



Residential ZNE – Picking the High-Hanging Fruit of the ZNE Tree

Matt Christie
TRC Energy Services
October 25, 2017

Fun Fact – Backcountry Kilts & Capes



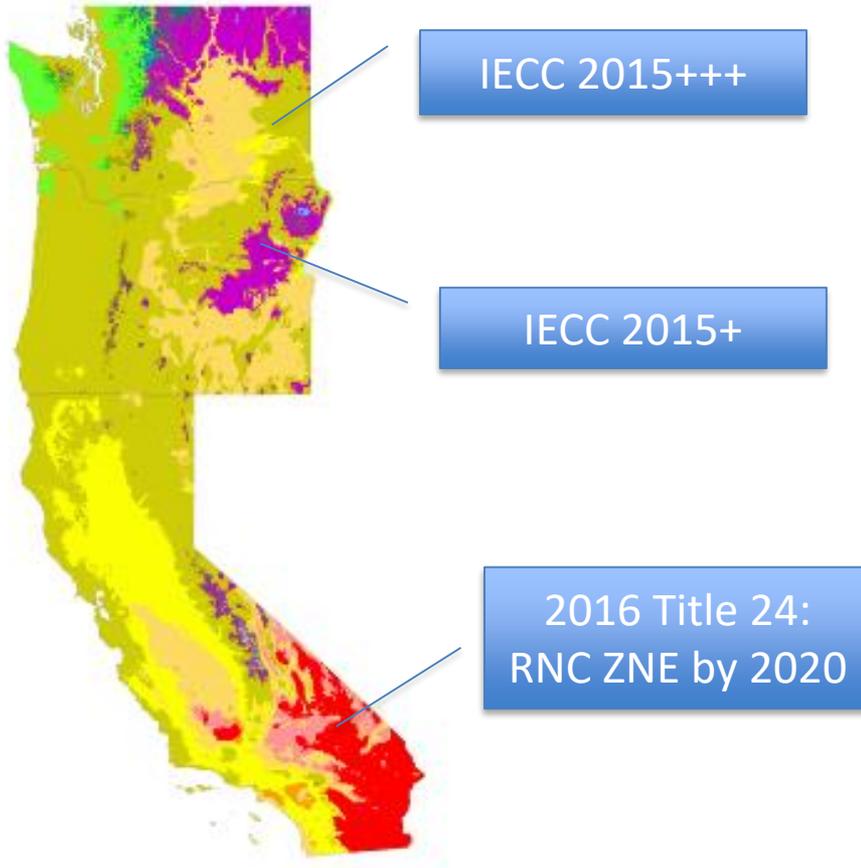
Fun Fact - Backcountry Kilts & Capes



Disclaimer

- **I'm sorry**

- **I work in California – I know we're not special and you're sick of hearing about us**
- **I also work in Oregon and Washington. We're a little bit special**



