Power Market Reform

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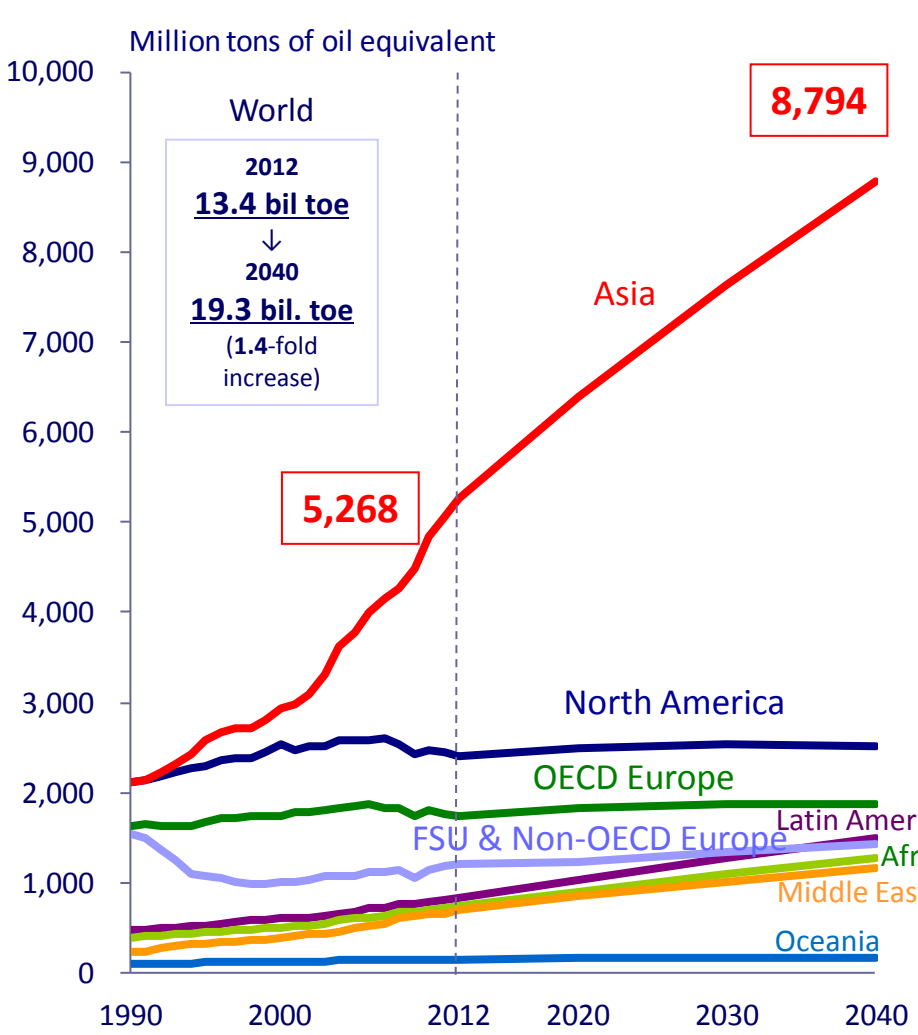
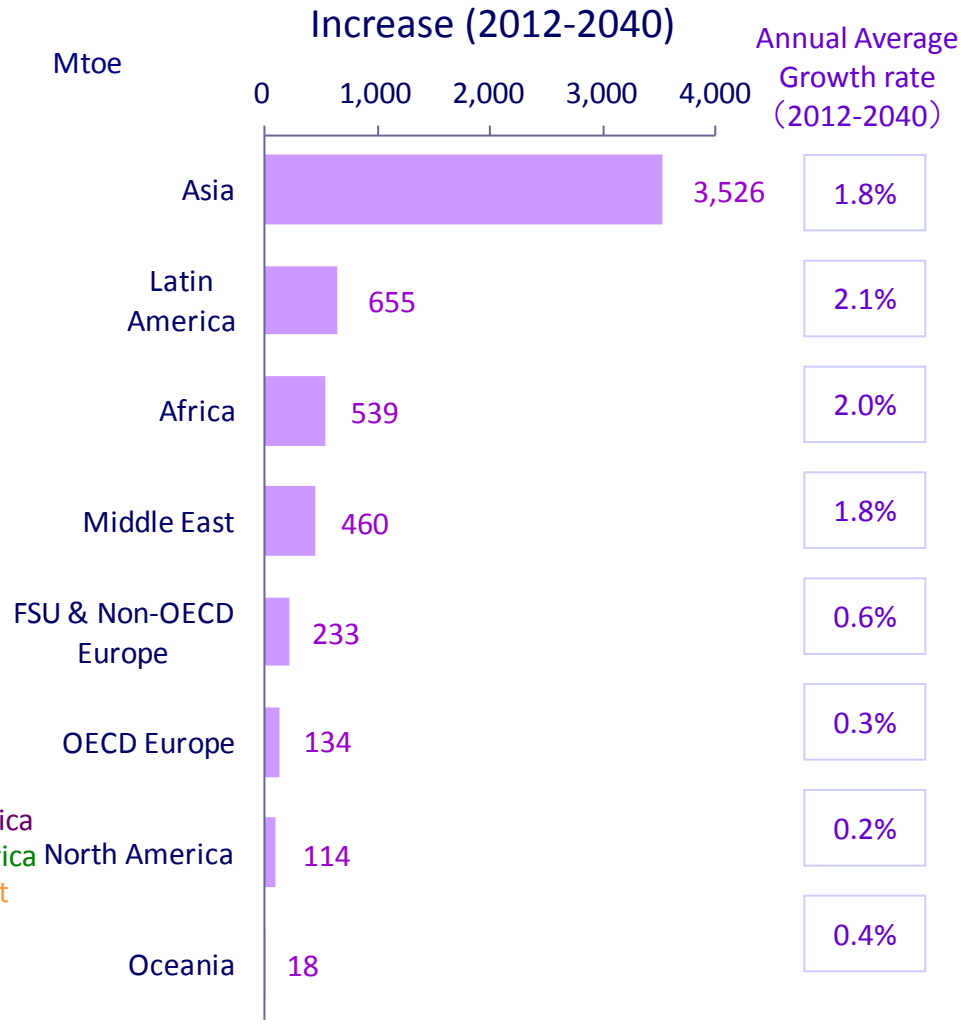
Introduction

- Energy Situation in Asia
  - Findings from “Asia/ World Energy Outlook 2014”
- Some background on Electricity Market Refor
- Today’s Discussion Points

