

RENEWABLE ENERGY

Medium-Term Market Report 2016

Medium-Term Renewable Energy Market Report 2016

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International Energy Agency*

Market Analysis and Forecasts to 2021

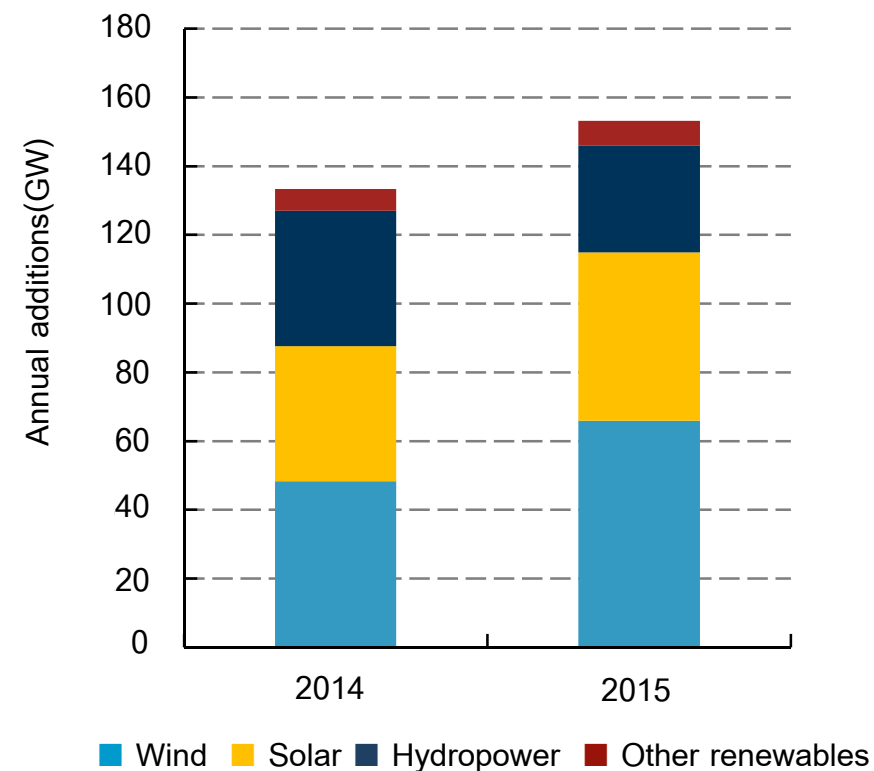
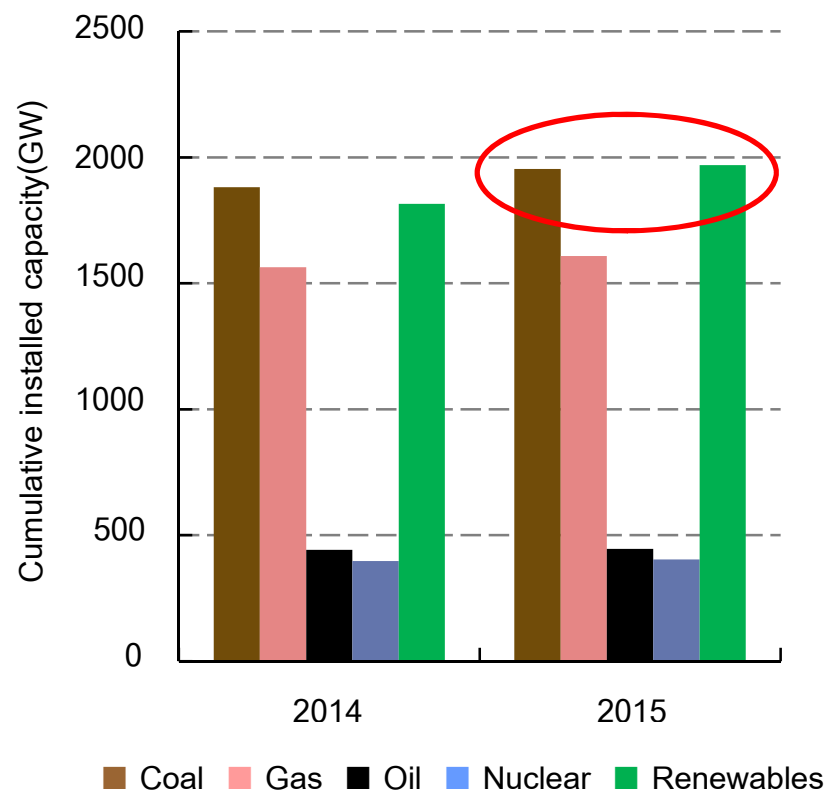
Tokyo, 14 December 2016

Renewable power capacity surpassed coal

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Cumulative grid connected power capacity (2014-15)



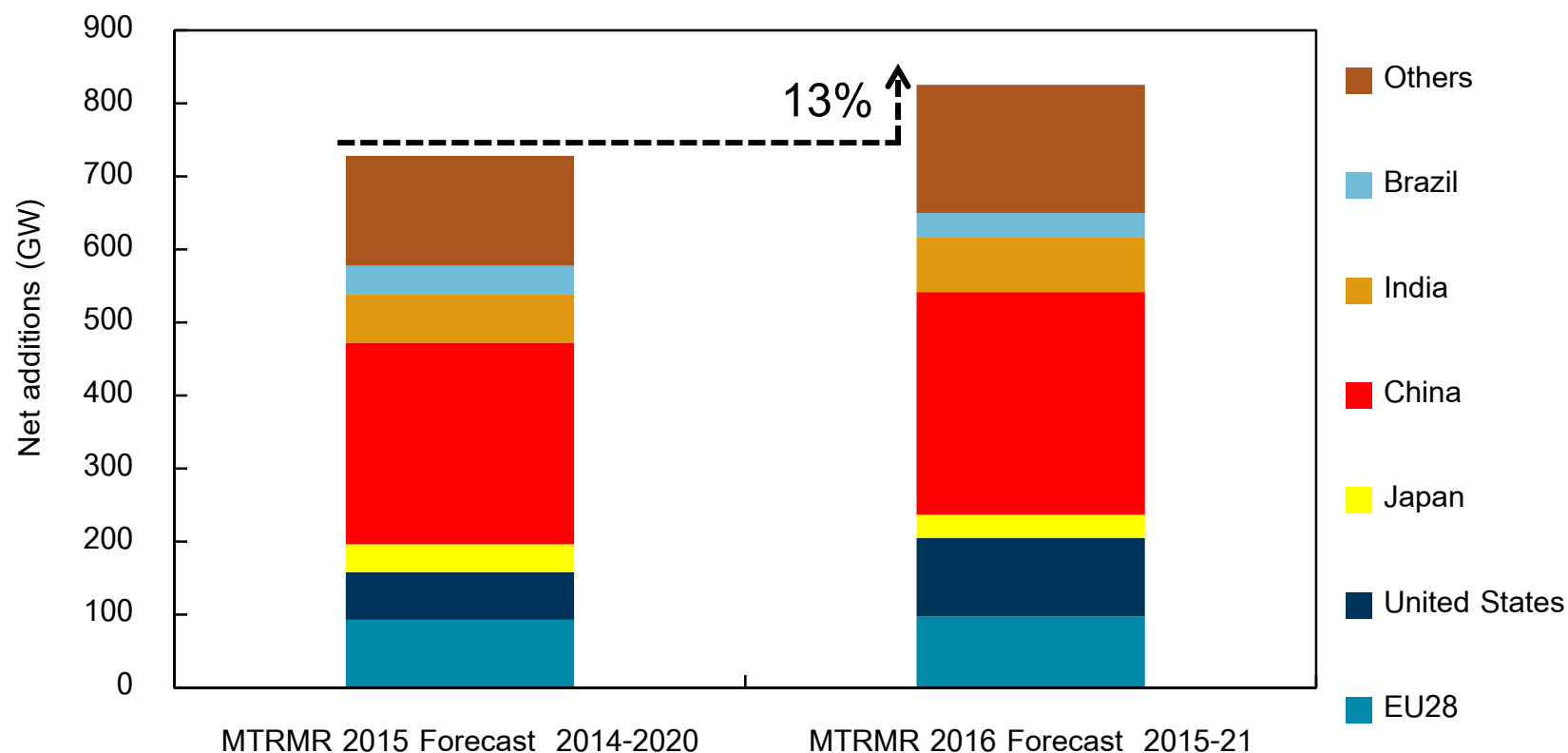
Record-level new renewable capacity of 153 GW was connected to the grid in 2015

New policies underpin a more bullish forecast for renewables

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Renewable electricity capacity growth (GW) in *MTRMR's main case*



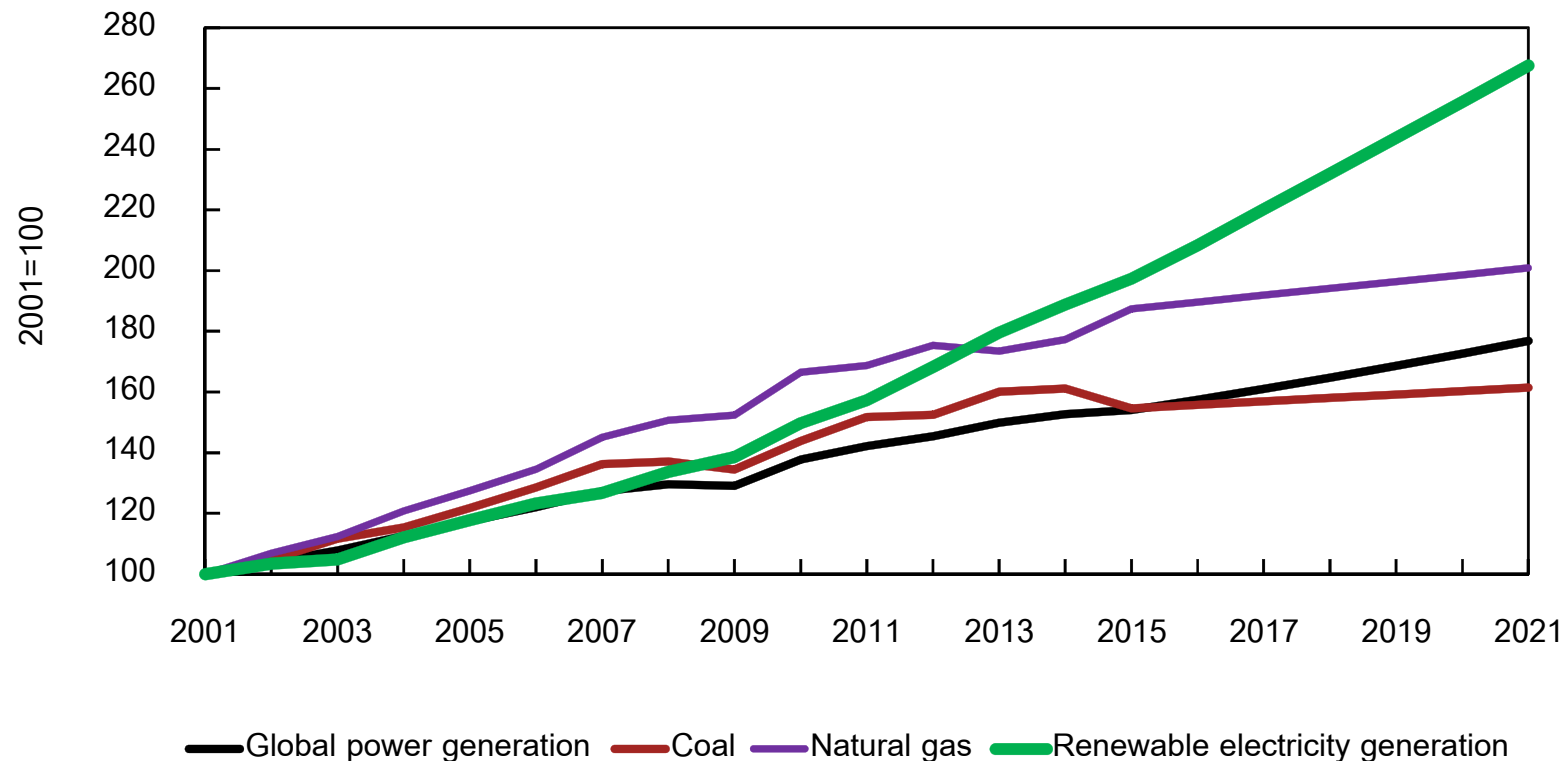
China remains key growth market for renewable capacity, while the United States surpasses the EU for the first time

Renewables to remain fastest growing source of electricity generation

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Indexed electricity generation by fuel (2001-21)



