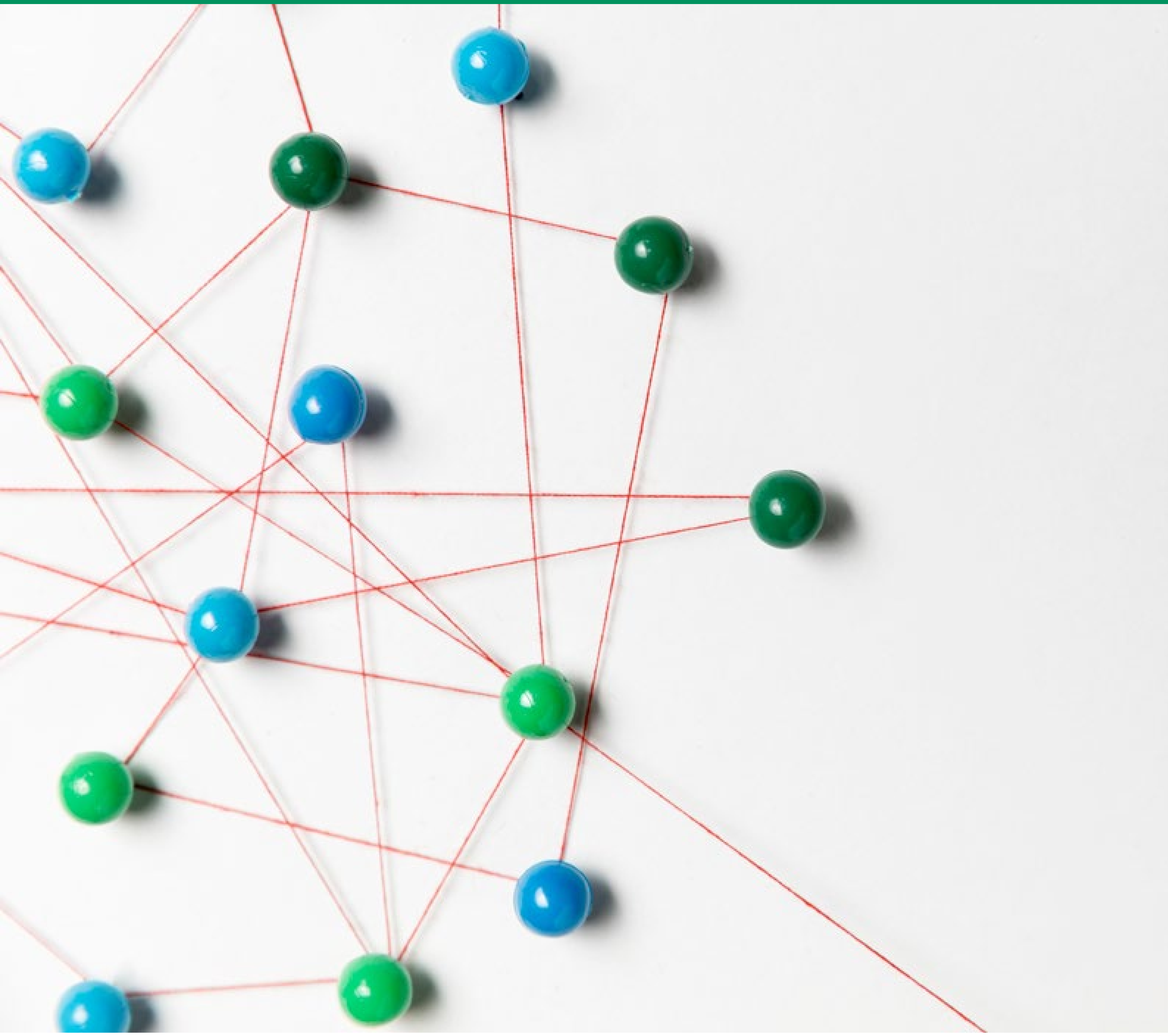
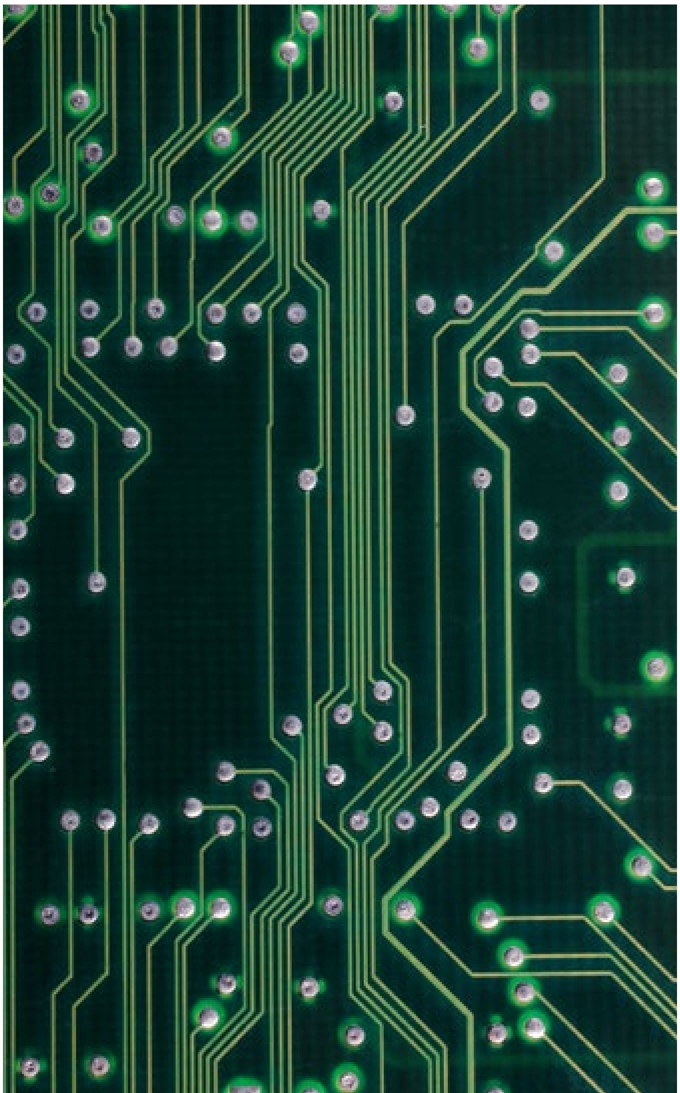


ENERGY STRATEGY 2050
MONITORING REPORT 2020
ABRIDGED VERSION

Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Swiss Federal Office of Energy SFOE

CONTENTS



CONTENTS

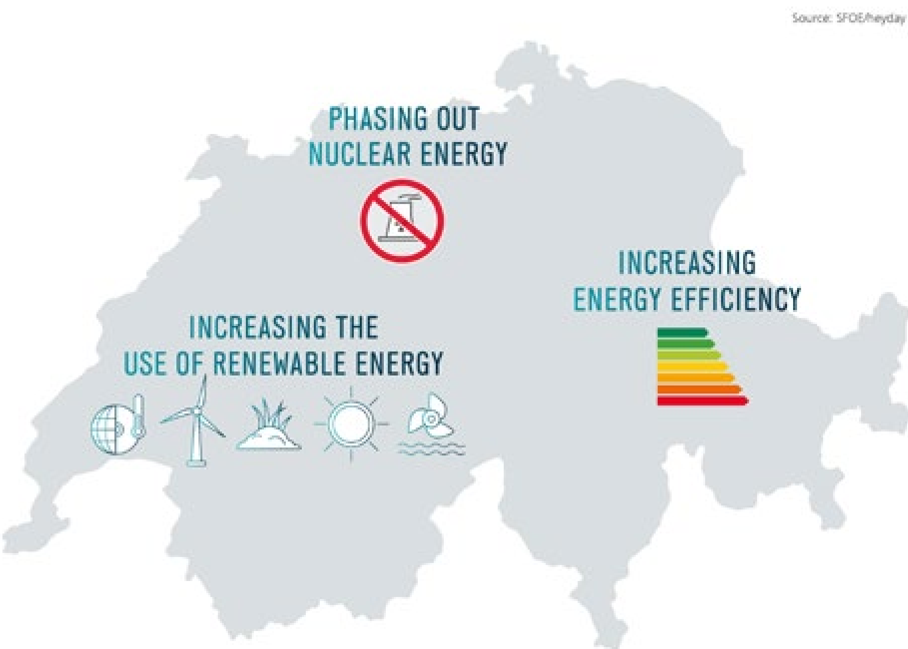
INTRODUCTION

Switzerland has reorganised its national energy policy as a result of the adoption of Energy Strategy 2050. The energy strategy should facilitate the gradual phasing out of nuclear energy and the successive reorganisation of the Swiss energy system by 2050. The entire process will take place while maintaining the high degree of security of supply and Switzerland's reasonable prices for energy. The intention is to significantly increase energy efficiency and the share of renewable energy used in the energy mix as well as reduce CO_2 emissions from energy sources. In addition, no further general licences for the construction of nuclear power plants may be issued (Federal Council, 2013).

Continued ▶ ▶ ▶

In the referendum of 21 May 2017 Swiss voters accepted the new energy legislation, which has been in force since the beginning of 2018. By amending the Electricity Supply Act the Federal Council proposes opening up the electricity market for all customers to strengthen decentralised electricity production and to better integrate renewable energies into the electricity market. In addition, with an amendment to the Energy Act, the Federal Council wants to extend the time period for contributions to domestic renewable energies and make the system more competitive; this should give the electricity branch greater security with respect to planning and investment and reinforce the security of supply (Federal Council, 2020a+b+2018).

In view of the fact that about three quarters of the greenhouse gas emissions in Switzerland are caused through using fossil energy carriers, the energy strategy is closely linked to climate policy. Here the focus is on the next stage with the complete revision of the CO_2 Act (Federal Council, 2017), which was approved by Parliament in the autumn session and which involves national implementation of the Paris Convention by 2030. As a signatory Switzerland has undertaken to half its greenhouse gas emissions in comparison to emissions in 1990 by this point in time. On the basis of new scientific findings issued by the Intergovernmental Panel on Climate Change (IPCC), on 28 August 2019 the Federal Council further decided that by 2050 Switzerland should not emit more greenhouse gases than can be absorbed naturally or by technical means (this means that net emissions will be reduced to zero by 2050); simultaneously the administration was asked to draft a corresponding long-term climate strategy for 2050 (Federal Council, 2019a).



↗ www.energystrategy2050.ch

The reorganisation of the Swiss energy system needed for Energy Strategy 2050 is a long-term project. The monitoring system operated by the Swiss Federal Office of Energy SFOE in collaboration with the State Secretariat for Economic Affairs (SECO) and other federal offices observes significant developments and progress, measures the degree to which significant targets are attained, and studies the economic cost and benefit from measures. This makes it possible to intervene early and to steer events based on facts in the case of undesirable developments. The legal bases for the monitoring procedure are provided in the energy legislation and in particular Art. 55ff of the Energy Act (EnG) and Art. 69ff of the Energy Ordinance (EnV). Article 74a of the Nuclear Energy Act (KEG) is also relevant to reporting about the development of nuclear technology.

The current Monitoring Report for 2020 (abridged version, most data stem from before and up to 2019)[1], deals first with selected indicators and contains a descriptive part containing the seven topics mentioned below derived from Energy Strategy 2050, the Energy Act and other State bills (which include the Electricity Grid Strategy, climate policy, and Swiss Coordinated Energy Research):

TOPIC	**ENERGY CONSUMPTION AND PRODUCTION**
TOPIC	**GRID DEVELOPMENT**
TOPIC	**SECURITY OF SUPPLY**
TOPIC	**EXPENDITURE AND PRICES**
TOPIC	**CO_2 EMISSIONS FROM ENERGY SOURCES**
TOPIC	**RESEARCH AND TECHNOLOGY**
TOPIC	**INTERNATIONAL ENVIRONMENT**

Further indicators can be found in the full version of the Monitoring Report (see **www.energymonitoring.ch**).

In addition, the Federal Council will prepapare a report for the attention of Parliament every five years containing in-depth analyses of further problems and topics thus facilitating a review of energy policy.

1 Possible effects of the COVID-19 pandemic on the energy sector are not included in any indicators with the exception of those for the global energy markets.

ENERGY CONSUMPTION AND PRODUCTION

Reduction of energy and electricity consumption by enhancing efficiency measures is one of the main objectives of Energy Strategy 2050 and therefore an important pillar of energy legislation. The same applies to the expansion of electricity production from renewable sources, which will have to partially compensate for the gradual loss of capacity from nuclear power plants. The indicators for this topic are in the main the predefined guidelines in the Energy Act for per capita energy and electricity consumption by 2020 and 2035, as well as the guidelines for the expansion of electricity production from renewable energies by 2020 and 2035, and for hydropower by 2035[2].

2 The guidelines given in the following text refer to the values defined in the valid Energy Act. Bringing the energy system into compliance with the 'Net zero greenhouse gas emissions by 2050' climate target means these values will be checked within the ongoing revision of the Energy Act, based on the updated energy perspectives.

FINAL ENERGY CONSUMPTION PER PERSON AND YEAR

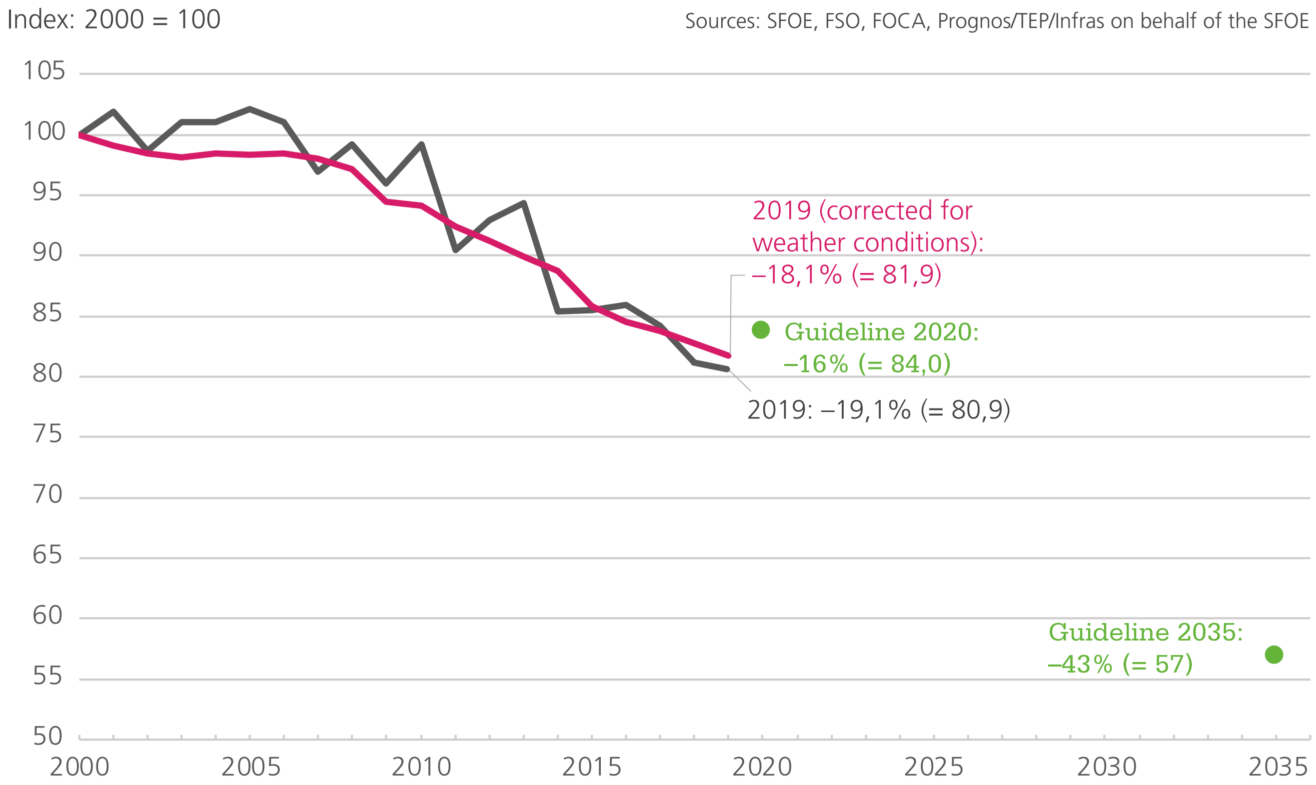


Figure 1: Development of per capita final energy consumption[3] since 2000 (indexed)

The per capita final energy consumption has fallen since 2000, as indicated in **figure 1**. The decline is a consequence of the lower absolute energy consumption in 2019 (–1.5 percent) compared to 2000 while at the same time the population increased by 19.4 percent. According to the Energy Act, the reduction target for 2020 is 16 percent in comparison to base year 2000, and 43 percent by 2035. In 2019 the per capita energy consumption was 87.1 gigajoules (0.024 GWh), and thus 19.1 percent lower than in 2000. When adjusted to take account of the weather the decline was 18.1 percent, thus undercutting the target for 2020 (*cf. red curve*). The per capita final energy consumption (adjusted to take account of the weather) will in future have to fall by 2.2 percent per annum to ensure the guideline for 2035 can be attained. The average annual reduction in the last 10 years is approximately 1.4 percent. The absolute final energy consumption in 2019 was 0.3 percent higher than the previous year. This was in the main a consequence of the cooler weather which led to a corresponding increase in demand for space heating. Over the entire period under consideration from 2000 to 2019, volume effects led to increased consumption; all 'pure' growth effects were counted, such as the overall economic output (excluding structural effects), population, energy consumption area, and the number of motor vehicles. Effects which tended to increase consumption were compensated by political measures and technological progress, which has increasingly had a dampening effect on consumption since 2000. Substitution of heating oil with gas and the increasing use of district heating plants, ambient heat and wood tended to reduce consumption between 2000 and 2019. In the fuels sector, the trend to substitute petrol with diesel fuel has been determined since 2016, but since then the effect of this change has become less significant (sources: SFOE; 2020a/FSO, 2020/FOCA, 2020/Prognos/TEP/Infras 2020a+b).

3 Excluding international air traffic, excluding compressor gas consumption in the gas transit pipeline, excluding statistical difference and agriculture.

