



energy

Department:
Energy
REPUBLIC OF SOUTH AFRICA

Where to start? Energy efficiency potential

Buildings: Maxine Jordan, IEA and Ian Hamilton, UCL Energy Institute

Pretoria, Monday 14th October 2019

Buildings energy efficiency sessions in partnership with:

UCL ENERGY
INSTITUTE



Energy Efficiency Training Week: Buildings programme

1. Where to start: Energy use in buildings
2. **Where to start: Energy efficiency potential in buildings**
Special session: GlobalABC Regional Roadmaps
3. Toolkit: Energy efficient building design technologies
4. Toolkit: Energy efficient building system technologies
Special session: Green Building in Africa – *Elizabeth Chege, KGBS*
Special session: The GlobalABC Africa Roadmap for buildings and construction
5. What are the steps? Determining the current status of policies
6. Toolkit: Energy efficiency policies and target setting *with guest speaker: Hlompho Vivian, GBC SA*
7. What are the steps? Implementing codes and standards
8. What are the steps? Building operations and procurement *with guest speaker: Christelle Van Vuuren, Carbon Trust*
Special session: The multiple benefits of energy efficiency
9. Did it work? Evaluation and energy efficiency indicators
Special session: Financing energy efficiency in buildings
10. Buildings quiz

Energy Efficiency Training Week: Buildings

2. Where to start: Energy efficiency potential in buildings

Trainers: Maxine Jordan, IEA

Purpose: To teach the fundamentals of the energy efficiency potential in buildings. This includes information on IEA's scenarios analysis modelling to determine potential impacts.

Scenario: You have been asked to create new a policy roadmap for energy efficient buildings.

Discussion question: How do you determine where to start and where to go?

How much potential is there?

What type of potential is there?

What can drive the potential?



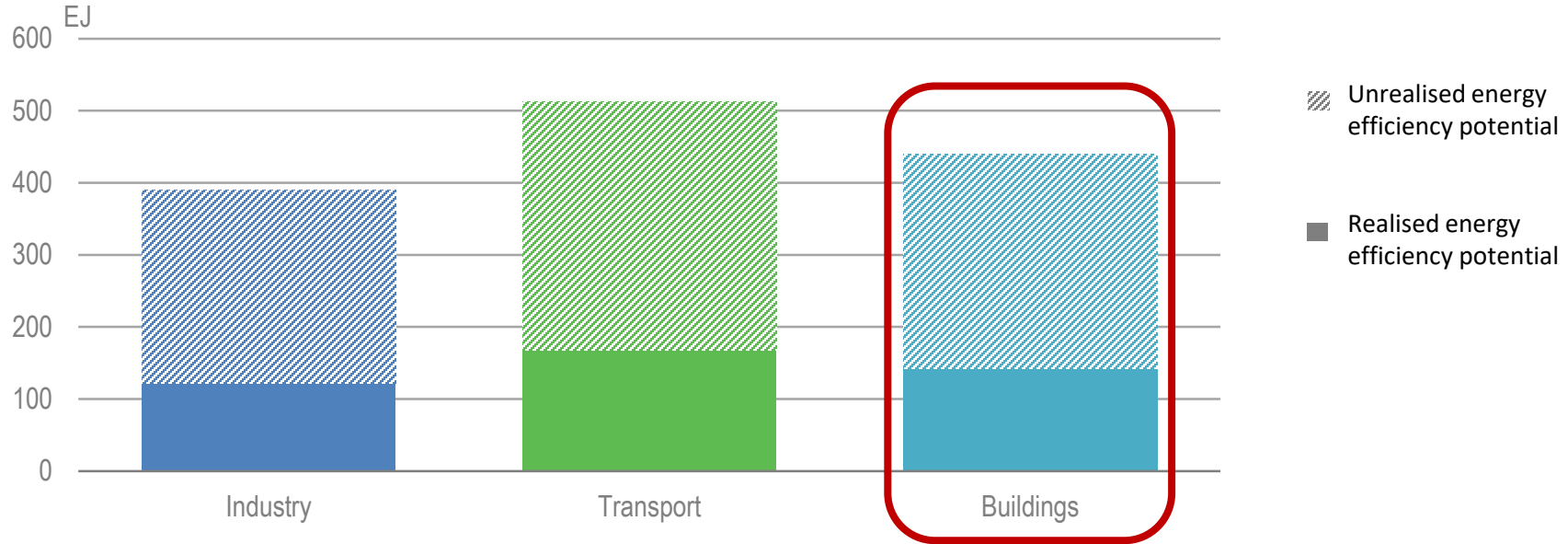
Type of energy efficiency potential: analysis approaches

1. **Technical potential:** analysing the total energy efficiency potential without any economic or market constraints (e.g. analysing the energy savings potential if all buildings used best available technology)
2. **Economic potential:** analysing the energy efficiency potential assuming economic constraints for cost effectiveness (e.g. analysing the energy savings potential if buildings used the most-efficient cost-effective technology)
3. **Market potential :** analysing the energy efficiency potential assuming market constraints in implementing energy efficiency (e.g. analysing the energy savings potential using a adoption curve to estimate typical market implementation given the available policies and technologies)

Technical potential, economic potential and market potential are used for different purposes.

