

# Policy on Thermal Power Plants in Japan

27 July 2015

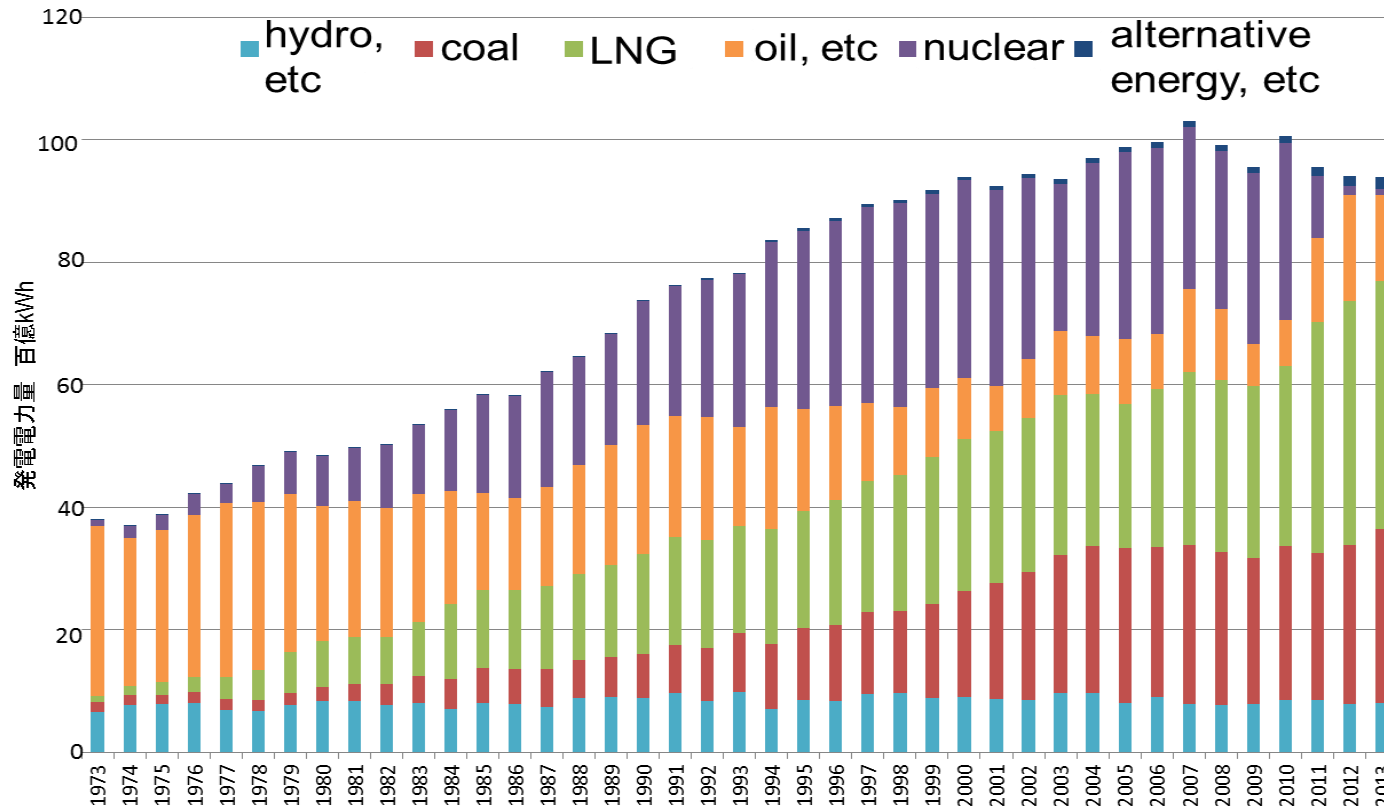
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# High Dependency On Fossil Fuels For Power Generation

- ◆ The nuclear power ratio in domestic power generation has decreased after the Great East Japan Earthquake due to the long-term shutdown of nuclear power plants .
- ◆ On the other hand, the thermal power ratio has increased to 90%. Currently, LNG thermal power alone accounts for nearly 50% of domestic power generation.

