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EI New Energy Top 100 Green Utilities

TOP 100 RANKINGS BASED ON CARBON EMISSIONS AND RENEWABLE ENERGY

Rank 2015	Rank 2014*	Points	Company	Country	Capacity (GW)
1	NA	234	Acciona	Spain	8.5
2	3	222	China General Nuclear (CGN)	China	23.3
3	1	215	Iberdrola	Spain	45.1
4	2	196	NextEra Energy	US	44.9
5	4	180	Energias de Portugal (EDP)	Portugal	22.5
6	5	173	Enel	Italy	96.1
7	6	167	China Guodian	China	125.2
8	NA	143	China Three Gorges	China	50.2
9	7	142	EDF	France	136.2
10	9	124	Dong Energy	Denmark	5.8
11	10	121	Exelon	US	32.8
12	12	120	Berkshire Hathaway Energy	US	28.1
13	11	118	Statkraft	Norway	18.2
14	8	118	E.On	Germany	58.9
15	30	114	China Power Investment (CPI)	China	96.7
16	17	113	China Huaneng	China	151.5
17	13	112	Verbund	Austria	9.7
18	NA	112	Axpo	Switzerland	8.9
19	19	109	China Datang	China	120.5
20	27	108	SSE	UK	11.7
21	41	101	China Huadian	China	122.5
22	14	101	Cemig	Brazil	7.2
23	15	100	PG&E	US	7.7
24	20	100	China National Nuclear Corp.	China	9.8
24	20	100	Energoatom	Ukraine	14.2
24	20	100	Rosatom	Russia	26.3
27	24	100	Hydro-Quebec	Canada	36.6
28	28	100	Ontario Power Generation	Canada	17.1
29	18	99	GDF Suez	France	81.3
30	25	98	BC Hydro	Canada	12.6
31	29	97	Eletrobras	Brazil	44.2
32	31	92	Gas Natural Fenosa	Spain	14.7
33	26	91	Fortum	Finland	14.6
34	36	87	A2A	Italy	10.3
35	32	87	Vattenfall	Sweden	40.1
36	37	85	Dominion Resources	US	22.6
37	33	82	Public Service Ent. Group (PSEG)	US	13.5
38	40	81	CEZ	Czech Rep.	15.3
39	38	81	Calpine	US	26.5
40	35	80	EuroSibEnergo	Russia	19.5
41	34	80	AES	US	34.7
42	39	80	Vietnam Electricity	Vietnam	18.6
43	45	79	Energie Baden-Wurttemberg (EnBW)	Germany	13.7
44	46	79	Tenaska	US	6.7
45	44	78	Comision Federal de Electricidad (CFE)	Mexico	41.5
46	43	77	Entergy	US	27.8
47	49	77	Duke Energy	US	61.6
48	42	76	RusHydro	Russia	37.0
49	47	75	RWE	Germany	48.9
50	51	71	Corpoelec	Venezuela	24.0
51	50	67	CLP Holdings	China	19.4
52	54	67	TransAlta	Canada	8.7
53	48	66	NRG Energy	US	52.3
54	64	65	DTE Energy	US	11.4
55	52	64	Egyptian Electricity Holding (EEHC)	Egypt	28.8
56	NA	62	Wec Energy	US	7.2
57	55	61	Korea Electric Power Corp. (Kepco)	S. Korea	77.1
58	NA	61	Dubai Elec. & Water Authority (Dewa)	UAE	9.7
59	57	61	Taiwan Power	Taiwan	32.0
60	69	59	Kyushu Electric Power Co.	Japan	23.1
61	59	59	Kansai Electric Power Co.	Japan	43.3
62	62	59	Taqa	UAE	9.5
63	58	58	Southern Co.	US	46.5
64	NA	57	Talen Energy	US	17.6
65	60	56	Inter Rao UES	Russia	35.0
66	65	56	Chubu Electric Power Co.	Japan	34.1
67	70	56	FirstEnergy	US	17.9
68	74	56	Tennessee Valley Authority (TVA)	US	33.3
69	66	55	Tohoku Electric Power Co.	Japan	22.4
70	63	55	OGE Energy	US	6.8
71	76	55	Acwa Power	Saudi Arabia	11.7
72	61	55	Tata Power	India	8.7
73	67	54	Tokyo Electric Power Co. (Tepco)	Japan	66.1
74	53	54	AGL	Australia	10.5
75	73	51	Tenaga Nasional Berhad (TNB)	Malaysia	8.6
76	72	50	Egat	Thailand	15.5
77	68	49	Tavanir	Iran	37.1
78	78	46	Kahramaa	Qatar	8.8
79	83	46	Xcel Energy	US	17.1
80	86	43	Chugoku Electric Power Co.	Japan	15.8
81	79	42	Hokuriku Electric Power Co.	Japan	8.1
82	71	42	J-Power	Japan	23.5
83	80	40	Mosenergo	Russia	12.7
84	82	40	Hokkaido Electric Power Co.	Japan	7.8
85	91	39	Ameren	US	10.2
86	89	38	Israel Electric Corp. (IEC)	Israel	13.6
87	75	38	Elektrik Uretim AS (EUAS)	Turkey	21.9
88	85	37	Shikoku Electric Power Co.	Japan	7.0
89	88	35	Sonelgaz	Algeria	10.7
90	87	35	Saudi Electricity Co.	Saudi Arabia	48.6
91	94	33	Perusahaan Listrik Negara (PLN)	Indonesia	39.3
92	93	32	Energy Future Holdings	US	13.8
93	92	30	American Electric Power (AEP)	US	38.4
94	81	28	PPL	US	8.0
95	84	23	Dynegy	US	13.2
96	95	22	Min. of Electricity and Water (MEW)	Kuwait	15.7
97	97	16	NTPC	India	45.5
98	98	14	Polska Grupa Energetyczna (PGE)	Poland	12.6
99	99	13	Eskom	South Africa	42.1
100	100	4	Public Power Corp. (PPC)	Greece	12.6

