



Measurement and reduction of carbon footprint of stores

INTRODUCTION

Several retailers already measure their carbon footprint and the progress of their climate change programmes. They committed themselves to continuously reduce their carbon emissions in an environmentally and cost efficient way. Listed retailers already respond for years to the ambitious requirements of the Carbon Disclosure Project (CDP).

A significant percentage of the carbon footprint of retailers originates in the stores. Heating, lighting, air conditioning, ventilation, cooking (e.g. bakery) and refrigeration are the main factors for direct energy consumption, and therefore of carbon emissions, of a retail outlet. Especially for food retailers, the use of refrigerants and their leakages represent important contributions to greenhouse gas emissions.

A distinction can be made between the energy consumption of a store for lighting, ventilation and refrigeration and the consumption of thermal energy for heating. The related carbon emissions from the energy consumption depend on the national energy mix. Retailers can have an impact only by using a higher share of renewable energy or by reducing their energy consumption.

For the heating retailers often use oil or gas. The carbon emissions of gas are lower than the ones of oil. Less carbon emissions are generated by using combined heat and power plants (CHP), either in the store itself or using district heating. Food retailers can use the waste heat of their refrigeration appliances to heat the store.

Refrigerants are used in air conditioning but mainly in the refrigeration appliances of food retailers. Their efficiency is measured with the Total Equivalent Warming Impact (TEWI). This indicator measures the energy consumption of an appliance but also the carbon emissions from the refrigerant leakages. Today retailers use HCFC, HFC and sometimes natural refrigerants in their appliances. Due to current technical conditions, today it is impossible to produce appliances that do not leak. Therefore retailers undertake measures to improve the maintenance of the appliances.

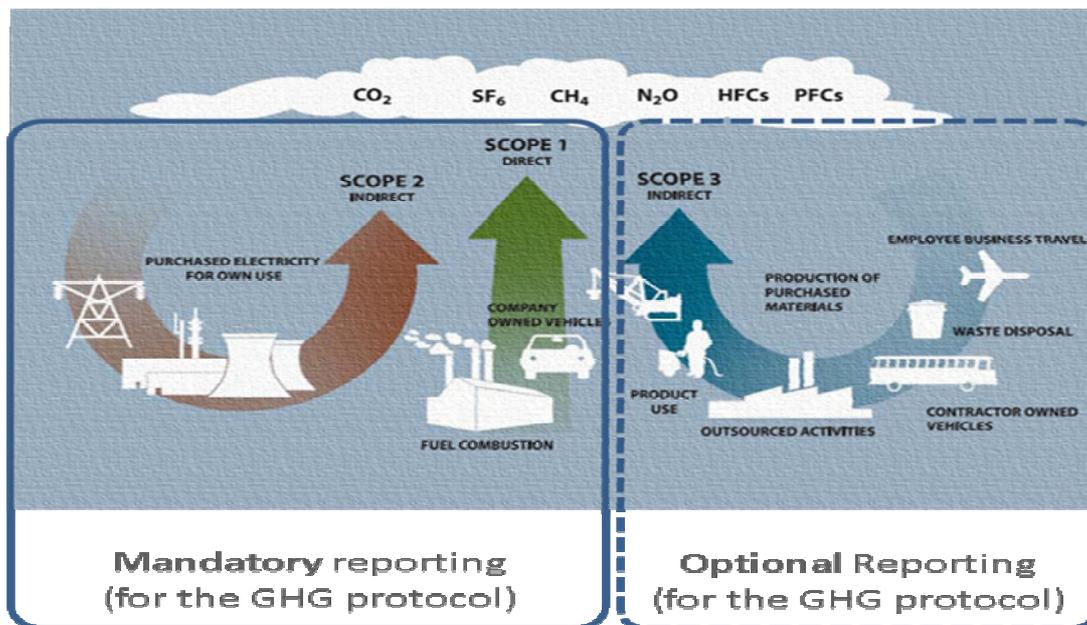
On average HFCs produce double as high greenhousegas-emissions compared to the formerly used HCFCs. HCFCs will be prohibited in the EU by 2015 due to their ozone-depleting potential. They have been prohibited in new appliances since 2001. Natural refrigerants are state of the art just in warehouses (ammonia) or plug-in appliances (carbohydrates).