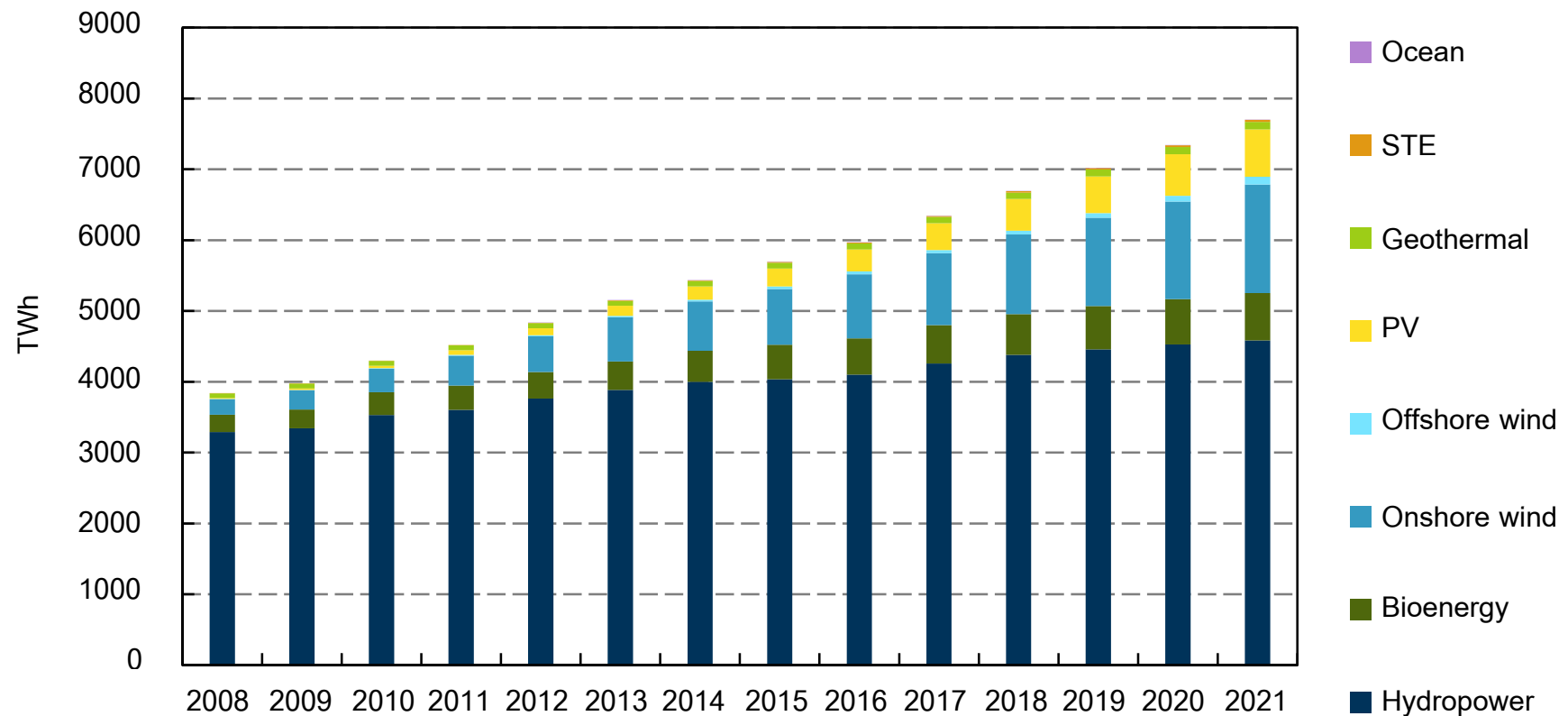
Generation from renewables to rise by almost two-fifths over 2015-2021, pushing their share of total electricity generation from 23% to 28%

Renewables fastest source of electricity generation growth

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Global renewable electricity generation



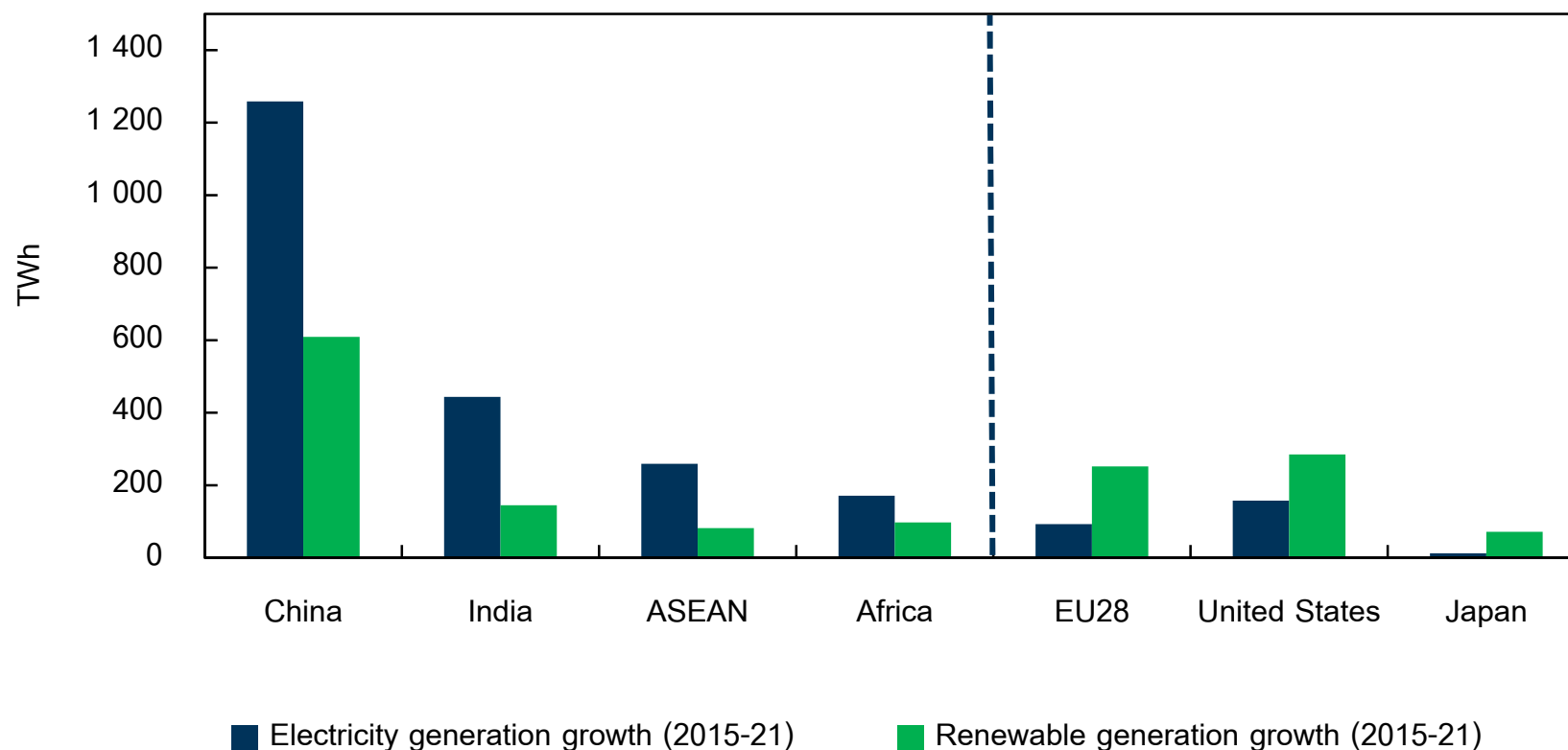
Between 2015-21 wind generation doubles and solar PV almost triples, with renewables reaching almost 28% of total electricity by 2021

A two-speed world for renewable electricity

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Electricity and renewable generation growth by country/region



Source: Total electricity generation from World Energy Outlook 2016, forthcoming.

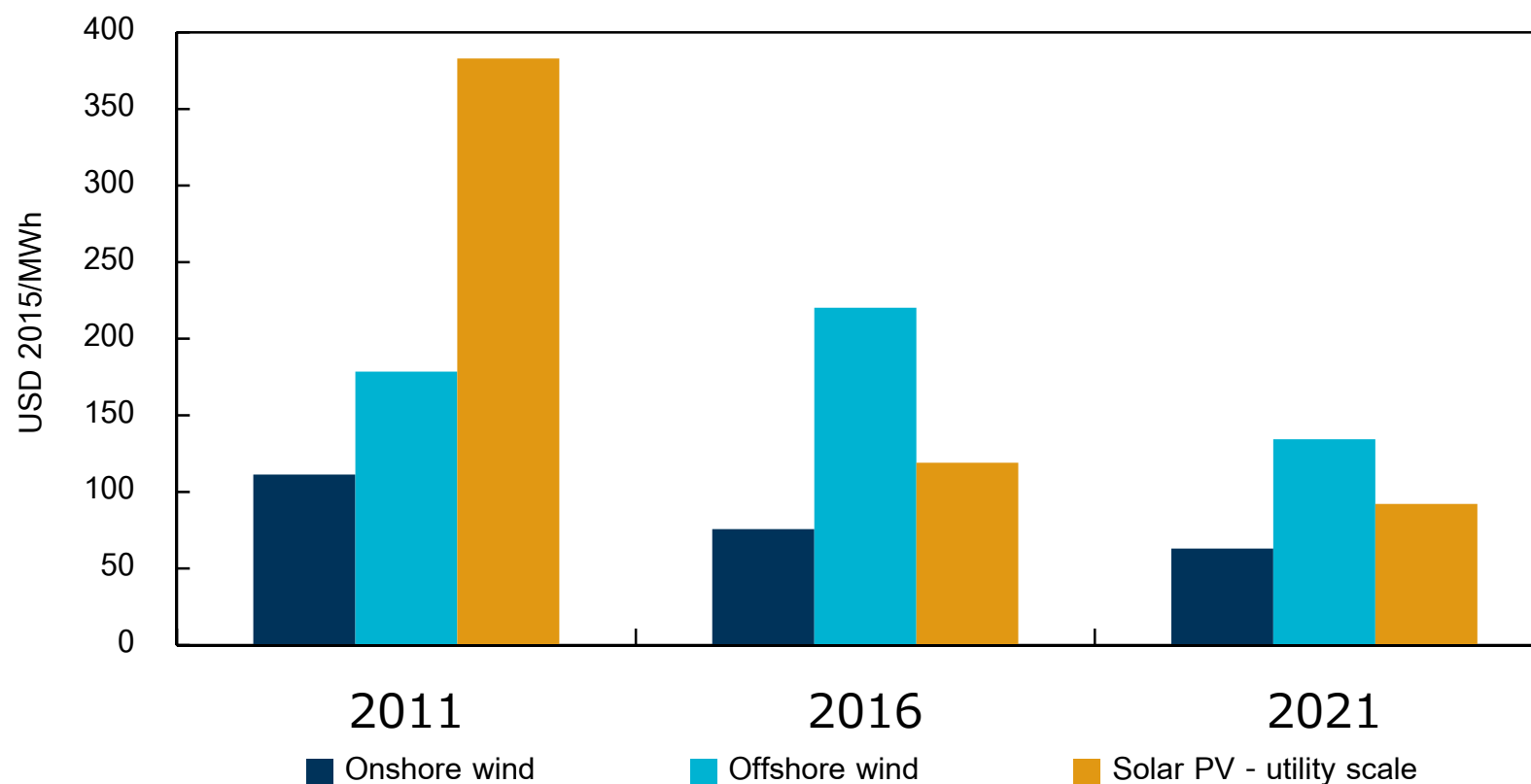
The increase in generation from renewables in 2015-2021 represents 60% of the global increase in electricity output, but prospects vary across regionally

Renewable costs reductions to remain an important driver for future growth

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Weighted average generation costs for solar PV and wind



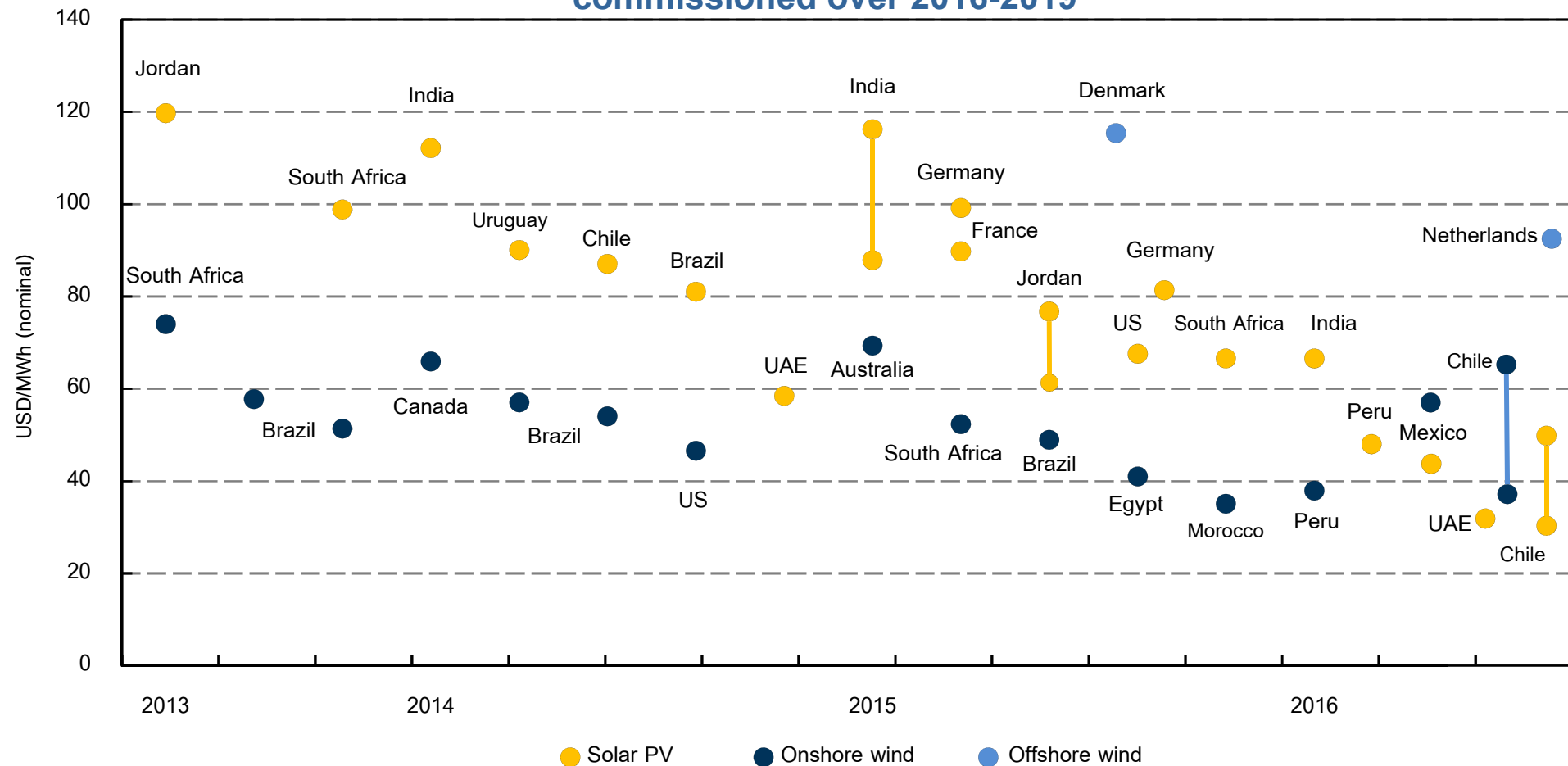
Utility-scale solar PV generation costs to fall by another quarter and onshore wind by 15% over 2015-21, largest absolute cost reduction expected from offshore wind

