



Frankfurt School  
FS-UNEP Collaborating Centre  
for Climate & Sustainable Energy Finance

# GLOBAL TRENDS IN RENEWABLE ENERGY INVESTMENT 2014

Key Findings

**Bloomberg**  
NEW ENERGY FINANCE

**Frankfurt School-UNEP Centre/BNEF. 2014.**

**Global Trends in Renewable Energy Investment 2014, <http://www.fs-unep-centre.org> (Frankfurt am Main)**

**Copyright © Frankfurt School of Finance & Management gGmbH 2014.**

This publication may be reproduced in whole or in part in any form for educational or non-profit purposes without special permission from the copyright holder, as long as provided acknowledgement of the source is made. Frankfurt School – UNEP Collaborating Centre for Climate & Sustainable Energy Finance would appreciate receiving a copy of any publication that uses this publication as source.

No use of this publication may be made for resale or for any other commercial purpose whatsoever without prior permission in writing from Frankfurt School of Finance & Management gGmbH.

#### **Disclaimer**

Frankfurt School of Finance & Management: The designations employed and the presentation of the material in this publication do not imply the expression of any opinion whatsoever on the part of the Frankfurt School of Finance & Management concerning the legal status of any country, territory, city or area or of its authorities, or concerning delimitation of its frontiers or boundaries. Moreover, the views expressed do not necessarily represent the decision or the stated policy of the Frankfurt School of Finance & Management, nor does citing of trade names or commercial processes constitute endorsement.

Cover photo reproduced with the permission of Gamesa.

Photos on page 18, 41 and 53 reproduced with permission of Glennmont Partners.

Photo on page 32 reproduced with permission of Aggreko.

Photos on pages 42, 46, 48, 62, 63 and 79 reproduced with permission of Enel Green Power.

Photo on page 47 reproduced with permission of Lightsource Renewable Energy.

Photo on page 52 reproduced with permission of Gamesa.

Photo on page 59 reproduced with permission of REC Solar.

Photo on page 61 reproduced with permission of Conergy.

Photo on page 67 reproduced with permission of Alstom.

The other photos are from the Bloomberg Photovault.

# ACKNOWLEDGEMENTS

This report is the result of a joint analysis by the Frankfurt School-UNEP Collaborating Centre, the United Nations Environment Programme (UNEP) and Bloomberg New Energy Finance (BNEF).

## CONCEPT AND EDITORIAL OVERSIGHT

Angus McCrone (Lead Author, Chief Editor)

Eric Usher (Lead Editor)

Virginia Sonntag-O'Brien

Ulf Moslener (Lead Editor)

Christine Grüning

## CONTRIBUTORS

Nicole Aspinall

Luke Mills

David Strahan

Rohan Boyle

Victoria Cuming

Kieron Stopforth

Sabrina Heckler

Lisa Becker

## COORDINATION

Angus McCrone

## DESIGN AND LAYOUT

The Bubblegate Company Limited

## MEDIA OUTREACH

Terry Collins

Shereen Zorba (UNEP)

Jennifer MacDonald (Bloomberg)

Angelika Werner (Frankfurt School of Finance & Management)

Miriam Wolf (Frankfurt School of Finance & Management)

## THANKS TO THE FOLLOWING EXPERTS WHO REVIEWED AND PROVIDED FEEDBACK ON THE DRAFT REPORT:

Jiwan Acharya, Michaela Pulkert, Wolfgang Mostert, Tobias Rinke, Barbara Buchner, Frederic Crampe, Tanja Faller, Mark Fulton, Tom Thorsch Krader, Sabine Miltner, Martin Stadelmann, Federico Mazza, Valerio Micale, Sean Kidney, Stan Dupré, Anton Eberhard, Miriam Gutzke, Rodney Boyd

Supported by the Federal Republic of Germany



Federal Ministry for the  
Environment, Nature Conservation  
and Nuclear Safety

# METHODOLOGY AND DEFINITIONS

All figures in this report, unless otherwise credited, are based on the output of the Desktop database of Bloomberg New Energy Finance – an online portal to the world's most comprehensive database of investors, projects and transactions in clean energy.

The Bloomberg New Energy Finance Desktop collates all organisations, projects and investments according to transaction type, sector, geography and timing. It covers 69,600 organisations (including start-ups, corporate entities, venture capital and private equity providers, banks and other investors), 45,000 projects and 42,100 transactions.

## METHODOLOGY

The following renewable energy projects are included: all biomass and waste-to-energy, geothermal, and wind generation projects of more than 1MW; all hydropower projects of between 1MW and 50MW; all wave and tidal energy projects; all biofuel projects with a capacity of one million litres or more per year; and all solar projects, with those less than 1MW estimated separately and referred to as small-scale projects, or small distributed capacity.

The 2014 Global Trends report concentrates on renewable power and fuels and does not cover energy-smart technologies such as smart grid, electric vehicles and power storage – except in the box at the end of Chapter 2.

The main body of the report also does not cover large hydro-electric projects of more than 50MW, since this technology has been mature for decades and is at a very different stage of its roll-out than, for instance, wind or solar. However there is coverage of large hydro in the box at the end of Chapter 5, and briefly in the Executive Summary.

Where deal values are not disclosed, Bloomberg New Energy Finance assigns an estimated value based on comparable transactions. Deal values are rigorously back-checked and updated when further information is released about particular companies and projects. The statistics used are historical figures, based on confirmed and disclosed investment.

Annual investment in small-scale and residential projects such as rooftop solar is estimated. These figures are based on annual installation data, provided by industry associations and REN21. Bloomberg New Energy Finance continuously monitors investment in renewable energy. This is a dynamic process: as the sector's visibility grows, information flow improves. New deals come to light and existing data are refined, meaning that historical figures are constantly updated.