If we consider the entire supply chain that begins in the production and ends in the waste/recycling of goods, stores represent a segment interconnected with suppliers, retailers and customers' operations. Although the carbon footprint from the operations of a store is not as significant as the supply chain or customer footprints over which retailers have some influence, store operations are directly under retailers' control.

SCOPE

There are numerous methodologies in use across different companies and countries for the calculation of organisation-level carbon footprints with varying scopes. Accurate carbon footprint calculation, accounting for direct and indirect emissions require significant technical knowledge and resources. Whilst there is no universally accepted method for carbon footprint calculation, comprehensive guidance is provided in the ISO norm 14064 and the GHG Protocol Corporate Reporting Standard.

This issue paper will refer mostly to scope 1 and 2 of the GHG protocol, because these include the activities that occur in stores and these are also the scopes which are referred to as “obligatory” in the GHG protocol guidelines. Scope 1 includes all direct emissions (e.g. heating with gas or oil and refrigerant leakage) and Scope 2 includes all indirect GHG emissions from consumption of purchased electricity, district heating/cooling or steam.



Most of these activities relate to energy usage and therefore there may be some crossover with the ‘Energy efficiency of stores’ issue paper¹.

DEFINITIONS AND TOOLS

The term ‘carbon footprint’ is widely used to indicate the contribution of human and industrial activities in terms of carbon emissions. For simplicity of reporting, it is expressed in terms of the amount of carbon dioxide (CO₂), plus its equivalent in other GHGs (CO₂-eq), emitted. A definition recently suggested for ‘carbon footprint’ is “the total set of greenhouse gas (GHG) emissions caused by an organization, event or product”².

The carbon footprint is a lifecycle assessment limited to the indicator of carbon emissions. Therefore the well-established standards of the ISO series are also applicable. The ISO 14064 comprises three standards, respectively detailing specifications and guidance for GHG Inventories, GHG projects and for their validation and verification.

The GHG Protocol Corporate Standard provides standards, guidance and tools for companies and other types of organizations preparing a GHG emissions inventory. It covers the accounting and reporting of the six greenhouse gases covered by the Kyoto Protocol³ —.

¹ http://ec.europa.eu/environment/industry/retail/pdf/Issue%20paper_Energy%20Efficiency%20w%20Annex.pdf

² Wiedmann, T. and Minx, J. (2008). A Definition of ‘Carbon Footprint’. In: C. C. Pertsova, Ecological Economics Research Trends: Chapter 1, pp. 1-11, Nova Science Publishers, Hauppauge NY, USA. https://www.novapublishers.com/catalog/product_info.php?products_id=5999.

³ Carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulphur hexafluoride (SF₆).



A more specific tool for the retail sector is set out by GS1 Belgium & Luxembourg⁴. A general guideline is developed in which all relevant sources and the proposed method to calculate linked emissions are described.

UNEP-SBCI proposed a Common Carbon Metric for measuring and reporting the energy use in and GHG emissions from existing building operations. The users of this metric could be governments, owners of large building portfolios and national building rating schemes. The idea is to have a tool for the measurement of the carbon footprint of buildings in a consistent and comparable way.⁵

THE LEGAL FRAMEWORK

Europe

There is no current European legislation directly addressing carbon emissions for non-industrial business organisations. However, retail stores fall within the scope of two important pieces of recently revised legislation: the Energy Performance of Buildings Directive and the Ecodesign Directive.

The recast of the Energy Performance of Buildings Directive (EPBD)⁶ introduces the definition of "Nearly zero energy buildings" and stresses the key role of renewable energy in guaranteeing the high energy performance of the building. The Directive sets up binding targets for Member States regarding all new buildings: by 31 December 2020 Member States must ensure that all newly-constructed buildings have a "very high energy performance". The Directive does not set up targets based on emission performance, but indicates that the energy performance of buildings shall include a numeric indicator of primary energy use, based on primary factors per energy carrier (to be defined at national/regional level). This will also be strongly connected to the CO₂ emission factors in the assessment of the carbon footprint. In the implementation of the Directive, Member States should determine cost-optimal levels of energy performance requirements. Therefore, the costs of energy efficiency measures (and thus of carbon mitigation options) have to be assessed during the expected building lifetime.

