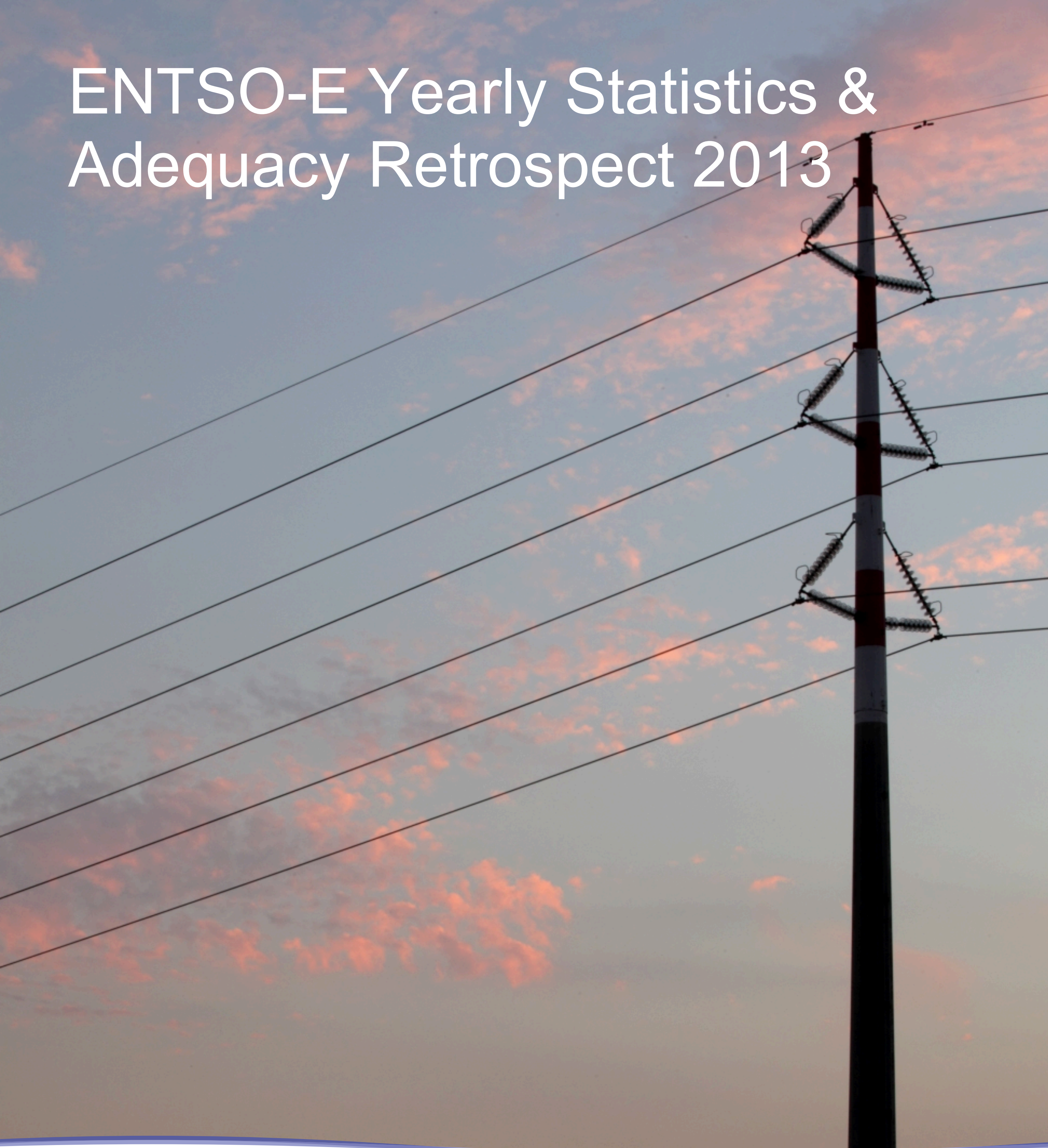
ENTSO-E Yearly Statistics & Adequacy Retrospect 2013



European Electricity System Data

European Network of
Transmission System Operators
for Electricity

entsoe

DATA EXPERT GROUP and *SYSTEM ADEQUACY & MARKET MODELLING W*orking Group

Contents

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1. General introduction

1.1. Report's background

The Yearly Statistics and Adequacy Retrospect 2013 (YS&AR 2013) is the second edition of the integrated report, which replaced Statistical Yearbook and the System Adequacy Retrospect reports. YS&AR 2013 report includes information from both reports combined, thus reducing redundant information in different timeframes and providing more transparency on the information from the associated TSOs.

This revised report structure will also reduce the total volume of the report, not by excluding any information but instead making more data available via excel downloads instead of printed tables. We hope that this will increase the usability of our product for customers. Merging the two reports will increase the coherence of data with different perspectives, however some exceptions exist and are explained in the next paragraph.

The YS&AR report aims to provide stakeholders in the European electricity market with an overview of the retrospect data and figures regarding the power systems of member Transmission System Operators (TSOs), as well as ENTSO-E as a whole. The report provides information about energy balance, power balance at reference points with a focus on adequacy and information about cross-border exchanges and network components.

The report was prepared under the support of the Data Expert Group directly under the supervision of the ENTSO-E Board; however, the Adequacy Retrospect chapter was prepared and written by the System Adequacy and Market Modelling Working Group under the supervision of the System Development Committee.

The glossary of terms used in this report is based on a web tool entitled ENTSO-E Metadata Repository (EMR), which contains a complete set of definitions collected by ENTSO-E. In addition, EMR includes a build-in engine called "EMR Workflow" that has been designed to improve the quality of the definitions and remove existing inconsistencies. For more information, please visit https://www.entsoe.eu/data/data-portal/glossary/.

1.2. About the data

Statistical and adequacy data is regularly delivered by member TSO Statistical Data Correspondents (STCs). The data is stored in the ENTSO-E statistical database, most of which can be accessed directly through web based queries (except for power balance data) or via reports published on the website https://www.entsoe.eu (for example, all data used in the YS&AR is available as excel attachments to the report). The data collection process for the YS&AR 2013 took place in July and August 2014 and the final check by the STCs was done in November 2014. It is expected that most of the data used is consolidated and final.

The data in this report is net data (more info about energy and power balance can be found in chapter 3.1 "Methodology").

The data and figures indicated for various countries may differ from some other national statistics published; this is because ENTSO-E statistics only describe the part of the electricity supply system,

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which concerns interconnected system operation. Consequently, this data may not represent the entire interconnected system in some countries.

Some differences can also be found within this report, especially between statistical data and adequacy data. The incoherency occurs for example between the Net Generation Capacity (NGC) as of 31st December and the NGC for December's reference point in the power balance data in the adequacy chapter (not caused by the 13 days difference between the reference points on 18 December and 31 December). Another example is the difference between sum of monthly energy generation and consumption and yearly energy provided for the adequacy chapter.

These differences arise for two main reasons:

- Geographical specifics, which concern differences between data referred to whole country or to synchronously interconnected system only.
- The representativity factor, which describes percentage data available for TSO. A part of data, coming from e.g. industry or from auto producers may not be available for TSO, therefore TSO can provide representativity factor, calculated on the basis of historical relation between TSO data and data from official national statistics. Following former UCTE Working Group Data decisions in UCTE / ENTSO-E statistical publications such as Statistical Factsheets (former Memo) and the previous Statistical Yearbook the energy generation, including all (sub) categories, and the energy consumption have been presented as 100% of a country. This means that for countries with a representativity factor other than 100% their national sums have been shown as 100%, determined according to the formula:

  $X_{100\%} = \frac{X_{\neq 100\%}}{\%_{\neq 100\%}} * 100\%$, where

  $X_{100\%}$ is the value after recalculation,

  $X_{\neq 100\%}$ is the value provided by STCs and

  $\%_{\neq 100\%}$ is the representativity factor provided by STCs.

  This remark concerns hourly peak load data available in the "YS&AR 2013 table no.1" as well as monthly energy data, available in the "YS&AR 2013 table no.2" excel attachments.

The adequacy section of the YS&AR coming from the previous System Adequacy Retrospect report is managed by the System Adequacy & Market Modelling group (System Adequacy sub-group in UCTE time) and data for this report was gathered by a different data collection mask. The representativity factor for this report has only been collected for information and data was not recalculated as 100% of a country. Consequently, all comparisons for countries and for the entire ENTSO-E are based on pure, national data. The ENTSO-E Data Expert Group and System Adequacy & Market Modelling Working Group are working on solutions to this problem to improve the quality of the YS&AR and its internal coherency for future editions. To recognize all national exceptions, it's worth reading the comments provided by correspondents as well as "Specific National Considerations" file, available at https://www.entsoe.eu.

In parallel activities related to data harmonisation processes, data definitions (e.g. EMR) and IT tools are still being worked on within ENTSO-E working groups, which will lead to the creation of a central database containing all the information.

The adequacy section also includes the area of Ukraine synchronously connected with ENTSO-E system, referred to as Ukraine West (UA_W), while the statistical section presents ENTSO-E member countries only.

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Some Switzerland power balance data for additional reference point represent ENTSO-E peak load time (17 January 2013 at 19:00) was estimated by ENTO-E, because this data was not available to Swissgrid. For additional reference point Swissgrid provided load and exchanges data only. More details can be found in the document “Specific National Considerations” mentioned above.

1.3. Transparency data

On 5 of January 2015, ENTSO-E will publish on its website, next to the statistical and adequacy data, transparency data related to the European regulation (543/2013). This data is to be published within certain timeframes in accordance with the regulation and therefore can originate from different sources and time frames as other information. Statistical and adequacy data is following different rules in gathering and is based on a country view whereas Transparency follows the bidding zone principles. Therefore differences can occur between the different publications although ENTSO-E tries to do its utmost to align definitions, time frames and national considerations in composing the data.

1.4. About ENTSO-E

ENTSO-E, the European Network of Transmission System Operators for Electricity, represents 41 Transmission System Operators (TSOs) from 34 countries across Europe. ENTSO-E was established and given legal mandate by the EU’s Third Legislative Package for the Internal Energy Market in 2009, which aims at further liberalising the gas and electricity markets in the EU.

ENTSO-E’s main objectives are:

- To promote cooperation across European TSOs so as to support the implementation of the EU energy and climate policy;
- To ensure security of supply and system reliability in an increasingly complex network;
- To ensure the completion of the IEM and the integration of renewable energy sources into the energy mix.

ENTSO-E contributes to the achievement of these objectives mainly through the drafting of network codes, a Ten-Year Network Development plan (TYNDP), recommendations for the coordination of technical cooperation between TSOs within the EU, annual outlooks for summer and winter electricity generation and the coordination of Research & Development (R&D) plans.

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2. Executive summary

2.1. ENTSO-E energy and power results

Year 2013 was the third year in a row, when electricity consumption decreased in the ENTSO-E power system[1]. 2013 decrease was also the biggest one and amounted to -1.3%. The relative decrease was lower, -1.0% when taking into account the fact that year 2012 was a leap year (one day more). This means that the consumption level is located between 2009 and 2010 consumption. Electricity generation decreased as well, by -1.2% compared to 2012. Figure 2.1.1 displays details of the evolution of energy.

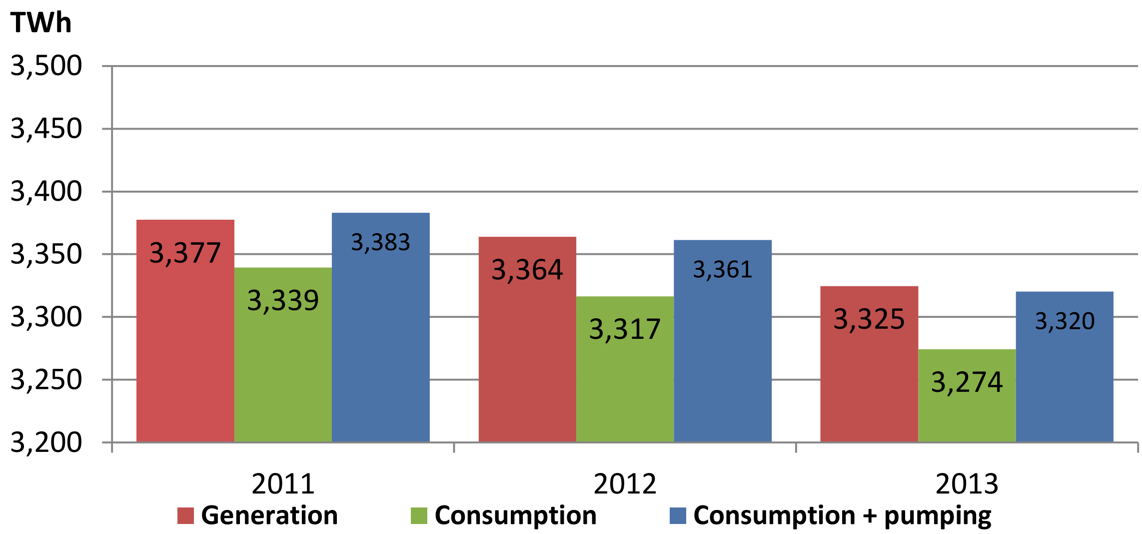

Figure 2.1.1: Energy evolution. Please note that the figure does not start from zero.

[1] As mentioned in the "General Introduction" all analysis in the report includes Ukraine West, a non-ENTSO-E system, while for statistical information in the excel attachments Ukraine West is excluded.

Year 2013 was also the second year, in which ENTSO-E power system exported more than imported. Net exports increased by 75.8%, however it is important to note, that 4.4 TWh (see Figure 2.1.3 below) is only 0.1% of ENTSO-E consumption. Both physical imports and physical exports in the ENTSO-E power system decreased a bit, but the level is higher than in year 2011. For more details see Figures 2.1.2 and 2.1.3.

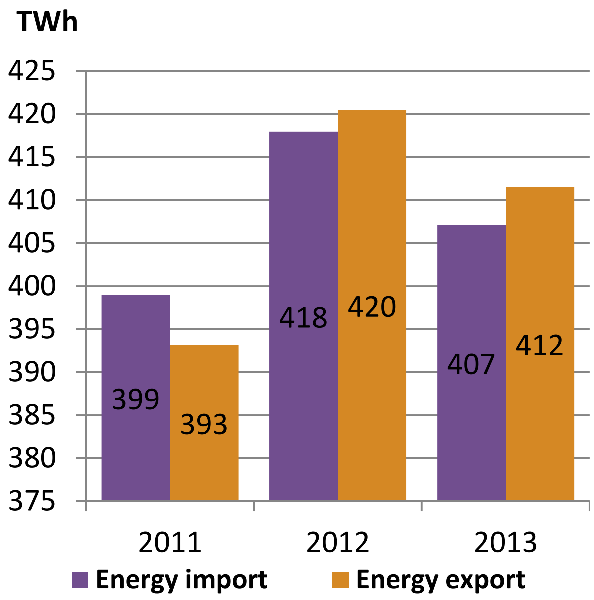

Figure 2.1.2: Import and export evolution

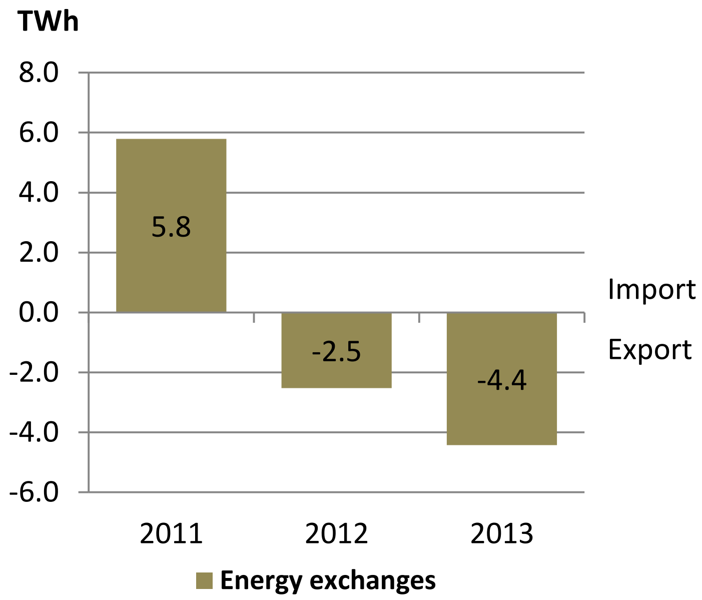

Figure 2.1.3: Exchange balance evolution

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The Net Generating Capacity (NGC) increased again, but the increase from 2012 to 2013 (14 GW) was not as large as from 2011 to 2012 (43 GW). In December 2013 there was 7.6 GW lack to cross the level of 1000 GW. On the other hand, the Unavailable Capacity (UC) registered in 12 reference points also had a year by year increase of 13.6 GW on average, (-6.6 GW – +35.7 GW depending on reference point). In other words, the NGC increase was of the same order of magnitude as the reported Unavailable Capacity (based on average values of UC from 12 reference points). This is because more and more power comes from Renewable Energy Sources (RES), large percentages of which are often unavailable. Both parameters are presented in Figures 2.1.4 and 2.1.5.

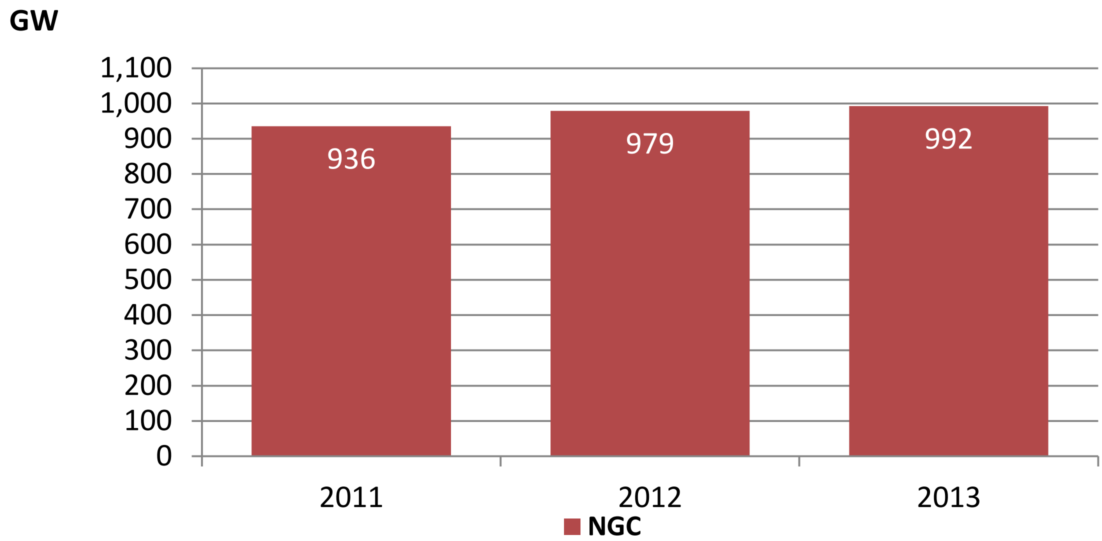

Figure 2.1.4: Net Generating Capacity evolution

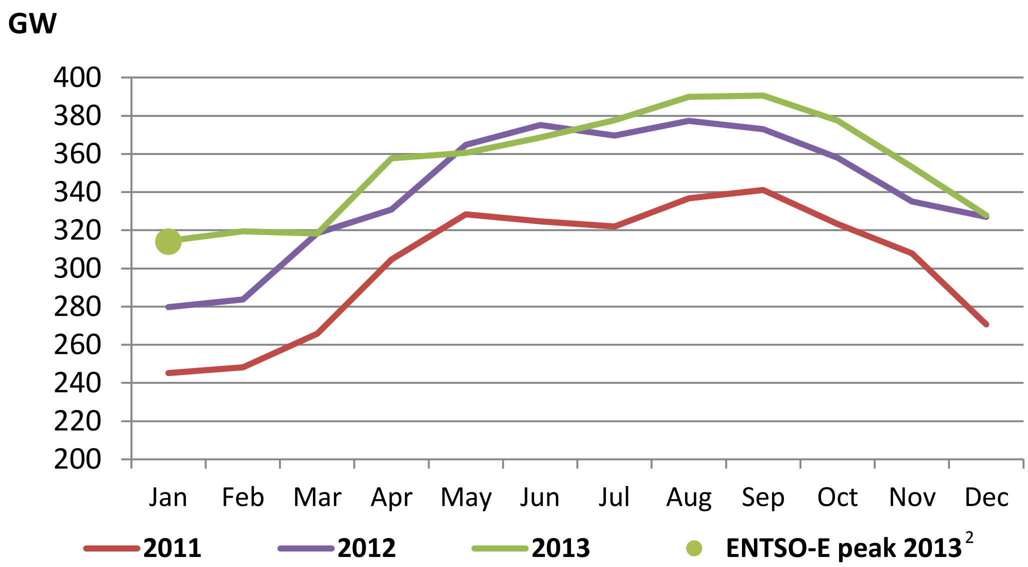

Figure 2.1.5: Unavailable Capacity evolution

[2] ENTSO-E peak 2013 marks the date of ENTSO-E peak load 2013, which took place on 17 January at 7 pm.

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The integration of large amounts of Renewable Energy Sources (RES), the completion of the internal electricity market, as well as new storage technologies, demand side response and evolving policies require revised adequacy assessment methodologies.

In this edition of YS&AR, apart from standard 12 reference points referred to 3rd Wednesday at 11:00 am., additional reference point was introduced. This reference point represents the time of ENTSO-E peak load in 2013 and it was chosen to assess generation adequacy in one of the stressed moment during the year. The same approach was applied to evaluate the associated impacts on security of supply at a pan-European level. However, with the development of the energy generation mix, which means more fluctuating renewables in the system and less conventional fossil fuel generation, critical situations may occur in the future at different times than at peak demand.

ENTSO-E is therefore working to improving its existing adequacy methodology with a special emphasis on hourly assessment of adequacy, harmonised inputs, system flexibility and interconnection assessments.

ENTSO-E published the final version of the three consultation documents together with the answers to the comments from stakeholders on the ENTSO-E website on 14 November 2014[3]

[3] https://www.entsoe.eu/news-events/announcements/announcements-archive/Pages/News/ENTSO-E-Assessment-of-the-Adequacy-Methodology-Consultation-is-Released-.aspx

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2.2. Yearly energy data per country in 2013 [GWh]

Pure national data with the representativity factor is presented below. This table is also available in the excel attachment “YS&AR 2013 table no.1”. Country comments can be found in the excel attachment and in chapters 3.2.2.2, 3.2.3.6 and 3.2.4.2.

