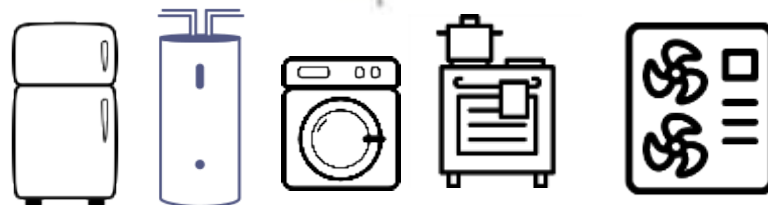
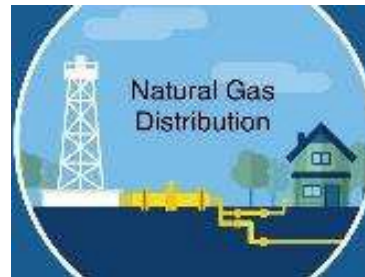
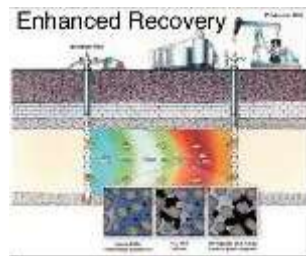
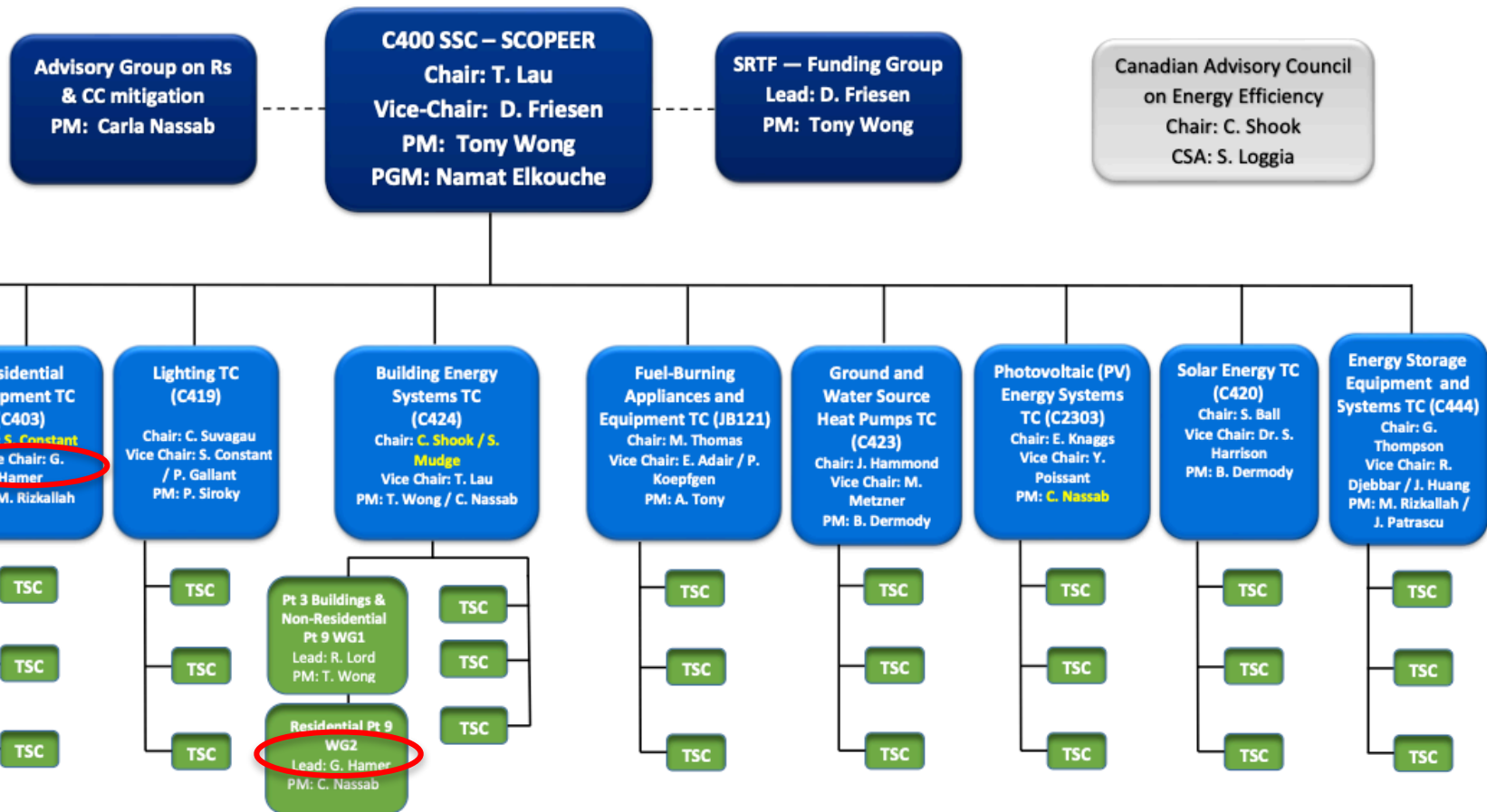


