Accelerating Energy Efficiency

SEforALL & Copenhagen Centre | Building Sector

SE4All Tokyo Forum

14 February 2017

Tokyo, Japan

Ksenia Petrichenko, Copenhagen Centre

UNEP DTU PARTNERSHIP | COPENHAGEN CENTRE ON ENERGY EFFICIENCY
SE4ALL EE HUB

1: Energy Efficiency is crucial for achieving the goals of the Paris Agreement

162 INDCs submitted, representing **189** countries

168 countries included **EE** in their INDCs

2: Shift in investments towards low carbon sources despite low energy prices

Source: IEA WEI 2016

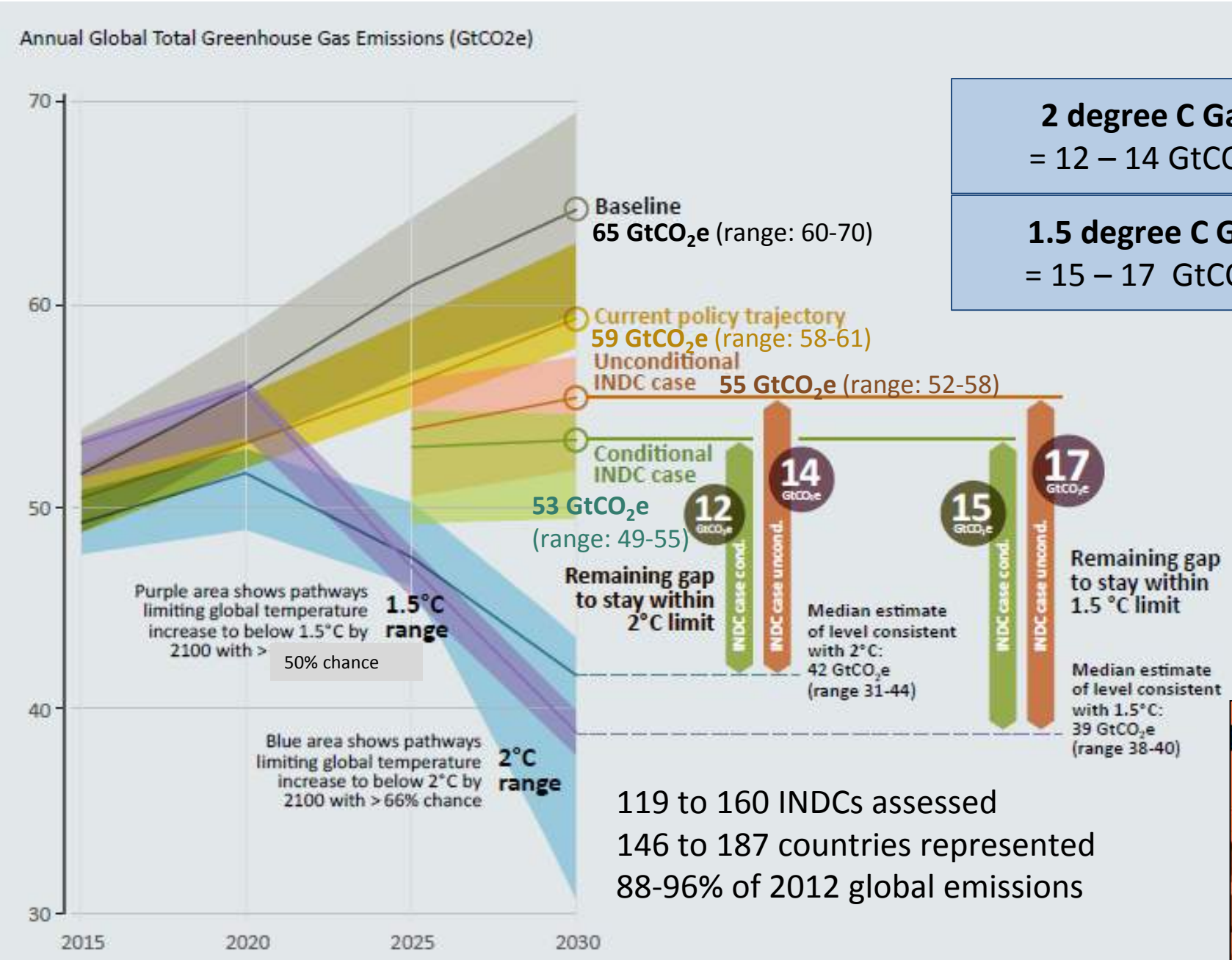
3: Energy Efficiency helps to achieve SDGs and brings multiple benefits

4: Significant mitigation potentials exist across sectors

	IPCC	*IEA*
WEO		
Buildings:	5.9 $GtCO_2$	30 $GtCO_2$
Industry:	4.1 $GtCO_2$	22 $GtCO_2$
Transport:	2.1 $GtCO_2$	12 $GtCO_2$

but require effective policy development

Mind the Gap!



2 degree C Gap
= 12 – 14 $GtCO_2e$

1.5 degree C Gap
= 15 – 17 $GtCO_2e$

119 to 160 INDCs assessed
146 to 187 countries represented
88-96% of 2012 global emissions

SEforAll & Copenhagen Centre

SEforAll as a delivery mechanism

One Goal - Three Objectives

Achieving Sustainable Energy for All by 2030

ENSURING *universal access* TO MODERN ENERGY SERVICES.

DOUBLING THE GLOBAL RATE OF IMPROVEMENT IN *energy efficiency.*

DOUBLING THE SHARE OF *renewable energy* IN THE GLOBAL ENERGY MIX.

COPENHAGEN CENTRE ON ENERGY EFFICIENCY
SE4ALL EE HUB

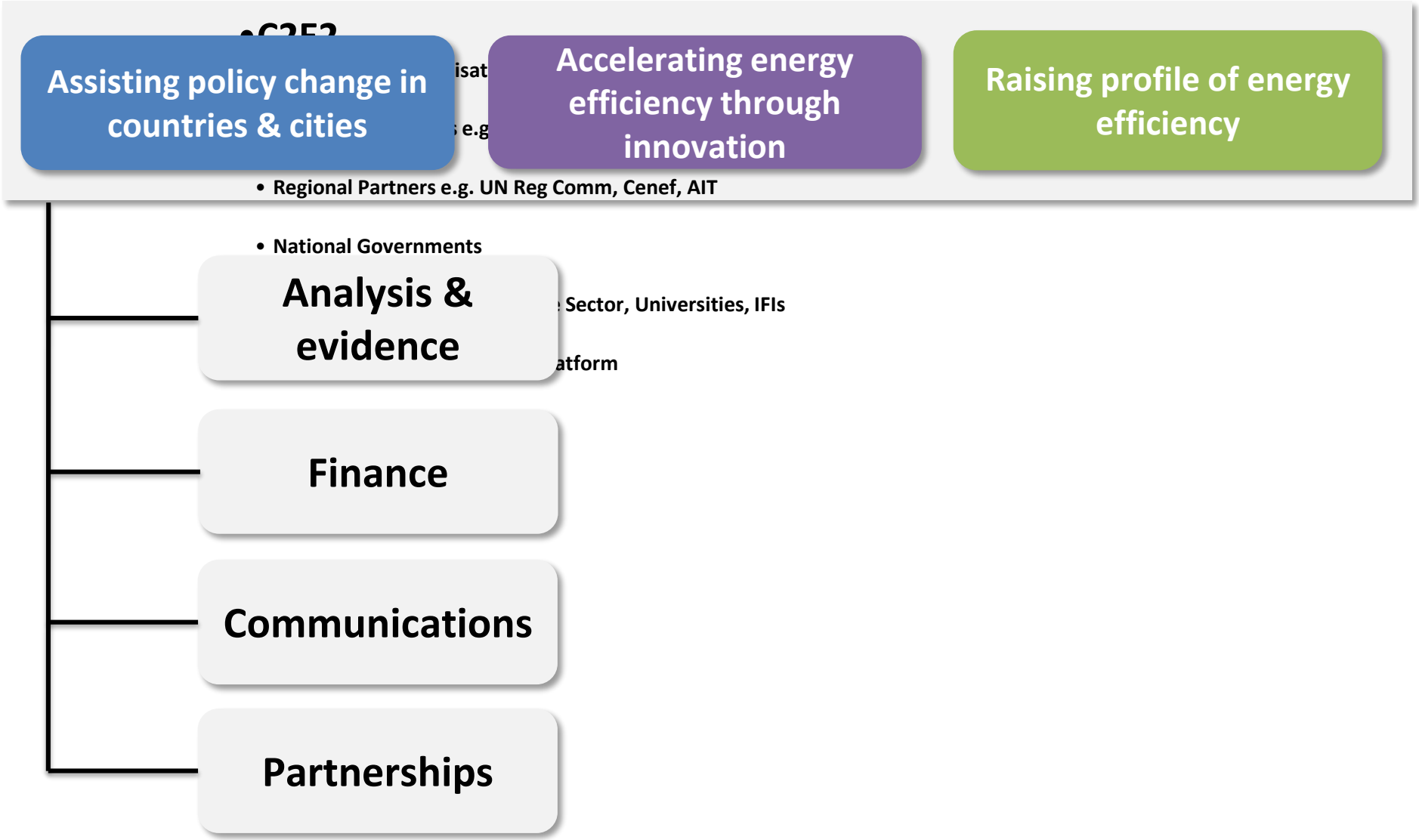
GLOBAL ENERGY EFFICIENCY ACCELERATOR PLATFORM

