Security of Power Supply in Europe in 2030: an overview

# Appendix

## Calculation principle - Summary of main assumptions - Uncertainties - Observations

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By 2030-2035, significant decommissioning of dispatchablepower is planned in Europe (in Germany, the exit from nuclear power is planned before 2022 and the total exit from coal in 2038, the total exit from fossil fuels and the reduction to 50% of nuclear power in France, the exit from fossil fuels and nuclear power in Belgium, etc.). Detailed adequacy studies have been carried out for the next five years, but generally not beyond. This is what motivated this investigation and even a simplified calculation, in order to determine whether negative margins do not appear, which are large enough to cast doubt on the coverage of the risk for all the probabilistic scenarios.

### Main assumptions

A spreadsheet, provided at the end of this appendix, has been developed to observe the supply/demand balance over the period 2020-2035. For each of the years 2020, 2025, 2030 and 2035, the assumptions of three European entities in charge of forecasting studies on the security of supply in their countries have been compiled:

- RTE - Forecast balance of electricity supply-demand in France - 2019 EDITION ;
- Elia (2019), *Adequacy and flexibility study for Belgium 2020-2030* ;
- *Definition and monitoring of security of supply in the European electricity markets*, january 2019, for the BMWi (Bundesministerium für Wirtschaft und Energie, ministry for Economy and Energy).

The data collected and entered in the spreadsheet relate to changes in the mix of the six countries bordering France (including the United Kingdom but excluding Luxembourg). This constitutes the "**technical scenario**". As many hypotheses are missing or unpublished in the TSO studies (particularly beyond 2030), France Stratégie has had to make its own choices or define its own, based on scientific studies such as that of the EWI in Cologne, Germany, according to :

- a "**likely scenario**", based on estimates that extend a trend
  The "natural" scenario of the technical scenario or applying legal objectives (e.g. 50% nuclear power in France in 2035);
- a "**possible scenario**", based on expert estimates from France Stratégie.

The data relate to the capacities :

- installed in dispatchable means: coal/lignite, gas, nuclear, large hydraulic and others (biomass);
- installed in intermittent renewable energy sources (iRES): onshore and offshore wind power, photovoltaic solar energy;
- short-term flexibility (storage and load management) ;
- of average peak demand (average and trough demand are recalled for the record) ;
- for France, the level of interconnection with its neighbours is mentioned for information.

France and Germany are the two countries whose changing mix has a strong impact at the European level, and the assumptions on the decommissioning rates for nuclear power in France (-21 GW in 2035 to reach 50%) and coal/lignite in Germany (exit in 2038) differ according to the institutes. Tables 1 and 2 below summarise them:

**Table 1 - Nuclear decommissioning assumptions in France**

**In bold the assumptions used by France Stratégie in the spreadsheet**

| *GW* | 2020 | 2025 | 2030 | 2035 |
|---|---|---|---|---|
| TEN (EPP) | **61,4** | **63** | **58** | **52** |
| BMWi (Germany) | 61,4 | 52,2 | 37,6 | |
| Elia (Belgium) | 61,4 | 52,2 | 63 | 59,3 |

**Table 2 - Decommissioning assumptions for coal/lignite in Germany**

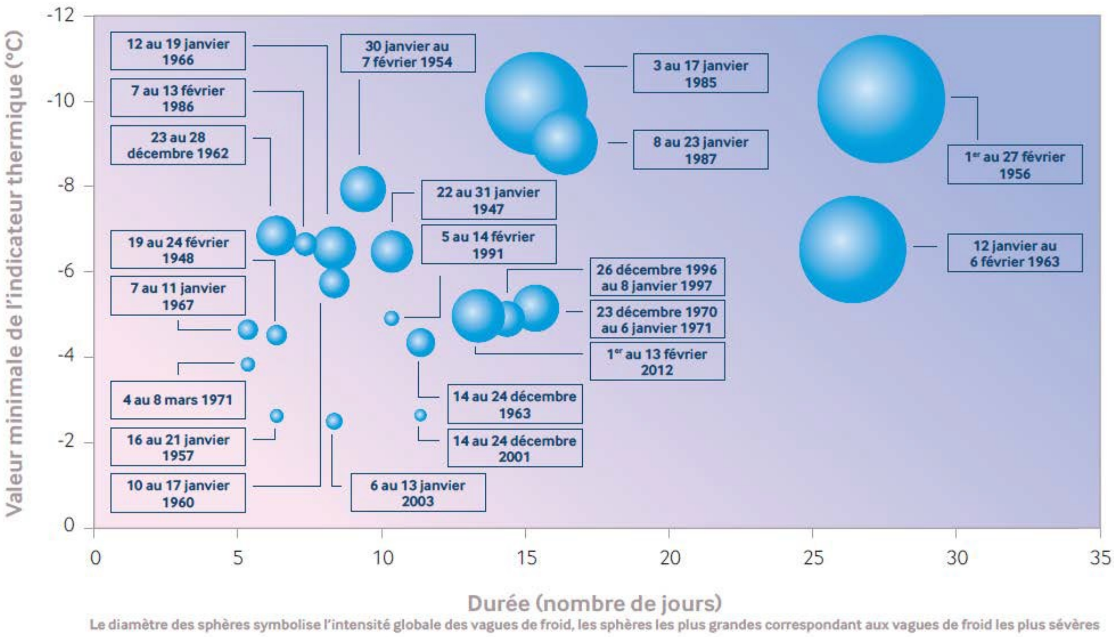
**In bold the assumptions used by France Stratégie in the spreadsheet**