Gary's Energy History



Performance, Energy Efficiency & Renewables



1st in the World – Air-air HPs & ACs

Purdue University
Purdue e-Pubs

International Refrigeration and Air Conditioning
Conference School of Mechanical Engineering

2022

CSA EXP07: Ongoing Progress, Lessons Learned, And Future
Work In Load-based Testing of Residential Heat Pumps

Bruce Harley
Mark Alatorre
Christopher Dymond
Gary Hamer

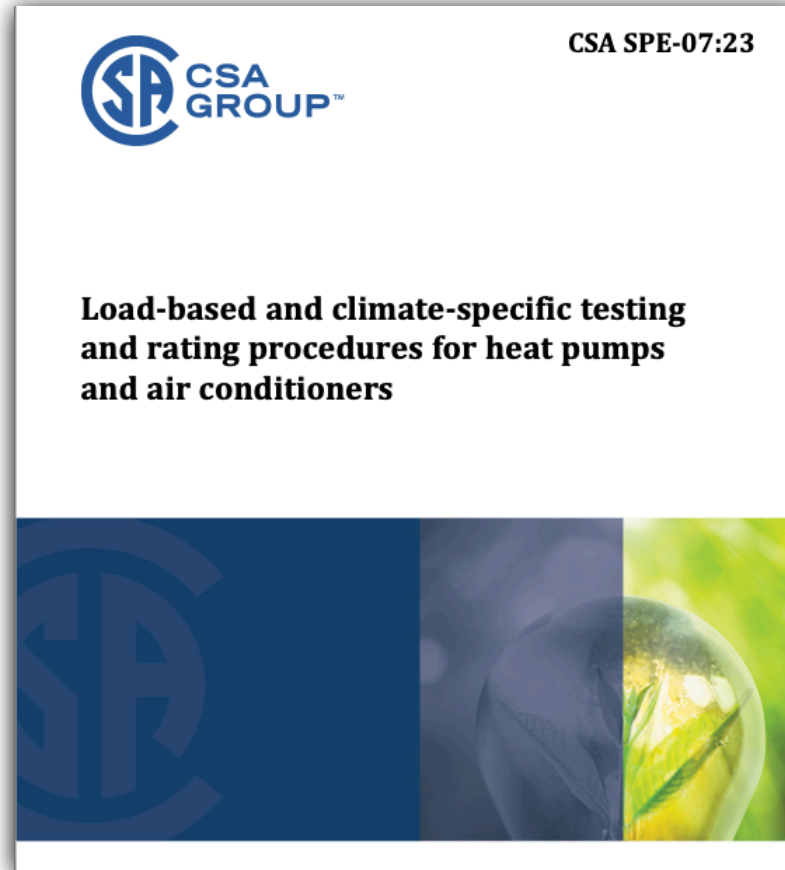
Follow this and additional works at: <https://docs.lib.purdue.edu/iracc>

