Impact Measurement and Performance Analysis of CSR (IMPACT)

The future impact of CSR in the food retail sector on climate change

SEVENTH FRAMEWORK PROGRAMME

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LIST OF ABBREVIATIONS

CSR	Corporate Social Responsibility
EF	emission factor
GHG	Green House Gas
GRI	Global Reporting Initiative
GWP	Global Warming Potential
kWh	kilowatt hour
LED	Light emitting diode
m^2	Square meter
TWh	terawatt hour

The future impact of CSR in the retail sector on climate change

Ex-ante analysis of CSR

1 Summary

IMPACT Task 6.2.2 is an in-depth analysis of CSR measures taken out by the most relevant companies representing the German food retail sector.

Despite the original focus of this task foreseen in the description of work of IMPACT, the analysis will not take the whole retail sector of the EU-27 into account, but *focuses on Germany*. This decision has been made as initial research very soon showed that data availability for this analysis will obviously be a hurdle even when focussing on one state (Germany) only. Taking into account all EU member states would have required to collect detailed data e.g. on a) the current & future development of retail in each country; b) details of electricity mix of each country; c) state of the art of CSR in retail in each country; etc.

The paper focuses on *food retail,* and not on retail with all its subsectors, as this is the most important retail subsector within the sector definition chosen in IMPACT and because it is the biggest submarket (38.5 %) within the German retail sector [Bosshammer 2011]. The companies in the food retail sector have become very active regarding their CSR performance. The study gives a compilation of current CSR measures by focusing on climate change aspects of stores (heating, cooling, and lighting). Other relevant aspects, like logistics or the life-cycle of sold products (production, product portfolio offered to consumers, energy use in use phase, and end of life of products) are not taken into account. The communication of CSR measures is relevant as the study tries to quantify the impacts of CSR measures regarding the greenhouse gas emissions on company and sector level. First, the structure of the food retail sector is described in detail by paying particular attention to sector-specificities. This leads to the derivation of benchmarks regarding the energy consumption of food retail stores. Bottom up market data and energy benchmarks build the baseline for the following ex-ante assessment. The ex-ante assessment is a scenario based foresight on how greenhouse gas emissions from the food retail sector are about to develop in the light of potential further CSR measures as well as the assumed market development. The special focus of this ex-ante assessment is to test whether the method can help to predict future impacts from companies' CSR activities.

As the consumption of electricity is the most relevant energy demand within the retail sector, the calculation of corresponding greenhouse gas (GHG) emissions is highly dependent on the chosen calculation method and emission factors (transforming electricity consumption into GHG emissions by calculation). Like in no other European country, the energy market in Germany is changing rapidly as renewable energy production is increasing significantly and nuclear power

plants are to be phased out in the near future. This has practical consequences on emission factors, changes and methodological questions – especially regarding the accountability of electricity from renewable sources. The ex-ante assessment is dealing with these framework conditions as well.

2 Scope of the Study

The goals and research questions for the study are as follows:

Primary goals:

- Identification of CSR efforts/measures with climate change aspects from companies in the German food retail sector.
- Calculation of current global warming potential (GWP) impact resulting from the operation of food stores (Status quo).
- Scenario analysis 2020 regarding development of GHG emissions in German food-retail.
- Derivation of recommendations concerning CSR strategies and methodological aspects by calculating corporate GHG emissions.

Specific goals:

- Market structure assessment of German food-retail sector as the most relevant submarket of entire retail sector.
- Identification of CSR topics and different CSR communication strategies in German food-retail.
- Literature research of specific energy consumption data of food stores. Derivation of benchmarks for existing distribution channels.
- Energy saving potential of different measures that are already implemented by some companies.
- Collection of contingencies & counterfactuals in order to answer the question how food retail submarket will develop in the next years.
- Implementation status of CSR measures.
- Reporting standards and discussion of methodological aspects as choice of emission factor.

2.1 Description of retail sector (food & non-food)

Over the last decades, the way how and where we buy food has changed significantly. Before supermarkets appeared in all European countries, people bought their daily nutrition at the bakery, butcher, small groceries or other specialized retail shops. In contrast, supermarkets are generalists and offer all products needed for the daily nutrition at one single location. Not only for food but also for non-food retail, the non-specialized form is nowadays predominant in Europe. In the food sector as well as in the non-food sector large retail chains dominate the markets in Europe. The whole non-specialised in-store retailing sector[1] in Europe has an annual turnover of about 900 000 million EURO. Subsector food is hereby predominating and has a share of 88 % of total [EUROSTAT 2009].

Figure 1 shows the breakdown of turnover in the in-store food retail sector in Europe 2006. In each country of the European Union, non-specialised distribution forms like supermarkets, discount markets or consumer markets have a market share of more than 60 %. In countries like Greece, Spain and Poland specialized markets still have the largest market share with 20-40 %. In Lithuania, Latvia and Estonia nearly 100 % of food retail takes place in supermarkets.

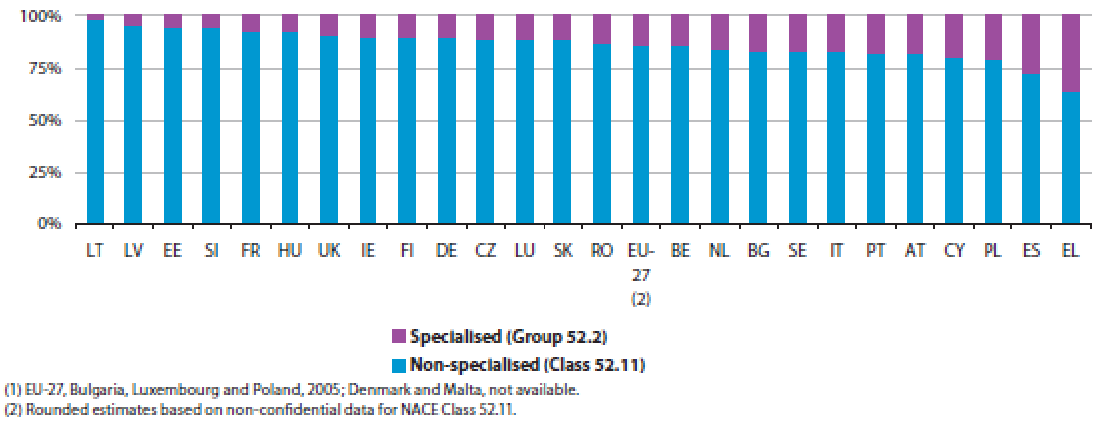


Figure 1: In-store food retailing, breakdown of turnover 2006. Source: [Eurostat 2009]

Germany is – after Great Britain – the second biggest market for non-specialised in-store retail in Europe (both, regarding value added and number of employees) [EUROSTAT 2009].

Food retail chains and business groups possess a dominating market power. From an environmental point of view, due to their market power, large companies are especially interesting as CSR measures potentially address many stores. Small specialized food retails belong to single owners which do not have the potential to influence many stores and actors.

2.1.1 Overview distribution channels of food retail

Examining the structure of food retailers in Germany, a differentiation into three distribution channels can be made. The size of single stores is a relevant distinguishing factor but also specific characteristics of distribution channels are considered. The food sector contains business groups

[1] **NACE Group 52.1:** non-specialised in-store retailing sector
NACE Class 52.11: non-specialised stores with food, beverages and tobacco predominating (supermarkets, hypermarkets, discount markets)
NACE Class 52.12: non-specialised stores with non-food products predominating (convenience markets)

operating companies in various submarkets (also non-food sector) as well as business groups operating exclusively within a certain distribution channel.

The distinction of food retail sector segments helps to better understand the market structure in Germany and related differences in CSR reporting. Finally, the derived benchmarks regarding energy consumption and GHG Emissions depend on market segments based on different distribution channels.

The following structure is derived from [Rhiemeier et. al 2008] but other classifications can be found [Nielson 2012].

Discount Markets

Discount markets have a sales area that is roughly between 400 and 800 square meters per store. Not only the rather small sales area but also the specific low-price strategy differentiates Discount markets from other distribution channels. The strategy is to attract price-conscious consumers and to sell high volumes of articles. The amount of different brands for single products is often limited (e.g. one type/brand of butter, milk etc.) and own brands or exclusively produced products are offered. By reducing the variety of brands, more items of the single products are bought and space of sales area can be saved. The in-store layout is generally simpler than in other food stores. Products are not sorted separately into shelves but kept in the opened transport packaging. Advice and service is mostly not provided. All this allows the retail company to accept low profit margins and compete successfully with supermarkets or consumer markets. Discount markets are the most remarkable concept of success in food retail over the last 40 years.

In some studies, discount markets are further subdivided into hard-discounter, soft-discounter and hybrid-discounter. Hereby, the range of sold products and the intensity of price-policy are used to differentiate companies operating in the sector [McKinsey 2009 and Voßkämper 2012]. This detailed differentiation will not be used within this analysis.

The share of food related items in these stores is 80 to 85 % [Rhiemeier et. al 2008].

Supermarkets

Supermarkets typically have a sales area between 600 and 1 500 square meters per store and in some cases up to 2 500 m². A supermarket is a traditional self-service grocery store that has a food assortment which includes fresh products. All products needed for the daily nutrition can be purchased. Here, the consumers find food-products from brands that do commercial advertisement in radio, television, print media and internet. Additionally, many supermarket companies offer own brands, the product range however is dominated by independent brands. Supermarkets also have a section reserved for non-food items; these normally do not to exceed 25 % [Rhiemeier et. al 2008].

During the last years a new form of supermarkets appeared, offering exclusively organic food. So far, organic, fair trade and vegan products were mostly offered in small and often independent grocery stores, in Germany known as “Reformhaus” (can be translated as health food shop). Due to the growing demand for organic products, medium sized retail companies developed, each managing between 25-300 stores, focusing mainly on large cities or regional context. The special form “Bio-Supermarket” shows dynamic growth rates and is interesting as sustainability aspects are part of the business model.

<u>Consumer Markets and Hypermarkets</u>

Consumer markets typically have a sales area between 1 500 and 5 000 square meters per store. Hypermarkets are a special form and even bigger than consumer markets, showing a sales area larger than 5 000 m² going up to 20 000 m². Stores of this category offer an extended range of products including numerous non-food articles that can be found in generalists like department stores. The sales area reserved for groceries amounts to approximately 1/3 of the entire sales space [Rhiemeier et. al 2008]. Especially in France, very large self-service stores are labelled as “Hypermarkets”. These stores can have a sales area up to 25 000 m² of which between 25 to 40 % is dedicated to groceries. Some consumer markets are reserved only for business clients like restaurant owners, hoteliers, catering companies etc.

On a quantitative basis, most food is being bought in stores belonging to one of the described distribution channels. Nevertheless, food and products from the food industry are provided in further locations. These also include gas stations and small grocery stores with self-service which can be found very often. Literature source count between 28 000 and 38 000 stores with a sales area less than 400 m² [Kaufeld 2008]! Nevertheless, these stores are not in scope of this study as they are often owned by independent owners and do not belong to large companies. Even if measures to reduce energy consumption would be carried out, it is unlikely that a CSR communication takes place allowing the collection of valid data for such stores.

2.1.2 Structure of food retail in Germany

On the basis of the given structure, a bottom-up research on company level was conducted to quantify the German food retail sector. All companies that operate national-wide were taken into account – solely regionally represented companies are out of scope. Business reports as well as internet and literature sources were evaluated (see for example [LZ 2012-33]). The sector is very dynamic, not only by the opening and closing of stores but also regarding a possible switchover in the ownership of stores from one company to another. In order to create a substantial data basis for the analysis, 2009/2010 was chosen as the basic reverence year. This decision is based on the publishing date of the available data. First profound CSR reports were published in 2009 and 2010 [Tengelmann 2009]; [Rewe 2010a]; [Metro 2010]. Further structure data like the number of markets per company is taken from the reference year in order to harmonize the dataset.

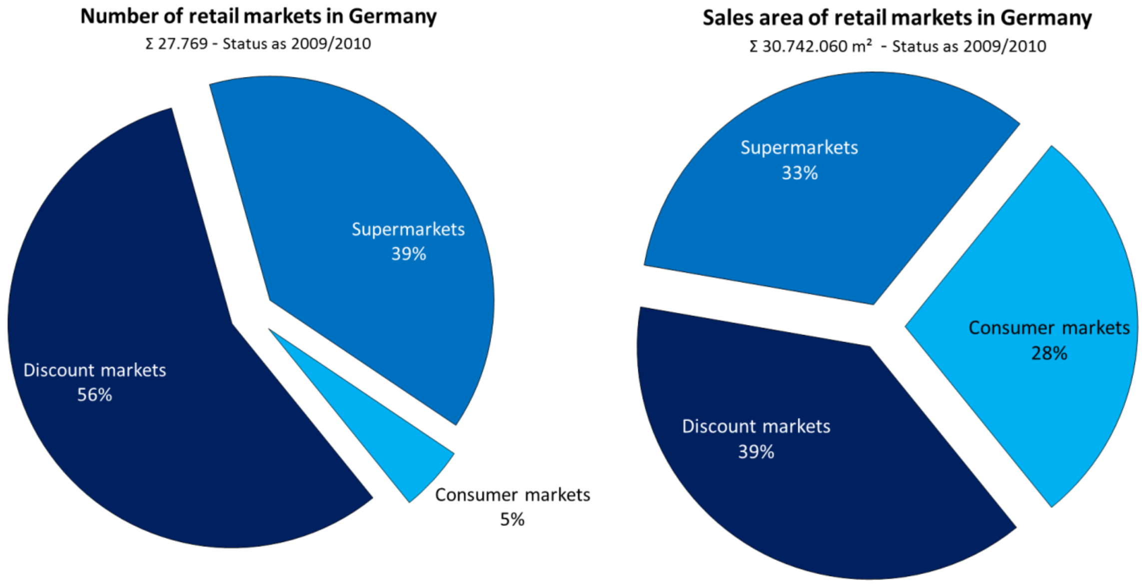


Figure 2: Number and sales area of food-retail markets in Germany. Source: annual reports, press, Wikipedia, internal data. Calculation by OEKO-Institut

Figure 2 shows the results of the bottom-up calculation. All relevant companies of the German food-retail sector are considered. Nevertheless, some regionally acting companies were not included as public available data on them is incomplete.

In total 27 769 food store markets were counted for the base year 2009/2010. Discount markets have the largest share with 56 % (15 683 stores). Supermarkets account for 39 % with 10 769 stores. Consumer markets have the smallest share with 5 %. When it comes to sales area, discount markets still have the largest share with 39 % out of 30.7 million square meters total sales area. As this type of market is rather small, the difference to supermarkets (33 %) is less obvious than for the share of the number of markets. The effect of sales area per store is getting more obvious in the case of consumer markets. 1 317 stores constitute for 28 % of the total sales area.

Table 1: Structure data for the German food retail sector as calculated for this study

	Number of stores	Ø sales area per store (in m²)	total sales area (in m²)
Discount Market	15 683	764	11 852 804
Supermarket	10 769	945	10 178 178
Consumer Market	1 317	6 614	8 711 078
Total	27 769		30 742 060

2.2 Recent and future developments

The food retail sector has changed significantly over the last decades. The process is mainly dominated by the disappearance of small grocery shops. Figure 3 shows the development over the last 40 years. The decline of small shops with a sales area less than 400m² occurs simultaneously with an increasing number of discount markets, supermarkets and consumer markets. The extinction of small grocery shops is dramatically, [Warich 2011] reports that between 2 000 and 2008, 18 336 small grocery markets were closed. This represents a drop of -26.8 %. The so called "Tante Emma Laden" – a small neighbourhood grocery shop (corner shop) offering a reduced product range for daily foodstuff – is threatened with extinction.

This development also provoked a change in the way how we buy food. With the disappearance of small neighbourhood groceries, the need to use the car for shopping trips increased. The common saying "a trunk compartment is the most favourable supermarket trolley" describes this change of attitude in a nutshell. However, the increasing demand to use the car is combined with well-known negative environmental impacts.

