34 Switzerland

34.1 Major Developments in 2017

34.1.1 Swiss Energy Strategy 2050

Swiss population is sensitive and open-minded to the climate issue. On May 21, 2017 the population approved by vote the ”Energy Strategy 2050” to reduce energy consumption, increase energy efficiency and promote renewable energies under the motto ”Energy Strategy 2050”.

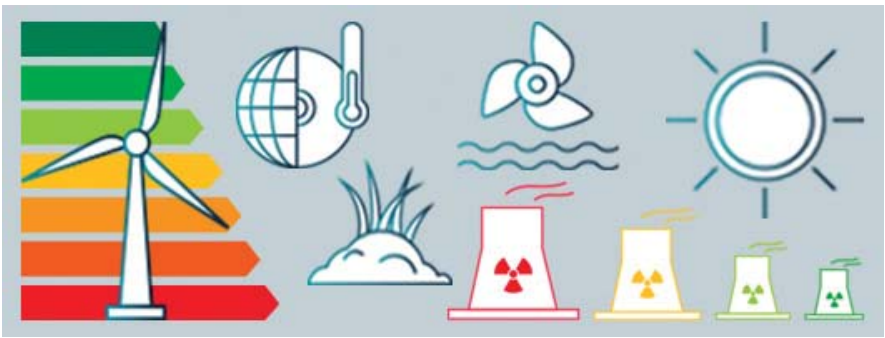

Figure 1: The first set of measures in the Swiss Energy Strategy 2050 (Source: SFOE)

Today Switzerland has a secure and cost-efficient supply of energy. Economic and technological developments as well as political decisions at home and abroad are currently leading to fundamental changes in the energy markets. In order to prepare Switzerland for these, the Federal Council has developed the Energy Strategy 2050. This should enable Switzerland to make advantageous use of the new starting position and maintain its high supply standard. At the same time the Strategy contributes to reducing Switzerland’s energy-related environmental impact[72].

[72] www.bfe.admin.ch/energiestrategie2050/index.html?lang=en&dossier_i

34.1.2 Swiss Population's Travel Behavior

The Microcensus on Mobility and Transport provides information on the mobility behavior of the Swiss population: possession of vehicles, driving licenses and public transport subscriptions, daily traffic volume, traffic purposes and use of transport modes. The data collected provide a detailed picture of passenger transport in Switzerland. They serve as a statistical basis for the preparation and validation of policy measures, but also as input for in-depth analyses of traffic development.

On average, each Swiss resident covered a daily distance of just under 37 kilometers within Switzerland in 2015. The majority of this (65 %) was covered by passenger cars. The most common reason for using transport (accounting for 44 % of the daily distances travelled) was leisure activities, followed by work (24 %).

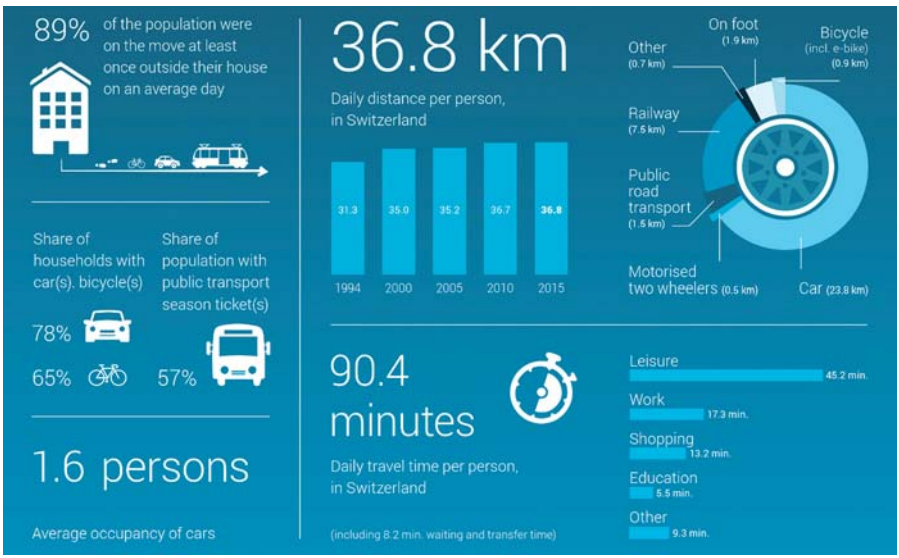

Figure 2: Swiss Population Mobility 2015 (Source: FSO, ARE)