2014 – 2019

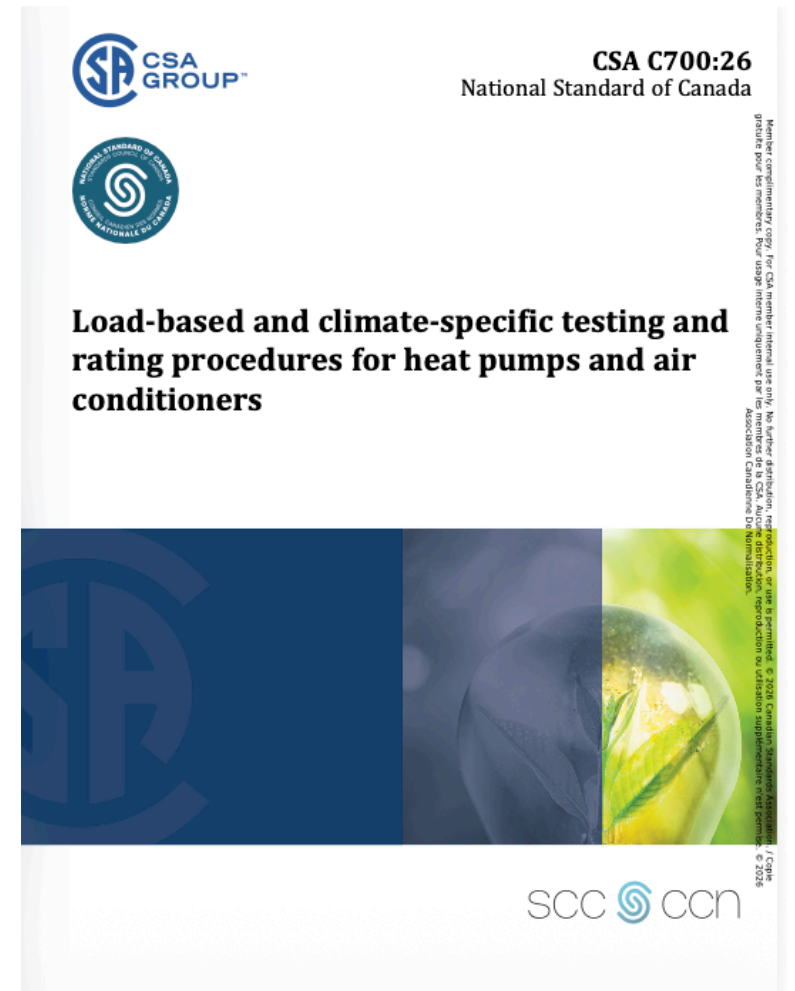
Current ratings do
not predict in-field
performance
accurately

