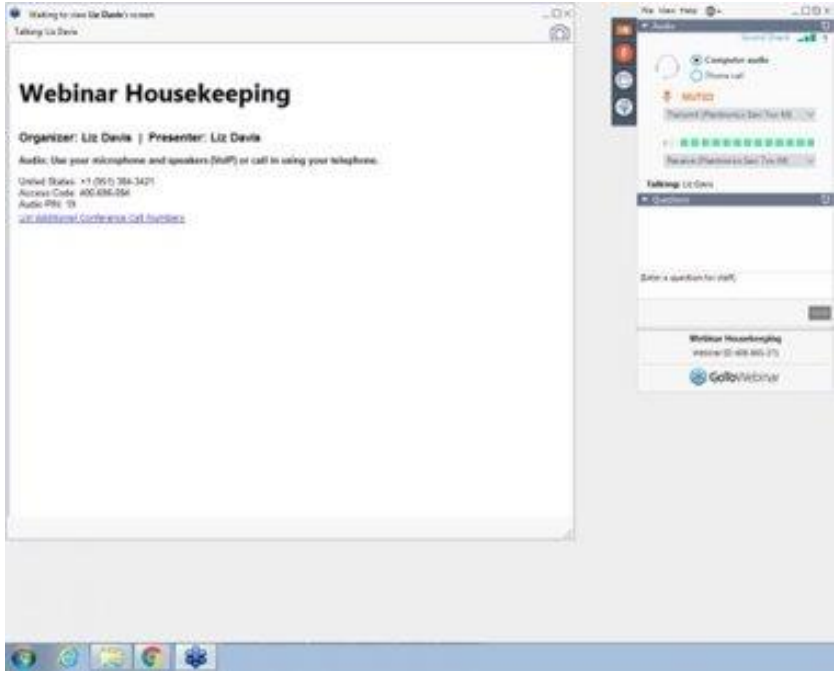
11/01/2022

Building standards and codes to drive renovation

US-EU exchange on energy efficiency in buildings and housing

Housekeeping



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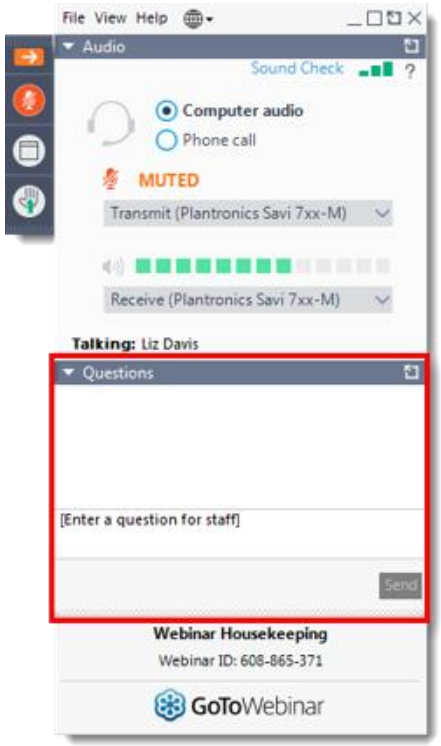

Your Participation

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- Choose “Mic & Speakers” to use VoIP
- Choose “Telephone” and dial using the information provided
- Please continue to submit your text questions and comments using the Questions panel
- The slides are available for download now as a handout

Questions/Comments:

- Submit questions and comments via the Questions panel
- Please continue to submit your text questions and comments using the Questions Panel

Note: Today’s presentation is being recorded and will be provided within 48 hours, along with the slide deck.

AGENDA

Introduction to codes and standards

- **Overview of European codes and standards in buildings**

Dimitrios Athanasiou, Energy Efficiency Policy Officer, DG ENER, European Commission

- **American building codes and standards**

David Nemtzow, Director, Building Technologies Office, US Department of Energy

Session 1: codes for new construction

- **Codes for New Construction: Setting the Baseline for Performance**

Amy Boyce, Associate Director, Codes and Technical Strategy, Institute for Market Transformation

- **European energy performance of buildings standards**

Jaap Hogeling, Manager for international standards at ISSO, Expert at EPB Center

- **Q&A**

Session 2: Standards for building renovation

- **The use of minimum energy performance standards to renovate Europe's existing buildings**

Louise Sunderland, Senior Advisory, Regulatory Assistance Project

- **Setting Codes and Standards in Affordable Housing**

Michael Freedberg, Senior Advisor for High performance Building, US Department of Housing and Development, Office Energy and Environment

- **Q&A**

Keynotes

Introduction to codes and standards

Dimitrios Athanasiou

Energy Efficiency Policy Officer, DG Energy, European Commission

David Nemtzow

Director, Building Technologies Office, US Department of Energy

Keynotes

Dimitrios Athanasiou

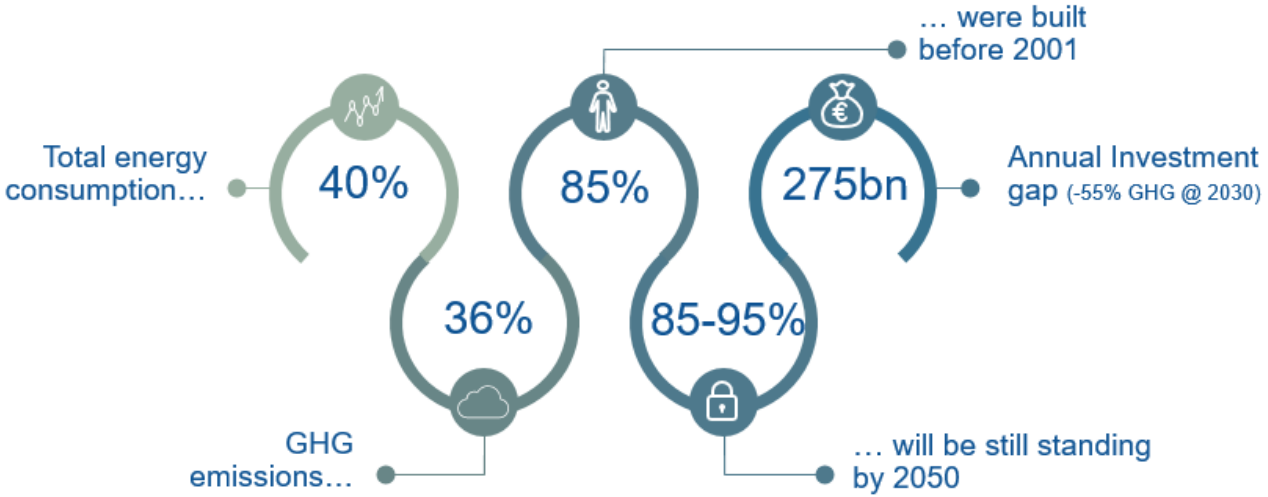
Energy Efficiency Policy Officer,
DG Energy, European Commission

US-EU exchange: Building standards and codes to drive renovation

Overview of European codes and standards in buildings

11 January 2022

The building sector in the EU



The current renovation rate ~1% per year

Comprehensive legislative framework

- **Energy Performance of Buildings Directive 2010/31/EU (EPBD)**
  - *the main instrument addressing building performance*

- Energy Efficiency Directive 2012/27/EU (EED)
  - *Public buildings, metering and billing, split-incentives, etc.*

- The EU energy labelling and Ecodesign legislation
  - *Ecodesign sets common EU wide minimum standards to eliminate the least performing products from the market.*
  - *The energy labels provide a clear and simple indication of the energy efficiency and other key features of products at the point of purchase.*

- Renewable Energy Directive
  - *Promotion of RES*

The Energy Performance of Buildings Directive

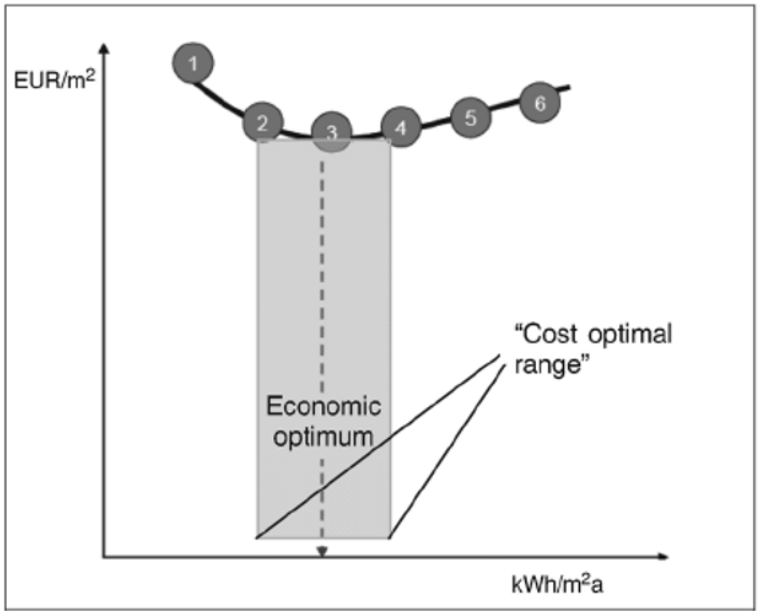
2010 recast

- Methodology for the calculation of energy performance of buildings
- Methodology for setting **cost-optimal** minimum energy performance **standards** for **new** buildings **and existing** buildings **undergoing major renovation**
- **Nearly zero-energy building targets** for **new** buildings
- Energy Performance Certification schemes
- Inspections of heating and cooling systems

✓ Flexibility to reflect national conditions (climate, market uptake, energy mix, type of buildings, construction methods, etc.)
✓ Energy performance of buildings standards (CEN)

https://ec.europa.eu/energy/topics/energy-efficiency/energy-efficient-buildings/energy-performance-buildings-directive_en

Cost – optimal methodology calculation



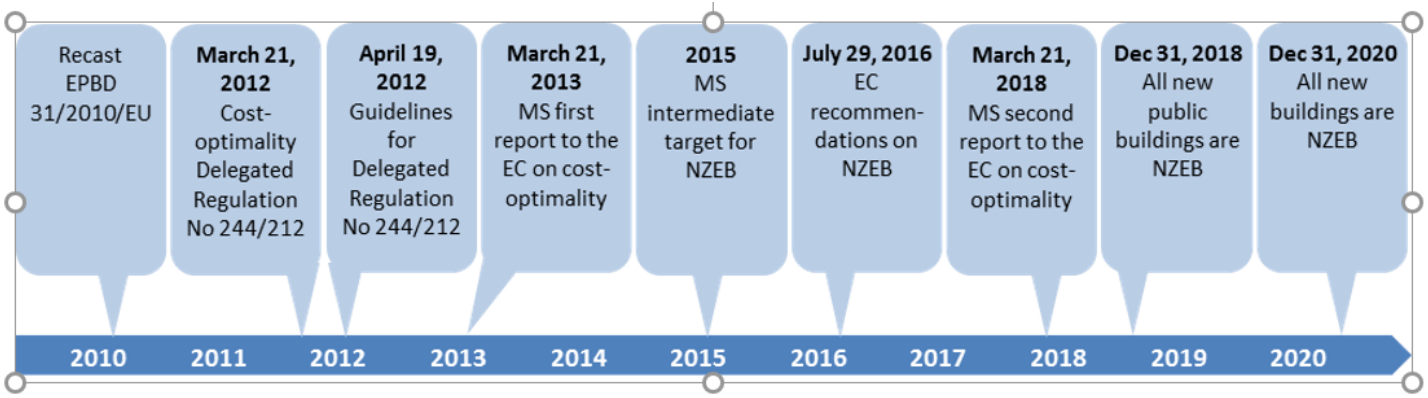
1. Definition of reference buildings
2. Identification of energy efficiency and renewable energy measures
3. Calculation of primary energy demand
4. Calculation of global costs
5. Calculation of the gap

EC NZEB Recommendation level of energy performance (kWh/m²y) per building type and climatic zone

Type of building	NZEB RECOMMENDATION BENCHMARK	
	Net primary energy use (on-site RES excluded) kWh/(m²y)	Primary energy use kWh/(m²y)
MEDITERRANEAN (CY, HR, IT, GR, MT, PT ES)		
Single family houses	0-15	50-65
Offices	20-30	80-90
OCEANIC (BE, DK, IE, DE, FR, LU, NL, UK)		
Single family houses	15-30	50-65
Offices	40-55	85-100
CONTINENTAL (AT, BG, CZ, HU, PL, RO, SL, SK)		
Single family houses	20-40	50-70
Offices	40-55	85-100
NORDIC (EE, FI, LV, LT, SE)		
Single family houses	40-65	65-90
Offices	55-70	85-100

European Commission

Implementation timeline for cost-optimality and NZEB requirements of EPBD



Towards a holistic approach

Average cost-optimal levels (primary energy kWh/m²y) for new (and existing) buildings per climatic zone, 2018 cost-optimal reports

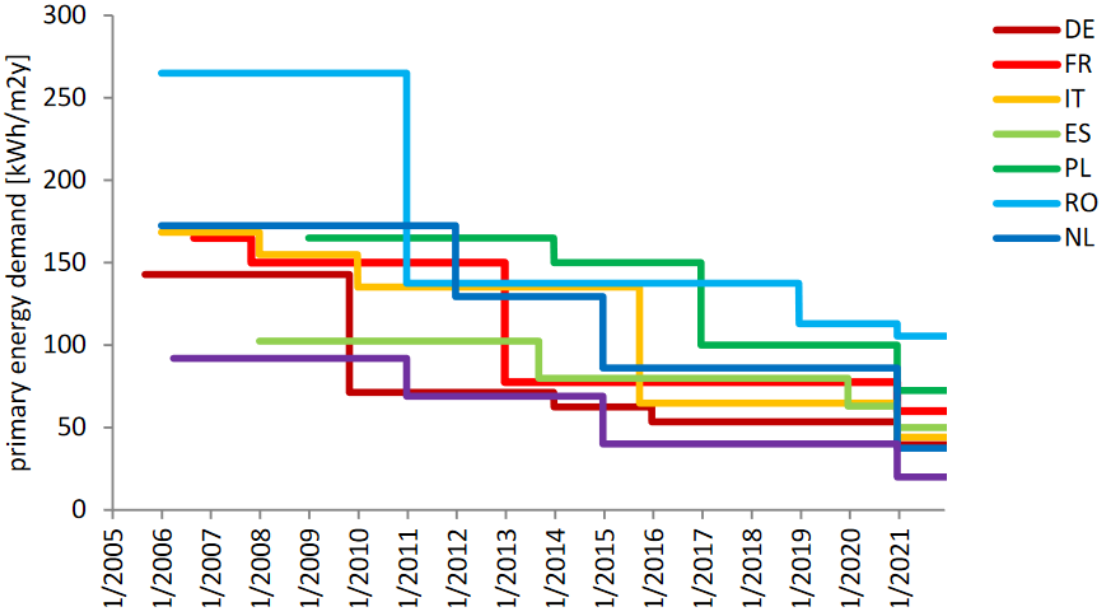
Climate	Single family house	Multi family house	Office	Other non-residential
warm	81 (161)	105 (148)	221 (275)	423 (775)
mild	83 (112)	80 (124)	130 (136)	176 (268)
cold	77 (183)	62 (77)	66 (78)	120 (122)

Average reduction of cost-optimal levels from 2013 and 2018 for new and existing buildings

Member States' average	New single-family house	New multi-family house	New office	Existing single-family house	Existing multi-family house	Existing office
	-23%	-23%	-17%	-17%	-21%	-9%