Figures of more than \$1 billion are stated to nearest billion in the text of the Key Findings and Executive Summary sections. They are stated to nearest \$0.1 billion in the chapters that follow.

This 2014 report contains revisions to a number of investment figures published in the 2013 UNEP Global Trends In Renewable Energy Investment report. Revisions reflect improvements made by Bloomberg New Energy Finance to its data during the course of the last 12 months, and also new transactions in 2012 and before that have since come to light.

## DEFINITIONS

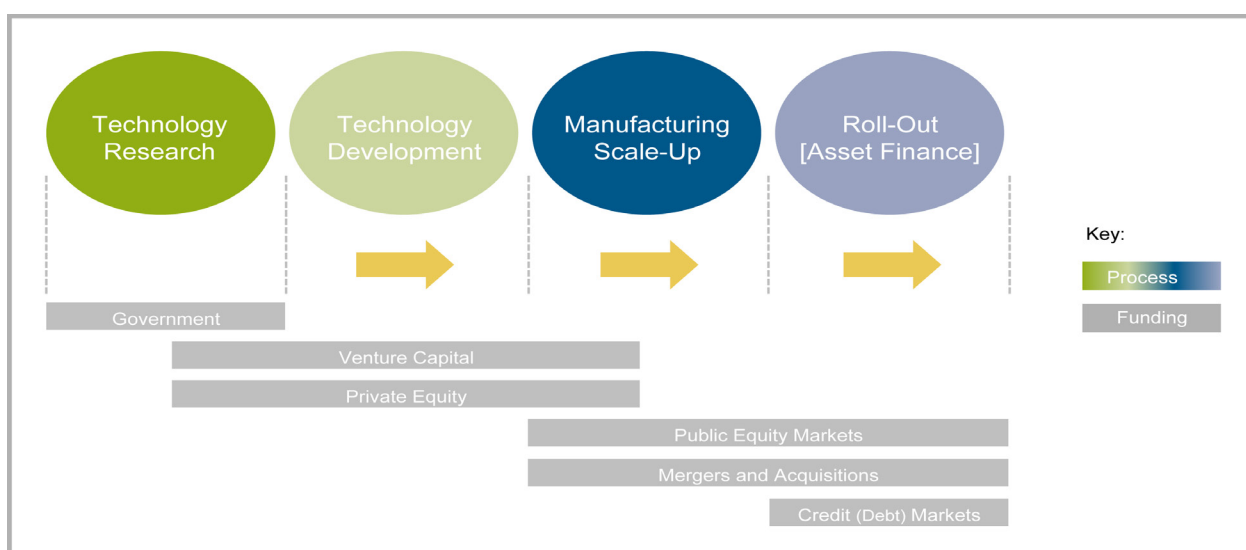
Bloomberg New Energy Finance tracks deals across the financing continuum, from R&D funding and venture capital for technology and early-stage companies, through to public market financing for projects and mature companies. Investment categories are defined as follows:

**Venture capital and private equity (VC/PE):** all money invested by venture capital and private equity funds in the equity of companies developing renewable energy technology. Similar investment in companies setting up generating capacity through special purpose vehicles is counted in the asset financing figure.

**Public markets:** all money invested in the equity of publicly quoted companies developing renewable energy technology and clean power generation.

**Asset finance:** all money invested in renewable energy generation projects (excluding large hydro), whether from internal company balance sheets, from loans, or from equity capital. This excludes refinancings.

**Mergers and acquisitions (M&A):** the value of existing equity and debt purchased by new corporate buyers, in companies developing renewable energy technology or operating renewable power and fuel projects.



REN21's annual **Renewables Global Status Report (GSR)** was first released in 2005. The Global Status Report is the sister publication to UNEP Global Trends in Renewable Energy Investment report, and its latest edition will be released in June 2014. It grew out of an effort to comprehensively capture, for the first time, the full status of renewable energy worldwide. Over the years, the GSR has expanded in scope and depth, in parallel with tremendous advances in renewable energy markets and industries. The report has become a major production that involves the amalgamation of thousands of data points, hundreds of reports and other documents, and personal communications with experts from around the world.



