Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

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

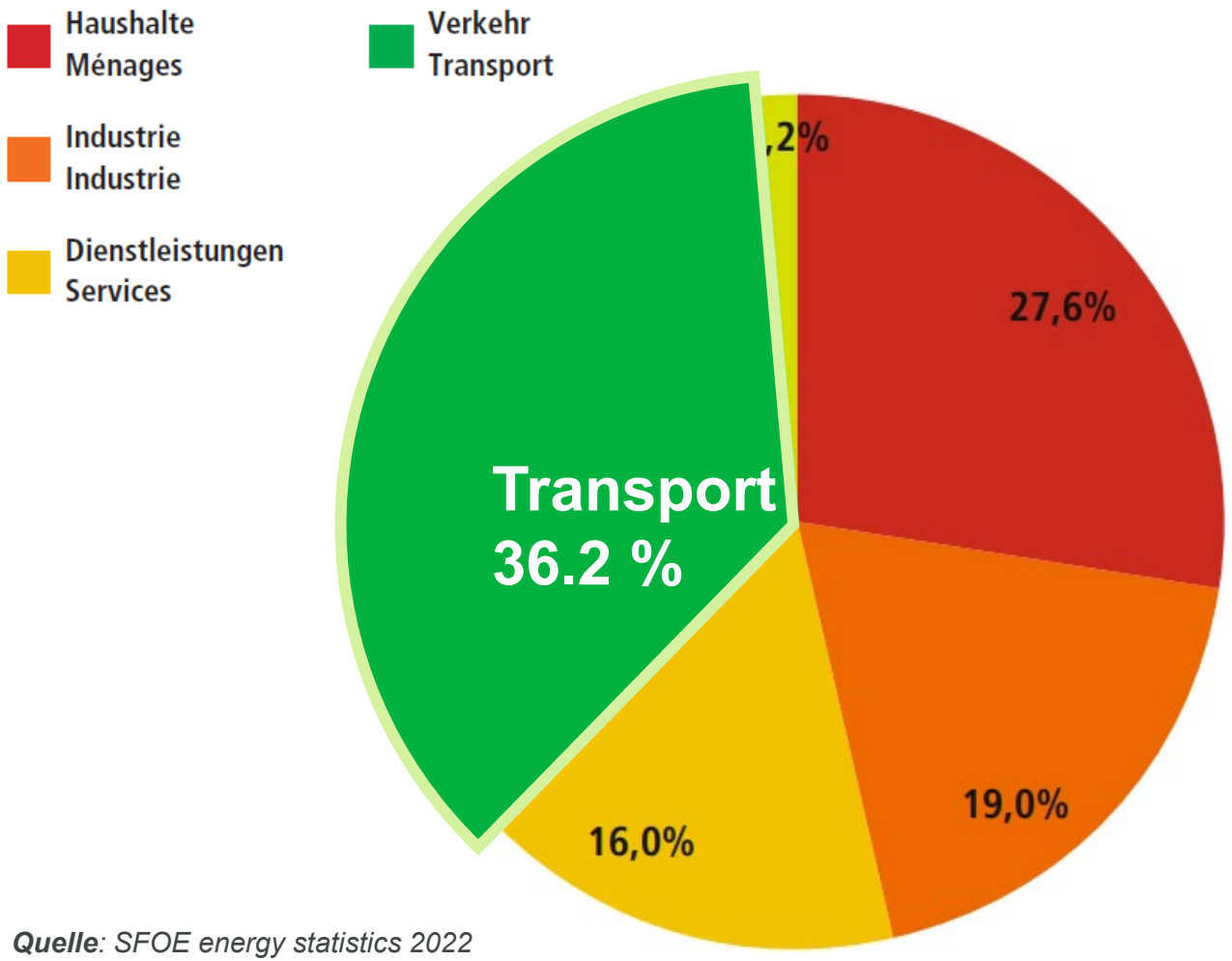
Powering electric mobility

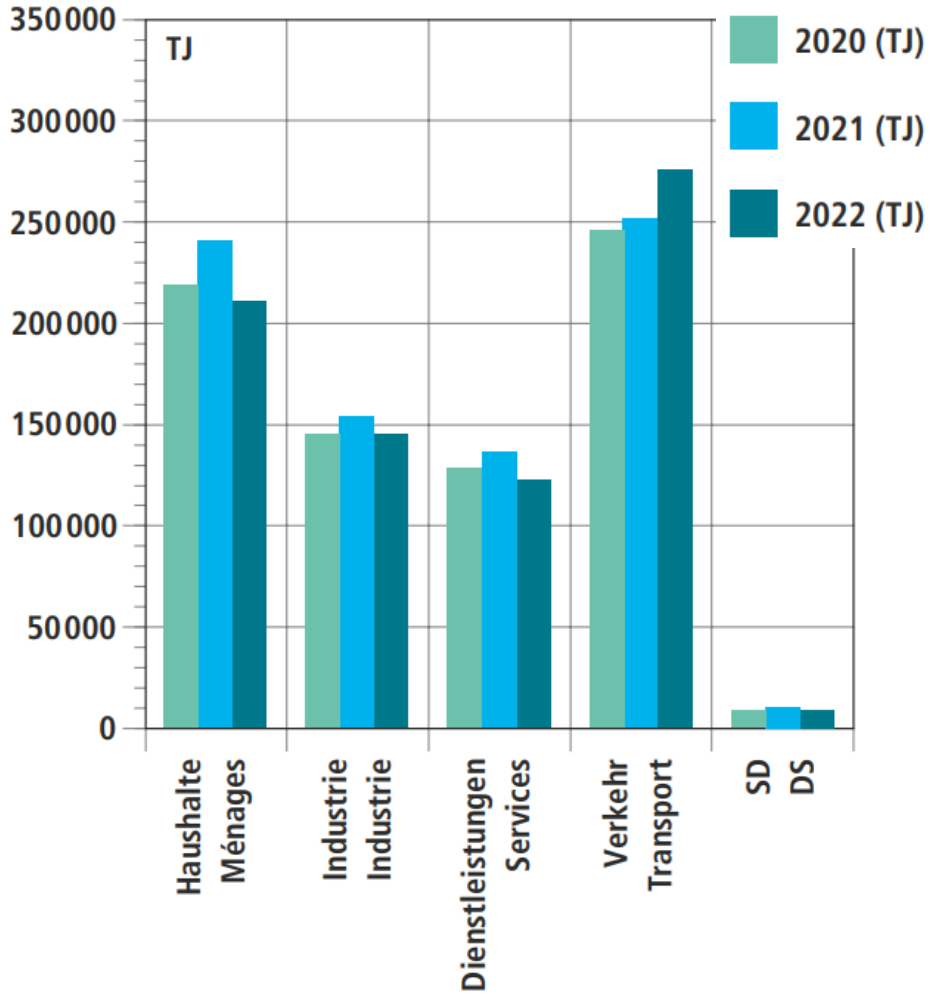
Grid integration and convergence of EV and PV

Dr. Luca Castiglioni · Energy Research & Cleantech · SFOE

CSFM Seminar, 19.03.2024

FINAL ENERGY DEMAND (SECTORIAL)

