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Bundesamt für Energie BFE  
Office fédéral de l'énergie OFEN  
Ufficio federale dell'energia UFE  
Swiss Federal Office of Energy SFOE



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# STATUS OF THE SWISS ENERGY TRANSITION

## WHERE ARE WE NOW AND WHAT COMES NEXT?



# CONTENTS

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## 1. Guidelines

2. Where are we now?

3. What comes next?



# SWISS ENERGY AND CLIMATE POLICY GUIDELINES

**Energy Policy:**  
Energy transition &  
Security of supply

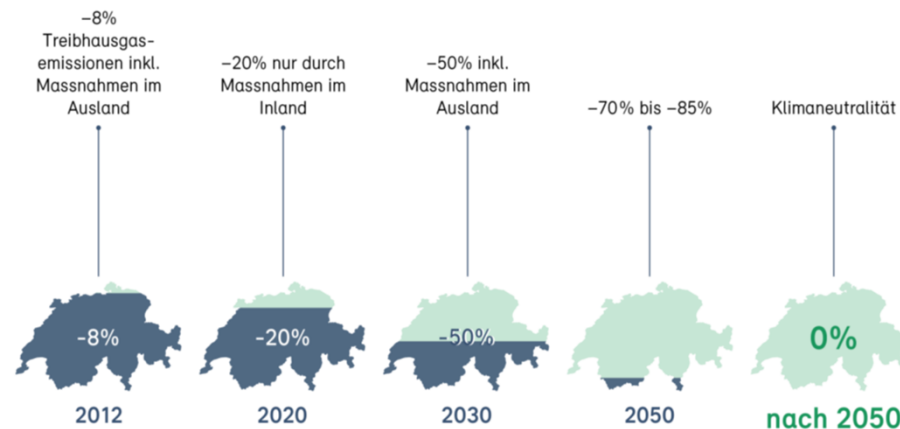


**Energy Strategy 2050:**

**Guidelines for:**

- Average per capita energy consumption
- Average per capita electricity consumption
- Average domestic renewable production excluding hydropower
- Hydropower

**Climate Policy:**  
Planned  
Greenhouse gas  
reduction



**CO<sub>2</sub>-Act (currently in parliament): Binding reduction target for 2030:**  
- 50% (compared to 1990)

CO<sub>2</sub>-Target 2050 shall be strengthened according Federal Council: Net Zero Emissions



# GUIDELINES ENERGY STRATEGY

Area	2020 (short term, EnG)	2035 (medium term, EnG)	2050 (long term according to Energy Act dispatch)
Per capita energy consumption	minus 16% <i>(compared to 2000)</i>	minus 43% <i>(compared to 2000)</i>	minus 54% <i>(compared to 2000)</i>
Per capita electricity consumption	minus 3% <i>(compared to 2000)</i>	minus 13% <i>(compared to 2000)</i>	minus 18% <i>(compared to 2000)</i>
Yearly renewable energy production (excl. hydro)	Min. 4400 GWh	Min. 11'400 GWh	Min 24'200 GWh
Yearly hydro production	(no target)	Min 37'400 GWh	Min 38'600 GWh



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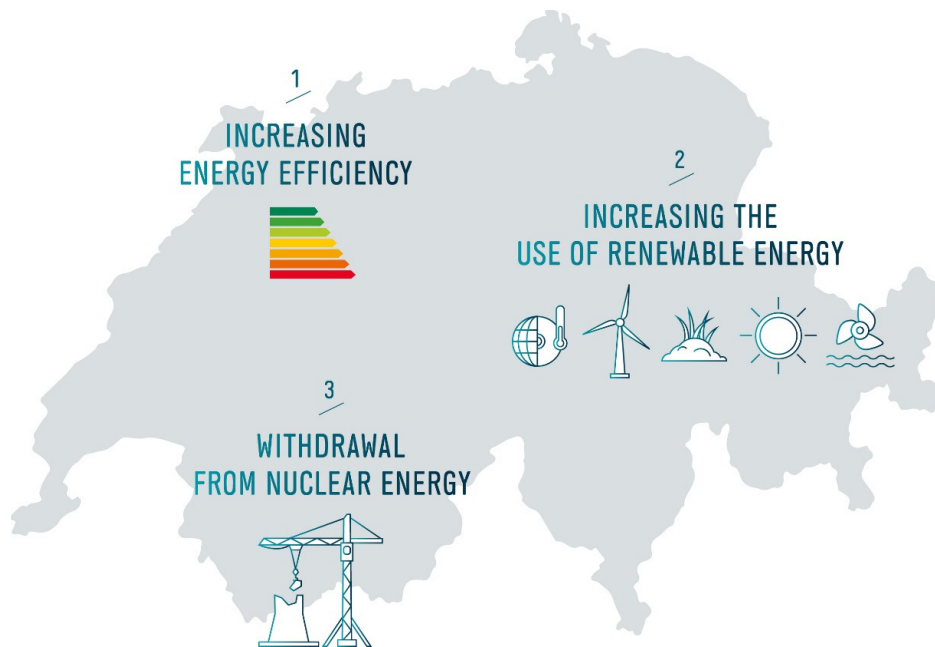
1. Guidelines

**2. Where are we now?**

3. What is coming next?

# ENERGY ACT STRATEGIC OBJECTIVES

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## Measures to increase energy efficiency

- Buildings, Mobility, Industry, Appliances

## Measures to increase the use of renewable energy

- Promotion, Improvement of legal framework

## Withdrawal from nuclear energy

- No new general licences, step-by-step withdrawal – safety as sole criterion

## Ensure access to international energy markets

## Advance the conversion and expansion of electrical networks and energy storage

## Strengthen energy research, P + D + L program and SwissEnergy

## Exercise role model role of the public sector



# MONITORING / INDICATORS

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**Monitoring Process** started **January 1st 2018** (annual SFOE report, 5-year Federal Council Progress Report)

**Objective: observe progress – create a case for intervening, if necessary**

## List of indicators (over 40)

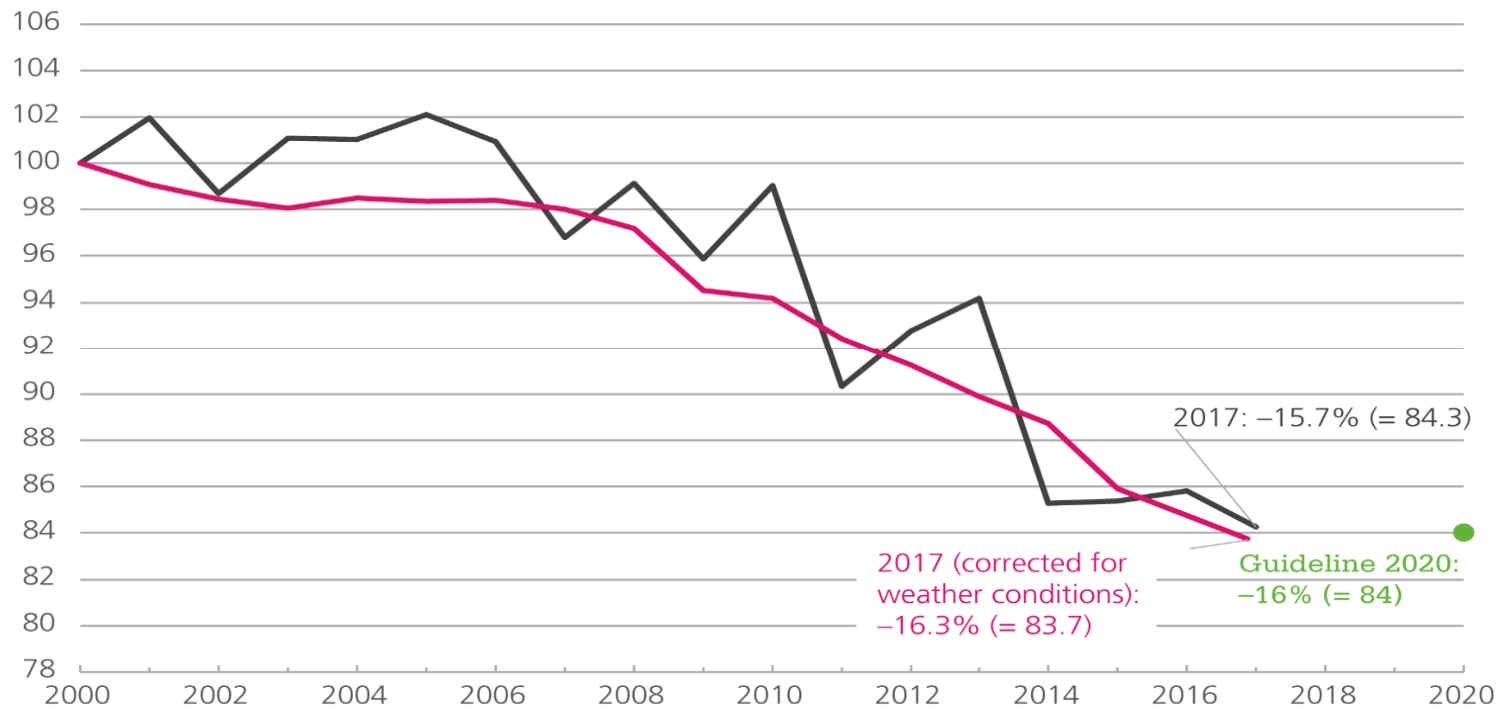
- **Consumption:** Energy and electricity power consumption
- **Production:** Electricity production from renewables & hydro
- **Network / Grid development:** Long lead times for grid development, high voltage cables underground (owes to social acceptance)
- **Security of supply:** Diversification of energy supply, dependence on other countries, system adequacy (electricity)
- **Expenditures & Prices:** Economic impact
- **CO<sub>2</sub>-Emissions:** Reduction of emissions
- **Research & Technology:** Public investment in research and innovation
- **International environment:** Switzerland is at the heart of Europe