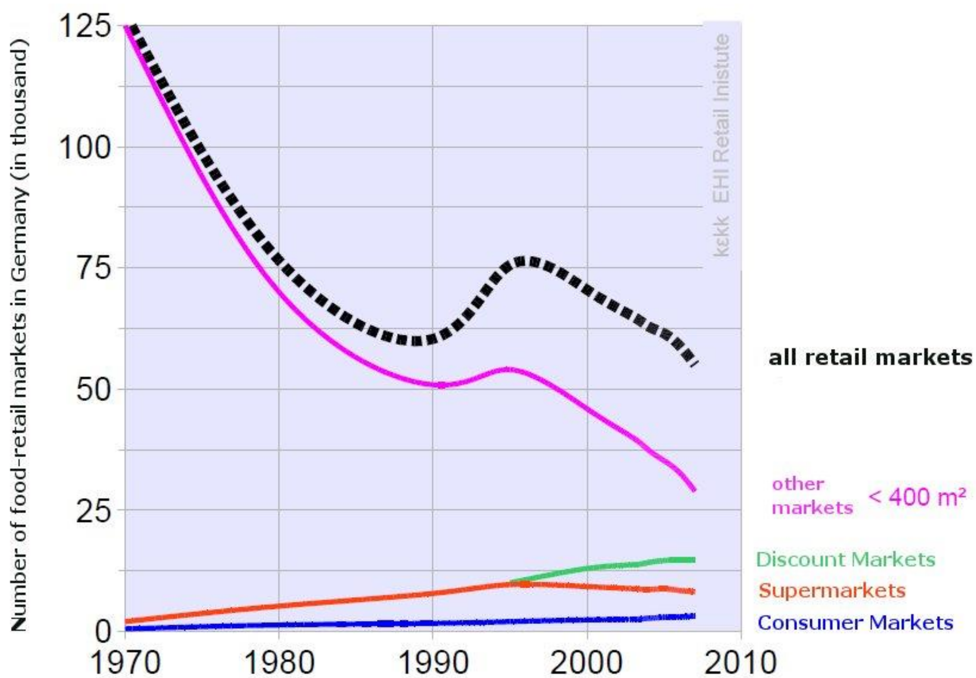


Figure 3: Development of food-retail markets in Germany over the last 40 years. Source: [Schwarz 2008]

The food sector is nowadays affected by a strong concentration process as food stores are nationwide accessible and the relevant food retailers have stretched a dense net of stores. It is said that each inhabitant is able to reach three different discount markets within a driving time of ten minutes by car [Axel Springer 2012]. Consequentially, the number of attractive new store locations is shrinking. From this point growth can only take place at the cost of the competitors (predatory competition) or on international level. This illustrates why most of the German retailers are also active in other, mainly eastern European, countries. Today, the biggest five retail companies cover more than 50 % of the market share [KPMG 2012]. The concentration process has reached a level that further merging intentions falls within the scope of federal merger control institutions.

In a saturated market, the societal condition framework also determines the future limits of growth. Like in many industrialised countries, Germany starts to recognize the demographic change. In 2020 German population will shrink by over 6.5 million. For retail companies this primarily means a significant net loss in customers. Besides this, the income development will influence the demand for food and the prices that can be demanded by the retailers.

The concept of the study does not include the derivation of concrete growth forecasts of the food-sector and the different distribution channels. Nevertheless, this issue is relevant when it comes to scenario stetting as part of the ex-ante analysis (see chapter 7). Therefore, stated considerations and forecasts about the state of retail segments in Germany from literature sources are presented:

- Development of **discount markets** will stagnate on a high level [Glaubitz 2011]. Recent growth rates from 3.5 % per year regarding annual turnover are not expected for the next years. Referring to the number of new stores, discount market segment grew recently on average 1 % per year [own calculation].
- **Supermarkets** are awaited to reinforce growth. Profound product ranges combined with the extension of service counters and provision of regional products meet the demand of consumers [KPMG 2012].
  Supermarkets for organic food showed the most dynamic growth rates within the last years. Analysts expect for the upcoming years a stagnation of this process and do not foresee further significant growth [KPMG 2012].
  Referring to the number of new stores, the supermarket segment grew recently on average 3 % per year [own calculation].
- **Consumer markets** already showed stagnating growth. No significant positive change in this situation is actually foreseen. It is even more probable that consumer market will lose market share [Glaubitz 2011] [KPMG 2012].

The German food retail sector in general showed little growth rates over the last years regarding turnover. The specific distribution channels show different growth expectations and the augmentation of sales area is not directly linked with increasing turnover. It is unlikely that the sector will change into a dynamic growing market. This has to be considered when defining scenarios in chapter 7.

3 CSR ISSUES IN GERMAN FOOD RETAIL SECTOR

The following chapter provides a compendium of CSR issues addressed by food retailers in the last years. This compendium does not say anything about the relevance of each of the issues, but is a collection of issues addressed by companies. Furthermore, the way how CSR issues are communicated is explained. All recent CSR reports or brochures as well as annual reports and internet communication from nation-wide operating retail companies were evaluated. The compendium is kept tight as the scope of the study lies on climate change issues (see chapter 4).

Environmental aspects

- Energy efficiency issues concerning the operation of food stores and logistic chains. Most measures address refrigeration, used refrigerants, lighting, heating.
- Calculation and monitoring of Corporate Carbon Footprint, derivation of climate goals. Sometimes investment in carbon offsetting projects.
- Own production of renewable energy and purchase of green electricity.
- Reduction of packaging waste, use of biodegradable materials.
- Green supply chain management.
- Provision of organic products.

Social aspects

- Social aspects in food production conditions, provision of fair trade products.
- Labour conditions for own employees, e.g. possibilities of further education, reconciliation of family and professional life.
- Healthy nutrition aspects, provision of organic products.

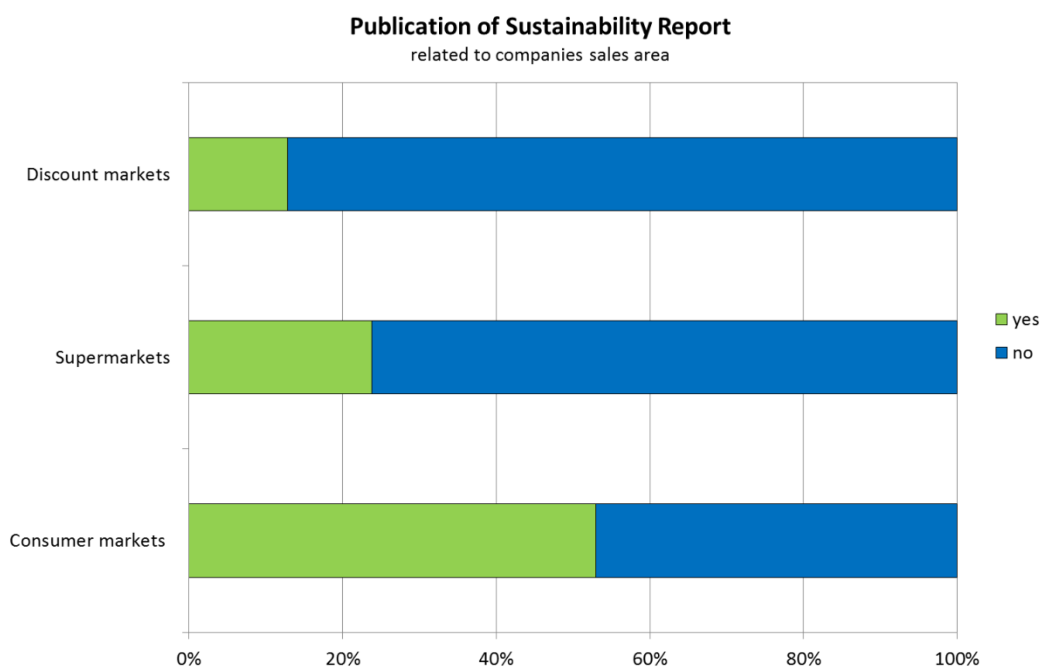
The list shows that German food-retailers address many sustainability issues. But from an overall point of view, further aspects linked with food retailing can be named. The following aspects are not yet found in companies CSR communication:

Missing sustainability aspects

- Critical discussion of retail business model in general. Is growth by expansion and offering dozens of alternatives for the same products sustainable?
- Critical discussion of company's labour conditions. Are paid wages sustainable in the sense of enough to make a living? How is the relation of wages compared to other sectors?
- Holistic aspects of sustainable nutrition in the sense of "less is more". Should certain unhealthy/unsustainable articles be sorted out? Should the total amount of e.g. consumed meat be reduced?
- Critical discussion of land use in general and especially land use changes caused by retailers.

- Aspects of sustainable consumer behaviour like e.g. the environmental-friendly shopping tour.
- Addressing the problem of food stuff being wasted and disposed even still consumable.

Generally, the way how CSR issues are communicated differs broadly and ranges from the publication of printed CSR reports or carbon footprint analysis over thematic brochures to short internet articles. In order to demonstrate the different communication strategies, a bottom-up analysis was carried out, differentiating whether CSR reports or internet communications is predominating. Figure 4 demonstrates the results: The top graph shows the existence of formal CSR reports related to the sales area per distribution channel. It is becoming clear that this kind of CSR communication is generally not very common in German retail, especially not for companies within the segment discount market. Only approx. 10 % of the total sales area of discount markets falls under the coverage of CSR reports. This is similar to the supermarket segment, where around 25 % of the total sales area is covered by CSR reports. When looking at consumer markets, more sales area is covered by CSR reports (around 50 %). Thus it has to be kept in mind that this segment consist of less competing companies and that only a few companies which do report can make a big difference (compare with Figure 2). The bottom graph of Figure 4 shows the existence of CSR communication via internet related to the sales area per distribution channel. Here, the situation is completely different as most food-retailers do CSR communication via Internet. Only within the discount market segment, around 25 % of the total sales is operated by companies without internet based CSR reporting.



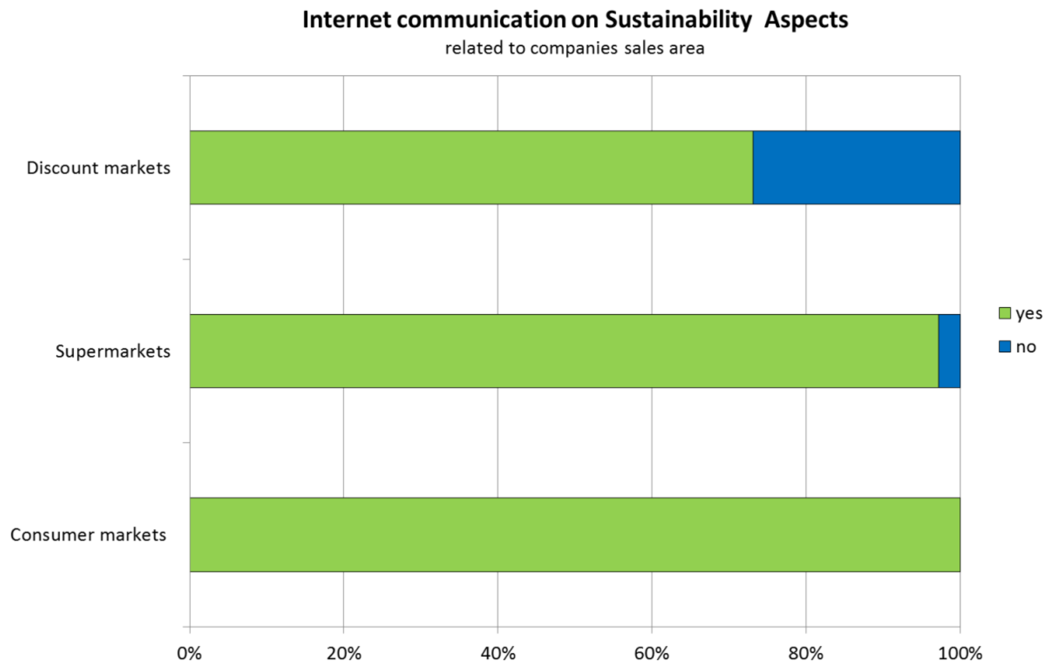


Figure 4: Publication of CSR reports and CSR communication via internet related to sales area per distribution channel [calculation by OEKO Institute]

It is noticeable that until now only two business groups have published profound CSR reports that comply with formal GRI or GHG protocol requirements (see chapter 6). The time and labour intense process to publish a formal CSR report makes it apparently unattractive for CSR communication of food retailers. Another reason may be that German consumers are the most price-sensitive consumers in Europe. The market participants await that product prices and not sustainability aspects are the main distinguishing feature in the food market. It appears that only for companies operating in the supermarket and consumer market segment, traditional CSR communication via standalone CSR reports creates additional value and may be used to justify higher prices.

> *"Various CSR issues are addressed in German food-retail sector. Communication takes places via internet. Formal sustainability reports are less common"*

The predominating CSR communication strategy is via the internet. Here, information can be communicated short and catchy – and it can frequently be updated. The problem is that the form of internet communication is diverse and it hard to find quantifiable information like derive benchmarks for energy consumption.

The following chapter will discuss this problem in detail.

4 Energy consumption in food-retail

The preceding chapter 3 showed that CSR issues expanded into the food retail market. Trying to calculate the effects of energy saving measures on GHG emissions (as will be done in chapter 7), a better understanding of the current energy consumption is needed. Therefore, the study focuses on energy consumption in food stores and we made the conscious decision to neglect fuel consumption from logistic chains as well as other sources of energy consumption throughout the product life cycle. It will be shown that public information to model a baseline is poor and the inclusion of logistic aspects would have overburdened the informative character of the study.

The following subchapters give information on the absolute level of energy consumption for both, electrical and heating energy per store. Furthermore, the single contributors to the electrical energy demand are discussed. Finally, the question of how heating energy is provided will be explained. All these steps have to be made in order to be then able to calculate the potential impacts of individual activities on energy saving.

4.1 Specific energy consumption per store

The first intention was to investigate average energy consumption values for stores of each company in the food retail sector. By doing so, the general methodological bottom-up approach of this study would have been preserved. However, during the investigation it became clear that this approach is not feasible as the information given by the companies is not sufficient. Average energy consumption values are regarded as confidential and therefore not communicated [Kabbe 2012]. Furthermore, it cannot be taken for granted that companies know the exact energy consumption of their stores as an energy monitoring system is required. The concrete energy monitoring is a challenging task; even for large business groups that have dealt with sustainability issues for several years [Kabbe 2012].

"Specific energy consumption values are only communicated on business group level. Literature sources are not sufficient to close this data gap"

The most frequently available indicator is the total energy consumption on business group level. In the case of large business groups with operating companies in different food and non-food markets, this information is useless for a breakdown on company- or even store level. In order to modulate the energy consumption of food-retailing, a relative indicator describing the annual energy consumption per square meter sales area is most favourable. This indicator is needed for electrical energy and heating energy.

Only few literature sources contain such relative indicators for energy consumption. The literature values for electrical energy per m² sales area differ between 310-376 kWh/m². Values for heat energy consumption differ between 107-215 kWh/m². All literature sources that could be found made no distinction between the different distribution channels.

Due to long-time experience, OEKO-Institute is able to provide further average energy consumption values for each distribution channel. OEKO-Institute data are deduced from individual market competitors and consequently are not representative for all companies within each subgroup. OEKO-Institute data for discount markets and supermarket segment are derived from two important market competitors, each having a share of sales area less than 20 % within its subgroup. The given data for consumer markets are derived from 4 companies, together having a share in sales area of more than 50 %.

All values investigated for energy consumption in food stores are displayed in Figure 5. The following literature was used:

Source 1: [ages 2005] –containing historic values from 1994
Source 2: [BMWi 2011]
Source 3: [BMVBS/BBSR 2009]
Source 4: [REWE 2010] company report, complemented with own calculation

As it can be seen, literature values spread significantly. Combined with the fact that literature values are not available for single distribution forms, all values from OEKO-Institute's own calculations are set as benchmarks and receive further consideration.

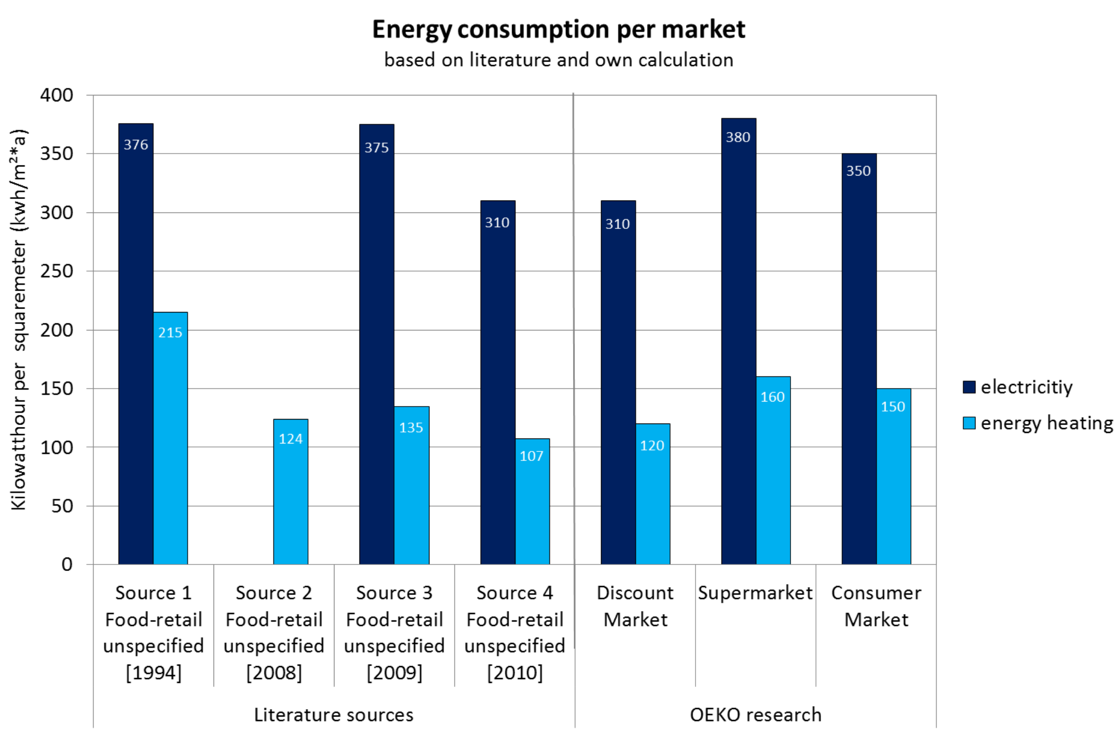


Figure 5: Energy consumption per store based on literature and own calculation

Discount markets show the lowest energy consumption values per square meter sales area (310 kWh electrical energy and 120 kWh heating energy per square meter sales area). This is plausible, as selling concept of discount markets is designated by simple in-store concepts with less refrigerated articles.