Renewables Make Up 80% of New Power Capacity

Once again, the top performer in *EI New Energy*'s annual ranking of 100 of the world's top "green" power generators — measured by their emissions and renewable energy capacity — is Spanish. But instead of Iberdrola, an incumbent utility now in third place, this year's winner, Acciona, is an independent power producer and a newcomer in the ranking. Originally a construction and engineering firm, Acciona started to invest in renewables two decades ago and now operates almost 9 gigawatts of wind, hydro, solar and biomass capacity.

Meanwhile, Chinese companies continue to climb the ranking, with China General Nuclear (CGN) now a solid No. 2, three Chinese companies in the top 10, and six Chinese firms among the 10 biggest owners of renewable capacity (NE Aug.27'15). Companies at the bottom of the ranking own little or no renewable capacity, and tend to be located in coal- and oil-producing countries such as South Africa, Poland, India, Kuwait, the US, Indonesia and Saudi Arabia.

The rankings are calculated using a system in which each company is awarded up to 300 points — up to 100 based on carbon dioxide emissions intensity, or CO2 per megawatt hour generated, and up to 200 based on non-hydro renewable capacity, in absolute and relative terms. The main table lists all 100 companies with points, their rank in 2015 and 2014, and their total capacity as an indication of size. Three other tables show the top 20 performers under each criterion — their CO2 emissions per MWh, the size of their renewable energy capacity in GW, and the proportion of non-hydro renewables in their total capacity.

Renewable energy technologies accounted for almost 80% of new capacity added in 2014 by the companies in the ranking. While fossil fuels grew by 12 GW and nuclear stagnated, they commissioned or acquired some 17 GW of hydropower and 24 GW of non-hydro renewable capacity. Of the non-hydro additions, 16 GW or almost 70% were built by Chinese companies, compared to 4 GW in the US, 2 GW in Europe and 2 GW in the rest of the world. The 100 companies represent 55% of the world's power generating capacity, with total sales last year amounting to around $2 trillion or $150 per MWh generated.

New additions include Acciona, China Three Gorges (ranked 8) replacing its subsidiary China Yangtze, Switzerland's Axpo (18), China National Nuclear Corp. (24), the US' Wec Energy (56), Dubai Electricity and Water Authority or Dewa (58), and the newly created US company Talen Energy (64), which combines assets from utility PPL and investment fund Riverstone. Companies dropping out of the top 100 include Switzerland's Alpiq and the US' Alliant Energy, CMS Energy, Great Plains Energy, Pinnacle West Capital and Westar Energy.

While Europe accounted for less than 10% of renewable capacity additions in the ranking last year, its companies continue to lead the ranking, with six of them in the top 10 and 11 in the top 20, including Spain's Acciona (1) and Iberdrola (3), Portugal's EDP (5), Italy's Enel (6), France's EDF (9), Denmark's Dong Energy (10), Norway's Statkraft (13), Germany's E.On (14), Austria's Verbund (17), Axpo (18) and the UK's SSE (20) (NE Jul.16'15).

