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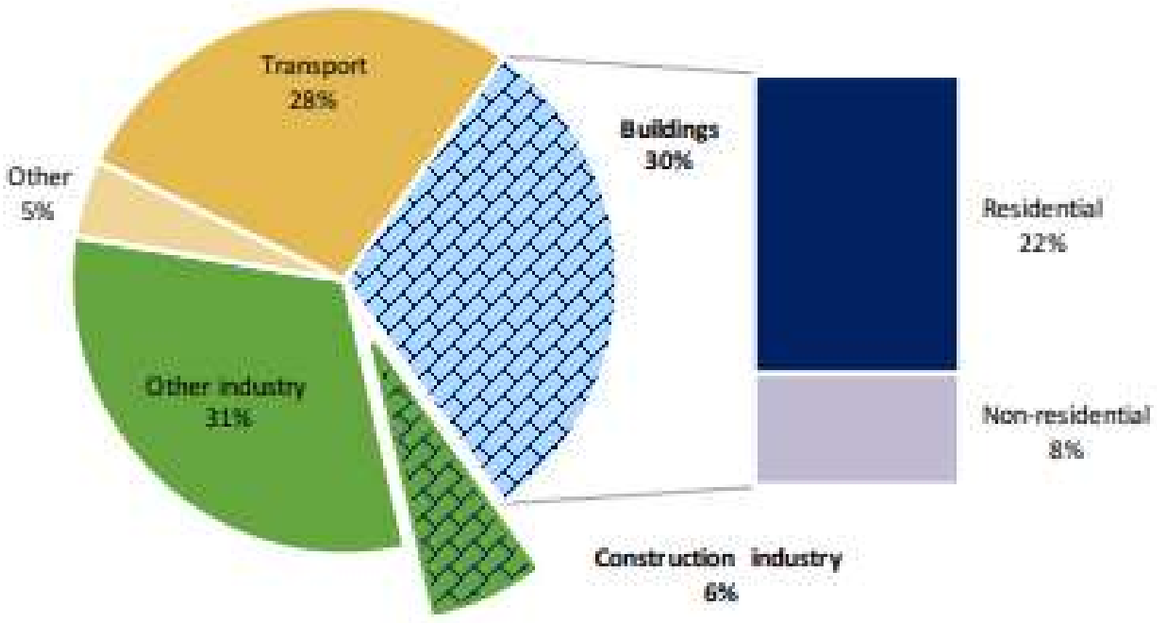
Decarbonizing Buildings and housings

Synergy of energy efficiency and renewable energy

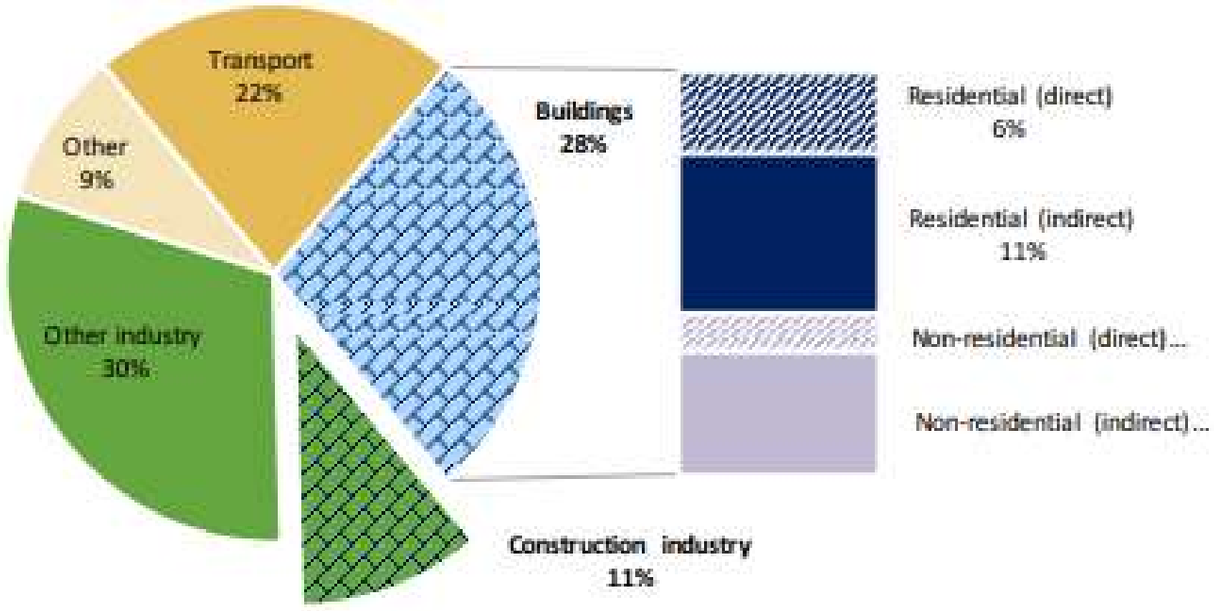
20181005 Symposium: Renewable Energy Institute
Yuko Nishida, Manager, Climate Group
Renewable Energy Institute

Building and construction account for nearly 40% of energy-related CO2 emissions

Share of global final energy consumption by sector, 2015



Share of global energy-related CO2 emissions by sector, 2015



The global buildings sector consumed about 125 EJ or 30% of total final energy use. Construction including manufacturing of materials for building accounted for an additional 6%.
Buildings represented 28% of global energy-related CO2 emissions. Building construction industry represented another 11% CO2 emissions

Buildings and construction emit one forth of the total global GHG emissions.

Global Alliance of Buildings and Construction
Global Status Report 2017
http://www.globalabc.org/bundles/app/pdf/20161114_GABC-GSR-Report_Updated_Web-version.pdf

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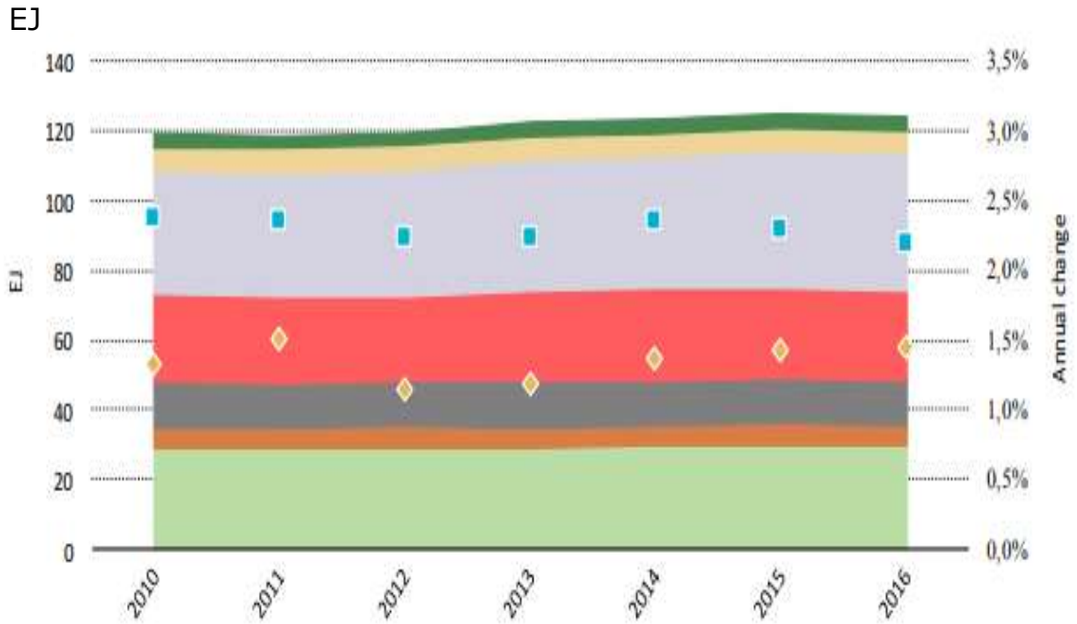
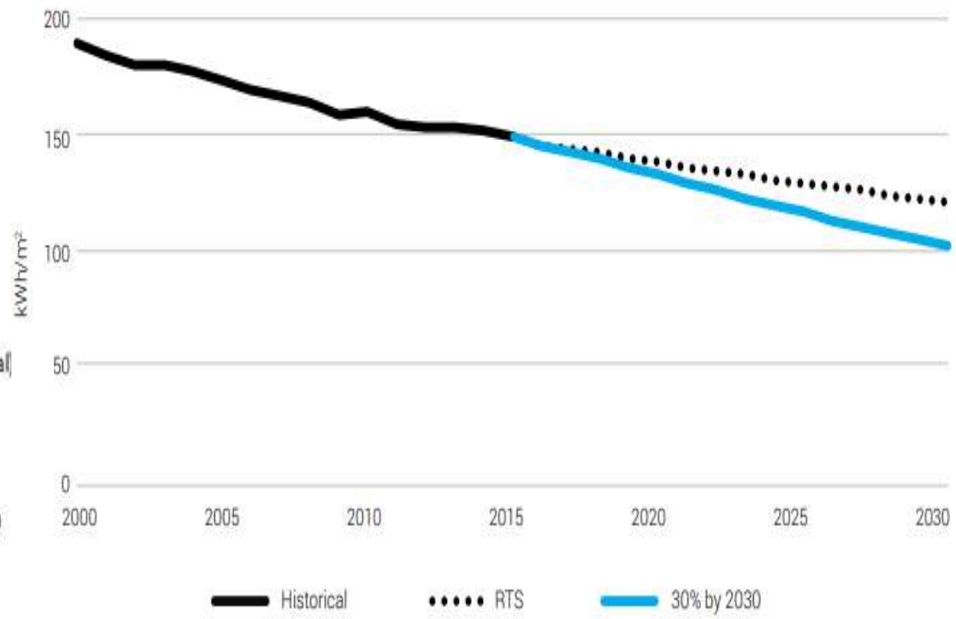
Progress in reducing energy consumption in building sector is slow