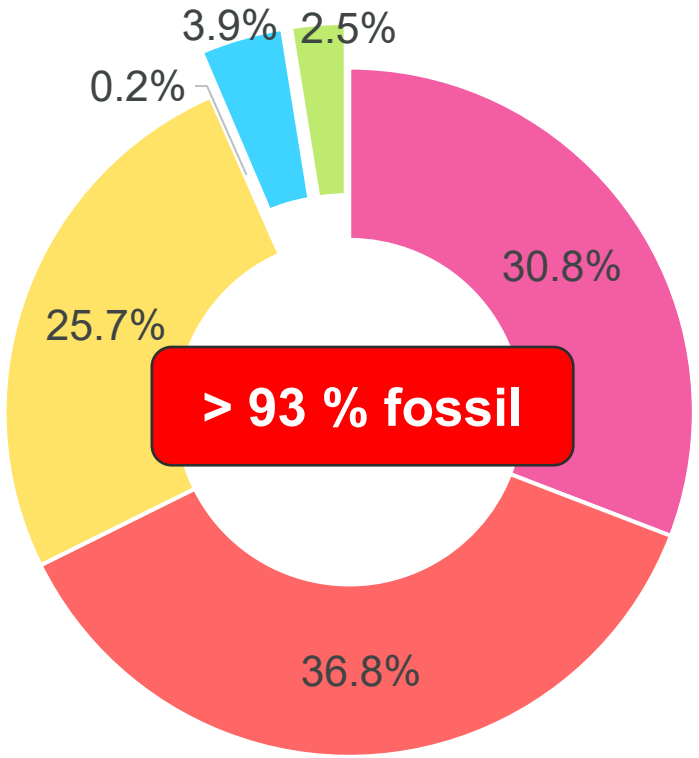




***Quelle**: SFOE energy statistics 2022*

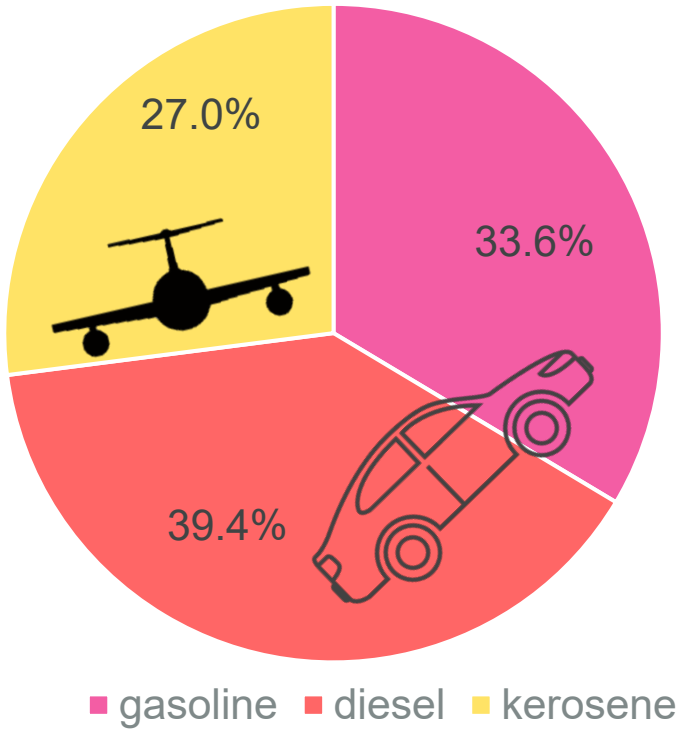
FUEL CONSUMPTION AND CO_2 EMISSIONS

Energy carriers for transport



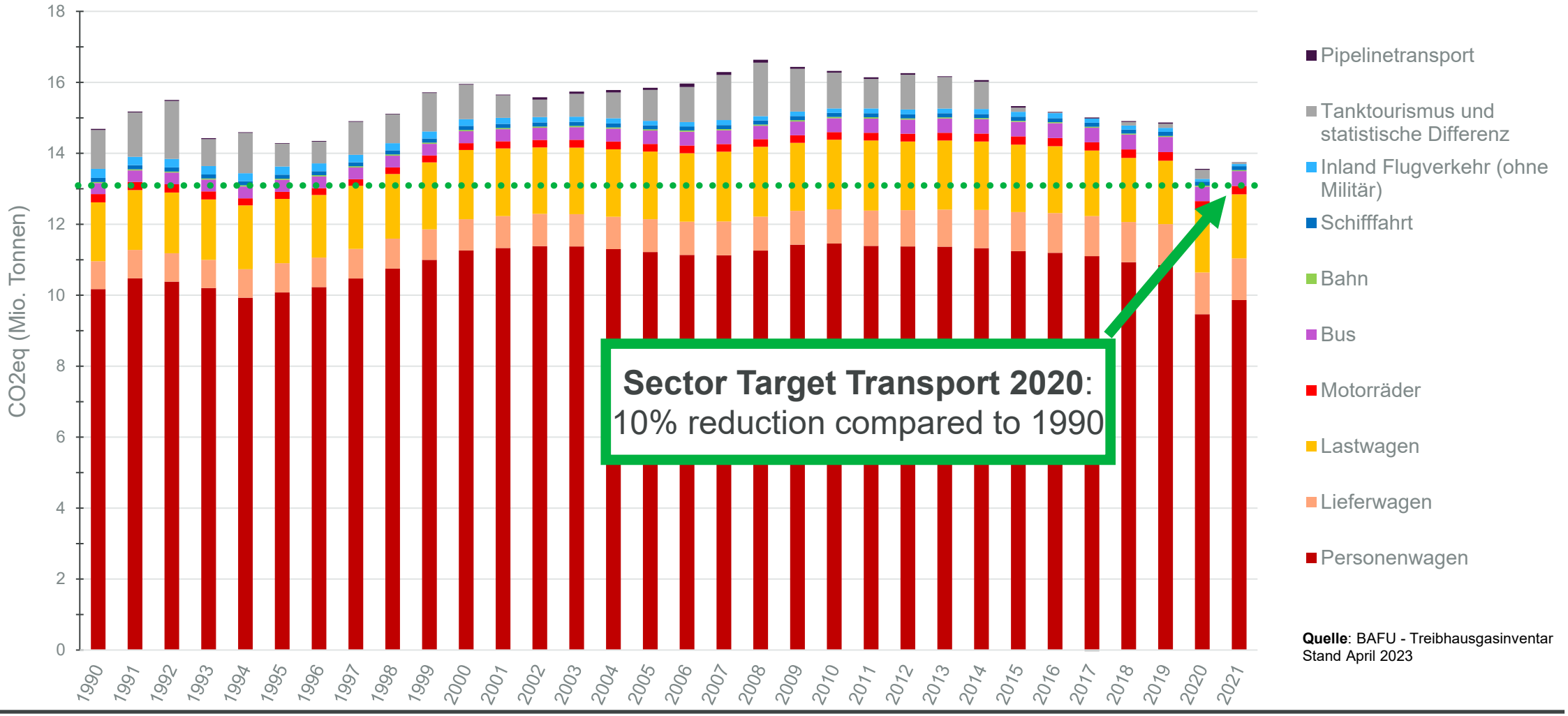
- **Road transport alone:** 7 Mio. tons of gasoline & diesel (60 TWh prim. energy)
- **12.2 bn expenses** for fossile energy. Completely dependent on imports.

CO_2 emissions (estimated)



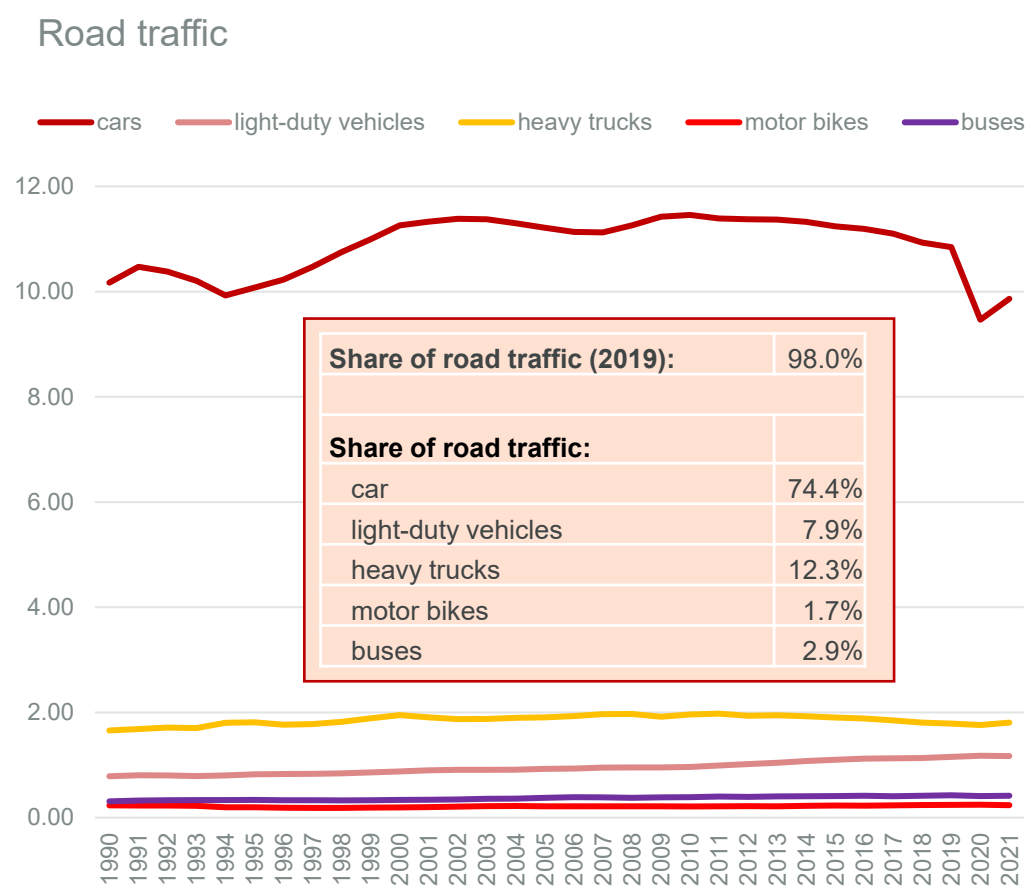
***source**: SFOE energy statistics 2019 &ex-post analyses*