Country	Nuclear	Fossil	of which lignite	of which coal	of which gas	of which oil	of which mixed fuels	of which other fossil fuels	RES except of hydro	of which wind	of which solar	of which biomass	of which other RES	Hydro	of which renewable hydro	of which other hydro	Non-identifiable	Total generation	Physical import	Physical export	Exch. balance	Pump	Consumption	Represen-tativity
AT	0	13 906	0	4 203	6 416	683	n.a.	2 604	5 769	2 970	215	2 584	0	40 963	37 201	3 762	7 079	67 717	24 960	17 689	7 271	5 374	69 614	100
BA	0	8 740	8 740	0	0	0	0	0	0	0	0	0	0	6 971	6 971	0	0	15 711	3 167	6 862	-3 695	0	12 016	
BE	40 632	26 917	0	2 352	19 985	0	1 077	3 503	9 128	3 563	2 424	3 141	0	1 672	357	1 315	0	78 349	17 140	7 607	9 533	1 750	86 132	100
BG	13 179	19 061	n.a.	n.a.	n.a.	n.a.	n.a.	19 061	2 790	1 371	1 358	61	0	4 755	4 084	671	n.a.	39 785	3 353	9 535	-6 182	1 043	32 560	100
CH	24 871	2 233	n.a.	n.a.	n.a.	n.a.	n.a.	2 233	1 636	108	n.a.	n.a.	1 528	39 572	37 440	2 132	n.a.	68 312	29 386	30 710	-1 324	2 132	64 856	100
CY	n.a.	3 942	n.a.	n.a.	n.a.	3 942	n.a.	0	229	229	n.a.	n.a.	0	n.a.	n.a.	n.a.	n.a.	4 171	n.a.	n.a.	0	n.a.	4 171	100
CZ	29 004	41 615	32 359	4 831	4 414	11	0	0	6 508	481	2 033	1 754	2 240	3 731	2 735	996	0	80 858	10 571	27 458	-16 887	1 217	62 754	100
DE	92 148	336 023	147 362	109 251	39 003	2 048	13 833	24 526	119 202	50 782	31 015	35 896	1 509	24 438	20 500	3 938	0	571 811	38 469	72 256	-33 787	7 473	530 551	100
DK	0	18 644	0	13 447	5 113	84	0	0	13 318	11 029	0	2 289	0	14	0	14	1	31 977	11 650	12 275	-625	0	31 352	100
EE	0	10 523	0	0	n.a.	n.a.	n.a.	10 523	1 098	529	0	569	0	25	25	0	0	11 646	2 416	6 011	-3 595	0	8 051	100
ES	54 182	104 884	3 432	36 804	54 460	10 189	n.a.	-1	73 794	54 709	12 765	6 321	-1	40 557	36 226	4 331	299	273 716	10 205	16 936	-6 731	5 960	261 025	100
FI	22 699	20 358	0	9 936	6 771	266	3 385	0	11 485	777	n.a.	10 708	0	12 717	12 717	0	925	68 184	17 591	1 876	15 715	n.a.	83 899	100
FR	403 756	44 653	0	19 829	19 952	4 872	0	0	26 819	15 941	4 660	4 803	1 415	75 432	70 434	4 998	0	550 660	11 687	60 148	-48 461	7 140	495 059	100
GB	66 061	210 101	0	129 247	80 556	19	278	1	18 059	18 027	0	0	32	5 746	2 836	2 910	0	299 967	17 501	4 455	13 046	3 914	309 099	94
GR	0	35 382	23 231	0	12 149	0	0	2	6 957	3 392	3 355	192	18	5 163	771	4 392	18	47 520	4 703	2 597	2 106	53	49 573	100
HR	0	4 089	0	2 184	1 594	42	269	0	625	494	10	121	0	8 046	8 046	0	0	12 760	11 255	6 762	4 493	150	17 103	100
HU	14 390	11 125	5 537	847	4 695	46	0	0	1 431	694	0	737	0	207	207	0	0	27 153	16 631	4 756	11 875	0	39 028	100
IE	0	18 623	2 318	4 177	12 097	32	0	-1	4 735	4 548	0	0	187	914	573	341	255	24 527	2 626	395	2 231	583	26 175	100
IS	0	0	n.a.	n.a.	n.a.	n.a.	n.a.	0	4 885	0	0	0	4 885	12 762	12 594	168	0	17 647	n.a.	n.a.	0	0	17 647	100
IT	0	166 746	0	40 268	93 977	17 940	14 561	0	57 877	14 811	21 229	16 516	5 321	54 069	50 825	3 244	0	278 692	44 481	2 203	42 278	2 495	318 475	100
LT	0	2 357	0	0	755	98	1 504	0	983	600	45	338	0	1 059	516	543	0	4 399	8 073	1 127	6 946	770	10 575	100
LU	0	1 338	0	0	1 338	0	0	0	270	0	68	45	157	1 149	n.a.	1 149	0	2 757	6 706	1 744	4 962	1 456	6 263	
LV	n.a.	2 793	n.a.	n.a.	2 105	n.a.	688	0	658	58	n.a.	600	0	2 854	n.a.	2 854	n.a.	6 305	5 005	3 650	1 355	n.a.	7 660	100
ME	0	1 311	1 311	n.a.	n.a.	n.a.	n.a.	0	n.a.	n.a.	n.a.	n.a.	n.a.	2 594	n.a.	2 594	n.a.	3 905	3 013	3 342	-329	n.a.	3 576	
MK	n.a.	4 081	3 741	n.a.	340	n.a.	n.a.	0	n.a.	n.a.	n.a.	n.a.	n.a.	1 362	n.a.	1 362	n.a.	5 443	2 490	62	2 428	n.a.	7 871	100
NI	0	5 988	0	2 484	3 428	5	0	71	1 397	1 313	0	42	42	11	0	11	0	7 396	1 885	411	1 474	0	8 870	100
NL	2 520	77 711	n.a.	n.a.	n.a.	n.a.	n.a.	77 711	11 945	5 509	50	6 376	10	113	113	0	0	92 289	33 252	14 875	18 377	0	110 666	100
NO	n.a.	3 323	n.a.	n.a.	3 323	n.a.	n.a.	0	1 894	1 894	n.a.	n.a.	0	129 022	129 022	0	n.a.	134 239	10 135	15 140	-5 005	n.a.	129 234	100
PL	0	135 735	52 167	80 520	3 047	0	0	1	12 160	5 689	0	6 360	111	2 957	2 402	555	0	150 852	7 801	12 323	-4 522	840	145 490	100
PT	0	18 298	0	10 951	6 910	191	243	3	14 890	11 749	441	2 700	0	14 639	13 482	1 157	0	47 827	8 099	5 325	2 774	1 459	49 142	100
RO	10 674	23 611	12 154	2 795	3 649	0	5 013	0	5 323	4 597	410	316	0	14 877	14 877	0	0	54 485	2 704	4 719	-2 015	167	52 303	100
RS	0	32 149	31 982	0	167	0	0	0	0	0	0	0	0	11 052	10 402	650	0	43 201	4 652	7 397	-2 745	1 012	39 444	100
SE	63 603	4 926	0	921	1 830	204	1 971	0	20 329	9 962	n.a.	10 367	0	60 815	60 815	0	0	149 673	15 132	25 094	-9 962	n.a.	139 711	100
SI	5 023	4 381	3 375	834	172	0	0	0	441	2	220	219	0	4 480	4 318	162	498	14 822	7 521	8 684	-1 163	392	13 268	100
SK	14 661	4 929	1 748	989	2 189	3	0	0	1 325	6	587	533	199	5 000	4 677	323	1 082	26 997	10 719	10 628	91	437	26 651	100
ENTSO-E	857 403	1 420 496	329 457	476 870	390 435	40 675	42 822		437 960	225 834	80 885	113 588		589 738	545 166		10 157	3 315 753	404 979	405 052	-73	45 817	3 269 864	
UA_W	0	8 755	0	0	0	0	8 755	0	11	0	11	0	0	123	123	0	0	8 889	2 115	6 471	-4 356	0	4 533	100
SUM	857 403	1 429 251	329 457	476 870	390 435	40 675	51 577		437 971	225 834	80 896	113 588		589 861	545 289		10 157	3 324 642	407 094	411 523	-4 429	45 817	3 274 397	

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2.3. Net Generating Capacity as of 31 December 2013 per country [MW]

Pure national data with the representativity factor is presented below. This NGC data represents statistics and may differ from the NGC provided for the adequacy section (see 1.2 for more information). This table is also available in the excel attachment “YS&AR 2013 table no.1”. Country comments can be found in the excel attachment.

Country	NGC Nuclear	NGC fossil fuels	of which lignite	of which hard coal	of which gas	of which oil	of which mixed fuels	NGC hydraulic power	of which renewable hydro	NGC renewables	of which wind	of which solar	of which biomass	NGC other sources	NGC Total Sum	Represen-tativity index
AT	-	7,847	-	1,171	5,119	360	497	13,427	13,427	2,305	1,555	324	426	244	23,823	100
BA	-	1,570	1,570	-	-	-	-	2,031	1,591	-	-	-	-	-	3,601	100
BE	5,926	7,500	-	410	6,880	210	-	1,430	120	5,740	1,720	2,680	1,340	-	20,596	100
BG	2,000	6,704	4,197	1,710	797	-	-	3,184	2,320	1,757	683	1,036	38	-	13,645	100
CH	3,308	426	-	-	-	-	-	13,805	12,422	775	49	437	289	243	18,557	100
CY	-	1,478	-	-	-	1,478	-	-	-	144	144	-	-	-	1,622	100
CZ	4,040	11,237	-	-	1,283	-	9,954	2,230	1,082	2,402	270	2,132	-	-	19,909	100
DE	12,068	82,891	21,247	24,939	28,090	4,082	4,533	10,780	4,430	77,360	34,040	36,913	5,856	-	183,099	100
DK	-	8,886	-	4,899	2,894	1,049	44	9	9	5,960	4,813	552	595	-	14,855	100
EE	-	2,361	-	-	234	16	110	7	7	370	276	-	94	-	2,738	100
ES	7,573	46,852	1,056	9,716	32,559	3,394	127	19,382	16,715	31,063	22,916	7,078	1,069	63	104,933	100
FI	2,752	9,312	-	3,573	1,936	1,744	2,060	3,168	3,168	2,484	447	-	2,037	21	17,737	100
FR	63,130	25,707	-	6,359	10,400	8,948	-	25,434	23,706	14,018	8,157	4,373	1,190	-	128,289	100
GB	9,749	53,287	-	20,524	30,485	2,278	-	3,969	1,070	7,926	6,528	-	1,398	-	74,931	89
GR	-	10,056	4,456	-	4,902	698	-	3,237	220	3,985	1,520	2,419	46	90	17,368	100
HR	-	1,788	-	315	-	320	1,153	2,110	2,110	301	256	20	25	-	4,199	100
HU	1,892	6,150	752	279	4,709	410	-	56	56	476	329	2	145	-	8,574	100
IE	-	6,149	346	855	3,752	1,128	68	530	238	1,898	1,844	-	54	60	8,637	100
IS	-	52	-	-	-	52	-	1,860	1,835	663	2	-	-	-	2,575	100
IT	-	71,194	-	6,393	35,750	15,720	13,331	22,009	-	31,547	8,542	18,420	3,856	-	124,750	100
LT	-	2,620	-	-	588	-	2,032	1,026	126	427	282	68	77	10	4,083	100
LU	-	493	-	-	493	-	-	1,134	38	174	57	106	11	21	1,822	100
LV	-	905	-	-	820	-	85	1,578	1,578	140	58	-	82	-	2,623	100
ME	-	220	-	-	-	-	-	660	10	-	-	-	-	-	880	100
MK	-	1,157	718	-	250	189	-	539	-	36	36	-	-	-	1,732	100
NI	-	5,988	-	2,513	4,370	4	5,983	12	-	1,398	1,313	-	26	-	7,398	100
NL	490	26,759	-	5,722	20,063	-	974	38	38	3,873	2,713	760	400	684	31,844	100
NO	-	1,090	-	-	1,090	-	-	30,753	30,753	757	757	-	-	-	32,600	100
PL	-	29,170	8,737	19,519	913	-	-	2,349	936	4,112	3,387	-	723	-	35,631	100
PT	-	7,306	-	1,756	4,758	360	414	5,652	5,652	4,834	4,368	282	177	-	17,792	100
RO	1,300	9,490	3,885	1,179	1,999	-	2,427	6,227	6,227	3,065	2,451	565	49	-	20,082	100
RS	-	5,594	5,283	-	311	-	-	2,959	2,345	-	-	-	-	-	8,553	100
SE	9,531	4,999	-	225	879	3,392	503	16,150	16,150	7,593	4,470	43	3,080	-	38,273	100
SI	696	1,239	578	222	84	-	355	1,129	949	-	-	-	-	-	3,064	
SK	1,940	2,801	567	440	1,104	280	410	2,531	1,614	802	3	537	176	-	8,074	100
ENTSO-E	**126,395**	**461,278**	**53,392**	**112,719**	**207,512**	**46,112**	**45,060**	**201,395**	**150,942**	**218,385**	**113,986**	**78,747**	**23,259**	**1,436**	**1,008,889**	-
UA_W	-	2,538	-	-	-	-	2,538	30	30	18	-	18	-	-	2,586	100
Sum	**126,395**	**463,816**	**53,392**	**112,719**	**207,512**	**46,112**	**47,598**	**201,425**	**150,972**	**218,403**	**113,986**	**78,765**	**23,259**	**1,436**	**1,011,475**	-

2.4. Tie lines

Figure 2.2.1 presents a simplified diagram of the tie lines (cross frontier) in the ENTSO-E areas as of 31 December 2013. This diagram is also available in high resolution in the download package

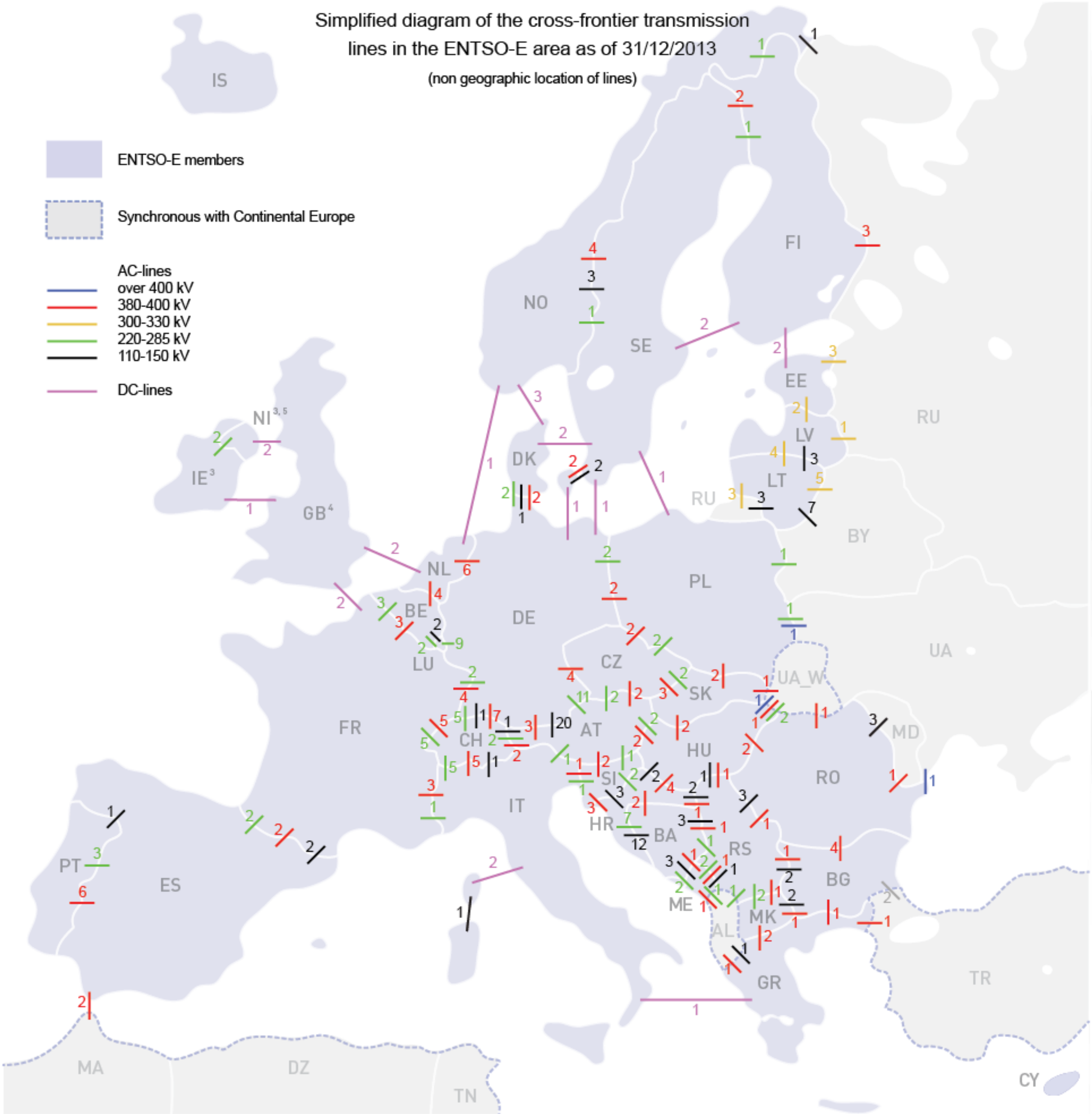

Figure 2.2.1: Tie lines

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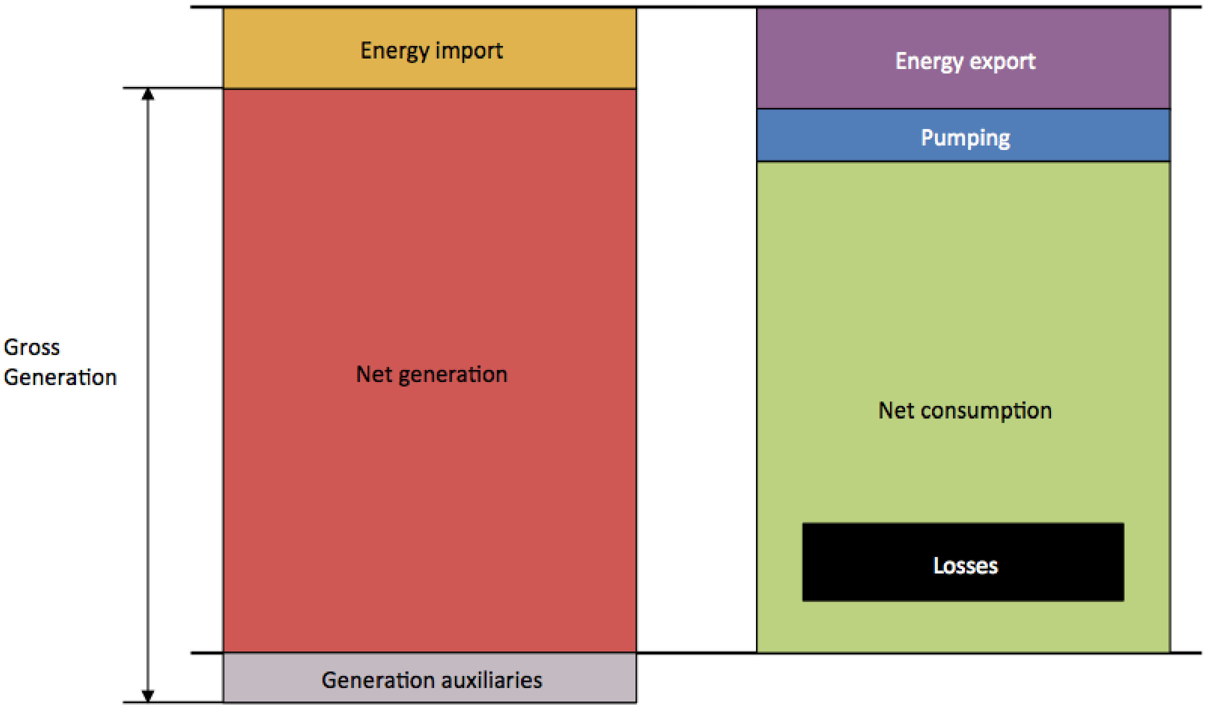
3. Adequacy retrospect

3.1. Methodology

3.1.1. Energy balance

The energy balance structure can be found below. This structure is common for both the adequacy section of the report and the statistical information, which is presented in the excel attachments (in the yearly perspective, based on monthly data)[4].



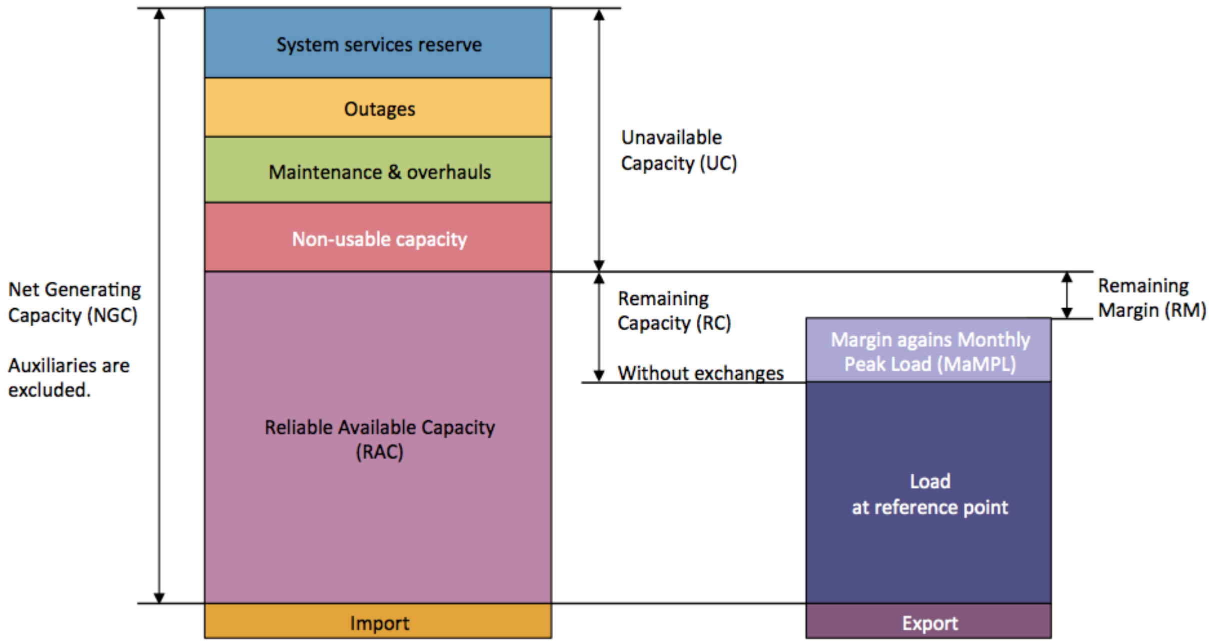
For energy analysis, data for Y-1 was collected. For some countries, data regarding year Y-1 could still have been provisional when collected in year Y. Data regarding year Y-2 sometimes differs from the data published in Y-1 because it has been updated in the meantime. Therefore, correspondents are invited to validate and update (if needed) the energy values for Y-2 when entering the values for Y-1.

3.1.2. Power balance

This subchapter describes the methodology for system adequacy analysis used by ENTSO-E in the adequacy chapter of the Yearly Statistics & Adequacy Retrospect report. The system adequacy of a power system pertains to the ability of a power system to supply the load in all the steady states in which the power system may exist, considering standard conditions. System adequacy is analysed here mainly through generation adequacy, whereby the generation adequacy of a power system is an

[4] All definitions of terms are located in ENTSO-E Glossary via EMR tool. More information can be found in the chapter 1.1.

assessment of the ability of the generation to match the consumption of the power system. The figure below shows the relationships between the quantities used in power balance analysis[5].



The generation adequacy retrospect in the power system is assessed through the **remaining capacity value**, which is the part of the **Net Generating Capacity** left in the power system after the **Load** at a **Reference Point** has been covered.

When the remaining capacity without exchanges is positive, the power system had enough internal generating capacity left to cover its load; when it is negative, the power system had to cover its load with the help of imports.

Considering the definition of the Remaining Margin (RM), the generation adequacy retrospect assessment is then extended monthly.

When the remaining margin without exchanges is positive, the power system had enough internal generating capacity left to cover its load at any time during the month. When the remaining margin without exchanges is negative, the power system may have had to rely on imports to cover its monthly peak load.

Generation adequacy is assessed for each individual country and for the whole ENTSO-E. In case of negative Remaining Capacity (RC) in individual countries, the power balance is still achieved when the RC of the respective regional block or ENTSO-E is positive and the interconnection capacities are sufficient to cope with the necessary exchanges.

[5] All definitions of terms are located in ENTSO-E Glossary via EMR tool. More information can be found in the chapter 1.1.

The power data collected for each country is synchronous at each reference point (date and time the power data is collected for) and can therefore be aggregated. In order to compare the evolution of the results, similar reference points are specified for each month and from one report to another.

Times in the studies are expressed in Central European Time (CET=UTC[6]+1) in winter and Central European Summer Time (CEST=UTC+2) in summer. A single monthly reference point is defined in the Adequacy Retrospect section: the 3rd Wednesday of each month at the 11th hour (from 10:00 CEST to 11:00 CEST) in summer and (10:00 CET to 11:00 CET) in winter. Data collected for the hour H is the average value[7] from the hour H-1 to the hour H.

This year edition includes data for new reference point, which represent the date when ENTSO-E peak load took place. This reference point was set based on the date of the ENSO-E peak load, calculated from national hourly load data delivered by correspondents for monthly statistics. ENTSO-E peak load in 2013 took place on Thursday, 17 January. The idea of introducing this additional reference point was to analyze more stressed moment in system operation point of view, than “standard” reference points on 3rd Wednesday, 11:00 a.m. Since ENTSO-E does not collect all elements of power balance, there is not possible to find ENTSO-E lowest level of RC, which is expected to be critical in the power balance point of view. So, power balance for the moment of ENTSO-E peak load looks to be optimal taking into account available data. Implementation of new transparency platform is additional chance to look for new, more interesting reference points, e.g. hour with higher ever (during reporting year) wind generation.

[6] UTC is the international designation for Universal Coordinated Time.
[7] When possible, power data used in the retrospect power balance is based on the hourly average values of the actual metering at every reference point.

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3.2. Energy balance

3.2.1. ENTSO-E Data Summary

Compared to 2012, both energy consumption and generation have decreased in 2013. The same was observed in exchanged imports and exports, whereas a smaller decrease of the latter contributed to ENTSO-E growing as net exporter (+75.8%). Regarding generation mix, RES was the only type of generation that has increased its share. All details can be found in Table 3.2.1.1[8].

TWh	2011	2012	2013	Change 2013 to 2012	
				Absolute value	%
Total Generation	**3 377.3**	**3 363.9**	**3 324.6**	**-39.3**	**-1.2%**
Fossil fuels generation	1 641.1	1 542.9	1 429.3	-113.7	-7.4%
Nuclear generation	886.6	862.8	857.4	-5.4	-0.6%
Non-renewable hydro generation	65.0	70.0	44.6	-25.5	-36.4%
RES generation (incl. renewable hydro)	774.8	878.1	983.3	105.2	12.0%
Not clearly identifiable energy sources gen.	9.8	10.1	10.2	0.1	0.9%
Energy exchanges	**5.8**	**-2.5**	**-4.4**	**-1.9**	**75.8%**
Energy import	398.9	417.9	407.1	-10.8	-2.6%
Energy export	393.1	420.5	411.5	-8.9	-2.1%
Pumping	**43.7**	**44.8**	**45.8**	**1.0**	**2.2%**
Consumption	**3 339.4**	**3 316.6**	**3 274.4**	**-42.2**	**-1.3%**

Table 3.2.1.1: ENTSO-E energy balance summary

The energy balance below (see Figure 3.2.1.1) displays the relationship between demand and supply as observed in 2013.

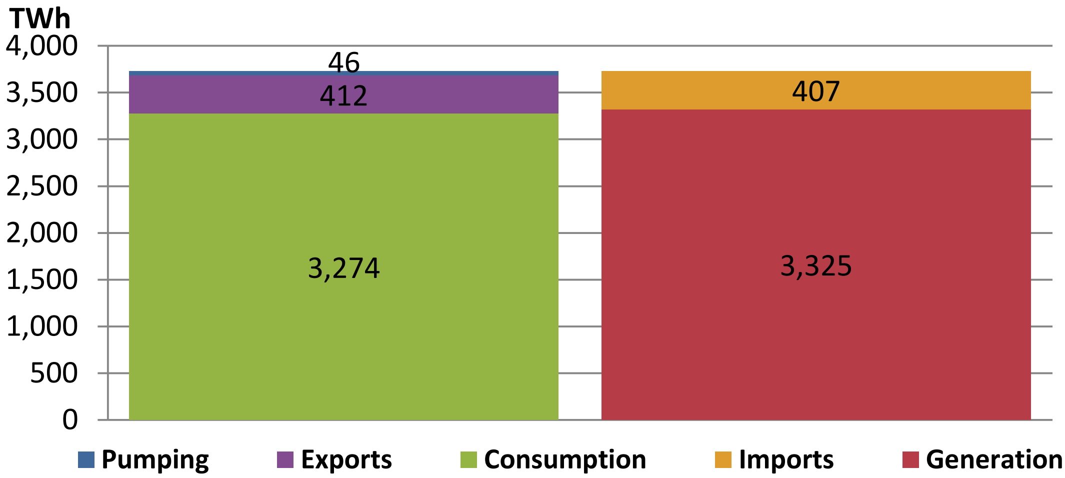

Figure 3.2.1.1: Energy balance in 2013

[8] As mentioned in paragraph 1.2 values of "total" or "sum" represent ENTSO-E, including the Ukraine West system.

