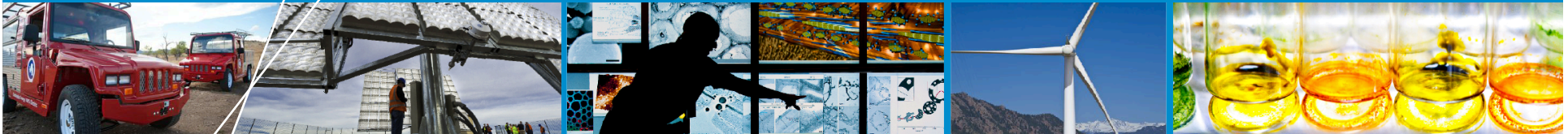


# Innovation in Finance for Clean Energy



Presentation to the Forum on Clean Energy Finance

May 20, 2016

# Agenda

---

- **Where are we today?**
- **What is the problem?**
- **What is changing?**
- **What does the future look like?**

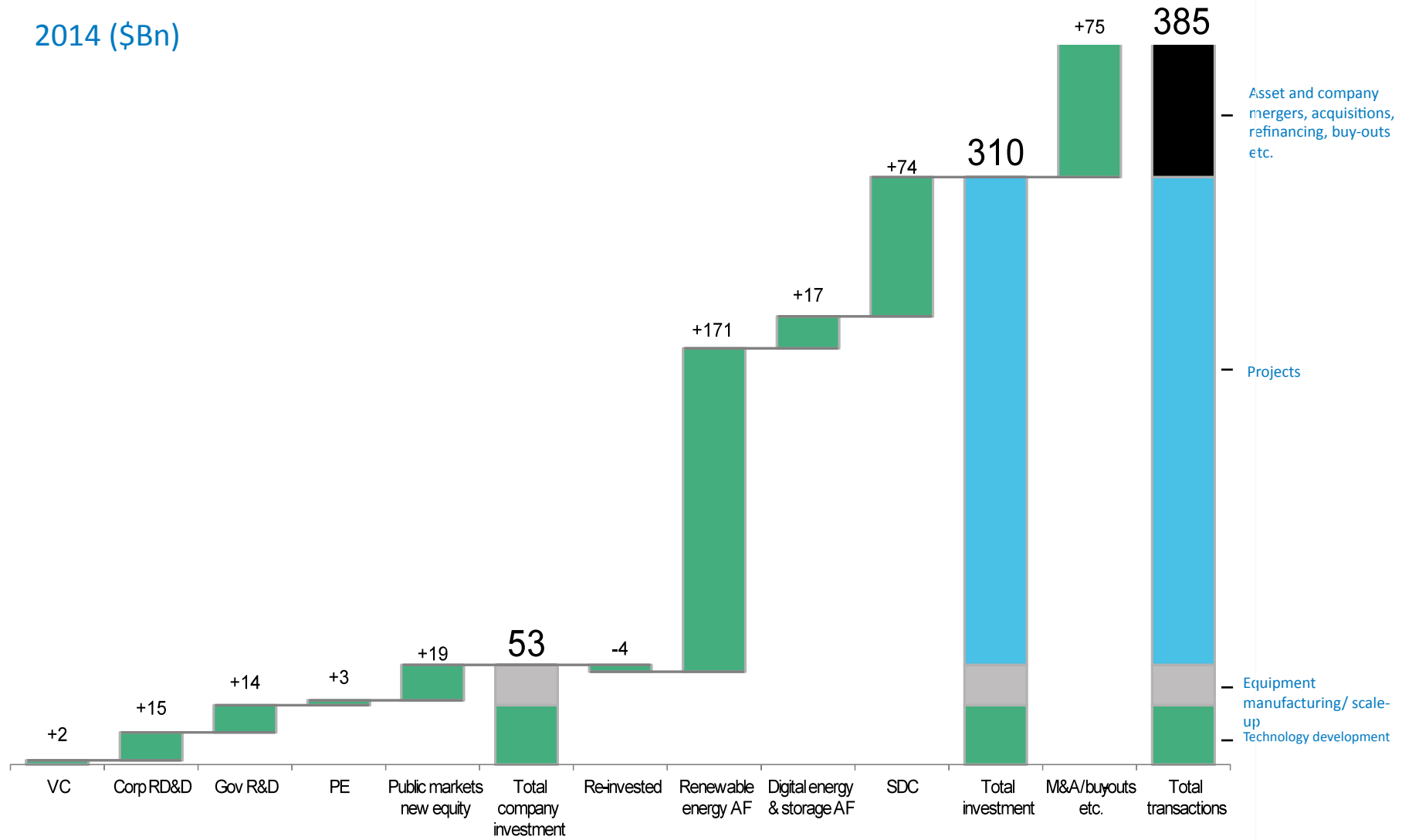
# State of Clean Energy Investment

---

- Emerging new markets
- European investment declined
- Declining costs
- Wind and solar's capacity share increases
- Renewables thrive in a period of historic low fossil fuel prices

# Global Clean Energy Investment

2014 (\$Bn)

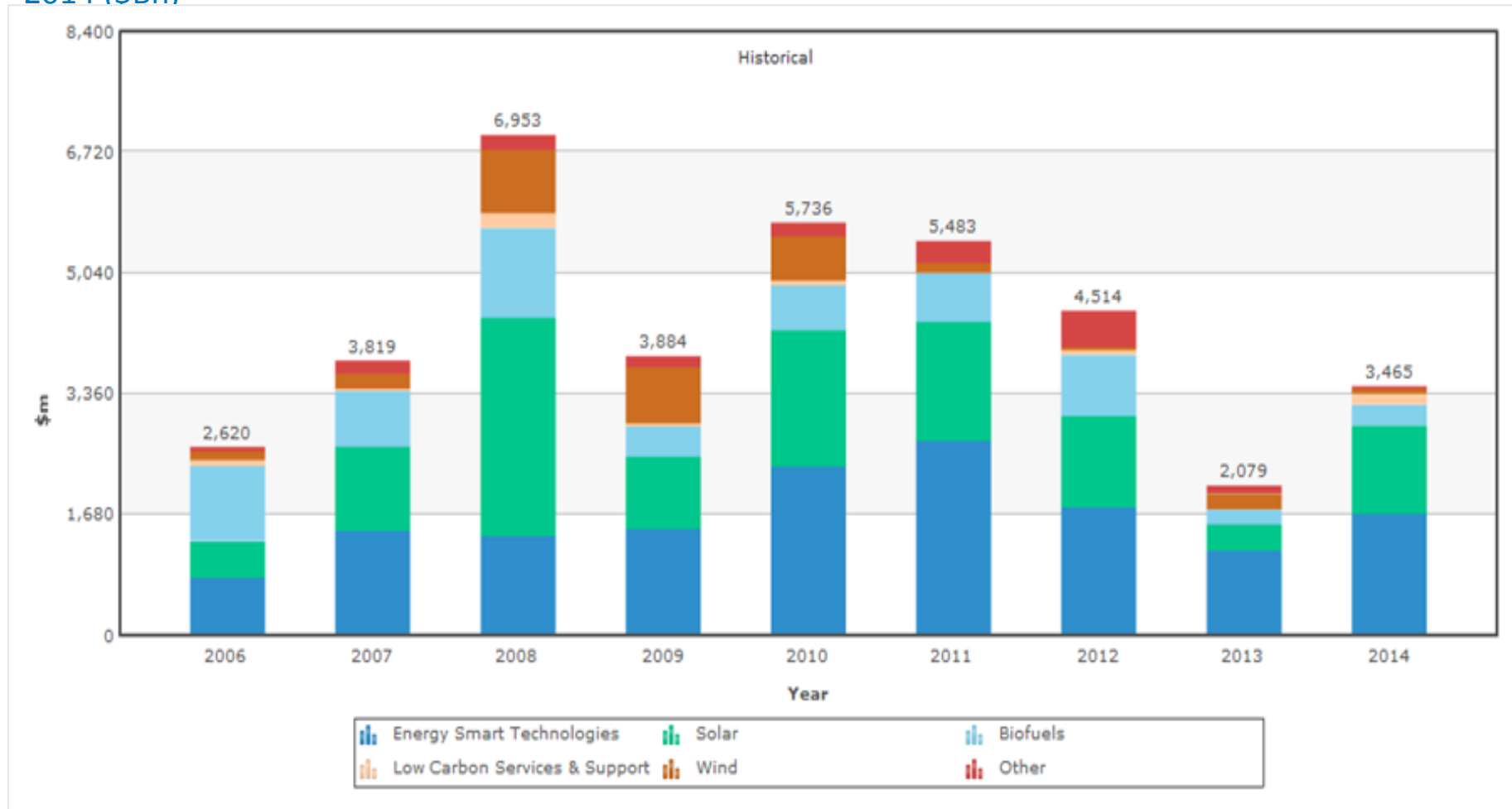


Note: Total values include estimates for undisclosed deals. AF = asset finance, SDC = small distributed capacity.

