The David and Lucile Packard Foundation Headquarters | Los Altos, CA *Photo: Jeremy Bittermann*

Building Performance Targets

Incorporating Energy Targets into Codes and Standards

nbi new buildings institute

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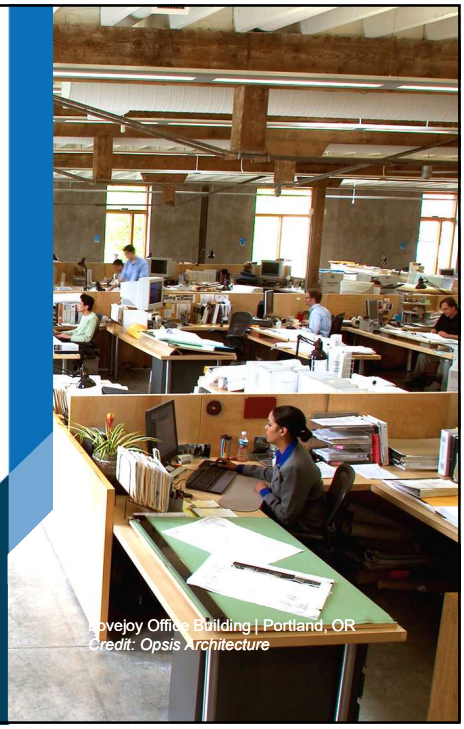
Agenda

1. Why shift to performance targets
2. Status of targets in codes
3. Key Metrics
4. Research findings



Lovejoy Office Building | Portland, OR
Credit: Opsis Architecture

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Why the Shift to Performance Target?

- Challenges with existing code approaches:
  - Prescribing increasingly efficient building components faces diminishing return on investment
  - Component based approach does not always translate to high performance buildings
  - Limited to “regulated building loads” and largely does not address plug and process loads
- Advantages of building performance targets:
  - Establishes a common performance goal
  - Provides a high level of flexibility in how target is achieved
  - Is a pathway that address whole building performance
  - Can align with existing building policies and help track performance over time

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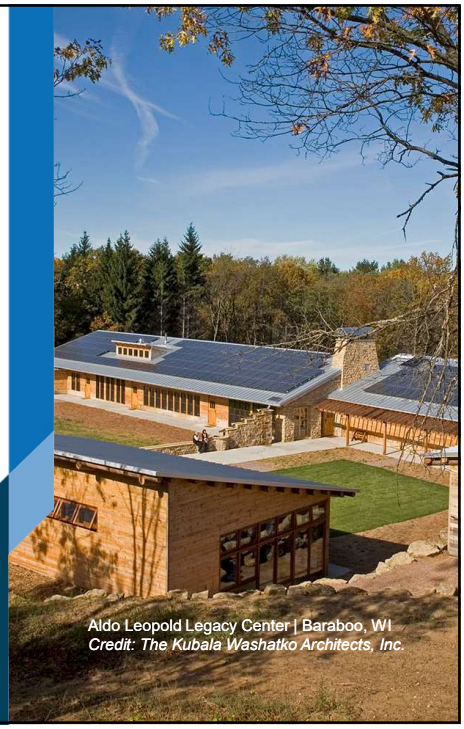
Status of Performance Targets

- The 2021 International Green Construction Code (IgCC) will include a target pathway for commercial buildings
- British Columbia, Toronto, and Vancouver BC have adopted building performance targets for residential and commercial buildings
- London Energy Transition Initiative (LETI) includes energy targets for commercial and residential buildings
- IECC, ASHRAE 90.2 and Title 24 (CA) include a target pathway for residential buildings
- Passive House standards (PHIUS and PHI) include building performance targets


Aldo Leopold Legacy Center | Baraboo, WI
Credit: The Kubala Washatko Architects, Inc.

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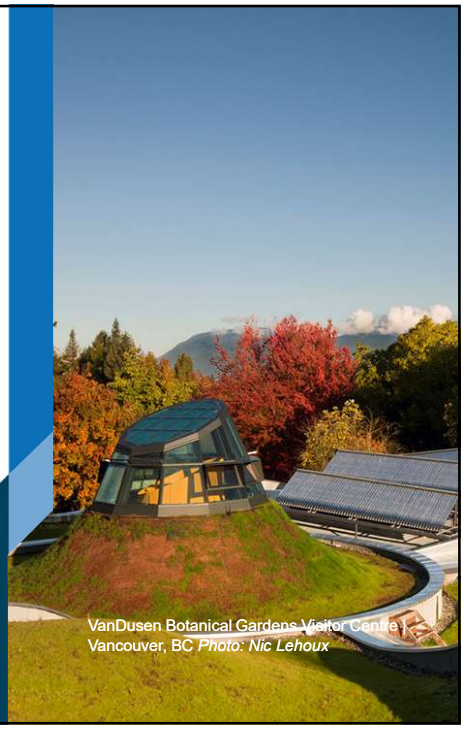
Leading North American Jurisdictions

- Toronto has building standard that includes energy and GHG targets for most buildings
- British Columbia has implanted a code framework that includes increasingly stringent energy targets for most buildings that can be adopted at the local level
- Seattle's energy code includes a Target Performance Path compliance path for a limited set of commercial buildings
- Boulder's 2020 energy code includes a fixed EUI Target pathway
- Washington DC's Stretch Code (Appendix Z) incorporates zEPI and thermal energy demand targets
- Both New York City and Massachusetts are developing target-based approaches for commercial buildings



