Federal Ministry
for Economic Affairs
and Climate Action

Arbeitsgruppe Erneuerbare Energien - Statistik

Time series for the development of renewable energy sources in Germany

based on statistical data from the
Working Group on Renewable Energy-Statistics (AGEE-Stat)
(Status: September 2023)

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Introduction

The Working Group on Renewable Energy Statistics (AGEE-Stat) was established in February 2004 in order to place statistics and data relating to renewable energy sources on a comprehensive, up-to-date and coordinated basis (more information on: www.erneuerbare-energien.de/EE/ee-in-zahlen-arbeitsgruppe).

With the increasing share of renewable energy sources in the energy system and increasing national and international reporting obligations the demand on reliable data concerning the development of all renewable energy sources in Germany has been growing. Therefore, the coordination office of the Working Group engages in various research projects to improve the data basis and the scientific calculation methods- supported by the working group members (ministries, federal offices and academic institutions).

To analyze the historic development of the renewable energy sources in Germany since 1990 several data sources were evaluated and supplemented by (model-based) calculations. Wherever possible official data were used. Partially missing values were extrapolated from existing data. Single data gaps were closed by estimations, which is why the data are governed by a certain degree of uncertainties.

In some cases data are not available before a specific point of time and previous years could not be estimated reliable, but if new information allow conclusions to be drawn on historic values these data will be complemented or corrected. In addition, changes of the data collection methods or categories may result in breaks in time series, but only in cases in which a retrospective amendment is not possible and reasonable. Rounding may also cause discrepancies in the totals. Therefore the published data are partially preliminary and can differ in comparison to previous issues.

Detailed background information on data sources and methodology of the time series of the gross electricity production and installed electrical capacity can be found on:
www.umweltbundesamt.de/publikationen/datenquellen-methodik-der-agee-stat-zeitreihen-zur (available in German only).

Beside these time tables the AGEE-Stat publishes monthly and quarterly reports.
These can be found on:
www.umweltbundesamt.de/themen/klima-energie/erneuerbare-energien/erneuerbare-energien-in-zahlen/monats-quartalsberichte-der-agee-stat

Further enquiries to the data and methodology can be adressed on

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Table 1: Development of renewable energy sources 1990 to 2022

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Figures in [GWh]	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Gross final energy consumption [1]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	166.950	188.482	228.537	262.940	269.075	265.811	307.126	318.255	353.843	366.348	361.608	390.210	391.876	423.542	437.582	459.460	475.673	473.697	503.106
Gross electricity production	18.934	16.465	19.240	20.128	22.739	25.327	26.140	22.673	25.087	28.902	36.227	38.744	45.440	46.775	58.044	63.538	72.795	89.999	95.106	96.974	106.446	125.647	145.090	153.677	163.741	190.073	191.106	217.674	225.281	243.599	253.539	236.912	254.185
Production of district heating	-	-	-	-	-	-	-	-	-	-	-	-	-	4.681	5.713	6.892	7.899	8.261	9.744	10.575	11.565	12.640	14.885	16.035	16.428	17.989	18.528	18.791	21.347	22.130	22.346	24.264	23.909
Final energy consumption for heating and cooling (including district heat) [2]	32.506	32.657	32.735	32.811	32.918	33.046	33.322	50.580	56.047	57.759	58.466	65.558	64.843	88.677	97.863	103.067	116.062	128.028	138.590	137.406	166.185	158.508	172.838	179.721	163.706	168.286	168.624	173.311	178.265	182.523	180.858	199.906	211.747
Final energy consumption for heating and cooling (without electricity and district heat) [3]	-	-	-	-	-	-	-	-	-	-	-	-	-	84.379	92.650	96.795	108.892	120.489	129.698	127.770	155.587	147.129	159.523	165.431	149.335	152.472	152.425	156.871	159.854	162.869	161.015	178.386	190.777
thereof in: Households	-	-	-	-	-	-	-	-	-	-	-	-	-	58.867	57.862	57.779	68.174	72.334	83.522	76.693	92.189	86.652	99.314	103.500	88.679	90.160	88.028	91.273	94.610	96.287	93.600	106.685	111.544
thereof in: TCS	-	-	-	-	-	-	-	-	-	-	-	-	-	10.395	13.490	14.471	16.853	19.588	24.173	26.530	31.945	26.734	29.332	31.301	29.058	31.850	32.134	33.526	33.813	35.266	36.338	38.878	37.491
thereof in: Industry	-	-	-	-	-	-	-	-	-	-	-	-	-	15.117	21.298	24.545	23.865	28.567	22.003	24.547	31.453	33.743	30.877	30.630	31.598	30.462	32.263	32.072	31.431	31.316	31.077	32.823	41.742
Final energy consumption in the transport sector [4]	465	477	609	653	982	1.175	1.398	1.725	1.872	2.312	3.752	4.908	7.181	8.998	11.765	22.627	40.456	45.969	36.226	32.441	35.623	35.361	37.223	34.277	35.348	33.296	33.643	34.622	35.994	36.040	44.337	39.810	40.744

Figures in [GWh]	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Gross final energy consumption EU-Directive [5]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	165.660	188.845	228.684	256.732	268.055	271.024	311.664	316.610	350.697	364.737	362.140	382.324	388.572	407.407	432.464	446.382	465.380	488.056	511.250
Final energy consumption in the transport sector EU-Directive [5]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	13.607	24.364	41.883	45.902	37.879	34.606	38.281	39.049	43.940	44.730	42.864	41.415	45.194	46.141	50.341	48.885	59.074	46.159	56.518

Figures in [PJ]	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Primary energy consumption [6]	196	197	207	228	253	275	270	345	379	403	417	432	455	588	682	790	965	1.120	1.161	1.159	1.321	1.377	1.541	1.591	1.587	1.692	1.696	1.808	1.844	1.921	1.988	1.975	2.071

differences in the totals may occur due to roundings

1) according to the German government's Energy Concept

2) sectoral local consumption of energy for application purposes of heating and cooling, without electricity, including district heat

3) sectoral local consumption of energy for application purposes of heating and cooling, without secondary energy carriers electricity and district heat

4) consumption of biogenic fuels and renewables-based electricity in the transport sector (excluding consumption in agriculture, forestry and military)

5) till 2020 according to the European Directive 2009/28/EC, since 2021 according to the European Directive (EU) 2018/2001

6) till 2002 by Working Group on Energy Balances (AGEB), calculated according to the "physical energy content" principle, since 2003 by AGEE-Stat based on JAQ-REN

Sources: AGEE-Stat based on AGEB [1]; Eurostat [18]; IEA [22]; EP/ER [16], [17] and further sources see table 3, 5 und 6; partially preliminary data

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Table 2: Shares of renewable energy sources 1990 to 2022

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Figures in [%]	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
of gross final energy consumption [1]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6,3	7,2	8,5	10,3	10,1	10,6	11,5	12,5	13,7	13,8	14,4	15,2	15,0	16,1	16,9	17,8	19,5	18,8	20,5
of gross national electricity consumption	3,4	3,1	3,6	3,8	4,3	4,7	4,7	4,1	4,5	5,2	6,3	6,6	7,7	7,7	9,4	10,3	11,7	14,4	15,3	16,6	17,2	20,6	23,8	25,3	27,5	31,6	31,8	36,2	37,9	42,2	45,5	41,5	46,0
of district heat production [2]	-	-	-	-	-	-	-	-	-	-	-	-	-	3,6	4,2	5,1	5,8	6,3	7,3	8,1	8,1	9,7	11,1	11,8	13,5	14,2	14,2	14,4	16,4	17,4	18,9	17,6	20,1
of final energy consumption for heating and cooling (including district heat) [3]	2,1	2,2	2,3	2,3	2,4	2,3	2,2	3,5	3,9	4,3	4,4	4,7	4,8	6,6	7,5	7,9	8,6	10,7	10,6	11,4	12,4	12,8	13,7	13,8	13,8	13,7	13,7	14,0	14,8	15,0	15,1	15,8	18,2
of final energy consumption for heating and cooling (without secondary energy carriers electricity and district heat) [4]	-	-	-	-	-	-	-	-	-	-	-	-	-	6,9	7,8	8,2	8,9	11,1	10,9	11,7	12,9	13,1	13,9	13,9	13,8	13,7	13,7	14,0	14,6	14,7	14,8	15,6	18,0
thereof in: Households	-	-	-	-	-	-	-	-	-	-	-	-	-	10,1	10,5	10,7	12,3	15,9	15,4	15,2	16,8	18,5	19,4	19,2	19,6	19,0	18,0	18,8	19,4	18,8	18,3	20,6	22,9
thereof in: TCS	-	-	-	-	-	-	-	-	-	-	-	-	-	5,6	7,2	6,8	7,0	10,9	11,7	13,5	15,8	13,7	15,3	14,8	14,5	15,5	18,1	18,5	21,0	21,4	22,7	23,0	23,8
thereof in: Industry	-	-	-	-	-	-	-	-	-	-	-	-	-	3,4	4,8	5,8	5,5	6,4	5,0	6,3	6,9	7,3	7,0	7,0	7,4	7,0	7,2	7,1	7,1	7,3	7,5	7,2	10,1
of final energy consumption in the transport sector	0,1	0,1	0,1	0,1	0,2	0,2	0,2	0,3	0,3	0,3	0,5	0,7	1,1	1,4	1,9	3,7	6,2	7,4	5,7	5,3	5,9	5,8	6,1	5,5	5,7	5,2	5,2	5,3	5,5	5,5	7,5	6,8	6,9

Figures in [%]	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
of gross final energy consumption EU-Directive [5]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6,2	7,2	8,5	10,0	10,1	10,9	11,7	12,5	13,5	13,8	14,4	14,9	14,9	15,5	16,7	17,3	19,1	19,4	20,8
of final energy consumption in the transport sector EU-Directive [5]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2,1	4,0	6,7	7,5	6,3	5,9	6,4	6,5	7,3	7,3	6,9	6,6	7,0	7,0	7,9	7,6	10,0	8,0	9,6

Figures in [%]	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
of primary energy consumption	1,3	1,3	1,4	1,6	1,8	1,9	1,8	2,4	2,6	2,8	2,9	2,9	3,2	4,0	4,7	5,4	6,5	7,9	8,1	8,6	9,3	10,2	11,3	11,4	12,0	12,6	12,6	13,4	14,0	15,0	16,7	15,8	17,6

1) according to the German government's Energy Concept

2) Net heat production, including grid losses

3) sectoral local consumption of energy for application purposes of heating and cooling, without electricity, including district heat

4) sectoral local consumption of energy for application purposes of heating and cooling, without secondary energy carriers electricity and district heat

5) till 2020 according to the European Directive 2009/28/EC, since 2021 according to the European Directive (EU) 2018/2001

Sources: see table 1 and 7; partially preliminary data

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Table 3: Gross electricity production from renewable energy sources 1990 to 2022

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Figures in [GWh]	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Hydropower [1]	17.426	14.891	17.397	17.878	19.930	21.780	21.957	17.357	17.216	19.647	21.732	22.733	23.124	18.322	20.745	19.638	20.031	21.170	20.443	19.031	20.953	17.671	21.755	22.998	19.587	18.977	20.546	20.150	18.098	20.135	18.721	19.657	17.625
Wind energy onshore	72	102	281	612	927	1.530	2.073	3.025	4.579	5.639	9.703	10.719	16.102	19.087	26.019	27.774	31.324	40.507	41.385	39.382	38.371	49.280	50.948	51.819	57.026	72.340	67.650	88.018	90.484	101.150	104.796	89.795	99.692
Wind energy offshore	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	38	176	577	732	918	1.471	8.284	12.274	17.675	19.467	24.744	27.306	24.374	25.124
Solar Photovoltaic	1	1	4	3	7	7	12	18	36	31	61	78	166	320	568	1.308	2.265	3.137	4.508	6.715	11.963	19.991	26.744	30.621	35.448	38.076	37.556	38.761	44.320	45.221	49.496	50.472	60.304
Solid biofuels [2]	4	9	14	32	51	85	118	179	210	246	925	1.112	1.485	3.392	5.162	7.478	8.819	8.699	9.296	9.746	10.351	10.516	10.693	10.555	10.798	11.034	10.797	10.644	11.068	11.038	11.306	10.738	10.254
Liquid biofuels	0	0	0	0	0	0	0	0	0	0	0	15	20	54	142	121	749	987	1.133	1.700	1.331	398	355	299	347	443	508	454	397	344	320	210	97
Biogas	1	2	3	4	6	18	31	44	118	145	445	745	1.046	1.614	1.181	1.803	3.557	8.915	11.648	14.020	16.265	19.936	25.920	27.468	28.614	30.086	30.726	31.089	30.266	30.106	30.671	30.552	30.469
Biomethane	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	21	46	81	385	596	1.117	1.713	2.512	3.147	3.146	2.966	2.980	2.990	3.046	3.273	3.098
Sewage gas	29	25	20	24	27	34	41	48	633	727	705	735	777	955	986	1.096	1.057	1.033	1.094	1.131	1.203	1.280	1.314	1.308	1.336	1.389	1.440	1.460	1.555	1.581	1.579	1.576	1.553
Landfill gas	188	224	259	372	485	525	565	605	677	727	812	748	771	793	988	1.068	1.092	1.009	864	788	674	628	536	483	435	396	358	338	305	287	247	229	201
Biogenic fraction of waste [3]	1.213	1.211	1.262	1.203	1.306	1.348	1.343	1.397	1.618	1.740	1.844	1.859	1.949	2.238	2.253	3.252	3.901	4.521	4.671	4.323	4.746	4.755	4.951	5.415	6.069	5.768	5.930	5.956	6.163	5.806	5.820	5.792	5.562
Geothermal energy	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,2	0,2	0,4	0,4	18	19	28	19	25	80	98	133	175	163	178	197	231	244	206
Total	**18.934**	**16.465**	**19.240**	**20.128**	**22.739**	**25.327**	**26.140**	**22.673**	**25.087**	**28.902**	**36.227**	**38.744**	**45.440**	**46.775**	**58.044**	**63.538**	**72.795**	**89.999**	**95.106**	**96.974**	**106.446**	**125.647**	**145.090**	**153.677**	**163.741**	**190.073**	**191.106**	**217.674**	**225.281**	**243.599**	**253.539**	**236.912**	**254.185**
for information: amount of electricity under the EEG [4]	-	-	-	-	-	-	-	-	-	-	10.391	18.145	24.970	28.417	38.511	43.967	51.545	67.010	71.148	75.377	82.332	103.136	118.330	125.693	136.936	162.730	162.348	188.300	196.306	212.765	221.956	203.362	219.765

1) river and storage power plants including pumped storage plants with natural inflow

2) including sewage sludge

3) biogenic fraction of waste in waste incineration plants estimated at 50 %, from 2008 only municipal waste

4) fixed remuneration, market premium (since 2012), "green electricity privilege" and other direct marketing as well as the amount of remunerated self consumed electricity of photovoltaic plants under the EEG regulations between 2009-2012, including mine gas

annual statement of account for the EEG of the transmission system operators: www.netztransparenz.de

Sources: AGEE-Stat based on StBA [26], [27]; BNetzA [8]; ÜNB; ZSW; DENA [24]; BDEW; VDEW [20]; AGEB [1]; DBFZ [13]; IE [21]; partially preliminary data

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Table 3.1: Net electricity production from renewable energy sources 2003 to 2022

