

RENEWABLE ENERGY

Medium-Term Market Report 2015

Medium-Term Renewable Energy Market Report 2015: Renewables poised to lead world power market growth

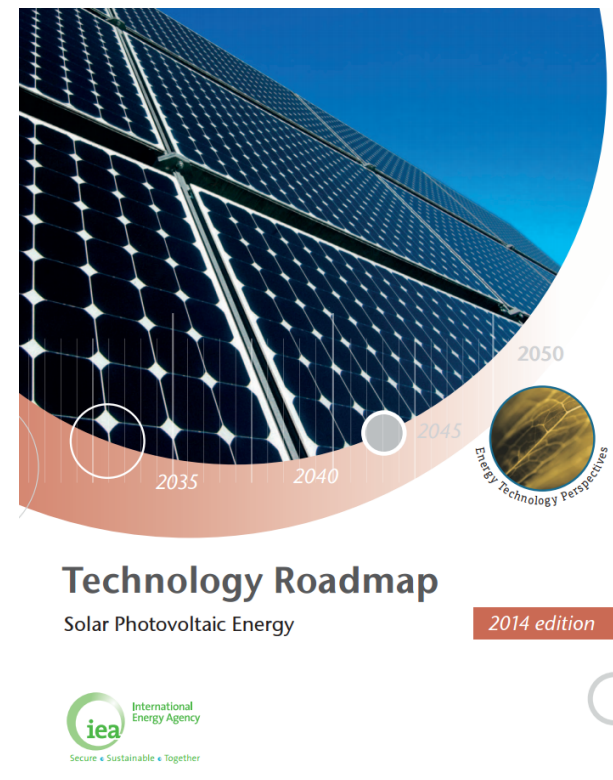
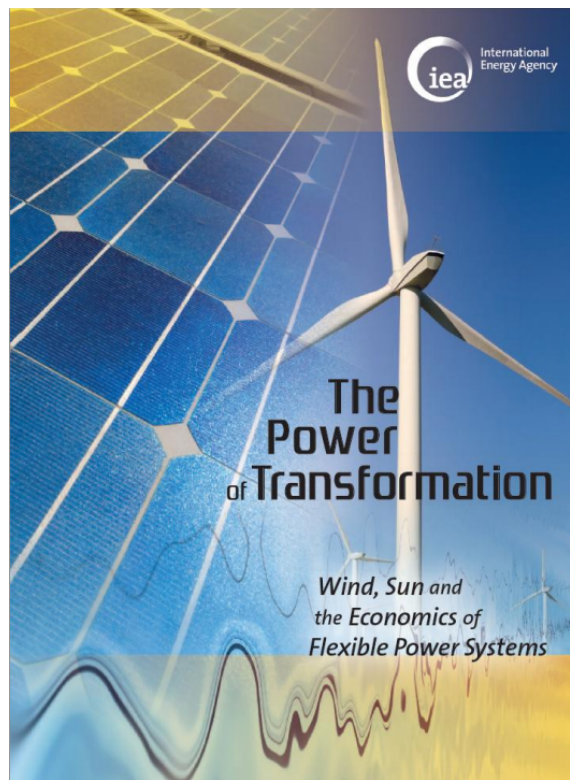
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Market Analysis and Forecasts to 2020

IEA work on renewables

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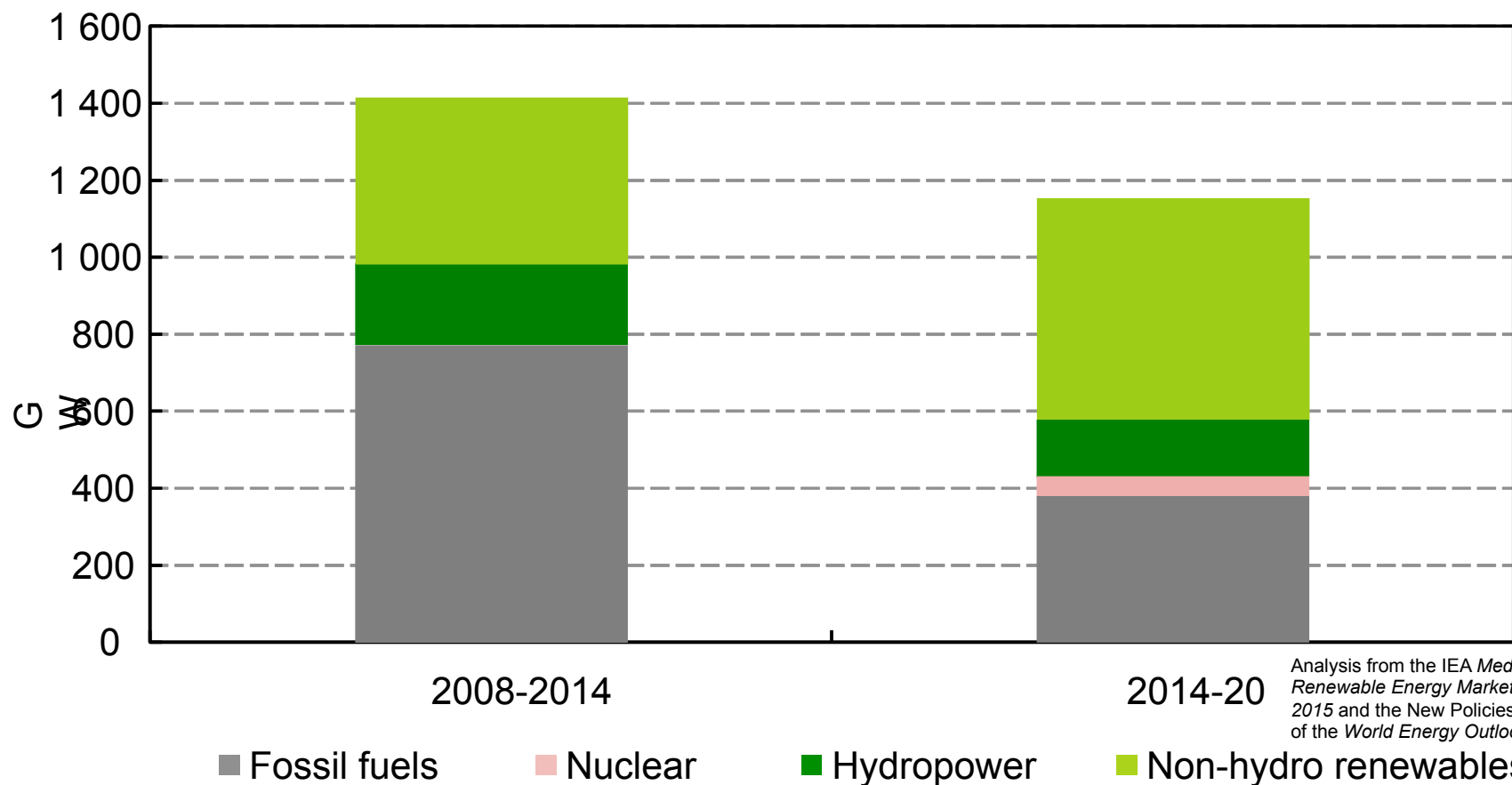
- Renewables analysis a crucial part of IEA long-term scenario analysis: e.g. *World Energy Outlook*, *Energy Technology Perspectives*, *Tracking Clean Energy Progress*
- IEA renewables website: <http://www.iea.org/topics/renewables/>
- Renewable Policies and Measures Database: <http://www.iea.org/topics/renewables/renewablesiea/policiesmeasuresdatabasepams/>

Profound changes underway in energy markets

- Signs of decoupling of energy-related CO₂ emissions and global economic growth
- Fossil-fuel prices at multi-year lows; emerging market economic growth slowing; uncertainty over monetary policy and interest rates in US
- But overarching 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

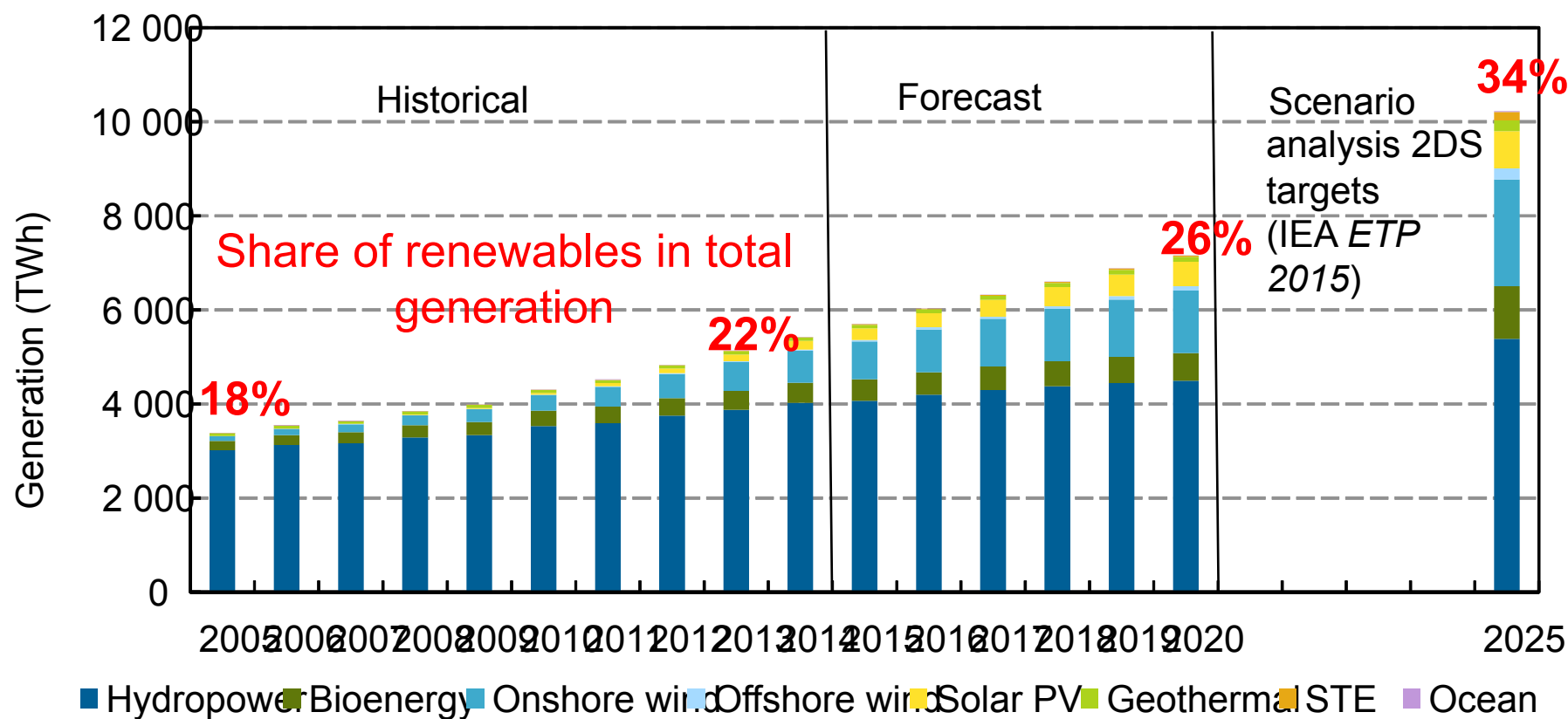
World net additions to power capacity



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

Strong momentum for renewable generation growth

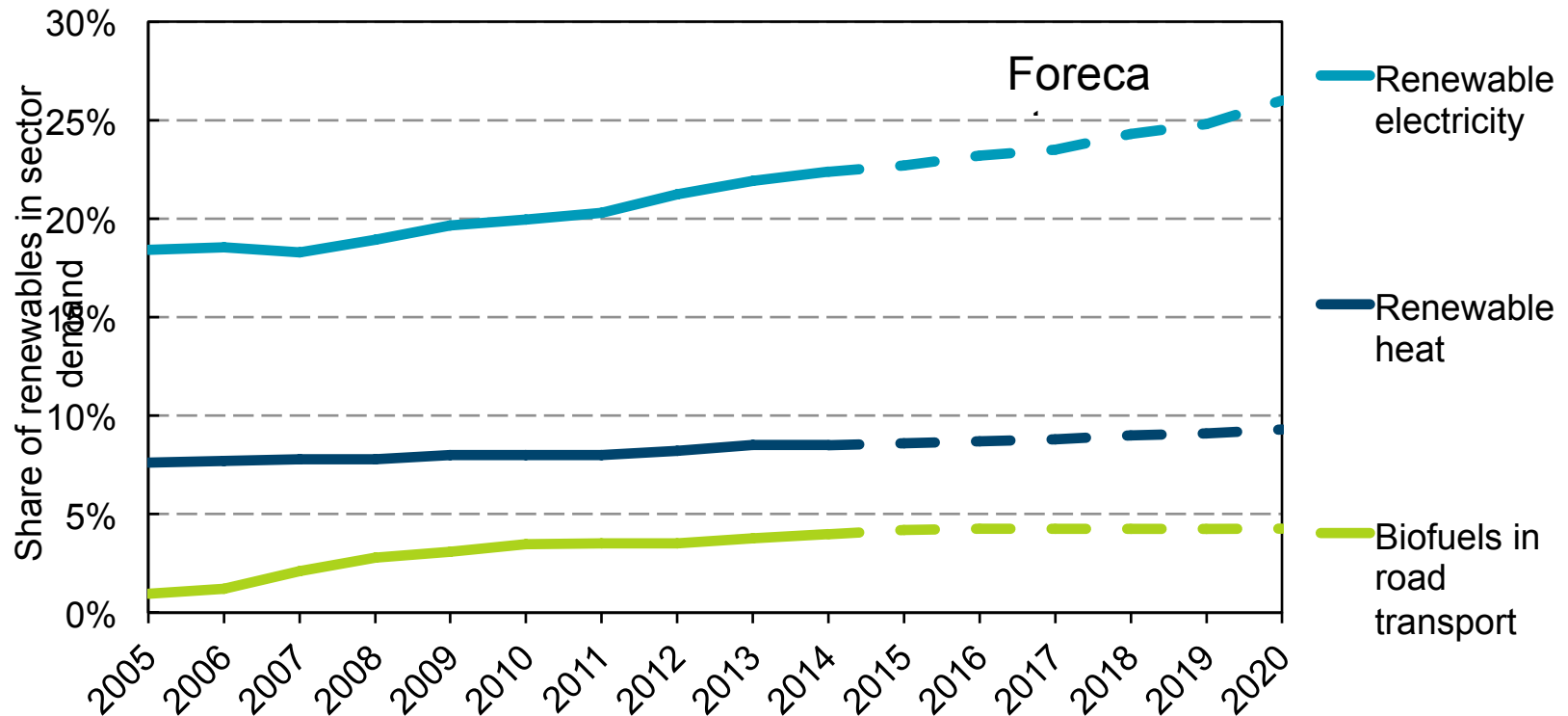
Renewable generation by technology, *main case* forecast and scenario analysis



