08 December 2015

LONG-TERM OUTLOOK FOR THE GLOBAL POWER SECTOR

2015 MENA Clean Energy Forum

Seb Henbest

Bloomberg NEW ENERGY FINANCE

PRODUCTS TO HELP YOU UNDERSTAND THE FUTURE OF ENERGY

Bloomberg NEW ENERGY FINANCE

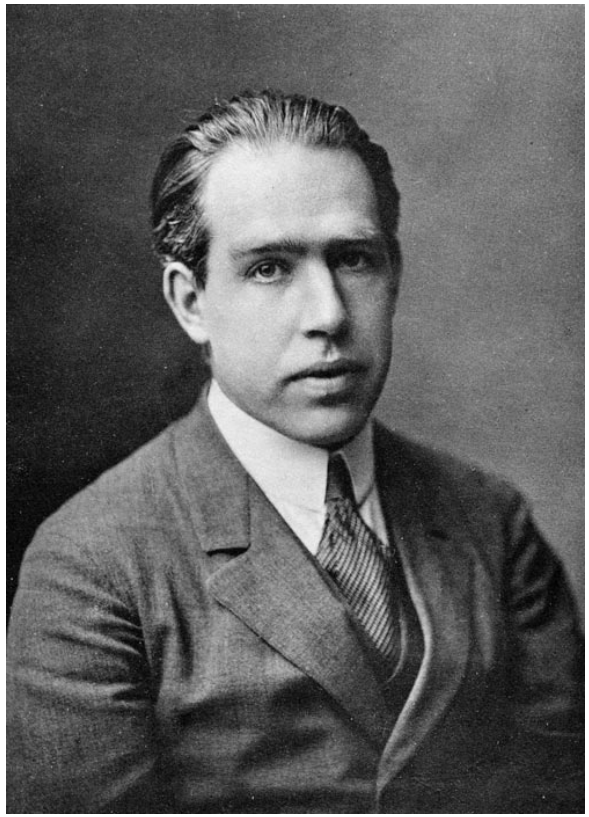
Solar | Wind | Other Renewables | Gas | Energy Smart Technologies | Advanced Transport | Carbon & RECs Markets

Americas

Europe, Middle East & Africa

Asia Pacific

NEW ENERGY OUTLOOK 2015
Seb Henbest
Lead Author
Seb is responsible for managing the production process, defining the report structure and extracting the most powerful findings and trends.
Elena Giannakopoulou
Lead Energy Economist
Elena is responsible for coordinating input from around the world, model development and data analysis.
The New Energy Outlook is Bloomberg New Energy Finance's annual long-term forecast for the global power sector. Drawing on the expertise of over 90 technology, economics and policy specialists around the world, these six reports capture our best assessment of how energy markets will evolve over the next 25 years.
GLOBAL SUMMARY
Full Report
Charts
Data
AMERICAS
Full Report
Charts
Data
SOLAR
Full Report
Charts
Data
ASIA-PACIFIC
Full Report
Charts
Data
WIND
Full Report
Charts
Data
EUROPE
Full Report
Charts
Data



"Prediction is difficult, especially about the future"

– Niels Bohr

NEO KEY FINDINGS

Bloomberg NEW ENERGY FINANCE

1. Renewables will command just under 60% of the 9,786GW of new capacity and 65% of the $12.2 trillion of power investment to 2040.

2. Economics – rather than policy – will increasingly drive the uptake of renewable technologies.

3. The real solar revolution will be on rooftops, driven by high retail prices, and the availability of residential storage in some countries.

4. In developed economies, the link between economic growth and electricity consumption appears to be weakening and daily load profiles are getting ‘peakier’.

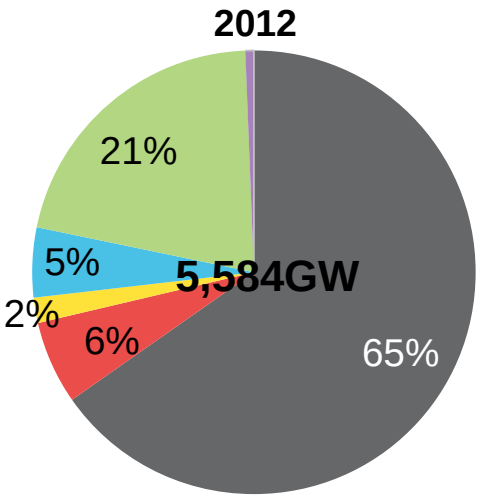
5. Gas’ role as a 'transitional fuel‘ is in question as less than 1,000GW of net capacity will be added globally by 2040.

6. Despite significant growth in renewables, fossil fuels will maintain a 44% share of generation in 2040 when CO_2 emissions will be 13% higher than today.

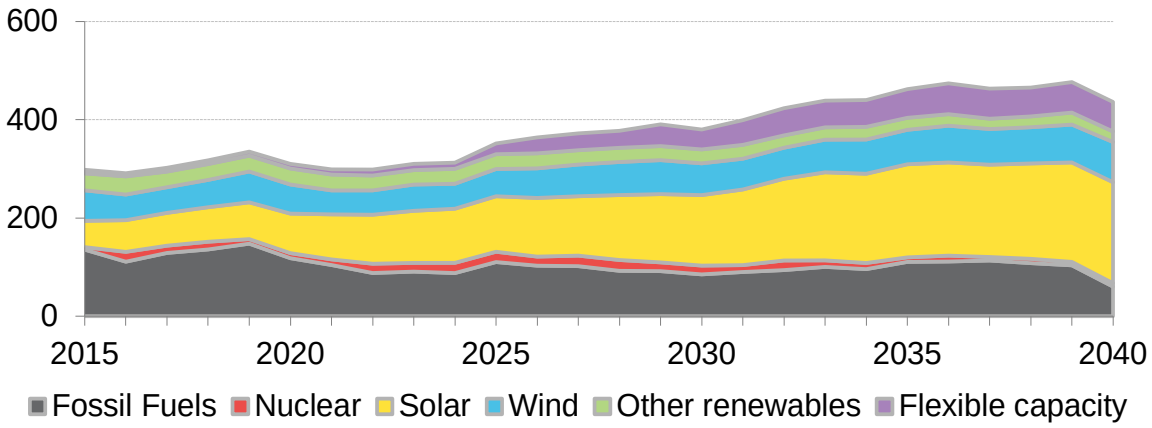
Source: Bloomberg New Energy Finance

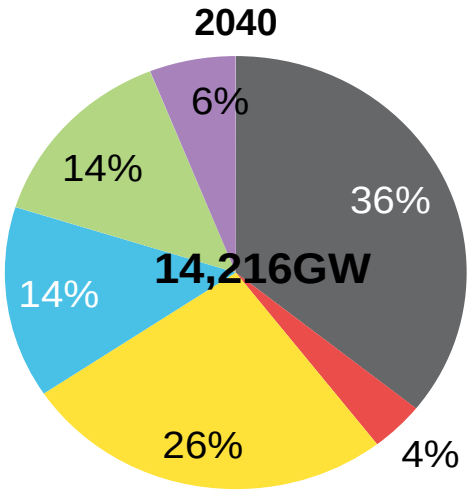
GLOBAL INSTALLED GENERATING CAPACITY AND PROJECTED ADDITIONS, BY TECHNOLOGY (GW)