UNEP DTU PARTNERSHIP | COPENHAGEN CENTRE ON ENERGY EFFICIENCY SE4ALL EE HUB

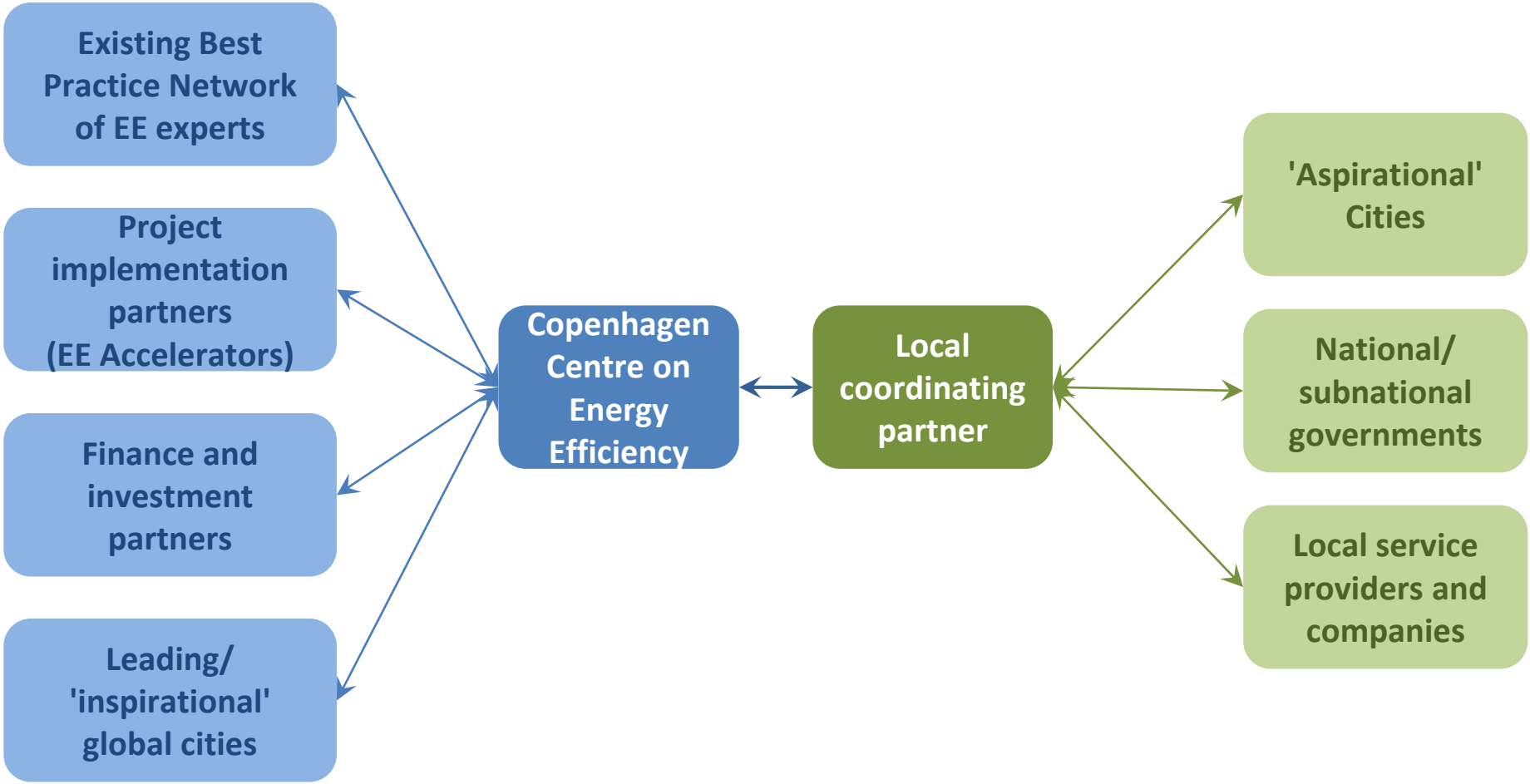
SUSTAINABLE ENERGY FOR ALL

Copenhagen Centre on Energy Efficiency

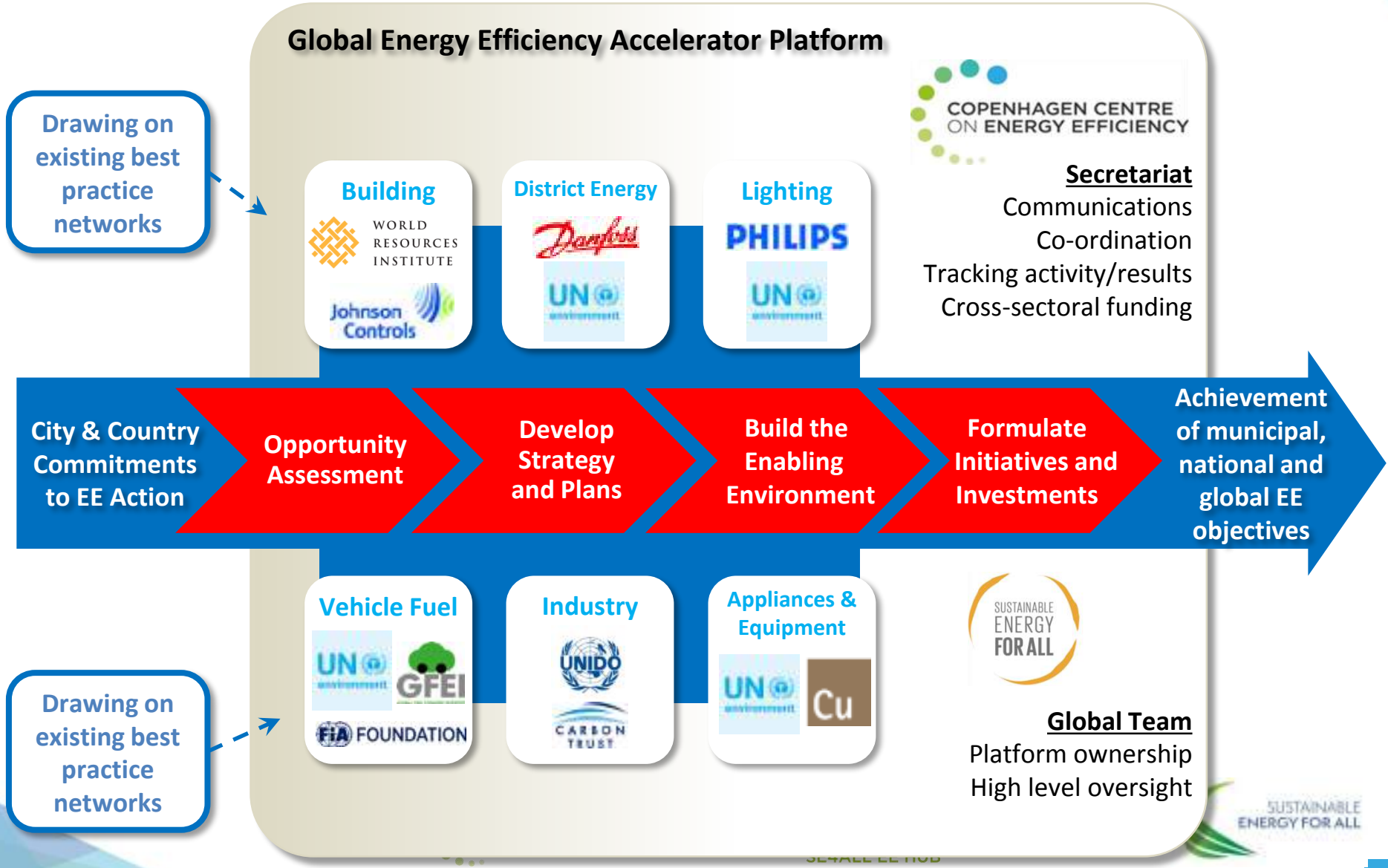
SEforAll Energy Efficiency Hub



Focus on energy efficiency implementation



Global Energy Efficiency Accelerator Platform



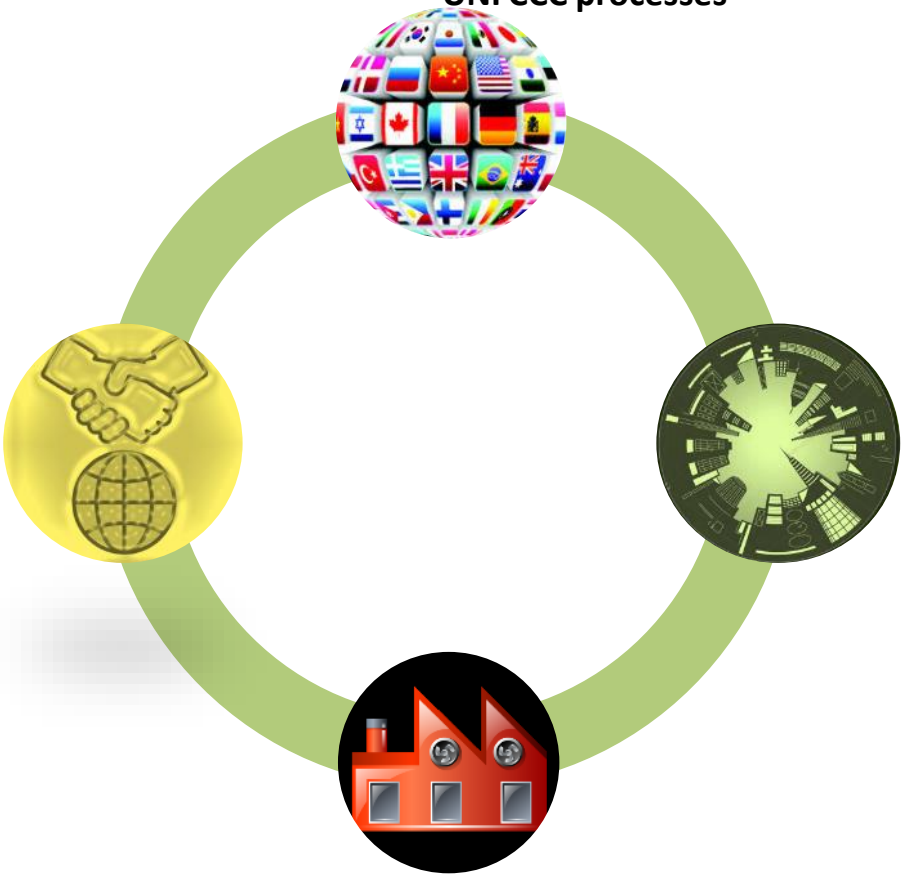
Existing energy efficiency implementation partners

Countries

- 110 countries developing energy efficiency actions with the Accelerators
- Partners to many G20, IEA, UN Environment and UNFCCC processes

International Energy Efficiency Organizations

SE4ALL's Network and



Cities

- Connection with city initiatives and organizations e.g. C40, ICLEI, Covenant of Mayors

