

WWF Switzerland

Topten Global Impact Assessment

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Zurich, 14 August 2015

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Executive Summary

The study at hand aims at quantifying the impacts of the Topten program in Europe, China and USA in terms of end electricity savings and CO₂-emission reduction. It takes into account Topten activities addressed to consumers, retailers, manufacturers and policy makers from 2006 to 2014.

Overall, the quantitative and qualitative impact assessment of the activities show that Topten contributes to an increased market share of energy-efficient appliances and thereby accounts for a substantial reduction of electricity consumption and related CO₂-emissions. Interviewees state that Topten plays a major role as a provider of up-to-date information on the most energy-efficient technologies and due to its efforts to shed light on new saving potentials. These activities provide a strong incentive for producers to invest in the development of products with improved energy efficiency and they facilitate the introduction of innovative products on the market thereby accelerating market transformation towards more energy-efficient technologies.

The assessment is based on a conceptual impact model developed at University of St.Gallen, which illustrates qualitatively how activities of Topten contribute to a change in the behaviour of the different target groups and stakeholders and how this subsequently results in an impact in terms of electricity savings and reduced CO₂-emissions. Since a quantitative assessment of the impacts requires reliable data along the impact chains, this study is based on an extensive desk research and around 20 expert interviews. A quantitative impact assessment is provided only when sufficiently reliable data are available. For impacts that cannot be quantified due to a lack of data, feasibility considerations point out how the existing data gaps could be addressed in order to be able to perform a more comprehensive impact assessment in the future.

Table 1 summarizes the impacts according to region and activity and it indicates in which domains a quantitative approach is limited due to a lack of further reliable data. The available data allow quantifying the impacts from activities addressed to private consumers and to policy makers. Over all regions, we estimate in 2014 an amount of about 15 to 18 TWh in terms of cumulative savings since 2006, which corresponds to a reduction of about 7.5 to 9 Mio. t CO₂ emissions. For activities addressed to large buyers, retailers and producers the data gathered from case studies provide some quantitative insight, but they do not allow for regional upscaling. A more detailed assessment would require a wider selection of case studies.

Based on the quantitative assessment, activities of Topten in Europe had an impact in the order of about 4 to 5.4 TWh/a in terms of annual savings in 2014. This results in electricity costs' savings of 800 to 1'000 million Euros.

These impacts can be put into relation with annual electricity consumption of households in EU-27, which amounts to 1000 TWh/a based on a prognosis¹ for 2015. Thus Topten contributes an estimated annual reduction of the total electricity consumption in the order of about 0.4% - 0.5%. For China and USA only activities addressed to private consumers were assessed quantitatively. Since they account only for a relatively small share of the total impact, they are not put into relation to the total annual electricity consumption.

Thus, based on the available data, a rather comprehensive impact assessment is possible only for Europe, where Topten is well established, since it started already in 2006. Comparison of the impacts resulting from different activities shows that the largest contribution results from policy advocacy work, which accounts for about 70-80 % of the estimated total savings. Given the complexity of the policy making process, contribution of Topten cannot be quantified exactly and therefore the impact is quantified in terms of ranges.

Table 1: Impacts 2014 in terms of end electricity savings and CO₂-emission reduction				
Activity	Activities intended to raise consumer awareness	Collaboration with large buyers	Collaboration with retailers & producers	Policy advocacy
Region	Chapter 3.2.1	Chapter 3.2.3	Chapter 3.2.4	Chapter 3.2.2
Europe	cumulative savings 6.7 TWh 3.4 Mio. t CO ₂ annual savings 1000 GWh/a	case study based quantification	case study based quantification	cumulative savings 7.5-10.7 TWh 3.7-5.3 Mio. t CO ₂ annual savings 2.9-4.2 TWh/a
China	cumulative savings 0.3 TWh 0.3 Mio. t CO ₂ annual savings 100 GWh/a	no quantification	no quantification	no quantification
USA	cumulative savings 0.09 TWh 0.05 Mio. t CO ₂ annual savings 30 GWh/a	no quantification	no quantification	no quantification

Impacts in terms of end electricity savings and CO₂-emission reduction according to region and activity in 2014. Cumulative savings indicate the sum of annual savings between 2006 and 2014.

The qualitative assessment of the impacts shows, that to a large extent the intended outcomes and impacts of the Topten program have been achieved. The product list on the website reaches a large number of consumers and indirectly, it provides an incentive to manufacturers

¹ <http://de.statista.com/statistik/daten/studie/12512/umfrage/prognose-zum-stromverbrauch-der-eu-27-bis-2020> (8.7.2015)

to develop more energy efficient devices. Key stakeholders value Topten as a provider of reliable, independent information on the market of energy efficient devices and the current developments. By launching a discussion on recent developments regarding energy efficiency, Topten contributes to the development of new and more stringent regulations. Overall, the assessment shows that Topten contributes to the improvement of market transparency, which is an important prerequisite in order to take any measures towards increased energy efficiency.

Feasibility considerations show that a comprehensive quantitative impact assessment would require a wider sample of case studies across all regions and additional data on the market share of energy efficient devices. This would encompass also further expert interviews, in particular with different target groups, such as large buyers, private consumers and retailers in order to assess to which extent their purchasing behaviour is affected by various activities of Topten. Given the inherent complexity of the impact chains, a substantial uncertainty will remain even if all outcomes are tracked in detail. Alternatively, an in-depth evaluation-study could provide more insight on how Topten's activities result in a behavioural change of the target groups and it could highlight potentials for improving the existing activities in order to achieve maximum impacts with the available resources.

1. Introduction

INFRAS was commissioned by WWF Switzerland to provide a quantitative impact assessment of Topten activities worldwide in the time period 2006 - 2014. First, the study at hand presents the methodological approaches used to estimate the impacts in terms of electricity savings and related reduction of CO₂-emissions (chapter 2). The quantitative impacts are then described separately for the different types of activity (chapter 3). The report concludes with feasibility considerations regarding a detailed quantitative impact assessment that provides a basis for future assessments (chapter 4) and a summary of the key findings and recommendations (chapter 5).

1.1. Overview of Topten activities

Topten was initiated in Switzerland in 2000. Six years later Topten was established at the European level in selected countries². In the US and in China, Topten activities began in 2010. Therefore, some of the impacts cannot yet be assessed, since they occur with a certain time lag. For those activities only a rough qualitative assessment is provided.

Topten is collaborating with different target groups³ in order to accelerate market transformation towards more energy efficient products. One of the main activities consists of raising consumer awareness by disseminating information via websites and other media. Besides maintaining up to date information on the best performing electrical appliances, Topten also actively tries to influence policy design by providing recommendations on how to improve regulations regarding energy efficiency labelling and minimum efficiency standards. Additionally, Topten collaborates with retailers in some countries in order to further promote energy-efficient products and with producers of electric appliances there is an ongoing exchange of information. Finally, Topten provides also recommendation for large buyers, such as energy efficient printers, computer monitors and lighting⁴.

1.2. Goals and key questions

The study primarily aims to quantitatively assess the impacts of Topten activities on electricity consumption and CO₂-emissions from usage of energy-efficient electrical appliances (chapter 3.2). The key question addressed in this study is the quantitative assessment of how much electricity was saved thanks to Topten activities 2006- 2014. Additionally, the study comments

² Topten started in 2006 in some European countries and over time additional countries joined Topten. However, up to now Topten is not implemented in all European countries.

³ www.topten.eu, www.topten.ch, www.top10.cn, www.toptenusa.org (8.7.2015)

⁴ <http://www.topten.eu/professional.html> (11.8.2015)

on the relevance in terms of climate change mitigation, effectiveness with respect to achieving an impact on electricity consumption and efficiency of the activities in terms of value for money of the Topten program (chapter 3.1) in a very general manner.

1.3. System boundaries and definitions

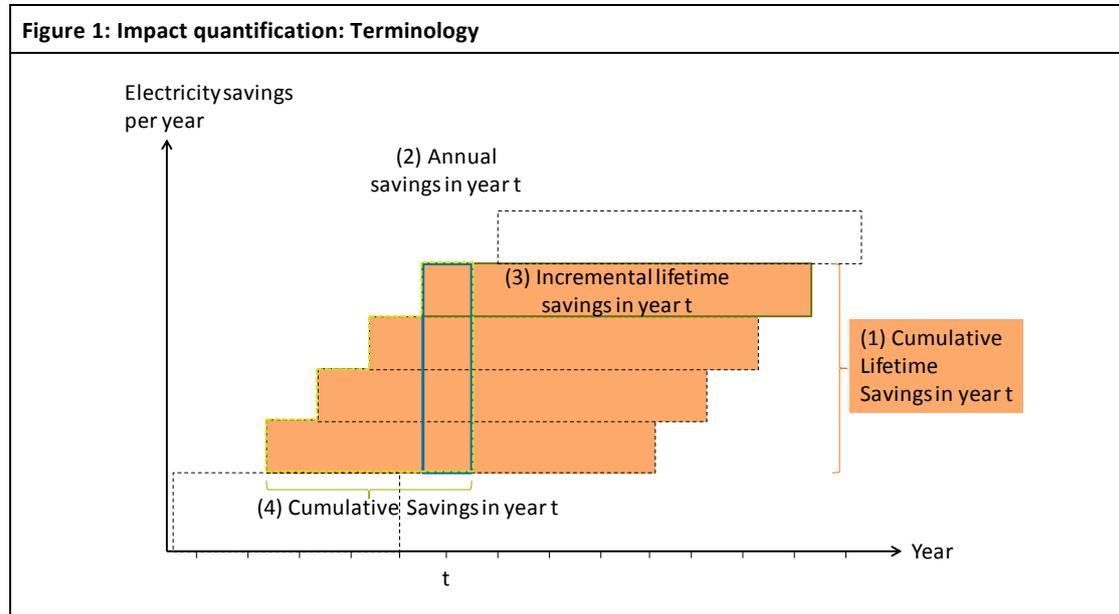
Temporal and geographical system boundaries

Due to the qualitative character and complexity of the impact chains of different Topten activities in terms of geographical differences among different countries, the scope of the present study was defined as follows: The impact assessment is confined to the time period 2006 - 2014 and the geographical boundaries include Europe and after 2010, also USA and China. Impacts from improved regulations cannot be confined to particular countries, as the regulations are implemented in all EU-countries. Apart from this exception impacts are only quantified for countries where Topten is implemented.

Definitions

Impacts are generally quantified in terms of annual end electricity⁵ savings and reductions of CO₂- for 2014. Hereafter, these savings are referred to as “annual electricity savings in year t” (Figure 1, case (2)). Savings that result over the entire product lifetime are referred to as “cumulative lifetime electricity savings in year t” (Figure 1, case (1)). Lifetime savings from products sold in a particular year are referred to as “incremental lifetime savings in year t” (Figure 1, case (3)). The sum of annual savings up to year t is referred to as “cumulative savings in year t” (Figure 1, case (4)).

⁵ Unless stated otherwise, electricity savings are estimated in terms of end electricity.



Cumulative lifetime savings in year t (1): electricity savings from Topten activities that result over the entire product lifetime from products that are in use in that particular year. **Annual savings in year t (2):** electricity savings from Topten activities that result in year t from products that are in use in that particular year. **Incremental lifetime savings in year t (3):** electricity savings from Topten activities over the lifetime from products sold in year t. **Cumulative savings in year t (4):** sum of annual electricity savings from Topten activities up to year t.