Supermarkets show the highest energy consumption values (380 kWh electrical energy and 160 kWh heating energy per square meter sales area). The predominating distinguishing factor from other distribution forms is the high quality of shopping experience combined with profound product range. Obviously, this leads to higher consumption values.

Consumer markets are in between supermarkets and discount markets (350 kWh electrical energy and 150 kWh heating energy per square meter sales area). One possible explanation for this might be that the selling concept is similar to supermarkets but due to bigger market sizes, economies of scale lead to lower average energy consumption values.

Table 2: Relative and total energy consumption for different distribution channels. Own calculation

	Electrical energy consumption		Heating energy consumption	
	relative per sales area (in kWh/m²)	*total per Ø store (in kWh)*	*relative per sales area (in kWh/m²)*	*total per Ø store (in kWh)*
Discount Market	310	236 950	120	91 722
Supermarket	380	359 152	160	151 222
Consumer Market	350	2 315 017	150	992 150

4.2 Single contributors to energy consumption

Beside the question of how much energy is consumed, it has to be verified which contributors cause the electrical energy consumption to be then able to derive relevant activities in a next step. In the case of food stores, sources like lighting and refrigeration come into mind. The role of individual contributors is relevant when it comes to the question how much energy can be saved by energy efficiency measures. This is only relevant for electrical energy. In the case of heating energy, all consumed energy is used with the purpose of heating.

Several literature sources can be found. Unfortunately the used classification to describe individual contributors of energy consumption is often not comparable. While the major classes “lighting”, “commercial refrigeration” and “air-conditioning/cooling” are used in nearly all sources, the way to classify the remaining contributors varies. Apart from the problem of classification, the identified share of energy consumption varies significantly. Figure 6 shows the findings form literature analysis. The following literature was used:

Source 1: [Energiekonsens 2005]
Source 2: [EHI 2011]
Source 3: [Mercadona 2010]
Source 4: [REWE 2010] company report, complemented with own calculation
Source 5: [EHI 2011]
Source 6: [EHI 2011]

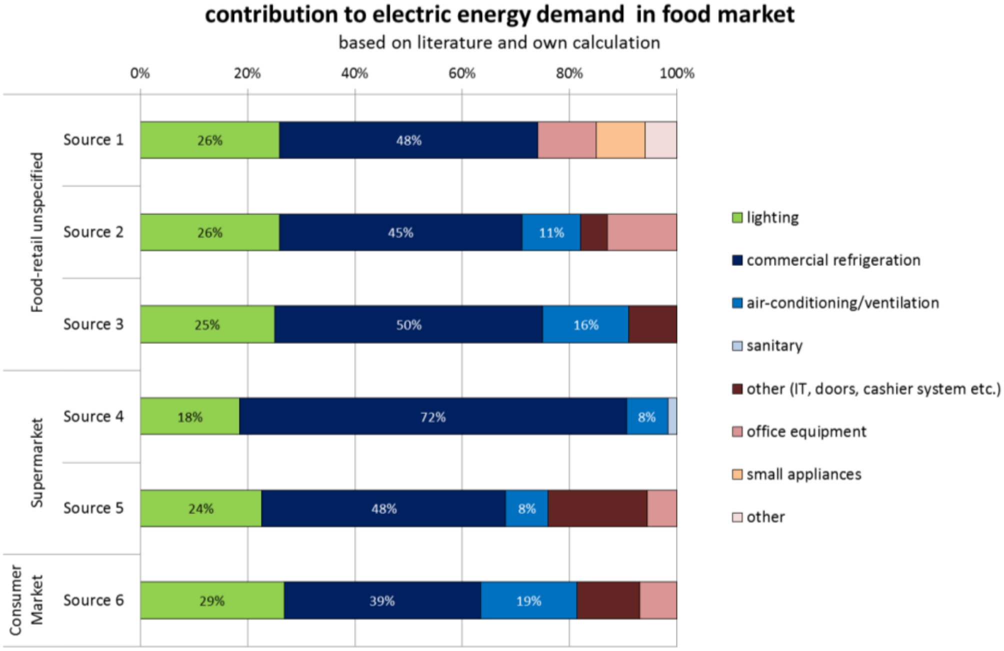


Figure 6: Literature source regarding individual contributors of energy consumption in food stores

Figure 6 illustrates the impacts of individual contributors to the electrical energy consumption as found in different literature sources. The share of lighting varies from 23–29 %. The share of Commercial refrigeration varies from 39 % to even 8 8%. Despite these large differences, it is becoming clear that lighting and commercial refrigeration are the most relevant contributors to energy consumption and make up over 70 % of total energy consumption.

The different classifications and great spread in detected impact makes it very unsatisfactory to set resilient benchmarks. Nevertheless, as this is essential to quantify effects of individual CSR measures, a reference share was calculated, based on the average values given in Figure 6. The following Table 3 shows the defined values.

Table 3: Share and total consumption of individual contributors to total consumption. Own calculation, used as reference for this study.

		Total consumption in kWh per (average) store		
	share from total	Discount Market	Supermarket	Consumer Market
Commercial refrigeration	50.5 %	119 551	181 207	1 168 024
Lighting	25.7 %	58 514	88 691	571 681
Air conditioning/ventilation	12.5 %	29 555	44 797	288 754
other	12.4 %	29 330	44 456	286 557

4.3 Use of fuels for heating

In the case of heating there are no activities to be differentiated, as all the energy is just used for heating. In this case however, the question how heating energy is produced has to be clarified as the combustion of different fuels leads to different amounts of GHG emissions.

Company's CSR communication does not address this issue. A similar situation was found within the literature research: Only two literature sources gave answer to this question. Unfortunately, these sources only address retail in general and do not differentiate in food- and non-food-retail. Again, OEKO-Institute is able to provide fuel mix calculations from its own Carbon Footprinting activities in the food retail sector. All identified values are presented in Figure 7. The following literature was used:

Source 1: [BMWi 2011]
Source 2: [ages 2005]

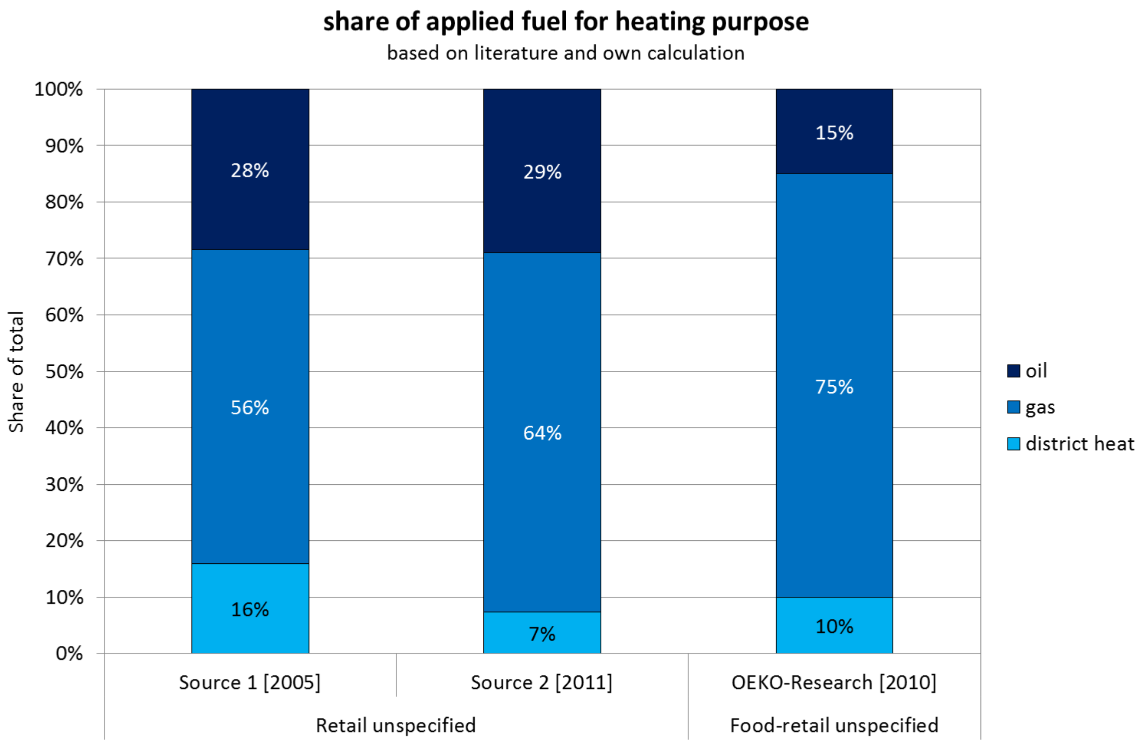


Figure 7: Share of fuel mixed used for heating purpose in German food-retail. Literature sources and own calculation

As it can be seen in Figure 7 literary sources indicate a change in the mix of fuels for heating purpose over time. While the use of oil remains constant, the share of gas increases at the cost of district heat. Compared to this, fuel mix for food retail as derived from OEKO Institutes own calculation varies from this. Significantly less oil and consequently more gas is used than in both literary sources. A possible explanation might be that OEKO Institutes data is based on company level from the food-retail market while both literary sources cover the entire retail market. A shift from district heat to other energy sources for food stores can be explained as food markets are are often located in suburban areas where the access to district heat is less common than in inner-city locations.

As OEKO Institute data is the only available data source explicitly for food-retail, given OEKO Institute share for fuel mix is used for the scenario setting as conducted in chapter 7.

5 CLIMATE CHANGE IN GERMAN FOOD RETAIL SECTOR

Chapter 3 showed the variety of CSR issues addressed by food retail companies. This chapter now focusses on climate change aspects among CSR activities. The chapter gives a detailed overview of measures already implemented by food-retailers. Climate change measures are distinguished in **energy saving measures** and **emission avoidance measures**. At first glance these two aspects seem to be similar. But with energy saving measures the total amount of consumed energy will be reduced while with the usage of renewable energies the resulting GHG emissions from energy consumption will be lowered – without necessarily reducing energy consumption at the same time (emission avoidance measures).

While chapter 5.1 describes the variety of measures, chapter 5.7 derives realistic energy savings that can achieved. Chapter 5.9 finally gives a profound status quo analysis of the implementation level of the different performance activities in the German food-retail market. All steps are relevant with regard to the subsequent chapters 6 and especially chapter 7 where an ex-ante analysis is being performed.

5.1 Performance–Activities: Overview of energy saving measures in food-retail sector

All existing CSR communication channels (see chapter 3) have been evaluated and identified measures that can be conducted in order to save energy and hereby reduce the company's impact on climate change. Most energy saving measures can be distinguished between savings in electrical- or heating energy. Further measures like energy management and new building concepts address the saving of both, electrical and heating energy.

All measures are displayed in Table 4 and briefly explained in the following text.

Table 4: Energy saving measures of German food-retailers.

	Area	Measure
Electricity	Cooling system; general	• E.g. abstinence from decentralized plug-in refrigeration units
	Freezer / Refrigeration	• Application of night blinds to avoid the loss of cooling • Application of doors to avoid the loss of cooling • Coated door panels to avoid fogging • Efficient lighting of refrigeration unit to minimize waste heat • Energy-saving components (fan, compressor, motor) and performance regulation • Management (no overload of products, maintenance) • Exchange of old devices
	Lighting	• Improvement in efficiency of fluorescent lamps (change of components, e.g. lamps, reflectors, electronic ballast) • New lighting concept (mix of LED & fluorescent lamps) • LED as paramount lighting material • Use of daylight & sensor-based control
	Ventilation	• New components, appropriate sensor-based control
	Miscellaneous	• e.g. Energy-saving cashier system
Heating	Ventilation system	• Heat recovery from exhaust air
	Refrigeration system	• Using waste heat for room heating
	Building insulation	• Thermal renovation (wall, window or roof insulation etc.)

Energy management	• Standardised energy monitoring for stores • Benchmarks for room temperature • Employee training • Designation of energy manager
New building concept	• Application of state of the art technologies in new buildings

5.2 Saving measures –Electricity

As shown in chapter 4.2, around 50 % of the total electrical energy consumption is needed for the refrigeration of products. Therefore, the majority of identified energy saving measures addresses the commercial refrigeration.

Cooling system; general

Commercial refrigeration subsumes the storage of all products that need to be refrigerated. This contains products displayed for selling as well as products stored in the store warehouse. With central refrigeration systems, the cooling capacity produced with compressors is used for both, in-store and warehouse cooling. Large food-stores typically are equipped with central refrigeration systems. Single refrigeration units that are equipped with autonomous cooling units are called plug-in systems. The advantage of plug-in lays in the greater flexibility. Store managers can vary were the unit is placed and hereby react on changing assortments. The needed cooling power can easily be adjusted by increasing the number of used units. As the plug-in cooling system is compact, energy losses can be reduced. However, the disadvantage of plug-in systems is that all waste heat from the cooling process is emitted to the inside space of the appliance were it provokes further air-conditioning. In consequence, plug-in systems require more energy than well managed central refrigeration systems. Many food stores today use central systems as well as plug-ins due to the recently increased cooling demand.

Different CSR measures can be used to address this issue and pursue e.g. the target to avoid plug-in systems and fully apply centralized systems. Other described measures focus on existing central systems with the intention to increase the energy efficiency with better technical configuration.

Freezer / Refrigeration

The diversity of available freezing and refrigeration units is very broad. Food products can be presented vertically in shelve-like units or horizontally with one central storage floor. There are also stand-alone islands that are accessible from all sides. From a marketing point of view, such units are very interesting as products should be directly accessible. That’s also why refrigerators traditionally are open and not equipped with doors like household appliances. However, cool air is constantly lost with open refrigeration units. The application of coverage elements is an efficient way to save energy. These can be **night blinds** that are rolled over the display area during the night time. This measure is only relevant as retrofit for existing appliance as new appliances are only built with night blinds [Rhiemeier et. al 2008].

In contrast to night blinds that can save energy only during closing hours, **glass doors** represent a permanent method to avoid the loss of cooling. The doors are closed all day as long as no chilled goods are taken out. The temperature distribution is more homogenous with glass doors and the temperature of the chilled goods can be better controlled. Glass doors are considered as one of the most efficient ways to preserve energy losses and are therefore frequently mentioned in CSR communication. However, one retailer reports that depending on a certain frequency of opening and closing procedures the effect can be reversed as with each opening cold air is pulled out of the unit. These effects exceed the constant loss of an open system [Schneider 2013]. One of the main problems of glass doors is that retailers generally fear a loss in sales due to glass doors, but so far there are no surveys known which analyse the influence of glass doors on the turnover of a store [Rhiemeier et. al 2008].

If a glass door is implemented the problem of fogging at the inner side of the door occurs. When a costumer opens the refrigerator door and takes out the product of choice, at the inner door side a fogging layer occurs. This is a marketing problem as the cooling system only slowly dissolves the fogging and other costumers may feel uncomfortable. One common measure is to use **coated doors or lids**. A thin metal layer effectively reflects the heat radiation and avoids coating.

For good presentation of the goods many refrigeration units and freezers have a lamp installed inside the unit. A large portion of the electrical energy from the lamp is converted into heat. The additional heat results in additional cooling load. With **energy saving lamps** the opportunity arises to save energy twice. On one hand, by reduced energy consumption directly for lighting and on the other hand by reduced cooling demand.

Energy-saving components (fan, compressor, motor) and performance regulation are further technical approaches to reduce the energy consumption of existing appliances. The implementation is time and cost intensive as each single unit has to be examined and the appropriate measures identified. The availability of professional technicians and maintenance staff can be a limitation factor for the implementation of such measures [Kabbe 2012].