| GW | 2020 | 2025 | 2030 | 2035 |
|---|---|---|---|---|
| BNetzA (Regulator) | **39** | **23,9** | **17,0** | **6** |
| BMWi (Ministry) | 39,5 | 35,0 | 27,0 | |
| Elia | 34,5 | 25,2 | 17,0 | |

## Drawing up state-of-the-art supply/demand balance sheets

A supply/demand matching study should usually involve probabilistic draws that only TSOs and specialised study groups are capable of carrying out, as this requires compiling very large amounts of data. These draws are based on climate records observed in the past, such as those shown in Figure 1, which still need to be coupled with wind conditions during these periods.

**Figure 1 - Cold waves in France, period 1947-2017**




*Source: Météo France*

This is how RTE operates, deducting a certain number of parameters which it then introduces into its capacity mechanism[1-2] , mainly the total capacity obligation for France, which corresponds to RTE's assessment of the average peak demand and "capacity credits". These represent the percentage of the total installed capacity of a generating facility available for electricity production at a certain level of confidence, which itself depends on the criterion applied to security of supply (in France less than three hours per year on average). This method is used by RTE, like various other European countries, in its capacity mechanism to assess the average guaranteed power to be supplied by the obligated players. Clearances are part of the capacity mechanism and are therefore assimilated to a means of production.

This modelling remains indicative because it is very difficult to aggregate into a coefficient the probability of occurrence of a phenomenon and its consequences for the system (for example, a long, windless cold spell will have a low probability but a very serious impact on the security of supply). RTE establishes these coefficients after having carried out numerous evaluations cross-referencing climatic chronicles, changes in demand and the production mix.

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[1] RTE, 2019 Forecast Balance Sheet, Technical Report, page 31.
[2] For a more detailed definition: https://www.services-rte.com/fr/decouvrez-nos-offres-de-services/participez- au-mecanisme-de-capacite.html

In its spreadsheet, France Stratégie reconstructed the functioning of this capacity mechanism and applied it to the seven countries studied. The assumptions used for average peak demand are based on those in publications by the bodies responsible for assessing security of supply (TSO, regulator or ministry) or academic bodies. The "capacity credits" are based on various scientific publications (whose references are listed below) and those evaluated by RTE. The following values have been retained :

- 85% for all conventional means. In the case of French nuclear power, this figure is too high for 2020, but it has been kept in order to be consistent with RTE's BP 2019, which was established before the health crisis. For the following years, this figure also appears high for two reasons. On the one hand, the official studies estimate the nuclear power installed in 2035 at 52 GW, which, in order to comply with the legal target of 50% nuclear power at that date, implies an extremely low load factor not exceeding 50% for some units. On the other hand, the "major refit" that the nuclear fleet will undergo in the coming decade must significantly reduce its availability, especially if we take into account the new conditions that the Nuclear Safety Authority plans to impose on EDF with a view to extending the life of the plants;
- 10% for onshore wind power, i.e. the average of the figures between 5% and 15% put forward by various studies (Mines-Ademe[3] , IEA cited by[4] , EDF[5] , EWI[6] , OECD[7] ...). It should be noted that the capacity credit of wind power decreases when the size of the installed park increases, as the risk of failure increases due to the proportion of dispatchable means decreasing. Note also that wind generation regularly reaches 1% of installed capacity ;
- 20 % for offshore wind energy, which is much more regular ;
- 2% for photovoltaic solar energy, which is a rather favourable value. Indeed, some studies take 0% because it never produces on winter evenings, while others take higher values because they see the daily morning peak increase with the development of load shedding, mainly used during the evening peak, which is sharper.