Bloomberg NEW ENERGY FINANCE



ANNUAL CAPACITY ADDITIONS, 2015-40

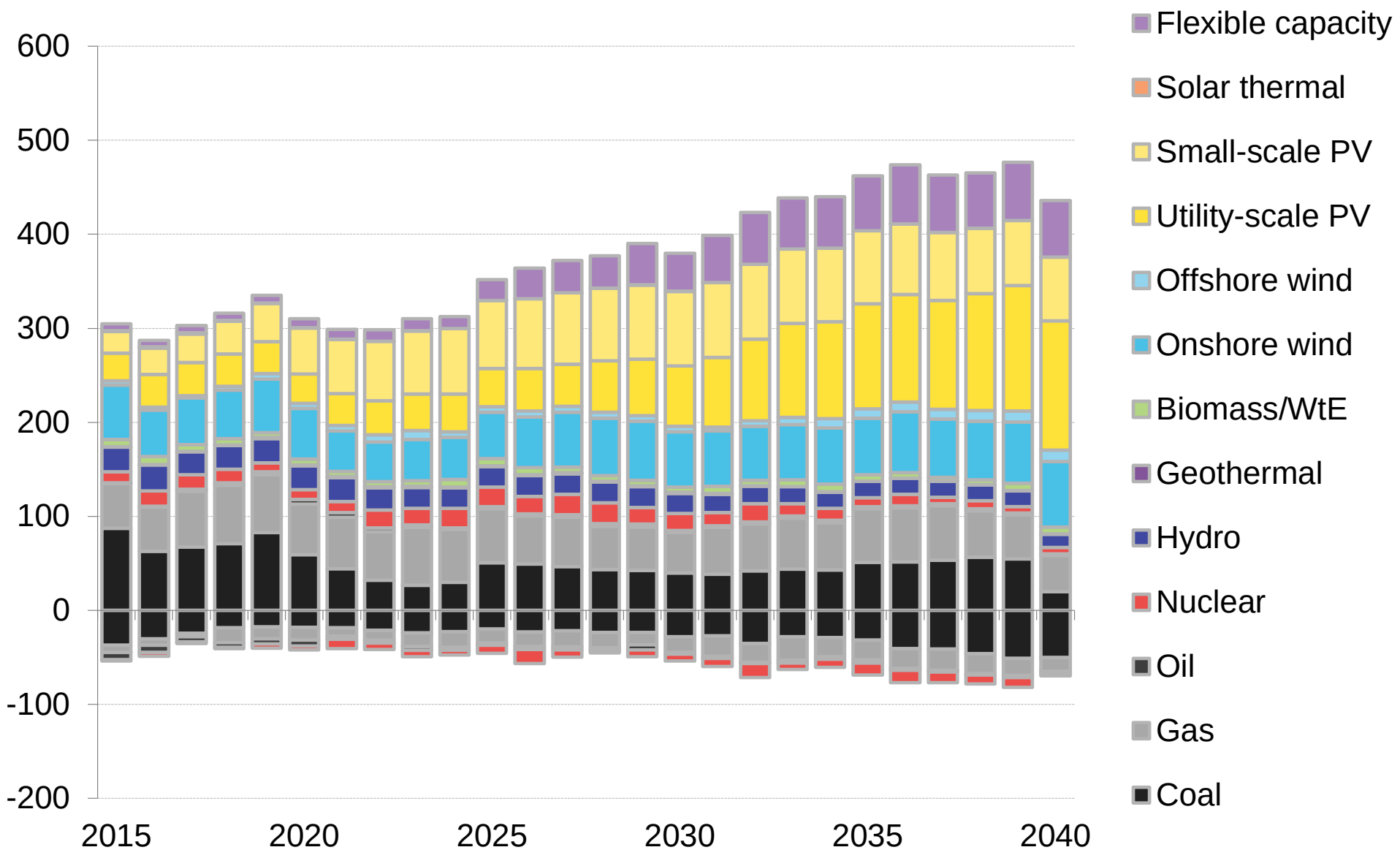




Source: Bloomberg New Energy Finance

GLOBAL GROSS ANNUAL CAPACITY ADDITIONS BY TECHNOLOGY, 2015-40 (GW)

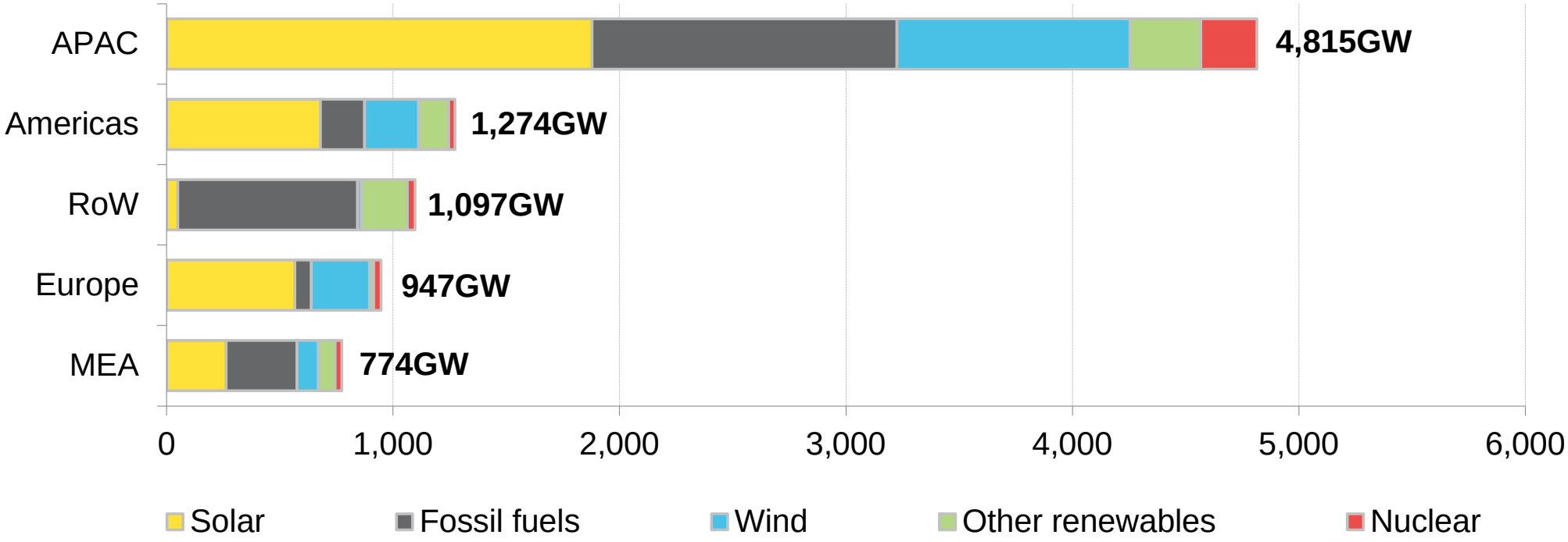
Bloomberg NEW ENERGY FINANCE



Source: Bloomberg New Energy Finance

GROSS CAPACITY ADDITIONS BY REGION AND BY TECHNOLOGY, 2015-40 (GW)

Bloomberg NEW ENERGY FINANCE



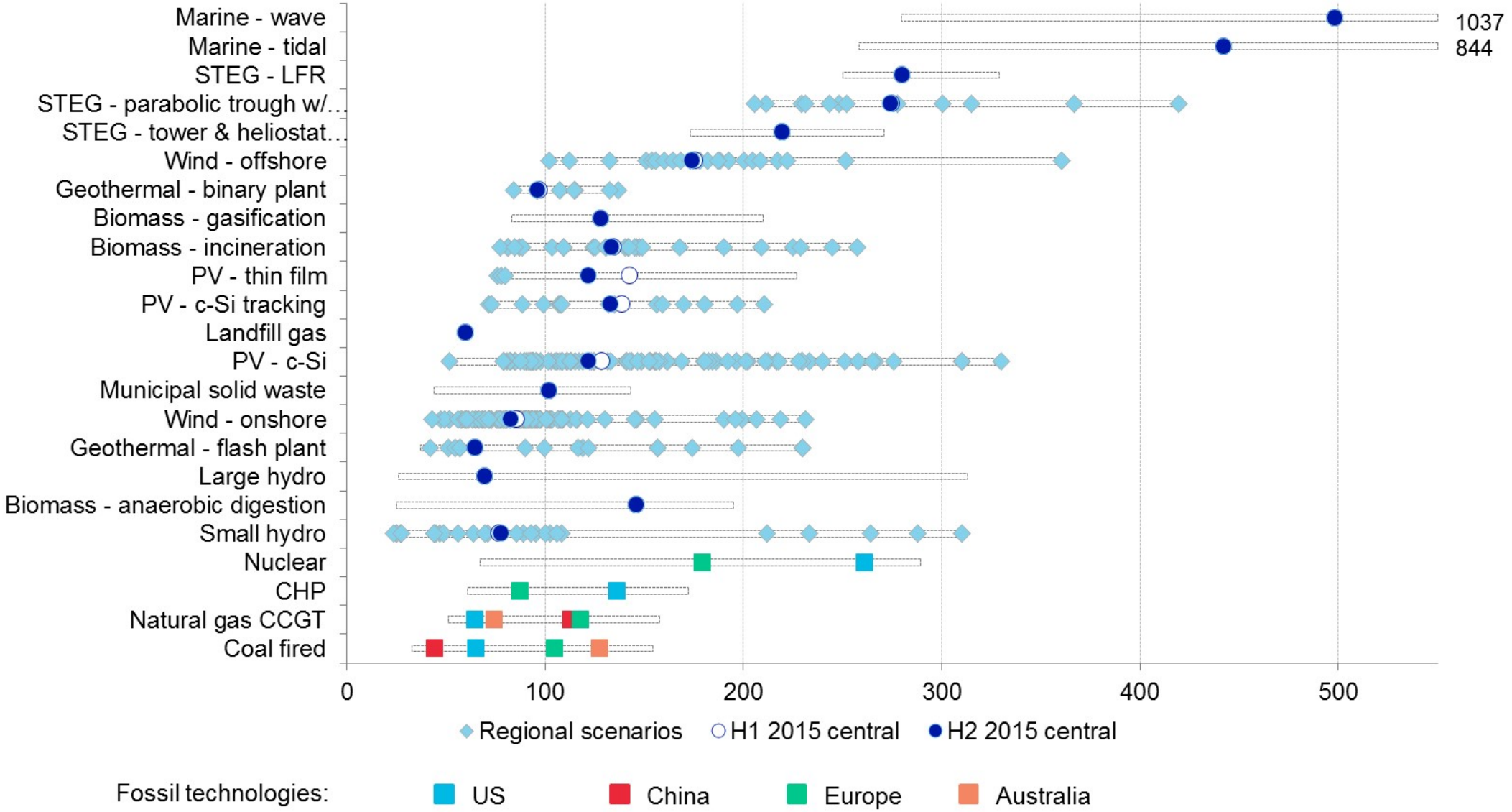
Note: Figure excludes other and flexible capacity.

