

VILNIUS UNIVERSITY
FACULTY OF MATHEMATICS AND INFORMATICS
INSTITUTE OF INFORMATICS

Software Engineering Project

Electricity Market Analyzer

Made by EGAZ Team:

Giedrius Dauknys

Airidas Gabinaitis

Олександр Ротасенко

Evelina Matelytė

Vilnius

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1. Introduction

1.1. Topic presentation

For our project, we chose to create an Electricity Market Analyzer. This specific topic caught our eye since all our team members are young adults and are concerned about the future and understand that electricity is important for financial purposes. For the project, we picked to analyze data about our homeland – Lithuania.

1.2. Goals and Objectives

For this topic, goals were set to find out what causes massive price growth/drop, and what electricity market is the most suitable for everyone's needs. Equally, it was important to visualize the data using graphs, create a user-friendly and interactive interface, and give solutions for the Electricity Consumption problems. Additionally, create automated testing and learn how to work in a group.

2. Data Analysis

For the project, there were 2 attributes we primarily searched for in Lithuanian electricity markets: price for kilowatt-hour and average electricity consumption. In comparison, we analyzed and decided to visualize “Ignitis” (source: <https://ignitis.lt>) and “Elektrum” (source: <https://www.elektrum.lt>) hourly costs for the present time. Moreover, each of the team gathered data on electricity from home, which was meant for further analysis and representation in the project.

3. Project

3.1. Requirements for the Project

There were many requirements for the Project; the first was to create a Git Repository using VU VPN. There was an expectation for a roadmap with at least 5 meaningful milestones, then to meet SE practices: task management, version control, reviews, codebase consistency, build tool, effective testing, continuous integration, and continuous delivery/deployment. Additionally, constantly give reviews in GitLab, label and name everything precisely. All the descriptions must be short and informative.

3.2. Configuration and Execution

Electricity Market Analyzer was created using multiple programming languages: PHP, JavaScript, JSON, and CSS. Additionally, XAMPP was used for hosting a server. All the data gathered from the home’s electricity written in a CSV file is used in the code. For optimizing JavaScript files, the “Gulp” runner was used as an automated task performer that operates on Node.js and is important for web development. For more efficiency, the “Instantiator” library was used to create new instances for classes without using API or a constructor. As well, dependency manager “Composer” was used for easier integration of third-party codes in the project. Cloning objects was helped by “DeepCopy” which was installed using Composer. Equivalently there were other libraries installed: “PHP Parser” to simplify code analysis, “Manifest” for reading phar.io manifest from PHAR (PHP Archive), “phpunit/php-code-coverage”, “php-file-iterator”, “phpunit/php-invoker”, “Text_Template”, “phpunit/php-timer”, “PHPUnit”, etc. The Software itself has a website, which is interactive and consists of 4 panels: “Home”, “About”, “Contact” and “Solutions”. All of these can be pressed on, and it navigates towards a new window with specific information in it. The idea was to create a

functional, user-friendly interface for easier and faster market analysis. To make project-making easier, some automated tests were implemented.

3.3. Design and Structure

The design for the project is simple since our work was into functionality (in this case, interactive interface). The font style for the project used – “Open Sans”, text-alignment – center, background-color: #f4f4f4 for the body, #44c04a for the header, and #f7f7f7 for the weather forecast. The “Home” page has visualized charts with examples of the prices between different electricity markets, as well as the importance of solar panels. On the same page, there is another graph “2022 hourly cost” which indicates the hourly prices of every month in the year, this graph is self-explanatory but also interactive, to make it clearer it is possible to press on the name of the month and the line in the graph disappear giving a clearer look. The most information is about the previous year – 2022, so there is also given brief information about the highest cost month in 2022, which one was the least expensive, it also answers the questions of why it happens and what exactly impacts the price growth/drop. The panel “About” and “Contact” gives all the necessary information related to our market such as our mission, who are we, why to choose us, and where to contact us. The last is the “Solutions” panel which provides help with electricity consumption for factories and homes. Apart from that, the structure is clear and understandable either in the code or in GitLab. There is a small detail added at the end of the website, and it is – the weather forecast, which shows the current temperature and describes the weather in words. However, besides design choices, there also is structure, which is crucial for project management. Navigation between files is easy, everything is named and described well, and code style rules are applied and documented correctly.

3.4. Testing

Automated testing was included in the project. Automated testing is done by testing scripts or tools, and it’s made for efficiency, making fewer mistakes, and in general – for better outcomes for the projects.

3.4.1. Data Testing

The data test is for checking data in CSV type of files, where all information about each home’s electricity is placed. The test checks the paths given, and tests if the hourly CSV file exists. If the hourly file is found, the test checks if today’s date exists in that file, and checks for the format of data.

3.4.2. Index Testing

The index test is simply to check if the following files exist and if it's non-empty in the given path. The output is either “File does not exist in the path”, or that a “File is empty”, depends on the result.

3.4.3. Port-Forwarding Testing

The port-forwarding test checks a base port, which is 80 in our case, and scans for other ports to create an automated port whether to establish a connection or not. If the response is not false, it means the connection is successful, otherwise it failed the port forwarding. After checking, it gives an equivalent output to the result: “Failed to establish a connection via port forwarding” or “Connection succeeded with invalid configurations”.

4. Achievements

4.1. Planning

For the planning, from the beginning, the team already had a vision of the final product. As required, 5 meaningful milestones were created and they are: website skeleton, gathering market data, analyzing data, automated testing, and solutions for electricity consumption. In total, there were 8 milestones, and all were defined by simple but descriptive names. Each of the milestones was implemented in the project.

4.2. SE Practices

There were many practices included in the project as expected such as informative descriptions, short and understandable names, and labels, actively using Git Repository, and adding commits. Fast tracing in larger projects is a necessity, so it was used in the project. The clear project environment is easier to maintain, so small and simple merge requests were posted. For the best outcome, communication has a large impact, so quick response to the questions and reviewing was used as well. As mentioned before, the codebase had to have a specific style which was followed to the end, and team members not only followed the uniform style but also documented it. Furthermore, more technical things were done such as making clear configurations, installations, building projects using only a single-command command, and making automated testing.

4.3. Documenting

As it was required, both presentations were made. The first was about progress made, and the second – the final one. The Final includes every important aspect of what was done or used in the project. The last requirement was this project's documentation.

5. Conclusion

- The Electricity Market Analyzer allows learning quicker about electricity and gives a brief overview of what other markets provide for the customers.
- Analyze the present situation with electricity by knowing the reasons for growth or drop in prices, what are the causes, whether will there be any stability, etc.
- The most important part of the project – it has all the necessary information and is easy to use for everyone so that electricity will not be a problem in the future.
- Provides help and solutions for electricity consumption for factories and homes.

Sources:

<https://www.delfi.lt/verslas/energetika/eso-paaiskina-kas-sudaro-elektros-kaina-ir-kodel-tiekeju-siulymai-skiriasi-90474213>

<https://www.lrt.lt/en/news-in-english/19/1763310/lithuania-sweden-power-link-maintenance-put-off-due-to-electricity-market-situation>

<https://www.delfi.lt/news/daily/world/zvalgyba-rusija-neatsisake-tikslo-sunaikinti-ukrainos-energetikos-sistema.d?id=92652365>

<https://ignitis.lt/lt/ismanus-valandinis-elektros-tiekimo-planas#birzos-kainos-grafikas>

<https://www.kaina24.lt/elektra/>