Global energy efficiency potential

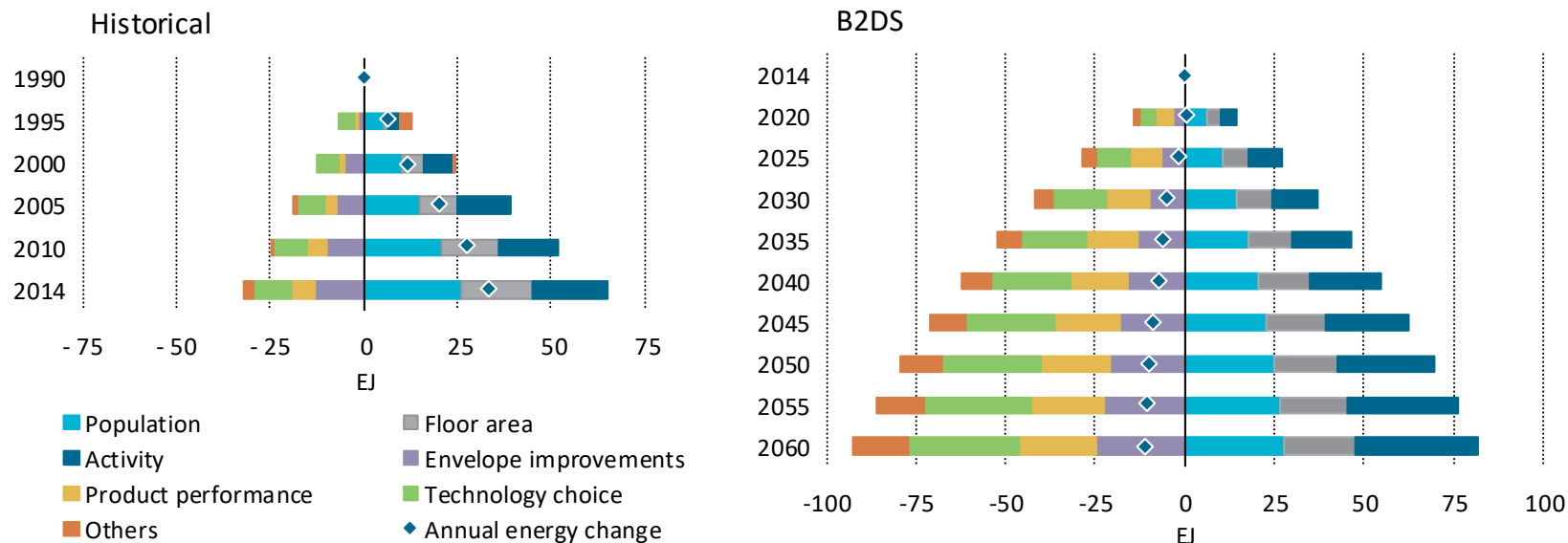
Energy efficiency potential by sector



70% of the economic potential to improve energy efficiency in buildings remains untapped.

Reversing historical trends...

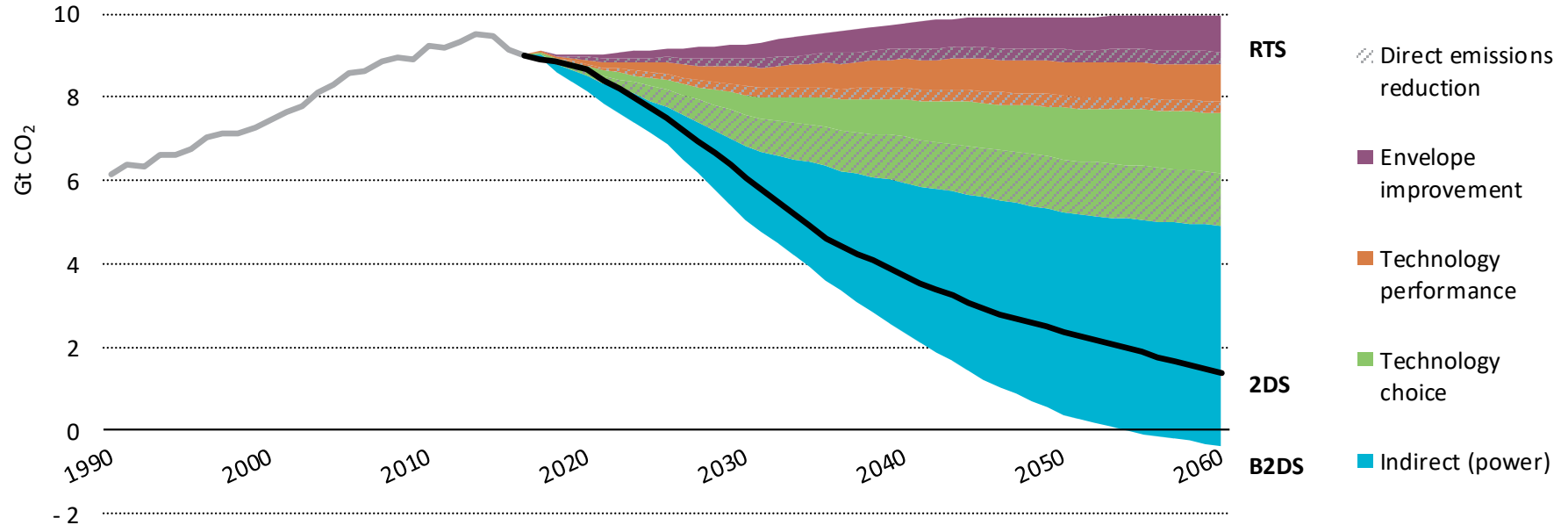
Decomposition of global final energy demand in buildings by key contribution



Energy efficiency measures can reverse historical trends, offsetting the effect of increasing global population, building activity and growing floor area in buildings.

