Facilitating Development and Deployment of High-Efficiency Coal Technologies

–Addressing Climate Change –

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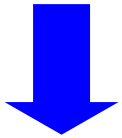
Clean coal technologies (CCTs) are key to addressing both climate change and energy issues.

Without coal, we cannot meet future energy demand;

and

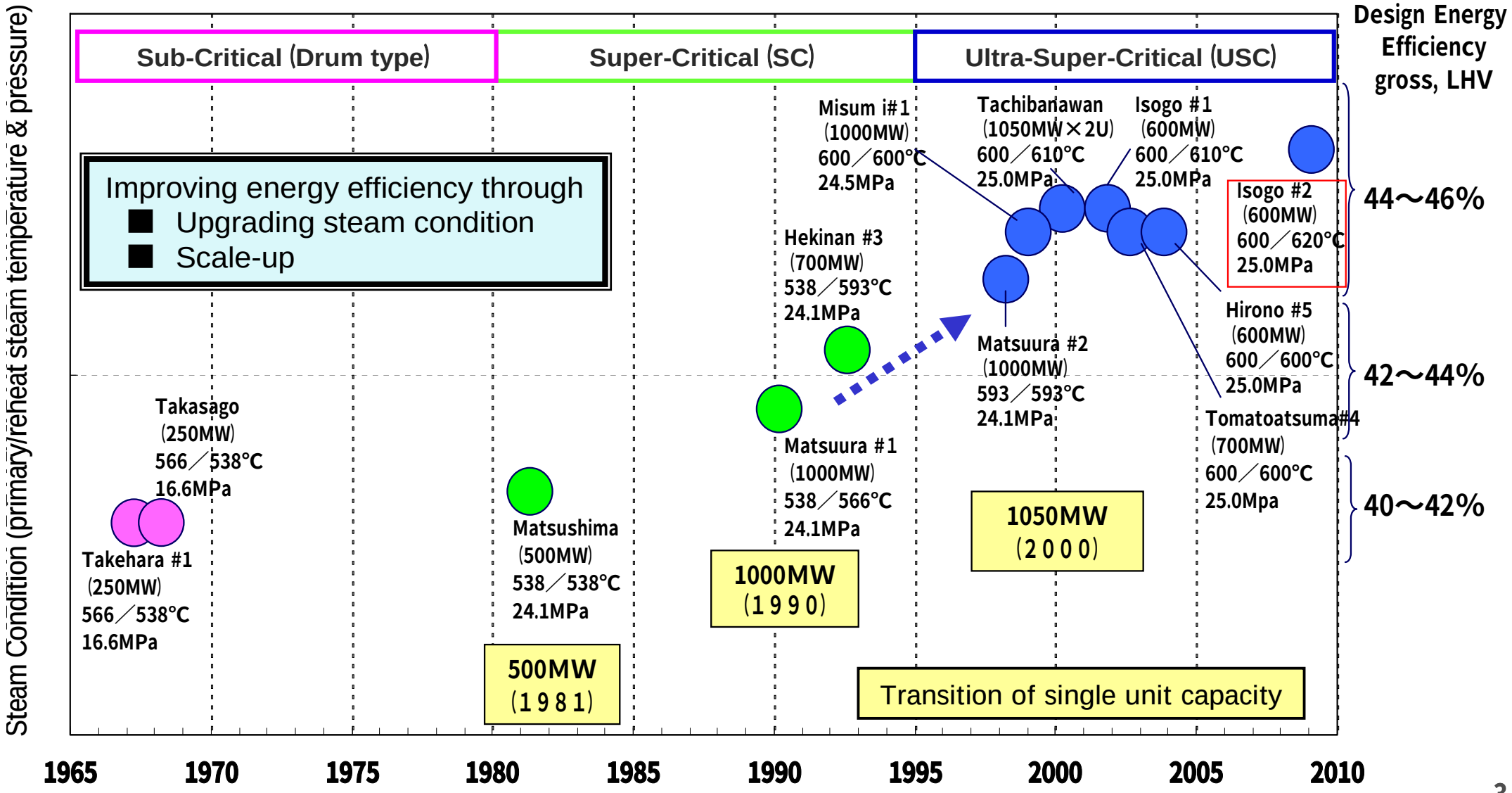
without reducing CO_2 emissions from coal-fired power plants, we cannot solve the climate change issue.



