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Description:	S2.4B Mazi Shirakh, CEC_ADA
Filer:	Raquel Kravitz
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IEPR Workshop

2022 Building Standards - Time Dependent Valuation (TDV) & Hourly Source Energy

Presenter: Mazi Shirakh, PE, Building Decarbonization Lead

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The Objectives of Building Standards

The 2022 Building Standards rely on its tools and metrics to align the Standards with the state's climate change and energy efficiency goals:

1. Support building decarbonization goals as established by SB100
2. Support building energy efficiency goals as established by SB350
3. Maintain and encourage thermal-resilient building envelope features that perform well in both heating and cooling climate zones, even as the planet warms up
4. Encourage self-utilization of onsite PV generation and demand flexibility measures

While efficiency and decarb goals often align, there are notable exceptions, such as electric resistance heating

The tools and metrics developed for the 2019 Standards and before were inadequate to meet these challenges at the same time, a new approach was needed.

New Tools and Metrics

To meet these challenges, the Standards paired the existing TDV metric with the new Source Energy metric

1. The Time Dependent Valuation (TDV) - since 2005 has been the "currency" for tradeoffs for the building standards
   i. Protects low monthly energy bills for the occupants
   ii. Protects efficient building envelope measures
   iii. Protects Demand flexibility and grid harmonization signals
   iv. Modest building electrification signal
   v. Electric and natural gas TDVs were both updated for the 2022 Standards to match with state's climate change policies

2. New Hourly Source Energy (HSE) – A new Long-run Marginal Source Energy metric has been added for the 2022 Standards
   ✓ Provides strong building electrification signal

HSE and TDV Together – The Best of Both Worlds

Pairing the two metrics – HSE defines the building carbon budget, TDV ensures that target is met cost effectively while protecting low monthly energy bills and demand flexibility signals

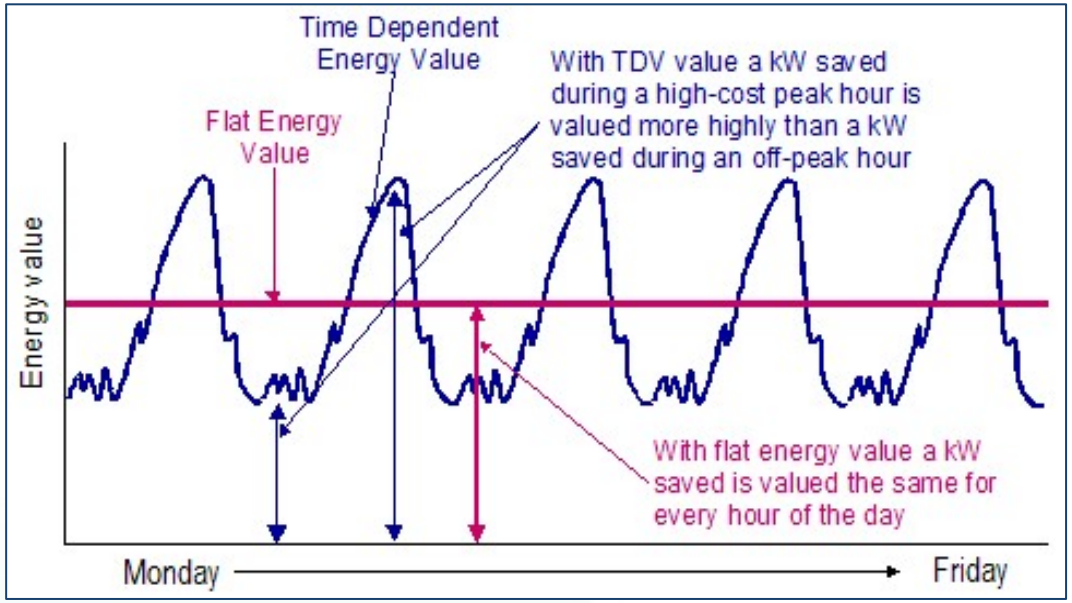
Metric:	Strengths of the Metric	Limitations of the Metric
Hourly Source Energy (HSE)	Strong signals electrification and efficient use of gas appliance	Weak or modest signals for efficient building envelope features, such as attic and wall insulation, high efficiency windows, low leakage envelope. HSE undervalues the costs of high-capacity value hours and demand flexibility/grid harmonization signals
TDV	Protects low monthly energy bills, efficient building envelope features while maintaining strong demand flexibility/grid harmonization signals, resulting in lower utility grid costs	Modest building electrification signal
HSE and TDV	Simultaneously encourage building electrification, low monthly energy bills, efficient building envelope, and maintaining strong demand flexibility/grid harmonization signals, lowering utility grid costs	

Time Dependent Valuation (TDV)

TDV is an hourly energy cost metric for both electricity and natural gas, in place of a flat energy value throughout the day. TDV assumes that utilities meet their RPS and other climate change obligations and is projected over the 30-year life of the building.

