Africa Energy Efficiency Policy in Emerging Economies Training Week

Buildings

Nairobi

18-22 March 2024

https://www.iea-events.org/energy-efficiency-training-week-nairobi

Introduction

Energy Efficiency Training Week: Buildings trainers

Ksenia Petrichenko
Energy Efficiency in Emerging Economies (E4),
International Energy Agency

Ian Hamilton
UCL Energy Institute,
University College London

Energy Efficiency Training Week: Buildings Content Programme

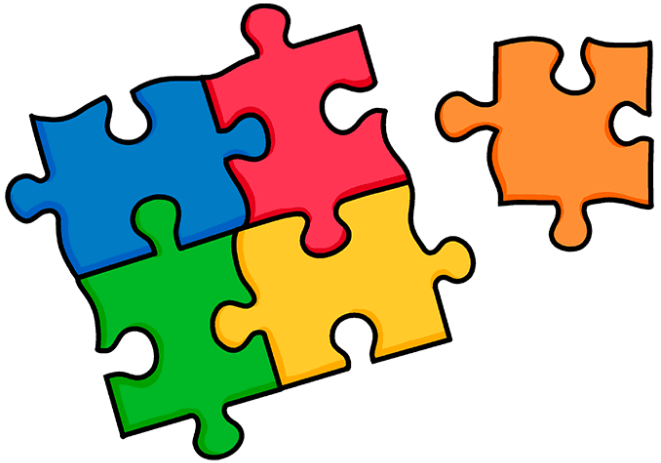
Be sure to:

- Attend!
- Participate
- Share your experience
- Ask questions
- Do the assignments
- Have fun!

Source: Estudie

Energy Efficiency Training Week: Buildings Attendees

Welcome!



- You’ve each picked up a piece of a puzzle
- When asked, please build your building

Introductory buildings puzzle

Introduction Instructions

1. Please write your name on your notepad
   a) On the blank piece of paper write your name at the top
   b) Then, write three words that describe you – it can be anything

2. Take your puzzle piece and build your building

3. Now, within each group, introduce yourselves by reading your name and three words*

*Please save your paper, we will use again later!

International Energy Agency

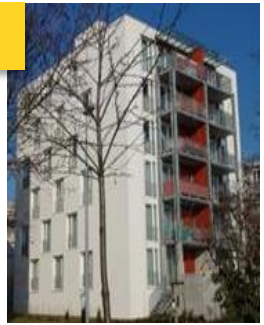
Energy Efficiency Training Week - Buildings - Day 1: 1. Where to Start: Energy use in buildings

Drivers of building energy demand

Drivers of building energy use: form

1

2



3

4

5

6

Form causes energy use: including through shape, size, materials, window placement.
Form enables energy efficiency: including thermal mass, passive solar and natural ventilation.

Sources: GBPN and IEA

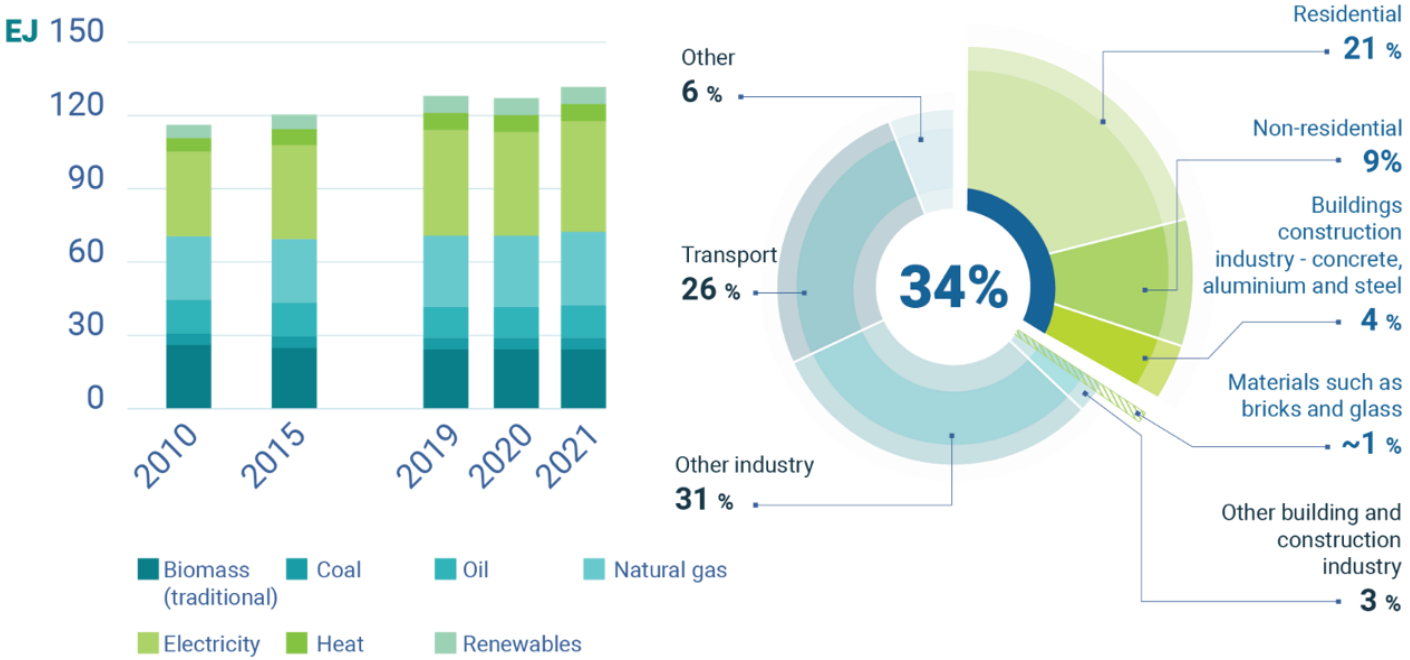
Drivers of building energy use: function

Energy follows function : people don’t demand energy, they demand energy services.

Sources: GBPN

Building total final energy consumption globally

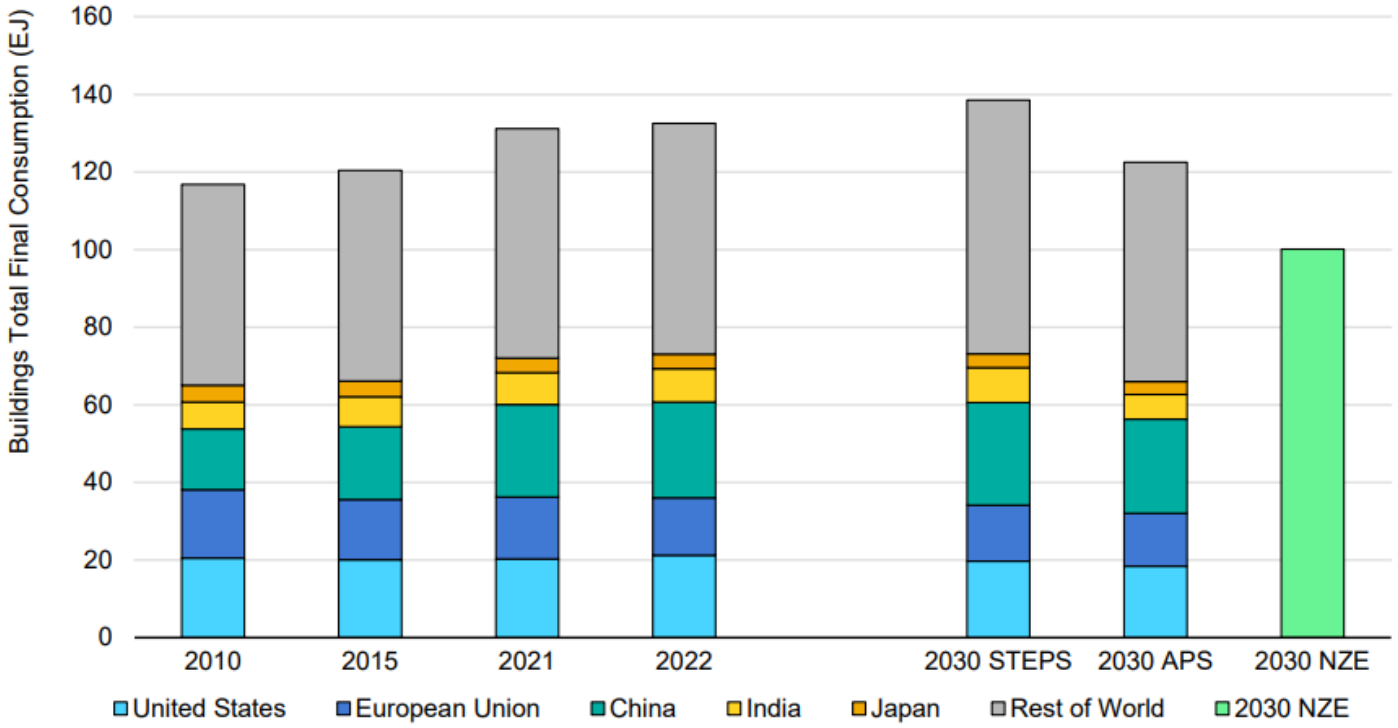
Buildings account for…



Building energy use plays a large role in the global energy system.

Source: IEA Energy Technology Perspective 2022

Total final energy consumption for buildings for selected regions

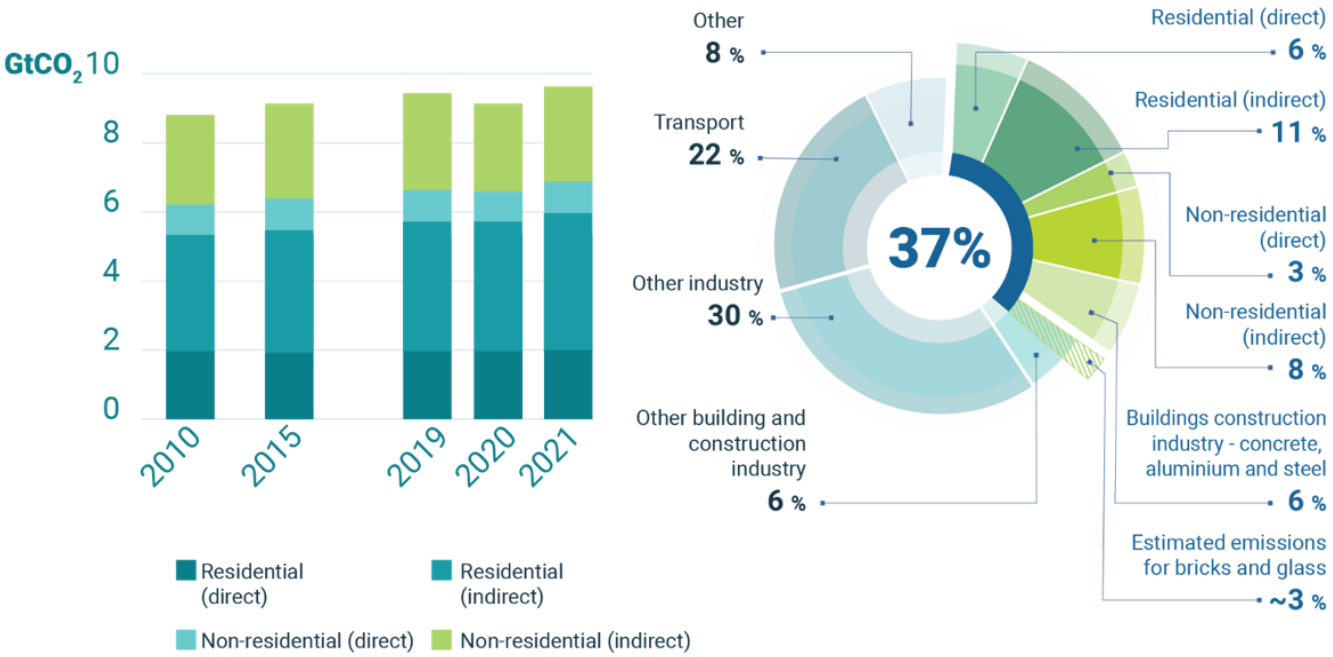


Several regions of the world account for more than a half of global buildings TFEC

Source: IEA (2023) Energy Efficiency 2023

Building CO_2 emissions globally

Buildings account for…

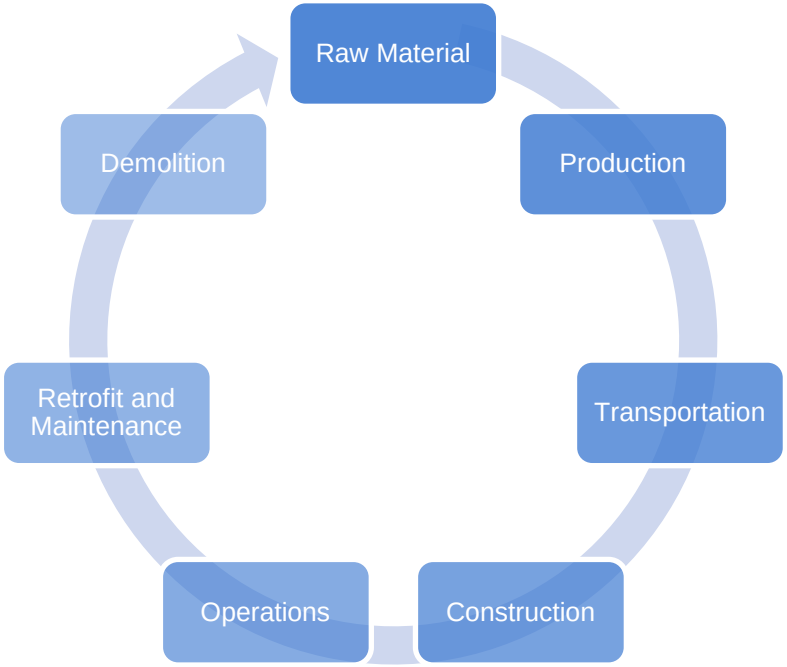


Building energy use contributes to a substantial proportion of global CO_2 emissions.

Source: IEA Energy Technology Perspective 2022

Building energy use

Building energy use: over the building lifecycle



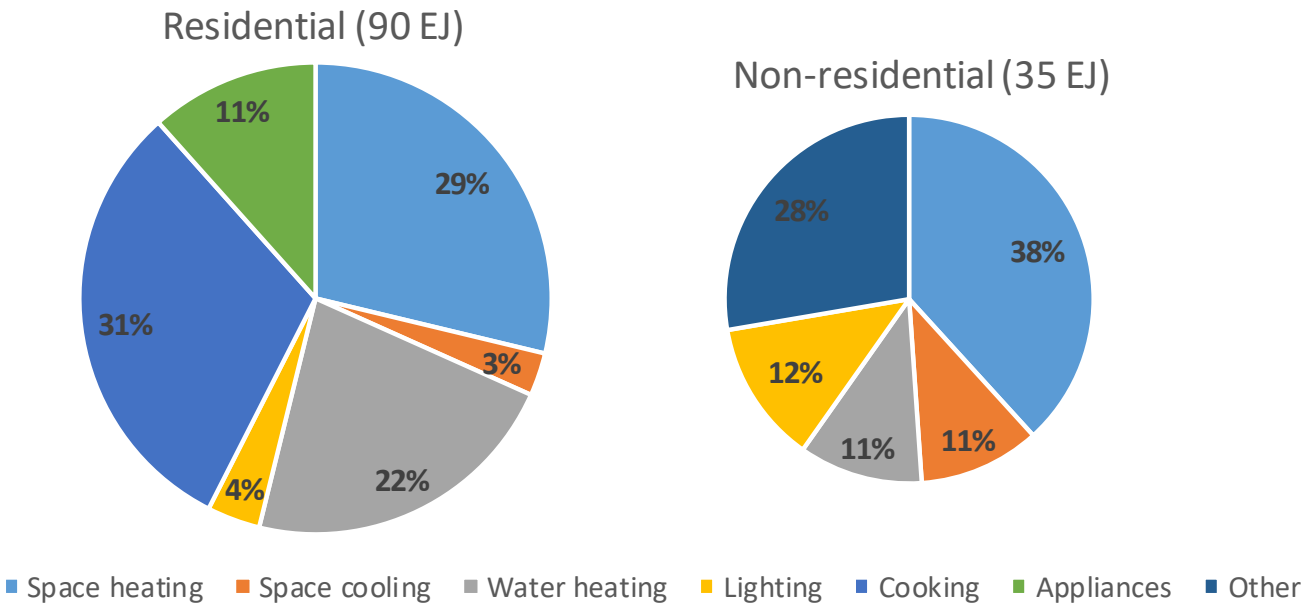
- Lifecycle analysis can estimate the impacts of each stage of the building life.
- The lifecycle includes embodied plus operational energy and emissions.

Each step of the lifecycle of the building results in energy input and emissions output.

Source: Adapted based on Built Constructions Magazine

Building energy use: by building type

Residential and non-residential buildings…

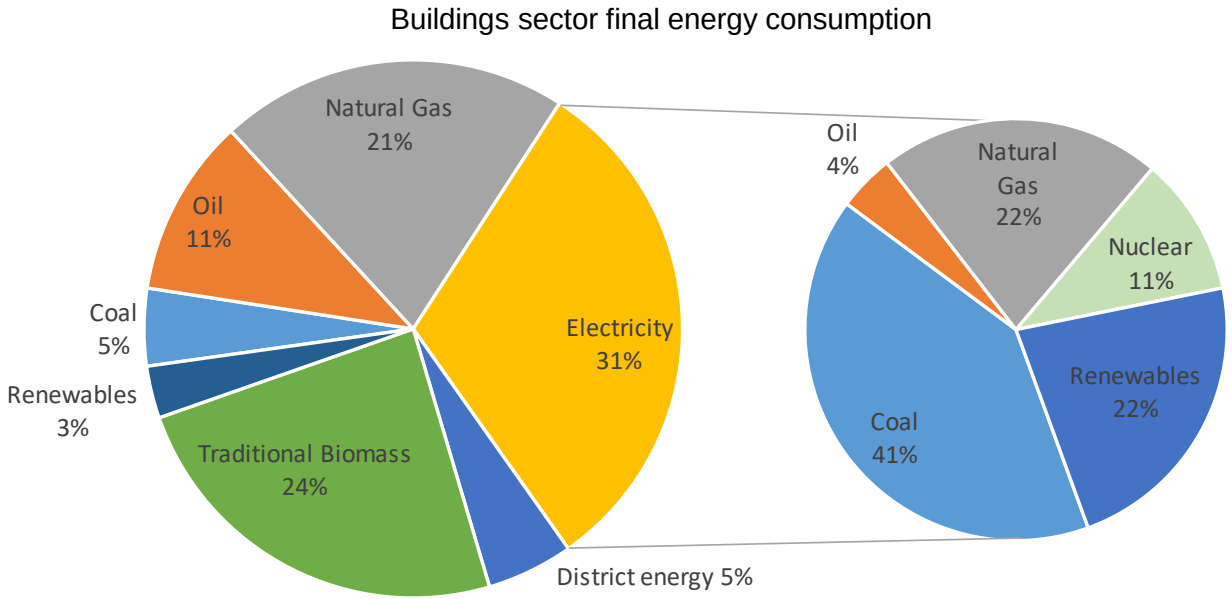


Residential buildings use more energy for cooking and water heating.
Non-residential buildings use more energy for space cooling, lighting and other equipment.

Source: IEA Energy Technology Perspective 2017

Building energy use: impact on energy markets

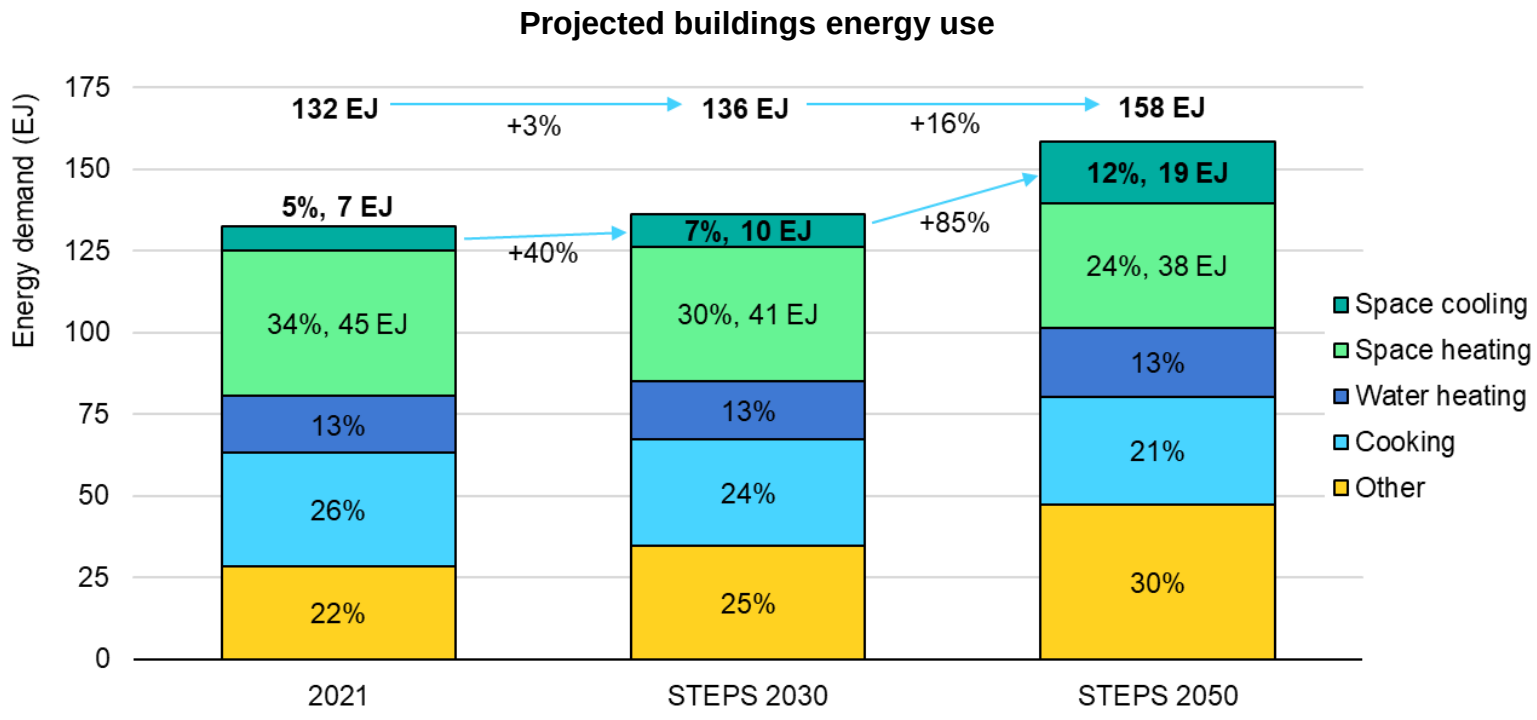
Primary energy use depends on energy utilities…



Buildings depend heavily on upstream energy and emissions (electricity and commercial heat).

Source: IEA Energy Technology Perspective 2017

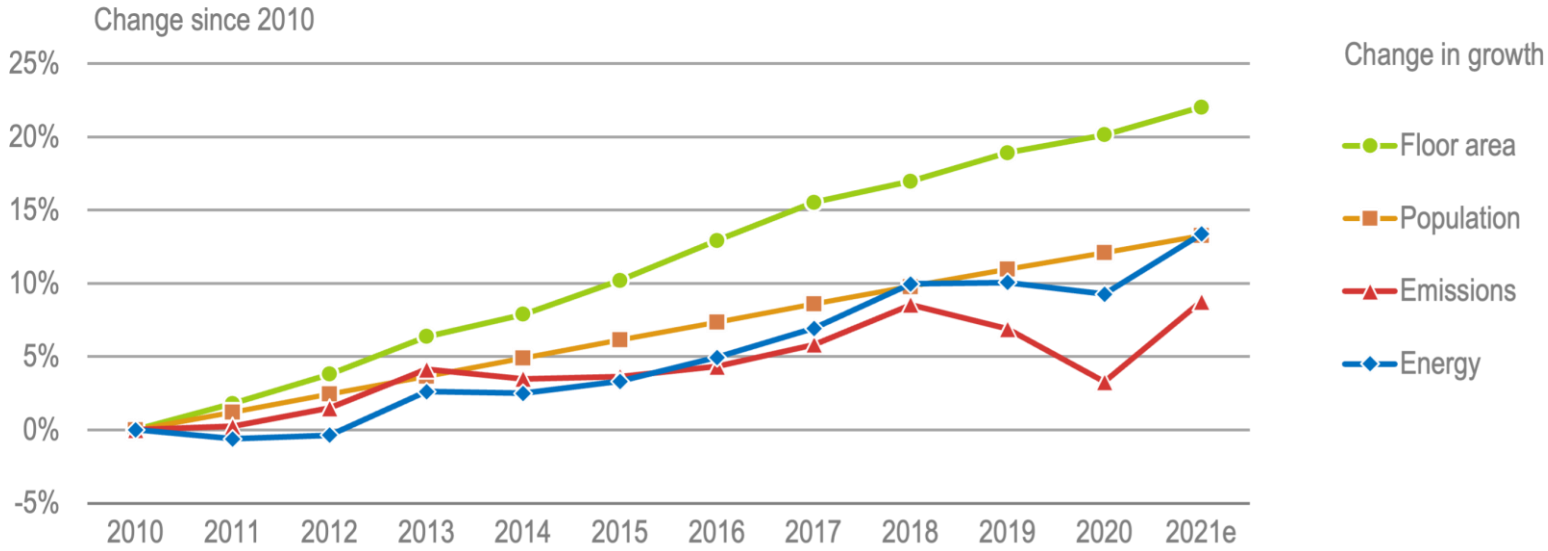
Building energy use: by end-use



Building energy use in business as usual (STEPS) scenario is expected to increase further

Source: IEA Energy Technology Perspective 2021

Drivers of building energy use

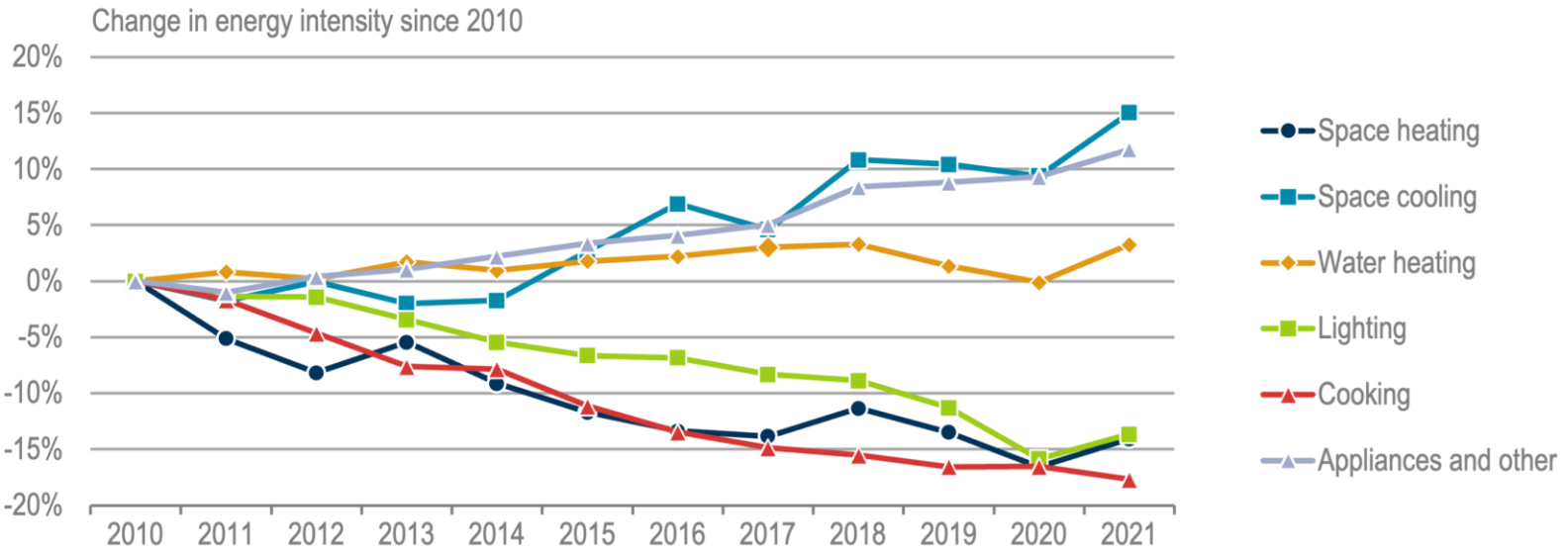


Despite energy efficiency improvements, the energy consumed in buildings is still highly correlated to population growth.