The Ecodesign Directive, after its recast⁷, now includes all energy-related products (not only energy-using products), which are products that do not consume energy during use but have an indirect impact on energy consumption, e.g. water-using devices, windows or insulation material. These products will have to respect environmental requirements in order to be energy efficient before they can be commercialised in the EU (such as commercial refrigeration, tertiary lighting, air conditioning and ventilation systems).

In place since June 2006, the overall objective of the EC Regulation on certain fluorinated greenhouse gases⁸ is to contain, prevent and thereby reduce emissions of high-global warming fluorinated greenhouse gases (F-Gases) covered by the Kyoto Protocol, such as hydrofluorocarbons (HFCs). The legislation applies to refrigerants used in stationary refrigeration containing more than 3 kg of F-gases, including commercial refrigeration, as well as air-conditioning and heat pump

⁴ "Guidelines for the Carbon Footprint Measurement of Transportation and Warehousing in the FMCG/retail sector" http://www.gs1belu.org/files/Carbon_footprint.pdf

⁵ UNEP SBCI (2009) Common Carbon Metric for Measuring Energy Use & Reporting Greenhouse Gas Emissions from Building Operations <http://www.unep.org/sbci/pdfs/UNEPSBCICarbonMetric.pdf>

⁶ Directive 2010/31/EU of 19 May 2010 on the energy performance of buildings

⁷ Directive 2009/125/EC of the European Parliament and of the Council of 21 October 2009 establishing a framework for the setting of ecodesign requirements for energy-related products

⁸ Regulation (EC) No 842/2006 of the European Parliament and of the Council of 17 May 2006 on certain fluorinated greenhouse gases



equipment. To achieve a reduction of F-Gases from these sources, the Regulation addresses the containment, use, recovery and destruction of F-Gases; the labelling and disposal of products and equipment containing those gases; the reporting of information on the use and the control of those gases; the prohibition to place products and equipment on the market; and the training and certification of servicing personnel and operators involved. The Regulation is subject to a review that is likely to bring about more stringent requirements in the future. Future reviews are likely to reflect developments at the international policy arena and more specifically any future restrictions in the use of HFCs that may be agreed under the Montreal Protocol on Substances that Deplete the Ozone Layer.

There are two European voluntary schemes involving retailers and the carbon footprint:

Ecolabel Directive⁹: The European Ecolabel is a voluntary scheme to encourage businesses to market products with the best environmental performance. Buildings are a target product group under development in the framework of the Ecolabel Directive. The criteria set for this development will include the carbon footprint as one of the principal aspects to be assessed.

EMAS: In the framework of the new EMAS III regulation¹⁰, sectoral best practice reference documents will be published. One of the first pilot studies corresponds to the Retail Trade sector, where the energy performance and the carbon footprint of stores are essential topics in the best practice reference document (the final version of which is scheduled for release at the beginning of 2011).

National

The so-called European "Effort Sharing Decision" establishes annual binding greenhouse gas emission targets for Member States for the period 2013–2020. These targets concern the emissions from sectors not included in the EU Emissions Trading System (ETS), including buildings.

Netherlands: when a company consumes more than 50.000 kWh electricity per annum or 25.000 m³ gas, the company is obliged to implement energy saving measures with a payback period of 5 years or less. When a company does not comply or when annual consumption is even more than 200.000 kWh electricity or 75.000 m³ gas, a municipality can force a company to conduct an energy study. This study must demonstrate whether a company adheres to the requirements as described before.

France: The "Grenelle 1" law embodies the conclusions of the nationwide environmental discussions which took place in France from July to October 2007 and which involved governmental representatives, NGOs, local administrations and employer/ employee representatives. The draft « Grenelle 2 » law was adopted on 15 June 2010. The « Grenelle 2 » law translates the general objectives listed in the « Grenelle 1 » law into specific measures regarding reduction of the energy consumption levels of existing buildings, energy efficiency certification and building permits..