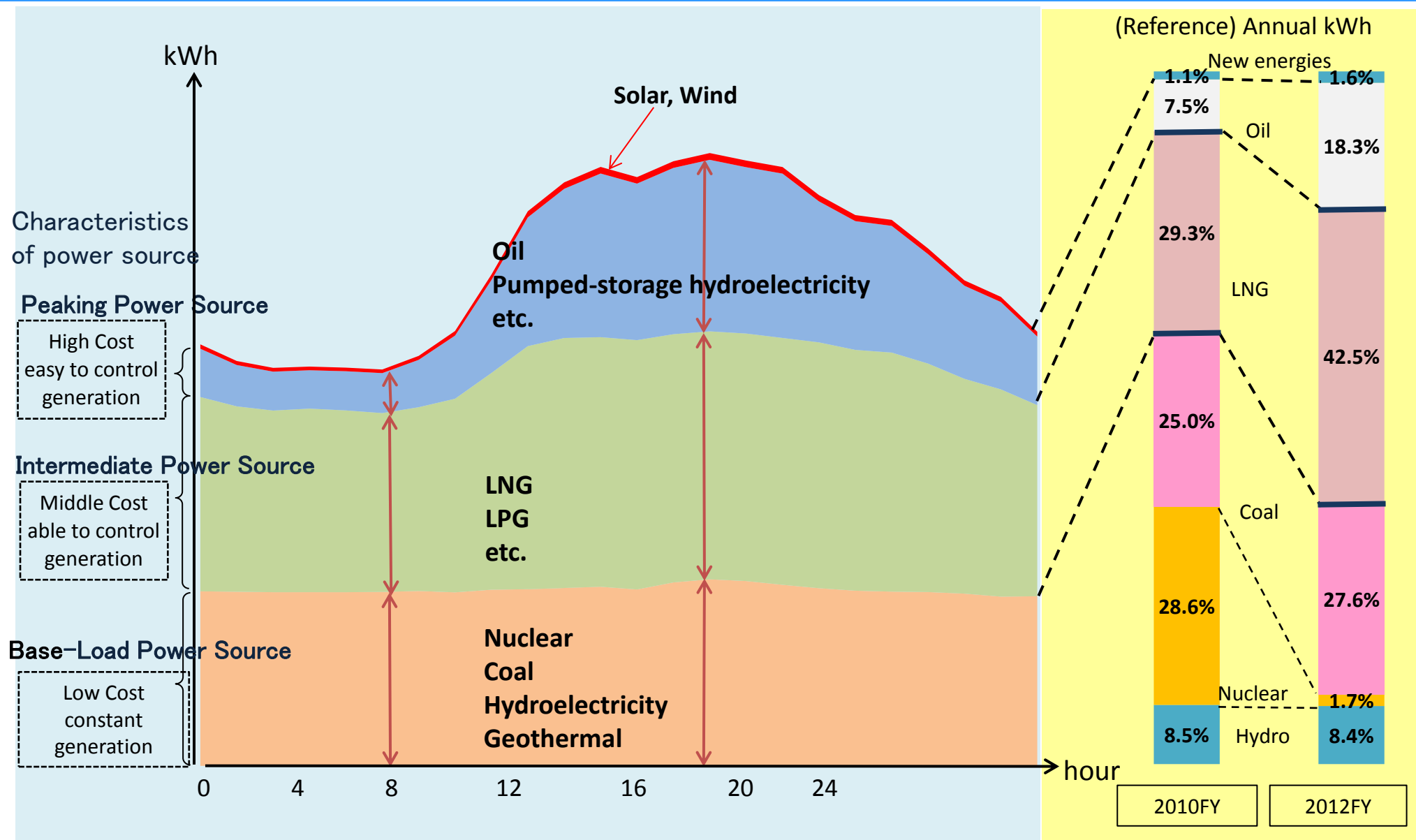
**Trend in Domestic Power Generation Ratio**



Power Generation 10TWh Ratio %			
2010	2011	2012	2013
1 1%	1 1%	2 2%	2 2%
29 29%	10 11%	2 2%	1 1%
8 7%	14 14%	17 18 %	14 15%
29 29%	38 39%	40 42 %	41 43%
25 25%	24 25%	26 28 %	28 30%
9 9%	9 9%	8 8%	8 9%

source: Agency for Natural Resources and Energy, METI Japan

# Constitution of Electric Power Supply Corresponding to Demand



Base-load Power Source: Low production cost that can be operated stably day and night regardless of the time

