

Tables for scenario projections

General note to the tables

This annex includes global historical and projected data by scenario for the following four datasets:

- A.1: Energy supply.
- A.2: Total final consumption.
- A.3: Electricity sector: gross electricity generation and electrical capacity.
- A.4: CO₂ emissions: carbon dioxide (CO₂) emissions from fossil fuel combustion and industrial processes.

Each dataset is given for the following scenarios: (a) Stated Policies [Tables A.1a. to A.4a]; (b) Announced Pledges [Tables A.1b. to A.4b]; (c) Sustainable Development [Tables A.1c. to A.4c]; and, (d) Net Zero Emissions by 2050 [Tables A.1d. to A.4d].

This annex also includes regional historical and projected data for the Stated Policies, Announced Pledges and Sustainable Development scenarios for the following datasets:

- Tables A.5 – A.6: Total energy supply, renewables energy supply in exajoules (EJ).
- Tables A.7 – A.10: Oil production, oil demand, world liquids demand, and, refining capacity and runs in million barrels per day (mb/d).
- Tables A.11 – A.12: Natural gas production, natural gas demand in billion cubic metres (bcm).
- Tables A.13 – A.14: Coal production, coal demand in million tonnes of coal equivalent (Mtce).
- Tables A.15 – A.21: Electricity generation by total and by source (renewables, solar photovoltaic [PV], wind, nuclear, natural gas, coal) in terawatt-hours (TWh).
- Tables A.22 – A.25: Total final consumption and consumption by sector (industry, transport and buildings) in exajoules (EJ).
- Table A.26 – A.28: Total CO₂ emissions, electricity and heat sectors CO₂ emissions, final consumption in million tonnes of CO₂ emissions (Mt CO₂).

Tables A.5 to A.28 cover: World, North America, United States, Central and South America, Brazil, Europe, European Union, Africa, Middle East, Eurasia, Russia, Asia Pacific, China, India, Japan and Southeast Asia. The definitions for regions, fuels and sectors are in Annex C.

Common abbreviations used in the tables include: CAAGR = compound average annual growth rate; CCUS = carbon capture, utilisation and storage. Consumption of fossil fuels in facilities without CCUS are classified as “unabated”.

Both in the text of this report and in these annex tables, rounding may lead to minor differences between totals and the sum of their individual components. Growth rates are calculated on a compound average annual basis and are marked “n.a.” when the base year is zero or the value exceeds 200%. Nil values are marked “-”.

Please see Box A.1 for details on where to download the *World Energy Outlook (WEO)* tables in Excel format. In addition, Box A.1 lists the links relating to the main *WEO* website, documentation and methodology of the World Energy Model (WEM), investment costs, policy databases and recent *WEO* special reports.

Data sources

The World Energy Model (WEM) is a very data-intensive model covering the global energy system. Detailed references on databases and publications used in the modelling and analysis may be found in Annex E.

The formal base year for the scenario projections is 2019, as this is the most recent year for which a complete picture of energy demand and production is available. However, we have used more recent data when available, and we include our 2020 estimates for energy production and demand in this annex. Estimates for the year 2020 are based on updates of the IEA Global Energy Review reports which are derived from a number of sources, including the latest monthly data submissions to the IEA Energy Data Centre, other statistical releases from national administrations, and recent market data from the IEA Market Report series that cover coal, oil, natural gas, renewables and electricity.

Historical data for gross electrical capacity are drawn from the S&P Global Market Intelligence World Electric Power Plants Database (March 2021 version) and the International Atomic Energy Agency PRIS database.

Definitional note: Energy supply and transformation tables

Total energy supply (TES) is equivalent to electricity and heat generation plus the *other energy sector*, excluding electricity, heat and hydrogen, plus total final consumption (TFC), excluding electricity, heat and hydrogen. TES does not include ambient heat from heat pumps or electricity trade. Solar in TES includes solar PV generation, concentrating solar power and final consumption of solar thermal. *Other renewables* in TES include geothermal, and marine (tide and wave) energy for electricity and heat generation. Hydrogen production and biofuels production in the other energy sector account for the energy input required to produce low-carbon hydrogen (excluding on site production and consumption within industrial facilities) and for the conversion losses to produce biofuels (mainly primary solid biomass) used in the energy sector. While not itemised separately, non-renewable waste and other sources are included in TES.

Definitional note: Energy demand tables

Sectors comprising **total final consumption** (TFC) include industry (energy use and feedstock), transport, buildings (residential, services and non-specified other) and other (agriculture and other non-energy use). Energy demand from international marine and aviation bunkers are included in global transport totals.

Definitional note: Fossil fuel production and demand tables

Oil production and demand is expressed in million barrels per day (mb/d). Tight oil includes tight crude oil and condensate production except for the United States, which includes tight crude oil only (US tight condensate volumes are included in natural gas liquids). Processing gains cover volume increases that occur during crude oil refining. Biofuels and their inclusion in liquids demand is expressed in energy-equivalent volumes of gasoline and diesel. Natural gas production and demand is expressed in billion cubic metres (bcm). Coal production and demand is expressed in million tonnes of coal equivalent (Mtce). Differences between historical production and demand volumes for oil, gas and coal are due to changes in stocks. Bunkers include both international marine and aviation fuels. Refining capacity at risk is defined as the difference between refinery capacity and refinery runs, with the latter including a 14% allowance for downtime. Projected shutdowns beyond those publicly announced are also counted as capacity at risk.

Definitional note: Electricity tables

Electricity generation expressed in terawatt-hours (TWh) and installed electrical capacity data expressed in gigawatts (GW) are both provided on a gross basis (i.e. includes own use by the generator). Projected gross electrical capacity is the sum of existing capacity and additions, less retirements. While not itemised separately, other sources are included in total electricity generation. Installed capacity for hydrogen and ammonia refers to full conversion only, not including co-firing with natural gas or coal.

Definitional note: CO₂ emissions tables

Total CO₂ includes carbon dioxide emissions from the combustion of fossil fuels and non-renewable wastes, from industrial and fuel transformation processes (process emissions) as well as CO₂ removals. Three types of CO₂ removals are presented:

- Captured and stored emissions from the combustion of bioenergy and renewable wastes.
- Captured and stored process emissions from biofuels production.
- Captured and stored CO₂ from the atmosphere, which is reported as direct air capture (DAC).

The first two entries are often reported as bioenergy with carbon capture and storage (BECCS). Note that some of the CO₂ captured from biofuels production and direct air capture is used to produce synthetic fuels, which is not included as CO₂ removal.

Total CO₂ captured includes the carbon dioxide captured from CCUS facilities (such as electricity generation or industry) and atmospheric CO₂ captured through direct air capture, but excludes that captured and used for urea production.

Table A.1a: World energy supply

	Stated Policies Scenario (EJ)						Shares (%)			CAAGR (%) 2020 to:	
	2010	2019	2020	2030	2040	2050	2020	2030	2050	2030	2050
	Total energy supply	544.7	613.0	589.1	671.0	714.8	743.9	100	100	100	1.3
Renewables	47.7	65.8	68.5	109.0	153.0	192.5	12	16	26	4.8	3.5
Solar	0.8	4.0	4.7	15.9	30.0	43.5	1	2	6	13	7.7
Wind	1.2	5.1	5.7	14.4	23.5	31.3	1	2	4	9.6	5.8
Hydro	12.4	15.2	15.6	18.3	21.1	24.3	3	3	3	1.6	1.5
Modern solid bioenergy	27.3	31.1	31.8	41.6	49.3	54.7	5	6	7	2.7	1.8
Modern liquid bioenergy	2.4	4.1	3.8	7.1	9.7	11.9	1	1	2	6.5	3.9
Modern gaseous bioenergy	1.0	2.1	2.2	3.8	6.1	9.4	0	1	1	5.6	4.9
Other renewables	2.6	4.2	4.5	7.9	13.3	17.6	1	1	2	5.8	4.7
Traditional use of biomass	26.2	24.2	24.1	21.0	19.1	17.2	4	3	2	-1.3	-1.1
Nuclear	30.1	30.5	29.4	34.0	38.4	40.5	5	5	5	1.5	1.1
Unabated natural gas	115.1	141.4	138.7	155.9	168.0	174.0	24	23	23	1.2	0.8
Natural gas with CCUS	0.1	0.4	0.4	1.0	1.3	1.5	0	0	0	8.3	4.2
Oil	172.1	187.9	171.4	198.5	199.6	198.3	29	30	27	1.5	0.5
<i>of which non-energy use</i>	23.6	28.5	28.5	34.6	37.5	38.2	5	5	5	1.9	1.0
Unabated coal	153.0	162.2	155.8	150.2	132.9	116.8	26	22	16	-0.4	-1.0
Coal with CCUS	-	0.0	0.0	0.2	0.8	1.0	0	0	0	35	18
Electricity and heat sectors	199.8	233.5	230.5	253.5	280.0	301.9	100	100	100	1.0	0.9
Renewables	21.2	35.7	38.1	66.9	100.4	131.3	17	26	43	5.8	4.2
Solar PV	0.1	2.5	3.0	12.6	24.1	34.8	1	5	12	15	8.5
Wind	1.2	5.1	5.7	14.4	23.5	31.3	2	6	10	9.6	5.8
Hydro	12.4	15.2	15.6	18.3	21.1	24.3	7	7	8	1.6	1.5
Bioenergy	5.1	9.5	10.1	15.0	19.2	23.2	4	6	8	4.1	2.8
Other renewables	2.4	3.4	3.6	6.7	12.6	17.7	2	3	6	6.4	5.5
Hydrogen	-	-	-	0.0	0.1	0.1	-	0	0	n.a.	n.a.
Ammonia	-	-	-	0.0	0.2	0.3	-	0	0	n.a.	n.a.
Nuclear	30.1	30.5	29.4	34.0	38.4	40.5	13	13	13	1.5	1.1
Unabated natural gas	46.7	55.7	55.1	57.3	60.8	63.3	24	23	21	0.4	0.5
Natural gas with CCUS	-	-	-	0.1	0.1	0.1	-	0	0	n.a.	n.a.
Oil	10.9	8.2	7.9	5.4	4.3	3.4	3	2	1	-3.7	-2.8
Unabated coal	91.0	103.3	100.0	89.6	75.1	62.0	43	35	21	-1.1	-1.6
Coal with CCUS	-	0.0	0.0	0.1	0.7	1.0	0	0	0	36	19
Other energy sector	54.2	59.1	58.1	66.9	72.4	76.7	100	100	100	1.4	0.9
Hydrogen production	-	-	-	0.4	1.3	2.2	-	1	3	n.a.	n.a.
Biofuels production	2.6	4.1	4.5	11.6	16.8	20.0	8	17	26	9.9	5.1

Table A.2a: World final consumption

	Stated Policies Scenario (EJ)						Shares (%)			CAAGR (%) 2020 to:	
	2010	2019	2020	2030	2040	2050	2020	2030	2050	2030	2050
Total final consumption	382.5	432.9	412.8	488.6	525.6	550.3	100	100	100	1.7	1.0
Electricity	64.5	82.4	81.8	103.0	124.3	144.0	20	21	26	2.3	1.9
Liquid fuels	152.5	173.3	157.3	190.6	196.3	199.0	38	39	36	1.9	0.8
Biofuels	2.4	4.1	3.8	7.1	9.7	11.9	1	1	2	6.5	3.9
Ammonia	-	-	-	0.0	0.0	0.1	-	0	0	n.a.	n.a.
Synthetic oil	-	-	-	-	-	-	-	-	-	n.a.	n.a.
Oil	150.1	169.3	153.5	183.5	186.5	187.1	37	38	34	1.8	0.7
Gaseous fuels	57.6	70.2	68.7	82.5	92.7	98.5	17	17	18	1.8	1.2
Biomethane	0.0	0.1	0.2	0.7	1.8	4.2	0	0	1	15	11
Hydrogen	0.0	0.0	0.0	0.2	0.5	1.0	0	0	0	37	18
Synthetic methane	-	-	-	-	-	-	-	-	-	n.a.	n.a.
Natural gas	57.2	69.7	68.2	81.1	89.5	92.3	17	17	17	1.8	1.0
Solid fuels	95.6	91.8	89.2	93.1	90.5	85.3	22	19	16	0.4	-0.1
Solid bioenergy	38.8	37.8	37.9	37.8	37.4	35.5	9	8	6	-0.0	-0.2
Coal	56.4	53.4	50.6	54.7	52.5	49.3	12	11	9	0.8	-0.1
Heat	11.5	12.8	13.1	14.9	15.2	14.8	3	3	3	1.3	0.4
Other	0.9	2.3	2.6	4.6	6.7	8.6	1	1	2	5.6	4.0
Industry	146.9	158.6	156.1	188.2	201.9	206.8	100	100	100	1.9	0.9
Electricity	26.8	34.4	34.4	42.5	47.7	51.3	22	23	25	2.1	1.3
Liquid fuels	31.3	31.3	31.3	37.8	41.1	41.7	20	20	20	1.9	1.0
Oil	31.3	31.3	31.3	37.8	41.1	41.7	20	20	20	1.9	1.0
Gaseous fuels	26.1	29.5	29.1	36.9	42.4	46.0	19	20	22	2.4	1.5
Biomethane	0.0	0.0	0.1	0.3	0.8	1.9	0	0	1	17	13
Hydrogen	-	-	-	0.0	0.0	0.0	-	0	0	n.a.	n.a.
Unabated natural gas	26.1	29.4	29.0	36.4	41.4	43.8	19	19	21	2.3	1.4
Natural gas with CCUS	-	0.0	0.0	0.2	0.2	0.2	0	0	0	15	5.5
Solid fuels	57.4	57.2	54.9	63.2	62.5	59.5	35	34	29	1.4	0.3
Solid bioenergy	8.1	9.3	9.5	11.1	11.6	11.3	6	6	5	1.7	0.6
Unabated coal	49.3	47.9	45.5	52.0	50.8	48.1	29	28	23	1.4	0.2
Coal with CCUS	-	0.0	0.0	0.0	0.1	0.1	0	0	0	33	11
Heat	5.3	6.1	6.3	7.6	7.9	7.7	4	4	4	1.9	0.7
Other	0.0	0.0	0.0	0.2	0.4	0.7	0	0	0	15	9.9
Iron and steel	31.2	36.0	36.1	41.7	41.6	41.1	23	22	20	1.5	0.4
Chemicals	19.0	21.5	21.4	26.5	28.2	27.8	14	14	13	2.2	0.9
Cement	9.5	11.0	11.3	12.1	11.7	10.7	7	6	5	0.7	-0.2

Table A.2a: World final consumption (continued)