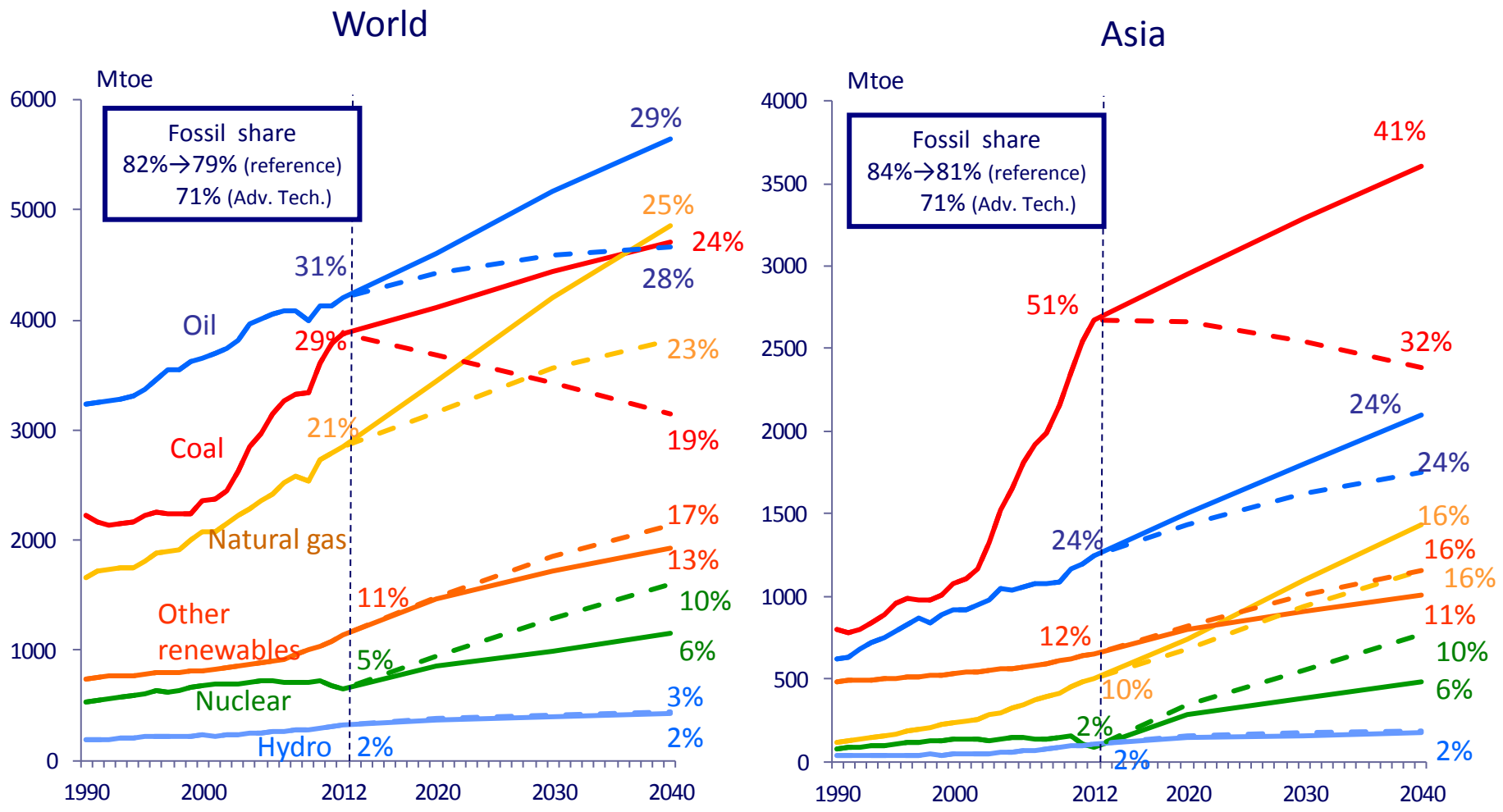
Primary Energy Demand by Region (World)





Source: IEEJ, Asia/ World Energy Outlook 2014

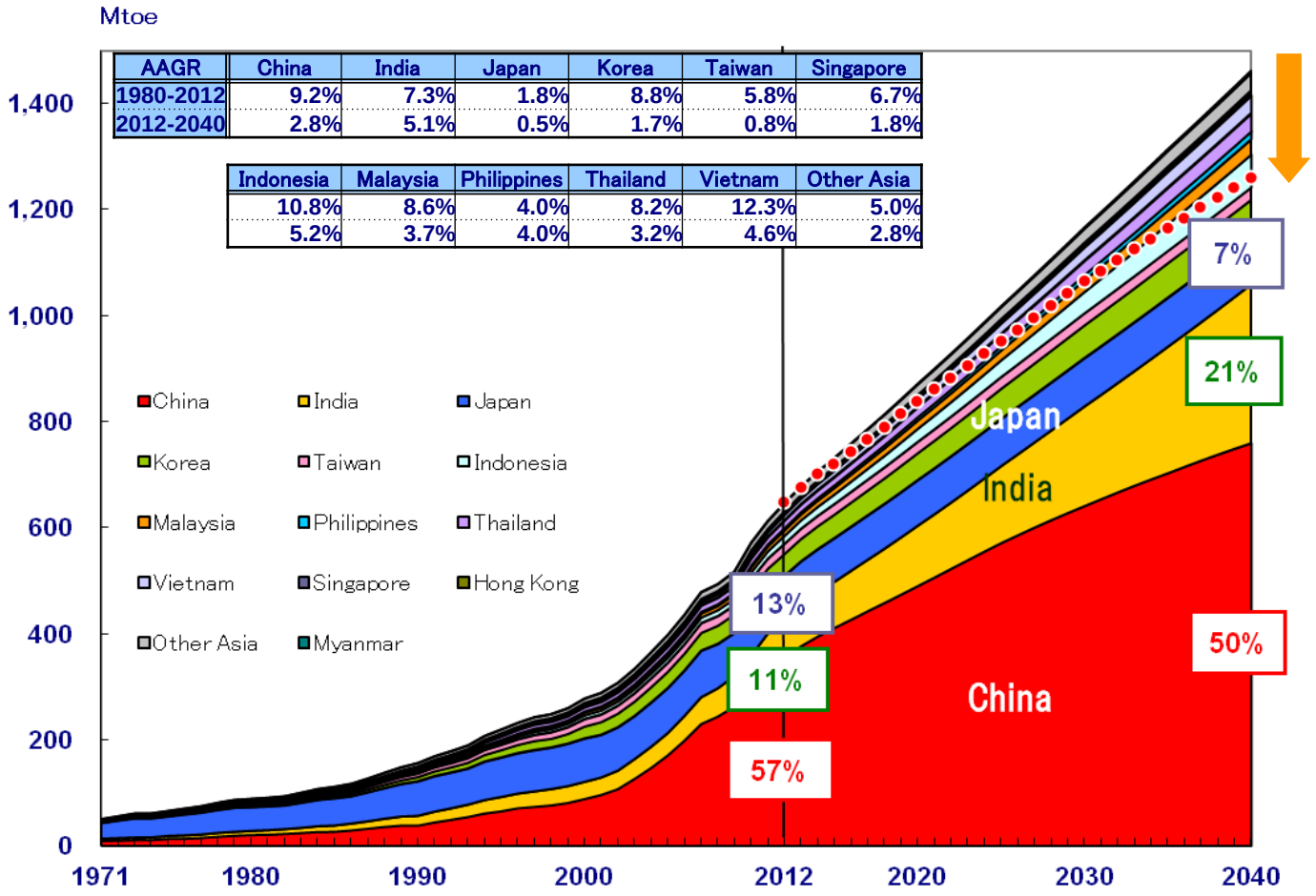
Primary Energy Demand by Energy



Source: IEEJ, Asia/ World Energy Outlook 2014

Electricity Demand by Country (Asia)

Reference
Adv. Tech.