Sources: IEA ETP 2021

Building energy use: by end-use

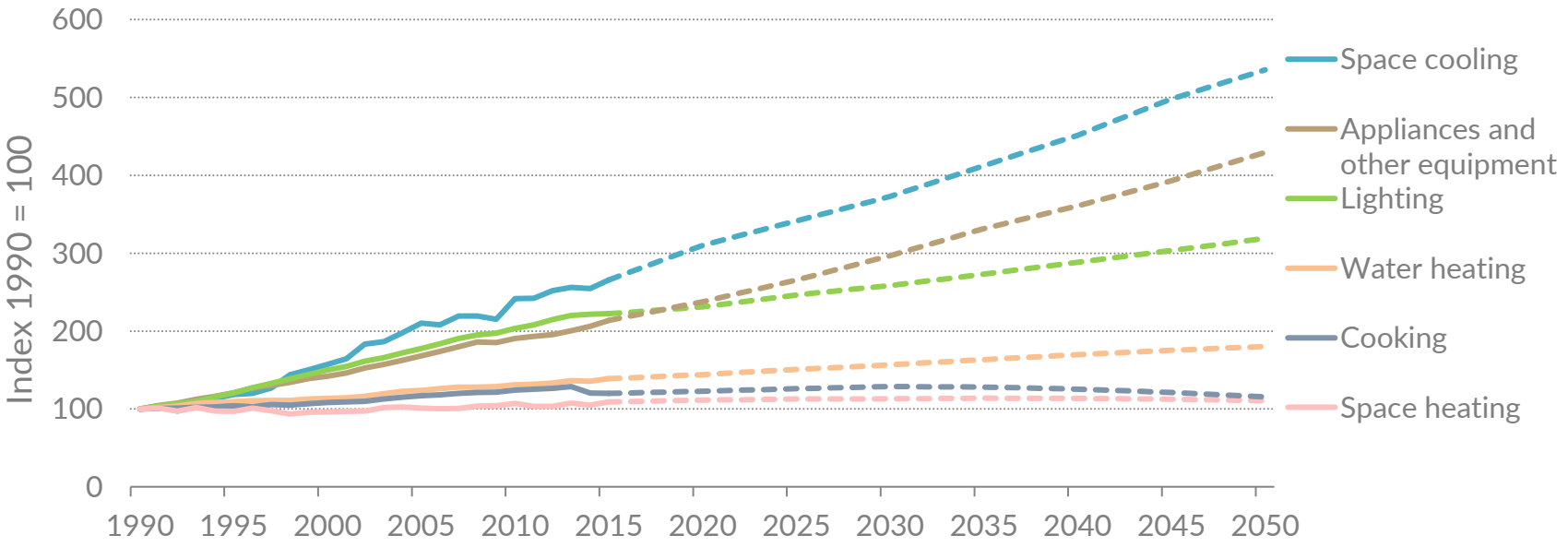
Historic buildings energy use



Building energy demand 2010 to 2021 shows cooling and appliances as the fastest growing by end-use

Source: IEA Energy Technology Perspective 2021

Building energy use: how important is space cooling becoming?



Space cooling energy use in business as usual scenario (STEPS) is expected to have significant increases due to increased ownership

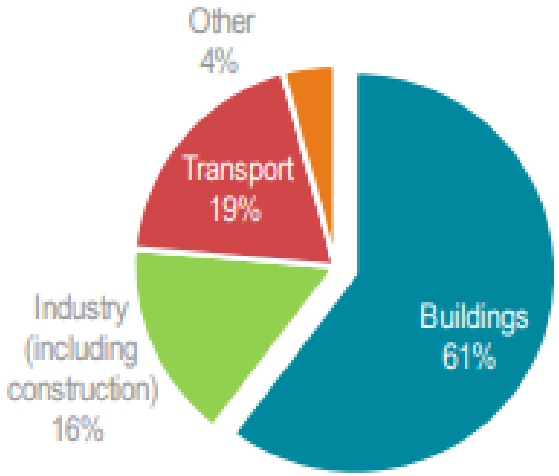
Source: www.iea.org/eemr16

Energy Trends in Africa

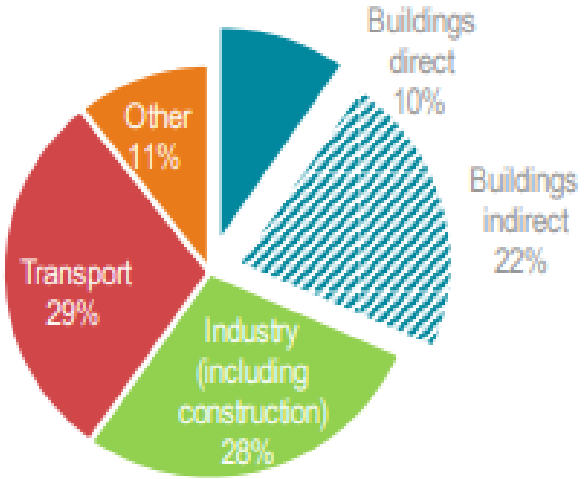
Buildings energy demand in Africa

Buildings in final energy and emissions in Africa, 2018

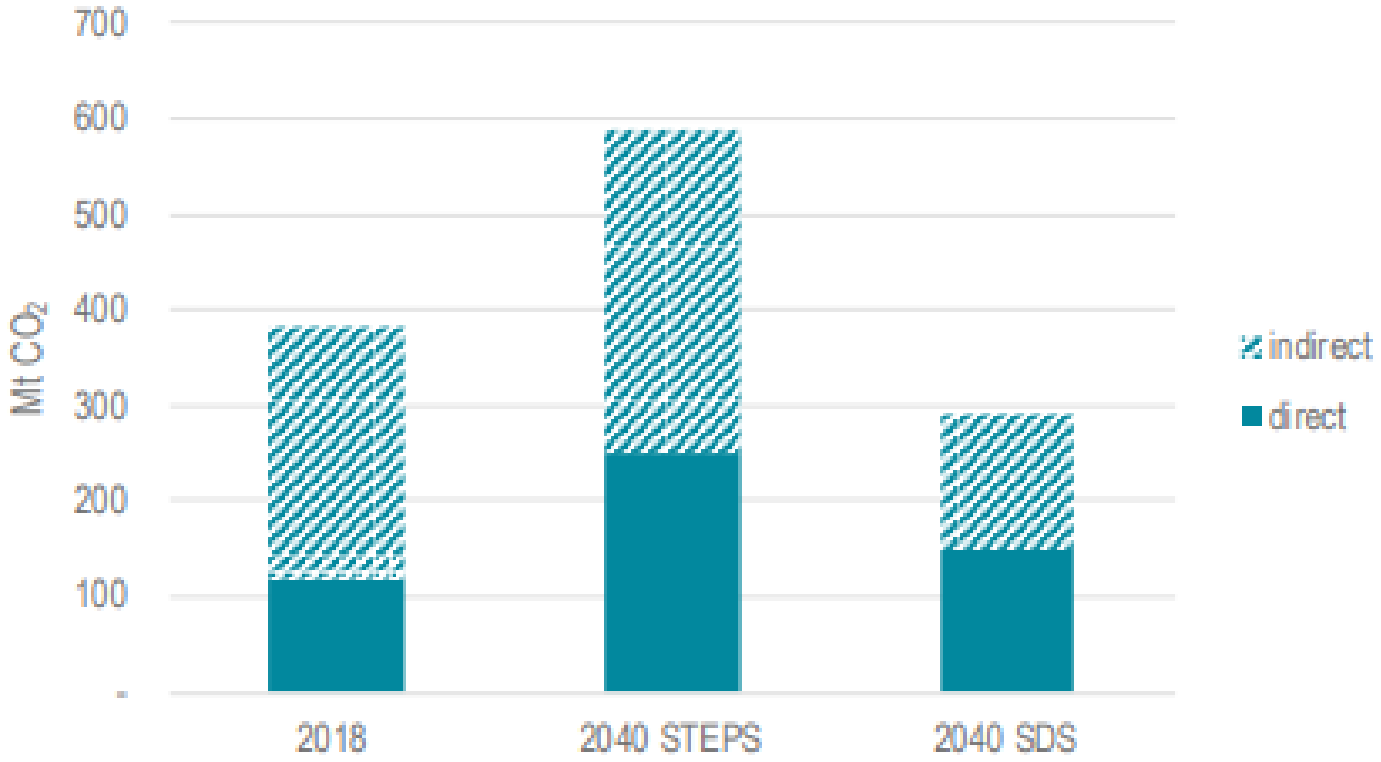
Buildings' share of total **final energy consumption** Africa, 2018



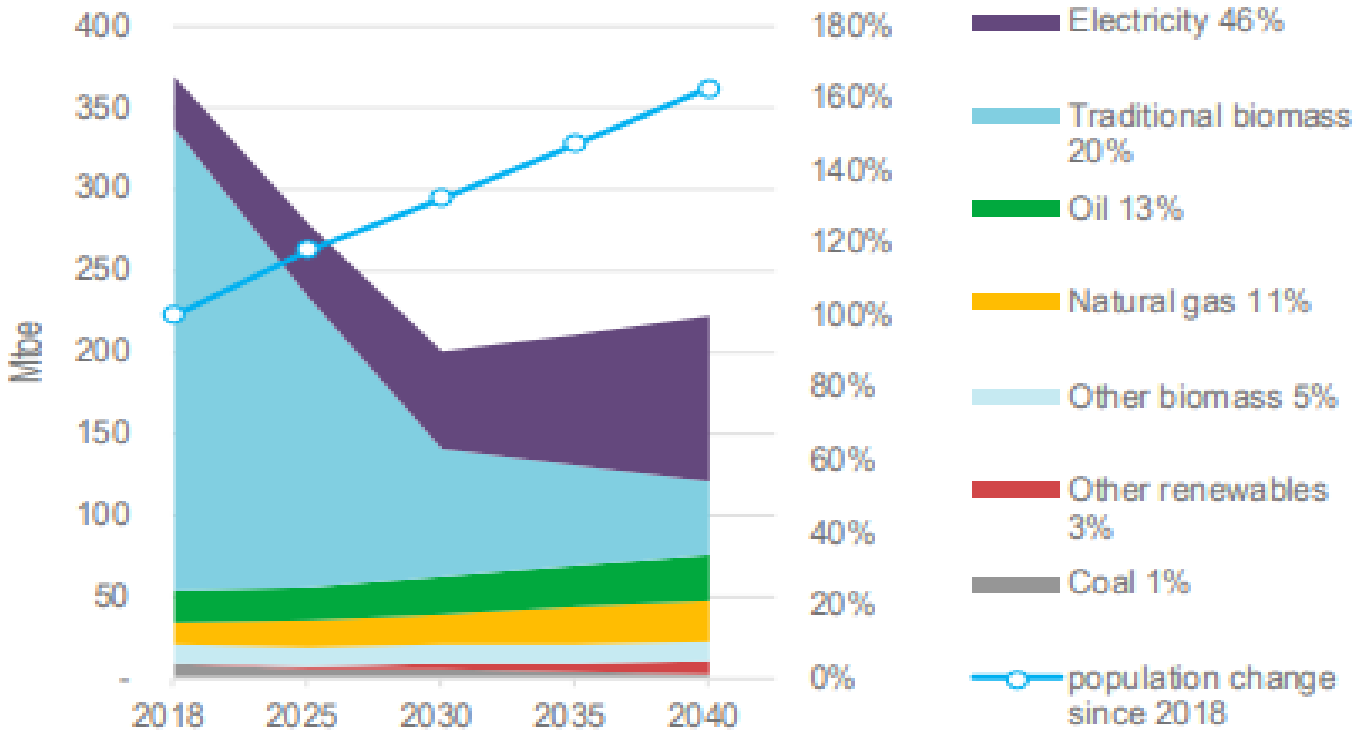
Buildings' share of total **CO_2 emissions** in Africa, 2018



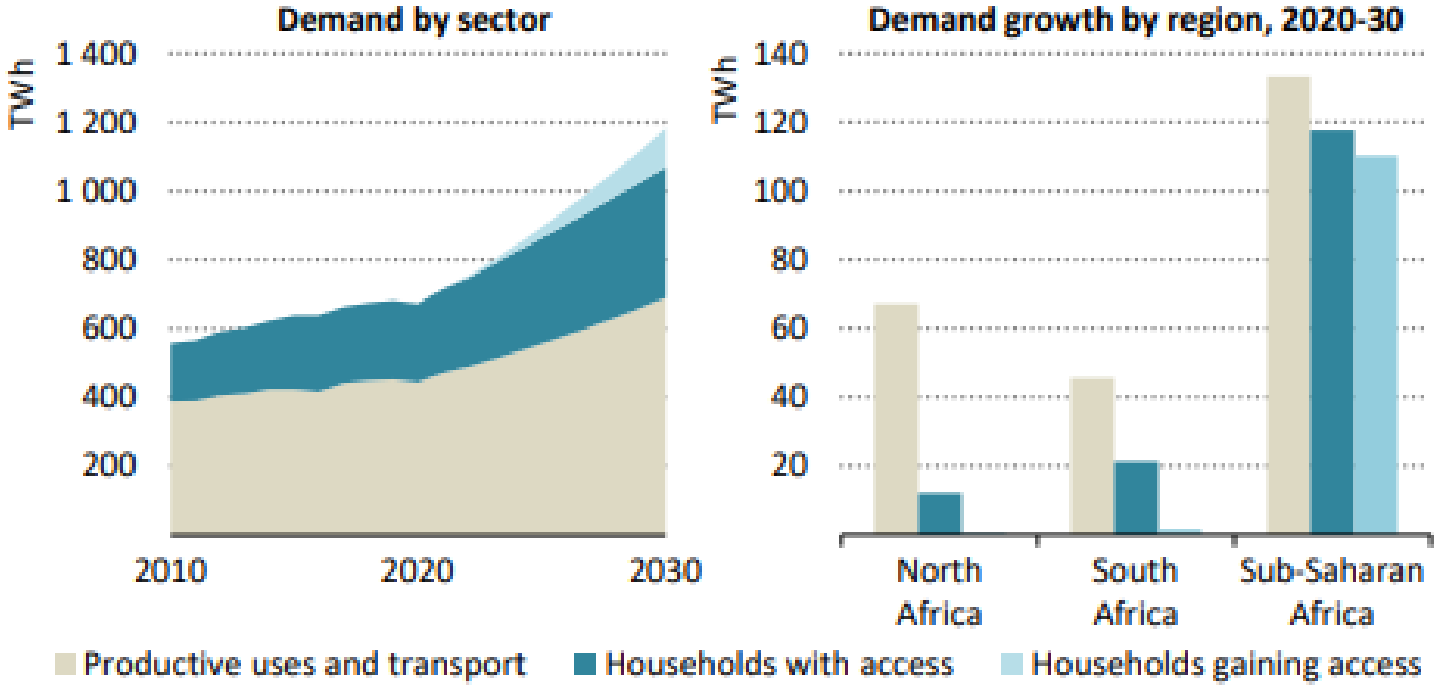
Emissions from buildings in Africa



Energy consumption in buildings in SDS

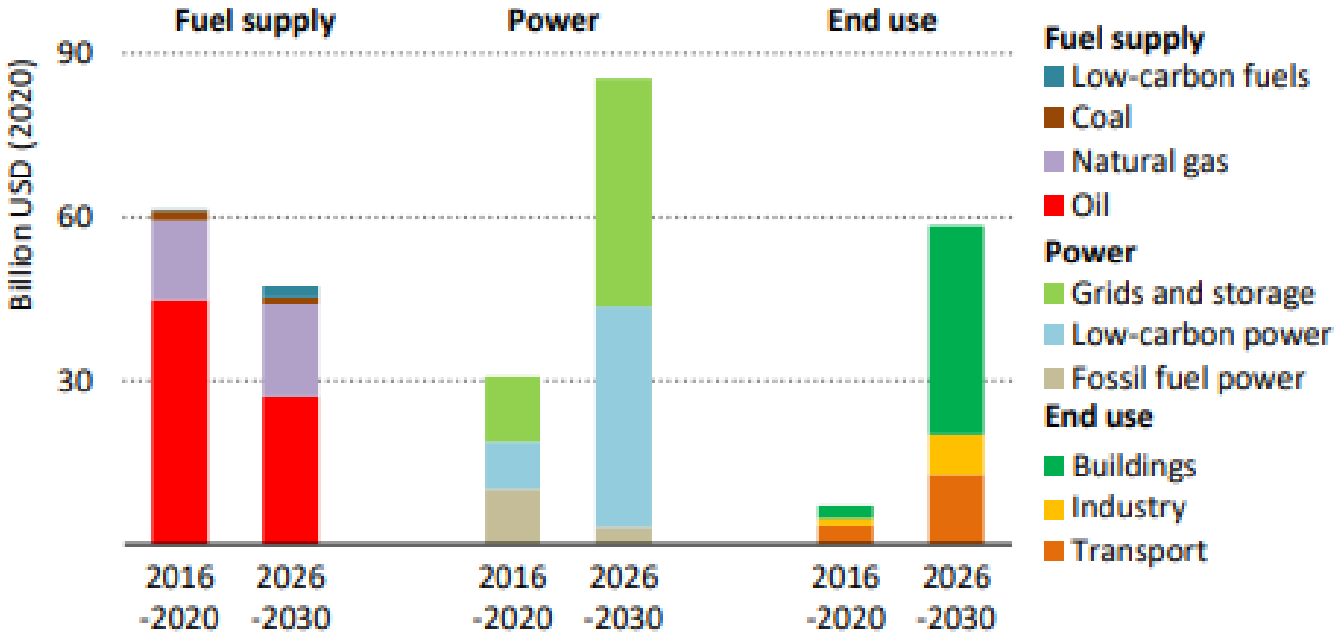


Electricity demand by sector and region in the SAS



Electricity demand almost doubles by 2030, with households making up over half of the increase and industry most of the balance

Average annual energy investment by fuel and sector in Africa



Investments in power and end-use efficiency surge to 2030, driven mainly by low-carbon power plants and grid expansion, as well as appliances and cooling equipment

Policy Package for Buildings

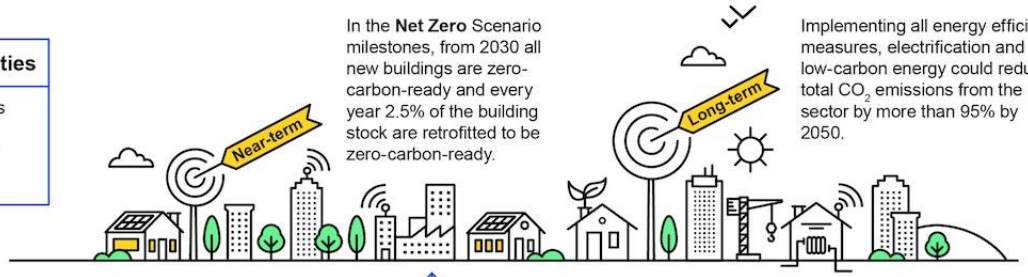
Buildings Energy Efficiency Policy Package

Immediate opportunities

Replacing fossil fuel boilers with high efficiency heat pumps can reduce energy use by up to 75%.

In the **Net Zero** Scenario milestones, from 2030 all new buildings are zero-carbon-ready and every year 2.5% of the building stock are retrofitted to be zero-carbon-ready.

Implementing all energy efficient measures, electrification and low-carbon energy could reduce total CO_2 emissions from the sector by more than 95% by 2050.



REGULATION

- **Targets for energy efficiency** in buildings, including for renovation rates, fosters market growth and facilitates long-term investment decisions.
- **Building energy codes** for new buildings and retrofits are essential to accelerate the transition to zero-carbon-ready buildings.
- **Minimum energy efficiency requirements** for renovation help guarantee performance and accelerate the process of renovation through instruments such as the standardisation of services.
- **Regulations** ensure that buildings can become "demand response ready" to enable future flexibility.

INFORMATION

- **Information on building performance** allows consumers to identify the most efficient options when buying or renovating buildings. Examples include energy performance certificates, disclosure programmes, one-stop shops for upgrades and renovation passports.
- **Smart interactive technologies** can show real-time energy performance and help adjust occupants' behaviour.
- **Training and education programmes** for building sector workers are important to ensure a suitably skilled work force.
- **Public awareness campaigns** designed to include behavioural insights encourage low-cost actions, such as thermostat adjustment.

INCENTIVES

- **Financial incentives** such as green mortgages, energy performance-based preferential loans and tax rebates and grants can motivate consumers and developers to increase investment in energy efficient solutions.
- **Expedited administrative procedures**, including accelerated permitting, targeted at high performing new build or retrofit projects, encourage the implementation of energy efficient measures.
- **Award and recognition programmes** encourage the development of highly energy efficient buildings.

Session Activity

International Energy Agency

Activity groups

1. Arrange yourselves into regional groups

2. Select a Country within your region to further develop for the group activities

Activity – Drivers of energy demand

Instructions

1. You will now assemble into groups (these are different than the earlier Introduction groups)

2. You will together discuss and select one country within your region on which you will work on a group activity for the remainder of the Buildings training days.

3. The first task is to use the provided template to characterize your selected Country's energy demand profile.

Population	126 million	
Population <16		
Economy	Emerging economy	
- GDP	$1.3 trillion	
- GDP/pp	$10,000/per capita	
Urbanization	81%	
CO_2 emissions	3.1 tCO_2/person	
Primary energy mix (Mtoe)	327	Coal
	3432	Natural gas
	126	Nuclear
	124	Hydro
	236	Renewables
	367	Biofuels
	3258	Oil
	7870	Total
Electricity generation (TWh)	46	Oil
	182	Natural gas
	11	Nuclear
	2	Biofuels
	34	Hydro
	5	Geothermal
	20	Wind
	12	Solar PV
Electrification rate	99% access to electricity	
Access to clean cooking	84% access to clean cooking	
Clean energy targets	Carbon neutrality by 2050	
Energy governance model	Centrally planned	
Construction rate	3% annual growth in construction market	
Renovation rate	<1% of stock per year	
Climate conditions	3 climate zones: Semi-arid climate Tropical rainforest	

Activity 1 – Drivers of energy demand

Describe the key drivers of energy demand in buildings in your selected country

International Energy Agency

Energy Efficiency Training Week

Africa Energy Efficiency Policy in Emerging Economies Training Week

Buildings

Nairobi

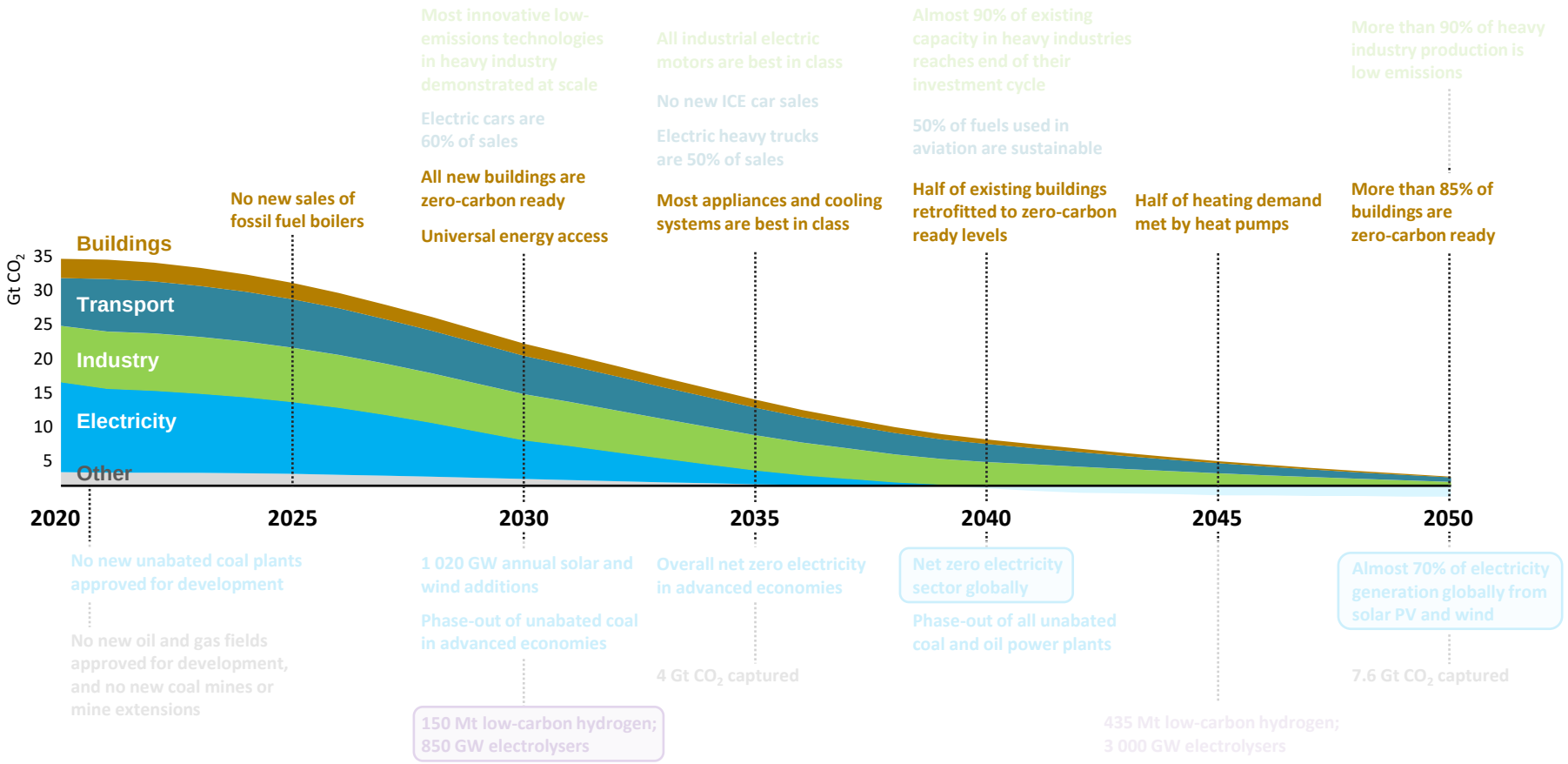
18-22 March 2024

https://www.iea-events.org/energy-efficiency-training-week-nairobi

International Energy Agency

Energy Efficiency Training Week - Buildings - Day 1: 2. Where to Start: Energy efficiency potential in buildings for net-zero

