THE UNIVERSITY OF SYDNEY
Business School

Data Visualisation for Managers (INFS6023)

Assignment Case

Hydro EU: Visualizing Renewable Energy Production Across Europe

Background

Hydro EU, headquartered in Milan, Italy, stands as Europe's leading producer of clean and renewable energy, with a focus on hydroelectric power generation. The company manages a vast and diverse portfolio of hydroelectric power plants spread across the continent, ranging from small run-of-river installations to large-scale pumped storage facilities.

As Hydro EU has grown over the years, so has the complexity of managing its widespread assets. The company's power plants vary greatly in terms of capacity, type, and geographical location. Some are situated in mountainous regions with high dams and large reservoirs, while others are located on rivers with a steady flow. This diversity, while a strength in terms of energy production flexibility, presents significant challenges in terms of asset management, strategic planning, and operational optimization.

Recognizing the complexity of their asset management, Hydro EU sought assistance from a data visualization team to develop a system that would provide a comprehensive overview of their operations. The goal was to create an interactive, visual representation of their entire hydroelectric portfolio, leveraging the wealth of data they had accumulated about each power plant.

Key Stakeholders

Dr. Elena Rossi, CEO: Responsible for overseeing the company's overall strategy and operations. Dr. Rossi is particularly interested in how improved asset management visualization can enhance operational efficiency and strategic decision-making.

Marco Bianchi, Operations Manager: Tasked with coordinating the maintenance and operation of turbines across Europe. Marco requires a clear, real-time view of asset status to optimize maintenance schedules and ensure continuous power supply.

Sofia Conti, Head of Maintenance Teams: Responsible for overseeing the on-ground maintenance of turbines. Sofia and her teams need accurate, timely information about scheduled outages and asset locations to plan their work effectively.

Dr. Andreas Schmidt, Chief Grid Operator: Manages the distribution of power across the European grid. Dr. Schmidt requires up-to-date information on which turbines are operational to balance power supply and demand effectively.

Luca Moretti, Lead Data Visualization Project Team: Heads the external team brought in

to design and implement the visualization solution for Hydro EU's asset management needs.

What Problem is Data Visualization Helping to Solve?

The primary challenge faced by Hydro EU was the lack of a unified, easily comprehensible view of their asset status across Europe. This deficiency led to several operational issues:

1. Inefficient Planning: Without a clear overview, scheduling maintenance and managing power distribution became unnecessarily complex and time-consuming.
2. Communication Gaps: Stakeholders at various levels of the organization struggled to access and understand the current status of assets, leading to potential misunderstandings and inefficiencies.
3. Suboptimal Decision-Making: The absence of a comprehensive view made it difficult for management to make informed, strategic decisions about asset utilization and maintenance prioritization.
4. Potential for Human Error: Relying on disparate sources of information increased the risk of overlooking critical maintenance needs or mismanaging power distribution.

What Data Can Be Used?

To create an effective visualization system, Hydro EU compiled and provided access to a comprehensive dataset of their hydroelectric power plants across Europe. The dataset includes the following key information:

1. Asset Identification: Unique identifier for each power plant (id), Name of the power plant (name), Associated IDs from other databases (pypsa_id, GEO, WRI)
2. Location Data: Country code (ISO 3166-1 alpha-2) (country_code), Latitude and longitude in decimal degrees (lat, lon)
3. Power Generation Capacity: Installed electrical power generation capacity in MW (installed capacity_MW), Pumping capacity in MW, where applicable (pumping_MW), Average annual generation in GWh (avg annual generation_GWh)
4. Plant Characteristics: Type of power plant according to Dispa-SET classification (type), Dam height in meters (dam height_m), Reservoir volume in million cubic meters (volume_Mm3), Storage capacity in MWh (storage capacity_MWh)

A comprehensive data dictionary can be found in the Appendix.

This rich dataset allows for a comprehensive visualization that not only shows the current state of Hydro EU's assets but also enables detailed analysis and planning.

Any Challenges That Had To Be Overcome?

The development and implementation of the data visualization system for Hydro EU presented several challenges:

Scalability was an issue that had to be overcome. Designing a system that could handle and display data for thousands of assets across Europe without compromising performance or user experience was a major technical challenge.

Data security was crucial. Given the sensitive nature of energy infrastructure information, implementing robust security measures to protect the data while still allowing necessary access was crucial.

Adoption of the data visualisation system among technology-resistant users was slow. Overcoming resistance to change and ensuring widespread adoption of the new system across different departments and levels of the organization required a comprehensive training and change management approach.

To address these challenges, Luca Moretti and his data visualization team worked closely with Hydro EU's IT department, conducted multiple stakeholder workshops, and implemented an agile development process with regular feedback loops. The resulting system not only met the initial requirements but also provided a foundation for future enhancements and data-driven decision-making at Hydro EU.

Appendix

Data Dictionary

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Variable Name	Type	Description
id	Categorical	Unique identifier of the hydro-power plant
name	Categorical	Name of the power plant
installed capacity_MW	Continuous	Electrical power generation capacity in MW
pumping_MW	Continuous	Pumping capacity in MW (only when specified)
type	Categorical	Typology of the power plant, according to the Dispa-SET classification of technologies
country_code	Categorical	Country code according to ISO 3166-1 alpha-2
lat	Continuous	Latitude of the power plant in decimal degrees
lon	Continuous	Longitude of the power plant in decimal degrees (-180, 180)
dam_height_m	Continuous	Nominal head of the dam in meters
volume_Mm3	Continuous	Useful capacity of the reservoir in million of cubic meters
storage capacity_MWh	Continuous	Potential quantity of energy that can be stored in MWh
avg annual generation_GWh	Continuous	Expected/average generation per year (GWh)
pypsa_id	Integer	Association with the ID column from PyPSA-Eur powerplants.csv
GEO	Categorical	Association with the GEO Assigned Identification Number from Global Energy Observatory
WRI	Categorical	Association with the WRI Global Power Plant Database