Key Performance Indicators for Electricity Consumption and Carbon Emissions for a Central IT-Security Monitoring Dashboard in AMPEG Security Lighthouse

Published in Bremen, Germany in August 2013

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Contents

1. Introductory remarks

Key performance indicators (KPIs) for electricity consumption are often taken into account in production. In the textiles industry, for example, more and more manufacturers are including electricity consumption and carbon emissions data in various production processes. The international company PUMA, which tracks carbon emissions as part of its supply-chain management, is a well-known pioneer in this area.[1]

Sustainability KPIs, which usually focus on electricity consumption and the therewith combined carbon emissions, can also be used effectively in IT departments, as shown in the following chart. Using sustainability KPIs not only enables companies to take steps to becoming more environmentally friendly – for instance, by reducing their carbon footprint – but also helps them to become more cost-efficient through lower consumption of resources.

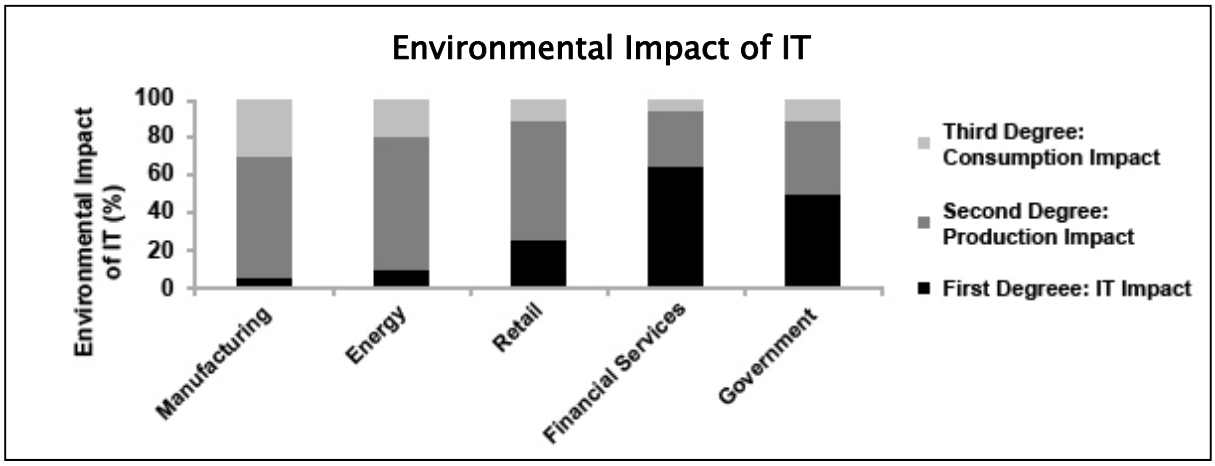

Figure 1: Electricity consumed by IT in five sectors.

Mainboard manufacturer Via is one positive example of an IT company that provides detailed sustainability KPIs. Via states exactly how much electricity its mainboards use in combination with different types of software.[2] This gives prospective buyers a good idea of how much power the mainboard will need to play videos or surf the internet, for example.

[1] Cf. PUMA [2012]

[2] Cf. Via Embedded [2013]

1.1 The idea behind the study

AMPEG GmbH also set itself the target of providing its customers with KPIs for its Security Lighthouse IT security monitoring software. To this end, the company measured the electricity consumption and carbon emissions of a central IT security dashboard that runs non-stop with Security Lighthouse, thus providing an overview of the security status.
Inspired by a 2012 study by TÜV Rheinland to determine the energy efficiency of web browsers[3], AMPEG GmbH also used three different browsers – Internet Explorer, Mozilla Firefox and Google Chrome – in its measurements. In addition, it ran Security Lighthouse on a PC that had been set up specifically for the IT security monitoring dashboard. The TÜV Rheinland study had already revealed significant differences in the amount of electricity that different browsers use.

The aim of AMPEG GmbH's study was to find out how much electricity the PC running the IT security dashboard used overall, as well as to show how much additional electricity it used by running Security Lighthouse in its browser. To determine this, we calculated the difference between basic power consumption, idle power consumption and power consumption while using Security Lighthouse in the various browsers.

1.2 The question addressed

The question arising from AMPEG GmbH's ideas was as follows:
How much additional carbon dioxide does a company emit when it runs AMPEG Security Lighthouse as an IT security dashboard on a central monitor that is constantly (24/7) switched on?