Direct emissions in buildings can be reduced by more than 95% by 2050

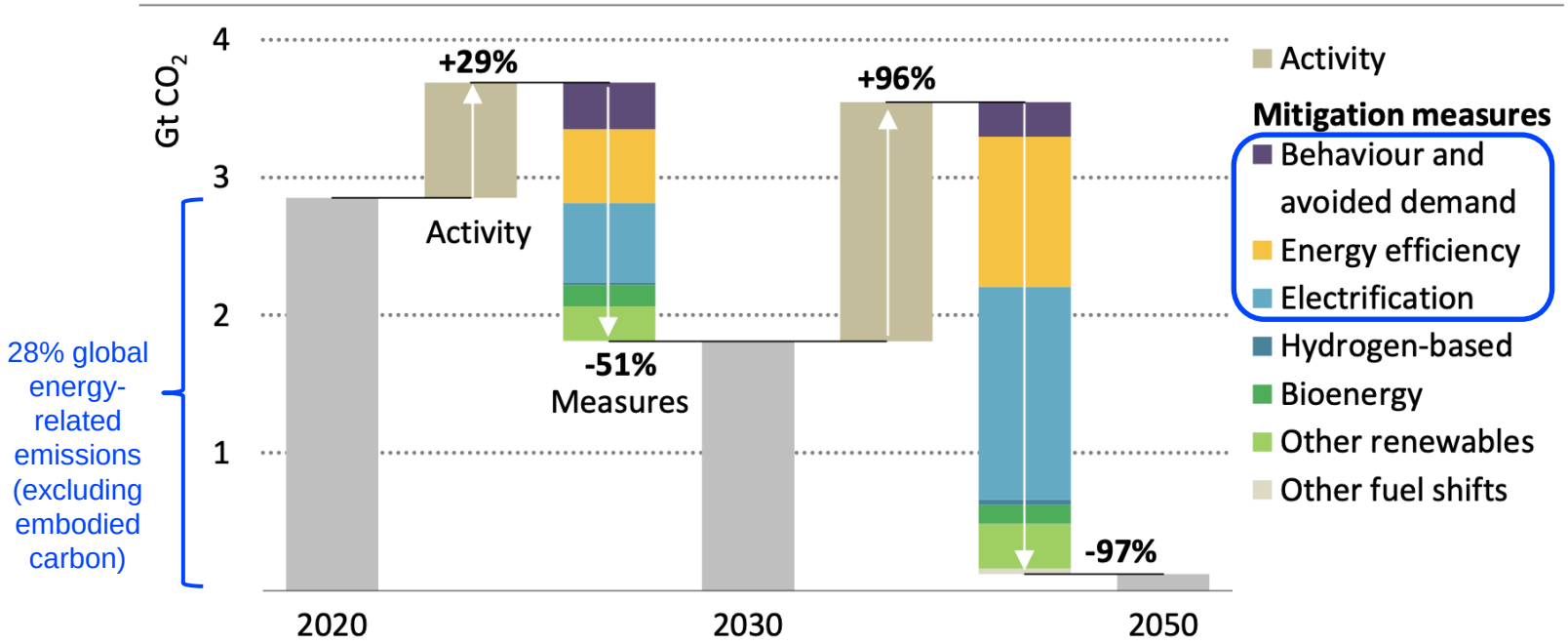


*accounting for emissions from direct fossil fuel combustion as well as from upstream electricity and heat generation.
IEA (2020). 'Is cooling the future of heating'

Net Zero by 2050
https://www.iea.org/reports/net-zero-by-2050

Buildings in a Net Zero Emissions Scenario

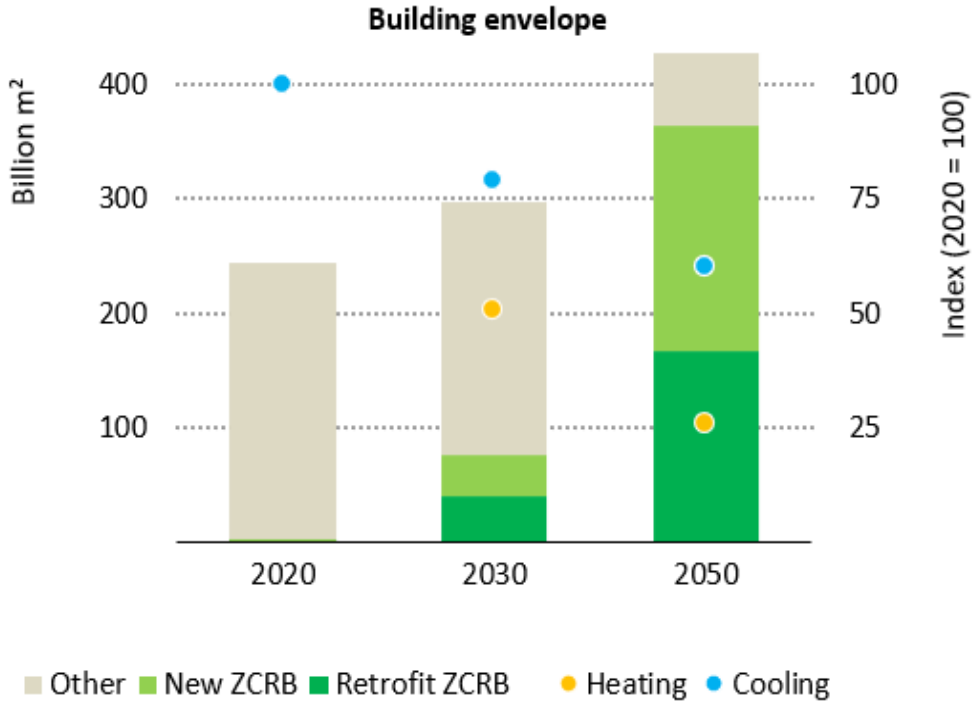
Global direct CO2 emissions reductions by mitigation in buildings in the NZE



Electrification and energy efficiency account for nearly 70% of buildings-related emissions reductions through to 2050

Source: IEA (2021), Net Zero by 2050, IEA, Paris https://www.iea.org/reports/net-zero-by-2050

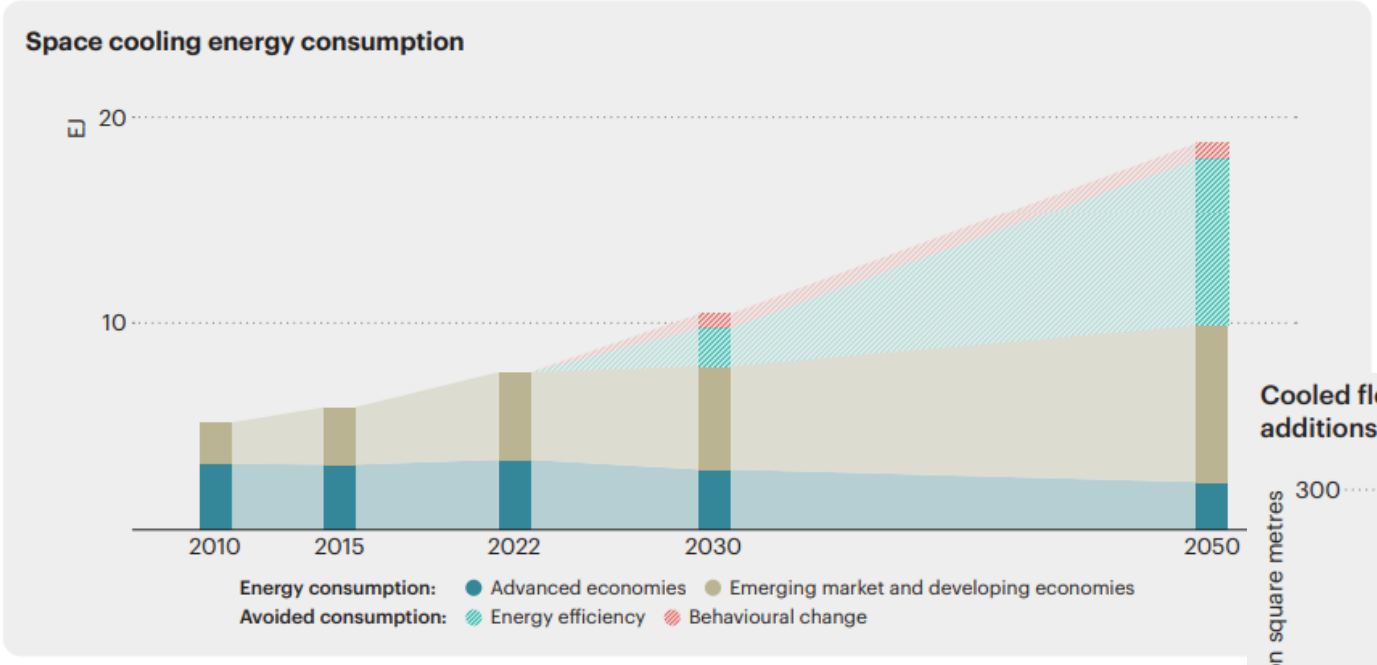
Transition to zero-carbon ready buildings is crucial for the NZE



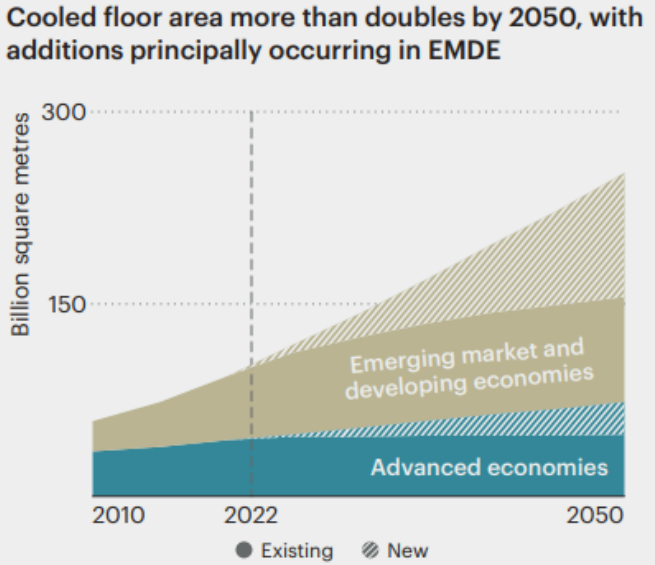
Over 85% of buildings meet zero-carbon-ready building energy codes by 2050, reducing average final intensity for space heating by 80% and for space cooling – by 60%

Net Zero by 2050

The Road to Net Zero: What is needed to get there?



Space cooling energy consumption is set to more than double by 2050 with no action taken

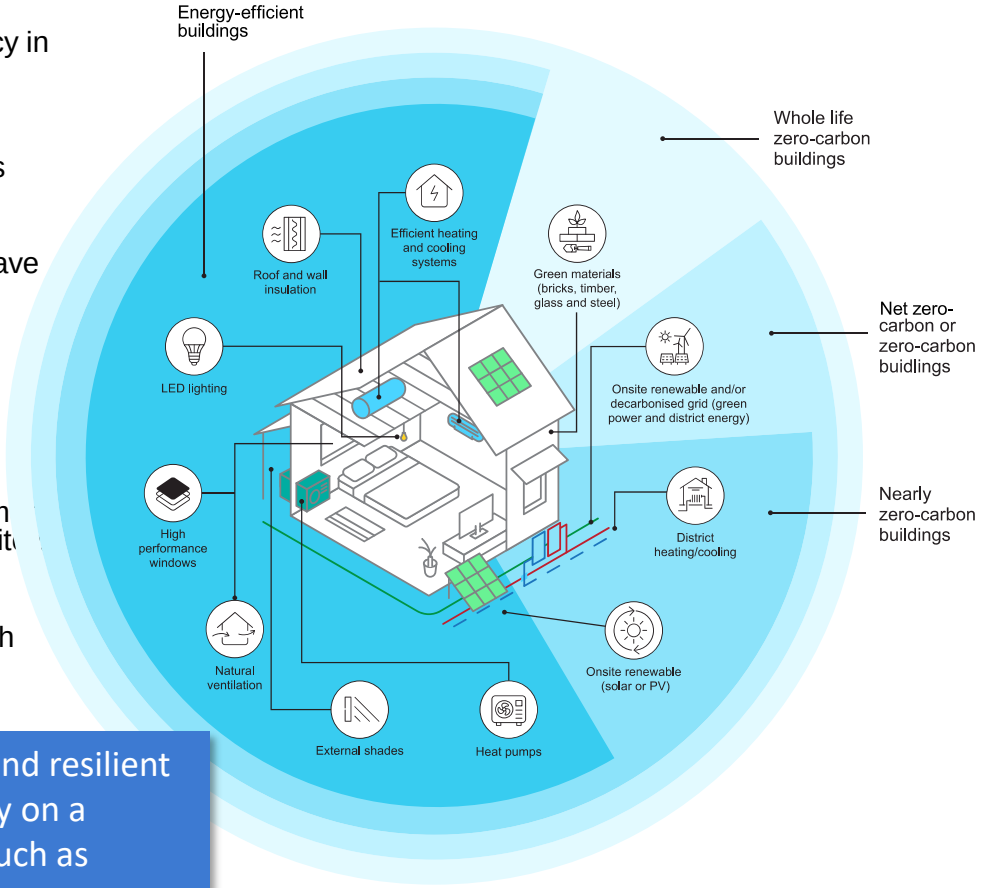


Passive designs, behavioural change and more efficient equipment are vital to temper demand growth and reduce the strain on electricity systems

Source: IEA (2023), Net Zero Roadmap. A Global Pathway to Keep the 1.5C Goal in Reach

Concept of zero carbon buildings

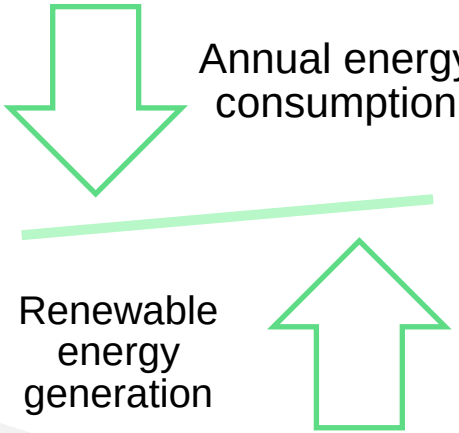
- **Energy-efficient:** a building with a high degree of energy efficiency in its fabric and building services that consume energy, e.g. heating, cooling, cooking, lighting, ventilation, hot water, and appliances.
- **Low-carbon:** a building that is energy efficient (low-energy) and is supplied by low-carbon energy.
- **Nearly-zero carbon:** a building that is energy efficient and may have some available renewable energy supply (onsite or offsite), but complete demand offset.
- **Net-zero carbon:** a building that is energy efficient and relies on renewable energy sources that meet the energy demand over the course of a period.
- **Zero-carbon:** a building that is energy efficient and its energy dem is completely met through renewable energy generated either onsit offsite.
- **Whole life-cycle net-zero carbon:** zero-carbon buildings, in which embodied carbon emissions from the materials used in their construction



Zero-carbon-ready buildings are highly energy-efficient and resilient buildings that either use renewable energy directly or rely on a source of energy supply that can be fully decarbonised, such as electricity or district energy

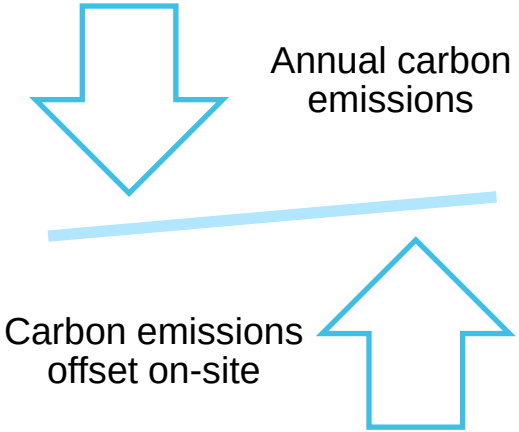
Concept of net zero

- **Net-zero energy:** over the course of a year, the building has consumed as much energy as has been generated on site, resulting in a net-zero annual energy consumption.



Final or primary energy?
Allow off-site generation?
Is net zero = efficient?

- **Net-zero carbon:** over the course of a year, the building has emitted as many carbon emissions as have been offset on site, resulting in a net-zero annual carbon emission.



What about embodied carbon?

What is needed for a zero-carbon-ready building?

Scope

- Operational carbon
- Embodied carbon

Energy use

- Reduce demand through passive design, high performance building envelope, high performance equipment

Energy supply

- Integrate locally available renewable resources, with energy storage where relevant

Integration with power systems

- Connectivity and automation to provide a flexible resource to the energy system

Net zero carbon construction value chain

- Promote material efficiency to reduce material demand
- Alternative materials and construction practices to lower embodied emissions

The Road to Net Zero: What is needed to get there?

	2020	2030	2050
Energy intensity	Improve by 6% per year 2020-2030	4% per year 2030-2040	3% per year 2040-2050
Share of existing buildings net-zero ready	<1%	20%	>85%
Avoided demand in homes from behaviour	-	12%	14%
Stock of heat pumps	180 million	600 million	1 800 million
Dwellings with solar thermal	250 million	400 million	1 200 million
Appliances unit consumption (relative to 2020)	-	-25%	-40%
Distributed PV generation	320 TWh	2 200 TWh	7 500 TWh

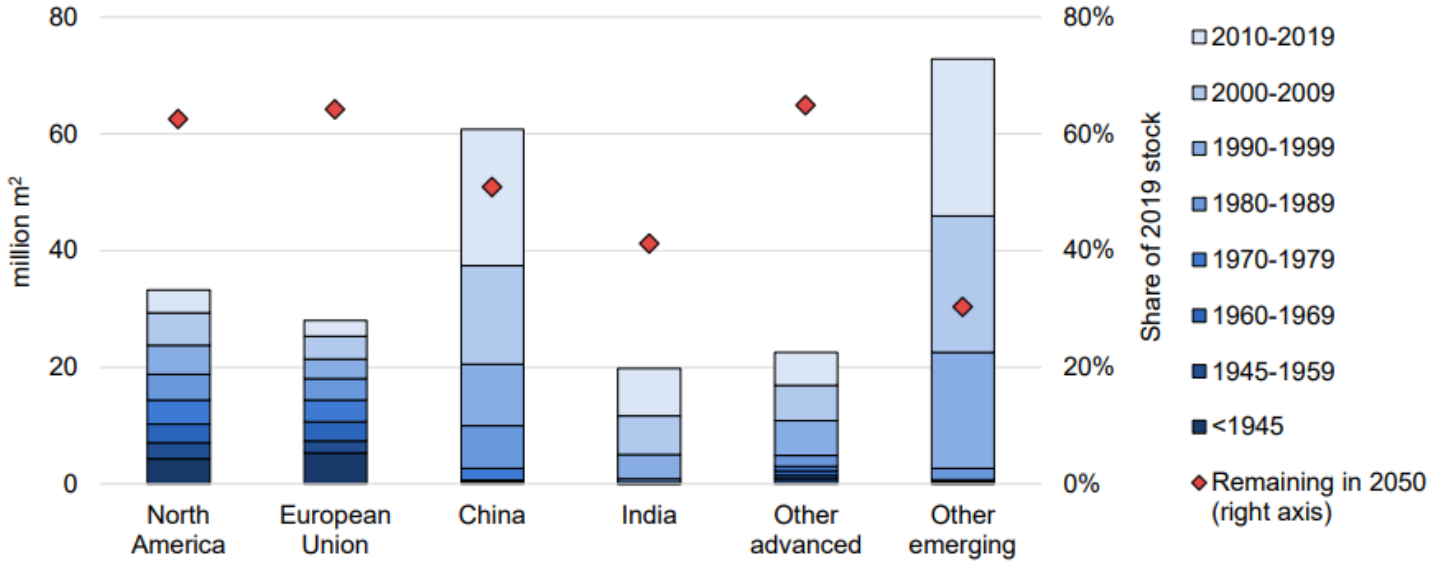
And also:

- ✓ 100% lighting by LEDs by 2030
- ✓ Universal access to electricity and clean cooking by 2030
- ✓ **All new buildings are zero-carbon-ready by 2030**
- ✓ **2.5% buildings are retrofitted to be zero-carbon-ready every year by 2030**

Source: IEA (2021), Net Zero by 2050, IEA, Paris https://www.iea.org/reports/net-zero-by-2050

Around half of today's building stock is likely to be in use in 2050

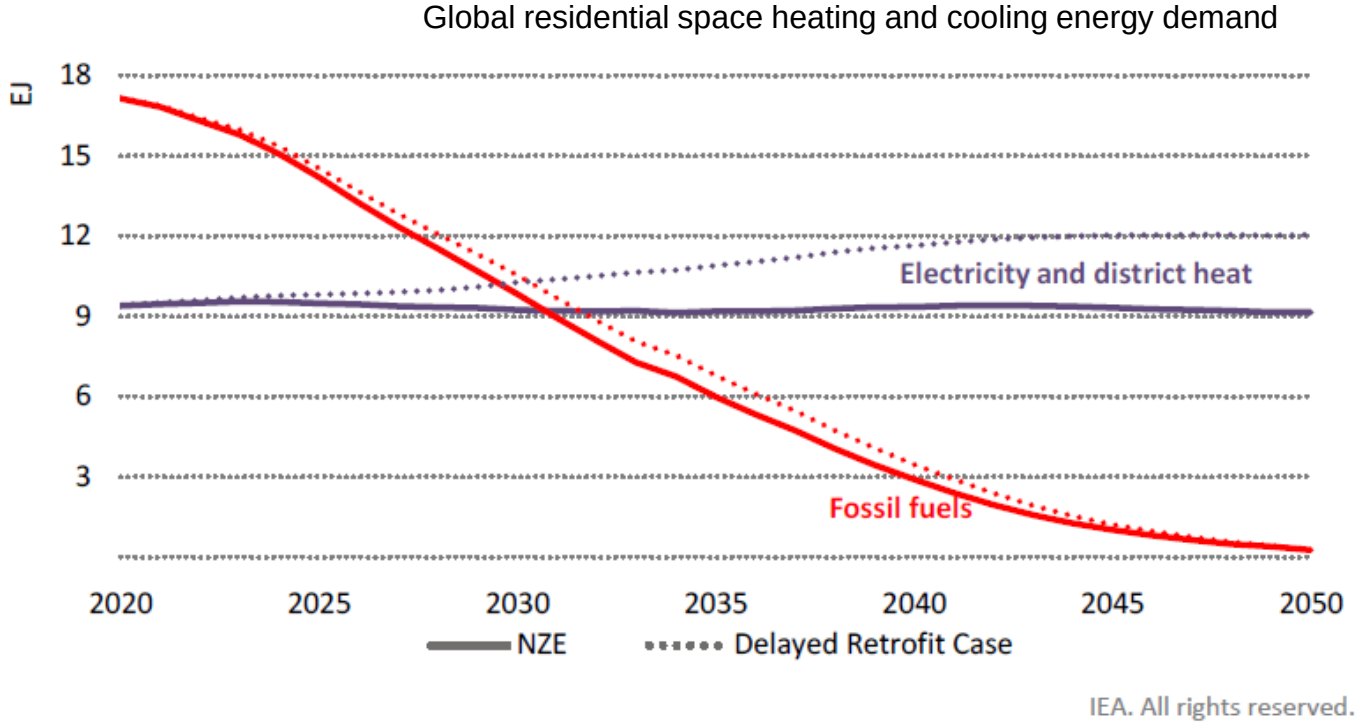
Building stock by year of construction and share of stock that remains in 2050



Note: Building floor area covers residential, commercial, services, education, health, hospitality, public and other non-residential sectors but excludes industrial premises.

Sources: Informed by NRCan (2020), RECS (2020), CBECS (2020), and EU Commission (2020), NBS China (2020).

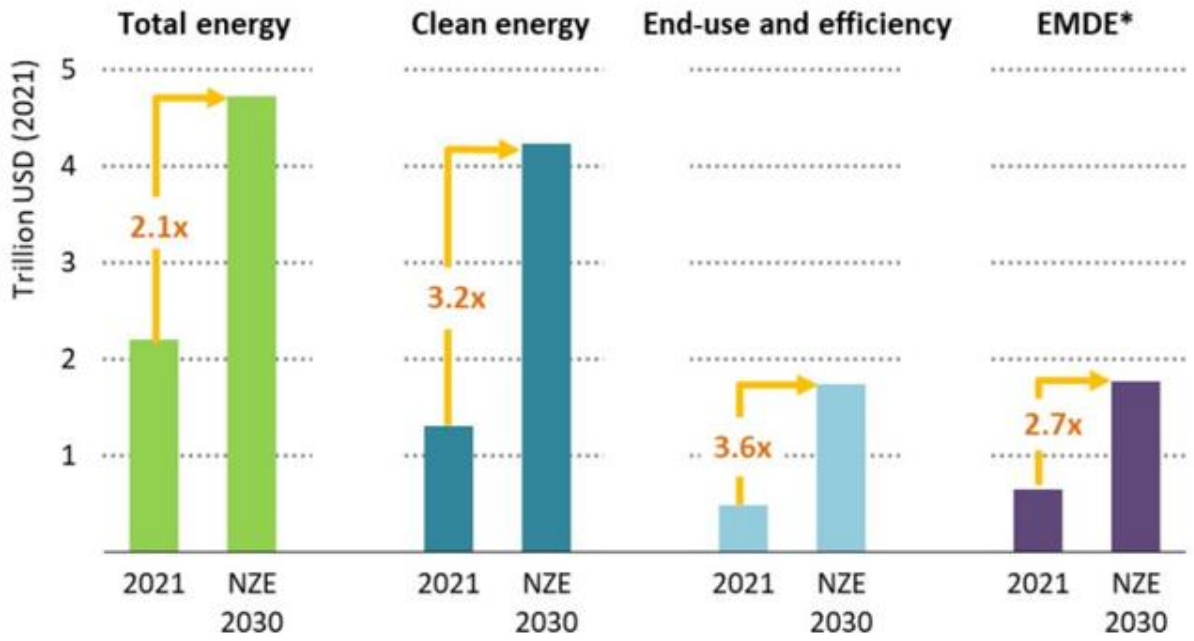
What can drive potential: timing



A delay of ten years in the acceleration of the retrofit rate to reach 2.5%, would increase residential space heating energy demand by 25% and space cooling demand by more than 20%, translating to a 20% increase in electricity demand in 2050 relative to the NZE

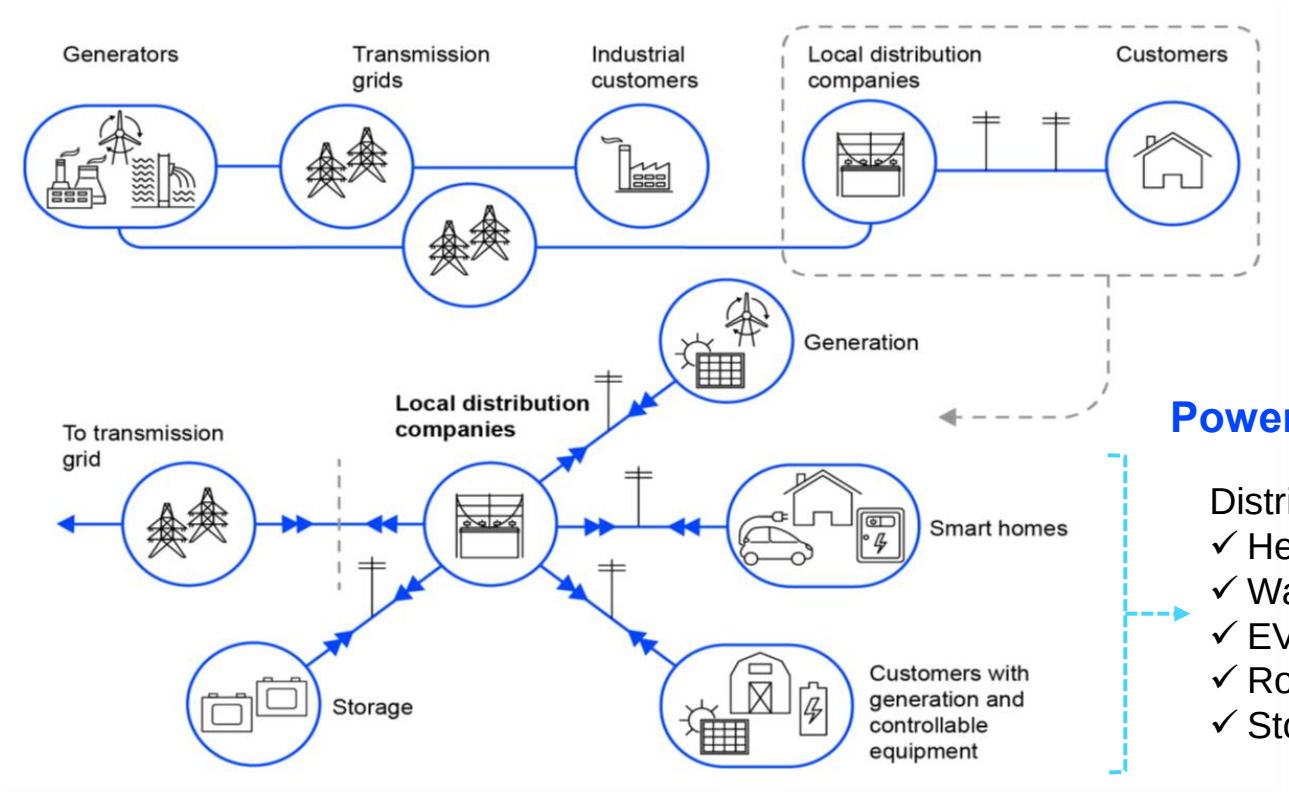
Delays in the ramp up of retrofit rates and depth would be almost impossible to catch up, placing further strain on the power sector and pushing up fossil fuel demand

What can drive potential: investments



Investment in end-uses such as buildings needs to increase substantially, though more is needed to generate clean energy, especially expanded electricity networks.