Source: Bloomberg New Energy Finance

H2 2015 LEVELISED COST OF ELECTRICITY

CENTRAL AND REGIONAL SCENARIOS ($/MWH)

Bloomberg NEW ENERGY FINANCE

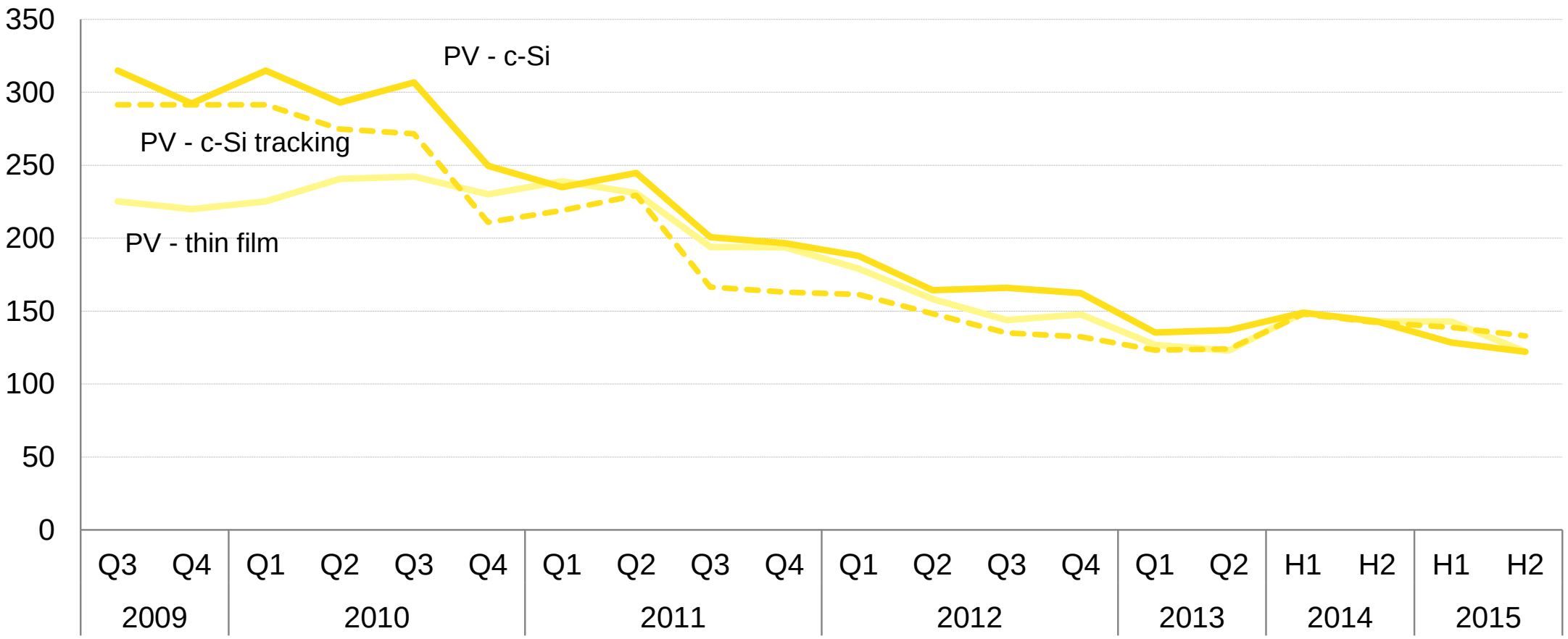


Note: STEG = solar thermal electric generation

Source: Bloomberg New Energy Finance

LCOE: PV (NO TRACKING)
CENTRAL SCENARIO ($/MWH)

