Smart and Green – Digital pathways to Net Zero

Switzerland forfeits climate protection potential due to insufficient ambitions in digitalization.

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Executive Summary

Switzerland has set ambitious international climate targets: Can digitalization help achieve them?

Climate Change – Switzerland is heavily impacted:

Climate change is globally evident, but it particularly affects Switzerland as an Alpine country. Since the pre-industrial era, the average temperature in Switzerland has increased by about 2 degrees Celsius. This is roughly twice the global average.[1]

Gap of 16 Mt CO_2eq-emissions to be saved by 2030:

Switzerland has committed internationally to climate targets, specifically to reduce emissions by 50% by 2030 compared to 1990 levels, as mandated by the Paris Climate Agreement. For Switzerland, this means reducing emissions from 55 to 28 million tons of CO_2eq. Compared to today's (2023[a]) emissions of 44 Mt CO_2eq, there is still a gap of approximately 16 Mt CO_2eq.[1,2,3]

Digitalization as a lever to achieve targets:

This study calculates the contribution of digital technologies to Switzerland's 2030 climate target. The aim is to identify the potential of digital technologies for climate protection and thus support the achievement of the 2030 climate target.

Approach and Methodology:

The study examines selected digital technologies in the most emission-relevant sectors — buildings, transportation, agriculture, industry, and the energy sector, which is crucial for the electrification of all sectors — based on secondary literature and expert opinions. This involves both quantifying the savings potential through digitalization and showcasing concrete practical use cases.

In quantifying the savings potential, the following factors are considered:

1) Two different digitalization speeds of companies, public institutions, and private individuals are considered: "Standard" vs. "Ambitious".
2) As the basis of the study, two CO_2 projections from the 2050+[4] energy perspectives created by the Swiss Federal Office of Energy (SFOE) are used: "Business-as-usual" (BAU) vs. "Zero Basis".
3) The CO_2 footprint of the digital technologies considered in the study is quantified and subtracted from the gross savings.

Each sector considered includes two use cases of digital technologies, selected based on their reduction potential:

Buildings	**Smart Homes** **Building Management Systems**
Trans-portation	**Mobility-as-a-Service** **Real-Time Route Optimization**
Agriculture	**Site-Specific Fertilization** **Digital Livestock Management**
Industry	**Automation and Robotics** **Digital Twins and Simulation**
Energy	**Predictive Maintenance** **Smart Grids**

Sources: 1: Climate Change in Switzerland (admin.ch); 2: Climate Targets - MeteoSwiss (admin.ch);3: Greenhouse Gas Emissions in Switzerland 1990-2021; 4: Swiss Federal Office of Energy (SFOE) (2022).
a: Since the greenhouse gas inventory does not yet include the year 2023, the average of the Zero Basis and BAU scenarios from the Energy Perspectives 2050+ is assumed for 2023.

Digitalization is a major lever for climate protection – but Switzerland is not yet using it enough

Final outcome – Digital technologies significantly contribute to the 2030 climate target:

The examined digital technologies can contribute between 1.2 and 3.2 Mt CO_2eq in savings by 2030. This corresponds to a reduction of 7% to 20% of the climate gap (the emissions to be reduced from now until 2030). For comparison: the canton of Thurgau emitted about 1.5 Mt CO_2eq in 2018.

Ambitious digitalization is important – CO_2eq savings are doubled by ambitious digitalization:

The results show that there is a significant difference between standard digitalization and ambitious digitalization. In the examined use cases, more than twice as many emissions can be reduced in Switzerland through ambitious digitalization.

High net effects of digitalization in the transport and building sectors:

Among the sectors considered, the transport sector can make the largest contribution to closing the 2030 climate gap with ambitious digitalization (2–7% of the climate gap). The building sector also contributes significantly with 2–5%. With standard digitalization, the building sector shows the highest contribution to closing the climate gap.

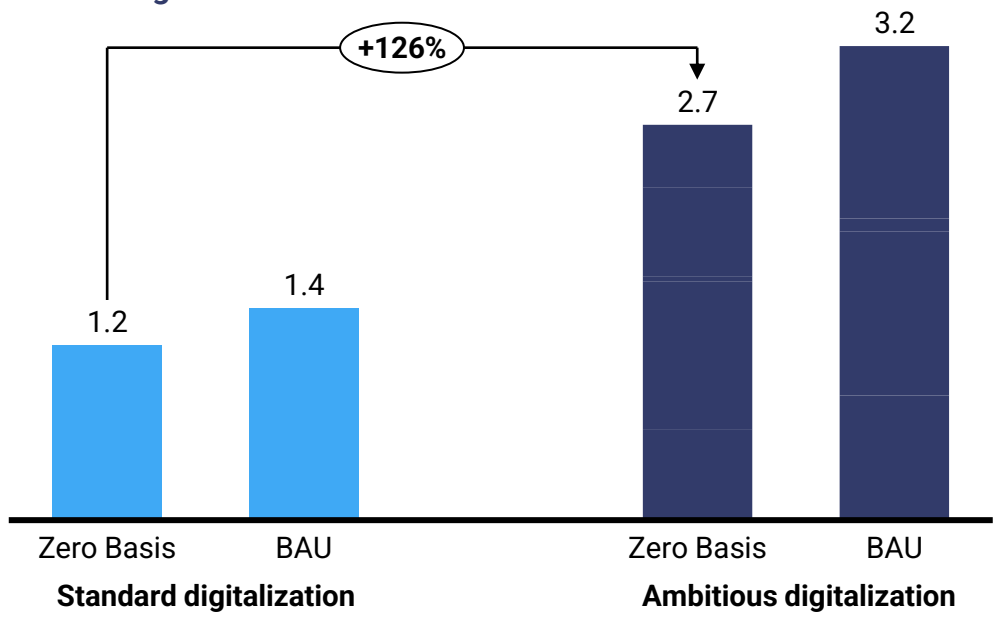
Agriculture – A small cog with great potential:

Despite the smaller contribution to the climate gap (2–4%), the sector has a high relative savings potential (6–11%) when considering its own sector emissions.[a]

Energy sector enables electrification of other sectors:

Switzerland's nearly climate-neutral electricity mix already works in its favor, resulting in a low CO_2eq savings potential of 0.1–0.5% of the climate gap through digitalization in the energy sector. Nevertheless, its important role in enabling the electrification of other sectors through stability improvements and efficiency gains is demonstrated.