[3] Cf. TÜV Rheinland [2012]

2. Test set-up and test conditions

This section describes the test conditions in detail. It also lists all of the hardware and software used. We did our best to make the test set-up as representative as possible in order to replicate our customers' actual circumstances to the greatest extent possible.

2.1 System environment

The system environment for the measurements was limited to what could be reconstructed as representative. For this reason, we only measured the PC's electricity consumption for the operating system, the browser and Security Lighthouse on the browser. We did not measure the network or the server running Security Lighthouse, since doing so involved too many incalculable variables. We did not include the PC monitor either, as the very wide range of electricity consumption rates for the different products on the market makes it impossible to reconstruct customers' actual circumstances using a specific monitor. In the following image, the area we measured is depicted in the black frame.

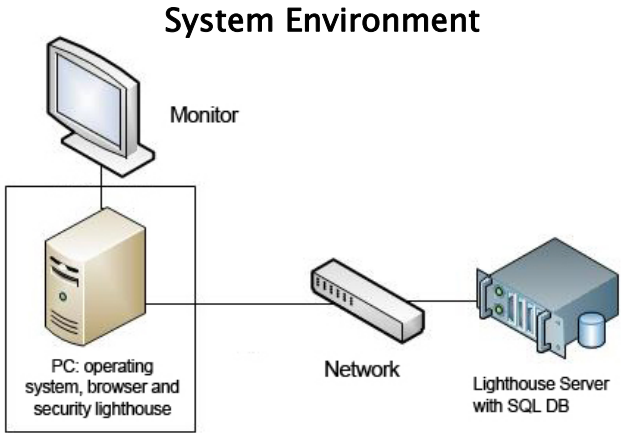

Figure 2: System Environment

2.2 Hardware

Our hardware consisted of an ENERGY 5.0 certified mini-tower PC, which we bought in 2012. It represents the current state of technology and energy efficiency. In addition, the manufacturer endeavoured to use environmentally friendly materials where possible.

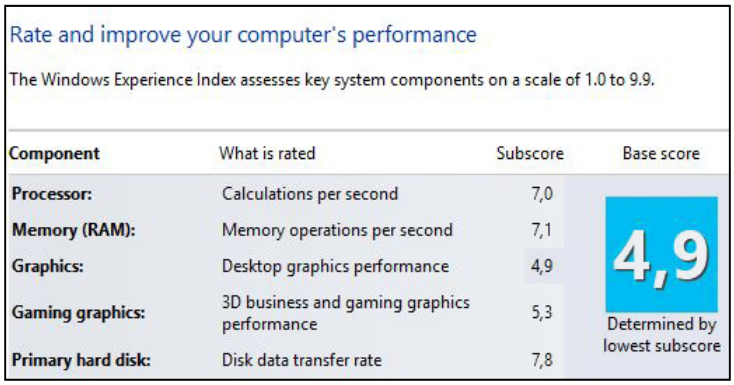

Figure 3: Experience index for the test PC

We took the following hardware information from the PC:

- Hard drive (SSD): Intel SSDSA2M120G2GC 120GB
- Processor: Intel(R) Core(TM) i5 CPU 650 @ 3.20 GHz, 3193 MHz, 2 cores, 4 logical processors
- Memory: 8 GB RAM
- Graphics card: Intel(R) HD Graphics – integrated in the processor
- Intel(R) 82578DM Gigabit Network Connection

The PC was connected to a Full HD monitor with a resolution of 1920x1080.

2.3 Software

We installed Windows 8 Enterprise 64-bit (version 6.2 build 9200) on the test PC. We used the standard Windows set-up and did not make any changes to the settings.

We measured the electricity consumption using Security Lighthouse version 5.10.0.19.

As antivirus solution, we installed Trend Micro OfficeScan Client for Windows, version 10.6.3205 Service Pack 2, on the PC.

We also installed all of the browsers we planned to test. They were:

- Mozilla Firefox V.17.02 ESR
- Internet Explorer V.10.0.9200.16484
- Google Chrome V.25.0.136497m

Mozilla offers an extra version of Firefox with extended support for large organisations (ESR). We used this version.
It is also worth to note that all of these browsers use different browser engines. Google Chrome uses the same engine as Apple's Safari browser. However, this does not make it possible to draw conclusions on Safari's electricity consumption.

2.4 A representative IT security dashboard

An expert from AMPEG helped us to create a representative IT security dashboard for the study. This Security Lighthouse dashboard was to be made available both to the IT security team and the company's management team. As a monitoring dashboard, its purpose was to provide a comprehensive overview of the most important data. The dashboard included the current pattern level, the top ten viruses and numerous other widgets, plus some other items. All dashboard widgets were updated every thirty minutes.