Policy transition from government-set tariffs to policy-driven auctions/tenders

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Recent announced long-term contract prices for new renewable power to be commissioned over 2016-2019



Best results occur where price competition, long-term contracts and good resource availability are combined

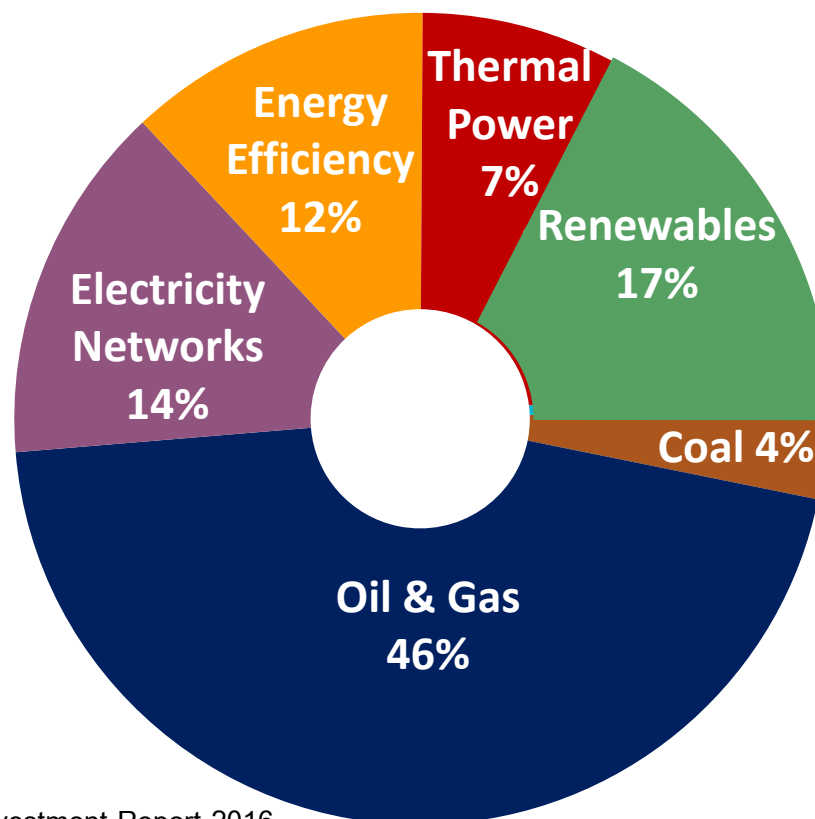
Investment flows signal a reorientation of the global energy system

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Global Energy Investment, 2015

USD 1.8 trillion



Source: IEA World Energy Investment Report 2016

An 8% reduction in 2015 global energy investment results from a \$200 billion decline in fossil fuels, while the share of renewables, networks and efficiency expands

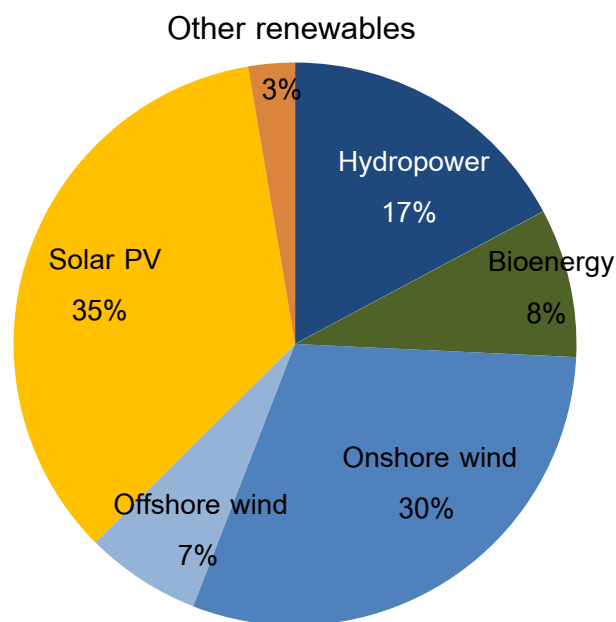
Solar PV and wind to represent almost $\frac{3}{4}$ of all renewable investment

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Cumulative renewable electricity investment over 2016-21

USD 1450 billion



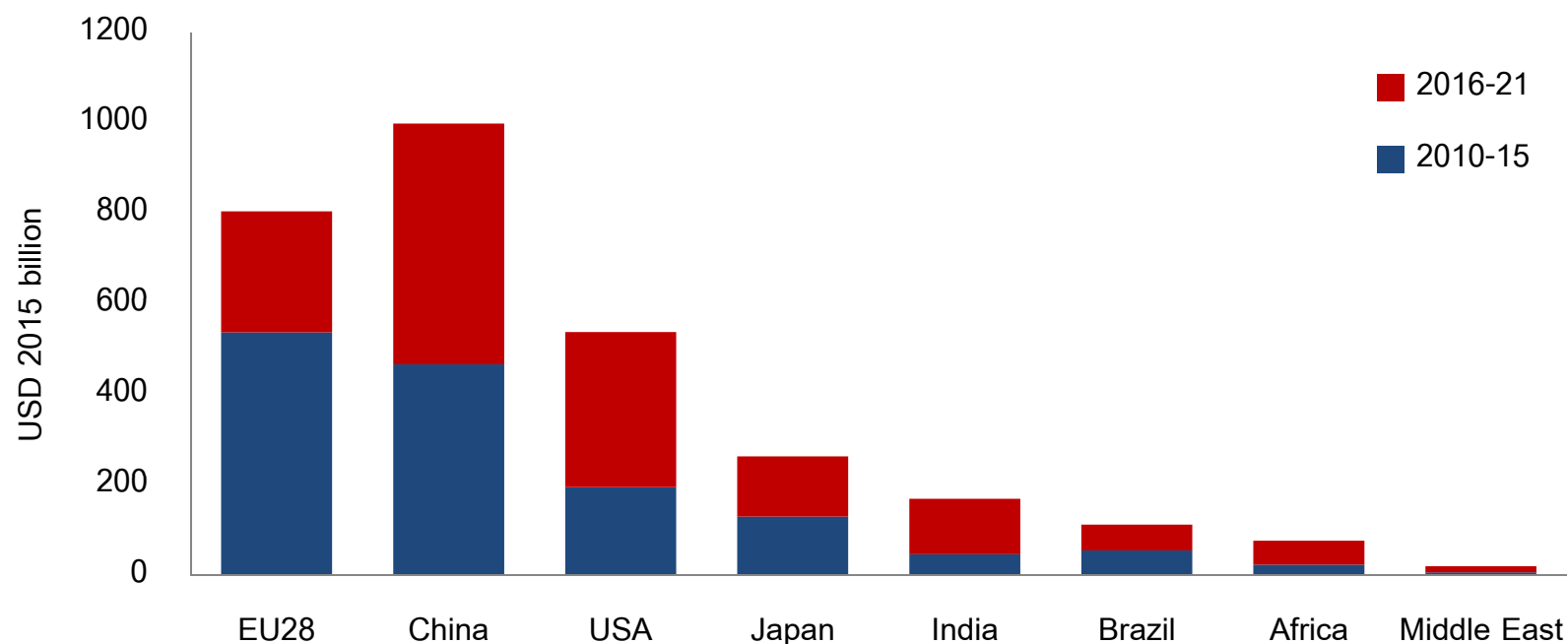
Annual investment in renewable electricity to be around USD 240 billion on average over 2016-21, lower than USD 290 billion in 2015

Investment to shift from Europe to emerging countries and North America

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Cumulative renewable electricity investment (2010-21)



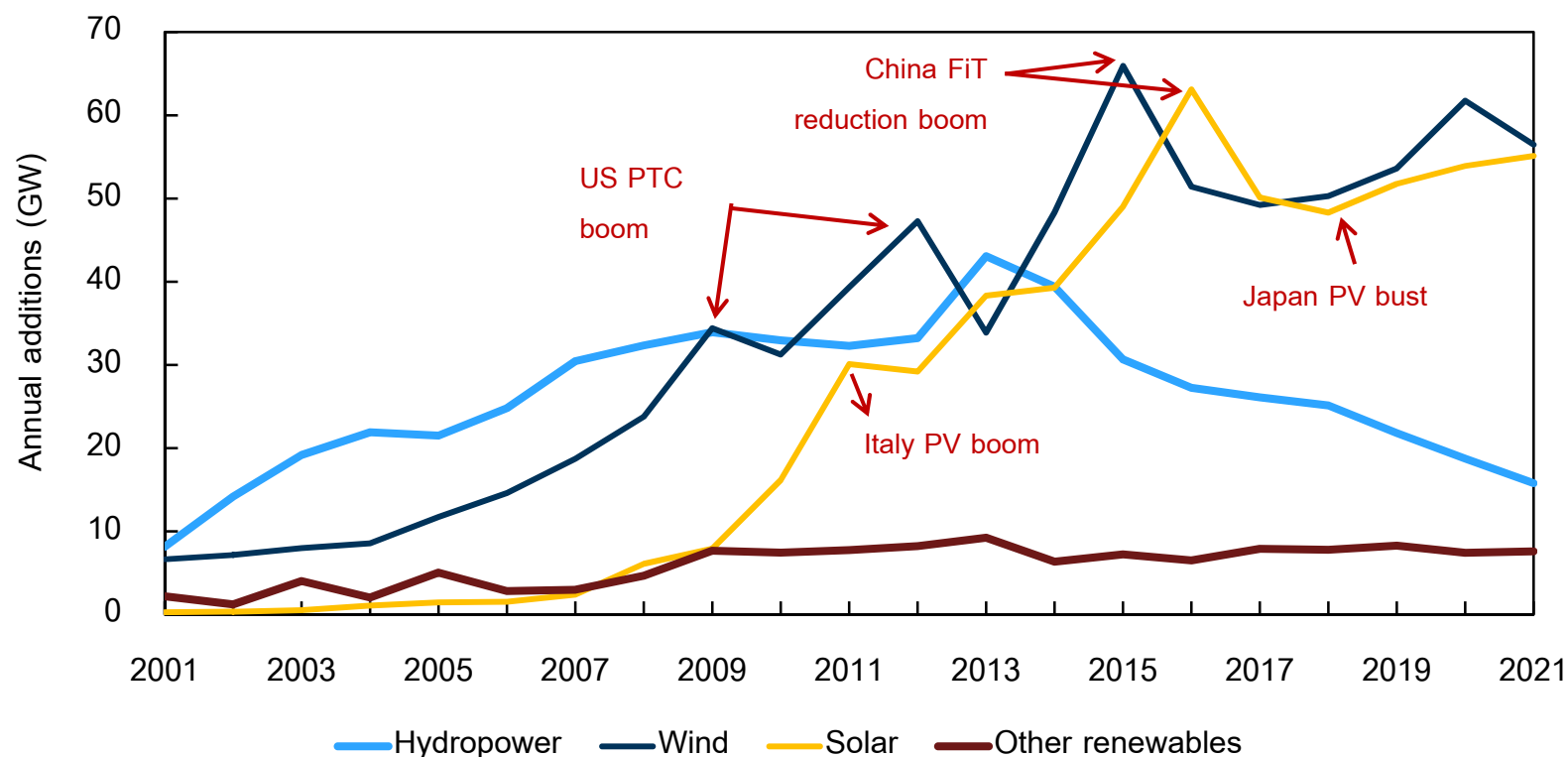
Investment in renewables in the EU to decline by half over 2016-21 compared to previous five years while it increases everywhere despite cost reductions

Wind and solar PV compensate for slower hydropower growth

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Renewable electricity capacity additions by technology (2001-21)



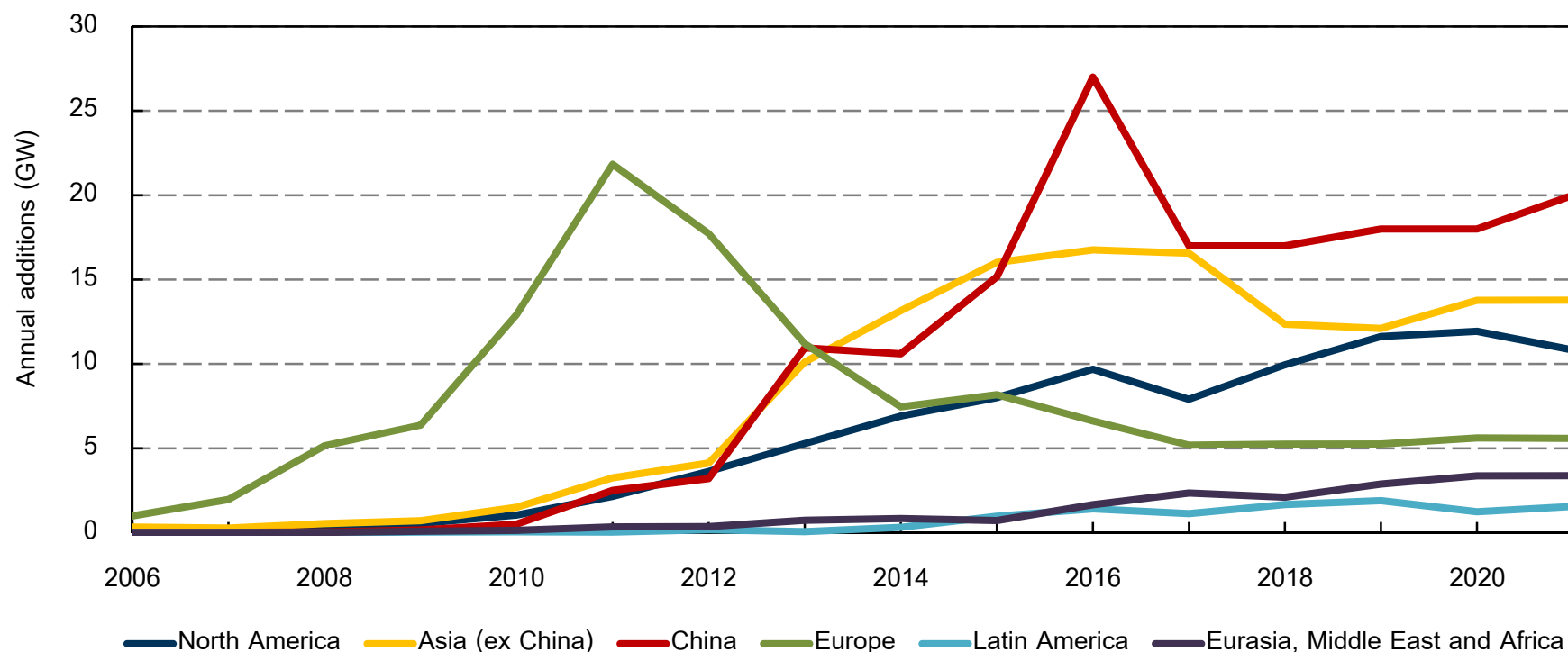
Predicting policy-driven boom and bust cycles remains a challenge, which is expected to continue over the medium-term.