Global building sector energy consumption by fuel type 2010 -2016



Global final energy use per square meter



Energy consumption in buildings are still growing.
Energy use per square meter has been progressed, but improvements are still not keeping up with growing developments and rising demand for energy services.

The energy intensity needs to improve on average by 30% by 2030 compared to 2015 to meet the target of the Paris Agreement, but the progress is slow.

Global Alliance of Buildings and Construction
Global Status Report 2017
http://www.globalabc.org/bundles/app/pdf/20161114_GABC-GSR-Report_Updated_Web-version.pdf

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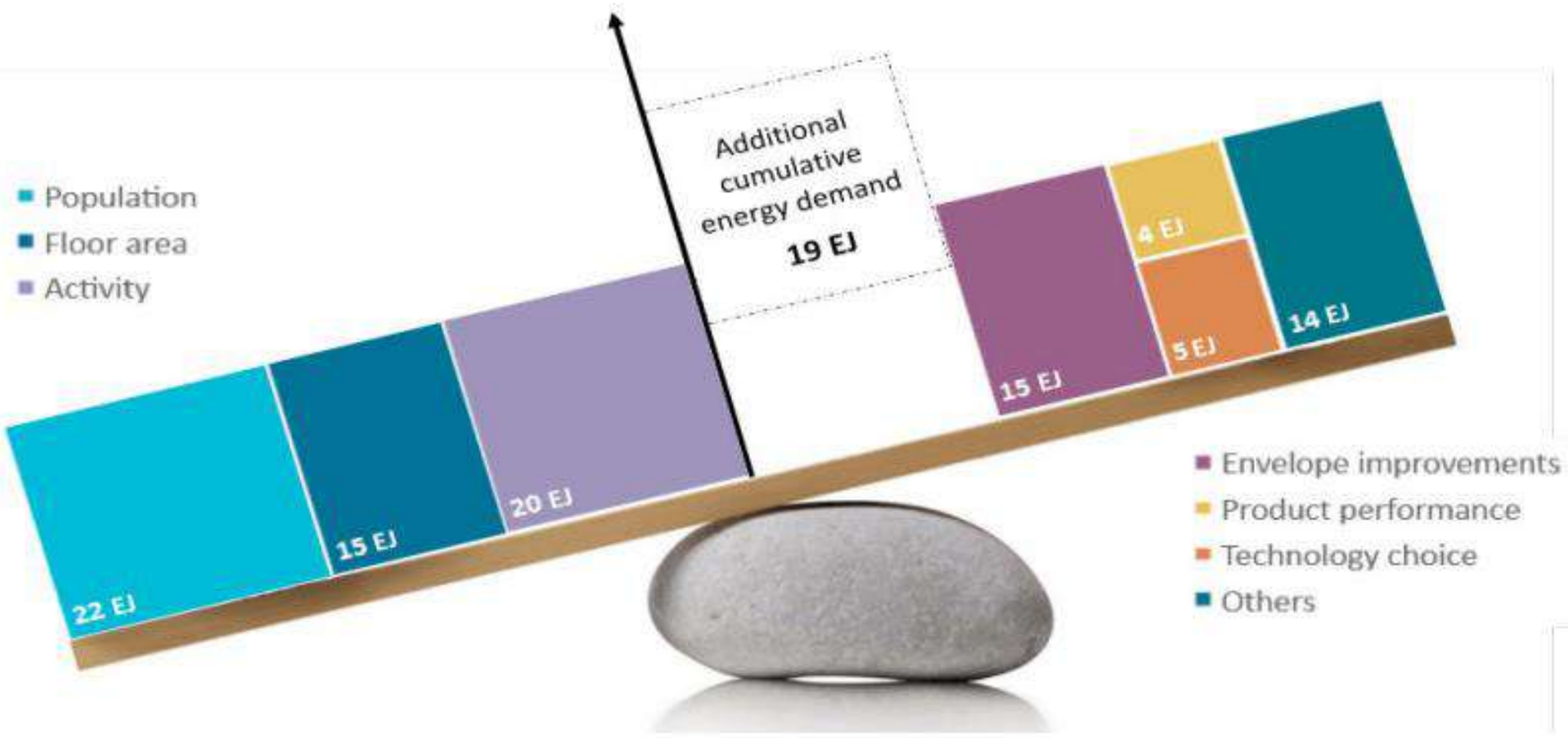
Expectation and challenge to building sector with growing population and developments

IPCC Ver.5

In contrast to a doubling or tripling, final energy use may stay constant or even decline by mid-century, as compared to today's levels, if today's cost-effective best practices and technologies are broadly diffused.

Realizing these opportunities requires aggressive and sustained policies and action including building codes and appliance standards.