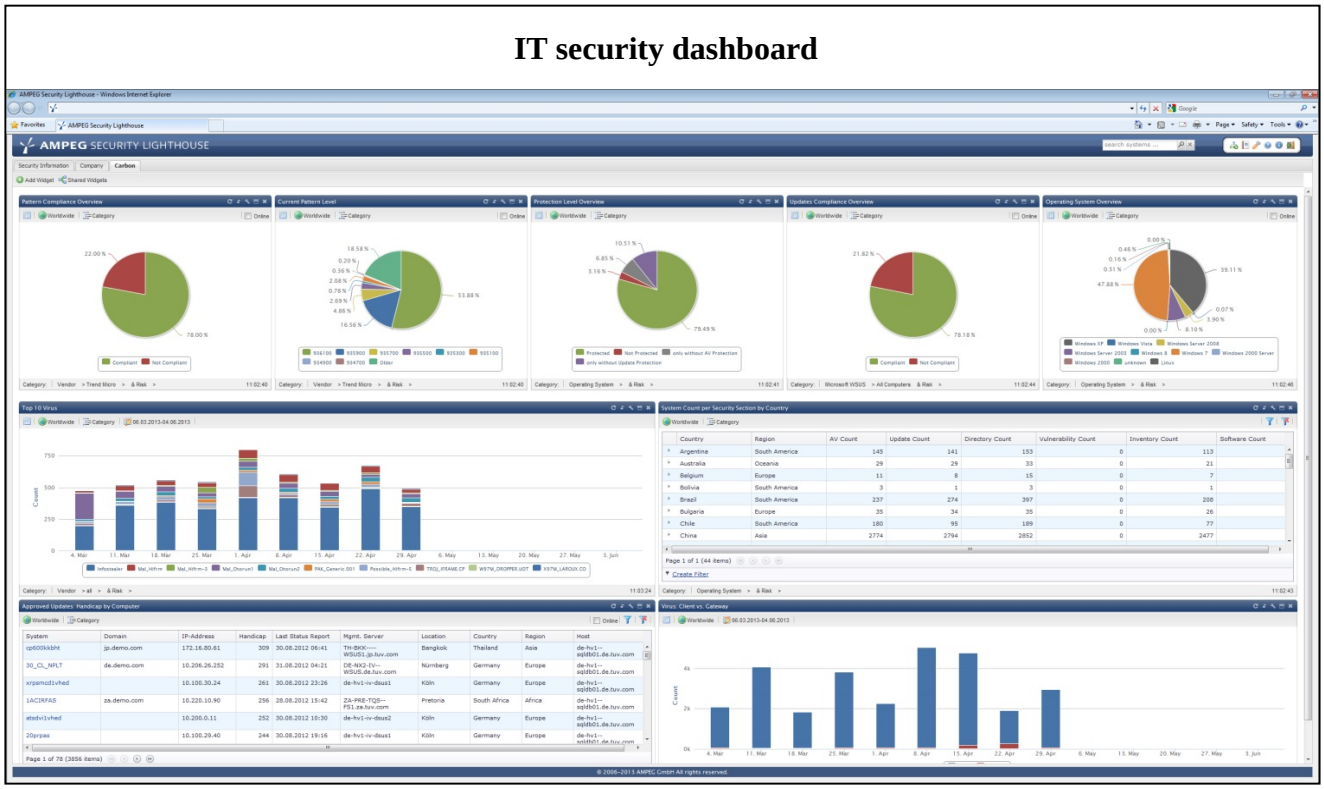

Figure 4: Screenshot of the IT security dashboard

2.5 The measuring device

We used an Energy Monitor 3000 as our measuring device. It received good ratings in various reviews, and typically only has deviations of one percent, and not more than two percent, when measuring up to 2,500 watts.