Although three quarters of China's electricity is still produced from coal, down from over 80% in 2012 and before, the country also performs well as its major generating companies keep investing in wind energy despite slowing power demand and frequent grid connection issues (NE Aug.20'15). Four of the "Big Five" — China Guodian (7), China Power Investment (15), China Huaneng (16) and China Datang (19) — are now in the top 25, and the fifth one, China Huadian (21), is likely to join them soon. CGN (2) is a unique example of a company combining nuclear and wind plus some solar and hydro, without any form of fossil fuel generation.

The US picture is diverse with three firms in the top 20, including NextEra Energy (4), the biggest wind owner in the country, Exelon (11), one of the world's least carbon-intensive utilities thanks to a large nuclear fleet and significant wind and hydro capacity, and Berkshire Hathaway Energy (12), another top wind owner (NE Sep.3'15). Similarly, PG&E (23), Dominion Resources (36), PSEG (37), Entergy (46) and Duke Energy (47) combine sizable nuclear capacity with some hydro or renewable generation. They also operate many high-efficiency, low-emissions gas-fired plants, which are independent producers' Calpine (39) and Tenaska (44) core business. More diversified independent generators such as NRG Energy (53), Talen Energy (64) and Dynegy (95) rank lower because they also operate coal plants. Similarly, while Midwest utilities typically tap into the region's abundant wind resources through power purchase agreements, their own fleet mostly relies on local coal, which puts them at the end of the ranking.

Companies in other big coal- or lignite-producing countries also rank low, such as India's Tata Power (72) and NTPC (97), Australia's AGL (74), Turkey's EUAS (87), Indonesia's PLN (91), Poland's PGE (98), South Africa's Eskom (99) and Greece's PPC (100). Germany's RWE (49), another lignite-heavy producer, also ranks lower than its Western European peers. While oil and gas are cleaner than coal, generators in Mideast producing countries, such as Iran's Tavanir (77), Qatar's Kahramaa (78), Algeria's Sonelgaz (89), Saudi Electricity Co. (90) and Kuwait's Ministry of Electricity and Water (96) perform equally low as they operate significant amounts of old steam cycle plants and own little renewable capacity, if any.

By contrast, modern combined-cycle gas turbines, often associated with seawater desalination, allow the UAE's Dewa (58) and Taqa (62) and Saudi Arabia's Acwa Power (71) to achieve lower emissions levels and perform reasonably well. Among oil and gas producing countries, Mexico's CFE (45), Venezuela's Corpoelec (50) and Egypt's EEHC (55) also take advantage of substantial local hydro resources.

Hydro similarly allow companies in several parts of the world to achieve very low emissions levels, including Norway's Statkraft (13), Brazil's Cemig (22) and Eletrobras (31), and Canada's Hydro-Quebec (27) (NE Oct.10'13). Likewise, nuclear specialists Ukraine's Energoatom (24) and Russia's Rosatom (24) also perform well because nuclear emits no CO2, and Canada's Ontario Power Generation (28), Finland's Fortum (33) and Sweden's Vattenfall (35) combine significant nuclear capacity with hydropower.

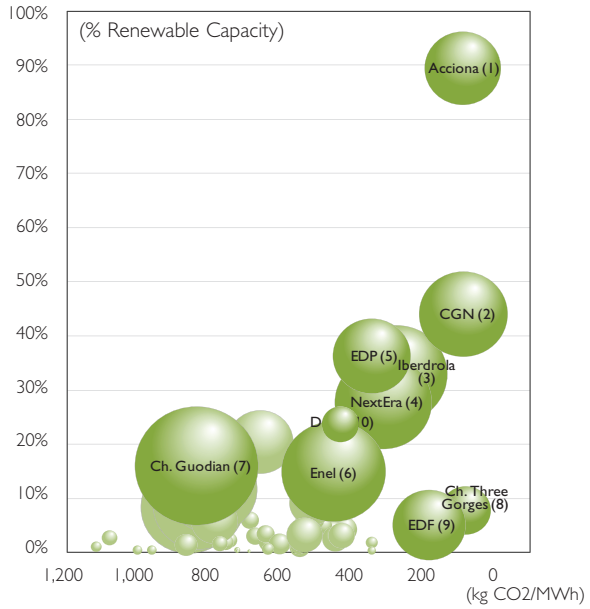
Japan, on the contrary, has been over 85% dependent on fossil fuel generation since the 2011 Fukushima accident, (NE Apr.30'15). All Japanese utilities are in the second half of the ranking, from Kyushu Electric (60) to Shikoku Electric (88). In the same region, Korea's Kepco (57) and Taiwan Power (59) still rely on nuclear and rank higher.