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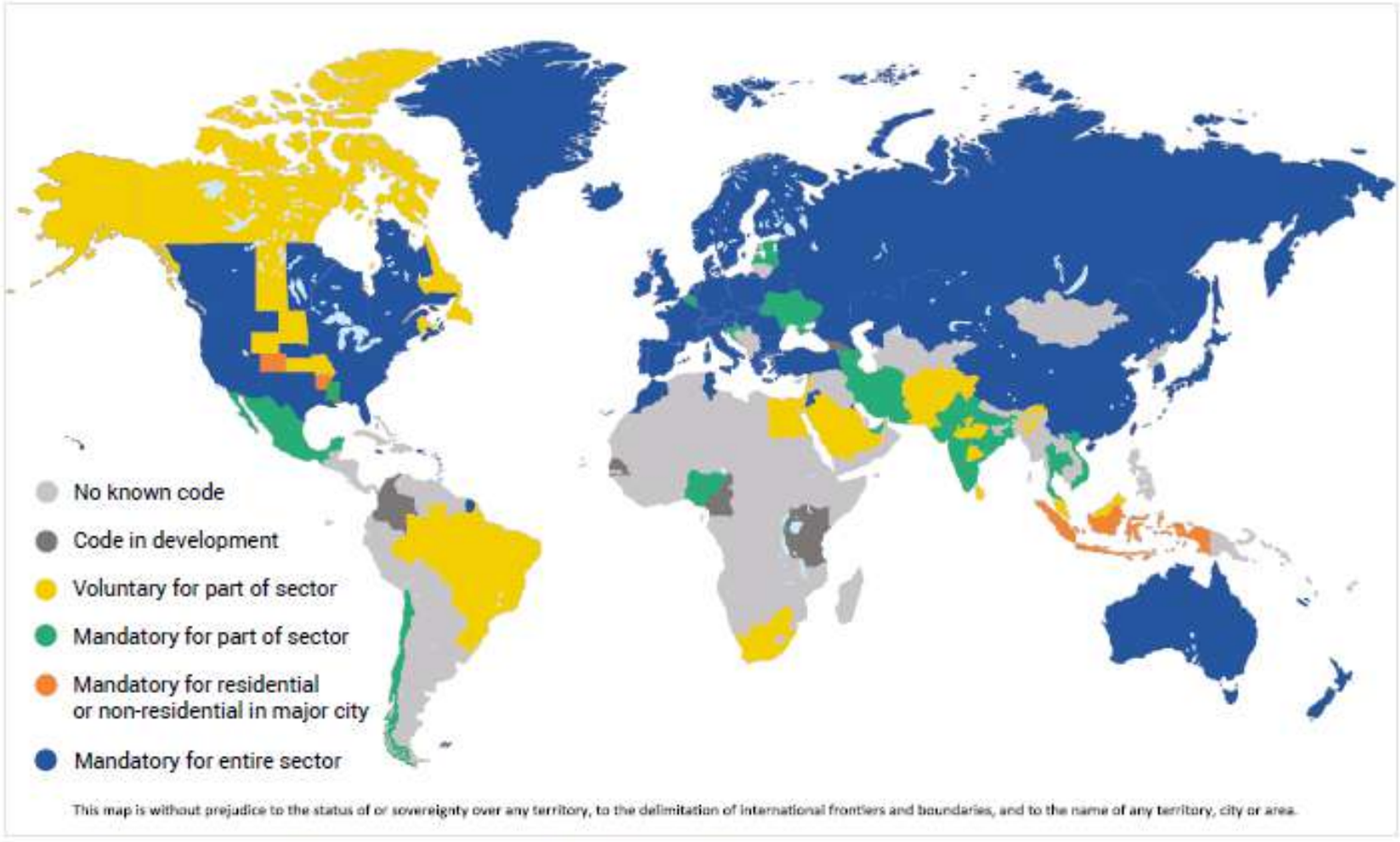
Buildings and energy: Key policy

Mandatory building energy codes need to be adopted as soon as possible for further jurisdictions to avoid lock-in effects



Source: IEA (2017), Building Energy Efficiency Policies (Database), https://www.iea.org/beep/

Countries to have mandatory building energy code in place 62／193
Countries to have energy certificate/labeling system in place 84／193

Global Alliance of Buildings and Construction
Global Status Report 2016
http://www.globalabc.org/bundles/app/pdf/20161114_GABC-GSR-Report_Updated_Web-version.pdf

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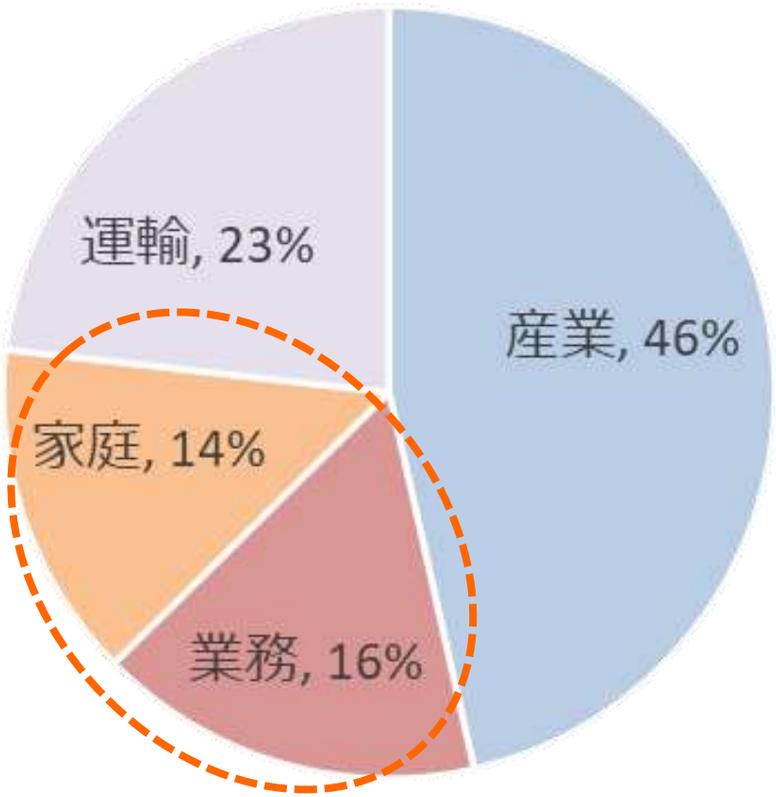
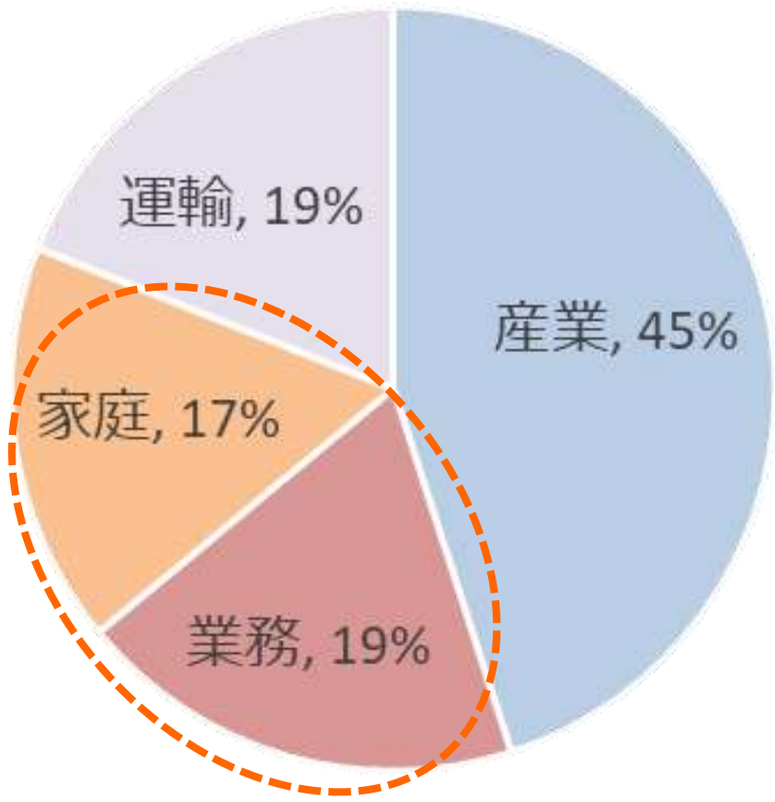
Buildings energy consumption in Japan

Final energy consumption by sector (2016)



CO2 emission by sector (2016)

*Distributed electricity consumption into each sector



In Japan 30% of final energy consumption and 35% of energy-related CO2 emissions account for building sector

Source : ANRE, METI “comprehensive energy statistics”
GHG emission inventory office, NIES