ELECTRICITY CONSUMPTION PER PERSON AND YEAR

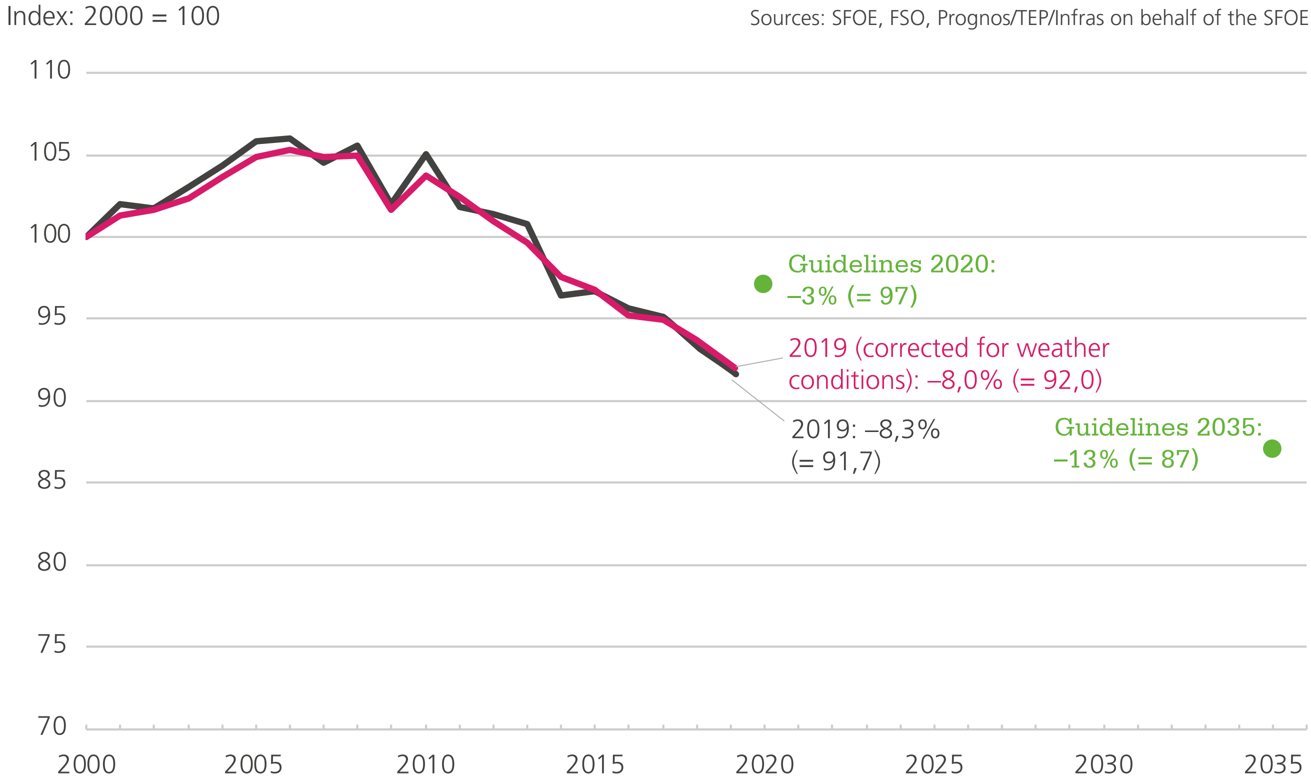


Figure 2: Development of per capita electricity consumption[4] since 2000 (indexed)

The per capita electricity consumption increased between 2000 and 2006 because the absolute electricity consumption rose by 10.3 percent while the population only increased by 4.2 percent. Since 2006 the trend has been reversed, as indicated in **figure 2**. Electricity consumption decreased by 1.0 percent between 2006 and 2019 while the population increased in the same time period by 14.6 percent. The major decline in per capita consumption in 2009 is a result of a clear cooling off in the economy. According to the Energy Act, the reduction guideline for per capita electricity consumption for 2020 is 3 percent in comparison to base year 2000, and 13 percent by 2035. In 2019 per capita electricity consumption was 23.6 gigajoules (0.007 GWh), and thus 8.3 percent less than in 2000. When adjusted to take account of the weather, the decline was 8.0 percent (*cf. red curve*) which means the guideline for 2020 has already been undercut. The per capita final electricity consumption (adjusted to take account of the weather) will in future have to decline by 0.4 percent per annum to ensure the guideline for 2035 (–13%) can be attained.

The average annual reduction in the last 10 years is about 1.0 percent. In 2019 the absolute electricity consumption decreased by 0.8 percent compared to 2018. The reasons for the decline were mainly technological progress and political measures. Further, the cooler weather had a tendency to slightly increase electricity consumption. The long-term increase in electricity consumption during the entire monitoring period from 2000 to 2019 was mainly caused by volume effects and to a lesser degree structural effects (e.g., differing growth rates in individual branches of industry). Energy policy instruments and measures (e.g., political requirements and the voluntary measures from the SwissEnergy programme) and technological developments (construction measures such as insulation and use of more efficient heating plant, electrical devices, lighting, and machines, etc.) had the opposite effect and increasingly tended to reduce electricity consumption (sources: SFOE, 2020a/FSO, 2020/Prognos/TEP/Infras, 2020a+b).

4 Excluding statistical difference and agriculture.

ELECTRICITY PRODUCTION FROM RENEWABLE ENERGIES (EXCLUDING HYDROPOWER)

Figure 3: Development of electricity production from renewable energies (excluding hydropower) since 2000 (GWh)

Electricity production from renewable sources has increased since 2000, as indicated in **figure 3**. Production gained momentum from 2010 on. In 2019, 4,186 gigawatt-hours (GWh) were produced; this corresponds to 6.2 percent of the overall net electricity production (excluding consumption by storage pumps). In base year 2010 electricity production from renewables was 1,402 GWh. As a consequence, between 2010 and 2020 a net increase of about 3,000 GWh will be striven for. Of this increase about 92.9 percent had already been attained in the reporting year. In 2019 the net increase compared to 2018 was 309 GWh; since 2011 the average increase has been 309 GWh per annum. Next year an annual net increase of 214 GWh will be required to attain the guideline of 4,400 GWh in 2020. The guideline for 2035 is 11,400 GWh, to attain this guideline a higher net increase of 451 GWh per annum will be required. When broken down according to technology, it is apparent that the photovoltaic sector has increased strongly in absolute terms since 2010. The photovoltaic sector contributes about 52 percent to electricity production from new renewables. Electricity production from waste incineration plants and renewable wastes has also increased and along with the photovoltaic sector makes the greatest contribution (28.1 %) to electricity production from renewables. Electricity production from furnaces burning wood and proportions of wood increased too since 2010 (share 2019: 7.5%). The increase in electricity production from biogas was only slightly lower (share in 2019; 8.9 %). And for its part wind energy has also increased since 2010, however, at 3.5 percent its share in electricity production from renewables is still small. No geothermal facilities for electricity production have yet been realised (source: SFOE, 2020a).

ELECTRICITY PRODUCTION FROM HYDROPOWER

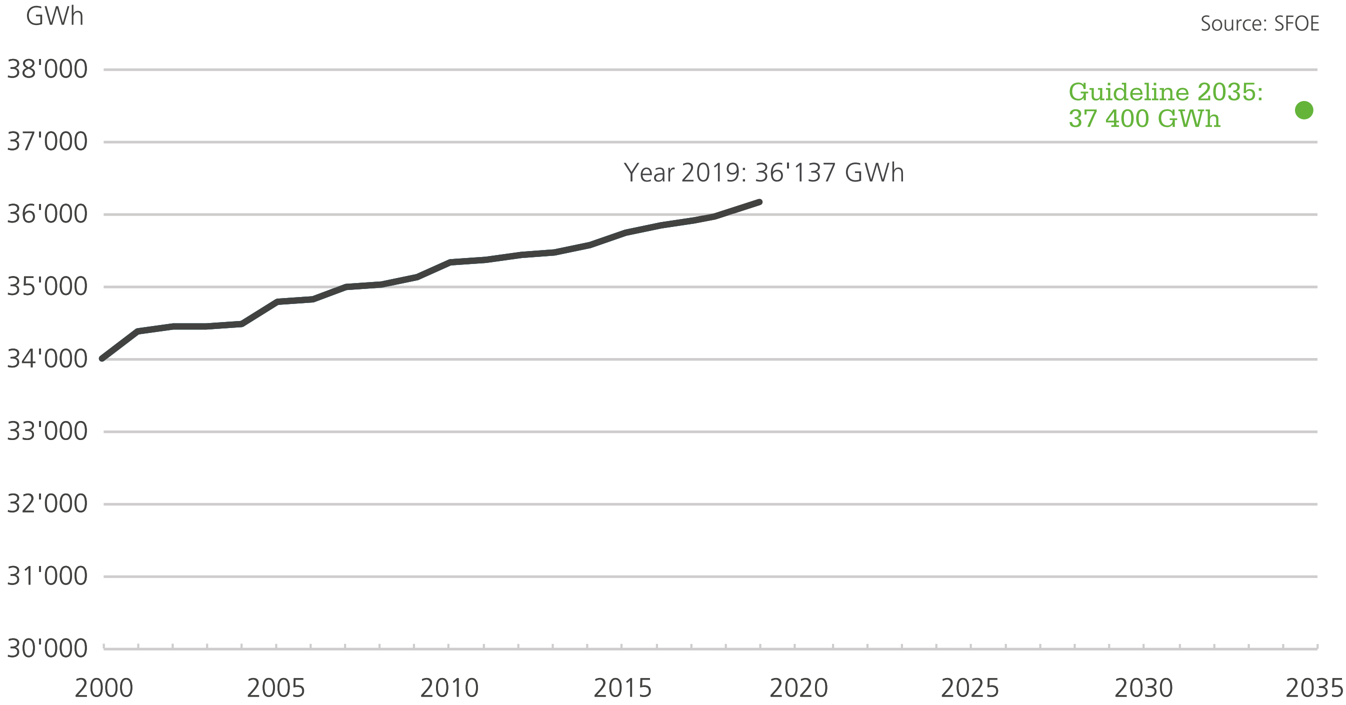


Figure 4: Development of anticipated average production[5] of electricity from hydropower since 2000 (in GWh)

Figure 4 (N.B. scale does not begin at zero) shows that electricity production from hydropower has grown continuously since 2000; this growth is primarily due to the addition of new facilities and expansion and optimisation of existing facilities. In 2019 (as at 1 January 2020) the anticipated average production was 36,137 GWh. In base year 2011 (as at 1 January 2012) the figure was 35,354 GWh. To achieve the guideline between 2011 and 2035 a net increase of about 2,000 GWh will be striven for. In the reporting year about 38.3 percent of this increase had already been attained. In 2019 the net increase compared to 2018 was 151 GWh; since 2012 this has been on average 90 GWh per year. To achieve the guideline by 2035, an average annual net increase of 79 GWh will be required over the coming years. According to the SFOE assessment (updated in 2019) concerning the potential for expansion of use of hydropower, from today's standpoint this guideline is indeed attainable, however to do this the entire potential identified for expansion by 2050 would have to be realised by 2035; what was not taken into consideration in the analysis is the potential from new glacial lakes or the potential from projects which the electricity industry has not declared on grounds of confidentiality (sources: SFOE, 2020b+2019).

5 Anticipated average production including anticipated production from small power plants <300 kW (according to statistics for hydropower plant in Switzerland, WASTA). Excluding average energy required for all storage system pumps (an efficiency rate of 83% is assumed) and excluding electricity required for recirculation.

↗ More detailed indicators to the topic
ENERGY CONSUMPTION AND PRODUCTION
(See the detailed version of
the Monitoring Report)

GRID DEVELOPMENT

The reorganisation of the energy system required in connection with Energy Strategy 2050 and the new international environment place new demands on the energy grid. Development of the electricity grid is crucial because it is the link between production and consumption. Grid development is also the focus of the legislation on the Federal Act on the Transformation and Extension of the Electricity Grid (Electricity Grid Strategy), which is part of the energy strategy, but was handled in a separate bill (Federal Council, 2016). The current focus of the monitoring programme is on the electricity grid.

STATUS AND DURATION OF PLANS FOR THE TRANSMISSION GRID

Energy Strategy 2050 and the Electricity Grid Strategy create reliable conditions for a needs-based, targeted development of electricity grids to guarantee the security of the electricity supply. To this end the standards for assessing the need to expand and modernise Switzerland's electricity grid have been developed, the authorisation procedures for line projects optimised and the requirements for deciding whether to place cables underground or to use overhead transmission lines have been also elaborated. The intention of the new regulations is to increase transparency in the grid planning process and improve acceptance for grid plans in general. The focus will be on the Swiss transmission grid: It will have to guarantee the transmission of energy fed in from domestic production centres as well as imported energy over long distances to centres of consumption in a satisfactory and safe way. In addition the grid will have to compensate for fluctuating rates of energy fed in from renewable energies through imports and exports as well as cope with the complementary characteristics of various types of power plant.

PROCEDURE AND PHASES OF A GRID PLAN IN THE TRANSMISSION GRID

Preliminary project: As the basis for the sectoral plan procedure, the national grid company Swissgrid draws up a preliminary project with the key parameters of the grid plan and makes sure the concerns of the cantons affected by the project are considered as early as possible in the planning stage. For the purposes of the monitoring programme the preliminary project phase begins as a rule with the start of the project and ends when the application is submitted for the plan to be incorporated in the sectoral plan for transmission lines (German SÜL). If a plan is not yet in either the preliminary phase or construction project phase and thus in an early stage of planning, it is designated in the monitoring programme as a project proposal.

SÜL: If a grid transmission line project will have a substantial impact on the area and the environment, a sectoral plan procedure has to be carried out before the planning approval procedure begins (*see below*). The SÜL applies to the electrical power line sector. The Swiss Federal Office of Energy (SFOE) is responsible for the SÜL procedure and receives support from the Federal Office for Spatial Development (ARE). In the first stage of the sectoral plan procedure a **planning area** is determined and in the second stage a **planning corridor** is selected for the path of the transmission line. At the same time as the planning corridor is determined, a decision is made as to which **transmission technology** will be employed (overhead transmission line or underground cable). The SÜL phase begins when Swissgrid submits an application for an SÜL procedure and ends when the decision is taken on the planning corridor by the Federal Council in the appropriate coordination plan. This plan is binding on all authorities, which means they have to take it into consideration when approving the plan and in any other spatial development activities.

Construction project: Once the planning corridor has been determined, Swissgrid's grid plan is elaborated in a concrete construction project. The company has to guarantee that the line will be built using the transmission technology determined and that the line route lies

In April 2015, the national grid company Swissgrid submitted a strategic grid plan[6] which took into consideration the gradual phasing out of nuclear power in accordance with Energy Strategy 2050 including suitable projects to upgrade and expand the transmission grid by 2025. The current monitoring process will follow the status and duration of grid plans at transmission grid level including Swissgrid's Strategic Grid 2025 plan as well as other important projects. The focus will be on the transmission line projects mentioned in **figure 5.**

6 cf. www.swissgrid.ch/netz2025

within the planning corridor that has been laid down. In the current monitoring procedure the construction project phase begins as a rule with the determination of the planning corridor (corresponds to the end of the SÜL phase) and ends when Swissgrid submits the planning approval application to the Federal Inspectorate for High Tension Installations (ESTI). In projects for which no SÜL is employed, the start of the construction project is as laid down in the appropriate SIA standard.

PGV: Swissgrid now submits the elaborated construction project (detailed project) together with the application for planning approval to the ESTI. This signals the start of the planning approval procedure (German PGV). ESTI is responsible for checking the dossier and for issuing planning approval. During the PGV checks are made to ensure compliance with safety regulations and legal stipulations, in particular environmental and spatial planning legislation. Additionally, checks are made of the grid plan to ensure conformity with the interests of private persons (landowners, neighbours). If ESTI is unable to resolve all the objections or cannot handle all the differences with the various state authorities concerned, the dossier is entrusted to the SFOE. The SFOE then proceeds with the planning approval procedure and issues planning approval provided the grid plan is in conformity with the legal requirements. A decision is also made on any other objections (for example objections to compulsory purchase). The parties involved can appeal to the Federal Administrative Court (BVGer) and thereafter in certain cases to the Federal Tribunal (BGer). If the SFOE approves the application for planning approval and no other objections are submitted within the legal deadlines, planning approval becomes final and Swissgrid can realise the transmission line project.

Realisation: For monitoring purposes the start of the realisation phase is counted as the date of the legally valid decision on planning approval. The realisation phases ends when the grid plan goes into operation.

GRID PROJECT	DESCRIPTION AND MAIN AIMS	CURRENT STATUS[7]	PLANNED OPERATION[8]
1. Chamoson–Chippis	▪ New 30 km long 380 kV overhead transmission line between Chamoson and Chippis ▪ Dismantling of almost 89 km of power lines in the Rhone plain ▪ Transfer production from hydropower plants in Valais ▪ Improved connection between Valais and the Swiss and European high tension grid ▪ Contribution to grid security in Switzerland	Realisation	2022
2. Bickigen–Chippis (Gemmi line)	▪ Modernisation of substations at Bickigen and Chippis and of the existing 106 km route by increasing current to 380 kV ▪ Installation of a 220/380 kV grid coupling transformer in the Chippis switchgear facility ▪ Improved transfer of electricity production from Valais ▪ Contribution to security of supply	PGV SFOE	2027
3. Pradella–La Punt	▪ Increase voltage from 220 to 380 kV on existing 50 km route ▪ Modification of switchgear at Pradella and increase of voltage to 380 kV ▪ Elimination of existing bottleneck ▪ Contribution to Swiss and European grid security	Realisation	2023
4. Chippis–Lavorgo 4.1. Chippis–Mörel 4.2. Mörel–Ulrichen (Gommer line) 4.3. Chippis–Stalden 4.4. Airolo–Lavorgo	▪ Increase voltage to 380 kV on 124 km Chippis-Mörel-Lavorgo axis (Chippis–Stalden remains at 220 kV) ▪ Dismantling of existing lines over 67 km ▪ Supplements the main supply route for Ticino ▪ Elimination of a critical supply bottleneck	4.1. PGV ESTI 4.2. Realisation (Mörel–Ernen)/In operation (Ernen–Ulrichen) 4.3. PGV SFOE (Agarn–Stalden)/PGV ESTI (Chippis–Agarn) 4.4. PGV ESTI	2029
5. Beznau–Mettlen 5.1. Beznau–Birr 5.2. Birr–Niederwil 5.3. Niederwil–Obfelden 5.4. Obfelden–Mettlen	▪ Optimisation of existing route over 40 km by increasing current to 380 kV and upgrading on a stretch of 24 km ▪ Elimination of a structural bottleneck ▪ Creation of the conditions needed to combine domestic hydropower plants with fluctuating energy from wind and photovoltaic plant to respond to demand	5.1. In operation 5.2. Preliminary project 5.3. SÜL 5.4. Preliminary project	2030

Figure 5: Overview of grid projects, status and proposed date of operation (as at 15.09.2020)