Source: Bloomberg New Energy Finance

# Global Clean Energy Investment

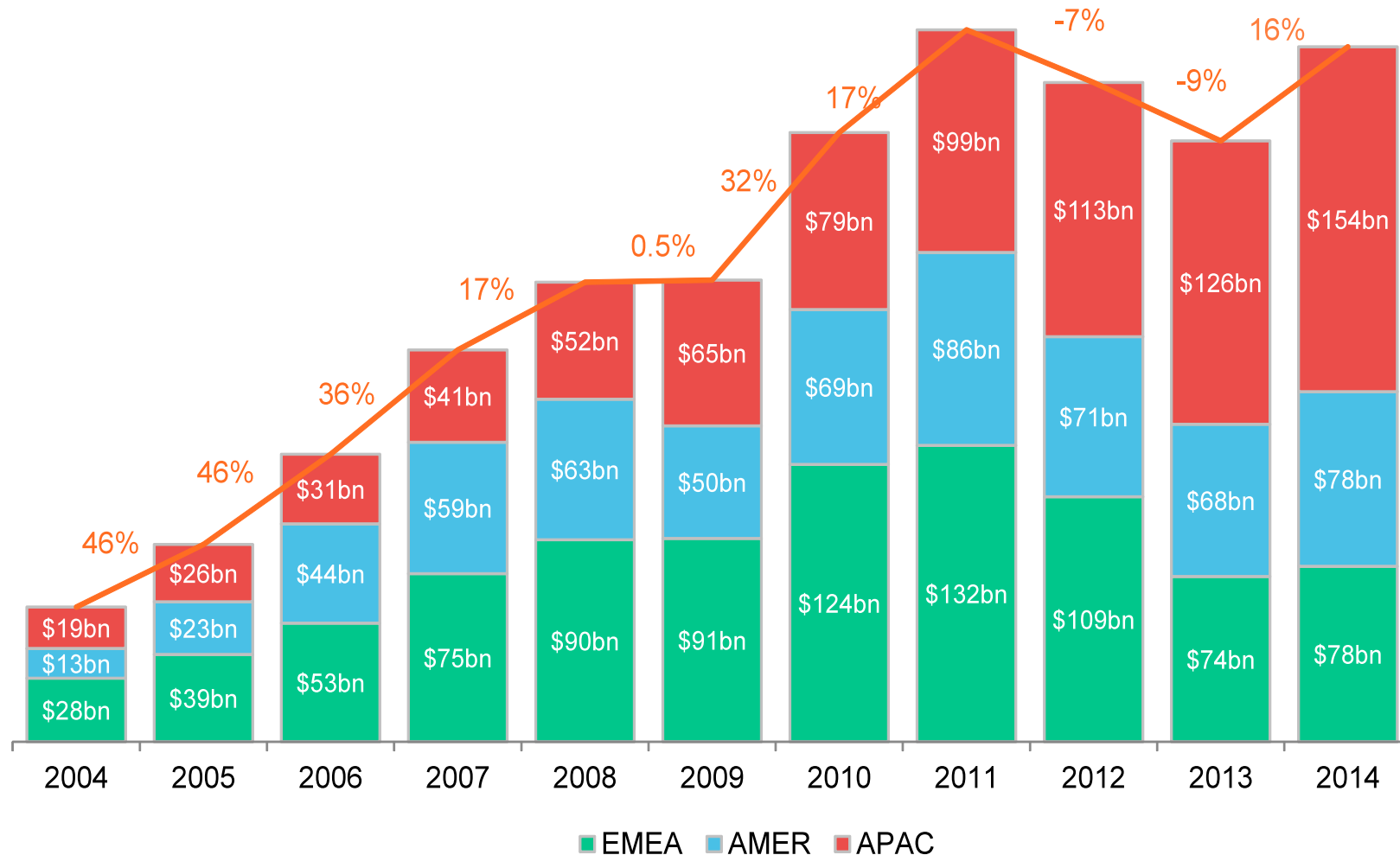
2014 (\$Bn)



Source: Bloomberg New Energy Finance

# New Investment in Clean Energy by Region

2004-14 (\$bn)

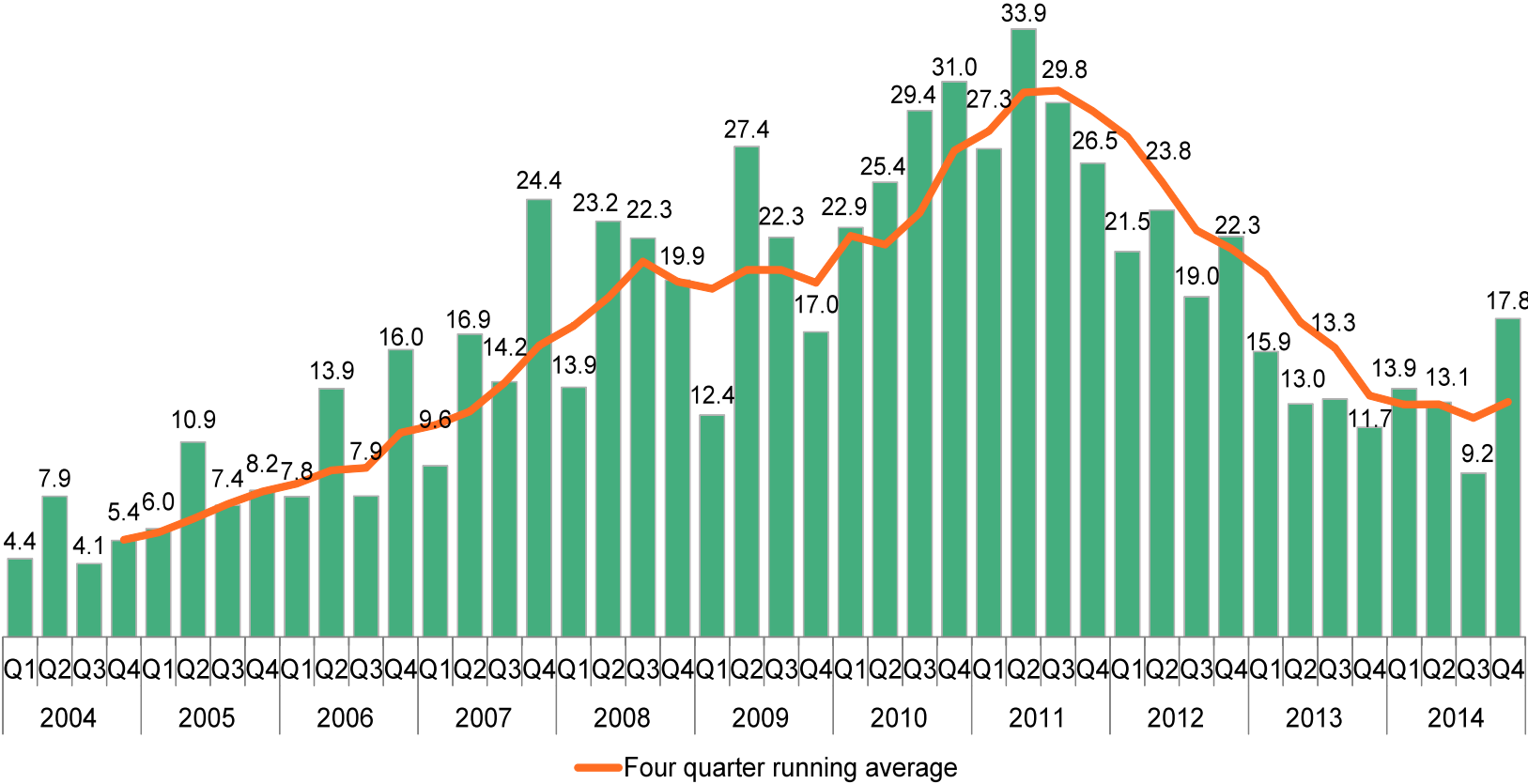


Note: Total values include estimates for undisclosed deals. Includes corporate and government R&D, and spending for digital energy and energy storage projects (not reported in quarterly statistics).