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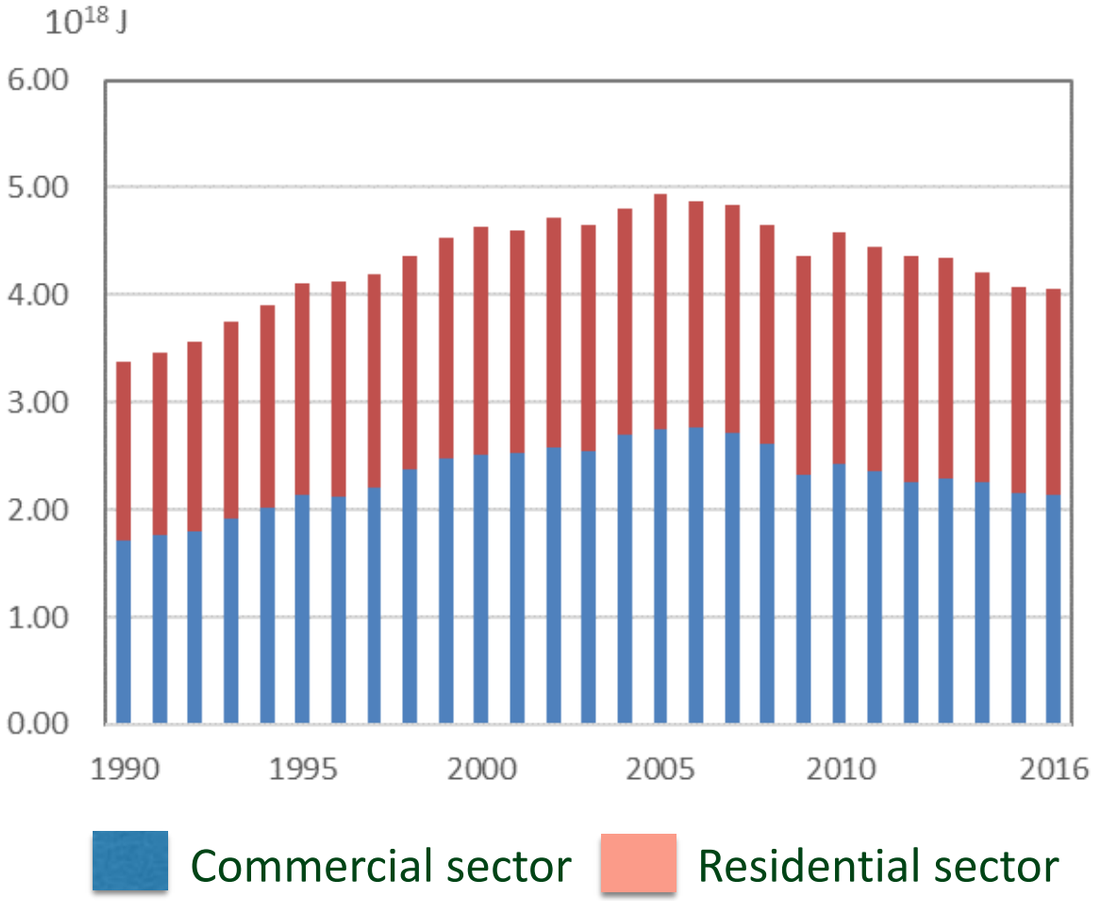
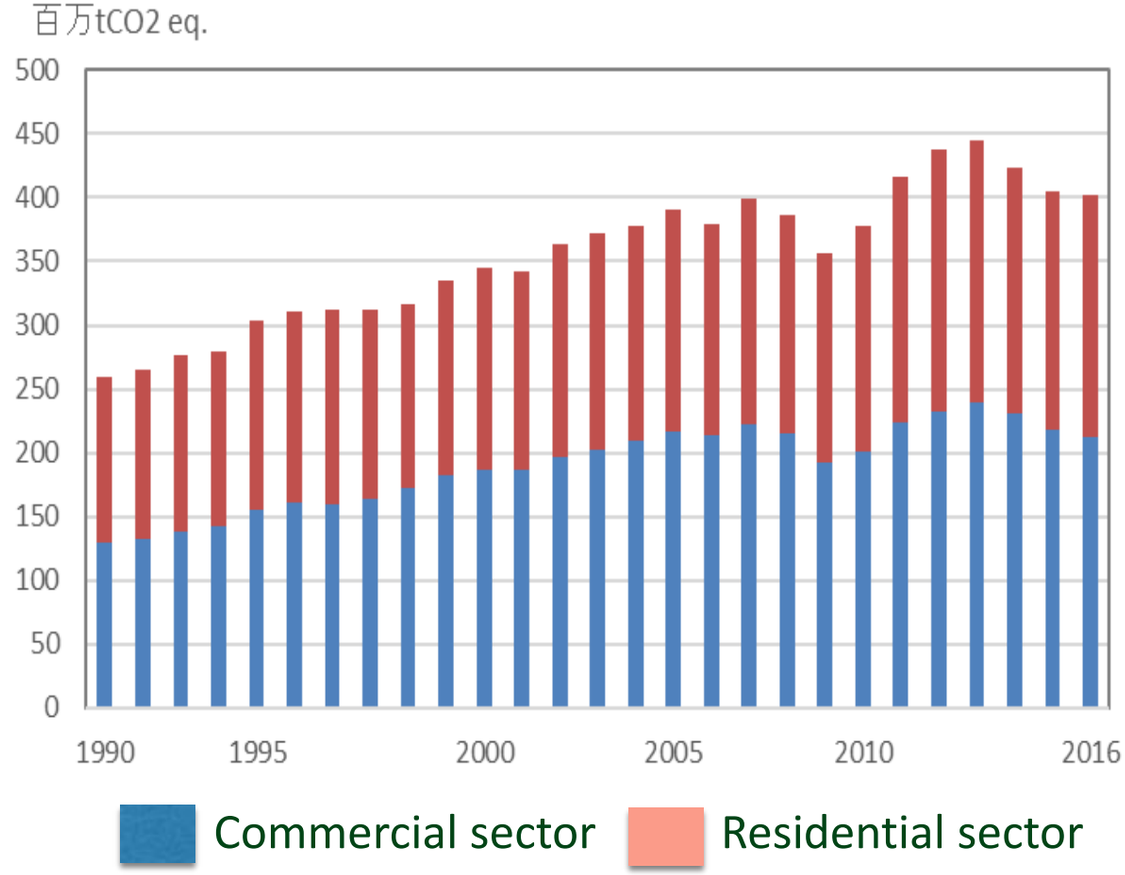
Buildings energy consumption in Japan

Final energy consumption in commercial and residential sector (Left)
CO2 emission (right)





In Japan final energy consumption in building sector (commercial and residential sector) is diminishing since 2005
However, CO_2 emissions are just the same level as “before the earthquake” affected by emission factor

Source : ANRE, METI “comprehensive energy statistics”
GHG emission inventory office, NIES