Global emissions savings potential

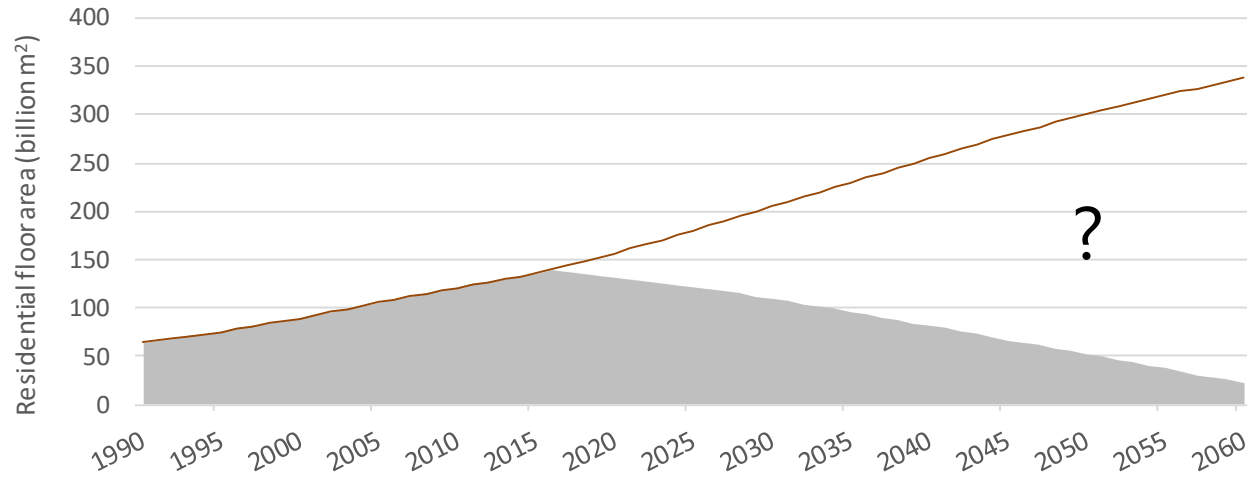
Global CO2 savings potential to 2060



More than 50% of cumulative CO₂ emissions reduction in buildings to 2060 under the B2DS results from shifts to low-carbon and high-performance technologies.

What can drive potential: floor area

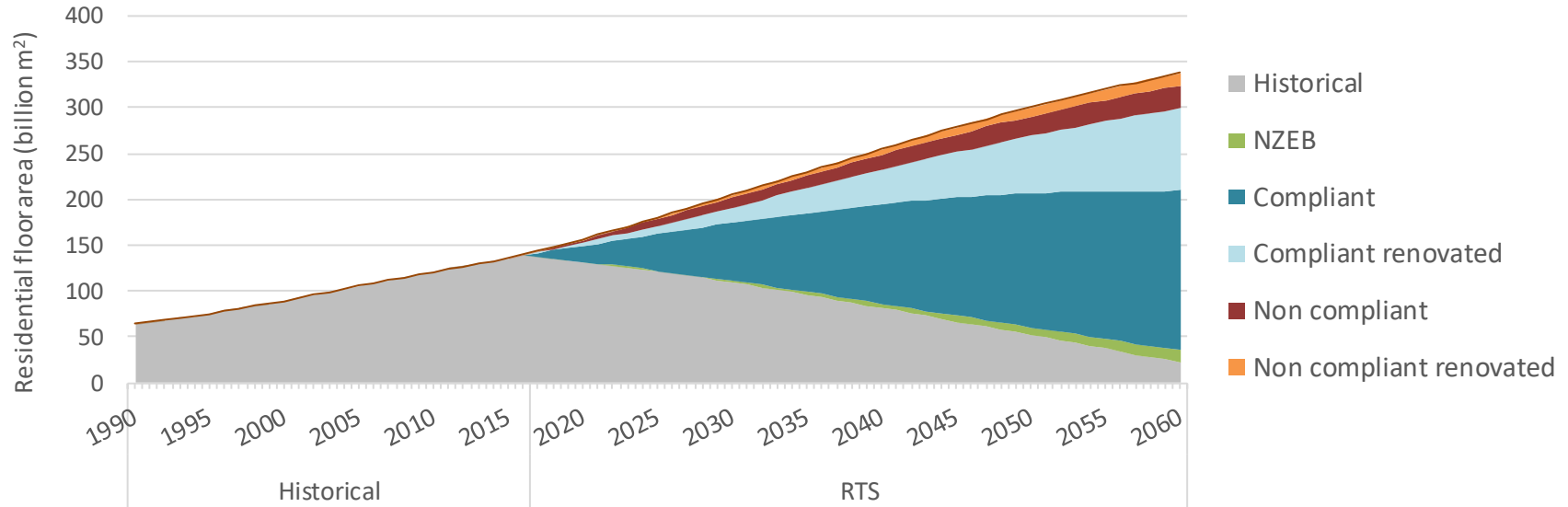
Global residential floor area growth and opportunity



Opportunity exists in both the historic stock and new building additions.