VanDusen Botanical Gardens Visitor Centre | Vancouver, BC *Photo: Nic Lehoux*

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Key Commercial Metrics

- **Site EUI** : Considers all energy consumed at the building on an annual basis, expressed in kBtu divided by square feet.
- **Zero Energy Performance Index (zEPI):** Considers the energy performance of a building on a scale of 0 to 100 by comparing the modeled or actual performance of a building design against a fixed baseline.
- **Thermal Energy Demand Intensity (TEDI):** Considers the amount of energy a building requires to maintain an indoor temperature that is comfortable for occupants per square foot of conditioned floor area per year. Expressed as a combination of annual heating and cooling demand.
- **Green House Gas Intensity (GHGI):** Considers the carbon emissions from the different energy sources consumed by the building on an annual basis in tons of CO_2 per square foot per year.

Frick Environmental Center | Pittsburrgh, PA *Photo: Ed Massey*

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Key Residential Metrics

- **Energy Rating Index (ERI)/Home Energy Rating System (HERS) and Energy Design Rating (EDR):** Uses a scale of 0 to 100 to compare a new home to a standard home built to the 2006 code.
- **kWh per Person:** Assigns an annual energy budget per person, which applies to the total energy use of residential units by using number of bedrooms + one to represent occupancy.
- **Annual heating and cooling demand/TEDI:** considers the amount of energy a building requires to maintain an indoor temperature that is comfortable for occupants per square foot of conditioned floor area per year.

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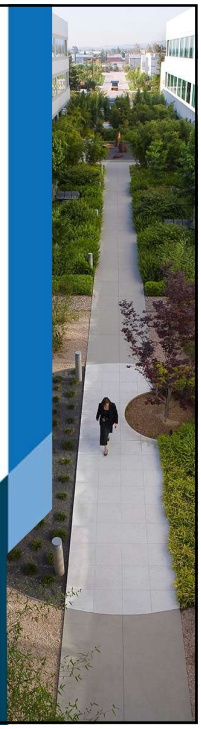
Findings: Selection of Metrics

- Start the process with an **advanced code framework** with a long-term horizon that serves to guide the processes, establish priorities and timeframes and ultimately inform the metric selection process.
- Determine if metric selection is intended to drive **efficiency, electrification, carbon reductions, or any combination**, and be explicit about alignment with climate action goals and objectives.
- Select metrics that are compatible with existing modeling software programs or that can be easily accommodated through modifications to the software.
- Targets for building efficiency are foundational and can be set at the whole building level or be set at the system level for envelope performance or HVAC system performance
- While examples are limited with regard to approaches that facilitate grid interactivity, work is underway to create metrics on which regulatory targets could be set

Toyota Motor Sales South Campus | Irvine, CA *Credit: LPA Design Studios*



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Findings: Modeling and Code Compliance

- Incorporate sufficient “mandatory minimum” efficiency requirements to reduce efficiency tradeoffs. ASHRAE 90.1 Appendix G is a good starting point
- Ensure modeling tools are available for specific target based codes which could include further modifications to the ResCheck and Comcheck software as well as versions of the tools being considered and developed nationally for simplified modeling compliance
- Develop energy modeling protocols , resources and guidelines to provide a high degree of consistency to the compliance and verification process.
- Address building verification and normalization approaches by engaging the energy modeling community in the process, developing capacity through the use of tools and primers, and building in feedback mechanism so that process of model verification can be improved over time.

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Findings: Performance Verification

- Validate performance after a certain time period has elapsed to compare the proposed building performance metrics that were submitted for permit to its actual measured energy performance.
- Avoid placing liability or regulatory hurdles on the project team that hinders the use of the targets approach.
- Consider over time, how, and over what period of a building’s operating life, to compare the targets required for new construction to the targets required in building performance standards.

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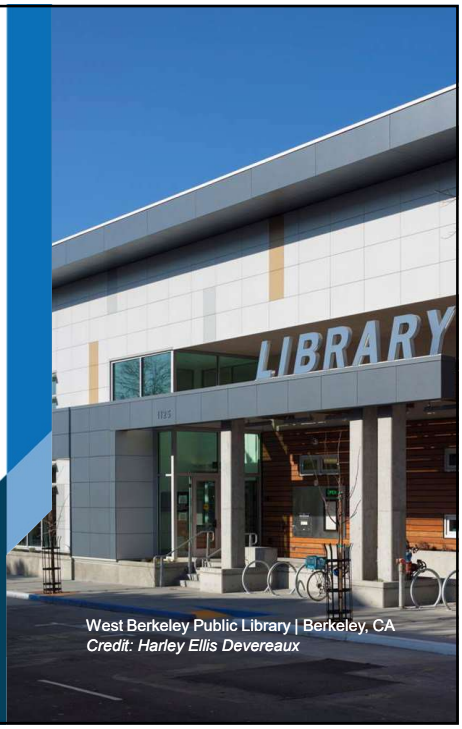
Closing thoughts

- Capacity building and education is an important part of the process for introducing the use of targets to the building community
- Form an advanced codes task force representing a broad range of stakeholders (including builders, developers, code officials, local governments, and architectural, engineering and energy modeling professionals) to build support for the approach.
- Effort requires dedicated funding for the documentation of the process in an effort to be as transparent as possible.



West Berkeley Public Library | Berkeley, CA
Credit: Harley Ellis Devereaux

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Thanks!

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