# ENERGY EFFICIENCY PER CAPITA FINAL ENERGY CONSUMPTION

Index: 2000 = 100

Source: SFOE, FSO, FOCA, Prognos/TEP/On behalf of the SFOE



**Guideline 2035:  
-43% (= 57)**

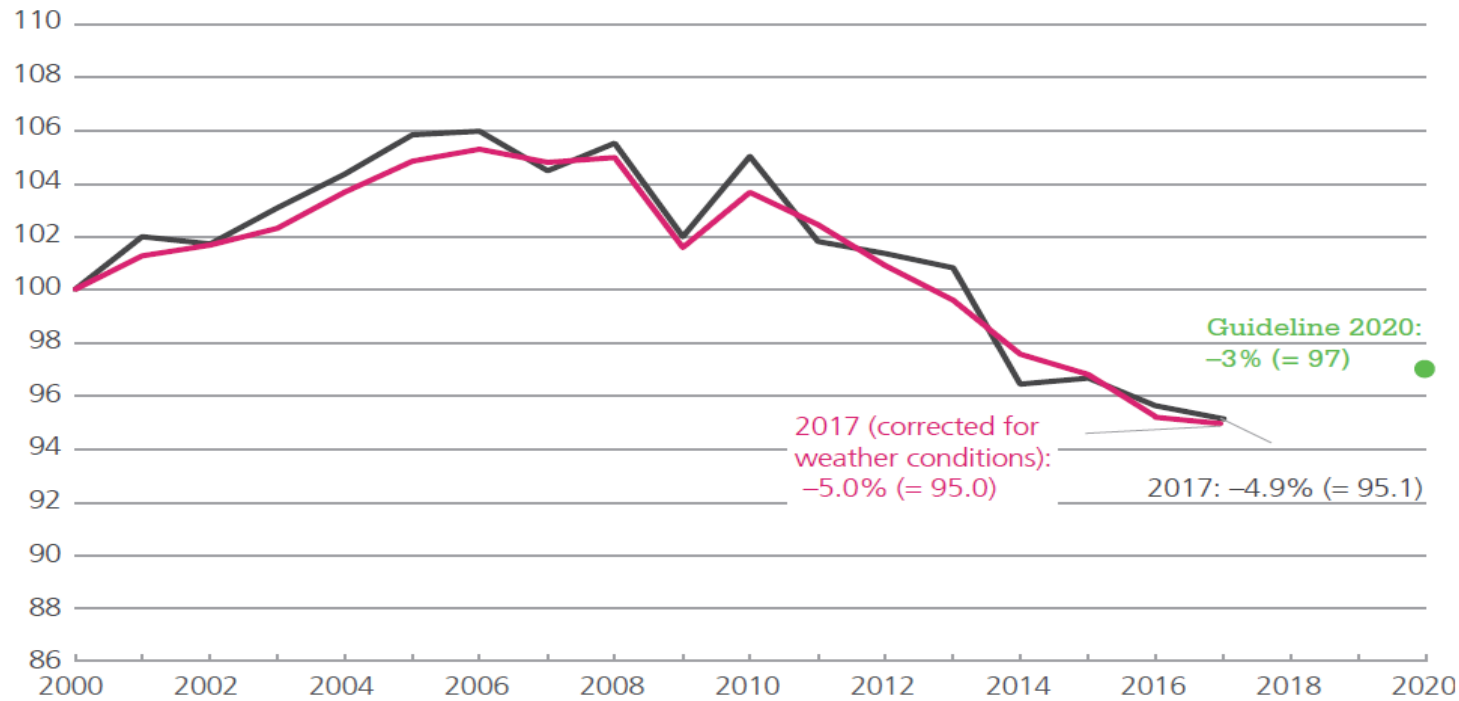




# ENERGY EFFICIENCY PER CAPITA ELECTRICITY CONSUMPTION

Index: 2000 = 100

Source: SFOE, FSO, Prognos/TEP/On behalf of the SFOE

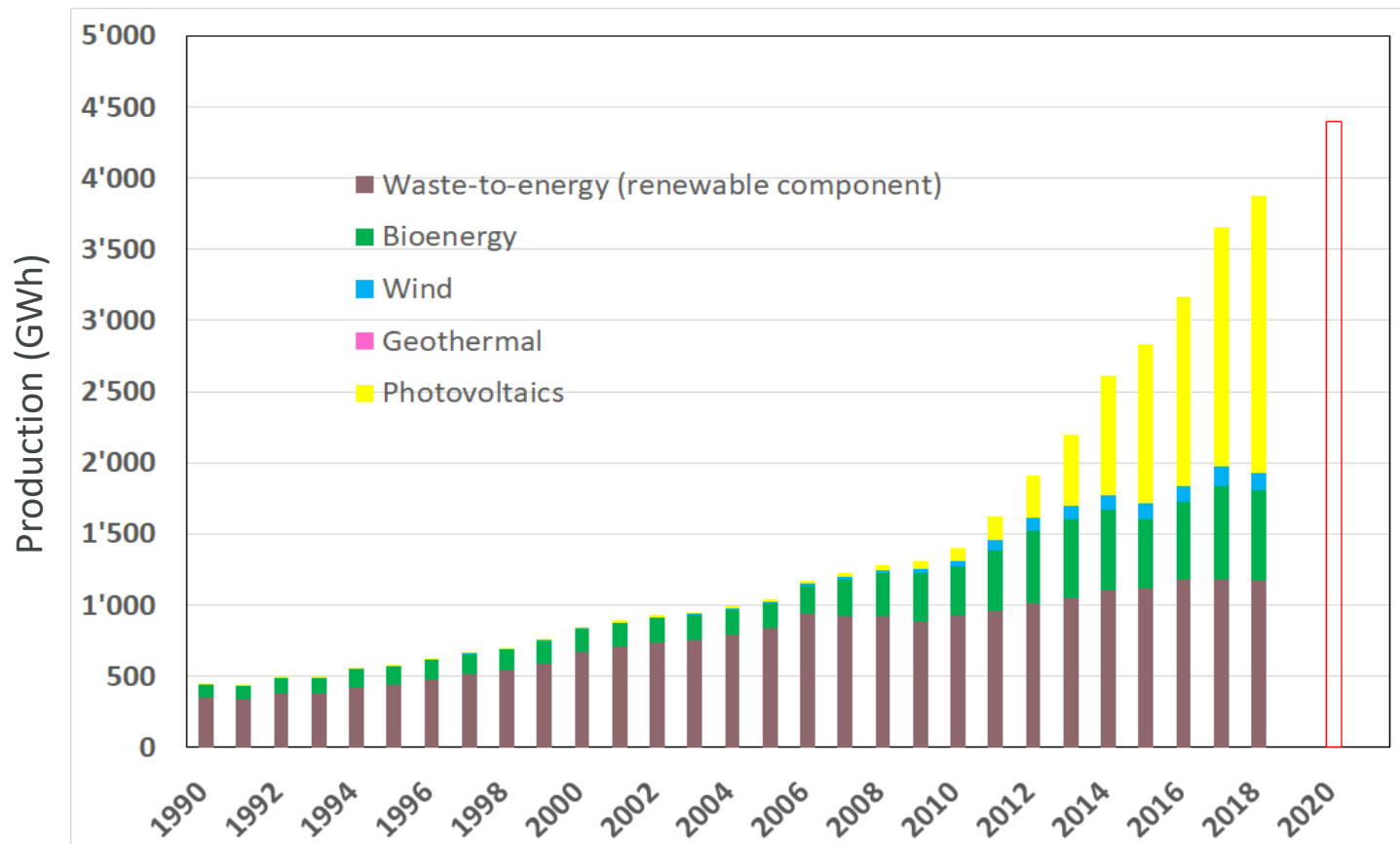


Development of per capita electricity consumption<sup>2</sup> since 2000 (indexed)