The correct filling of refrigerated shelves and cabinets does not only ensure a correct temperature of the goods, but it also aids to save energy. According to Faramarzi, overfilled, open refrigerated shelves need up to 6 % more energy [Faramarzi 2004]. The **training of staff for an optimized management of refrigeration units** is a non-technical measure to save energy.

From a certain point retrofit measures are not suitable and old devices must be exchanged. This happens often for economic reasons as maintenance costs are too high or spare parts not available. The **exchange of old devices** can be the result from ecological or economic considerations.

Lighting

Behind Commercial refrigeration, lighting is the second largest contributor to electrical energy consumption. Energy saving measures focus on efficiency improvements of currently used fluorescent lamps. Savings can be achieved by **changing the lamp itself** (standard T8 lamp to efficient T5 lamp) or by **changing single components** like reflector or electronic ballast.

The implementation of a **new lighting concept** in food stores is a complex measure to achieve energy savings. The exclusive use of fluorescent lamps is rolled back and efficient lighting systems like LED lamps are combined with energy saving fluorescent lamps (T5 with electronic ballast). This measure is usually only applied when building a new store or in the course of thorough renovation measures of an existing store.

Due to decreasing prices over the last years, retrofitting LED lamps became an attractive alternative to fluorescent lamps. The LED lamp has the same size as a fluorescent lamp and can easily be retrofitted in existing bulb sockets. One CSR measure would be to address the usage of **LED as paramount lighting material.**

Besides the optimization of lamp systems, energy savings can be achieved by **using daylight**. As extensive replacements (like insertion of windows or attaching a sensor-based control) have to be done to use the daylight, this measure is favourable only for newly constructed or renovated stores. In cases were the store is located in the basement of apartment houses or office buildings this measure is not an option.

Ventilation and other

With regard to energy consumption, air conditioning or ventilation is not as relevant as commercial refrigeration or lighting but still savings can be achieved. Existing ventilation systems can be retrofitted with a **sensor-based control** which measures the demand for fresh air in the interior and regulates the ventilation intensity. When air conditioning is used, comparable technical solutions as for commercial refrigeration exist (e.g. **new components** such as compressor, fan or motor).

Apart from the field of refrigeration, lighting and ventilation, occasionally **miscellaneous measures** like e.g. energy-saving cashier systems are described as possible CSR measures. These measures are less frequent and less described.

5.3 Saving measures – Heating energy

As seen in chapter 4.1 the demand for heating energy is less energy intensive than that from electrical appliances. Heating energy is directly depending on local climatic conditions and varies therefore annually and geographically.

Ventilation and Refrigeration

Ventilation and refrigeration systems offer chances for savings by **recuperation of energy from exhaust air**. The recovered thermal energy can be used to support the central heating boiler. This is only useful in winter times when in-store heating is needed while in summer time no usage for the recovered heat exists. When waste heat is consistently used for heat recovery, a large part of the energy demand for the heating of the supermarket can be saved [Rhiemeier et. al 2008].

Building insulation

The construction elements walls, windows and roof form the building shell and are responsible for thermal losses. Hence, the **thermal renovation** of stores by replacing insufficient construction elements with better insulated formats plays an important role in achieving energy savings. At the same time, thermal renovation is expensive and only cost-efficient when conducted in combination or together with further building modernisation works. Standalone measures like solitarily changing the windows are not economic. Consequently, thermal renovation is a slow process and high replacement rates are difficult to achieve.

5.4 Saving measures – Energy management

Following the slogan “you can’t manage what you can’t measure”, companies build up **energy monitoring systems** that collect and record the energy consumption of all individual stores. With a consumption analysis, inefficient stores are identified. By choosing first the most inefficient stores for modernisation measures, high total energy savings are achieved and investments have a short payback period. As Germany’s largest supermarket companies control more than 2,500 stores, building up an energy monitoring system can be very challenging for companies. At the same time, the central availability of energy consumption data is important for an accurate and prompt reporting in the context of implementing CSR activities.

The perception of warm and cold differs from person to person. This is why air-conditioning or heating systems are adjusted due to personal preferences. By setting **benchmarks for room temperature** disparities can be overcome and unnecessary energy consumption avoided.

CSR measures presented so far are mostly technical solutions. Apart from this, food-retailers also implement soft measures to sensitise own employees or external service staff. **Employee training** is a way to communicate the company’s CSR strategy and to ask for a conscious use of energy. Another form to include internal and external staff is to carry out competitions on environmental topics. One large supermarket company e.g. carries out an annual competition for the best configuration of commercial refrigeration devices [Kabbe 2012]. The **designation of an energy manager** enables a direct communication between business administration and local staff. The energy manager controls the energy consumption from the store, helps to identify possible saving measures and is contact person for energy related questions.

5.5 New building concept

Most of the energy saving measures described above are designed to improve certain subareas like lighting or ventilation in food markets. The advantage is that retrofit measures can be adopted without changing the whole store structure. However, with the implementation of **new, holistic building concepts,** all subareas can be harmonised and state of the art technologies can be applied. These stores can be described as pilot-markets. Here, companies demonstrate their own vision of sustainable food markets and are at the same time able to collect experience with new techniques.

5.6 Emission avoidance measures

Apart from the intention to reduce the amount of consumed energy with saving measures, a contribution to climate protection can be realized with emission avoidance measures. Emission avoidance can be achieved by **purchasing of electricity from renewable sources** like wind or hydropower plants. German suppliers of energy provide several electricity products and guarantee the customer that the exact amount of consumed electricity is produced and fed into the grid from renewable sources. The imputation of GHG emissions from green electricity is crucial. This aspect is discussed in detail in chapter 6.2

The German Renewable Energies Act (EEG) guarantees fixed feed-in prices for **producers of renewable energy** – especially for electricity. This makes investments in green power calculable and offers new possibilities for retailers on how to reduce GHG emissions: The large abundance of roof area on standalone food stores makes it profitable to attach photovoltaic modules and generate renewable energy on its own. From an economic point of view it is more profitable to feed the produced electricity into the grid and to receive fixed prices than to consume the electricity directly in the market. The production of green electricity does not directly influence the company GHG balance but contributes to a green transformation of the entire energy market in Germany. See also chapter 6.2 for a detailed discussion.

The role of commercial refrigeration devices and energy consumption has already been described above. Apart from the problem of energy consumption, the used refrigerants have a serious global warming potential (GWP). Refrigerants or fluorinated gases (F-gases) are chemical substances that are used for the energy transport within a cooling cycle of refrigeration units. The diversity of used substances is wide as different refrigerators need specific refrigerants. Refrigerants have already been in the focus of environmental concern regarding their ozone depletion potential and therefore several substances have already been removed from the market. Nevertheless, the currently used refrigerants still have a significant global warming potential, e.g. the GWP from the most common refrigerant R134a is 1 430 times higher than that from carbon dioxide. A cooling circle ideally is a hermetically closed loop but refrigerant losses occur due to leakage or maintenance work. The amount of lost refrigerant can be detected by the amount of refilled refrigerant. It will be shown later on that – due to its enormous GWP – the influence of refrigerant losses is relevant compared to the overall GHG emissions per store (see chapter 8).

Consequently, the **replacement of refrigerants with high GWP** is an important CSR measure to avoid GHG emissions. Some companies **test alternative refrigerants** such as carbon dioxide, as climate friendly alternatives. Food retail companies that have yet published sustainability or GHG reports disclose the total amount of GHG emissions resulting from refrigerant losses and sometime refill rates. Specific GHG emissions per square meter sales – like for energy consumption – are not available.

Similar to energy monitoring systems, **refrigerant monitoring systems** are reported to be installed to centrally control the used and lost refrigerants within all the company's stores. In 2006 the European Union passed legislation in order to control the use of harmful refrigerants. The so-called F-gas Regulation (EC) No 842/2006 contains obligations on reporting, training and labeling for operators of large refrigerant systems as in food markets. Therefore, the companies are obliged to fulfill this legislation and measures in this field cannot be regarded as additional CSR measures. The regulation pinpoints the monitoring of applied refrigerants but does not set limits for annual refrigerant loss rates certain rates. Consequently, companies voluntarily may set internal goals for annual refrigerant loss rate or improve their environmental performance by using refrigerants with low GWP.

Table 5 shows the above introduced list of emission avoidance measures that can be found in German food retail.

Table 5: Major emission avoidance measures by German food-retailers

Category	Description of measurement
Energy	• Purchase of electricity from renewable sources • Generation of renewable energy
Refrigerant	• Use of refrigerants with low global warming potential • Tests with alternative refrigerants (e. g. CO_2) • Monitoring system to control the refrigerant circulation & losses

5.7 Achievable savings

After the spectrum of possible and already implemented CSR measures in the field of climate change is presented in the previous chapters, it is now the intention to quantify the achievable savings. The public available CSR communication derives as primary information source for this. Later on, information from literature sources is examined and included.

Following the slogan: "Do good and talk about it", companies intend to communicate the savings achieved with CSR measures. Therefore, the investigated documents contain several information on effects of CSR measures. Unfortunately, savings are often calculated as a result from a bundle of measures. Descriptions of effects from single measure are missing in most cases. When multi-measure-effects are communicated, the challenge is to break down total savings and allocate them to single measures. This cannot be achieved without additional information – which is usually not available for people outside the company.

Another restriction for calculating effects from individual activities is that business groups only communicate global data for the entire group and do not split data on company level. Only three German business groups (Metro, REWE & Tengelmann) have so far published CSR reports. These documents comply with the common GRI and GHG Protocol requirements (see chapter 6) and contain total energy consumption values, total GHG emissions and total savings achieved by reduction measures. However, all business groups consist of companies that operate in the food and non-food sector – and all information given is always related to the group level. It is furthermore not explained in which companies the described measures took place. In consequence, no conclusions can be drawn regarding achievable saving potentials on (food) company level.

In the case of REWE a simple estimation about the realized energy savings on group level can be made. For the year 2009, REWE reports a total consumption from 14 756 terajoules of indirect energy sources. The indicator "indirect energy" is composed of electrical power and district heating, while electrical power is predominant. Without knowing the exact share of the dimensions electrical power and district heating, in a conservative approach it is assumed that 80 % from indirect energy refers to electrical power. This means that 11 804 terajoules of electrical power were consumed. Rewe reports the implementation of various measures to save electrical power and calculates total savings of 125.25 terajoules [Rewe 2010]. The achieved savings then account for 1.1 % of the total consumption of electrical power. It is has to be kept in mind that cost-efficient measures are primarily realized. Cost-efficiency means that energy savings (and consequently cost savings) are high enough to achieve a return of invests in a short period of time. In contrast, when cost-efficient measures are implemented, the effort increases to achieve further savings. It will be interesting to see if REWE will maintain this rate of annual energy saving, when activities with low costs and large effects are already exploited.

Beside the allocation problem of energy savings to individual measures, the physical quantity in which achieved savings are displayed varies. In many examples, the effects from measures are expressed as savings of GHG emissions. The dimension is CO_2 or CO_2-equivalents. In other cases, savings are expressed in power units. This can either be primary energy consumption (unit: joule) or power (unit: kilowatt-hour). Due to methodological problems how to transform power units to GHG emissions (see chapter 6), it is complicated to compare calculated savings from one company to another.

Table 6 shows the range of energy savings that can be found in literature or CSR communication from companies. The saving potential is expressed in percentage and refers to the consumption of the same appliance without the implementation of a saving measure. For example energy consumption of refrigerant units without doors and savings due to applied doors. The displayed saving potential is not necessarily cumulative as some measures exclude each other. For example in the field of lighting, LED as dominating lighting system cannot be combined with an improvement of fluorescent lighting technology.

For the field of commercial refrigeration, the application of glass doors to prevent cooling losses has saving potentials between 20–40 %. However, the intention to calculate total savings (in kWh) per store on this basis fails: In chapter 4.2 total energy consumption for commercial refrigeration is explained: Commercial refrigeration includes refrigeration appliances, cold storage and glass fronted service counter. There is no data is available on energy consumption only from *refrigeration appliances* that are favourable for retrofitting glass doors. Consequently, the calculation of the total savings from glass doors cannot be assessed.

The change from fluorescent lamps to LED lighting provides savings of around 40 %. The total annual energy consumption for lighting is calculated between 58 514 kWh for an average Discount market and 88 691 kWh per average supermarket (see Table 3). This means 40 % less energy due to LED lamps can save on average 23 405 kWh per discount market and 35 476 kWh per supermarket.

Table 6: Compendium of achievable energy savings as stated in literature and CSR communication

	Type of consumer	Description of measurement	Source 1 HDE 2013	Source 2 Energieagentur.NRW 2003	Source 3 NETTO 2013	Source 4 Lidl 2013	Source 5 Aldi Süd 2013	Source 6 real 2013	Source 7 Tengelmann 2013	Source 8 Rewe 2008
			Savings in %							
Electricity	Cooling system; general	E.g. abstinence of decentralized plug-in refrigeration units	30-40							
	Commercial Refrigeration	application of doors to avoid the loss of cooling		20-40					35-50	
		coated door panes to avoid fogging								
		application of night blinds to avoid the loss of cooling								
		Efficient lighting of refrigeration unit to minimize waste heat			25					
		Energy-saving components & performance regulation								
		Management (no overload of products, maintenance)	15	15						
		Exchange of old devices					20			
	Lighting	Improvement in efficiency of flourescent lamps (change of components)	20	23			35	40		
		New lighting concept (mix of LED & flourescent lamps)								
		LED as paramount lighting material			40					
		Use of daylight & sensor-based control								
	Ventilation	new components, appropriate sensor-based control	60-70			75				
	miscellanous	e.g. Energy-saving cashier system								50
Heating	Ventilation system	Heat recovery from exhaust air	60				60			
	Refrigeration system	Using waste heat for room heating	40				40			
	Heat management	Limitation of room temperatur								
	Building insulation	Intensification of the wall or window insulation etc.								

It has to be distinguished whether an existing store is retrofitted by efficiency measures or a new store is constructed by applying a new building concept. The total saving potential for new building concept store is higher as energy consumers like refrigeration and ventilation can be coordinated and adjusted idealistically to each other. The following Table 7 displays achievable savings for existing and newly built stores as calculated for this study.

Table 7: Achievable savings for existing and new build stores [own calculation]

		Saving potential for retrofit measures in existing stores		Saving potential for new build stores (New-Building-Concept)	
Type of Energy	Sector	Saving refer to sector	refer to energy	Saving refer to sector	refer to energy
Electricity	Commercial Refrigeration	40 %	33 %	60 %	44 %

	Lighting	25 %		30 %	
	Ventilation	50 %		50 %	
	miscellaneous	4 %		4 %	
Heating		40 %	40 %	100 %	100 %

5.8 Contingencies & Counterfactuals

For a better market understanding and derivation of reliable scenarios, this chapter assorts the structural developments which are applicable to influence results of other (e.g. CSR) activities by the potential to influence the energy consumption of food stores. They have to be taken into account when modelling scenarios as e.g. economic decline alone will have a great impact on energy consumption without any additional CSR activity.

- The demographic change will lead to change of customer spectra and subsequent decline of potential customers. This will force food retailers to re-evaluate their expansion strategies and profitability of new store locations [KPMG 2012] .Less new stores will be opened compared to the last years. Even if the expansion rate will slow down due to demographic change, it can be expected that the total sales area and consequentially the net energy consumption will further augment. It is difficult to quantify this effect but slight growth in energy consumption can be expected.
- The demographic change also leads to more single person households. This will lead to a demand for smaller package sizes [KPMG 2012]. Retailers have to decide whether to increase sales area or reduce product range. Actually, a tendency towards more offered products is more likely. This results in an increase of energy demand.
- With the aging of the population, the need for short distances and centrally located stores arises. The tendency towards newly opened stores in city locations with a smaller sales area and less products is already visible [LZ 2012-35]. On a long term perspective, when large stores in industrial zones at the edge of cities are closed due to a reduced demand, this effect would lead to declining energy consumption.
- The food retail sector is currently in a phase of upgrading business concepts. This can be observed in various developments:
    - Increasing product diversity like for example the provision of more fresh products, flowers, personal hygiene articles (see [LZ 2012-36]; [LZ 2012-34]; [LZ 2012-46], [LZ 2012-48]).
    - Increasing number of service offers such as baking stations (see [LZ 2012-39] and [LZ 2013-2] or counters for hot snacks.
    - Growing level of technical equipment in food markets. E.g. flat screens in cashier zone, self scanning cashier systems, introduction of RFID technology or Electronic Shelf Label (see LZ 2013-7])

All effects from concept upgrades lead to increasing demand for sales area [LZ 2012-48] and a growing energy consumption.

