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Documentation of Elisa´s Carbon dioxide emission saving calculations

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Content

IMPLEMENTATION AND RELIABILITY OF MEASUREMENTS

Elisa's emission savings calculations are made as transparent as possible and assured by a third party. The assurance included assessing the reliability of the data collection and reporting systems, the existing controls, and the risks relating to the data calculation method and data collection. This calculation document has not been assured. This publication specifies all underlying assumptions and methodology of the calculations. Elisa consulted Gaia Consulting Ltd for these matters.

The independent assurance for emission savings meters and carbon footprint 2016 was carried out by EY. These included assessment of the requirements and objectives set for the calculations, and the risks affecting the correctness of the information. They also included review of the reporting and data formation processes, the systems and data collection instructions. The objective is to ensure that the policies, practices and information systems created will allow for a sufficiently accurate and reliable calculation.

SIGNIFICANT ADJUSTEMENTS TO PREVIOUS ACCOUNTING PERIOD

Significant adjustments to previous accounting period (2015) in carbon footprint calculation:

- Scope 3 emissions have been reported in 2016 according to GHG protocol Corporate Value Chain - standard as in CDP reporting in previous years.
- In Scope 2 reporting the new GHG protocol Scope 2 guidelines have taken into account.
- In Capital goods - section only base stations are reported in year 2016. Other equipment to network will be reported in CDP reporting in June. We are improving the reporting in this during the year 2017.
- The calculation boundary of wastes has been changed. Now a waste figure covers all wastes in Elisa Finland. Waste figures have been calculated retroactively with new boundaries to year 2014.
- Scope 1 emissions have been corrected retroactively to year 2014.

Significant adjustments in carbon emission savings calculations:

- There is one significant change in the calculations compared to the last reporting period. Purchased renewal energy is now calculated in own meter (See further from the section Renewal energy). Impact of renewal energy is omitted from the other indicators to avoid double accounting. This significantly affects to Mobile work- meter, where emission savings have declined.

SERVICES REDUCING CUSTOMERS' EMISSIONS

Virtual conferencing

The objective is to calculate the CO_2 emission savings of the virtual conferences arranged by Elisa for customers, compared with a traditional conference where participants are travelling to the conference venue. Elisa offers customers several virtual conference solutions. The conferencing types consist of Videra's video conferencing services and Microsoft's Lync. Teleconferences were excluded from the calculation. The services included in the calculation will subsequently be called *virtual conferencing*.

Videra´s systems provide information about number of participants in Videra´s videoconferences. In respect of Lync service, information about participants is not available. To assess the meeting volumes, the results of surveys made to Elisa´s Office 365 customers 3.4.2013 and 10.4.2014 were used.

Total 187 companies have been participated to surveys. According the surveys an average 7, 97 virtual meeting were held per one user (it´s the same as per one license) in half year. In average 3,46 participants in one meeting. In external benchmark, Crimson Consulting Group´s survey, average participant in meetings is 4 persons. (Crimson Consulting Group 2009).

Virtual conferencing can replace traditional conferencing but it will increase the total number of meetings as the threshold for virtual conferencing is low. The growth in the number of meetings carried out due to possibility of using virtual conferencing was estimated on the basis of the related surveys available and the meeting and business travel behavior of Elisa's own employees. The calculation is largely based on the changed business travel behavior of Elisa's employees. **In the calculation, one videoconference in three was considered to have replaced a traditional meeting.**

The emission volumes of the various means of transport were calculated using emissions factors obtained for road and rail travel from VTT's Lipasto calculation system and for air Defra´s emission factors (DEFRA 2015).