<sup>2</sup> Excluding statistical difference and agriculture



# ELECTRICITY PRODUCTION RENEWABLES (EX. HYDRO) - UPDATE



**Guideline 2035: 11'400 GWh  
(+ 465 GWh p.a.)**

Annual increases:  
2017: 486 GWh  
2018: 224 GWh

Short term-Guidelines are  
realistic and not challenging  
(+250 GWh p.a).

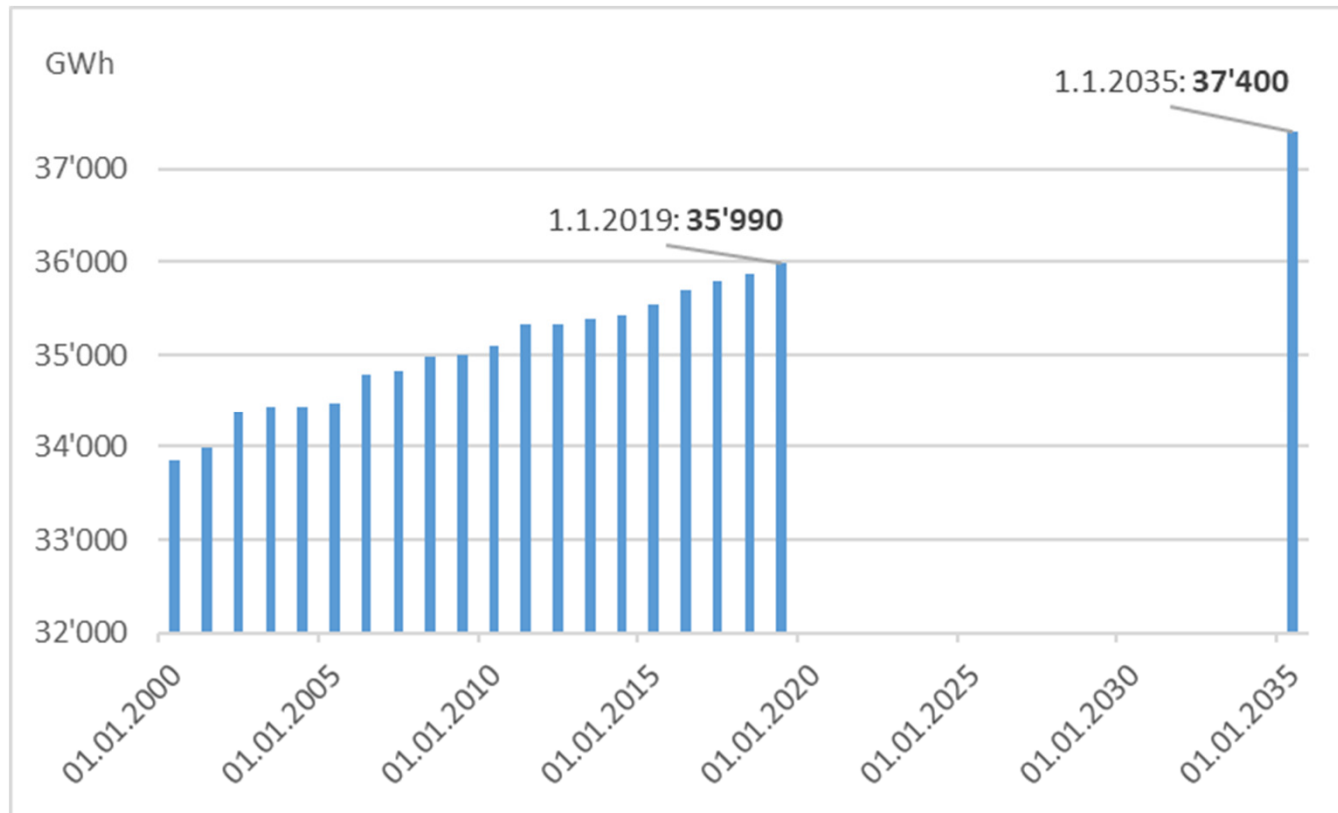
### SCCER-SoE:

- Geothermal is absent
- Possibly 5-30 GWh from Lavey and Haute-Sorne by 2025.



# ELECTRICITY PRODUCTION

## HYDRO POWER - UPDATE



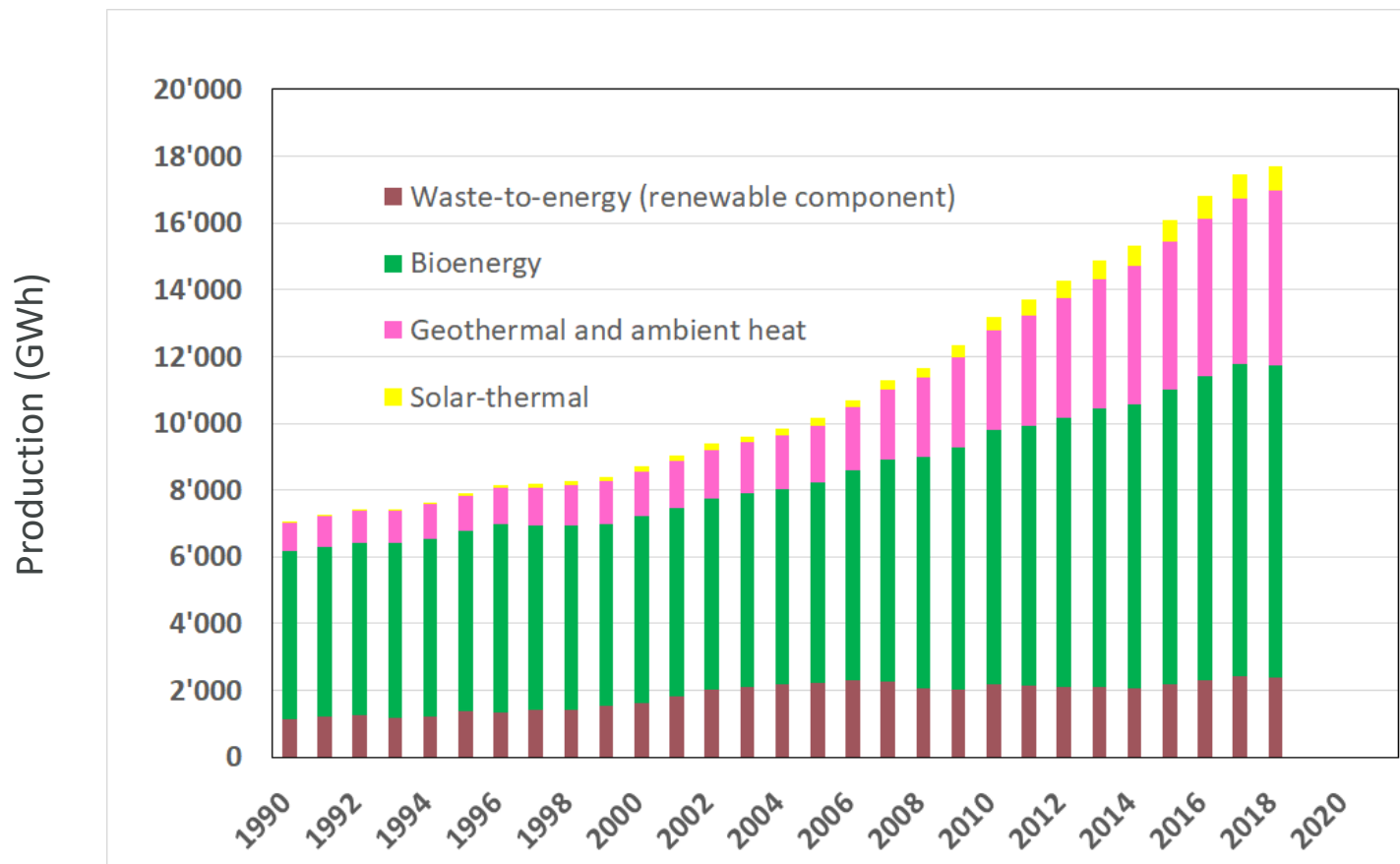
**Guideline 2035:**  
**+ 85 GWh p.a.**

### Recent SFOE- Report:

- Guidelines 2035 (still) manageable with actual potential
- Potential small hydro & residual water volumes relevant