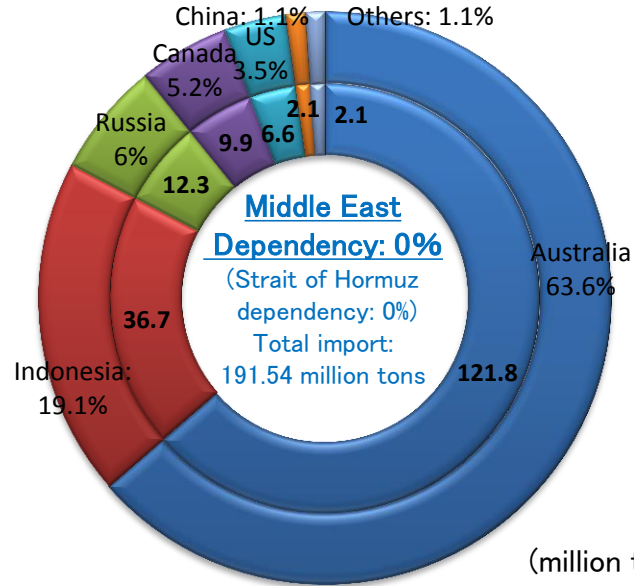
Intermediate Power Source: Production cost is next lowest to base-load source. Generation can be adjusted in accordance with electricity demand

Peaking Power Source: Easy to control generation in accordance with electricity demand while production cost is high

# Japan's Fossil Fuel Import Sources

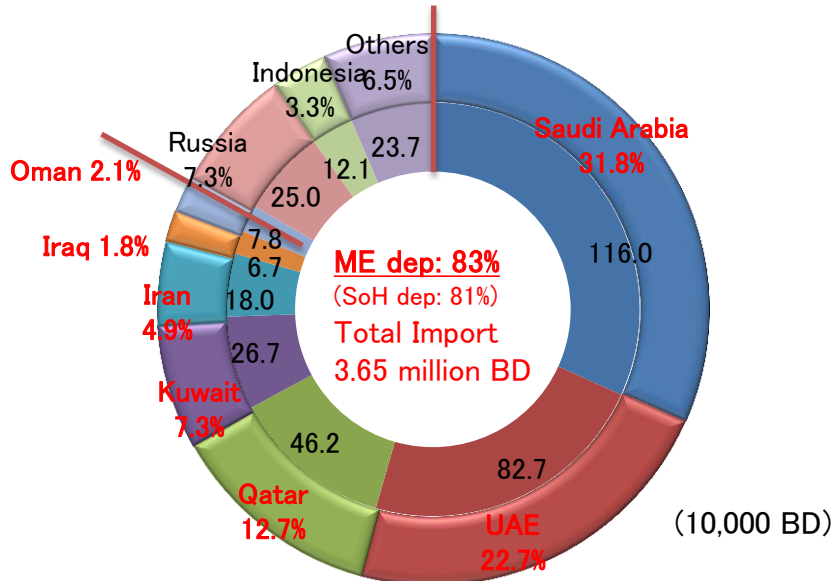


## Coal (2013)

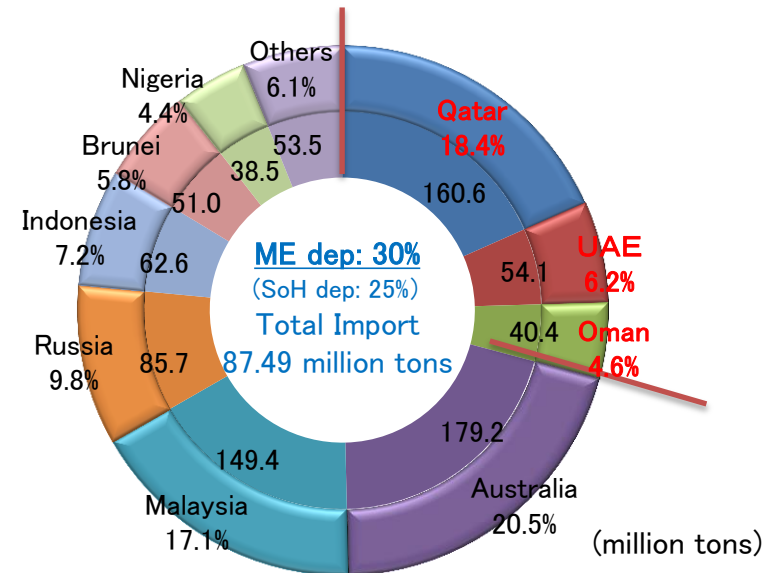


Source: government trade statistics

## Crude Oil (2013)



## Natural Gas (2013)



# Accelerated Introduction of High-Efficiency Thermal Power Plants

- ◆ Wider acceptance of high-efficiency thermal power plants is more important than ever.
- ◆ Balance environmental requirements with the introduction of latest technologies to new and modernized power plants, thereby realizing the optimal coal/LNG/oil thermal power mix.

