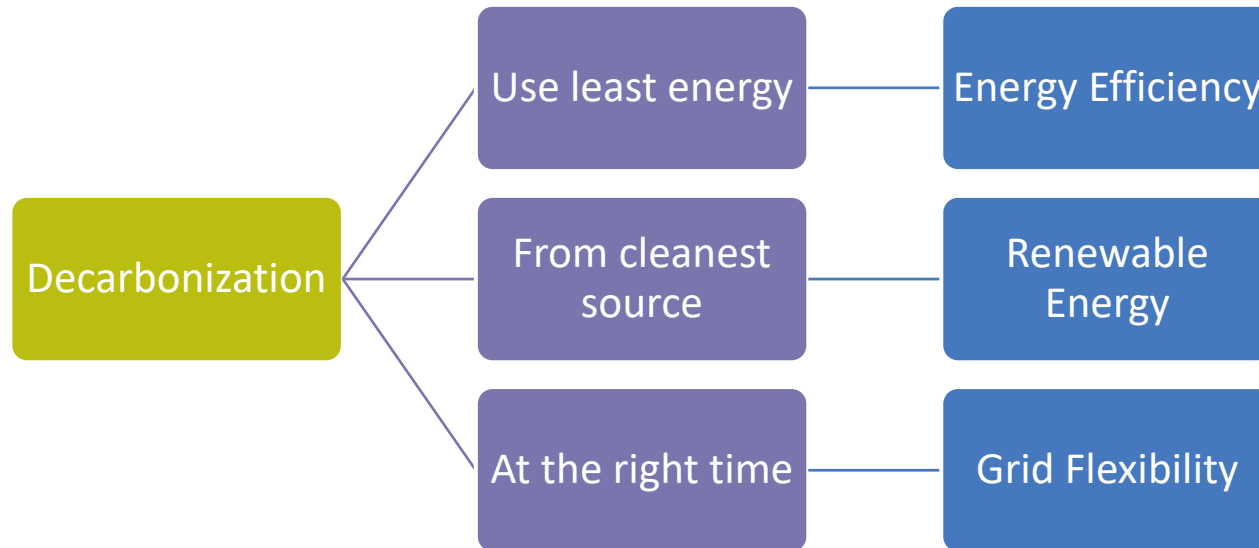# Load Shifting Compliance Credits for Heat Pump Water Heaters in California Building Code