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Figures in [GWh]	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Hydropower [1)]	18.075	20.494	19.344	19.718	20.811	20.134	18.743	20.682	17.326	21.332	22.660	19.310	18.665	20.215	19.985	17.926	19.957	18.546	19.483	17.458
Wind energy onshore	18.713	25.509	27.229	30.710	39.713	40.574	38.610	37.619	48.314	49.949	50.803	55.908	70.922	66.324	86.293	88.710	99.166	102.741	88.034	97.738
Wind energy offshore	0	0	0	0	0	0	38	174	568	722	905	1.449	8.162	12.092	17.414	19.179	24.379	26.903	24.014	24.752
Solar Photovoltaic	313	557	1.282	2.220	3.075	4.420	6.583	11.729	19.599	26.220	30.020	34.753	37.330	36.820	38.001	43.451	44.334	48.525	49.482	59.121
Solid biofuels [2)]	3.016	4.512	6.721	7.913	7.824	8.285	8.733	9.247	9.395	9.509	9.392	9.657	9.855	9.673	9.542	9.807	9.790	10.002	9.594	9.199
Liquid biofuels	53	137	117	726	958	1.099	1.649	1.291	386	319	286	333	425	481	428	381	330	308	201	91
Biogas	1.565	1.146	1.749	3.450	8.647	11.298	13.599	15.777	19.338	25.143	26.644	27.756	29.184	29.804	30.156	29.358	29.206	29.754	29.639	29.558
Biomethane	0	0	0	0	20	44	79	376	582	1.091	1.672	2.452	3.071	3.070	2.895	2.930	2.923	2.977	3.195	3.024
Sewage gas	923	947	1.057	1.023	999	1.033	1.042	1.093	1.179	1.217	1.215	1.283	1.308	1.331	1.357	1.551	1.578	1.576	1.572	1.550
Landfill gas	741	967	1.040	1.046	962	826	713	600	595	512	461	416	384	343	324	279	262	233	215	188
Biogenic fraction of waste [3)]	1.649	1.647	2.422	2.965	3.519	3.667	3.352	3.755	3.795	3.971	4.305	4.838	4.565	4.746	4.802	4.932	4.626	4.638	4.575	4.374
Geothermal energy	0	0	0	0	0	12	13	20	19	25	69	67	91	164	157	126	144	173	174	152
Total	**45.048**	**55.916**	**60.961**	**69.771**	**86.528**	**91.392**	**93.154**	**102.363**	**121.096**	**140.010**	**148.432**	**158.222**	**183.962**	**185.063**	**211.354**	**218.630**	**236.695**	**246.376**	**230.178**	**247.205**

1) river and storage power plants including pumped storage plants with natural inflow

2) including sewage sludge

3) biogenic fraction of waste in waste incineration plants estimated at 50 %, from 2008 only municipal waste

annual statement of account for the EEG of the transmission system operators: www.netztransparenz.de

Sources: AGEE-Stat based on StBA [26], [27]; BNetzA [8]; ÜNB; ZSW; DENA [24]; BDEW; VDEW [20]; AGEB [1]; DBFZ [13]; IE [21]; partially preliminary data

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Table 4: Installed electrical capacity of renewable energy plants 1990 to 2022

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Figures in [MW]	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Hydropower [1]	3.982	4.033	4.049	4.117	4.211	4.348	4.305	4.296	4.369	4.547	4.831	4.831	4.937	4.953	5.186	5.210	5.193	5.137	5.164	5.340	5.407	5.625	5.607	5.590	5.580	5.589	5.629	5.627	5.347	5.396	5.454	5.489	5.621
Wind energy onshore	55	106	174	326	618	1.121	1.549	2.089	2.877	4.435	6.097	8.738	11.976	14.381	16.419	18.248	20.474	22.116	22.794	25.697	26.823	28.524	30.711	32.969	37.620	41.297	45.283	50.174	52.328	53.187	54.276	55.904	58.014
Wind energy offshore [2]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	35	80	188	268	508	994	3.283	4.152	5.406	6.393	7.555	7.807	7.807	8.149
Solar Photovoltaic	2	2	6	9	12	18	28	42	54	70	114	176	296	435	1.105	2.056	2.899	4.170	6.120	10.566	18.006	25.916	34.077	36.710	37.900	39.224	40.679	42.293	45.158	48.864	54.314	60.038	67.479
Solid biofuels	64	64	65	72	80	80	93	115	135	194	304	384	523	859	1.020	1.218	1.411	1.431	1.457	1.470	1.502	1.554	1.558	1.623	1.589	1.592	1.600	1.601	1.567	1.568	1.571	1.587	1.592
Liquid biofuels	0	0	0	0	0	0	0	0	0	0	0	5	6	18	21	60	177	295	341	412	410	345	277	263	232	232	231	230	230	231	231	201	196
Biogas [3]	1	2	2	3	4	9	15	19	43	49	78	111	160	190	249	665	1.000	1.226	1.419	2.520	3.015	3.837	4.212	4.317	4.380	4.601	4.780	5.173	5.610	5.951	6.343	6.453	6.516
Biomethane [3]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	16	18	96	218	256	383	603	614	653	567	602	603	621	629	630
Sewage gas [4]	5	5	4	4	5	6	8	9	115	132	128	134	141	149	157	161	170	177	186	192	200	233	236	240	245	245	245	242	421	396	374	373	371
Landfill gas	59	64	68	95	119	132	145	158	168	173	193	193	200	212	240	248	252	257	268	261	237	232	214	210	211	183	172	165	169	162	156	137	132
Geothermal energy	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	3	8	8	8	19	30	33	34	38	38	42	47	47	54	59
Biogenic fraction of waste [5]	275	275	275	282	250	255	276	264	270	278	293	293	293	451	472	587	637	614	684	720	762	743	714	930	944	962	978	1.004	1.063	1.084	1.024	1.040	1.023
Total	**4.443**	**4.551**	**4.643**	**4.908**	**5.299**	**5.969**	**6.419**	**6.992**	**8.031**	**9.878**	**12.038**	**14.865**	**18.532**	**21.648**	**24.869**	**28.453**	**32.213**	**35.432**	**38.452**	**47.239**	**56.546**	**67.423**	**78.149**	**83.773**	**90.331**	**97.856**	**104.440**	**112.520**	**118.930**	**125.044**	**132.218**	**139.712**	**149.782**

1) river and storage power plants including pumped storage plants with natural inflow

2) installed capacity of offshore wind energy plants connected to the network

3) since 2013 including additional capacity for increased flexibility of electricity production

4) till 2014 calculated based on the electricity production and full-load hours specific to the energy source, since 2015 net additions according to registry data of the Federal Network Agency (BNetzA), since 2018 based on StBA

5) the stated values represent an amount of 50% of the total installed capacity of thermal waste combustion plants using municipal renewable and fossil waste. For the whole time series 50% of the total capacity is considered as renewable.

Sources: AGEE-Stat based on BNetzA [8]; StBA [27]; ZSW, DENA [24]; BDEW; VDEW [20], DBFZ [13], DEWI [14]; IE [21]; partially preliminary data

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Table 5: Final energy consumption from renewable sources for heating and cooling 1990 to 2022

Status: September 2023

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Figures in [GWh]	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Solid biofuels (households) [1]	25.355	25.448	25.448	25.448	25.448	25.448	25.448	42.740	44.369	45.590	45.834	52.307	50.963	54.279	53.044	52.222	61.496	64.092	74.020	65.220	79.304	71.904	83.015	85.941	69.484	69.477	66.289	68.393	70.192	71.154	66.874	78.559	79.968
Solid biofuels (TCS sector) [2]	-	-	-	-	-	-	-	-	-	-	-	-	-	6.972	9.581	9.695	11.120	11.443	16.046	16.476	21.236	15.813	17.437	18.696	14.945	17.137	16.731	17.450	17.812	19.219	19.101	21.821	20.414
Solid biofuels (industry) [3]	2.909	2.909	2.909	2.909	2.909	2.909	2.788	2.788	3.959	3.917	3.898	4.161	4.273	12.442	18.462	21.266	20.319	22.367	20.156	22.972	28.088	29.089	27.793	25.600	26.530	25.108	27.031	26.326	24.522	23.784	23.279	24.820	33.946
Solid biofuels (HP/CHP) [4]	1	3	5	11	18	30	41	63	74	86	324	389	520	994	1.797	2.043	2.104	2.225	2.759	3.581	4.057	4.665	5.776	5.532	5.465	5.957	6.259	6.193	5.740	6.121	6.296	6.796	6.346
Liquid biofuels [5]	0	0	0	0	0	0	0	0	3	2	8	10	48	701	823	1.225	1.814	2.869	3.442	3.735	3.442	2.603	2.204	2.196	2.372	2.189	2.188	2.194	2.298	2.383	3.217	2.599	2.430
Biogas	-	-	-	-	-	-	-	-	-	-	-	-	-	312	466	875	1.495	3.935	3.728	5.412	7.811	9.352	8.903	9.458	10.639	11.588	12.306	12.980	13.304	13.783	14.339	14.818	15.152
Biomethane	-	-	-	-	-	-	-	-	-	-	-	-	-	0	0	0	0	23	68	136	505	760	1.329	2.533	3.268	3.970	4.039	3.740	3.861	3.983	4.216	4.982	4.769
Sewage gas	-	-	-	-	-	-	-	-	-	-	-	-	-	1.830	1.968	2.082	1.852	1.858	1.972	1.977	1.999	2.059	2.017	1.805	1.801	2.001	2.050	2.141	2.500	2.402	2.378	2.367	2.375
Landfill gas	-	-	-	-	-	-	-	-	-	-	-	-	-	176	165	231	227	210	154	155	117	101	94	93	98	120	116	107	110	107	95	85	81
Gaseous biofuels	-	-	-	-	-	-	-	-	1.335	1.263	1.355	1.353	1.438	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Biogenic fraction of waste [6]	2.308	2.308	2.308	2.308	2.308	2.308	2.538	2.290	3.405	3.674	3.548	3.421	3.295	5.642	6.034	7.199	8.433	10.747	6.662	6.530	7.260	8.140	9.033	11.645	11.380	11.807	11.669	12.669	14.508	15.308	15.060	15.601	14.836
Solarthermal energy	131	168	219	263	334	417	521	656	785	1.036	1.226	1.540	1.814	2.389	2.421	2.857	3.363	3.746	4.293	5.061	5.383	6.160	6.416	6.500	7.026	7.562	7.604	7.834	8.955	8.667	9.014	8.551	9.733
Geothermal energy [7]	100	100	100	100	100	100	111	111	113	113	113	114	114	445	464	532	525	524	550	623	689	722	805	864	1.052	969	1.146	1.168	1.308	1.369	1.427	1.575	1.819
Near-surface geothermal energy, ambient heat [8]	1.702	1.721	1.746	1.772	1.801	1.834	1.875	1.932	2.004	2.078	2.160	2.263	2.378	2.495	2.638	2.840	3.314	3.989	4.740	5.528	6.294	7.140	8.016	8.858	9.646	10.401	11.196	12.116	13.155	14.243	15.562	17.332	19.878
Total	**32.506**	**32.657**	**32.735**	**32.811**	**32.918**	**33.046**	**33.322**	**50.580**	**56.047**	**57.759**	**58.466**	**65.558**	**64.843**	**88.677**	**97.863**	**103.067**	**116.062**	**128.028**	**138.590**	**137.406**	**166.185**	**158.508**	**172.838**	**179.721**	**163.706**	**168.286**	**168.624**	**173.311**	**178.265**	**182.523**	**180.858**	**199.906**	**211.747**

1) till 2004 according to the Working Group on Energy Balances (AGEB); since 2005 according to Thünen Institute; including charcoal

2) TCS = trade, commerce and service sector; Final energy consumption for heat only production acccording to Thünen Institute plus fuel input for heat production in decentralised CHP plants; including charcoal; since 2018 including sewage sludge

3) in accordance with Section 8 Energy Statistics Act; including sewage sludge

4) in accordance with Section 3 and 5 Energy Statistics Act, including sewage sludge; HP = heating plants, CHP plant = combined heat and power plant

5) including consumption of biodiesel in agriculture, forestry and military; since 2010 including blended bioethanol

6) biogenic fraction of waste in waste incineration plants estimated at 50 %, since 2008 municipal waste only, decrease 2008 due to first-time inclusion of newly available data (statistical adjustment)

7) before 2003 balneological plants are not taken into account

8) Based on GZB and FH-ISE, renewable heat from heat pumps (air-water, water-water, brine-water, process water and gas heat pumps)

Sources: AGEE-Stat based on StBA [26], [28]; ZSW; AGEB [1]; TI [23], [29], [31]; FNR [19]; Uni HH [15]; DENA [24]; DBFZ; LIAG; GZB [2]; BDH; BSW; DEPV; BWP; partially preliminary data

Table 5.1: Renewable energy sources in the production of district heating 2003 to 2022

Status: September 2023

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Figures in [GWh]	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Biogenic fraction of waste [1]	3.454	3.577	4.378	5.304	5.482	6.373	6.105	6.563	6.728	7.414	8.371	8.225	8.412	8.518	8.993	10.010	10.133	9.628	10.541	10.072
Solid biofuels [2]	1.082	1.968	2.242	2.314	2.438	3.028	3.929	4.428	5.184	6.467	6.210	6.250	6.783	7.169	7.084	6.657	6.895	7.091	7.666	7.239
Gaseous and liquid biofuels [3]	145	168	272	281	341	343	541	574	728	1.004	869	915	1.127	1.147	1.130	2.348	2.590	2.840	3.099	3.421
Biomethane	-	-	-	-	-	-	-	-	-	-	524	951	1490	1471	1404	1960	2028	2235	2401	2315
Geothermal energy, ambient heat, solarthermal energy	-	-	-	-	-	-	-	-	-	-	61	87	177	223	180	372	484	552	557	862
Total	**4.681**	**5.713**	**6.892**	**7.899**	**8.261**	**9.744**	**10.575**	**11.565**	**12.640**	**14.885**	**16.035**	**16.428**	**17.989**	**18.528**	**18.791**	**21.347**	**22.130**	**22.346**	**24.264**	**23.909**

Figures in [%]	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
for information: share of grid losses and consumption in the transformation sector [4]	8,1	8,7	8,9	9,1	8,7	8,9	8,9	8,4	10,0	10,7	10,9	12,6	12,2	12,7	12,6	13,8	11,2	11,2	11,3	12,3

Grid losses are not taken into account

1) biogenic fraction of waste in waste incineration plants estimated at 50 %, from 2008 only municipal waste

2) including sewage sludge

3) sum of gaseous and liquid biomasses: biogas, biomethane, sewage gas, landfill gas and liquid biofuels; until 2012 including geothermal energy, near-surface geothermal energy, ambient heat and biomethane; reported separately as of 2013

4) share of grid losses including consumption in the transformation sector, with reference to the total district heat production (renewable and fossil energy sources)

Sources: AGEE-Stat based on StBA [26]

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Table 5.2: Final energy consumption from renewable sources for heating and cooling by sectors 2003 to 2022

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Total

Figures in [GWh]	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Solid biofuels [1]	73.690	81.081	83.183	92.935	97.902	110.221	104.669	128.630	116.806	128.244	130.237	110.957	111.723	110.051	112.169	112.526	114.157	109.255	125.200	134.328
Gaseous and liquid biofuels [2]	2.896	3.292	4.207	5.181	8.622	9.104	10.987	13.410	14.231	13.658	12.779	14.115	14.912	15.662	16.446	16.182	16.368	17.501	17.115	17.028
Biomethane	-	-	-	-	-	-	-	-	-	-	2.066	2.437	2.661	2.755	2.513	2.172	2.182	2.232	2.853	2.739
Biogenic fraction of waste [3]	2.467	2.768	3.210	3.611	5.743	855	966	1.245	2.086	2.411	4.188	4.188	4.419	4.233	4.807	5.877	6.314	6.513	6.256	6.006
Geothermal energy, ambient heat, solarthermal energy	5.326	5.509	6.195	7.165	8.222	9.518	11.148	12.302	14.006	15.210	16.161	17.638	18.757	19.724	20.936	23.097	23.848	25.514	26.963	30.676
Total	**84.379**	**92.650**	**96.795**	**108.892**	**120.489**	**129.698**	**127.770**	**155.587**	**147.129**	**159.523**	**165.431**	**149.335**	**152.472**	**152.425**	**156.871**	**159.854**	**162.869**	**161.015**	**178.386**	**190.777**

Households

Figures in [GWh]	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Solid biofuels [1]	54.276	53.038	52.222	61.496	64.093	74.020	65.220	79.304	71.904	83.014	85.941	69.483	69.477	66.289	68.393	70.192	71.154	66.874	78.559	79.968
Gaseous and liquid biofuels [2]	43	72	162	381	948	943	1.421	1.753	2.055	2.466	2.277	2.591	2.822	3.008	3.176	2.994	3.014	3.109	3.158	3.101
Biomethane	-	-	-	-	-	-	-	-	-	-	554	644	662	697	659	563	574	577	624	680
Solarthermal energy	2.189	2.234	2.649	3.138	3.504	4.032	4.772	5.090	5.840	6.094	6.184	6.696	7.218	7.265	7.491	8.566	8.293	8.621	8.174	9.310
Geothermal energy [4]	18	44	82	50	47	67	95	164	184	245	253	236	267	346	323	267	294	281	441	414
Near-surface geothermal energy, ambient heat [6]	2.341	2.474	2.664	3.109	3.742	4.460	5.185	5.878	6.669	7.495	8.291	9.029	9.714	10.423	11.231	12.028	12.958	14.138	15.729	18.071
Total	**58.867**	**57.862**	**57.779**	**68.174**	**72.334**	**83.522**	**76.693**	**92.189**	**86.652**	**99.314**	**103.500**	**88.679**	**90.160**	**88.028**	**91.273**	**94.610**	**96.287**	**93.600**	**106.685**	**111.544**