## 1. Clarify/accelerate environmental assessment procedures for (coal) thermal power stations

- Guidelines for evaluating the implementation of the Best Available Technology (BAT) for power generation have been established.
- Thermal power replacement schedule has been shortened from three years to almost one year, by running the central and local governments' assessment processes in parallel. Procedures for new or modernized facilities should also be accelerated.

## 2. R & D support for thermal power generation

- Introduce Advanced Ultra-Super Critical generator by the 2020s: efficiency 39%→46%.  
<FY2015 budget plan: \1.84 billion>
- Develop Integrated Coal Gasification Fuel-cell Combined Cycle (IGFC) technology by 2025, to be introduced by the 2030s: efficiency 39% → 55%.  
<FY2015 budget plan: \5.95 billion>
- Introduce 1700° C gas turbine LNG thermal plant around 2020: efficiency 52% → 57%.  
<FY2015 budget plan: \3.04 billion>

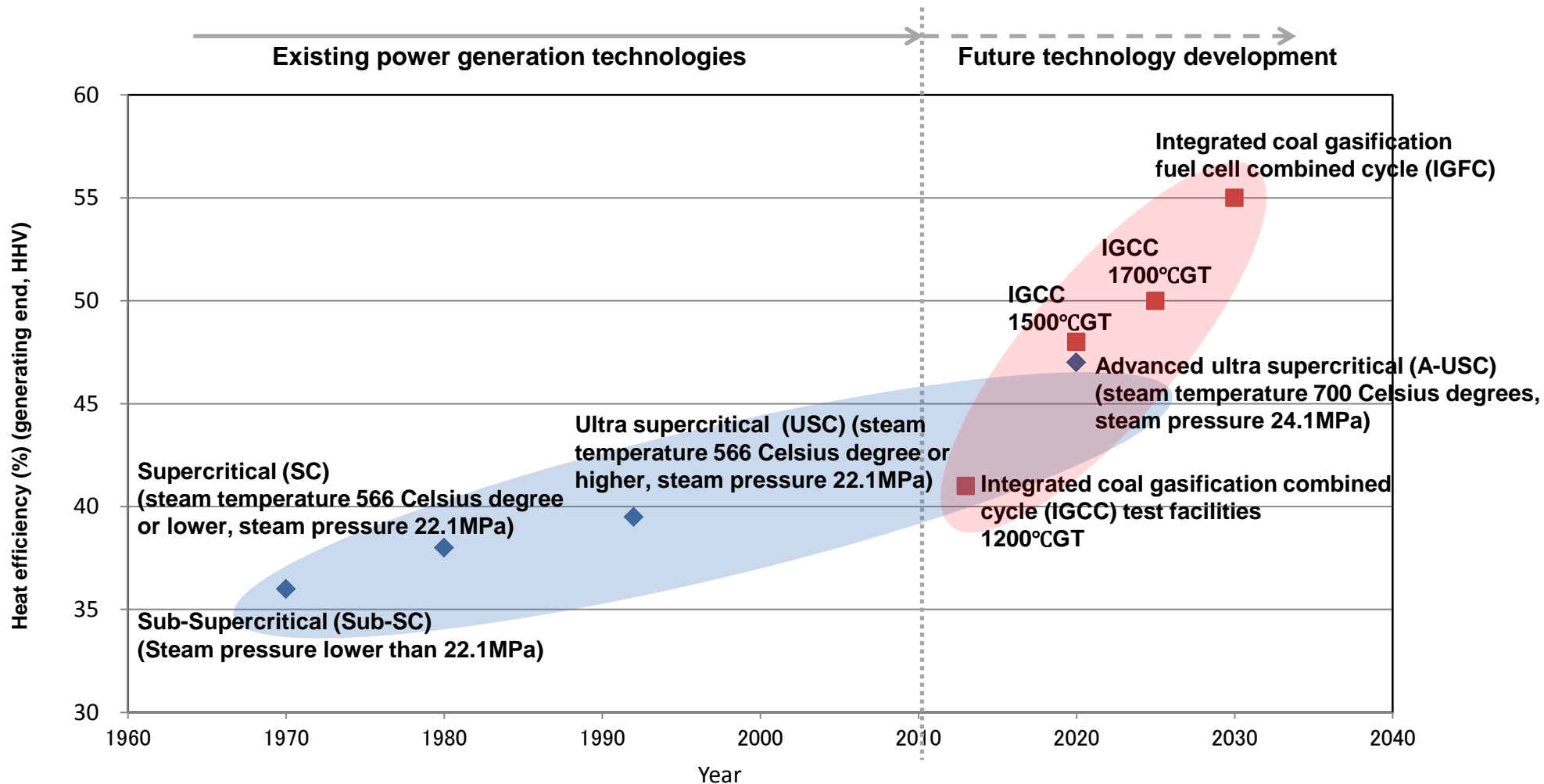
## 3. Tax relief for facility investment

- Under the Green Investment Tax Relief Policy, 30% special depreciation can be applied to the acquisition cost of combined-cycle power generation gas turbines.