What can drive potential: floor area

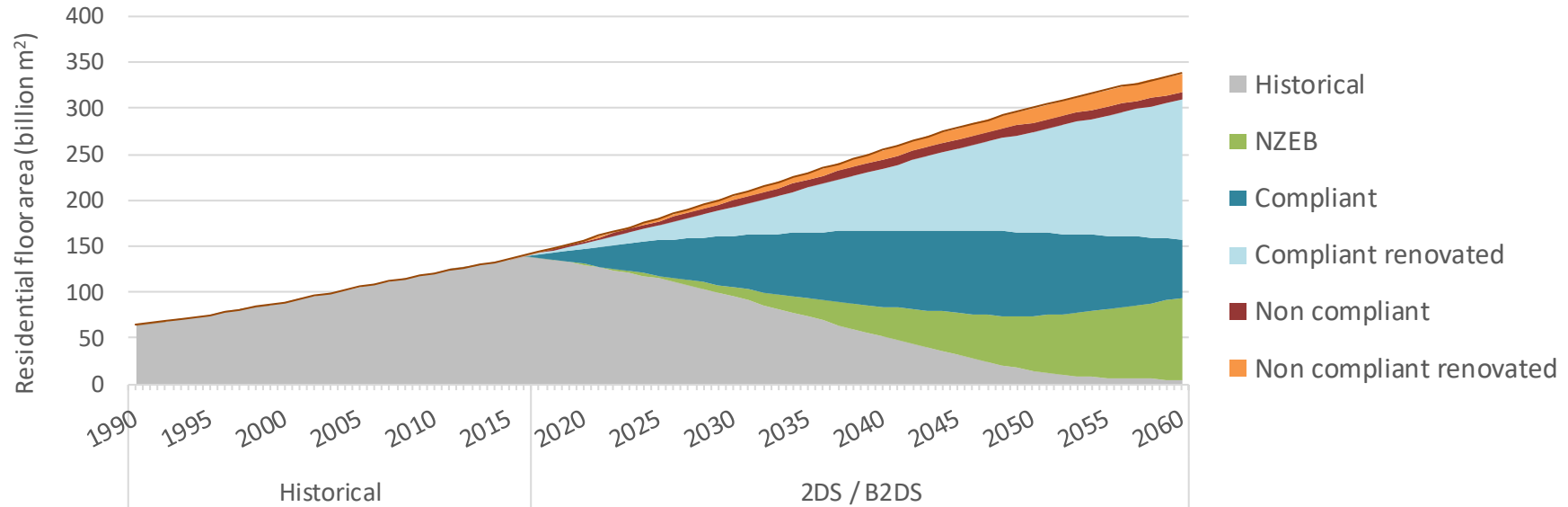
Global residential floor area growth and opportunity (business as usual)



With business as usual growth, we expect continued high levels of non-compliance in new construction and minimal retrofits of existing stock.

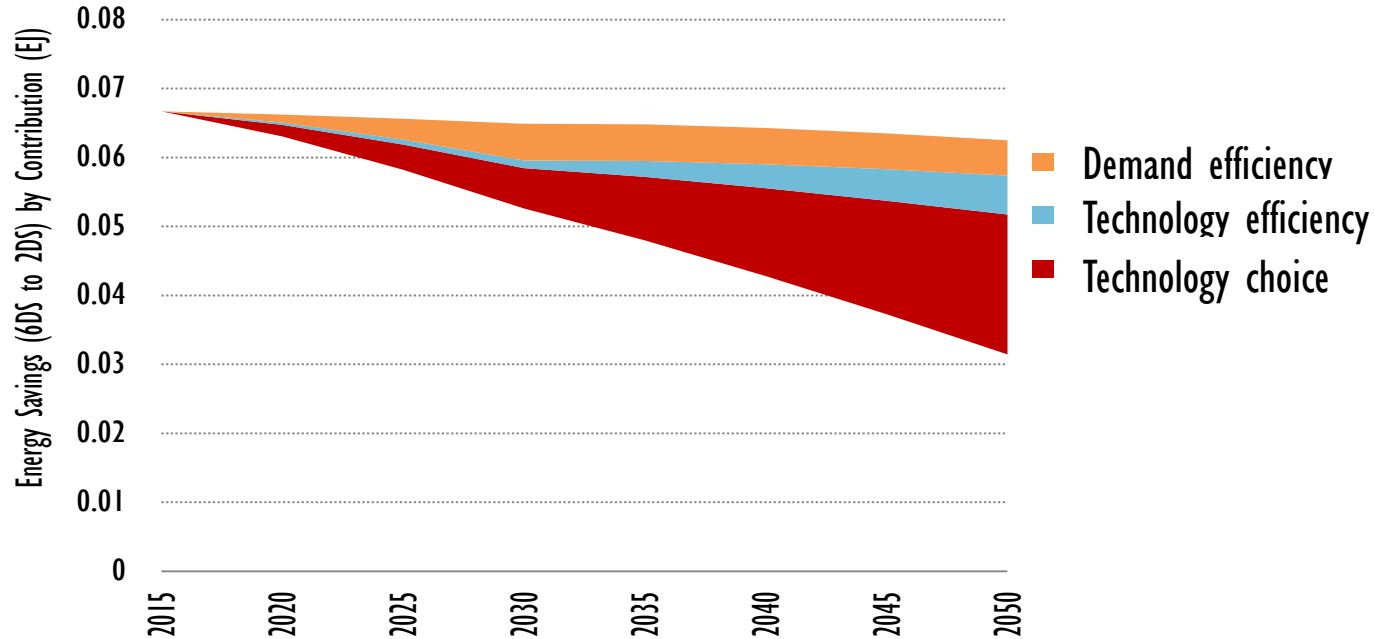
What can drive potential: floor area

Global residential floor area growth and opportunity (more efficient)



In a below 2 degree scenarios, we expect more high performance new buildings and high levels of deep energy retrofits that can contribute to significant energy reductions.