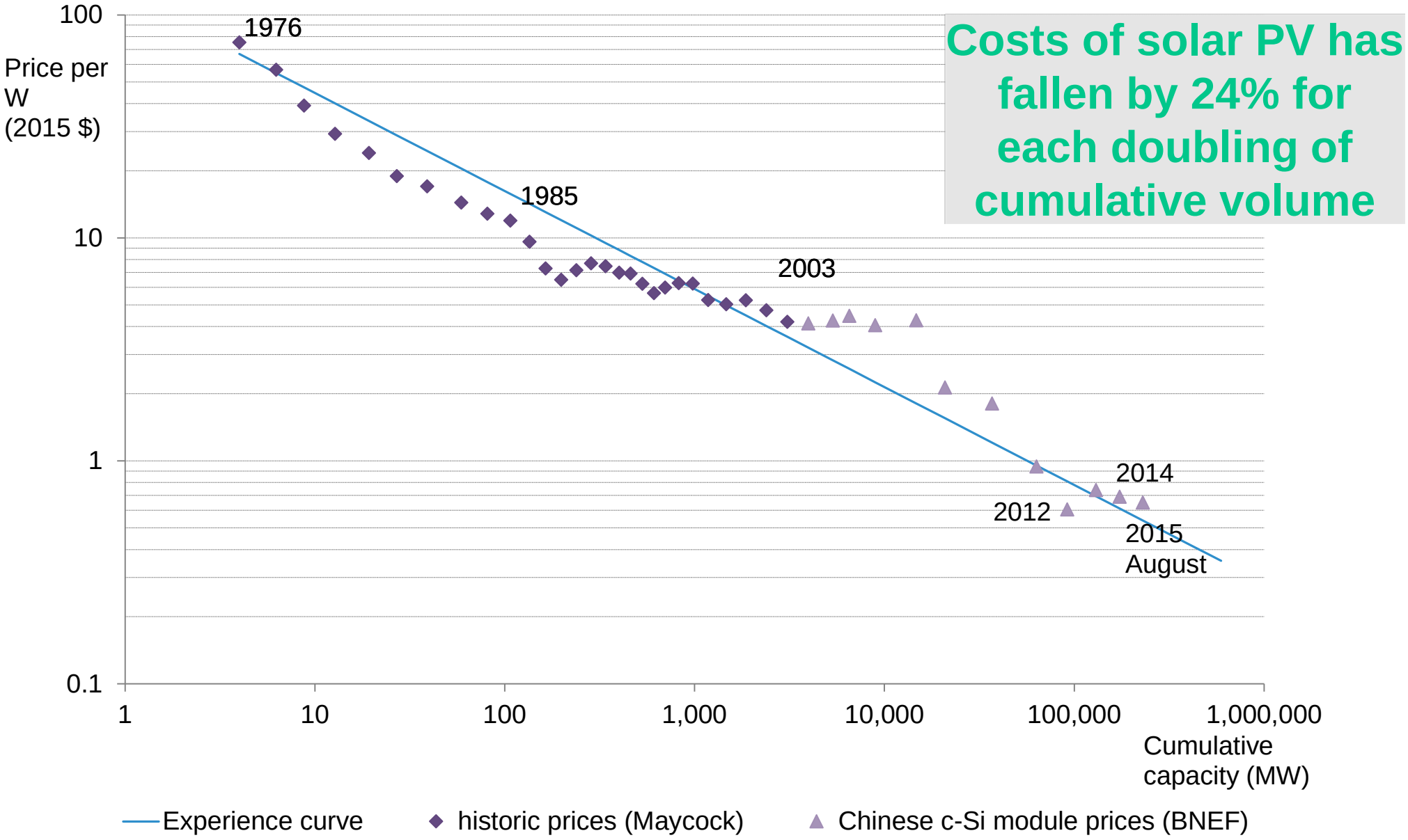
Bloomberg NEW ENERGY FINANCE



Source: Bloomberg New Energy Finance

PV EXPERIENCE CURVE, 1976-2015
2015 $/W

Bloomberg NEW ENERGY FINANCE



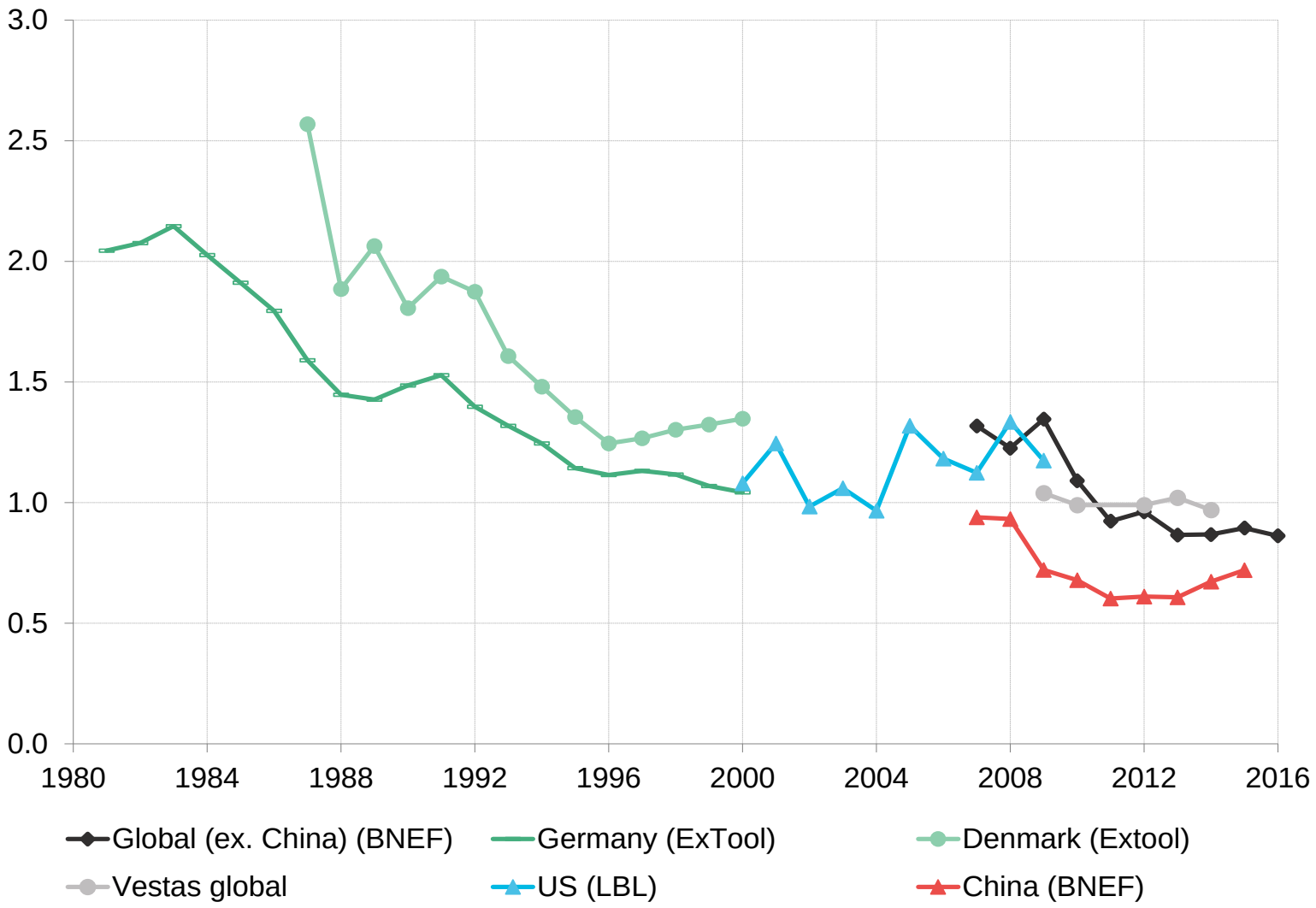
Costs of solar PV has fallen by 24% for each doubling of cumulative volume

Note: Prices inflation indexed to US PPI.

Source: Paul Maycock, Bloomberg New Energy Finance

WIND TURBINE PRICE
1984-2016E (2014 MEUR/MW, REAL 2014)

Bloomberg NEW ENERGY FINANCE



Note: China pricing exhibited for reference. As most data are available in Euros, we have converted the US wind turbine pricing data and China's wind turbine pricing data into Euros, which are subjected to exchange rate fluctuation effects.

Source: Source: Bloomberg New Energy Finance, Lawrence Berkeley National Laboratory (LBNL), ExTool study (Neij et al.2003), Vestas annual reports.

IMPROVEMENTS IN TURBINE TECHNOLOGY FOR WIND

Bloomberg NEW ENERGY FINANCE

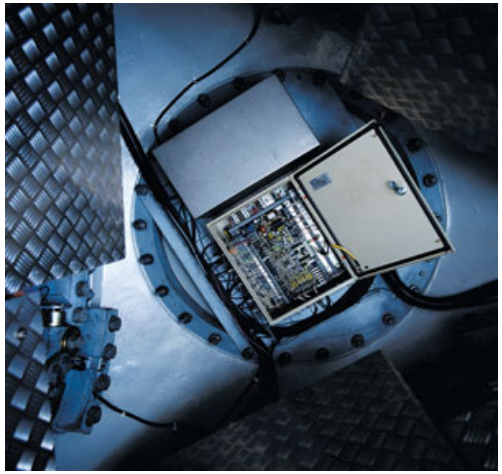
Hub height

Blade length, blade design

Improved component parts

Siting

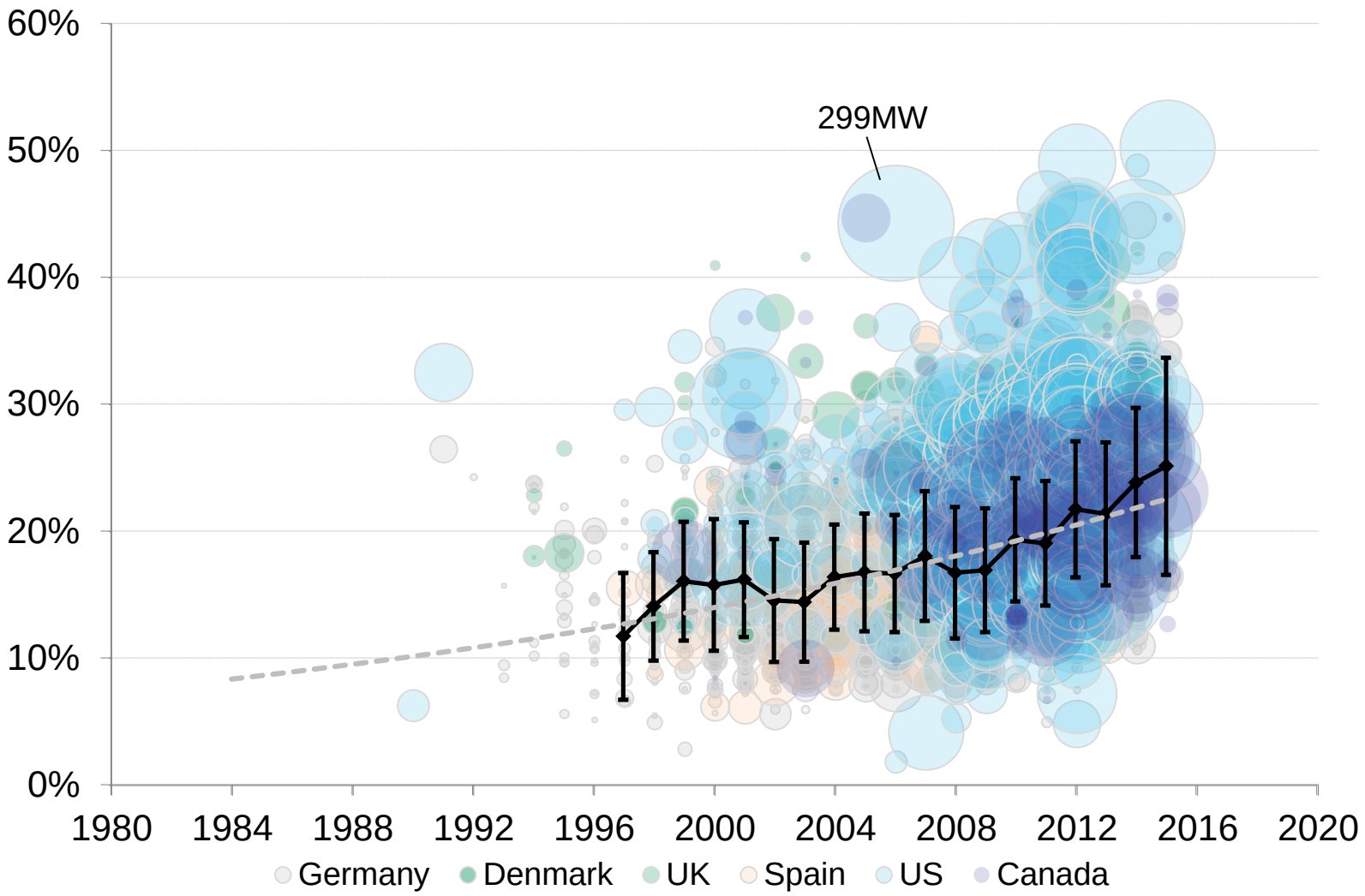
Turbine control software



Improved availability

GLOBAL (EX. CHINA) ONSHORE WIND CAPACITY FACTOR IMPROVEMENT OVER YEARS, 1997-2015 (%)

