International Energy Agency
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RENEWABLE ENERGY
Medium-Term Market Report 2015

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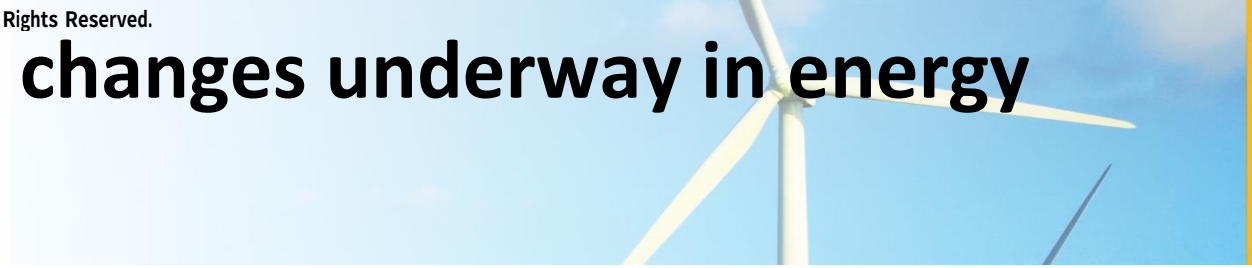
Market Analysis and Forecasts to 2020

The 88th IEEJ Energy Seminar, 5th October 2015

Profound changes underway in energy markets



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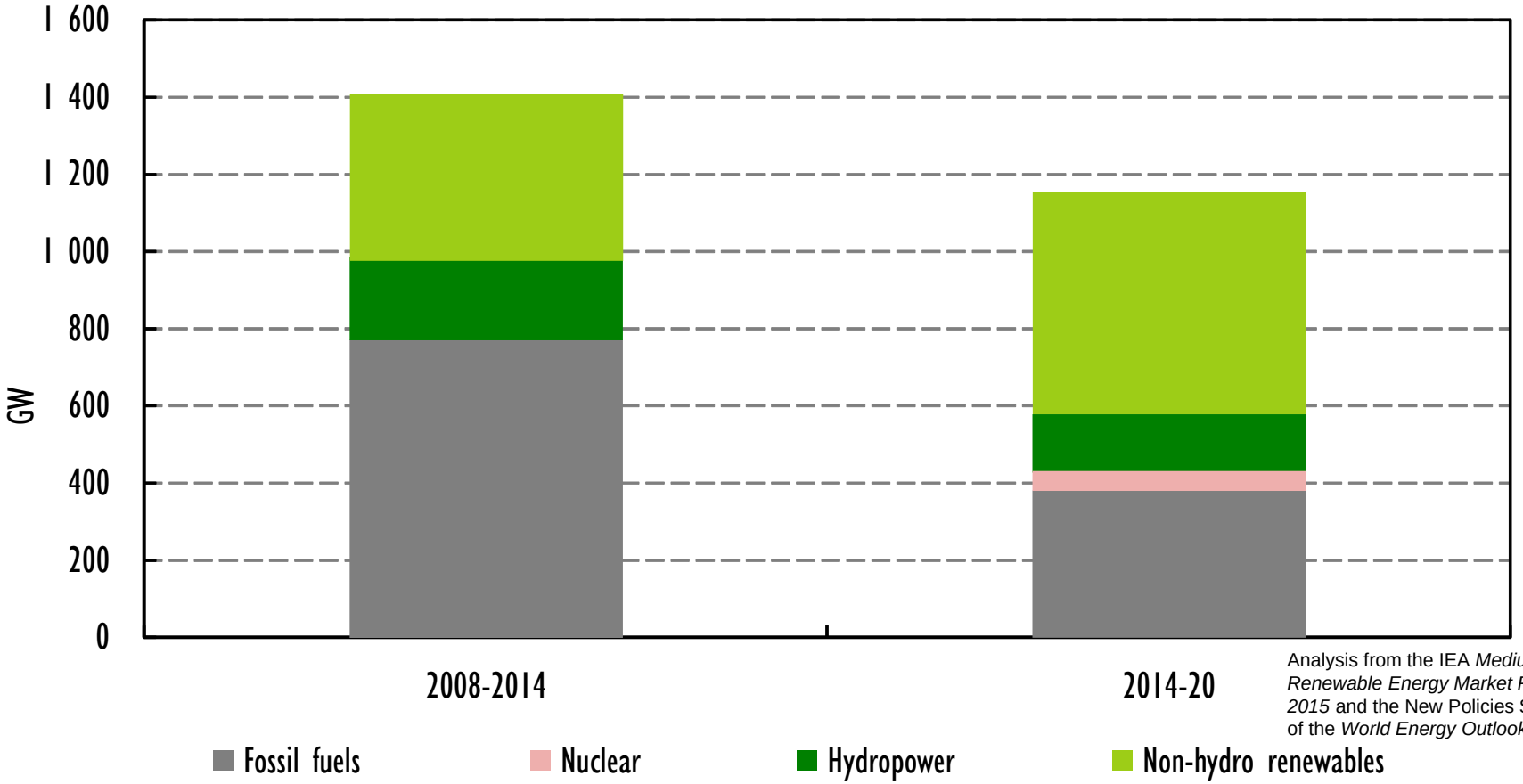
- Signs of decoupling of energy-related CO_2 emissions and global economic growth
- Oil prices have fallen precipitously, raising questions over the competitiveness of renewables
- But policy drivers for renewable electricity – energy diversification, local pollution and decarbonisation – remain robust
- Renewables are key to the unprecedented pledges ahead of COP 21
- Renewables to become first source for electricity in the longer term, but addressing policy uncertainty in the next five years is crucial

Renewables are becoming the largest source of new power generation capacity

World net additions to power capacity

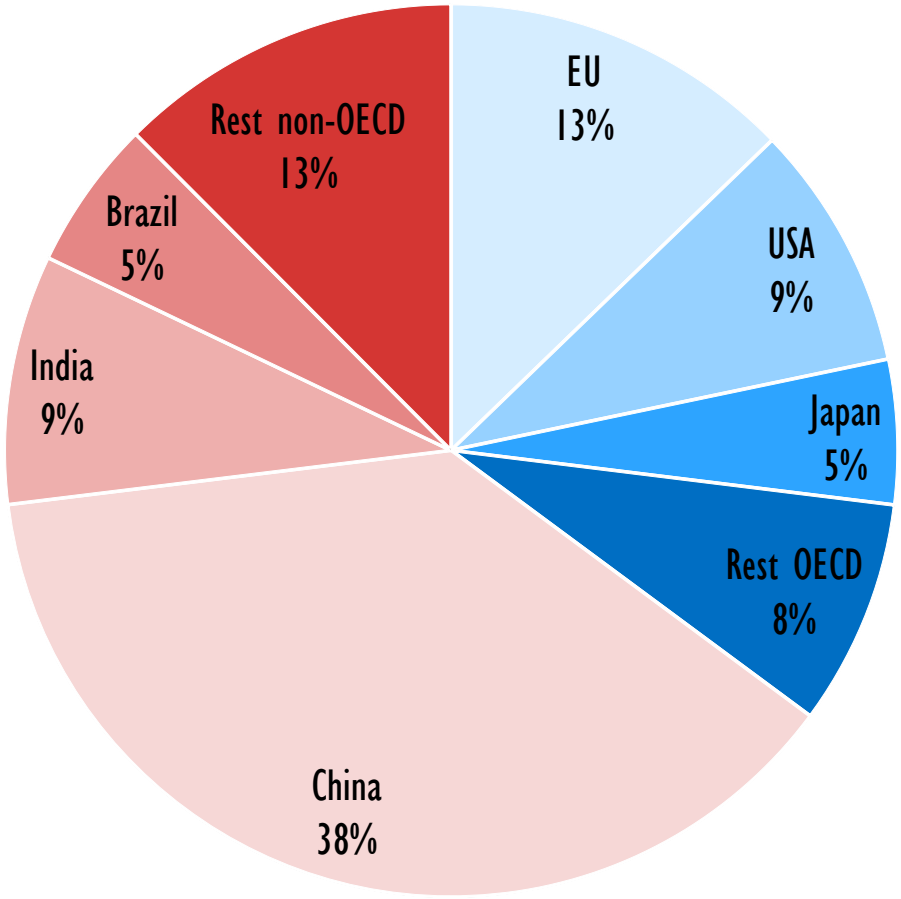


Analysis from the IEA *Medium-Term Renewable Energy Market Report 2015* and the New Policies Scenario of the *World Energy Outlook 2015*.