More than twice as many emissions (in Mt CO_2eq) can be saved through ambitious digitalization.



Conclusion

An ambitious digitalization in Switzerland is essential to fully realize the CO_2eq savings potential of digital technologies. Businesses and policymakers are called upon to create the necessary framework conditions to leverage this potential more effectively.

Notes: a: The relative savings potential is the reduction potential in relation to agricultural emissions.

Results Overview

Switzerland has set ambitious targets – now it's about achieving them

+2 degrees

Climate Change – Switzerland experiences its impacts:

Climate change is evident worldwide, and Switzerland, as an Alpine country, is particularly affected. Since the pre-industrial era, the average temperature has increased by about 2 degrees Celsius. This is roughly double the global average. Noticeable consequences include more frequent hot days, heavier rainfall, drier summers, and snow-poor winters. The impacts of climate change are also increasingly evident in glacier regions.[1]

Hopeful outlook – Successful Revision of the CO_2 Law:

The CO_2-law enshrines climate targets at the national level and serves as an essential foundation for emission reduction measures, such as a CO_2 tax, a building program, or CO_2 emission regulations for vehicles. The Parliament has adopted the new law, setting targets and measures for the period from 2025 to 2030. The focus is primarily on investments in the areas of buildings, transportation, and energy.[4]

CO2-Law

International commitments – Switzerland sets ambitious climate targets:

To curb the progression of climate change and secure its future, Switzerland has committed internationally to reducing its greenhouse gas emissions. Specifically, emissions must be reduced by 50% by 2030 compared to 1990 levels, as mandated by the Paris Agreement. This corresponds to a reduction from 55 to 28 million tons of CO_2eq. Compared to today's (2023[a]) emissions of 44 Mt CO_2eq, Switzerland still has a climate gap of approximately 16 Mt CO_2eq.[1,2]

2003
Ratification of the Kyoto Protocol

2017
Ratification of the Paris Agreement

Milestones 2020 (vs. 1990)[5]		Actual Reduction[5]	
Buildings:	-40%	-39%	✗
Trans-portation:	-10%	-8%	✗
Industry:	-15%	-17%	✓
Other[b]:	-10%	-2%	✗

Interim Report 2020 – Sectoral milestones were barely missed:

The interim target of reducing total Swiss emissions by 20% by 2020 compared to 1990 was narrowly missed, achieving a 19% reduction. The sectors of buildings, transportation, as well as other emissions from agriculture, waste, and synthetic gases, failed to meet their respective 2020 milestones compared to 1990. Only the industrial sector reached its reduction target (17% reduction including waste incineration plants – without waste incineration plants, the sector achieved approximately a 35% reduction vs. 1990). The figures for 2020 were collected during the COVID-19 pandemic. In 2021, emissions rose by 3% (from 44 Mt CO_2eq to 45 Mt CO_2eq).[3,a]

Innovation Hub Switzerland – Recognizing the potential of digitalization for climate protection:

To achieve the 2030 climate target, Switzerland must now leverage every tool at its disposal, including digitalization. With the "Digital Switzerland Strategy", the Federal Council sets the guidelines for the country's digital transformation. Additionally, in the Energy Strategy 2050, digitalization has top priority for enhancing energy efficiency. Furthermore, the federal government promotes technological innovations through the Technology Fund—a measure of the aforementioned CO2-law—which aims to reduce greenhouse gases and resource consumption, favor the use of renewable energies, and increase energy efficiency.[6]
Switzerland recognizes the potential but has yet to fully exploit it. This study aims to provide a quantified assessment of this potential to drive change.

Sources: 1: Climate Change in Switzerland (admin.ch); 2: Climate Targets -MeteoSwiss (admin.ch), Greenhouse Gas Emissions in Switzerland 1990-2021; 3: Greenhouse Gas Inventory of Switzerland (admin.ch); 4: Climate Change in Switzerland (admin.ch); 22.061 | CO2 Law for the Post-2024 Period. Revision | Business | The Swiss Parliament; Long-term Climate Strategy of Switzerland: Digital Switzerland - DETEC (admin.ch), Switzerland's measures to reduce its Greenhouse Gas Emissions (admin.ch); 5: Federal Council, Press Release (2022); 6: Energy Strategy 2050 – Digitalization as Absolute Priority – OBT.

Note: a: Since the greenhouse gas inventory does not yet include the year 2023, the average of the Zero Basis and BAU scenarios from the Energy Perspectives 2050+ is assumed for 2023. b: Agriculture, waste, and synthetic gases.

What do the study results mean for Switzerland?

Christoph Mäder
Chairman of economiesuisse

"Digital innovation is not only an economic opportunity but also a key instrument in the fight against climate change. The study shows that digitalization has the **potential to close up to one-fifth of the climate gap that is expected to open regarding the climate targets by 2030**."