Bloomberg NEW ENERGY FINANCE

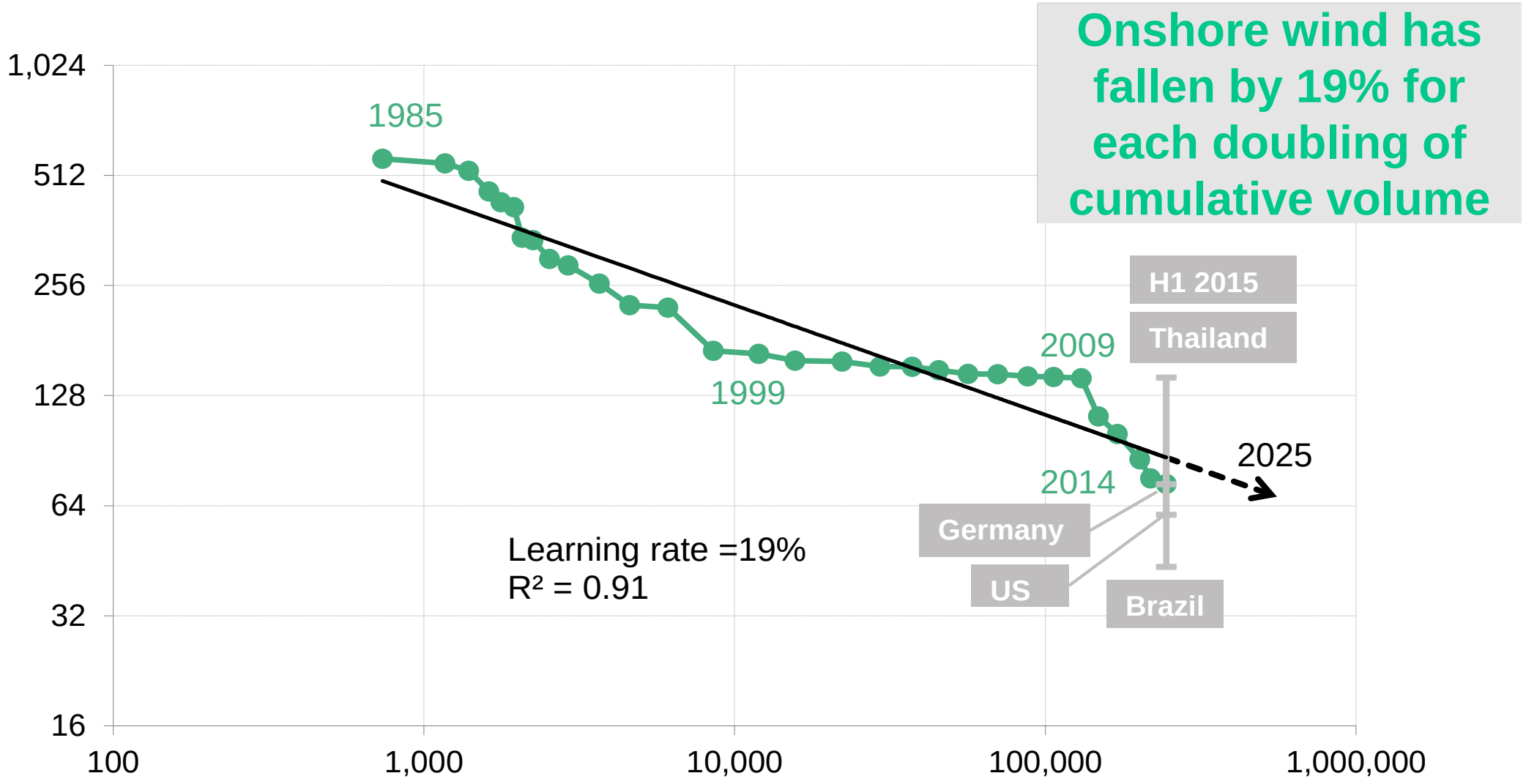


Note: We calculate the capacity factor with our proprietary Wind Farm Capacity Factor Tool using wind resource data provided by 3TIER by Vaisala. We assume P90 value in the capacity factor tool.

Source: Bloomberg New Energy Finance

ONSHORE WIND EXPERIENCE CURVE, 1985-2015 (2014 EUR/MWH, MW)

Bloomberg NEW ENERGY FINANCE

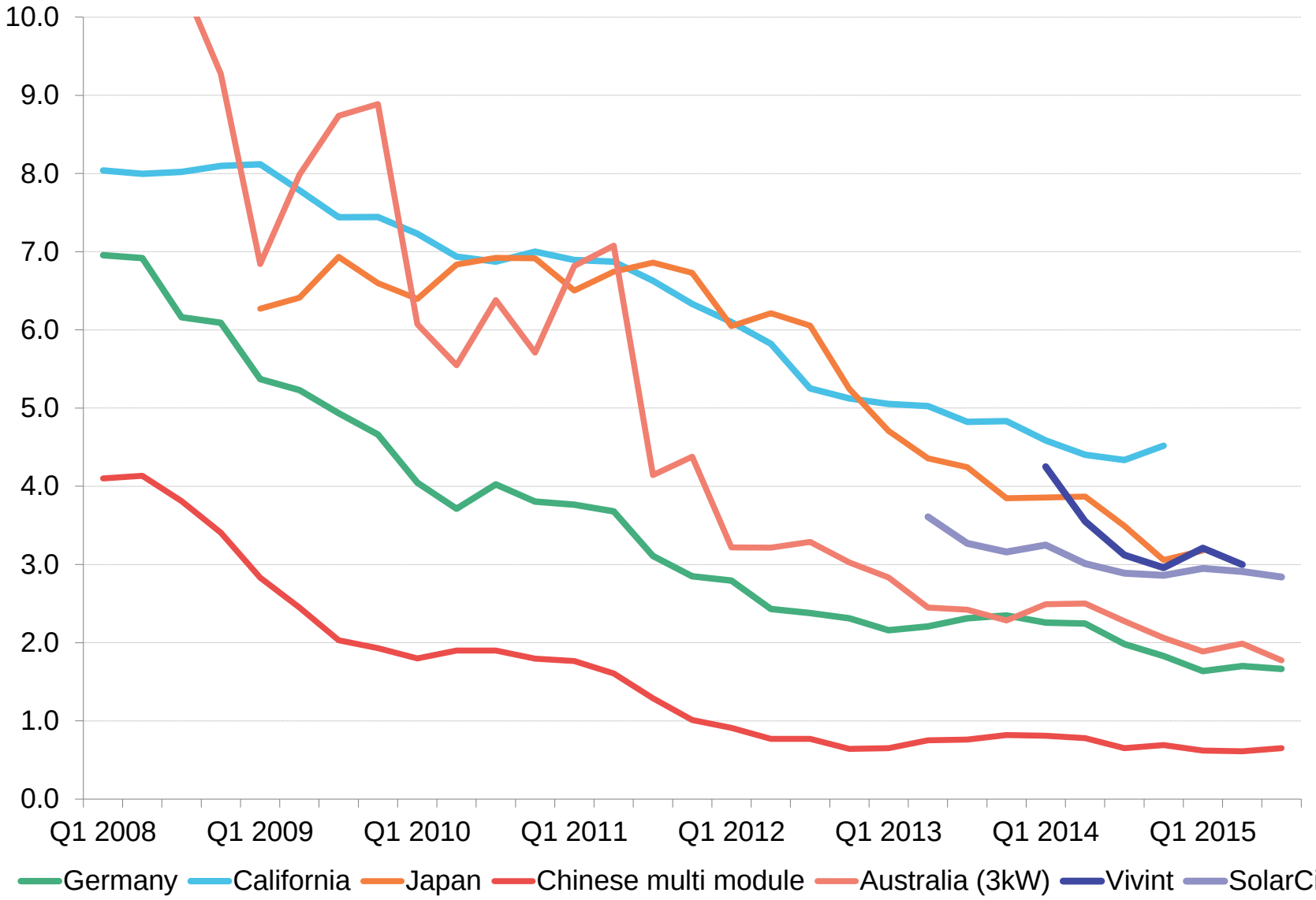


Note: Pricing data has been inflation corrected to 2014. We assume the debt ratio of 70%, cost of debt (bps to LIBOR) of 175, cost of equity of 8%. H1 2015 average LCOE data refers to H1 2015 Wind Levelised cost of electricity update. We convert US dollar to Euro based on the exchange rate of 0.8979 (exchange rate on 30 July 2015). Learning curve is least square regression: R^2 = 0.91 and learning rate=19%