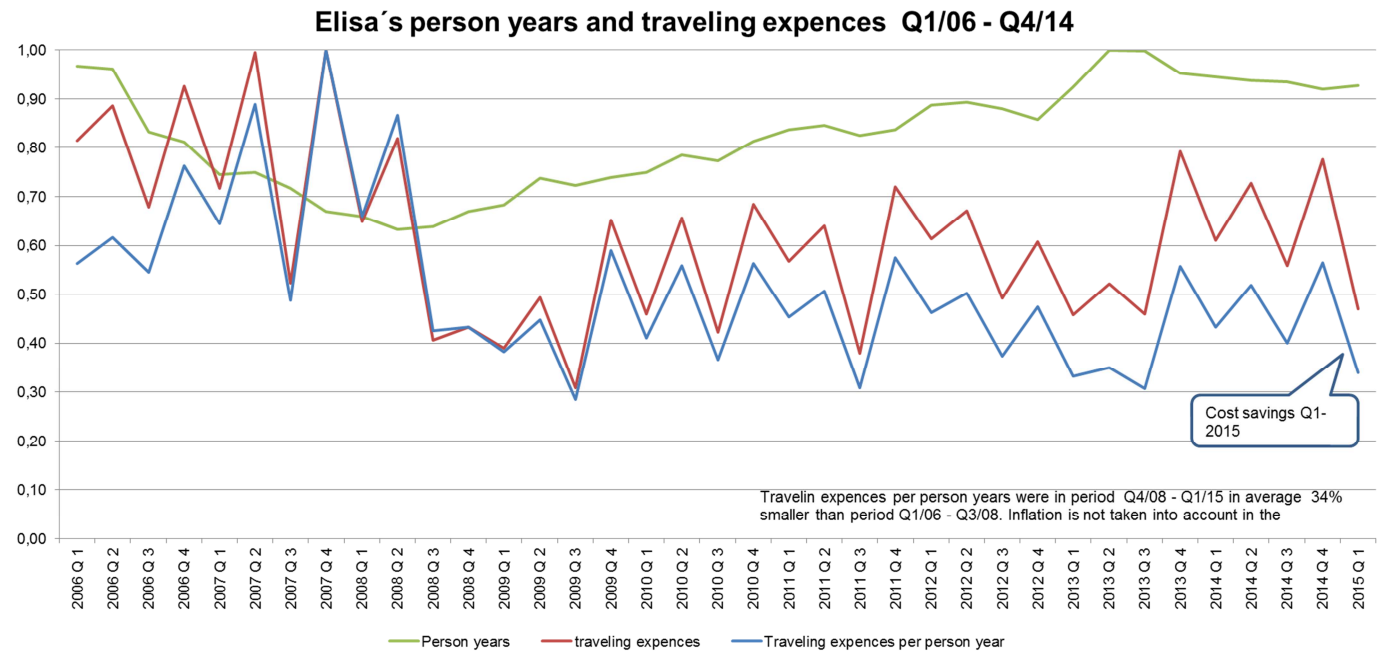
Business travel changes in Elisa Corporation

In H1/2010 Elisa employees attended over 30,000 virtual conferences, which were well documented. According data gathered virtual conference users' central place of work and Elisa employees' average methods of transportation based on travel invoicing and distances between different Elisa office locations, theoretical travel distance of virtual meetings was calculated and normalized. The result was 1.2 million kilometers, excluding such virtual meetings, where the use of international and domestic flights would have been the most likely means of replacement. Reliable data on these distances was not available.

The review of Elisa's travel expenses indicates that the total amount of business travel has decreased considerably, whereas the total amount of virtual conferencing has increased significantly. Based on the travel expenses development during 2006-2010, the statistical cost reduction of travel expenses during calculation period can be roughly estimated and converted to kilometers based on allowances for travel expenses paid for employees at Elisa using their own cars. Recalculation the travel expenses in the spring of 2014 showed that the travel expenses per man-year have permanently stabilized at a very low level.

The train is commonly used for short and medium distances in Elisa business travels. However, at the time of calculation, the amount of train travel could not be comprehensively separated from other travel expenses. Therefore allowances for travel expenses for employees using the train are assumed according to the use of car. The expense of train per kilometer is based on Statistics Finland's review of train expenses in Finland for a travel distance of 200 km in 2010. As a result, the actual replacement could be calculated from the period, as travel expense reductions (excluding flights, lodging and other expense) and virtual meetings as 100 percent replacement distances were converted to kilometers. The calculation result shows that the percentage at which virtual conferencing has replaced traditional conferencing, was 31 per cent. If we assume that 60 per cent of travel allowances for this period related to travelling by train, the replacement degree would increase to as high as 39 per cent.