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[3] Balea L., Siebert N., Kariniotakis G. et Peirano E. (2020), "Quantification of capacity credit and reserve requirements from the large scale integration of wind energy in the french power system", École des Mines de Paris-ADEME (Proc. of the Global WindPower 2004 Conference, Chicago, USA, March 2004).

[4] Crassous R. and Roques F. (2013), *The costs associated with the insertion of intermittent ENRs into the electrical system. Une revue de la littérature*, Fondation Paris Dauphine, December.

[5] Burtin A. et Silva V. (2015), *Technical and economic analysis of the European electricity system with 60 % RES*, juin.

[6] Paulus M., Grave K et Lindenberger D. (2011), "A methodology to estimate security of supply in electricity generation: results for Germany until 2030 given a high level of intermittent electricity feed-in", *EWI Working Paper*, n° 10/2011.

[7] Keppler J. H. and Cometto M. (2013), "The Interaction between Nuclear and Renewable Energy and its Systemic Effects in Low Carbon Electricity Grids", LEDa-Laboratory of Economics of Dauphine, OECD.

## Comments

### Period 2020-2025

Calculations made by France Stratégie confirm the forecasts for France of RTE's BP 2019, which sees slightly positive margins and hints at the tensions announced by the French and Belgian TSOs for the coming winters, due to a lower availability of nuclear power as a result of the corona crisis. The years that will follow 2022, when the last nuclear units in Germany (8 GW) will be decommissioned, as well as more than 12.5 GW of coal-fired power stations (out of 39 GW at the beginning of 2020), will show a significant deficit of dispatchable power in this country.

### Period 2025-2035

Still in Germany, this deficit will increase over the period 2030-2035 solely because of the expected increase in peak consumption, itself due to the electrification of uses. At this horizon, however, there is some uncertainty as to the capacities of gas-fired power plants that will replace coal-fired plants that will actually be deployed.

In France, after 2030, nuclear power will have decreased significantly and the situation appears to be significantly tense if no new dispatchable means are integrated into the network or the flexibilities sufficiently developed, knowing that it is forbidden to build new means based on fossil energy.

France and Germany will therefore both have to rely on imports in periods of tension, knowing that neighbouring countries all have declining margins. Italy, Switzerland and Spain keep positive margins, but Great Britain and Belgium show frankly negative margins.

For all the seven countries studied, if no new dispatchable means are added to the network during this period, and assuming that the ENR development objectives are respected, the margins rise from +34 GW in 2020 to +16 GW in 2025, then become negative at -7.5 GW in 2030 and -10 GW in 2035.

## Uncertainties on assumptions

### On request :

This will depend on :

- the strength of the economic recovery in the short and medium term after the corona crisis;
- achieving the energy efficiency objectives of government policies, particularly in the thermal renovation of buildings;
- the development of new uses (EV, Heat Pumps) ;
- for the peak of intra-day flexibility, behaviour, rates, average demand level, etc...

### On flexibilities :

- the total power in fatal energies (wind, solar and partly hydraulic, biomass not being counted) is likely to reach more than three times the power during demand troughs, which poses a huge problem of flexibility management and in particular storage ;
- battery storage: RTE sees only a few hundred MW in 2030. Batteries are not suitable for storage over periods exceeding a few days;
- Hydrogen solutions will not be mature before 2030 (and most likely 2035);
- plant closures : RTE sees 3 to 6 GW in 2030 in France. For the moment, the economic model and regulation are not defined. Few hypotheses are published for the other countries and France Stratégie has retained figures of the same order of magnitude as for the French system.

### Networks and interconnections

- their development remains slow on land because of the poor acceptability of the populations. Added to this, the lack of real coordination means that it is not always the most relevant segments that are built first.

