

GLOBAL ENERGY TRENDS – POLICY IMPLICATIONS

HOUSE OF LORDS & LONG FINANCE SEMINAR

MICHAEL WILSHIRE

19 NOVEMBER 2013



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.

DRIVERS AND CHALLENGES FOR CLEAN ENERGY

DRIVERS

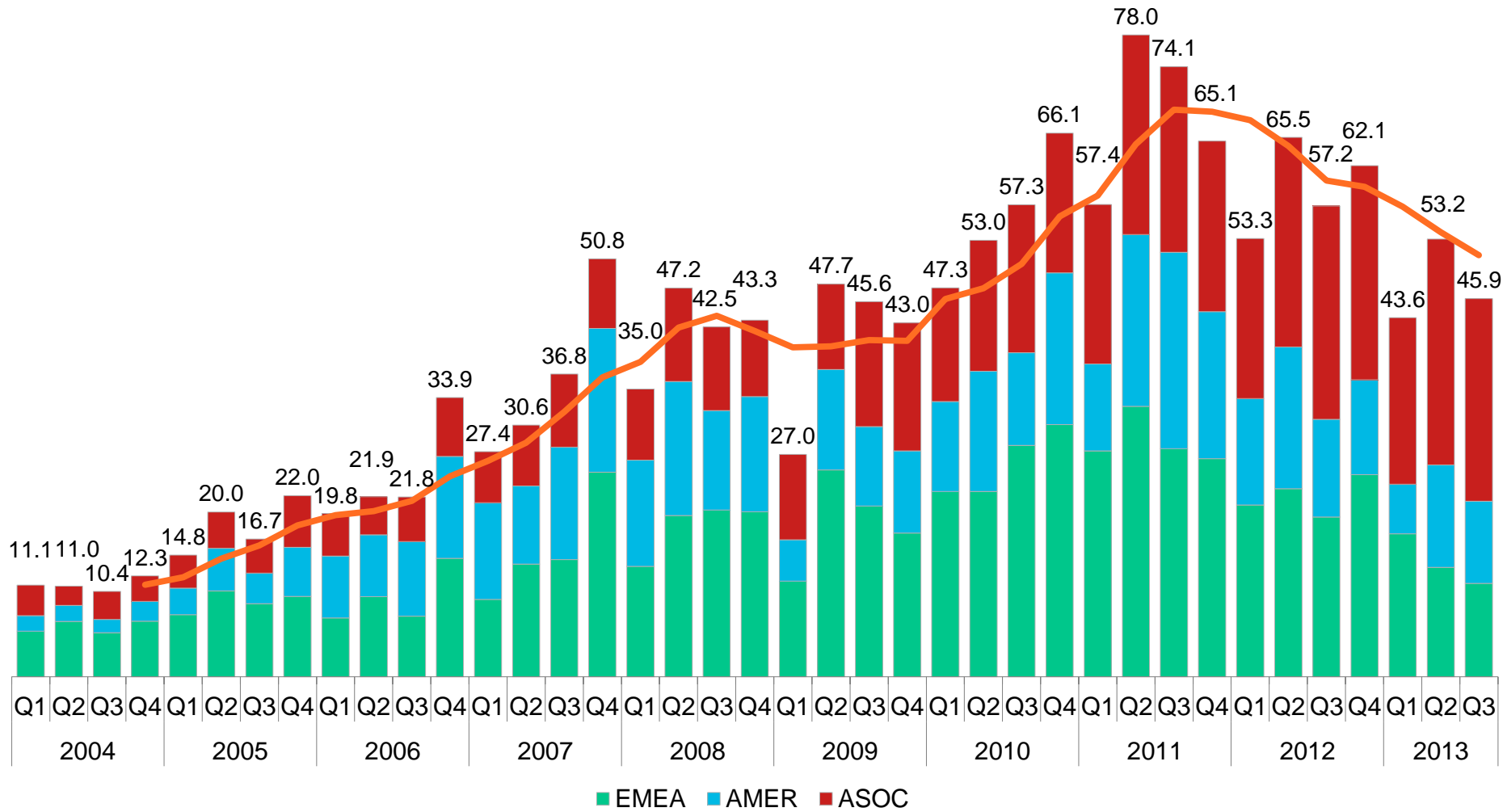
- Policy support/subsidies for clean energy
- Increasing cost competitiveness of renewable generation
- Diversity and fuel security
- Attractiveness as an asset class/alternative to bonds

CHALLENGES

- Escalating cost of renewable subsidies
- Cutbacks/uncertainty over policy support – eg US, Spain, Italy, UK.
- Difficulty in aligning support with changes in technology prices
- Shortage of project debt as banks retrench; 15 year debt hard to find
- Competition from gas-fired generation
- New sources of finance, eg bonds for institutions, but limited progress to date

NEW INVESTMENT IN CLEAN ENERGY BY REGION

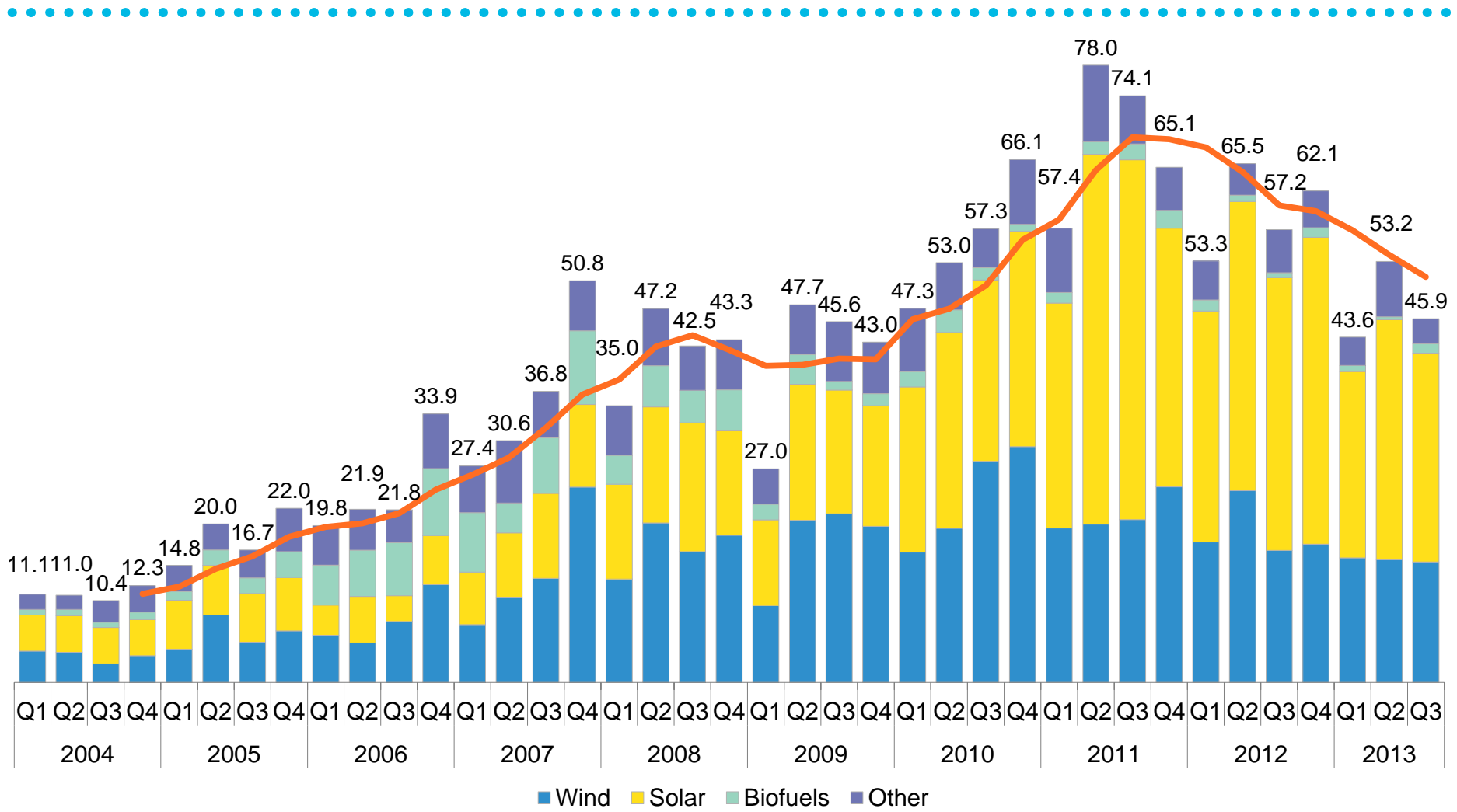
Q1 2004–Q3 2013 (\$BN)



Note: Total values include estimates for undisclosed deals. Excludes corporate R&D, government R&D, digital energy asset investment and energy storage asset investment (only available annually) Source: Bloomberg New Energy Finance