According to the report of the Carbon Disclosure Project, at the initial phase 44 per cent of virtual conferences are new but their share reaches 66 per cent after five years. This means that at first 56 per cent of the virtual conferences replace travelling and that the share falls to 34 per cent after five years. (Carbon Disclosure Project Study 2010, The Telepresence Revolution). The point of departure here was the careful assumption that at least 30 per cent of the conferences replace traditional conferences, a trend also supported by information available from other sources (Crimson Consulting Group 2009, James 2009, 2005).



Elisa's travel expenses/employee within the period 2006-2013

Measuring distances

The use of Elisa's own virtual conferences is comprehensively documented. The data collected in Elisa's Meeting Centre reports are utilized when assessing virtual conference behavior among customers: the number of participants, length of avoided conference travel, and distribution by modes of transport. Complementary data was derived from national commutation surveys (Statistics Finland as the source for overseas areas and the National Travel Survey 2004–2005 for Finland) and surveys held to customers.

The basic assumption made on office space distribution of the conference participants is**: head office or nearby area 87 per cent, other parts of Finland 8 per cent, Europe 4per cent and other continents 2 per cent.** Calculation assumption based on two customer inquiry. In year 2010 the sample of survey was 7 companies, in year 2013 56 companies and in year 2014 118 companies. Distribution of companies offices were volume weighted average of these inquiries.

The shares of transportation by mode Finland were assumed to be: passenger car kilometers 69 per cent, train kilometers 22 per cent, ship kilometers 0 per cent and short flights 9 per cent. Calculation assumption is average on Elisa's own use and the National Travel Surveys 2004–2005 and 2011.

The assumption for medium-long flights in Europe was 100 per cent and that for intercontinental flights 100 per cent. The average travel distance was assumed to be 390 km in Finland (based on Elisa's own use), 2,000 km in Europe (Helsinki-London 1,800 km) and 8,000 km to other continents (Helsinki-New York approx. 6,600 km).

Despite careful background surveys and operational assessments, the calculation of the decrease in travel owing to the use of virtual conferencing still contains many assumptions and generalizations that are based on Elisa's own structure and the geographical location of its offices. However, Elisa has complied with the prudence principle and thus used the lowest coefficient in both teleconferencing and other calculations of emission saving.

Cloud services for customers

Elisa's cloud services provide customers with a virtual server, i.e. server capacity from Elisa's equipment, instead of traditional server solutions.

The objective is to calculate the CO_2 emission reductions enabled by Elisa's cloud services, compared with a service produced traditionally.

First, the number of virtual servers available was verified. It was then estimated how many traditional servers would be necessary to produce a corresponding service. Next, the energy consumption of servers Elisa's cloud services and of servers in a traditional system was assessed. Finally, energy savings were calculated by comparing a cloud service system to a traditional system. It was assumed in the calculation that the service to be replaced is implemented using traditional server technology.

The power consumption of virtual servers and traditional server solutions was assessed based on the values given by the manufacturers. The power consumption of a traditional server solution was assessed on the basis of the average PUE figure (EPA, 2010). The power consumption in Elisa´s data center was assessed on the basis of the measured PUE figure.

Elisa calculated an indicator for the amount of electricity saved for each virtual server. The actual figure was calculated on the basis of the number of virtual servers sold. The number includes the virtual servers sold by Elisa and those sold by subsidiaries Elisa Links Ltd, Appelsiini Ltd and Elisa Estonia.

The virtual data centers were converted into individual virtual servers by dividing the calculation power reserved for the service by the power requirement reserved for the virtual server. For Elisa's cloud services, the CO_2 emission factor for electricity Rediss- coefficient´s three year average. For traditional server technology, the customer purchases were assumed to be the corresponding service from a non-specified service supplier in Finland. Here also the Rediss- coefficient´s three year average was used as the emission factor.

