

Project report



HSLU

- Specialization Integrales Data Visualisation for AI and Machine Learning
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My Choice of Topic 'Switzerland's Objectives in Addressing Climate Change'

The selection of the topic for my DVIZ project, 'Switzerland's Objectives in Addressing Climate Change,' was the result of various considerations and personal motivations. In this section, I would like to explain the reasons and motivations that led me to delve into this significant topic.

Responsibility as a Parent:

A crucial drive behind my choice of this topic is my role as a new parent. With the birth of my child this year, I have started to think more about my child's future. I wish for a world where my son can grow up healthy and lead his life in an environment that is not affected by the negative impacts of climate change. This personal responsibility has motivated me to examine Switzerland's Objectives in Addressing Climate Change in-depth to better understand how our country is shaping the future for the coming generations.

Public Concern About Climate Change:

Another significant factor that influenced my choice is the widespread concern in the Swiss population regarding climate change. According to the Comparis Sorgenbarometer, approximately 65% of Swiss citizens are worried about the effects of climate change. This high approval rate clearly demonstrates that climate change is an urgent concern for the people in our country. Demands for actions to reduce greenhouse gas emissions and adapt to climate change are louder than ever.

Timeliness of the Topic:

Climate change has become one of the most pressing global issues of our time. It is constantly present in the media, political discussions, and society in general. The fact that this topic is featured prominently in nearly every other talk show and in the news has piqued my interest. I want to understand how Switzerland is responding to this pressing challenge and what specific objectives Switzerland has to address the impacts of climate change.

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1 Introduction

In this project, the emphasis has been placed on data storytelling. This decision was made for the following reasons:

Data storytelling allows for a vivid presentation of data and information, making complex concepts more easily understandable. This is particularly relevant as the target audience for the visualizations consists of average Swiss citizens who may have varying backgrounds and levels of expertise.

Furthermore, data storytelling provides the opportunity to visually control the design and narrative of the data, facilitating the creation of a coherent and engaging story. This is crucial for capturing the attention of the average Swiss readers and effectively conveying important insights.

The choice of data storytelling also allows for the use of various types of charts and visualization elements to present information optimally. This enables a versatile approach to data representation and encourages creativity in the development of visualizations.

Overall, data storytelling offers an effective means of communicating complex data patterns and guiding average Swiss readers through a compelling visual narrative, which is of particular interest in this bachelor's thesis.

2 Data Description

Unten ist eine Liste der Genutzten Daten Sätze:

1. **EP2050+ Strom:** The EP2050+ Electricity dataset from the Federal Office of Energy sheds light on the electricity planning for the year 2050 and beyond, providing essential insights into Switzerland's long-term energy policy.
2. **Endenergieverbrauch nach Energieträger:** This dataset, also provided by the Federal Office of Energy, presents the consumption of final energy categorized by various energy sources.
3. **Elektrizitätserzeugung in GWh:** These data, also provided by the Federal Office of Energy, indicate the quantity of electricity generated in Switzerland.
4. **Energieeinfuhr und -ausfuhr:** These data originate from the Federal Office of Energy and provide insights into energy trade and Switzerland's dependence on foreign energy sources.
5. **Treibhausgasemissionen nach Verbrauchergruppen:** Data from the Federal Office for the Environment enables the analysis of greenhouse gas emissions concerning different consumer groups
6. **Treibhausgasemissionen pro Kopf:** The data on greenhouse gas emissions per capita, furnished by the Federal Office for the Environment, provide insights into individual contributions to environmental impact.
7. **Bevölkerungswachstum:** The Federal Statistical Office tracks population growth and provides insights into Switzerland's demographic evolution.

All the utilized data are stored in the 'Daten' folder.

2.1 Daten-Preprocessing

The initial data processing was carried out using Excel files, where relevant data was copied to a new worksheet. In this process, the data related to 'Treibhausgasemissionen pro Kopf' and 'Bevölkerungswachstum' were combined to enhance clarity. When processing the data in Python, duplicates and NaN values were identified and removed. Furthermore, the data was sorted by years for the creation of meaningful line plots.

A significant insight gained from the data preprocessing is the importance of avoiding manual Excel manipulations in the future. This is because, when data updates occur, the entire process would need to be repeated. It is more efficient and sustainable to perform data processing directly in Python to save time and resources

2.2 Data Analysis

Initial data analysis and inspiration on how to visualize the data were derived from the websites of the Swiss Federal Offices of Statistics, Energy, and the Environment, as they described and presented the data. Following this, the data was plotted to gain an understanding of its characteristics. Subsequently, a plan was formulated to outline the objectives and key messages of the blog.