The share of renewables in net additions to power capacity continues to rise with non-hydro sources reaching nearly half of the total

Growth shifting to emerging markets and developing countries

Shares of net additional renewable capacity, 2014-20



As the OECD slows, non-OECD countries account for two-thirds of renewable growth, driven by fast-growing power demand, diversification needs and local pollution concerns

More renewables for less money

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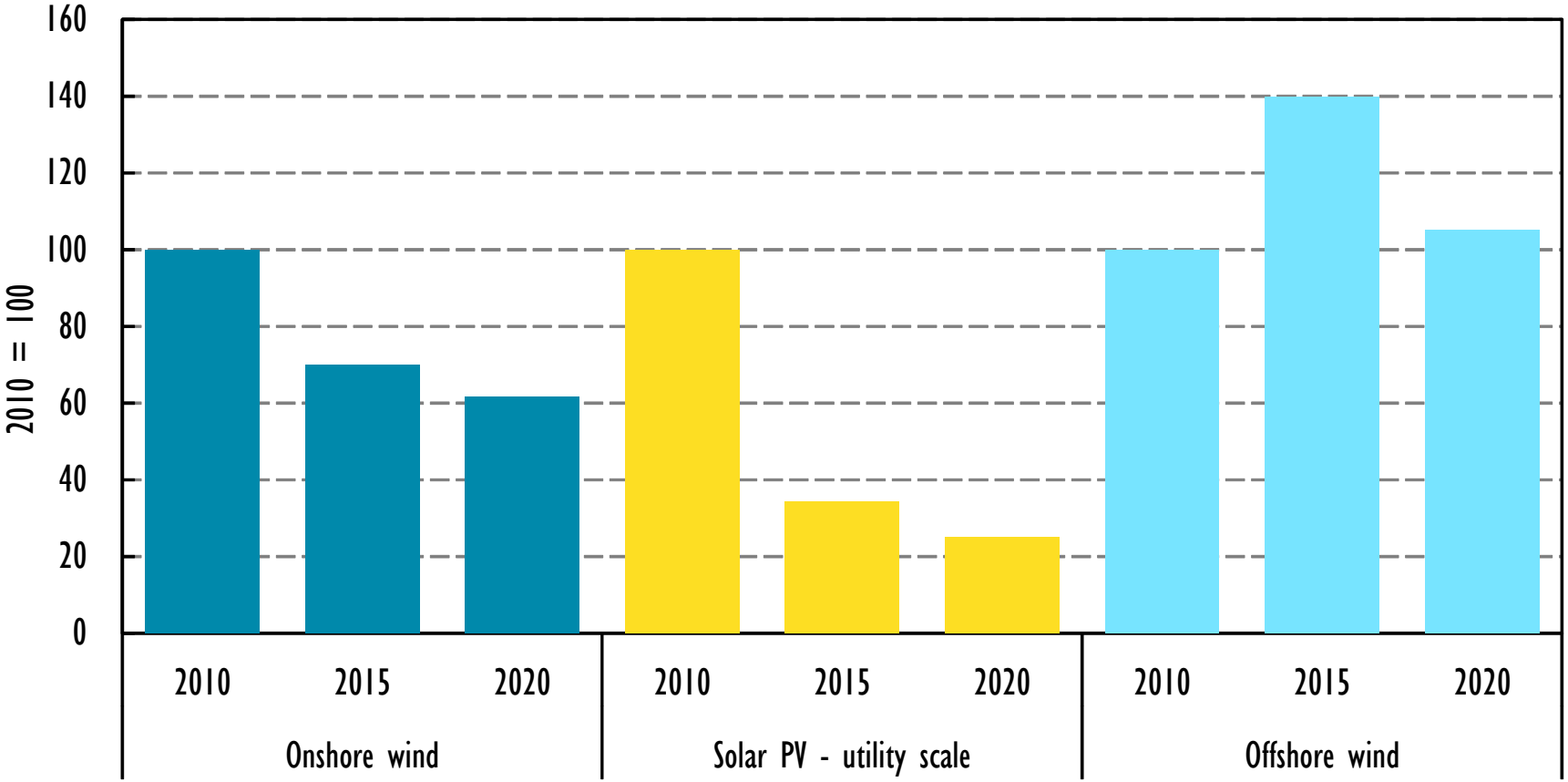
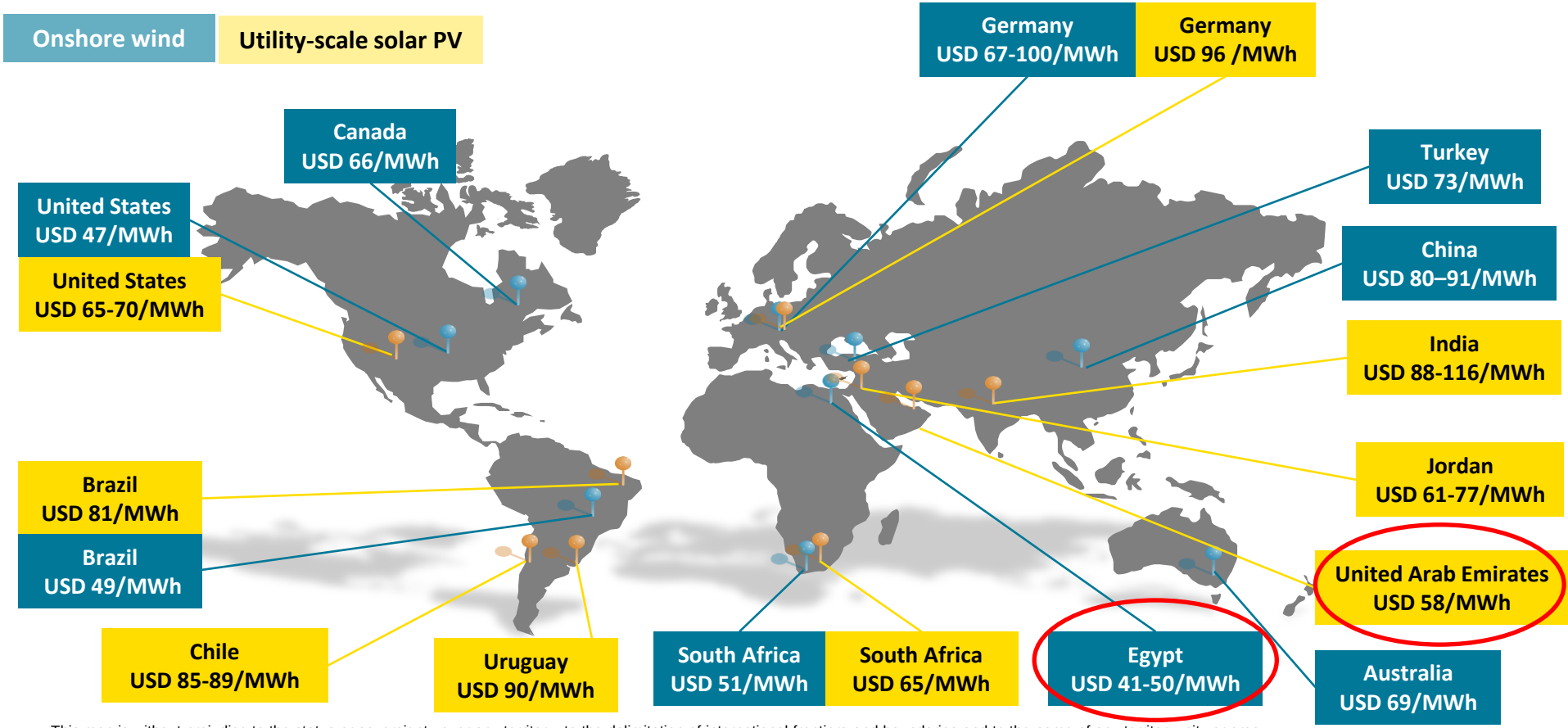
Global indicative generation costs for new plants



High levels of incentives are no longer necessary for solar PV and onshore wind, but their economic attractiveness still depends on the regulatory framework and market design