Solar PV deployment accelerating in Asia

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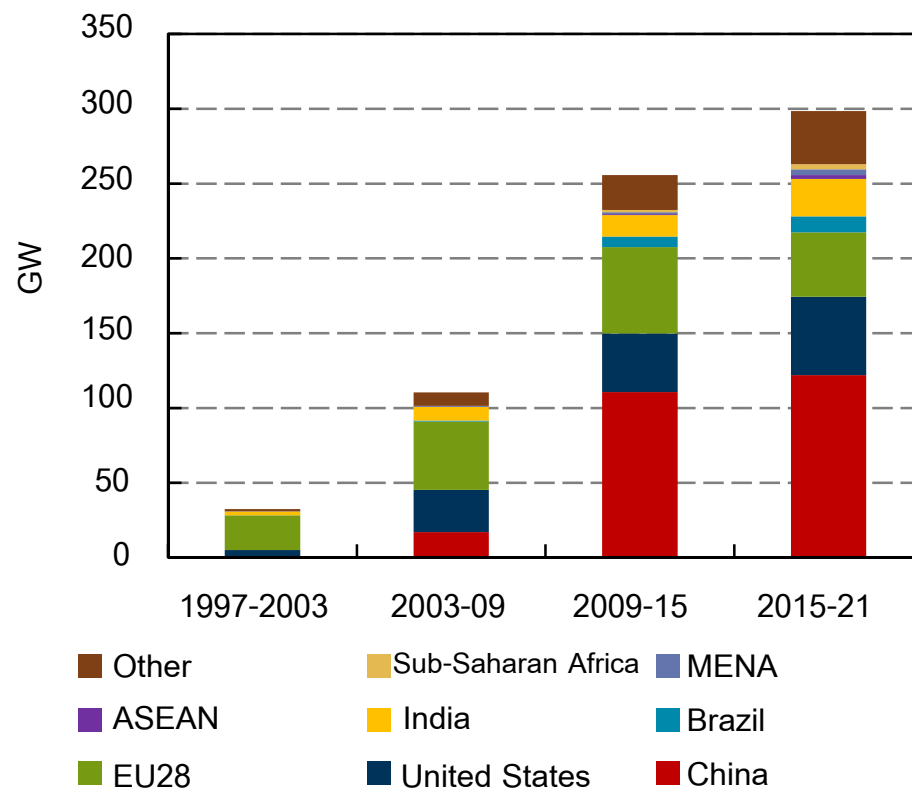
Solar PV net annual additions by region (GW)



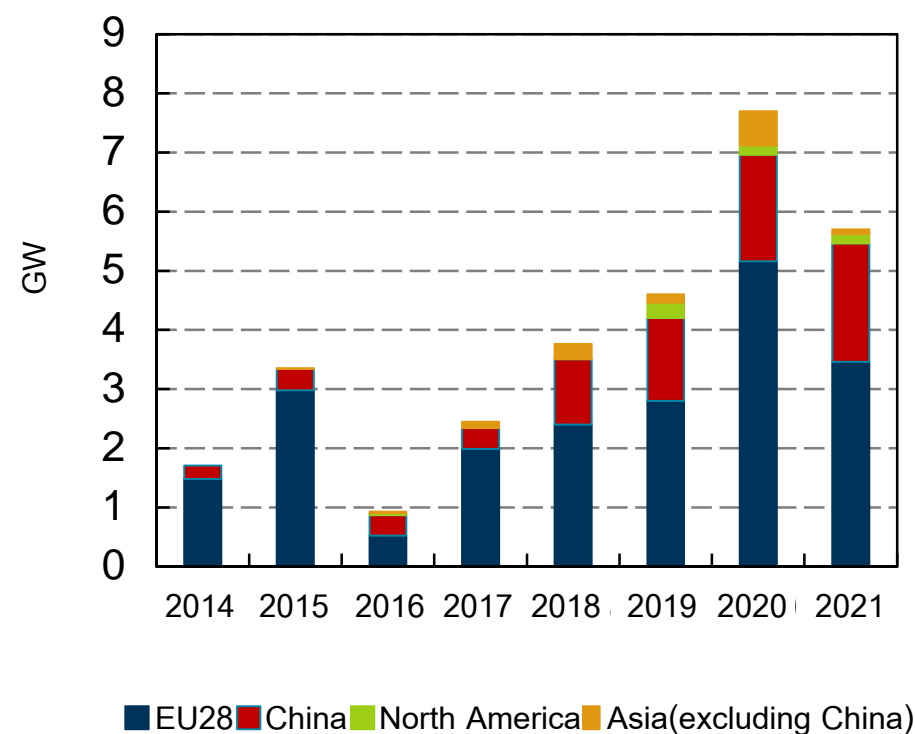
Pending EU legislations concerning 2030 renewable targets, incentive reductions, policy uncertainties at country level and overcapacity remain challenges

EU onshore wind growth to slow down but it remains largest offshore market

Capacity growth onshore wind



Annual additions offshore wind



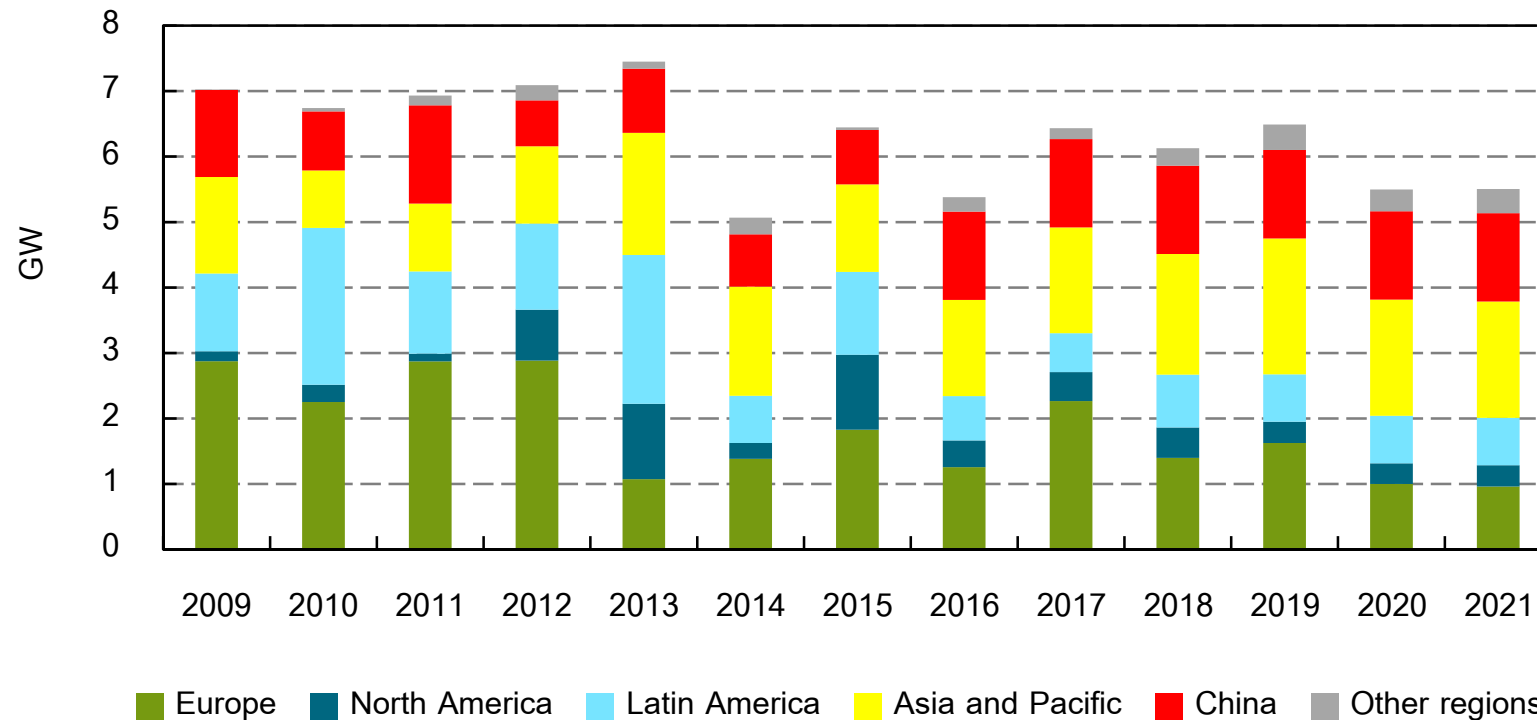
US tops the EU to become second largest onshore wind market behind China while offshore wind annual market will be more regionally diversified

Global bioenergy capacity additions to remain stable

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Bioenergy power annual additions (2009-21)



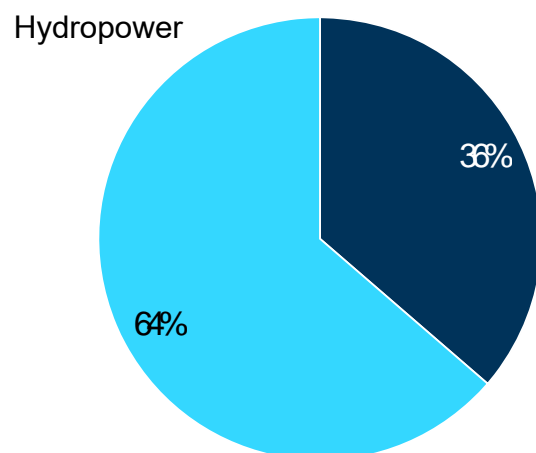
An acceleration of bioenergy deployment over the medium term is not anticipated. While Europe has led deployment historically, Asia is forecast to drive growth moving forward.

China is the undisputed leader of renewable capacity growth

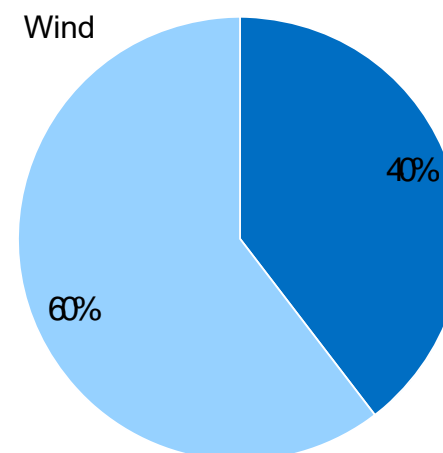
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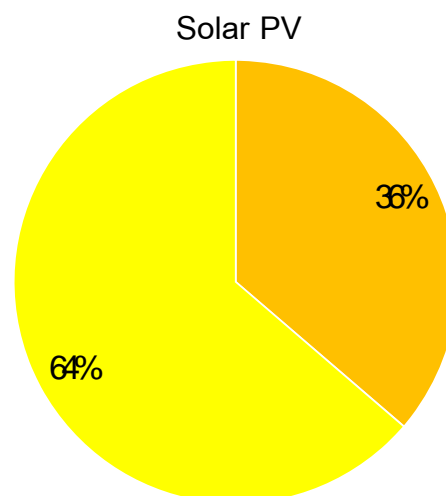
Share of China in global renewable capacity growth(2015-21)