Recycling terminal equipment

The objective is to calculate the emission savings achieved in the manufacture of new terminal equipment by recycling used phones. The assumption was that if the customer does not purchase a used mobile phone, he/she will be purchase a new, inexpensive phone. The calculation is based on the number of used phones sold and the carbon footprint of manufacturing a new phone. The cheapest bestselling phone (under hundred euros) was Samsung J1 (Samsung 2015).

In respect of USB mobile broadband modems, the carbon footprint of basic GMS- phone (C2-01) were used to estimate emissions (Microsoft 2015).

The calculation did not take into account any possible emission reductions resulting from material server cycling, as carbon footprint standards take into consideration the use of recycled material in a product manufactured. It proved to be very challenging to estimate the amount of material resulting from phone recycling or parts to be utilized as components, the energy spent on their recycling process, and the carbon footprint of the virgin production of each material or component. The calculation did not take account of the energy consumption of phones and chargers. Depending on assumptions made, older phone models have higher energy consumption, equal to one to three per cent of the emissions of manufacturing a new mobile phone (Nokia Oyj, 2014).

EMISSION REDUCTIONS IN SERVICE PRODUCTION

Elisa is determined to make every effort to reduce its own emissions throughout the 2000´s. In day-to-day operations, Elisa has reduced its carbon footprint by improving energy efficiency, making the most of its own services, and changing its operating methods.

Mobile work

The objective is to calculate the extent to which mobile work solutions have reduced carbon dioxide emissions in Elisa's operations. Mobile work means accessibility of people, services and data regardless of time and place. Emission reductions were calculated for three sub-areas: (1) emission reductions with the help of teleworking, (2) emission reductions in business travel with the help of virtual conferences, and (3) emission reductions with the help of a multi-functional office solution.

Lower level metric: teleworking

The objective is to calculate the extent of Elisa's employees reduced carbon dioxide emissions, taking into consideration the travel-related carbon dioxide emissions saved by Elisa's personnel by reduced daily commuting.

Employees who are working in Elisa´s offices were sent the link to survey in October 2016. The survey is conducted yearly to evaluate the amount of teleworking days deployed by employees during the year. The response rate in survey has been over 50 per cent. The latest survey showed an average of 7.0 days a month of teleworking. The surveys also collected data of the distance of daily commute to a central place of work (average ca. 21 km) and the methods of transportation. The emission volumes for each were calculated using emission factors obtained for road and rail travel from VTT's Lipasto calculation system.

Lower level metric: decrease in business travel

The objective is to calculate the extent of Elisa's own virtual conferences reduced carbon dioxide emissions during calculation period, taking into consideration the travel related carbon dioxide emissions saved by Elisa's personnel by attending virtual conferences.

The base of the calculation was that as a rule the possibility to arrange virtual conferences will increase the number of conferences. It was defined in the calculation that the total number of virtual conferences replaces traditional conferences by 30%. The conservative assumption of a 30% replacement rate is supported by other information sources and further justifications are presented in the "Virtual conferencing" chapter of this report.

The calculation covered all conferences arranged by Elisa's personnel using the following services: Lync, Vidyo and Teleprecense and Webex (Webex- service was discontinued from 1.4.2016) Teleconferencing was omitted from the calculation. Teleconferences were omitted from the calculation due to lack of sufficiently reliable and extensive information. Teleconferencing is generally used during Webex and LiveMeeting conferences as part of more versatile virtual conferencing technology.