Evidence of lower costs on the horizon

Recent announced long-term contract prices for new renewable power

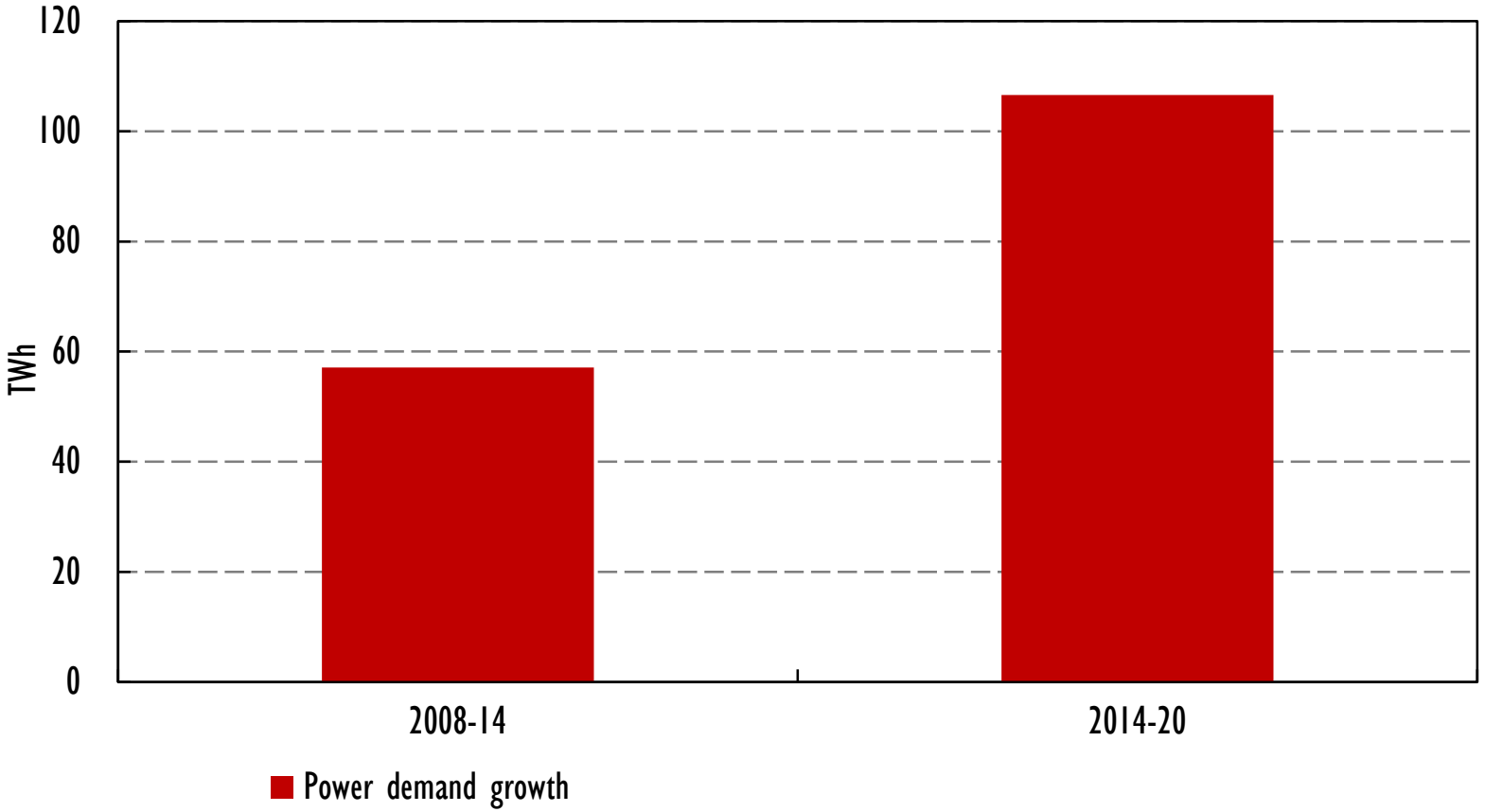


This map is without prejudice to the status or sovereignty over any territory, to the delimitation of international frontiers and boundaries and to the name of any territory, city or area

A combination of price competition, long-term contracts, good resources and financial de-risking measures is creating deployment opportunities in newer markets and at lower costs

Renewables can power Africa's economic growth

Sub-Saharan Africa power demand growth versus supply sources



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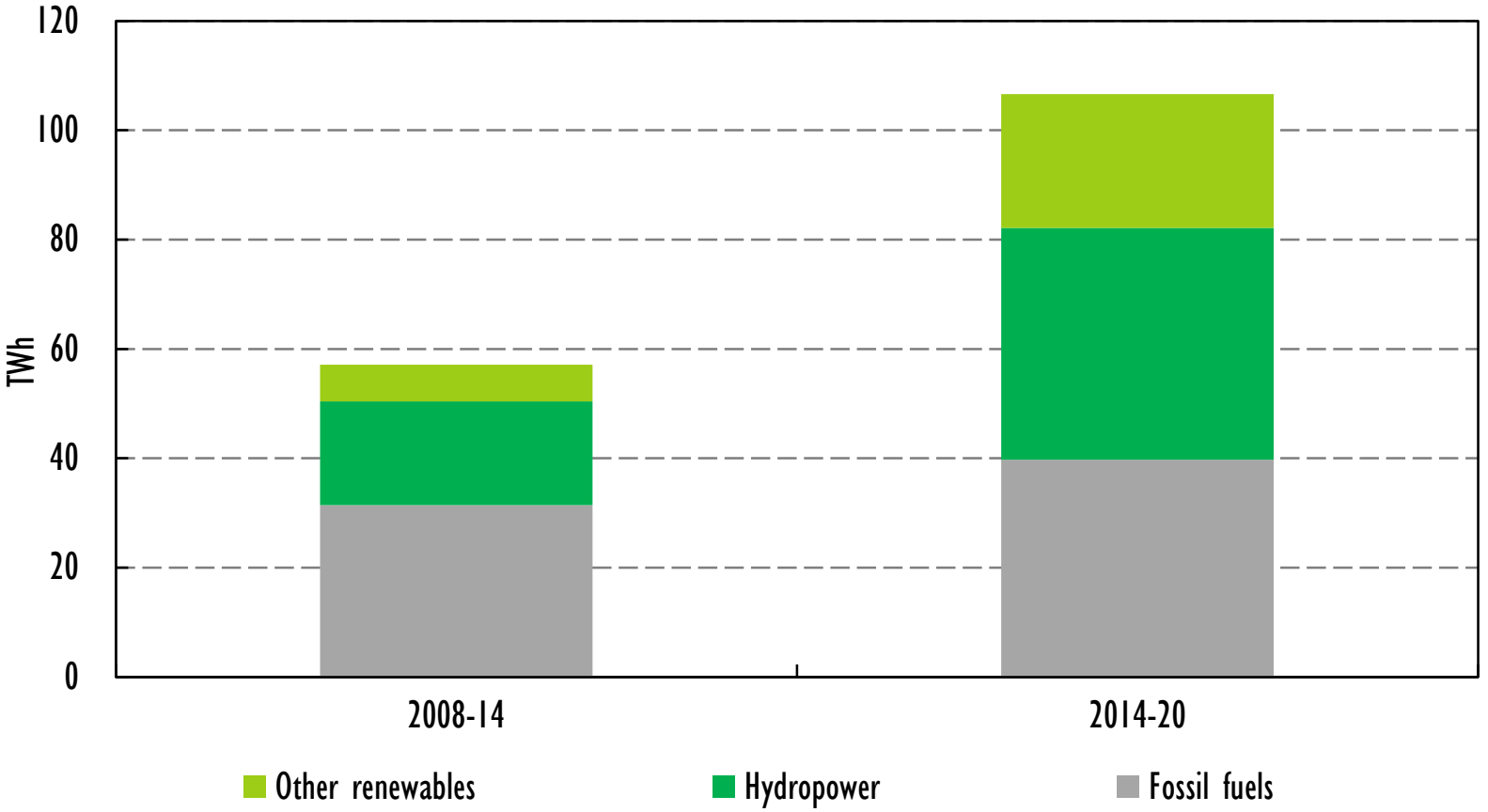