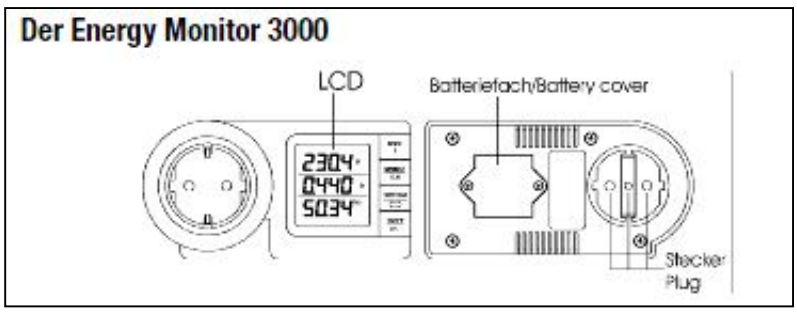

Figure 5: The measuring device

2.6 Taking the measurements

We measured the PC's idle electricity consumption, i.e. while only the operating system was running, for a period of four hours. We also measured how much power the PC used when it was running each of the three web browsers along with the Security Lighthouse dashboard, this time for a period of eight hours. The idle measurement period was shorter than the measurement period when the PC was running the browsers and the IT security dashboard because the former is far less prone to fluctuations.

3. Results of the measurements

We have divided the results of our measurements into two parts. Section 3.1 lists the electricity consumption and carbon emissions results for the entire PC running IT security monitoring with a web browser and Security Lighthouse. Section 3.2 shows how much additional power the browsers and Security Lighthouse consumed. In other words, it subtracts the results for the idle PC (i.e. with no programmes running) from the results for the PC running a browser and Security Lighthouse.

3.1 Results for the entire monitoring PC

The first column in the chart below shows the results of our four test measurements. First we show the results for the idle PC for four hours, i.e. while the test PC was only running the operating system. Then we show the results for the PC running the three different browsers and Security Lighthouse for eight hours.

The second column shows the results converted into the number of watts used, while the third column shows the results converted into annual carbon emissions in kilograms (kg). These figures are also shown as bar graphs in the appendix on pages 11 and 12.

	Results of the measurements in [kWh]	PC's electricity consumption in [W]	PC's carbon emissions per year In [kg]
Idle [4 hours]	0.098	24.50	123.70
Firefox [8 hours]	0.200	25.00	126.23
Internet Explorer [8 hours]	0.213	26.63	134.43
Chrome [8 hours]	0.223	27.88	140.74

*Figure 6: Results of electricity measurements – KPIs for the entire PC**

Annual carbon emissions for the entire PC ranged from around 126 kg to about 140 kg, depending on the browser. In comparison, a small car with carbon emissions of 120 grams per kilometre would have to drive more than 1,000 kilometres to emit the same amount of carbon dioxide.

3.2 Results for the browsers' electricity consumption with Security Lighthouse

We figured out the difference of the results (described in Section 3) in order to show how much additional electricity the web browsers consumed in combination with Security Lighthouse.
Once again, we calculated the amount of power used in watts, as well as the carbon emissions this would produce each year in kilograms. These figures are also shown as bar graphs in the appendix on pages 11 and 12.

	Browser's electricity consumption in [W]	Browser's carbon emissions per year in [kg]
Firefox	**0.50**	**2.52**
Internet Explorer	**2.125**	**10.72**
Chrome	**3.38**	**17.04**

*Figure 7: Additional electricity used by the browsers in combination with Security Lighthouse**

It is striking that Firefox uses very little power when running Security Lighthouse. Internet Explorer uses more than four times as much electricity as Firefox, while Chrome uses six times as much.

It is worth noting that AMPEG GmbH staff members found that Security Lighthouse was significantly faster when paired with Google Chrome than with the other two browsers in the test.

*To calculate carbon emissions, we took the electricity consumption figure and multiplied it by a factor of 576g CO_2/kWh, the official figure for the German electricity mix in 2012.[4]

[4] Cf. Federal Environment Agency (Umweltbundesamt)

4. Summary and evaluation of the results

We now know how much additional carbon dioxide a company emits when it runs AMPEG Security Lighthouse non-stop (24/7) as an IT security dashboard on a central PC. We produced sustainability KPIs for the total electricity consumption and carbon dioxide emissions of our monitoring PC, as well as just for the additional electricity used by the browsers and Security Lighthouse.

Purchasing departments can use this information as a selection criterion in tenders and when deciding to buy Security Lighthouse. Providing people with a specific figure for electricity consumption can help them to estimate their annual costs more accurately before they buy.
Companies that offset their carbon emissions can use these KPIs directly. Adopting sustainability KPIs can also help companies to gain ISO 14001, EMAS or other types of certification for their environmental management systems.