Source: Bloomberg New Energy Finance

# New Investment in Clean Energy In Europe

Q1 2004-Q4 2014 (\$BN)

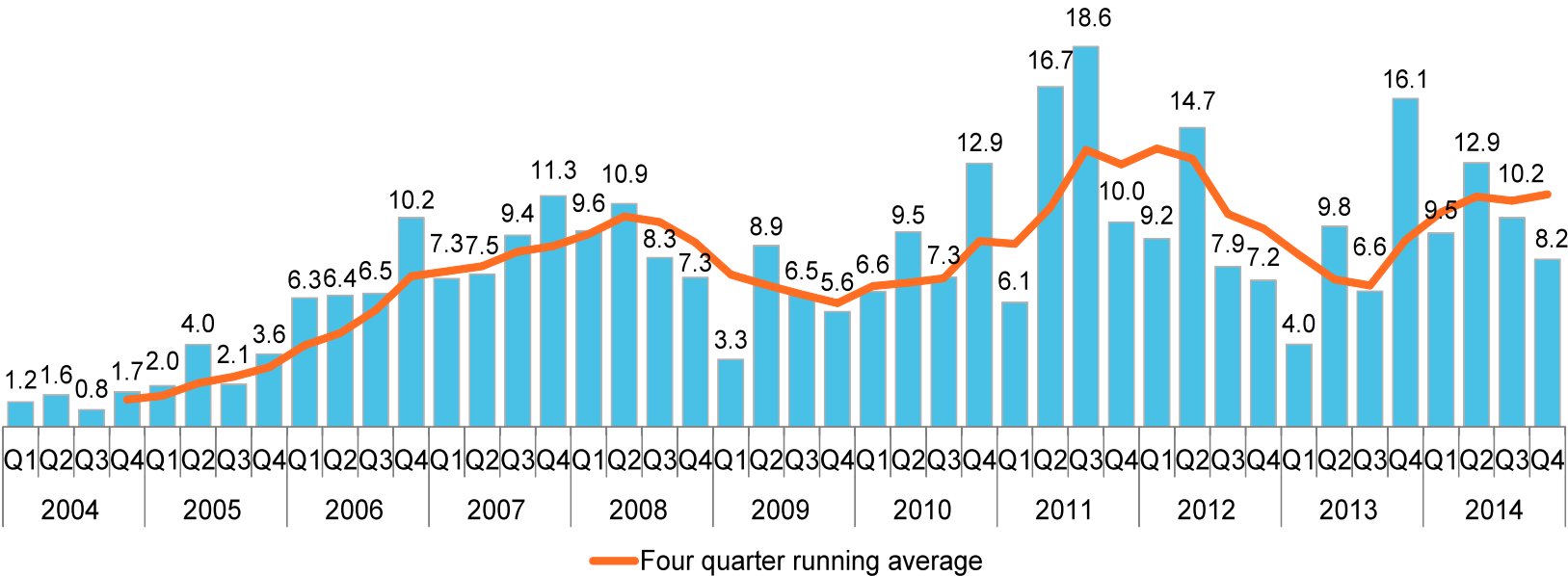


Note: Total values include estimates for undisclosed deals. Excludes corporate and government R&D, and spending for digital energy and energy storage projects (reported in annual statistics only).

Source: Bloomberg New Energy Finance

# New Investment in Clean Energy In the US

Q1 2004-Q4 2014 (\$BN)

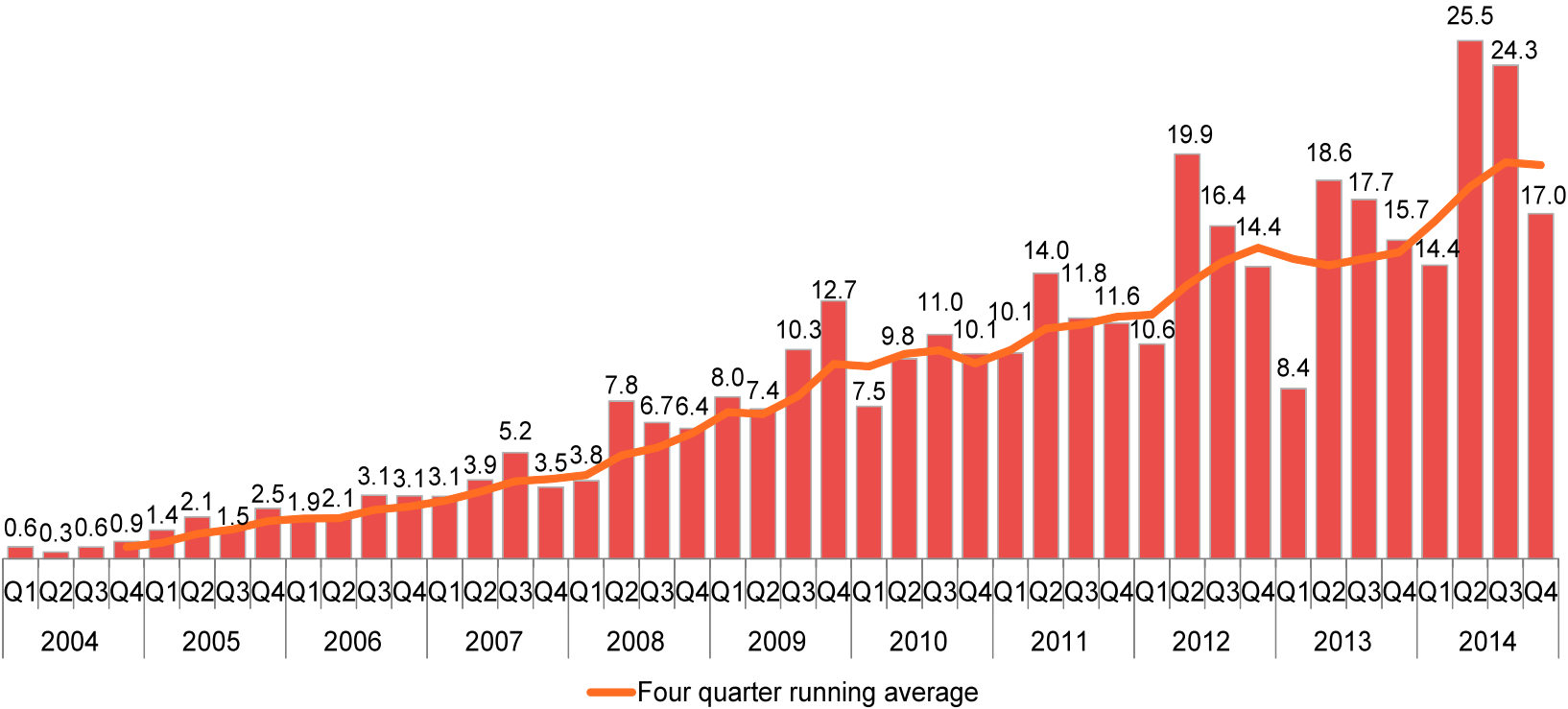


Note: Total values include estimates for undisclosed deals. Excludes corporate and government R&D, and spending for digital energy and energy storage projects (reported in annual statistics only).

Source: Bloomberg New Energy Finance

# New Investment in Clean Energy In China

Q1 2004-Q4 2014 (\$BN)

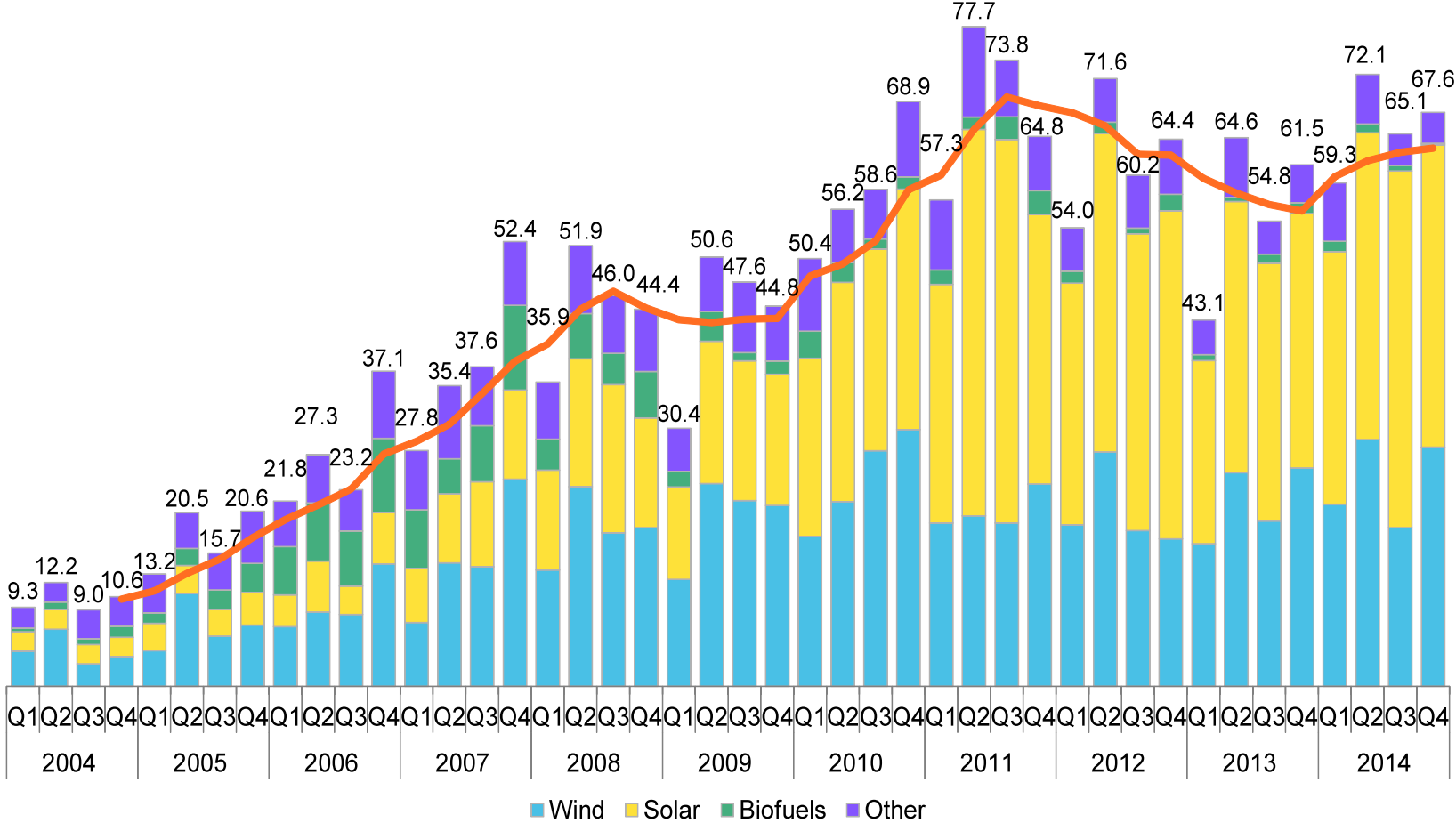


Note: Total values include estimates for undisclosed deals. Excludes corporate and government R&D, and spending for digital energy and energy storage projects (reported in annual statistics only).