Developed and developing countries should cooperate closely to promote aggressive R&D and worldwide deployment of CCTs.

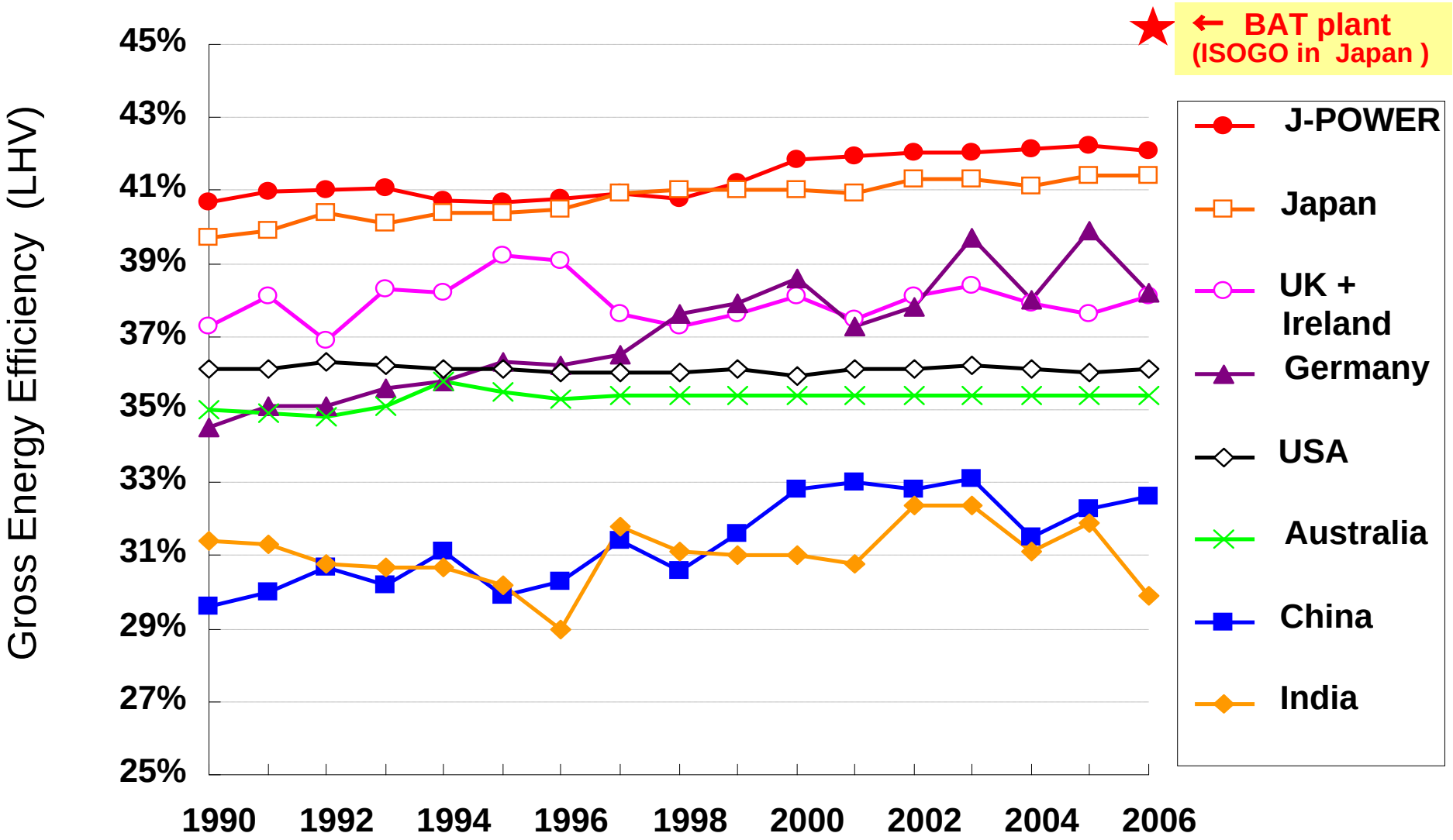
J-POWER's Thermal Efficiency Improvements

◆ Japan has continuously improved thermal efficiency (reduced CO_2 emissions) because of strict environmental regulations and fuel economics.