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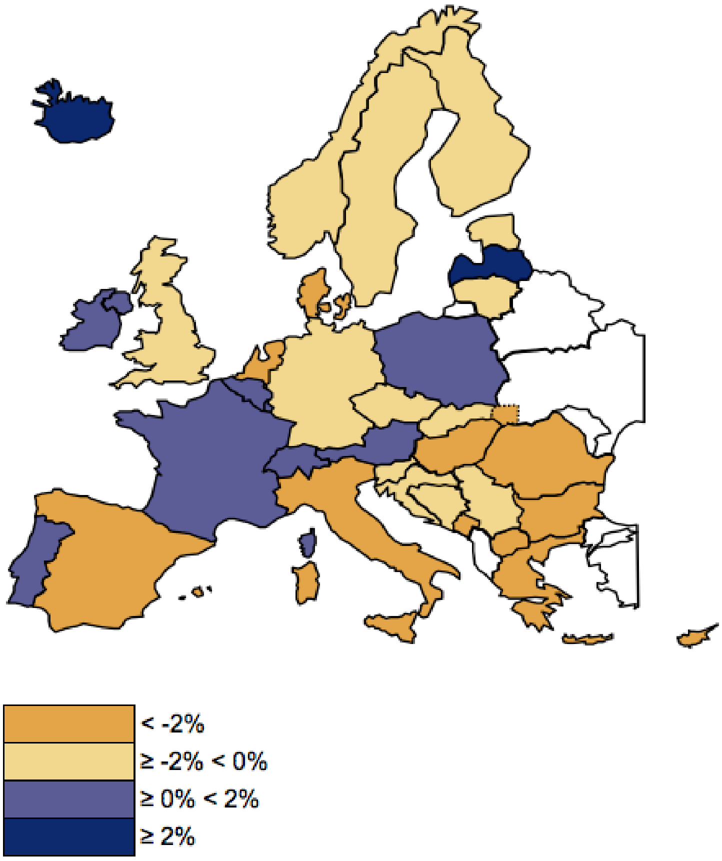
3.2.2. Energy consumption

3.2.2.1. ENTSO-E overview

In 2013, the consumption of electricity maintained its downward trend that was started in 2010 and that accounts for a cumulative decrease of nearly 86 TWh, meaning 2.6% below 2010 values. Compared to 2012, the decrease amounted to -1.3% (-1.0% when taking into account the 2012 leap year).

Looking at the country details, only 11 out of the 36 countries (30.5%) present increased consumptions in the last year. Map 3.2.2.1.1 shows the variations of each country for 2013 compared to 2012.

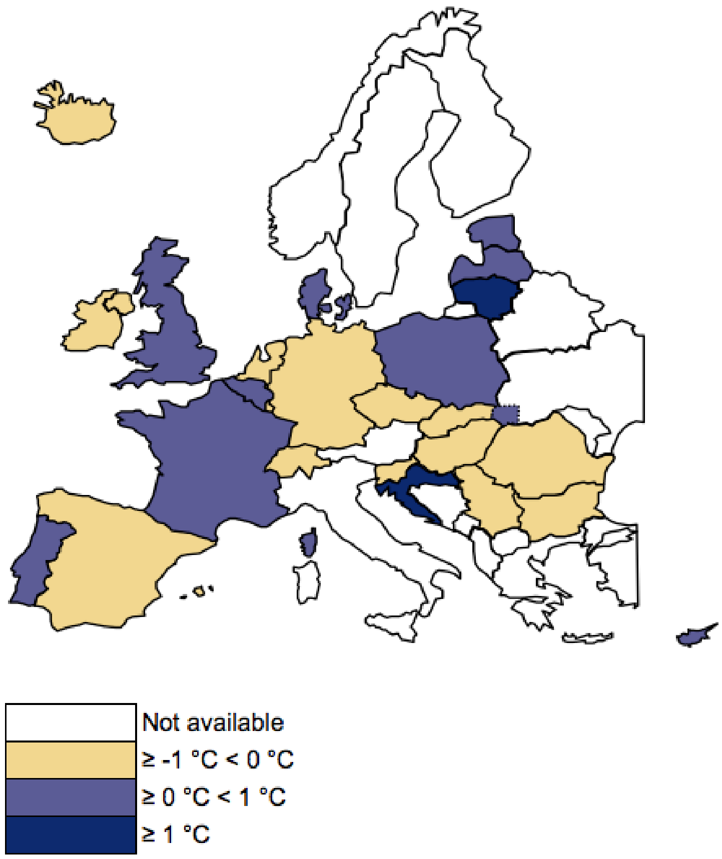


Data related to the map
Used formula:
$(Cons_{2013}-Cons_{2012})/Cons_{2012}$

AT	0.5%	IS	3.1%
BA	-0.9%	IT	-3.0%
BE	1.6%	LT	-0.3%
BG	-2.7%	LU	0.4%
CH	0.2%	LV	2.8%
CY	-10.6%	ME	-8.4%
CZ	-0.4%	MK	-7.0%
DE	-1.7%	NI	0.1%
DK	-8.4%	NL	-4.4%
EE	-1.8%	NO	-0.4%
ES	-2.3%	PL	0.4%
FI	-1.6%	PT	0.2%
FR	1.1%	RO	-3.9%
GB	-1.2%	RS	-0.5%
GR	-6.0%	SE	-1.9%
HR	-1.0%	SI	-0.9%
HU	-2.2%	SK	-0.7%
IE	1.8%	UA_W	-4.2%

Map 3.2.2.1.1: Consumption changes per country in 2013

During 2013, the average annual temperatures in most of ENTSO-E countries were lower than in 2012 (see Map 3.2.2.1.2 below). Nevertheless, negative differences were never below -0.8ºC.



Data related to the map
Used formula:
$Temp_{2013}$-$Temp_{2012}$

AT	n.a.	IS	-0.8°C
BA	n.a.	IT	n.a.
BE	0.7°C	LT	1.2°C
BG	-0.1°C	LU	-0.6°C
CH	-0.6°C	LV	0.9°C
CY	0.1°C	ME	n.a.
CZ	-0.5°C	MK	n.a.
DE	-0.4°C	NI	-0.2°C
DK	0.4°C	NL	-0.5°C
EE	0.6°C	NO	n.a.
ES	-0.3°C	PL	0°C
FI	n.a.	PT	0.4°C
FR	0°C	RO	-0.1°C
GB	0°C	RS	-0.2°C
GR	n.a.	SE	n.a.
HR	2°C	SI	-0.4°C
HU	-0.2°C	SK	-0.1°C
IE	-0.6°C	UA_W	0.4°C

Map 3.2.2.1.2: Temperature changes per country in 2013

3.2.2.2. National comments on consumption

IE – Ireland
Increase nearly 1% from last year.

PL – Poland
Polish TSO data.

3.2.3. Energy generation

3.2.3.1. ENTSO-E overview

Generally energy generation in ENTSO-E system has been nearly matching energy consumption. This is due to the fact that exchanges with non-ENTSO-E neighbouring countries (Russia, Belarus, Ukraine, the Republic of Moldova, Turkey and Morocco) are quite limited when compared to the size of ENTSO-E.

Overall energy generation in 2013 decreased 1.2% compared to 2012. Figure 3.2.3.1.1 shows how energy sources have been changing since 2011.

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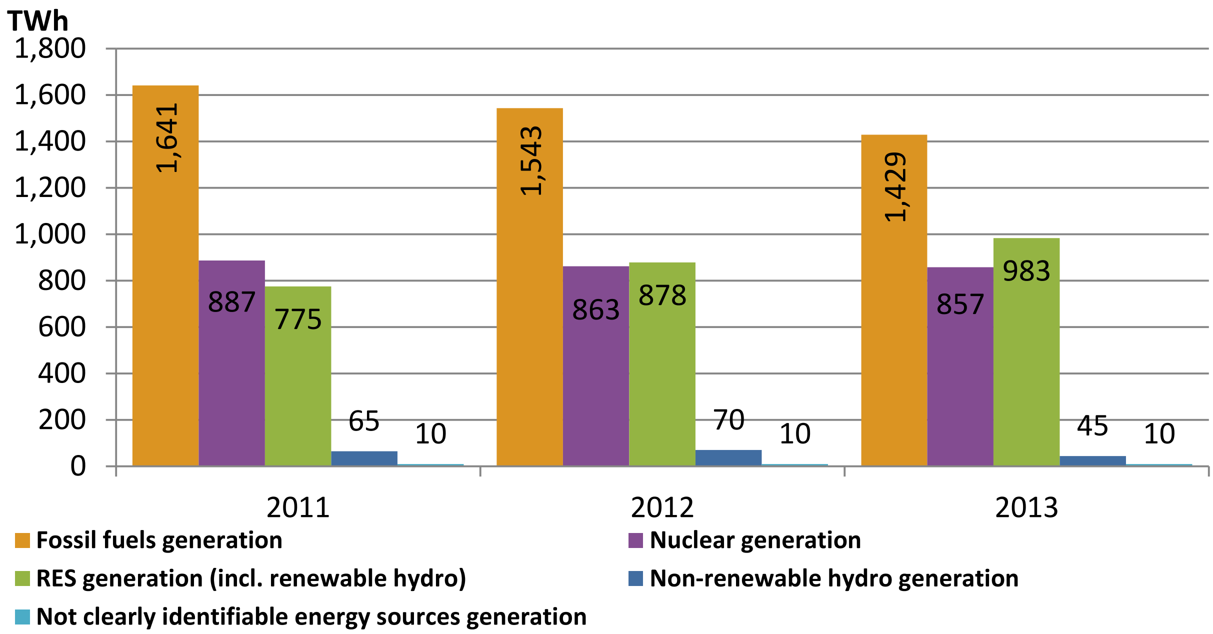

Figure 3.2.3.1.1: Generation category evolution

When looking at generation mixes in 2012 and 2013 (Figures 3.2.3.1.2 and 3.2.3.1.3) the quite high increase of renewable generation is reflected in the growth (by 12%) registered in this category. Moreover, since nuclear decreased by less than average it also managed to slightly grow its share (by 0.2 percentage point). The shares of the other categories decreased except for the not clearly identifiable category, which kept stable.

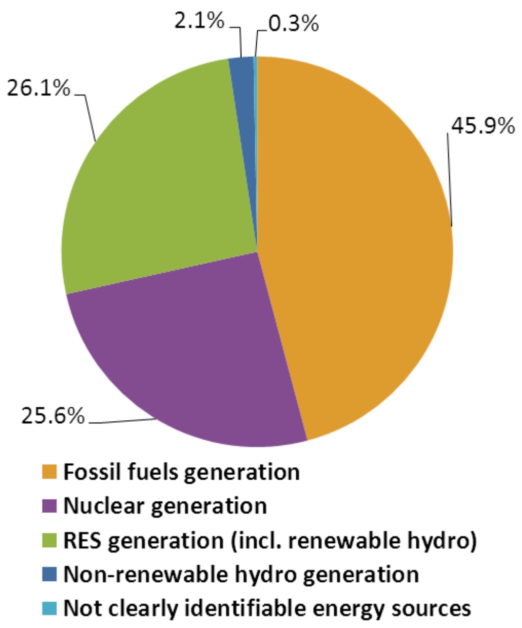

Figure 3.2.3.1.2: Generation mix in 2012

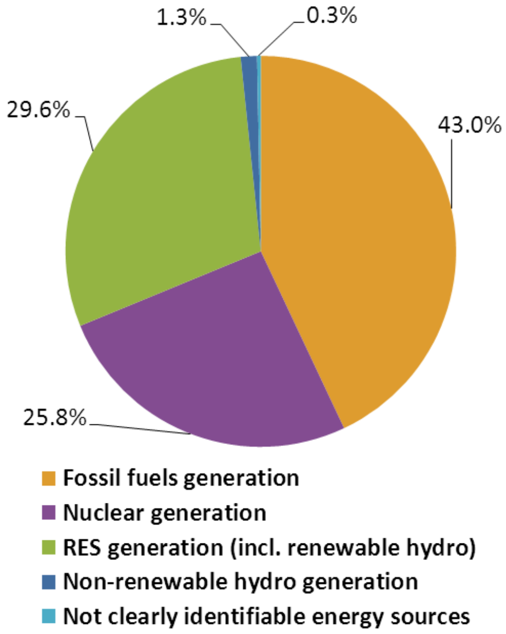

Figure 3.2.3.1.3: Generation mix in 2013

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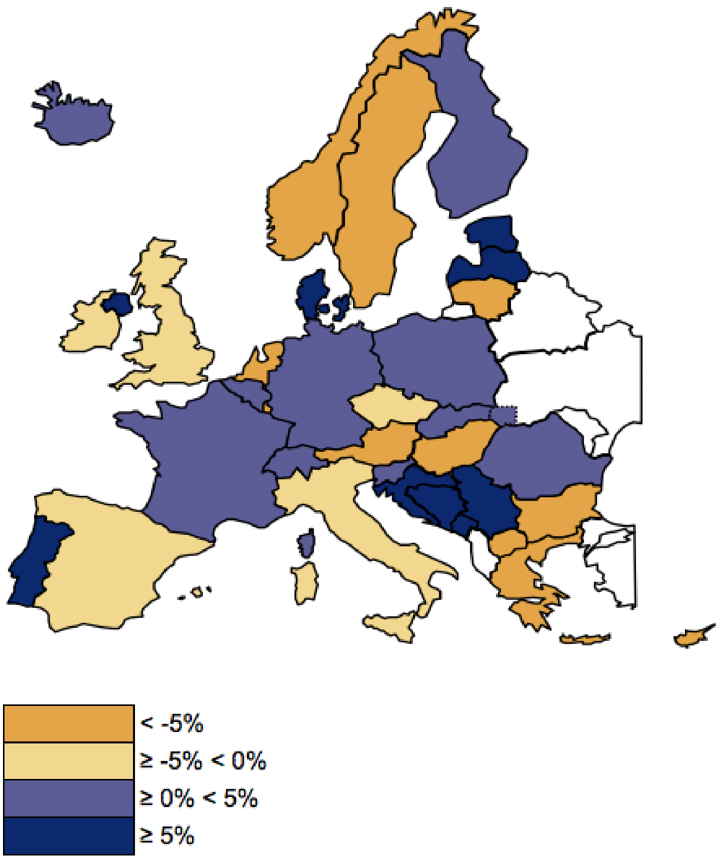
In spite of the overall decrease of generation at ENTSO-E level, more than half of the countries presented positive changes as shown in Map 3.2.3.1.1 below. Individual differences between values observed in 2013 and 2012 range from nearly -24.7% up to +40.3%.



Data related to the map
Used formula:
$(Gen_{2013}-Gen_{2012})/Gen_{2012}$

AT	-6.0%	IS	3.1%
BA	28.4%	IT	-3.1%
BE	2.2%	LT	-6.5%
BG	-7.1%	LU	-24.7%
CH	0.4%	LV	9.5%
CY	-10.6%	ME	40.3%
CZ	-0.3%	MK	-6.4%
DE	0.2%	NI	5.9%
DK	10.2%	NL	-6.5%
EE	11.3%	NO	-9.2%
ES	-3.4%	PL	1.7%
FI	0.7%	PT	12.4%
FR	1.7%	RO	0.3%
GB	-2.2%	RS	8.4%
GR	-7.2%	SE	-7.6%
HR	28.8%	SI	1.9%
HU	-15.0%	SK	0.8%
IE	-4.4%	UA_W	3.9%

Map 3.2.3.1.1: Generation changes per country in 2013

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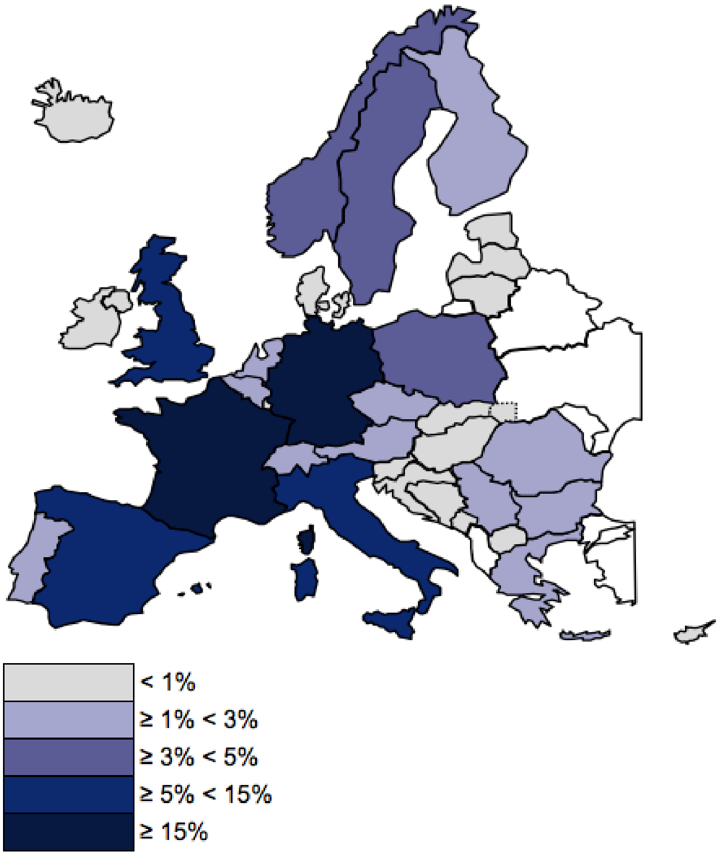
Regarding the share of generation, the 4 countries with the highest contributions (Germany, France, Italy and Spain) account for more than half of total ENTSO-E generation in 2013 (Map 3.2.3.1.2).



Data related to the map
Used formula:
$Gen_{2013}/Gen_{2013}(ENTSO\text{-}E)$

AT	2.0%	IS	0.5%
BA	0.5%	IT	8.4%
BE	2.4%	LT	0.1%
BG	1.2%	LU	0.1%
CH	2.1%	LV	0.2%
CY	0.1%	ME	0.1%
CZ	2.4%	MK	0.2%
DE	17.2%	NI	0.2%
DK	1.0%	NL	2.8%
EE	0.4%	NO	4.0%
ES	8.2%	PL	4.5%
FI	2.1%	PT	1.4%
FR	16.6%	RO	1.6%
GB	9.0%	RS	1.3%
GR	1.4%	SE	4.5%
HR	0.4%	SI	0.4%
HU	0.8%	SK	0.8%
IE	0.7%	UA_W	0.3%

Map 3.2.3.1.2: Share of each country in the total generation in 2013

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Figures 3.2.3.1.4 and 3.2.3.1.5 show the share of the different individual fuel types as part of total generation of each country.

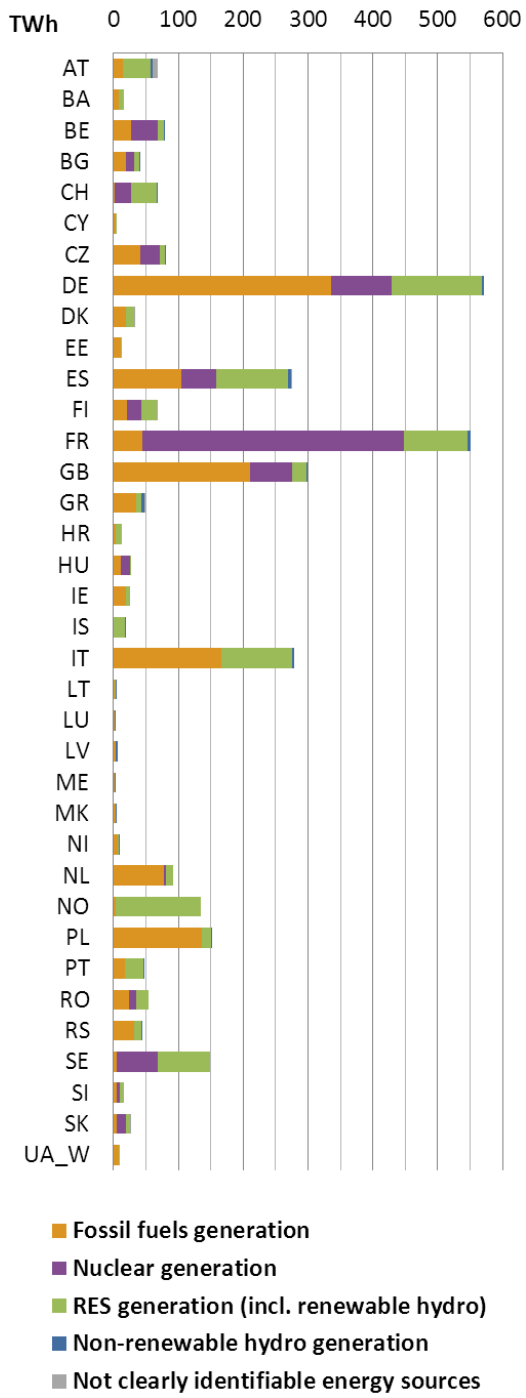

Figure 3.2.3.1.4: Generation mix per country in 2013 (absolute values)

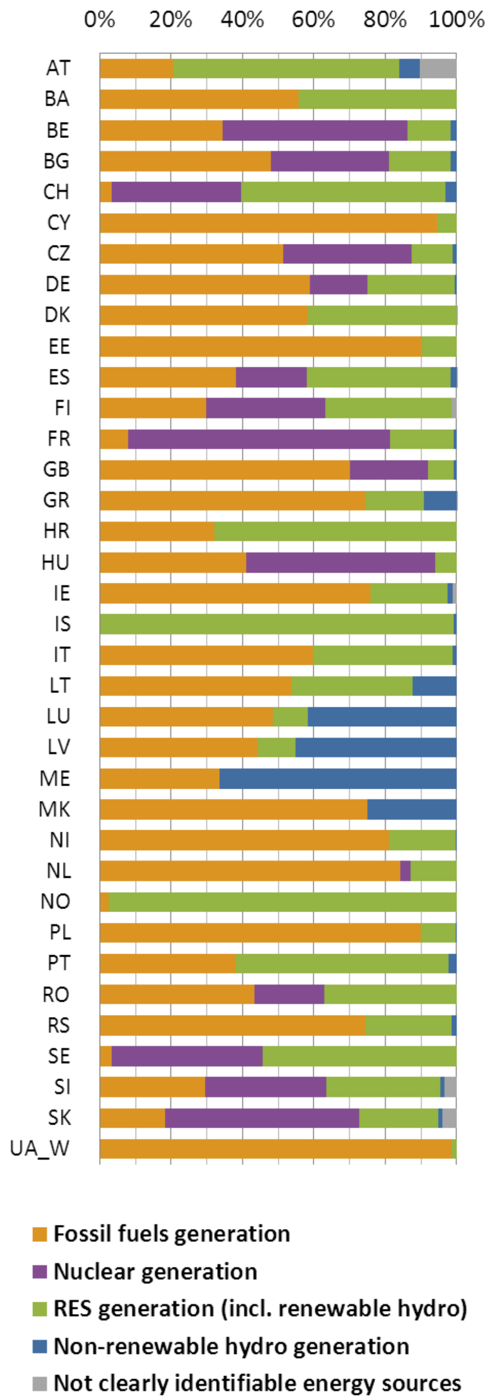

Figure 3.2.3.1.5: Generation mix per country in 2013 (percentage values)

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3.2.3.2. Fossil fuels generation

As shown in Figure 3.2.3.2.1 and Table 3.2.3.2.1, although there was a general reduction of generation from fossil fuels in 2013 (-7.4%), both hard coal and lignite fuel types were able to increase their contributions back to the levels of 2011. On the other hand generation from gas continued its downward trend, decreasing more than 15.4%, which corresponds to less 70.3 TWh than previous year. The same occurred to mixed fuels and other fossil fuels sources that lost approximately 40% of their generation.

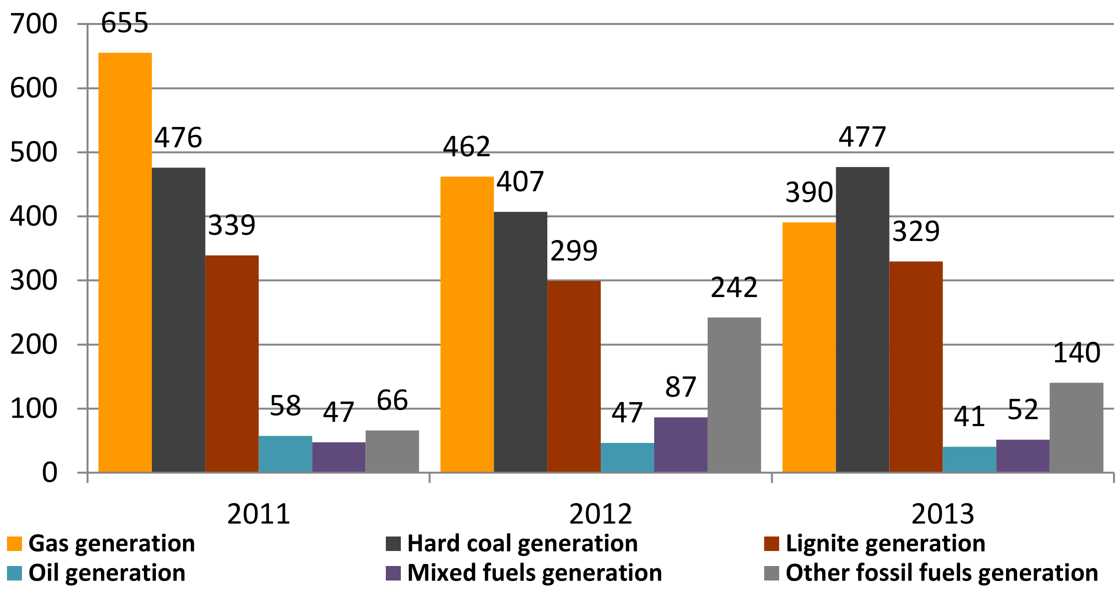

Figure 3.2.3.2.1: Fossil fuels generation evolution per source

	Total Fossil fuels generation	of which					
		Lignite generation	Hard coal generation	Gas generation	Oil generation	Mixed fuels generation	Other fossil fuels generation
%	-7.4%	10.2%	17.1%	-15.4%	-12.6%	-40.4%	-42.0%
TWh	-113.7	30.5	69.7	-71.3	-5.9	-35.0	-101.7

Table 3.2.3.2.1: Fossil fuels generation changes per source

The share of different types of fossil fuels in 2013 is depicted in Figure 3.2.3.2.2, where hard coal is highlighted, exceeding natural gas and covering more than one third of total generation. Lignite also increased its share, positioning not far from gas that is now only 4.2 percentage points ahead.

