



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



GLOBAL TRENDS
IN RENEWABLE
ENERGY
INVESTMENT
2016



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NEW ENERGY FINANCE

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Figure 1

Global new investment in renewable energy by asset class, 2004-2015

\$bn

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Asset finance*	32.0	52.5	83.8	106.7	132.3	118.3	148.4	178.0	160.5	156.1	184.8	193.2
Small distributed capacity	8.5	10.2	9.4	14.1	22.3	33.5	62.6	75.7	79.3	53.9	60.4	67.4
Public markets	0.3	3.6	9.3	21.4	10.9	12.9	11.2	10.0	3.8	10.1	16.2	12.8
VC/PE	0.7	1.5	4.2	5.7	9.9	4.5	7.9	4.9	4.0	2.1	2.5	3.4
Government R&D	1.9	2.0	2.2	2.7	2.8	5.4	4.9	4.8	4.7	5.2	4.5	4.4
Corporate R&D	3.2	2.9	3.1	3.5	4.0	4.1	4.2	5.1	5.0	6.6	4.5	4.7
Total	46.6	72.8	112.0	154.0	182.2	178.7	239.2	278.5	257.3	234.0	273.0	285.9
% Growth	-	56%	54%	37%	18%	-2%	34%	16%	-8%	-9%	17%	5%

Footnote:

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

Source:

UNEP, Bloomberg New Energy Finance

Figure 2

Global transactions in renewable energy, 2015
\$bn

	2015
PE	2.1
VC	1.3
Gov RD&D	4.4
Corp RD&D	4.7
Public markets new equity	12.8
Total company investment	25
Re-invested	(6)
Asset finance	199
SDC	67
Total investment	286
M&A/buy-outs etc.	94
Total transactions	380

Footnote: 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

Figure 4

Global new investment in renewable energy: developed v developing countries, 2004-2015

\$bn

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Developed	37	53	83	108	123	114	164	191	151	136	142	130
Developing	9	20	29	46	60	64	75	87	106	98	131	156
Total	47	73	112	154	182	179	239	279	257	234	270	286
% Growth	-	56%	54%	37%	18%	-2%	34%	16%	-8%	-9%	17%	6%

Footnote: 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, 2015, and growth on 2014
\$bn

	2015	% growth on 2014
Marine	0.2	-42%
Geothermal	2	-23%
Biofuels	3	-35%
Small hydro	4	-29%
Biomass & w-t-e	6	-42%
Wind	110	4%
Solar	161	12%

Footnote: New investment volume adjusts for re-invested equity. Total values include deals.

Source: UNEP, Bloomberg New Energy Finance

Figure 6

VC/PE new investment in renewable energy by sector, 2015
\$bn

	2015	% growth on 2014
Solar	2.4	58%
Biofuels	0.5	-3%
Wind	0.4	17%
Biomass & w-t-e	0.07	-53%
Marine	0.03	13%
Small hydro	0.03	222%
Geothermal	0.01	0 in 2014

Footnote: 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, 2015
\$bn

	2015	% growth on 2014
Solar	10.1	21%
Wind	2.0	-69%
Biomass & w-t-e	0.3	-10%
Biofuels	0.3	-48%
Geothermal	0.01	46%
Marine	0.004	-91%
Small Hydro	0.0001	-100%

Footnote:

Source: UNEP, Bloomberg New Energy Finance

Figure 8

Renewable energy asset finance and small distributed capacity investment by sector, 2015, and growth on 2014
\$bn

	2015	% growth on 2014
Large hydro	43	-7%
Marine	0.002	-99%
Biofuels	1	-67%
Geothermal	2	-25%
Small hydro	4	-26%
Biomass & w-t-e	5	-46%
Wind	107	9%
Solar	148	12%

Footnote: Total values include estimates for undisclosed deals.

Source: UNEP, Bloomberg New Energy Finance

Figure 9

Figure 9. Global average levelised cost of electricity for wind and solar, Q3 2009 to H2 2015, \$ per MWh
\$ per MWh

	2009		2010				2011				2012				2013		2014		2015	
	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	H1	H2	H1	H2	H1	H2
Onshore wind	96	90	86	86	93	82	84	87	82	75	77	80	82	83	81	78	82	82	85	83
Offshore wind	151	169	178	176	185	176	184	190	208	219	226	228	220	219	218	213	212	203	176	174
Parabolic trough with storage	275	267	275	275	283	261	281	291	257	260	239	252	264	264	264	264	265	265	275	274
Solar - crystalline silicon	315	292	315	293	307	249	235	245	201	197	188	164	166	162	135	137	149	143	129	122