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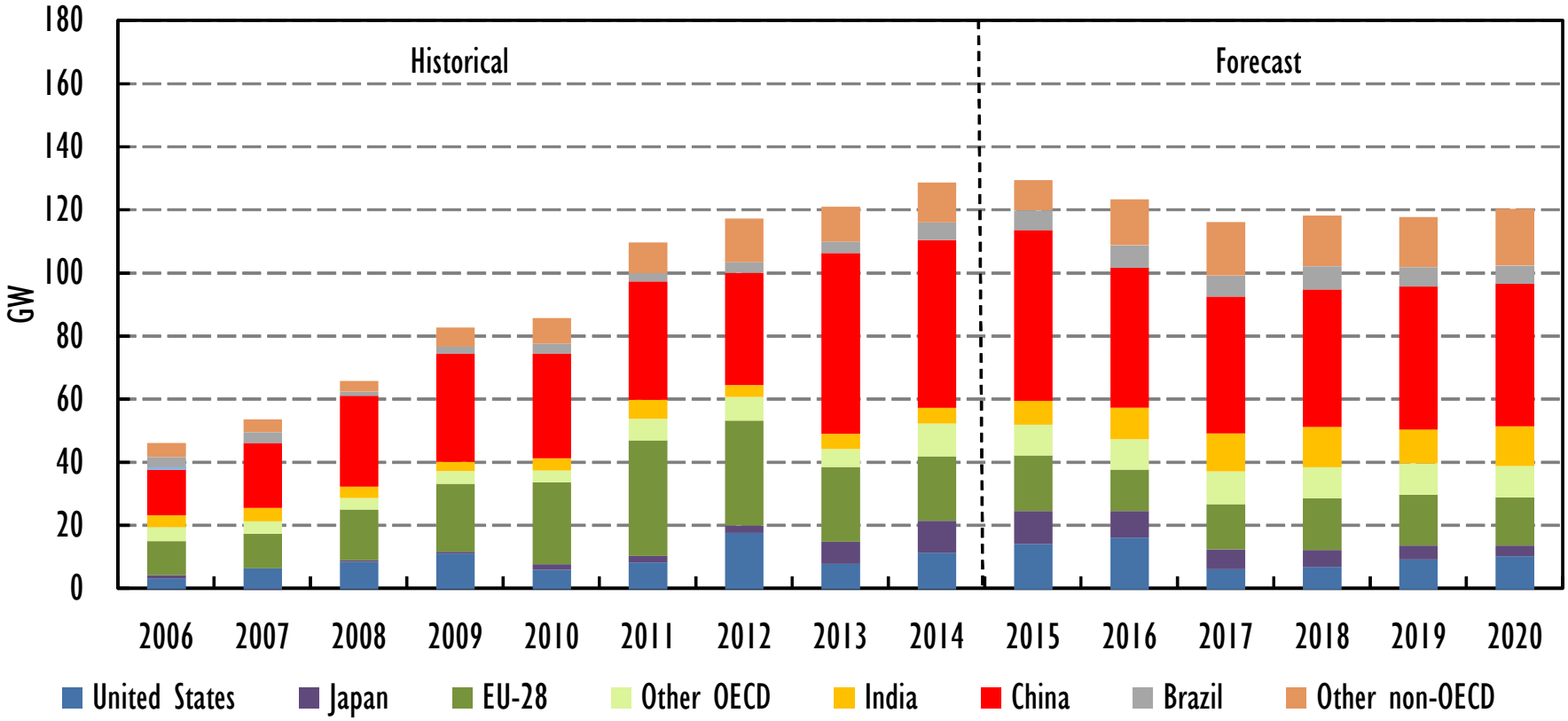
Renewable growth can be accelerated back on track to meet climate goals

World renewable power capacity growth, main versus accelerated case



Renewable energy can be brought back rising annual installation growth, through enhanced domestic policies, e.g. grid integration of variable renewables

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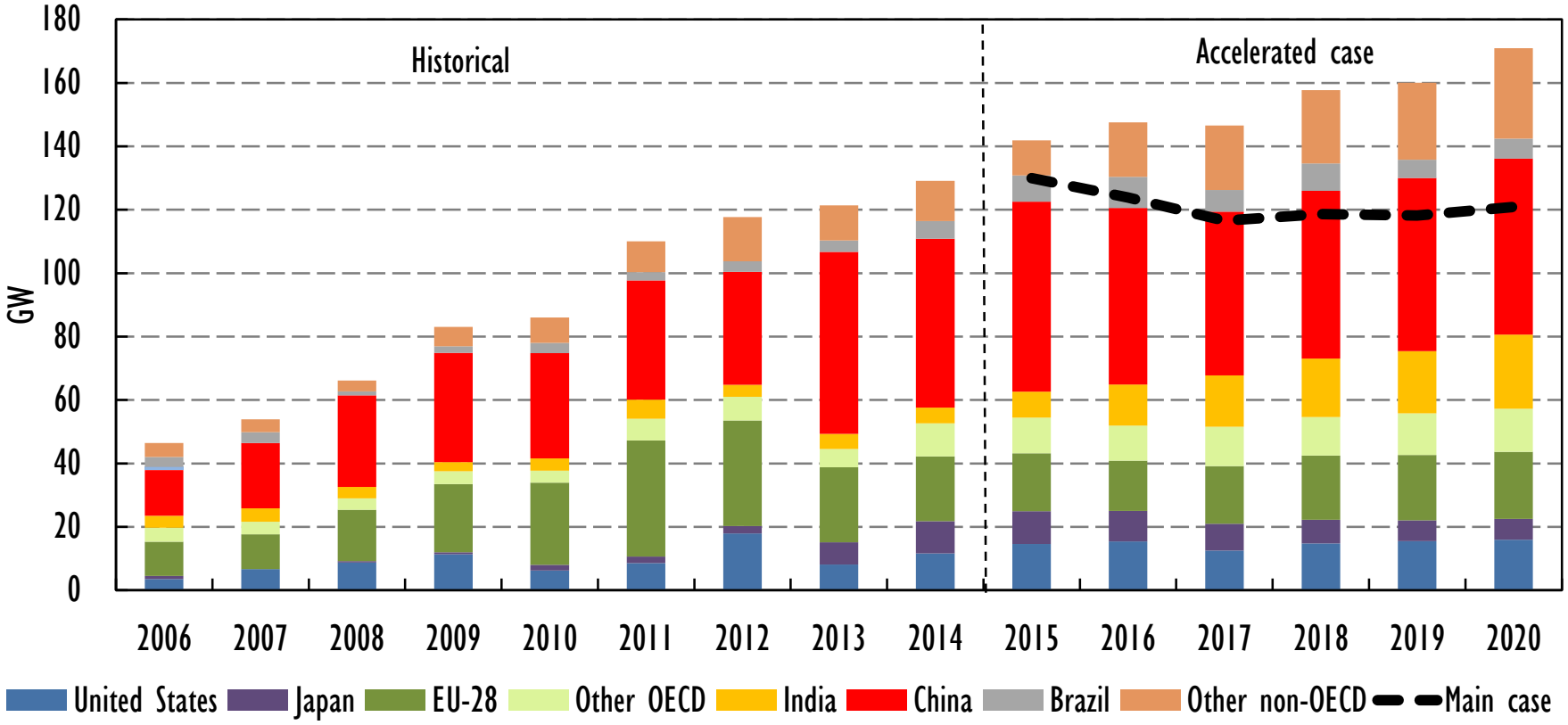

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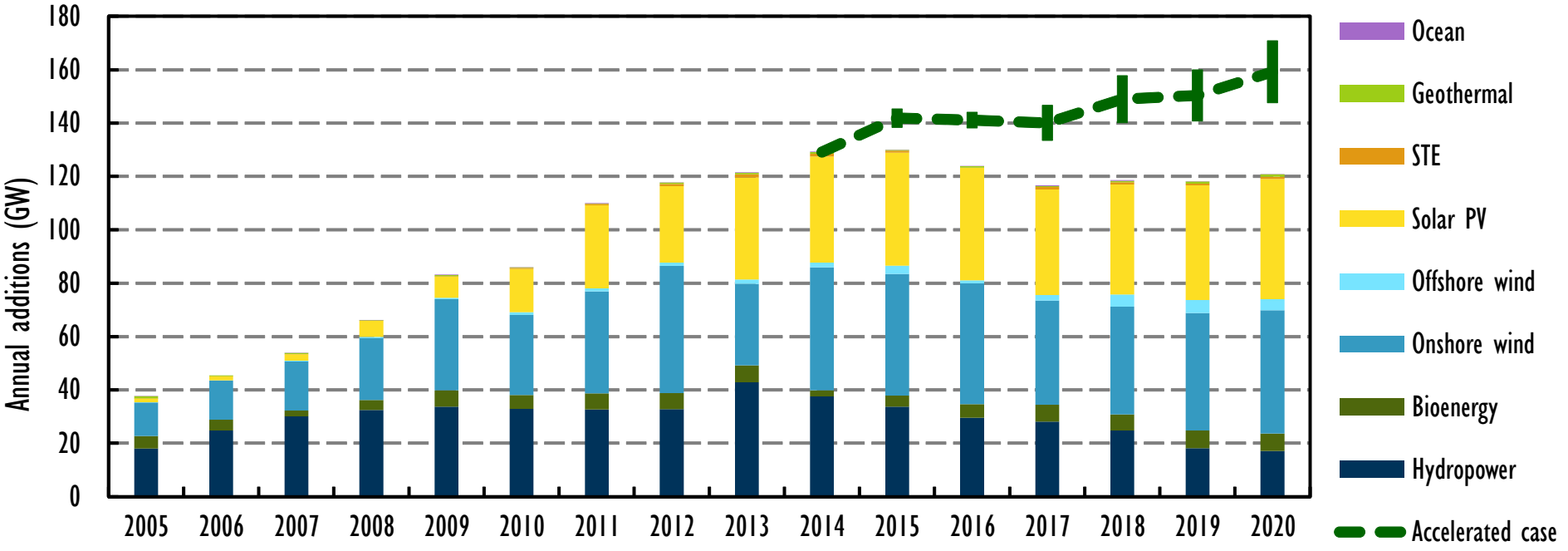
A decisive moment for the future of renewables