- The increasing need for flexible working schedules and changing shopping habits demand for longer store opening hours. This directly affects energy consumption per store. One can assume that 1 additional hour in store opening leads to 3.5-4 % energy consumption of refrigeration (in case of commercial cooling appliances without night blinds [Rhiemeier et. al 2008]).
- New business concepts in the field of e-commerce are currently tested in the market. Prominent examples are pick-up stations for pre-ordered goods. The consumer makes his purchase decision electronically via internet and collects his order at specific counters or pick-up stations. As new technical infrastructure is needed, a growing energy demand results.
- Consumer demand for milk and milk based products like yoghurts or ice cream increased constantly in the past years [MIV 2011]. The growing product diversity provokes increasing need for refrigeration.

Table 8: Compendium: Development processes and conceivable effects on energy consumption of stores

Development	**effect on total energy demand (estimated)**
Moderate expansions rates due to demographic change	slight increase
Augmentation of product range due to more single households	increase
Revitalisation of city locations with rather small stores	decrease (long-term)
Concept upgrade: Increase of product range, fresh products; service counter; technical infrastructure	increase
Extended opening hours	increase
Upcoming new concepts: e-commerce combined with pick-up stations for pre-order purchase.	slight increase
Increasing number of milk based products -> need for refrigeration.	increase

Most of the presented effects lead to an increasing energy demand in food stores. It is difficult to quantify the single effects but statements from personal communication support the assumption that energy demand in food stores is actually increasing –mainly due to concept upgrades [Kabbe 2012]. Therefore, increasing energy demand in the near future is a fundamental assumption for the scenario analysis in chapter 7. In order to quantify this development an annual increase of 0.25 % electrical power consumption for all distribution channels is defined. Over the whole time period of 10 years that is covered by the scenario analysis, the assumption of +0.25 % p.a. means a total increase of +3 % energy consumption till 2020.

5.9 Implementation-check

For this study, CSR documents from the major 19 food retail companies in Germany were analysed. All companies together manage nearly 28 000 stores in Germany. With regard to the total number of existing stores it becomes clear that the implementation of CSR measures on a comprehensive level is a challenging task. When evaluating the impact of CSR measures, information about its implementation level as part of the business as usual scenario (BAU) is relevant. In fact, drawing conclusions on the actual implementation level out of the examined CSR documents can be tricky as the chosen wording is sometimes vague. In contrast, in some documents the precise number of stores with successfully implemented CSR measures are stated [Rewe 2009a]; [Metro 2011].

In order to throw a light on the current implementation level of CSR measures, all available information is summarized in an overview table. The current situation is described with five categories reaching from pilot stage to full implementation. Two categories are used to differentiate whether a measure is implemented by retrofitting existing systems or only when new systems are purchased.

In a first step, all available information was screened and – as far as possible – information on the kind of measure and the current implementation level recorded. Therefore, the list of possible measures presented in chapter 5 was used as a structure. Secondly, each company was contacted and asked for more detailed statements about the implementation level of their measures. Only 25 % of all companies responded and gave additional information. The feedback loop showed that all responding companies were able to specify the implementation level. Some even extended the company profile with measures that were not directly mentioned in their CSR communication. A possible explanation is that companies favour clear and brief CSR communication and some measures are conducted without explicitly mentioning them.

The results from the implementation check are displayed in Table 9. All displayed measures are not to be understood as cumulative, as some measures exclude each other.

Table 9: Implementation status of energy efficiency and energy saving measures in German food retail companies. Information taken from companies reports and additional information from to personal enquiries

Measurements electrical energy		Discount Market							Supermarket							Consumer Market				
		Company 1	Company 2	Company 3	Company 4	Company 5	Company 6	Company 7	Company 1	Company 2	Company 3	Company 4	Company 5	Company 6	Company 7	Company 1	Company 2	Company 3	Company 4	Company 5
Freezer	application of doors to avoid the loss of cooling		purchase	pilot		partial			partial	partial	purchase	full	purchase							pilot
	Efficient lighting of refrigeration unit to minimize waste heat		purchase	pilot						partial	pilot									
	Energy-saving components (fan, compressor, motor) & performance regulation		retrofitting							partial										
	Exchange of old devices		retrofitting			retrofitting			retrofitting										partial	
Refrigeration	application of doors to avoid the loss of cooling					full			full	partial		full	full			full			retrofitting	pilot
	coated door panes to avoid fogging										pilot									pilot
	application of night blinds to avoid the loss of cooling		partial										partial							
	Efficient lighting of refrigeration unit to minimize waste heat		purchase	pilot						partial	pilot									pilot
	Energy-saving components (fan, compressor, motor) & performance regulation		retrofitting	pilot						partial										
	Management (no overload of products, maintenance)		full			full			full							full		partial	partial	
	Exchange of old devices		retrofitting			retrofitting			retrofitting											
Lighting	Efficiency improvement of flour. lamps (component-change e.g. lamps, reflectors)			pilot	pilot	retrofitting				pilot								retrofitting	retrofitting	pilot
	New lighting concept (mix of LED & flourescent lamps)		full						retrofitting											
	LED as paramount lighting material		pilot	pilot						pilot	pilot									pilot
	Use of daylight & sensor-based control		pilot						pilot		pilot									pilot
Ventilation	new components, appropriate sensor-based control			pilot																partial
miscellanous	e.g. Energy-saving cashier system		partial			partial			partial											

Measurements heating energy		Discount Market							Supermarket							Consumer Market				
		Company 1	Company 2	Company 3	Company 4	Company 5	Company 6	Company 7	Company 1	Company 2	Company 3	Company 4	Company 5	Company 6	Company 7	Company 1	Company 2	Company 3	Company 4	Company 5
Ventilation	Heat recovery from exhaust air		full	pilot									purchase							
Refrigeration	Using waste heat for room heating		retrofitting	pilot	pilot				partial	pilot	pilot		partial						partial	purchase
Heat generatior	Operation of geothermal plants		pilot						pilot	partial	pilot									pilot
	Operation of heat pump systems		pilot										partial							purchase
Management	Limitation of room temperatur		full									full								
Insulation	Intensification of the wall or window insulation etc.		purchase	pilot	pilot				pilot				partial							
Refrigerant	Use of refrigerants with low global warming potential		retrofitting	pilot		retrofitting			retrofitting	partial	purchase		retrofitting							purchase
	Tests with alternative refr. (e. g. CO_2)		purchase		pilot	pilot			pilot	pilot	pilot		pilot			pilot			purchase	pilot
	Monitoring system to control the refrigerant circulation & losses		full															full	full	partial

- full implementation
- implementation by retrofitting
- implementation at purchase
- implementation partial/unclear
- pilot stage

Conclusions

13 of 19 companies report the realization of energy saving measures in a way that conclusions about the implementation level were possible. Only for six companies the communication of CSR measures is completely missing. Companies within the supermarket sector seem to be most engaged to conduct – or at least more engaged to report – CSR measures. As this project has to rely on publicly available data this bias cannot be solved. However, it can be assumed that companies that do not report about their CSR activities are not very highly engaged.

Pilot projects are very popular, most companies have at least one pilot store were state of the art energy efficiency techniques are tested (and promoted). The role of pilot stores is relevant as learnings from these projects are the basis for the decision whether measures are being rolled out and applied for further markets. Pilot stores are also an attractive topic for CSR communication. But one has to be careful that CSR communication does not solitarily concentrate on the flagship store and the situation in ordinary stores is being ignored.

All 13 reporting companies conduct measures in the field of commercial refrigeration. The implementation level is higher than in the field of lighting and air conditioning/ventilation. Attaching doors to prevent cooling losses from refrigerant devices shows the highest integration level (5 companies fully implemented the measure). Companies pay close attention to management measures like building up an energy monitoring of employee trainings. Measures to reduce energy consumption from lighting are by majority in pilot stage. 10 companies report to realize saving measures in this field.

The counter-check showed the existing differences between individual companies regarding the level of implementation. The German food sector contains companies that are relatively active in the area of CSR while other companies to not seem to be engaged at all. It can be assumed that CSR active companies are able to improve their performance indicators while others don't. This contradicts the approach from chapter 4.1 to set for each distribution channel benchmarks that are valid for each company within the subsector as this is obviously not the case. But the problem cannot be overcome as long as no business group or food company has yet reported sufficient performance indicators.

Due to this finding, the chosen method to use a general benchmark per submarket is less accurate but justifiable and there is no better approach available.

6 Calculation and Reporting of Greenhouse Gas Emissions

While the previous chapters focused on specific energy consumption and ways to achieve savings, it now has to be discussed how to calculate and report greenhouse gas (GHG) emissions.

The first subchapter 6.1 gives a brief explanation about the calculation of GHG emissions and the requirements reporting standards set. The subchapter 6.2 will discuss differences in existing emission factor databases and literature sources in greater detail. The German energy sector is currently in a phase of significant change as the German administration has set the goal to fully transform the energy sector towards renewable sources in the coming years. This immense political, societal and economic task has relevant effects on the way how electricity is produced and consequently on the question how to calculate GHG emissions from consumed electricity.

6.1 GHG emissions and reporting standards

Calculation basics

The global warming potential represents the contribution of anthropogenic emissions to the radiate forcing or heat radiation absorption in the atmosphere and therefore is the track indicator to express the so-called 'greenhouse-effect'. Pollutants contributing to the global warming phenomenon are inventoried and aggregated taking their Global Warming Potential (GWP) into account. The GWP denotes the pollutant impact of the different substances in relation to carbon dioxide (CO_2). As an indicator for the emission of greenhouse gases, the global warming potential is expressed in terms of CO_2 equivalents ($CO_{2\text{-eq.}}$). 100 years are set as the inventory period for calculating values. The characterisation factors used for calculation of impact categories are taken from [IPCC 2007]. The calculation includes the Kyoto 'basket' (CO_2, CH_4 and N_2O). Only carbon dioxide emissions from fossil fuels are relevant regarding climate change and are therefore taken into account. Carbon dioxide emissions from renewable sources (e.g. biogas) are proposed to be reported separately but not considered regarding the GHG balance.

Assessing the GHG emissions from a certain process – like e.g. the combustion of fuels to produce electricity – a differentiation between direct and indirect emissions is needed. Direct emissions represent all greenhouse gases occurring during the combustion itself while indirect emissions occur in previous or following process stages. Using the example of fuel combustion, previous or upstream processes include emissions from resource extraction, transportation and losses. Expenditures to construct the combustion plant are also calculated as indirect upstream emissions. Indirect downstream GHG emissions mainly occur in transitional losses.

Reporting Standards

General reporting principles of GHG accounting are formulated in ISO 14064-1 standard "Greenhouse gases – Part 1: Specification with guidance at the organization level for quantification and reporting of GHG emissions and removals". Basic requirements for the creation of company-related greenhouse gas balances are identified as follows:

- **Relevance**: Used data and methods concerning GHG emissions have to be adjusted to users and target group requirements.
- **Completeness:** The scope of the GHG balance is chosen in a way that all GHG emissions are recorded that are relevant for the company.

- **Consistency:** The balance sheet framework, the data used and the method of calculation are to be selected in a way that reliable comparisons in GHG-related information for future calculations will be possible.
- **Accuracy:** Distortions and uncertainties have to be reduced as far as possible.
- **Transparency:** GHG-related information has to be presented in a sufficient and appropriate manner to form a trust basis for decision makers to formulate activities and goals.

The most prevalent standards for organizations to report sustainability issues are the GRI standard and GHG Protocol. The standard developed by the non-profit organization Global Reporting Initiative (GRI) [GRI 2011a] gives an orientation for harmonized organizational reporting. Participants are encouraged to report their environmental performance by using specific criteria (Environment Performance Indicators). While the GRI standard includes all dimensions of sustainability, the GHG Protocol focuses on the accounting and reporting of greenhouse gas emissions. The GHG Protocol has been developed by an international consortium of scientists under the auspices of the World Business Council for Sustainable Development (WBCSD) and the World Resources Institute (WRI). The “Corporate Accounting and Reporting Standard” [WBCSD/WRI 2004] uses – like the GRI standard – the distinction between direct and indirect energy consumption and GHG emission.

The terminology of the GHG Protocol sets direct emissions from the combustion of fuels and fuels as Scope 1. Indirect emissions through the provision of power are denoted as Scope 2. GHG Protocol further distinguishes Scope 3, other indirect emissions, “such as the extraction and production of purchased materials and fuels, transport-related activities in vehicles not owned or controlled by the reporting entity, electricity-related activities (e.g. T&D losses) not covered in Scope 2, outsourced activities, waste disposal, etc.” [WBCSD/WRI 2004]. However, experience shows that Scope 3 emissions make a relevant contribution, in some cases the largest contribution, to the overall business-related greenhouse gas emissions. In 2010 WRI published the Corporate Value Chain (Scope 3) Accounting and Reporting Standard [WBCSD/WRI 2010]. This supplement to the GHG Protocol Corporate Accounting and Reporting Standard specifies the calculation of Scope 3 emissions (see Figure 8).

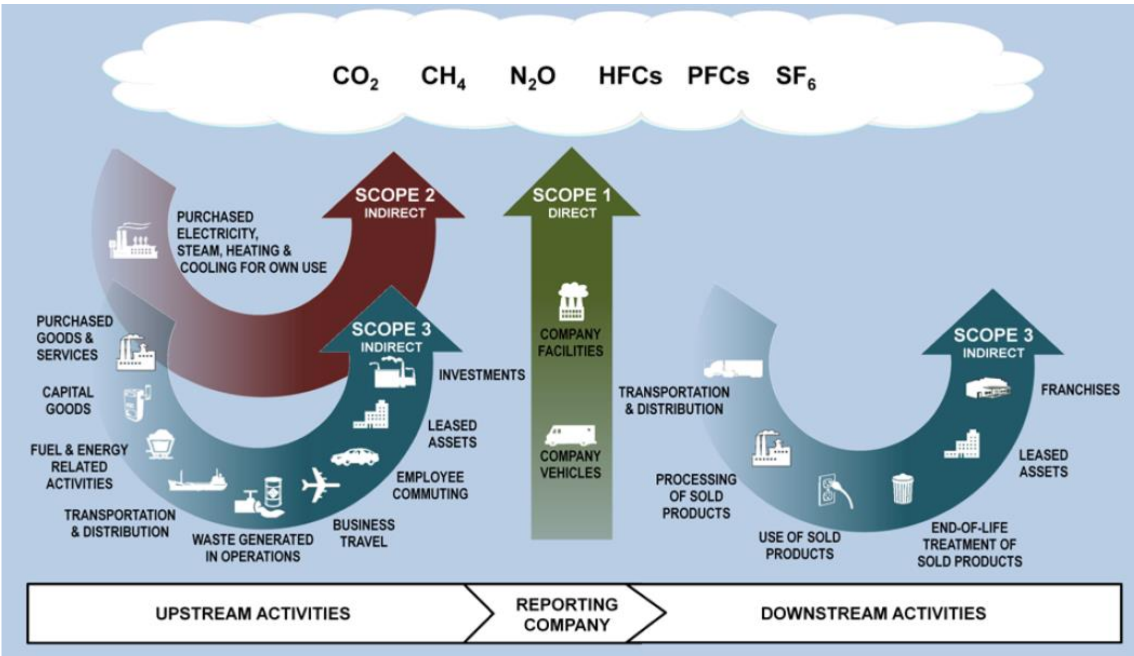


Figure 8: Distinction of direct and indirect GHG emissions [WBCSD/WRI 2010]

A profound assessment of Scope 3 for a company out of the retail sector is a herculean task. Accounting Scope 3 emissions entirely would include the production and transportation of all offered products (supply side) as well as the use and disposal from the customers. In a food retail company with some thousand products this is nearly impossible. This explains why most of the currently available corporate carbon assessments do include Scope 3 emissions from business travel, transportation & distribution or consumed advertising material but entirely omit life-cycle emissions from traded products.

Table 10 displays similarities and differences of GRI Performance Indicators and GHG Scope 1-3 classification. GRI indicators EN 3 and EN 4 refer to energy consumption from reporting organizations and are mandatory for GRI conform reporting. EN 5 also refers to energy consumption but is regarded as additional. In order to make different energy sources (e.g. gas, coal, oil etc.) comparable, GRI proposes the transition of consumed energy into primary energy (reported as giga- or petajoule) and gives fixed convert volumes of primary sources. As GHG Protocol focus on emissions, the reporting of consumed energy is not mandatory. Nevertheless, for the accounting of GHG emissions, energy consumption assessment is needed.