Source: Bloomberg New Energy Finance

# New Investment in Clean Energy - Sector

Q1 2004-Q4 2014 (\$BN)

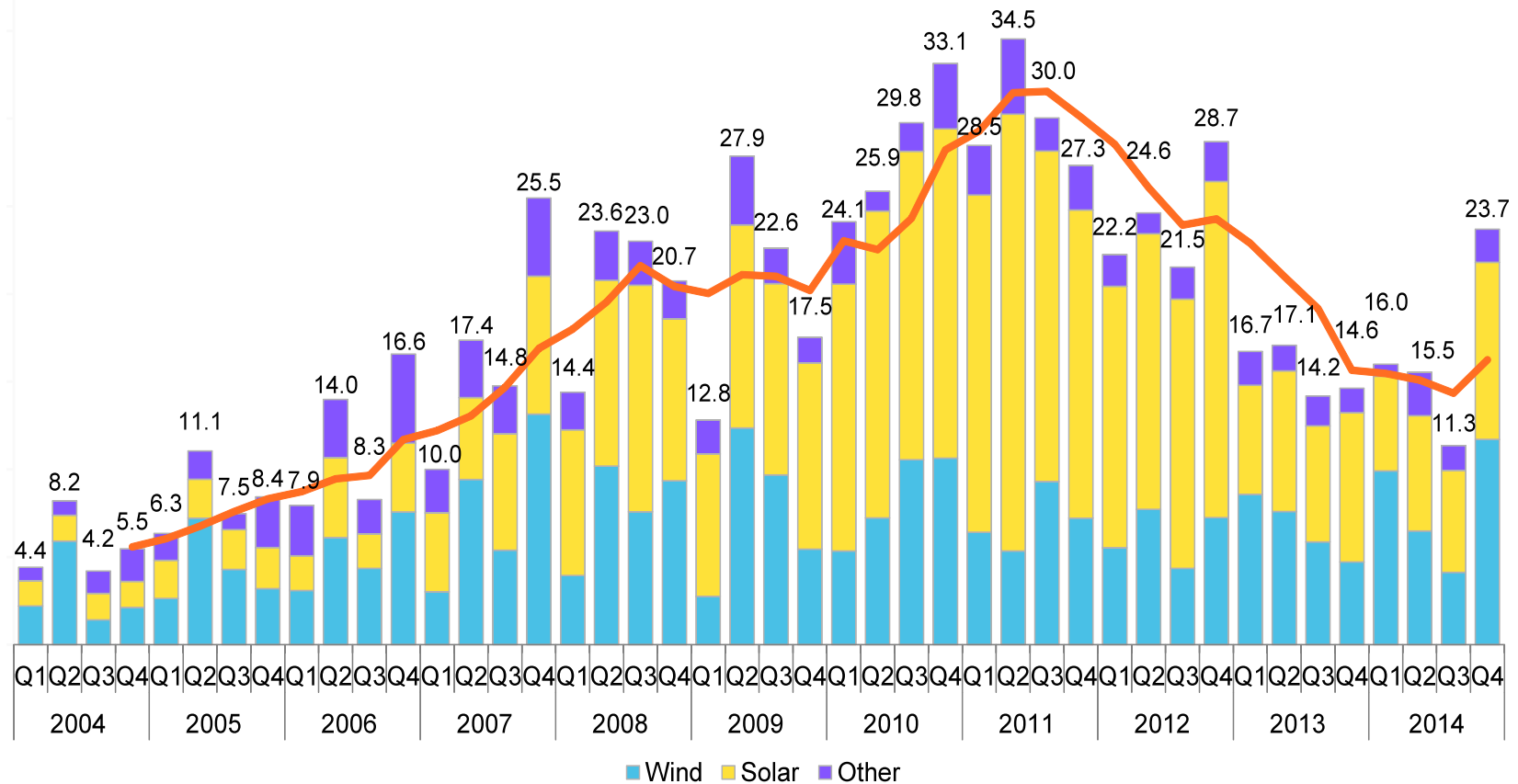


Note: Total values include estimates for undisclosed deals. Excludes corporate and government R&D, and spending for digital energy and energy storage projects (reported in annual statistics only).

Source: Bloomberg New Energy Finance

# EMEA New Investment in Clean Energy - Sector

Q1 2004-Q4 2014 (\$BN)

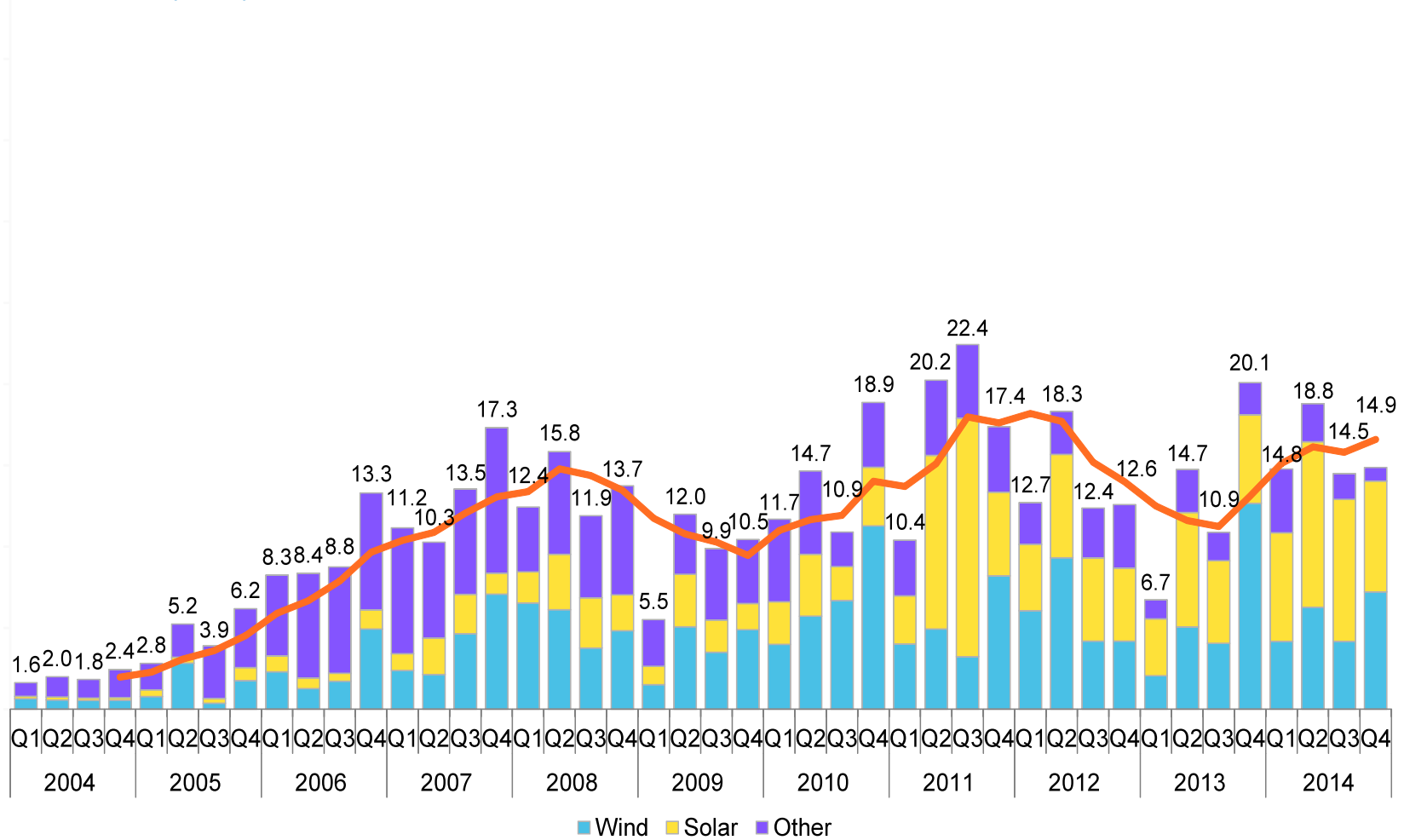


Note: Total values include estimates for undisclosed deals. Excludes corporate and government R&D, and spending for digital energy and energy storage projects (reported in annual statistics only).

