12 January 2017

Global trends in clean energy investment.

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KEY FINDINGS

- New investment in clean energy fell to $287.5bn in 2016, 18% lower than the record investment of $348.5bn in 2015.

- The 2016 setback in global investment partly reflected sharp falls in equipment prices, particularly in solar photovoltaics.

- There was a marked cooling in two key markets, China and Japan. China and Japan are cutting back on building new large-scale projects and shifting towards digesting the capacity they have already put in place.

- Offshore wind was the brightest spot in 2016. Capital spending commitments hit $29.9bn in 2016, up 40% on the previous year, as developers in Europe and China took advantage of bigger turbines and improved economics.

- Acquisition activity in clean energy totaled $117.5bn in 2016, up from $97bn in 2015 and the first time this has broken the $100bn level. Behind this surge were a rise in renewable energy project acquisitions to $72.7bn, but particularly a leap in corporate M&A to a record $33bn.

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CLEAN ENERGY INVESTMENT HOMEPAGE

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Clean Energy Investment by Region ($BN)

Legend: APAC, EMEA, AMER

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Clean energy coverage & definitions.

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CLEAN ENERGY COVERAGE

Key:

Renewable	✓ Quarterly
Clean Energy	✓ (red) Annual Only

	Technology / Services	Asset Class							
		Asset Finance (1MW+)	Small Scale Finance (<1MW)	Public Markets	VCPE	M&A	Re-Invested Equity	Corporate R&D	Government R&D
Renewables	Biofuels	✓		✓	✓	✓	✓	✓	✓
	Biomass & Waste	✓		✓	✓	✓	✓	✓	✓
	Geothermal	✓		✓	✓	✓	✓	✓	✓
	Marine	✓		✓	✓	✓	✓	✓	✓
	Small hydro	✓		✓	✓	✓	✓	✓	✓
	Solar	✓	✓	✓	✓	✓	✓	✓	✓
	Wind	✓		✓	✓	✓	✓	✓	✓
	Offshore wind transmission	✓							
Low Carbon Services	Carbon Markets			✓	✓	✓		✓ (red)	✓ (red)
	General Finance & Legal Services			✓	✓	✓			
	Services & Support (Clean Energy)			✓	✓	✓			
Energy Smart Technologies	Digital Energy	✓ (red)		✓	✓	✓		✓ (red)	✓ (red)
	Efficiency: Built Environment			✓	✓	✓			
	Efficiency: Industry			✓	✓	✓			
	Efficiency: Supply Side			✓	✓	✓			
	Electrified Transport			✓	✓	✓			
	Energy Storage	✓ (red)		✓	✓	✓			
	Fuel Cells			✓	✓	✓			
	Hydrogen			✓	✓	✓			

(Left spanning label for all rows: Total Clean Energy)

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DEFINITIONS: ASSET CLASSES

Venture capital & private equity (VCPE)	Early and late stage VC funding rounds as well as funds raised privately for the purposes of expansion by companies that are primarily involved in the clean energy industry according to BNEF exposure ratings.
Public markets (PM)	New equity raised on capital or over-the-counter markets by publicly quoted companies that are primarily involved in the clean energy industry according to BNEF exposure ratings . This may be through initial public offerings (IPOs) or follow-on offerings (secondary, PIPEs, convertibles etc).
Asset finance (AF)	The new-build financing of renewable energy generating projects. This includes both electricity generating and biofuel production assets. Projects may be financed via the balance sheets of the project owners, or through financing mechanisms such as syndicated equity from institutional investors, or project debt from banks.
Asset finance (EST)	Same as above, but for digital energy and energy storage sub categories of the Energy Smart Technologies sector. We only calculate this on an annual basis, so will not be included in quarterly investment estimates.
Re-invested equity	Isolates values for balance-sheet-financed project investments (AF) by companies that have raised money through VC/PE investors or on the capital markets over the past 12 months. The purpose of this calculation is to prevent double-counting upon aggregation of project investments and company investments when calculating total new financial investment in clean energy.
Small-scale solar	Rooftop solar PV below 1MW in capacity. Given the difficulty in tracking individual residential-scale projects, our main asset finance database excludes projects below a certain threshold. This threshold for most tracked sectors is around 1MW. To compensate for this, we add back top-level estimates for missed deals of this nature.
Government R&D	Government R&D figures are sourced from the IEA, IMF, OECD, various government agencies and the BNEF green stimulus dataset.
Corporate R&D	The Bloomberg terminal is used to source Corporate R&D figures for key quoted companies in each clean energy sector, supplemented by data from the BNEF desktop and insight.

Source: Bloomberg New Energy Finance

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New Energy Finance
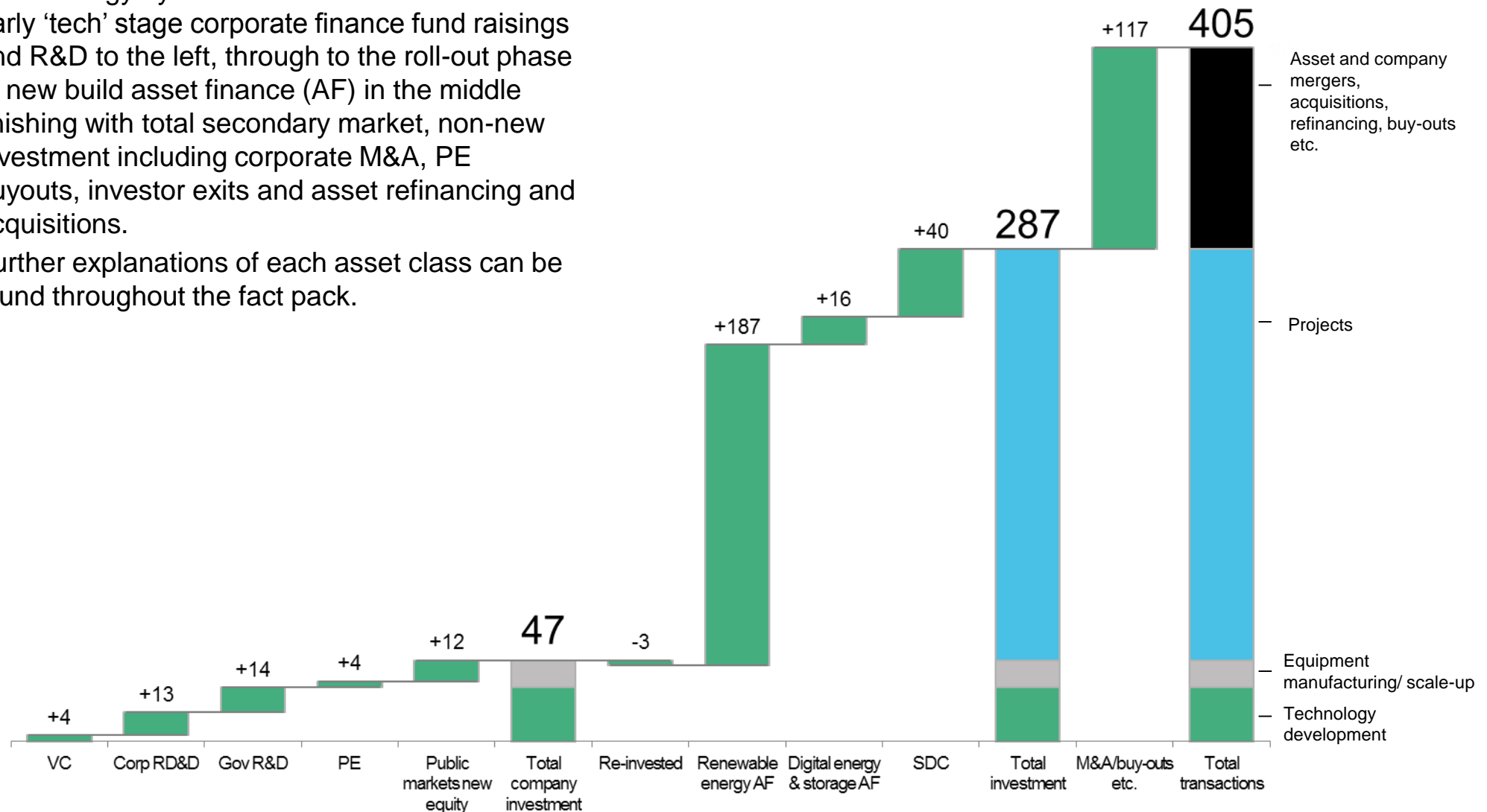
DEFINITIONS: SECTORS

Wind	Included in this sector are players across the entire value chain of both onshore and offshore developments. From direct investment into wind farms to funds raised by manufacturers of turbines, components and subassemblies, developers, generators, utilities and engineering firms.
Solar	All technologies that capture energy directly from the sun. These include production of electricity using semiconductor-based photovoltaic (PV) materials, use of concentrated sunlight to heat fluid to drive power generation equipment (solar thermal electricity generation or 'STEG'), and passive methods which use solar to replace fossil fuel energy, e.g. to heat water. Whilst company level investment of passive methods is recorded, investment in passive projects is not.
Biofuels	Liquid transportation fuels including biodiesel and bioethanol. These can be derived from a range of biomass sources, including sugar cane, rape seed (canola), soybean oil or cellulose. Our database excludes producers of base biomass, but includes suppliers of everything from the processing technologies and equipment, through the logistics of distribution, to manufacturers of energy systems that are specially adapted for the use of biofuels and products, and the services on which they depend.
Biomass & waste	Production and consumption of solid and gaseous fuels derived from biomass. Solid biomass for the energy sector can include a number of specially-grown crops, such as elephant grass or coppiced willow, but it can also consist of crop residues such as straw. We include in this sector processors of other waste matter for energy generation, such as sewage waste, chemical by-products and biogas produced from municipal waste, as their exploitation often involves the same technologies as grown-for-purpose biomass.
Other renewables	Includes: Small hydro – the generation of electric power from the movement of water, with project capacity between 1MW and 50MW Geothermal – the extraction of useful power from heat stored in the earth Marine – the extraction of energy from the sea.
Energy smart technologies (EST)	This sector covers a range of non-renewable clean energy technologies including digital energy and smart grids, power storage, hydrogen and fuel cells, advanced transportation and energy efficiency on both the demand and supply side. For more in depth definitions of these please visit our corporate website:
Other low-carbon tech / services	This sector covers clean energy service companies such as consultants, government agencies and policy makers, NGOs, financial service providers, investors, and clean energy information providers (such as ourselves). It also covers the corporate activity of organisations across the carbon capture and storage (CCS) and carbon market value chains.

Source: Bloomberg New Energy Finance

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Annual clean energy investment overview.

2016 CLEAN ENERGY INVESTMENT TYPES & FLOWS
($BN)

- This chart shows the full range of investment in clean energy by asset class. It runs from the early 'tech' stage corporate finance fund raisings and R&D to the left, through to the roll-out phase of new build asset finance (AF) in the middle finishing with total secondary market, non-new investment including corporate M&A, PE buyouts, investor exits and asset refinancing and acquisitions.

- Further explanations of each asset class can be found throughout the fact pack.

Asset and company mergers, acquisitions, refinancing, buy-outs etc.

Projects

Equipment manufacturing/ scale-up

Technology development

Chart labels: +4 (VC), +13 (Corp RD&D), +14 (Gov R&D), +4 (PE), +12 (Public markets new equity), 47 (Total company investment), -3 (Re-invested), +187 (Renewable energy AF), +16 (Digital energy & storage AF), +40 (SDC), 287 (Total investment), +117 (M&A/buy-outs etc.), 405 (Total transactions)

Note: Total values include estimates for undisclosed deals. AF = asset finance, SDC = small distributed capacity.