Share of non-hydropower in renewable electricity generation is expected to increase significantly, but an acceleration is needed to meet climate change objectives

Persistent challenges slow growth in heat and transport

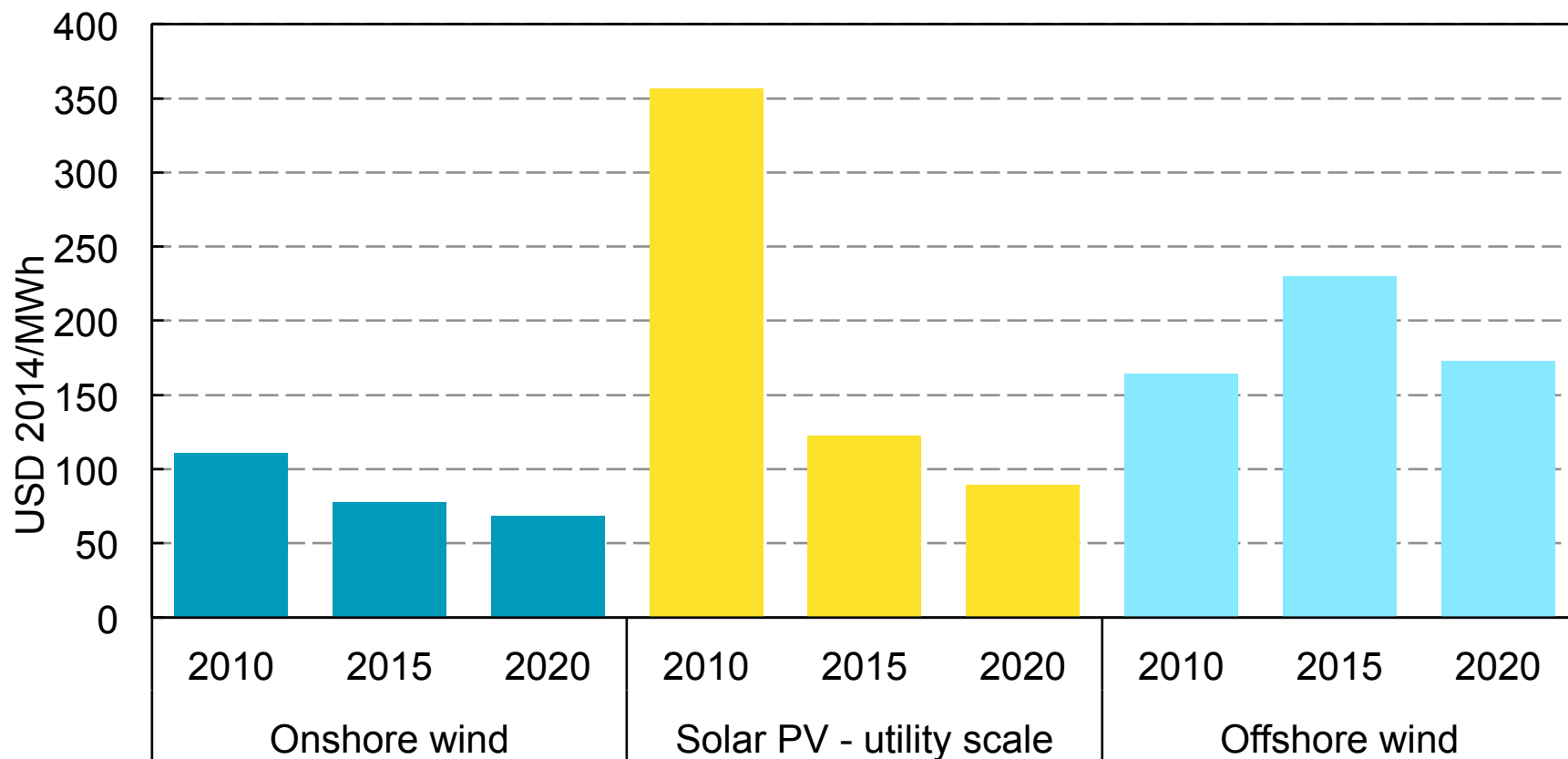
Historical and forecast share of renewables in electricity, heat and transport sectors 2005-20



Renewable heat and transport are growing more slowly than electricity. Advanced biofuels are starting to scale up, but development requires further policy support.

Renewables generation costs will decrease further

Historical and forecast global weighted average generation costs for new plants



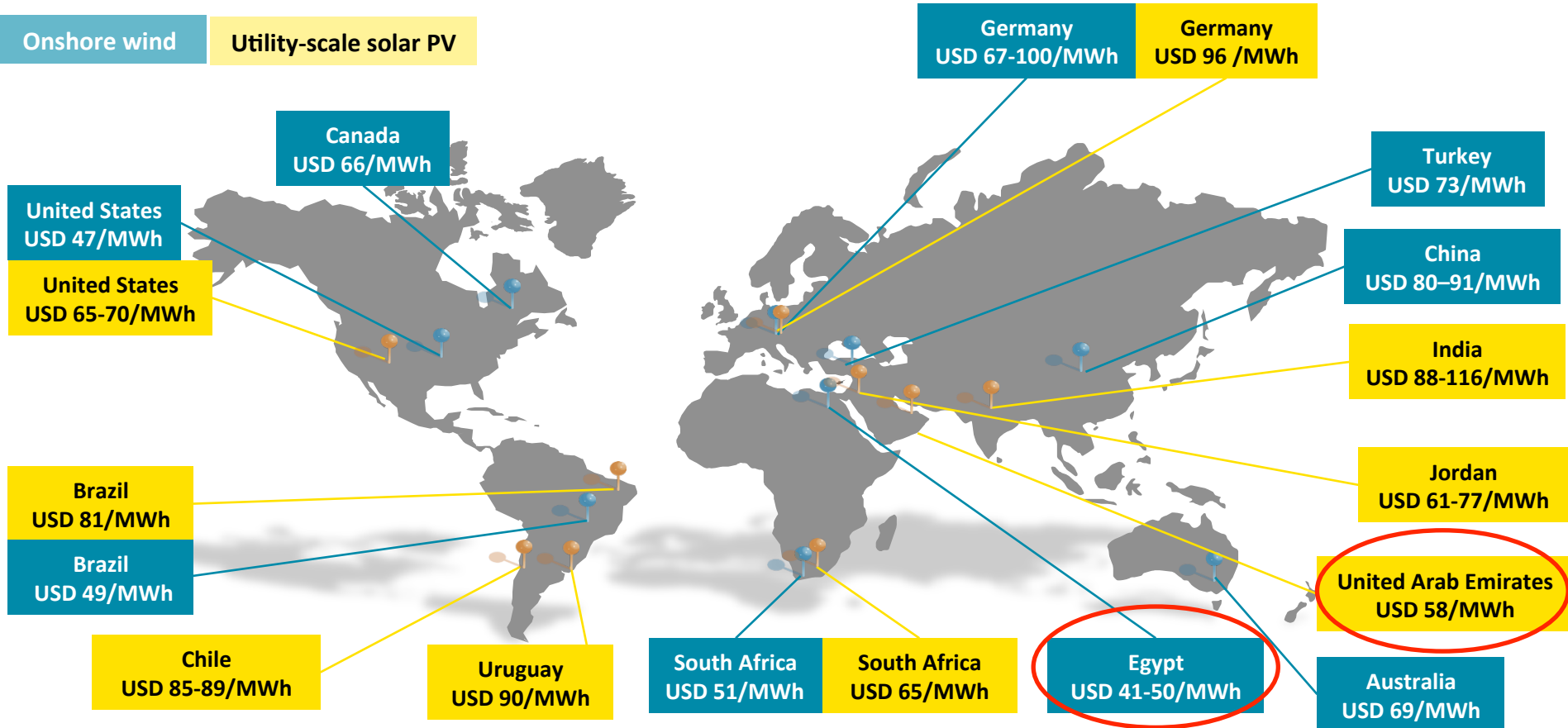
High levels of incentives are no longer necessary for solar PV and onshore wind, but their economic attractiveness still depends on the regulatory framework and market design

Evidence of lower costs on the horizon

Recent announced long-term contract prices for new renewable power

Onshore wind

Utility-scale solar PV

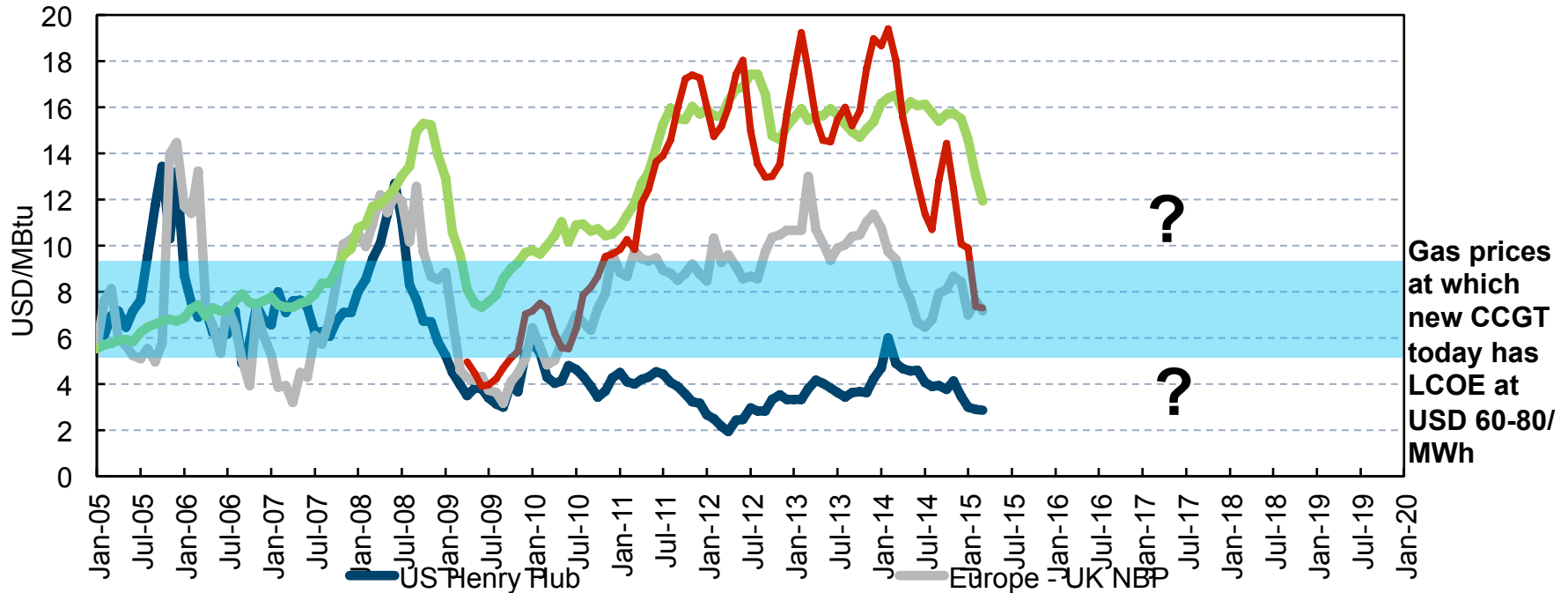


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A combination of price competition, long-term contracts, good resources and financial de-risking measures is creating deployment opportunities in newer markets and at lower costs