TDV incorporates the hourly cost of:

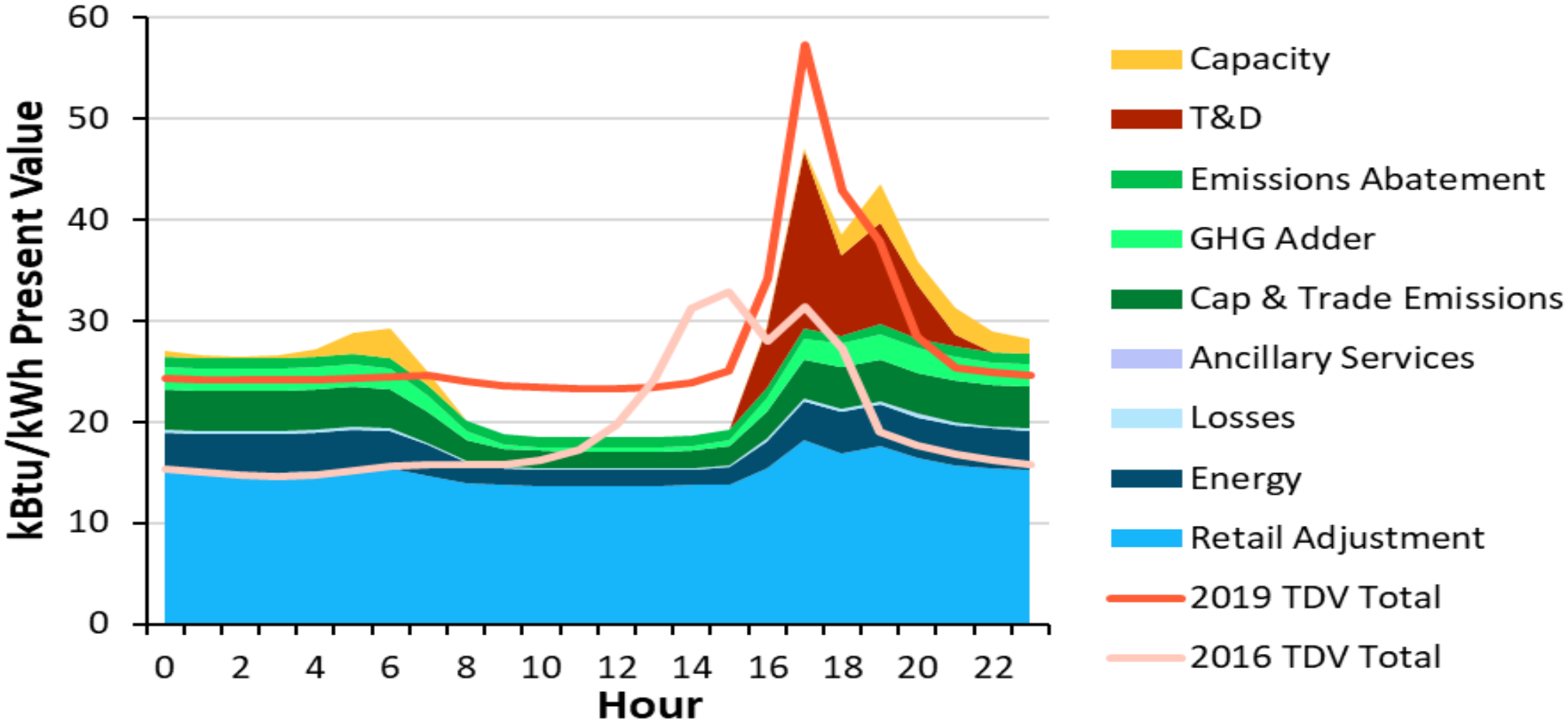
- marginal generation
- transmission and distribution
- energy
- capacity
- losses
- cap-and-trade-based CO2 emissions.



TDV values for electricity favor designs that reduce cooling loads when grid costs are highest and shift energy use from peak to off-peak periods. TDV values tend to provide a mild electrification signal because of “similar” cost of natural gas and electricity.

2022 Standards TDV Update

2022 Nonresidential Electricity TDV for CZ12, compared to 2019 and 2016 TDV



Hourly Source Energy (HSE)

Like TDV, HSE is an hourly energy metric for both electricity and natural gas. HSE assumes utilities meet all RPS and other climate change obligations and is projected out over the 30-year life of the building.

Whenever a renewable resource is on the margin, which increasingly occurs as RPS requirements increase, the source energy for that hour goes to zero. In hours where renewable resources are not available, the heat rate of the natural gas resource on the margin determines the source energy.