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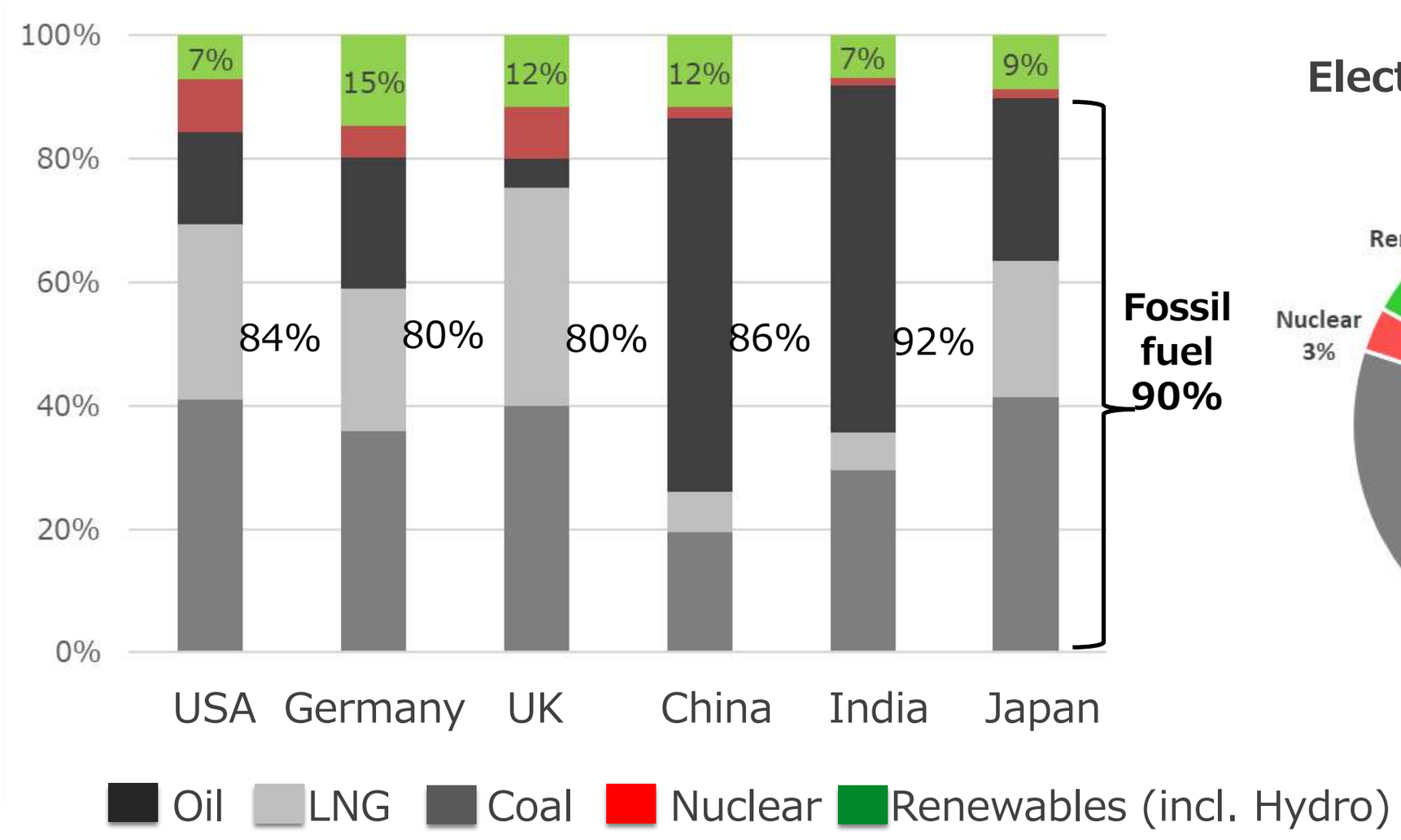
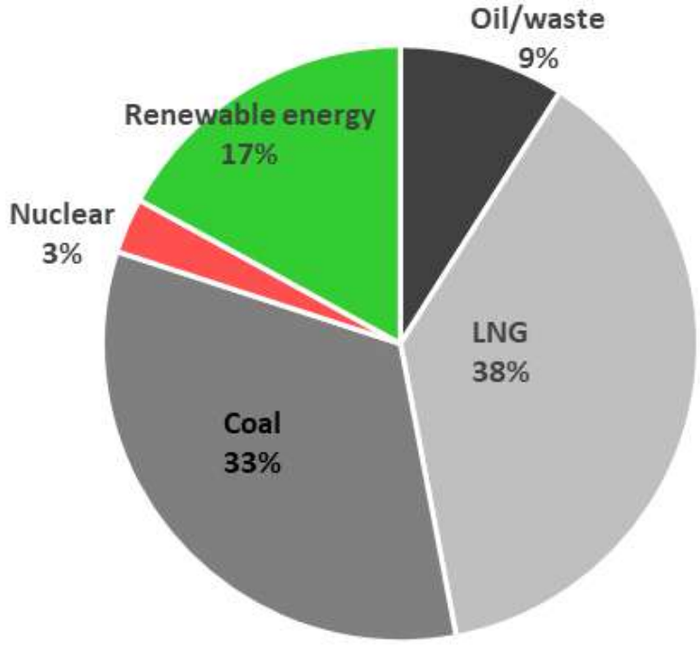
Japan's energy mix
Fossil fuel dependent

Fossil fuel share of primary energy consumption in major counties



Electricity generation mix（2017）



出典：　BP Statistical Review of World Energy June 2018
METI/ANRE "Monthly Report on Electricity Statistics" (accessed on 07/20/2018)

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Pathway to GHG 80% reduction
＝Pathway to Zero carbon buildings

Target: GHG 80% reduction by 2050

①Reduce energy consumption＝

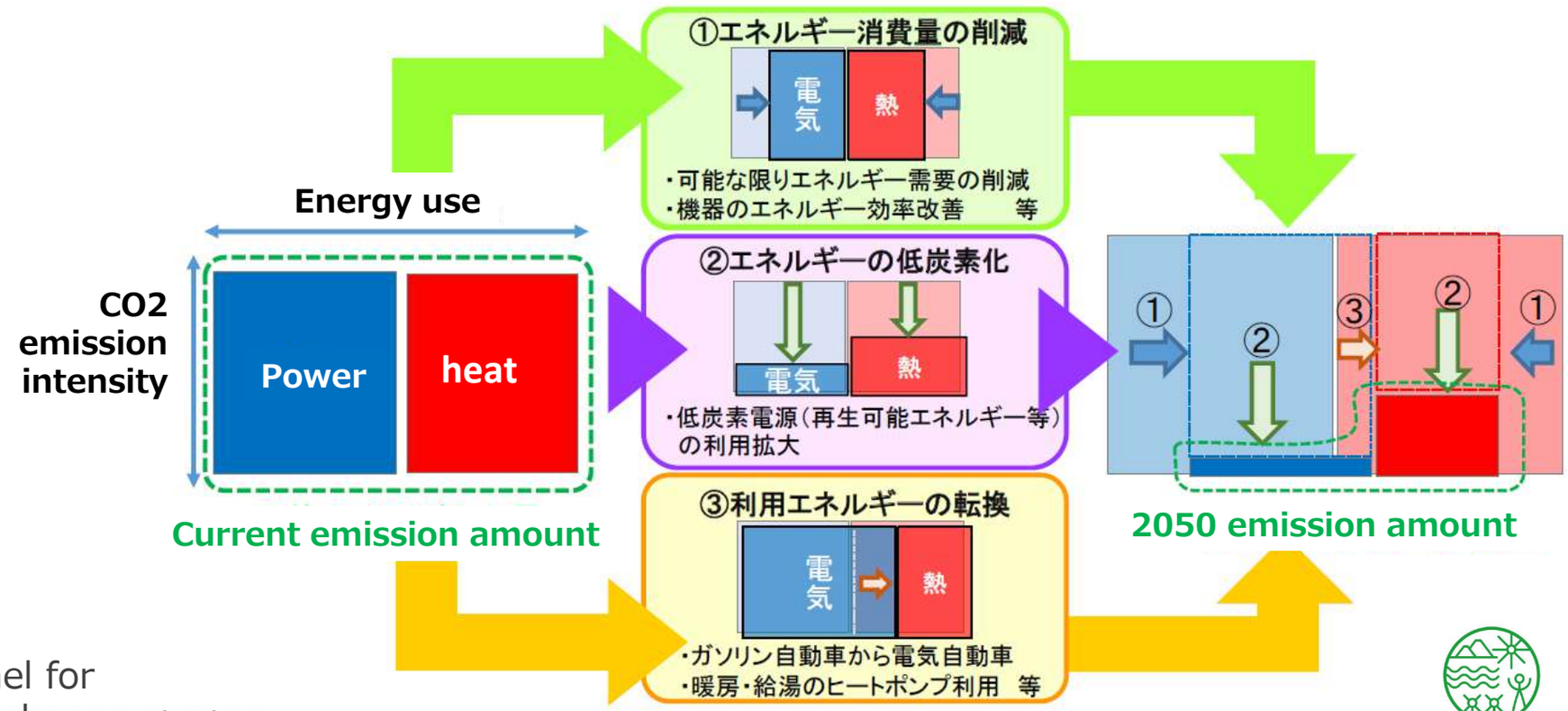
Improvement of building envelope and efficient energy equipment

②Decarbonization of source energy＝

Renewable electricity and heat

⇐ On site PV/solar heat/ground-source heat pump
Gird renewable electricity

③Shifting energy source＝Electrification (heat pump technology for heat and HW)



MoE : Advisory panel for
Long-term climate change strategy

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Synergies between energy efficiency and renewable energy

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Energy efficiency improvement and renewable energy introduction has synergies when they go together