Generation cost profile of alternatives vary with fossil fuel prices

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



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

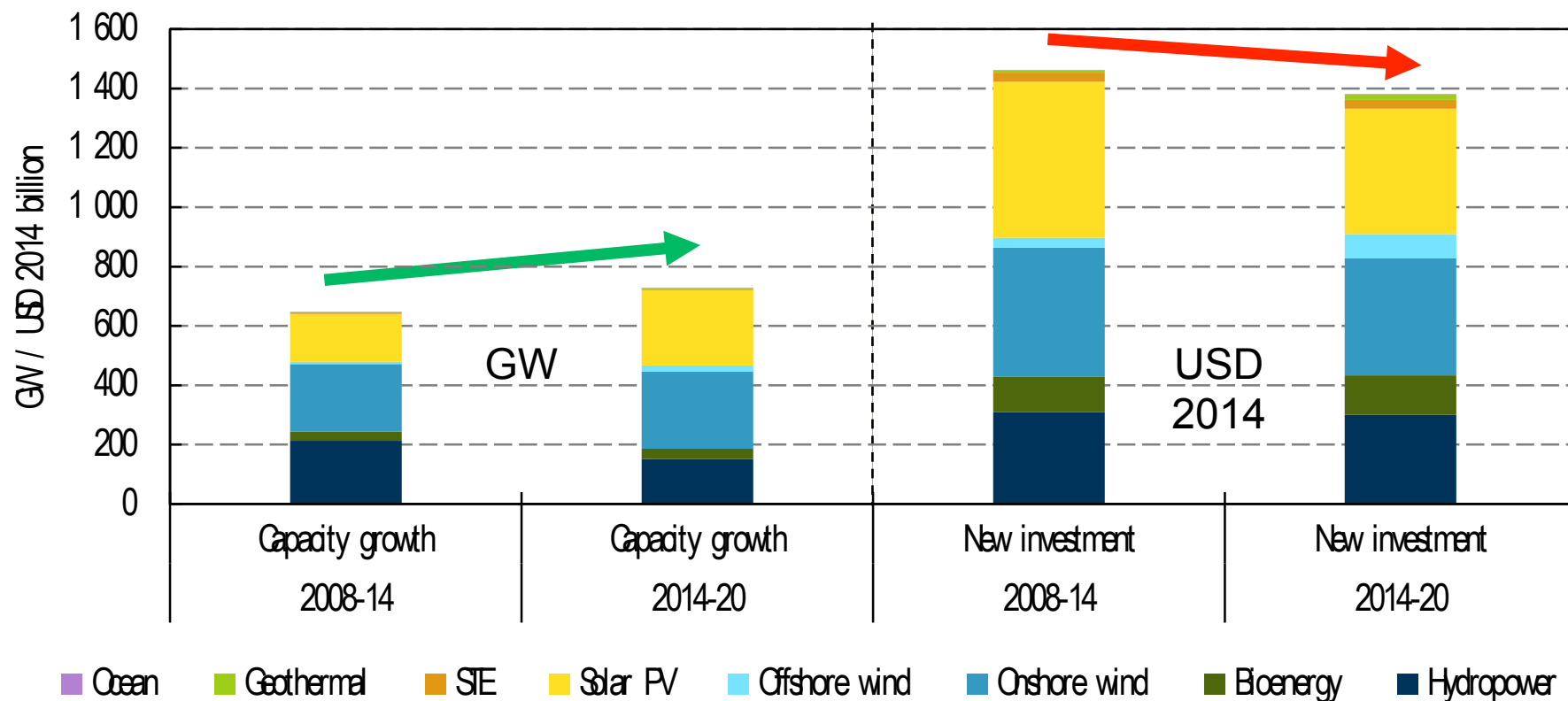
More robust competitiveness assessments would account for:

- Value of electricity generated – when and where
- Flexibility needs from high shares of variable renewable generation
- Fossil fuel and carbon price volatility, hedging costs

→ **System Transformation and Market Design Reform**

More renewables for less money

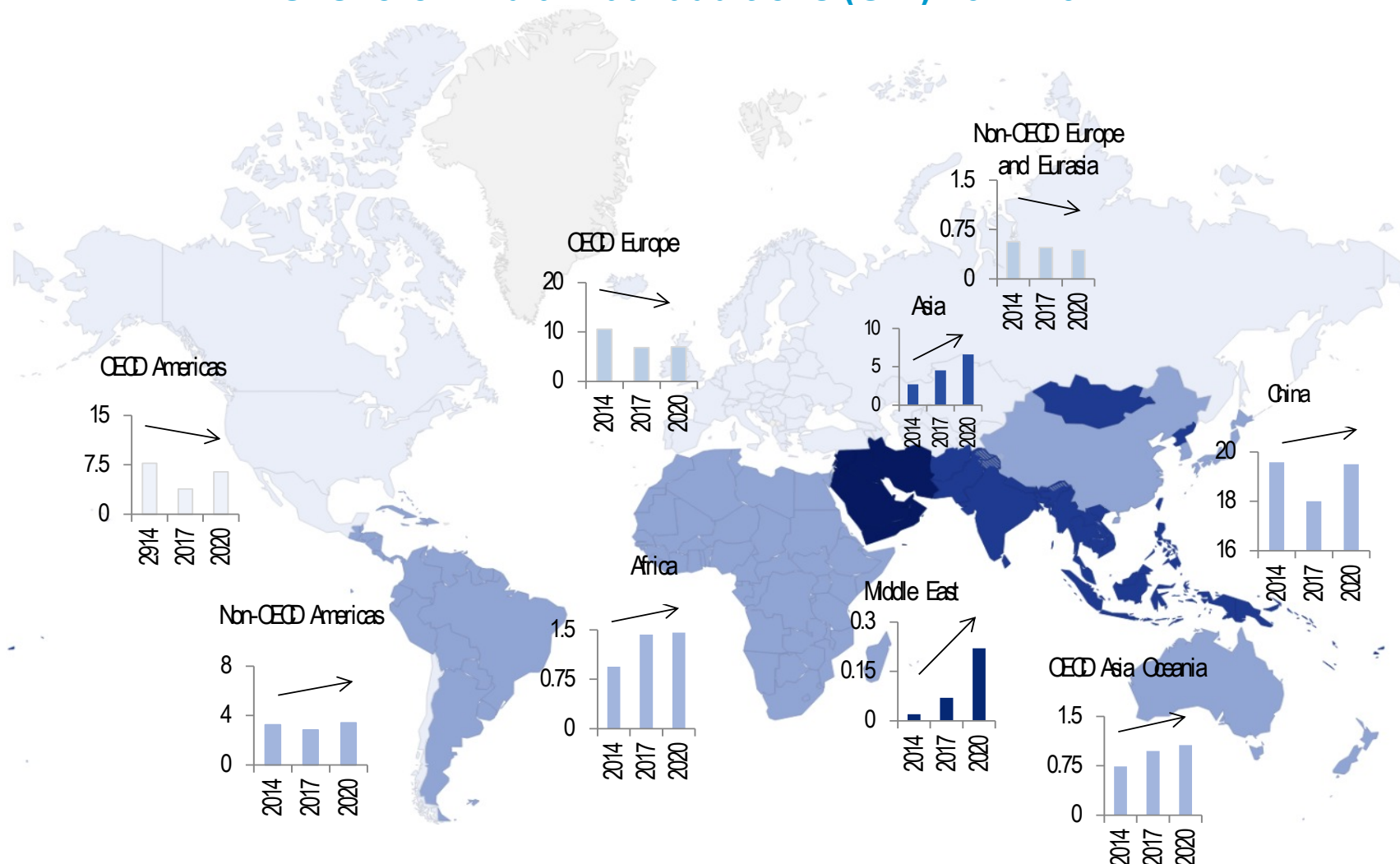
Renewable power capacity – net additions versus new investment



Wind and solar PV comprise two thirds, or USD 900 billion, of new investment needs to 2020 and capacity increases are being made at lower cost than in the past

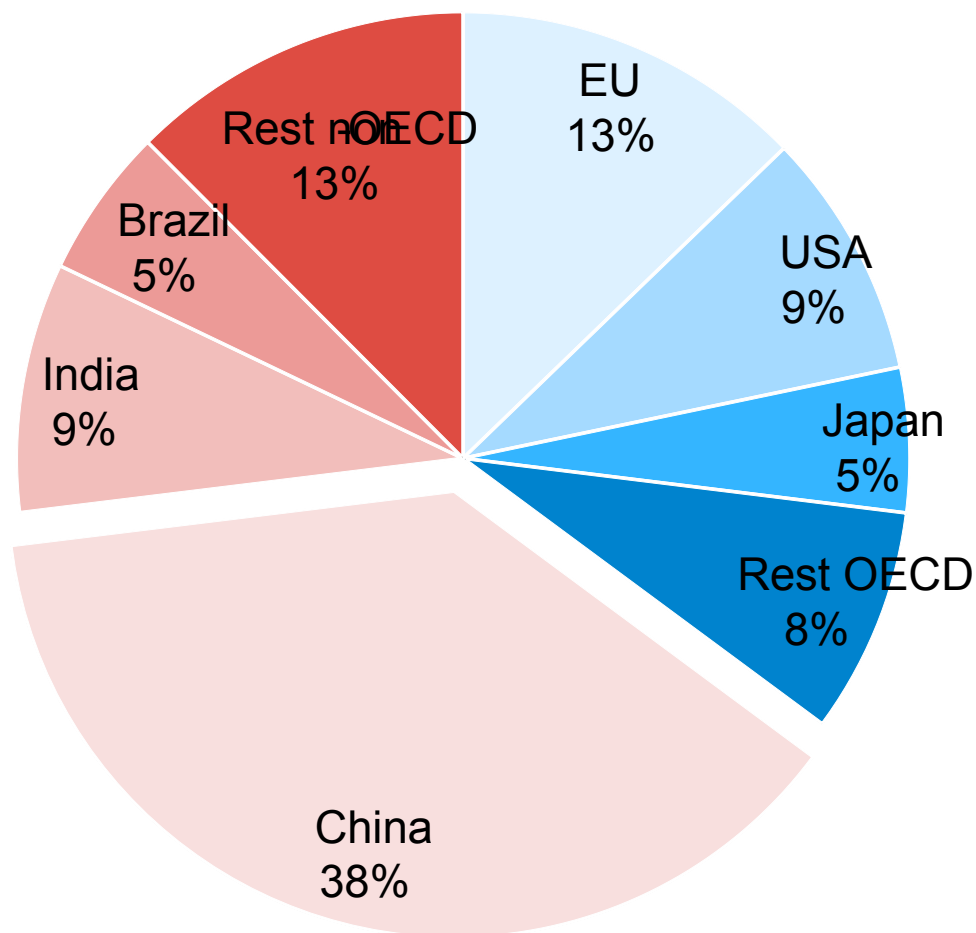
Onshore wind leads growth as deployment spreads

Onshore wind annual additions (GW) 2014-20



Growth shifting to emerging markets and developing countries

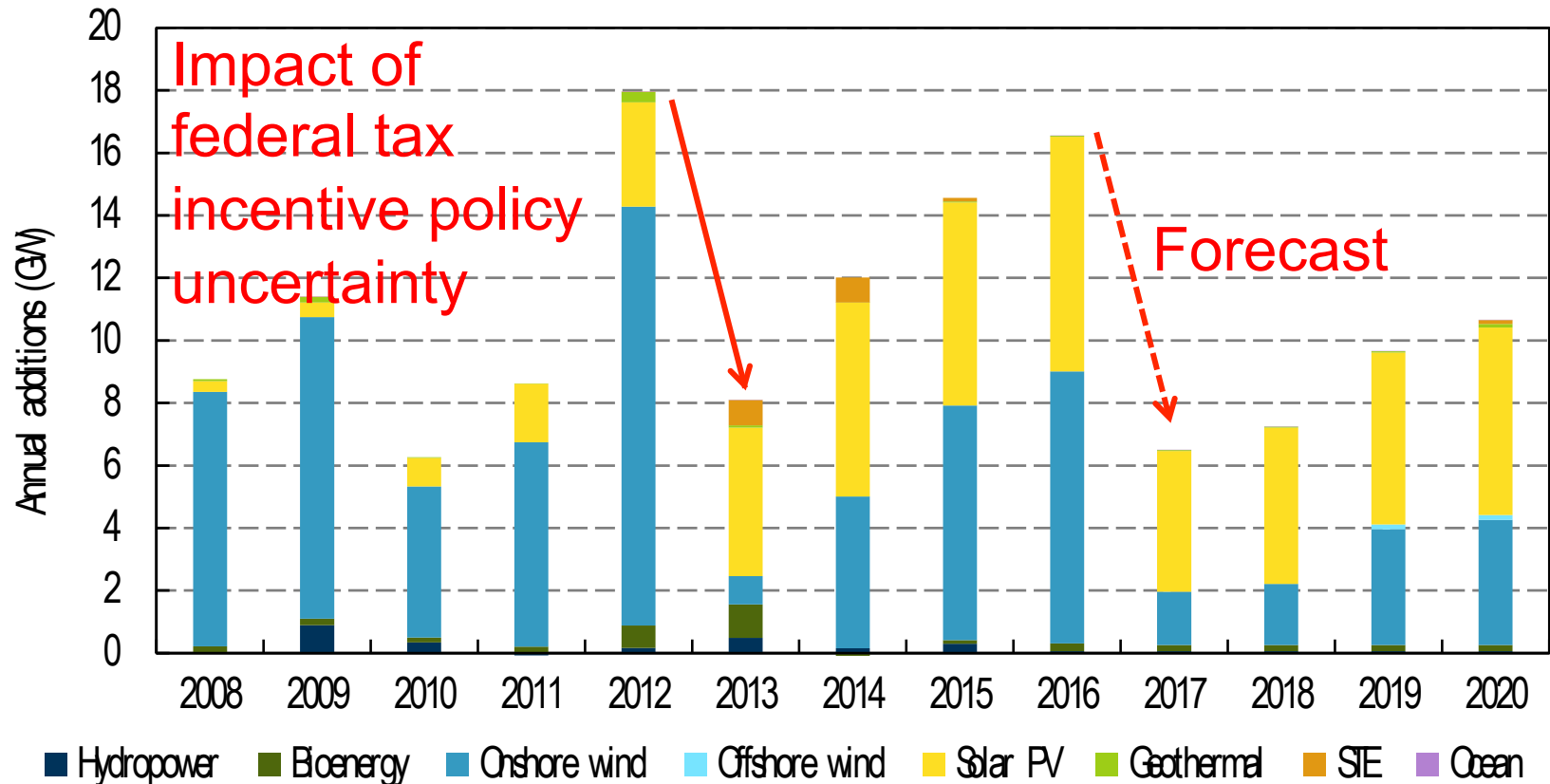
Shares of net additional renewable power capacity, 2014-20