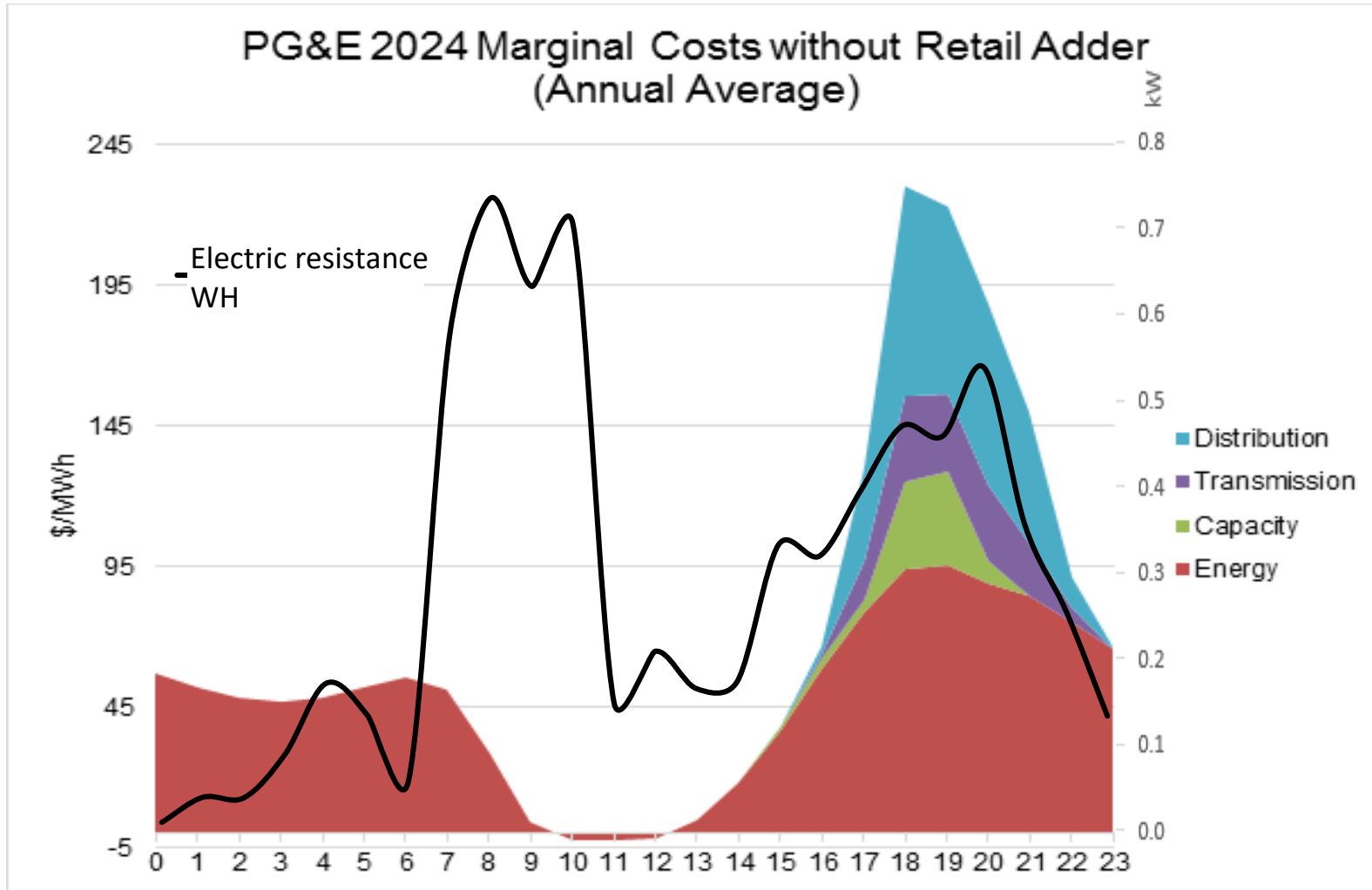June 12, 2019

Pierre Delforge, NRDC
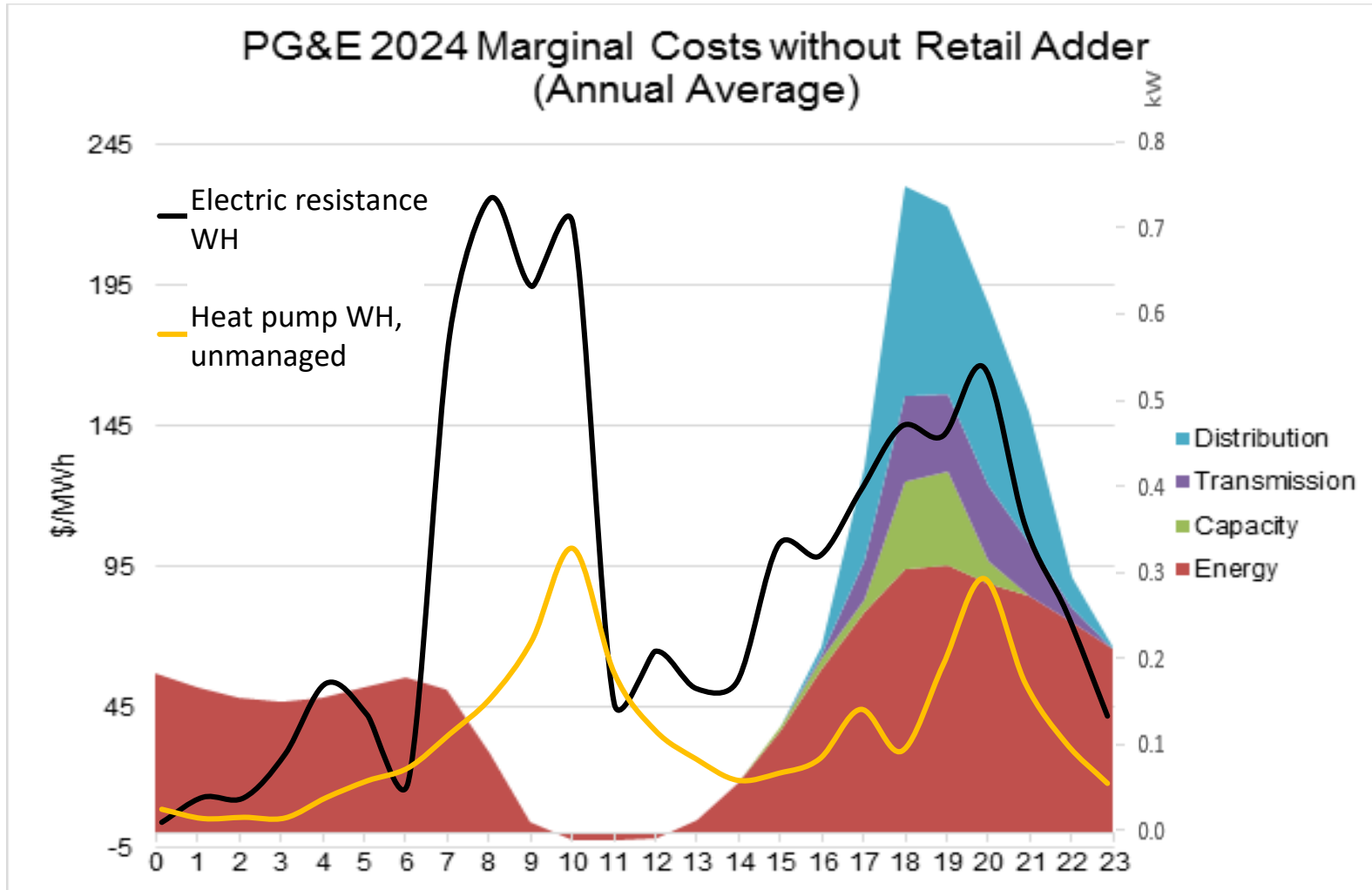
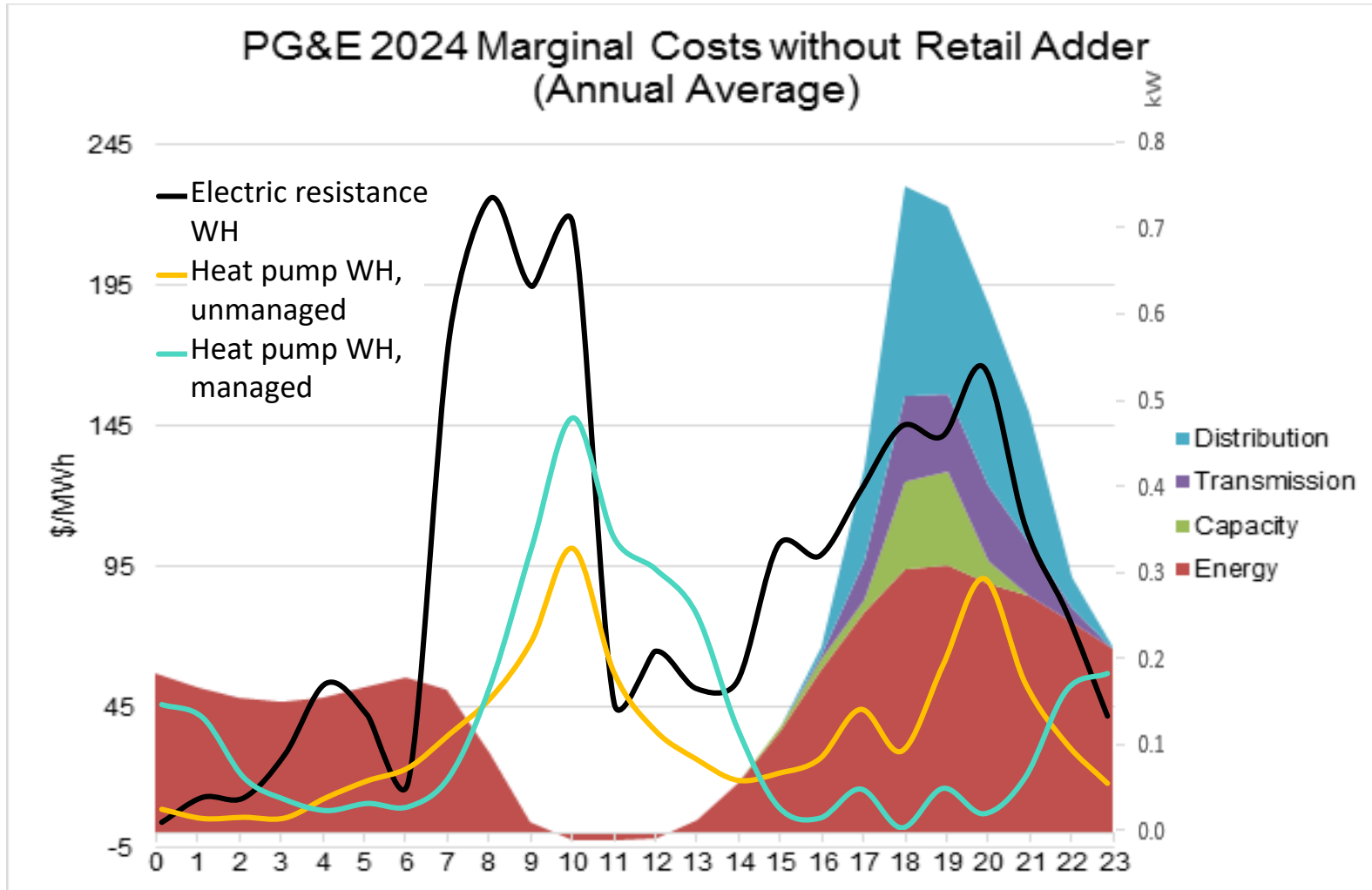# Why grid-friendly heat pump water heaters?

```
                          ┌──────────────────┐      ┌──────────────────┐
                          │  Use least energy │──────│ Energy Efficiency │
                          └──────────────────┘      └──────────────────┘
┌──────────────────┐      ┌──────────────────┐      ┌──────────────────┐
│  Decarbonization │──────│  From cleanest    │──────│   Renewable       │
└──────────────────┘      │    source         │      │    Energy         │
                          └──────────────────┘      └──────────────────┘
                          ┌──────────────────┐      ┌──────────────────┐
                          │ At the right time │──────│ Grid Flexibility  │
                          └──────────────────┘      └──────────────────┘
```