Energy Efficiency in World's Coal-Fired Power Plants

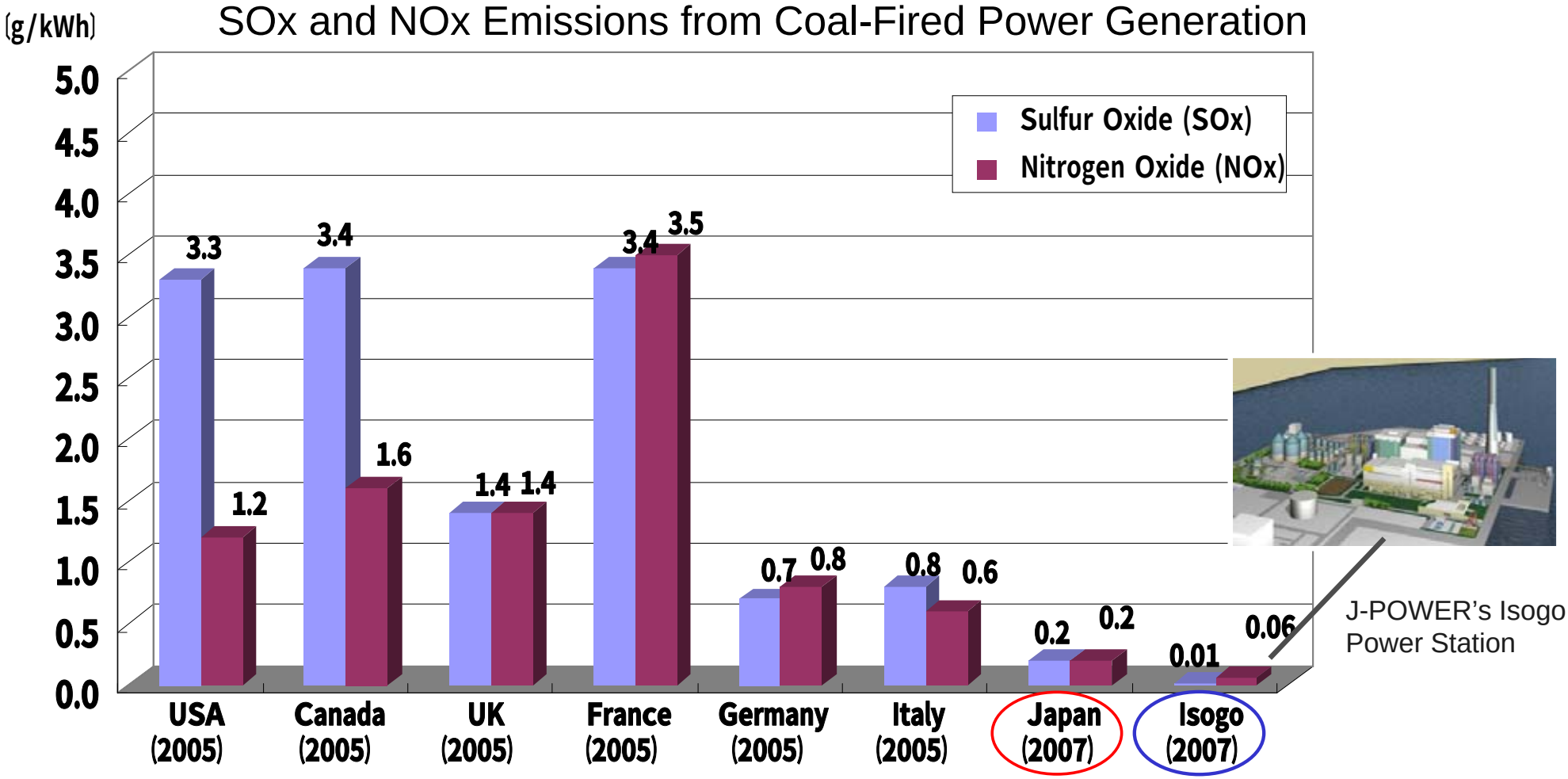
- Japan's coal-fired power plants are world leaders in energy efficiency.
- Energy efficiency in China, USA and India, the world's major CO_2 emitters, is relatively low.