NEW INVESTMENT IN CLEAN ENERGY BY SECTOR

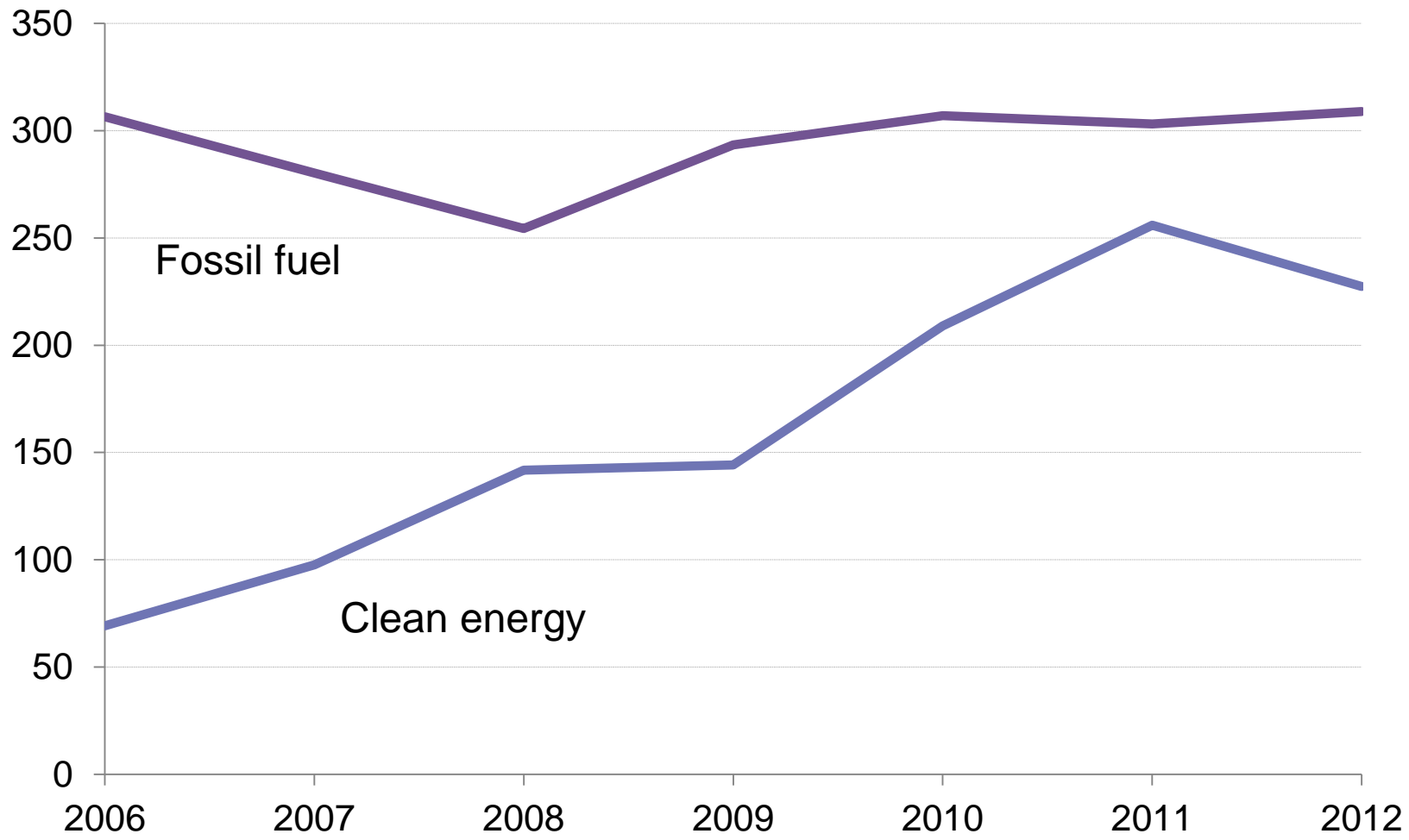
Q1 2004–Q3 2013 (\$BN)



Note: Total values include estimates for undisclosed deals. Excludes corporate R&D, government R&D, digital energy asset investment and energy storage asset investment (only available annually)

Source: Bloomberg New Energy Finance

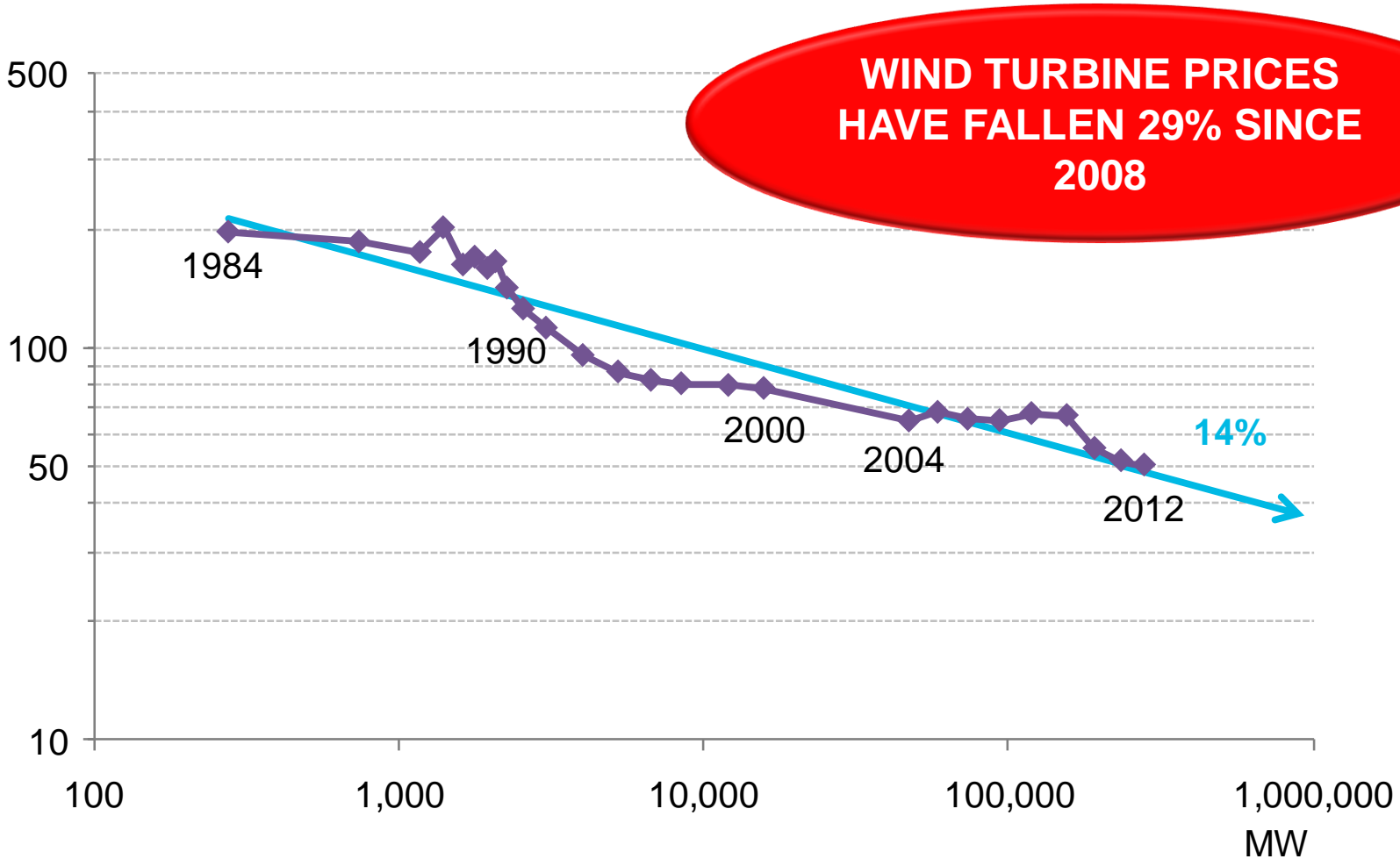
CLEAN VS FOSSIL-BASED GENERATING CAPACITY INVESTMENT, 2006–12 (\$BN)



Note: Clean energy total excludes large hydro. Fossil fuel is investment on coal and gas capacity. We assume capacity retirement of 3.3%/yr for coal and 4%/yr for gas.

Source: Bloomberg New Energy Finance

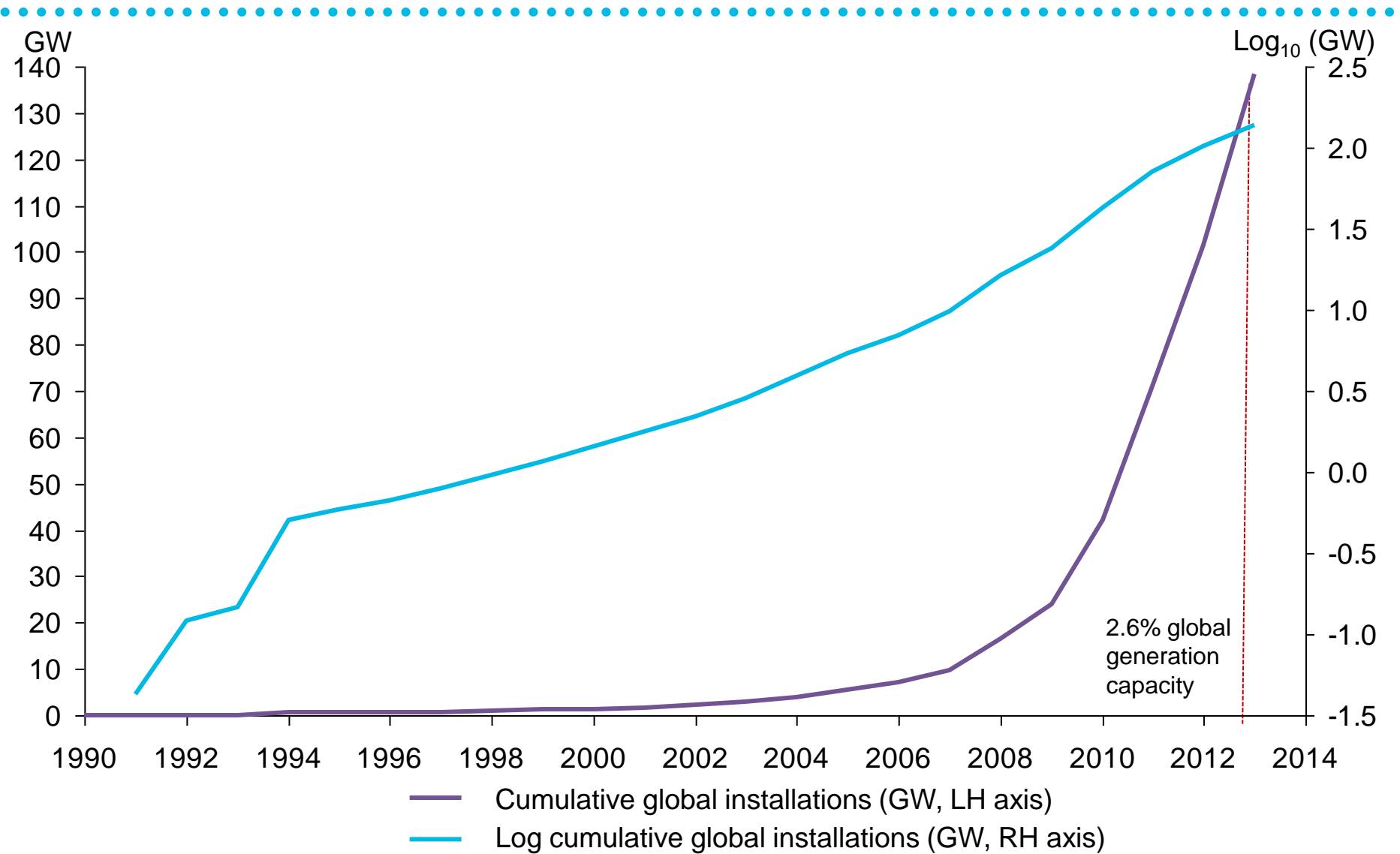
AVERAGE LEVELISED COST OF ONSHORE WIND, 1984-2012 (€/MWH)