When sufficient data are available, also the temporal evolution is estimated for the relevant time period. Due to the complexity of the impact chains there is a time lag between the time of an activity and the corresponding impact. However, a sound impact assessment is possible only at the time of the impact. Thus a number of ongoing activities are not included in the quantitative impact assessment since they did not yet result in an impact. Some of these ongoing activities are mentioned in this study in so far as they are expected to contribute a large impact in the near future but they are not included in the quantitative impact assessment.

Restrictions

Electricity savings from Topten activities can only be assessed in an approximate way based on numerous assumptions. The estimated impacts are affected by high uncertainty and due to a lack of adequate data. Thus the impacts can be quantified only based on data from selected case studies. Therefore, not all of the relevant activities can be assessed quantitatively. For those activities the study at hand provides a rough qualitative impact assessment.

The scope of the assessment encompasses solely the impact level and does not comprise an evaluation of Topten activities globally to date. The different activities of Topten are assessed in so far as they are relevant for the estimation of the final impacts. Furthermore, the impact assessment considers only savings from electrical appliances. Impacts in terms of re-

duced fossil fuel consumption by promoting alternative heating systems and fuel efficient cars are not part of this impact assessment, since in the case of cars energy efficiency is expected to play only a minor role in the purchasing decision. The accuracy of the quantitative assessment presented in this report is to a large extent driven by the availability of reliable data. Thus chapter 4 discusses the feasibility of a complete and detailed impact analysis as a basis for possible future analysis.

2. Methodology

The impact assessment is based on a conceptual model that illustrates the most important impact chains for the different Topten activities (chapter 2.1). The model is based on an impact model developed at University of St.Gallen (Burkhardt et. al. 2012). For the purpose of the study at hand the model was simplified. The methodological approaches used to assess the impacts are described in chapter 2.2.

2.1. Impact model

Topten activities consist of preparing and disseminating information on energy efficiency and saving potentials of household appliances to key stakeholders. The aim is to trigger a change in consumer behaviour that results in an increase in market share of energy efficient products and consequently reduced electricity consumption. Due to the high number of website visitors, Topten activities indirectly create an incentive for manufacturers to produce more energy efficient devices. Additionally, Topten tries to influence the policy making process by pushing towards more strict regulations.

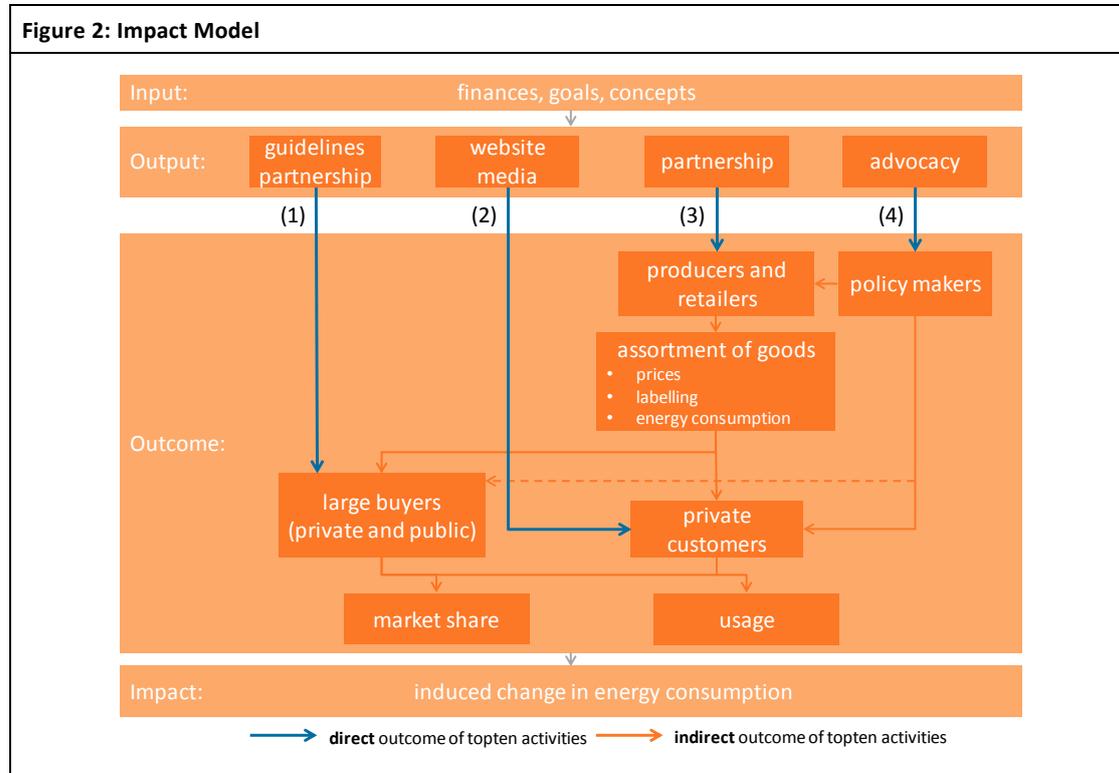
In order to quantitatively assess these impacts, the complex interactions between the different target groups are simplified in the form of a conceptual model (Figure 2). Starting from Topten activities (Output) subsequent changes in the behaviour of the involved stakeholders is assessed (Outcome) and the resulting reduction in electricity consumption and CO₂-emissions is estimated (Impact). Four main domains of activities and impact chains are assessed in the present study:

1. The Topten website provides information on energy efficiency of a large number of product categories. Thereby, Topten increases market transparency. As a result, Topten activities achieved an increase in the market share of energy-efficient domestic appliances. Besides promoting energy-efficient devices Topten also disseminates information on energy-efficient usage of appliances, such as washing at low temperatures and avoiding standby mode.

2. Topten disseminates recommendations on energy-efficient products to large buyers such as large private companies and public procurers. In addition, in several countries there is a direct collaboration with large buyers, where Topten experts provide specific advice to a private company or to public procurers.
3. Topten collaborates with retailers in some countries by providing information on the most energy efficient products available on the market. As a result the retailers are able to increase the supply of energy-efficient products, which finally increases the market share of energy-efficient products.
4. Topten is also active at the level of policy design by providing the necessary information on energy efficient products on the market either directly to the regulator, e.g. the European Commission, or indirectly by informing other organizations that are actively lobbying for increased energy efficiency. These activities help to achieve more stringent regulations regarding the labelling of energy-efficient products. As these improved regulations are implemented, energy is saved as compared to a scenario without improved regulations. Besides improving existing regulations Topten is also actively pushing towards introduction of new regulations for products that initially were not labelled in terms of energy efficiency.

For each of these activities the subsequent impact is – as far as possible based on the available data and information – assessed by a combination of a top-down and a bottom-up approach. These approaches are described in the following section (chapter 2.2).

In reality, the impacts cannot be attributed solely to one specific activity. For example, a higher share of energy efficient products in the product range in a store is not only the result of Topten's direct collaboration with retailers, but is affected also by policy advocacy activities that result in new regulations and by media activities that result in increased consumer awareness, which is an additional incentive for retailers to increase the share of energy-efficient appliances in the assortment of goods. In order to allow for a quantification of the impacts, only the main activities are considered.



The main impact chains that are quantitatively assessed in this study encompass (1) collaboration with large buyers, (2) the website addressed to private consumers, (3) partnership with manufacturers and retailers and (4) advocacy at the policy level.

2.2. Impact assessment

The impact assessment is primarily based on desk research and semi-structured telephone interviews. In total, 21 interviews were conducted with selected Topten representatives in selected countries (Annex 1) and with other stakeholders, such as producers, retailers and non-governmental organisations. The experts selected for the interviews allow for both a high regional coverage as well as detailed information on how Topten activities are translated into energy savings along the impact chain. The information gathered from these interviews is anonymized.

The desk research builds on available literature which consists of annual reports, studies on assessing the impacts of the Euro-Topten websites (EURO-TOPTEN MAX 2015a,b,c), independent studies on policy impacts at the EU-level as well as general documentation on the market development of energy-efficient products.

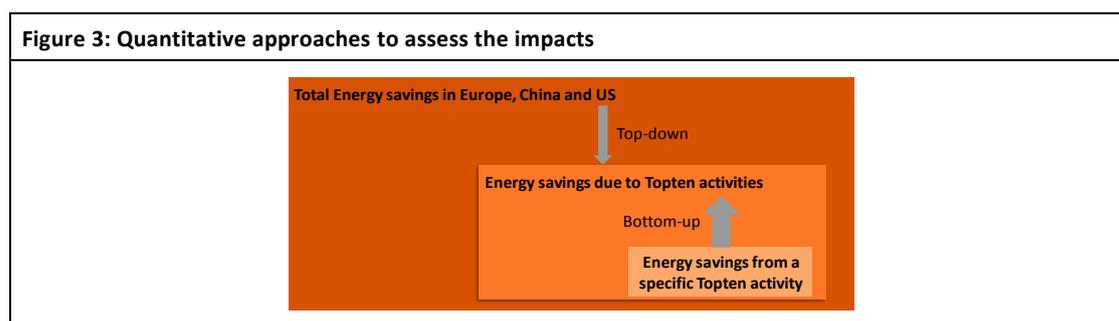
The impacts of Topten activities are the result of a complex impact chain. Due to this complexity a combined approach of top-down and bottom up is chosen in order to account for regional differences and at the same time provide an overall impact assessment for impacts of Topten activities globally.

Additionally, impacts can only be quantified with respect to a reference scenario that can only be based on assumptions. The present study assumes that without the activities of Topten a similar appliance of low to average energy efficiency would have been bought. The electricity savings can therefore be estimated by comparing the consumption of an average appliance with one that fulfils Topten criteria.

Quantitative impact assessment

Electricity savings from the use of a Topten product are estimated for a given year in terms of “annual electricity savings” (Figure 1). Electricity consumption during the manufacturing of an appliance is not accounted for. The estimated savings are converted to a corresponding reduction in CO₂-emissions by applying average emission factors for each region that account for the emissions that are caused by the production of electricity consumed during the use of a product.

For this study, impacts are quantified whenever sufficient quantitative information is available or realistic assumption can be made. The extent to which impacts can be quantified strongly depends on data availability. Due to a lack of publicly available data on the market share of appliances according to energy efficiency classes, a complete quantification is not possible. The quantification in this study therefore relies to a large extent on extrapolation of data from either specific studies on a particular activity or on overall electricity savings for which the contribution of Topten is estimated. These methods of estimating electricity savings are referred to as bottom-up and top-down approaches respectively (Figure 3).



The impact assessment is based on extrapolation of savings from specific Topten activities (bottom-up) as well as by quantifying the extent to which Topten contributed to the overall savings achieved between 2006 and 2014.

Top-down approach

The top-down approach looks at the total electricity savings achieved in a specific product category since 2006 and estimates to which extent Topten activities contributed to the savings. Total savings are estimated based on the difference between the observed electricity consumption with a reference scenario that depicts a development under business as usual as-

assumptions without new measures such as improved regulations. Assessing the contribution of the Topten program to the total savings is rather uncertain since besides Topten there are a number of other influencing factors that account for some share of the achieved savings. Among other factors, there is an autonomous shift towards more efficient products due to technical innovation that is initiated by manufacturers without any direct contribution by another party (Fraunhofer ISI 2009). Furthermore, savings are achieved to a large extent by the introduction of more stringent regulations and energy efficiency standards. Thus even though Topten is pushing towards more stringent regulations, only a fraction of the resulting savings is attributable to Topten activities. The top-down approach is used for quantification of the policy impact in Europe. For China only potential savings can be estimated based on a best policy approach. In the USA there are no concrete activities at the policy level.