## Summary of results

***Colour codes*** *"technical scenario*

*"probable scenario".*

*"possible scenario".*

*Excel calculation result*

| 2020 - GW | coeff | FR | DE | BE | SP | GB | IT | CH | TOTAL |
|---|---|---|---|---|---|---|---|---|---|
| **Dispatchable power** | *85%* | 90,3 | 86,4 | 12,7 | 53,2 | 55,4 | 64,9 | 17,5 | **381,2** |
| **IRES power** | *2 à 15%* | 27,9 | 117,5 | 7,4 | 38,2 | 36,5 | 34,2 | 2,9 | **264,6** |
| **Peak demand** | | 94,3 | 90,2 | 12,6 | 41,0 | 60,0 | 60,0 | 11,0 | **369,1** |
| **Load management/storage** | | 3,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | **3,0** |
| **Margin at peak** | | **1,0** | **4,6** | **0,9** | **15,2** | **-1,0** | **6,4** | **6,6** | **33,6** |
| **Interconnections** | | 9,8 | 2,4 | 1,6 | 1,8 | 1,8 | 1,0 | 1,2 | **9,8** |

| 2025 - GW | coeff | FR | DE | BE | SP | GB | IT | CH | TOTAL |
|---|---|---|---|---|---|---|---|---|---|
| **Dispatchable power** | *85%* | 89,2 | 72,0 | 9,6 | 53,7 | 50,2 | 64,6 | 17,3 | **357,3** |
| **IRES power** | *2 à 15%* | 53,7 | 147,6 | 10,5 | 66,6 | 46,0 | 40,0 | 4,5 | **368,9** |
| **Peak demand** | | 94,3 | 91,0 | 13,9 | 46,9 | 60,0 | 60,0 | 11,0 | **377,1** |
| **Load management/storage** | | 3,0 | 2,0 | 0,5 | 1,0 | 1,0 | 3,0 | 0,5 | **11,0** |
| **Margin at peak** | | **1,7** | **-7,0** | **-2,8** | **12,3** | **-3,7** | **9,4** | **6,9** | **16,7** |
| **Interconnections** | | 12,0 | 2,4 | 1,6 | 1,8 | 3,0 | 2,0 | 1,2 | **12,0** |

| 2030 - GW | coeff | FR | DE | BE | SP | GB | IT | CH | TOTAL |
|---|---|---|---|---|---|---|---|---|---|
| **Dispatchable power** | *85%* | 80,8 | 70,0 | 7,6 | 46,0 | 45,9 | 58,5 | 14,7 | **323,4** |
| **IRES power** | *2 à 15%* | 75,0 | 186,0 | 15,0 | 96,5 | 50,0 | 45,9 | 6,3 | **474,7** |
| **Peak demand** | | 94,3 | 92,0 | 14,5 | 49,6 | 60,0 | 62,0 | 11,0 | **383,4** |
| **Load management/storage** | | 3,5 | 4,0 | 1,0 | 2,0 | 2,0 | 6,0 | 1,0 | **19,5** |
| **Margin at peak** | | **-4,9** | **-5,9** | **-4,5** | **4,3** | **-6,3** | **4,8** | **4,9** | **-7,5** |
| **Interconnections** | | 14,0 | 2,4 | 1,6 | 3,0 | 3,8 | 2,0 | 1,2 | **14,0** |

| 2035 - GW | coeff | FR | DE | BE | SP | GB | IT | CH | TOTAL |
|---|---|---|---|---|---|---|---|---|---|
| **Dispatchable power** | *85%* | 73,1 | 67,5 | 8,1 | 45,1 | 45,9 | 58,5 | 14,7 | **312,8** |
| **IRES power** | *2 à 15%* | 105,0 | 220,0 | 15,0 | 115,0 | 55,0 | 58,9 | 8,5 | **577,4** |
| **Peak demand** | | 94,3 | 95,0 | 15,5 | 52,0 | 60,0 | 65,0 | 11,0 | **392,8** |
| **Load management/storage** | | 4,5 | 7,0 | 1,5 | 5,0 | 5,0 | 6,0 | 1,5 | **30,5** |
| **Margin at peak** | | **-9,2** | **-6,1** | **-4,5** | **4,8** | **-2,3** | **2,3** | **5,4** | **-9,6** |
| **Interconnections** | | 16,0 | 2,4 | 1,6 | 3,5 | 4,3 | 3,0 | 1,2 | **16,0** |