	Stated Policies Scenario (EJ)						Shares (%)			CAAGR (%) 2020 to:	
	2010	2019	2020	2030	2040	2050	2020	2030	2050	2030	2050
Transport	101.7	120.9	105.1	136.4	147.3	157.1	100	100	100	2.6	1.4
Electricity	1.1	1.5	1.5	4.0	8.6	13.0	1	3	8	10	7.5
Liquid fuels	96.9	114.3	98.6	125.1	128.9	132.2	94	92	84	2.4	1.0
Biofuels	2.4	4.0	3.7	6.8	9.3	11.4	4	5	7	6.3	3.8
Oil	94.5	110.3	94.9	118.2	119.5	120.8	90	87	77	2.2	0.8
Gaseous fuels	3.7	5.0	4.9	7.2	9.7	11.9	5	5	8	3.9	3.0
Biomethane	0.0	0.1	0.1	0.2	0.6	1.4	0	0	1	16	11
Hydrogen	0.0	0.0	0.0	0.1	0.4	0.9	0	0	1	35	18
Natural gas	3.7	5.0	4.9	6.9	8.7	9.6	5	5	6	3.5	2.3
Road	75.9	89.5	80.5	99.0	104.2	108.4	77	73	69	2.1	1.0
Passenger cars	38.6	47.7	41.7	47.0	47.9	48.2	40	34	31	1.2	0.5
Heavy-duty trucks	20.3	24.5	22.5	32.8	37.0	41.5	21	24	26	3.8	2.1
Aviation	10.5	14.4	8.5	18.0	21.7	24.7	8	13	16	7.8	3.6
Shipping	10.4	11.4	10.7	13.5	15.0	17.0	10	10	11	2.4	1.6
Buildings	117.9	128.8	127.2	136.1	147.4	157.8	100	100	100	0.7	0.7
Electricity	34.6	43.2	42.6	52.5	63.6	75.1	33	39	48	2.1	1.9
Liquid fuels	13.3	13.1	12.8	11.4	9.8	9.1	10	8	6	-1.2	-1.1
Biofuels	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0	2.2	1.8
Oil	13.3	13.1	12.8	11.4	9.7	9.1	10	8	6	-1.2	-1.1
Gaseous fuels	26.6	30.6	29.8	32.4	34.2	34.5	23	24	22	0.9	0.5
Biomethane	0.0	0.0	0.1	0.2	0.4	0.9	0	0	1	12	9.8
Hydrogen	-	-	-	0.0	0.1	0.1	-	0	0	n.a.	n.a.
Natural gas	26.2	30.1	29.4	31.7	33.0	32.6	23	23	21	0.8	0.3
Solid fuels	36.5	33.1	32.8	28.4	26.7	24.6	26	21	16	-1.4	-1.0
Modern biomass	4.5	4.5	4.5	5.7	6.7	6.9	4	4	4	2.3	1.4
Traditional use of biomass	26.2	24.2	24.1	21.0	19.1	17.2	19	15	11	-1.3	-1.1
Coal	5.7	4.4	4.1	1.5	0.8	0.4	3	1	0	-9.3	-7.6
Heat	6.1	6.6	6.7	7.2	7.2	7.0	5	5	4	0.6	0.1
Other	0.9	2.2	2.5	4.2	5.9	7.5	2	3	5	5.3	3.7
Residential	84.3	90.4	89.4	92.7	98.5	105.1	70	68	67	0.4	0.5
Services	33.6	38.4	37.9	43.4	48.9	52.7	30	32	33	1.4	1.1
Other	15.9	24.7	24.3	28.0	28.9	28.6	100	100	100	1.4	0.5

Table A.3a: World electricity sector

	Stated Policies Scenario (TWh)						Shares (%)			CAAGR (%) 2020 to:	
	2010	2019	2020	2030	2040	2050	2020	2030	2050	2030	2050
Total generation	21 520	26 959	26 762	33 575	40 553	46 703	100	100	100	2.3	1.9
Renewables	4 250	7 114	7 593	14 056	21 218	27 883	28	42	60	6.4	4.4
Solar PV	32	681	833	3 492	6 700	9 667	3	10	21	15	8.5
Wind	342	1 421	1 596	4 102	6 628	8 805	6	12	19	9.9	5.9
Hydro	3 446	4 236	4 347	5 087	5 872	6 739	16	15	14	1.6	1.5
Bioenergy	360	672	709	1 145	1 500	1 852	3	3	4	4.9	3.3
<i>of which BECCS</i>	-	-	-	-	-	-	-	-	-	n.a.	n.a.
CSP	2	13	13	46	158	302	0	0	1	13	11
Geothermal	68	91	94	176	314	423	0	1	1	6.5	5.1
Marine	1	1	1	9	47	95	0	0	0	20	15
Nuclear	2 756	2 790	2 692	3 115	3 517	3 711	10	9	8	1.5	1.1
Hydrogen and ammonia	-	-	-	5	29	44	-	0	0	n.a.	n.a.
Fossil fuels with CCUS	-	1	1	20	87	118	0	0	0	44	20
Coal with CCUS	-	1	1	11	78	104	0	0	0	36	19
Natural gas with CCUS	-	-	-	9	9	13	-	0	0	n.a.	n.a.
Unabated fossil fuels	14 480	17 019	16 440	16 345	15 668	14 915	61	49	32	-0.1	-0.3
Coal	8 671	9 911	9 467	8 733	7 418	6 189	35	26	13	-0.8	-1.4
Natural gas	4 843	6 356	6 257	7 112	7 858	8 418	23	21	18	1.3	1.0
Oil	966	752	716	500	393	308	3	1	1	-3.5	-2.8

	Stated Policies Scenario (GW)						Shares (%)			CAAGR (%) 2020 to:	
	2010	2019	2020	2030	2040	2050	2020	2030	2050	2030	2050
Total capacity	5 192	7 467	7 782	11 143	14 719	17 844	100	100	100	3.7	2.8
Renewables	1 346	2 710	2 989	5 998	9 061	11 692	38	54	66	7.2	4.7
Solar PV	39	605	739	2 550	4 516	6 163	9	23	35	13	7.3
Wind	181	623	737	1 603	2 357	2 995	9	14	17	8.1	4.8
Hydro	1 027	1 306	1 327	1 564	1 779	1 995	17	14	11	1.7	1.4
Bioenergy	87	154	163	234	293	347	2	2	2	3.6	2.5
<i>of which BECCS</i>	-	-	-	-	-	-	-	-	-	n.a.	n.a.
CSP	1	6	6	17	50	92	0	0	1	10	9.3
Geothermal	11	15	16	27	47	61	0	0	0	5.7	4.7
Marine	0	1	1	4	19	37	0	0	0	17	14
Nuclear	402	415	415	447	495	525	5	4	3	0.7	0.8
Hydrogen and ammonia	-	-	-	-	-	6	-	-	0	n.a.	n.a.
Fossil fuels with CCUS	-	0	0	3	14	20	0	0	0	38	19
Coal with CCUS	-	0	0	2	12	17	0	0	0	30	18
Natural gas with CCUS	-	-	-	1	2	3	-	0	0	n.a.	n.a.
Unabated fossil fuels	3 443	4 331	4 361	4 537	4 613	4 555	56	41	26	0.4	0.1
Coal	1 622	2 105	2 109	2 035	1 837	1 618	27	18	9	-0.4	-0.9
Natural gas	1 384	1 793	1 822	2 211	2 542	2 752	23	20	15	2.0	1.4
Oil	437	433	430	290	234	185	6	3	1	-3.9	-2.8
Battery storage	1	12	17	159	535	1 046	0	1	6	25	15

Table A.4a: World CO₂ emissions

	Stated Policies Scenario (Mt CO ₂)						CAAGR (%) 2020 to:	
	2010	2019	2020	2030	2040	2050	2030	2050
Total CO₂*	32 345	35 966	34 156	36 267	35 312	33 903	0.6	-0.0
Combustion activities (+)	30 447	33 464	31 617	33 353	32 305	30 940	0.5	-0.1
Coal	13 828	14 768	14 240	13 487	11 857	10 277	-0.5	-1.1
Oil	10 530	11 344	10 123	11 693	11 590	11 468	1.5	0.4
Natural gas	6 040	7 270	7 165	8 091	8 779	9 123	1.2	0.8
Bioenergy and waste	49	82	89	83	79	72	-0.7	-0.7
Industry removals (-)	-	0	1	1	1	1	0.0	0.0
Biofuels production	-	0	1	1	1	1	0.0	0.0
Direct air capture	-	-	-	-	-	-	n.a.	n.a.
Electricity and heat sectors	12 380	13 933	13 530	12 425	11 116	9 915	-0.8	-1.0
Coal	8 933	10 171	9 832	8 791	7 373	6 100	-1.1	-1.6
Oil	826	626	601	412	325	256	-3.7	-2.8
Natural gas	2 621	3 136	3 097	3 222	3 418	3 559	0.4	0.5
Bioenergy and waste	-	-	-	-	-	-	n.a.	n.a.
Other energy sector*	1 434	1 565	1 435	1 725	1 770	1 786	1.9	0.7
Final consumption*	18 530	20 467	19 191	22 118	22 425	22 202	1.4	0.5
Coal	4 692	4 464	4 288	4 563	4 358	4 058	0.6	-0.2
Oil	9 075	10 106	8 967	10 700	10 719	10 718	1.8	0.6
Natural gas	2 836	3 395	3 380	3 993	4 422	4 568	1.7	1.0
Bioenergy and waste	48	82	89	83	80	72	-0.7	-0.7
Industry*	8 191	8 876	8 736	10 078	10 309	10 068	1.4	0.5
Iron and steel	1 989	2 500	2 591	2 945	2 861	2 743	1.3	0.2
Chemicals	1 143	1 182	1 160	1 382	1 456	1 428	1.8	0.7
Cement	1 921	2 455	2 534	2 774	2 771	2 630	0.9	0.1
Transport	7 010	8 211	7 102	8 886	9 082	9 229	2.3	0.9
Road	5 217	6 043	5 419	6 391	6 311	6 194	1.7	0.4
Passenger cars	2 615	3 192	2 788	3 003	2 862	2 688	0.7	-0.1
Heavy-duty trucks	1 420	1 673	1 532	2 190	2 415	2 638	3.6	1.8
Aviation	751	1 027	606	1 242	1 463	1 631	7.4	3.4
Shipping	796	866	811	999	1 063	1 171	2.1	1.2
Buildings	2 891	2 941	2 917	2 706	2 596	2 494	-0.7	-0.5
Residential	1 963	2 023	1 958	1 760	1 625	1 557	-1.1	-0.8
Services	928	918	960	946	971	937	-0.1	-0.1
Total CO₂ removals	-	0	1	1	1	1	1.8	1.6
Total CO₂ captured	4	40	40	89	176	228	8.3	6.0

*Includes industrial process emissions.

Table A.1b: World energy supply

	Announced Pledges Scenario (EJ)						Shares (%)			CAAGR (%) 2020 to:	
	2010	2019	2020	2030	2040	2050	2020	2030	2050	2030	2050
Total energy supply	544.7	613.0	589.1	651.1	670.4	674.4	100	100	100	1.0	0.5
Renewables	47.7	65.8	68.5	120.6	194.4	248.4	12	19	37	5.8	4.4
Solar	0.8	4.0	4.7	19.1	42.3	64.2	1	3	10	15	9.1
Wind	1.2	5.1	5.7	18.0	37.4	51.4	1	3	8	12	7.6
Hydro	12.4	15.2	15.6	18.3	21.5	24.7	3	3	4	1.6	1.5
Modern solid bioenergy	27.3	31.1	31.8	42.4	57.4	62.0	5	7	9	2.9	2.2
Modern liquid bioenergy	2.4	4.1	3.8	9.9	12.9	14.8	1	2	2	10	4.6
Modern gaseous bioenergy	1.0	2.1	2.2	4.4	8.3	11.9	0	1	2	7.2	5.8
Other renewables	2.6	4.2	4.5	8.5	14.5	19.5	1	1	3	6.6	5.0
Traditional use of biomass	26.2	24.2	24.1	20.7	18.8	17.1	4	3	3	-1.5	-1.1
Nuclear	30.1	30.5	29.4	35.8	44.1	48.5	5	5	7	2.0	1.7
Unabated natural gas	115.1	141.4	138.7	143.6	127.4	119.1	24	22	18	0.3	-0.5
Natural gas with CCUS	0.1	0.4	0.4	2.9	8.7	14.1	0	0	2	20	12
Oil	172.1	187.9	171.4	185.1	162.4	147.6	29	28	22	0.8	-0.5
<i>of which non-energy use</i>	23.6	28.5	28.5	33.7	34.3	33.9	5	5	5	1.7	0.6
Unabated coal	153.0	162.2	155.8	140.9	101.5	62.7	26	22	9	-1.0	-3.0
Coal with CCUS	-	0.0	0.0	0.6	12.0	15.6	0	0	2	55	29
Electricity and heat sectors	199.8	233.5	230.5	252.6	295.7	323.6	100	100	100	0.9	1.1
Renewables	21.2	35.7	38.1	75.1	131.0	177.7	17	30	55	7.0	5.3
Solar PV	0.1	2.5	3.0	15.1	33.3	51.1	1	6	16	18	9.9
Wind	1.2	5.1	5.7	18.0	37.4	51.4	2	7	16	12	7.6
Hydro	12.4	15.2	15.6	18.3	21.5	24.7	7	7	8	1.6	1.5
Bioenergy	5.1	9.5	10.1	16.2	23.5	29.0	4	6	9	4.9	3.6
Other renewables	2.4	3.4	3.6	7.5	15.1	21.5	2	3	7	7.6	6.1
Hydrogen	-	-	-	0.6	2.3	3.1	-	0	1	n.a.	n.a.
Ammonia	-	-	-	0.0	0.2	0.5	-	0	0	n.a.	n.a.
Nuclear	30.1	30.5	29.4	35.8	44.1	48.5	13	14	15	2.0	1.7
Unabated natural gas	46.7	55.7	55.1	52.9	44.8	44.5	24	21	14	-0.4	-0.7
Natural gas with CCUS	-	-	-	0.6	2.4	4.2	-	0	1	n.a.	n.a.
Oil	10.9	8.2	7.9	4.9	3.9	3.1	3	2	1	-4.6	-3.0
Unabated coal	91.0	103.3	100.0	82.2	58.2	29.9	43	33	9	-1.9	-3.9
Coal with CCUS	-	0.0	0.0	0.5	8.8	12.1	0	0	4	57	30
Other energy sector	54.2	59.1	58.1	65.9	75.1	79.1	100	100	100	1.3	1.0
Hydrogen production	-	-	-	2.5	13.7	22.7	-	4	29	n.a.	n.a.
Biofuels production	2.6	4.1	4.5	10.6	16.1	21.6	8	16	27	8.9	5.3