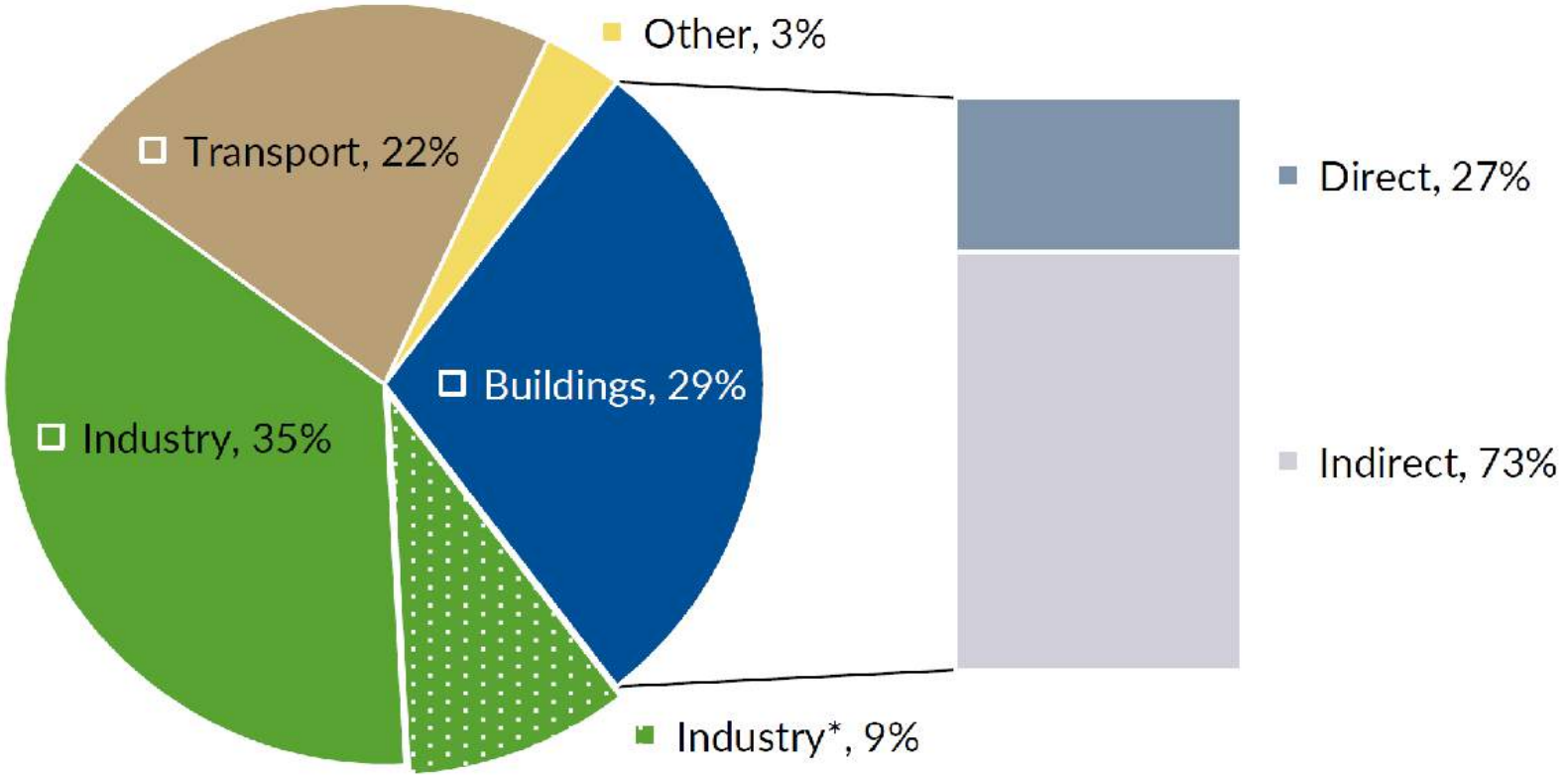
Companies and Private Sector

- Links with active companies, industry bodies, expert providers and financiers

Building sector

SHORPY

Emissions from Buildings & Construction



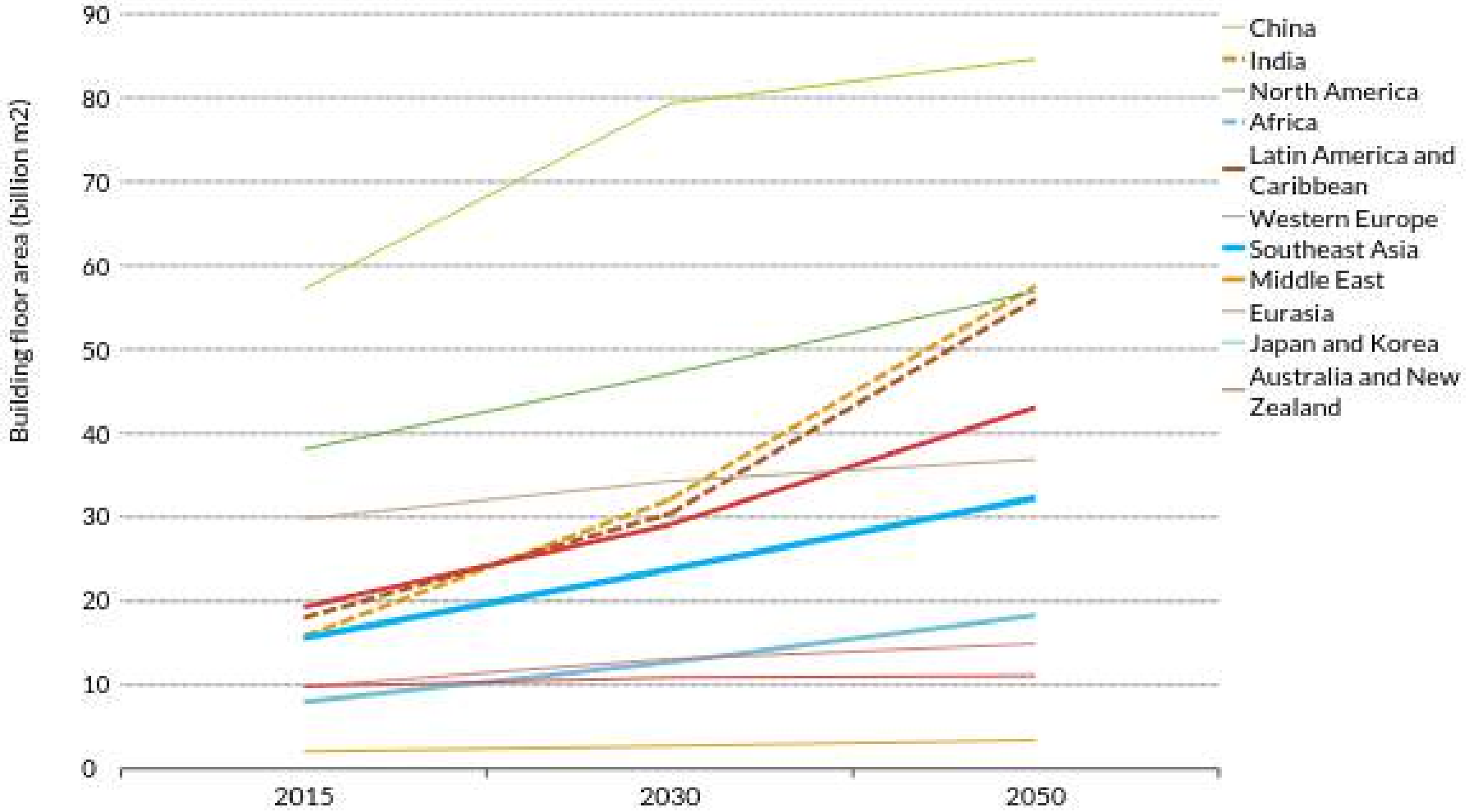
GABC Global Status Report: http://www.globalabc.org/

Buildings and construction make up nearly 40% of the global direct and indirect energy-related CO_2 emissions.

Floor Area Growth in Buildings

Global Alliance for Buildings and Construction

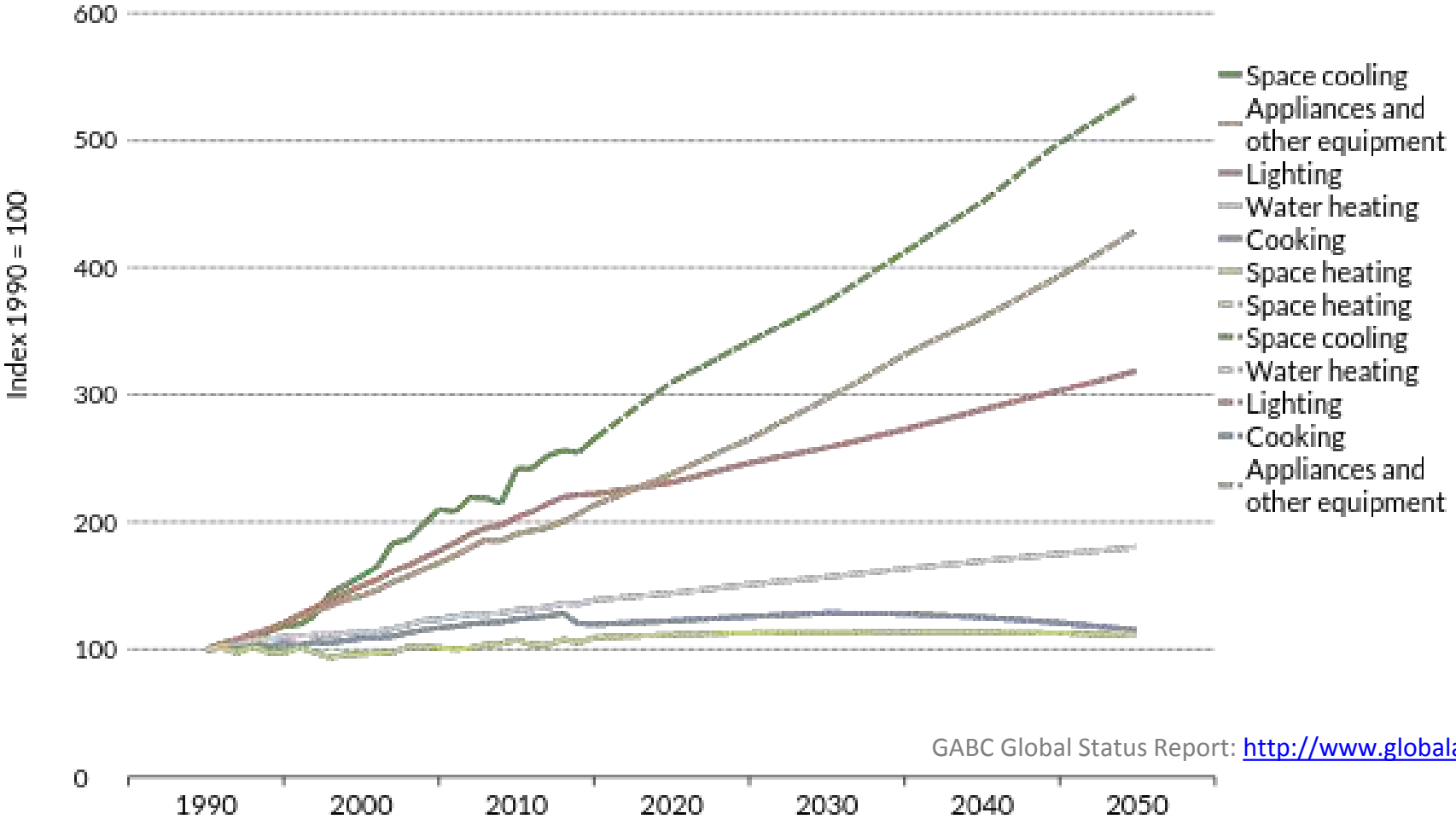
Major growth in buildings is expected in India and Africa (over 200%); and in Latin America, Southeast Asia and Middle East (over 100%).



GABC Global Status Report: http://www.globalabc.org/

End-use Growth in Buildings

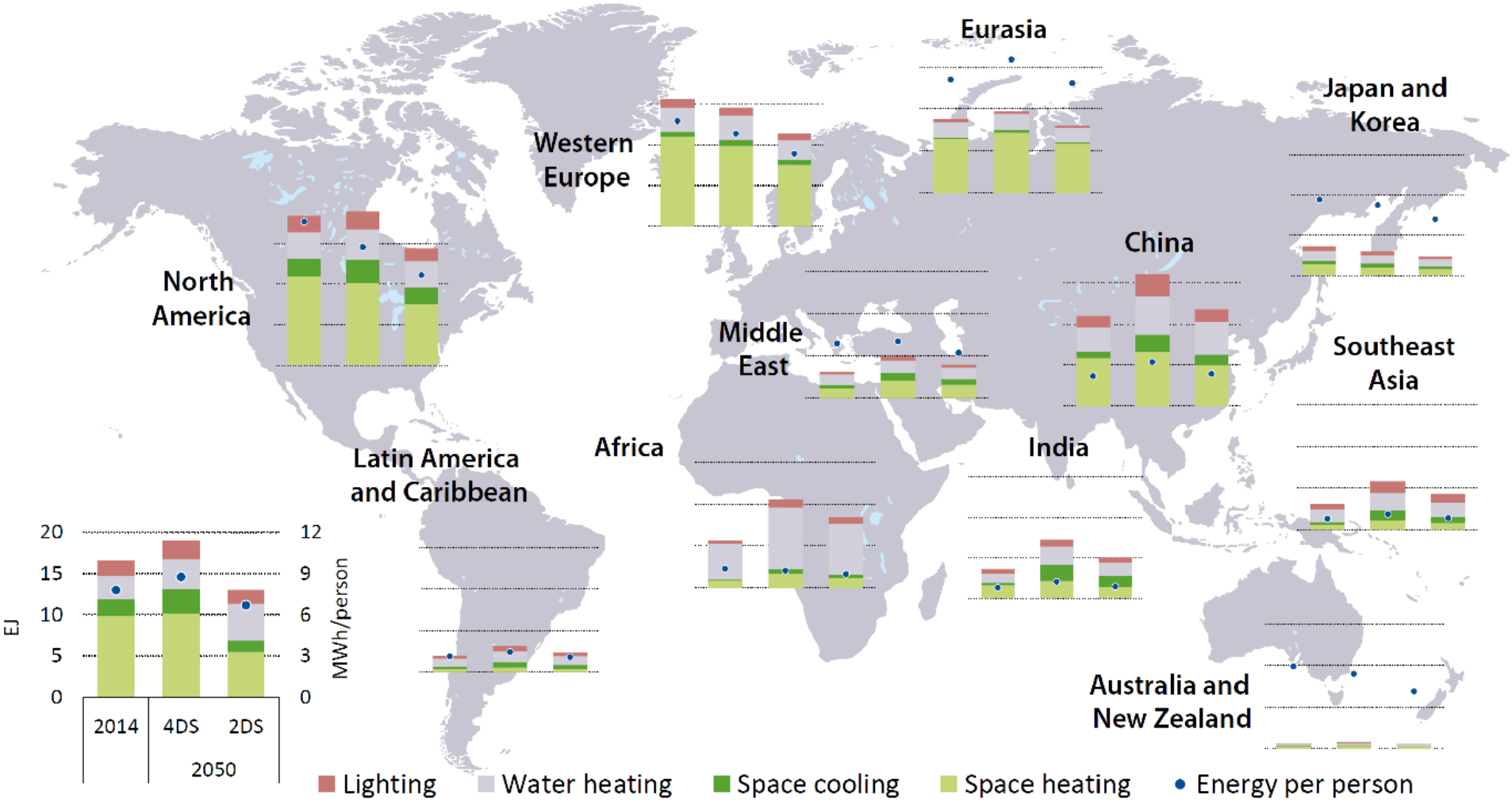
Space cooling will continue to be the fastest growing end-use to 2050



GABC Global Status Report: http://www.globalabc.org/

Sustainable Pathway for Buildings

Significant reductions in building energy use is needed to achieve the 2°C scenario out to 2050