TCS sector

Figures in [GWh]	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Solid biofuels [1]	6.972	9.581	9.695	11.120	11.443	16.046	16.476	21.237	15.813	17.437	18.696	14.945	17.137	16.731	17.450	17.812	19.219	19.101	21.821	20.414
Gaseous biofuels [5]	2.006	2.170	2.514	2.846	4.307	4.341	5.572	6.534	7.452	8.503	7.809	8.645	9.436	9.965	10.514	10.351	10.268	10.477	10.611	10.462
Liquid biofuels, biodiesel in agriculture and forestry	521	776	1.110	1.683	2.596	2.591	3.148	2.762	2.137	2.016	1.910	2.066	1.912	1.894	1.935	2.096	2.146	3.009	2.439	2.274
Biomethane	-	-	-	-	-	-	-	-	-	-	1.453	1.725	1.807	1.854	1.736	1.444	1.459	1.407	1.529	1.590
Solarthermal energy	199	187	208	226	242	261	289	293	319	319	312	327	343	338	341	385	369	381	358	403
Geothermal energy [4]	424	406	416	436	440	418	464	462	523	536	554	732	528	579	666	721	647	666	659	669
Near-surface geothermal energy, ambient heat [6]	155	164	176	206	247	280	343	415	471	521	567	618	687	773	884	1.004	1.158	1.297	1.461	1.679
Total [7]	**10.395**	**13.490**	**14.471**	**16.853**	**19.588**	**24.173**	**26.530**	**31.945**	**26.734**	**29.332**	**31.301**	**29.058**	**31.850**	**32.134**	**33.526**	**33.813**	**35.266**	**36.338**	**38.878**	**37.491**

Industry

Figures in [GWh]	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Solid biofuels [1]	12.442	18.462	21.266	20.319	22.366	20.155	22.973	28.089	29.089	27.793	25.600	26.529	25.109	27.031	26.326	24.522	23.784	23.280	24.820	33.946
Gaseous and liquid biofuels [2]	326	274	421	271	771	1.229	846	2.361	2.587	673	783	813	742	795	821	741	940	906	907	1.191
Biomethane	-	-	-	-	-	-	-	-	-	-	59	68	192	204	118	165	149	248	700	469
Biogenic fraction of waste [3]	2.349	2.562	2.858	3.275	5.430	619	728	1.003	2.067	2.411	4.188	4.188	4.419	4.233	4.807	5.877	6.314	6.513	6.256	6.006
Geothermal energy, ambient heat, solarthermal energy	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	126	129	130	140	130
Total	**15.117**	**21.298**	**24.545**	**23.865**	**28.567**	**22.003**	**24.547**	**31.453**	**33.743**	**30.877**	**30.630**	**31.598**	**30.462**	**32.263**	**32.072**	**31.431**	**31.316**	**31.077**	**32.823**	**41.742**

1) including sewage sludge
2) sum of gaseous and liquid biomasses: biogas, biomethane, sewage gas, landfill gas and liquid biofuels; since 2013 biomethane depicted separately
3) biogenic fraction of waste in waste incineration plants estimated at 50 %, from 2008 only municipal waste
4) before 2003 balneological plants are not taken into account
5) sum of biogas, biomethane, sewage gas and landfill gas; biomethane since 2013 depicted separately
6) Based on GZB and FH-ISE, renewable heat from heat pumps (air-water, water-water, brine-water, process water and gas heat pumps)
7) includes low amounts of energy from the biogenic fraction of waste of the TCS sector

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Table 6: Final energy consumption from renewable sources in the transport sector 1990 to 2022

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Figures in [GWh]	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Biodiesel [1]	0	2	52	52	289	362	568	930	1.033	1.343	2.583	3.617	5.683	7.919	9.942	17.666	27.938	32.282	25.873	22.966	24.359	23.556	24.628	21.945	22.676	20.829	20.896	21.354	22.329	22.109	30.170	25.072	24.849
Vegetable oil	0	0	21	31	31	52	52	104	115	146	167	209	251	73	125	1.828	7.206	8.533	4.042	961	574	188	251	0	52	10	31	31	10	21	21	21	21
Bioethanol	0	0	0	0	0	0	0	0	0	0	0	0	0	0	486	1.780	3.828	3.391	4.608	6.576	8.537	9.031	9.149	8.832	9.002	8.589	8.604	8.464	8.685	8.353	8.014	8.412	8.692
Biomethane [2]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	13	75	92	333	483	449	345	379	445	389	660	884	965	1.061
RE electricity consumption in transport [3]	465	475	536	570	662	761	778	691	724	823	1.002	1.082	1.247	1.006	1.212	1.353	1.484	1.763	1.699	1.925	2.078	2.494	2.862	3.017	3.169	3.523	3.733	4.328	4.581	4.897	5.248	5.340	6.121
Total	**465**	**477**	**609**	**653**	**982**	**1.175**	**1.398**	**1.725**	**1.872**	**2.312**	**3.752**	**4.908**	**7.181**	**8.998**	**11.765**	**22.627**	**40.456**	**45.969**	**36.226**	**32.441**	**35.623**	**35.361**	**37.223**	**34.277**	**35.348**	**33.296**	**33.643**	**34.622**	**35.994**	**36.040**	**44.337**	**39.810**	**40.744**

Figures in [1.000 t]	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Biodiesel [1]	0	0,2	5	5	28	35	55	90	100	130	250	350	550	771	968	1.720	2.720	3.143	2.519	2.236	2.361	2.258	2.322	2.059	2.148	1.998	2.005	2.073	2.169	2.145	2.805	2.378	2.368
Vegetable oil	0	0	2	3	3	5	5	10	11	14	16	20	24	7	12	175	690	817	387	92	55	18	24	0	5	1	3	3	1	2	2	2	2
Bioethanol	0	0	0	0	0	0	0	0	0	0	0	0	0	0	65	238	512	460	625	892	1.158	1.225	1.241	1.198	1.221	1.165	1.167	1.148	1.178	1.133	1.087	1.141	1.179
Biomethane [2]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	6	7	25	36	33	25	28	33	29	49	65	71	78
Total	**0**	**0,2**	**7**	**8**	**31**	**40**	**60**	**100**	**111**	**144**	**266**	**370**	**574**	**778**	**1.045**	**2.133**	**3.922**	**4.420**	**3.531**	**3.221**	**3.580**	**3.508**	**3.612**	**3.293**	**3.407**	**3.189**	**3.203**	**3.257**	**3.377**	**3.329**	**3.959**	**3.592**	**3.627**

1) consumption of biodiesel (including HVO) in the transport sector (excluding consumption in agriculture, forestry and military)

2) based on the net calorific value, relation of gross to net calorific value according to a convention of BDEW/AGEB

3) calculated on the share of renewables-based electricity generation in gross electricity consumption in each year

Sources: AGEE-Stat based on BAFA [5]; BLE [3], [4]; BMF [6]; BReg [9], [10], [11], [12]; StBA [25]; FNR; ZSW; DBFZ; AGQM; UFOP; partially preliminary data

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Table 7: Development of energy consumption in Germany 1990 to 2022

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Figures in [TWh]	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Gross electricity consumption [1]	549,9	538,7	531,6	526,6	531,1	541,8	550,4	547,7	555,4	557,1	578,0	588,9	592,7	605,8	615,2	618,3	622,9	624,9	621,5	584,5	618,9	610,4	610,1	607,2	594,5	600,7	600,6	601,9	594,6	577,6	557,8	571,5	552,1
Production of district heating						115,7	108,2	100,0	101,2	94,2	87,1	87,6	87,9	129,6	136,6	136,1	135,8	130,1	133,0	130,4	143,1	129,8	133,6	135,6	121,8	127,1	130,3	130,5	130,2	127,2	118,3	137,8	119,1
Final energy consumption for heating and cooling (including district heat) [2]	1.529,0	1.493,9	1.404,5	1.418,1	1.391,1	1.421,7	1.513,1	1.462,0	1.421,0	1.349,7	1.322,5	1.399,4	1.336,5	1.335,3	1.311,7	1.298,5	1.353,6	1.200,1	1.312,0	1.208,8	1.339,2	1.242,9	1.265,7	1.306,9	1.186,0	1.227,3	1.228,5	1.234,4	1.204,1	1.218,9	1.194,5	1.263,9	1.162,0
Final energy consumption for heating and cooling (without electricity and district heat) [3]	-	-	-	-	-	-	-	-	-	-	-	-	-	1.216,2	1.187,1	1.174,6	1.230,1	1.081,4	1.190,8	1.090,1	1.208,0	1.126,3	1.146,4	1.186,1	1.079,6	1.115,6	1.114,8	1.120,4	1.092,7	1.106,8	1.089,8	1.142,2	1.057,3
thereof in: Households	-	-	-	-	-	-	-	-	-	-	-	-	-	583,6	551,3	538,7	555,3	454,4	541,8	504,8	549,9	467,9	511,4	538,7	451,5	474,9	488,5	484,8	487,9	511,6	512,4	518,8	486,7
thereof in: TCS	-	-	-	-	-	-	-	-	-	-	-	-	-	185,6	187,9	214,3	240,9	180,2	206,0	196,8	202,5	194,9	191,9	212,0	200,5	206,0	177,4	180,9	160,8	164,6	160,4	168,8	157,6
thereof in: Industry	-	-	-	-	-	-	-	-	-	-	-	-	-	447,0	447,9	421,6	433,9	446,8	443,0	388,5	455,6	463,5	443,1	435,4	427,6	434,7	448,9	454,7	444,0	430,6	417,0	454,6	413,0
Final energy consumption in the transport sector [4]	615,8	630,0	651,8	668,7	654,4	669,2	669,5	672,6	684,0	703,9	691,6	678,3	671,5	637,0	619,0	614,8	648,8	624,0	632,3	609,2	606,7	613,0	607,5	619,4	616,2	642,5	650,8	655,3	657,0	652,9	593,6	583,3	593,9

Figures in [PJ]	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Gross final energy consumption EU-Directive [5]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	9.608	9.486	9.724	9.206	9.581	8.991	9.617	9.140	9.318	9.543	9.063	9.234	9.395	9.477	9.345	9.308	8.776	9.065	8.830
Final energy consumption in the transport sector EU-Directive [5]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.293	2.219	2.250	2.194	2.159	2.120	2.149	2.176	2.160	2.206	2.237	2.270	2.320	2.363	2.282	2.307	2.125	2.086	2.125

Figures in [PJ]	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Primary energy consumption [6]	14.905	14.610	14.320	14.309	14.185	14.269	14.746	14.614	14.521	14.323	14.401	14.679	14.427	14.589	14.573	14.504	14.852	14.199	14.381	13.512	14.137	13.527	13.632	13.917	13.251	13.389	13.513	13.534	13.197	12.826	11.904	12.469	11.750

1) gross electricity production by fossil fuels accounting to AGEB status September 2023, data on electricity trade according to StBA

2) sectoral local consumption of energy for application purposes of heating and cooling, without electricity consumption, including district heat; calculation based on Working Group on Energy Balances (AGEB), status 15. September 2023 and AGEE-Stat

3) sectoral local consumption of energy for application purposes of heating and cooling, without secondary energy carriers electricity and district heat; calculation based on Working Group on Energy Balances (AGEB), status 15. September 2023 and AGEE-Stat

4) calculation based on Working Group on Energy Balances (AGEB), status 15. September 2023 and AGEE-Stat, without energy consumption for international aviation

5) till 2020 according to the European Directive 2009/28/EC, since 2021 according to the European Directive (EU) 2018/2001

6) calculation based on Working Group on Energy Balances (AGEB), status 15. September 2023 and AGEE-Stat, calculated by the "physical energy content" principle

Sources: AGEE-Stat based on AGEB [1]; StBA [30]; Eurostat [18]; IEA [22]; EP/ER [16], [17]; partially preliminary data

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Table 8.1: Greenhouse gas emissions avoided through the use of renewable energy sources 1990 to 2022

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Figures in [1.000 t CO_2-eq.]	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
by RE gross electricity production	21.284	18.370	21.449	22.263	25.000	27.541	27.319	22.402	23.749	28.029	33.903	36.776	43.267	43.132	52.922	55.977	55.608	65.831	64.701	67.307	73.473	90.695	91.765	94.601	111.749	128.041	127.911	140.837	147.325	174.871	181.259	167.526	180.647
by RE final energy consumption for heating and cooling	7.082	7.118	7.116	7.131	7.153	7.178	7.176	10.914	12.225	12.439	12.572	14.103	13.864	19.714	22.237	20.470	22.514	25.074	27.303	27.956	32.960	32.066	34.290	35.074	32.744	34.283	34.589	34.736	36.991	37.820	37.828	41.728	46.000
by RE final energy consumption in the transport sector [1) 2)]	0	0,4	14	16	62	80	121	202	225	293	537	746	1.151	1.654	2.155	4.247	7.685	8.728	6.914	6.117	6.663	6.540	7.078	6.478	6.747	6.359	6.972	7.456	7.783	7.569	11.117	9.885	9.939
Total avoided GHG-emissions	**28.366**	**25.488**	**28.579**	**29.410**	**32.215**	**34.799**	**34.616**	**33.518**	**36.199**	**40.761**	**47.012**	**51.625**	**58.282**	**64.500**	**77.314**	**80.694**	**85.807**	**99.633**	**98.918**	**101.380**	**113.096**	**129.301**	**133.133**	**136.153**	**151.240**	**168.683**	**169.472**	**183.029**	**192.099**	**220.260**	**230.204**	**219.139**	**236.586**

Figures in [g CO_2-eq./kWh]	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Avoidance factor of RE gross electricity production	1.124	1.116	1.115	1.106	1.099	1.087	1.045	988	947	970	936	949	952	922	912	881	764	731	680	694	690	722	632	616	682	674	669	647	654	718	715	707	711
Avoidance factor of RE final energy consumption for heating and cooling	218	218	217	217	217	217	215	216	218	215	220	219	218	226	231	202	197	198	199	206	201	205	201	198	203	206	208	203	210	210	211	210	218
Avoidance factor of RE final energy consumption in the transport sector [1) 2)]	-	193	190	189	193	193	194	195	196	196	195	195	194	207	204	200	197	197	200	200	199	199	206	207	210	214	233	246	248	243	284	287	287

1) consumption of biogenic fuels in the transport sector (excluding consumption in agriculture, forestry and military and excluding electricity consumption in the transport sector)

2) based on data of the Federal Office for Agriculture and Food (BLE) for the year 2021 and the fossil reference values according § 3 and § 10 of 38. BImschV

Source: UBA [30] based on sources quoted there; partially preliminary data

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Table 8.2: CO_2-emissions avoided through the use of renewable energy sources 1990 to 2022

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Figures in [1.000 t CO_2]	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
by RE gross electricity production	21.102	18.213	21.263	22.072	24.784	27.291	27.063	22.162	23.470	27.624	33.174	35.935	41.889	41.437	50.411	53.943	52.396	62.104	61.715	65.081	71.393	87.371	89.525	92.679	108.617	128.915	129.558	141.122	146.751	171.803	178.820	164.844	177.140
by RE final energy consumption for heating and cooling	6.974	7.010	7.008	7.021	7.043	7.066	7.047	10.822	12.085	12.260	12.372	13.912	13.647	19.157	21.519	20.028	22.049	24.808	27.146	27.859	33.430	32.581	34.842	35.810	33.592	35.809	36.171	36.346	37.820	38.680	38.913	42.859	46.947
by RE final energy consumption in the transport sector [1)]	0	0,5	17	19	74	96	143	239	266	346	634	881	1.361	1.957	2.553	5.063	9.259	10.581	8.285	7.244	7.876	7.588	8.061	7.357	7.632	7.148	7.646	8.100	8.384	8.198	11.965	10.559	10.613
Total avoided CO_2-emissions	**28.076**	**25.224**	**28.288**	**29.112**	**31.901**	**34.453**	**34.253**	**33.223**	**35.821**	**40.230**	**46.180**	**50.728**	**56.897**	**62.551**	**74.483**	**79.034**	**83.704**	**97.493**	**97.146**	**100.184**	**112.699**	**127.540**	**132.428**	**135.846**	**149.841**	**171.872**	**173.375**	**185.568**	**192.955**	**218.681**	**229.698**	**218.262**	**234.700**