Source: Bloomberg New Energy Finance

PUBLIC CAPEX BENCHMARKS FOR RESIDENTIAL PV SYSTEMS ($/W)

Bloomberg NEW ENERGY FINANCE



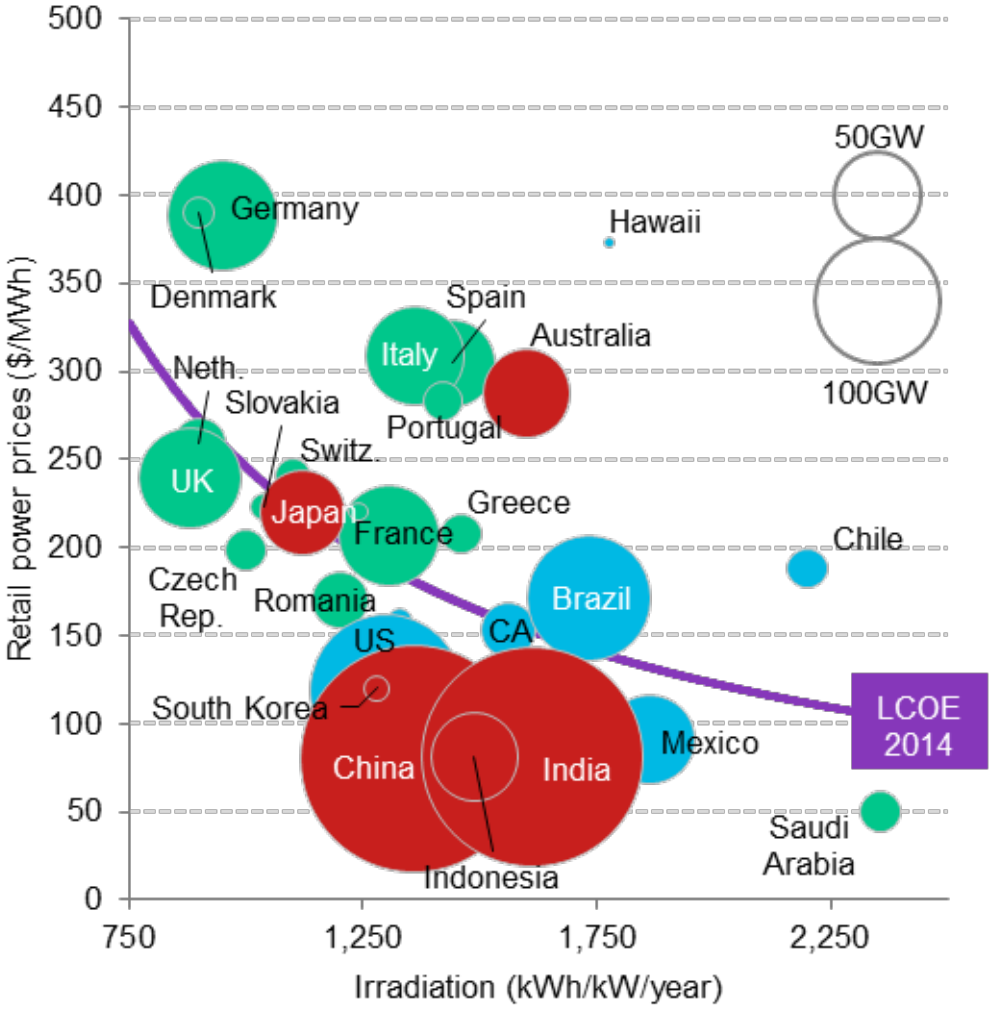
Source: Bloomberg New Energy Finance, BSW-Solar, Solarchoice.au, METI, company filings

Note: Data here.