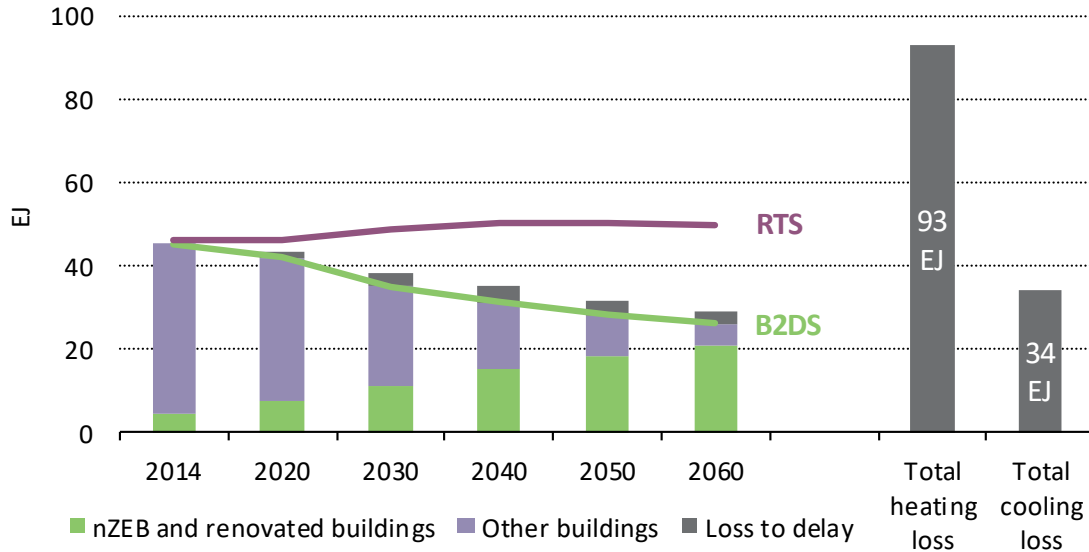
What can drive potential: building technologies



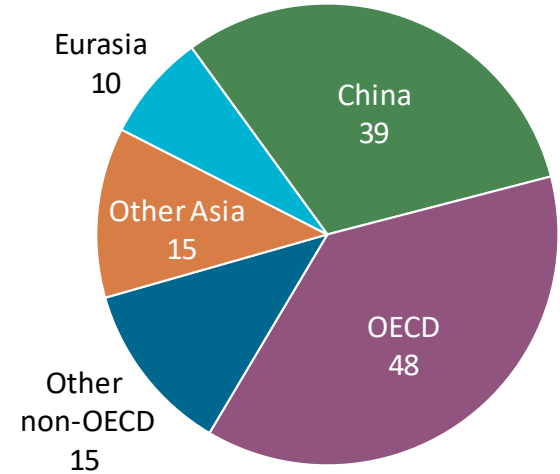
There are multiple ways to increase the efficiency through building technologies.

What can drive potential: timing

Consequences of a ten-year delay



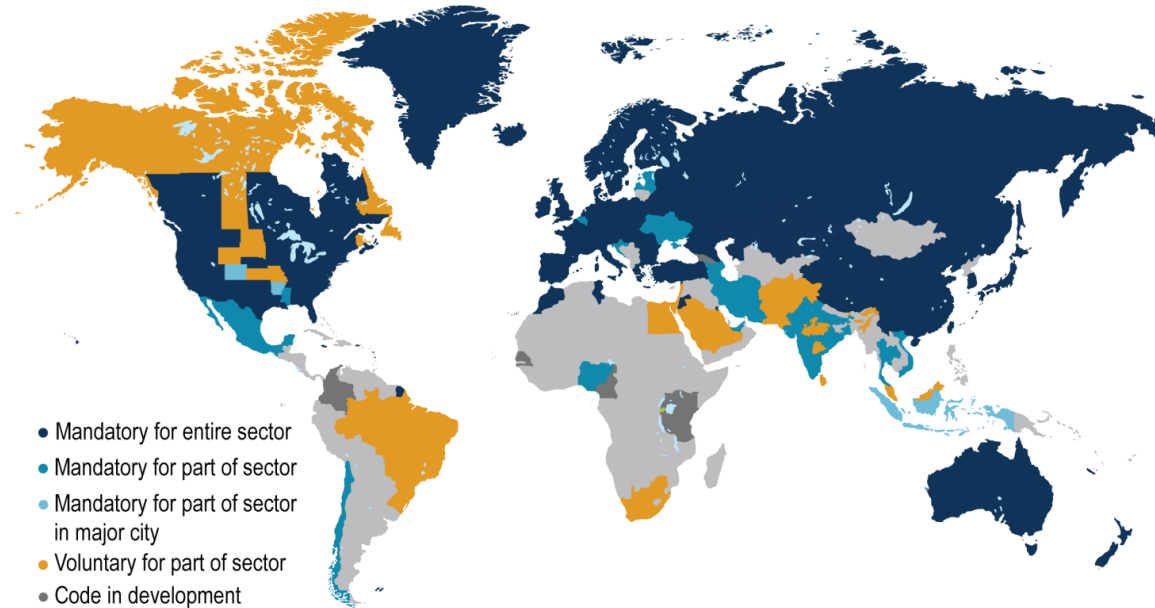
Cumulative loss by region (EJ)



Delaying implementation and enforcement of building envelope measures could result in the equivalent of **three years of additional energy consumption** for heating and cooling in the buildings sector.