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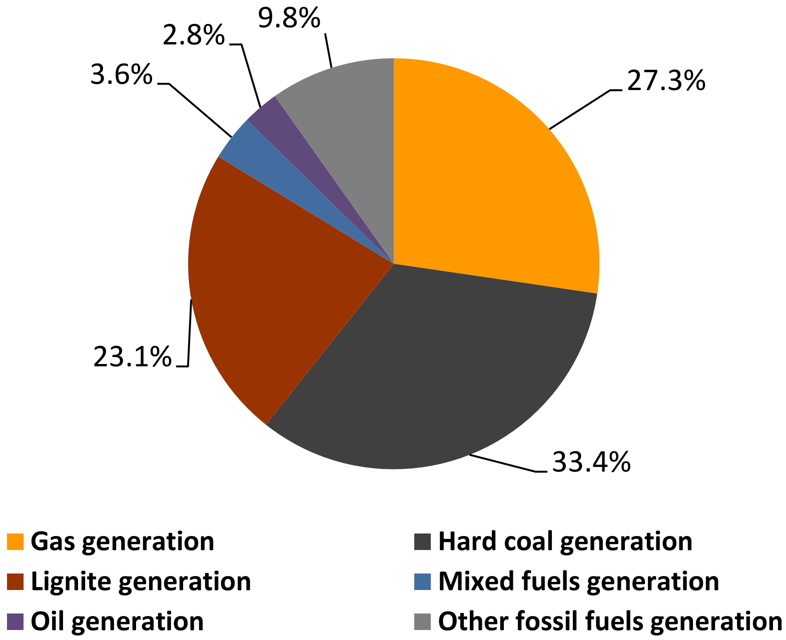
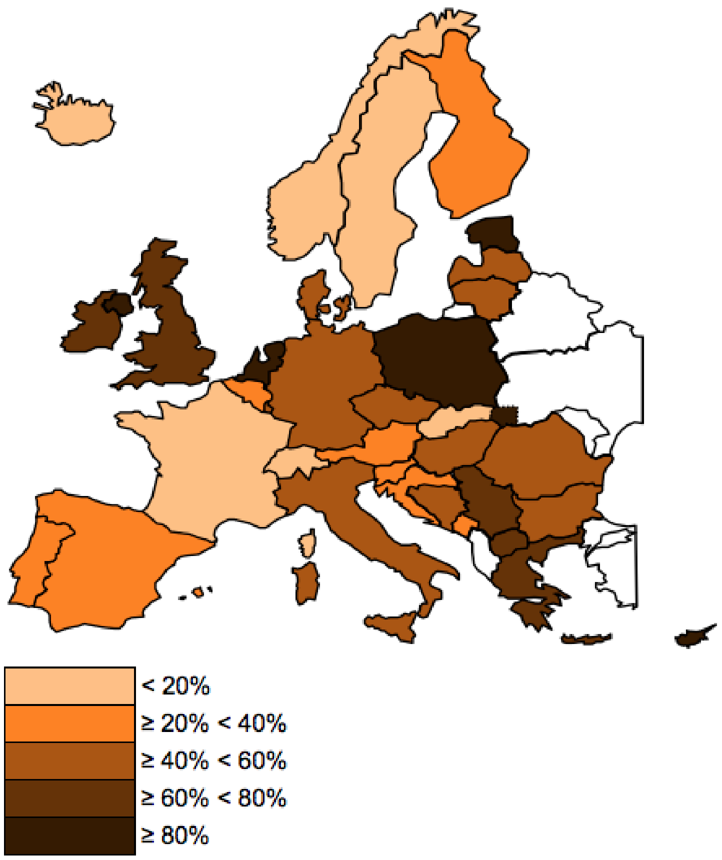


Figure 3.2.3.2.2: Fossil fuels generation mix in 2013

Map 3.2.3.2.1 shows the relative importance of fossil fuels in the total generation of each country in 2013, with values comprehended between 0% and 98.5%.

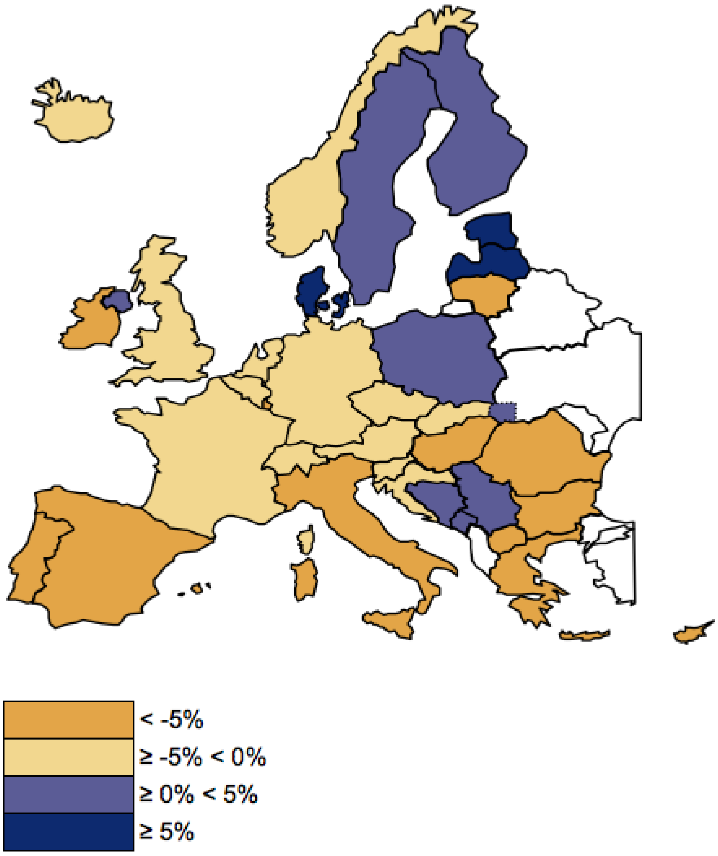


Data related to the map
Used formula:
$Fossil_{2013}/Gen_{2013}$

AT	20.5%	IS	0.0%
BA	55.6%	IT	59.8%
BE	34.4%	LT	53.6%
BG	47.9%	LU	48.5%
CH	3.3%	LV	44.3%
CY	94.5%	ME	33.6%
CZ	51.5%	MK	75.0%
DE	58.8%	NI	81.0%
DK	58.3%	NL	84.2%
EE	90.4%	NO	2.5%
ES	38.3%	PL	90.0%
FI	29.9%	PT	38.3%
FR	8.1%	RO	43.3%
GB	70.0%	RS	74.4%
GR	74.5%	SE	3.3%
HR	32.0%	SI	29.6%
HU	41.0%	SK	18.3%
IE	75.9%	UA_W	98.5%

Map 3.2.3.2.1: Share of fossil fuels in the total generation of each country in 2013

As seen in Map 3.2.3.2.2, most of ENTSO-E countries (nearly 70%) contributed to the decrease of fossil fuel as part of their generation in 2013[9].



Data related to the map
Used formula:
$(Fossil_{2013}-Fossil_{2012})/Gen_{2013}$

AT	-4.9%	IS	0.0%
BA	2.0%	IT	-10.2%
BE	-2.4%	LT	-15.4%
BG	-7.8%	LU	-36.7%
CH	-0.1%	LV	17.7%
CY	-12.9%	ME	1.8%
CZ	-2.5%	MK	-12.3%
DE	-1.9%	NI	1.5%
DK	7.0%	NL	-4.9%
EE	12.3%	NO	-0.1%
ES	-11.3%	PL	1.0%
FI	4.7%	PT	-10.1%
FR	-0.6%	RO	-9.2%
GB	-3.9%	RS	4.9%
GR	-13.4%	SE	0.2%
HR	-4.8%	SI	-1.7%
HU	-13.1%	SK	-3.2%
IE	-7.3%	UA_W	3.6%

Map 3.2.3.2.2: Fossil fuels generation changes 2012/2013 as part of the total generation in 2013 per country

3.2.3.3. Nuclear generation

ENTSO-E nuclear generation (see Figure 3.2.3.3.1 below) maintained the downward trend that has been observed in the last years, decreasing by 0.6% (-5.4 TWh).

[9] To avoid misunderstanding concerning the maps, which show the percentage increase / decrease of generation (mainly fluctuations in generation in countries where the share of each primary fuel is very small), and avoid underlining only big systems on the map with changes in absolute value, these maps show the increase / decrease of generation as a part of the total generation in each country.

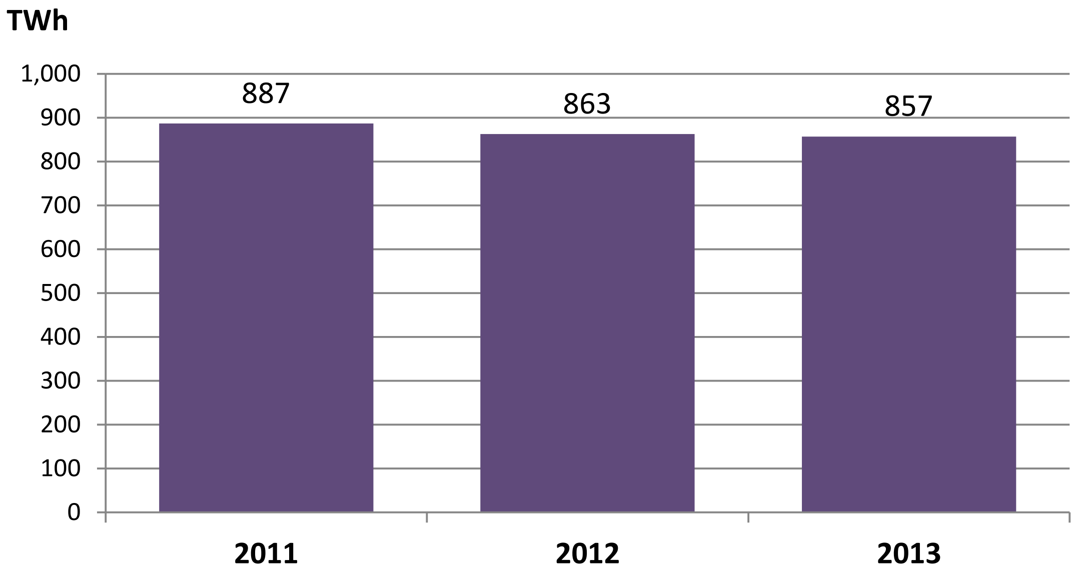
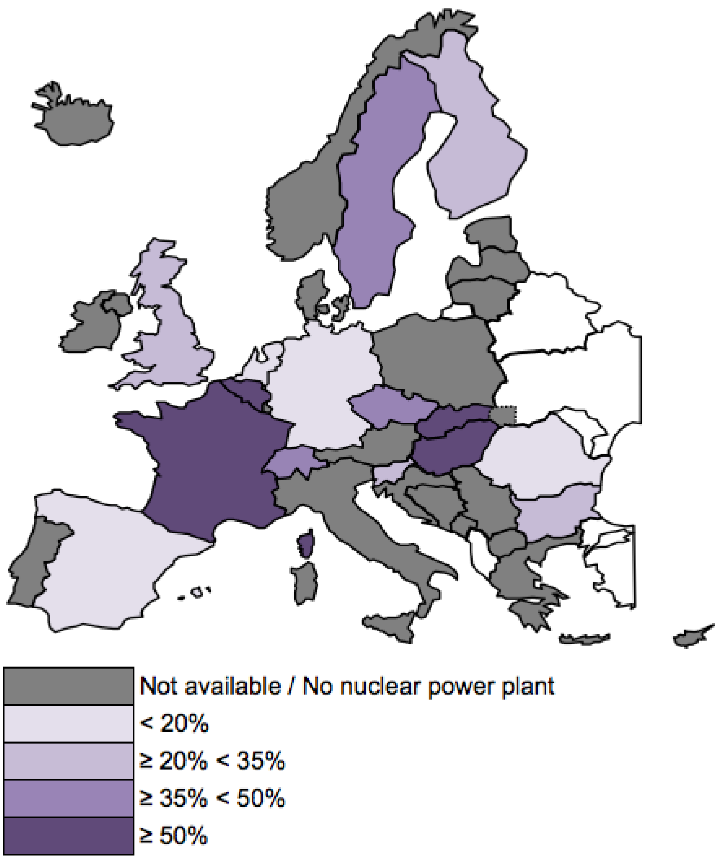


Figure 3.2.3.3.1: Nuclear generation evolution

The importance of nuclear source as part of each ENTSO-E country generation in 2013 is depicted in Map 3.2.3.3.1.

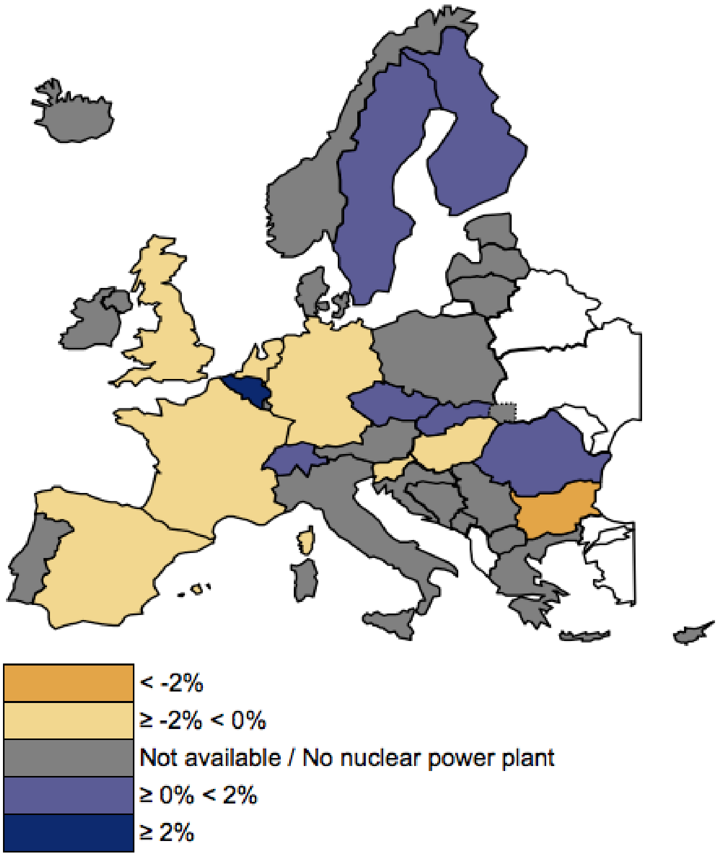


Data related to the map
Used formula:
$Nucl_{2013}/Gen_{2013}$

AT	n.a.	IS	n.a.
BA	n.a.	IT	n.a.
BE	51.9%	LT	n.a.
BG	33.1%	LU	n.a.
CH	36.4%	LV	n.a.
CY	n.a.	ME	n.a.
CZ	35.9%	MK	n.a.
DE	16.1%	NI	n.a.
DK	n.a.	NL	2.7%
EE	n.a.	NO	n.a.
ES	19.8%	PL	n.a.
FI	33.3%	PT	n.a.
FR	73.3%	RO	19.6%
GB	22.0%	RS	n.a.
GR	n.a.	SE	42.5%
HR	n.a.	SI	33.9%
HU	53.0%	SK	54.3%
IE	n.a.	UA_W	n.a.

Map 3.2.3.3.1: Share of nuclear in the total generation of each country in 2013

The changes in nuclear generation from 2012 to 2013 as part of the total generation per country are shown on Map 3.2.3.3.2. Values range oscillated between -3.8% and +2.8%.



Data related to the map
Used formula:
$(Nucl_{2013}-Nucl_{2012})/Gen_{2013}$

AT	n.a.	IS	n.a.
BA	n.a.	IT	n.a.
BE	2.8%	LT	n.a.
BG	-3.8%	LU	n.a.
CH	0.8%	LV	n.a.
CY	n.a.	ME	n.a.
CZ	0.5%	MK	n.a.
DE	-0.4%	NI	n.a.
DK	n.a.	NL	-1.5%
EE	n.a.	NO	n.a.
ES	-1.6%	PL	n.a.
FI	0.9%	PT	n.a.
FR	-0.2%	RO	0.2%
GB	0.0%	RS	n.a.
GR	n.a.	SE	1.5%
HR	n.a.	SI	-1.4%
HU	-1.7%	SK	0.8%
IE	n.a.	UA_W	n.a.

Map 3.2.3.3.2: Nuclear generation changes 2012/2013 as part of the total generation in 2013 per country

3.2.3.4. Renewable energy sources generation

In this report Renewable Energy Sources (RES) comprise wind, solar, biomass (including biogas for some countries), renewable hydro and other renewables (sources not mentioned in the subcategories, e.g. geothermal energy or sources not clearly identified).

For certain countries, RES values were not properly identified. They were occasionally included in the non-identifiable energy sources, or the RES share in hydro generation was only partially identified or not identified at all[10].

The evolution of RES subcategories during the last three years and the share of individual renewable sources in the total ENTSO-E´s RES generation in 2013 are depicted in Figures 3.2.3.4.1 and 3.2.3.4.2 respectively.

[10] For these countries the RES were considered to be zero.

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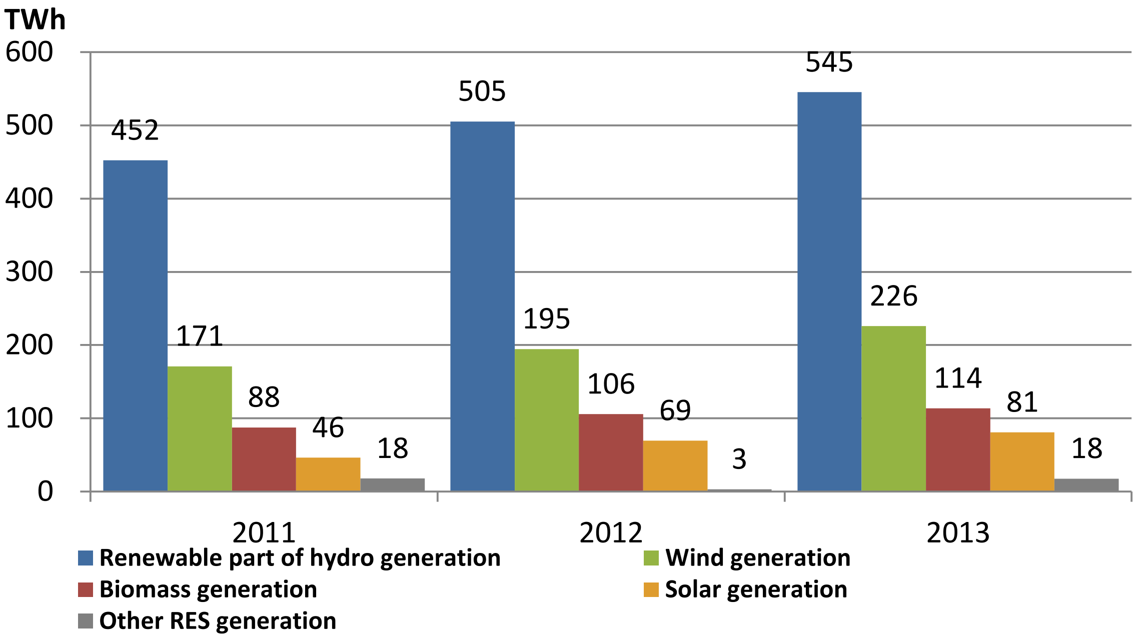

Figure 3.2.3.4.1: Renewable generation evolution

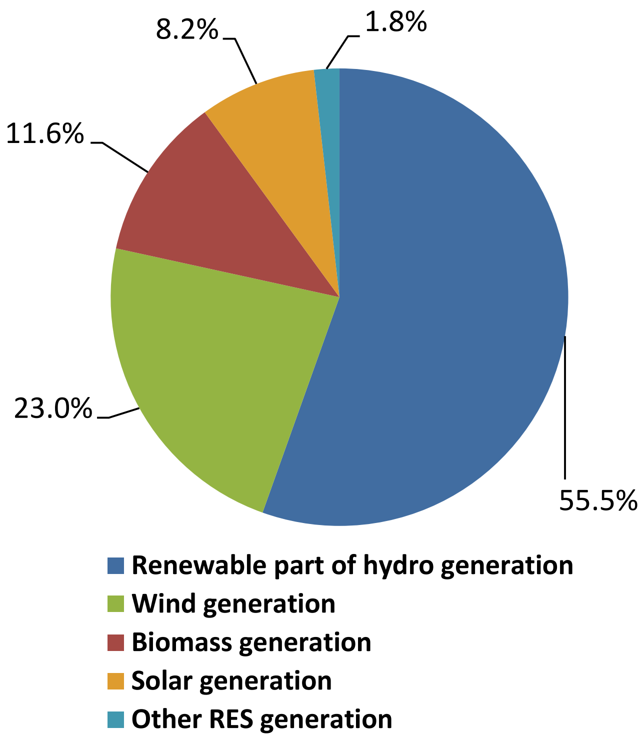

Figure 3.2.3.4.2: Renewable generation mix in 2013

Generation from renewable energy sources in ENTSO-E increased by as much as 12.0% (see Table 3.2.3.4.1) in 2013. All subcategories registered growth including other RES which recovered back to 2011 levels. Increasing rates (above 16%) of wind and solar generation should be highlighted.

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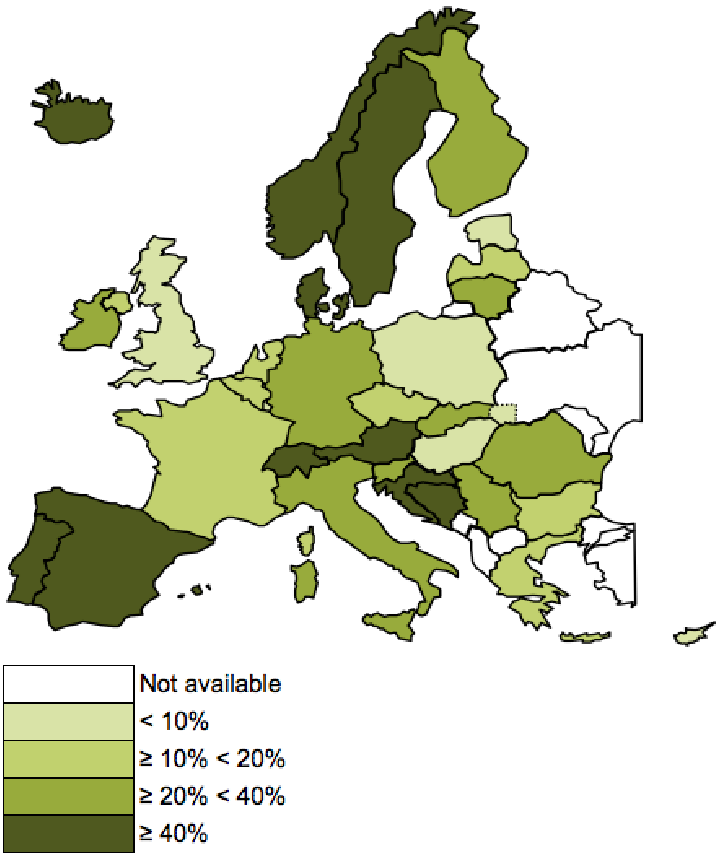
	Total Renewable Energy Sources generation	of which				
		Wind generation	Solar generation	Biomass generation	Renewable part of hydro generation	Other RES generation
%	12.0%	16.1%	16.6%	7.5%	7.9%	478.0%
TWh	105.2	31.3	11.5	7.9	39.9	14.6

Table 3.2.3.4.1: Renewable generation changes per source

Map 3.2.3.4.1 below shows the share of RES in the total generation of each country in 2013.