Bottom-up approach

The overall electricity savings from a Topten activity type could also be estimated by extrapolating the savings from a particular Topten activity by the number of similar activities that were carried out by Topten (e.g. in other countries etc.). For example, if an annual saving of 0.1 GWh is achieved due to collaboration with a particular retailer, overall savings can be estimated by multiplying these savings with the number of similar activities that were carried out by Topten. As for the top-down approach, this case study based extrapolation is affected by high uncertainty since Topten activities vary among regions for example in terms of product type that is addressed or in terms of the extent to which the collaboration results in an actual impact on electricity consumption. The same activity might result in a higher number of sales of an energy-efficient product in one country as compared to another region. The bottom-up approach is applied to quantify the impacts of activities regarding consumer awareness activities that were analysed in an online survey. In theory, this approach could also be applied to quantify the impacts from collaboration with retailers, manufacturers and large buyers. However, the number of case studies with sufficient data availability is too small to extrapolate to the regional level. Therefore, only a qualitative assessment is provided.

Uncertainties and assumptions

Both methodological approaches are based on a number of assumptions and the authors were required to decide on a range of estimations whenever data availability was limited. These assumptions are to be considered as best guesses that can be supported by the information gained from the expert interviews and from existing literature. All assumptions are documented in this study in order to describe the estimated electricity savings in a transparent way.

Whenever possible, the electricity savings are presented as a range between a “conservative estimate” and an “optimistic” impact.

Semi-quantitative and qualitative impact assessment

Several activities of Topten are affecting energy efficiency in an indirect way, which results in a highly complex impact chain. For example the impact of a newspaper article may result in an increased number of website visitors and might finally contribute to some increase in the sales of energy-efficient products.

Impacts that are not quantifiable due to a lack of reliable data or due to the complexity of the impact chain are therefore assessed qualitatively based on information gathered from interviewing energy efficiency experts and other stakeholders. These impacts are assessed whenever possible by a semi-quantitative approach by categorizing and prioritizing the impact of different activities with respect to one another. The semi-quantitative approach is adopted whenever there are data gaps or when activities result in an impact which is also influenced by a large number of other factors. In those cases contribution of Topten activities needs to be estimated in terms of a share of the total impact. As there is generally no quantitative basis to estimate these contributions they are roughly quantified by categorizing qualitative statements of the interviewed experts.

Data sources

Activities of Topten are documented in detail in Topten annual reports available on the websites (see chapter Literature in the Appendix and websites⁶). Additional sources were included in order to assess the total impacts resulting from Eco-design and Energy Labelling directives in the EU. This includes impact assessment studies on regulations commissioned by the EU (e.g. VHK 2014). Data gaps were – as far as possible – filled based on information gathered from interviewing experts affiliated with Topten and other relevant stakeholders (see Annex 1: Expert Interviews).

3. Results and discussion

3.1. Overall assessment of Topten activities

Relevance

The Topten program is promoting energy-efficient appliances by providing information as an independent third party to all relevant stakeholders and by shedding light on existing saving

⁶ www.topten.eu, www.topten.ch, www.top10.cn, www.toptenusa.org (8.7.2015)

potentials. As a result, market transparency is improved, which is an important prerequisite in order to take any measures towards increased energy efficiency. Topten's activities also incentivize the development of energy-efficient products and therefore the Topten program provides valuable information that allows consumers, retailers and manufacturers to take concrete action. To a lesser extent Topten is also promoting sufficiency, which is another important strategy to reduce energy consumption and CO₂-emissions.

Electricity consumption is dependent on many other factors beyond appliance use. Additionally, since appliances are commonly replaced only after 5-15 years the corresponding impacts are visible only after a certain time. So despite in some cases the impacts cannot be quantitatively assessed Topten plays an important role in the market transformation process towards increased energy efficiency and is therefore relevant for climate change mitigation.

The role of Topten in the market transformation process varies across countries. For example in Switzerland, Topten is well established and there is ongoing collaboration with many different market actors. In the rest of Europe, Topten is also active at many different levels, however in most countries focus lies on raising consumer awareness by providing an up-to-date product list on the websites. At the EU-level, substantial impacts arise from policy advocacy. In China, e.g. Topten had a strong influence on the subsidy program and in the USA Topten had a strong indirect influence as contributed to the improvement of the Energy Star label.

Effectiveness

To a large extent the intended outcomes and impacts of the Topten program have been achieved. Challenges arise along the impact chain as the involved stakeholders are required to change their behavior in order to achieve the desired impacts. For example, as a result of collaboration with Topten, retailers are expected to increase the share of energy-efficient products in their assortment of goods and only if these products are eventually bought by the consumers an actual impact on energy consumption can be achieved. Especially in the case of complex impact chains as for example the impact of policy advocacy, the outcome is also influenced by a number of other factors and therefore even qualitatively the impacts are difficult to assess.

Efficiency

The Topten program tries to influence the behavior of all key stakeholders along the impact chain. The limited resources available are therefore invested in diverse activities that allow establishing collaboration with a number of relevant stakeholders. Due to the complexity of the impact chains, it is necessary to address different players, such as policy makers, manufacturers, retailers as well as private and public consumers. According to a rough analysis of Topten activities along

the value chain we conclude that generally speaking the Topten program is allocating its resources efficiently.

3.2. Total electricity savings and emission reductions achieved

This chapter provides an overview of the main findings and the results of the quantitative impact assessment. The detailed results are described in chapters 3.2.1-3.2.4.

Cumulative electricity savings and CO₂-emission reduction

Based on the quantitative assessment (chapters 3.2.1-3.2.4), over the time period 2006-2014 cumulative electricity savings thanks to Topten amount to about 15 to 18 TWh, depending on whether a more conservative or a more optimistic scenario is assumed. With more than 70% of the total impact, activities related to the policy making process contribute the largest share.

The corresponding impact in terms of reduced CO₂-emissions amounts to about 7.5 Mio. t CO₂ under conservative assumptions. When assuming an optimistic scenario the reduction amounts to about 9 Mio. t CO₂. As in China fuel based production of electricity is more prevalent, the impacts in terms of reduced CO₂-emissions are higher in China as compared to Europe and USA.

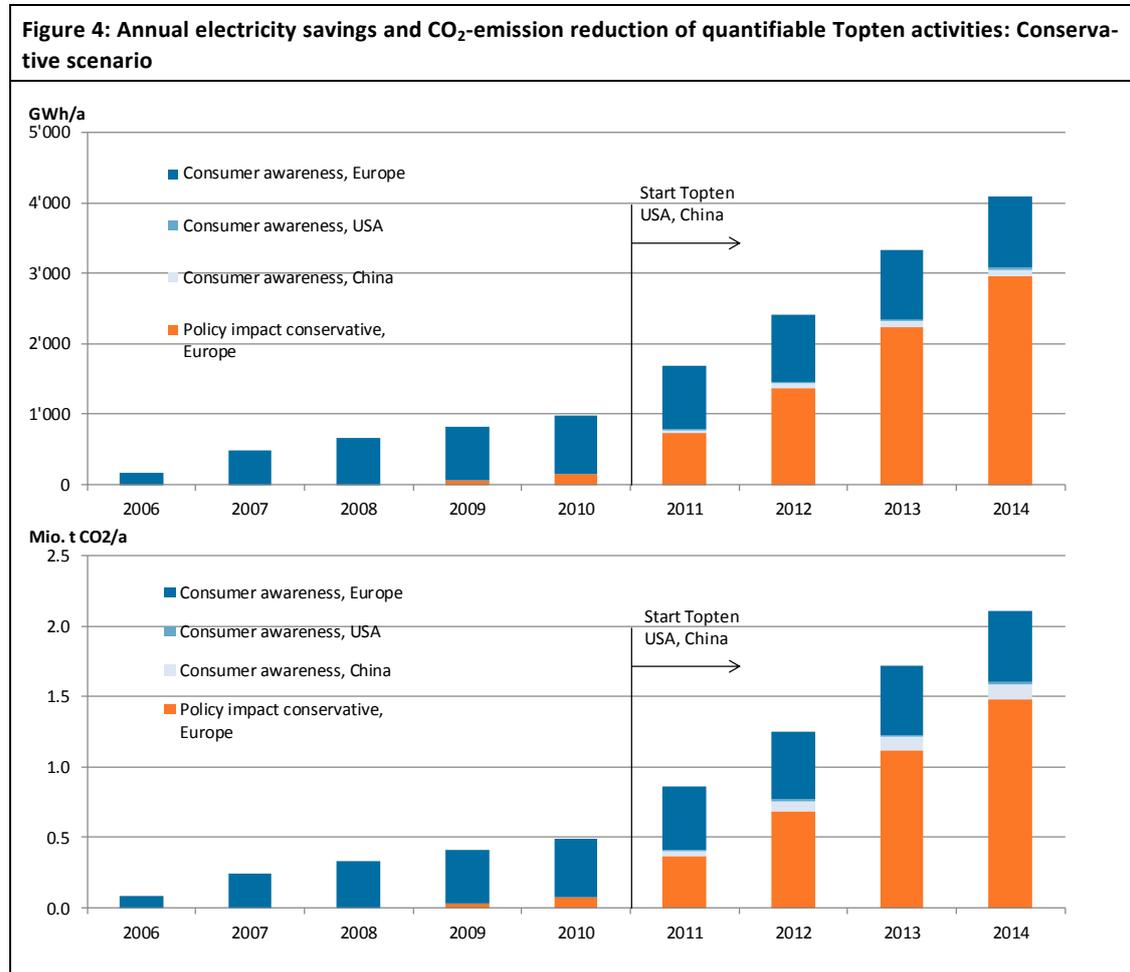
Annual electricity savings at the regional scale

Based on the quantitative assessment, activities of Topten in Europe had an impact in the order of about 4 – 5.4 TWh in terms of annual savings (Figure 4). This results in savings of electricity costs of 800 to 1'000 million Euros⁷. These impacts can be put into relation with annual electricity consumption of households in EU-27, which amounts to 1'000 TWh based on a prognosis⁸ for 2015. Thus Topten contributes an annual reduction of the total electricity consumption in the order of about 0.4% - 0.54%. For China and USA the data basis only activities addressed to private consumers were assessed quantitatively and therefore they cannot be put into relation to the total annual electricity consumption.

⁷ Estimated based on average electricity prices including taxes and levies in 2014 in EU 27

http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=nrg_pc_204&lang=en

⁸ <http://de.statista.com/statistik/daten/studie/12512/umfrage/prognose-zum-stromverbrauch-der-eu-27-bis-2020>



Impacts due to activities addressed to consumers and to policy makers were assessed quantitatively. Due to a lack of quantitative data the quantitative impact assessment does not include impacts from activities addressed to large buyers, manufacturers and retailers. Additionally, also the estimation of policy impacts is limited by data availability. For example in China there is no quantitative basis to estimate policy impacts and therefore the data are to be considered as a conservative estimate of the total impact. Results for the optimistic scenario are shown in Annex 5. Topten USA and China started only in 2010 and therefore the impacts can only be quantified starting from 2011.

