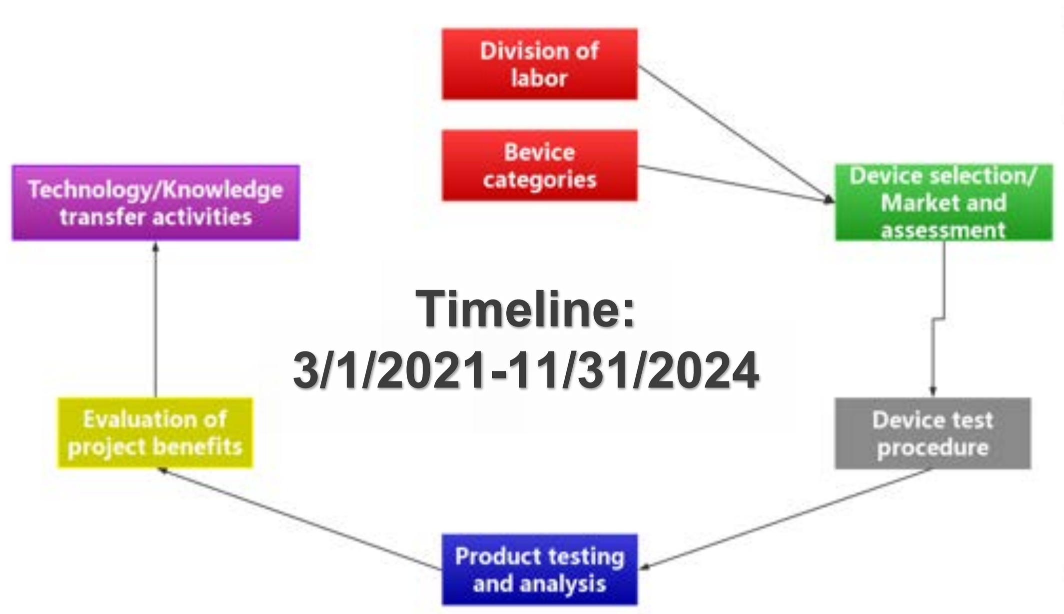
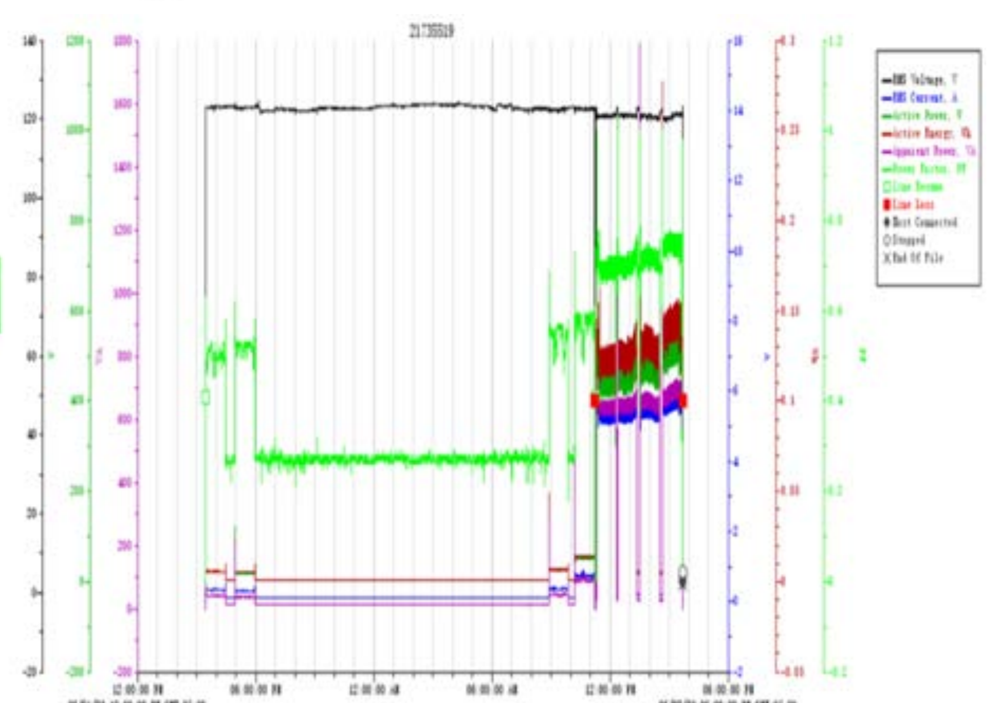
ARCS
AUTONOMY RESEARCH CENTER FOR STEAHM
Autonomy for Sustainability