7 As at 15 september 2020

8 According to Swissgrid planning

GRID PROJECT	DESCRIPTION AND MAIN AIMS	CURRENT STATUS[7]	PLANNED OPERATION[8]
6. Bassecourt–Mühleberg	▪ Upgrading of the existing line over a length of 45 km by increasing the voltage level to 380 kV because decommissioning Mühleberg nuclear power plant will lead to withdrawal of some feed-in at the 220 kV grid level ▪ Contribution to Swiss grid security and security of supply	BVGer	2023
7. Magadino	▪ Installation of transformers between the 220 kV and 380 kV grids ▪ The aim is to improve the transfer of energy generated in Maggiatal by hydropower ▪ Contribution to security of supply in Ticino	Project idea	2035
8. Génissiat–Foretaille	▪ Upgrading of (replacement of cable) the existing 220 kV twin lines over a length of 17 km ▪ Eliminates frequent bottlenecks which occur for imports from France	In operation	Concluded in 2018 and in operation
9. Mettlen–Ulrichen 9.1. Mettlen–Innertkirchen 9.2. Innertkirchen–Ulrichen (Grimsel line)	▪ Upgrade the existing 220 kV line over 88 km to cope with a future increase to 380 kV ▪ Important for the connection of new pump storage power plants to the 380 kV grid and transfer of energy to the rest of Switzerland	9.1. Preliminary project (trunk line) 9.2. SÜL	2035
10. All'Acqua-Vallemaggia-Magadino	▪ New 220 kV line through the Valle Maggia ▪ Existing line built in the 1960s will be dismantled – thus lessening the impact on the protected areas in Upper Ticino ▪ Increase of grid capacity to convey energy generated in hydropower plants in Valle Maggia ▪ Greater security of supply in the sounthern Alps – today production at power plants has to be curbed	SÜL	2035
Connection of Nant de Drance NdD_1 Le Verney/Rosel–Bâtiaz NdD_2 Bâtiaz–Châtelard NdD_3 Châtelard–Nant de Drance	▪ Connection of pump storage power plant Nant de Drance to the high tension grid ▪ Part of the strategic grid in the Swissgrid initial grid ▪ Contribution to integrate new renewable energy sources	NdD_1 Realisation NdD_2 In operation NdD_3 In operation	2022
ASR (Axe Stratégique Réseau) in the Geneva area	▪ Underground cabling of existing 220 kV line from Foretaille-Verbois over a length of about 4.5 km alongside Geneva airport	Realisation	2023

Figure 5: Overview of grid projects, status and proposed date of operation (as at 15.09.2020)

7 As at 15 september 2020

8 According to Swissgrid planning

GRID PROJECT	DESCRIPTION AND MAIN AIMS	CURRENT STATUS[7]	PLANNED OPERATION[8]
Obfelden–Samstagern OS_1 Schweikrüti (Mast 46)–Kilchberg OS_2 Kilchberg–Wollishofen (Frohalp) OS_3 Wollishofen (Frohalp)–Waldegg OS_4 Waldegg–Obfelden OS_5 Siebnen–Samstagern	▪ Expansion and/or substitution of the existing 150 kV line between the Obfelden substation, the planned substation at Waldegg, and the Samstagern substation with a 380/220 kV line. ▪ Improvement of the energy supply of the consumer centres of the City of Zurich and the region of Thalwil.	OS_1 BGer (Federal Tribunal) OS_2 Construction project OS_3 Construction project OS_4 Preliminary project OS_5 PGV SFOE	2030
Grynau–Siebnen	▪ Replacement of existing 220 kV line with a 380 kW line (closing the gap in the 380 kV grid) ▪ Improvement of security of supply in the Lake of Zurich region/Linth plain ▪ Increase import capacity from the North	PGV SFOE	2028
Amsteg–Mettlen AM_1 Lauerz AM_2 Eyschachen near Altdorf	▪ AM_1: Swissgrid places the line outside landslide area above Lauerz (SZ) ▪ AM_2: Swissgrid and the SBB place high-voltage lines in the Uri valley floor. This will relieve the burden on the set-tlement areas in Attinghausen and the Werkmatt development area in Uri.	AM_1 Construction project AM_2 In operation	2028
Airolo–Mettlen	▪ Opportunity to bundle infrastructure in the second tunnel of the Gotthard Road Tunnel ▪ Checking cabling of the existing 220 kV line from Airolo-Mettlen in the Gotthard sector	Preliminary project	2029

Figure 5: Overview of grid projects, status and proposed date of operation (as at 15.09.2020)

7 As at 15 september 2020

8 According to Swissgrid planning

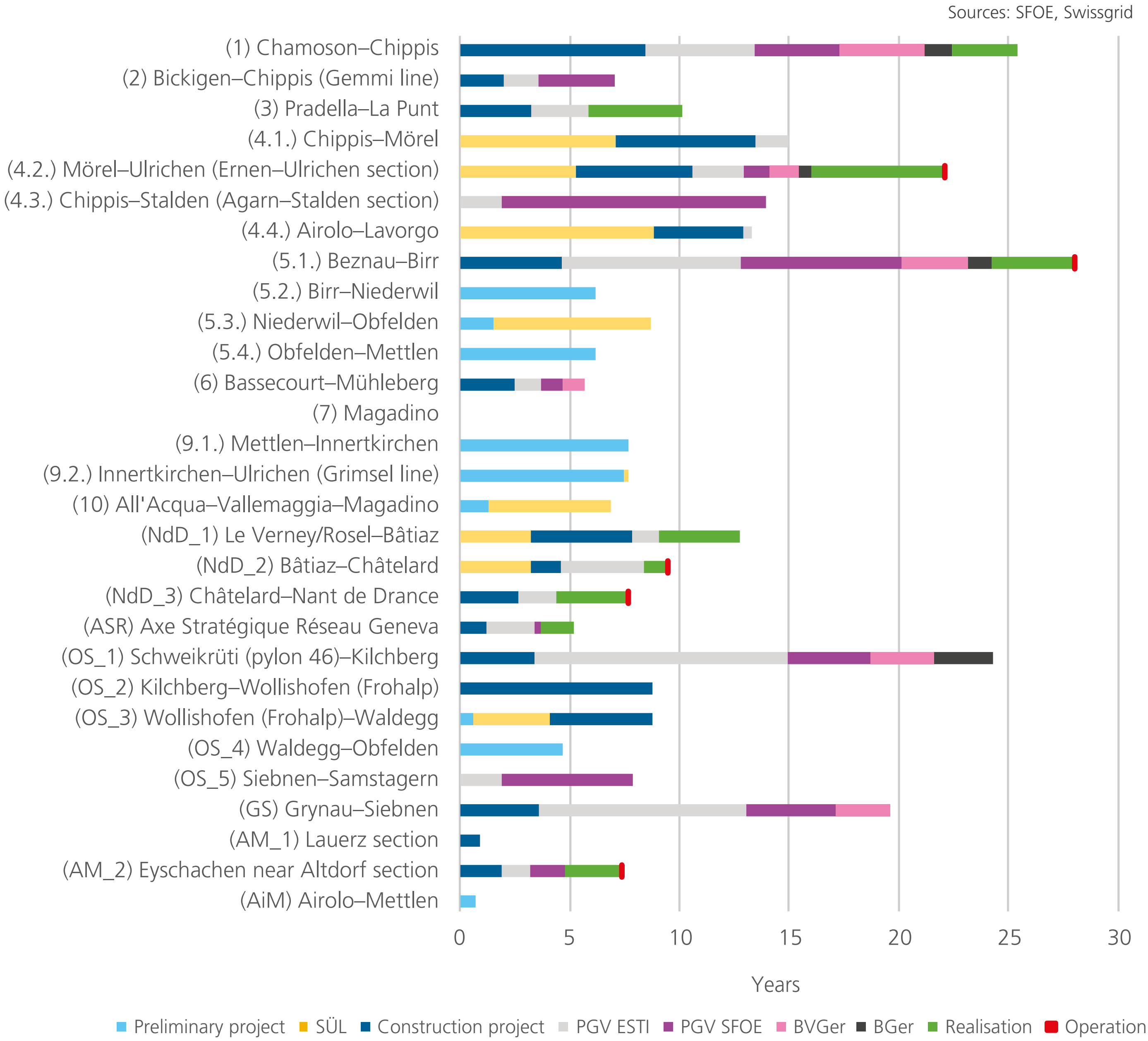


Figure 6: Accumulated duration of project phases of selected grid plans in years on grid level 1 as at 15 September 2020[9]

Figure 6 presents the duration of each individual project phase for the grid projects listed above. The duration is presented in a simplified manner in that any supplementary loops in the course of the project (that is if the procedure is returned to the SFOE after a decision by the Federal Administrative Court and/or the Federal Tribunal) are not shown separately. If specific project phases have to be gone through again as a result of a court decision, the overall duration of single project phases is presented as if each was unique and proceeded linearly. The figure corresponds to the initial position according to current legislation. No statement is implied as to whether or not Energy Strategy 2050 and the Electricity Grid Strategy will be able to further optimise the procedures as anticipated at present, because most of the corresponding legislation only took force in June 2019. The new stipulations are intended to optimise and streamline the authorisation procedures.

*9 **Remarks on the method used:** a) In the case of grid plans with a long preliminary period the duration was calculated from the relaunch of the project concerned; b) in the case of plans with a long preliminary period, it is not always possible to establish the preliminary project phase and the construction project phase, which is why they are not shown in the figure in some cases; c) assumptions were made in agreement with Swissgrid about some dates which are no longer known; d) when the courts refer a PGV decision to the SFOE, half of the supplementary duration of the procedure is allotted to the PGV phase and half to the construction project phase.*

BRIEF DESCRIPTION OF EACH GRID PLAN (AS AT 15 SEPTEMBER 2020):

1. Chamoson–Chippis

Construction of the new line from Chamoson to Chippis in the Canton of Valais was initiated before the transmission grid sectoral plan (SÜL) was elaborated and the project was the subject of planning and authorisation phases for many years. An important milestone was reached in 2017: in its decision of 1 September 2017 the Federal Tribunal dismissed the appeals against the decision of the Federal Administrative Court of 14 December 2016 and confirmed the PGV decision of the SFOE of 19 January 2015. Thereafter Swissgrid proceeded with the realisation of the new overhead transmission line project. Construction started in 2018 and since then, according to Swissgrid, this work is well advanced. Even in the relaisation phase there is still strong resistance to the project among the population. Operation of the line was originally planned for 2021; in the meantime Swissgrid has changed the deadline to 2022 because conditions for access to some plots where masts are located have to be further clarified.

2. Bickigen–Chippis

The SÜL procedure could be dispensed with for the project to increase the voltage and modernise the existing line between Bickigen and Chippis because the project only had a modest effect on the area. After a construction project phase of about two years, the PGV procedure started with an application to ESTI in mid-2015, and almost two years later the dossier was passed on to the SFOE. The PGV is currently pending at the SFOE. Operation of the line is planned for 2027.

3. Pradella–La Punt

As part of the project to increase grid capacity a second continuous 380-kV circuit will be added to the 50 km line between Pradella and La Punt. The transfer of energy on the existing 220-kV overhead transmission line between Zernez and Pradella from the Ova Spin power plant will be substituted by a 380-kV circuit. The energy generated at Ova Spin power plant will be transported over a new 110-kV valley cable, which still has to be constructed. No SÜL procedure was necessary because of the minimal effect on the area. The construction project and PGV phases each lasted about three years. The project has been in the process of realisation since mid-2016 because there was no opposition to the ESTI planning approval procedure. The line should go into operation at the end of 2023.

4. Chippis–Lavorgo

Operation of the entire Chippis–Lavorgo grid plan project is planned for 2029. The project consists of a number of sub-projects the current status of which is shown here:

4.1. Chippis–Mörel

The plan for the construction of the new line underwent an SÜL procedure lasting almost seven years and the construction project took almost six and a half years: the PGV was submitted to ESTI at the end of March 2019.

4.2. Mörel–Ulrichen

The plan for the construction of the new line was subject to a planning and authorisation procedure lasting many years; the section between Ernen and Ulrichen has gone into operation mid-October 2019; in the section Mörel–Ernen the Federal Tribunal ordered that a study on the use of a cable should be made for the 'Binnegga–Binnachra–Hockmatta–Hofstatt' area (crossing the Binna) and this has been submitted to the SFOE; the SFOE approved the overhead line version on 23 December 2016 and turned down all objections. Objections to the decision were submitted to the Federal Administrative Court, which confirmed on 26 March 2019 that the overhead power line variant would be implemented. No appeal was lodged with the Federal Tribunal within the deadline so the decision is now in force. Construction of the line has started.

4.3. Chippis–Stalden

The planning approval procedure for the Agarn–Stalden sector is being processed by the SFOE (procedure under former law, no SÜL procedure was carried out). However, in 2012, it was determined in the sectoral plan procedure for the line from Chippis–Mörel that the Chippis–Agarn section would have to be led through the planning corridor parallel to the Rhone Valley line. The PGV for the Chippis–Agarn stage has been submitted to ESTI.

4.4. Airolo–Lavorgo

The plan for the construction of the new line underwent an SÜL procedure lasting almost nine years and construction project planning took a full four years. At the end of April 2020 Swissgrid submitted the planning approval dossier to ESTI.

5. Beznau–Mettlen

Operation of the overall Beznau–Mettlen grid project is planned for 2030. The project consists of a number of sub-projects the current status of which is shown here:

5.1. Beznau–Birr

The line with partial underground cabling of 'Gabihübel' at Riniken was initiated before the SÜL was elaborated and went through planning and authorisation phases lasting many years. An important milestone was reached in 2016: planning approval given by the SFOE became final so realisation of the project was initiated. Contrary to the original plan, construction work for the cable route could only begin in August 2018. Since then work has progressed rapidly and on 19 May 2020 Swissgrid began to use the line including the partially cabled section referred to in which a longer section of the 380 kV high tension line was placed underground.

5.2. Birr–Niederwil

The line is currently in the preproject phase.

5.3. Niederwil–Obfelden

The project to increase the voltage level went through a preliminary project phase lasting about one and a half years and an SÜL procedure has been in progress for a number of years; a significant interim stage was reached in 2016 with the determination of the planning area. The corridor and the choice of technology will be determined in the next stage.

5.4. Obfelden–Mettlen

The line is currently in the preproject phase.

6. Bassecourt–Mühleberg

The Bassecourt–Mühleberg high tension line was authorised by ESTI to operate at a voltage of 380 kV in 1978, however it has been operating at 220 kV up to now. No SÜL procedure was required for the envisaged increase in voltage because of the minimal effect the project would have on the area. After a construction project phase lasting about two and a half years, Swissgrid submitted the PGV dossier to ESTI on 30 June 2017. A number of objections to the project were submitted. ESTI handed the dossier over to the SFOE on 24 August 2018 and the plan was approved on 22 August 2019. A number of objectors have lodged appeals against this decision with the Federal Administrative Court. In its decision of September 2020 the Federal Administrative Court dismissed the objections it did consider. Provided no appeal against this decision is lodged with the Federal Tribunal, it can be assumed that operation of the line will commence at the end of 2023.

7. Magadino

The project is still in the early stages and has been submitted as a project proposal. According to Strategic Grid 2025 operation was originally foreseen for 2018, however, according to updated plans it is now proposed for 2035.

8. Génissiat–Foretaille

Swissgrid has adapted the scope of the project and reduced it to resolving the bottlenecks between France and Switzerland. The original plan to strengthen the Foretaille–Verbois line on the Swiss side has been abandoned. Additional cables on the French side of the Génissiat–Verbois line and the corresponding modification of protection for the line in Switzerland and France are sufficient in the opinion of Swissgrid; the bottleneck in France has been eliminated. The project was concluded in 2018 and the line is in operation.

9. Mettlen–Ulrichen

Operation of the overall grid plan is planned for 2035. The project consists of two sub-projects the current status of which is shown here:

9.1. Mettlen–Innertkirchen

The line has been in the preproject phase for a number of years. At the end of June 2020 Swissgrid applied to the SFOE to conduct an SÜL procedure for a new line into Innertkirchen substation. It is anticipated that the application for an SÜL procedure for the main section of the line will be submittted later.

9.2. Innertkirchen–Ulrichen (Grimsel line)

Upgrading of the existing 220 kV line to 380 kV between Innertkirchen and Ulrichen (Grimsel line) along its length is a key element of the strategic grid plan for 2025. Swissgrid applied for an SÜL procedure for this line at the beginning of July 2020.

10. All'Acqua–Vallemaggia–Magadino

Planning of the line project in the All'Acqua–Maggiatal–Magadino area (and of subproject *4.4 Airolo–Lavorgo* mentioned above) is based on a comprehensive study carried out in 2013 concerning reorganisation of the high voltage grids in Upper Ticino to coordinate the refurbishment and modernisation of lines in coordination with spatial planning. Subsequently, the preproject phase was elaborated and the SÜL procedure commenced in 2015. In 2016 a significant stage in the project was attained when the planning area was defined. Currently, the SÜL procedure to determine the planning corridor is ongoing. Because of its size, the project was divided into sections that could be carried out in manageable stages. Operation of the 220-kV line is planned for 2035. Finally, the lines that are no longer need will be dismantled.

FURTHER SELECTED PROJECTS

Connection of the Nant de Drance pump storage power plant to the high tension grid contributes to integrating new renewable energies thus making it important with respect to Energy Strategy 2050. The project consists of three sub-projects. The first two sub-projects went through an SÜL procedure lasting about three years, followed by the construction project phase (almost five and one and a half years respectively) and the planning approval procedure (over one year and then almost four years). The third sub-project went through relatively quick construction project and PGV phases of two and a half and just under two years respectively (no SÜL procedure was necessary). In 2017 and 2018 the *Châtelard–La Bâtiaz (NdD 2)* overhead transmission line and the *Châtelard–Nant de Drance (NdD_3)* underground cable within the cavern connecting Nant de Drance power plant and Châtelard substation could be completed and brought into operation. The third and final section, the underground connection between *Le Verney/Rosel–Bâtiaz (NdD_1)* is still under construction; operation of this line is planned approximately for 2022. However, according to Swissgrid, the power plant could be connected provisionally to the high tension grid by increasing the voltage from 220 to 380 kV on one of the existing La Bâtiaz–Rosel overhead transmission lines in 2019.

The Canton of Geneva, Geneva airport and a group of private investors are planning a number of urban development projects around the airport entitled **Axe Stratégique Réseaux (ASR)**. To realise these urban projects the existing 220 kV line will be laid underground simultaneously with the extension of the motorway and a building air-conditioning project led by SIG (Services Industriels de Genève) on a 4.5 km long stretch beside the motorway and the airport. The Canton of Geneva and the investors are financing the project. Planning approval was issued at the end of March 2019 by the SFOE (an SÜL procedure was not required) two and a half years after the application for planning approval had been submitted to ESTI. At present the plan is for the line to become operational at the end of 2023.