# ADDITIONAL: HEAT SUPPLY RENEWABLES



## No numeric guideline

Annual increases:

2016-2017: 446 GWh

2017-2018: 235 GWh

Swiss Federal Office of Energy is currently working on a “heat and cooling strategy”

## SCCER-SoE:

- Shallow geothermal is doing well (80-300 GWh annual weather-adjusted growth)
- (Deep) geothermal will enter the picture – about 300 GWh in project pipeline



# GRID DEVELOPMENT

## ELECTRICITY NETWORK STRATEGY (IN FORCE 6/2019)

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- **Progress of grid extension** (especially grid level 1, «*electricity highway*»):  
Simplified phases of decision for network extension
- **Predefined cost overrun factors** for simplified acceptance of **placing cables underground** (*development of grid levels, 3, 5, 7 see back up; currently 86% of the grid is underground*) **to increase social acceptance**



# SECURITY OF SUPPLY

## DIVERSIFICATION SUPPLY, GROSS IMPORT SHARE, SYSTEM ADEQUACY

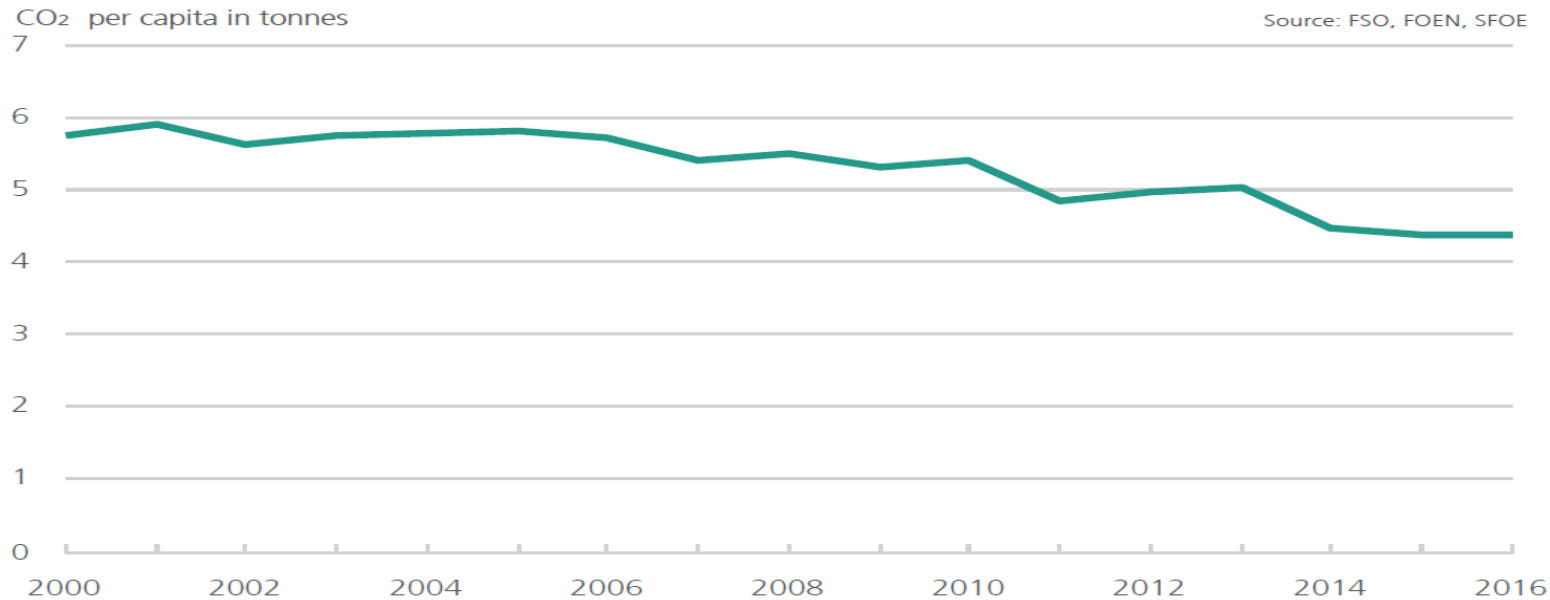
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- **Diversification of Energy Supply**
  - Petroleum ~ 50%, Electricity ~ 25%, Natural gas 14%
  - **Changes (compared to 2000):** Petroleum (-10%), Gas (+3%), Electricity (+2.5%), Wood & Charcoal (+1.3%), Other Renewables (+2.4%), District heating (+0.8%)
- **Import share gross energy consumption: 75.3 percent**
- **System adequacy (availability of electricity & transportation capacities)**
  - **SFOE** (ETH & UNIBAS): Security of supply non-critical until 2035 provided integration into the European electricity market. Update in autumn 2019.
  - **EICom:** Security of supply guaranteed for 2025 in probable scenario, even when some stressors are taken into consideration. Situation will become more strained in very extreme (and unlikely) stress scenarios.
  - **PLEF:** Study of Central-Western-Europe: no serious problems for CH (2023/24).



# CO2-EMISSIONS

## EMISSION PER CAPITA



Per capita CO<sub>2</sub> emissions from energy sources (in t CO<sub>2</sub> per capita)

**CO<sub>2</sub>-Emissions in TOTAL: 37 Mio. tonnes (2016) -10% (2000)**

**Shares: 41% Transport excl. air traffic, (-0.7 Mio. tonnes, but + 3%), 24% Households, 12% Service Sector**



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1. Guidelines

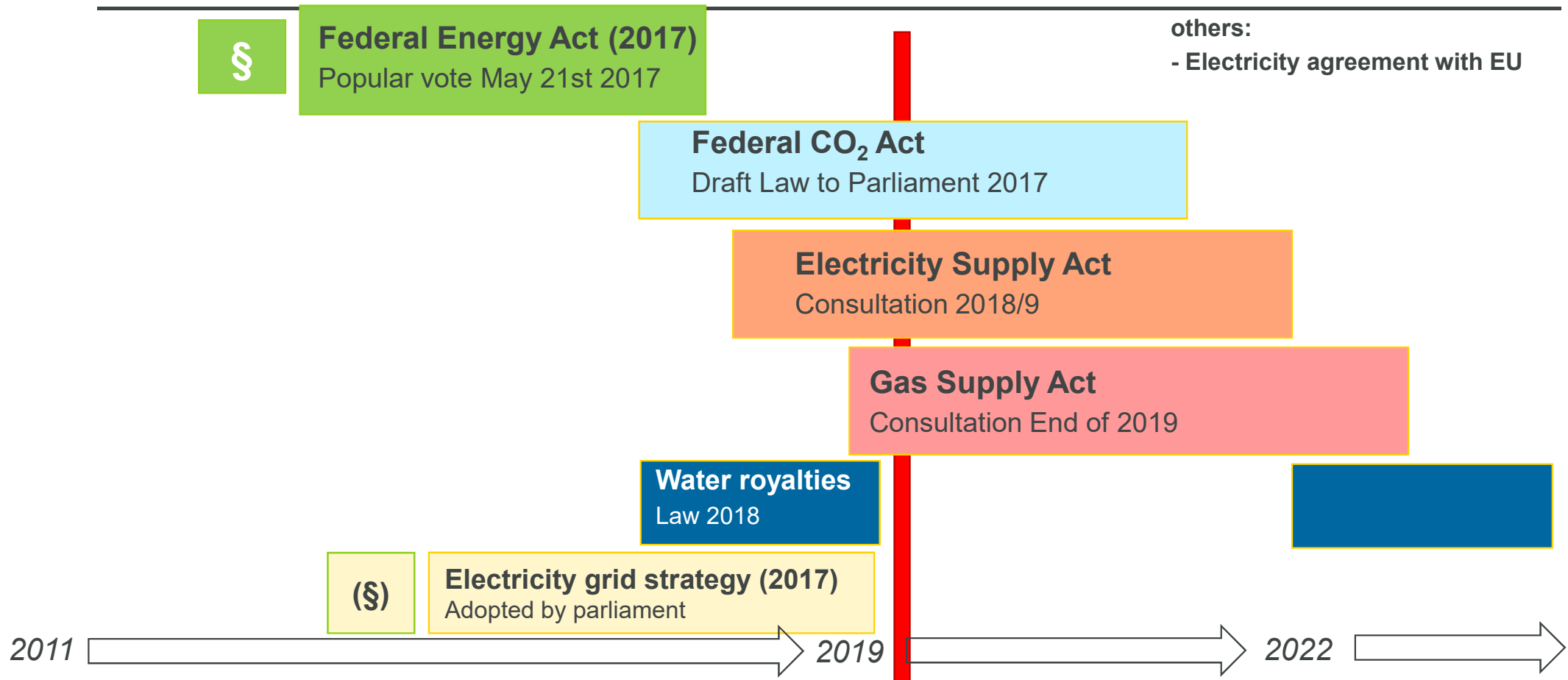
2. Where are we now?