3 Inspirational Work

The ZDF website 'Daten zum Klimawandel im Überblick' [1] served as valuable inspiration, demonstrating how to effectively visualize climate goals and current CO2 equivalents. Additionally, reports such as 'IPCC_AR6_WGI_TS' and 'ETH Zuerich Energiezukunft Schweiz' provided insightful approaches to visualizing various scenarios and forecasts.

Of particular interest was the report on the 'Langfristige Klimastrategie der Schweiz' which elucidated Switzerland's long-term goals and highlighted potential financial implications if these goals are not achieved. All these reports are listed in the 'Quellen' section.

4 Target Audience

The target audience for the blog post "Switzerland's Objectives in Addressing Climate Change" is the average Swiss population. The average Swiss citizens play a crucial role in Switzerland's efforts to combat climate change. This group is characterized by a wide diversity, encompassing people of different ages, educational backgrounds, and social contexts. Their interests and expectations regarding climate change are as diverse as their individual lifestyles.

4.1 The Target Audience of Average Swiss Citizens

Average Swiss citizens represent a population that is unique in many ways. Switzerland has a strong tradition of direct democracy, which means that citizens are actively involved in political decision-making processes. They expect to be informed about political matters and participate in discussions and votes that influence their environment and daily lives.

Furthermore, Swiss citizens are often well-informed and highly environmentally conscious. They have a strong interest in the impact of climate change on their unique natural environment, including the Alps and numerous lakes in the country. The expectations of this target audience for information about climate change are high because they rely on facts and scientific insights to make informed decisions.

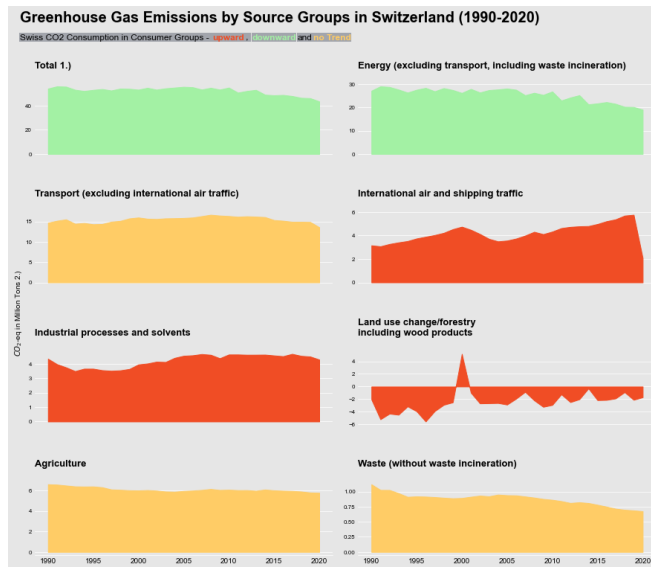
4.2 Expectations of the Target Audience Regarding Climate Change

Average Swiss citizens expect information that provides:

1. **Clarity and Timeliness:** They expect precise and up-to-date information on the current status of climate change, its effects on Switzerland, and the measures taken to mitigate it.
2. **Local Relevance:** As climate change can have regional variations, they expect information that is tailored to Swiss conditions and takes into account the impact on local communities and the environment.
3. **Calls to Action:** The target audience desires concrete calls to action and advice on how they can reduce their own ecological footprint.
4. **Transparency and Trustworthiness:** They value information from trusted sources that transparently outline how Switzerland is addressing climate change and the progress made.

5 Chart description

5.1 Explanation of Line Plots

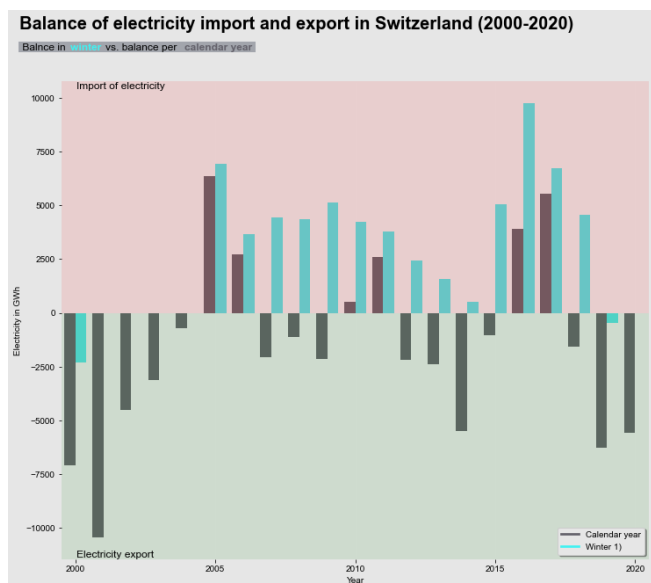


Continuous Trends: Line plots are particularly effective in illustrating continuous trends in Switzerland's CO2 emissions and energy generation over time. Using lines allows for a precise visualization of key indicators' developments and fluctuations.