Figures in [g CO_2/kWh]	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Avoidance factor of RE gross electricity production	1.115	1.106	1.105	1.097	1.090	1.078	1.035	977	936	956	916	927	922	886	868	849	720	690	649	671	671	695	617	603	663	678	678	648	651	705	705	696	697
Avoidance factor of RE final energy consumption for heating and cooling	215	215	214	214	214	214	211	214	216	212	216	216	215	220	223	197	193	196	198	206	204	208	204	202	208	216	217	212	215	214	217	216	223
Avoidance factor of RE final energy consumption in the transport sector [1)]	-	228	233	234	230	231	231	231	232	232	231	230	229	245	242	238	238	239	240	237	235	231	235	235	237	240	256	267	267	263	306	306	307

1) consumption of biogenic fuels in the transport sector (excluding consumption in agriculture, forestry and military and excluding electricity consumption in the transport sector)

Source: UBA [30] based on sources quoted there; partially preliminary data

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Table 8.3: Acidifying emissions avoided through the use of renewable energy sources 1990 to 2022 [2]

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Figures in [1.000 t SO_2-eq.]	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
by RE gross electricity production	123,4	105,6	123,6	127,9	143,1	156,7	128,5	83,0	62,9	55,7	41,3	41,3	43,3	33,1	37,0	33,6	26,1	24,3	24,1	21,9	23,7	32,9	21,9	19,9	30,4	97,7	83,3	100,7	111,1	125,8	123,8	114,5	131,0
by RE final energy consumption for heating and cooling	7,6	7,7	7,7	7,7	7,7	7,7	6,5	10,1	9,2	7,7	6,2	6,9	6,2	8,0	7,0	-1,4	-2,5	-3,7	1,6	-1,1	-4,1	-4,1	-7,0	-11,0	-8,8	-12,6	-13,1	-20,3	-20,5	-21,0	-24,5	-25,9	-20,5
by RE final energy consumption in the transport sector [1]	0	0,00002	0,003	0,004	0,01	0,01	0,01	0,03	0,03	0,04	0,1	0,1	0,1	0,1	-0,2	-1,2	-3,6	-11,9	-7,8	-4,8	-7,0	-4,6	-6,0	-6,9	-4,8	-3,7	-3,6	-1,8	-1,9	-2,9	5,9	4,7	4,6
Total avoided acidifying agents [2]	**131,0**	**113,3**	**131,3**	**135,6**	**150,8**	**164,4**	**135,0**	**93,1**	**72,1**	**63,4**	**47,6**	**48,3**	**49,6**	**41,2**	**43,8**	**31,0**	**20,0**	**8,7**	**17,9**	**16,0**	**12,6**	**24,2**	**8,9**	**2,0**	**16,8**	**81,4**	**66,6**	**78,6**	**88,7**	**101,9**	**105,2**	**93,3**	**115,1**

Figures in [g SO_2-eq./kWh]	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Avoidance factor of RE gross electricity production	6,52	6,41	6,42	6,35	6,29	6,19	4,92	3,66	2,51	1,93	1,14	1,07	0,95	0,71	0,64	0,53	0,36	0,27	0,25	0,23	0,22	0,26	0,15	0,13	0,19	0,51	0,44	0,46	0,49	0,52	0,49	0,48	0,52
Avoidance factor of RE final energy consumption for heating and cooling	0,23	0,23	0,23	0,24	0,23	0,23	0,20	0,20	0,16	0,13	0,11	0,11	0,10	0,09	0,07	-0,01	-0,02	-0,03	0,01	-0,01	-0,02	-0,03	-0,04	-0,06	-0,05	-0,08	-0,08	-0,12	-0,12	-0,12	-0,14	-0,13	-0,10
Avoidance factor of RE final energy consumption in the transport sector [1]	-	0,01	0,04	0,05	0,02	0,03	0,02	0,03	0,03	0,03	0,02	0,02	0,02	0,01	-0,02	-0,06	-0,09	-0,27	-0,22	-0,16	-0,21	-0,14	-0,17	-0,22	-0,15	-0,12	-0,12	-0,06	-0,06	-0,09	0,15	0,14	0,13

1) consumption of biogenic fuels in the transport sector (excluding consumption in agriculture, forestry and military and excluding electricity consumption in the transport sector)

2) as acidifying emissions only SO_2 and Nox are taking into account

Source: UBA [30] based on sources quoted there; partially preliminary data

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Table 9.1: Investments in construction of renewable energy plants 2000 to 2022

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Figures in [million euro] [1]	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Hydropower	520	340	120	170	210	240	220	330	370	500	350	300	200	130	90	80	60	60	120	110	100	70	60
Wind energy onshore	1.920	3.070	3.930	3.360	2.710	2.490	3.220	2.470	2.540	2.800	2.110	2.860	3.550	4.490	7.060	5.370	6.910	7.450	3.390	1.560	2.080	2.840	3.600
Wind energy offshore	-	-	-	-	-	-	-	30	170	470	450	610	2.440	4.270	3.940	3.680	3.370	3.400	4.100	2.130	80	290	1.250
Solar Photovoltaic	260	360	680	760	3.530	4.840	4.010	5.330	7.970	13.570	19.580	15.860	11.980	3.380	1.450	1.480	1.570	1.660	2.580	3.370	4.780	5.230	7.880
Solar thermal energy	440	610	370	480	470	630	990	760	1.700	1.490	990	1.060	950	860	790	800	700	540	490	440	530	550	690
Geothermal energy, ambient heat	130	180	190	210	290	410	940	920	1.230	1.140	960	990	1.060	1.090	1.080	1.010	1.210	1.320	1.520	1.410	1.920	2.530	4.560
Biomass electricity	530	800	770	1.340	1.640	1.910	2.270	2.280	1.980	2.020	2.240	3.120	790	700	670	220	270	280	390	350	320	220	170
Biomass heat	900	920	900	1.080	1.100	1.510	2.300	1.500	1.760	1.610	1.210	1.320	1.500	1.560	1.320	1.290	1.230	1.230	1.240	1.260	1.940	2.730	3.710
Total	**4.700**	**6.280**	**6.960**	**7.400**	**9.950**	**12.030**	**13.950**	**13.620**	**17.720**	**23.600**	**27.890**	**26.120**	**22.470**	**16.480**	**16.400**	**13.930**	**15.320**	**15.940**	**13.830**	**10.630**	**11.750**	**14.460**	**21.920**

1) differences in the totals may occur due to roundings

Source: ZSW [32]; partially preliminary data

Table 9.2: Economic stimuli from the operation of renewable energy plants 2000 to 2022

Status: September 2023

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Figures in [million euro] [1]	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Hydropower	100	110	110	120	120	130	130	140	150	160	170	190	190	200	200	200	210	210	210	220	230	230	230
Wind energy onshore	160	220	310	400	480	550	630	710	790	870	970	1.060	1.200	1.360	1.550	1.730	1.890	2.080	2.230	2.300	2.300	2.310	2.290
Wind energy offshore	-	-	-	-	-	-	-	-	-	10	20	30	60	130	210	280	350	420	500	560	600	620	650
Solar Photovoltaic	10	10	20	30	70	130	190	260	360	530	770	1.040	1.250	1.360	1.400	1.420	1.440	1.470	1.500	1.540	1.600	1.670	1.760
Solar thermal energy	-	10	20	30	40	50	70	90	110	140	170	190	210	230	240	260	270	290	300	310	320	330	340
Geothermal energy, ambient heat	170	180	190	200	220	240	290	360	440	530	620	730	820	900	980	1.060	1.140	1.230	1.340	1.450	1.580	1.750	2.010
Biomass electricity	160	220	280	450	520	720	1.100	1.680	2.020	2.420	2.880	3.320	4.080	4.200	4.500	4.650	4.640	4.670	4.670	4.780	4.830	4.600	4.700
Biomass heat	1.130	1.160	1.180	1.210	1.250	1.460	1.740	1.960	2.150	2.450	2.880	2.870	3.120	3.320	3.030	3.180	3.360	3.390	3.340	3.350	3.370	3.830	5.120
Biomass fuels	210	300	460	670	880	1.790	3.150	3.750	3.530	2.390	2.920	3.690	3.720	3.050	2.640	2.440	2.560	2.710	2.700	2.830	3.540	4.980	6.730
Total	**1.940**	**2.210**	**2.570**	**3.110**	**3.580**	**5.070**	**7.300**	**8.950**	**9.550**	**9.500**	**11.400**	**13.120**	**14.650**	**14.750**	**14.750**	**15.220**	**15.860**	**16.470**	**16.790**	**17.340**	**18.370**	**20.320**	**23.830**

1) differences in the totals may occur due to roundings

Source: ZSW [32]; partially preliminary data

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		RE 1990 [GWh]		Share of renewable energy [%]	avoided GHG-emissions [1.000 t CO_2-eq.]
Gross electricity production	Hydropower	17.426	of national gross electricity consumption	3,2	20.329
	Wind energy onshore	72		0,01	35
	Wind energy offshore	0		0	0
	Solar Photovoltaic	1		0,0002	0,5
	Solid biofuels	4		0,001	2
	Liquid biofuels	0		0	0
	Biogas	1		0,0002	0,1
	Sewage gas	29		0,005	29
	Landfill gas	188		0,03	190
	Biogenic fraction of waste	1.213		0,2	699
	Geothermal energy	0		0	0
	Total	**18.934**		**3,4**	**21.284**
Final energy consumption for heating and cooling	Solid biofuels (households)	25.355	of final energy consumption for heating and cooling	1,7	5.499
	Solid biofuels (industry)	2.909		0,2	903
	Solid biofuels (HP/CHP)	1		0,0001	0,3
	Liquid biofuels	0		0	0
	Gaseous biofuels	0		0	0
	Biogenic fraction of waste	2.308		0,2	550
	Solar thermal energy	131		0,01	39
	Deep geothermal energy	100		0,01	30
	Near-surface geothermal energy & ambient heat	1.702		0,1	61
	Total	**32.506**		**2,1**	**7.082**
Final energy con-sumption transport	Biodiesel	0	of final energy con-sumption transport	0	0
	Vegetable oil	0		0	0
	Bioethanol	0		0	0
	RE electricity consumption transport	465		0,1	
	Total	**465**		**0,1**	**0**

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		RE 1991 [GWh]		Share of renewable energy [%]	avoided GHG-emissions [1.000 t CO_2-eq.]
Gross electricity production	Hydropower	14.891	of national gross electricity consumption	2,8	17.367
	Wind energy onshore	102		0,02	49
	Wind energy offshore	0		0	0
	Solar Photovoltaic	1		0,0002	0,5
	Solid biofuels	9		0,002	4
	Liquid biofuels	0		0	0
	Biogas	2		0,0004	0,2
	Sewage gas	25		0,005	25
	Landfill gas	224		0,04	226
	Biogenic fraction of waste	1.211		0,2	697
	Geothermal energy	0		0	0
	Total	**16.465**		**3,1**	**18.370**
Final energy consumption for heating and cooling	Solid biofuels (households)	25.448	of final energy consumption for heating and cooling	1,7	5.524
	Solid biofuels (industry)	2.909		0,2	903
	Solid biofuels (HP/CHP)	3		0,0002	0,8
	Liquid biofuels	0		0	0
	Gaseous biofuels	0		0	0
	Biogenic fraction of waste	2.308		0,2	550
	Solar thermal energy	168		0,01	50
	Deep geothermal energy	100		0,01	30
	Near-surface geothermal energy & ambient heat	1.721		0,1	61
	Total	**32.657**		**2,2**	**7.118**
Final energy con-sumption transport	Biodiesel	2	of final energy con-sumption transport	0,0003	0,4
	Vegetable oil	0		0	0
	Bioethanol	0		0	0
	RE electricity consumption transport	475		0,1	
	Total	**477**		**0,1**	**0,4**

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		RE 1992 [GWh]		Share of renewable energy [%]	avoided GHG-emissions [1.000 t CO_2-eq.]
Gross electricity production	Hydropower	17.397	of national gross electricity consumption	3,3	20.296
	Wind energy onshore	281		0,1	134
	Wind energy offshore	0		0	0
	Solar Photovoltaic	4		0,001	1,9
	Solid biofuels	14		0,003	7
	Liquid biofuels	0		0	0
	Biogas	3		0,001	0,4
	Sewage gas	20		0,004	20
	Landfill gas	259		0,05	263
	Biogenic fraction of waste	1.262		0,2	727
	Geothermal energy	0		0	0
	Total	**19.240**		**3,6**	**21.449**
Final energy consumption for heating and cooling	Solid biofuels (households)	25.448	of final energy consumption for heating and cooling	1,8	5.483
	Solid biofuels (industry)	2.909		0,2	905
	Solid biofuels (HP/CHP)	5		0,0004	1,3
	Liquid biofuels	0		0	0
	Gaseous biofuels	0		0	0
	Biogenic fraction of waste	2.308		0,2	550
	Solar thermal energy	219		0,02	65
	Deep geothermal energy	100		0,01	30
	Near-surface geothermal energy & ambient heat	1.746		0,1	82
	Total	**32.735**		**2,3**	**7.116**
Final energy con-sumption transport	Biodiesel	52	of final energy con-sumption transport	0,01	10,0
	Vegetable oil	21		0,003	3,8
	Bioethanol	0		0	0
	RE electricity consumption transport	536		0,1	
	Total	**609**		**0,1**	**14**

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		RE 1993 [GWh]		Share of renewable energy [%]	avoided GHG-emissions [1.000 t CO_2-eq.]
Gross electricity production	Hydropower	17.878	of national gross electricity consumption	3,4	20.858
	Wind energy onshore	612		0,1	293
	Wind energy offshore	0		0	0
	Solar Photovoltaic	3		0,001	1,4
	Solid biofuels	32		0,01	16
	Liquid biofuels	0		0	0
	Biogas	4		0,001	0,5
	Sewage gas	24		0,005	24
	Landfill gas	372		0,1	377
	Biogenic fraction of waste	1.203		0,2	693
	Geothermal energy	0		0	0
	Total	**20.128**		**3,8**	**22.263**
Final energy consumption for heating and cooling	Solid biofuels (households)	25.448	of final energy consumption for heating and cooling	1,8	5.480
	Solid biofuels (industry)	2.909		0,2	905
	Solid biofuels (HP/CHP)	11		0,001	3
	Liquid biofuels	0		0	0
	Gaseous biofuels	0		0	0
	Biogenic fraction of waste	2.308		0,2	550
	Solar thermal energy	263		0,02	77
	Deep geothermal energy	100		0,01	30
	Near-surface geothermal energy & ambient heat	1.772		0,1	85
	Total	**32.811**		**2,3**	**7.131**
Final energy con-sumption transport	Biodiesel	52	of final energy con-sumption transport	0,01	10
	Vegetable oil	31		0,005	6
	Bioethanol	0		0	0
	RE electricity consumption transport	570		0,1	
	Total	**653**		**0,1**	**16**

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		RE 1994 [GWh]		Share of renewable energy [%]	avoided GHG-emissions [1.000 t CO_2-eq.]
Gross electricity production	Hydropower	19.930	of national gross electricity consumption	3,8	23.256
	Wind energy onshore	927		0,2	443
	Wind energy offshore	0		0	0
	Solar Photovoltaic	7		0,001	3
	Solid biofuels	51		0,01	25
	Liquid biofuels	0		0	0
	Biogas	6		0,001	0,8
	Sewage gas	27		0,01	27
	Landfill gas	485		0,1	492
	Biogenic fraction of waste	1.306		0,2	752
	Geothermal energy	0		0	0
	Total	**22.739**		**4,3**	**25.000**
Final energy consumption for heating and cooling	Solid biofuels (households)	25.448	of final energy consumption for heating and cooling	1,8	5.475
	Solid biofuels (industry)	2.909		0,2	905
	Solid biofuels (HP/CHP)	18		0,001	5
	Liquid biofuels	0		0	0
	Gaseous biofuels	0		0	0
	Biogenic fraction of waste	2.308		0,2	550
	Solar thermal energy	334		0,02	98
	Deep geothermal energy	100		0,01	30
	Near-surface geothermal energy & ambient heat	1.801		0,1	90
	Total	**32.918**		**2,4**	**7.153**
Final energy con-sumption transport	Biodiesel	289	of final energy con-sumption transport	0,04	56
	Vegetable oil	31		0,005	6
	Bioethanol	0		0	0
	RE electricity consumption transport	662		0,1	
	Total	**982**		**0,2**	**62**