GLOBAL RESIDENTIAL-SCALE PV SYSTEM ECONOMICS

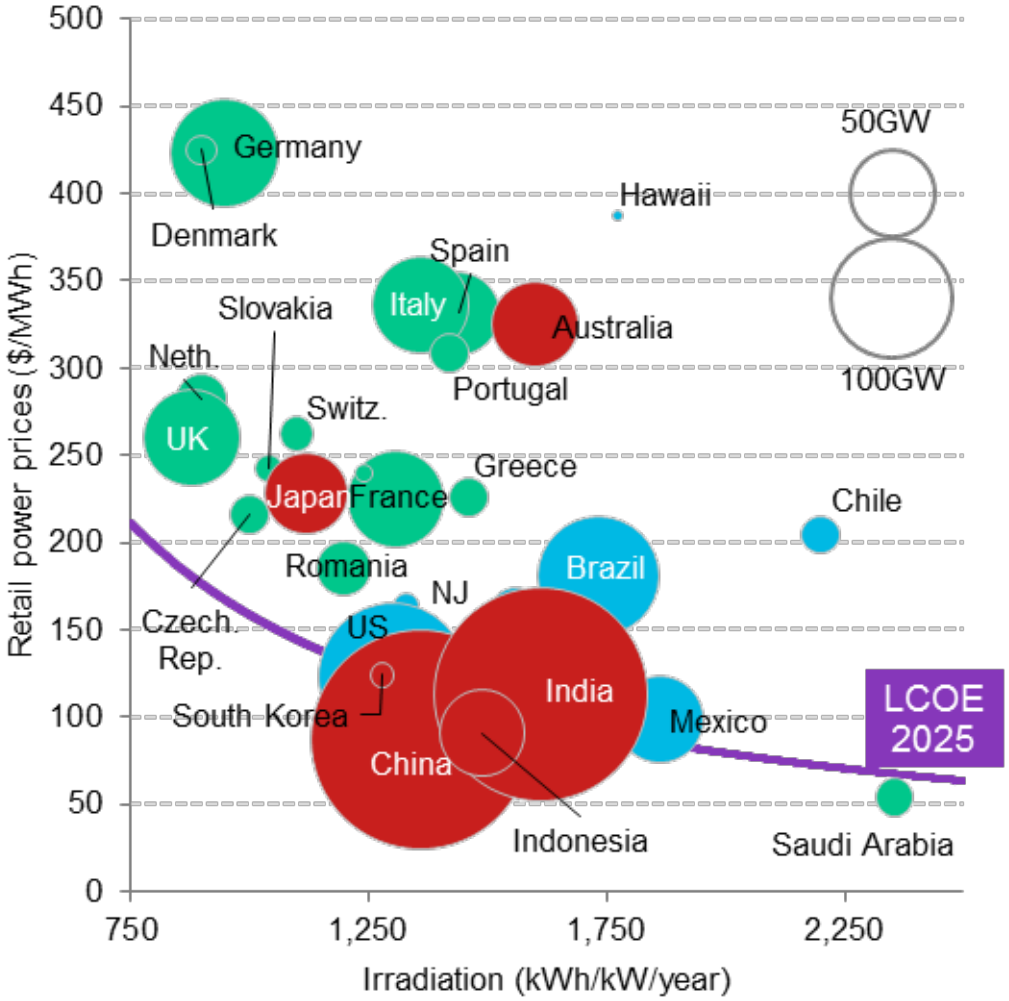
Bloomberg NEW ENERGY FINANCE

2014



Note: NJ, New Jersey; CA, California. Source: Bloomberg New Energy Finance

2025

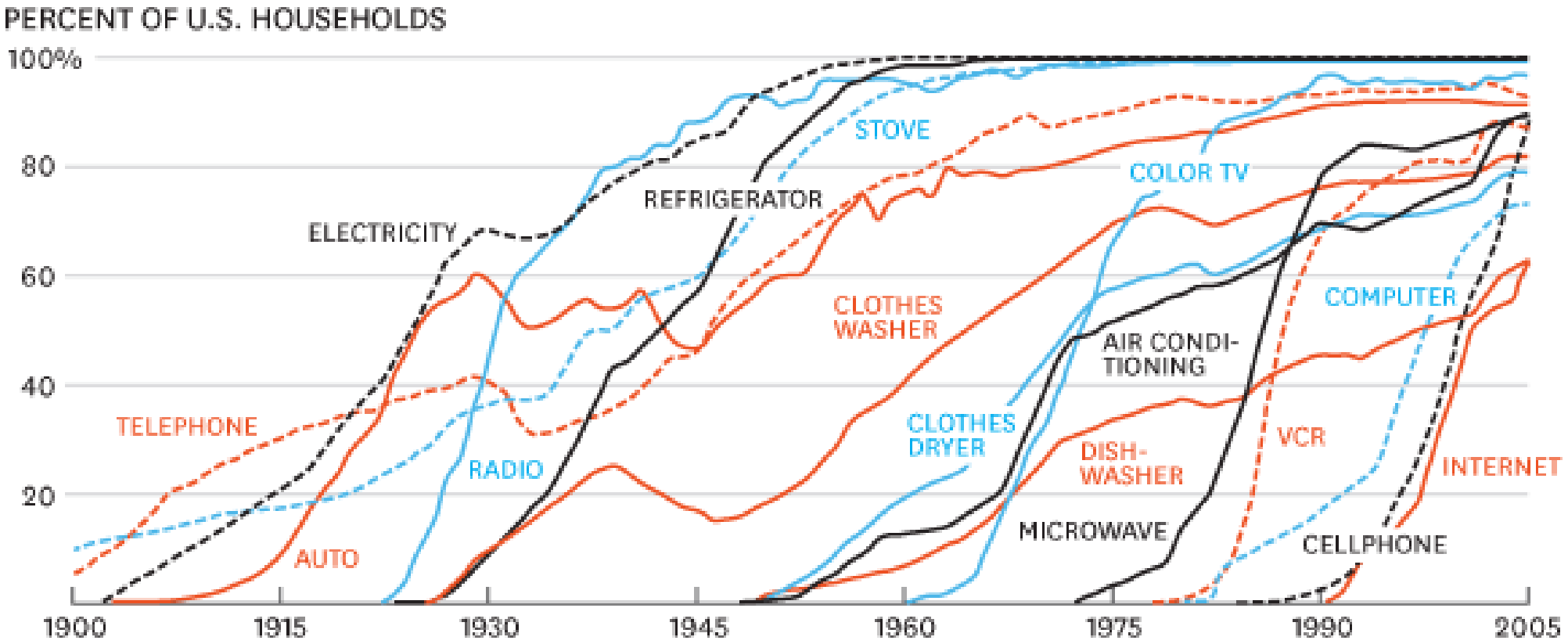


Note: NJ, New Jersey; CA, California. Source: Bloomberg New Energy Finance

Twitter: @SebHenbest

TECHNOLOGY UPTAKE CURVES

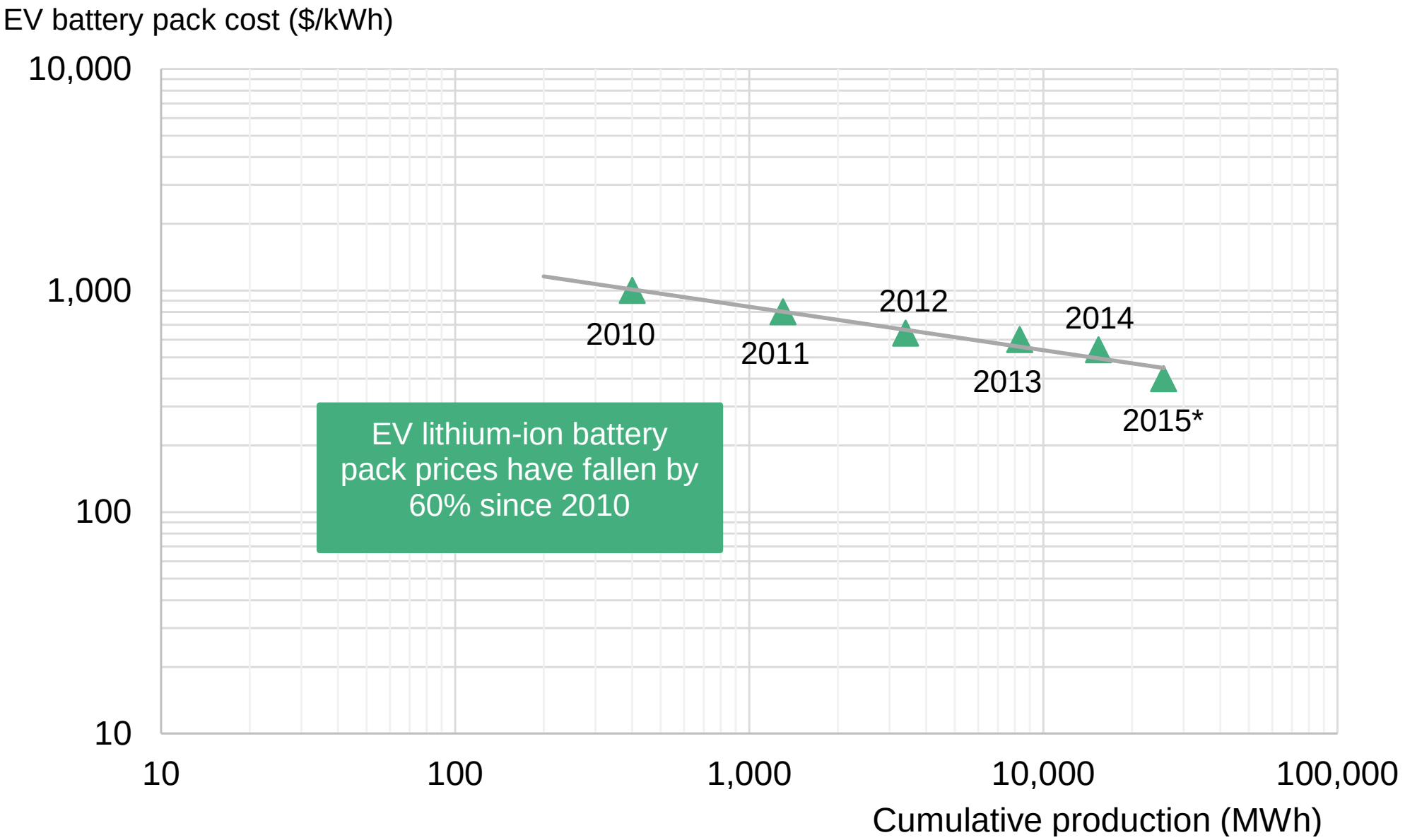
Bloomberg NEW ENERGY FINANCE



Source: Michael Felton, The New York Times, Harvard Business Review

EV LITHIUM-ION BATTERY PACKS: HISTORICAL COST REDUCTIONS

Bloomberg NEW ENERGY FINANCE



Note: Values from 2010-2014 are based on BNEF's annual battery price index, *2015 based on H1 data. For more see here: https://www.bnef.com/Insight/10299. Cumulative production is based on total EVs sold and their respective battery pack size.

Source: Bloomberg New Energy Finance

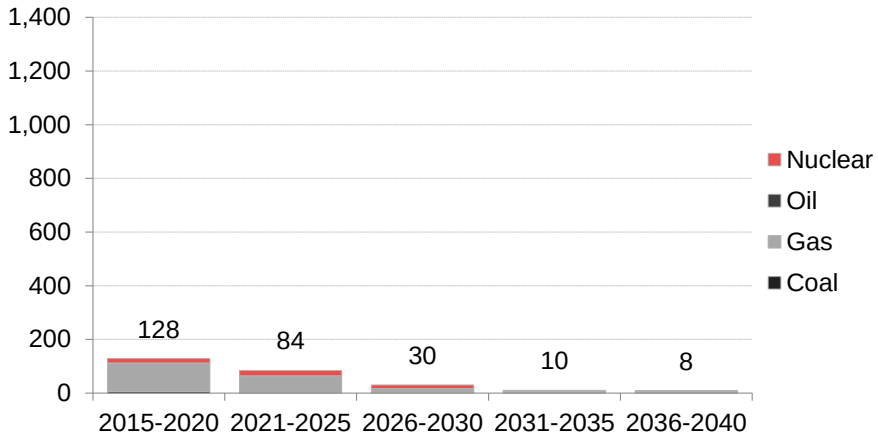
GROSS ANNUAL CAPACITY ADDITIONS
(GW)

