Accelerating Energy Efficiency
SEforALL & Copenhagen Centre | Building Sector

SE4All Tokyo Forum
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Tokyo, Japan

Ksenia Petrichenko, Copenhagen Centre
1: Energy Efficiency is crucial for achieving the goals of the Paris Agreement

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

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

4: Significant mitigation potentials exist across sectors

**IPCC**
- Buildings: 5.9 GtCO₂
- Industry: 4.1 GtCO₂
- Transport: 2.1 GtCO₂

**IEA**
- Buildings: 30 GtCO₂
- Industry: 22 GtCO₂
- Transport: 12 GtCO₂

but require effective policy development

Source: IEA WEI 2016
Mind the Gap!

- **2 degree C Gap**
  - $= 12 – 14 \text{ GtCO}_2\text{e}$

- **1.5 degree C Gap**
  - $= 15 – 17 \text{ GtCO}_2\text{e}$

- **Baseline**
  - $65 \text{ GtCO}_2\text{e}$ (range: 60-70)

- **Current policy trajectory**
  - $59 \text{ GtCO}_2\text{e}$ (range: 58-61)

- **Unconditional INDC case**
  - $55 \text{ GtCO}_2\text{e}$ (range: 52-58)

- **Conditional INDC case**
  - $53 \text{ GtCO}_2\text{e}$ (range: 49-55)

- **Remaining gap to stay within 2°C limit**
  - $12 \text{ GtCO}_2\text{e}$
  - $14 \text{ GCO}_2\text{e}$ (range: 31-44)
  - $15 \text{ GCO}_2\text{e}$ (range: 38-40)

- **Purple area** shows pathways limiting global temperature increase to below 1.5°C by 2100 with > 50% chance.

- **Blue area** shows pathways limiting global temperature increase to below 2°C by 2100 with > 66% chance.

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

GLOBAL ENERGY EFFICIENCY ACCELERATOR PLATFORM
Copenhagen Centre on Energy Efficiency
SEforAll Energy Efficiency Hub

- C2E2
- Assisting policy change in countries & cities
- International Organisations e.g. UNEP, IEA, IRENA
- Development Banks e.g. World Bank, ADB, IDB, EBRD
- Regional Partners e.g. UN Reg Comm, Cenef, AIT
- National Governments
- Other Stakeholders e.g. Private Sector, Universities, IFIs

Accelerating energy efficiency through innovation

Raising profile of energy efficiency

Analysis & evidence

Finance

Communications

Partnerships
Focus on energy efficiency implementation

- Existing Best Practice Network of EE experts
- Project implementation partners (EE Accelerators)
- Finance and investment partners
- Leading/"inspirational" global cities
- Copenhagen Centre on Energy Efficiency
- Local coordinating partner
- 'Aspirational' Cities
- National/subnational governments
- Local service providers and companies
Global Energy Efficiency Accelerator Platform

Drawing on existing best practice networks

Building
- World Resources Institute
- Johnson Controls

District Energy
- Danfoss

Lighting
- Philips

Vehicle Fuel
- UN @ environment

Industry
- UNIDO
- Carbon Trust

Appliances & Equipment
- UN @ environment

City & Country Commitments to EE Action

Opportunity Assessment

Develop Strategy and Plans

Build the Enabling Environment

Formulate Initiatives and Investments

Achievement of municipal, national and global EE objectives

Secretariat
- Communications
- Co-ordination
- Tracking activity/results
- Cross-sectoral funding

Global Team
- Platform ownership
- High level oversight
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
Emissions from Buildings & Construction

Buildings and construction make up nearly 40% of the global direct and indirect energy-related CO$_2$ emissions.


**Diagram:**
- **Transport, 22%**
- **Buildings, 29%**
- **Industry, 35%**
- **Industry*, 9%**
- **Other, 3%**

- **Direct, 27%**
- **Indirect, 73%**
Major growth in buildings is expected in India and Africa (over 200%); and in Latin America, Southeast Asia and Middle East (over 100%).
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

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

- **Codes, standards, regulations, etc.**
- **Green loans, Rebates, Taxes, etc.**
- **Voluntary schemes, Capacity building, Awareness**
- **Targets, roadmaps**
- **Sticks**
- **Carrots**
- **Tambourines**

**Business models, private sector engagement**
Unique combination of ‘carrots and sticks'

Singapore

These mechanisms complement efforts by government to mandates minimum performance levels.

Synergies:
Participants can apply for financial incentives if they aim to achieve the highest rating levels of Green Mark.

- **Awareness**
  - (Benchmarking)
  - BCA Green Mark Scheme

- **Incentives**
  - Financial incentives for best performance

**Efficient residential and non-residential buildings (new and existing)**

- **Targets**
- **Action for Utilities**
- **Codes**
  - Building Control (environmental sustainability)
  - Regulations
- **Capacity Building**
  - Green Mark Managers
  - Green Mark Facility Managers
  - Green Mark Professionals
  - Certified Energy Manager Program + ESCO Accreditation

**Source:** Institute for Building Efficiency, WRI
Global Map of Building Energy Codes

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

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 as NZE
- **2030**: 50% of existing commercial buildings to be retrofitted as NZE
Three messages on Building Codes

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

To allow trade-offs between elements of the building envelope.

Energy use of a building demonstrated through its operation.

1970 | 2000 | now

Why?
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
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

Examples exist, but scale is small

GABC Global Status Report: http://www.globalabc.org/
Message 3: Focus on enforcement

- 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
Message 3: Going beyond individual buildings

- 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
- Building

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
Country level: Denmark

- DK 50% wind in the grid
- Copenhagen CO$_2$ neutral
- DK independent of fossil fuels
- DK 40% CO$_2$ reduction
- DK fossil free power and heat

Timeline:
- 2010
- 2020
- 2025 (Copenhagen CO$_2$ neutral)
- 2030
- 2040
- 2050
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

- Power grid operation
- Storage flexibility
- Fuel shift components
- Flexibility from heat and cooling grids
- Measurements and data warehouse
- Flexible buildings and users
- Integrated markets and control centers
- Smart charging infrastructure
- Showroom and visualisation

Source: DTU

www.energylabnordhavn.dk
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**

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

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

**Development**
- 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

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

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

- Kisii County, Kenya
- Nairobi, Kenya
- Mérida, Mexico
## City Commitments by Working Group

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<th>Codes</th>
<th>Leadership / Incentives</th>
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2017 Initial Priority Recruitment Regions

CHINA

AFRICA

INDONESIA
Knowledge Management System

The Copenhagen Centre’s Knowledge Management System (KMS) engages stakeholders in energy efficiency initiatives through knowledge sharing and outreach. The KMS provides users with access to selected information, reports, publications, and databases on energy efficiency. The KMS is linked to many other energy efficiency initiatives.

http://kms.energyefficiencycentre.org/

Ksenia Petrichenko, ksepe@dtu.dk
IEA's work on Building Codes & Standards

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

IEA 2008

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

IEA 2013

- 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

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

IEA 2013