Distances were calculated on the basis of assumptions underlying Elisa's own calculations and based on the business travel behavior of Elisa's personnel and data available on the use of the service. For Webex and Telepresence, the figures for kilometers travelled between offices were obtained from Elisa's Webex and Telepresence reporting (Elisa meeting center reporting) for the calculation of period H1/2010. The starting point was the conference participant's office, which was obtained from his/her registration data (name and

e-mail address) and personnel management software. Distances between the points were calculated for travel by car, train and air, and the following websites were used to determine distances:

• Car: Googelmaps: www.maps.google.fi

• Train: Publication of the Railway Administration Centre: http://portal.liikennevirasto.fi/sivu/www/f/liikenneverkko/rautatiet

• Airplane: Data on distances between airports: http://www.partow.net/miscellaneous/airportdatabase/

The percentages of different means of transport between offices were drawn on a matrix. The most likely means of transport between Elisa's offices were assessed. Elisa's offices furthest from Helsinki are located in Joensuu, Kokkola and Oulu. The share of flights to and from these offices was checked from Elisa's travel invoices. The emission volumes of the various means of transport were calculated using emissions factors obtained for road and rail travel from VTT's Lipasto calculation system and for air travel from the GHG - Protocol. The average number of Lync conference participants and travel distances were assumed to be the same as the average in Webex.

The emission savings were calculated on the basis of the emission calculations for H1/2010 by first calculating emission savings for one conference based on the data for H1/2010 (Webex, Lync and Videran Office Mobile- service 12,10 kg CO2/meeting ja Teleprecence ja Videra´s physical virtual meetings 44,2 kg CO2/meeting). This figure was multiplied by the number of conferences. Since the calculation for H1/2010 involved analyzing data on approximately 15,000 conferences, the resulting figure can be considered reliable.

Lower level metric: space efficiency

There are no dedicated desks for any employees Elisa's multi-functional offices. As a result of mobile working, Elisa has reduced the office space and the number of desks. **The calculation of the space efficiency metrics aimed to show the carbon dioxide emission savings for the office space that otherwise would have required heating.**

Emission calculations are limited to the consumption of electricity and heat and consumer electricity in the property. Water consumption was excluded from the calculation as the impact of lifecycle emissions from water purification is very small.

The calculation compared Elisa with the average Finnish space efficiency figure of 23 m^2/person (source: Consulting office DTZ 23.6.2009). The result indicated the assumed emissions for the amount of space saved during the calculation period. The floor area in square meters and the number of employees were obtained from Elisa's facility service information system. The emissions were calculated by using the average figure of specific consumptions for Elisa's offices that was obtained in Elisa's carbon footprint calculation.

Energy efficiency of server environments

The objective is to calculate savings in carbon dioxide emissions in Elisa's server centers as compared to average energy efficiency of the ICT sector. There were three different aspects in the calculation:

• Efficiency of the IT infrastructure measured with a PUE figure

• Level of virtualization (The number of virtual servers)

• Reuse of the waste heat arising from the servers

Lower level metric: Calculated energy efficiency with the PUE figure

Cooling has a major role in data center energy consumption. PUE is calculated by dividing the total energy consumption of the machine rooms by IT energy consumption (Green Grid). The following calculation formula was used:

(Elisa's IT energy consumption * reference PUE) – (Elisa's IT energy consumption * Elisa's PUE) =energy efficiency as compared to the average ICT company

During the reporting period, calculations were limited based on data of only two major data centers due to the lack of accurate measurements in other centers and computer rooms. For the data centers, the emission factor for electricity consumption was Rediss- coefficient´s three year average. The reference PUE figure was 1.91 (EPA, 2010).

Lower level metric: Cloud services

Elisa's cloud services provide customers with a virtual server, i.e. server capacity from Elisa's equipment, instead of traditional solutions. From the customers' point of view, virtual servers and data centers allow for the expansion of the service in compliance with currently valid customer needs. The advantage of virtual servers is their energy efficiency, which allows for using the servers more efficiently at the maximum utilization rate. More detail calculation principles are in the chapter Customers' cloud services.

Lower level metrics: Heat utilization

In summer of 2011, Elisa started to deliver the heat generated by a server center in Espoo to Fortum's district heating network. Next autumn, the heat recovery system was expanded, which considerably increased the volume of utilized heat energy. In the system, the heat generated by servers is bound with the district heating system's coolant and transferred, along with it, to the district heating network of Espoo. The heat generated is used in the district heating network as an energy source, instead of using the heat generated by fossil fuels. The quantity of heat is measured based on heat coefficient of the coolant, the flow rate and the temperature difference of liquid before and after the server center.