Source: Bloomberg New Energy Finance

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NEW INVESTMENT IN CLEAN ENERGY
2004-16 ($BN)

- Total annual new investment in clean energy. This includes all asset classes in all clean energy sectors.
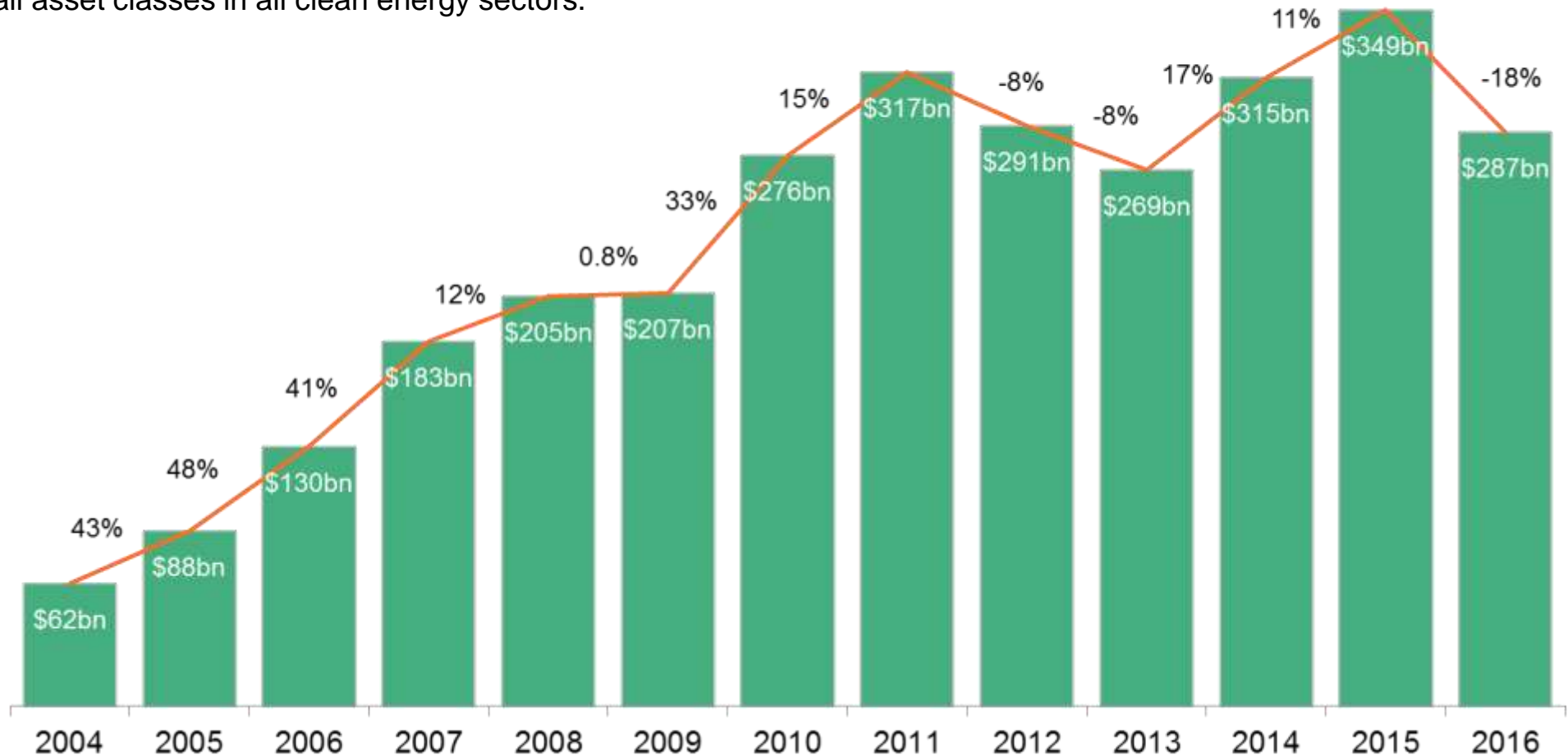
Year	Value	Change
2004	$62bn	43%
2005	$88bn	48%
2006	$130bn	41%
2007	$183bn	12%
2008	$205bn	0.8%
2009	$207bn	33%
2010	$276bn	15%
2011	$317bn	-8%
2012	$291bn	-8%
2013	$269bn	17%
2014	$315bn	11%
2015	$349bn	-18%
2016	$287bn	

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NEW INVESTMENT IN CLEAN ENERGY BY REGION
2004-16 ($BN)

- Total annual new investment in clean energy by region. This includes all asset classes and all clean energy sectors.
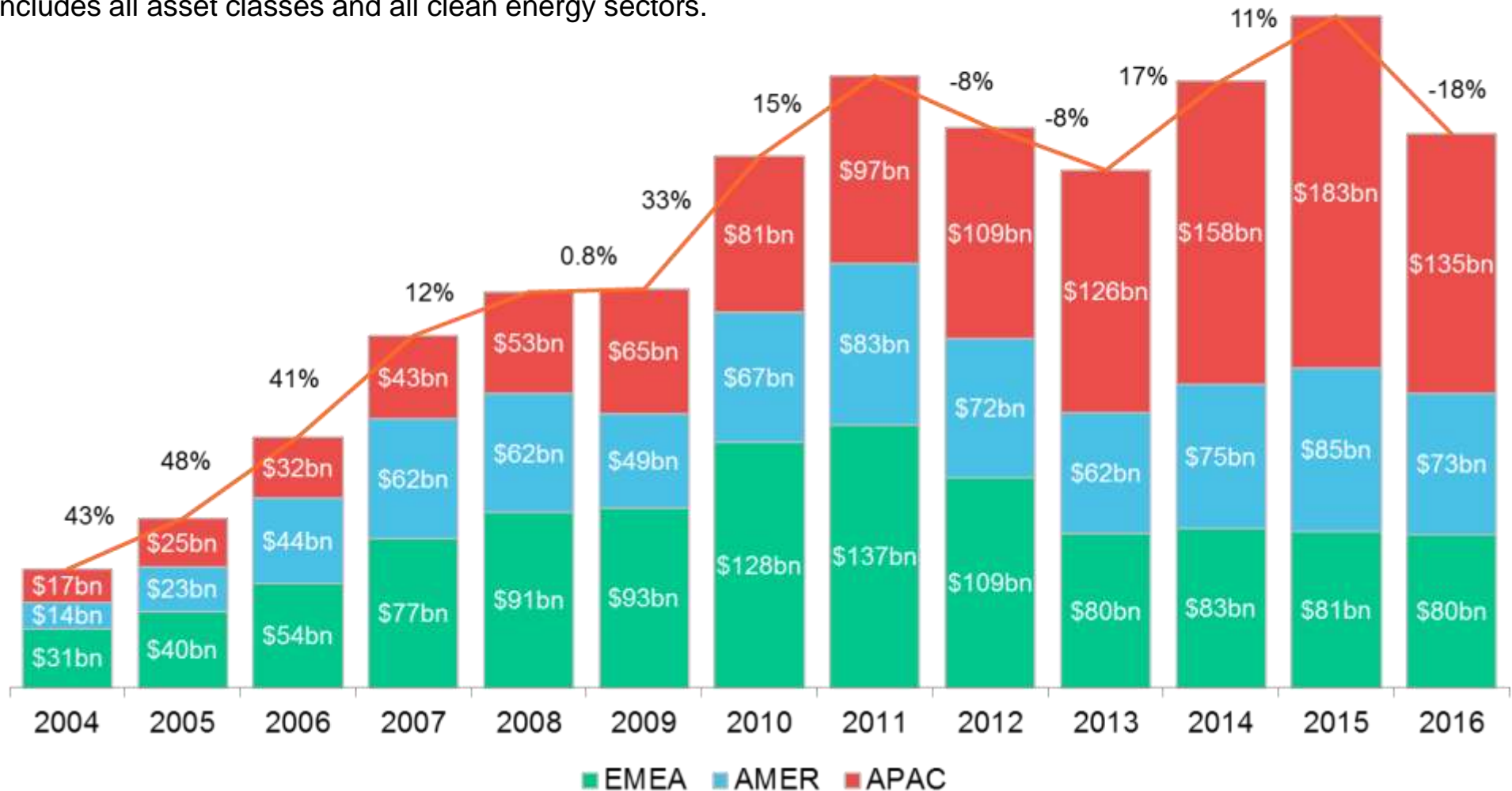
Quarterly trends in clean energy: new investment.

NEW INVESTMENT IN CLEAN ENERGY
Q1 2004-Q4 2016 ($BN)

- Quarterly new investment in clean energy. This includes investment into all asset classes except EST asset finance and R&D, which are compiled on an annual basis only.
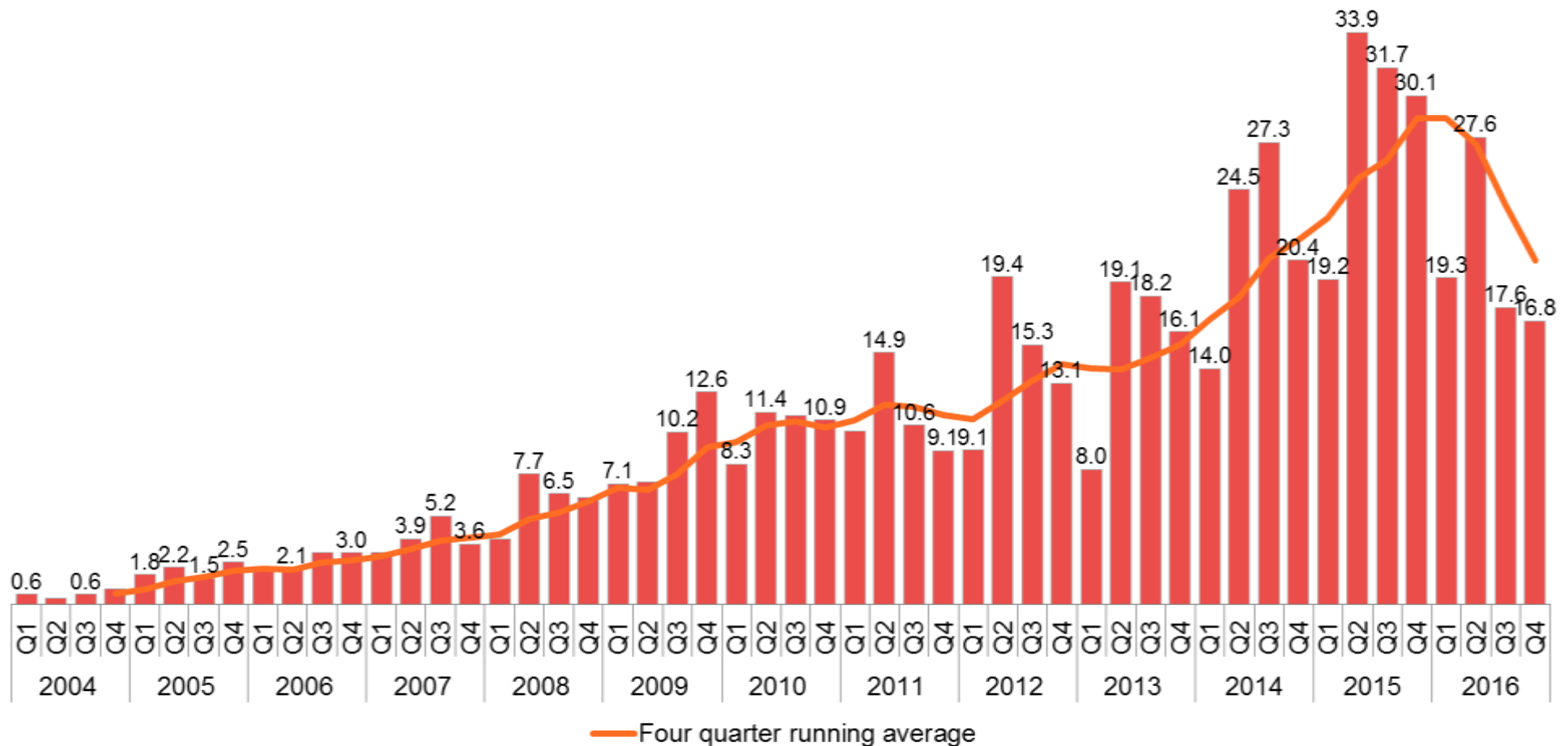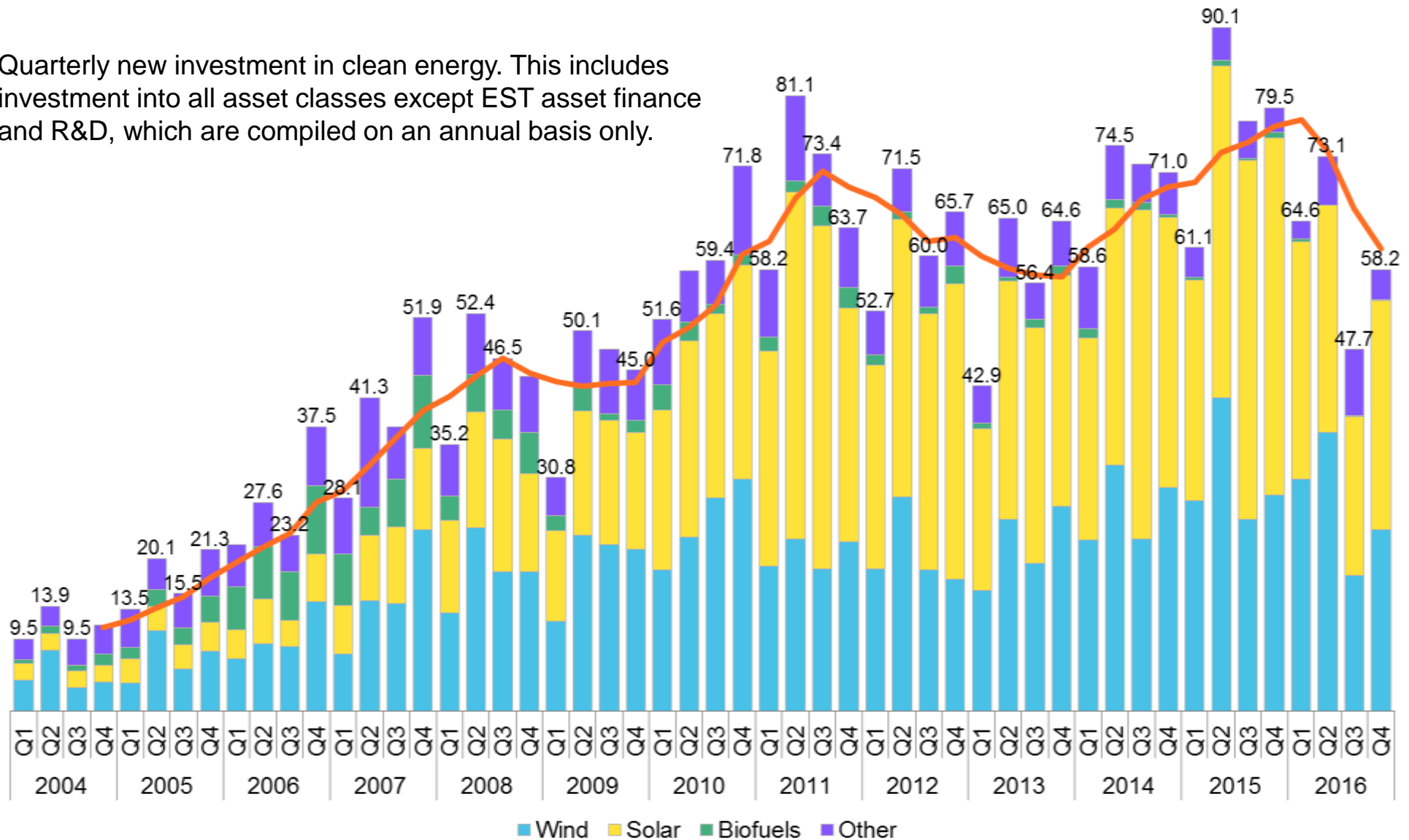