UK: In April 2010, the CRC Energy Efficiency Scheme started. It is a mandatory carbon trading scheme for large 'low energy-intensive' organizations (both public and private). Organisations that meet the qualification criteria, which are based on how much electricity they were supplied in 2008, will be obliged to participate in CRC. Participating organisations will have to monitor their emissions and purchase allowances, initially sold by Government, for each tonne of CO₂ they emit. In addition, the better an organisation performs in terms of reducing its emissions, the higher it will appear in the

⁹ Regulation (EC) No 66/2010 of the European Parliament and of the Council of 25 November 2009 on the EU Ecolabel

¹⁰ Regulation (EC) No 1221/2009 of the European Parliament and of the Council of 25 November 2009 on the voluntary participation by organisations in a Community eco-management and audit scheme (EMAS), repealing Regulation (EC) No 761/2001 and Commission Decisions 2001/681/EC and 2006/193/EC



annually published table, showing the comparative performance of all participants. This in turn provides a further benefit: all the revenue raised from selling allowances is 'recycled' back to participants, and the league table position affects how much of the revenue each organisation receives.¹¹

OPPORTUNITIES AND BARRIERS

Although the process can be costly and requires technical competences, there is an increasing attention towards the measurement of carbon emissions from retail operations and stores. Reasons for individual companies to measure the emissions of their stores arise from both internal and external interests. There are common drives that push retailers to calculate and to improve the environmental performance of their stores and common factors that hinder or challenge this process.

Opportunities

- To identify hot spots in their stores with the biggest potential for carbon reduction.
- To use carbon emissions as another criteria for decisions over technical appliances (heating: gas, oil, district heating or waste heat of refrigeration; refrigeration: plug in or refrigeration system, refrigerant, etc.).
- To better evaluate the risks and chances of climate change and resource scarcity on the core business of a retailer (e.g. the possible costs of carbon emission trading schemes).
- To cut costs: the cut in energy usage and the use of more efficient techniques reduce emissions and at the same time costs. Some of the mitigation options would help to improve the company response to energy market fluctuations and foreseen higher energy tariffs.
- To contribute to reduce the overall environmental footprint of retail activities.
- To enhance company reputation towards consumers, stakeholders and decision makers.
- To be able to respond to the increasing demand from stakeholders and public authorities for data on emission performances.

Barriers

- Costs and difficulty in collecting and assessing data.
- Tenant-owner-dilemma, difficulties in sharing data.
- Difficulties in comparing data between different companies for an overall approach: different conditions in each Member States (differences in opening hours¹², share of refrigerated areas, conversion factors, availability or cost of renewable energy sources, legislation) and different nature of business.
- Limited impact of stores' emission performance on consumer behaviour.
- The payback time for investments in energy saving measures may be longer than for other investments, and in relation to lease agreements for tenant-retailers (it should not exceed 4-5 years)¹³.
- Lack of knowledge regarding carbon footprint of alternative techniques (i.e. natural refrigerants)

¹¹ http://www.decc.gov.uk/assets/decc/what%20we%20do/a%20low%20carbon%20uk/crc/1_20100406154137_e_@@_21934crcpdfawv9.pdf, Environment Agency (2010) The CRC Energy Efficiency Scheme – User Guide

¹² For some of these barriers or challenges, solutions can be found by redefining the parameters. The grenelle I proposition measyres KwH/y.sqrm. To avoid distortion in comparison through differences in opening hours the parameter could include in its numerator KwH, and in its denominator hours of client access

¹³ McKinsey & Company (2009) Pathways to a Low-Carbon Economy. Version 2 of the Global Greenhouse Gas Abatement Cost Curve



CONCLUSIONS

Retailers face challenges both when measuring the carbon footprint of their stores and when trying to improve their performance and reduce emissions. Retailers are trying to improve the performance of the existing buildings, and invest in new well performing buildings, within the context of existing technical and regulatory tools. Apart from reducing refrigerant related emissions (by adopting natural refrigerants and reducing leakage) the main way to reduce the CO₂ footprint will be by adopting renewable energy. The main barrier to adopting renewables is cost - return on investment with subsidies 10 years and without even more. The solutions can be more efficient technology (more electricity generated per euro invested) and financial incentives (buy back tariffs, subsidies...). There are divergent approaches to the implementation of techniques concerning energy performance and refrigeration, with different cost and environmental effectiveness. In some cases, different approaches to energy management relate to divergences in carbon footprint measurement. Harmonized methodologies and guidance would facilitate the task.

Key challenges

- To make data from different companies comparable.
- To find a satisfactory combination between the robustness/accuracy of the GHG reporting methods and its ease of use .
- To improve cooperation between tenants and landlords.
- To communicate efficiently to consumers about measures that require changes in their shopping behaviour.
- To identify effective and economically viable (short return on investment) technologies.
- To find a satisfactory combination between cost and performance of those technologies.