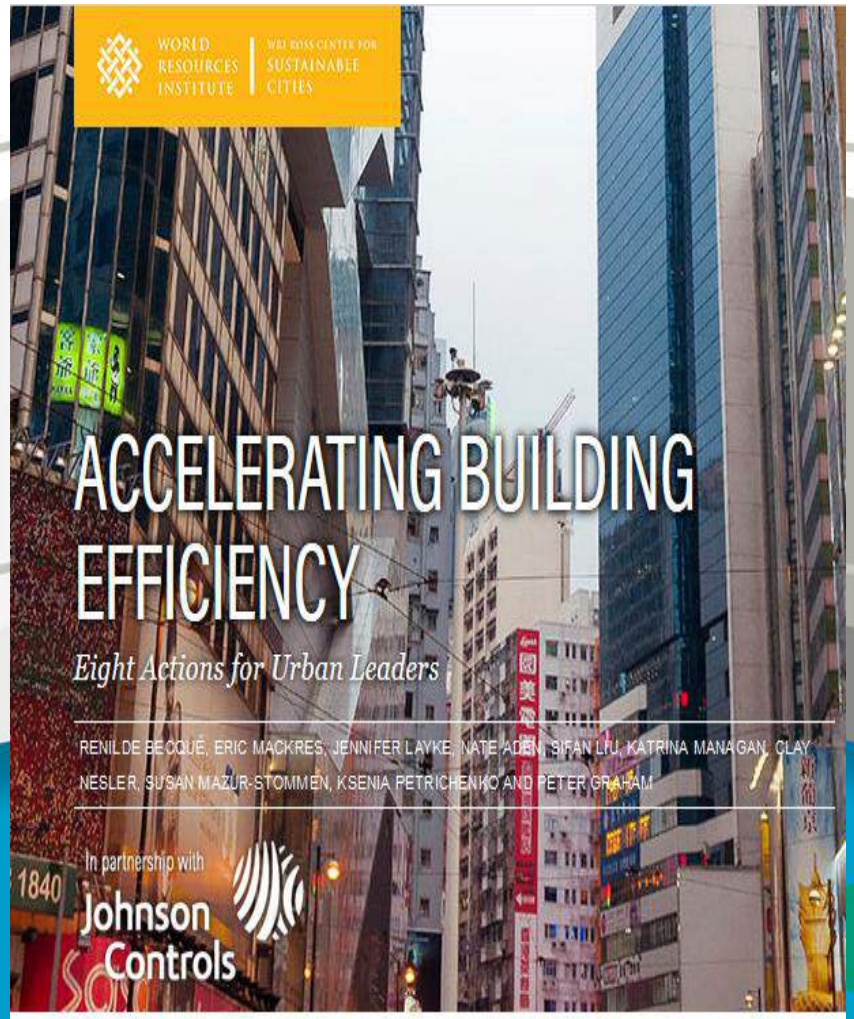


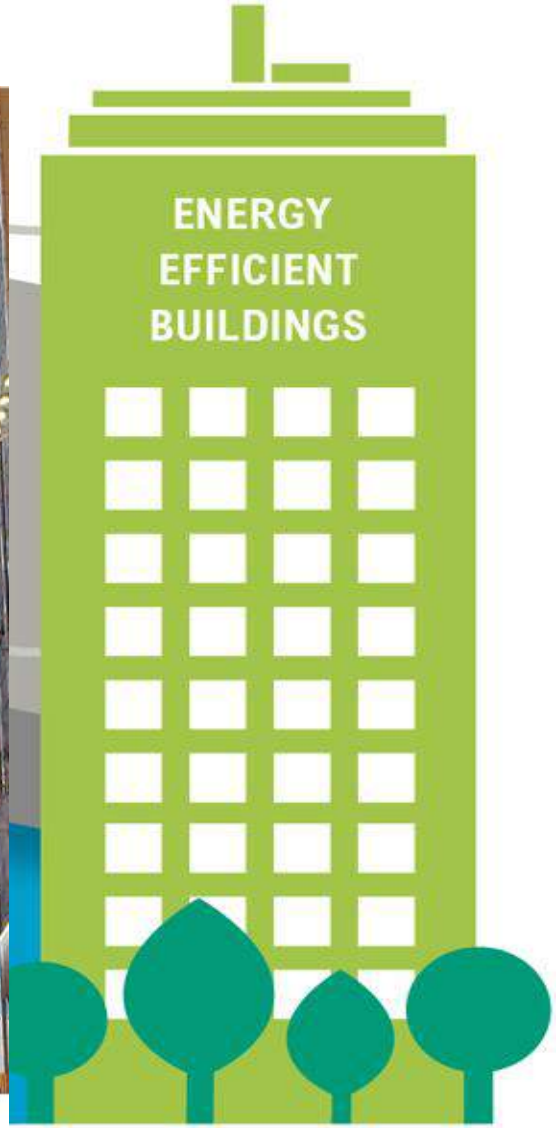
GABC Global Status Report: http://www.globalabc.org/

Accelerating EE in buildings

STAKEHOLDERS

- National and provincial governments
- Local governments
- Energy utilities
- Civil society organizations
- Developers and self-help builders
- Design & construction professionals
- Suppliers & manufacturers
- Financial service providers and investors
- Building owners and managers
- Building occupants





http://publications.wri.org/buildingefficiency/

Policy Package to drive the change

There is no single policy, which can address all existing barriers
→ **EFFECTIVE POLICY PACKAGE** is needed

Targets, roadmaps

Analysis of barriers

Codes, standards, regulations, etc.

Green loans, Rebates, Taxes, etc

Voluntary schemes, Capacity building, Awareness

Sticks

Carrots

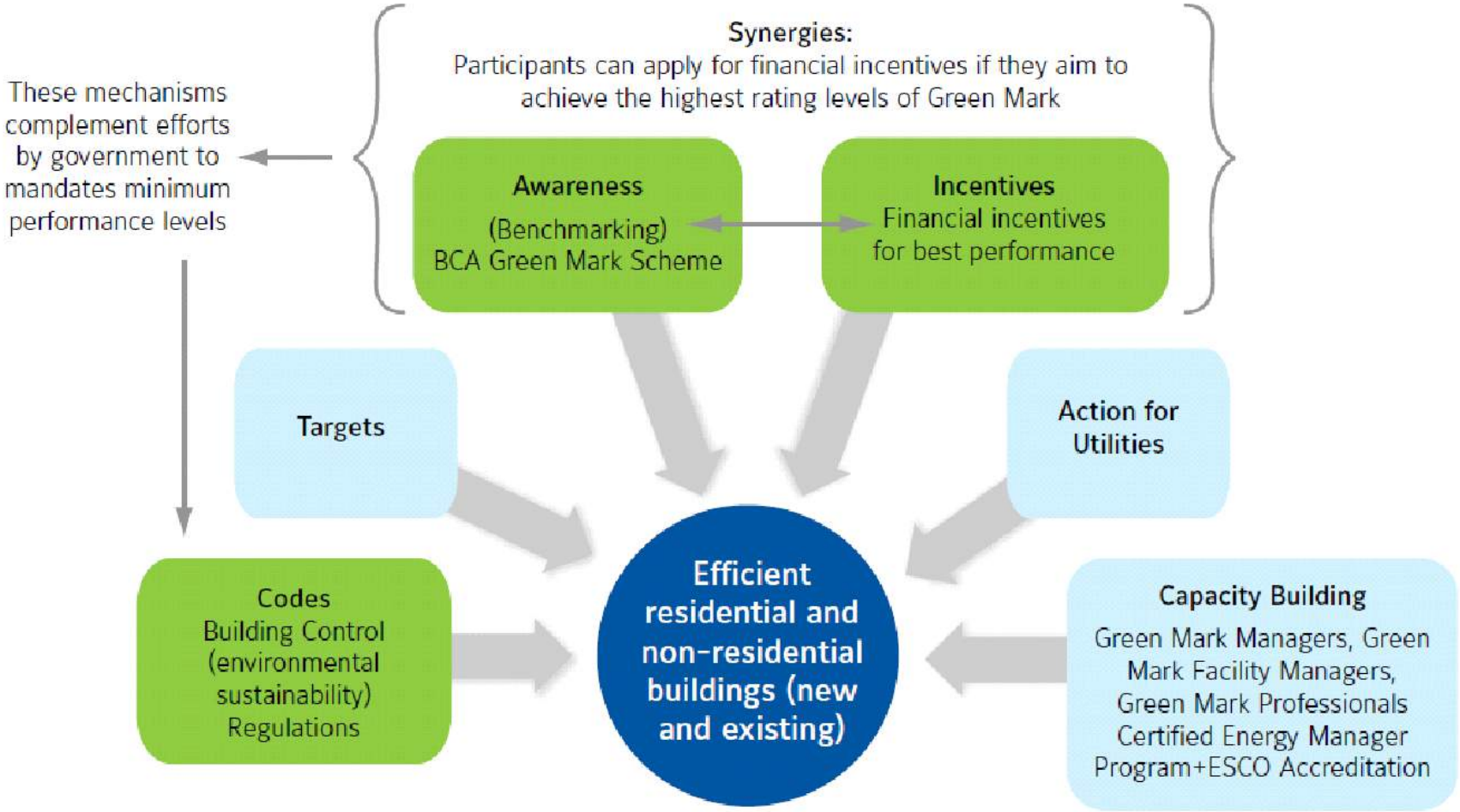
Tambourines

Business models, private sector engagement

UNEP DTU PARTNERSHIP | COPENHAGEN CENTRE ON ENERGY EFFICIENCY
SE4ALL EE HUB

Unique combination of ‘carrots and sticks'

Singapore



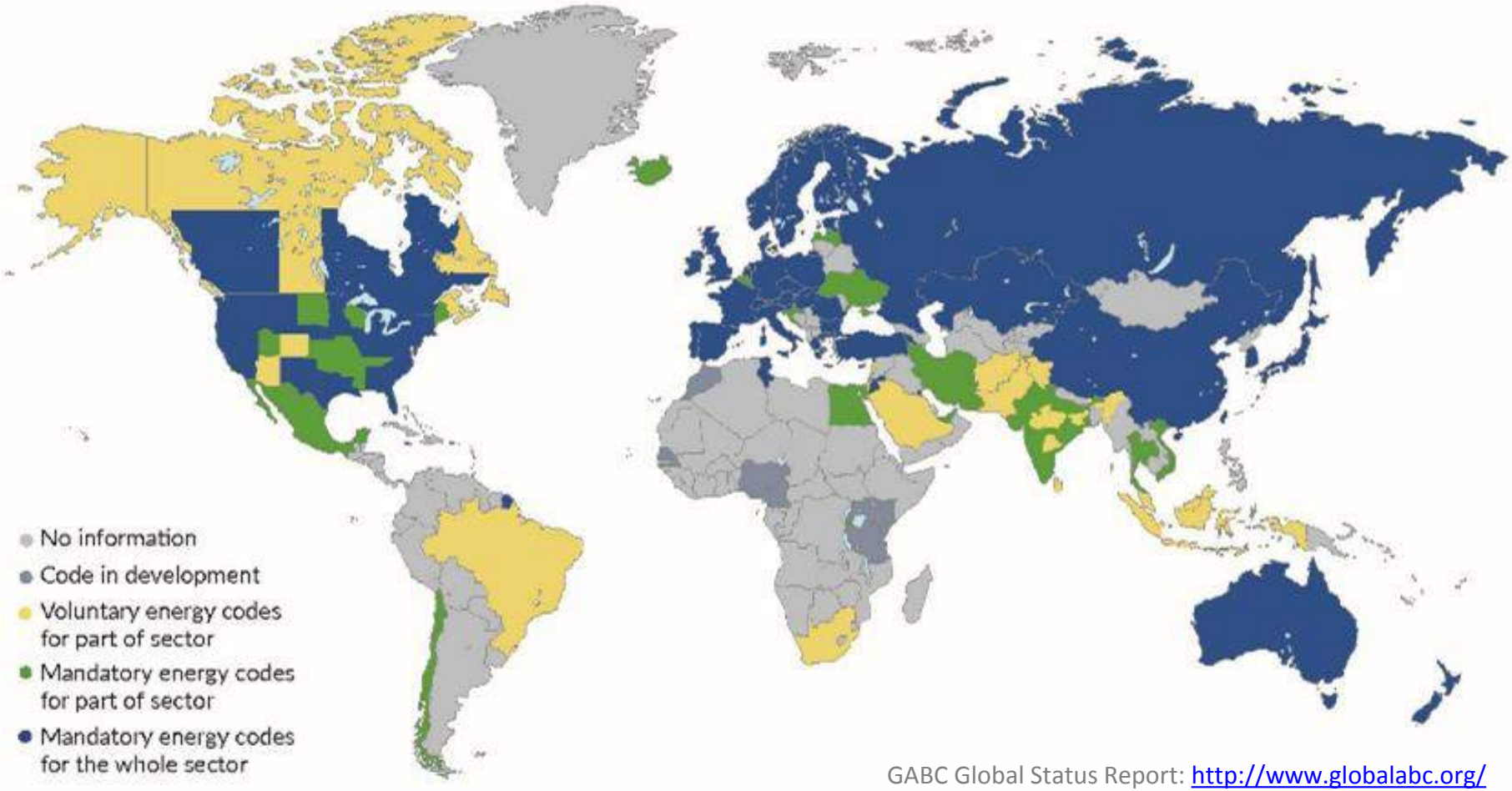
UNEP DTU PARTNERSHIP | COPENHAGEN CENTRE ON ENERGY EFFICIENCY
SE4ALL EE HUB

Source: Institute for Building Efficiency, WRI

Global Map of Building Energy Codes

Global Alliance for Buildings and Construction

Policy development of building energy codes is continuing to become more prevalent globally