# KEY FINDINGS

- Total investment in renewable power and fuels (excluding large hydro-electric projects) fell for the second year running in 2013, reaching \$214 billion worldwide, some 14% lower than in 2012 and 23% below the 2011 record. The decline reflected a sharp fall in solar system prices, and the effect of policy uncertainty in many countries. The latter issue also depressed investment in fossil fuel generation in 2013.
- If the drop in investment was a cloud, it had several silver linings. One was the sharply reduced cost of solar photovoltaic systems, which meant that a record amount of PV capacity (some 39GW) was constructed in 2013, and for less money than the smaller 2012 total of 31GW. A second silver lining was that 2013 brought a 54% recovery in clean energy share prices, stimulating equity raising by specialist companies on the public markets.
- A third was that in 2013 cost reductions and efficiency improvements enabled onshore wind and PV projects to be built in a growing number of locations around the world without subsidy support. Wind and PV may be able to out-compete fossil-fuel options as long as there are plentiful local sunshine or wind resources, low capital costs, and no cheap, indigenous coal or gas feedstocks.
- A fourth was that, renewable energy excluding large hydro made up 43.6% of the new power capacity added in all technologies in 2013 (the same figure as in the previous year), and raised its share of total generation worldwide to 8.5% from 7.8%. Global energy-related CO2 emissions would have been some 1.2 billion tonnes higher but for this contribution.
- Investment in wind was relatively resilient in 2013, falling just 1% to \$80 billion, while that in solar tumbled 20% to \$114 billion. Biofuels saw a 26% drop in investment to \$5 billion, the lowest for nine years, while biomass and waste-to-energy fell 28% to \$8 billion, and small hydro-electric (projects of less than 50MW) declined 16% to \$5 billion. Geothermal was the only riser, investment in it gaining 38% to \$2.5 billion.
- 2013 also saw an interruption to the previously rising trend of renewable energy investment in developing economies as a whole. After eight years of increases, this fell 14% last year to \$93 billion. Investment in developed economies also retreated 14%, to \$122 billion.
- Last year was the first ever that China invested more in renewable energy than the whole of Europe. The Chinese total, although down 6% to \$56 billion, finished well ahead of Europe's shrunken \$48 billion, down 44%. The US saw a fall of 10% to \$36 billion, while India moved 15% down to \$6 billion, and Brazil 54% down to \$3 billion, the lowest since 2005.
- The only regions gaining ground in 2013 were the Americas excluding the US and Brazil, with a 26% increase to \$12 billion, helped by positive trends in several Hispanic countries and in Canada, and Asia-Oceania excluding China and India, with a 47% rise to \$43 billion. Japan was the biggest contributor to the latter move, as its solar boom helped to drive an 80% increase in renewable energy investment to \$29 billion (excluding R&D).
- Among the different types of investment, asset finance of utility-scale wind farms, solar parks and other new installations fell 13% to \$133 billion, while outlays on small-scale projects such as rooftop solar lurched downwards 25% to \$60 billion – mostly due to the decline in PV system costs.
- Venture capital and private equity investment in specialist renewable energy companies slumped 46% to \$2 billion, the lowest figure since 2005, as funds took a cautious view of young high-technology enterprises and of the chances of securing a profitable exit. Government research and development spending on renewables rose 3% to \$5 billion, while corporate R&D was 6% lower at \$5 billion.
- The star performer among investment types was public market equity raising by renewable energy companies. This jumped 201% to \$11 billion, the highest since 2010, spurred on by the rally in clean energy share prices and by institutional investors' increased appetite for funds offering solid yields on portfolios of operating projects.
- Large hydro-electric projects, of more than 50MW, were another important area of renewable energy activity, albeit outside the main scope of the statistics in this report. At least 20GW of capacity are estimated to have come on stream in 2013, equivalent to approximately \$35 billion of investment.
- Although investment in renewable energy capacity including all hydro in 2013 was once again below gross investment in fossil-fuel power, at \$227 billion compared to \$270 billion, it was roughly double the net figure for investment in fossil-fuel power excluding replacement plant.

# EXECUTIVE SUMMARY

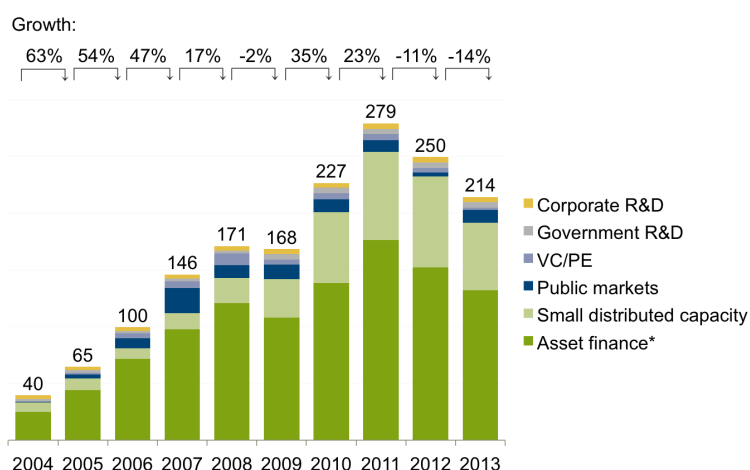
Some foundations for future growth in the renewable energy market fell into place in 2013, even as investment levels declined for the second successive year. Lower costs, a return to profitability on the part of some leading manufacturers, the phenomenon of unsubsidised market uptake in a number of countries, and a warmer attitude to renewables among public market investors, were hopeful signs after several years of painful shake-out in the sector.

Renewable energy continued to build up its share of the global electricity market. Renewables excluding large hydro projects accounted for 43.6% of the new generating capacity installed worldwide in 2013, raising its share of world electricity generation from 7.8% in 2012, to 8.5%. If this capacity were not present, world energy-related CO<sub>2</sub> emissions would have been an estimated 1.2 gigatonnes higher in 2013, adding about 12% to

the 2020 projected emissions gap that needs to be closed to remain within a two degrees Celsius global temperature increase.<sup>1</sup>

New investment in renewable energy excluding large hydro-electric projects slipped 14% in 2013 to \$214 billion, but even this disguised one major positive development. One of the two main reasons for this fall in 2013 was a reduction in costs in photovoltaics – even as the dollar investment in solar went down, the number of gigawatts of PV systems added went up.

**FIGURE 1. GLOBAL NEW INVESTMENT IN RENEWABLE ENERGY BY ASSET CLASS, 2004-2013, \$BN**



\*Asset finance volume adjusts for re-invested equity. Total values include estimates for undisclosed deals

Source: UNEP, Bloomberg New Energy Finance

Nevertheless, the decline in investment was disappointing for the industry and those hoping to see investors and financiers increasing their dollar commitments to the decarbonisation of the energy system.

There were setbacks to investment in many important geographical areas, including China (down 6% at \$56 billion), the US (down 10% at \$36 billion) and – most of all – Europe (down 44% at \$48 billion). The biggest exception to the downward trend was Japan, where investment excluding research and development soared 80% to \$29 billion.

<sup>1</sup> The Emissions Gap Report 2013, UNEP, Nairobi.



### BEHIND THAT \$214 BILLION FIGURE

Worries about policy support, and reductions in technology costs, were the two main reasons for the fall in global financial commitments to renewable energy in 2013. Both factors were also instrumental in the drop in investment in 2012 from its record in 2011, so the decline in 2013 could be seen as the second half of a two-year downward trend amounting to 23%. Investment in fossil fuel generation was also somewhat lower in 2013 than a year earlier.