## Detailed results by country

| France | Participation at peak loadv | | 2020 | 2025 | 2030 | 2035 |
|---|---|---|---|---|---|---|
| Installed power GW | Nuclear | *85%* | 61,4 | 63,0 | *58* | *52* |
| | Coal/lignite | *85%* | 2,4 | 0,0 | 0 | 0 |
| | Gas | *85%* | 12,0 | 12,0 | *8* | *6* |
| | Hydraulics | *85%* | 25,8 | 26,0 | *26* | *26* |
| | Others | *85%* | 4,6 | 3,9 | *3* | *2* |
| | *Total dispatchable at peak* | | *90,3* | *89,2* | *80,8* | *73,1* |
| | Onshore Wind | 10% | 17,9 | 27,4 | *35* | *45* |
| | Offshore Wind | 20% | 0,0 | 3,0 | *5* | *10* |
| | Solar | 2% | 10,0 | 23,3 | *35* | *50* |
| | *Participation of IRES to peak* | | *2,0* | *3,8* | *5,2* | *7,5* |
| | Erasures/short term storage | | m3,0 | 3,0 | *3,5* | *4,5* |
| | *Total available at peak* | | *95,3* | *96,0* | *89,5* | *85,1* |
| Demand | Average | | 55,4 | 55,0 | *55* | *55* |
| | Average peak | | 94,3 | 94,3 | *94* | *94* |
| | Average minimum | | 35,0 | 35,0 | *35* | *35* |
| | *Maximum fatal power* | 85% | *32* | *54* | *72* | *98* |
| | *Margin at peak* | | ***1,0*** | ***1,7*** | ***-4,9*** | ***-9,2*** |
| Interconnection capacity with neighbouring | Total Imports | | 9,8 | 12,0 | 14 | 16 |

| Germany | Participation at peak loadv | | 2020 | 2025 | 2030 | 2035 |
|---|---|---|---|---|---|---|
| Installed power GW | Nuclear | *85%* | 8,1 | 0,0 | *0* | *0* |
| | Coal/lignite | *85%* | 39,0 | 23,9 | *17* | *6* |
| | Gas | *85%* | 29,7 | 36,6 | *42* | *50* |
| | Hydraulics | *85%* | 15,4 | 15,4 | *15* | *15* |
| | Others | *85%* | 9,5 | 8,8 | *8* | *8* |
| | *Total dispatchable at peak* | | *86,4* | *72,0* | *70,0* | *67,5* |
| | Onshore Wind | 10% | 57,7 | 63,5 | 71 | *80* |
| | Offshore Wind | 20% | 7,7 | 10,8 | 15 | *20* |
| | Solar | 2% | 52,1 | 73,3 | 100 | *120* |
| | *Participation of IRES to peak* | | *8,4* | *10,0* | *12,1* | *14,4* |
| | Load shedding/short term storage | | 0,0 | 2,0 | 4,0 | 7 |
| | *Total available at peak* | | *94,8* | *84,0* | *86,1* | *88,9* |
| Demand | Average | | 61,3 | 61,3 | 63 | 65 |
| | Average peak | | 90,2 | 91 | *92* | *95* |
| | Average minimum | | 30,0 | 30,0 | *30* | *30* |
| | *Maximum fatal power* | 85% | *105* | *131* | *163* | *192* |
| | *Margin at peak* | | ***4,6*** | ***-7,0*** | ***-5,9*** | ***-6,1*** |
| Interconnection capacity with France | exports | | 2,4 | 2,4 | 2,4 | 2,4 |

| Belgium | Participation at peak loadv | | 2020 | 2025 | 2030 | 2035 |
|---|---|---|---|---|---|---|
| Installed power GW | Nuclear | *85%* | 5,9 | 0,0 | *0* | *0* |
| | Coal/lignite | *85%* | 0,0 | 0,0 | 0 | 0 |
| | Gas | *85%* | 5,8 | 8,3 | *5* | *5* |
| | Hydraulics | *85%* | 1,4 | 1,5 | *1,5* | *1,5* |
| | Others | *85%* | 1,8 | 1,5 | *2* | *3* |
| | *Total dispatchable at peak* | | *12,7* | *9,6* | *7,6* | *8,1* |
| | Onshore Wind | 10% | 2,8 | 3,6 | 4,5 | *4,5* |
| | Offshore Wind | 20% | 2,3 | 2,3 | 4,0 | *4* |
| | Solar | 2% | 5,1 | 8,2 | 11,0 | *11* |
| | Load shedding/short term | | 0,0 | 0,5 | 1,0 | 1,5 |
| | *Total available at peak* | | *13,5* | *11,1* | *10,0* | *11,0* |
| Demand | Average | | *9* | *9* | *9* | *9* |
| | Average peak | | 12,6 | 13,9 | 14,5 | 16 |
| | Average minimum | | *7,0* | *7,0* | *7,0* | *7,0* |
| | *Maximum fatal power* | 85% | *9* | *12* | *17* | *17* |
| | *Margin at peak* | | ***0,9*** | ***-2,8*** | ***-4,5*** | ***-4,5*** |
| Interconnection capacity with France | exports | | 1,6 | 1,6 | 1,6 | 1,6 |