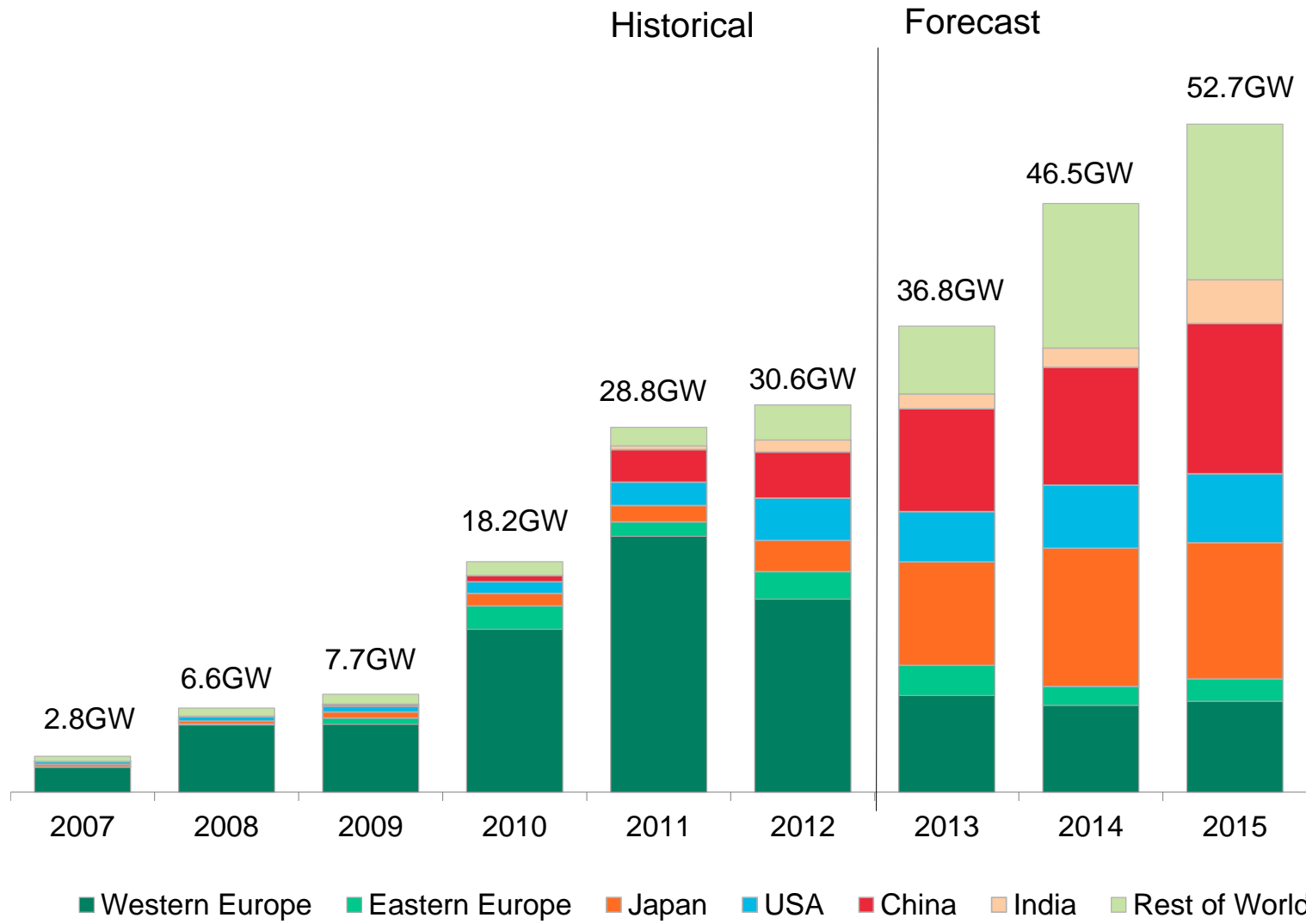
Note: Learning curve (blue line) is least square regression: $R^2 = 0.88$ and 14% learning rate.

Source: Bloomberg New Energy Finance, ExTool

THE EXPONENTIAL GROWTH OF SOLAR PV: GW, LOG(GW)

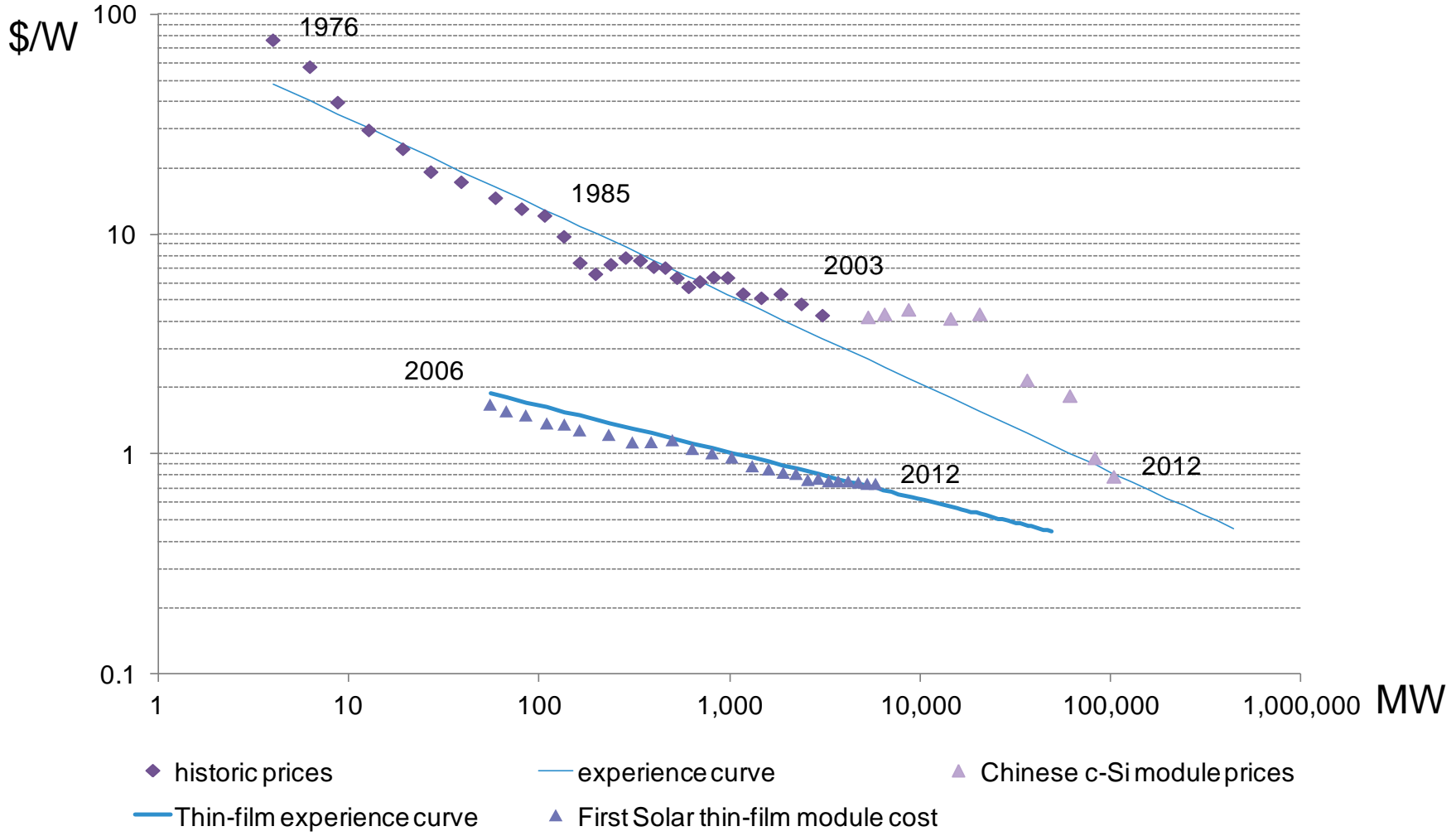


PV INSTALLATION BY YEAR, HISTORICAL AND CENTRAL FORECAST, 2007-15 (MW)



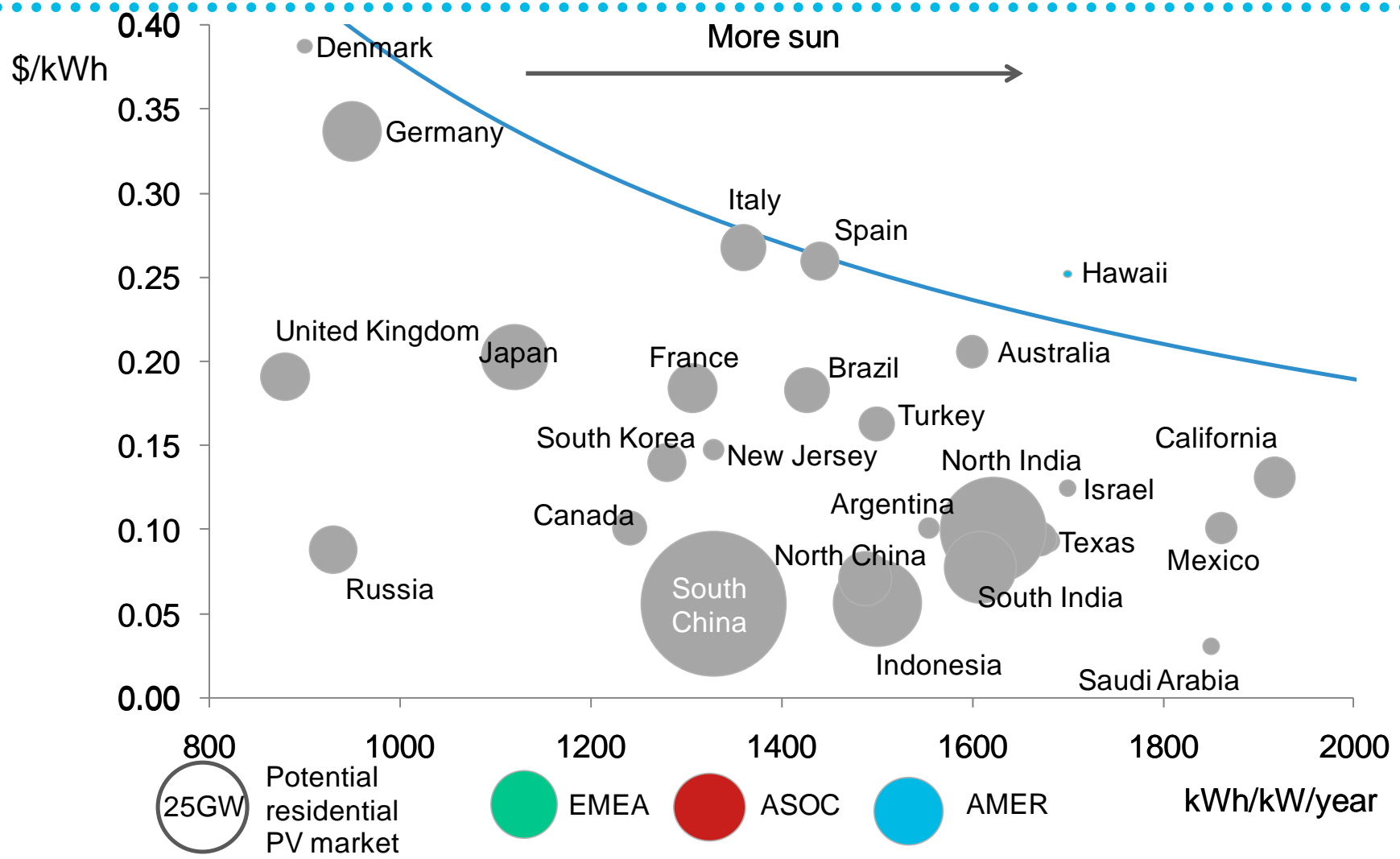
Source: Grid operators, incentive programme administrators, industry associations, Bloomberg New Energy Finance