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		RE 1995 [GWh]		Share of renewable energy [%]	avoided GHG-emissions [1.000 t CO_2-eq.]
Gross electricity production	Hydropower	21.780	of national gross electricity consumption	4,0	25.417
	Wind energy onshore	1.530		0,3	732
	Wind energy offshore	0		0	0
	Solar Photovoltaic	7		0,001	3
	Solid biofuels	85		0,02	42
	Liquid biofuels	0		0	0
	Biogas	18		0,003	2,5
	Sewage gas	34		0,01	34
	Landfill gas	525		0,1	533
	Biogenic fraction of waste	1.348		0,2	776
	Geothermal energy	0		0	0
	Total	**25.327**		**4,7**	**27.541**
Final energy consumption for heating and cooling	Solid biofuels (households)	25.448	of final energy consumption for heating and cooling	1,8	5.465
	Solid biofuels (industry)	2.909		0,2	905
	Solid biofuels (HP/CHP)	30		0,002	8
	Liquid biofuels	0		0	0
	Gaseous biofuels	0		0	0
	Biogenic fraction of waste	2.308		0,2	550
	Solar thermal energy	417		0,03	122
	Deep geothermal energy	100		0,01	30
	Near-surface geothermal energy & ambient heat	1.834		0,1	97
	Total	**33.046**		**2,3**	**7.178**
Final energy con-sumption transport	Biodiesel	362	of final energy con-sumption transport	0,1	71
	Vegetable oil	52		0,01	9
	Bioethanol	0		0	0
	RE electricity consumption transport	761		0,1	
	Total	**1.175**		**0,2**	**80**

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		RE 1996 [GWh]		Share of renewable energy [%]	avoided GHG-emissions [1.000 t CO_2-eq.]
Gross electricity production	Hydropower	21.957	of national gross electricity consumption	4,0	24.948
	Wind energy onshore	2.073		0,4	971
	Wind energy offshore	0		0	0
	Solar Photovoltaic	12		0,002	5
	Solid biofuels	118		0,02	55
	Liquid biofuels	0		0	0
	Biogas	31		0,01	3,7
	Sewage gas	41		0,01	40
	Landfill gas	565		0,1	558
	Biogenic fraction of waste	1.343		0,2	737
	Geothermal energy	0		0	0
	Total	**26.140**		**4,7**	**27.319**
Final energy consumption for heating and cooling	Solid biofuels (households)	25.448	of final energy consumption for heating and cooling	1,7	5.409
	Solid biofuels (industry)	2.788		0,2	862
	Solid biofuels (HP/CHP)	41		0,003	10
	Liquid biofuels	0		0	0
	Gaseous biofuels	0		0	0
	Biogenic fraction of waste	2.538		0,2	596
	Solar thermal energy	521		0,03	152
	Deep geothermal energy	111		0,01	33
	Near-surface geothermal energy & ambient heat	1.875		0,1	114
	Total	**33.322**		**2,2**	**7.176**
Final energy con-sumption transport	Biodiesel	568	of final energy con-sumption transport	0,1	111
	Vegetable oil	52		0,01	9
	Bioethanol	0		0	0
	RE electricity consumption transport	778		0,1	
	Total	**1.398**		**0,2**	**121**

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		RE 1997 [GWh]		Share of renewable energy [%]	avoided GHG-emissions [1.000 t CO_2-eq.]
Gross electricity production	Hydropower	17.357	of national gross electricity consumption	3,2	19.548
	Wind energy onshore	3.025		0,6	1.377
	Wind energy offshore	0		0	0
	Solar Photovoltaic	18		0,003	8
	Solid biofuels	179		0,03	81
	Liquid biofuels	0		0	0
	Biogas	44		0,01	4,7
	Sewage gas	48		0,01	47
	Landfill gas	605		0,1	592
	Biogenic fraction of waste	1.397		0,3	745
	Geothermal energy	0		0	0
	Total	**22.673**		**4,1**	**22.402**
Final energy consumption for heating and cooling	Solid biofuels (households)	42.740	of final energy consumption for heating and cooling	2,9	9.126
	Solid biofuels (industry)	2.788		0,2	872
	Solid biofuels (HP/CHP)	63		0,004	16
	Liquid biofuels	0		0	0
	Gaseous biofuels	0		0	0
	Biogenic fraction of waste	2.290		0,2	536
	Solar thermal energy	656		0,04	190
	Deep geothermal energy	111		0,01	33
	Near-surface geothermal energy & ambient heat	1.932		0,1	140
	Total	**50.580**		**3,5**	**10.914**
Final energy con-sumption transport	Biodiesel	930	of final energy con-sumption transport	0,1	183
	Vegetable oil	104		0,02	19
	Bioethanol	0		0	0
	RE electricity consumption transport	691		0,1	
	Total	**1.725**		**0,3**	**202**

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		RE 1998 [GWh]	Share of renewable energy [%]		avoided GHG-emissions [1.000 t CO_2-eq.]
Gross electricity production	Hydropower	17.216	of national gross electricity consumption	3,1	19.091
	Wind energy onshore	4.579		0,8	2.310
	Wind energy offshore	0		0	0
	Solar Photovoltaic	36		0,01	15
	Solid biofuels	210		0,04	107
	Liquid biofuels	0		0	0
	Biogas	118		0,02	17
	Sewage gas	633		0	608
	Landfill gas	677		0,1	651
	Biogenic fraction of waste	1.618		0,3	951
	Geothermal energy	0,0		0,0	0
	Total	**25.087**		**4,5**	**23.749**
Final energy consumption for heating and cooling	Solid biofuels (households)	44.369	of final energy consumption for heating and cooling	3,1	9.437
	Solid biofuels (industry)	3.959		0,3	1.221
	Solid biofuels (HP/CHP)	74		0,01	19
	Liquid biofuels	3		0,0002	0,6
	Gaseous biofuels	1.335		0,1	347
	Biogenic fraction of waste	3.405		0,2	799
	Solar thermal energy	785		0,1	227
	Deep geothermal energy	113		0,01	34
	Near-surface geothermal energy & ambient heat	2.004		0,1	142
	Total	**56.047**		**3,9**	**12.225**
Final energy con-sumption transport	Biodiesel	1.033	Total	0,2	204
	Vegetable oil	115		0,0	21
	Bioethanol	0		0,0	0
	RE electricity consumption transport	724		0,1	
	Total	**1.872**		**0,3**	**225**

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		RE 1999 [GWh]	Share of renewable energy [%]		avoided GHG-emissions [1.000 t CO_2-eq.]
Gross electricity production	Hydropower	19.647	of national gross electricity consumption	3,5	22.040
	Wind energy onshore	5.639		1,0	3.229
	Wind energy offshore	0		0	0
	Solar Photovoltaic	31		0,01	13
	Solid biofuels	246		0,04	144
	Liquid biofuels	0		0	0
	Biogas	145		0,03	29
	Sewage gas	727		0,1	710
	Landfill gas	727		0,1	710
	Biogenic fraction of waste	1.740		0,3	1.155
	Geothermal energy	0		0	0
	Total	**28.902**		**5,2**	**28.029**
Final energy consumption for heating and cooling	Solid biofuels (households)	45.590	of final energy consumption for heating and cooling	3,4	9.551
	Solid biofuels (industry)	3.917		0,3	1.189
	Solid biofuels (HP/CHP)	86		0,01	21
	Liquid biofuels	2		0,0001	0,4
	Gaseous biofuels	1.263		0,1	330
	Biogenic fraction of waste	3.674		0,3	856
	Solar thermal energy	1.036		0,1	298
	Deep geothermal energy	113		0,01	34
	Near-surface geothermal energy & ambient heat	2.078		0,2	159
	Total	**57.759**		**4,3**	**12.439**
Final energy con-sumption transport	Biodiesel	1.343	Total	0,2	266
	Vegetable oil	146		0,02	26
	Bioethanol	0		0	0
	RE electricity consumption transport	823		0,1	
	Total	**2.312**		**0,3**	**293**

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		RE 2000 [GWh]	Share of renewable energy [%]		avoided GHG-emissions [1.000 t CO_2-eq.]
Gross electricity production	Hydropower	21.732	of national gross electricity consumption	3,8	23.800
	Wind energy onshore	9.703		1,7	6.458
	Wind energy offshore	0		0	0
	Solar Photovoltaic	61		0,01	29
	Solid biofuels	925		0,2	635
	Liquid biofuels	0		0	0
	Biogas	445		0,1	128
	Sewage gas	705		0,1	669
	Landfill gas	812		0,1	772
	Biogenic fraction of waste	1.844		0,3	1.411
	Geothermal energy	0		0	0
	Total	**36.227**		**6,3**	**33.903**
Final energy consumption for heating and cooling	Solid biofuels (households)	45.834	of final energy consumption for heating and cooling	3,5	9.580
	Solid biofuels (industry)	3.898		0,3	1.177
	Solid biofuels (HP/CHP)	324		0,02	81
	Liquid biofuels	8		0,001	2
	Gaseous biofuels	1.355		0,1	348
	Biogenic fraction of waste	3.548		0,3	829
	Solar thermal energy	1.226		0,1	351
	Deep geothermal energy	113		0,01	34
	Near-surface geothermal energy & ambient heat	2.160		0,2	171
	Total	**58.466**		**4,4**	**12.572**
Final energy con-sumption transport	Biodiesel	2.583	Total	0,4	507
	Vegetable oil	167		0,02	30
	Bioethanol	0		0	0
	RE electricity consumption transport	1.002		0,1	
	Total	**3.752**		**0,5**	**537**

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		RE 2001 [GWh]	Share of renewable energy [%]		avoided GHG-emissions [1.000 t CO_2-eq.]
Gross electricity production	Hydropower	22.733	of national gross electricity consumption	3,9	25.119
	Wind energy onshore	10.719		1,8	7.644
	Wind energy offshore	0		0	0
	Solar Photovoltaic	78		0,01	34
	Solid biofuels	1.112		0,2	814
	Liquid biofuels	15		0,003	8
	Biogas	745		0,1	226
	Sewage gas	735		0,1	704
	Landfill gas	748		0,1	717
	Biogenic fraction of waste	1.859		0,3	1.509
	Geothermal energy	0		0	0
	Total	**38.744**		**6,6**	**36.776**
Final energy consumption for heating and cooling	Solid biofuels (households)	52.307	of final energy consumption for heating and cooling	3,7	10.992
	Solid biofuels (industry)	4.161		0,3	1.228
	Solid biofuels (HP/CHP)	389		0,03	97
	Liquid biofuels	10		0,001	2
	Gaseous biofuels	1.353		0,1	333
	Biogenic fraction of waste	3.421		0,2	798
	Solar thermal energy	1.540		0,1	439
	Deep geothermal energy	114		0,01	34
	Near-surface geothermal energy & ambient heat	2.263		0,2	180
	Total	**65.558**		**4,7**	**14.103**
Final energy con-sumption transport	Biodiesel	3.617	Total	0,5	708
	Vegetable oil	209		0,03	38
	Bioethanol	0		0	0
	RE electricity consumption transport	1.082		0,2	
	Total	**4.908**		**0,7**	**746**

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		RE 2002 [GWh]	Share of renewable energy [%]		avoided GHG-emissions [1.000 t CO_2-eq.]
Gross electricity production	Hydropower	23.124	of national gross electricity consumption	3,9	25.620
	Wind energy onshore	16.102		2,7	12.725
	Wind energy offshore	0		0	0
	Solar Photovoltaic	166		0,03	73
	Solid biofuels	1.485		0,3	1.215
	Liquid biofuels	20		0,003	13
	Biogas	1.046		0,2	382
	Sewage gas	777		0,1	747
	Landfill gas	771		0,1	742
	Biogenic fraction of waste	1.949		0,3	1.749
	Geothermal energy	0		0	0
	Total	**45.440**		**7,7**	**43.267**
Final energy consumption for heating and cooling	Solid biofuels (households)	50.963	of final energy consumption for heating and cooling	3,8	10.623
	Solid biofuels (industry)	4.273		0,3	1.264
	Solid biofuels (HP/CHP)	520		0,04	129
	Liquid biofuels	48		0,004	8
	Gaseous biofuels	1.438		0,1	332
	Biogenic fraction of waste	3.295		0,2	765
	Solar thermal energy	1.814		0,1	515
	Deep geothermal energy	114		0,01	34
	Near-surface geothermal energy & ambient heat	2.378		0,2	194
	Total	**64.843**		**4,9**	**13.864**
Final energy con-sumption transport	Biodiesel	5.683	Total	0,8	1.105
	Vegetable oil	251		0,04	45
	Bioethanol	0		0	0
	RE electricity consumption transport	1.247		0,2	
	Total	**7.181**		**1,1**	**1.151**

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		RE 2003 [GWh]		Share of renewable energy [%]	avoided GHG-emissions [1.000 t CO_2-eq.]
Gross electricity production	Hydropower	18.322	of national gross electricity consumption	3,0	19.837
	Wind energy onshore	19.087		3,2	15.793
	Wind energy offshore	0		0	0
	Solar Photovoltaic	320		0,1	148
	Solid biofuels & sewage sludge	3.392		0,6	2.928
	Liquid biofuels	54		0,01	38
	Biogas	1.614		0,3	637
	Sewage gas	955		0,2	897
	Landfill gas	793		0,1	745
	Biogenic fraction of waste	2.238		0,4	2.110
	Geothermal energy	0		0	0
	Total	**46.775**		**7,7**	**43.132**
Final energy consumption for heating and cooling	Solid biofuels & charcoal (households)	54.279	of final energy consumption for heating and cooling	4,1	10.952
	Solid biofuels & charcoal (TCS sector)	6.972		0,5	1.825
	Solid biofuels & sewage sludge (industry)	12.442		0,9	3.628
	Solid biofuels & sewage sludge (HP/CHP)	994		0,1	248
	Liquid biofuels	701		0,05	152
	Biogas	312		0,02	51
	Sewage gas	1.830		0,1	448
	Landfill gas	176		0,01	54
	Biogenic fraction of waste	5.642		0,4	1.329
	Solar thermal energy	2.389		0,2	675
	Deep geothermal energy	445		0,03	134
	Near-surface geothermal energy & ambient heat	2.495		0,2	220
	Total	**88.677**		**6,6**	**19.714**
Final energy consumption transport	Biodiesel	7.919	of final energy consumption transport	1,2	1.601
	Vegetable oil	73		0,01	53
	Bioethanol	0		0	0
	RE electricity consumption transport	1.006		0,2	
	Total	**8.998**		**1,4**	**1.654**

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		RE 2004 [GWh]		Share of renewable energy [%]	avoided GHG-emissions [1.000 t CO_2-eq.]
Gross electricity production	Hydropower	20.745	of national gross electricity consumption	3,4	22.219
	Wind energy onshore	26.019		4,2	21.476
	Wind energy offshore	0		0	0
	Solar Photovoltaic	568		0,1	262
	Solid biofuels & sewage sludge	5.162		0,8	4.445
	Liquid biofuels	142		0,02	98
	Biogas	1.181		0,2	470
	Sewage gas	986		0,2	916
	Landfill gas	988		0,2	919
	Biogenic fraction of waste	2.253		0,4	2.117
	Geothermal energy	0,2		0,00003	0,1
	Total	**58.044**		**9,4**	**52.922**
Final energy consumption for heating and cooling	Solid biofuels & charcoal (households)	53.044	of final energy consumption for heating and cooling	4,0	10.594
	Solid biofuels & charcoal (TCS sector)	9.581		0,7	2.497
	Solid biofuels & sewage sludge (industry)	18.462		1,4	5.464
	Solid biofuels & sewage sludge (HP/CHP)	1.797		0,1	447
	Liquid biofuels	823		0,06	187
	Biogas	466		0,04	76
	Sewage gas	1.968		0,2	477
	Landfill gas	165		0,01	50
	Biogenic fraction of waste	6.034		0,5	1.448
	Solar thermal energy	2.421		0,2	681
	Deep geothermal energy	464		0,04	144
	Near-surface geothermal energy & ambient heat	2.638		0,2	172
	Total	**97.863**		**7,5**	**22.237**
Final energy consumption transport	Biodiesel	9.942	of final energy consumption transport	1,6	1.987
	Vegetable oil	125		0,0	62
	Bioethanol	486		0,1	106
	RE electricity consumption transport	1.212		0,2	
	Total	**11.765**		**1,9**	**2.155**