Disclaimer #2

WARNING

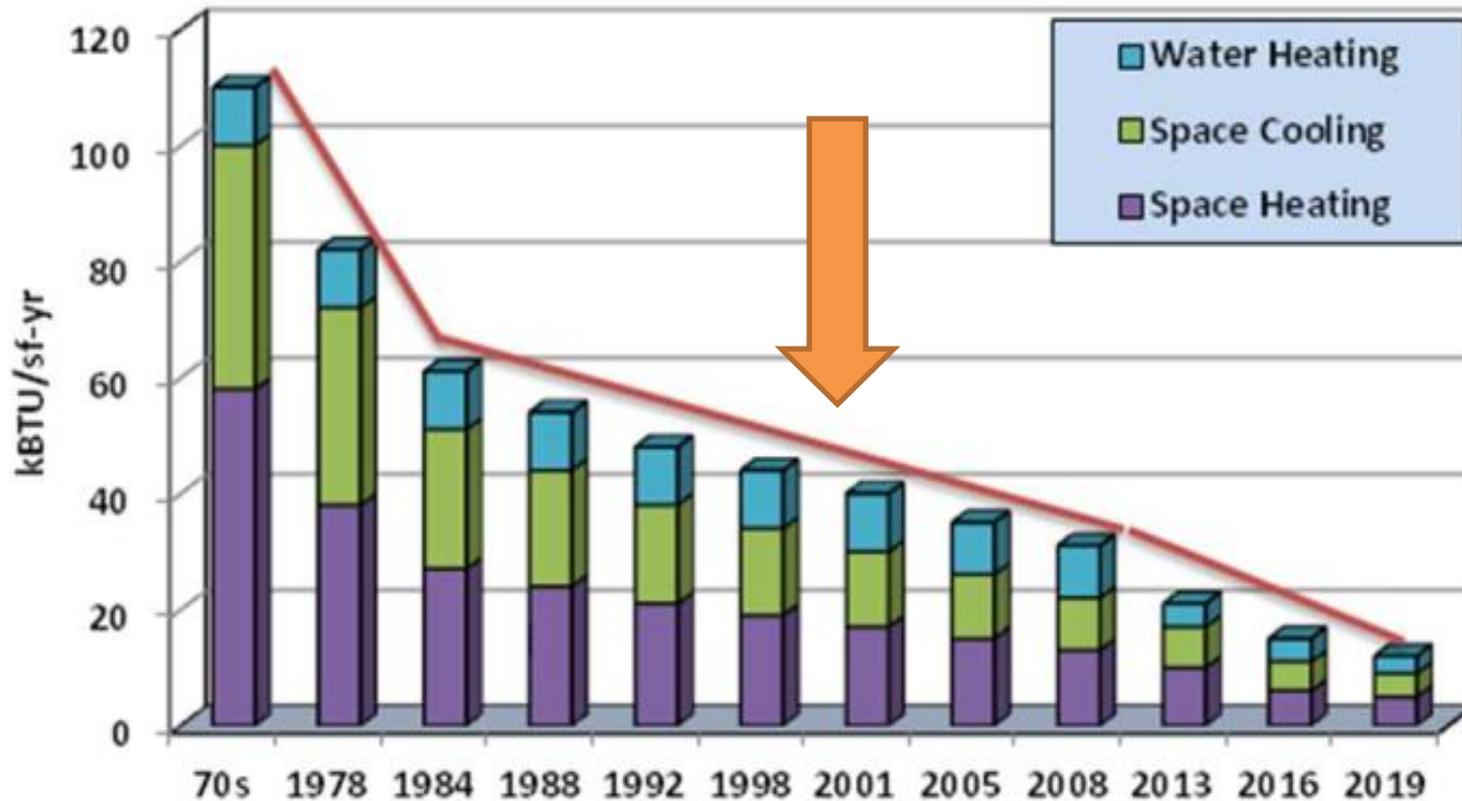
**Matt is known to be overly
enthusiastic about the prospects
of Residential-ZNE.**

**His presentation does not
necessarily represent the
opinions of TRC or their clients**

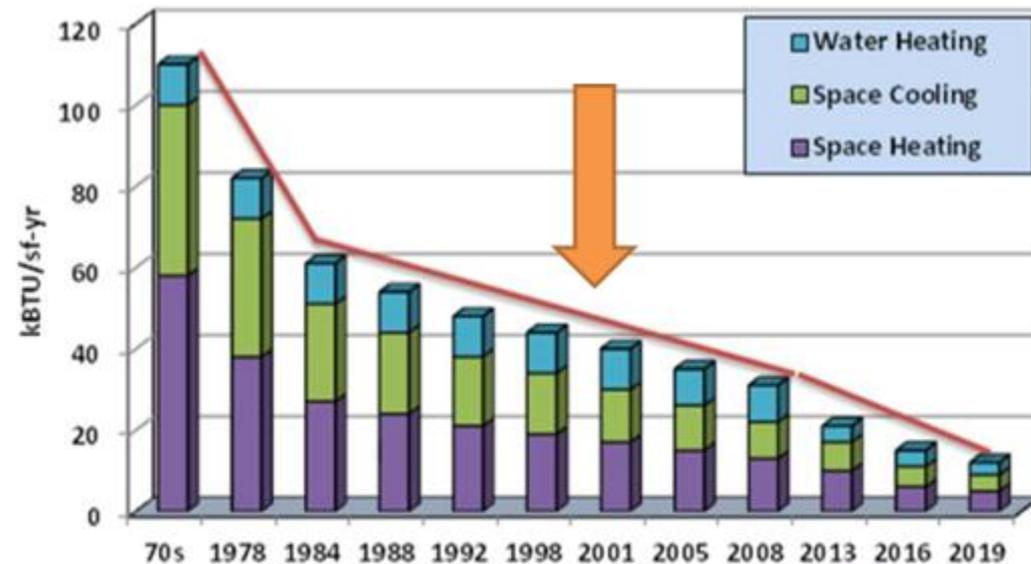
Rev. Code Wash. (ARCW) § 4.24.530 (1994)