- Increasingly affordable renewables are set to dominate the growing power systems of the world
- The effect of the lower oil price environment on global renewable growth is more perception than reality, though biofuels are an exception
- Further policy action is needed for heat and biofuel sectors, in the face of structural challenges.
- Yet, wavering policy commitments risk undermining investor confidence and are dampening growth
- While variability of renewables is a challenge energy systems can learn to adapt to, variability of policies poses a far greater risk

Global Renewable Technologies

Renewable electricity expanded at its fastest rate in 2014, despite sharp fall in oil prices

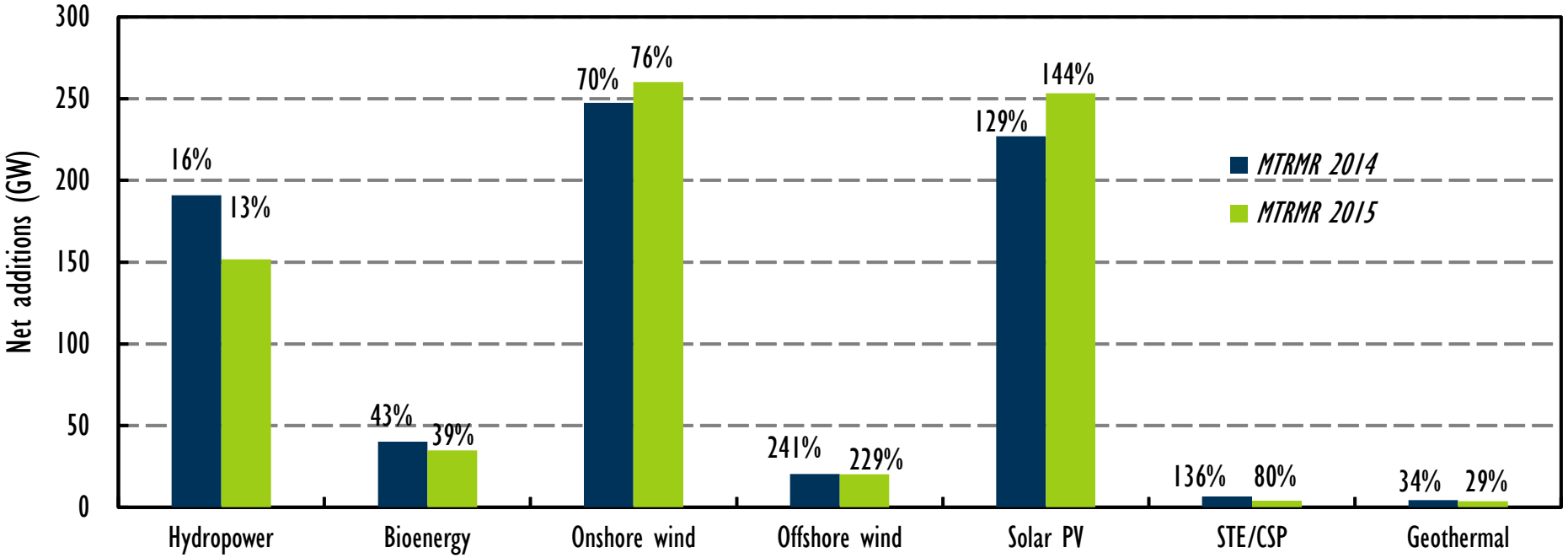
World net additions to renewable power capacity, historical and forecast (GW)



The global expansion for renewable electricity remains robust and renewable power capacity rises by 40% over 2014-20. The outlook stems from **greater cost-effective deployment of solar PV and onshore wind.** ***Still annual forecast remains relatively flat, with a dip in 2016/17***

Onshore wind leads global renewable capacity additions, with higher growth forecast versus MTRMR 2014

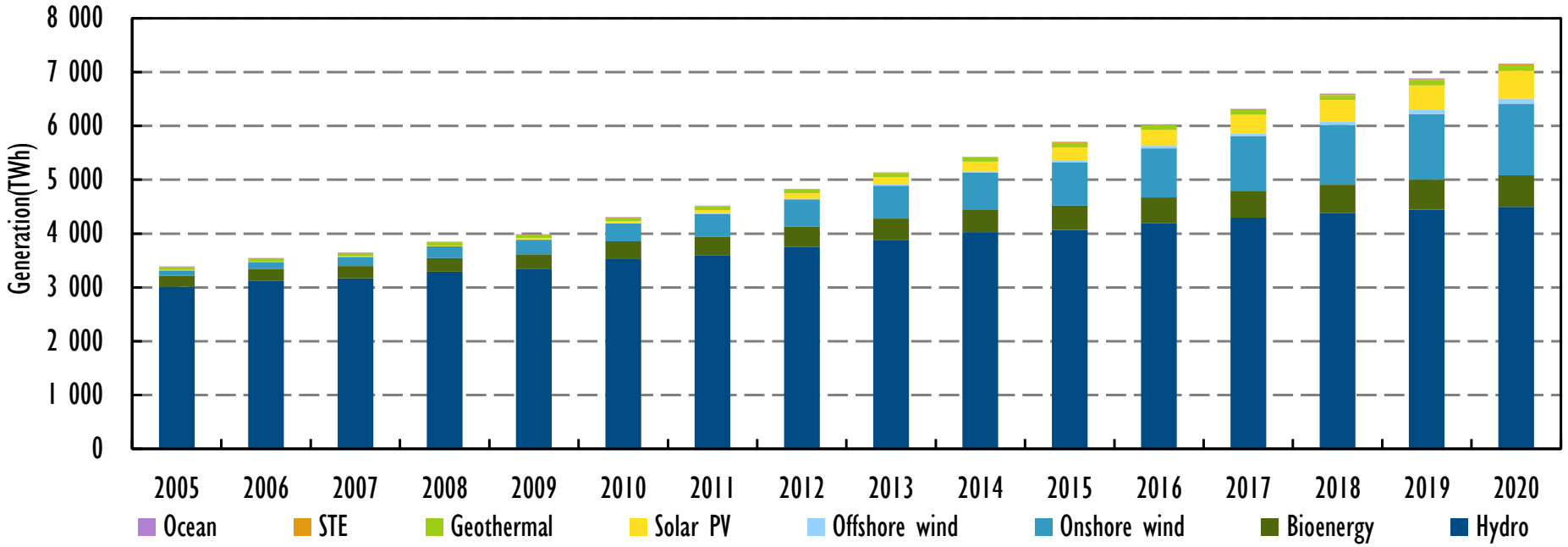
World net additions to renewable capacity, absolute and percentage growth, 2014-20



The forecast for onshore wind is more optimistic mostly due to China and Brazil. Solar PV is the second-largest source of capacity growth, with a raised forecast reflecting more optimistic growth prospects across a number of markets.