DOMESTIC TRANSPORT
CO_2 EMISSIONS 1990-2021

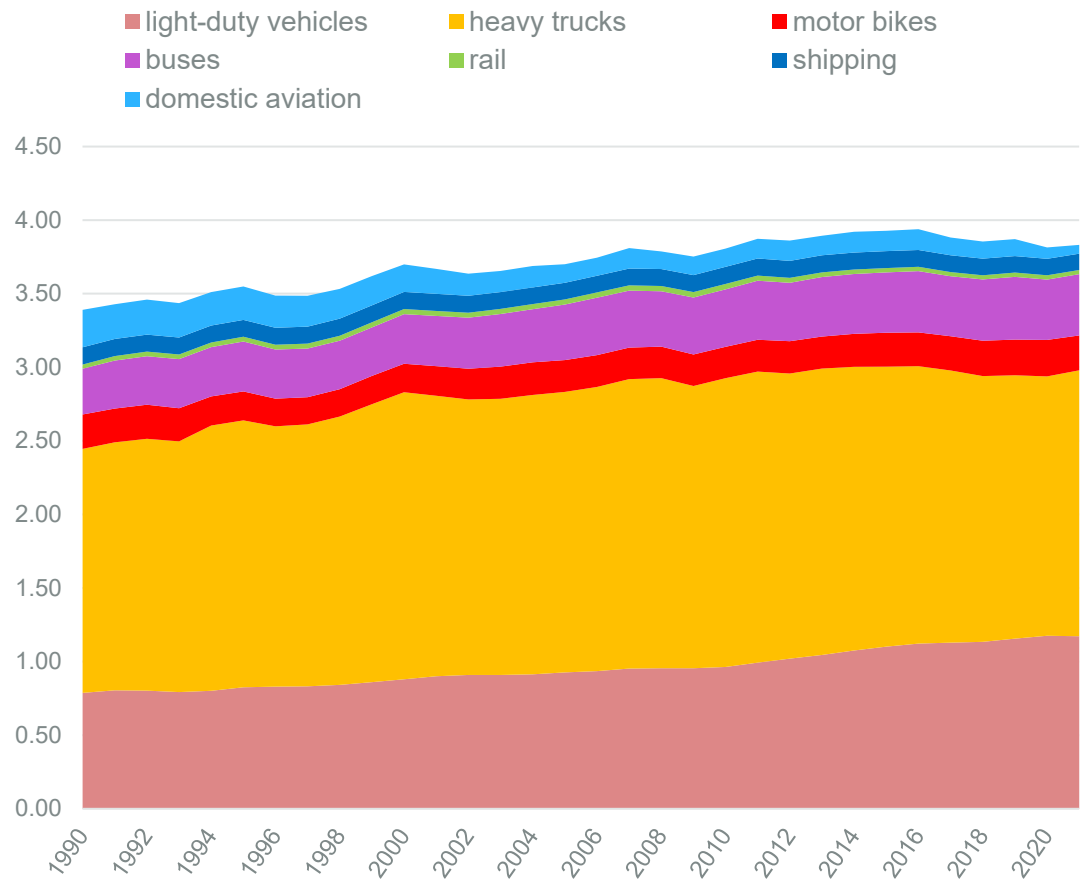


Quelle: BAFU - Treibhausgasinventar Stand April 2023

CO_2 EMISSIONS 1990-2021

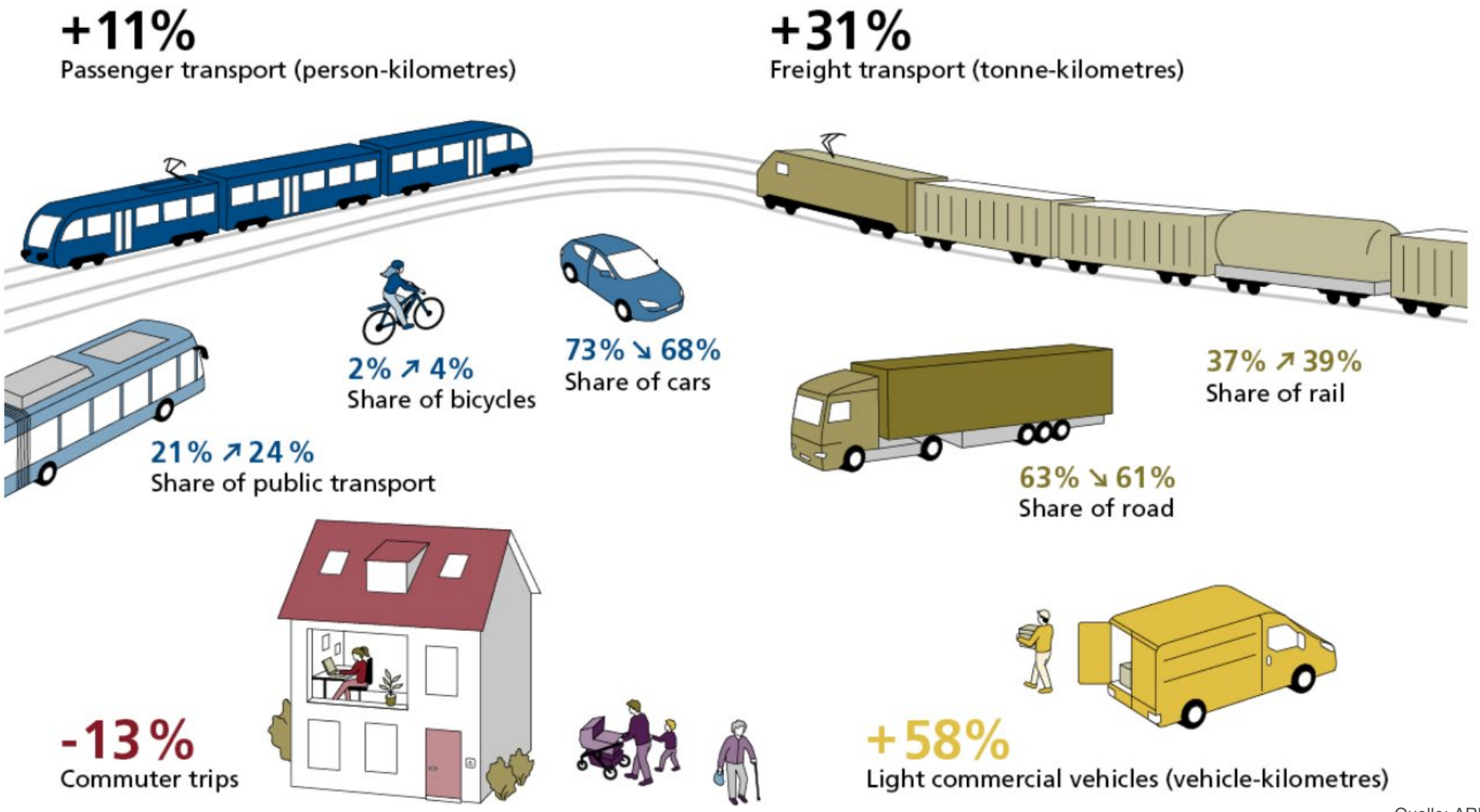


Share of road traffic (2019):	98.0%
Share of road traffic:	
car	74.4%
light-duty vehicles	7.9%
heavy trucks	12.3%
motor bikes	1.7%
buses	2.9%



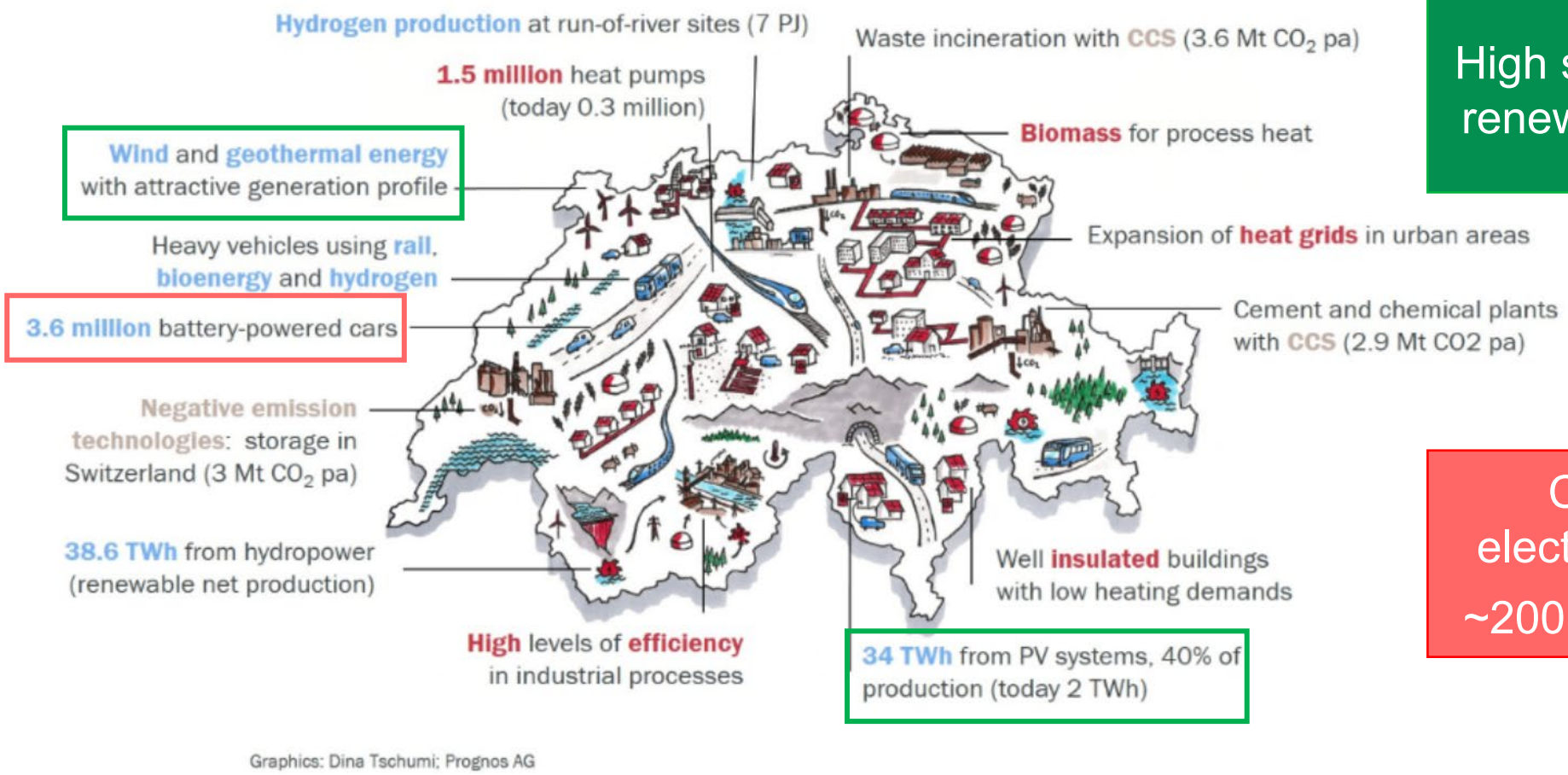
source: FOEN – GHG inventory April 2023

DEVELOPMENTS IN PASSENGER AND FREIGHT TRANSPORT
TRANSPORT OUTLOOK 2050



Quelle: ARE Verkehrsperspektiven 2050 (admin.ch)