California Res Codes 1975 to Today

Impact of building standards on home energy use



The Asymptote of ZNE Achievement



- Decoupling – IOUs profit from savings
- Abundance of cost effective measures (low hanging fruit)
- CPUC, CEC & IOU backing

- Preemption
- Society's profit-promise to regulated utilities
- Grid harmonization and time of use
- Incrementalism

Good News! Residential ZNE is:

Technically Feasible

- For simple single family building types

Financially Cost Effective

- With integrated design efforts and an experienced design-build team

Politically Viable

- Up to a point with natural-gas complications galore

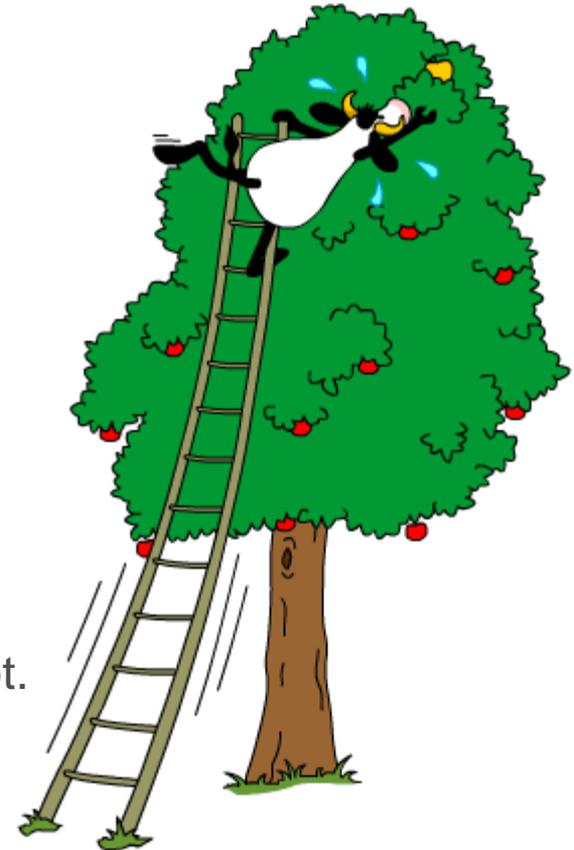
High-hanging Fruit – Advanced Measures

- California

- High Performance Attics or Ducts in Conditioned Space
- 0.051 U-factor walls (2x6 - R21+R5)
- Whole-house fans
- HERS verifications galore
- 0.32/0.25 fenestration

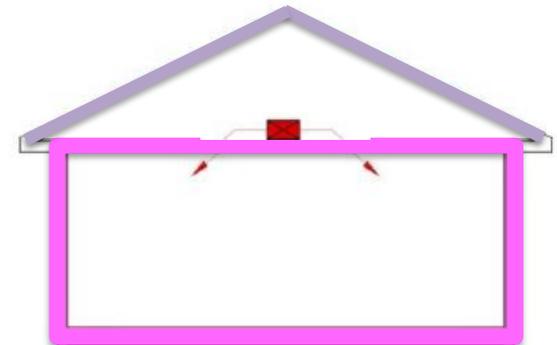
- Washington

- Mandatory heat-pump backup with electric resistance
- Option points-tables mimics performance concept. 1-point option samples (out of ~3.5 required):
 - 94% AFUE furnace
 - All-HVAC & ducts in conditioned space
 - R21+5 walls, R-49 attic, R-38 floors, U-0.25 glazing, R-10 perimeter, below grade, and under-slab



High Hanging Fruits – Advanced Specifications

- NEEA Cold-weather hot-water heat pump specification – in use in all three state codes
- Upcoming NEEA DHP testing/rating procedure
- High Performance Attic Concept
- Integrated DSM, EV Charging, Smart T-Stats