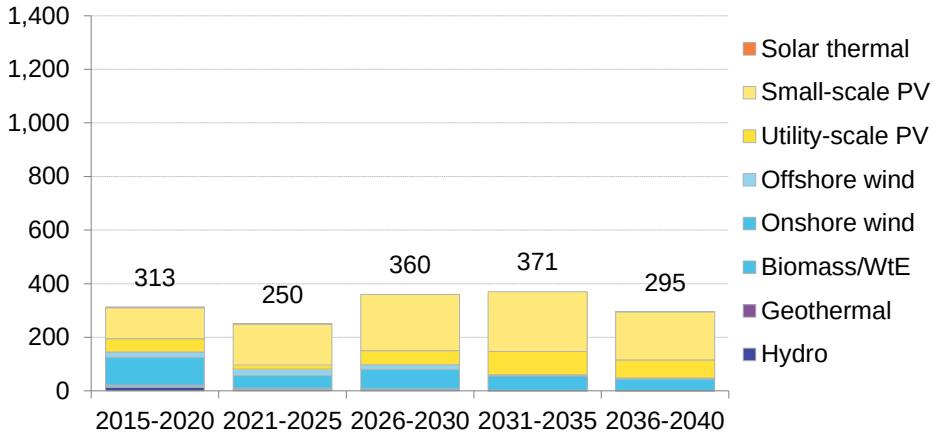
Bloomberg NEW ENERGY FINANCE

FOSSIL & NUCLEAR

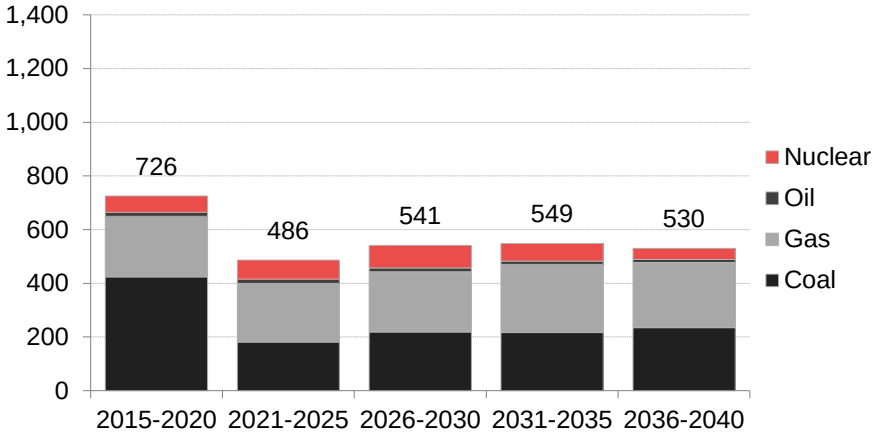
RENEWABLES

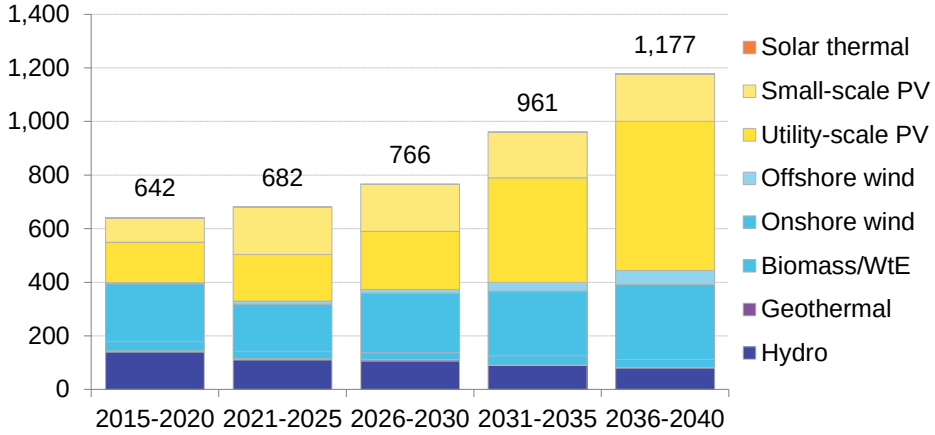
OECD





Non-OECD

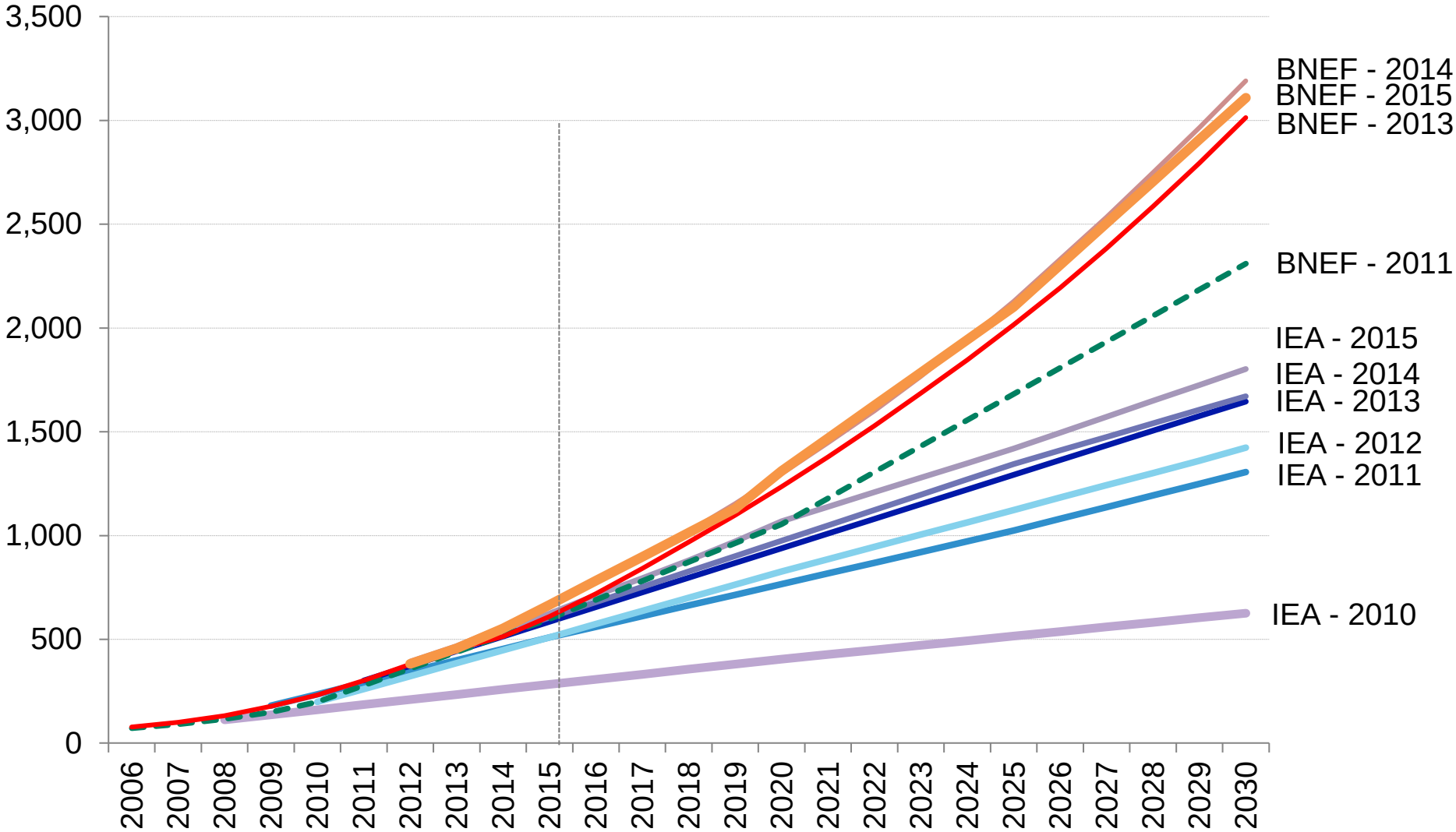




Source: Bloomberg New Energy Finance

BNEF & IEA: WIND & SOLAR CAPACITY FORECASTS (GW)

Bloomberg NEW ENERGY FINANCE



BNEF renewables forecasts have always outpaced IEA forecasts, and were closer to actual installed wind and solar capacity.

Source: Bloomberg New Energy Finance, IEA

COPYRIGHT AND DISCLAIMER

This publication is the copyright of Bloomberg New Energy Finance. No portion of this document may be photocopied, reproduced, scanned into an electronic system or transmitted, forwarded or distributed in any way without prior consent of Bloomberg New Energy Finance.

The information contained in this publication is derived from carefully selected sources we believe are reasonable. We do not guarantee its accuracy or completeness and nothing in this document shall be construed to be a representation of such a guarantee. Any opinions expressed reflect the current judgment of the author of the relevant article or features, and does not necessarily reflect the opinion of Bloomberg New Energy Finance, Bloomberg Finance L.P., Bloomberg L.P. or any of their affiliates ("Bloomberg"). The opinions presented are subject to change without notice. Bloomberg accepts no responsibility for any liability arising from use of this document or its contents. Nothing herein shall constitute or be construed as an offering of financial instruments, or as investment advice or recommendations by Bloomberg of an investment strategy or whether or not to "buy," "sell" or "hold" an investment.

MARKETS

Renewable Energy
Energy Smart Technologies
Advanced Transport
Gas
Carbon and RECs

SERVICES

Americas Service
Asia Pacific Service
EMEA Service
Applied Research
Events and Workshops

Unique analysis, tools and data for decision-makers driving change in the energy system

sales.bnef@bloomberg.net

Seb Henbest

shenbest@bloomberg.net

Bloomberg
NEW ENERGY FINANCE