AAGR	China	India	Japan	Korea	Taiwan	Singapore
1980-2012	9.2%	7.3%	1.8%	8.8%	5.8%	6.7%
2012-2040	2.8%	5.1%	0.5%	1.7%	0.8%	1.8%

Indonesia	Malaysia	Philippines	Thailand	Vietnam	Other Asia
10.8%	8.6%	4.0%	8.2%	12.3%	5.0%
5.2%	3.7%	4.0%	3.2%	4.6%	2.8%

▲0.2billion toe
(▲14%)

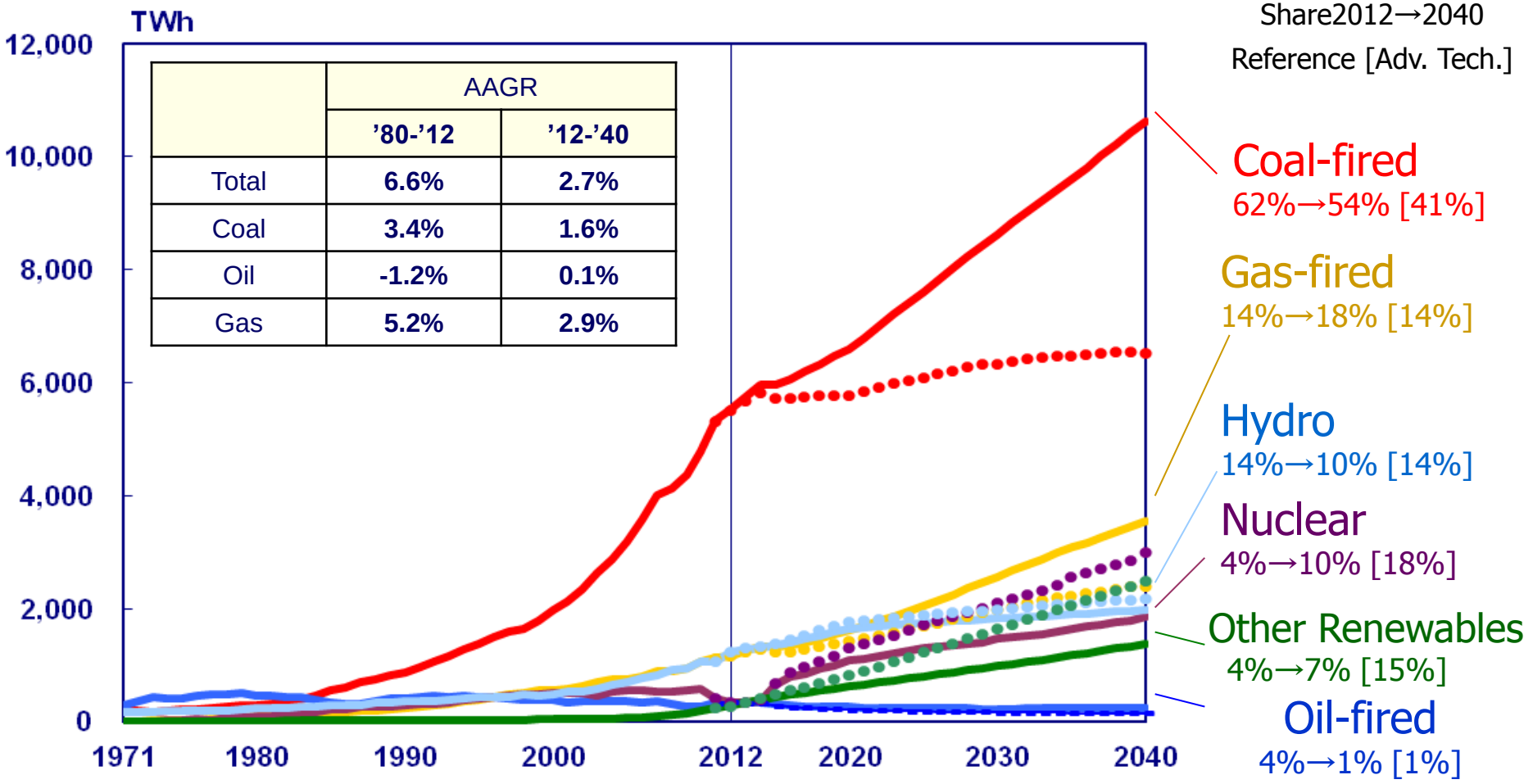
2012
0.7 billion toe
↓
2040
Reference
1.5 billion toe

Adv. Tech. Scenario
1.3 billion toe

Source: IEEJ, Asia/ World Energy Outlook 2014

Power Generation Mix by Source (Asia)

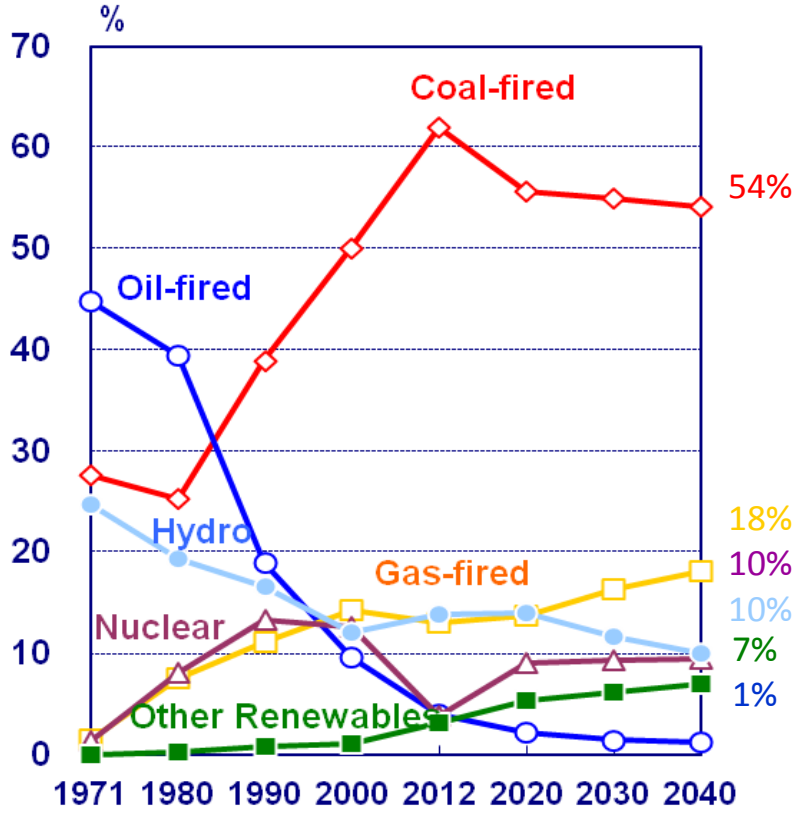
Solid line: Reference
Dotted line: Adv. Tech.