Last year's total of \$214 billion was the lowest since 2009 and some \$65 billion below the 2011 peak, although still five and a half times the 2004 tally of \$40 billion and one and a half times the 2007 figure of \$146 billion.

The make-up of the 2013 investment total is shown in Figure 2. The figure for new investment, \$214 billion, is shown alongside a \$54 billion number representing acquisition activity—corporate mergers and takeovers, asset purchases, buy-outs and refinancings. These acquisitions do not represent new investment but are important for recycling finance in the sector, and are covered in this report in Chapter 10.

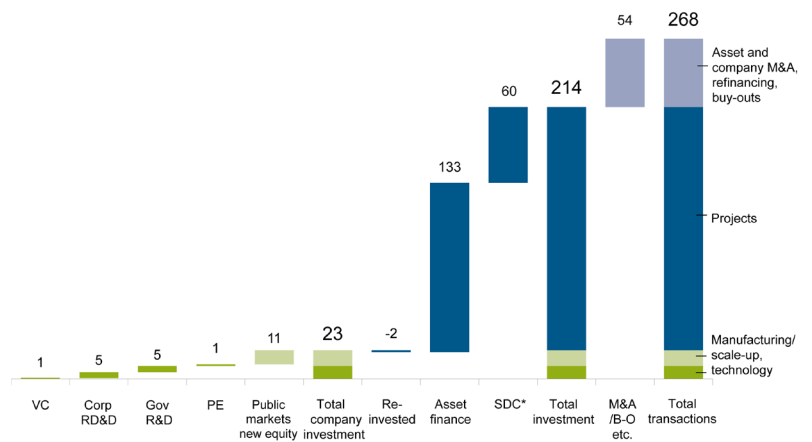
The new investment total consists of all the elements to the left of the \$214 billion figure in Figure 2, starting with early-stage technology support through venture capital and government and corporate research and development, via assistance for more mature businesses from private equity and public market investors. Finally, there is the roll-out of utility-scale wind farms, solar parks and other projects via asset finance, and the deployment of small-scale distributed capacity such as rooftop solar. The year-by-year changes in each of these aggregates, and the headline sector and regional shifts, are shown in Figure 3.

Looking at the reasons for the decline in overall investment in 2013, worries about future policy support for renewables delayed investment decisions in countries such as the US, Germany, India, the UK, France, Sweden, Romania and Poland. In some other countries, such as Spain and Bulgaria, retroactive subsidy cuts for existing projects almost killed off investment entirely, while in Italy, the amount of PV capacity eligible for support quickly ran up against a government-set cap. The issues in these countries are explored in more depth in Chapter 1.



Technology costs were a second big reason for the latest fall in investment. Although PV module prices bottomed out in early 2013 as the industry's severe over-capacity eased, balance-of-plant costs for PV systems continued to fall. In addition, there was a shift in the global mix of PV installations in 2013, with a lower share of relatively high-cost per MW residential systems and a higher share of relatively low-cost per MW utility-scale systems, particularly in China. The result was that although PV capacity installed was up from 31GW in 2012 to a record 39GW in 2013, dollar investment in solar capacity was down 23% at \$104 billion.

FIGURE 2. GLOBAL TRANSACTIONS IN RENEWABLE ENERGY, 2013, \$BN



SDC = small distributed capacity. Total values include estimates for undisclosed deals. Figures may not add up exactly to totals, due to rounding.  
Source: UNEP, Bloomberg New Energy Finance

There were other, local reasons for the lower investment figure in 2013. For instance, the Chinese wind market was held back by grid connection delays and by cash shortages as a result of a nationwide

credit squeeze. In some other developing countries, there was a pause in the flow of investment decisions. Financings in Brazil, for instance, were affected by the delay between auction rounds (in