3.2.1. Activities intended to raise consumer awareness

Assessment of Topten websites impact based on an online survey in Europe

Maintaining up-to-date information on the Topten websites increases market transparency and finally results in a higher market share of energy-efficient products. This impact was assessed quantitatively in 2012 by means of an online survey. In a first round the questions aimed at evaluating the European Topten websites (EURO-TOPTEN MAX 2015a). The second round of questioning addressed the purchasing behaviour (EURO-TOPTEN MAX 2015b). The number appliances purchased by the participants is therefore known and can be converted to an electricity saving per visitor by assuming a reference product that the consumer would have

bought without the information provided by the website. In that study, the incremental end electricity savings from all purchases over the product lifetime are estimated in the order of 521'000 kWh. Per participant of the online survey this results in a lifetime saving of 1'380 kWh (EURO-TOPTEN MAX 2015a,b). The number of website visitors is provided in Annex 6. The approach for assessing the impacts in China and USA are described below.

Estimation of related CO₂-emission reduction

In order to convert the resulting electricity savings into a related reduction of CO₂-emissions, the emission factor of electricity consumption has to be applied. Since the emissions per kWh of consumed electricity vary depending on the technology, there are strong regional differences in the emission factors. Since the study at hand aims at quantifying the total emissions in Europe, rather than at the level of single countries, an average emission factor for Europe is applied. The data source used is based on a technical paper for electricity-specific emission factors for grid electricity (Brander et. al 2011). In China CO₂-emissions related to electricity consumption are almost twice as high as in Europe (Table 2).

Table 2: CO ₂ -emission factors of electricity consumption	
Region	kg CO ₂ /kWh
Europe	0.50
United States	0.59
China	1.04

Regional differences in CO₂-emission factors of electricity consumption. Source: Brander et. al. 2011

Applying these emission factors to the electricity savings that are estimated for the web survey (1'380 kWh per participant) a corresponding reduction of CO₂-emissions can be derived (0.64 t CO₂ per participant) (EURO-TOPTEN MAX 2015a,b,c).

$$\text{CO}_2\text{-emission reduction per participant} = \text{electricity savings per participant} \times \text{CO}_2\text{-emission factor}$$

$$640 \text{ kg CO}_2 = 1380 \text{ kWh} \times 0.50 \text{ kg CO}_2/\text{kWh}$$

Upscaling of the web survey data to all website visitors

Since in the online survey the participants were not selected randomly but could chose themselves whether to participate or not the results are affected by a "self-selection bias" (EURO-TOPTEN MAX 2015a,b,c). Thus the estimated electricity savings per participant cannot be directly transferred to all website visitors. Since it is assumed that people participating in the survey are more likely to be interested in actually purchasing a device, the average electricity

savings per visitor are smaller than estimated for the participants of the survey. This factor is assumed to be around 20% of the total. Additionally the number of visitors has to be corrected for visits that last only a few seconds, which is estimated to be in the order of 50% (EURO-TOPTEN MAX 2015a,b,c). Based on this methodological framework the electricity savings and the corresponding emission reductions can be estimated from the annual statistics of the number of website visitors. Thus the electricity savings per visitors are computed by accounting for these two facts, the “self selection bias” (20% discount”) and visits that lasted only a few seconds (50% discount).

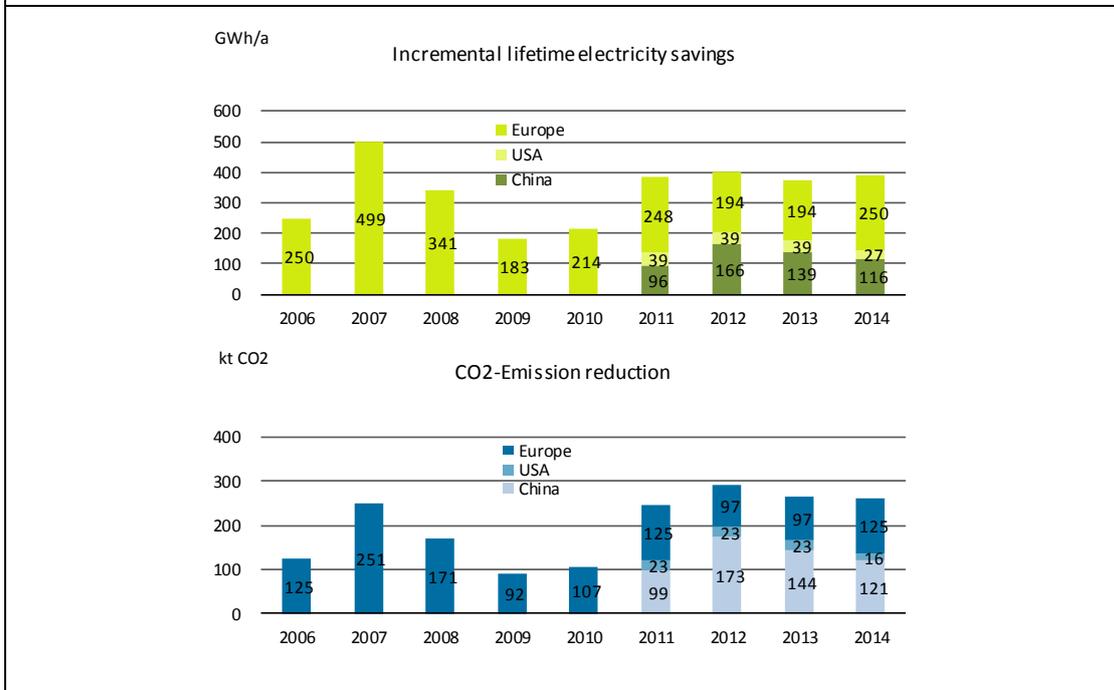
$\begin{aligned} \text{Electricity savings per visitor} &= 20 \% \times 50 \% \times \text{electricity savings per participant} \\ 138 \text{ kWh} &= 20 \% \times 50 \% \times 1380 \text{ kWh} \end{aligned}$

For the web statistics of the European websites, this results in incremental lifetime electricity saving of 138 kWh (64 kg CO₂) per visitor. It is thus ten times smaller than the savings estimated per participant (EURO-TOPTEN MAX 2015a,b,c).

Regarding effects in China and the USA the estimated electricity savings per visitor are not directly applicable, since there are regional differences in the market share of different product groups as well as product types. Due to a lack of more concrete information, the same factors are applied to estimate electricity savings per website visitor. Therefore, the results presented in chapter 3.2.1 are to be interpreted with caution.

Quantitative impact assessment

The total end electricity savings are estimated based on the number of website visitors (Annex 6). In total, the incremental lifetime savings for Europe, China and USA amount to about 400 to 500 GWh. This corresponds to a reduction of about 200 to 300 kt CO₂ (Figure 5). For Europe incremental lifetime savings amount to around 200 GWh (100 kt CO₂). For the USA and China electricity savings and related CO₂-emission reductions are estimated by the same methodological approach. Since the website statistics are not differentiated according to product categories, only the overall impact can be quantified (Figure 5).

Figure 5: Incremental lifetime savings of electricity and related CO₂-emission reduction

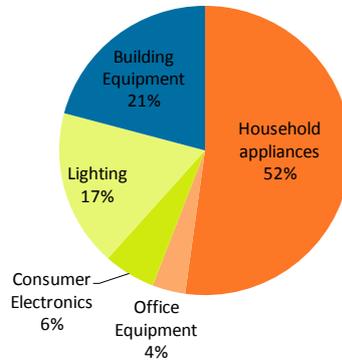
Incremental lifetime savings in terms of electricity and related CO₂-emissions for China, USA and Europe. Annual fluctuations are to be interpreted carefully since they are based on different web statistics (see Annex 6 for details).

A regional comparison shows that in terms of incremental lifetime end electricity savings the highest impact was achieved in Europe, where more than half of the total savings occurred. The USA contributes to about 5-10% of the total savings (27-40 GWh) and savings in China are about four times higher than in the USA ranging between 100-160 GWh.

In terms of CO₂-emissions the largest reduction was achieved in China, since electricity produced in China releases about twice as much CO₂ as in Europe or in the USA (Table 2). Thus about 50% of the CO₂-emission reduction occurred in China and USA is accounting for roughly 10% of the total reduction. Europe contributes the remaining 40%.

In Europe website statistics were evaluated with respect to product categories. The results show that household appliances contribute to about half of the savings and also lighting products and building equipment add substantially to the total savings (Figure 6).

Figure 6: Incremental lifetime electricity savings according to product categories



The share of the different product categories is estimated based on incremental lifetime electricity savings over the product lifetime from the 2012/2013 online survey for Europe (excl. cars). Data source: Wuppertal Institute for Climate, Environment and Energy, Germany.

In 2014 Europe contributed about 1000 GWh/a to the annual savings, USA around 30 GWh/a and China about 100 GWh/a.

Uncertainties and methodological issues

The estimated impact from maintaining an up-to-date website is to be considered as an approximate order of magnitude of potential savings. It is based on a comparatively small number of website visitors and therefore the estimated electricity savings are not necessarily representative for the total number of visitors. A more robust estimation would require a survey of a larger number of visitors. Additionally, the online survey was restricted to Europe. Application of the same factors to the number of visitors of the websites of USA and China implies a similar purchasing behaviour. However, regional differences are to be expected and therefore the estimation for China and the USA is affected by higher uncertainty.

Qualitative impact assessment

Stakeholders assess the Topten websites as an important provider of unbiased, reliable platforms for product information. Topten contributes to increased consumer awareness of the environmental and economic benefits of energy-efficient devices and thus helps to increase market transparency, which provides an incentive to produce and sell energy-efficient products. Therefore, Topten communication activities address stakeholders such as retailers, policy makers and manufacturers. For example, the number of website visitors indicates that Topten has a relevant influence on the purchasing behaviour of the consumers and can thereby pro-

vide leverage in the dialogue with other relevant stakeholders. This indirect impact cannot be assessed quantitatively but is expected to exceed the direct impact substantially.

Contribution of Topten to the achieved electricity savings

The estimated savings are entirely based on data obtained from the web survey described above. The savings can therefore directly be attributed to Topten. However, it cannot be assessed to which extent the Topten criteria actually played a role in the purchasing decision of the consumers. Therefore, the quantitative results are to be considered as a rough estimate of the potential savings.

Conclusion

In 2014 Topten in Europe contributed about 1000 GWh/a to the annual electricity savings, Topten USA around 30 GWh/a and Topten China about 100 GWh/a. Annual electricity savings from consumer awareness activities are relatively small (20-30%)⁹ compared to the overall annual savings as described in chapter 3.1. However, consumer awareness activities contribute also in an indirect way since they provide an incentive for producers and retailers to produce and sell energy-efficient appliances.

3.2.2. Policy activities

For many years advocacy activities within the policy decision process has been a focus of the Topten program. Amongst others, this includes provision of information for decision makers, participation in consultation rounds, development of technical papers and methodologies and networking with stakeholders involved. Topten participates in the EU legislative process for developing directives on the design of electric appliances and labelling. Since 2010 this holds also true for China, where information on potential electricity savings and policy recommendations are presented to decision makers.