Source: Bloomberg New Energy Finance

# AMER New Investment in Clean Energy - Sector

Q1 2004-Q4 2014 (\$BN)

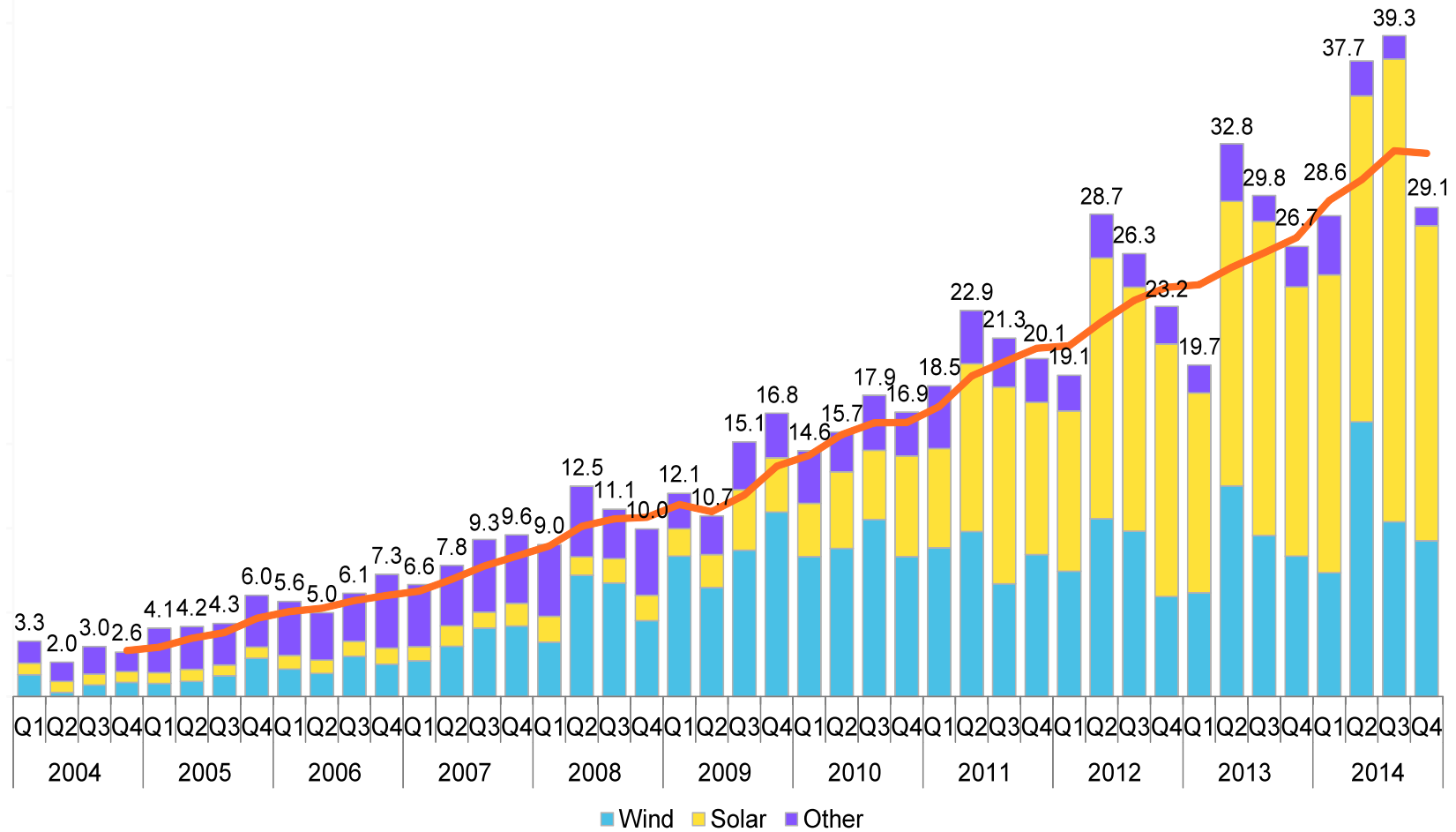


Note: Total values include estimates for undisclosed deals. Excludes corporate and government R&D, and spending for digital energy and energy storage projects (reported in annual statistics only).

Source: Bloomberg New Energy Finance

# APAC New Investment in Clean Energy - Sector

Q1 2004-Q4 2014 (\$BN)

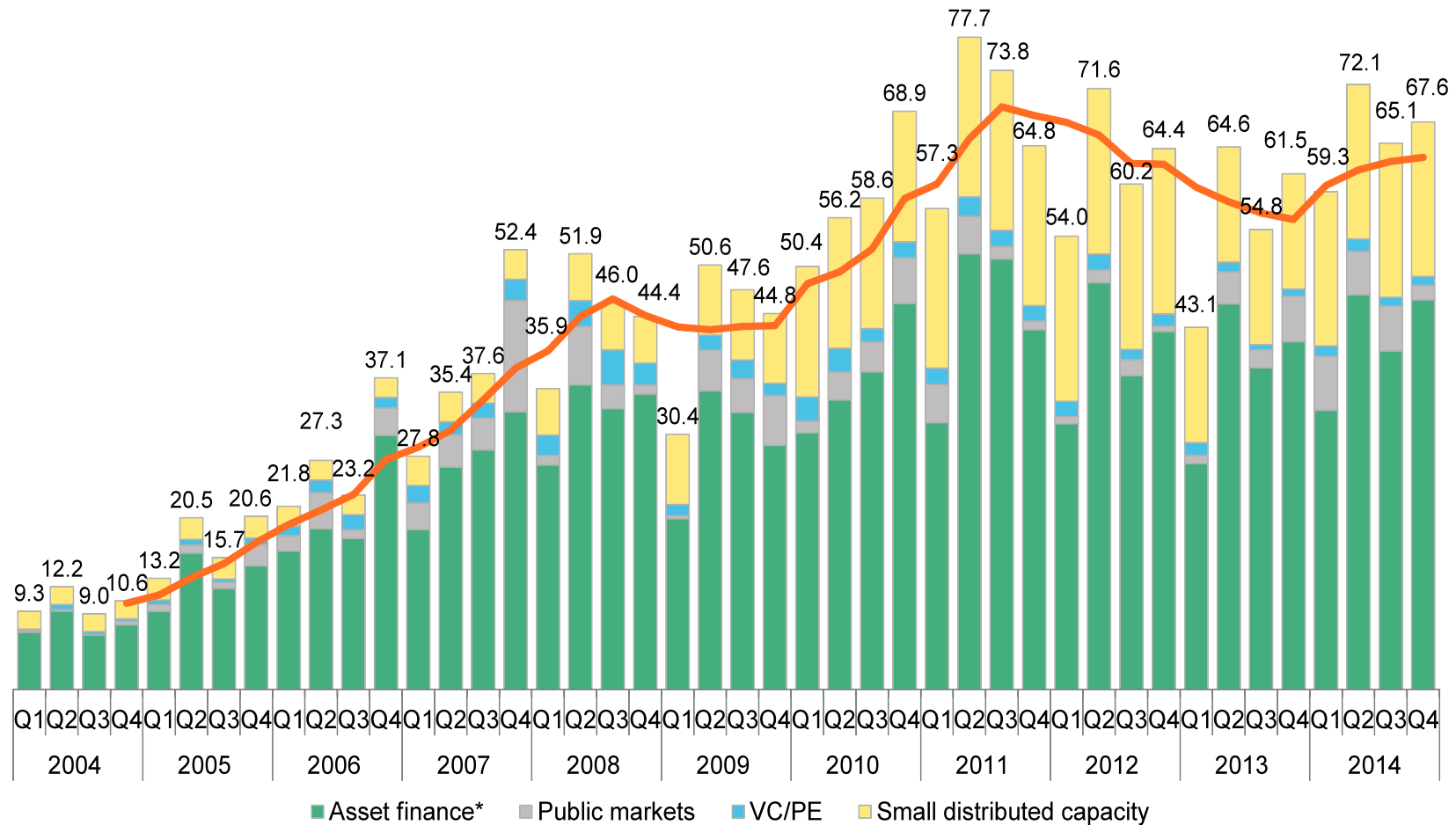


Note: Total values include estimates for undisclosed deals. Excludes corporate and government R&D, and spending for digital energy and energy storage projects (reported in annual statistics only).