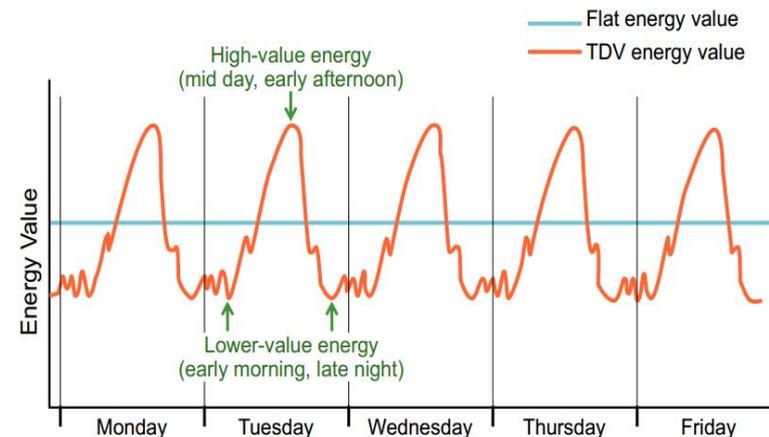
High Hanging Fruits – Advanced Metrics

- Not all BTUs are created equal



- Time Dependent Valuation (TDV) Energy (CA)

- Energy type (electric vs. gas)
- Date and hour
- Climate zone



High Hanging Fruits – Advanced Methods



- \$30,000 walls and attics
- \$20,000 attics
- \$10,000 walls

Incentives



- Design charrette workshops and value engineering meetings
- Dedicated design and construction assistance, and one-on-one technical support
- Regular contact with program team