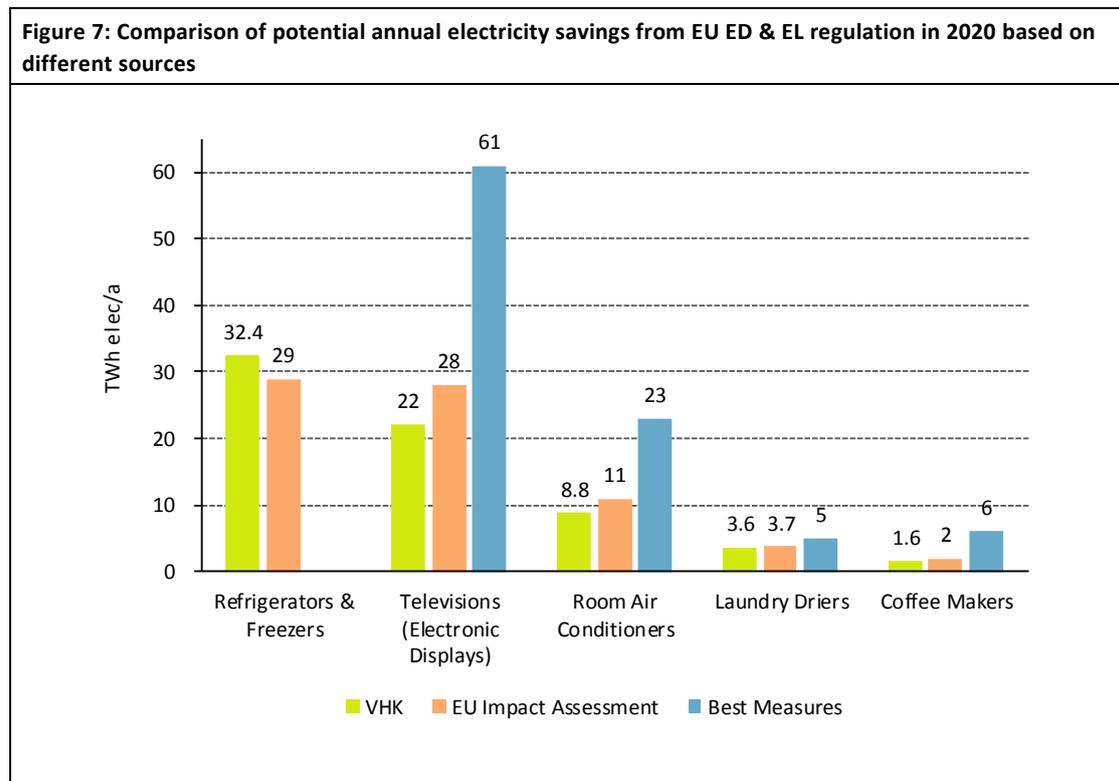
From this activity strand of Topten substantial electricity savings and CO₂-emission reductions were achieved in the years 2006-2014. In the following section the results of the quantitative bottom-up and top-down impact assessment are presented separately by region. The methodological approaches chosen are described in Annex 7.2.

Top-down impact assessment EU level

The electricity savings of EU ED&EL regulations for selected electric appliances reported in various studies has been compared. The most comprehensive impact assessment reports are

⁹ Range depending on whether a more conservative or a more optimistic scenario is assumed

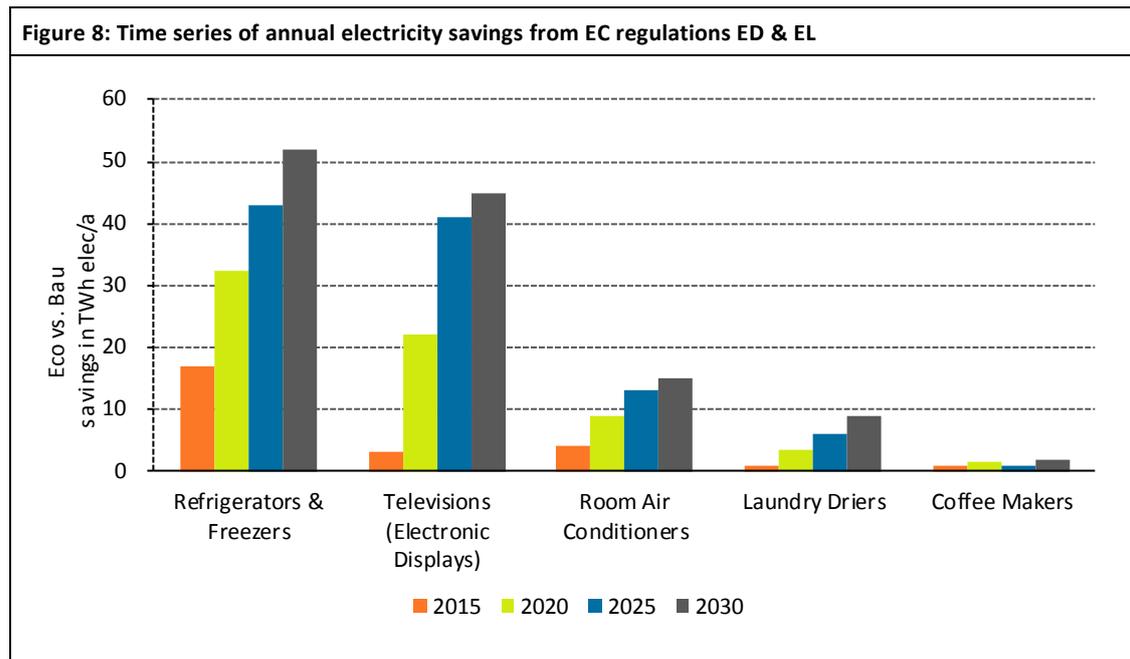
VHK (2014) and the impact assessment commissioned by the EC for selected appliance regulations. Furthermore, a best measure compilation was provided by Topten (2015) that gave insights to potential savings if best available technologies (BAT) and strict regulation were to be applied. Figure 7 provides an overview of the estimated annual savings reported from these three sources for the year 2020 and for electric appliances mentioned in the interviews to be key for Topten activities.



Potential annual electricity savings from EU ED&EL regulation in 2020 as reported by VHK and the EU impact assessments. Savings are only for 2020 and not accumulated in this figure. The blue bars show what savings could be if best practice policies would be implemented (where available) (Topten 2015).

Main savings are expected from further regulating refrigerators and freezers (households and commercial) as well as television appliances. Comparing the estimates from VHK and EC impact assessment reveals a fair match while the “best measure” estimate indicates that still substantial electricity saving potential could be tapped in future. Figure 8 depicts how expected savings from regulations are expected to evolve over time until 2030. Given that the stock of more efficient appliances after enacting a regulation grows continuously, also annual savings increase for all appliances analysed. It becomes also evident that in 2015 the expected savings are comparably small since regulations or their revisions are only recently set in place and thus impacts occur with a certain time lag only. Since in the study at hand is confined to the time

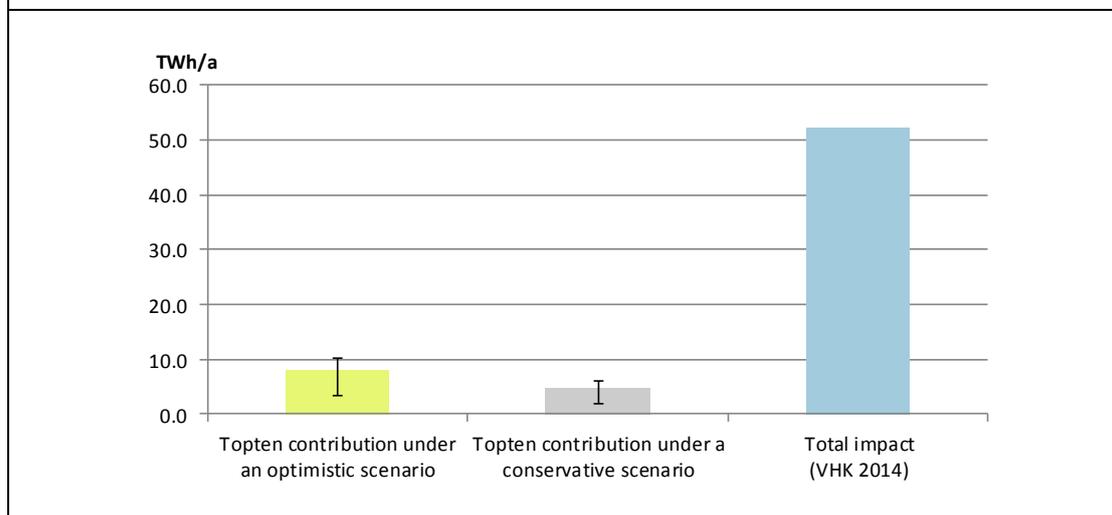
period 2006 - 2014 the impacts are estimated from the available data by interpolating between the data of 2015 and the time of implementation. As the study at hand, only includes impacts that occurred up to 2014, impacts from laundry driers and coffee makers are not accounted for in the following Topten impact quantification.



Time series of annual electricity savings for selected appliances in four selected years, not accumulated with preceding years (VHK 2014; ECO vs. BAU scenario). ECO: scenario with implementation of new regulations, BAU: Business as usual scenario. Source: VHK 2014.

Contribution of Topten to total impact from ED & EL regulations

For the second step of the top-down impact assessment the share of Topten's contribution was estimated from the indicator matrix in terms of a relative share and prorated with the envisaged overall electricity savings from regulations in the year 2014. Since the assessment inherently is based on qualitative assumptions and personal estimates, the results are presented in ranges encompassing two assessment scenarios: contribution from Topten a) under conservative assumptions and b) under optimistic assumptions. From the indicator matrix the minimum, maximum and average estimates from interviewees are provided. These contributions are then scaled such that the average reaches around 10% of the total impact under conservative assumptions and around 15% under an optimistic scenario. Under conservative assumptions, contribution of Topten ranges from 4 to 13% and under the optimistic scenario, the contribution ranges between 6 and 22% (Figure 9).

Figure 9: ED & EL annual electricity savings thanks to Topten activities in 2014

Annual electricity savings due to Topten activities according to a conservative and an optimistic scenario in comparison to the total impact according to VHK 2014. The error bars indicate the range between the minimum and maximum contribution estimated by the semi-quantitative evaluation of the expert interviews. Source: VHK 2014 and semi-quantitative evaluation of expert interviews.

The Topten contribution is then applied to the time series of total annual savings provided by the study on “Ecodesign impact accounting” by VHK (2014) as illustrated in Table 3. Since for 2014 no assessment of the total impact is possible for coffee makers and laundry dryers, they cannot be quantified. For coffee machines a bottom-up quantification is provided instead (see next section).