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

Federal tax incentive uncertainty drives bumpy US renewable growth

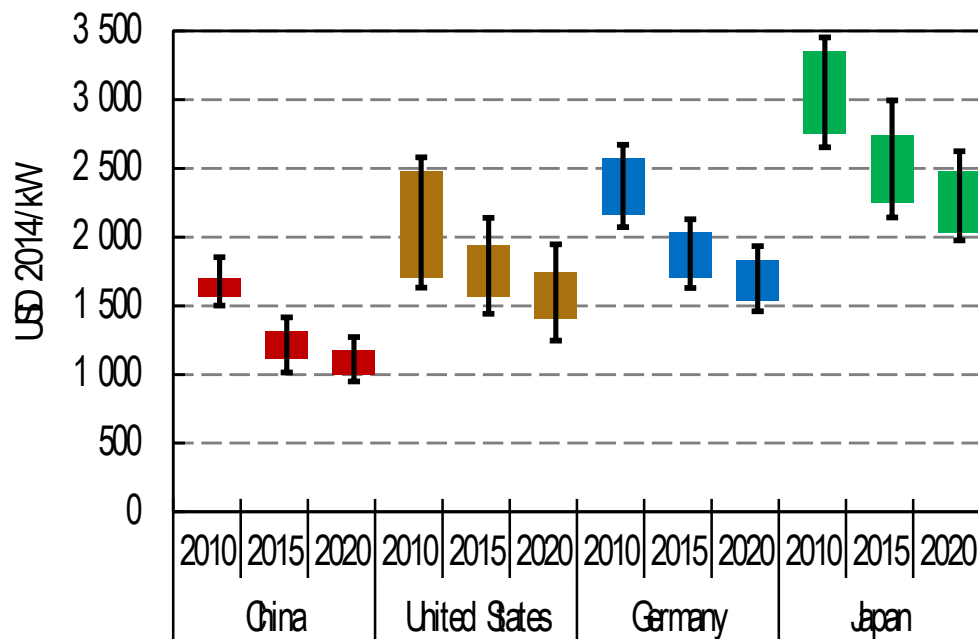
US annual net additions to renewable capacity



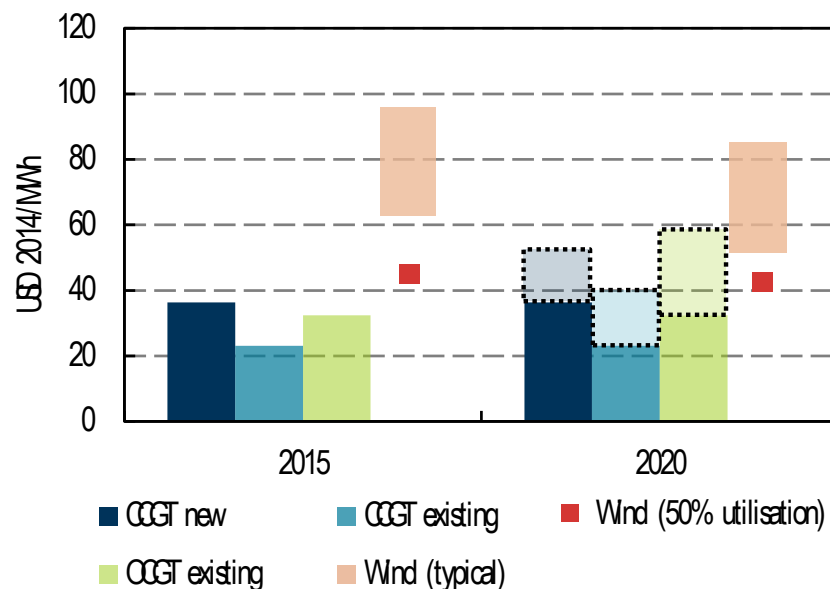
After China and Europe, the US is the third largest market for new renewable generation, but federal and state-level policy uncertainties create volatile deployment pattern

Onshore wind costs improving, but low gas prices remain a challenge

US investment cost for onshore wind



Generation costs: onshore wind vs gas

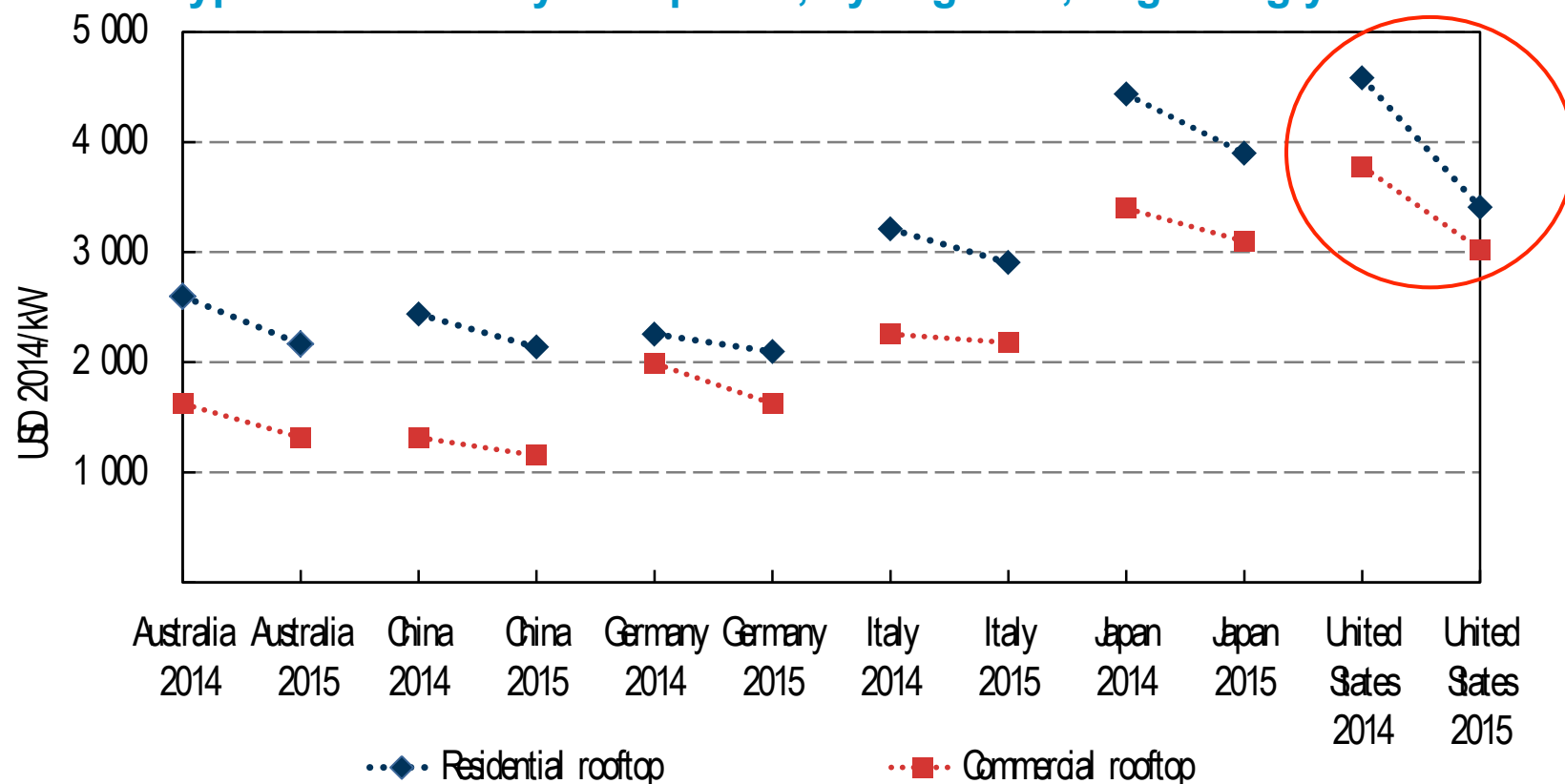


Note: For CCGT and OCGT, fuel cost assumption is USD 2.85/MMBtu (May 2015 Henry Hub Spot Price) in 2015 and USD 6.2/MMBtu in 2020 (IEA Projecting Costs of Generating Electricity 2015 Edition), discount rate 7%, capacity factor 65% and 15% (OCGT). For wind, typical utilisation rate is 30-36%, 50% utilisation is observed in the interior region.

US wind costs are relatively low, due to strong manufacturing, competition and scale. But more widespread competitiveness would require further cost reductions and higher gas prices.

Strong potential and improving economics, but uncertainties over growth of distributed solar PV

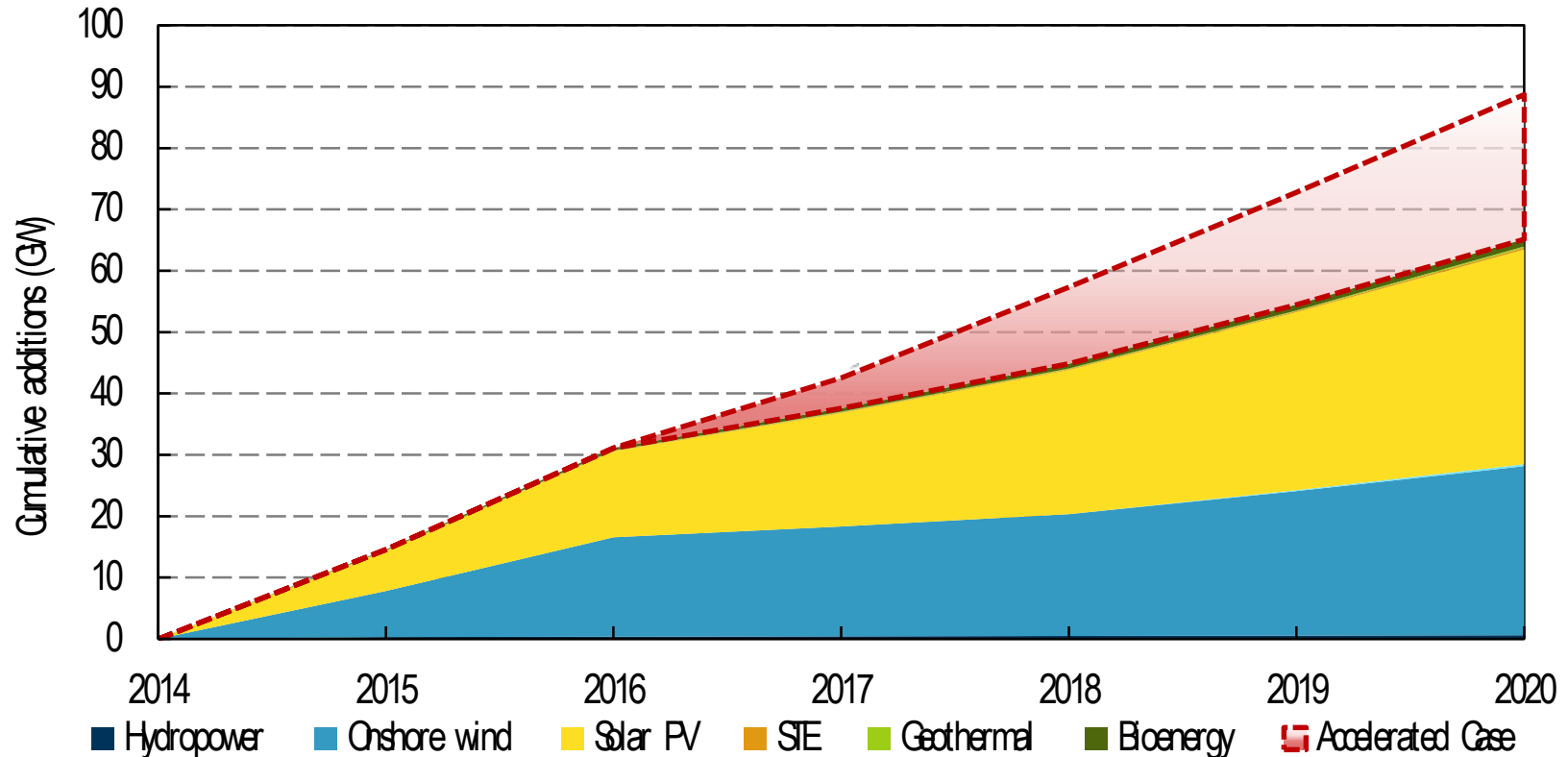
Typical solar PV system prices, by segment, beginning year



Cost reductions needed to bring US distributed PV in line with international benchmarks. Evolution of state-level net metering rules and electricity rate design are forecast keys.