Source: Bloomberg New Energy Finance

Figure 12

Global new investment in renewable energy by region, 2004-2015
\$bn

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	Total
United States	5.6	11.9	29.1	33.2	35.5	23.9	34.7	49.1	40.6	35.3	37.0	44.1	380.0
Brazil	0.8	3.1	5.2	11.4	11.8	7.9	7.2	10.2	7.7	4.4	8.0	7.1	84.8
AMER (excl. US & Brazil)	1.7	3.3	3.7	5.0	6.1	5.5	12.0	9.3	10.1	12.0	13.3	12.8	94.8
Europe	24.8	33.3	46.9	66.8	81.8	82.7	113.4	122.9	89.0	60.0	62.0	48.8	832.3
Middle East & Africa	0.6	0.8	1.1	1.8	2.3	1.6	4.1	3.0	10.2	9.3	7.9	12.5	55.1
China	3.0	8.3	11.2	16.7	25.6	38.8	39.6	47.4	61.7	62.0	87.8	102.9	505.1
India	2.7	3.0	4.9	6.7	5.6	4.3	8.8	12.8	7.8	6.6	8.3	10.2	81.6
ASOC (excl. China & India)	7.3	9.0	10.0	12.4	13.6	13.9	19.3	23.8	30.2	44.4	48.8	47.6	280.4

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

Source: UNEP, Bloomberg New Energy Finance

Figure 13

Global new investment in renewable energy by region, 2015
\$bn

	2015	% growth on 2014
China	102.9	17%
Europe	48.8	-21%
ASOC (excl. China & India)	47.6	-2%
United States	44.1	19%
AMER (excl. US & Brazil)	12.8	-3%
Middle East & Africa	12.5	58%
India	10.2	22%
Brazil	7.1	-10%

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

Source: UNEP, Bloomberg New Energy Finance

Figure 24

Renewable power generation and capacity as a share of global power, 2007-2015

%

	2007	2008	2009	2010	2011	2012	2013	2014	2015
Renewable capacity change as a % of global capacity change (net)	19.5%	27.3%	41.7%	31.6%	39.8%	48.6%	40.2%	49.0%	53.6%
Renewable power as a % of global power capacity	7.5%	8.2%	9.2%	10.2%	11.4%	12.7%	13.8%	15.2%	16.2%
Renewable power as a % of global power generation	5.2%	5.3%	5.9%	6.1%	6.9%	7.8%	8.5%	9.1%	10.3%

Footnote:

Renewables figure excludes large hydro. Capacity and generation based on Bloomberg New Energy Finance totals.

Source: Bloomberg New Energy Finance

Figure 25

**Net power generating capacity added in 2015 by main technology
GW**

	2015
Coal	42
Gas	40
Nuclear	15
Large hydro	22
Renewable ex large hydro	134

Source: Bloomberg New Energy Finance

Figure 26

Investment in power capacity – renewable, fossil-fuel and nuclear, 2008-2015, \$bn
\$bn

	2008	2009	2010	2011	2012	2013	2014	2015
Renewables ex large hydro	142	147	208	250	238	210	247	266
Fossil fuel					129	100	125	130
Nuclear					12	13	17	20
Large hydro	53	33	44	33	33	33	46.3	42.8

Source: Bloomberg New Energy Finance

Figure 35

Asset finance investment in renewable energy by region, 2004-2015
\$bn

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Europe	16.8	22.6	32.1	43.2	56.8	53.1	57.3	61.4	39.3	35.1	45.0	34.1
China	2.3	7.4	9.6	14.2	23.5	32.0	36.0	39.8	53.2	58.8	81.0	95.7
United States	4.0	8.7	23.1	25.2	22.6	12.7	23.2	39.8	28.4	20.2	18.6	24.4
ASOC (excl. China & India)	3.5	5.0	5.7	8.1	9.2	5.9	7.5	7.1	9.5	14.9	13.8	8.0
AMER (excl. US & Brazil)	1.6	2.9	3.3	3.9	5.8	4.7	11.0	8.4	9.2	11.4	12.6	11.8
Brazil	0.8	2.6	5.2	9.0	11.6	7.2	6.7	9.9	7.4	3.7	5.5	7.7
India	2.6	2.7	4.7	5.2	5.2	3.9	8.0	12.5	7.5	6.1	6.8	9.1
Middle East & Africa	0.4	0.5	0.8	1.0	1.1	0.6	3.3	2.5	8.6	7.7	5.1	8.4
Disclosed deal count	236	501	684	904	962	833	914	924	804	752	790	870
Total deal count	1125	1621	1991	2213	2410	2329	2851	3077	2935	3325	3444	2424

Footnote: Total values include estimates for undisclosed deals.