The **Obfelden–Samstagern** project involves upgrading the existing line from 150 kV to 380/220 kV. In addition, traction current of 132 kV will be partly bundled on the same line. This scheme is divided up into various sections: After a three and a half year SÜL procedure, in 2015, the Federal Council determined the planning corridor for a cable line for the *Wollishofen (Frohalp)–Waldegg* section; a construction project is now being prepared. The section *Kilchberg–Wollishofen (Frohalp)* is exempt from the sectoral plan process and the route is being planned. After the Federal Tribunal had returned the planning approval dossier to the SFOE for the *Schweikrüti (Mast 46)–Kilchberg* section, the SFOE issued a mandate for construction of an overhead transmission line. An appeal was lodged with the Federal Administrative Court. This appeal was rejected in February 2020 and a mandate issued to construct an overhead transmission line. Objections were lodged with the Federal Tribunal. The Federal Tribunal turned down the application for a suspensive effect on 23 June 2020. Correspondence was terminated on 25 September. The *Waldegg–Obfelden* line is an existing 150 kV line, for which proof of compliance with the Ordinance on Protection from Non-Ionising Radiation (NISV) for operation at 220/380 kV (ESTI) was provided in September 2016. In coordination with construction of the Waldegg substation, when appropriate Swissgrid will submit to ESTI an application to increase the voltage from 2x150 kV to 2x220 kV. The *Siebnen–Samstagern* section has been in a PGV at the SFOE since 2014; further stages are currently being clarified. Realisation of the overall project is projected for 2030.

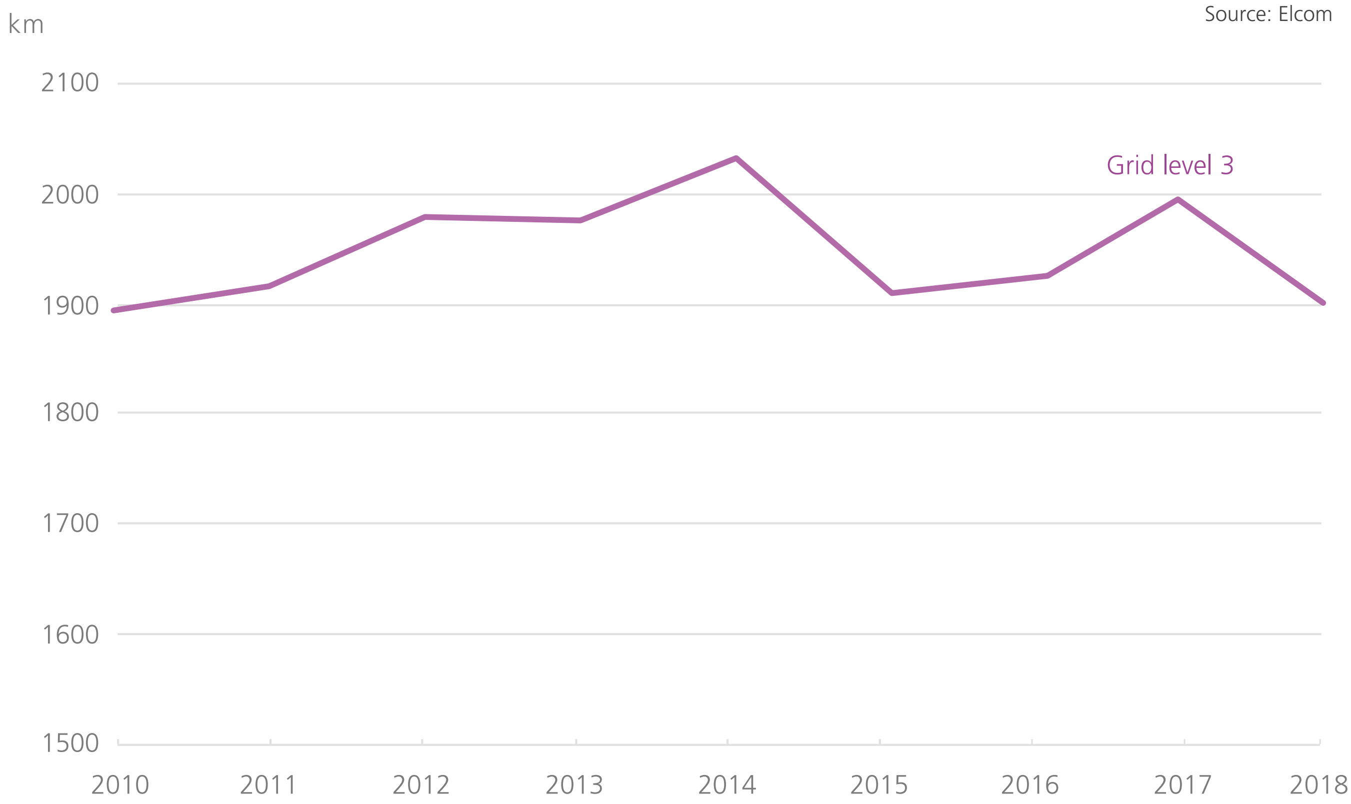
The 220 kV overhead transmission line between **Grynau and Siebnen** will be replaced with a 380 kV line. The scheme was initiated before the SÜL was elaborated and went through an almost ten-year long PGV at ESTI, from where the dossier was passed to the SFOE in October 2006. A full two years later the latter issued planning approval, which was then contested at the Federal Administrative Court. The court returned the procedure to the SFOE and requested a study on the feasibility of underground cabling and a re-assessment of the scheme. At the request of Swissgrid, the SFOE suspended the procedure a number of times between the end of 2013 and June 2020. On 30 June 2020 Swissgrid submitted a revised, updated planning approval dossier to the SFOE. Realisation of the scheme is anticipated by 2028.

In the Uri valley floor Swissgrid and SBB are relocating high tension lines. At the end of 2001, Alpiq, the former owner, submitted an application for planning approval for the complete refurbishment of the Ingenbohl–Mettlen section of the 380 kV **Amsteg–Mettlen** line. In the meantime most of the line has been modernised; the *Eyschachen near Altdorf* section went into operation finally in spring 2008. The *Lauerz* section is still pending and currently in the construction project stage. No SÜL procedure was required because the spatial planning impact had already been discussed on cantonal and on municipal level respectively as part of the application to waive the SÜL procedure. The conditions imposed in the SÜL waiver procedure are being further elaborated. Realisation of the scheme is planned for 2028.

Swissgrid plans to renew the 220 kV **Airolo–Mettlen** overhead transmission line as part of its replacement planning. Concerning the bundling of infrastructure, the current plans for the second Gotthard Road Tunnel envisage a separate channel under the road for utility lines. Swissgrid intends to check if such a variant could be implemented while considering whether the cost of the investments involved can be passed on. Cabling would be an alternative to an overhead transmission line in this section.

(Sources: SFOE/Swissgrid, 2020/Swissgrid 2015).

PLACING CABLES UNDERGROUND



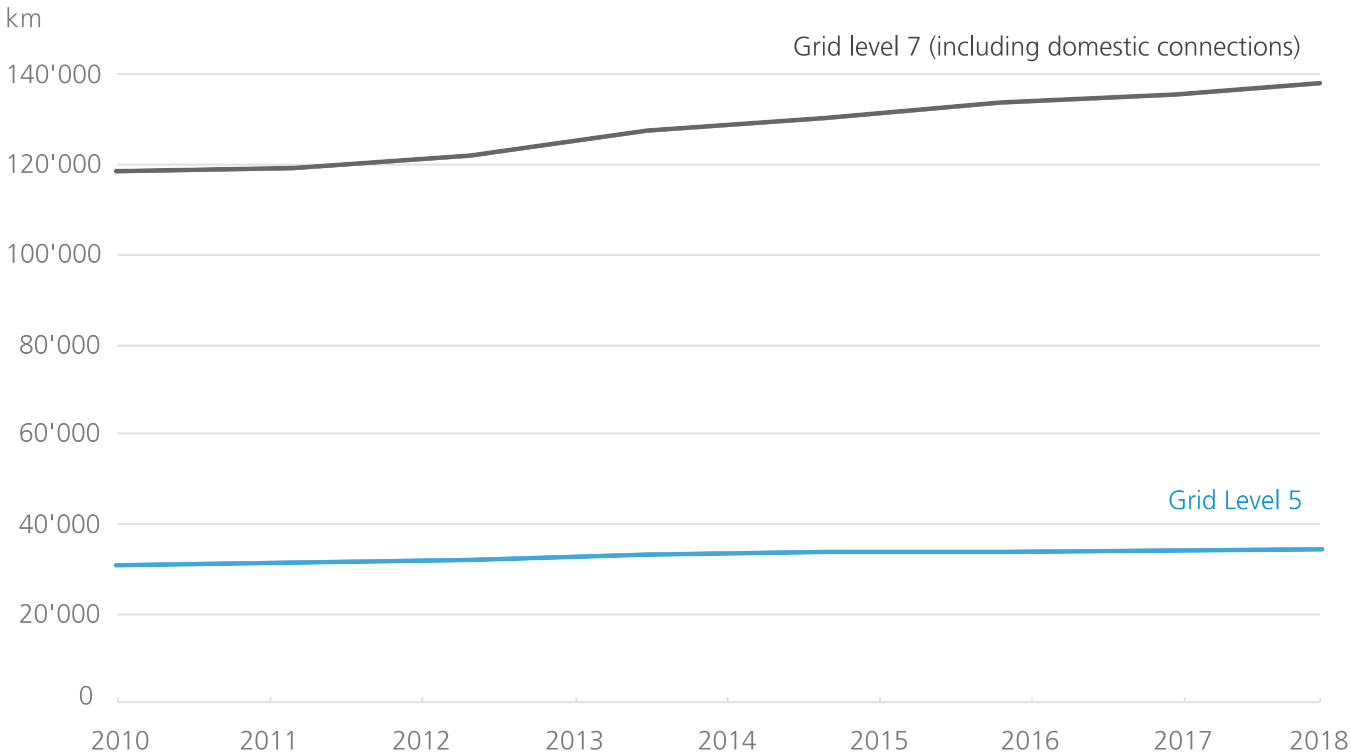


Figure 7: Inventory of cables in the distribution grid (in km)

PLACING CABLES UNDERGROUND

Placing electricity cables underground can contribute to greater acceptance of line construction by the population meaning projects can be completed quicker. As a rule the quality of the countryside is improved and the risks of electrocution and of birds colliding with installations can be avoided. However, whether to construct a transmission grid cable (grid level 1) as an overhead line or place it underground has to be decided on the basis of objective criteria[10] on a case to case basis. According to the Federal Act on the Transformation and Extension of the Electricity Grid (Electricity Grid Strategy), distribution grid lines (grid levels 3, 5 and 7) should be placed underground provided a specific cost factor is not exceeded (cost overrun factor). For this reason development of the use of underground cable at distribution grid level is a subject of the monitoring process. This will also provide information about the impact of the cost overrun factor.

More cables have been placed underground at all grid levels of the distribution grid to varying extents since 2010, as indicated in **figure 7**. In general, there is more underground cable in use at lower grid levels; grid level 7 in particular consists almost entirely of underground cable. At grid level 5 cabling has advanced, in particular in urban areas. In contrast, only a slight increase in the number of underground lines can be observed at grid level 3, but to a lesser degree than at all other grid levels (*cf. purple curve in the upper graph with differing scale*). The trend toward underground cabling is not so pronounced at this level. In addition, between 2014 and 2015 and between 2017 and 2018 a decline was observed the reasons for which are not clear. Overall, the three transmission grid levels (overhead transmission lines and cables including domestic connections) are 198,231 km in length, of which almost 88 percent consists of underground cable. Up to now very few transmission grid lines (6,700 km in length) have been laid underground (grid level 1). However, in the case of the ‘Beznau–Birr’ line (*see above*) with partial cabling at ‘Gäbihübel’ near Bözberg/Riniken, a longer section (around 1.3 kilometers) of a 380 kV high-voltage line was laid in the ground and commissioned for the first time. In addition, there is an underground cable project involving an extra-high voltage line for the ‘Bâtiaz–Le Vernay’ grid scheme where construction of a new 2 x 380 kV cable is planned as a replacement for the existing 220 kV overhead transmission line that crosses the Valley of the Rhone over a distance of 1.3 kilometres. A further underground cable project involving a transmission grid line is the replacement of the existing 220 kV line over a length of 4.5 kilometres in the ASR project in the Canton of Geneva (sources: ElCom, 2020/SFOE/Swissgrid 2020).

10 cf. SFOE evaluation scheme for transmission grid lines: www.bfe.admin.ch

SMART METER

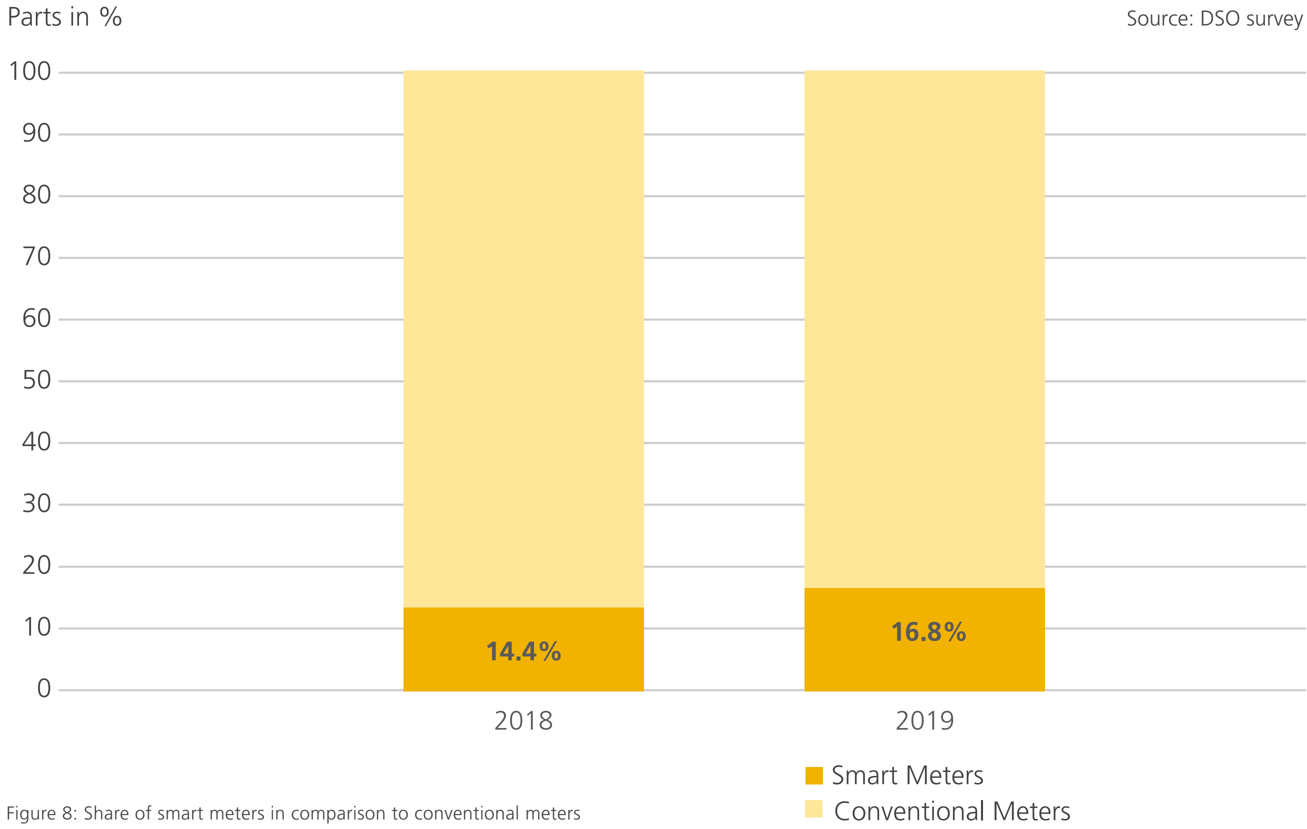


Figure 8: Share of smart meters in comparison to conventional meters

The increasing proportion of electricity generated by decentralised providers is leading to many challenges for the grid. In addition to renewal and expansion, an important priority of Energy Strategy 2050 is the establishment of a smart grid. Using information and communications technology an integrated data and electricity network with innovative functions will be constructed. This means for example that intelligent control systems can balance out fluctuations in electricity generation from renewable energies with electricity consumption. Smart grids guarantee secure, efficient and reliable system and grid operation and make a contribution to minimising the extent of the grid expansion required. Smart meters are a central component of intelligent grids. Introduction of such meters is viewed as an important initial step towards establishing smart grids. Correspondingly the Federal Electricity Supply Act (StromVV) lays down the minimum technical requirements and stipulates use of such systems. After an interim period of 10 years from the coming into force of the StromVV at the beginning of 2018 (that is by the end of 2027), 80 percent of all measuring systems in a grid area will have to comply with the requirements; the remaining 20 percent may remain in use until they no longer function.

According to information from distribution system operators, in 2019, there were approximately 944,220 smart meters installed and in operation throughout Switzerland; this constitutes a share of almost 17 percent, as shown in **figure 8** (2018; a full 14%) (source: DSO, 2020).

↗ More detailed indicators on the topic of **GRID DEVELOPMENT** (See the detailed version of the Monitoring Report)

SECURITY OF SUPPLY

One of the purposes of Energy Strategy 2050 is to guarantee the current high level ofwstablished in the energy article of the Federal Constitution and the Energy Act. By categorising energy carriers (diversification) and dependence on foreign supplies, the monitoring process observes indicators which characterise significant aspects of development in the field of security of supply from the overall energy perspective. With the phasing out of nuclear power, the expansion of use of renewable energies, increased energy efficiency, and the fairly long-term decarbonisation of the energy system, the electricity sector is also a centre of focus.

DIVERSIFICATION OF THE ENERGY SUPPLY

Figure 9 indicates that petroleum products (combustibles, vehicle fuel, including aircraft fuel in international traffic) constituted almost half of the final energy consumption in 2019. Electricity accounted for about one quarter of the final energy consumption and gas accounted for about 14 percent of this energy. The share of petroleum products in the energy mix fell by 10 percent between 2000 and 2019 because of a reduction in the volume of petroleum combustibles used. The shares of gas (+2.8%), electricity (+2.4%), wood and charcoal (+1.4%), other renewable energies (+2.9%) and of district heating (+1%) have increased. In comparison to 2018, in 2019 no greater deviations were observed in the segments: petroleum combustibles (–0.4%), petroleum fuels (+0.1%), gas (+0.3%), electricity (–0.3%), and renewable energies (+0.2%). Overall the energy supply is broadly diversified, which contributes to the high degree of security of supply in Switzerland (source: SFOE, 2020a).