■ China
■ Rest of the world



■ China
■ Rest of the world



■ China
■ Rest of the world

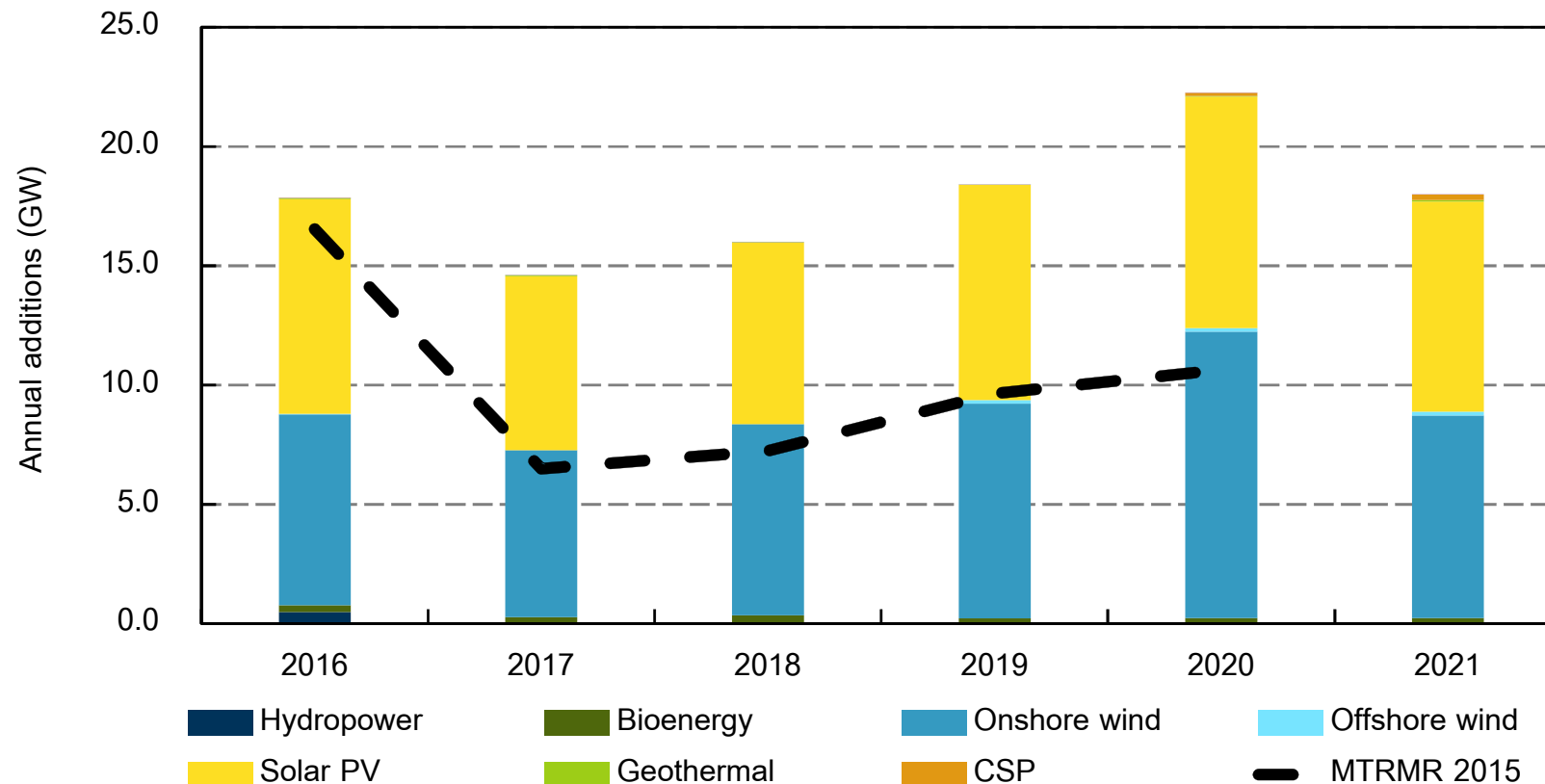
Despite strong growth, grid integration remains an important challenge along with overcapacity in the power sector

US multi-year tax credit extension to drive 60% more growth

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United States annual renewable capacity additions



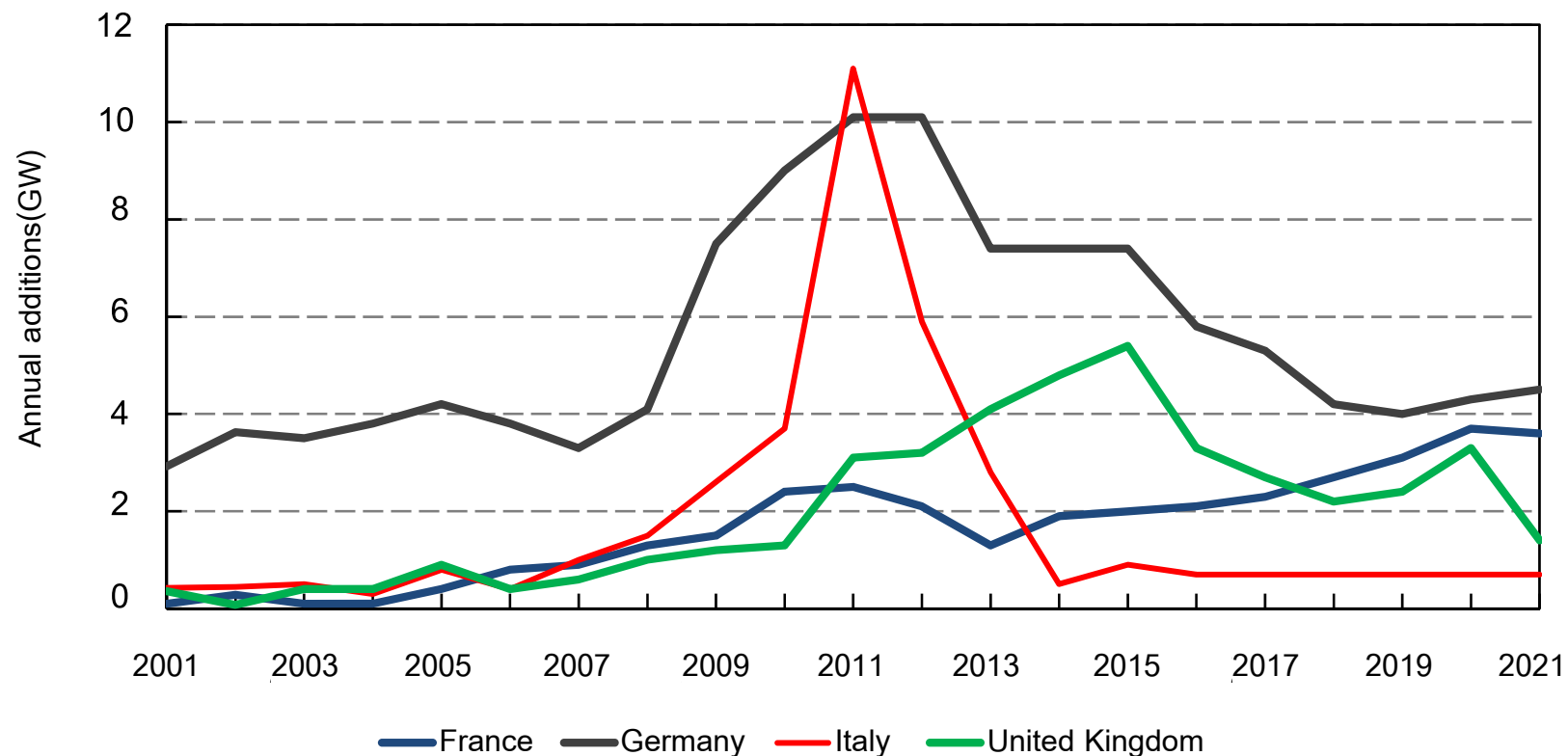
**ITC and PTC extension to give more policy visibility to wind and solar developers
but uncertainty remains for other renewables**

Slower growth in Europe as policy transition continues

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Annual renewable additions for France, Germany, Italy and UK



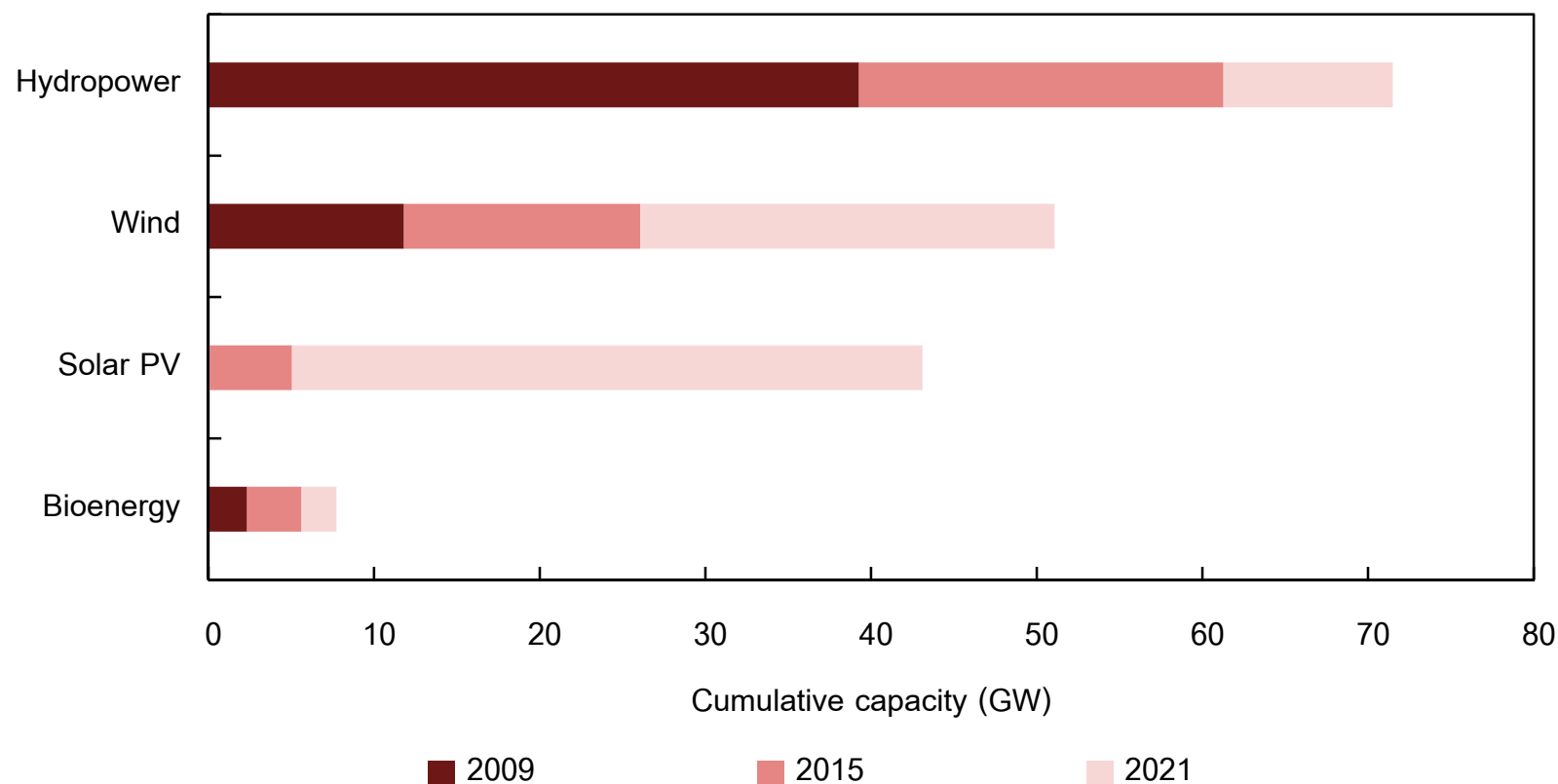
Pending EU legislations concerning 2030 renewable targets, incentive reductions, policy uncertainties at country level and overcapacity remain challenges

Solar PV to drive India's forecast but meeting the target remains a challenge

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India renewable capacity by technology



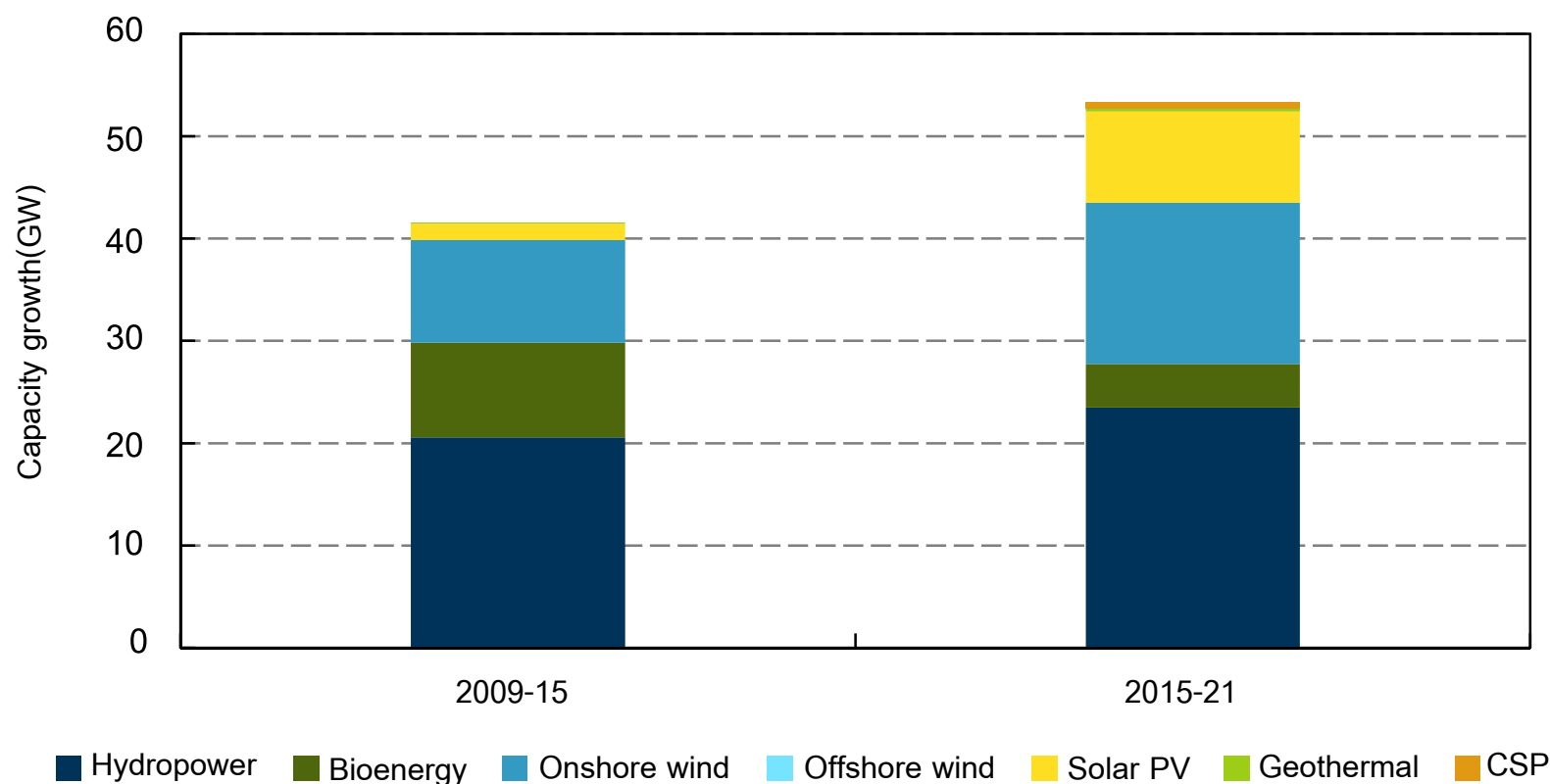
Financial health of utilities, better state-level implementation of RPOs, faster grid infrastructure expansion and reducing land acquisition barriers remain challenges