Sources：Ecofys "International Comparison of Fossil Power Efficiency and CO2 Intensity 2009"

Reduction of SOx and NOx is Also Important

- Many power plants in the world still do not address major pollutants (SOx & NOx)
- SOx and NOx emission levels in Japan are much lower than other countries, almost equivalent to gas-fired levels.



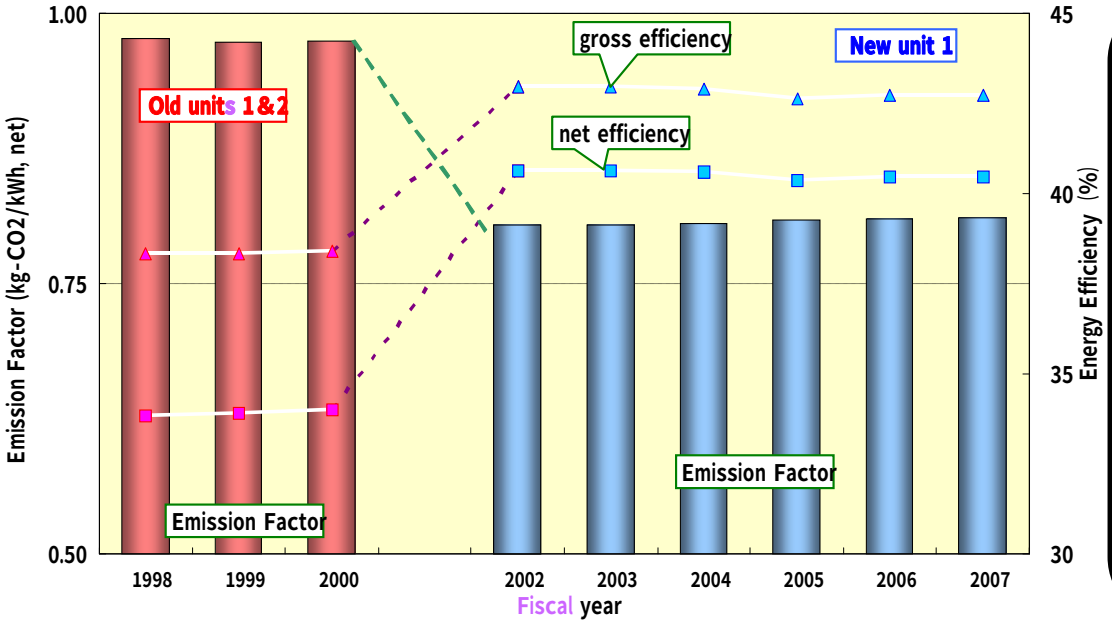
Source: Federation of Electric Power Companies, Japan (and actual data for Isogo)

Replacement of Old Coal-Fired Power Plant with “USC”