Source: Bloomberg New Energy Finance

# New Investment in Clean Energy - Asset Class

Q1 2004-Q4 2014 (\$BN)



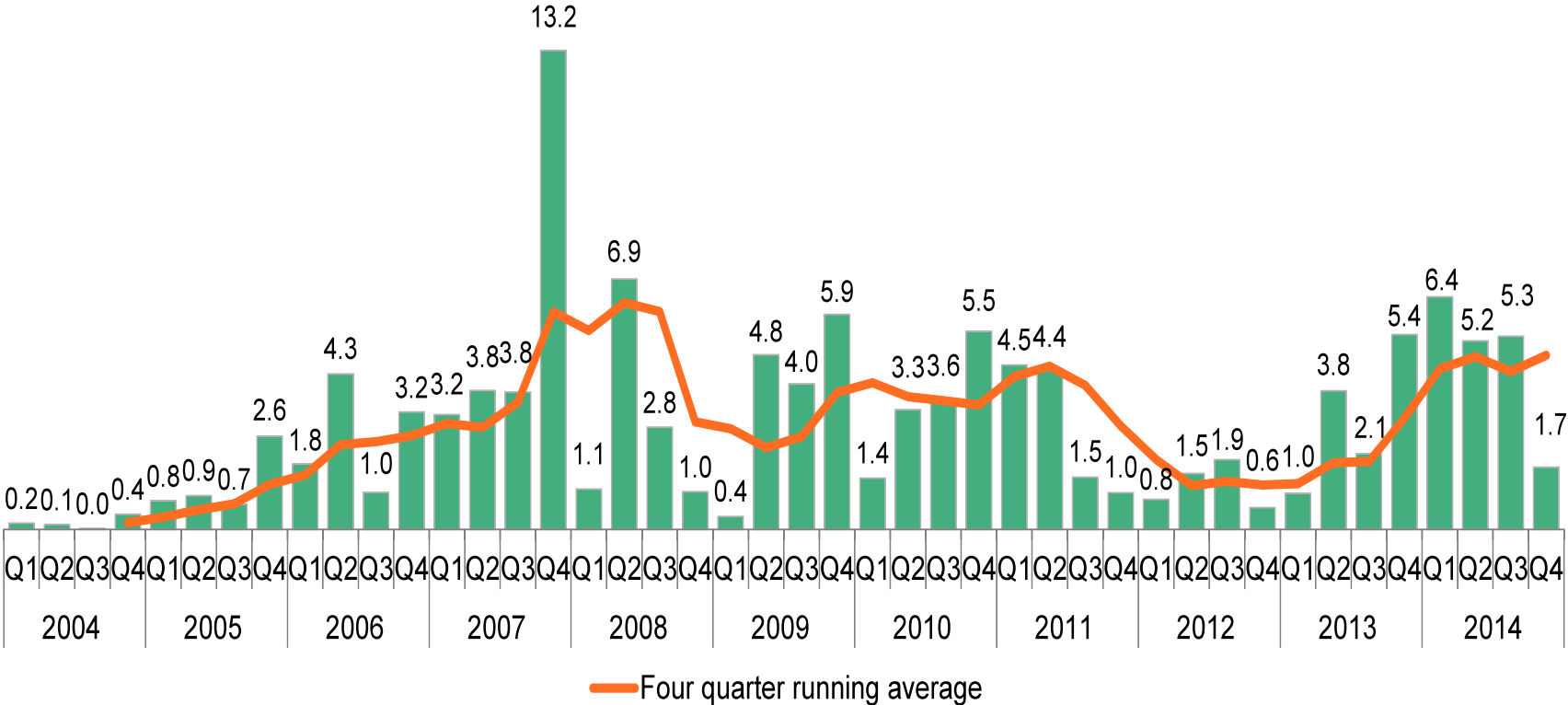
\*Asset finance adjusted for re-invested equity

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

# Public Market New Investment in Clean Energy

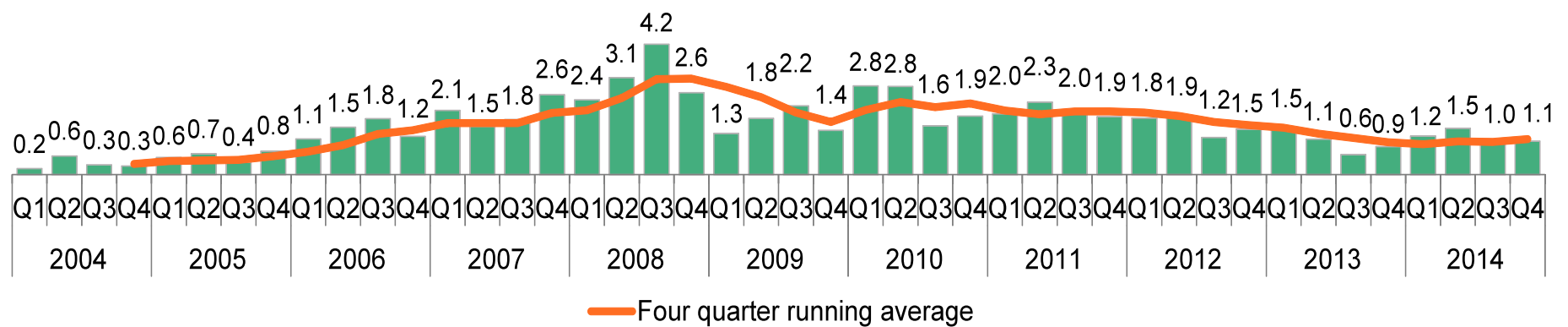
Q1 2004-Q4 2014 (\$BN)



Source: Bloomberg New Energy Finance

# VC/PE New Investment in Clean Energy

Q1 2004-Q4 2014 (\$BN)

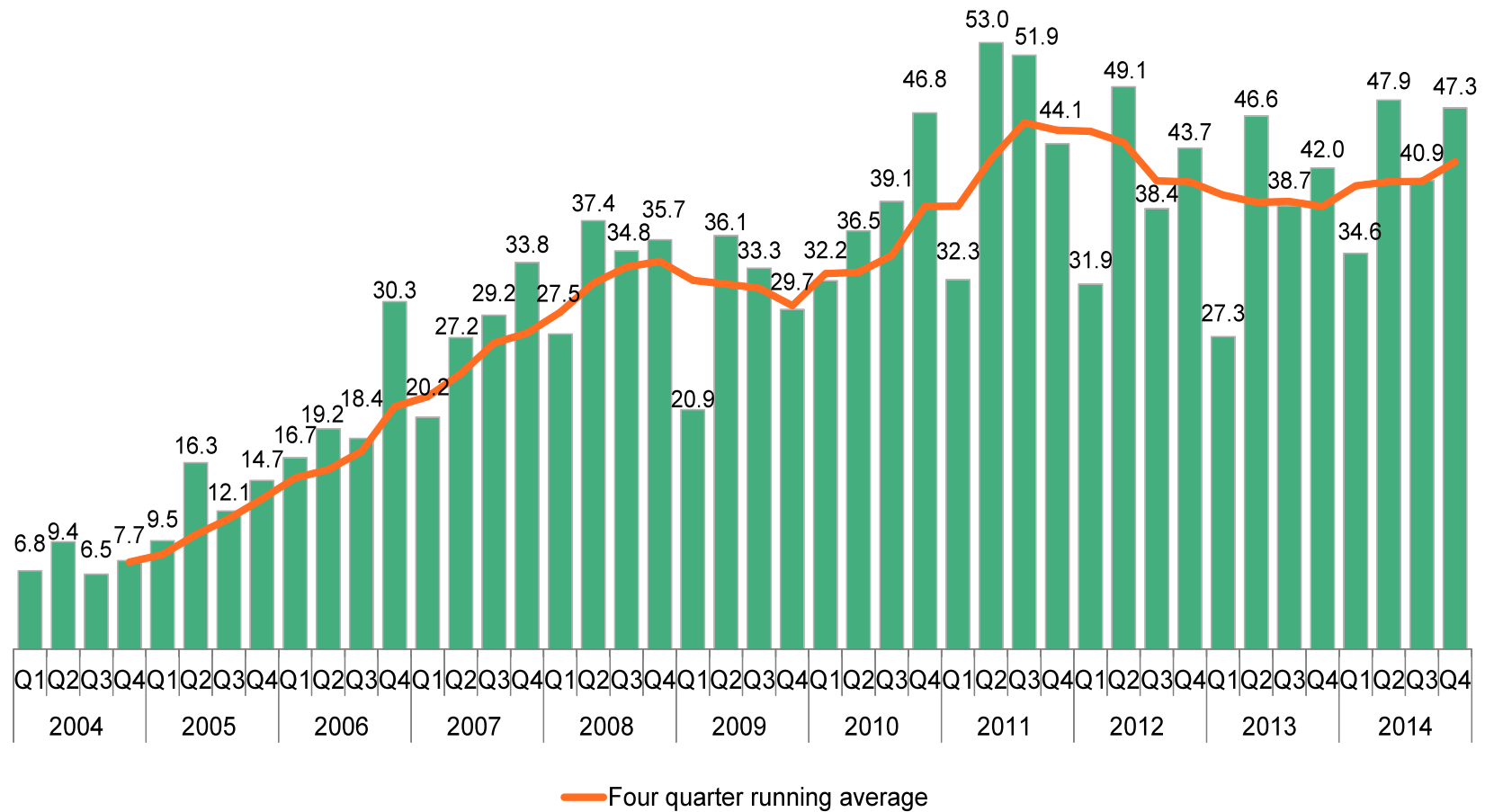


Note: Total values include estimates for undisclosed deals.