34.1.3 Update on Swiss Regulations

CO_2 Emission Regulations

Since 2012, CO_2 emission regulations for new passenger cars have been in force in Switzerland in the same way as in the EU: by 2015, the average emissions of passenger cars registered for the first time on the roads should have been reduced to 130 grams of CO_2 per kilometer. At 134 grams of CO_2 per kilometer, this target was also slightly exceeded in 2016.

In the next stage, Switzerland, like the EU, will gradually reduce the CO_2 target for new passenger cars to 95 grams per kilometer from 2020 and introduce new targets for delivery vans and light articulated lorries (147 grams CO_2 per kilometer). In Switzerland, these values are to be reached in full by the end of 2023. Until the end of 2022, vehicles with a maximum of 50 grams of CO_2 per kilometer are subject to so-called supercredits, i.e. they are credited several times, and a small part of the fleet is still exempt from meeting the target (phasing-in). The relevant laws and regulations came into force on January 1, 2018.

News on the Energy Label for Passenger Cars

The new energy label classifications for passenger cars have been in force since January 1, 2018. In addition, the following points are new:

The average CO_2 emissions of all passenger cars registered for the first time in 2018 will now be 133 grams per kilometer instead of 134 grams as in 2017 – New is the energy label for cars driving on hydrogen, such as fuel cell vehicles. For the calculation of the gasoline equivalent, the CO_2 emissions from the pre-processes and the primary energy gasoline equivalents, the production path of the mix, which can be obtained at the two hydrogen filling stations open to the public in 2017, is used.

Revised National Road Regulation

The approximately one hundred rest areas (with WC and partly a snack bar) along the national roads are under the sovereignty of the federal government. Under previous law it was not possible to set up quick charging stations here. With the entry into force of the revised National Roads Ordinance on January 1, 2018, the Federal Roads Office is now obliged to create the technical conditions to enable the construction and operation of plants for the supply of alternative means of propulsion.

In order for the charging station network along the national roads to be completed quickly, it is important to provide a power supply with the necessary connections. The federal government supports this because - unlike the rest areas - there are no shops or restaurants with which the business model could be combined. The revised Federal Ordinance does not result in any changes for service areas under the sovereignty of the cantons. Quick charging stations are still possible.

New Energy Law Allows Private Energy Consumption Groups

On January 1, 2018, the “regulations for associations for own consumption” of electricity produced in-house came into force with the totally revised Energy Act.

The regulations create legal certainty and should encourage the formation of self-consumption communities. This is of interest to electric car owners, among others, who want to operate their vehicles with solar power they produce themselves.

34.1.4 SCCER Study

The SCCER Study[73] "Towards an Energy Efficient and Climate Compatible Future Swiss Transportation System" analyzes the status and structure of the Swiss transport system and sketches possible paths for its evolution towards an energy efficient, climate compatible and environmentally friendly mobility future. The report was motivated by the need to provide strategic directions, primarily to the research carried out within the Swiss Competence Center for Energy Research - Efficient Technologies and Systems for Mobility (SCCER Mobility). Moreover, it aims to communicate insights from engineering/natural as well as social/economic sciences to policy makers, opinion leaders and the interested public in general. It serves as a platform for reflection and synthesis of views from a variety of disciplines.