Stefan Metzger
CEO digitalswitzerland

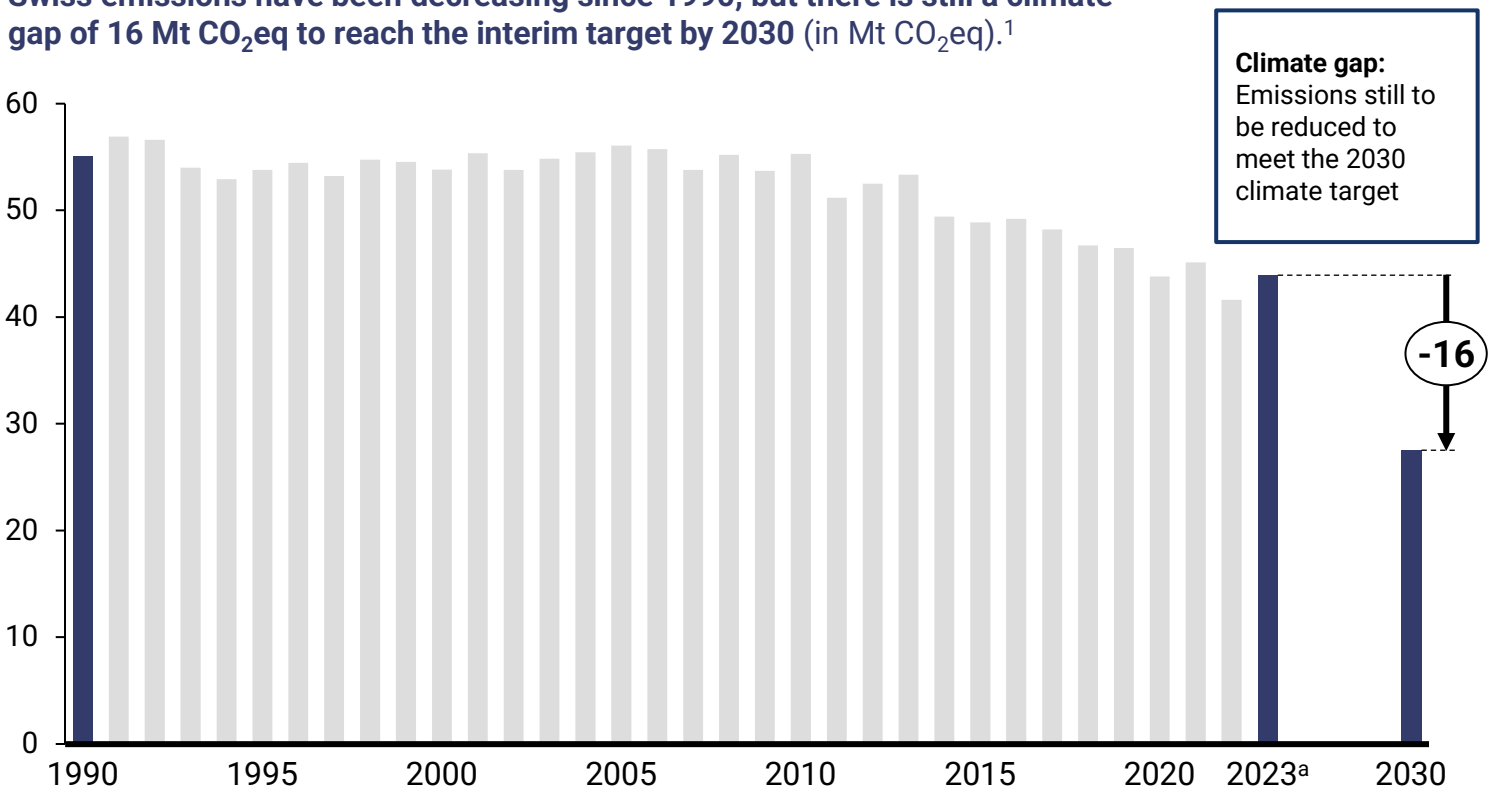
"Our study has shown that Switzerland has the potential to save between **1 and 3 million tonnes of CO_2 equivalents annually by 2030** through digital technologies. This is the **equivalent to one or two times the total emissions of the canton of Thurgau** (in 2018) - a great opportunity for companies to significantly support Switzerland's ambitious targets."

Marco Huwiler
Country Managing Director Accenture Schweiz

"A technology is always good when it not only has a benefit but also makes economic sense. Those who invest in digitalization to reduce emissions not only decrease their own CO_2 footprint but also lay the foundation for better products and services. **Fewer emissions, more competitiveness – that's a win-win situation.**"

Ambitious climate target presents a major challenge for Switzerland: CO_2eq emissions must decrease by 16 Mt CO_2eq by 2030

Swiss emissions have been decreasing since 1990, but there is still a climate gap of 16 Mt CO_2eq to reach the interim target by 2030 (in Mt CO_2eq).[1]



Climate targets

By ratifying the Paris Climate Agreement in 2017, Switzerland committed to halving its greenhouse gas emissions by 2030 compared to 1990 levels. This corresponds to a reduction from 55 Mt CO_2eq in 1990 to 28 Mt CO_2eq in 2030.

Retrospective

In the past 33 years (1990–2023[a]), Switzerland has reduced its emissions from 55 Mt CO_2eq to 44 Mt CO_2eq. This corresponds to a reduction of 11 Mt CO_2eq (20% reduction). At the same time, GDP has grown from approximately 369 billion CHF in 1990 to 781 billion CHF in 2023 (112% growth).[2]

Nearly half of the total reduction target for 1990–2030 was achieved by 2023, but it took 33 years. The other half must be achieved in the next 7 years.