What can drive potential: system's efficiency



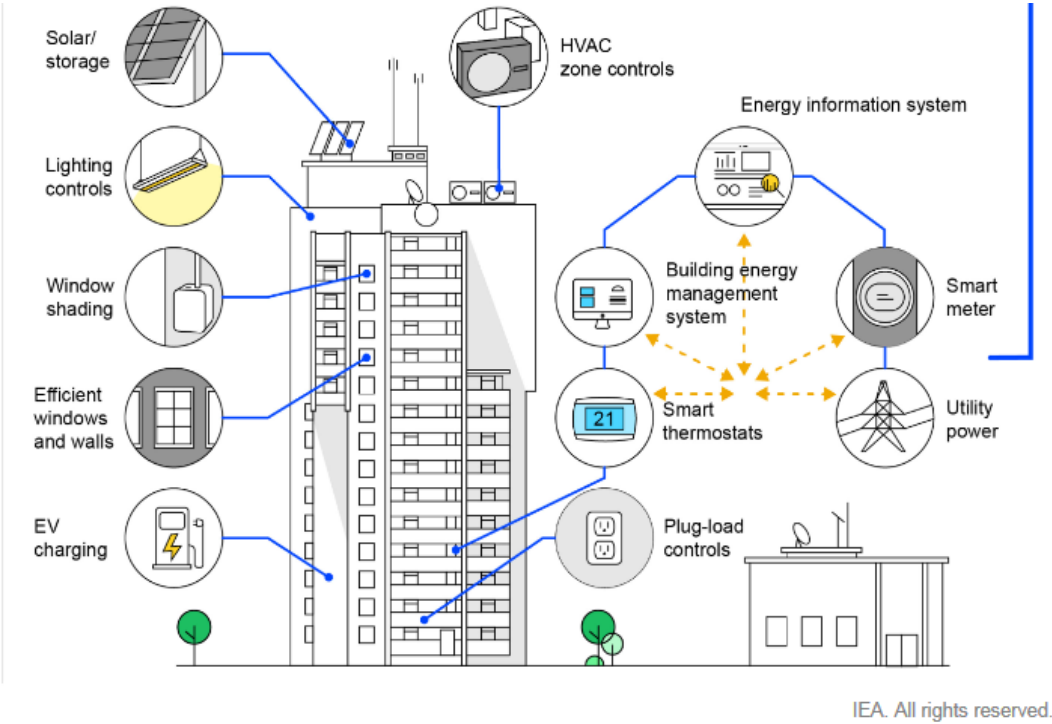
Power systems are changing…

Distributed energy resources, es.:

- ✓ Heat pumps;
- ✓ Water heaters;
- ✓ EVs;
- ✓ Rooftop PV;
- ✓ Storage.

Data, analytics, advanced controls – essential for planning, operation, maintenance, markets…orchestration

What can drive potential: digitalisation



By 2030

250 MtCO2

Due to digitalisation and smart controls enable efficiency gains

By 2030

350 MtCO2

Due to behaviour changes: lower temperature settings for space heating or reducing excessive hot water temperatures

Grid interactive buildings and smart charging for EVs can help to manage the expanding share of variable renewable energy and increasing peak demand

How do I calculate potential?

Ask questions

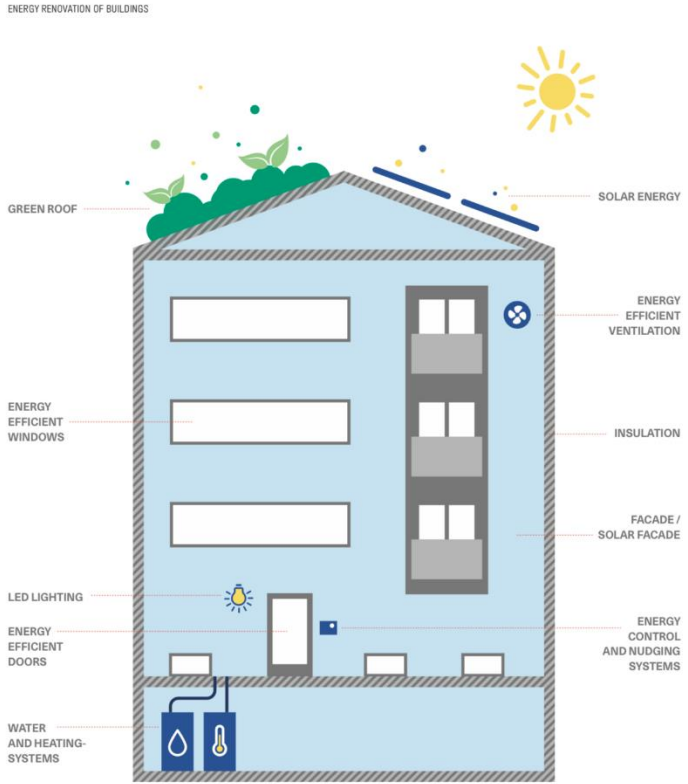
Data

Modelling

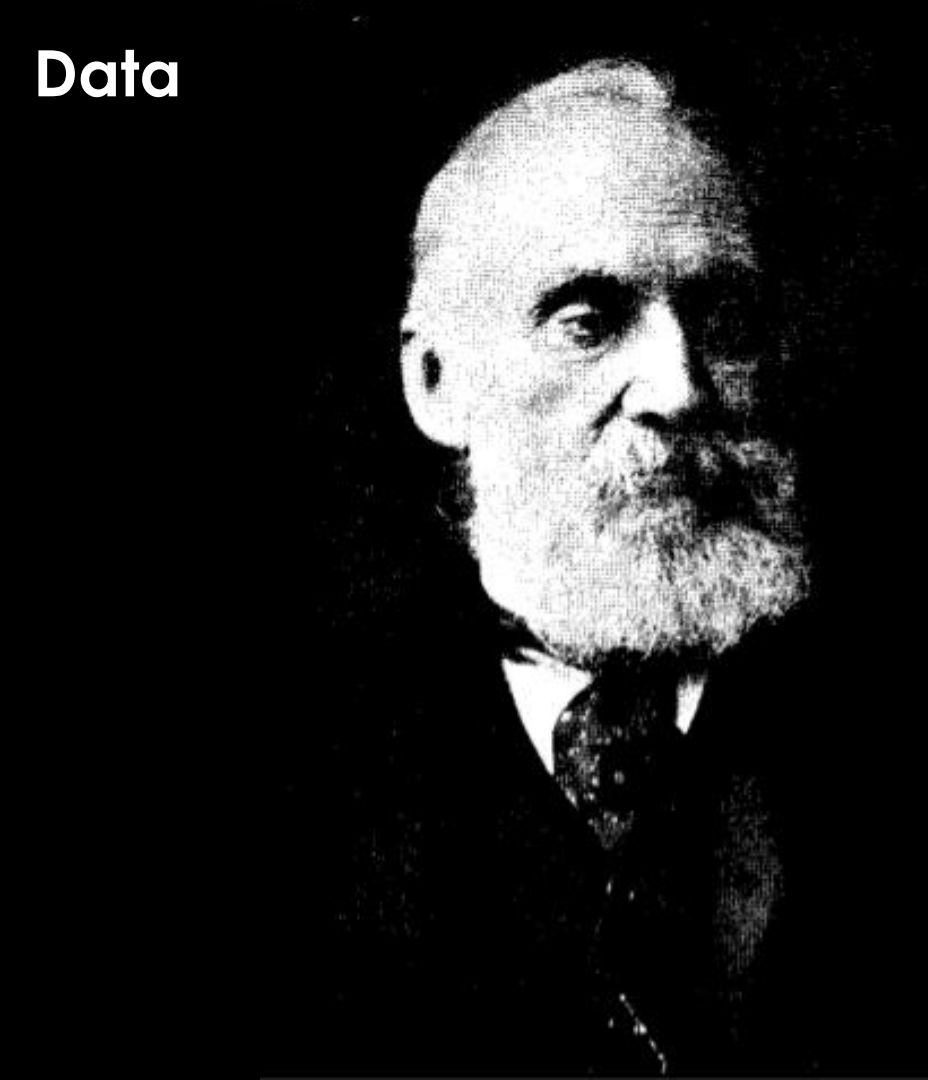
How do I calculate potential: where do I start?

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?



Data

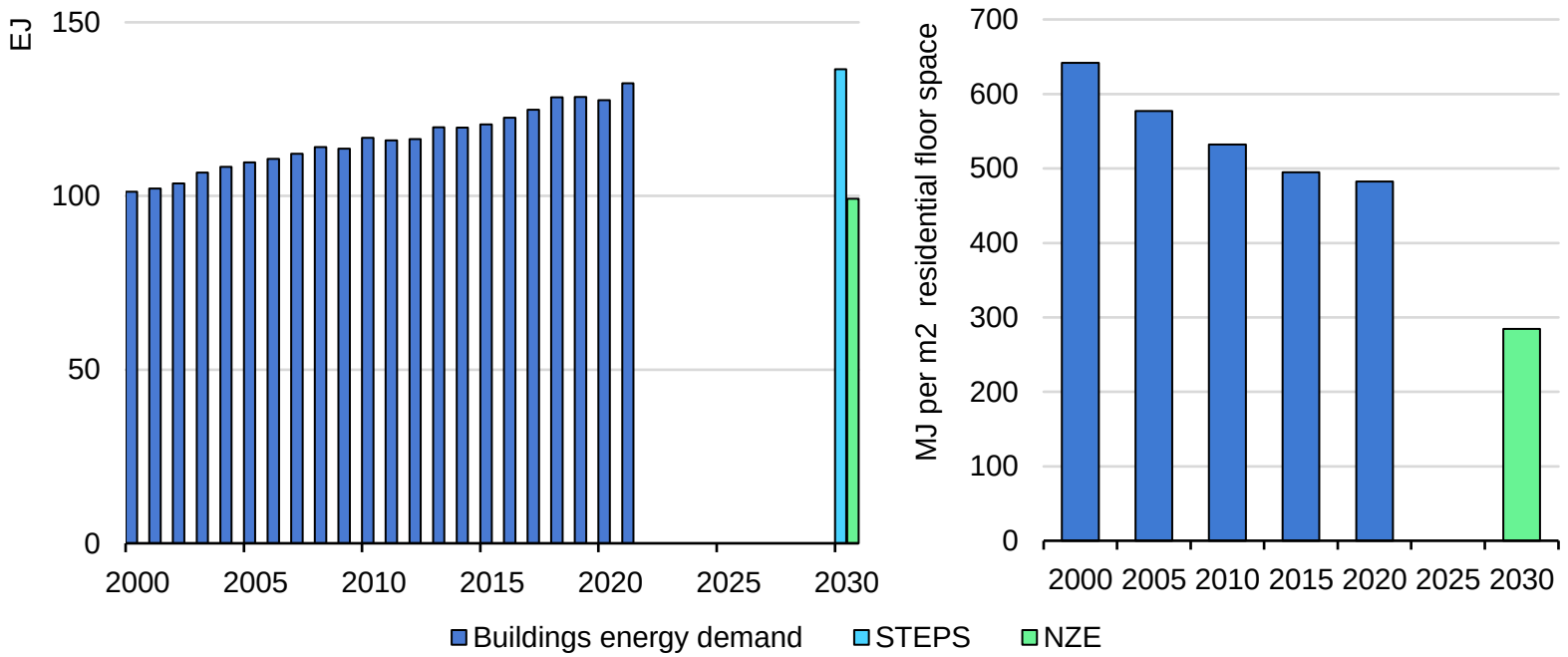


If You Can't Measure It, You Can't Improve It

(William Thomson, Lord Kelvin)

Buildings' energy demand trend far off track for net zero emissions

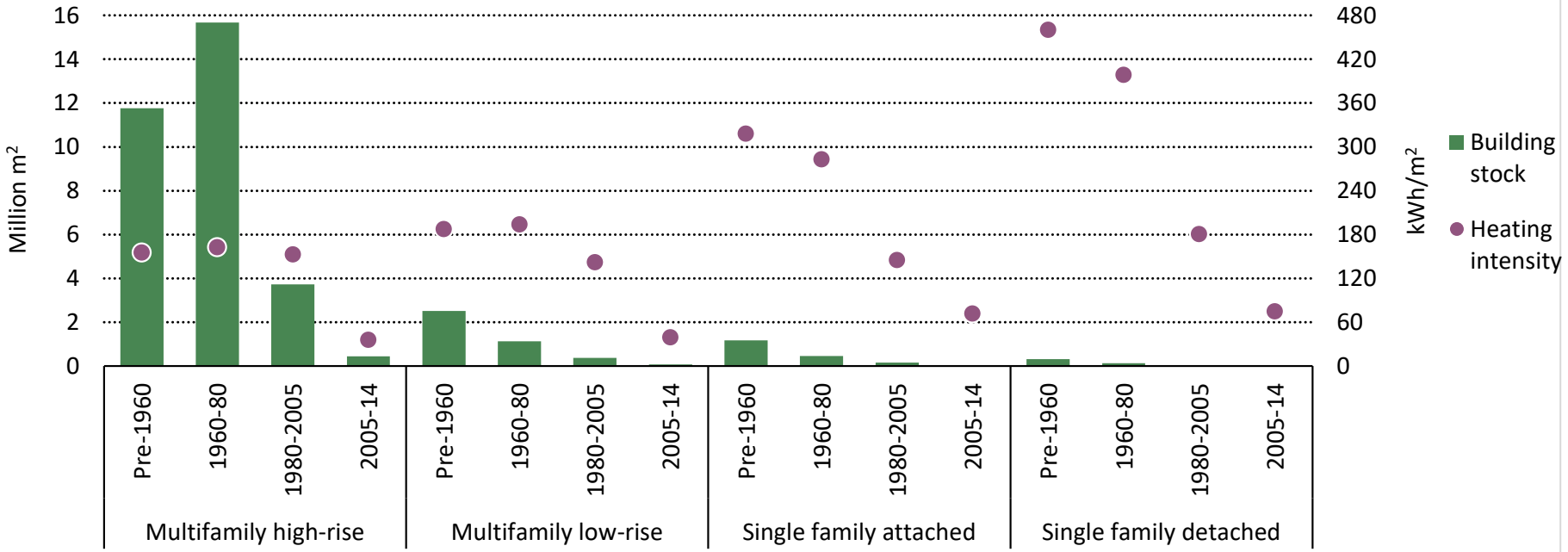
Global buildings final energy demand and efficiency indicator, by scenario, 2000-2020



Efficiency improvements in buildings have slowed down - global energy demand in buildings In 2021 increased by almost 4%, the highest year-on-year increase in over 20 years

How do I calculate potential: data

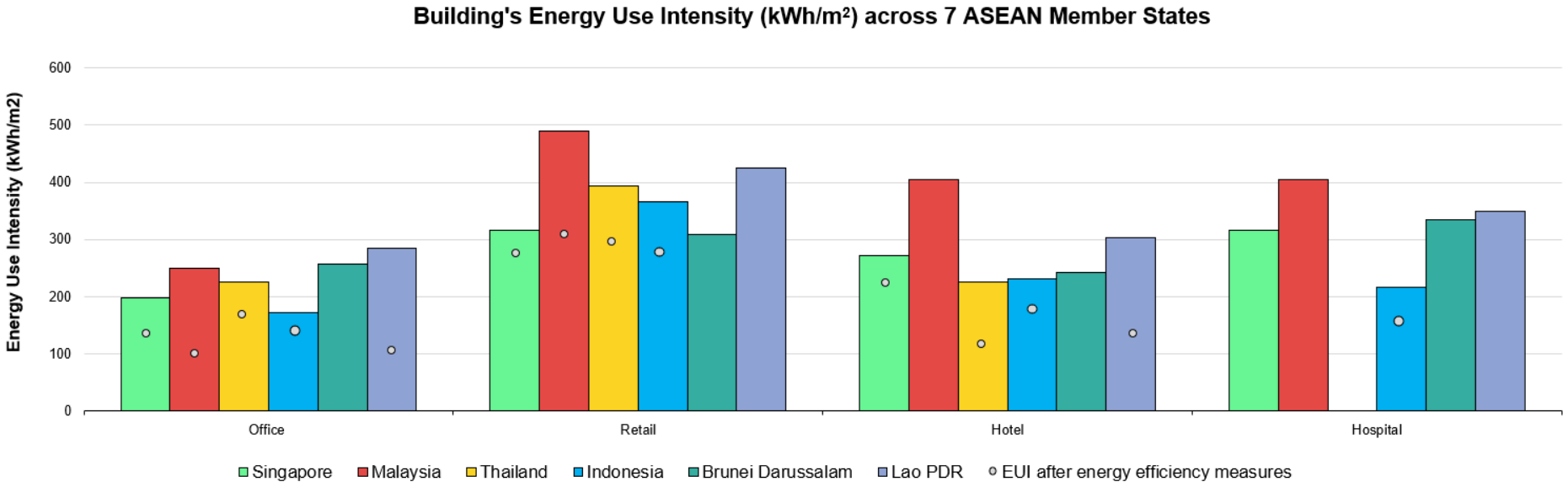
Example: Building stock accounting for Turin (Italy)



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

Source: IEA Energy Technology Perspectives 2017

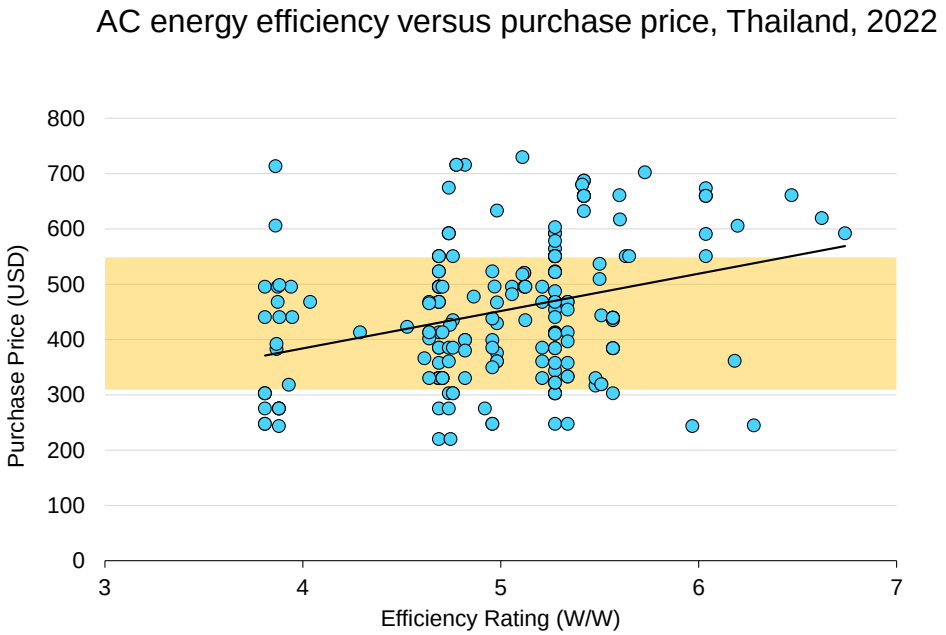
How do I calculate potential: baseline



Mapping existing data from all available sources is the first step to understanding the baseline

How do I calculate potential: data analysis

- Space cooling is among the fastest growing end uses in ASEAN, with electricity consumption expected to more than quadruple by 2040.
- Market data shows that more efficient cooling systems are not necessarily more expensive.



Policy action on more efficient ACs, fans and building envelopes could reduce space cooling energy use by over one-third by 2040

Modelling

All models are wrong

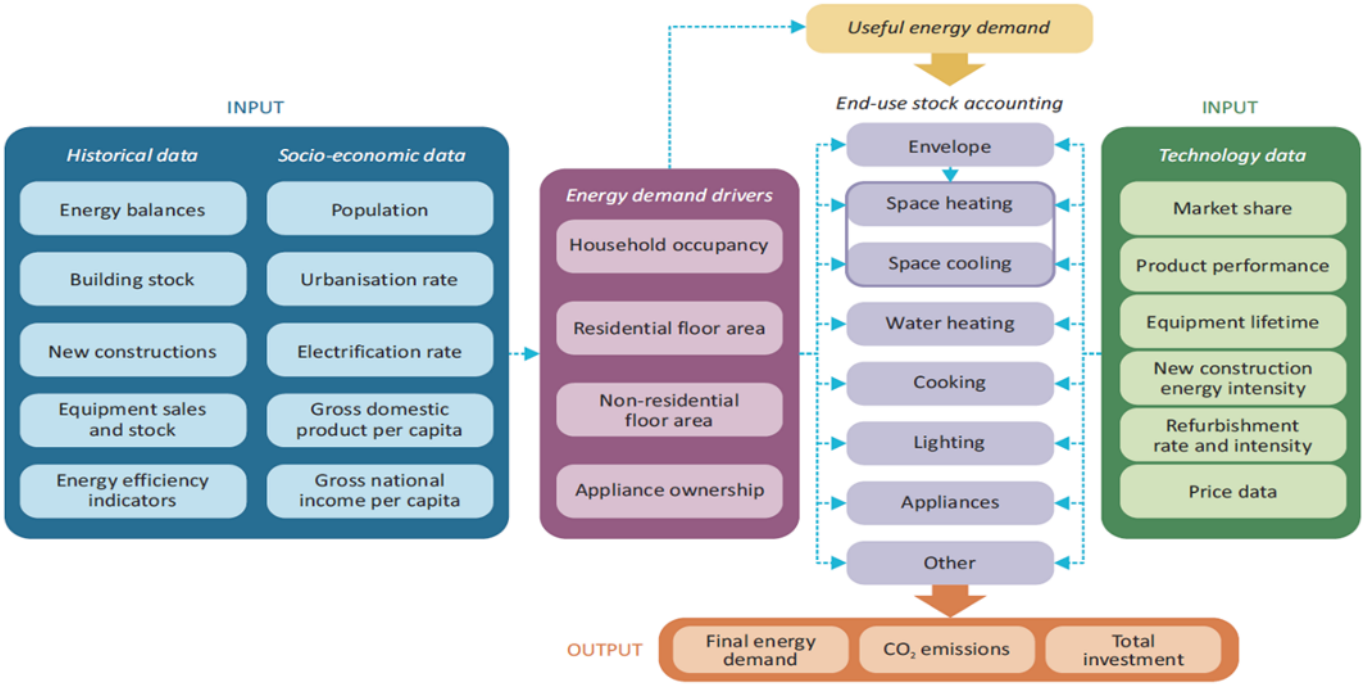
but some are useful

George E.P. Box

(Statistician)

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

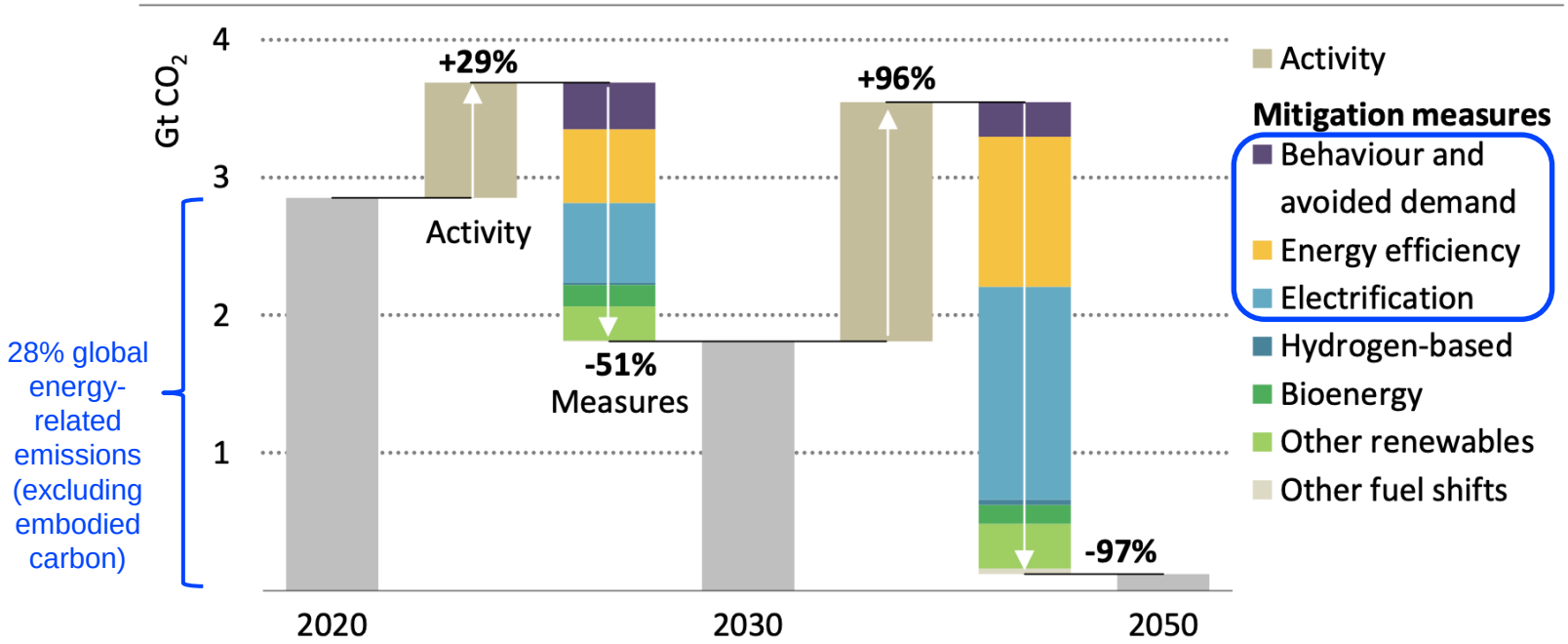
Example: IEA's Buildings Energy Model (ETP)



Energy models are essential to better estimating the energy efficiency potential

Buildings in a Net Zero Emissions Scenario

Global direct CO2 emissions reductions by mitigation in buildings in the NZE



Electrification and energy efficiency account for nearly 70% of buildings-related emissions reductions through to 2050

Source: IEA (2021), Net Zero by 2050, IEA, Paris https://www.iea.org/reports/net-zero-by-2050

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 tool resources are already available

Source: US DOE BEST Directory and Copenhagen Center for Energy Efficiency

Session Activity

International Energy Agency

Activity - Energy efficiency potential in buildings for net-zero

You are about to start the development of a policy package for your Country. Describe: 1) data you need collect 2) analytical results you need to get before you start on this process 3) barriers to improving energy efficiency in buildings

International Energy Agency

Energy Efficiency Training Week

Energy Efficiency in Buildings Policy in SSA

Presented by Elizabeth Wangeci Chege

March 2024

SUSTAINABLE ENERGY FOR ALL

Mission Efficiency

The Powers of Energy Efficiency

Energy Efficient Life

The Powers of Energy Efficiency

Energy efficiency may not be visible, but it has power.

