The Global Evolution of Energy Efficiency Policy and its implications for Japan

Brian Motherway
Tokyo, Institute for Energy Efficiency of Japan
Overview

• Recent trends
  - Savings from energy efficiency
  - Policies

• Energy efficiency as a part of central energy policy
  - Climate policy
  - Energy security
  - Industrial competitiveness
  - Cost of living

• Future developments
  - New business models
  - Digitalisation
Savings from energy efficiency in Japan

Energy Intensity in the G7 (TPES/GDP in PPP)

Japanese intensity has decreased by 24% since 2000 (15% since 2010) and is 17% less than the G7 average.
Efficiency measures introduced since 2000 saved G7 countries 15% of their energy demand in 2015; just as one example, tighter standards for household appliances saved 85 TWh of electricity.
Savings from energy efficiency in G20

Efficiency measures since 2000 saved G20 countries 13% of their energy demand in 2015; tighter standards for household appliances saved 200 TWh of electricity.
The impact of efficiency savings on carbon emissions

CO2 emissions savings from efficiency improvements since 2000

In 2015, efficiency gains in IEA and China reduced their combined emissions by 15%; Efficiency policy in China has become one of the most important global actions to reduce emissions.
Coverage of mandatory energy efficiency policies is increasing globally.

Policy coverage in Japan extends across all end-use sectors.

© IEA 2017
Mandatory energy efficiency regulations are a key policy driver

Energy use covered by mandatory efficiency regulations

Japan is one of the top 3 nations with highest share of energy consumption covered by standards, primarily due to the Top Runner Programme
Savings from energy efficiency in Japan

Final Energy consumption and savings in Japan

Efficiency measures since 2000 saved Japan 19% of its energy demand in 2015; tighter standards for household appliances saved 15 TWh of electricity.
Breakdown of energy demand change in Japan between 2000-2015

Due to efficiency improvement Japanese TFC decreased by 27Mtoe, 10% since 2000
Energy efficient space cooling equipment

Performance standards for space cooling

Japan’s space cooling standards are closest to best available technologies worldwide
Japan’s efficiency standards for passenger vehicles are best in class and if every major vehicle market adopted them, oil demand would be reduced by an additional 2.3 million barrels per day.
The next phase for transport efficiency standards – Freight Trucks

Global energy consumption in light, medium- and heavy-trucks covered by efficiency standards

Japan was the first country to implement truck standards in 2005 with full enforcement phased in from 2015. These standards aimed to improve truck efficiency by 12% over 2002 levels by 2020.
Market Based Instruments (MBIs) for energy efficiency

Utility obligations and efficiency auctions have been developed in many countries.
MBIs create a market for energy efficiency

Market based instruments have led to USD 26 billion in energy efficiency investment
Importance of policy design

- MBIs have worked successfully in many jurisdictions but the evidence on their relative effectiveness is not conclusive.

- Freedom for private sector to innovate and discover best delivery routes.

- Risk for policy maker that – if designed or implemented badly – market participants will find ways to game the system.

MBIs put a premium on good policy design, including strong monitoring, verification and evaluation.
MBI design requires attention

Many considerations are required around instrument choice and design.

General design features of MBIs
- Fuel coverage
- Lifetimes
- Sectors
- Calculation of savings
- Eligible measures
- Monitoring & verification
- Evaluation

Obligation-specific design features
- Obligated parties
- Customers
- Target
- Cost recovery
- Banking and borrowing
- Trading
- Penalties

Auction-specific design features
- Pricing and payment
- Project size
- Competition with energy supply

Context shaping instrument design
- Structural factors
- Existing policies
- Historical, political and cultural factors

© IEA 2017
Considerable variation in cost among programmes

Expenditure by obligated parties and payments to auction winners per unit of energy saved

MBIs are saving significant amounts of energy for less than the cost of supply
The market for energy efficiency services appears poised for growth.