- ✓ Easy
- ✓ Repeatable
- ? Reproduceable
- ✗ Representative

ZERO ENERGY/EMISSIONS
BUILDINGS
LEARNING CENTRE



2019 – 2023

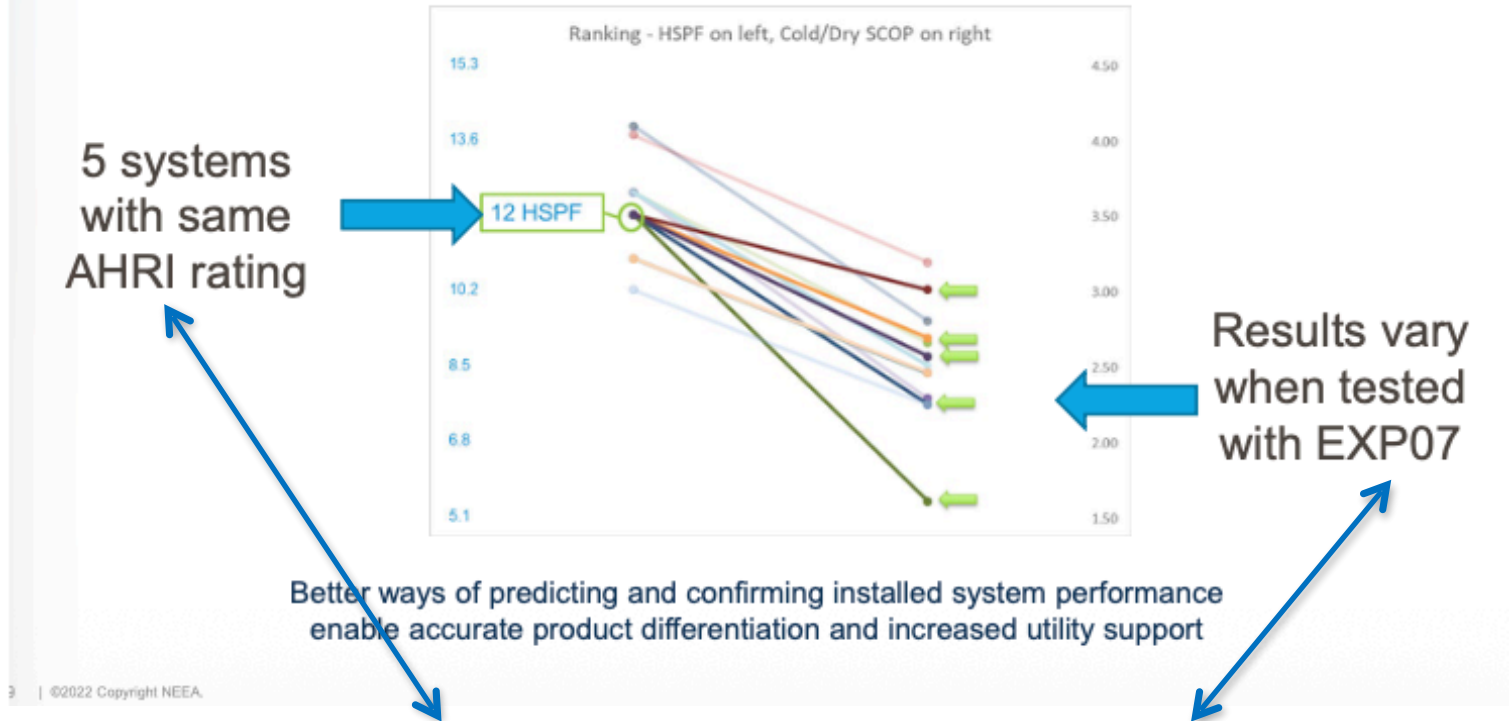


2023 – 2026



Performance Standards for Heat Pumps

Load Based Testing Revealed Slightly Lower Performance and Rank Order Changes



International Energy Agency



Energy in Buildings and Communities Programme

Evaluation and Demonstration of Actual Energy Efficiency of Heat Pump Systems in Buildings (Annex 88)

“...energy efficiency of **heat pumps under low partial load conditions** (i.e., heat pumps operated inevitably much below their maximum capacity) is **not appropriately