Latin America to take advantage of more affordable solar PV and onshore wind

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Latin America renewable capacity growth (GW)

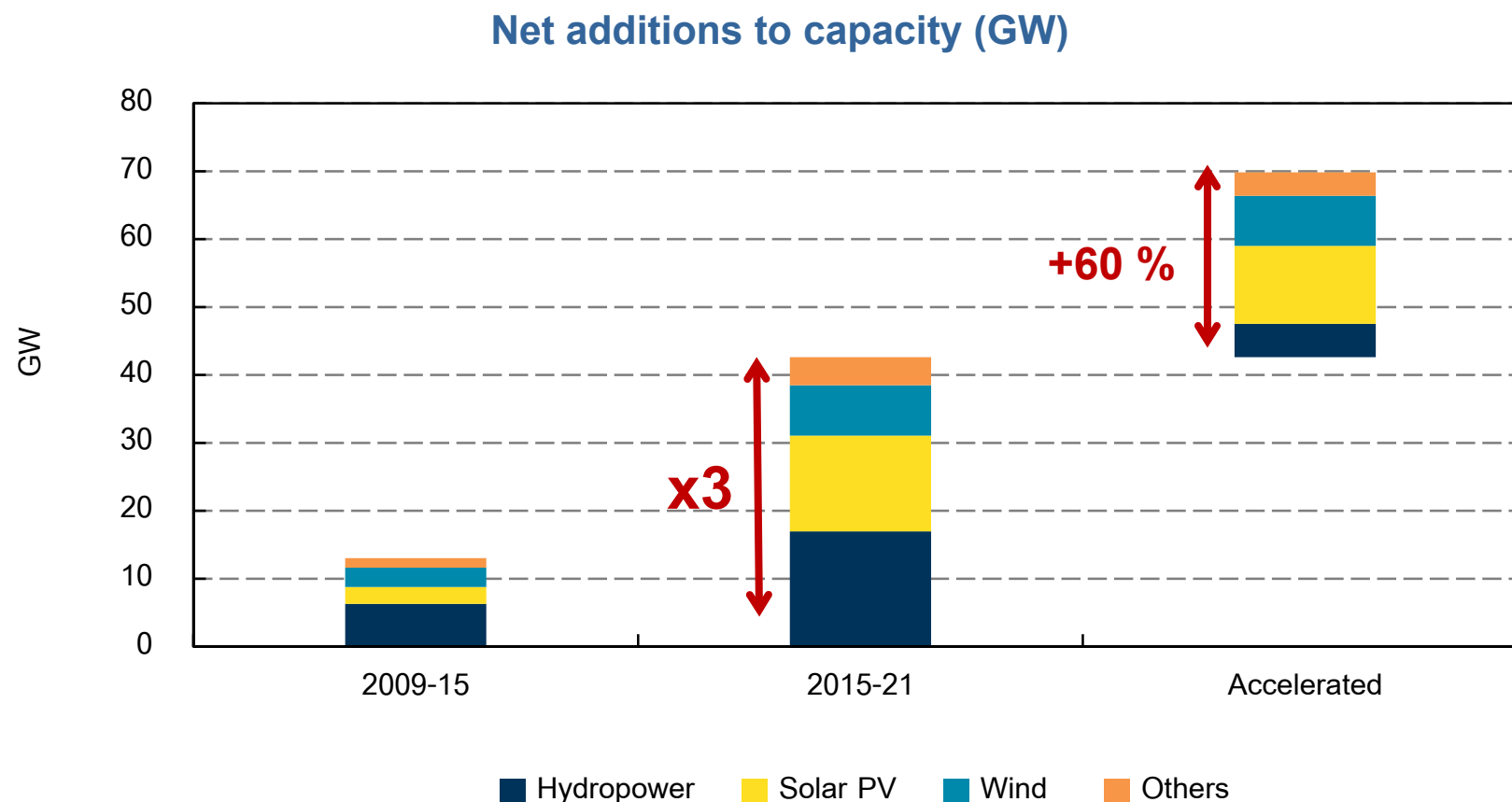


Diversification needs, energy security concerns and decreasing prices, drive solar and wind expansion in Latin America while large-scale hydropower growth will continue.

Demand and diversification drive growth in Middle East & Africa

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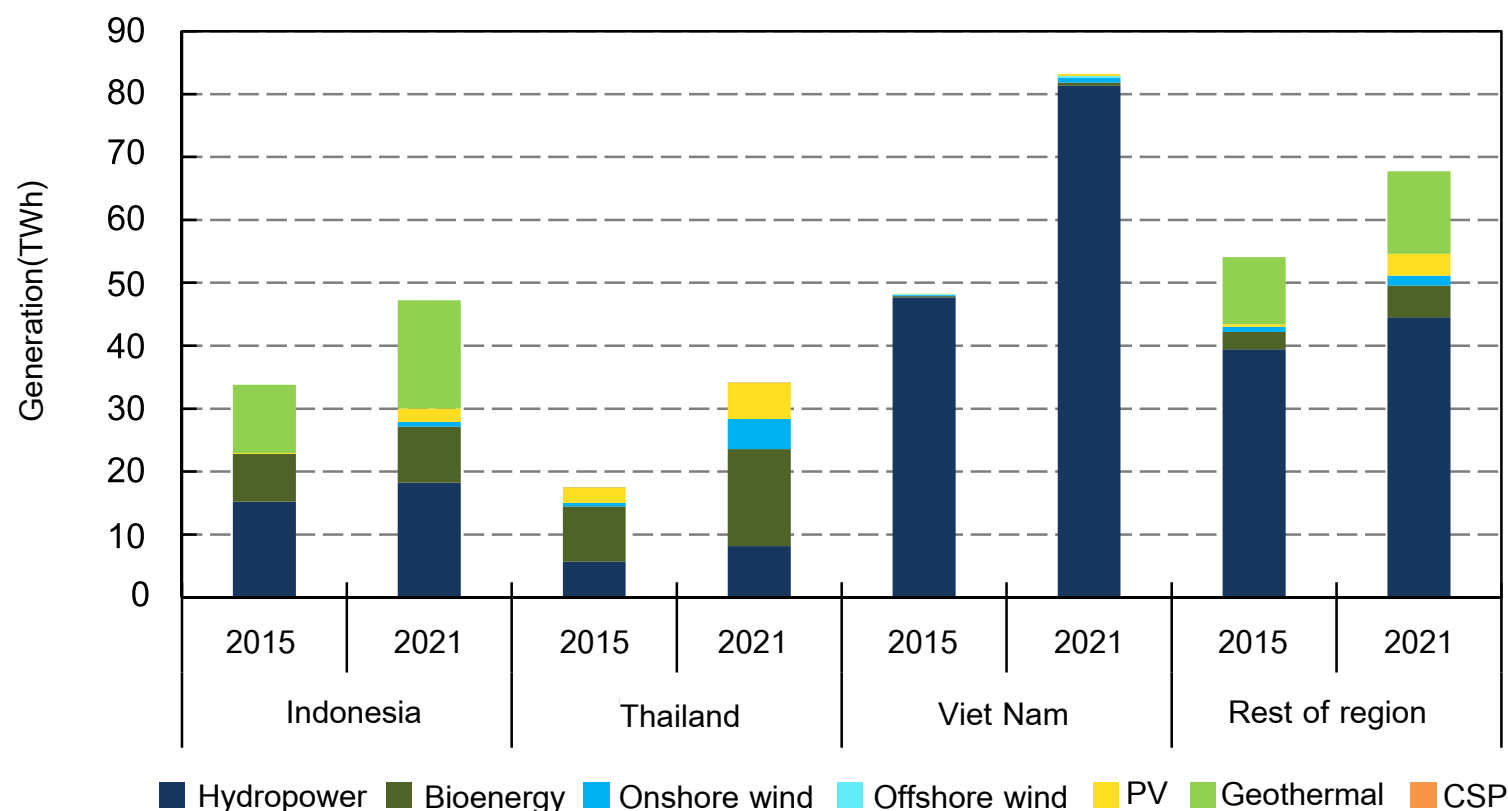
Non-hydro pace dictated by auction schedules and grid integration; faster growth possible with quicker implementation and more access to low-cost financing

ASEAN to increase diversification in the energy mix

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ASEAN renewable generation growth and share of renewables in total generation (2015-21)



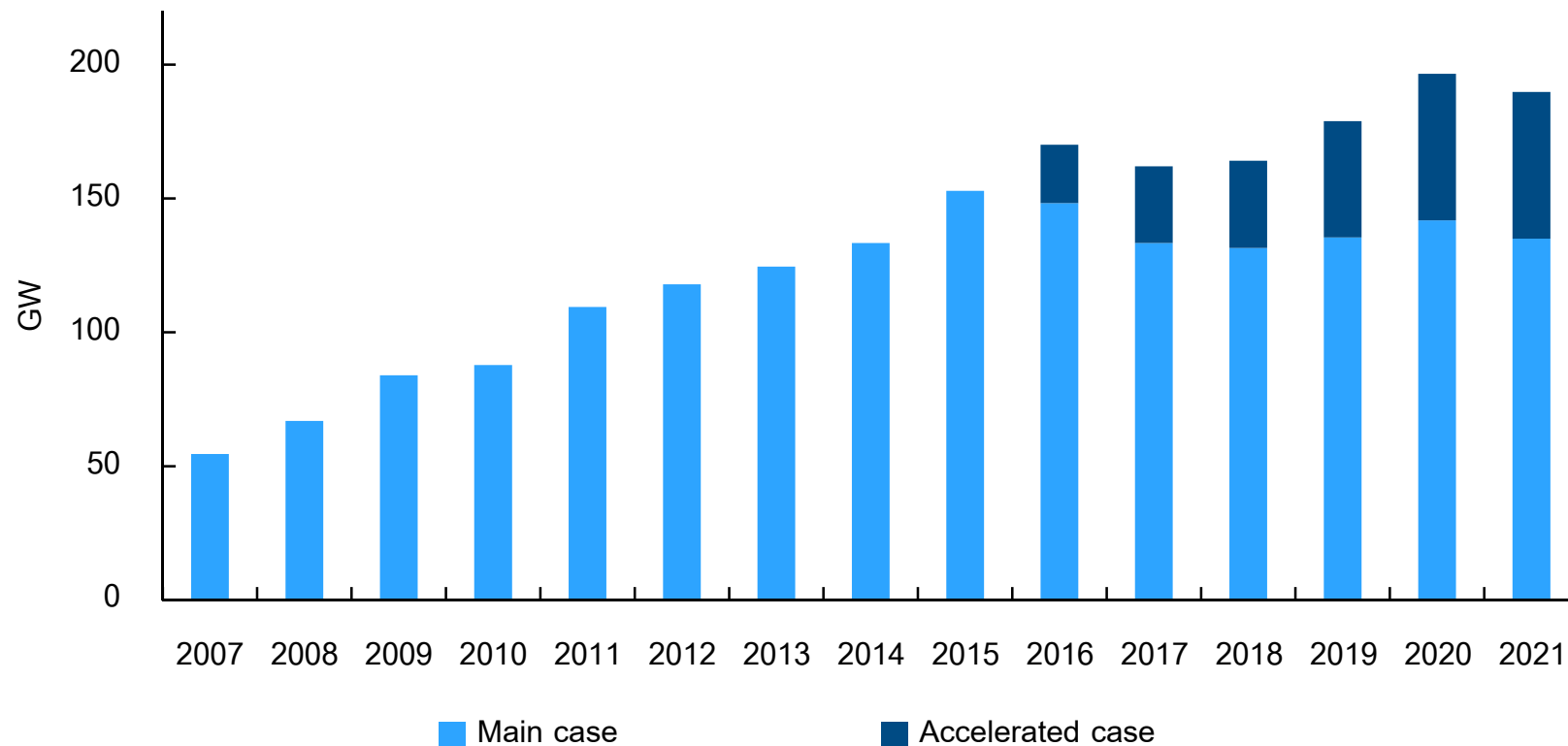
Hydropower generation growth will slow in most ASEAN countries (except Viet Nam) while energy diversification needs will help non-hydro renewables to pick up gradually

More ambitious policies could further enhance the outlook in line 2°C target

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Renewable electricity capacity additions in Accelerated Case vs. Main Case