FIGURE 3. GLOBAL TRENDS IN RENEWABLE ENERGY INVESTMENT 2013 DATA TABLE, \$BN

Category	Year Unit	2004 \$bn	2005 \$bn	2006 \$bn	2007 \$bn	2008 \$bn	2009 \$bn	2010 \$bn	2011 \$bn	2012 \$bn	2013 \$bn	2012-13 Growth %	2004-13 CAGR %
<b>1 Total Investment</b>													
1.1 New investment		39.5	64.5	99.6	145.9	171.2	168.4	226.7	279.4	249.5	214.4	-14%	21%
1.2 Total transactions		48.3	90.8	135.3	204.3	230.6	232.7	285.2	352.8	309.9	268.2	-13%	21%
<b>2 New Investment by Value Chain</b>													
2.1 Technology development													
2.1.1 Venture capital		0.4	0.6	1.2	2.2	3.3	1.6	2.5	2.5	2.4	0.8	-67%	9%
2.1.2 Government R&D		1.9	2.1	2.3	2.7	2.8	5.1	4.6	4.6	4.5	4.6	3%	10%
2.1.3 Corporate RD&D		3.2	2.9	3.1	3.5	4.0	4.1	4.2	5.1	5.0	4.7	-6%	4%
2.2 Equipment Manufacturing													
2.2.1 Private equity expansion capital		0.3	1.0	3.0	3.6	6.7	2.9	3.1	2.6	1.7	1.4	-16%	17%
2.2.2 Public markets		0.3	3.7	9.0	22.0	11.5	13.0	11.4	10.7	3.7	11.1	201%	51%
2.3 Projects													
2.3.1 Asset finance		24.8	44.1	72.3	100.9	124.3	109.8	144.2	180.3	154.2	133.4	-13%	21%
Of which re-invested equity		0.0	0.1	0.7	3.0	3.6	1.7	5.8	3.7	1.8	1.5	-18%	-
2.3.3 Small distributed capacity		8.6	10.3	9.5	14.1	22.3	33.6	62.5	77.2	80.0	59.9	-25%	24%
<b>Total Financial Investment</b>		<b>25.8</b>	<b>49.3</b>	<b>84.7</b>	<b>125.7</b>	<b>142.2</b>	<b>125.5</b>	<b>155.4</b>	<b>192.4</b>	<b>160.1</b>	<b>145.3</b>	<b>-9%</b>	<b>21%</b>
Gov't R&D, corporate RD&D, small projects		13.7	15.3	14.8	20.2	29.0	42.9	71.3	87.0	89.4	69.2	-23%	20%
<b>Total New Investment</b>		<b>39.5</b>	<b>64.5</b>	<b>99.6</b>	<b>145.9</b>	<b>171.2</b>	<b>168.4</b>	<b>226.7</b>	<b>279.4</b>	<b>249.5</b>	<b>214.4</b>	<b>-14%</b>	<b>21%</b>
<b>3 M&amp;A Transactions</b>													
3.1 Private equity buy-outs		0.8	3.7	1.8	3.6	5.5	2.2	1.9	3.2	3.2	0.6	-81%	-3%
3.2 Public markets investor exits		0.4	2.4	2.7	4.1	1.0	2.5	4.9	0.2	0.4	1.7	286%	19%
3.3 Corporate M&A		2.4	7.6	12.6	20.6	18.0	21.7	18.7	29.8	7.9	11.5	45%	19%
3.4 Project acquisition & refinancing		5.3	12.5	18.6	30.2	34.8	37.8	32.9	40.2	48.8	39.9	-18%	25%
<b>4 New Investment by Sector</b>													
4.1 Wind		14.5	25.1	32.1	56.6	69.3	73.0	94.8	85.9	80.9	80.1	-1%	21%
4.2 Solar		12.1	16.3	21.7	38.7	59.5	62.9	100.3	157.8	142.9	113.7	-20%	28%
4.3 Biofuels		3.7	9.2	27.6	29.3	19.2	10.4	8.9	9.4	6.6	4.9	-26%	3%
4.4 Biomass & w-t-e		6.2	8.0	10.6	13.2	14.1	13.6	14.2	15.5	11.1	8.0	-28%	3%
4.5 Small hydro		1.7	4.9	5.4	5.5	7.2	5.4	4.8	6.8	6.0	5.1	-16%	13%
4.6 Geothermal		1.3	1.0	1.4	1.9	1.8	2.7	3.5	3.7	1.8	2.5	38%	8%
4.7 Marine		0.0	0.1	0.9	0.7	0.2	0.3	0.2	0.3	0.2	0.1	-41%	11%
<b>Total</b>		<b>39.5</b>	<b>64.5</b>	<b>99.6</b>	<b>145.9</b>	<b>171.2</b>	<b>168.4</b>	<b>226.7</b>	<b>279.4</b>	<b>249.5</b>	<b>214.4</b>	<b>-14%</b>	<b>21%</b>
<b>5 New Investment by Geography</b>													
5.1 United States		5.5	11.7	28.2	33.6	35.9	23.5	34.7	53.4	39.7	35.8	-10%	23%
5.2 Brazil		0.6	2.6	4.6	11.0	12.2	7.8	7.7	9.7	6.8	3.1	-54%	21%
5.3 AMER (excl. US & Brazil)		1.4	3.3	3.2	4.9	5.8	6.1	11.5	8.7	9.9	12.4	26%	27%
5.4 Europe		19.7	29.4	39.1	61.8	73.4	75.3	102.4	114.8	86.4	48.4	-44%	10%
5.5 Middle East & Africa		0.5	0.5	0.9	1.6	2.3	1.4	4.3	3.2	10.4	9.0	-14%	37%
5.6 China		2.4	5.8	10.1	15.8	24.9	37.1	36.7	51.9	59.6	56.3	-6%	42%
5.7 India		2.5	2.9	4.4	6.3	5.4	4.2	8.7	12.6	7.2	6.1	-15%	10%
5.8 ASOC (excl. China & India)		6.8	8.2	9.0	10.9	11.4	12.9	20.7	25.3	29.5	43.3	47%	23%
<b>Total</b>		<b>39.5</b>	<b>64.5</b>	<b>99.6</b>	<b>145.9</b>	<b>171.2</b>	<b>168.4</b>	<b>226.7</b>	<b>279.4</b>	<b>249.5</b>	<b>214.4</b>	<b>-14%</b>	<b>21%</b>

New investment volume adjusts for re-invested equity. Total values include estimates for undisclosed deals.

Source: UNEP, Bloomberg New Energy Finance

which large amounts of new wind capacity were awarded power purchase agreements last year) and the subsequent signatures on debt and equity deals for those projects.

A consequence of all these issues was that, for the first time for at least a decade, there was a fall in investment in renewable energy in developing countries. The 14% reduction in dollar commitments to \$93 billion in 2013 is shown in Figure 4, along with a similarly-sized slippage in investment in developed economies.<sup>2</sup>

As well as the \$214 billion global figure mentioned above, there were additional sums of money committed to large hydro-electric projects of more than 50MW. These projects are mature in terms of technology and fall outside the main scope of this report. However, at least 20GW of large hydro capacity are estimated to have been commissioned in 2013, equivalent to approximately \$35 billion of investment. There is a box on large hydro investment at the end of Chapter 5.

## IMPROVEMENT IN FUNDAMENTALS

Although renewable energy investment in 2013 was some 14% down on 2012, there were more hopeful signs for investment in 2014 and beyond. The first sign was the further gain in the cost-competitiveness of the two leading renewable power technologies – solar PV and onshore wind. Chapter 3 explains how over a five-year period to the first quarter of 2014, the worldwide average levelised cost of electricity has declined by 53% for crystalline silicon PV systems, and 15% for onshore wind turbines. Over the same years, the cost per MWh of coal- and gas-fired generation has increased in many countries, with the notable exception of the US where gas prices remain much lower than elsewhere.