Top Utilities Ranked by Carbon Emissions

Rank	Points	Emissions (kg CO_2/MWh)	Company	Country
1	100	0	China General Nuclear (CGN)	China
1	100	0	China National Nuclear Corp.	China
1	100	0	China Three Gorges	China
1	100	0	Energoatom	Ukraine
1	100	0	Rosatom	Russia
6	100	1	Hydro-Quebec	Canada
7	100	1	Acciona	Spain
8	100	4	Statkraft	Norway
9	100	4	Ontario Power Generation	Canada
10	98	18	BC Hydro	Canada
11	98	23	Cemig	Brazil
12	96	48	Axpo	Switzerland
13	95	52	Verbund	Austria
14	93	80	Eletrobras	Brazil
15	93	82	Exelon	US
16	92	89	PG&E	US
17	91	102	EDF	France
18	84	177	Fortum	Finland
19	81	212	Iberdrola	Spain
20	80	218	EuroSibEnergo	Russia

Ranking of top 20 generators based only on emissions intensity of power generation, or the volume of carbon dioxide emitted per megawatt hour of electricity. 100 points = no emissions, 0 point = maximum emissions. Latest available data, usually 2014. *Source: Energy Intelligence*

Top 10 Green Utilities



EI New Energy top 10 green utilities are represented in dark color, with ranking. The other 90 are in light color. Size of bubble represents volume of renewable capacity in GW. Position on the chart represents % of renewable capacity and carbon emissions intensity. Best position = top right with large bubble. *Source: Energy Intelligence*

Top Utilities Ranked by Renewables Capacity (%)

Rank	Points	Renewables % of Total	Company	Country
1	96	89%	Acciona	Spain
2	70	44%	China General Nuclear (CGN)	China
3	64	36%	Energias de Portugal (EDP)	Portugal
4	60	32%	Iberdrola	Spain
5	55	28%	NextEra Energy	US
6	51	24%	Dong Energy	Denmark
7	46	20%	Berkshire Hathaway Energy	US
8	41	17%	SSE	UK
9	39	16%	China Guodian	China
10	38	15%	TransAlta	Canada
11	38	15%	Enel	Italy
12	31	11%	CLP Holdings	China
13	30	11%	China Power Investment (CPI)	China
14	29	10%	AGL	Australia
15	28	10%	E.On	Germany
16	26	9%	China Datang	China
17	26	9%	DTE Energy	US
18	25	8%	China Huaneng	China
19	24	8%	China Huadian	China
20	23	8%	China Three Gorges	China

Ranking of top 20 generators based only on % share of renewable power (excluding large hydropower) in total generating capacity. 100 points = 100% renewables; 0 point = 0% renewables. Latest available data, usually 2014. *Source: Energy Intelligence*

Top Utilities Ranked by Renewables Capacity (Volume)

Rank	Points	Renewables (GW)	Company	Country
1	100	19.8	China Guodian	China
2	74	14.7	Iberdrola	Spain
3	71	14.0	Enel	Italy
4	63	12.4	NextEra Energy	US
5	63	12.4	China Huaneng	China
6	54	10.7	China Datang	China
7	53	10.4	China Power Investment (CPI)	China
8	52	10.3	China General Nuclear (CGN)	China
9	49	9.7	China Huadian	China
10	41	8.1	Energias de Portugal (EDP)	Portugal
11	38	7.6	Acciona	Spain
12	34	6.8	EDF	France
13	29	5.7	Berkshire Hathaway Energy	US
14	28	5.6	E.On	Germany
15	19	3.8	GDF Suez	France
16	19	3.8	China Three Gorges	China
17	18	3.6	RWE	Germany
18	15	3.0	NRG Energy	US
19	11	2.2	CLP Holdings	China
20	10	2.0	Vattenfall	Sweden

Ranking of top 20 generators based only on volume of renewable power generating capacity (excluding hydropower) in gigawatts. 100 points = greatest volume of renewables; 0 points = smallest volume. Latest available data, usually 2014. *Source: Energy Intelligence*

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How We Rank the Top 100 Green Utilities

For this ranking, *EI New Energy* selected 100 of the largest power generators from around the world, based on total installed capacity, renewable capacity and the availability of information. Their capacity ranges from 150 gigawatts for China Huaneng, now bigger than France's EDF, to just under 6 GW for Denmark's Dong Energy, with non-hydro renewables ranging from China Guodian's 20 GW, to zero or just a few megawatts for about 25 companies. In all, they total 3,100 GW, or 55% of the world's total generating capacity, based on 2012 data from the International Energy Agency — including 87% of capacity in Japan, 68% in Europe, 60% in China, 56% in the Mideast and Africa, and 53% in the US. Some large utilities in terms of sales, such as New York's Con Edison, are not included, as they only supply power without generating it. Conversely, pure generators without retail activity, such as Spain's Acciona and the US' Calpine, are included.