Table A.2b: World final consumption

	Announced Pledges Scenario (EJ)						Shares (%)			CAAGR (%) 2020 to:	
	2010	2019	2020	2030	2040	2050	2020	2030	2050	2030	2050
Total final consumption	382.5	432.9	412.8	473.2	477.3	479.3	100	100	100	1.4	0.5
Electricity	64.5	82.4	81.8	104.4	129.1	150.2	20	22	31	2.5	2.0
Liquid fuels	152.5	173.3	157.3	181.1	165.4	155.8	38	38	33	1.4	-0.0
Biofuels	2.4	4.1	3.8	9.9	12.9	14.8	1	2	3	10	4.6
Ammonia	-	-	-	0.1	0.9	1.6	-	0	0	n.a.	n.a.
Synthetic oil	-	-	-	0.1	0.8	1.7	-	0	0	n.a.	n.a.
Oil	150.1	169.3	153.5	171.1	150.7	137.7	37	36	29	1.1	-0.4
Gaseous fuels	57.6	70.2	68.7	76.7	78.4	78.4	17	16	16	1.1	0.4
Biomethane	0.0	0.1	0.2	1.1	3.6	6.1	0	0	1	21	13
Hydrogen	0.0	0.0	0.0	0.8	4.8	8.3	0	0	2	62	27
Synthetic methane	-	-	-	-	-	-	-	-	-	n.a.	n.a.
Natural gas	57.2	69.7	68.2	74.1	69.1	62.6	17	16	13	0.8	-0.3
Solid fuels	95.6	91.8	89.2	91.3	82.8	72.5	22	19	15	0.2	-0.7
Solid bioenergy	38.8	37.8	37.9	37.7	38.8	36.8	9	8	8	-0.1	-0.1
Coal	56.4	53.4	50.6	53.1	43.6	35.5	12	11	7	0.5	-1.2
Heat	11.5	12.8	13.1	14.7	13.2	11.2	3	3	2	1.1	-0.5
Other	0.9	2.3	2.6	5.1	8.4	11.2	1	1	2	6.7	4.9
Industry	146.9	158.6	156.1	184.0	187.1	182.3	100	100	100	1.7	0.5
Electricity	26.8	34.4	34.4	43.6	51.7	57.5	22	24	32	2.4	1.7
Liquid fuels	31.3	31.3	31.3	35.9	34.8	33.0	20	20	18	1.4	0.2
Oil	31.3	31.3	31.3	35.9	34.8	33.0	20	20	18	1.4	0.2
Gaseous fuels	26.1	29.5	29.1	34.9	37.4	37.2	19	19	20	1.8	0.8
Biomethane	0.0	0.0	0.1	0.5	1.6	3.2	0	0	2	24	14
Hydrogen	-	-	-	0.2	1.1	1.2	-	0	1	n.a.	n.a.
Unabated natural gas	26.1	29.4	29.0	33.8	33.1	30.3	19	18	17	1.5	0.1
Natural gas with CCUS	-	0.0	0.0	0.4	1.6	2.5	0	0	1	23	14
Solid fuels	57.4	57.2	54.9	62.0	56.1	48.6	35	34	27	1.2	-0.4
Solid bioenergy	8.1	9.3	9.5	11.4	13.8	13.8	6	6	8	1.9	1.3
Unabated coal	49.3	47.9	45.5	50.5	39.2	31.3	29	27	17	1.0	-1.2
Coal with CCUS	-	0.0	0.0	0.1	3.2	3.5	0	0	2	49	27
Heat	5.3	6.1	6.3	7.3	6.0	4.5	4	4	2	1.6	-1.1
Other	0.0	0.0	0.0	0.3	1.0	1.5	0	0	1	24	13
Iron and steel	31.2	36.0	36.1	41.1	39.7	37.8	23	22	21	1.3	0.2
Chemicals	19.0	21.5	21.4	26.0	25.8	24.3	14	14	13	2.0	0.4
Cement	9.5	11.0	11.3	12.1	11.3	10.4	7	7	6	0.7	-0.3

Table A.2b: World final consumption (continued)

	Announced Pledges Scenario (EJ)						Shares (%)			CAAGR (%) 2020 to:	
	2010	2019	2020	2030	2040	2050	2020	2030	2050	2030	2050
Transport	101.7	120.9	105.1	129.9	128.3	131.4	100	100	100	2.1	0.7
Electricity	1.1	1.5	1.5	5.1	12.7	18.8	1	4	14	13	8.8
Liquid fuels	96.9	114.3	98.6	118.3	106.4	100.3	94	91	76	1.8	0.1
Biofuels	2.4	4.0	3.7	9.4	11.9	13.5	4	7	10	9.8	4.4
Oil	94.5	110.3	94.9	108.7	92.7	83.4	90	84	63	1.4	-0.4
Gaseous fuels	3.7	5.0	4.9	6.5	9.2	12.4	5	5	9	2.7	3.1
Biomethane	0.0	0.1	0.1	0.2	0.7	1.1	0	0	1	17	11
Hydrogen	0.0	0.0	0.0	0.3	2.4	5.3	0	0	4	49	25
Natural gas	3.7	5.0	4.9	5.9	6.1	6.0	5	5	5	1.9	0.7
Road	75.9	89.5	80.5	95.1	90.1	89.5	77	73	68	1.7	0.4
Passenger cars	38.6	47.7	41.7	44.5	39.2	37.3	40	34	28	0.7	-0.4
Heavy-duty trucks	20.3	24.5	22.5	31.9	33.2	35.3	21	25	27	3.5	1.5
Aviation	10.5	14.4	8.5	17.2	20.2	22.8	8	13	17	7.3	3.4
Shipping	10.4	11.4	10.7	12.6	12.6	13.2	10	10	10	1.7	0.7
Buildings	117.9	128.8	127.2	131.6	134.2	139.0	100	100	100	0.3	0.3
Electricity	34.6	43.2	42.6	51.7	60.2	69.2	33	39	50	1.9	1.6
Liquid fuels	13.3	13.1	12.8	11.0	8.6	7.9	10	8	6	-1.5	-1.6
Biofuels	0.0	0.0	0.0	0.0	0.1	0.1	0	0	0	3.6	5.6
Oil	13.3	13.1	12.8	11.0	8.5	7.8	10	8	6	-1.5	-1.6
Gaseous fuels	26.6	30.6	29.8	29.4	25.6	22.8	23	22	16	-0.1	-0.9
Biomethane	0.0	0.0	0.1	0.4	1.2	1.7	0	0	1	23	12
Hydrogen	-	-	-	0.2	1.2	1.8	-	0	1	n.a.	n.a.
Natural gas	26.2	30.1	29.4	28.2	22.3	18.3	23	21	13	-0.4	-1.6
Solid fuels	36.5	33.1	32.8	27.8	25.9	23.5	26	21	17	-1.6	-1.1
Modern biomass	4.5	4.5	4.5	5.6	6.3	6.0	4	4	4	2.1	1.0
Traditional use of biomass	26.2	24.2	24.1	20.7	18.8	17.1	19	16	12	-1.5	-1.1
Coal	5.7	4.4	4.1	1.5	0.6	0.3	3	1	0	-9.9	-8.9
Heat	6.1	6.6	6.7	7.2	7.0	6.5	5	5	5	0.6	-0.1
Other	0.9	2.2	2.5	4.5	7.0	9.1	2	3	7	6.0	4.4
Residential	84.3	90.4	89.4	90.3	90.9	94.4	70	69	68	0.1	0.2
Services	33.6	38.4	37.9	41.3	43.4	44.6	30	31	32	0.9	0.6
Other	15.9	24.7	24.3	27.7	27.7	26.5	100	100	100	1.3	0.3

Table A.3b: World electricity sector

	Announced Pledges Scenario (TWh)						Shares (%)			CAAGR (%) 2020 to:	
	2010	2019	2020	2030	2040	2050	2020	2030	2050	2030	2050
Total generation	21 520	26 959	26 762	34 362	45 618	54 716	100	100	100	2.5	2.4
Renewables	4 250	7 114	7 593	15 917	28 390	38 959	28	46	71	7.7	5.6
Solar PV	32	681	833	4 190	9 262	14 194	3	12	26	18	9.9
Wind	342	1 421	1 596	5 115	10 508	14 384	6	15	26	12	7.6
Hydro	3 446	4 236	4 347	5 080	5 975	6 852	16	15	13	1.6	1.5
Bioenergy	360	672	709	1 249	1 891	2 375	3	4	4	5.8	4.1
<i>of which BECCS</i>	-	-	-	47	284	443	-	0	1	n.a.	n.a.
CSP	2	13	13	78	359	589	0	0	1	20	14
Geothermal	68	91	94	190	331	449	0	1	1	7.3	5.3
Marine	1	1	1	15	63	115	0	0	0	27	16
Nuclear	2 756	2 790	2 692	3 282	4 040	4 449	10	10	8	2.0	1.7
Hydrogen and ammonia	-	-	-	100	376	517	-	0	1	n.a.	n.a.
Fossil fuels with CCUS	-	1	1	131	1 152	1 729	0	0	3	74	31
Coal with CCUS	-	1	1	43	804	1 113	0	0	2	56	29
Natural gas with CCUS	-	-	-	89	348	616	-	0	1	n.a.	n.a.
Unabated fossil fuels	14 480	17 019	16 440	14 899	11 627	9 029	61	43	17	-1.0	-2.0
Coal	8 671	9 911	9 467	7 926	5 779	3 047	35	23	6	-1.8	-3.7
Natural gas	4 843	6 356	6 257	6 522	5 488	5 691	23	19	10	0.4	-0.3
Oil	966	752	716	450	361	291	3	1	1	-4.5	-3.0

	Announced Pledges Scenario (GW)						Shares (%)			CAAGR (%) 2020 to:	
	2010	2019	2020	2030	2040	2050	2020	2030	2050	2030	2050
Total capacity	5 192	7 467	7 782	11 996	17 867	22 795	100	100	100	4.4	3.6
Renewables	1 346	2 710	2 989	6 912	12 151	16 514	38	58	72	8.7	5.9
Solar PV	39	605	739	3 063	6 232	9 095	9	26	40	15	8.7
Wind	181	623	737	1 943	3 522	4 633	9	16	20	10	6.3
Hydro	1 027	1 306	1 327	1 584	1 837	2 050	17	13	9	1.8	1.5
Bioenergy	87	154	163	257	369	444	2	2	2	4.6	3.4
<i>of which BECCS</i>	-	-	-	11	54	81	-	0	0	n.a.	n.a.
CSP	1	6	6	28	110	173	0	0	1	16	12
Geothermal	11	15	16	30	56	73	0	0	0	6.9	5.3
Marine	0	1	1	7	25	46	0	0	0	24	15
Nuclear	402	415	415	465	572	641	5	4	3	1.1	1.5
Hydrogen and ammonia	-	-	-	-	300	479	-	-	2	n.a.	n.a.
Fossil fuels with CCUS	-	0	0	21	224	341	0	0	1	68	30
Coal with CCUS	-	0	0	8	131	189	0	0	1	51	28
Natural gas with CCUS	-	-	-	14	93	151	-	0	1	n.a.	n.a.
Unabated fossil fuels	3 443	4 331	4 361	4 296	3 704	3 207	56	36	14	-0.2	-1.0
Coal	1 622	2 105	2 109	1 963	1 594	1 265	27	16	6	-0.7	-1.7
Natural gas	1 384	1 793	1 822	2 071	1 909	1 786	23	17	8	1.3	-0.1
Oil	437	433	430	261	202	156	6	2	1	-4.9	-3.3
Battery storage	1	12	17	302	916	1 613	0	3	7	33	16

Table A.4b: World CO₂ emissions

	Announced Pledges Scenario (Mt CO ₂)						CAAGR (%) 2020 to:	
	2010	2019	2020	2030	2040	2050	2030	2050
Total CO₂*	32 345	35 966	34 156	33 640	26 722	20 726	-0.2	-1.7
Combustion activities (+)	30 447	33 464	31 617	30 822	24 634	19 471	-0.3	-1.6
Coal	13 828	14 768	14 240	12 614	9 235	5 713	-1.2	-3.0
Oil	10 530	11 344	10 123	10 754	9 041	7 988	0.6	-0.8
Natural gas	6 040	7 270	7 165	7 415	6 521	6 087	0.3	-0.5
Bioenergy and waste	49	82	89	40	-164	-317	-7.8	n.a.
Industry removals (-)	-	0	1	35	193	518	46	24
Biofuels production	-	0	1	33	142	361	45	23
Direct air capture	-	-	-	2	50	157	n.a.	n.a.
Electricity and heat sectors	12 380	13 933	13 530	11 375	8 424	5 506	-1.7	-3.0
Coal	8 933	10 171	9 832	8 056	5 787	3 045	-2.0	-3.8
Oil	826	626	601	374	298	238	-4.6	-3.0
Natural gas	2 621	3 136	3 097	2 976	2 531	2 524	-0.4	-0.7
Bioenergy and waste	-	-	-	-32	-193	-301	n.a.	n.a.
Other energy sector*	1 434	1 565	1 435	1 570	1 160	726	0.9	-2.2
Final consumption*	18 530	20 467	19 191	20 696	17 188	14 650	0.8	-0.9
Coal	4 692	4 464	4 288	4 436	3 362	2 635	0.3	-1.6
Oil	9 075	10 106	8 967	9 865	8 357	7 451	1.0	-0.6
Natural gas	2 836	3 395	3 380	3 598	3 219	2 807	0.6	-0.6
Bioenergy and waste	48	82	89	72	29	-16	-2.2	n.a.
Industry*	8 191	8 876	8 736	9 661	7 958	6 483	1.0	-1.0
Iron and steel	1 989	2 500	2 591	2 871	2 325	1 964	1.0	-0.9
Chemicals	1 143	1 182	1 160	1 301	1 009	755	1.1	-1.4
Cement	1 921	2 455	2 534	2 707	2 175	1 642	0.7	-1.4
Transport	7 010	8 211	7 102	8 149	7 012	6 339	1.4	-0.4
Road	5 217	6 043	5 419	5 889	4 855	4 338	0.8	-0.7
Passenger cars	2 615	3 192	2 788	2 725	2 135	1 889	-0.2	-1.3
Heavy-duty trucks	1 420	1 673	1 532	2 040	1 865	1 734	2.9	0.4
Aviation	751	1 027	606	1 147	1 205	1 145	6.6	2.1
Shipping	796	866	811	909	781	702	1.1	-0.5
Buildings	2 891	2 941	2 917	2 476	1 902	1 589	-1.6	-2.0
Residential	1 963	2 023	1 958	1 670	1 235	1 027	-1.6	-2.1
Services	928	918	960	806	667	562	-1.7	-1.8
Total CO₂ removals	-	0	1	67	409	885	54	26
Total CO₂ captured	4	40	40	350	2 501	3 813	24	16

*Includes industrial process emissions.