Table 10: Similarities and differences of GRI Performance Indicators and GHG Scope 1-3 classification

	GRI Standard			GHG Protocol Standard	
	Performance Indicator	Subject	Need to report	Scope	Need to report
Energy	EN3	direct energy consumption by primary energy source	core		
	EN4	indirect energy consumption by primary source	core		
	EN5	energy saved due to conservation and efficiency improvements	additional		
GHG Emissions	EN16	Total direct and indirect greenhouse gas emissions by weight	core	Scope 1 & 2	mandatory
	EN17	Other relevant indirect greenhouse gas emissions by weight.	core	Scope 3	voluntary
	EN18	Initiatives to reduce greenhouse gas emissions and reductions achieved.	additional		

The most significant differences between GRI and GHG Protocol can be detected in the way how they treat other indirect emissions which are not included in indirect emissions from purchased electricity, heat or steam. GHG protocol gives profound explanations how to calculate Scope 3 emissions but leaves it to the reporting organization to report them or not. In contrast, GRI sets PI EN 17 as core indicator and advises participants to address these emissions to a certain degree.

Under both standards, the reporting of total GHG emissions is obligatory. Apart from information on the absolute quantity of GHG emissions released to the atmosphere, the company's GHG emissions may be normalized by some business metrics that results in a ratio indicator. GRI and GHG Protocol propose the declaration of ratio indicators but keep leave it up to the organizations whether they want to report or not. GHG Protocol describes the benefit from ratio indicators as a way to facilitate comparisons between similar products and processes over time. Ratio indicators can be either "Productivity/Efficiency Ratios" (e.g. sales per GHG), "Intensity Ratios" (e.g. GHG emissions per product) or "Percentages" (e.g. GHG emissions expressed as percentage of base year)

Altogether, GRI and GHG Protocol are mature instruments that enable organizations to profoundly analyze and report their environmental performance. Regarding the German food-retail sector, one business group has published GRI compliant sustainability reports [Rewe 2008 and 2010a]. The Tengelmann business group has published a GHG Protocol compliant carbon footprint analysis for the years 2007 and 2009 [Tengelmann 2007 & 2009]. Another business group [Metro 2007- 2011] has also published a GHG Protocol compliant sustainability reports but also reports on some indicators which are comparable to GRI. All reporting organizations are business groups containing several companies operating in food and non-food market as well as on international level. Table 11 shows the findings from all business groups that have published GHG calculations.

Table 11: Summarized findings of GHG reporting from German business groups

	Metro AG	**Rewe Group**	**Tengelmann Group**
Area of operations	Food and non-food sector	Food and non-food sector	Food and non-food sector
Territorial expansion	Worldwide	Europe	Europe
Baseline			
Baseline of GHG reporting	2006	2006	2006/2007
Scope of GHG balance	Electricity, heating energy, refrigerant loss, paper consumption, business travel, logistic	Electricity, heating energy, refrigerant loss, paper consumption, business travel, logistic	Electricity, heating energy, refrigerant loss, business travel, logistic
Completeness	All companies in business group included	All companies in business group included	One US-company not in scope
Total GHG emissions in Mio. Tones CO2-eq.	4.15	2.5	1.4 (original) 0.72 (after consolidation)
Ratio Indicator GHG emissions per sales area (in kg CO_2-eq/m²)	406	339	185 (original) 125 (after consolidation)
GHG saving goal	-15 % till 2015 regarding specific GHG emissions	-30 % till 2015 regarding specific GHG emissions	No saving goal defined

comments			Tengelmann consolidated baseline calculation as a relevant company left the business group
Status Quo			
Total GHG emissions in Mio. Tones CO_2-eq.	10.3 (2011)	2.5 (2010)	0.6 (2009)
Ratio Indicator GHG emissions per sales area (in kg CO_2-eq/m²)	315 (2011)	258 (2010)	97 (2009)
Reduction of ratio indicator	-22.5 %	-23.9 %	-22.4 %
Comments	In 2011, the scope of GHG calculation was readjusted and logistic emissions were removed. A new saving goal was defined (-20 % till 2020) referring to 2011		

All business groups displayed in Table 11 control several companies operating in the food as well as in the non-food sector and have different sizes regarding turnover[2], related companies and stores. Rewe and Tengelmann are represented in Europe while Metro is operating worldwide. All GHG emission reportings start in the year 2006 and at least one preceding GHG balance has been conducted. The defined boundaries of considered emissions are comparable, however, in one case GHG emissions from consumed paper products (merchandising, office paper etc.) were not included.

As the business groups have different group sizes (regarding turnover, related companies and stores) and performed different over the last years, it make it difficult to directly compare the overall GHG emissions. Tengelmann reduced the total GHG emissions in the reported period. Overall emissions from Rewe stagnated. Metro shows significantly increasing absolute emissions.

All reporting organizations disclose the ratio indicator GHG emissions per sales area. This is remarkable as ratio indicators are optional to be reported. Nevertheless, the reported indicator values differ greatly. The most obvious explanation derives from the different structure of the report-

[2] Turnover 2011: Metro: 66 739 Mio. €; REWE Group: 48 400 Mio.€; Tengelmann Group 10 780 Mio. €

ing organizations. Metro operates department stores and electronic markets while Tengelmann operates discount markets for clothing and building supplies stores. Rewe is mostly represented in the food sector but also active in electronics and travel. The relevance of food retail companies within the business groups is different, which makes the ratio indicator on group level unsuitable to draw conclusions regarding the performance of food retail companies. This highlights the general problem of GRI and GHG Protocol standards. As the reporting organizations are multi-sectoral and multi-national business groups, the highly aggregated values (energy and GHG emissions) do not allow distinctions on sub-sector company level.

All reporting organizations report a reduction of ratio indicator from around 22-24 % within each individual reporting time period. This shows that remarkable emission reductions in the retail sector can be achieved.

Actualisation of GRI standards

End of May 2013, the Global Reporting Initiative published fully revised versions of the GRI reporting standards [GRI 2013a&b]. Apart from methodological aspects, GRI introduced revised indicators and requirements that are related to the interest of this study and therefore briefly introduced:

- Reporting organizations are now able to define by themselves which performance indicators are chosen. GRI no longer specifies core or additional indicators – now the organizations have to decide which indicators are regarded as relevant and which indicators are left out because of insignificance.
- Differentiation between direct and indirect energy is transformed into energy consumption inside and outside from the organization. This definition is used to avoid misunderstandings and allocation problems.
- Additional information has to be reported for indicator EN 3. Reporting of only the total energy consumption is no longer sufficient. Organisations have to distinguish the total consumption (or sale) of Electricity; Heating; Cooling and Steam. GRI quits giving fixed conversion factors to transform energy dimension but requests reporting organizations to report the source of used conversion factors.
- Additional information regarding applied methodologies and conversion factors have to be reported also for indicator EN 4 (“energy consumption outside of the organization”)
- GRI strengthened the application of intensity ratios by introducing EN 5 “Energy intensity” indicator. While any form of intensity ratio has been optional in previous versions, this type of indicator is now put on the same level as other environmental indicators.
- In previous versions differences occurred between GHG Protocol Scope 1-3 methodology and GRI direct/indirect indicators. This now has been curbed as for each GHG-Protocol Scope a single GRI-indicator exists.
- It is newly introduced that CO_2 and further greenhouse gases are reported separately.
- Applied emission factors are to be reported separately.

Conclusion of reviewed GRI standards:

GRI sharpened the requirements for the single performance indicators. This will increase the information level provided with each applied indicator. Especially the requirement to disclose the applied emission factor will help to better understand GHG emissions resulting from electrical energy consumption. Furthermore, the role of ratio indicators is now strengthened by GRI.

Nevertheless, it has to be criticised that GRI no longer provides obligatory indicators but enables reporting organizations to decide individually which indicators to report. GRI only demands a transparent decision making process to develop relevant performance indicators. The intention is that organizations shall spend their capacities to report relevant indicators instead of reporting unimportant but obligatory indicators. This intention is justifiable but it remains to be seen whether future reports are more or less comparable with obligatory performance indicators.

6.2 Inferences from the German energy transition on GHG calculation

When it comes to the calculation of GHG emissions, the amount of GHG emissions per defined amount of energy has to be known. Several life cycle assessment software tools fulfil this requirement and provide datasets for processes, products or services. Furthermore, literature sources provide GHG factors for energy processes. The combustion of fossil fuels leads to GHG emissions independent from geographical or temporal settings. Meaning the combustion of 1 litre fuel oil causes the same direct GHG emissions when consumed in the US in 2009 or in Germany in 2011. Nevertheless, disparities in extraction methods or transportation distances may lead to different indirect emissions. For fuel oil, indirect emissions cause around 16 % of the total GHG emissions.

Problems arise in the case of electrical power as the type of power station(s) regarding used fuel and efficiency directly influences the resulting GHG emission per unit of consumed electricity. Here, significant national disparities in the existing fleet of power stations can be found. The German government decided to transform the energy sector towards renewable energy sources. Till the middle of the century, the majority of electrical power shall be produces from renewable sources. This leads to a comprehensive transformation in the structure of used power stations and consequently to a significant decline of the emission factor (EF) for consumed electricity. As the process of transformation is currently taking place and showing a great dynamic, the German emission factor for electricity changes in short intervals of time. Databases and literature sources are not capable to take this development into account in a suitable manner. The following Figure 9 displays different EF for purchased electricity as found in databases and literature sources. From all sources the most current emission factor is chosen.

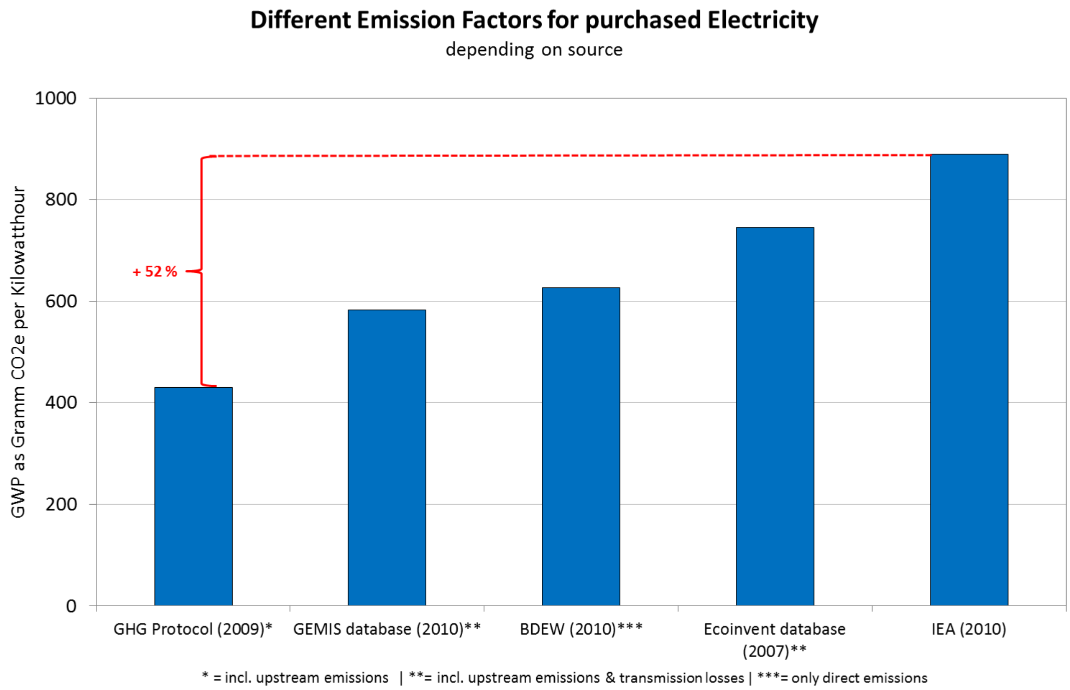


Figure 9: Different emission factors for purchased electricity in Germany [own calculation]

Figure 9 clearly shows the large differences in available emission factors for electricity. The lowest emission factor (430 g $CO_{2\text{-eq}}$/kWh) comes from a calculation tool provided from the GHG Protocol [WBCSD/WRI 2010] and covers the year 2009. The highest emission factor (889 g $CO_{2\text{-eq}}$/kWh) comes from the International Energy Association [IEA 2012] and covers the year 2010. Between both values is a stunning difference of 52 %. The dimension of aberration is very disappointing as GRI and GHG Protocol leave it up to the reporting organization which emission factors to use in the reporting. GRI for example explicitly refers reporting organizations to investigate the needed emission factors at GHG Protocol and IEA sources. There is no clear explanation for the large differences between the given sources; the underlying calculation models seem not to be capable to sufficiently capture a process like the German energy transition. Figure 9 also demonstrates, that not all sources disclose GHG emissions to the same extend. For example BDEW emission factor only covers the direct CO_2-emissions resulting from the power production. The full range of Kyoto gases, indirect emissions from upstream processes and transmission losses are not considered.

In consequence, selecting an adequate emission factor for electricity is a tricky task and requests certain knowledge about the effects of the German energy transition process on emission factors. The variety of existing emission factors limits the comparability of resulting overall emissions between different reporting organizations. The problem increases as applied emission factors are usually not disclosed in GHG reports.

The German energy transition process also leads to unexpected calculation effects when looking into long-term future. As the political goal is to fully transform the energy production towards renewable sources, the emission factor will further decline in the next years. By this, the impact of consumed electricity on the total GHG balance will sink. Efficiency measures to reduce the total amount of consumed electricity are becoming more and more unattractive. A reporting organization may prefer to use the external effect of declining emission factors instead of becoming active itself. However, this is only from a GHG balance perspective, the cost for energy increased constantly over the last years and is proposed to continue in the next years. Increasing energy prices give strong incentives to carry out efficiency measures. On behalf from a large German company, OEKO-Institute conducted a company GHG balance and also modelled the long-term development. Figure 10 shows the result of the long-term GHG development till 2050. The blue line shows the GHG emissions from business as usual (BAU) scenario when the no additional efficiency are conducted. The green line describes the development in an efficient scenario when the company implements the full range of reasonable efficiency measures. The model further distinguishes both scenarios in a version with constant emission factors (solid line) and a version of declining emission factors (broken line) as foreseen at this point of time.

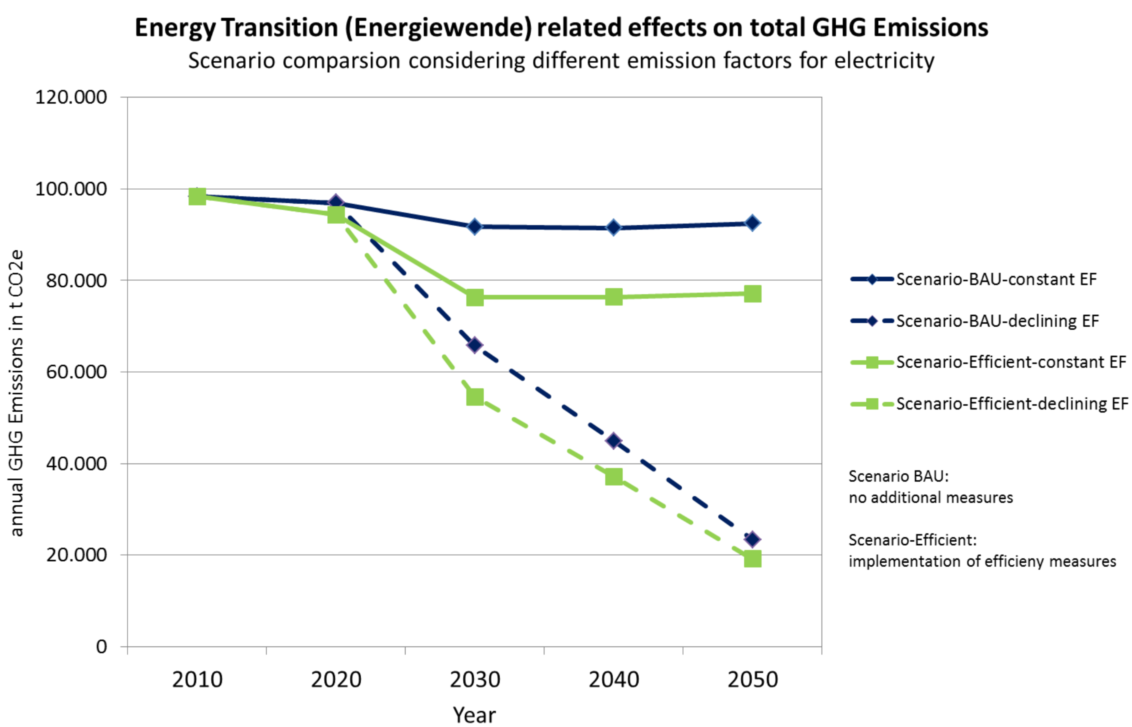


Figure 10: Example for long-term effects of declining electricity emission factors on company's total GHG emissions [own calculation OEKO-Institute]

In case of BAU scenario with constant emission factors (EF), the model predicts a slight decrease of total GHG emissions. This is mainly because of regular energy saving effects like the phasing out of classic light bulbs. In contrast, the efficient scenario with constant EF leads to significantly lower total GHG emissions due to efficiency measures. When considering energy transition related declining EF, both scenarios lead to significantly less total emissions. Furthermore, the shrinking difference between BAU and efficient scenario is notable. In the year 2050, the overall GHG emissions in the efficient scenario are only marginally lower than in the BAU scenario. On a long-term perspective, the GHG savings from efficiency measures are nearly disolved from the effect of declining EF. From a pure GHG emission perspective, the cost and time consuming implementation of saving measures is unattractive. At this point, companies have to be encouraged to become an active part in the energy transition process and support the change by reducing the total amount of consumed electricity. Only by doing so, the challenging and ground breaking process can succeed.