Four quarter running average
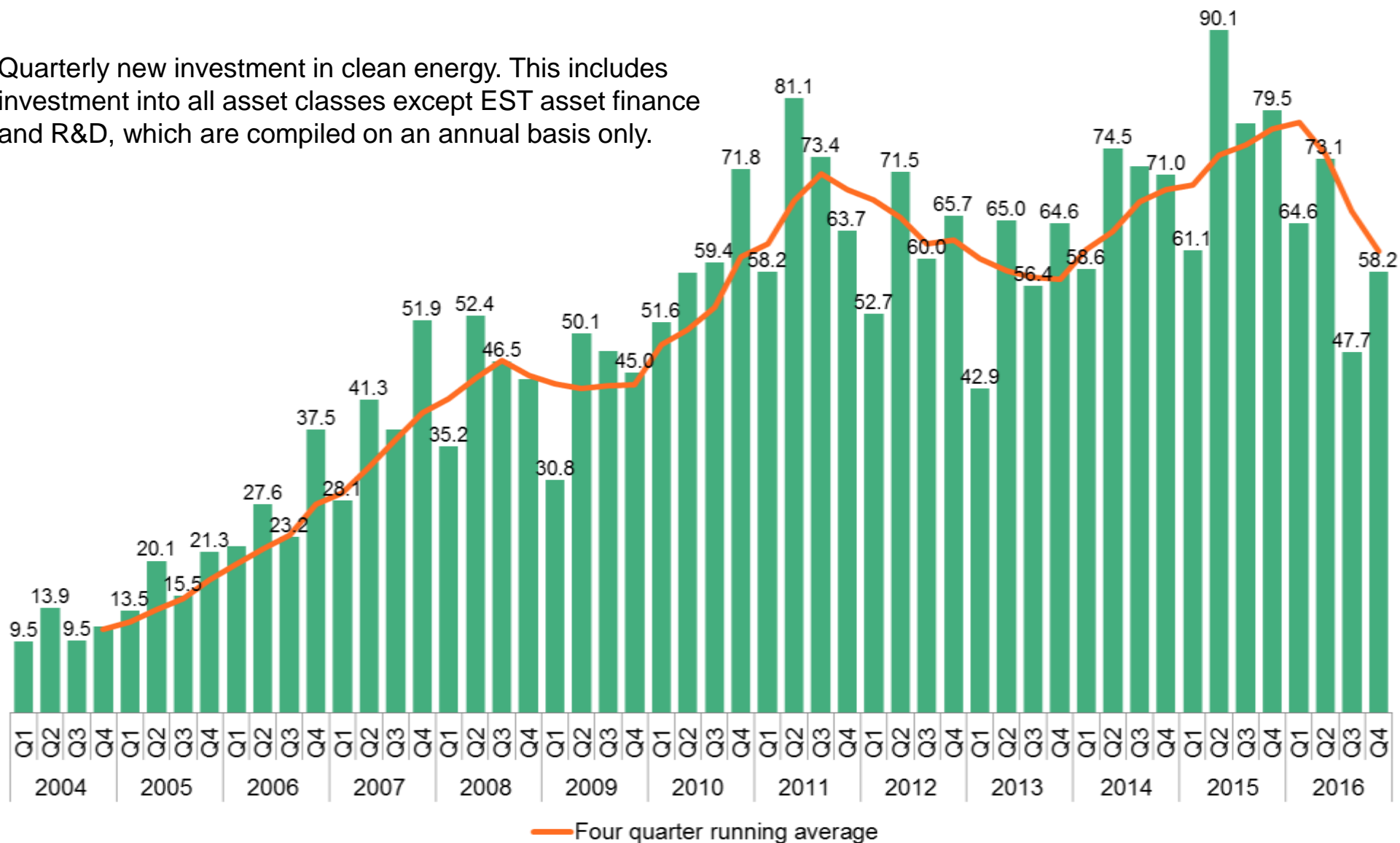
Bloomberg
New Energy Finance

NEW INVESTMENT IN CLEAN ENERGY BY REGION
Q1 2004-Q4 2016 ($BN)

- Quarterly new investment in clean energy. This includes investment into all asset classes except EST asset finance and R&D, which are compiled on an annual basis only.

Legend: ■ EMEA ■ AMER ■ APAC
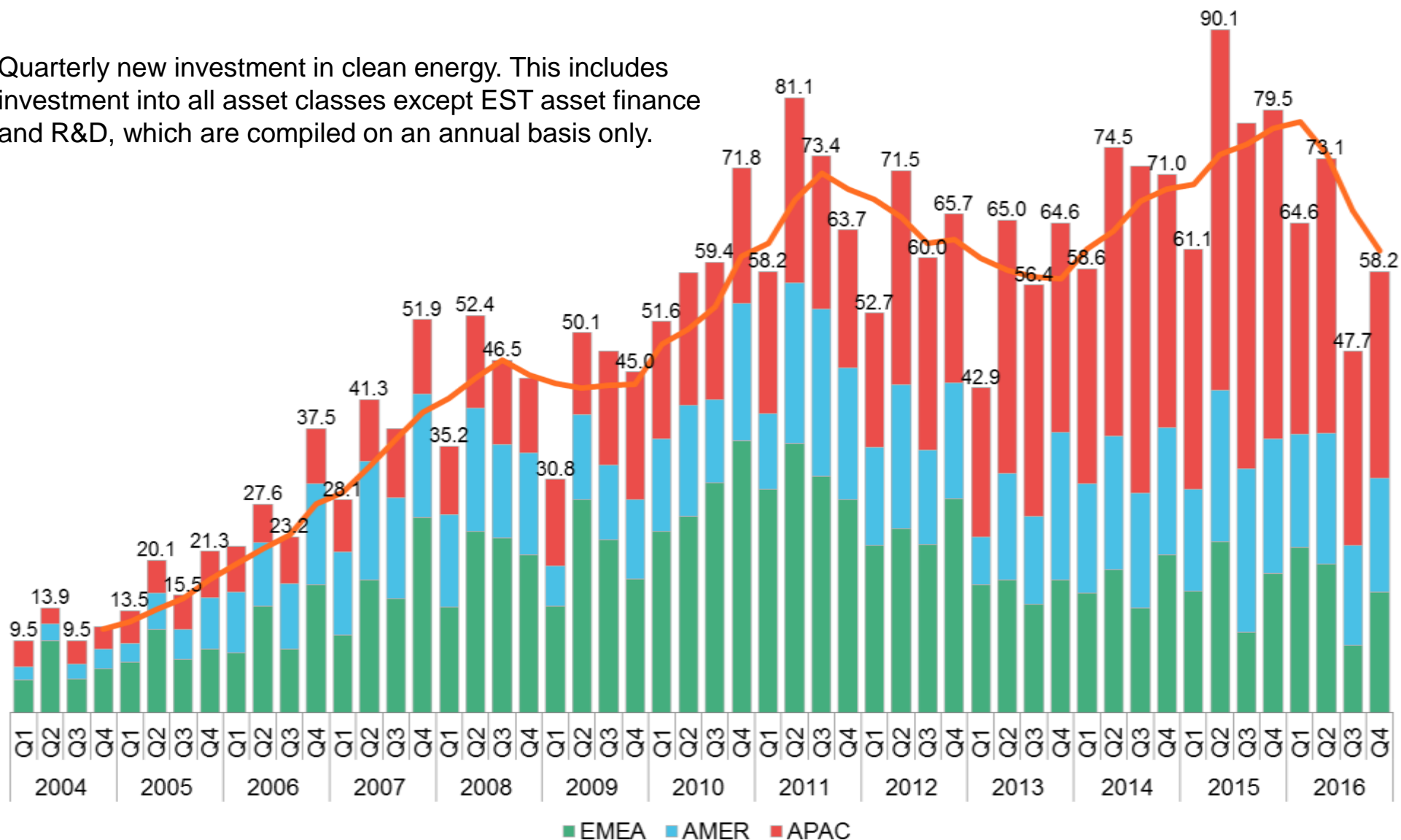
Bloomberg
New Energy Finance

NEW INVESTMENT IN CLEAN ENERGY IN EUROPE
Q1 2004-Q4 2016 ($BN)

- Quarterly new investment in clean energy. This includes investment into all asset classes except EST asset finance and R&D, which are compiled on an annual basis only.
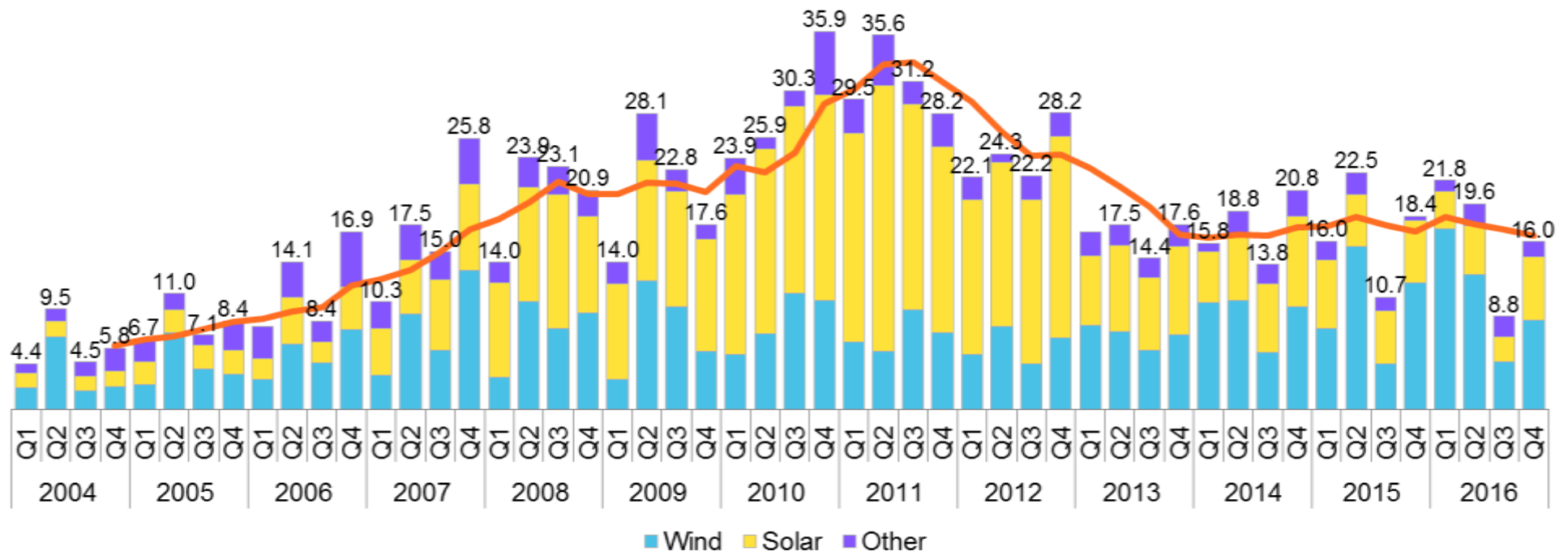