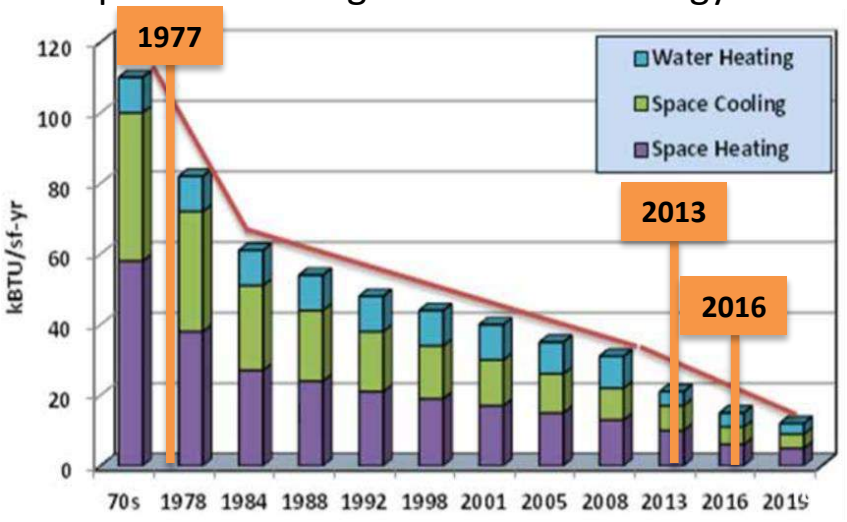
GABC Global Status Report: http://www.globalabc.org/

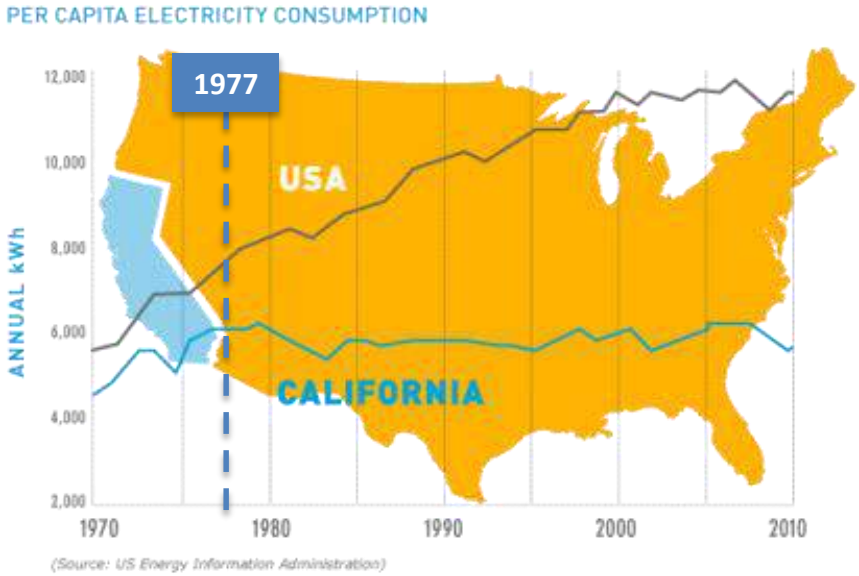
This map is without prejudice to the status of or sovereignty over any territory, to the delimitation of international frontiers and boundaries, and to the name of any territory, city or area.

Standards - driver for energy savings

California

Impact of building standards on energy use





2020: all new residential to be NZE

2030: all new commercial buildings to be NZE

2025: all new state buildings and major retrofits to be NZE

2025: 50% of existing state-owned buildings to be retrofitted a NZE

2030: 50% of existing commercial buildings to be retrofitted as NZE

UNEP DTU PARTNERSHIP | COPENHAGEN CENTRE ON ENERGY EFFICIENCY
SE4ALL EE HUB

Three messages on Building Codes

1. Importance of actual energy use
2. High level of ambition
3. Engagement of different levels of governance

to allow trade-offs between elements of the building envelope

Message 1: Importance of actual energy use

ing such a

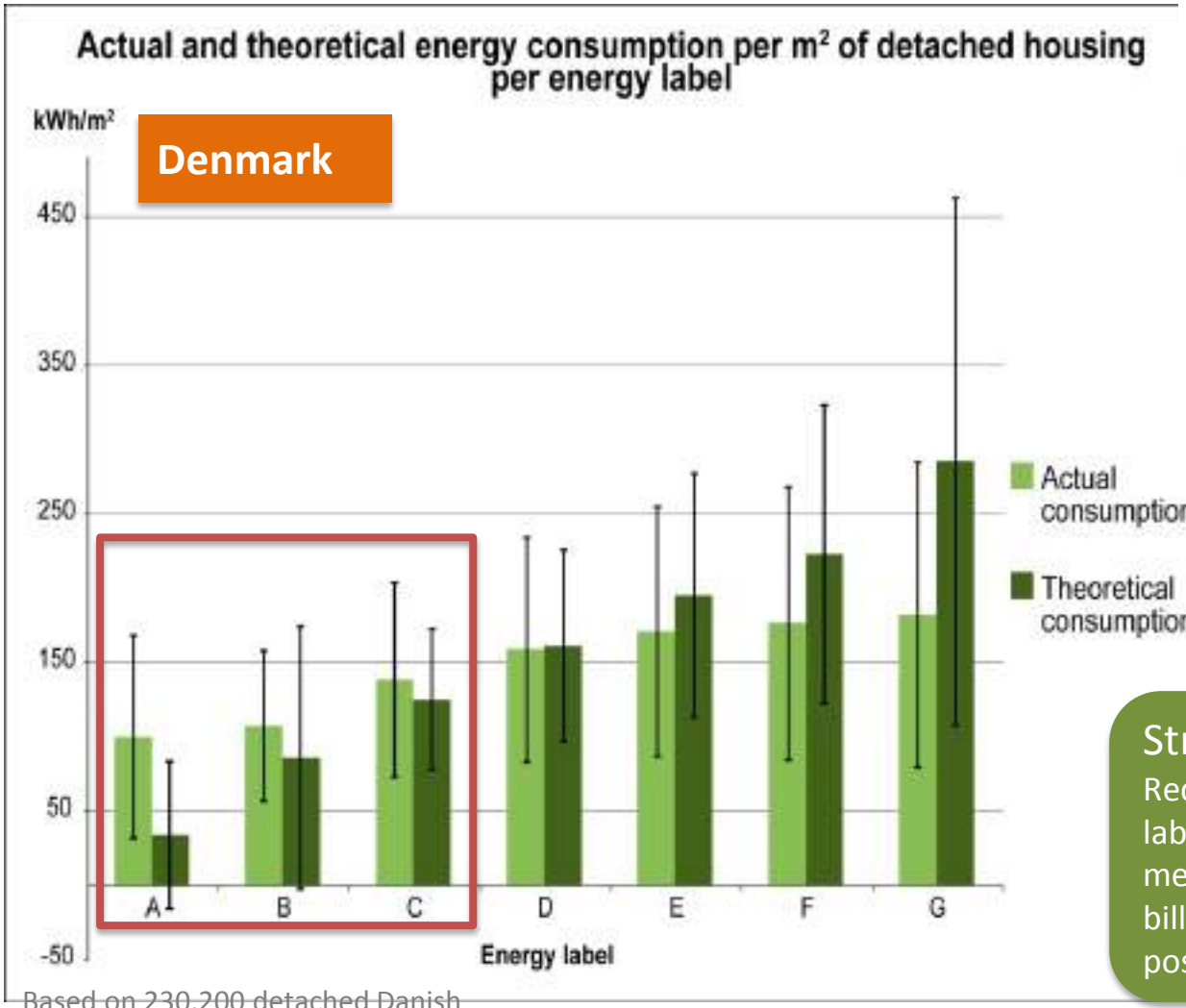
1970

2000

now

rgy

Efficient design versus efficient practices….



Based on 230.200 detached Danish houses with an energy label.
Gram-Hansen and Hansen (2016)

Rebound effect:

in efficient buildings actual energy use is often higher than the theoretical one due to occupants' behaviour

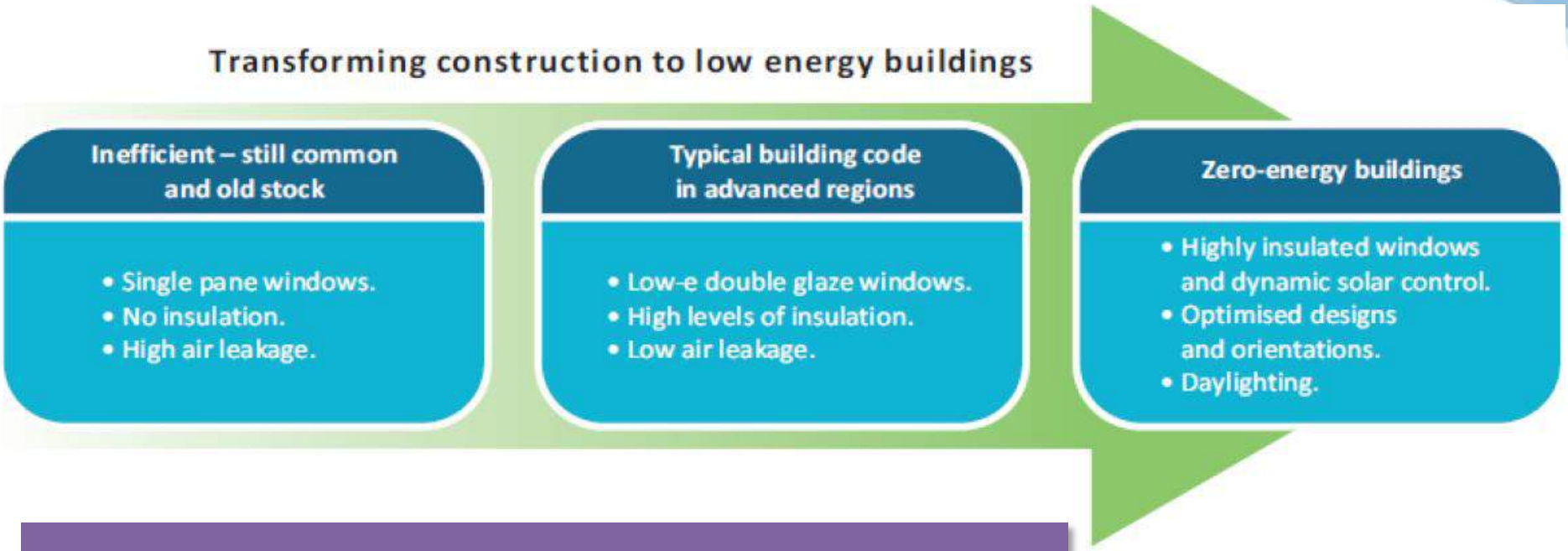
Strategies:

Recognition in policy design, standards & labeling, awareness raising, smart meters, consumer feedback & enhanced billing, benchmarking, identity signalling, positive examples

UNEP DTU PARTNERSHIP | COPENHAGEN CENTRE ON ENERGY EFFICIENCY
SE4ALL EE HUB

SUSTAINABLE ENERGY FOR ALL

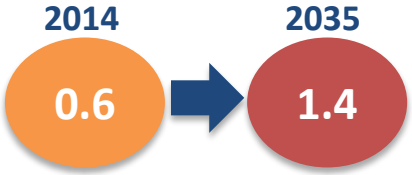
Message 2: High level of ambition



Step 1: reduce the need for space heating and cooling through building envelope measures
Step 2: reduce heating and cooling energy use through efficient HVAC systems
Step 3: integrate RE supply

IEA 2013. Technology Roadmap - Energy Efficient Building Envelopes

Global market of NZEBs
(trl.USD)



Navigant Research (2014)

UNEP DTU PARTNERSHIP | COPENHAGEN CENTRE ON ENERGY EFFICIENCY
SE4ALL EE HUB

SUSTAINABLE ENERGY FOR ALL

Examples exist, but scale is small

Global Alliance for Buildings and Construction


© Vandermaster Design

Single Family House
North Carolina, USA


© VeAir

Single Family House
France

Denmark, Solhuset | e+ School
Solhuset (The Sun House)

Building shape, orientation and windows are optimised in relation to plot and sun to maxise use of daylight and solar heat. A combined solar and geothermal system provides the needed energy for heating and hot water, while solar cells also produce electricity.