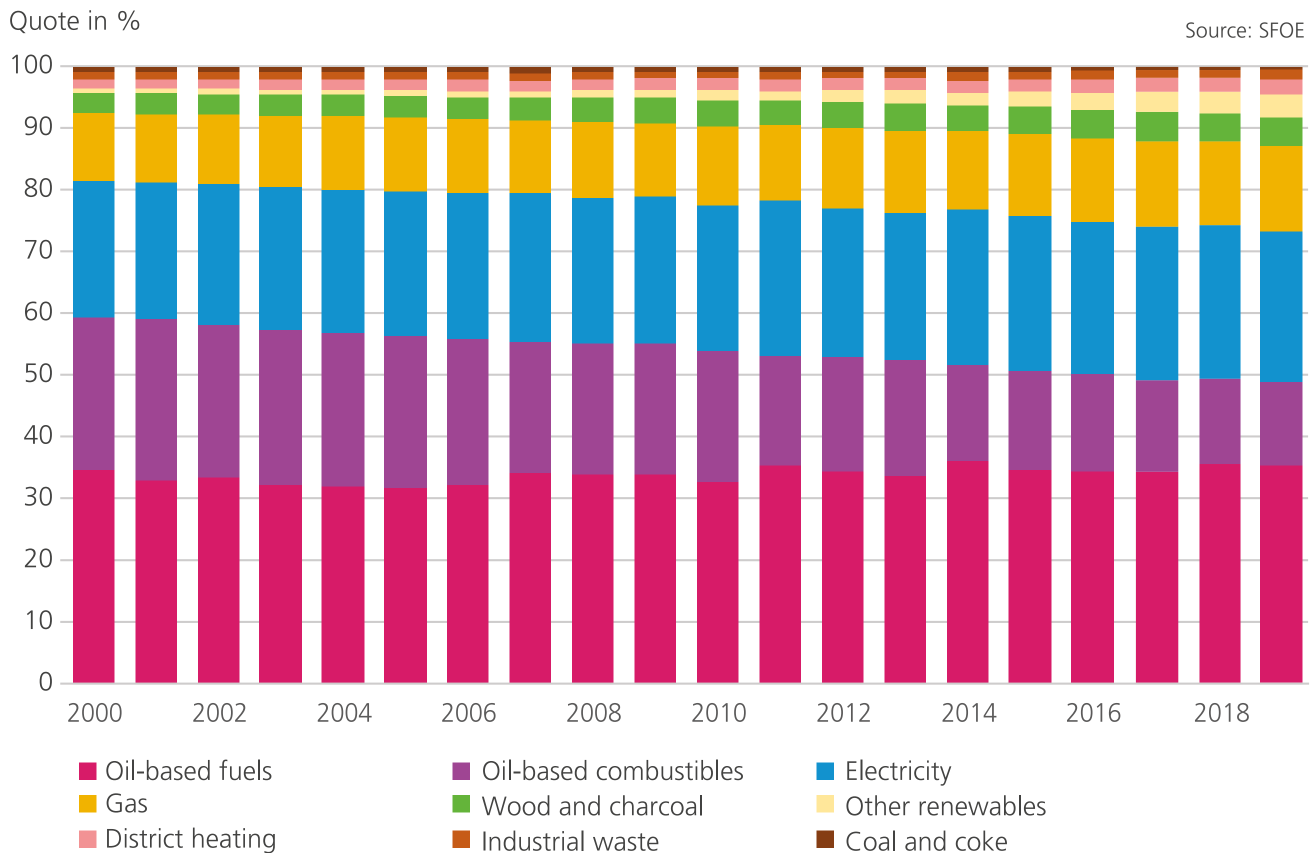


Figure 9: Diversification of the energy supply: share of energy carriers in final energy consumption

DEPENDENCY ON OTHER COUNTRIES

Figure 10 indicates that the import surplus tended to rise between 2000 and 2006, after which it fell, although one or two strong fluctuations were seen. At the same time the trend in domestic production has been toward increase since 2000. Gross imports were composed in the main of fossil energy carriers and nuclear fuel, that is energy from non-renewable sources. The most significant domestic energy source remains hydropower while the other renewable energies continue to grow. As indicated by the grey curve in the graph, the share of imports in gross energy consumption (dependency on other countries) grew from 2000 to 2006 and has declined since then, however this share remains at a high level: in 2019 the share of imports in gross energy consumption was 74.6 percent (2018: 75.0% and 2006: 81.6%). This ratio has to be interpreted with caution because there are a number of different factors which influence it. In general it can be said that energy efficiency measures that lower consumption, and thus imports of fossil energy in particular, and the expansion of domestic energy production from renewable sources reduce dependency on other countries and have a positive effect on security of supply (sources: SFOE, 2020a/FSO/FOEN/ARE, 2020).

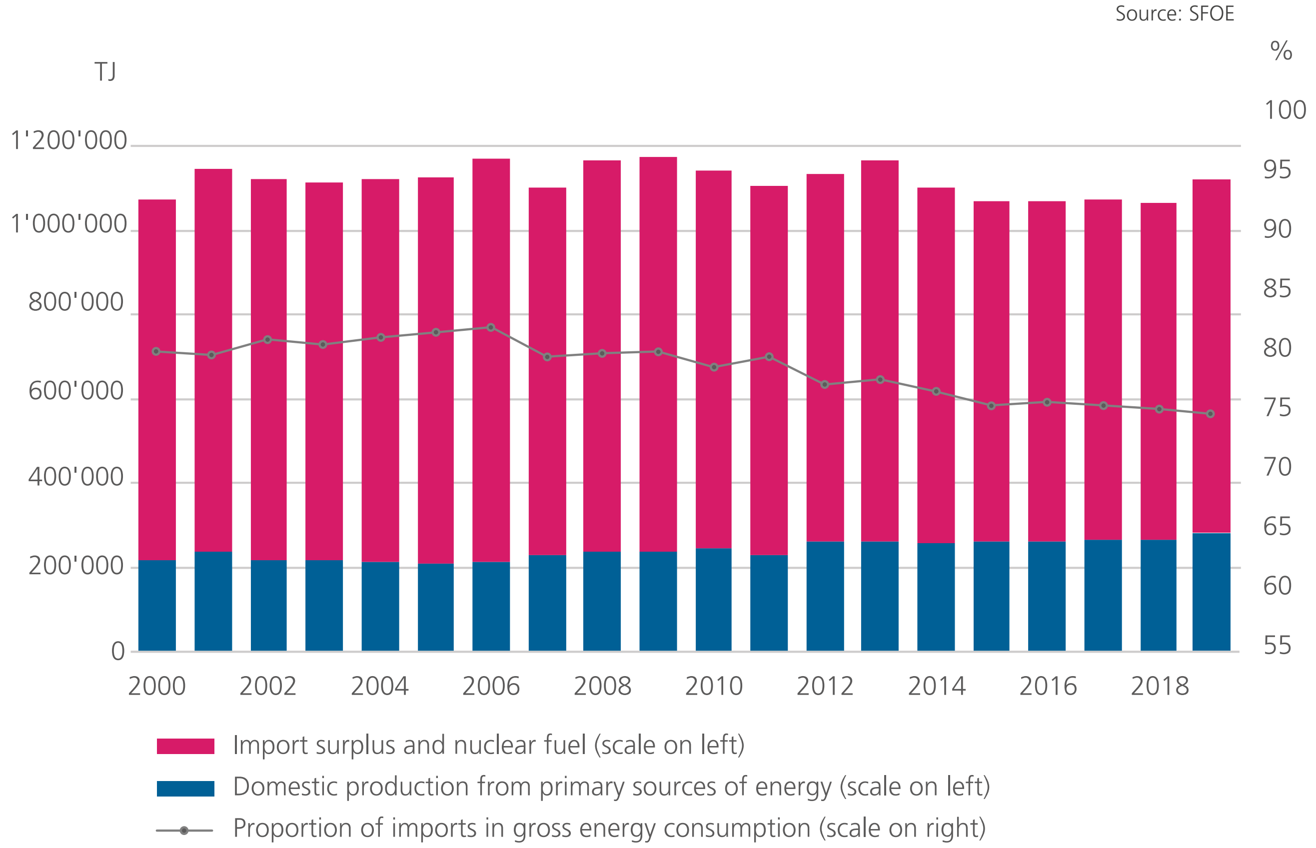


Figure 10: Import surplus and inland production (in TJ) and share of energy imports in gross energy consumption (in %)

SYSTEM ADEQUACY

Guaranteeing the **security of the electricity supply** in Switzerland is also based on the interplay between power plant capacity and the grid, which makes transmission and distribution of the energy produced possible. The grids supplement domestic power plant capacity and are equally important for ensuring security of supply. As a strongly networked country Switzerland is also dependent on the circumstances in neighbouring states. However, because countries are rearranging their strategies (above all in the EU) the situation changes over time so periodic overall analyses of system adequacy (SA) are required to evaluate the security of supply. That means using an overall modelling approach for the security of supply situation which looks at the strategic direction taken in the sectors generation, consumption and the grid infrastructure required.

In 2017, the ETH Zurich and the University of Basel conducted such a study on behalf of the SFOE for the first time concerning Switzerland for the period up to the year 2035; in 2019 the study was updated to encompass a further five year time **horizon up to the year 2040** and published at the beginning of 2020. As in 2017, the study is based on a selection of energy scenarios concerning the development of demand and supply in Switzerland and Europe. The findings of the updated SA study 2019 are similar to those of the prior study dating from 2017: For the anticipated political developments in the reference scenarios, no load shedding[11] was indicated in Switzerland, regardless of the structure of the national supply ('Renewable and Imports' or 'Conventional and renewable'). This evaluation also applies for the time after nuclear power plants have been phased out in Switzerland. Delay in the expansion of the grid and limited possibilities for importing electricity into Switzerland have little influence on this supply situation. Similarly, the Swiss supply situation does not become more acute in the case of the European capacity reductions selected (nuclear power plants in France, coal power plants in Germany). Local problems only begin to occur when a significant drifting apart of demand and supply occurs, and this was analysed within the electrification variant. In combination with variations in grid and supply, the increased demand also led to increased supply problems. Under these conditions the expansion of local Swiss renewable capacity can make a contribution to Switzerland's security of supply, whereby the problem of overall European security of supply remains. Switzerland's good supply situation is based on two pillars: *First, Switzerland's good network with neighbouring countries*: In all scenarios Switzerland is dependent on imports to cover the country's total demand while Switzerland's hydropower plants are mainly export oriented. Considering the circumstances, the availability of capacity for exchange of electricity with neighbouring countries is crucial. In the actual models grid capacity is indicated corresponding to its physical potential, which is more than enough for Switzerland's need for exchange. Secondly, potential shortages on the export side toward Europe can be balanced out by the important pillar of *Switzerland's supply – flexible hydropower*. The load in Switzerland can be covered through hydropower even in critical scenarios because the hourly and daily dynamics of demand in the European electricity system generally mean there is an adequate time window open for imports and for the use of pump storage power plants. In this respect, Switzerland is also an exporter as a rule in critical hours of supply regardless of its own domestic demand. *Additional expansion of the renewable energy sector would therefore positively influence the supply situation in Switzerland* because supplementary feed-in – even if it does not occur at peak load times – would certainly increase Switzerland's flexibility with respect to the need for imports and the use of hydropower. The findings from this study and the SA 17 study indicate that integration into the cross-border electricity trade remains a central concern for Switzerland. Thanks to the available hydropower capacity, Switzerland will be able to react to many European developments without having to fear any domestic supply problems. Nevertheless, according to the SA 2019 study, regular monitoring of possible developments in Europe and in Switzerland should continue to identify potentially critical long-term trends (e.g., significantly higher

SYSTEM ADEQUACY

growth in demand without any adaptation on the supply side and of the required grid capacity linked with such growth) in good time and to be able to adopt the necessary measures as appropriate. With the amendments to the Federal Electricity Supply Act, the Federal Council proposed adapting the promotion instruments for electricity from hydropower and the new, renewable energies so as to contribute to the necessary investments; further, it proposed that a storage reserve be established to act as an 'energy insurance' to supply Switzerland should any unforeseen extreme situation arise. No final resilient results are yet available from the present SA study 2019 for the electrification variant. System adequacy studies, which take appropriate account of the aspects of complete decarbonisation in the longer term, must therefore at least incorporate development scenarios for Switzerland and the EU up to 2050, in particular with regard to the inventory of power plants and the development of demand, grid expansion plans adapted for this purpose, and with regard to adapted demand dynamics and structural parameters for technologies offering flexibility (sources: University of Basel/ETHZ, 2019+2017/Federal Council, 2020a+b).

In mid-June 2020 the Federal Electricity Commission (ElCom) published an SA study with a **time horizon of 2030**. According to ElCom, it can be concluded from the the numerical results that system adequacy in the probable scenarios (base scenario 2030 and stress scenario 1–2030) can be guaranteed by the market. However, in particular for the probable base scenario, it has to be taken into account that maximum production is assumed to be available in Switzerland and base-load capacity in France. As further base-load production will be phased out in Germany by 2030, the significance of the availability of French (and Swiss) production in the winter half year tends to increase. The more controllable production in France seems to be the most important improvement in comparison to the situation for 2025. Because of the lower probability of supply bottlenecks in France, the risk of importing supply bottlenecks to Switzerland declines. The results of the stress scenarios for 2030 also show we are not able to eliminate situations with non-delivery of energy in the winter half year if a chain of unfortunate circumstances were to occur. According to the assumptions made supply problems would result most likely in winter, in particular if both nuclear power plants were to be unavailable (source: ElCom, 2020b).

In addition, in May 2020, the transmission system operators from the member states of the Pentalateral Energy Forum (Penta Forum: Germany, France, Belgium, The Netherlands, Luxembourg, Austria, Switzerland) published a third joint report about the security of the electricity supply in a regional context (Central West Europe) with a **time horizon of 2025**. The results for Switzerland in the base scenario do not currently indicate any relevant supply bottlenecks up to then (source: PENTA, 2020).

11 When a specific grid frequency is undercut load shedding leads to electricity cuts in single supply areas. This reduces the overall strain on the grid because the number of consumers is reduced. This measure protects the entire grid and prevents supraregional or even transnational power failures

↗ More detailed information on the topic of **SECURITY OF SUPPLY:**

- See the detailed version of the Monitoring Report
- SFOE report on system adequacy in Switzerland
- ElCom report on security of supply and system adequacy in Switzerland
- PENTA report on regional security of the electricity supply (Central West Europe)

EXPENDITURE AND PRICES

In addition to safety and environmental compatibility, a further significant dimension for a sustainable energy supply is economic viability. Energy article 89 of the Constitution and article 1 of the Energy Act determine the need to strive for a sufficient, diversified, safe, economic and environmentally compatible energy supply. The purpose of Energy Strategy 2050 is to successively reorganise Switzerland's energy systems without jeopardising the international competitiveness of Switzerland as a business location. Therefore the focus in this area is on final consumer expenditure for energy and energy prices.

FINAL CONSUMER EXPENDITURE FOR ENERGY

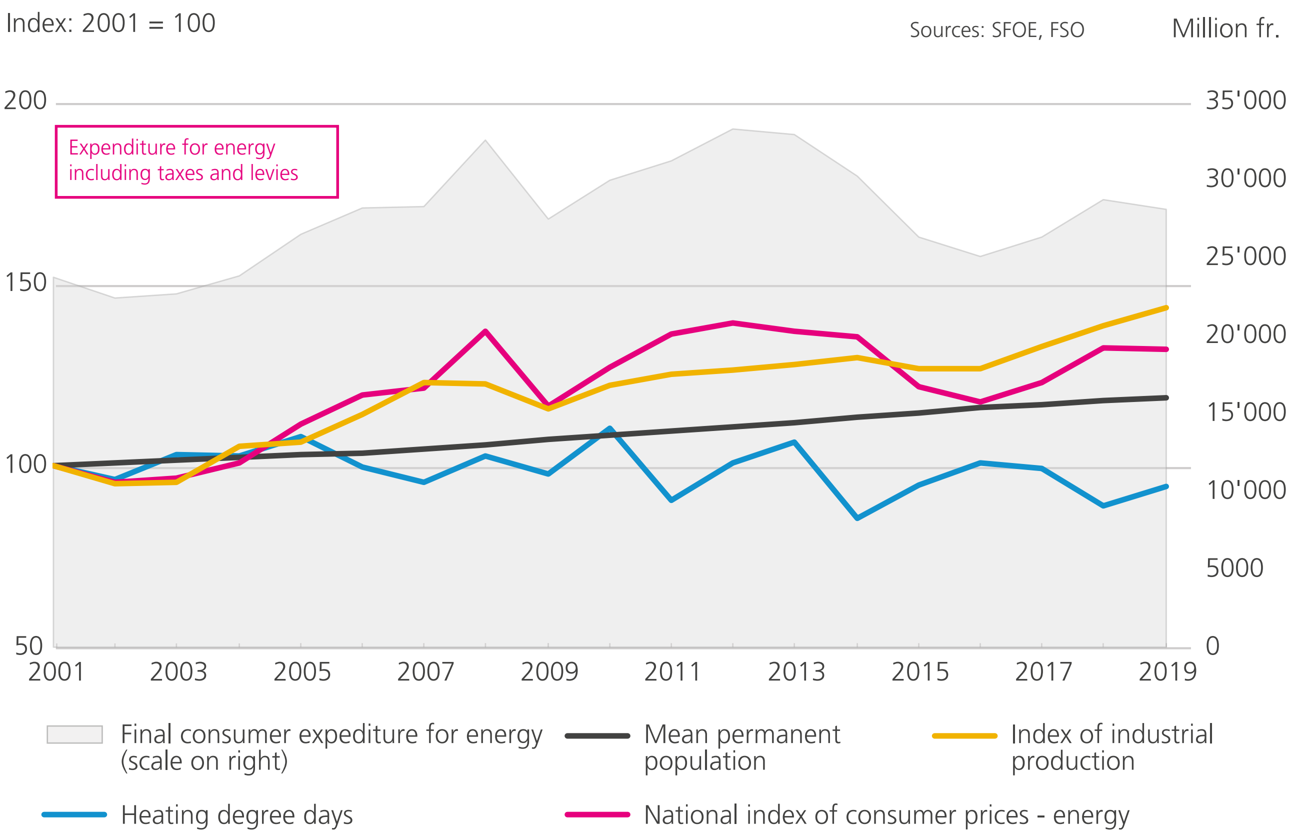
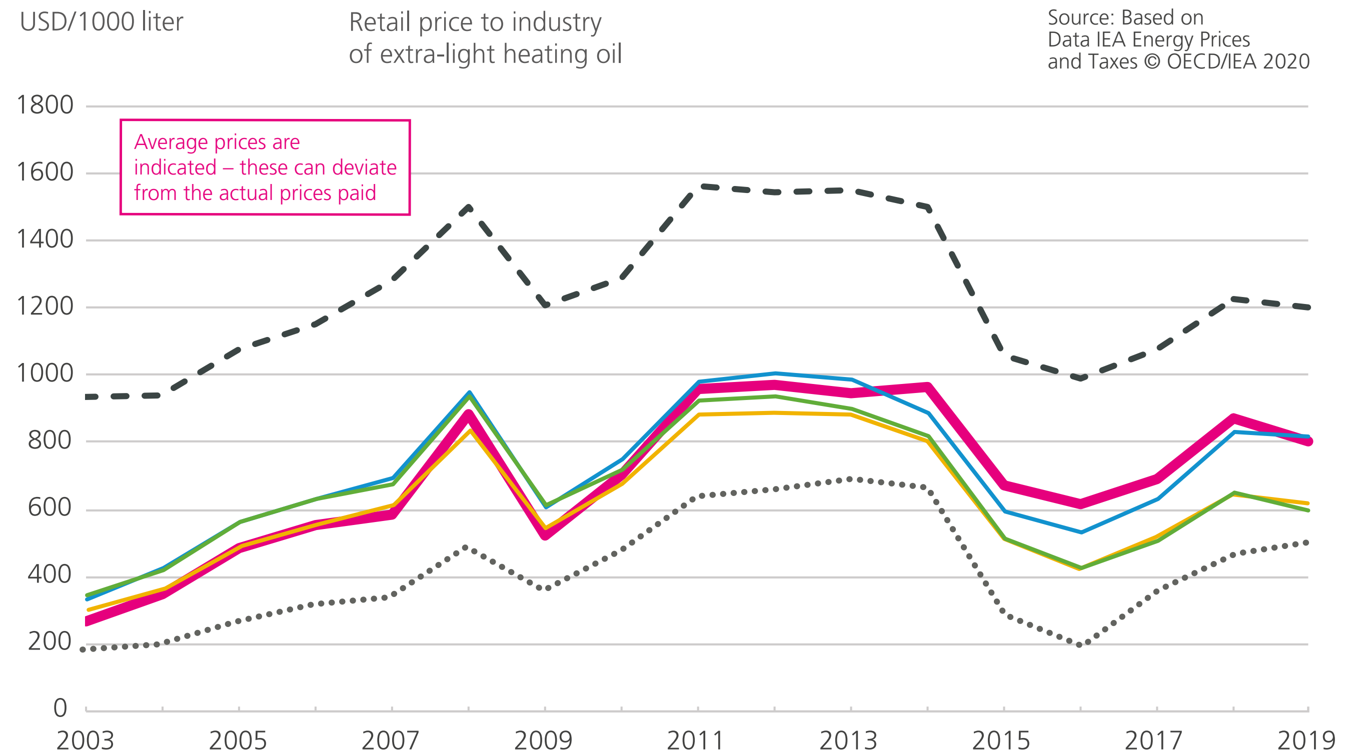