Four quarter running average
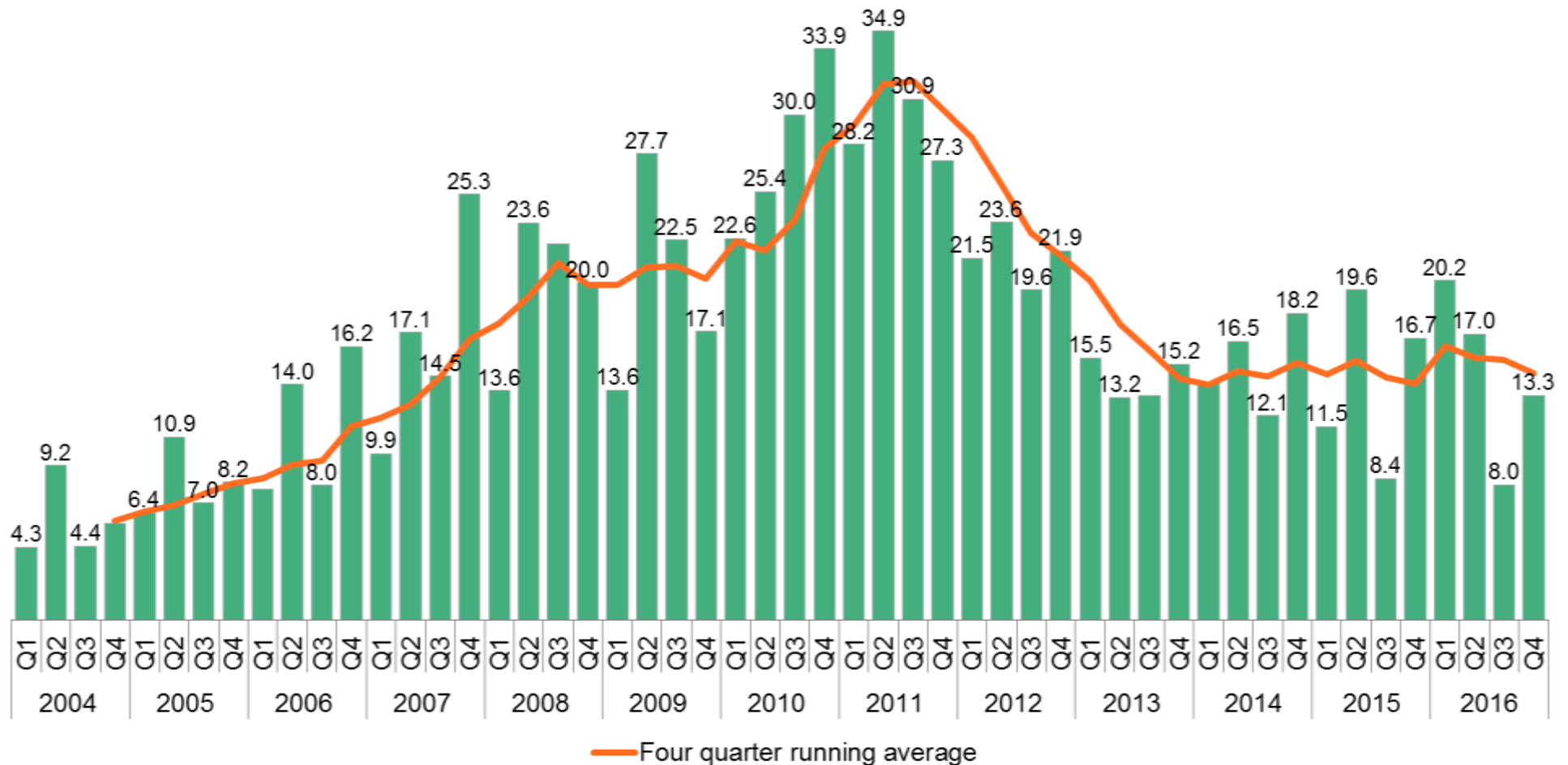
Bloomberg
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NEW INVESTMENT IN CLEAN ENERGY IN THE US
Q1 2004-Q4 2016 ($BN)

- Quarterly new investment in clean energy. This includes investment into all asset classes except EST asset finance and R&D, which are compiled on an annual basis only.

Four quarter running average
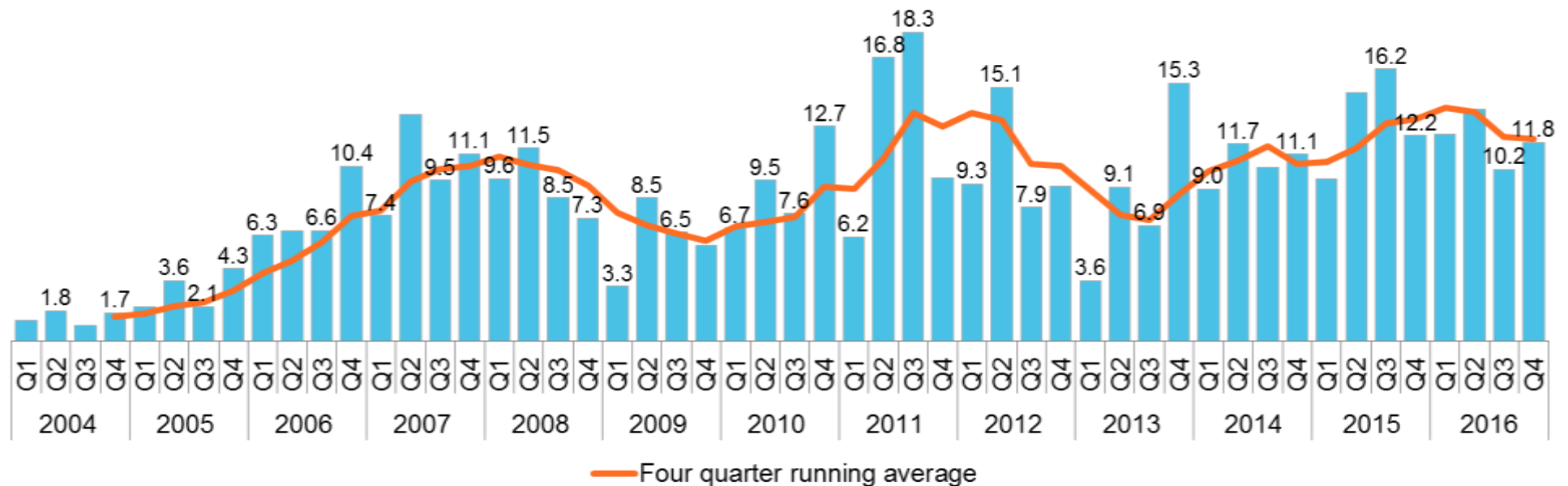
Bloomberg
New Energy Finance

NEW INVESTMENT IN CLEAN ENERGY IN CHINA
Q1 2004-Q4 2016 ($BN)

- Quarterly new investment in clean energy. This includes investment into all asset classes except EST asset finance and R&D, which are compiled on an annual basis only.
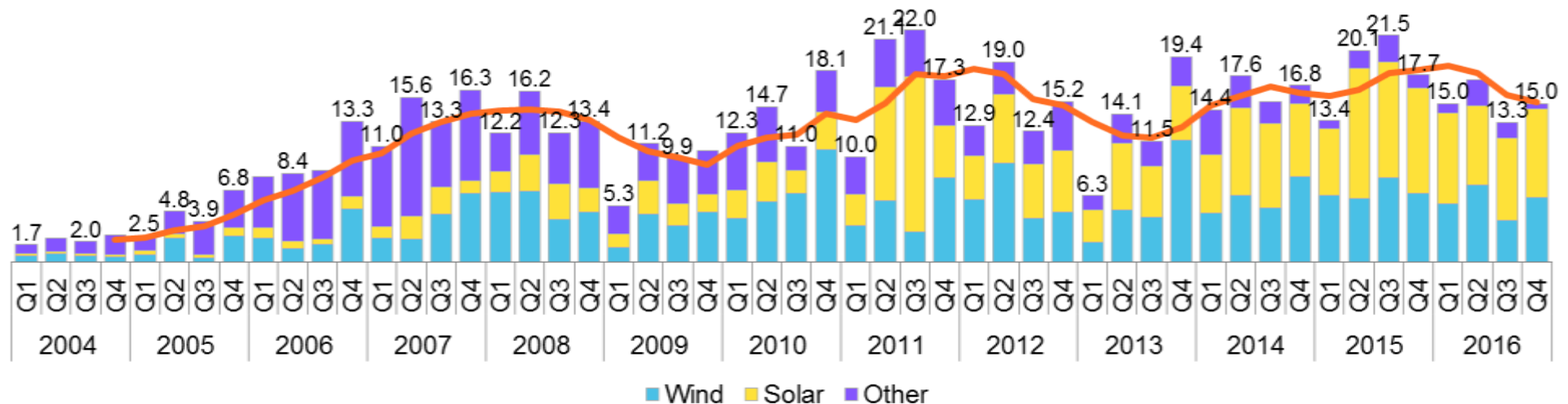

Four quarter running average

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NEW INVESTMENT IN CLEAN ENERGY BY SECTOR
Q1 2004-Q4 2016 ($BN)

- Quarterly new investment in clean energy. This includes investment into all asset classes except EST asset finance and R&D, which are compiled on an annual basis only.

Legend: ■ Wind ■ Solar ■ Biofuels ■ Other

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EMEA NEW INVESTMENT IN CLEAN ENERGY BY SECTOR
Q1 2004-Q4 2016 ($BN)

- Quarterly new investment in clean energy. This includes investment into all asset classes except EST asset finance and R&D, which are compiled on an annual basis only.
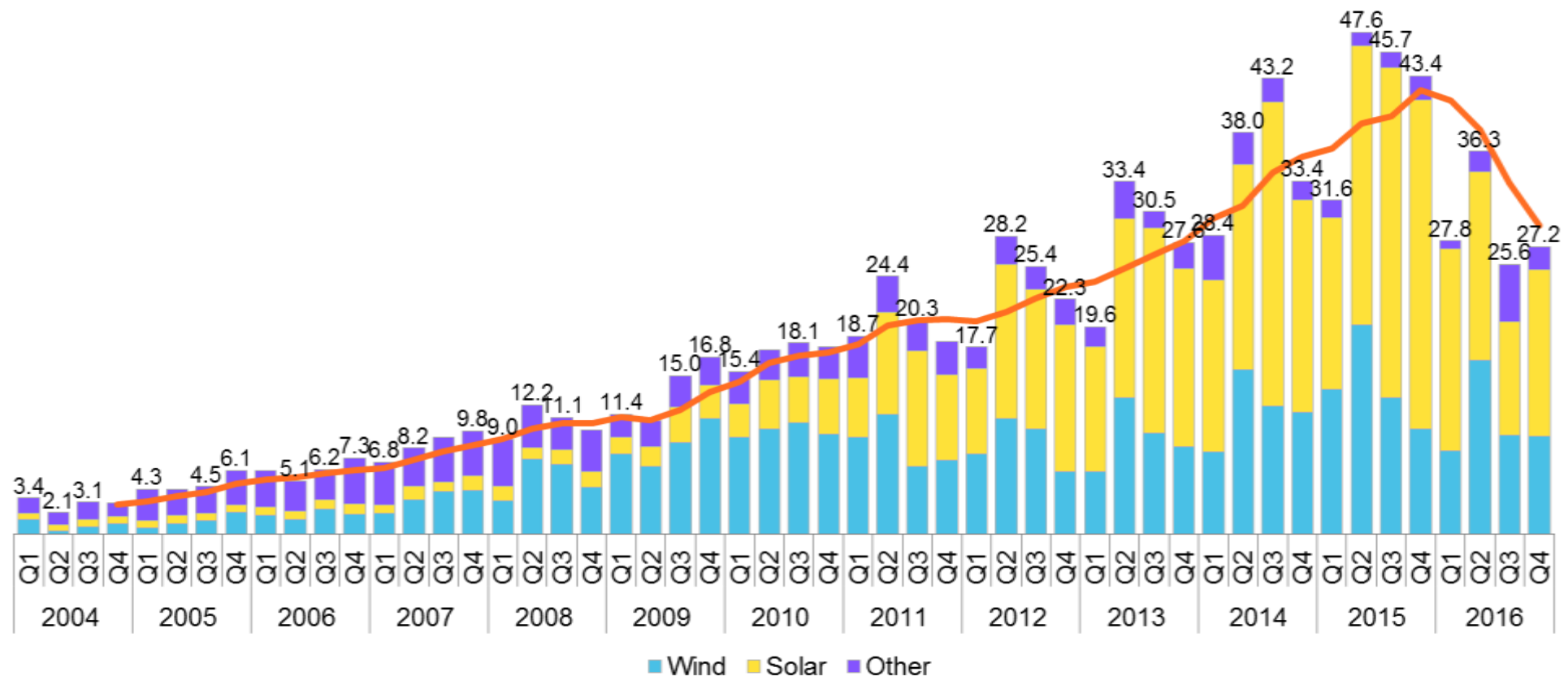