■Smaller energy consumption enhance renewable energy share

■Smaller domestic energy demand create higher community renewable source

■Technology showing synergies

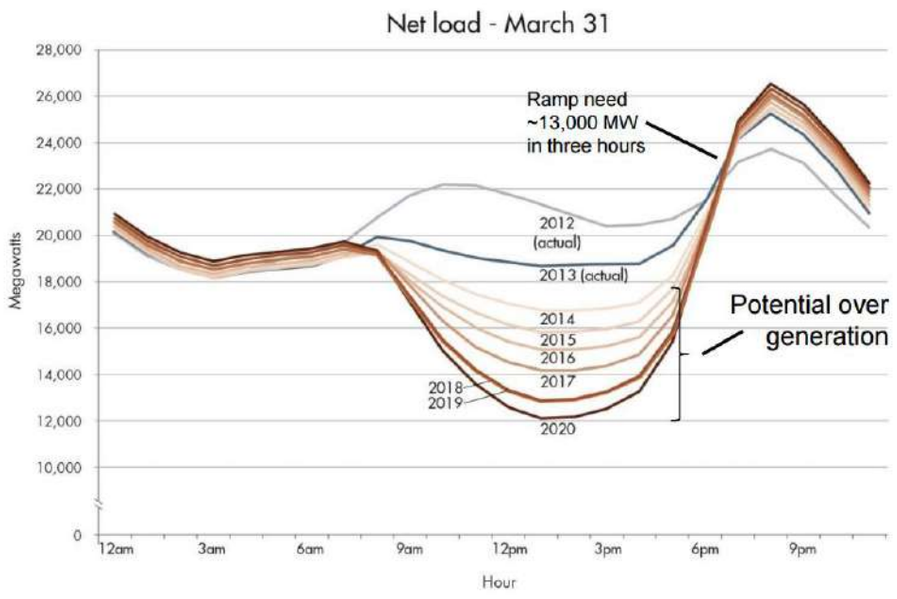
- **Heat pump** : Significantly efficient compared to conventional boilers
  ＋can use renewable electricity
- **EV** : Significantly efficient compared to ICT vehicles
  ＋can use renewable electricity
  ＋can use as battery

■Electrification of end-use energy services offer balancing opportunity for a grid system

Necessary when the renewable share getting high

※Mitigating the duck curb effect in California

- **Demand Response** by utilizing batteries (EV) and heat-pump hot water system
- **VPP（virtual power plant)**



California duck curve California ISO

Synergies between energy efficiency and renewable energy

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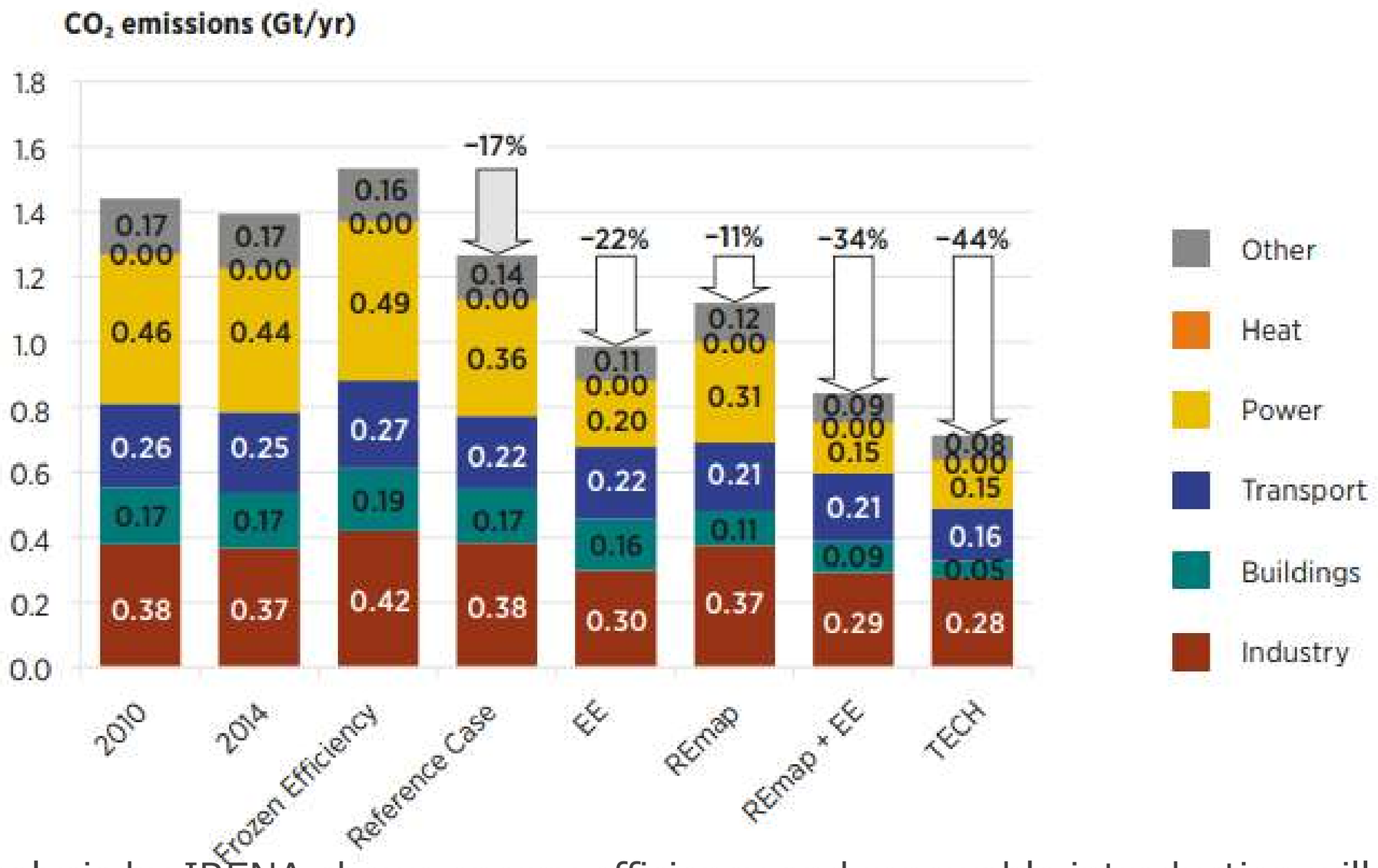
Scenario analysis on CO2 emissions in Japan



Scenario analysis by IRENA shows energy efficiency and renewable introduction will have greater results when they go together. Synergies is shown in total reduction cost, too.

IRENA 2017 : Synergies between renewable energy and energy efficiency

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Leading Policies

California
Zero Net Energy Building Policy

Target California Energy Efficiency Strategic Plan (2008)

- All new residential construction will be zero net energy (ZNE) by 2020.
- All new commercial construction will be ZNE by 2030
- 50% of commercial buildings will be retrofit to ZNE by 2030

Measures Energy standard – CA Zero Net Energy Code

May 2018 Introduction of 2019 Building Energy Efficiency Standard
(Enforced in 1 January, 2020)

- **Mandate PV system installation in new residences**
- Enhance insulation standards
- Ventilation standard for residential and non-residential buildings
- Lighting standards for non-residential buildings

Points

- Mandate highly cost-efficient measures
  Under 30 years' mortgage, additional $40 initial payment saves $80 in monthly energy bill
- 30% energy reductions by code enhancement particularly in lighting standard for non-residential buildings