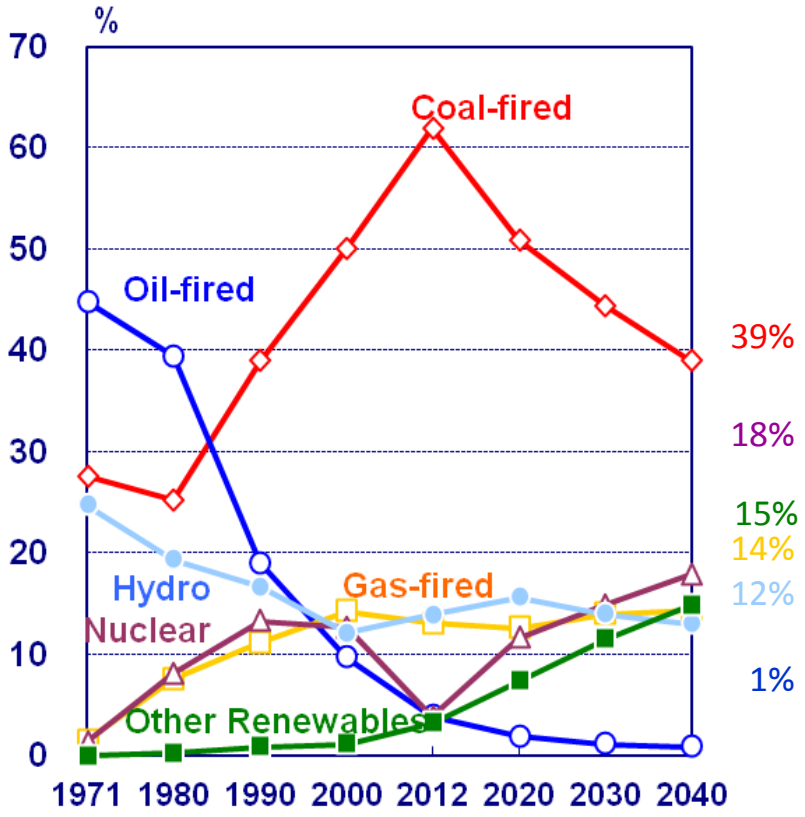
Source: IEEJ, Asia/ World Energy Outlook 2014

Power Generation Mix by Source (Asia)

Reference Scenario



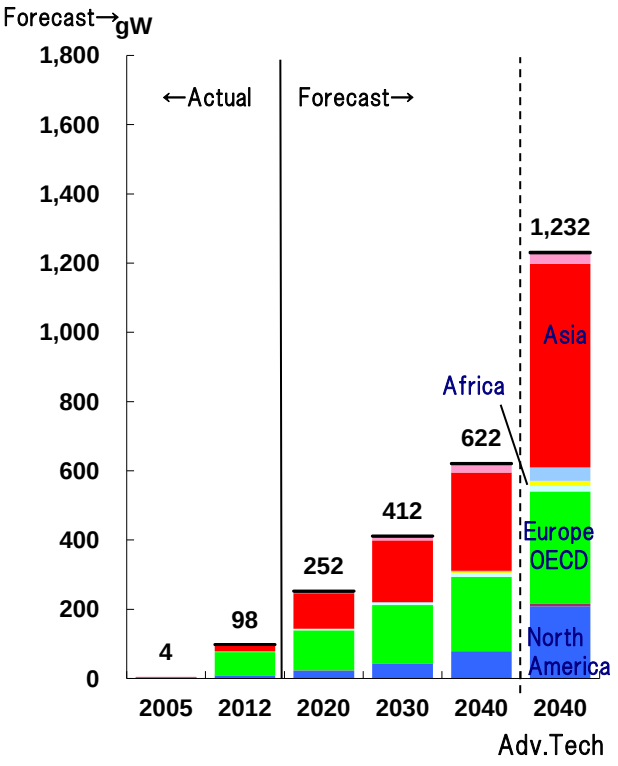
Adv. Tech. Scenario



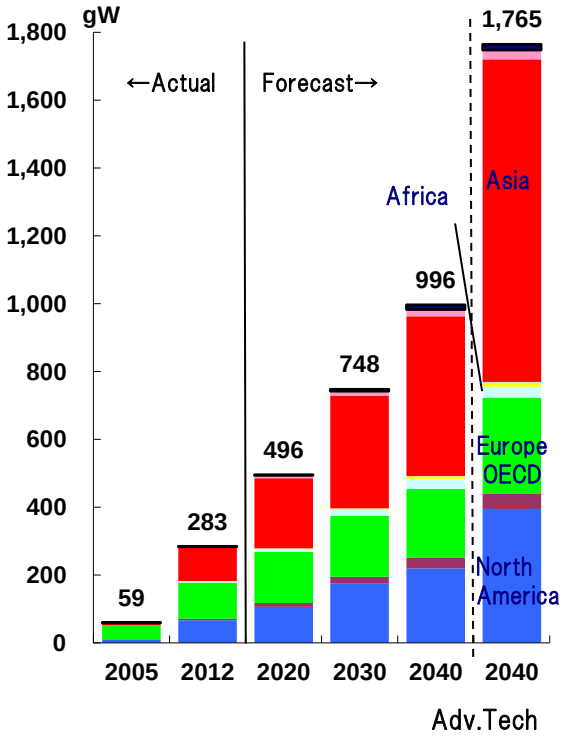
Source: IEEJ, Asia/ World Energy Outlook 2014

Electrical Power Plant Capacity
by solar power and wind power generation (World)

Solar Power



Wind Power



Solar Power

World	Asia
2012 98GW ↓ 2040 In Ref. In Adv.Tech 622 GW 1,232GW (6 times) (13 times)	2012 17GW ↓ 2040 In Ref. In Adv.Tech 284 GW 588GW (17times)(35times)

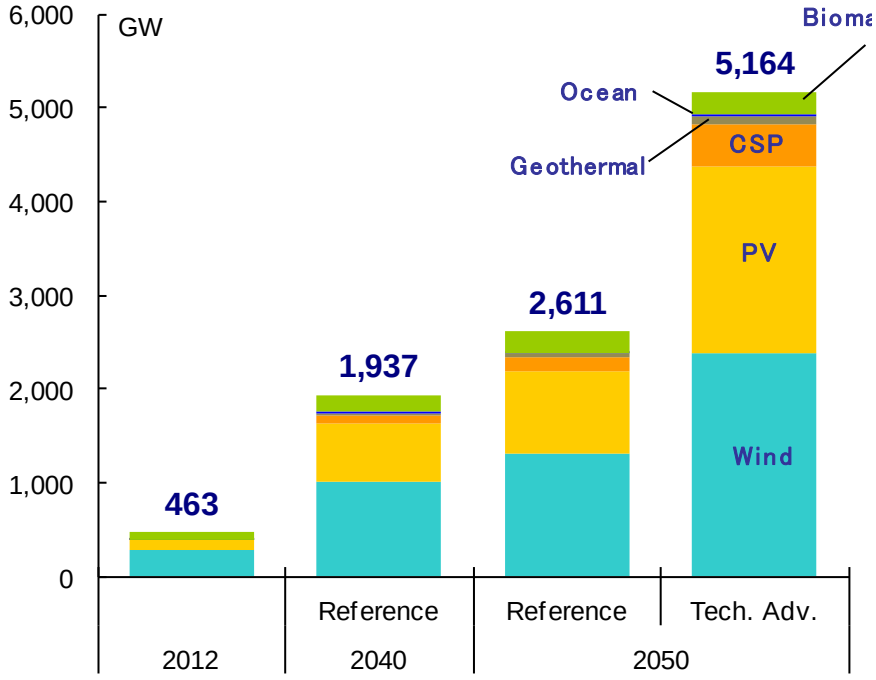
Wind Power

World	Asia
2012 283 GW ↓ 2040 In Ref. In Adv.Tech 996 GW 1,765GW (4 times) (6 times)	2012年 98GW ↓ 2040年 In Ref. In Adv.Tech 471 GW 951GW (5times) (10times)