What can drive potential: policies

Building energy code coverage, 2017

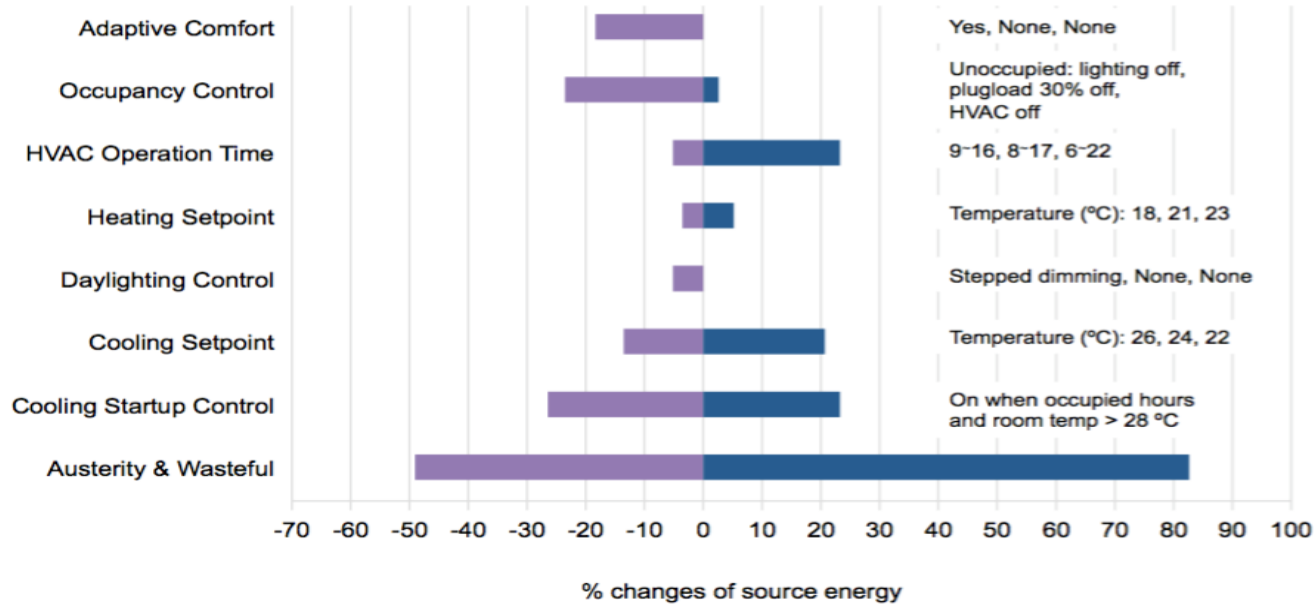


This map is without prejudice to the status of or sovereignty over any territory, to the delimitation of international frontiers and boundaries, and to the name of any territory, city or area.

All regions have potential to improve the adoption and enforcement of building energy policies.

What can drive potential: behaviour

Impacts of Occupant Behaviour



Occupant and Operator Behavior is critical: the impact of day to day comfort and building operations decisions can have a very dramatic impact on energy consumption.

How do I calculate potential?

Scenario:

You have been asked to create new policies for energy efficient buildings.

How do you determine where to start?

How do I calculate potential?

Ask questions

Data

Modelling



How do I calculate potential: where do I start?

Asking some questions...

- Why is it important to know the potential?
- What is energy efficiency potential in buildings?
- How big is it?
- How do I estimate it?
- What are the challenges?

