

energy [r]evolution

A SUSTAINABLE WORLD ENERGY OUTLOOK 2015

100% RENEWABLE ENERGY FOR ALL



GWEC
GLOBAL WIND ENERGY COUNCIL

 SolarPower
Europe

GREENPEACE

GLOSSARY, REFERENCES & APPENDIX

REFERENCES

GLOSSARY OF COMMONLY USED
TERMS AND ABBREVIATIONS

ANNEXES



IMAGE LOCATED NEAR THE EQUATOR IN CENTRAL AFRICA, THE NYAMURAGIRA AND NYIRAGONGO VOLCANOES ARE OFTEN OBSCURED FROM SATELLITE VIEW BY CLOUDS. BUT ON FEBRUARY 9, 2015, CLEAR SKIES AFFORDED AN UNOBSTRUCTED VIEW FROM SPACE OF TWO PLUMES VENTING FROM THE VOLCANIC DUO IN THE DEMOCRATIC REPUBLIC OF THE CONGO. OCCASIONALLY, NYIRAGONGO SPEWS MORE THAN JUST STEAM AND VOLCANIC GASES. ERUPTIONS OF FLUID LAVA FROM THE VOLCANO IN 1977 AND 2002 HAD DEADLY CONSEQUENCES FOR THE CITY OF GOMA, WHICH LIES ABOUT 15 KILOMETERS (9 MILES) SOUTH OF THE VOLCANO.

13.1 REFERENCES

INTRODUCTION

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13.2 GLOSSARY OF COMMONLY USED TERMS AND ABBREVIATIONS

TERM/UNIT/ABBREVIATION

CHP	Combined Heat and Power
CO ₂	Carbon dioxide, the main greenhouse gas
GDP	Gross Domestic Product (means of assessing a country's wealth)
PPP	Purchasing Power Parity (adjustment to GDP assessment to reflect comparable standard of living)
IEA	International Energy Agency
J	Joule, a measure of energy
kJ	Kilojoule = 1,000 Joules
MJ	Megajoule = 1 million Joules
GJ	Gigajoule = 1 billion Joules
PJ	Petajoule = 10 ¹⁵ Joules
EJ	Exajoule = 10 ¹⁸ Joules
W	Watt, measure of electrical capacity
kW	Kilowatt = 1,000 watts
MW	Megawatt = 1 million watts
GW	Gigawatt = 1 billion watts
TW	Terawatt = 10 ¹² watts
kWh	Kilowatt-hour, measure of electrical output = 1,000 watt-hours
TWh	Terawatt-hour, or 10 ¹² watt-hours
t	Tonnes, measure of weight
Gt	Gigatonnes = 1 billion tonnes

CONVERSION FACTORS - FOSSIL FUELS

COAL	23.03	MJ/kg	1 cubic	0.0283 m ³
LIGNITE	8.45	MJ/kg	1 barrel	159 liter
OIL	6.12	GJ/barrel	1 US gallon	3.785 liter
GAS	38000.00	kJ/m ³	1 UK gallon	4.546 liter

CONVERSION FACTORS - DIFFERENT ENERGY UNITS

FROM:	TO:	TJ	Gcal	Mtoe	Mbtu	GWh
		MULTIPLY BY	MULTIPLY BY	MULTIPLY BY	MULTIPLY BY	MULTIPLY BY
TJ		1	238.8	2.388 x 10 ⁻⁵	947.8	0.2778
Gcal		4.1868 x 10 ⁻³	1	10 ⁻⁷	3.968	1.163 x 10 ⁻³
Mtoe		4.1868 x 10 ⁴	10 ⁷	1	3968 x 10 ⁷	11630
Mbtu		1.0551 x 10 ⁻³	0.252	2.52 x 10 ⁻⁸	1	2.931 x 10 ⁻⁴
GWh		3.6	860	8.6 x 10 ⁻⁶	3412	1

13.2.1 DEFINITION OF SECTORS

The definition of different sectors follows the sectorial break down of the IEA World Energy Outlook series.

All definitions below from *IEA Key World Energy Statistics*.

Industry sector:

Consumption in the industry sector includes the following subsectors (energy used for transport by industry is not included -> see under "Transport")

- Iron and steel industry
- Chemical industry
- Non-metallic mineral products e.g. glass, ceramic, cement etc.
- Transport equipment
- Machinery
- Mining
- Food and tobacco
- Paper, pulp and print
- Wood and wood products (other than pulp and paper)
- Construction
- Textile and Leather

Transport sector:

The Transport sector includes all fuels from transport such as road, railway, aviation, domestic navigation. Fuel used for ocean, coastal and inland fishing is included in "Other Sectors"

Other sectors:

Other sectors cover agriculture, forestry, fishing, residential, commercial and public services

Non-energy use:

Covers use of other petroleum products such as paraffin waxes, lubricants, bitumen etc.

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GLOBAL: REFERENCE SCENARIO

Table 13.1.1 Global: Electricity generation TWh/a

	2012	2020	2025	2030	2040	2050
Power plants	19,125	24,639	28,392	32,169	39,767	45,752
Hard coal (& non-renewable waste)	5,477	7,315	8,702	10,167	13,224	15,074
Lignite	1,718	1,897	2,044	2,143	2,380	2,617
Gas	3,876	4,614	5,665	6,710	9,020	10,759
of which from H+	0	0	0	0	0	0
Oil	889	647	532	418	301	212
Diesel	147	158	180	202	234	255
Nuclear	2,450	3,215	3,443	3,670	3,856	4,054
Biomass (& renewable waste)	205	523	652	780	1,009	1,251
Hydro	3,672	4,458	4,832	5,207	5,862	6,431
Wind	521	1,254	1,608	1,962	2,552	3,202
of which wind offshore	19	69	123	189	346	521
PV	97	408	519	630	832	1,096
Geothermal	69	111	148	185	283	419
Solar thermal power plants	5	34	60	85	173	303
Ocean energy	0	3	6	10	41	76
Combined heat and power plants	3,478	3,854	3,983	4,088	4,240	4,359
Hard coal (& non-renewable waste)	1,670	1,873	1,929	1,966	1,958	1,891
Lignite	193	187	185	182	175	171
Gas	1,351	1,510	1,577	1,650	1,785	1,941
of which from H+	0	0	0	0	0	0
Oil	88	63	50	36	26	23
Biomass (& renewable waste)	175	218	237	259	290	326
Geothermal	2	2	3	3	4	6
Hydrogen	0	1	1	1	1	1
CHP by producer						
Main activity producers	1,576	1,632	1,633	1,631	1,628	1,641
Autoproducers	1,903	2,222	2,349	2,457	2,612	2,717
Total generation	22,604	28,492	32,374	36,256	44,007	50,110
Fossil	15,409	18,266	20,865	23,464	29,104	32,945
Hard coal (& non-renewable waste)	7,148	9,189	10,631	12,123	15,182	16,966
Lignite	1,911	2,085	2,229	2,325	2,556	2,787
Gas	5,226	6,124	7,242	8,360	10,806	12,700
Oil	978	710	582	454	327	236
Diesel	147	158	180	202	234	256
Nuclear	2,450	3,215	3,443	3,670	3,856	4,054
Hydrogen	0	1	1	1	1	1
of which renewable H+	0	0	0	0	0	0
Renewables (w/o renewable hydrogen)	4,744	7,010	8,066	9,121	11,046	13,111
Hydro	3,672	4,458	4,832	5,207	5,862	6,431
Wind	521	1,254	1,608	1,962	2,552	3,202
PV	97	408	519	630	832	1,096
Biomass (& renewable waste)	379	740	890	1,039	1,299	1,577
Geothermal	70	113	151	188	287	425
Solar thermal power plants	5	34	60	85	173	303
Ocean energy	0	3	6	10	41	76
Distribution losses	1,839	2,371	2,751	3,130	3,922	4,615
Own consumption electricity	1,910	2,161	2,328	2,495	2,835	2,878
Electricity for hydrogen production	0	3	3	4	4	4
Electricity for synfuel production	0	0	0	0	0	0
Final energy consumption (electricity)	18,863	23,969	27,304	30,639	37,255	42,622
Fluctuating RES (PV, Wind, Ocean)	618	1,665	2,133	2,602	3,425	4,374
Share of fluctuating RES	3%	6%	7%	7%	8%	9%
RES share	21%	25%	25%	25%	25%	26%

Table 13.1.2 Global: Final energy consumption in transport PJ/a

	2012	2020	2025	2030	2040	2050
Road	78,688	89,912	98,701	107,510	120,944	130,313
Fossil fuels	74,800	84,096	91,476	98,864	108,461	114,616
Biofuels	2,486	3,622	4,487	5,352	7,224	7,982
Synfuels	0	0	0	0	0	0
Natural gas	1,394	2,095	2,472	2,850	4,319	6,218
Hydrogen	0	0	0	0	0	0
Electricity	9	99	267	444	939	1,497
Rail	2,766	3,134	3,335	3,517	3,887	4,260
Fossil fuels	1,701	1,839	1,952	2,054	2,256	2,452
Biofuels	0	0	0	0	0	0
Synfuels	0	0	0	0	0	0
Electricity	1,065	1,294	1,383	1,463	1,631	1,808
Navigation	2,173	2,506	2,707	2,963	3,269	3,470
Fossil fuels	2,173	2,506	2,707	2,963	3,269	3,470
Biofuels	0	0	0	0	0	0
Synfuels	0	0	0	0	0	0
Aviation	4,120	5,026	5,512	5,943	6,730	7,573
Fossil fuels	4,120	5,026	5,512	5,943	6,730	7,573
Biofuels	0	0	0	0	0	0
Synfuels	0	0	0	0	0	0
Total (incl. pipelines)	90,119	103,044	112,778	122,511	137,518	148,418
Fossil fuels	82,794	93,468	101,647	109,825	120,716	128,112
Biofuels (incl. biogas)	2,486	3,622	4,487	5,352	7,224	7,982
Synfuels	0	0	0	0	0	0
Natural gas	3,765	4,561	4,994	5,427	7,008	9,020
Hydrogen	0	0	0	0	0	0
Electricity	1,074	1,393	1,650	1,907	2,570	3,304
Total RES	2,711	3,964	4,698	5,832	7,869	8,846
RES share	3%	4%	4%	5%	6%	6%

Table 13.1.3 Global: Heat supply PJ/a

	2012	2020	2025	2030	2040	2050
District heating plants	8,275	9,035	9,538	10,053	10,456	10,732
Fossil fuels	8,030	8,713	9,173	9,638	9,945	10,139
Biomass	239	309	348	393	477	548
Solar collectors	0	1	1	2	5	11
Geothermal	6	13	16	20	28	34
Heat from CHP¹	10,083	11,280	11,876	12,498	13,876	16,079
Fossil fuels	9,566	10,557	11,030	11,502	12,519	13,893
Biomass	507	704	823	969	1,320	2,139
Geothermal	10	15	19	23	31	40
Hydrogen	0	4	5	5	6	6
Direct heating	129,751	149,371	159,100	169,071	188,257	205,512
Fossil fuels	91,517	107,600	115,232	123,061	137,389	149,826
Biomass	26,739	28,805	29,945	31,105	33,793	36,299
Solar collectors	803	1,385	1,745	2,105	2,840	3,830
Geothermal	0	0	0	0	0	0
Heat pumps ²	468	661	775	886	1,217	1,646
Electric direct heating	10,224	10,921	11,404	11,914	13,018	13,911
Hydrogen	0	0	0	0	0	0
Total heat supply³	148,109	169,687	180,515	191,622	212,588	232,322
Fossil fuels	109,112	126,869	135,434	144,200	159,853	173,858
Biomass	27,486	29,818	31,115	32,467	35,590	38,986
Solar collectors	804	1,386	1,746	2,107	2,845	3,841
Geothermal	16	28	35	43	59	74
Heat pumps ²	468	661	775	886	1,217	1,646
Electric direct heating	10,224	10,921	11,404	11,914	13,018	13,911
Hydrogen	0	4	5	5	6	6
RES share (including RES electricity)	21%	20%	20%	20%	20%	21%

1 public CHP and CHP autoproduction / 2 heat from ambient energy and electricity use / 3 incl. process heat, cooking

Table 13.1.4: Global: Installed capacity GW

	2012	2020	2025	2030	2040	2050
Total generation	5,680	7,343	8,237	9,130	10,747	12,033
Fossil	3,712	4,500	5,016	5,532	6,534	7,134
Hard coal (& non-renewable waste)	1,407	1,820	2,092	2,373	2,888	3,081
Lignite	373	387	408	422	453	484
Gas (w/o H ₂)	1,499	1,918	2,178	2,439	2,930	3,341
Oil	378	308	264	216	161	112
Diesel	55	66	73	83	102	105
Nuclear	393	447	471	496	517	544
Hydrogen (fuel cells, gas power plants, gas CHP)	0	0	0	0	0	0
Renewables	1,575	2,396	2,749	3,101	3,696	4,355
Hydro	1,099	1,331	1,438	1,544	1,715	1,878
Wind	277	554	681	807	998	1,217
of which wind offshore	5	20	36	55	98	145
PV	97	332	413	494	635	803
Biomass (& renewable waste)	11	150	172	199	243	293
Geothermal	87	170	22	28	42	62
Solar thermal power plants	3	11	19	26	49	74
Ocean energy	0	1	2	4	15	28
Fluctuating RES (PV, Wind, Ocean)	375	887	1,096	1,305	1,647	2,048
Share of fluctuating RES	7%	12%	13%	14%	15%	17%
RES share	28%	33%	33%	34%	34%	36%

Table 13.1.5: Global: Final energy demand PJ/a

	2012	2020	2025	2030	2040	2050
Total (incl. non-energy use)	360,650	418,349	451,812	485,226	541,973	587,701
Total energy use¹	326,859	379,586	410,576	441,590	495,388	538,502
Transport	90,119	103,044	112,778	122,511	137,518	148,418
Oil products	82,794	93,468	101,647	109,825	120,716	128,112
Natural gas	3,765	4,561	4,994	5,427	7,008	9,020
Biofuels	2,486	3,622	4,487	5,352	7,224	7,982
Synfuels	0	0	0	0	0	0
Electricity	1,074	1,393	1,650	1,907	2,570	3,304
RES electricity	225	343	411	480	645	865
Hydrogen	0	0	0	0	0	0
RES share Transport	3%	4%	4%	5%	6%	6%
Industry	106,313	129,641	140,466	151,290	170,465	186,496
Electricity	28,747	37,294	41,992	46,689	55,149	62,870
RES electricity	6,034	9,176	10,462	11,746	13,843	16,449
Public district heat	5,446	6,052	6,263	6,473	6,496	6,446
RES district heat	113	307	348	394	456	508
Hard coal & lignite	25,402	32,795	33,324	34,396	35,528	36,033
Oil products	12,939	14,200	14,512	14,824	14,989	14,585
Gas	26,305	29,915	33,643	36,828	43,349	48,889
Solar	13	70	106	141	272	470
Biomass	7,441	9,290	10,600	11,909	14,647	17,158
Geothermal	20	24	27	29	37	45
Hydrogen	0	0	0	0	0	0
RES share Industry	13%	15%	15%	16%	17%	19%
Other Sectors	130,428	146,901	157,332	167,789	187,404	203,589
Electricity	38,088	47,601	54,653	61,705	76,400	87,266
RES electricity	7,994	11,712	13,617	15,524	19,178	22,832
Public district heat	6,555	6,709	6,969	7,229	7,711	8,285
RES district heat	136	340	388	440	541	654
Hard coal & lignite	5,718	5,878	5,977	6,076	5,954	5,903
Oil products	17,894	18,409	18,663	18,940	19,301	19,849
Gas	24,960	29,178	31,634	34,091	38,538	43,036
Solar	790	1,314	1,639	1,964	2,568	3,359
Biomass	36,126	37,374	37,275	37,177	36,076	34,701
Geothermal	297	437	521	605	856	1,189
Hydrogen	0	0	0	0	0	0
RES share Other Sectors	35%	35%	34%	33%	32%	31%
Total RES	61,675	74,010	79,880	85,762	96,342	106,213
RES share	19%	19%	19%	19%	19%	20%
Non energy use	33,791	38,763	41,237	43,636	46,585	49,199
Oil	24,430	27,189	28,234	29,263	30,036	30,424
Gas	7,735	9,499	10,683	11,818	13,760	15,822
Coal	1,625	2,075	2,320	2,555	2,790	2,992

Table 13.1.8 Global: Electricity generation TWh/a

	2012	2020	2025	2030	2040	2050
Power plants	19,125	23,246	25,397	28,497	37,019	43,831
Hard coal (& non-renewable waste)	5,477	6,330	5,830	4,745	2,357	468
Lignite	1,718	1,419	842	338	99	0
Gas	3,876	4,912	4,972	4,807	3,550	1,288
Oil	0	0	0	0	28	69
of which from H+	0	0	0	0	0	0
Diesel	889	575	404	166	33	9
Nuclear	147	111	73	51	15	5
Biomass (& renewable waste)	2,450	1,872	1,345	559	182	0
Hydro	205	510	555	580	606	620
Wind	3,672	4,349	4,513	4,613	4,773	4,937
of which wind offshore	521	1,932	3,848	6,278	11,291	14,938
PV	19	126	473	1,098	2,831	4,008
of which wind offshore	97	942	2,123	3,844	7,054	9,914
Geothermal	69	166	365	664	1,385	2,032
Solar thermal power plants	5	97	428	1,601	4,844	8,138
Ocean energy	1	31	101	251	831	1,482
Combined heat and power plants	3,478	4,046	4,620	5,134	5,817	6,021
Hard coal (& non-renewable waste)	1,670	1,773	1,615	1,328	562	126
Lignite	193	155	82	22	0	0
Gas	1,351	1,602	1,907	2,156	2,270	1,921
Oil	0	0	0	2	56	281
of which from H+	88	58	25	8	3	1
Biomass (& renewable waste)	175	427	876	1,335	2,043	2,419
Geothermal	2	24	97	252	813	1,253
Hydrogen	0	7	16	32	126	300
CHP by producer						
Main activity producers	1,576	1,738	1,956	2,171	2,385	2,327
Autoproducers	1,903	2,308	2,663	2,963	3,433	3,694
Total generation	22,604	27,292	30,016	33,631	42,837	49,852
Fossil	15,409	16,936	15,752	13,619	8,805	3,469
Hard coal (& non-renewable waste)	7,148	8,104	7,446	6,074	2,919	594
Lignite	1,911	1,574	925	360	99	0
Gas	5,226	6,514	6,879	6,960	5,736	2,859
Oil	978	633	429	174	36	11
Diesel	147	111	73	51	15	5
Nuclear	2,450	1,872	1,345	559	182	0
Hydrogen	0	7	16	34	211	650
of which renewable H+	0	2	7	20	166	604
Renewables (w/o renewable hydrogen)	4,744	8,478	12,904	19,419	33,640	45,733
Hydro	3,672	4,349	4,513	4,613	4,773	4,937
Wind	521	1,932	3,848	6,278	11,291	14,938
PV	97	942	2,123	3,844	7,054	9,914
Biomass (& renewable waste)	379	937	1,430	1,915	2,649	3,039
Geothermal	70	190	462	916	2,198	3,286
Solar thermal power plants	5	97	428	1,601	4,844	8,138
Ocean energy	1	31	101	251	831	1,482
Distribution losses	1,839	2,246	2,430	2,622	2,965	3,211
Own consumption electricity	1,910	2,050	2,098	2,058	1,826	1,315
Electricity for hydrogen production	0	36	245	983	4,237	8,330
Electricity for syngas production	0	0	0	0	0	0
Final energy consumption (electricity)	18,863	22,980	25,268	27,973	33,816	37,004
Fluctuating RES (PV, Wind, Ocean)	618	2,904	6,071	10,373	19,176	26,334
Share of fluctuating RES	3%	11%	20%	31%	45%	53%
RES share	21%	31%	43%	58%	79%	93%

Table 13.1.9 Global: Final energy consumption in transport PJ/a

	2012	2020	2025	2030	2040	2050
Road	78,688	83,781	82,443	79,473	67,361	57,356
Fossil fuels	74,800	77,617	72,348	62,387	32,730	12,138
Biofuels	2,486	3,759	4,945	6,126	6,588	5,829
Synfuels	0	0	0	0	0	0
Natural gas	1,394	1,981	2,498	2,864	3,044	2,724
Hydrogen	0	18	367	1,990	8,190	13,521
Electricity	9	406	2,284	6,106	16,810	23,144
Rail	2,766	3,110	3,231	3,338	3,631	3,751
Fossil fuels	1,701	1,662	1,461	1,142	697	274
Biofuels	0	67	129	252	267	164
Synfuels	0	0	0	0	0	0
Electricity	1,065	1,381	1,640	1,945	2,667	3,314
Navigation	2,173	2,492	2,615	2,728	2,849	2,860
Fossil fuels	2,173	2,442	2,485	2,447	2,151	1,589
Biofuels	0	49	130	281	698	1,271
Synfuels	0	0	0	0	0	0
Aviation	4,120	4,683	4,767	4,712	4,667	5,004
Fossil fuels	4,120	4,678	4,621	4,335	3,638	2,946
Biofuels	0	4	146	377	1,030	2,058
Synfuels	0	0	0	0	0	0
Total (incl. pipelines)	90,119	96,169	94,941	91,918	79,738	69,735
Fossil fuels	82,794	86,400	80,915	70,311	39,216	16,947
Biofuels (incl. biogas)	2,486	3,880	5,351	7,035	8,583	9,322
Synfuels	0	0	0	0	0	0
Natural gas	3,765	4,074	4,352	4,464	4,043	2,960
Hydrogen	0	18	367	1,990	8,190	13,521
Electricity	1,074	1,797	3,956	8,117	19,706	26,985
Total RES	2,711	4,444	7,210	12,877	30,598	46,972
RES share	3%	5%	8%	14%	38%	67%

Table 13.1.10 Global: Heat supply PJ/a

	2012	2020	2025	2030	2040	2050
District heating plants	8,275	8,580	9,343	9,658	10,355	9,738
Fossil fuels	8,030	7,855	7,008	5,946	2,466	430
Biomass	239	622	1,311	1,852	2,768	2,384
Solar collectors	0	56	686	1,170	2,963	3,917
Geothermal	6	47	338	689	2,158	3,006
Heat from CHP¹	10,083	12,720	15,517	18,605	25,629	31,685
Fossil fuels	9,566	10,950	11,165	10,821	8,729	5,871
Biomass	507	1,537	3,437	5,485	9,132	12,459
Geothermal	10	187	799	2,067	6,703	10,328
Hydrogen	0	46	116	232	1,064	3,025
Direct heating	129,751	141,519	140,142	137,770	127,812	115,170
Fossil fuels	91,517	95,693	85,672	72,665	40,425	13,432
Biomass	26,739	29,247	30,159	29,281	26,603	23,718
Solar collectors	803	2,620	6,296	11,814	22,742	27,461
Geothermal	0	421	810	1,329	2,462	3,389
Heat pumps ²	468	1,477	3,249	6,332	13,289	18,041
Electric direct heating	10,224	12,062	13,909	16,216	21,494	26,134
Hydrogen	0	0	47	133	797	2,995
Total heat supply³	148,109	162,819	165,002	166,032	163,796	156,593
Fossil fuels	109,112	114,499	103,844	89,431	51,620	19,734
Biomass	27,486	31,406	34,907	36,619	38,504	38,562
Solar collectors	804	2,675	6,982	12,984	25,704	31,378
Geothermal	16	655	1,948	4,085	11,323	16,723
Heat pumps ²	468	1,477	3,249	6,332	13,289	18,041
Electric direct heating	10,224	12,062	13,909	16,216	21,494	26,134
Hydrogen	0	46	163	366	1,862	6,021
RES share (including RES electricity)	21%	25%	33%	42%	66%	86%

¹ public CHP and CHP autoproduction / ² heat from ambient energy and electricity use / ³ incl. process heat, cooking

Table 13.1.10: Global: Installed capacity GW

	2012	2020	2025	2030	2040	2050
Total generation	5,680	7,492	9,148	11,521	16,112	19,469
Fossil	3,712	4,098	3,902	3,662	3,089	2,140
Hard coal (& non-renewable waste)	1,407	1,612	1,474	1,305	743	264
Lignite	373	232	171	69	21	0
Gas (w/o H ₂)	1,499	1,863	2,018	2,164	2,285	1,861
Oil	378	284	203	96	28	10
Diesel	55	47	35	28	12	5
Nuclear	393	260	184	76	25	0
Hydrogen (fuel cells, gas power plants, gas CHP)	0	2	4	9	64	250
Renewables	1,575	3,132	5,058	7,774	12,934	17,079
Hydro	1,099	1,316	1,365	1,397	1,445	1,503
Wind	277	820	1,573	2,510	4,316	5,575
of which wind offshore	5	37	142	326	814	1,131
PV	97	732	1,603	2,839	4,988	6,745
Biomass (& renewable waste)	87	194	284	392	558	746
Geothermal	1	28	69	137	325	485
Solar thermal power plants	3	31	126	405	984	1,473
Ocean energy	0	11	37	95	318	552
Fluctuating RES (PV, Wind, Ocean)	375	1,563	3,214	5,444	9,622	12,871
Share of fluctuating RES	7%	21%	35%	47%	60%	66%
RES share	28%	42%	55%	67%	80%	88%

Table 13.1.12: Global: Final energy demand PJ/a

	2012	2020	2025	2030	2040	2050
Total (incl. non-energy use)	360,850	392,643	391,235	384,295	355,240	323,128
Total energy use	326,859	356,213	354,466	347,228	319,112	288,506
Transport	90,119	96,169	94,941	91,918	79,738	69,735
Oil products	82,794	86,400	80,915	70,311	39,216	16,947
Natural gas	3,765	4,074	4,352	4,464	4,043	2,960
Biofuels	2,486	3,880	5,351	7,035	8,583	9,322
Synfuels	0	0	0	0	0	0
Electricity	1,074	1,797	3,956	8,117	19,706	26,985
RES electricity	225	558	1,702	4,692	15,552	25,083
Hydrogen	0	18	367	1,990	8,190	13,521
RES share Transport	3%	5%	8%	14%	38%	67%
Industry	106,313	122,283	122,458	120,769	110,931	98,343
Electricity	28,747	36,525	39,464	42,319	46,866	48,360
RES electricity	6,034	11,349	16,974	24,460	36,986	44,951
Public district heat	5,446	5,989	6,511	6,853	7,082	6,896
RES district heat	220	741	1,872	2,908	5,135	6,167
Hard coal & lignite	25,402	28,584	24,724	19,246	6,362	633
Oil products	12,939	11,564	8,530	5,536	2,028	304
Gas	26,305	28,191	28,654	28,064	21,649	9,260
Solar	13	710	2,066	4,440	9,313	10,747
Biomass	7,441	9,966	10,976	11,315	10,866	11,173
Geothermal	20	754	1,478	2,842	5,862	7,792
Hydrogen	0	0	54	154	904	3,177
RES share Industry	13%	19%	27%	38%	62%	85%
Other Sectors	130,428	137,762	137,068	134,542	128,443	120,428
Electricity	38,088	44,408	47,544	50,268	55,165	57,853
RES electricity	7,994	13,798	20,450	29,054	43,635	53,774
Public district heat	6,555	6,860	8,125	9,181	11,450	12,049
RES district heat	265	849	2,335	3,896	8,302	10,775
Hard coal & lignite	5,718	4,926	3,213	1,487	272	55
Oil products	17,894	15,749	11,997	9,108	3,656	379
Gas	24,960	27,097	25,597	22,594	12,819	5,462
Solar	790	1,910	4,231	7,374	13,429	16,713
Biomass	36,126	36,115	34,733	31,510	25,305	18,788
Geothermal	297	697	1,628	3,019	6,347	9,127
Hydrogen	0	0	0	0	0	0
RES share Other Sectors	35%	39%	46%	56%	75%	91%
Total RES	61,910	81,333	103,976	133,785	196,390	239,934
RES share	19%	23%	29%	39%	62%	83%
Non energy use	33,791	36,430	36,769	37,066	36,128	34,623
Oil	24,430	24,948	23,344	22,006	18,455	15,131
Gas	7,735	8,271	8,533	8,699	8,569	8,233
Coal	1,625	3,211	4,891	6,362	9,105	11,258

GLOBAL: ADVANCED ENERGY [R]EVOLUTION SCENARIO

Table 13.1.15 Global: Electricity generation TWh/a

	2012	2020	2025	2030	2040	2050
Power plants	19,125	23,540	26,677	31,733	46,121	61,524
Hard coal (& non-renewable waste)	5,477	6,162	5,445	4,016	992	0
Lignite	1,718	1,419	842	338	99	0
Gas	3,876	4,872	4,920	4,719	3,165	1,358
of which from H ₂	0	0	21	53	381	1,358
Oil	889	585	401	153	28	0
Diesel	147	111	76	54	16	0
Nuclear	2,450	1,872	1,345	559	182	0
Biomass (& renewable waste)	205	552	630	658	683	701
Hydro	3,672	4,349	4,519	4,621	4,779	4,966
Wind	521	2,158	4,645	7,737	15,480	21,673
of which wind offshore	19	180	682	1,623	4,425	6,330
PV	97	1,090	2,659	5,067	9,442	13,613
Geothermal	69	186	460	897	2,106	3,167
Solar thermal power plants	5	131	608	2,552	7,988	14,035
Ocean energy	1	32	128	363	1,141	2,010
Combined heat and power plants	3,478	4,046	4,620	5,134	5,818	6,011
Hard coal (& non-renewable waste)	1,670	1,773	1,615	1,328	557	0
Lignite	193	155	82	22	0	0
Gas	1,351	1,602	1,907	2,155	2,251	1,728
of which from H ₂	0	0	10	38	308	1,728
Oil	88	58	25	8	3	0
Biomass (& renewable waste)	175	427	876	1,335	2,051	2,492
Geothermal	2	24	97	252	817	1,380
Hydrogen	0	7	16	33	138	411
CHP by producer						
Main activity producers	1,576	1,738	1,956	2,171	2,385	2,327
Autoproducers	1,903	2,308	2,663	2,963	3,433	3,684
Total generation	22,604	27,586	31,297	36,867	51,939	67,535
Fossil	15,409	16,757	15,284	12,703	6,443	0
Hard coal (& non-renewable waste)	7,148	7,955	7,061	5,344	1,549	0
Lignite	1,911	1,574	925	360	99	0
Gas	5,226	6,474	6,796	6,783	4,746	0
Oil	978	643	426	161	32	0
Diesel	147	111	76	54	16	0
Nuclear	2,450	1,872	1,345	559	182	0
Hydrogen	0	7	48	123	828	3,497
of which renewable H ₂	0	2	22	79	721	3,497
Renewables (w/o renewable hydrogen)	4,744	8,950	14,621	23,482	44,487	64,037
Hydro	3,672	4,349	4,519	4,621	4,779	4,966
Wind	521	2,158	4,645	7,737	15,480	21,673
PV	97	1,090	2,659	5,067	9,442	13,613
Biomass (& renewable waste)	379	979	1,505	1,993	2,734	3,193
Geothermal	70	210	558	1,149	2,923	4,547
Solar thermal power plants	5	131	608	2,552	7,988	14,035
Ocean energy	1	32	128	363	1,141	2,010
Distribution losses	1,839	2,246	2,430	2,622	3,069	3,318
Own consumption electricity	1,910	2,050	2,098	2,058	1,776	1,230
Electricity for hydrogen production	0	98	812	2,176	8,403	19,317
Electricity for synfuel production	0	51	70	328	1,851	3,514
Final energy consumption (electricity)	18,863	23,161	25,912	29,689	36,847	40,163
Fluctuating RES (PV, Wind, Ocean)	618	3,281	7,432	13,167	26,063	37,296
Share of fluctuating RES	3%	12%	24%	36%	50%	55%
RES share	21%	32%	47%	64%	87%	100%

Table 13.1.16 Global: Final energy consumption in transport PJ/a

	2012	2020	2025	2030	2040	2050
Road	78,688	82,653	78,457	71,706	51,475	38,750
Fossil fuels	74,800	76,151	66,806	52,751	16,057	0
Biofuels	2,486	3,659	4,742	5,190	5,451	3,996
Synfuels	0	67	91	388	1,988	2,737
Natural gas	1,394	1,922	2,080	1,788	645	0
Hydrogen	0	169	1,305	3,773	11,228	14,039
Electricity	9	751	3,524	8,204	18,095	20,715
Rail	2,766	3,278	3,922	4,718	6,774	8,356
Fossil fuels	1,701	1,557	1,256	881	340	0
Biofuels	0	47	103	152	175	130
Synfuels	0	1	2	11	64	89
Electricity	1,065	1,673	2,561	3,674	6,196	8,138
Navigation	2,173	2,492	2,615	2,698	2,739	2,700
Fossil fuels	2,173	2,451	2,554	2,323	1,703	0
Biofuels	0	40	60	349	759	1,603
Synfuels	0	1	1	26	277	1,098
Aviation	4,120	4,636	4,635	4,423	3,885	3,602
Fossil fuels	4,120	4,615	4,548	3,826	2,452	0
Biofuels	0	21	85	555	1,050	2,138
Synfuels	0	0	2	42	383	1,464
Total (incl. pipelines)	90,119	95,181	91,510	85,457	67,846	56,534
Fossil fuels	82,794	84,774	75,165	59,782	20,552	0
Biofuels (incl. biogas)	2,486	3,767	4,990	6,247	7,436	7,866
Synfuels	0	69	95	467	2,711	5,387
Natural gas	3,765	3,964	3,797	3,161	1,142	0
Hydrogen	0	169	1,305	3,773	11,228	14,039
Electricity	1,074	2,438	6,158	12,027	24,778	29,242
Total RES	2,711	4,635	8,526	16,643	41,135	56,533
RES share	3%	5%	9%	19%	61%	100%

Table 13.1.17 Global: Heat supply PJ/a

	2012	2020	2025	2030	2040	2050
District heating plants	8,275	8,571	9,339	9,650	10,330	9,287
Fossil fuels	8,030	7,847	7,008	5,946	2,463	0
Biomass	239	621	1,308	1,847	2,758	2,330
Solar collectors	0	56	685	1,168	2,954	3,823
Geothermal	6	47	338	689	2,155	3,134
Heat from CHP¹	10,083	12,729	15,526	18,624	25,701	32,842
Fossil fuels	9,566	10,957	11,136	10,712	7,849	0
Biomass	507	1,537	3,444	5,497	9,177	12,859
Geothermal	10	188	799	2,068	6,735	11,407
Hydrogen	0	46	147	348	1,939	8,576
Direct heating	129,751	141,520	140,137	137,759	127,765	114,433
Fossil fuels	91,517	95,694	85,379	71,879	35,740	0
Biomass	26,739	29,246	30,158	29,279	26,593	24,198
Solar collectors	803	2,620	6,309	11,826	22,947	28,624
Geothermal	0	421	810	1,329	2,505	3,579
Heat pumps ²	468	1,477	3,249	6,332	13,623	18,707
Electric direct heating	10,224	12,062	14,003	16,477	22,674	29,176
Hydrogen	0	0	228	638	3,683	10,149
Total heat supply³	148,109	162,819	165,002	166,033	163,795	156,563
Fossil fuels	109,112	114,498	103,523	88,536	46,052	0
Biomass	27,486	31,404	34,909	36,623	38,527	39,386
Solar collectors	804	2,676	6,994	12,994	25,901	32,446
Geothermal	16	657	1,948	4,085	11,395	18,121
Heat pumps ²	468	1,477	3,249	6,332	13,623	18,707
Electric direct heating	10,224	12,062	14,003	16,477	22,674	29,176
Hydrogen	0	46	375	986	5,622	18,726
RES share (including RES electricity)	21%	25%	33%	43%	70%	100%

1 public CHP and CHP autoproduction / 2 heat from ambient energy and electricity use / 3 incl. process heat, cooking

Table 13.1.18: Global: Installed capacity GW

	2012	2020	2025	2030	2040	2050
Total generation	5,680	7,645	9,873	13,146	19,951	25,835
Fossil	3,712	4,035	3,831	3,500	2,491	0
Hard coal (& non-renewable waste)	1,407	1,586	1,399	1,136	377	0
Lignite	373	291	172	70	21	0
Gas (w/o H ₂)	1,499	1,821	2,021	2,172	2,054	0
Oil	378	289	202	93	24	0
Diesel	55	47	36	30	15	0
Nuclear	393	260	184	76	25	0
Hydrogen (fuel cells, gas power plants, gas CHP)	0	2	14	37	330	2,220
Renewables	1,575	3,348	5,844	9,532	17,105	23,614
Hydro	1,099	1,316	1,368	1,402	1,457	1,536
Wind	277	904	1,873	3,064	5,892	8,040
of which wind offshore	5	51	201	480	1,271	1,781
PV	97	844	2,000	3,725	6,678	9,295
Biomass (& renewable waste)	87	200	295	405	579	742
Geothermal	11	31	85	171	452	706
Solar thermal power plants	3	42	177	635	1,616	2,555
Ocean energy	0	11	46	131	432	738
Fluctuating RES (PV, Wind, Ocean)	375	1,760	3,919	6,919	13,001	18,074
Share of fluctuating RES	7%	23%	40%	53%	65%	70%
RES share	28%	44%	59%	73%	86%	91%

Table 13.1.19: Global: Final energy demand PJ/a

	2012	2020	2025	2030	2040	2050
Total (incl. non-energy use)	360,650	391,662	387,812	379,271	346,573	313,575
Total energy use¹	326,859	355,232	351,043	342,204	310,445	278,953
Transport	90,119	95,181	91,510	85,457	67,846	56,534
Oil products	82,794	84,774	75,165	59,782	20,552	0
Natural gas	3,765	3,964	3,797	3,161	1,142	0
Biofuels	2,486	3,767	4,990	6,247	7,436	7,866
Synfuels	0	69	95	467	2,711	5,387
Electricity	1,074	2,438	6,158	12,027	24,778	29,242
RES electricity	225	791	2,881	7,686	21,567	29,242
Hydrogen	0	169	1,305	3,773	11,228	14,039
RES share Transport	3%	5%	9%	19%	61%	100%
Industry	106,313	122,283	122,441	121,143	111,788	98,630
Electricity	28,747	36,525	39,576	43,008	48,877	52,409
RES electricity	6,034	11,854	18,517	27,486	42,542	52,408
Public district heat	5,446	5,989	6,511	6,852	7,076	6,787
RES district heat	220	741	1,876	2,925	5,225	6,787
Hard coal & lignite	25,402	28,584	24,724	19,241	6,292	0
Oil products	12,939	11,564	8,530	5,425	1,844	0
Gas	26,305	28,191	28,456	27,636	18,914	0
Solar	13	710	2,066	4,440	9,339	11,791
Biomass	7,441	9,966	10,976	11,315	10,858	11,302
Geothermal	20	754	1,478	2,842	5,953	8,004
Hydrogen	0	0	124	382	2,634	8,338
RES share Industry	13%	20%	29%	41%	68%	100%
Other Sectors	130,428	137,769	137,092	135,605	130,811	123,788
Electricity	38,088	44,417	47,561	51,885	59,177	63,763
RES electricity	7,994	14,415	22,253	33,158	51,507	63,762
Public district heat	6,555	6,859	8,129	9,188	11,447	11,919
RES district heat	265	849	2,341	3,922	8,452	11,919
Hard coal & lignite	5,718	4,927	3,234	1,437	234	0
Oil products	17,894	15,746	11,989	8,833	3,168	0
Gas	24,960	27,097	25,442	22,016	9,935	0
Solar	790	1,910	4,243	7,386	13,608	16,833
Biomass	36,126	36,115	34,732	31,508	25,309	19,322
Geothermal	297	697	1,628	3,019	6,544	9,606
Hydrogen	0	0	135	334	1,390	2,346
RES share Other Sectors	35%	39%	48%	58%	82%	100%
Total RES	61,910	82,646	108,759	145,102	223,973	278,949
RES share	19%	23%	31%	42%	72%	100%
Non energy use	33,791	36,430	36,769	37,066	36,128	34,623
Oil	24,430	24,948	23,344	22,006	18,286	14,744
Gas	7,735	8,271	8,533	8,699	8,569	8,233
Coal	1,625	3,211	4,891	6,362	9,274	11,646

Table 13.1.22: Global: Investments in electricity generation

REF	UNIT	2012-2020	2021-2030	2031-2040	2041-2050	2012-2050	UNIT	ANNUAL AVERAGE 2012-2050
Fossil (w/o CHP)	billion \$	1,673.6	2,205.0	2,725.4	2,866.8	9,470.9	billion \$/a	242.8
Nuclear	billion \$	678.6	740.5	654.9	731.1	2,805.1	billion \$/a	71.9
CHP (fossil + renewable)	billion \$	712.2	651.8	433.5	123.8	1,921.3	billion \$/a	49.3
Renewables (w/o CHP)	billion \$	2,417.8	2,274.4	2,863.0	2,775.8	10,331.0	billion \$/a	264.9
Total	billion \$	5,482.3	5,871.7	6,676.8	6,497.6	24,528.3	billion \$/a	628.9
Conventional (fossil & nuclear)	billion \$	2,996.6	3,512.9	3,753.8	3,680.7	13,944.1	billion \$/a	357.5
Renewables	billion \$	2,485.7	2,358.8	2,922.9	2,816.9	10,584.3	billion \$/a	271.4
Biomass	billion \$	209.1	229.3	281.1	265.3	984.8	billion \$/a	25.3
Hydro	billion \$	999.9	984.4	900.9	895.3	3,780.5	billion \$/a	96.9
Wind	billion \$	585.5	690.7	973.4	1,011.5	3,261.1	billion \$/a	83.6
PV	billion \$	516.5	253.5	454.5	281.4	1,505.9	billion \$/a	38.6
Geothermal	billion \$	113.4	111.4	132.0	157.5	514.2	billion \$/a	13.2
Solar thermal power plants	billion \$	56.2	76.9	139.9	174.3	447.5	billion \$/a	11.5
Ocean energy	billion \$	4.9	12.5	41.1	31.6	90.2	billion \$/a	2.3
E[R]								
Fossil (w/o CHP)	billion \$	1,248.5	544.4	819.7	858.0	3,470.6	billion \$/a	89.0
Nuclear	billion \$	197.6	0.6	0.8	0.0	198.9	billion \$/a	5.1
CHP (fossil + renewable)	billion \$	851.2	1,362.8	1,490.5	1,675.0	5,379.5	billion \$/a	137.9
Renewables (w/o CHP)	billion \$	3,808.8	9,872.1	12,385.8	13,170.0	39,236.7	billion \$/a	1,006.1
Total	billion \$	6,106.1	11,779.9	14,696.7	15,703.0	48,285.8	billion \$/a	1,238.1
Conventional (fossil & nuclear)	billion \$	2,072.6	1,066.4	1,147.0	1,019.4	5,305.3	billion \$/a	136.0
Renewables	billion \$	4,033.5	10,713.5	13,549.8	14,683.7	42,980.4	billion \$/a	1,102.1
Biomass	billion \$	341.0	659.3	747.5	1,136.2	2,884.0	billion \$/a	73.9
Hydro	billion \$	963.8	643.0	567.1	608.8	2,782.7	billion \$/a	71.4
Wind	billion \$	1,068.3	3,361.5	4,437.7	5,176.3	14,043.8	billion \$/a	360.1
PV	billion \$	1,212.8	2,812.9	2,914.4	3,045.8	9,986.0	billion \$/a	256.1
Geothermal	billion \$	214.5	898.8	1,299.3	1,280.3	3,692.9	billion \$/a	94.7
Solar thermal power plants	billion \$	168.7	1,921.2	2,796.6	2,818.1	7,704.7	billion \$/a	197.6
Ocean energy	billion \$	64.3	416.8	787.1	618.1	1,886.4	billion \$/a	48.4
ADV E[R]								
Fossil (w/o CHP)	billion \$	1,167.4	496.0	938.5	1,069.2	3,671.1	billion \$/a	94.1
Nuclear	billion \$	197.6	0.6	0.8	0.0	198.9	billion \$/a	5.1
CHP (fossil + renewable)	billion \$	851.9	1,359.0	1,467.1	1,619.6	5,297.6	billion \$/a	135.8
Renewables (w/o CHP)	billion \$	4,292.3	13,403.0	18,094.0	19,835.9	55,625.2	billion \$/a	1,426.3
Total	billion \$	6,509.1	15,258.6	20,500.3	22,524.7	64,792.8	billion \$/a	1,661.4
Conventional (fossil & nuclear)	billion \$	1,981.0	1,016.8	1,250.2	1,194.9	5,443.0	billion \$/a	139.6
Renewables	billion \$	4,528.1	14,241.8	19,250.1	21,329.9	59,349.8	billion \$/a	1,521.8
Biomass	billion \$	364.0	673.6	773.7	1,036.2	2,847.5	billion \$/a	73.0
Hydro	billion \$	963.8	657.3	588.7	668.8	2,878.7	billion \$/a	73.8
Wind	billion \$	1,243.5	4,341.0	6,518.9	7,549.4	19,652.8	billion \$/a	503.9
PV	billion \$	1,402.1	3,826.3	3,845.3	4,333.3	13,406.9	billion \$/a	343.8
Geothermal	billion \$	266.5	1,136.0	1,822.3	1,856.6	5,071.3	billion \$/a	130.0
Solar thermal power plants	billion \$	230.3	3,019.3	4,654.6	5,071.2	12,975.3	billion \$/a	332.7
Ocean energy	billion \$	67.9	588.3	1,046.7	814.4	2,517.3	billion \$/a	64.5

Table 13.1.23: Global: Investments in renewable heat generation

REF	UNIT	2012-2020	2021-2030	2031-2040	2041-2050	2012-2050	UNIT	ANNUAL AVERAGE 2012-2050
Heat pumps	billion \$	131.7	134.3	169.9	184.6	620.5	billion \$/a	15.9
Deep geothermal	billion \$	6.2	0.5	10.1	6.1	22.9	billion \$/a	0.6
Solar thermal	billion \$	119.2	145.2	216.1	251.4	731.8	billion \$/a	18.8
Biomass	billion \$	1,034.4	912.8	427.9	391.7	2,766.9	billion \$/a	70.9
Total	billion \$	1,291.5	1,192.8	824.0	833.8	4,142.1	billion \$/a	106.2
E[R]								
Heat pumps	billion \$	332.5	1,325.4	1,951.0	2,282.9	5,891.9	billion \$/a	151.1
Deep geothermal	billion \$	122.9	252.4	1,133.5	1,003.7	2,512.5	billion \$/a	64.4
Solar thermal	billion \$	401.2	1,778.8	2,258.7	1,749.4	6,188.1	billion \$/a	158.7
Biomass	billion \$	893.7	403.7	269.5	164.1	1,731.0	billion \$/a	44.4
Total	billion \$	1,750.3	3,760.4	5,612.6	5,200.2	16,323.0	billion \$/a	418.5
ADV E[R]								
Heat pumps	billion \$	332.5	1,325.4	2,040.8	2,393.0	6,091.7	billion \$/a	156.2
Deep geothermal	billion \$	123.0	252.4	1,139.7	1,123.1	2,638.2	billion \$/a	67.6
Solar thermal	billion \$	401.3	1,782.2	2,304.6	1,819.0	6,307.2	billion \$/a	161.7
Biomass	billion \$	893.6	403.5	268.6	130.3	1,695.9	billion \$/a	43.5
Total	billion \$	1,750.3	3,763.5	5,753.7	5,465.4	16,733.0	billion \$/a	429.1

Table 13.1.24: Global: Total employment in the energy sector MILLION JOBS

	REFERENCE SCENARIO				ADV E[n] SCENARIO		
By fuel	2015	2020	2025	2030	2020	2025	2030
Coal	9.76	9.67	8.63	7.70	4.80	3.28	1.97
Gas, oil & diesel	3.58	4.16	4.56	4.67	4.00	4.18	3.98
Nuclear	0.73	0.86	0.83	0.74	0.52	0.52	0.51
Renewable	14.62	15.41	15.59	14.84	26.91	38.68	41.56
Total jobs	28.69	30.11	29.62	27.95	36.24	46.65	48.01
By sector							
Construction and installation	4.86	5.09	4.60	3.95	8.32	14.59	15.56
Manufacturing	2.38	2.44	2.23	1.91	5.49	8.87	9.58
Operations and maintenance	3.23	3.94	4.30	4.27	4.82	6.96	9.00
Fuel supply (domestic)	17.76	18.12	17.93	17.27	17.27	15.97	13.67
Coal and gas export	0.47	0.52	0.54	0.57	0.34	0.26	0.20
Total jobs (million)	28.69	30.11	29.62	27.95	36.24	46.65	48.01
By technology							
Coal	9.76	9.67	8.63	7.70	4.80	3.28	1.97
Gas, oil & diesel	3.58	4.16	4.56	4.67	4.00	4.18	3.98
Nuclear	0.73	0.86	0.83	0.74	0.52	0.52	0.51
Biomass	10.97	11.85	12.05	11.76	12.07	12.55	11.54
Hydro	1.45	1.46	1.47	1.29	1.01	0.83	0.71
Wind	0.70	0.72	0.76	0.65	4.22	6.91	8.18
PV	1.01	0.87	0.84	0.66	6.69	11.04	10.32
Geothermal power	0.03	0.03	0.03	0.03	0.18	0.30	0.39
Solar thermal power	0.03	0.04	0.05	0.08	0.45	1.66	2.66
Ocean	0.00	0.00	0.00	0.01	0.23	0.45	0.65
Solar - heat	0.36	0.37	0.34	0.31	1.59	3.94	5.64
Geothermal & heat pump	0.07	0.05	0.04	0.04	0.48	0.99	1.46
Total jobs (million)	28.7	30.1	29.6	28.0	36.2	46.7	48.0

OECD NORTH AMERICA: REFERENCE SCENARIO

Table 13.2.1 OECD North America: Electricity generation ^{TWh/a}

	2012	2020	2025	2030	2040	2050
Power plants	4,856	5,460	5,800	6,140	6,891	7,649
Hard coal (& non-renewable waste)	768	908	909	967	1,069	1,132
Lignite	941	1,011	1,095	1,121	1,180	1,259
Gas	1,234	1,316	1,450	1,584	1,952	2,367
<i>of which from H₂</i>	0	0	0	0	0	0
Oil	75	45	36	26	16	8
Diesel	9	10	10	9	8	6
Nuclear	905	951	954	957	937	935
Biomass (& renewable waste)	42	89	109	129	165	202
Hydro	691	730	748	765	798	806
Wind	157	295	349	403	501	605
<i>of which wind offshore</i>	0	6	11	17	42	74
PV	9	56	79	101	145	201
Geothermal	24	36	43	49	58	69
Solar thermal power plants	1	14	21	28	37	47
Ocean energy	0	0	1	2	5	12
Combined heat and power plants	347	334	311	287	250	221
Hard coal (& non-renewable waste)	42	39	32	26	19	8
Lignite	5	3	3	2	2	2
Gas	254	249	233	217	189	169
<i>of which from H₂</i>	0	0	0	0	0	0
Oil	12	7	6	5	2	1
Biomass (& renewable waste)	34	35	36	37	38	41
Geothermal	0	0	0	0	0	0
Hydrogen	0	0	0	0	0	0
CHP by producer						
Main activity producers	194	182	157	133	93	63
Autoproducers	153	153	154	155	157	159
Total generation	5,203	5,794	6,111	6,428	7,141	7,871
Fossil	3,340	3,588	3,773	3,957	4,457	4,952
Hard coal (& non-renewable waste)	810	947	941	993	1,108	1,139
Lignite	946	1,014	1,098	1,123	1,182	1,261
Gas	1,487	1,565	1,683	1,801	2,141	2,537
Oil	87	52	42	31	17	9
Diesel	9	10	10	9	8	6
Nuclear	905	951	954	957	937	935
Hydrogen	0	0	0	0	0	0
<i>of which renewable H₂</i>	0	0	0	0	0	0
Renewables (w/o renewable hydrogen)	958	1,255	1,384	1,514	1,748	1,984
Hydro	691	730	748	765	798	806
Wind	157	295	349	403	501	605
PV	9	56	79	101	145	201
Biomass (& renewable waste)	76	124	145	166	204	243
Geothermal	24	36	43	49	58	69
Solar thermal power plants	1	14	21	28	37	47
Ocean energy	0	0	1	2	5	12
Distribution losses	358	406	433	459	519	582
Own consumption electricity	382	384	391	399	416	416
Electricity for hydrogen production	0	0	0	0	0	0
Electricity for synfuel production	0	0	0	0	0	0
Final energy consumption (electricity)	4,459	5,001	5,284	5,567	6,204	6,870
Fluctuating RES (PV, Wind, Ocean)	166	351	428	506	651	818
Share of fluctuating RES	3%	6%	7%	8%	9%	10%
RES share (domestic generation)	18%	22%	23%	24%	24%	25%

Table 13.2.2 OECD North America: Final energy consumption in transport ^{PJ/a}

	2012	2020	2025	2030	2040	2050
Road	25,564	26,133	26,090	26,039	26,275	26,487
Fossil fuels	24,388	24,509	24,065	23,615	22,425	21,421
Biofuels	1,139	1,499	1,793	2,086	2,857	3,154
Synfuels	0	0	0	0	0	0
Natural gas	32	105	193	281	848	1,631
Hydrogen	0	0	0	0	0	0
Electricity	5	19	38	58	144	280
Rail	663	696	723	749	804	877
Fossil fuels	624	658	682	705	757	827
Biofuels	0	0	0	0	0	0
Synfuels	0	0	0	0	0	0
Electricity	39	39	41	44	47	50
Navigation	550	571	589	602	630	657
Fossil fuels	550	571	589	602	630	657
Biofuels	0	0	0	0	0	0
Synfuels	0	0	0	0	0	0
Aviation	2,161	2,253	2,307	2,372	2,529	2,717
Fossil fuels	2,161	2,253	2,307	2,372	2,529	2,717
Biofuels	0	0	0	0	0	0
Synfuels	0	0	0	0	0	0
Total (incl. pipelines)	29,748	30,504	30,579	30,654	31,170	31,712
Fossil fuels	27,723	27,992	27,643	27,294	26,341	25,623
Biofuels (incl. biogas)	1,139	1,499	1,793	2,086	2,857	3,154
Synfuels	0	0	0	0	0	0
Natural gas	842	956	1,064	1,173	1,781	2,605
Hydrogen	0	0	0	0	0	0
Electricity	44	58	80	101	191	330
Total RES	1,147	1,512	1,811	2,110	2,904	3,237
RES share	4%	5%	6%	7%	9%	10%

Table 13.2.3 OECD North America: Heat supply ^{PJ/a}

	2012	2020	2025	2030	2040	2050
District heating plants	0	48	61	72	82	96
Fossil fuels	0	46	59	69	77	90
Biomass	0	2	2	4	5	7
Solar collectors	0	0	0	0	0	0
Geothermal	0	0	0	0	0	0
Heat from CHP¹	867	865	839	820	830	969
Fossil fuels	779	771	736	704	665	646
Biomass	88	94	103	117	165	323
Geothermal	0	0	0	0	0	0
Hydrogen	0	0	0	0	0	0
Direct heating	19,082	20,914	21,471	22,031	23,247	24,607
Fossil fuels	15,798	17,333	17,619	17,911	18,343	18,746
Biomass	1,697	1,920	2,069	2,217	2,736	3,328
Solar collectors	68	125	199	272	474	766
Geothermal	0	0	0	0	0	0
Heat pumps ²	14	14	14	14	15	15
Electric direct heating	1,506	1,522	1,571	1,616	1,680	1,752
Hydrogen	0	0	0	0	0	0
Total heat supply³	19,949	21,827	22,371	22,924	24,159	25,672
Fossil fuels	16,577	18,149	18,414	18,684	19,085	19,481
Biomass	1,784	2,016	2,174	2,338	2,905	3,658
Solar collectors	68	125	199	272	474	766
Geothermal	0	0	0	0	0	0
Heat pumps ²	14	14	14	14	15	15
Electric direct heating	1,506	1,522	1,571	1,616	1,680	1,752
Hydrogen	0	0	0	0	0	0
RES share (including RES electricity)	11%	11%	12%	13%	16%	19%

¹ public CHP and CHP autoproduction / ² heat from ambient energy and electricity use / ³ incl. process heat, cooking

Table 13.2.4: OECD North America: Installed capacity ^{GW}

	2012	2020	2025	2030	2040	2050
Total generation	1,356	1,472	1,544	1,616	1,742	1,943
Fossil	932	959	986	1,013	1,075	1,197
Hard coal (& non-renewable waste)	163	161	157	164	177	182
Lignite	188	171	183	185	189	201
Gas (w/o H ₂)	495	570	598	625	680	797
Oil	75	45	38	30	17	8
Diesel	11	12	11	10	12	9
Nuclear	124	123	123	123	120	120
Hydrogen (fuel cells, gas power plants, gas CHP)	0	0	0	0	0	0
Renewables	300	391	435	479	547	626
Hydro	204	208	213	217	214	214
Wind	67	109	127	144	175	207
<i>of which wind offshore</i>	0	2	3	5	11	20
PV	9	40	55	70	99	133
Biomass (& renewable waste)	16	24	28	31	37	45
Geothermal	4	6	6	7	8	10
Solar thermal power plants	1	5	7	9	11	14
Ocean energy	0	0	0	1	2	4
Fluctuating RES (PV, Wind, Ocean)	75	148	182	215	276	343
Share of fluctuating RES	6%	10%	12%	13%	16%	18%
RES share (domestic generation)	22%	27%	28%	30%	31%	32%