Greater policy clarity key for accelerated growth in the United States

US cumulative additions to renewable capacity (2014-2020), *main case vs accelerated case*



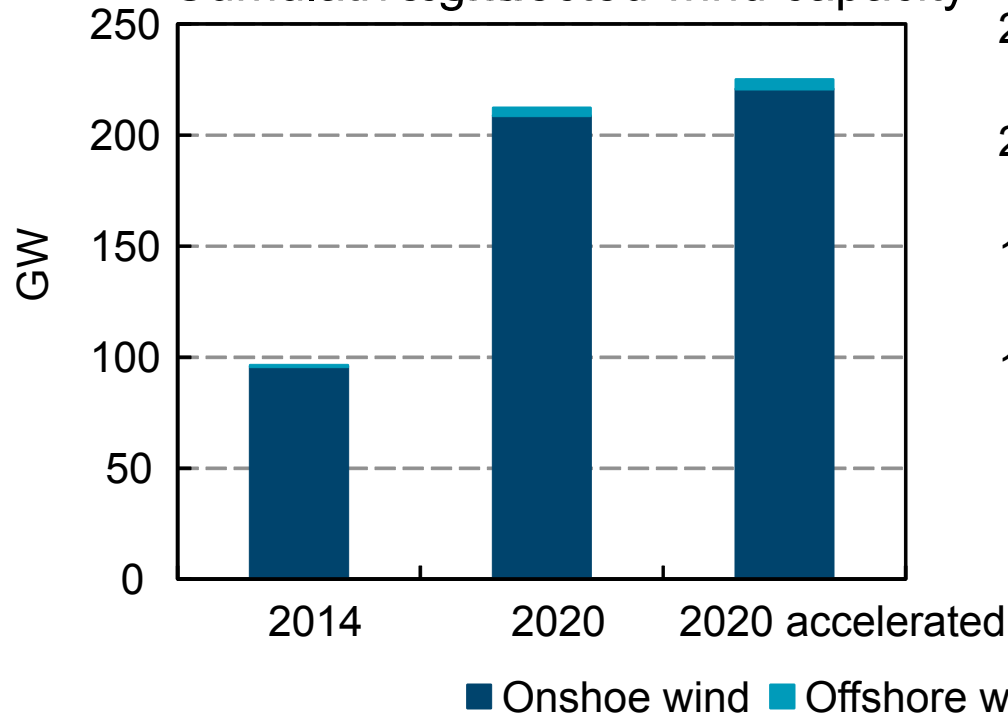
Renewable capacity rises by 30%, but could increase up to 45% with clearer signals on federal tax incentives and emissions reductions efforts and state-level policy enhancements

China to be market leader in both wind and solar PV by 2020

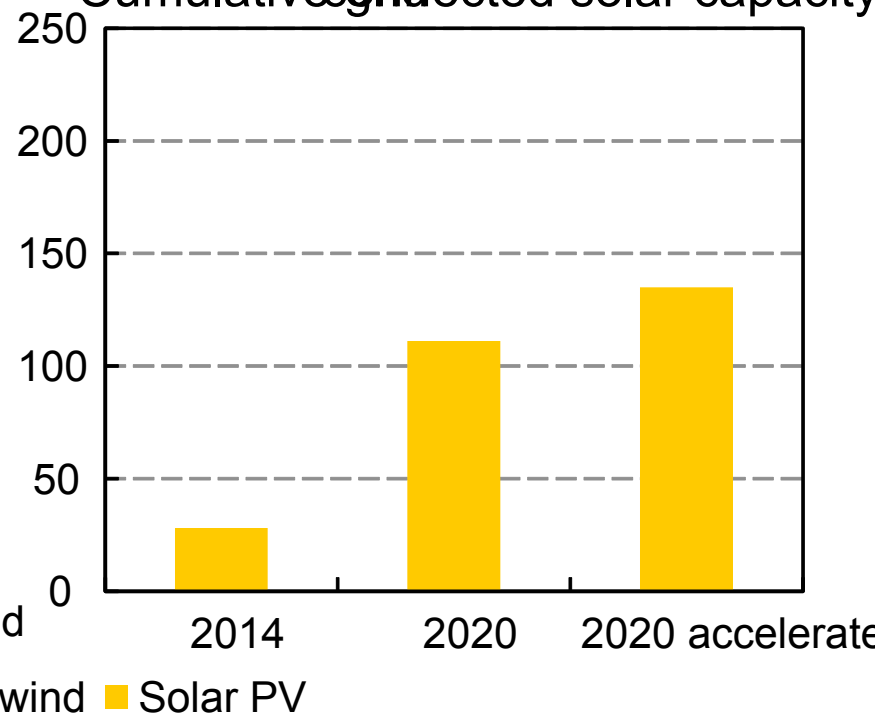
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Cumulative grid-connected wind capacity



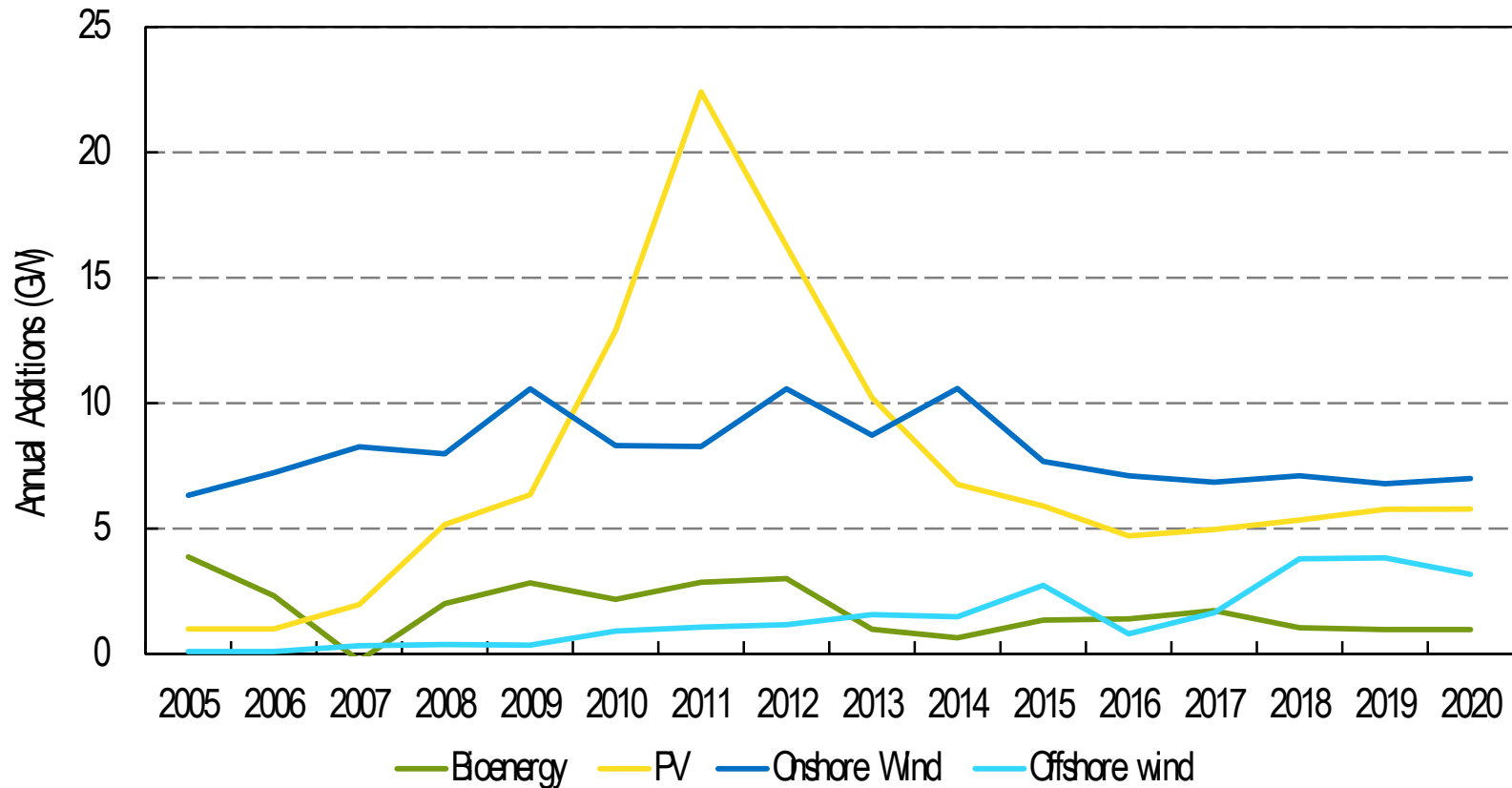
Cumulative grid-connected solar capacity



China's cumulative wind capacity to more than double while solar PV to quadruple in 2020 but further growth is possible if higher targets are set

Europe transitioning to slower renewable growth profile

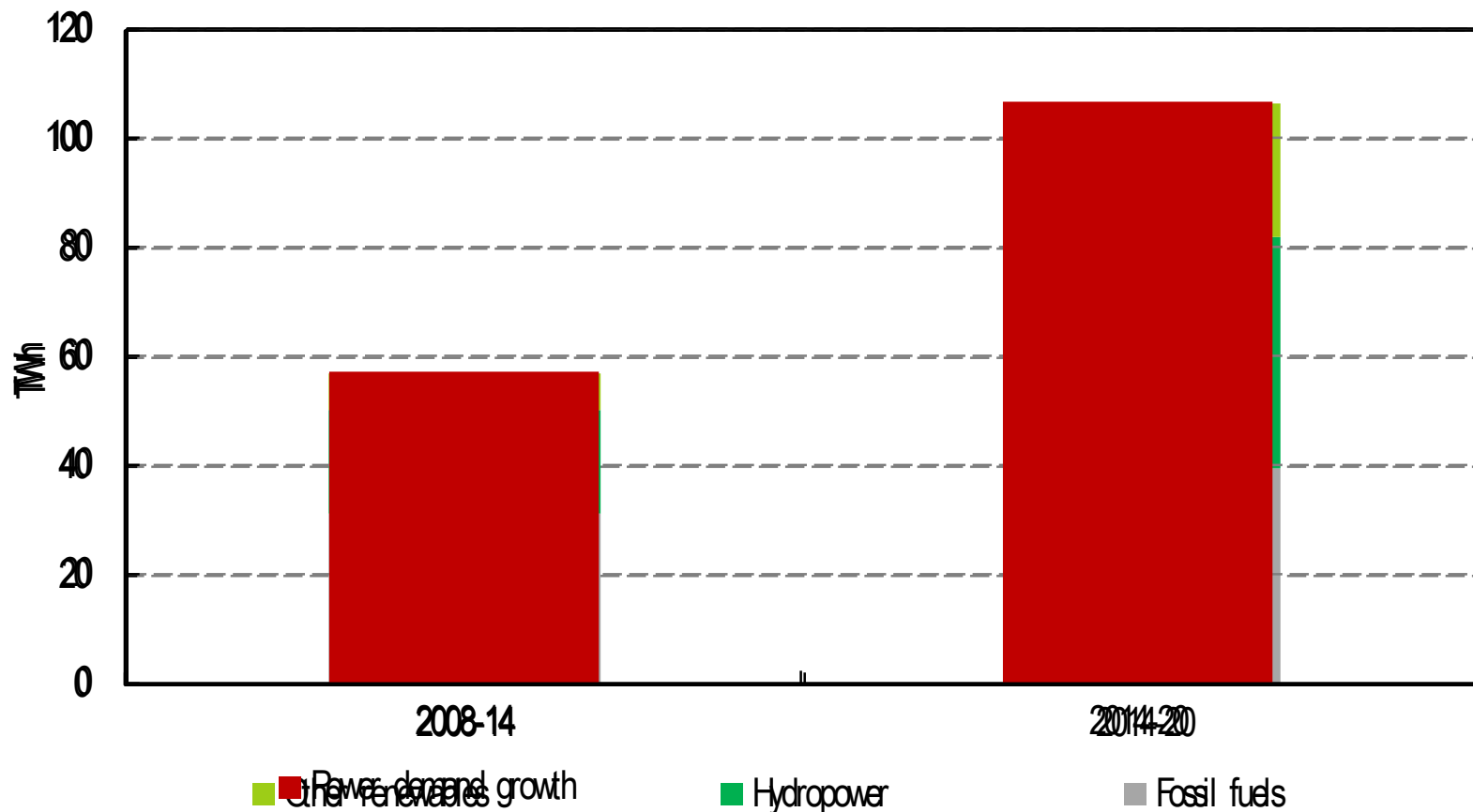
OECD Europe annual net additions to renewable capacity



- Weak power demand growth, overcapacity, incentive reductions in a number of markets
- Uncertainties over policy frameworks (e.g. EU, UK) and integration of high levels of VRE
- Still, offshore wind deployment triples by 2020 and decarbonisation drivers remain robust