Isogo Coal-Fired Power Plant
opened in1967

New Isogo Coal-Fired Power Plant
Unit 1 opened in 2002, **Unit 2** in 2009

17% CO_2 intensity improvement



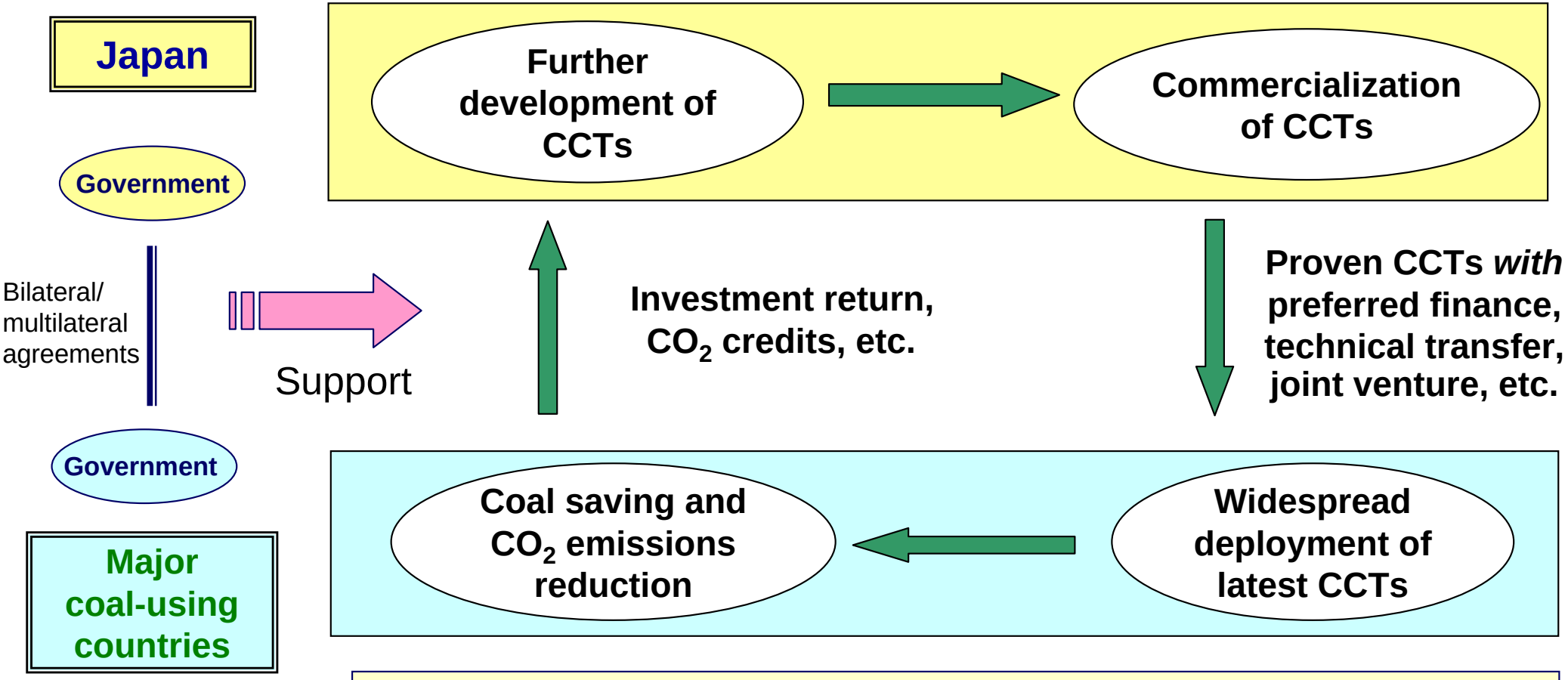
Capacity	530 MW (265 MW×2)	→	1200 MW (600 MW×2)
SOx	60 ppm	→	10 ppm (20)
NOx	159 ppm	→	13 ppm (10)
PM	50 mg/m3N	→	5 mg/m3N (10)

Numbers in ( ) are for Unit #1

Steam	Subcritical	→	Ultra-Supercritical
efficiency (gross HHV)	38%	→	43%
CO_2 intensity (net)	100 (base)	→	83

Contribute to Worldwide CO_2 Emission Reduction through CCTs

- Japan could effectively contribute to rapid growth in infrastructure building and climate change mitigation in Asia through its CCTs and financial support.



Deploy latest proven CCTs when building new plants and replacing old/low-efficiency power plants to achieve energy savings and CO_2 reductions.