The power to create jobs, to grow sustainable economies and shield them from energy crises, and to accelerate the vision of SDG 7 and the Paris Agreement

VISIT THE WEBSITE

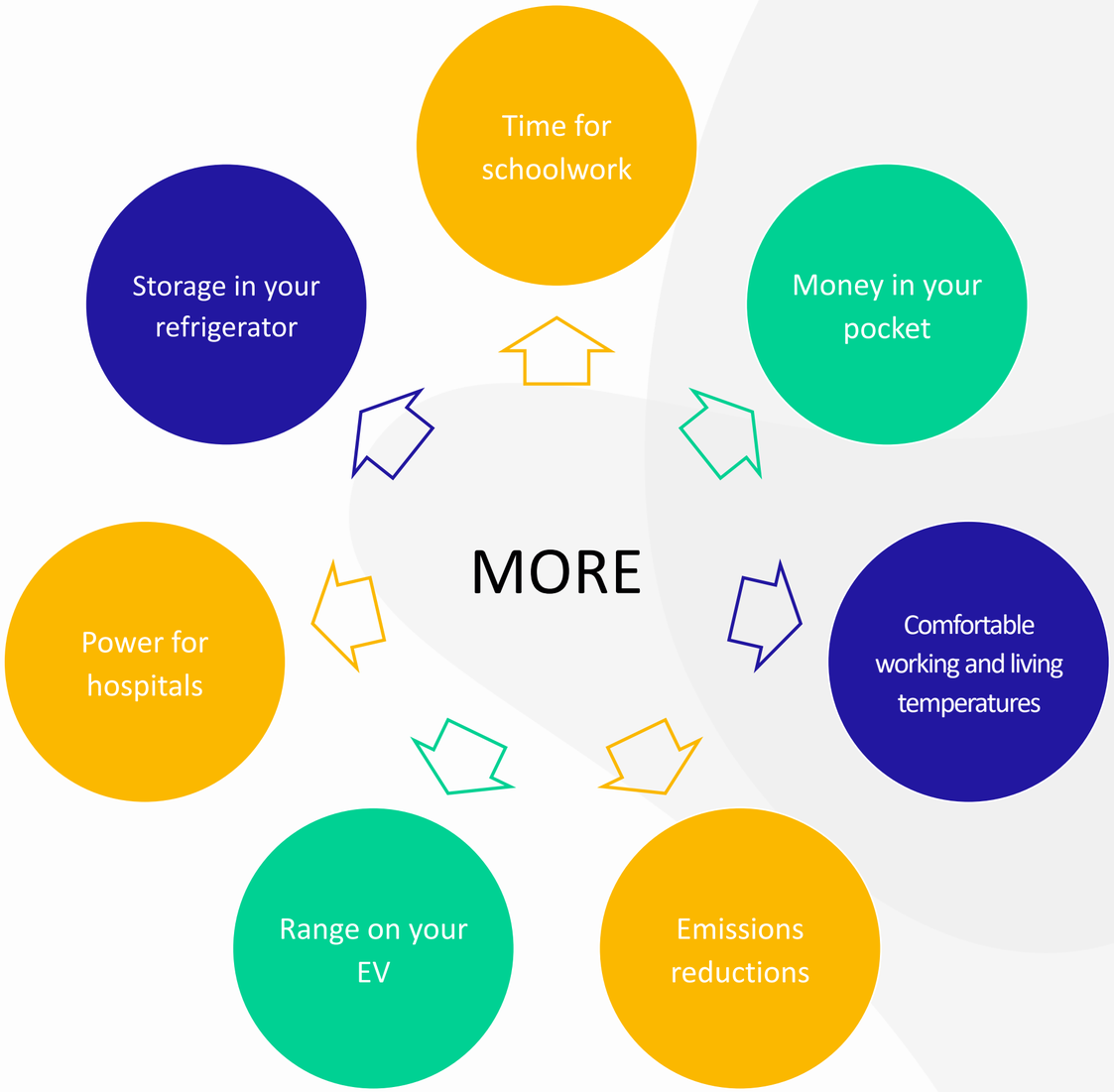
Energy efficiency powers:

- Access to modern and sustainable energy for all
- Off-grid electrification
- Energy security and fights inflation
- Progress on climate change and just, equitable energy transitions
- Sustainable development
- Modern lives and livelihoods

Join us at Mission Efficiency to harness the power of energy efficiency for people, the planet, and achieving SDG 7.

An energy efficient life is **more, not less.**

More Comfort
More Money
More Power

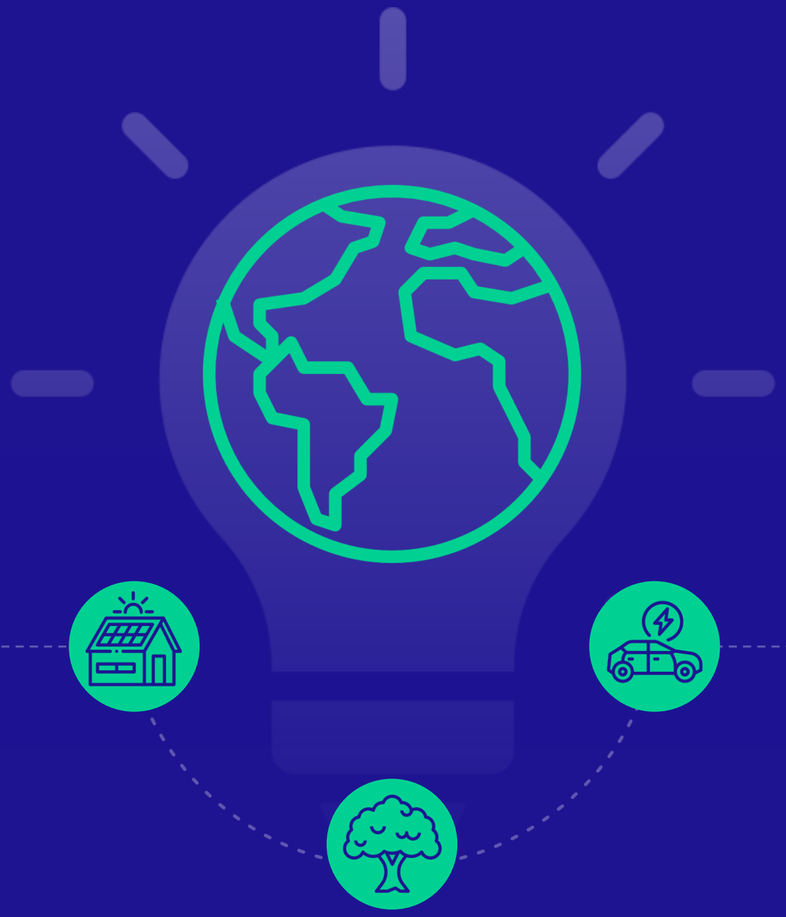


missionefficiency.org

Energy-Efficient Lives Add Up to **an Energy-Efficient World**

BIG CHANGES

AN ENERGY EFFICIENT WORLD



Small actions

Energy efficient lives

Mission Efficiency

SUSTAINABLE ENERGY FOR ALL

Help the planet.
Help your wallet.

An Energy Efficient Life is accessible to all.

Current Challenges

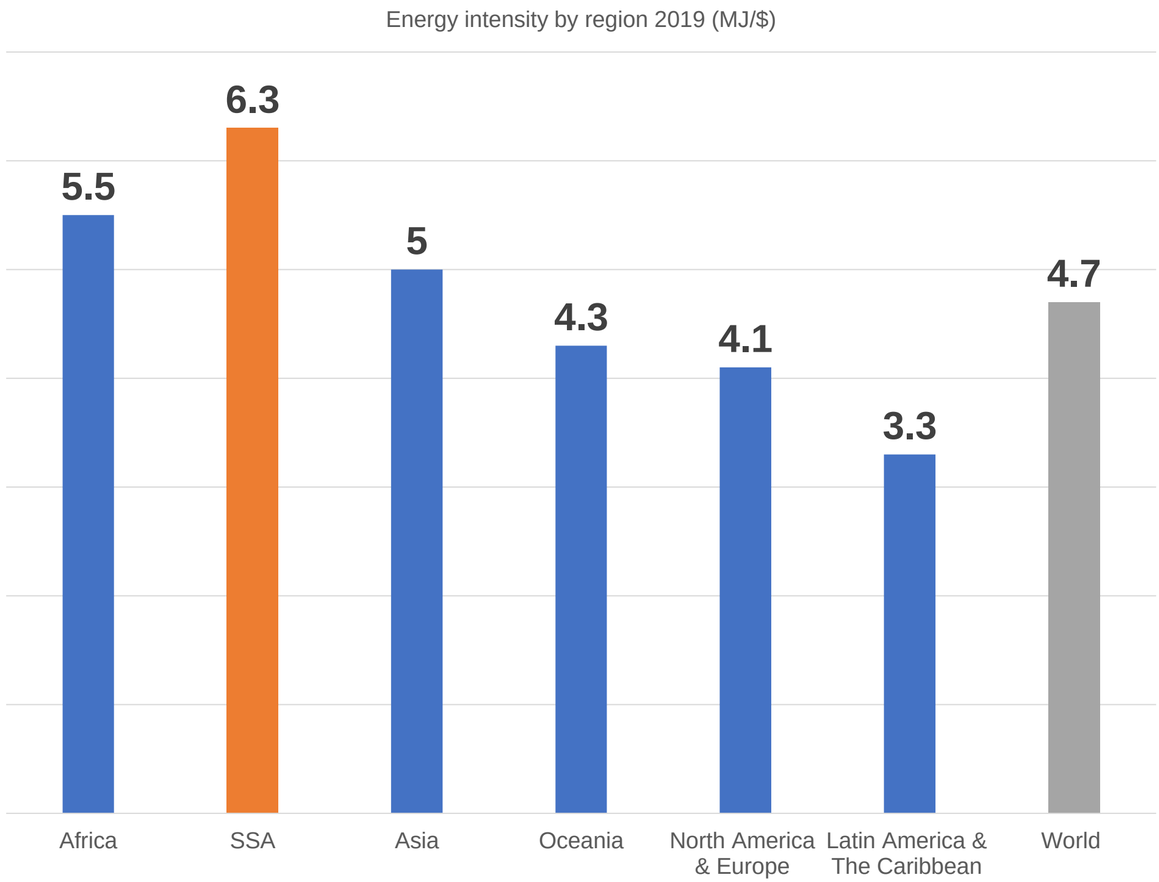
The world is off track to meet SDG 7.3

Significant efforts are needed to put the world back on track

- The energy intensity rate of improvement has significantly slowed down in recent years.
- It currently takes 4.7 MJ (megajoules) of energy to generate USD 1 of economic activity globally.
- To achieve SDG7.3 **the world must achieve an average of 3.2** annual improvement – compared to the initial annual target of 2.6.

A clear urgency for energy efficiency in Africa

- **Africa is the least efficient region** with 5.5 MJ/USD GDP, followed by Asia with 5.0 MJ/USD GDP while **SSA** uses 6.3 MJ of energy to generate 1 USD of economic activity.

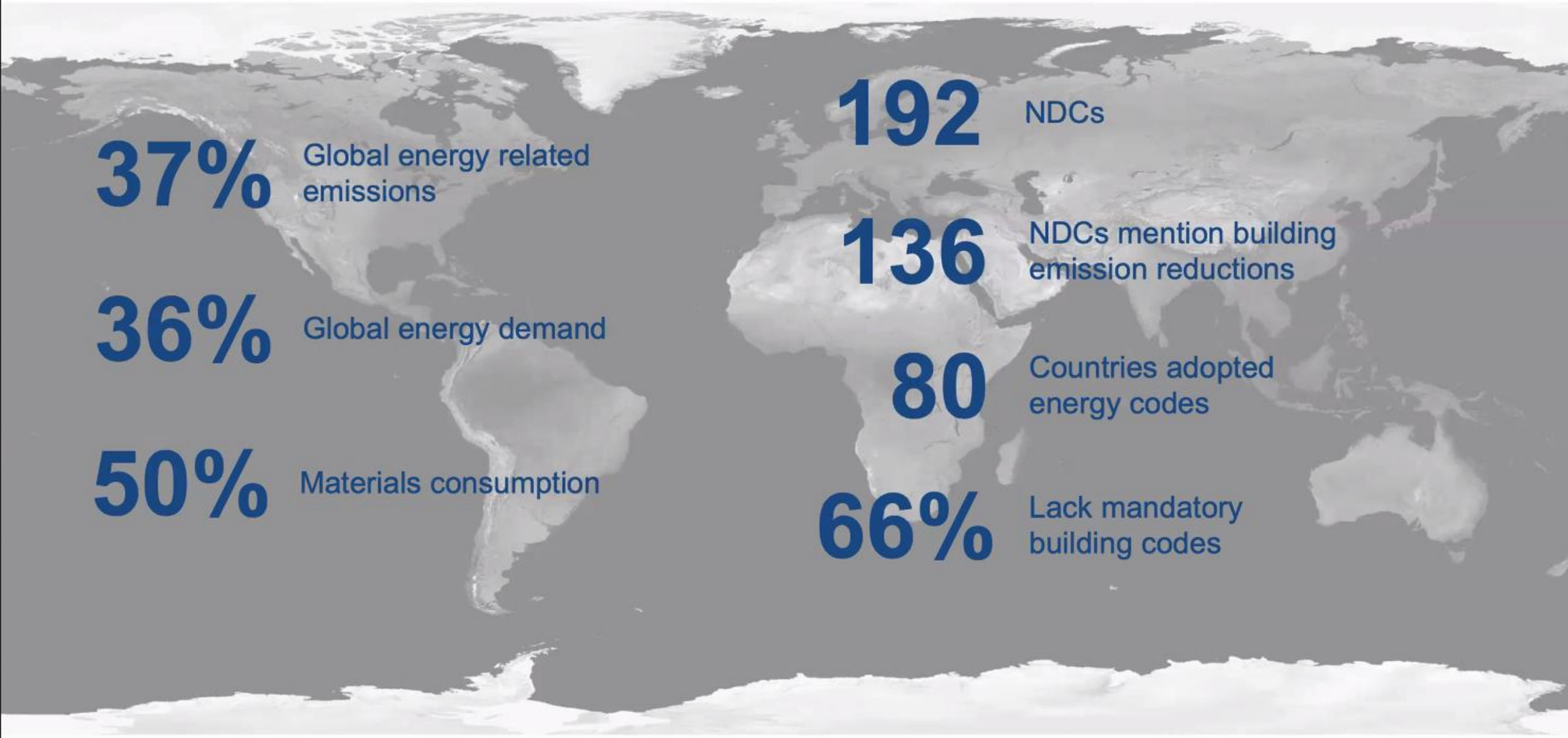


Source: ESMAP, 2022
Chart: Energy intensity in Africa includes SSA.

Where do we stand?

ADVANCING NET ZERO

WORLD GREEN BUILDIN COUNCI



37% Global energy related emissions

36% Global energy demand

50% Materials consumption

192 NDCs

136 NDCs mention building emission reductions

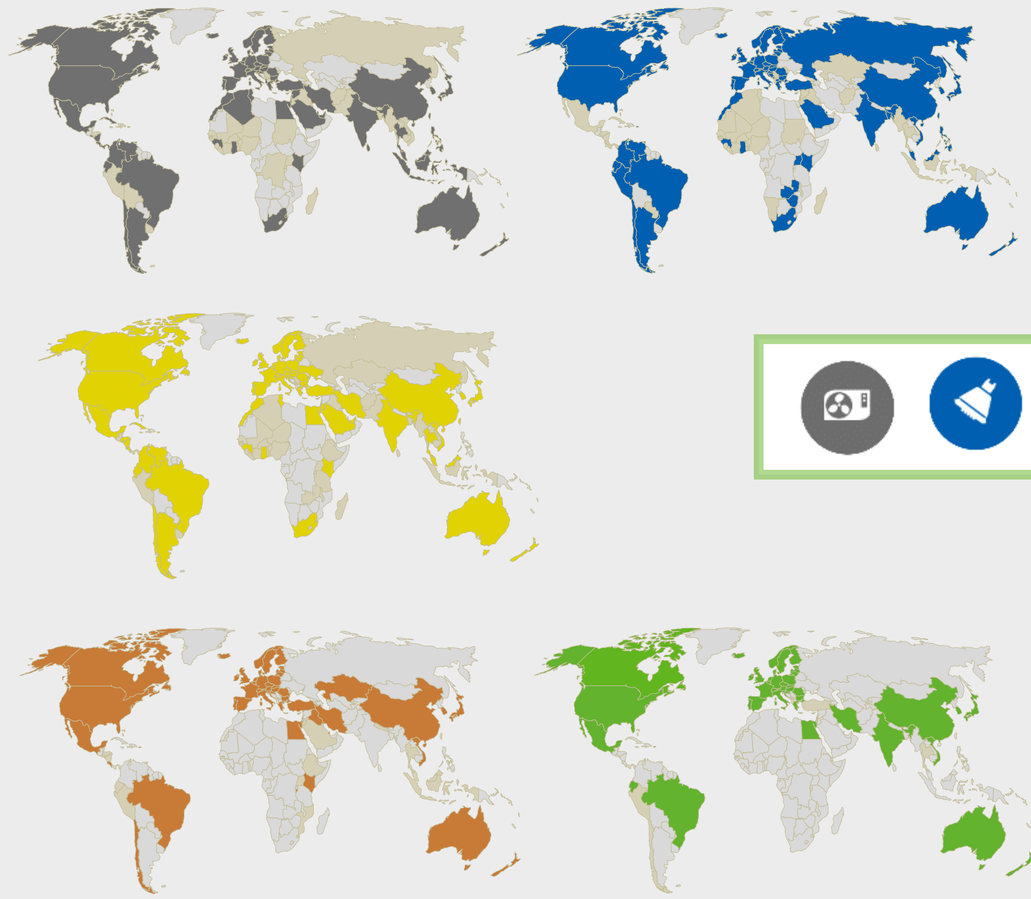
80 Countries adopted energy codes

66% Lack mandatory building codes

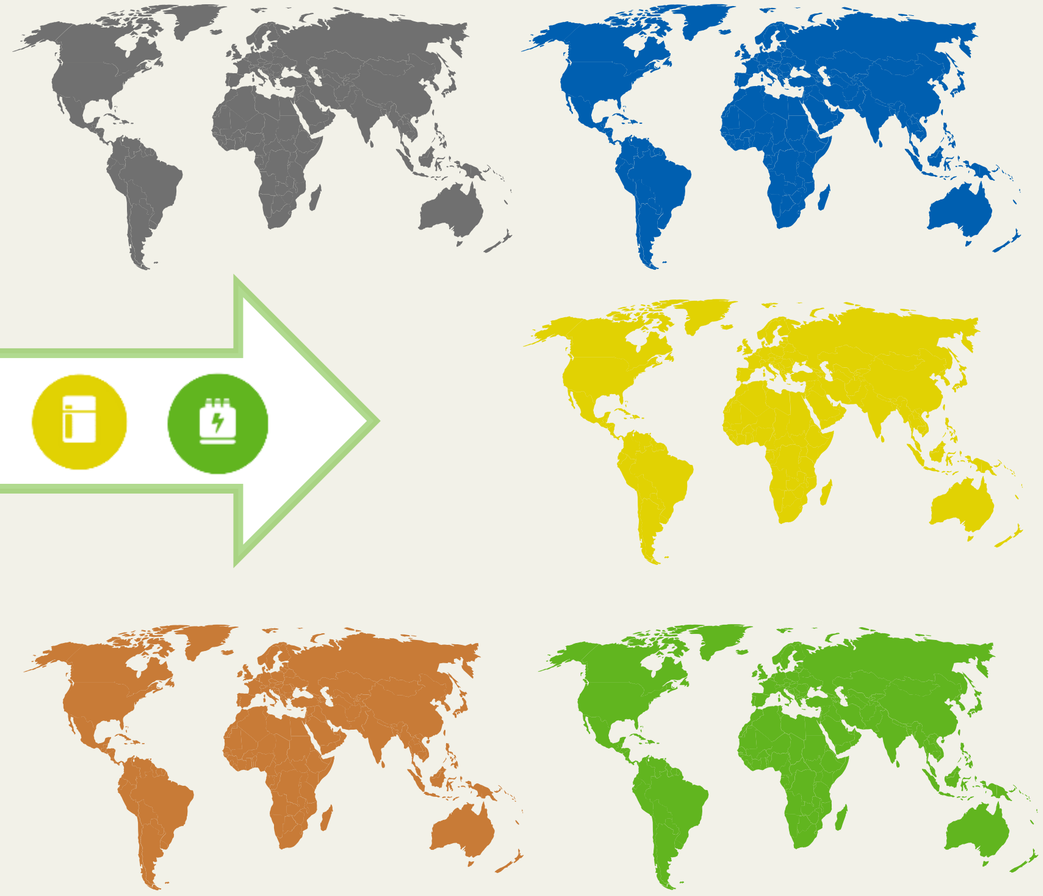
Based on data from Global Alliance of Buildings

Most Developing Countries Do Not Have Policies in Place Today to Leapfrog to Efficient Products

MEPS in 2022: mostly in OECD Countries



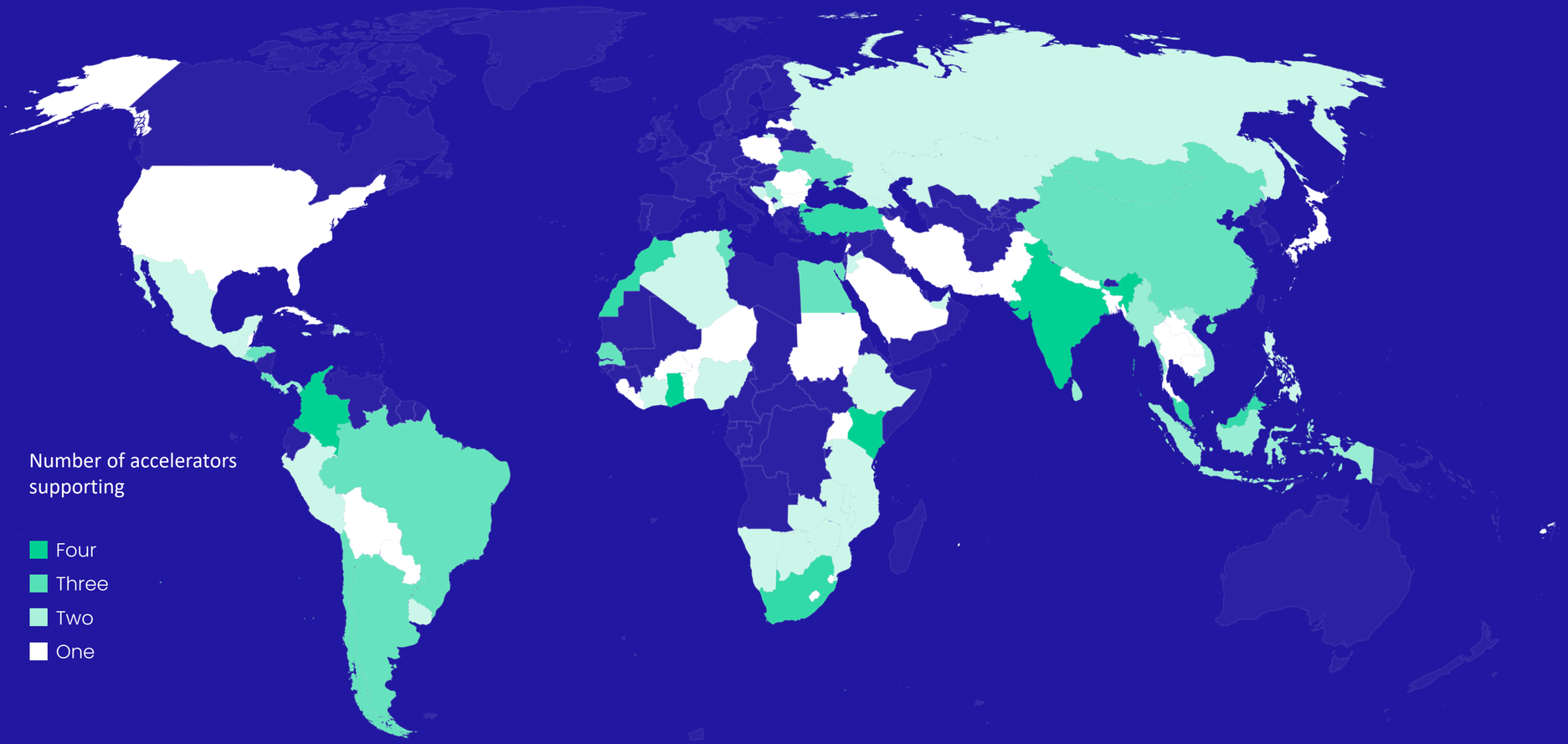
Our goal: MEPS in all countries!



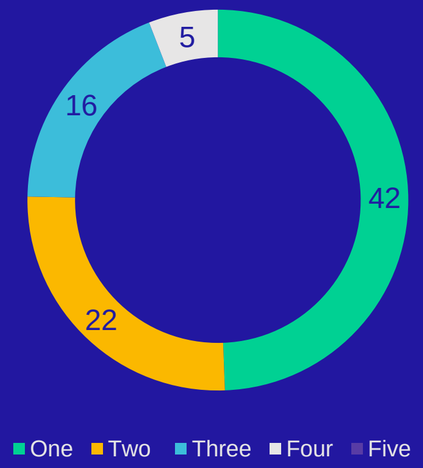
Source: UNEP

Mission Efficiency builds on the **Global Energy Efficiency Accelerator Platform**, which together:

- ✔ Has supported 85 countries to deliver energy efficiency progress
- ✔ Mobilized almost $180M in efficiency investment by 2020



Countries supported by one or more accelerators



$176.9M

investment mobilized

Motor Efficiency Global Alliance (MEGA)

1 2

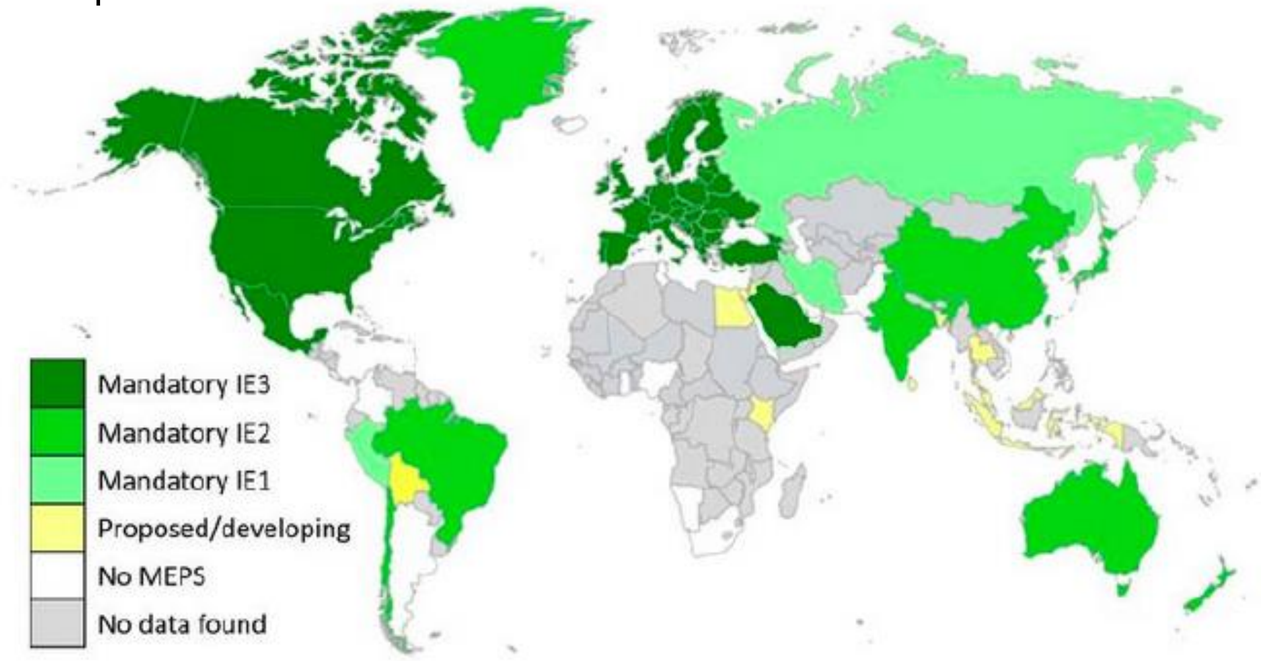
THE OPPORTUNITY

Electric motor systems use over 53% of global electricity and around 70% of global industrial electricity. New and existing technologies can reduce global energy demand of motor systems by 20% –30% with short payback periods.

THE MISSION

Transform the market for electrical motors in favour of higher efficiency motors (IE3), to help reduce electricity losses and CO2 emissions from electric motors in industry and buildings.

"Electric motor systems are the largest user of electricity – and offer large untapped opportunities to improve efficiency and curb emissions."



Motor MEPS around the World (Source: ISR-UC, 2018).

Existing Regulations, Standards, Incentives

Buildings in Sub-Saharan Africa are often energy-intensive due to poor insulation, inefficient appliances, and reliance on traditional lighting. Improving efficiency can significantly reduce energy demand, lowering greenhouse gas emissions and the strain on power grids.