Source: JRC own calculation

Improvement of residential minimum energy performance requirements in some key Member States, since the entry in force of the first EPBD



Source: JRC own calculation

The Energy Performance of Buildings Directive

2018 revision

as part of the Clean Energy for All Europeans package

- National long-term renovation strategies
- Optional scheme for 'smart readiness'
- Support for e-mobility
- Promotion of Building Automation and Control Systems
- Promotion of Energy performance of buildings standards (CEN)

A broader scope

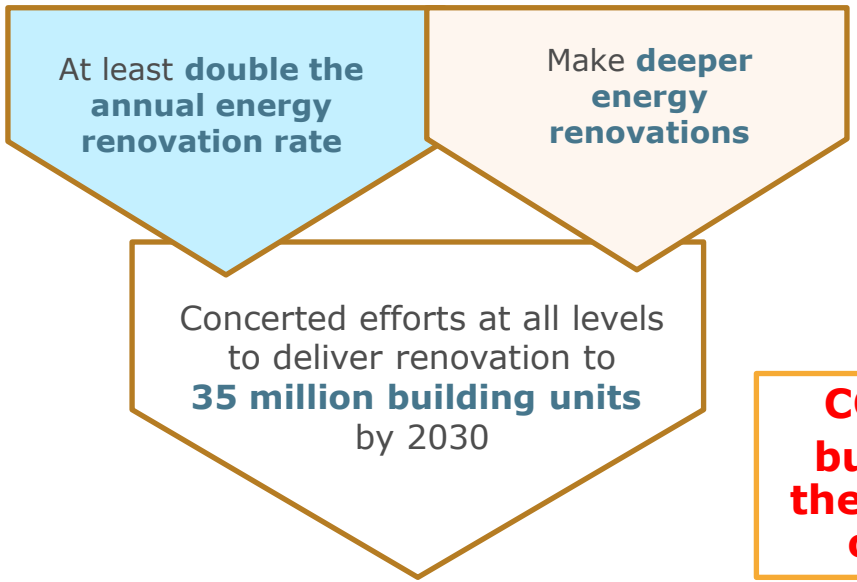
https://ec.europa.eu/energy/topics/energy-efficiency/energy-efficient-buildings/energy-performance-buildings-directive_en

Some general remarks

- The NZEB requirements are currently 70% more ambitious than the national cost-optimal minimum energy performance requirements.
- This was obtained through progressive legislative steps over the last 10 years.
- A significant reduction of relevant technology costs is expected, which could make it possible to further increase the level of ambition for NZEBs.
- The main challenge for the decarbonisation of the building stock by 2050 is to increase the current low renovation rates and the application of ambitious minimum requirements for existing buildings.
- Future generations of NZEBs will integrate smart technologies and digitalization solutions and could also be scaled-up and integrated at district level

The Renovation wave

Greening our buildings faster, Creating jobs, Improving lives



COVID-19: buildings in the center for our lives

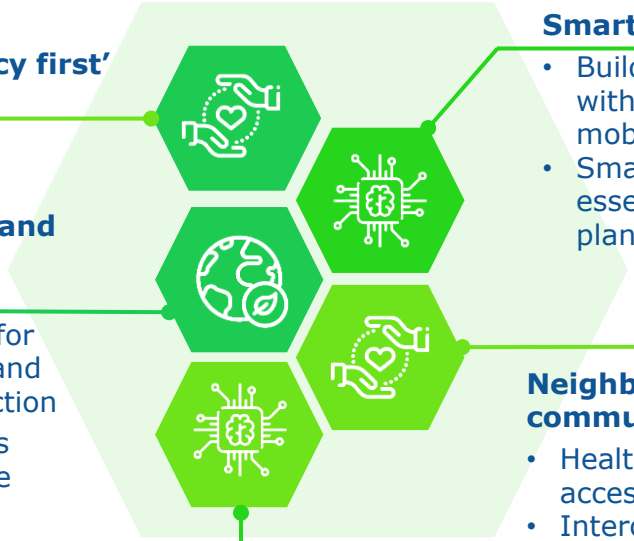
https://ec.europa.eu/energy/topics/energy-efficiency/energy-efficient-buildings/renovation-wave_en

A comprehensive vision on building renovation

'Energy efficiency first' principle

Life cycle thinking and circular economy principles

- Reduced pressure for natural resources and greenfield construction
- Adaptable buildings resilient to extreme natural events
- Reduce water consumption, remove hazardous materials
- Address fire safety
- Promote climate resilience and biodiversity



Integration of in-built and onsite renewables

Smart buildings

- Buildings producing energy, with recharging points for e-mobility and bike parking
- Smart buildings providing essential data for city planning and services

Neighbourhood and communities

- Healthier, greener & more accessible buildings
- Interconnected neighbourhood districts
- Energy communities

Proposal to revise the EPBD

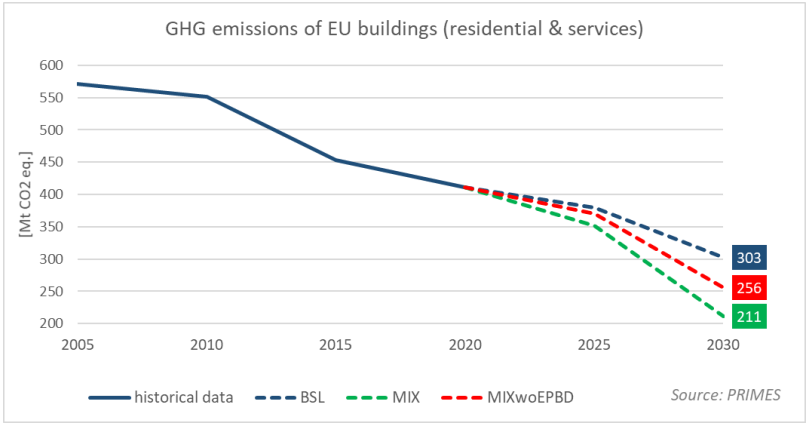
Twofold objective:

→ Contribute to reducing buildings' GHG emissions and final energy consumption by 2030

→ Provide a long-term vision for buildings and ensure an adequate contribution to achieving climate neutrality in 2050

Climate Target Plan: by 2030 the EU should reduce buildings':

- GHG emissions by **60%**
- final energy consumption by **14%**
- energy consumption for heating and cooling by **18%**



European Commission

Proposal to revise the EPBD: focus areas

Renovation

- Minimum Energy Performance Standards
- Energy Performance Certificates
- National Building Renovation Plans and renovation passports for individual buildings

Decarbonisation

- Introduction of zero-emission buildings as new standard for new buildings
- Consideration of whole life cycle carbon
- Phasing out incentives for fossil fuels and new legal basis for national bans

Financing

- Sustainable finance and energy poverty alleviation
- Deep renovation standard
- Renovation passports for individual buildings

Modernisation & system integration

- Infrastructure for sustainable mobility
- Smart Readiness Indicator
- Indoor air quality: ventilation and other technical building systems

Main provisions on new buildings

From nearly zero energy to zero emission buildings

- Update based on benchmarks per climatic zones, to be applied by 2030 (2027 for public buildings)
- Stronger incentive to on-site renewables, efficient district heating and energy communities
- Zero-emission buildings become the level to be attained by a deep renovation as of 2030 and the vision for the building stock in 2050

The life-cycle Global Warming Potential (GWP) of new buildings will have to be calculated as of 2030 in accordance with the Level(s) framework, informing on whole life-cycle carbon emissions (2027 for large buildings)

Strengthened requirements for recharging of e-vehicles, and mandatory bicycle parking in new buildings

Main provisions on existing buildings

Minimum Energy Performance Standards: Union-wide MEPS to phase out worst-performing buildings

- Public and other non-residential buildings: at least EPC class F by 2027 & EPC class E by 2030
- Residential buildings: at least EPC class F by 2030 & EPC class E by 2033

National Building Renovation Plans (replacing the long-term renovation strategies)

BRP to be integrated into the NECP process, except the first plan

Common template with only national goals and key mandatory indicator, several elements opening to other dimensions beyond energy remain voluntary (accessibility, safety,..)

Definition of „deep renovation"

Strengthened requirements for recharging of e-vehicles in case of major renovation

Stronger provisions on the removal of obstacles and barriers to renovation (right to renovate)

Member States must not subsidise fossil-fuel boilers as of 2027

Thank you!

Dimitrios Athanasiou

Policy Officer, Directorate-General for Energy

European Commission

Dimitrios.ATHANASIOU@ec.europa.eu

Keynotes

David Nemtzow

Director, Building Technologies Office,
US Department of Energy

Toward a Decarbonized Future: US Building Energy Codes

BPIE US-EU exchange: Building standards and codes to drive renovation

David Nemtzow, Director, Building Technologies Office, U.S. Department of Energy

11 January 2022

U.S. National Climate and Energy Goals

By 2030

United Nations Climate Change

United States of America Nationally Determined Contribution

Reduce net greenhouse gas emissions by **50-52%** below 2005 levels

By 2035

THE WHITE HOUSE WASHINGTON

United States of America Power Sector

Achieve **100 percent** carbon pollution-free electricity by 2035

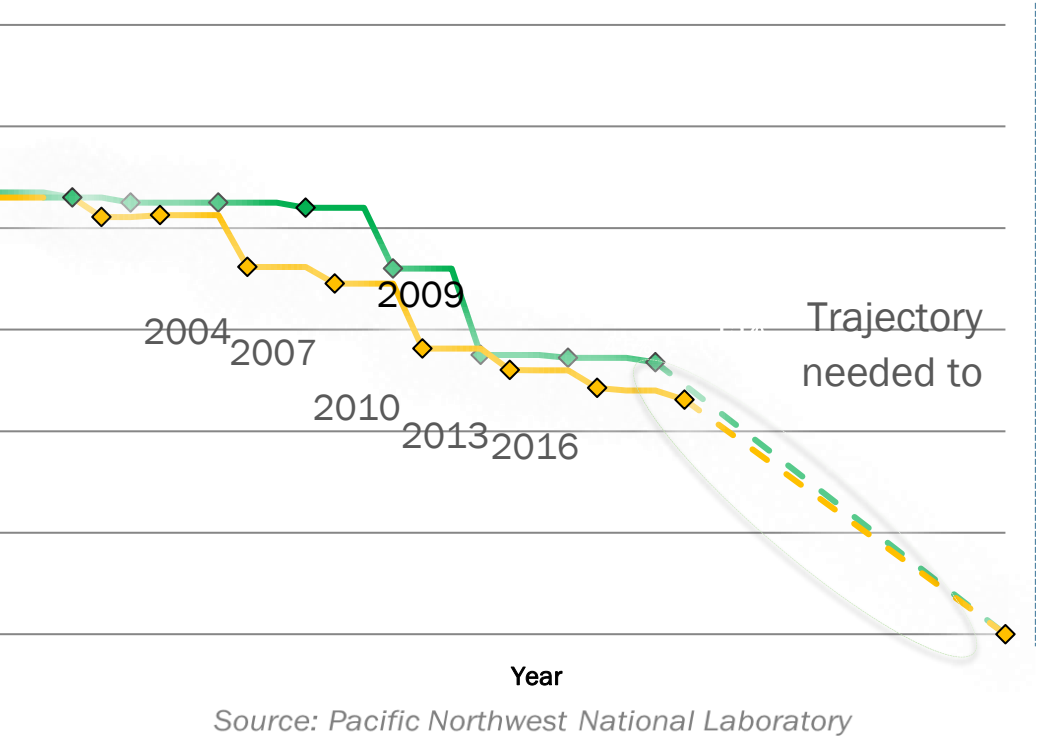
By 2050

THE WHITE HOUSE WASHINGTON

United States of America Economy

Achieve a fully carbon-neutral **clean energy economy**

Model building energy codes: Progress over time



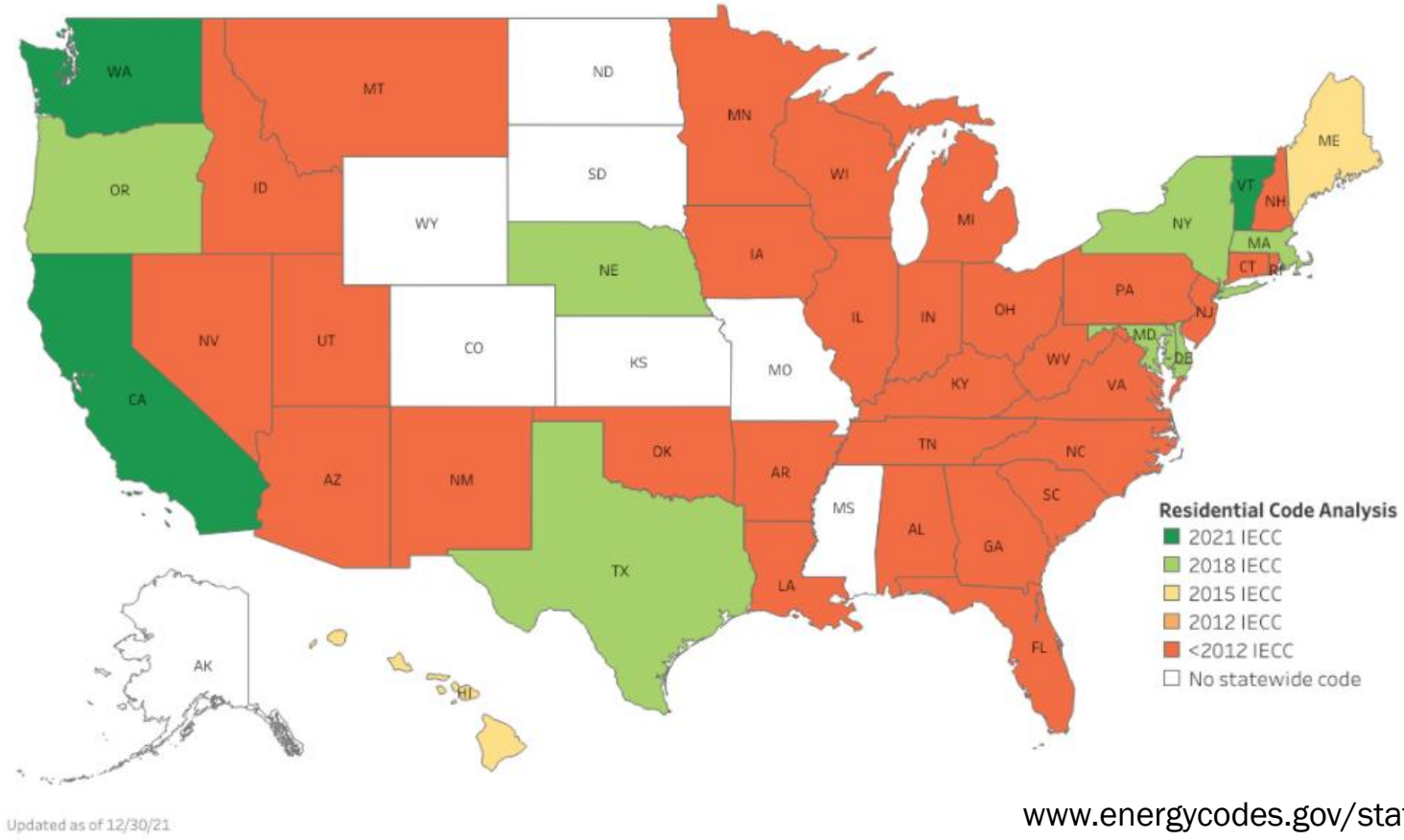
Source: Pacific Northwest National Laboratory