# High Efficiency of Coal-Fired Power Generation

For further improvement of coal thermal power generation efficiency, development of technologies such as Integrated coal Gasification Combined Cycle (IGCC), Integrated coal Gasification Fuel Cell combined Cycle (IGFC), Advanced Ultra SuperCritical thermal power generation (A-USC) taking advantage of Japan's technologies is important.

## <Efficiency improvement of coal thermal power generation>

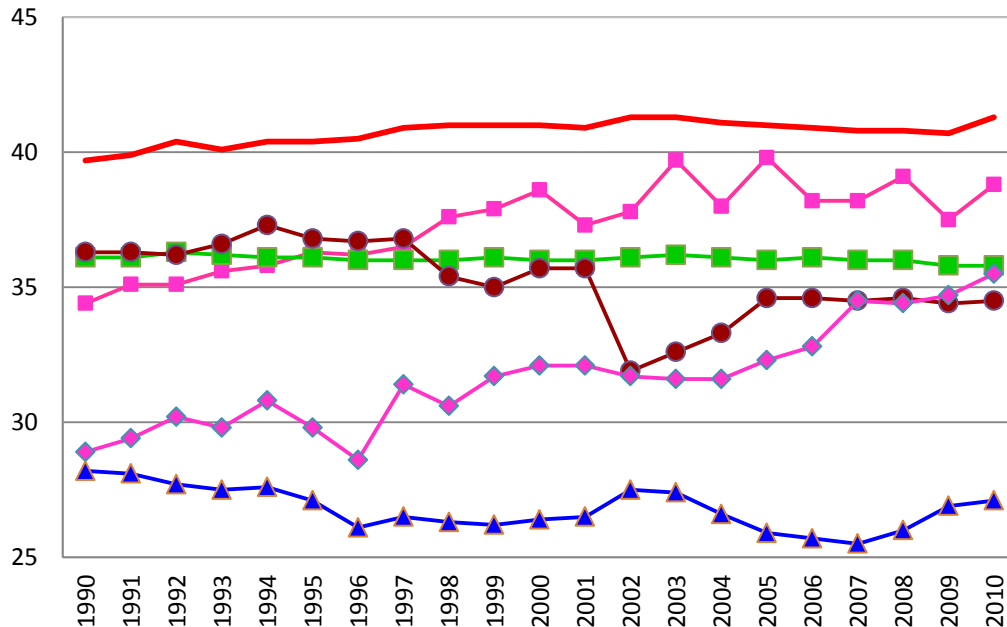


# Japan's Technical Advantages on Coal-Fired Power Generation

Japan's coal fired power plant has attained the world's highest efficiency by supercritical (SC) and ultra supercritical (USC) technologies, and can keep the level for a long period by operating and maintenance know-how.

## Changes in the Average Efficiency of Coal-Fired Power in Each Country

Thermal Efficiency (% LHV)