represented by existing testing standards** and calculation methods for building energy codes.

Equipment only

Equipment + Controls

Current ratings do not predict in-field performance accurately

- ✓ Easy
- ✓ Repeatable
- ? Reproduceable
- ✗ Representative



Other New Heat Pump Standards



CSA C750:25
National Standard of Canada



**Airflow and static pressure measurements
in residential ductwork systems**

CSA SPE-17:23



HVAC guide for Part 9 homes

Other Load-based, Climate-Specific Testing & Rating Standards...

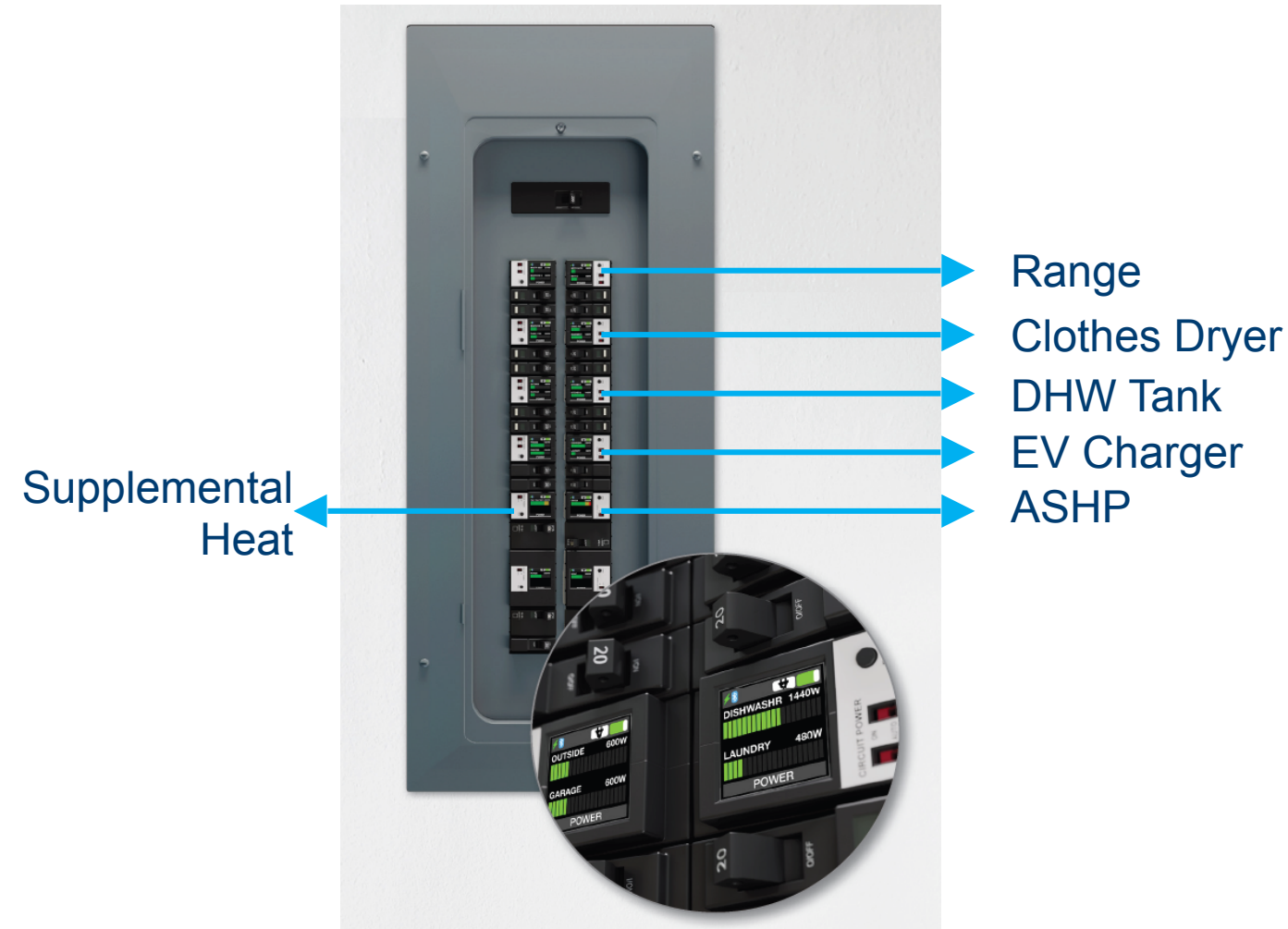
***C715:2026** – combination space and water heating heat pump systems