Table A.1c: World energy supply

	Sustainable Development Scenario (EJ)						Shares (%)			CAAGR (%) 2020 to:	
	2010	2019	2020	2030	2040	2050	2020	2030	2050	2030	2050
Total energy supply	544.7	613.0	589.1	599.2	580.5	577.9	100	100	100	0.2	-0.1
Renewables	47.7	65.8	68.5	142.7	238.6	316.4	12	24	55	7.6	5.2
Solar	0.8	4.0	4.7	23.8	55.2	86.3	1	4	15	17	10
Wind	1.2	5.1	5.7	21.6	45.7	62.9	1	4	11	14	8.3
Hydro	12.4	15.2	15.6	19.4	23.8	28.5	3	3	5	2.2	2.0
Modern solid bioenergy	27.3	31.1	31.8	48.8	66.5	74.4	5	8	13	4.4	2.9
Modern liquid bioenergy	2.4	4.1	3.8	12.3	16.3	18.7	1	2	3	12	5.5
Modern gaseous bioenergy	1.0	2.1	2.2	4.9	9.1	13.5	0	1	2	8.2	6.2
Other renewables	2.6	4.2	4.5	12.0	22.0	32.1	1	2	6	10	6.8
Traditional use of biomass	26.2	24.2	24.1	-	-	-	4	-	-	n.a.	n.a.
Nuclear	30.1	30.5	29.4	37.0	46.8	51.4	5	6	9	2.3	1.9
Unabated natural gas	115.1	141.4	138.7	134.6	93.2	59.4	24	22	10	-0.3	-2.8
Natural gas with CCUS	0.1	0.4	0.4	4.7	14.7	25.8	0	1	4	27	14
Oil	172.1	187.9	171.4	168.3	124.8	89.4	29	28	15	-0.2	-2.1
<i>of which non-energy use</i>	23.6	28.5	28.5	32.7	32.6	31.0	5	5	5	1.4	0.3
Unabated coal	153.0	162.2	155.8	107.6	46.6	16.9	26	18	3	-3.6	-7.1
Coal with CCUS	-	0.0	0.0	3.4	15.0	17.9	0	1	3	84	29
Electricity and heat sectors	199.8	233.5	230.5	242.4	277.1	327.6	100	100	100	0.5	1.2
Renewables	21.2	35.7	38.1	88.1	165.0	234.1	17	36	71	8.8	6.2
Solar PV	0.1	2.5	3.0	18.0	40.6	62.8	1	7	19	20	11
Wind	1.2	5.1	5.7	21.6	45.7	62.9	2	9	19	14	8.3
Hydro	12.4	15.2	15.6	19.4	23.8	28.5	7	8	9	2.2	2.0
Bioenergy	5.1	9.5	10.1	18.0	29.2	38.7	4	7	12	6.0	4.6
Other renewables	2.4	3.4	3.6	11.2	25.7	41.2	2	5	13	12	8.5
Hydrogen	-	-	-	0.6	2.4	3.3	-	0	1	n.a.	n.a.
Ammonia	-	-	-	0.0	0.3	3.2	-	0	1	n.a.	n.a.
Nuclear	30.1	30.5	29.4	37.0	46.8	51.4	13	15	16	2.3	1.9
Unabated natural gas	46.7	55.7	55.1	51.3	29.9	17.1	24	21	5	-0.7	-3.8
Natural gas with CCUS	-	-	-	0.7	3.2	5.1	-	0	2	n.a.	n.a.
Oil	10.9	8.2	7.9	3.8	2.2	1.6	3	2	0	-7.1	-5.2
Unabated coal	91.0	103.3	100.0	58.3	16.5	0.7	43	24	0	-5.3	-15
Coal with CCUS	-	0.0	0.0	2.5	10.9	11.1	0	1	3	86	29
Other energy sector	54.2	59.1	58.1	61.6	69.2	77.5	100	100	100	0.6	1.0
Hydrogen production	-	-	-	4.0	17.3	34.6	-	7	45	n.a.	n.a.
Biofuels production	2.6	4.1	4.5	10.3	16.0	19.9	8	17	26	8.6	5.1

Table A.2c: World final consumption

	Sustainable Development Scenario (EJ)						Shares (%)			CAAGR (%) 2020 to:	
	2010	2019	2020	2030	2040	2050	2020	2030	2050	2030	2050
Total final consumption	382.5	432.9	412.8	434.3	411.0	392.3	100	100	100	0.5	-0.2
Electricity	64.5	82.4	81.8	104.3	131.0	155.8	20	24	40	2.5	2.2
Liquid fuels	152.5	173.3	157.3	168.8	135.4	107.3	38	39	27	0.7	-1.3
Biofuels	2.4	4.1	3.8	12.3	16.3	18.7	1	3	5	12	5.5
Ammonia	-	-	-	0.2	1.3	2.7	-	0	1	n.a.	n.a.
Synthetic oil	-	-	-	0.2	1.1	2.2	-	0	1	n.a.	n.a.
Oil	150.1	169.3	153.5	156.2	116.6	83.8	37	36	21	0.2	-2.0
Gaseous fuels	57.6	70.2	68.7	73.3	66.9	59.6	17	17	15	0.6	-0.5
Biomethane	0.0	0.1	0.2	1.2	3.6	6.5	0	0	2	22	13
Hydrogen	0.0	0.0	0.0	1.6	6.1	11.4	0	0	3	73	28
Synthetic methane	-	-	-	-	-	-	-	-	-	n.a.	n.a.
Natural gas	57.2	69.7	68.2	69.6	56.0	40.4	17	16	10	0.2	-1.7
Solid fuels	95.6	91.8	89.2	68.1	56.0	46.6	22	16	12	-2.7	-2.1
Solid bioenergy	38.8	37.8	37.9	23.0	24.0	23.8	9	5	6	-4.9	-1.5
Coal	56.4	53.4	50.6	44.5	31.5	22.3	12	10	6	-1.3	-2.7
Heat	11.5	12.8	13.1	13.1	10.9	8.5	3	3	2	0.0	-1.4
Other	0.9	2.3	2.6	6.7	10.9	14.5	1	2	4	9.7	5.8
Industry	146.9	158.6	156.1	175.9	172.9	164.5	100	100	100	1.2	0.2
Electricity	26.8	34.4	34.4	44.8	54.5	61.8	22	25	38	2.7	2.0
Liquid fuels	31.3	31.3	31.3	33.2	30.5	26.7	20	19	16	0.6	-0.5
Oil	31.3	31.3	31.3	33.2	30.5	26.7	20	19	16	0.6	-0.5
Gaseous fuels	26.1	29.5	29.1	34.6	34.4	31.3	19	20	19	1.8	0.2
Biomethane	0.0	0.0	0.1	0.5	1.6	3.3	0	0	2	24	15
Hydrogen	-	-	-	0.7	1.8	2.4	-	0	1	n.a.	n.a.
Unabated natural gas	26.1	29.4	29.0	32.7	28.2	20.4	19	19	12	1.2	-1.2
Natural gas with CCUS	-	0.0	0.0	0.7	2.7	5.3	0	0	3	31	17
Solid fuels	57.4	57.2	54.9	56.1	46.9	38.6	35	32	23	0.2	-1.2
Solid bioenergy	8.1	9.3	9.5	13.6	15.9	16.7	6	8	10	3.7	1.9
Unabated coal	49.3	47.9	45.5	41.8	27.1	15.2	29	24	9	-0.8	-3.6
Coal with CCUS	-	0.0	0.0	0.7	3.9	6.8	0	0	4	74	30
Heat	5.3	6.1	6.3	6.3	4.8	3.3	4	4	2	0.1	-2.1
Other	0.0	0.0	0.0	0.8	1.8	2.6	0	0	2	35	15
Iron and steel	31.2	36.0	36.1	39.7	36.7	34.3	23	23	21	1.0	-0.2
Chemicals	19.0	21.5	21.4	25.3	25.2	23.2	14	14	14	1.7	0.3
Cement	9.5	11.0	11.3	12.1	10.8	9.9	7	7	6	0.7	-0.4

Table A.2c: World final consumption (continued)

	Sustainable Development Scenario (EJ)						Shares (%)			CAAGR (%) 2020 to:	
	2010	2019	2020	2030	2040	2050	2020	2030	2050	2030	2050
Transport	101.7	120.9	105.1	121.6	108.0	101.2	100	100	100	1.5	-0.1
Electricity	1.1	1.5	1.5	5.6	15.2	25.7	1	5	25	14	9.9
Liquid fuels	96.9	114.3	98.6	110.2	85.0	64.4	94	91	64	1.1	-1.4
Biofuels	2.4	4.0	3.7	11.5	14.7	16.8	4	9	17	12	5.2
Oil	94.5	110.3	94.9	98.3	67.8	42.8	90	81	42	0.3	-2.6
Gaseous fuels	3.7	5.0	4.9	5.8	7.8	11.1	5	5	11	1.6	2.7
Biomethane	0.0	0.1	0.1	0.3	0.7	1.3	0	0	1	18	11
Hydrogen	0.0	0.0	0.0	0.5	2.9	7.0	0	0	7	54	26
Natural gas	3.7	5.0	4.9	5.1	4.2	2.8	5	4	3	0.4	-1.8
Road	75.9	89.5	80.5	89.2	74.7	65.6	77	73	65	1.0	-0.7
Passenger cars	38.6	47.7	41.7	40.8	29.6	22.6	40	34	22	-0.2	-2.0
Heavy-duty trucks	20.3	24.5	22.5	30.3	29.1	29.3	21	25	29	3.0	0.9
Aviation	10.5	14.4	8.5	16.2	18.3	20.4	8	13	20	6.7	3.0
Shipping	10.4	11.4	10.7	11.5	10.6	10.4	10	9	10	0.8	-0.1
Buildings	117.9	128.8	127.2	110.3	104.6	103.1	100	100	100	-1.4	-0.7
Electricity	34.6	43.2	42.6	49.9	57.1	64.2	33	45	62	1.6	1.4
Liquid fuels	13.3	13.1	12.8	10.4	5.7	3.4	10	9	3	-2.1	-4.4
Biofuels	0.0	0.0	0.0	0.2	0.3	0.3	0	0	0	21	9.1
Oil	13.3	13.1	12.8	10.2	5.4	3.0	10	9	3	-2.2	-4.7
Gaseous fuels	26.6	30.6	29.8	26.9	18.7	11.6	23	24	11	-1.0	-3.1
Biomethane	0.0	0.0	0.1	0.4	1.2	1.8	0	0	2	23	12
Hydrogen	-	-	-	0.3	1.4	2.0	-	0	2	n.a.	n.a.
Natural gas	26.2	30.1	29.4	25.4	15.2	6.7	23	23	7	-1.4	-4.8
Solid fuels	36.5	33.1	32.8	10.9	8.6	7.6	26	10	7	-10	-4.8
Modern biomass	4.5	4.5	4.5	9.5	8.4	7.4	4	9	7	7.7	1.7
Traditional use of biomass	26.2	24.2	24.1	-	-	-	19	-	-	n.a.	n.a.
Coal	5.7	4.4	4.1	1.3	0.0	0.0	3	1	0	-11	-20
Heat	6.1	6.6	6.7	6.7	6.0	5.1	5	6	5	-0.1	-0.9
Other	0.9	2.2	2.5	5.5	8.6	11.2	2	5	11	8.3	5.1
Residential	84.3	90.4	89.4	71.7	67.5	67.8	70	65	66	-2.2	-0.9
Services	33.6	38.4	37.9	38.6	37.1	35.3	30	35	34	0.2	-0.2
Other	15.9	24.7	24.3	26.6	25.5	23.5	100	100	100	0.9	-0.1

Table A.3c: World electricity sector

	Sustainable Development Scenario (TWh)						Shares (%)			CAAGR (%) 2020 to:	
	2010	2019	2020	2030	2040	2050	2020	2030	2050	2030	2050
Total generation	21 520	26 959	26 762	34 424	45 885	57 950	100	100	100	2.5	2.6
Renewables	4 250	7 114	7 593	18 283	34 349	48 436	28	53	84	9.2	6.4
Solar PV	32	681	833	4 989	11 273	17 433	3	14	30	20	11
Wind	342	1 421	1 596	6 115	12 817	17 577	6	18	30	14	8.3
Hydro	3 446	4 236	4 347	5 387	6 599	7 921	16	16	14	2.2	2.0
Bioenergy	360	672	709	1 362	2 336	3 199	3	4	6	6.8	5.2
<i>of which BECCS</i>	-	-	-	42	328	593	-	0	1	n.a.	n.a.
CSP	2	13	13	129	717	1 377	0	0	2	26	17
Geothermal	68	91	94	284	538	801	0	1	1	12	7.4
Marine	1	1	1	16	69	129	0	0	0	28	16
Nuclear	2 756	2 790	2 692	3 395	4 293	4 714	10	10	8	2.3	1.9
Hydrogen and ammonia	-	-	-	100	389	805	-	0	1	n.a.	n.a.
Fossil fuels with CCUS	-	1	1	323	1 480	1 790	0	1	3	91	31
Coal with CCUS	-	1	1	226	1 019	1 046	0	1	2	84	29
Natural gas with CCUS	-	-	-	97	460	744	-	0	1	n.a.	n.a.
Unabated fossil fuels	14 480	17 019	16 440	12 290	5 341	2 172	61	36	4	-2.9	-6.5
Coal	8 671	9 911	9 467	5 618	1 559	42	35	16	0	-5.1	-17
Natural gas	4 843	6 356	6 257	6 345	3 610	2 011	23	18	3	0.1	-3.7
Oil	966	752	716	327	172	119	3	1	0	-7.5	-5.8

	Sustainable Development Scenario (GW)						Shares (%)			CAAGR (%) 2020 to:	
	2010	2019	2020	2030	2040	2050	2020	2030	2050	2030	2050
Total capacity	5 192	7 467	7 782	12 728	19 883	25 996	100	100	100	5.0	4.1
Renewables	1 346	2 710	2 989	8 017	14 725	20 304	38	63	78	10	6.6
Solar PV	39	605	739	3 582	7 421	10 865	9	28	42	17	9.4
Wind	181	623	737	2 378	4 471	5 881	9	19	23	12	7.2
Hydro	1 027	1 306	1 327	1 679	2 032	2 360	17	13	9	2.4	1.9
Bioenergy	87	154	163	281	456	599	2	2	2	5.6	4.4
<i>of which BECCS</i>	-	-	-	9	63	107	-	0	0	n.a.	n.a.
CSP	1	6	6	46	232	424	0	0	2	22	15
Geothermal	11	15	16	44	86	124	0	0	0	11	7.2
Marine	0	1	1	7	28	51	0	0	0	25	15
Nuclear	402	415	415	475	607	669	5	4	3	1.4	1.6
Hydrogen and ammonia	-	-	-	-	360	528	-	-	2	n.a.	n.a.
Fossil fuels with CCUS	-	0	0	53	288	384	0	0	1	84	31
Coal with CCUS	-	0	0	37	170	203	0	0	1	78	28
Natural gas with CCUS	-	-	-	16	118	181	-	0	1	n.a.	n.a.
Unabated fossil fuels	3 443	4 331	4 361	3 843	2 782	1 988	56	30	8	-1.3	-2.6
Coal	1 622	2 105	2 109	1 564	782	283	27	12	1	-2.9	-6.5
Natural gas	1 384	1 793	1 822	2 023	1 798	1 548	23	16	6	1.0	-0.5
Oil	437	433	430	256	202	157	6	2	1	-5.1	-3.3
Battery storage	1	12	17	341	1 122	2 123	0	3	8	35	17