~ **US$138 billion** energy cost savings
~ **900 MMT** of avoided carbon emissions
~ **13 quads** of primary energy

These savings equate to the annual emissions of:

~ 195 million passenger vehicles
~ 108 million homes

Status of energy code adoption – Residential

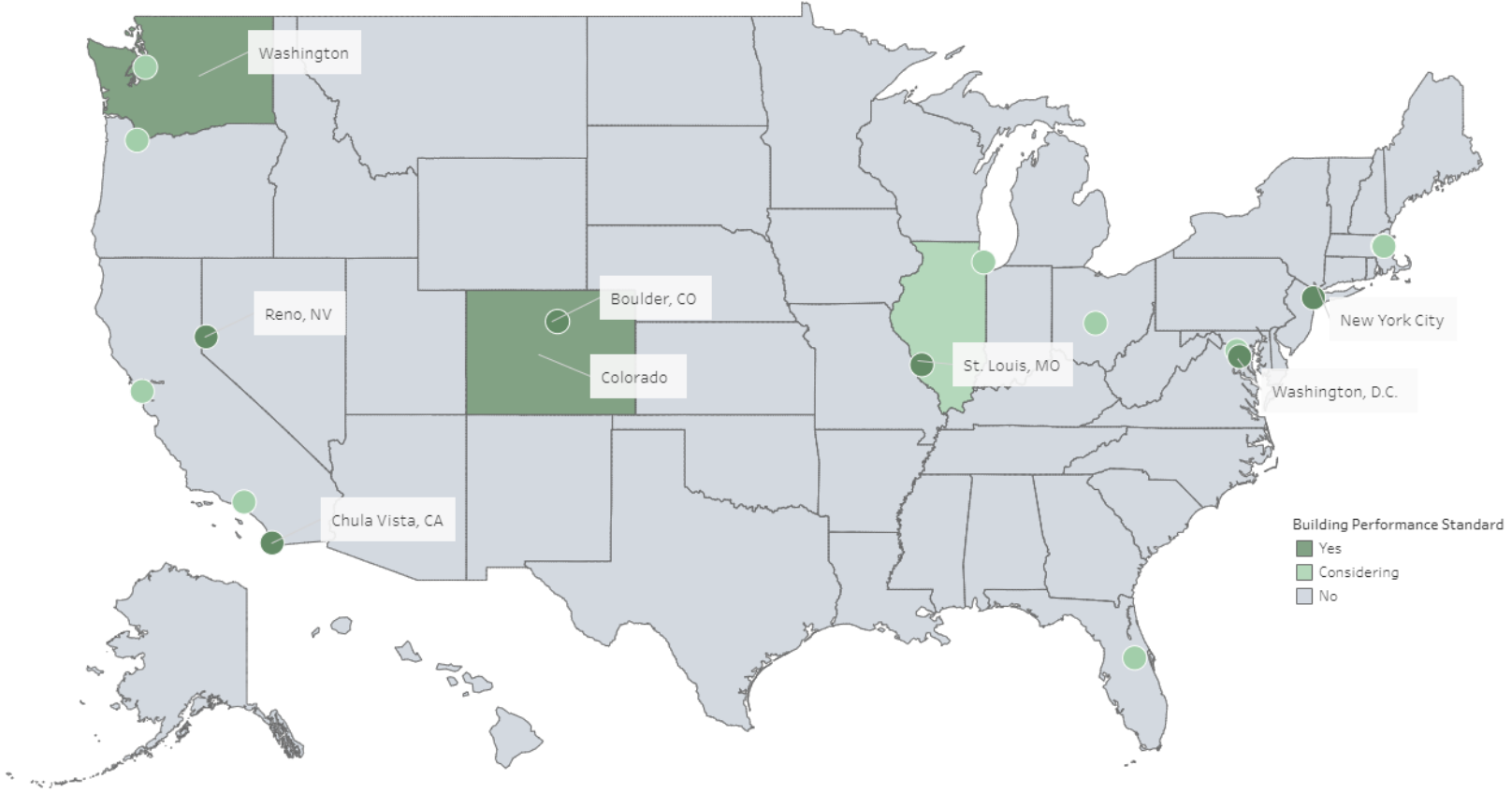


www.energycodes.gov/status

Emerging themes in US (and elsewhere)

- ✓ **Net zero energy** (+Readiness)
  - ICC specified optional stretch goal of zero energy by ‘30; optional zero-ready appendices in ‘21 IECC
- ✓ **Electrification** (+Readiness):
  - Pre-wiring for future electric appliances, reserved space for heat pump water heaters
  - Explicit prohibition of fossil fuels
- ✓ **Electric Vehicles / charging**: Pre-wiring or actual charging
- ✓ **PV, storage integration**: California Title 24, ASHRAE Standard 90.1
- ✓ **Grid integration**: Grid-interactive water heaters, smart thermostats, etc.
- ✓ **Carbon-measured / decarbonization codes**
- ✓ **Performance-based codes**
- ✓ **Compliance focus,** including: remote technologies, training for regulat*or* and regulate*d*
- ✓ **Existing buildings,** particularly via **Building Performance Standards** (BPS)

Building Performance Standards – wave of the future?



You are welcome to participate as an expert in the ***Building Energy Codes Working Group*** of the IEA Buildings and Communities Programme

- Contact your EBC national representative www.iea-ebc.org/contacts
  - If your country is not listed, please contact
    - BECWG Chairs and Operating Agent: *Meredydd Evans* (Operating Agent), m.evans (at) pnnl.gov, or
    - EBC's Secretariat: *Malcolm Orme*, malcolm.orme (at) aecom.com
- Get on the mailing list for quarterly webinars and e-newsletters (POC: *Alison Delgado*, Alison.Delgado (at) pnnl.gov)

www.iea-ebc.org/working-group/building-energy-codes

The stakes are high

Building energy codes are projected to result for US in (2020 through 2040):

US$138 billion in energy cost savings to homes and businesses

13 quads (13.7 EJ) of primary energy savings

900 million tonnes of avoided CO_2 emissions

www.energycodes.gov/impacts

Thank you!

david.nemtzow (at) hq.doe.gov

Codes: energycodes.gov

BTO: www.energy.gov/eere/buildings

BTO and DOE are hiring! Contact me/us!

SESSION 1

Codes for new construction

Amy Boyce

Associate Director,
Codes and Technical Strategy,
Institute for Market Transformation

Jaap Hogeling

Manager for international standards at ISSO,
Expert at EPB Center

SESSION 1

Amy Boyce

Associate Director,
Codes and Technical Strategy,
Institute for Market Transformation

Codes for New Construction: Setting the Baseline for Performance

US-EU Exchange

Building Standards and Codes to Drive Renovation

About the Institute for Market Transformation (IMT)

Mission

Catalyze widespread and sustained demand for high-performing buildings.

How we work

Advancing policies and business practices that enable people to build and operate healthy, high-performing buildings.

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The US Model Energy Codes: IECC and Standard 90.1

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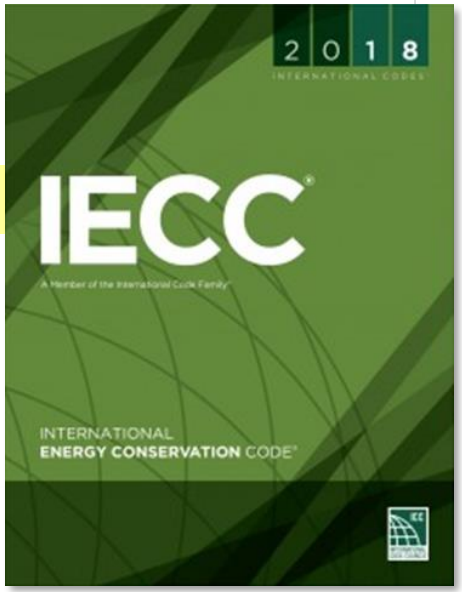


CONTENTS

ANSI/ASHRAE/IES Standard 90.1-2019
Energy Standard for Buildings Except Low-Rise Residential Buildings (I-P Edition)

SECTION

Foreword . . . . .

1 Purpose . . . . .

2 Scope . . . . .

3 Definitions, Abbreviations, and Acronyms . . . . .

4 Administration and Enforcement . . . . .

5 Building Envelope . . . . .

6 Heating, Ventilating, and Air Conditioning . . . . .

7 Service Water Heating . . . . .

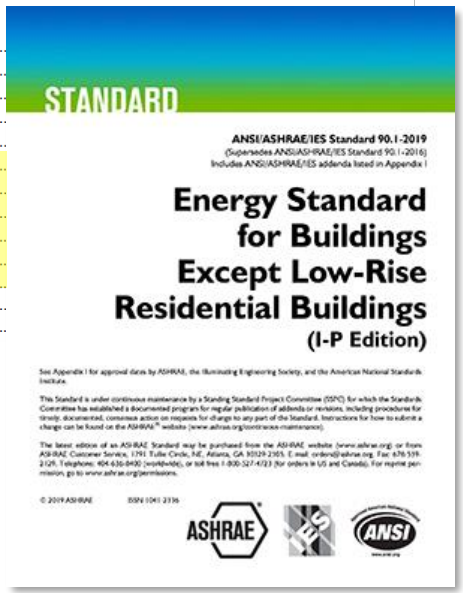
8 Power . . . . .

9 Lighting . . . . .

10 Other Equipment . . . . .

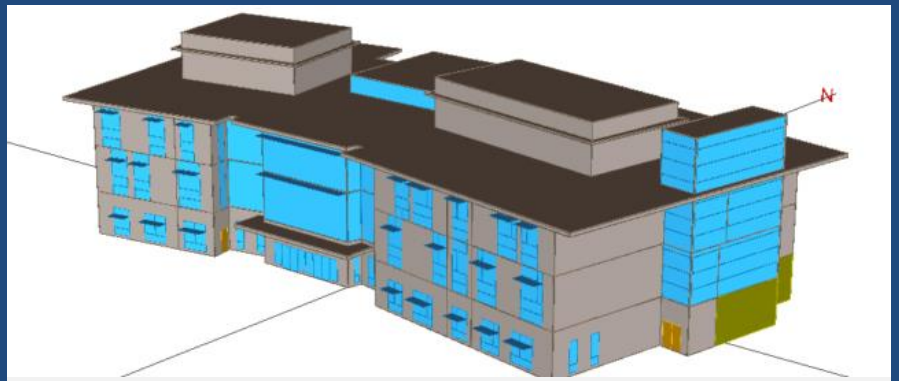
11 Energy Cost Budget Method . . . . .

12 Normative References . . . . .



Code Compliance: Prescriptive versus Performance

- Requires following a set list of requirements
- No energy use estimates
- Simpler option for smaller buildings are those with less complex feature



- Performance method requires energy modeling
- Results in an estimated energy use as compared to a baseline
- Most often used for more complex buildings or systems

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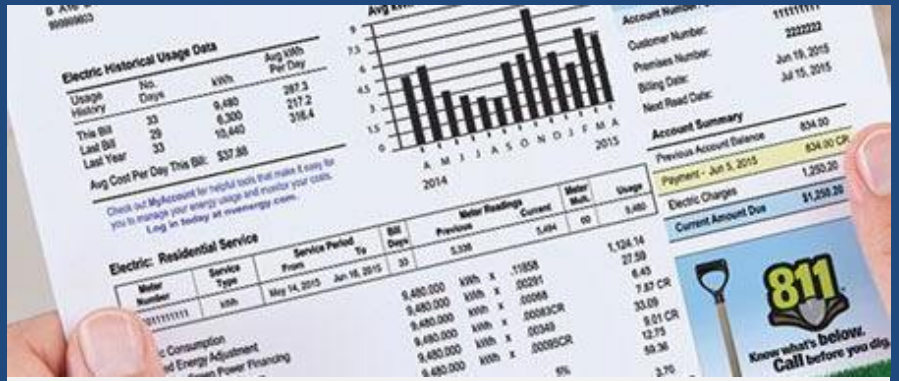
Modeling End Goal: Compliance or Prediction?

Compliance modeling

- Comparison to baseline building
- Required for code
- Uses standard assumptions



Predictive modeling

- Uses actual building characteristics
- Takes into account measured energy use (when possible)

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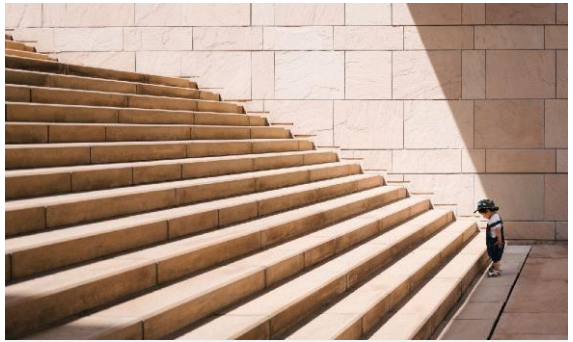
What is a Building Performance Standard (BPS)?

Metric

What are we measuring? Carbon, Energy, EUI?



Standard

Where do we want buildings to be? How aggressive is our approach?

.

Compliance Path

How do we expect buildings to improve, and how quickly? What programs exist to help?

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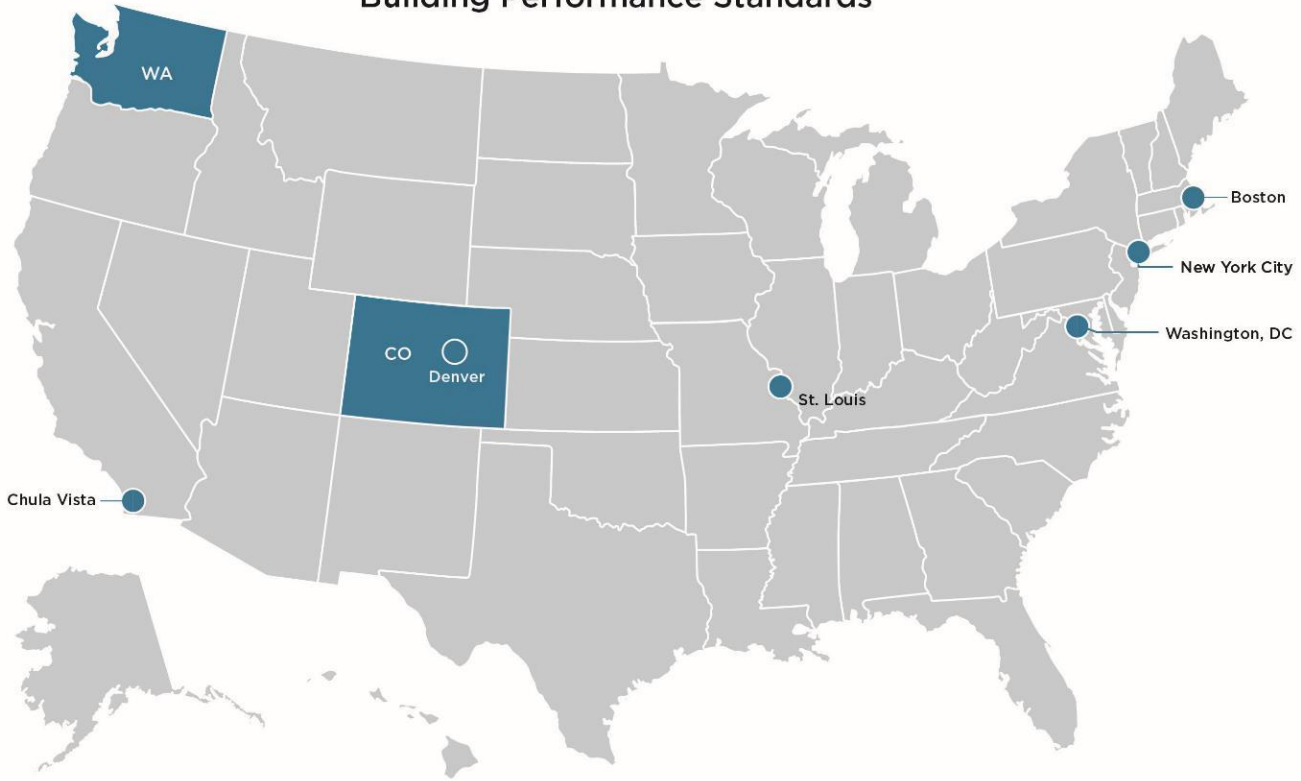
U.S. City and State Policies for Existing Buildings: Building Performance Standards