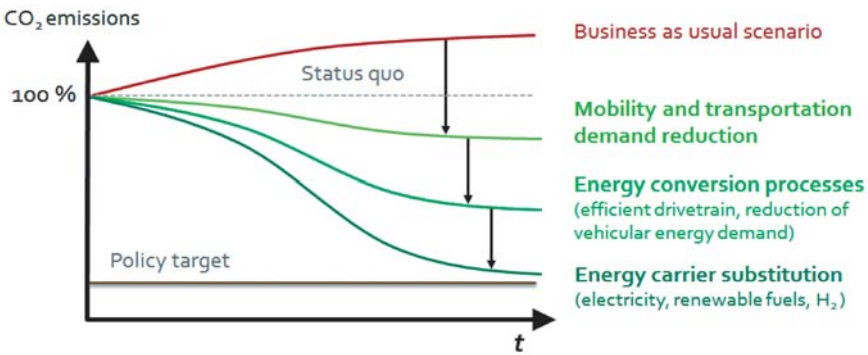

Figure 3: A systemic approach towards minimization of CO_2 emissions from transport must use synergetic efforts on both the demand and supply side (Source: SCCER)

In accordance with the Swiss Energy Strategy 2050 and recognizing the importance of the overarching goal of climate change mitigation, we focus on energy demand and in particular on CO_2 emissions as a proxy for the overall sustainability of future mobility. The core of our analysis concentrates on road transport, as it is the dominant contributor to both energy demand and CO_2 emissions of the Swiss transport sector. We focus on motorized individual transport, which accounts for about two-thirds of CO_2 emissions stemming from transportation, and in selected cases, we comment on the development of the even

[73] http://sccer-mobility.ch/export/sites/sccer-mobility/capacity-areas/dwn_capacity_areas/TowardsAnEnergyEfficientSwissTransportationSystem_Ver1.2.pdf

faster growing freight transportation sector as well. However, the report does not closely consider international aviation – despite its growing worldwide importance – since corresponding policy is a matter of international cooperation. Closer consideration of this mode will be important in the future.

34.1.5 Market Trends 2017 on Energy Efficient Vehicles by Swiss Energy

The edition 2017 of Market Trends on energy efficient vehicles by swiss energy, an initiative of the Swiss Federal Office of Energy SFOE, has been elaborated again by e'mobile, a division of Electrosuisse specialized on efficient mobility[74]. This yearly publication focusses on category "A" energy efficient cars that emit a maximum of 95 grams of CO_2 per kilometer. CO_2 emission regulations for new cars and light commercial vehicles: like the EU, Switzerland introduced CO_2 emission regulations for new cars in July 2012. The average level of emissions from cars registered in Switzerland for the first time may not exceed 130 grams of CO_2 per kilometer. This level is applicable until the end of 2019. With effect from 2020, a target level of 95 grams of CO_2 per kilometer will apply for cars.

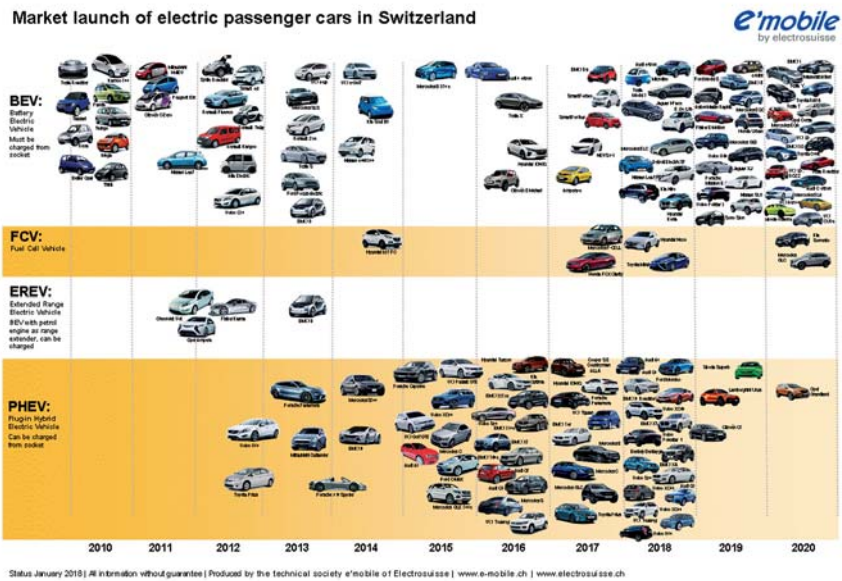

Figure 4: Market launch of electric passenger cars in Switzerland as of January 2018. (Source: e-mobile.ch)

[74] https://e-mobile.ch/media/76/download

In the editorial of this yearly publication, Benoît Revaz, Director of the Swiss Federal Office of Energy (SFOE) emphasizes on the most important trends in the field of the efficient mobility: Electrification of the drive train - new forms of shared mobility - autonomous driving cars - potential of data and information in the always connected vehicles.