What can retailers do?

- Use the available tools to calculate the carbon footprint of stores and improve performances, where possible.
- Cooperate with landlords in order to find win-win solutions, perhaps within ad-hoc fora¹⁴.
- Develop specific guidelines in cooperation with decision makers.
- Learn from current voluntary initiatives and implement best practices throughout their business.
- Set up internal policies to measure and reduce the direct and indirect emissions deriving from their operations in stores.
- To implement or to renovate the environmental and energy management systems, creating knowledge-based schemes within the company.
- Switch to natural refrigerant where technical and environmental conditions allow it.
- Set up integrated building management systems for energy efficient heating, lighting, air conditioning, ventilation and refrigeration.
- Raise consumer awareness on the point of sale.

What can policy-makers do?

- Invest resources in education in order to improve the knowledge about carbon emissions amongst consumers and business.
- Invest resources and provide subsidies to R&D initiatives.
- Ensure the implementation of the Sustainable Consumption and Production Action Plan through developing ambitious Ecodesign, Energy Labelling and Eco-label criteria.
- Provide incentives for companies to improve the environmental impact of their premises (e.g. schemes to promote and facilitate investment in store renewable energy production).
- Invest resources and provide subsidies to R&D initiatives.

¹⁴ An example of such cooperation is the International Sustainability Alliance. For reference, see the Best Practices session.



- Calculate the carbon footprint of their own buildings and publish a reduction target

What can others do?

- Real estate owners: invest in building energy performance improvement.
- Consumer organisations: raise consumer awareness about their possibility to contribute to lower the carbon footprint of stores, e.g. by supporting that fresh and frozen cabinets in stores are equipped with doors in order to save energy.
- Equipment manufacturers: improve the efficiency level (TEWI¹⁵) and reduce the leakages of the cooling equipment that they supply. Consider the use of natural refrigerants with low global warming potential in the refrigeration equipment.
- Equipment suppliers: invest in training for technicians and provide efficient technical assistance in order to ensure the smooth roll out and adequate servicing of new efficient technologies.

¹⁵ Total Equivalent Warming Impact



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EXAMPLES OF GOOD PRACTICE:

The following examples of good practices were sent by stakeholders:

RETAIL COMPANIES

C&A Mainz, Germany: example of cooperation between landlord and tenant

The building, with retail floor space of around 6,500 m², was constructed in 1961 and has been undergoing a thorough overhaul for the past year or so. One of the main priorities was to achieve a lasting reduction in the building's energy consumption and CO₂ emissions. In future, the store will use around 50% less electricity and 70 % less heating fuel. It will also be carbon-neutral.

<http://www.redevco.com/Portals/0/press%20releases/Germany/REDEVCO%20First%20CA%20Eco%20Store%20in%20Mainz%20with%20BREEAM%20certification%20Very%20Good%2021-10.pdf>

Tesco

Tesco has five stores using CO₂ refrigeration systems in the UK with plans to install six new CO₂ transcritical systems by 2010, 20-30 systems in 2010/2011, and 150 by 2012.

<http://www.r744.com/articles/2009-10-30-update-atmosphere-2009-co2-highlights-ii.php>

In January 2009, TESCO opened the UK's most energy-efficient store in Manchester, UK, which uses a CO₂ transcritical refrigeration system. The Cheetham Hill store's carbon footprint is 70% less than an equivalent store built in 2006. Although Tesco is still in the measurement stage of the refrigeration system, preliminary results show that the CO₂ system leads to efficiency improvements of 40% compared to typical systems used by the retailer in 2006.

<http://www.tescopl.com/plc/media/pr/pr2009/2009-01-13b>

Carrefour Group

The Carrefour Group undertook a diagnosis of its refrigeration systems operating in its retail shops worldwide after the recent entry into force of the HCFC phase out in the European Union. As a result, the company decided the implementation of new climate-friendly refrigeration systems to cover newly built installations or installations that are obsolete and need to be replaced. Carrefour realized that CO₂ refrigeration could help the retailer minimizing its direct greenhouse gas emissions while using an energy efficient refrigerant that would keep energy bills unchanged. As a result, the retailer decided to invest on CO₂ cascade refrigeration systems for freezing foodstuffs, all the more so because the prices of these systems have become more affordable and thus make sense from an investment point of view.