Data related to the map
Used formula:
RES_{2013}/Gen_{2013}

AT	63.5%	IS	99.0%
BA	44.4%	IT	39.0%
BE	12.1%	LT	34.1%
BG	17.3%	LU	9.8%
CH	57.2%	LV	10.4%
CY	5.5%	ME	n.a.
CZ	11.4%	MK	n.a.
DE	24.4%	NI	18.9%
DK	41.6%	NL	13.1%
EE	9.6%	NO	97.5%
ES	40.2%	PL	9.7%
FI	35.5%	PT	59.3%
FR	17.7%	RO	37.1%
GB	7.0%	RS	24.1%
GR	16.3%	SE	54.2%
HR	68.0%	SI	32.1%
HU	6.0%	SK	22.2%
IE	21.6%	UA_W	1.5%

Map 3.2.3.4.1: Share of renewables in the total generation of each country in 2013

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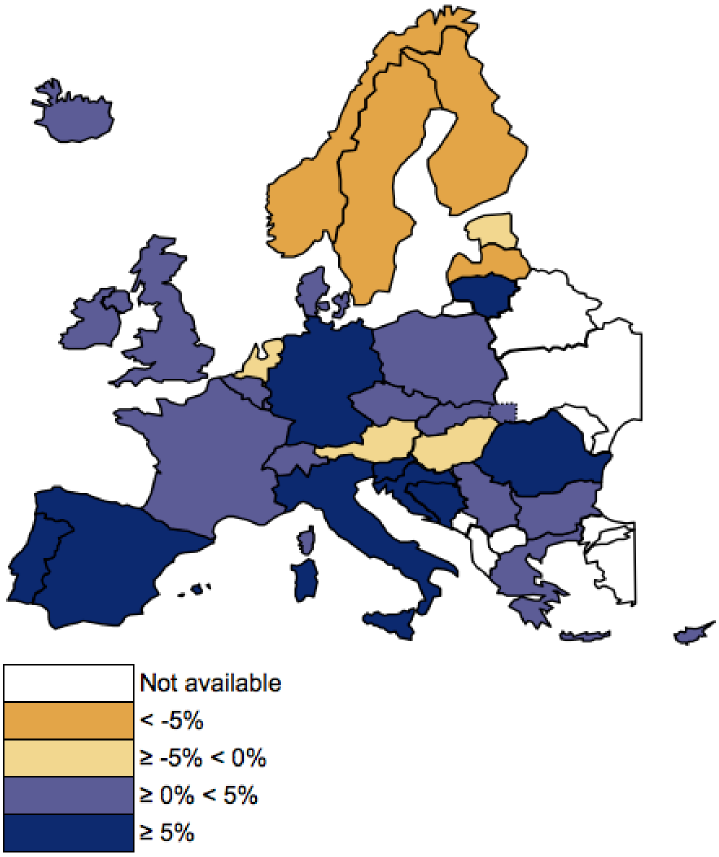
The following Map 3.2.3.4.2 depicts the evolution of RES generation as a part of total generation per country. As shown, in spite of the overall increase of RES in ENTSO-E, 9 (out of 34) countries lowered their renewable contribution to generation in 2013 when compared to 2012.



Data related to the map
Used formula:
$(RES_{2013}-RES_{2012})/Gen_{2013}$

AT	-1.6%	IS	3.1%
BA	20.6%	IT	11.1%
BE	1.8%	LT	7.8%
BG	4.3%	LU	4.0%
CH	0.2%	LV	-54.3%
CY	1.1%	ME	n.a.
CZ	1.5%	MK	n.a.
DE	5.9%	NI	4.1%
DK	2.3%	NL	-0.5%
EE	-2.1%	NO	-10.1%
ES	9.2%	PL	0.5%
FI	-5.1%	PT	21.0%
FR	2.4%	RO	9.2%
GB	1.7%	RS	2.8%
GR	4.6%	SE	-9.9%
HR	27.2%	SI	8.2%
HU	-2.9%	SK	2.6%
IE	1.8%	UA_W	1.5%

Map 3.2.3.4.2: Renewable generation changes in 2012/2013 as part of the total generation in 2013 per country

3.2.3.5. Non-renewable hydro generation

The non-renewable hydro generation category includes hydropower generation that cannot be considered as renewable (i.e. predominantly pure pumped storage hydro power plants or non-identifiable hydro), accounted as the difference between the total hydro generation and the renewable hydro generation duly confirmed by correspondents. The renewable part of hydropower generation is included in the RES category (see paragraph 3.2.3.4 above).

As shown in Figure 3.3.3.5.1, in 2013 the non-renewable hydro generation in ENTSO-E decreased by 36.4%. Nevertheless, total hydro generation was able to keep its upward trend due to the contribution of its renewable part.

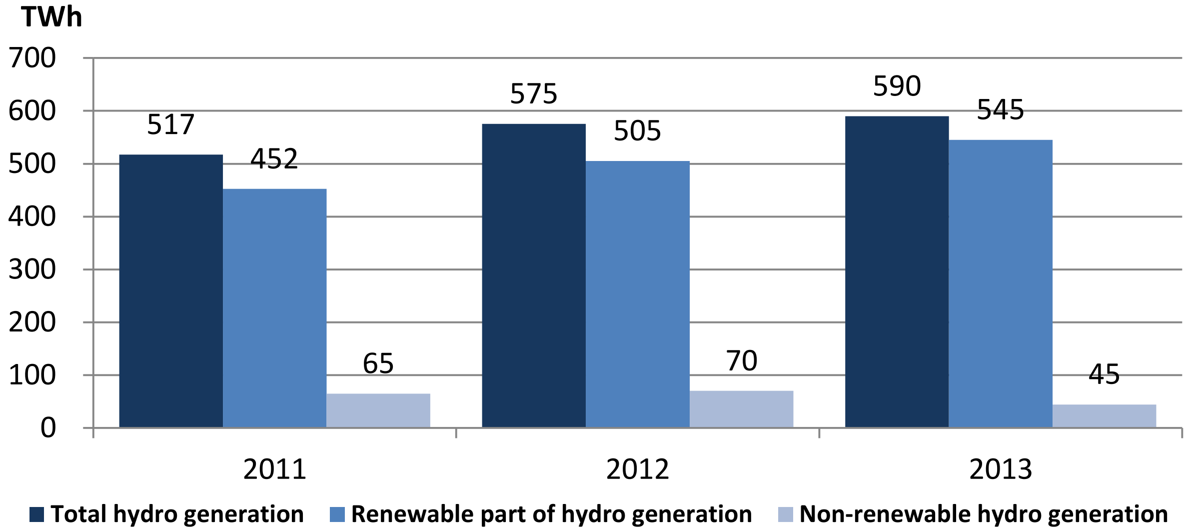


Figure 3.3.3.5.1: Hydro generation evolution

3.2.3.6. National comments on generation

AT – Austria

Source of information: E-Control Austria; Data about renewables concern only publicly funded renewables.

BG – Bulgaria

The differences come from renewable sources because not all of their generation is accountable on monthly basis.

DE – Germany

Electricity generation and consumption also comprise shares of generation from industry’s own power stations and feed-in from private generators (total of 12 monthly values). The part of net electricity generation relevant to primary control power amounts to 555,222 TWh.

EE – Estonia

Majority of fossil fuels generation is of oil shale.

IE – Ireland

Wind increasing from last year.

PL – Poland

Polish TSO data. Net generation of biomass includes energy from biogas and from biomass co-fired in conventional thermal unit. Some fossil fuels units are co-firing biomass. The amount of energy is shared into fossil fuels generation and renewable energy sources generation according to primary fuel share. Some CHPs use an oil, but no precise information is available for the TSO; power and energy is classified in the hard coal subcategory.

SI – Slovenia
The ownership of nuclear power plant Krsko is equally divided between Slovenia and Croatia. According to the international agreement half of the energy produced in NPP Krsko is delivered to the Croatia. The figures consider 100% of the NPP Krsko production.

3.2.4. Physical Energy flows

3.2.4.1. ENTSO-E overview

Exchanges are the physical import and export flows in every interconnection line of a power system. The exchange balance is the difference between the physical import and export flows. The import/export of the overall ENTSO-E perimeter is the sum of the import/export of each ENTSO-E country member. The physical flows are metered at the exact border or at a virtual metering point estimated from the actual one.

In 2013, exports and imports were 2.1% and 2.6% lower than in previous year. Overall exchange balance in ENTSO-E resulted in a net exporting system like it was observed in 2012.

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Figure 3.2.4.1.1 shows the evolution of exchanges per country during the last three years.

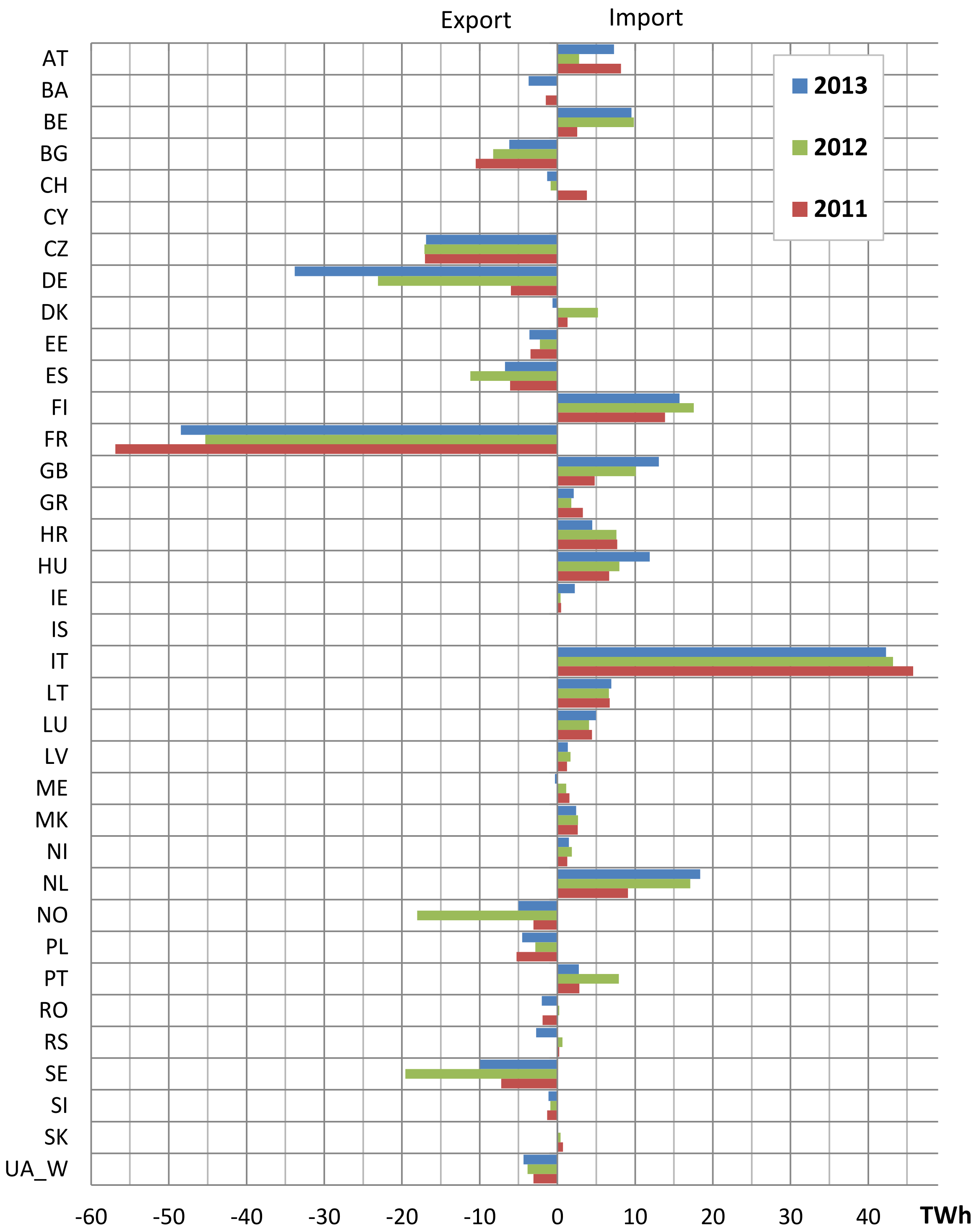

Figure 3.2.4.1.1: Exchanges evolution per country

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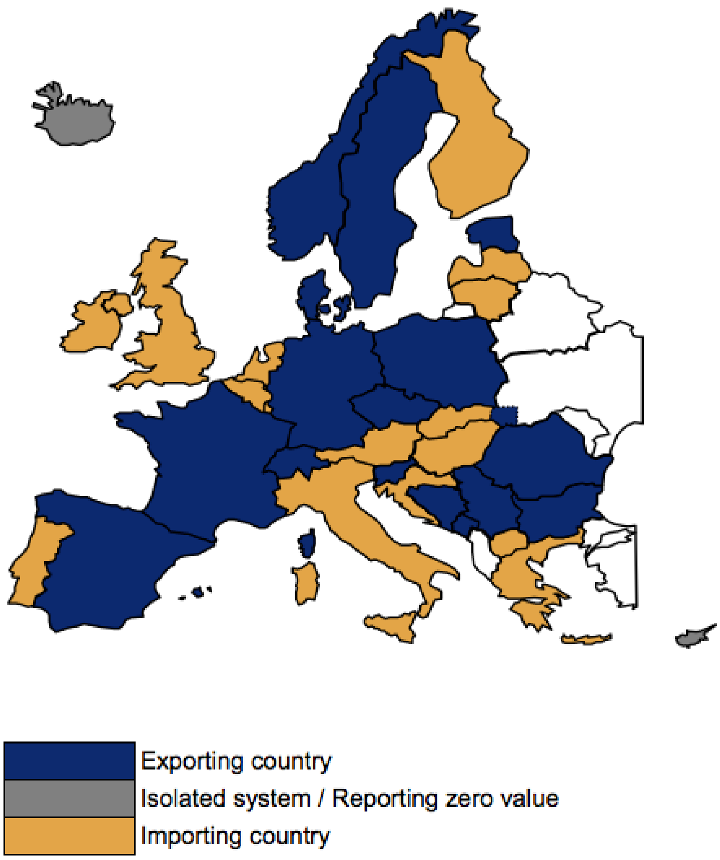
An overview of importing/exporting ENTSO-E countries in 2013 is depicted in Map 3.2.4.1.1 below.



Map 3.2.4.1.1: Net importing / exporting countries in 2013

To show the role of imports/exports in ENTSO-E countries, net exchanges per country as part of their consumption are shown in Figure 3.2.4.1.2 and Figure 3.2.4.1.3.

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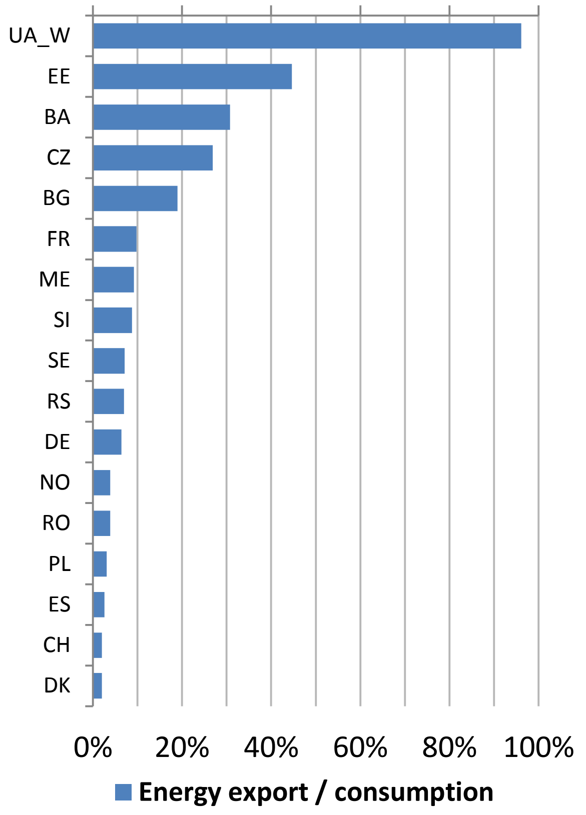

Figure 3.2.4.1.2: Net export as part of the consumption per country

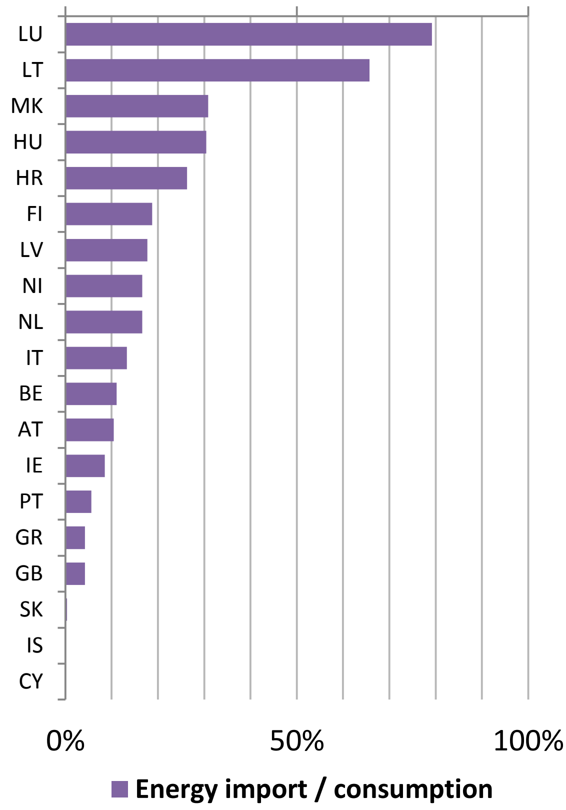

Figure 3.2.4.1.3: Net import as part of the consumption per country

3.2.4.2. National comments on energy flows

IE – Ireland
More imports over EWIC.

PL – Poland
National values (not harmonized with neighbouring countries).

3.3. Power balance

3.3.1. ENTSO-E Data Summary

Unless otherwise stated, all graphs and tables in this chapter refer to the reference point of December for the respective year.

Table 3.3.1.1 displays power balance results for December's reference point. While Net Generating Capacity (NGC) results are representative of the entire year, Unavailable Capacity (UC), load and exchanges fluctuate over the year and strongly depend on weather, market and economic conditions at the reference point. The table 3.3.1.1 and Figure 3.3.1.1 must be treated as examples of power balance valid for December 2013, not as typical structures of power balance. Details concerning results in all reference points are presented in chapters 3.3.4 and 3.3.5.

GW	2011	2012	2013	Change 2013 to 2012	
				Absolute value (MW)	%
Net Generating Capacity	**935.5**	**978.6**	**992.4**	**13.9**	**1.4%**
Fossil fuels power	454.8	458.4	449.1	-9.2	-2.0%
Nuclear power	125.7	125.4	126.3	0.9	0.7%
RESs power (incl. renewable hydro)	284.3	357.1	381.2	24.1	6.7%
Non-renewable hydro power	66.1	36.8	35.0	-1.9	-5.1%
Not clearly identif. energy sources power	4.5	0.9	0.8	-0.1	-9.6%
Unavailable capacity	**270.6**	**327.0**	**327.9**	**0.9**	**0.3%**
Non-usable capacity	189.4	230.5	235.0	4.5	2.0%
Maintenance & overhauls	30.2	36.0	39.0	3.0	8.4%
Outages	20.0	27.6	22.9	-4.7	-17.0%
System services reserve	31.1	32.9	31.0	-1.9	-5.9%
Reliable Available Capacity	**664.9**	**651.6**	**664.6**	**13.0**	**2.0%**
Load	**473.5**	**481.3**	**475.4**	**-6.0**	**-1.2%**
Remaining Capacity	**191.4**	**170.3**	**189.2**	**18.9**	**11.1%**
Exchanges	**-2.2**	**-1.1**	**-0.1**	**1.0**	**-91.6%**
Imports	51.2	46.1	59.6	13.5	29.2%
Exports	53.4	47.2	59.7	12.5	26.5%

Table 3.3.1.1: ENTSO-E power balance summary for December reference point

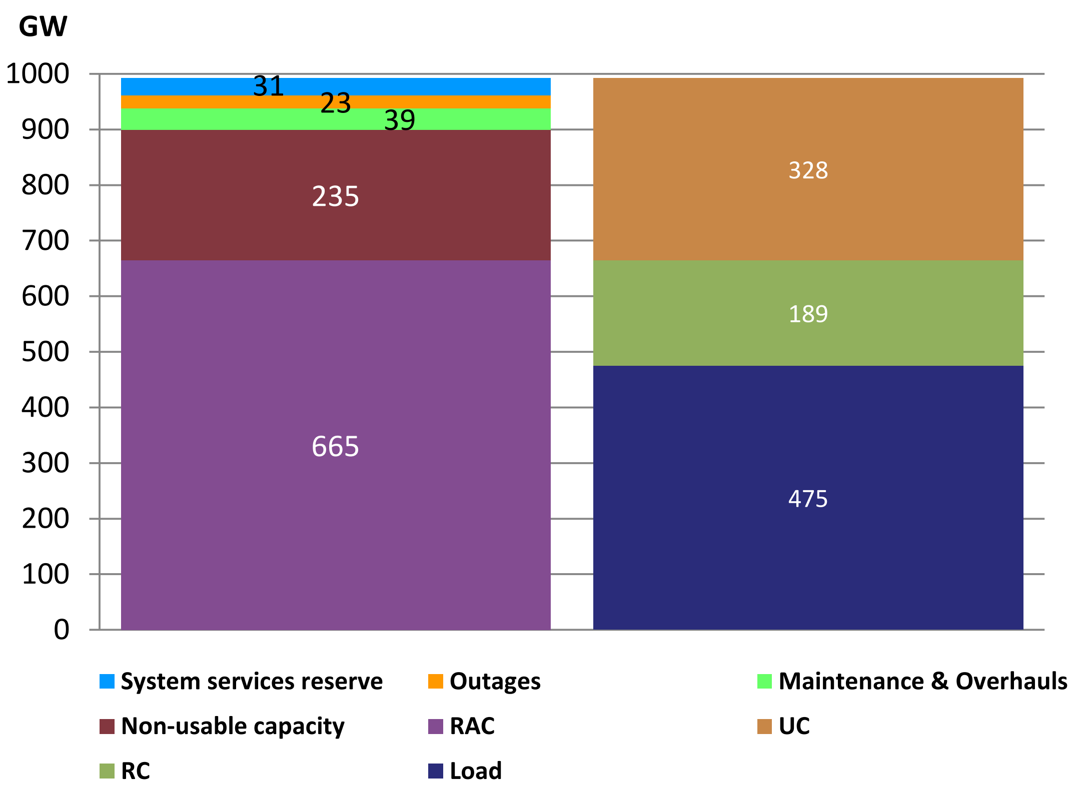

Figure 3.3.1.1: Power balance in December 2013

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3.3.2. Load

3.3.2.1. ENTSO-E overview

The total ENTSO-E load in 2013 was registered on January 17th at 19:00 and amounted 529 GW. The real value is higher, because some countries (Germany, Great Britain and Slovenia) reported representativity factor of adequacy data differ than 100%[11]. The difference of ENTSO-E peak load to load in January reference point (3rd Wednesday, 16th at 11:00) amounted 20 GW. As usual, minimum load from among reference points took place in August, however this minimum was historical highest ever (it is important to underline that in 2012 the 3rd Wednesday in August was on the 15th – holiday in most countries). Figure 3.3.2.1.1 shows load at reference points including 2013 ENTSO-E peak load, in Table 3.3.2.1.1 precise data can be found.

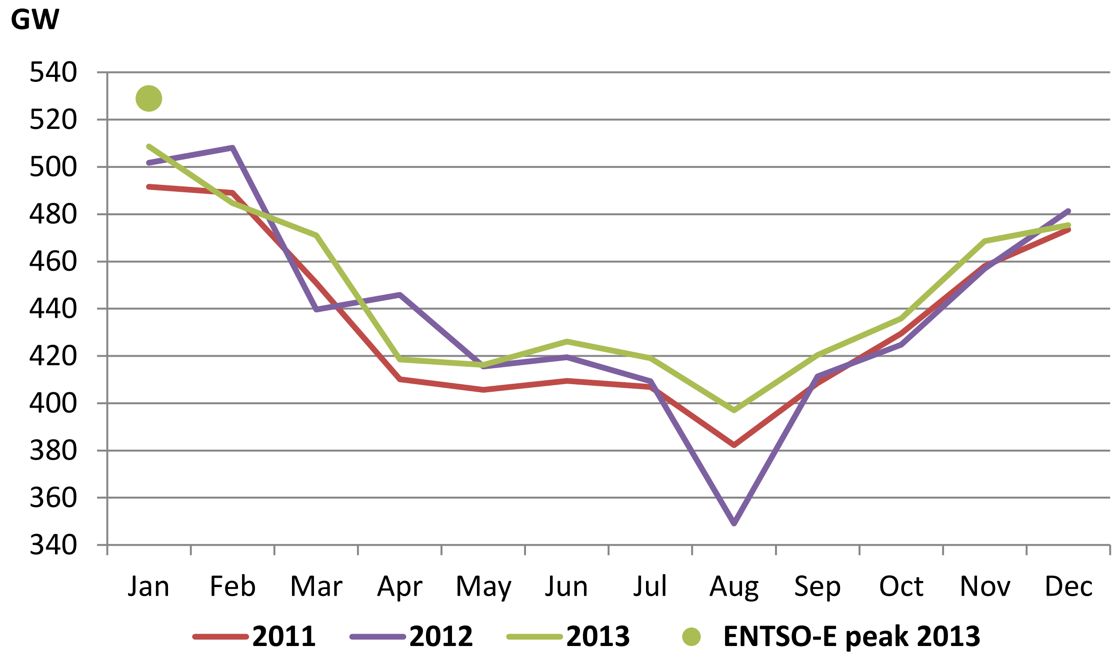


Figure 3.3.2.1.1: Load evolution

GW	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Peak 2013
2011	491.6	489.0	450.9	410.1	405.7	409.4	406.9	382.3	408.5	429.6	458.1	473.5	
2012	501.8	508.2	439.6	445.9	415.5	419.5	409.4	349.1	411.4	424.8	457.0	481.3	
2013	508.7	484.7	471.0	418.5	416.2	426.2	419.1	397.0	420.4	435.8	468.6	475.4	528.9

Table 3.3.2.1.1: Load evolution per reference point

[11] More information about representativity can be found in Chapter 1.2

3.3.2.2. National peak load

Table 3.3.2.2.1 presents all information concerning instantaneous peak load per country, including historical peak loads (this table is also included in excel attachment “YS&AR 2013 table no.1”). It is necessary to underline that these values should be higher (or at least the same) than the values provided for Monthly Statistics, because the average hourly load is collected in the monthly data[12]. Hourly peak load is also available in the excel attachment mentioned above. Differences in date and hour of peak (hourly vs instantaneous) could be also found due to specificity of load curve and load measures.