Source: Bloomberg New Energy Finance, UNEP

Figure 36

Asset finance investment in renewable energy by sector, 2004-2015
\$bn

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Wind	17.8	26.9	37.0	49.1	69.9	73.8	94.1	79.7	79.9	86.3	97.8	107.0
Solar	0.3	1.1	4.6	13.3	25.5	18.5	29.9	68.3	59.9	54.5	71.8	80.9
Biomass & w-t-e	7.3	8.9	11.1	14.1	16.3	13.2	14.5	16.5	12.3	9.6	9.6	5.2
Biofuels	3.2	7.9	22.9	24.9	15.9	6.9	7.2	7.0	4.1	2.0	2.0	0.7
Small hydro	2.4	7.1	7.3	6.5	7.1	5.8	4.6	6.9	5.9	5.1	4.7	3.5
Geothermal	0.9	0.8	0.7	1.5	1.0	1.8	2.5	2.9	1.2	0.5	2.4	1.8
Marine	0.005	0.03	0.8	0.5	0.04	0.1	0.03	0.1	0.1		0.1	0.002
Disclosed deal count	236	501	684	904	962	833	914	924	804	752	790	870
Total deal count	1125	1621	1991	2213	2410	2329	2851	3077	2935	3325	3444	2424

Footnote: Total values include estimates for undisclosed deals.

Source: Bloomberg New Energy Finance, UNEP

Figure 38

Small distributed capacity investment, 2004-2015
\$bn

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Total	8.5	10.2	9.4	14.1	22.3	33.5	62.6	75.7	79.3	53.9	60.4	67.4
% Growth		21%	-8%	50%	58%	50%	87%	21%	5%	-32%	12%	12%

Footnote: Represents investments in solar PV projects with capacities below 1MW

Source: Bloomberg New Energy Finance

Figure 41

Public market new investment in renewable energy by stage, 2004-2015
\$bn

	2004	2005	2006	2007	2008	2009
IPO	0.2	2.2	5.5	11.9	3.2	3.1
Secondary & PIPE	0.1	0.7	2.7	4.2	1.6	5.9
Convertible & other		0.2	0.3	3.8	4.1	2.7
OTC	0.02	0.5	0.8	1.5	1.9	1.3
IPO/Secondary & PIPE/Convertible & Other/OTC deal count	(6/8/0/4)	(23/34/9/7)	(40/55/9/18)	(42/80/25/32)	(17/49/22/21)	(10/86/14/23)

	2010	2011	2012	2013	2014	2015
IPO	5.3	4.2	1.2	3.8	3.5	2.3
Secondary & PIPE	3.2	3.3	1.8	3.6	6.5	6.7
Convertible & other	2.4	2.1	0.5	2.4	5.9	3.7
OTC	0.2	0.37	0.3	0.3	0.3	0.1
IPO/Secondary & PIPE/Convertible & Other/OTC deal count	(31/74/22/14)	(21/57/19/16)	(17/57/20/2)	(12/60/17/3)	(21/64/23/9)	(11/67/17/4)

Footnote: PIPE = private investment in public equity, OTC = over-the-counter

Source: Bloomberg New Energy Finance, UNEP

Figure 48

VC/PE new investment in renewable energy by stage, 2004-2015
\$bn

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
VC early stage	0.2	0.3	0.6	1.3	1.9	0.7	1.0	0.8	0.7	0.2	0.2	0.4
VC late stage	0.2	0.3	0.6	0.8	1.4	0.9	1.5	1.7	1.6	0.5	0.7	0.9
PE expansion capital	0.3	1.0	3.1	3.6	6.7	2.9	5.4	2.4	1.6	1.4	1.6	2.1
Total	0.7	1.5	4.2	5.7	9.9	4.5	7.9	4.9	4.0	2.1	2.5	3.4
% Growth	-	126%	174%	35%	74%	-55%	76%	-38%	-18%	-47%	19%	34%
Disclosed deal count	55	80	141	213	248	194	261	262	211	145	102	98
Total deal count	75	101	178	248	291	224	275	286	242	158	112	109

Footnote: Buy-outs are not included as new investment. Total values include estimates for undisclosed deals

Source: Bloomberg New Energy Finance, UNEP

Figure 57

Acquisition transactions in renewable energy by type, 2004-2015
\$bn

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
PE buy-outs	0.8	3.7	1.9	3.6	5.1	2.2	1.9	3.0	3.3	0.5	2.6	3.5
Public market investor exits	0.4	2.4	2.7	4.0	0.9	2.5	4.9	0.2	0.4	1.7	1.8	1.8
Corporate M&A	2.4	7.6	11.9	20.4	16.9	21.8	19.4	29.7	10.2	16.3	11.8	19.2
Asset acquisitions & refinancing	5.3	12.5	19.5	30.7	36.4	37.7	32.3	40.6	53.7	48.6	71.2	69.3
Total	8.9	26.2	35.9	58.7	59.4	64.2	58.5	73.5	67.6	67.1	87.3	93.9
Disclosed deal count	43	129	168	274	288	294	295	290	287	337	324	325
Total deal count	94	266	373	514	548	583	637	728	703	786	783	747

Footnote: Total values include estimates for undisclosed deals.

Source: Bloomberg New Energy Finance