Legend: ■ Wind ■ Solar ■ Other

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AMER NEW INVESTMENT IN CLEAN ENERGY BY SECTOR
Q1 2004-Q4 2016 ($BN)

- Quarterly new investment in clean energy. This includes investment into all asset classes except EST asset finance and R&D, which are compiled on an annual basis only.
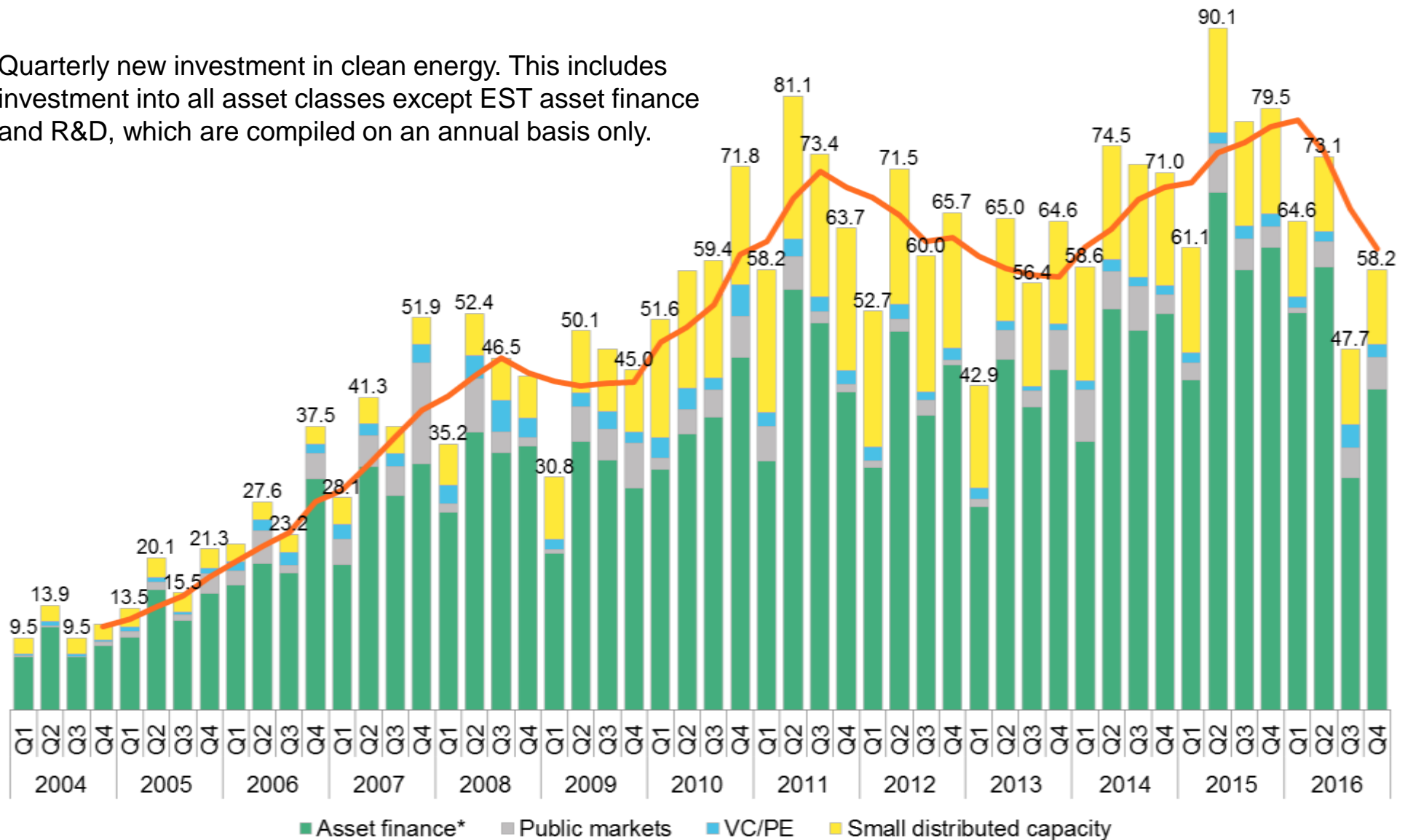

Legend: Wind, Solar, Other

Note: Total values include estimates for undisclosed deals. Excludes corporate and government R&D, and spending for digital energy and energy storage projects (reported in annual statistics only).
Source: Bloomberg New Energy Finance

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New Energy Finance

APAC NEW INVESTMENT IN CLEAN ENERGY BY SECTOR
Q1 2004-Q4 2016 ($BN)

- Quarterly new investment in clean energy. This includes investment into all asset classes except EST asset finance and R&D, which are compiled on an annual basis only.

Wind · Solar · Other

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NEW INVESTMENT IN CLEAN ENERGY BY ASSET CLASS
Q1 2004-Q4 2016 ($BN)

- Quarterly new investment in clean energy. This includes investment into all asset classes except EST asset finance and R&D, which are compiled on an annual basis only.

Legend: ■ Asset finance* ■ Public markets ■ VC/PE ■ Small distributed capacity

*Asset finance adjusted for re-invested equity
Note: Total values include estimates for undisclosed deals. Excludes corporate and government R&D, and spending for digital energy and energy storage projects (reported in annual statistics only).
Source: Bloomberg New Energy Finance

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PUBLIC MARKET NEW INVESTMENT IN CLEAN ENERGY
Q1 2004-Q4 2016 ($BN)

- New equity raised on capital or over-the-counter (OTC) markets by publicly quoted companies that are primarily involved in the clean energy industry. This may be through initial public offerings (IPOs) or follow-on offerings (secondary, PIPEs, convertibles etc).

Four quarter running average
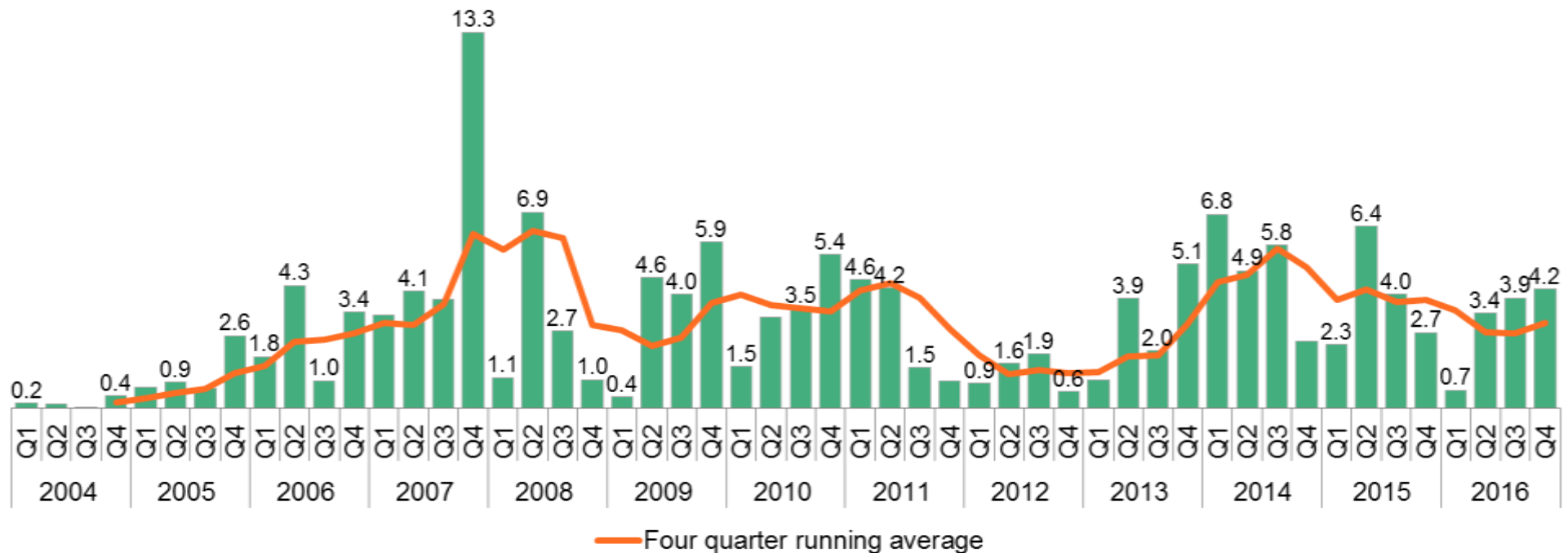
Note: Total values include estimates for undisclosed deals.
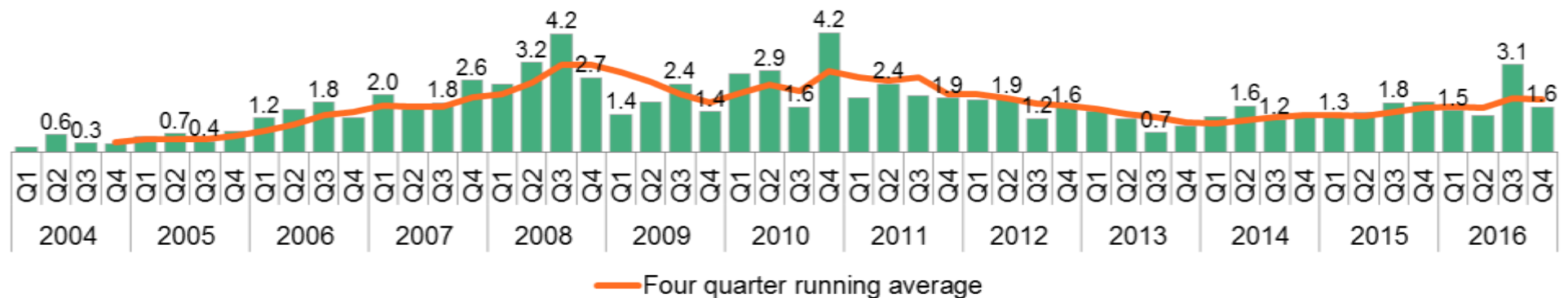
Source: Bloomberg New Energy Finance

TOP PUBLIC MARKET TRANSACTIONS OF THE QUARTER
Q4 2016

Organisation	Stock exchange	Sector	Type of transaction	New equity raised	Total offering size
Innogy	Deutsche Börse	Solar	IPO	$2,230m	$2,230m
Nibe Industrier	Stockholm Stock Exchange	Solar	Exercise of Rights	$350m	$350m
Hexing Electrical	Shanghai Stock Exchange	Energy smart technologies	IPO	$325m	$325m
Greencoat UK Wind	London Stock Exchange	Wind	Secondary	$184m	$184m
Meyer Burger Technology	SIX Swiss Exchange	Solar	Exercise of Rights	$163m	$163m

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VC/PE NEW INVESTMENT IN CLEAN ENERGY
Q1 2004-Q4 2016 ($BN)

- Early- and late-stage VC funding rounds as well as funds raised privately for the purposes of expansion by companies that are primarily involved in the clean energy industry according to BNEF exposure ratings.