Until now, only methodological aspects for average electricity from the nation grid were discussed. This is relevant for organizations that purchase an average electricity product. Apart from those standard products, power suppliers offer special green power products. Suppliers guarantee that 100 % of the electricity comes from renewable sources. These kinds of products are meant attract consumers that are willing to make an additional contribution to green energies. Eco-power products receive an increasing popularity among private consumers as well as business clients. From a methodological point of view, the question which emission factor results from eco-power products is crucial with regard to a company's overall GHG emissions. Standards like GRI and GHG Protocol simply recommend calculating zero emissions for any eco-power product. This seems reasonable as power production from renewable sources in fact does not cause any direct GHG emissions. However, besides the direct emissions, upstream processes like efforts to construct renewable power units (e.g. wind turbines) leads to GHG emissions that should be considered. By doing so, the GHG emissions resulting from the production, installation, maintenance and disposal are allocated on the total amount of produced electricity within the lifespan of the power unit. GEMIS database for example calculates for electricity from large wind parks 23 g $CO_{2\text{-eq}}$/kWh, for electricity from solar modules 136 g $CO_{2\text{-eq}}$/kWh and for electricity from water turbines 10 g $CO_{2\text{-eq}}$/kWh. Compared to average GHG emissions from the national grid (around 600 g $CO_{2\text{-eq}}$/kWh), theses indirect emissions only play a secondary role. Nevertheless, the prevailing attitude is that green power does not cause any emissions.

The question how to calculate green power GHG emissions is even more complicated when capturing a holistic point of view. In the year 2000 German government introduced the Renewable Energies Act (EEG) that guarantees producers of electricity from renewable source fixed feed-in prices over a certain period of time. The cost for fixed feed-in prices is allocated on all energy consumers. By doing so, investments in green power became calculable and economically attractive. The Renewable Energies Act is an an internationally recognised success story that paved the way for a shift from fossil and atomic energy supplies to renewable energy sources. The EF for German grid electricity decreased over the last decade as the composition of the power station fleet became more and more green. Today, many power suppliers offer green power products with electricity 100 % from renewable sources. Unfortunately, many power providers pick out single renewable units and exclusively sell the electricity as green power with zero emissions. The consequence of this kind of "cherry picking" is that the average grid emissions increase as single renewable units are taken out of the fleet. This effect does not fit to the costumer's original intention as the costumer wants his extra money to be spent for an additional impulse towards green energy. In the cases where electricity comes from old and already amortized power stations, the linkage between eco-power products and additional impulse is missing. Several German environmental institutions opened up the discussion to set clear standards when additional effects can be derived from eco-power products [Öko-Institut et al. 2009]. This approach proposes to distinguish whether a power station receives subsidies from EEG or not. Only for electricity from renewable power sources that operate without financial EEG support, a clear additional effect can be assumed and emission reduction for the specific product credited. Furthermore, the age of power stations is a relevant criterion to evaluate the additional effect. Only modern plants or units receive full emission reduction. In fact, most electricity from eco-power products comes from several power units. In consequence, even recommendable eco-power products are not calculated with zero emission but show an emission factor around 276 g $CO_{2\text{-eq}}$/kWh (calculation method based on [IFEU et al. 2009]). Up to now, only two independent labels for eco-power products apply this calculation approach. The whole market for green power product is little regulated and difficult to oversee for costumers without detailed knowledge.

The OEKO-Institute strongly recommends to use a conservative calculation approach and not to simply calculate eco-power products with zero emissions. This simplification does not represent the reality on the energy market and furthermore makes it unattractive to reduce the total energy consumption. Coming back to food retail markets, the question how to calculate GHG emissions from power consumption is fundamental as electricity is the predomination energy source.

In the following chapter, different calculation approaches will be considered and the effects discussed.

7 SCENARIO SETTING AND RESULTS

In this chapter, several scenarios for the ex-ante analysis of GHG emissions for the German food retail sector are defined. The GHG balance for each scenario is composed of emissions from electrical and heating energy consumption as well as refrigerant losses. All information regarding energy consumption from the previous chapters is therefore being considered. Refrigerant losses were only introduced on a qualitative basis and no specific GHG emissions disclosed. For the ex-ante analysis, specific GHG emissions due to refrigerant losses are taken from [UBA 2008]. This is the only source that gives specific values for the distribution channels as introduced in this study. Further parameters for each scenario are: number of stores per distribution channel, average sales area per store, annual growth rate regarding number of stores and average sales area.

As the intention of the ex-ante analysis is to give an idea of future developments, all scenarios refer to the time horizon 2010 - 2020. The status quo analysis serves as baseline with which the other scenarios are being compared. While in this chapter all scenarios are defined and explained, the results of the ex-ante analysis is presented in chapter 8.

7.1 Status quo

The status quo situation is based on the structural data regarding distribution channels and existing food retail stores as presented in chapter 2.1.2. Furthermore, all in chapter 4 derived benchmarks for specific energy consumption (electricity and heating energy) and fuel mix are applied. The emission factors for energy are taken from GEMIS database (version 4.7). The methodological problem to calculate emissions from eco-power products (see chapter 6) is considered as follows: Currently, seven out of twenty food retail companies report to purchase eco-power. Among these, five companies report to use 100 % eco-power and two companies use eco-power to a smaller degree. If a company reports to use eco-power, it was checked whether additional information regarding quality or origin of the eco-power product is provided. Power products without indications on quality or origin are rate with the EF from average German mix (583 g $CO_{2\text{-}eq}$/kWh). Eco-power used in companies that give additional information is rated according to the approach from German NGOs (276 g $CO_{2\text{-}eq}$/kWh).

The status quo describes only the current situation (reference year 2010) as is not designated to display future development.

The following Table 12 displays the database for the status quo.

Table 12: Database for status quo

Distribution Channel	structural data		specific consumption per m² sales area		
	Total number of existing markets	*Average sales area (in m²)*	*Electricity (kWh/m²)*	*heat energy (kWh/m²)*	*GWP due to refrigerant loss (kg $CO_{2\text{-}eq.}$/m²) [UBA2008]*
Discount Market	15 683	764	310	120	36
Supermarket	10 769	945	380	160	114
Consumer Market	1 317	6 614	350	150	212

Table 13: Results of status quo analysis [calculation OEKO-Institute]

	Energy consumption	GWP
	TWh	*Mt $CO_{2\ eq.}$*
Electricity	10.6	5 744
Heating	4.4	1 143

Refrigerant loss	-	3 434
Total	15	10 321

Based on the given assumptions German food retail stores caused in 2010 **10.3 Million tonnes of GHG emissions**. The consumption of electrical power leads to GHG emissions of 5 744 118 tonnes $CO_{2eq.}$ and is the most relevant contribution to the total emissions (56 %). Refrigerant losses lead to GHG emissions of 3 433 762 tonnes $CO_{2eq.}$ (33 % from total). GHG emissions from heating cause 1 143 491 tonnes $CO_{2eq.}$ (11 %).

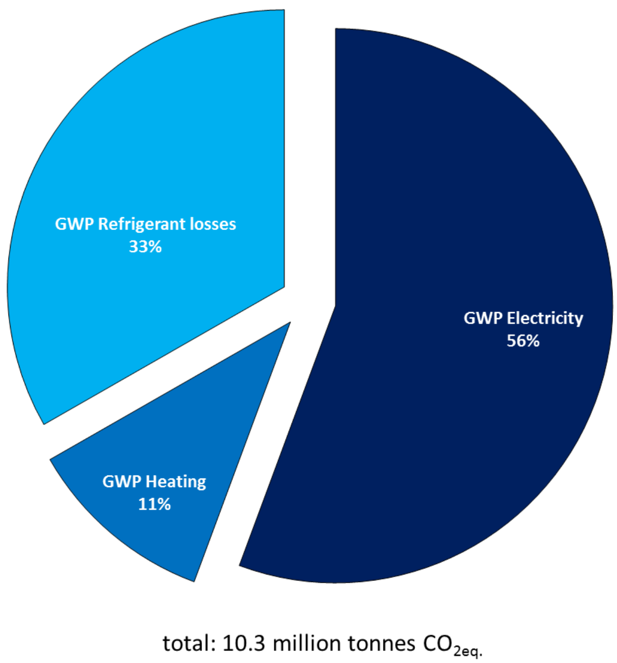


Figure 11: Status quo GHG emissions from German food retail stores [Calculation OEKO Institut]

The dominant share of power consumption shows that the choice of emission factors has a strong impact on the total balance. This aspect will receive further consideration in the other scenarios. The dominant share of power consumption also illustrates the importance of reduction measures in this field.

The GWP from refrigerant losses is also highly relevant. It is surprising how little attention this issue receives in CSR communication. Measures are carried out but little quantifiable information on achieved mitigation or reduction goals is available. Calculations of GWP from refrigerant losses in this study are based on one single literature study [Rhiemeier et. al 2008]. Ratio indicators like GWP refrigerant loss per m² sales area are missing in the CSR communication of all companies!

7.2 Business as usual (BAU) scenario

The BAU scenario is based on the status quo scenario and gives a foresight by more or less prolonging the recent development. As it is not clear how the growth rates for new opened food stores will develop in the next years, the BAU scenario is subdivided into a BAU 1 and BAU 2 scenario.

BAU 1 assumes that the number of new opened stores will show a slightly increase, simultaneous to the development in the recent years. For BAU 1, the recent growth rates (see also [LZ 2013-8]) from all distribution channels were assessed and prolonged for the years 2010-2015. A special case is the organic supermarket as subgroup within the supermarket distribution channel. Here, a great dynamic occurred in the last years and growth rates have been significantly higher than for regular supermarkets (see [LZ 2012-38] and [LZ 2012-45]). Therefore, growth rates for organic supermarkets are considered separately. For the time period 2015-2020 it is assumed that the dynamic of all newly opened shops will slow down and growth rates will decrease by about 50 %. The average sales area per store remains constant.

Internal discussion and literature studies [KPMG 2012] suggest that the saturated food retail market may also show a zero percent growth in the next years. This aspect is considered in BAU 2 sub scenario and no further growth in the number of food store is assumed. The average sales area per store also remains constant. Table 14 displays the applied growth rates for BAU 1 and BAU 2 scenario.

Table 14: Annual growth rates regarding number of stores for BAU 1 and BAU 2 scenario

	BAU 1		**BAU 2**	
	2010-2015	2015-2020	2010-2015	2015-2020
	annual growth rates (regarding number of stores)			
Discount Markets	0.5 %	0.3 %	0.0 %	0.0 %
Supermarkets	1.0 %	0.5 %	0.0 %	0.0 %
subgroup Organic Supermarkets	7.0 %	3.5 %	0.0 %	0.0 %
Consumer Markets	0.5 %	0.3 %	0.0 %	0.0 %

Most characteristic for the BAU scenario is that no additional CSR-activities are carried out by the food retail companies. In consequence, the effect of structural development – dominated by a concept upgrade – as presented in chapter 5.8 will lead to a slightly increasing energy consumption in existing stores. This process is considered by increasing specific electrical energy consumption of +0.25 % per year (for BAU 1 and BAU 2). The newly constructed stores that are assumed in the BAU 1 sub scenario consume the same energy as the average store of each distribution channel (= no modernisation effects). As the BAU scenario generally assumes no additional CSR activities, the number of companies using eco-power is set as constant compared to the status quo. The calculation of the corresponding EF is similar to the status quo. Specific heat energy consumption remains constant till 2020 as displayed for the status quo. For both, electrical power and heating energy, emission factors are adapted to GEMIS database prognosis for 2020. The specific GHG emissions from refrigerant losses are the same as for the status quo and remain constant till 2020.

7.2.1 Results BAU 1 scenario

The results of the BAU 1 scenario (Table 15) show that a growing number of markets combined with concept upgrades will lead to an increasing energy consumption in 2020 of 16 TWh or 9 % compared to the status quo in 2010. Electrical energy consumption shows a plus of 11.6 TWh (9 %) and Heating energy a plus of 4.7 TWh (7 %).

Table 15: Results BAU 1 scenario

	Energy Consumption			GWP		
	Status Quo 2010	BAU 1 2020		Status Quo 2010	BAU 1 2020	
	TWh	*TWh*	*% to 2010*	*Mt CO_{2eq}.*	*Mt $CO_{2eq.}$*	*% to 2010*
Electricity	10.6	11.6	9 %	5 744	4 181	-27 %
Heating	4.4	4.7	7 %	1 143	1 186	4 %
Refrigerant loss	-	-	-	3 434	3 649	6 %
Total	**15**	**16**	**9 %**	**10 321**	**9 016**	**-13 %**

Looking at the resulting GWP from energy consumption, the effects of the German energy transition (decreasing emission factors) dominate the scenario results and lead to a total reduction of GHG emissions compared to 2010. Despite increasing power consumption resulting GHG emissions fall (minus 27 %).

Consumption of heating energy will increase by 0.3 TWh –a plus of 7 %. Emission factors for heating energy are predicted to fall slightly. This is mainly because electrical energy processes within the supply chain will improve due to the German energy transition. Subsequently, total GHG emissions from heating increase by 43 000 tonnes $CO_{2\text{-eq.}}$ Refrigerant losses increase due to growth and lead also to increasing GHG emissions (plus 6 % = 215 000 tonnes $CO_{2\text{-eq.}}$)

The total GHG emissions for the BAU 1 scenario are 13 % (around 1.3 million tonnes CO2-eq.) lower than in the status quo situation. These results illustrate that it can be a cheap strategy for companies not to carry out any CSR measures but to gain profit from external effects like the German energy transition.

7.2.2 Results BAU 2 scenario

The BAU 2 scenario differs from the BAU 1 only with zero growth rates. Consequently, power consumption increases only through estimated concept upgrades. Heating energy and refrigerant losses are set as constant.

Table 16: Results of BAU 2 scenario [calculation OEKO-Institute]

	Energy Consumption			**GWP**		
	Status Quo 2010	**BAU 2 2020**		**Status Quo 2010**	**BAU 2 2020**	
	TWh	*TWh*	*% to 2010*	*Mt $CO_{2eq.}$*	*Mt $CO_{2eq.}$*	*% to 2010*
Electricity	10.6	10.9	3 %	5 744	3 935	-31 %
Heating	4.4	4.4	0 %	1 143	1 115	-2 %
Refrigerant loss	-	-	-	3 434	3 439	0 %
Total	**15**	**15**	**2 %**	**10 321**	**8 489**	**-18 %**

Similar to the BAU 1 results, the effect of the German energy transition also dominates the BAU 2 results. The slight increase of the total power consumption (plus 3 %) is exceeded by decreasing emission factor leading to a reduction of 1.8 million tonnes $CO_{2\text{-eq.}}$ (minus 31 % compared to 2010). In the case of heating energy, slightly decreasing emission factors lead to a reduction of GHG emissions of about 28 000 tonnes $CO_{2\text{-eq.}}$ (minus 2 % compared to 2010). Due to the assumed zero growth, GHG emissions from refrigerant losses remain on the level of 2010.

The overall GHG emissions will drop to 8.5 million tonnes $CO_{2\text{-eq.}}$ (minus 1.8 million tonnes $CO_{2\text{-eq.}}$).

7.3 CSR scenario

The CSR scenario intends to encompass the visible trend towards more CSR activities in the food retail sector. Aspects of sustainable consumption become more and more relevant to customers and investors. In combination with stricter laws and environmental safety regulations, food retail companies see themselves forced to implement sustainability aspects in their business concept and conduct measures to reduce negative environmental impacts. Increasing energy costs foster measures to reduce the energy consumption like investments in energy efficient equipment and short reconditioning rates for stores.

Basic characteristic of the CSR scenario are:

- The awaited increase of power consumption (structural development/ concept upgrade) in existing stores can be reversed by strengthened CSR activities. This leads to an overall decrease of specific electrical power consumption of -0.25 % per year for existing stores.
- Growth rates for new stores are set like in BAU 1,
- All new stores are constructed energy efficient. This means they have a traditional building concept but are equipped with modern and efficient technology. All new stores show reduced energy consumption values like presented in chapter 5.7 for retrofit measures (electrical power -33 %, heating energy -40 %). The effect of new building concepts for stores is considered in the following scenario.