ENERGY STRATEGY 2050
ENERGY PERSPECTIVES 2050+

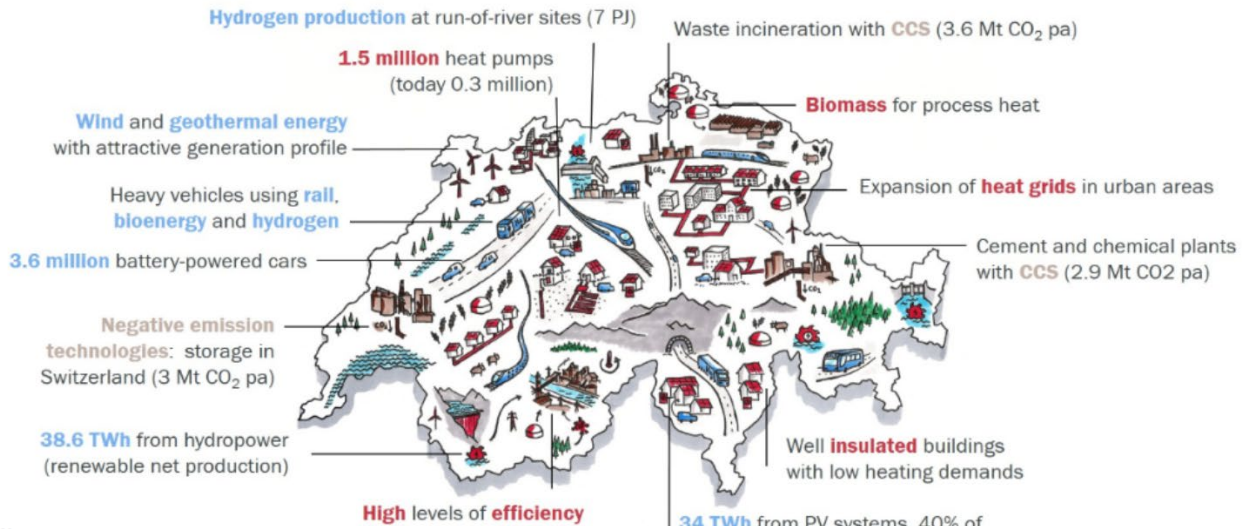


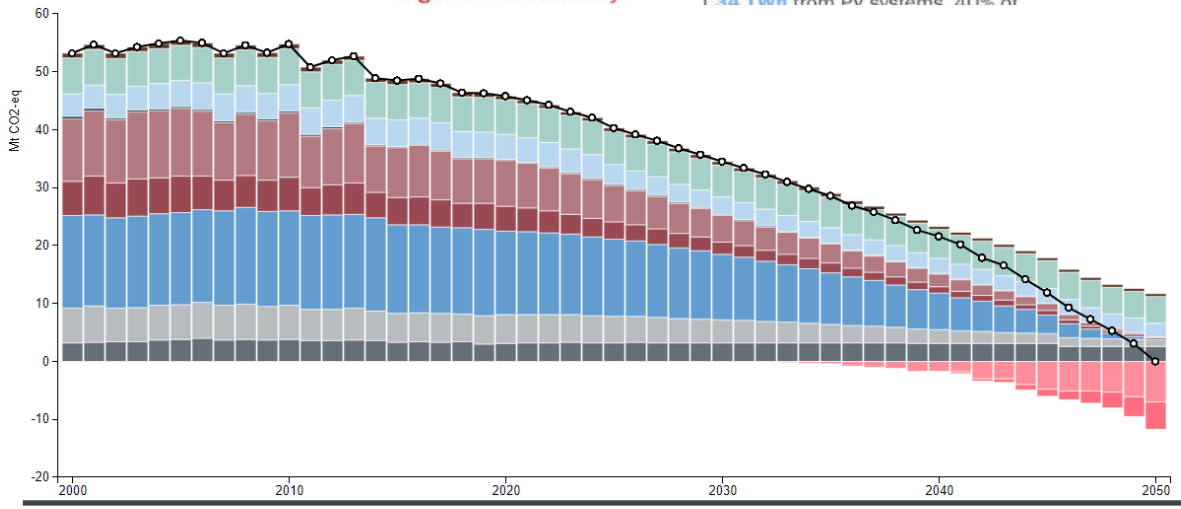
High share of intermitting renewables (PV + Wind)

Car fleet largely electrified: >4 Mio BEV

~200 GWh storage cpty.

ENERGY STRATEGY 2050
ENERGY PERSPECTIVES 2050+



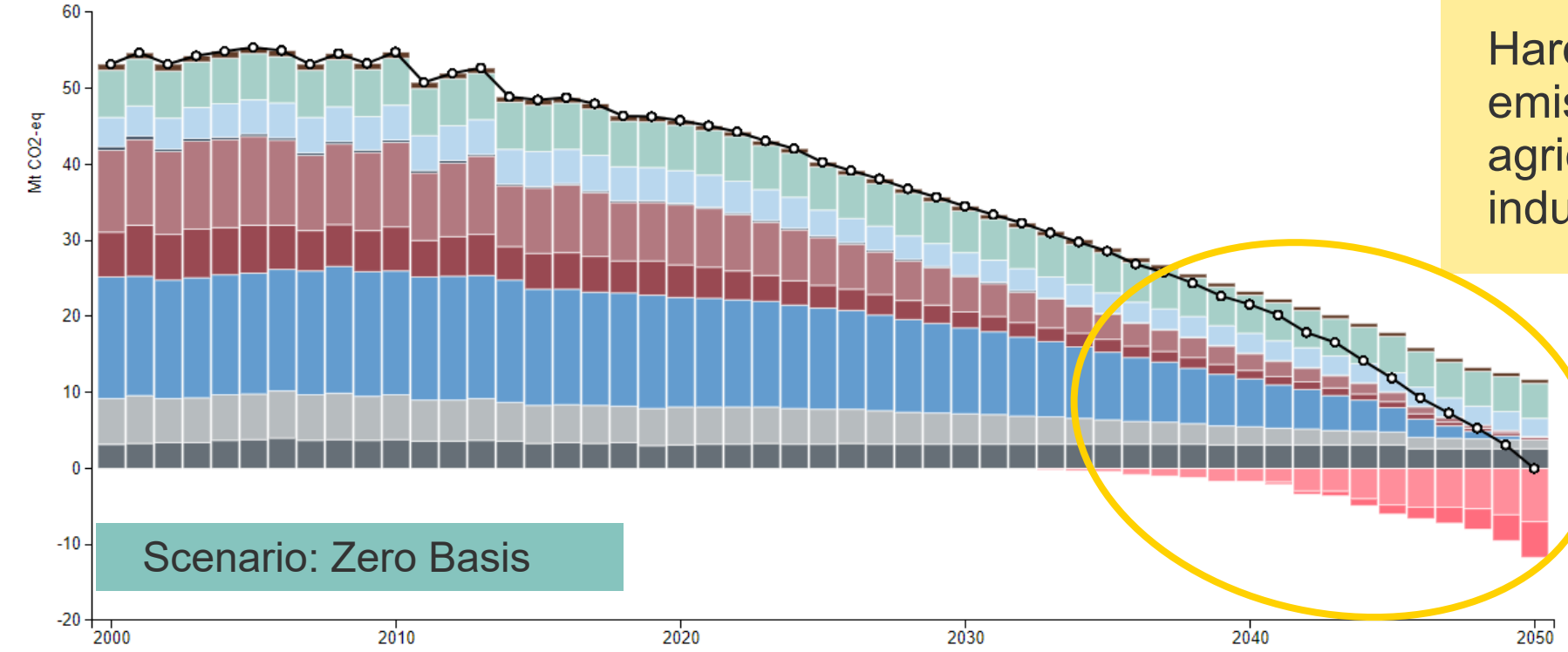


Energy Perspectives 2050+

Scenarios that combine the Swiss **Energy Strategy 2050** and the net-zero climate target from the **Paris Agreement.**