Energy & Appliance Standards for Plug Loads: Assessing Current Needs and Future Opportunities







Date	Time	Arms	Arms MIN	Arms MAX
		A	A	A
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2023/3/25	16:55:14	0.13	0.11	0.17
2023/3/25	17:00:14	0.13	0.1	0.17
2023/3/25	17:05:14	0.13	0.11	0.19
2023/3/25	17:10:14	0.13	0.11	0.18
2023/3/25	17:15:14	0.12	0.1	0.35
2023/3/25	17:20:14	0.11	0.1	0.14
2023/3/25	17:25:14	0.11	0.1	0.18
2023/3/25	17:30:14	0.11	0.1	0.13
2023/3/25	17:35:14	0.11	0.1	0.15

European Commission

IEC

ENERGY STAR

Synopsis

- The California Energy Alliance (CEA) and California Energy Commission (CEC) are collaborating with CSUN to develop effective methods for optimizing energy consumption in laboratory equipment. This partnership aims to identify approaches that can improve the energy efficiency of lab operations.
- Due to the lack of existing measurement standards for laboratory equipment, CSUN has focused its research on creating energy consumption standards specifically for lab environments. The goal is to establish guidelines that will help reduce energy usage and support sustainable practices in laboratories.

Research Objective

- **Benchmark Study**: Identify plug load devices with the most potential for cost-effective energy savings.
- **Research Standards**: Develop test procedures to reliably quantify energy use & related performance attributes for compliance purposes.
- **Methods:** Test devices to determine energy consumption in active, standby, sleep, idle and/or other operating modes.
- **Data evaluation**: Analyze test data and extrapolate results to determine specific C&S opportunities. Model the impact of the C&S recommendations to determine statewide savings and related impacts.

Research Approach

- One of the most effective ways to reduce plug load energy use is through the adoption of device-level appliance energy standards.
- In order to identify achievable energy savings opportunities, however, research must be completed to develop a market and manufacturing understanding of each unregulated device type, its subsystems, potential and existing operating modes, and its range of energy use and demand.
- This will lead to new codes and standards opportunities for these plug load devices focused on such things as maximum power ratings, mandatory operational states (e.g., sleep or standby power use) and minimum component-level efficiencies.
- In addition, future codes and standards will require specification of existing test procedures or development of new test or performance verification procedures to quantify energy use and, in the future, determine code compliance.

Research Results and Products

Data obtained from laboratory freezers, water baths, incubators, centrifuges and autoclaves show that:

- **Before the standard was established:** Laboratory freezers, water baths, incubators, centrifuges and autoclaves did not have a specified energy stability standard.
- **After the standard was established:** Based on limited data, laboratory freezers, water baths, incubators, and centrifuges have preliminary standards. The complex structure of the autoclave should be optimized according to its operating principle.
- **Future development direction:** Since laboratory equipment is not included in the energy plan, it can be optimized according to the frequency of use and efficiency of its internal components.

Commercialization and/or Societal Impact Opportunities

Energy stability standard: After a large number of tests, it is convenient to further formulate detailed standards.

Academic purpose: Provide test methods and experimental data within limited data.

Team Names & Collaborators

Student:
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Collaborators:
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Keith Graeber, CLTC at UC Davis

Citations

Sánchez, D., et al. (2022). Energy impact evaluation of different low-GWP alternatives to replace R134a in beverage cooler: Experimental analysis and optimization for the pure refrigerants R152a, R1234yf, R290, R1270, R600a, and R744. Energy Conversion and Management, 256, 115388. https://doi.org/10.1016/j.enconman.2022.115388

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