SPE18 – HRVs & ERVs

- > Thermal Storage
- > Sizing storage & gen systems

***CSA / ANSI**

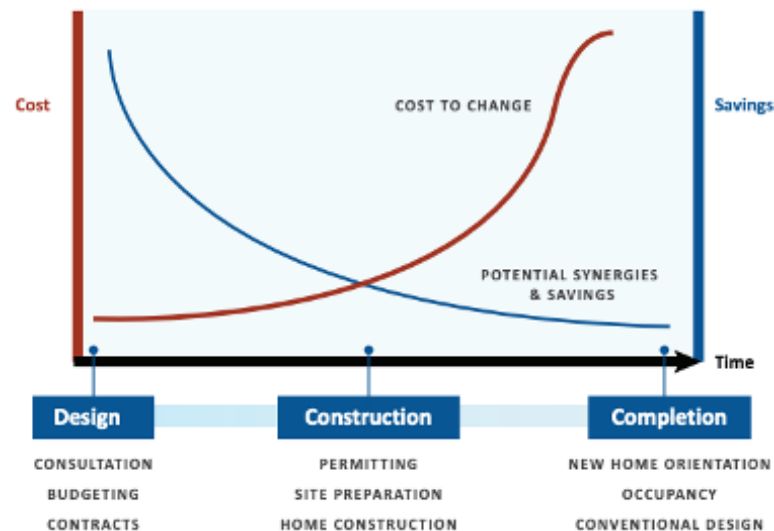
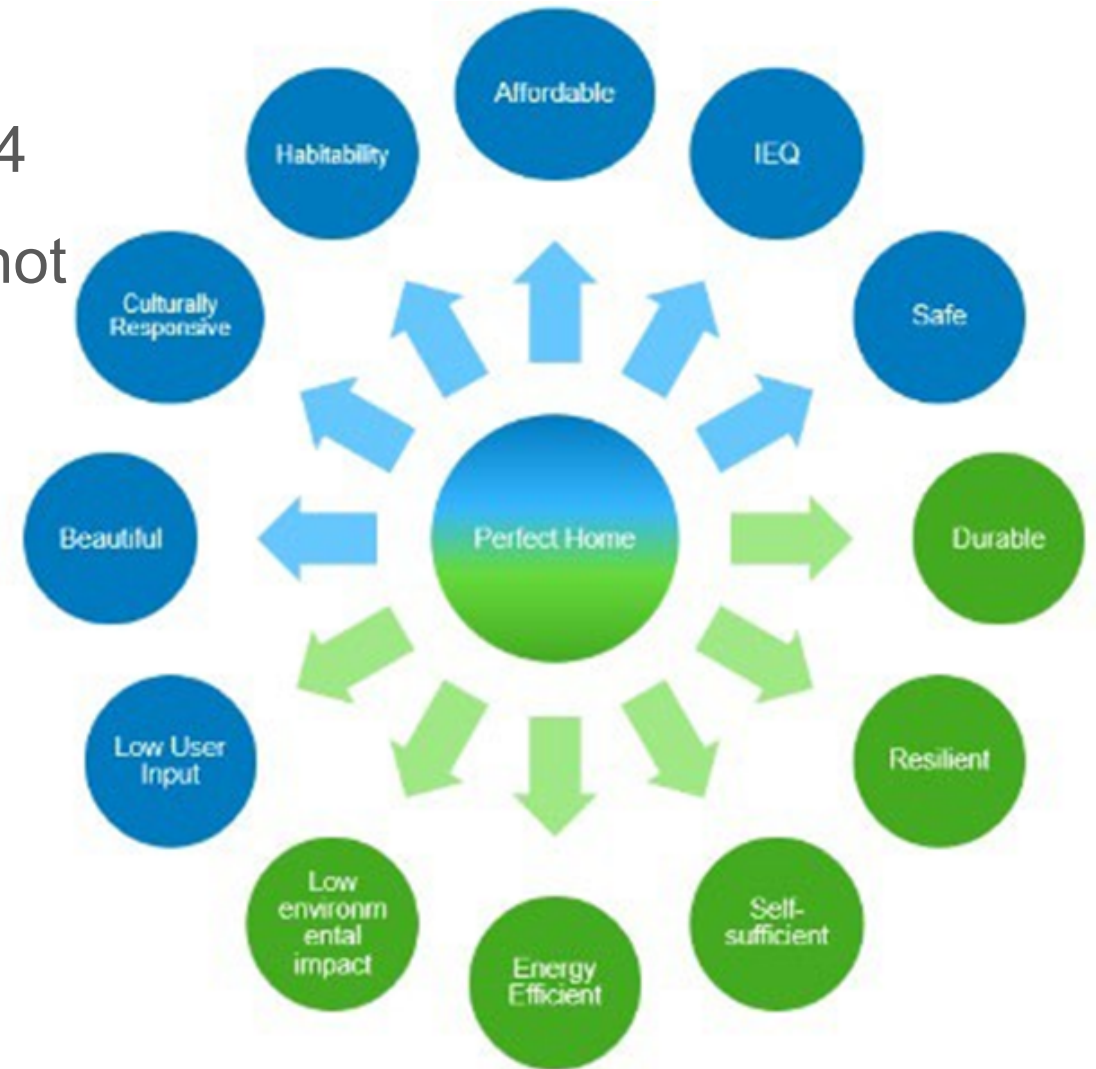
Prioritized Load Enabling/Shedding (Smart Panels)



- Smart Panel enables/disables continuous electrical loads based on real-time service current measurement.
- Loads prioritized based on available service current margin and programmed load shedding.
- **Rules 8-106 2) 3) and 8-106 11).**
- Not widely endorsed by safety authorities but holds future promise.