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Energy Codes versus Performance Standards

Energy Codes	Building Performance Standards
Address design/construction	Address performance
(Mostly) Adopted at state level	(Mostly) Adopted at city level
Have been in effect for decades	Are just being implemented
Are widely adopted	Have limited adoption
Up to engineers/contractors to meet requirements	Up to building operators to meet requirements
Are enforced through building departments	Are enforced through energy departments

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Energy Codes and Performance Standards

Energy Codes and Building Performance Standards
Address building energy use from prior to construction through operation
Adopted by local governments to ensure a baseline of energy efficiency
Are a different approach to buildings than traditional (e.g. building) codes
Levels of stringency and adoption vary by jurisdiction
Building industry professionals are responsible for meeting requirements
Are enforced through local government departments

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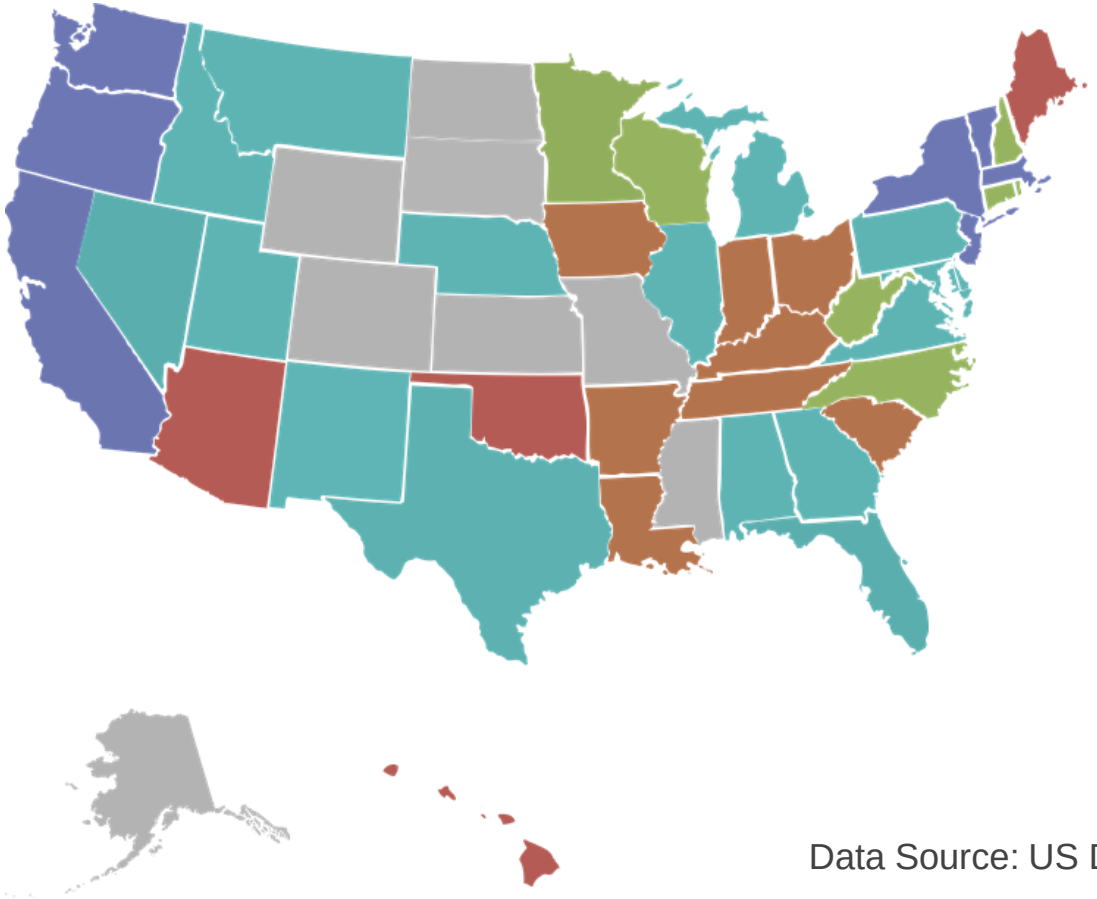
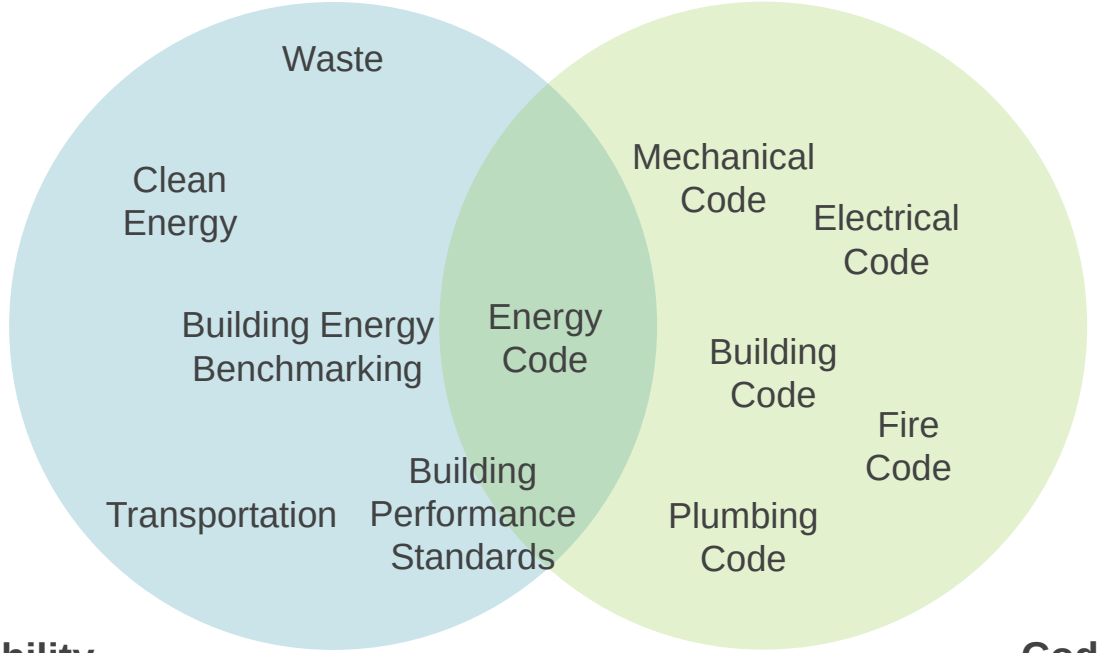
State Adoption: Commercial Energy Code



Data Source: US DOE

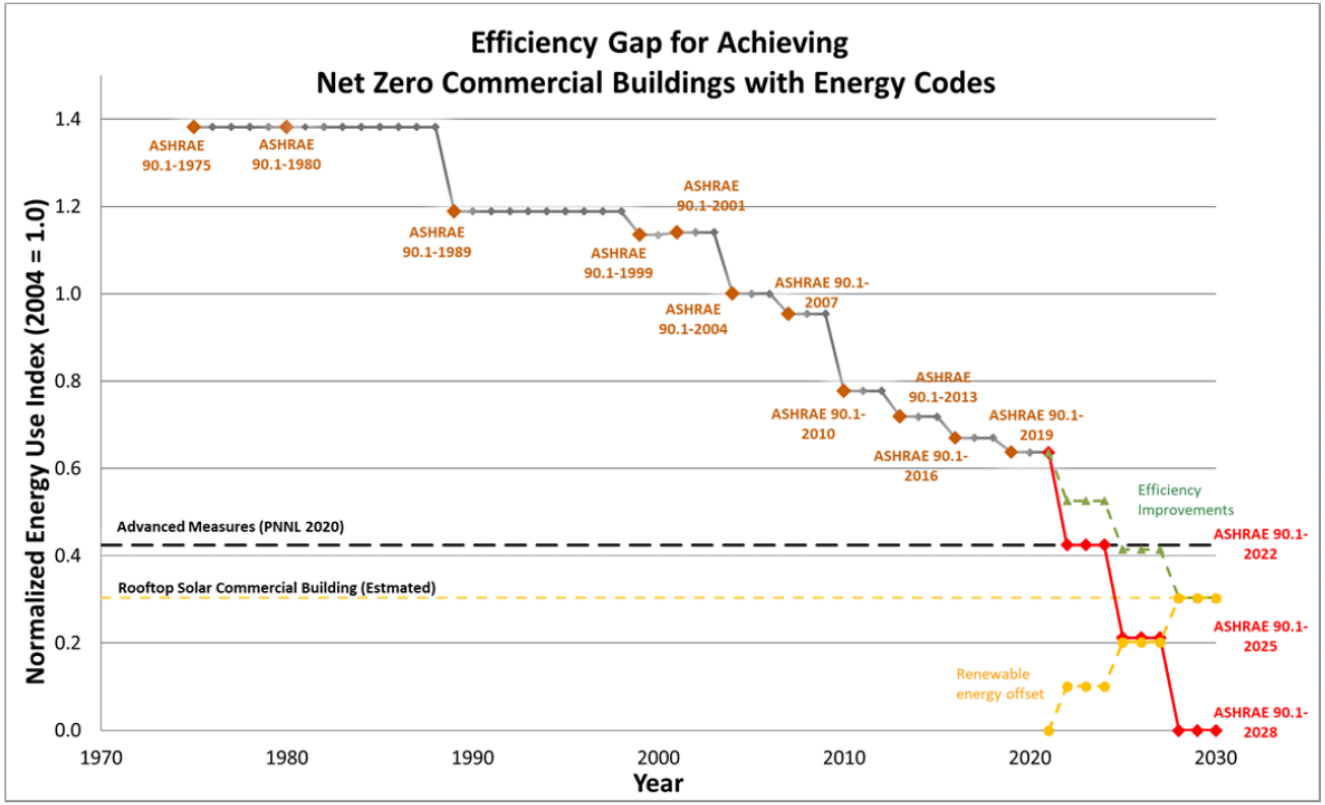
Who is Regulating Building Energy?



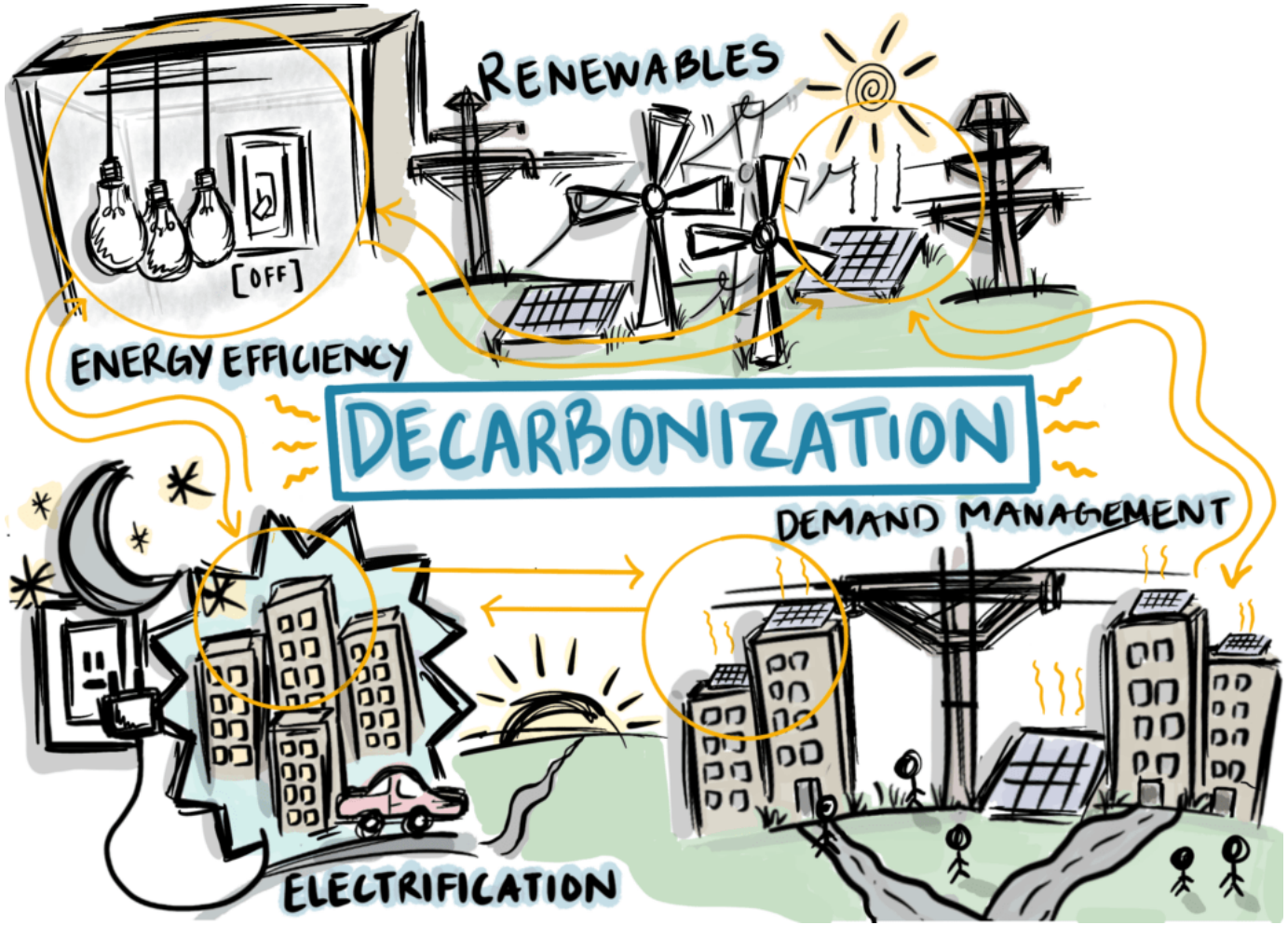
Energy/Sustainability Departments

Code Officials/ Building Departments

Commercial Code Improvement



Source: Franconi, E, J. Lerond, C. Nambiar, D. Kim, D. Winiarski, and M. Rosenberg. *Filling the Efficiency Gap to Achieve Zero Energy Buildings with Energy Codes*. PNNL-30547, Pacific Northwest National Laboratory, Richland, Washington [publication pending].


RENEWABLES
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ENERGY EFFICIENCY
DECARBONIZATION
DEMAND MANAGEMENT
ELECTRIFICATION

Thank you!