Table 13.2.5: OECD North America: Final energy demand ^{PJ/a}

	2012	2020	2025	2030	2040	2050
Total (incl. non-energy use)	73,586	79,453	80,815	82,178	85,148	88,579
Total energy use	67,806	72,296	73,628	74,959	78,064	81,630
Transport	29,748	30,504	30,579	30,654	31,170	31,712
Oil products	27,723	27,992	27,643	27,294	26,341	25,623
Natural gas	842	956	1,064	1,173	1,781	2,605
Biofuels	1,139	1,499	1,793	2,086	2,857	3,154
Synfuels	0	0	0	0	0	0
Electricity	44	58	80	101	191	330
RES electricity	8	12	18	24	47	83
Hydrogen	0	0	0	0	0	0
RES share Transport	4%	5%	6%	7%	9%	10%
Industry	14,131	15,780	15,973	16,166	16,503	16,894
Electricity	4,191	4,804	4,961	5,119	5,408	5,726
RES electricity	772	1,040	1,124	1,206	1,324	1,443
Public district heat	241	256	240	224	199	174
RES district heat	8	14	13	13	12	10
Hard coal & lignite	988	1,102	1,050	998	907	732
Oil products	1,406	1,417	1,372	1,328	1,263	1,188
Gas	5,943	6,555	6,574	6,593	6,572	6,626
Solar	0	8	12	16	22	29
Biomass	1,358	1,634	1,759	1,884	2,128	2,415
Geothermal	4	4	4	4	4	4
Hydrogen	0	0	0	0	0	0
RES share Industry	15%	17%	18%	19%	21%	23%
Other Sectors	23,927	26,012	27,075	28,139	30,392	33,024
Electricity	11,819	13,142	13,982	14,822	16,734	18,677
RES electricity	2,177	2,846	3,168	3,491	4,095	4,707
Public district heat	57	49	40	32	11	3
RES district heat	2	3	2	2	1	0
Hard coal & lignite	49	37	33	29	20	14
Oil products	3,119	2,816	2,641	2,467	2,024	1,746
Gas	7,906	8,813	9,072	9,331	9,782	10,293
Solar	68	117	186	256	452	737
Biomass	905	1,032	1,114	1,195	1,362	1,548
Geothermal	5	6	6	6	7	7
Hydrogen	0	0	0	0	0	0
RES share Other Sectors	13%	15%	17%	18%	19%	21%
Total RES	6,446	8,217	9,199	10,182	12,310	14,138
RES share	10%	11%	12%	14%	16%	17%
Non energy use	5,780	7,157	7,188	7,219	7,084	6,949
Oil	4,932	5,778	5,488	5,239	4,675	3,945
Gas	842	1,377	1,700	1,979	2,409	3,005
Coal	6	1	0	0	0	0

OECD NORTH AMERICA: ENERGY [R]EVOLUTION SCENARIO

Table 13.2.8 OECD North America: Electricity generation TWh/a

	2012	2020	2025	2030	2040	2050
Power plants	4,856	4,975	5,259	5,725	6,704	6,649
Hard coal (& non-renewable waste)	768	477	278	210	85	0
Lignite	941	709	374	27	0	0
Gas	1,234	1,607	1,558	1,459	887	147
of which from H ₂	0	0	0	0	0	0
Oil	75	40	31	16	4	0
Diesel	9	7	5	3	1	0
Nuclear	905	508	374	53	0	0
Biomass (& renewable waste)	42	44	34	26	14	16
Hydro	691	741	765	776	782	782
Wind	157	559	1,095	1,527	2,153	2,306
of which wind offshore	0	16	50	109	451	578
PV	9	203	542	964	1,252	1,318
Geothermal	24	49	87	173	301	409
Solar thermal power plants	1	16	87	415	957	1,209
Ocean energy	0	17	29	77	269	460
Combined heat and power plants	347	398	435	496	548	502
Hard coal (& non-renewable waste)	42	38	30	19	4	0
Lignite	5	0	0	0	0	0
Gas	254	279	283	296	242	121
of which from H ₂	0	0	0	0	0	4
Oil	12	6	3	2	1	1
Biomass (& renewable waste)	34	64	88	119	166	182
Geothermal	0	4	16	35	86	141
Hydrogen	0	6	15	25	48	57
CHP by producer						
Main activity producers	194	221	231	250	262	238
Autoproducers	153	177	205	246	286	264
Total generation	5,203	5,373	5,694	6,221	7,252	7,151
Fossil	3,340	3,162	2,662	2,032	1,224	267
Hard coal (& non-renewable waste)	810	515	308	229	88	0
Lignite	946	709	374	27	0	0
Gas	1,487	1,885	1,841	1,756	1,129	264
Oil	87	46	35	18	5	3
Diesel	9	7	5	3	1	0
Nuclear	905	508	374	53	0	0
Hydrogen	0	6	15	25	48	61
of which renewable H ₂	0	2	7	17	40	58
Renewables (w/o renewable hydrogen)	958	1,697	2,743	4,111	5,980	6,823
Hydro	691	741	765	776	782	782
Wind	157	559	1,095	1,527	2,153	2,306
PV	9	203	542	964	1,252	1,318
Biomass (& renewable waste)	76	109	121	144	180	198
Geothermal	24	53	103	208	387	550
Solar thermal power plants	1	16	87	415	957	1,209
Ocean energy	0	17	29	77	269	460
Distribution losses	358	399	414	431	453	446
Own consumption electricity	382	362	374	388	411	405
Electricity for hydrogen production	0	31	162	477	1,178	1,690
Electricity for syngas production	0	0	0	0	0	0
Final energy consumption (electricity)	4,459	4,578	4,741	4,922	5,207	4,607
Fluctuating RES (PV, Wind, Ocean)	166	778	1,666	2,568	3,674	4,085
Share of fluctuating RES	3%	14%	29%	41%	51%	57%
RES share (domestic generation)	18%	32%	48%	66%	83%	96%

Table 13.2.9 OECD North America: Final energy consumption in transport PJ/a

	2012	2020	2025	2030	2040	2050
Road	25,564	22,925	20,439	17,497	11,049	7,927
Fossil fuels	24,388	21,554	18,129	13,380	4,003	700
Biofuels	1,139	1,185	1,131	1,089	583	453
Synfuels	0	0	0	0	0	0
Natural gas	32	10	59	128	183	200
Hydrogen	0	11	178	794	2,113	3,212
Electricity	5	166	943	2,106	4,168	3,362
Rail	663	676	697	686	710	559
Fossil fuels	624	567	489	389	259	84
Biofuels	0	34	63	81	103	56
Synfuels	0	0	0	0	0	0
Electricity	39	75	145	217	348	418
Navigation	550	566	576	598	637	696
Fossil fuels	550	550	548	528	437	357
Biofuels	0	16	28	70	200	339
Synfuels	0	0	0	0	0	0
Aviation	2,161	2,047	1,922	1,762	1,582	1,678
Fossil fuels	2,161	2,047	1,868	1,596	1,190	1,007
Biofuels	0	0	54	166	392	671
Synfuels	0	0	0	0	0	0
Total (incl. pipelines)	29,748	26,878	24,224	21,060	14,347	11,083
Fossil fuels	27,723	24,717	21,034	15,894	5,889	2,148
Biofuels (incl. biogas)	1,139	1,235	1,276	1,405	1,278	1,520
Synfuels	0	0	0	0	0	0
Natural gas	842	670	640	624	487	271
Hydrogen	0	11	178	794	2,113	3,212
Electricity	44	243	1,097	2,343	4,582	3,932
Total RES	1,147	1,316	1,891	3,486	6,835	8,396
RES share	4%	5%	8%	17%	48%	76%

Table 13.2.10 OECD North America: Heat supply PJ/a

	2012	2020	2025	2030	2040	2050
District heating plants	0	103	352	653	1,553	1,823
Fossil fuels	0	0	0	0	0	0
Biomass	0	55	146	224	378	152
Solar collectors	0	25	114	239	642	904
Geothermal	0	23	92	189	534	768
Heat from CHP¹	867	1,119	1,456	1,903	2,678	3,120
Fossil fuels	779	799	842	888	762	406
Biomass	88	247	370	550	884	1,188
Geothermal	0	32	135	286	688	1,105
Hydrogen	0	42	108	179	344	421
Direct heating	19,082	20,003	19,331	18,515	15,967	13,373
Fossil fuels	15,798	15,559	13,652	11,415	5,645	1,597
Biomass	1,697	1,896	1,800	1,593	1,143	592
Solar collectors	68	549	1,345	2,309	3,979	4,372
Geothermal	0	73	111	149	219	208
Heat pumps ²	14	245	625	1,135	2,630	3,736
Electric direct heating	1,506	1,680	1,751	1,778	1,925	2,201
Hydrogen	0	0	47	137	426	667
Total heat supply³	19,949	21,226	21,139	21,072	20,198	18,316
Fossil fuels	16,577	16,358	14,494	12,303	6,407	2,003
Biomass	1,784	2,198	2,316	2,367	2,405	1,932
Solar collectors	68	574	1,459	2,548	4,620	5,275
Geothermal	0	128	338	625	1,440	2,080
Heat pumps ²	14	245	625	1,135	2,630	3,736
Electric direct heating	1,506	1,680	1,751	1,778	1,925	2,201
Hydrogen	0	42	156	316	770	1,089
RES share (including RES electricity)	11%	18%	27%	39%	67%	89%

¹ public CHP and CHP autoproduction / ² heat from ambient energy and electricity use / ³ incl. process heat, cooking

Table 13.2.10: OECD North America: Installed capacity GW

	2012	2020	2025	2030	2040	2050
Total generation	1,356	1,472	1,879	2,328	2,814	2,785
Fossil	932	801	761	693	626	416
Hard coal (& non-renewable waste)	163	87	51	46	18	0
Lignite	188	122	64	5	0	0
Gas (w/o H ₂)	495	545	606	621	599	412
Oil	11	39	34	18	7	4
Diesel	11	7	5	3	2	0
Nuclear	124	66	48	7	0	0
Hydrogen (fuel cells, gas power plants, gas CHP)	0	2	4	7	13	17
Renewables	300	604	1,066	1,621	2,175	2,353
Hydro	204	213	219	225	230	233
Wind	67	206	397	544	730	763
of which wind offshore	0	5	14	30	124	156
PV	9	145	379	668	850	869
Biomass (& renewable waste)	16	21	23	27	33	62
Geothermal	4	8	15	31	56	80
Solar thermal power plants	1	5	25	101	181	198
Ocean energy	0	5	9	26	96	149
Fluctuating RES (PV, Wind, Ocean)	75	366	784	1,238	1,675	1,780
Share of fluctuating RES	6%	24%	42%	53%	60%	64%
RES share (domestic generation)	22%	41%	57%	70%	77%	84%

Table 13.2.12: OECD North America: Final energy demand PJ/a

	2012	2020	2025	2030	2040	2050
Total (incl. non-energy use)	73,586	72,407	68,013	62,729	50,750	41,781
Total energy use	67,806	65,608	61,544	56,593	45,438	37,264
Transport	29,748	26,878	24,224	21,060	14,347	11,083
Oil products	27,723	24,717	21,034	15,894	5,889	2,148
Natural gas	842	670	640	624	487	271
Biofuels	1,139	1,235	1,276	1,405	1,278	1,520
Synfuels	0	0	0	0	0	0
Electricity	44	243	1,097	2,343	4,582	3,932
RES electricity	8	77	530	1,554	3,803	3,784
Hydrogen	0	11	178	794	2,113	3,212
RES share Transport	4%	5%	8%	17%	48%	76%
Industry	14,131	14,805	14,269	13,560	11,765	9,918
Electricity	4,191	4,746	4,910	4,882	4,631	5,033
RES electricity	772	1,501	2,371	3,239	4,093	4,843
Public district heat	241	284	294	304	307	276
RES district heat	15	105	163	206	262	262
Hard coal & lignite	988	833	633	392	111	0
Oil products	1,406	1,103	796	514	205	8
Gas	5,943	5,966	5,419	5,025	3,281	1,684
Solar	0	150	383	588	916	966
Biomass	1,358	1,583	1,550	1,368	934	532
Geothermal	4	151	229	333	620	716
Hydrogen	0	0	54	154	461	702
RES share Industry	15%	24%	33%	43%	61%	81%
Other Sectors	23,927	23,925	23,051	21,973	19,325	16,263
Electricity	11,819	11,493	11,080	10,494	9,234	7,619
RES electricity	2,177	3,634	5,342	6,963	7,666	7,332
Public district heat	57	144	504	929	2,076	2,515
RES district heat	4	53	280	631	1,773	2,390
Hard coal & lignite	49	22	0	0	0	0
Oil products	3,119	2,454	1,924	1,305	549	55
Gas	7,906	8,270	7,329	6,051	2,352	203
Solar	68	399	961	1,720	3,063	3,405
Biomass	905	1,050	950	845	524	173
Geothermal	5	94	323	629	1,528	2,294
Hydrogen	0	0	0	0	0	0
RES share Other Sectors	13%	22%	34%	49%	75%	96%
Total RES	6,455	10,035	14,472	20,110	28,597	31,985
RES share	10%	15%	24%	36%	63%	86%
Non energy use	5,780	5,799	6,469	6,136	5,313	4,517
Oil	4,932	5,378	4,285	3,544	1,845	535
Gas	842	697	650	525	340	191
Coal	6	724	1,534	2,067	3,128	3,787

OECD NORTH AMERICA: ADVANCED ENERGY [R]EVOLUTION SCENARIO

Table 13.2.15 OECD North America: Electricity generation ^{TWh/a}

	2012	2020	2025	2030	2040	2050
Power plants	4,856	5,065	5,755	6,473	7,833	8,574
Hard coal (& non-renewable waste)	768	364	159	35	24	0
Lignite	941	709	374	27	0	0
Gas	1,234	1,607	1,558	1,449	851	146
<i>of which from H₂</i>	0	0	16	30	103	146
Oil	75	40	31	16	4	0
Diesel	9	7	5	1	0	0
Nuclear	905	508	374	53	0	0
Biomass (& renewable waste)	42	44	34	26	14	16
Hydro	691	741	765	776	782	782
Wind	157	674	1,417	1,858	2,524	2,942
<i>of which wind offshore</i>	0	20	60	143	582	774
PV	9	275	779	1,289	1,531	1,852
Geothermal	24	57	106	223	457	588
Solar thermal power plants	1	22	118	612	1,312	1,648
Ocean energy	0	18	34	96	343	600
Combined heat and power plants	347	398	435	496	548	502
Hard coal (& non-renewable waste)	42	38	30	19	4	0
Lignite	5	0	0	0	0	0
Gas	254	279	283	296	242	122
<i>of which from H₂</i>	0	0	3	6	29	122
Oil	12	6	3	2	1	0
Biomass (& renewable waste)	34	64	88	119	166	182
Geothermal	0	4	16	35	86	141
Hydrogen	0	6	15	25	48	57
CHP by producer						
Main activity producers	194	221	231	250	262	238
Autoproducers	153	177	205	246	286	264
Total generation	5,203	5,463	6,190	6,969	8,381	9,076
Fossil	3,340	3,049	2,425	1,812	995	0
Hard coal (& non-renewable waste)	810	402	189	54	28	0
Lignite	946	709	374	27	0	0
Gas	1,487	1,885	1,823	1,710	961	0
Oil	87	46	35	18	5	0
Diesel	9	7	5	3	1	0
Nuclear	905	508	374	53	0	0
Hydrogen	0	6	33	60	180	325
<i>of which renewable H₂</i>	0	2	18	44	158	325
Renewables (w/o renewable hydrogen)	958	1,901	3,358	5,033	7,216	8,751
Hydro	691	741	765	776	782	782
Wind	157	674	1,417	1,858	2,524	2,942
PV	9	275	779	1,289	1,531	1,852
Biomass (& renewable waste)	76	109	121	144	180	198
Geothermal	24	62	123	258	544	730
Solar thermal power plants	1	22	118	612	1,312	1,648
Ocean energy	0	18	34	96	343	600
Distribution losses	358	399	414	431	453	446
Own consumption electricity	382	362	374	388	411	405
Electricity for hydrogen production	0	47	443	782	1,599	2,720
Electricity for synfuel production	0	9	22	29	275	501
Final energy consumption (electricity)	4,459	4,643	4,934	5,325	5,650	5,002
Fluctuating RES (PV, Wind, Ocean)	166	968	2,230	3,243	4,398	5,393
Share of fluctuating RES	3%	18%	36%	47%	52%	59%
RES share (domestic generation)	18%	35%	55%	73%	88%	100%

Table 13.2.16 OECD North America: Final energy consumption in transport ^{PJ/a}

	2012	2020	2025	2030	2040	2050
Road	25,564	22,542	19,288	15,624	8,504	5,477
Fossil fuels	24,388	21,070	16,155	10,809	1,795	0
Biofuels	1,139	1,150	1,159	989	702	278
Synfuels	0	12	28	31	223	138
Natural gas	32	0	0	0	0	0
Hydrogen	0	52	660	1,247	2,049	2,501
Electricity	5	270	1,314	2,579	3,957	2,699
Rail	663	743	885	1,043	1,401	1,399
Fossil fuels	624	536	427	299	130	0
Biofuels	0	16	41	51	66	47
Synfuels	0	0	1	2	21	23
Electricity	39	190	416	691	1,184	1,329
Navigation	550	566	576	598	637	696
Fossil fuels	550	561	567	517	414	0
Biofuels	0	6	8	78	169	465
Synfuels	0	0	0	2	54	231
Aviation	2,161	2,026	1,865	1,639	1,249	1,091
Fossil fuels	2,161	2,016	1,846	1,426	812	0
Biofuels	0	10	18	207	332	729
Synfuels	0	0	0	6	105	361
Total (incl. pipelines)	29,748	26,549	23,226	19,443	12,373	9,009
Fossil fuels	27,723	24,183	18,995	13,051	3,152	0
Biofuels (incl. biogas)	1,139	1,182	1,227	1,325	1,269	1,520
Synfuels	0	13	30	41	403	753
Natural gas	842	653	557	454	200	0
Hydrogen	0	52	660	1,247	2,049	2,501
Electricity	44	466	1,758	3,325	5,300	4,236
Total RES	1,147	1,367	2,562	4,691	8,082	9,009
RES share	4%	5%	11%	24%	65%	100%

Table 13.2.17 OECD North America: Heat supply ^{PJ/a}

	2012	2020	2025	2030	2040	2050
District heating plants	0	103	352	653	1,553	1,824
Fossil fuels	0	0	0	0	0	0
Biomass	0	55	146	224	378	152
Solar collectors	0	25	114	239	642	904
Geothermal	0	23	92	189	534	768
Heat from CHP¹	867	1,119	1,456	1,903	2,678	3,118
Fossil fuels	779	799	835	871	672	0
Biomass	88	247	370	550	884	1,188
Geothermal	0	32	135	286	688	1,105
Hydrogen	0	42	116	196	434	825
Direct heating	19,082	20,003	19,331	18,515	15,967	13,375
Fossil fuels	15,798	15,559	13,574	11,317	5,310	0
Biomass	1,697	1,896	1,800	1,593	1,143	592
Solar collectors	68	549	1,358	2,321	4,033	4,388
Geothermal	0	73	111	149	219	203
Heat pumps ²	14	245	625	1,135	2,630	3,737
Electric direct heating	1,506	1,680	1,751	1,797	1,971	2,351
Hydrogen	0	0	113	203	661	2,103
Total heat supply³	19,949	21,226	21,139	21,072	20,198	18,316
Fossil fuels	16,577	16,358	14,409	12,188	5,982	0
Biomass	1,784	2,198	2,316	2,367	2,405	1,932
Solar collectors	68	574	1,472	2,561	4,675	5,292
Geothermal	0	128	338	625	1,440	2,076
Heat pumps ²	14	245	625	1,135	2,630	3,737
Electric direct heating	1,506	1,680	1,751	1,797	1,971	2,351
Hydrogen	0	42	229	398	1,095	2,928
RES share (including RES electricity)	11%	18%	28%	40%	69%	100%

¹ public CHP and CHP autoproduction / ² heat from ambient energy and electricity use / ³ incl. process heat, cooking

Table 13.2.18: OECD North America: Installed capacity ^{GW}

	2012	2020	2025	2030	2040	2050
Total generation	1,356	1,554	2,197	2,768	3,290	3,629
Fossil	932	785	774	712	575	0
Hard coal (& non-renewable waste)	163	68	38	12	12	0
Lignite	188	121	65	6	0	0
Gas (w/o H ₂)	495	547	632	671	552	0
Oil	75	41	34	21	8	0
Diesel	11	7	5	3	2	0
Nuclear	124	66	48	7	0	0
Hydrogen (fuel cells, gas power plants, gas CHP)	0	2	10	21	89	528
Renewables	300	702	1,365	2,028	2,626	3,102
Hydro	204	213	219	227	239	257
Wind	67	248	514	661	852	971
<i>of which wind offshore</i>	0	6	17	40	159	209
PV	9	197	546	893	1,038	1,224
Biomass (& renewable waste)	16	21	23	27	33	37
Geothermal	4	9	20	36	95	134
Solar thermal power plants	1	7	34	149	248	286
Ocean energy	0	6	11	33	122	193
Fluctuating RES (PV, Wind, Ocean)	75	451	1,070	1,586	2,011	2,387
Share of fluctuating RES	6%	29%	49%	57%	61%	66%
RES share (domestic generation)	22%	45%	62%	73%	80%	85%

Table 13.2.19: OECD North America: Final energy demand ^{PJ/a}

	2012	2020	2025	2030	2040	2050
Total (incl. non-energy use)	73,586	72,086	67,040	61,433	49,361	40,402
Total energy use	67,806	65,286	60,571	55,297	44,048	35,885
Transport	29,748	26,549	23,226	19,443	12,373	9,009
Oil products	27,723	24,183	18,995	13,051	3,152	0
Natural gas	842	653	557	454	200	0
Biofuels	1,139	1,182	1,227	1,325	1,269	1,520
Synfuels	0	13	30	41	403	753
Electricity	44	466	1,758	3,325	5,300	4,236
RES electricity	8	162	959	2,426	4,658	4,236
Hydrogen	0	52	660	1,247	2,049	2,501
RES share Transport	4%	5%	11%	24%	65%	100%
Industry	14,131	14,805	14,269	13,623	11,875	10,049
Electricity	4,191	4,746	4,910	4,994	5,138	5,374
RES electricity	772	1,653	2,678	3,644	4,515	5,374
Public district heat	241	284	294	304	307	276
RES district heat	15	105	164	208	267	276
Hard coal & lignite	988	833	633	387	111	0
Oil products	1,406	1,103	796	479	154	0
Gas	5,943	5,966	5,419	5,065	3,251	0
Solar	0	150	383	588	916	962
Biomass	1,358	1,583	1,550	1,368	934	532
Geothermal	4	151	229	333	620	712
Hydrogen	0	0	54	105	445	2,193
RES share Industry	15%	25%	35%	46%	64%	100%
Other Sectors	23,927	23,932	23,075	22,231	19,800	16,826
Electricity	11,819	11,502	11,094	10,852	9,903	8,396
RES electricity	2,177	4,006	6,051	7,918	8,703	8,396
Public district heat	57	144	504	929	2,076	2,516
RES district heat	4	53	281	635	1,805	2,516
Hard coal & lignite	49	22	5	11	13	0
Oil products	3,119	2,452	1,916	1,221	389	0
Gas	7,906	8,270	7,236	5,893	1,986	0
Solar	68	399	974	1,733	3,117	3,426
Biomass	905	1,050	950	845	524	173
Geothermal	5	94	323	629	1,528	2,294
Hydrogen	0	0	73	120	265	21
RES share Other Sectors	13%	23%	37%	53%	80%	100%
Total RES	6,455	10,611	16,215	22,756	31,636	35,884
RES share	10%	16%	27%	41%	72%	100%
Non energy use	5,780	6,799	6,469	6,136	5,313	4,517
Oil	4,932	5,378	4,285	3,544	1,845	539
Gas	842	697	650	525	340	191
Coal	6	724	1,534	2,067	3,128	3,787

OECD NORTH AMERICA: INVESTMENT AND EMPLOYMENT

Table 13.2.22: OECD North America: Investments in electricity generation

REF	UNIT	2012-2020	2021-2030	2031-2040	2041-2050	2012-2050	UNIT	ANNUAL AVERAGE 2012-2050
Fossil (w/o CHP)	billion \$	354.1	462.1	606.2	458.1	1,880.4	billion \$/a	48.2
Nuclear	billion \$	123.3	155.4	129.1	160.3	568.2	billion \$/a	14.6
CHP (fossil + renewable)	billion \$	88.1	47.8	11.9	5.9	153.7	billion \$/a	3.9
Renewables (w/o CHP)	billion \$	380.6	398.3	433.5	462.0	1,674.5	billion \$/a	42.9
Total	billion \$	946.2	1,063.6	1,180.7	1,086.3	4,276.8	billion \$/a	109.7
Conventional (fossil & nuclear)	billion \$	555.6	658.0	746.2	621.9	2,581.6	billion \$/a	66.2
Renewables	billion \$	390.5	405.6	434.5	464.5	1,695.2	billion \$/a	43.5
Biomass	billion \$	40.1	34.5	45.2	43.4	163.3	billion \$/a	4.2
Hydro	billion \$	120.1	139.0	97.1	105.2	461.4	billion \$/a	11.8
Wind	billion \$	109.5	139.7	182.8	192.0	623.9	billion \$/a	16.0
PV	billion \$	64.4	44.6	66.5	53.2	228.8	billion \$/a	5.9
Geothermal	billion \$	32.7	24.7	18.4	25.4	101.1	billion \$/a	2.6
Solar thermal power plants	billion \$	23.7	21.0	20.5	40.7	105.9	billion \$/a	2.7
Ocean energy	billion \$	0.0	2.2	4.0	4.5	10.7	billion \$/a	0.3
E[R]								
Fossil (w/o CHP)	billion \$	183.9	213.6	319.0	96.9	813.5	billion \$/a	20.9
Nuclear	billion \$	4.5	0.0	0.0	0.0	4.5	billion \$/a	0.1
CHP (fossil + renewable)	billion \$	134.2	143.6	134.0	230.8	642.6	billion \$/a	16.5
Renewables (w/o CHP)	billion \$	802.4	2,306.2	1,979.3	1,759.9	6,847.7	billion \$/a	175.6
Total	billion \$	1,124.9	2,663.4	2,432.3	2,087.6	8,308.2	billion \$/a	213.0
Conventional (fossil & nuclear)	billion \$	280.9	266.4	333.6	105.2	986.1	billion \$/a	25.3
Renewables	billion \$	844.0	2,397.0	2,098.7	1,982.4	7,322.1	billion \$/a	187.7
Biomass	billion \$	41.9	49.3	59.4	139.8	290.4	billion \$/a	7.4
Hydro	billion \$	137.3	144.9	123.5	117.6	523.4	billion \$/a	13.4
Wind	billion \$	293.1	718.6	756.8	755.5	2,524.0	billion \$/a	64.7
PV	billion \$	249.9	696.1	327.5	424.6	1,698.1	billion \$/a	43.5
Geothermal	billion \$	60.4	190.3	183.5	211.0	645.1	billion \$/a	16.5
Solar thermal power plants	billion \$	28.0	497.7	411.0	202.3	1,139.0	billion \$/a	29.2
Ocean energy	billion \$	33.3	100.1	237.0	131.7	502.1	billion \$/a	12.9
ADV E[R]								
Fossil (w/o CHP)	billion \$	135.6	214.8	405.6	147.0	903.0	billion \$/a	23.2
Nuclear	billion \$	4.5	0.0	0.0	0.0	4.5	billion \$/a	0.1
CHP (fossil + renewable)	billion \$	134.2	146.2	136.4	142.7	559.4	billion \$/a	14.3
Renewables (w/o CHP)	billion \$	988.3	3,015.7	2,479.2	2,665.7	9,158.9	billion \$/a	234.8
Total	billion \$	1,272.7	3,376.7	3,021.1	2,955.4	10,625.8	billion \$/a	272.5
Conventional (fossil & nuclear)	billion \$	232.7	270.1	422.5	156.1	1,081.5	billion \$/a	27.7
Renewables	billion \$	1,039.9	3,106.6	2,598.6	2,799.2	9,544.3	billion \$/a	244.7
Biomass	billion \$	41.9	49.3	59.4	50.8	201.4	billion \$/a	5.2
Hydro	billion \$	137.3	153.8	146.4	164.0	601.5	billion \$/a	15.4
Wind	billion \$	372.6	867.4	879.2	1,054.1	3,173.4	billion \$/a	81.4
PV	billion \$	339.4	932.2	343.1	694.0	2,308.7	billion \$/a	59.2
Geothermal	billion \$	74.6	237.7	359.8	311.7	983.7	billion \$/a	25.2
Solar thermal power plants	billion \$	37.2	738.3	506.6	351.6	1,633.7	billion \$/a	41.9
Ocean energy	billion \$	36.9	127.7	304.1	173.0	641.8	billion \$/a	16.5

Table 13.2.23: OECD North America: Investments in renewable heat generation

REF	UNIT	2012-2020	2021-2030	2031-2040	2041-2050	2012-2050	UNIT	ANNUAL AVERAGE 2012-2050
Heat pumps	billion \$	1.2	1.3	0.4	0.4	3.3	billion \$/a	0.1
Deep geothermal	billion \$	0.0	0.0	0.0	0.0	0.0	billion \$/a	0.0
Solar thermal	billion \$	27.7	48.7	67.2	97.4	241.1	billion \$/a	6.2
Biomass	billion \$	135.9	136.6	69.9	72.0	414.5	billion \$/a	10.6
Total	billion \$	164.8	186.6	137.6	169.8	658.9	billion \$/a	16.9
E[R]								
Heat pumps	billion \$	62.0	263.3	460.9	527.1	1,313.2	billion \$/a	33.7
Deep geothermal	billion \$	31.8	25.1	231.0	198.0	485.8	billion \$/a	12.5
Solar thermal	billion \$	156.0	503.3	578.0	348.7	1,586.0	billion \$/a	40.7
Biomass	billion \$	139.4	10.3	12.1	0.0	161.8	billion \$/a	4.1
Total	billion \$	389.2	802.0	1,281.9	1,073.8	3,546.9	billion \$/a	90.9
ADV E[R]								
Heat pumps	billion \$	62.0	263.3	460.9	527.3	1,313.4	billion \$/a	33.7
Deep geothermal	billion \$	31.8	25.1	231.0	198.2	486.1	billion \$/a	12.5
Solar thermal	billion \$	156.0	507.0	589.0	347.0	1,599.1	billion \$/a	41.0
Biomass	billion \$	139.4	10.3	12.1	0.0	161.8	billion \$/a	4.1
Total	billion \$	389.2	805.7	1,292.9	1,072.5	3,560.3	billion \$/a	91.3

Table 13.2.24: OECD North America: Total employment in the energy sector THOUSAND JOBS

By sector	REFERENCE SCENARIO				ADV E[R] SCENARIO		
	2015	2020	2025	2030	2020	2025	2030
Construction and installation	138	83	90	85	388	458	442
Manufacturing	119	75	72	58	437	516	533
Operations and maintenance	380	402	405	407	443	535	623
Fuel supply (domestic)	551	526	514	502	540	513	475
Coal and gas export	-	-	-	-	-	-	-
Solar and geothermal heat	89	59	71	68	243	753	691
Total jobs (thousands)	1,278	1,145	1,152	1,120	2,051	2,774	2,764
By technology							
Coal	294	253	228	209	246	177	135
Gas, oil & diesel	175	178	180	176	162	166	157
Nuclear	84	82	81	80	96	101	110
Renewable	725	631	662	654	1,547	2,330	2,363
Biomass	276	296	313	328	391	459	455
Hydro	60	57	59	58	48	48	51
Wind	129	116	122	110	341	434	486
PV	164	93	86	70	468	517	512
Geothermal power	1.8	1.6	1.5	1.4	10	15	20
Solar thermal power	5.5	6.5	7.2	10.0	29	71	102
Ocean	0.6	2.3	2.7	8.7	16.6	32	46
Solar - heat	74	48	60	59	186	636	544
Geothermal & heat pump	14.7	10.7	10.2	9.6	57	117	146
Total jobs (thousands)	1,278	1,145	1,152	1,120	2,051	2,774	2,764

LATIN AMERICA: REFERENCE SCENARIO

Table 13.3.1 Latin America: Electricity generation TWh/a

	2012	2020	2025	2030	2040	2050
Power plants	1,152	1,495	1,742	1,989	2,490	2,904
Hard coal (& non-renewable waste)	31	7	80	90	125	234
Lignite	7	8	8	9	10	11
Gas	198	247	340	434	639	778
of which from H ₂	0	0	0	0	0	0
Oil	121	95	75	55	33	15
Diesel	29	33	37	41	54	63
Nuclear	22	34	41	48	58	71
Biomass (& renewable waste)	10	27	37	46	66	75
Hydro	722	921	1,029	1,137	1,319	1,400
Wind	8	48	73	96	130	170
of which wind offshore	0	1	2	4	10	17
PV	0	6	10	15	24	36
Geothermal	4	6	10	13	21	25
Solar thermal power plants	0	0	2	3	11	23
Ocean energy	0	0	0	0	1	2
Combined heat and power plants	63	72	75	79	85	92
Hard coal (& non-renewable waste)	1	0	0	0	0	0
Lignite	0	0	0	0	0	0
Gas	16	17	16	16	15	15
of which from H ₂	0	0	0	0	0	0
Oil	6	7	7	7	7	8
Biomass (& renewable waste)	40	48	52	55	63	69
Geothermal	0	0	0	0	0	0
Hydrogen	0	0	0	0	0	0
CHP by producer						
Main activity producers	0	0	0	0	0	0
Autoproducers	63	72	75	78	85	92
Total generation	1,216	1,567	1,817	2,067	2,576	2,996
Fossil	409	476	564	662	884	1,124
Hard coal (& non-renewable waste)	32	70	81	90	125	234
Lignite	8	8	9	9	10	11
Gas	213	264	356	449	654	793
Oil	127	101	82	62	40	23
Diesel	29	33	37	41	54	63
Nuclear	22	34	41	48	58	71
Hydrogen	0	0	0	0	0	0
of which renewable H ₂	0	0	0	0	0	0
Renewables (w/o renewable hydrogen)	784	1,057	1,212	1,368	1,633	1,801
Hydro	722	921	1,029	1,137	1,319	1,400
Wind	8	48	73	96	130	170
PV	0	6	10	15	24	36
Biomass (& renewable waste)	50	75	89	102	129	144
Geothermal	4	6	10	13	21	25
Solar thermal power plants	0	0	2	3	11	23
Ocean energy	0	0	0	0	1	2
Distribution losses	179	233	272	310	390	454
Own consumption electricity	50	55	53	52	42	42
Electricity for hydrogen production	0	0	0	0	0	0
Electricity for synfuel production	0	0	0	0	0	0
Final energy consumption (electricity)	987	1,285	1,498	1,711	2,150	2,505
Fluctuating RES (PV, Wind, Ocean)	8	54	83	113	155	208
Share of fluctuating RES	1%	3%	5%	5%	6%	7%
RES share (domestic generation)	64%	67%	67%	66%	63%	60%

Table 13.3.2 Latin America: Final energy consumption in transport PJ/a

	2012	2020	2025	2030	2040	2050
Road	6,326	7,489	8,286	9,093	10,099	9,856
Fossil fuels	5,561	6,292	6,792	7,303	7,863	7,480
Biofuels	557	944	1,215	1,486	1,836	1,856
Synfuels	0	0	0	0	0	0
Natural gas	207	252	273	295	384	494
Hydrogen	0	0	0	0	0	0
Electricity	0	2	5	8	16	26
Rail	128	156	196	225	284	343
Fossil fuels	109	137	176	204	261	317
Biofuels	0	0	0	0	0	0
Synfuels	0	0	0	0	0	0
Electricity	18	19	20	21	23	25
Navigation	122	150	168	186	223	259
Fossil fuels	122	150	168	186	223	259
Biofuels	0	0	0	0	0	0
Synfuels	0	0	0	0	0	0
Aviation	200	252	288	324	386	418
Fossil fuels	200	252	288	324	386	418
Biofuels	0	0	0	0	0	0
Synfuels	0	0	0	0	0	0
Total (incl. pipelines)	6,839	8,135	9,037	9,939	11,126	11,035
Fossil fuels	5,993	6,831	7,424	8,018	8,732	8,474
Biofuels (incl. biogas)	557	944	1,215	1,486	1,836	1,856
Synfuels	0	0	0	0	0	0
Natural gas	271	339	373	407	519	653
Hydrogen	0	0	0	0	0	0
Electricity	18	22	25	29	39	51
Total RES	569	958	1,232	1,505	1,861	1,887
RES share	8%	12%	14%	15%	17%	17%

Table 13.3.3 Latin America: Heat supply PJ/a

	2012	2020	2025	2030	2040	2050
District heating plants	0	0	0	0	0	0
Fossil fuels	0	0	0	0	0	0
Biomass	0	0	0	0	0	0
Solar collectors	0	0	0	0	0	0
Geothermal	0	0	0	0	0	0
Heat from CHP¹	134	176	199	230	332	580
Fossil fuels	60	67	68	69	73	81
Biomass	74	108	131	161	259	500
Geothermal	0	0	0	0	0	0
Hydrogen	0	0	0	0	0	0
Direct heating	7,354	9,056	10,240	11,433	14,049	15,669
Fossil fuels	4,221	5,568	6,430	7,311	9,092	10,167
Biomass	2,241	2,404	2,595	2,789	3,358	3,713
Solar collectors	22	54	74	94	149	220
Geothermal	0	0	0	0	0	0
Heat pumps ²	0	0	0	0	0	0
Electric direct heating	870	1,030	1,140	1,240	1,450	1,570
Hydrogen	0	0	0	0	0	0
Total heat supply³	7,487	9,232	10,439	11,664	14,381	16,250
Fossil fuels	4,281	5,635	6,499	7,380	9,165	10,247
Biomass	2,314	2,512	2,726	2,950	3,616	4,213
Solar collectors	22	54	74	94	149	220
Geothermal	0	0	0	0	0	0
Heat pumps ²	0	0	0	0	0	0
Electric direct heating	870	1,030	1,140	1,240	1,450	1,570
Hydrogen	0	0	0	0	0	0
RES share (including RES electricity)	39%	35%	34%	33%	33%	33%

¹ public CHP and CHP autoproduction / ² heat from ambient energy and electricity use / ³ incl. process heat, cooking

Table 13.3.4: Latin America: Installed capacity GW

	2012	2020	2025	2030	2040	2050
Total generation	272	370	430	490	604	695
Fossil	103	135	155	175	223	268
Hard coal (& non-renewable waste)	6	13	14	15	20	37
Lignite	2	2	2	2	2	2
Gas (w/o H ₂)	54	74	96	118	163	194
Oil	34	35	30	24	16	9
Diesel	8	11	13	16	22	26
Nuclear	3	5	5	6	8	9
Hydrogen (fuel cells, gas power plants, gas CHP)	0	0	0	0	0	0
Renewables	166	231	270	309	374	418
Hydro	148	192	217	242	285	304
Wind	4	16	23	31	40	51
of which wind offshore	0	0	1	1	2	5
PV	0	4	8	11	17	26
Biomass (& renewable waste)	14	18	20	22	26	29
Geothermal	1	1	1	2	3	4
Solar thermal power plants	0	0	0	1	3	5
Ocean energy	0	0	0	0	0	0
Fluctuating RES (PV, Wind, Ocean)	4	20	31	42	57	77
Share of fluctuating RES	1%	5%	7%	8%	9%	11%
RES share (domestic generation)	61%	62%	63%	63%	62%	60%

Table 13.3.5: Latin America: Final energy demand PJ/a

	2012	2020	2025	2030	2040	2050
Total (incl. non-energy use)	20,497	24,678	27,531	30,383	35,460	37,865
Total energy use	18,999	23,122	25,974	28,826	33,903	36,308
Transport	6,839	8,135	9,037	9,939	11,126	11,035
Oil products	5,993	6,831	7,424	8,018	8,732	8,474
Natural gas	271	339	373	407	519	653
Biofuels	557	944	1,215	1,486	1,836	1,856
Synfuels	0	0	0	0	0	0
Electricity	18	22	25	29	39	51
RES electricity	12	15	17	19	25	31
Hydrogen	0	0	0	0	0	0
RES share Transport	8%	12%	14%	15%	17%	17%
Industry	6,962	8,680	9,690	10,699	12,817	14,215
Electricity	1,599	1,997	2,267	2,536	3,134	3,729
RES electricity	1,012	1,347	1,512	1,678	1,988	2,241
Public district heat	1	2	2	2	2	3
RES district heat	1	2	2	2	2	2
Hard coal & lignite	373	708	813	917	1,110	1,147
Oil products	1,627	1,771	1,823	1,876	1,937	1,830
Gas	1,518	2,061	2,453	2,844	3,744	4,453
Solar	0	9	14	18	33	49
Biomass	1,874	2,131	2,319	2,506	2,857	3,004
Geothermal	0	0	0	0	0	0
Hydrogen	0	0	0	0	0	0
RES share Industry	41%	40%	40%	39%	38%	37%
Other Sectors	5,198	6,306	7,247	8,187	9,960	11,059
Electricity	1,987	2,607	3,100	3,593	4,565	5,240
RES electricity	1,269	1,758	2,068	2,377	2,896	3,150
Public district heat	0	0	0	0	0	0
RES district heat	0	0	0	0	0	0
Hard coal & lignite	3	6	7	8	10	12
Oil products	1,269	1,629	1,927	2,226	2,715	2,949
Gas	566	675	759	843	1,013	1,135
Solar	22	44	60	76	116	171
Biomass	1,370	1,345	1,393	1,441	1,539	1,552
Geothermal	0	0	0	0	0	0
Hydrogen	0	0	0	0	0	0
RES share Other Sectors	51%	50%	49%	48%	46%	44%
Total RES	6,116	7,595	8,599	9,603	11,291	12,057
RES share	32%	33%	33%	33%	33%	33%
Non energy use	1,498	1,557	1,557	1,557	1,557	1,557
Oil	969	845	802	757	668	638
Gas	524	706	748	793	883	919
Coal	5	6	6	6	6	0

¹ excluding heat produced by CHP autoproducers

Table 13.3.6: Latin America: CO₂ emissions Mill t/a

	2012	2020	2025	2030	2040	2050
Condensation power plants	248	289	313	338	430	572
Hard coal (& non-renewable waste)	34	65	73	80	107	200</

Table 13.3.8 Latin America: Electricity generation TWh/a

	2012	2020	2025	2030	2040	2050
Power plants	1,152	1,378	1,517	1,681	2,235	2,812
Hard coal (& non-renewable waste)	31	34	32	20	1	0
Lignite	7	7	5	1	0	0
Gas	198	229	221	204	107	50
of which from H+	0	0	0	0	0	15
Oil	121	79	59	15	2	0
Diesel	29	25	15	10	2	0
Nuclear	22	18	11	0	0	0
Biomass (& renewable waste)	10	30	42	66	122	188
Hydro	722	797	799	806	814	820
Wind	8	103	192	305	568	815
of which wind offshore	0	1	17	65	200	345
PV	0	45	95	150	313	451
Geothermal	4	10	14	17	31	37
Solar thermal power plants	0	2	30	85	255	415
Ocean energy	0	0	1	2	20	37
Combined heat and power plants	63	81	114	160	288	400
Hard coal (& non-renewable waste)	1	0	0	0	0	0
Lignite	0	0	0	0	0	0
Gas	16	21	29	46	93	130
of which from H+	0	0	0	2	5	68
Oil	6	6	3	0	0	0
Biomass (& renewable waste)	40	54	78	104	148	162
Geothermal	0	1	4	8	39	90
Hydrogen	0	0	0	1	7	18
CHP by producer						
Main activity producers	0	5	13	22	42	47
Autoproducers	63	76	101	138	246	353
Total generation	1,216	1,459	1,631	1,840	2,523	3,213
Fossil	409	401	365	294	201	98
Hard coal (& non-renewable waste)	32	34	33	20	1	0
Lignite	8	7	5	1	0	0
Gas	213	250	250	248	195	98
Oil	127	85	62	15	2	0
Diesel	29	25	15	10	2	0
Nuclear	22	18	11	0	0	0
Hydrogen	0	0	0	3	11	100
of which renewable H+	0	0	0	3	10	94
Renewables (w/o renewable hydrogen)	784	1,040	1,255	1,543	2,310	3,015
Hydro	722	797	799	806	814	820
Wind	8	103	192	305	568	815
PV	0	45	95	150	313	451
Biomass (& renewable waste)	50	83	120	170	270	350
Geothermal	4	11	18	25	70	127
Solar thermal power plants	0	2	30	85	255	415
Ocean energy	0	0	1	2	20	37
Distribution losses	179	209	220	231	254	280
Own consumption electricity	50	57	58	58	60	61
Electricity for hydrogen production	0	0	15	39	251	643
Electricity for synfuel production	0	0	0	0	0	0
Final energy consumption (electricity)	987	1,195	1,341	1,515	1,961	2,231
Fluctuating RES (PV, Wind, Ocean)	8	148	288	457	901	1,303
Share of fluctuating RES	1%	10%	18%	25%	36%	41%
RES share (domestic generation)	64%	71%	77%	84%	92%	97%

Table 13.3.9 Latin America: Final energy consumption in transport PJ/a

	2012	2020	2025	2030	2040	2050
Road	6,326	7,326	7,177	6,836	5,886	5,053
Fossil fuels	5,561	5,961	5,124	3,947	1,387	193
Biofuels	557	1,052	1,281	1,691	2,081	1,737
Synfuels	0	0	0	0	0	0
Natural gas	207	293	574	752	837	637
Hydrogen	0	0	36	68	543	863
Electricity	0	20	162	377	1,037	1,623
Rail	128	143	146	146	173	170
Fossil fuels	109	118	93	67	33	2
Biofuels	0	4	17	21	21	7
Synfuels	0	0	0	0	0	0
Electricity	18	21	35	58	119	162
Navigation	122	164	188	205	258	307
Fossil fuels	122	164	179	180	155	31
Biofuels	0	0	9	25	103	276
Synfuels	0	0	0	0	0	0
Aviation	200	229	235	241	278	301
Fossil fuels	200	229	228	217	167	30
Biofuels	0	0	7	24	111	271
Synfuels	0	0	0	0	0	0
Total (incl. pipelines)	6,839	7,936	7,819	7,500	6,664	5,886
Fossil fuels	5,993	6,472	5,624	4,411	1,742	256
Biofuels (incl. biogas)	557	1,056	1,315	1,761	2,317	2,291
Synfuels	0	0	0	0	0	0
Natural gas	271	367	646	821	894	663
Hydrogen	0	0	36	68	543	863
Electricity	18	41	198	438	1,169	1,814
Total RES	569	1,085	1,495	2,186	3,892	4,881
RES share	8%	14%	19%	29%	58%	83%

Table 13.3.10 Latin America: Heat supply PJ/a

	2012	2020	2025	2030	2040	2050
District heating plants	0	3	9	22	78	109
Fossil fuels	0	0	1	2	2	0
Biomass	0	2	6	15	49	49
Solar collectors	0	0	1	3	16	38
Geothermal	0	0	1	2	12	22
Heat from CHP¹	134	228	380	595	1,389	2,532
Fossil fuels	60	78	103	148	310	226
Biomass	74	142	245	365	676	1,172
Geothermal	0	8	31	70	345	785
Hydrogen	0	0	1	13	58	349
Direct heating	7,354	8,535	8,149	8,344	7,923	6,660
Fossil fuels	4,221	4,559	3,549	3,005	1,485	393
Biomass	2,241	2,589	2,825	2,980	2,831	2,513
Solar collectors	22	301	514	825	1,364	1,358
Geothermal	0	6	26	55	150	176
Heat pumps ²	0	76	118	169	352	491
Electric direct heating	870	1,005	1,116	1,310	1,740	1,719
Hydrogen	0	0	0	0	0	9
Total heat supply³	7,487	8,766	8,538	8,961	9,390	9,301
Fossil fuels	4,281	4,637	3,653	3,154	1,796	619
Biomass	2,314	2,733	3,076	3,359	3,557	3,734
Solar collectors	22	301	515	828	1,380	1,396
Geothermal	0	14	59	127	507	983
Heat pumps ²	0	76	118	169	352	491
Electric direct heating	870	1,005	1,116	1,310	1,740	1,719
Hydrogen	0	0	1	13	58	359
RES share (including RES electricity)	39%	44%	54%	63%	79%	93%

¹ public CHP and CHP autoproduction / ² heat from ambient energy and electricity use / ³ incl. process heat, cooking

Table 13.3.10: Latin America: Installed capacity GW

	2012	2020	2025	2030	2040	2050
Total generation	272	391	474	560	837	1,073
Fossil	103	130	134	121	128	89
Hard coal (& non-renewable waste)	6	7	7	4	0	0
Lignite	2	1	1	0	0	0
Gas (w/o H ₂)	54	84	98	107	126	89
Oil	34	29	22	6	1	0
Diesel	8	9	5	4	1	0
Nuclear	3	2	2	0	0	0
Hydrogen (fuel cells, gas power plants, gas CHP)	0	0	0	1	3	57
Renewables	166	259	338	438	706	926
Hydro	148	164	165	166	168	169
Wind	4	34	60	92	162	225
of which wind offshore	0	0	4	16	48	81
PV	0	35	71	111	227	322
Biomass (& renewable waste)	14	23	31	42	71	102
Geothermal	0	1	3	4	10	18
Solar thermal power plants	0	1	8	23	63	80
Ocean energy	0	0	0	1	6	10
Fluctuating RES (PV, Wind, Ocean)	4	69	132	203	394	557
Share of fluctuating RES	1%	18%	28%	36%	47%	52%
RES share (domestic generation)	61%	66%	71%	78%	84%	86%

Table 13.3.12: Latin America: Final energy demand PJ/a

	2012	2020	2025	2030	2040	2050
Total (incl. non-energy use)	20,497	23,558	23,070	22,974	21,497	19,382
Total energy use	18,999	22,001	21,545	21,464	20,018	17,903
Transport	6,839	7,936	7,819	7,500	6,664	5,886
Oil products	5,993	6,472	5,624	4,411	1,742	256
Natural gas	271	367	646	821	894	663
Biofuels	557	1,056	1,315	1,761	2,317	2,291
Synfuels	0	0	0	0	0	0
Electricity	18	41	198	438	1,169	1,814
RES electricity	12	30	153	368	1,076	1,756
Hydrogen	0	0	36	68	543	863
RES share Transport	8%	14%	19%	29%	58%	83%
Industry	6,962	8,254	7,908	8,138	7,431	6,153
Electricity	1,569	1,903	2,066	2,302	2,683	2,631
RES electricity	1,012	1,356	1,590	1,934	2,468	2,546
Public district heat	1	11	53	55	87	110
RES district heat	1	10	45	45	70	90
Hard coal & lignite	373	611	565	458	27	0
Oil products	1,627	1,326	703	380	30	7
Gas	1,518	1,925	1,684	1,573	968	103
Solar	0	169	278	493	752	647
Biomass	1,874	2,270	2,498	2,740	2,555	2,263
Geothermal	0	39	81	137	328	382
Hydrogen	0	0	0	0	0	10
RES share Industry	41%	47%	57%	66%	83%	97%
Other Sectors	5,198	5,812	5,817	5,827	5,923	5,864
Electricity	1,967	2,359	2,563	2,715	3,206	3,587
RES electricity	1,269	1,682	1,972	2,281	2,949	3,471
Public district heat	0	26	41	99	225	231
RES district heat	0	23	35	82	181	189
Hard coal & lignite	3	6	5	4	0	0
Oil products	1,269	1,149	815	616	194	22
Gas	566	632	619	624	574	439
Solar	22	132	236	332	612	711
Biomass	1,370	1,488	1,509	1,398	1,031	712
Geothermal	0	19	29	39	81	162
Hydrogen	0	0	0	0	0	0
RES share Other Sectors	51%	58%	65%	71%	82%	89%
Total RES	6,117	8,275	9,768	11,667	14,919	16,065
RES share	32%	38%	45%	54%	75%	90%
Non energy use	1,498	1,657	1,526	1,510	1,479	1,479
Oil	969	866	803	749	645	578
Gas	524	654	656	664	680	710
Coal	5	37	67	97	154	191

1 excluding heat produced by CHP autoproducers

Table 13.3.13: Latin America: CO₂ emissions Mill t/a

	2012	2020	2025	2030	2040	2050
Condensation power plants	248	226	182	120	46	14
Hard coal (& non-renewable waste)	34	31	30	18	1	0
Lignite	10	8	5	1	0	0
Gas	101	105	93	82	42	14
Oil	67	51	38	9	2	0
Diesel	37	30	16	9	2	0
Combined heat and power plants	15	16	19	24	45	30
Hard coal (& non-renewable waste)	1	1	1	0	0	0
Lignite	0	0	0	0	0	0
Gas	10	12	16	24	45	30
Oil	4	4	2	0	0	0
CO₂ emissions power and CHP plants	263	242	201	144	91	44
Hard coal (& non-renewable waste)	35	32	30	18	1	0
Lignite	10	8	5	1	0	0
Gas	111	117	110	106	87	43
Oil & diesel	107	85	56	19	3	0

LATIN AMERICA: ADVANCED ENERGY [R]EVOLUTION SCENARIO

Table 13.3.15 Latin America: Electricity generation TWh/a

	2012	2020	2025	2030	2040	2050
Power plants	1,152	1,427	1,666	1,974	2,929	3,672
Hard coal (& non-renewable waste)	31	31	23	7	0	0
Lignite	7	7	5	1	0	0
Gas	198	194	183	144	67	22
<i>of which from H₂</i>	0	0	0	0	8	22
Oil	121	89	59	15	4	0
Diesel	29	25	15	10	1	0
Nuclear	22	18	11	0	0	0
Biomass (& renewable waste)	10	45	62	96	154	217
Hydro	722	797	799	811	817	820
Wind	8	130	275	438	940	1,255
<i>of which wind offshore</i>	0	30	85	148	430	580
PV	0	65	125	230	446	647
Geothermal	4	10	14	17	64	131
Solar thermal power plants	0	17	85	170	376	490
Ocean energy	0	0	10	35	60	90
Combined heat and power plants	63	81	114	160	288	400
Hard coal (& non-renewable waste)	1	0	0	0	0	0
Lignite	0	0	0	0	0	0
Gas	16	21	29	46	93	128
<i>of which from H₂</i>	0	0	0	0	11	128
Oil	6	6	3	0	0	0
Biomass (& renewable waste)	40	54	78	104	146	163
Geothermal	0	1	4	8	41	92
Hydrogen	0	0	0	1	7	18
CHP by producer						
Main activity producers	0	5	13	22	42	47
Autoproducers	63	76	101	138	246	353
Total generation	1,216	1,509	1,780	2,134	3,216	4,072
Fossil	409	374	317	223	146	0
Hard coal (& non-renewable waste)	32	32	23	7	0	0
Lignite	8	7	5	1	0	0
Gas	213	215	212	190	141	0
Oil	127	95	62	15	4	0
Diesel	29	25	15	10	1	0
Nuclear	22	18	11	0	0	0
Hydrogen	0	0	0	1	26	168
<i>of which renewable H₂</i>	0	0	0	1	25	168
Renewables (w/o renewable hydrogen)	784	1,117	1,452	1,909	3,045	3,904
Hydro	722	797	799	811	817	820
Wind	8	130	275	438	940	1,255
PV	0	65	125	230	446	647
Biomass (& renewable waste)	50	98	140	200	300	380
Geothermal	4	11	18	25	105	222
Solar thermal power plants	0	17	85	170	376	490
Ocean energy	0	0	10	35	60	90
Distribution losses	179	209	220	231	254	280
Own consumption electricity	50	57	58	58	60	61
Electricity for hydrogen production	0	0	64	135	556	1,146
Electricity for synfuel production	0	0	0	1	70	87
Final energy consumption (electricity)	987	1,245	1,441	1,711	2,279	2,500
Fluctuating RES (PV, Wind, Ocean)	8	195	410	703	1,446	1,992
Share of fluctuating RES	1%	13%	23%	33%	45%	49%
RES share (domestic generation)	64%	74%	82%	90%	95%	100%

Table 13.3.16 Latin America: Final energy consumption in transport PJ/a

	2012	2020	2025	2030	2040	2050
Road	6,326	7,052	6,580	5,941	4,409	3,664
Fossil fuels	5,561	5,620	4,426	3,079	669	0
Biofuels	557	992	1,106	1,319	1,163	758
Synfuels	0	0	0	1	81	78
Natural gas	207	273	444	419	146	0
Hydrogen	0	0	156	334	1,070	1,176
Electricity	0	168	448	789	1,361	1,731
Rail	128	163	208	257	415	442
Fossil fuels	109	108	80	49	11	0
Biofuels	0	3	14	16	20	4
Synfuels	0	0	0	0	1	0
Electricity	18	51	114	191	383	437
Navigation	122	164	188	205	258	307
Fossil fuels	122	159	170	154	90	0
Biofuels	0	5	19	51	157	278
Synfuels	0	0	0	0	11	29
Aviation	200	219	223	225	245	253
Fossil fuels	200	213	201	168	86	0
Biofuels	0	7	22	56	149	229
Synfuels	0	0	0	0	10	24
Total (incl. pipelines)	6,839	7,673	7,270	6,694	5,461	4,744
Fossil fuels	5,993	6,100	4,876	3,451	857	0
Biofuels (incl. biogas)	557	1,007	1,162	1,443	1,488	1,269
Synfuels	0	0	0	1	103	131
Natural gas	271	346	513	483	191	0
Hydrogen	0	0	156	334	1,070	1,176
Electricity	18	219	563	983	1,753	2,168
Total RES	569	1,169	1,748	2,622	4,280	4,744
RES share	8%	15%	24%	39%	78%	100%

Table 13.3.17 Latin America: Heat supply PJ/a

	2012	2020	2025	2030	2040	2050
District heating plants	0	3	9	22	79	109
Fossil fuels	0	0	1	2	2	0
Biomass	0	2	6	15	50	49
Solar collectors	0	0	1	3	16	38
Geothermal	0	0	1	2	12	22
Heat from CHP¹	134	227	385	602	1,388	2,539
Fossil fuels	60	78	104	155	288	0
Biomass	74	141	248	370	663	1,173
Geothermal	0	8	32	70	357	799
Hydrogen	0	0	1	7	80	567
Direct heating	7,354	8,536	8,145	8,337	7,923	6,653
Fossil fuels	4,221	4,560	3,549	3,005	1,234	0
Biomass	2,241	2,589	2,825	2,980	2,767	2,386
Solar collectors	22	301	514	825	1,364	1,356
Geothermal	0	6	26	55	150	176
Heat pumps ²	0	76	118	169	352	490
Electric direct heating	870	1,005	1,112	1,304	1,905	1,767
Hydrogen	0	0	0	0	150	477
Total heat supply³	7,487	8,766	8,538	8,961	9,390	9,301
Fossil fuels	4,281	4,638	3,654	3,162	1,524	0
Biomass	2,314	2,732	3,079	3,365	3,479	3,608
Solar collectors	22	301	515	828	1,380	1,394
Geothermal	0	14	59	127	520	997
Heat pumps ²	0	76	118	169	352	490
Electric direct heating	870	1,005	1,112	1,304	1,905	1,767
Hydrogen	0	0	1	7	230	1,045
RES share (including RES electricity)	39%	44%	55%	63%	83%	100%

1 public CHP and CHP autoproduction / 2 heat from ambient energy and electricity use / 3 incl. process heat, cooking