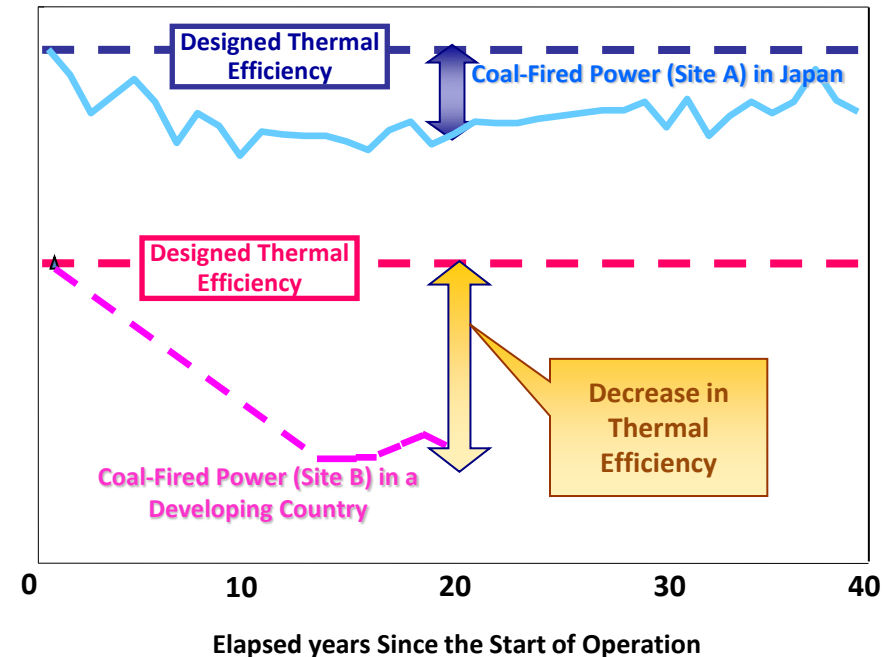


— Japan    — Germany    — USA    — Australia    — China    — India  
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Source: Energy balances of OECD/Non-OECD countries-2012

## Importance of Appropriate Plant Operation & management

Thermal Efficiency

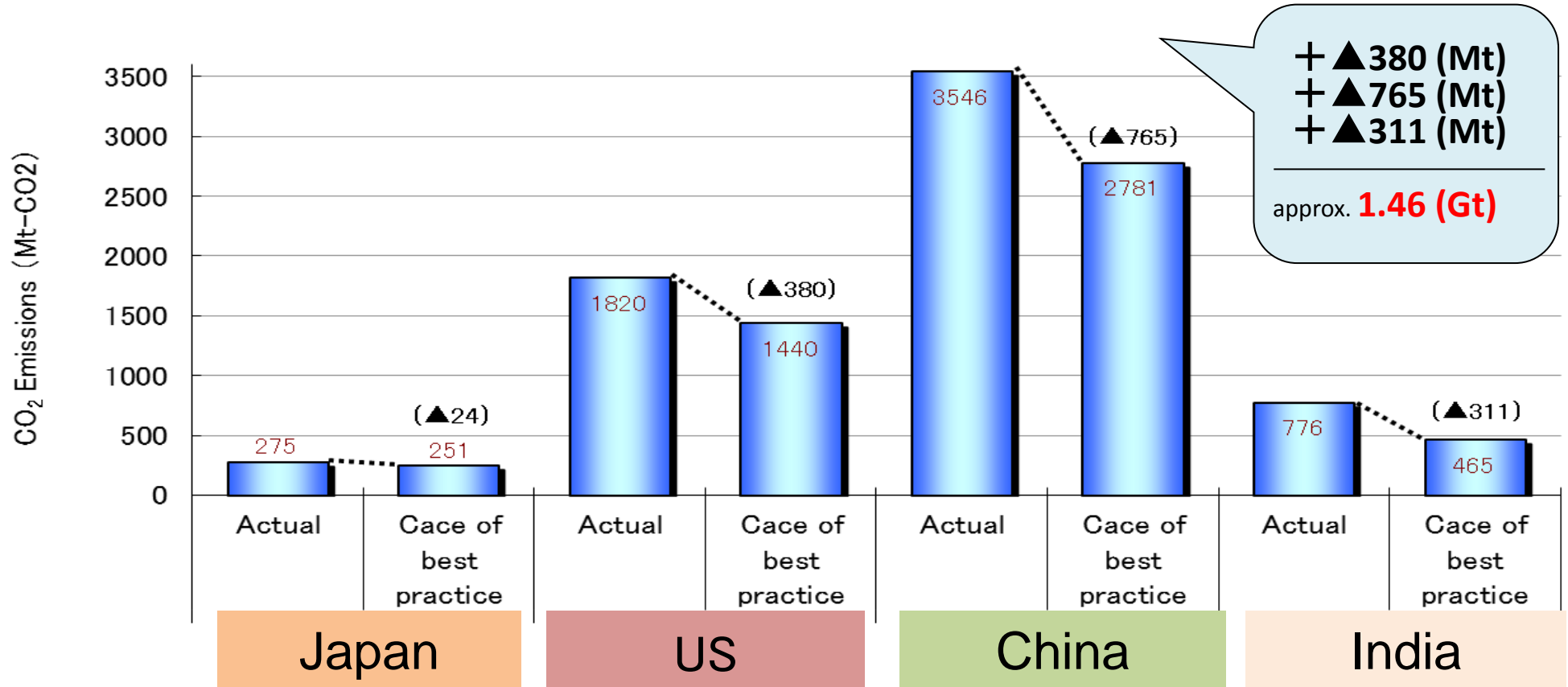


Source: The Federation of Electric Power Companies of Japan

# CO2 Emission Reductions through Technological Transfer

If the most advanced coal fired power technology is introduced to all the coal-fired power plants in the US, China, and India, the CO2 reduction effect is estimated to be about 1.5 billion tons, which is larger than the amount of total annual CO2 emissions in Japan