Renewables can power Africa's economic growth

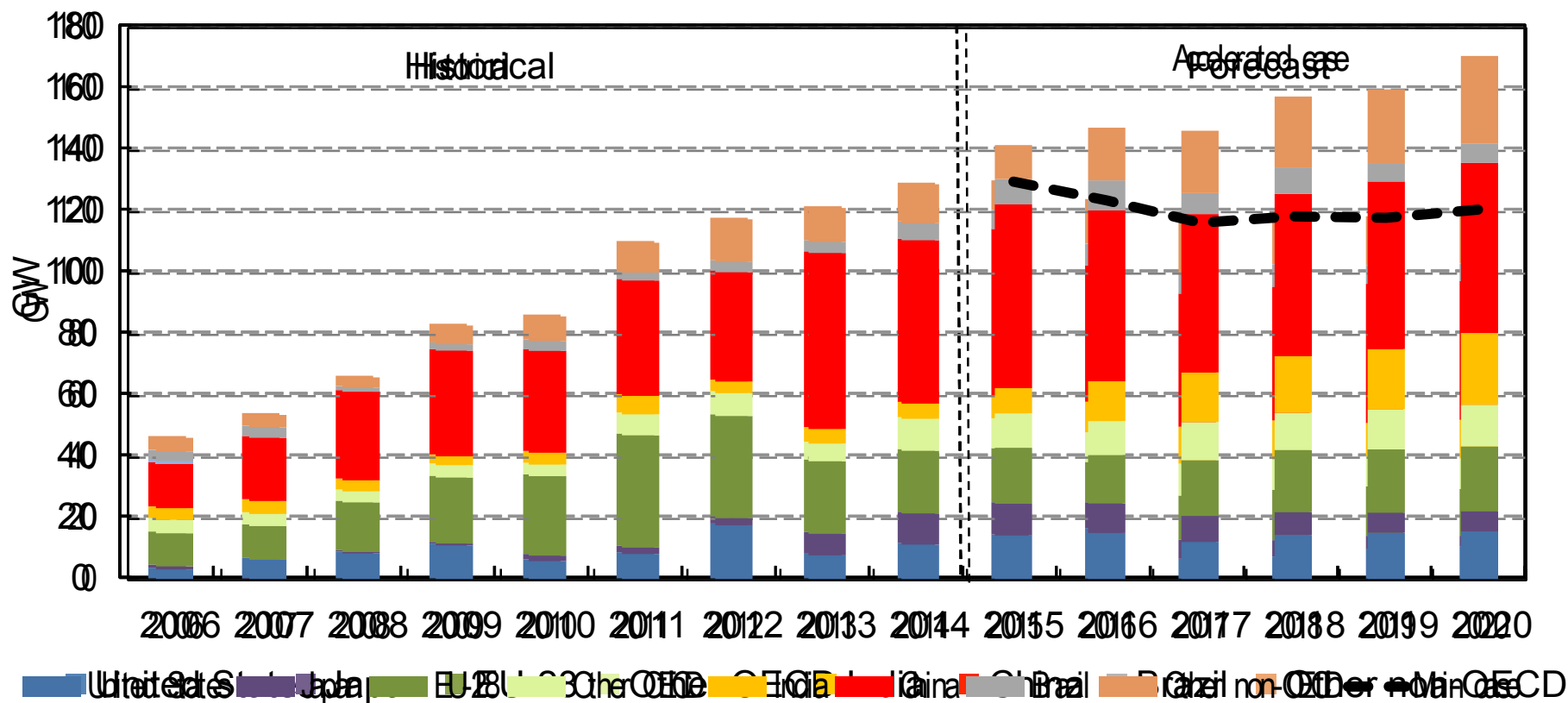
Sub-Saharan Africa power demand growth versus supply sources



With huge resources, improving cost-effectiveness and policy momentum, renewables account for almost two-thirds of demand growth in Sub-Saharan Africa

Can renewables get back on track to meet climate change goals?

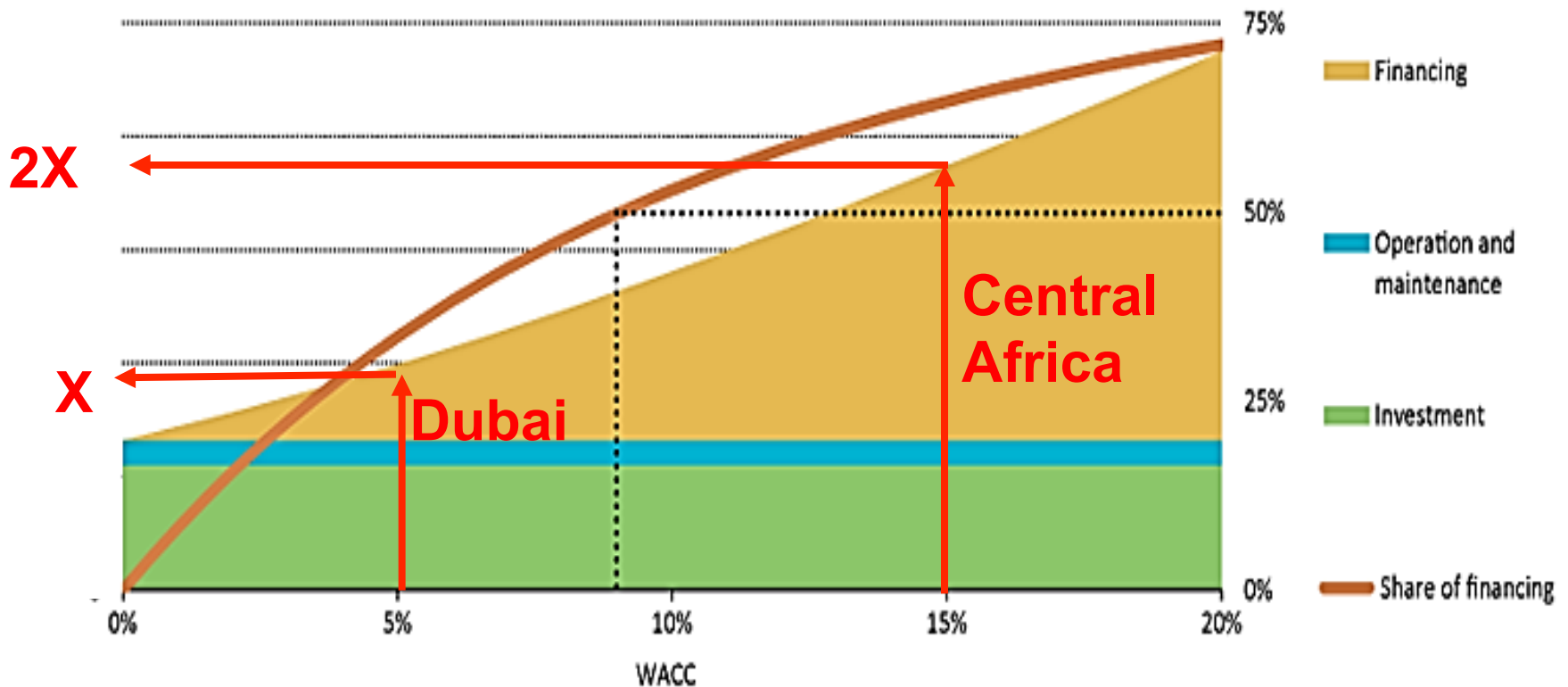
World renewable power capacity growth, main versus accelerated case



With policy enhancements renewables can be back on track to meet long-term climate change goals

Reducing financing costs key to more cost-effective deployment

Impact of cost of capital (WACC) on the levelised generation cost of solar PV (for equivalent resource and investment cost)



Market and regulatory risks can increase weighted average cost of capital and undermine competitiveness of PV and wind power

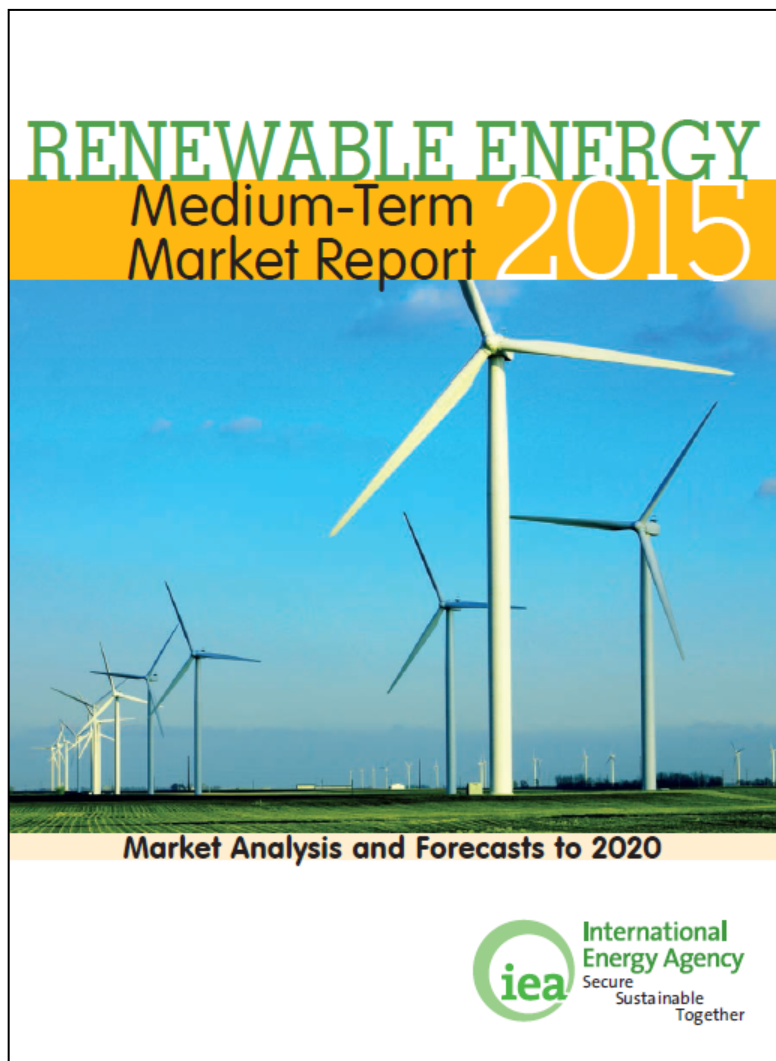
A decisive moment for the future of renewables

- Increasingly affordable renewables are set to dominate the growing power systems of the world
- The impact of the lower oil price environment on global deployment of renewables is limited – in particular for the power sector
- While variability of renewables is a challenge energy systems can learn to adapt to, variability of policies poses a far greater risk
- Accelerated growth of renewables to meet energy security, local pollution and climate protection goals is feasible
- US remains dynamic, but stronger growth could be achieved with clearer policy signals on federal incentives and emissions reduction plans

For further insights and analysis

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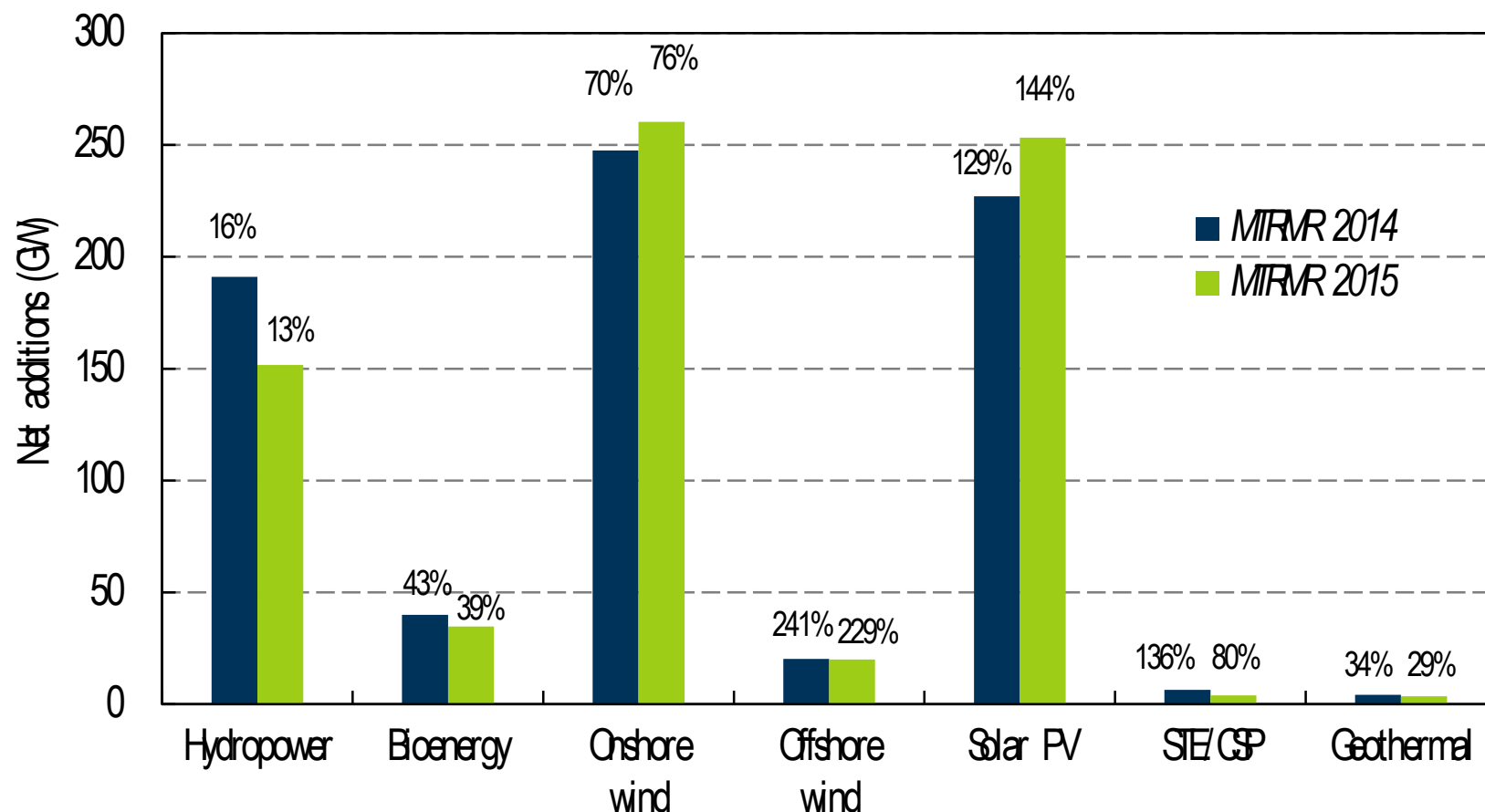
- The Medium-Term Renewable Energy Market Report 2015 can be purchased at:

www.iea.org/bookshop/

- Thank you for your attention!