Four quarter running average

Note: Total values include estimates for undisclosed deals.
Source: Bloomberg New Energy Finance

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TOP VC/PE TRANSACTIONS OF THE QUARTER
Q4 2016

Organisation	Country	Sector	Type of transaction	Value
Altus Power America	United States	Solar	PE Expansion Capital	$205m
Hindustan Powerprojects	India	Small Hydro	PE Expansion Capital	$130m
Nova Lumos Netherlands Holding	Netherlands	Solar	VC Early Stage	$90m
Sonnen	Germany	Energy Storage	VC Late Stage	$85m
Soltage	United States	Solar	PE Expansion Capital	$70m

ASSET FINANCING FOR NEW-BUILD RENEWABLE ENERGY ASSETS Q1 2004-Q4 2016 ($BN)

- The new-build financing of utility-scale renewable energy generating projects. This includes both electricity and biofuel production assets. Projects may be financed via the balance sheets of the project owners, or through mechanisms such as syndicated equity from institutional investors and project debt from banks.
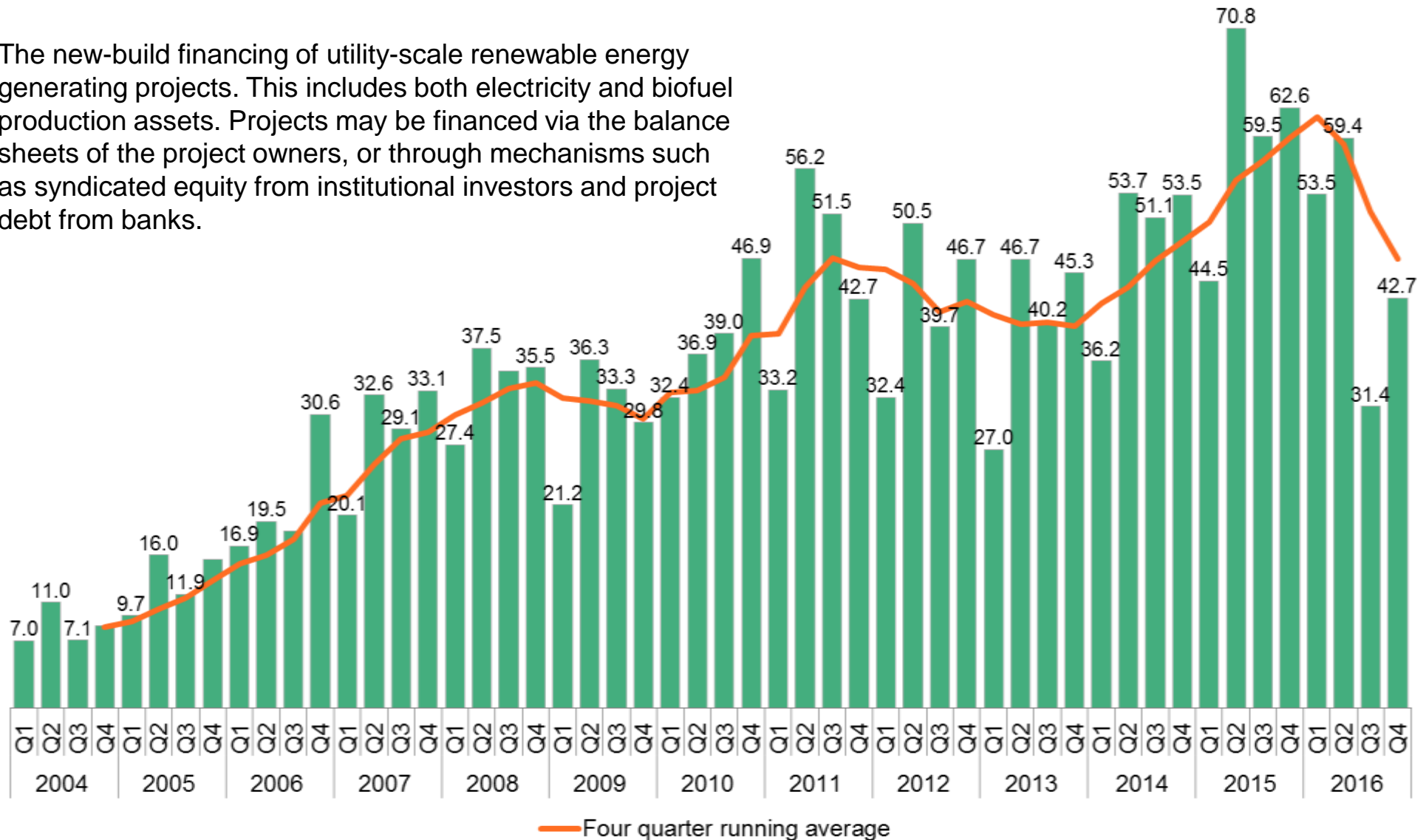
Four quarter running average

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TOP ASSET FINANCE TRANSACTIONS OF THE QUARTER
Q4 2016

Project name	Country	Sector	Type of transaction	Capacity	Value
Norther Offshore Wind Farm	Belgium	Wind	Debt	370MW	$1,300m
Rentel Offshore Wind Farm	Belgium	Wind	Debt	309MW	$1,233m
31 Dominion SBL Solar Portfolio	United States	Solar	Debt	580MW	na
sPower Lancaster PV Portfolio	United States	Solar	Debt	339.4MW	$519m
Invenergy Hardin Wind Farm	United States	Wind	Equity	300MW	na

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Quarterly trends in clean energy: funds in circulation.

FUNDS IN CIRCULATION IN CLEAN ENERGY
Q1 2004-Q4 2016 ($BN)

- Global secondary market acquisition transactions. This shows non-new investment in the clean energy industry through corporate M&A, private equity buy-outs and public market investor exits, as well as the refinancing or acquisition of renewable assets.
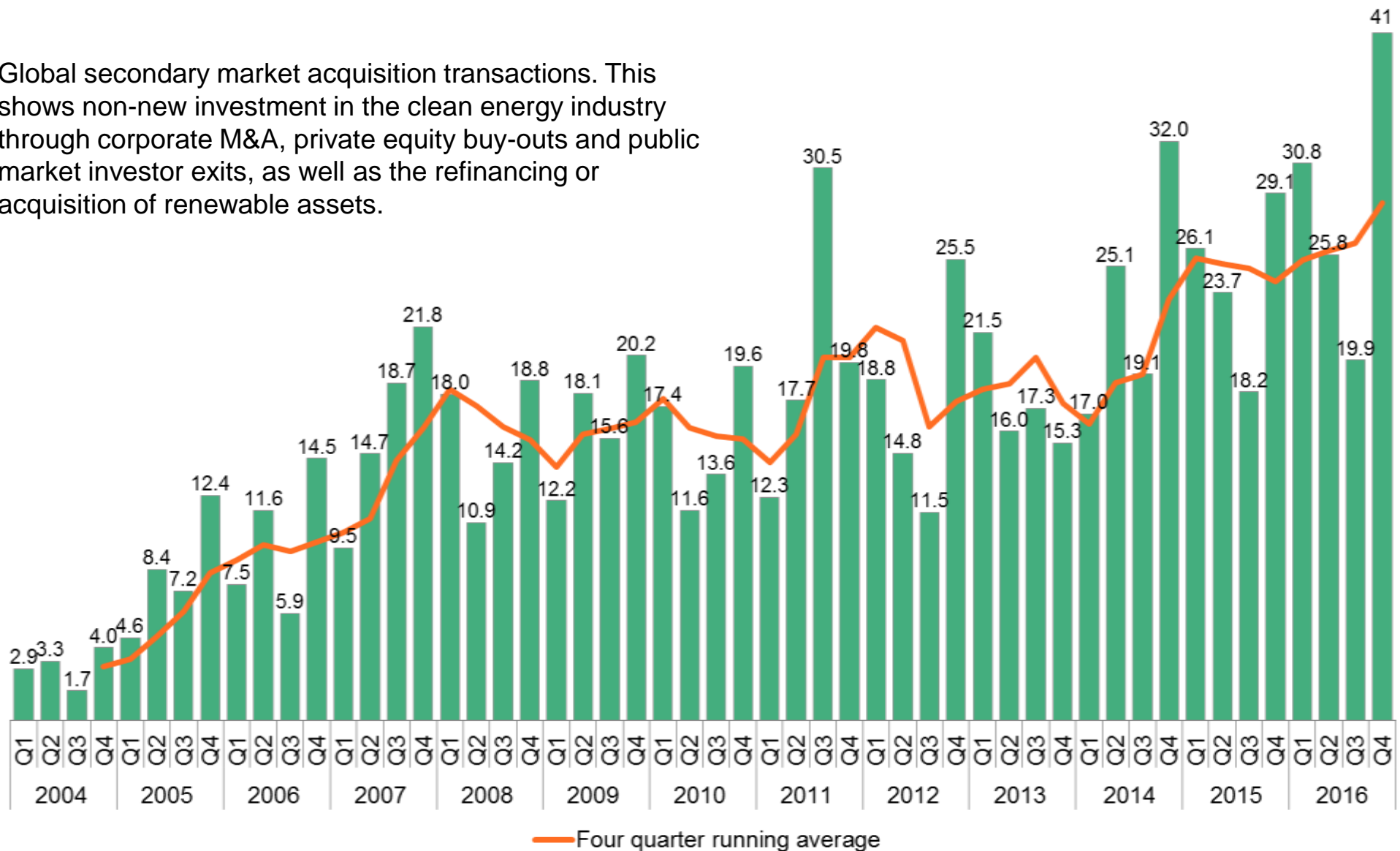
Four quarter running average

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TOP TRANSACTIONS FOR FUNDS IN CIRCULATION
Q4 2016

Organisation	Country	Sector	Type of transaction	Acquirer	Value
SolarCity	United States	Solar	Equity (company)	Tesla Motors Inc	$4,864m
Innogy	Germany	Solar	IPO (investor exit)	na	$2,946m
China High Speed Transmission Equipment Group	Hong Kong	Wind	Equity: Strategic Stake in Public Company	Five Seasons XVI	$2,056m
Race Bank Offshore Wind Farm Macquarie Acquisition	United Kingdom	Wind	Acquisition	Macquarie Capital Ltd, Macquarie Infrastructure Corp	$1,977m
Sensus USA	United States	Digital Energy	Equity (company)	Xylem Inc/NY	$1,700m

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CORPORATE M&A TRANSACTIONS IN CLEAN ENERGY
Q1 2004-Q4 2016 ($BN)

- Global mergers and acquisitions of companies that are primarily involved in the clean energy industry according to BNEF exposure ratings.

Four quarter running average
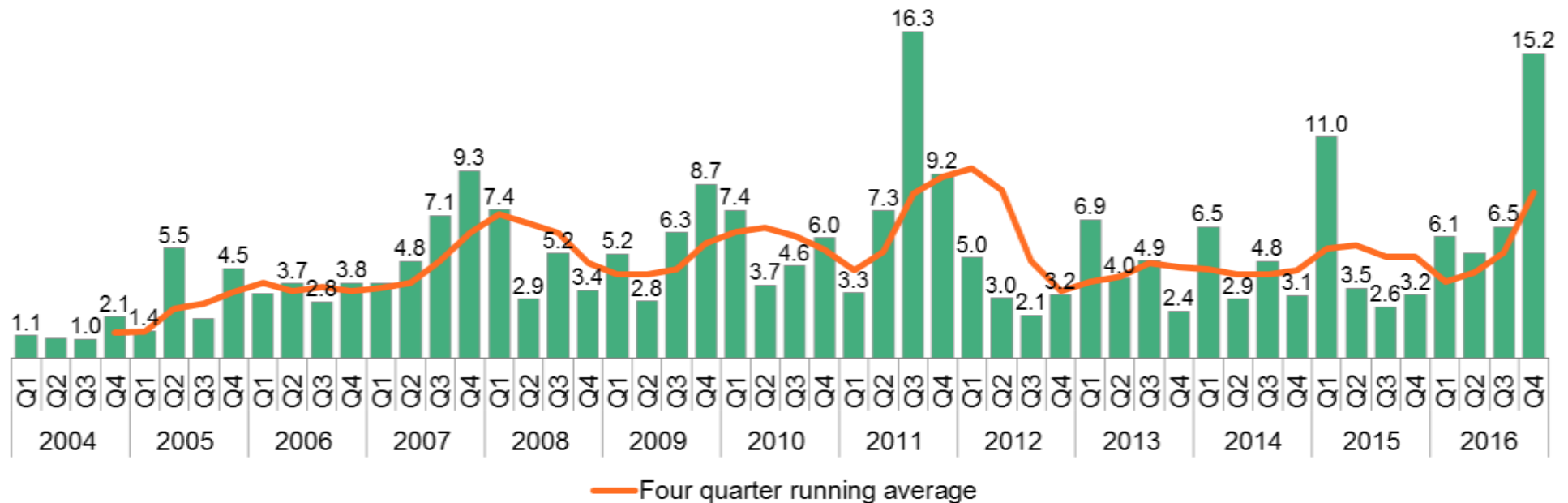
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RENEWABLE ENERGY ASSET ACQUISITIONS & REFINANCING Q1 2004-Q4 2016 ($BN)