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		RE 2005 [GWh]		Share of renewable energy [%]	avoided GHG-emissions [1.000 t CO_2-eq.]
Gross electricity production	Hydropower	19.638	of national gross electricity consumption	3,2	20.793
	Wind energy onshore	27.774		4,5	22.485
	Wind energy offshore	0		0	0
	Solar Photovoltaic	1.308		0,2	601
	Solid biofuels & sewage sludge	7.478		1,2	6.329
	Liquid biofuels	121		0,02	82
	Biogas	1.803		0,3	699
	Sewage gas	1.096		0,2	1.007
	Landfill gas	1.068		0,2	981
	Biogenic fraction of waste	3.252		0,5	3.000
	Geothermal energy	0,2		0,00003	0,1
	Total	**63.538**		**10,3**	**55.977**
Final energy consumption for heating and cooling	Solid biofuels & charcoal (households)	52.222	of final energy consumption for heating and cooling	4,0	7.462
	Solid biofuels & charcoal (TCS sector)	9.695		0,7	2.449
	Solid biofuels & sewage sludge (industry)	21.266		1,6	6.241
	Solid biofuels & sewage sludge (HP/CHP)	2.043		0,2	497
	Liquid biofuels	1.225		0,1	270
	Biogas	875		0,1	144
	Sewage gas	2.082		0,2	505
	Landfill gas	231		0,02	71
	Biogenic fraction of waste	7.199		0,6	1.647
	Solar thermal energy	2.857		0,2	791
	Deep geothermal energy	532		0,04	157
	Near-surface geothermal energy & ambient heat	2.840		0,2	237
	Total	**103.067**		**7,9**	**20.470**
Final energy con-sumption transport	Biodiesel	17.666	of final energy con-sumption transport	2,9	3.480
	Vegetable oil	1.828		0,3	374
	Bioethanol	1.780		0,3	394
	RE electricity consumption transport	1.353		0,2	
	Total	**22.627**		**3,7**	**4.247**

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		RE 2006 [GWh]		Share of renewable energy [%]	avoided GHG-emissions [1.000 t CO_2-eq.]
Gross electricity production	Hydropower	20.031	of national gross electricity consumption	3,2	17.363
	Wind energy onshore	31.324		5,0	23.492
	Wind energy offshore	0		0	0
	Solar Photovoltaic	2.265		0,4	1.344
	Solid biofuels & sewage sludge	8.819		1,4	6.827
	Liquid biofuels	749		0,1	414
	Biogas	3.557		0,6	1.431
	Sewage gas	1.057		0,2	696
	Landfill gas	1.092		0,2	720
	Biogenic fraction of waste	3.901		0,6	3.320
	Geothermal energy	0,4		0,0001	0,2
	Total	**72.795**		**11,7**	**55.608**
Final energy consumption for heating and cooling	Solid biofuels & charcoal (households)	61.496	of final energy consumption for heating and cooling	4,5	8.833
	Solid biofuels & charcoal (TCS sector)	11.120		0,8	2.844
	Solid biofuels & sewage sludge (industry)	20.319		1,5	5.877
	Solid biofuels & sewage sludge (HP/CHP)	2.104		0,2	484
	Liquid biofuels	1.814		0,1	406
	Biogas	1.495		0,1	246
	Sewage gas	1.852		0,1	446
	Landfill gas	227		0,02	69
	Biogenic fraction of waste	8.433		0,6	1.926
	Solar thermal energy	3.363		0,2	928
	Deep geothermal energy	525		0,04	155
	Near-surface geothermal energy & ambient heat	3.314		0,2	300
	Total	**116.062**		**8,6**	**22.514**
Final energy consumption transport	Biodiesel	27.938	of final energy consumption transport	4,3	5.462
	Vegetable oil	7.206		1,1	1.366
	Bioethanol	3.828		0,6	856
	RE electricity consumption transport	1.484		0,2	
	Total	**40.456**		**6,2**	**7.685**

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		RE 2007 [GWh]		Share of renewable energy [%]	avoided GHG-emissions [1.000 t CO_2-eq.]
Gross electricity production	Hydropower	21.170	of national gross electricity consumption	3,4	17.845
	Wind energy onshore	40.507		6,5	30.227
	Wind energy offshore	0		0	0
	Solar Photovoltaic	3.137		0,5	1.855
	Solid biofuels & sewage sludge	8.699		1,4	6.618
	Liquid biofuels	987		0,2	545
	Biogas	8.915		1,4	3.599
	Biomethane	21		0,003	10
	Sewage gas	1.033		0,2	678
	Landfill gas	1.009		0,2	662
	Biogenic fraction of waste	4.521		0,7	3.792
	Geothermal energy	0,4		0,0001	0,3
	Total	**89.999**		**14,4**	**65.831**
Final energy consumption for heating and cooling	Solid biofuels & charcoal (households)	64.092	of final energy consumption for heating and cooling	5,3	9.379
	Solid biofuels & charcoal (TCS sector)	11.443		1,0	2.938
	Solid biofuels & sewage sludge (industry)	22.367		1,9	6.469
	Solid biofuels & sewage sludge (HP/CHP)	2.225		0,2	532
	Liquid biofuels	2.869		0,2	641
	Biogas	3.935		0,3	655
	Biomethane	23		0,002	3
	Sewage gas	1.858		0,2	445
	Landfill gas	210		0,02	64
	Biogenic fraction of waste	10.747		0,9	2.404
	Solar thermal energy	3.746		0,3	1.028
	Deep geothermal energy	524		0,04	150
	Near-surface geothermal energy & ambient heat	3.989		0,3	367
	Total	**128.028**		**10,7**	**25.074**
Final energy con-sumption transport	Biodiesel	32.282	of final energy con-sumption transport	5,2	6.357
	Vegetable oil	8.533		1,4	1.598
	Bioethanol	3.391		0,5	773
	RE electricity consumption transport	1.763		0,3	
	Total	**45.969**		**7,4**	**8.728**

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		RE 2008 [GWh]		Share of renewable energy [%]	avoided GHG-emissions [1.000 t CO_2-eq.]
Gross electricity production	Hydropower	20.443	of national gross electricity consumption	3,3	16.134
	Wind energy onshore	41.385		6,7	28.801
	Wind energy offshore	0		0	0
	Solar Photovoltaic	4.508		0,7	3.049
	Solid biofuels & sewage sludge	9.296		1,5	6.471
	Liquid biofuels	1.133		0,2	613
	Biogas	11.648		1,9	4.654
	Biomethane	46		0,01	21
	Sewage gas	1.094		0,2	710
	Landfill gas	864		0,1	560
	Biogenic fraction of waste	4.671		0,8	3.677
	Geothermal energy	18		0,003	10
	Total	**95.106**		**15,3**	**64.701**
Final energy consumption for heating and cooling	Solid biofuels & charcoal (households)	74.020	of final energy consumption for heating and cooling	5,6	11.035
	Solid biofuels & charcoal (TCS sector)	16.046		1,2	4.082
	Solid biofuels & sewage sludge (industry)	20.156		1,5	6.187
	Solid biofuels & sewage sludge (HP/CHP)	2.759		0,2	676
	Liquid biofuels	3.442		0,3	718
	Biogas	3.728		0,3	640
	Biomethane	68		0,005	10
	Sewage gas	1.972		0,2	475
	Landfill gas	154		0,01	47
	Biogenic fraction of waste	6.662		0,5	1.529
	Solar thermal energy	4.293		0,3	1.185
	Deep geothermal energy	550		0,04	164
	Near-surface geothermal energy & ambient heat	4.740		0,4	555
	Total	**138.590**		**10,6**	**27.303**
Final energy consumption transport	Biodiesel	25.873	of final energy con-sumption transport	4,1	5.123
	Vegetable oil	4.042		0,6	761
	Bioethanol	4.608		0,7	1.029
	Biomethane	4		0,001	1
	RE electricity consumption transport	1.699		0,3	
	Total	**36.226**		**5,7**	**6.914**

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		RE 2009 [GWh]	Share of renewable energy [%]		avoided GHG-emissions [1.000 t CO_2-eq.]
Gross electricity production	Hydropower	19.031	of national gross electricity consumption	3,3	15.410
	Wind energy onshore	39.382		6,7	28.470
	Wind energy offshore	38		0,01	28
	Solar Photovoltaic	6.715		1,1	4.622
	Solid biofuels & sewage sludge	9.746		1,7	6.986
	Liquid biofuels	1.700		0,3	958
	Biogas	14.020		2,4	5.993
	Biomethane	81		0,01	40
	Sewage gas	1.131		0,2	760
	Landfill gas	788		0,1	529
	Biogenic fraction of waste	4.323		0,7	3.500
	Geothermal energy	19		0,003	11
	Total	**96.974**		**16,6**	**67.307**
Final energy consumption for heating and cooling	Solid biofuels & charcoal (households)	65.220	of final energy consumption for heating and cooling	5,4	9.839
	Solid biofuels & charcoal (TCS sector)	16.476		1,4	4.172
	Solid biofuels & sewage sludge (industry)	22.972		1,9	7.018
	Solid biofuels & sewage sludge (HP/CHP)	3.581		0,3	887
	Liquid biofuels	3.735		0,3	802
	Biogas	5.412		0,4	921
	Biomethane	136		0,01	19
	Sewage gas	1.977		0,2	468
	Landfill gas	155		0,01	47
	Biogenic fraction of waste	6.530		0,5	1.513
	Solar thermal energy	5.061		0,4	1.405
	Deep geothermal energy	623		0,1	188
	Near-surface geothermal energy & ambient heat	5.528		0,5	675
	Total	**137.406**		**11,4**	**27.956**
Final energy consumption transport	Biodiesel	22.966	of final energy con-sumption transport	3,8	4.490
	Vegetable oil	961		0,2	189
	Bioethanol	6.576		1,1	1.435
	Biomethane	13		0,002	3
	RE electricity consumption transport	1.925		0,3	
	Total	**32.441**		**5,3**	**6.117**

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		RE 2010 [GWh]		Share of renewable energy [%]	avoided GHG-emissions [1.000 t CO_2-eq.]
Gross electricity production	Hydropower	20.953	of national gross electricity consumption	3,4	16.890
	Wind energy onshore	38.371		6,2	27.641
	Wind energy offshore	176		0,03	127
	Solar Photovoltaic	11.963		1,9	8.218
	Solid biofuels & sewage sludge	10.351		1,7	7.567
	Liquid biofuels	1.331		0,2	742
	Biogas	16.265		2,6	7.012
	Biomethane	385		0,1	189
	Sewage gas	1.203		0,2	802
	Landfill gas	674		0,1	449
	Biogenic fraction of waste	4.746		0,8	3.820
	Geothermal energy	28		0,005	17
	Total	**106.446**		**17,2**	**73.473**
Final energy consumption for heating and cooling	Solid biofuels & charcoal (households)	79.304	of final energy consumption for heating and cooling	5,9	11.866
	Solid biofuels & charcoal (TCS sector)	21.236		1,6	5.314
	Solid biofuels & sewage sludge (industry)	28.088		2,1	7.974
	Solid biofuels & sewage sludge (HP/CHP)	4.057		0,3	982
	Liquid biofuels	3.442		0,3	722
	Biogas	7.811		0,6	1.385
	Biomethane	505		0,04	73
	Sewage gas	1.999		0,1	478
	Landfill gas	117		0,01	36
	Biogenic fraction of waste	7.260		0,5	1.645
	Solar thermal energy	5.383		0,4	1.536
	Deep geothermal energy	689		0,1	203
	Near-surface geothermal energy & ambient heat	6.294		0,5	746
	Total	**166.185**		**12,4**	**32.960**
Final energy consumption transport	Biodiesel	24.359	of final energy con-sumption transport	4,0	4.669
	Vegetable oil	574		0,1	115
	Bioethanol	8.537		1,4	1.846
	Biomethane	75		0,01	33
	RE electricity consumption transport	2.078		0,3	
	Total	**35.623**		**5,9**	**6.663**

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		RE 2011 [GWh]		Share of renewable energy [%]	avoided GHG-emissions [1.000 t CO_2-eq.]
Gross electricity production	Hydropower	17.671	of national gross electricity consumption	2,9	14.849
	Wind energy onshore	49.280		8,1	37.994
	Wind energy offshore	577		0,1	429
	Solar Photovoltaic	19.991		3,3	14.314
	Solid biofuels & sewage sludge	10.516		1,7	7.981
	Liquid biofuels	398		0,1	229
	Biogas	19.936		3,3	9.299
	Biomethane	596		0,1	311
	Sewage gas	1.280		0,2	882
	Landfill gas	628		0,1	433
	Biogenic fraction of waste	4.755		0,8	3.963
	Geothermal energy	19		0,003	12
	Total	**125.647**		**20,6**	**90.695**
Final energy consumption for heating and cooling	Solid biofuels & charcoal (households)	71.904	of final energy consumption for heating and cooling	5,8	10.840
	Solid biofuels & charcoal (TCS sector)	15.813		1,3	4.036
	Solid biofuels & sewage sludge (industry)	29.089		2,3	8.455
	Solid biofuels & sewage sludge (HP/CHP)	4.665		0,4	1.138
	Liquid biofuels	2.603		0,2	535
	Biogas	9.352		0,8	1.735
	Biomethane	760		0,1	114
	Sewage gas	2.059		0,2	502
	Landfill gas	101		0,01	32
	Biogenic fraction of waste	8.140		0,7	1.858
	Solar thermal energy	6.160		0,5	1.760
	Deep geothermal energy	722		0,1	214
	Near-surface geothermal energy & ambient heat	7.140		0,6	848
	Total	**158.508**		**12,8**	**32.066**
Final energy consumption transport	Biodiesel	23.556	of final energy con-sumption transport	3,8	4.594
	Vegetable oil	188		0,03	34
	Bioethanol	9.031		1,5	1.895
	Biomethane	92		0,02	17
	RE electricity consumption transport	2.494		0,4	
	Total	**35.361**		**5,8**	**6.540**

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		RE 2012 [GWh]		Share of renewable energy [%]	avoided GHG-emissions [1.000 t CO_2-eq.]
Gross electricity production	Hydropower	21.755	of national gross electricity consumption	3,6	16.767
	Wind energy onshore	50.948		8,4	33.858
	Wind energy offshore	732		0,1	493
	Solar Photovoltaic	26.744		4,4	16.768
	Solid biofuels & sewage sludge	10.693		1,8	7.500
	Liquid biofuels	355		0,06	187
	Biogas	25.920		4,2	10.647
	Biomethane	1.117		0,2	512
	Sewage gas	1.314		0,2	837
	Landfill gas	536		0,1	341
	Biogenic fraction of waste	4.951		0,8	3.841
	Geothermal energy	25		0,004	14
	Total	**145.090**		**23,8**	**91.765**
Final energy consumption for heating and cooling	Solid biofuels & charcoal (households)	83.015	of final energy consumption for heating and cooling	6,6	12.686
	Solid biofuels & charcoal (TCS sector)	17.437		1,4	4.479
	Solid biofuels & sewage sludge (industry)	27.793		2,2	7.915
	Solid biofuels & sewage sludge (HP/CHP)	5.776		0,5	1.420
	Liquid biofuels	2.204		0,2	457
	Biogas	8.903		0,7	1.542
	Biomethane	1.329		0,1	180
	Sewage gas	2.017		0,2	464
	Landfill gas	94		0,01	28
	Biogenic fraction of waste	9.033		0,7	2.075
	Solar thermal energy	6.416		0,5	1.833
	Deep geothermal energy	805		0,1	240
	Near-surface geothermal energy & ambient heat	8.016		0,6	972
	Total	**172.838**		**13,7**	**34.290**
Final energy consumption transport	Biodiesel	24.628	of final energy con-sumption transport	4,1	5.065
	Vegetable oil	251		0,04	45
	Bioethanol	9.149		1,5	1.902
	Biomethane	333		0,1	65
	RE electricity consumption transport	2.862		0,5	
	Total	**37.223**		**6,1**	**7.078**