Table 13.3.18: Latin America: Installed capacity GW

	2012	2020	2025	2030	2040	2050
Total generation	272	408	517	658	1,039	1,310
Fossil	103	119	115	89	77	0
Hard coal (& non-renewable waste)	6	6	5	2	0	0
Lignite	2	1	1	0	0	0
Gas (w/o H ₂)	54	71	81	78	75	0
Oil	4	32	22	6	2	0
Diesel	8	9	5	4	0	0
Nuclear	3	2	2	0	0	0
Hydrogen (fuel cells, gas power plants, gas CHP)	0	0	0	0	12	80
Renewables	166	286	401	569	950	1,230
Hydro	148	164	165	167	168	169
Wind	4	41	82	128	280	344
<i>of which wind offshore</i>	0	8	21	36	102	137
PV	0	51	94	170	323	461
Biomass (& renewable waste)	14	23	32	45	73	105
Geothermal	0	6	23	45	93	94
Solar thermal power plants	0	0	3	10	17	25
Ocean energy	0	0	0	0	0	0
Fluctuating RES (PV, Wind, Ocean)	4	91	179	308	600	830
Share of fluctuating RES	1%	22%	35%	47%	58%	63%
RES share (domestic generation)	61%	70%	77%	86%	91%	94%

Table 13.3.19: Latin America: Final energy demand PJ/a

	2012	2020	2025	2030	2040	2050
Total (incl. non-energy use)	20,497	23,295	22,521	22,290	20,556	18,623
Total energy use	18,999	21,738	20,995	20,780	19,077	17,144
Transport	6,839	7,673	7,270	6,694	5,461	4,744
Oil products	5,993	6,100	4,876	3,451	857	0
Natural gas	271	346	513	483	191	0
Biofuels	557	1,007	1,162	1,443	1,488	1,269
Synfuels	0	0	0	1	103	131
Electricity	18	219	563	983	1,753	2,168
<i>RES electricity</i>	12	162	459	880	1,673	2,168
Hydrogen	0	0	156	334	1,070	1,176
RES share Transport	8%	15%	24%	39%	78%	100%
Industry	6,962	8,254	7,908	8,183	7,541	6,331
Electricity	1,599	1,903	2,066	2,365	2,947	2,903
<i>RES electricity</i>	1,012	1,409	1,685	2,117	2,813	2,903
Public district heat	1	11	53	55	87	110
<i>RES district heat</i>	1	10	45	45	69	110
Hard coal & lignite	373	611	565	458	27	0
Oil products	1,627	1,326	703	369	12	0
Gas	1,518	1,925	1,664	1,566	735	0
Solar	0	169	278	493	752	647
Biomass	1,874	2,270	2,498	2,740	2,555	2,240
Geothermal	0	39	81	137	328	382
Hydrogen	0	0	0	0	98	50
RES share Industry	41%	47%	58%	68%	88%	100%
Other Sectors	5,198	5,812	5,817	5,903	6,075	6,070
Electricity	1,987	2,359	2,559	2,813	3,503	3,929
<i>RES electricity</i>	1,269	1,748	2,087	2,519	3,342	3,929
Public district heat	0	25	45	106	225	230
<i>RES district heat</i>	0	22	39	87	180	230
Hard coal & lignite	3	7	6	4	0	0
Oil products	1,269	1,149	815	598	155	0
Gas	566	632	619	613	484	0
Solar	22	132	236	332	612	709
Biomass	1,370	1,488	1,509	1,398	951	586
Geothermal	0	19	29	39	81	162
Hydrogen	0	0	0	0	64	453
RES share Other Sectors	51%	59%	67%	74%	86%	100%
Total RES	6,117	8,476	10,235	12,529	16,117	17,144
RES share	32%	39%	49%	60%	84%	100%
Non energy use	1,498	1,657	1,526	1,510	1,479	1,479
Oil	969	866	803	749	645	578
Gas	524	654	656	664	680	710
Coal	5	37	67	97	154	191

1 excluding heat produced by CHP autoproducers

Table 13.3.20 Latin America: CO₂ emissions Mill t/a

	2012	2020	2025	2030	2040	2050
Condensation power plants	248	214	157	84	26	0
Hard coal (& non-renewable waste)	34	29	21	6	0	0
Lignite	10	8	5	1	0	0
Gas	101	89	77	58	23	0
Oil	67	58	38	9	2	0
Diesel	37	30	16	9	1	0
Combined heat and power plants	15	16	19	25	42	0
Hard coal (& non-renewable waste)	1	1	1	0	0	0
Lignite	0	0	0	0	0	0
Gas	10	12	16	25	42	0
Oil	4	4	2	0	0	0
CO₂ emissions power and CHP plants	263	230	176	109	68	0
Hard coal (& non-renewable waste)	35	29	21	6	0	0
Lignite	10	8	5	1	0	0
Gas	111	101	94	83	65	0
Oil & diesel	107	92	56	19	3	0

Table 13.3.22: Latin America: Investments in electricity generation

REF	UNIT	2012-2020	2021-2030	2031-2040	2041-2050	2012-2050	UNIT	ANNUAL AVERAGE 2012-2050
3 Fossil (w/o CHP)	billion \$	53.9	52.7	83.2	115.7	305.5	billion \$/a	7.8
Nuclear	billion \$	8.3	9.2	7.8	11.3	36.7	billion \$/a	0.9
CHP (fossil + renewable)	billion \$	22.3	27.8	11.8	6.2	68.0	billion \$/a	1.7
Renewables (w/o CHP)	billion \$	226.9	265.2	276.6	219.1	987.8	billion \$/a	25.3
Total	billion \$	311.4	354.8	379.4	352.4	1,398.0	billion \$/a	35.8
Conventional (fossil & nuclear)	billion \$	75.0	70.4	94.3	128.5	368.3	billion \$/a	9.4
Renewables	billion \$	236.4	284.4	285.1	223.9	1,029.8	billion \$/a	26.4
Biomass	billion \$	18.7	31.3	24.8	19.4	94.3	billion \$/a	2.4
Hydro	billion \$	181.8	205.3	192.5	128.5	708.1	billion \$/a	18.2
Wind	billion \$	21.0	26.0	36.6	42.9	126.5	billion \$/a	3.2
PV	billion \$	8.2	8.4	11.0	11.8	39.5	billion \$/a	1.0
Geothermal	billion \$	6.6	8.3	9.2	7.0	31.2	billion \$/a	0.8
Solar thermal power plants	billion \$	0.0	5.0	10.4	13.7	29.2	billion \$/a	0.7
Ocean energy	billion \$	0.0	0.0	0.5	0.6	1.0	billion \$/a	0.0
E[R]								
Fossil (w/o CHP)	billion \$	41.0	21.4	36.6	46.9	145.8	billion \$/a	3.7
Nuclear	billion \$	3.4	0.0	0.0	0.0	3.4	billion \$/a	0.1
CHP (fossil + renewable)	billion \$	51.3	90.3	98.7	86.5	326.9	billion \$/a	8.4
Renewables (w/o CHP)	billion \$	242.1	454.3	746.1	687.1	2,129.5	billion \$/a	54.6
Total	billion \$	337.8	566.0	881.3	820.5	2,605.6	billion \$/a	66.8
Conventional (fossil & nuclear)	billion \$	71.7	53.8	77.2	76.8	279.4	billion \$/a	7.2
Renewables	billion \$	266.1	512.2	804.2	743.7	2,326.2	billion \$/a	59.6
Biomass	billion \$	34.3	76.4	99.1	124.8	334.7	billion \$/a	8.6
Hydro	billion \$	105.7	66.2	69.1	70.3	311.4	billion \$/a	8.0
Wind	billion \$	48.9	119.8	199.6	236.8	605.1	billion \$/a	15.5
PV	billion \$	61.4	100.7	153.4	135.8	451.2	billion \$/a	11.6
Geothermal	billion \$	12.5	12.0	24.9	23.5	72.9	billion \$/a	1.9
Solar thermal power plants	billion \$	3.4	134.4	240.3	140.0	518.1	billion \$/a	13.3
Ocean energy	billion \$	0.0	2.6	17.7	12.5	32.8	billion \$/a	0.8
ADV E[R]								
Fossil (w/o CHP)	billion \$	37.3	11.9	32.0	14.1	95.3	billion \$/a	2.4
Nuclear	billion \$	3.4	0.0	0.0	0.0	3.4	billion \$/a	0.1
CHP (fossil + renewable)	billion \$	31.6	84.1	75.0	73.1	263.8	billion \$/a	6.8
Renewables (w/o CHP)	billion \$	337.6	745.0	1,054.8	895.5	3,033.0	billion \$/a	77.8
Total	billion \$	410.0	840.9	1,161.9	982.7	3,395.5	billion \$/a	87.1
Conventional (fossil & nuclear)	billion \$	57.6	40.6	62.3	33.9	194.4	billion \$/a	5.0
Renewables	billion \$	352.4	800.3	1,099.6	948.8	3,201.2	billion \$/a	82.1
Biomass	billion \$	32.8	80.9	95.4	130.4	339.4	billion \$/a	8.7
Hydro	billion \$	105.7	69.2	67.8	68.4	311.2	billion \$/a	8.0
Wind	billion \$	77.4	190.1	367.2	322.9	957.5	billion \$/a	24.6
PV	billion \$	88.2	155.8	208.3	199.8	652.1	billion \$/a	16.7
Geothermal	billion \$	12.5	12.0	52.7	65.9	143.0	billion \$/a	3.7
Solar thermal power plants	billion \$	35.9	241.9	285.0	135.1	697.9	billion \$/a	17.9
Ocean energy	billion \$	0.0	50.4	23.2	26.3	99.9	billion \$/a	2.6

Table 13.3.23: Latin America: Investments in renewable heat generation

REF	UNIT	2012-2020	2021-2030	2031-2040	2041-2050	2012-2050	UNIT	ANNUAL AVERAGE 2012-2050
Heat pumps	billion \$	0.0	0.0	0.0	0.0	0.0	billion \$/a	0.0
Deep geothermal	billion \$	0.0	0.0	0.0	0.0	0.0	billion \$/a	0.0
Solar thermal	billion \$	3.0	3.0	6.4	6.6	19.1	billion \$/a	0.5
Biomass	billion \$	74.4	96.8	37.4	27.9	236.4	billion \$/a	6.1
Total	billion \$	77.4	99.8	43.8	34.5	255.5	billion \$/a	6.6
E[R]								
Heat pumps	billion \$	17.4	19.3	51.7	51.9	140.4	billion \$/a	3.6
Deep geothermal	billion \$	1.4	10.1	23.9	13.9	49.3	billion \$/a	1.3
Solar thermal	billion \$	40.1	68.1	88.9	13.4	210.4	billion \$/a	5.4
Biomass	billion \$	92.3	85.9	2.1	0.5	180.8	billion \$/a	4.6
Total	billion \$	151.3	183.4	166.5	79.6	580.9	billion \$/a	14.9
ADV E[R]								
Heat pumps	billion \$	17.4	19.3	51.7	51.8	140.2	billion \$/a	3.6
Deep geothermal	billion \$	1.4	10.1	23.9	13.8	49.3	billion \$/a	1.3
Solar thermal	billion \$	40.1	68.1	88.9	13.3	210.4	billion \$/a	5.4
Biomass	billion \$	92.3	85.9	2.1	0.5	180.8	billion \$/a	4.6
Total	billion \$	151.3	183.4	166.6	79.3	580.7	billion \$/a	14.9

Table 13.3.24: Latin America: Total employment in the energy sector THOUSAND JOBS

By sector	REFERENCE SCENARIO				ADV E[R] SCENARIO		
	2015	2020	2025	2030	2020	2025	2030
Construction and installation	224	210	206	180	485	687	769
Manufacturing	99	96	97	89	230	361	552
Operations and maintenance	284	319	351	372	434	572	717
Fuel supply (domestic)	790	890	987	1,057	891	920	962
Coal and gas export	45.9	54.0	58.9	62.6	32.6	21.9	11.3
Solar and geothermal heat	29	29	27	24	438	321	411
Total jobs (thousands)	1,472	1,597	1,727	1,784	2,510	2,884	3,423
By technology							
Coal	88	81	89	109	34	27	13
Gas, oil & diesel	418	483	530	544	422	367	312
Nuclear	9	10	10	11	4	5	7
Renewable	958	1,024	1,098	1,120	2,050	2,485	3,092
Biomass	584	629	678	718	766	899	998
Hydro	299	303	320	303	103	122	113
Wind	19	25	31	32	207	267	511
PV	26	33	35	33	414	651	750
Geothermal power	2.3	3.0	2.9	2.8	6.2	7.5	20.8
Solar thermal power	0.3	1.6	3.2	6.1	84	165	254
Ocean	-	1	0	1	32.6	52.6	33
Solar - heat	28.9	28.8	27.3	24.2	388	289	375
Geothermal & heat pump	-	-	-	-	49	33	36
Total jobs (thousands)	1,472	1,597	1,727	1,784	2,510	2,884	3,423

OECD EUROPE: REFERENCE SCENARIO

Table 13.4.1 OECD Europe: Electricity generation TWh/a

	2012	2020	2025	2030	2040	2050
Power plants	2,928	3,237	3,444	3,650	4,091	4,414
Hard coal (& non-renewable waste)	454	415	409	406	441	488
Lignite	256	249	241	232	217	181
Gas	400	475	651	823	1,073	1,212
<i>of which from H₂</i>	0	0	0	0	0	0
Oil	35	12	8	6	0	2
Diesel	8	7	7	7	6	6
Nuclear	869	852	772	692	649	606
Biomass (& renewable waste)	55	83	89	96	108	117
Hydro	562	591	607	624	646	669
Wind	208	407	493	580	704	828
<i>of which wind offshore</i>	18	49	75	101	152	203
PV	67	124	135	146	163	182
Geothermal	10	13	14	16	20	25
Solar thermal power plants	4	10	14	18	32	49
Ocean energy	0	1	3	5	26	48
Combined heat and power plants	674	697	707	717	731	746
Hard coal (& non-renewable waste)	148	137	136	131	122	103
Lignite	90	87	86	84	79	75
Gas	306	326	330	339	355	375
<i>of which from H₂</i>	0	0	0	0	0	0
Oil	33	19	14	7	2	0
Biomass (& renewable waste)	96	126	139	152	168	186
Geothermal	2	2	3	3	4	6
Hydrogen	0	0	0	0	0	0
CHP by producer						
Main activity producers	477	496	504	511	522	532
Autoproducers	197	201	203	205	209	214
Total generation	3,602	3,935	4,151	4,366	4,822	5,160
Fossil	1,729	1,727	1,881	2,035	2,301	2,443
Hard coal (& non-renewable waste)	601	552	544	537	564	591
Lignite	346	336	326	316	296	256
Gas	706	800	981	1,162	1,428	1,587
Oil	68	31	22	13	7	2
Diesel	8	7	7	7	6	6
Nuclear	869	852	772	692	649	606
Hydrogen	0	0	0	0	0	0
<i>of which renewable H₂</i>	0	0	0	0	0	0
Renewables (w/o renewable hydrogen)	1,004	1,356	1,498	1,639	1,872	2,111
Hydro	562	591	607	624	646	669
Wind	208	407	493	580	704	828
PV	67	124	135	146	163	182
Biomass (& renewable waste)	151	209	228	248	275	303
Geothermal	12	15	17	19	25	31
Solar thermal power plants	4	10	14	18	32	49
Ocean energy	0	1	3	5	26	48
Distribution losses	248	275	292	308	341	366
Own consumption electricity	281	245	244	242	253	263
Electricity for hydrogen production	0	0	0	0	0	0
Electricity for synfuel production	0	0	0	0	0	0
Final energy consumption (electricity)	3,067	3,401	3,601	3,802	4,212	4,515
Fluctuating RES (PV, Wind, Ocean)	275	532	631	731	894	1,059
Share of fluctuating RES	8%	14%	15%	17%	19%	21%
RES share (domestic generation)	28%	34%	36%	38%	39%	41%

Table 13.4.2 OECD Europe: Final energy consumption in transport PJ/a

	2012	2020	2025	2030	2040	2050
Road	12,527	12,572	12,545	12,557	11,937	11,328
Fossil fuels	11,864	11,705	11,513	11,360	10,340	9,530
Biofuels	606	747	858	971	1,234	1,268
Synfuels	0	0	0	0	0	0
Natural gas	56	92	116	140	202	277
Hydrogen	0	0	0	0	0	0
Electricity	2	28	57	86	161	253
Rail	387	401	409	417	430	442
Fossil fuels	149	149	149	149	149	149
Biofuels	0	0	0	0	0	0
Synfuels	0	0	0	0	0	0
Electricity	238	253	260	268	282	293
Navigation	238	300	331	331	338	341
Fossil fuels	238	300	331	331	338	341
Biofuels	0	0	0	0	0	0
Synfuels	0	0	0	0	0	0
Aviation	262	400	450	491	507	518
Fossil fuels	262	400	450	491	507	518
Biofuels	0	0	0	0	0	0
Synfuels	0	0	0	0	0	0
Total (incl. pipelines)	13,467	13,731	13,794	13,858	13,279	12,699
Fossil fuels	12,512	12,554	12,443	12,331	11,334	10,538
Biofuels (incl. biogas)	606	747	858	971	1,234	1,268
Synfuels	0	0	0	0	0	0
Natural gas	109	149	176	202	267	347
Hydrogen	0	0	0	0	0	0
Electricity	240	281	318	354	443	546
Total RES	672	844	972	1,104	1,406	1,491
RES share	5%	6%	7%	8%	11%	12%

Table 13.4.3 OECD Europe: Heat supply PJ/a

	2012	2020	2025	2030	2040	2050
District heating plants	641	643	656	667	707	670
Fossil fuels	486	467	466	464	467	416
Biomass	149	163	172	182	207	209
Solar collectors	0	1	1	2	5	11
Geothermal	6	12	16	20	28	33
Heat from CHP¹	1,696	1,882	2,029	2,187	2,580	3,324
Fossil fuels	1,364	1,406	1,473	1,541	1,762	2,176
Biomass	322	460	537	624	787	1,108
Geothermal	10	15	19	23	31	40
Hydrogen	0	0	0	0	0	0
Direct heating	19,089	20,370	20,815	21,269	22,093	22,979
Fossil fuels	14,447	15,122	15,255	15,393	15,514	15,645
Biomass	1,916	2,266	2,458	2,635	3,013	3,400
Solar collectors	107	210	279	349	495	674
Geothermal	0	0	0	0	0	0
Heat pumps ²	163	230	266	301	408	546
Electric direct heating	2,457	2,523	2,557	2,592	2,663	2,714
Hydrogen	0	0	0	0	0	0
Total heat supply³	21,425	22,895	23,500	24,124	25,380	26,973
Fossil fuels	16,296	16,996	17,194	17,397	17,743	18,237
Biomass	2,387	2,908	3,167	3,441	4,007	4,717
Solar collectors	107	211	281	351	500	685
Geothermal	15	28	35	43	59	74
Heat pumps ²	163	230	266	301	408	546
Electric direct heating	2,457	2,523	2,557	2,592	2,663	2,714
Hydrogen	0	0	0	0	0	0
RES share (including RES electricity)	16%	19%	20%	21%	24%	27%

¹ public CHP and CHP autoproduction / ² heat from ambient energy and electricity use / ³ incl. process heat, cooking

Table 13.4.4: OECD Europe: Installed capacity GW

	2012	2020	2025	2030	2040	2050
Total generation	1,020	1,202	1,268	1,334	1,454	1,529
Fossil	483	525	555	584	637	642
Hard coal (& non-renewable waste)	117	114	108	102	102	102
Lignite	67	69	65	60	54	44
Gas (w/o H ₂)	240	305	353	402	466	486
Oil	53	30	21	13	8	3
Diesel	6	7	7	7	7	7
Nuclear	127	123	111	99	91	85
Hydrogen (fuel cells, gas power plants, gas CHP)	0	0	0	0	0	0
Renewables	409	553	602	651	727	803
Hydro	202	214	220	225	232	240
Wind	102	176	205	235	273	310
<i>of which wind offshore</i>	5	14	21	28	41	53
PV	68	113	123	132	145	156
Biomass (& renewable waste)	33	44	46	49	53	59
Geothermal	2	3	4	3	3	4
Solar thermal power plants	2	3	4	5	9	14
Ocean energy	0	0	1	2	11	19
Fluctuating RES (PV, Wind, Ocean)	170	290	330	369	429	485
Share of fluctuating RES	17%	24%	26%	28%	29%	32%
RES share (domestic generation)	40%	46%	47%	49%	50%	52%

Table 13.4.5: OECD Europe: Final energy demand PJ/a

	2012	2020	2025	2030	2040	2050
Total (incl. non-energy use)	50,988	53,477	54,372	55,268	56,140	56,709
Total energy use	46,619	49,210	50,247	51,284	52,544	53,500
Transport	13,467	13,731	13,794	13,858	13,279	12,699
Oil products	12,512	12,554	12,443	12,331	11,334	10,538
Natural gas	109	149	176	202	267	347
Biofuels	606	747	858	971	1,234	1,268
Synfuels	0	0	0	0	0	0
Electricity	240	281	318	354	443	546
<i>RES electricity</i>	67	97	115	133	172	223
Hydrogen	0	0	0	0	0	0
RES share Transport	5%	6%	7%	8%	11%	12%
Industry	12,059	12,388	12,331	12,274	11,996	11,547
Electricity	4,030	4,439	4,543	4,648	4,806	4,945
<i>RES electricity</i>	1,140	1,530	1,640	1,745	1,896	2,023
Public district heat	677	685	671	657	625	576
<i>RES district heat</i>	68	175	186	195	199	190
Hard coal & lignite	1,237	1,246	1,189	1,131	1,005	820
Oil products	1,375	1,261	1,170	1,078	998	724
Gas	3,900	3,743	3,650	3,556	3,350	3,091
Solar	12	15	18	20	31	42
Biomass	767	997	1,089	1,180	1,280	1,346
Geothermal	2	2	2	2	2	3
Hydrogen	0	0	0	0	0	0
RES share Industry	16%	22%	24%	26%	28%	31%
Other Sectors	21,092	23,092	24,122	25,152	27,269	29,254
Electricity	6,710	7,523	8,104	8,684	9,915	10,765
<i>RES electricity</i>	1,870	2,594	2,925	3,261	3,850	4,403
Public district heat	1,269	1,390	1,512	1,633	1,900	2,199
<i>RES district heat</i>	127	356	419	486	604	725
Hard coal & lignite	860	827	828	828	834	839
Oil products	3,233	3,046	2,760	2,473	1,936	1,499
Gas	7,026	7,946	8,381	8,816	9,495	10,212
Solar	95	195	262	328	464	632
Biomass	1,790	2,005	2,090	2,175	2,428	2,701
Geothermal	109	158	186	214	297	407
Hydrogen	0	0	0	0	0	0
RES share Other Sectors	19%	23%	24%	26%	28%	30%
Total RES	6,650	8,872	9,787	10,711	12,427	13,963
RES share	14%	18%	19%	21%	24%	26%
Non energy use	4,370	4,267	4,125	3,984	3,596	3,209

Table 13.4.8 OECD Europe: Electricity generation TWh/a

	2012	2020	2025	2030	2040	2050
Power plants	2,928	2,999	2,954	3,004	3,384	3,694
Hard coal (& non-renewable waste)	454	327	251	216	44	4
Lignite	256	183	59	22	0	0
Gas	400	540	554	554	343	56
of which from H ₂	0	0	0	0	0	0
Oil	35	3	0	0	0	0
Diesel	8	7	6	5	3	1
Nuclear	869	560	360	80	0	0
Biomass (& renewable waste)	55	100	102	100	90	79
Hydro	562	591	596	600	610	620
Wind	208	479	682	915	1,349	1,592
of which wind offshore	18	58	121	211	431	563
PV	67	183	276	376	577	723
Geothermal	10	12	24	39	70	161
Solar thermal power plants	4	12	31	68	208	327
Ocean energy	0	2	12	30	90	130
Combined heat and power plants	674	721	763	805	790	710
Hard coal (& non-renewable waste)	148	104	64	36	0	0
Lignite	90	67	26	3	0	0
Gas	306	350	371	376	307	183
of which from H ₂	0	0	0	0	9	26
Oil	33	24	7	0	0	0
Biomass (& renewable waste)	96	171	278	351	366	351
Geothermal	2	5	15	39	111	149
Hydrogen	0	0	0	0	6	27
CHP by producer						
Main activity producers	477	510	525	540	515	460
Autoproducers	197	211	238	265	275	250
Total generation	3,602	3,720	3,716	3,809	4,174	4,404
Fossil	1,729	1,605	1,339	1,212	688	219
Hard coal (& non-renewable waste)	601	431	315	252	44	4
Lignite	346	250	85	25	0	0
Gas	706	890	925	930	641	214
Oil	68	27	8	0	0	0
Diesel	8	7	6	5	3	1
Nuclear	869	560	360	80	0	0
Hydrogen	0	0	0	0	15	53
of which renewable H ₂	0	0	0	0	13	50
Renewables (w/o renewable hydrogen)	1,004	1,555	2,017	2,517	3,470	4,132
Hydro	562	591	596	600	610	620
Wind	208	479	682	915	1,349	1,592
PV	67	183	276	376	577	723
Biomass (& renewable waste)	151	272	380	451	456	430
Geothermal	12	17	39	77	180	309
Solar thermal power plants	4	12	31	68	208	327
Ocean energy	0	2	12	30	90	130
Distribution losses	248	255	245	240	230	230
Own consumption electricity	281	240	228	217	173	134
Electricity for hydrogen production	0	2	35	146	606	1,016
Electricity for synfuel production	0	0	0	0	0	0
Final energy consumption (electricity)	3,067	3,238	3,252	3,340	3,465	3,424
Fluctuating RES (PV, Wind, Ocean)	275	664	970	1,321	2,016	2,446
Share of fluctuating RES	8%	18%	26%	35%	48%	56%
RES share (domestic generation)	28%	42%	54%	66%	83%	95%

Table 13.4.9 OECD Europe: Final energy consumption in transport PJ/a

	2012	2020	2025	2030	2040	2050
Road	12,527	11,069	9,519	8,157	5,690	4,925
Fossil fuels	11,864	10,221	8,405	6,376	2,025	554
Biofuels	606	618	584	517	415	321
Synfuels	0	0	0	0	0	0
Natural gas	56	111	143	150	164	177
Hydrogen	0	5	86	370	1,389	1,885
Electricity	2	114	301	744	1,697	1,987
Rail	387	407	412	417	434	446
Fossil fuels	149	133	114	81	48	19
Biofuels	0	7	6	19	19	10
Synfuels	0	0	0	0	0	0
Electricity	238	267	292	317	367	417
Navigation	238	290	284	265	247	240
Fossil fuels	238	276	269	241	198	156
Biofuels	0	15	14	24	49	84
Synfuels	0	0	0	0	0	0
Aviation	262	380	400	410	390	370
Fossil fuels	262	380	389	385	312	240
Biofuels	0	0	11	25	78	130
Synfuels	0	0	0	0	0	0
Total (incl. pipelines)	13,467	12,196	10,660	9,289	6,792	6,000
Fossil fuels	12,512	11,009	9,177	7,084	2,583	969
Biofuels (incl. biogas)	606	639	616	585	561	544
Synfuels	0	0	0	0	0	0
Natural gas	109	161	187	189	189	186
Hydrogen	0	5	86	370	1,389	1,885
Electricity	240	381	594	1,062	2,070	2,415
Total RES	672	801	985	1,531	3,448	4,628
RES share	5%	7%	9%	16%	51%	77%

Table 13.4.10 OECD Europe: Heat supply PJ/a

	2012	2020	2025	2030	2040	2050
District heating plants	641	645	807	859	1,244	1,464
Fossil fuels	486	429	337	262	119	59
Biomass	149	190	242	245	261	249
Solar collectors	0	6	145	219	585	849
Geothermal	6	19	83	133	279	307
Heat from CHP¹	1,696	1,962	2,370	2,756	3,358	3,885
Fossil fuels	1,364	1,311	1,176	1,049	801	519
Biomass	322	618	1,087	1,426	1,645	1,934
Geothermal	10	33	107	278	837	1,156
Hydrogen	0	0	0	3	75	276
Direct heating	19,089	18,537	17,477	16,505	14,684	12,797
Fossil fuels	14,447	13,132	11,044	8,984	5,139	1,919
Biomass	1,916	2,128	2,119	2,041	1,864	1,691
Solar collectors	107	355	1,004	1,597	2,476	2,963
Geothermal	0	0	0	0	0	0
Heat pumps ²	163	435	840	1,459	2,902	3,617
Electric direct heating	2,457	2,487	2,471	2,424	2,247	2,256
Hydrogen	0	0	0	0	58	351
Total heat supply³	21,425	21,144	20,654	20,120	19,287	18,145
Fossil fuels	16,296	14,872	12,556	10,295	6,059	2,496
Biomass	2,387	2,937	3,448	3,712	3,770	3,874
Solar collectors	107	362	1,149	1,816	3,061	3,811
Geothermal	15	52	190	411	1,116	1,463
Heat pumps ²	163	435	840	1,459	2,902	3,617
Electric direct heating	2,457	2,487	2,471	2,424	2,247	2,256
Hydrogen	0	0	0	3	132	627
RES share (including RES electricity)	16%	23%	34%	45%	67%	86%

1 public CHP and CHP autoproduction / 2 heat from ambient energy and electricity use / 3 incl. process heat, cooking

Table 13.4.10: OECD Europe: Installed capacity GW

	2012	2020	2025	2030	2040	2050
Total generation	1,020	1,220	1,288	1,434	1,731	1,848
Fossil	483	487	392	369	293	164
Hard coal (& non-renewable waste)	117	89	63	50	9	1
Lignite	67	51	17	5	0	0
Gas (w/o H ₂)	240	313	299	309	281	162
Oil	53	26	7	0	0	0
Diesel	6	7	6	5	3	1
Nuclear	127	81	52	11	0	0
Hydrogen (fuel cells, gas power plants, gas CHP)	0	0	0	0	6	20
Renewables	409	653	844	1,053	1,432	1,664
Hydro	202	214	216	216	219	223
Wind	102	207	281	363	502	570
of which wind offshore	5	16	34	59	117	148
PV	68	168	252	341	513	620
Biomass (& renewable waste)	33	57	77	95	97	100
Geothermal	2	2	5	10	24	41
Solar thermal power plants	2	4	8	16	43	65
Ocean energy	0	1	5	12	34	45
Fluctuating RES (PV, Wind, Ocean)	170	376	538	716	1,049	1,235
Share of fluctuating RES	17%	31%	42%	50%	61%	67%
RES share (domestic generation)	40%	53%	66%	73%	83%	90%

Table 13.4.12: OECD Europe: Final energy demand PJ/a

	2012	2020	2025	2030	2040	2050
Total (incl. non-energy use)	50,988	49,081	45,889	42,821	37,012	32,989
Total energy use	46,819	44,814	41,764	38,837	33,416	29,780
Transport	13,467	12,196	10,660	9,289	6,792	6,000
Oil products	12,512	11,009	9,177	7,084	2,583	969
Natural gas	109	161	187	189	189	186
Biofuels	606	639	616	585	561	544
Synfuels	0	0	0	0	0	0
Electricity	240	381	594	1,062	2,070	2,415
RES electricity	67	159	322	702	1,727	2,293
Hydrogen	0	5	86	370	1,389	1,885
RES share Transport	5%	7%	9%	16%	51%	77%
Industry	12,059	11,880	11,350	10,784	9,660	8,758
Electricity	4,030	4,241	4,196	4,209	4,204	4,133
RES electricity	1,140	1,773	2,277	2,781	3,509	3,925
Public district heat	677	729	797	908	1,004	955
RES district heat	140	248	430	593	821	858
Hard coal & lignite	1,237	1,035	605	332	153	46
Oil products	1,375	1,011	574	295	105	14
Gas	3,900	3,767	3,780	3,397	2,058	1,053
Solar	12	87	292	475	736	874
Biomass	767	959	1,016	970	869	832
Geothermal	2	51	91	197	469	481
Hydrogen	0	0	0	0	62	369
RES share Industry	17%	26%	36%	47%	67%	84%
Other Sectors	21,092	20,739	19,754	18,764	16,963	15,022
Electricity	6,710	7,033	6,918	6,753	6,201	5,778
RES electricity	1,870	2,940	3,755	4,461	5,175	5,487
Public district heat	1,269	1,420	1,787	1,932	2,308	2,517
RES district heat	262	482	964	1,261	1,886	2,261
Hard coal & lignite	860	561	180	0	0	0
Oil products	3,233	2,676	1,751	1,181	382	49
Gas	7,026	6,692	6,178	5,300	3,248	1,176
Solar	95	268	712	1,122	1,740	2,089
Biomass	1,790	1,836	1,724	1,629	1,425	1,181
Geothermal	109	252	503	848	1,659	2,233
Hydrogen	0	0	0	0	0	0
RES share Other Sectors	20%	28%	39%	50%	70%	88%
Total RES	6,857	9,698	12,749	15,868	21,787	25,197
RES share	15%	22%	31%	41%	65%	85%
Non energy use	4,370	4,267	4,125	3,984	3,596	3,208
Oil	3,844	3,571	3,333	3,091	2,521	2,057
Coal	471	500	504	514	500	511
Gas	55	196	289	378	575	642

OECD EUROPE: ADVANCED ENERGY [R]EVOLUTION SCENARIO

Table 13.4.15 OECD Europe: Electricity generation TWh/a

	2012	2020	2025	2030	2040	2050
Power plants	2,928	3,028	3,088	3,346	4,183	5,054
Hard coal (& non-renewable waste)	454	323	248	199	13	0
Lignite	256	183	59	22	0	0
Gas	400	540	554	554	283	70
of which from H ₂	0	0	3	11	40	70
Oil	35	3	0	0	0	0
Diesel	8	7	6	5	3	0
Nuclear	869	560	360	80	0	0
Biomass (& renewable waste)	55	120	122	120	120	102
Hydro	562	591	596	600	610	620
Wind	208	485	736	1,068	1,822	2,351
of which wind offshore	18	60	150	294	625	901
PV	67	188	325	468	760	1,080
Geothermal	1	13	33	66	144	241
Solar thermal power plants	4	13	36	128	318	430
Ocean energy	0	2	14	35	110	160
Combined heat and power plants	674	721	763	805	790	710
Hard coal (& non-renewable waste)	148	104	64	36	0	0
Lignite	90	67	26	3	0	0
Gas	306	350	371	376	307	170
of which from H ₂	0	0	2	8	43	170
Oil	33	24	7	0	0	0
Biomass (& renewable waste)	96	171	278	351	366	365
Geothermal	2	5	15	39	111	149
Hydrogen	0	0	0	0	6	27
CHP by producer						
Main activity producers	477	510	525	540	515	460
Autoproducers	197	211	238	265	275	250
Total generation	3,602	3,749	3,851	4,151	4,973	5,764
Fossil	1,729	1,601	1,331	1,177	524	0
Hard coal (& non-renewable waste)	601	427	312	235	13	0
Lignite	346	250	85	25	0	0
Gas	706	890	920	911	507	0
Oil	68	27	8	0	0	0
Diesel	8	7	6	5	3	0
Nuclear	869	560	360	80	0	0
Hydrogen	0	0	5	19	89	267
of which renewable H ₂	0	0	3	13	80	267
Renewables (w/o renewable hydrogen)	1,004	1,588	2,155	2,875	4,360	5,498
Hydro	562	591	596	600	610	620
Wind	208	485	736	1,068	1,822	2,351
PV	67	188	325	468	760	1,080
Biomass (& renewable waste)	151	292	400	471	486	467
Geothermal	12	18	48	104	255	390
Solar thermal power plants	4	13	36	128	318	430
Ocean energy	0	2	14	35	110	160
Distribution losses	248	255	245	240	230	230
Own consumption electricity	281	240	228	217	173	134
Electricity for hydrogen production	0	18	93	295	1,022	1,924
Electricity for synfuel production	0	0	21	37	90	207
Final energy consumption (electricity)	3,067	3,250	3,309	3,515	3,859	3,889
Fluctuating RES (PV, Wind, Ocean)	275	675	1,075	1,571	2,692	3,591
Share of fluctuating RES	8%	18%	28%	38%	54%	62%
RES share (domestic generation)	28%	42%	56%	70%	89%	100%

Table 13.4.16 OECD Europe: Final energy consumption in transport PJ/a

	2012	2020	2025	2030	2040	2050
Road	12,527	10,985	9,099	7,406	4,404	3,505
Fossil fuels	11,864	10,080	7,823	5,468	917	0
Biofuels	606	618	602	496	382	194
Synfuels	0	0	28	45	90	112
Natural gas	56	109	122	98	27	0
Hydrogen	0	45	147	450	1,383	1,611
Electricity	2	132	404	894	1,695	1,700
Rail	387	422	494	570	743	866
Fossil fuels	149	122	93	64	24	0
Biofuels	0	6	9	10	13	9
Synfuels	0	0	0	1	3	5
Electricity	238	294	392	495	703	852
Navigation	238	290	284	265	247	240
Fossil fuels	238	276	281	229	161	0
Biofuels	0	15	3	33	70	152
Synfuels	0	0	0	3	17	87
Aviation	262	376	388	385	339	296
Fossil fuels	262	376	386	335	221	0
Biofuels	0	0	2	46	96	188
Synfuels	0	0	0	4	23	108
Total (incl. pipelines)	13,467	12,123	10,336	8,710	5,851	5,034
Fossil fuels	12,512	10,854	8,583	6,096	1,322	0
Biofuels (incl. biogas)	606	639	616	585	561	544
Synfuels	0	0	28	53	133	312
Natural gas	109	158	165	134	43	0
Hydrogen	0	45	147	450	1,383	1,611
Electricity	240	426	797	1,392	2,409	2,567
Total RES	672	839	1,161	1,903	4,065	5,034
RES share	5%	7%	11%	22%	69%	100%

Table 13.4.17 OECD Europe: Heat supply PJ/a

	2012	2020	2025	2030	2040	2050
District heating plants	641	645	807	859	1,244	1,436
Fossil fuels	486	429	337	262	119	0
Biomass	149	190	242	245	261	244
Solar collectors	0	6	145	219	585	833
Geothermal	6	19	83	133	279	359
Heat from CHP¹	1,696	1,962	2,370	2,756	3,358	3,913
Fossil fuels	1,364	1,311	1,171	1,031	713	0
Biomass	322	618	1,087	1,426	1,645	2,005
Geothermal	10	33	107	278	837	1,156
Hydrogen	0	0	4	21	163	752
Direct heating	19,089	18,537	17,477	16,505	14,684	12,797
Fossil fuels	14,447	13,132	11,000	8,831	4,057	0
Biomass	1,916	2,128	2,119	2,041	1,864	1,691
Solar collectors	107	355	1,004	1,597	2,624	3,184
Geothermal	0	0	0	0	0	0
Heat pumps ²	163	435	840	1,459	2,992	3,786
Electric direct heating	2,457	2,487	2,471	2,424	2,555	2,605
Hydrogen	0	0	43	153	593	1,531
Total heat supply³	21,245	21,144	20,654	20,120	19,287	18,145
Fossil fuels	16,296	14,872	12,509	10,124	4,889	0
Biomass	2,387	2,937	3,448	3,712	3,770	3,940
Solar collectors	107	362	1,149	1,816	3,209	4,016
Geothermal	15	52	190	411	1,116	1,515
Heat pumps ²	163	435	840	1,459	2,992	3,786
Electric direct heating	2,457	2,487	2,471	2,424	2,555	2,605
Hydrogen	0	0	48	174	756	2,283
RES share (including RES electricity)	16%	23%	35%	46%	73%	100%

¹ public CHP and CHP autoproduction / ² heat from ambient energy and electricity use / ³ incl. process heat, cooking

Table 13.4.18: OECD Europe: Installed capacity GW

	2012	2020	2025	2030	2040	2050
Total generation	1,020	1,203	1,349	1,577	2,066	2,460
Fossil	483	458	380	344	217	0
Hard coal (& non-renewable waste)	117	88	62	47	3	0
Lignite	67	51	17	5	0	0
Gas (w/o H ₂)	240	286	288	287	211	0
Oil	53	26	7	0	0	0
Diesel	6	7	6	5	3	0
Nuclear	127	81	52	11	0	0
Hydrogen (fuel cells, gas power plants, gas CHP)	0	0	1	6	36	181
Renewables	409	664	915	1,216	1,813	2,279
Hydro	202	214	216	216	219	223
Wind	102	210	300	416	672	831
of which wind offshore	5	17	42	82	169	237
PV	68	173	297	425	675	926
Biomass (& renewable waste)	33	61	81	100	105	108
Geothermal	2	2	6	14	34	52
Solar thermal power plants	2	4	10	30	66	85
Ocean energy	0	1	6	14	42	53
Fluctuating RES (PV, Wind, Ocean)	170	383	603	856	1,388	1,811
Share of fluctuating RES	17%	32%	45%	54%	67%	74%
RES share (domestic generation)	40%	55%	68%	77%	88%	93%

Table 13.4.19: OECD Europe: Final energy demand PJ/a

	2012	2020	2025	2030	2040	2050
Total (incl. non-energy use)	50,988	49,008	45,565	42,458	36,562	32,798
Total energy use	46,619	44,742	41,440	38,475	32,866	29,589
Transport	13,467	12,123	10,336	8,710	5,851	5,034
Oil products	12,512	10,854	8,583	6,096	1,322	0
Natural gas	109	158	165	134	43	0
Biofuels	606	639	616	585	561	544
Synfuels	0	0	28	53	133	312
Electricity	400	426	797	1,392	2,409	2,567
RES electricity	247	181	447	969	2,151	2,567
Hydrogen	0	45	147	450	1,383	1,611
RES share Transport	5%	7%	11%	22%	69%	100%
Industry	12,059	11,880	11,350	10,826	9,758	8,911
Electricity	4,090	4,241	4,196	4,268	4,444	4,548
RES electricity	1,140	1,797	2,351	2,970	3,967	4,548
Public district heat	677	729	797	906	1,004	955
RES district heat	140	248	430	598	834	955
Hard coal & lignite	1,237	1,035	605	332	137	0
Oil products	1,375	1,011	574	285	88	0
Gas	3,900	3,767	3,761	3,323	1,684	0
Solar	12	87	292	475	768	990
Biomass	767	959	1,016	970	869	832
Geothermal	2	51	91	197	493	568
Hydrogen	0	0	19	67	271	1,018
RES share Industry	17%	26%	37%	49%	74%	100%
Other Sectors	21,092	20,739	19,754	18,939	17,357	15,644
Electricity	6,710	7,033	6,918	6,995	7,038	6,887
RES electricity	1,870	2,980	3,877	4,867	6,284	6,887
Public district heat	1,269	1,420	1,787	1,932	2,308	2,517
RES district heat	262	482	965	1,267	1,916	2,517
Hard coal & lignite	860	561	180	0	0	0
Oil products	3,233	2,676	1,751	1,140	317	0
Gas	7,026	6,692	6,148	5,170	2,341	0
Solar	95	268	712	1,122	1,856	2,193
Biomass	1,790	1,836	1,724	1,629	1,425	1,181
Geothermal	109	252	503	848	1,702	2,272
Hydrogen	0	0	30	104	370	594
RES share Other Sectors	20%	28%	39%	52%	78%	100%
Total RES	6,857	9,799	13,150	16,962	24,750	29,589
RES share	15%	22%	32%	44%	75%	100%
Non energy use	4,370	4,267	4,125	3,984	3,596	3,209
Oil	3,844	3,571	3,333	3,091	2,621	2,057
Gas	471	500	504	514	600	511
Coal	55	196	289	378	575	642

¹ excluding heat produced by CHP autoproducers

Table 13.4.20 OECD Europe: CO₂ emissions Mill t/a

Table 13.4.22: OECD Europe: Investments in electricity generation

REF	UNIT	2012-2020	2021-2030	2031-2040	2041-2050	2012-2050	UNIT	ANNUAL AVERAGE 2012-2050
Fossil (w/o CHP)	billion \$	177.1	187.9	202.1	243.1	810.2	billion \$/a	20.8
Nuclear	billion \$	135.6	17.1	79.8	77.7	310.1	billion \$/a	8.0
CHP (fossil + renewable)	billion \$	190.8	133.8	73.9	27.0	425.5	billion \$/a	10.9
Renewables (w/o CHP)	billion \$	520.5	461.4	632.2	537.2	2,151.3	billion \$/a	55.2
Total	billion \$	1,024.0	800.2	988.0	884.9	3,697.1	billion \$/a	94.8
Conventional (fossil & nuclear)	billion \$	458.6	285.2	311.4	321.1	1,376.4	billion \$/a	35.3
Renewables	billion \$	565.4	515.0	676.6	563.8	2,320.8	billion \$/a	59.5
Biomass	billion \$	63.8	71.3	68.2	47.1	250.4	billion \$/a	6.4
Hydro	billion \$	128.8	133.9	126.5	134.0	523.2	billion \$/a	13.4
Wind	billion \$	208.7	228.8	296.1	280.5	1,014.1	billion \$/a	26.0
PV	billion \$	138.4	52.4	109.9	39.8	340.6	billion \$/a	8.7
Geothermal	billion \$	9.9	8.2	11.2	8.7	38.0	billion \$/a	1.0
Solar thermal power plants	billion \$	13.9	11.8	33.4	32.9	92.0	billion \$/a	2.4
Ocean energy	billion \$	1.9	8.6	31.1	20.8	62.4	billion \$/a	1.6
E[R]								
Fossil (w/o CHP)	billion \$	148.9	81.3	66.8	96.6	393.7	billion \$/a	10.1
Nuclear	billion \$	61.1	0.0	0.0	0.0	61.1	billion \$/a	1.6
CHP (fossil + renewable)	billion \$	224.4	259.6	195.3	179.0	858.2	billion \$/a	22.0
Renewables (w/o CHP)	billion \$	685.0	994.7	1,323.5	1,174.6	4,177.7	billion \$/a	107.1
Total	billion \$	1,119.4	1,335.5	1,585.6	1,450.2	5,490.7	billion \$/a	140.8
Conventional (fossil & nuclear)	billion \$	349.0	137.6	110.2	96.6	693.5	billion \$/a	17.8
Renewables	billion \$	770.4	1,197.9	1,475.4	1,353.6	4,797.2	billion \$/a	123.0
Biomass	billion \$	108.1	184.3	102.8	140.4	535.6	billion \$/a	13.7
Hydro	billion \$	128.8	105.5	110.9	117.8	462.9	billion \$/a	11.9
Wind	billion \$	268.2	448.2	590.0	546.8	1,853.2	billion \$/a	47.5
PV	billion \$	232.2	257.4	326.2	240.2	1,056.0	billion \$/a	27.1
Geothermal	billion \$	13.3	73.5	111.5	135.6	333.9	billion \$/a	8.6
Solar thermal power plants	billion \$	15.4	71.3	153.8	138.7	379.2	billion \$/a	9.7
Ocean energy	billion \$	4.3	57.7	80.3	34.1	176.4	billion \$/a	4.5
ADV E[R]								
Fossil (w/o CHP)	billion \$	126.4	85.5	56.0	112.0	380.0	billion \$/a	9.7
Nuclear	billion \$	61.1	0.0	0.0	0.0	61.1	billion \$/a	1.6
CHP (fossil + renewable)	billion \$	224.4	259.6	195.3	188.9	868.1	billion \$/a	22.3
Renewables (w/o CHP)	billion \$	711.2	1,347.5	1,767.3	1,649.9	5,476.0	billion \$/a	140.4
Total	billion \$	1,123.1	1,692.6	2,018.6	1,950.9	6,785.2	billion \$/a	174.0
Conventional (fossil & nuclear)	billion \$	326.5	141.9	99.4	112.0	679.8	billion \$/a	17.4
Renewables	billion \$	796.6	1,550.7	1,919.3	1,838.9	6,105.4	billion \$/a	156.5
Biomass	billion \$	117.8	186.1	118.9	146.8	569.6	billion \$/a	14.6
Hydro	billion \$	128.8	105.5	110.9	117.8	462.9	billion \$/a	11.9
Wind	billion \$	273.7	579.2	833.0	850.1	2,536.0	billion \$/a	65.0
PV	billion \$	240.1	363.8	410.6	413.3	1,427.9	billion \$/a	36.6
Geothermal	billion \$	14.7	99.4	148.0	144.1	406.1	billion \$/a	10.4
Solar thermal power plants	billion \$	17.1	148.7	199.3	128.1	493.3	billion \$/a	12.6
Ocean energy	billion \$	4.3	68.0	98.6	38.7	209.6	billion \$/a	5.4

Table 13.4.23: OECD Europe: Investments in renewable heat generation

REF	UNIT	2012-2020	2021-2030	2031-2040	2041-2050	2012-2050	UNIT	ANNUAL AVERAGE 2012-2050
Heat pumps	billion \$	46.8	46.2	55.0	60.1	208.0	billion \$/a	5.3
Deep geothermal	billion \$	6.2	0.5	10.0	6.1	22.8	billion \$/a	0.6
Solar thermal	billion \$	47.3	50.3	71.0	71.0	239.7	billion \$/a	6.1
Biomass	billion \$	169.2	200.1	81.2	71.7	522.2	billion \$/a	13.4
Total	billion \$	269.5	297.1	217.2	208.9	992.7	billion \$/a	25.5
E[R]								
Heat pumps	billion \$	104.0	319.8	454.9	460.6	1,339.2	billion \$/a	34.3
Deep geothermal	billion \$	10.8	8.2	88.7	37.6	145.3	billion \$/a	3.7
Solar thermal	billion \$	91.4	376.1	328.0	424.0	1,219.4	billion \$/a	31.3
Biomass	billion \$	89.8	22.1	3.0	0.0	114.9	billion \$/a	2.9
Total	billion \$	296.0	726.2	874.6	922.1	2,818.9	billion \$/a	72.3
ADV E[R]								
Heat pumps	billion \$	104.0	319.8	477.0	479.0	1,379.7	billion \$/a	35.4
Deep geothermal	billion \$	10.8	8.2	88.7	93.6	201.3	billion \$/a	5.2
Solar thermal	billion \$	91.4	376.1	364.4	437.0	1,269.0	billion \$/a	32.5
Biomass	billion \$	89.8	22.1	3.0	0.3	115.2	billion \$/a	3.0
Total	billion \$	296.0	726.2	933.1	1,009.9	2,965.2	billion \$/a	76.0

Table 13.4.24: OECD Europe: Total employment in the energy sector THOUSAND JOBS

By sector	REFERENCE SCENARIO				ADV E[R] SCENARIO		
	2015	2020	2025	2030	2020	2025	2030
Construction and installation	138	83	90	85	388	458	442
Manufacturing	119	75	72	58	437	516	533
Operations and maintenance	380	402	405	407	443	535	623
Fuel supply (domestic)	551	526	514	502	540	513	475
Coal and gas export	-	-	-	-	-	-	-
Solar and geothermal heat	89	59	71	68	243	753	691
Total jobs (thousands)	1,278	1,145	1,152	1,120	2,051	2,774	2,764
By technology							
Coal	294	253	228	209	246	177	135
Gas, oil & diesel	175	178	180	176	162	166	157
Nuclear	84	82	81	80	96	101	110
Renewable	725	631	662	654	1,547	2,330	2,363
Biomass	276	296	313	328	391	459	455
Hydro	60	57	59	58	48	48	51
Wind	129	116	122	110	341	434	486
PV	164	93	86	70	468	517	512
Geothermal power	1.8	1.6	1.5	1.4	10	15	20
Solar thermal power	5.5	6.5	7.2	10.0	29	71	102
Ocean	0.6	2.3	2.7	8.7	16.6	32	46
Solar - heat	74	48	60	59	186	636	544
Geothermal & heat pump	14.7	10.7	10.2	9.6	57	117	146
Total jobs (thousands)	1,278	1,145	1,152	1,120	2,051	2,774	2,764

AFRICA: REFERENCE SCENARIO

Table 13.5.1 Africa: Electricity generation TWh/a

	2012	2020	2025	2030	2040	2050
Power plants	716	1,014	1,237	1,457	2,068	2,680
Hard coal (& non-renewable waste)	256	314	352	389	501	649
Lignite	0	0	0	0	0	0
Gas	256	384	482	579	823	917
of which from H ₂	0	0	0	0	0	0
Oil	68	86	79	71	64	60
Diesel	5	7	9	11	15	16
Nuclear	13	13	19	25	41	65
Biomass (& renewable waste)	2	9	16	23	39	61
Hydro	112	167	212	258	368	509
Wind	2	13	22	30	51	81
of which wind offshore	0	0	0	1	3	8
PV	0	10	22	34	65	113
Geothermal	2	8	16	23	58	118
Solar thermal power plants	0	3	8	14	41	91
Ocean energy	0	0	0	0	0	0
Combined heat and power plants	0	3	8	16	29	42
Hard coal (& non-renewable waste)	0	1	4	7	12	15
Lignite	0	0	0	0	0	0
Gas	0	1	3	5	10	16
of which from H ₂	0	0	0	0	0	0
Oil	0	0	0	0	0	0
Biomass (& renewable waste)	0	1	2	3	7	10
Geothermal	0	0	0	0	0	0
Hydrogen	0	0	0	0	0	0
CHP by producer						
Main activity producers	0	0	0	0	0	0
Autoproducers	0	3	8	16	29	42
Total generation	716	1,017	1,245	1,473	2,097	2,722
Fossil	585	794	928	1,063	1,426	1,674
Hard coal (& non-renewable waste)	256	316	356	396	513	664
Lignite	0	0	0	0	0	0
Gas	256	385	484	584	833	933
Oil	68	86	79	71	64	61
Diesel	5	7	9	11	15	16
Nuclear	13	13	19	25	41	65
Hydrogen	0	0	0	0	0	0
of which renewable H ₂	0	0	0	0	0	0
Renewables (w/o renewable hydrogen)	118	210	298	386	629	984
Hydro	112	167	212	258	368	509
Wind	2	13	22	30	51	81
PV	0	10	22	34	65	113
Biomass (& renewable waste)	2	9	18	27	45	72
Geothermal	2	8	16	23	58	118
Solar thermal power plants	0	3	8	14	41	91
Ocean energy	0	0	0	0	0	0
Distribution losses	88	126	155	184	263	345
Own consumption electricity	47	63	69	74	87	91
Electricity for hydrogen production	0	0	0	0	0	0
Electricity for synfuel production	0	0	0	0	0	0
Final energy consumption (electricity)	588	837	1,030	1,223	1,752	2,293
Fluctuating RES (PV, Wind, Ocean)	3	24	44	64	117	194
Share of fluctuating RES	0%	2%	4%	4%	6%	7%
RES share (domestic generation)	17%	21%	24%	26%	30%	36%

Table 13.5.2 Africa: Final energy consumption in transport PJ/a

	2012	2020	2025	2030	2040	2050
Road	3,657	4,405	5,110	5,786	7,839	9,881
Fossil fuels	3,640	4,387	5,086	5,758	7,795	9,820
Biofuels	0	0	0	0	0	0
Synfuels	0	0	0	0	0	0
Natural gas	17	16	18	20	26	35
Hydrogen	0	0	0	0	0	0
Electricity	0	3	6	9	17	26
Rail	32	34	35	37	39	42
Fossil fuels	12	13	14	14	15	17
Biofuels	0	0	0	0	0	0
Synfuels	0	0	0	0	0	0
Electricity	20	21	22	22	24	25
Navigation	26	30	32	31	31	32
Fossil fuels	26	30	30	31	31	32
Biofuels	0	0	0	0	0	0
Synfuels	0	0	0	0	0	0
Aviation	105	139	140	170	275	389
Fossil fuels	105	139	140	170	275	389
Biofuels	0	0	0	0	0	0
Synfuels	0	0	0	0	0	0
Total (incl. pipelines)	3,857	4,650	5,361	6,071	8,238	10,405
Fossil fuels	3,783	4,568	5,270	5,972	8,117	10,258
Biofuels (incl. biogas)	0	0	0	0	0	0
Synfuels	0	0	0	0	0	0
Natural gas	54	58	63	68	81	95
Hydrogen	0	0	0	0	0	0
Electricity	20	24	28	32	41	51
Total RES	3	5	7	8	12	19
RES share	0%	0%	0%	0%	0%	0%

Table 13.5.3 Africa: Heat supply PJ/a

	2012	2020	2025	2030	2040	2050
District heating plants	0	0	0	0	0	0
Fossil fuels	0	0	0	0	0	0
Biomass	0	0	0	0	0	0
Solar collectors	0	0	0	0	0	0
Geothermal	0	0	0	0	0	0
Heat from CHP¹	0	8	22	49	114	243
Fossil fuels	0	6	18	39	87	169
Biomass	0	1	4	10	27	74
Geothermal	0	0	0	0	0	0
Hydrogen	0	0	0	0	0	0
Direct heating	7,354	9,295	10,439	11,635	14,366	16,825
Fossil fuels	2,710	3,614	4,193	4,782	6,380	7,892
Biomass	4,334	5,273	5,792	6,344	7,322	8,106
Solar collectors	5	17	33	50	104	186
Geothermal	0	0	0	0	0	0
Heat pumps ²	0	0	0	0	0	0
Electric direct heating	305	390	420	460	560	641
Hydrogen	0	0	0	0	0	0
Total heat supply³	7,354	9,302	10,461	11,685	14,480	17,068
Fossil fuels	2,710	3,621	4,211	4,822	6,467	8,061
Biomass	4,334	5,274	5,796	6,354	7,349	8,180
Solar collectors	5	17	33	50	104	186
Geothermal	0	0	0	0	0	0
Heat pumps ²	0	0	0	0	0	0
Electric direct heating	305	390	420	460	560	641
Hydrogen	0	0	0	0	0	0
RES share (including RES electricity)	60%	58%	57%	56%	53%	50%

¹ public CHP and CHP autoproduction / ² heat from ambient energy and electricity use / ³ incl. process heat, cooking

Table 13.5.4: Africa: Installed capacity GW

	2012	2020	2025	2030	2040	2050
Total generation	157	249	308	367	522	674
Fossil	129	193	226	258	341	395
Hard coal (& non-renewable waste)	42	58	68	77	101	131
Lignite	0	0	0	0	0	0
Gas (w/o H ₂)	59	100	123	145	205	229
Oil	26	33	32	30	29	27
Diesel	2	3	4	5	7	7
Nuclear	2	2	3	4	6	9
Hydrogen (fuel cells, gas power plants, gas CHP)	0	0	0	0	0	0
Renewables	26	54	80	105	175	271
Hydro	25	38	49	60	86	119
Wind	1	5	8	12	19	30
of which wind offshore	0	0	0	0	1	2
PV	0	6	14	21	40	69
Biomass (& renewable waste)	0	2	4	6	9	14
Geothermal	0	1	2	4	9	18
Solar thermal power plants	0	1	3	4	11	20
Ocean energy	0	0	0	0	0	0
Fluctuating RES (PV, Wind, Ocean)	1	12	22	32	59	99
Share of fluctuating RES	1%	5%	7%	9%	11%	15%
RES share (domestic generation)	17%	22%	26%	29%	33%	40%