Source: Bloomberg New Energy Finance

# Asset Financing - New Build RE Assets

Q1 2004-Q4 2014 (\$BN)

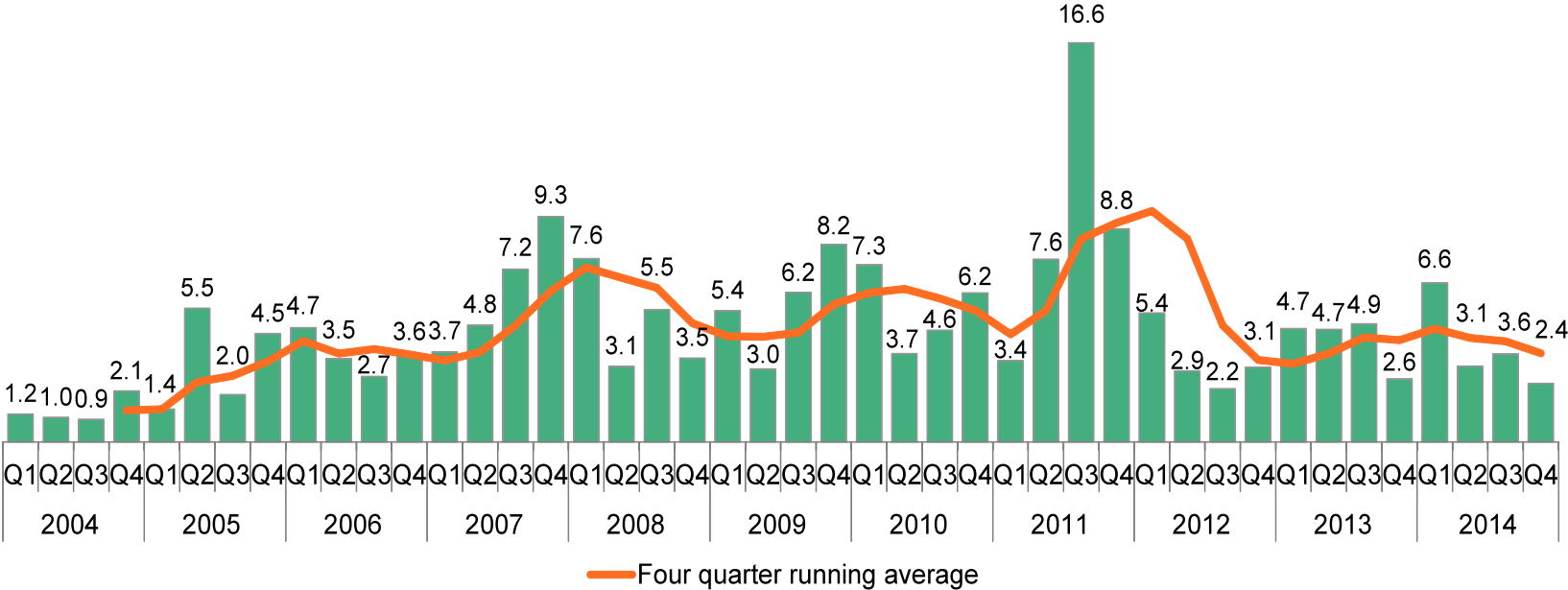


Note: Total values include estimates for undisclosed deals. Excludes spending for digital energy and energy storage projects (reported in annual statistics only).

Source: Bloomberg New Energy Finance

# Corporate M&A Transactions in Clean Energy

Q1 2004-Q4 2014 (\$BN)

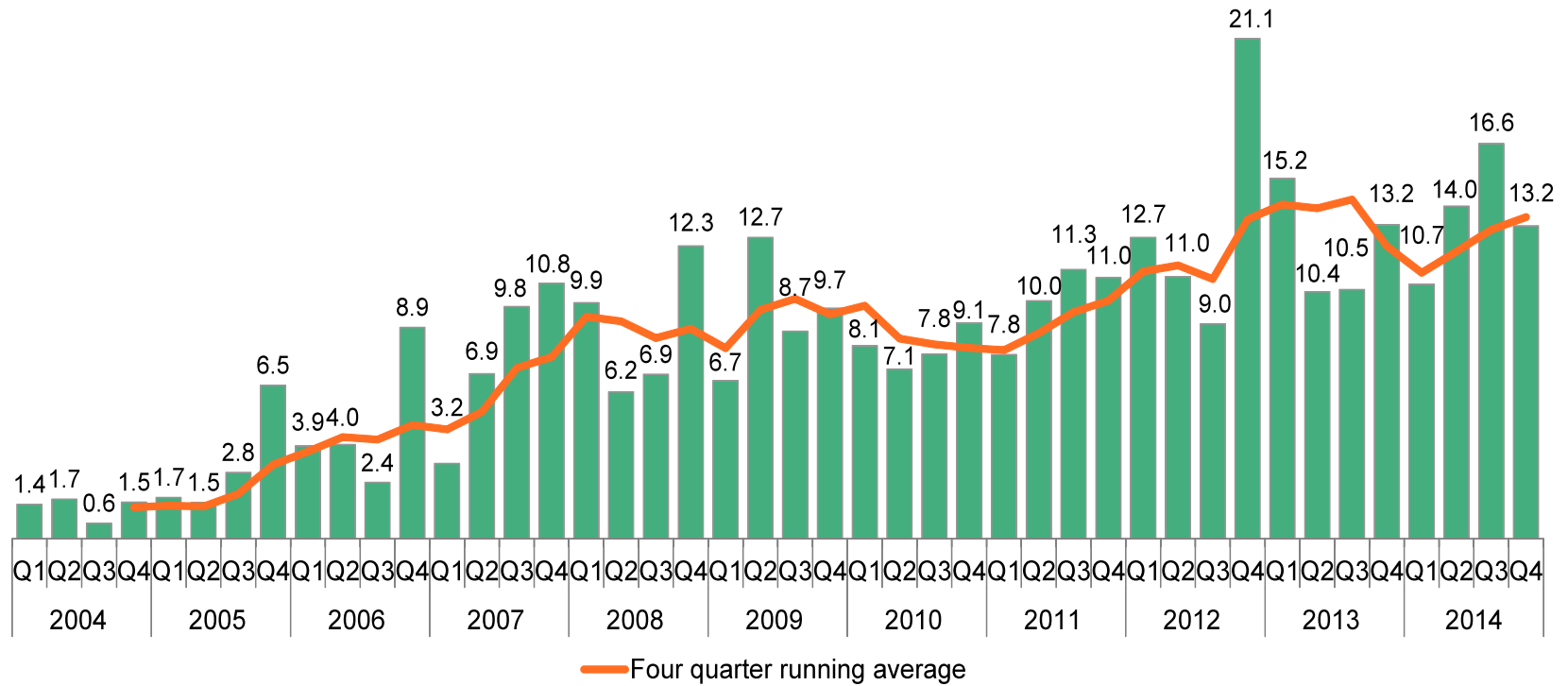


Note: Total values include estimates for undisclosed deals

Source: Bloomberg New Energy Finance

# RE Asset Acquisitions and Refinancing

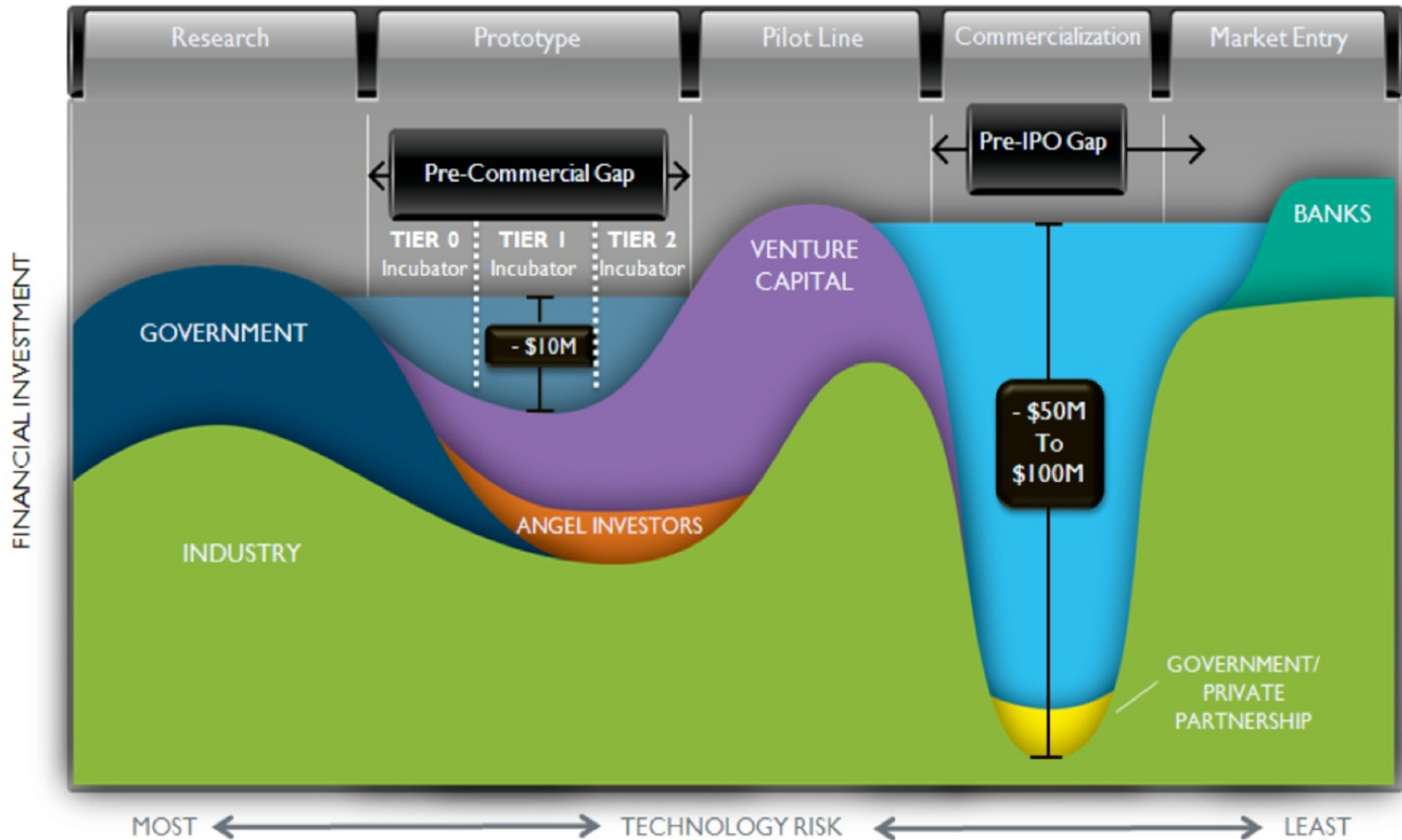
Q1 2004-Q4 2014 (\$BN)