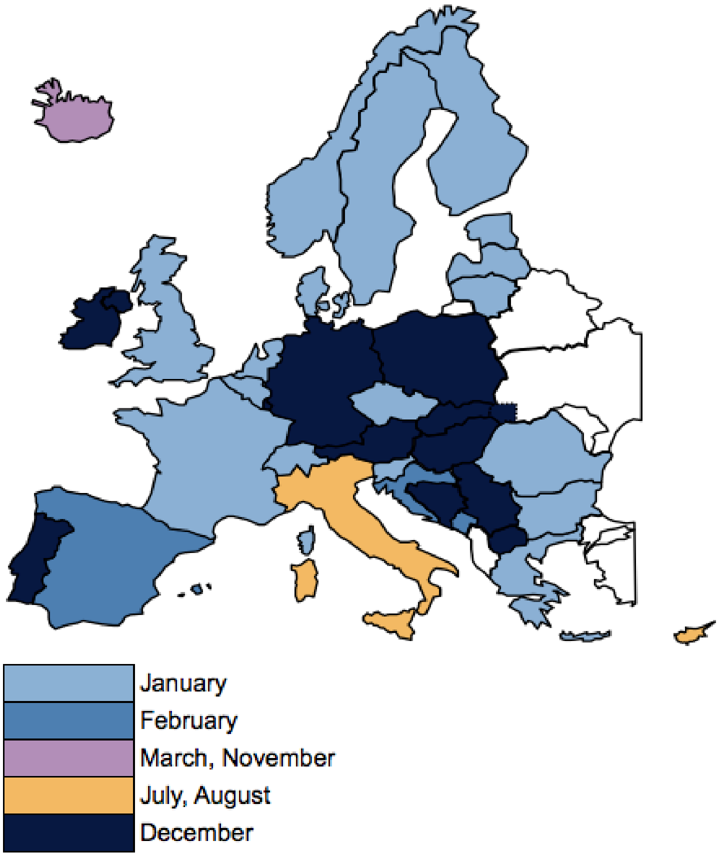
Country	Weekday	Calendar Day	Month	Time	Daily Average (°C)	Deviation from Normal (°C)	Instantaneous Peak Load (MW)	Compared to Last Year's (%)	Day of Historic Peak Load	Year	Instantaneous Historic Peak Load (MW)	Deviation from Normal (°C)
AT	Wednesday	27	11	17:45	n.a.	n.a.	11470	-1.26	Tue 7 Feb	2012	11613	n.a.
BA	Tuesday	24	12	18:00	n.a.	n.a.	2074	-3.22	Fri 31 Dec	2010	2173	n.a.
BE	Thursday	17	1	18:00	-5.58	-9.08	13470	-5.36	Fri 10 Dec	2010	14390	-8.5
BG	Wednesday	9	1	18:00	-5.2	-0.6	6805	-11.59	Wed 20 Dec	1989	8396	n.a.
CH	Wednesday	16	1	17:45	-3	0	10296	-3.67	Fri 10 Dec	2010	10749	0
CY	Friday	30	8	13:15	30	-6	840	-15.75	Tue 3 Aug	2010	1148	-6
CZ	Tuesday	22	1	17:00	-5.2	-4.5	9981	-6.94	Tue 7 Feb	2012	10725	-12
DE	Thursday	5	12	17:45	2.5	1.8	79849	-2.45	Tue 7 Feb	2012	81858	-12.4
DK	Thursday	24	1	18:00	-4.1	n.a.	6138	-1.24	Tue 24 Jan	2006	6436	n.a.
EE	Friday	18	1	15:45	-14	-9	1433	-8.84	Thu 28 Jan	2010	1587	-13
ES	Wednesday	27	2	20:45	7.3	-2.1	40277	-7.47	Mon 17 Dec	2007	45450	-1.9
FI	Friday	18	1	8:00	n.a.	n.a.	14170	-1.82	Fri 18 Feb	2011	14965	n.a.
FR	Thursday	17	1	19:00	-1.9	-6.8	92630	-9.27	Wed 8 Feb	2012	102098	-11
GB	Wednesday	16	1	18:30	-2.2	5.5	56495	-4.22	Mon 17 Dec	2007	60700	-2.9
GR	Tuesday	8	1	19:00	1	8	8764	-11.42	Mon 23 Jul	2007	10414	5
HR	Monday	11	2	20:00	n.a.	n.a.	2813	-11.90	Mon 6 Feb	2012	3193	n.a.
HU	Wednesday	4	12	16:45	-3.6	-5.8	5920	-1.60	Thu 29 Nov	2007	6180	-5.7
IE	Tuesday	17	12	18:30	6.4	5.6	4523	-1.44	Tue 21 Dec	2010	5090	-4.7
IS	Wednesday	6	3	15:30	-3.05	-2.8	2258	4.15	Wed 6 Mar	2013	2258	0
IT	Friday	26	7	12:00	29.5	2.5	53976	-0.25	Tue 18 Dec	2007	56882	1.5
LT	Monday	21	1	8:00	-14.2	7.42	1810	-3.98	Tue 18 Apr	1989	3153	n.a.
LU	Friday	13	12	18:00	-1.1	-10.1	994	-1.49	Wed 21 Sep	2011	1188	-14
LV	Monday	14	1	17:00	-10.8	-5.5	1344	-1.75	Wed 21 Dec	1988	1997	n.a.
ME	Monday	11	2	21:00	n.a.	n.a.	621	-12.29	Sun 23 Jan	2011	735	n.a.
MK	Sunday	22	12	18:00	n.a.	n.a.	1527	-5.68	Sat 31 Dec	2011	1642	n.a.
NI	Saturday	21	12	19:00	0.33	8.5	1697	-1.45	Wed 22 Dec	2010	1777	11.87
NL	Thursday	17	1	18:00	-5.3	-8	18457	0.10	Wed 14 Dec	2011	19169	1.6
NO	Wednesday	23	1	8:00	-13	n.a.	24180	3.14	Wed 23 Jan	2013	24180	n.a.
PL	Tuesday	10	12	17:30	0.5	2.3	22878	-4.56	Tue 7 Feb	2012	23970	3
PT	Monday	9	12	19:30	8.7	-2.4	8322	-2.71	Mon 11 Jan	2010	9403	-2.5
RO	Monday	14	1	17:00	-1.7	2.8	8312	-3.65	Thu 23 Nov	1989	10248	n.a.
RS	Wednesday	18	12	18:00	0.9	n.a.	6930	-8.39	Fri 31 Dec	2010	7656	n.a.
SE	Friday	25	1	8:00	-12	7.5	26871	2.56	Mon 5 Feb	2001	27000	9
SI	Wednesday	16	1	18:00	-0.2	-1.6	2001	-4.74	Thu 26 Jan	2006	2110	1
SK	Tuesday	17	12	17:00	-0.83	0.68	4175	-5.01	Tue 12 Dec	1989	4471	n.a.
UA_W	Wednesday	11	12	17:00	-2.7	3	1048	-12.45	Fri 3 Feb	2012	1197	-13

Table 3.3.2.2.1: National instantaneous peak load overview 2013

As usual peak loads during the summer took place in Cyprus and Italy (in the morning), while Greece in 2013 registered its peak in January. On the other hand, most “winter” countries registered their peak loads in second part on January 2013, but only in three countries: France, Belgium and The Netherlands peak load took place exactly on 17 January, which was the ENTSO-E peak load date.

[12] It is worth saying, that hourly peak load is recalculated based on representativity factor, while instantaneous peak load not, so for countries which provided representativity factor differ than 100% hourly peak may be higher than instantaneous.

Two of them had their peak at 18:00 and only France had peak at 19:00, which was the ENTSO-E peak load hour. It means, that France defined ENTSO-E peak load in 2013. Usually, “winter” continental countries had their peak in the evening, while Nordic countries in morning – this year besides Norway, Sweden and Finland there was Lithuania as well. New peak months occurred in 2013 – November for Austria and March for Iceland. Map 3.3.2.2.1 displays month of peak and in the table next to it there is time of peak presented.



Data related to the map
Used data:
Time of peak load

AT	17:45	IS	15:30
BA	18:00	IT	12:00
BE	18:00	LT	8:00
BG	18:00	LU	18:00
CH	17:45	LV	17:00
CY	13:15	ME	21:00
CZ	17:00	MK	18:00
DE	17:45	NI	19:00
DK	18:00	NL	18:00
EE	15:45	NO	8:00
ES	20:45	PL	17:30
FI	8:00	PT	19:30
FR	19:00	RO	17:00
GB	18:30	RS	18:00
GR	19:00	SE	8:00
HR	20:00	SI	18:00
HU	16:45	SK	17:00
IE	18:30	UA_W	17:00

Map 3.3.2.2.1: Month and time of peak load

Average peak load of ENTSO-E countries in 2013 was lower than in 2012 by -4.7%, only Iceland, Norway, The Netherlands and Sweden registered peak growth, however from among these countries only Iceland and Norway had their historical peak load in 2013. The rest of the countries had their historical peak load in the past. Map 3.3.2.2.2 shows the height of this historical peak load in comparison with load in 2013. As in previous year, the biggest difference was registered for Lithuania and Latvia, as the result of political changes in the late 80’s and early 90’s – their historical peak loads took place in 1989.

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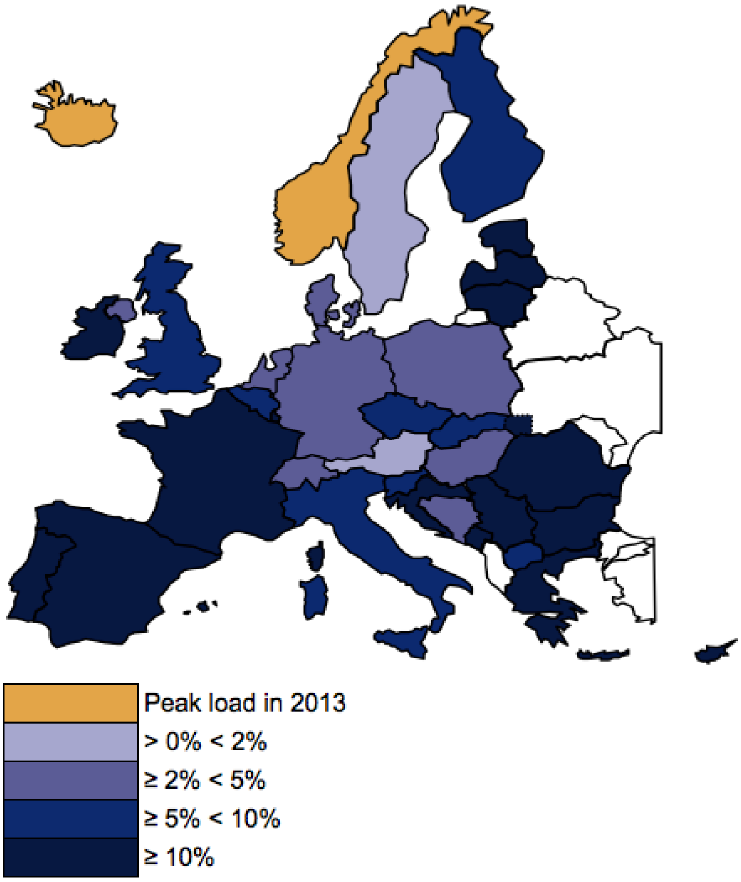

Data related to the map
Used formula:
$(Peak_{historic}-Peak_{2013})/Peak_{historic}$

AT	1.2%	IS	0.0%
BA	4.8%	IT	5.4%
BE	6.8%	LT	74.2%
BG	23.4%	LU	19.5%
CH	4.4%	LV	48.6%
CY	36.7%	ME	18.4%
CZ	7.5%	MK	7.5%
DE	2.5%	NI	4.7%
DK	4.9%	NL	3.9%
EE	10.7%	NO	0.0%
ES	12.8%	PL	4.8%
FI	5.6%	PT	13.0%
FR	10.2%	RO	23.3%
GB	7.4%	RS	10.5%
GR	18.8%	SE	0.5%
HR	13.5%	SI	5.5%
HU	4.4%	SK	7.1%
IE	12.5%	UA_W	14.2%

Map 3.3.2.2.2: Difference between historical peak load and peak load in 2013

3.3.2.3. National comments on load and peak load

AT – Austria
Monthly peak load are estimated values as they are not publicly available.

CY – Cyprus
Instantaneous peak Load includes 815MW thermal generation injected in the transmission system and 25MW RES generation in the distribution system.

CZ – Czech Republic
Load values are calculated from gross ones.

FI – Finland
One hour average values, instantaneous values not available.

IE – Ireland
Peak for 2013 occurred when temperature was significantly higher than normal.

IS – Iceland
New all time peak load.

NL – The Netherlands
Weather information from The Royal Netherlands Meteorological Institute.

PL – Poland
Polish TSO data.

SE – Sweden
Peak load average in hour 08-09.

3.3.3. Net generating capacity

3.3.3.1. ENTSO-E overview

Between January and December referent points of the year 2013 NGC increased by 10.2 GW (Table 3.3.3.1.1). Comparison of this result with the increase from December 2012 to December 2013 (14.0 GW) shows that 3.8 GW was commissioned at the turn of 2012 and 2013.

GW		Change December to January	
January	December	Absolute value	%
982.3	992.4	10.2	1.0%

Table 3.3.3.1.1: NGC evolution in 2012 (January – December)

In detail, the main contributors of the power increase in 2013 (in absolute values) were Germany with a 6.7 GW increase and Spain with a 3.7 GW increase. In percentages, those with the highest increases from the previous year as a part of NGC were Cyprus (48.3%) and Greece (9.2%), but in Cyprus this increase was caused by commissioning the destroyed generating units of Vasilikos Power Station that were damaged in 2011.

Some ENTSO-E countries registered a decrease of NGC, among these countries Great Britain had the biggest one (2.9 GW of absolute value). The highest percentage decrease took place in Hungary (-6.2%).

NGC changes per category over the last three years are shown in Figure 3.3.3.1.1. Noticeable growth 2013 vs 2012 took place for Renewable Energy Sources (RES) only (24.1 GW), however this increase was not so significant as in previous year (72.8 GW). NGC of rest sources was stable in general, with a 9.2 GW decrease of fossil fuels.

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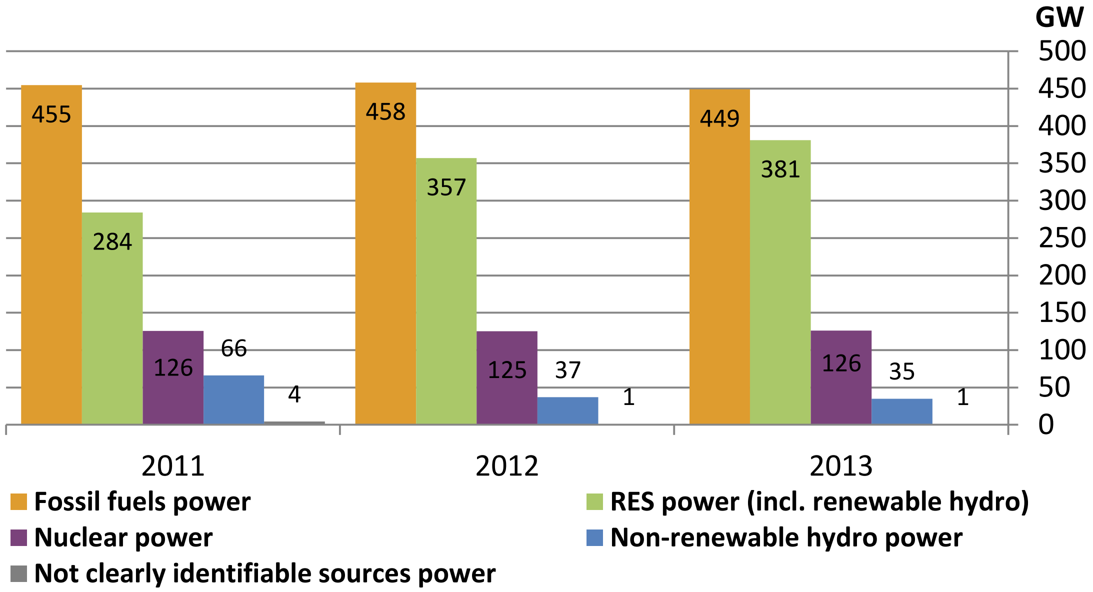

Figure 3.3.3.1.1: NGC category evolution

The share of fossil fuels in the total NGC follows changes in absolute values, except for nuclear, which share decrease, while in absolute value small growth took place. Results are visible in Figures 3.3.2.1.2 and 3.3.2.1.3.

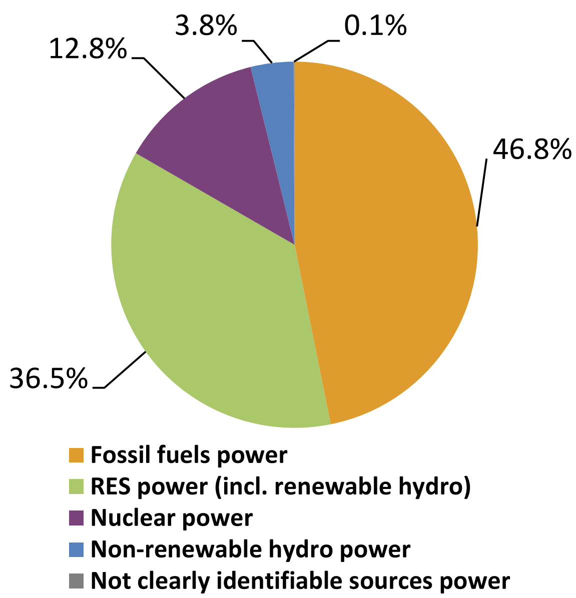

Figure 3.3.3.1.2: NGC mix in 2012

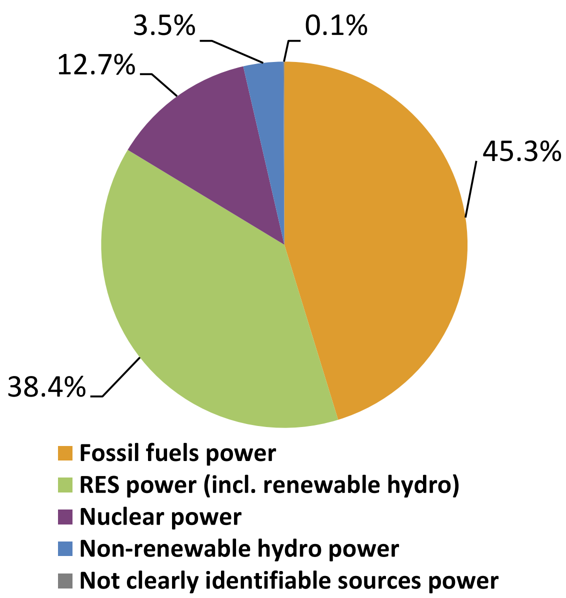

Figure 3.3.3.1.3: NGC mix in 2013

3.3.3.2. Fossil fuels power

The main contributor of the previously mentioned decrease in fossil is hard coal (-8.6 GW), however some fossil fuel NGC increased of which gas had the highest growth (2.1 GW). This increase of NGC is in opposite to gas energy generation, which significantly decreased. Figure 3.3.3.2.1 shows the development of fossil fuels within the space of three years, and Table 3.3.3.2.1 shows precise values concerning changes.

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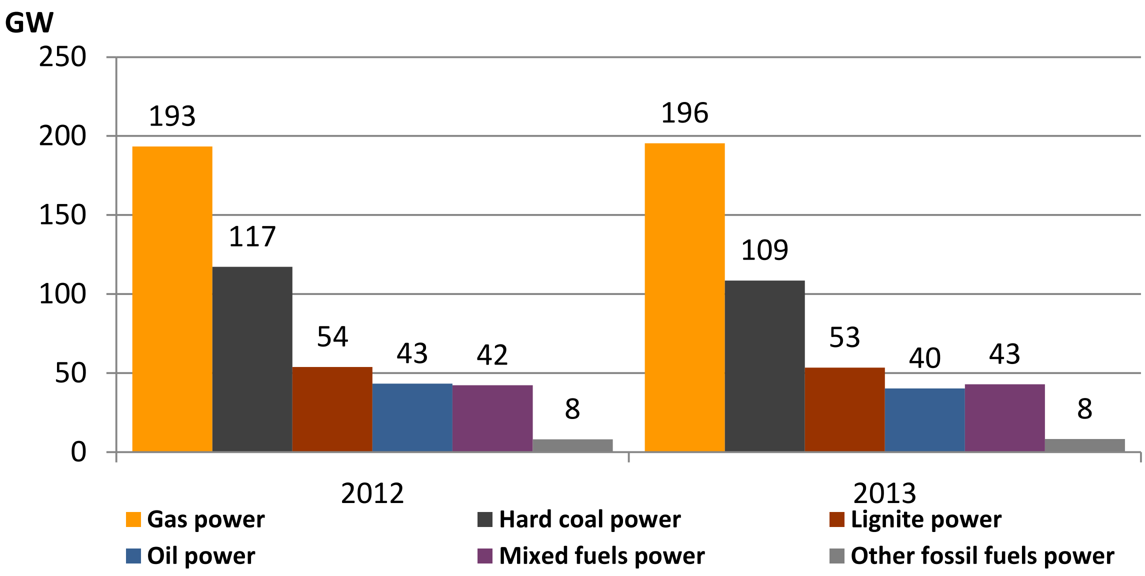

Figure 3.4.3.2.1: Fossil fuels NGC evolution per source

GW	December 2011	December 2012	December 2013	Change 2013 to 2012	
				Absolute value	%
Fossil fuels power	454.8	458.4	449.1	-9.2	-2.0%
Lignite power	60.8	53.9	53.5	-0.4	-0.8%
Hard coal power	119.1	117.2	108.6	-8.6	-7.3%
Gas power	189.5	193.5	195.5	2.1	1.1%
Oil power	45.8	43.3	40.3	-3.0	-6.9%
Mixed fuels power	30.9	42.3	42.9	0.7	1.5%
Other fossil fuels power	8.7	8.1	8.2	0.1	1.3%

Table 3.3.3.2.1: Fossil fuels evolution

The decrease of fossil fuel power in Great Britain (-5.0 GW) had the crucial influence on ENTSO-E results. On the other hand the highest increases in the NGC of fossil fuels can be attributed to Spain (1.8 GW).

Returning to ENTSO-E data, the present share of each category in total NGC is presented in Figure 3.3.3.2.2. No significant changes comparing year 2012, only gas extended their domination to hard coal.

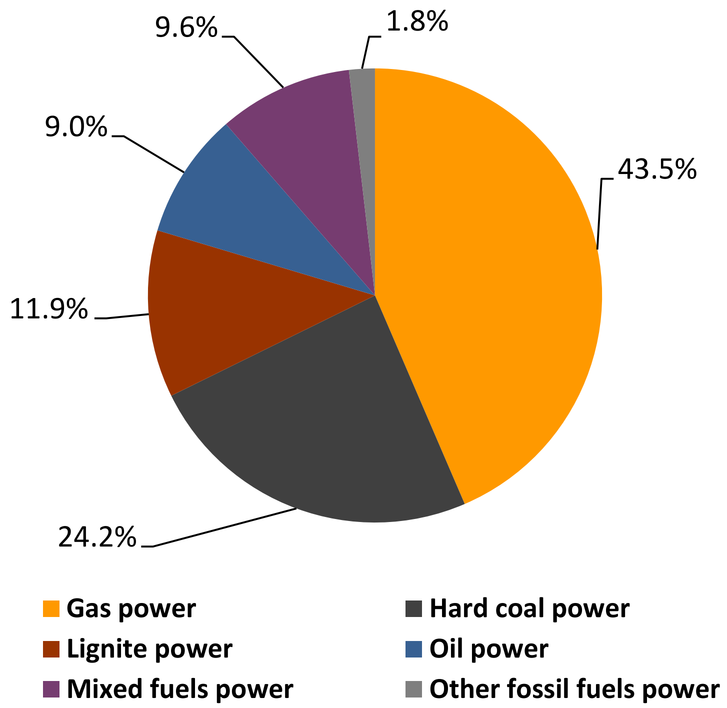

Figure 3.3.3.2.2: Fossil fuels NGC mix in 2013

3.3.3.3. Nuclear power

NGC of nuclear was stable compared to year 2012. Countries with highest installed capacity in ENTSO-E (France, Germany, Great Britain, Sweden and Spain) reported negligible changes of their share in total NGC with respect to 2012. France still has a half of nuclear power in ENTSO-E. Precise data is displayed in Figure 3.3.3.3.1.

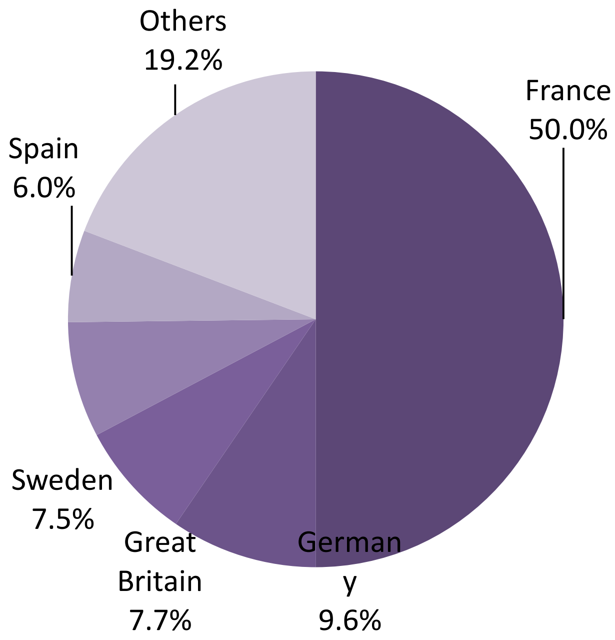

Figure 3.3.3.3.1: The share of nuclear NGC per country as a part of the total nuclear NGC in ENTSO-E

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3.3.3.4. Renewable energy sources power

As expected, the highest increase of NGC within all categories concerning RES is amounted to 24.1 GW, which corresponds to 6.7%. All renewable subcategories grew except for the subcategory “other”, which means that TSOs are able to identify their renewable sources more accurately. The dominant RES technologies wind and solar, show an increase over 9 GW each, however solar development was more dynamic (14.0%) than wind (9.0 %). The highest development was registered for biomass (15.4%). All details referring to the NGC of renewables can be found in Figure 3.3.3.4.1 and in Table 3.3.3.4.1.