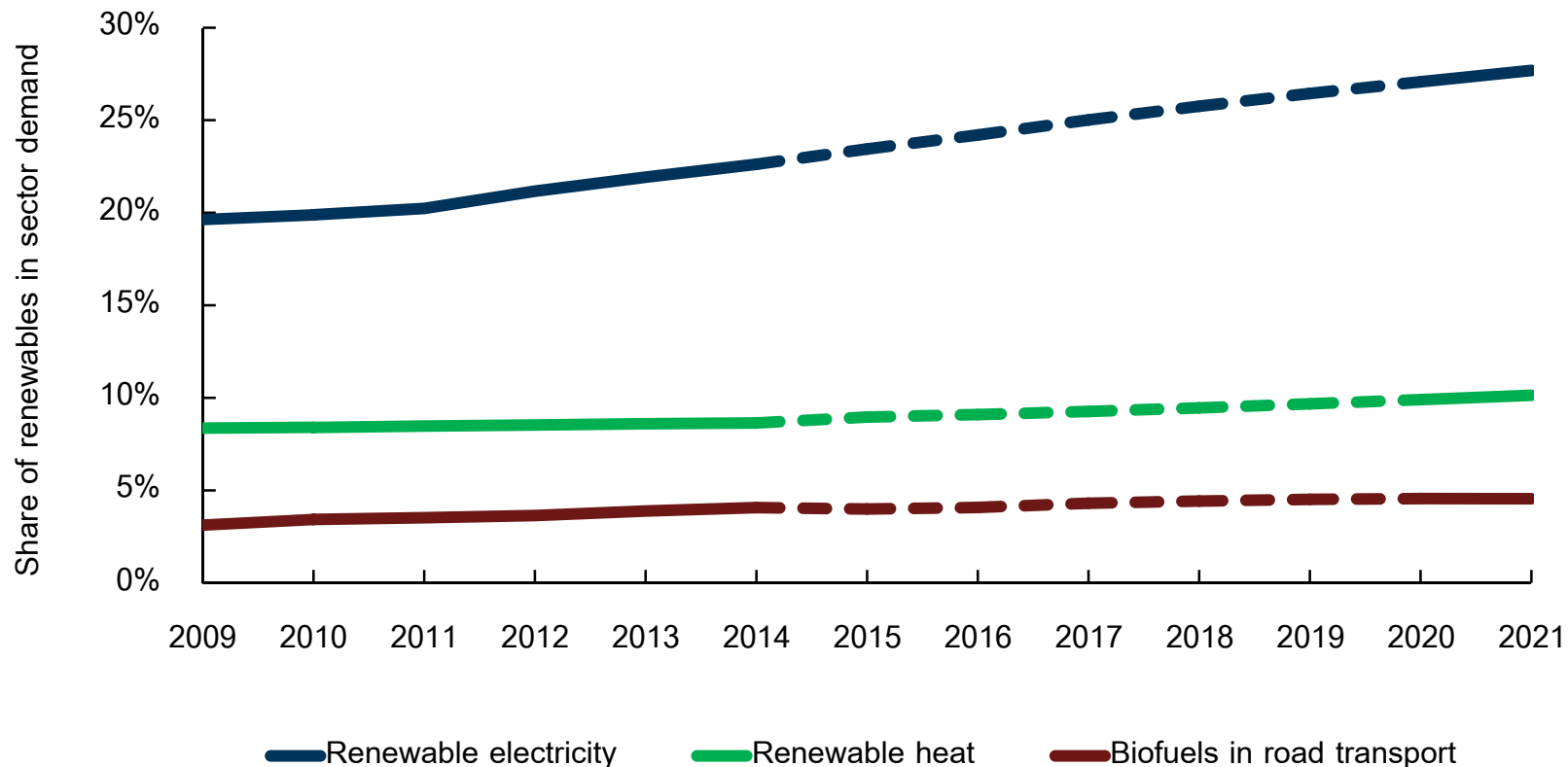


Renewables are in line with NDC pledges by 2030 but reducing policy uncertainty and overcoming financing & grid integration challenges remain key to achieve 2°C target

Renewables to dominate electricity growth, but less progress in heat and transport

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Share of renewables in electricity, heat and transport sectors



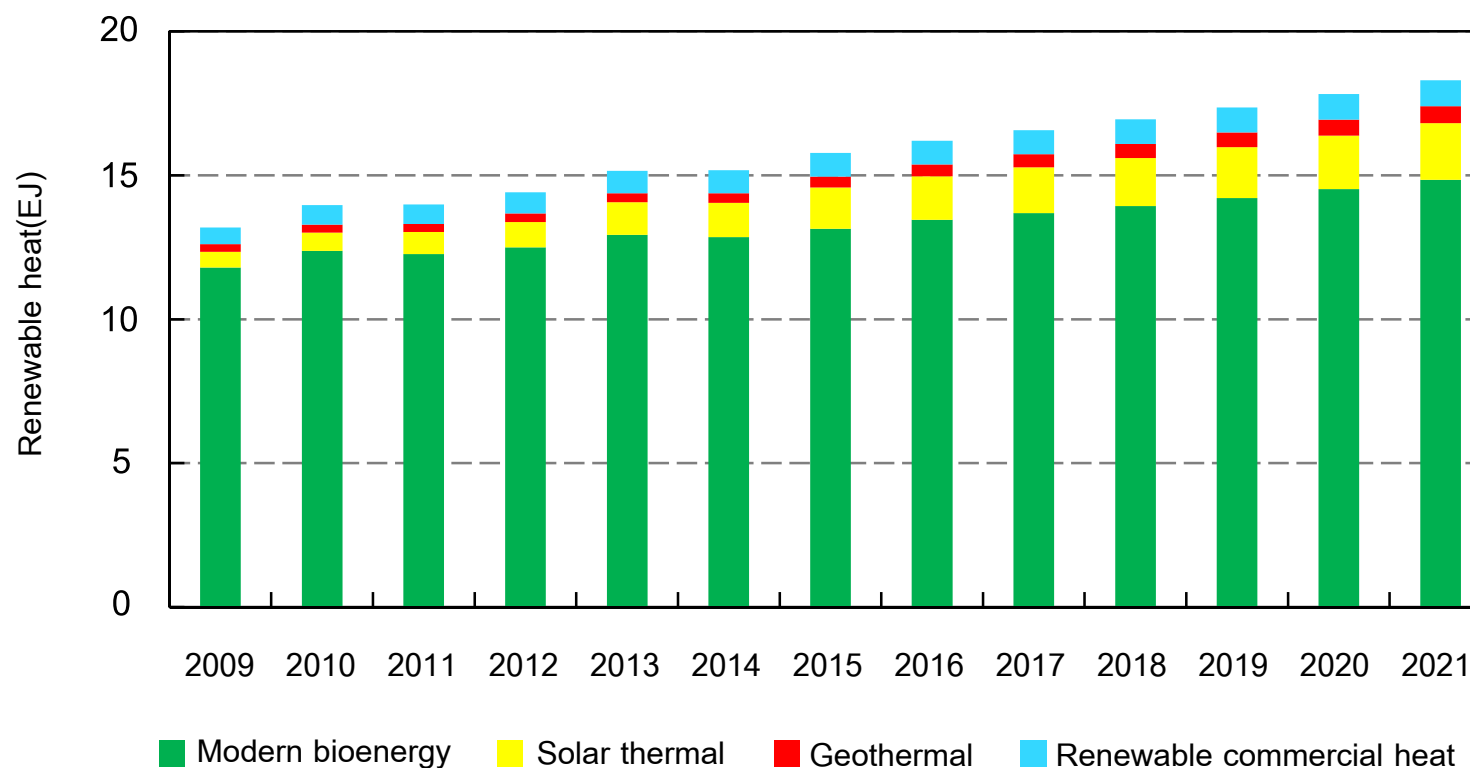
The share of renewables rises in all sectors, despite persistent challenges in heat & transport; interactions between energy efficiency & renewables become critical

Use of renewables for heating is increasing but slower than for electricity

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Final renewable heat consumption (2009-21)



Heat accounts for 54% of final energy consumption and 38% of CO2 emissions
Bioenergy continue to dominate heat production over the medium term

Accelerated renewable heat needs targeted policies to overcome barriers

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Summary of economic and non-economic barriers for renewable heat

Economic Barriers	Non-economic Barriers
Higher capital costs than fossil fuel alternatives.	Renewable heat options may not be suitable in certain buildings
Split incentives in the rented building sector	Specific requirements of industrial heat loads
No level playing field with fossil heating fuels	Distressed purchase and consumer inertia
Current low and cyclical fossil fuel prices	Disruption and “hassle” factors for retro-fit solutions
Lack of economies of scale resulting in higher system costs	Need for trained workforce to undertake specification, installation and O&M.

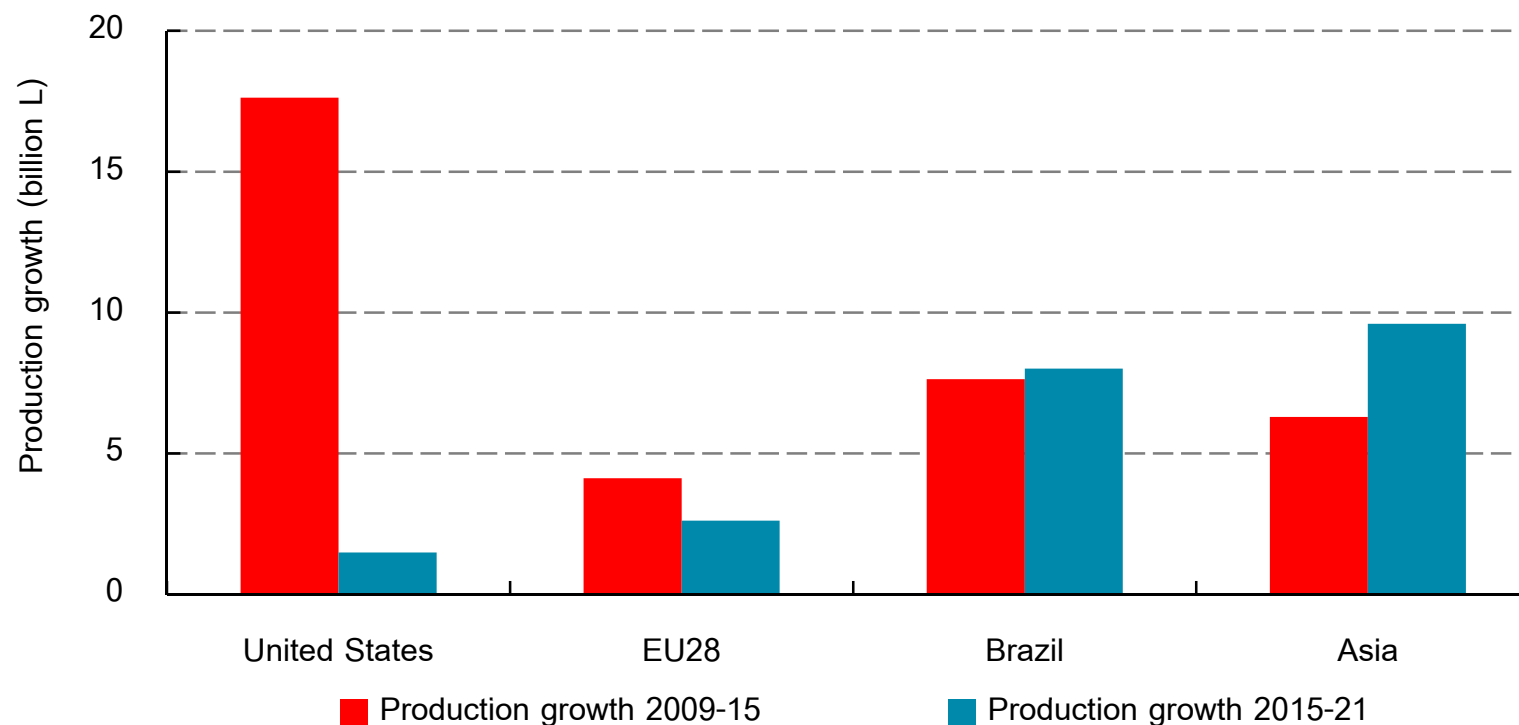
Renewable heat faces economic and non-economic barriers requiring policy solutions; carbon taxation, fiscal incentives & including renewables in building standards have proved effective.

Biofuel production shifts to Asia, as EU and US slows

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Biofuels production growth (billion litres)

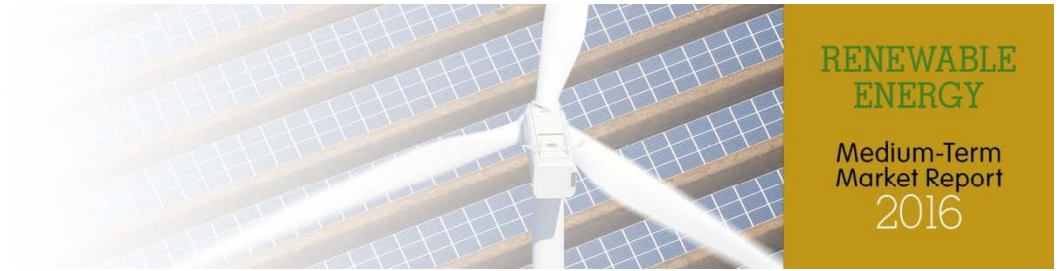


Structural challenges in the US & policy uncertainty post-2020 in the EU slow growth; Thailand, India & Indonesia have strengthened policies despite low oil prices

Conclusions



- **Prospects for renewables electricity revised upwards, driven by policy improvements, cost reductions & efforts to improve air quality**
- **The impact of lower fossil fuel prices on renewables varies by sector. Wind (onshore) & solar PV are the only technologies on track for a 2°C scenario**
- **Competition in Asia between renewables & coal/gas will be critical to meeting global decarbonisation targets**
- **Attracting investment in renewables hinges on appropriate market rules & regulations, particularly in markets with slow electricity demand growth**
- **IEA is working to accelerate energy transition with its analysis on policy & technology and system integration of renewables.**