MTRMR forecast more optimistic for onshore wind and solar PV

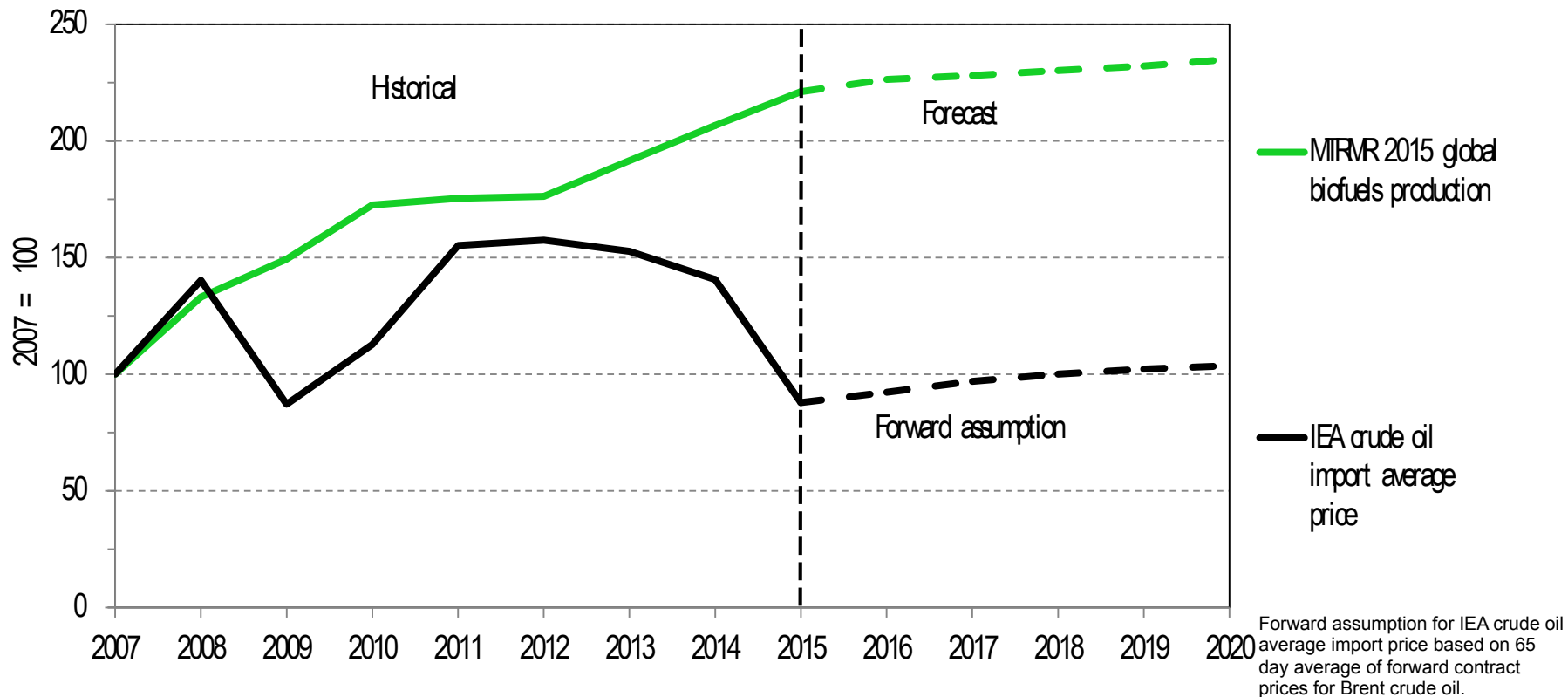
World net additions to renewable capacity, absolute and percentage growth (2014-20)



Onshore wind and solar PV more optimistic with increased deployment in emerging markets and developing countries

Policies support biofuels output, but structural challenges limit growth

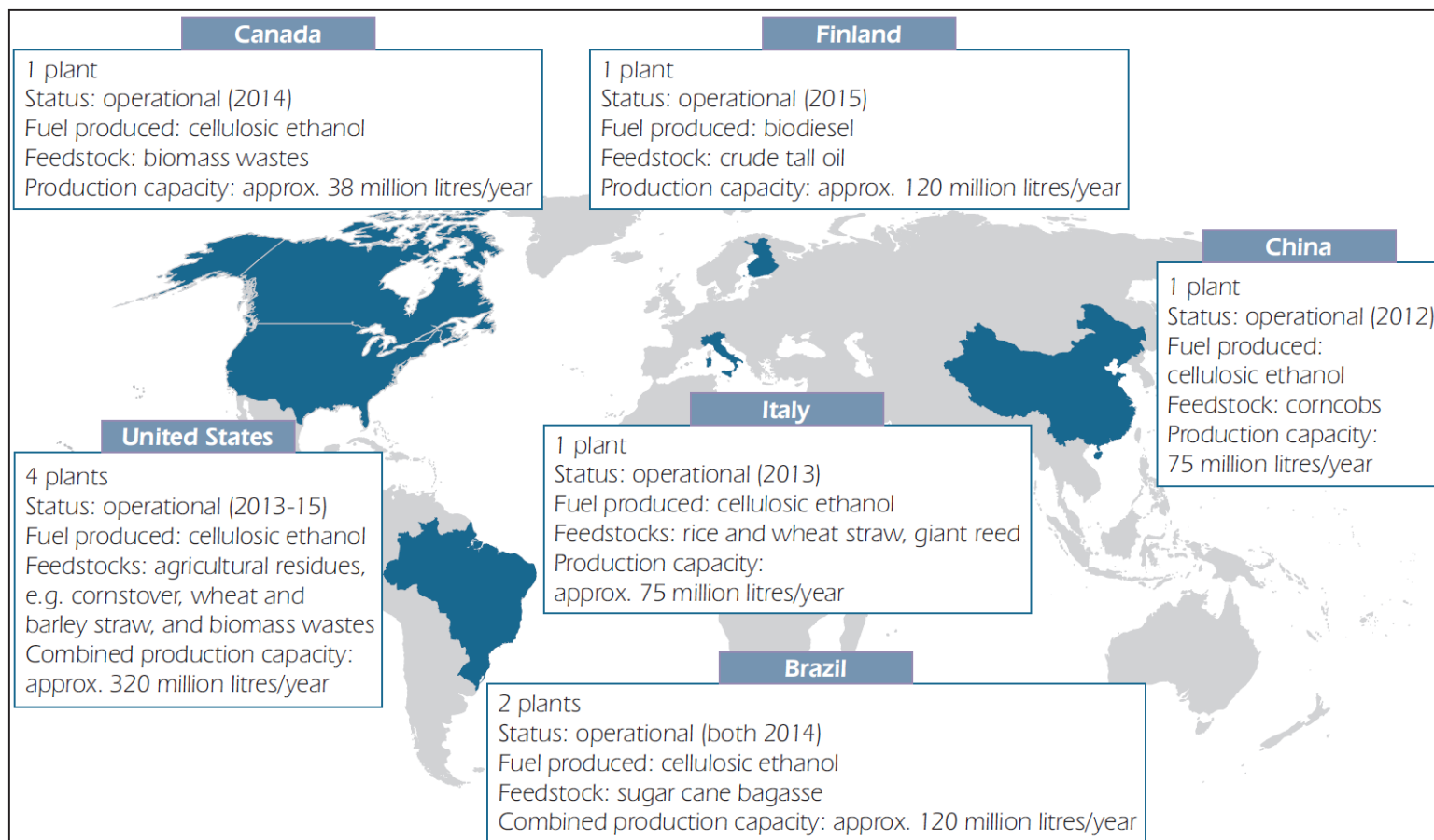
Comparison of global biofuels production and oil prices 2007-20 (indexed)



Blending mandates support demand, even with lower oil prices. Advanced biofuels – needed for long-term decarbonisation of the transport sector – require further support to scale up

Early signs of commercialisation in the advanced biofuels sector

Commissioned commercial scale advanced biofuel plants

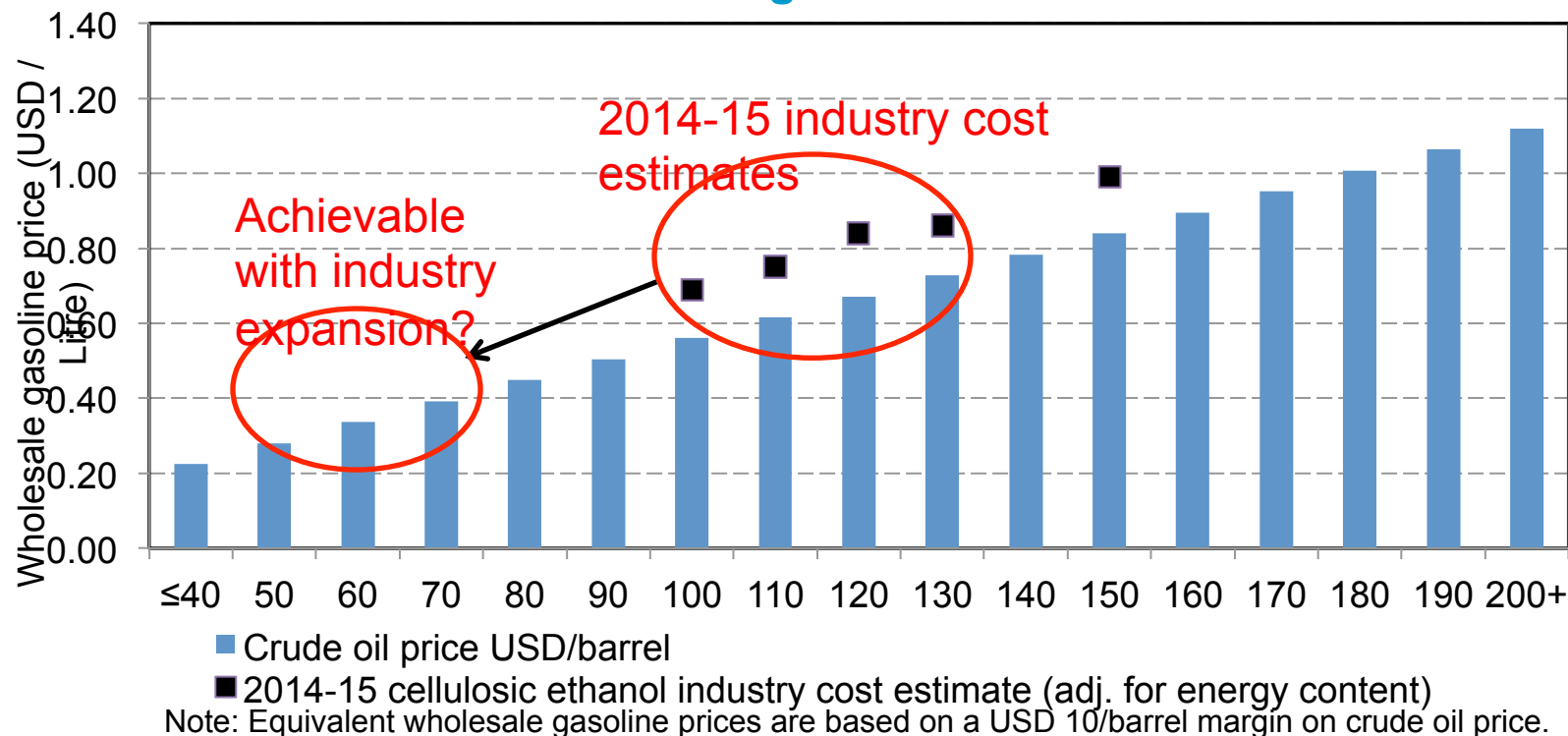


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Advanced biofuels – needed for long-term decarbonisation of the transport sector – are starting to scale up, but development requires further policy support.