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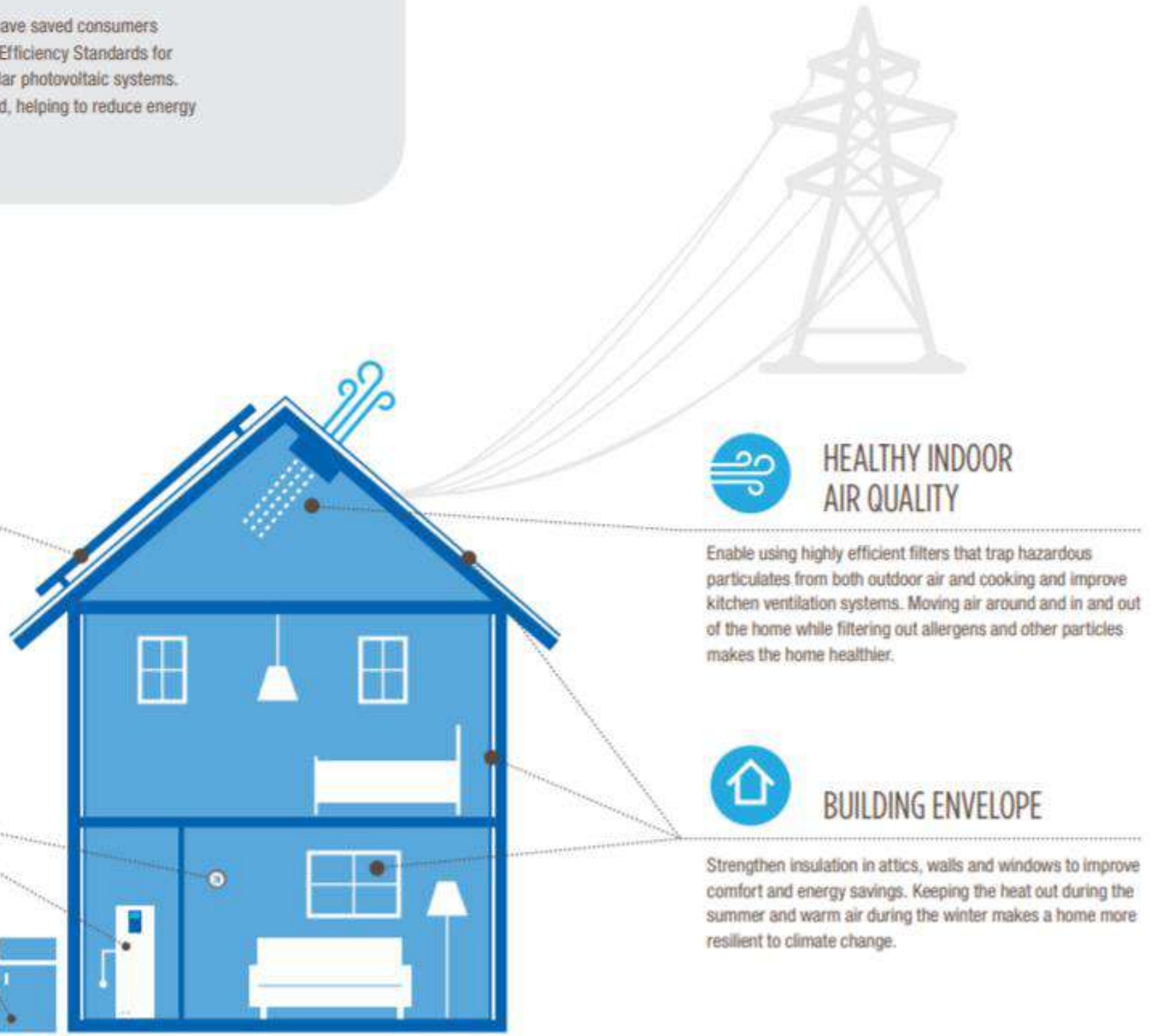
CALIFORNIA'S 2019 RESIDENTIAL

BUILDING ENERGY EFFICIENCY STANDARDS

CALIFORNIA ENERGY COMMISSION

The state's energy efficiency standards for new buildings and appliances have saved consumers billions in lower electricity and natural gas bills. The 2019 Building Energy Efficiency Standards for residential buildings includes a first-in-the-nation requirement to install solar photovoltaic systems. Other features enable homes to reduce the electricity demand from the grid, helping to reduce energy bills and the carbon footprint.

$19,000 SAVINGS OVER A 30 YR. MORTGAGE | INITIAL COST $9,500



SOLAR PHOTOVOLTAIC SYSTEM

Promote installing solar photovoltaic systems in newly constructed residential buildings. The systems include smart inverters with optional battery storage. This will increase the self-utilization of the electricity generated to power the home's electricity loads including plug-in appliances. California is the first state in the nation to require smart systems on homes.

DEMAND RESPONSE COMPLIANCE OPTIONS

Encourage battery storage and heat pump water heaters that shift the energy use of the house from peak periods to off-peak periods. Utilities moving to time-of-use pricing assists the grid to meet the state's climate change goals and helps homes reduce energy bills.

HEALTHY INDOOR AIR QUALITY

Enable using highly efficient filters that trap hazardous particulates from both outdoor air and cooking and improve kitchen ventilation systems. Moving air around and in and out of the home while filtering out allergens and other particles makes the home healthier.

BUILDING ENVELOPE

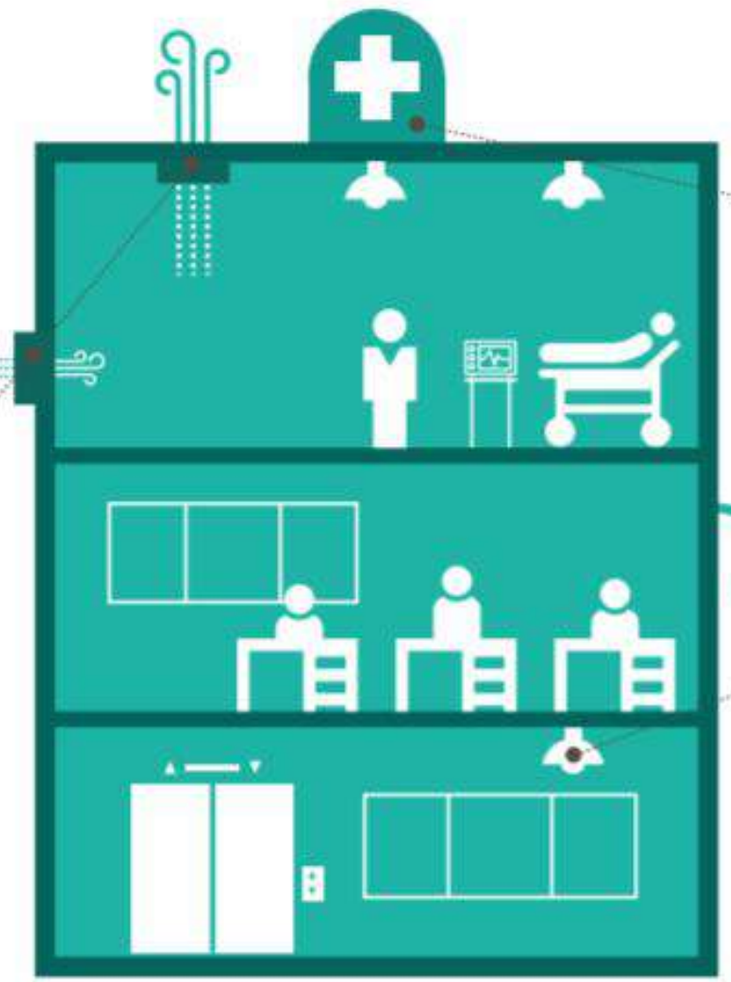
Strengthen insulation in attics, walls and windows to improve comfort and energy savings. Keeping the heat out during the summer and warm air during the winter makes a home more resilient to climate change.

CALIFORNIA'S 2019 NONRESIDENTIAL

BUILDING ENERGY EFFICIENCY STANDARDS

CALIFORNIA ENERGY COMMISSION

The state's energy efficiency standards for new buildings and appliances have saved consumers billions in lower electricity and natural gas bills. The 2019 Building Energy Efficiency Standards for nonresidential buildings include better lighting and ventilation. The standards also extend requirements for the first time to newly constructed healthcare facilities.



HEALTHCARE FACILITIES

For the first time, energy efficiency standards extend to newly constructed healthcare facilities and incorporates the appropriate application of standards.