**3. What comes next?**





# OVERVIEW OF POLITICAL AFFAIRS





# REVISION OF ELECTRICITY SUPPLY ACT

Version of  
Consultation

Aims	Measures in the revision
Security of Supply	Storage Reserve ( <i>for late months in winter</i> ) Default for basic supply ( <i>nudging of households energy-mix</i> )
Affordable prices & enhancing efficiency	Market Opening Sunshine Regulation ( <i>transparency instrument, Incentive Regulation</i> ) Regulation of flexibility ( <i>ownership rights, integration into network planning, peak shaving, differentiated contracts, ...</i> ) Network tarification ( <i>less energy related tariffs possible, dynamic tariffs</i> ) Measuring ( <i>market opening for industry &amp; large producers</i> )
Integration of renewables	Regulation of flexibility Default for basic supply
Growth of internal production & CO2-reductions	No topic ( <i>several inputs during consultation</i> )



# REVISION OF FEDERAL CO<sub>2</sub> ACT



## Measures transport sector

- Emission standards cars & light duty vehicles (e.g. 2021-24: 95g / 147g, 2025 - 29: following EU regulations)
- Increasing compensation fuel importers (*max 90%, min 15% in CH*)



## Measures buildings sector

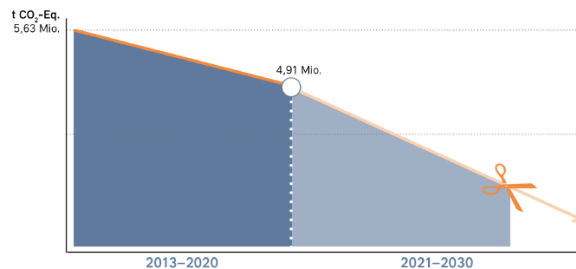
- Cantonal measures (“Gebäudeprogramm” financed by CO<sub>2</sub> levy, until 2025)
- Focus building refurbishment: Subsidiary introduction CO<sub>2</sub> emission limits buildings (by 2029, based on status 2026/27; until 2050 – 80%)



## Measures industry

- Emission trading (linking CH-EHS & EU-EHS, higher reduction of emission rights)
- Increase maximal CO<sub>2</sub> levy on fossil fuels (210 CHF)
- Technology fund (financed by CO<sub>2</sub>-levy)

*In discussion: airline ticket tax, new climate fund, emission standards heavy trucks, emission offset by electromobility, prolongation tax exemptions renewable fuels, ...*





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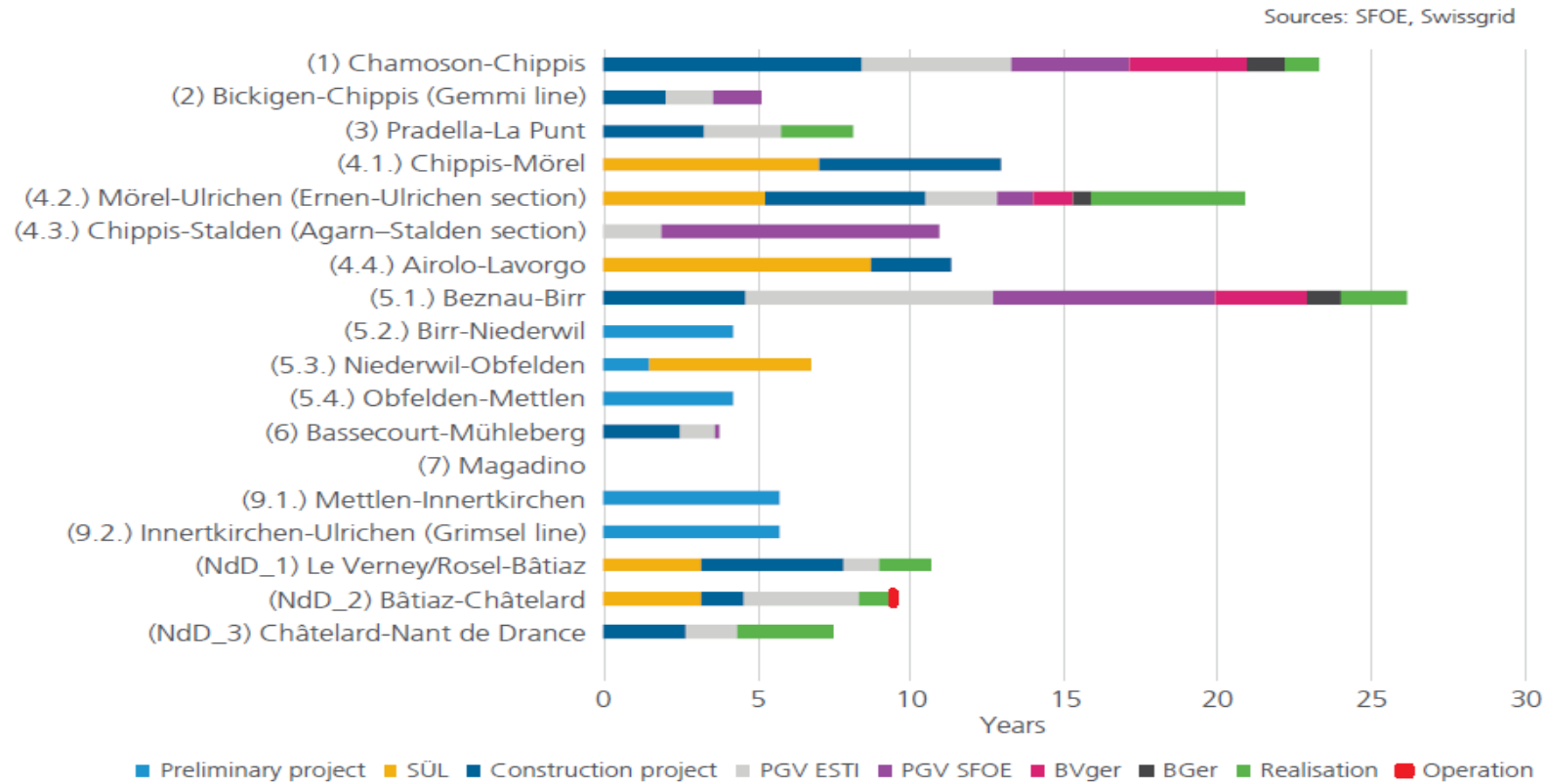
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Office fédéral de l'énergie OFEN  
Ufficio federale dell'energia UFE  
Swiss Federal Office of Energy SFOE



***THANK YOU FOR YOUR ATTENTION***

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# GRID DEVELOPMENT SWISSGRID (GRID LEVEL 1)



Accumulated duration of project phases of selected grid plans in years on grid level 1 as at 17 October 2018<sup>7</sup>