PV EXPERIENCE CURVE, 1976-2012 (\$/W)



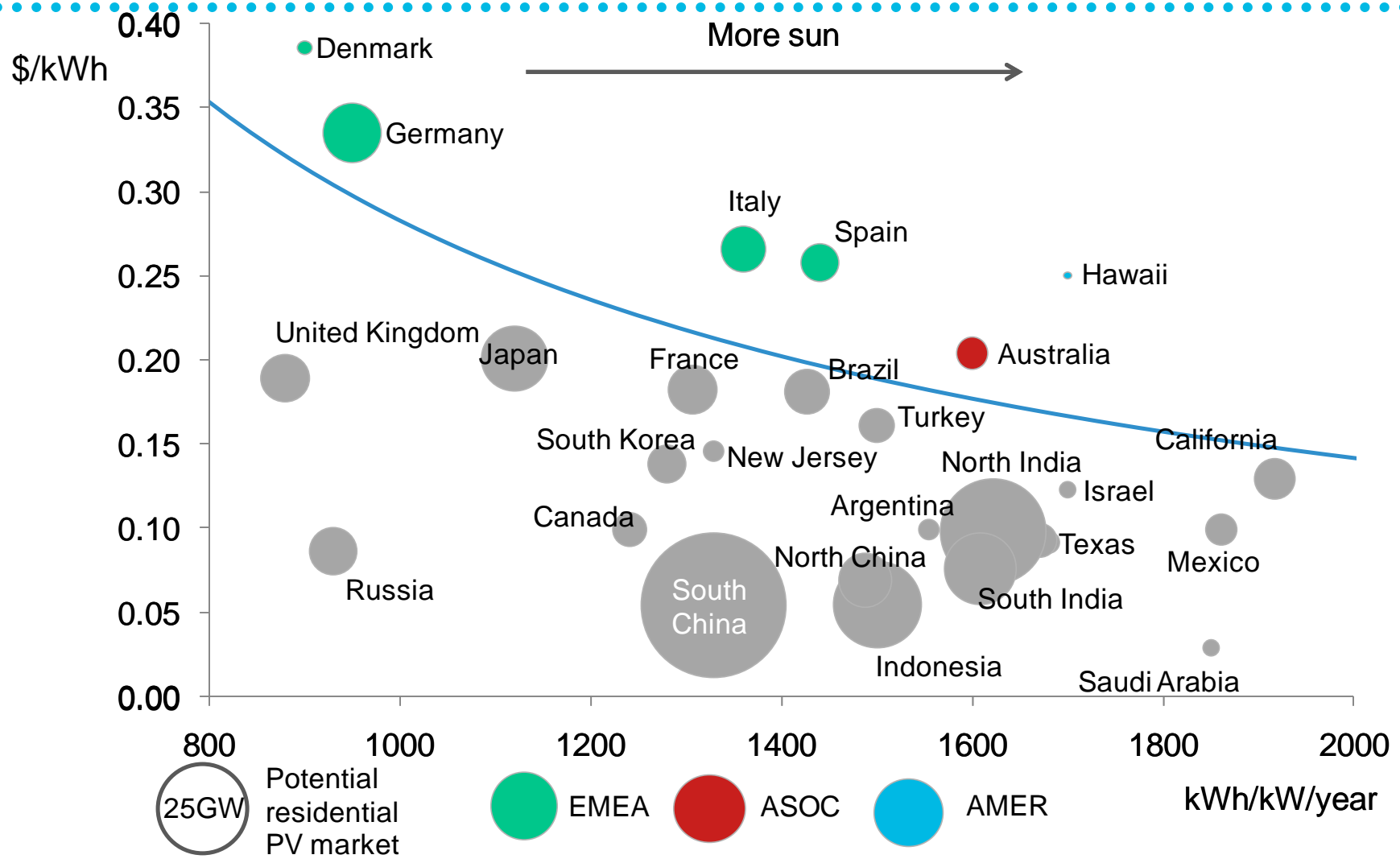
Note: learning rate crystalline silicon calculated at 24.3% 1976-2003 (2004-2008 are clearly value-based). FSLR calculated at 13.7%, 2006- May 2012. Prices inflation indexed. Source: Paul Maycock, Bloomberg New Energy Finance

RESIDENTIAL ELECTRICITY PRICE 2012, INSOLATION, RESIDENTIAL PV LCOE 2010



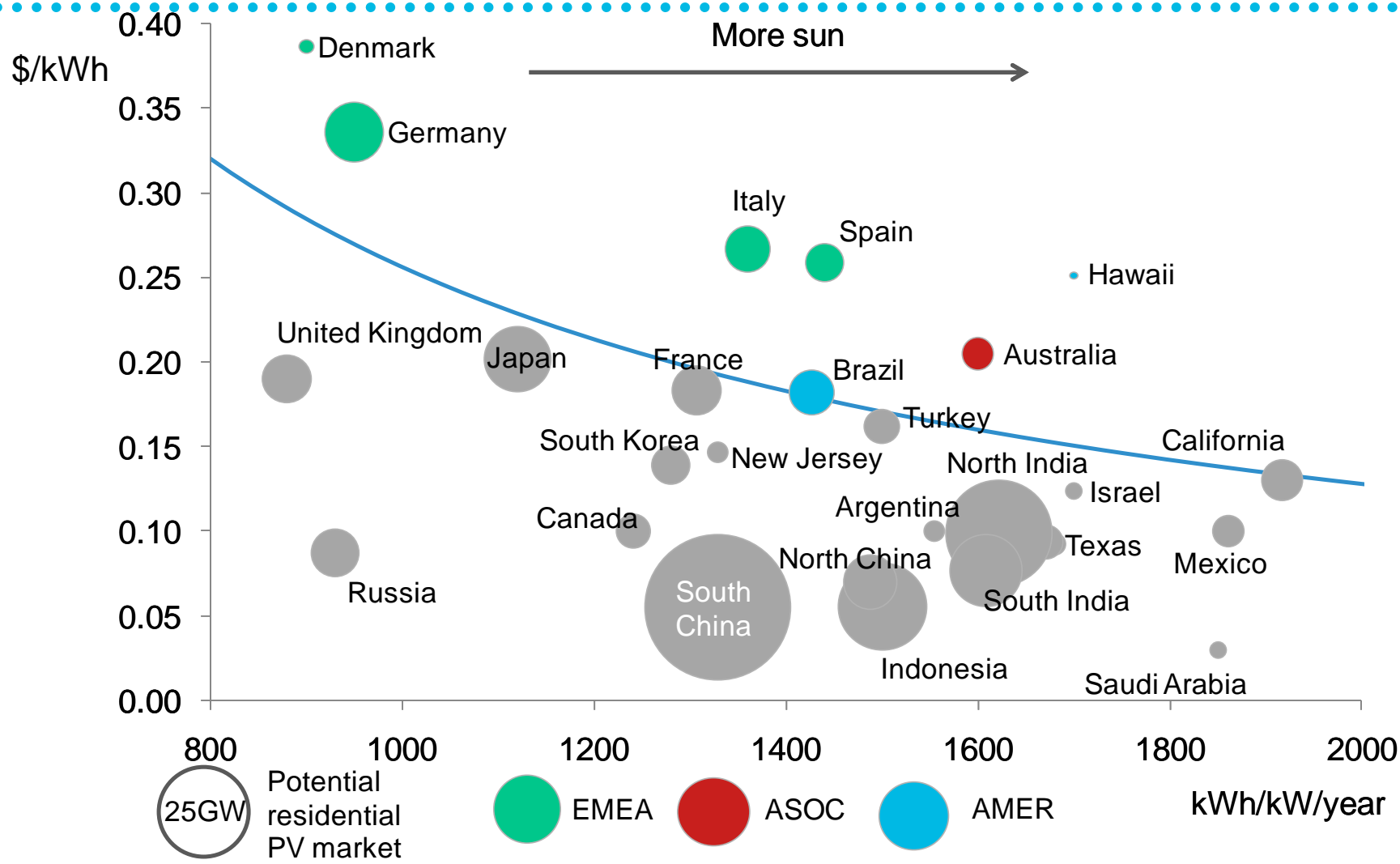
Note: LCOE based on 6% weighted average cost of capital, 0.7%/year module degradation, 1% capex as O&M annually. \$4.03/W capex assumed for 2010 Source: Eurostat, grid operators, Bloomberg New Energy Finance

RESIDENTIAL ELECTRICITY PRICE 2012, INSOLATION, RESIDENTIAL PV LCOE 2012



Note: LCOE based on 6% weighted average cost of capital, 0.7%/year module degradation, 1% capex as O&M annually. \$3.01/W capex assumed for 2012 Source: Eurostat, grid operators, Bloomberg New Energy Finance