Table 13.5.5: Africa: Final energy demand PJ/a

	2012	2020	2025	2030	2040	2050
Total (incl. non-energy use)	22,565	27,547	30,556	33,564	40,579	47,275
Total energy use	21,718	26,559	29,483	32,409	39,263	45,727
Transport	3,857	4,650	5,361	6,071	8,238	10,405
Oil products	3,783	4,568	5,270	5,972	8,117	10,258
Natural gas	54	58	63	68	81	95
Biofuels	0	0	0	0	0	0
Synfuels	0	0	0	0	0	0
Electricity	20	24	28	32	41	51
RES electricity	3	5	7	8	12	19
Hydrogen	0	0	0	0	0	0
RES share Transport	0%	0%	0%	0%	0%	0%
Industry	3,447	4,561	5,314	6,068	8,262	10,116
Electricity	872	1,180	1,398	1,616	2,247	3,015
RES electricity	144	244	335	423	674	1,088
Public district heat	0	0	0	0	0	0
RES district heat	0	0	0	0	0	0
Hard coal & lignite	350	623	713	804	1,072	1,236
Oil products	650	779	848	917	1,064	1,095
Gas	738	872	996	1,120	1,441	1,632
Solar	0	4	8	12	29	54
Biomass	837	1,104	1,351	1,599	2,409	3,085
Geothermal	0	0	0	0	0	0
Hydrogen	0	0	0	0	0	0
RES share Industry	28%	30%	32%	34%	38%	42%
Other Sectors	14,413	17,349	18,808	20,269	22,763	25,207
Electricity	1,223	1,809	2,283	2,756	4,020	5,188
RES electricity	202	374	546	722	1,206	1,875
Public district heat	0	0	0	0	0	0
RES district heat	0	0	0	0	0	0
Hard coal & lignite	295	296	302	309	335	363
Oil products	1,107	1,566	1,858	2,151	2,950	3,966
Gas	305	354	417	480	655	874
Solar	5	14	26	38	75	132
Biomass	11,479	13,310	13,923	14,536	14,728	14,683
Geothermal	0	0	0	0	0	0
Hydrogen	0	0	0	0	0	0
RES share Other Sectors	81%	79%	77%	75%	70%	66%
Total RES	12,671	15,054	16,195	17,337	19,134	20,937
RES share	58%	57%	55%	53%	49%	46%
Non energy use	847	988	1,073	1,156	1,315	1,548
Oil	427	484	517	546	596	672
Gas	363	441	488	536	635	778
Coal	57	63	68	74	84	99

¹ excluding heat produced by CHP autoproducers

Table 13.5.6: Africa: CO₂ emissions Mill t/a

	2012	2020	2025	2030	2040	2050
Condensation power plants	415	531	588	646	822	1,039
Hard coal (& non-renewable waste)	238	295	325	354	446	620
Lignite	0	0	0	0	0	0
Gas	117	168	199	232	319	363
Oil	51	62	55	48	42	40
Diesel	8	7	9	11	15	16
Combined heat and power plants	0	2	6	11	20	27
Hard coal (& non-renewable waste)	0	2	4	8	15	19
Lignite	0	0	0	0	0	0
Gas	0	1	3	5	7	9
Oil	0	0	0	0	0	0
CO₂ emissions power and CHP plants	415	533	593	657	842	1,065
Hard coal (& non-renewable waste)	238	296	323	363	461	638
Lignite	0	0	0	0	0	0
Gas	117	168	200	235	324	370
Oil & diesel	60	69	64	60	57	56
CO₂ intensity (g/kWh)						
without credit for CHP heat						
CO ₂ intensity fossil electr. generation	710	672	639	619	590	636
CO ₂ intensity total electr. generation	580	524	477	446	402	391
CO₂ emissions by sector	1,052	1,311	1,468	1,626	2,106	2,617
% of 1990 emissions (545 Mill t)	193%	240%	269%	298%	386%	480%
Industry ¹	123	167	191	217	280	315
Other sectors ¹	128	165	191	217	289	380
Transport	285	343	396	449	610	771
Power generation ²	415	531	588	646	822	1,039
Other conversion ³	102	104	102	97	105	111
Population (Mill.)	1,084	1,312	1,468	1,634	1,999	2,393
CO₂ emissions per capita (t/capita)	1.0	1.0	1.0	1.0	1.0	1.1

Table 13.5.8 Africa: Electricity generation TWh/a

	2012	2020	2025	2030	2040	2050
Power plants	716	971	1,132	1,450	2,503	4,096
Hard coal (& non-renewable waste)	256	251	216	159	11	0
Lignite	0	0	0	0	0	0
Gas	256	356	354	301	206	130
of which from H+	0	0	0	0	0	0
Oil	68	54	39	20	6	0
Diesel	15	6	6	5	4	3
Nuclear	13	8	4	0	0	0
Biomass (& renewable waste)	2	13	14	16	16	18
Hydro	112	150	162	175	200	225
Wind	2	58	139	284	631	961
of which wind offshore	0	1	18	85	222	350
PV	0	44	126	290	690	1,089
Geothermal	2	8	25	61	125	208
Solar thermal power plants	0	23	42	122	564	1,362
Ocean energy	0	0	5	18	50	100
Combined heat and power plants	0	10	68	98	145	170
Hard coal (& non-renewable waste)	0	0	0	0	0	0
Lignite	0	0	0	0	0	0
Gas	0	4	31	49	74	78
of which from H+	0	0	0	0	4	27
Oil	0	0	0	0	0	0
Biomass (& renewable waste)	0	6	35	44	52	56
Geothermal	0	0	1	4	12	17
Hydrogen	0	0	0	0	7	19
CHP by producer						
Main activity producers	0	0	0	0	0	0
Autoproducers	0	10	68	98	145	170
Total generation	716	981	1,199	1,548	2,648	4,266
Fossil	585	671	646	534	297	183
Hard coal (& non-renewable waste)	256	251	216	159	11	0
Lignite	0	0	0	0	0	0
Gas	256	360	385	350	276	180
Oil	68	54	39	20	6	0
Diesel	5	6	6	5	4	3
Nuclear	13	8	4	0	0	0
Hydrogen	0	0	0	0	11	46
of which renewable H+	0	0	0	0	10	44
Renewables (w/o renewable hydrogen)	118	302	549	1,014	2,340	4,037
Hydro	112	150	162	175	200	225
Wind	2	58	139	284	631	961
PV	0	44	126	290	690	1,089
Biomass (& renewable waste)	2	19	49	60	68	74
Geothermal	2	8	26	65	137	225
Solar thermal power plants	0	23	42	122	564	1,362
Ocean energy	0	0	5	18	50	100
Distribution losses	88	126	145	177	279	434
Own consumption electricity	47	63	67	67	61	45
Electricity for hydrogen production	0	0	1	18	209	577
Electricity for synfuel production	0	0	0	0	0	0
Final energy consumption (electricity)	588	791	966	1,179	1,859	2,889
Fluctuating RES (PV, Wind, Ocean)	3	102	270	592	1,371	2,150
Share of fluctuating RES	0%	10%	23%	38%	52%	50%
RES share (domestic generation)	17%	31%	46%	65%	89%	96%

Table 13.5.9 Africa: Final energy consumption in transport PJ/a

	2012	2020	2025	2030	2040	2050
Road	3,657	4,131	4,407	4,663	4,991	5,436
Fossil fuels	3,640	4,109	4,183	4,221	3,560	2,457
Biofuels	0	0	129	222	352	434
Synfuels	0	0	0	0	0	0
Natural gas	17	21	40	46	72	163
Hydrogen	0	0	1	47	437	990
Electricity	0	2	53	127	570	1,392
Rail	32	45	49	56	64	94
Fossil fuels	12	19	19	18	14	8
Biofuels	0	0	1	2	4	4
Synfuels	0	0	0	0	0	0
Electricity	20	26	29	36	46	82
Navigation	26	45	58	62	81	89
Fossil fuels	26	44	55	55	67	62
Biofuels	0	1	3	7	15	27
Synfuels	0	0	0	0	0	0
Aviation	105	125	139	150	194	244
Fossil fuels	105	125	139	148	178	171
Biofuels	0	0	0	1	16	73
Synfuels	0	0	0	0	0	0
Total (incl. pipelines)	3,857	4,386	4,694	4,974	5,374	5,907
Fossil fuels	3,783	4,296	4,396	4,442	3,819	2,698
Biofuels (incl. biogas)	0	2	133	234	386	537
Synfuels	0	0	0	0	0	0
Natural gas	54	61	80	87	108	183
Hydrogen	0	0	1	47	437	990
Electricity	20	28	83	164	625	1,498
Total RES	3	10	172	372	1,328	2,917
RES share	0%	0%	4%	7%	25%	49%

Table 13.5.10 Africa: Heat supply PJ/a

	2012	2020	2025	2030	2040	2050
District heating plants	0	0	0	0	0	0
Fossil fuels	0	0	0	0	0	0
Biomass	0	0	0	0	0	0
Solar collectors	0	0	0	0	0	0
Geothermal	0	0	0	0	0	0
Heat from CHP¹	0	25	194	319	610	951
Fossil fuels	0	12	95	156	235	183
Biomass	0	13	87	127	215	404
Geothermal	0	0	12	35	104	153
Hydrogen	0	0	0	0	56	211
Direct heating	7,354	8,593	9,151	9,703	11,149	12,566
Fossil fuels	2,710	3,330	3,187	2,809	1,996	955
Biomass	4,334	4,759	5,098	5,219	5,450	4,809
Solar collectors	5	43	203	701	1,820	3,336
Geothermal	0	25	56	90	141	201
Heat pumps ²	0	5	26	88	313	589
Electric direct heating	305	431	581	796	1,430	2,507
Hydrogen	0	0	0	0	0	168
Total heat supply³	7,354	8,619	9,346	10,022	11,759	13,517
Fossil fuels	2,710	3,342	3,282	2,965	2,231	1,138
Biomass	4,334	4,772	5,185	5,346	5,664	5,213
Solar collectors	5	43	203	701	1,820	3,336
Geothermal	0	25	69	125	245	354
Heat pumps ²	0	5	26	88	313	589
Electric direct heating	305	431	581	796	1,430	2,507
Hydrogen	0	0	0	0	56	379
RES share (including RES electricity)	60%	58%	62%	68%	80%	91%

¹ public CHP and CHP autoproduction / ² heat from ambient energy and electricity use / ³ incl. process heat, cooking

Table 13.5.10: Africa: Installed capacity GW

	2012	2020	2025	2030	2040	2050
Total generation	157	254	353	543	997	1,539
Fossil	129	157	158	162	131	133
Hard coal (& non-renewable waste)	42	46	43	40	5	0
Lignite	0	0	0	0	0	0
Gas (w/o H ₂)	59	88	96	109	120	130
Oil	26	21	16	10	4	0
Diesel	2	2	2	2	2	3
Nuclear	2	1	1	0	0	0
Hydrogen (fuel cells, gas power plants, gas CHP)	0	0	0	0	3	12
Renewables	26	96	195	381	863	1,394
Hydro	25	34	37	41	47	53
Wind	0	23	52	102	220	333
of which wind offshore	0	0	5	25	65	102
PV	0	28	77	177	423	669
Biomass (& renewable waste)	0	4	10	13	15	17
Geothermal	0	1	4	10	20	34
Solar thermal power plants	0	7	11	30	113	239
Ocean energy	0	0	3	9	25	50
Fluctuating RES (PV, Wind, Ocean)	1	50	132	288	668	1,052
Share of fluctuating RES	1%	20%	37%	53%	67%	68%
RES share (domestic generation)	17%	38%	55%	70%	87%	91%

Table 13.5.12: Africa: Final energy demand PJ/a

	2012	2020	2025	2030	2040	2050
Total (incl. non-energy use)	22,565	24,826	25,201	25,312	26,637	28,535
Total energy use	21,718	23,868	24,182	24,237	25,479	27,297
Transport	3,857	4,386	4,694	4,974	5,374	5,907
Oil products	3,783	4,296	4,396	4,442	3,819	2,698
Natural gas	54	61	80	87	108	183
Biofuels	0	2	133	234	386	537
Synfuels	0	0	0	0	0	0
Electricity	20	28	83	164	625	1,498
RES electricity	3	9	38	108	554	1,432
Hydrogen	0	0	1	47	437	990
RES share Transport	0%	0%	4%	7%	25%	49%
Industry	3,447	4,049	4,071	4,163	4,739	5,591
Electricity	872	1,100	1,216	1,363	1,899	2,569
RES electricity	144	339	557	906	1,685	2,457
Public district heat	0	0	0	0	0	0
RES district heat	0	0	0	0	0	0
Hard coal & lignite	350	469	370	229	161	15
Oil products	650	697	594	475	114	25
Gas	738	831	839	809	766	437
Solar	0	12	49	175	461	703
Biomass	837	911	938	975	1,083	1,296
Geothermal	0	28	65	117	254	369
Hydrogen	0	0	0	0	0	177
RES share Industry	28%	32%	40%	52%	74%	89%
Other Sectors	14,413	15,432	15,416	15,100	15,366	15,799
Electricity	1,223	1,721	2,177	2,695	4,168	6,334
RES electricity	202	530	996	1,765	3,698	6,068
Public district heat	0	0	0	0	0	0
RES district heat	0	0	0	0	0	0
Hard coal & lignite	295	332	380	282	189	55
Oil products	1,107	1,362	1,218	989	417	14
Gas	305	427	498	612	691	570
Solar	5	31	154	526	1,359	2,633
Biomass	11,479	11,559	10,980	9,961	8,427	5,918
Geothermal	0	0	9	36	116	274
Hydrogen	0	0	0	0	0	0
RES share Other Sectors	81%	79%	79%	81%	89%	94%
Total RES	12,671	13,420	13,921	14,832	18,411	22,795
RES share	58%	56%	58%	61%	72%	84%
Non energy use	847	958	1,019	1,075	1,157	1,238
Oil	427	478	509	536	578	618
Gas	363	419	425	427	413	393
Coal	57	61	85	111	166	228

1 excluding heat produced by CHP autoproducers

Table 13.5.13: Africa: CO₂ emissions Mill t/a

	2012	2020	2025	2030	2040	2050
Condensation power plants	415	435	379	284	104	53
Hard coal (& non-renewable waste)	238	235	200	145	10	0
Lignite	0	0	0	0	0	0
Gas	117	156	146	121	87	50
Oil	51	39	27	13	4	0
Diesel	8	6	6	5	4	3
Combined heat and power plants	0	2	17	27	35	24
Hard coal (& non-renewable waste)	0	0	0	0	0	0
Lignite	0	0	0	0	0	0
Gas	0	2	17	26	35	24
Oil	0	0	0	0	0	0
CO₂ emissions power and CHP plants	415	438	396	311	139	77
Hard coal (& non-renewable waste)	238	235	200	145	10	0
Lignite	0	0	0	0	0	0
Gas	117	158	163	147	122	74
Oil & diesel	60	45	33	19	8	0

AFRICA: ADVANCED ENERGY [R]EVOLUTION SCENARIO

Table 13.5.15 Africa: Electricity generation TWh/a

	2012	2020	2025	2030	2040	2050
Power plants	716	978	1,160	1,633	3,552	6,016
Hard coal (& non-renewable waste)	256	237	154	82	1	0
Lignite	0	0	0	0	0	0
Gas	256	356	354	301	185	126
<i>of which from H₂</i>	0	0	0	0	46	126
Oil	68	54	39	20	6	0
Diesel	5	6	6	5	4	0
Nuclear	13	8	4	0	0	0
Biomass (& renewable waste)	2	18	24	26	27	30
Hydro	112	150	162	175	200	225
Wind	2	68	179	344	945	1,535
<i>of which wind offshore</i>	0	6	28	95	292	450
PV	0	50	156	410	977	1,379
<i>of which wind offshore</i>	0	8	25	61	124	201
Solar thermal power plants	0	23	52	192	994	2,340
Ocean energy	0	0	5	18	90	180
Combined heat and power plants	0	10	68	98	145	170
Hard coal (& non-renewable waste)	0	0	0	0	0	0
Lignite	0	0	0	0	0	0
Gas	0	4	31	49	65	54
<i>of which from H₂</i>	0	0	0	0	16	54
Oil	0	0	0	0	0	0
Biomass (& renewable waste)	0	6	35	44	59	73
Geothermal	0	0	1	4	13	24
Hydrogen	0	0	0	0	7	19
CHP by producer						
Main activity producers	0	0	0	0	0	0
Autoproducers	0	10	68	98	145	170
Total generation	716	988	1,227	1,731	3,697	6,186
Fossil	585	657	584	457	198	0
Hard coal (& non-renewable waste)	256	237	154	82	1	0
Lignite	0	0	0	0	0	0
Gas	256	360	385	350	188	0
Oil	68	54	39	20	6	0
Diesel	5	6	6	5	4	0
Nuclear	13	8	4	0	0	0
Hydrogen	0	0	0	0	70	199
<i>of which renewable H₂</i>	0	0	0	0	65	199
Renewables (w/o renewable hydrogen)	118	323	639	1,274	3,429	5,987
Hydro	112	150	162	175	200	225
Wind	2	68	179	344	945	1,535
PV	0	50	156	410	977	1,379
Biomass (& renewable waste)	2	24	59	70	86	103
Geothermal	2	8	26	65	137	225
Solar thermal power plants	0	23	52	192	994	2,340
Ocean energy	0	0	5	18	90	180
Distribution losses	88	126	145	177	279	434
Own consumption electricity	47	63	67	67	61	45
Electricity for hydrogen production	0	0	1	71	687	1,338
Electricity for synfuel production	0	0	0	0	288	735
Final energy consumption (electricity)	588	798	994	1,292	2,061	3,137
Fluctuating RES (PV, Wind, Ocean)	3	118	340	772	2,012	3,094
Share of fluctuating RES	0%	12%	28%	45%	54%	50%
RES share (domestic generation)	17%	33%	52%	74%	95%	100%

Table 13.5.16 Africa: Final energy consumption in transport PJ/a

	2012	2020	2025	2030	2040	2050
Road	3,657	4,072	4,208	4,324	3,953	3,521
Fossil fuels	3,640	4,039	3,938	3,689	1,916	0
Biofuels	0	0	122	194	338	524
Synfuels	0	0	0	0	370	979
Natural gas	17	19	33	29	16	0
Hydrogen	0	0	1	182	926	1,542
Electricity	0	14	114	229	757	1,455
Rail	32	56	85	113	162	283
Fossil fuels	12	17	16	13	6	0
Biofuels	0	0	1	2	2	2
Synfuels	0	0	0	0	2	4
Electricity	20	38	68	98	151	277
Navigation	26	45	58	62	81	89
Fossil fuels	26	45	58	57	53	0
Biofuels	0	0	1	6	14	31
Synfuels	0	0	0	0	15	58
Aviation	105	125	139	148	190	229
Fossil fuels	105	124	137	135	123	0
Biofuels	0	1	1	13	32	80
Synfuels	0	0	0	0	35	149
Total (incl. pipelines)	3,857	4,339	4,532	4,690	4,801	5,148
Fossil fuels	3,783	4,225	4,148	3,893	2,099	0
Biofuels (incl. biogas)	0	1	125	216	366	637
Synfuels	0	0	0	0	422	1,191
Natural gas	54	60	73	68	41	0
Hydrogen	0	0	1	182	926	1,542
Electricity	20	52	184	331	929	1,778
Total RES	3	19	222	594	2,537	5,148
RES share	0%	0%	5%	13%	53%	100%

Table 13.5.17 Africa: Heat supply PJ/a

	2012	2020	2025	2030	2040	2050
District heating plants	0	0	0	0	0	0
Fossil fuels	0	0	0	0	0	0
Biomass	0	0	0	0	0	0
Solar collectors	0	0	0	0	0	0
Geothermal	0	0	0	0	0	0
Heat from CHP¹	0	25	194	319	624	1,049
Fossil fuels	0	12	95	156	164	0
Biomass	0	13	87	127	245	526
Geothermal	0	0	12	35	117	214
Hydrogen	0	0	0	0	98	308
Direct heating	7,354	8,593	9,151	9,703	11,135	12,468
Fossil fuels	2,710	3,330	3,187	2,665	1,536	0
Biomass	4,334	4,759	5,098	5,219	5,446	5,014
Solar collectors	5	43	203	701	1,818	3,315
Geothermal	0	25	56	90	140	195
Heat pumps ²	0	5	26	88	312	582
Electric direct heating	305	431	581	940	1,595	2,756
Hydrogen	0	0	0	0	289	606
Total heat supply³	7,354	8,619	9,346	10,022	11,759	13,517
Fossil fuels	2,710	3,342	3,282	2,821	1,700	0
Biomass	4,334	4,772	5,185	5,346	5,690	5,540
Solar collectors	5	43	203	701	1,818	3,315
Geothermal	0	25	69	125	257	409
Heat pumps ²	0	5	26	88	312	582
Electric direct heating	305	431	581	940	1,595	2,756
Hydrogen	0	0	0	0	387	914
RES share (including RES electricity)	60%	58%	62%	69%	85%	100%

¹ public CHP and CHP autoproduction / ² heat from ambient energy and electricity use / ³ incl. process heat, cooking

Table 13.5.18: Africa: Installed capacity GW

	2012	2020	2025	2030	2040	2050
Total generation	157	260	378	639	1,420	2,180
Fossil	129	154	145	142	117	0
Hard coal (& non-renewable waste)	42	43	31	20	0	0
Lignite	0	0	0	0	0	0
Gas (w/o H ₂)	59	88	96	109	111	0
Oil	26	21	16	10	4	0
Diesel	2	2	2	2	2	0
Nuclear	2	1	1	0	0	0
Hydrogen (fuel cells, gas power plants, gas CHP)	0	0	0	0	39	175
Renewables	26	104	232	497	1,264	2,004
Hydro	25	34	37	41	47	53
Wind	0	26	67	124	333	541
<i>of which wind offshore</i>	0	1	8	28	85	131
PV	0	31	96	250	598	847
Biomass (& renewable waste)	0	5	12	15	21	30
Geothermal	0	1	4	10	20	34
Solar thermal power plants	0	7	14	48	199	411
Ocean energy	0	0	3	9	45	90
Fluctuating RES (PV, Wind, Ocean)	1	58	165	383	977	1,478
Share of fluctuating RES	1%	22%	44%	60%	69%	68%
RES share (domestic generation)	17%	40%	61%	78%	89%	92%

Table 13.5.19: Africa: Final energy demand PJ/a

	2012	2020	2025	2030	2040	2050
Total (incl. non-energy use)	22,565	24,778	25,039	25,080	26,223	28,022
Total energy use	21,718	23,820	24,020	24,005	25,065	26,784
Transport	3,857	4,339	4,532	4,690	4,801	5,148
Oil products	3,783	4,225	4,148	3,893	2,099	0
Natural gas	54	60	73	68	41	0
Biofuels	0	1	125	216	366	637
Synfuels	0	0	0	0	422	1,191
Electricity	20	52	184	331	929	1,778
RES electricity	3	17	96	244	878	1,778
Hydrogen	0	0	1	182	926	1,542
RES share Transport	0%	0%	5%	13%	53%	100%
Industry	3,447	4,049	4,071	4,183	4,775	5,555
Electricity	872	1,100	1,216	1,411	1,970	2,740
RES electricity	144	360	633	1,038	1,861	2,740
Public district heat	0	0	0	0	0	0
RES district heat	0	0	0	0	0	0
Hard coal & lignite	350	469	370	229	160	0
Oil products	650	697	594	471	106	0
Gas	738	831	839	806	565	0
Solar	0	12	49	175	459	682
Biomass	837	911	938	975	1,078	1,256
Geothermal	0	28	65	117	253	358
Hydrogen	0	0	0	0	186	519
RES share Industry	28%	32%	41%	55%	80%	100%
Other Sectors	14,413	15,432	15,416	15,131	15,489	16,081
Electricity	1,223	1,721	2,177	2,909	4,523	6,776
RES electricity	202	563	1,133	2,141	4,274	6,776
Public district heat	0	0	0	0	0	0
RES district heat	0	0	0	0	0	0
Hard coal & lignite	295	332	380	197	149	0
Oil products	1,107	1,362	1,218	977	396	0
Gas	305	427	498	525	394	0
Solar	5	31	154	526	1,359	2,633
Biomass	11,479	11,559	10,980	9,961	8,427	6,279
Geothermal	0	0	9	36	116	274
Hydrogen	0	0	0	0	124	119
RES share Other Sectors	81%	79%	80%	84%	92%	100%
Total RES	12,671	13,482	14,184	15,563	20,657	26,784
RES share	58%	57%	59%	65%	82%	100%
Non energy use	847	958	1,019	1,075	1,157	1,238
Oil	427	478	509	536	578	618
Gas	363	419	425	427	413	393
Coal	57	61	85	111	166	228

¹ excluding heat produced by CHP autoproducers

Table 13.5.20 Africa: CO₂ emissions Mill t/a

	2012	2020	2025	2030	2040	2050
Condensation power plants	415	422	321	214	67	0
Hard coal (& non-renewable waste)	238	222	142	75	1	0
Lignite	0	0	0	0	0	0
Gas	117	156	146	121	58	0
Oil	51	39	27	13	4	0
Diesel	8	6	6	5	4	0
Combined heat and power plants	0	2	17	27	24	0
Hard coal (& non-renewable waste)	0	0	0	0	0	0
Lignite	0	0	0	0	0	0
Gas	0	2	17	26	24	0
Oil	0	0	0	0	0	0
CO₂ emissions power and CHP plants	415	424	339	240	91	0
Hard coal (& non-renewable waste)	238	222	142	75	1	0
Lignite	0	0	0	0	0	0
Gas	117	158	163	147	83	0
Oil & diesel	60	45	33	19	8	0

Table 13.5.22: Africa: Investments in electricity generation

REF	UNIT	2012-2020	2021-2030	2031-2040	2041-2050	2012-2050	UNIT	ANNUAL AVERAGE 2012-2050
Fossil (w/o CHP)	billion \$	91.9	90.7	142.3	142.5	467.3	billion \$/a	12.0
Nuclear	billion \$	1.8	8.3	10.4	14.9	35.4	billion \$/a	0.9
CHP (fossil + renewable)	billion \$	2.1	7.9	7.7	10.1	27.9	billion \$/a	0.7
Renewables (w/o CHP)	billion \$	78.0	129.6	189.2	262.0	658.9	billion \$/a	16.9
Total	billion \$	173.8	236.5	349.7	429.5	1,189.4	billion \$/a	30.5
Conventional (fossil & nuclear)	billion \$	95.5	105.5	158.8	164.7	524.5	billion \$/a	13.4
Renewables	billion \$	78.3	131.0	190.9	264.7	664.9	billion \$/a	17.0
Biomass	billion \$	3.9	7.7	11.1	17.4	40.1	billion \$/a	1.0
Hydro	billion \$	39.5	62.2	73.1	91.7	266.4	billion \$/a	6.8
Wind	billion \$	6.3	10.6	17.1	26.3	60.3	billion \$/a	1.5
PV	billion \$	11.9	19.3	26.1	34.2	91.5	billion \$/a	2.3
Geothermal	billion \$	11.7	18.4	32.5	52.5	115.0	billion \$/a	2.9
Solar thermal power plants	billion \$	5.1	12.8	30.9	42.7	91.5	billion \$/a	2.3
Ocean energy	billion \$	0.0	0.0	0.0	0.0	0.0	billion \$/a	0.0
E[R]								
Fossil (w/o CHP)	billion \$	61.1	25.3	49.8	34.0	170.2	billion \$/a	4.4
Nuclear	billion \$	1.0	0.0	0.0	0.0	1.0	billion \$/a	0.0
CHP (fossil + renewable)	billion \$	8.5	66.3	24.7	39.0	138.5	billion \$/a	3.6
Renewables (w/o CHP)	billion \$	157.5	585.9	1,011.6	1,349.9	3,104.9	billion \$/a	79.6
Total	billion \$	228.0	677.5	1,086.1	1,422.9	3,414.5	billion \$/a	87.6
Conventional (fossil & nuclear)	billion \$	67.5	72.9	67.4	53.8	261.7	billion \$/a	6.7
Renewables	billion \$	160.6	604.6	1,018.7	1,369.0	3,152.9	billion \$/a	80.8
Biomass	billion \$	8.7	19.8	12.9	22.9	64.3	billion \$/a	1.6
Hydro	billion \$	30.3	24.4	23.3	23.2	101.2	billion \$/a	2.6
Wind	billion \$	32.7	161.9	258.0	339.9	792.5	billion \$/a	20.3
PV	billion \$	48.1	194.5	279.5	308.3	830.4	billion \$/a	21.3
Geothermal	billion \$	11.6	60.6	58.6	76.4	207.3	billion \$/a	5.3
Solar thermal power plants	billion \$	29.2	98.9	330.3	533.2	991.5	billion \$/a	25.4
Ocean energy	billion \$	0.0	44.6	56.1	65.0	165.7	billion \$/a	4.2
ADV E[R]								
Fossil (w/o CHP)	billion \$	57.0	16.2	70.9	64.4	208.4	billion \$/a	5.3
Nuclear	billion \$	1.0	0.0	0.0	0.0	1.0	billion \$/a	0.0
CHP (fossil + renewable)	billion \$	8.5	66.3	23.0	38.0	135.8	billion \$/a	3.5
Renewables (w/o CHP)	billion \$	175.1	779.1	1,624.7	1,968.7	4,547.6	billion \$/a	116.6
Total	billion \$	241.5	861.6	1,718.5	2,071.1	4,892.8	billion \$/a	125.5
Conventional (fossil & nuclear)	billion \$	63.3	63.8	83.3	78.5	288.9	billion \$/a	7.4
Renewables	billion \$	178.2	797.8	1,635.2	1,992.6	4,603.8	billion \$/a	118.0
Biomass	billion \$	11.0	22.1	23.1	37.2	93.4	billion \$/a	2.4
Hydro	billion \$	30.3	24.4	23.3	23.2	101.2	billion \$/a	2.6
Wind	billion \$	41.7	191.5	420.1	505.6	1,158.9	billion \$/a	29.7
PV	billion \$	54.5	283.4	387.5	363.8	1,089.2	billion \$/a	27.9
Geothermal	billion \$	11.6	60.6	57.6	73.2	203.1	billion \$/a	5.2
Solar thermal power plants	billion \$	29.2	171.1	602.9	876.8	1,680.0	billion \$/a	43.1
Ocean energy	billion \$	0.0	44.6	120.7	112.8	278.0	billion \$/a	7.1

Table 13.5.23: Africa: Investments in renewable heat generation

REF	UNIT	2012-2020	2021-2030	2031-2040	2041-2050	2012-2050	UNIT	ANNUAL AVERAGE 2012-2050
Heat pumps	billion \$	0.0	0.0	0.0	0.0	0.0	billion \$/a	0.0
Deep geothermal	billion \$	0.0	0.0	0.0	0.0	0.0	billion \$/a	0.0
Solar thermal	billion \$	1.0	2.0	4.4	6.2	13.6	billion \$/a	0.3
Biomass	billion \$	302.6	261.0	58.5	55.7	697.9	billion \$/a	17.9
Total	billion \$	303.6	263.0	62.8	62.0	711.4	billion \$/a	18.2
E[R]								
Heat pumps	billion \$	0.8	21.3	50.9	87.8	160.9	billion \$/a	4.1
Deep geothermal	billion \$	5.5	13.3	13.6	20.4	52.9	billion \$/a	1.4
Solar thermal	billion \$	2.9	38.6	66.6	98.7	206.9	billion \$/a	5.3
Biomass	billion \$	137.7	22.8	13.4	13.2	187.1	billion \$/a	4.8
Total	billion \$	147.0	96.1	144.6	220.1	607.7	billion \$/a	15.6
ADV E[R]								
Heat pumps	billion \$	0.8	21.3	50.8	86.9	159.9	billion \$/a	4.1
Deep geothermal	billion \$	5.5	13.3	13.5	19.5	51.9	billion \$/a	1.3
Solar thermal	billion \$	2.9	38.6	66.3	96.3	204.2	billion \$/a	5.2
Biomass	billion \$	137.7	22.8	13.1	11.6	185.2	billion \$/a	4.7
Total	billion \$	147.0	96.1	143.8	214.3	601.1	billion \$/a	15.4

Table 13.5.24: Africa Total employment in the energy sector THOUSAND JOBS

By sector	REFERENCE SCENARIO				ADV E[R] SCENARIO		
	2015	2020	2025	2030	2020	2025	2030
Construction and installation	366	442	422	455	937	1,825	2,150
Manufacturing	161	179	176	197	221	534	832
Operations and maintenance	235	308	384	413	453	787	1,213
Fuel supply (domestic)	6,315	6,930	7,313	7,668	6,174	5,900	5,298
Coal and gas export	39.6	46.5	53.2	59.8	25.4	17.9	10.5
Solar and geothermal heat	18.9	18.9	35.2	30	106	404	1,025
Total jobs (thousands)	7,134	7,925	8,383	8,823	7,918	9,468	10,528
By technology							
Coal	376	391	391	420	111	79	42
Gas, oil & diesel	223	247	263	278	171	183	169
Nuclear	16	23	27	29	8	9	8
Renewable	6,521	7,264	7,702	8,096	7,628	9,197	10,309
Biomass	6,244	6,871	7,254	7,601	6,228	5,994	5,408
Hydro	158	209	216	229	98	99	86
Wind	19	28	36	42	295	588	1,005
PV	66	109	126	138	751	1,709	2,058
Geothermal power	6.9	10.1	10.7	15.1	17	37	36
Solar thermal power	8.1	17.4	24.1	42.3	89	294	609
Ocean	-	-	-	-	43	71	82
Solar - heat	18.9	18.9	35.2	30	80	351	932
Geothermal & heat pump	0.0	-	-	-	26.4	53.0	93
Total jobs (thousands)	7,134	7,925	8,383	8,823	7,918	9,468	10,528

MIDDLE EAST: REFERENCE SCENARIO

Table 13.6.1 Middle East: Electricity generation TWh/a

	2012	2020	2025	2030	2040	2050
Power plants	904	1,204	1,430	1,655	2,093	2,477
Hard coal (& non-renewable waste)	1	3	5	6	7	9
Lignite	0	0	0	0	0	0
Gas	552	809	1,013	1,216	1,585	1,842
<i>of which from H-</i>	0	0	0	0	0	0
Oil	275	260	219	182	140	101
Diesel	53	72	94	113	133	153
Nuclear	2	20	36	53	66	82
Biomass (& renewable waste)	0	3	5	8	20	40
Hydro	22	28	33	37	43	50
Wind	0	2	7	12	44	106
<i>of which wind offshore</i>	0	0	0	0	4	13
PV	0	4	10	15	31	57
Geothermal	0	0	0	0	0	0
Solar thermal power plants	0	4	9	13	23	36
Ocean energy	0	0	0	0	0	0
Combined heat and power plants	0	1	2	5	10	15
Hard coal (& non-renewable waste)	0	0	0	0	0	0
Lignite	0	0	0	0	0	0
Gas	0	0	1	3	5	8
<i>of which from H-</i>	0	0	0	0	0	0
Oil	0	0	1	2	3	5
Biomass (& renewable waste)	0	0	0	1	1	2
Geothermal	0	0	0	0	0	0
Hydrogen	0	0	0	0	0	0
CHP by producer						
Main activity producers	0	0	0	0	0	0
Autoproducers	0	1	2	5	10	15
Total generation	904	1,205	1,432	1,660	2,103	2,492
Fossil	880	1,143	1,332	1,521	1,874	2,118
Hard coal (& non-renewable waste)	1	3	5	6	7	9
Lignite	0	0	0	0	0	0
Gas	552	809	1,014	1,218	1,590	1,850
Oil	275	260	220	183	144	106
Diesel	53	72	94	113	133	153
Nuclear	2	20	36	53	66	82
Hydrogen	0	0	0	0	0	0
<i>of which renewable H-</i>	0	0	0	0	0	0
Renewables (w/o renewable hydrogen)	22	41	64	87	162	292
Hydro	22	28	33	37	43	50
Wind	0	2	7	12	44	106
PV	0	4	10	15	31	57
Biomass (& renewable waste)	0	3	6	8	21	42
Geothermal	0	0	0	0	0	0
Solar thermal power plants	0	4	9	13	23	36
Ocean energy	0	0	0	0	0	0
Distribution losses	116	155	185	216	276	330
Own consumption electricity	56	75	81	87	88	88
Electricity for hydrogen production	0	0	0	0	0	0
Electricity for synfuel production	0	0	0	0	0	0
Final energy consumption (electricity)	734	977	1,168	1,360	1,741	2,078
Fluctuating RES (PV, Wind, Ocean)	0	7	17	28	75	163
Share of fluctuating RES	0%	1%	1%	2%	4%	7%
RES share (domestic generation)	2%	3%	4%	5%	8%	12%

Table 13.6.2 Middle East: Final energy consumption in transport PJ/a

	2012	2020	2025	2030	2040	2050
Road	5,226	6,835	8,197	9,565	11,673	12,486
Fossil fuels	4,981	6,545	7,853	9,167	11,166	11,847
Biofuels	0	0	0	0	0	0
Synfuels	0	0	0	0	0	0
Natural gas	245	290	344	398	507	638
Hydrogen	0	0	0	0	0	0
Electricity	0	0	0	0	0	0
Rail	2	2	2	2	2	2
Fossil fuels	1	1	1	1	1	1
Biofuels	0	0	0	0	0	0
Synfuels	0	0	0	0	0	0
Electricity	1	1	1	1	1	1
Navigation	0	0	0	0	0	0
Fossil fuels	0	0	0	0	0	0
Biofuels	0	0	0	0	0	0
Synfuels	0	0	0	0	0	0
Aviation	46	62	76	84	116	154
Fossil fuels	46	62	76	84	116	154
Biofuels	0	0	0	0	0	0
Synfuels	0	0	0	0	0	0
Total (incl. pipelines)	5,293	6,923	8,301	9,679	11,825	12,680
Fossil fuels	5,028	6,608	7,930	9,252	11,283	12,002
Biofuels (incl. biogas)	0	0	0	0	0	0
Synfuels	0	0	0	0	0	0
Natural gas	263	313	369	425	540	676
Hydrogen	0	0	0	0	0	0
Electricity	1	1	1	1	1	2
Total RES	0	0	0	0	0	0
RES share	0%	0%	0%	0%	0%	0%

Table 13.6.3 Middle East: Heat supply PJ/a

	2012	2020	2025	2030	2040	2050
District heating plants	0	0	0	0	0	0
Fossil fuels	0	0	0	0	0	0
Biomass	0	0	0	0	0	0
Solar collectors	0	0	0	0	0	0
Geothermal	0	0	0	0	0	0
Heat from CHP¹	0	1	6	15	33	60
Fossil fuels	0	1	5	13	28	44
Biomass	0	0	0	1	5	15
Geothermal	0	0	0	0	0	0
Hydrogen	0	0	0	0	0	0
Direct heating	6,409	7,590	8,725	9,907	12,991	15,205
Fossil fuels	5,938	6,969	7,984	9,046	11,771	13,649
Biomass	20	76	131	186	345	554
Solar collectors	7	25	40	55	94	149
Geothermal	0	0	0	0	0	0
Heat pumps ²	0	0	0	0	0	0
Electric direct heating	445	520	570	620	780	852
Hydrogen	0	0	0	0	0	0
Total heat supply³	6,409	7,591	8,731	9,922	13,024	15,265
Fossil fuels	5,938	6,970	7,990	9,059	11,799	13,693
Biomass	20	76	131	188	350	569
Solar collectors	7	25	40	55	94	149
Geothermal	0	0	0	0	0	0
Heat pumps ²	0	0	0	0	0	0
Electric direct heating	445	520	570	620	780	852
Hydrogen	0	0	0	0	0	0
RES share (including RES electricity)	1%	2%	2%	3%	4%	5%

¹ public CHP and CHP autoproduction / ² heat from ambient energy and electricity use / ³ incl. process heat, cooking

Table 13.6.4: Middle East: Installed capacity GW

	2012	2020	2025	2030	2040	2050
Total generation	256	343	387	431	508	593
Fossil	241	315	347	379	424	458
Hard coal (& non-renewable waste)	0	1	1	1	1	2
Lignite	0	0	0	0	0	0
Gas (w/o H ₂)	166	226	261	296	344	381
Oil	62	69	80	51	41	30
Diesel	12	19	25	31	38	44
Nuclear	1	3	5	8	9	11
Hydrogen (fuel cells, gas power plants, gas CHP)	0	0	0	0	0	0
Renewables	15	24	34	44	75	124
Hydro	14	18	21	23	26	30
Wind	0	1	3	5	19	45
<i>of which wind offshore</i>	0	0	0	0	1	4
PV	0	3	6	9	19	35
Biomass (& renewable waste)	0	0	1	1	3	7
Geothermal	0	0	0	0	0	0
Solar thermal power plants	0	2	3	5	8	7
Ocean energy	0	0	0	0	0	0
Fluctuating RES (PV, Wind, Ocean)	0	4	9	15	38	80
Share of fluctuating RES	0%	1%	2%	3%	7%	14%
RES share (domestic generation)	6%	7%	9%	10%	15%	21%

Table 13.6.5: Middle East: Final energy demand PJ/a

	2012	2020	2025	2030	2040	2050
Total (incl. non-energy use)	18,967	23,152	26,825	30,499	37,962	43,112
Total energy use	15,306	18,950	22,152	25,366	31,728	35,791
Transport	5,293	6,923	8,301	9,679	11,825	12,680
Oil products	5,028	6,608	7,930	9,252	11,283	12,002
Natural gas	263	313	369	425	540	676
Biofuels	0	0	0	0	0	0
Synfuels	0	0	0	0	0	0
Electricity	1	1	1	1	1	2
<i>RES electricity</i>	0	0	0	0	0	0
Hydrogen	0	0	0	0	0	0
RES share Transport	0%	0%	0%	0%	0%	0%
Industry	5,271	6,112	7,122	8,132	10,595	12,483
Electricity	578	734	835	936	1,175	1,463
<i>RES electricity</i>	14	25	37	49	91	171
Public district heat	0	0	0	0	0	0
<i>RES district heat</i>	0	0	0	0	0	0
Hard coal & lignite	79	90	87	84	88	35
Oil products	1,453	1,551	1,675	1,798	2,012	2,013
Gas	3,162	3,672	4,395	5,118	6,953	8,404
Solar	0	1	3	4	7	10
Biomass	0	64	128	192	360	557
Geothermal	0	0	0	0	0	0
Hydrogen	0	0	0	0	0	0
RES share Industry	0%	1%	2%	3%	4%	6%
Other Sectors	4,742	5,915	6,729	7,554	9,308	10,628
Electricity	2,064	2,781	3,370	3,959	5,092	6,014
<i>RES electricity</i>	51	95	151	207	383	705
Public district heat	0	0	0	0	0	0
<i>RES district heat</i>	0	0	0	0	0	0
Hard coal & lignite	0	0	0	0	0	0
Oil products	970	995	993	1,001	1,003	962
Gas	1,670	2,072	2,276	2,481	3,040	3,401
Solar	7	24	37	51	87	140
Biomass	32	43	52	62	86	112
Geothermal	0	0	0	0	0	0
Hydrogen	0	0	0	0	0	0
RES share Other Sectors	2%	3%	4%	4%	6%	9%
Total RES	104	252	408	564	1,024	1,695
RES share	1%	1%	2%	2%	3%	5%
Non energy use	3,661	4,202	4,674	5,133	6,234	7,321
Oil	1,734	1,903	2,066	2,212	2,543	2,831
Gas	1,916	2,289	2,596	2,909	3,675	4,490
Coal	10	11	12	13	16	0

¹ excluding heat produced by CHP autoproducers

Table 13.6.6: Middle East: CO₂ emissions Mill t/a

	2012	2020	2025	2030	2040	2050
Condensation power plants	609	798	851	908	1,044	1,072
Hard coal (& non-renewable waste)	1	4	5	6	7	9
Lignite	0	0	0	0	0	0
Gas	327	449	519	591	740	786
Oil	210	250	203	161	120	82
Diesel	71	95	124	149	177	195
Combined heat and power plants	0	0	1	3	5	7
Hard coal (& non-renewable waste)	0	0	0	0	1	0
Lignite	0	0	0	0	0	0
Gas	0	0	1	1	3	4
Oil	0	0	0	1	2	3
CO₂ emissions power and CHP plants	609	798	853	911	1,049	1,079
Hard coal (& non-renewable waste)	1	4	5	7	8	10
Lignite	0	0	0	0	0	0
Gas	327	449	520	593	742	790
Oil & diesel	281	345	328	311	299	279
CO₂ intensity (g/kWh)						
without credit for CHP heat						
CO ₂ intensity fossil electr. generation	691	698	640	599	560	509
CO ₂ intensity total electr. generation	673	662	595	549	499	433
CO₂ emissions by sector	1,670	2,064	2,305	2,551	3,050	3,253
% of 1990 emissions (554 Mill t)	301%	372%	416%	460%	550%	587%
Industry ¹	317	357	411	466	598	682
Other sectors ¹	180	206	218	231	265	284
Transport	422	553	663	773	945	1,011
Power generation ²	609	798	851	908	1,044	1,072
Other conversion ³	143	150	161	172	198	205
Population (Mill.)	218	253	272	289	322	349
CO₂ emissions per capita (t/capita)	7.7	8.2	8.5	8.8	9.5	9.4

Table 13.6.8 Middle East: Electricity generation TWh/a

	2012	2020	2025	2030	2040	2050
Power plants	904	1,119	1,263	1,596	2,413	3,400
Hard coal (& non-renewable waste)	1	0	0	0	0	0
Lignite	0	0	0	0	0	0
Gas	552	730	721	699	541	229
Oil	0	0	0	0	0	0
of which from H+	275	189	132	58	4	2
Diesel	53	45	25	15	1	0
Nuclear	2	3	3	3	0	0
Biomass (& renewable waste)	0	5	8	14	15	18
Hydro	22	28	33	37	43	50
Wind	0	35	105	190	302	439
of which wind offshore	0	0	10	15	25	40
Geothermal	0	1	10	35	77	66
Solar thermal power plants	0	25	95	260	809	1,473
Ocean energy	0	3	13	14	33	51
Combined heat and power plants	0	15	25	30	55	85
Hard coal (& non-renewable waste)	0	0	0	0	0	0
Lignite	0	0	0	0	0	0
Gas	0	3	5	5	7	11
Oil	0	0	0	0	0	0
of which from H+	0	1	1	1	0	0
Biomass (& renewable waste)	0	7	12	14	23	27
Geothermal	0	3	6	9	22	38
Hydrogen	0	0	1	1	3	9
CHP by producer						
Main activity producers	0	0	0	0	0	0
Autoproducers	0	15	25	30	55	85
Total generation	904	1,134	1,288	1,626	2,468	3,485
Fossil	880	969	884	778	563	242
Hard coal (& non-renewable waste)	1	0	0	0	0	0
Lignite	0	0	0	0	0	0
Gas	552	733	725	704	548	240
Oil	275	190	134	59	4	2
Diesel	53	45	25	15	1	0
Nuclear	2	3	3	3	0	0
Hydrogen	0	0	1	1	3	9
of which renewable H+	0	0	0	1	2	8
Renewables (w/o renewable hydrogen)	22	162	401	843	1,913	3,234
Hydro	22	28	33	37	43	50
Wind	0	35	105	190	302	439
PV	0	55	120	250	589	1,072
Biomass (& renewable waste)	0	12	20	28	38	45
Geothermal	0	4	16	44	99	105
Solar thermal power plants	0	25	95	260	809	1,473
Ocean energy	0	3	13	14	33	51
Distribution losses	116	141	153	165	192	212
Own consumption electricity	56	60	57	54	49	44
Electricity for hydrogen production	0	1	5	62	344	709
Electricity for synfuel production	0	0	0	0	0	0
Final energy consumption (electricity)	734	932	1,068	1,317	1,823	2,440
Fluctuating RES (PV, Wind, Ocean)	0	93	238	454	924	1,562
Share of fluctuating RES	0%	8%	18%	28%	37%	45%
RES share (domestic generation)	2%	14%	31%	52%	78%	93%

Table 13.6.9 Middle East: Final energy consumption in transport PJ/a

	2012	2020	2025	2030	2040	2050
Road	5,226	6,717	6,613	6,515	5,787	5,053
Fossil fuels	4,981	6,291	5,873	5,091	2,847	524
Biofuels	0	128	309	443	502	524
Synfuels	0	0	0	0	0	0
Natural gas	245	269	278	326	322	331
Hydrogen	0	0	7	148	874	1,597
Electricity	0	29	146	508	1,242	2,077
Rail	2	3	3	4	3	5
Fossil fuels	1	1	1	1	1	0
Biofuels	0	0	0	0	0	0
Synfuels	0	0	0	0	0	0
Electricity	1	2	2	2	3	5
Navigation	0	0	0	0	0	0
Fossil fuels	0	0	0	0	0	0
Biofuels	0	0	0	0	0	0
Synfuels	0	0	0	0	0	0
Aviation	46	53	62	65	80	85
Fossil fuels	46	53	60	61	71	51
Biofuels	0	0	1	4	10	34
Synfuels	0	0	0	0	0	0
Total (incl. pipelines)	5,293	6,792	6,696	6,600	5,885	5,150
Fossil fuels	5,028	6,346	5,935	5,153	2,918	575
Biofuels (incl. biogas)	0	128	310	447	512	558
Synfuels	0	0	0	0	0	0
Natural gas	263	288	295	342	333	335
Hydrogen	0	0	7	148	874	1,597
Electricity	1	30	149	511	1,248	2,085
Total RES	0	133	359	789	2,158	3,984
RES share	0%	2%	5%	12%	37%	77%

Table 13.6.10 Middle East: Heat supply PJ/a

	2012	2020	2025	2030	2040	2050
District heating plants	0	0	0	0	0	0
Fossil fuels	0	0	0	0	0	0
Biomass	0	0	0	0	0	0
Solar collectors	0	0	0	0	0	0
Geothermal	0	0	0	0	0	0
Heat from CHP¹	0	57	107	146	333	631
Fossil fuels	0	12	17	18	24	40
Biomass	0	17	31	41	95	196
Geothermal	0	27	56	81	198	344
Hydrogen	0	1	3	6	17	51
Direct heating	6,409	7,242	7,400	7,603	8,024	8,030
Fossil fuels	5,938	6,138	5,879	5,391	3,888	1,633
Biomass	20	98	121	146	207	315
Solar collectors	7	159	370	733	1,609	2,020
Geothermal	0	110	144	180	231	366
Heat pumps ²	0	53	87	122	293	577
Electric direct heating	445	684	798	1,031	1,796	2,858
Hydrogen	0	0	0	0	0	261
Total heat supply³	6,409	7,299	7,507	7,749	8,357	8,661
Fossil fuels	5,938	6,150	5,896	5,408	3,912	1,673
Biomass	20	115	152	187	302	511
Solar collectors	7	159	370	733	1,609	2,020
Geothermal	0	137	200	261	429	710
Heat pumps ²	0	53	87	122	293	577
Electric direct heating	445	684	798	1,031	1,796	2,858
Hydrogen	0	1	3	6	17	51
RES share (including RES electricity)	1%	8%	14%	24%	49%	78%

1 public CHP and CHP autoproduction / 2 heat from ambient energy and electricity use / 3 incl. process heat, cooking

Table 13.6.10: Middle East: Installed capacity GW

	2012	2020	2025	2030	2040	2050
Total generation	256	352	416	572	923	1,392
Fossil	241	268	230	211	204	222
Hard coal (& non-renewable waste)	0	0	0	0	0	0
Lignite	0	0	0	0	0	0
Gas (w/o H+)	166	205	187	190	202	220
Oil	62	51	36	16	1	1
Diesel	12	12	7	4	0	0
Nuclear	0	0	0	0	0	0
Hydrogen (fuel cells, gas power plants, gas CHP)	0	0	0	0	1	2
Renewables	15	83	186	360	719	1,168
Hydro	14	18	21	23	26	30
Wind	0	16	45	82	130	188
of which wind offshore	0	0	3	5	8	13
PV	0	34	73	151	358	656
Biomass (& renewable waste)	0	2	3	5	7	9
Geothermal	0	1	2	6	14	15
Solar thermal power plants	0	10	35	86	167	245
Ocean energy	0	2	6	7	17	26
Fluctuating RES (PV, Wind, Ocean)	0	62	125	240	505	870
Share of fluctuating RES	0%	15%	30%	42%	55%	62%
RES share (domestic generation)	6%	24%	45%	63%	78%	84%

Table 13.6.12: Middle East: Final energy demand PJ/a

	2012	2020	2025	2030	2040	2050
Total (incl. non-energy use)	18,967	21,530	21,950	22,433	22,228	21,212
Total energy use	15,306	17,981	18,119	18,320	17,918	17,203
Transport	5,293	6,792	6,696	6,600	5,885	5,150
Oil products	5,028	6,346	5,935	5,153	2,918	575
Natural gas	263	288	295	342	333	335
Biofuels	0	128	310	447	512	558
Synfuels	0	0	0	0	0	0
Electricity	1	30	149	511	1,248	2,085
RES electricity	0	4	46	265	968	1,940
Hydrogen	0	0	7	148	874	1,597
RES share Transport	0%	2%	5%	12%	37%	77%
Industry	5,271	5,677	5,628	5,615	5,634	5,607
Electricity	578	772	846	1,010	1,476	2,282
RES electricity	14	110	264	524	1,145	2,124
Public district heat	0	0	0	0	0	0
RES district heat	0	0	0	0	0	0
Hard coal & lignite	79	41	49	44	0	0
Oil products	1,453	1,133	859	620	248	61
Gas	3,162	3,450	3,381	3,168	2,606	1,161
Solar	0	88	222	422	756	994
Biomass	0	64	92	120	176	272
Geothermal	0	129	179	231	373	572
Hydrogen	0	0	0	0	0	275
RES share Industry	0%	7%	13%	23%	43%	75%
Other Sectors	4,742	5,512	5,795	6,105	6,398	6,446
Electricity	2,064	2,551	2,851	3,221	3,840	4,417
RES electricity	51	364	888	1,672	2,979	4,109
Public district heat	0	0	0	0	0	0
RES district heat	0	0	0	0	0	0
Hard coal & lignite	0	0	0	0	0	0
Oil products	970	903	815	613	413	119
Gas	1,670	1,891	1,876	1,840	1,124	534
Solar	7	71	148	311	853	1,036
Biomass	32	78	80	83	95	114
Geothermal	0	18	26	36	73	227
Hydrogen	0	0	0	0	0	0
RES share Other Sectors	2%	10%	20%	34%	63%	85%
Total RES	104	1,054	2,257	4,189	8,608	13,676
RES share	1%	6%	12%	23%	48%	80%
Non energy use	3,661	3,549	3,831	4,114	4,310	4,009
Oil	1,734	1,574	1,738	1,907	2,084	2,019
Gas	1,916	1,824	1,778	1,703	1,353	858
Coal	10	151	316	504	673	1,133

1 excluding heat produced by CHP autoproducers

Table 13.6.13: Middle East: CO₂ emissions Mill t/a

	2012	2020	2025	2030	2040	2050
Condensation power plants	609	647	525	412	250	98
Hard coal (& non-renewable waste)	1	0	0	0	0	0
Lignite	0	0	0	0	0	0
Gas	327	406	369	340	245	96
Oil	210	182	122	52	3	2
Diesel	71	60	33	20	1	0
Combined heat and power plants	0	3	3	3	4	6
Hard coal (& non-renewable waste)	0	0	0	0	0	0
Lignite	0	0	0	0	0	0
Gas	0	2	3	3	4	6
Oil	0	1	1	0	0	0
CO₂ emissions power and CHP plants	609	650	529	415	254	103
Hard coal (& non-renewable waste)	1	0	0	0	0	0
Lignite	0	0	0	0	0	0
Gas	327	407	372	343	249	101
Oil & diesel	281	242	156	72	4	0

MIDDLE EAST: ADVANCED ENERGY [R]EVOLUTION SCENARIO

Table 13.6.15 Middle East: Electricity generation TWh/a

	2012	2020	2025	2030	2040	2050
Power plants	904	1,127	1,318	1,798	3,007	4,621
Hard coal (& non-renewable waste)	1	0	0	0	0	0
Lignite	0	0	0	0	0	0
Gas	552	721	677	661	367	139
of which from H ₂	0	0	0	0	18	139
Oil	275	189	132	48	2	0
Diesel	53	45	25	15	0	0
Nuclear	2	3	3	3	0	0
Biomass (& renewable waste)	0	5	13	14	15	18
Hydro	22	28	36	37	43	50
Wind	0	45	135	248	533	664
of which wind offshore	0	0	10	15	45	65
Geothermal	0	9	25	35	77	116
Solar thermal power plants	0	25	105	355	1,174	2,362
Ocean energy	0	3	13	14	59	92
Combined heat and power plants	0	15	25	30	55	85
Hard coal (& non-renewable waste)	0	0	0	0	0	0
Lignite	0	0	0	0	0	0
Gas	0	3	5	5	7	11
of which from H ₂	0	0	0	0	0	11
Oil	0	1	1	1	0	0
Biomass (& renewable waste)	0	7	12	14	23	27
Geothermal	0	3	6	9	22	38
Hydrogen	0	0	1	1	3	9
CHP by producer						
Main activity producers	0	0	0	0	0	0
Autoproducers	0	15	25	30	55	85
Total generation	904	1,142	1,343	1,828	3,062	4,706
Fossil	880	959	840	730	357	0
Hard coal (& non-renewable waste)	1	0	0	0	0	0
Lignite	0	0	0	0	0	0
Gas	552	724	681	666	355	0
Oil	275	190	134	49	2	0
Diesel	53	45	25	15	0	0
Nuclear	2	3	3	3	0	0
Hydrogen	0	0	1	1	21	159
of which renewable H ₂	0	0	0	1	19	158
Renewables (w/o renewable hydrogen)	22	180	499	1,094	2,683	4,547
Hydro	22	28	36	37	43	50
Wind	0	45	135	248	533	664
PV	0	55	155	368	737	1,180
Biomass (& renewable waste)	0	12	25	28	38	45
Geothermal	0	12	31	44	99	155
Solar thermal power plants	0	25	105	355	1,174	2,362
Ocean energy	0	3	13	14	59	92
Distribution losses	116	141	153	165	192	212
Own consumption electricity	56	60	57	54	49	44
Electricity for hydrogen production	0	1	22	154	627	1,517
Electricity for syngas production	0	0	0	0	107	59
Final energy consumption (electricity)	734	940	1,105	1,424	2,006	2,749
Fluctuating RES (PV, Wind, Ocean)	0	103	303	630	1,329	1,936
Share of fluctuating RES	0%	9%	23%	34%	43%	41%
RES share (domestic generation)	2%	16%	37%	60%	88%	100%