Amy Boyce

Associate Director,

Codes and Technical Strategy

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SESSION 1

Jaap Hogeling

Manager for international standards at ISSO,
Expert at EPB Center

The modular set of EPB standards
EU Green Deal - Fit for 55 by 2030: drivers for the EPBD revision in 2022
The use of the set of EPB standards for New and Existing Buildings

Jaap Hogeling

Chair CEN/TC 371 Energy Performance of Buildings

ISO/TC 163/WG 4: Joint Working Group (JWG) between ISO/TC 163 and ISO/TC 205: Energy performance of buildings using holistic approach

jaap.hogeling@epb.center

The EPB Center is an initiative of ISSO and REHVA and was supported by the EU-Commission Service Contract ENER/C3/2017-437/SI2.785185 Start 21 September 2018 for 3 years

www.epb.center

My background

- CEN/TC 371: Energy Performance of Buildings, chairperson since 2004
- Project leader of the EU Mandate/480 to CEN regarding the development of the set of EPB standards.
- Participation in 5 CEN/TC's and 2 ISO/TC's related to Energy Performance of Buildings
- Manager international standards at ISSO, Rotterdam, the Netherlands
- Initiator of EPB Center (an initiative of ISSO and REHVA)
- Fellow of ASHRAE and REHVA

In this presentation I will refer to several video and webinars that are available at https://epb.center/support/

The Set of EPB Standards

Codes or Standards: the set of EPB standards describe in a normative way the EP assessment procedures. It is up to the regulating authorities to lay down in "codes" how they refer to these standards and provide the (national) policy choices connected to the use of these standards

The Energy Performance of Buildings assessment method is:

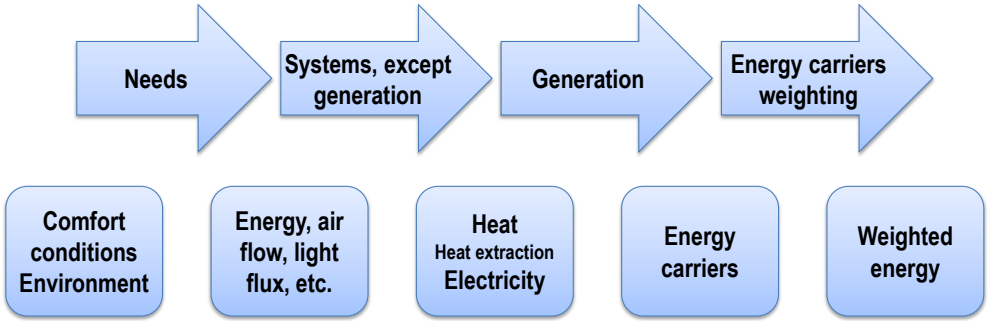
- **Functional**: it works for all types of buildings and systems, New and existing buildings
- **Sensitive**: it reacts to all available options and encloses both new and old technologies to support a correct renovation evaluation for existing buildings
- **Usable**: it has clear data input, it is adaptable to context, and it provides suitable results for its scope, compliance with EP requirements and energy performance display (certificates)

… is: **comprehensive**, **traceable**, **realistic**, **adaptable** …

… but also **simple**, **short**, **compact**, **easy to read** and **software proof**, …

Modularity

Modularity allows to combine simple items to build or describe a complex system. (see also EPB Center webinar 7)



You start from the needs: some can be reduced (insulation) others can't.
Technical systems, up to generation, loose some energy and use auxiliary energy
Generators provide heat, heat extraction and electricity using energy carriers
Energy carriers are weighted to provide the energy performance

Then you can explode each step into several "modules"

Systems → subsystems

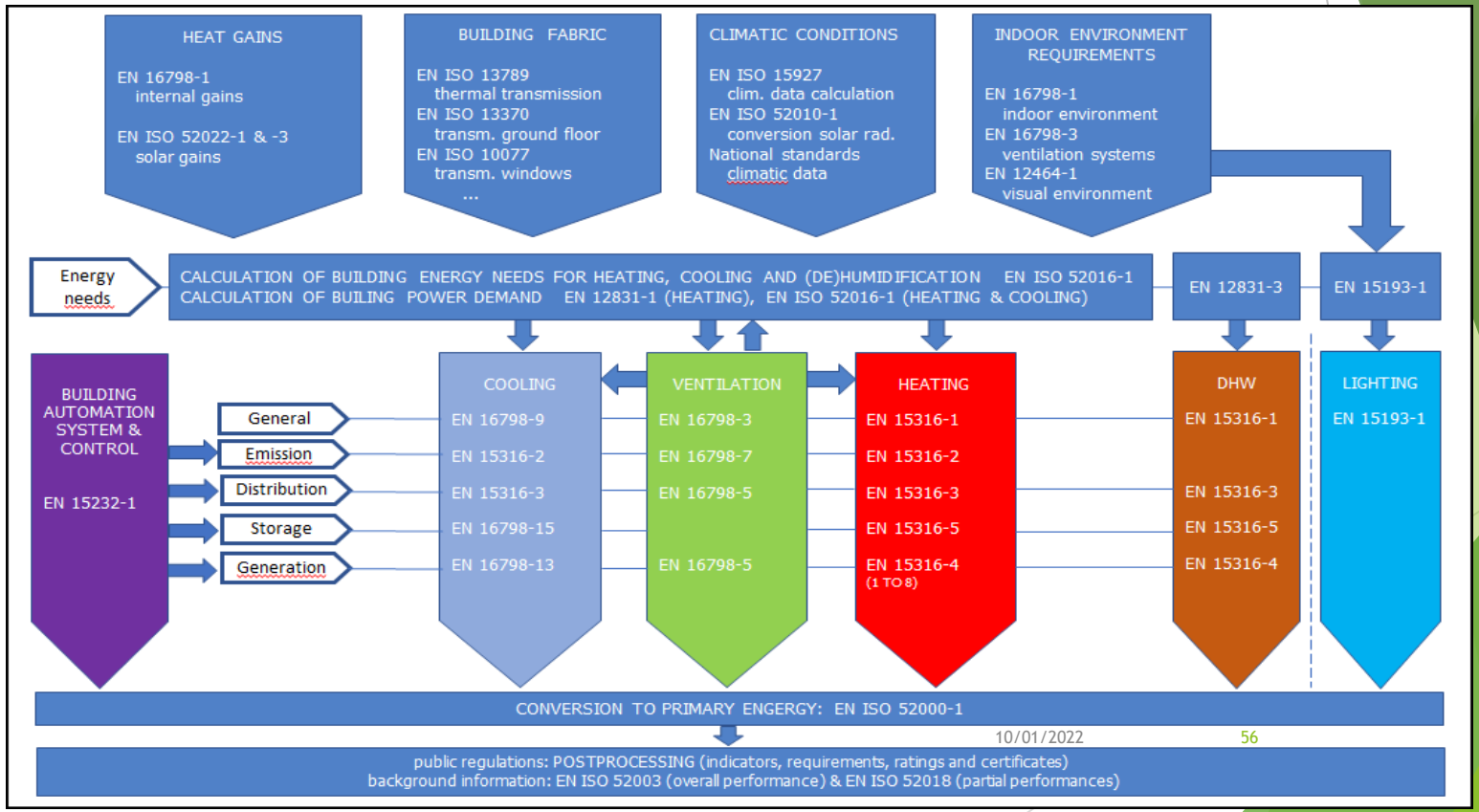
Generation → type of generators

Then repeat for all services

An overview of all modules was given in EPBC Webinar 2

This resulted in the set EPB standards

See also webinar 1, Feb 4, 2020)



Why modularity ?

Modularity is a real advantage. The «modules» have similar properties and internal organization (structure) :

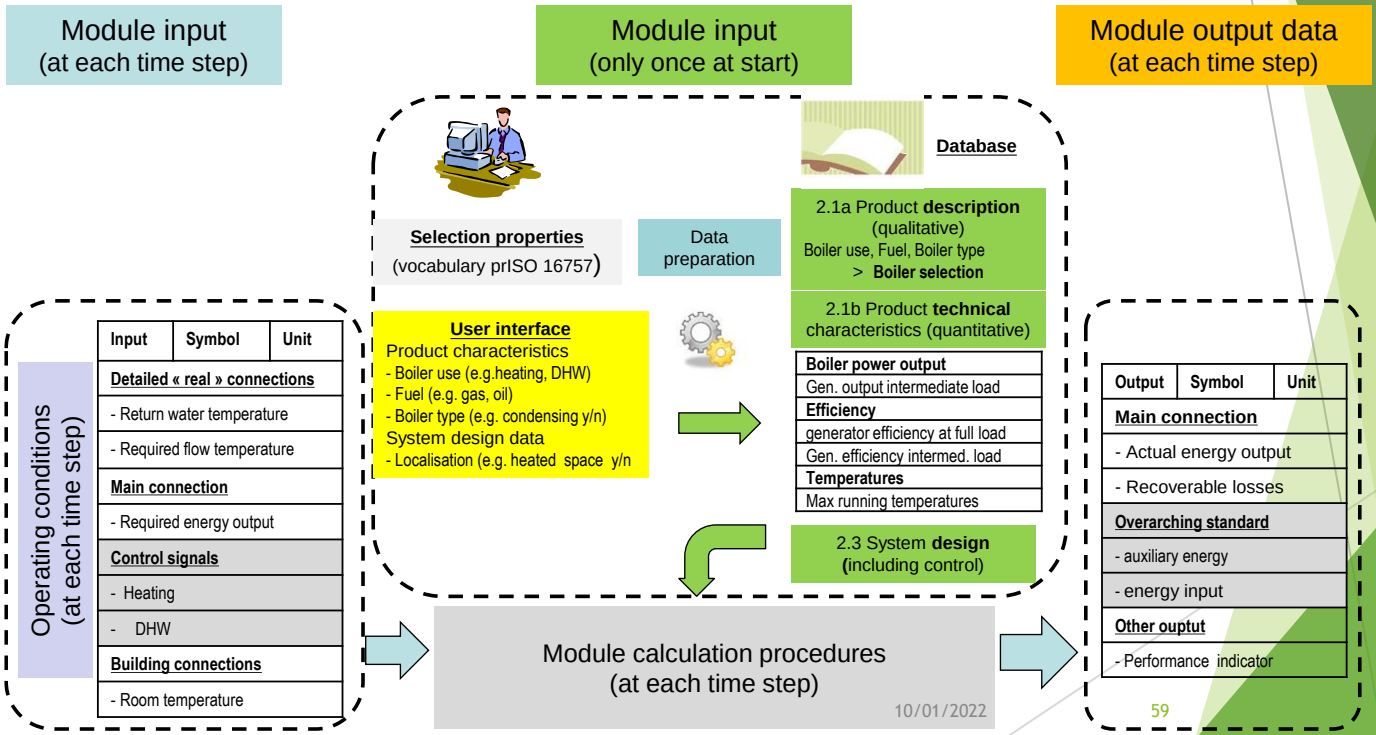
- If you know one, you (nearly) know all of them
- You can easily replace one with another one for e.g.
  - another type of generator
  - a default / special module (EN / national)

CEN-TS 16629 «detailed technical rules» specifies the common properties of all modules

Common properties of «EN EPB modules»

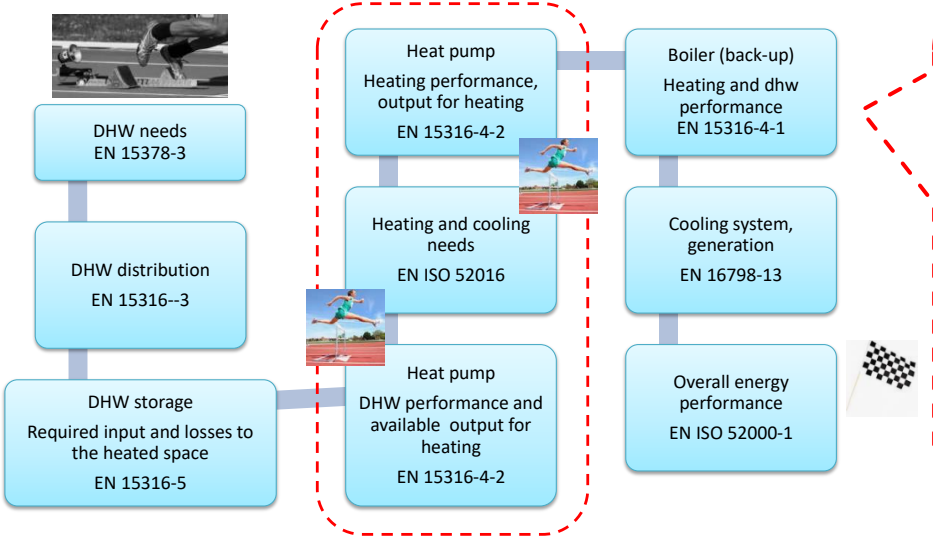
- **The structure: Organisation of the contents of the EPB standard and of the related TR**
- **Annex A / annex B mechanism**
- **Structuring of the input data**
  - **Product data** (local)
    - product description (qualitative, standardized selection properties);
    - product technical data (quantitative, standardized technical properties);
  - **System design data** (application case properties, local);
    - process design data;
    - control type;
  - **Operating conditions** (connection with structure)
  - **Constants** and **other data**
- **Structure of the accompanying Excel → connection**

Structure and use of each module (heating system example)



The real challenge…

It's relatively simple to deal with each module…
… the real challenge is having them work together smoothly.



Webinar 9

The calculation order has to be carefully designed to avoid iterations

Not shown: there might be several thermal zones and serviced areas

But don't be afraid…

There is a front-end and a back-end

- **Front-end**: is only seen by those who actually do the calculation and use the method. Their concerns are:
  - Describing the configuration of the building and systems
  - Inputting the data about all building elements and system components
  - Describing the operation of the building and systems
  - Understanding the calculation and the indicators
- **Back-end:** for those who design the method. Their concerns are:
  - Structuring the modules and their input and output so that it is easy to combine them and link them to catalogues and data-bases
  - **Defining a calculation structure that is software proof and easy to adapt to actual building and system configuration**

Conclusion

Modern buildings and systems are more and more various and complex and interactions between building envelope and technical systems are more and more relevant in both ways.

A clear modular structure allows to adapt the calculation to the actual case.

It's a real challenge to define a general structure to connect all modules in a smooth way: concern for standard developers and a challenge for the software developers.

The structure issue is not seen by the end user: the flexible structure allows him/her to describe a large variety of situations.

EU Green Deal – Fit for 55 by 2030

- drivers for the EPBD revision in 2022,
- will it affect the use of the set of EPB standards?

Yes, by the clear references to the EPB standards in the EPBD

Process of EPBD revision

- Target: a first draft ready by end of 2021,
- Vision on **decarbonisation** of building stock
  - A large majority (74%) welcomed an **EU-harmonised GHG metric;** *which is great as the current EPBD includes just an encouragement to MS's to report on GHG emission in the EPC, some countries do, but not all*
  - **see EN 17423 Energy performance of buildings - Determination and reporting of Primary Energy Factors (PEF) and CO2 emission coefficient - General Principles**

EN 17423:2020 > towards transparency on declaring the PEF's and CO2 Emission coefficients by regulating authorities

- **The target group of this standard are all the users of the set of EPB standards and especially national standardization experts and/or building authorities who are in charge of defining the PEFs and CO2 emission coefficients for each energy carrier used in buildings.**
- **This standard provides a transparent framework for reporting on the choices related to the procedure to determine primary energy factors (PEFs) and CO2 emission coefficients for energy delivered to and exported from the buildings as described in EN ISO 52000-1.**
- **This standard specifies the choices to be made to calculate the PEF(s) and CO2 emission coefficients related to different energy carriers.**
- **Primarily intended for supporting and complementing EN ISO 52000-1 (see table B16), as this standard requires values for the PEFs and CO2 emission coefficients to complete the EPB calculation for the EP—Certificate.**
- **The use of EN 17423 is required in the proposed new EPBD**

Thank you!
Questions?