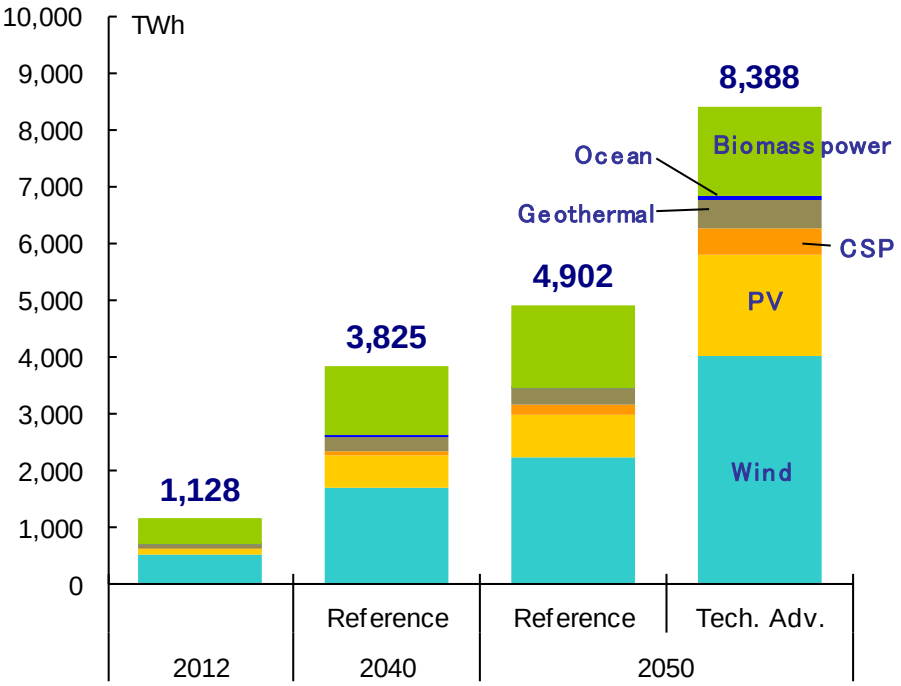
Source: IEEJ, Asia/ World Energy Outlook 2014

Renewable Power Generation (World)

Electric Power Capacity

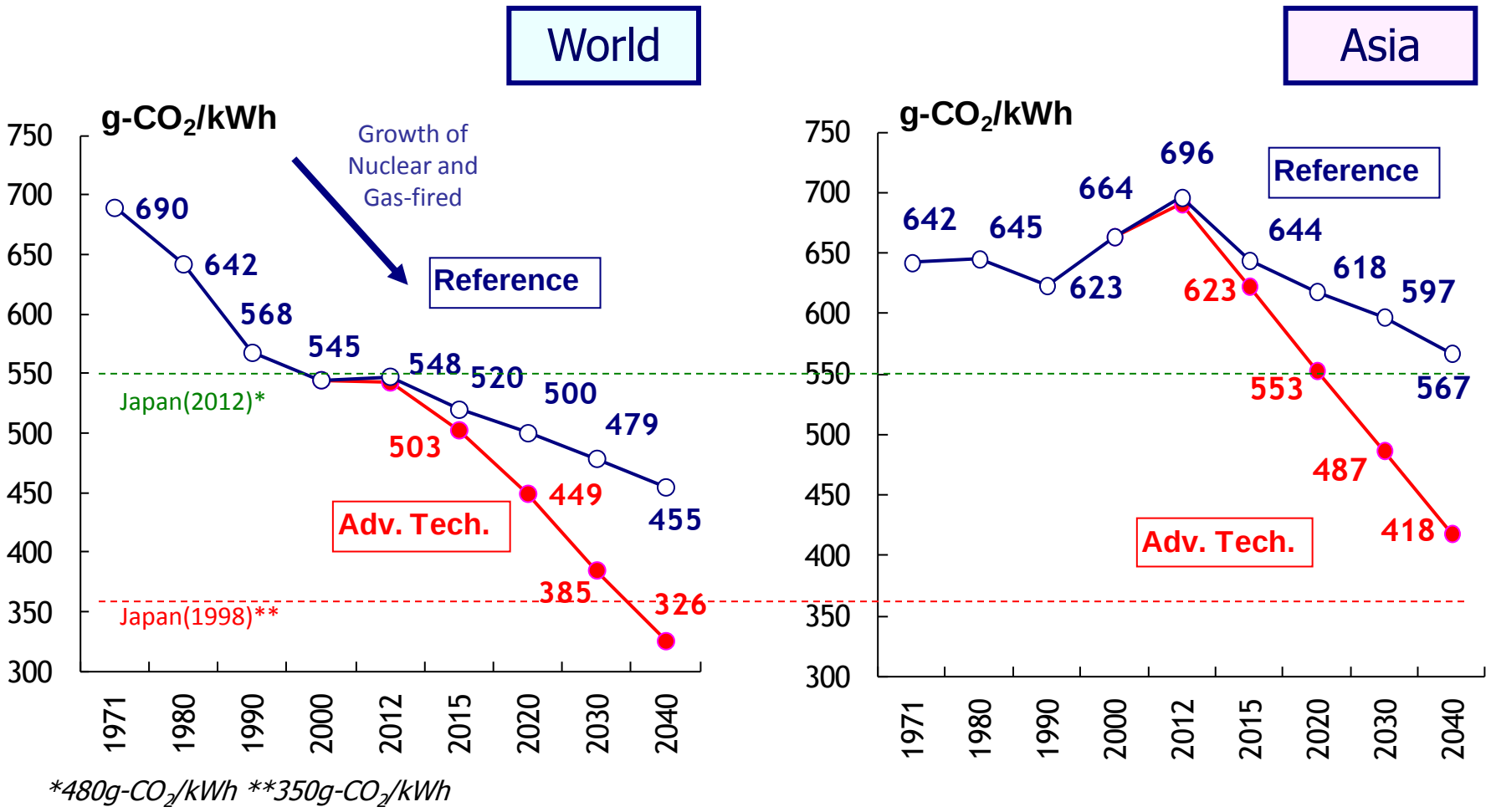


Electric Power Generation



Source: IEEJ, Asia/ World Energy Outlook 2014

Carbon Intensity of Electricity (CO_2 Emissions per kWh)