34.1.6 Electric Mobility Guideline for Communes by Swiss Energy

Road traffic in Switzerland is today almost completely dependent from fossil energy sources and responsible for over a quarter of the Swiss energy consumption. The Swiss "Energy Strategy 2050" aims, among other things, to increase energy efficiency and through that reduce the total energy consumption while at the same time reducing emissions of CO_2 and generally speaking air pollution.

Electric mobility is one way of achieving these goals, as electric motors are highly efficient compared to internal combustion engines. When using renewable energies, it can help to reduce dependence on fossil fuels and local emissions of air pollutants, greenhouse gases and noise. Electric mobility does indeed lead to an increased demand for electricity. However, thanks to its electricity mix with a high proportion of renewable energy sources, the conditions for meeting this demand on a sustainable basis are favorable in Switzerland.

In addition to the federal government and cantons, cities and municipalities can also make the transition from fossil fuel based road traffic towards energy-efficient and climate-friendly road traffic. They thus make a contribution to achieving Switzerland's ambitious energy and climate policy goals.

This guide shows cities and municipalities what they can do in the field of electric mobility. This includes proposals for measures, practical examples and information on further information and contact points. The guide is aimed at decision-makers in cities and municipalities and internal administrative experts in the fields of energy, transport, environment, construction and spatial planning[75].

34.1.7 New Head at e'mobile by Electrosuisse

One of the leading organizations in Switzerland pushing the electric mobility is e'mobile by Electrosuisse, a neutral specialist unit for efficient mobility. e'mobile has been strongly committed to the market launch of low-consumption and low-emission vehicles (road shows in the communities with car-explainers and cross-

[75] https://www.energieschweiz.ch/page/de-ch/Elektromobilitaet---Ein-neuer-Leitfaden-fuer-Staedte-und-Gemeinden

brand test drives, joint stand with partners from the industry at the Geneva International Motor Show) for decades with a wide range of measures in cooperation with the industry. Claudio Pfister, new head at e'mobile by electrosuisse, has taken over his responsibilities as of April 1, 2017.

34.2 HEVs, PHEVs and EVs on the Road

In 2017, a total of 412,827 new road vehicles were registered in Switzerland. This is 0.5 % less than in 2015. The total stock has increased to over 6 million vehicles (+1.2 %), 76 % of which were passenger cars. 4,985 new BEVs and EREVs were registered which is almost 40 % more than in the previous year and a market share of 1.6 % of passenger cars. This compares to 11,812 new gasoline-electric and diesel-electric HEVs and PHEVs (+24.2 %). However, with a market share of 3.8 % they are still a long way from the mass market.

The best sold BEV, as in the years before, is Tesla Model S (1,128), followed by Tesla Model X (824), Renault ZOE (741), BMW i3 (699) and Opel Ampera-e (397).

Only 1,001 e-scooters and motorcycles including three and four wheeled vehicles were sold in 2017, which is again less (-28 %) than in the year before. The best-selling e-model was once again the three wheeled Kyburz DXP (253 vehicles, -51 %) with Swiss Post being its major customer. Second best selling was Vengo V100 with 83 vehicles (-58 %).

34.3 Charging Infrastructure or EVSE

By the end of 2017, about 2,000 public charging locations with a total of over 5,000 charging points were registered in the Swiss national database. There were over 1,500 Type 1 and Type 2 AC-locations with 1 to 3 EVSEs each and 436 fast charging points (CHAdeMO, CSS, Tesla Superchargers).

The Swiss charging infrastructure is still built and operated almost exclusively by the private sector.

Three major developments have been observed in 2017:

- **MOVE**: The MOVE charging networks is one of the biggest players in Switzerland. Their new MOVE network gives access to 620 stations throughout Switzerland and is compatible to 1,600 further stations in Switzerland and 20,000 stations all over Europe. A smart phone app easily directs the user to the next free charging station. The customer gets access either by a prepaid system or by subscription and is benefitting from a support service around the clock.