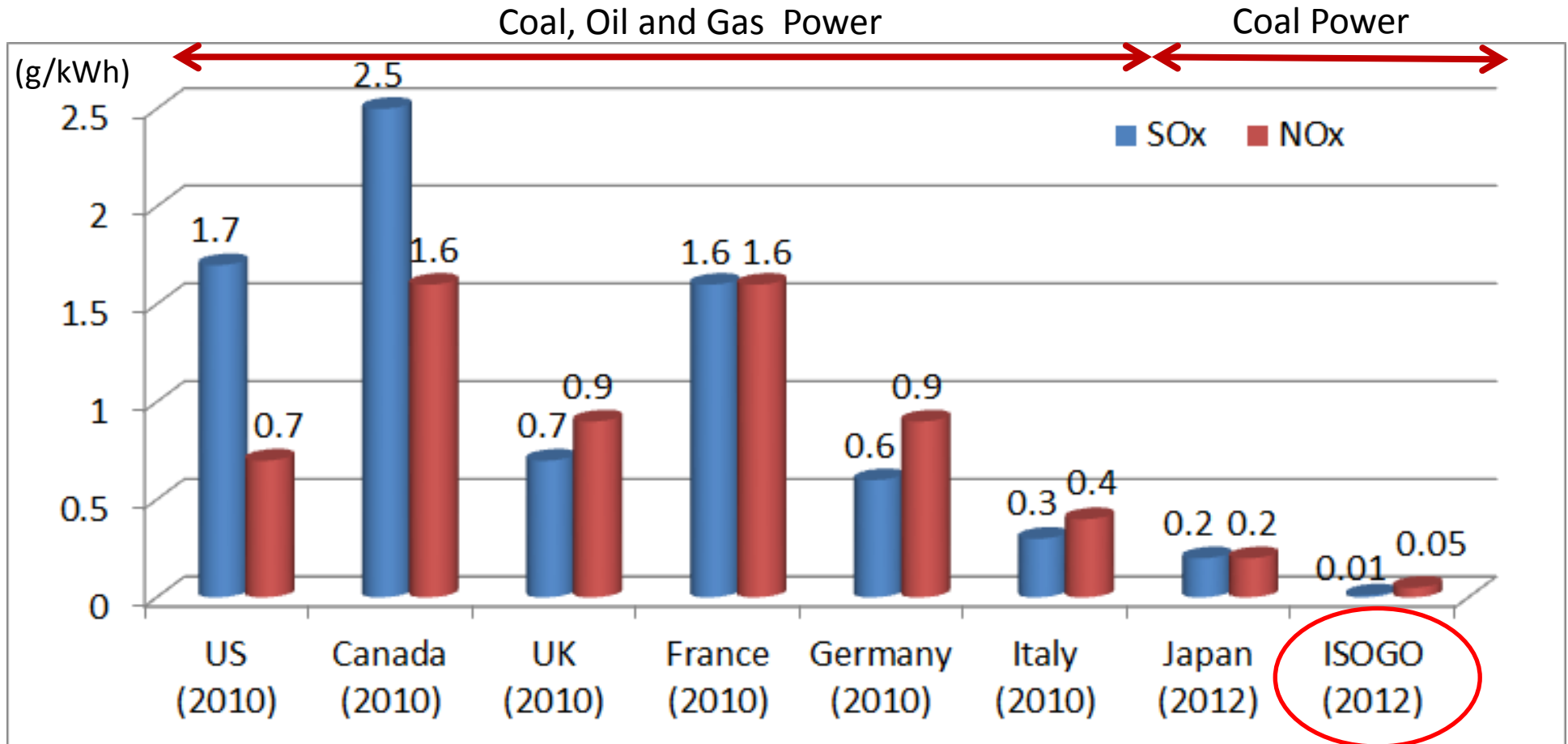
## Actual CO2 Emissions from Coal Fired Power Generation (2010) and Case of Adopting currently Most Advanced Technology