# OVERVIEW GRID PROJECTS

GRID PROJECT	DESCRIPTION AND MAIN AIMS	CURRENT STATUS <sup>5</sup>	PLANNED OPERATION <sup>6</sup>
<b>1. Chamoson–Chippis</b>	<ul style="list-style-type: none"> <li>New 30 km long 380 kV overhead transmission line between Chamoson and Chippis</li> <li>Dismantling of almost 89 km of power lines in the Rhone plain</li> <li>Transfer production from hydropower plants in Valais</li> <li>Improved connection between Valais and the Swiss and European high tension grid</li> <li>Contribution to grid security in Switzerland</li> </ul>	Realisation	2021
<b>2. Bickigen–Chippis (Gemmi line)</b>	<ul style="list-style-type: none"> <li>Modernisation of substations at Bickigen and Chippis and of the existing 106 km route by increasing current to 380 kV</li> <li>Installation of a 220/380 kV grid coupling transformer in the Chippis switchgear facility</li> <li>Improved transfer of electricity production from Valais</li> <li>Contribution to security of supply</li> </ul>	PGV SFOE	2021
<b>3. Pradella–La Punt</b>	<ul style="list-style-type: none"> <li>Increase voltage from 220 to 380 kV on existing 50 km route</li> <li>Modification of switchgear at Pradella and increase of voltage to 380 kV</li> <li>Elimination of existing bottleneck</li> <li>Contribution to Swiss and European grid security</li> </ul>	Realisation	2021
<b>4. Chippis–Lavorgo</b> 4.1. Chippis–Mörel 4.2. Mörel–Ulrichen (Gommer line) 4.3. Chippis–Stalden 4.4. Aiolo–Lavorgo	<ul style="list-style-type: none"> <li>Increase voltage to 380 kV on 124 km Chippis–Mörel–Lavorgo axis (Chippis–Stalden remains at 220 kV)</li> <li>Dismantling of existing lines over 67 km</li> <li>Supplements the main supply route for Ticino</li> <li>Elimination of a critical supply bottleneck</li> </ul>	4.1. Construction project 4.2. BVGer (Mörel–Ernen)/ Realisation (Ernen–Ulrichen) 4.3. PGV SFOE (Agarn–Stalden)/ Construction project (Chippis–Agarn) 4.4. Construction project	2024
<b>5. Beznau–Mettlen</b> 5.1. Beznau–Birr 5.2. Birr–Niederwil 5.3. Niederwil–Obfelden 5.4. Obfelden–Mettlen	<ul style="list-style-type: none"> <li>Optimisation of existing route over 40 km by increasing current to 380 kV and upgrading on a stretch of 24 km</li> <li>Elimination of a structural bottleneck</li> <li>Creation of the conditions needed to combine domestic hydropower plants with fluctuating energy from wind and photovoltaic plant to respond to demand</li> </ul>	5.1. Realisation 5.2. Preliminary project 5.3. SÜL 5.4. Preliminary project	2025

GRID PROJECT	DESCRIPTION AND MAIN AIMS	CURRENT STATUS <sup>5</sup>	PLANNED OPERATION <sup>6</sup>
<b>6. Bassecourt–Mühleberg</b>	<ul style="list-style-type: none"> <li>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</li> <li>Contribution to Swiss grid security and security of supply</li> </ul>	PGV SFOE	2025  From the end of 2019 technically ready for provisional change to 380 kV if required in compliance with the original authorisation for the line
<b>7. Magadino</b>	<ul style="list-style-type: none"> <li>Installation of transformers between the 220 kV and 380 kV grids</li> <li>The aim is to improve the transfer of energy generated in Maggiatal by hydropower</li> <li>Contribution to security of supply in Ticino</li> </ul>	Project idea	2024
<b>8. Génissiat–Foretaille</b>	<ul style="list-style-type: none"> <li>Upgrading of (replacement of cable) the existing 220 kV twin lines over a length of 17 km</li> <li>Eliminates frequent bottlenecks which occur for imports from France</li> </ul>	In operation	Concluded in 2018 and in operation
<b>9. Mettlen–Ulrichen</b> 9.1. Mettlen–Innertkirchen 9.2. Innertkirchen–Ulrichen (Grimsel line)	<ul style="list-style-type: none"> <li>Upgrade the existing 220 kV line over 88 km to cope with a future increase to 380 kV</li> <li>Important for the connection of new pump storage power plants to the 380 kV grid and transfer of energy to the rest of Switzerland</li> </ul>	Preliminary project	2030
<b>Anschluss Nant de Drance</b> NdD_1 Le Verney/Rosel–Bâtiaz NdD_2 Bâtiaz–Châtelard NdD_3 Châtelard–Nant de Drance	<ul style="list-style-type: none"> <li>Connection of pump storage power plant Nant de Drance to the high tension grid</li> <li>Part of the strategic grid in the Swissgrid initial grid</li> <li>Contribution to integrate new renewable energy sources</li> </ul>	NdD_1 Realisation NdD_2 in operation NdD_3 Realisation/ partly operational	2017–2019

Overview of grid projects, status and proposed date of operation (as at 17.10.2018)