Figure 11: Final consumer expenditure for energy (in million francs) and significant influencing factors (indexed)

Figure 11 indicates the development of final consumer expenditure for energy in Switzerland, which has increased from 23.8 billion francs in 2001 to about 28.2 billion francs in 2019. About half of the expenditure was for petroleum products, one third for electricity, 10 percent for gas, and the remainder for solid combustibles and district heating[12]. Between 2001 and 2019 this constituted an average increase of 0.9 percent per annum. During the same time period growth has been seen in industrial production (1.9% per annum), the population (0.9% per annum) and the Swiss consumer price index for energy (1.5% per annum). What is noticeable is the similarity between the progression of final consumer expenditure and the consumer price index for energy. Among other reasons, this is because energy prices have little influence on consumer behaviour in the short term because this behaviour depends more on other existing and comparatively constant factors, such as the number of vehicles and homes. This constitutes an example of low, short-term price elasticity. In the course of events, a significant increase in final consumer expenditure and energy prices can be seen in 2008, followed by a drop in the next year; this can be partially explained by the improvement in the economy and the slump that followed as a result of the financial and economic crisis. In 2019 final consumer expenditure fell slightly compared to 2018 and this is attributable to price reductions. Improved energy efficiency measures can reduce energy consumption and therefore final consumer expenditure (sources: SFOE, 2020a/FSO, 2020).

12 In addition to expenditure for energy and transport, all taxes and levies are included in energy expenditure (e.g., CO_2 levy, petroleum tax, value added tax, etc.). According to an estimate by the SFOE taxes and levies for 2018 for petroleum fuels amounted to 5.24 billion Swiss francs, for petroleum combustibles 1.24 billion Swiss francs, for electricity (excluding grid usage charges) 2.04 billion Swiss francs, and for gas (excluding grid usage charges) 0.76 billion Swiss francs

ENERGY PRICES FOR SECTORS OF INDUSTRY IN INTERNATIONAL COMPARISON



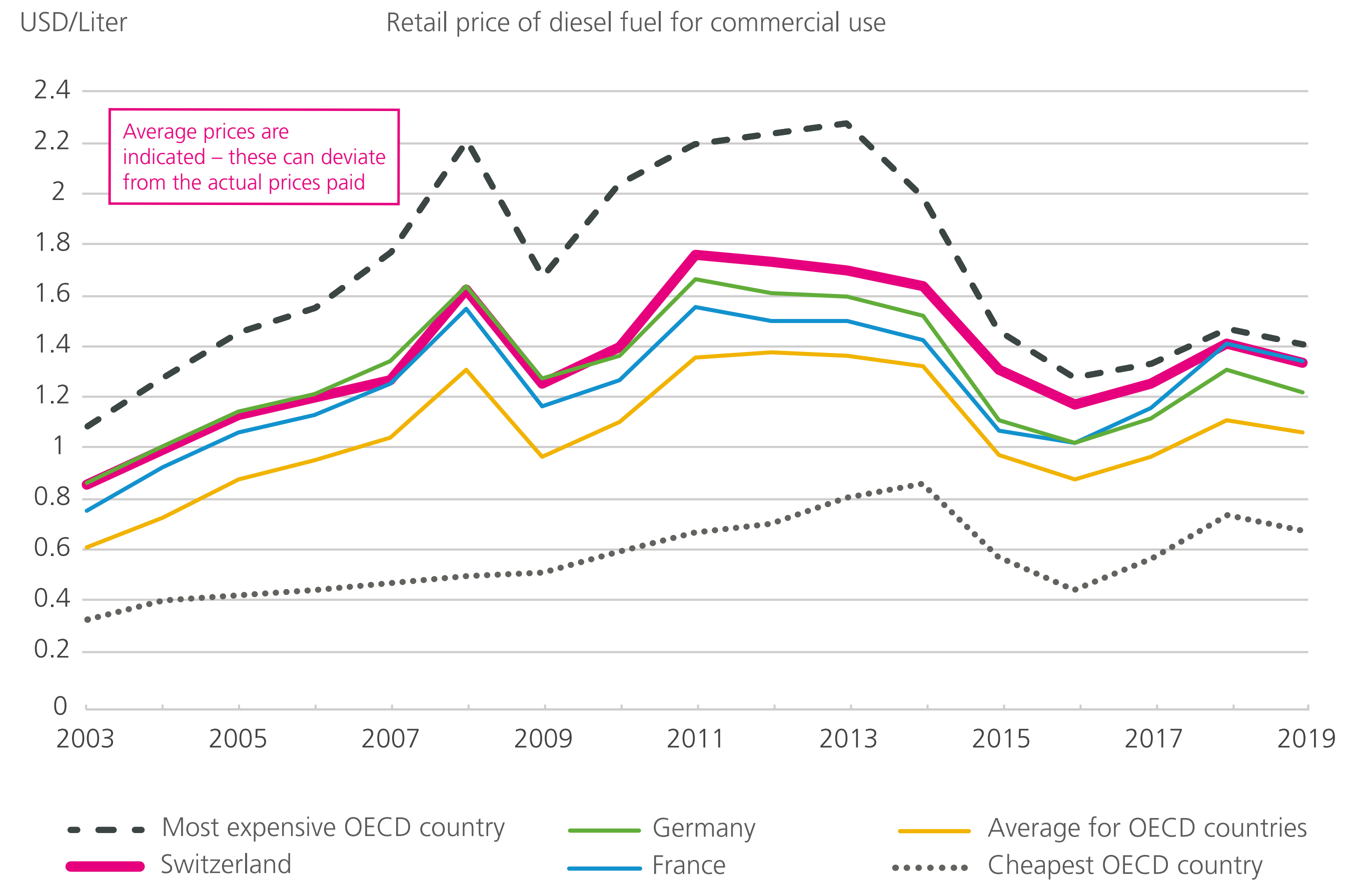


Figure 12: Average nominal end-user prices for heating oil and diesel fuel including taxes for the industrial sector in USD (calculated on the basis of market exchange rates)

Oil as a raw material and the energy carriers resulting from the refining process, such as **heating oil** and **diesel**, are traded on the global market. This partly explains the similar development of prices in most of the countries indicated in the graphic (**cf. figure 12**). In 2019 the price for Swiss **heating oil** was above the OECD average, and prices fell slightly in the OECD and in Switzerland compared to 2018. One explanation for the increase in Swiss prices for heating oil in relation to other countries could at least partly be the gradual increase in the CO_2 levy since it was introduced in 2008 from 12 to 96 francs per tonne of CO_2 in 2018; this increase was implemented because the interim biannual targets determined by the Federal Council for reduction of emissions from fossil combustibles were not attained. The price level for **diesel** in Switzerland is higher than in Germany or about average compared to OECD countries – the price in France has risen since 2018 to a price similar to that in Switzerland. The picture for petrol may differ because diesel is more heavily taxed than petrol in Switzerland than in other countries. Information about comparative international petrol prices is not monitored in the report because petrol is less significant for industry. The diesel price in Switzerland is significantly nearer to that in the most expensive rather than the cheapest OECD country (source: OECD/IEA, 2020a).

ENERGY PRICES FOR SECTORS OF INDUSTRY IN INTERNATIONAL COMPARISON

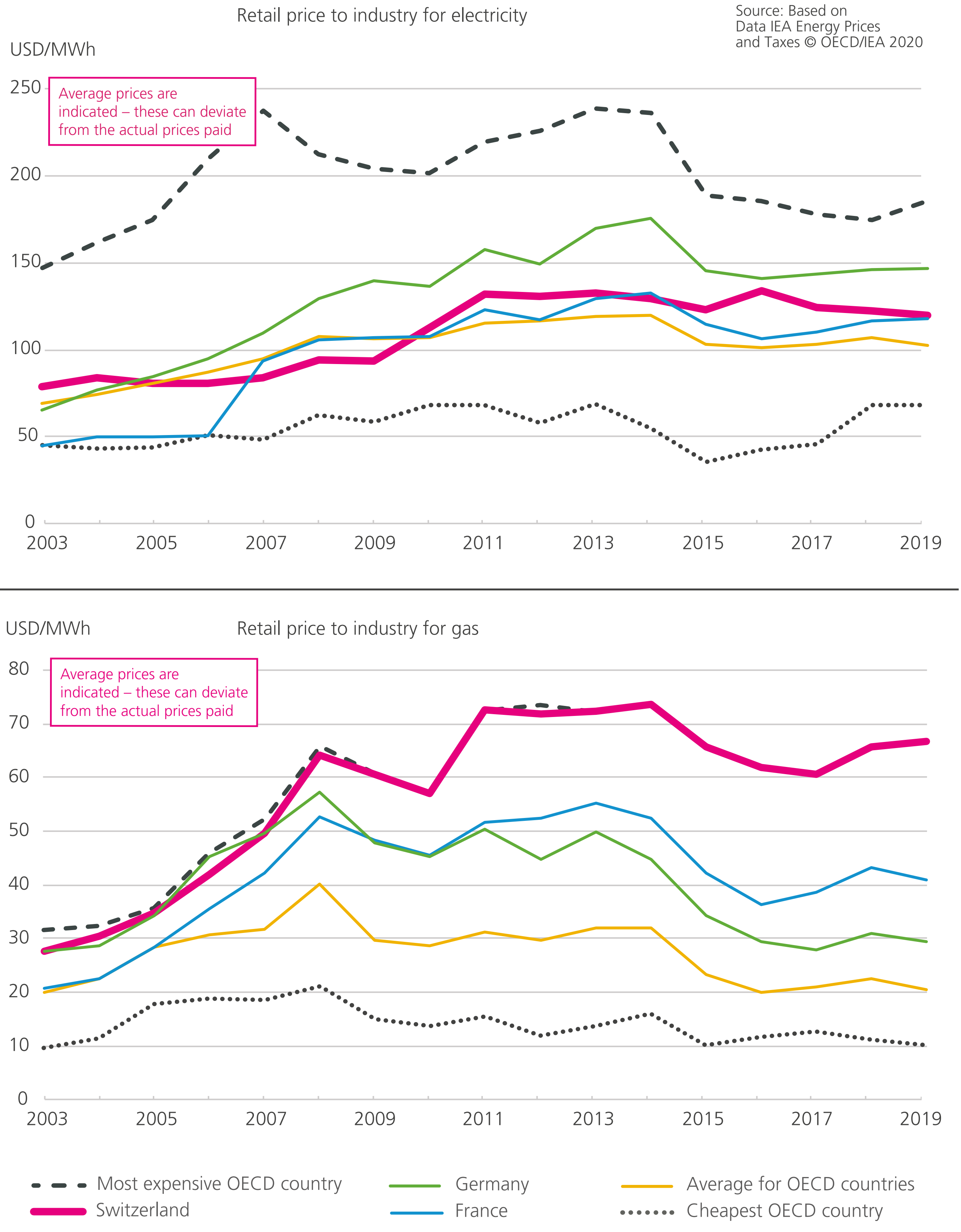


Figure 13: Average nominal retail price for electricity and gas including taxes for the industrial sector in USD (calculated on the basis of market exchange rates)

The **electricity price** depends on many factors, including the technology used in generation, the production and transport costs, capacity of the grids, market structures and levies. The same tendency as seen in Germany, France and the average OECD country can be seen in the development of electricity prices in Switzerland, where prices tended to move laterally (**cf. figure 13**). Thus, the price level in Switzerland lies close to the OECD average and to that in France while it is lower than that in Germany, or especially that of Italy (Italy had the highest electricity prices throughout the entire time period). The differences in price levels should be interpreted cautiously because companies that consume large amounts electricity can be exempted from paying levies contained in prices and the data base is incomplete. In fact, the prices in Switzerland for those industrial customers who cover their needs on the open market are not compiled. The share of these industrial customers has risen steadily since the market was partly opened up. Today, about two thirds of all eligible customers have switched to the free market; these purchase four fifths of the corresponding energy volumes[13]. Domestic prices for **gas** are much higher than in Germany and France and about average for OECD countries. In 2010 and 2011, and since 2013, Switzerland has been the most expensive OECD country in this respect. The difference to the other OECD countries is substantial, and in particular in contrast to the US, the country with the lowest prices in 2019. There are a number of possible explanations for the difference in prices. The CO_2 levy on combustibles was increased and this is reflected in the figures. It should also be noted that some companies are able to gain exemption from the fee if they undertake to reduce emissions in return – however this is not shown in the current figures. In fact such companies pay the end-user price but they are able to apply for a refund of the fee. The situation around the CO_2 levy is only a partial explanation for the relatively high prices and is no explanation for the figures before 2008. Further potential explanations could be the higher grid costs (arising because there are only a low number of connections per kilometre) and the current intensity of competition. For example, the gas markets in the countries to which Switzerland is being compared were all completely opened up. In Switzerland, in 2012 gas sales conditions were regulated for major industrial customers on the basis of an association agreement, according to which a few hundred end-users are free to choose their gas supplier. At the end of October 2019, in the course of the consultation procedure about the Gas Supply Act, the Federal Council proposed that the market should be partially opened up, a measure which would give significantly more customers (about 40,000 consumption sites) free access to the market. The Competition Commission also fully opened up the market for gas in the Lucerne area with a decision taken in June 2020. The commission anticipates this decision will have a signal effect on the whole of Switzerland (sources: OECD/IEA, 2020a/Federal Council, 2019c/COMCO, 2020).

13 Source: ElCom report on activities 2019, p. 9.

↗ More detailed indicators on the topic of **EXPENDITURE AND PRICES** (See the detailed version of the Monitoring Report)

CO_2 EMISSIONS

There is a close relationship between energy policy and climate policy because about three quarters of all greenhouse gas emissions in Switzerland are caused by the use of fossil energy carriers. Energy Strategy 2050 should contribute toward lowering the consumption of fossil energy as well as greenhouse gas emissions from energy sources. This with reference to climate policy for the period up to 2030, which was adopted in Parliament in autumn 2020 in connection with the complete revision of the CO_2 Act, as well as with reference to the long-term target adopted by the Federal Council on 28 August 2019 (net zero greenhouse gas emissions by 2050), and the long-term climate strategy, for which the Federal Council has simultaneously issued a mandate to define the targets (Federal Council, 2017+2019a). The most significant greenhouse gas in volume is carbon dioxide (CO_2), which arises mainly when fossil combustibles and fuels are burnt (heating oil, gas, petrol, diesel fuel). The annual monitoring process traces the development of CO_2 emissions from energy sources. The most important source for indicators is Switzerland's greenhouse gas inventory which is compiled annually by the Federal Office for the Environment (FOEN) in compliance with the requirements of the UNO Framework Convention on Climate Change.

PER CAPITA CO_2 EMISSIONS FROM ENERGY SOURCES

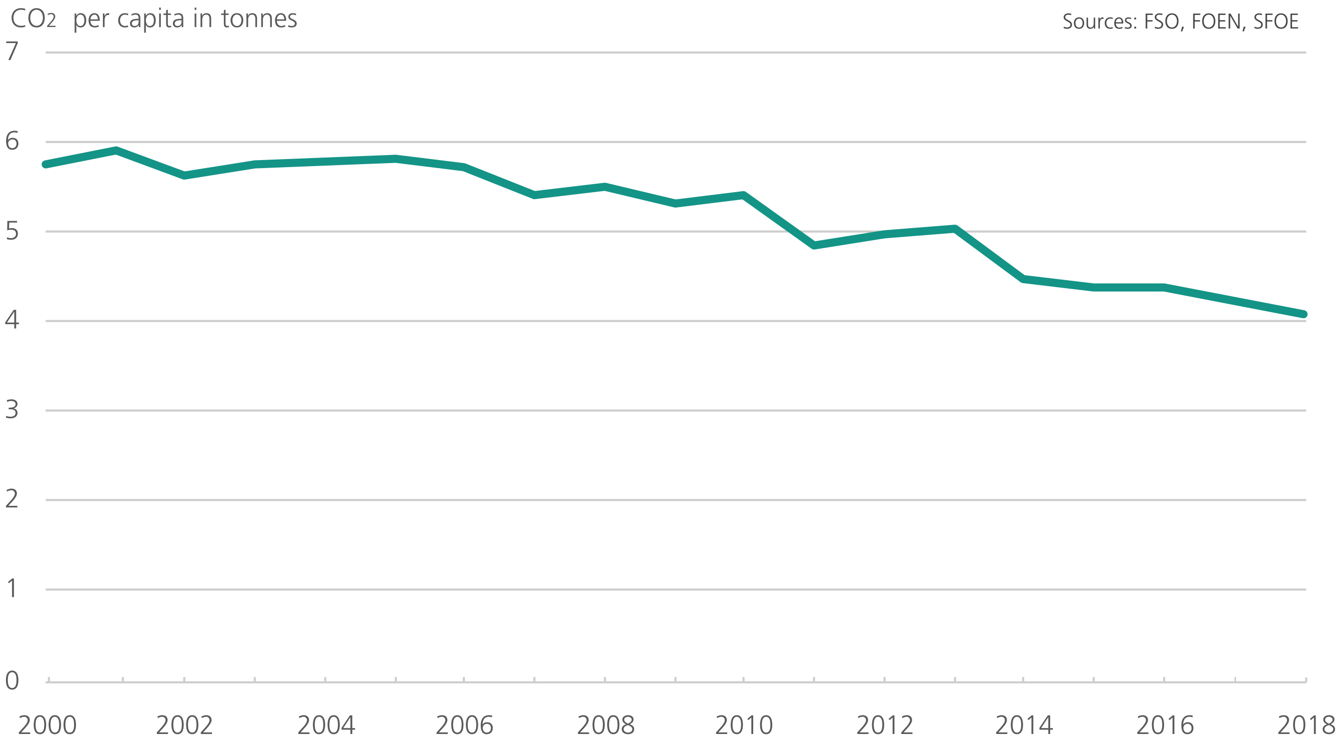


Figure 14: Per capita CO_2 emissions from energy sources (in t CO_2 per capita)[14]

Per capita CO_2 emissions from energy sources have been falling constantly since 2000, as indicated in **figure 14**. While CO_2 emissions from energy sources have fallen slightly since 2000 (*c.f. figure below*), the population of the country has increased in the same time period. There appears to be an increasing separation of the factors population growth and CO_2 emissions. In 2018 domestic per capita emissions were about 4.1 tonnes and thus almost 30 percent lower than the value for 2000 (5.8 tonnes). When compared internationally, this is a relatively low value resulting from the fact that Switzerland's electricity production is largely CO_2 free and the service sector contributes a major share of the added value. In order to be able to attain the long-term, strategic, overall objective, toward which the energy strategy is currently oriented[15] (in accordance with the dispatch on the first set of measures for Energy Strategy 2050 – reduction of CO_2 emissions to 1 to 1.5 tonnes by 2050, excluding international air traffic according to the definition of the target) a further continuous per capita decline of about 0.08 tonnes per year is required (sources: FOEN, 2020/FSO, 2020/SFOE, 2020a).