Table A.4c: World CO₂ emissions

	Sustainable Development Scenario (Mt CO ₂)						CAAGR (%) 2020 to:	
	2010	2019	2020	2030	2040	2050	2030	2050
Total CO₂*	32 345	35 966	34 156	28 487	16 441	8 170	-1.8	-4.7
Combustion activities (+)	30 447	33 464	31 617	26 049	14 924	7 807	-1.9	-4.6
Coal	13 828	14 768	14 240	9 493	4 034	1 395	-4.0	-7.5
Oil	10 530	11 344	10 123	9 571	6 413	3 986	-0.6	-3.1
Natural gas	6 040	7 270	7 165	6 931	4 645	2 799	-0.3	-3.1
Bioenergy and waste	49	82	89	54	-168	-373	-5.0	n.a.
Industry removals (-)	-	0	1	73	234	643	57	25
Biofuels production	-	0	1	64	181	419	55	23
Direct air capture	-	-	-	10	53	224	n.a.	n.a.
Electricity and heat sectors	12 380	13 933	13 530	8 891	3 376	887	-4.1	-8.7
Coal	8 933	10 171	9 832	5 741	1 733	179	-5.2	-12
Oil	826	626	601	290	168	121	-7.0	-5.2
Natural gas	2 621	3 136	3 097	2 888	1 698	990	-0.7	-3.7
Bioenergy and waste	-	-	-	-28	-223	-403	n.a.	n.a.
Other energy sector*	1 434	1 565	1 435	1 296	681	101	-1.0	-8.5
Final consumption*	18 530	20 467	19 191	18 311	12 437	7 406	-0.5	-3.1
Coal	4 692	4 464	4 288	3 637	2 226	1 190	-1.6	-4.2
Oil	9 075	10 106	8 967	8 850	5 996	3 719	-0.1	-2.9
Natural gas	2 836	3 395	3 380	3 345	2 461	1 462	-0.1	-2.8
Bioenergy and waste	48	82	89	82	56	30	-0.8	-3.5
Industry*	8 191	8 876	8 736	8 377	5 874	3 447	-0.4	-3.1
Iron and steel	1 989	2 500	2 591	2 574	1 745	1 027	-0.1	-3.0
Chemicals	1 143	1 182	1 160	1 169	873	440	0.1	-3.2
Cement	1 921	2 455	2 534	2 552	1 635	755	0.1	-4.0
Transport	7 010	8 211	7 102	7 348	5 112	3 239	0.3	-2.6
Road	5 217	6 043	5 419	5 343	3 468	1 996	-0.1	-3.3
Passenger cars	2 615	3 192	2 788	2 425	1 356	617	-1.4	-4.9
Heavy-duty trucks	1 420	1 673	1 532	1 866	1 457	1 076	2.0	-1.2
Aviation	751	1 027	606	1 028	968	797	5.4	0.9
Shipping	796	866	811	809	564	372	-0.0	-2.6
Buildings	2 891	2 941	2 917	2 249	1 238	599	-2.6	-5.1
Residential	1 963	2 023	1 958	1 582	891	419	-2.1	-5.0
Services	928	918	960	667	347	180	-3.6	-5.4
Total CO₂ removals	-	0	1	103	466	1 076	60	27
Total CO₂ captured	4	40	40	892	3 461	5 404	36	18

*Includes industrial process emissions.

Table A.1d: World energy supply

	Net Zero Emissions by 2050 Scenario (EJ)						Shares (%)			CAAGR (%) 2020 to:	
	2010	2019	2020	2030	2040	2050	2020	2030	2050	2030	2050
	Total energy supply	544.7	613.0	589.1	547.1	534.5	543.0	100	100	100	-0.7
Renewables	47.7	65.8	68.5	166.6	294.6	362.1	12	30	67	9.3	5.7
Solar	0.8	4.0	4.7	32.0	78.3	109.1	1	6	20	21	11
Wind	1.2	5.1	5.7	28.5	67.3	88.9	1	5	16	17	9.6
Hydro	12.4	15.2	15.6	21.1	26.8	30.5	3	4	6	3.1	2.2
Modern solid bioenergy	27.3	31.1	31.8	53.8	73.3	73.5	5	10	14	5.4	2.8
Modern liquid bioenergy	2.4	4.1	3.8	12.5	14.3	14.6	1	2	3	13	4.6
Modern gaseous bioenergy	1.0	2.1	2.2	5.4	10.0	13.7	0	1	3	9.4	6.3
Other renewables	2.6	4.2	4.5	13.2	24.5	31.8	1	2	6	11	6.7
Traditional use of biomass	26.2	24.2	24.1	-	-	-	4	-	-	n.a.	n.a.
Nuclear	30.1	30.5	29.4	41.4	54.3	60.6	5	8	11	3.5	2.4
Unabated natural gas	115.1	141.4	138.7	116.1	43.6	17.4	24	21	3	-1.8	-6.7
Natural gas with CCUS	0.1	0.4	0.4	13.3	31.0	43.3	0	2	8	40	16
Oil	172.1	187.9	171.4	137.4	79.2	42.2	29	25	8	-2.2	-4.6
<i>of which non-energy use</i>	23.6	28.5	28.5	31.7	30.9	29.3	5	6	5	1.1	0.1
Unabated coal	153.0	162.2	155.8	67.5	16.0	3.3	26	12	1	-8.0	-12
Coal with CCUS	-	0.0	0.0	4.4	15.6	13.9	0	1	3	89	28
Electricity and heat sectors	199.8	233.5	230.5	239.9	307.7	370.7	100	100	100	0.4	1.6
Renewables	21.2	35.7	38.1	106.7	220.4	284.4	17	44	77	11	6.9
Solar PV	0.1	2.5	3.0	25.1	61.3	84.5	1	10	23	24	12
Wind	1.2	5.1	5.7	28.5	67.3	88.9	2	12	24	17	9.6
Hydro	12.4	15.2	15.6	21.1	26.8	30.5	7	9	8	3.1	2.2
Bioenergy	5.1	9.5	10.1	18.4	34.7	38.6	4	8	10	6.2	4.6
Other renewables	2.4	3.4	3.6	13.5	30.2	41.9	2	6	11	14	8.5
Hydrogen	-	-	-	5.1	11.5	10.5	-	2	3	n.a.	n.a.
Ammonia	-	-	-	1.0	1.9	1.6	-	0	0	n.a.	n.a.
Nuclear	30.1	30.5	29.4	41.4	54.3	60.6	13	17	16	3.5	2.4
Unabated natural gas	46.7	55.7	55.1	49.3	4.3	1.8	24	21	0	-1.1	-11
Natural gas with CCUS	-	-	-	1.2	4.9	4.7	-	1	1	n.a.	n.a.
Oil	10.9	8.2	7.9	2.2	0.1	0.1	3	1	0	-12	-14
Unabated coal	91.0	103.3	100.0	29.7	0.0	0.0	43	12	0	-11	-34
Coal with CCUS	-	0.0	0.0	3.2	10.4	7.1	0	1	2	91	27
Other energy sector	54.2	59.1	58.1	61.3	75.9	90.6	100	100	100	0.5	1.5
Hydrogen production	-	-	-	21.4	49.2	69.7	-	35	77	n.a.	n.a.
Biofuels production	2.6	4.1	4.5	12.2	16.1	15.4	8	20	17	10	4.2

Table A.2d: World final consumption

	Net Zero Emissions by 2050 Scenario (EJ)						Shares (%)			CAAGR (%) 2020 to:	
	2010	2019	2020	2030	2040	2050	2020	2030	2050	2030	2050
Total final consumption	382.5	432.9	412.8	393.6	362.5	343.6	100	100	100	-0.5	-0.6
Electricity	64.5	82.4	81.8	103.2	139.8	169.2	20	26	49	2.3	2.5
Liquid fuels	152.5	173.3	157.3	142.6	96.2	65.8	38	36	19	-1.0	-2.9
Biofuels	2.4	4.1	3.8	12.5	14.2	14.4	1	3	4	13	4.5
Ammonia	-	-	-	0.9	2.9	4.6	-	0	1	n.a.	n.a.
Synthetic oil	-	-	-	0.4	2.3	4.8	-	0	1	n.a.	n.a.
Oil	150.1	169.3	153.5	128.8	76.7	42.1	37	33	12	-1.7	-4.2
Gaseous fuels	57.6	70.2	68.7	67.9	60.3	53.0	17	17	15	-0.1	-0.9
Biomethane	0.0	0.1	0.2	2.0	5.0	7.6	0	1	2	29	14
Hydrogen	0.0	0.0	0.0	6.4	12.4	19.7	0	2	6	99	31
Synthetic methane	-	-	-	0.2	1.1	4.0	-	0	1	n.a.	n.a.
Natural gas	57.2	69.7	68.2	58.3	40.3	19.8	17	15	6	-1.6	-4.0
Solid fuels	95.6	91.8	89.2	64.4	49.9	38.7	22	16	11	-3.2	-2.7
Solid bioenergy	38.8	37.8	37.9	23.7	25.3	25.3	9	6	7	-4.6	-1.3
Coal	56.4	53.4	50.6	37.6	20.7	9.7	12	10	3	-2.9	-5.4
Heat	11.5	12.8	13.1	11.7	8.7	5.9	3	3	2	-1.2	-2.7
Other	0.9	2.3	2.6	3.8	7.6	11.1	1	1	3	3.8	4.9
Industry	146.9	158.6	156.1	170.1	169.4	160.4	100	100	100	0.9	0.1
Electricity	26.8	34.4	34.4	46.8	62.5	73.8	22	28	46	3.1	2.6
Liquid fuels	31.3	31.3	31.3	30.6	27.2	23.4	20	18	15	-0.2	-1.0
Oil	31.3	31.3	31.3	30.6	27.2	23.4	20	18	15	-0.2	-1.0
Gaseous fuels	26.1	29.5	29.1	35.2	34.1	28.1	19	21	18	1.9	-0.1
Biomethane	0.0	0.0	0.1	0.5	2.0	4.3	0	0	3	26	16
Hydrogen	-	-	-	3.1	4.3	4.8	-	2	3	n.a.	n.a.
Unabated natural gas	26.1	29.4	29.0	30.1	22.0	9.2	19	18	6	0.4	-3.8
Natural gas with CCUS	-	0.0	0.0	1.3	5.1	6.5	0	1	4	39	18
Solid fuels	57.4	57.2	54.9	50.7	39.5	29.6	35	30	18	-0.8	-2.0
Solid bioenergy	8.1	9.3	9.5	14.9	19.1	20.2	6	9	13	4.6	2.6
Unabated coal	49.3	47.9	45.5	34.6	15.1	2.6	29	20	2	-2.7	-9.2
Coal with CCUS	-	0.0	0.0	1.2	5.3	6.8	0	1	4	84	30
Heat	5.3	6.1	6.3	5.5	3.4	1.6	4	3	1	-1.2	-4.5
Other	0.0	0.0	0.0	1.2	2.6	3.8	0	1	2	41	16
Iron and steel	31.2	36.0	36.1	36.7	35.7	31.4	23	22	20	0.2	-0.5
Chemicals	19.0	21.5	21.4	25.4	25.3	23.7	14	15	15	1.7	0.3
Cement	9.5	11.0	11.3	11.1	10.7	10.5	7	7	7	-0.2	-0.3

Table A.2d: World final consumption (continued)

	Net Zero Emissions by 2050 Scenario (EJ)						Shares (%)			CAAGR (%) 2020 to:	
	2010	2019	2020	2030	2040	2050	2020	2030	2050	2030	2050
Transport	101.7	120.9	105.1	102.4	84.5	79.5	100	100	100	-0.3	-0.9
Electricity	1.1	1.5	1.5	7.3	22.1	34.8	1	7	44	17	11
Liquid fuels	96.9	114.3	98.6	89.0	52.7	30.2	94	87	38	-1.0	-3.9
Biofuels	2.4	4.0	3.7	11.5	12.0	11.4	4	11	14	12	3.8
Oil	94.5	110.3	94.9	76.2	35.5	9.4	90	74	12	-2.2	-7.4
Gaseous fuels	3.7	5.0	4.9	6.1	9.7	14.5	5	6	18	2.1	3.7
Biomethane	0.0	0.1	0.1	0.5	1.2	1.5	0	0	2	25	12
Hydrogen	0.0	0.0	0.0	1.4	6.2	12.8	0	1	16	71	29
Natural gas	3.7	5.0	4.9	4.2	2.3	0.1	5	4	0	-1.5	-11
Road	75.9	89.5	80.5	73.2	56.5	50.0	77	72	63	-0.9	-1.6
Passenger cars	38.6	47.7	41.7	29.7	18.7	16.7	40	29	21	-3.3	-3.0
Heavy-duty trucks	20.3	24.5	22.5	27.8	24.3	22.1	21	27	28	2.1	-0.1
Aviation	10.5	14.4	8.5	13.2	12.8	14.0	8	13	18	4.5	1.7
Shipping	10.4	11.4	10.7	11.3	10.2	9.9	10	11	12	0.5	-0.3
Buildings	117.9	128.8	127.2	99.0	88.7	86.0	100	100	100	-2.5	-1.3
Electricity	34.6	43.2	42.6	45.3	51.2	56.9	33	46	66	0.6	1.0
Liquid fuels	13.3	13.1	12.8	9.5	4.4	2.0	10	10	2	-3.0	-5.9
Biofuels	0.0	0.0	0.0	0.3	0.6	0.9	0	0	1	28	13
Oil	13.3	13.1	12.8	9.2	3.8	1.2	10	9	1	-3.3	-7.6
Gaseous fuels	26.6	30.6	29.8	23.0	12.5	6.3	23	23	7	-2.6	-5.1
Biomethane	0.0	0.0	0.1	0.8	1.7	1.5	0	1	2	32	12
Hydrogen	-	-	-	1.8	1.9	2.1	-	2	2	n.a.	n.a.
Natural gas	26.2	30.1	29.4	19.3	7.5	0.7	23	20	1	-4.1	-12
Solid fuels	36.5	33.1	32.8	10.2	7.0	6.1	26	10	7	-11	-5.5
Modern biomass	4.5	4.5	4.5	9.0	6.9	6.0	4	9	7	7.1	1.0
Traditional use of biomass	26.2	24.2	24.1	-	-	-	19	-	-	n.a.	n.a.
Coal	5.7	4.4	4.1	1.1	0.1	0.0	3	1	0	-12	-21
Heat	6.1	6.6	6.7	6.0	5.1	4.2	5	6	5	-1.2	-1.6
Other	0.9	2.2	2.5	5.1	8.3	10.6	2	5	12	7.4	4.9
Residential	84.3	90.4	89.4	66.8	58.6	58.0	70	67	67	-2.9	-1.4
Services	33.6	38.4	37.9	32.3	30.1	28.0	30	33	33	-1.6	-1.0
Other	15.9	24.7	24.3	22.1	20.0	17.7	100	100	100	-1.0	-1.1