HEALTHY INDOOR AIR QUALITY

Enable using highly efficient filters that trap hazardous particulates from both outdoor air and cooking and improve kitchen ventilation systems. Moving air around and in and out of the home while filtering out allergens and other particles helps improve the health of a building. The standards add airflow requirements specific to small duct, high velocity systems, and sets, sensor control requirements.

LIGHTING

Update indoor and outdoor lighting values to assume the use of LED lighting. LED lights use little energy and will save money on monthly electricity bills meaning smaller operating budgets for commercial buildings. Maintenance costs are reduced because bulbs do not need to be changed as often. The standards also add occupancy sensing requirements for restrooms.

Net Zero Energy Building Policy in EU

Target Energy Performance Building Directive (2010) (EPBD)

New public buildings to be NZEB by 2018

All new buildings to be NZEB by 2020

Points

- Member countries required to establisl
- Definition of NZEB “is a building that h
  The nearly zero or very low amount of
  to a very significant extent by energy f
  energy from renewable sources produc

- Detailed definitions with numeric index are determined to be suitable to each county
- Each country required to establish NZEB plan setting programs, providing finance, information and so on.
- Concrete plans in Demark, Belgian, and France

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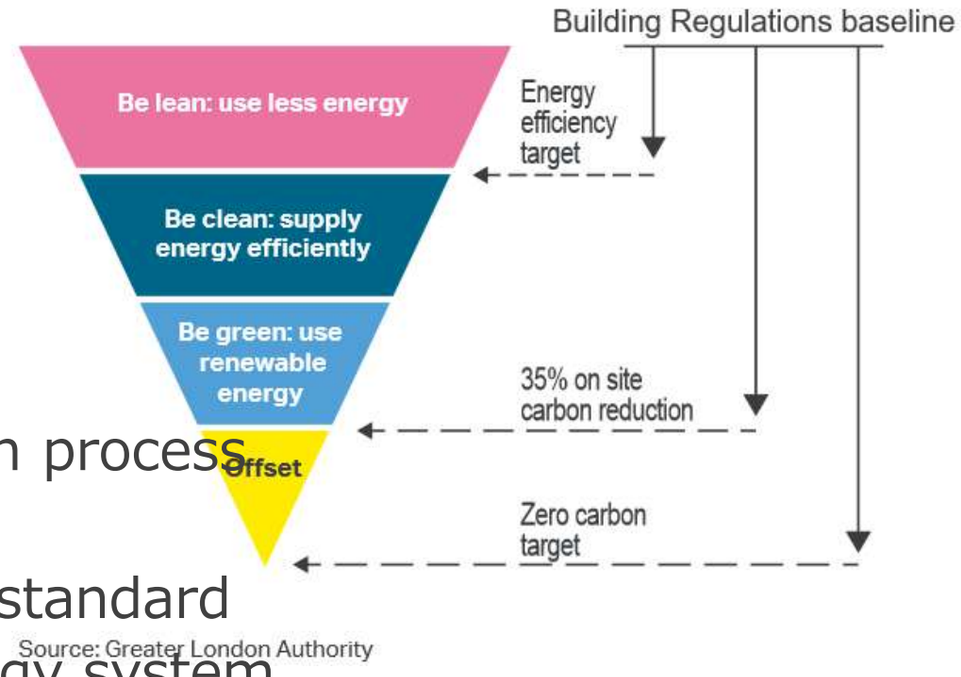
London Zero Carbon Home regulation

Target

60% CO2 emission reduction by 2025 (from 1990 base)in GLA

2016～New residential buildings in major development are required to be zero carbon home

2019～New non-residential buildings to be zero carbon building



Source: Greater London Authority

Point

- Set targets in “London Plan”, the master pan in urban planning
  integrated in planning system and building permission process

【Energy Planning Hierarchy】

Be lean: energy efficiency 35% higher the national standard

Be Clean : Supply efficient energy～distributed energy system

Be Green : Renewable energy introduction

- Although the UK government withdraw the zero carbon home target in 2015、the mayor of GLA kept the commitment. Enforced in Oct. 2016
- Shifting to the distributed heat and power system
- Promoting renewable energy introduction
- Offsetting is allowed if it’s short for “zero-carbon level”

London Zero Carbon Home regulation

Development process

- Developers in major developments

  --Required to build 35% more energy efficient houses compared to the national regulation--Mandatory

  --Try to introduce on-site renewables, to use district heating system

  When the total estimated carbon emission become above zero, developer has to pay for it to the borough

  GLA established the guideline for calculation and other technical issues

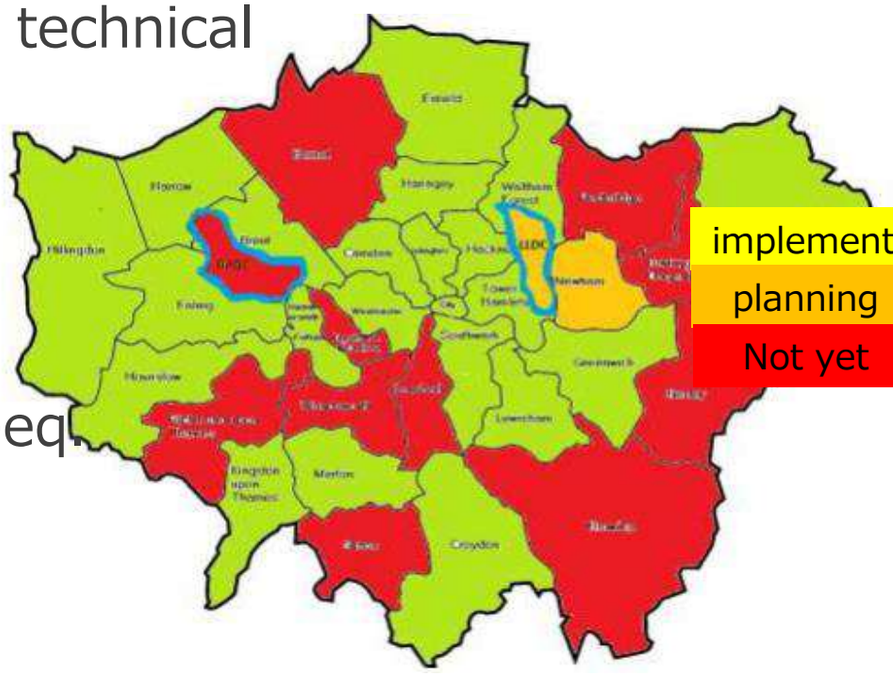
- Enforced by borough governments

  ・Boroughs required to establish their own CO2 offset fund and collect offset money.

  ・Off-set price: Around ￡1800（￥270,000円)／t CO2-eq.（￡60×30yrs)

  ・Borough offices required to find high potential area/opportunity for renewables

  ・Borough offices are granted discretionary power to certain extent such as collecting off-set money, using the fund, setting the off-set price …



Boroughs implementing off-setting (May 2016)

WORLD GREEN BUILDING COUNCIL

Net Zero Carbon Buildings Declaration

C40 CITIES

19 Global Cities Commit to Make New Buildings "Net-Zero Carbon" by 2030 Regulations and planning policy will also target existing buildings to make them net-zero carbon by 2050 to ensure cities deliver on the highest goals of Paris Agreement

19 Cities; Copenhagen, Johannesburg, London, Los Angeles, Montreal, New York City, Newburyport, Paris, Portland, San Francisco, San Jose, Santa Monica, Stockholm, Sydney, Tokyo, Toronto, Tshwane, Vancouver & Washington D.C

GLOBAL CLIMATE ACTION SUMMIT

"Tokyo aims to achieve 'Zero Emission Tokyo' that produces no CO2 emissions and has been implementing ambitious actions to reduce CO2 emissions from buildings, such as the Tokyo Cap and Trade Program, which is the first city-level mandatory CO2 emissions reduction program in the world to include office buildings. As a member of the C40 steering committee, I will work hand in hand with the world's major cities, and advance the initiatives," said **Yuriko Koike, Governor of Tokyo**

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Photo by IISD/Kiara Worth
http://enb.iisd.org/climate/cop21/enb/12dec.html