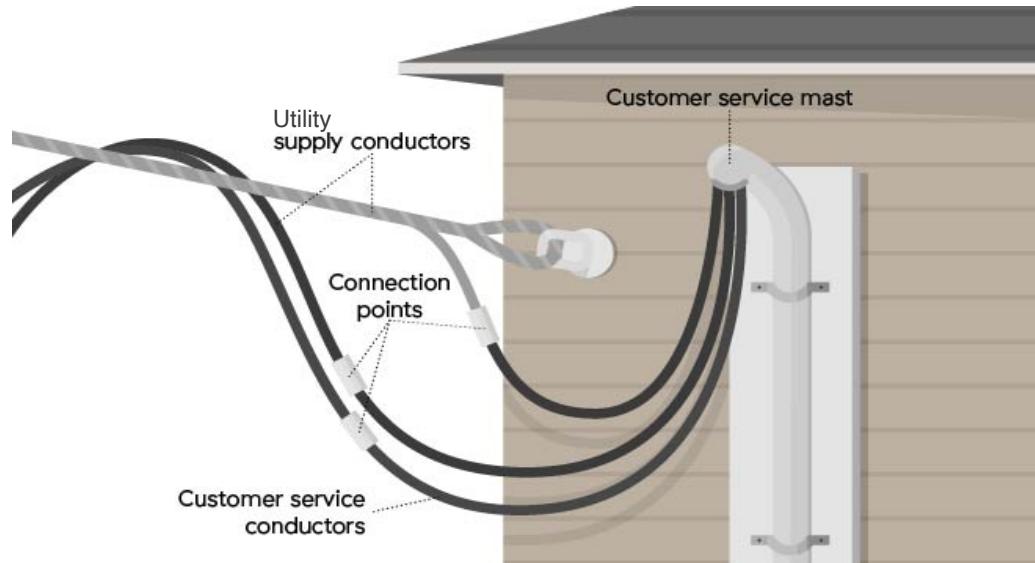
Why integration matters

- Attributes of the Perfect Home, CSA SPE14
- Many attributes are valued by occupants (not just cost)
- These attributes are all inter-related
- An integrated approach is needed . . .



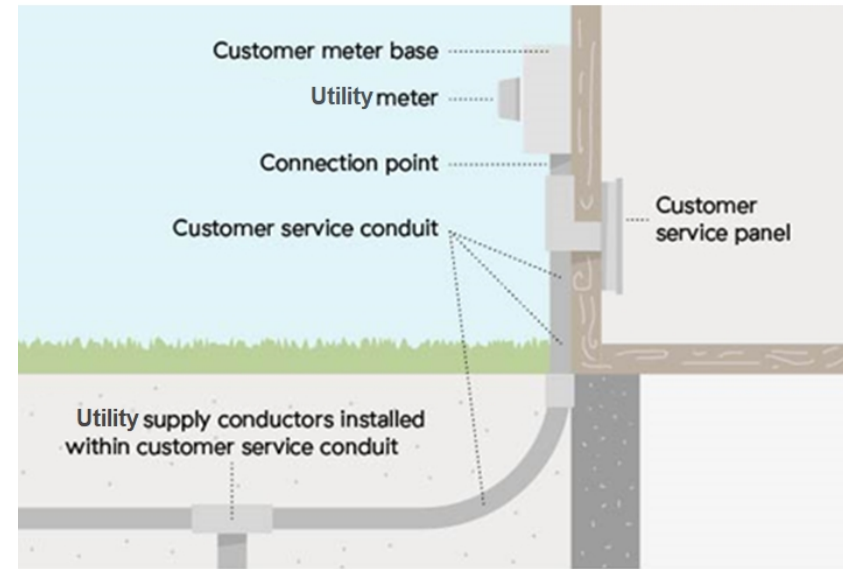
Customer Service Constraints

Overhead Service



- Supply conductors most easily upsized.