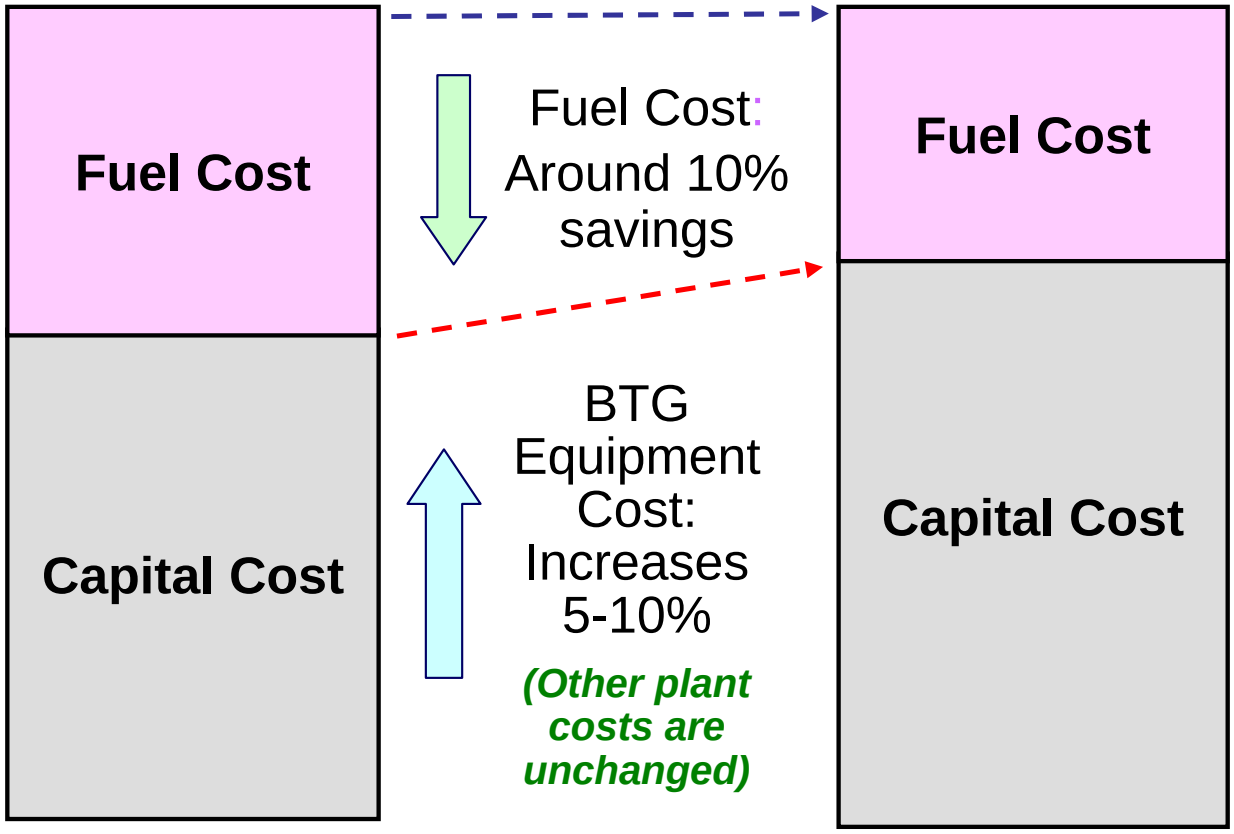
High Efficiency Technologies - *Barriers and Required Actions*

Barriers	Actions required
Financial barriers	Financial support for increased costs of SC/USC
Technical application barriers	Packaged technical support
Political/regulatory barriers	Suitable policy and regulatory structure
Business barriers (in some countries)	Business environment to attract private investment

Support for Capital Cost Increase

～For Reference～

Total cost/benefit balance varies according to coal price, CO_2 cost, discount rate, plant specification, etc.



Sub-Critical Plant → **Latest USC Plant**

Efficiency 38% (Gross, HHV)

Efficiency up 5%
CO_2 down 12%

Efficiency 43% (Gross, HHV)

For USC deployment in developing countries, financial support is necessary to cover such capital cost increases