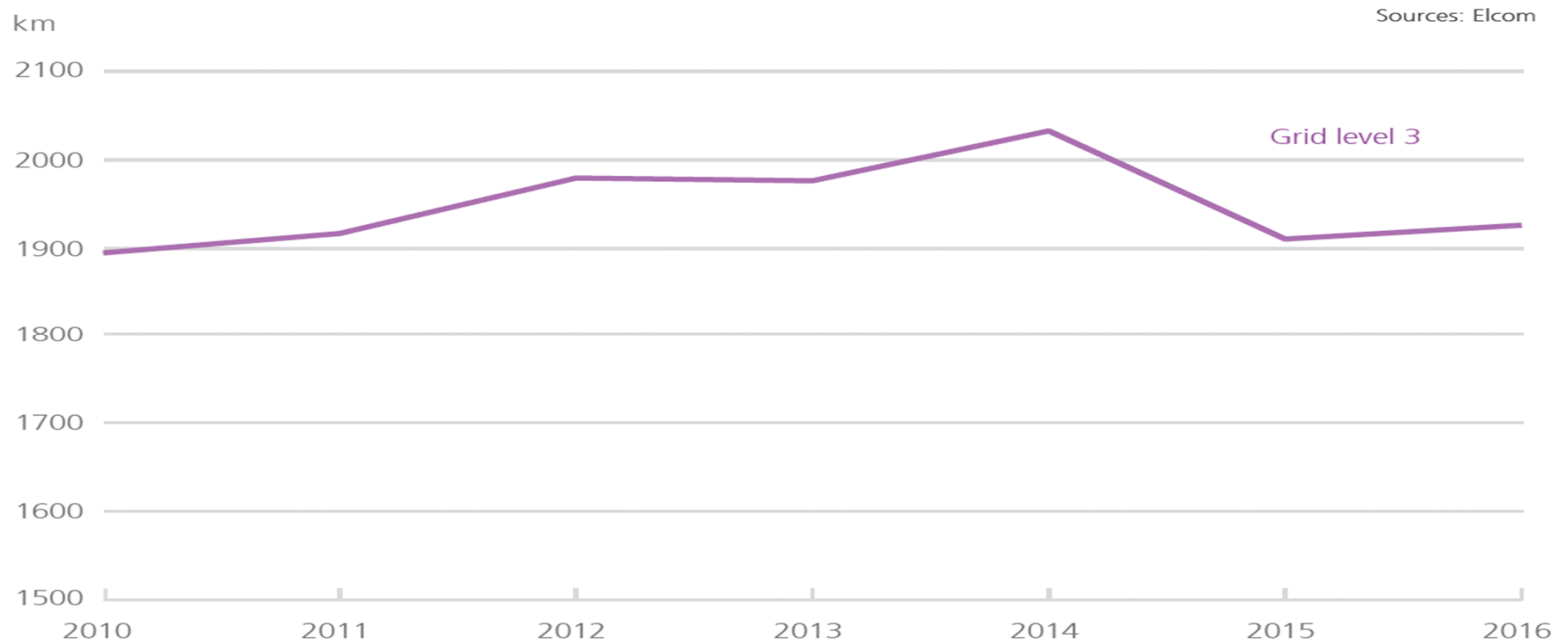
<sup>5</sup> As at 17 October 2018

<sup>6</sup> According to Swissgrid plans



# GRID DEVELOPMENT

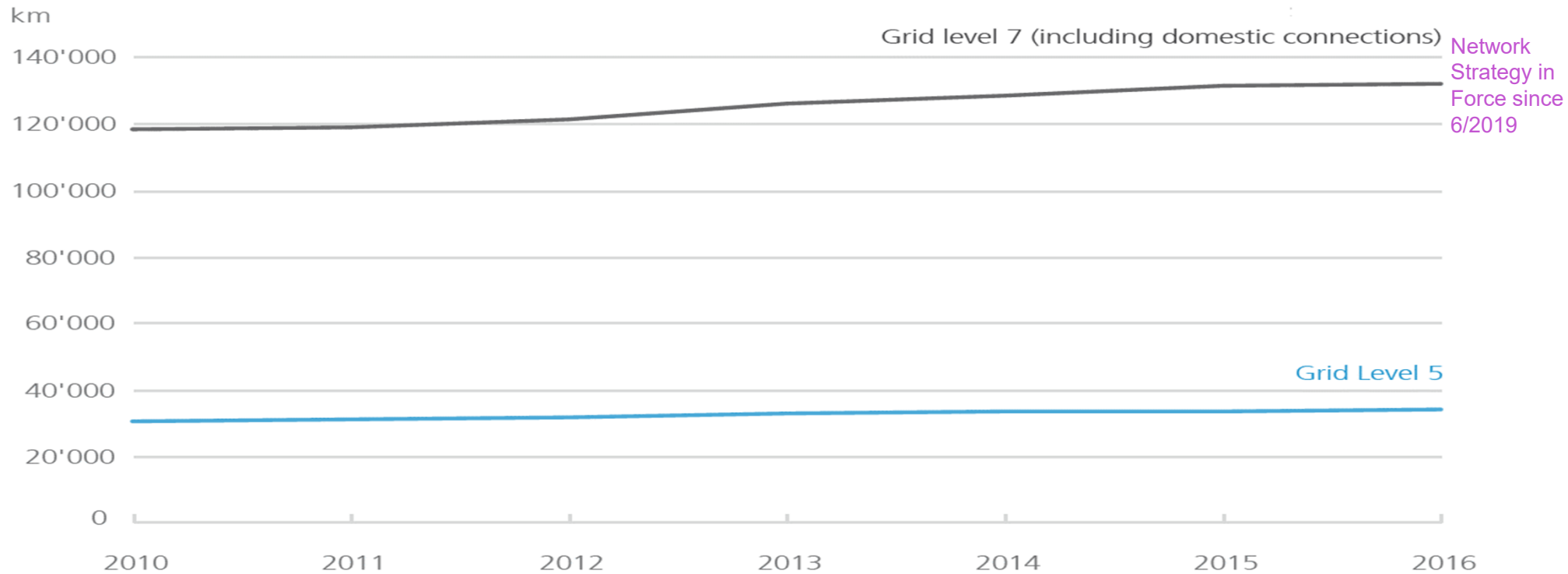
## PLACING CABLES UNDERGROUND (LEVEL3)





# GRID DEVELOPMENT

## PLACING CABLES UNDERGROUND (LEVEL 5 & 7)



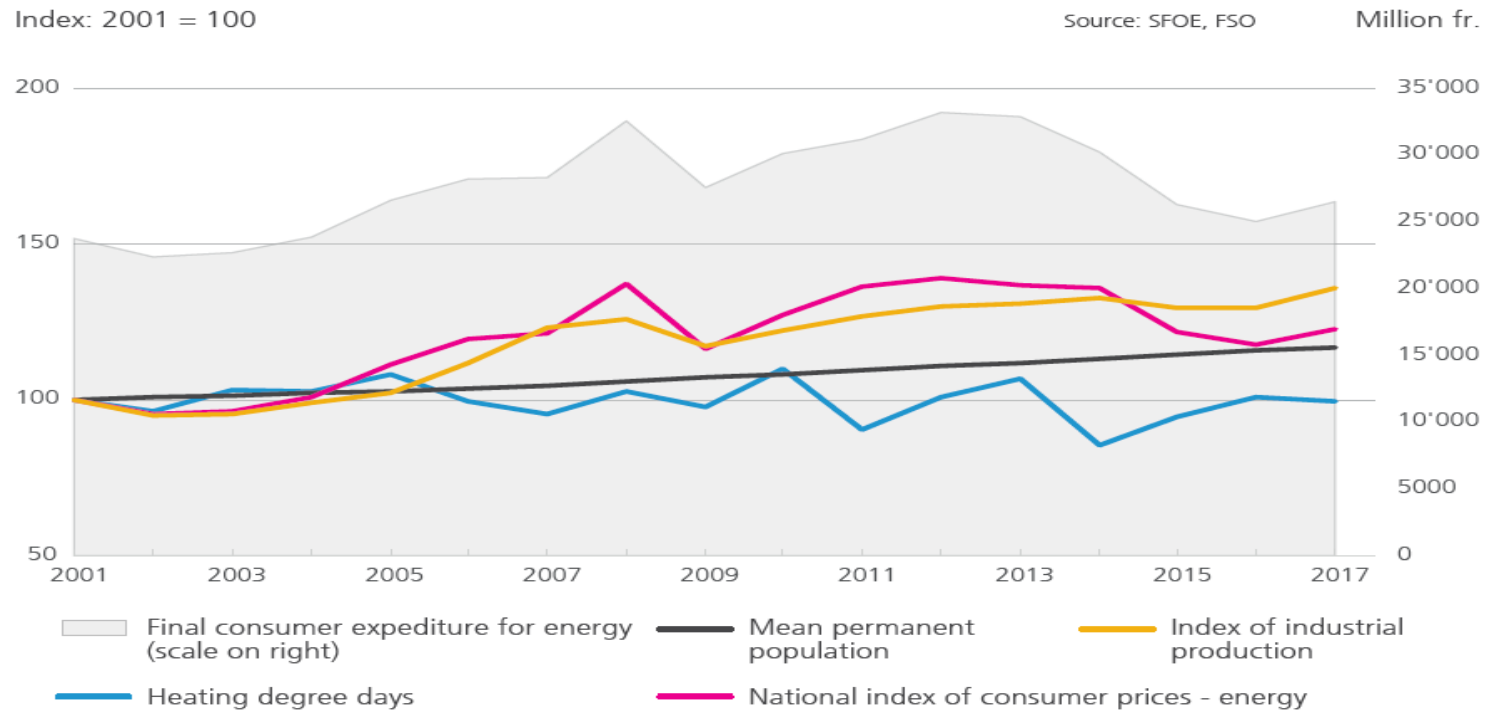
Inventory of cables in the distribution grid (in km)





# EXPENDITURES & PRICES

## FINAL EXPENDITURE FOR ENERGY



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



# EXPENDITURES & PRICES

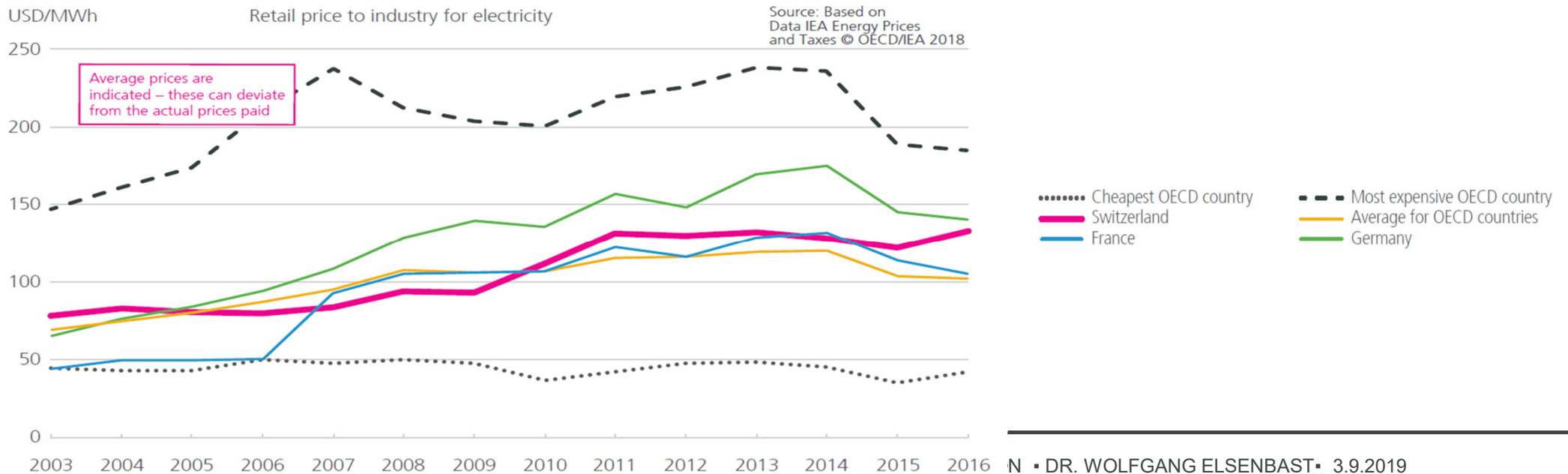
## ENERGY EXPENDITURES, RETAIL PRICES

### Expenditures for Energy

- 26.5 billion CHF (2017); + 0.7 % p.a. (23.8 billion CHF in 2000), GDP-share constant