Table A.3d: World electricity sector

	Net Zero Emissions by 2050 Scenario (TWh)						Shares (%)			CAAGR (%) 2020 to:	
	2010	2019	2020	2030	2040	2050	2020	2030	2050	2030	2050
Total generation	21 520	26 959	26 762	37 316	56 553	71 164	100	100	100	3.4	3.3
Renewables	4 250	7 114	7 593	22 817	47 521	62 333	28	61	88	12	7.3
Solar PV	32	681	833	6 970	17 031	23 469	3	19	33	24	12
Wind	342	1 421	1 596	8 008	18 787	24 785	6	21	35	18	9.6
Hydro	3 446	4 236	4 347	5 870	7 445	8 461	16	16	12	3.0	2.2
Bioenergy	360	672	709	1 407	2 676	3 279	3	4	5	7.1	5.2
<i>of which BECCS</i>	-	-	-	129	673	842	-	0	1	n.a.	n.a.
CSP	2	13	13	204	880	1 386	0	1	2	32	17
Geothermal	68	91	94	330	625	821	0	1	1	13	7.5
Marine	1	1	1	27	77	132	0	0	0	34	16
Nuclear	2 756	2 790	2 692	3 777	4 855	5 497	10	10	8	3.4	2.4
Hydrogen and ammonia	-	-	-	875	1 857	1 713	-	2	2	n.a.	n.a.
Fossil fuels with CCUS	-	1	1	459	1 659	1 332	0	1	2	97	30
Coal with CCUS	-	1	1	289	966	663	0	1	1	89	27
Natural gas with CCUS	-	-	-	170	694	669	-	0	1	n.a.	n.a.
Unabated fossil fuels	14 480	17 019	16 440	9 358	632	259	61	25	0	-5.5	-13
Coal	8 671	9 911	9 467	2 947	0	0	35	8	0	-11	-40
Natural gas	4 843	6 356	6 257	6 222	626	253	23	17	0	-0.1	-10
Oil	966	752	716	189	6	6	3	1	0	-12	-15

	Net Zero Emissions by 2050 Scenario (GW)						Shares (%)			CAAGR (%) 2020 to:	
	2010	2019	2020	2030	2040	2050	2020	2030	2050	2030	2050
Total capacity	5 192	7 467	7 782	14 933	26 384	33 415	100	100	100	6.7	5.0
Renewables	1 346	2 710	2 989	10 293	20 732	26 568	38	69	80	13	7.6
Solar PV	39	605	739	4 956	10 980	14 458	9	33	43	21	10
Wind	181	623	737	3 101	6 525	8 265	9	21	25	15	8.4
Hydro	1 027	1 306	1 327	1 804	2 282	2 599	17	12	8	3.1	2.3
Bioenergy	87	154	163	297	534	640	2	2	2	6.2	4.7
<i>of which BECCS</i>	-	-	-	28	125	152	-	0	0	n.a.	n.a.
CSP	1	6	6	73	281	426	0	0	1	27	15
Geothermal	11	15	16	52	98	126	0	0	0	13	7.2
Marine	0	1	1	11	32	55	0	0	0	31	15
Nuclear	402	415	415	515	730	812	5	3	2	2.2	2.3
Hydrogen and ammonia	-	-	-	139	1 455	1 867	-	1	6	n.a.	n.a.
Fossil fuels with CCUS	-	0	0	81	312	394	0	1	1	92	31
Coal with CCUS	-	0	0	53	182	222	0	0	1	84	29
Natural gas with CCUS	-	-	-	28	130	171	-	0	1	n.a.	n.a.
Unabated fossil fuels	3 443	4 331	4 361	3 320	1 151	677	56	22	2	-2.7	-6.0
Coal	1 622	2 105	2 109	1 192	432	158	27	8	0	-5.5	-8.3
Natural gas	1 384	1 793	1 822	1 950	679	495	23	13	1	0.7	-4.3
Oil	437	433	430	178	39	25	6	1	0	-8.4	-9.0
Battery storage	1	12	17	585	2 005	3 097	0	4	9	43	19

Table A.4d: World CO₂ emissions

	Net Zero Emissions by 2050 Scenario (Mt CO ₂)						CAAGR (%) 2020 to:	
	2010	2019	2020	2030	2040	2050	2030	2050
Total CO₂*	32 345	35 966	34 156	21 147	6 316	0	-4.7	n.a.
Combustion activities (+)	30 447	33 464	31 617	19 254	6 030	940	-4.8	-11
Coal	13 828	14 768	14 240	5 915	1 299	195	-8.4	-13
Oil	10 530	11 344	10 123	7 426	3 329	928	-3.1	-7.7
Natural gas	6 040	7 270	7 165	5 960	1 929	566	-1.8	-8.1
Bioenergy and waste	49	82	89	- 48	- 528	- 748	n.a.	n.a.
Industry removals (-)	-	0	1	214	914	1 186	75	28
Biofuels production	-	0	1	142	385	553	68	24
Direct air capture	-	-	-	71	528	633	n.a.	n.a.
Electricity and heat sectors	12 380	13 933	13 530	5 816	- 81	- 369	-8.1	n.a.
Coal	8 933	10 171	9 832	2 950	102	69	-11	-15
Oil	826	626	601	173	6	6	-12	-14
Natural gas	2 621	3 136	3 097	2 781	268	128	-1.1	-10
Bioenergy and waste	-	-	-	- 87	- 457	- 572	n.a.	n.a.
Other energy sector*	1 434	1 565	1 435	679	- 85	- 368	-7.2	n.a.
Final consumption*	18 530	20 467	19 191	13 574	6 438	1 139	-3.4	-9.0
Coal	4 692	4 464	4 288	2 935	1 186	117	-3.7	-11
Oil	9 075	10 106	8 967	6 973	3 242	880	-2.5	-7.4
Natural gas	2 836	3 395	3 380	2 668	1 453	303	-2.3	-7.7
Bioenergy and waste	48	82	89	40	- 70	- 176	-7.8	n.a.
Industry*	8 191	8 876	8 736	6 892	3 485	519	-2.3	-9.0
Iron and steel	1 989	2 500	2 591	1 996	909	112	-2.6	-9.9
Chemicals	1 143	1 182	1 160	1 078	634	65	-0.7	-9.1
Cement	1 921	2 455	2 534	1 899	906	133	-2.8	-9.4
Transport	7 010	8 211	7 102	5 719	2 686	689	-2.1	-7.5
Road	5 217	6 043	5 419	4 077	1 793	340	-2.8	-8.8
Passenger cars	2 615	3 192	2 788	1 626	547	85	-5.2	-11
Heavy-duty trucks	1 420	1 673	1 532	1 614	890	198	0.5	-6.6
Aviation	751	1 027	606	783	469	210	2.6	-3.5
Shipping	796	866	811	705	348	122	-1.4	-6.1
Buildings	2 891	2 941	2 917	1 809	685	122	-4.7	-10
Residential	1 963	2 023	1 958	1 377	541	108	-3.5	-9.2
Services	928	918	960	432	144	14	-7.7	-13
Total CO₂ removals	-	0	1	317	1 457	1 936	80	29
Total CO₂ captured	4	40	40	1 665	5 619	7 602	45	19

*Includes industrial process emissions.

Table A.5: Total energy supply (EJ)

	Historical			Stated Policies		Announced Pledges		Sustainable Development	
	2010	2019	2020	2030	2050	2030	2050	2030	2050
World	544.7	613.0	589.1	671.0	743.9	651.1	674.4	599.2	577.9
North America	112.6	115.8	107.7	112.1	106.2	101.9	82.7	101.3	80.3
United States	94.1	94.8	88.3	90.9	83.6	82.3	64.4	82.6	64.5
Central and South America	26.6	28.5	26.9	31.4	41.0	29.8	35.9	28.7	33.3
Brazil	12.1	13.5	13.1	15.3	19.8	13.9	15.4	14.2	15.8
Europe	89.2	82.4	77.5	75.5	69.9	71.8	61.6	70.2	56.5
European Union	64.5	59.5	55.5	52.4	45.1	48.9	37.8	48.8	37.6
Africa	28.0	34.6	34.0	42.4	61.8	41.7	59.5	29.6	43.1
Middle East	26.2	32.9	32.2	39.3	53.6	39.5	55.2	34.9	45.0
Eurasia	35.2	39.8	38.3	42.4	47.2	42.6	47.2	40.0	37.1
Russia	28.5	32.2	31.0	34.1	35.6	34.2	35.6	32.5	29.9
Asia Pacific	211.8	261.4	259.4	306.7	335.6	303.8	309.1	276.2	265.1
China	107.3	143.4	146.1	163.4	157.3	162.5	133.4	149.9	125.1
India	29.3	39.1	37.2	52.1	70.5	52.0	70.4	43.6	52.7
Japan	20.9	17.4	16.2	15.8	13.3	15.0	12.1	15.0	12.1
Southeast Asia	22.7	29.9	29.1	39.5	51.9	39.6	51.8	36.1	40.2

Table A.6: Renewables energy supply (EJ)

	Historical			Stated Policies		Announced Pledges		Sustainable Development	
	2010	2019	2020	2030	2050	2030	2050	2030	2050
World	47.7	65.8	68.5	109.0	192.5	120.6	248.4	142.7	316.4
North America	9.4	12.6	12.8	18.8	29.0	24.9	43.8	26.0	46.6
United States	6.9	9.8	9.9	15.0	23.6	20.2	36.8	20.8	37.6
Central and South America	7.7	9.5	9.5	12.6	19.5	12.9	20.4	14.0	23.5
Brazil	5.6	6.6	6.6	8.4	12.0	8.5	11.8	8.8	12.2
Europe	10.3	13.8	14.3	20.2	27.9	22.8	34.0	23.8	37.4
European Union	8.1	10.3	10.5	15.0	19.9	17.1	25.7	17.1	25.7
Africa	3.3	4.5	4.6	7.9	16.5	8.3	17.6	10.2	27.0
Middle East	0.1	0.2	0.2	1.0	4.8	1.0	6.2	3.0	17.9
Eurasia	1.1	1.3	1.3	1.9	4.7	1.9	4.6	3.3	11.2
Russia	0.9	1.0	1.0	1.5	3.9	1.5	3.8	2.4	8.1
Asia Pacific	15.7	23.9	25.8	46.0	88.0	47.9	117.8	61.1	146.6
China	4.7	11.7	12.9	24.7	43.0	25.3	67.7	30.5	67.4
India	2.6	4.2	4.4	7.9	20.3	7.9	20.3	10.7	29.9
Japan	0.9	1.3	1.4	1.9	3.2	2.5	5.2	2.5	5.2
Southeast Asia	2.8	4.9	5.1	7.7	12.9	7.6	12.9	10.9	26.1

Table A.7: Oil production (mb/d)

	Historical			Stated Policies		Announced Pledges		Sustainable Development	
	2010	2019	2020	2030	2050	2030	2050	2030	2050
World supply	85.5	97.9	91.3	103.0	103.0	96.1	76.7	87.6	47.0
Processing gains	2.2	2.4	2.1	2.6	3.0	2.4	2.3	2.2	1.4
World production	83.4	95.5	89.2	100.4	99.9	93.7	74.4	85.4	45.6
Conventional crude oil	66.8	65.1	59.6	64.1	61.2	59.9	46.6	53.6	25.1
Tight oil	0.7	7.7	7.3	10.6	10.9	9.8	7.8	8.7	6.4
Natural gas liquids	12.7	18.1	18.1	20.4	21.4	19.3	17.2	18.6	11.7
Extra-heavy oil & bitumen	2.6	3.8	3.3	4.1	5.0	3.8	2.3	3.5	2.2
Other	0.6	0.8	0.9	1.2	1.4	0.9	0.5	1.0	0.2
Non-OPEC	50.1	60.5	58.3	63.8	56.2	59.1	39.1	53.6	25.9
OPEC	33.3	35.0	30.9	36.6	43.7	34.6	35.4	31.7	19.6
North America	14.2	24.7	23.8	27.7	23.2	25.2	15.6	23.7	13.3
Central and South America	7.4	6.3	5.9	7.9	10.9	7.5	6.2	6.7	3.4
Europe	4.4	3.6	3.8	3.2	1.6	2.9	0.7	2.6	0.7
European Union	0.7	0.5	0.5	0.4	0.3	0.3	0.1	0.3	0.1
Africa	10.2	8.5	7.0	6.9	7.3	6.5	4.1	6.0	3.4
Middle East	25.4	30.2	27.7	34.0	39.7	32.1	34.3	29.3	17.9
Eurasia	13.4	14.6	13.4	14.4	12.5	13.9	10.2	11.9	5.1
Asia Pacific	8.4	7.7	7.5	6.2	4.7	5.6	3.2	5.1	1.9
Southeast Asia	2.6	2.3	2.1	1.4	0.9	1.4	0.8	1.3	0.4

Table A.8: Oil demand (mb/d)

	Historical			Stated Policies		Announced Pledges		Sustainable Development	
	2010	2019	2020	2030	2050	2030	2050	2030	2050
World	86.7	96.6	87.9	103.0	103.0	96.1	76.7	87.6	47.0
North America	22.2	22.7	20.1	21.3	16.7	18.0	7.7	17.7	6.8
United States	17.8	18.4	16.4	17.4	13.4	14.7	5.4	14.6	5.4
Central and South America	5.5	5.5	5.0	5.4	6.0	4.8	4.0	4.5	2.4
Brazil	2.3	2.4	2.3	2.4	2.5	1.9	1.1	1.9	1.0
Europe	13.9	13.0	11.9	10.4	6.4	9.0	3.6	8.7	2.2
European Union	10.6	9.7	8.9	7.4	4.1	6.2	1.4	6.2	1.3
Africa	3.3	4.0	3.6	5.1	8.4	5.0	7.9	4.6	4.3
Middle East	6.6	7.4	6.7	8.2	10.2	8.2	10.2	7.2	6.1
Eurasia	3.2	3.8	3.7	4.4	4.5	4.4	4.5	4.0	2.6
Russia	2.6	3.1	3.0	3.5	3.1	3.5	3.1	3.2	2.0
Asia Pacific	25.0	32.0	30.8	38.5	38.8	37.8	30.1	33.0	17.2
China	8.8	13.1	13.3	15.7	13.4	15.7	6.4	13.6	5.9
India	3.3	4.8	4.4	7.2	9.2	7.2	9.2	6.0	4.1
Japan	4.2	3.4	3.1	2.8	1.8	2.4	0.8	2.4	0.8
Southeast Asia	4.0	5.1	4.7	6.6	7.7	6.6	7.6	5.6	3.2
International bunkers	7.0	8.3	6.1	9.6	11.9	8.9	8.8	7.9	5.4

Table A.9: World liquids demand (mb/d)

	Historical		Stated Policies		Announced Pledges		Sustainable Development	
	2019	2020	2030	2050	2030	2050	2030	2050
Total liquids	98.6	89.7	106.4	108.7	100.8	83.3	93.3	55.1
Biofuels	2.0	1.9	3.5	5.7	4.7	6.6	5.8	8.1
Total oil	96.6	87.9	103.0	103.0	96.1	76.7	87.6	47.0
CTL, GTL and additives	0.8	0.8	1.1	1.3	1.0	0.5	0.9	0.2
Direct use of crude oil	1.0	0.7	0.4	0.2	0.4	0.2	0.2	0.0
Oil products	94.8	86.3	101.5	101.5	94.8	76.1	86.4	46.7
LPG and ethane	12.7	12.5	15.1	15.3	14.3	12.9	13.2	7.6
Naphtha	6.3	6.3	7.6	9.0	7.4	7.6	7.3	7.6
Gasoline	24.6	21.8	24.2	20.5	22.1	14.1	19.9	5.6
Kerosene	7.8	5.6	9.1	11.6	8.4	8.1	7.4	5.6
Diesel	27.3	24.9	29.4	30.0	27.3	20.6	24.3	10.7
Fuel oil	6.2	5.8	5.7	5.7	5.2	4.0	4.6	2.1
Other products	11.7	11.1	11.9	10.8	11.5	9.3	10.8	7.9
Products from NGLs	11.4	11.4	13.1	12.9	12.2	10.2	12.1	7.2
Refinery products	83.4	75.0	88.4	88.6	82.6	65.9	74.4	39.5
<i>Refinery market share</i>	85%	84%	83%	82%	82%	79%	80%	72%

Note: CTL = coal-to-liquids; GTL = gas-to-liquids; NGLs = natural gas liquids; LPG = liquefied petroleum gas.