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		RE 2013 [GWh]	Share of renewable energy [%]		avoided GHG-emissions [1.000 t CO_2-eq.]
Gross electricity production	Hydropower	22.998	of national gross electricity consumption	3,8	16.405
	Wind energy onshore	51.819		8,5	36.738
	Wind energy offshore	918		0,2	653
	Solar Photovoltaic	30.621		5,0	18.293
	Solid biofuels & sewage sludge	10.555		1,7	6.895
	Liquid biofuels	299		0,05	140
	Biogas	27.468		4,5	9.806
	Biomethane	1.713		0,3	697
	Sewage gas	1.308		0,2	760
	Landfill gas	483		0,1	281
	Biogenic fraction of waste	5.415		0,9	3.893
	Geothermal energy	80		0,01	41
	Total	**153.677**		**25,3**	**94.601**
Final energy consumption for heating and cooling	Solid biofuels & charcoal (households)	85.941	of final energy consumption for heating and cooling	6,6	13.300
	Solid biofuels & charcoal (TCS sector)	18.696		1,4	4.846
	Solid biofuels & sewage sludge (industry)	25.600		2,0	6.953
	Solid biofuels & sewage sludge (HP/CHP)	5.532		0,4	1.204
	Liquid biofuels	2.196		0,2	446
	Biogas	9.458		0,7	1.615
	Biomethane	2.533		0,2	341
	Sewage gas	1.805		0,1	412
	Landfill gas	93		0,01	27
	Biogenic fraction of waste	11.645		0,9	2.665
	Solar thermal energy	6.500		0,5	1.854
	Deep geothermal energy	864		0,1	256
	Near-surface geothermal energy & ambient heat	8.858		0,7	1.155
	Total	**179.721**		**13,8**	**35.074**
Final energy consumption transport	Biodiesel	21.945	of final energy con-sumption transport	3,5	4.516
	Vegetable oil	0		0	0
	Bioethanol	8.832		1,4	1.867
	Biomethane	483		0,1	95
	RE electricity consumption transport	3.017		0,5	
	Total	**34.277**		**5,5**	**6.478**

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Renewable energy sources in the year 2014

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		RE 2014 [GWh]	Share of renewable energy [%]		avoided GHG-emissions [1.000 t CO_2-eq.]
Gross electricity production	Hydropower	19.587	of national gross electricity consumption	3,3	15.586
	Wind energy onshore	57.026		9,6	43.568
	Wind energy offshore	1.471		0,2	1.138
	Solar Photovoltaic	35.448		6,0	23.623
	Solid biofuels & sewage sludge	10.798		1,8	7.870
	Liquid biofuels	347		0,1	190
	Biogas	28.614		4,8	12.487
	Biomethane	2.512		0,4	1.219
	Sewage gas	1.336		0,2	881
	Landfill gas	435		0,1	287
	Biogenic fraction of waste	6.069		1,0	4.841
	Geothermal energy	98		0,02	58
	Total	**163.741**		**27,5**	**111.749**
Final energy consumption for heating and cooling	Solid biofuels & charcoal (households)	69.484	of final energy consumption for heating and cooling	5,9	11.001
	Solid biofuels & charcoal (TCS sector)	14.945		1,3	3.824
	Solid biofuels & sewage sludge (industry)	26.530		2,2	7.251
	Solid biofuels & sewage sludge (HP/CHP)	5.465		0,5	1.205
	Liquid biofuels	2.372		0,2	487
	Biogas	10.639		0,9	1.825
	Biomethane	3.268		0,3	441
	Sewage gas	1.801		0,2	411
	Landfill gas	98		0,01	29
	Biogenic fraction of waste	11.380		1,0	2.612
	Solar thermal energy	7.026		0,6	2.004
	Deep geothermal energy	1.052		0,1	314
	Near-surface geothermal energy & ambient heat	9.646		0,8	1.338
	Total	**163.706**		**13,8**	**32.744**
Final energy consumption transport	Biodiesel	22.676	of final energy con-sumption transport	3,7	4.731
	Vegetable oil	52		0,01	9
	Bioethanol	9.002		1,5	1.915
	Biomethane	449		0,1	91
	RE electricity consumption transport	3.169		0,5	
	Total	**35.348**		**5,7**	**6.747**

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Renewable energy sources in the year 2015

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		RE 2015 [GWh]	Share of renewable energy [%]		avoided GHG-emissions [1.000 t CO_2-eq.]
Gross electricity production	Hydropower	18.977	of national gross electricity consumption	3,2	14.889
	Wind energy onshore	72.340		12,0	53.494
	Wind energy offshore	8.284		1,4	6.069
	Solar Photovoltaic	38.076		6,3	25.561
	Solid biofuels & sewage sludge	11.034		1,8	7.869
	Liquid biofuels	443		0,1	234
	Biogas	30.086		5,0	12.762
	Biomethane	3.147		0,5	1.432
	Sewage gas	1.389		0,2	898
	Landfill gas	396		0,1	256
	Biogenic fraction of waste	5.768		1,0	4.499
	Geothermal energy	133		0,02	78
	Total	**190.073**		**31,6**	**128.041**
Final energy consumption for heating and cooling	Solid biofuels & charcoal (households)	69.477	of final energy consumption for heating and cooling	5,7	10.720
	Solid biofuels & charcoal (TCS sector)	17.137		1,4	4.267
	Solid biofuels & sewage sludge (industry)	25.108		2,0	7.214
	Solid biofuels & sewage sludge (HP/CHP)	5.957		0,5	1.185
	Liquid biofuels	2.189		0,2	486
	Biogas	11.588		0,9	2.850
	Biomethane	3.970		0,3	872
	Sewage gas	2.001		0,2	524
	Landfill gas	120		0,01	42
	Biogenic fraction of waste	11.807		1,0	2.471
	Solar thermal energy	7.562		0,6	1.981
	Deep geothermal energy	969		0,1	278
	Near-surface geothermal energy & ambient heat	10.401		0,8	1.393
	Total	**168.286**		**13,7**	**34.283**
Final energy consumption transport	Biodiesel	20.829	of final energy con-sumption transport	3,2	4.432
	Vegetable oil	10		0,002	2
	Bioethanol	8.589		1,3	1.855
	Biomethane	345		0,1	70
	RE electricity consumption transport	3.523		0,5	
	Total	**33.296**		**5,2**	**6.359**

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Renewable energy sources in the year 2016

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		RE 2016 [GWh]	Share of renewable energy [%]		avoided GHG-emissions [1.000 t CO_2-eq.]
Gross electricity production	Hydropower	20.546	of national gross electricity consumption	3,4	15.880
	Wind energy onshore	67.650		11,3	49.837
	Wind energy offshore	12.274		2,0	9.122
	Solar Photovoltaic	37.556		6,3	25.052
	Solid biofuels & sewage sludge	10.797		1,8	7.627
	Liquid biofuels	508		0,1	266
	Biogas	30.726		5,1	12.830
	Biomethane	3.146		0,5	1.448
	Sewage gas	1.440		0,2	926
	Landfill gas	358		0,1	230
	Biogenic fraction of waste	5.930		1,0	4.591
	Geothermal energy	175		0,03	101
	Total	**191.106**		**31,8**	**127.911**
Final energy consumption for heating and cooling	Solid biofuels & charcoal (households)	66.289	of final energy consumption for heating and cooling	5,4	10.369
	Solid biofuels & charcoal (TCS sector)	16.731		1,4	4.182
	Solid biofuels & sewage sludge (industry)	27.031		2,2	7.744
	Solid biofuels & sewage sludge (HP/CHP)	6.259		0,5	1.246
	Liquid biofuels	2.188		0,2	518
	Biogas	12.306		1,0	2.934
	Biomethane	4.039		0,3	807
	Sewage gas	2.050		0,2	541
	Landfill gas	116		0,01	42
	Biogenic fraction of waste	11.669		0,9	2.352
	Solar thermal energy	7.604		0,6	1.986
	Deep geothermal energy	1.146		0,1	322
	Near-surface geothermal energy & ambient heat	11.196		0,9	1.546
	Total	**168.624**		**13,7**	**34.589**
Final energy consumption transport	Biodiesel	20.896	of final energy con-sumption transport	3,2	4.904
	Vegetable oil	31		0,005	6
	Bioethanol	8.604		1,3	1.978
	Biomethane	379		0,1	84
	RE electricity consumption transport	3.733		0,6	
	Total	**33.643**		**5,2**	**6.972**

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Renewable energy sources in the year 2017

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		RE 2017 [GWh]	Share of renewable energy [%]		avoided GHG-emissions [1.000 t CO_2-eq.]
Gross electricity production	Hydropower	20.150	of national gross electricity consumption	3,3	15.020
	Wind energy onshore	88.018		14,6	61.669
	Wind energy offshore	17.675		2,9	12.542
	Solar Photovoltaic	38.761		6,4	24.955
	Solid biofuels & sewage sludge	10.644		1,8	7.219
	Liquid biofuels	454		0,1	219
	Biogas	31.089		5,2	12.271
	Biomethane	2.966		0,5	1.313
	Sewage gas	1.460		0,2	904
	Landfill gas	338		0,1	209
	Biogenic fraction of waste	5.956		1,0	4.423
	Geothermal energy	163		0,03	92
	Total	**217.674**		**36,2**	**140.837**
Final energy consumption for heating and cooling	Solid biofuels & charcoal (households)	68.393	of final energy consumption for heating and cooling	5,5	10.652
	Solid biofuels & charcoal (TCS sector)	17.450		1,4	3.715
	Solid biofuels & sewage sludge (industry)	26.326		2,1	7.372
	Solid biofuels & sewage sludge (HP/CHP)	6.193		0,5	1.260
	Liquid biofuels	2.194		0,2	557
	Biogas	12.980		1,1	3.061
	Biomethane	3.740		0,3	817
	Sewage gas	2.141		0,2	578
	Landfill gas	107		0,01	40
	Biogenic fraction of waste	12.669		1,0	2.475
	Solar thermal energy	7.834		0,6	2.045
	Deep geothermal energy	1.168		0,1	328
	Near-surface geothermal energy & ambient heat	12.116		1,0	1.836
	Total	**173.311**		**14,0**	**34.736**
Final energy consumption transport	Biodiesel	21.354	of final energy con-sumption transport	3,3	5.224
	Vegetable oil	31		0,005	6
	Bioethanol	8.464		1,3	2.126
	Biomethane	445		0,1	99
	RE electricity consumption transport	4.328		0,7	
	Total	**34.622**		**5,3**	**7.456**

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		RE 2018 [GWh]	Share of renewable energy [%]		avoided GHG-emissions [1.000 t CO_2-eq.]
Gross electricity production	Hydropower	18.098	of national gross electricity consumption	3,0	13.617
	Wind energy onshore	90.484		15,2	64.349
	Wind energy offshore	19.467		3,3	13.986
	Solar Photovoltaic	44.320		7,5	27.801
	Solid biofuels & sewage sludge	11.068		1,9	7.617
	Liquid biofuels	397		0,1	186
	Biogas	30.266		5,1	12.469
	Biomethane	2.980		0,5	1.385
	Sewage gas	1.555		0,3	985
	Landfill gas	305		0,1	193
	Biogenic fraction of waste	6.163		1,0	4.633
	Geothermal energy	178		0,03	103
	Total	**225.281**		**37,9**	**147.325**
Final energy consumption for heating and cooling	Solid biofuels & charcoal (households)	70.192	of final energy consumption for heating and cooling	5,8	11.282
	Solid biofuels & charcoal (TCS sector)	17.812		1,5	3.895
	Solid biofuels & sewage sludge (industry)	24.522		2,0	7.161
	Solid biofuels & sewage sludge (HP/CHP)	5.740		0,5	1.310
	Liquid biofuels	2.298		0,2	572
	Biogas	13.304		1,1	3.127
	Biomethane	3.861		0,3	873
	Sewage gas	2.500		0,2	681
	Landfill gas	110		0,01	42
	Biogenic fraction of waste	14.508		1,2	3.061
	Solar thermal energy	8.955		0,7	2.402
	Deep geothermal energy	1.308		0,1	381
	Near-surface geothermal energy & ambient heat	13.155		1,1	2.205
	Total	**178.265**		**14,8**	**36.991**
Final energy consumption transport	Biodiesel	22.329	of final energy con-sumption transport	3,4	5.456
	Vegetable oil	10		0,002	2
	Bioethanol	8.685		1,3	2.240
	Biomethane	389		0,1	85
	RE electricity consumption transport	4.581		0,7	
	Total	**35.994**		**5,5**	**7.783**

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		RE 2019 [GWh]	Share of renewable energy [%]		avoided GHG-emissions [1.000 t CO_2-eq.]
Gross electricity production	Hydropower	20.135	of national gross electricity consumption	3,5	16.317
	Wind energy onshore	101.150		17,5	77.041
	Wind energy offshore	24.744		4,3	19.165
	Solar Photovoltaic	45.221		7,8	31.653
	Solid biofuels & sewage sludge	11.038		1,9	8.312
	Liquid biofuels	344		0,1	169
	Biogas	30.106		5,2	14.455
	Biomethane	2.990		0,5	1.588
	Sewage gas	1.581		0,3	1.116
	Landfill gas	287		0,05	201
	Biogenic fraction of waste	5.806		1,0	4.724
	Geothermal energy	197		0,03	130
	Total	**243.599**		**42,2**	**174.871**
Final energy consumption for heating and cooling	Solid biofuels & charcoal (households)	71.154	of final energy consumption for heating and cooling	5,8	11.172
	Solid biofuels & charcoal (TCS sector)	19.219		1,6	4.090
	Solid biofuels & sewage sludge (industry)	23.784		2,0	6.720
	Solid biofuels & sewage sludge (HP/CHP)	6.121		0,5	1.458
	Liquid biofuels	2.383		0,2	565
	Biogas	13.783		1,1	3.285
	Biomethane	3.983		0,3	987
	Sewage gas	2.402		0,2	694
	Landfill gas	107		0,01	41
	Biogenic fraction of waste	15.308		1,3	3.451
	Solar thermal energy	8.667		0,7	2.315
	Deep geothermal energy	1.369		0,1	400
	Near-surface geothermal energy & ambient heat	14.243		1,2	2.642
	Total	**182.523**		**15,0**	**37.820**
Final energy consumption transport	Biodiesel	22.109	of final energy con-sumption transport	3,4	5.241
	Vegetable oil	21		0,003	4
	Bioethanol	8.353		1,3	2.198
	Biomethane	660		0,1	126
	RE electricity consumption transport	4.897		0,8	
	Total	**36.040**		**5,5**	**7.569**

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		RE 2020 [GWh]		Share of renewable energy [%]	avoided GHG-emissions [1.000 t CO_2-eq.]
Gross electricity production	Hydropower	18.721	of national gross electricity consumption	3,4	15.085
	Wind energy onshore	104.796		18,8	79.351
	Wind energy offshore	27.306		4,9	21.079
	Solar Photovoltaic	49.496		8,9	34.572
	Solid biofuels & sewage sludge	11.306		2,0	8.477
	Liquid biofuels	320		0,1	130
	Biogas	30.671		5,5	14.793
	Biomethane	3.046		0,5	1.611
	Sewage gas	1.579		0,3	1.120
	Landfill gas	247		0,04	172
	Biogenic fraction of waste	5.820		1,0	4.715
	Geothermal energy	231		0,04	154
	Total	**253.539**		**45,5**	**181.259**
Final energy consumption for heating and cooling	Solid biofuels & charcoal (households)	66.874	of final energy consumption for heating and cooling	5,6	10.496
	Solid biofuels & charcoal (TCS sector)	19.101		1,6	4.001
	Solid biofuels & sewage sludge (industry)	23.279		1,9	6.467
	Solid biofuels & sewage sludge (HP/CHP)	6.296		0,5	1.531
	Liquid biofuels	3.217		0,3	709
	Biogas	14.339		1,2	3.439
	Biomethane	4.216		0,4	1.018
	Sewage gas	2.378		0,2	727
	Landfill gas	95		0,01	36
	Biogenic fraction of waste	15.060		1,3	3.556
	Solar thermal energy	9.014		0,8	2.401
	Deep geothermal energy	1.427		0,1	410
	Near-surface geothermal energy & ambient heat	15.562		1,3	3.036
	Total	**180.858**		**15,1**	**37.828**
Final energy consumption transport	Biodiesel	30.170	of final energy con-sumption transport	5,1	8.359
	Vegetable oil	21		0,004	5
	Bioethanol	8.014		1,4	2.484
	Biomethane	884		0,1	269
	RE electricity consumption transport	5.248		0,9	
	Total	**44.337**		**7,5**	**11.117**