Consulting Services

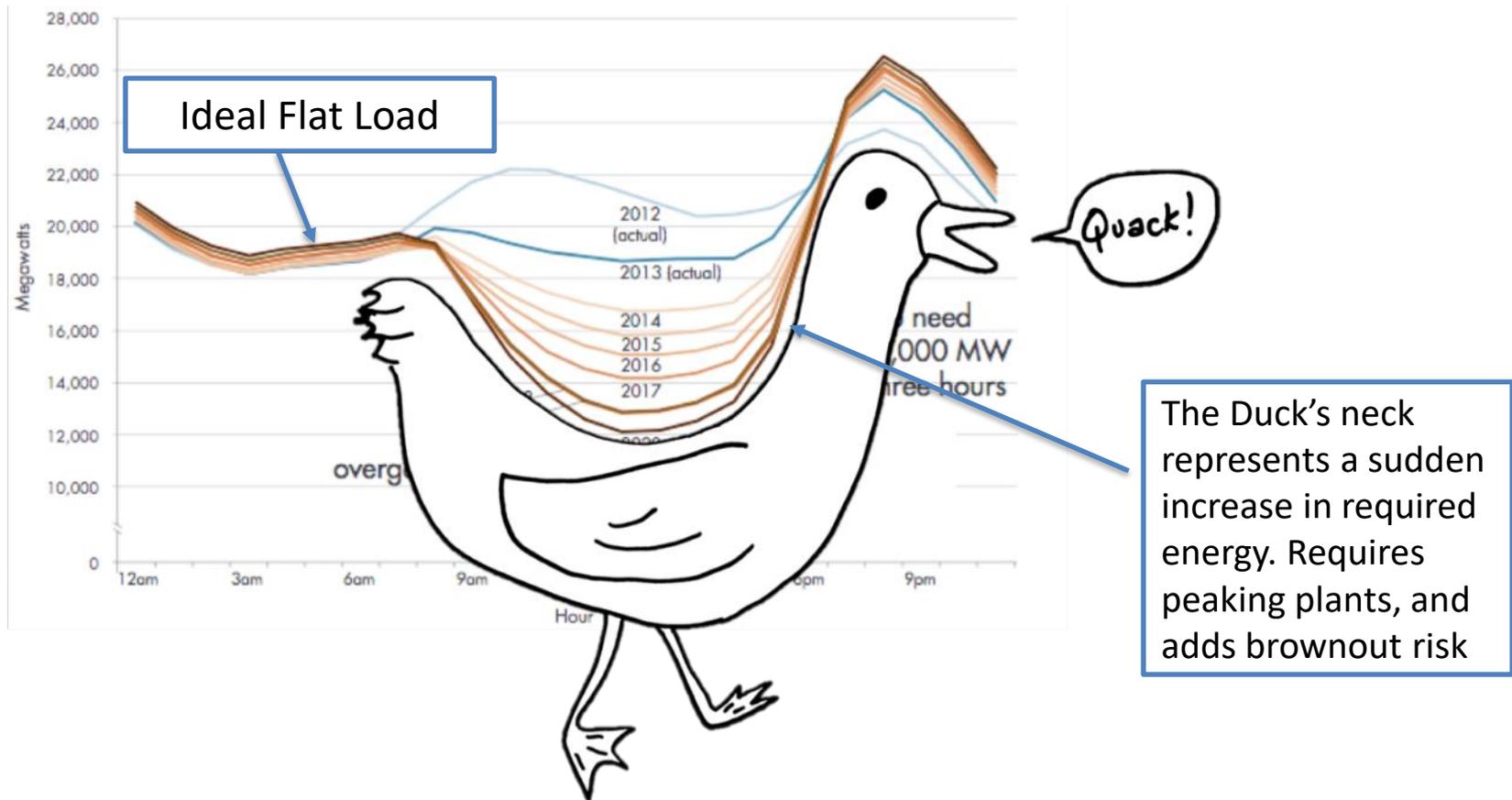


- On-site training in collaboration with WISE
- Installation and product guides from manufacturers

Training and Resources



Grid harmonization = a need for load shifting



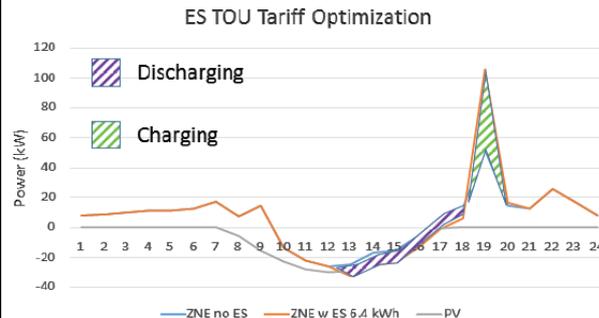
Load shifting through battery storage

Could Energy storage Provide a Potential Solution

Controls are key

Operation based on ToU rates Optimization

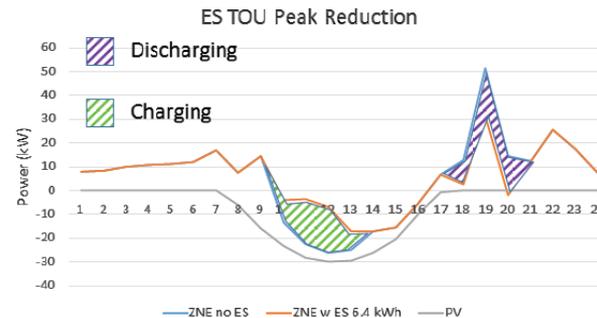
- Energy storage is operated to optimize for current ToU rates
 - Peak is Noon – 6 PM (ES discharge)
 - Off-peak is 6 PM – 6 AM (ES charge)
- 100% SOC maintained overnight



The ES TOU tariff optimization control scheme could potentially cause adverse impacts.

Operation based on ToU Peak Reduction

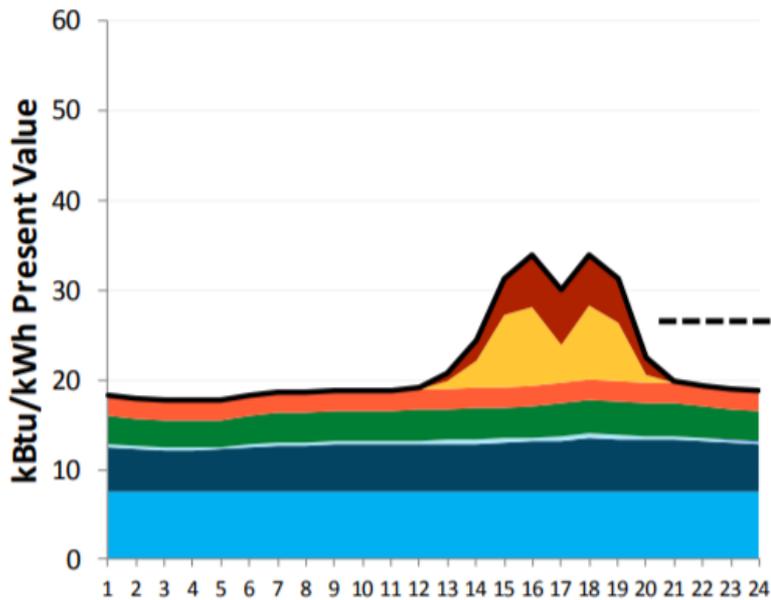
- Energy storage systems operated with “simulated peak and off-peak”
 - Peak is 5 PM – 8 PM (ES discharge)
 - Off-peak is 9 AM – 12 PM (ES charge)
- 25% SOC maintained overnight