<http://www.r744.com/article.print.php?id=1111>



Coop Norway

As regards in-store actions, Coop Norway uses CO₂ as refrigerant on all new equipment. In addition to that, Coop Norway Swan-labels every new outlet it opens.

<http://www.coop.no/PageFiles/11512/%c3%85rs-%20oog%20samfunnsrapport%20for%20Coop%20Norge%202009.pdf> (in Norwegian only)

Coop Sweden

In Sweden, the local consumer co-operative introduced new energy-efficient pilot stores which are able to reduce energy-consumption by up to 50% thanks to the use of heat recovery systems, the exploitation of daylight for lightning and the use of doors and locks on all refrigerators and freezers.

http://www.coop.se/Global/KF/Finansiell%20information/KF_VB_09_FINAL.pdf.

Coop Denmark

During 2009, Coop Denmark calculated the carbon footprint of all its shops and in nine shops energy saving possibilities were tested. The test was a success which showed great energy savings potential and it will be applied to all shops with the aim to reduce energy consumption by 10% in 2012.

<http://issuu.com/ansvarlighed/docs/folder?mode=embed&layout=http%3A%2F%2Fskin.issuu.com%2Fv%2Flight%2Flayout.xml&showFlipBtn=true> (in Danish only)

S Group Finland

In Finland, the S Group made in the period 1995-2006 strong investments in heat recovery systems as well as in new electrical technologies (e.g. night covers for cold units, low-energy lightening, heat pumps etc.). In the outlets in which these new systems are installed, the Group is able to save up to 60% in heating and 25% in electricity in comparison to outlets in which they are not. The S Group also features outlets bearing carbon dioxide based refrigeration appliances and ammonia based refrigeration appliances (Kilo logistic centre). Also, the co-operative Society Arina uses state-of-the-art integrated refrigeration and HVAC technology in its new outlets.

http://s-kanava.fi/getbinary?siteId=1&src=/kuvat/skanava/liitetiedostot/2010/monikanavaisen_liitteet/S_respons_review_2009.pdf.

Coop Italy

Coop Italy features 1 EMAS-registered shop; 211 "Green light" registered points of sale, in which 3 million kWh were saved during 2009 for a total of almost a million and a half of tonnes of CO₂; 35 shops and 2 parking areas which used light signs with LED technology; 6 shops using LED technology for accent lighting; 17 shops connected to district heating; 29 shops using solar panels for the production of hot water; 160 shops featuring condensing boilers; 27 shops featuring high-efficiency refrigerating plants and 90 shops featuring closed freezers. Furthermore, Coop Italy concluded in 2009 the 'Coop for Kyoto' project, which saw the voluntary compliance from coop brand suppliers to the Kyoto objectives for the reduction of CO₂ emissions and to other actions for the reduction of energy consumption. Since the launch of the project in 2006 and until 2008 the emission



index diminished from 0,194 CO₂/Kg to 0,182 with a 63% improvement of the production plants in terms of efficiency.

<http://www.e-coop.it/CoopRepository/COOP/CoopItalia/file/fil00000057199.pdf> (in Italian only)

The Co-operative Group UK

By the end of 2009, the British Co-operative Group had reduced energy consumption across the business by 12% compared to 2006 levels. This progress means that it is on track to meet its target to reduce energy consumption by 20% by 2010 and by 25% by 2012 (based on 2006 levels). The Group also kept the pace in reducing greenhouse gas emissions from refrigeration with the aim of realising a 20% reduction by 2011 based on 2007 levels. Finally, in 2009, 700 stores were refitted with more energy-efficient HFC units, with a further 650 stores planned for refit in 2010.

<http://www.co-operative.coop/corporate/sustainability/ecological-sustainability/>.

RETAIL COMPANIES AND OTHERS

International Sustainability Alliance (ISA)

The International Sustainability Alliance is a global network of leading real estate organisations – developers, owners, occupiers, investors – who understand the business imperatives in achieving a more sustainable built environment. ISA is working in creating the world's largest and most comprehensive confidential database of asset and environmental performance of buildings and properties. Retailers and landlords can upload and exchange environmental data, needed to calculate the carbon footprint, through the ISA database. The database can be used for multiple purposes, such as internal reporting, external reporting, benchmarking and eventually certification. C&A is one of the founding members of the ISA.

www.internationalsustainabilityalliance.org