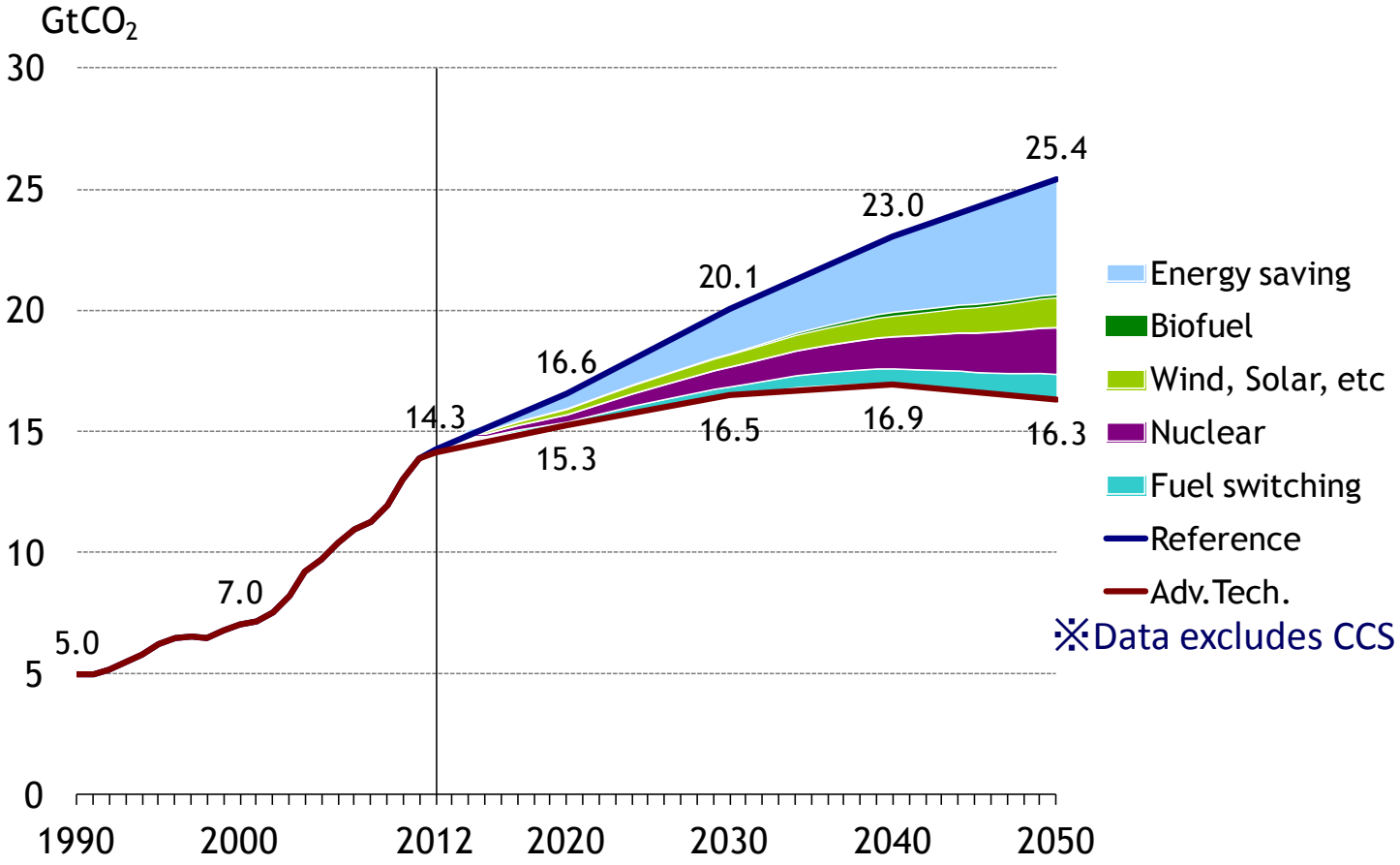


*480g-CO_2/kWh **350g-CO_2/kWh

Source: IEEJ, Asia/ World Energy Outlook 2014

CO_2 Emissions Reduction by Technology (Asia)

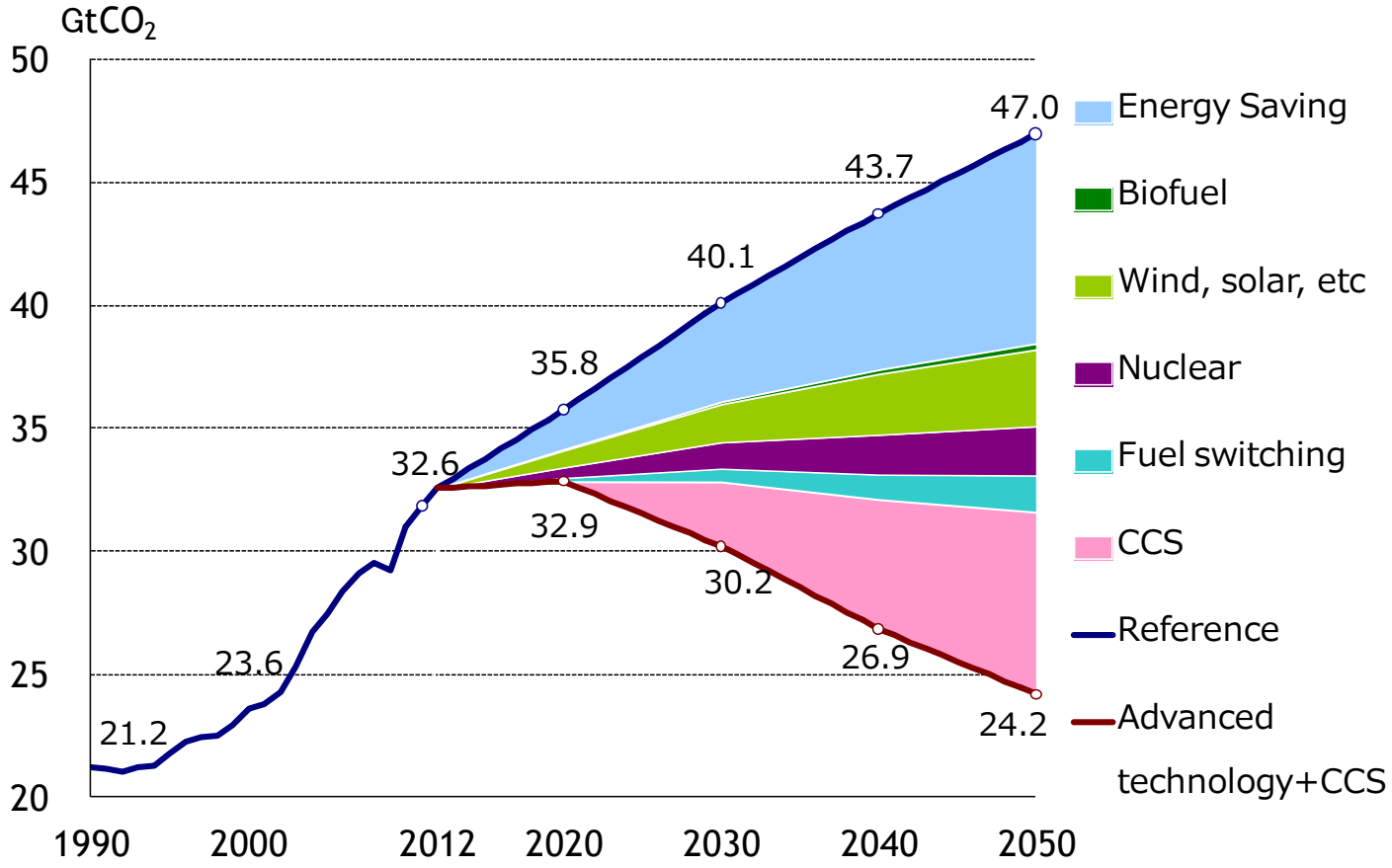
Reference
Adv. Tech.