More information on
the set of EPB standards:

www.epb.center

Contact: jaap.hogeling@epb.center

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SESSION 1

Q&A

SESSION 2

Standards for building renovation

Louise Sunderland

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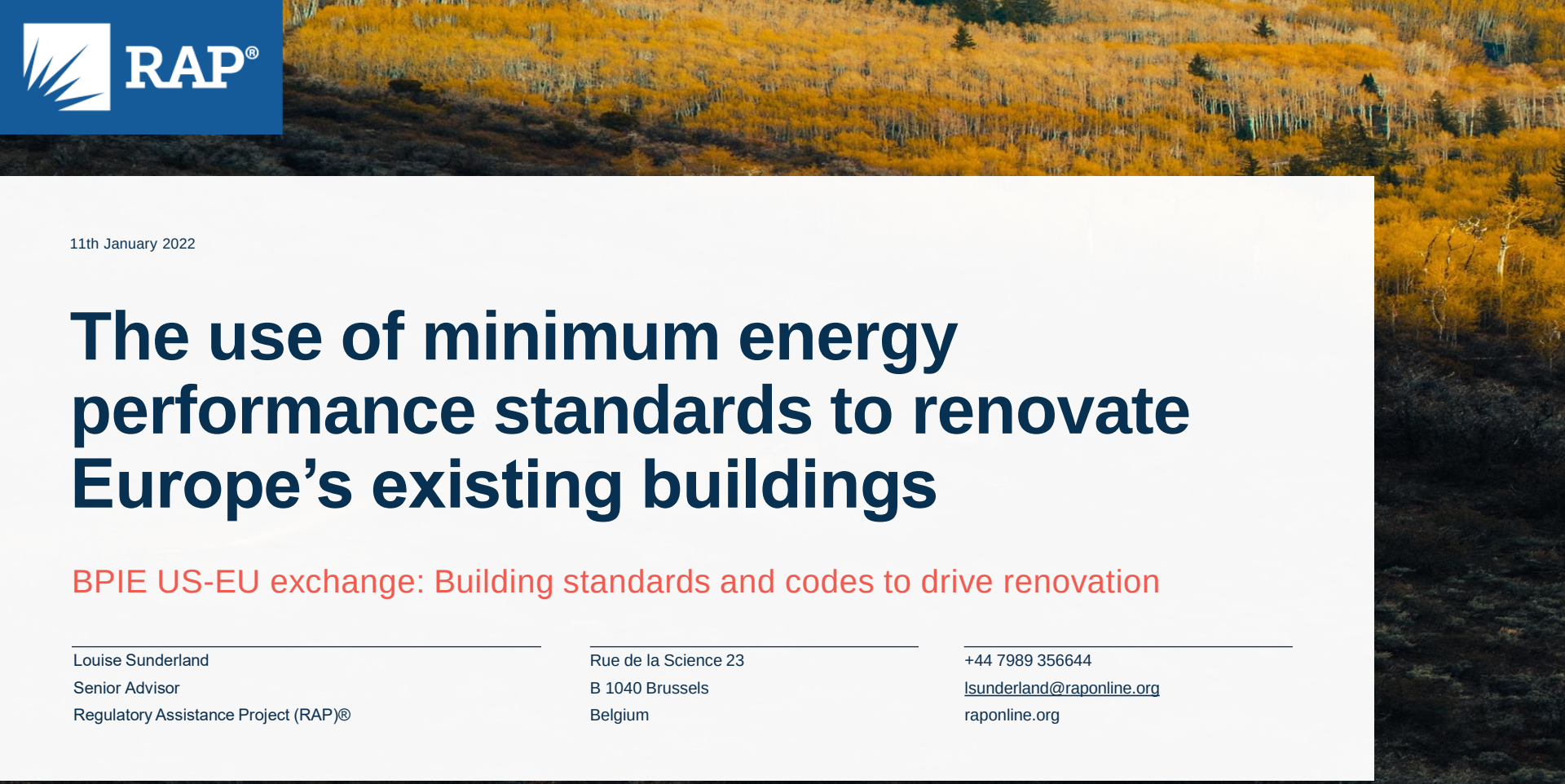
performance Building,
US Department of Housing
and Development,
Office Energy and
Environment

SESSION 2

Louise Sunderland

Senior Advisory,
Regulatory Assistance Project



11th January 2022

The use of minimum energy performance standards to renovate Europe's existing buildings

BPIE US-EU exchange: Building standards and codes to drive renovation

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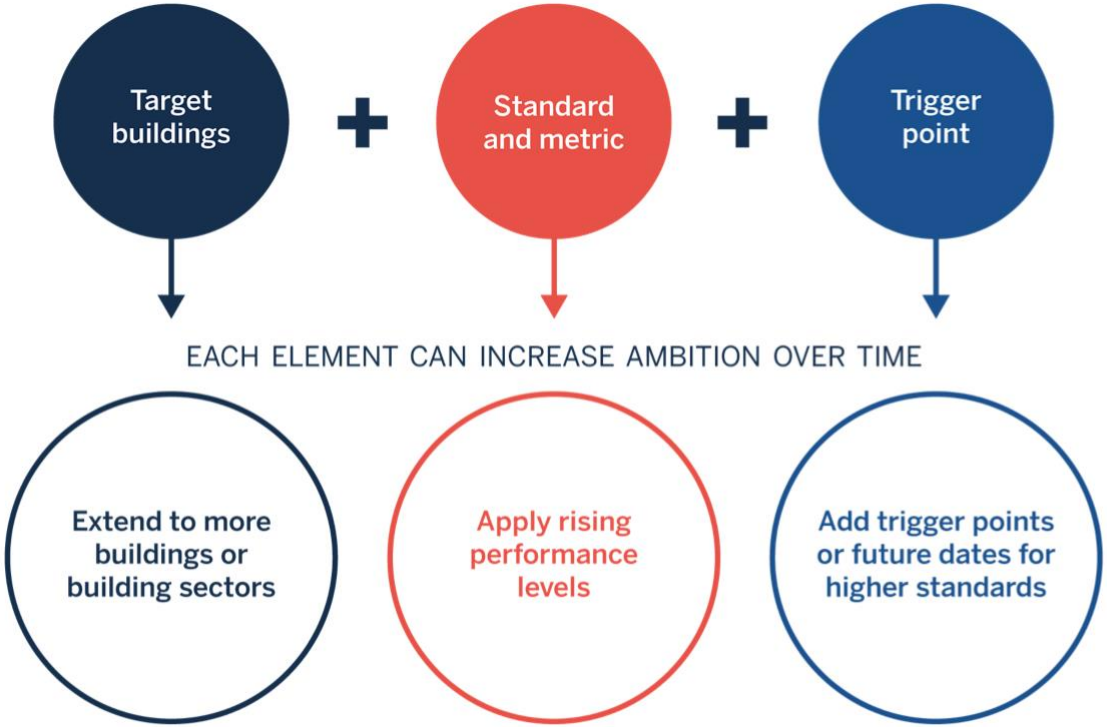
What are MEPS?

Minimum energy performance standards are regulations that require existing buildings to meet a minimum performance standard at a chosen trigger point and/or date.

MEPS are made up of three design elements



https://www.raponline.org/knowledge-center/next-steps-for-meps-designing-minimum-energy-performance-standards-for-european-buildings/

European Energy Performance of Buildings Directive recast proposal, December 2021

- Public and non-residential buildings must be:
  - EPC F by 2027
  - EPC E by 2030
- Residential buildings must be:
  - EPC F by 2030
  - EPC E by 2033

Article 9

Minimum energy performance standards

1. Member States shall ensure that

(a) buildings and building units owned by public bodies achieve at the latest

(i) after 1 January 2027, at least energy performance class F; and

(ii) after 1 January 2030, at least energy performance class E;

(b) non-residential buildings and building units, other than those owned by public bodies, achieve at the latest

(i) after 1 January 2027, at least energy performance class F; and

(ii) after 1 January 2030, at least energy performance class E;

(c) residential buildings and building units achieve at the latest

(i) after 1 January 2030, at least energy performance class F; and

(ii) after 1 January 2033, at least energy performance class E;

Proposal for the recast of the EPBD (July 2021) https://ec.europa.eu/energy/sites/default/files/proposal-recast-energy-performance-buildings-directive.pdf

The value of the Energy Performance Certificate framework

EPC framework provides

- Building assessment
- User-friendly label
- EPC register
- Stock data

Figure 12 - Estonia's new EPC design

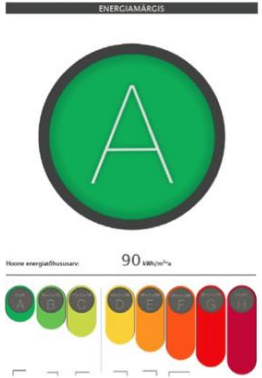


Figure 13 - Flander's new EPC design

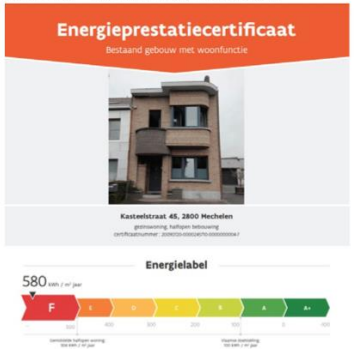


Figure 14 - Italy's EPC

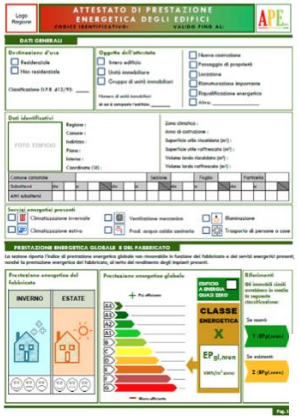
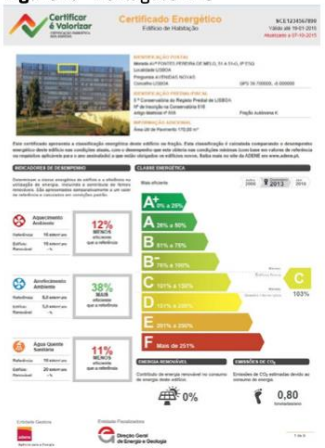
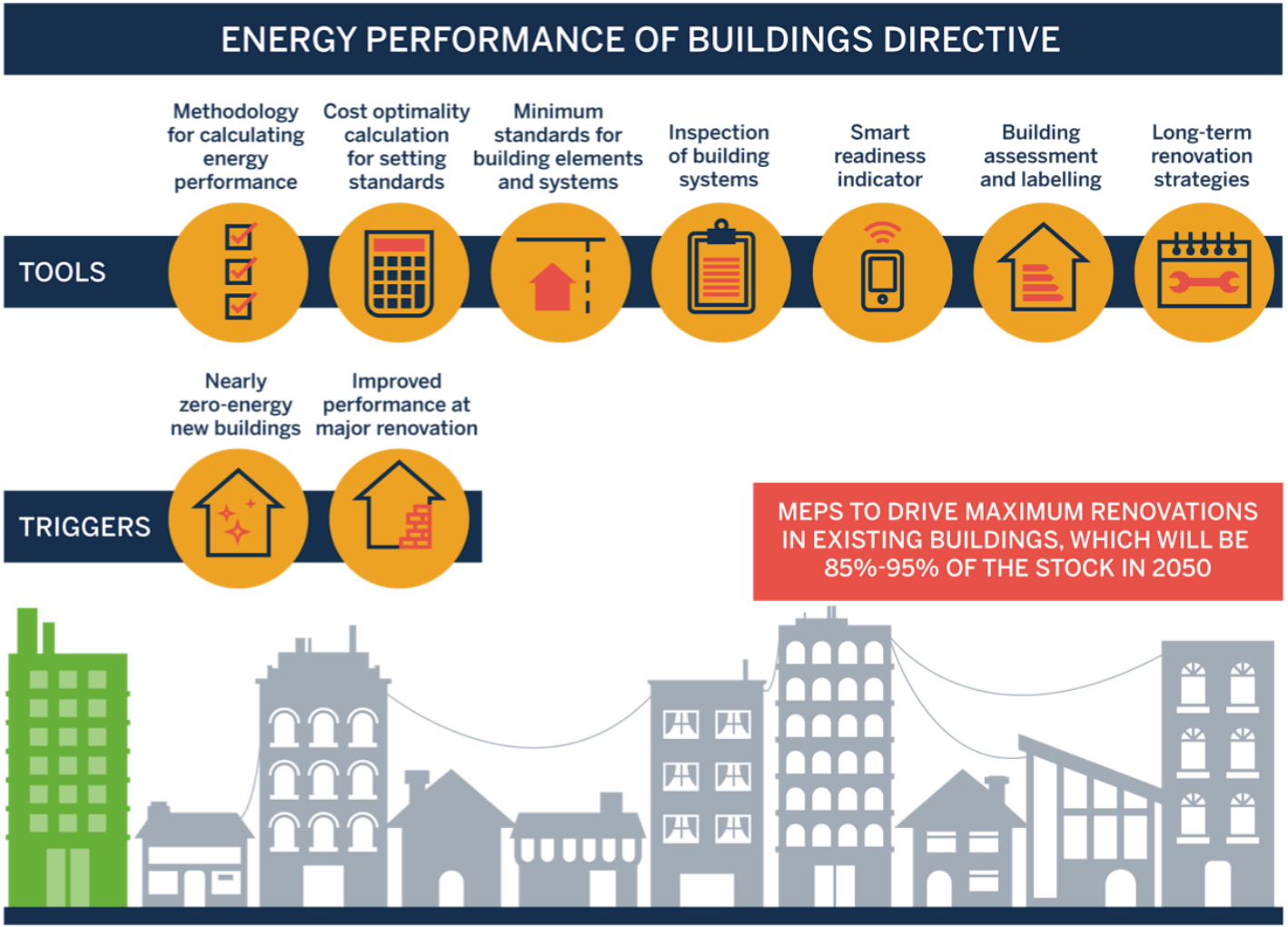


Figure 15 - Portugal's EPC



Extendo (2020) Energy performance certificates: Assessing their status and potential. https://x-tendo.eu/wp-content/uploads/2020/05/X-TENDO-REPORT_FINAL_pages.pdf



https://www.raponline.org/knowledge-center/next-steps-for-meps-designing-minimum-energy-performance-standards-for-european-buildings/

Member States implementing MEPS, examples

- England and Wales all privately rented homes must be EPC E by 2020.
- E&W all privately rented non-domestic must be EPC E by 2023 and EPC B by 2030.
- The Netherlands offices must be EPC C by 2023.
- France all private homes must be EPC E by 2028.
- Flanders, Belgium all homes (enforced for rented homes) must have minimum insulation by 2020 and glazing by 2028.
- Brussels-Capital, Belgium (draft) one step on renovation plan carried out every five years.

https://www.raponline.org/knowledge-center/filling-the-policy-gap-minimum-energy-performance-standards-for-european-buildings/.