Table A.10: Refining capacity and runs (mb/d)

	Refining capacity				Refinery runs				Capacity at risk
	2019	2020	2030	2050	2019	2020	2030	2050	2050
World (Stated Policies)	101.7	101.8	104.7	105.8	81.6	74.4	85.8	85.5	16.4
North America	22.3	22.0	21.2	20.9	18.9	16.4	18.5	17.5	1.8
Europe	16.4	16.2	14.2	13.2	13.4	11.8	10.7	8.8	5.7
Asia Pacific	36.8	36.9	40.6	42.3	29.8	28.3	33.3	34.8	5.2
Japan and Korea	7.0	6.9	6.2	5.7	6.0	5.2	4.9	4.1	2.1
China	16.8	17.0	18.9	18.9	13.0	13.4	14.7	14.0	2.9
India	5.2	5.3	6.9	8.2	5.1	4.5	6.4	7.7	-
Southeast Asia	5.5	5.4	6.6	7.3	3.9	3.8	5.7	6.8	0.2
Middle East	9.1	9.6	11.9	12.3	7.7	6.8	10.1	10.7	0.7
Russia	6.7	6.7	6.5	6.4	5.7	5.4	5.3	5.0	1.0
Africa	3.5	3.5	4.0	4.3	2.0	1.9	3.1	3.6	0.6
Brazil	2.2	2.2	2.3	2.3	1.8	1.8	2.2	2.2	-
Other	4.7	4.7	4.1	4.1	2.3	2.0	2.6	3.0	1.3
Atlantic Basin	55.3	54.7	52.0	51.0	43.7	38.9	42.1	39.8	10.4
East of Suez	46.4	47.1	52.7	54.9	37.9	35.4	43.7	45.7	6.0
Announced Pledges	101.7	101.8	99.8	80.3	81.6	74.4	80.2	63.6	38.1
Sustainable Development	101.7	101.8	93.2	60.8	81.6	74.4	72.2	38.1	61.7

Table A.11: Natural gas production (bcm)

	Historical			Stated Policies		Announced Pledges		Sustainable Development	
	2010	2019	2020	2030	2050	2030	2050	2030	2050
World	3 275	4 115	4 014	4 554	5 113	4 249	3 852	4 038	2 452
Conventional gas	2 771	3 003	2 899	3 177	3 634	3 084	3 047	2 975	1 899
Tight gas	272	298	290	279	223	229	71	277	113
Shale gas	155	731	742	1 013	1 136	853	650	705	373
Coalbed methane	77	79	80	62	94	59	84	57	68
Other	-	5	3	24	25	24	0	24	0
North America	811	1 182	1 165	1 305	1 188	1 071	549	1 006	433
Central and South America	160	174	151	154	209	150	162	133	98
Europe	341	259	241	200	181	179	96	172	41
European Union	148	70	55	41	34	32	5	32	5
Africa	203	249	244	305	446	305	399	278	252
Middle East	463	646	645	800	1 124	805	1 018	742	577
Eurasia	807	971	926	1 088	1 183	1 038	990	1 006	601
Asia Pacific	489	635	643	702	782	701	639	700	450
Southeast Asia	216	213	196	199	246	199	238	199	103

Table A.12: Natural gas demand (bcm)

	Historical			Stated Policies		Announced Pledges		Sustainable Development	
	2010	2019	2020	2030	2050	2030	2050	2030	2050
World	3 336	4 076	3 999	4 554	5 113	4 249	3 852	4 038	2 452
North America	835	1 122	1 096	1 154	1 073	933	418	900	328
United States	678	895	876	905	813	720	248	711	233
Central and South America	148	164	148	154	191	152	154	134	98
Brazil	29	37	35	32	41	28	22	27	21
Europe	696	611	596	587	497	504	234	483	118
European Union	446	413	401	392	297	315	60	314	57
Africa	106	164	164	208	319	210	308	193	170
Middle East	391	554	559	658	839	665	841	541	435
Eurasia	574	624	597	663	711	668	712	634	419
Russia	467	507	481	536	531	541	533	516	348
Asia Pacific	588	837	839	1 114	1 442	1 105	1 164	1 146	880
China	111	305	322	454	521	443	314	438	359
India	64	64	63	133	207	133	206	173	142
Japan	107	104	99	74	59	64	34	63	34
Southeast Asia	150	172	164	226	333	230	333	231	141
International bunkers	-	0	1	16	40	12	21	8	5

Table A.13: Coal production (Mtce)

	Historical			Stated Policies		Announced Pledges		Sustainable Development	
	2010	2019	2020	2030	2050	2030	2050	2030	2050
World	5 231	5 717	5 462	5 132	4 020	4 828	2 672	3 786	1 189
Steam coal	4 065	4 485	4 296	3 944	3 057	3 703	1 982	2 839	771
Coking coal	866	973	940	1 005	843	971	605	850	406
Lignite and peat	300	260	226	182	119	154	86	97	13
North America	818	542	410	262	110	153	58	138	34
Central and South America	75	87	63	48	34	35	0	35	0
Europe	330	218	178	88	41	65	29	51	8
European Union	220	151	124	53	13	34	5	34	5
Africa	210	225	213	199	170	151	67	149	46
Middle East	1	1	1	1	2	1	0	1	0
Eurasia	309	430	394	411	417	391	428	249	131
Asia Pacific	3 487	4 213	4 203	4 123	3 245	4 034	2 091	3 164	972
Southeast Asia	318	510	484	479	443	457	458	325	148

Table A.14: Coal demand (Mtce)

	Historical			Stated Policies		Announced Pledges		Sustainable Development	
	2010	2019	2020	2030	2050	2030	2050	2030	2050
World	5 221	5 536	5 317	5 132	4 020	4 828	2 672	3 786	1 189
North America	768	430	346	192	59	84	35	79	28
United States	716	393	318	177	47	71	24	71	24
Central and South America	37	47	44	42	49	27	25	23	16
Brazil	21	22	19	24	31	15	12	15	12
Europe	538	385	330	197	151	157	124	116	54
European Union	360	250	204	96	48	57	22	57	22
Africa	155	168	156	168	159	139	72	118	29
Middle East	3	5	4	11	15	11	15	5	3
Eurasia	203	234	221	221	211	221	211	137	46
Russia	151	178	168	166	147	166	147	107	40
Asia Pacific	3 516	4 268	4 216	4 301	3 375	4 189	2 191	3 310	1 014
China	2 567	2 968	2 986	2 847	1 980	2 814	879	2 389	614
India	399	597	557	729	691	728	688	468	215
Japan	166	165	153	116	72	107	46	107	46
Southeast Asia	122	255	257	338	393	338	388	214	79

Table A.15: Electricity generation (TWh)

	Historical			Stated Policies		Announced Pledges		Sustainable Development	
	2010	2019	2020	2030	2050	2030	2050	2030	2050
World	21 520	26 959	26 762	33 575	46 703	34 362	54 716	34 424	57 950
North America	5 233	5 364	5 221	5 619	6 726	6 066	9 063	6 048	9 155
United States	4 354	4 371	4 243	4 490	5 175	4 874	7 435	4 874	7 435
Central and South America	1 130	1 307	1 277	1 616	2 435	1 584	2 637	1 575	2 987
Brazil	516	626	605	752	1 148	702	1 216	702	1 216
Europe	4 121	4 080	3 952	4 601	5 594	4 911	7 091	4 926	7 267
European Union	2 957	2 884	2 757	3 145	3 577	3 411	5 040	3 411	5 040
Africa	670	839	827	1 215	2 384	1 239	2 542	1 400	3 488
Middle East	829	1 202	1 189	1 616	2 764	1 625	3 130	1 485	3 724
Eurasia	1 251	1 394	1 335	1 617	2 057	1 617	2 057	1 630	2 114
Russia	1 036	1 120	1 057	1 253	1 488	1 253	1 488	1 255	1 508
Asia Pacific	8 284	12 773	12 961	17 292	24 743	17 320	28 195	17 360	29 215
China	4 236	7 509	7 787	10 232	13 187	10 193	15 947	10 232	15 329
India	972	1 637	1 609	2 545	5 000	2 545	5 000	2 596	5 812
Japan	1 164	1 037	1 003	984	1 055	1 031	1 362	1 031	1 362
Southeast Asia	684	1 132	1 111	1 682	2 843	1 682	2 843	1 623	3 045

Table A.16: Renewables generation (TWh)

	Historical			Stated Policies		Announced Pledges		Sustainable Development	
	2010	2019	2020	2030	2050	2030	2050	2030	2050
World	4 250	7 114	7 593	14 056	27 883	15 917	38 959	18 283	48 436
North America	867	1 258	1 340	2 270	4 045	3 367	7 416	3 422	7 748
United States	452	777	842	1 615	3 036	2 618	6 227	2 618	6 227
Central and South America	744	871	870	1 277	2 102	1 274	2 378	1 323	2 815
Brazil	437	518	515	681	1 035	650	1 141	650	1 141
Europe	976	1 496	1 617	2 743	4 068	3 130	5 737	3 260	6 247
European Union	672	1 001	1 082	1 887	2 680	2 252	4 307	2 252	4 307
Africa	114	162	173	438	1 396	510	1 639	776	3 095
Middle East	18	28	26	153	878	162	1 244	464	3 157
Eurasia	229	264	264	323	580	323	580	479	1 320
Russia	170	200	195	234	432	234	432	332	867
Asia Pacific	1 303	3 035	3 303	6 852	14 814	7 150	19 965	8 559	24 055
China	791	2 025	2 222	4 540	8 076	4 641	12 418	5 186	12 340
India	160	339	360	922	3 587	922	3 587	1 386	5 202
Japan	115	204	234	328	593	384	796	384	796
Southeast Asia	104	254	255	463	1 121	463	1 121	701	2 608

Table A.17: Solar PV generation (TWh)

	Historical			Stated Policies		Announced Pledges		Sustainable Development	
	2010	2019	2020	2030	2050	2030	2050	2030	2050
World	32	681	833	3 492	9 667	4 190	14 194	4 989	17 433
North America	3	105	134	534	1 492	974	2 851	1 002	3 061
United States	3	94	117	497	1 300	929	2 648	929	2 648
Central and South America	0	18	22	133	346	152	410	175	530
Brazil	-	7	8	70	172	74	205	74	205
Europe	23	151	176	504	714	583	903	601	1 017
European Union	23	120	142	421	541	499	728	499	728
Africa	0	7	10	82	370	100	449	215	1 191
Middle East	-	7	11	80	445	88	775	209	1 560
Eurasia	-	2	4	14	37	14	37	15	49
Russia	-	1	1	6	19	6	19	6	22
Asia Pacific	6	390	476	2 146	6 263	2 281	8 770	2 772	10 026
China	1	224	270	1 304	3 140	1 355	5 378	1 523	5 286
India	0	51	64	415	2 107	415	2 107	636	2 651
Japan	4	69	79	133	188	155	241	155	241
Southeast Asia	-	12	18	91	348	91	348	164	732

Table A.18: Wind generation (TWh)

	Historical			Stated Policies		Announced Pledges		Sustainable Development	
	2010	2019	2020	2030	2050	2030	2050	2030	2050
World	342	1 421	1 596	4 102	8 805	5 115	14 384	6 115	17 577
North America	105	344	391	787	1 399	1 349	3 109	1 362	3 199
United States	95	298	340	688	1 179	1 187	2 759	1 187	2 759
Central and South America	4	78	78	190	393	224	665	247	835
Brazil	2	56	57	118	221	129	353	129	353
Europe	154	463	517	1 148	1 945	1 401	3 317	1 475	3 659
European Union	140	367	398	844	1 365	1 083	2 706	1 083	2 706
Africa	2	17	17	78	271	124	427	156	605
Middle East	0	2	2	27	261	28	299	185	1 033
Eurasia	-	1	2	28	121	28	121	69	345
Russia	-	0	1	20	99	20	99	32	212
Asia Pacific	77	516	588	1 845	4 414	1 961	6 446	2 622	7 901
China	45	406	471	1 414	2 631	1 445	4 249	1 778	4 236
India	20	68	68	200	916	200	916	382	1 557
Japan	4	8	8	45	205	68	306	68	306
Southeast Asia	0	6	7	50	201	50	201	126	620

Table A.19: Nuclear generation (TWh)

	Historical			Stated Policies		Announced Pledges		Sustainable Development	
	2010	2019	2020	2030	2050	2030	2050	2030	2050
World	2 756	2 790	2 692	3 115	3 711	3 282	4 449	3 395	4 714
North America	936	956	933	812	642	886	895	886	898
United States	839	843	823	721	517	794	817	794	817
Central and South America	22	25	25	34	67	35	69	35	77
Brazil	15	16	14	24	39	26	42	26	42
Europe	1 032	931	838	776	710	842	821	841	832
European Union	855	765	681	592	519	656	625	656	625
Africa	12	13	13	29	44	29	54	29	72
Middle East	-	7	7	51	96	51	96	47	148
Eurasia	173	211	218	221	283	221	283	256	427
Russia	170	209	216	219	275	219	275	254	409
Asia Pacific	582	647	658	1 193	1 871	1 220	2 232	1 302	2 260
China	74	348	366	675	1 222	675	1 528	751	1 450
India	26	47	46	109	292	109	292	113	303
Japan	288	64	42	195	193	212	259	212	259
Southeast Asia	-	-	-	-	24	-	24	-	40

Table A.20: Natural gas generation (TWh)