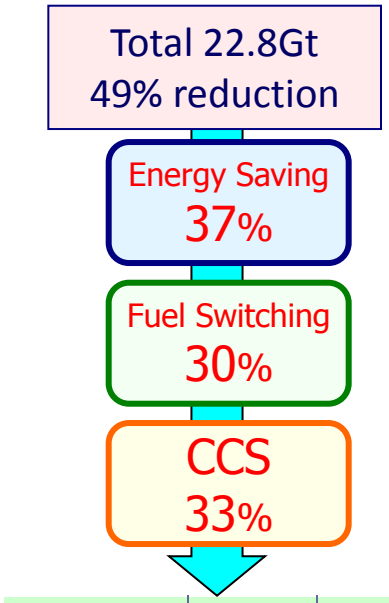


Source: IEEJ, Asia/ World Energy Outlook 2014

CO_2 Emissions Reduction by Technology (World)

Reference
[Adv. Tech.]+CCS

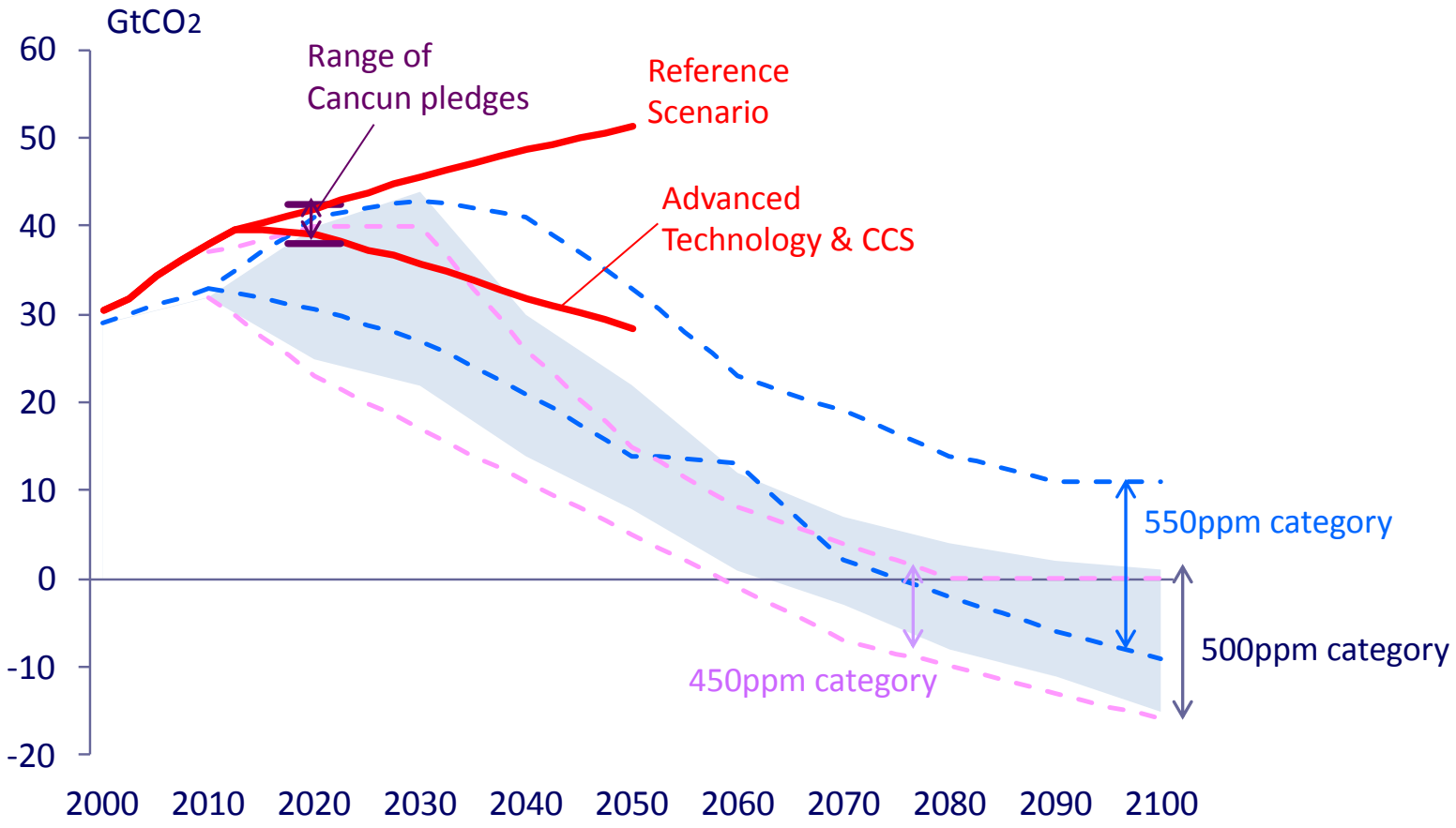




	Gt-CO_2	Share
Energy saving	8.5	37%
Biofuel	0.2	1%
Solar, wind, etc	3.1	14%
Nuclear	2.0	9%
Fuel switching	1.5	7%
CCS	7.4	33%
計	22.8	100%

Source: IEEJ, Asia/ World Energy Outlook 2014

CO_2 Emissions Paths by GHG Concentration Categories



Source: IEEJ, Asia/ World Energy Outlook 2014

We need electricity

- Access to energy often means access to electricity.
  - The problem lies between ``**keeping** the lights on``(developed) and ``**turning** the lights on``(developing).
- Youth's lifestyles require electricity supply which they do not care from which power station or source it is generated…
- Social systems & economic activities : production lines, hospitals, offices, households, entertainment and comforts….

  ➔ These services are supplied by **electricity**.
- New social infrastructures utilizing ICTs and ITs use electricity
- Sudden blackout means…

  ➔ **no** train, **no** traffic lights, **no** medical equipment, **no** lightings, **no** A/C, **no** elevators, **no** water, etc.

The market is not the same, any more

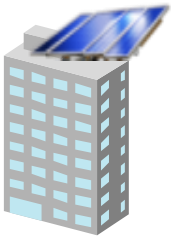
- The electricity sector in most developing economies was owned and operated within the public domain, through vertically integrated entities to perform the functions of **generation**, **transmission** and **distribution** (as well as infrastructure creation).
- Vertically integrated monopolies, based on economies of scale argument, were initially deemed to be **the best way** to deliver electricity to the majority, lacking access to it.
- We are no longer at the turn of the 20th century where huge initial investments were required financed by governments.
- Deregulation and liberalization of the market are required for more efficient power supply and reduction of electricity prices.
- We are in the 21st century and size of investments are varied with many different and new players in the market.

Investments are always at the core of the discussions for **reforms**.
Electricity is unquestionably a part of our lives!!

