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

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Fun Fact – Backcountry Kilts & Capes
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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

IECC 2015+++

IECC 2015+

2016 Title 24: RNC ZNE by 2020
Disclaimer #2

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.
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

Source: http://www.ductsinside.org/
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

**Incentives**
- $30,000 walls and attics
- $20,000 attics
- $10,000 walls

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

**Training and Resources**
- On-site training in collaboration with WISE
- Installation and product guides from manufacturers
Mandatory PV in CA for ZNE (2019 Res Code)

“PV array sized to displace the annual site kWh”

- Mixed Fuel
  - End uses covered by PV: cooling, lighting, plug loads, ventilation, appliances

- All-Electric 1
  - End uses covered by PV: cooling, lighting, plug loads, ventilation, appliances, DHW, heating, cooking

- All-electric 2
  - End uses covered by PV: cooling, lighting, plug loads, ventilation, appliances, DHW, heating, cooking
Grid harmonization = a need for load shifting

The Duck's neck represents a sudden increase in required energy. Requires peaking plants, and adds brownout risk.
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

**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 tariff optimization control scheme could potentially cause adverse impacts.

The ES TOU grid balancing control scheme could be beneficial.
Updated TDV multipliers changes everything
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
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Questions?

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