- **evpass**: Green Motion is further expanding the ”evpass” charging stations network together with partners including McDonald’s, Aldi, Parking Zurich, Avia service stations, the energy utility SAK in St. Gall and others. Their installed charging stations counts 791 and Green Motion plans to increase this number to over 3,000 stations by the end of 2020.
- **GOFAST** opened its first high performance charging station (150 kW / 1,000 V) in alliance with Energy 360° that allows charging all electric vehicles capable for fast charging, through the special DC-Type-2-Plug even for Teslas. GOFAST is a founding member of the European Open Fast Charging Alliance that owns and operates more than 500 fast chargers in six countries.
- **Plug’n’Roll**, the charging network of RePower and its partners focusses not only on the public charging infrastructure, but also on companies and private locations to combine them all into a performing charging network counting over 1,000 locations throughout Europe today.

Table 1: Information on charging infrastructure in 2017 in Switzerland

Charging Infrastructure on 31 December 2017	
Chargers	**Quantity**
AC Level 1 Chargers	334
AC Level 2 Chargers	1,180
Fast Chargers	162
Superchargers	13
Inductive Charging	n.a.
Totals	**1,689**

34.4 EV Demonstration Projects

34.4.1 Race for Water Catamaran

The Swiss catamaran, which will circumnavigate the earth for the second time between 2017 and 2021 using only renewable energies (solar energy, wind, hydrogen) in order to draw attention to the pollution of the oceans and to demonstrate as a floating laboratory that innovative technological developments can protect the oceans.

34.4.2 E-Dumper

At the beginning of 2018 the E-Dumper has left the factory to head for its defined operation. The Swiss industry develops locomotives, aerial cableways, trolley

buses, construction machines, agricultural and military vehicles, as well as electric vehicles and aircraft. The research, development and marketing of heavy electrical transport and construction machines should be added to this tradition. A fully laden Komatsu e-Dumper from Kuhn Schweiz AG (total weight 111 tons) transports 60 tons of lime and marl from the high-elevation extraction area to the permanently installed transport system. Energy recovered on the downhill (laden) run is stored in batteries, provided by Lithium Storage GmbH, and is used to power the uphill run, and the surplus is fed into the electricity grid. With a history of constructing electric goods vehicles, Kuhn Schweiz AG is defining a new goal: the development, construction and marketing of electrified 100-tonne+ construction machines[76].

Figure 5: Race for Water Catamaran (Source: raceforwater.org)

Figure 6: E-Dumper in action (Source: edumper.ch)

[76] http://odyssey.raceforwater.org

Lithium Storage GmbH and Kuhn Schweiz Ltd built the world's largest battery-powered tipper truck, based on the Komatsu 605-7. The e-dumper is not only the world's largest electric vehicle, it also has the largest battery (600 kWh) ever installed in a vehicle. A comparable diesel vehicle consumes between 50,000 and 100,000 liters of diesel per year and emits 131 to 262 tons of CO_2. Never before has it been possible to save as much CO_2 by replacing a single vehicle by an electric one. The e-dumper can even be operated as a plus energy vehicle. It can generate more energy by driving downhill fully loaded than it consumes driving uphill without a load.

30.4.3 SBB Green Class

After the successful testing of their new mobility concept "SBB Green Class" in a one year pilot project, which combines individual and public transport by customized door-to-door transport at a flat rate of 12,200 CHF (11,100 EUR) per year, SBB has decided to extend the pilot to an offering for the public with different options. The participants od the pilot got a 1st class annual train pass for unlimited travel, annual subscriptions to the PubliBike cycle scheme for 900 bicycles and e-bikes at 100 locations, Mobility car sharing for 2,900 cars at 1,460 locations and the yearlong use of a BMW i3. The fully insured electric car comes with a charging port at home and an annual parking pass for car parks at Swiss rail stations. ETH Zurich monitored the participants' movements by a smart phone app, allowing researchers to analyze how and when Green Class participants use the various means of transport included in the pass[77].