**WE LEARN MORE BY
LOOKING FOR THE
ANSWER TO A QUESTION
AND NOT FINDING IT
THAN WE DO FROM LEARNING THE
ANSWER ITSELF**

- LLOYD ALEXANDER

Data

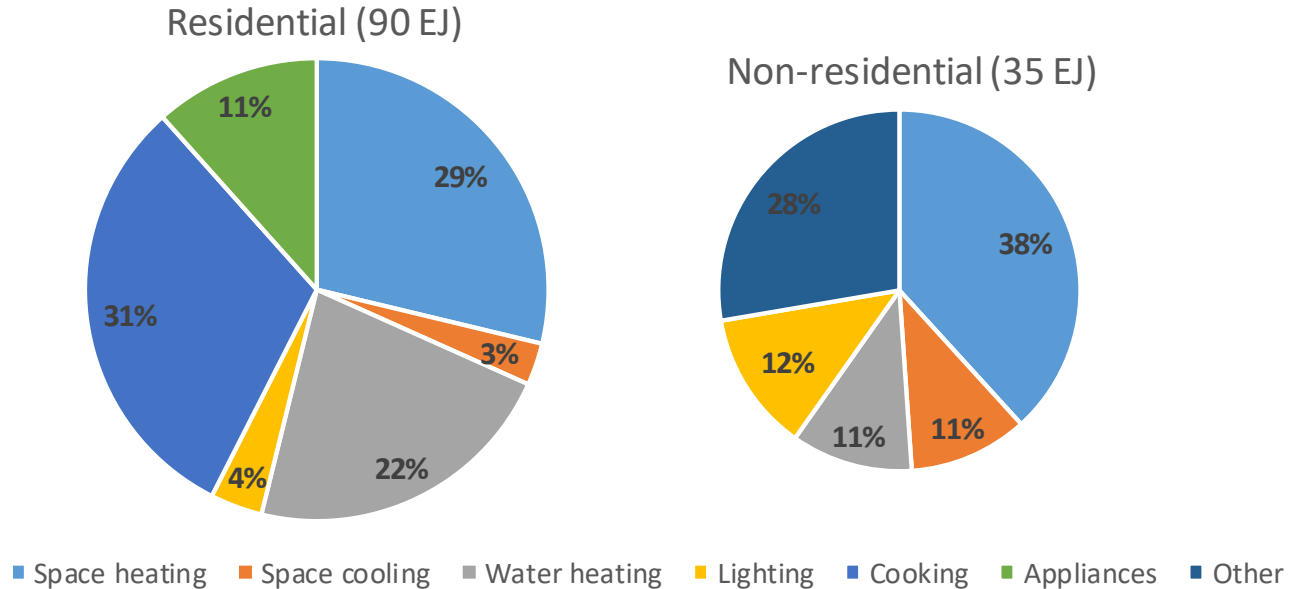


If You Can't
Measure It,
You Can't
Improve It

(William Thomson, Lord Kelvin)

How do I calculate potential: data

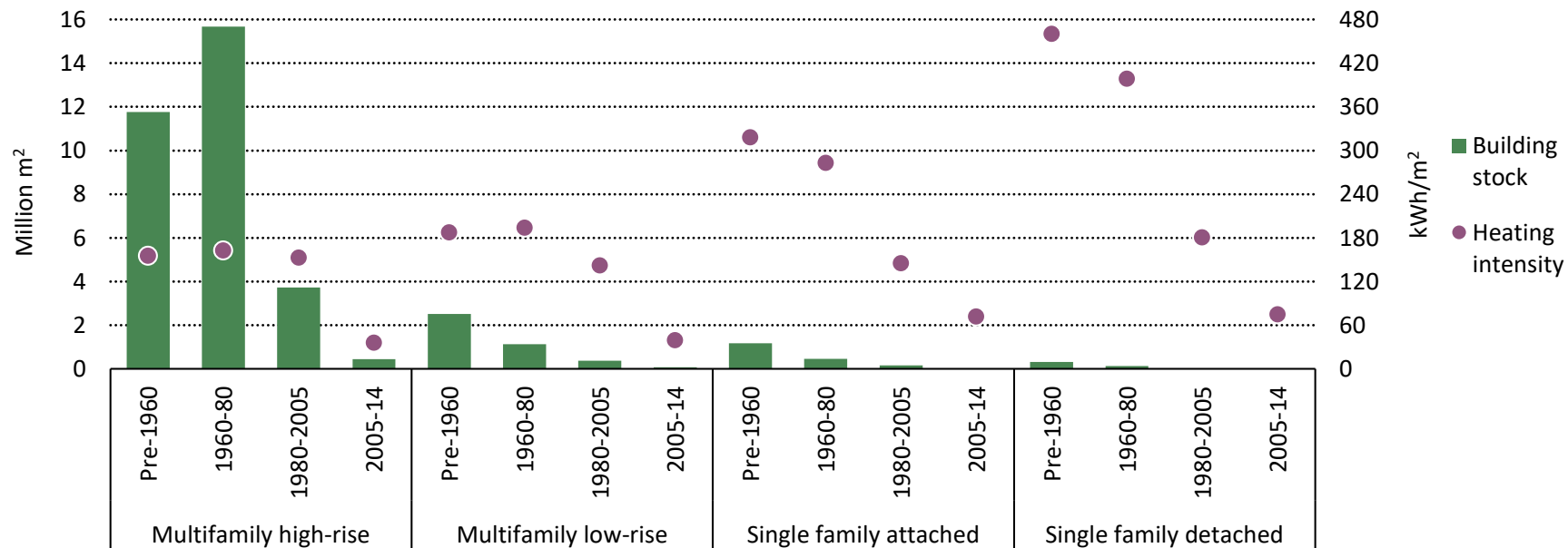
Start with the existing data:



Use existing data to understand the energy efficiency potential.

How do I calculate potential: data

Example: Building stock accounting for Turin (Italy)



Breaking the data down in a stock model can help you identify where the potential is.