Developed Country
Preferred loan, export insurance, ODA, etc

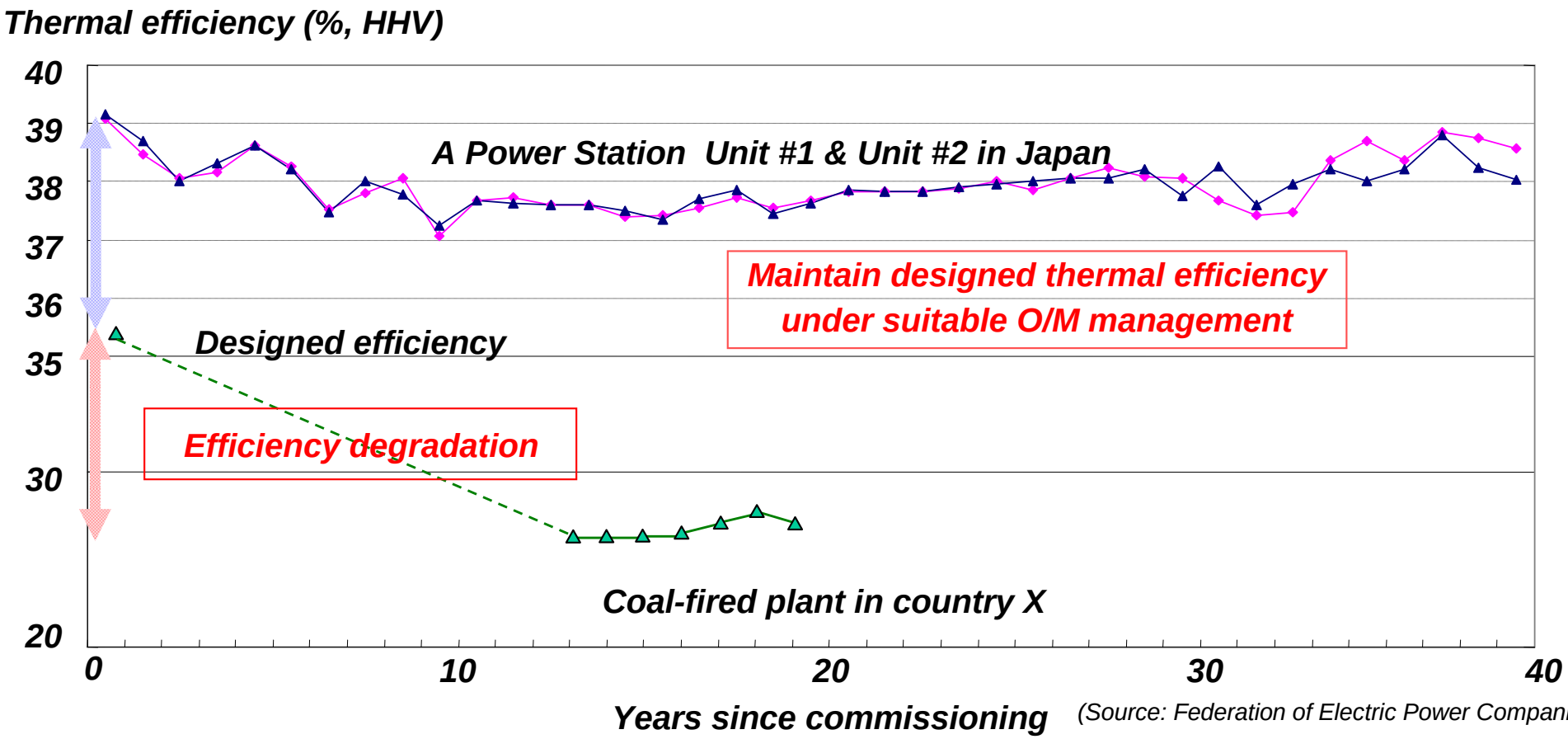
International Bank
Set higher environmental criteria for finance and preferred finance programs for CCTs (e.g. IBRD, CTF)

Developing Country
Preferred electricity tariff, longer power purchase period, tax incentives, other special support

Carbon Market
Carbon credits (CDM, etc.)