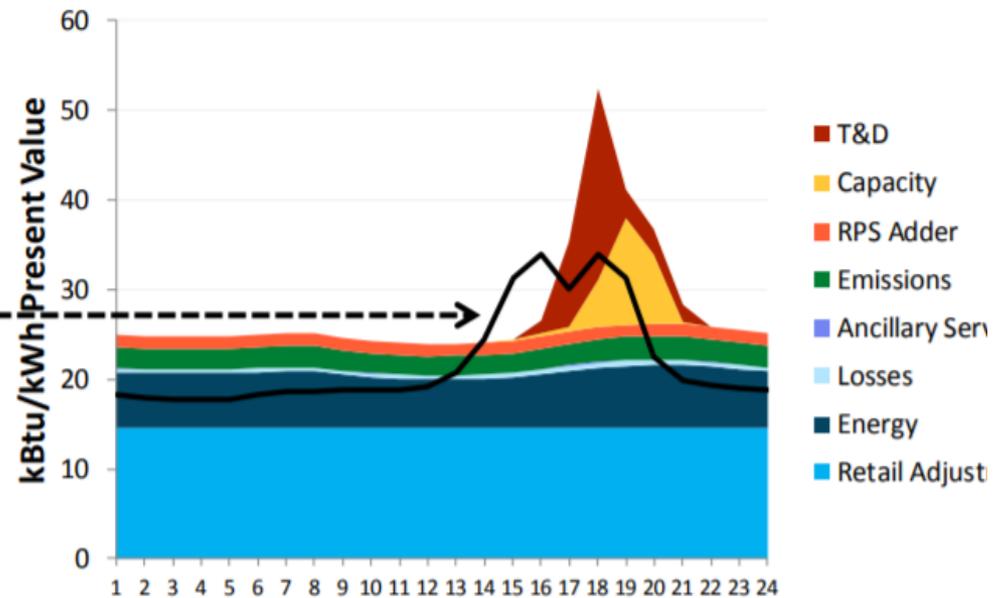
The ES TOU grid balancing control scheme could be beneficial.

Updated TDV multipliers changes everything

2016 Electric TDVs*



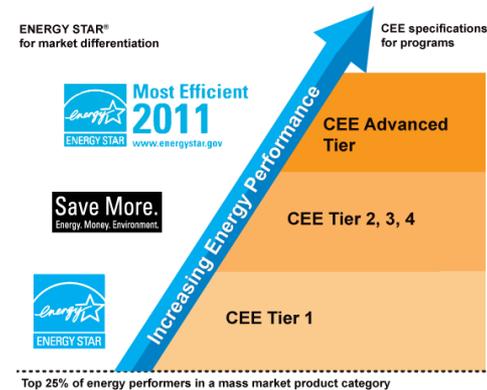
2019 Electric TDVs*



*CZ 12 Residential 30-Yr Present Value

High Hanging Fruits – What’s Next?

- Attempt energy reductions from other loads
 - Plug loads, lighting and appliances through HEMS
 - All CEE Tier3 appliances
 - Behavioral savings
 - Pay-for-performance
- More measures!
 - Triple pane windows
- Focus on peak reductions & grid harmonization
- “True” ZNE rather than ZNe
- Greenhouse gas reduction metrics



Code Cleanup – Res Title 24 2022



Code Cleanup – Res Title 24 2022



Thank you

Questions?

Matt Christie

TRC Energy Services

mchristie@trcsolutions.com

916-844-0167