# SOx NOx Emissions from Thermal Power Plants

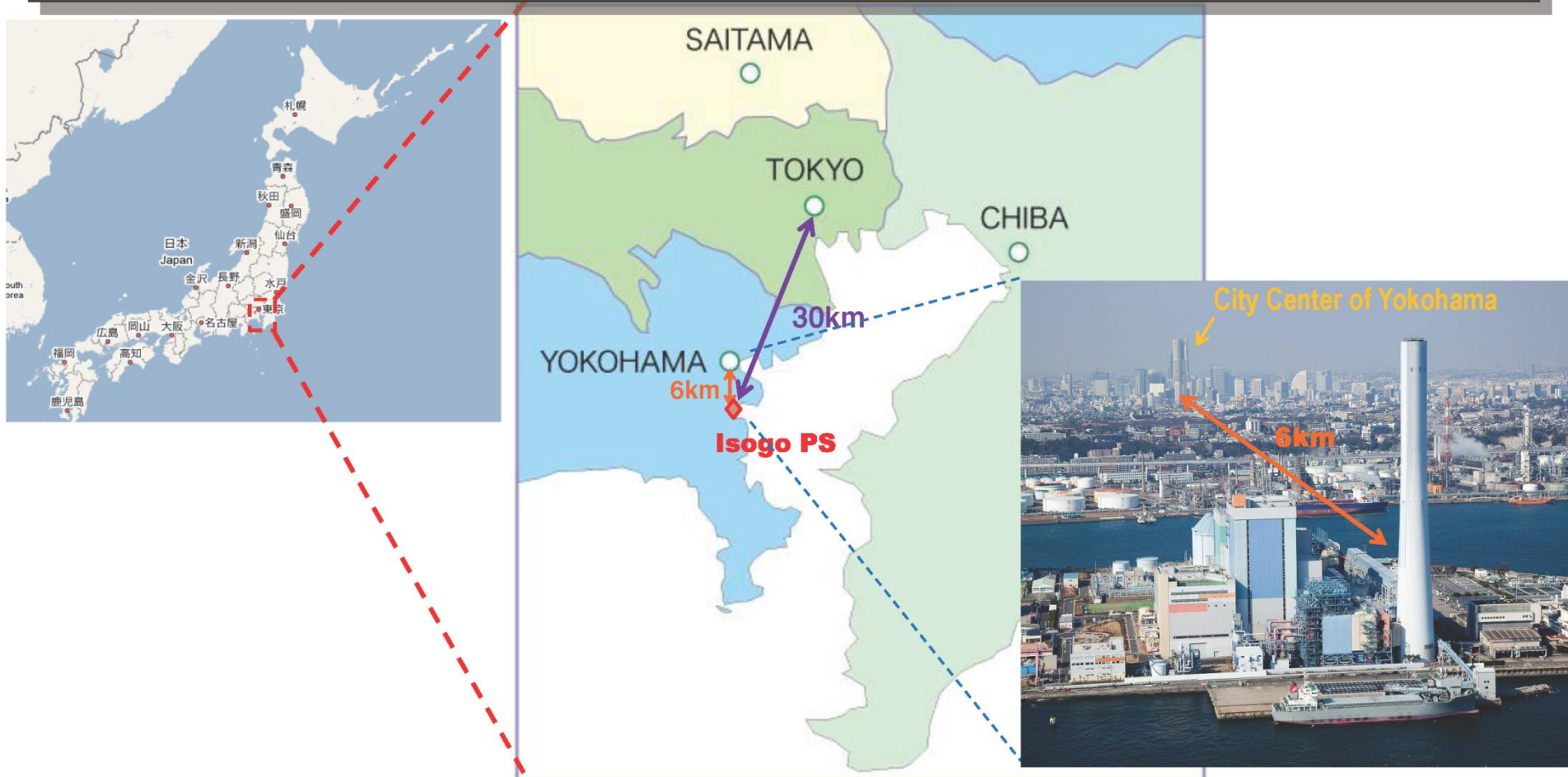
SOx and NOx emissions from ISOGO Power Plant is outstandingly low among thermal power plants in developed countries due to its advanced DeSOx and DeNOx system.



Source: IEA Energy Balance 2012, OECD Statistics Extract, Japan's federation of Electric Power Companies, J-Power

# Urban Type Coal-fired Power Station

- ◆ Isogo PS is located in Yokohama City with 3.7 million population, the 2nd largest city in Japan.
- ◆ It is located only 6km away from center of Yokohama, 30km away from center of Tokyo
- ◆ To be the unique urban type coal-fired power station, it employs the most advanced CCTs.



# High-efficiency LNG Power Station

- ◆ The world's first commercially operational 1500° C-class gas turbine with 52% thermal efficiency.
- ◆ R & D target for high-capacity generators: 1700° C turbine with 57% efficiency.
- ◆ R & D target for small-/mid-capacity generators: commercially operational Advanced Humid Air Turbine (AHAT) with the same efficiency as combined-cycle systems.

## <Increasing LNG Power Station Efficiency>