- **Building Codes:** While not yet universal, several countries including Ghana, Rwanda, South Africa, and Uganda have updated their building codes in the last decade to incorporate energy efficiency requirements [*World Bank, Building foundations for a safe, green and inclusive built environment in Sub-Saharan Africa*].

- **Standards: Appliance Labeling Programs:** This empowers consumers to make informed decisions that can significantly reduce energy consumption [*USAID, Examining Energy Efficiency Issues in Sub-Saharan Africa*]. Ghana's appliance labeling program is an example of a successful initiative. Regional bodies like the Southern African Development Community (SADC) have adopted energy efficiency policy frameworks. Initiatives promoting energy-saving appliances like LEDs are underway.

Existing Regulations, Standards, Incentives

- **Financial Measures:** Some countries are offering tax breaks, rebates, and low-interest loans to property owners who undertake energy-efficient retrofits in existing buildings

- **NDCs and Building Efficiency:** While not every NDC explicitly mentions building efficiency, many African countries acknowledge the need for a holistic approach to energy. This opens the door for incorporating building efficiency measures into future NDCs.

Turning Point

Barriers to Implementation

- ✓ Limited Awareness,
- ✓ Financial Resources
- ✓ Technical Capacity Constraints

Driving Sustainability & Economic Growth

- ✓ Successful Initiatives, innovative technologies
- ✓ Case Studies on Energy Savings
- ✓ Energy Efficiency as a Service

Driving Sustainability & Economic Growth…1/

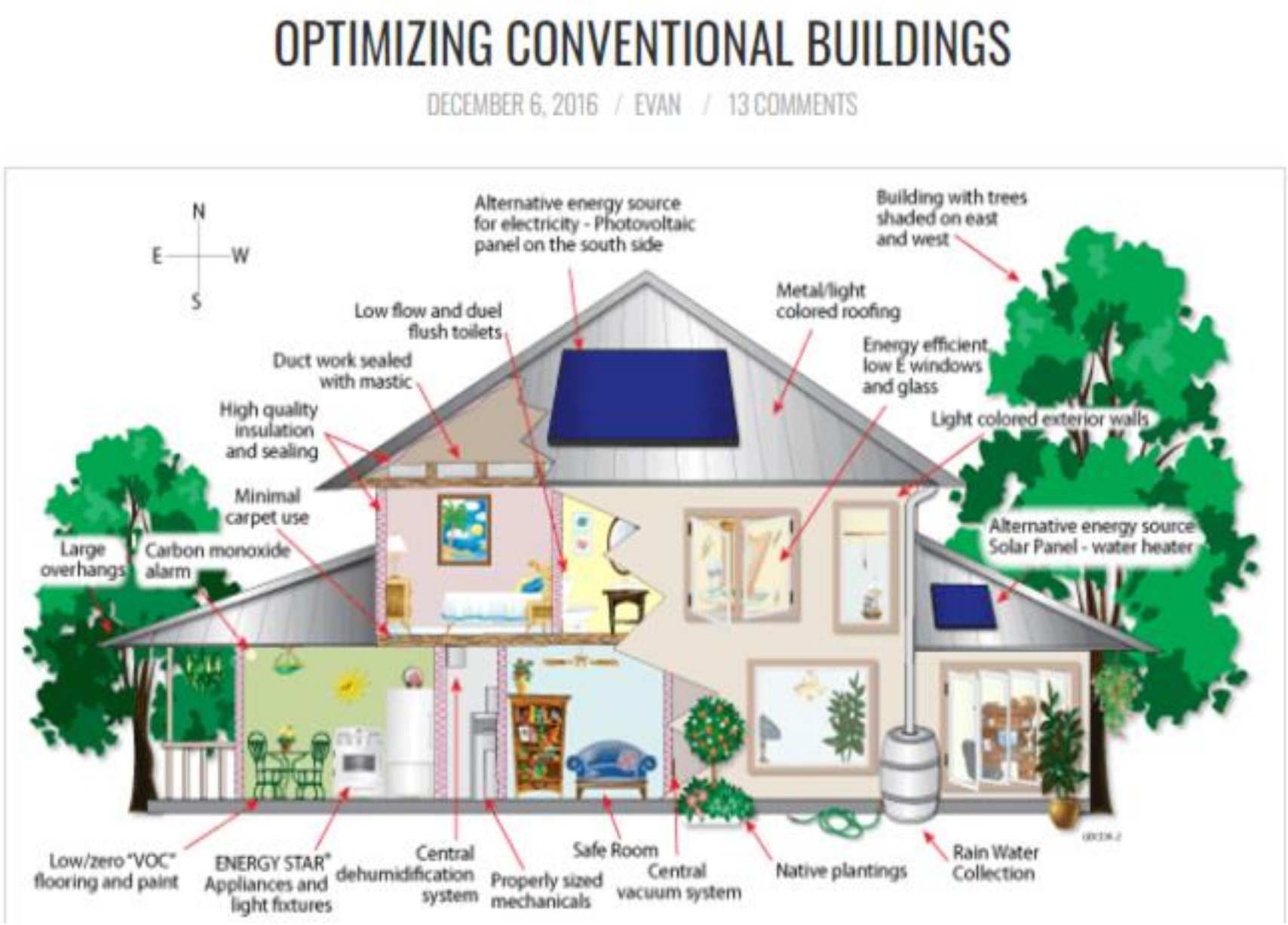
Globally known Green Products Ecolabels

WORLD ECOLABEL DAY

Driving Sustainability & Economic Growth...2/

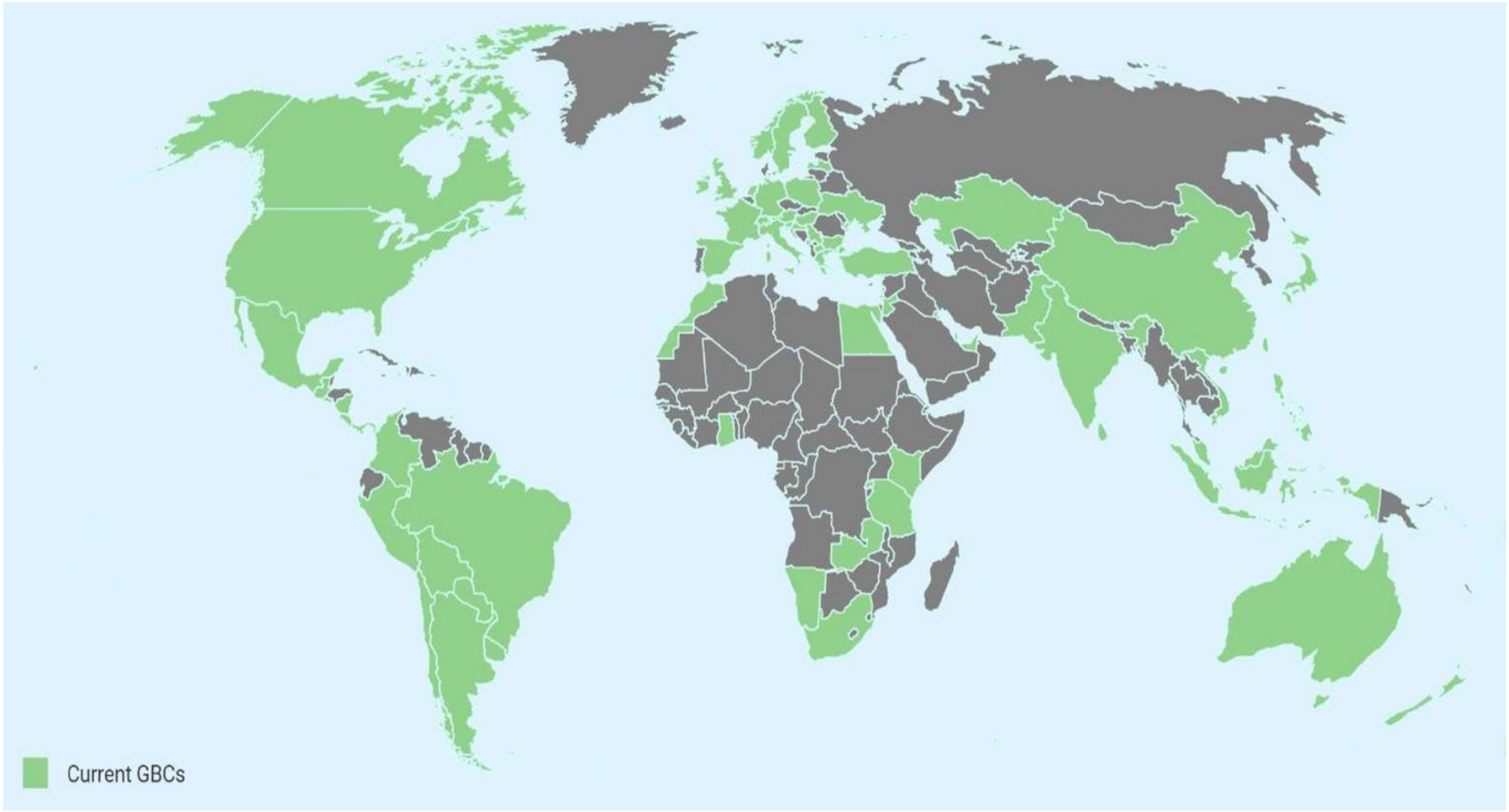
Retrofitting

Existing Buildings can be renovated to achieve high levels of energy performance and lower levels of embodied carbon to reduce fuel costs and improve thermal comfort.



Driving Sustainability & Economic Growth…3/

Green Building Councils



Advancing Net Zero

ADVANCING NET ZERO

WORLD GREEN BUILDING COUNCIL

A global campaign to accelerate total sector decarbonisation by 2050

Increase awareness and education of the urgency and achievability of net zero carbon buildings

Achieve alignment and commonality between GBC approaches and certification schemes

To expedite uptake in global markets by sharing market leadership examples

GLOBAL PROGRAMME PARTNERS

MOTT MACDONALD

lendlease

SOM

CBRE

Kingspan

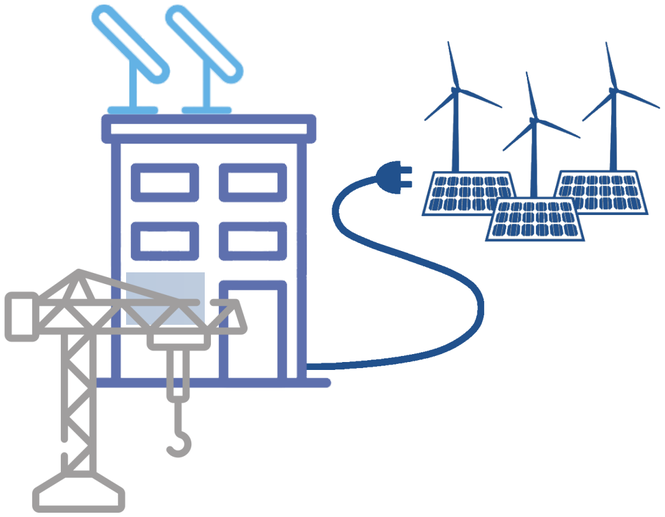
Schneider Electric

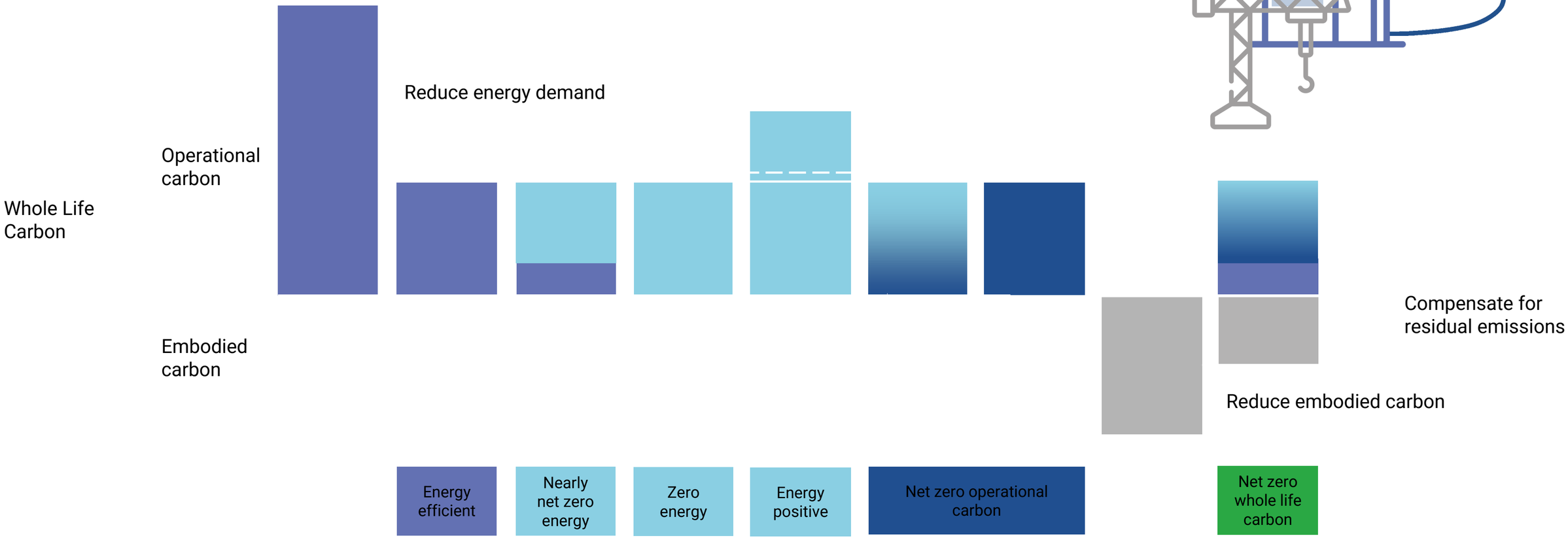
WE MEAN BUSINESS COALITION

Definitions: Net Zero Carbon Buildings

ADVANCING NET ZERO

WORLD GREEN BUILDING COUNCIL





EE in Buildings Vision:

By 2030, all new buildings, infrastructure and renovations will have at least 40% less **embodied carbon** with significant **upfront carbon** reduction, and all new buildings must be net zero **operational carbon**.

By 2050, new buildings, infrastructure and renovations will have net zero **embodied carbon**, and all buildings, including existing buildings, must be net zero **operational carbon**.

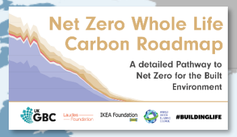
ADVANCING NET ZERO

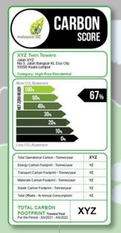
WORLD GREEN BUILDING COUNCIL

GBCs Advancing Net Zero

ADVANCING NET ZERO

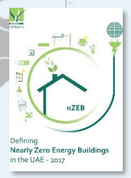
WORLD GREEN BUILDING COUNCIL

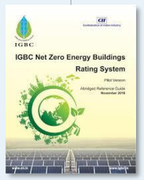


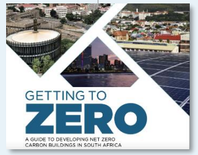


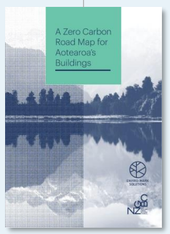
LEED Zero

PROGRAMA NET ZERO









- Africa
- Americas
- Asia Pacific
- Europe
- MENA

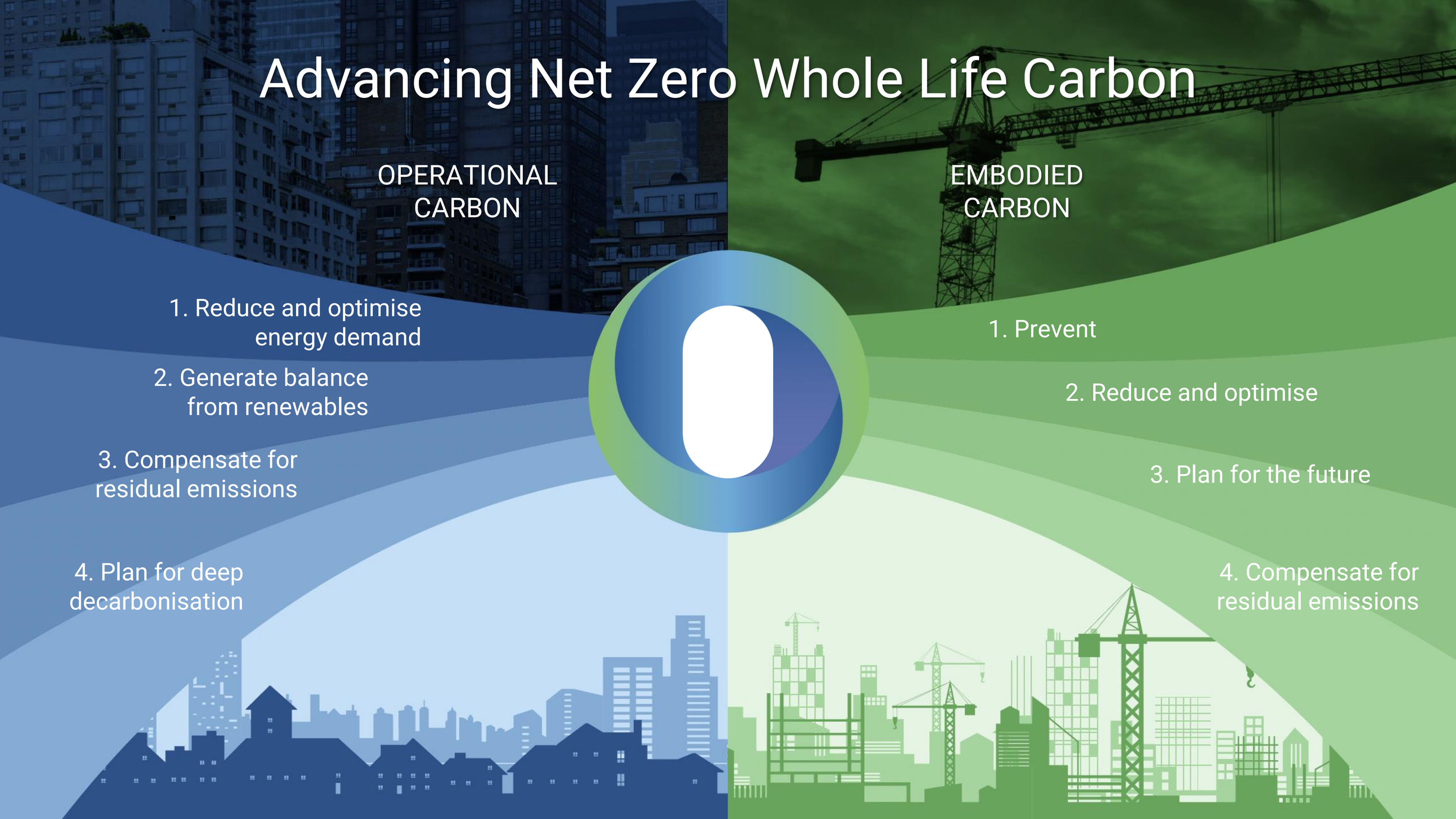
Advancing Net Zero Whole Life Carbon

OPERATIONAL CARBON

1. Reduce and optimise energy demand
2. Generate balance from renewables
3. Compensate for residual emissions
4. Plan for deep decarbonisation

EMBODIED CARBON

1. Prevent
2. Reduce and optimise
3. Plan for the future
4. Compensate for residual emissions



Advancing Net Zero Whole Life Carbon

Leadership: Net Zero Carbon Buildings Commitment (businesses & organisations)

2030

By 2030, **existing buildings** reduce energy consumption and eliminate emissions from energy and refrigerants.

By 2030, **new developments and major renovations** to also achieve **maximum reduction** in embodied carbon.

Where necessary, compensate for residual emissions.

Mainstream: All buildings globally

By 2030, **all new buildings, infrastructure and renovations** will have at least **40% less embodied carbon** with significant upfront carbon reduction.

All **new buildings** must be **net zero operational carbon.**

Advocate through business activities for **all buildings to be net zero whole life carbon** by 2050.

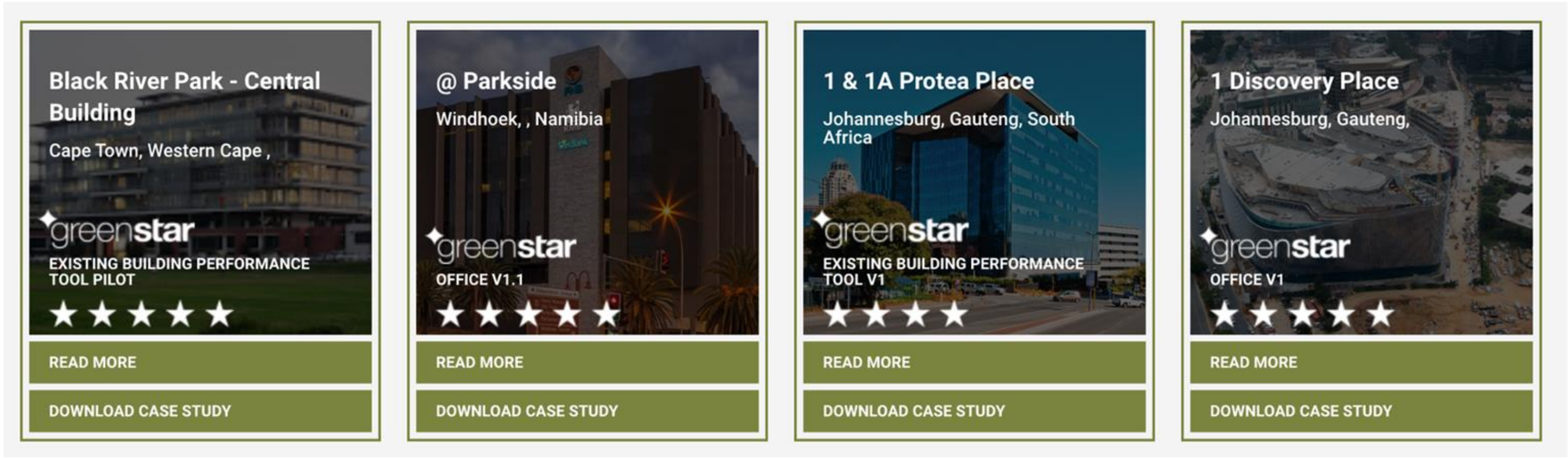
2050

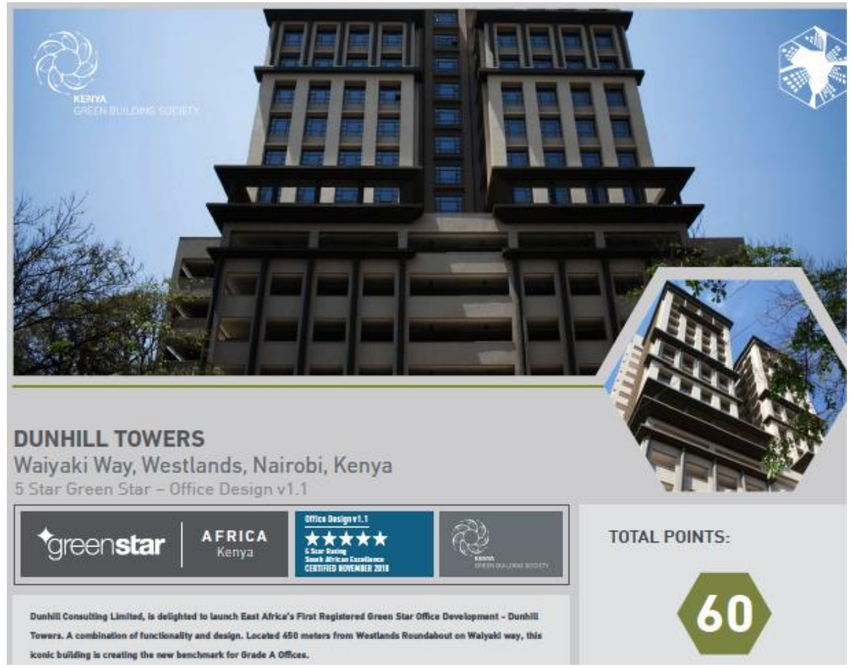
By 2050, **all new buildings, infrastructure and renovations** will have **net zero embodied carbon.**

All buildings, including existing buildings must be **net zero operational carbon.**

Green Building Rating Systems and Certification levels: USGBC LEED

Buildings Certified to Green Star Africa





Green Building Rating Systems and Certification levels: EDGE

An innovation of IFC, EDGE (“Excellence in Design for Greater Efficiencies”) is an online platform- a free software-, a green building standard and a certification system for use globally.