The cost reductions for the two leading renewable technologies have enabled subsidies for new projects to be reduced, and brought wind and solar much closer to full competitiveness with fossil-fuel alternatives – even where the latter are not encumbered by carbon emission charges.

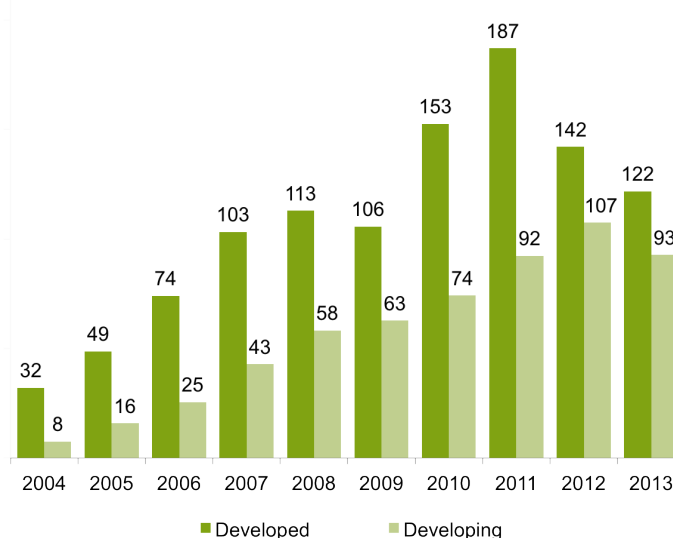
<sup>2</sup> In this report, developed economies are defined as all member countries of the OECD, other than Chile, Mexico and Turkey. Developing economies are defined as all non-OECD countries plus those three.

That brings us to the second patch of brightness in 2013. The year brought a trickle of significant projects – many of them in Latin America but others in the Middle East and Africa – in which hundreds of millions of dollars' worth of investment was being made in wind and solar without any subsidy support. Hydro-electric has for decades competed head-on with coal and gas. Now, in an increasing number of locations – generally those with strong wind resource or sunshine, an expanding need for power and no cheap indigenous fossil fuel reserves – wind and solar are doing the same.

The third shaft of light for renewables in 2013 came from investors themselves. After a four-and-a-half-year bear market in clean energy stocks that brought share prices down by a total of 78%, the WilderHill New Energy Global Innovation Index, or NEX, bottomed out in July 2012. This bottoming developed into a strong rally during 2013, with the NEX, which tracked 96 clean energy stocks worldwide last year, gaining 54%. The improved share price performance took place as many companies in the solar and wind manufacturing chains moved back towards profitability after the painful period of over-capacity and corporate distress in 2011-12. The impact of this on public market investment flows is examined in Chapter 7.

There has also been a deepening in the involvement of long-term investors such as pension funds, insurance companies, wealth managers and private individuals in the equity and debt of wind and solar projects. This process is at a relatively early stage, and renewable energy still makes

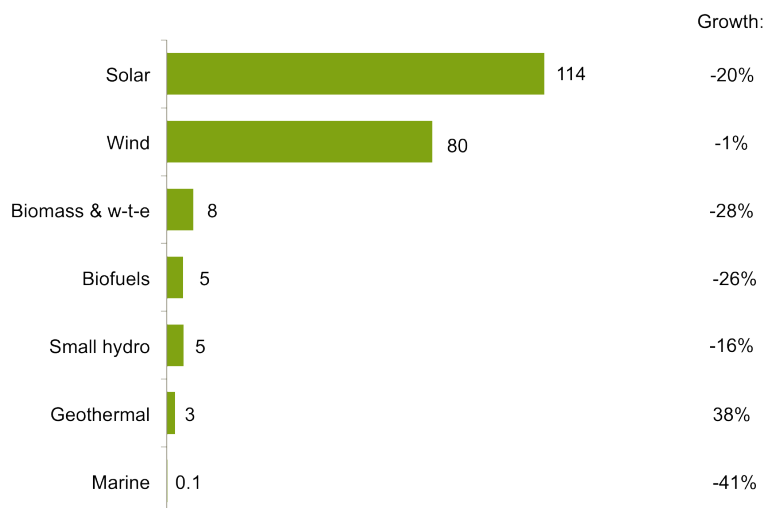
**FIGURE 4. GLOBAL NEW INVESTMENT IN RENEWABLE ENERGY: DEVELOPED V DEVELOPING COUNTRIES, 2004-2013, \$BN**



New investment volume adjusts for re-invested equity. Total values include estimates for undisclosed deals. Developed volumes are based on OECD countries excluding Mexico, Chile, and Turkey.

Source: UNEP, Bloomberg New Energy Finance

**FIGURE 5. GLOBAL NEW INVESTMENT IN RENEWABLE ENERGY BY SECTOR, 2013, AND GROWTH ON 2012, \$BN**



New investment volume adjusts for re-invested equity. Total values include estimates for undisclosed deals.

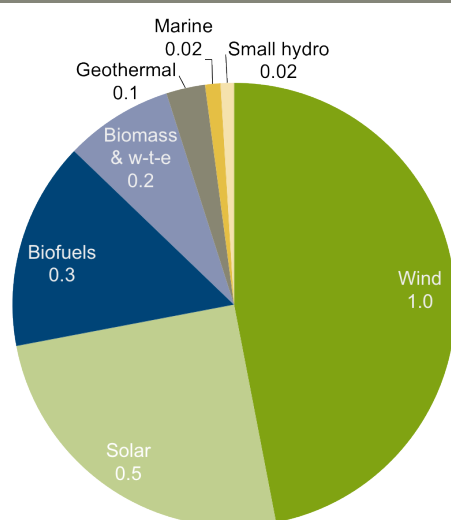
Source: UNEP, Bloomberg New Energy Finance

up only a tiny fraction, for instance, of pension fund assets. Both the developments of 2013 and some of the remaining obstacles are discussed in Chapter 4.