New Delhi, India | NZEB Office
Indira Paryavaran Bhavan

Solar passive design reduces heat ingress in building envelope and allows for 75% of natural daylight use to reduce energy consumption. Uses energy-efficient chilled beam system for air-conditioning and geothermal heat rejection for the cooling towers of HVAC system. On-site solar photovoltaic cells to meet total energy demand.

USA, Los Altos | e+ Office
David and Lucile Packard Foundation

Triple-paned windows reduce the thermal bridges throughout the building envelope. A cooling tower provides chilled water (circulated throughout the building to chilled beam exchangers) to a storage tank that is passively cooled during the night. Two narrow office wings are configured around a central courtyard to maximise daylighting potential.


© William Shelfall

Leon County Extension
Florida, USA

Shanghai, China | e+ Residential

Strict design of thermal insulation and exterior facade for increased shading co-efficient. Energy system includes a solar collector system, an HVAC & DHW system, an indoor terminal unit (heat recovery ventilator) and a renewable energy power system.

Israel, Ramat-Gan | NZEB Residential
Team Israel

Building-integrated photovoltaics designed for climate control and vertical solar harvesting. Designed to maximise entry of indirect natural sunlight.

Two stall office building

Brazil, São Paulo | NZEB Stadium
Estádio Nacional

Stadium includes strip of solar panels encircling the roof, which is semi-transparent, allowing natural light to filter through to reduce lighting costs.


© United Nations Environment Programme

UNEP Headquarters
Nairobi, Kenya


© Crossways Farm Village

House Rhino, South Africa


© University of Wollongong

Illawarra Flame, Australia

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.

GABC Global Status Report: http://www.globalabc.org/

UNEP DTU PARTNERSHIP | COPENHAGEN CENTRE ON ENERGY EFFICIENCY
SE4ALL EE HUB

SUSTAINABLE ENERGY FOR ALL

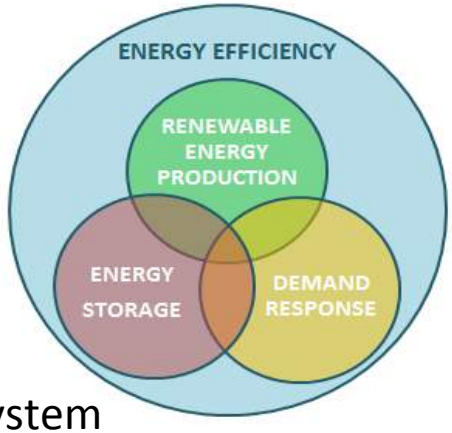
Message 3: Focus on enforcement

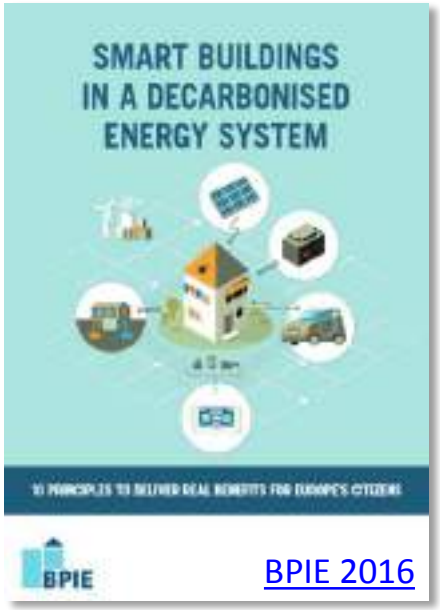
China

- Certified inspection companies to analyze building architectural plans
- Building license is granted after a positive compliance report review
- Certified engineering inspection companies perform inspections during construction
- Local quality supervision agency performs compliance checks during the building process
- Random annual inspections through the Ministry of Housing
- Occupancy permits issued only if buildings pass all compliance checks

IEA 2013. Policy Pathway - Modernising Building Energy Codes

Message 3: Going beyond individual buildi





BPIE 2016

- A building or a group of buildings flexibly connected and synchronised with an energy system
- Able to produce, store and consume energy efficiently
- Flexible, adapting to the needs and strengthening the energy system

Maximise the buildings' energy efficiency first	Increase on-site or nearby RES production and self-consumption	Stimulate energy-storage capacities in buildings	Incorporate demand response capacity in the building stock	Decarbonise the heating and cooling energy for buildings
Empower end-users via smart meters and controls	Make dynamic price signals available for all consumers	Foster business models aggregating micro energy-hubs	Build smart and interconnected districts	Building infrastructure to drive further market uptake of Electric Vehicles

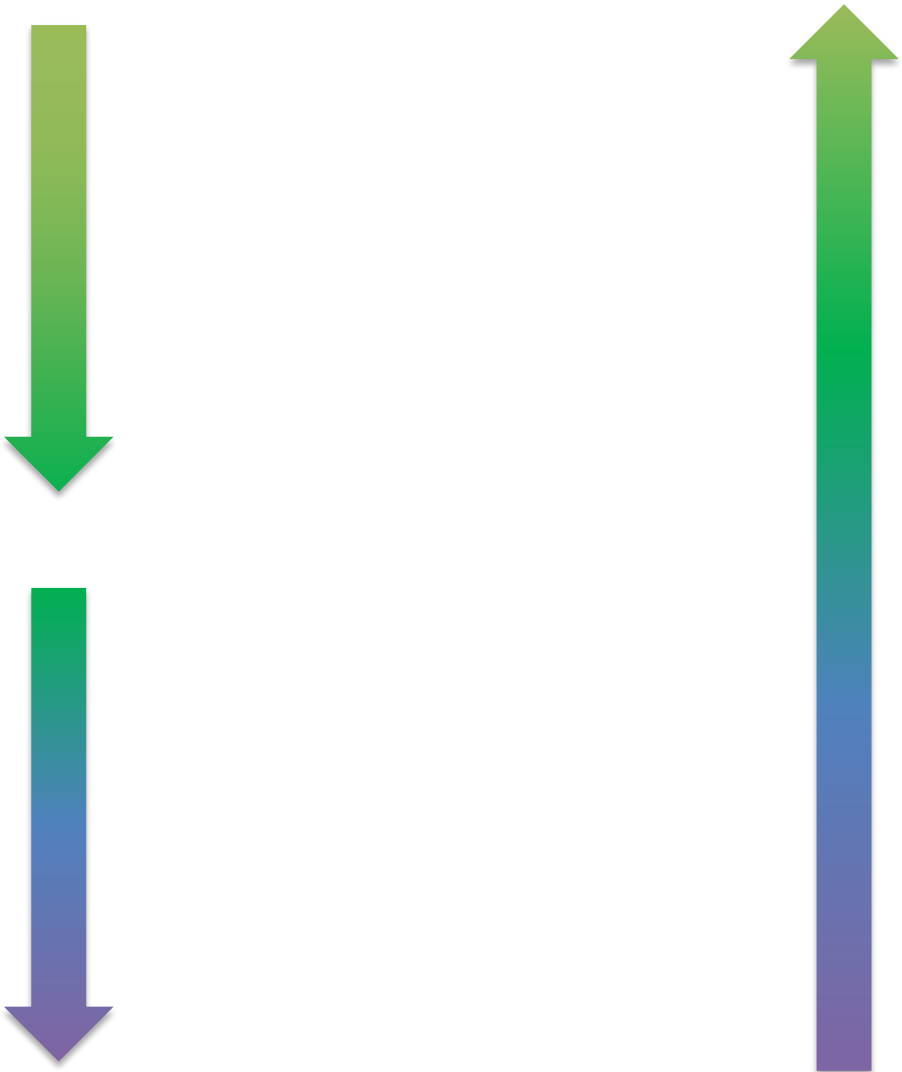
Message 3: Engagement of different levels of governance

- Country
- **City**
- District

National targets and policies to be translated into policies and actions at the city level

City-level targets and policies to drive the construction and renovation projects

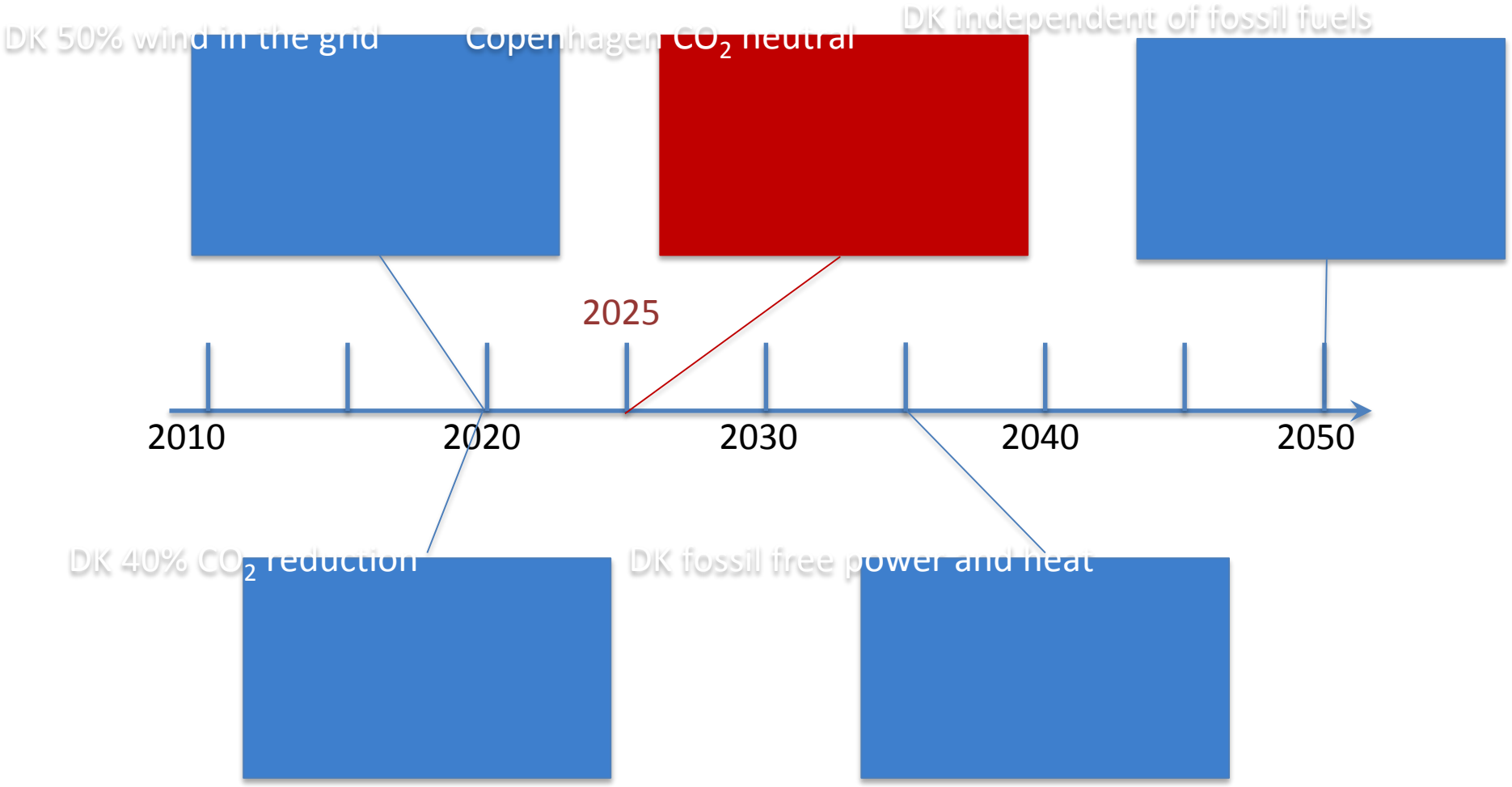
City-level projects and initiatives to drive the policy change at the city and even national levels