Difficult for cellulosic ethanol to compete at current low oil prices

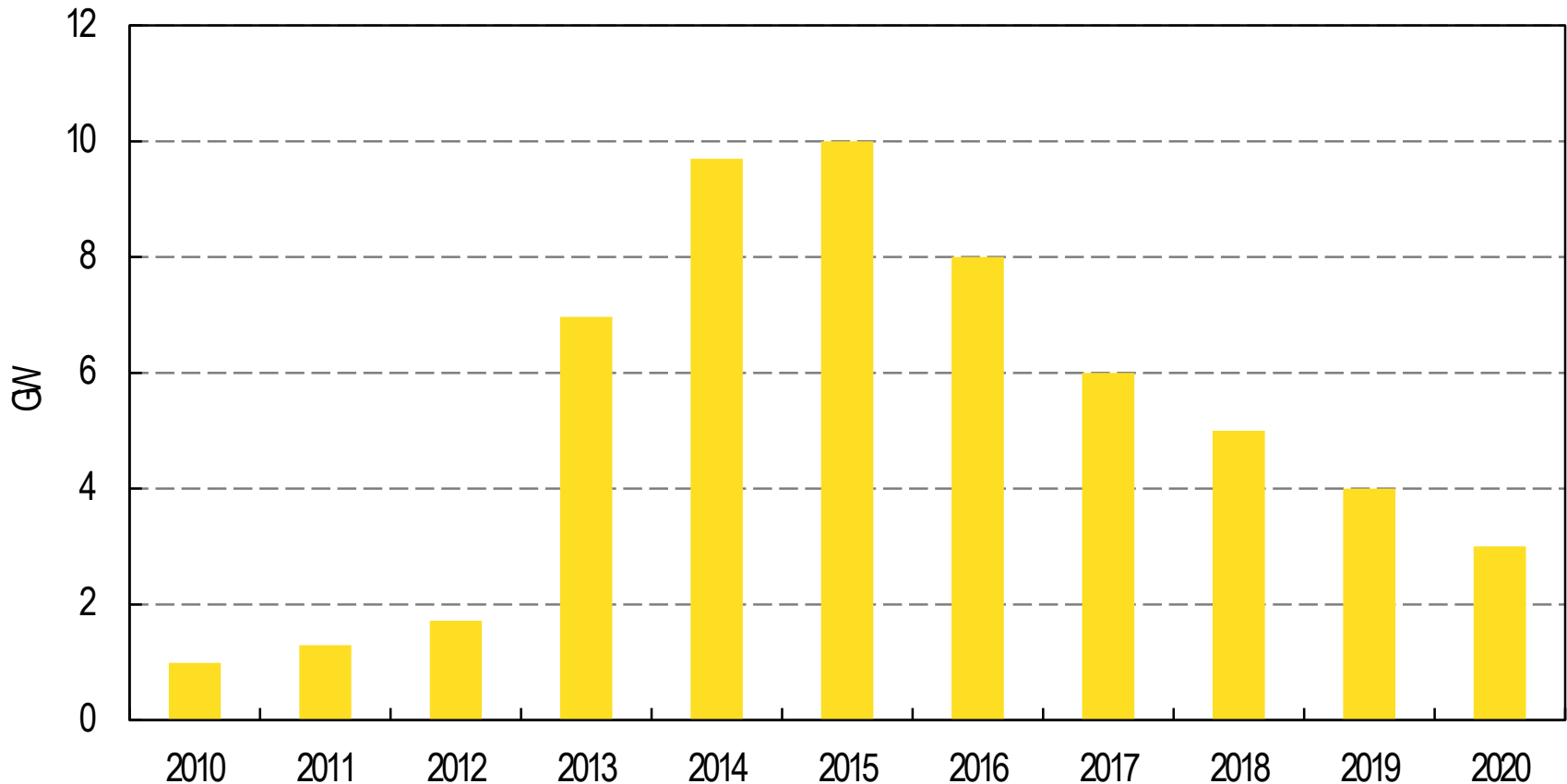
Analysis of a breakeven crude oil price for cellulosic ethanol to be competitive with gasoline



Current production cost estimates suggest breakeven with gasoline at USD 100-130/barrel crude oil prices, but realising significant scope for cost reduction could change this picture.

Grid and system integration main constraint to Japan PV deployment

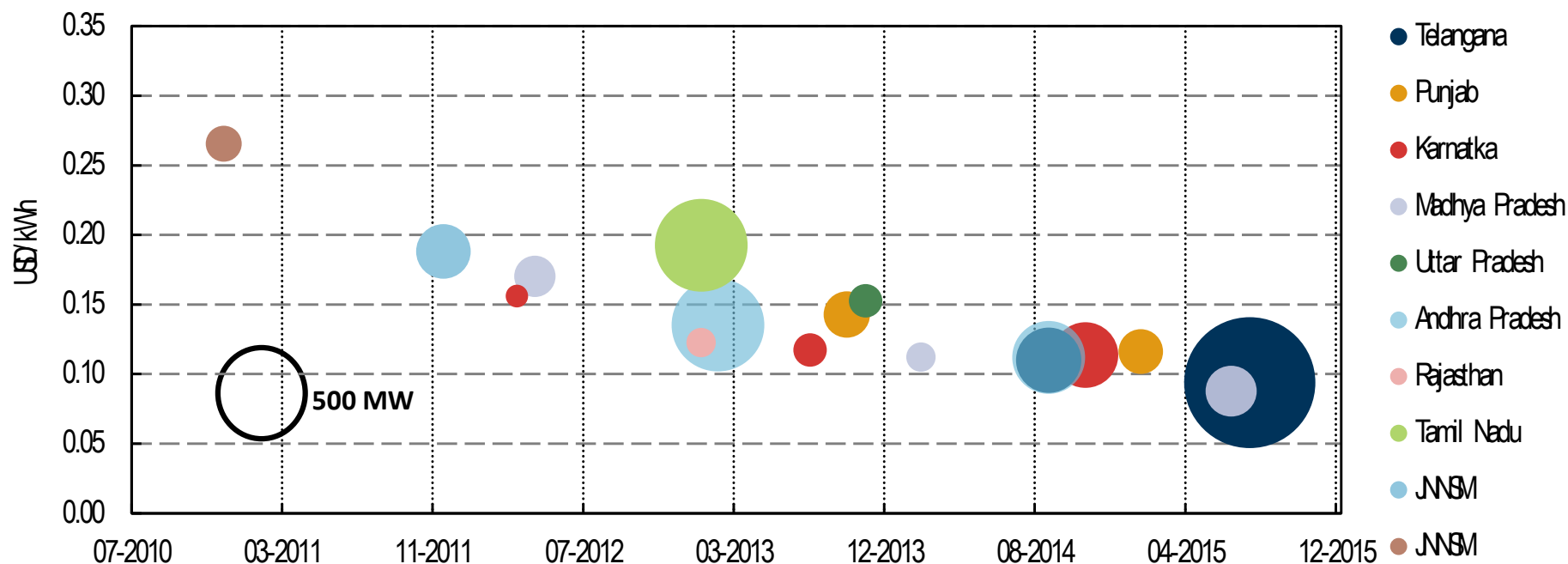
Japan annual solar PV capacity additions, historical and forecast



Power diversification needs and generous incentives support Japan's PV growth, but greater progress is needed in variable renewable integration and power sector reform

Improving cost effectiveness supports stronger renewable growth in India

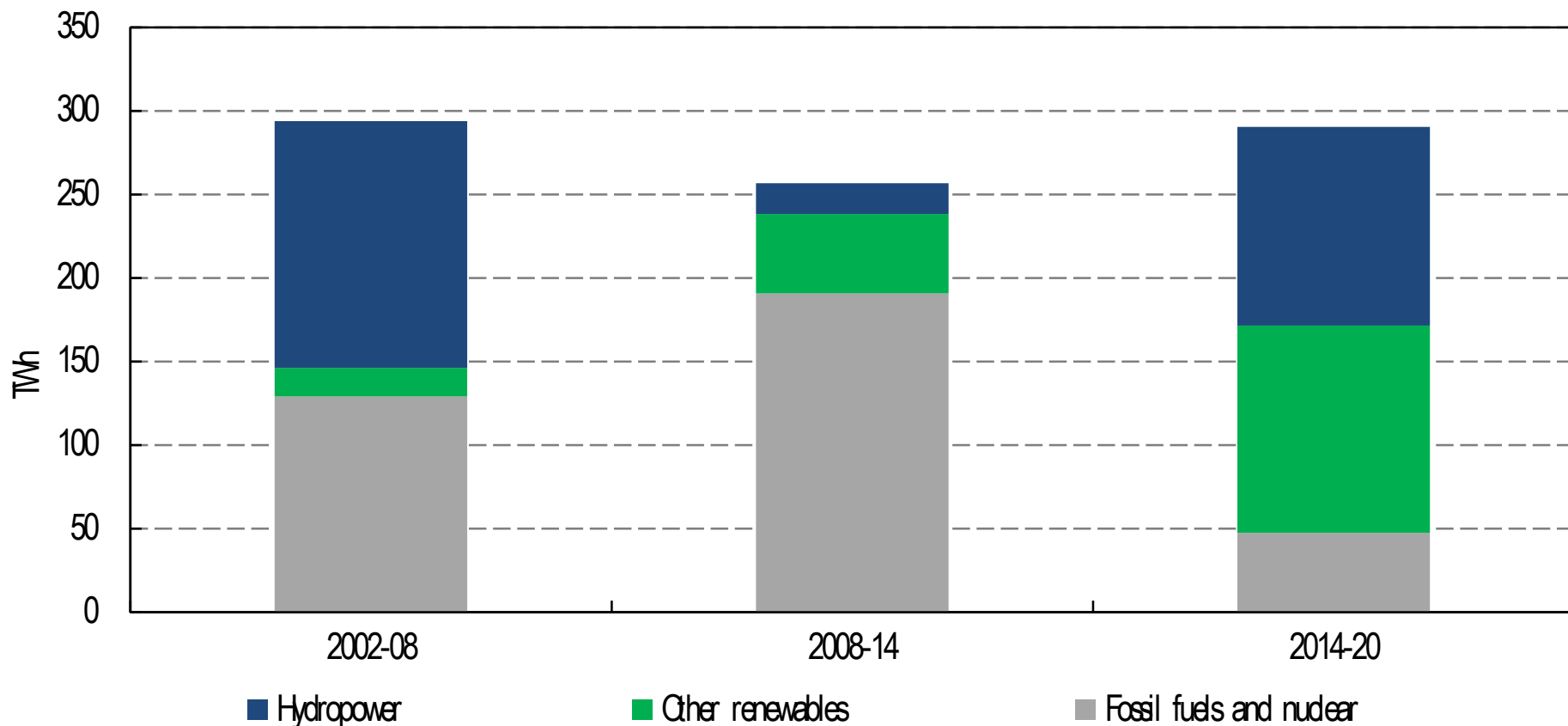
India weighted average PPA bid prices in PV auctions, state and JNNSM



- Ambitious target of 100 GW solar PV by 2022, but MTRMR sees < 30 GW by 2020
- Auctions for utility-scale PV reducing costs, though they remain higher than coal
- Clear and credible implementation of supporting regulations needed to reduce offtaker risks, promote net metering and reduce administrative barriers
- Significant grid expansion, strengthening and management needed

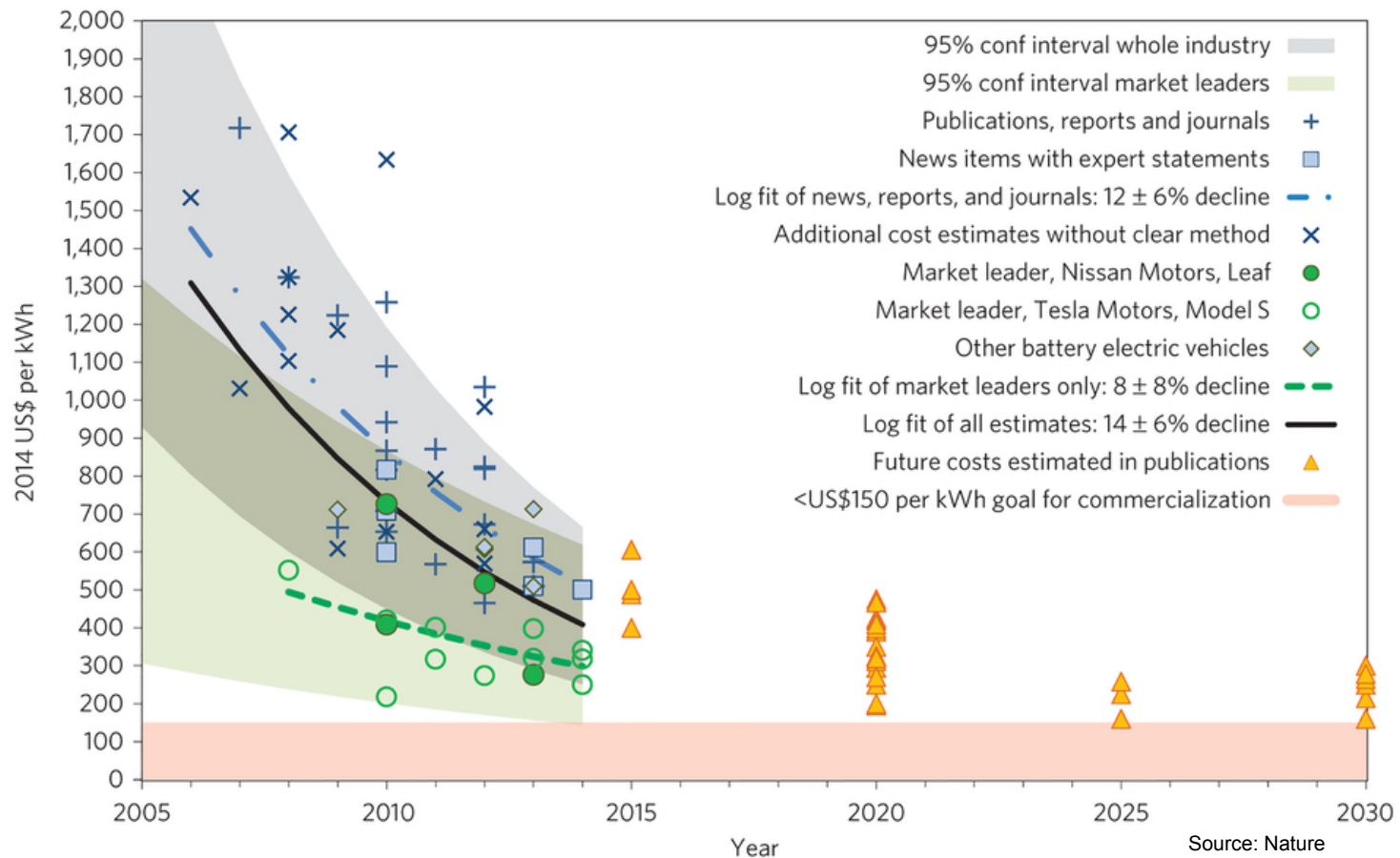
Renewables are powering Latin America's economic growth

Latin America power demand growth versus new renewable generation



Excellent resources have underpinned hydropower's strong role. Now, with policy momentum, attractive economics and diversification needs, other renewable sources grow more rapidly.

Battery storage cost trends – a breakthrough in sight?



But widespread adoption of behind the meter storage requires reduced regulatory barriers and market design to monetize of value of applications