Note: Total values include estimates for undisclosed deals

Source: Bloomberg New Energy Finance

# The Problem



# New Models – Financial/Business Innovation

---

- **Strategic Partnerships**
- **Foundations and Family Offices**
- **Solar City**
- **Tesla**

# New Models – Department of Energy

---

## ***Lab-Corps***

- Entrepreneurial training program for DOE Laboratory researchers with a customized curriculum built on the Lean LaunchPad methodology

### Program Goals:

- Increase the number of lab-developed technologies that are transferred into commercial development or industry agreements
- Train lab researchers to better-understand the commercialization process and private sector needs
- Strengthen entrepreneurial culture and institutional support for commercialization activity at the national labs

## ***Small Business Voucher Program***

- \$20 million in vouchers administered by 5 Labs in 9 technology areas

### Program Goals:

- Increase small business accessibility to lab capabilities
- Broaden lab awareness of small business needs and technologies

## ***Incubatenergy***

- Nationwide coordination of clean energy incubators and stakeholders
- Share best practices, support clean energy entrepreneurs
- Facilitate a smoother transition to a more sustainable clean energy economy.

# New Models – Laboratory Programs

---

## *NREL Commercialization Assistance Program*

- NREL Commercial Assistance Program provides assistance and information to help energy efficiency and renewable energy small businesses solve technology challenges

## *Industry Growth Forum*

- The NREL IGF facilitates access to financial capital and partnership resources for clean energy startups
- Since 2003, the presenting cleantech startups have collectively raised over \$5 billion in growth financing!

# New Models – State Based Investment

---

## *State-Based Clean Energy Funds*

- Over the last decade, a number of states have launched locally focused clean energy investment and/or enterprise development funds including:
  - California
  - Colorado
  - Connecticut
  - Massachusetts,
  - New Jersey
  - New York
  - Oregon
- Utilize varying combinations of ratepayer, state, and federal resources
- provide formal business development or investment support for local clean energy start-ups

# New Models - Not for Profit

---

## ***PRIME***

- PRIME is a new 501(c)(3) organization
- Unites leading philanthropies with opportunities to invest in “mission-critical” technological innovations supporting the well-being of the planet
- PRIME assists donors with tools and structures to facilitate rapid decision-making and solution development
- Serves as a clearinghouse of pre-commercial resources for entrepreneurs with high impact ideas in its fields of concentration
- Selected opportunities must have high impact for climate change

## ***CalCharge (UC-Davis Energy Efficiency Center)***

- 501(c)(3) entity sponsored by the California Clean Energy Fund (CalCEF) that
- Focus: heating, lighting, a/c, ventilation, and transportation
- Mission is to accelerate the development and commercialization of energy efficiency technologies and solutions, while also training future leaders in the sector.
- The center relies upon a strong public-private partnership and active collaboration among industry, government, and university partners

# New Models – Technology Incubators

---

## *Cyclotron Road*

- Launched in 2014
- Focused on the very early stage challenges of the science-to-product gap
- Anchored by Lawrence Berkeley National Laboratory (LBNL)
- Program aims to advance progress in clean energy “hard technologies” (those involving physical devices)
- Cyclotron Road recruits top technical talent with strong entrepreneurial drive, immersing the recruits in a supported laboratory environment, and linking them with technical and commercial mentors.
- Program focuses on:
  - Recruiting the best and “most driven” advanced energy technology innovators
  - Focusing on potential innovations that are believed to be both commercially relevant and scalable, leading to market impact potential
  - Leveraging the R&D support offered by LBNL and other national labs
  - Assisting the recruited technology leaders with top flight technical and commercial mentors, training, and seed funding

# New Models – Non Traditional Partners

---

## *Innovation Incubator*

- The Innovation Incubator (IN2) is a partnership between Wells Fargo and the National Renewable Energy Laboratory
- 5 year, \$10MM grant agreement
- IN<sup>2</sup> is designed to support buildings related technologies and startups at various stages of development
- Program sources a pipeline of early stage clean technologies from channel partners
- Companies are identified that need of technical development and/or validation, financial education and funding for business assistance.
- Technologies that meet required milestones may be selected for beta testing on Wells Fargo or partner sites

# New Models – Structurally Different

	Program	Technology Status	Value Proposition	Funding
6-24 Month Timeline Per Project	Tier I: Bench Scale	<ul style="list-style-type: none"> <li>Conceptual stage with physical proof that the concept may work</li> <li>Development plans for prototyping and testing</li> <li>3-5 years to market</li> </ul>	<ul style="list-style-type: none"> <li>Access to world-class researchers and facilities</li> <li>Further technology development</li> </ul>	Funding levels area anticipated to be between \$50K–\$250K dependent on project needs
	Tier II: Prototype	<ul style="list-style-type: none"> <li>Prototype available for testing and validation</li> <li>Plans available for development to final product</li> <li>Less than 2 years to market</li> </ul>	<ul style="list-style-type: none"> <li>Access to world-class researchers and facilities</li> <li>Testing and validation of prototype</li> </ul>	
	Tier III: Commercially-ready	<ul style="list-style-type: none"> <li>Production models available in limited quantity</li> <li>Less than 18 months to market</li> </ul>	<ul style="list-style-type: none"> <li>Access to world-class researchers and facilities</li> <li>Potential for deployment within WF footprint</li> <li>Evaluation and support of deployment plan</li> </ul>	

# NREL Investor Advisory Board

---

**NREL Investor Advisory Board serves to create mutually beneficial relationships between NREL and the investment community. The Board meets four times per year to provide the Lab a window into the investment community and to provide investors insights into the latest developments, findings, and innovations in renewable energy and clean technology research.**

**Currently 36 members serve on the Investor Advisory Board including representatives from venture capital, corporate investment, family offices, independent investors, and other investment and financial institutions.**

**A sampling of companies represented on the board include:**

- Advance Capital Markets, Inc.
- Black Coral Capital
- Bright Capital
- BASF Venture Capital
- EnerTech Capital
- Fairfield & Woods, P.C.
- Constellation Ventures
- GE Ventures
- LG Ventures
- MOMUS, LLC
- Prelude Ventures
- Saudi Aramco Ventures
- Siemens Venture Capital, Inc.
- Silicon Valley Bank
- Southern Cross Ventures
- Westly Group
- OnRamp Capital
- Wells Fargo Bank
- Pangaea Ventures

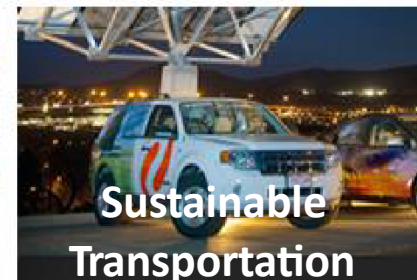
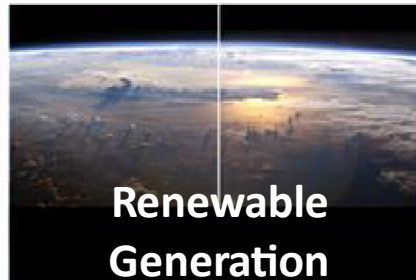
# 40 Years of Energy Research

---

- Founded as Solar Energy Research Institute (SERI) in 1977
- Designated national laboratory in 1991 and renamed National Renewable Energy Laboratory
- Today managed by the Alliance for Sustainable Energy, LLC, for the U.S. Dept. of Energy
- World-class facilities, renowned scientists
- Nearly 1,700 employees
- Campus is a model of sustainable energy
- National economic impact of \$872M annually
- Colorado economic impact of ~\$700M annually



# Scope of NREL Research Portfolio



## Analysis & Decision Support

Residential Buildings  
Commercial Buildings

Solar  
Wind and Water  
Biomass  
Hydrogen  
Geothermal

Advanced Biofuels  
Vehicle Components and Systems

Grid Infrastructure  
Distribution Integration  
Storage  
Integrated Energy Planning  
System Design

## Foundational Science