5. Appendix

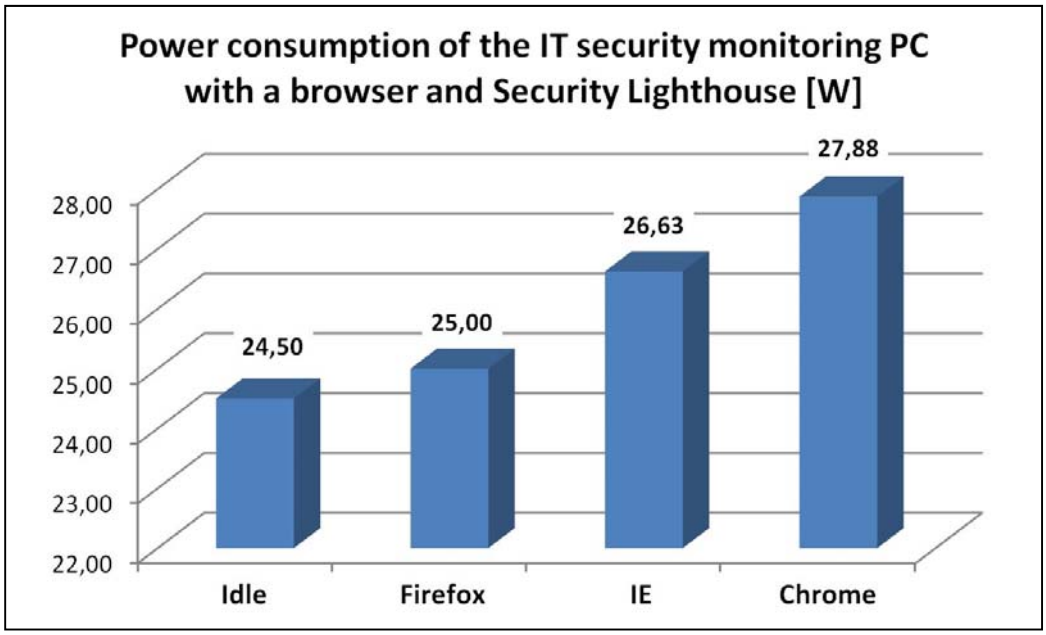

Figure 8: The test PC's electricity consumption when running a browser and Security Lighthouse

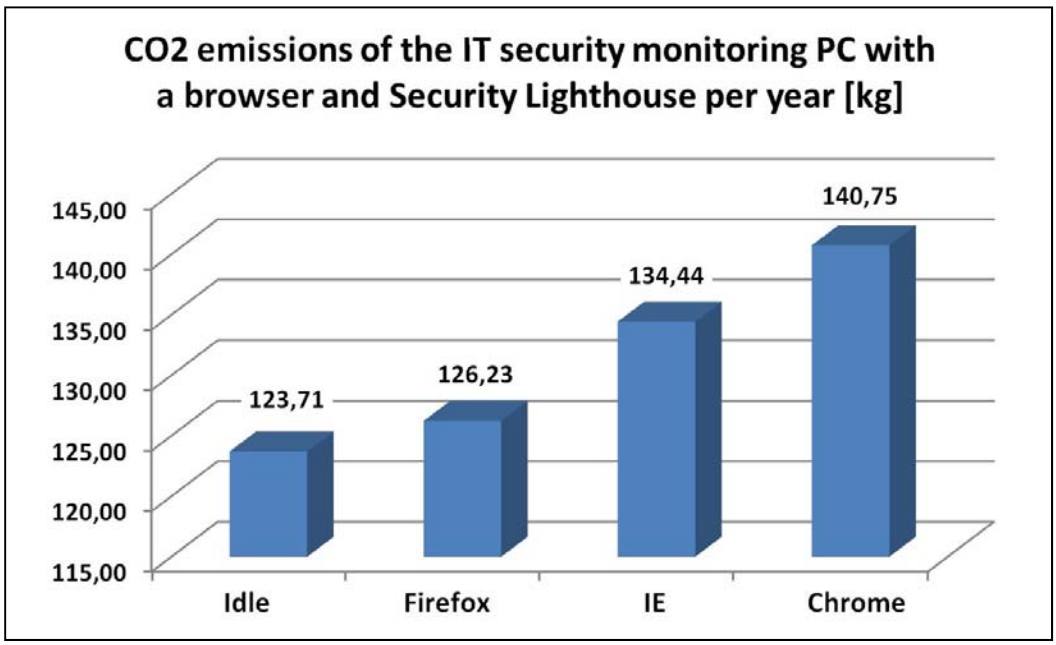

Figure 9: The test PC's carbon emissions when running a browser and Security Lighthouse