Subsidiaries of larger groups such as renewable developers China Longyuan, part of China Guodian, EDF's EDF Energies Nouvelles and Enel's Enel Green Power, are excluded to avoid double counting. Big countries such as Australia, where the power sector is fragmented, are hardly represented or, as for Argentina, not represented at all. Similarly, most power generation in countries such as the UK, Belgium and the Netherlands has been taken over by foreign companies.

To evaluate their "greenness," each utility was awarded up to 300 points based on three criteria:

• The first assesses direct greenhouse gas emissions, measured as carbon dioxide emissions per megawatt hour of electricity produced, with 100 points for the lowest emitters — such as pure renewable or nuclear generators — and zero for the highest emitter, Greece's lignite-heavy PPC, at around 1,100 kilograms of CO2 per MWh. Other companies' points are based on how they compare to the highest and lowest emitters. Nuclear energy and renewable sources — including wind, solar and hydropower — are considered to be emission free, despite some controversies on indirect emissions. Emissions caused by generating the electricity companies may procure from independent generators are not taken into account. On average, companies in the ranking emit 520 kg CO2/MWh.

• The second and third criteria measure a company's renewable energy capacity in volume and in proportion to total capacity. These criteria exclude hydropower because large dams are controversial, since they flood large areas and drastically change rivers' water patterns. The firm with the highest renewable capacity, China Guodian at 20 GW, earned 100 points in the second criterion, while companies without renewable generation were assigned zero points and the other companies were awarded points according to their relative performance — for example EDP, at 8 GW or 41% of China Guodian's 20 GW, was given 41 points. Similarly in the third criterion, a company with 100% renewables would earn 100 points and companies without renewables would earn no points. Points under these two criteria are to some extent correlated, but large companies may own significant renewable capacity that only amounts to a modest share of total generation, while smaller ones may have a high proportion of renewable capacity without it being sizable in gigawatt terms.

The ranking uses the latest available full-year data, usually fiscal 2014, mostly from official company sources. Since information on CO2 emissions can be hard to obtain, external sources were used for about 10 companies, such as the Air Emissions Benchmarking which a group of US companies and nonprofits publishes annually. For roughly 15 more companies, we produced our own estimates based on published or estimated fuel consumption data. Several entries from 2014 were revised with additional or corrected information, resulting in changes to rankings.

Top Green Utilities: Carbon-Free Generation Capacity (GW)

Rank	Company	Country	Nuclear	Hydro	Renewables	Total CO_2-free	CO_2-free /Total
1	Acciona	Spain	0.0	0.9	7.6	8.5	100%
1	China General Nuclear (CGN)	China	11.6	1.5	10.3	23.3	100%
1	China National Nuclear Corp.	China	9.8	0.0	0.0	9.8	100%
1	China Three Gorges	China	0.0	46.4	3.8	50.2	100%
1	Energoatom	Ukraine	13.8	0.3	0.0	14.2	100%
1	Rosatom	Russia	26.3	0.0	0.0	26.3	100%
7	Hydro-Quebec	Canada	0.0	36.1	0.0	36.1	99%
8	Cemig	Brazil	0.0	6.9	0.1	7.0	97%
9	BC Hydro	Canada	0.0	11.4	0.0	11.4	91%
10	Eletrobras	Brazil	2.0	37.8	0.3	40.0	91%
11	Statkraft	Norway	0.0	14.8	0.8	15.6	86%
12	Verbund	Austria	0.0	7.7	0.4	8.2	84%
13	Ontario Power Generation	Canada	6.6	7.4	0.0	14.0	82%
14	PG&E	US	2.2	3.9	0.2	6.3	82%
15	Axpo	Switzerland	3.3	3.4	0.4	7.0	79%
16	RusHydro	Russia	0.0	28.6	0.1	28.7	78%
17	EuroSibEnergo	Russia	0.0	15.0	0.0	15.0	77%
18	EDF	France	73.5	21.8	6.8	102.2	75%
19	Energias de Portugal (EDP)	Portugal	0.2	7.7	8.1	16.0	71%
20	Exelon	US	19.3	1.6	1.9	22.8	70%

Ranking of top 20 generators based on CO2-free generation, including nuclear, hydropower and renewables. Other generation emits CO2 and includes coal-, gas- and oil-fired capacity. Latest available data, usually 2014. *Source: Energy Intelligence*