### Prices

- Development of retail prices (electricity, gas, petrol prices, heating oil, diesel)





# CO<sub>2</sub>-EMISSIONS

## EMISSIONS FROM ENERGY SOURCES

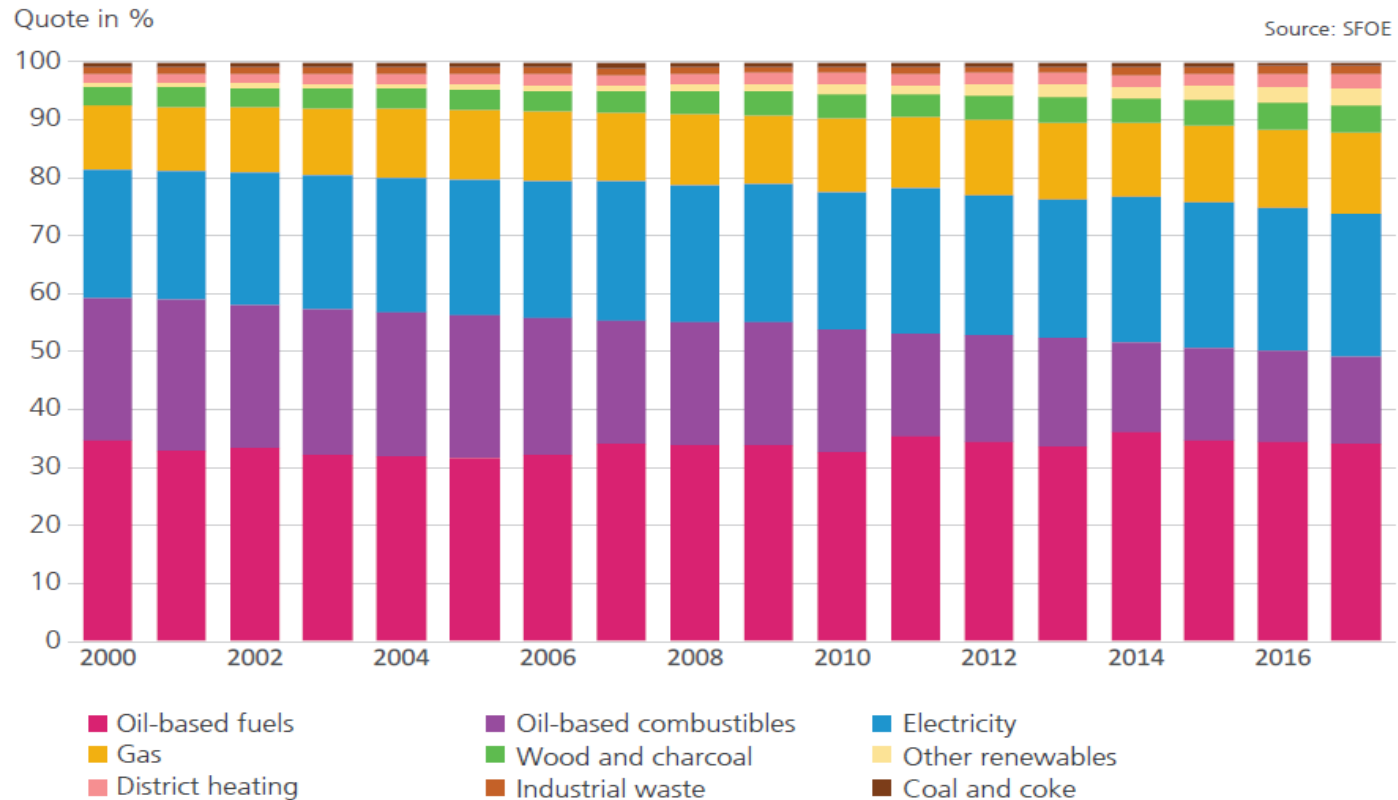


CO<sub>2</sub> emissions from energy sources in total and by sector (in million tonnes CO<sub>2</sub> excluding international air traffic)



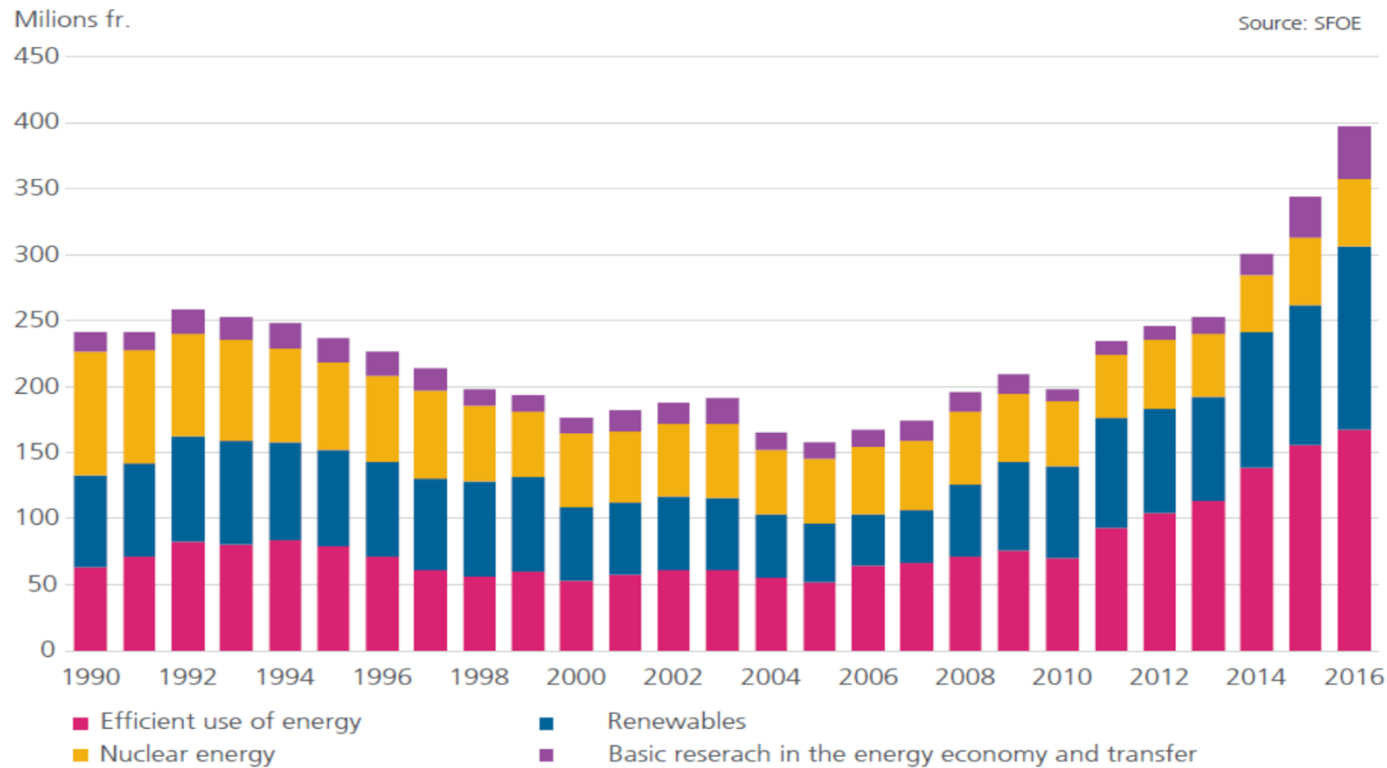
# SECURITY OF SUPPLY

## DIVERSIFICATION OF ENERGY SUPPLY





# ENERGY RESEARCH: PUBLIC INVESTMENT IN RESEARCH AND INNOVATION



Public expenditure for energy research by field of research (in million francs, actual sum)<sup>11</sup>

<sup>11</sup> Expenditure includes a share in overheads (indirect research costs) of the research institutes.