Table 13.6.16 Middle East: Final energy consumption in transport PJ/a

	2012	2020	2025	2030	2040	2050
Road	5,226	6,642	6,356	6,031	4,976	4,469
Fossil fuels	4,981	6,212	5,523	4,336	1,652	0
Biofuels	0	127	291	377	461	417
Synfuels	0	0	0	0	150	81
Natural gas	245	263	252	217	102	0
Hydrogen	0	0	49	382	1,290	1,812
Electricity	0	41	241	719	1,472	2,240
Rail	2	20	44	60	88	89
Fossil fuels	1	1	1	1	0	0
Biofuels	0	0	0	0	0	0
Synfuels	0	0	0	0	0	0
Electricity	1	19	43	59	88	89
Navigation	0	0	0	0	0	0
Fossil fuels	0	0	0	0	0	0
Biofuels	0	0	0	0	0	0
Synfuels	0	0	0	0	0	0
Aviation	46	53	62	65	80	85
Fossil fuels	46	53	61	59	52	0
Biofuels	0	0	0	6	21	71
Synfuels	0	0	0	0	7	14
Total (incl. pipelines)	5,293	6,735	6,479	6,172	5,309	4,731
Fossil fuels	5,028	6,266	5,585	4,396	1,704	0
Biofuels (incl. biogas)	0	127	291	383	482	488
Synfuels	0	0	0	0	157	95
Natural gas	263	281	269	230	104	0
Hydrogen	0	0	49	382	1,290	1,812
Electricity	1	61	285	782	1,572	2,336
Total RES	0	136	416	1,080	3,146	4,731
RES share	0%	2%	6%	17%	59%	100%

Table 13.6.17 Middle East: Heat supply PJ/a

	2012	2020	2025	2030	2040	2050
District heating plants	0	0	0	0	0	0
Fossil fuels	0	0	0	0	0	0
Biomass	0	0	0	0	0	0
Solar collectors	0	0	0	0	0	0
Geothermal	0	0	0	0	0	0
Heat from CHP¹	0	57	107	146	333	631
Fossil fuels	0	12	17	18	23	0
Biomass	0	17	31	41	95	196
Geothermal	0	27	56	81	198	344
Hydrogen	0	1	3	6	18	91
Direct heating	6,409	7,242	7,400	7,603	8,024	8,030
Fossil fuels	5,938	6,138	5,883	5,398	3,718	0
Biomass	20	98	121	146	207	315
Solar collectors	7	159	370	733	1,609	2,386
Geothermal	0	110	144	180	231	366
Heat pumps ²	0	53	87	122	293	577
Electric direct heating	445	684	794	1,024	1,796	3,219
Hydrogen	0	0	0	0	170	1,167
Total heat supply³	6,409	7,299	7,507	7,749	8,357	8,661
Fossil fuels	5,938	6,150	5,901	5,415	3,741	0
Biomass	20	115	152	187	302	511
Solar collectors	7	159	370	733	1,609	2,386
Geothermal	0	137	200	261	429	710
Heat pumps ²	0	53	87	122	293	577
Electric direct heating	445	684	794	1,024	1,796	3,219
Hydrogen	0	1	3	6	188	1,258
RES share (including RES electricity)	1%	8%	15%	25%	53%	100%

¹ public CHP and CHP autoproduction / ² heat from ambient energy and electricity use / ³ incl. process heat, cooking

Table 13.6.18: Middle East: Installed capacity GW

	2012	2020	2025	2030	2040	2050
Total generation	256	355	463	706	1,203	1,587
Fossil	241	265	233	225	196	0
Hard coal (& non-renewable waste)	0	0	0	0	0	0
Lignite	0	0	0	0	0	0
Gas (w/o H ₂)	166	203	190	208	195	0
Oil	62	51	36	14	0	0
Diesel	12	12	7	4	0	0
Nuclear	0	0	0	0	0	0
Hydrogen (fuel cells, gas power plants, gas CHP)	0	0	0	0	11	82
Renewables	15	89	229	480	996	1,505
Hydro	14	18	23	23	26	30
Wind	0	21	59	107	229	285
of which wind offshore	0	0	3	5	15	22
PV	0	34	94	223	449	722
Biomass (& renewable waste)	0	2	4	5	6	8
Geothermal	0	2	5	6	14	22
Solar thermal power plants	0	10	38	109	242	394
Ocean energy	0	2	6	7	30	46
Fluctuating RES (PV, Wind, Ocean)	0	57	159	337	707	1,052
Share of fluctuating RES	0%	16%	34%	48%	59%	66%
RES share (domestic generation)	6%	25%	49%	68%	83%	95%

Table 13.6.19: Middle East: Final energy demand PJ/a

	2012	2020	2025	2030	2040	2050
Total (incl. non-energy use)	18,967	21,472	21,734	22,095	21,893	21,101
Total energy use	15,306	17,924	17,903	17,981	17,583	17,092
Transport	5,293	6,735	6,479	6,172	5,309	4,731
Oil products	5,028	6,266	5,585	4,396	1,704	0
Natural gas	263	281	269	230	104	0
Biofuels	0	127	291	383	482	488
Synfuels	0	0	0	0	157	95
Electricity	1	61	285	782	1,572	2,336
RES electricity	0	10	106	468	1,387	2,336
Hydrogen	0	0	49	382	1,290	1,812
RES share Transport	0%	2%	6%	17%	59%	100%
Industry	5,271	5,677	5,628	5,653	5,741	5,748
Electricity	578	772	846	1,063	1,624	2,807
RES electricity	14	121	315	637	1,433	2,807
Public district heat	0	0	0	0	0	0
RES district heat	0	0	0	0	0	0
Hard coal & lignite	79	41	49	44	0	0
Oil products	1,453	1,133	859	611	231	0
Gas	3,162	3,450	3,381	3,162	2,453	0
Solar	0	88	222	422	756	1,350
Biomass	0	64	92	120	176	272
Geothermal	0	129	179	231	373	572
Hydrogen	0	0	0	0	128	747
RES share Industry	0%	7%	14%	25%	50%	100%
Other Sectors	4,742	5,512	5,796	6,156	6,533	6,613
Electricity	2,064	2,551	2,846	3,284	4,026	4,754
RES electricity	51	401	1,059	1,967	3,553	4,754
Public district heat	0	0	0	0	0	0
RES district heat	0	0	0	0	0	0
Hard coal & lignite	0	0	5	8	0	0
Oil products	970	903	815	601	382	0
Gas	1,670	1,891	1,876	1,833	1,049	0
Solar	7	71	148	311	853	1,036
Biomass	32	78	80	83	95	114
Geothermal	0	18	26	36	73	227
Hydrogen	0	0	0	0	54	482
RES share Other Sectors	2%	10%	23%	39%	71%	100%
Total RES	104	1,107	2,536	4,886	10,619	17,092
RES share	1%	6%	14%	27%	60%	100%
Non energy use	3,661	3,549	3,831	4,114	4,310	4,009
Oil	1,734	1,574	1,738	1,907	2,084	2,019
Gas	1,916	1,824	1,778	1,703	1,353	858
Coal	10	151	316	504	873	1,133

¹ excluding heat produced by CHP autoproducers

Table 13.6.20 Middle East: CO₂ emissions Mill t/a

	2012	2020	2025	2030	2040	2050
Condensation power plants	609	642	502	384	164	0
Hard coal (& non-renewable waste)	1	0	0	0	0	0
Lignite	0	0	0	0	0	0
Gas	327	400	347	321	163	0
Oil	210	182	122	43	1	0
Diesel	71	60	33	20	0	0
Combined heat and power plants	0	3	3	3	4	0
Hard coal (& non-renewable waste)	0	0	0	0	0	0
Lignite	0	0	0	0	0	0
Gas	0	2	3	3	4	0
Oil	0	1	1	0	0	0
CO₂ emissions power and CHP plants	609	645	506	387	168	0
Hard coal (& non-renewable waste)	1	0	0	0	0	0
Lignite	0	0	0	0	0	0
Gas	327	402	349	324	166	0
Oil & diesel	281	242	156	63	1	0

Table 13.6.22: Middle East: Investments in electricity generation

REF	UNIT	2012-2020	2021-2030	2031-2040	2041-2050	2012-2050	UNIT	ANNUAL AVERAGE 2012-2050
Fossil (w/o CHP)	billion \$	99.3	94.2	155.5	144.7	493.8	billion \$/a	12.7
Nuclear	billion \$	10.4	17.7	7.2	8.6	43.9	billion \$/a	1.1
CHP (fossil + renewable)	billion \$	0.5	3.3	2.8	3.9	10.4	billion \$/a	0.3
Renewables (w/o CHP)	billion \$	40.0	58.5	80.2	108.1	286.9	billion \$/a	7.4
Total	billion \$	150.2	173.7	245.7	265.3	834.9	billion \$/a	21.4
Conventional (fossil & nuclear)	billion \$	110.2	114.9	165.2	156.6	547.0	billion \$/a	14.0
Renewables	billion \$	40.1	58.7	80.5	108.7	288.0	billion \$/a	7.4
Biomass	billion \$	0.9	2.0	5.0	9.0	17.0	billion \$/a	0.4
Hydro	billion \$	21.8	22.6	17.7	20.8	82.8	billion \$/a	2.1
Wind	billion \$	1.6	6.5	22.8	47.8	78.7	billion \$/a	2.0
PV	billion \$	4.8	8.7	12.8	17.4	43.8	billion \$/a	1.1
Geothermal	billion \$	0.0	0.0	0.0	0.0	0.0	billion \$/a	0.0
Solar thermal power plants	billion \$	10.9	19.0	22.1	13.7	65.7	billion \$/a	1.7
Ocean energy	billion \$	0.0	0.0	0.0	0.0	0.0	billion \$/a	0.0
E[R]								
Fossil (w/o CHP)	billion \$	67.5	21.7	99.6	40.2	229.0	billion \$/a	5.9
Nuclear	billion \$	5.1	0.0	0.0	0.0	5.1	billion \$/a	0.1
CHP (fossil + renewable)	billion \$	8.9	5.6	12.3	9.2	36.0	billion \$/a	0.9
Renewables (w/o CHP)	billion \$	183.9	815.1	919.9	1,218.0	3,137.0	billion \$/a	80.4
Total	billion \$	265.4	842.4	1,031.8	1,267.4	3,407.1	billion \$/a	87.4
Conventional (fossil & nuclear)	billion \$	77.6	23.6	102.8	42.1	246.0	billion \$/a	6.3
Renewables	billion \$	187.8	818.8	929.1	1,225.3	3,161.1	billion \$/a	81.1
Biomass	billion \$	5.1	6.4	9.8	10.3	31.5	billion \$/a	0.8
Hydro	billion \$	21.8	22.6	17.7	20.8	82.8	billion \$/a	2.1
Wind	billion \$	25.1	108.8	99.9	190.2	424.1	billion \$/a	10.9
PV	billion \$	59.4	152.4	249.8	316.6	778.2	billion \$/a	20.0
Geothermal	billion \$	0.6	36.8	36.9	5.1	79.4	billion \$/a	2.0
Solar thermal power plants	billion \$	66.6	462.1	479.0	645.5	1,653.2	billion \$/a	42.4
Ocean energy	billion \$	9.2	29.7	36.0	36.8	111.8	billion \$/a	2.9
ADV E[R]								
Fossil (w/o CHP)	billion \$	66.0	33.1	93.4	0.0	192.5	billion \$/a	4.9
Nuclear	billion \$	5.1	0.0	0.0	0.0	5.1	billion \$/a	0.1
CHP (fossil + renewable)	billion \$	8.9	5.6	12.3	9.2	36.0	billion \$/a	0.9
Renewables (w/o CHP)	billion \$	205.1	1,071.5	1,408.5	1,787.4	4,472.5	billion \$/a	114.7
Total	billion \$	285.1	1,110.3	1,514.1	1,796.6	4,706.2	billion \$/a	120.7
Conventional (fossil & nuclear)	billion \$	76.1	35.1	96.5	1.9	209.6	billion \$/a	5.4
Renewables	billion \$	209.1	1,075.2	1,417.6	1,794.7	4,496.6	billion \$/a	115.3
Biomass	billion \$	5.1	6.4	9.2	9.5	30.1	billion \$/a	0.8
Hydro	billion \$	21.8	22.4	17.7	20.8	82.7	billion \$/a	2.1
Wind	billion \$	32.3	140.1	225.0	217.7	615.1	billion \$/a	15.8
PV	billion \$	59.4	244.9	262.7	358.4	925.4	billion \$/a	23.7
Geothermal	billion \$	14.7	29.6	36.9	48.2	129.4	billion \$/a	3.3
Solar thermal power plants	billion \$	66.6	602.1	787.5	1,085.3	2,541.4	billion \$/a	65.2
Ocean energy	billion \$	9.2	29.7	78.6	54.9	172.5	billion \$/a	4.4

Table 13.6.23: Middle East: Investments in renewable heat generation

REF	UNIT	2012-2020	2021-2030	2031-2040	2041-2050	2012-2050	UNIT	ANNUAL AVERAGE 2012-2050
Heat pumps	billion \$	0.0	0.0	0.0	0.0	0.0	billion \$/a	0.0
Deep geothermal	billion \$	0.0	0.0	0.0	0.0	0.0	billion \$/a	0.0
Solar thermal	billion \$	0.7	1.0	1.7	2.4	5.8	billion \$/a	0.1
Biomass	billion \$	7.1	11.6	15.6	21.0	55.3	billion \$/a	1.4
Total	billion \$	7.8	12.6	17.4	23.4	61.2	billion \$/a	1.6
E[R]								
Heat pumps	billion \$	13.3	15.1	45.2	82.8	156.4	billion \$/a	4.0
Deep geothermal	billion \$	24.3	14.4	28.7	33.8	101.2	billion \$/a	2.6
Solar thermal	billion \$	16.3	37.5	49.7	27.5	131.0	billion \$/a	3.4
Biomass	billion \$	13.6	5.9	14.5	10.5	44.5	billion \$/a	1.1
Total	billion \$	67.5	72.9	138.1	154.6	433.1	billion \$/a	11.1
ADV E[R]								
Heat pumps	billion \$	13.3	15.1	45.2	82.8	156.4	billion \$/a	4.0
Deep geothermal	billion \$	24.3	14.4	28.7	33.8	101.2	billion \$/a	2.6
Solar thermal	billion \$	16.3	37.5	49.7	27.5	131.0	billion \$/a	3.4
Biomass	billion \$	13.6	5.9	14.5	10.5	44.5	billion \$/a	1.1
Total	billion \$	67.5	72.9	138.1	154.6	433.1	billion \$/a	12.1

Table 13.6.24: Middle East: Total employment in the energy sector THOUSAND JOBS

By sector	REFERENCE SCENARIO				ADV E[R] SCENARIO		
	2015	2020	2025	2030	2020	2025	2030
Construction and installation	36	41	38	32	211	371	336
Manufacturing	17	17	16	12	46	72	67
Operations and maintenance	63	76	85	87	110	181	284
Fuel supply (domestic)	338	384	422	436	360	335	293
Coal and gas export	57.5	58.7	64.9	66.3	61.2	45.9	30.6
Solar and geothermal heat	5	5	7	5	105	107	105
Total jobs (thousands)	516	581	632	638	894	1,112	1,116
By technology							
Coal	3	2	2	2	1	1	1
Gas, oil & diesel	473	523	563	564	451	394	317
Nuclear	8	11	10	9	0	0	0
Renewable	31	45	56	63	442	716	797
Biomass	5	9	14	19	36	51	54
Hydro	12	13	14	11	19	9	11
Wind	0.9	2.6	3.8	8.3	54	77	104
PV	5.7	10	11.6	13.8	159	316	287
Geothermal power	0.0	0.0	0.0	0.0	4.7	4.4	6
Solar thermal power	2.4	4.4	5.6	5.9	53	146	214
Ocean	-	-	-	-	12	6	17
Solar - heat	5	5	6.7	5.4	69	93	92
Geothermal & heat pump	0.0	-	-	-	36	14	13
Total jobs (thousands)	516	581	632	638	894	1,112	1,116

EASTERN EUROPE/EURASIA: REFERENCE SCENARIO

Table 13.7.1 Eastern Europe/Eurasia: Electricity generation TWh/a

	2012	2020	2025	2030	2040	2050
Power plants	810	974	1,152	1,329	1,693	2,067
Hard coal (& non-renewable waste)	82	61	76	90	146	262
Lignite	69	76	81	87	100	113
Gas	62	136	223	307	497	614
of which from H ₂	0	0	0	0	0	0
Oil	7	3	2	2	1	0
Diesel	3	3	3	3	3	2
Nuclear	297	333	369	405	417	430
Biomass (& renewable waste)	0	12	18	24	46	69
Hydro	283	326	346	367	413	458
Wind	5	16	23	29	48	67
of which wind offshore	0	0	1	2	6	10
PV	1	5	6	7	8	11
Geothermal	0	3	6	8	13	20
Solar thermal power plants	0	0	0	0	0	0
Ocean energy	0	0	0	0	0	0
Combined heat and power plants	933	975	993	1,014	1,044	1,075
Hard coal (& non-renewable waste)	175	187	193	199	201	202
Lignite	91	91	90	89	87	85
Gas	635	677	698	720	751	785
of which from H ₂	0	0	0	0	0	0
Oil	30	19	11	3	1	0
Biomass (& renewable waste)	1	2	2	2	3	4
Geothermal	0	0	0	0	0	0
Hydrogen	0	0	0	0	0	0
CHP by producer						
Main activity producers	864	899	912	926	945	963
Autoproducers	69	76	81	88	99	112
Total generation	1,743	1,949	2,146	2,343	2,737	3,142
Fossil	1,155	1,252	1,376	1,500	1,787	2,083
Hard coal (& non-renewable waste)	257	248	269	289	347	484
Lignite	160	166	171	176	187	198
Gas	697	813	920	1,027	1,249	1,399
Oil	37	22	13	5	2	0
Diesel	3	3	3	3	3	2
Nuclear	297	333	369	405	417	430
Hydrogen	0	0	0	0	0	0
of which renewable H ₂	0	0	0	0	0	0
Renewables (w/o renewable hydrogen)	291	363	400	437	532	629
Hydro	283	326	346	367	413	458
Wind	5	16	23	29	48	67
PV	1	5	6	7	8	11
Biomass (& renewable waste)	1	13	20	26	49	73
Geothermal	0	3	6	8	13	20
Solar thermal power plants	0	0	0	0	0	0
Ocean energy	0	0	0	0	0	0
Distribution losses	184	211	234	258	303	353
Own consumption electricity	294	296	308	320	366	376
Electricity for hydrogen production	0	0	0	0	0	0
Electricity for synfuel production	0	0	0	0	0	0
Final energy consumption (electricity)	1,254	1,434	1,595	1,757	2,060	2,405
Fluctuating RES (PV, Wind, Ocean)	7	21	29	36	57	78
Share of fluctuating RES	0%	1%	1%	2%	2%	2%
RES share (domestic generation)	17%	19%	19%	19%	19%	20%

Table 13.7.2 Eastern Europe/Eurasia: Final energy consumption in transport PJ/a

	2012	2020	2025	2030	2040	2050
Road	3,712	4,053	4,450	4,846	5,404	5,515
Fossil fuels	3,666	3,971	4,297	4,623	5,024	4,956
Biofuels	18	23	22	21	21	20
Synfuels	0	0	0	0	0	0
Natural gas	27	50	89	129	214	303
Hydrogen	0	0	0	0	0	0
Electricity	1	9	42	72	145	236
Rail	591	635	658	682	732	777
Fossil fuels	189	208	215	222	234	244
Biofuels	0	0	0	0	0	0
Synfuels	0	0	0	0	0	0
Electricity	401	427	442	460	497	533
Navigation	45	66	68	71	72	75
Fossil fuels	45	66	68	71	72	75
Biofuels	0	0	0	0	0	0
Synfuels	0	0	0	0	0	0
Aviation	297	337	360	382	429	474
Fossil fuels	297	337	360	382	429	474
Biofuels	0	0	0	0	0	0
Synfuels	0	0	0	0	0	0
Total (incl. pipelines)	6,012	6,471	6,929	7,388	8,072	8,305
Fossil fuels	4,198	4,582	4,940	5,299	5,759	5,749
Biofuels (incl. biogas)	18	23	22	21	21	20
Synfuels	0	0	0	0	0	0
Natural gas	1,393	1,429	1,483	1,536	1,649	1,768
Hydrogen	0	0	0	0	0	0
Electricity	402	436	484	532	642	769
Total RES	86	104	112	121	146	174
RES share	1%	2%	2%	2%	2%	2%

Table 13.7.3 Eastern Europe/Eurasia: Heat supply PJ/a

	2012	2020	2025	2030	2040	2050
District heating plants	4,069	3,832	4,132	4,431	4,866	5,295
Fossil fuels	4,002	3,746	4,027	4,305	4,699	5,082
Biomass	66	85	104	125	167	213
Solar collectors	0	0	0	0	0	0
Geothermal	0	0	0	0	0	0
Heat from CHP¹	4,031	4,045	4,027	4,033	4,004	4,016
Fossil fuels	4,015	4,025	4,005	4,010	3,977	3,985
Biomass	16	20	22	24	27	31
Geothermal	0	0	0	0	0	0
Hydrogen	0	0	0	0	0	0
Direct heating	9,640	11,543	12,475	13,431	15,213	17,196
Fossil fuels	8,397	9,997	10,851	11,727	13,336	15,115
Biomass	427	710	777	846	996	1,176
Solar collectors	4	6	7	8	10	14
Geothermal	0	0	0	0	0	0
Heat pumps ²	5	7	8	9	12	15
Electric direct heating	807	824	832	841	859	876
Hydrogen	0	0	0	0	0	0
Total heat supply³	17,440	19,420	20,633	21,895	24,084	26,507
Fossil fuels	16,414	17,768	18,883	20,042	22,013	24,181
Biomass	509	816	904	995	1,190	1,421
Solar collectors	4	6	7	8	10	14
Geothermal	0	0	0	0	0	0
Heat pumps ²	5	7	8	9	12	15
Electric direct heating	807	824	832	841	859	876
Hydrogen	0	0	0	0	0	0
RES share (including RES electricity)	4%	5%	5%	5%	6%	6%

¹ public CHP and CHP autoproduction / ² heat from ambient energy and electricity use / ³ incl. process heat, cooking

Table 13.7.4: Eastern Europe/Eurasia: Installed capacity GW

	2012	2020	2025	2030	2040	2050
Total generation	432	476	508	539	612	681
Fossil	290	310	327	344	391	431
Hard coal (& non-renewable waste)	68	65	66	67	71	94
Lignite	42	43	42	41	38	38
Gas (w/o H ₂)	157	185	207	229	277	297
Oil	21	15	9	4	2	0
Diesel	2	2	2	2	3	2
Nuclear	43	47	52	56	57	59
Hydrogen (fuel cells, gas power plants, gas CHP)	0	0	0	0	0	0
Renewables	99	119	129	139	164	191
Hydro	93	103	108	114	125	139
Wind	4	8	11	13	20	27
of which wind offshore	0	0	0	1	2	3
PV	1	4	5	6	7	9
Biomass (& renewable waste)	1	3	4	5	9	13
Geothermal	0	0	1	1	2	3
Solar thermal power plants	0	0	0	0	0	0
Ocean energy	0	0	0	0	0	0
Fluctuating RES (PV, Wind, Ocean)	5	13	16	19	28	36
Share of fluctuating RES	1%	3%	3%	4%	5%	5%
RES share (domestic generation)	23%	25%	25%	26%	27%	28%

Table 13.7.5: Eastern Europe/Eurasia: Final energy demand PJ/a

	2012	2020	2025	2030	2040	2050
Total (incl. non-energy use)	31,063	34,176	36,582	38,938	42,623	46,114
Total energy use	27,438	30,457	32,602	34,747	38,328	41,764
Transport	6,012	6,471	6,929	7,388	8,072	8,305
Oil products	4,198	4,582	4,940	5,299	5,759	5,749
Natural gas	1,393	1,429	1,483	1,536	1,649	1,768
Biofuels	18	23	22	21	21	20
Synfuels	0	0	0	0	0	0
Electricity	402	436	484	532	642	769
RES electricity	67	81	90	99	125	154
Hydrogen	0	0	0	0	0	0
RES share Transport	1%	2%	2%	2%	2%	2%
Industry	9,526	10,982	11,858	12,734	14,078	15,557
Electricity	2,009	2,320	2,568	2,816	3,252	3,742
RES electricity	336	433	479	526	632	749
Public district heat	2,403	2,413	2,529	2,645	2,765	2,886
RES district heat	12	30	36	43	56	71
Hard coal & lignite	1,448	2,003	2,131	2,258	2,437	2,571
Gas	789	866	879	862	870	849
Oil products	2,826	3,270	3,604	3,938	4,493	5,151
Solar	0	0	0	0	1	1
Biomass	51	111	148	184	261	358
Geothermal	0	0	0	0	0	0
Hydrogen	0	0	0	0	0	0
RES share Industry	4%	5%	6%	6%	7%	8%
Other Sectors	11,901	13,004	13,814	14,624	16,178	17,902
Electricity	2,104	2,406	2,691	2,976	3,523	4,147
RES electricity	351	449	502	555	685	830
Public district heat	4,122	4,013	4,143	4,274	4,490	4,714
RES district heat	21	50	59	70	91	115
Hard coal & lignite	467	465	478	491	495	493
Oil products	1,077	1,078	1,061	1,043	997	952
Gas	3,604	4,212	4,573	4,935	5,691	6,530
Solar	4	5	6	7	10	13
Biomass	519	821	856	891	964	1,042
Geothermal	0	5	6	6	9	11
Hydrogen	0	0	0	0	0	0
RES share Other Sectors	8%	10%	10%	10%	11%	11%
Total RES	1,383	2,008	2,206	2,404	2,854	3,364
RES share	5%	7%	7%	7%	7%	8%
Non energy use	3,624	3,719	3,980	4,191	4,295	4,360
Oil	1,825	1,873	2,004	2,110	2,163	2,190
Gas	1,771	1,817	1,945	2,048	2,099	2,125
Coal	28	29	31	33	33	34

¹ excluding heat produced by CHP autoproducers

Table 13.7.6: Eastern Europe/Eurasia: CO₂ emissions Mill t/a

	2012	2020	2025	2030	2040	2050
Condensation power plants	208	252	318	380	553	730
Hard coal (& non-renewable waste)	80	65	80	93	143	264
Lignite	83	97	102	107	117	128
Gas	36	82	130	174	290	338
Oil	5	4	4	4	1	0
Diesel	3	3	3	3	2	0
Combined heat and power plants	853	801	769	743	692	650
Hard coal (& non-renewable waste)	220	227	227	229	223	218
Lignite	126	123	120	118	113	108
Gas	476	434	411	392	355	328
Oil	30	17	10	3	1	0
CO₂ emissions power and CHP plants	1,060	1,052	1,086	1,123	1,245	1,382
Hard coal (& non-renewable waste)	300	292	307	322	365	480
Lignite	210	220	222	225	230	234
Gas	512	516	541	566	645	666
Oil & diesel	39	24	17	10	5	2
CO₂ intensity (g/kWh)						
without credit for CHP heat						
CO ₂ intensity fossil electr. generation	918	840	789	748	697	664
CO ₂ intensity total electr. generation	608	540	506	479	455	440
CO₂ emissions by sector	2,713	2,803	2,921	3,040	3,298	3,566
% of 1990 emissions (3,986 Mill t)	69%	71%	74%	77%	83%	90%
Industry ¹	415	484	509	537	575	617
Other sectors ¹	322	355	374	393	431	473
Transport	304	333	361	388	426	430
Power generation ²	977	980	1,020	1,059	1,188	1,325
Other conversion ³	694	651	658	662	678	711
Population (Mill.)	341	341	339	335	326	316
CO₂ emissions per capita (t/capita)	8.0	8.2	8.6	9.1	10.1	11.3

EASTERN EUROPE/EURASIA: ENERGY [R]EVOLUTION SCENARIO

Table 13.7.8 Eastern Europe/Eurasia: Electricity generation TWh/a

	2012	2020	2025	2030	2040	2050
Power plants	810	927	1,132	1,387	1,962	2,336
Hard coal (& non-renewable waste)	82	43	37	38	15	0
Lignite	69	43	33	15	0	0
Gas	62	170	189	209	226	81
of which from H+	0	0	1	0	0	0
Oil	7	3	1	3	2	1
Diesel	2	3	3	3	2	1
Nuclear	297	269	230	150	0	0
Biomass (& renewable waste)	0	23	39	41	40	21
Hydro	283	326	346	360	375	380
Wind	5	36	193	415	892	1,256
of which wind offshore	0	1	17	48	161	240
PV	1	8	48	123	285	410
Geothermal	0	4	10	24	76	104
Solar thermal power plants	0	0	1	5	26	40
Ocean energy	0	0	1	5	24	44
Combined heat and power plants	933	976	989	1,001	1,012	966
Hard coal (& non-renewable waste)	175	164	136	85	0	0
Lignite	91	80	51	18	0	0
Gas	635	669	691	711	609	389
of which from H+	0	0	0	0	26	79
Oil	30	14	5	0	0	0
Biomass (& renewable waste)	1	49	97	151	288	384
Geothermal	0	0	10	36	114	186
Hydrogen	0	0	0	0	0	6
CHP by producer						
Main activity producers	864	899	903	903	888	829
Autoproducers	69	77	86	98	124	137
Total generation	1,743	1,903	2,121	2,388	2,973	3,302
Fossil	1,155	1,188	1,145	1,078	826	392
Hard coal (& non-renewable waste)	257	207	173	122	15	0
Lignite	160	123	84	33	0	0
Gas	697	838	880	920	809	391
Oil	37	17	5	0	0	0
Diesel	3	3	3	3	2	1
Nuclear	297	269	230	150	0	0
Hydrogen	0	0	0	0	27	85
of which renewable H+	0	0	0	0	19	75
Renewables (w/o renewable hydrogen)	291	447	746	1,160	2,120	2,825
Hydro	283	326	346	360	375	380
Wind	5	36	193	415	892	1,256
PV	1	8	48	123	285	410
Biomass (& renewable waste)	1	72	136	191	328	405
Geothermal	0	4	20	60	190	290
Solar thermal power plants	0	0	1	5	26	40
Ocean energy	0	0	1	5	24	44
Distribution losses	184	206	234	268	328	347
Own consumption electricity	294	294	293	288	224	124
Electricity for hydrogen production	0	0	1	7	190	468
Electricity for synfuel production	0	0	0	0	0	0
Final energy consumption (electricity)	1,254	1,404	1,593	1,825	2,232	2,363
Fluctuating RES (PV, Wind, Ocean)	7	44	242	543	1,201	1,710
Share of fluctuating RES	0%	2%	11%	23%	40%	52%
RES share (domestic generation)	17%	23%	35%	49%	72%	88%

Table 13.7.9 Eastern Europe/Eurasia: Final energy consumption in transport PJ/a

	2012	2020	2025	2030	2040	2050
Road	3,712	4,013	4,146	4,151	3,729	2,648
Fossil fuels	3,666	3,848	3,683	3,285	1,972	451
Biofuels	18	99	277	491	526	475
Synfuels	0	0	0	0	0	0
Natural gas	27	53	100	107	129	111
Hydrogen	0	0	2	19	209	445
Electricity	1	13	85	249	894	1,166
Rail	591	639	655	685	740	780
Fossil fuels	189	193	171	129	86	52
Biofuels	0	10	9	31	34	28
Synfuels	0	0	0	0	0	0
Electricity	401	436	475	525	620	700
Navigation	45	66	66	65	61	57
Fossil fuels	45	63	63	59	49	37
Biofuels	0	3	3	6	12	20
Synfuels	0	0	0	0	0	0
Aviation	297	337	343	347	357	365
Fossil fuels	297	337	333	327	286	237
Biofuels	0	0	10	21	71	128
Synfuels	0	0	0	0	0	0
Total (incl. pipelines)	6,012	6,289	6,306	6,206	5,570	4,250
Fossil fuels	4,198	4,441	4,249	3,800	2,393	777
Biofuels (incl. biogas)	18	112	299	548	643	650
Synfuels	0	0	0	0	0	0
Natural gas	1,393	1,281	1,177	1,027	681	211
Hydrogen	0	0	2	19	209	445
Electricity	402	455	578	812	1,644	2,166
Total RES	86	219	503	952	1,976	2,943
RES share	1%	3%	8%	15%	35%	69%

Table 13.7.10 Eastern Europe/Eurasia: Heat supply PJ/a

	2012	2020	2025	2030	2040	2050
District heating plants	4,069	3,756	4,065	4,044	3,535	2,558
Fossil fuels	4,002	3,473	3,314	2,847	1,326	256
Biomass	66	275	568	793	1,220	1,113
Solar collectors	0	4	102	243	495	550
Geothermal	0	4	81	162	495	639
Heat from CHP¹	4,031	4,050	3,978	3,970	4,109	4,275
Fossil fuels	4,015	3,852	3,513	3,089	1,994	1,008
Biomass	16	197	393	615	1,194	1,617
Geothermal	0	0	73	266	832	1,358
Hydrogen	0	0	0	0	89	292
Direct heating	9,640	11,065	10,690	10,312	9,371	7,933
Fossil fuels	8,397	9,126	7,874	6,335	2,865	589
Biomass	427	961	1,227	1,442	1,633	1,635
Solar collectors	4	54	259	597	1,520	1,721
Geothermal	0	0	8	39	142	167
Heat pumps ²	5	46	181	455	1,272	1,630
Electric direct heating	807	877	1,141	1,443	1,882	2,042
Hydrogen	0	0	0	0	57	150
Total heat supply³	17,740	18,871	18,734	18,326	17,016	14,766
Fossil fuels	16,414	16,452	14,701	12,272	6,185	1,852
Biomass	509	1,434	2,188	2,850	4,047	4,365
Solar collectors	4	58	361	840	2,015	2,271
Geothermal	0	4	162	467	1,469	2,165
Heat pumps ²	5	46	181	455	1,272	1,630
Electric direct heating	807	877	1,141	1,443	1,882	2,042
Hydrogen	0	0	0	0	146	442
RES share (including RES electricity)	4%	9%	18%	29%	61%	86%

¹ public CHP and CHP autoproduction / ² heat from ambient energy and electricity use / ³ incl. process heat, cooking

Table 13.7.10: Eastern Europe/Eurasia: Installed capacity GW

	2012	2020	2025	2030	2040	2050
Total generation	432	473	571	723	1,071	1,334
Fossil	290	290	267	245	224	179
Hard coal (& non-renewable waste)	68	54	43	29	8	0
Lignite	42	32	21	9	0	0
Gas (w/o H ₂)	157	191	198	205	214	178
Oil	1	12	4	0	0	0
Diesel	2	2	2	2	2	1
Nuclear	43	38	32	21	0	0
Nuclear (fuel cells, gas power plants, gas CHP)	0	0	0	0	7	35
Renewables	99	145	272	457	839	1,119
Hydro	93	103	106	111	114	115
Wind	4	18	91	187	370	506
of which wind offshore	0	0	5	15	50	72
PV	1	7	42	107	246	342
Biomass (& renewable waste)	1	16	27	39	67	90
Geothermal	0	1	3	8	26	40
Solar thermal power plants	0	0	0	1	5	8
Ocean energy	0	0	1	2	11	18
Fluctuating RES (PV, Wind, Ocean)	5	25	133	297	627	866
Share of fluctuating RES	1%	5%	23%	41%	59%	65%
RES share (domestic generation)	23%	31%	48%	63%	78%	84%

Table 13.7.12: Eastern Europe/Eurasia: Final energy demand PJ/a

	2012	2020	2025	2030	2040	2050
Total (incl. non-energy use)	31,063	33,152	33,033	32,491	29,761	25,594
Total energy use	27,438	29,470	29,252	28,635	26,110	22,114
Transport	6,012	6,289	6,306	6,206	5,570	4,250
Oil products	4,198	4,441	4,249	3,600	2,393	777
Natural gas	1,393	1,281	1,177	1,027	681	211
Biofuels	18	112	299	548	643	650
Synfuels	0	0	0	0	0	0
Electricity	402	455	578	812	1,644	2,166
RES electricity	67	107	203	395	1,183	1,902
Hydrogen	0	0	2	19	209	445
RES share Transport	1%	3%	8%	15%	35%	69%
Industry	9,526	10,598	10,599	10,550	9,467	7,614
Electricity	2,009	2,240	2,510	2,618	3,175	3,074
RES electricity	336	525	882	1,389	2,284	2,699
Public district heat	2,403	2,412	2,535	2,557	2,322	2,078
RES district heat	23	154	397	679	1,346	1,737
Hard coal & lignite	1,448	1,631	1,133	633	0	0
Oil products	789	697	504	307	98	6
Gas	2,826	3,187	3,153	3,087	2,028	394
Solar	0	16	118	236	496	528
Biomass	51	410	611	806	962	1,000
Geothermal	0	5	36	107	324	375
Hydrogen	0	0	0	0	62	158
RES share Industry	4%	10%	19%	30%	58%	85%
Other Sectors	11,901	12,583	12,347	11,879	11,073	10,250
Electricity	2,104	2,358	2,647	2,939	3,216	3,267
RES electricity	351	553	931	1,427	2,314	2,888
Public district heat	4,122	3,977	4,059	4,017	3,926	3,498
RES district heat	467	416	234	53	0	0
Hard coal & lignite	1,077	786	353	220	66	16
Oil products	3,604	4,128	3,838	2,999	1,041	316
Gas	4	39	142	361	1,024	1,193
Solar	519	852	976	1,032	1,049	946
Biomass	0	27	100	259	751	1,014
Geothermal	0	0	0	0	0	0
Hydrogen	0	0	0	0	0	0
RES share Other Sectors	8%	14%	23%	35%	67%	87%
Total RES	1,414	3,053	5,331	8,293	14,846	18,365
RES share	5%	10%	18%	29%	57%	83%
Non energy use	3,624	3,682	3,781	3,856	3,651	3,480
Oil	1,825	1,804	1,607	1,349	876	557
Gas	1,771	1,841	1,985	2,121	2,154	2,192
Coal	28	37	189	386	621	731

EASTERN EUROPE/EURASIA: ADVANCED ENERGY [R]EVOLUTION SCENARIO

Table 13.7.15 Eastern Europe/Eurasia: Electricity generation TWh/a

	2012	2020	2025	2030	2040	2050
Power plants	810	928	1,198	1,619	2,736	4,025
Hard coal (& non-renewable waste)	82	43	33	11	0	0
Lignite	69	43	33	15	0	0
Gas	62	170	189	209	232	154
of which from H ₂	0	0	1	4	32	154
Oil	7	0	0	0	0	0
Diesel	3	3	3	3	2	0
Nuclear	297	269	230	150	0	0
Biomass (& renewable waste)	0	23	39	41	40	19
Hydro	283	326	346	360	375	380
Wind	5	37	229	579	1,341	2,205
of which wind offshore	0	1	32	127	353	570
PV	1	8	66	181	462	780
Geothermal	0	4	27	54	203	367
Solar thermal power plants	0	0	1	9	46	60
Ocean energy	0	0	1	7	34	60
Combined heat and power plants	933	976	989	1,001	1,012	956
Hard coal (& non-renewable waste)	175	164	136	85	0	0
Lignite	91	80	51	18	0	0
Gas	635	669	691	711	603	316
of which from H ₂	0	0	3	14	84	316
Oil	30	14	5	0	0	0
Biomass (& renewable waste)	1	49	97	151	288	393
Geothermal	0	0	10	36	114	222
Hydrogen	0	0	0	0	7	25
CHP by producer						
Main activity producers	864	899	903	903	888	829
Autoproducers	69	77	86	98	124	127
Total generation	1,743	1,904	2,187	2,620	3,747	4,980
Fossil	1,155	1,188	1,137	1,033	721	0
Hard coal (& non-renewable waste)	257	207	169	95	0	0
Lignite	160	123	84	33	0	0
Gas	697	838	876	902	718	0
Oil	37	17	5	0	0	0
Diesel	3	3	3	3	2	0
Nuclear	297	269	230	150	0	0
Hydrogen	0	0	4	19	124	495
of which renewable H ₂	0	0	2	10	99	495
Renewables (w/o renewable hydrogen)	291	447	816	1,418	2,903	4,485
Hydro	283	326	346	360	375	380
Wind	5	37	229	579	1,341	2,205
PV	1	8	66	181	462	780
Biomass (& renewable waste)	1	72	136	191	328	412
Geothermal	0	4	37	91	317	589
Solar thermal power plants	0	0	1	9	46	60
Ocean energy	0	0	1	7	34	60
Distribution losses	184	206	234	268	328	347
Own consumption electricity	294	294	293	288	224	124
Electricity for hydrogen production	0	0	47	153	712	1,820
Electricity for syngas production	0	0	0	0	25	144
Final energy consumption (electricity)	1,254	1,404	1,614	1,910	2,459	2,545
Fluctuating RES (PV, Wind, Ocean)	7	45	296	767	1,837	3,045
Share of fluctuating RES	0%	2%	14%	29%	49%	61%
RES share (domestic generation)	17%	23%	37%	55%	80%	100%

Table 13.7.16 Eastern Europe/Eurasia: Final Energy Consumption Transport PJ/a

	2012	2020	2025	2030	2040	2050
Road	3,712	4,013	4,046	3,859	3,012	1,870
Fossil fuels	3,666	3,848	3,555	3,085	1,215	0
Biofuels	18	99	268	305	493	359
Synfuels	0	0	0	0	28	120
Natural gas	27	53	92	76	32	0
Hydrogen	0	0	33	87	354	461
Electricity	1	14	99	307	919	1,050
Rail	591	639	679	749	910	985
Fossil fuels	189	191	154	102	43	0
Biofuels	0	10	8	18	27	30
Synfuels	0	0	0	0	2	10
Electricity	401	438	517	629	838	945
Navigation	45	66	66	65	61	57
Fossil fuels	45	63	63	56	40	0
Biofuels	0	3	3	9	20	43
Synfuels	0	0	0	0	1	14
Aviation	297	337	336	330	311	292
Fossil fuels	297	337	326	287	202	0
Biofuels	0	0	9	43	103	219
Synfuels	0	0	0	0	6	73
Total (incl. pipelines)	6,012	6,246	6,137	5,833	4,789	3,424
Fossil fuels	4,198	4,439	4,098	3,530	1,500	0
Biofuels (incl. biogas)	18	112	288	375	643	650
Synfuels	0	0	0	0	37	217
Natural gas	1,393	1,238	1,065	829	240	0
Hydrogen	0	0	33	87	354	461
Electricity	402	458	653	1,013	2,016	2,095
Total RES	86	220	545	974	2,571	3,424
RES share	1%	4%	9%	17%	54%	100%

Table 13.7.17 Eastern Europe/Eurasia: Heat Supply PJ/a

	2012	2020	2025	2030	2040	2050
District heating plants	4,069	3,756	4,065	4,044	3,527	2,259
Fossil fuels	4,002	3,473	3,314	2,847	1,323	0
Biomass	66	275	568	793	1,217	1,073
Solar collectors	0	4	102	243	494	531
Geothermal	0	4	81	162	494	655
Heat from CHP¹	4,031	4,050	3,978	3,971	4,129	4,466
Fossil fuels	4,015	3,852	3,500	3,036	1,764	0
Biomass	16	197	393	615	1,194	1,657
Geothermal	0	0	73	266	836	1,623
Hydrogen	0	0	13	54	335	1,187
Direct heating	8,940	11,065	10,690	10,311	9,358	8,024
Fossil fuels	8,397	9,126	7,844	6,227	2,291	0
Biomass	427	961	1,227	1,441	1,631	1,630
Solar collectors	4	54	259	597	1,518	1,742
Geothermal	0	0	8	39	141	166
Heat pumps ²	5	46	181	455	1,392	1,888
Electric direct heating	807	877	1,141	1,443	2,028	2,293
Hydrogen	0	0	31	108	357	305
Total heat supply³	17,740	18,871	18,734	18,326	17,015	14,749
Fossil fuels	16,414	16,452	14,658	12,110	5,378	0
Biomass	509	1,434	2,188	2,849	4,042	4,360
Solar collectors	4	58	361	839	2,012	2,273
Geothermal	0	4	162	467	1,471	2,444
Heat pumps ²	5	46	181	455	1,392	1,888
Electric direct heating	807	877	1,141	1,443	2,028	2,293
Hydrogen	0	0	44	162	692	1,492
RES share (including RES electricity)	4%	9%	18%	30%	66%	100%

¹ public CHP and CHP autoproduction / ² heat from ambient energy and electricity use / ³ incl. process heat, cooking

Table 13.7.18: Eastern Europe/Eurasia: Installed capacity GW

	2012	2020	2025	2030	2040	2050
Total generation	432	473	602	838	1,468	2,054
Fossil	290	290	265	234	237	0
Hard coal (& non-renewable waste)	68	54	42	22	0	0
Lignite	42	32	21	9	0	0
Gas (w/o H ₂)	157	191	197	201	235	0
Oil	21	12	4	0	0	0
Diesel	2	2	2	2	0	0
Nuclear	43	38	32	21	0	0
Hydrogen (fuel cells, gas power plants, gas CHP)	0	0	1	4	40	261
Renewables	99	145	304	578	1,190	1,793
Hydro	93	103	108	111	114	115
Wind	4	19	106	252	542	869
of which wind offshore	0	0	10	40	109	170
PV	1	7	57	157	399	600
Biomass (& renewable waste)	1	16	27	39	67	91
Geothermal	0	1	5	13	44	81
Solar thermal power plants	0	0	0	2	10	12
Ocean energy	0	0	1	3	16	25
Fluctuating RES (PV, Wind, Ocean)	5	26	163	413	956	1,494
Share of fluctuating RES	1%	5%	27%	49%	66%	73%
RES share (domestic generation)	23%	31%	50%	69%	81%	87%

Table 13.7.19: Eastern Europe/Eurasia: Final energy demand PJ/a

	2012	2020	2025	2030	2040	2050
Total (incl. non-energy use)	31,063	33,109	32,864	32,195	29,131	24,993
Total energy use	27,438	29,427	29,083	28,339	25,480	21,513
Transport	6,012	6,246	6,137	5,833	4,789	3,424
Oil products	4,198	4,439	4,098	3,530	1,500	0
Natural gas	1,393	1,238	1,065	829	240	0
Biofuels	18	112	288	375	643	650
Synfuels	0	0	0	0	37	217
Electricity	402	458	653	1,013	2,016	2,095
RES electricity	67	107	244	552	1,615	2,095
Hydrogen	0	0	33	87	354	461
RES share Transport	1%	4%	9%	17%	54%	100%
Industry	9,526	10,598	10,599	10,569	9,492	7,673
Electricity	2,009	2,240	2,510	2,845	3,359	3,332
RES electricity	336	526	938	1,551	2,691	3,332
Public district heat	2,403	2,412	2,535	2,557	2,318	2,073
RES district heat	23	154	399	687	1,386	2,073
Hard coal & lignite	1,448	1,631	1,133	633	0	0
Oil products	789	697	504	302	90	0
Gas	2,826	3,187	3,137	3,022	1,653	0
Solar	0	16	118	236	495	555
Biomass	51	410	611	806	960	998
Geothermal	0	5	36	107	349	395
Hydrogen	0	0	16	61	268	321
RES share Industry	4%	10%	20%	32%	64%	100%
Other Sectors	11,901	12,583	12,347	11,937	11,199	10,416
Electricity	2,104	2,368	2,647	3,020	3,476	3,734
RES electricity	351	554	989	1,646	2,785	3,734
Public district heat	4,122	3,977	4,059	4,017	3,924	3,365
RES district heat	40	253	638	1,079	2,346	3,365
Hard coal & lignite	467	416	234	53	0	0
Oil products	1,077	786	353	207	45	0
Gas	3,604	4,128	3,819	2,930	751	0
Solar	4	39	142	361	1,024	1,188
Biomass	519	852	976	1,032	1,048	942
Geothermal	4	27	100	259	813	1,188
Hydrogen	0	0	19	59	119	0
RES share Other Sectors	8%	14%	23%	37%	72%	100%
Total RES	1,414	3,055	5,503	8,803	16,778	21,513
RES share	5%	10%	19%	31%	66%	100%
Coal excluding heat produced by CHP autoproducers	3,624	3,682	3,781	3,856	3,651	3,480
Oil	1,825	1,804	1,607	1,349	876	567
Gas	1,771	1,841	1,985	2,121	2,154	2,192
Coal	28	37	189	386	621	731

¹ excluding heat produced by CHP autoproducers

Table 13.7.20 Eastern Europe/Eurasia: CO₂ emissions Mill t/a

	2012	2020	2025	2030	2040	2050
Condensation power plants	208	209	190	149	119	0
Hard coal (& non-renewable waste)	80	46	35	11	0	0
Lignite	83	55	42	18	0	0
Gas	36	102	110	116	116	0
Oil	5	4	1	1	1	0
Diesel	3	3	3	3	2	0
Combined heat and power plants	853	745	631	494	241	0
Hard coal (& non-renewable waste)	220	197	159	96	0	0
Lignite	126	108	67	24	0	0
Gas	476	427	400	374	241	0
Oil	30	13	4	0	0	0
CO ₂ emissions power and CHP plants	1,060	954	821	643	360	0
Hard coal (& non-renewable waste)	300	243	194	108	0	0
Lignite	210	163	109	42	0	0
Gas	512	529	510	490	358	0
Oil & diesel	39	20	8	3	3	0

Table 13.7.22: Eastern Europe/Eurasia: Investments in electricity generation

REF	UNIT	2012-2020	2021-2030	2031-2040	2041-2050	2012-2050	UNIT	ANNUAL AVERAGE 2012-2050
Fossil (w/o CHP)	billion \$	36.6	57.4	75.5	135.5	305.1	billion \$/a	7.8
Nuclear	billion \$	52.2	70.4	39.3	55.8	217.8	billion \$/a	5.6
CHP (fossil + renewable)	billion \$	166.0	101.1	43.7	7.5	318.3	billion \$/a	8.2
Renewables (w/o CHP)	billion \$	86.5	96.9	126.3	130.6	440.3	billion \$/a	11.3
Total	billion \$	341.3	325.8	284.8	329.5	1,281.5	billion \$/a	32.9
Conventional (fossil & nuclear)	billion \$	254.4	228.1	157.5	198.1	838.1	billion \$/a	21.5
Renewables	billion \$	86.9	97.8	127.3	131.4	443.4	billion \$/a	11.4
Biomass	billion \$	5.9	5.3	14.0	13.5	38.7	billion \$/a	1.0
Hydro	billion \$	60.4	75.1	80.0	87.8	303.2	billion \$/a	7.8
Wind	billion \$	9.4	9.8	22.5	20.2	61.9	billion \$/a	1.6
PV	billion \$	6.8	2.2	5.9	2.5	17.4	billion \$/a	0.4
Geothermal	billion \$	4.4	5.4	4.9	7.4	22.2	billion \$/a	0.6
Solar thermal power plants	billion \$	0.0	0.0	0.0	0.0	0.0	billion \$/a	0.0
Ocean energy	billion \$	0.0	0.0	0.0	0.0	0.0	billion \$/a	0.0
E[R]								
Fossil (w/o CHP)	billion \$	29.6	15.1	29.5	25.0	99.3	billion \$/a	2.5
Nuclear	billion \$	23.3	0.0	0.0	0.0	23.3	billion \$/a	0.6
CHP (fossil + renewable)	billion \$	175.8	172.9	231.9	246.0	826.7	billion \$/a	21.2
Renewables (w/o CHP)	billion \$	114.0	529.1	653.4	749.3	2,045.8	billion \$/a	52.5
Total	billion \$	342.7	717.2	914.8	1,020.3	2,995.0	billion \$/a	76.8
Conventional (fossil & nuclear)	billion \$	193.8	79.9	56.6	26.5	356.9	billion \$/a	9.2
Renewables	billion \$	148.9	637.3	858.1	993.8	2,638.1	billion \$/a	67.6
Biomass	billion \$	46.0	70.8	134.1	153.0	403.9	billion \$/a	10.4
Hydro	billion \$	60.4	69.3	53.9	52.3	235.8	billion \$/a	6.0
Wind	billion \$	25.2	279.9	343.1	475.0	1,123.2	billion \$/a	28.8
PV	billion \$	11.4	130.9	148.9	153.6	444.8	billion \$/a	11.4
Geothermal	billion \$	5.9	68.8	127.9	128.2	330.8	billion \$/a	8.5
Solar thermal power plants	billion \$	0.0	5.9	21.3	13.9	41.1	billion \$/a	1.1
Ocean energy	billion \$	0.0	11.7	28.9	17.9	58.4	billion \$/a	1.5
ADV E[R]								
Fossil (w/o CHP)	billion \$	32.5	11.6	60.6	28.4	133.1	billion \$/a	3.4
Nuclear	billion \$	23.3	0.0	0.0	0.0	23.3	billion \$/a	0.6
CHP (fossil + renewable)	billion \$	175.8	172.8	231.3	265.1	865.0	billion \$/a	22.2
Renewables (w/o CHP)	billion \$	114.5	781.5	1,071.9	1,425.5	3,393.4	billion \$/a	87.0
Total	billion \$	346.2	965.9	1,363.8	1,738.9	4,414.8	billion \$/a	113.2
Conventional (fossil & nuclear)	billion \$	196.7	76.4	86.6	28.4	388.1	billion \$/a	10.0
Renewables	billion \$	149.4	889.6	1,277.2	1,710.5	4,026.7	billion \$/a	103.2
Biomass	billion \$	46.0	70.8	134.1	163.1	414.0	billion \$/a	10.6
Hydro	billion \$	60.4	69.3	53.9	52.3	235.8	billion \$/a	6.0
Wind	billion \$	25.8	424.8	552.3	916.2	1,919.0	billion \$/a	49.2
PV	billion \$	11.4	195.8	253.8	278.1	739.1	billion \$/a	19.0
Geothermal	billion \$	5.9	101.9	204.6	264.8	577.2	billion \$/a	14.8
Solar thermal power plants	billion \$	0.0	10.8	37.5	13.1	61.4	billion \$/a	1.6
Ocean energy	billion \$	0.0	16.2	41.1	23.0	80.2	billion \$/a	2.1

Table 13.7.23: Eastern Europe/Eurasia: Investments in renewable heat generation

REF	UNIT	2012-2020	2021-2030	2031-2040	2041-2050	2012-2050	UNIT	ANNUAL AVERAGE 2012-2050
Heat pumps	billion \$	1.5	1.9	1.1	1.5	5.9	billion \$/a	0.2
Deep geothermal	billion \$	0.0	0.0	0.0	0.0	0.1	billion \$/a	0.0
Solar thermal	billion \$	0.6	0.7	0.7	0.7	2.7	billion \$/a	0.1
Biomass	billion \$	91.8	55.8	64.0	32.3	243.9	billion \$/a	6.3
Total	billion \$	93.9	58.3	65.8	34.6	252.6	billion \$/a	6.5
E[R]								
Heat pumps	billion \$	13.5	118.3	234.9	201.8	568.5	billion \$/a	14.6
Deep geothermal	billion \$	2.5	17.9	202.6	157.4	380.5	billion \$/a	9.8
Solar thermal	billion \$	10.5	123.5	182.0	131.1	447.1	billion \$/a	11.5
Biomass	billion \$	125.6	119.3	112.4	39.3	396.7	billion \$/a	10.2
Total	billion \$	152.2	378.9	731.9	529.7	1,792.7	billion \$/a	46.0
ADV E[R]								
Heat pumps	billion \$	13.5	118.3	265.3	243.5	640.6	billion \$/a	16.4
Deep geothermal	billion \$	2.5	17.9	201.9	166.1	388.5	billion \$/a	10.0
Solar thermal	billion \$	10.5	123.5	181.6	133.0	448.6	billion \$/a	11.5
Biomass	billion \$	125.6	119.3	112.1	20.6	377.6	billion \$/a	9.7
Total	billion \$	152.2	378.9	760.9	563.3	1,855.3	billion \$/a	47.6

Table 13.7.24: Eastern Europe/Eurasia Total employment in the energy sector THOUSAND JOBS

By sector	REFERENCE SCENARIO				ADV E[R] SCENARIO		
	2015	2020	2025	2030	2020	2025	2030
Construction and installation	88	104	83	81	324	685	677
Manufacturing	32	40	37	42	140	364	378
Operations and maintenance	318	336	340	319	403	557	707
Fuel supply (domestic)	1,047	838	754	707	896	844	779
Coal and gas export	234.9	288.1	311.7	334.3	157.7	142.5	138.6
Solar and geothermal heat	1	2	2	2	92	437	601
Total jobs (thousands)	1,720	1,609	1,527	1,485	2,003	3,030	3,281
By technology							
Coal	752	586	465	407	356	173	55
Gas, oil & diesel	631	657	701	736	646	642	635
Nuclear	104	115	101	83	70	71	68
Renewable	234	250	260	258	930	2,144	2,523
Biomass	110	126	134	137	393	562	643
Hydro	93	94	93	89	94	81	63
Wind	12	15.4	17.6	20.6	197	553	568
PV	17.0	11.8	11.0	8.9	142	470	575
Geothermal power	1.0	1.4	1.4	1.2	7	25	38
Solar thermal power	-	-	-	-	1.4	4.9	12.3
Ocean	-	-	-	0.13	4	10.8	22.6
Solar - heat	0.7	1.2	1.2	1.0	61	282	387
Geothermal & heat pump	0.4	0.8	0.8	0.6	31	155	214
Total jobs (thousands)	1,720	1,609	1,527	1,485	2,003	3,030	3,281