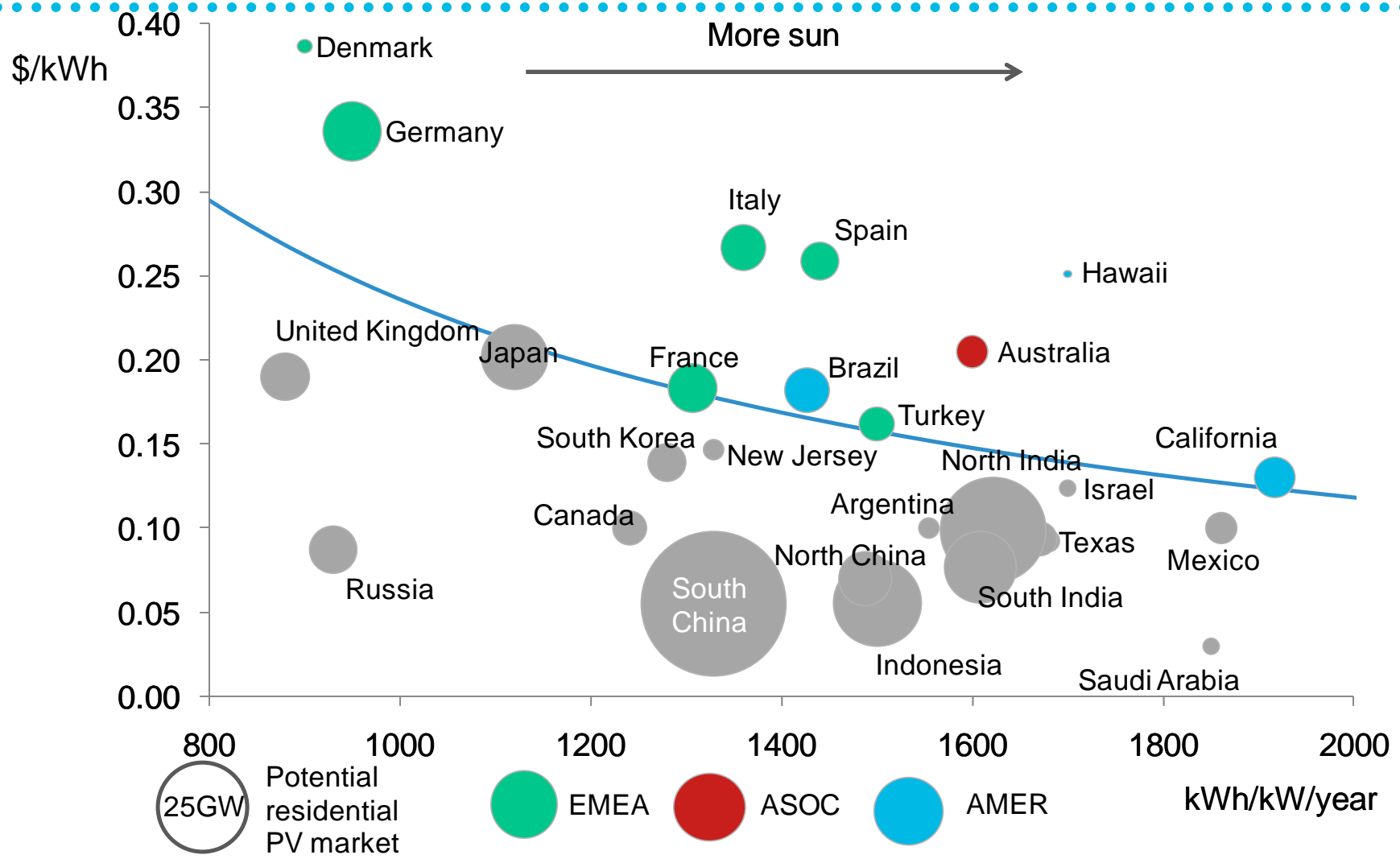
RESIDENTIAL ELECTRICITY PRICE 2012, INSOLATION, RESIDENTIAL PV LCOE 2013



Note: LCOE based on 6% weighted average cost of capital, 0.7%/year module degradation, 1% capex as O&M annually. \$2.72/W capex assumed for 2013

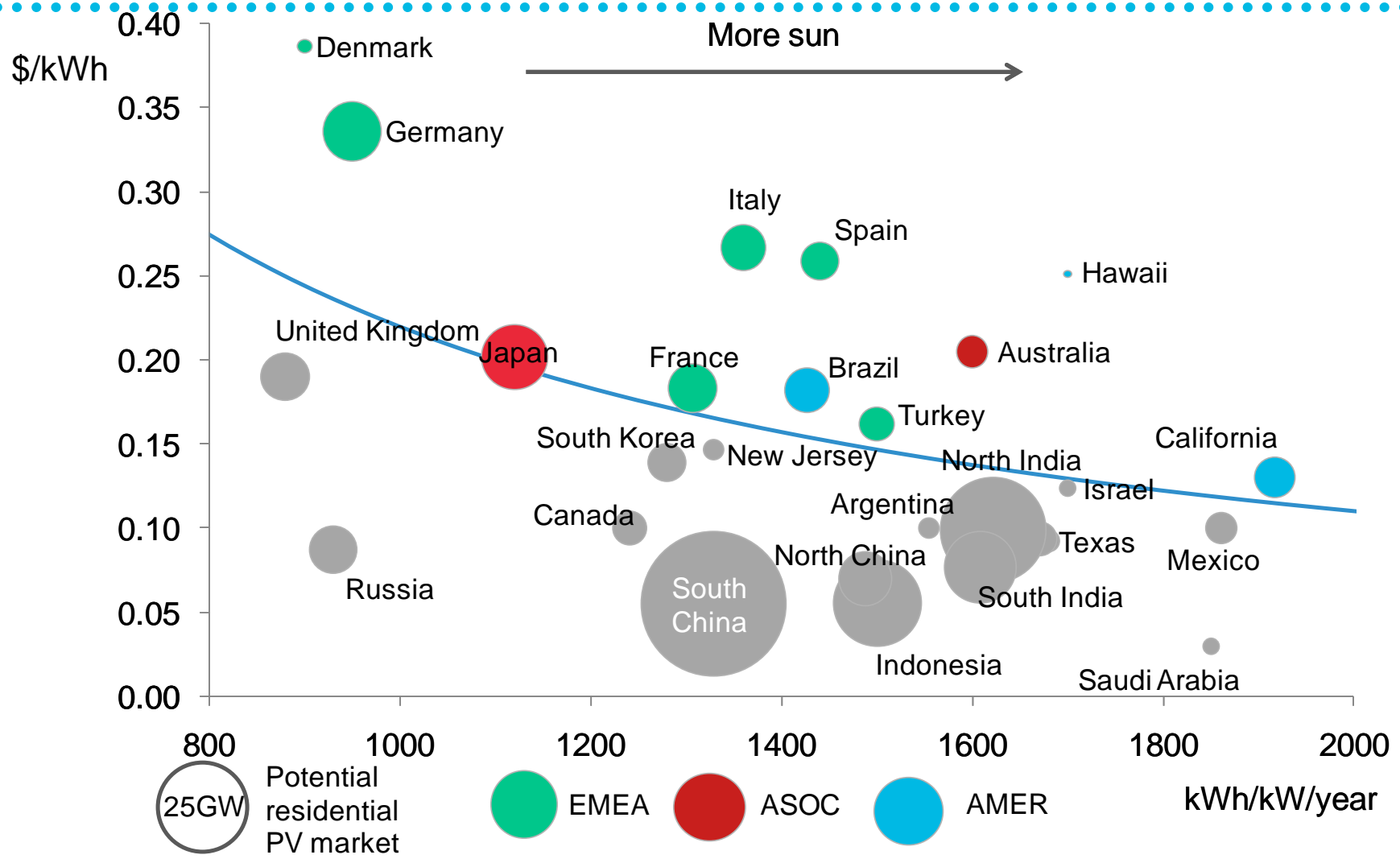
Source: Eurostat, grid operators, Bloomberg New Energy Finance

RESIDENTIAL ELECTRICITY PRICE 2012, INSOLATION, RESIDENTIAL PV LCOE 2014



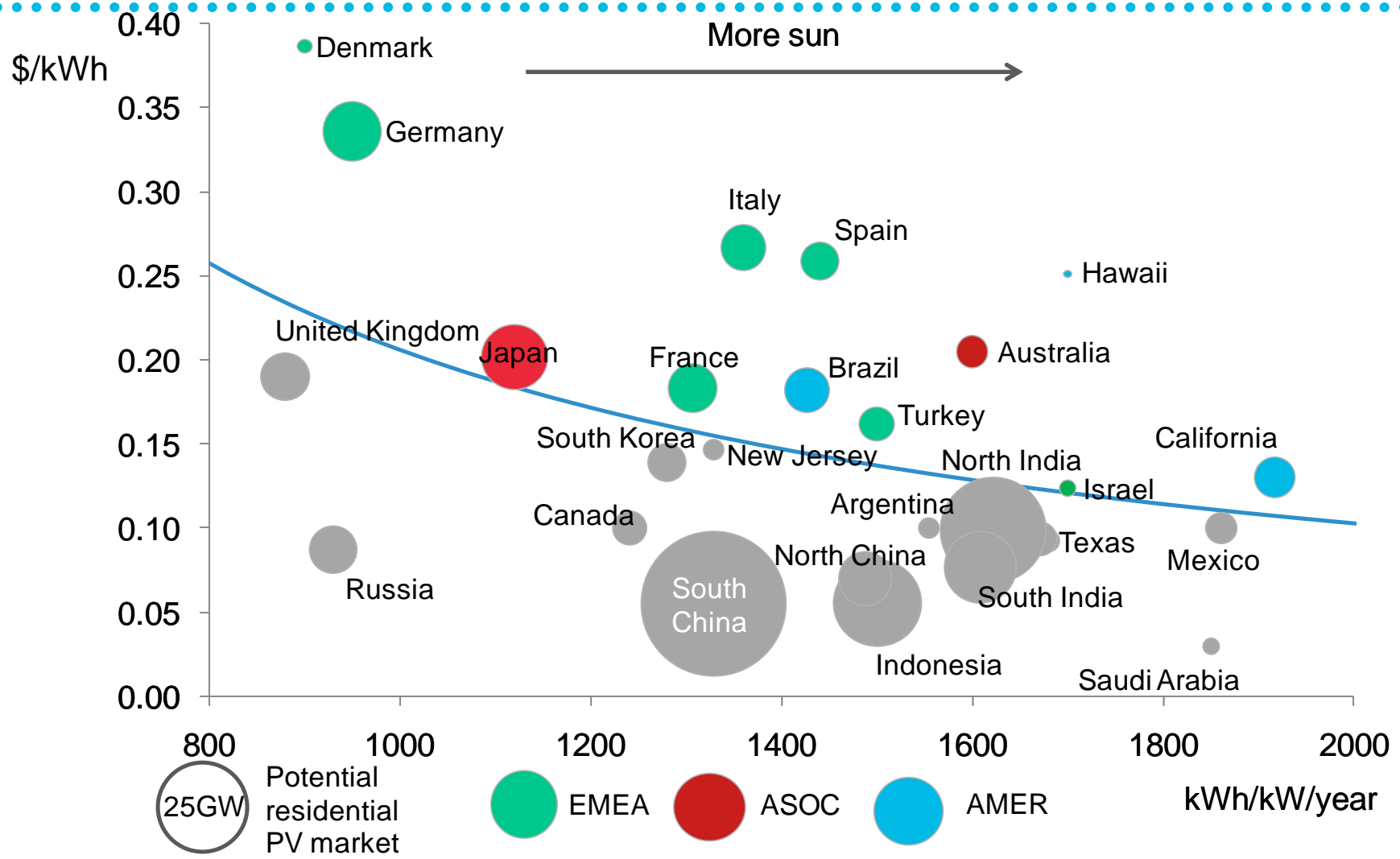
Note: LCOE based on 6% weighted average cost of capital, 0.7%/year module degradation, 1% capex as O&M annually. \$2.51/W capex assumed for 2014 Source: Eurostat, grid operators, Bloomberg New Energy Finance