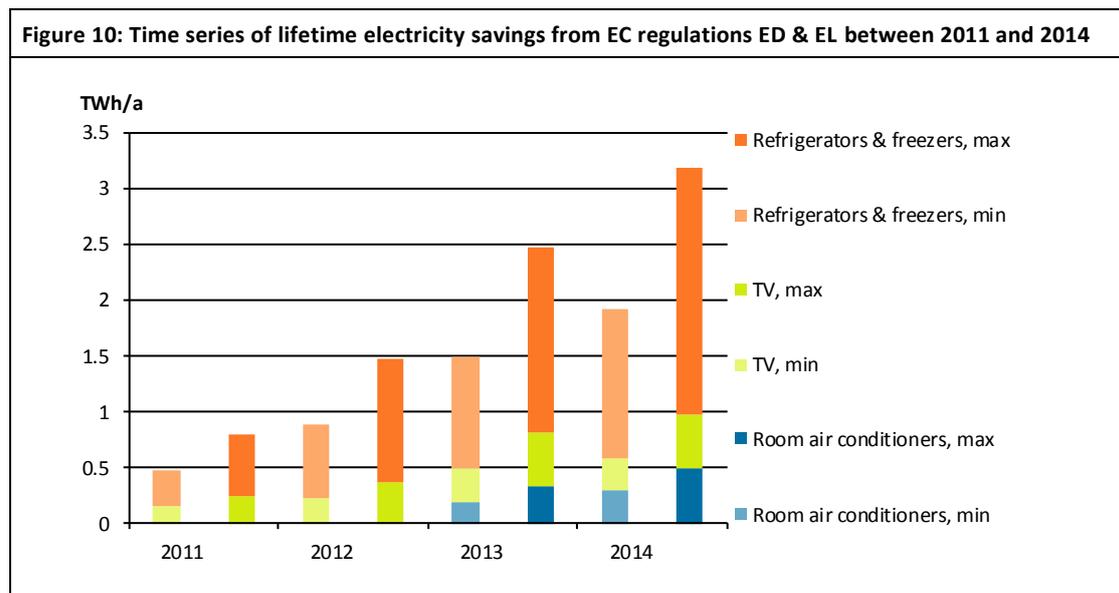
Table 3: Impact of eco-design and energy labelling regulations thanks to Topten activities according to optimistic and conservative assumptions

	VHK impact	Optimistic			Conservative		
		Min	Max	Average	Min	Max	Average
TWh/a	-						
Refrigerators & Freezers	38	2.3	3.3	1.5	1.4	2.0	0.9
Televisions (electronic displays)	10	0.6	0.9	0.6	0.4	0.6	0.3
Room Air Conditioners	5	0.3	0.5	0.3	0.2	0.3	0.2
Total	52	3.3	4.7	2.4	2.0	2.8	1.4

Estimated annual electricity saving impact from Topten from policy activities in TWh/a in 2014. For refrigerators and freezers only the impacts of household appliances are considered, since there is not yet a quantitative estimation for the impact of professional appliances. Total savings in 2014 are estimated based on the data provided by the study on “Eco-design impact accounting” (VHK, 2014). Topten contribution is based on a semi-quantitative assessment of information gathered from expert interviews.

Based on the semi-quantitative evaluation of the expert interviews, the contribution of Topten activities to the total impact is estimated to range from 10% under conservative assumptions up to 15% in an optimistic scenario. Depending on the interviewee the estimated contribution

varies in the order of ± 5 percentage points for both scenarios. Thus the impact thanks to the Topten program is expected to be in the order of 5 to 20 % of the total impact. By applying these shares to the total impacts the range of Topten's contribution can be derived. Total annual electricity savings increased from around 0.5-1 TWh/a in 2011 to about 2-3 TWh/a in 2014 (Figure 10).



Optimistic and conservative estimate of Topten's contribution to cumulative electricity savings from main product groups. Source: estimated based on data from VHK 2014 and stakeholder interviews in the framework of this study.

The main lifetime electricity savings 2006-2014 result from Topten's policy activities targeting refrigerators and freezers, televisions and room air conditioners. In 2014 around 70% of the total savings were contributed by improved regulations of household refrigerators and freezers¹⁰. The savings from regulations regarding room air conditioners and TVs contribute each about 15% to the total savings.

There are substantial differences in the estimations of the contribution of Topten to the policy impacts achieved. Experts affiliated with Topten tend to estimate the share of Topten higher as compared to experts with no direct connection to Topten. To be on the safe side the study focuses on the conservative assumption, which is based on more independent information.

¹⁰ "No savings were projected for professional refrigeration, as at the reference date for the projections (1.11.2013) there was no draft Working Document and the information in the preparatory study was insufficient to derive any credible targets", VHK 2014 p. 17

Bottom-up impact assessment EU level and individual countries

There are few flagship case studies where quantitative estimates reflecting the Topten impacts from policy activities targeting specific electric appliances are available. From the interviews and additional research the following impacts in terms of cumulative electricity savings were quantified for 2014:

EU/Country	Appliance	Impact estimate	Comment	Source
EU level	Coffee makers (standby mode)	2.2 TWh	Topten contributed considerably to the enforcement of auto shut-down function. Rough estimate about contribution by Topten of 50% to total savings 2009-2014.	Rough calculation by interviewees
Switzerland	Tumble dryer	0.6 TWh	Topten contributed considerably to the ban of tumble dryer without heatpump since 2012 in Switzerland. Rough estimate about contribution by Topten of 50% to total savings 2012-2014.	Rough calculation by interviewees

Table 4: Bottom up estimates of Topten contribution to cumulative electricity savings from policy activities on EU level and in Switzerland since the implementation of the corresponding regulation.

Furthermore, Topten is currently active in a variety of policy decision processes that will trigger substantial savings from 2015 onwards. This holds particularly true for commercial refrigeration as well as the appliances analysed in the impact assessment above. For example for professional cooling devices an updated energy labelling regulation and a new eco-design regulation were implemented in May 2015. Topten contributed substantially to the tightening of the highest energy efficiency classes¹¹. Additionally, the efforts of Topten to facilitate and accelerate the introduction of heat pump tumble dryers on the Swiss and in the European market. The Topten program has also launched similar activities in the USA where a large saving potential still exists (Werle et al. 2011).

Impact assessment Topten activities China

For Topten in China, there is neither data available for a top-down assessment nor are there specific examples or case studies of electric appliances where Topten activities can be linked to decisions from policy makers on electricity regulations in China. Furthermore Topten China is operative only since 2010, thus impacts will surface in the future only.

However, a study on the market of China energy-efficient products (Topten China and CLASP, 2013) was conducted that estimates the potential cumulative savings from best practice policies. The report concludes that potentially 269 TWh of cumulative savings could be achieved in

¹¹ Mail: S.Stamatis (ECOS) to E.Geilinger (Bush Energie GmbH), 9. July 2015

2030. Breaking down the numbers reveals potential cumulative savings of 4.1 TWh between 2013 and 2015 (whereof 2 TWh are attributed to savings from televisions).

Qualitative impact assessment

Topten has a relevant role in providing information about technologies, appliance markets and potentials for improving existing regulations. Most importantly Topten's role as a provider of technical knowhow facilitates lobbying for more strict regulations by organizations such as ECOS¹². In Europe, additional assets are Topten's long term presence in the policy forum, which increases credibility and reliance, and Topten's well established network, which is a channel to place policy demands and which facilitates the access to relevant information for policy makers.

The relevance of Topten can therefore be summarized as an important provider of technical knowhow and expertise. Additionally, Topten often takes the role of a first mover that brings attention to new saving potentials or loopholes in existing regulations that were not yet a focus for policy makers and other stakeholders. By launching a discussion on new topics Topten contributes substantially to the development of more strict regulations.

One example of Topten's successfully intervening in the policy making process at EU-level is the tightening of the A+++ class by about 10%. This was possible thanks to Topten revealing that there are already appliances on the market that fulfil the A+++ class requirements. Additionally, in the context of developing new shut down technologies for the standby mode of coffee machines, Topten contributed by recommending how to measure electricity consumption and how to regulate it. Another example concerning Swiss regulation is Topten's considerable contribution to the ban of tumble dryer without heat pumps, which was implemented in 2012.

In China, the subsidy scheme for electrical appliances was adapted as a result of Topten's policy efforts. It resulted in more strict criteria for defining eligible appliances, thereby reducing the number of subsidized models and increasing the subsidy amount per appliance. In the USA Topten was not geared to influence federal policy processes.

In the next years significant impacts are to be expected from Topten's current activities at EU level concerning policy work on commercial refrigerators, with a new eco-design regulation being implemented in 2015. Further focus topics are vacuum cleaners, lighting and dish washers.

¹² <http://ecostandard.org/> (9.7.2015)

Conclusion

Topten policy activities on the EU level account for the largest contribution to the overall annual savings as described in chapter 3.1 (70-80%, depending on whether a more conservative or a more optimistic scenario is assumed). Compared to total savings reported by VHK, contribution from Topten amounts to about 10-15 % depending on whether it is based on a conservative or an optimistic assumption. However, the uncertainty range is even larger if minimum and maximum contribution provided by the interviewees is considered. The lowest range reveals a contribution of around 5% and the highest share is in the order of 20%.

Based on this assessment a substantial fraction of the total savings can be attributed to Topten. To a large extent it stems from improvements regarding the EU regulation of refrigerators and televisions. In the latter case, however, it is not sure how much the TV market itself was changing already which might diminish the estimated savings impact of Topten.

3.2.3. Collaboration with large buyers

Quantitative and qualitative impact assessment

The extent to which Topten is collaborating with large buyers varies among different countries. Some of them report that there is no direct collaboration (e.g. Czech Republic) or that it is only about to start (e.g. Portugal).

- At the EU-level Topten is disseminating recommendations for public procurement and is collaborating with ICLEI - Local Governments for Sustainability¹³, an organization that is promoting sustainable urban development.
- Since 2010 Topten is actively promoting energy-efficient commercial cooling devices in collaboration with ProKilowatt in Switzerland. As of May 2015, the estimated cumulative lifetime savings from the existing support program¹⁴ are in the order of 42 GWh. Since also other parties contributed to this program, the expected savings cannot be entirely attributed to Topten efforts. Therefore, we estimate contribution of Topten to be in the order of about 15 GWh or roughly a third of the total savings. In 2015 a similar program was launched in the EU (ProCold¹⁵) and thus in future increased savings can be expected. Over the entire project duration a cumulative lifetime saving of 331 GWh is expected according to the ProCold grant agreement¹⁶. As this activity started only in 2015 it is not included in the impact assessment.

¹³ www.iclei.org (8.7.2015)

¹⁴ www.topten.ch/gewerbe (8.7.2015)

¹⁵ www.pro-cold.eu (8.7.2015)

¹⁶ grant agreement 649293, p. 15

- Impacts of activities with large buyers were assessed for Swiss retailer Migros, who consulted Topten regarding procurement of energy-efficient cooling devices. The annual savings thanks to more efficient cooling devices are estimated to be in the order of around 0.1 GWh. Assuming an average product lifetime of 15 years a cumulative lifetime saving of 1.5 GWh/a was achieved in 2014.
- The city of Zurich decided in 2003 to equip its housing projects with electrical appliances by applying according to Topten criteria. In addition, Topten collaborated with utilities in the development of subsidy programs by providing technical information.
- The experts interviewed in this study have no knowledge of whether Topten's recommendations on public procurement in the EU provided on the website are actually used by large buyers.
- In China Topten actively tries to strengthen cooperation with stakeholders in the procurement sector (Top10 China, 2014, p.21). Based on the expert interviews, the basis for a quantitative impact assessment is insufficient. It would require direct exchange with the involved stakeholders, such as public procurers of cities and communities as well as large buyers in private companies. In the US there was no direct collaboration with large buyers.

Uncertainties and methodological issues

Data on the outcome of Topten activities with large buyer are available only for selected case studies. Additionally, the savings are assumed to vary case by case such that no simple upscaling to the EU-region or China is possible. In order to assess the impacts more thoroughly a larger number of representative case studies should be investigated.

Contribution of Topten to the achieved electricity savings

In general, the experts interviewed for this study report that collaboration with Topten has resulted in valuable inputs in the form of technical information on energy-efficient devices on the market. However, energy efficiency is only one of several criteria that a procurer is considering when selecting a product. Therefore, the electricity savings resulting from these sales cannot be fully considered as an impact resulting from Topten activities.