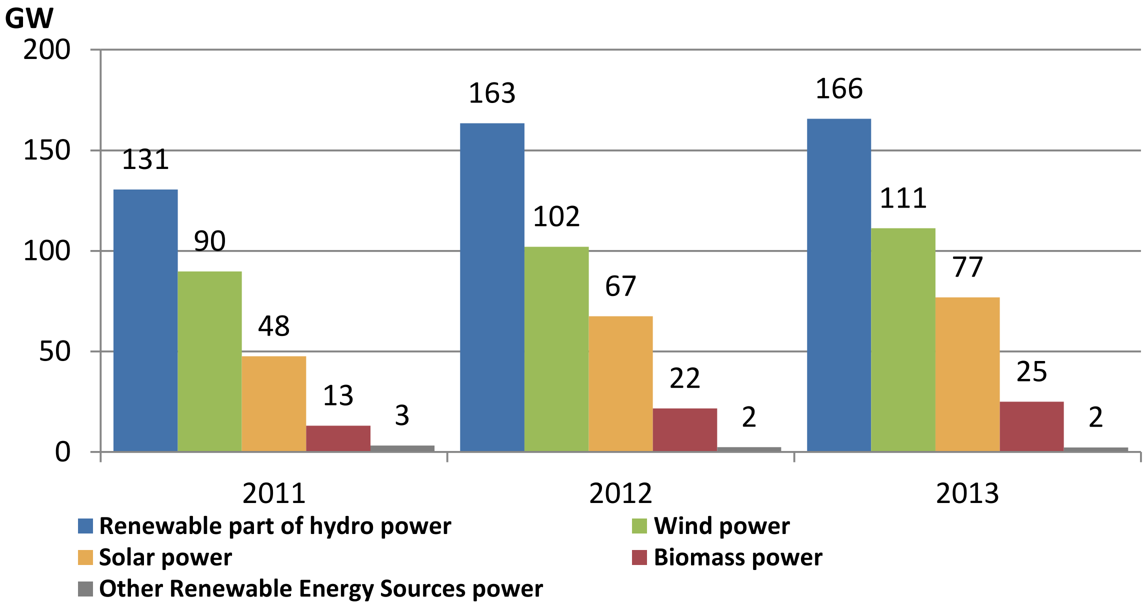

Figure 3.3.3.4.1: Renewable generation NGC evolution per source

GW	December 2011	December 2012	December 2013	Difference 2013 to 2012	
				Absolute value	%
Renewable Energy Sources power	284.3	357.1	381.2	24.1	6.7%
Wind power	89.9	102.1	111.2	9.2	9.0%
Solar power	47.6	67.5	76.9	9.5	14.0%
Biomass power	13.1	21.7	25.0	3.3	15.4%
Renewable part of hydro power	130.5	163.5	165.7	2.2	1.4%
Other Renewable Energy Sources power	3.2	2.4	2.3	-0.1	-3.4%

Table 3.3.3.4.1: Renewable generation evolution

All countries, except for France registered the increase of RES NGC. The leading countries in terms of renewable development (increase in 2013 as a part of the total national NGC in 2013) are Romania (6.5%), Greece (6.1%) and Denmark (5.6%)[13]. The highest increase in absolute values took place in Germany (6.2 GW).

[13] HR and BA registered huge increase of RES NGC, 54.4% and 44.2 % respectively, but this increase was due to availability of renewable part of hydro data in 2013, while in 2012 data was not available.

Looking at the structure of renewables NGC presented in Figures 3.3.3.4.2 and 3.3.3.4.3, despite NGC growth of renewable part of hydro in absolute values, its share in total renewables NGC decreased. Nevertheless renewable part of hydro is still the leader. As previous year more than 30% of this came from Nordic countries: Norway, Sweden and Finland.

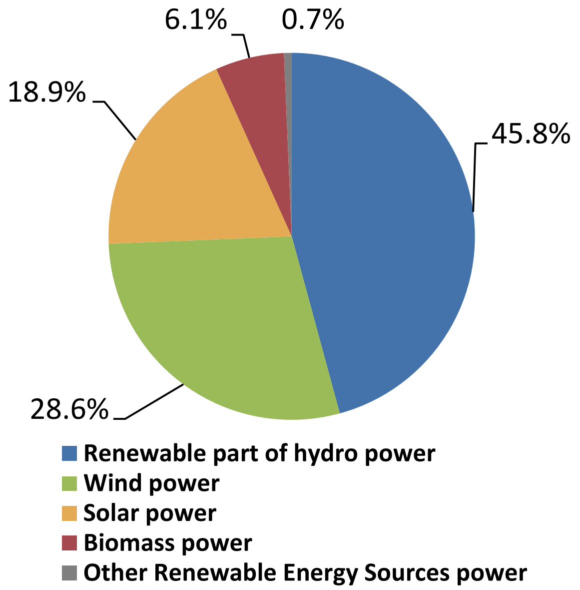

Figure 3.3.3.4.2: Renewable generation NGC mix in 2012

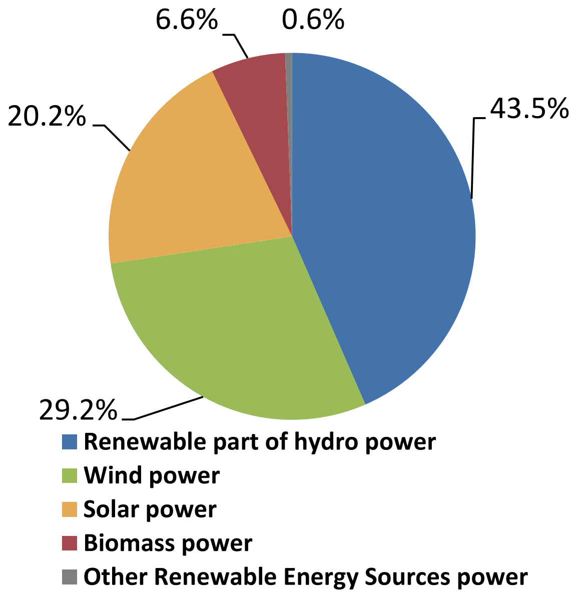

Figure 3.4.3.4.3: Renewable generation NGC mix in 2013

3.3.3.5. Non-renewable hydro power

This category represents the hydro element that could not be confirmed as renewable and is calculated as the total hydro minus the renewable hydro.

Since 2012, the structure of the ENTSO-E database has provided the strictly renewable part of hydro, while for previous years there was the division into run-of-river and renewable part of storage and pump storage. This is one reason why renewable hydro is more recognizable inside TSOs. The renewable part of hydro growth, whereas the non-renewable part decreased slightly. The total NGC hydro power plants remains stable though, as shown in Table 3.3.3.5.1.

GW	December 2011	December 2012	December 2013	Difference 2013 to 2012	
				Absolute value	%
Total hydro power	196.7	200.3	200.7	0.4	0.2%
Renewable part of hydro power	130.5	163.5	165.7	2.2	1.4%
Non-renewable hydro power	66.1	36.8	35.0	-1.9	-5.1%

Table 3.3.3.5.1: Hydro evolution

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3.3.3.6. National comments on NGC

AT – Austria
700 MW of NGC Fossil Fuels are not attributable. All hydro power plants are considered as renewable as pump storage plants have natural inflows.

BE – Belgium
The reported figures are best estimates based on actual measurements and extrapolations.

CH – Switzerland
(Comment for NGC hydro): Pumps.

EE – Estonia
All the rest of fossil fuels, beside gas and mixed fuel, is from oil shale.

IE – Ireland
Biomass consists of LFG and 50% of waste generation.
(Comment for NGC non-identifiable): Consists of demand side units.

IS – Iceland
(Comment for NGC Renewables): Geothermal (months 1 and 4).

LT – Lithuania
During 2012 oil fuel power plant has been adopted to burn gas. So, from the beginning of 2013 mix fuel power plants dominate in Lithuania.

NL – Netherlands
Biomass category interpreted as total waste.

PL – Poland
Polish TSO data.
Some fossil fuels units are co-firing biomass, but full NGC is classified in the category fossil fuel. Some CHPs use an oil, but no precise information about amount of energy is available for the TSO (energy is classified to hard coal subcategory), therefore power is classified in hard coal as well.
NGC of biomass subcategory includes also biogas.

SI – Slovenia

(General comment): hourly values are available for the transmission system only.
(Comment for NGC nuclear): the ownership of nuclear power plant Krsko is equally divided between Slovenia and Croatia. According to the international agreement half of the energy produced in NPP Krsko is delivered to the Croatia. The figures consider 100% of the NPP Krsko NGC.

UA_W – Ukraine West
(Comment for NGC Fossil Fuels) / RES and Hydro: including auxiliaries.

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3.3.4. Unavailable capacity & Reliable Available capacity

3.3.4.1. ENTSO-E overview

Unavailable Capacity (UC) refers to the part of the Net Generating Capacity (NGC) that was not available to power plant operators due to limitations of the output of power plants. It consists of non-usable capacity, maintenance and overhauls, outages and system services reserve.

Reliable Available Capacity (RAC) in a power system is the difference between NGC and UC. RAC is the element of NGC, which is actually available to cover the load at a reference point.

Figure 3.3.4.1.1 shows the structure NGC shared into UC and RAC in 2013.

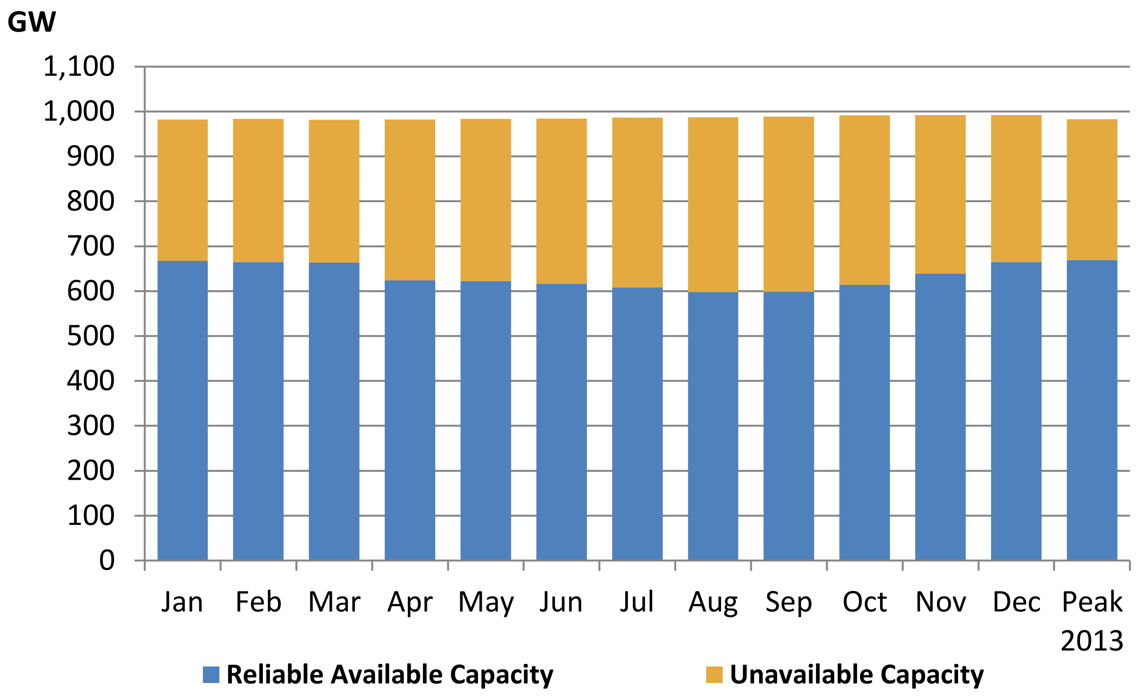

Figure 3.3.4.1.1: RAC overview in 2013 compared to UC

As usual RAC was higher in winter months, which is determined by load structure within the year. Therefore UC must be lower during these months. Table 3.3.4.1.1 presents UC evolution within the space of 2013 reference points.

GW	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Peak 2013
2011	245.2	248.2	265.8	304.7	328.4	324.6	322.1	336.8	341.1	323.3	307.9	270.6	
2012	279.8	283.7	318.5	330.9	364.7	375.2	369.6	377.3	373.0	358.1	335.1	327.0	
2013	314.5	319.5	318.2	357.8	360.6	368.6	377.7	389.8	390.6	377.5	353.2	327.9	314.1

Table 3.3.4.1.1: UC evolution

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The lower level of UC during winter months is achieved by adequate planning of maintenance and overhauls – their level during winter was two-three times lower comparing non winter months. On the other hand the most stable element of UC is system services reserve, required for operation for whole year. Outages are also stable within the year, their growth is expected rather due to severe conditions, than due to the season. The last element of UC with the highest share in total UC is non-usable capacity. It represents reductions of NGC due to different reasons. Foremost among these reasons are the limited availability of the primary energy source (especially in cases of hydro, wind and solar power plants) and other temporary constraints like mothballing of units, heat extraction for co-generation in Combined Heat and Power (CHP) and test operation. Most of these reasons referred to weather conditions and are in general unpredictable. The structure of UC is presented in Figure 3.3.4.1.2.

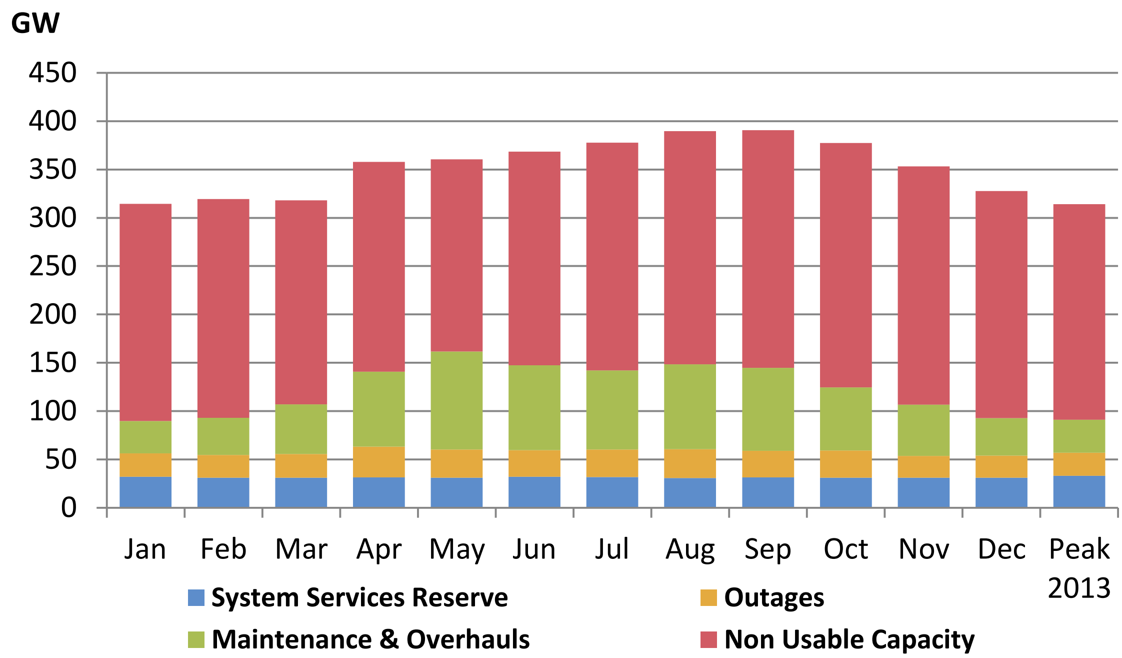

Figure 3.3.4.1.2: UC and its structure overview in 2013

UC as a part of NGC for the time span of three years is shown in Figure 3.3.4.1.3. The level of UC as a part of NGC in 2013 was more or less similar like in 2012, except for January and February. This level in reference point represents ENTSO-E peak load time was only slightly higher than in 3rd Wednesday of January.

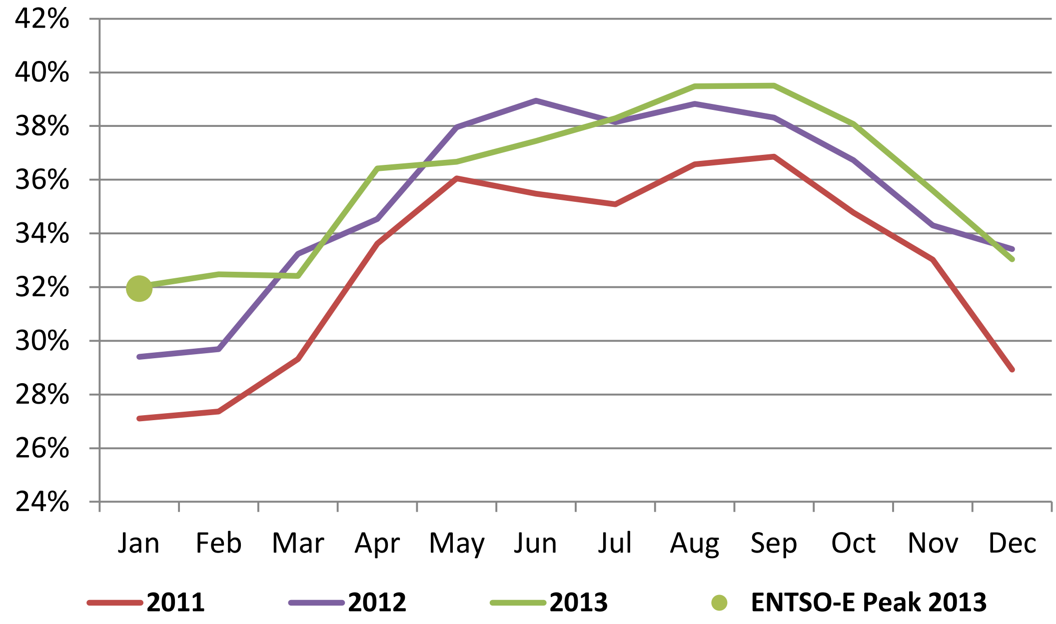

Figure 3.3.4.1.3: UC as a part of NGC evolution

3.3.4.2. Non-usable capacity

Non-usable capacity represents the aggregated reductions of NGC due to several causes:

- Unintentional temporary limitations due to various reasons, e.g. the availability of primary energy sources, including wind and solar, fuel management constraints, heat supply or environmental and ambient limitations. Limitation of generation output power due to network constrains is also a part of non-usable capacity.
- Decisions taken by relevant authorities and power plant operators, e.g. test operation, mothballing of units until a possible re-commissioning or final shutdown.

Figure 3.3.4.2.1 compares the monthly evolution of non-usable capacity as a part of NGC in the past three years. The share of non-usable capacity in 2013 reference points was higher than in 2012 except for reference points in March, May, June and December, while when comparing 2013 with 2011 is found that non-usable capacity in 2013 is higher for all reference points. Such results show, that year by year, more and more part of NGC is not available for TSOs. In October 2013 the highest ever level of non-usable capacity was registered, both in absolute values (252.9 GW) and as a part of NGC (25.5%).

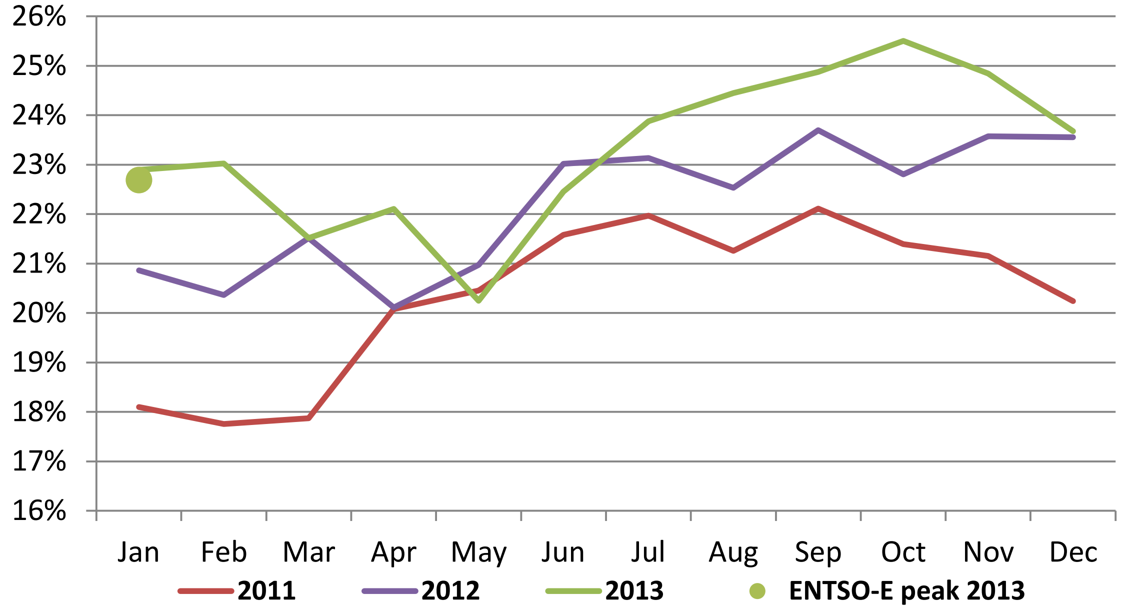

Figure 3.3.4.2.1: Non-usable capacity as a part of NGC evolution

3.3.4.3. System services reserve

System services reserve is required to maintain the security of supply according to the operation rules of each TSO. It is necessary for the compensation of real time imbalances and also for voltage and frequency control. System services reserve consists of the primary control reserve, the secondary control reserve and a part of the tertiary control reserve available for activation within one hour, excluding longer-term tertiary reserves.

Figure 3.4.4.3.1 shows the system services reserve as part of NGC in the past three years. The share of services reserve was lower in all 2013 reference points with single exception in July. In 2013 system services reserve level was also lower in absolute values.

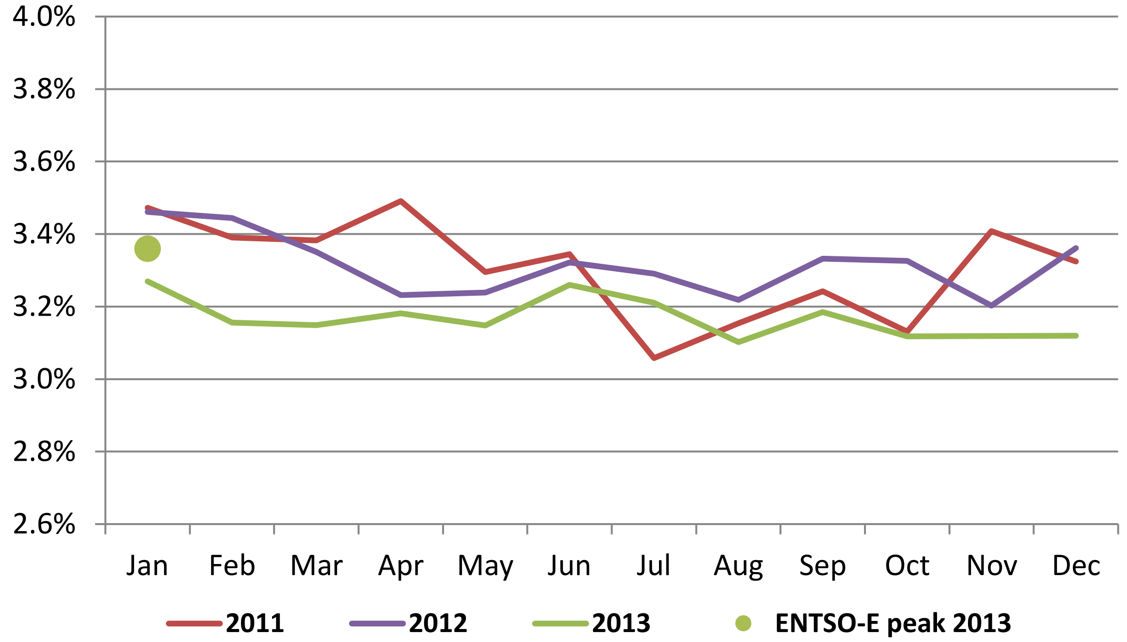

Figure 3.3.4.3.1: System services reserve as a part of NGC evolution

3.3.4.4. Maintenance & overhauls

The maintenance and overhauls subcategory aggregates the scheduled unavailability of net generating capacity for regular inspections and maintenance. As mentioned at the beginning of paragraph referred to UC, the level of maintenance and overhauls is determined by load curve during the year, so in winter it was 33.3 GW in January (3.4% of NGC), while for May it was 101.3 GW (10.3% of NGC).

3.3.4.5. Outages

In outages the forced (i.e. not scheduled) unavailability of generating capacity is aggregated. As mentioned at the beginning of paragraph referred to UC, the level of outages is quite stable in referent points both in absolute values (between 22.5 GW in November and 31.8 GW in April) and as a part of NGC (between 2.3% and 3.2% respectively).

3.3.4.6. National comments on UC and RAC

EE – Estonia
System Service Reserve is actually 100 MW but it was hold in Latvia.

IE – Ireland
Non Usable Capacity consists of the difference between installed Wind and the Wind Capacity Credit Value.

PL – Poland
System services reserve contents of primary and secondary reserves, where secondary referred to the biggest unit in the system.

3.3.5. Remaining capacity & Remaining margin

3.3.5.1. Basic information

The remaining capacity (RC) is the part of the net generation capacity (NGC) left in the system after the load at the reference point has been covered. The RC of a power system is the difference between the Reliably Available Capacity (RAC) and the load.

As reference points for the Adequacy Retrospect are the 3rd Wednesdays, 11:00 of every month (except for ENTSO-E peak reference point), to extend the results from a unique reference point to a whole month the Margin Against Monthly Peak Load (MaMPL) is introduced. It is calculated as the difference in power between the maximum peak load metering over the month and the load at the reference point in this month. For ENTSO-E peak reference point, MaMPL is expected to be the lowest one and for countries, where peak load occurred at the same time as for ENTSO-E should amount zero.

The Remaining Margin (RM) in a power system is the difference between the RC and the MaMPL. It is the part of the NGC that has not been used to cover the monthly peak load. On the other hand, the negative margin shows the situation that could happen if the monthly peak load occurs at a reference point, meaning that the system would not be balanced due to lack of RAC (or an excess of Unavailable Capacity).