In CO2 emission saving calculations was used emission factor which obtained from Fortum. The emission factor consisted production of district cooling and the emissions savings resulting from avoided production of district heating. Amount of used district heating in reporting period was multiplied by the emission factor.

Reuse of products

Product returns

The purpose of this calculation is to monitor the emission savings arising from the recycling of product returns. In H1/2010 was used as the reference point. Some of the devices sent by Elisa to consumer customers (phones, SIM cards, modems, etc.) are returned to Elisa after a short testing period. Improved checking and packaging methods enable Elisa to recover more efficiently those devices that are still functional and forward them to other customers. Recycled devices are sent to customers as replacements for new devices. Since the carbon dioxide emissions generated by the manufacturing of electronic devices are large, the new practice results in remarkable emissions savings.

The calculations included the following products:

• Mobile phones

• Mobile broadband dongles

• Broadband modems

• IPTV set-top box

• Home Security Service devices

SIM cards were omitted from the calculation, because nearly all SIM cards have undergone recycling for many years.

The products that were returned by customers and sent by Elisa to new customers were regarded as recycled products. The recycling was considered to have generated emission savings that equal the emissions arising from the manufacture of new similar devices.

The emission coefficients used are based on the sector's publications and the information given by manufacturers. The emission coefficients of some products were not available. In that case, the figures originating from corresponding products are used as their emission coefficients. An article dealing with the reliability of the lifecycle calculations of consumer electronics devices was used as an important background source. The article was published in 2010 in the series of the International Journal of Life Cycle Assessment. According to this article, the product-specific average for a mobile phone is 18.3 kg CO_2 and for a laptop computer 198 kgCO_2, for example. Another important source was the information on carbon dioxide emissions provided by Apple for its devices.

The emission coefficients used in calculations:

• IPTV set-top box 244 kgCO_2/product

• Home Security Service: central unit 59 kgCO_2/product

• Home Security Service: camera 12 kgCO_2/product

• Home Security Service devices 71 kgCO_2/product

• Broadband modem 39 kgCO_2/product

• Mobile broadband dongle 9 kgCO_2/product

• Mobile phone 18 kgCO_2/product

Electronic invoicing

The objective is to calculate the CO2 emission reductions enabled by Elisa's electronic invoicing and electronic order confirmations, compared with invoicing produced traditionally. The calculation covered electronic invoices and order confirmations delivered by the Elisa parent company. Both have similar processes.

The emissions of traditional processes and electronic processes were first calculated. Finally, emission savings were calculated by comparing an invoice or order confirmation sent traditionally to an electronic

one. An indicator was calculated on the basis of estimated emission savings that shows the amount of emissions saved for each electronic invoice or order confirmation.

The actual figure was thus calculated on the basis of the number of electronic invoices sent. The emissions of processing (including, servers, enveloping and printing) and delivering a paper invoice or order confirmation were calculated using emissions factors reported by Itella, including Itella carbon neutral delivery (Itella 2011). The paper emission factor used in the calculation is based on average emissions reported by four different manufacturers. The paper emission factor included the following framework:

• GHG emissions from pulp and paper production

• GHG emissions associated with producing virgin or recovered fiber

• GHG emissions associated with producing other raw materials

• GHG emissions associated with purchased electricity and steam

• Transport-related GHG emissions (customer delivery logistics not included)

Moreover, the calculation includes emissions from disposal and recycling as well as archiving (6 years) for corporate customers. The emission volumes of disposal are calculated using emissions factors obtained from VTT LEADER research project (VTT LEADER 2007–2010). The emission factor for archiving was obtained from a study published by Federation of Finnish Financial Services 2010. Elisa's electronic invoicing is processed by a subcontractor. Regarding the emissions for processing electronic invoicing or order confirmation, the subcontractor refers to the emissions factors reported by the Federation of Finnish Financial Services (Federation of Finnish Financial Services 2010).