UNEP DTU PARTNERSHIP | COPENHAGEN CENTRE ON ENERGY EFFICIENCY
SE4ALL EE HUB

SUSTAINABLE ENERGY FOR ALL

Country level: Denmark



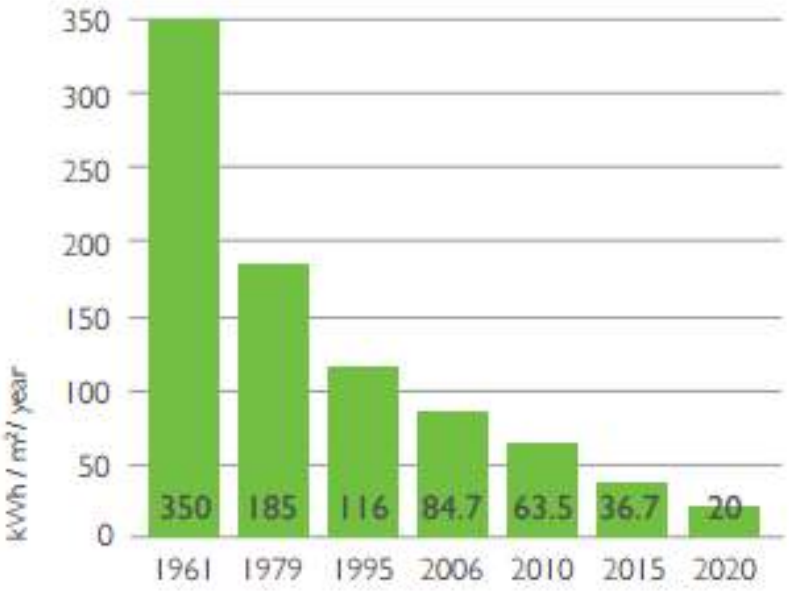
UNEP DTU PARTNERSHIP | COPENHAGEN CENTRE ON ENERGY EFFICIENCY
SE4ALL EE HUB

SUSTAINABLE ENERGY FOR ALL

City level: Copenhagen

- Since 1990, carbon emissions reduced by 40% with real economic growth of 50%
- District Heating: 98% coverage
- Effective public transport network
  - 98% of public less than 350m

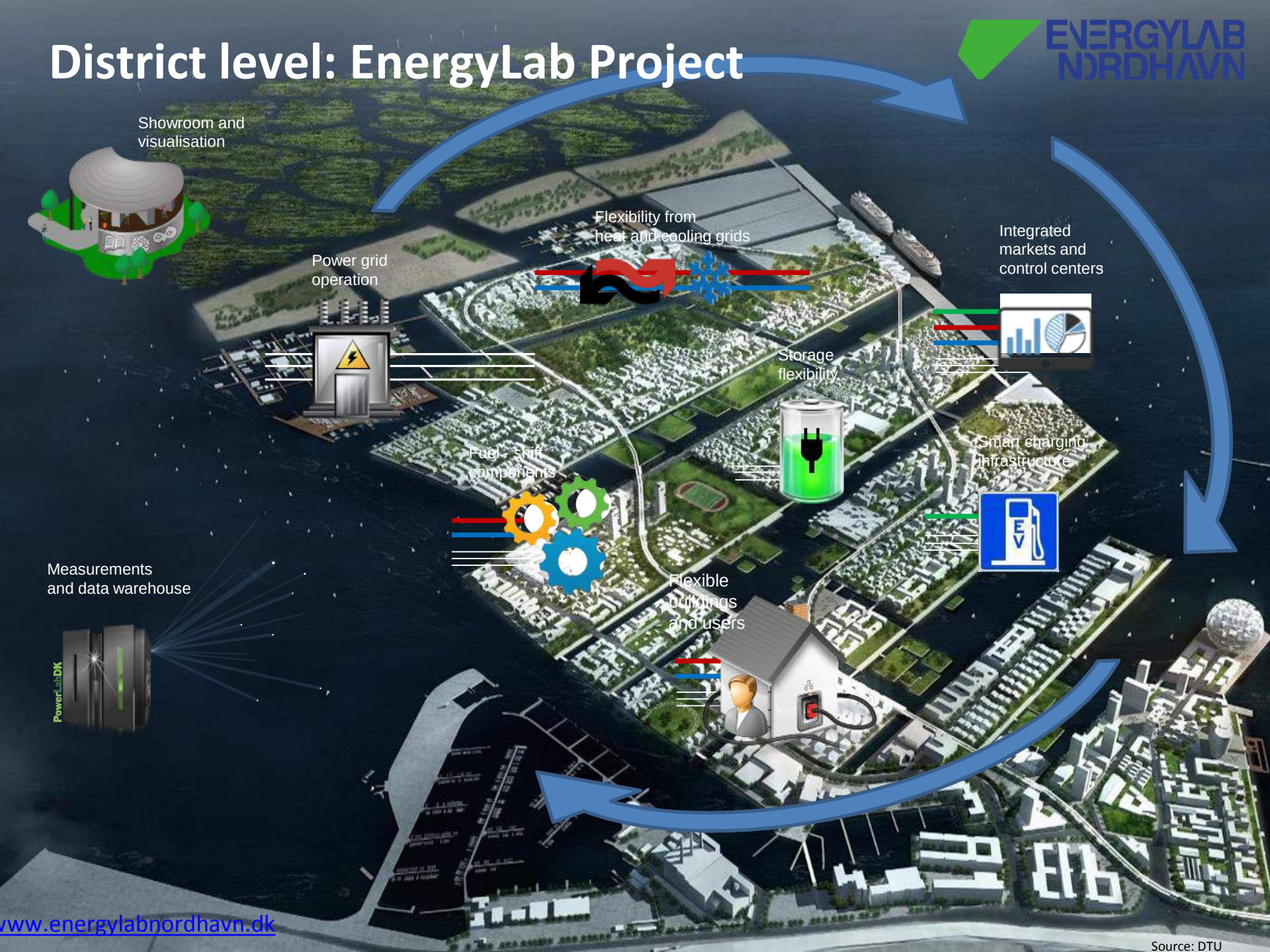
  to public transport
  - 400km of Biking lanes
- Car sharing schemes
- LED Street lighting
- Strict building energy codes and standards



Maximum allowed energy demand (heating, ventilation, cooling and domestic hot water) per year and m2 heated floor space in a new 150 m2 residential building

For more information on Danish Building Energy Code:
https://ens.dk/sites/ens.dk/files/Globalcooperation/tool_ee_byg_web.pdf

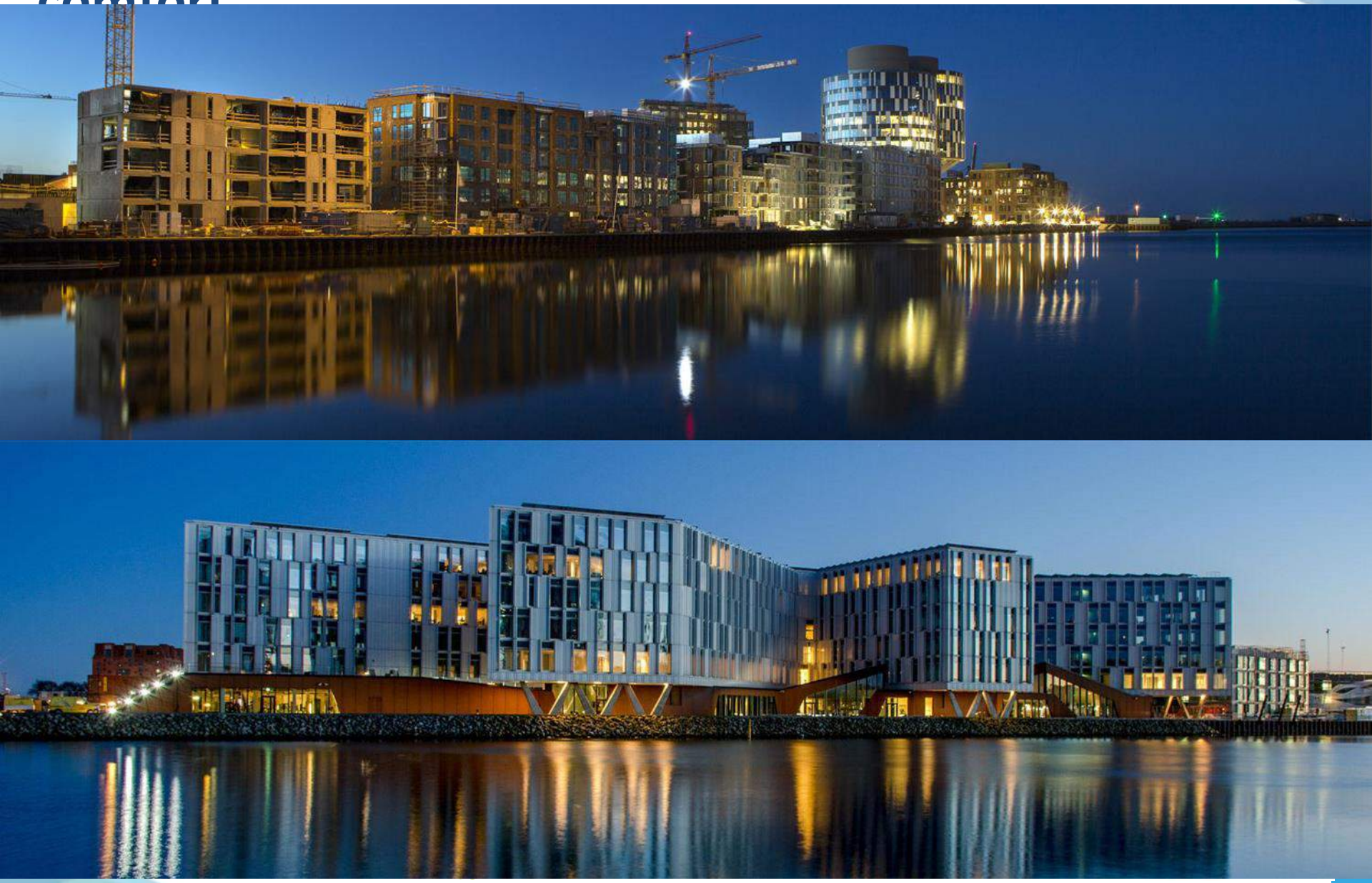
District level: EnergyLab Project



www.energylabnordhavn.dk

Source: DTU

Building level: focus on energy efficiency & comfort



Local-level partnerships to drive actions

Global Covenant of Mayors for Climate & Energy - largest global coalition of cities (7,100) committed to climate leadership

ICLEI (Local Governments for Sustainability) - global network of over 1500 cities, towns and regions committed to a sustainable future

R20 Regions of Climate Change - a coalition of partners that connects over 560 sub-national governments dedicated to developing and implementing low carbon economic development projects, policies and best practices