Global energy service company revenues by country/region, 2015

- China: USD 13 billion
- United States: USD 6.3 billion
- European Union: USD 2.7 billion
- Other: USD 1.9 billion

The global energy services market was USD 24 billion in 2015 and indicators point to future growth.
Energy efficiency’s role in wider policy
New energy efficiency policies in other countries/regions

  - 30% reduction in energy use by 2030

- China – 13th five year plan
  - 15% reduction in energy intensity by 2020

- Canada
  - Energy efficiency key focus of new climate policy framework

- Mexico
  - Energy transition law

- Other countries that are progressing energy efficiency policies:
  - Saudi Arabia, Brazil
Energy efficiency as part of mainstream energy policy

GHG emissions reduction by measure in the Bridge Scenario, relative to the INDC Scenario, 2030

Improvements to energy efficiency in Japan represent 42% of greenhouse gas emissions reduction

Source: IEA, World Energy Outlook Analysis
Where do emissions savings come from?

In Japan, the majority of greenhouse gas emissions savings from energy efficiency are obtained from improvements to industrial motors and road transport.

Source: IEA, World Energy Outlook Analysis
Energy efficiency and energy security

Avoided imports for Japan from efficiency gains, 2015

Energy efficiency savings have reduced the amount of coal, oil and gas imports required by Japan.
If energy savings from efficiency since 2000 are treated as a domestic resource, Japanese gas import dependency would be 13% less and oil import dependency would be 14% less in 2015.
Efficiency measures following Fukushima

2011
- Power outages (March)
- Large user limits (August)
- Numerical targets for electricity use

2012
- Numerical targets for required electricity saving

2013 – 2015
- Requirement for electricity savings (no numerical targets)
- Peak demand shift

2016
- Electricity savings measures came to an end
Energy efficiency improvements are responsible for replacing the largest share of nuclear power electricity supply in 2015.
Avoided electricity power plant from demand side

Avoided power plant capacity from demand side measures following Fukushima

Energy efficiency and conservation avoided 21 GWₑ of new electricity supply capacity since 2010, equivalent to nearly half of Japan’s total nuclear power generation capacity.
Electricity use between 2010 and 2014 decreased more in the industry and residential sectors than the service sector, although service sector energy use decreased more in 2011 than the other sectors.
Japan’s higher energy prices provide a strong economic driver for industrial energy efficiency
Comparison of industrial energy intensity

Industrial energy intensity in IEA member economies adjusted for industry structure, 2014

Variation in industrial energy intensity due to multiple factors
Despite rising energy prices, energy efficiency improvements have contributed to a reduction in the impact on gross value added and competitiveness.

Source: IEA and WIOD (2016)
Energy efficiency in Japanese cement manufacturing

Thermal energy intensity of clinker production in cement manufacturing, 2014

Source: IEA Energy Technology Perspectives (2017)
Energy efficiency in Japanese cement manufacturing

Thermal energy intensity of clinker production in cement manufacturing, 2014

Thermal energy intensity in Japan is lower than North American or European countries due in part to a higher percentage of kilns with waste heat recovery.

Source: IEA Energy Technology Perspectives (2017)
Energy efficiency benefits for Japanese households

Indices of energy price, proportion of income spent on energy, and efficiency in residential buildings

Energy efficiency improvements within the residential sector limited the impact of rising energy prices on household expenditure on energy
**Future developments for energy efficiency**

- New models for delivering energy efficiency
  - Energy as a service
  - Integration with renewable energy

- Energy efficiency as a fuel
  - Demand side response
  - Capacity auctions

- Digitalisation
  - Advanced metering
  - Improved control and optimisation of industrial processes
  - Real time data collection and analysis
Increased electricity demand by connected devices

The energy use of connected/networked devices is growing rapidly, presenting new challenges for energy efficiency.

Integration of energy services - efficiency and renewables

• Shifting focus from providing energy to providing a service e.g. illumination, entertainment etc.

• Opportunity to increase combination of energy efficiency and renewable energy

• Example of BBOXX:
  - Energy efficient appliances together with the BBOXX home solar system enable customers to use the following appliances for up to 6 hours:
    - 4 LED lights;
    - 15.6” TV;
    - Radio;
    - Portable light;
    - Charge 2 mobile phones;
Energy efficiency and renewables will be the twin drivers of the transition

Global CO₂ emissions savings in 450 Scenario relative to the New Policies Scenario

The New Policies Scenario including all the NDCs from the Paris agreement still leaves a significant amount of efficiency potential untapped.