Strong global momentum for renewable electricity generation

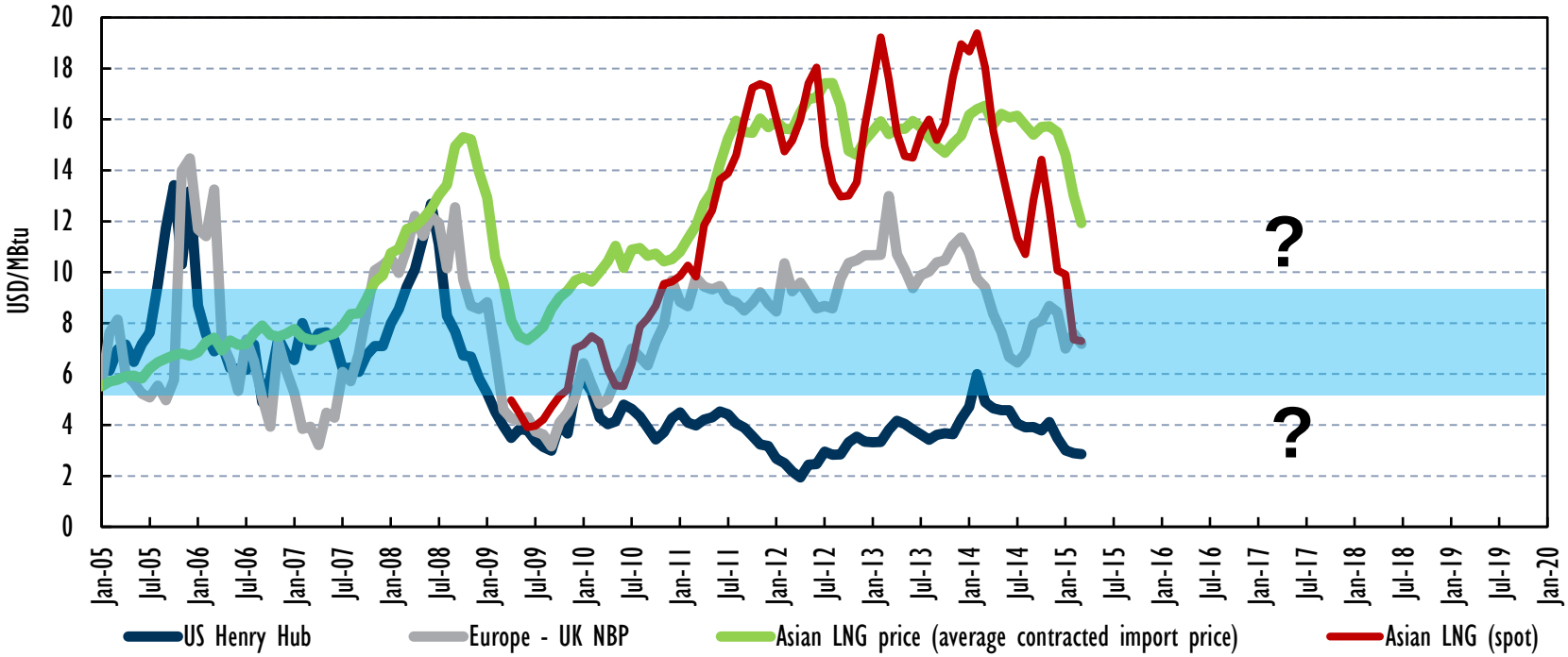
World renewable generation and forecast (TWh)



In 2020, renewable generation reaches over 7 150 TWh, more than today's combined demand of China, India and Brazil

Generation cost profile for fossil-fuels varies under fixed prices versus historical volatility

Historical gas prices by region versus price range for LCOE of new CCGT at USD 60-80/MWh



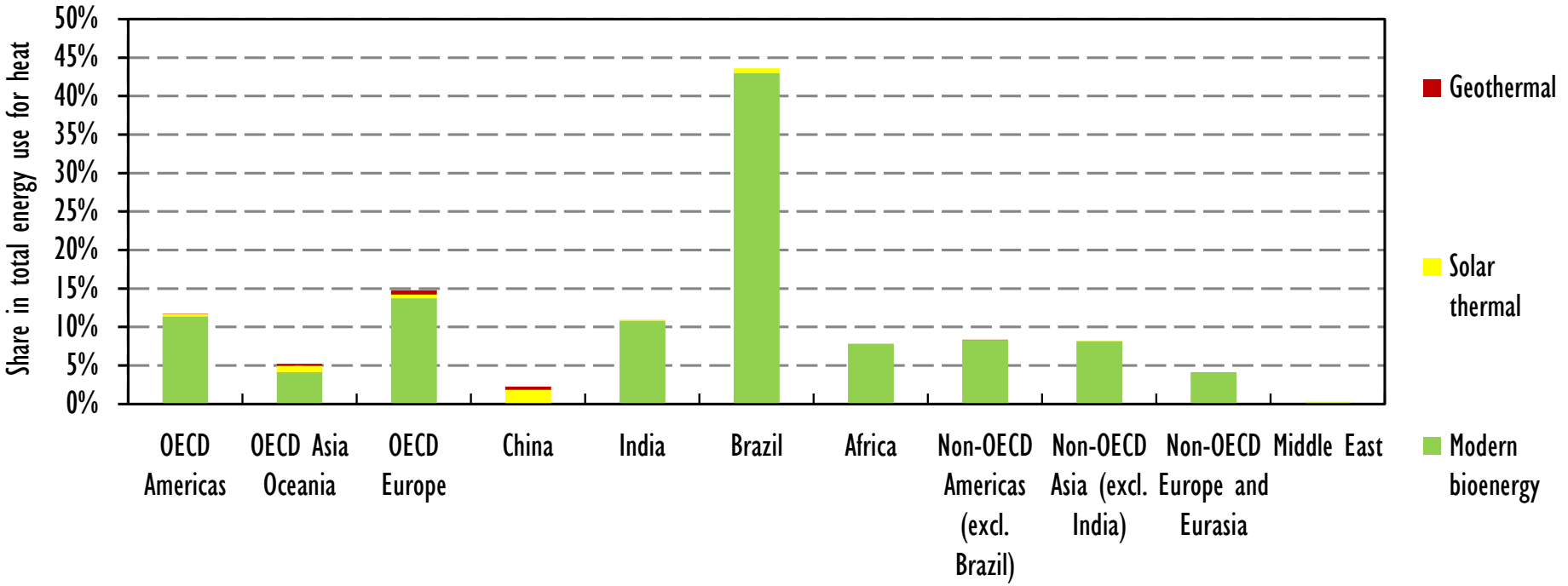
Gas prices at which new CCGT today has LCOE at USD 60-80/MWh (Benchmark for recent wind costs)

Note: LCOE for CCGT is calculated using a ~65% capacity factor and 7% discount rate. No carbon pricing is included in LCOEs.

More robust competitiveness assessments would account for value of electricity generated when and where, and fossil fuel and carbon price volatility

The heating sector offers particular challenges for policy makers

Share of renewable energy in total FEH in different world regions, 2013

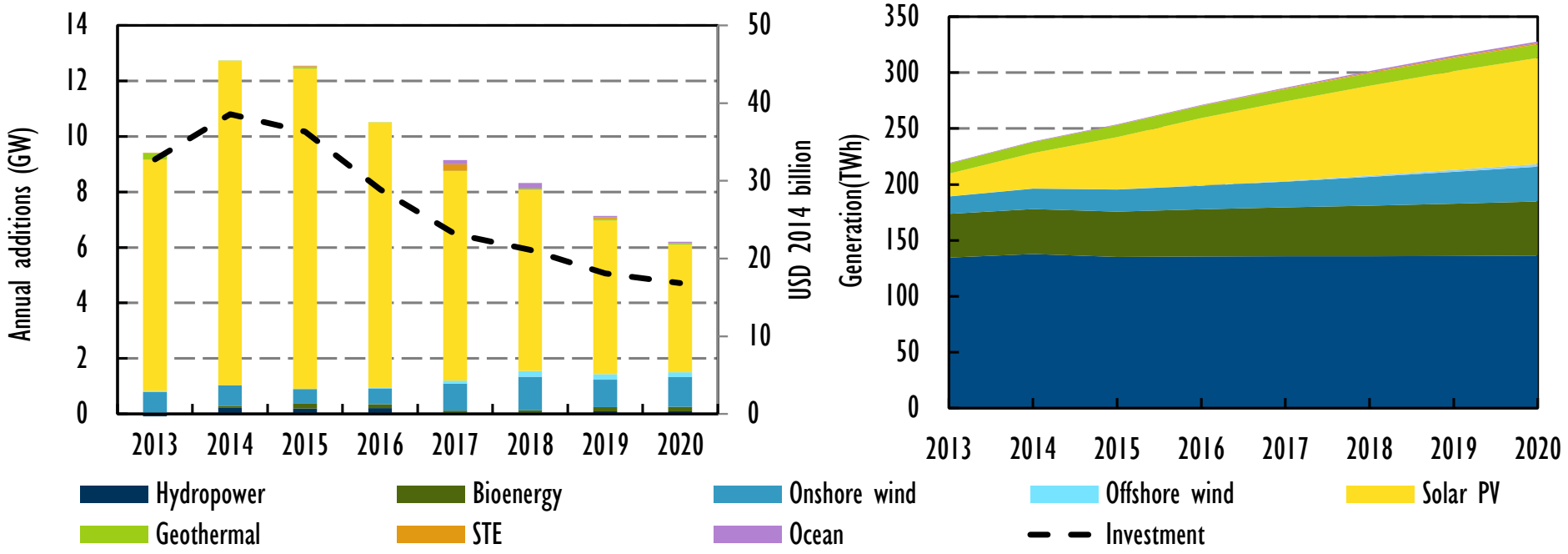


There are no targets and support policies for renewables hearting and cooling in Japan, while the strongest policy drivers today have been adopted in OECD Europe as a result of the EU's mandatory 2020 targets for renewable energy

Focus on Japan

In OECD Asia Oceania, despite strong annual growth in the near term, the additions will slow

OECD Asia Oceania historical and forecasted capacity additions, generation and investment



Renewable additions are expected to slow over the medium term, with uncertainties over progress in integrating higher levels of variable renewables in Japan and reduced expectations in Australia, where electricity demand is expected to stagnate.