C40 Cities - Connects 86 cities to share technical expertise on best practices

The Climate Group - specialize in climate and energy initiatives with the world's leading businesses, state and regional governments

100 Resilient Cities - is helping 100 global cities become more resilient to the growing physical, social and economic challenges

City Energy Efficiency Project - The City Energy Project is an initiative of the USA to create healthier and more prosperous American cities by improving the energy efficiency of buildings

World Green Building Council - Advancing Net Zero to deliver NZ energy/carbon certification pathways across GBCs worldwide

Architecture 2030 - Achieving Zero is a roadmap for government entities to enact incremental actions over a fifteen-year timespan to phase out CO2 emissions in the built environment by mid-century

Building Energy Efficiency Accelerator

City Engagement Process

- Sign **partnership agreement**
- Identify preliminary **interest areas**

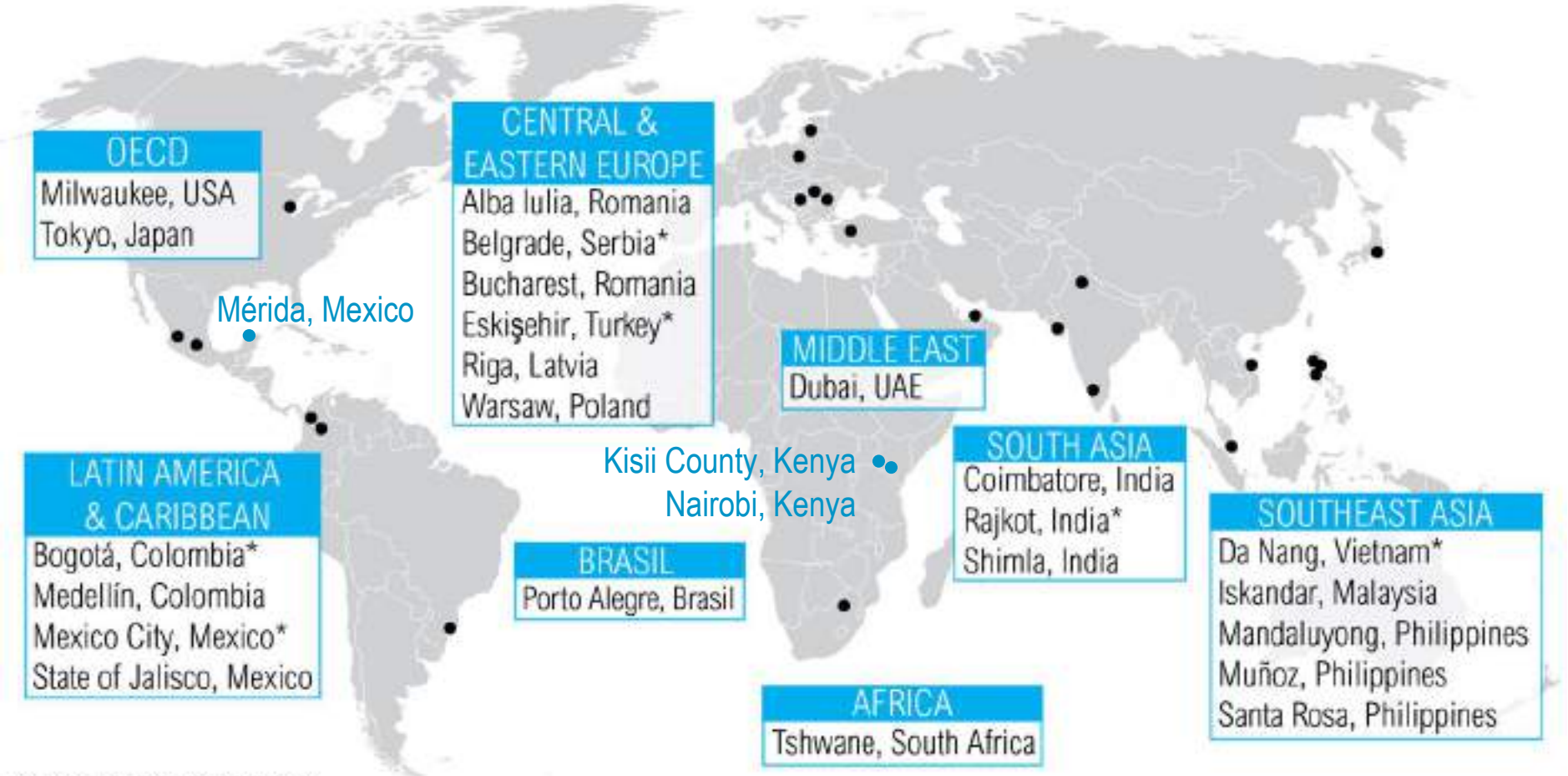
- Assess **locally-appropriate** building efficiency actions
- Access BEA Partners' best practice **technical solutions and expertise**

- **Engage with stakeholders** to help prioritize actions
- Develop an **action plan** for implementing prioritized policies and activities
- Solicit **technical and financial assistance** from BEA partners

- **Fund and staff** BEA policy & project
- **Implement** BEA policy & project

- Establish building efficiency **performance baseline** and track improvements.
- Share best practices with other BEA cities
- Develop an approach for **continuous improvement**

Committed Jurisdictions

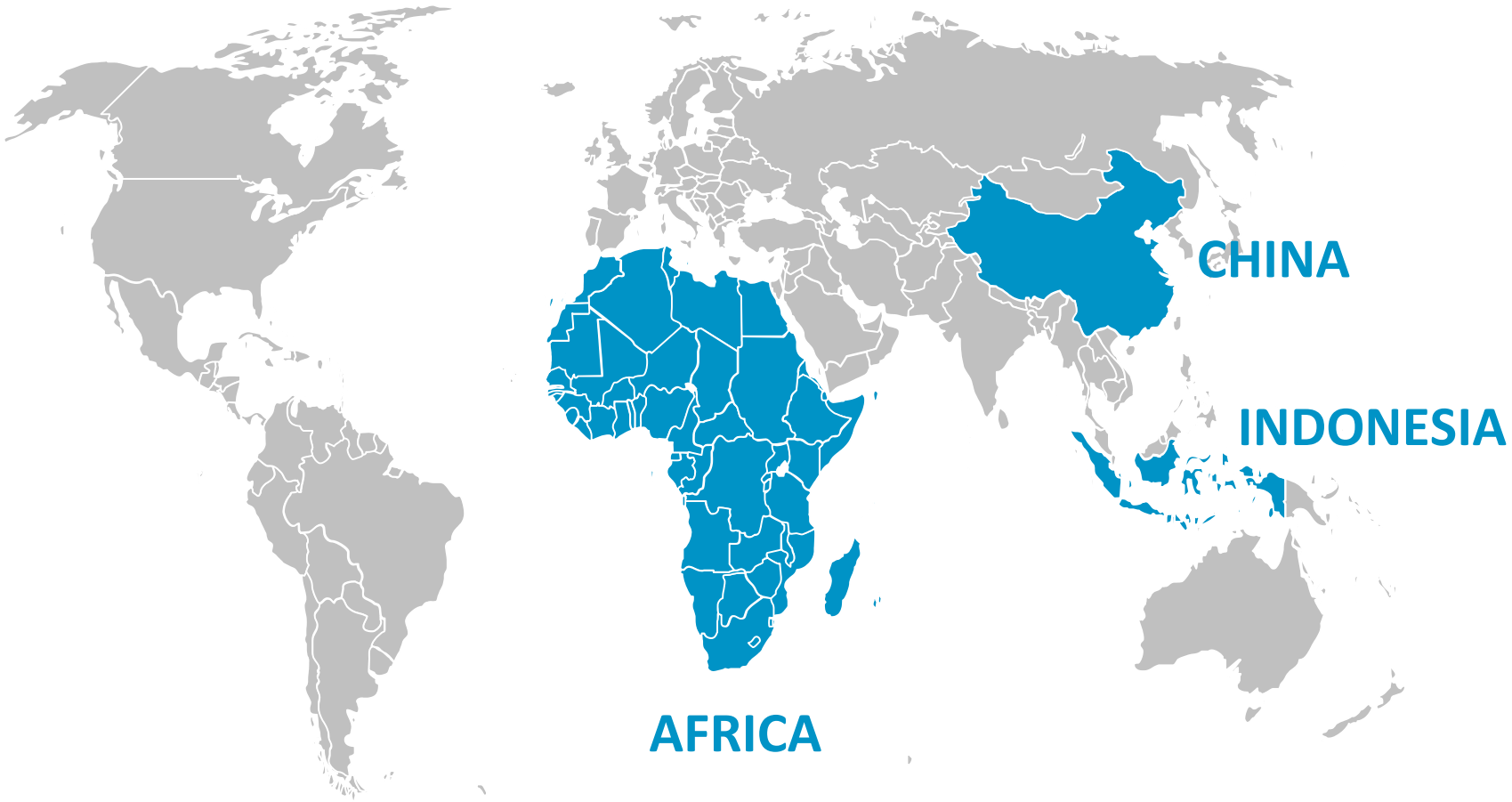


*City selected for "Deep Dive" engagement

City Commitments by Working Group

	Codes	Leadership / Incentives	Retrofits	Procurement	Finance	Tracking	Other
Alba Iulia							
Belgrade							
Bogota							
Bucharest							
Coimbatore							
Da Nang							
Dubai							
Eskişehir							
Iskandar							
Jalisco							
Mandaluyong							
Medellin							
Mexico City							
Milwaukee							
Porto Alegre							
Rajkot							
Riga							
Santa Rosa							
Science City of Muñoz							
Shimla							
Tokyo							
Tshwane							
Warsaw							

2017 Initial Priority Recruitment Regions



UNEP DTU PARTNERSHIP | WORLD RESOURCES INSTITUTE | COPENHAGEN CENTRE ON ENERGY EFFICIENCY | SE4ALL EE HUB

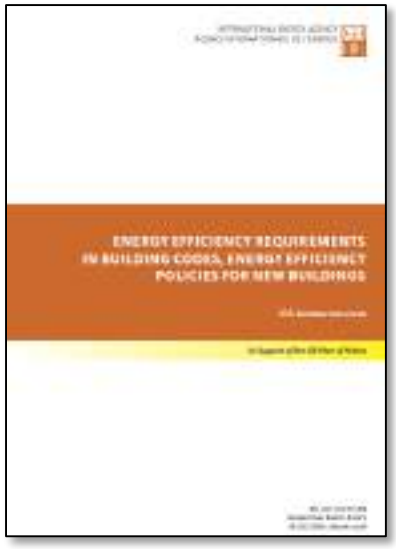
UNEP | gef

http://kms.energyefficiencycentre.org/

UNEP DTU PARTNERSHIP | COPENHAGEN CENTRE ON ENERGY EFFICIENCY
SE4ALL EE HUB

Ksenia Petrichenko, ksepe@dtu.dk

IEA's work on Building Codes & Standards

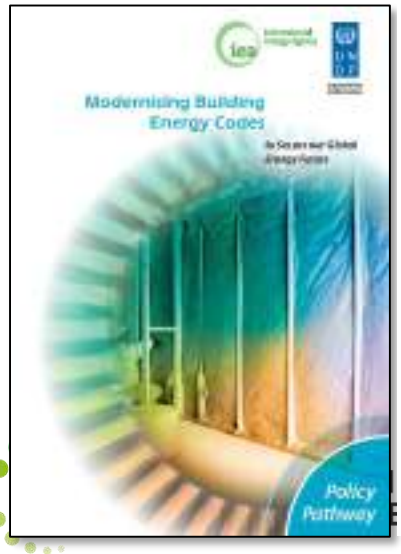


- Design principles for Building Energy Codes
- General principles fro EE in new buildings
- Types of regulation
- Enforcement

IEA 2008

- Global and regional analysis, energy and emissions reduction forecasts
- Technical opportunities and recommendations: envelope; heating and cooling; appliances, lighting and cooking
- Policies for buildings

IEA 2013



- Energy sufficiency, energy efficiency and renewable energy
- Holistic approach and achieving zero-energy buildings
- Importance of implementation

IEA 2013

- Key actions in the next ten years
- Status and technologies development for insulation, air sealing, windows, etc.
- Policy developments

IEA 2013