Conclusion

The case study based impact assessment shows that substantial electricity savings can be achieved in the procurement sector. An exact quantitative assessment of Topten's contribution is not possible. Only for selected case studies in Switzerland, data availability allows a quantitative approach. Since only a small sample of case studies is available, which is not representative for other regions, data cannot be extrapolated to the regional level.

3.2.4. Collaboration with producers and retailers

Quantitative and qualitative impact assessment

Form and intensity of collaboration with producers and retailers varies among the different EU countries and is also continuously changing as new collaborations are started and other activities are ceased. Therefore, data availability poses a major challenge in the quantitative assessment. Based on interviews with some retailers it is possible to provide a rough estimation of the impacts achieved. In most cases, however, impacts are not assessed formally and therefore the numbers provided are to be considered as an estimated order of magnitude. Thus, only a few examples are illustrated without attempting to upscale the data.

- The Swiss retailer Migros has set as a goal to achieve a share of 33 % of electric appliances that meet Topten criteria¹⁷ by the end of 2015. Currently the share is about 30 %. Due to the continuous updating of Topten products according to the market development, the product supply needs to be changed frequently in order to maintain and eventually increase the share of energy-efficient products offered. There exist for example no 4K TV¹⁸ models that meet Topten criteria and thus even maintaining the same share of Topten products presents a challenge.
- The Swiss retailer Coop as also an ongoing collaboration with Topten in order to identify potentials to increase the share of energy-efficient appliances in their supply. Coop also reports a decline in the sales of Topten products since 2012, mainly due to an increased share of entertainment electronics that do not meet Topten criteria.
- Topten criteria are also used in support schemes for energy-efficient devices. For example in Switzerland Topten was part of the ProKilowatt-Programme¹⁹, which contributed an estimated annual saving of about 100 GWh in 2011 (SAFE 2012). Since besides Topten also other parties were involved, the contribution of Topten is estimated to be in the order of about a 30% or 30 GWh.
- In China, Topten has an ongoing collaboration with 300 flagship stores of the retailer GOME. Topten provides stickers highlighting the most energy-efficient products. However, no data are available for a quantitative assessment of the impacts from this ongoing activity.

¹⁷ <http://www.migros.ch/generation-m/de/nachhaltigkeit-bei-der-migros/unsere-versprechen/versprechen-filter/versprechen-konsum/energie.html> (8.7.2015)

¹⁸ 4K TV: High resolution Television with horizontal resolution of 4000 pixels

¹⁹ <http://www.bfe.admin.ch/prokilowatt/index.html?lang=de> (8.7.2015)

Collaboration with producers was not assessed quantitatively, since none of the interviewees could provide any quantitative information. On one hand, Topten influences manufacturers in an indirect way, by pushing towards more ambitious regulations thereby creating an incentive for them to develop more energy-efficient devices and on the other hand, Topten is in direct dialogue with producers and industry associations²⁰. Both of these activities contribute to increased market transparency but the impacts cannot be assessed quantitatively.

Uncertainties and methodological issues

Data availability on the outcome of Topten activities with retailers and producers is relatively scarce. Additionally, the savings are assumed to vary case by case such that no simple extrapolation to the EU-region, China and the USA is possible. In order to assess the impacts more thoroughly a larger number of representative case studies should be investigated.

Contribution of Topten to the achieved savings

In general, the retailers interviewed for this study report that collaboration with Topten has resulted in valuable inputs in the form of technical information on energy-efficient devices on the market. However, energy efficiency is only one of several criteria that a retailer is considering when selecting a product. Therefore, electricity savings resulting from these sales cannot be fully considered as an impact resulting from Topten activities. Similarly also the production of more energy-efficient appliances is a result of a number of factors. Besides the activities of Topten also other factors favour technological innovation and therefore the savings cannot be entirely considered as an impact resulting from Topten.

Conclusion

The case study based impact assessment shows that substantial electricity savings can be achieved by collaborating with retailers. An exact quantitative assessment of Topten's contribution is not possible. However, Topten plays an essential role as a provider of up-to-date information and as an independent third party, which helps to increase credibility. Case studies that allow a quantitative approach are focused on Switzerland and are therefore not representative for Europe. The contribution of Topten to the total electricity is expected to be substantial. Since only a small sample of case studies is available data can therefore not be extrapolated to the regional level.

²⁰ For example in Czech Republic, Topten asks manufacturers for recommendations on which models to list on the websites. So the collaboration consists of exchanging technical information with manufacturers.

4. Feasibility of a detailed impact assessment of Topten activities

To a large extent the impact quantification is limited by data availability and uncertainties concerning the contribution of Topten. On one hand, there is a lack of sufficient reliable data that are necessary to quantify the total impact. On the other hand, there are methodological issues in the impact assessment. Due to the complexity of the impact chains, the estimated impacts are a result from a number of different factors acting at the same time and it is therefore difficult to isolate contribution of Topten to the changes in the behaviour of the target groups and to the resulting impact.

Based on the present study, conclusions can be drawn regarding possible approaches and improvements for further assessments. Two possibilities for further development of the impact assessment are presented. In a pragmatic approach, the assessment could be refined by focusing on further data collection (chapter 4.1). Additionally, focusing on further developing the impact model would allow a refined assessment of the contribution of Topten to the achieved impacts and would provide a basis for an evaluation of the Topten program (chapter 4.2).

4.1. Focus on data collection

In this approach, focus lies on filling the most important data gaps that were identified in the present study based on the same conceptual model as applied in the study at hand. Since up to now data on impacts from collaboration with retailers, manufacturers and large buyers is insufficient for a quantitative assessment, future work should focus on exploring a wider selection of case studies. These data would then provide a representative sample that can be extrapolated to the regional level thereby allowing a rough estimate of the total impact.

Data availability

Due to limited data availability, the impact assessment in the present study is based on a number of assumptions, which cause considerable uncertainty in the estimated impacts. Therefore, the following table provides a qualitative overview of the estimated uncertainties in the impact assessment. It is also intended to serve as a basis for future impact assessment as it highlights aspects that could not be quantified due to a lack of sufficient quantitative data (Table 5).

Table 5: Data availability and uncertainty of the estimated impacts			
	Medium uncertainty: Sufficient data sources available for a rough quantitative impact assessment		
	High uncertainty: Limited data availability, quantit. assessment based on a numerous assumptions		
	No data source available for a quantitative impact assessment		
	No Topten activities reported between 2006 and 2014		
Impact chain	Europe	USA	China
Website & media	<ul style="list-style-type: none"> Based on the online survey and the web statistics the impacts of the consumer information on the website can be roughly assessed. 	<ul style="list-style-type: none"> Only the total number of website visitors is available. The assessment is therefore based on the assumption that the market share of different product groups is similar, comparable products are on the market and consumer behaviour is – all in all – similar. 	
Policy design	<ul style="list-style-type: none"> Based on existing impact studies the impacts can be roughly assessed by estimating the contribution of Topten. 	<ul style="list-style-type: none"> In the USA, there is no policy impact study available. The extent to which Topten contributed is not known for both China and USA is not known 	
Retailers & producers	<ul style="list-style-type: none"> Data is available for selected case studies. However, there is no sufficient basis for a regional extrapolation in Europe. 	<ul style="list-style-type: none"> Extent and progress of collaboration with retailers/producers is not known. 	
Large buyers	<ul style="list-style-type: none"> Data is available for selected case studies. However, there is no sufficient basis for a regional extrapolation in Europe. 	<ul style="list-style-type: none"> no activities²¹ 	<ul style="list-style-type: none"> Extent and progress of collaboration with large buyers is not known.

Data requirements

Based on the data availability (Table 5), the data requirements for a more detailed quantitative impact assessment can be derived for the impact level (Table 6). This compilation is intended to serve as a basis for a more detailed quantitative impact assessment in the future. Especially collaboration with retailers, manufacturers and large buyers is expected to show high temporal and regional variation. Thus a more extensive collection of quantitative case studies would provide a sounder basis for a quantitative impact assessment of these activities.

²¹ Topten USA worked with several utilities in four states (California, Connecticut, Massachusetts, and Rhode Island) by contributing to the energy efficiency program outreach and promotions. As for Europe, data availability is limited and a quantitative assessment is not possible and multipliers were not a focus of this assessment.

Table 6: Data requirements for future impact assessments			
Impact chain	Europe	USA	China
Website & media	<ul style="list-style-type: none"> This estimation could be refined in future by performing a similar survey with a larger number of participants or by performing a choice experiment. 	<ul style="list-style-type: none"> Verification of transferability of the results of the online survey in Europe Further refinement could be achieved by performing additional surveys or choice experiments in both regions in order to account for the regional differences in purchasing behaviour. 	
Policy design	<ul style="list-style-type: none"> This estimation could be refined in future by assessing in more detail to which extent Topten contributed to the savings and to which extent the individual countries comply with the regulations. 	<ul style="list-style-type: none"> Policy impacts should be estimated from a reference scenario based on the assumption of “business as usual” in comparison to a scenario, where the new regulations are implemented. The estimated policy impact can then partially be attributed to the Topten program. The extent of this contribution would also require a more detailed assessment of the policy making process 	
Retailers & producers	<ul style="list-style-type: none"> A detailed impact assessment of collaborations with retailers & producers would require a larger number of case studies and a more detailed evaluation of the electricity savings achieved. 		
Large buyers	<ul style="list-style-type: none"> A detailed impact assessment of collaborations with large buyers would require a larger number of case studies and a more detailed evaluation of the electricity savings achieved. 	<ul style="list-style-type: none"> no activities 	<ul style="list-style-type: none"> A detailed impact assessment of collaborations with large buyers would require a larger number of case studies and a more detailed evaluation of the electricity savings achieved.

- A detailed quantitative impact assessment of activities addressed to **private consumers** would require an online survey in USA and China in order to verify, whether the assumption of a similar consumer behavior as in Europe can be justified. Additionally, also a repeated survey in Europe would provide valuable insight as to which extent consumer behavior changes over time. Furthermore, choice experiments with private consumers would allow assessing the extent to which Topten had an influence on their purchasing decision. Additionally, there is a general lack of publicly available data on the market share of electrical appliances according to energy efficiency classes. Such a product registration system, which exists in China—and other countries, is a prerequisite for a thorough impact assessment and for optimizing the current activities in order to achieve maximum impact. Topten is pushing for such a system in Europe²².
- Regarding collaboration with **large buyers, retailers and producers**, possible future assessment should focus on gathering more case study based data. The empirical approach would primarily be based on interviews with the target groups. Data should be collected

²² http://www.topten.info/uploads/File/Topten-discussion-paper-product-registration-database_Nov_14.pdf

based on a wider selection of expert interviews and case studies are to be selected such that the sample is representative for all regions.²³

- Regarding **policy impacts**, uncertainty arises mainly from estimating Topten's contribution to the total impacts. As the policy making process is the result of a dialogue with various stakeholders, it is not directly quantifiable but can only be assessed based on expert judgement. Thus a refined estimate would require a more extensive series of expert interviews involving all relevant stakeholder perspectives and a more detailed assessment of the policy making process based on selected case studies.

Due to the inherent complexity of the impact chains a substantial uncertainty will remain even if more data are available. For example new regulations are the result of a sequence of dialogues and a decision making process that involves numerous stakeholders. Therefore, contribution of Topten as one of many involved parties is not exactly quantifiable. Another example is impacts from activities addressed to raise consumer awareness. Also here, the outcome in terms of changed consumer behaviour is hard to quantify, since the purchasing decisions are influenced by many factors out of which energy efficiency is only one of many criteria. In those cases, a refined qualitative assessment would provide additional insight on relevant contributions from Topten and it could serve as a basis for a future evaluation (see chapter 4.2).