Overall CO_2 emissions from energy sources (**see figure 15**) amounted to 34.7 million tonnes in 2018 and were thus more than 16 percent lower than in the year 2000. The greatest share can be allotted to **Transport** (share 2018: 43%; excluding international air traffic), where emissions mainly stem from motorised vehicles[16]. Between 2000 and 2018 CO_2 emissions in the transport sector fell by 0.9 million tonnes. The decline in the trend of visitors from neighbouring countries filling up their vehicles in Switzerland accounts for most of the fall seen since 2015. This trend stopped after the Swiss National Bank decided to abolish the minimum exchange rate for the Swiss franc against the euro. However, international air traffic is playing a greater role. After a decrease seen at the beginning of the millennium, emissions from air traffic have climbed steadily and now constitute more than 5.6 million tonnes of CO_2[17]. In **Industry** (share 2018: 23%) CO_2 emissions mainly originate from manufacture of goods and to a lesser extent from building heating. A slight decline has been reported since 2000, showing the effectiveness of the measures implemented as well as increases in energy efficiency and a decoupling of

CO_2 EMISSIONS FROM ENERGY SOURCES OVERALL AND BY SECTOR

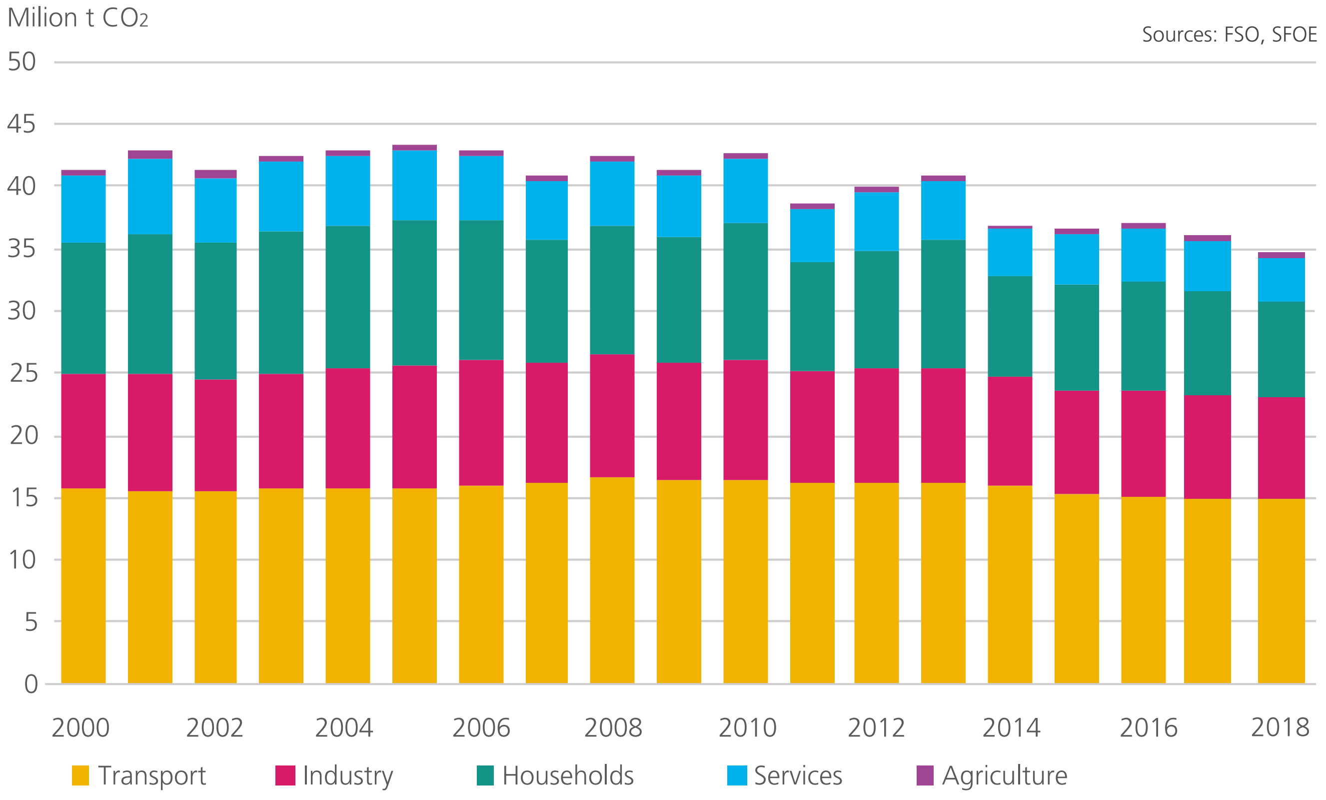


Figure 15: CO_2 emissions from energy sources in total and by sector (in million tonnes CO_2 excluding international air traffic)

the factors CO_2 output and industrial production. In addition, an interruption in operations at a refinery, which is still ongoing, led to a perceptible decline in 2015. The variations over the course of time are due to the state of the economy and climatic conditions. In the **Household** sector (share 2018: 22%) emissions originate in the main from heating and hot water heating. Since 2000 emissions have fallen although the dwelling area to be heated has increased. This also shows there has been an increase in efficiency and a tendency to employ technology creating lower emissions of CO_2. However, development of annual emissions is strongly influenced by the climate; dependency on fossil fuel heating systems is also as large as ever. The same applies to the **Services** sector (share 2018: 10%): here, too, CO_2 emissions from energy sources have been declining slightly since 2000. In **Agriculture** CO_2 emissions from energy sources have similarly decreased slightly since 2000 while the overall share in CO_2 emissions is also very low (share 2018: 2%). Significant in agriculture are not greenhouse gas emissions from energy sources, but rather those from methane and nitrogen dioxide. Overall each sector's share of energy related CO_2 emissions has changed only little since 2000. Emissions from the Transport sector and Industry have increased (from 38 to 43% and 22 to 23% respectively) while Households and Services contributed slightly less (sources: FOEN, 2020+2018/SFOE, 2020a/Ecoplan, 2017/Ecoplan/EPFL/FHNW, 2015).

14 Differentiation according to CO2 Act (excluding international air traffic, including statistical differences). Not corrected for the influence of climate.

15 This target is currently being checked and will likely be adapted within the work on Climate Strategy 2050, which the Federal Council commissioned on 28 August 2019.

16 In certain publications, the SFOE shows the share of transport in total greenhouse gas emissions. This share is currently around one third (32%).

17 International air traffic is not included in international balances so no results flow into the evaluation of attainment of climate policy targets. If air traffic were included, its share in overall CO2 emissions would be about 14 percent. If the sector is assigned to the transport sector, the share would be 27%.

↗ More detailed indicators on the topic of **CO_2-EMISSIONS** (See the detailed version of the Monitoring Report)

RESEARCH + TECHNOLOGY

It can be assumed that the short-term guidelines in the Energy Act and in Energy Strategy 2050 could be attained with the technology available today. However, attaining the long-term goals will require new developments in the technology sector. To stimulate further development, the Federal Council and Parliament have allocated significantly more resources to energy research with which new research activities could be commenced and existing efforts reinforced. Progress in research and technology cannot generally be measured directly with indicators. For this reason the annual monitoring process focuses on public expenditure for energy research as an indicator for efforts being made in energy research.

PUBLIC EXPENDITURE FOR ENERGY RESEARCH

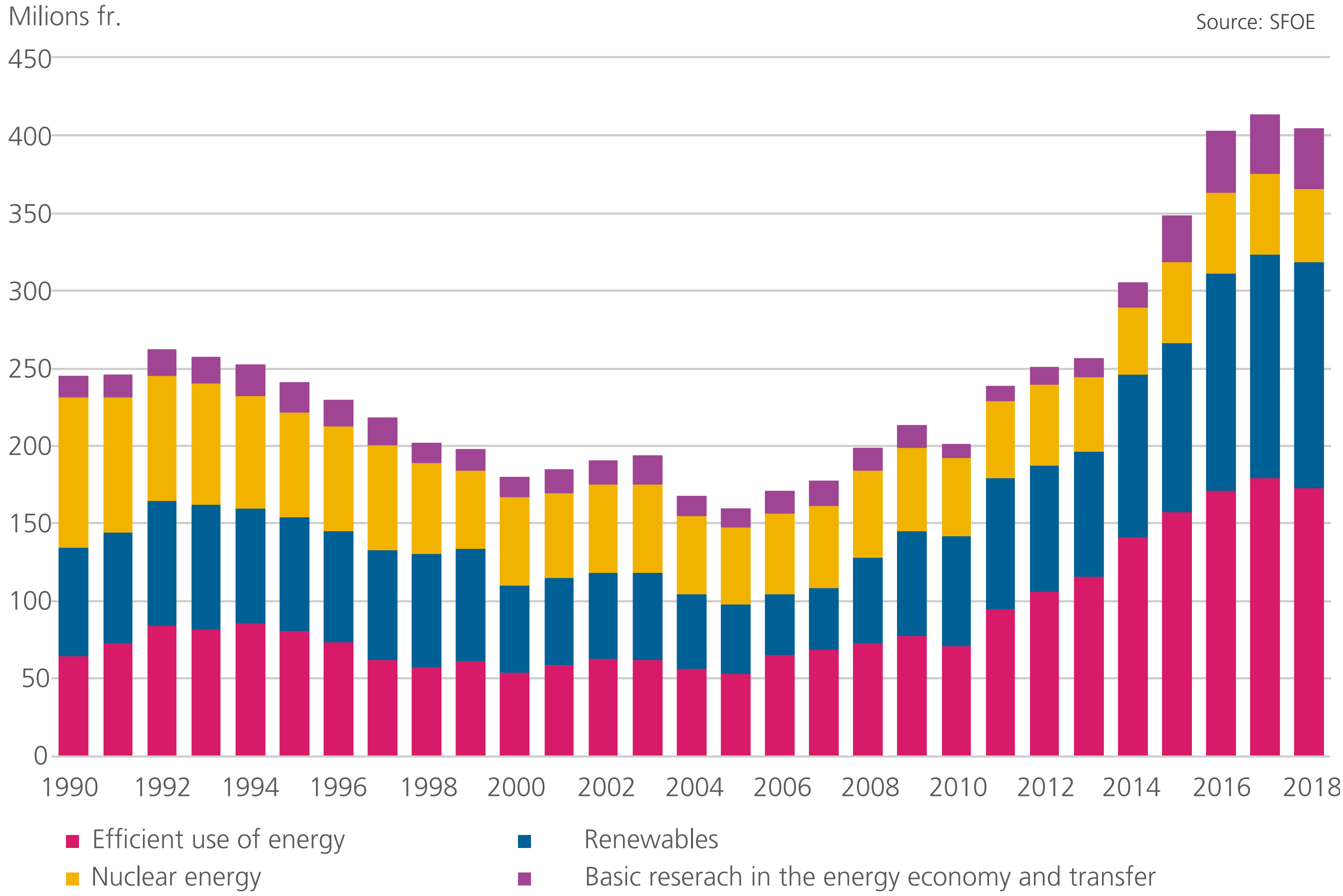


Figure 16: Public expenditure for energy research by field of research (in million francs, actual sum)[18]

Since 2005, public funding for energy research has increased continuously, as indicated in **figure 16**. Above all a significant increase in expenditure has been seen since 2014 within the framework of Energy Strategy 2050 and the Coordinated Energy Research in Switzerland action plan, although a degree of stabilisation could be observed in 2018. A major contribution has been made by the development and establishment of the Swiss Competence Centers for Energy Research (SCCER) by Innosuisse, new National Research Programmes in the energy sector (NRP 70 and 71) by the Swiss National Science Foundation, and targeted expansion of pilot, demonstration and lighthouse activities by the SFOE. In 2018 public expenditure in the sector amounted to 404 million francs (2017: almost 414 million francs). In accordance with the priorities of Energy Strategy 2050, the greater part flowed into the research fields *Energy efficiency* (share 2018: 42.7%) and *Renewable energies* (share: 2018: 35.9%). Absolute expenditure for *Nuclear energy* research fields (nuclear fission and atomic fusion) has been stable since 2004, however, the share of total expenditure has fallen and amounted to 11.7 percent in 2018. The share in expenditure of the research field *Basic research in the energy economy and transfer* was 9.7 percent in 2018 (source: SFOE, 2020c).

18 Expenditure includes a share in overheads (indirect research costs) of the research institutes.

↗ More detailed indicators on the topic of **RESEARCH + TECHNOLOGY** (See the detailed version of the Monitoring Report)

INTERNATIONAL ENVIRONMENT

The international environment is important to Switzerland because the country is closely integrated into the international energy markets and because Switzerland is strongly dependent on energy imports. On the regulatory level the developments in Europe in particular are crucial to Switzerland. International efforts to combat climate change are also important factors. Changes in the international environment cannot be measured with any indicators. For this reason annual monitoring focusses on a descriptive overview of substantial developments.

DEVELOPMENT OF GLOBAL ENERGY MARKETS

The COVID-19 pandemic also affected global energy markets in 2020; growth prospects for fossil energy carriers were corrected to reflect the downward trend. For coal and gas the following details are mainly based on reports from the International Energy Agency (IEA) and the EU from spring 2020, for oil on IEA reports from August 2020.

Oil: In its medium-term forecast the IEA anticipates annual global demand for oil will grow at less than one million barrels per day on average and by 2025 will reach a level of about 105.7 million barrels per day; thus demand will be about 2 million barrels per day lower than the value estimated in 2019 before the COVID-19 pandemic began. For the whole of 2020 the IAE assumes that demand will slump by about 8 percent, or 8 million barrels per day compared to the previous year, and in 2021 will still remain 3 percent below the level seen in 2019. In 2019, the global supply of oil increased only slightly over 2018 to 100.5 million barrels per day. Demand thus rose by 0.7 million barrels per day to 100 million barrels per day. In April 2020 OPEC+ (OPEC and other countries under the leadership of Russia) agreed to reduce production by 9.7 million barrels per day to counter the collapse in price. OPEC+ represents almost half of worldwide oil production. While the oil price in 2019 had fluctuated between 60 dollars and 75 dollars per barrel, in the spring of 2020 it fell to a historically low value as a consequence of the COVID-19 pandemic; negative prices were even recorded in the USA for a short time. However, since June 2020 the price has recovered and now lies at a little more than 40 dollars per barrel (sources: OECD/IAE, 2020b+c).

Natural gas: While the IAE had anticipated in its medium-term forecast before the corona crisis that the annual growth in demand for gas would be 1.8 percent by 2024, this prognosis was corrected downwards in June 2020 to 1.5 percent such that the global demand would attain 4,370 billion cubic metres by 2025. For 2020 the IEA expects a global decrease in demand of 4 percent (to 3,840 billion cubic meters) and for Europe of 7 percent. In 2019 global gas production rose by 3.3 percent compared to the previous year to a new record level of 4,088 billion cubic meters. Demand thus increased by 1.5 percent to 3,986 billion cubic metres. In 2019 gas prices fell in all major consumption regions and were 2 US dollars per million British Thermal Units (mmbtu) in the USA (Henry Hub) and 4 US dollars per mmbtu in Europe (TTF spot). As a consequence of the corona crisis, prices in May 2020 fell compared to January 2020 by 22 (Henry Hub), 71 (TTF Europe), and 62 percent (LNG Asia). By October the price for natural gas in Europe had recovered to reach the level of February 2020 (sources: OECD/IEA, 2020d+e/EU, 2020/Argus Gas Connections[19]).

DEVELOPMENT OF GLOBAL ENERGY MARKETS

Coal: In its medium-term forecast the IEA makes the assumption that the annual global demand for coal will more or less stagnate until 2024 at a level of 5,645 billion tonnes. After 2018, when global coal production increased (+3.3%), a rise of only 1.5 percent was seen in 2019. Global coal consumption fell in 2019 by 1.2 percent mainly because demand fell by 12 percent in OECD countries (mainly EU lands). Driven by the dynamics of the market in Asia and as a result of China introducing measures to restrict domestic coal production, coal prices had increased significantly in 2016. By July 2018, the CIF ARA spot price was 100 US dollars per tonne, the highest price since 2012, before it fell by mid-2019 to about 50 US dollars per tonne where it has since remained (sources: OECD/IEA, 2019+2020f/ Argus Gas Connections).

CO_2 in the European Union Emission Trading Scheme: The price for CO_2 emission rights was subject to volatile swings during lockdown because the uncertainty of the impact of the COVID-19 pandemic on the economy led to a temporary reduction in liquidity. However, by the end of May 2020, the price for CO_2 emission rights balanced out almost all losses incurred during the most acute phase of the pandemic. The average CO_2 spot price in the first quarter of 2020 fell compared to the fourth quarter of 2019 by 8 percent to 23 euros per tonne of CO_2. In April and May 2020 the average CO_2 spot price reached 20 euros per tonne of CO_2. In June 2020 the price rose to 23.5 euros per tonne of CO_2 reaching the level that existed before the crisis. In particular, the announcement by the EU Commission that by 2030 CO_2 emissions would be reduced not just by 40 percent but by 55 percent drove the price to the level of 30 euros per tonne in summer 2020. In August 2020 the price for futures for the month of December 2021 was also at 30 euros (sources: EU, 2020/EEX[20]).