NRDC-Ecotope Study 2018

PG&E 2024 Marginal Costs without Retail Adder
(Annual Average)

Electric resistance WH

Legend:
- Distribution
- Transmission
- Capacity
- Energy

* CA climate zone 12: Sacramento

NRDC-Ecotope Study 2018

PG&E 2024 Marginal Costs without Retail Adder (Annual Average)

Legend: Electric resistance WH; Heat pump WH, unmanaged; Distribution; Transmission; Capacity; Energy

* CA climate zone 12: Sacramento

NRDC-Ecotope Study 2018

PG&E 2024 Marginal Costs without Retail Adder (Annual Average)

— Electric resistance WH
— Heat pump WH, unmanaged
— Heat pump WH, managed

Distribution
Transmission
Capacity
Energy

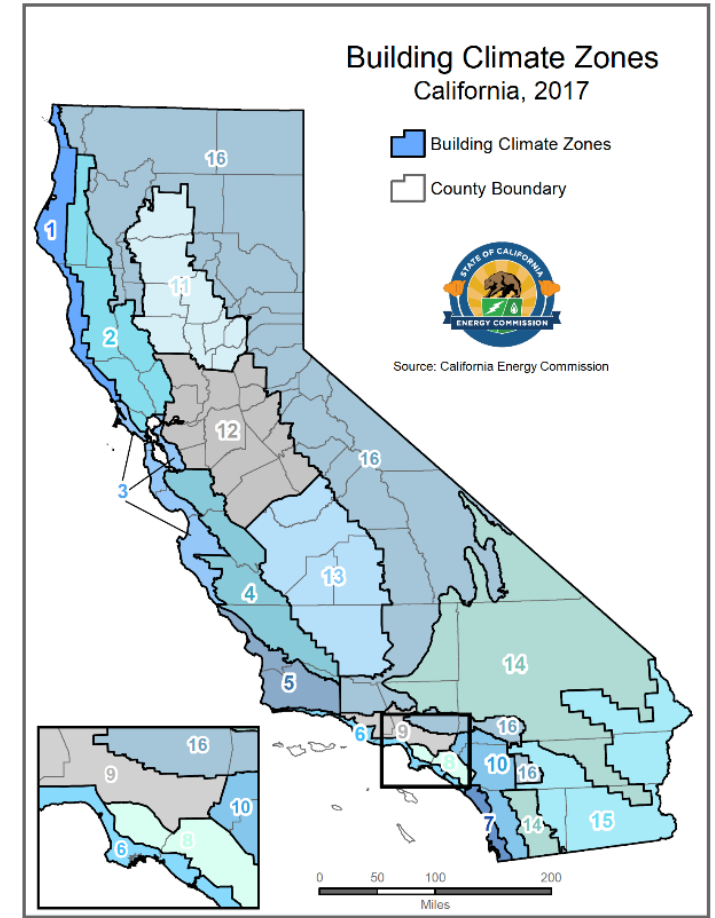* CA climate zone 12: Sacramento

NRDC-Ecotope Study 2018

* CA climate zone 12: Sacramento

Why CA Building Code (Title 24)?

Create a strong market signal for grid-friendly HPWHs:

❑ Large market: 100k units per year in CA, incl. 60k+ with individual water heaters

❑ Today 90% gas but the times they are a 'changing…

   ✓ 2019 code: HPWH-friendly

   ✓ 50+ cities pursuing zero-emissions reach building codes

   ✓ State policy moving toward building electrification

Building Climate Zones
California, 2017
■ Building Climate Zones
▢ County Boundary
Source: California Energy Commission

Time-of-use rates being rolled-out across CA
Southern California Edison TOU-D-PRIME Rate Plan (as of 6/4/2019)

Highest rates: 4 p.m. - 9 p.m.
Daily Basic Charge: $0.40
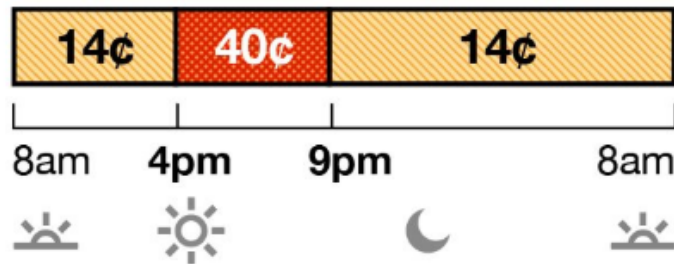**Minimum Daily Charge**: None
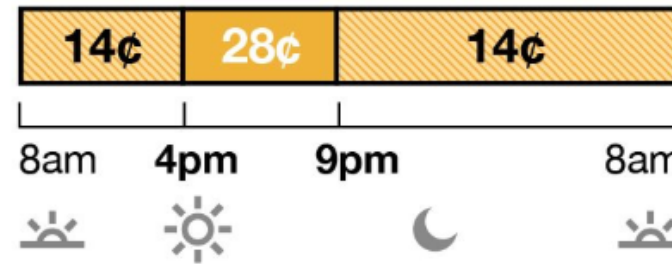**Baseline Credit**: None