> Expansion of renewables (PV)
> Decarbonisation
> Increasing energy efficiency

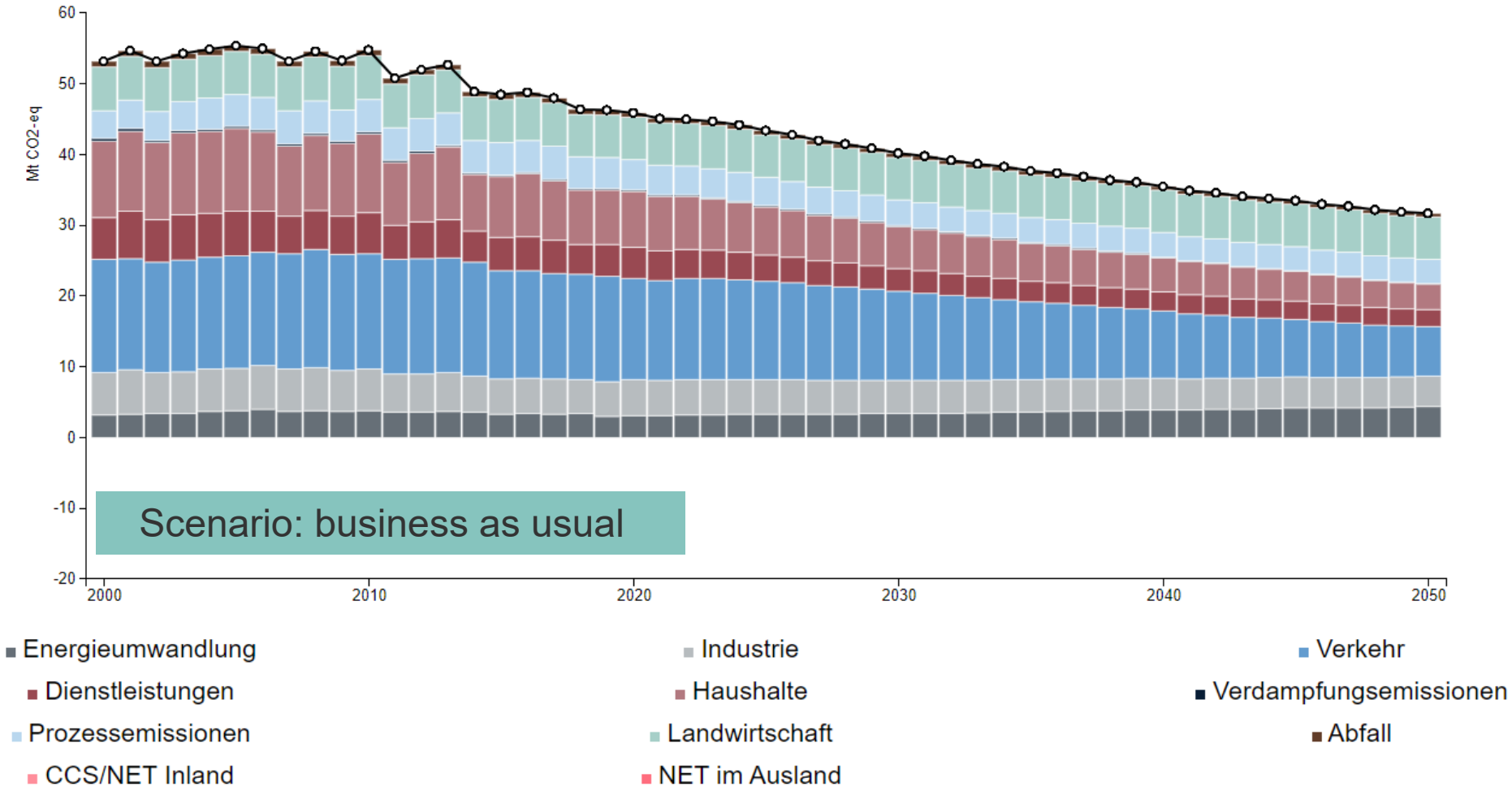
ENERGY PERSPECTIVES 2050+
CO2 REDUCTION PATHWAYS



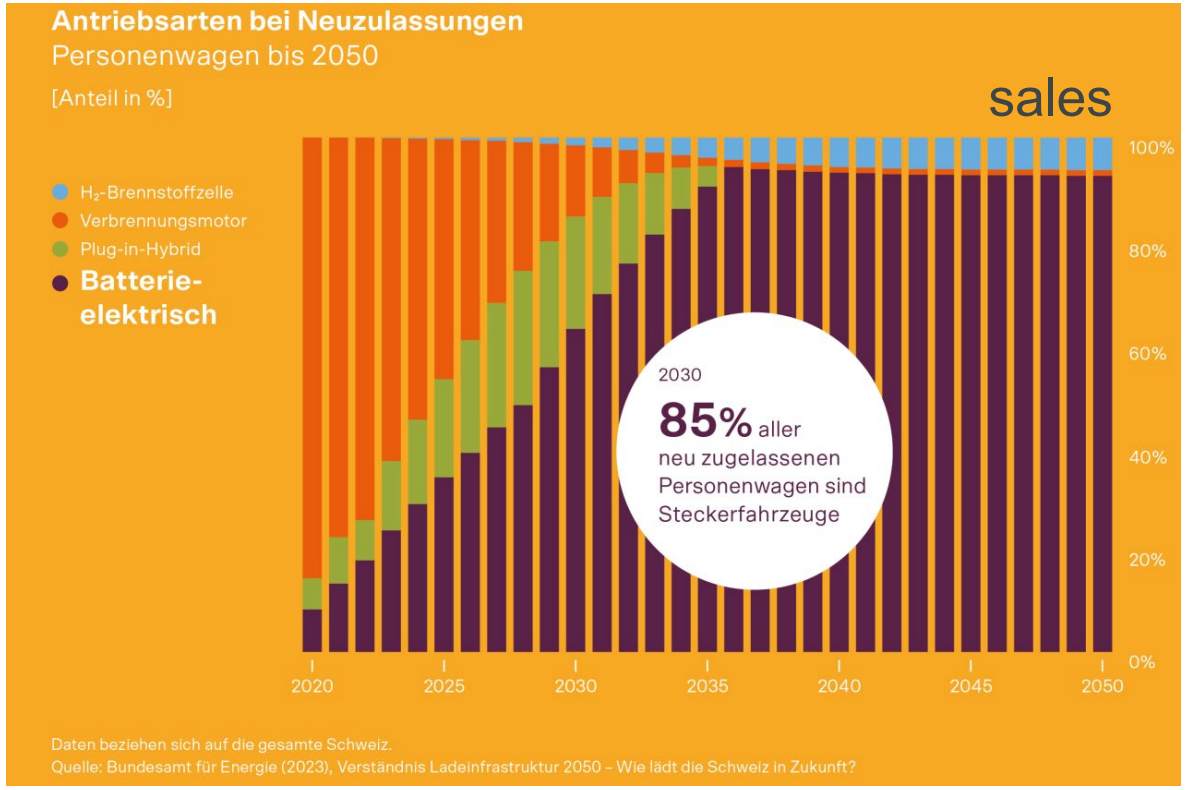
Hard to abate residual emissions in agriculture and industrial processes...

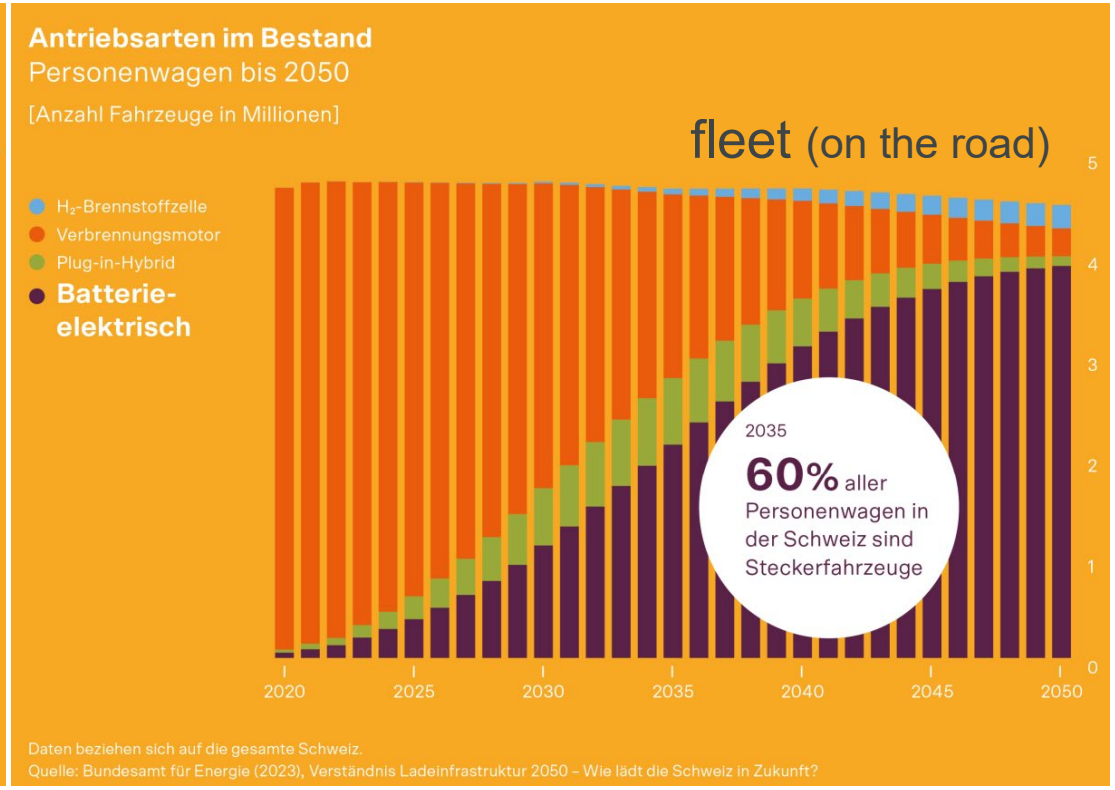
Negative-emission-technologies (NET) required