RESIDENTIAL ELECTRICITY PRICE 2012, INSOLATION, RESIDENTIAL PV LCOE 2015



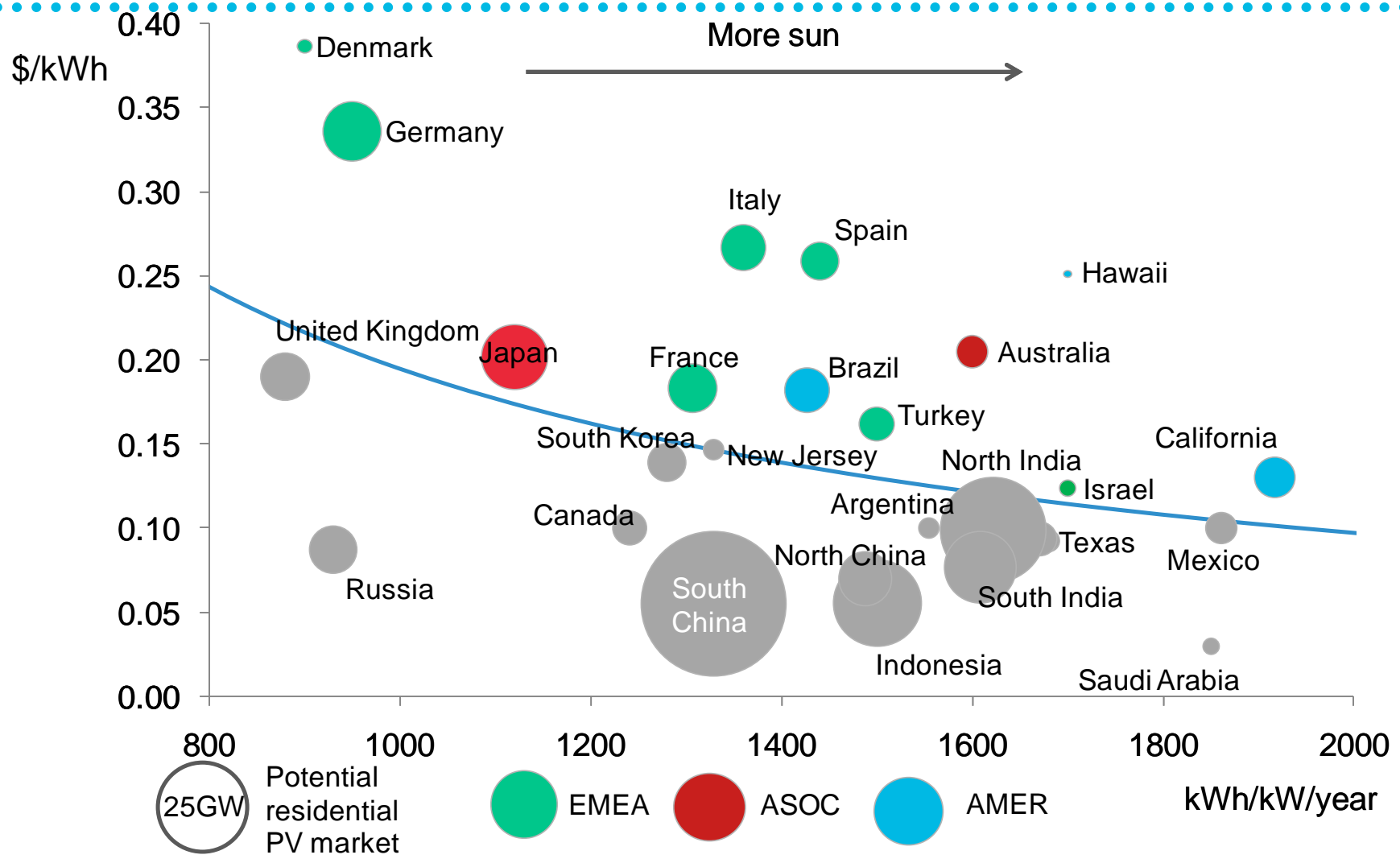
Note: LCOE based on 6% weighted average cost of capital, 0.7%/year module degradation, 1% capex as O&M annually. \$2.34/W capex assumed for 2015
 Source: Eurostat, grid operators, Bloomberg New Energy Finance

RESIDENTIAL ELECTRICITY PRICE 2012, INSOLATION, RESIDENTIAL PV LCOE 2016



Note: LCOE based on 6% weighted average cost of capital, 0.7%/year module degradation, 1% capex as O&M annually. \$2.19/W capex assumed for 2016
 Source: Eurostat, grid operators, Bloomberg New Energy Finance

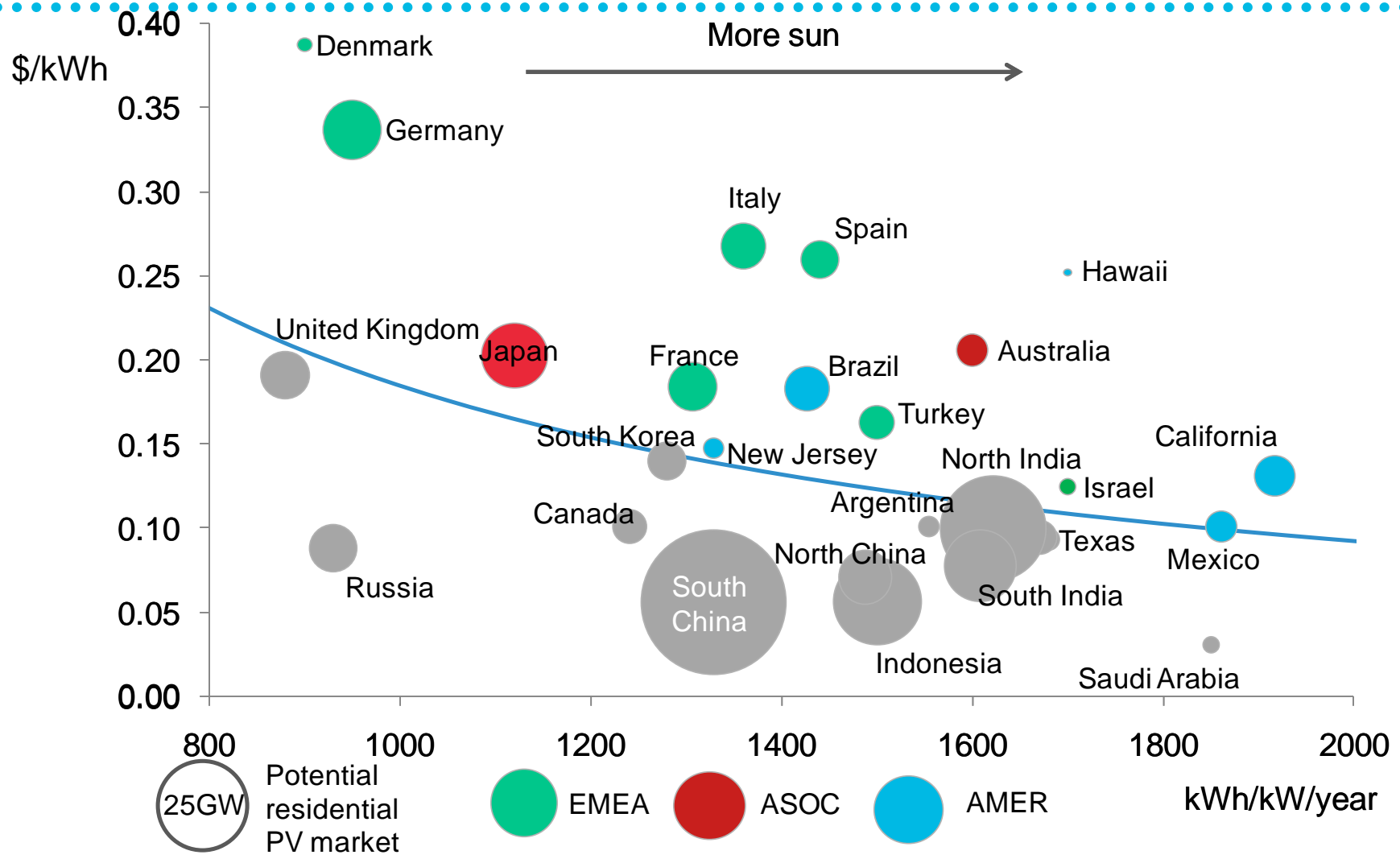
RESIDENTIAL ELECTRICITY PRICE 2012, INSOLATION, RESIDENTIAL PV LCOE 2017



Note: LCOE based on 6% weighted average cost of capital, 0.7%/year module degradation, 1% capex as O&M annually. \$2.07/W capex assumed for 2017