## WHERE INVESTMENT WENT IN 2013

Figure 5 shows that investment in renewable power and fuels was dominated by wind and solar in 2013. Both generation sources saw reductions in their financial flows, of 1% and 20% respectively, but they still accounted for 90% of investment in renewables excluding large hydro.

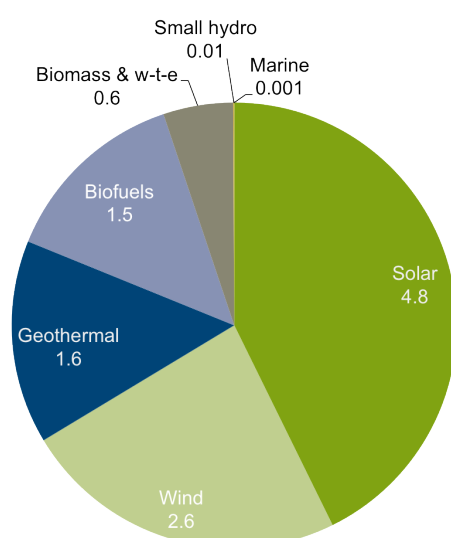
**FIGURE 6. VC/PE NEW INVESTMENT IN RENEWABLE ENERGY BY SECTOR, 2013, \$BN**



VC/PE new investment excludes PE buy-outs. Total values include estimates for undisclosed deals.

Source: UNEP, Bloomberg New Energy Finance

**FIGURE 7. PUBLIC MARKETS NEW INVESTMENT IN RENEWABLE ENERGY BY SECTOR, 2013, \$BN**



Source: UNEP, Bloomberg New Energy Finance

In earlier years, other technologies such as biofuels and biomass and waste-to-energy accounted for much bigger slices of the overall cake, but in 2013, those two sectors saw investment of just \$5 billion and \$8 billion respectively, down 26% and 28% respectively. The figure for biofuels was the lowest in any year since 2004, and for biomass the lowest since 2005. Small hydro and geothermal remained small features in the overall renewable energy investment picture last year, accounting for \$5 billion (down 16%) and \$3 billion (up 38%) of outlays respectively.

Venture capital and private equity investment in renewable energy was depressed in 2013, down 46% at \$2.2 billion, the lowest figure since 2005. VC/PE investors were held back by a lack of available capital, as there has been a dearth of successful exits for venture-backed clean energy companies in recent years and it has been difficult to raise new funds; and by general wariness after a tough few years for early-stage technology players in renewable power.

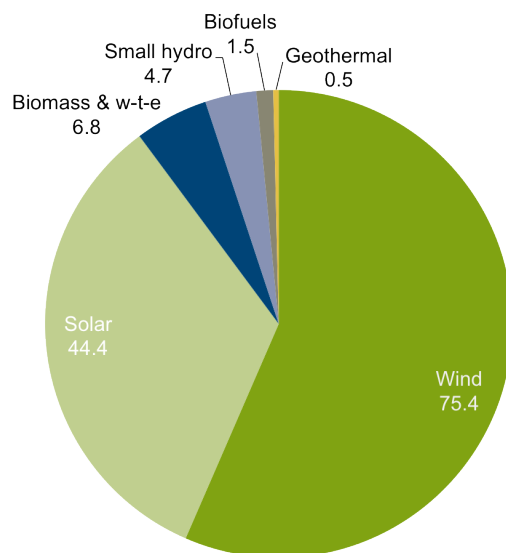
The shrunken VC/PE flow of 2013 was allocated as shown in Figure 6. Surprisingly, given that it is generally seen as a mature technology, wind was the largest recipient, at \$1 billion. Much of the explanation was that wind attracted a significant amount of new private equity capital into project development businesses. Solar soaked up \$549 million of VC/PE investment, far down on the peak year of 2008 when it took \$5 billion, while biofuels took \$333 million.

There was a very different outcome for public markets investment, which was buoyed up by the share price gains discussed above and recorded a 201% jump in 2013 to its highest level since 2010. Figure 7 reveals that solar took nearly half the \$11 billion total last year,





FIGURE 8. ASSET FINANCE OF RENEWABLE ENERGY ASSETS BY SECTOR, 2013, \$BN



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

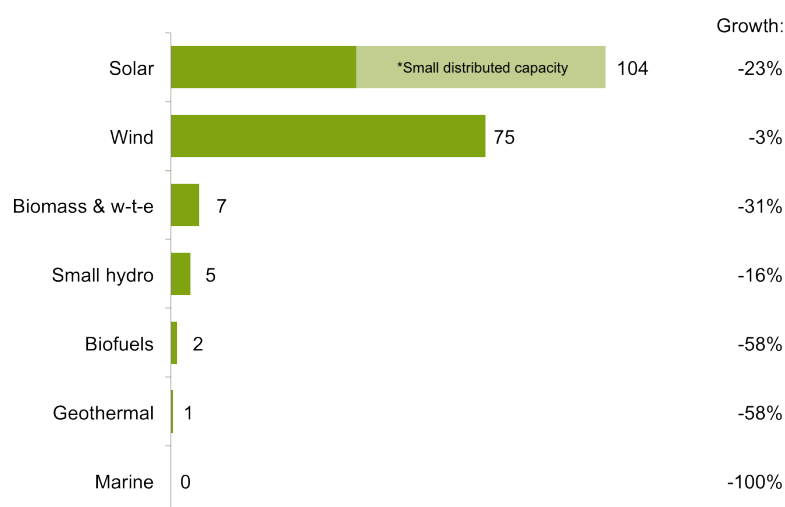
with wind second and important contributions also by geothermal and biofuels.