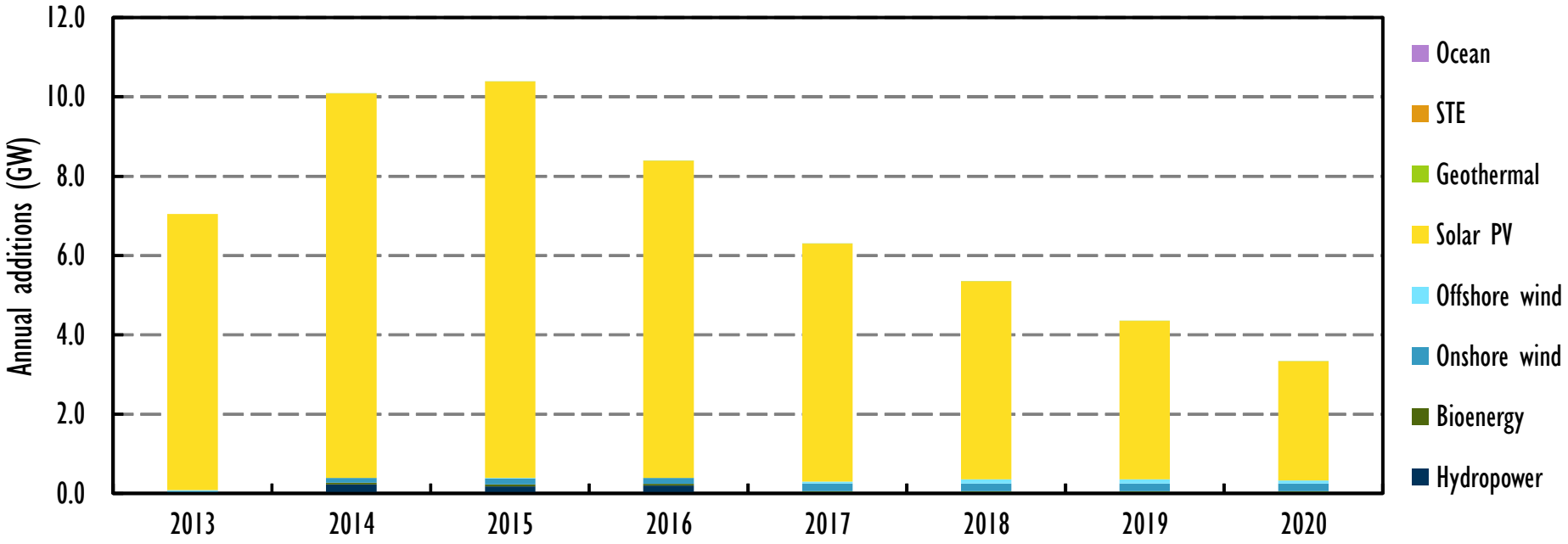
Drivers and Challenges in Japan

- **Drivers**
  - Strong policy environment backed by generous FITs and need for new generation
  - Potential for increased system flexibility in the electricity sector through planned reforms

- **Challenges**
  - Integration of variable renewables in certain regions and maintaining a dynamic approach to support scheme adjustments
  - Implementation of new electricity sector reforms and new strategic plan

Over 2014-20, solar PV expands by 36 GW, but deployment pattern may be volatile

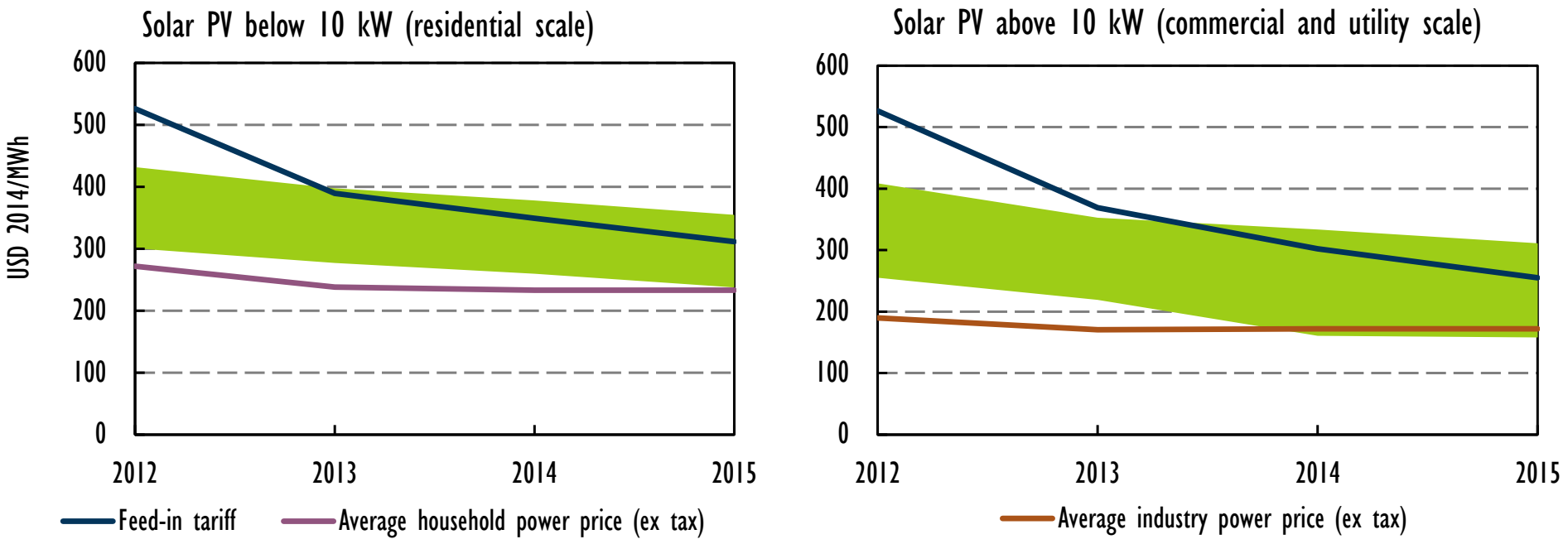
Japan annual net additions to renewable capacity and new investment



While the solar PV cumulative capacity reaches 60 GW in 2020, the pattern may be volatile, with high levels in 2015 followed by a shrinking market, due to assumed grid constraints.

Japan's solar PV approaching benchmark prices

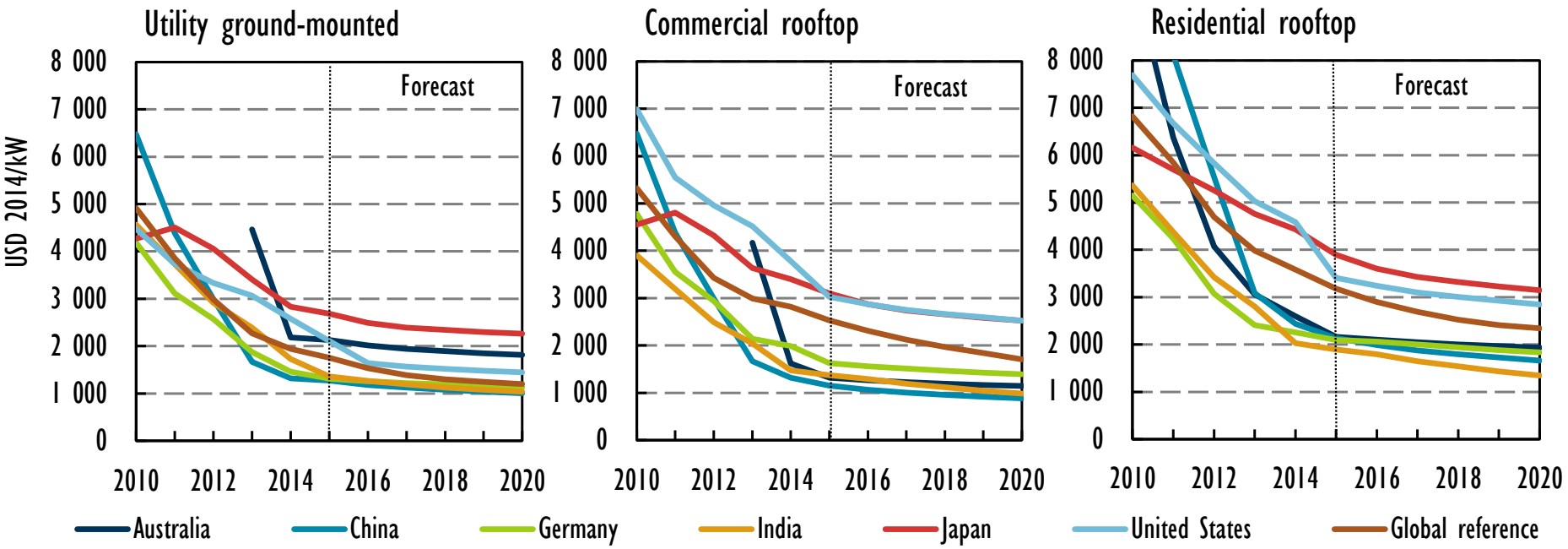
Japan estimated solar PV LCOE ranges versus FIT and end-user price levels