INDIA: REFERENCE SCENARIO

Table 13.8.1 India: Electricity generation TWh/a

	2012	2020	2025	2030	2040	2050
Power plants	1,128	1,734	2,280	2,826	4,063	5,184
Hard coal (& non-renewable waste)	642	993	1,314	1,625	2,316	2,957
Lignite	158	228	274	328	473	624
Gas	95	145	216	287	484	601
of which from H ₂	0	0	0	0	0	0
Oil	23	19	17	15	9	5
Diesel	0	0	0	0	0	0
Nuclear	33	64	99	134	205	277
Biomass (& renewable waste)	20	42	50	59	75	92
Hydro	126	162	196	231	307	383
Wind	28	60	78	96	124	152
of which wind offshore	0	0	1	3	6	9
PV	2	21	35	49	68	91
Geothermal	0	0	0	1	1	1
Solar thermal power plants	0	0	0	0	1	1
Ocean energy	0	0	0	0	1	1
Combined heat and power plants	0	0	0	0	0	0
Hard coal (& non-renewable waste)	0	0	0	0	0	0
Lignite	0	0	0	0	0	0
Gas	0	0	0	0	0	0
of which from H ₂	0	0	0	0	0	0
Oil	0	0	0	0	0	0
Biomass (& renewable waste)	0	0	0	0	0	0
Geothermal	0	0	0	0	0	0
Hydrogen	0	0	0	0	0	0
CHP by producer						
Main activity producers	0	0	0	0	0	0
Autoproducers	0	0	0	0	0	0
Total generation	1,128	1,734	2,280	2,826	4,063	5,184
Fossil	919	1,385	1,820	2,256	3,282	4,187
Hard coal (& non-renewable waste)	642	993	1,314	1,625	2,316	2,957
Lignite	158	228	274	328	473	624
Gas	95	145	216	287	484	601
Oil	23	19	17	15	9	5
Diesel	0	0	0	0	0	0
Nuclear	33	64	99	134	205	277
Hydrogen	0	0	0	0	0	0
of which renewable H ₂	0	0	0	0	0	0
Renewables (w/o renewable hydrogen)	176	286	361	436	576	721
Hydro	126	162	196	231	307	383
Wind	28	60	78	96	124	152
PV	2	21	35	49	68	91
Biomass (& renewable waste)	20	42	50	59	75	92
Geothermal	0	0	0	1	1	1
Solar thermal power plants	0	0	0	0	1	1
Ocean energy	0	0	0	0	1	1
Distribution losses	193	288	379	470	676	878
Own consumption electricity	71	153	198	242	341	351
Electricity for hydrogen production	0	0	0	0	0	0
Electricity for synfuel production	0	0	0	0	0	0
Final energy consumption (electricity)	869	1,298	1,709	2,119	3,051	3,961
Fluctuating RES (PV, Wind, Ocean)	30	81	113	145	192	244
Share of fluctuating RES	3%	5%	5%	5%	5%	5%
RES share (domestic generation)	16%	16%	16%	15%	14%	14%

Table 13.8.2 India: Final energy consumption in transport PJ/a

	2012	2020	2025	2030	2040	2050
Road	2,811	4,490	6,326	8,147	13,031	17,844
Fossil fuels	2,734	4,291	6,004	7,702	12,269	16,677
Biofuels	9	48	79	109	284	504
Synfuels	0	0	0	0	0	0
Natural gas	69	150	240	330	458	620
Hydrogen	0	0	0	0	0	0
Electricity	0	1	3	5	20	45
Rail	168	226	261	297	356	387
Fossil fuels	112	151	181	211	266	300
Biofuels	0	0	0	0	0	0
Synfuels	0	0	0	0	0	0
Electricity	56	75	81	86	90	87
Navigation	29	57	72	92	132	170
Fossil fuels	29	57	72	92	132	170
Biofuels	0	0	0	0	0	0
Synfuels	0	0	0	0	0	0
Aviation	71	132	175	227	379	632
Fossil fuels	71	132	175	227	379	632
Biofuels	0	0	0	0	0	0
Synfuels	0	0	0	0	0	0
Total (incl. pipelines)	3,078	4,905	6,834	8,762	13,898	19,033
Fossil fuels	2,945	4,631	6,431	8,232	13,045	17,779
Biofuels (incl. biogas)	9	48	79	109	284	504
Synfuels	0	0	0	0	0	0
Natural gas	69	150	240	330	458	620
Hydrogen	0	0	0	0	0	0
Electricity	56	76	84	91	110	131
Total RES	17	60	92	123	300	522
RES share	1%	1%	1%	1%	2%	3%

Table 13.8.3 India: Heat supply PJ/a

	2012	2020	2025	2030	2040	2050
District heating plants	0	0	0	0	0	0
Fossil fuels	0	0	0	0	0	0
Biomass	0	0	0	0	0	0
Solar collectors	0	0	0	0	0	0
Geothermal	0	0	0	0	0	0
Heat from CHP¹	0	0	0	0	0	0
Fossil fuels	0	0	0	0	0	0
Biomass	0	0	0	0	0	0
Geothermal	0	0	0	0	0	0
Hydrogen	0	0	0	0	0	0
Direct heating	10,904	13,571	15,365	17,188	20,315	24,268
Fossil fuels	5,172	7,367	8,958	10,577	13,631	17,380
Biomass	5,433	5,868	6,042	6,219	6,223	6,334
Solar collectors	20	54	80	106	171	261
Geothermal	0	0	0	0	0	0
Heat pumps ²	0	0	1	1	1	2
Electric direct heating	279	282	284	285	288	291
Hydrogen	0	0	0	0	0	0
Total heat supply³	10,904	13,571	15,365	17,188	20,315	24,268
Fossil fuels	5,172	7,367	8,958	10,577	13,631	17,380
Biomass	5,433	5,868	6,042	6,219	6,223	6,334
Solar collectors	20	54	80	106	171	261
Geothermal	0	0	0	0	0	0
Heat pumps ²	0	0	1	1	1	2
Electric direct heating	279	282	284	285	288	291
Hydrogen	0	0	0	0	0	0
RES share (including RES electricity)	50%	44%	40%	37%	32%	27%

¹ public CHP and CHP autoproduction / ² heat from ambient energy and electricity use / ³ incl. process heat, cooking

Table 13.8.4: India: Installed capacity GW

	2012	2020	2025	2030	2040	2050
Total generation	235	413	554	695	985	1,190
Fossil	162	291	397	502	729	873
Hard coal (& non-renewable waste)	106	193	267	340	495	594
Lignite	26	44	56	69	101	125
Gas (w/o H ₂)	23	46	65	85	127	150
Oil	7	9	8	6	4	4
Diesel	0	0	0	0	0	0
Nuclear	5	10	14	19	29	40
Hydrogen (fuel cells, gas power plants, gas CHP)	0	0	0	0	0	0
Renewables	68	112	143	173	226	277
Hydro	42	54	65	76	101	126
Wind	18	34	42	50	62	72
of which wind offshore	0	0	0	1	2	3
PV	1	15	25	35	47	59
Biomass (& renewable waste)	6	9	11	12	15	19
Geothermal	0	0	0	0	0	0
Solar thermal power plants	0	0	0	0	0	0
Ocean energy	0	0	0	0	0	0
Fluctuating RES (PV, Wind, Ocean)	20	49	67	85	109	132
Share of fluctuating RES	8%	12%	12%	12%	11%	11%
RES share (domestic generation)	29%	27%	26%	25%	23%	23%

Table 13.8.5: India: Final energy demand PJ/a

	2012	2020	2025	2030	2040	2050
Total (incl. non-energy use)	21,417	28,467	34,161	39,855	51,982	64,887
Total energy use	19,925	26,362	31,738	37,113	48,777	61,219
Transport	3,078	4,905	6,834	8,762	13,898	19,033
Oil products	2,945	4,631	6,431	8,232	13,045	17,779
Natural gas	69	150	240	330	458	620
Biofuels	9	48	79	109	284	504
Synfuels	0	0	0	0	0	0
Electricity	56	76	84	91	110	131
RES electricity	9	13	13	14	16	18
Hydrogen	0	0	0	0	0	0
RES share Transport	1%	1%	1%	1%	2%	3%
Industry	7,034	10,443	12,814	15,186	19,767	25,340
Electricity	1,381	2,010	2,535	3,059	4,221	5,694
RES electricity	216	331	401	472	598	792
Public district heat	0	0	0	0	0	0
RES district heat	0	0	0	0	0	0
Hard coal & lignite	2,926	4,744	5,819	6,893	8,810	11,055
Gas	789	1,182	1,385	1,587	1,978	2,439
Oil products	684	966	1,299	1,631	2,279	3,131
Solar	1	12	19	27	41	61
Biomass	1,254	1,528	1,759	1,989	2,437	2,958
Geothermal	0	0	0	0	0	0
Hydrogen	0	0	0	0	0	0
RES share Industry	21%	18%	17%	16%	16%	15%
Other Sectors	9,813	11,014	12,089	13,165	15,112	16,846
Electricity	1,692	2,588	3,533	4,478	6,654	8,434
RES electricity	264	426	559	690	943	1,173
Public district heat	0	0	0	0	0	0
RES district heat	0	0	0	0	0	0
Hard coal & lignite	469	483	488	494	440	390
Oil products	1,525	1,600	1,799	1,998	2,357	2,763
Gas	111	124	158	192	311	475
Solar	18	42	61	80	130	200
Biomass	5,998	6,176	6,050	5,923	5,220	4,582
Geothermal	0	0	0	1	1	1
Hydrogen	0	0	0	0	0	0
RES share Other Sectors	64%	60%	55%	51%	42%	35%
Total RES	7,769	8,576	9,940	11,304	14,670	18,289
RES share	39%	33%	28%	25%	20%	17%
Non energy use	1,492	2,105	2,423	2,741	3,205	3,668
Oil	955	1,347	1,551	1,755	2,051	2,347
Gas	537	758	872	987	1,154	1,320
Coal	0	0	0	0	0	0

¹ excluding heat produced by CHP autoproducers

Table 13.8.6: India: CO₂ emissions Mill t/a

	2012	2020	2025	2030	2040	2050
Condensation power plants	1,039	1,319	1,647	1,978	2,786	3,431
Hard coal (& non-renewable waste)	774	975	1,238	1,492	2,089	2,559
Lignite	199	267	308	360	509	645
Gas	41	59	86	112	180	224
Oil	24	18	16	14	8	5
Diesel	0	0	0	0	0	0
Combined heat and power plants	0	0	0	0	0	0
Hard coal (& non-renewable waste)	0	0	0	0	0	0
Lignite	0	0	0	0	0	0
Gas	0	0	0	0	0	0
Oil	0	0	0	0	0	0
CO₂ emissions power and CHP plants	1,039	1,319	1,647	1,978	2,786	3,431
Hard coal (& non-renewable waste)	774	975	1,238	1,492	2,089	2,559
Lignite	199	267	308	360	509	645
Gas	41	59	86	112	180	224
Oil & diesel	24	18	16	14	8	5

Table 13.8.8 India: Electricity generation TWh/a

	2012	2020	2025	2030	2040	2050
Power plants	1,128	1,711	2,230	2,836	4,277	5,630
Hard coal (& non-renewable waste)	642	890	854	727	396	123
Lignite	158	213	213	190	90	0
Gas	95	155	287	283	259	182
of which from H ₂	0	0	0	0	0	0
Oil	23	15	14	5	0	0
Diesel	0	0	0	0	0	0
Nuclear	33	53	48	43	24	0
Biomass (& renewable waste)	20	55	70	70	69	68
Hydro	126	162	196	199	205	210
Wind	28	78	305	653	1,451	2,230
of which wind offshore	0	1	32	111	292	430
PV	2	88	214	425	921	1,430
Geothermal	0	0	6	25	157	268
Solar thermal power plants	0	2	21	186	615	970
Ocean energy	0	0	3	30	90	150
Combined heat and power plants	0	20	66	118	307	541
Hard coal (& non-renewable waste)	0	0	0	0	0	0
Lignite	0	0	0	0	0	0
Gas	0	10	30	44	74	98
of which from H ₂	0	0	0	0	0	3
Oil	0	0	0	0	0	0
Biomass (& renewable waste)	0	10	33	59	154	271
Geothermal	0	0	4	14	62	122
Hydrogen	0	0	0	1	17	51
CHP by producer						
Main activity producers	0	0	5	10	20	30
Autoproducers	0	20	61	108	287	511
Total generation	1,128	1,731	2,296	2,954	4,584	6,171
Fossil	919	1,283	1,396	1,249	820	400
Hard coal (& non-renewable waste)	642	890	854	727	396	123
Lignite	158	213	213	190	90	0
Gas	95	165	316	327	333	277
Oil	23	15	14	5	0	0
Diesel	0	0	0	0	0	0
Nuclear	33	53	48	43	24	0
Hydrogen	0	0	0	1	17	53
of which renewable H ₂	0	0	0	1	14	50
Renewables (w/o renewable hydrogen)	176	395	852	1,661	3,724	5,718
Hydro	126	162	196	199	205	210
Wind	28	78	305	653	1,451	2,230
PV	2	88	214	425	921	1,430
Biomass (& renewable waste)	20	65	103	129	222	338
Geothermal	0	1	9	39	220	390
Solar thermal power plants	0	2	21	186	615	970
Ocean energy	0	0	3	30	90	150
Distribution losses	193	278	349	420	496	518
Own consumption electricity	71	143	163	167	161	125
Electricity for hydrogen production	0	0	2	30	258	618
Electricity for synfuel production	0	0	0	0	0	0
Final energy consumption (electricity)	869	1,315	1,787	2,343	3,675	4,916
Fluctuating RES (PV, Wind, Ocean)	30	166	522	1,108	2,462	3,810
Share of fluctuating RES	3%	10%	23%	38%	54%	62%
RES share (domestic generation)	16%	23%	37%	56%	82%	93%

Table 13.8.9 India: Final energy consumption in transport PJ/a

	2012	2020	2025	2030	2040	2050
Road	2,811	4,390	5,839	7,093	8,209	8,477
Fossil fuels	2,734	4,149	5,433	6,278	5,786	3,570
Biofuels	9	68	127	221	367	394
Synfuels	0	0	0	0	0	0
Natural gas	69	171	248	323	353	391
Hydrogen	0	0	5	64	444	840
Electricity	0	1	25	207	1,260	3,283
Rail	168	228	273	314	390	450
Fossil fuels	112	140	154	133	104	59
Biofuels	0	7	8	32	26	32
Synfuels	0	0	0	0	0	0
Electricity	56	80	110	150	260	360
Navigation	29	57	71	87	112	130
Fossil fuels	29	54	68	80	90	84
Biofuels	0	3	4	8	22	46
Synfuels	0	0	0	0	0	0
Aviation	71	132	173	216	322	442
Fossil fuels	71	132	168	203	258	288
Biofuels	0	0	5	13	64	155
Synfuels	0	0	0	0	0	0
Total (incl. pipelines)	3,078	4,807	6,355	7,711	9,034	9,500
Fossil fuels	2,945	4,476	5,824	6,693	6,237	4,000
Biofuels (incl. biogas)	9	78	144	273	480	625
Synfuels	0	0	0	0	0	0
Natural gas	69	171	248	323	353	391
Hydrogen	0	0	5	64	444	840
Electricity	56	82	135	357	1,520	3,643
Total RES	17	97	196	510	2,081	4,815
RES share	1%	2%	3%	7%	23%	51%

Table 13.8.10 India: Heat supply PJ/a

	2012	2020	2025	2030	2040	2050
District heating plants	0	0	38	129	414	796
Fossil fuels	0	0	0	0	0	0
Biomass	0	0	29	91	186	199
Solar collectors	0	0	9	32	182	470
Geothermal	0	0	1	6	46	127
Heat from CHP¹	0	84	283	550	1,628	3,010
Fossil fuels	0	35	103	153	254	329
Biomass	0	45	148	265	694	1,222
Geothermal	0	4	32	123	558	1,089
Hydrogen	0	0	0	8	123	371
Direct heating	10,904	13,216	14,054	14,955	15,512	14,289
Fossil fuels	5,172	6,882	6,813	6,368	4,637	1,765
Biomass	5,433	5,787	5,779	5,549	4,800	3,902
Solar collectors	20	82	514	1,145	2,209	2,850
Geothermal	0	0	30	124	274	509
Heat pumps ²	0	7	112	387	800	1,216
Electric direct heating	279	457	806	1,381	2,751	3,804
Hydrogen	0	0	0	0	41	242
Total heat supply³	10,904	13,300	14,375	15,633	17,555	18,096
Fossil fuels	5,172	6,917	6,916	6,521	4,891	2,094
Biomass	5,433	5,832	5,955	5,905	5,680	5,323
Solar collectors	20	82	522	1,177	2,391	3,320
Geothermal	0	4	63	254	878	1,725
Heat pumps ²	0	7	112	387	800	1,216
Electric direct heating	279	457	806	1,381	2,751	3,804
Hydrogen	0	0	0	8	164	614
RES share (including RES electricity)	50%	45%	49%	55%	69%	87%

¹ public CHP and CHP autoproduction / ² heat from ambient energy and electricity use / ³ incl. process heat, cooking

Table 13.8.10: India: Installed capacity GW

	2012	2020	2025	2030	2040	2050
Total generation	235	451	692	1,064	1,815	2,447
Fossil	162	268	280	283	256	193
Hard coal (& non-renewable waste)	106	173	161	151	120	61
Lignite	26	38	39	35	19	0
Gas (w/o H ₂)	23	49	73	94	116	131
Oil	0	7	7	3	0	0
Diesel	0	0	0	0	0	0
Nuclear	5	8	7	6	3	0
Hydrogen (fuel cells, gas power plants, gas CHP)	0	0	0	0	5	14
Renewables	68	176	405	775	1,551	2,240
Hydro	42	54	65	66	68	69
Wind	18	43	157	320	667	941
of which wind offshore	0	0	10	35	87	123
PV	1	64	153	302	576	841
Biomass (& renewable waste)	6	14	22	30	51	79
Geothermal	0	0	2	7	26	64
Solar thermal power plants	0	1	5	40	125	194
Ocean energy	0	0	1	10	28	52
Fluctuating RES (PV, Wind, Ocean)	20	107	311	632	1,271	1,834
Share of fluctuating RES	8%	24%	45%	59%	70%	75%
RES share (domestic generation)	29%	39%	59%	73%	85%	92%

Table 13.8.12: India: Final energy demand PJ/a

	2012	2020	2025	2030	2040	2050
Total (incl. non-energy use)	21,417	27,719	31,452	34,757	38,487	38,599
Total energy use	19,925	25,656	29,150	32,289	35,731	35,599
Transport	3,078	4,807	6,355	7,711	9,034	9,500
Oil products	2,945	4,476	5,824	6,693	6,237	4,000
Natural gas	69	171	248	323	353	391
Biofuels	9	78	144	273	480	625
Synfuels	0	0	0	0	0	0
Electricity	56	82	135	357	1,520	3,643
RES electricity	9	19	50	201	1,239	3,405
Hydrogen	0	0	5	64	444	840
RES share Transport	1%	2%	3%	7%	23%	51%
Industry	7,034	10,068	11,164	12,196	13,366	12,881
Electricity	1,381	2,070	2,692	3,386	4,946	6,209
RES electricity	216	472	999	1,905	4,033	5,803
Public district heat	0	0	43	124	286	678
RES district heat	0	0	38	115	349	657
Hard coal & lignite	2,926	4,534	4,414	4,272	2,963	469
Oil products	789	934	833	576	124	8
Gas	684	939	1,269	1,337	1,443	1,052
Solar	1	18	150	497	1,189	1,526
Biomass	1,254	1,569	1,655	1,612	1,479	1,413
Geothermal	0	5	109	391	811	1,271
Hydrogen	0	0	0	0	44	255
RES share Industry	21%	20%	26%	37%	59%	85%
Other Sectors	9,813	10,781	11,630	12,382	13,331	13,219
Electricity	1,692	2,584	3,607	4,691	6,765	7,845
RES electricity	264	590	1,338	2,638	5,515	7,332
Public district heat	0	0	7	22	68	132
RES district heat	0	0	6	20	65	128
Hard coal & lignite	469	473	385	249	80	0
Oil products	1,525	1,454	1,212	1,023	540	23
Gas	111	176	244	293	384	511
Solar	18	64	364	647	1,019	1,325
Biomass	5,998	6,030	5,812	5,447	4,425	3,233
Geothermal	0	0	0	10	50	149
Hydrogen	0	0	0	0	0	0
RES share Other Sectors	64%	62%	65%	71%	83%	92%
Total RES	7,769	8,845	10,666	13,793	21,054	27,892
RES share	39%	34%	37%	43%	59%	78%
Non energy use	1,492	2,063	2,302	2,467	2,756	3,000
Oil	955	1,320	1,404	1,431	1,378	1,110
Gas	537	743	783	790	827	840
Coal	0	0	115	247	551	1,050

1 excluding heat produced by CHP autoproducers

Table 13.8.13: India: CO₂ emissions Mill t/a

	2012	2020	2025	2030	2040	2050
Condensation power plants	1,039	1,201	1,170	991	551	174
Hard coal (& non-renewable waste)	774	874	805	667	357	106
Lignite	199	250	239	209	97	0
Gas	41	63	113	111	97	68
Oil	24	14	13	5	0	0
Diesel	0	0	0	0	0	0
Combined heat and power plants	0	4	13	20	34	43
Hard coal (& non-renewable waste)	0	0	0	0	0	0
Lignite	0	0	0	0	0	0
Gas	0	4	13	20	34	43
Oil	0	0	0	0	0	0
CO₂ emissions power and CHP plants	1,039	1,205	1,184	1,011	585	217
Hard coal (& non-renewable waste)	774	874	805	667	357	106
Lignite	199	250	239	209	97	0
Gas	41	68	127	131	130	111
Oil & diesel	24	14	13	5	0	0

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Table 13.8.15 India: Electricity generation TWh/a

	2012	2020	2025	2030	2040	2050
Power plants	1,128	1,725	2,324	3,116	5,397	7,759
Hard coal (& non-renewable waste)	642	890	828	573	142	0
Lignite	158	213	213	190	90	0
Gas	95	155	287	283	260	169
of which from H ₂	0	0	1	6	36	169
Oil	23	15	14	5	0	0
Diesel	0	0	0	0	0	0
Nuclear	33	53	48	43	24	0
Biomass (& renewable waste)	20	57	65	68	70	73
Hydro	126	162	196	199	205	210
Wind	28	84	406	926	2,269	3,570
of which wind offshore	0	3	57	183	430	635
PV	2	93	233	550	1,325	2,078
Geothermal	0	1	11	36	199	320
Solar thermal power plants	0	3	22	210	714	1,170
Ocean energy	0	0	3	33	100	170
Combined heat and power plants	0	20	66	118	307	541
Hard coal (& non-renewable waste)	0	0	0	0	0	0
Lignite	0	0	0	0	0	0
Gas	0	10	30	44	74	61
of which from H ₂	0	0	0	1	10	61
Oil	0	0	0	0	0	0
Biomass (& renewable waste)	0	10	33	59	154	271
Geothermal	0	0	4	14	62	127
Hydrogen	0	0	0	1	17	82
CHP by producer						
Main activity producers	0	0	5	10	20	30
Autoproducers	0	20	61	108	287	511
Total generation	1,128	1,746	2,390	3,234	5,704	8,300
Fossil	919	1,282	1,369	1,069	519	0
Hard coal (& non-renewable waste)	642	890	828	573	142	0
Lignite	158	213	213	190	90	0
Gas	95	165	315	321	287	0
Oil	23	15	14	5	0	0
Diesel	0	0	0	0	0	0
Nuclear	33	53	48	43	24	0
Hydrogen	0	0	2	8	64	312
of which renewable H ₂	0	0	1	5	58	312
Renewables (w/o renewable hydrogen)	176	410	972	2,094	5,098	7,988
Hydro	126	162	196	199	205	210
Wind	28	84	406	926	2,269	3,570
PV	2	93	233	550	1,325	2,078
Biomass (& renewable waste)	20	67	98	127	224	344
Geothermal	0	2	14	50	261	446
Solar thermal power plants	0	3	22	210	714	1,170
Ocean energy	0	0	3	33	100	170
Distribution losses	193	278	349	420	496	518
Own consumption electricity	71	143	163	167	161	125
Electricity for hydrogen production	0	7	28	109	650	1,652
Electricity for synfuel production	0	0	0	23	246	542
Final energy consumption (electricity)	869	1,322	1,855	2,520	4,156	5,469
Fluctuating RES (PV, Wind, Ocean)	30	177	642	1,508	3,694	5,818
Share of fluctuating RES	3%	10%	27%	47%	65%	70%
RES share (domestic generation)	16%	23%	41%	65%	90%	100%

Table 13.8.16 India: Final Energy Consumption Transport PJ/a

	2012	2020	2025	2030	2040	2050
Road	2,811	4,356	5,595	6,432	5,557	4,629
Fossil fuels	2,734	4,095	5,131	5,420	2,422	0
Biofuels	9	67	120	223	389	434
Synfuels	0	0	0	27	292	567
Natural gas	69	169	212	212	57	0
Hydrogen	0	18	52	194	1,013	1,224
Electricity	0	9	81	383	1,676	2,971
Rail	168	234	325	450	894	1,342
Fossil fuels	112	129	131	105	47	0
Biofuels	0	7	7	17	18	20
Synfuels	0	0	0	2	13	25
Electricity	56	99	186	327	816	1,297
Navigation	29	57	71	87	112	130
Fossil fuels	29	54	68	76	73	0
Biofuels	0	3	4	11	22	56
Synfuels	0	0	0	1	17	74
Aviation	71	131	168	201	251	265
Fossil fuels	71	131	163	175	163	0
Biofuels	0	0	5	23	50	115
Synfuels	0	0	0	3	38	150
Total (incl. pipelines)	3,078	4,779	6,159	7,196	7,107	6,934
Fossil fuels	2,945	4,409	5,493	5,775	2,705	0
Biofuels (incl. biogas)	9	76	135	273	480	625
Synfuels	0	0	0	33	360	816
Natural gas	69	169	212	212	57	0
Hydrogen	0	18	52	194	1,013	1,224
Electricity	56	107	267	709	2,492	4,268
Total RES	17	106	265	881	3,973	6,934
RES share	1%	2%	4%	12%	56%	100%

Table 13.8.17 India: Heat Supply PJ/a

	2012	2020	2025	2030	2040	2050
District heating plants	0	0	34	121	397	756
Fossil fuels	0	0	0	0	0	0
Biomass	0	0	26	85	179	189
Solar collectors	0	0	8	30	175	446
Geothermal	0	0	1	6	44	121
Heat from CHP¹	0	84	288	561	1,654	3,191
Fossil fuels	0	35	105	154	226	0
Biomass	0	45	151	273	709	1,251
Geothermal	0	4	32	124	559	1,136
Hydrogen	0	0	1	11	161	805
Direct heating	10,904	13,216	14,053	14,951	15,503	14,147
Fossil fuels	5,172	6,882	6,695	6,218	4,089	0
Biomass	5,433	5,787	5,778	5,547	4,796	3,876
Solar collectors	20	82	514	1,144	2,218	2,989
Geothermal	0	0	30	124	320	726
Heat pumps ²	0	7	112	387	800	1,199
Electric direct heating	279	457	918	1,505	3,104	4,616
Hydrogen	0	0	6	25	178	741
Total heat supply³	10,904	13,300	14,375	15,633	17,555	18,095
Fossil fuels	5,172	6,917	6,799	6,372	4,314	0
Biomass	5,433	5,832	5,955	5,905	5,684	5,316
Solar collectors	20	82	521	1,174	2,392	3,436
Geothermal	0	4	63	254	923	1,982
Heat pumps ²	0	7	112	387	800	1,199
Electric direct heating	279	457	918	1,505	3,104	4,616
Hydrogen	0	0	6	36	338	1,546
RES share (including RES electricity)	50%	45%	49%	56%	74%	100%

¹ public CHP and CHP autoproduction / ² heat from ambient energy and electricity use / ³ incl. process heat, cooking

Table 13.8.18: India: Installed capacity GW

	2012	2020	2025	2030	2040	2050
Total generation	235	459	738	1,243	2,409	3,414
Fossil	162	268	264	236	166	0
Hard coal (& non-renewable waste)	106	173	145	106	43	0
Lignite	26	39	39	35	19	0
Gas (w/o H ₂)	23	49	72	92	103	0
Oil	7	7	7	3	0	0
Diesel	5	8	7	6	3	0
Nuclear	0	0	0	2	21	151
Hydrogen (fuel cells, gas power plants, gas CHP)	0	0	0	0	0	0
Renewables	68	183	467	999	2,218	3,263
Hydro	42	54	65	66	68	69
Wind	18	46	206	449	1,048	1,518
of which wind offshore	0	1	18	58	128	184
PV	1	68	167	390	828	1,222
Biomass (& renewable waste)	6	14	21	29	54	87
Geothermal	0	0	2	8	43	73
Solar thermal power plants	0	1	6	46	146	234
Ocean energy	0	0	1	11	31	59
Fluctuating RES (PV, Wind, Ocean)	20	114	373	850	1,907	2,799
Share of fluctuating RES	8%	25%	51%	68%	79%	82%
RES share (domestic generation)	29%	40%	63%	80%	92%	96%

Table 13.8.19: India: Final energy demand PJ/a

	2012	2020	2025	2030	2040	2050
Total (incl. non-energy use)	21,417	27,690	31,237	34,340	36,805	36,162
Total energy use	19,925	25,628	28,935	31,673	34,049	33,162
Transport	3,078	4,779	6,159	7,196	7,107	6,934
Oil products	2,945	4,409	5,493	5,775	2,705	0
Natural gas	69	169	212	212	57	0
Biofuels	9	76	135	273	480	625
Synfuels	0	0	0	33	360	816
Electricity	56	107	267	709	2,492	4,268
RES electricity	9	25	109	460	2,252	4,268
Hydrogen	0	18	52	194	1,013	1,224
RES share Transport	1%	2%	4%	12%	56%	100%
Industry	7,034	10,068	11,148	12,201	13,390	12,743
Electricity	1,381	2,070	2,804	3,540	5,348	6,900
RES electricity	216	486	1,443	2,238	4,834	6,900
Public district heat	0	0	43	124	366	667
RES district heat	0	0	37	113	346	667
Hard coal & lignite	2,926	4,534	4,414	4,272	2,908	0
Oil products	789	934	833	571	115	0
Gas	684	939	1,134	1,170	970	0
Solar	1	18	150	497	1,189	1,688
Biomass	1,254	1,569	1,655	1,612	1,479	1,390
Geothermal	0	5	109	391	857	1,476
Hydrogen	0	0	6	24	156	641
RES share Industry	21%	21%	28%	40%	66%	100%
Other Sectors	9,813	10,781	11,629	12,475	13,552	13,485
Electricity	1,692	2,584	3,607	4,824	7,122	8,520
RES electricity	264	607	1,468	3,132	6,437	8,520
Public district heat	0	0	7	22	68	132
RES district heat	0	0	6	20	64	132
Hard coal & lignite	469	473	385	249	68	0
Oil products	1,525	1,454	1,211	1,000	503	0
Gas	111	176	243	274	257	0
Solar	18	64	364	647	1,028	1,321
Biomass	5,998	6,030	5,811	5,444	4,419	3,224
Geothermal	0	0	0	10	50	149
Hydrogen	0	0	1	5	36	139
RES share Other Sectors	64%	62%	66%	74%	89%	100%
Total RES	7,769	8,885	11,008	15,062	24,852	33,162
RES share	39%	35%	38%	47%	73%	100%
Non energy use	1,492	2,063	2,302	2,467	2,756	3,000
Oil	955	1,320	1,404	1,431	1,378	1,110
Gas	537	743	783	790	827	840
Coal	0	0	115	247	551	1,050

¹ excluding heat produced by CHP autoproducers

Table 13.8.20 India: CO₂ emissions Mill t/a

	2012	2020	2025	2030	2040	2050
Condensation power plants	1,039	1,200	1,145	848	308	0
Hard coal (& non-renewable waste)	774	873	780	526	128	0
Lignite	199	250	239	209	97	0
Gas	41	63	113	108	83	0
Oil	24	14	13	5	0	0
Diesel	0	0	0	0	0	0
Combined heat and power plants	0	4	13	20	29	0
Hard coal (& non-renewable waste)	0	0	0	0	0	0
Lignite	0	0	0	0	0	0
Gas	0	4	13	20	29	0
Oil	0	0	0	0	0	0
CO ₂ emissions power and CHP plants	1,039	1,205	1,158	867	337	0
Hard coal (& non-renewable waste)	774	873	780	526	128	0
Lignite	199	250	239	209	97	0
Gas	41	68	126	128	112	0
Oil & diesel	24	14	13	5	0	0

Table 13.8.22: India: Investments in electricity generation

REF	UNIT	2012-2020	2021-2030	2031-2040	2041-2050	2012-2050	UNIT	ANNUAL AVERAGE 2012-2050
Fossil (w/o CHP)	billion \$	215.3	354.3	418.6	487.1	1,475.3	billion \$/a	37.8
Nuclear	billion \$	18.5	37.8	44.6	51.0	151.9	billion \$/a	3.9
CHP (fossil + renewable)	billion \$	0.0	0.0	0.0	0.0	0.0	billion \$/a	0.0
Renewables (w/o CHP)	billion \$	109.8	153.0	181.7	187.3	631.7	billion \$/a	16.2
Total	billion \$	343.6	545.1	644.9	725.4	2,259.0	billion \$/a	57.9
Conventional (fossil & nuclear)	billion \$	233.8	392.1	463.2	538.1	1,627.3	billion \$/a	41.7
Renewables	billion \$	109.8	153.0	181.7	187.3	631.7	billion \$/a	16.2
Biomass	billion \$	10.2	13.3	17.9	19.5	60.8	billion \$/a	1.6
Hydro	billion \$	43.1	72.8	84.0	87.1	287.1	billion \$/a	7.4
Wind	billion \$	28.9	40.3	50.7	54.2	174.0	billion \$/a	4.5
PV	billion \$	27.5	26.4	28.2	24.9	107.0	billion \$/a	2.7
Geothermal	billion \$	0.0	0.0	0.3	0.4	0.7	billion \$/a	0.0
Solar thermal power plants	billion \$	0.1	0.3	0.3	0.7	1.3	billion \$/a	0.0
Ocean energy	billion \$	0.0	0.0	0.4	0.5	0.9	billion \$/a	0.0
E[R]								
Fossil (w/o CHP)	billion \$	176.3	28.3	24.9	114.3	343.7	billion \$/a	8.8
Nuclear	billion \$	13.0	0.0	0.0	0.0	13.0	billion \$/a	0.3
CHP (fossil + renewable)	billion \$	8.3	53.4	118.3	169.0	348.9	billion \$/a	8.9
Renewables (w/o CHP)	billion \$	216.2	1,110.4	1,567.8	1,782.8	4,677.2	billion \$/a	119.9
Total	billion \$	413.8	1,192.0	1,711.0	2,066.0	5,382.8	billion \$/a	138.0
Conventional (fossil & nuclear)	billion \$	192.1	37.5	34.4	127.6	391.5	billion \$/a	10.0
Renewables	billion \$	221.7	1,154.6	1,676.6	1,938.4	4,991.3	billion \$/a	128.0
Biomass	billion \$	20.4	41.3	67.0	99.1	227.8	billion \$/a	5.8
Hydro	billion \$	43.1	45.4	21.7	21.5	131.8	billion \$/a	3.4
Wind	billion \$	43.8	478.1	618.3	875.6	2,015.9	billion \$/a	51.7
PV	billion \$	111.2	311.6	344.7	393.9	1,161.4	billion \$/a	29.8
Geothermal	billion \$	0.9	52.5	190.1	177.1	420.6	billion \$/a	10.8
Solar thermal power plants	billion \$	2.2	178.3	368.3	314.7	863.4	billion \$/a	22.1
Ocean energy	billion \$	0.0	47.4	66.6	56.6	170.5	billion \$/a	4.4
ADV E[R]								
Fossil (w/o CHP)	billion \$	176.0	26.4	25.3	131.7	359.4	billion \$/a	9.2
Nuclear	billion \$	13.0	0.0	0.0	0.0	13.0	billion \$/a	0.3
CHP (fossil + renewable)	billion \$	8.3	53.4	118.3	168.1	348.0	billion \$/a	8.9
Renewables (w/o CHP)	billion \$	232.5	1,476.8	2,242.7	2,565.2	6,517.1	billion \$/a	167.1
Total	billion \$	429.8	1,556.6	2,386.3	2,864.9	7,237.5	billion \$/a	185.6
Conventional (fossil & nuclear)	billion \$	191.8	35.5	34.8	137.9	400.1	billion \$/a	10.3
Renewables	billion \$	237.9	1,521.0	2,351.5	2,727.0	6,837.4	billion \$/a	175.3
Biomass	billion \$	21.3	39.3	75.3	106.7	242.7	billion \$/a	6.2
Hydro	billion \$	43.1	45.4	21.7	21.5	131.8	billion \$/a	3.4
Wind	billion \$	49.8	700.1	1,011.4	1,377.3	3,138.6	billion \$/a	80.5
PV	billion \$	117.5	418.6	516.9	560.3	1,613.2	billion \$/a	41.4
Geothermal	billion \$	2.6	65.1	218.6	195.5	481.8	billion \$/a	12.4
Solar thermal power plants	billion \$	3.5	200.5	433.4	399.6	1,037.1	billion \$/a	26.6
Ocean energy	billion \$	0.0	52.0	74.2	66.0	192.3	billion \$/a	4.9

Table 13.8.23: India: Investments in renewable heat generation

REF	UNIT	2012-2020	2021-2030	2031-2040	2041-2050	2012-2050	UNIT	ANNUAL AVERAGE 2012-2050
Heat pumps	billion \$	0.1	0.2	0.2	0.3	0.8	billion \$/a	0.0
Deep geothermal	billion \$	0.0	0.0	0.0	0.0	0.0	billion \$/a	0.0
Solar thermal	billion \$	3.2	4.0	6.7	8.2	22.1	billion \$/a	0.6
Biomass	billion \$	170.0	54.8	38.0	46.7	309.5	billion \$/a	7.9
Total	billion \$	173.3	59.0	44.9	55.2	332.5	billion \$/a	8.5
E[R]								
Heat pumps	billion \$	1.1	62.9	71.8	134.0	269.9	billion \$/a	6.9
Deep geothermal	billion \$	0.0	25.2	48.5	100.5	174.2	billion \$/a	4.5
Solar thermal	billion \$	5.2	105.5	144.0	173.9	428.5	billion \$/a	11.0
Biomass	billion \$	105.6	26.7	5.5	6.9	144.6	billion \$/a	3.7
Total	billion \$	111.9	220.3	269.8	415.3	1,017.2	billion \$/a	26.1
ADV E[R]								
Heat pumps	billion \$	1.1	62.9	71.8	131.6	267.4	billion \$/a	6.9
Deep geothermal	billion \$	0.0	25.2	55.8	125.3	206.3	billion \$/a	5.3
Solar thermal	billion \$	5.2	105.2	143.7	192.1	446.1	billion \$/a	11.4
Biomass	billion \$	105.6	26.3	5.4	2.3	139.6	billion \$/a	3.6
Total	billion \$	111.9	219.6	276.6	451.3	1,059.5	billion \$/a	27.2

Table 13.8.24: India: Total employment in the energy sector THOUSAND JOBS

By sector	REFERENCE SCENARIO				ADV E[R] SCENARIO		
	2015	2020	2025	2030	2020	2025	2030
Construction and installation	1,226	1,622	1,427	1,204	1,459	2,532	2,283
Manufacturing	628	819	719	598	1,691	2,627	2,395
Operations and maintenance	414	560	664	621	780	1,239	1,625
Fuel supply (domestic)	2,265	2,323	2,211	1,826	2,304	2,106	1,540
Coal and gas export	-	-	-	-	-	-	-
Solar and geothermal heat	20	20	23	22	50	466	733
Total jobs (thousands)	4,554	5,344	5,035	4,271	6,284	8,969	8,576
By technology							
Coal	2,252	2,769	2,552	2,324	839	618	384
Gas, oil & diesel	224	299	362	343	319	437	357
Nuclear	84	118	133	120	31	26	18
Renewable	1,993	2,158	1,989	1,483	5,095	7,889	7,817
Biomass	1,515	1,584	1,433	1,076	1,688	1,659	1,312
Hydro	146	204	198	170	204	80	64
Wind	131	143	142	103	1,409	2,513	2,662
PV	177	203	189	109	1,606	2,742	2,365
Geothermal power	1.6	1.2	0.9	0.6	25	46	73
Solar thermal power	3.0	2.6	2.4	1.8	75	287	479
Ocean	-	-	0.01	1.1	39.0	95.7	128.7
Solar - heat	19.7	19.4	22.8	22.2	45	382	549
Geothermal & heat pump	-	0.4	0.3	0.3	5	83	185
Total jobs (thousands)	4,554	5,344	5,035	4,271	6,284	8,969	8,576

OTHER ASIA: REFERENCE SCENARIO

Table 13.9.1 Other Asia: Electricity generation TWh/a

	2012	2020	2025	2030	2040	2050
Power plants	1,180	1,640	2,021	2,402	3,487	4,503
Hard coal (& non-renewable waste)	203	441	647	852	1,454	1,823
Lignite	143	181	201	221	260	299
Gas	467	559	643	727	1,037	1,433
of which from H-	0	0	0	0	0	0
Oil	84	69	55	38	14	4
Diesel	32	19	14	12	8	4
Nuclear	45	72	75	78	56	39
Biomass (& renewable waste)	8	33	47	62	90	127
Hydro	175	220	267	315	396	492
Wind	2	10	24	38	82	154
of which wind offshore	0	0	1	2	7	18
PV	1	8	14	20	33	51
Geothermal	20	27	33	39	55	74
Solar thermal power plants	0	0	0	1	1	3
Ocean energy	0	0	0	0	0	0
Combined heat and power plants	39	47	50	52	57	64
Hard coal (& non-renewable waste)	28	33	34	35	37	40
Lignite	5	6	6	7	7	8
Gas	4	6	8	9	11	15
of which from H-	0	0	0	0	0	0
Oil	2	2	2	2	2	1
Biomass (& renewable waste)	0	0	0	0	0	0
Geothermal	0	0	0	0	0	0
Hydrogen	0	0	0	0	0	0
CHP by producer						
Main activity producers	8	10	11	11	12	14
Autoproducers	31	37	39	41	45	50
Total generation	1,219	1,687	2,071	2,454	3,544	4,567
Fossil	969	1,317	1,609	1,901	2,830	3,627
Hard coal (& non-renewable waste)	231	474	680	887	1,490	1,863
Lignite	147	187	207	227	267	307
Gas	471	566	651	736	1,048	1,447
Oil	87	71	57	40	16	6
Diesel	32	19	14	12	8	4
Nuclear	45	72	75	78	56	39
Hydrogen	0	0	0	0	0	0
of which renewable H-	0	0	0	0	0	0
Renewables (w/o renewable hydrogen)	206	298	386	475	658	901
Hydro	175	220	267	315	396	492
Wind	2	10	24	38	82	154
PV	1	8	14	20	33	51
Biomass (& renewable waste)	8	33	47	62	90	127
Geothermal	20	27	33	39	55	74
Solar thermal power plants	0	0	0	1	1	3
Ocean energy	0	0	0	0	0	0
Distribution losses	99	137	168	199	288	374
Own consumption electricity	54	68	83	98	135	135
Electricity for hydrogen production	0	0	0	0	0	0
Electricity for synfuel production	0	0	0	0	0	0
Final energy consumption (electricity)	1,081	1,497	1,835	2,172	3,137	4,074
Fluctuating RES (PV, Wind, Ocean)	3	18	38	58	115	205
Share of fluctuating RES	0%	1%	2%	2%	3%	4%
RES share (domestic generation)	17%	18%	19%	19%	19%	20%

Table 13.9.2 Other Asia: Final energy consumption in transport PJ/a

	2012	2020	2025	2030	2040	2050
Road	5,471	6,863	7,738	8,601	10,138	10,927
Fossil fuels	5,143	6,414	7,227	8,029	9,264	9,702
Biofuels	79	198	237	274	381	457
Synfuels	0	0	0	0	0	0
Natural gas	248	249	272	295	489	759
Hydrogen	0	0	0	0	0	0
Electricity	1	1	2	3	5	8
Rail	65	89	105	122	159	199
Fossil fuels	50	68	81	93	118	142
Biofuels	0	0	0	0	0	0
Synfuels	0	0	0	0	0	0
Electricity	15	20	25	29	42	56
Navigation	177	228	264	300	372	444
Fossil fuels	177	228	264	300	372	444
Biofuels	0	0	0	0	0	0
Synfuels	0	0	0	0	0	0
Aviation	172	263	318	384	507	652
Fossil fuels	172	263	318	384	507	652
Biofuels	0	0	0	0	0	0
Synfuels	0	0	0	0	0	0
Total (incl. pipelines)	5,886	7,442	8,425	9,407	11,177	12,222
Fossil fuels	5,543	6,973	7,889	8,806	10,261	10,941
Biofuels (incl. biogas)	79	198	237	274	381	457
Synfuels	0	0	0	0	0	0
Natural gas	248	249	272	295	489	759
Hydrogen	0	0	0	0	0	0
Electricity	15	21	27	32	46	64
Total RES	82	202	242	280	390	470
RES share	1%	3%	3%	3%	3%	4%

Table 13.9.3 Other Asia: Heat supply PJ/a

	2012	2020	2025	2030	2040	2050
District heating plants	0	0	0	0	0	0
Fossil fuels	0	0	0	0	0	0
Biomass	0	0	0	0	0	0
Solar collectors	0	0	0	0	0	0
Geothermal	0	0	0	0	0	0
Heat from CHP¹	105	141	164	190	268	406
Fossil fuels	105	141	164	190	268	406
Biomass	0	0	0	0	0	0
Geothermal	0	0	0	0	0	0
Hydrogen	0	0	0	0	0	0
Direct heating	10,247	12,398	13,751	15,144	18,719	21,532
Fossil fuels	5,167	6,953	8,147	9,367	12,563	15,199
Biomass	4,215	4,509	4,583	4,651	4,820	4,780
Solar collectors	4	26	41	55	96	154
Geothermal	0	0	0	0	0	0
Heat pumps ²	0	0	0	0	0	0
Electric direct heating	861	910	980	1,070	1,240	1,399
Hydrogen	0	0	0	0	0	0
Total heat supply³	10,352	12,539	13,915	15,333	18,988	21,938
Fossil fuels	5,272	7,094	8,311	9,557	12,831	15,605
Biomass	4,215	4,509	4,583	4,651	4,820	4,780
Solar collectors	4	26	41	55	96	154
Geothermal	0	0	0	0	0	0
Heat pumps ²	0	0	0	0	0	0
Electric direct heating	861	910	980	1,070	1,240	1,399
Hydrogen	0	0	0	0	0	0
RES share (including RES electricity)	42%	37%	35%	32%	27%	24%

¹ public CHP and CHP autoproduction / ² heat from ambient energy and electricity use / ³ incl. process heat, cooking

Table 13.9.4: Other Asia: Installed capacity GW

	2012	2020	2025	2030	2040	2050
Total generation	289	411	501	591	826	1,067
Fossil	221	303	362	422	596	754
Hard coal (& non-renewable waste)	41	86	122	157	253	311
Lignite	26	34	37	40	45	51
Gas (w/o H ₂)	109	139	163	187	270	374
Oil	33	34	32	29	19	11
Diesel	12	9	8	10	7	7
Nuclear	0	0	10	10	0	5
Hydrogen (fuel cells, gas power plants, gas CHP)	0	0	0	0	0	0
Renewables	62	99	129	159	222	308
Hydro	52	74	90	107	135	168
Wind	1	5	11	16	34	62
of which wind offshore	0	0	0	1	2	6
PV	1	6	11	15	25	39
Biomass (& renewable waste)	5	10	12	14	19	26
Geothermal	3	4	5	6	8	11
Solar thermal power plants	0	0	0	0	0	1
Ocean energy	0	0	0	0	0	0
Fluctuating RES (PV, Wind, Ocean)	2	11	21	32	59	102
Share of fluctuating RES	1%	3%	4%	5%	7%	10%
RES share (domestic generation)	21%	24%	26%	27%	27%	29%

Table 13.9.5: Other Asia: Final energy demand PJ/a

	2012	2020	2025	2030	2040	2050
Total (incl. non-energy use)	26,182	31,750	35,545	39,340	48,317	55,148
Total energy use	23,024	28,234	31,690	35,137	43,545	50,151
Transport	5,886	7,442	8,425	9,407	11,177	12,222
Oil products	5,543	6,973	7,889	8,806	10,261	10,941
Natural gas	248	249	272	295	489	759
Biofuels	79	198	237	274	381	457
Synfuels	0	0	0	0	0	0
Electricity	15	21	27	32	46	64
RES electricity	3	4	5	6	9	13
Hydrogen	0	0	0	0	0	0
RES share Transport	1%	3%	3%	3%	3%	4%
Industry	7,331	9,892	11,385	12,879	16,602	19,724
Electricity	1,751	2,354	2,747	3,140	4,162	5,327
RES electricity	295	416	513	607	773	1,061
Public district heat	9	9	9	10	12	13
RES district heat	0	0	0	0	0	0
Hard coal & lignite	1,922	2,592	2,911	3,230	3,892	4,034
Oil products	1,167	1,441	1,462	1,463	1,483	1,354
Gas	1,433	2,229	2,883	3,536	5,368	7,212
Solar	0	9	11	13	18	21
Biomass	1,048	1,258	1,363	1,468	1,678	1,764
Geothermal	0	0	0	0	0	0
Hydrogen	0	0	0	0	0	0
RES share Industry	18%	17%	17%	16%	15%	14%
Other Sectors	9,807	10,900	11,880	12,851	15,767	18,205
Electricity	2,125	3,014	3,831	4,649	7,083	9,275
RES electricity	358	533	715	899	1,315	1,830
Public district heat	28	35	42	48	68	84
RES district heat	0	0	0	0	0	0
Hard coal & lignite	183	222	264	307	453	654
Oil products	1,328	1,397	1,483	1,560	1,748	1,835
Gas	477	677	858	1,040	1,494	1,916
Solar	4	17	30	42	78	133
Biomass	5,663	5,537	5,372	5,206	4,841	4,307
Geothermal	0	0	0	0	0	0
Hydrogen	0	0	0	0	0	0
RES share Other Sectors	61%	56%	51%	48%	40%	34%
Total RES	7,451	7,973	8,244	8,515	9,092	9,576
RES share	32%	28%	26%	24%	21%	19%
Non energy use	3,158	3,516	3,855	4,202	4,772	4,997
Oil	2,489	2,701	2,944	3,191	3,579	3,700
Gas	662	767	858	954	1,127	1,228
Coal	7	48	53	57	65	68

¹ excluding heat produced by CHP autoproducers

Table 13.9.6: Other Asia: CO₂ emissions Mill t/a

	2012	2020	2025	2030	2040	2050
Condensation power plants	673	915	1,125	1,335	1,976	2,483
Hard coal (& non-renewable waste)	180	392	577	763	1,287	1,806

Table 13.9.8 Other Asia: Electricity generation TWh/a

	2012	2020	2025	2030	2040	2050
Power plants	1,180	1,627	1,907	2,339	3,698	4,815
Hard coal (& non-renewable waste)	203	379	344	206	32	0
Lignite	143	154	67	32	4	0
Gas	467	575	594	609	554	260
of which from H+	0	0	0	0	11	26
Oil	84	68	54	21	4	1
Diesel	32	15	10	8	1	0
Nuclear	45	40	35	30	12	0
Biomass (& renewable waste)	8	25	25	25	30	36
Hydro	175	225	240	250	270	300
Wind	2	74	228	490	1,136	1,666
of which wind offshore	0	3	77	167	351	500
PV	1	46	143	305	694	1,041
Geothermal	20	27	114	179	364	495
Solar thermal power plants	0	0	48	163	488	797
Ocean energy	0	0	5	20	110	220
Combined heat and power plants	39	67	112	159	231	283
Hard coal (& non-renewable waste)	28	31	29	27	10	4
Lignite	5	3	2	1	0	0
Gas	4	12	38	61	106	129
of which from H+	0	0	0	0	5	44
Oil	2	2	2	1	0	0
Biomass (& renewable waste)	0	12	28	45	75	94
Geothermal	0	6	14	23	39	55
Hydrogen	0	0	0	0	0	0
CHP by producer						
Main activity producers	8	11	19	29	46	63
Autoproducers	31	56	93	130	185	220
Total generation	1,219	1,694	2,019	2,497	3,929	5,098
Fossil	969	1,239	1,139	967	695	325
Hard coal (& non-renewable waste)	231	410	373	233	42	4
Lignite	147	157	69	34	4	0
Gas	471	587	631	670	644	319
Oil	87	70	56	23	4	1
Diesel	32	15	10	8	1	0
Nuclear	45	40	35	30	12	0
Hydrogen	0	0	0	0	16	70
of which renewable H+	0	0	0	0	13	65
Renewables (w/o renewable hydrogen)	206	415	845	1,500	3,206	4,703
Hydro	175	225	240	250	270	300
Wind	2	74	228	490	1,136	1,666
PV	1	46	143	305	694	1,041
Biomass (& renewable waste)	8	38	53	70	105	130
Geothermal	20	32	128	202	403	550
Solar thermal power plants	0	0	48	163	488	797
Ocean energy	0	0	5	20	110	220
Distribution losses	99	128	145	174	244	323
Own consumption electricity	54	64	70	73	67	45
Electricity for hydrogen production	0	0	11	95	481	1,052
Electricity for synfuel production	0	0	0	0	0	0
Final energy consumption (electricity)	1,081	1,502	1,793	2,154	3,136	3,678
Fluctuating RES (PV, Wind, Ocean)	3	120	376	815	1,940	2,927
Share of fluctuating RES	0%	7%	19%	33%	49%	57%
RES share (domestic generation)	17%	25%	42%	60%	82%	94%

Table 13.9.9 Other Asia: Final energy consumption in transport PJ/a

	2012	2020	2025	2030	2040	2050
Road	5,471	6,650	7,034	7,202	7,129	5,398
Fossil fuels	5,143	6,085	6,095	5,554	3,105	649
Biofuels	79	320	530	686	825	665
Synfuels	0	0	0	0	0	0
Natural gas	248	239	224	216	185	119
Hydrogen	0	0	28	244	1,141	1,843
Electricity	1	5	158	501	1,873	2,122
Rail	65	83	89	108	136	160
Fossil fuels	50	62	58	61	37	14
Biofuels	0	1	3	5	16	12
Synfuels	0	0	0	0	0	0
Electricity	15	20	28	43	83	134
Navigation	177	200	209	235	213	221
Fossil fuels	177	194	198	206	181	122
Biofuels	0	6	10	28	32	100
Synfuels	0	0	0	0	0	0
Aviation	172	212	250	264	345	499
Fossil fuels	172	208	238	245	293	274
Biofuels	0	4	13	18	52	224
Synfuels	0	0	0	0	0	0
Total (incl. pipelines)	5,886	7,144	7,582	7,808	7,824	6,278
Fossil fuels	5,543	6,548	6,588	6,067	3,616	1,059
Biofuels (incl. biogas)	79	332	556	738	925	1,000
Synfuels	0	0	0	0	0	0
Natural gas	248	239	224	216	185	119
Hydrogen	0	0	28	244	1,141	1,843
Electricity	15	25	186	544	1,956	2,256
Total RES	82	338	646	1,211	3,463	4,835
RES share	1%	5%	9%	16%	44%	77%

Table 13.9.10 Other Asia: Heat supply PJ/a

	2012	2020	2025	2030	2040	2050
District heating plants	0	0	2	2	3	4
Fossil fuels	0	0	0	0	0	0
Biomass	0	0	1	1	1	1
Solar collectors	0	0	0	1	1	1
Geothermal	0	0	1	1	1	1
Heat from CHP¹	105	248	481	728	1,181	1,672
Fossil fuels	105	151	227	306	397	354
Biomass	0	46	130	216	424	686
Geothermal	0	52	124	205	343	473
Hydrogen	0	0	0	0	17	159
Direct heating	10,247	11,785	12,361	12,895	14,097	14,175
Fossil fuels	5,167	5,775	5,511	4,980	3,850	1,577
Biomass	4,215	4,692	4,625	4,168	3,162	2,485
Solar collectors	4	107	446	1,131	2,529	3,178
Geothermal	0	182	327	485	945	1,264
Heat pumps ²	0	4	93	378	759	1,549
Electric direct heating	861	1,025	1,359	1,753	2,851	3,625
Hydrogen	0	0	0	0	0	498
Total heat supply³	10,352	12,033	12,844	13,625	15,280	15,851
Fossil fuels	5,272	5,926	5,738	5,286	4,247	1,931
Biomass	4,215	4,738	4,756	4,386	3,587	3,173
Solar collectors	4	107	446	1,131	2,530	3,179
Geothermal	0	234	451	690	1,289	1,738
Heat pumps ²	0	4	93	378	759	1,549
Electric direct heating	861	1,025	1,359	1,753	2,851	3,625
Hydrogen	0	0	0	0	17	657
RES share (including RES electricity)	42%	44%	49%	56%	69%	86%

1 public CHP and CHP autoproduction / 2 heat from ambient energy and electricity use / 3 incl. process heat, cooking

Table 13.9.10: Other Asia: Installed capacity GW

	2012	2020	2025	2030	2040	2050
Total generation	289	431	604	875	1,595	2,200
Fossil	221	265	264	254	270	231
Hard coal (& non-renewable waste)	41	68	72	55	12	1
Lignite	26	27	14	7	1	0
Gas (w/o H ₂)	109	129	142	171	252	229
Oil	1	33	34	16	5	2
Diesel	12	7	6	6	1	0
Nuclear	0	0	0	0	2	0
Hydrogen (fuel cells, gas power plants, gas CHP)	0	0	0	0	6	34
Renewables	62	161	335	617	1,317	1,935
Hydro	52	75	81	85	92	102
Wind	1	33	92	196	443	645
of which wind offshore	0	1	26	56	114	160
PV	1	36	111	235	535	801
Biomass (& renewable waste)	5	11	13	16	26	35
Geothermal	3	5	20	32	61	83
Solar thermal power plants	0	0	15	43	105	159
Ocean energy	0	0	3	10	55	110
Fluctuating RES (PV, Wind, Ocean)	2	69	205	442	1,033	1,555
Share of fluctuating RES	1%	16%	34%	50%	65%	71%
RES share (domestic generation)	21%	37%	56%	71%	83%	88%