A project that reaches the EDGE standard of 20% less energy use, 20 percent less water use, and 20 percent less embodied energy in materials compared to a base case building can be independently certified.

https://edgebuildings.com/about/about-edge/

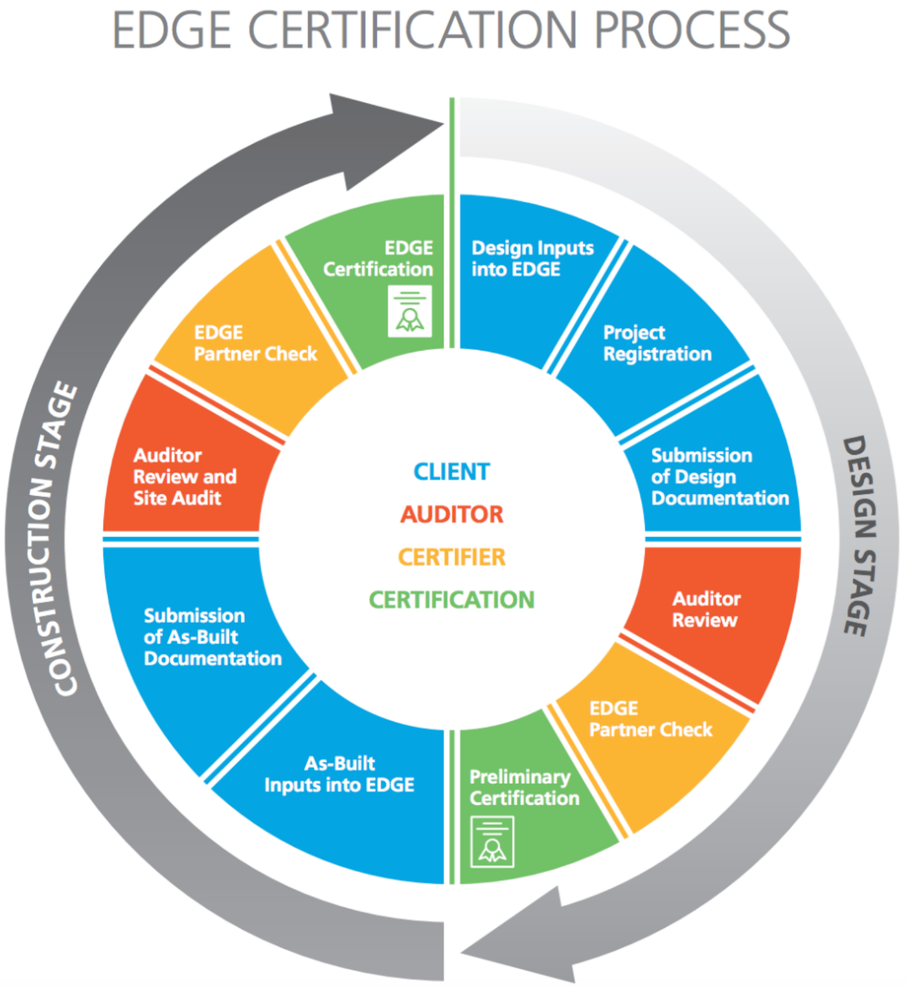
Excellence In Design For Greater Efficiencies

Edge

20%

PASS

FAIL



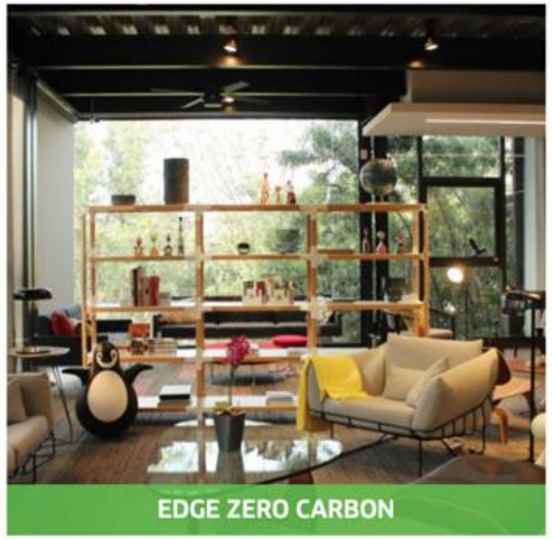
Buildings Certified to EDGE Net Zero

Stallion Laboratories, Pvt. Ltd. (Unit II)

Offices in India

ProCredit Bank Bulgaria Head Office

Offices in Bulgaria



Ufficio BJX

Offices in Mexico

ArthaLand Century Pacific Tower

Offices in Philippines

Some Green Buildings adopting EE

ABSA Bank Kenya Portfolio

Offices in Kenya

335 Rhapta

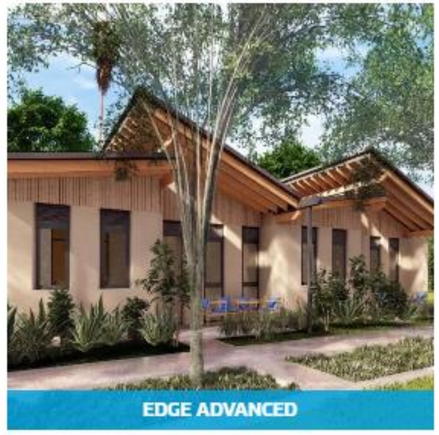
Homes in Kenya

Signature Healthcare Warehouse

Warehouses in Kenya

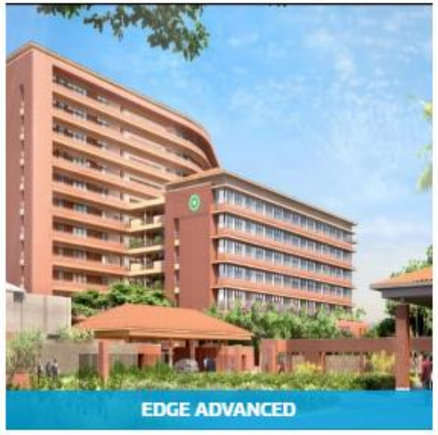
Caxton House

Offices in Kenya



Mvule Gardens by 14 Trees

Homes in Kenya



The Aga Khan University Centre Nairobi

Education in Kenya

KRIL Hospital

Hospitals in Kenya

Purple Tower

Offices in Kenya

Future Outlook

Mission Efficiency

Mission Efficiency

An Energy Efficiency Ecosystem

missionefficiency.org

November 2023

The energy efficiency opportunity

Quick

Energy efficiency can be done today

Local

Energy efficiency investment brings local jobs and local benefits

Ready

Energy efficiency policy and technology solutions are available

Beneficial

Energy efficiency brings social, economic and health benefits

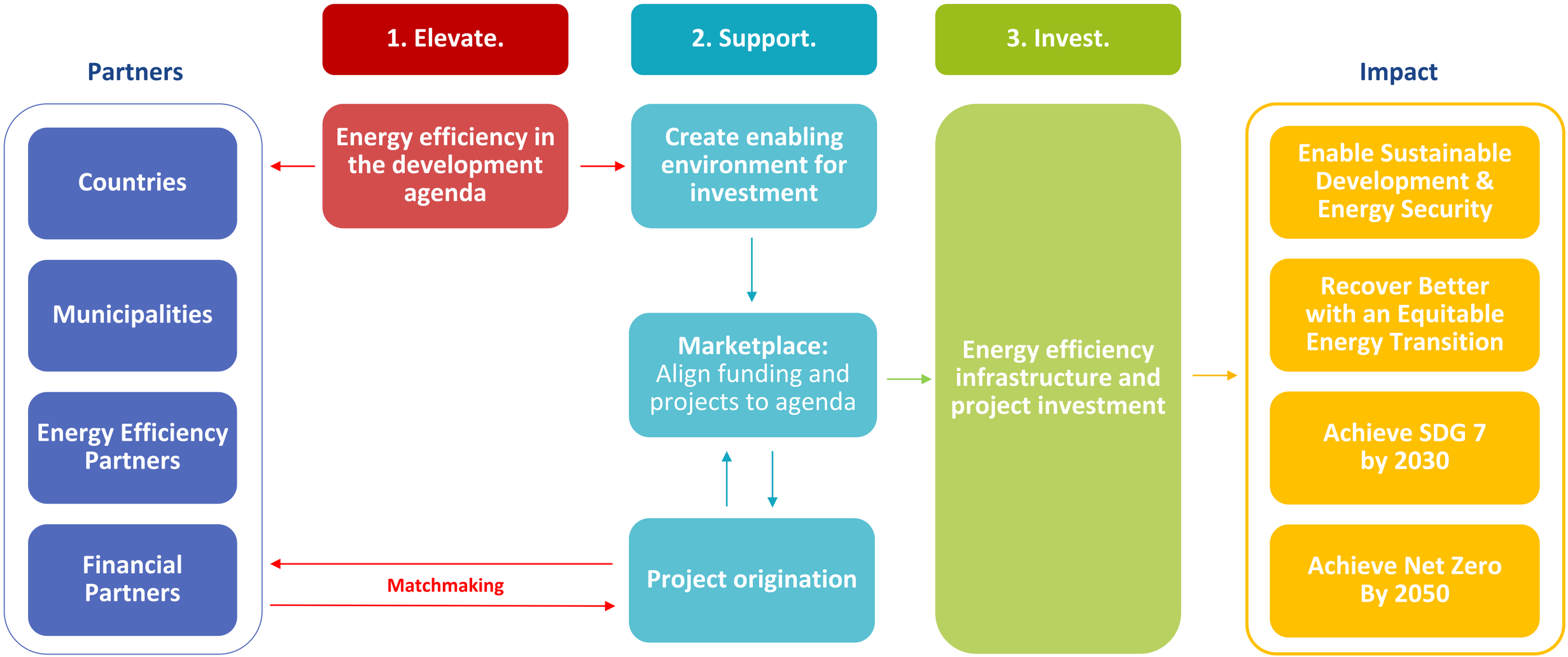
Significant

Energy efficiency to deliver over 40% of the Paris Agreement

Cost effective

Energy efficiency can cost-effectively support net-zero by 2030

Mission Efficiency Activities



www.MissionEfficiency.org

An Energy Efficiency Ecosystem

ARGENTINA CANADA COLOMBIA DENMARK ESTONIA ETHIOPIA GHANA HONDURAS HUNGARY INDIA IRELAND ITALY KENYA PORTUGAL SENEGAL UNITED KINGDOM

non-exhaustive list of ecosystem partners

An Energy Efficiency Ecosystem. Country Engagement

Mission Efficiency works closely with country governments and international development partners to identify energy efficiency potential, match efficiency opportunities with solutions and support implementation.

ACTIVITIES INCLUDE:

INDIA

- ✔ Support India's G20 Presidency and Mission LiFE.

KENYA

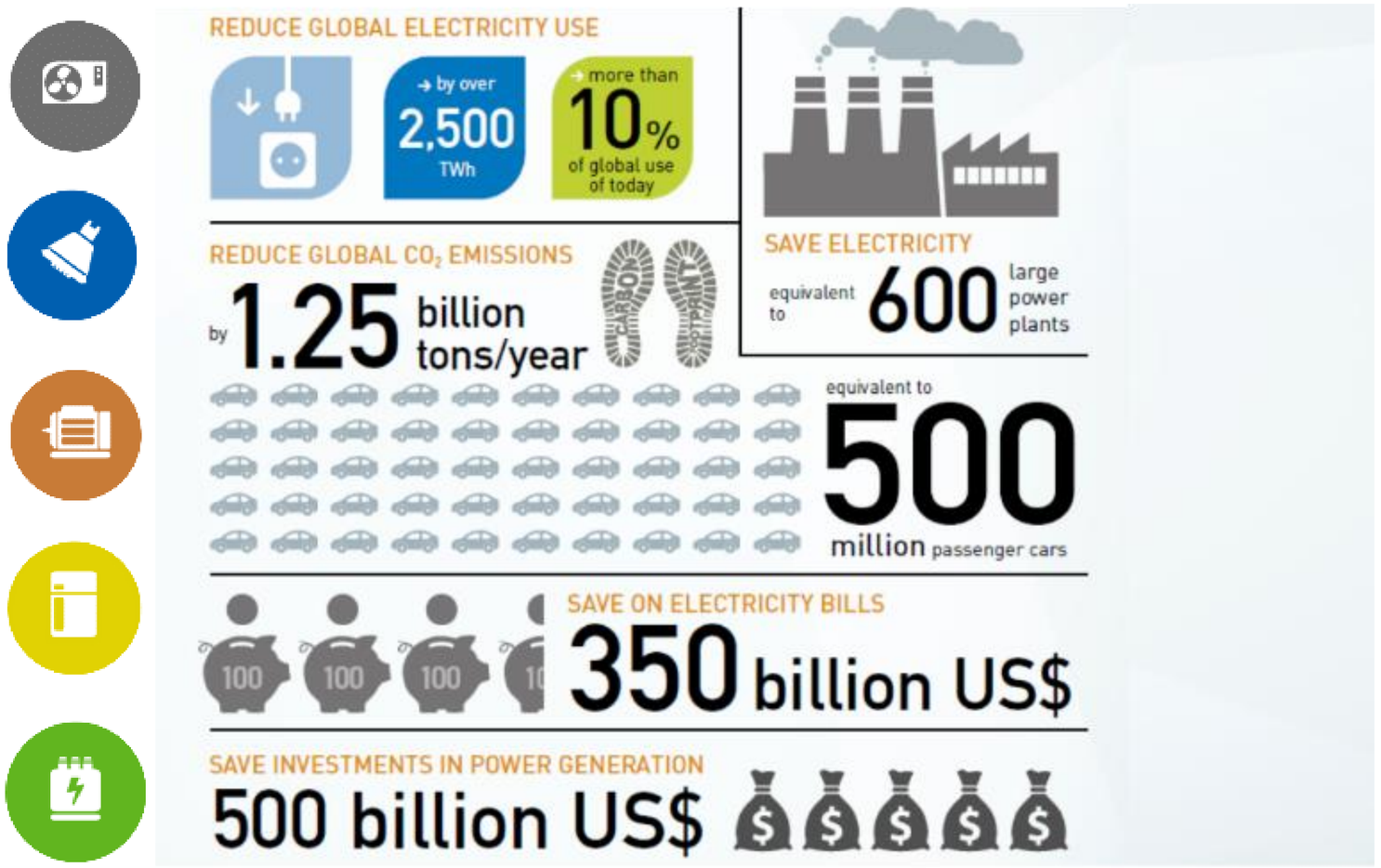
- ✔ Support development and implementation of the Kenya National Energy Efficiency and Conservation Strategy involving coordination of high impact priority projects for the marketplace.

GHANA

- ✔ Creating an ecosystem of Energy Efficiency actors as well as matchmaking between project developers and project financiers for energy efficiency growth.

THREE PERCENT CLUB COUNTRY MEMBERS

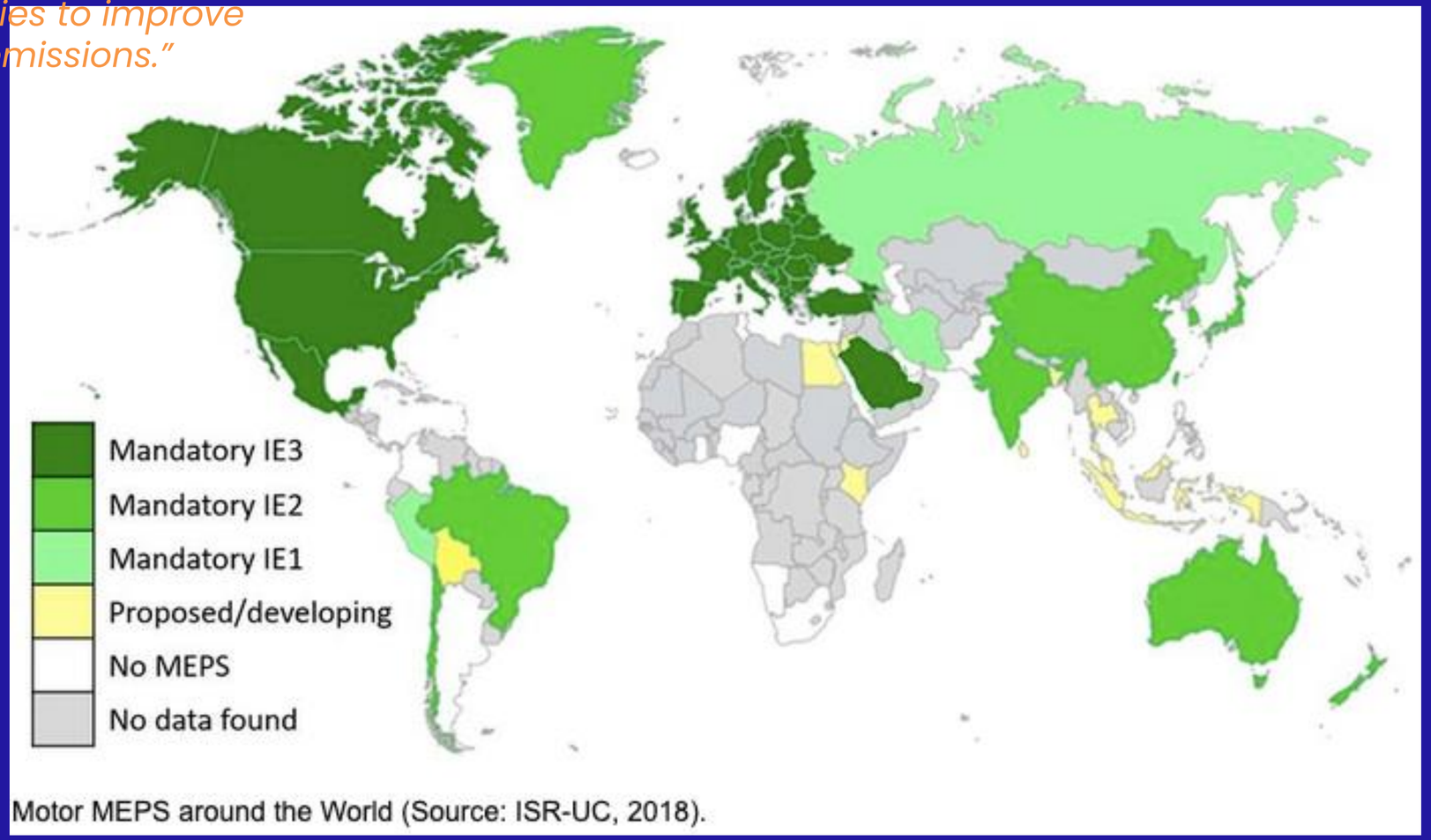
The Potential of Improving Energy Efficiency in the Top 6 High-consuming Products



Sources: UNEP, 2014 (estimated annual figures for 2030)

MEPS around the world

"Electric motor systems are the largest user of electricity – and offer large untapped opportunities to improve efficiency and curb emissions."



Motor MEPS around the World (Source: ISR-UC, 2018).

We are seeking to drive progress on energy efficiency

Elevate energy efficiency in personal, organizational and global agendas - a clear narrative, convening partners, matching solution offers and advocating for energy efficiency.

Support energy efficiency with strategic and technical assistance by partners for progress in countries on key issues in high impact sectors, across multiple sectors or economy wide.

Invest in energy efficiency with coordinated and actionable project funding through loans, grants and incentives for infrastructure and projects by countries, funds and financial institutions.

Energy Efficiency Market Readiness

The outcomes of the Energy Efficiency Financing Charette included the creation of four taskforces to work together in supporting market readiness for energy efficiency investment:

Energy Efficiency Narrative Taskforce

To reframe key messages for a range of audiences on the benefits, experiences and feelings received from energy efficiency.

Widening the Net Taskforce

Identification of key partners and socializing energy efficiency investment with country/city governments, solution providers and capital markets.

Solutions Selector Tool Taskforce

Building on years of success with the EBRD Green Technology Selector and Carbon Trust's work, this taskforce will work to further expand the tool for use across more countries and to capture all bankable energy efficiency solutions (technologies, services) and the policies that enable energy efficiency investment.

Mission Efficiency Marketplace Taskforce

Supporting market readiness for energy efficiency investment, including through a facility to de-risk energy efficiency finance, through project origination and matchmaking and through collective support from partner initiatives to enable integrated investments and reduce risk, cost and time for financial institutions and investors.

Mission Efficiency Marketplace

The **Mission Efficiency Marketplace** is a platform connecting energy efficiency projects with funding opportunities.

Mission Efficiency focuses on select countries, convening key players to identify impactful energy-saving projects and potential funders. We create investment-grade projects, offering de-risking instruments to unlock financing and accelerate progress.

Mission Efficiency Marketplace three-step models

Workshops that convey key players to identify both impactful projects and funders.	Loan guarantees, grants, energy savings insurances, performance-based contracts,	ESCOs, multilateral and bilateral institutions, private banks, philanthropic organizations.

Financing of energy efficiency projects

Step 1: Capacity building and technical assistance.

Ensuring the enabling environment for energy efficiency projects, including existence of appropriate policies, e.g., Minimum Energy Performance Standards (MEPS), knowledge on total cost of ownership, guidelines for sustainable public procurement, etc. Critically, robust data are needed to understand the current status of the market(s) being considered for energy efficiency, energy-savings modeling, and recommended solutions. Capacity Building/Technical Assistance is not profitable in and of itself, and yet without it, there is no project hence philantropy would be essential at this stage.

Step 2: Insurance.

Energy savings insurance can help mitigate the risks associated with energy efficiency investments. Over time, the energy savings can surpass the premiums paid, resulting in long-term savings and build trust in the market.

Step 3: Financing.

The Mission Efficiency Marketplace serves as a matchmaking platform for energy efficiency projects with financial institutions and ESCOs.

Mission Efficiency

Call to Action

2023: the Year of Global Momentum

March

IPCC Sixth Assessment Report
Demand-side measures and can reduce global GHG emissions in end-use sectors by 40–70% by 2050 compared to baseline scenarios

June

Versailles Statement during IEA EE Conference
46 governments “support stronger policies and actions” towards doubling the global annual rate of energy efficiency improvements this decade

July

G20 Energy Transition Ministers Meeting
Voluntary Action Plan on doubling the global rate of energy efficiency improvement by 2030 – recalled by G20 Leaders New Delhi Declaration

August

Africa Climate Summit Nairobi Declaration
Call to accelerate decarbonization of transport, industry and electricity sectors with efficient technologies

September

UNFCCC 1st Global Stocktake
Measures for systems transformations in industry, transport, buildings and other sectors must rapidly reduce process and energy emissions

October

COP28 Presidency, IRENA and the GRA Report
At COP28, the international community must agree to 3x renewable power generation capacity and 2x energy efficiency by 2030 to keep 1.5°C within reach

From Call to Action

- Endorse the Mission Efficiency Call to Action
- Submit a Mission Efficiency Pledge
- Submit a UN-Energy Compact
- Update or enhance your Nationally Determined Contributions

Your role at Mission Efficiency

Joining Mission Efficiency doesn't require a formal process. It's about your commitment and ambition to boost energy efficiency. Your dedication, be it through time, expertise, or advocacy, can significantly contribute to our shared goal of improving energy efficiency.

- **Be a Mission Efficiency Ambassador**. Advocate for more than doubling energy efficiency improvements this decade, enhanced collaboration and partnerships.
- **Inspire others** to engage with and support progress in energy efficiency through your example, commitments and enthusiasm towards energy efficiency.
- **Foster collaboration** to advance progress and leverage collective ressources. Invite other partners to join Mission Efficiency.
- **Promote exchange of knowledge** and lessons learned through the Taskforces or other activities.

Get involved

Mission Efficiency

Mission Efficiency

Join Mission Efficiency

Africa Energy Efficiency Policy in Emerging Economies Training Week

Buildings

Nairobi

18-22 March 2024

https://www.iea-events.org/energy-efficiency-training-week-nairobi

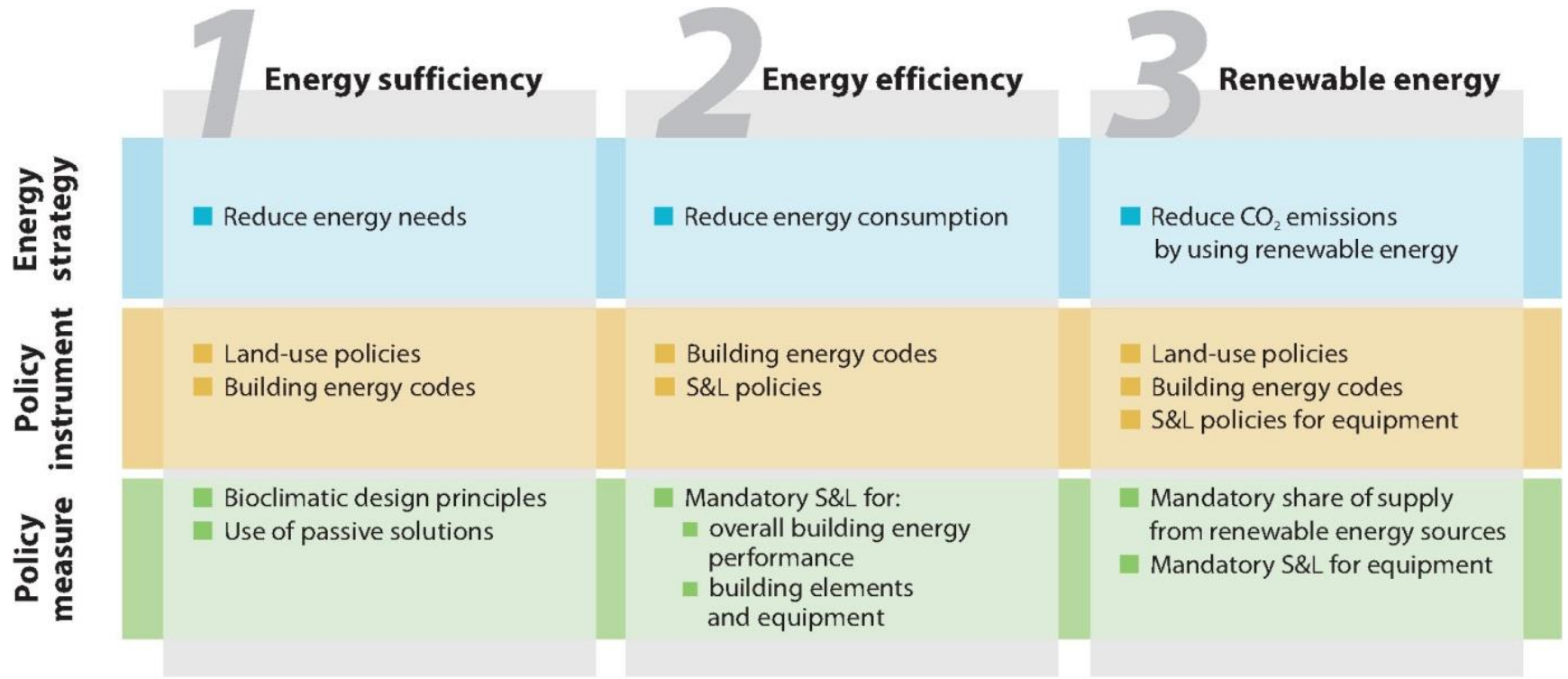
International Energy Agency

Energy Efficiency Training Week - Buildings - Day 1: 4. Toolkit - Energy efficiency building design

Efficient building design

The need for efficient passive design

Path to zero emissions or net zero energy buildings



Source: www.iea.org/publications/policypathwaysseries/

Efficient passive design

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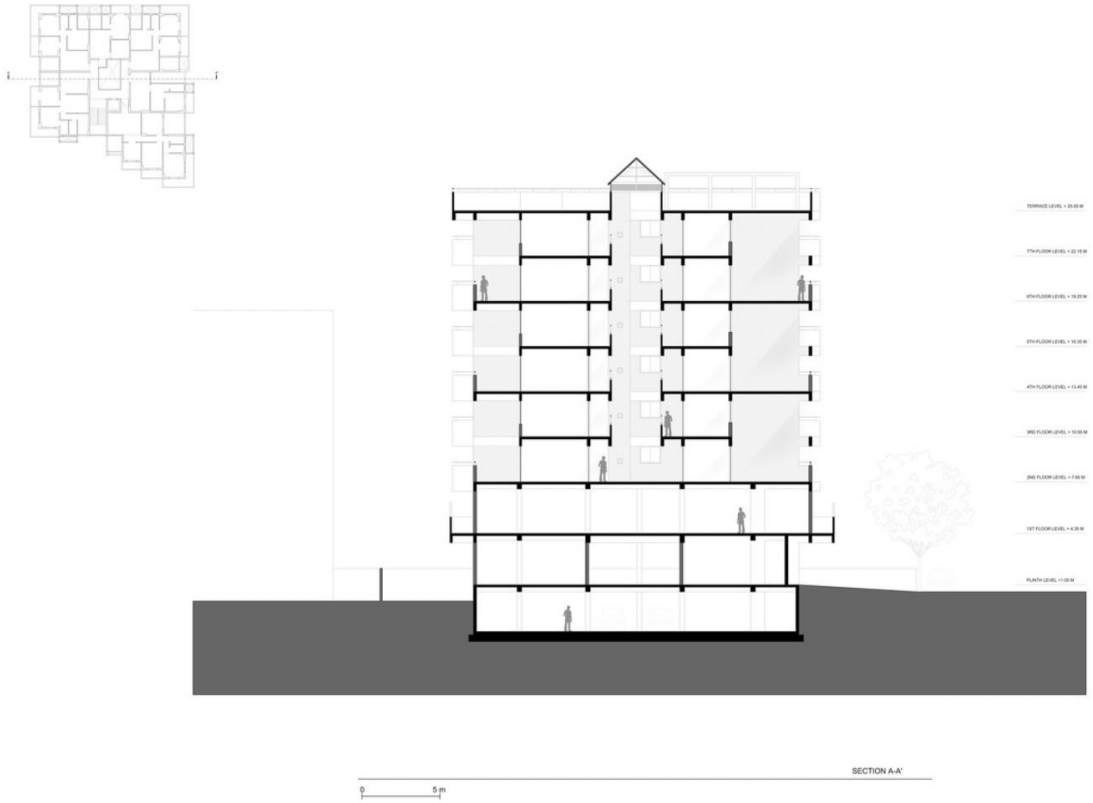
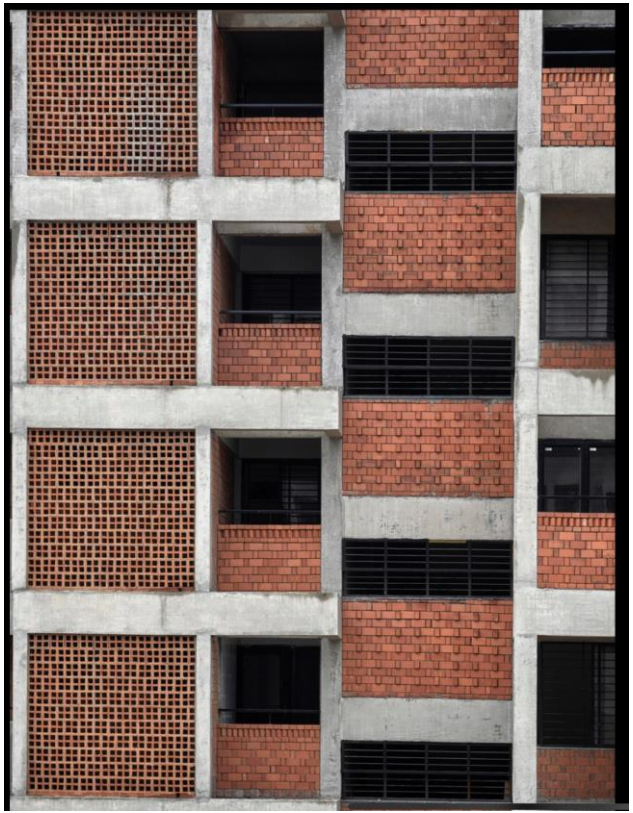
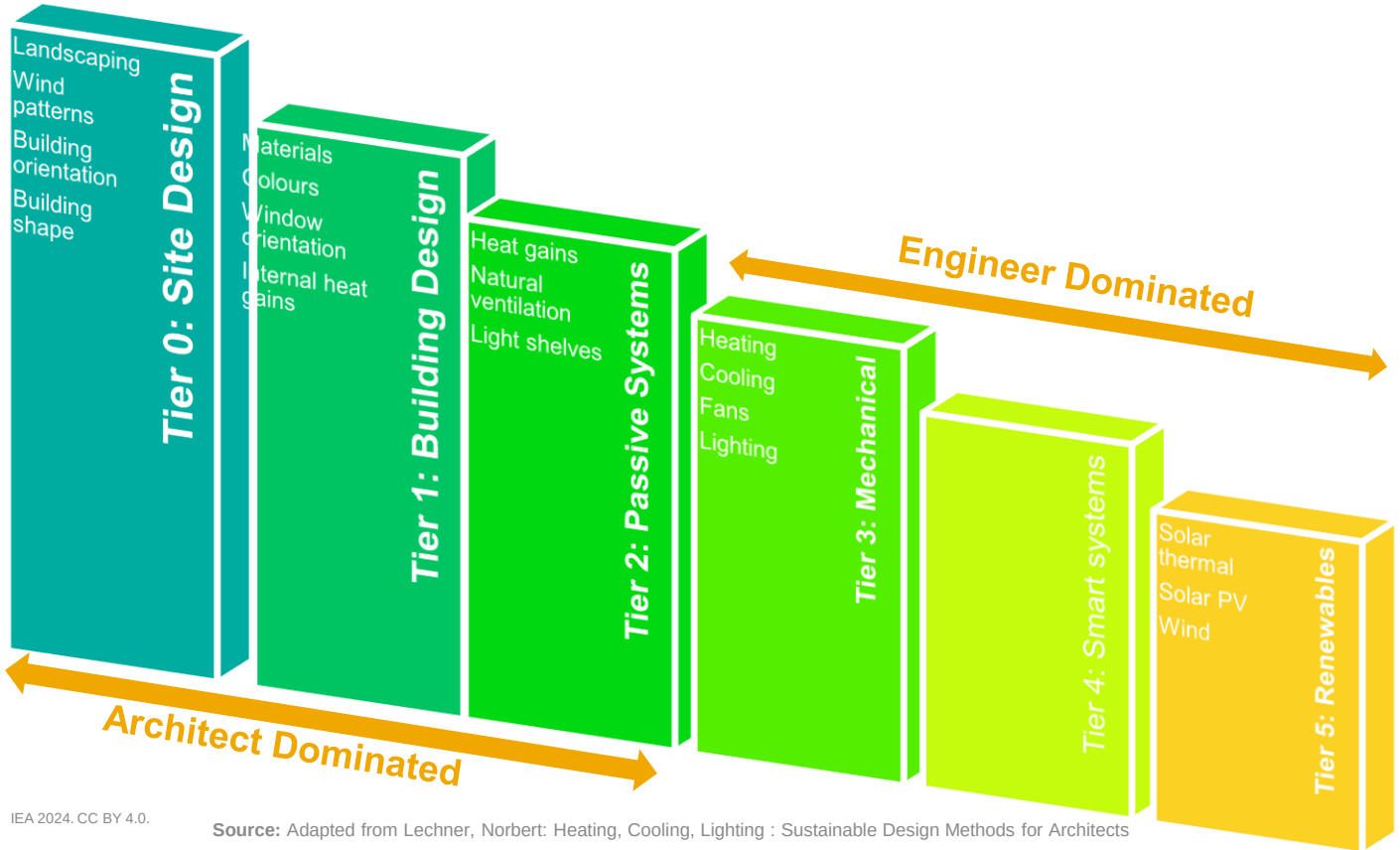