- Global acquisitions or refinancing's of utility-scale (1MW+) renewable energy generating assets.
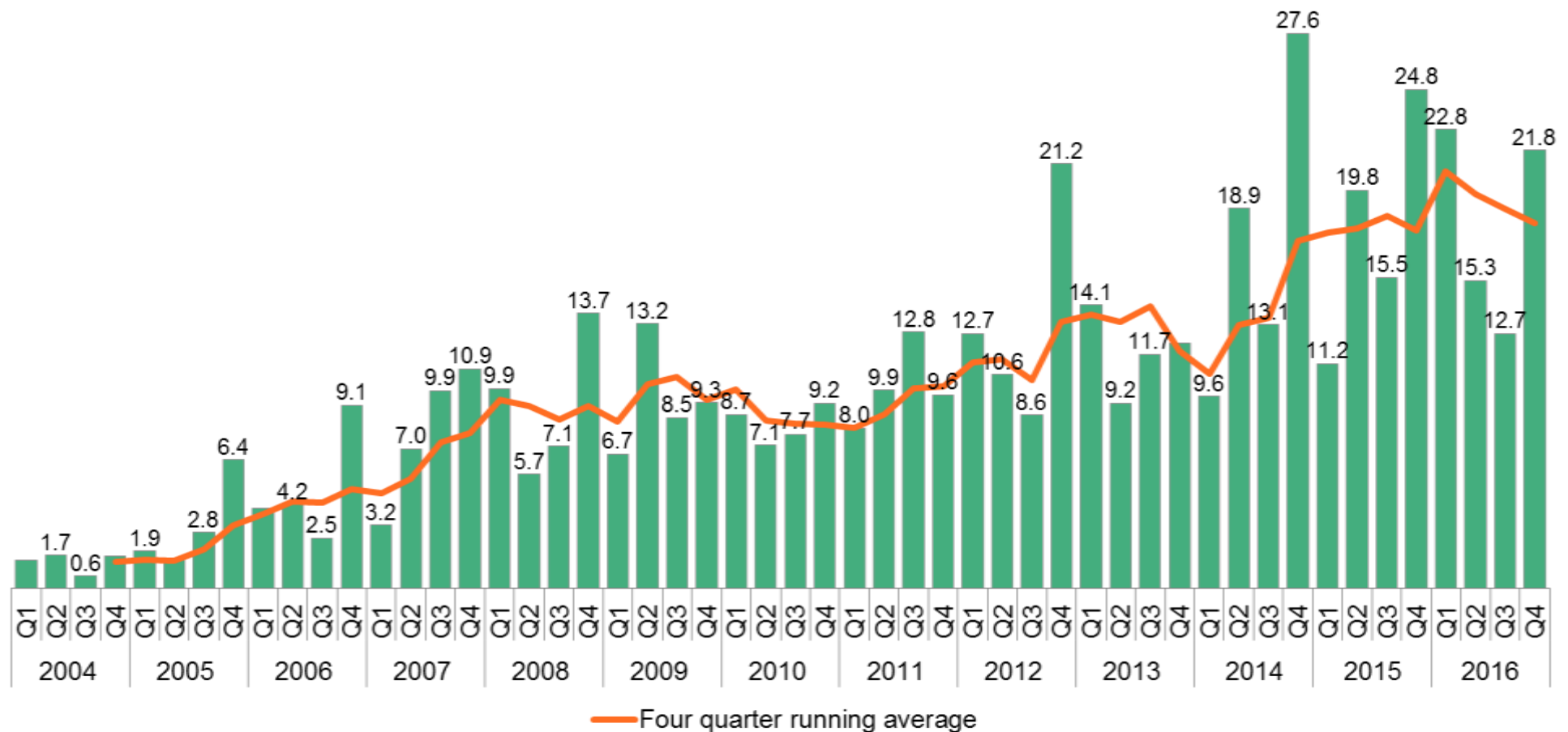
Four quarter running average

Note: Total values include estimates for undisclosed deals
Source: Bloomberg New Energy Finance

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Clean energy indexes.

NEX CLEAN ENERGY INDEX
2003–17 YTD

- The WilderHill New Energy Global Innovation Index (NEX) is a modified dollar-weighted index of publicly tr
  companies active in renewable and low-carbon energy, and which stand to benefit from responses to clima
  and energy security concerns. The majority of index members are quoted outside the US.

Legend:
- NEX (red)
- NASDAQ (grey)
- S&P 500 (green)

Note: Values as of 9 January 2017; NASDAQ and S&P 500 rebased to 100 on 1 Jan 2003
Source: Bloomberg New Energy Finance

NEX CLEAN ENERGY INDEX
2012–17 YTD
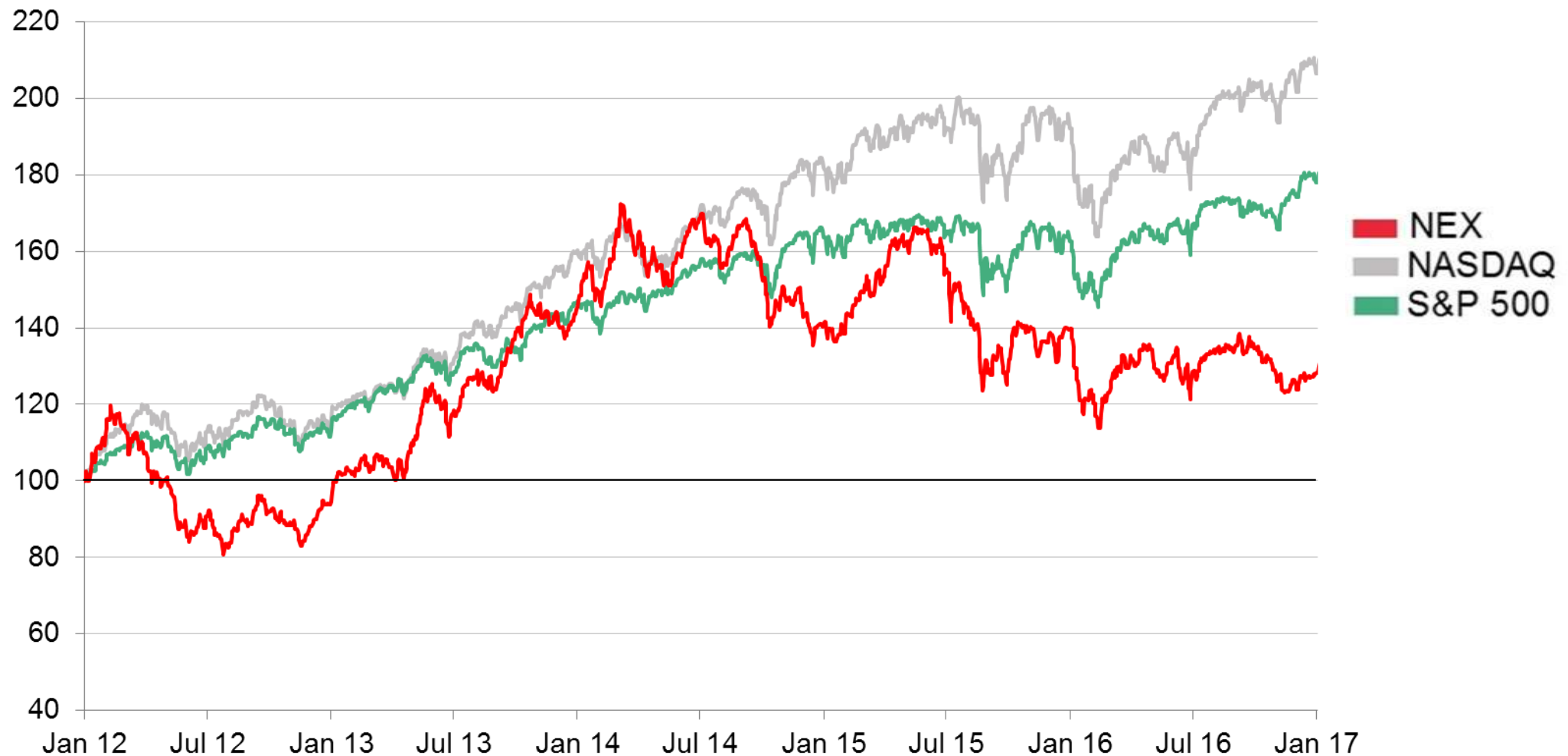
Legend: NEX, NASDAQ, S&P 500

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NEX CLEAN ENERGY INDEX
2013–17 YTD