Time Series Analysis: In analyzing time-dependent data like CO2 emissions and energy production, Line Plots are indispensable. They facilitate capturing temporal patterns, such as seasonal variations or long-term changes.

The use of red and green enables the targeted highlighting of Greenhouse Emissions trends. The other Line Plots share the same rationale.

5.2 Explanation for the Bar Chart in "Balance of Electricity Import and Export in Switzerland (2000-2020)"



Clear Quantity Representation: Bar charts excel at visually representing quantities. In this context, different types of electricity balance (Winter vs. Calendar Year) can be easily compared.

Indication of Positive and Negative Values: Background colors alert viewers that red backgrounds represent positive values (more import than export), indicating a potential shortage in local energy production. Green backgrounds, on the other hand, represent negative values (more export than import), indicating a surplus in energy production, which is positive as more electricity was generated than needed.

6 Work summary

Date	Planned time	Actual time	Done by	Task description	Status	Problems
Blog post						
18.09.2023	2	3	Lukas Loup	Data Research	Done	getting lost in the data
19.09.2023	3	2.5	Lukas Loup	Data Preparation	Done	-
20.09.2023	5	6	Lukas Loup	Research Papers and Articles on Climate Change in Switzerland	Done	-
20.09.2023	1	1	Lukas Loup	Outlining a story	Done	-
20.09.2023	0.5	1	Lukas Loup	Setting up the programming environment	Done	-
20.09.2023	0.5	1	Lukas Loup	create a class for data quality assessment	Done	-
20.09.2023	0.5	1	Lukas Loup	Conducting a data quality assessment on the data	Done	-
10.11.2023	3	4	Lukas Loup	Creating the initial plots	Done	it takes a little while to get back into plotting after a break
20.12.2023	10	10	Lukas Loup	customize plots	Done	-
20.12.2023	1	0.5	Lukas Loup	Searching for icons for plotting	Done	-
20.12.2023	2	0.5	Lukas Loup	customize plots whit icons	Done	-
25.12.2023	5	5.5	Lukas Loup	Describing the plots	Done	-
25.12.2023	1	2	Lukas Loup	Describing Switzerland's Climate Measures	Done	-
26.12.2023	1	1.5	Lukas Loup	Write an abstract	Done	-
projekt report						
28.12.2023	0.5	1	Lukas Loup	Format the project report	Done	-
29.12.2023	1	1	Lukas Loup	Create a motivation letter	Done	-
30.12.2023	1	2	Lukas Loup	Description of exploratory work	Done	-
31.12.2023	1	1	Lukas Loup	Target group description	Done	-
29.12.2023	2	2	Lukas Loup	Explanation of chart types	Done	-
30.12.2023	1	1	Lukas Loup	List of tools used	Done	-
31.12.2023	1	1	Lukas Loup	Create a bibliography	Done	-

7 Used Tools

7.1 Python Libraries

7.1.1 OS

OS in Python provides an interface to operating system functions, enabling operations such as file and directory manipulation, executing commands in the operating system, managing processes, and more. In this work, it was utilized for data retrieval.

7.1.2 NumPy

NumPy is a numerical library for matrix and array manipulation. NumPy was primarily used implicitly, as many other libraries work with NumPy arrays.

7.1.3 Pandas

Pandas is a data processing library, allowing efficient reading and manipulation of data. Pandas builds on NumPy.

7.1.4 Matplotlib

Matplotlib is a visualization library used to create simple as well as complex visualizations. To interact with data, Matplotlib internally uses Pandas and NumPy, forming the basis for its functionality.

7.1.5 Seaborn

Seaborn is another visualization library that builds on Matplotlib. It features a simpler API, attractive defaults, and better color management.

7.2 Other Tools

7.2.1 ChatGPT

ChatGPT is an AI-based chatbot capable of generating human-like responses. Trained on a vast amount of text data, it can respond to questions and queries by accessing its learned knowledge. ChatGPT was used to check the grammar of written texts.

7.2.2 DeepL

DeepL is an online translation service based on artificial intelligence. It employs neural networks to translate texts into different languages. DeepL was employed to translate between German and English.

7.2.3 Quarto

Quarto is an open-source publishing system for scientific and technical content, allowing the creation of dynamic content using various tools and programming languages such as Jupyter Notebooks, Python, R, Julia, and Observable. It enables authors to publish high-quality articles, presentations, and books in various formats and share knowledge within organizations.

8 Sources

- [1] M. Zajonz, „Daten zum Klimawandel im Überblick,“
<https://www.zdf.de/nachrichten/politik/klimawandel-deutschland-welt-folgen-daten-100.html>,
2023.