Summer Rates   Winter Rates

Nearly 3:1 peak / off-peak ratio!

June to September (4 months)

Weekdays

| 14¢ | 40¢ | 14¢ | 14¢ |

8am   4pm   9pm   8am

Weekends

| 14¢ | 28¢ | 14¢ | 14¢ |

8am   4pm   9pm   8am

Super Off-Peak   Off-Peak   Mid-Peak   On-Peak   Above rates are per kWh.

openADR
ALLIANCE

8

Building code compliance credit

What's a compliance credit?

- ❑ Energy budget under performance path

- ❑ Eligible HPWH get compliance credit
  - ➢ Incentive for builder adoption

How does it work?

- ❑ Spec defines eligibility criteria: Joint Appendix 13 ("JA-13")

- ❑ CBECC-Res compliance software credits eligible HPWHs for load shifting

But building code compliance credit brings unique requirements

Will HPWHs that get the credit actually deliver
grid services over their life?

And therefore deserve full credit?

❑ Most customers will not sign-up for load shifting program

➢ Opt-out approach: local TOU load shifting setup and verified pre-occupancy

❑ Even when they do, high likelihood that connection will be lost over life of HPWH

➢ Require grid-connectivity capability, but also capable of local load shifting based on TOU price schedule

➢ Ultimate goal is grid-connectivity, local TOU load shifting is stepping stone

Challenge: how to setup and update local TOU rate schedules?

Connected Scenario

- Price signals
  - Regular download of TOU schedules to HPWH for local backup
  - Can also receive day-ahead hourly prices

- Dispatch signals
  - Conventional DR commands: Load-Up, Shed…

Non-Connected Scenario

- If occasional/temporary connection:
  - Initial temporary connection to download TOU schedules
  - System regularly checks for TOU updates if/when connected

- If no connection at all:
  - Manual input by installer
  - Manual updates by occupant/service technician,
    like programmable thermostat

One block at a time

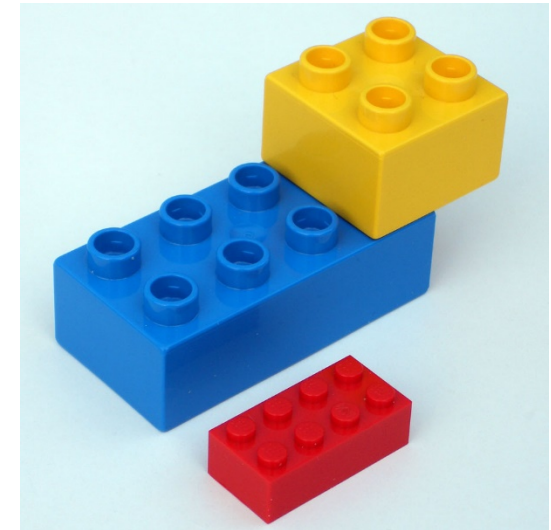JA-13 2019 will bring HPWH to market that support:

❑ Both price-driven and dispatch-driven load shifting
❑ Both remote (grid-connected) and local (non-grid connected) load shifting

Still needed:

❑ Standard TOU format
❑ Protocol for distributing and updating TOU schedules

Goal:

❑ All new HPWHs provide load shifting, in new + existing buildings
❑ Both local and remote control, initially; Mostly remote ultimately
❑ Automatic TOU setup (e.g. ZIP code-based)

Thank you!