Modelling

*All models are wrong
but some are useful*



George E.P. Box

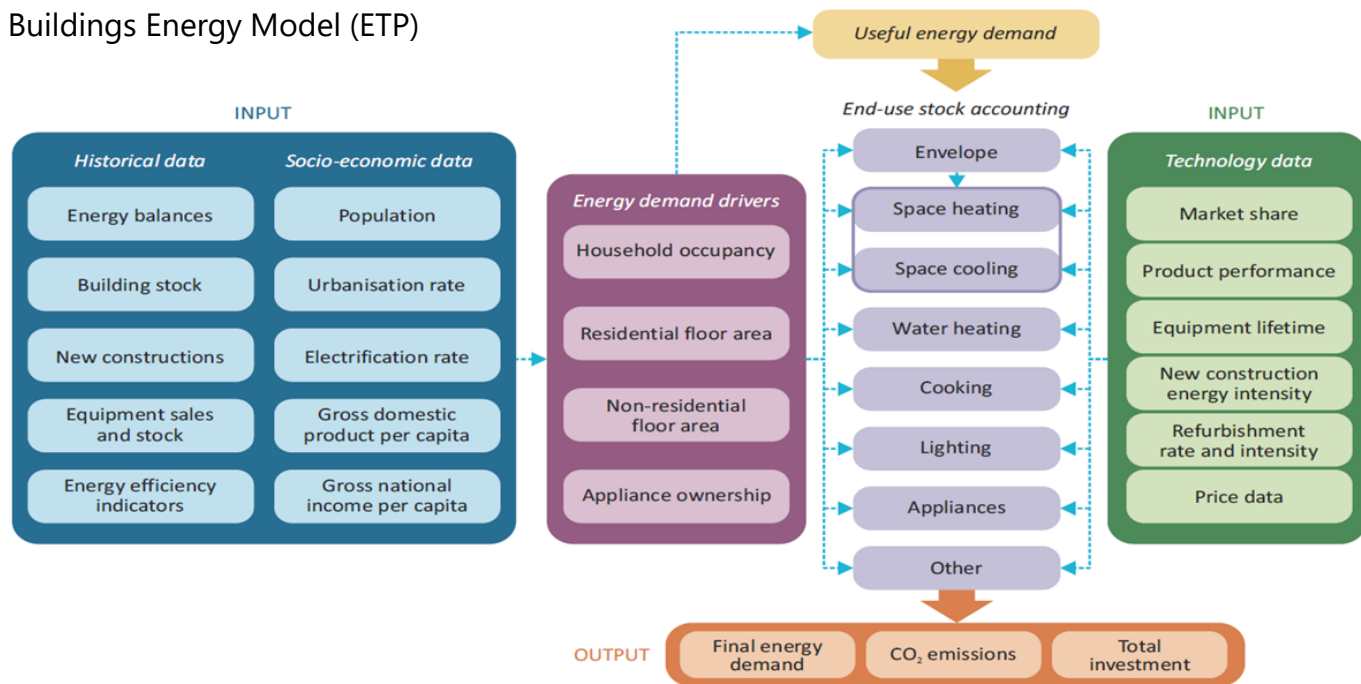
How do I calculate potential: modelling

Modelling approaches:

1. **Bottom-up**: constructing a “stock model” of building data
2. **Top-down**: disaggregating economy-wide data
3. **Hybrid top-down and bottom-up**: using the best available data and calibrating bottom-up data to top-down statistics

How do I calculate potential: modelling (top-down and hybrid)

Example: IEA's Buildings Energy Model (ETP)



Energy models are essential to better estimating the energy efficiency potential.

How do I calculate potential: modelling (bottom-up)

Use existing resources (many are free)



EnergyPlus

EnergyPlus is DOE's whole-building energy simulation engine.

Whole-building Energy Simulation | HVAC System Selection and Sizing | Code Compliance

Last Software Update: 30 September 2015 | Last Entry Update: 12 December 2015

Ratings ★★★★★ | Reviews 0 | [Add to compare](#)



OpenStudio

OpenStudio is an open-source SDK (software development kit) for building energy simulation.

Whole-building Energy Simulation | Energy Conservation Measures | Lighting Simulation

Last Software Update: 30 September 2015 | Last Entry Update: 15 December 2015

Ratings ★★★★★ | Reviews 0 | [Add to compare](#)



eQUEST

eQUEST® is a widely used, time-proven whole building energy performance design tool.

Whole-building Energy Simulation

Last Software Update: 30 June 2010 | Last Entry Update: 03 October 2015

Ratings ☆☆☆☆☆ | Reviews 0 | [Add to compare](#)

Local Energy Efficiency Policy Calculator (LEEP-C)

Tool / Instrument

The tool provides the opportunity to analyse the impacts of 23 different policy types from 4 energy-using sectors: public buildings, commercial buildings, residential buildings, and transportation.

Target Finder

Tool / Instrument

Target Finder is an online calculator that helps architects, engineers, and property owners and managers assess the energy performance of commercial building designs and existing buildings.

The 2015 City Energy Efficiency Scorecard

Publication / Report

The second biennial ACEEE City Energy Efficiency Scorecard measures the progress of city policies and programs that save energy while benefiting the environment and promoting economic growth.

Tool for Rapid Assessment of City Energy (TRACE)

Tool / Instrument

This tool is a decision-support tool designed to help cities quickly identify under-performing sectors, evaluate improvement and cost-saving potential, and prioritize sectors and actions for energy efficiency (EE) intervention.

The Co-benefits Evaluation Tool for the Urban Energy System

Tool / Instrument

The tool evaluates climate co-benefits for the urban energy system based on different scenarios of socioeconomic, technological and demographic developments.

Tracking Implementation of Building Energy Codes and Certification (Webinar) - 29.07.2016

Web Resource

This is the first in a series of webinars that addresses building energy codes and certification. The target audience includes local and national stakeholders in the building

Many tools and resources are available, many are free.

How do I calculate potential?

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How do you determine where to start and where to go?



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