Effective Technical Transfer of O&M Know-How

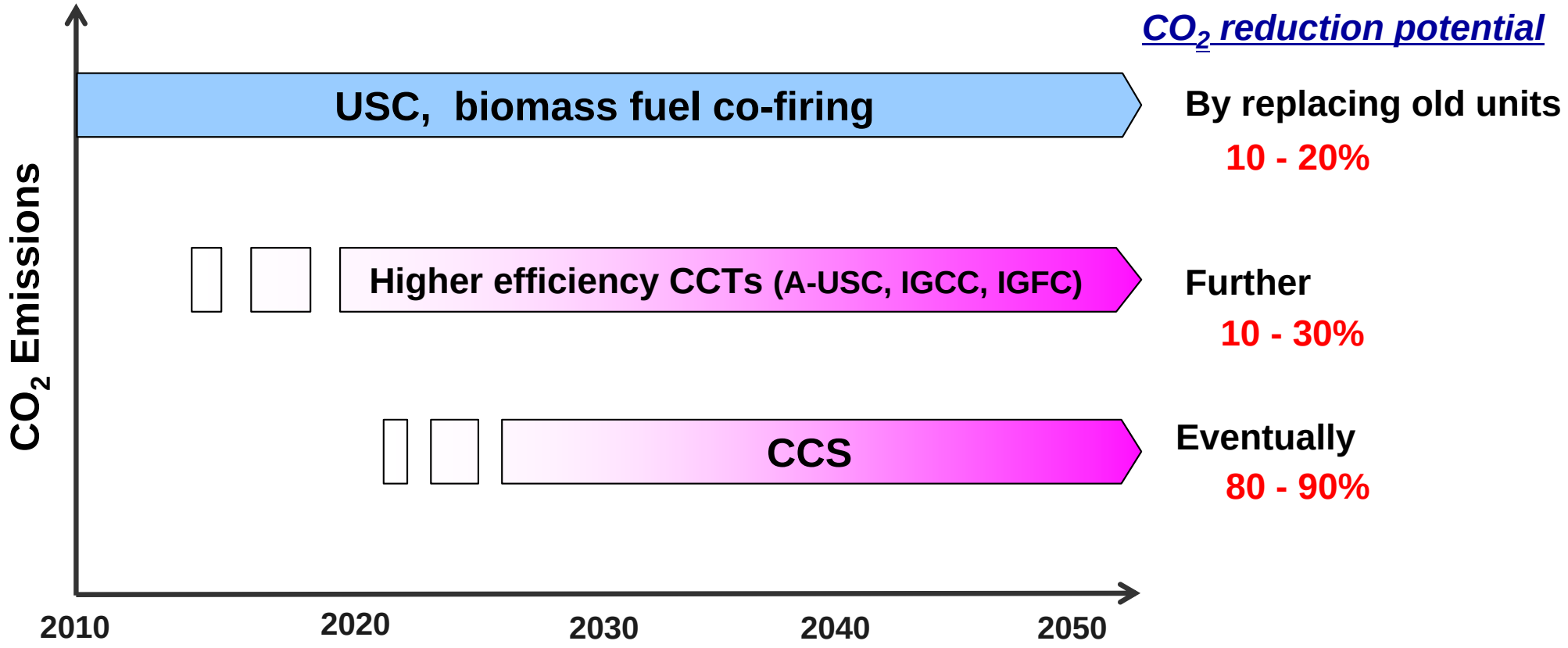
- SC/USC requires sophisticated plant operation and maintenance.
- When deploying USC plants, developing countries require comprehensive technical support, not only for plant construction, but also for O&M.
- Reliable O&M contributes to stable supply of electricity.



(Source: Federation of Electric Power Companies, Japan)

Challenges in the Development of CCTs

- Promoting CCT development with a view to future zero-emissions plants.
- After 2020, a series of innovative CCTs could be introduced in new plants, including replacement of existing old coal-fired power plants.
- In the short term, USC and biomass fuel co-firing are the best options. In the 2020s, we expect that IGCC, IGFC and A-USC will become proven and commercially available. Widespread deployment of CCS may take longer.



How Can CCTs Help Reduce Worldwide CO_2 Emissions?

- ✓ R&DD of a series of innovative CCTs including IGCC, A-USC, Oxy-fuel and CCS is undoubtedly an important step towards achieving a final zero-emissions target. Developed countries need to further accelerate such efforts with possible multilateral and/or bilateral cooperation.
- ✓ ….However, commercializing such innovative CCTs takes time, especially for developing countries.
- ✓ In parallel with such R&DD efforts, we should facilitate widespread deployment of present state-of-the-art CCTs (especially USC) in all major coal-using countries.

We hope to help reduce worldwide CO_2 emissions through aggressive development and deployment of CCTs.