ENERGY PERSPECTIVES 2050+
CO_2 REDUCTION PATHWAYS



EV CHARGING INFRASTRUCTURE 2050
ENERGY PERSPECTIVES 2050+

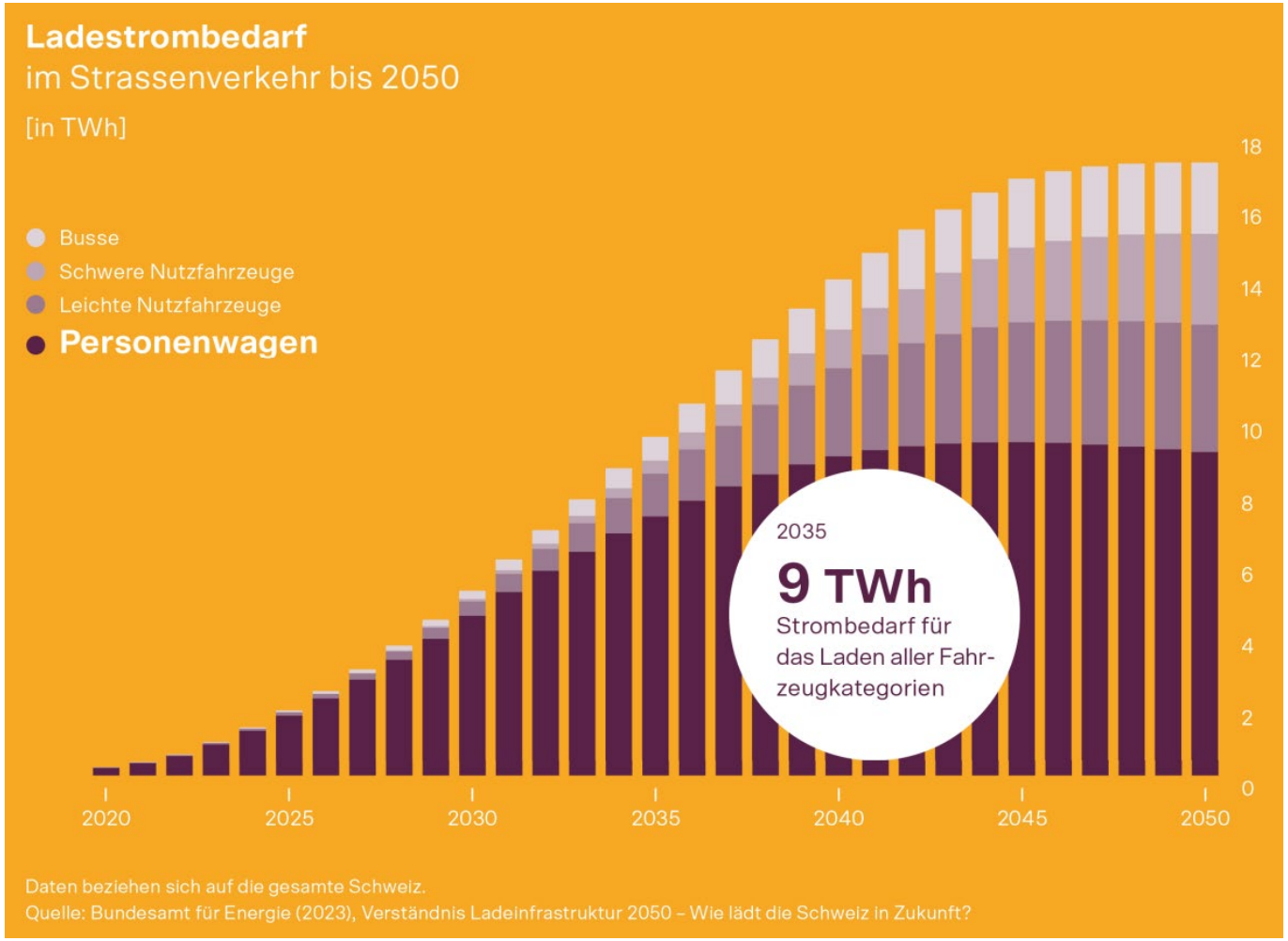




Faster and more thorough market penetration of electric mobility than previously expected.

source: Verständnis Ladeinfrastruktur 2050 (laden-punkt.ch)

EV CHARGING INFRASTRUCTURE 2050
ENERGY PERSPECTIVES 2050+



Energy demand for electric mobility: Ladeinfrastruktur 2050 vs. EP2050+

2035: 9 TWh vs. 5 TWh
2050: 17 TWh vs. 14 TWh

source: Verständnis Ladeinfrastruktur 2050 (laden-punkt.ch)

REVISION OF FEDERAL ACTS ON ENERGY (MANTELERLASS)
CLEAR ORIENTATION THROUGH LONG-TERM TARGETS

Targets for production expansion and consumption (Art. 2 und 3 EnG)

Binding targets for 2035 and 2050.

Accelerated and increased expansion of renewable energies.

Ambitious consumption targets despite extensive electrification (decarbonization of transport and buildings).

	2035	2050
Renewable energies (without hydropower)	**35 TWh**	**45 TWh**
(per person and year)	- 43% vs. 2000	- 53% vs. 2000

Convergence of EV & PV

Electric mobility as «**flexible**» consumer enables **optimal integration of renewables by smart-charging** and **V2X**.

NET ZERO BY 2050
IEA ROADMAP

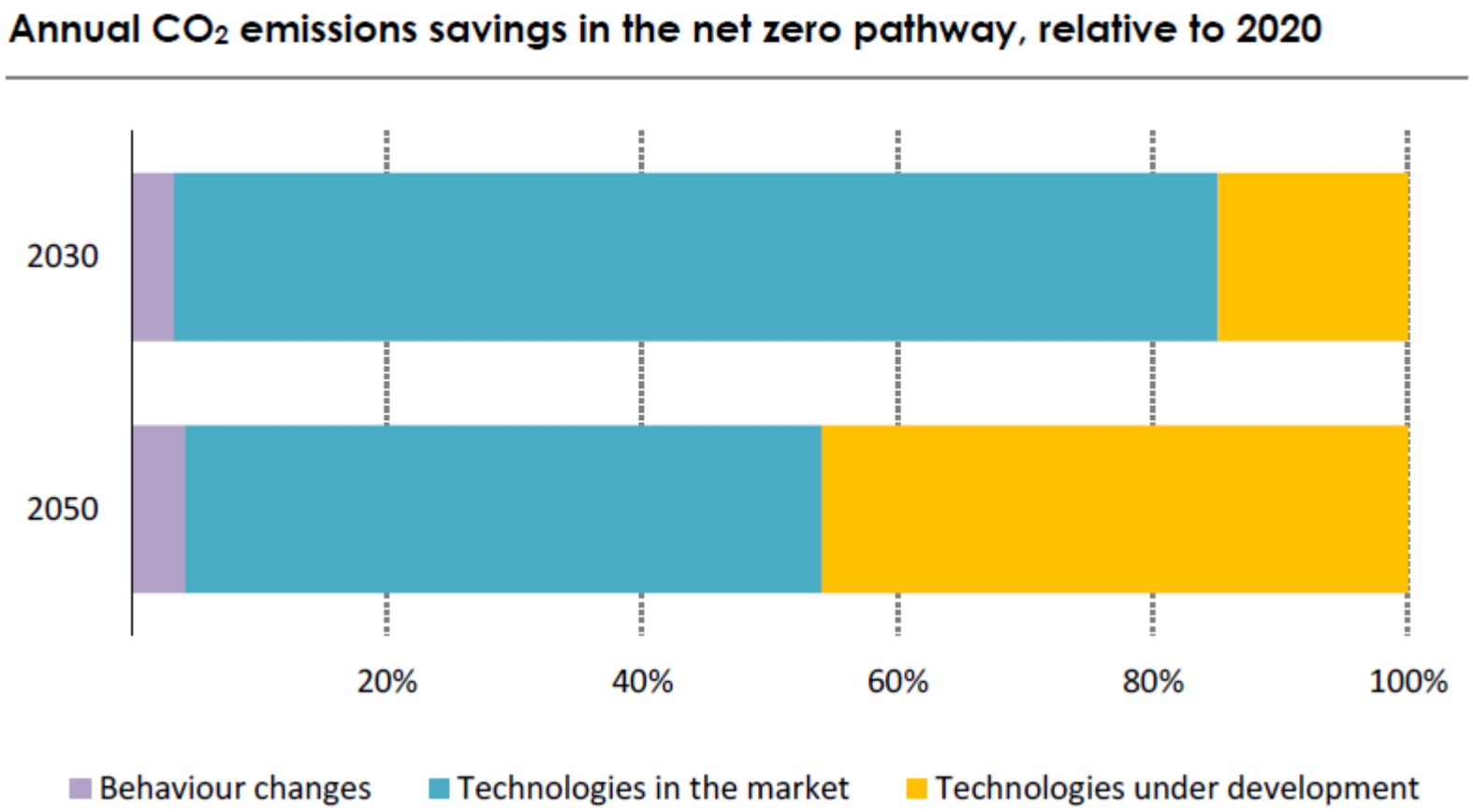
2020

The path to net-zero emissions is narrow

Staying on it requires the massive deployment of all available clean energy technologies – such as renewables, EVs and energy efficient building retrofits – between now and 2030.