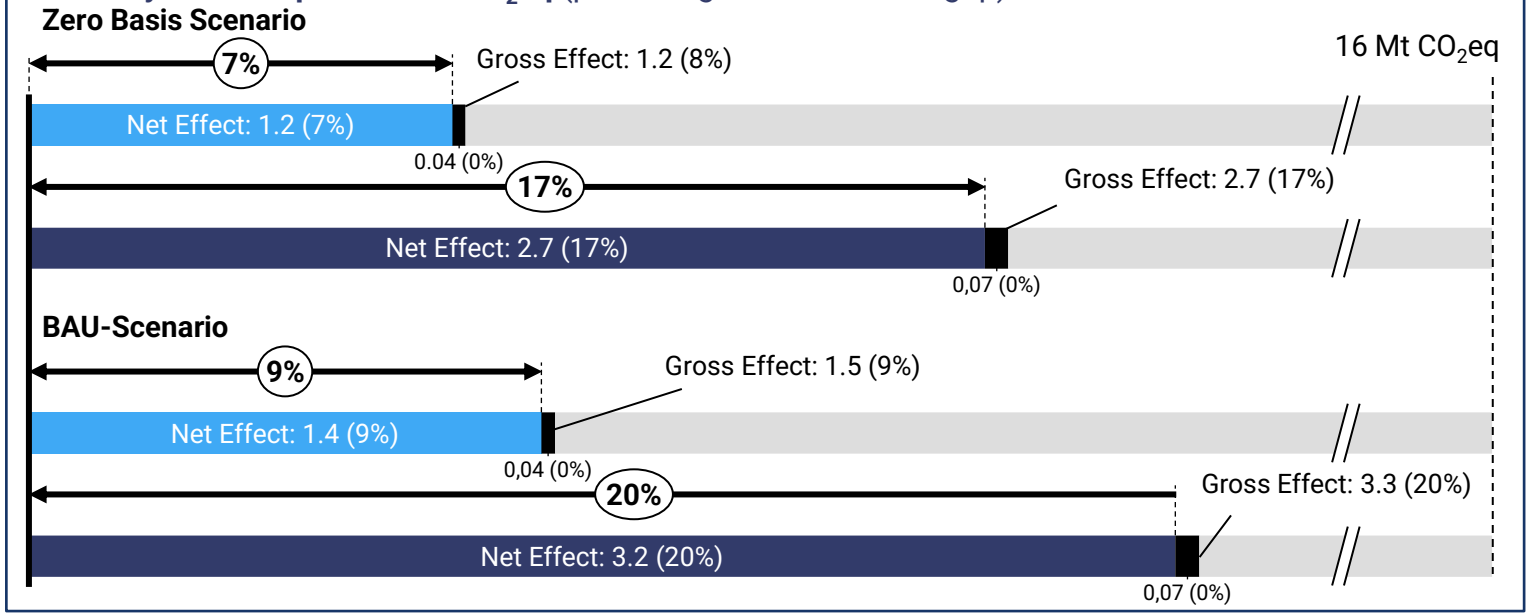
Climate Gap

To still achieve the 2030 climate target, annual emissions in 2030 must be reduced by 16 Mt CO_2eq (37% reduction) compared to 2023 levels, defined as the climate gap. To explore how digitalization can help, the study examines two digitalization speeds – "Standard" and "Ambitious."

Sources: 1: FOEN (2024); 2: Gross domestic product, long series - 1948-2022 | FSO (admin.ch)
Notes: a: Since the greenhouse gas inventory does not yet include the year 2023, the average of the Zero Basis and BAU scenarios from the Energy Perspectives 2050+ is assumed for 2023.

Digitalization as an important lever: digital technologies can contribute 7 to 20% to achieving the Swiss climate target for 2030

Digital technologies can close between 7-20% of the climate gap, with the IT-footprint showing relatively minor impacts in Mt CO_2eq (percentage of the climate gap).



Two opposing effects

This study calculates both the CO_2eq savings potential of technologies by 2030 and the emissions caused by the CO_2eq footprint of digital technologies.

CO_2eq savings potential

With standard digitalization, digital technologies can contribute gross savings of approximately 1.2 to 1.5 Mt CO_2eq towards the current reduction target. With ambitious digitalization, this increases to 2.7 to 3.3 Mt CO_2eq.

CO_2eq footprint of digital technologies

Each of the digital technologies considered generates a specific amount of CO_2eq as its footprint: about 0.04 Mt CO_2eq for standard digitalization and about 0.07 Mt CO_2eq for ambitious digitalization.

CO_2eq net effect

The savings potential for 2030, minus the footprint, gives the net CO_2eq reduction:

CO_2eq Net Effect =

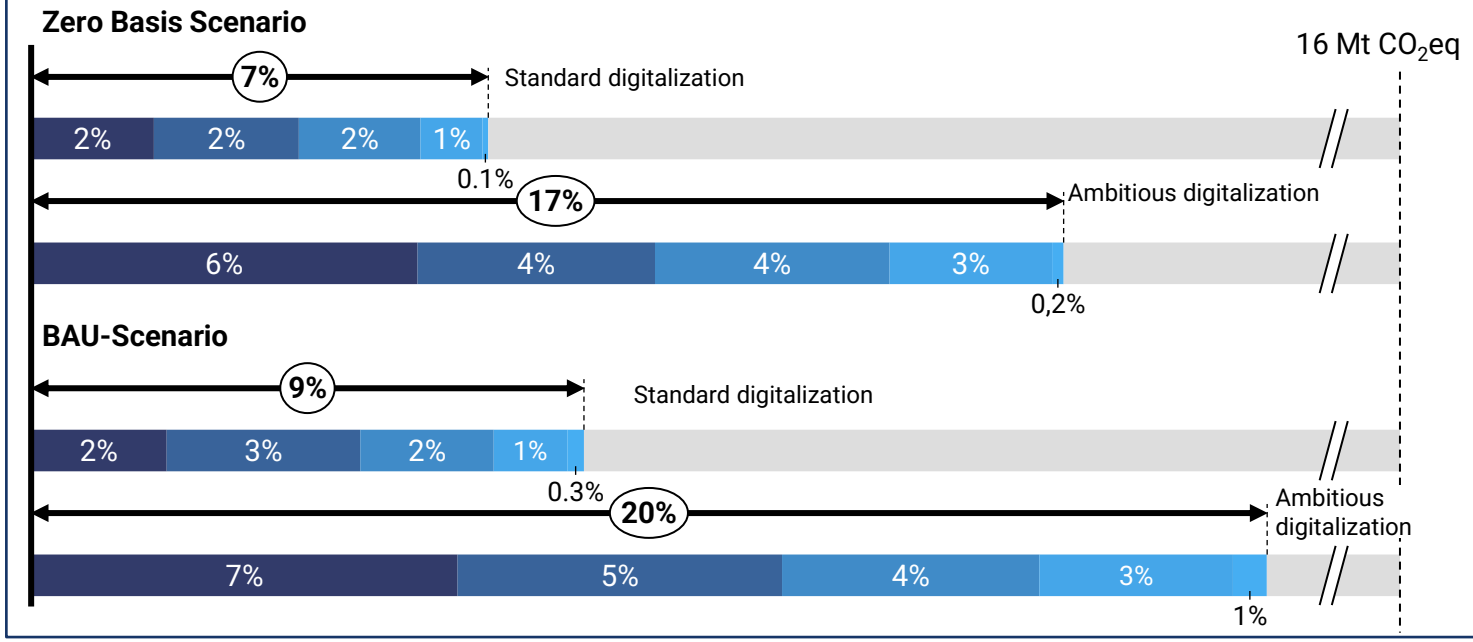
CO_2eq Savings Potential - CO_2eq Footprint

This amounts to 1.2 to 1.4 Mt CO_2eq for standard digitalization and 2.7 to 3.2 Mt CO_2eq for ambitious digitalization.

Notes: Deviations in totals may result from rounding.

Digital technologies can make a significant contribution in every sector, particularly in the transportation, building, and agriculture sectors

In the sectors studied, digitalization helps close the climate gap (as a percentage of the climate gap)



Reduction contribution by sectors

Progressive digitalization is increasingly recognized as a crucial factor for achieving climate targets. In Switzerland, it could contribute 7–9% with standard digitalization and 17–20% with ambitious digitalization towards closing the climate gap by 2030.

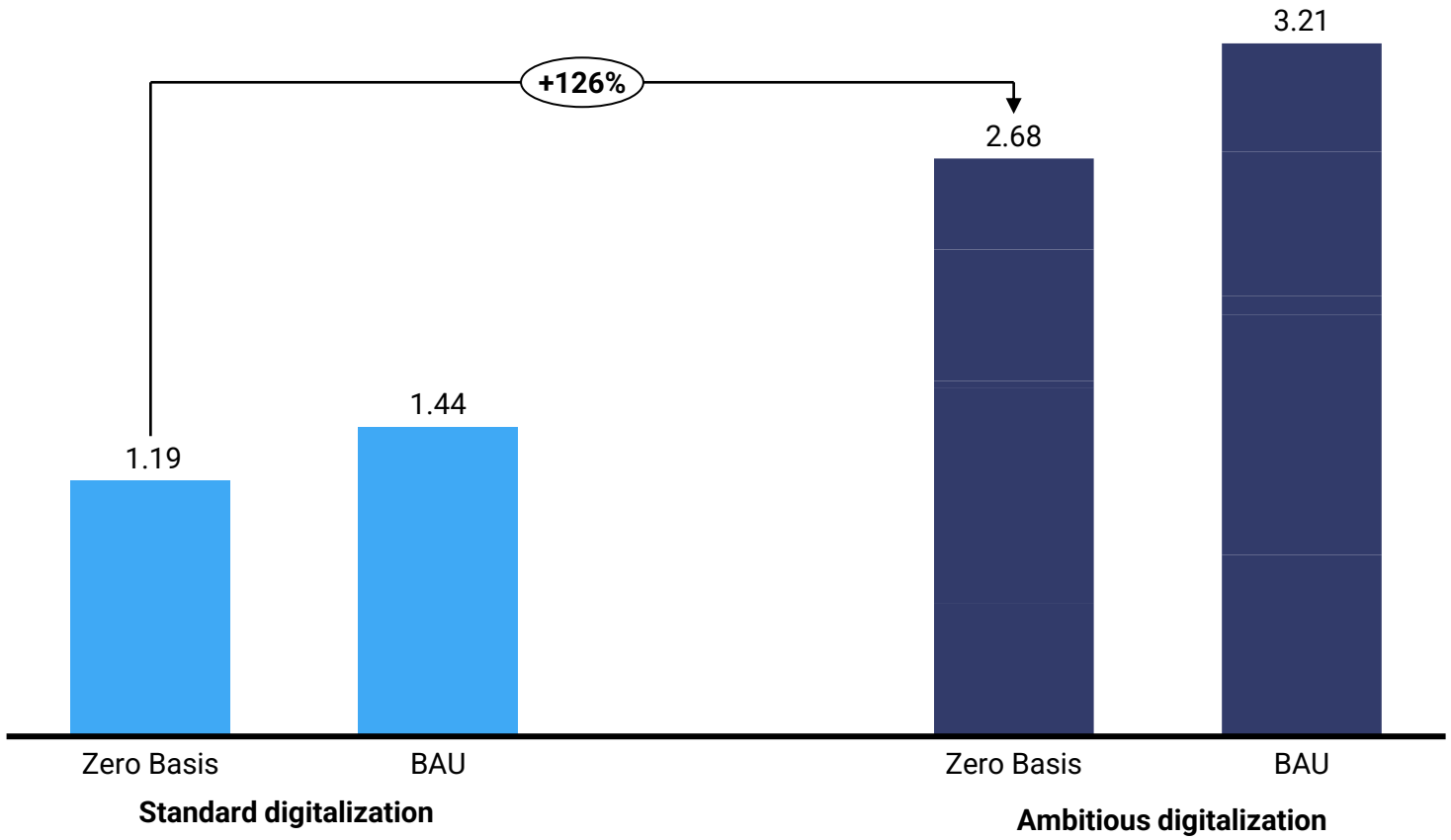
Digitalization promises a significant contribution to reducing the climate gap through decarbonization, particularly in the transportation (2–7%), building (2–5%), and agriculture (2–4%) sectors. It also offers opportunities in the industrial sector.