The tiered approach for the integrated design process



Integration of:

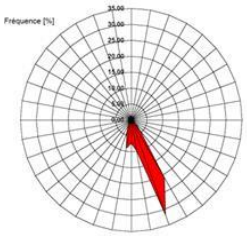
- Multiple design professionals
- Multiple aspects of building design and construction

Source: Adapted from Lechner, Norbert: Heating, Cooling, Lighting : Sustainable Design Methods for Architects

Integrated Design Process: Tier 0 – Site Design

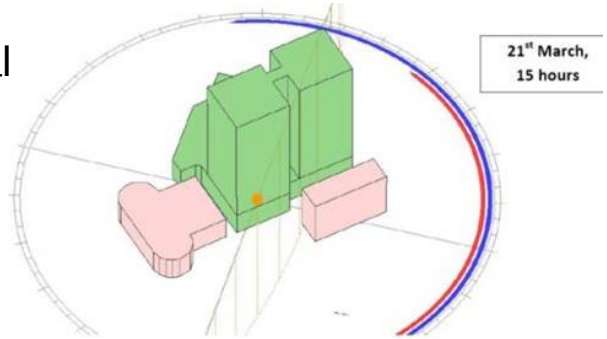
Landscaping

- Impact on solar gains on building
- Impact on airflow
- Seasonal variation



Wind patterns

- Dominant wind direction in hot summer
- Layout of buildings for natural ventilation potential



Building orientation & building shape

- Solar gains on facades
- Optimal orientation of facades

Source: Adapted from Lechner, Norbert: Heating, Cooling, Lighting : Sustainable Design Methods for Architects

Integrated Design Process: Tier 1 – Building Design

Building envelope is often the main source of heat gain/loss

- Walls, windows, roof, uncontrolled air infiltration
- There is a wide variation in the quality of building envelopes:

U ~ 3.5 W/m^2.K
Monolithic concrete wall

U ~ 0.5 W/m^2.K

35% Windows with inadequate shading

10% Windows with shading

Source: Adapted from Lechner, Norbert: Heating, Cooling, Lighting : Sustainable Design Methods for Architects

Integrated Design Process: Tier 2 – Passive Systems

“ancient” architecture (low window to wall ratio, natural ventilation, …

“modern” architecture 70-100% glazed, no natural ventilation, all air systems

“sustainable” architecture 15-40% window to wall ratio, bioclimatic design approach, natural/hybrid ventilation, external movable solar protection, radiant cooling

Source: BEEP India

Integrated Design Process: Tier 3 – Mechanical Systems

After all of the passive options are used, mechanical systems can deliver the designed comfort:

- Active heating systems
- Active cooling systems
- Fans
- Active lighting

Intelligent controls Flexibility

Source: Adapted from Lechner, Norbert: Heating, Cooling, Lighting : Sustainable Design Methods for Architects

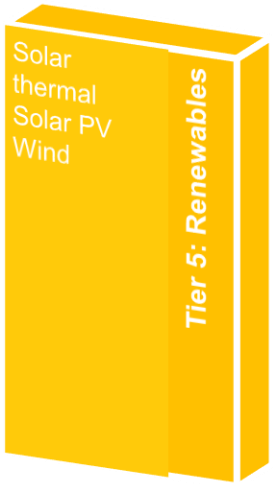
Integrated Design Process: Tier 4 – Smart systems

Adopting smart technologies to monitor and manage system operations and user interfacing offers an opportunity to further achieve efficiencies through:

- Smart occupant sensing
- Daylight/artificial light shifting
- Automated weather adjusted comfort controls
- Grid interactive buildings

Source: Adapted from Lechner, Norbert: Heating, Cooling, Lighting : Sustainable Design Methods for Architects

Integrated Design Process: Tier 5 – Clean Renewable Energy



Onsite zero carbon clean energy provides an opportunity to meet building energy demand through:

- Lowering cost of energy bills through onsite generation
- Producing clean energy and helping to reduce air pollution
- Increasing building and grid resilience
- Be a “Prosumer” by selling excess energy

Source: Adapted from Lechner, Norbert: Heating, Cooling, Lighting : Sustainable Design Methods for Architects

Building Design: building design

Elements of a good building envelope include:

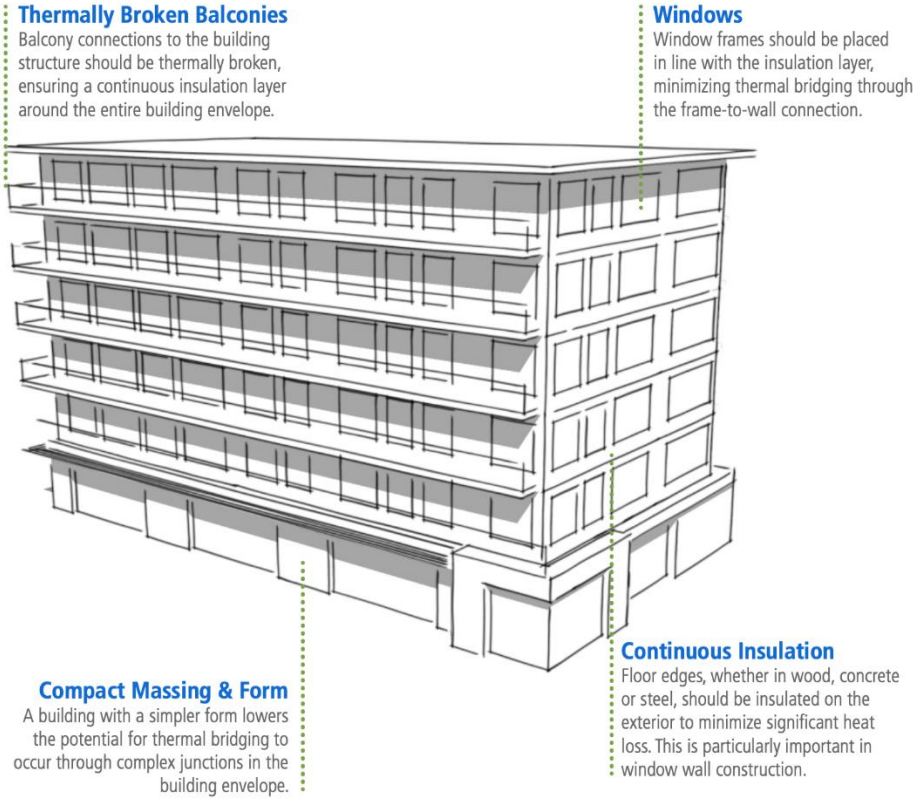
> Compact Massing & Form

> Thermally Broken Envelope Details

> Continuous Insulation

> Window Frame Detailing

A durable, high-quality building envelope that consistently prevents air and moisture from entering interior spaces is the most effective way of improving a building's energy performance.



Source: [Designing for Energy Efficiency Buildings, City of Surrey]

Building Design: Passive heating

Elements of a passive heating strategy include:

> Orientation

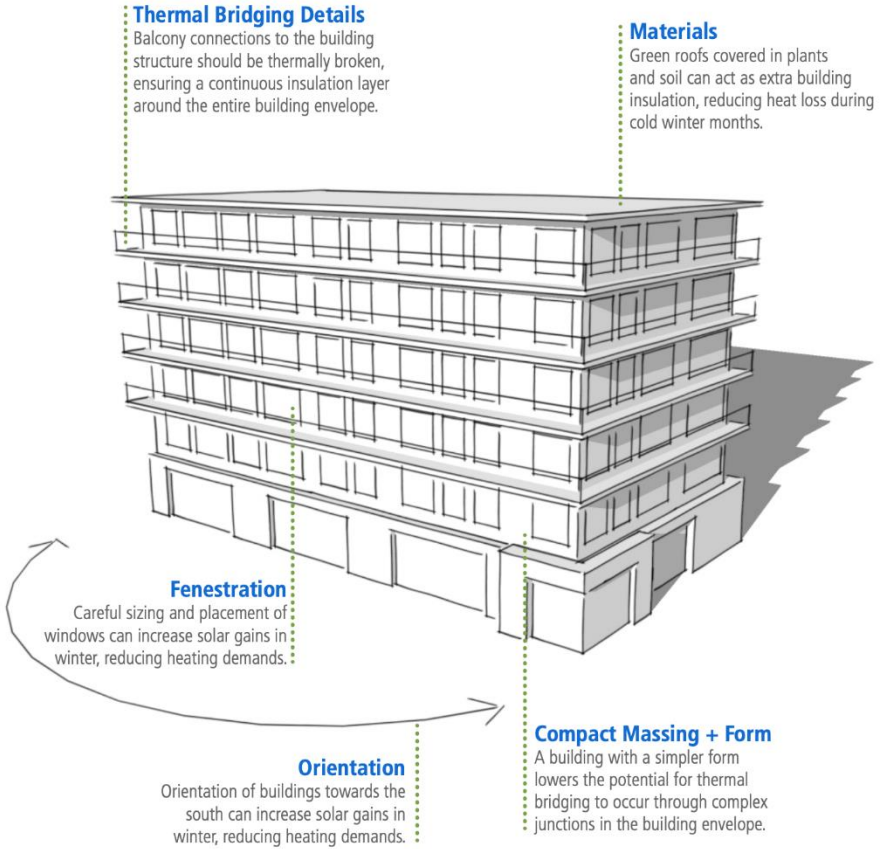
> Compact Massing & Form

> Fenestration

> Thermal Bridging Details

> Material Selection

Passive heating is achieved by collecting sunlight into a building's internal spaces via the use of properly-sized, south-facing windows that maximize heat gains without the addition of active heating systems.



Source: [Designing for Energy Efficiency Buildings, City of Surrey]

Building Design: Passive cooling

Elements of a passive cooling strategy include:

> Fenestration

> Shading

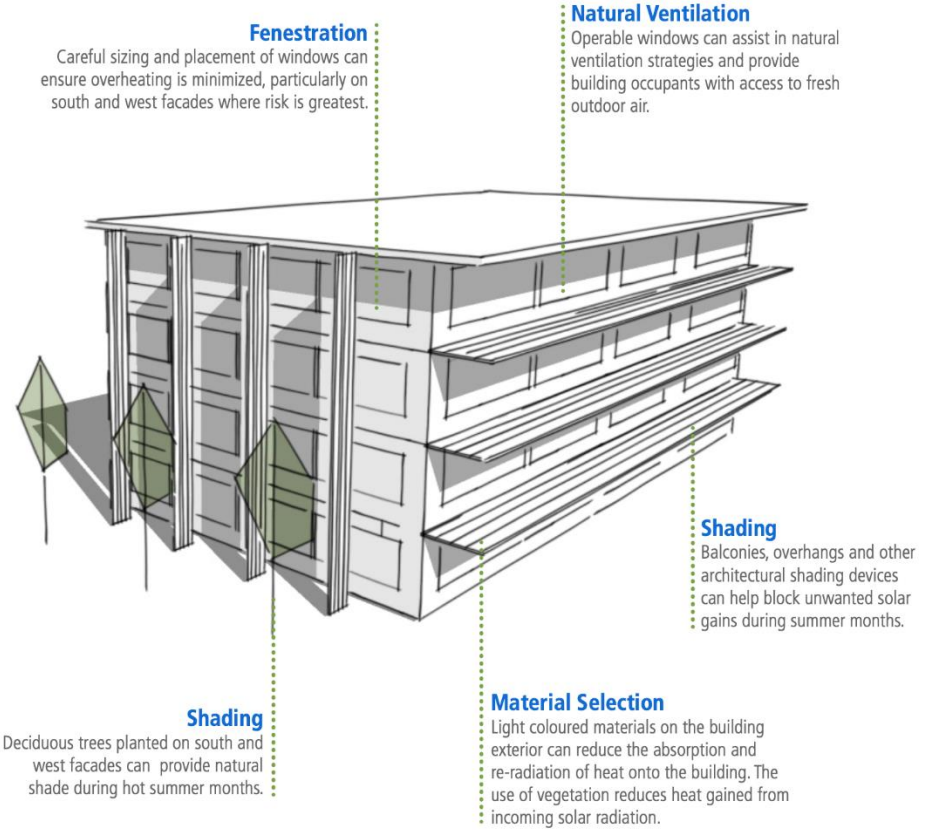
> Natural Ventilation

> Material Selection

Passive cooling is achieved by preventing and/or removing unwanted heat gains to keep interior spaces at a comfortable temperature throughout warmer summer months.

Unwanted heat from incoming solar radiation (or “solar gains”) can be blocked by using external features such as shades, overhangs, and vegetation.

Unwanted heat can be removed by naturally ventilating the space with cooler outdoor air, or by storing excess heat in thermal masses within the space.



Source: Designing for Energy Efficiency Buildings, City of Surrey

Building Design: Passive ventilation

Elements of a passive ventilation strategy include:

> Orientation

> Massing & Form

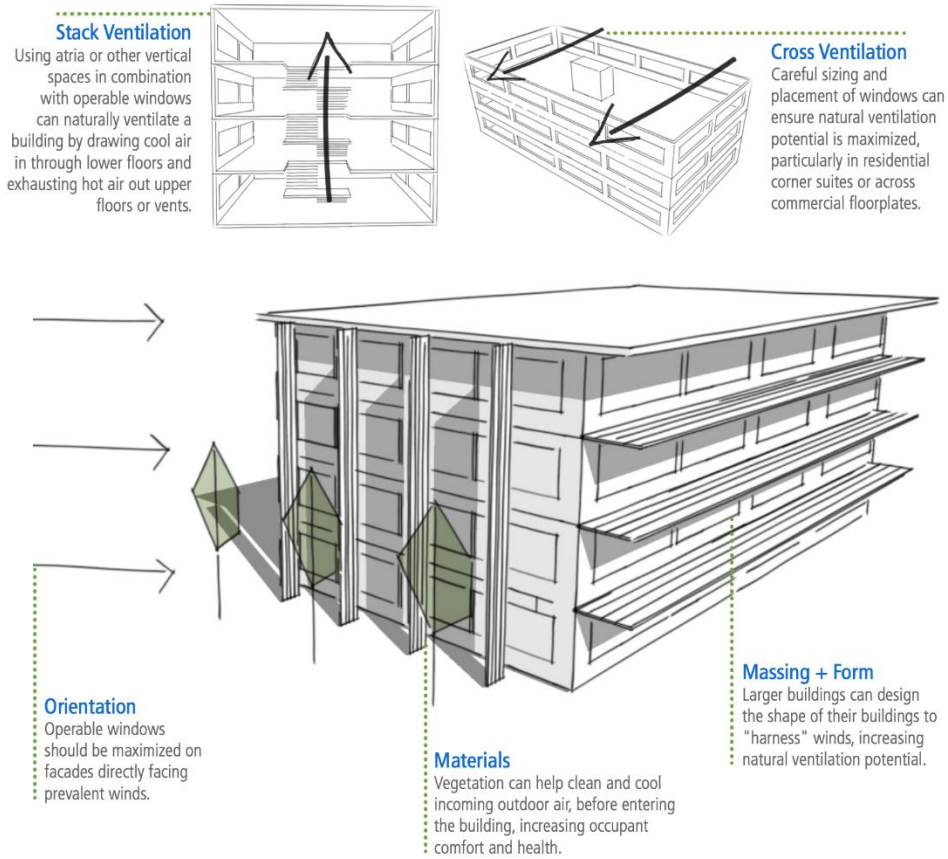
> Cross & Stack Ventilation

> Material Selection

Passive ventilation refers to the use of a natural flow of air to remove stale, unwanted air and introduce fresh air into a building.

This can occur through cross-ventilation, in which air is moved across an individual dwelling unit or an entire building floor through adjacent or opposing windows or openings.

Another form of passive ventilation can be achieved through the stack-effect, in which air is moved via convection through vertically stacked windows or vertically oriented spaces in a building, such as an elevator shaft.



Source: [Designing for Energy Efficiency Buildings, City of Surrey]

Building Design: Passive daylighting

Elements of a passive daylighting strategy include:

> Orientation

> Fenestration

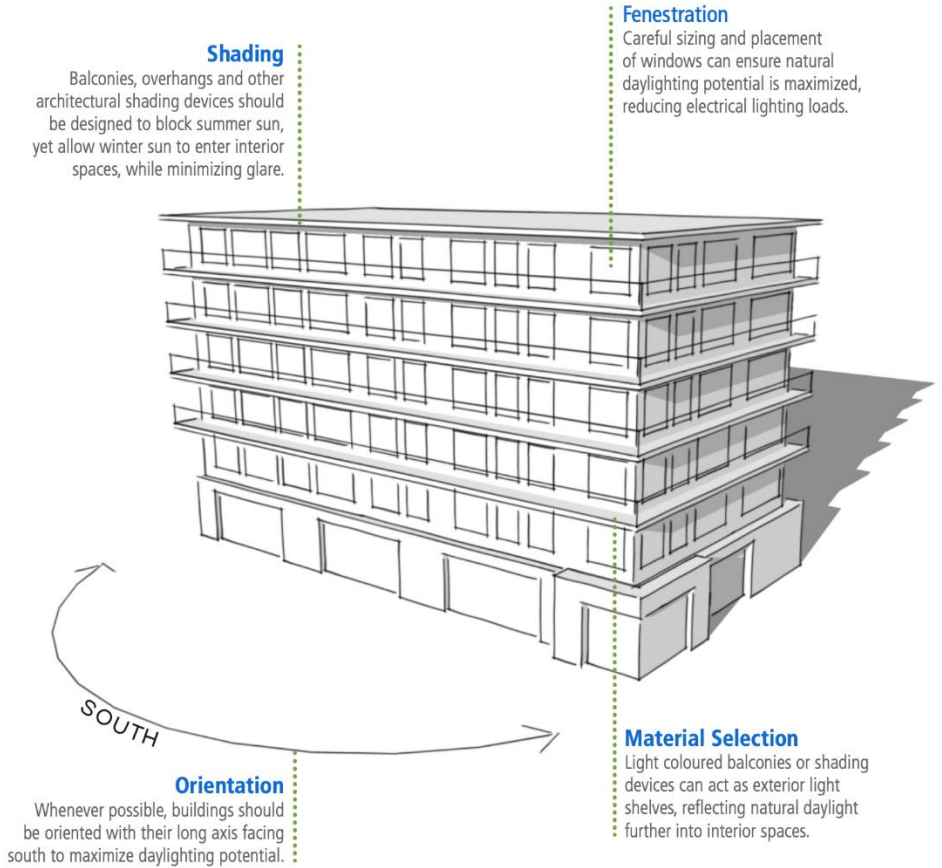
> Shading

> Material Selection

Daylighting refers to the use of natural light from the sun and reflected light from exterior surroundings to light a building interior.

This strategy reduces the need for artificial, electric lighting, and can dramatically reduce a building's overall electricity consumption.

The use of daylighting can also reduce energy requirements for space cooling through the elimination or reduction in the number of heat-generating light fixtures.

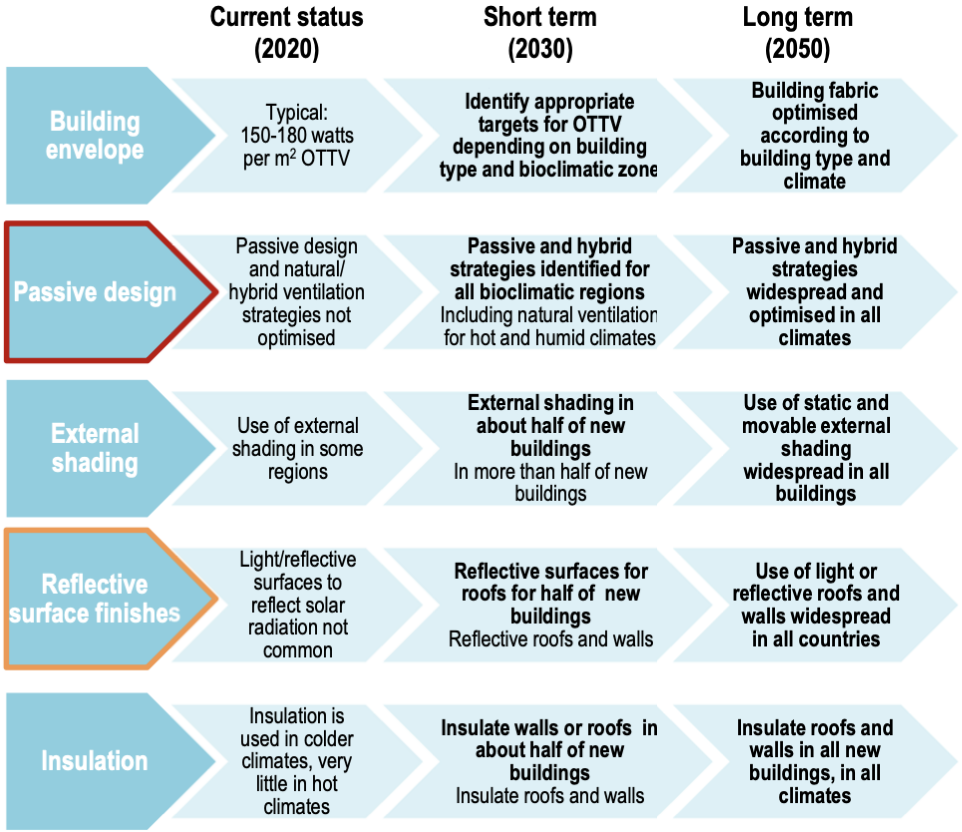


Source: Designing for Energy Efficiency Buildings, City of Surrey

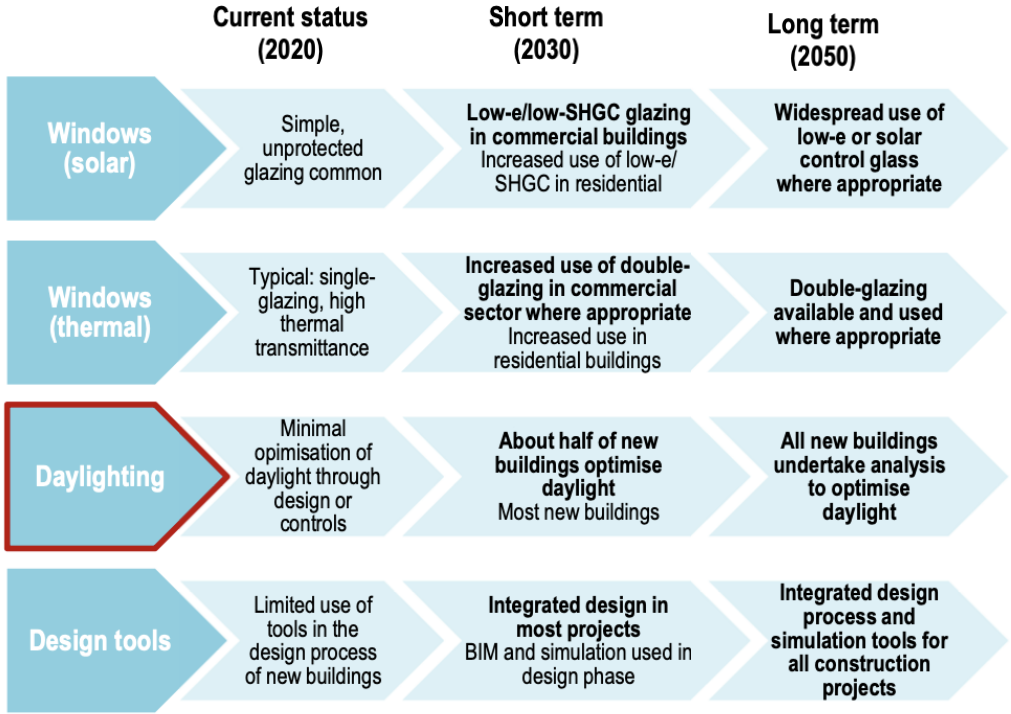
Building envelope technology: window and building shading

Ancient and modern shading can be a no or low cost demand efficiency measures.

Path to net zero emission buildings



Path to net zero emission buildings



Session Activity

International Energy Agency

Activity – Energy efficiency building technologies

For each of the following elements, describe	Current practice	Best available practice	Net zero practice
Building fabric			
Glazing			
Shading			
Ventilation			

International Energy Agency

Energy Efficiency Training Week