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		RE 2021 [GWh]	Share of renewable energy [%]		avoided GHG-emissions [1.000 t CO_2-eq.]
Gross electricity production	Hydropower	19.657	of national gross electricity consumption	3,4	15.823
	Wind energy onshore	89.795		15,7	67.798
	Wind energy offshore	24.374		4,3	18.721
	Solar Photovoltaic	50.472		8,8	34.636
	Solid biofuels & sewage sludge	10.738		1,9	7.997
	Liquid biofuels	210		0,04	64
	Biogas	30.552		5,3	14.672
	Biomethane	3.273		0,6	1.704
	Sewage gas	1.576		0,3	1.110
	Landfill gas	229		0,04	156
	Biogenic fraction of waste	5.792		1,0	4.686
	Geothermal energy	244		0,04	160
	Total	**236.912**		**41,5**	**167.526**
Final energy consumption for heating and cooling	Solid biofuels & charcoal (households)	78.559	of final energy consumption for heating and cooling	6,2	12.629
	Solid biofuels & charcoal (TCS sector)	21.821		1,7	4.653
	Solid biofuels & sewage sludge (industry)	24.820		2,0	6.884
	Solid biofuels & sewage sludge (HP/CHP)	6.796		0,5	1.653
	Liquid biofuels	2.599		0,2	554
	Biogas	14.818		1,2	3.693
	Biomethane	4.982		0,4	1.171
	Sewage gas	2.367		0,2	773
	Landfill gas	85		0,01	31
	Biogenic fraction of waste	15.601		1,2	3.709
	Solar thermal energy	8.551		0,7	2.277
	Deep geothermal energy	1.575		0,1	449
	Near-surface geothermal energy & ambient heat	17.332		1,4	3.251
	Total	**199.906**		**15,8**	**41.728**
Final energy consumption transport	Biodiesel	25.072	of final energy con-sumption transport	4,3	6.981
	Vegetable oil	21		0,004	5
	Bioethanol	8.412		1,4	2.606
	Biomethane	965		0,2	294
	RE electricity consumption transport	5.340		0,9	
	Total	**39.810**		**6,8**	**9.885**

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		RE 2022 [GWh]	Share of renewable energy [%]		avoided GHG-emissions [1.000 t CO_2-eq.]
Gross electricity production	Hydropower	17.625	of national gross electricity consumption	3,2	14.240
	Wind energy onshore	99.692		18,1	75.560
	Wind energy offshore	25.124		4,6	19.371
	Solar Photovoltaic	60.304		10,9	41.627
	Solid biofuels & sewage sludge	10.254		1,9	7.662
	Liquid biofuels	97		0,0	26
	Biogas	30.469		5,5	14.660
	Biomethane	3.098		0,6	1.620
	Sewage gas	1.553		0,3	1.095
	Landfill gas	201		0,04	135
	Biogenic fraction of waste	5.562		1,0	4.516
	Geothermal energy	206		0,04	134
	Total	**254.185**		**46,0**	**180.647**
Final energy consumption for heating and cooling	Solid biofuels & charcoal (households)	79.968	of final energy consumption for heating and cooling	6,9	13.243
	Solid biofuels & charcoal (TCS sector)	20.414		1,8	4.542
	Solid biofuels & sewage sludge (industry)	33.946		2,9	9.696
	Solid biofuels & sewage sludge (HP/CHP)	6.346		0,5	1.547
	Liquid biofuels	2.430		0,2	521
	Biogas	15.152		1,3	4.002
	Biomethane	4.769		0,4	1.199
	Sewage gas	2.375		0,2	811
	Landfill gas	81		0,01	29
	Biogenic fraction of waste	14.836		1,3	3.528
	Solar thermal energy	9.733		0,8	2.669
	Deep geothermal energy	1.819		0,2	517
	Near-surface geothermal energy & ambient heat	19.878		1,7	3.697
	Total	**211.747**		**18,2**	**46.000**
Final energy consumption transport	Biodiesel	24.849	of final energy con-sumption transport	4,2	6.919
	Vegetable oil	21		0,004	5
	Bioethanol	8.692		1,5	2.692
	Biomethane	1.061		0,2	323
	RE electricity consumption transport	6.121		1,0	
	Total	**40.744**		**6,9**	**9.939**

Methodological changes

National and international reporting obligations increase the demand of reliable and long-term updateable statistical data on the development of all renewable energy sources in Germany. The Working Group on Renewable Energy Statistics (AGEE-Stat) continuously improves and unifies data base and calculation methods. If new information allow conclusions to be drawn on historic values, these data are complemented or corrected. An overview of the implemented methodological changes in comparison to the previous publication is provided below:

New data source for grid feed-in for gross and net electricity generation from renewable energy sources since 2021

The designated time series data for gross and net electricity generation from renewable energy sources are mainly based on annual accounts of the Transmission System Operators (associated with the support mechanism of the Renewable Energy Sources Act (EEG)), supplemented by self-consumed own production (economic self-consumption) and technical self-consumption. Due to a continuously increasing number of installations reaching their maximum support duration since 2021 and an increasing number of power plants marketing their electricity partially outside of the EEG, a realignment of the data basis for grid feed-in was necessary. From 2021 the data source for electricity quantities fed into the public grid is switched to data from grid operator surveys (066N) of the Federal Statistical Office. This survey (066N) records the electricity fed into the public electricity grid by all connected generating facilities, regardless of their size or support or marketing format. The data is supplemented by self-consumed own production (economic self-consumption) and technical self-consumption.

Furthermore, the accounting of electricity based on biogas, biomethane, solid, and liquid biomass has been further refined and brought up to date. This includes accounting for transformer and grid losses and economic self-consumption. For biogas plants, it also includes operational self-consumption (for pumps, agitators, etc.), when it is covered by self-generated electricity. Concerning the generation of electricity from solid biomass, official surveys are used to a greater extent than before. Additionally estimations of technical self-consumption and economic self-consumption for facilities with less than 1 MW of electrical capacity are now included.

Update of the methodology for measuring heat supply from heat pumps

Based on scientific recommendations and after consultation with heat pump experts at an AGEE-Stat specialist discussion, the methodology for measuring near-surface geothermal and environmental heat has been updated. Different service life curves for air-to-water, ground-source and water-source heat pumps have been implemented into the model. In addition, time series data regarding the sales of electric heat pumps have been slightly updated and adjusted for those heat pumps whose heat source could not be clearly identified as renewable. Other existing model parameters for the average performance and efficiency have been considered plausible by heat pump experts and retained.

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Conversion factors

Joule	J	for energy, work, heat
Watt	W	for capacity, energy flow, heat flow
1 Joule (J) = 1 Newton metre (Nm) = 1 Watt second (Ws)		

Legally binding units in Germany since 1978.
Calorie and derived units such as coal equivalent and oil equivalent are still used as alternatives.

referred to net calorific value		PJ	TWh	Mtce	Mtoe
1 Petajoule	PJ	1	0,2778	0,0341	0,0239
1 Terawatt hour	TWh	3,6	1	0,123	0,0861
1 million tonne of hard coal unit	Mtce	29,308	8,14	1	0,7
1 million tonne of oil equivalent	Mtoe	41,869	11,63	1,429	1

1 TWh = 1 billion kWh	Kilo (k)	10^3	Tera (T)	10^{12}
1 GWh = 1 million kWh	Mega (M)	10^6	Peta (P)	10^{15}
1 MWh = 1.000 kWh	Giga (G)	10^9	Exa (E)	10^{18}

Abbreviations

eq.	Equivalent
RE	Renewable energies
EEG	Renewable Energy Sources Act (Erneuer-bare-Energien-Gesetz)
FEC	Final energy consumption
N/A	Not quantified
PEC	Primary energy consumption
HP	Heating plant
CHP	Combined heat and power plant

List of institutions, references and literatur

INSTITUIONS

AGEB	Working Group on Energy Balances e.V., Berlin.
BAFA	Federal Office for Economic Affairs and Export Control, Eschborn.
BDEW	German Association of Energy and Water Industries e.V., Berlin.
BLE	Federal Office of Agriculture and Food, Bonn.
BMEL	Federal Ministry of Food and Agriculture, Bonn.
BMU	Federal Ministry for the Environment, Nature Conservation and Nuclear Safety, Berlin.
BMWi	Federal Ministry for Economic Affairs and Energy, Berlin.
BNetzA	Federal Network Agency, Bonn.
BSW	German Solar Association, Berlin.
BWE	German Wind Energy Association e.V., Berlin.
BWP	German Heat Pump Association e.V., Berlin.
DBFZ	German Biomass Research Centre, Leipzig.
DENA	German Energy Agency, Berlin.
DEPV	German Energy Pellet Association e.V., Berlin.
DIW	German Institute for Economic Research, Berlin.
FNR	Specialist agency renewable raw materials e.V., Gülzow.
GtV	Geothermal Energy Association e.V., Berlin.
GZB	International Geothermal Center, Bochum
LIAG	Leibniz Institute for Applied Geophysics: Geothermal Information System for Germany, www.geotis.de.
RWI	Leibniz Institute for Economic Research, Essen.
StBA	Federal Statistical Office, Wiesbaden.
TI	Institute of International Forestry and Forest Economics, Hamburg.
UBA	Federal Environment Agency, Dessau-Roßlau.
UL	UL International GmbH, DEWI, Wilhelmshaven.
ÜNB	Information platform of the German Transmission System Operators, www.netztransparenz.de
ZSW	Centre for Solar Energy and Hydrogen Research Baden-Württemberg, Stuttgart.

REFERENCES & LITERATURE

[1] Working Group on Energy Balances (AGEB): Energy balance of the Federal Republic of Germany, Berlin

[2] Born, H. et al.: Analysis of the German heat pump market – overview and trends, 2. update, International Geothermal Centre, Bochum, 2017.

[3] Federal Office of Agriculture and Food (BLE): Evaluation and Progress Reports - Biomass Energy Sustainability Ordinance, Biofuel Sustainability Ordinance, Bonn, https://www.ble.de/EN/Topics/Climate-Energy/Sustainable-Biomass-Production/Information-Materials/information-materials_node.html

[4] Federal Office of Agriculture and Food (BLE): Applications on the rate for the reduction of greenhouse gas emissions - final data for 2017.

[5] Federal Office for Economic Affairs and Export Control (BAFA), Federal mineral oel statistik, www.bafa.de.

[6] Federal Ministry of Finance (BMF) and Office for Biofuel Quotas: Statistical data on fulfilling the biofuel quota, Berlin.

[7] Federal Ministry for Economic Affairs and Energy (BMWi): Energiedata – national und international developement, Berlin.

[8] Federal Network Agency (BNetzA): Renewable Energy Sources Act – statistics report on annual accounts, Renewable Energy Sources Act in figures and evaluation of BNetzA register data, Bonn, www.bundesnetzagentur.de

[9] Federal Government (BReg): Report of the German Federal Government regarding the development of the reduction in greenhouse gas emissions of biofuels, the biomass potential and the amounts of biomethane in the transport fuel market, State: 10 May 2012, http://dip21.bundestag.de/dip21/btd/17/096/1709621.pdf

[10] Federal Government (BReg): National Reports for the implementation of the directive 2003/30/EG from 08 May 2003 on the promotion of the use of biofuels or other renewable fuels in the transport sector.

[11] Federal Government (BReg): Ordinance on requirements for the sustainable production of biofuels (Biokraftstoff-Nachhaltigkeitsverordnung) of 30 September 2009 (Federal Law Gazette 9 I p. 3182).

[12] Federal Government (BReg): Ordinance on requirements for the sustainable production of liquid biomass for the power generation (Biomass Energy Sustainability Ordinance – BioSt-NachV) from 23 July 2009 (Federal Law Gazette I p. 2174).

[13] German Biomass Research Centre (DBFZ) in cooperation with Fraunhofer Institute for Wind Energy Systems (IWES), Private Institute for Sustainable Land Management (INL) und Bosch & Partner GmbH: Power generation from biomass – intermediate and final reports, Leipzig.

[14] German Wind Energy Institute (UL International (DEWI)): Wind energy in Germany – installation figures for the years 1990 to 2002, www.dewi.de and publications in the DEWI magazine

[15] Döring, P.; Glasenapp, S.; Mantau, U.: Resource monitoring for wood: Use of fuelwood in private housholds 2014 - Market volume and used timber assortments, Final report February 2016, Universität Hamburg.

[16] EP/EC: Directive 2009/28/EC of the European parliament and of the Council of 23 April 2009 on the promotion of the use of energy from renewable sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC. Official Journal of the European Union, L 140/16 of 15 June 2009

[17] EP/EC: Directive 2015/1513 of the European parliament and of the Council of 9 September 2015 amending Directive 98/70/EC relating to the quality of petrol and diesel fuels and amending Directive 2009/28/EC on the promotion of the use of energy from renewable sources. Official Journal of the European Union, L 239/1 of 15 September 2015

[18] Eurostat, Statistical Office of the European Communities, Luxembourg: SHARES - Short Assessment of Renewable Energy Sources; http://ec.europa.eu/eurostat/web/energy/data/shares

[19] Agency for Renewable Resources (FNR): Resource monitoring for wood. https://forst.fnr.de/projekte-und-foerderung/projekte/holzbereitstellung/rohstoffmonitoring-holz/

[20] Grawe, J.; Wagner, E.: Use of renewable energy in the electricity industry 1992, 1994, 1996, 1999; in: ew (Elektrizitätswirtschaft).

[21] Institute for Energetic and Environment (IE), Leipzig, Fichtner GmbH & Co. KG, Stuttgart, Thuringian State Institute for Agriculture (TLL), Jena: Monitoring report on the impact of the Renewable Energy Sources Act on electricity generation from biomass.

[22] International Energy Agency (IEA), Statistische Amt der Europäischen Gemeinschaften Eurostat, United Nations/ Economic Commission for Europe (UNECE): Energy Questionnaires for Germany.

[23] Jochem D., Weimar H., Bösch M. et al. (2015) Estimation of wood removals and fellings in Germany: a calculation approach based on the amount of used roundwood. Eur J Forest Res 134(5):869-888, DOI:10.1007/s10342-015-0896-9

[24] Reinholz, T.; Völler, K.: Brief study – Data of the biomethane market - Gathering and analysis of currently available data as well as retroactive time series, Berlin, July 2018.

[25] Federal Statistical Office (StBA) : Energy tax statistics – special series 14 series 9.3

[26] Federal Statistical Office (StBA) : Environment – Waste disposal. Special series 19 series 1. https://www.destatis.de/DE/Publikationen/Thematisch/UmweltstatistischeErhebungen/Abfallwirtschaft/Abfallentsorgung.html

[27] Federal Statistical Office (StBA) : Statistical surveys in the sektors electricity production and capacity: 066K, 067, 070 and 073.

[28] Federal Statistical Office (StBA) : Statistical surveys in the heat sector: 060, 062, 064, 066K, 067, 073 and external trade statistics.

[29] Thünen-Institute of International Forestry and Forest Economics: Fellings and use of roundwood. https://www.thuenen.de/en/wf/figures-facts/production-and-use/fellings-and-roundwood-use/

[30] Federal Environment Agency (UBA): Emission balance of renewable energy sources. Determining the volume of emissions eliminated in 2018, Dessau-Roßlau, 2019.

[31] Weimar, H.: From empirical studies to bioenergy statistics: bridging the GAP of unrecorded wood-bioenergy in Germany. In: 9th International Scientific Conference: The path forward for wood products: A global perspective; Baton Rouge, Louisiana, USA, October 5th - 8th 2016. WoodEMA, pp 135-142.

[32] Centre for Solar Energy and Hydrogen Research Baden-Württemberg (ZSW): Economic impacts of the expansion of renewable energies. Data about renewable energy as an economic factor. Stuttgart, September 2023.

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