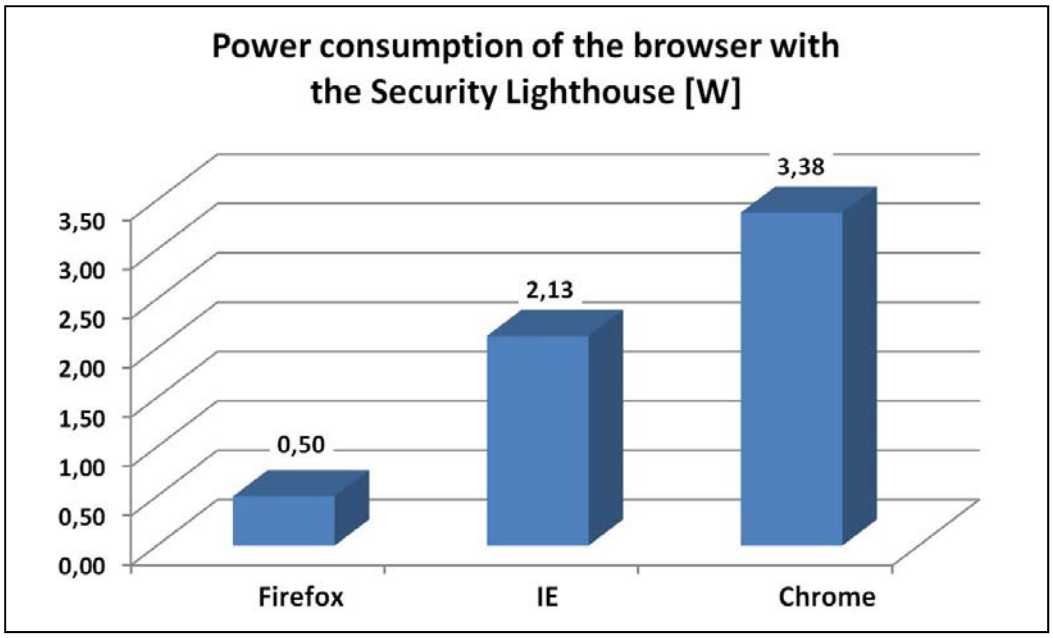

Figure 10: The browsers' electricity consumption when running Security Lighthouse

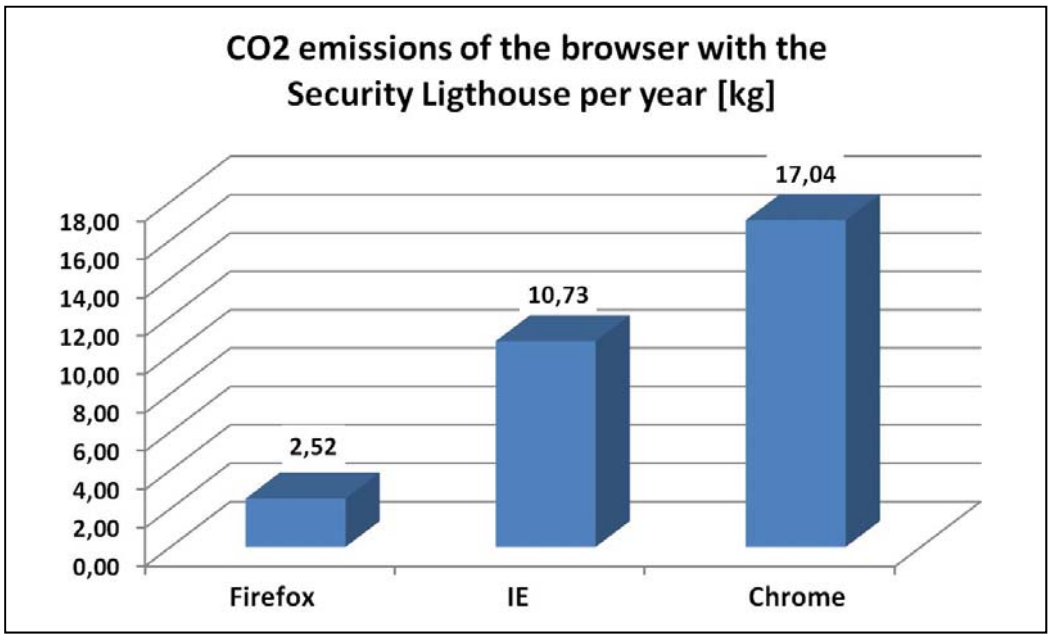

Figure 11: The browsers' carbon emissions when running Security Lighthouse

6. References and list of figures

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