3.3.5.2. ENTSO-E overview

As expected RC was the lowest for reference point referred to ENTSO-E peak load. Whole monthly results in last three years are presented in Table 3.3.5.2.1.

GW	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	peak 2013
2011	168.1	169.7	189.8	191.6	176.8	181.0	188.8	201.8	175.7	176.8	166.4	191.4	
2012	169.8	163.7	200.0	181.2	180.7	168.8	189.8	245.3	189.1	192.1	185.0	170.3	
2013	159.1	179.7	192.4	205.9	206.5	189.7	189.5	200.7	177.7	178.0	170.5	189.2	140.1

Table 3.3.5.2.1 RC evolution

A general overview of the structure of NGC, as the sum of RC, UC and load is shown in Figure 3.3.5.2.1.

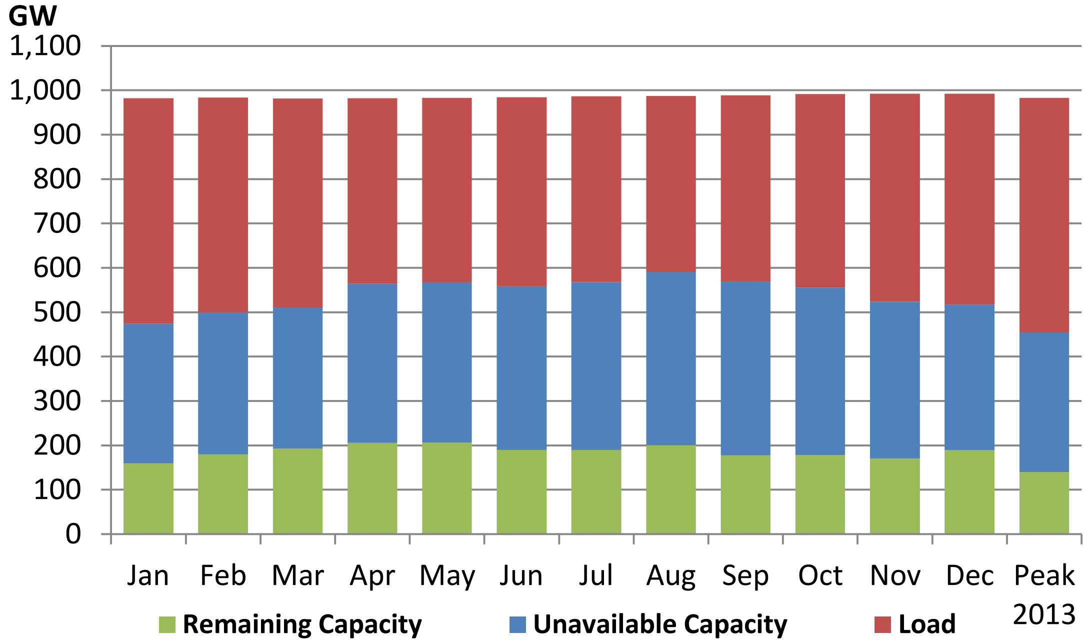

Figure 3.3.5.2.1: RC overview in 2013 compared to UC and load

Comparing with 2011 and 2012 in 2013 there was no significant differences for RC as the part of NGC, except to January reference point on 3rd Wednesday, when the lowest ever level of RC as a part of NGC registered (16.2%). Nevertheless it was more than for ENTSO-E peak load reference point, when RC as a part of NGC amounted 14.3%. For rest reference points values oscillated between 17.2% in November and 21.0% in April and May. Details can be found in Figure 3.3.5.2.2.

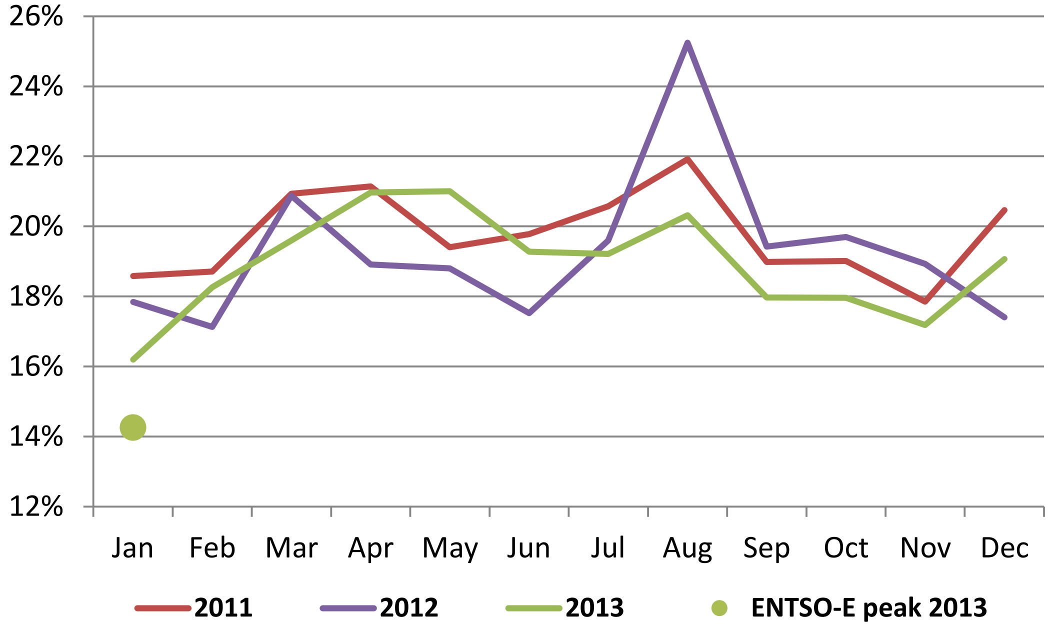

Figure 3.3.5.2.2: RC as a part of NGC evolution

Throughout the year 2013 the total ENTSO-E RM was always positive and higher than 100 GW, which correspond with 10% of NGC. This means that the ENTSO-E system as such did not rely on imports of electricity from neighbouring countries (Russia, Belarus, Ukraine, the Republic of Moldova, Turkey and Morocco) and had enough generating capacity to cover its demand at any time during the year. These values were generally not very different from what has been observed in recent years (2011 and 2012). The following table and figures show these results, based on the aggregated values of the different countries. On the other hand, some countries reported a negative RM. More details are presented in the excel attachment “YS&AR 2012 table no.1”, sheet “Power”.

GW	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Peak 2013
RC	159.1	179.7	192.4	205.9	206.5	189.7	189.5	200.7	177.7	178.0	170.5	189.2	140.1
MAMPL	38.6	53.6	45.5	68.4	35.8	32.7	39.8	53.9	38.2	41.3	63.6	60.4	16.4
RM	120.5	126.0	146.9	137.5	170.7	157.1	149.7	146.8	139.5	136.8	106.9	128.8	123.1

Table 3.3.5.2.2: RM overview in 2013

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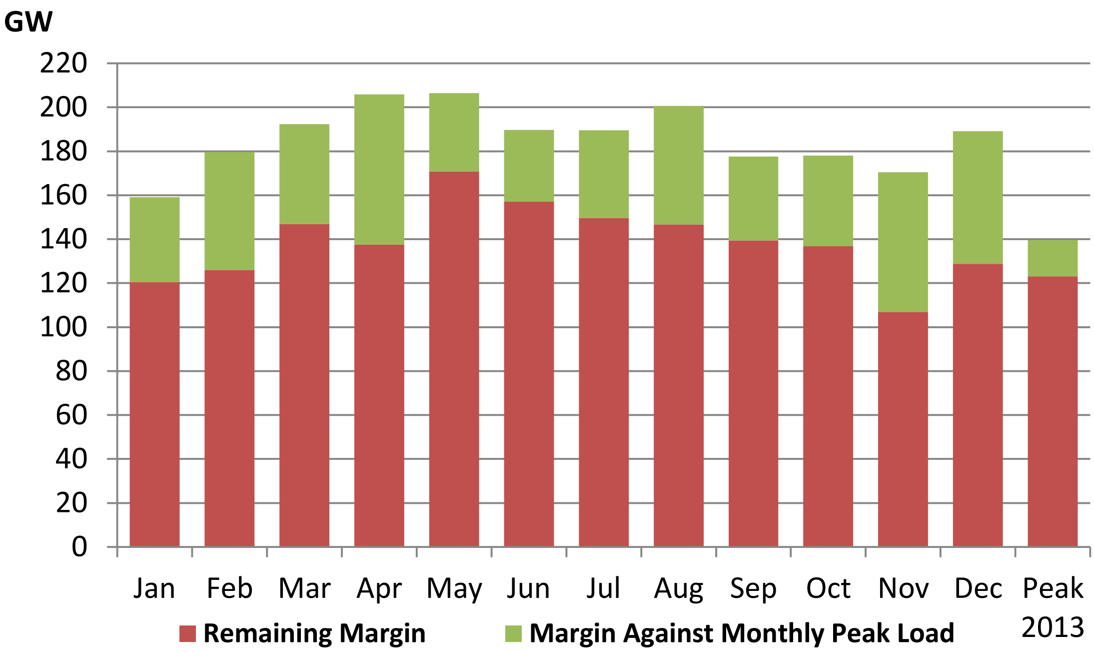


Figure 3.3.5.2.3: RM and MAMPL overview 2013

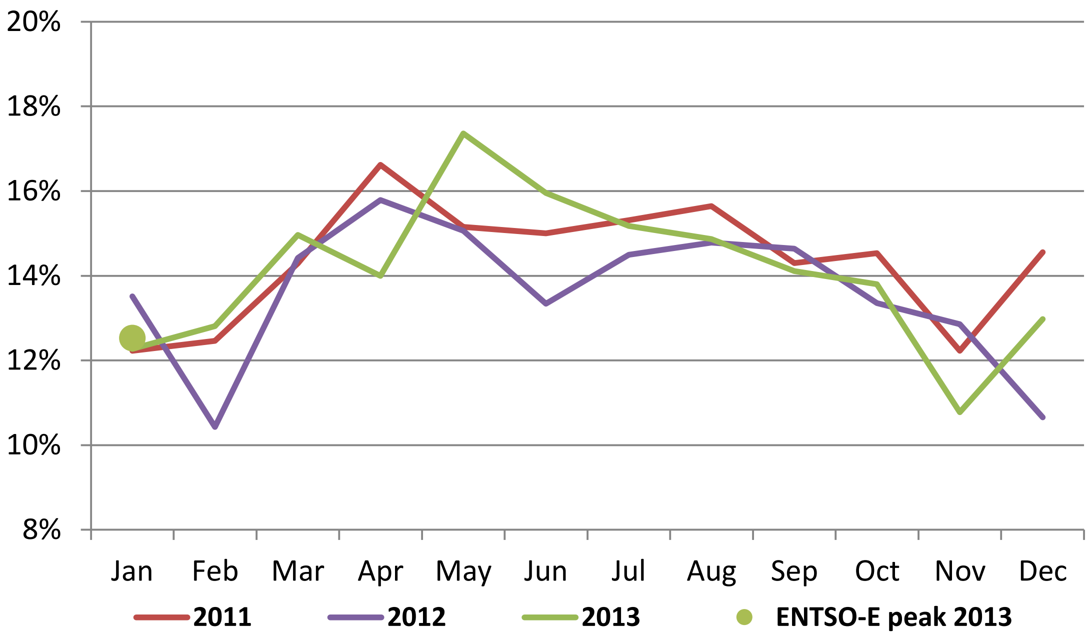
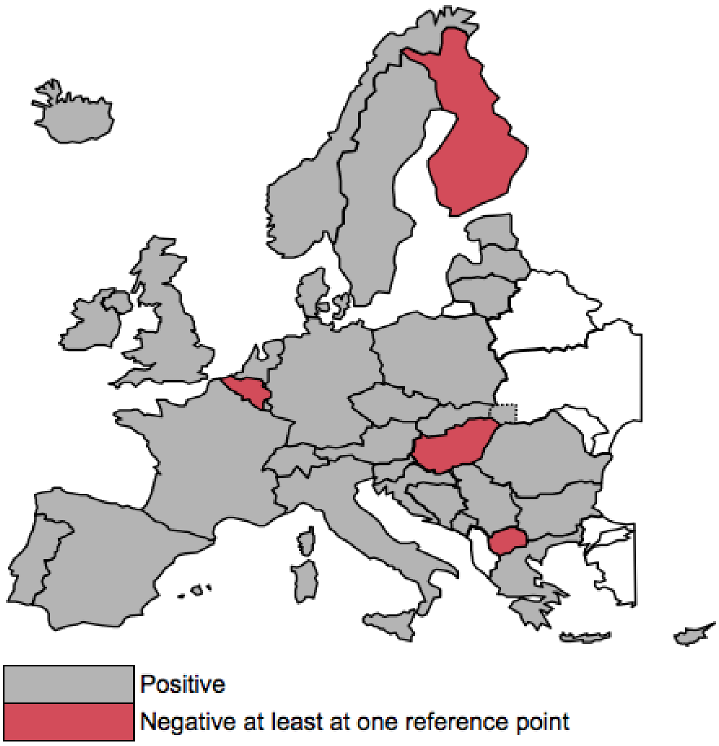


Figure 3.3.5.2.4: RM as a part of NGC evolution

3.3.5.3. National RC

Positive national RC means that at reference point, a country covered their load by itself and remained power might be exported, while negative RC means that national RAC was not enough to cover load at reference point and to balance the system the import was required. In some situations referred to negative RC, the difference in the energy prices on the market may cause that imports are more economically favourable than increase of national generation and then a part of national NGC is not used due to cost and classified as e.g. non-usable capacity (mothballed).

In the majority of ENTSO-E countries the RC was positive during the whole year (without considering the influence of exchanges). Only four countries: Belgium, Finland, Hungary and Former Yugoslav Republic of Macedonia reported negative RC. For BE, FI and HU negative RC was registered in six reference points, while single for MK what is presented on Map 3.3.5.3.1.



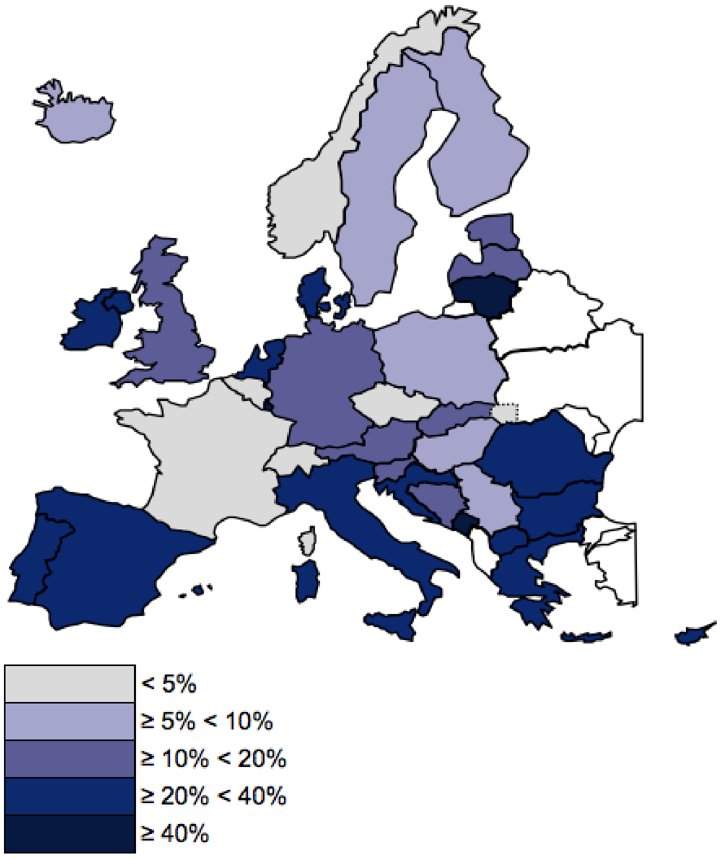
Data related to the map
Used data:
Months with negative RC

BE	HU
January	March
January$_{ENTSO-E}$	May
February	June
March	August
April	November
May	December

FI	MK
January$_{ENTSO-E}$	December
June	
July	
August	
September	
October	

Map 3.3.5.3.1: Reference points with negative RC in 2013 (without exchanges)

In normal operation system is balanced when RC including exchanges is positive every moment. Map 3.3.5.3.2 shows RC with exchanges as a part of NGC per country in ENTSO-E peak load reference point and map Map 3.3.5.3.3 results for May reference point. These points represent reference points with the lowest level of RC (in ENTSO-E peak) and the highest RC (in May).



Data related to the map

Used formula:

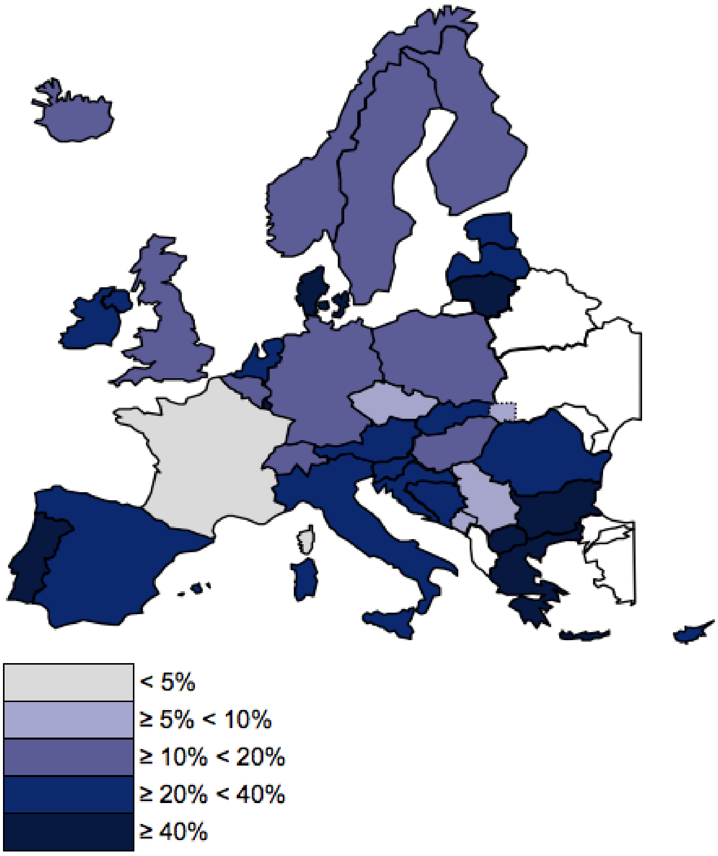
$(RC+exch)_{ENTSO\text{-}E\ peak}/NGC_{ENTSO\text{-}E\ peak}$

AT	17.5%	IS	6.1%
BA	10.7%	IT	20.8%
BE	1.5%	LT	73.8%
BG	32.6%	LU	50.6%
CH	0.0%	LV	19.0%
CY	35.5%	ME	66.3%
CZ	0.9%	MK	22.1%
DE	10.5%	NI	32.0%
DK	26.0%	NL	21.5%
EE	13.1%	NO	0.9%
ES	29.1%	PL	6.5%
FI	8.9%	PT	35.4%
FR	4.3%	RO	21.7%
GB	13.2%	RS	6.9%
GR	25.6%	SE	8.2%
HR	34.6%	SI	13.4%
HU	9.3%	SK	19.3%
IE	22.8%	UA_W	2.7%

Map 3.3.5.3.2: RC with exchanges as a part of NGC in reference point representing ENTSO-E peak load per country

The ENTSO-E average level of RC with exchanges as a part of NGC on 17 January 2013 at 19:00 (ENTSO-E peak load) amounted 20.1%, the highest result was for Lithuania (73.5%), the lowest for Czech Republic and Norway (both 0.9%)[14]. In May reference point the ENTSO-E average level was at the level of 26.1% and that time Luxembourg was the leader (79.4%), on the opposite spectrum was France (4.9%).

[14] As mentioned in paragraph 1.2 "About the data" some CH data is an estimation and result of RC with exchanges may not be confirmed as reliable.



Data related to the map
Used formula:
$(RC+exch)_{May}/NGC_{May}$

AT	20.2%	IS	18.6%
BA	26.9%	IT	27.2%
BE	13.0%	LT	52.4%
BG	45.1%	LU	79.4%
CH	19.8%	LV	28.2%
CY	31.7%	ME	6.8%
CZ	7.0%	MK	42.0%
DE	16.6%	NI	33.4%
DK	45.6%	NL	26.4%
EE	21.6%	NO	16.4%
ES	35.6%	PL	16.2%
FI	14.4%	PT	40.5%
FR	4.9%	RO	29.3%
GB	14.1%	RS	8.2%
GR	48.9%	SE	10.4%
HR	38.0%	SI	30.9%
HU	19.3%	SK	20.8%
IE	29.2%	UA_W	5.0%

Map 3.3.5.3.3: RC with exchanges as a part of NGC in May 2013 per country

3.3.5.4. National comments on RC and RM

No comments!

4. ENTSO-E members and statistical data correspondents

4.1. Member companies

Country		Company	Abbreviation
AT	Austria	Austrian Power Grid AG	APG
		Vorarlberger Übertragungsnetz GmbH	VUEN
BA	Bosnia and Herzegovina	Nezavisni operator sustava u Bosni i Hercegovini	NOS BiH
BE	Belgium	Elia System Operator SA	Elia
BG	Bulgaria	Electroenergien Sistemen Operator EAD	ESO
CH	Switzerland	Swissgrid ag	Swissgrid
CY	Cyprus	Cyprus Transmission System Operator	Cyprus TSO
CZ	Czech Republic	ČEPS a.s.	ČEPS
DE	Germany	TransnetBW GmbH	TransnetBW
		TenneT TSO GmbH	TenneT DE
		Amprion GmbH	Amprion
		50Hertz Transmission GmbH	50Hertz
DK	Denmark	Energinet.dk	Energinet.dk
EE	Estonia	Elering AS	Elering AS
ES	Spain	Red Eléctrica de España: S.A.	REE
FI	Finland	Fingrid OyJ	Fingrid
FR	France	Réseau de Transport d'Electricité	RTE
GB[15]	United Kingdom	National Grid Electricity Transmission plc	National Grid
		System Operator for Northern Ireland Ltd	SONI (NI)[16]
		Scottish Hydro Electric Transmission plc	SHETL
		Scottish Power Transmission plc	SHE Transmission
GR	Greece	Independent Power Transmission Operator S.A.	IPTO

[15] The country code GB represents the sum data for England, Scotland and Wales.
[16] The country code NI represents the data for Northern Ireland.

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HR	Croatia	HOPS d.o.o.	HOPS
HU	Hungary	MAVIR Magyar Villamosenergia-ipari Átviteli Rendszerirányító Zártkörűen Működő Részvénytársaság	MAVIR ZRt.
IE	Ireland	EirGrid plc	EirGrid
IS	Iceland	Landsnet hf	Landsnet
IT	Italy	Terna - Rete Elettrica Nazionale SpA	Terna
LT	Lithuania	Litgrid AB	Litgrid
LU	Luxembourg	Creos Luxembourg S.A.	Creos Luxembourg
LV	Latvia	AS Augstsprieguma tĭkls	Augstsprieguma tĭkls
ME	Montenegro	Crnogorski elektroprenosni sistem AD	Crnogorski elektroprenosni sistem
MK	FYR of Macedonia	Macedonian Transmission System Operator AD	MEPSO
NL	Netherlands	TenneT TSO B.V.	TenneT NL
NO	Norway	Statnett SF	Statnett
PL	Poland	Polskie Sieci Elektroenergetyczne	PSE
PT	Portugal	Rede Eléctrica Nacional, S.A.	REN
RO	Romania	C.N. Transelectrica S.A.	Transelectrica
RS	Serbia	JP Elektromreža Srbije	EMS
SE	Sweden	Svenska Kraftnät	Svenska Kraftnät
SI	Slovenia	ELES, d.o.o.	ELES
SK	Slovak Republic	Slovenska elektrizacna prenosova sustava, a.s.	SEPS

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[17] The country code UA_W (Ukraine West) represents the data for the western part of the Ukrainian system called Burshtyn Island. Non-ENTSO-E member.

5. List of appendices

Excel attachment "YS&AR 2013 table no. 1 - operational data 2013"

1. Table of Contents
2. Energy (Yearly Energy balance)
3. Generation (ENTSO-E monthly energy generation based on Monthly Statistics data)
4. Flows (Harmonized flows based on Monthly Statistics data)
5. NGC (Net generating capacity as of 31 December)
6. Power Balance (Power balance on reference points)
7. Hourly peak (Maximum and minimum yearly hourly load based on Monthly Statistics data)
8. Instantaneous peak (Maximum instantaneous load)
9. Thermal (Inventory of thermal power units as of 31 December)
10. Hydro (Inventory of hydro power units as of 31 December)
11. Transformers (Inventory of transformers as of 31 December)
12. Lines (Inventory of lines (including DC cables) as of 31 December)
13. Circuits (Number of circuit lines as of 31 December)
14. Tie lines table (Characteristics of the ENTSO-E tie lines as of the 31 December)
15. Tie lines comments (Comments to characteristics of the ENTSO-E tie lines)
16. Cables (Characteristics of the ENTSO-E tie lines as of the 31 December – of which cables)
17. Unavailability (Unavailability of international tie lines based on Monthly Statistics data)
18. Abbreviation (Abbreviation of the companies)

Excel attachment "YS&AR 2013 table no. 2 – country operational data 2013, 2012"

1. General remark
2. ENTSO-E data based on Monthly Statistics data
3. Country data based on Monthly Statistics data

Excel attachment "YS&AR 2013 table no. 3 – monthly harmonised flows per border 2013, 2012, 2008"

1. General remark
2. Yearly flows 2013- matrix
3. Yearly flows 2013 - graph
4. Country data based on Monthly Statistics data

PDF attachment "Tie lines - simplified diagram of the cross-frontier transmission lines"

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6. Glossary information

Terms and their definitions used in the report can be found in the ENTSO-E Glossary, via EMR tool: https://emr.entsoe.eu/glossary/

The Adequacy Retrospect part of this report was prepared by the following members of the System Adequacy & Market Modelling Working Group:

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