Saving measures in the radio network

The purpose of the calculation were to monitor the carbon dioxide emission savings resulting from the tasks of the measures that will reduce radio network power consumption in Elisa's radio network. For reference was a situation, that no action should not be taken.

With regard to electricity saving features, savings are based on the measured energy consumption of base station sites and the difference in energy consumption before and after the procedure.

Other measures are the physical base station configurations changes. For those measures, the savings is calculated by adding the number of measures in the calculation period. The measures are multiplied by the amount of electricity savings per measure, which are based in measured electricity consumption in radio network. The result is electricity savings in calculation period. Electricity savings in calculation period are multiplied by a coefficient of carbon dioxide emissions.

Renewal energy

The purpose of the calculation is to monitor carbon dioxide emission savings resulting from the purchase of renewable energy.

The reference situation is where purchased energy is not produced with renewal energy. Certificates of origin shall be purchased in advance at the beginning of the year. The amount of purchased electricity for reporting year can be get from guarantees of origin. This amount is divided by two to get the guarantees purchased to one calculating period (H).

OTHER EMISSION SAVINGS RESULTING FROM ENERGY EFFICIENCY

Energy consumption of one mobile subscription

The objective is to calculate energy consumption of one mobile subscription. In the calculation, the energy consumption of the mobile network was divided by the number of subscriptions.

Calculation of the electricity consumption of the radio network is based on the measured electricity consumption of base stations in sites. In sites where we have rented, energy consumption is based on the configurations of the base stations in sites and base station specific electricity consumption, which is based on measured consumption in our own sites. The energy consumption of drivers is included as well as the estimated electrical power required by heating and cooling.

Those subscriptions of Elisa and Saunalahti that have generated invoiced income during the six-month period were taken into consideration in the calculation. The calculation covered all subscription types (postpaid, prepaid, telematics and non-commercial subscriptions).

Energy consumption of mobile data

The objective is to calculate energy consumption of the mobile network per package data volume transmitted through the network. The criteria for calculating the energy consumption were discussed in the previous chapter. The energy consumption of the radio network is divided by the amount of data transferred. The number of mobile data in the mobile network will be obtained from maintenance statistics.

ELISA´S CARBON FOOTPRINT FOR 2016

The carbon footprint calculation at Elisa is based on the Greenhouse Gas Protocol (GHG), which is developed by the World Resources Institute and the World Business Council for Sustainable Development. In the light of the present information, this is the most reliable calculation method. In addition, standard ISO 14064–1:2006 (Greenhouse gases - Part 1) is used in the calculation. The future development of standards and guidelines will also be considered.

The GHG protocol calculation and reporting are based on complying with the general principles used by companies in their calculation and reporting of the key financial indicators. These principles consist of relevance, comprehensiveness, consistency, transparency and precision.

Elisa has taken the general calculation principles into account. The calculation criteria have been defined for the various functions with a view to ensuring that they correspond to Elisa’s operations, products and services as well as possible. The calculation has been implemented to ensure the method is transparent and assurable by a third party. All assumptions and stages in the calculation have been reported clearly. The reliability of data collection and reporting systems, existing controls and the risks connected with the data calculation method and data collection have been assessed by a third party. The results were calculated in accordance with standard ISO 14064–1:2006 and can thus be verified according to standard ISO 14064–3:2006 (Greenhouse gases - Part 3), where necessary. The results of calculations are assured by a third party.

Coefficients used in the calculation

Elisa's carbon footprint and emission savings were calculated by using the latest emission coefficients available. With regard to electricity Elisa has purchased, the three year average of RE-DISS emission coefficients (2012-2014) was used in the calculation of electricity (RE-DISS 2015). Elisa is purchasing renewable energy, as well as in Finland and Estonia. Reported total carbon footprint is calculated by a 0 factor for electricity In so far as a third party was responsible for supplying the electric power for the equipment space and the original electric power seller was not known, the three year average of RE-DISS emission factors (2012-2014) was used.

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