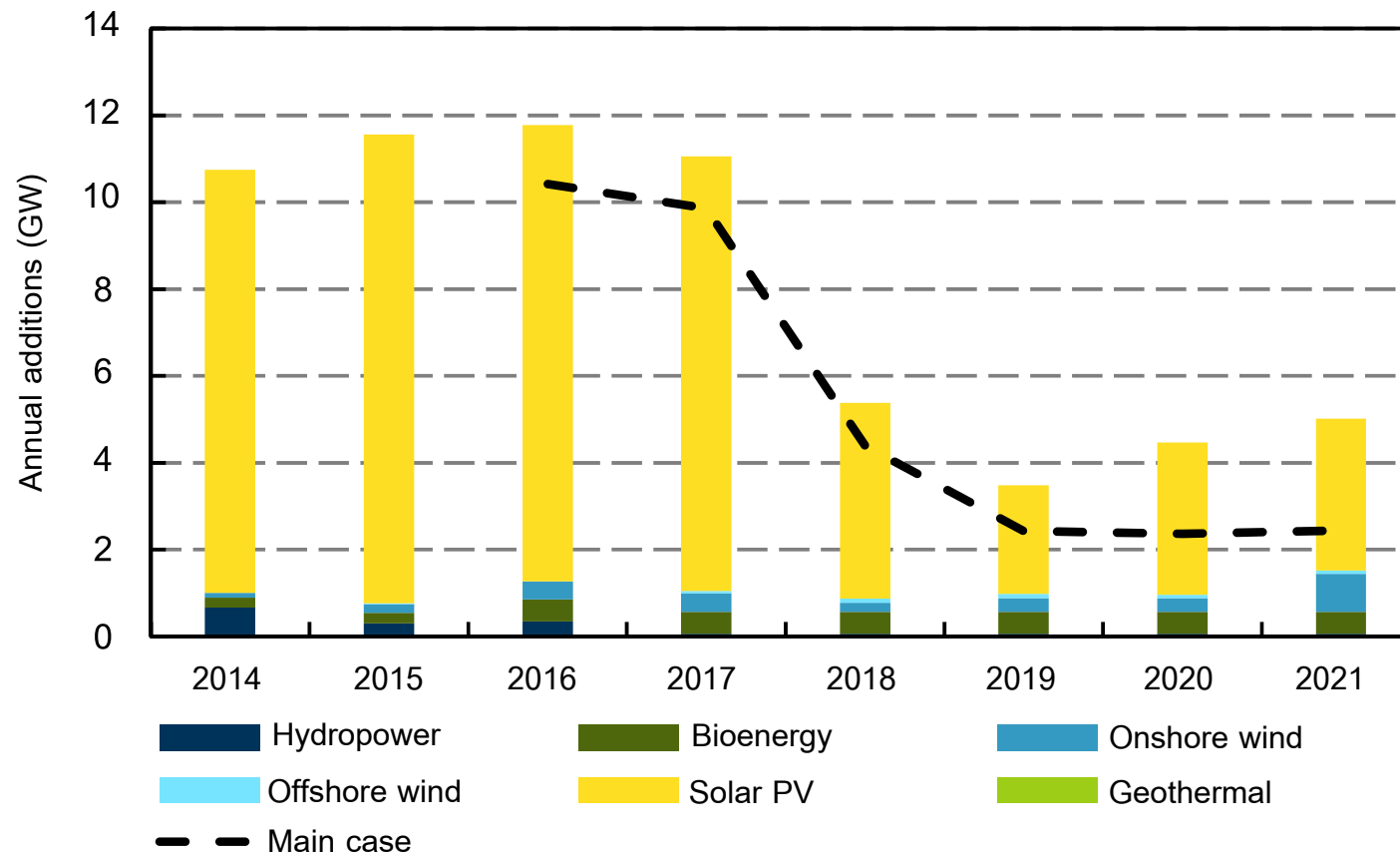
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Focus on Japan

Solar PV still dominates RE market, while cancellation slow the growth

Japan annual net additions to renewable capacity (2014-21):
Accelerated case versus Main case



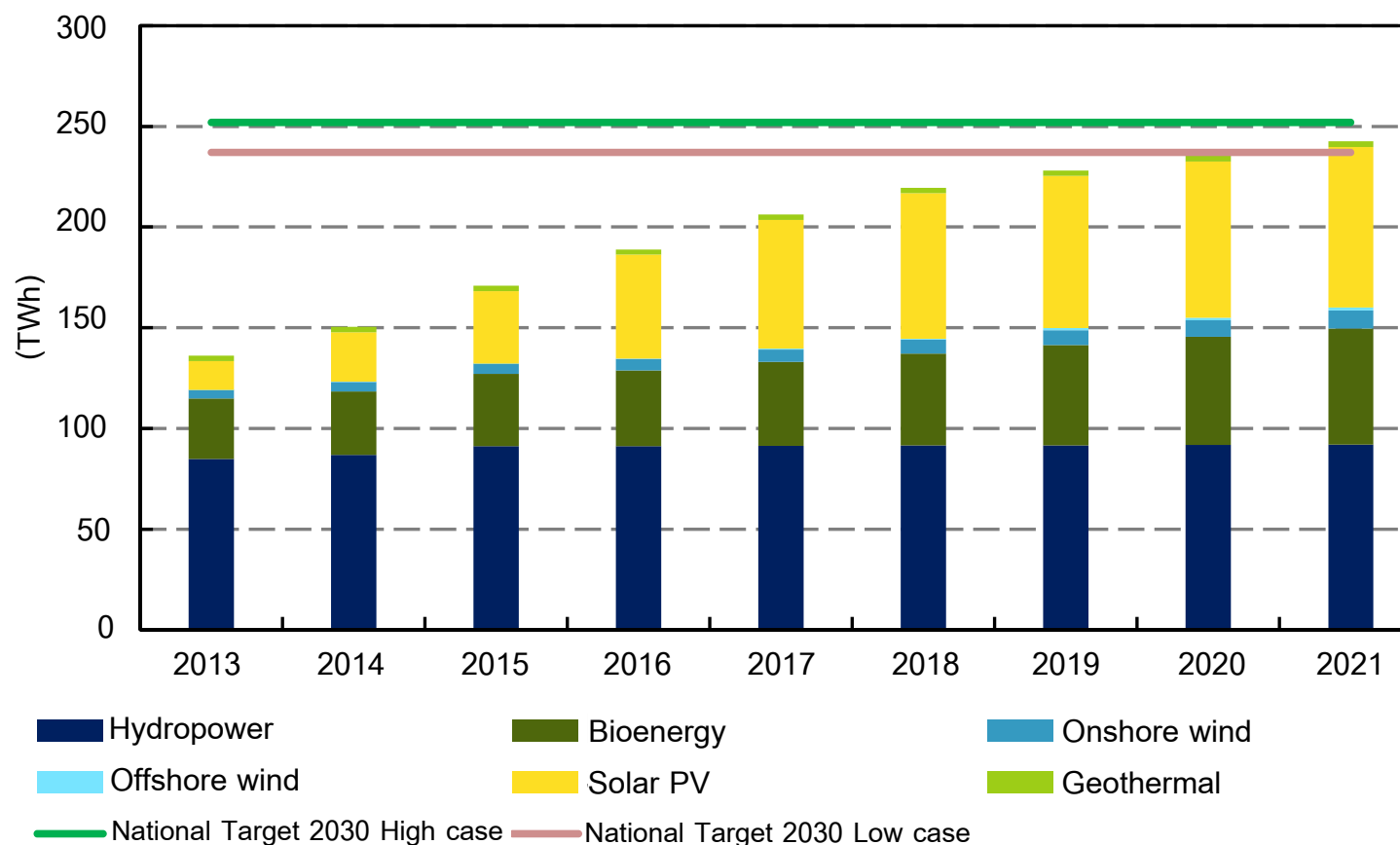
Japan's auction scheme in 2017 will bring cost reduction of solar PV, which could create new PV opportunities without supports after 2020

Solar PV and Bioenergy contribute to Japan's national target 2030

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Japan annual electricity generations from renewables (2013-21)



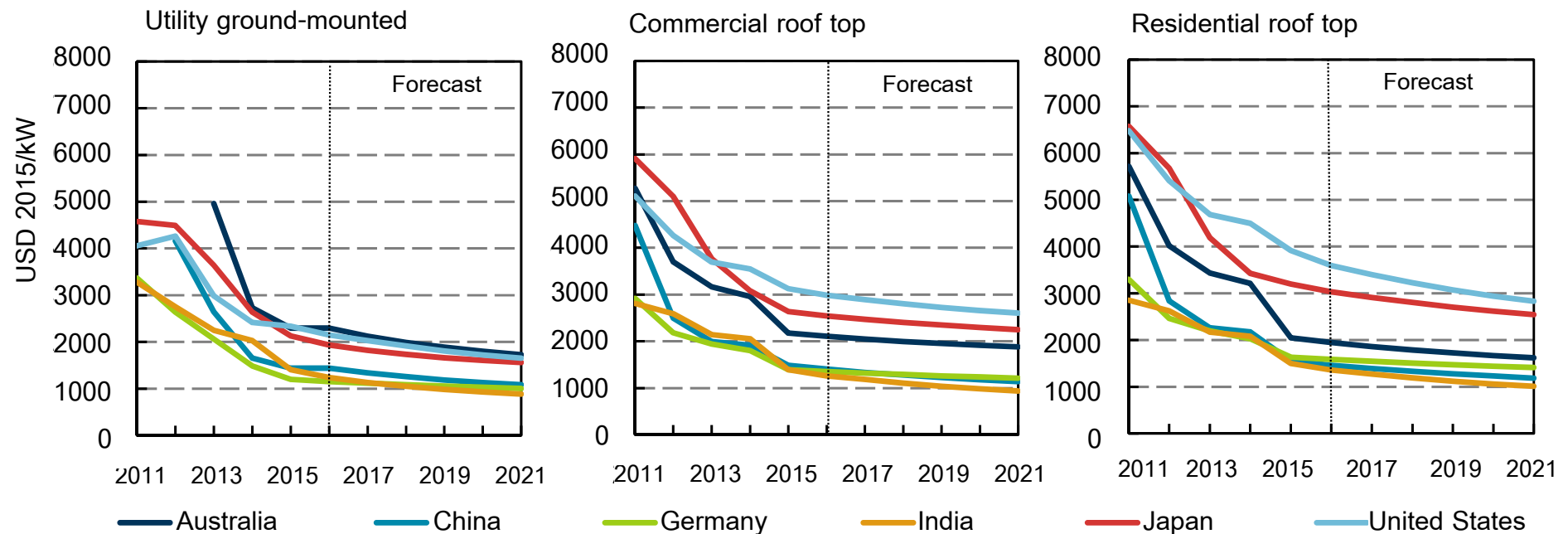
Renewables spurred by FIT would achieve its national target (22-24 % of total electricity generation in 2030), with 10 years earlier than expectation

Price competitions lead PV system cost reduction

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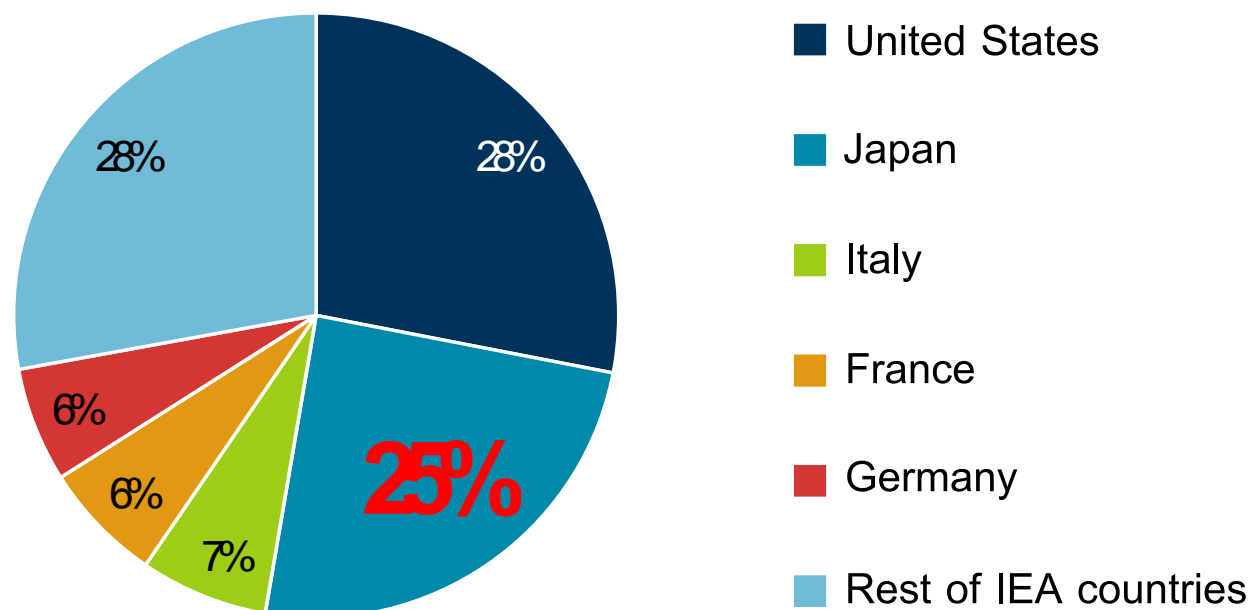
Historical and forecast typical solar PV investment costs, average for new capacity



Increasing competition, access to low-cost financing, and regulation to reduce permitting costs contribute to system cost reductions

Japan's promising flexible capacity

Pumping Hydro capacity by IEA member countries in 2014



There is no reason not to make the most of existing more than 27 GW of pumping and turbine capacity (hydropower), which increases flexibility in the networks

Priorities for Japan



- Reduce renewable energy costs also through **competitive procurement schemes**
- Facilitate the rapid uptake of a balanced portfolio of renewable energy through a **measures to expedite local consents for geothermal** that Japan has rich resources **and onshore wind**
- Ensure user-friendly energy data infrastructure by creating **one-stop website to publish generation and consumption data to the public**
- **Make the most of value of existing pumped hydropower** through inter-regional grids to bridge VRE rich areas and hydro rich areas
- Continue renewable R&DD projects to integrate over sectors, such as **Demand Response** to balance PV generation; **PV connecting EV and charger systems**; or **P2G (Hydrogen from VRE's electricity excess)**

Thank you. Any questions?

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Whole report with dataset of capacities and generations by countries can be purchased online at:

<http://www.iea.org/bookshop/734-Medium-Term Renewable Energy Market Report 2016>

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<http://www.iea.org/publications/freepublications/publication/medium-term-renewable-energy-market-report-2016---market-analysis-and-forecasts-to-2020---japanese-version.html>

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