Figure 7: SBB Green Class advertisement picture (Source: sbb.ch)

[77] https://www.sbb.ch/en/travelcards-and-tickets/railpasses/greenclass.html

Table 2: Distribution and sales of EVs, PHEVs and HEVs in 2017 (Data source: Swiss Federal Statistical Office and Swiss Federal Office of Energy). In Switzerland, the fleet totals are available only as of 30 September, whereas total sales are reported for the full calendar year (1 January through to 31 December)

Fleet Totals on 30 September 2017					
Vehicle Type	**EVs**	**PHEVs**	**HEVs**	**FCVs**	**Total[6]**
2- and 3-Wheelers[1]	n.a.	n.a.	n.a.	n.a.	712,734
Passenger Vehicles[2]	14,539	n.a.	n.a.	n.a.	4,570,823
Buses and Minibuses[3]	n.a.	n.a.	n.a.	n.a.	73,814
Light commercial vehicles[4]	n.a.	n.a.	n.a.	n.a.	363,131
Medium and Heavy Weight Trucks[5]	n.a.	n.a.	n.a.	n.a.	53,370
Totals without bicycles	**14,539**	**n.a.**	**n.a.**	**n.a.**	**5,790,287**

Total Sales during 2017					
Vehicle Type	**EVs**	**PHEVs**	**HEVs**	**FCVs**	**Total[6]**
2- and 3-Wheelers[1]	n.a.	n.a.	n.a.	n.a.	45,894
Passenger Vehicles[2]	4,773	3,402	8,410	2	315,032
Buses and Minibuses[3]	n.a.	n.a.	n.a.	n.a.	5,607
Light commercial vehicles[4]	n.a.	n.a.	n.a.	n.a.	32,794
Medium and Heavy Weight Trucks[5]	n.a.	n.a.	n.a.	n.a.	4,705
Totals without bicycles	**n.a.**	**n.a.**	**n.a.**	**n.a.**	**405,514**

n.a. = not available

[1] UNECE categories L1-L5

[2] UNECE categories M1

[3] UNECE categories M2-M3

[4] UNECE categories N1

[5] UNECE categories N2-N3

[6] Including non-electric vehicles

Table 3: Available vehicles and prices

Market-Price Comparison of Selected EVs and PHEVs in Switzerland	
Available Passenger Vehicles	**Untaxed, Unsubsidized Sales Price (in EUR)**
Audi A3 e-tron PHEV	39,400
BMW i3 (18.8kWh) BEV	33,500
BMW i3 REX	39,400
Citroën C0 (14.5kWh) BEV	20,500
Hyundai Nexo FCV	60,800
Hyundai Ioniq (28kWh) BEV	33,600
Hyundai Kona (64kWh) BEV	32,600
Jaguar I-Pace (90kWh) BEV	75,300
Kia Soul (27kWh) BEV	33,500
Mercedes B 250 e (28kWh) BEV	33,500
Micro Microlino (8kWh) BEV	12,000
Mitsubishi i-MiEV (16kWh) BEV	20,000
Mitsubishi Outlander PHEV	36,300
Nissan Leaf (40kWh) BEV	32,500
Nissan e-NV200 Evalia (40kWh) BEV	40,000
Opel Ampera-e (60kWh) BEV	47,900
Peugeot iOn (14.5kWh) BEV	20,500
Renault Twizy (6.1kWh) BEV	10,500
Renault Zoe (41kWh) BEV	32,000
Renault Kangoo Z.E. (33kWh) BEV	25,200
Renault Master Z.E, (33kWh) BEV	53,600
Smart Fortwo EQ (17.6kWh) BEV	21,700
Smart Fortfour EQ (17.6kWh) BEV	22,600
Tesla Model S (75kWh) BEV	72,900
Tesla Model X (75kWh) BEV	77,800
Toyota Mirai FCV	81,700
Volvo V60 PHEV	65,500
Volvo XC90 PHEV	84,800
VW e-up! (18.7kWh) BEV	27,200
VW e-Golf (35.8kWh) BEV	36,100
VW Golf GTE PHEV	42,800