While the energy sector has less potential for CO_2eq savings due to the already high share of renewable energies in the Swiss electricity mix, digitalization is still essential. It creates the conditions for further electrification in other sectors, meets increasing demand intelligently, and manages the system integration of more and more decentralized renewable energy production.

Notes: Deviations in totals may result from rounding.

Through ambitious digitalization, the savings potential of digital technologies doubles by 2030

Through ambitious digitalization, more than twice as many emissions can be saved (in Mt CO_2eq)



Digitalization speeds

The study examines two different digitalization speeds: standard digitalization and ambitious digitalization. These are defined by the market adoption of use cases in 2030 compared to their market adoption in 2023.

Standard digitalization

Standard digitalization assumes that digitalization in the examined use cases continues according to existing trends and expectations. The study results show that with standard digitalization in the Zero Basis scenario, 1.19 Mt CO_2eq can be saved by 2030.

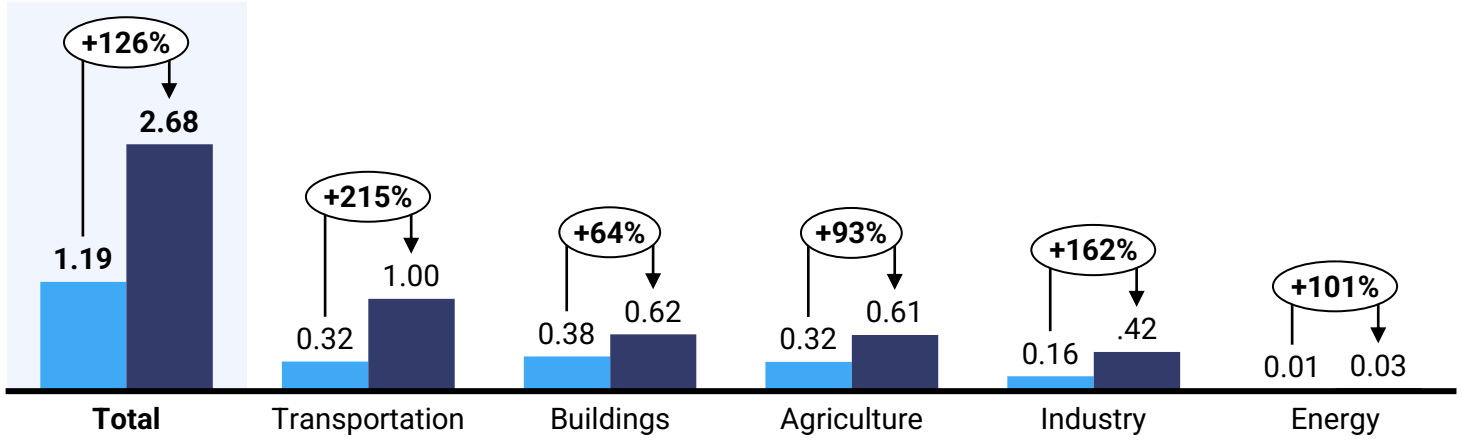
Ambitious digitalization

For ambitious digitalization, the study calculates a scenario where by 2030 some use cases are inspired by successful examples, while others fully exploit their user potential. The study results show that with ambitious digitalization in the Zero Basis scenario, 2.68 Mt CO_2eq can be saved by 2030. In this scenario, ambitious digitalization increases the potential CO_2-reduction by 126%.

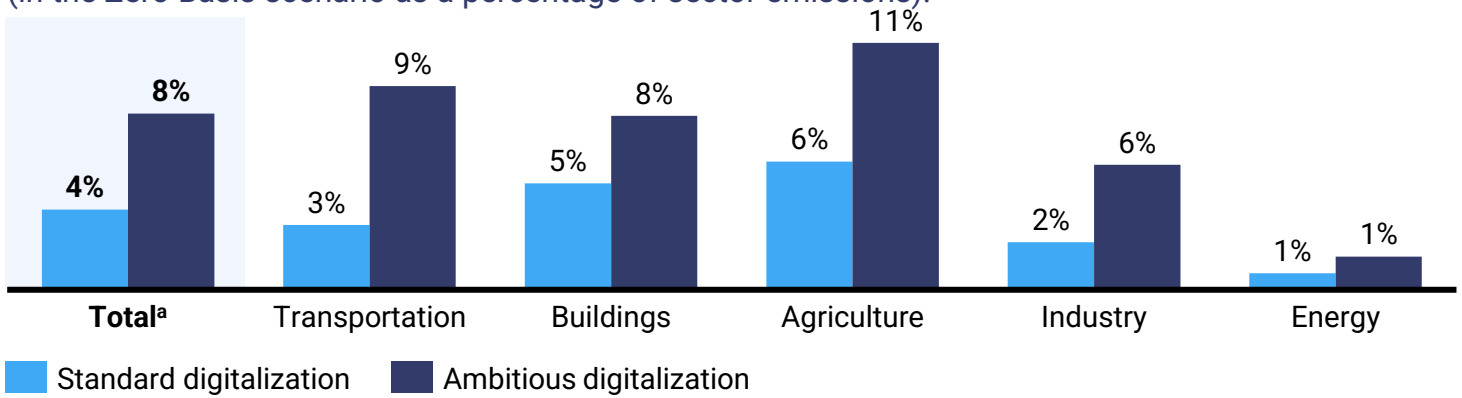
Notes: Deviations in percentage figures may result from rounding.