| Spain | Participation at peak loadv | | 2020 | 2025 | 2030 | 2035 |
|---|---|---|---|---|---|---|
| Installed power GW | Nuclear | *85%* | 7,1 | 7,1 | *3,2* | *0* |
| | Coal/lignite | *85%* | 4,3 | 4,3 | *0,0* | *0* |
| | Gas | *85%* | 29,6 | 28,8 | *27,5* | *30* |
| | Hydraulics | *85%* | 20,4 | 21,4 | *21,4* | *21* |
| | Others | *85%* | 1,2 | 1,6 | *2,0* | *2* |
| | *Total dispatchable at peak* | | *53,2* | *53,7* | *46,0* | *45,1* |
| | Onshore Wind | 10% | 27,5 | 39,0 | *50,0* | 55 |
| | Offshore Wind | 20% | *0* | *0* | *0* | *0* |
| | Solar | 2% | 10,7 | 27,6 | 46,5 | 60 |
| | Load shedding/short term | | 0,0 | 1,0 | 2,0 | 5 |
| | *Total available at peak* | | *56,2* | *59,2* | *53,9* | *56,8* |
| Demand | Average | | *32* | *32* | *32* | *32* |
| | Average peak | | 41,0 | 46,9 | 49,6 | 52 |
| | Average minimum | | *25,0* | *25,0* | *25,0* | *25,0* |
| | *Maximum fatal power* | 85% | *39* | *64* | *89* | *105* |
| | *Margin at peak* | | ***15,2*** | ***12,3*** | ***4,3*** | ***4,8*** |
| Interconnection capacity with France | exports | | 1,8 | 1,8 | 3 | 3,5 |

| Great Britain | Participation at peak loadv | | 2020 | 2025 | 2030 | 2035 |
|---|---|---|---|---|---|---|
| Installed power GW | Nuclear | *85%* | 9,2 | 7,1 | *5* | *10* |
| | Coal/lignite | *85%* | 4,3 | 0,0 | *0,0* | *0* |
| | Gas | *85%* | 38,8 | 38,2 | *35,0* | *30* |
| | Hydraulics | *85%* | 4,6 | 5,1 | *5,0* | *5* |
| | Others | *85%* | 8,3 | 8,6 | *9,0* | *9* |
| | *Total dispatchable at peak* | | *55,4* | *50,2* | *45,9* | *45,9* |
| | Onshore Wind | 10% | 12,8 | 13,7 | *15,0* | *15* |
| | Offshore Wind | 20% | 10,0 | 17,6 | *20,0* | *25* |
| | Solar | 2% | 13,7 | 14,7 | *15,0* | *15* |
| | Load management/storage | | *0,0* | *1,0* | *2,0* | *5* |
| | *Total available at peak* | | *59,0* | *56,3* | *53,7* | *57,7* |
| Demand | Average | | *38* | *38* | *38* | *38* |
| | Average peak | | 60,0 | 60,0 | *60,0* | *60* |
| | Average minimum | | *30,0* | *30,0* | *30,0* | *30,0* |
| | *Maximum fatal power* | 85% | *33* | *41* | *44* | *48* |
| | Load shedding/short term | | ***-1,0*** | ***-3,7*** | ***-6,3*** | ***-2,3*** |
| Interconnection capacity with France | exports | | 1,8 | 3,0 | *3,8* | *4,3* |