Source: Eurostat, grid operators, Bloomberg New Energy Finance

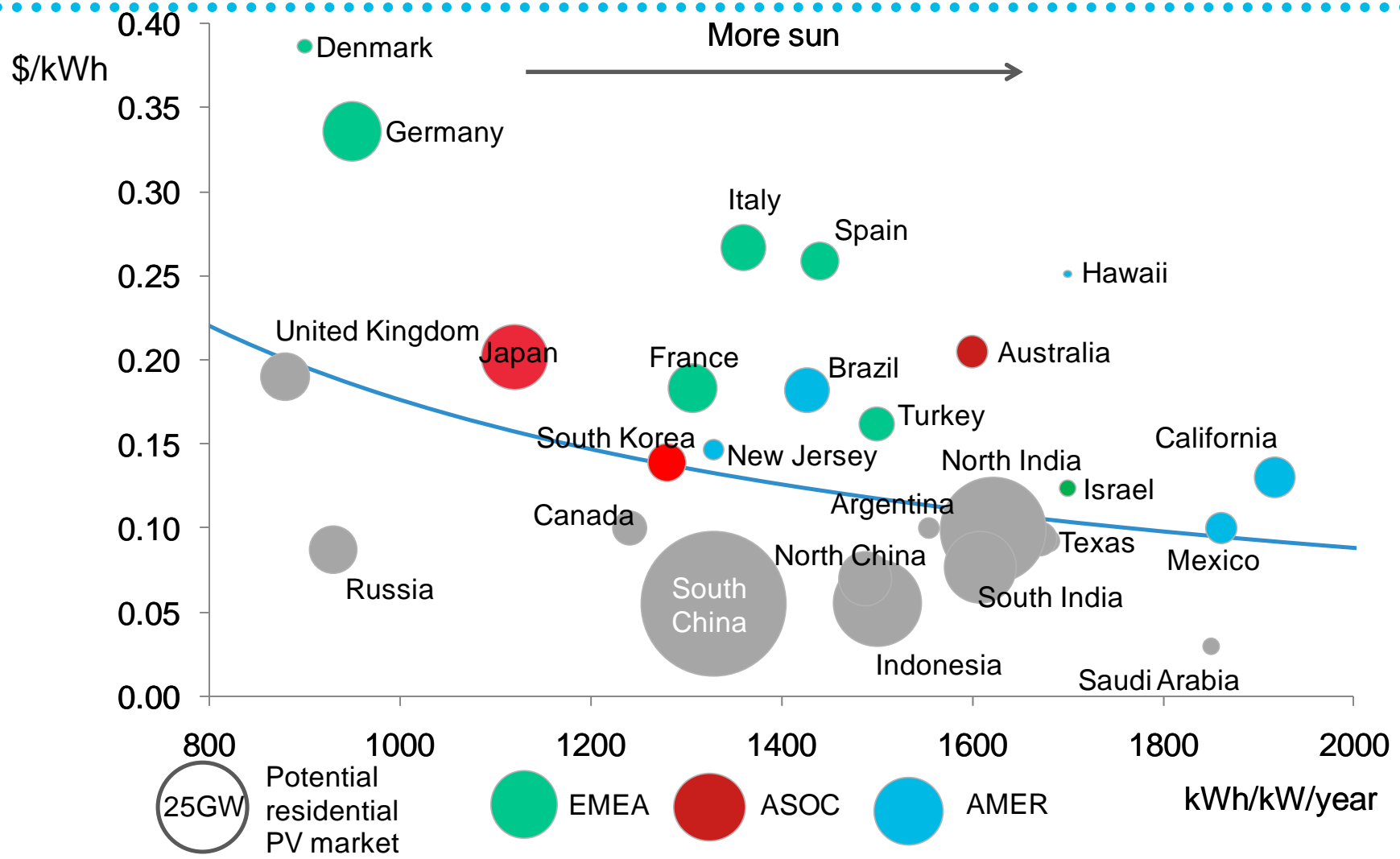
RESIDENTIAL ELECTRICITY PRICE 2012, INSOLATION, RESIDENTIAL PV LCOE 2018



Note: LCOE based on 6% weighted average cost of capital, 0.7%/year module degradation, 1% capex as O&M annually. \$1.97/W capex assumed for 2018

Source: Eurostat, grid operators, Bloomberg New Energy Finance

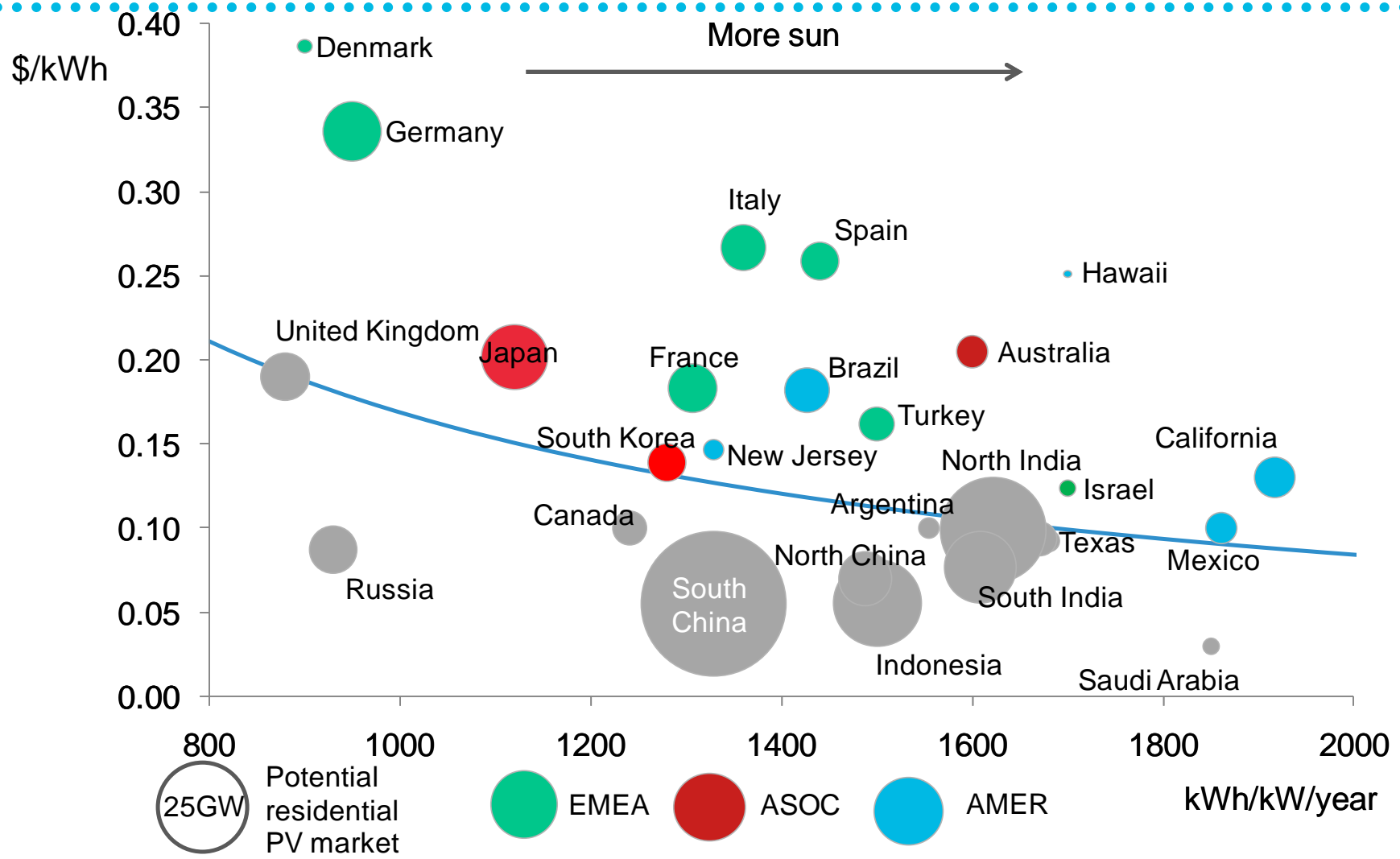
RESIDENTIAL ELECTRICITY PRICE 2012, INSOLATION, RESIDENTIAL PV LCOE 2019



Note: LCOE based on 6% weighted average cost of capital, 0.7%/year module degradation, 1% capex as O&M annually. \$1.88/W capex assumed for 2019

Source: Eurostat, grid operators, Bloomberg New Energy Finance

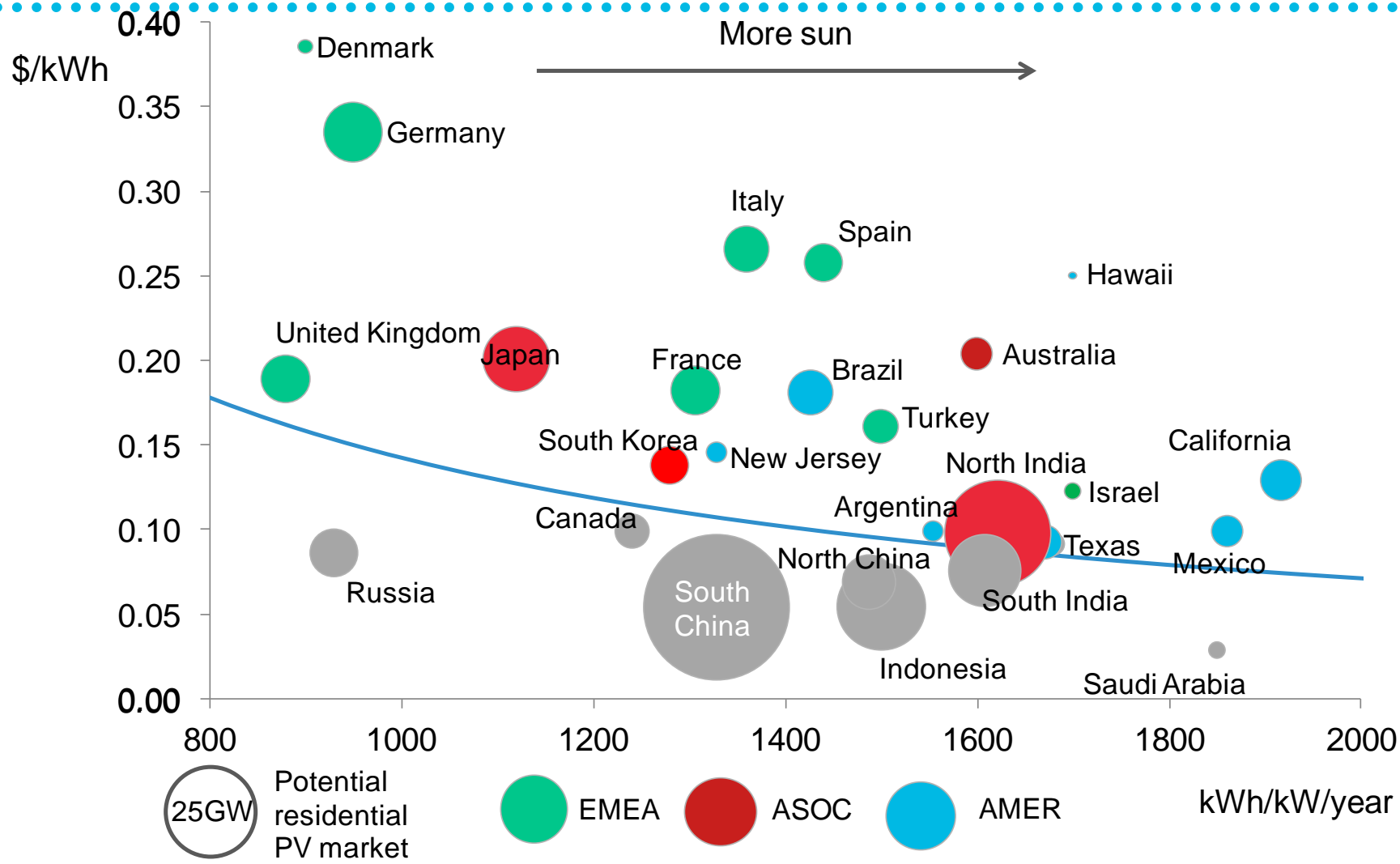
RESIDENTIAL ELECTRICITY PRICE 2012, INSOLATION, RESIDENTIAL PV LCOE 2020



Note: LCOE based on 6% weighted average cost of capital, 0.7%/year module degradation, 1% capex as O&M annually. \$1.80/W capex assumed for 2020