Table 13.9.12: Other Asia: Final energy demand PJ/a

	2012	2020	2025	2030	2040	2050
Total (incl. non-energy use)	26,182	30,298	31,679	32,479	33,882	32,860
Total energy use	23,024	27,120	28,356	29,050	30,240	28,841
Transport	5,886	7,144	7,582	7,808	7,824	6,278
Oil products	5,543	6,548	6,588	6,067	3,616	1,059
Natural gas	248	239	224	216	185	119
Biofuels	79	332	556	738	925	1,000
Synfuels	0	0	0	0	0	0
Electricity	15	25	186	544	1,956	2,256
RES electricity	3	6	78	327	1,603	2,111
Hydrogen	0	0	28	244	1,141	1,843
RES share Transport	1%	5%	9%	16%	44%	77%
Industry	7,331	9,240	9,771	10,093	10,826	10,819
Electricity	1,751	2,358	2,707	3,096	3,924	4,480
RES electricity	295	578	1,133	1,860	3,215	4,191
Public district heat	9	6	91	127	194	242
RES district heat	0	11	67	103	177	224
Hard coal & lignite	1,922	2,296	1,937	1,021	196	41
Oil products	1,167	1,094	841	709	495	105
Gas	1,433	1,960	2,277	2,621	2,679	1,269
Solar	0	61	261	692	1,418	1,703
Biomass	1,048	1,260	1,306	1,292	803	658
Geothermal	0	183	350	534	1,118	1,797
Hydrogen	0	0	0	0	0	524
RES share Industry	18%	23%	32%	44%	62%	84%
Other Sectors	9,807	10,736	11,003	11,149	11,590	11,744
Electricity	2,125	3,023	3,560	4,115	5,411	6,504
RES electricity	358	741	1,490	2,472	4,433	6,084
Public district heat	28	38	45	74	124	188
RES district heat	0	15	33	60	114	174
Hard coal & lignite	183	94	12	22	0	0
Oil products	1,328	1,013	844	772	429	18
Gas	477	688	807	811	622	390
Solar	4	46	185	438	1,112	1,475
Biomass	5,663	5,833	5,508	4,695	3,509	2,541
Geothermal	0	1	42	221	384	628
Hydrogen	0	0	0	0	0	0
RES share Other Sectors	61%	62%	66%	71%	82%	93%
Total RES	7,451	9,068	11,021	13,577	19,745	24,800
RES share	32%	33%	39%	47%	65%	86%
Non energy use	3,158	3,178	3,323	3,429	3,643	4,019
Oil	2,489	2,296	2,268	2,203	2,048	1,939
Gas	662	680	711	734	779	860
Coal	7	202	345	493	815	1,221

1 excluding heat produced by CHP autoproducers

Table 13.9.13: Other Asia: CO

OTHER ASIA: ADVANCED ENERGY [R]EVOLUTION SCENARIO

Table 13.9.15 Other Asia: Electricity generation TWh/a

	2012	2020	2025	2030	2040	2050
Power plants	1,180	1,629	1,948	2,465	4,255	6,298
Hard coal (& non-renewable waste)	203	364	272	108	2	0
Lignite	143	154	67	32	4	0
Gas	467	590	644	639	588	305
of which from H ₂	0	0	0	0	59	305
Oil	84	68	51	18	1	0
Diesel	32	15	13	11	4	0
Nuclear	45	40	35	30	12	0
Biomass (& renewable waste)	8	25	30	30	33	28
Hydro	175	225	243	253	273	300
Wind	2	74	228	505	1,253	1,988
of which wind offshore	0	3	77	182	397	600
PV	1	46	149	376	862	1,338
Geothermal	20	27	129	209	414	564
Solar thermal power plants	0	1	81	234	698	1,556
Ocean energy	0	0	5	20	110	220
Combined heat and power plants	39	67	112	159	231	283
Hard coal (& non-renewable waste)	28	31	29	27	7	0
Lignite	5	3	2	1	0	0
Gas	4	12	38	61	102	90
of which from H ₂	0	0	0	0	10	90
Oil	2	2	2	1	0	0
Biomass (& renewable waste)	0	12	28	45	77	107
Geothermal	0	6	14	23	39	56
Hydrogen	0	0	0	0	6	31
CHP by producer						
Main activity producers	8	11	19	29	46	63
Autoproducers	31	56	93	130	185	220
Total generation	1,219	1,696	2,060	2,624	4,485	6,581
Fossil	969	1,240	1,118	899	639	0
Hard coal (& non-renewable waste)	231	396	302	135	9	0
Lignite	147	157	69	34	4	0
Gas	471	602	681	700	621	0
Oil	87	70	53	20	1	0
Diesel	32	15	13	11	4	0
Nuclear	45	40	35	30	12	0
Hydrogen	0	0	0	0	75	425
of which renewable H ₂	0	0	0	0	64	425
Renewables (w/o renewable hydrogen)	206	416	907	1,695	3,760	6,156
Hydro	175	225	243	253	273	300
Wind	2	74	228	505	1,253	1,988
PV	1	46	149	376	862	1,338
Biomass (& renewable waste)	8	38	58	75	110	135
Geothermal	20	32	143	232	453	620
Solar thermal power plants	0	1	81	234	698	1,556
Ocean energy	0	0	5	20	110	220
Distribution losses	99	128	145	174	244	323
Own consumption electricity	54	64	70	73	67	45
Electricity for hydrogen production	0	0	17	127	836	2,136
Electricity for synfuel production	0	0	0	0	15	69
Final energy consumption (electricity)	1,081	1,503	1,828	2,250	3,322	4,008
Fluctuating RES (PV, Wind, Ocean)	3	120	382	901	2,226	3,546
Share of fluctuating RES	0%	7%	19%	34%	50%	54%
RES share (domestic generation)	17%	25%	44%	65%	85%	100%

Table 13.9.16 Other Asia: Final Energy Consumption Transport PJ/a

	2012	2020	2025	2030	2040	2050
Road	5,471	6,650	6,747	6,676	6,080	4,078
Fossil fuels	5,143	6,085	5,774	4,969	2,022	0
Biofuels	79	320	502	614	730	431
Synfuels	0	0	0	0	18	48
Natural gas	248	239	212	195	129	0
Hydrogen	0	0	41	323	1,322	1,750
Electricity	1	5	218	575	1,878	1,897
Rail	65	83	157	237	408	559
Fossil fuels	50	57	47	42	19	0
Biofuels	0	1	5	7	12	12
Synfuels	0	0	0	0	0	1
Electricity	15	25	106	187	377	546
Navigation	177	200	209	235	213	221
Fossil fuels	177	198	206	212	139	0
Biofuels	0	2	3	22	73	199
Synfuels	0	0	0	0	2	22
Aviation	172	212	245	256	321	399
Fossil fuels	172	211	243	233	209	0
Biofuels	0	1	2	23	110	359
Synfuels	0	0	0	0	3	40
Total (incl. pipelines)	5,886	7,144	7,358	7,403	7,040	5,305
Fossil fuels	5,543	6,551	6,270	5,456	2,388	0
Biofuels (incl. biogas)	79	324	512	667	925	1,000
Synfuels	0	0	0	0	23	112
Natural gas	248	239	212	195	129	0
Hydrogen	0	0	41	323	1,322	1,750
Electricity	15	30	323	762	2,254	2,443
Total RES	82	332	673	1,368	3,992	5,305
RES share	1%	5%	9%	18%	57%	100%

Table 13.9.17 Other Asia: Heat Supply PJ/a

	2012	2020	2025	2030	2040	2050
District heating plants	0	1	2	2	2	2
Fossil fuels	0	0	0	0	0	0
Biomass	0	1	1	1	1	1
Solar collectors	0	0	0	1	1	1
Geothermal	0	0	1	1	1	1
Heat from CHP¹	105	248	481	728	1,193	1,773
Fossil fuels	105	150	227	306	348	0
Biomass	0	45	130	216	431	775
Geothermal	0	52	124	205	345	482
Hydrogen	0	0	0	0	69	516
Direct heating	10,247	11,785	12,361	12,895	14,084	14,076
Fossil fuels	5,167	5,775	5,520	4,994	3,491	0
Biomass	4,215	4,692	4,625	4,168	3,226	2,578
Solar collectors	4	107	446	1,131	2,527	3,703
Geothermal	0	182	327	485	944	1,248
Heat pumps ²	0	4	93	378	759	1,540
Electric direct heating	861	1,025	1,350	1,740	2,849	4,093
Hydrogen	0	0	0	0	290	914
Total heat supply³	10,352	12,033	12,844	13,625	15,280	15,851
Fossil fuels	5,272	5,926	5,747	5,300	3,839	0
Biomass	4,215	4,738	4,756	4,386	3,658	3,353
Solar collectors	4	107	446	1,131	2,528	3,703
Geothermal	0	234	451	690	1,289	1,731
Heat pumps ²	0	4	93	378	759	1,540
Electric direct heating	861	1,025	1,350	1,740	2,849	4,093
Hydrogen	0	0	0	0	358	1,431
RES share (including RES electricity)	42%	44%	49%	57%	72%	100%

¹ public CHP and CHP autoproduction / ² heat from ambient energy and electricity use / ³ incl. process heat, cooking

Table 13.9.18: Other Asia: Installed capacity GW

	2012	2020	2025	2030	2040	2050
Total generation	289	432	621	944	1,829	2,751
Fossil	221	266	262	238	253	0
Hard coal (& non-renewable waste)	41	66	58	31	2	0
Lignite	26	27	14	7	1	0
Gas (w/o H ₂)	109	132	153	178	244	0
Oil	33	34	30	14	1	0
Diesel	12	7	7	8	5	0
Nuclear	6	5	5	4	2	0
Hydrogen (fuel cells, gas power plants, gas CHP)	0	0	0	0	29	301
Renewables	62	161	355	702	1,547	2,450
Hydro	52	75	82	86	83	102
Wind	1	33	92	201	488	769
of which wind offshore	0	1	26	61	128	192
PV	1	36	116	290	665	1,030
Biomass (& renewable waste)	5	11	15	17	27	34
Geothermal	3	5	23	36	69	93
Solar thermal power plants	0	0	25	61	150	311
Ocean energy	0	0	3	10	55	110
Fluctuating RES (PV, Wind, Ocean)	2	69	210	502	1,208	1,909
Share of fluctuating RES	1%	16%	34%	53%	66%	69%
RES share (domestic generation)	21%	37%	57%	74%	85%	89%

Table 13.9.19: Other Asia: Final energy demand PJ/a

	2012	2020	2025	2030	2040	2050
Total (incl. non-energy use)	26,182	30,298	31,457	32,176	33,377	32,132
Total energy use	23,024	27,120	28,133	28,747	29,734	28,112
Transport	5,886	7,144	7,358	7,403	7,040	5,305
Oil products	5,543	6,551	6,270	5,456	2,388	0
Natural gas	248	239	212	195	129	0
Biofuels	79	324	512	667	925	1,000
Synfuels	0	0	0	0	23	112
Electricity	15	30	323	762	2,254	2,443
RES electricity	3	7	142	492	1,921	2,443
Hydrogen	0	0	41	323	1,322	1,750
RES share Transport	1%	5%	9%	18%	57%	100%
Industry	7,331	9,240	9,771	10,128	10,909	10,806
Electricity	1,751	2,358	2,707	3,146	4,054	5,080
RES electricity	295	578	1,192	2,032	3,456	5,080
Public district heat	9	28	91	127	193	243
RES district heat	0	12	67	103	179	243
Hard coal & lignite	1,922	2,296	1,937	1,021	196	0
Oil products	1,167	1,094	841	700	479	0
Gas	1,433	1,960	2,277	2,615	2,389	0
Solar	0	61	261	692	1,415	2,228
Biomass	1,048	1,260	1,306	1,292	801	649
Geothermal	0	183	350	534	1,117	1,775
Hydrogen	0	0	0	0	264	821
RES share Industry	18%	23%	33%	46%	66%	100%
Other Sectors	9,807	10,736	11,004	11,216	11,785	12,001
Electricity	2,125	3,023	3,551	4,191	5,651	6,896
RES electricity	358	741	1,564	2,707	4,817	6,896
Public district heat	28	38	45	74	124	188
RES district heat	0	16	33	60	115	188
Hard coal & lignite	183	94	23	38	0	0
Oil products	1,328	1,013	844	758	402	0
Gas	477	688	807	801	464	0
Solar	4	46	185	438	1,112	1,475
Biomass	5,663	5,833	5,508	4,695	3,599	2,673
Geothermal	0	1	42	221	384	628
Hydrogen	0	0	0	0	49	141
RES share Other Sectors	61%	62%	67%	72%	85%	100%
Total RES	7,451	9,063	11,180	14,142	21,254	28,112
RES share	32%	33%	40%	49%	71%	100%
Non energy use	3,158	3,178	3,323	3,429	3,643	4,019
Oil	2,489	2,296	2,268	2,203	1,880	1,552
Gas	662	680	711	734	779	860
Coal	7	202	345	493	983	1,608

Table 13.9.22: Other Asia: Investments in electricity generation

REF	UNIT	2012-2020	2021-2030	2031-2040	2041-2050	2012-2050	UNIT	ANNUAL AVERAGE 2012-2050
Fossil (w/o CHP)	billion \$	150.6	205.6	301.3	331.7	989.2	billion \$/a	25.4
Nuclear	billion \$	14.3	8.3	0.0	0.3	22.9	billion \$/a	0.6
CHP (fossil + renewable)	billion \$	8.5	6.5	5.2	4.4	24.5	billion \$/a	0.6
Renewables (w/o CHP)	billion \$	132.5	169.3	188.1	246.1	736.0	billion \$/a	18.9
Total	billion \$	305.9	389.7	494.7	582.4	1,772.7	billion \$/a	45.5
Conventional (fossil & nuclear)	billion \$	173.4	220.4	306.5	336.4	1,036.6	billion \$/a	26.6
Renewables	billion \$	132.5	169.3	188.1	246.1	736.0	billion \$/a	18.9
Biomass	billion \$	12.2	16.9	22.5	30.2	81.8	billion \$/a	2.1
Hydro	billion \$	78.7	99.3	91.0	107.7	376.7	billion \$/a	9.7
Wind	billion \$	5.5	18.6	32.9	62.0	119.1	billion \$/a	3.1
PV	billion \$	11.0	12.2	16.6	18.3	57.9	billion \$/a	1.5
Geothermal	billion \$	25.1	21.7	24.6	27.1	96.4	billion \$/a	2.5
Solar thermal power plants	billion \$	0.0	0.6	0.7	0.7	2.1	billion \$/a	0.1
Ocean energy	billion \$	0.0	0.0	0.0	0.0	0.0	billion \$/a	0.0
E[R]								
Fossil (w/o CHP)	billion \$	104.9	56.3	91.1	96.1	348.3	billion \$/a	8.9
Nuclear	billion \$	5.3	0.6	0.8	0.0	6.6	billion \$/a	0.2
CHP (fossil + renewable)	billion \$	28.5	58.2	63.9	85.3	235.9	billion \$/a	6.0
Renewables (w/o CHP)	billion \$	226.6	1,078.5	1,482.1	1,652.6	4,439.8	billion \$/a	113.8
Total	billion \$	365.3	1,193.6	1,637.8	1,833.9	5,030.7	billion \$/a	129.0
Conventional (fossil & nuclear)	billion \$	119.0	71.7	104.6	113.2	408.6	billion \$/a	10.5
Renewables	billion \$	246.3	1,121.8	1,533.2	1,720.7	4,622.0	billion \$/a	118.5
Biomass	billion \$	16.3	21.4	38.6	46.3	122.6	billion \$/a	3.1
Hydro	billion \$	82.9	38.1	34.7	44.9	200.6	billion \$/a	5.1
Wind	billion \$	49.5	340.2	486.8	634.1	1,510.6	billion \$/a	38.7
PV	billion \$	62.5	261.0	343.0	363.6	1,030.1	billion \$/a	26.4
Geothermal	billion \$	34.8	221.2	197.3	201.0	654.4	billion \$/a	16.8
Solar thermal power plants	billion \$	0.3	190.7	269.1	295.3	755.4	billion \$/a	19.4
Ocean energy	billion \$	0.0	49.3	163.6	135.5	348.4	billion \$/a	8.9
ADV E[R]								
Fossil (w/o CHP)	billion \$	103.4	46.6	96.5	82.5	328.9	billion \$/a	8.4
Nuclear	billion \$	5.3	0.6	0.8	0.0	6.6	billion \$/a	0.2
CHP (fossil + renewable)	billion \$	28.5	58.2	64.0	82.8	233.4	billion \$/a	6.0
Renewables (w/o CHP)	billion \$	227.5	1,286.7	1,760.2	2,430.1	5,704.5	billion \$/a	146.3
Total	billion \$	364.7	1,392.0	1,921.4	2,595.4	6,273.5	billion \$/a	160.9
Conventional (fossil & nuclear)	billion \$	117.5	62.0	109.0	91.2	379.7	billion \$/a	9.7
Renewables	billion \$	247.2	1,330.0	1,812.4	2,504.2	5,893.8	billion \$/a	151.1
Biomass	billion \$	16.3	22.8	38.9	45.4	123.4	billion \$/a	3.2
Hydro	billion \$	82.9	40.7	34.7	42.0	200.3	billion \$/a	5.1
Wind	billion \$	49.5	356.5	558.2	778.9	1,743.0	billion \$/a	44.7
PV	billion \$	62.5	330.0	418.4	483.0	1,294.0	billion \$/a	33.2
Geothermal	billion \$	34.8	257.5	214.7	227.1	734.2	billion \$/a	18.8
Solar thermal power plants	billion \$	1.2	273.2	383.9	792.3	1,450.5	billion \$/a	37.2
Ocean energy	billion \$	0.0	49.3	163.6	135.5	348.4	billion \$/a	8.9

Table 13.9.23: Other Asia: Investments in renewable heat generation

REF	UNIT	2012-2020	2021-2030	2031-2040	2041-2050	2012-2050	UNIT	ANNUAL AVERAGE 2012-2050
Heat pumps	billion \$	0.0	0.0	0.0	0.0	0.0	billion \$/a	0.0
Deep geothermal	billion \$	0.0	0.0	0.0	0.0	0.0	billion \$/a	0.0
Solar thermal	billion \$	3.1	2.0	5.0	4.6	14.7	billion \$/a	0.4
Biomass	billion \$	52.6	35.3	24.8	14.1	126.9	billion \$/a	3.3
Total	billion \$	55.7	37.3	29.8	18.8	141.6	billion \$/a	3.6
E[R]								
Heat pumps	billion \$	0.9	108.8	91.0	253.2	453.8	billion \$/a	11.6
Deep geothermal	billion \$	40.4	62.0	116.2	100.9	319.5	billion \$/a	8.2
Solar thermal	billion \$	17.9	163.5	199.1	203.3	583.9	billion \$/a	15.0
Biomass	billion \$	122.0	15.7	0.0	0.1	137.7	billion \$/a	3.5
Total	billion \$	181.1	350.0	406.4	557.4	1,494.9	billion \$/a	38.3
ADV E[R]								
Heat pumps	billion \$	0.9	108.8	91.0	252.0	452.6	billion \$/a	11.6
Deep geothermal	billion \$	40.5	62.0	115.9	98.2	316.6	billion \$/a	8.1
Solar thermal	billion \$	17.9	163.5	198.6	203.6	585.6	billion \$/a	17.6
Biomass	billion \$	122.0	15.7	0.0	0.0	137.6	billion \$/a	3.5
Total	billion \$	181.3	349.9	405.5	655.7	1,592.4	billion \$/a	40.8

Table 13.9.24: Other Asia: Total employment in the energy sector THOUSAND JOBS

By sector	REFERENCE SCENARIO				ADV E[R] SCENARIO		
	2015	2020	2025	2030	2020	2025	2030
Construction and installation	644	722	646	689	903	1,660	1,500
Manufacturing	297	341	312	344	376	786	845
Operations and maintenance	349	433	484	467	547	849	1,105
Fuel supply (domestic)	1,812	1,985	1,980	1,742	2,021	1,963	1,568
Coal and gas export	71.3	50.1	22.4	-	52.3	23.3	-
Solar and geothermal heat	36	36	32.5	25.2	363	927	1,511
Total jobs (thousands)	3,209	3,567	3,476	3,267	4,262	6,208	6,528
By technology							
Coal	783	870	816	946	126	90	45
Gas, oil & diesel	811	963	1,019	964	960	987	905
Nuclear	38	37	31	28.1	20.0	19.8	16.7
Renewable	1,578	1,697	1,610	1,329	3,166	5,112	5,562
Biomass	1,266	1,305	1,210	985	1,391	1,321	1,032
Hydro	203	249	249	199	150	118	99
Wind	13.3	32.7	43	56	412	823	886
PV	47	62	63	55.1	699	1,472	1,483
Geothermal power	12.4	11.4	9.9	7.9	78	92	90
Solar thermal power	0.2	0.8	1.0	1.0	37	299	306
Ocean	-	-	-	-	35.4	60	153.7
Solar - heat	36	36	32.5	25.2	243	773	1,207
Geothermal & heat pump	0.0	-	-	-	120	154	305
Total jobs (thousands)	3,209	3,567	3,476	3,267	4,262	6,208	6,528

CHINA: REFERENCE SCENARIO

Table 13.10.1 China: Electricity generation TWh/a

	2012	2020	2025	2030	2040	2050
Power plants	3,671	5,936	7,253	8,599	10,634	11,591
Hard coal (& non-renewable waste)	2,526	3,543	4,344	5,174	6,572	6,964
Lignite	0	0	0	0	0	0
Gas	41	139	213	287	444	522
of which from H ₂	0	0	0	0	0	0
Oil	8	5	4	4	4	3
Diesel	0	0	0	0	0	0
Nuclear	97	431	607	783	908	1,033
Biomass (& renewable waste)	34	174	220	267	321	375
Hydro	863	1,181	1,257	1,333	1,423	1,514
Wind	96	365	470	585	733	881
of which wind offshore	1	11	30	55	107	147
PV	6	106	133	160	200	247
Geothermal	0	1	2	3	8	17
Solar thermal power plants	0	1	2	4	20	42
Ocean energy	0	0	0	0	2	3
Combined heat and power plants	1,353	1,607	1,704	1,772	1,862	1,899
Hard coal (& non-renewable waste)	1,270	1,461	1,514	1,539	1,543	1,498
Lignite	0	0	0	0	0	0
Gas	83	147	190	233	319	401
of which from H ₂	0	0	0	0	0	0
Oil	0	0	0	0	0	0
Biomass (& renewable waste)	0	0	0	0	0	0
Geothermal	0	0	0	0	0	0
Hydrogen	0	0	0	0	0	0
CHP by producer						
Main activity producers	0	0	0	0	0	0
Autoproducers	1,353	1,607	1,704	1,772	1,862	1,899
Total generation	5,024	7,543	8,957	10,372	12,496	13,490
Fossil	3,928	5,294	6,265	7,237	8,881	9,379
Hard coal (& non-renewable waste)	3,796	5,004	5,858	6,713	8,115	8,451
Lignite	0	0	0	0	0	0
Gas	124	285	403	520	763	924
Oil	8	5	4	4	4	3
Diesel	0	0	0	0	0	0
Nuclear	97	431	607	783	908	1,033
Hydrogen	0	0	0	0	0	0
of which renewable H ₂	0	0	0	0	0	0
Renewables (w/o renewable hydrogen)	999	1,818	2,085	2,352	2,707	3,079
Hydro	863	1,181	1,257	1,333	1,423	1,514
Wind	96	365	470	585	733	881
PV	6	106	133	160	200	247
Biomass (& renewable waste)	34	174	221	267	321	375
Geothermal	0	1	2	3	8	17
Solar thermal power plants	0	1	2	4	20	42
Ocean energy	0	0	0	0	2	3
Distribution losses	295	453	542	630	763	828
Own consumption electricity	556	689	764	839	960	970
Electricity for hydrogen production	0	0	0	0	0	0
Electricity for synfuel production	0	0	0	0	0	0
Final energy consumption (electricity)	4,172	6,402	7,652	8,903	10,775	11,694
Fluctuating RES (PV, Wind, Ocean)	102	461	603	745	934	1,131
Share of fluctuating RES	2%	6%	7%	7%	7%	8%
RES share (domestic generation)	20%	24%	23%	23%	22%	23%

Table 13.10.2 China: Final energy consumption in transport PJ/a

	2012	2020	2025	2030	2040	2050
Road	8,149	12,096	15,204	18,338	20,217	22,234
Fossil fuels	7,656	11,124	14,028	16,946	18,238	19,772
Biofuels	51	135	255	375	579	696
Synfuels	0	0	0	0	0	0
Natural gas	443	819	839	859	1,044	1,257
Hydrogen	0	0	0	0	0	0
Electricity	0	19	82	158	356	510
Rail	582	742	795	835	927	1,039
Fossil fuels	395	395	395	395	395	395
Biofuels	0	0	0	0	0	0
Synfuels	0	0	0	0	0	0
Electricity	187	347	400	440	532	643
Navigation	806	935	1,019	1,191	1,321	1,352
Fossil fuels	806	935	1,019	1,191	1,321	1,352
Biofuels	0	0	0	0	0	0
Synfuels	0	0	0	0	0	0
Aviation	513	879	1,082	1,184	1,260	1,279
Fossil fuels	513	879	1,082	1,184	1,260	1,279
Biofuels	0	0	0	0	0	0
Synfuels	0	0	0	0	0	0
Total (incl. pipelines)	10,058	14,663	18,112	21,561	23,742	25,923
Fossil fuels	9,370	13,332	16,524	19,715	21,215	22,798
Biofuels (incl. biogas)	51	135	255	375	579	696
Synfuels	0	0	0	0	0	0
Natural gas	450	829	851	873	1,061	1,277
Hydrogen	0	0	0	0	0	0
Electricity	187	366	482	597	888	1,153
Total RES	88	223	367	511	771	959
RES share	1%	2%	2%	2%	3%	4%

Table 13.10.3 China: Heat supply PJ/a

	2012	2020	2025	2030	2040	2050
District heating plants	3,413	4,366	4,547	4,730	4,656	4,501
Fossil fuels	3,402	4,334	4,504	4,676	4,584	4,413
Biomass	12	32	43	54	72	87
Solar collectors	0	0	0	0	0	0
Geothermal	0	0	0	0	0	0
Heat from CHP¹	3,077	3,852	4,225	4,552	5,153	5,698
Fossil fuels	3,077	3,852	4,225	4,552	5,152	5,697
Biomass	0	0	0	0	1	1
Geothermal	0	0	0	0	0	0
Hydrogen	0	0	0	0	0	0
Direct heating	32,424	37,248	38,366	39,492	39,606	39,400
Fossil fuels	23,433	28,441	29,541	30,656	30,476	29,770
Biomass	6,209	5,383	5,087	4,777	4,466	4,293
Solar collectors	539	821	928	1,036	1,114	1,207
Geothermal	0	0	0	0	0	0
Heat pumps ²	256	379	454	527	746	1,029
Electric direct heating	1,987	2,225	2,356	2,496	2,803	3,101
Hydrogen	0	0	0	0	0	0
Total heat supply³	38,915	45,467	47,138	48,773	49,414	49,599
Fossil fuels	29,912	36,626	38,269	39,883	40,212	39,880
Biomass	6,221	5,416	5,131	4,832	4,539	4,382
Solar collectors	539	821	928	1,036	1,114	1,207
Geothermal	0	0	0	0	0	0
Heat pumps ²	256	379	454	527	746	1,029
Electric direct heating	1,987	2,225	2,356	2,496	2,803	3,101
Hydrogen	0	0	0	0	0	0
RES share (including RES electricity)	19%	16%	15%	15%	14%	15%

¹ public CHP and CHP autoproduction / ² heat from ambient energy and electricity use / ³ incl. process heat, cooking

Table 13.10.4: China: Installed capacity GW

	2012	2020	2025	2030	2040	2050
Total generation	1,204	1,858	2,163	2,467	2,863	3,011
Fossil	854	1,145	1,330	1,515	1,779	1,785
Hard coal (& non-renewable waste)	788	1,035	1,191	1,346	1,563	1,539
Lignite	0	0	0	0	0	0
Gas (w/o H ₂)	55	100	130	160	208	239
Oil	11	10	10	9	7	7
Diesel	0	0	0	0	0	0
Nuclear	14	58	82	106	122	139
Hydrogen (fuel cells, gas power plants, gas CHP)	0	0	0	0	0	0
Renewables	337	655	751	847	962	1,087
Hydro	249	360	383	406	434	461
Wind	75	183	227	269	312	362
of which wind offshore	0	4	10	18	33	44
PV	7	81	103	124	155	186
Biomass (& renewable waste)	0	30	38	46	55	64
Geothermal	0	0	1	1	5	10
Solar thermal power plants	0	0	0	0	1	1
Ocean energy	0	0	0	0	0	0
Fluctuating RES (PV, Wind, Ocean)	82	265	329	393	468	550
Share of fluctuating RES	7%	14%	15%	16%	16%	18%
RES share (domestic generation)	28%	35%	35%	34%	34%	36%

Table 13.10.5: China: Final energy demand PJ/a

	2012	2020	2025	2030	2040	2050
Total (incl. non-energy use)	71,629	91,470	101,200	110,930	119,619	124,618
Total energy use	65,916	83,813	92,382	100,952	108,228	111,814
Transport	10,058	14,663	18,112	21,561	23,742	25,923
Oil products	9,370	13,332	16,524	19,715	21,215	22,798
Natural gas	450	829	851	873	1,061	1,277
Biofuels	51	135	255	375	579	696
Synfuels	0	0	0	0	0	0
Electricity	187	366	482	597	888	1,153
RES electricity	37	88	112	135	192	263
Hydrogen	0	0	0	0	0	0
RES share Transport	1%	2%	2%	2%	3%	4%
Industry	33,988	43,843	46,986	50,129	52,957	53,865
Electricity	10,071	14,936	17,531	20,127	23,963	26,360
RES electricity	2,003	3,600	4,081	4,564	5,191	6,016
Public district heat	2,026	2,603	2,726	2,849	2,816	2,726
RES district heat	4	19	26	33	43	53
Hard coal & lignite	14,919	18,167	17,176	16,728	15,045	13,445
Oil products	2,452	2,688	2,729	2,769	2,631	2,272
Gas	4,512	5,367	6,540	7,170	7,762	7,725
Solar	0	9	18	26	84	194
Biomass	0	62	254	445	732	1,112
Geothermal	7	11	14	16	23	31
Hydrogen	0	0	0	0	0	0
RES share Industry	6%	8%	9%	10%	11%	14%
Other Sectors	21,870	25,307	27,284	29,262	31,529	32,027
Electricity	4,761	7,744	9,536	11,328	13,938	14,585
RES electricity	947	1,867	2,220	2,569	3,020	3,329
Public district heat	937	1,053	1,056	1,058	1,041	1,024
RES district heat	2	8	10	12	16	20
Hard coal & lignite	3,311	3,488	3,524	3,559	3,322	3,096
Oil products	2,379	2,530	2,506	2,482	2,242	2,036
Gas	1,487	2,425	3,133	3,841	4,673	5,531
Solar	539	812	911	1,010	1,030	1,013
Biomass	8,289	7,003	6,313	5,622	4,758	3,999
Geothermal	166	253	307	361	524	741
Hydrogen	0	0	0	0	0	0
RES share Other Sectors	45%	39%	36%	33%	30%	28%
Total RES	12,045	13,867	14,519	15,168	16,193	17,467
RES share	18%	17%	16%	15%	15%	16%
Non energy use	5,714	7,657	8,818	9,979	11,391	12,804
Oil	3,714	5,021	5,806	6,596	7,583	8,576
Gas	577	805	946	1,092	1,296	1,516
Coal	1,423	1,831	2,066	2,291	2,512	2,712

¹ excluding heat produced by CHP autoproducers

Table 13.10.6: China: CO₂ emissions Mill t/a

	2012	2020	2025	2030	2040	2
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CHINA: ENERGY [R]EVOLUTION SCENARIO

Table 13.10.8 China: Electricity generation TWh/a

	2012	2020	2025	2030	2040	2050
Power plants	3,671	5,655	6,107	6,519	7,765	8,455
Hard coal (& non-renewable waste)	2,526	3,438	3,348	2,856	1,753	341
Lignite	0	0	0	0	0	0
Gas	41	87	91	100	92	86
of which from H ₂	0	0	0	0	0	0
Oil	8	4	3	2	0	0
Diesel	0	0	0	0	0	0
Nuclear	97	250	230	200	146	0
Biomass (& renewable waste)	34	141	150	150	151	141
Hydro	863	1,181	1,220	1,250	1,310	1,370
Wind	96	390	679	1,108	2,128	2,940
of which wind offshore	1	20	82	177	467	700
PV	6	171	348	652	1,293	1,910
Geothermal	0	1	3	14	49	137
Solar thermal power plants	0	1	32	177	783	1,370
Ocean energy	0	0	2	10	60	160
Combined heat and power plants	1,353	1,658	1,909	2,102	2,235	2,119
Hard coal (& non-renewable waste)	1,270	1,428	1,346	1,153	545	122
Lignite	0	0	0	0	0	0
Gas	83	188	344	475	683	744
of which from H ₂	0	0	0	0	7	27
Oil	0	0	0	0	0	0
Biomass (& renewable waste)	0	42	200	399	671	744
Geothermal	0	0	19	73	303	403
Hydrogen	0	0	0	2	34	106
CHP by producer						
Main activity producers	0	50	200	350	525	550
Autoproducers	1,353	1,608	1,709	1,752	1,710	1,569
Total generation	5,024	7,313	8,016	8,621	10,001	10,574
Fossil	3,928	5,146	5,132	4,586	3,065	1,265
Hard coal (& non-renewable waste)	3,796	4,866	4,694	4,009	2,298	462
Lignite	0	0	0	0	0	0
Gas	124	275	435	575	768	803
Oil	8	4	3	2	0	0
Diesel	0	0	0	0	0	0
Nuclear	97	250	230	200	146	0
Hydrogen	0	0	0	2	41	134
of which renewable H ₂	0	0	0	1	28	117
Renewables (w/o renewable hydrogen)	999	1,918	2,653	3,833	6,748	9,175
Hydro	863	1,181	1,220	1,250	1,310	1,370
Wind	96	390	679	1,108	2,128	2,940
PV	6	171	348	652	1,293	1,910
Biomass (& renewable waste)	34	183	350	549	822	885
Geothermal	0	1	22	87	352	540
Solar thermal power plants	0	1	32	177	783	1,370
Ocean energy	0	0	2	10	60	160
Distribution losses	295	420	440	430	398	329
Own consumption electricity	556	654	687	654	547	272
Electricity for hydrogen production	0	0	5	56	523	1,245
Electricity for synfuel production	0	0	0	0	0	0
Final energy consumption (electricity)	4,172	6,240	6,884	7,482	8,534	8,730
Fluctuating RES (PV, Wind, Ocean)	102	552	1,029	1,770	3,481	5,010
Share of fluctuating RES	2%	8%	13%	21%	35%	47%
RES share (domestic generation)	20%	26%	33%	44%	68%	88%

Table 13.10.9 China: Final energy consumption in transport PJ/a

	2012	2020	2025	2030	2040	2050
Road	8,149	11,524	12,819	13,575	12,120	10,290
Fossil fuels	7,656	10,622	11,593	11,473	7,062	2,945
Biofuels	51	142	243	386	515	442
Synfuels	0	0	0	0	0	0
Natural gas	443	724	731	709	672	457
Hydrogen	0	0	13	123	680	1,359
Electricity	0	36	238	884	3,191	5,088
Rail	582	742	772	790	850	950
Fossil fuels	395	385	332	242	108	35
Biofuels	0	0	18	58	42	15
Synfuels	0	0	0	0	0	0
Electricity	187	357	422	490	700	900
Navigation	806	930	1,000	1,060	1,110	1,010
Fossil fuels	806	930	950	965	888	707
Biofuels	0	0	50	95	222	303
Synfuels	0	0	0	0	0	0
Aviation	513	870	975	1,000	880	800
Fossil fuels	513	870	948	940	704	560
Biofuels	0	0	27	60	176	240
Synfuels	0	0	0	0	0	0
Total (incl. pipelines)	10,058	14,075	15,575	16,435	14,970	13,060
Fossil fuels	9,370	12,807	13,823	13,620	8,762	4,247
Biofuels (incl. biogas)	51	142	338	599	955	1,000
Synfuels	0	0	0	0	0	0
Natural gas	450	733	740	719	681	462
Hydrogen	0	0	13	123	680	1,359
Electricity	187	394	661	1,375	3,893	5,993
Total RES	88	245	561	1,265	4,053	7,461
RES share	1%	2%	4%	8%	27%	57%

Table 13.10.10 China: Heat supply PJ/a

	2012	2020	2025	2030	2040	2050
District heating plants	3,413	3,922	3,916	3,755	3,334	2,806
Fossil fuels	3,402	3,834	3,244	2,728	975	112
Biomass	12	68	280	427	581	505
Solar collectors	0	20	313	413	1,000	1,066
Geothermal	0	0	78	188	777	1,122
Heat from CHP¹	3,077	4,655	5,793	7,028	9,356	10,043
Fossil fuels	3,077	4,485	4,804	4,739	3,721	2,676
Biomass	0	170	821	1,641	2,766	3,055
Geothermal	0	0	168	635	2,602	3,447
Hydrogen	0	0	0	13	266	864
Direct heating	32,424	35,575	34,993	32,742	25,769	21,272
Fossil fuels	23,433	25,620	23,490	19,577	8,997	2,709
Biomass	6,209	5,766	5,887	5,380	4,601	4,865
Solar collectors	539	922	1,400	2,303	4,427	4,793
Geothermal	0	0	73	141	251	292
Heat pumps ²	256	555	1,070	1,939	3,506	4,046
Electric direct heating	1,987	2,711	3,073	3,402	3,733	3,962
Hydrogen	0	0	0	0	254	605
Total heat supply³	38,915	44,152	44,702	43,525	38,459	34,121
Fossil fuels	29,912	33,939	31,537	27,043	13,692	5,498
Biomass	6,221	6,005	6,989	7,448	7,949	8,425
Solar collectors	539	942	1,713	2,716	5,427	5,859
Geothermal	0	0	319	964	3,631	4,862
Heat pumps ²	256	555	1,070	1,939	3,506	4,046
Electric direct heating	1,987	2,711	3,073	3,402	3,733	3,962
Hydrogen	0	0	0	13	520	1,469
RES share (including RES electricity)	19%	19%	25%	34%	62%	82%

¹ public CHP and CHP autoproduction / ² heat from ambient energy and electricity use / ³ incl. process heat, cooking

Table 13.10.10: China: Installed capacity GW

	2012	2020	2025	2030	2040	2050
Total generation	1,204	1,863	2,163	2,599	3,382	3,876
Fossil	854	1,111	1,101	1,049	786	433
Hard coal (& non-renewable waste)	788	1,006	954	866	566	201
Lignite	0	0	0	0	0	0
Gas (w/o H ₂)	55	95	140	178	219	232
Oil	11	10	7	5	0	0
Diesel	0	0	0	0	0	0
Nuclear	14	34	31	27	20	0
Hydrogen (fuel cells, gas power plants, gas CHP)	7	0	0	0	11	36
Renewables	337	718	1,031	1,523	2,565	3,407
Hydro	249	360	372	361	399	418
Wind	75	195	320	498	884	1,181
of which wind offshore	0	7	27	56	144	209
PV	7	131	265	483	892	1,232
Biomass (& renewable waste)	0	31	60	106	164	194
Geothermal	0	0	3	13	53	81
Solar thermal power plants	0	0	9	39	154	249
Ocean energy	0	0	1	4	21	52
Fluctuating RES (PV, Wind, Ocean)	82	326	587	985	1,796	2,465
Share of fluctuating RES	7%	17%	27%	38%	53%	64%
RES share (domestic generation)	28%	39%	48%	59%	76%	88%

Table 13.10.12: China: Final energy demand PJ/a

	2012	2020	2025	2030	2040	2050
Total (incl. non-energy use)	71,829	87,019	89,449	88,209	78,033	68,393
Total energy use	65,916	79,745	81,865	80,426	70,287	60,967
Transport	10,058	14,075	15,575	16,435	14,970	13,060
Oil products	9,370	12,807	13,823	13,620	8,762	4,247
Natural gas	450	733	740	719	681	462
Biofuels	51	142	338	599	955	1,000
Synfuels	0	0	0	0	0	0
Electricity	187	394	661	1,375	3,893	5,993
RES electricity	37	103	219	611	2,638	5,267
Hydrogen	0	0	13	123	680	1,359
RES share Transport	1%	2%	4%	8%	27%	57%
Industry	33,988	41,097	41,443	39,710	33,075	27,185
Electricity	10,071	14,657	15,784	16,563	17,107	15,845
RES electricity	2,003	3,843	5,218	7,366	11,592	13,926
Public district heat	2,026	2,450	2,549	2,590	2,581	2,248
RES district heat	7	112	619	998	1,909	2,030
Hard coal & lignite	14,919	15,915	14,120	11,265	2,519	60
Oil products	2,452	2,376	1,873	914	269	26
Gas	4,512	5,161	6,000	6,289	5,296	1,918
Solar	0	98	244	691	2,356	2,571
Biomass	0	321	634	738	1,342	2,380
Geothermal	7	119	259	660	1,329	1,499
Hydrogen	0	0	0	0	275	637
RES share Industry	6%	11%	17%	26%	57%	84%
Other Sectors	21,870	24,573	24,847	24,281	22,241	20,722
Electricity	4,761	7,413	8,358	8,997	9,723	9,588
RES electricity	947	1,944	2,767	4,001	6,588	8,427
Public district heat	937	1,061	1,459	1,837	2,322	2,456
RES district heat	3	49	354	708	1,717	2,218
Hard coal & lignite	3,311	2,968	1,977	861	0	0
Oil products	2,379	2,382	1,886	1,538	398	46
Gas	1,487	2,408	2,475	2,469	1,918	1,171
Solar	539	825	1,156	1,612	2,071	2,222
Biomass	8,289	7,247	6,966	6,097	4,317	3,411
Geothermal	166	268	571	870	1,494	1,827
Hydrogen	0	0	0	0	0	0
RES share Other Sectors	45%	42%	48%	55%	73%	87%
Total RES	12,049	15,071	19,349	25,005	38,954	48,532
RES share	18%	19%	24%	31%	55%	80%
Non energy use	5,714	7,274	7,583	7,783	7,746	7,426
Oil	3,714	4,647	4,671	4,561	4,075	3,535
Gas	577	852	986	1,167	1,472	1,634
Coal	1,423	1,775	1,926	2,055	2,200	2,257

CHINA: ADVANCED ENERGY [R]EVOLUTION SCENARIO

Table 13.10.15 China: Electricity generation TWh/a

	2012	2020	2025	2030	2040	2050
Power plants	3,671	5,697	6,260	7,208	9,765	12,666
Hard coal (& non-renewable waste)	2,526	3,436	3,319	2,770	792	0
Lignite	0	0	0	0	0	0
Gas	41	87	91	100	97	100
of which from H-	0	0	0	2	14	100
Oil	8	4	3	2	0	0
Diesel	0	0	0	0	0	0
Nuclear	97	250	230	200	146	0
Biomass (& renewable waste)	34	141	150	150	151	150
Hydro	863	1,181	1,220	1,250	1,310	1,400
Wind	96	401	760	1,321	3,032	4,145
of which wind offshore	1	22	113	286	951	1,375
PV	6	191	421	826	1,752	2,520
of which wind offshore	0	2	9	52	220	432
Geothermal	0	2	52	522	2,185	3,729
Solar thermal power plants	0	0	4	15	80	190
Ocean energy	0	0	0	0	0	0
Combined heat and power plants	1,353	1,658	1,909	2,102	2,235	2,119
Hard coal (& non-renewable waste)	1,270	1,428	1,346	1,153	545	0
Lignite	0	0	0	0	0	0
Gas	83	188	344	475	683	729
of which from H-	0	0	2	10	96	729
Oil	0	0	0	0	0	0
Biomass (& renewable waste)	0	42	200	399	671	775
Geothermal	0	0	19	73	303	479
Hydrogen	0	0	0	2	34	137
CHP by producer						
Main activity producers	0	50	200	350	525	550
Autoproducers	1,353	1,608	1,709	1,752	1,710	1,569
Total generation	5,024	7,355	8,169	9,310	12,001	14,785
Fossil	3,928	5,144	5,101	4,488	2,007	0
Hard coal (& non-renewable waste)	3,796	4,864	4,665	3,923	1,336	0
Lignite	0	0	0	0	0	0
Gas	124	275	433	564	671	0
Oil	8	4	3	2	0	0
Diesel	0	0	0	0	0	0
Nuclear	97	250	230	200	146	0
Hydrogen	0	0	2	13	143	966
of which renewable H-	0	0	1	7	117	966
Renewables (w/o renewable hydrogen)	999	1,961	2,835	4,608	9,705	13,820
Hydro	863	1,181	1,220	1,250	1,310	1,400
Wind	96	401	760	1,321	3,032	4,145
PV	6	191	421	826	1,752	2,520
Biomass (& renewable waste)	34	183	350	549	822	925
Geothermal	0	2	28	125	523	911
Solar thermal power plants	0	2	52	522	2,185	3,729
Ocean energy	0	0	4	15	80	190
Distribution losses	295	420	440	430	502	437
Own consumption electricity	556	654	687	654	497	187
Electricity for hydrogen production	0	18	69	246	1,329	4,012
Electricity for synfuel production	0	5	0	215	614	950
Final energy consumption (electricity)	4,172	6,258	6,973	7,765	9,061	9,202
Fluctuating RES (PV, Wind, Ocean)	102	593	1,185	2,161	4,864	6,855
Share of fluctuating RES	2%	8%	15%	23%	41%	46%
RES share (domestic generation)	20%	27%	35%	50%	82%	100%

Table 13.10.16 China: Final Energy Consumption Transport PJ/a

	2012	2020	2025	2030	2040	2050
Road	8,149	11,430	12,263	12,043	8,440	5,892
Fossil fuels	7,656	10,475	10,882	9,572	2,859	0
Biofuels	51	142	251	404	631	426
Synfuels	0	7	0	207	595	608
Natural gas	443	713	625	466	112	0
Hydrogen	0	44	113	360	1,361	1,383
Electricity	0	55	392	1,241	3,477	4,083
Rail	582	759	885	1,049	1,522	2,105
Fossil fuels	395	354	283	191	54	0
Biofuels	0	0	15	22	19	10
Synfuels	0	0	0	11	17	15
Electricity	187	405	588	824	1,432	2,080
Navigation	806	930	1,000	1,030	1,000	850
Fossil fuels	806	930	990	891	650	0
Biofuels	0	0	10	92	180	350
Synfuels	0	0	0	47	170	500
Aviation	513	861	946	930	695	520
Fossil fuels	513	861	941	809	452	0
Biofuels	0	0	5	80	125	214
Synfuels	0	0	0	41	118	306
Total (incl. pipelines)	10,058	13,996	15,103	15,269	12,262	9,985
Fossil fuels	9,370	12,620	13,096	11,463	4,015	0
Biofuels (incl. biogas)	51	142	281	599	955	1,000
Synfuels	0	7	0	306	900	1,429
Natural gas	450	722	634	475	119	0
Hydrogen	0	44	113	360	1,361	1,383
Electricity	187	460	980	2,066	4,913	6,173
Total RES	88	278	660	1,953	6,826	9,985
RES share	1%	2%	4%	13%	56%	100%

Table 13.10.17 China: Heat Supply PJ/a

	2012	2020	2025	2030	2040	2050
District heating plants	3,413	3,922	3,916	3,755	3,334	2,700
Fossil fuels	3,402	3,834	3,244	2,728	975	0
Biomass	12	68	280	427	581	486
Solar collectors	0	20	313	413	1,000	1,026
Geothermal	0	0	78	188	777	1,188
Heat from CHP¹	3,077	4,655	5,793	7,028	9,356	10,639
Fossil fuels	3,077	4,485	4,799	4,711	3,450	0
Biomass	0	170	821	1,641	2,766	3,177
Geothermal	0	0	168	635	2,602	4,131
Hydrogen	0	0	5	41	537	3,331
Direct heating	32,424	35,575	34,993	32,742	25,769	20,770
Fossil fuels	23,433	25,620	23,453	19,423	8,204	0
Biomass	6,209	5,766	5,887	5,380	4,601	5,406
Solar collectors	539	922	1,400	2,303	4,427	4,685
Geothermal	0	0	73	141	251	292
Heat pumps ²	256	555	1,070	1,939	3,632	4,313
Electric direct heating	1,987	2,711	3,073	3,402	3,733	4,107
Hydrogen	0	0	37	153	921	1,966
Total heat supply³	38,915	44,152	44,702	43,525	38,459	34,108
Fossil fuels	29,912	33,939	31,495	26,862	12,629	0
Biomass	6,221	6,005	6,989	7,448	7,949	9,068
Solar collectors	539	942	1,713	2,716	5,427	5,711
Geothermal	0	0	319	964	3,631	5,611
Heat pumps ²	256	555	1,070	1,939	3,632	4,313
Electric direct heating	1,987	2,711	3,073	3,402	3,733	4,107
Hydrogen	0	0	42	194	1,458	5,297
RES share (including RES electricity)	19%	19%	25%	35%	65%	100%

¹ public CHP and CHP autoproduction / ² heat from ambient energy and electricity use / ³ incl. process heat, cooking

Table 13.10.18: China: Installed capacity GW

	2012	2020	2025	2030	2040	2050
Total generation	1,204	1,889	2,254	2,876	4,107	5,074
Fossil	854	1,111	1,095	1,026	520	0
Hard coal (& non-renewable waste)	788	1,006	948	847	313	0
Lignite	0	0	0	0	0	0
Gas (w/o H ₂)	55	95	140	175	206	0
Oil	11	10	7	5	0	0
Diesel	0	0	0	0	0	0
Nuclear	14	34	31	27	20	0
Hydrogen (fuel cells, gas power plants, gas CHP)	0	0	1	4	43	338
Renewables	337	744	1,128	1,819	3,525	4,736
Hydro	249	360	372	381	399	427
Wind	75	205	355	562	1,220	1,604
of which wind offshore	0	7	37	91	293	402
PV	7	146	321	612	1,208	1,626
Biomass (& renewable waste)	6	31	60	106	164	203
Geothermal	0	0	4	19	79	137
Solar thermal power plants	0	1	14	114	429	678
Ocean energy	0	0	1	5	27	62
Fluctuating RES (PV, Wind, Ocean)	82	352	678	1,199	2,455	3,291
Share of fluctuating RES	7%	19%	30%	42%	60%	65%
RES share (domestic generation)	28%	39%	50%	63%	86%	93%

Table 13.10.19: China: Final energy demand PJ/a

	2012	2020	2025	2030	2040	2050
Total (incl. non-energy use)	71,629	86,940	88,977	87,280	75,923	65,692
Total energy use¹	65,916	79,666	81,393	79,497	68,177	58,266
Transport	10,058	13,996	15,103	15,269	12,262	9,985
Oil products	9,370	12,620	13,096	11,463	4,015	0
Natural gas	450	722	634	475	119	0
Biofuels	51	142	281	599	955	1,000
Synfuels	0	7	0	306	900	1,429
Electricity	187	460	980	2,066	4,913	6,173
RES electricity	37	123	340	1,024	4,021	6,173
Hydrogen	0	44	113	360	1,361	1,383
RES share Transport	1%	2%	4%	13%	56%	100%
Industry	33,988	41,097	41,443	39,783	33,283	26,926
Electricity	10,071	14,657	15,764	16,663	17,395	16,442
RES electricity	2,003	3,907	5,473	8,260	14,236	16,442
Public district heat	2,026	2,450	2,549	2,590	2,581	2,154
RES district heat	7	112	619	1,000	1,928	2,154
Hard coal & lignite	14,919	15,915	14,120	11,265	2,519	0
Oil products	2,452	2,376	1,873	897	238	0
Gas	4,512	5,161	5,970	6,153	4,754	0
Solar	0	98	244	691	2,356	2,463
Biomass	0	321	634	738	1,342	2,607
Geothermal	7	119	259	660	1,329	1,437
Hydrogen	0	0	30	125	769	1,823
RES share Industry	6%	11%	17%	29%	66%	100%
Other Sectors	21,870	24,573	24,847	24,446	22,632	21,355
Electricity	4,761	7,413	8,358	9,225	10,312	10,511
RES electricity	947	1,976	2,902	4,573	8,439	10,511
Public district heat	937	1,061	1,459	1,837	2,322	2,456
RES district heat	3	49	354	709	1,734	2,456
Hard coal & lignite	3,311	2,968	1,977	861	0	0
Oil products	2,379	2,382	1,886	1,500	336	0
Gas	1,487	2,408	2,463	2,397	1,462	0
Solar	539	825	1,156	1,612	2,071	2,222
Biomass	8,289	7,247	6,966	6,097	4,317	3,829
Geothermal	166	268	571	870	1,586	2,091
Hydrogen	0	0	12	47	228	246
RES share Other Sectors	45%	42%	48%	57%	81%	100%
Total RES	12,049	15,200	19,853	27,246	46,980	58,266
RES share	18%	19%	24%	34%	69%	100%
Non energy use	5,714	7,274	7,583	7,783	7,746	7,426
Oil	3,714	4,647	4,671	4,561	4,075	3,535
Gas	577	852	986	1,167	1,472	1,634
Coal	1,423	1,775	1,926	2,055	2,200	2,257

Table 13.10.22: China: Investments in electricity generation

REF	UNIT	2012-2020	2021-2030	2031-2040	2041-2050	2012-2050	UNIT	ANNUAL AVERAGE 2012-2050
Fossil (w/o CHP)	billion \$	327.4	578.5	579.6	668.4	2,153.9	billion \$/a	55.2
Nuclear	billion \$	134.4	172.0	69.5	81.1	457.0	billion \$/a	11.7
CHP (fossil + renewable)	billion \$	132.4	278.7	210.5	26.2	647.8	billion \$/a	16.6
Renewables (w/o CHP)	billion \$	651.9	401.4	553.1	470.3	2,076.7	billion \$/a	53.2
Total	billion \$	1,246.1	1,430.6	1,412.8	1,246.0	5,335.5	billion \$/a	136.8
Conventional (fossil & nuclear)	billion \$	594.1	1,029.2	859.6	775.7	3,258.6	billion \$/a	83.6
Renewables	billion \$	652.0	401.4	553.1	470.3	2,076.8	billion \$/a	53.3
Biomass	billion \$	40.1	30.8	54.1	43.7	168.7	billion \$/a	4.3
Hydro	billion \$	290.7	129.1	93.8	95.2	608.8	billion \$/a	15.6
Wind	billion \$	174.0	177.0	268.4	241.1	860.5	billion \$/a	22.1
PV	billion \$	145.5	58.3	113.5	58.7	375.9	billion \$/a	9.6
Geothermal	billion \$	0.7	2.7	4.2	7.4	14.9	billion \$/a	0.4
Solar thermal power plants	billion \$	1.0	3.5	17.3	23.0	44.9	billion \$/a	1.2
Ocean energy	billion \$	0.0	0.0	1.8	1.2	3.1	billion \$/a	0.1
E[R]								
Fossil (w/o CHP)	billion \$	293.7	25.4	12.1	209.6	540.8	billion \$/a	13.9
Nuclear	billion \$	59.0	0.0	0.0	0.0	59.0	billion \$/a	1.5
CHP (fossil + renewable)	billion \$	149.3	442.6	541.5	470.0	1,603.4	billion \$/a	41.1
Renewables (w/o CHP)	billion \$	750.6	1,293.0	2,095.6	2,181.7	6,320.9	billion \$/a	162.1
Total	billion \$	1,252.6	1,761.0	2,649.3	2,861.3	8,524.1	billion \$/a	218.6
Conventional (fossil & nuclear)	billion \$	486.8	228.8	151.1	272.2	1,139.0	billion \$/a	29.2
Renewables	billion \$	765.8	1,532.1	2,498.2	2,589.0	7,385.2	billion \$/a	189.4
Biomass	billion \$	46.3	157.1	169.7	263.9	637.0	billion \$/a	16.3
Hydro	billion \$	290.7	79.4	75.1	76.2	521.4	billion \$/a	13.4
Wind	billion \$	195.4	519.6	827.0	929.2	2,471.2	billion \$/a	63.4
PV	billion \$	231.4	462.4	550.5	543.6	1,787.9	billion \$/a	45.8
Geothermal	billion \$	0.7	123.1	307.6	248.4	679.8	billion \$/a	17.4
Solar thermal power plants	billion \$	1.1	173.5	508.1	450.4	1,133.1	billion \$/a	29.1
Ocean energy	billion \$	0.1	17.1	60.2	77.4	154.8	billion \$/a	4.0
ADV E[R]								
Fossil (w/o CHP)	billion \$	293.4	16.1	20.9	348.2	678.6	billion \$/a	17.4
Nuclear	billion \$	59.0	0.0	0.0	0.0	59.0	billion \$/a	1.5
CHP (fossil + renewable)	billion \$	149.3	442.6	541.5	555.5	1,688.8	billion \$/a	43.3
Renewables (w/o CHP)	billion \$	795.2	1,987.3	3,827.7	3,451.5	10,061.7	billion \$/a	258.0
Total	billion \$	1,296.9	2,446.0	4,390.1	4,355.1	12,488.1	billion \$/a	320.2
Conventional (fossil & nuclear)	billion \$	486.4	219.6	159.9	408.1	1,274.0	billion \$/a	32.7
Renewables	billion \$	810.5	2,226.4	4,230.2	3,947.0	11,214.2	billion \$/a	287.5
Biomass	billion \$	46.3	157.1	169.7	279.0	652.1	billion \$/a	16.7
Hydro	billion \$	290.7	79.4	75.1	94.6	539.9	billion \$/a	13.8
Wind	billion \$	210.5	676.9	1,338.7	1,228.9	3,455.0	billion \$/a	88.6
PV	billion \$	257.7	610.4	758.4	694.4	2,321.0	billion \$/a	59.5
Geothermal	billion \$	2.6	164.5	419.6	423.6	1,010.2	billion \$/a	25.9
Solar thermal power plants	billion \$	2.5	511.9	1,390.9	1,141.5	3,046.8	billion \$/a	78.1
Ocean energy	billion \$	0.1	26.2	77.9	85.0	189.2	billion \$/a	4.9