In the Zero Basis scenario, 4–8% of total Swiss emissions in 2030 can be reduced through digital technologies

The absolute CO_2eq savings potential shows that the transportation sector can save the most emissions
(in the Zero Basis scenario in Mt CO_2eq).



The relative CO2eq savings potential shows the impact on sector-specific emissions
(in the Zero Basis scenario as a percentage of sector emissions).



Absolute CO_2eq savings potential

In the Zero Basis scenario, between 1.19 and 2.68 Mt CO_2eq of total Swiss emissions in 2030 can be reduced, highlighting the importance of ambitious digitalization.

Certain sectors stand out in particular:

The transportation sector could increase its CO2eq savings by 215% and the industrial sector by 162% through ambitious digitalization. Overall, digitalization is crucial for all sectors.

Relative CO_2eq savings potential

Agriculture shows the greatest relative potential for reducing its own CO_2eq emissions through digitalization. With standard digitalization, 6% can be saved, and with ambitious digitalization, 11%. The transportation and building sectors also show significant relative savings potentials. The transportation sector could reduce between 3% and 9%, and the building sector between 5% and 8% of their emissions through digitalization measures. For other sectors, like industry and energy, digitalization also plays an important role.

Notes: Deviations in percentage figures may result from rounding. a: The indicated relative savings potential for total emissions pertains to the attributable emissions of all sectors.

The BAU scenario has similar relative savings potentials but higher absolute savings potentials of up to 3.2 Mt CO2eq, compared to the Zero Basis scenario

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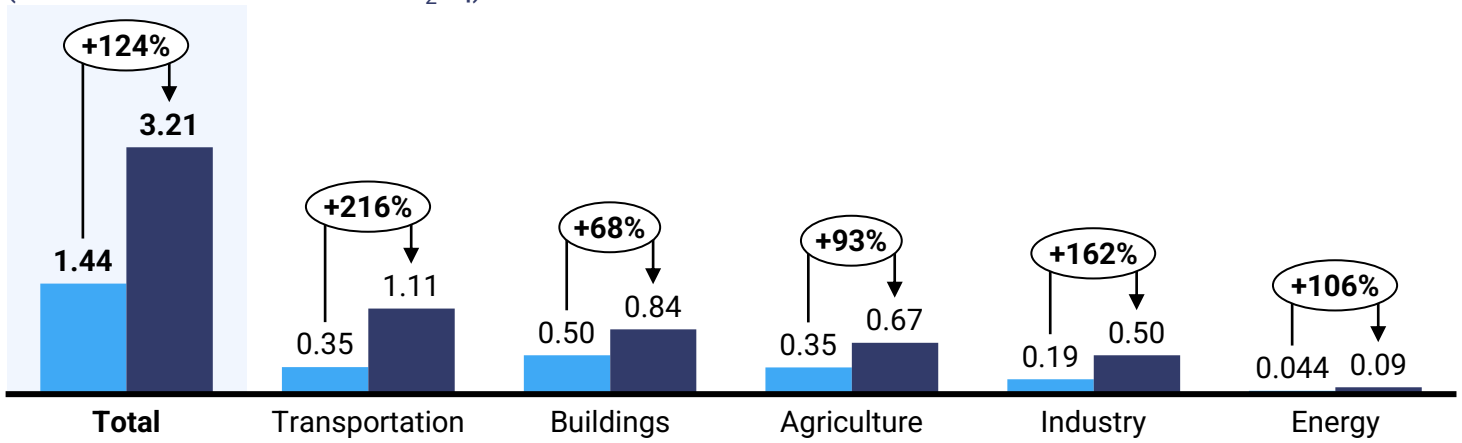

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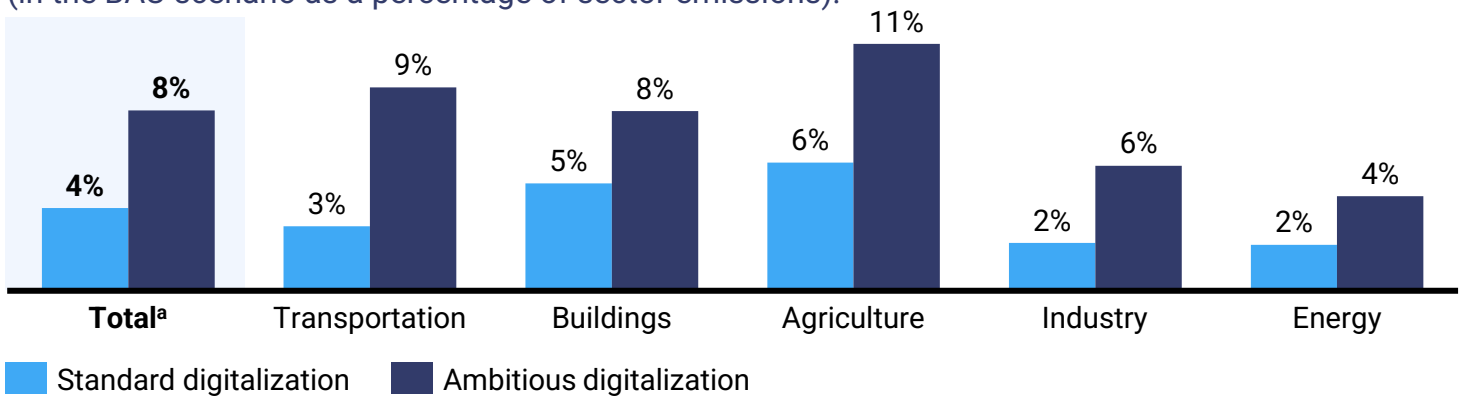

Absolute CO_2eq savings potential

In the BAU scenario ("Business-as-Usual"), between 1.44 and 3.21 Mt CO_2eq of total Swiss emissions can be reduced with standard and ambitious digitalization, respectively. This highlights the importance of ambitious digitalization.