Legend: NEX, NASDAQ, S&P 500

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New Energy Finance

NEX CLEAN ENERGY INDEX
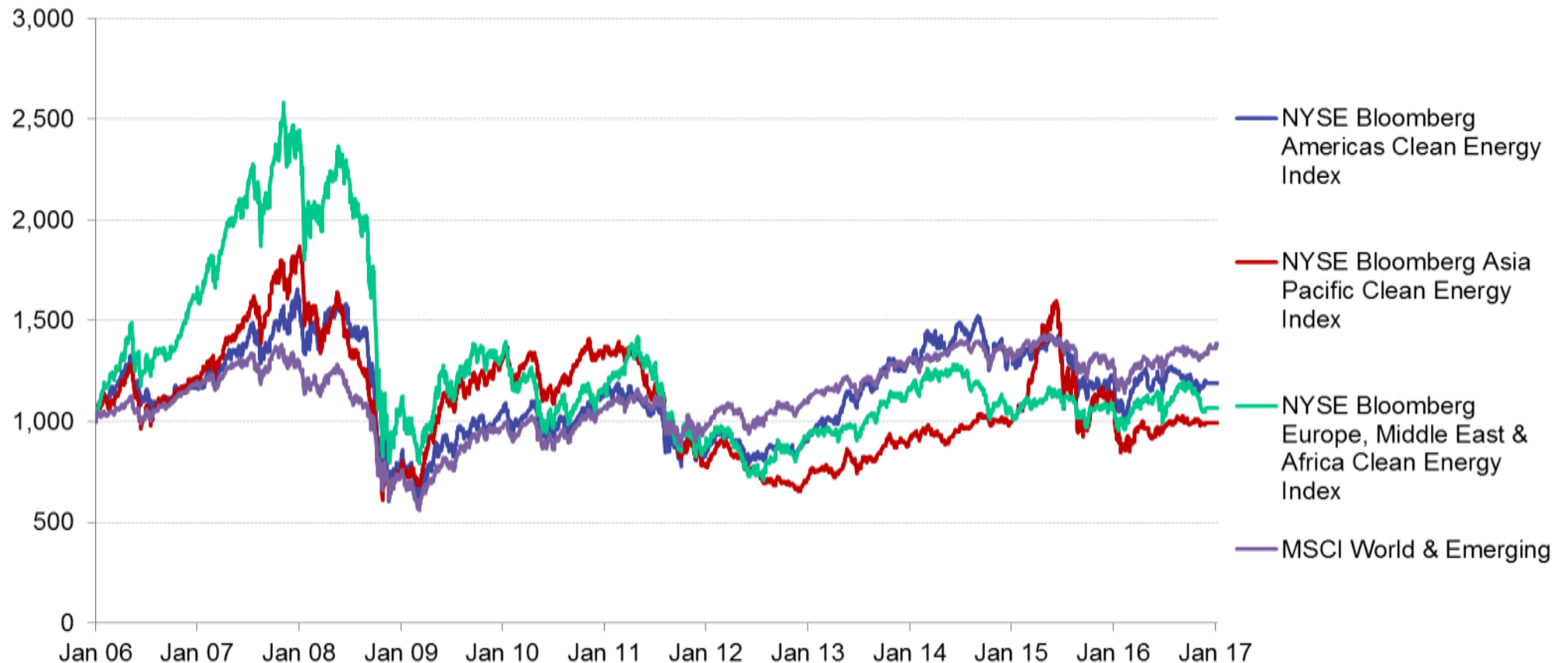## 2014–17 YTD
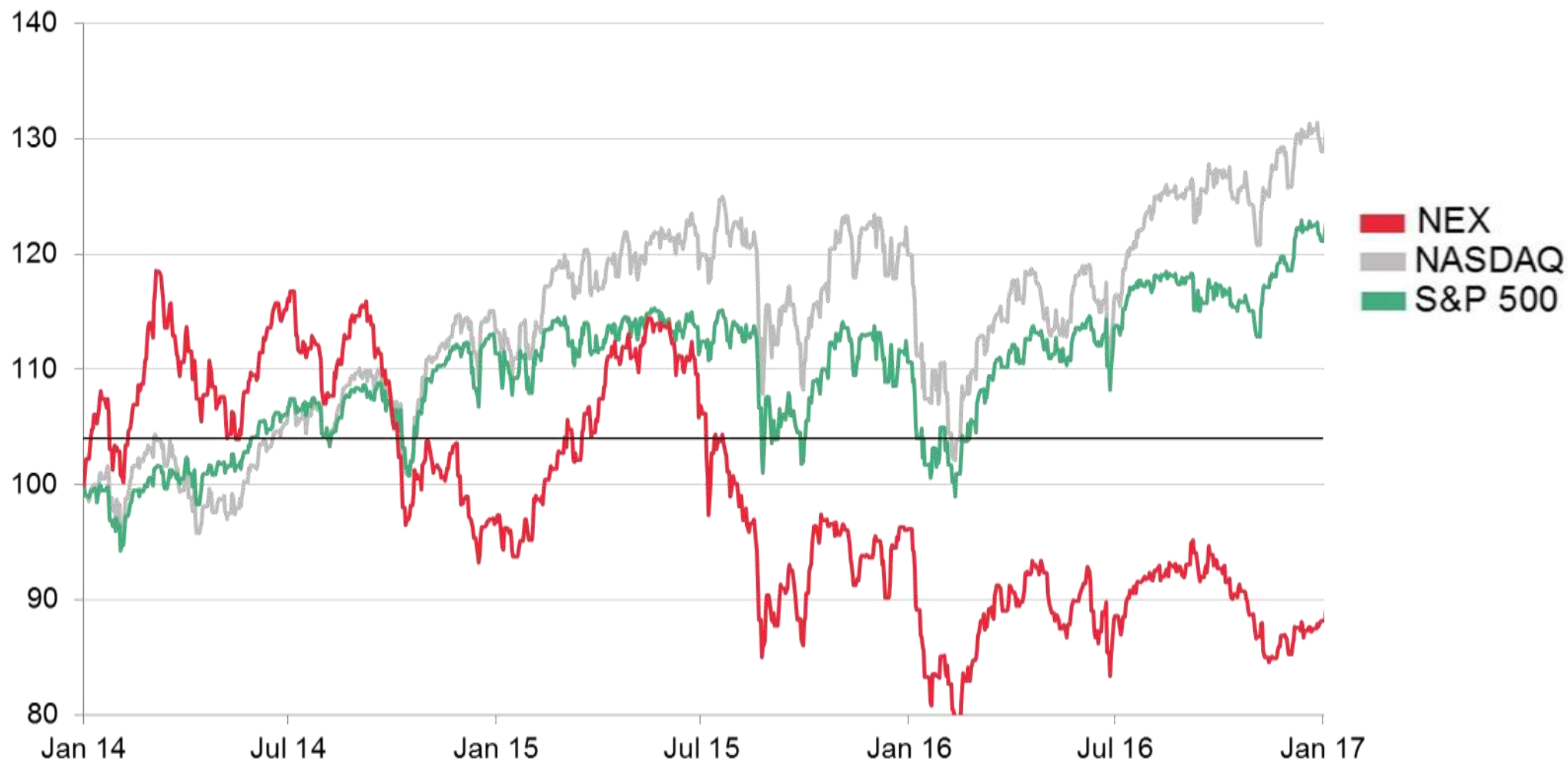
Note: Values as of 9 January 2017; NASDAQ and S&P 500 rebased to 100 on 1 Jan 2014
Source: Bloomberg New Energy Finance

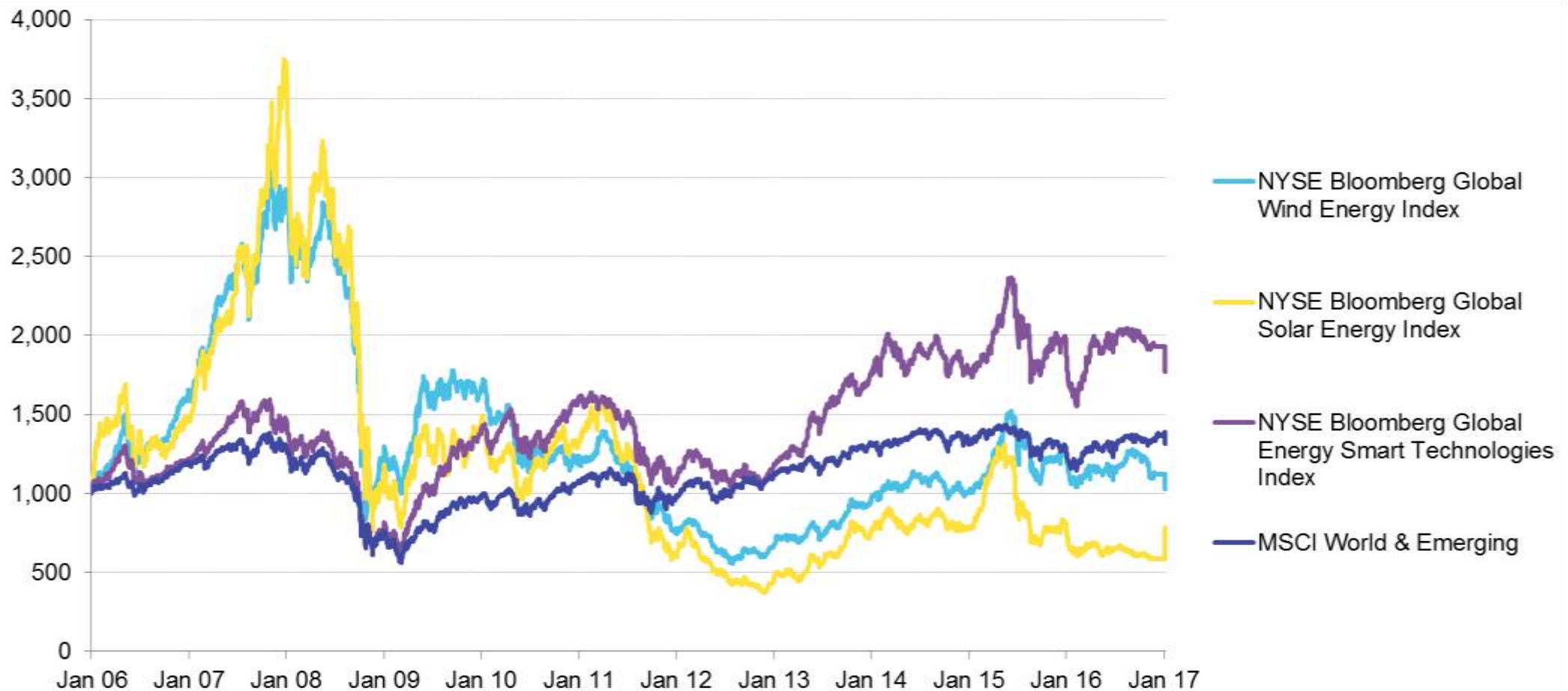# NYSE BNEF REGIONAL CLEAN ENERGY INDEXES
2006-17 YTD

Legend:
— NYSE Bloomberg Americas Clean Energy Index
— NYSE Bloomberg Asia Pacific Clean Energy Index
— NYSE Bloomberg Europe, Middle East & Africa Clean Energy Index
— MSCI World & Emerging

NYSE GLOBAL CLEAN ENERGY SECTOR INDEXES
2006-17 YTD

Legend:
- NYSE Bloomberg Global Wind Energy Index
- NYSE Bloomberg Global Solar Energy Index
- NYSE Bloomberg Global Energy Smart Technologies Index
- MSCI World & Emerging

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Renewable energy capacity investment.

RENEWABLE ENERGY CAPACITY INVESTMENT EXCLUDING LARGE HYDRO 2004-16 ($BN)

- Total annual investment into new build renewable energy generating assets (excluding large hydro). This includes large and small scale project finance.
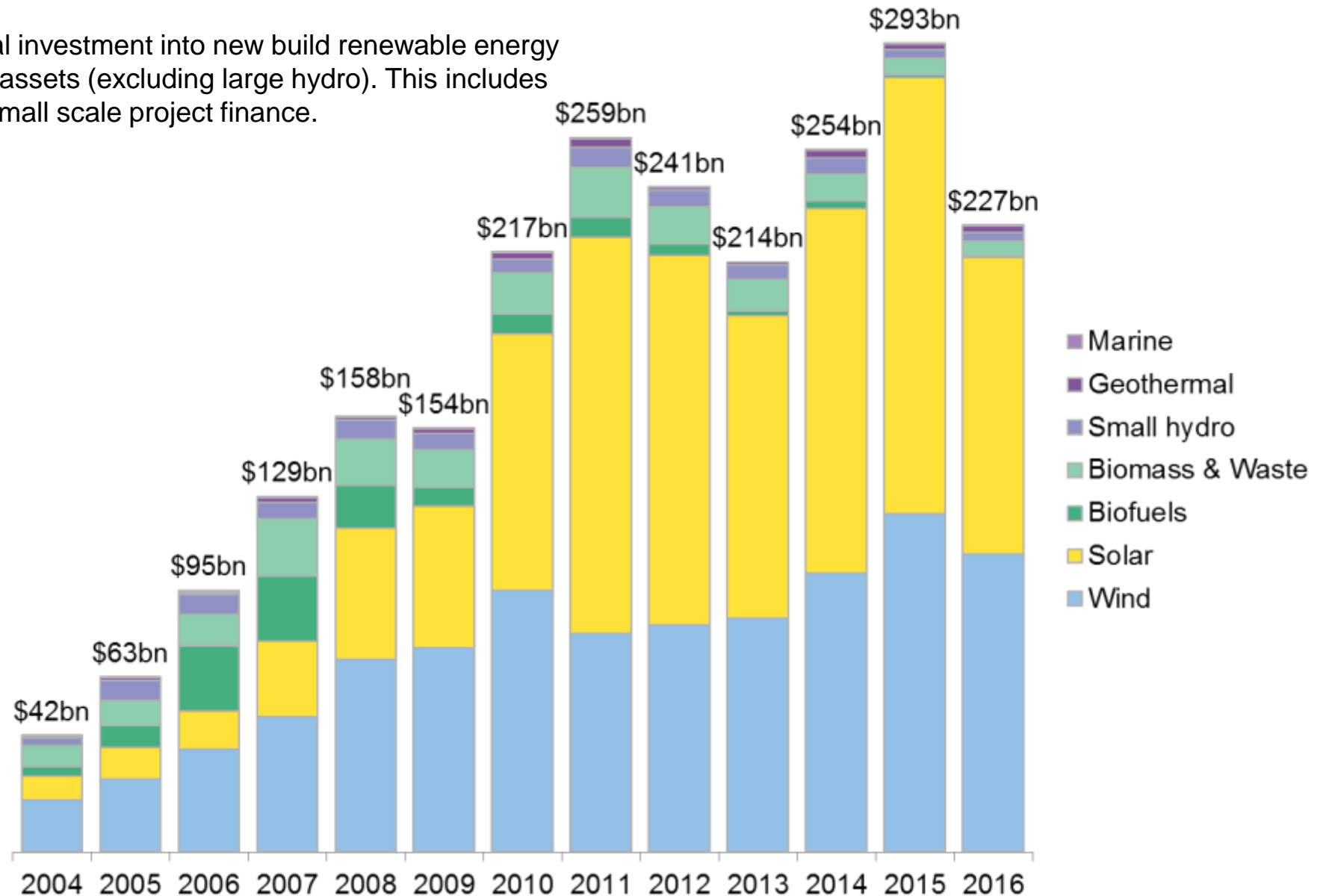
Legend:
- Marine
- Geothermal
- Small hydro
- Biomass & Waste
- Biofuels
- Solar
- Wind

Values: $42bn (2004), $63bn (2005), $95bn (2006), $129bn (2007), $158bn (2008), $154bn (2009), $217bn (2010), $259bn (2011), $241bn (2012), $214bn (2013), $254bn (2014), $293bn (2015), $227bn (2016)

Note: Total values include estimates for undisclosed deals.
Source: Bloomberg New Energy Finance

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COVERAGE

Renewable Energy

Power & Utilities

Energy Smart Technologies

Transport

Gas

Carbon Markets & Climate Negotiations

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