Table 13.10.23: China: Investments in renewable heat generation

REF	UNIT	2012-2020	2021-2030	2031-2040	2041-2050	2012-2050	UNIT	ANNUAL AVERAGE 2012-2050
Heat pumps	billion \$	77.7	80.7	111.4	121.0	390.7	billion \$/a	10.0
Deep geothermal	billion \$	0.0	0.0	0.0	0.0	0.0	billion \$/a	0.0
Solar thermal	billion \$	22.4	19.3	34.8	30.2	106.7	billion \$/a	2.7
Biomass	billion \$	5.8	22.5	20.1	37.9	86.2	billion \$/a	2.2
Total	billion \$	105.9	122.4	166.3	189.0	583.6	billion \$/a	15.0
E[R]								
Heat pumps	billion \$	111.2	357.7	416.9	414.4	1,300.1	billion \$/a	33.3
Deep geothermal	billion \$	0.0	68.1	364.8	314.0	746.9	billion \$/a	19.2
Solar thermal	billion \$	51.3	238.1	527.1	248.6	1,065.1	billion \$/a	27.3
Biomass	billion \$	23.5	50.5	58.8	69.4	202.3	billion \$/a	5.2
Total	billion \$	186.1	714.3	1,367.7	1,046.4	3,314.4	billion \$/a	85.0
ADV E[R]								
Heat pumps	billion \$	111.2	357.7	454.3	467.9	1,391.1	billion \$/a	35.7
Deep geothermal	billion \$	0.0	68.1	364.8	346.1	779.0	billion \$/a	20.0
Solar thermal	billion \$	51.3	238.1	527.1	144.1	960.6	billion \$/a	24.6
Biomass	billion \$	23.5	50.5	58.8	80.5	213.4	billion \$/a	5.5
Total	billion \$	186.1	714.3	1,405.1	1,038.6	3,344.1	billion \$/a	85.7

Table 13.10.24: China: Total employment in the energy sector

By sector	REFERENCE SCENARIO				ADV E[R] SCENARIO		
	2015	2020	2025	2030	2020	2025	2030
Construction and installation	1,544	1,328	1,197	776	931	1,499	1,441
Manufacturing	808	667	619	403	918	1,303	1,353
Operations and maintenance	720	998	1,075	1,039	1,069	1,373	1,653
Fuel supply (domestic)	4,167	3,730	3,219	2,773	3,616	2,929	2,314
Coal and gas export	-	-	-	-	-	-	-
Solar and geothermal heat	205	233	138	129	410	884	1,264
Total jobs (thousands)	7,443	6,956	6,248	5,121	6,934	7,987	8,025
By technology							
Coal	4,985	4,462	3,832	3,029	2,950	2,016	1,238
Gas, oil & diesel	316	501	632	747	549	695	852
Nuclear	178	253	223	170	53	46	32
Renewable	1,964	1,739	1,560	1,175	3,382	5,230	5,903
Biomass	709	738	694	549	860	1,256	1,265
Hydro	422	263	249	173	213	187	150
Wind	298	280	281	189	789	1,109	1,316
PV	326	221	195	126	1,054	1,496	1,309
Geothermal power	1.2	1.2	1.1	1.0	8	37	60
Solar thermal power	2.0	2.9	3.3	6.2	35	233	499
Ocean	0.01	0.17	0.30	0.75	12.3	28.3	40.1
Solar - heat	155	192	107	104	317	625	968
Geothermal & heat pump	50.2	40.2	31.2	25.8	93	258	296
Total jobs (thousands)	7,443	6,956	6,248	5,121	6,934	7,987	8,025

OECD ASIA OCEANIA: REFERENCE SCENARIO

Table 13.11.1 OECD Asia Oceania: Electricity generation TWh/a

	2012	2020	2025	2030	2040	2050
Power plants	1,780	1,944	2,031	2,122	2,258	2,281
Hard coal (& non-renewable waste)	515	567	567	568	573	547
Lignite	144	145	145	145	140	130
Gas	570	406	434	466	487	472
of which from H ₂	0	0	0	0	0	0
Oil	194	54	37	19	16	12
Diesel	7	7	7	7	7	6
Nuclear	166	446	471	496	517	517
Biomass (& renewable waste)	35	52	60	67	79	94
Hydro	116	133	137	141	149	149
Wind	14	46	69	91	135	158
of which wind offshore	0	1	2	4	11	19
PV	10	68	76	83	94	106
Geothermal	9	16	25	33	49	69
Solar thermal power plants	0	1	3	4	7	11
Ocean energy	0	2	2	3	6	10
Combined heat and power plants	69	117	133	146	172	204
Hard coal (& non-renewable waste)	7	15	17	19	23	26
Lignite	2	0	0	0	0	0
Gas	53	87	100	109	129	157
of which from H ₂	0	0	0	0	0	0
Oil	5	9	9	10	8	7
Biomass (& renewable waste)	2	5	7	8	10	13
Geothermal	0	0	0	0	0	0
Hydrogen	0	1	1	1	1	1
CHP by producer						
Main activity producers	33	45	50	50	56	69
Autoproducers	36	72	83	96	116	135
Total generation	1,849	2,061	2,164	2,268	2,430	2,485
Fossil	1,497	1,289	1,316	1,342	1,383	1,357
Hard coal (& non-renewable waste)	521	581	584	587	597	573
Lignite	146	145	145	145	140	130
Gas	623	493	534	575	616	629
Oil	200	63	46	29	24	20
Diesel	7	7	7	7	7	6
Nuclear	166	446	471	496	517	517
Hydrogen	0	1	1	1	1	1
of which renewable H ₂	0	0	0	0	0	0
Renewables (w/o renewable hydrogen)	186	325	377	429	529	610
Hydro	116	133	137	141	149	149
Wind	14	46	69	91	135	158
PV	10	68	76	83	94	106
Biomass (& renewable waste)	37	58	66	75	89	106
Geothermal	9	16	25	33	49	69
Solar thermal power plants	0	1	3	4	7	11
Ocean energy	0	2	2	3	6	10
Distribution losses	78	87	91	96	103	105
Own consumption electricity	119	133	137	142	148	148
Electricity for hydrogen production	0	3	3	4	4	4
Electricity for syngas production	0	0	0	0	0	0
Final energy consumption (electricity)	1,652	1,837	1,931	2,025	2,174	2,227
Fluctuating RES (PV, Wind, Ocean)	23	116	147	177	234	275
Share of fluctuating RES	1%	6%	7%	8%	10%	11%
RES share (domestic generation)	10%	16%	17%	19%	22%	25%

Table 13.11.2 OECD Asia Oceania: Final energy consumption in transport PJ/a

	2012	2020	2025	2030	2040	2050
Road	5,244	4,976	4,757	4,538	4,332	3,755
Fossil fuels	5,167	4,858	4,610	4,361	4,076	3,412
Biofuels	27	28	29	29	32	28
Synfuels	0	0	0	0	0	0
Natural gas	51	73	88	103	148	203
Hydrogen	0	0	0	0	0	0
Electricity	0	17	31	45	76	113
Rail	149	151	152	152	153	154
Fossil fuels	59	60	60	60	60	60
Biofuels	0	0	0	0	0	0
Synfuels	0	0	0	0	0	0
Electricity	90	91	92	92	93	94
Navigation	180	170	165	160	150	140
Fossil fuels	180	170	165	160	150	140
Biofuels	0	0	0	0	0	0
Synfuels	0	0	0	0	0	0
Aviation	292	308	317	325	342	338
Fossil fuels	292	308	317	325	342	338
Biofuels	0	0	0	0	0	0
Synfuels	0	0	0	0	0	0
Total (incl. pipelines)	5,881	5,621	5,405	5,190	4,992	4,403
Fossil fuels	5,698	5,397	5,151	4,906	4,628	3,949
Biofuels (incl. biogas)	27	28	29	29	32	28
Synfuels	0	0	0	0	0	0
Natural gas	67	88	103	118	163	219
Hydrogen	0	0	0	0	0	0
Electricity	90	108	122	137	169	207
Total RES	36	45	50	55	68	78
RES share	1%	1%	1%	1%	1%	2%

Table 13.11.3 OECD Asia Oceania: Heat supply PJ/a

	2012	2020	2025	2030	2040	2050
District heating plants	153	146	142	152	144	170
Fossil fuels	140	119	116	124	118	139
Biomass	12	27	26	28	26	31
Solar collectors	0	0	0	0	0	0
Geothermal	0	0	0	0	0	0
Heat from CHP¹	172	310	365	421	562	783
Fossil fuels	165	286	336	384	506	689
Biomass	7	20	25	32	50	87
Geothermal	1	0	0	0	0	0
Hydrogen	0	4	5	5	6	6
Direct heating	7,249	7,387	7,454	7,541	7,657	7,829
Fossil fuels	6,234	6,237	6,254	6,290	6,282	6,263
Biomass	249	377	409	441	513	615
Solar collectors	27	46	64	81	131	199
Geothermal	0	0	0	0	0	0
Heat pumps ²	30	31	33	34	36	38
Electric direct heating	708	695	695	695	695	714
Hydrogen	0	0	0	0	0	0
Total heat supply³	7,573	7,842	7,961	8,114	8,363	8,782
Fossil fuels	6,540	6,643	6,706	6,799	6,906	7,091
Biomass	268	423	460	501	589	733
Solar collectors	27	46	64	81	131	199
Geothermal	1	0	0	0	0	0
Heat pumps ²	30	31	33	34	36	38
Electric direct heating	708	695	695	695	695	714
Hydrogen	0	4	5	5	6	6
RES share (including RES electricity)	5%	8%	9%	9%	11%	13%

¹ public CHP and CHP autoproduction / ² heat from ambient energy and electricity use / ³ incl. process heat, cooking

Table 13.11.4: OECD Asia Oceania: Installed capacity GW

	2012	2020	2025	2030	2040	2050
Total generation	458	549	574	599	631	651
Fossil	297	323	331	339	338	333
Hard coal (& non-renewable waste)	77	95	98	101	103	99
Lignite	21	24	24	25	24	22
Gas (w/o H ₂)	140	172	182	191	191	195
Oil	57	29	23	18	16	13
Diesel	2	3	1	1	4	4
Nuclear	68	67	66	65	68	68
Hydrogen (fuel cells, gas power plants, gas CHP)	0	0	0	0	0	0
Renewables	93	159	177	194	225	250
Hydro	69	71	72	74	76	76
Wind	6	16	24	31	44	51
of which wind offshore	0	0	1	1	3	5
PV	10	59	65	71	79	89
Biomass (& renewable waste)	6	10	11	12	15	18
Geothermal	1	2	4	5	7	10
Solar thermal power plants	0	0	1	1	2	2
Ocean energy	0	1	1	1	2	3
Fluctuating RES (PV, Wind, Ocean)	16	76	89	102	125	144
Share of fluctuating RES	4%	14%	16%	17%	20%	22%
RES share (domestic generation)	20%	29%	31%	32%	36%	38%

Table 13.11.5: OECD Asia Oceania: Final energy demand PJ/a

	2012	2020	2025	2030	2040	2050
Total (incl. non-energy use)	23,756	24,178	24,225	24,272	24,143	23,393
Total energy use	20,108	20,583	20,680	20,798	21,007	20,596
Transport	5,881	5,621	5,405	5,190	4,992	4,403
Oil products	5,698	5,397	5,151	4,906	4,628	3,949
Natural gas	67	88	103	118	163	219
Biofuels	27	28	29	29	32	28
Synfuels	0	0	0	0	0	0
Electricity	90	108	122	137	169	207
RES electricity	9	17	21	26	37	51
Hydrogen	0	0	0	0	0	0
RES share Transport	1%	1%	1%	1%	1%	2%
Industry	6,564	6,960	6,991	7,022	6,888	6,755
Electricity	2,235	2,520	2,606	2,691	2,779	2,869
RES electricity	225	398	454	509	605	704
Public district heat	89	85	86	86	78	70
RES district heat	3	11	11	11	10	9
Hard coal & lignite	1,161	1,521	1,437	1,352	1,172	960
Oil products	1,231	1,243	1,170	1,098	953	820
Gas	1,590	1,181	1,251	1,322	1,387	1,463
Solar	0	2	3	5	7	9
Biomass	252	401	432	462	505	557
Geothermal	7	7	7	7	7	7
Hydrogen	0	0	0	0	0	0
RES share Industry	7%	12%	13%	14%	16%	19%
Other Sectors	7,663	8,002	8,284	8,586	9,127	9,439
Electricity	3,624	3,987	4,224	4,462	4,877	4,940
RES electricity	364	629	736	844	1,061	1,213
Public district heat	142	168	176	184	200	261
RES district heat	4	22	22	24	26	35
Hard coal & lignite	81	56	52	49	45	41
Oil products	1,886	1,751	1,635	1,539	1,329	1,142
Gas	1,810	1,881	2,007	2,133	2,384	2,669
Solar	27	44	60	77	125	190
Biomass	80	101	113	126	149	175
Geothermal	13	15	16	17	19	21
Hydrogen	0	0	0	0	0	0
RES share Other Sectors	6%	10%	11%	13%	15%	17%
Total RES	1,011	1,674	1,904	2,137	2,582	2,999
RES share	5%	8%	9%	10%	12%	15%
Non energy use	3,647	3,595	3,545	3,475	3,136	2,797
Oil	3,542	3,484	3,428	3,353	3,014	2,702
Gas	71	79	85	90	94	95
Coal	34	32	32	31	28	0

¹ excluding heat produced by CHP autoproducers

Table 13.11.6: OECD Asia Oceania: CO₂ emissions Mill t/a

	2012	2020	2025	2030	2040	2050
Condensation power plants	998	844	824	811	799	750
Hard coal (& non-renewable waste)	440	463	461	454	451	434
Lignite	171	160	156	153	144	134
Gas	254	176	175	183	186	167
Oil	127	39	27	15	13	9
Diesel	5	6	5	5	5	5
Combined heat and power plants	45	71	80	87	100	114
Hard coal (& non-renewable waste)	9	20	23	26	30	32
Lignite	3	0	0	0	0	0
Gas	27	44	50	54	64	77
Oil	6	7	7	7	5	5
CO₂ emissions power and CHP plants	1,043	915	904	897	898	864
Hard coal (& non-renewable waste)	450	483	483	480	481	467
Lignite	174	160	157	153	145	134
Gas	281	220	225	237	250	245
Oil & diesel	138	51	39	27	23	19

Table 13.11.8 OECD Asia Oceania: Electricity generation TWh/a

	2012	2020	2025	2030	2040	2050
Power plants	1,780	1,883	1,897	1,959	2,077	1,943
Hard coal (& non-renewable waste)	515	492	469	313	20	0
Lignite	144	110	92	50	5	0
Gas	570	462	403	390	337	69
of which from H ₂	0	0	0	0	17	28
Oil	194	120	72	29	13	5
Diesel	1	3	3	1	0	0
Nuclear	166	163	50	0	0	0
Biomass (& renewable waste)	35	74	71	73	60	37
Hydro	116	150	155	159	163	180
Wind	14	130	230	390	680	732
of which wind offshore	0	25	50	110	230	262
PV	10	98	210	310	440	469
Geothermal	9	56	72	99	135	146
Solar thermal power plants	0	16	40	100	140	175
Ocean energy	0	9	30	45	85	130
Combined heat and power plants	69	100	140	166	208	245
Hard coal (& non-renewable waste)	7	8	10	9	3	0
Lignite	2	5	3	0	0	0
Gas	53	68	87	90	73	36
of which from H ₂	0	0	0	0	0	5
Oil	5	4	3	4	2	0
Biomass (& renewable waste)	2	11	27	50	100	148
Geothermal	0	4	8	11	25	54
Hydrogen	0	1	1	2	4	8
CHP by producer						
Main activity producers	33	42	60	68	88	110
Autoproducers	36	58	80	98	120	135
Total generation	1,849	1,983	2,036	2,125	2,285	2,188
Fossil	1,497	1,272	1,143	887	436	78
Hard coal (& non-renewable waste)	521	500	480	322	23	0
Lignite	146	115	95	50	5	0
Gas	623	530	490	480	393	73
Oil	200	124	75	33	15	5
Diesel	7	3	3	3	1	0
Nuclear	166	163	50	0	0	0
Hydrogen	0	1	1	2	21	40
of which renewable H ₂	0	0	0	1	17	38
Renewables (w/o renewable hydrogen)	186	548	843	1,237	1,828	2,070
Hydro	116	150	155	159	163	180
Wind	14	130	230	390	680	732
PV	10	98	210	310	440	469
Biomass (& renewable waste)	37	85	98	123	160	184
Geothermal	9	60	80	110	160	200
Solar thermal power plants	0	16	40	100	140	175
Ocean energy	0	9	30	45	85	130
Distribution losses	78	83	85	87	90	90
Own consumption electricity	119	112	100	90	73	59
Electricity for hydrogen production	0	3	8	52	198	317
Electricity for synfuel production	0	0	0	0	0	0
Final energy consumption (electricity)	1,652	1,786	1,843	1,896	1,924	1,722
Fluctuating RES (PV, Wind, Ocean)	23	237	470	745	1,205	1,331
Share of fluctuating RES	1%	12%	23%	35%	53%	61%
RES share (domestic generation)	10%	28%	41%	58%	81%	96%

Table 13.11.9 OECD Asia Oceania: Final energy consumption in transport PJ/a

	2012	2020	2025	2030	2040	2050
Road	5,244	5,037	4,450	3,784	2,771	2,150
Fossil fuels	5,167	4,778	3,830	2,782	984	96
Biofuels	27	148	333	379	422	386
Synfuels	0	0	0	0	0	0
Natural gas	51	90	103	107	128	137
Hydrogen	0	1	12	114	360	486
Electricity	0	20	173	402	878	1,044
Rail	149	144	135	132	131	138
Fossil fuels	59	45	30	20	7	1
Biofuels	0	3	4	4	3	1
Synfuels	0	0	0	0	0	0
Electricity	90	96	102	108	121	136
Navigation	180	173	162	151	130	110
Fossil fuels	180	168	154	133	87	33
Biofuels	0	5	8	18	43	77
Synfuels	0	0	0	0	0	0
Aviation	292	298	269	258	239	221
Fossil fuels	292	298	250	213	179	88
Biofuels	0	0	19	45	60	132
Synfuels	0	0	0	0	0	0
Total (incl. pipelines)	5,881	5,665	5,029	4,335	3,277	2,622
Fossil fuels	5,698	5,289	4,264	3,148	1,257	219
Biofuels (incl. biogas)	27	156	364	447	527	596
Synfuels	0	0	0	0	0	0
Natural gas	67	103	114	117	133	138
Hydrogen	0	1	12	114	360	486
Electricity	90	117	275	510	1,000	1,182
Total RES	36	188	483	810	1,625	2,204
RES share	1%	3%	10%	19%	50%	84%

Table 13.11.10 OECD Asia Oceania: Heat supply PJ/a

	2012	2020	2025	2030	2040	2050
District heating plants	153	151	154	192	193	178
Fossil fuels	140	120	112	108	44	4
Biomass	12	31	39	57	91	117
Solar collectors	0	0	1	20	43	39
Geothermal	0	0	2	8	15	19
Heat from CHP¹	172	292	473	611	986	1,564
Fossil fuels	165	216	284	274	226	98
Biomass	7	42	125	238	539	985
Geothermal	1	31	60	88	195	418
Hydrogen	0	3	4	11	27	63
Direct heating	7,249	6,968	6,536	6,197	5,316	4,076
Fossil fuels	6,234	5,570	4,673	3,797	1,885	272
Biomass	249	570	678	763	913	911
Solar collectors	27	46	241	475	809	872
Geothermal	0	26	35	65	109	205
Heat pumps ²	30	51	97	200	461	591
Electric direct heating	708	704	812	897	1,139	1,159
Hydrogen	0	0	0	0	0	67
Total heat supply³	7,573	7,410	7,163	7,000	6,496	5,818
Fossil fuels	6,540	5,906	5,069	4,179	2,155	373
Biomass	268	643	842	1,059	1,543	2,012
Solar collectors	27	47	243	495	852	911
Geothermal	1	57	96	161	320	642
Heat pumps ²	30	51	97	200	461	591
Electric direct heating	708	704	812	897	1,139	1,159
Hydrogen	0	3	4	11	27	131
RES share (including RES electricity)	5%	14%	23%	35%	64%	93%

¹ public CHP and CHP autoproduction / ² heat from ambient energy and electricity use / ³ incl. process heat, cooking

Table 13.11.10: OECD Asia Oceania: Installed capacity GW

	2012	2020	2025	2030	2040	2050
Total generation	458	585	708	823	948	975
Fossil	297	322	315	274	172	65
Hard coal (& non-renewable waste)	77	62	50	64	5	0
Lignite	21	19	16	9	1	0
Gas (w/o H ₂)	140	164	179	180	156	62
Oil	57	56	38	20	10	3
Diesel	2	1	2	2	0	0
Nuclear	68	24	7	0	0	0
Hydrogen (fuel cells, gas power plants, gas CHP)	0	0	0	0	8	38
Renewables	93	239	385	548	767	872
Hydro	69	80	82	83	83	82
Wind	6	45	75	125	208	223
of which wind offshore	0	7	13	29	59	67
PV	10	84	180	264	370	394
Biomass (& renewable waste)	6	14	16	20	29	58
Geothermal	1	8	12	16	24	30
Solar thermal power plants	0	4	10	25	28	35
Ocean energy	0	3	10	14	26	40
Fluctuating RES (PV, Wind, Ocean)	16	132	265	403	604	657
Share of fluctuating RES	4%	23%	37%	49%	64%	67%
RES share (domestic generation)	20%	41%	54%	67%	81%	89%

Table 13.11.12: OECD Asia Oceania: Final energy demand PJ/a

	2012	2020	2025	2030	2040	2050
Total (incl. non-energy use)	23,756	23,053	21,498	20,090	16,953	13,781
Total energy use	20,108	19,950	18,690	17,377	14,476	11,537
Transport	5,881	5,665	5,029	4,335	3,277	2,622
Oil products	5,698	5,289	4,264	3,148	1,257	219
Natural gas	67	103	114	117	133	138
Biofuels	27	156	364	447	527	596
Synfuels	0	0	0	0	0	0
Electricity	90	117	275	510	1,000	1,182
RES electricity	9	32	114	297	807	1,139
Hydrogen	0	1	12	114	360	486
RES share Transport	1%	3%	10%	19%	50%	84%
Industry	6,564	6,615	6,254	5,959	4,967	3,817
Electricity	2,235	2,439	2,556	2,668	2,521	2,103
RES electricity	225	674	1,059	1,554	2,035	2,026
Public district heat	89	74	150	187	220	308
RES district heat	5	19	61	108	180	298
Hard coal & lignite	1,161	1,219	898	600	233	0
Oil products	1,231	1,193	953	748	340	44
Gas	1,590	1,015	874	758	524	189
Solar	0	11	69	170	232	247
Biomass	252	619	675	693	681	526
Geothermal	7	44	79	136	236	329
Hydrogen	0	0	0	0	0	71
RES share Industry	7%	21%	31%	45%	67%	92%
Other Sectors	7,663	7,670	7,407	7,082	6,231	5,098
Electricity	3,624	3,873	3,803	3,647	3,403	2,915
RES electricity	364	1,070	1,575	2,124	2,747	2,808
Public district heat	142	194	224	271	401	511
RES district heat	8	48	91	156	328	494
Hard coal & lignite	81	54	40	16	4	0
Oil products	1,886	1,572	1,180	852	267	16
Gas	1,810	1,785	1,734	1,595	864	153
Solar	27	35	172	305	577	625
Biomass	80	141	229	325	504	558
Geothermal	13	17	24	73	212	320
Hydrogen	0	0	0	0	0	0
RES share Other Sectors	6%	17%	28%	42%	70%	94%
Total RES	1,018	2,867	4,517	6,452	9,338	10,502
RES share	5%	14%	24%	37%	65%	91%
Non energy use	3,647	3,104	2,808	2,713	2,477	2,245
Oil	3,542	3,014	2,727	2,635	2,405	2,180
Gas	71	62	56	54	50	45
Coal	34	28	25	24	22	20

1 excluding heat produced by CHP autoproducers

Table 13.11.13: OECD Asia Oceania: CO₂ emissions Mill t/a

	2012	2020	2025	2030	2040	2050
Condensation power plants	998	813	697	481	153	19
Hard coal (& non-renewable waste)	440	402	381	251	15	0
Lignite	171	122	99	53	5	0
Gas	254	200	162	153	122	15
Oil	127	86	53	22	10	4
Diesel	5	2	2	2	0	0
Combined heat and power plants	45	54	64	59	42	15
Hard coal (& non-renewable waste)	9	11	14	11	4	0
Lignite	3	6	5	0	0	0
Gas	27	34	44	45	36	15
Oil	6	3	3	3	1	0
CO₂ emissions power and CHP plants	1,043	867	762	540	195	34
Hard coal (& non-renewable waste)	450	413	395	262	20	0
Lignite	174	128	104	53	5	0
Gas	281	234	206	196	158	30
Oil & diesel	138	91	58	27	12	0

OECD ASIA OCEANIA: ADVANCED ENERGY [R]EVOLUTION SCENARIO

Table 13.11.15 OECD Asia Oceania: Electricity generation *TWh/a*

	2012	2020	2025	2030	2040	2050
Power plants	1,780	1,935	1,961	2,112	2,454	2,838
Hard coal (& non-renewable waste)	515	494	408	241	8	0
Lignite	144	110	92	50	5	0
Gas	570	452	383	370	267	128
<i>of which from H₂</i>	0	0	0	0	27	128
Oil	194	120	72	29	13	0
Diesel	3	7	3	3	1	0
Nuclear	166	163	50	0	0	0
Biomass (& renewable waste)	35	74	91	88	59	48
Hydro	116	150	155	159	163	180
Wind	14	160	280	450	820	1,020
<i>of which wind offshore</i>	0	35	70	150	320	380
PV	10	118	250	370	590	758
Geothermal	9	56	82	144	205	206
Solar thermal power plants	0	26	55	120	170	250
Ocean energy	0	9	40	90	155	248
Combined heat and power plants	69	100	140	166	208	245
Hard coal (& non-renewable waste)	7	8	10	9	2	0
Lignite	2	5	3	0	0	0
Gas	53	68	87	90	73	47
<i>of which from H₂</i>	0	0	0	0	7	47
Oil	5	4	3	4	2	0
Biomass (& renewable waste)	2	11	27	50	101	136
Geothermal	0	4	8	11	25	54
Hydrogen	0	1	1	2	4	8
CHP by producer						
Main activity producers	33	42	60	68	88	110
Autoproducers	36	58	80	98	120	135
Total generation	1,849	2,035	2,100	2,278	2,662	3,083
Fossil	1,497	1,264	1,062	795	336	0
Hard coal (& non-renewable waste)	521	502	419	250	10	0
Lignite	146	115	95	50	5	0
Gas	623	520	470	460	306	0
Oil	200	124	75	33	15	0
Diesel	7	3	3	3	1	0
Nuclear	166	163	50	0	0	0
Hydrogen	0	1	1	2	38	183
<i>of which renewable H₂</i>	0	0	0	1	33	183
Renewables (w/o renewable hydrogen)	186	608	988	1,482	2,288	2,900
Hydro	116	150	155	159	163	180
Wind	14	160	280	450	820	1,020
PV	10	118	250	370	590	758
Biomass (& renewable waste)	37	85	118	138	160	184
Geothermal	9	60	90	155	230	260
Solar thermal power plants	0	26	55	120	170	250
Ocean energy	0	9	40	90	155	248
Distribution losses	78	83	85	87	90	90
Own consumption electricity	119	112	100	90	73	59
Electricity for hydrogen production	0	7	25	92	335	823
Electricity for syngas production	0	37	27	24	119	220
Final energy consumption (electricity)	1,652	1,797	1,863	1,986	2,045	1,891
Fluctuating RES (PV, Wind, Ocean)	23	287	570	910	1,565	2,026
Share of fluctuating RES	1%	14%	27%	40%	59%	66%
RES share (domestic generation)	10%	30%	47%	65%	87%	100%

Table 13.11.16 OECD Asia Oceania: Final Energy Consumption Transport *PJ/a*

	2012	2020	2025	2030	2040	2050
Road	5,244	4,912	4,276	3,421	2,156	1,521
Fossil fuels	5,167	4,628	3,600	2,325	590	0
Biofuels	27	146	322	319	178	51
Synfuels	0	47	34	28	126	129
Natural gas	51	84	88	75	24	0
Hydrogen	0	10	52	214	460	579
Electricity	0	44	214	487	903	890
Rail	149	157	160	191	231	285
Fossil fuels	59	41	25	15	4	0
Biofuels	0	2	3	3	1	0
Synfuels	0	1	0	0	1	0
Electricity	90	113	131	173	225	284
Navigation	180	173	162	151	130	110
Fossil fuels	180	166	153	131	84	0
Biofuels	0	5	9	18	27	31
Synfuels	0	2	1	2	19	79
Aviation	292	295	265	245	203	172
Fossil fuels	292	292	244	199	132	0
Biofuels	0	2	19	42	42	49
Synfuels	0	1	2	4	29	123
Total (incl. pipelines)	5,881	5,597	4,910	4,046	2,852	2,221
Fossil fuels	5,698	5,127	4,022	2,671	811	0
Biofuels (incl. biogas)	27	156	353	382	247	132
Synfuels	0	50	37	34	175	331
Natural gas	67	97	98	82	20	0
Hydrogen	0	10	52	214	460	579
Electricity	90	157	347	663	1,140	1,178
Total RES	36	221	558	975	1,794	2,221
RES share	1%	4%	11%	24%	63%	100%

Table 13.11.17 OECD Asia Oceania: Heat Supply *PJ/a*

	2012	2020	2025	2030	2040	2050
District heating plants	153	141	154	192	193	202
Fossil fuels	140	111	112	108	44	0
Biomass	12	29	39	57	91	137
Solar collectors	0	0	1	20	43	45
Geothermal	0	0	2	8	15	21
Heat from CHP¹	172	302	473	611	986	1,523
Fossil fuels	165	223	284	274	201	0
Biomass	7	43	125	238	543	911
Geothermal	1	32	60	88	195	418
Hydrogen	0	3	4	11	47	194
Direct heating	7,249	6,968	6,536	6,197	5,316	4,093
Fossil fuels	6,234	5,570	4,673	3,797	1,763	0
Biomass	249	570	678	763	913	711
Solar collectors	27	46	241	475	809	876
Geothermal	0	26	35	65	109	205
Heat pumps ²	30	51	97	200	461	594
Electric direct heating	708	704	812	897	1,139	1,369
Hydrogen	0	0	0	0	122	338
Total heat supply³	7,573	7,410	7,163	7,000	6,496	5,818
Fossil fuels	6,540	5,905	5,069	4,179	2,008	0
Biomass	268	642	842	1,059	1,548	1,758
Solar collectors	27	47	243	495	852	921
Geothermal	1	59	96	161	320	645
Heat pumps ²	30	51	97	200	461	594
Electric direct heating	708	704	812	897	1,139	1,369
Hydrogen	0	3	4	11	169	533
RES share (including RES electricity)	5%	14%	23%	36%	67%	100%

¹ public CHP and CHP autoproduction / ² heat from ambient energy and electricity use / ³ incl. process heat, cooking

Table 13.11.18: OECD Asia Oceania: Installed capacity *GW*

	2012	2020	2025	2030	2040	2050
Total generation	458	612	752	897	1,120	1,376
Fossil	297	319	297	252	130	0
Hard coal (& non-renewable waste)	0	77	82	70	50	2
Lignite	21	19	16	9	1	0
Gas (w/o H ₂)	140	161	171	172	116	0
Oil	57	56	38	20	10	0
Diesel	2	1	2	2	0	0
Nuclear	68	24	7	0	0	0
Hydrogen (fuel cells, gas power plants, gas CHP)	0	0	0	0	14	123
Renewables	93	268	447	644	976	1,252
Hydro	69	80	82	83	83	92
Wind	0	6	92	143	248	310
<i>of which wind offshore</i>	0	10	19	40	82	97
PV	10	101	214	315	496	637
Biomass (& renewable waste)	6	14	20	23	29	39
Geothermal	1	8	13	23	39	49
Solar thermal power plants	0	7	14	30	34	50
Ocean energy	0	3	13	28	48	76
Fluctuating RES (PV, Wind, Ocean)	16	159	318	486	791	1,023
Share of fluctuating RES	4%	26%	42%	54%	71%	74%
RES share (domestic generation)	20%	44%	59%	72%	87%	91%

Table 13.11.19: OECD Asia Oceania: Final energy demand *PJ/a*

	2012	2020	2025	2030	2040	2050
Total (incl. non-energy use)	23,756	22,985	21,379	19,924	16,742	13,651
Total energy use	20,108	19,882	18,570	17,211	14,265	11,407
Transport	5,881	5,597	4,910	4,046	2,852	2,221
Oil products	5,698	5,127	4,022	2,671	811	0
Natural gas	67	97	98	82	20	0
Biofuels	27	156	353	382	247	132
Synfuels	0	50	37	34	175	331
Electricity	90	157	347	663	1,140	1,178
<i>RES electricity</i>	9	47	163	432	994	1,178
Hydrogen	0	10	52	214	460	579
RES share Transport	1%	4%	11%	24%	63%	100%
Industry	6,564	6,615	6,254	5,992	5,022	3,889
Electricity	2,235	2,439	2,556	2,713	2,598	2,274
<i>RES electricity</i>	225	728	1,203	1,766	2,264	2,274
Public district heat	89	74	150	187	220	308
<i>RES district heat</i>	5	19	61	108	182	308
Hard coal & lignite	1,161	1,219	898	600	233	0
Oil products	1,231	1,193	953	740	332	0
Gas	1,590	1,015	874	753	461	0
Solar	0	11	69	170	232	247
Biomass	252	619	675	693	661	526
Geothermal	7	44	79	136	236	329
Hydrogen	0	0	0	0	50	206
RES share Industry	7%	21%	33%	48%	72%	100%
Other Sectors	7,663	7,670	7,407	7,173	6,390	5,297
Electricity	3,624	3,873	3,803	3,772	3,623	3,360
<i>RES electricity</i>	364	1,157	1,790	2,455	3,159	3,360
Public district heat	142	194	224	271	401	515
<i>RES district heat</i>	8	49	91	156	332	515
Hard coal & lignite	81	54	40	16	4	0
Oil products	1,886	1,572	1,180	831	243	0
Gas	1,810	1,785	1,734	1,581	747	0
Solar	27	35	172	306	577	630
Biomass	80	141	229	325	504	320
Geothermal	13	17	24	73	212	322
Hydrogen	0	0	0	0	80	151
RES share Other Sectors	6%	18%	31%	46%	76%	100%
Total RES	1,018	3,042	4,952	7,160	10,267	11,407
RES share	5%	15%	27%	42%	72%	100%
Non energy use	3,647	3,104	2,808	2,713	2,477	2,245
Oil	3,542	3,014	2,727	2,635	2,405	2,180
Gas	71	62	56	54	50	45
Coal	34	28	25	24	22	20

¹ excluding heat produced by CHP autoproducers

Table 13.11.22: OECD Asia Oceania: Investments in electricity generation

REF	UNIT	2012-2020	2021-2030	2031-2040	2041-2050	2012-2050	UNIT	ANNUAL AVERAGE 2012-2050
Fossil (w/o CHP)	billion \$	167.4	121.6	161.1	140.0	590.1	billion \$/a	15.1
Nuclear	billion \$	179.7	244.4	267.2	270.0	961.3	billion \$/a	24.6
CHP (fossil + renewable)	billion \$	101.4	45.1	66.0	32.7	245.1	billion \$/a	6.3
Renewables (w/o CHP)	billion \$	191.0	140.6	202.0	153.0	686.9	billion \$/a	17.6
Total	billion \$	639.7	551.8	696.3	595.8	2,483.4	billion \$/a	63.7
Conventional (fossil & nuclear)	billion \$	445.9	409.2	491.0	439.7	1,785.7	billion \$/a	45.8
Renewables	billion \$	193.8	142.6	205.2	156.1	697.7	billion \$/a	17.9
Biomass	billion \$	13.2	16.3	18.3	22.0	69.8	billion \$/a	1.8
Hydro	billion \$	35.0	45.2	45.2	37.1	162.6	billion \$/a	4.2
Wind	billion \$	20.5	33.4	43.5	44.6	142.1	billion \$/a	3.6
PV	billion \$	98.0	21.0	64.0	20.5	203.5	billion \$/a	5.2
Geothermal	billion \$	22.4	22.0	26.7	21.6	92.7	billion \$/a	2.4
Solar thermal power plants	billion \$	1.5	2.9	4.2	6.2	14.9	billion \$/a	0.4
Ocean energy	billion \$	3.1	1.7	3.3	4.1	12.1	billion \$/a	0.3
E[R]								
Fossil (w/o CHP)	billion \$	141.6	56.1	90.2	98.4	386.4	billion \$/a	9.9
Nuclear	billion \$	21.8	0.0	0.0	0.0	21.8	billion \$/a	0.6
CHP (fossil + renewable)	billion \$	82.4	70.2	69.9	160.2	382.7	billion \$/a	9.8
Renewables (w/o CHP)	billion \$	430.5	705.0	606.6	614.2	2,356.4	billion \$/a	60.4
Total	billion \$	676.4	831.3	766.7	872.9	3,147.3	billion \$/a	80.7
Conventional (fossil & nuclear)	billion \$	234.2	94.1	109.1	105.3	542.6	billion \$/a	13.9
Renewables	billion \$	442.2	737.2	657.6	767.6	2,604.6	billion \$/a	66.8
Biomass	billion \$	25.4	32.5	54.2	135.8	248.0	billion \$/a	6.4
Hydro	billion \$	62.8	47.2	37.2	64.1	211.4	billion \$/a	5.4
Wind	billion \$	86.3	186.5	258.1	193.2	724.2	billion \$/a	18.6
PV	billion \$	145.1	246.1	190.9	165.8	747.8	billion \$/a	19.2
Geothermal	billion \$	82.6	59.8	60.9	73.9	277.2	billion \$/a	7.1
Solar thermal power plants	billion \$	22.7	108.4	15.5	84.1	230.7	billion \$/a	5.9
Ocean energy	billion \$	17.3	56.7	40.8	50.7	165.4	billion \$/a	4.2
ADV E[R]								
Fossil (w/o CHP)	billion \$	139.8	33.8	77.4	141.0	391.8	billion \$/a	10.0
Nuclear	billion \$	21.8	0.0	0.0	0.0	21.8	billion \$/a	0.6
CHP (fossil + renewable)	billion \$	82.4	70.2	70.1	76.3	299.1	billion \$/a	7.7
Renewables (w/o CHP)	billion \$	495.1	912.0	856.9	996.5	3,260.5	billion \$/a	83.6
Total	billion \$	739.1	1,016.0	1,004.4	1,213.8	3,973.3	billion \$/a	101.9
Conventional (fossil & nuclear)	billion \$	232.3	71.7	95.9	146.9	546.8	billion \$/a	14.0
Renewables	billion \$	506.8	944.3	908.5	1,066.9	3,426.5	billion \$/a	87.9
Biomass	billion \$	25.4	38.8	49.8	67.4	181.3	billion \$/a	4.6
Hydro	billion \$	62.8	47.2	37.2	64.1	211.4	billion \$/a	5.4
Wind	billion \$	110.3	214.4	333.8	297.7	956.3	billion \$/a	24.5
PV	billion \$	171.2	291.3	285.7	288.1	1,036.3	billion \$/a	26.6
Geothermal	billion \$	82.6	107.6	109.8	102.5	402.5	billion \$/a	10.3
Solar thermal power plants	billion \$	37.1	120.8	27.6	147.8	333.3	billion \$/a	8.5
Ocean energy	billion \$	17.3	124.1	64.6	99.3	305.3	billion \$/a	7.8

Table 13.11.23: OECD Asia Oceania: Investments in renewable heat generation

REF	UNIT	2012-2020	2021-2030	2031-2040	2041-2050	2012-2050	UNIT	ANNUAL AVERAGE 2012-2050
Heat pumps	billion \$	4.5	4.2	1.9	1.3	11.8	billion \$/a	0.3
Deep geothermal	billion \$	0.0	0.0	0.0	0.0	0.0	billion \$/a	0.0
Solar thermal	billion \$	10.1	14.1	18.1	24.0	66.4	billion \$/a	1.7
Biomass	billion \$	24.9	18.2	18.5	12.5	74.1	billion \$/a	1.9
Total	billion \$	39.5	36.5	38.5	37.7	152.2	billion \$/a	3.9
E[R]								
Heat pumps	billion \$	8.2	39.1	72.9	69.3	189.5	billion \$/a	4.9
Deep geothermal	billion \$	6.1	8.1	15.5	27.2	56.9	billion \$/a	1.5
Solar thermal	billion \$	9.5	124.6	95.2	80.4	309.7	billion \$/a	7.9
Biomass	billion \$	44.2	44.6	47.7	24.3	160.7	billion \$/a	4.1
Total	billion \$	68.0	216.3	231.3	201.2	716.7	billion \$/a	18.4
ADV E[R]								
Heat pumps	billion \$	8.2	39.1	72.9	70.2	190.3	billion \$/a	4.9
Deep geothermal	billion \$	6.1	8.1	15.5	28.4	58.1	billion \$/a	1.5
Solar thermal	billion \$	9.5	124.6	95.2	83.3	312.7	billion \$/a	8.0
Biomass	billion \$	44.0	44.7	47.6	4.0	140.3	billion \$/a	3.6
Total	billion \$	67.9	216.4	231.1	186.0	701.4	billion \$/a	18.0

Table 13.11.24: OECD Asia Oceania: Total employment in the energy sector THOUSAND JOBS

By sector	REFERENCE SCENARIO				ADV E[R] SCENARIO		
	2015	2020	2025	2030	2020	2025	2030
Construction and installation	185	123	120	108	363	387	373
Manufacturing	35	15	15	10	95	113	108
Operations and maintenance	135	158	160	162	176	233	276
Fuel supply (domestic)	112	114	118	123	132	149	154
Coal and gas export	5.0	11.3	19.1	26.9	3.8	2.3	0.8
Solar and geothermal heat	6	7	9	9	13	108	145
Total jobs (thousands)	478	428	442	438	782	992	1,056
By technology							
Coal	90	81	88	88	52	41	24
Gas, oil & diesel	78	72	73	70	77	72	72
Nuclear	134	135	133	133	145	144	140
Renewable	177	140	147	147	509	735	820
Biomass	48	54	59	63	95	120	135
Hydro	17	17	18	18	21	19	17
Wind	9.7	13.0	15.2	16.7	68	109	130
PV	93.0	45.8	42.8	35.9	269	298	333
Geothermal power	1.0	2.1	2.1	2.0	8.1	12.9	10.3
Solar thermal power	0.4	0.7	0.9	1.1	15.1	32.2	26.7
Ocean	0.9	0.8	0.8	1.2	19	37	23.1
Solar - heat	6	6	9	8.6	6	99	119
Geothermal & heat pump	0.3	0.29	0.277	0.3	7	8	26
Total jobs (thousands)	478	428	442	438	782	992	1,056

13.5 2005 – 2015 – ONE DECADE OF ENERGY [R]EVOLUTION SCENARIOS

Greenpeace published the first Energy [R]evolution scenario in May 2005 for the EU-25 in conjunction with a 7-month long ship tour from Poland all the way down to Egypt. During the past 10 years, this work has developed significantly. The very first scenario was launched on board the ship with the support of former EREC Policy Director Oliver Schäfer, the start of a long-lasting fruitful Energy [R]evolution collaboration between Greenpeace International and EREC. The German Aerospace Center's Institute for Engineering Thermodynamics under Dr. Wolfram Krewitt's leadership has been the scientific institution behind all published energy revolutions since then as well. Between 2005 and 2009, these three very different stakeholders managed to put together over 30 scenarios for countries from all continents and published two editions of the Global Energy [R]evolution scenario, which became a well-respected, progressive, alternative energy blueprint. The work has been translated into over 15 different languages including Arabic, Chinese, French, German, Hebrew, Japanese, Russian, Spanish, Thai and Turkish.

The concept of an Energy [R]evolution scenario has been under constant development ever since. Today, we are able to calculate employment effects in parallel to the scenario development. The calculation program Mesap/PlaNet is from software firm seven2one, and lots of features were developed for this project. For the 2010 edition, we developed a standardised report tool, which provides us with a "ready to print" executive summary for each region and/or country we investigate. All regions also interact with each other, so the global scenario is set up like a cascade. These innovative developments serve for an ever improving quality, faster development times and more user-friendly outputs.

In the past years, a team of about 20 scientists from all regions across the world came together to review regional and/or country-specific scenarios and make sure that they properly reflect their region.

In some cases, these Energy [R]evolutions scenarios were the first ever published as long-term energy scenario for a country, such as the Turkish scenario published in 2009. Since the first Global Energy [R]evolution scenario published in January 2007, we have held side events at every single UNFCCC climate conference, countless energy conferences and panel debates. Over 200 presentations in more than 30 languages always had one message in common. "The Energy [R]evolution is possible; it is needed and pays off for future generations!"

Many high level meetings took place, for example on 15 July 2009, when Chilean President Michelle Bachelet attended our launch event for the Energy [R]evolution Chile.

The Energy [R]evolution work is a corner-stone of the Greenpeace climate and energy work worldwide. We would like to thank all involved stakeholders. Unfortunately, in October 2009, Dr Wolfram Krewitt of DLR passed away far

too early and left a huge gap for everybody. His energy and dedication helped to make the Energy [R]evolution project a true success story. Arthouros Zervos and Christine Lins of EREC were involved in this work from 2005 until 2013 when EREC stopped operation. Dr. Sven Teske of Greenpeace International developed the Energy [R]evolution scenario series and has headed this global project since the first development stage in November 2004.

Dr. Thomas Pregger, Dr. Tobias Naegler and Dr. Sonja Simon form the DLR core team responsible for modelling all Energy [R]evolution scenarios since 2009.

The well received layout of all Energy [R]evolution documents has been done – also from the very beginning – by Tania Dunster and Jens Christiansen from "onehemisphere" in Sweden with enormous passion, especially in the final phase when the report goes to print.

Over the past decade, all report texts have been written and/or edited by technical editors: Crispin Aubrey, Alexandra Dawe, Caroline Chisholm and – for the latest edition – Craig Morris made sure that the international science team published results in easy to read English.

With the third version of Energy [R]evolution 2010 report, published in June 2010 in Berlin, we reached out the scientific community to a much larger extent. The IPCC's Special Report Renewables (SRREN) chose the Energy [R]evolution as one of the four benchmark scenarios for climate mitigation energy scenarios (discussed in this edition in Chapter 5). The Energy [R]evolution was the most ambitious scenario: combining an uptake of renewable energy and energy efficiency, it put forwards the highest renewable energy share by 2050. However, this high share resulted in a very strict efficiency strategy, and other scenarios actually had more renewables in terms of exajoules by 2050. Following the publication of the SRREN in May 2011 in Abu Dhabi, the E[R] became a widely quoted energy scenario and is now part of many scientific debates and referenced in numerous scientific peer-reviewed literatures.

The fourth edition, Energy [R]evolution 2012, takes into account the significantly changed situation of the global energy sector that has occurred in just two years. In Japan, the 2011 Fukushima Nuclear disaster following the devastating tsunami in Japan, triggered a faster phase-out on nuclear power in several countries. A serious oil spill occurred at the Deepwater Horizon drilling platform in the Gulf of Mexico in 2010, highlighting the damage that can be done to eco-systems, and some countries are indicating new oil exploration in ever-more sensitive environments like the Arctic Circle. In the gas sector, there is an increase in shale gas projects, a particularly carbon-intensive way to obtain gas; it has required a more detailed analysis of the gas use projection in the Energy [R]evolution.

In March 2015, the Energy [R]evolution received worldwide recognition when a widely circulated report from the US

American Meister Consultants Group concluded that the rapid market growth of renewable power generation has been largely underestimated and report that “just about no one saw it coming. The world’s biggest energy agencies, financial institutions, and fossil fuel companies, for the most part, seriously underestimated just how fast the clean power sector could and would grow”. Meister identifies one group that got the market scenario closest to right, however, and it wasn’t the International Energy Agency or Goldman Sachs or the US Department of Energy (DOE).

“Over the past 15 years, a number of predictions—by the International Energy Agency, the US Energy Information Administration, and others—have been made about the future of renewable energy growth,” the Meister report noted. “Almost every one of these predictions has underestimated the scale of actual growth experienced by the wind and solar markets. Only the most aggressive growth projections, such as Greenpeace’s Energy [R]evolution scenarios, have been close to accurate.”

In the renewable energy sector, there has been a faster cost reduction in the photovoltaic and wind industries, creating earlier break-even points for these renewable energy investments. New and more detailed analysis of renewable energy potential is available, and new storage technologies are available, which could change the proportions of energy input types, for instance, reducing the need for bioenergy to make up the greenhouse gas reduction targets of the model. Several studies independently find that solar photovoltaic power generation will be the cheapest of all power generation technologies, with cost estimations of down to 3 to 5 cents per kilowatt-hour even in central Europe. In combination with new battery technology, PV has the potential to become truly disruptive for utilities.

During 2013 and 2014, when the costs for renewables dropped and for the first time outpaced investments in new fossil power generation, the 100% renewable energy movement grew. More and more communities, companies and civil society now demand a transition towards a fossil and nuclear free future by 2050 – only one generation from now.

This fifth edition of the Energy [R]evolution presents the first global energy pathway for a complete switch to renewables and what this means for future employment.

Taking the above into account, this edition of the Energy [R]evolution includes:

- Detailed investment pathways for power, heating and transport
- Detailed employment calculations for all sectors and the development of a social plan for oil, coal and gas workers
- Detailed market analysis of the current power plant market
- Detailed transport development pathway.

13.6 OVERVIEW OF THE ENERGY [R]EVOLUTION CAMPAIGN SINCE 2005

Greenpeace published the first Energy [R]evolution scenario in May 2005 for Europe.

A Global Energy [R]evolution scenario have been published in several scientific and peer-review journals like “Energy Policy”. See below a selection of milestones from the Energy [R]evolution work between 2005 and June 2010.

June 2005: First Energy [R]evolution scenario for EU 25 presented in Luxembourg for members of the EU’s Environmental Council

July – August 2005: National Energy [R]evolution scenarios for France, Poland and Hungary launched during an “Energy revolution” ship tour with a sailing vessel across Europe

January 2007: First Global Energy [R]evolution scenario published parallel in Brussels and Berlin

April 2007: Turkish translation from the Global scenario

July 2007: Futu[r]e Investment – an analysis of the needed global investment pathway for the energy revolution scenarios

November 2007: Energy [R]evolution for Indonesia in Jakarta / Indonesia

January 2008: Energy [R]evolution for New Zealand in Wellington / NZ

March 2008: Energy [R]evolution for Brazil in Rio de Janeiro / Brazil

April 2008: Energy [R]evolution for China in Beijing / China

June 2008: Energy [R]evolution for Japan in Aoi Mori & Tokyo/Japan

June 2008: Energy [R]evolution for Australia in Canberra / Australia

August 2008: Energy [R]evolution for the Philippines in Manila/Philippines

August 2008: Energy [R]evolution for the Mexico in Mexico City / Mexico

October 2008. Second edition of the Global Energy [R]evolution Report

December 2008: Energy [R]evolution for the EU-27 in Brussels / Belgium

December 2008. Launch of a concept for specific feed-in-tariff mechanism to implement the Global Energy [R]evolution Report in developing countries at a COP13 side event in Poznan / Poland

March 2009: Energy [R]evolution for the USA in Washington/USA

March 2009: Energy [R]evolution for India in Delhi / India

April 2009: Energy [R]evolution for Russia in Moscow / Russia

May 2009: Energy [R]evolution for Canada in Ottawa/Canada

June 2009: Energy [R]evolution for Greece in Athens/Greece

June 2009: Energy [R]evolution for Italy in Rome / Italy

July 2009: Energy [R]evolution for Chile in Santiago / Chile

July 2009: Energy [R]evolution for Argentina in Buenos Aires /Argentina

September 2009. Launch of the first detailed Job Analysis “Working for the Climate” – based on the global Energy [R]evolution report in Sydney/Australia

October 2009: Energy [R]evolution for South Africa in Johannesburg / SA

November 2009: Energy [R]evolution for Turkey in Istanbul / Turkey

November 2009: “Renewable 24/7” a detailed analysis for the needed grid infrastructure in order to implement the Energy [R]evolution for Europe with 90% renewable power in Berlin / Germany

April 2010: Energy [R]evolution for Sweden

May 2011: Energy [R]evolution South Africa

September 2011: Energy [R]evolution Japan

September 2011: Energy [R]evolution Argentina

November 2011: Energy [R]evolution Hungary

13 April 2012: Energy [R]evolution for South Korea

June 2012: 4th Edition of the Global Energy [R]evolution

June 2012: Energy [R]evolution for Czech Republic

October 2012: Energy [R]evolution for Israel

October 2012: Energy [R]evolution for EU 27

November 2012: Energy [R]evolution for Finland

November 2012: Energy [R]evolution for India

February 2013: Energy [R]evolution for New Zealand

April 2013: Energy [R]evolution for South Korea

August 2013: Energy [R]evolution for Brazil

September 2013: Energy [R]evolution for ASEAN region

November 2013: Energy [R]evolution for Switzerland

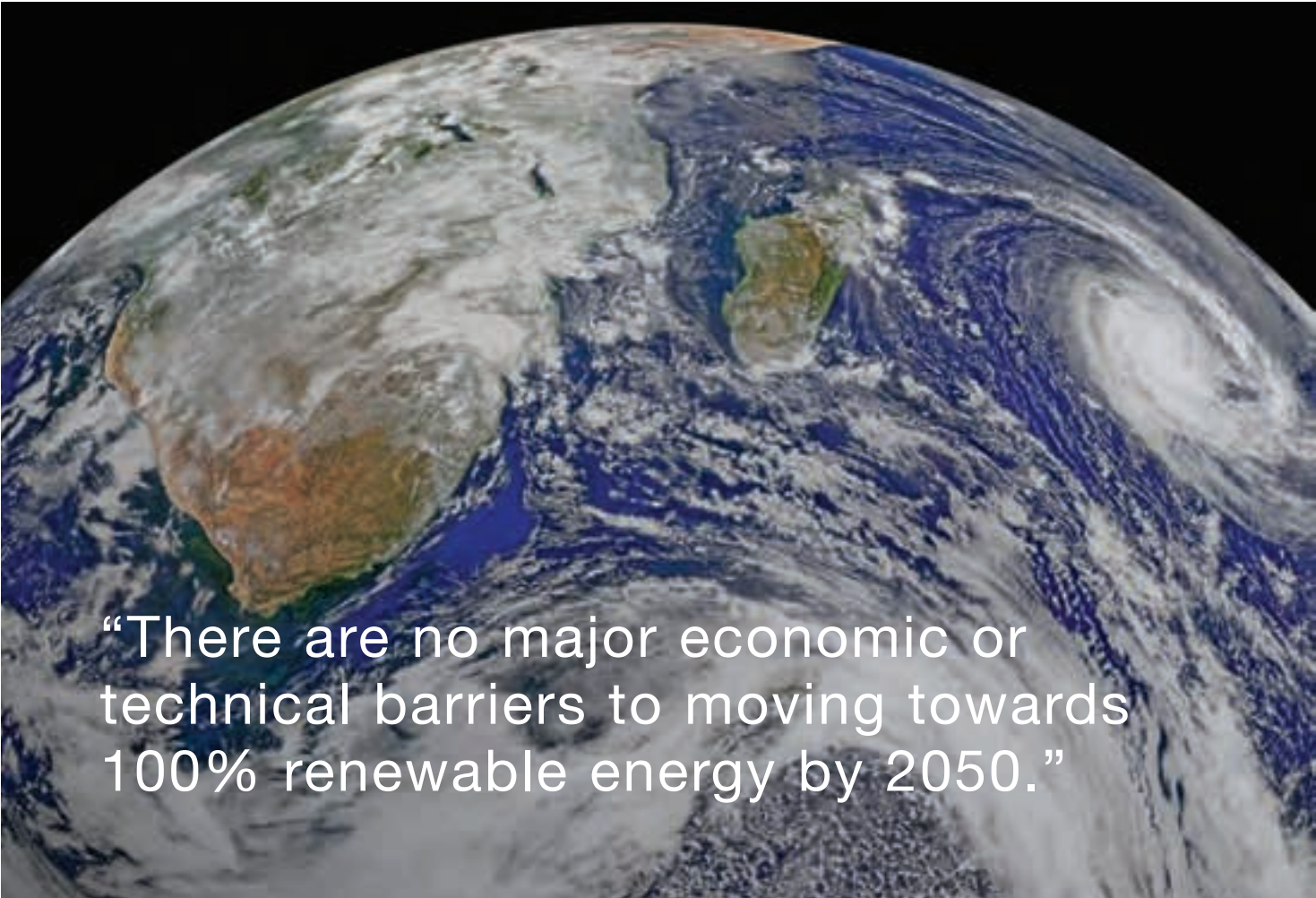
Nov 2013: Energy [R]evolution for Italy

February 2014: Energy [R]evolution for Mexico

April 2014: “powE[R] 2030” a detailed analysis for the needed grid infrastructure in order to implement the Energy [R]evolution for Europe with 75% renewable power by 2030

May 2014: Energy [R]evolution for USA

June 2015: Energy [R]evolution for Turkey



“There are no major economic or technical barriers to moving towards 100% renewable energy by 2050.”



GREENPEACE

Greenpeace is a global organisation that uses non-violent direct action to tackle the most crucial threats to our planet's biodiversity and environment. Greenpeace is a non-profit organisation, present in 40 countries across Europe, the Americas, Africa, Asia and the Pacific. It speaks for 2.8 million supporters worldwide, and inspires many millions more to take action every day. To maintain its independence, Greenpeace does not accept donations from governments or corporations but relies on contributions from individual supporters and foundation grants. Greenpeace has been campaigning against environmental degradation since 1971 when a small boat of volunteers and journalists sailed into Amchitka, an area west of Alaska, where the US Government was conducting underground nuclear tests. This tradition of 'bearing witness' in a non-violent manner continues today, and ships are an important part of all its campaign work.

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GWEC
GLOBAL WIND ENERGY COUNCIL



The Global Wind Energy Council (GWEC) is the voice of the global wind energy sector. GWEC works at highest international political level to create better policy environment for wind power. GWEC's mission is to ensure that wind power established itself as the answer to today's energy challenges, producing substantial environmental and economic benefits. GWEC is a member based organisation that represents the entire wind energy sector. The members of GWEC represent over 1,500 companies, organisations and institutions in more than 70 countries, including manufacturers, developers, component suppliers, research institutes, national wind and renewables associations, electricity providers, finance and insurance companies.

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SolarPower Europe, the new EPIA (European Photovoltaic Industry Association), is a member-led association representing organisations active along the whole value chain. Our aim is to shape the regulatory environment and enhance business opportunities for solar power in Europe.

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