For solar power, it is equivalent to installing the world's current largest solar park roughly every day.

NET ZERO BY 2050
IEA ROADMAP



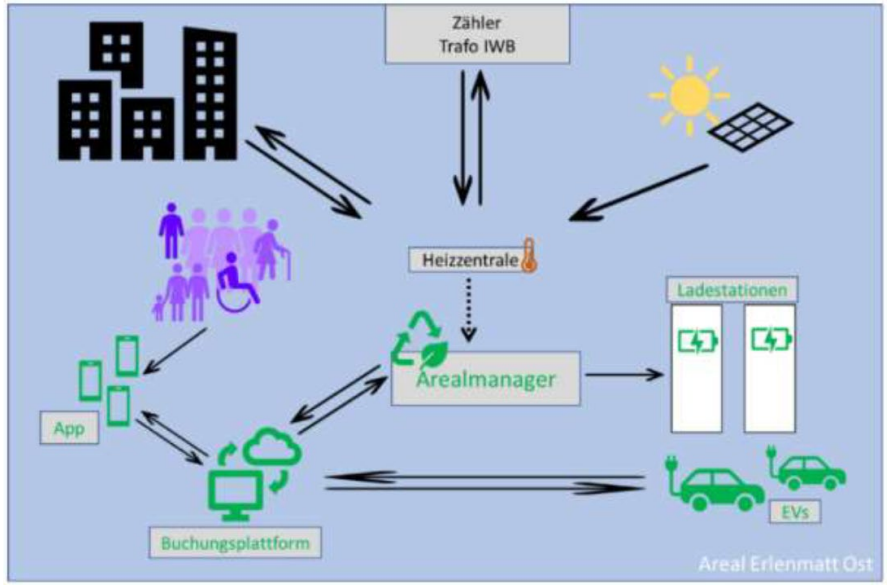
Technology for short-term savings (2030) largely in the market.

2030 target requires massive deployment of available technologies:

- > **Electric vehicles**
- > Renewables (PV)
- > Building retrofits (heat pumps)

Source: Net Zero by 2050 – Analysis - IEA

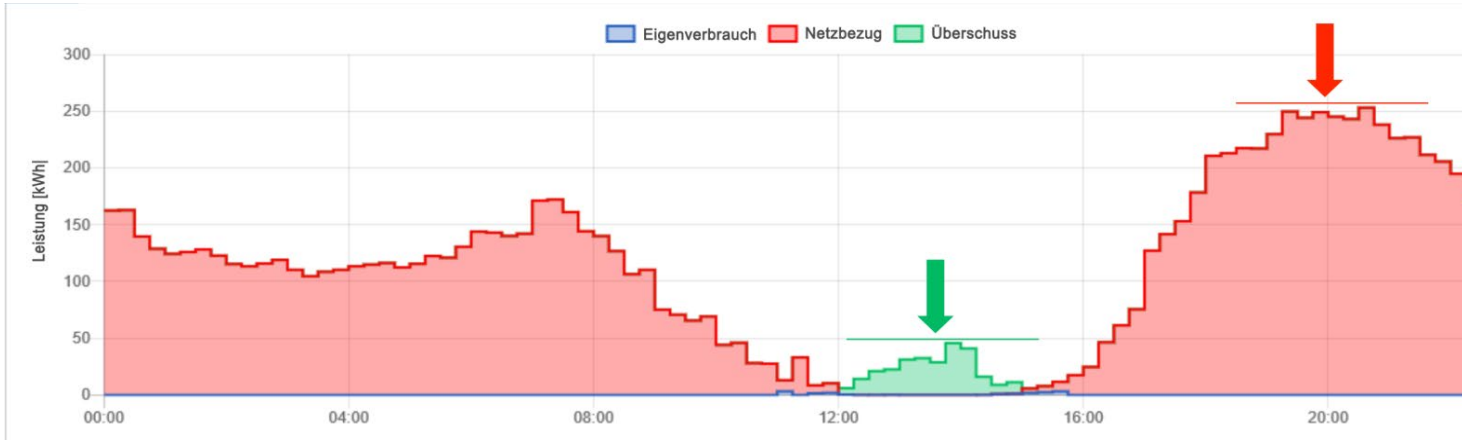
ERLENMATT OST, BASEL
V2X AND CARSHARING IN ENERGY COMMUNITY

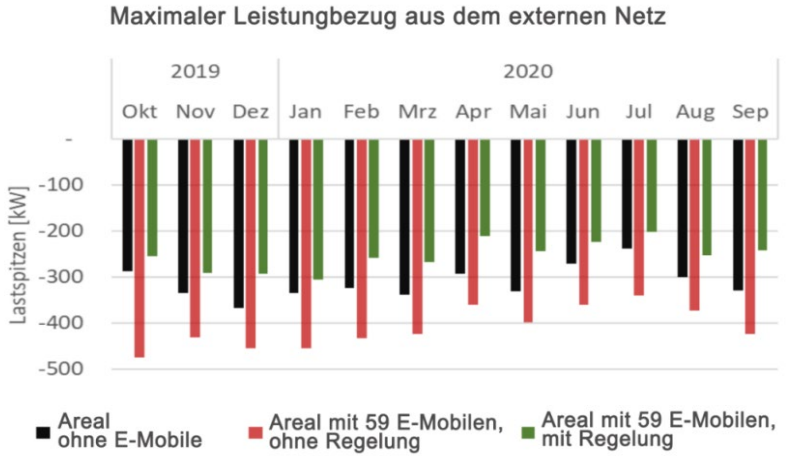


Increasing self-consumption and «peak-shaving»

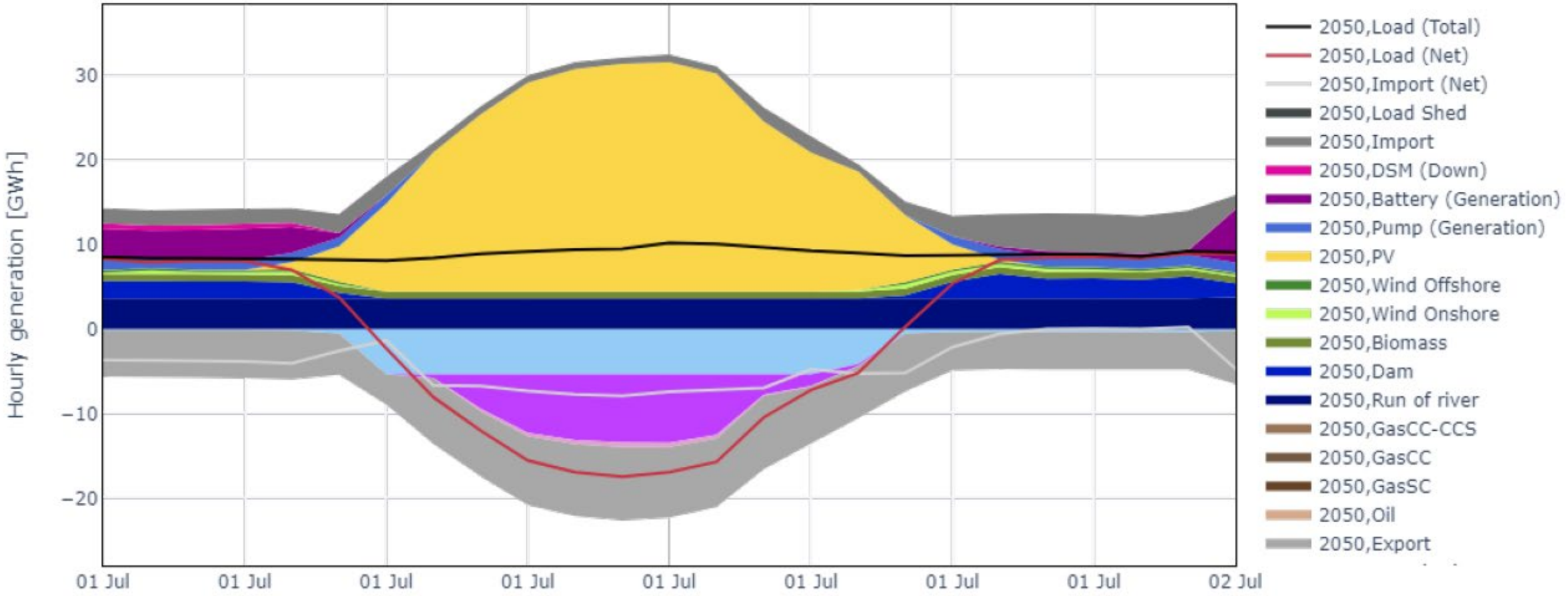
1. Temporary storage of excess PV production during noon in car battery.
2. Stored energy can be fed back into grid during evening peak consumption.