| Italy | Participation at peak loadv | | 2020 | 2025 | 2030 | 2035 |
|---|---|---|---|---|---|---|
| Installed power GW | Nuclear | *85%* | 0 | 0 | 0 | *0* |
| | Coal/lignite | *85%* | 6,4 | 6,4 | 0 | *0* |
| | Gas | *85%* | 41,5 | 40,8 | *40,0* | *40,0* |
| | Hydraulics | *85%* | 23,0 | 23,0 | *23* | *23* |
| | Others | *85%* | 5,4 | 5,8 | *5,8* | *5,8* |
| | *Total dispatchable at peak* | | *64,9* | *64,6* | *58,5* | *58,5* |
| | Onshore Wind | 10% | 10,9 | 12,4 | *15,0* | *18* |
| | Offshore Wind | 20% | 0,0 | *0,3* | *0,9* | *0,9* |
| | Solar | 2% | 23,3 | 27,3 | *30* | *40* |
| | Load shedding/short term | | *0,0* | *3,0* | *6,0* | *6,0* |
| | *Total available at peak* | | *66,4* | *69,4* | *66,8* | *67,3* |
| Demand | Average | | *33* | *33* | *33* | *33* |
| | Average peak | | 60,0 | 60,0 | *62,0* | *65* |
| | Average minimum | | *30,0* | *30,0* | *30,0* | *30,0* |
| | *Maximum fatal power* | 85% | *37* | *42* | *47* | *58* |
| | *Margin at peak* | | ***6,4*** | ***9,4*** | ***4,8*** | ***2,3*** |
| Interconnection capacity with France | exports | | 1,0 | 2,0 | 2 | 3 |

| Switzerl | Participation at peak loadv | | 2020 | 2025 | 2030 | 2035 |
|---|---|---|---|---|---|---|
| Installed power GW | Nuclear | *85%* | 2,9 | 2,2 | *0,0* | *0* |
| | Coal/lignite | *85%* | 0 | 0 | *0* | *0* |
| | Gas | *85%* | 0,8 | 0,8 | *0,0* | *0* |
| | Hydraulics | *85%* | 16,3 | 16,3 | *16,3* | *16* |
| | Others | *85%* | 0,6 | 1,0 | *1,0* | *1* |
| | *Total dispatchable at peak* | | *17,5* | *17,3* | *14,7* | *14,7* |
| | Onshore Wind | 10% | 0,1 | 0,2 | *0,3* | *0,5* |
| | Offshore Wind | 20% | 0 | 0 | *0* | *0* |
| | Solar | 2% | 2,8 | 4,3 | *6,0* | *8* |
| | Load shedding/short term | | *0,0* | *0,5* | *1,0* | *1,5* |
| | *Total available at peak* | | *17,6* | *17,9* | *15,9* | *16,4* |
| Demand | Average | | *8* | *8* | *8* | *8* |
| | Average peak | | 11,0 | 11,0 | *11,0* | *11* |
| | Average minimum | | *5,0* | *5,0* | *5,0* | *5,0* |
| | *Maximum fatal power* | 85% | *8* | *9* | *11* | *13* |
| | *Margin at peak* | | ***6,6*** | ***6,9*** | ***4,9*** | ***5,4*** |
| Interconnection capacity with France | exports | | 1,2 | 1,2 | 1,2 | 1,2 |

| TOTAL (7 countries) | Participation at peak loadv | | 2020 | 2025 | 2030 | 2035 |
|---|---|---|---|---|---|---|
| Installed power GW | Nuclear | | 94,6 | 79,4 | 66 | 62 |
| | Coal/lignite | | 56,4 | 34,6 | 17 | 6 |
| | Gas | | 158,2 | 165,5 | 158 | 161 |
| | Hydraulics | | 106,9 | 108,7 | 108 | 108 |
| | Others | | 31,4 | 31,2 | 32 | 31 |
| | *Total dispatchable at peak* | | *380* | *356* | *323* | *313* |
| | Onshore Wind | | 130 | 160 | 191 | 218 |
| | Offshore Wind | | 20 | 34 | 45 | 60 |
| | Solar | | 118 | 179 | 244 | 304 |
| | *Participation of IRES at the* | | *17* | *23* | *28* | *34* |
| | Load shedding/short term | | 3,0 | 11,0 | 20 | 31 |
| | *Total available at peak* | | *403* | *394* | *376* | *383* |
| Demand | Average | | 237 | 236 | 238 | 240 |
| | Average peak | | 369 | 377 | 383 | 393 |
| | Average minimum | | 162 | 162 | 162 | 162 |
| | *Maximum fatal power* | | 263 | 353 | 443 | 531 |
| | *Margin at peak* | | ***33,6*** | ***16,7*** | ***-7,5*** | ***-9,6*** |
| Interconnection capacity | imports | | 9,8 | 12,0 | 14 | 16 |
| with France | exports | | 9,8 | 12,0 | 14 | 16 |