More and more food retail companies report to purchase green power products for the operation of their stores. In Chapter 6, different approaches to calculate eco-power products have been introduced. As the resulting GHG emission vary greatly between different approaches, the sub scenarios CSR 1 and CSR 2 are introduced to address this aspect. Both sub scenarios assume a complete shift towards electricity from renewable sources till 2020. CSR 1 considers the option for companies to calculate energy from renewable sources generally with zero emissions (CO_2=0). Consequently, all eco-power products are calculated with zero emissions, this is also applied for the base year 2010.

CSR 2 follows the conservative calculation approach by considering the construction age and whether a power station falls under EEG legislation. Based on this calculation method, the EF for eco-power in the year 2020 is 191 g $CO_{2\text{-}eq}$/kWh.

Regarding GHG emissions from refrigerant losses, for CSR 1 and CSR 2 it is assumed that companies implement further measures and a reduction of specific GHG emissions from -0.5 % per year is achieved.

7.3.1 Results CSR 1 scenario

Despite expanded CSR efforts leading to sinking specific electrical consumption values and new stores equipped with state of the art technology, the total energy consumption will slightly increase till 2020 (plus 2 %). This is because assumed growth rates lead to 2 011 new opened stores and overall increasing energy consumption.

Table 17: Results of CSR 1 scenario [calculation OEKO-Institute]

	Energy Consumption			GWP		
	Status Quo 2010	CSR 1 2020		Status Quo 2010	CSR 1 2020	
	TWh	*TWh*	*% to 2010*	*Mt $CO_{2eq.}$*	*Mt $CO_{2eq.}$*	*% to 2010*
Electricity	10.6	10.8	2 %	5 744	0	-100 %
Heating	4.4	4.5	4 %	1 143	1 158	1 %
Refrigerant loss	-	-	-	3 434	3 470	1 %
Total	15	15	2 %	10 321	4 628	-55 %

When looking at resulting GHG emissions, the complete shift towards renewable energy sources and balancing them with zero emissions dominates the overall results by far. Total emissions drop to 4.6 million tonnes $CO_{2\text{-eq.}}$ (minus 55 %) compared to 2010. This shows imposingly that renewable energies play a major role regarding overall emissions. On the other hand it can be attractive for a reporting company to change the type of electrical energy source without focussing on net reduction of consumed power.

7.3.2 Results CSR 2 scenario

Choosing a more conservative approach to calculate GHG emissions from renewable energy sources draws a different picture on the overall emissions. The consumption of 10.8 TWh electrical power then leads to about 2 million tonnes $CO_{2\text{-eq.}}$. This is still a minus of 64 % compared to 2010. The overall balance reduces for 3.6 million tonnes $CO_{2\text{-eq.}}$ to the total of 6.7 million tonnes $CO_{2\text{-eq.}}$ This means a minus of 35 % compared to 2010.

Table 18: Results of CSR 2 scenario [calculation OEKO-Institute]

	Energy Consumption			GWP		
	Status Quo 2010	CSR 2 2020		Status Quo 2010	CSR 2 2020	
	TWh	*TWh*	*% to 2010*	*Mt $CO_{2eq.}$*	*Mt $CO_{2eq.}$*	*% to 2010*
Electricity	10.6	10.8	2 %	5 744	2 060	-64 %
Heating	4.4	4.5	4 %	1 143	1 158	1 %
Refrigerant loss	-	-	-	3 434	3 470	1 %
Total	15	15	2 %	10 321	6 688	-35 %

7.4 Accelerated green development (AGD) scenario

The AGD scenario illuminates a development were all food retail companies implement a full range of possible CSR measures. The AGD scenario can be understood as a best practice case and considers the maximum reduction of GHG emissions. The scenario is based on the setting of the previous CSR 2 scenario but also assumes a gradual retrofitting of existing stores (10 % p.a.) with the maximum of measures introduced in chapter 5.7. Furthermore, it is assumed that all newly opened stores are constructed under the new building concept regime as presented in chapter 5.7.

7.4.1 Results AGD scenario

Based on the described assumptions, the AGD scenario leads to declining total energy consumption. This is remarkable as all previous scenarios lead to increasing total energy consumption. Consequently, a reduction of total energy consumption can only be reached with an intense effort of saving measures (retrofitting of existing markets and new building concepts for new opened markets).

Table 19: Results of AGD scenario [calculation by OEKO-Institute]

	Energy Consumption			GWP		
	Status Quo 2010	AGD 2020		Status Quo 2010	AGD 2020	
	TWh	*TWh*	*% to 2010*	*Mt $CO_{2eq.}$*	*Mt $CO_{2eq.}$*	*% to 2010*
Electricity	10.6	8.5	-19 %	5 744	1 630	-72 %
Heating	4.4	3.2	-26 %	1 143	8 25	-28 %
Refrigerant loss	-	-	-	3 434	3 308	-4 %
Total	15	12	-21 %	10 321	5 763	-44 %

The full range of saving measures in combination with an entire switch to high quality renewable energies (calculated with conservative approach) will reduce the total GHG emissions by about 4.6 million tonnes $CO_{2\text{-eq.}}$ This means 44 % less GHG emissions compared to 2010.

8 RESULTS OF EX-ANTE ASSESSMENT AND RECOMMENDATIONS

The goal of this chapter is to summarize the findings from the scenario results and the identified methodological problems. Finally, recommendations are derived which indicators should be provided in CSR communication to achieve a better traceability of a company's environmental performance development.

At first, the status quo impact of German food stores on climate change is calculated with 10.3 million tones $CO_{2\text{-eq}}$. Compared to the national GHG emission from 2010 (936.8 million tones $CO_{2\text{-eq}}$. -[UBA 2013]), the management of food stores is responsible for 1.1 % of Germany's total GHG emissions. This calculation does not cover emissions resulting from for example food production, logistic chain, advertising activities, management activities nor efforts from the use phase of sold products. Nevertheless, food store operation has a relevant impact on Germany's overall GHG balance and consequently offers a significant reduction potential.

In the status quo situation, the consumption of electrical energy contributes to 56 % of the total GHG emissions from food retail. It is therefore reasonable that energy saving measures are most prominent in company's CSR strategy and communication. Looking forward to the year 2020, the consumption of electrical energy does only decrease in the AGD (accelerated green development) scenario while the BAU and the CSR scenarios lead to increasing energy consumption (see Figure 12). This is mainly due to the assumption of a growing number of food stores but also through the fact that food markets are in a phase of general concept upgrades. Concept upgrade summarizes the current development towards more refrigerated products with cooling demand, more electronic equipment like flat screens etc. (see chapter 5.8). With regard to the numerous developments that cause increasing energy demand, the assumption of +0.25 % p.a. seems even conservative. The chosen growth rate is an extrapolation of recent growth rates including a slow-down from 2015 to 2020.

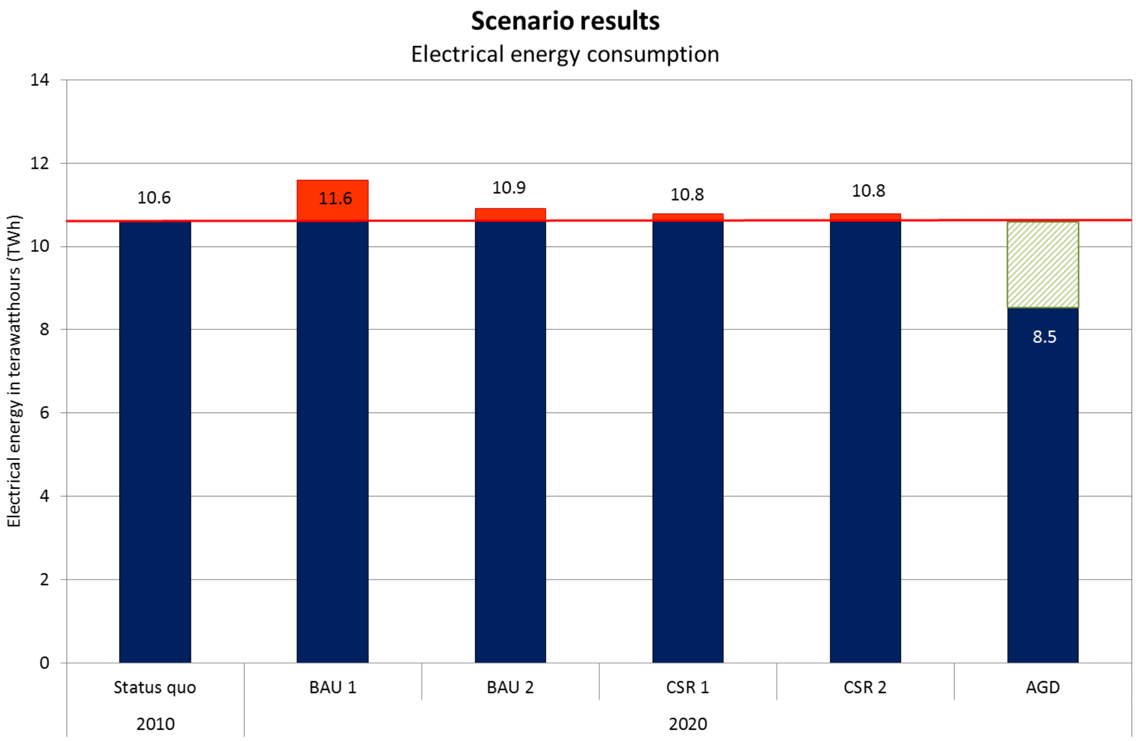


Figure 12: Scenario results for electrical energy consumption in all scenario calculations

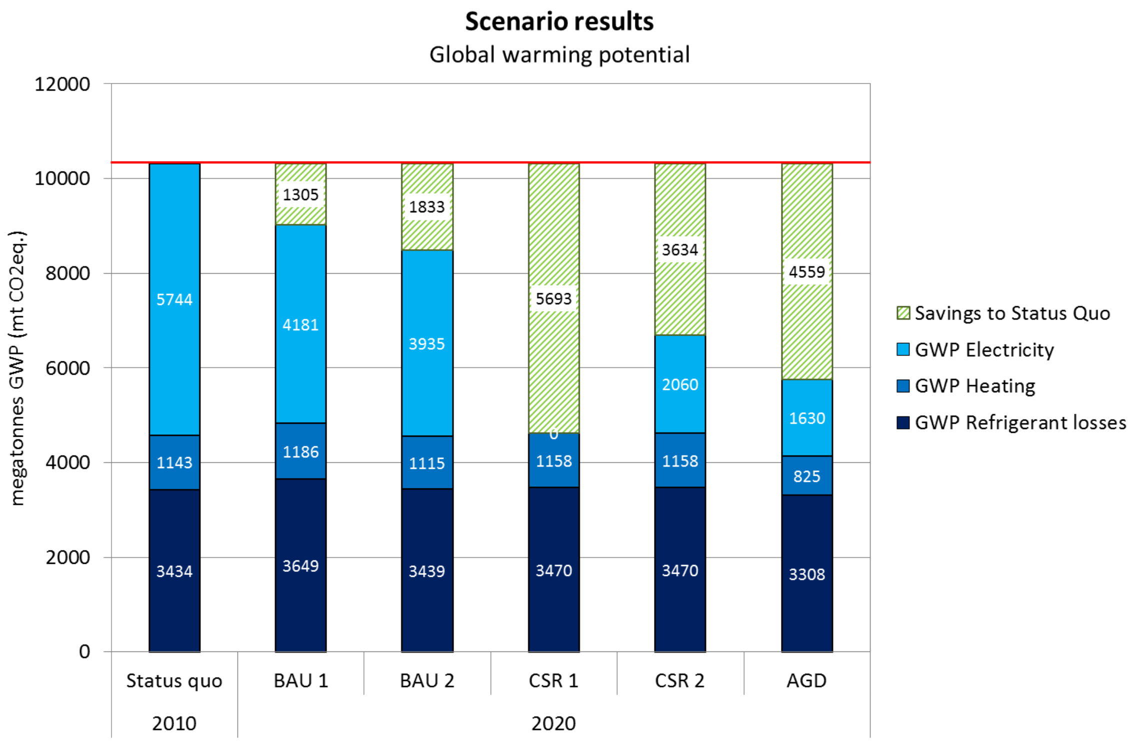


Figure 13: Scenario results for GWP in all scenario calculations

By looking at climate change effects in all scenario calculations (Figure 13), it becomes clear that the mentioned increase in energy consumption does not influence resulting GHG emissions in the same way. Figure 13 shows the calculated GHG savings for all scenarios. The highest reduction of GHG emissions is calculated for the CSR 1 scenario (-5.7 million tonnes $CO_{2\text{-eq.}}$). In this case all electrical energy is provided from renewable sources and calculated with zero emission (CO_2 = 0). Accounting renewable energy with zero emissions is from a methodological point of view feasible. Accounting standards like GRI or GHG Protocol even propose this method. Nevertheless, environmental organizations like OEKO Institute do not follow this simplification but recommend a more differentiated and conservative approach. The CSR 2 and AGD scenario cover this approach. In consequence, GHG savings are still significant but not as high as in CSR 1 scenario.

Even with a conservative calculation approach, achievable savings from the CSR 2 and the AGD scenario vary between -35 % and -44 % in contrast to the status quo. Existing GHG reduction goals from retail business groups (see chapter 6.1) range between -15 % and -20 % within an approximately 5 year time period. In this context, the calculated reductions from the CSR 2 and the AGD scenario (within 10 years) seem ambitious but not completely unrealistic.

One important finding from the ex-ante calculation is that **choosing eco-power products to satisfy the demand for electrical energy brings significant GHG reductions.** Compared to technical measures introduced in Table 6, the switch to renewable energy is an easy way to achieve high GHG savings.

The choice of emission factors in combination with the effects of decreasing emission factors is crucial when interpreting the results shown in Figure 13. It is unclear whether reporting companies are aware of the broad variety of available emission factors. Generally, **the need for a better transparency of existing and appropriate emission factors is seen**. The previous version 3 of GRI reporting standard (on which all current CSR reports from food retailers are based) does not sufficiently address the problem of different existing emission factors. GRI gives references where reporting organizations can pick emission factors. A least with the new version 4, reporting organizations have to disclose the chosen emission factors.

Beside the problem of appropriate emission factors, it must be avoided that companies chose one of the following strategies:

- accounting eco-power with zero emissions without implementing reduction measures
- doing nothing and awaiting the external effects of the German energy transition.

Even though eco-power products are an important tool to improve a corporate GHG balance, **the focus of CSR activities must lay on increasing energy efficiency.** Better energy efficiency reduces the energy consumption which leads to sinking energy costs. Secondly, fostering energy efficiency supports the political goal of changing the energy structure. In other words: No energy transition without energy efficiency. Assessments of CSR strategies must have a stronger focus on the role of energy efficiency for the company. Ratio indicators that address specific electrical energy consumption per square meter are regarded as most helpful to reconstruct improvements in CSR measures and ensure comparability to other companies. Version 4 of GRI reporting standards fosters the usage of ratio indicators. All currently used ratio indicators operate with the parameter GHG emissions per square meter. Due to the described problems with different emission factors and the calculation of eco-power products, GHG based ratio indicators must be regarded as insufficient. Changes in the ratio indicator can either be caused by changes in energy consumption or by changes of the applied emission factor. Ratio indicators based on the energy consumption itself (idealistically only for single type of energy) is an appropriate way to avoid such uncertainties.

An improved comparability can be achieved when **business groups disclose separate energy data for each company within the group.** A better understanding of sector-wide developments can achieved.

The second largest contribution to GHG emissions from food stores derive from refrigerant losses (33 %). In contrast to its GHG relevance, applied refrigerants and GWP from losses are less prominently addressed in CSR communication. The implementation check (see chapter 5.9) demonstrates that measurers addressing the global warming potential of refrigerants are carried out to a certain extent but profound information on achieved savings or benchmarks such as ratio indicators for refrigerant losses are mostly missing. All benchmarks for the scenario analysis are taken from a single literature source [Rhiemeier et. al 2008]. A notable exception comes from the Metro AG. The current CSR report [Metro 2012] gives information on refrigerant losses and refill rates. Furthermore, the revised climate change goal also considers reduction targets for GHG emissions from applied refrigerants. Nevertheless this example is rather an exception than a rule. It is therefore strongly recommended **to strengthen quantifiable information level on refrigerant losses**.

The presented study tries to give a robust status quo analysis and forecast regarding GHG emissions in the food retail sector by using mainly available data from public CSR communication. The research work showed that most companies launch CSR activities and provide various information. Nevertheless, the given data is not sufficient to derive benchmarks which are essential to modulate the entire food retail market. The scenario analysis is therefore based on literature values and information from OEKO Institute’s own work. A transfer of the scenario methodology to other markets or countries can only be successful if either information structure from literature is significantly better or if companies are able or willing to provide more detailed information.

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