The Netherlands

- History of the use of voluntary agreements on standards for social and rented housing
- EPC C standard by 2023 for offices
- New advisory insulation standard defined for 4 building architypes:
  - intended to define a ‘2050-fit’ insulation level
  - to enable the switch to lower flow temperature heat via heat pumps or district heating
  - in preparation for the area-based phase out of the fossil gas grid.

https://www.raponline.org/knowledge-center/next-steps-for-meps-designing-minimum-energy-performance-standards-for-european-buildings/

Scotland

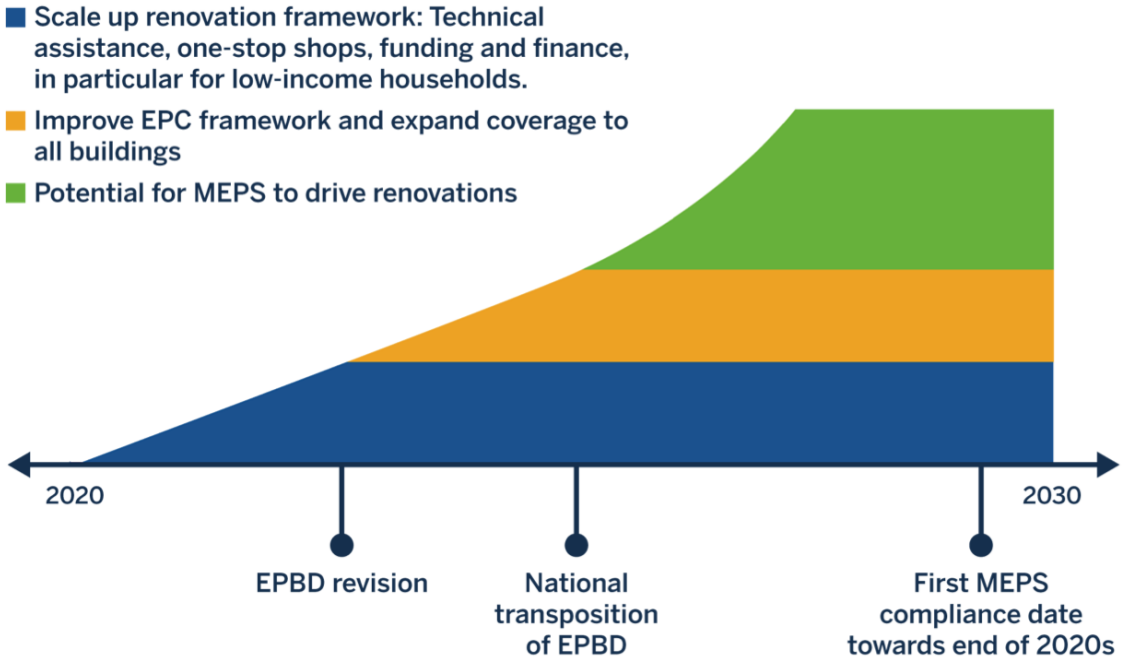
- Rented homes must be EPC E by 2021 and EPC D by 2025 (unimplemented due to covid)
- All private homes must be EPC C: PRS by 2028 and owner-occupied homes by 2033 (use of trigger points beforehand).
- All tenure zero emissions heat standard:
  - Phase out of fossil boilers in off-gas areas at replacement from 2025 (proposed)
  - Phase out of mains gas boilers at replacement from 2030 (proposed)

Scottish Government
Riaghaltas na h-Alba
gov.scot

Scottish Government (2021) https://www.gov.scot/publications/heat-buildings-strategy-achieving-net-zero-emissions-scotlands-buildings/

Regulations alone do not make successful renovations

- Building assessments
- Technical support
- Financial support
- Safeguards to protect housing affordability
- Effective enforcement



https://www.raponline.org/knowledge-center/next-steps-for-meps-designing-minimum-energy-performance-standards-for-european-buildings/

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Further resources

- Sunderland, L., and M. Santini. 2021. Next Steps for MEPS: Designing minimum energy performance standards for European buildings. June 2021. Regulatory Assistance Project. https://www.raponline.org/knowledge-center/next-steps-for-meps-designing-minimum-energy-performance-standards-for-european-buildings/
- Sunderland, L., and M. Santini. 2020. Filling the Policy Gap: Minimum Energy Performance Standards *for European Buildings*. Regulatory Assistance Project. June 2020. https://www.raponline.org/knowledge-center/filling-the-policy-gap-minimum-energy-performance-standards-for-european-buildings/
- Sunderland, L., and M. Santini. 2020. *Case Studies: Minimum Energy Performance Standards for European Buildings*. Regulatory Assistance Project. July 2020. https://www.raponline.org/knowledge-center/case-studies-minimum-energy-performance-standards-for-european-buildings/

About RAP

The Regulatory Assistance Project (RAP)® is an independent, non-partisan, non-governmental organization dedicated to accelerating the transition to a clean, reliable, and efficient energy future.

Learn more about our work at raponline.org

SESSION 2

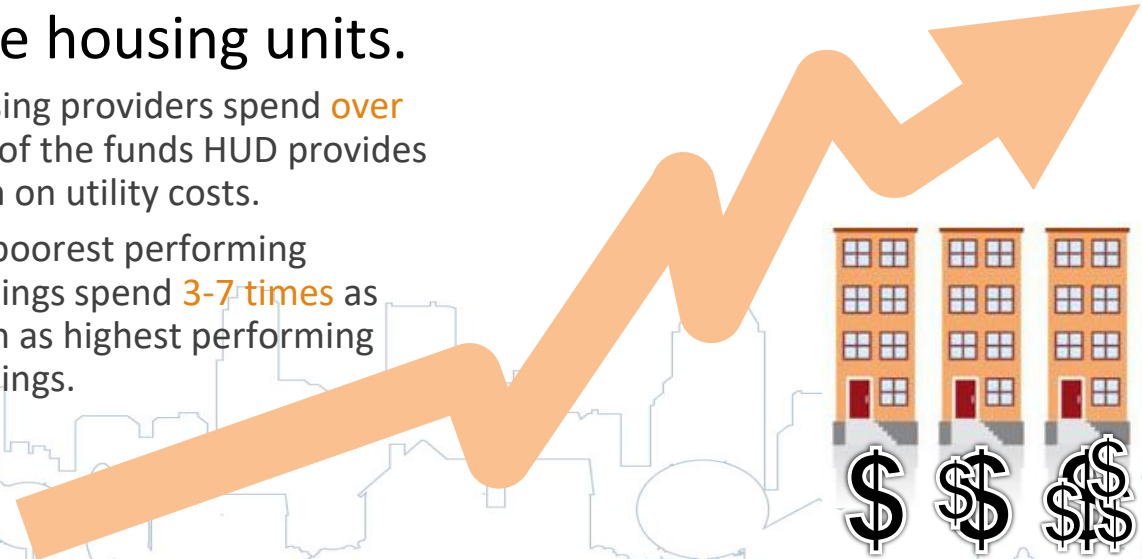
Michael Freedberg

Senior Advisor for High performance Building,
US Department of Housing and Development,
Office Energy and Environment

Setting Codes and Standards in Affordable Housing

We spend *how* much?

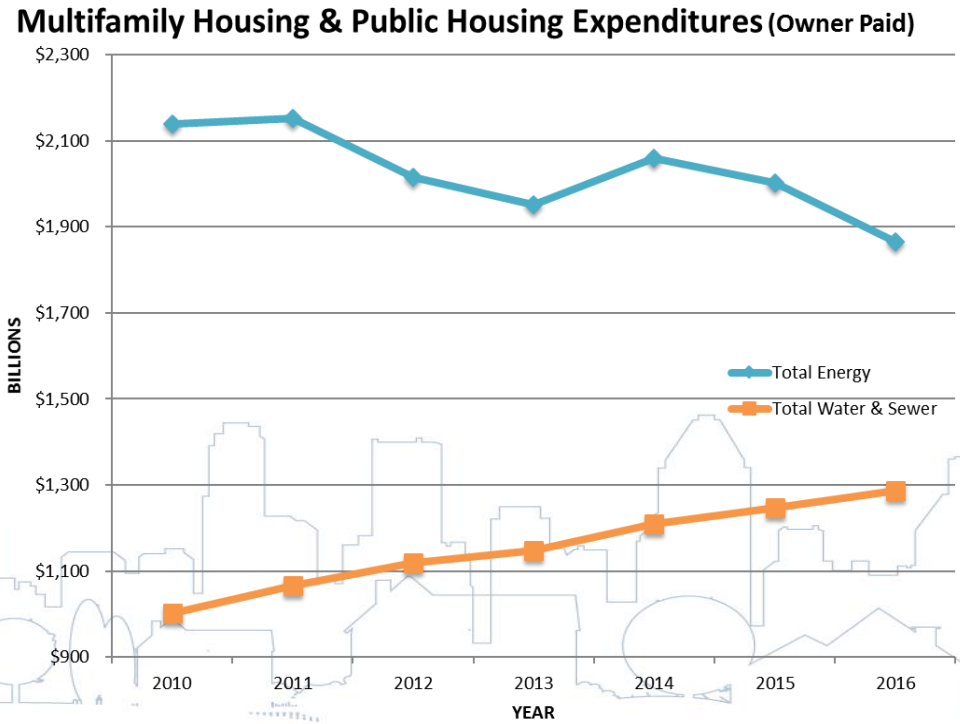
- Each year, HUD spends a growing amount – now estimated at almost **$7 Billion/year** – to cover utilities costs for 4.5 million affordable housing units.
  - Housing providers spend over 20% of the funds HUD provides them on utility costs.
  - The poorest performing buildings spend 3-7 times as much as highest performing buildings.



U.S. DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT

COMMUNITY PLANNING & DEVELOPMENT

Water Costs Rising

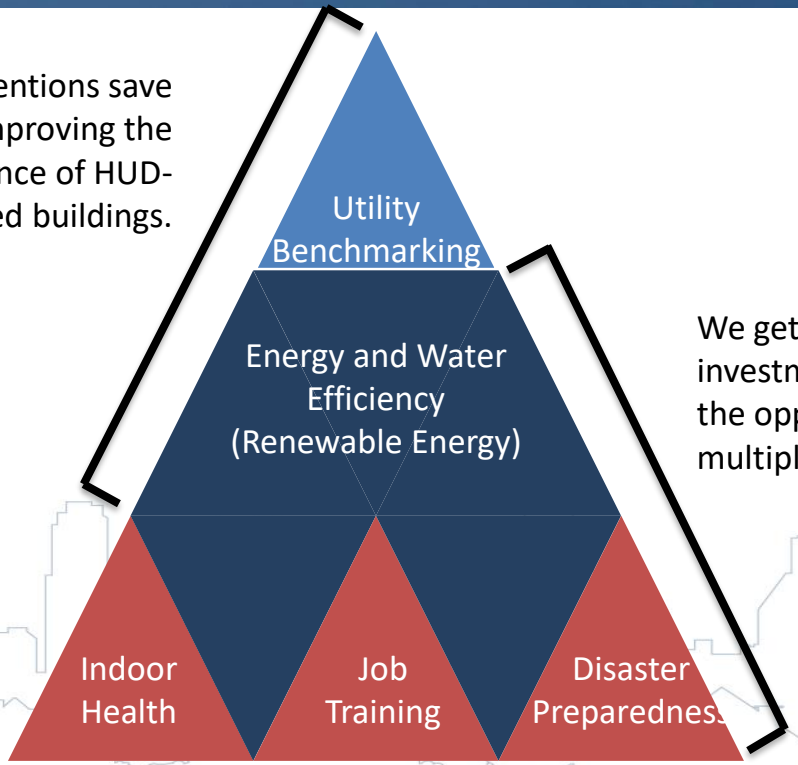


Key Initiatives

- Multifamily Better Buildings Challenge
- Energy Efficient Codes and Standards
- Utilities, Benchmarking, and Data Access
- Financing Energy Efficiency
  - Energy Performance Contracts (EPCs)
  - Mortgage Insurance Premium (MIP) Reduction
  - Rate Reduction Incentive (RRI)
- Healthy Housing
- Climate Resilience, Disaster Mitigation and Recovery

Focus is on Cutting Costs, Climate Resilience, Resident Health and Safety

Our interventions save money by improving the performance of HUD-funded buildings.



We get the best return on investment when we take the opportunity to create multiple benefits.

Multifamily Sector Overview

Opportunity

- Untapped market, large investment opportunity
- High energy costs for tenants and owners
- Retrofits are cost effective
- Rental housing has higher share of low-income residents than homeownership

Barriers

- Complicated ownership structure
- Limited financial incentive
- Limited capacity
- Difficult to benchmark and track
- Resident engagement
- Lack of capital

Three main sub-sectors: public housing, subsidized, and market rate

Minimum New Construction Standards

- 2021 IECC* - Residential Buildings:
  - ✓ One- and two-family dwellings, townhouses of any size and R-2, R-3, R-4 ≤ 3 stories
  - ✓ All buildings that are not “residential” by definition are “commercial”
- ASHRAE 90.1** Commercial/Multifamily
  - ✓ Buildings 4+ stories

* International Energy Conservation Code

** American Society of Heating Refrigeration And Air Conditioning Engineers

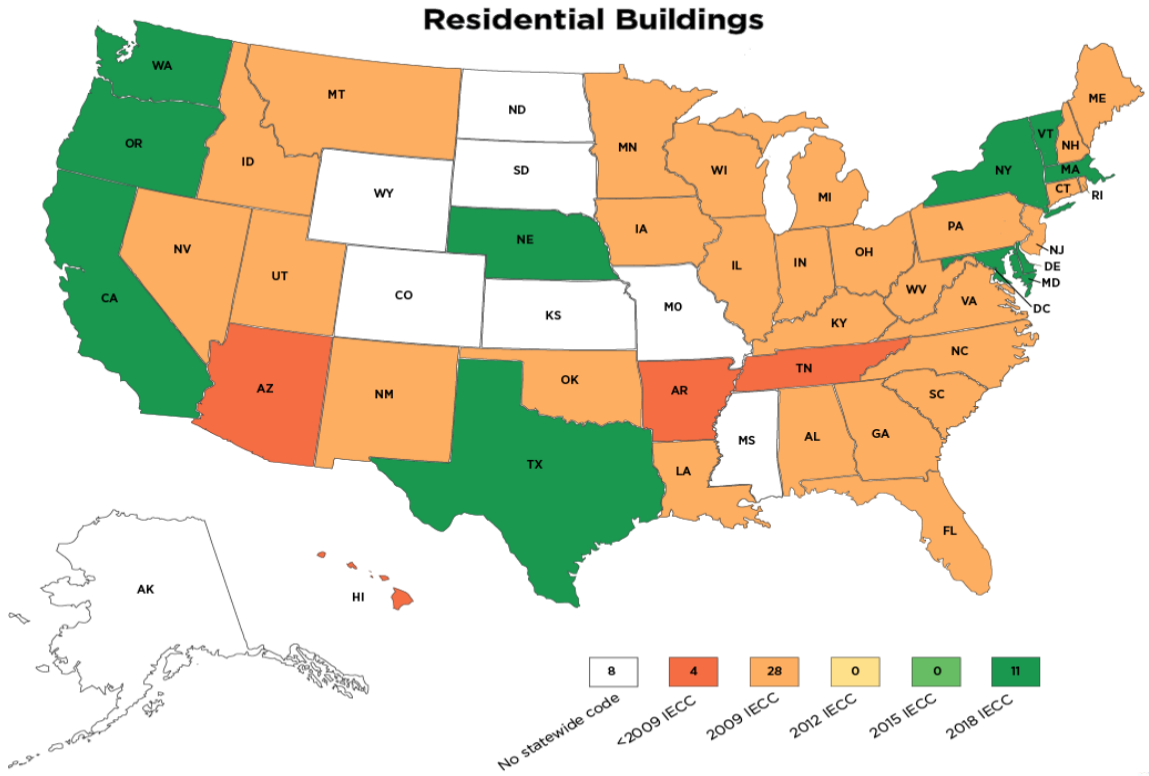
U.S. Department of Housing and Urban Development