Underground Service



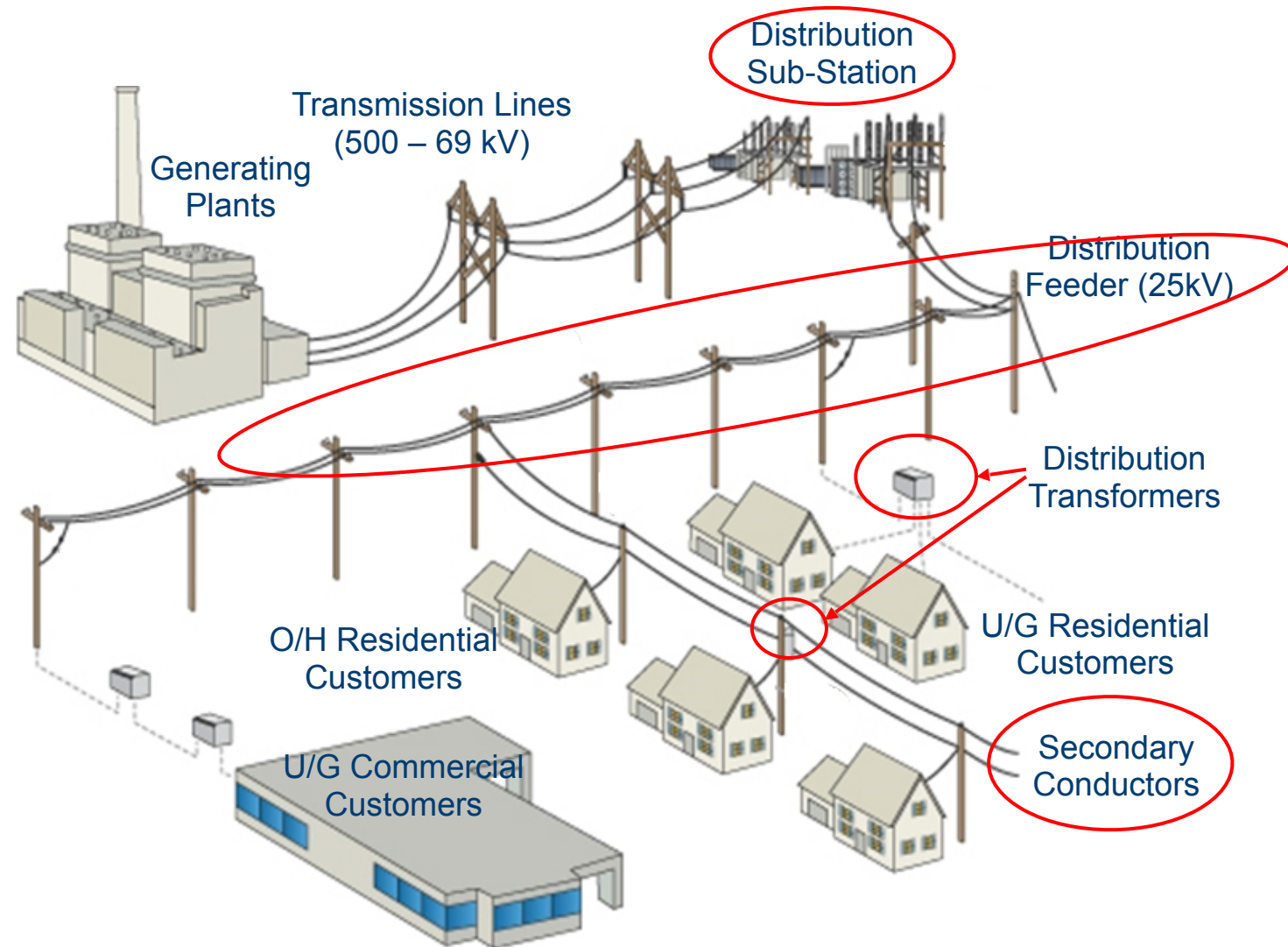
- Supply conductor upsizing requires excavation, driveway cutting/repairs, landscaping disruptions, etc.

Utility Infrastructure Limitations

Multiple neighborhood or service area service upgrades can require utility infrastructure upgrades including:

- Substation equipment
- Distribution feeders
- Distribution transformers
- Secondary conductors.

Expensive, difficult, or even impossible in some regions.

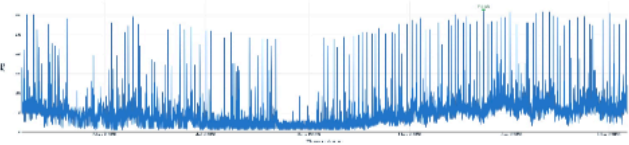


LEEP SPARK Tool – Peak Amperage from Real kWh

One-page report

Demand profile

Demand profile



Panel calculator

Panel calculator
Starting from the one-year peak demand, apply adjustment factor and breaker loading.

Service size: 800 A
Main breaker: 100
Breaker loading? 100 %
Existing load: 120 A
Proposed loads: 0 A
One-year peak: 62.9 A
DIVERSIFIED TOTAL: 62.9 A (ADJUSTED TO 76.6 A)

Available margin
21.4 A
Demand appears to be within the main breaker allowance. Always confirm with local code (NEC) and utility rules.
Effective main breaker capacity: 100.0 A (capped by 100 A service/breaker) at 100%.
Existing load after adjustment: 76.6 A - Proposed additions: 0.0 A.

One-page report
Copy the highlights for your permit package.

COVERAGE 2025-03-11 — 2026-03-11	CADENCE 60-minute data
PEAK AMPS 62.9 A	VERDICT OK (21.4 A margin)

PROPOSED LOADS
No proposed loads were added to this scenario.

Screening tool only — always confirm against code and utility requirements.

- Using historical interval meter data, SPARK calculates peak amperage and demonstrated demand.
- SPARK helps homeowners, utilities, programs & contractors avoid unnecessary panel upgrades.

One-page report
Copy the highlights for your permit package.

COVERAGE 2025-03-11 — 2026-03-11	CADENCE 60-minute data
PEAK AMPS 62.9 A	VERDICT OK (21.4 A margin)

Smart Panels: Verifying Performance – existing and new?



Questions?