

# How Green is the Web?

## Visualising the Power Quality of Websites

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### Abstract

Visualizing the quality of a product or a service regarding its environmental impact is an important step to foster sustainability. Since Internet and Information Technology have an increasing consumption of power, it is interesting to visualize if a Website is hosted with green electricity. We developed a prototypical Firefox extension, which depicts this power quality. The service bases on a database where several providers are stored who offer hosting with green electricity.

### 1. Introduction

The power consumption of the Internet is still increasing. Actual approximations assume that the worldwide Internet infrastructure consumed in 2007 about 208 TWh power<sup>3</sup>. One important step to make the Web environmentally friendlier is to reduce power consumption with newer hardware, virtualization, and efficient algorithms (see e. g. [Fichter 2007]). However, for the required residual consumption, green power from renewable energy sources is the best choice to foster Sustainable Development. But up to now it is rarely possible for Web surfers to see if a Website is hosted with green power (only when the Website itself makes this information available). In order to solve this problem, we developed a browser extension called “Power Indicator” to visualize the green power status of the actual Website to the user.

### 2. Existing Approaches

Up to now, a Web surfer has very limited options to find out if a Website is hosted with green power. Based on our knowledge special tools to determine this are not available. However, some providers make special labels like “Atomstromfreies Internet” (nuclear power free Internet) available (e. g. Greenpeace<sup>4</sup>). Websites can integrate this label and visualize that they are hosted nuclear-free. There exist also Websites, which list ecological Internet Service Providers (ISP), like ecologie.net<sup>5</sup>.

However, all these approaches lack in three central points:

- (1) They are restricted only to a few Websites
- (2) The user must know the ISP of a Website or must identify the label (if available)
- (3) The label-service is not always provider-neutral

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<sup>3</sup> See <http://www.spiegel.de/netzwelt/tech/0,1518,495503,00.html>, last visited 2008-05-23

<sup>4</sup> See <http://www.atomstromfreies-internet.de>, last visited 2008-05-23

<sup>5</sup> <http://www.ecologie.net/Endanwender/%dcbersichtDer%d6ko-ISPs>, last visited 2008-05-23

### 3. The “Power Indicator” Application

In order to resolve these lacks we developed an extension for the Web browser Firefox<sup>6</sup>. Within Firefox, extensions are easy to develop and to maintain. However, the concept behind the application can also be implemented within other browsers. The main idea of this extension is to visualize in real-time whether a Website is hosted with green power or not.

#### 3.1 Functionality

The Power Indicator is easy to use. It is developed as a Firefox extension<sup>7</sup> and can be downloaded and installed in a standardized way. After installation an icon shows the power quality (figure 1) down to the right of the Firefox window.



Figure 1. Screenshot of the extension

In detail, after a Website is loaded within Firefox, Power Indicator identifies the associated IP-Address via the URL. This IP-Address is sent to our database, where several providers and their green power status are stored. Depending on the query result the extension displays if the Website is hosted with green power (figure 1). It also visualizes the quality of green electricity.

#### 3.2 Power Quality Classes - Defining User Options

The user has different possibilities to configure the local installation. A main point assures that the user will be able to deactivate the extension easily if he does not want that his URLs are sent to our backend. Additionally, all connections use HTTPS.

The second configuration option is connected with some special characteristics of green power. Here several quality levels exist (for discussions about the quality of green electricity see e.g. [Lange 2007]). Because we do not want to domineer over the users, and left the decision to them which green power quality status is acceptable. By default our application distinguishes three classes of green power:

<sup>6</sup> <http://www.mozilla-europe.org/en/products/firefox>, last visited 2008-05-23

<sup>7</sup> See <https://addons.mozilla.org/de/firefox>, last visited 2008-05-23, for more information

*Quality A:* Pure renewable energies with additional plants; no mixing with conventional energy production; clear criteria for the renewable energies.

*Quality B:* Pure renewable energies with additional plants; the power provider may be mixed up with conventional energies.

*Quality C:* Systems like the Renewable Energy Certificate System (RECS)<sup>8</sup> and other systems which do just trade with certificates without fostering additional plants.

These qualities are visualized on the browser surface with a green label containing the related character. However, with the options dialog the user can decide e. g. that the default quality C for him is acceptable as quality B.

### 3.3 Overall Architecture

Power Indicator bases on a three-layer architecture. In detail we use a PostgreSQL-Database in the backend and a Zope-based application server with the content management system Plone. The frontend is realized by a Firefox extension and contains scripts based on Javascript and the XML User Interface Language (XUL). Fig. 2 illustrates the overall architecture.