The largest single part of overall investment in renewable energy is the asset finance of utility-scale projects of 1MW or more. In 2013, this fell 13% to \$133 billion, with the sector make-up displayed in Figure 8. Wind made up the largest part of this and suffered only a 3% decline, while solar, second largest, saw dollar commitments fall 20% even though the number of utility-scale megawatts installed actually increased.

Adding small-scale projects of less than 1MW to the comparison for capacity investment shows that solar was by some distance the leading renewable energy sector in 2013, just as it was in 2012 (see Figure 9). The last year in which



**FIGURE 9. ASSET FINANCE OF RENEWABLE ENERGY ASSETS AND SMALL DISTRIBUTED CAPACITY BY SECTOR, 2013, AND GROWTH ON 2012, \$BN**



Total values include estimates for undisclosed deals.

Source: UNEP, Bloomberg New Energy Finance

there was higher dollar investment in wind capacity than in solar capacity was 2010.

There is, however, a difference between how those two top technologies compare in developed countries, and developing countries. Despite the PV boom taking place in China, the dominant share of solar capacity investment in

2013 still occurred in developed economies, while developing economies took the lion's share of spending on wind power projects. Developing countries also led in small hydro while, last year at least, developed countries made up most of the investment in biofuel, biomass and geothermal capacity. A full geographical analysis of investment flows follows in Chapter 1.

In summary, it could be said that 2013 for renewable energy was the flip-side of 2011. In the earlier year, investment hit a record worldwide of \$279 billion. However, there were many dark clouds, including collapsing share prices, severe pressure on solar and wind manufacturers caused by over-capacity, the fading of the green stimulus programmes, and the imposition of retroactive feed-in tariff cuts in Spain. In 2013, investment was down at \$214 billion, but the mood was more cheerful, with share prices up, manufacturers rebuilding margins, and renewable energy being chosen for projects around the world on the back of its improved cost-competitiveness.

## FRANKFURT SCHOOL OF FINANCE & MANAGEMENT

The Frankfurt School of Finance & Management (FS) is a research-based business school. In education, research and advisory FS covers economics, management, finance and banking. With 48 members, its faculty is one of the biggest economics faculties in Germany. National and international rankings prove the FS 'excellent performance in education and research.

Frankfurt School offers professional and executive education as well as university degree programmes. Its experts manage consulting and training projects on finance in emerging and developing countries. With UNEP, the United Nations Environment Programme, FS runs a Collaborating Centre for Climate & Sustainable Energy Finance. In research, advisory and education the Centre develops and disseminates solutions on financing renewable energy in emerging and developing countries. FS is part of a global network of about 100 partner universities and business schools. It hosts offices in Nairobi, Istanbul, Beijing and Pune. [www.fs.de](http://www.fs.de)

## FRANKFURT SCHOOL – UNEP COLLABORATING CENTRE FOR CLIMATE & SUSTAINABLE ENERGY FINANCE

The Frankfurt School – UNEP Collaborating Centre for Climate & Sustainable Energy Finance is a strategic cooperation between Frankfurt School of Finance & Management and UNEP. Funded by the German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety, the Centre is designed to support the transformation to resilient low-carbon and resource-efficient economies by attracting new types of investors, in particular catalysing the financing of clean energy by the private sector, which has a pivotal role to play. The Centre encourages and assists the finance community to scale-up current investment, or to take the first steps into new markets.

As a unique “think-and-do” tank combining research, education and project implementation, the Centre is in a position to bring together academic know-how with practical project experience. This maximises lessons learnt, allowing developing countries to leapfrog from their current status to leading global solutions.



## BLOOMBERG NEW ENERGY FINANCE

Bloomberg New Energy Finance (BNEF) is the definitive source of insight, data and news on the transformation of the energy sector. BNEF has staff of 180, based in London, New York, Beijing, Hong Kong, New Delhi, Singapore, Sydney, Tokyo, Cape Town, São Paulo, Washington D.C., San Francisco, Munich and Zurich.

BNEF Insight Services provide financial, economic and policy analysis in the following industries and markets: advanced transportation, bioenergy, carbon capture and storage, carbon markets, digital energy, energy efficiency, energy storage, gas, geothermal, hydro & marine, nuclear, power markets, REC markets, solar, water and wind. BNEF's Industry Intelligence Service provides access to the world's most comprehensive database of assets, investments, companies and equipment in the same sectors. The BNEF News Service is the leading global news service focusing on finance, policy and economics for the same sectors. The group also undertakes custom research on behalf of clients and runs senior-level networking events, including the annual BNEF Summit, the premier event on the future of the energy industry.

New Energy Finance Limited was acquired by Bloomberg L.P. in December 2009, and its services and products are now owned and distributed by Bloomberg Finance L.P., except that Bloomberg L.P. and its subsidiaries distribute these products in Argentina, Bermuda, China, India, Japan, and Korea. For more information on Bloomberg New Energy Finance: <http://about.bnef.com>.





Frankfurt School  
FS-UNEP Collaborating Centre  
for Climate & Sustainable Energy Finance

**UNEP Collaborating Centre  
Frankfurt School of Finance & Management**

Sonnemannstrasse 9–11  
60314 Frankfurt am Main  
<http://fs-unep-centre.org>  
[www.frankfurt-school.de](http://www.frankfurt-school.de)  
E-Mail: [fs\\_unep@fs.de](mailto:fs_unep@fs.de)  
Phone: +49 (0)69 154008-647  
Fax: +49 (0)69 154008-4647

Supported by the Federal Republic of Germany:



Federal Ministry for the  
Environment, Nature Conservation  
and Nuclear Safety