Solar PV residential and commercial LCOEs are seen falling to near current household and industry retail prices, potentially creating incentives for deployment under self-consumption

However, Japan's solar PV costs still remain high compared with international standards

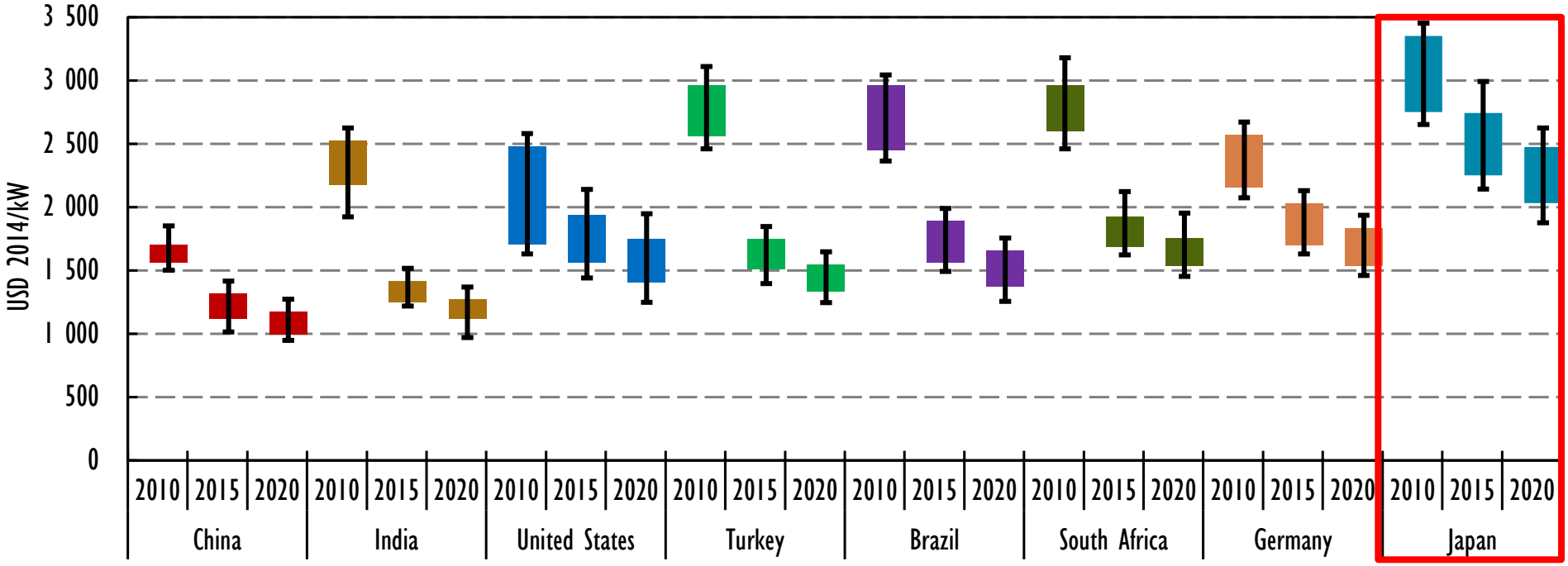
Historical and forecasted typical solar PV investment costs, beginning year



Japan's utility-scale solar PV investment costs remain notably higher the general investment cost range in the world (USD 1 000-2 000/kW), in part due to constricted land availability and grid connection and permitting challenges

Onshore Wind Investment costs in Japan remains highest

Typical onshore wind total investment costs per kW in selected countries (2010-20)

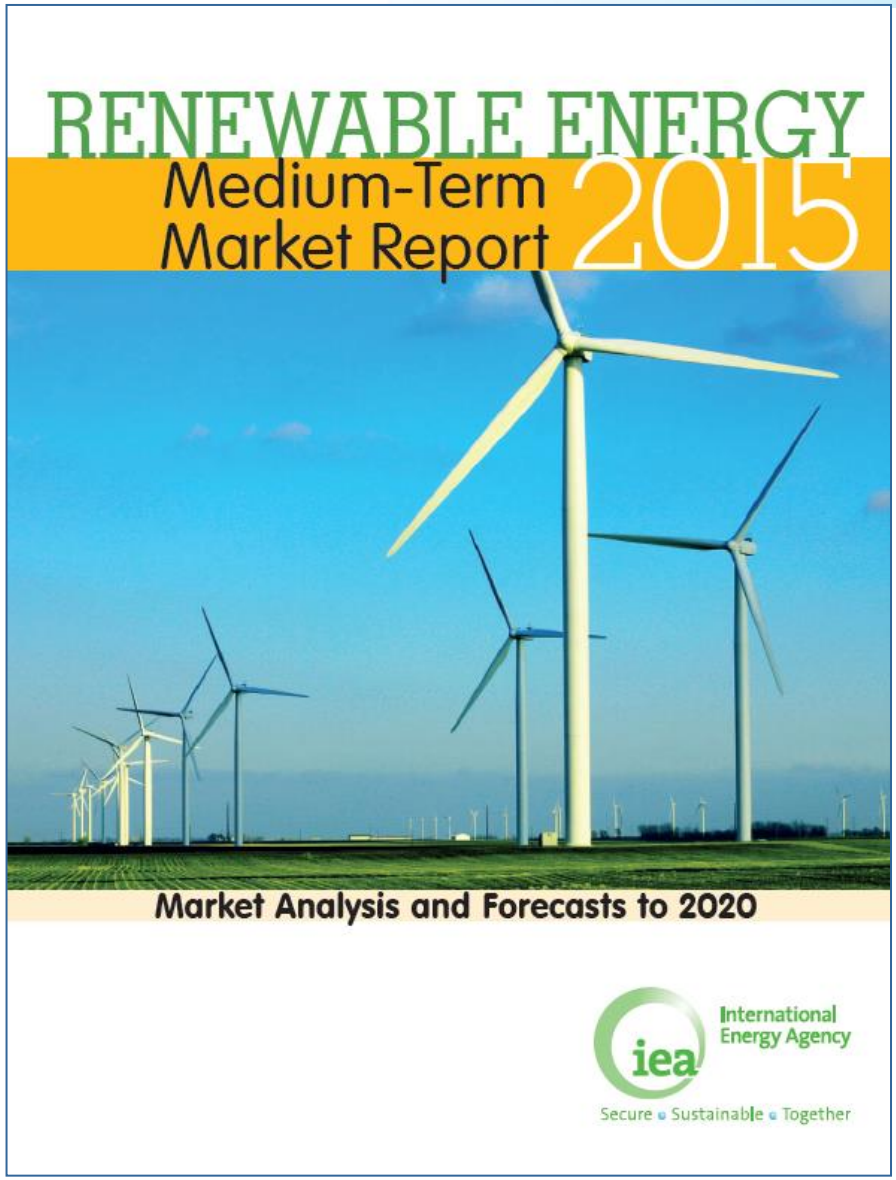


Difficult topography, costly turbines adapted to special meteorological conditions, high construction costs and lack of grid availability combined with expensive and long pre-development process are the main factors behind these high investment costs.

Priorities for Renewables in Japan

- Objective should remain to foster a well-balanced portfolio of renewable energy technologies
- Proceed in the power system reforms
  - Strengthen interconnections and enlarge balancing areas
  - Allow for fair and equal grid access conditions
- Policies on Solar PV should be adapted to reduce unit costs as much as possible and rapidly align with international benchmarks prices
- For development of renewable heating and cooling policy, need to obtain reliable data on production, utilisation and costs

For further insights and analysis…



- The *Medium-Term Renewable Energy Market Report 2015* was launched on 2nd October and can be purchased online at:

  http://www.iea.org/

- Thank you for your attention!

Contact:report@tky.ieej.or.jp