	Historical			Stated Policies		Announced Pledges		Sustainable Development	
	2010	2019	2020	2030	2050	2030	2050	2030	2050
World	4 843	6 356	6 257	7 121	8 432	6 611	6 307	6 442	2 755
North America	1 217	1 926	1 955	2 046	1 967	1 571	531	1 509	290
United States	1 018	1 640	1 676	1 681	1 555	1 236	177	1 236	177
Central and South America	178	252	242	230	234	223	162	179	86
Brazil	37	60	55	31	62	25	27	25	27
Europe	947	864	846	802	633	742	292	734	103
European Union	590	569	556	535	356	459	41	459	41
Africa	220	331	329	431	705	430	689	366	209
Middle East	527	869	844	1 149	1 574	1 149	1 574	816	375
Eurasia	603	642	598	835	951	835	951	807	367
Russia	521	514	471	654	653	654	653	620	232
Asia Pacific	1 151	1 472	1 443	1 628	2 367	1 662	2 108	2 032	1 325
China	93	226	230	308	539	288	494	413	703
India	107	65	69	120	172	120	172	316	124
Japan	332	386	367	213	139	204	102	204	102
Southeast Asia	336	376	360	537	857	537	857	557	149

Table A.21: Coal generation (TWh)

	Historical			Stated Policies		Announced Pledges		Sustainable Development	
	2010	2019	2020	2030	2050	2030	2050	2030	2050
World	8 671	9 912	9 468	8 744	6 293	7 969	4 160	5 843	1 088
North America	2 106	1 144	912	462	58	156	53	146	51
United States	1 994	1 070	858	450	55	144	50	144	50
Central and South America	43	66	66	34	21	13	13	6	-
Brazil	11	21	17	12	9	0	-	0	-
Europe	1 068	726	593	254	173	179	177	75	22
European Union	755	491	386	110	15	35	20	35	20
Africa	259	260	241	251	175	204	74	166	31
Middle East	0	1	3	17	29	17	29	7	7
Eurasia	236	267	247	235	242	235	242	86	-
Russia	166	188	168	144	127	144	127	46	-
Asia Pacific	4 958	7 448	7 406	7 491	5 594	7 165	3 572	5 357	977
China	3 264	4 899	4 958	4 704	3 349	4 579	1 410	3 867	738
India	658	1 181	1 127	1 389	947	1 389	947	777	110
Japan	317	329	316	202	65	192	50	192	50
Southeast Asia	185	483	479	667	830	667	830	358	29

Table A.22: Total final consumption (EJ)

	Historical			Stated Policies		Announced Pledges		Sustainable Development	
	2010	2019	2020	2030	2050	2030	2050	2030	2050
World	382.5	432.9	412.8	488.6	550.3	473.2	479.3	434.3	392.3
North America	76.6	80.5	74.3	80.7	77.3	73.0	52.7	72.6	51.1
United States	63.8	66.9	62.0	66.8	62.4	60.3	40.6	60.3	40.6
Central and South America	19.2	20.4	19.2	22.9	29.5	21.6	24.6	20.3	21.3
Brazil	9.0	9.7	9.5	11.0	13.7	9.9	9.9	9.9	9.9
Europe	62.9	60.0	56.7	57.2	52.2	53.8	42.4	52.9	38.3
European Union	45.9	43.5	40.9	40.0	34.0	37.1	25.2	37.1	25.2
Africa	20.4	24.9	24.4	30.9	45.8	30.5	44.8	21.1	27.9
Middle East	18.3	23.2	22.4	28.6	39.5	28.6	39.5	25.9	29.2
Eurasia	23.6	27.4	26.2	30.6	33.5	30.6	33.5	28.2	24.1
Russia	19.0	22.5	21.5	24.6	24.7	24.6	24.7	23.1	18.8
Asia Pacific	146.5	179.1	176.6	216.5	244.0	215.0	216.6	194.7	179.6
China	76.2	96.6	98.0	114.4	112.4	114.4	88.9	105.2	85.6
India	20.5	26.8	25.2	36.8	53.9	36.8	53.9	31.5	38.1
Japan	14.2	12.6	11.7	11.7	10.3	10.9	8.1	10.9	8.1
Southeast Asia	16.0	19.9	19.3	26.7	34.9	26.7	34.9	23.7	25.2

Table A.23: Industry consumption (EJ)

	Historical			Stated Policies		Announced Pledges		Sustainable Development	
	2010	2019	2020	2030	2050	2030	2050	2030	2050
World	146.9	158.6	156.1	188.2	206.8	184.0	182.3	175.9	164.5
North America	19.7	18.4	17.9	20.8	21.3	18.9	15.9	18.8	15.6
United States	15.8	14.5	14.1	16.4	16.5	14.8	11.5	14.8	11.5
Central and South America	7.5	6.7	6.5	7.9	9.6	7.6	8.4	7.6	8.3
Brazil	4.0	3.7	3.6	4.3	5.2	4.0	4.3	4.0	4.3
Europe	19.7	18.7	18.1	19.0	18.0	17.9	15.6	17.6	14.4
European Union	14.4	13.8	13.3	13.5	11.7	12.5	9.6	12.5	9.6
Africa	4.1	4.0	3.9	5.6	8.6	5.5	8.2	5.2	6.9
Middle East	7.6	9.7	9.5	11.4	14.4	11.4	14.4	11.1	12.6
Eurasia	10.1	9.0	8.8	11.3	12.2	11.3	12.2	10.8	10.1
Russia	8.6	7.8	7.6	9.6	9.7	9.6	9.7	9.2	8.2
Asia Pacific	78.3	92.1	91.5	112.0	122.7	111.4	107.5	104.8	96.5
China	49.2	57.3	58.0	66.1	63.1	66.1	49.7	61.8	49.4
India	7.9	10.7	10.1	16.6	26.0	16.6	26.0	15.4	19.6
Japan	6.0	5.5	5.1	5.4	4.8	5.1	4.0	5.1	4.0
Southeast Asia	6.5	8.5	8.7	11.9	15.6	11.9	15.6	11.3	12.7

Table A.24: Transport consumption (EJ)

	Historical			Stated Policies		Announced Pledges		Sustainable Development	
	2010	2019	2020	2030	2050	2030	2050	2030	2050
World	101.7	120.9	105.1	136.4	157.1	129.9	131.4	121.6	101.2
North America	29.6	31.7	27.1	30.0	26.6	26.6	15.7	26.5	15.1
United States	24.9	26.7	23.0	25.4	22.2	22.4	12.1	22.4	12.1
Central and South America	6.1	7.4	6.6	8.0	11.2	7.6	8.9	7.2	6.8
Brazil	2.9	3.6	3.4	3.9	4.9	3.6	3.0	3.6	3.0
Europe	15.6	16.6	14.5	14.4	11.5	13.5	8.7	13.2	7.6
European Union	11.7	12.1	10.7	10.1	7.4	9.3	4.9	9.3	4.9
Africa	3.6	5.0	4.5	6.6	11.2	6.5	10.8	6.2	7.8
Middle East	4.9	5.9	5.1	6.9	9.5	6.9	9.5	6.1	5.9
Eurasia	4.7	5.1	4.7	5.6	6.6	5.6	6.6	5.0	4.3
Russia	4.0	4.2	3.8	4.3	4.4	4.3	4.4	3.9	3.0
Asia Pacific	22.1	31.8	29.7	43.5	51.9	43.2	46.0	39.0	33.0
China	8.3	13.7	13.5	19.2	18.0	19.2	13.1	17.3	12.4
India	2.7	4.4	3.8	7.5	12.3	7.5	12.3	6.6	8.0
Japan	3.3	2.9	2.6	2.4	1.9	2.2	1.2	2.2	1.2
Southeast Asia	3.7	5.7	5.1	8.3	10.7	8.3	10.7	7.4	6.5

Table A.25: Buildings consumption (EJ)

	Historical			Stated Policies		Announced Pledges		Sustainable Development	
	2010	2019	2020	2030	2050	2030	2050	2030	2050
World	117.9	128.8	127.2	136.1	157.8	131.6	139.0	110.3	103.1
North America	23.8	24.8	24.0	23.7	23.5	21.5	15.8	21.3	15.3
United States	20.5	21.1	20.4	19.9	19.0	18.2	12.7	18.2	12.7
Central and South America	4.3	4.9	4.8	5.5	7.0	5.0	5.8	4.2	4.7
Brazil	1.4	1.7	1.7	2.0	2.8	1.5	1.9	1.5	1.9
Europe	24.3	21.6	21.0	20.5	19.6	19.3	15.4	19.0	13.8
European Union	17.6	15.3	14.8	14.2	12.9	13.2	9.2	13.2	9.2
Africa	11.9	14.9	15.1	17.4	24.0	17.2	23.8	8.5	11.5
Middle East	5.3	6.5	6.5	8.9	14.2	8.9	14.2	7.6	10.0
Eurasia	8.4	10.3	9.9	10.5	11.3	10.5	11.3	9.3	6.5
Russia	6.2	7.7	7.5	7.8	7.5	7.8	7.5	7.0	4.7
Asia Pacific	39.9	45.8	46.0	49.6	58.2	49.1	52.7	40.3	41.2
China	15.6	21.4	22.2	24.3	27.0	24.3	22.6	21.7	20.5
India	8.7	9.2	8.9	9.1	12.1	9.1	12.1	6.1	7.8
Japan	4.3	3.8	3.7	3.6	3.3	3.4	2.7	3.4	2.7
Southeast Asia	5.2	4.5	4.4	5.0	7.0	5.0	7.0	3.7	4.6

Table A.26: Total CO₂ emissions* (Mt CO₂)

	Historical			Stated Policies		Announced Pledges		Sustainable Development	
	2010	2019	2020	2030	2050	2030	2050	2030	2050
World	32 345	35 966	34 156	36 267	33 903	33 640	20 726	28 487	8 170
North America	6 423	5 867	5 229	4 944	3 881	3 616	655	3 497	280
United States	5 418	4 826	4 303	3 969	2 936	2 834	129	2 817	107
Central and South America	1 144	1 185	1 093	1 179	1 370	1 041	889	933	485
Brazil	411	443	421	461	532	356	189	354	185
Europe	4 633	3 977	3 642	3 036	2 218	2 518	1 045	2 283	376
European Union	3 236	2 744	2 485	1 957	1 208	1 488	134	1 482	128
Africa	1 109	1 370	1 297	1 617	2 287	1 529	1 948	1 352	883
Middle East	1 572	1 886	1 849	2 150	2 644	2 159	2 626	1 687	822
Eurasia	2 017	2 165	2 068	2 247	2 332	2 258	2 336	1 896	935
Russia	1 565	1 691	1 612	1 727	1 619	1 737	1 624	1 489	710
Asia Pacific	14 326	18 220	18 007	19 569	17 245	19 115	9 836	15 585	3 556
China	8 766	11 198	11 356	11 385	8 341	11 263	1 748	9 375	1 331
India	1 683	2 475	2 304	3 305	3 687	3 301	3 676	2 441	969
Japan	1 159	1 071	996	797	513	682	20	683	20
Southeast Asia	1 152	1 712	1 674	2 238	2 704	2 245	2 695	1 726	659

* Includes industrial process emissions.

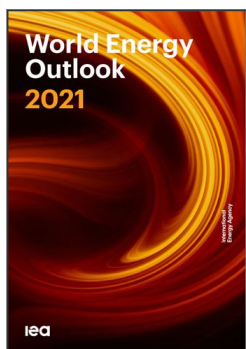
Table A.27: Electricity and heat sectors CO₂ emissions (Mt CO₂)

	Historical			Stated Policies		Announced Pledges		Sustainable Development	
	2010	2019	2020	2030	2050	2030	2050	2030	2050
World	12 380	13 933	13 530	12 425	9 915	11 375	5 506	8 891	887
North America	2 579	1 911	1 707	1 214	767	670	17	637	- 74
United States	2 329	1 682	1 501	1 053	607	526	- 108	526	- 108
Central and South America	235	261	242	157	115	128	76	99	33
Brazil	46	64	51	30	36	11	10	11	10
Europe	1 694	1 216	1 089	666	484	528	271	419	33
European Union	1 154	811	715	388	196	243	- 7	243	- 7
Africa	419	501	478	488	475	448	371	378	148
Middle East	550	681	682	692	789	692	789	466	152
Eurasia	1 014	976	951	975	962	975	962	779	250
Russia	871	791	762	785	706	785	706	635	194
Asia Pacific	5 890	8 388	8 381	8 234	6 323	7 935	3 022	6 113	345
China	3 486	5 242	5 362	5 019	3 684	4 914	615	4 009	220
India	785	1 172	1 124	1 344	915	1 344	915	844	- 24
Japan	488	483	456	270	106	238	- 5	238	- 5
Southeast Asia	397	702	688	887	1 042	887	1 042	612	69

Table A.28: Total final consumption CO₂ emissions* (Mt CO₂)

	Historical			Stated Policies		Announced Pledges		Sustainable Development	
	2010	2019	2020	2030	2050	2030	2050	2030	2050
World	18 530	20 467	19 191	22 118	22 202	20 696	14 650	18 311	7 407
North America	3 444	3 530	3 149	3 278	2 694	2 615	687	2 576	507
United States	2 837	2 892	2 591	2 664	2 113	2 127	348	2 127	348
Central and South America	811	843	777	931	1 135	826	749	764	438
Brazil	344	356	348	402	463	321	180	321	180
Europe	2 768	2 605	2 409	2 231	1 631	1 873	728	1 782	332
European Union	1 970	1 830	1 674	1 475	946	1 175	124	1 175	124
Africa	576	749	707	982	1 636	945	1 513	848	721
Middle East	919	1 058	1 043	1 290	1 643	1 290	1 643	1 079	647
Eurasia	887	1 107	1 047	1 188	1 281	1 188	1 281	1 052	653
Russia	635	849	806	888	858	888	858	811	493
Asia Pacific	8 006	9 278	9 088	10 692	10 257	10 554	6 659	8 954	3 275
China	5 021	5 623	5 670	5 997	4 352	5 996	1 225	5 074	1 226
India	866	1 242	1 122	1 869	2 661	1 869	2 661	1 523	949
Japan	643	568	524	514	398	434	93	434	93
Southeast Asia	690	933	913	1 267	1 535	1 267	1 535	1 047	582

* Includes industrial process emissions.



From:
World Energy Outlook 2021

Access the complete publication at:

<https://doi.org/10.1787/14fcb638-en>

Please cite this chapter as:

International Energy Agency (2021), "Tables for scenario projections", in *World Energy Outlook 2021*, OECD Publishing, Paris.

DOI: <https://doi.org/10.1787/01555e11-en>

This work is published under the responsibility of the Secretary-General of the OECD. The opinions expressed and arguments employed herein do not necessarily reflect the official views of OECD member countries.

This document, as well as any data and map included herein, are without prejudice to the status of or sovereignty over any territory, to the delimitation of international frontiers and boundaries and to the name of any territory, city or area. Extracts from publications may be subject to additional disclaimers, which are set out in the complete version of the publication, available at the link provided.

The use of this work, whether digital or print, is governed by the Terms and Conditions to be found at <http://www.oecd.org/termsandconditions>.