Technologies have evolved

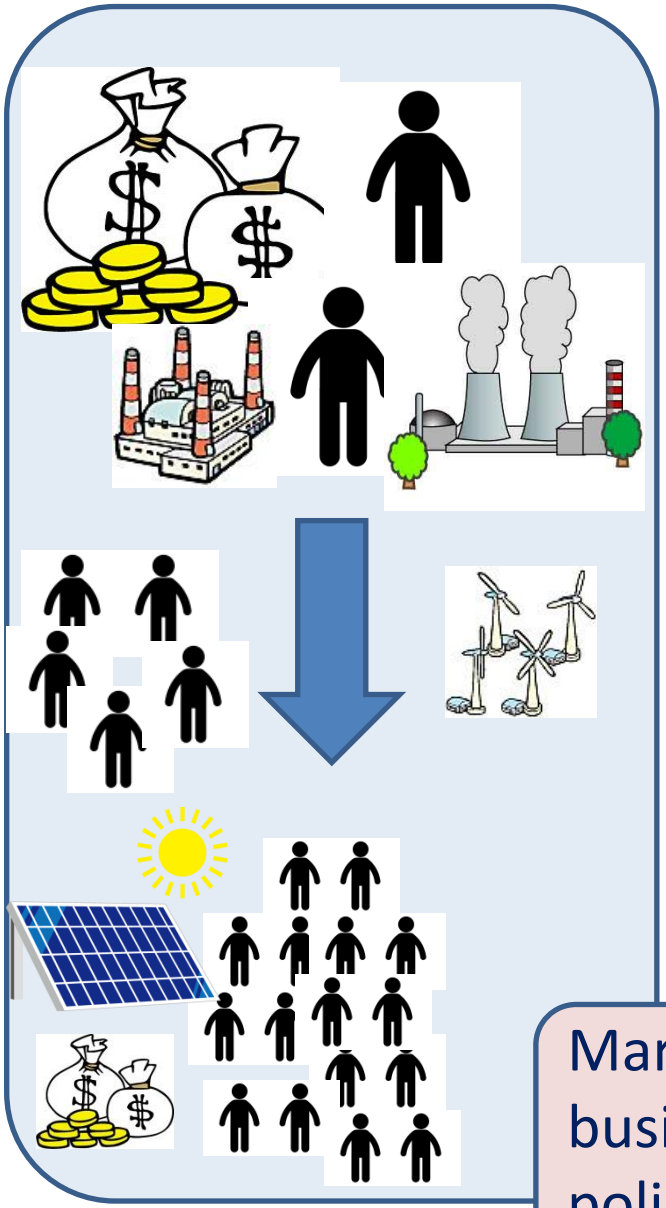
- Initial installation of big-scale plants and grids
  - thermal power plants, nuclear power plants, national grids …..

- More quick to install technologies became available:
  - gas turbines, roof-top PVs, Fuel cells ……..



- System integration is required connecting different sectors, businesses, customers, technologies, appliances and balancing supply-demand.
  - Smart cities, HEMs, BEMs, TEMs, ZEB …….

Illustration of Evolution of Electricity Market



<In the past, say 1980's to 90's>

- Investments by governments in the order of billions of $$$ required.
  - ➢ National grid, nuclear, thermal plants…

<Since the 1990's…>

- Investments by industries in the order of millions of $$
  - ➢ Gas turbines, wind mills…

<Nowadays…>

- Investments by individuals in the order of thousands of $

-Scales are different but more players there!

Markets are changing and it calls for changes in business models, technologies, price schemes, policies and others!!

What is Market Reform?

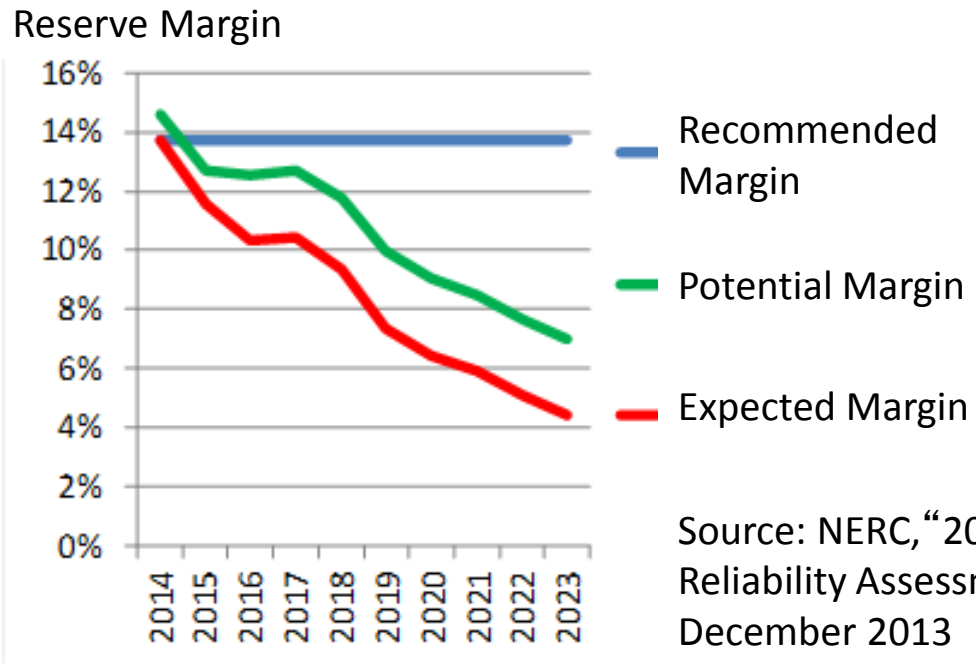
- To unbundle vertically integrated monopolies to address inefficiencies and infuse transparency in the operations of state-owned enterprises
- To liberalize retail market, create competition and lower electricity prices …… fundamental rule

- But concerns for supply security caused setbacks:
  - California (2000 summer, 2001 winter), Italy (2003), Scandinavia south (2003), North America Grid (2003),

Many varied styles of "Market Reform"
depending on national circumstances and requirements!!

State of Texas, USA

- 60% of the electricity consumption is supplied by new marketers (middleman).
- **Competitive** retail market with no leading supplier.
- **Increasing concern** for insufficient future investment to supply **increasing power demand** needed by growing economy (Shale).
- Low reserve margin is expected by 2020 (down to 4%) and **policy intervention** is being considered.



Source: NERC,"2013 Long-Term Reliability Assessment", December 2013

Many Reasons Why we need Market Reform

- To lower the cost and retail prices at the competitive level with sufficient electricity supply relative to demand
- To ensure “nation-wide supply-demand balance” (Japan)
- To transform the power systems into more efficient ones (UK)
- To unify the energy market (liberalize retails, create ISO, ITO: EU)
- To introduce “competitive market” (USA)
- To accommodate “renewables” and address “climate change”
- To introduce more flexibility for consumers
- To involve customers through “demand response” to induce “peak shift”.

and many more….

Many varied reasons why we want “Market Reform” depending on national circumstances and requirements!!

Some Merits and Demerits of Market Reform

Merits:

- More efficient management
- Lower electricity price introduced by new players and efficiency
- Diversification of service menu

Demerits:

- Lower reserve margin induced by insufficient investment
- Higher risks of blackouts
  - ➔ supply security concern ➔ capacity market
- Difficulties in promoting low-carbon power generation
  - ➔ CfD (Feed-in-Tariff with Contracts for Difference :UK)

The paradox..

- Electricity **prices** in a liberalized market are set according to the system marginal cost (i.e. the short-term marginal cost of the last plant required in order to meet demand). Wind has **high capital costs** but a **zero marginal cost** of generation.
- In order to encourage investments required in wind (or other renewables), government must offer support schemes (FIT) or subsidies which essentially **undermine** the role of the **liberalized market** in setting prices and motivating investments.
- The requirements for investments should be called for through the price signals rather than externally imposed standards or policy objectives.

Some Points for Today's Discussion

a) What is the aim of "Electricity Market Reform"?

b) How do we plan to reform the market and/or what have we done and what are the differences and similarities among our ways of market reform?

d) What are the implications of the market reform to the business sector and what business opportunities and challenges are there for them?

e) Is unbundling **inconsistent** with the introduction of smart grids and more renewables?

e) What are the market design issues in the presence of low carbon technologies?

f) How to balance between "reform" and "control"?

g) What are the keys to a successful & functional electricity sector?

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