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We must act today and create the right conditions for digital technologies in all Swiss sectors

We must act now

The study examines the period up to 2030, during which Switzerland must achieve important interim targets. It is shown that digital technologies can make a significant contribution to reaching these targets. However, climate protection does not end there: Switzerland must be CO_2-neutral by 2050. Therefore, it will be necessary to unlock even greater potentials beyond 2030.

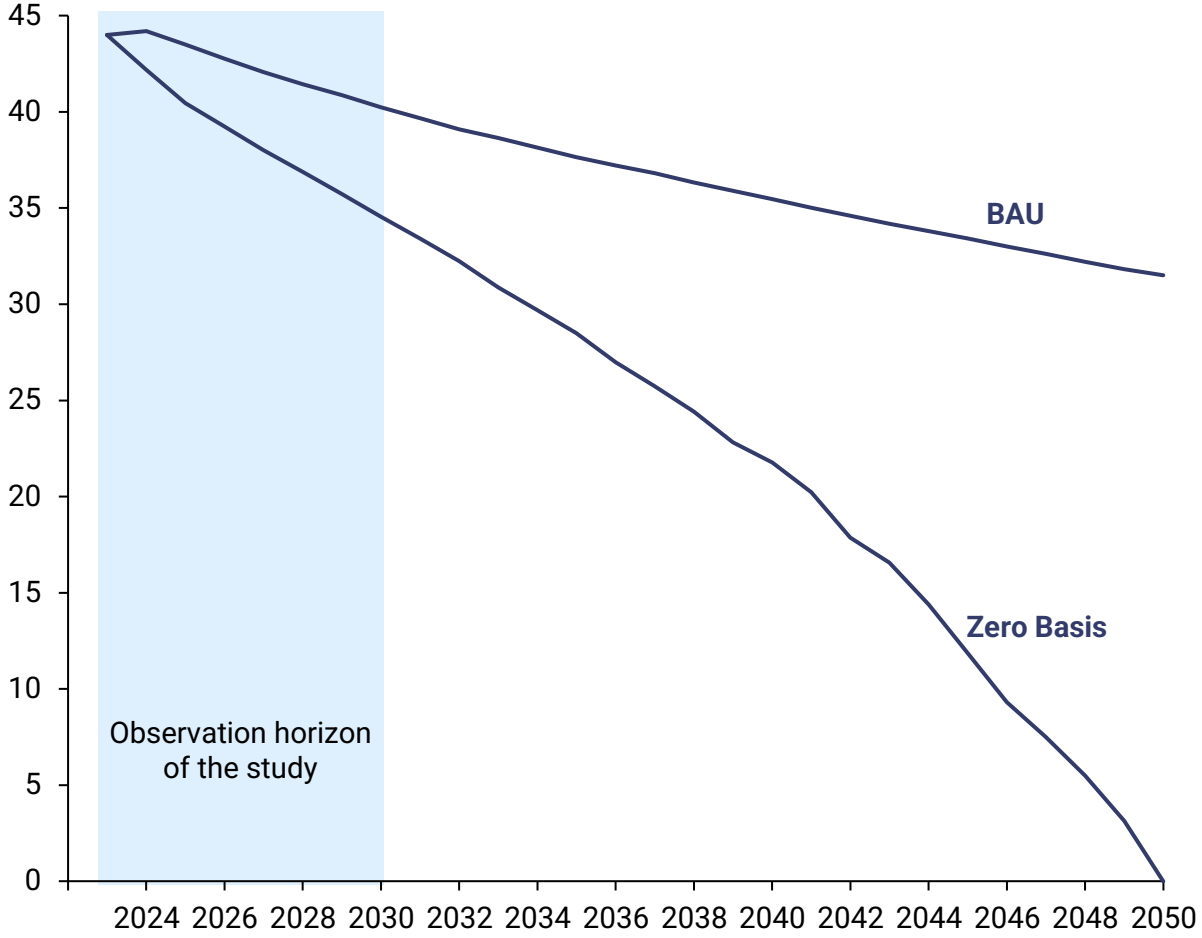
Prerequisites must be established

The challenges we face until 2030 and beyond to 2050, along with the clearly demonstrated savings potentials, underscore the urgency of accelerated digitalization as an imperative for climate protection. Neglecting this formidable tool any longer would be a grave oversight.

Effective economic policy goes hand in hand with advanced digital policy. Access to capital and qualified professionals must be as straightforward as possible. Regulatory and bureaucratic barriers need to be minimized to ensure smooth translation of research findings into practice. Additionally, it is essential to actively address existing skepticism towards digitalization both in politics and among the public.

A political and regulatory environment that fosters innovation and reduces bureaucratic hurdles is crucial. Support for the use of alternative fuels and the promotion of partnerships between businesses, the public sector, and educational institutions will accelerate research and development, creating a robust ecosystem that drives economically sustainable digitalization.

Even after 2030, Switzerland will face major challenges[1,a] (in Mt CO_2eq)



Sources: 1: Energy Perspectives 2050+;
Notes: a: Includes carbon capture and storage, as well as negative emission technologies