MINIMUM ENERGY STANDARDS OR REQUIREMENTS

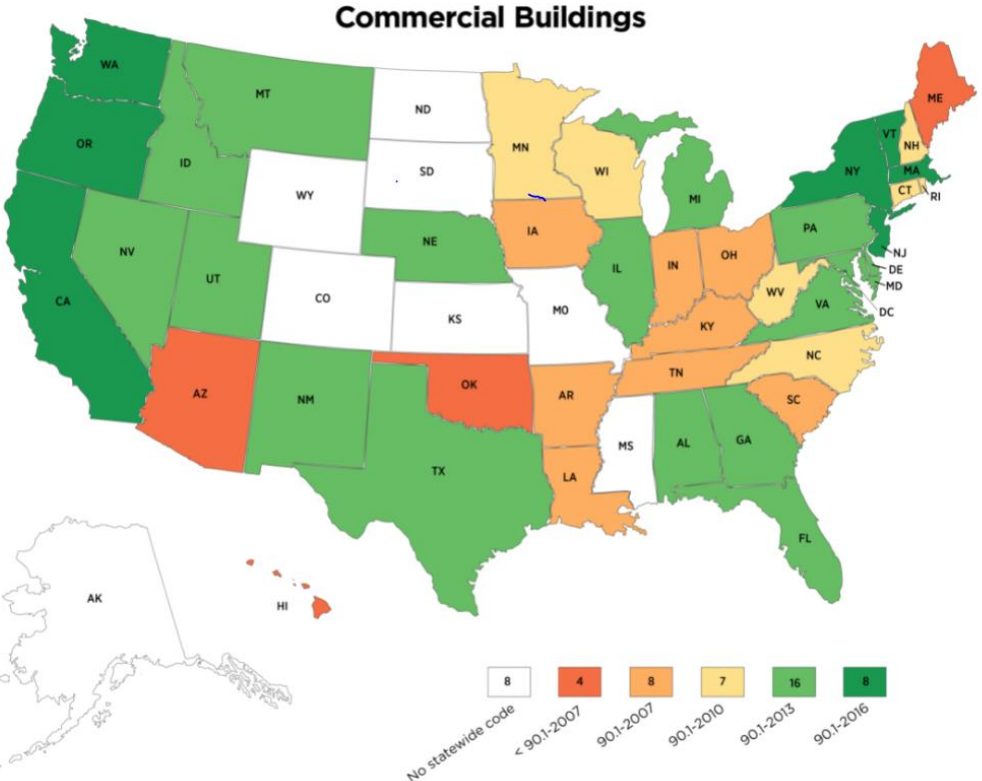
[New Construction]

Program	Program Type	Minimum Requirements	Additional Points or Incentives
FHA MULTIFAMILY			
Multifamily Mortgage Insurance	Mortgage Insurance Sections 213, 220, 221(d)(4), 231, 232, 241(a).	**Low-Rise Multifamily** (3 stories or less): 2009 IECC **Mid- or High-Rise:** ASHRAE 90.1-2007	Discounted Mortgage Insurance Premium (MIP) for Energy Star Score of at least 75 in EPA Portfolio Manager AND Recognized Green Building Standard: Enterprise Green Communities; LEED-H, LEED-H Midrise, LEED-NC or LEED for Building O&M; ENERGY STAR Certified New Construction; EarthCraft; Earth Advantage; Greenpoint Rated; National Green Building Standard (NGBS); Passive Building or EnerPHit certification from Passive House Institute US (PHIUS), International Passive House Association, or Passive House Institute; Living Building Challenge or other HUD-approved standard.[1]
Rental Assistance Demonstration (RAD)	Conversions To Project-Based Rental Assistance (Section 8)	***New Construction*:** **Single Family/Low-Rise Multifamily:** 2009 IECC **Multifamily Mid- or High-Rise:** ASHRAE 90.1-2007 ***Rehabilitation:*** Energy Star appliances, WaterSense or FEMP-designated products Most cost-effective measures identified in Capital Needs Assessment required when "financially feasible"	RAD Notice Revision 4 (9/5/19) Increase contract rent by 75% of approved reduction in Utility Allowance due to energy and water efficiency. Applicants encouraged to build to Energy Star Single Family New Homes or Multifamily New Construction standards, or industry-recognized Green Building standard: LEED, Enterprise Green Communities, National Green Building Standard, Green Globes, GreenPoint Rating, EarthCraft, Earth Advantage, Passive House, or Living Buildings.

Current state adoption – single family



Current state adoption - multifamily



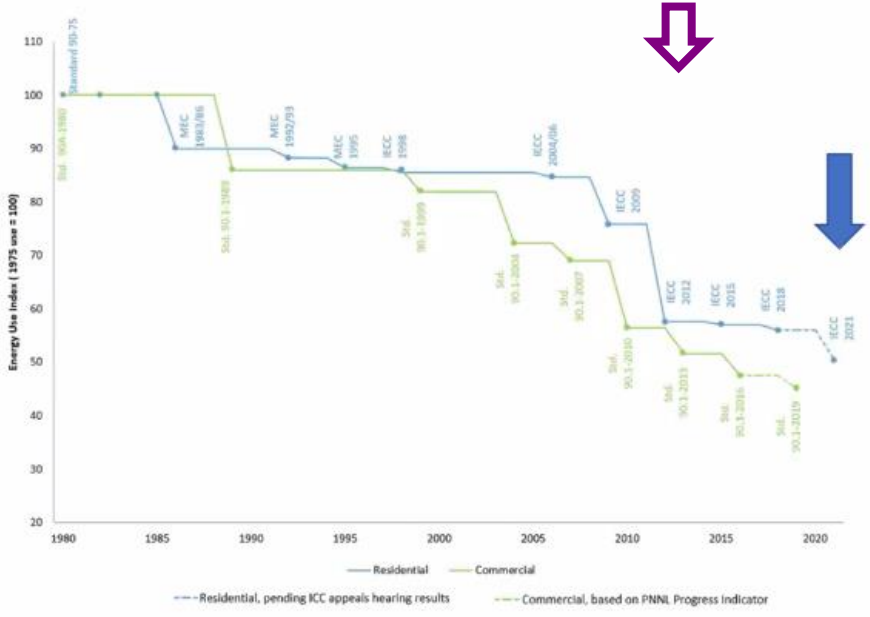
DOE Efficiency Determinations 7/21

- Residential 2021 IECC
  - 9.4% savings annual site energy use
  - 8.79 percent annual source energy use;
  - 8.66 percent annual energy cost savings;
  - 8.66 percent in carbon emissions
- Multifamily ASHRAE 90.1-2019:
  - 4.7% savings over ASHRAE 90.1-2016
  - 4.3 percent source energy
  - 4.3 percent energy cost savings
  - 4.2 percent carbon emissions

https://www.energycodes.gov/determinations

Towards Net Zero

Building Energy Code Progress



Source: Data from Pacific Northwest National Laboratory & U.S. DOE Building Codes Program, except 2021 which are ACEEE estimates

ACEEE
American Council for an Energy-Efficient Economy

COMMUNITY PLANNING & DEVELOPMENT

Green Mortgage Insurance Premium

Green Recognition + Energy Performance = MIP Reduction

Green Recognition

(Certification per Earthcraft, LEED, National Green Building Standard, etc)

Energy Performance – Utility Benchmarking

(Annual ENERGY STAR score of 75+ in Portfolio Manager)

U.S. DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT

COMMUNITY PLANNING & DEVELOPMENT

Eligible Green Building Standard

- **New Construction & Gut Rehabilitation:**
  - Energy Star Certified New Homes
  - Energy Star Indoor Air Plus
  - LEED Home/LO/Mid Rise
  - LEED High Rise
  - Green Point Rated New Home MF
  - Passive House
  - Enterprise Green Communities
  - Earthcraft House (townhouse/rowhouse)
  - Earthcraft Multifamily
  - Earth Advantage
  - National Green Building Standard
  - Living Building Challenge

Which Green Standard is Appropriate?

- **Substantial Rehab & 223(f) with Repairs > 223(a)(7) Limit**
  - Enterprise Green Communities
  - Earthcraft House (townhouse/rowhouse)
  - Earthcraft MF
  - Earth Advantage
  - National Green Building Standard
  - Living Building Challenge
  - Green Point Rated Existing Home-MF Whole Building
  - EnerPHit

Some Green Standards Recognize Certain Building Types, Categories, Locations

- Regional standards, location
  - Green Point Rated Existing Home – MF Whole Building, California
  - Earthcraft House (Townhouse or Rowhouse) Southeast, hot, humid zone
  - Earthcraft MF, Southeast, hot, humid zone
  - Earth Advantage, Oregon, Washington
- Building Type, usually evident in the Standard name
  - Low rise, high rise, number of stories
- Property Use, e.g. Enterprise Green Communities (affordable housing)
- **Owner's selection must be appropriate**

U.S. DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT

COMMUNITY PLANNING & DEVELOPMENT

Green MIP Reduction

Green Recognition + Energy Performance = MIP Reduction

ENERGY PERFORMANCE (ANNUAL REPORTING)

- How do we measure Energy Performance?
  - With An ENERGY STAR score:
  - A 1-100 index score created by EPA
  - Obtained from EPA's Portfolio Manager benchmarking software
  - Reported in a standard form called a "Statement of Energy Performance" (SEP)
  - 75 is minimum score for MIP Reduction, meaning the property must perform in the top quartile of its peers among a reference group of 500 properties separately surveyed by EPA.

U.S. DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT

COMMUNITY PLANNING & DEVELOPMENT

Utility Benchmarking

Asset Management/Utility Benchmarking

- Enables owners to target investments in lowering utility costs
- Studies show that benchmarking alone reduces energy 2-4%
- Increasingly common approach: local benchmarking policies adopted in 25 cities, 12 states

Sample Output Screen

Data Needed

Property Use Details

- Gross Floor Area (accuracy essential)
- # Units
  - # Units# In hi-rise setting (10+ stories)
  - # in mid-rise setting (5-9 stories)
  - # in low rise setting (up to 4 stories)
- Total # bedrooms

Zip code of property, needed for weather normalization

Whole Building Energy Use

- Metered use for existing properties (modeled estimate for construction)
- 12 full, consecutive months
- All fuels
- All tenant & common areas

Disaster Recovery Retrofit Checklist

WATER AND ENERGY CONSERVATION MEASURES

- Water-Conserving Fixtures

  Install or retrofit water conserving fixtures in any unit and common facility: Toilets-- 1.28 gpf; Urinals-- 0.5 gpf; Showerheads-- 2.0 gpm; Kitchen faucets-- 2.0 gpm; and Bathroom faucets-- 1.5gpm. [gpf = gallons per flush; gpm = gallons per minute]

- ENERGY STAR Appliances

  Install ENERGY STAR-labeled clothes washers, dishwashers, and refrigerators, if these appliance categories are provided in units or common areas.

- Air Sealing: Building Envelope

  Seal all accessible gaps and penetrations in the building envelope. if applicable, use low VOC caulk or foam.

- Insulation: Flooring (if applicable to building type)

  Install ≥ R-19 insulation in contact with the subfloor in buildings with floor systems over vented crawl spaces. Install a 6-mil vapor barrier in contact with 100% of the floor of the crawl space (the ground), overlapping seams and piers at least 6 inches.

- Duct Sealing (if applicable to building type)

  In buildings with ducted forced-air heating and cooling systems, seal all penetrations of the air distribution system to reduce leakage in order to meet or exceed ENERGY STAR for Homes' duct leakage standard.

- Air Barrier System

  Ensure continuous unbroken air barrier surrounding all conditioned space and dwelling units. Align insulation completely and continuously with the air barrier.

Disaster Recovery Retrofit Checklist – 2

- Windows
  - When replacing windows, install geographically appropriate ENERGY STAR rated windows.
- Sizing of Heating and Cooling Equipment
  - When replacing, size heating and cooling equipment in accordance with the Air Conditioning Contractors of America (ACCA) Manuals, Parts J and S, or 2012 ASHRAE Handbook--HVAC Systems and Equipment or most recent edition.
- Domestic Hot Water Systems
  - When replacing domestic water heating system(s), ensure the system(s) meet or exceed the efficiency requirements of ENERGY STAR for Homes' Reference Design. Insulate pipes by at least R-4.
- Efficient Lighting: Interior Units
  - Follow guidance appropriate for project type: install ENERGY STAR Advanced Lighting Package (ALP); OR follow the ENERGY STAR MFHR program guidelines, which require that 80% of installed lighting fixtures within units must be ENERGY STAR-qualified or have ENERGY STAR-qualified lamps installed; OR when replacing, new fixtures and ceiling fans must meet or exceed ENERGY STAR efficiency levels.
- Efficient Lighting: Common Areas and Emergency Lighting
  - ENERGY STAR-labeled fixtures or any equivalent high-performance lighting fixtures and bulbs in all common areas; ***OR*** when replacing, new common space and emergency lighting fixtures must meet or exceed ENERGY STAR efficiency levels. For emergency lighting, if installing new or replacing, all exist signs shall meet or exceed LED efficiency levels and conform to local building codes.
- Efficient Lighting: Exterior
  - When replacing windows, install geographically appropriate ENERGY STAR rated windows.

Retrofit Checklist -3

INDOOR AIR QUALITY

- Air Ventilation: Single Family and Multifamily
  - Install in-unit ventilation system providing fresh are per ASHRAE 62.2
- Air Ventilation: Multifamily (four stories or more)
  - Install ASHRAE 62.2 for all dwelling units and common area ventilation systems ASHRAE 62.1. If economically feasible consider heat/energy recovery for 100% corridor air supply
- Composite Wood Products – Low/No Formaldehyde
- Environmentally preferable Flooring
- Low/No VOC Paints and Primers
- Low/No VOC Adhesive and Sealants
- Clothes Dryer Exhaust

Retrofit Checklist -4

- Mold Inspection and Remediation
- Mold Prevention: Water Heaters, Surfaces, Tub/Shower Enclosures
  - Provide adequate drainage for water heaters that includes drains or catch pans with drains piped to the exterior of the dwelling.
- Combustion Equipment
  - When installing new space and water-heating equipment, specify power-vented or direct vent combustion equipment.
- Lead Safe Work Practices
  - For properties built before 1978, if the project will involve disturbing painted surfaces or cleaning up lead contaminated dust or soil, use certified renovation or lead abatement contractors and workers using lead-safe work practices and clearance examinations consistent with the more stringent of EPA's Renovation, Repair, and Painting Rule and HUD's Lead Safe Housing Rule.
- Radon Testing and Mitigation
- Test for Radon and install radon systems in buildings with radon levels of 4pCi/L or more

Retrofit Case Studies

Corcoran Management

Worcester, MA

Partner Since: 2013

Total Units: 11,000

Showcase Project Energy Savings: 30%

Est. Cumulative Utility Cost Savings To Date: $4.0 Million

New York City Housing Authority

New York City, NY

Partner Since: 2016

Total Units: 174,555

Showcase Project Energy Savings: 20% (anticipated)

Est. Cumulative Utility Cost Savings To Date: $6.5 Million

ACTION Housing

McKeesport, PA

Partner Since: 2013

Total Units: 1,068

Showcase Project Energy Savings: 46%

Est. Cumulative Utility Cost Savings To Date: $388,000

Houston Housing Authority

Houston, TX

Partner Since: 2014

Total Units: 3,325

Showcase Project Energy Savings: 57%

Est. Cumulative Utility Cost Savings To Date: $369,000

U.S. DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT

COMMUNITY PLANNING & DEVELOPMENT

CONCLUSIONS

Oliver Rapf
Executive Director, Buildings Performance Institute Europe

Thank you!

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