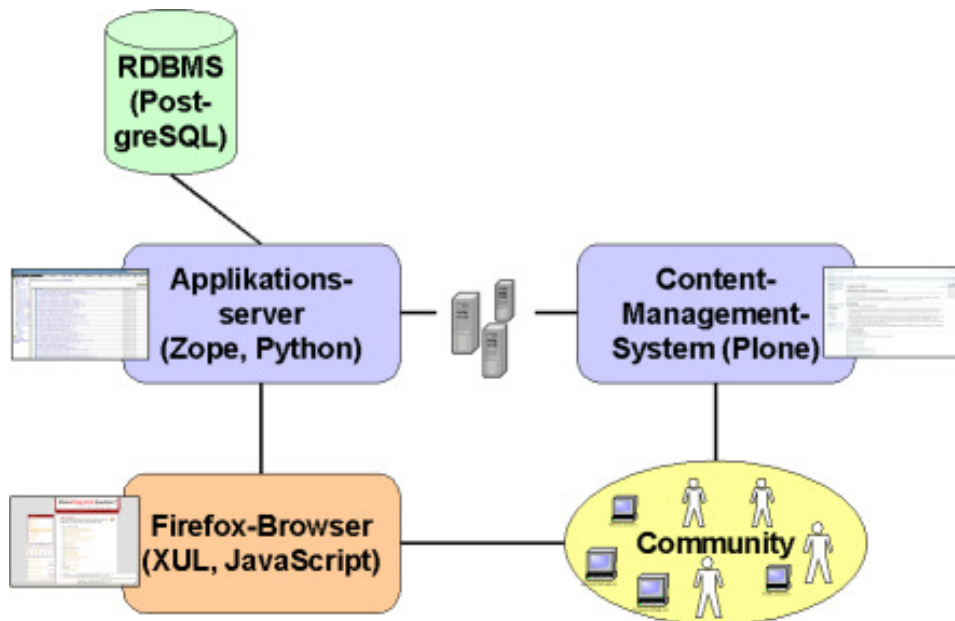


Figure 2. Overall architecture of the Firefox extension "Power Indicator"

### 3.4 Possibilities and Limitations of the "Power Indicator"

The Power Indicator gives Web surfers the opportunity to see if a Website is hosted with green power. However, the quality of this service bases on two essential factors: Firstly, the database content must be as complete and correct as possible, and secondly, the tool must provide the correct power quality informa-

<sup>8</sup> <http://www.recs.org>, last visited 2008-05-23

tion in real-time. The first factor bases onto good investigations and can be supported by an active community, which checks new entries and examines ISP, electricity producers, Website providers etc. The second point tends to good software quality and can be guaranteed by structured software tests, a transparent software architecture etc. This comprises that the software must be easy to install, to use, and to deinstall.

Consequently, our tool is as good as these two factors are put into practice. Considering the special purpose – to foster sustainability by visualizing feedback about Websites and their power quality – we must also consider questions regarding data volumes and also personal data protection. In order to reduce data volumes and to avoid a rebound effect pitfall the amount of the downloaded data is very small and comprises only one byte. To ensure personal data protection no URLs are stored on the server side; additionally, the connection is based on HTTPS.

#### **4. Conclusions and Outlook**

The described Firefox extension Power Indicator shows if a Website is hosted with green power. We give the Web surfers the chance to see if a Website and its provider is really “green”. Therefore, they can decide if they want to use that Website. Therefore our tool can support a “greener” Web indirectly. We are optimistic that sensors like the power indicator help to enhance Sustainable Development. They are one step to visualize the implications of Internet and Information Technology onto the environment and therefore also to sharpen new research fields like “Sustainable Software Engineering” [Naumann 2006].

Actually the prototype of our software “Power Indicator” is undergoing a beta-test. Up to now the database contains about ten German providers who provide webhosting with green power. With help of an interested community we hope to complete and maintain our database within the next months.

The Power Indicator is one step to make the Internet more sustainable because it visualizes whether a Website is hosted with green power or not. One next step could be to send information about the eco-status of Websites directly (and certified) with the Website metadata, e. g. in a standardized exchange format based on XML. And of course the service should also be available on other browser systems.

#### **5. References**

- Fichter, Klaus (2007): Zukunftsmarkt energieeffiziente Rechenzentren. Studie im Auftrag des Bundesministeriums für Umwelt, Naturschutz und Reaktorsicherheit (BMU), Berlin
- Lange, Lars (2007): Die Ökostrom-Lüge. Telepolis, 23.11.2007.  
<http://www.heise.de/tp/r4/artikel/26/26671/1.html>, last visited 2008-03-18
- Naumann, Stefan (2006): Referenzmodellierung für nicht-professionelle Kontexte. Akteursorientierung, Kooperation und Nachhaltigkeit. Dissertation, Universität Hamburg, 2006, <http://www.sub.uni-hamburg.de/opus/volltexte/2007/3164>