Source: Eurostat, grid operators, Bloomberg New Energy Finance

RESIDENTIAL ELECTRICITY PRICE 2012, INSOLATION, RESIDENTIAL PV LCOE 2025

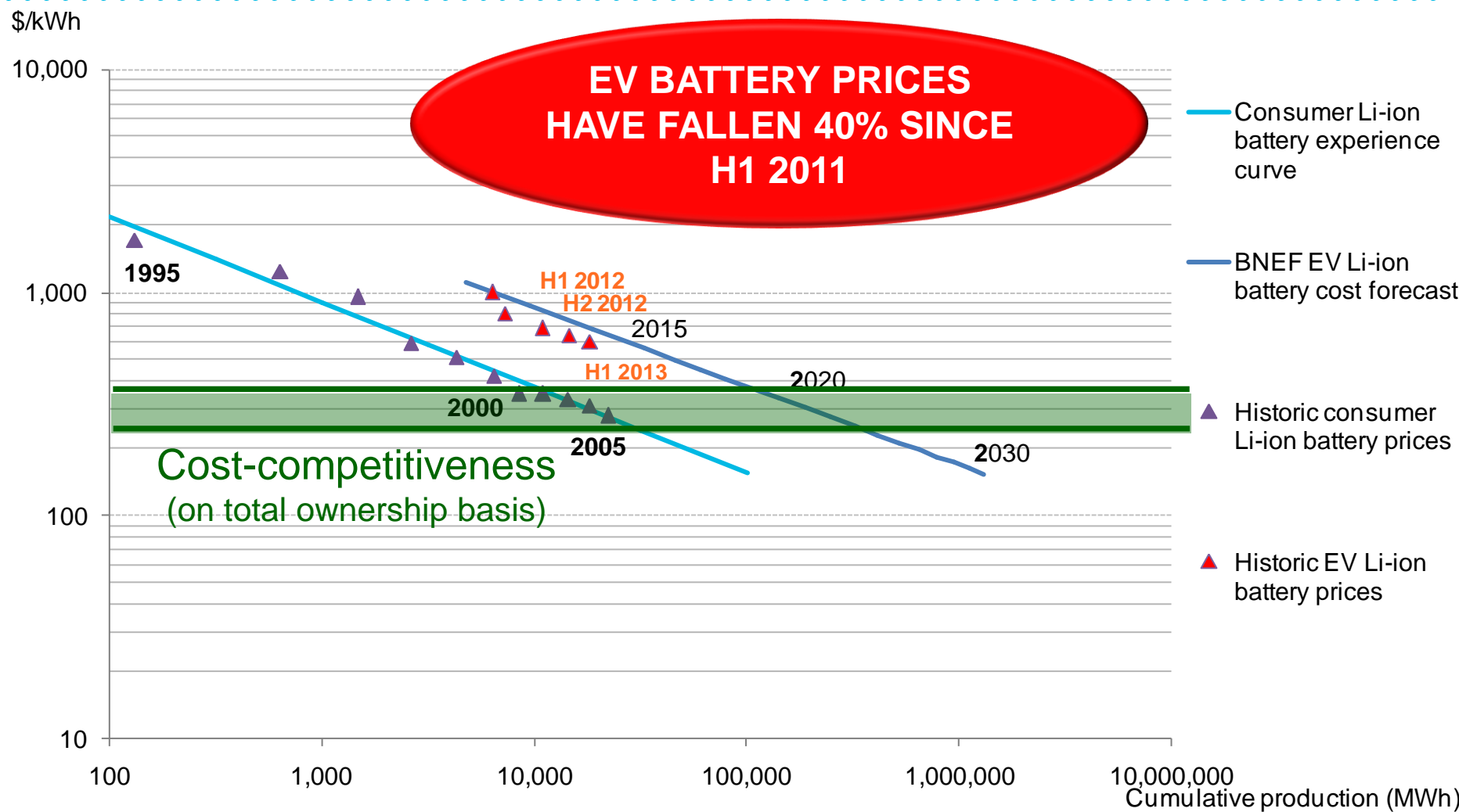


Note: LCOE based on 6% weighted average cost of capital, 0.7%/year module degradation, 1% capex as O&M annually. \$1.52/W capex assumed for 2025

Source: Eurostat, grid operators, Bloomberg New Energy Finance

LITHIUM-ION BATTERY EXPERIENCE CURVE

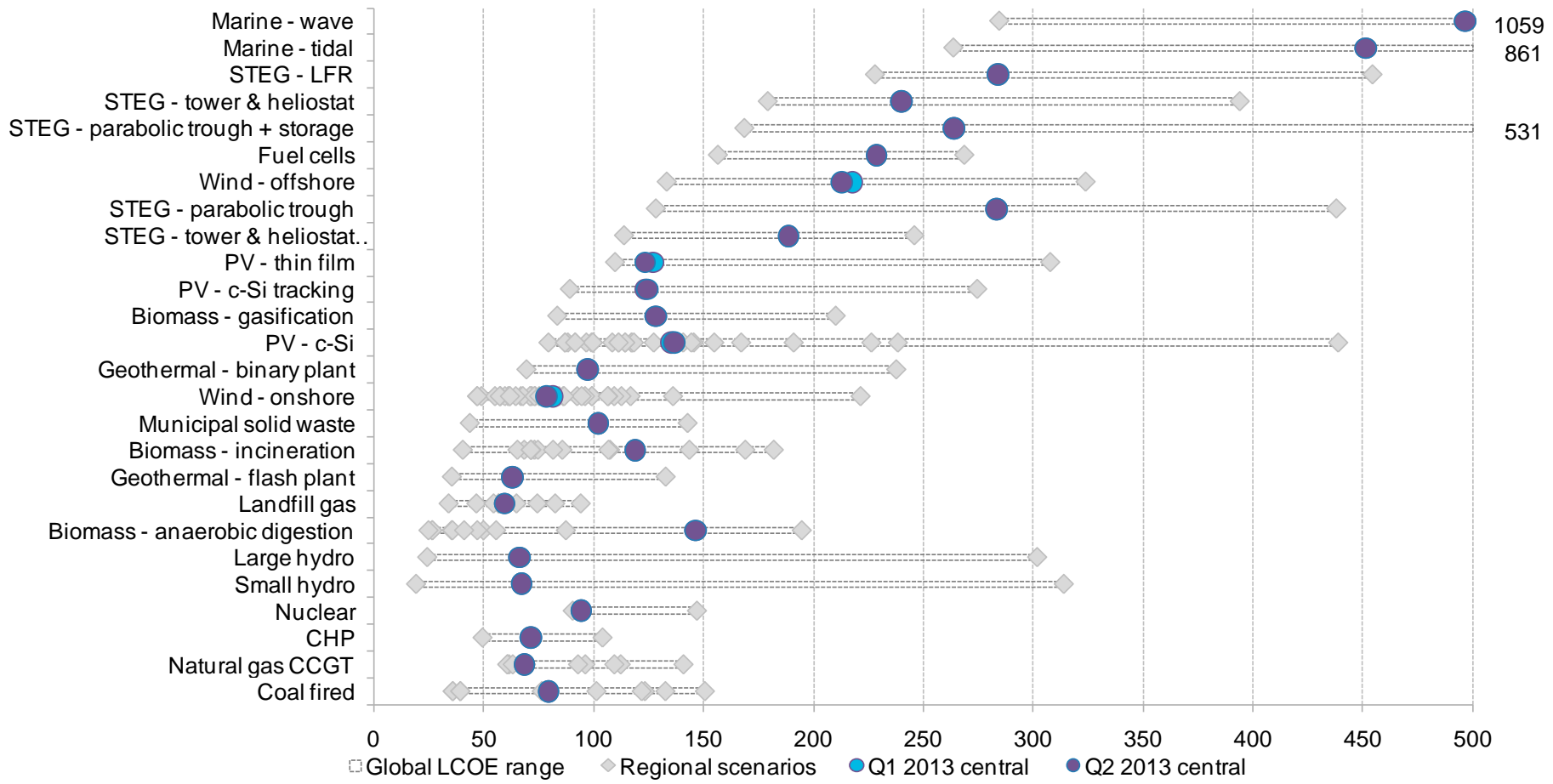
(\$/MWh)



Source: Battery University, MIIT, IIT, Bloomberg New Energy Finance

LEVELISED COST OF ELECTRICITY

Q3 2013 (\$/MWH)



Source: Bloomberg New Energy Finance

GLOBAL ENERGY TRENDS – POLICY IMPLCATIONS

MWILSHIRE1@BLOOMBERG.NET

MARKETS

Renewable Energy

Carbon Markets

Energy Smart Technologies

Renewable Energy Certificates

Carbon Capture & Storage

Power

Water

Nuclear

SERVICES

Insight: research, analysis & forecasting

Industry Intelligence: data & analytics

News & Briefing: daily, weekly & monthly

Applied Research: custom research & data mining

Knowledge Services: Summit, Leadership Forums, Executive Briefings & workshops

Subscription-based news, data
and analysis to support your
decisions in clean energy, power
and water and the carbon markets

sales.bnef@bloomberg.net

Bloomberg
NEW ENERGY FINANCE