HSE represents the depletable energy content of the marginal generation resource required in each hour to meet incremental energy demand

The resulting HSE values are proportional to the GHG emissions for each hour of the year, and therefore are a good proxy for GHG and a strong metric for encouraging fuel switching and decarbonization, and for reducing natural gas use.

Source Energy's Many Flavors

Source energy comes in different flavors:

- **Source energy**: The total system input energy (in the form of fuel including both NG and electricity) that is required to serve building loads; a flat metric that does not change with hours of the year
- **Average hourly source energy**: The total source energy for electric generation in each hour divided by the total load served in each hour, for a given balancing area (ex. CAISO).
- **Short-run marginal source energy**: Short-run marginal source energy is the change in energy system input for a change in a building's electricity consumption *without* a change in powerplant capacity.
- **Long-run marginal source energy:** Long-run marginal source energy is the change in energy system input for a change in a building's electricity consumption *with* a long-term change in in powerplant capacity.

The 2022 Standards relies on the **long-run marginal source energy** as a carbon proxy, because it most accurately represents the hourly emissions on the margin, accounting for long term changes of the grid in response to RPS and SB100 mandates

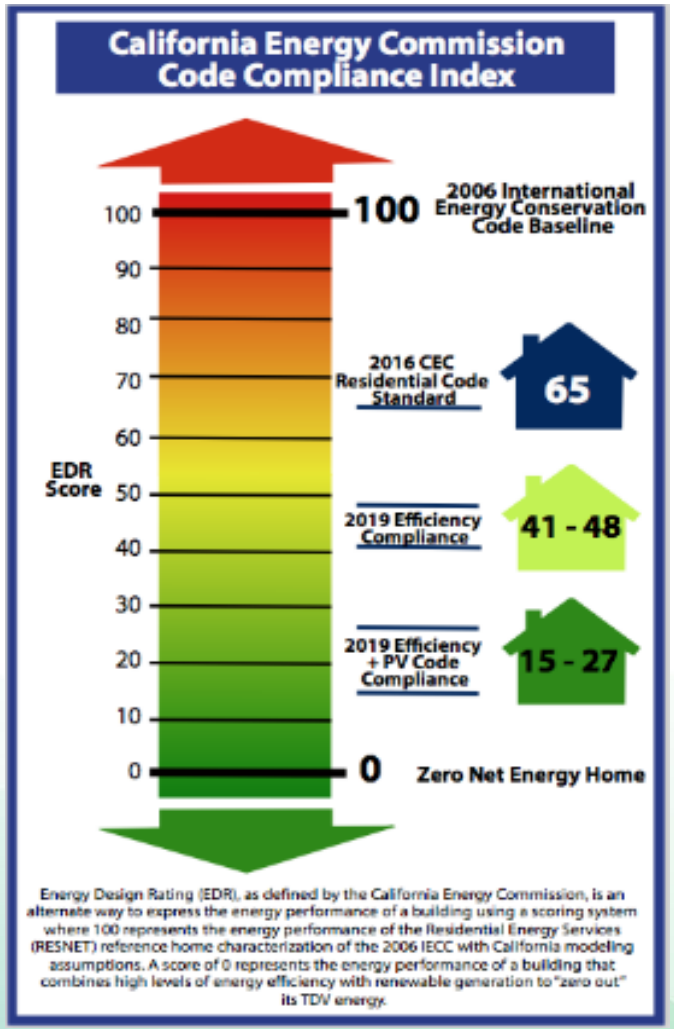
Energy Design Rating - EDR

For Lowrise Residential Buildings The Standards use EDR to demonstrate compliance

- EDR is the ratio of the TDVs of Proposed Design and Reference Building
- Reference home is a 2006 IECC compliant home, EDR=100
- A score of zero means a ZNE building
- Establishes targets for efficiency and PV/storage

EDR approach provides maximum flexibility for the builders

- EDR defines performance targets
- Builder decides which measures to use to meet the targets



Recommended Approach – Lowrise Residential Buildings

Two Independent Metrics – 2 EDRs Based on Long-run Marginal Source Energy and TDV

EDR1 Target – Long-run Marginal Source Energy: Establishes a "carbon-proxy budget" for the building in kBTU/sf-yr units to support decarbonization and electrification policy goals

EDR2 Target - TDV: A TDV based metric is used to protect the building envelope, lower utility bills, and maintain strong grid harmonization and utility cost reduction signals

Tradeoff Rules: No tradeoffs are allowed between EDR1 and EDR2; for a building to comply, it must pass both EDR1 and EDR2 independently and simultaneously.

This ensures that decarbonization, building envelope protection, utility bill protection, and grid harmonization signals all remain uncompromised

Approach for Highrise Residential and Nonresidential Buildings

The approach for highrise residential and nonresidential buildings are the same, except instead of EDR targets, total TDV and source energy “Standard and Proposed Design” budgets are used to demonstrate compliance with the Standards

Questions?