Electricity: Electricity production increased globally between 1974 and 2018 from 6,298 TWh to 26,730 TWh, corresponding to an average annual growth rate of 3.3 percent according to the IEA. In 2018 production was 3.9 percent higher than in 2017. The European Power Benchmark (index for the average wholesale power price on the European market) fell in the first quarter of 2020 to 30 euros/MWh, which was 28 percent lower than in the same quarter in 2019, the same historically low level as in February 2016. The baseload price for Switzerland (Swissix) followed suit (sources: OECD/IEA, 2020g/EU, 2020).

19 www.argusmedia.com
20 www.eex.com

DEVELOPMENTS IN THE EU: THE 'EUROPEAN GREEN DEAL'

The EU's goal to become the first climate-neutral continent in the world is at the heart of the European Green Deal, which the commission of President Ursula von der Leyen presented on 11 December 2019. The commission set out its vision of a climate-neutral EU by 2050 for the first time in November 2018. This is in agreement with the goals of the Paris Convention which envisaged limiting global warning to significantly less than 2 degrees and to continue such efforts to limit warming to 1.5 degrees. The European Green Deal is a comprehensive strategy encompassing all branches of the economy (transport, energy, agriculture, buildings and the steel, cement, ICT, textile and chemical industries). The following aspects in particular are central to the strategy (source: COM(2019) 640 final):

- **Climate protection**: By 2030 greenhouse gas emissions shall be reduced by 55 percent compared to 1990; the previous target (minus 40%) will be increased. By 2050, as mentioned at the outset, net greenhouse gas emissions will no longer be emitted. For the case where different targets could come to apply outside the EU while the EU is intensifying its efforts, the commission is planning a CO_2 border adjustment mechanism for specific sectors to reduce the risk of CO_2 emissions being transferred. Further, a revision of energy taxation guidelines is being planned in which particular consideration will be given to environmental questions. Finally, a new strategy to adapt to climate change will be launched.

- **Energy supply**: The commission emphasised the importance of further decarbonisation of the energy system to attain the climate targets for 2030 and 2050. The focus is on intensifying efforts in the field of energy efficiency and the expansion and integration of renewable energies supplemented with a rapid phasing out of coal and the decarbonisation of gas. At the same time the EU's energy supply has to remain secure and affordable for consumers and companies; for this reason the commission will ensure the European energy market is completely integrated, networked and digitalised, while respecting the principle of technology neutrality. Concerning infrastructure the commission emphasises that the legal framework has to be checked to guarantee it is in harmony with the target of climate-neutrality; this framework should then make it possible to promote the introduction of innovative technologies and new types of infrastructure (smart grids, hydrogen grids, CO_2 capture, storage and use, and energy storage) and facilitate an integrated energy approach.

- **Mobility**: Transport plays a central role on the path to a climate-neutral future. According to information from the commission, greenhouse gas emissions from transport will have to be reduced by 90 percent by 2050. All modes of transport (road, rail, air transport and shipping) will have to contribute to achieving this goal. Multi-modal transport will have to be promoted vigorously to make the transport system more efficient. Transfer of goods from road to rail will be decisive in reducing emissions. Transport in towns in particular will have to be more ecological. Automated and networked mobility is ascribed even greater significance by the commission and alternative, sustainable fuels are to be further promoted.

DEVELOPMENTS IN THE EU: THE 'EUROPEAN GREEN DEAL'

- **Buildings**: According to the commission, 40 percent of energy consumption is caused by buildings; the annual refurbishment rate in member states is between 0.4 and 1.2 percent. To attain the energy efficiency and climate targets renovation of buildings is essential. A wave of refurbishment of private and public buildings should cause the rate to rise. Consideration is being given to including emissions from buildings in the European Emission Trading Scheme.

To finance the Green Deal the commission presented an **investment plan** that will start a **wave of sustainable investment amounting to one trillion euros by 2030**. It is anticipated that a large proportion of the expenditure for climate and environmental measures from the EU budget will help to mobilise private funding too. The European Investment Bank, which announced in November 2019 that it will no longer finance any projects involving fossil energy after 2022, will play a key role in this plan. Further, **37.5 percent of funding from the 'Next Generation EU'** recovery plan in the wake of the COVID-19 pandemic will be dispensed for Green Deal targets, as the President of the EU Commission Ursula von der Leyen declared in her state of the union speech at the Plenary Meeting of the European Parliament on 16 September 2020 in Brussels. The European Council agreed on the Next Generation EU plan at an extraordinary meeting in July; within this framework the commission will be able borrow up to 750 billion euros on the money markets (sources: COM(2020) 21 final/COM, 2020/European Council, 2020).

The **European Council** gave its approval to the goal of a climate-neutral EU by 2050 on 12 December 2019. The conclusion notes that one country (Poland) is not able to adhere to this goal at this time (source: European Council, 2019).

To legally anchor the principle of climate-neutrality by 2050, the commission submitted the **European Climate Law** at the beginning of March 2020. According to the legislation, by 2050, no more greenhouse gases are to be emitted in net terms. The commission proposed that a further target path for reduction of greenhouse gas emissions should be determined for the period from 2030 to 2050. At the same time the law aims to strengthen the efforts being made to adapt to climate change. In mid-September the commission also submitted an amendment to the proposed climate law to stipulate that the emission reduction target of at least 55 percent by 2030 be established as an interim target on the path towards climate neutrality (sources: COM(2020) 80 final/COM(2020) 562 final).

The Green Deal **is also of interest to Switzerland**. It strengthens the direction European energy and climate policy will take for the coming decades, which is something that will also influence Switzerland's energy and climate policy. Many aspects of the Green Deal are being dealt with internally by the EU, financing in particular. However, Switzerland can use the opportunity to intensify its discussions with the EU on specific topics. At the same time it will be necessary to observe carefully the concrete action taken and to identify promptly any challenges for Switzerland.

INTERNATIONAL CLIMATE POLICY

In respect of the further implementation of the **Paris Agreement**, in mid-December 2019 at the 25th Climate Change Conference (COP25) in Madrid no rules for market mechanisms could be adopted which would exclude double crediting of emission reductions achieved abroad. Switzerland regretted this decision and together with other parties will now push for ambitious, binding market rules. In addition, the country is also now considering bilateral cooperation with a number of states. To this end the Federal Council approved in 2020 treaties with Peru an Ghana. The planned COP26 conference in Glasgow at the end of 2020 has been postponed because of the COVID-19 pandemic and will now take place in November 2021.

After years of negotiation on the part of the international community, the Paris Convention has been in force since 4 November 2016. It continued on from the second commitment period of the Kyoto Protocol and obliges all states to adopt measures to reduce greenhouse gas emissions holding the increase in the global average temperature to well below 2 degrees Celsius above pre-industrial levels while at the same time striving to limit the temperature increase to 1.5 degrees Celsius above pre-industrial levels. The further aims of the Convention entail improving adaptability to the non-avoidable consequences of climate change and making finance flows consistent with a pathway towards low greenhouse gas emissions and climate-resilient development. In the meantime all 197 parties to the United Nations Framework Convention on Climate Change (UNFCCC) have adopted the Convention and 189 states and the EU have already ratified it. On 1 June 2017, the President of the United States Donald Trump announced the USA wanted to withdraw from the Paris Convention. Thus the USA would become the only contracting party that will not participate in the Convention. However, formal exit from the convention is only possible in November 2020 because of the effective notice period. Until then the USA is legally party to the Convention.

Switzerland ratified the Convention on 6 October 2017 after the Federal Assembly had given its approval on 16 June 2017. By approving the Convention the Federal Assembly also voted in favour of reducing greenhouse gases overall by 50 percent by 2030 in comparison to levels in 1990. The proviso was added that allocation of the reduction between the domestic share and the reduction achieved abroad would be determined in the process of national implementation (according to the revised CO_2 Act at least 75% of the reduction required should take place domestically). Since the ratification of the Convention Switzerland has been legally obliged to introduce measures to contain emissions and adapt

INTERNATIONAL CLIMATE POLICY

to climate change. As before a Biennial Report also has to be submitted to the Secretariat of the UNO Convention on Climate Change about the development of greenhouse gas emissions, measures planned to reduce emissions and adapt to climate change, and the contributions made to financing international climate policy. With the complete revision of the CO_2 Act, Parliament has agreed to implement the Paris Convention in national law; the law should go into force at the beginning of 2022, depending on the result of a possible referendum.

In 2018, the Intergovernmental Panel on Climate Change highlighted in a special report the consequences of global warming of 1.5 degrees Celsius and compared these consequences with those of global warming by 2 degrees Celsius. The report made clear serious changes in the ecological system would have to be anticipated with global warming of 1.5 degrees and that the changes would be even more significant with additional warming of 2 degrees. To restrict global warming to 1.5 degrees, a CO_2 balance of net zero would have to be reached by the middle of the century. As a consequence of this information, the Federal Council commissioned the FOEN to check the long-term climate targets once again and to elaborate what possible action could be taken. On 28 August 2019 the Federal Council decided that by 2050 Switzerland should no longer emit any further greenhouse gases because natural and technical storage facilities (sinks) could take up the gases. This will mean zero emissions by 2050. This climate target will ensure Switzerland makes its contribution to limiting global warming to a maximum of 1.5 degrees Celsius. At the beginning of September 2019, the Federal Council proposed in the consultation process on the direct counter-proposal to the Glacier Initiative to include the previously indicative net zero target as a binding objective in the Constitution (sources: Federal Council, 2020c+d+2019a+2017/IPCC, 2018).

INTERNATIONAL COOPERATION IN THE ENERGY SECTOR

Switzerland is negotiating a **bilateral electricity agreement** with the EU. In the main the negotiations centre upon mutual access to the electricity market. The content and scope of the agreement have been largely defined. Some questions in different sectors of the agreement are still the subject of negotiations. These talks have been suspended since mid-2018, because the EU has coupled the continuation of the negotiations with the progress made on the institutional agreement between Switzerland and the EU. The legal framework in the EU in the energy sector has changed comprehensively because of the Clean Energy Package (CEP). It is likely that a change in the negotiation mandate will be required because negotiations will have to be based on the CEP and not as up to now on the third package of measures for the internal electricity market.

With respect to **regional cooperation**, Switzerland has participated as a permanent and active observer of the Pentalateral Energy Forum since February 2011. The energy ministries of the following countries all take part voluntarily in the Forum: Germany, France, Belgium, The Netherlands, Luxembourg, Austria and Switzerland. The Forum is concerned with the topics the electricity market, security of the electricity supply, flexibility in the electricity market and hydrogen. In mid-June 2020 the President of the Swiss Confederation Simonetta Sommaruga signed a joint policy declaration of the Pentalateral Energy Forum that highlighted the role of hydrogen in the decarbonisation of the energy system. In May the transmission sytem operators from the Forum's member states published their third joint report about the regional security of the electricity supply; Swissgrid, Switzerland's transmission system operator, also participated in analytical work. Switzerland will continue to work within the Pentalateral Forum.

The numerous interdependencies with neighbouring countries in the energy sector call for deepening of **bilateral relations**. In 2020, energy and the climate were the topics during the visits of the President of the Swiss Confederation Simonetta Sommaruga during her visits to Austria, Ukraine and Germany. In discussions with the President of the EU Commission Ursula von der Leyen at the WEF in Davos and with Italy's prime minister Giuseppe Conte in Rome the focus was on the green dimensions of measures to stabilise the economy in the wake of the COVID-19 pandemic.

In the field of **multilateral cooperation** Switzerland is active within the multilateral energy institutions including the International Energy Agency (IEA). Within the Energy Charter Treaty, Switzerland has suggested that negotiations about modernising the treaty should be held after 2020 with the emphasis on adapting it to conform with the current requirements to reduce CO_2 and to the new practices in international investment treaties. Two such rounds of negotiations took place in July and September 2020; the negotiations are to be continued in 2021. In January 2020, as in 2019, Switzerland organised a workshop about hydropower on the periphery of the annual meeting of the International Renewable Energy Agency (IRENA). Switzerland retains a seat on the IRENA board from 2019 to 2020 and intends to do so in 2021 and 2022. Switzerland also cooperates with the UNO International Atomic Energy Agency.

(Sources: Federal Council, 2019b/DETEC, 2020)

↗ More detailed information on the topic **INTERNATIONAL ENVIRONMENT** (See the detailed version of the Monitoring Report)

LITERATURE AND BIBLIOGRAPHY

COM(2019) 640 final	Communication from the Commission on the European Green Deal.
COM(2020) 21 final	Communication from the Commission on the Investment Plan for the European Green Deal.
COM(2020) 562 final	Communication from the Commission concerning a stricter climate target for 2030.
COM(2020) 80 final	Proposal for a Regulation of the European Parliament and the Council for establishing the framework for achieving climate neutrality and amending Regulation (EU) 2018/1999 (European Climate Law).
COM (2020)	State of the Union Address by President von der Leyen of 16 September 2020 at the European Parliament Plenary.
COMCO (2020)	Competition Commission, press release of 4 June 2020, WEKO opens gas market in Central Switzerland.
DETEC (2020)	Department of the Environment, Transport, Energy and Communication, various press releases.
DSO (2020)	Data collection from distribution system operators on own consumption and intelligent network components, on behalf of the SFOE.
Ecoplan (2017)	Estimate of the effectiveness of the CO_2 levy, updated until 2015, on behalf of FOEN
Ecoplan/EPFL/FHNW (2015)	Estimate of the effectiveness of the CO_2 levy, on behalf of FOEN
ElCom (2020a)	Federal Electricity Commission, 2019 report on activities.
ElCom (2020b)	Federal Electricity Commission, ElCom System Adequacy 2030.
EU (2020)	European Commission, Directorate-General for Energy: Market Observation for Energy.
European Council (2019)	Conclusions of the meeting of 12 December.
European Council (2020)	Conclusions of the special meeting of 17–21 July.

LITERATURE AND BIBLIOGRAPHY

Federal Council (2013)	Dispatch on the first package of measures for Energy Strategy 2050 (revision of the Energy Act) and on the popular initiative 'For an orderly withdrawal from the nuclear energy programme (Nuclear Withdrawal Initiative)' BBI 2013 7561.
Federal Council (2016)	Dispatch on the Federal Act on the Transformation and Extension of the Electricity Grid (revision of the Federal Electricity Act and the Energy Act), BBI 2016 3865
Federal Council (2017)	Dispatch on the the complete revision of the CO_2 Act after 2020, BBI 2018 247.
Federal Council (2018)	Consultation procedure on the revision of the Energy Act, BBI 2018 6391.
Federal Council (2019a)	Press release of 28 August 2019 on Switzerland's climate targets for 2050 (zero emissions).
Federal Council (2019b)	Press release of 7 June 2019 on the Europe dossier.
Federal Council (2019c)	Consultation procedure on the Federal Gas Supply Act.
Federal Council (2020a)	Press release of 11 November 2020 on the Federal Act about a secure electricity supply with renewable energies.
Federal Council (2020b)	Consultation procedure on the revision of the Energy Act (promotional measures from 2023 on), BBI 2020 3123.
Federal Council (2020c)	Consultation procedure on the popular initiative 'Für ein gesundes Klima (Gletscher-Initiative' (For a healthy climate [Glacier Initiative]), and on the direct counter proposal (Resolution of the Federal Council on Climate Policy), BBI 2020 7030.
Federal Council (2020d)	Press release of 14 October 2020 and 18 November on Agreements between Switzerland and Peru respectively Ghana in the climate protection sector.
FOCA (2020)	Data extract on international air traffic 2019 within the framework of the inventory of greenhouse gases.
FOEN (2018)	Federal Office for the Environment, Switzerland's seventh national communication and third biennial report under the UNFCCC.
FOEN (2020)	Federal Office for the Environment, Inventory of greenhouse gases 2018.
FSO (2020)	Federal Statistical Office, Population and Households Statistics (STATPOP) 2019.
FSO/FOEN/ARE (2020)	Indicator system for monitoring sustainable development MONET.
IPCC (2018)	Intergovernmental Panel on Climate Change, Special Report: Global Warming of 1.5 °C.

LITERATURE AND BIBLIOGRAPHY

OECD/IEA (2019)	International Energy Agency, Coal 2019: Analysis and Forecasts to 2024.
OECD/IEA (2020a)	International Energy Agency, Energy Prices and Taxes 2019.
OECD/IEA (2020b)	International Energy Agency, Oil 2019: Analysis and Forecasts to 2025.
OECD/IEA (2020c)	International Energy Agency, Oil Market Reports, Annual Statistical Supplement 2019.
OECD/IEA (2020d)	International Energy Agency, Gas 2019: Analysis and Forecasts to 2025.
OECD/IEA (2020e)	International Energy Agency, Natural Gas Information: Overview 2020.
OECD/IEA (2020f)	International Energy Agency, Coal Information: Overview 2020.
OECD/IEA (2020g)	International Energy Agency, Electricity Information: Overview 2020.
PENTA (2020)	Pentalateral Energy Forum, Generation Adequacy Assessment.
Prognos/TEP/Infras (2020a)	Ex-post analysis of Swiss energy consumption 2000 to 2019 according to the main factors, on behalf of the SFOE.
Prognos/TEP/Infras (2020b)	Analysis of Swiss energy consumption 2000 to 2019 according to the use, on behalf of the SFOE.
SFOE (2019)	Swiss Federal Office of Energy, Potential for Switzerland's hydropower. Estimate of the potential for expansion of the use of hydropower within Energy Strategy 2050.
SFOE (2020a)	Federal Office of Energy, Swiss overall energy statistics 2019.
SFOE (2020b)	Statistic of Switzerland's hydropower plants (WASTA) 2019.
SFOE (2020c)	Swiss Federal Office of Energy, Energy research statistics 2018.
SFOE/Swissgrid (2020)	Information on the status of grid projects.
Swissgrid (2015)	Strategic Grid 2025.
University of Basel/ETHZ (2017)	Research Centre for Sustainable Supply of Energy and Water, University of Basel, Research Centre for Energy Networks ETHZ, Modelling the System Adequacy of the Swiss Electricity Supply, on behalf of the SFOE.
University of Basel/ETHZ (2019)	Research Centre for Sustainable Supply of Energy and Water, University of Basel, Research Centre for Energy Networks ETHZ, Modelling the System Adequacy of the Swiss Electricity Supply, on behalf of the SFOE.

LIST OF FIGURES

IMPRINT

NOVEMBER 2020

Publisher — Swiss Federal Office of Energy SFOE

Pulverstrasse 13 · CH-3063 Ittigen · Postal adress: Swiss Federal Office of Energy SFOE, CH-3003 Bern · Phone +41 58 462 56 11 · contact@bfe.admin.ch · www.bfe.admin.ch twitter.com/bfeenergeia

Images: freepik.com, shutterstock.com

↗ **www.energymonitoring.ch**