



## How Green is the Web? Visualizing the Power Quality of Websites

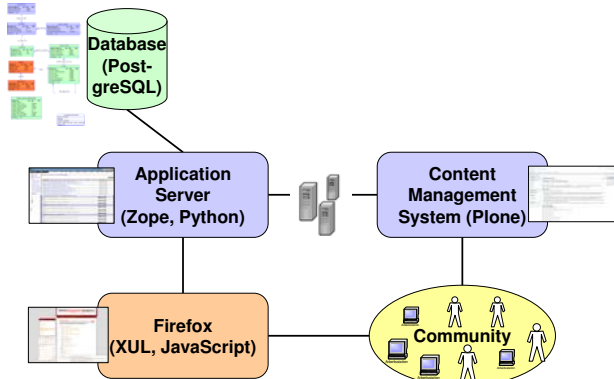
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- I. Introduction and Motivation
- II. The “Power Indicator” Application
- III. First Usage Results
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- Power consumption of Internet still increasing
- Several approximations exists, e. g. an approximated consumption in 2007 of 208 TWh power
- In Germany the power consumption of Data Processing Centers is estimated with 8,67 TWh power, that means 1,42% of the complete Power Consumption in Germany
- Several Approaches can reduce this consumption
  - Better hardware
  - Virtualization
  - Efficient algorithms and efficient Software

## II. The “Power Indicator” Application

## Overall Architecture



## Order of Events

The database request proceeds as following

1. Load a Website into Firefox
2. Send the URL to the Application Server via HTTPS
3. Identify the corresponding IP
4. Identify the corresponding provider in the database (if an entry is available)
5. Send information about the Green Power status to the Firefox client
6. Visualize the Green Power status within Firefox

## Screenshot

The screenshot shows the website for **OPENSOURCE CONSULT**. A table on the right side of the page lists various power status indicators and their corresponding icons. A red circle highlights the table, and a blue arrow points to the 'error' row.

Text	Icon
Power Indicator active	pi
Power Indicator inactive	pi
Green Power Class A	🟢
Green Power Class B	🟡
Green Power Class C	🟠
No Green Power	🔴
Power Quality unknown	?
searching	***
error	e

## III. First Usage Results

## Test results

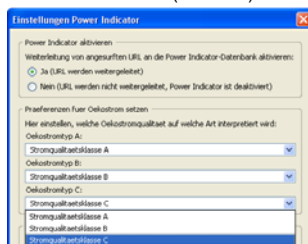
A test phase with 10 users over 1 week yields to the following results:

Provider	Energy Provider	Quality	Hits	%
Internic GmbH	Greenpeace Energy	A	153	6,05%
opensource-consult	Elektrizitaetswerke Schoenau	A	71	2,81%
Wissenschaftsladen Dortmund	Elektrizitaetswerke Schoenau	A	15	0,59%
Tenema GmbH	Greenpeace Energy	A	11	0,43%
Trilos IT-Dienstleistungen	Greenpeace Energy	A	4	0,16%
New Media Markets & Networks GmbH	Greenpeace Energy	A	2	0,08%
teuto.net	Greenpeace Energy	A	2	0,08%
Gaia e.V.	Unknown	B	19	0,75%
Unknown	Unknown	-	2254	89,06%
Sum			2537	100,00%

## IV. Conclusions and Outlook

## Advantages of the Application

- Light weighted Software, available as a Firefox extension
- The information about the power quality is independent from the Website
- The connection to our server is encoded (HTTPS)
- “Green Power” has several quality levels => These levels can be maintained and visualized by the user



## Limitations

- Up to now, the “Power Indicator” is just prototypical implemented
- Only internet providers (10) and power providers (2) from Germany are available
- The success of the application is strong related with quality and the amount of the data basis
- Up to now restricted to Firefox
- Analysis of usage is restricted regarding privacy protection

## Future Work

- Implement the application on other browser platforms
- Motivate some stakeholders to set up a community to maintain the data
- Up to now, the content is stored in a database. In the future it would be reasonable if the provider provide a certified green power state directly (or use meta data of a Website):

```
- <power_data>
- <ip>
  <utility name="Elektrizitätswerke Schönsau" atom="001" coal="001" solar="unbekannt" bkk="unbekannt"> </utility>
  193.28.225.39
  <ip>
  <ip_range start="193.28.225.35" end="193.28.225.37">
  <utility name="Elektrizitätswerke Schönsau" atom="001" coal="001" solar="unbekannt" bkk="unbekannt"> </utility>
  <ip_range>
  <ip_range start="193.28.225.42" end="193.28.225.44">
  <utility name="Elektrizitätswerke Schönsau" atom="001" coal="001" solar="unbekannt" bkk="unbekannt"> </utility>
  <ip_range>
  193.28.225.46
  <utility name="Elektrizitätswerke Schönsau" atom="001" coal="001" solar="unbekannt" bkk="unbekannt"> </utility>
  </ip>
```

## Summary

- The "Power Indicator" visualizes if a Website is hosted with Green Power
- The client application bases on Firefox, in the backend we use Python, Zope, Plone, and PostgreSQL
- The "Power Indicator" is part of our project "Greening Our Web" and part of "Sustainability Informatics"
- To avoid a rebound effect, the transferred data volume is very small
- We plan to fulfill the data base and to set up a community to look for the data quality and for criteria of Green Power

## End.

**Thank you for your attention.**

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