Significant peak-shaving with only 2 EVs!
→ EVs amortized after only 3 years.



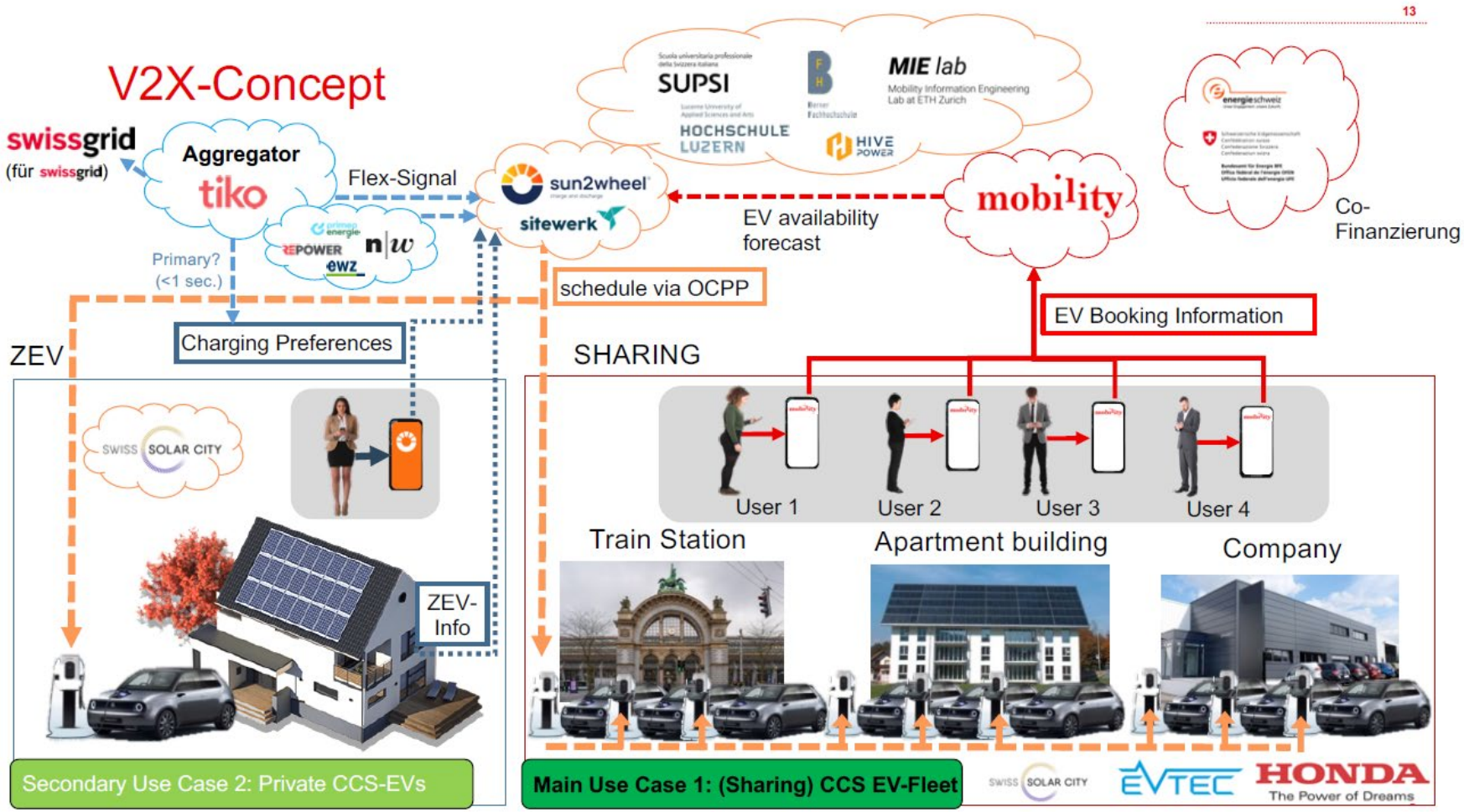


ETH NEXUS-G STUDY
THE VALUE OF V2G FOR SWITZERLAND

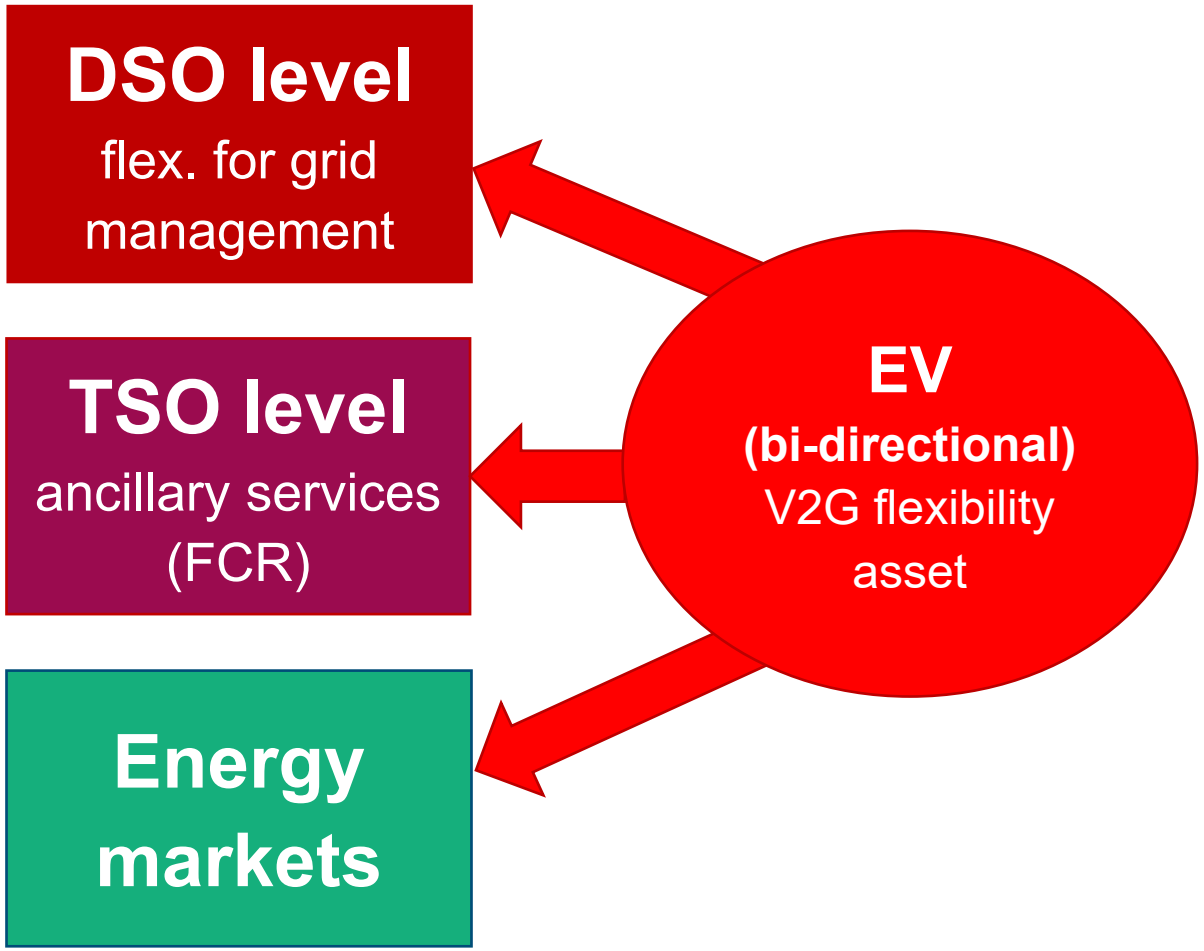


Source: Nexus-e - Vehicle-to-grid in Switzerland

V2X SUISSE
V2X AND CARSHARING



Federal Act on Secure Electricity Supply (Mantelerlass)
REGULATION AND INCENTIVES FOR V2G



Grid charge exemption
(Art 14a StromVG)

- Reimburs. for reinjected energy
- Equal treatment of storage tech.

Control/use of flexibility
(Art 17c StromVG)

- Business models for flex. use

Smart meter / dynamic tarifs
(Art 17a & Art 12 StromVG)

- Automated/dynamic control
- Incentives for grid/system friendly use of flexibility

ELECTRIFICATION OF HEAVY-DUTY VEHICLES & OTHER ALTERNATIVES

Electric mobility already a reality for heavy goods vehicles and buses.

> battery electric & megawatt-charging (MCS)
> opportunity charging (mostly buses)
> electrified roads (catenary & inductiv)

ELECTRIFICATION OF HEAVY-DUTY VEHICLES & OTHER ALTERNATIVES

H_2 fuel cell

+ no local emissions
+ long range, “fast” refueling
- poor overall energy efficiency

Synfuels / Biofuels (H_2 ICE)

+ compatible with existing infrastructure
+ availability/storability of fuels
+ long range, fast refueling
- NOx and other emissions remain
- Very poor overall energy efficiency

CHALLENGES IN THE TRANSPORT SECTOR
SUSTAINABLE DEVELOPMENT POLICY

AVOID

→ General reduction of passenger/tonne-km

SHIFT

→ Change modal share in favor of energy-efficient and CO_2-neutral transport modes

IMPROVE

→ Increase energy efficiency
reduce CO_2 emissions

THANKS FOR YOUR ATTENTION!

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