4.2. Focus on qualitative aspects

Based on the present study, several conclusions can be drawn regarding the methodological approaches. The impact model applied in this study simplifies the complex relations among the activities of Topten and the different target groups in order to facilitate a quantification of the impacts. However, in order to provide a basis for a possible future in-depth evaluation of the Topten program, the impact assessment would have to be complemented with a more detailed qualitative assessment that highlights the numerous relations and feedbacks between different activities and stakeholders.

Since in most cases it is not only one single activity but their combination that generate a change in the behaviour of a target group, a more detailed qualitative assessment of the impact chains would allow to better illustrate how the different activities interact and contribute to the overall impact. This approach would require a refinement of the impact model and a more detailed qualitative description of the impact chains and the contributions of Topten.

²³ Topten USA worked with several utilities in four states (California, Connecticut, Massachusetts, and Rhode Island) by contributing to the energy efficiency program outreach and promotions. As for Europe, data availability is limited and a quantitative assessment is not possible. However, multipliers were not a focus of this assessment.

One of the most crucial aspects in the impact assessment is the definition of an appropriate reference scenario that depicts a hypothetical situation without any Topten activities. Since in most cases an experimental approach will not be possible, the reference scenario would have to be refined based on additional interviews with various stakeholders.

Overall, a more detailed qualitative impact assessment would better highlight how Topten is influencing the behaviour of the involved target groups. It could also serve as a basis for a future in-depth evaluation that would assess potentials for improving the existing activities in order to achieve maximum impacts with the available resources.

5. Conclusion

Based on data availability, a quantitative impact assessment is provided only for activities addressed to private consumers and policy makers. Given the uncertainties the impacts can only be quantified in terms of ranges. Under conservative assumptions, the impact in 2014 is estimated to be in the order of about 4 TWh annual electricity savings, which corresponds to about 2.1 million tons of CO₂. Since 2006 the annual electricity savings also continuously increased from around 0.1 TWh in 2006 to about 4 TWh by the end of 2014 (Figure 4). Assuming a more optimistic scenario, the activities of Topten are estimated to have an impact in the order of 5.4 TWh or about 2.7 million tons of CO₂ in 2014. With more than 70 % of the total lifetime electricity savings, policy advocacy work constitutes the main contribution. The impacts increased strongly since 2011 and based on the ongoing activities impacts are expected to continue to rise in the near future.

The direct quantitative effects of activities intended to raise awareness of private consumers are comparatively small. However, media presence and the maintenance of up-to-date information on the Topten websites are indirectly providing an incentive for manufacturers to produce more efficient appliances and for retailers to increase the share of energy-efficient devices in their supply. The impacts of activities addressed to private consumers seem to be relatively constant since 2006.

A quantitative assessment of other activities is possible only for selected cases. Data availability is however insufficient for an upscaling to the regional level. Based on the quantitative assessment, activities aimed achieving more stringent regulations have shown to be most effective. Given that not all of the relevant activities were assessed quantitatively, this conclusion is to be considered with caution. The qualitative assessment shows that the diversity of Topten's activities is necessary in order to ensure that an actual impact results. As the impact chains involve many different target groups it is essential to address all relevant stakeholders.

Overall, the quantitative and qualitative impact assessment of the activities show that Topten contributes to an increased market share of energy-efficient appliances and thereby account for a substantial reduction in electricity consumption and related CO₂-emissions. Interviewees state that Topten plays a major role as a provider of up-to-date information on the most energy-efficient technologies and due to its efforts to shed light on new saving potentials. These activities provide a strong incentive for producers to invest in the development of products with improved energy efficiency and they facilitate the introduction of innovative products on the market thereby accelerating market transformation towards more energy-efficient technologies.

Outlook for a future impact assessment

The thorough reporting of Topten provides a detailed documentation on the activities that were implemented (output level). Uncertainties arise when assessing to which extent these activities caused a change in the behaviour of the different target groups and stakeholders (outcome level). A future assessment would require a more detailed examination of these behavioural changes based on a qualitative assessment and further data collection. The efforts should therefore focus on estimating the effect of Topten activities on the behaviour of the target groups such as consumers, policy makers, manufacturers, retailers and large buyers.

Tentative recommendations for improving the Topten strategy

The present analysis and information gathered from expert interviews provide some indication on how the Topten strategy could be improved:

- The main impacts so far, in Europe, arise from activities at the level of policy making. Efforts should therefore focus on this area in particular. Additionally, a more detailed follow up on how the activities result in a behavioral change of the target groups and stakeholders would provide a sounder basis for assessing the impacts. A better knowledge of the impacts would then allow to focus on successful activities and to improve activities that did not achieve the desired outcomes and impacts. Periodical assessment of the impacts would also allow a continuous optimization of the existing activities in order to achieve maximum impacts.
- In order to mitigate climate change a primary focus should be on the electricity consumption in China, since fossil fuel based electricity consumption is more prevalent than in other regions and therefore there is a higher potential for climate change mitigation.
- Topten is already pushing for the development of a Europe-wide product registration system for electrical appliance. Such a database could serve as a basis for a more detailed impact assessment and therefore these efforts should be continued.

- From a retailer's perspective, the continuous updating of Topten criteria poses a challenge since the product supply cannot be changed on short notice. A better coordination of updating Topten criteria and the process of planning the assortment of the next season might allow retailers to increase the share of Topten products.

Literature

- Brander et. al. 2011:** Brander. M, Sood A., Wylie C., Haughton A., Lovell J., Technical Paper: Electricity-specific emission factors for grid electricity, Ecometrica, August 2011
- Burkhardt et. al. 2012:** Burkhard C., Kuznetsova J., Topten International: Developing comparable measures to evaluate impact on market transformation towards energy-efficient products, Practical Project, University St.Gallen, June 2012.
- Clasp, Top10 2013:** Hu Bo, Zheng Tan, Jayond Li; Market Analysis of China Energy Efficient Products; September 2013
- EC 2014:** Study evaluating the current energy efficiency policy framework in the EU and providing orientation on policy options for realising the cost-effective energy efficiency/saving potential until 2020 and beyond. European Commission, DG ENER. Karlsruhe, Vienna, Rome
- Ecofys 2014:** Evaluation of the Energy Labelling Directive and specific aspects of the Ecodesign Directive. Final technical report and background documents on energy savings from ED and EL. European Commission, Directorate-General for Energy. Brussels.
- EURO-TOPTEN MAX 2015a:** Maximising Topten Communication on Top Runner Products, Survey Report No. 1, European visitor feed-back survey on Euro-Topten Websites, Deliverable D 5.4, WP 5, Prepared by Wuppertal Institute for Climate, Environment and Energy, Germany
- EURO-TOPTEN MAX 2015b:** Maximising Topten Communication on Top Runner Products, Survey Report No. 2, European visitor feed-back survey on Euro-Topten Websites, Deliverable D 5.4, WP 5, Prepared by Wuppertal Institute for Climate, Environment and Energy, Germany
- EURO-TOPTEN MAX 2015c:** Maximising Topten Communication on Top Runner Products, Monitoring Report No. 4, Reporting period from February to December 2014, Deliverable D 5.1, WP 5, Prepared by Wuppertal Institute for Climate, Environment and Energy, Germany
- EURO-TOPTEN MAX 2014:** Maximising Topten Communication on Top Runner Products, Monitoring Report No. 3 Reporting period from July 2013 to February 2014 Deliverable D 5.1, WP 5, Prepared by, Wuppertal Institute for Climate, Environment and Energy, Germany
- EURO-TOPTEN MAX 2013:** Maximising Topten Communication on Top Runner Products, Monitoring Report No. 1, Reporting period from January to June 2012 Deliverable D 5.1, WP 5, Prepared by, Wuppertal Institute for Climate, Environment and Energy, Germany
- Fraunhofer ISI 2009:** Study on the Energy Savings Potentials in EU Member States, Candidate Countries and EEA Countries, Final Report for the European Commission Directorate-

General Energy and Transport, EC Service Contract Number TREN/D1/239-2006/S07.66640, Karlsruhe/Grenoble/Rome/Vienna/Wuppertal, 15. March 2009

Topten 2015: Various documents, policy recommendations and regulation compilation with expected impacts from Anette Michel. Personal communication with Anette Michel, Topen. Email from 26.05.2015.

Euro Topten 2012: Grant agreement no. SI2.500405 / IEE/07/714, Extension and strengthening of the European Topten Initiatives and of the market for innovative and efficient products, Intelligent Energy – Europe (IEE), Final Technical Implementation Report (FR), Period covered: from 1. January 2009 to 31 December 2011

Euro Topten 2007: Monitoring of the number of the project internet websites visitors, Semester 3 (I / 2007), part of Deliverable 9, Work package 3, Web Frequentation note n.2, Prepared by SEVEn, The Energy Efficiency Center, Czech Republic

SAFE 2012: E. Bush, Schweizerische Agentur für Energieeffizienz, S.A.F.E. Zürich, B. Cabernard, Coop, Basel; Endauswertung 2011, Bonus-Programm für Bestgeräte (Förderprogramm im Rahmen der Wettbewerblichen Ausschreibungen), June 2012 (in German)

Top10 China 2011: Status Report no. 2, 1 July 2011 to 31 December 2011

Top10 China 2012: Status Report no. 4, 1 July 2012 to 31 December 2012

Top10 China 2013: Status Report no. 6, 1 July 2013 to 31 December 2013

Top10 China 2014: Status Report no. 8, 1 January 2013 to 31 December 2014

Top10 China and CLASP 2013: Market Analysis of China Energy Efficient Products (MACEEP). Topen China and CLASP 2013. Beijing.

Top10 China 2014: ZHENG Tan, YI Shui, HU Bo, HUANG Luting, WANG Tingting, ZHAO Feiyan, Eric Bush, Conrad U. Brunner, Sophie Attali, Bella Roscher, Top10 China: Status Report no. 8, 1 January to 31 December 2014

Topten CH 2012: E. Bush, B. Josephy: Topen Schweiz: Jahresbericht 2012

Topten CH 2013: E. Bush, B. Josephy: Topen Schweiz: Jahresbericht 2013

Topten global 2011: B. Roscher, Topen global annual report 2011

Topten global 2012: B. Roscher, Topen global annual report 2012

Topten global 2013: B. Roscher, Topen global annual report 2013

Topten global 2014: B. Roscher, Topen global annual report 2014

Topten USA 2015: A.A. Niederberger, S. Bauer, C. Calwell, S. Coakley, D. Lis, J. Thorne Amann Informing the Next Generation of Energy Efficiency Promotion: Learnings and Recommendations from the TopTen USA Experience (Draft, 2.6.2015)

VHK 2014: Ecodesign impact accounting. Part 1 – Status November 2013. European Commission. Brussels.

Werle et al. 2011: Rita Werle, Eric Bush, Barbara Josephy, Jürg Nipkow; Energy-efficient heat pump driers – European experiences and efforts in the USA and Canada, Topten International Services

Annex 1: Expert Interviews

Name	First name	Institution	Region	Date
Attali	Sophie	TIS and Topten France	EU	07.04.2015
Barthel	Claus	Wuppertal Institute for Climate, Environment and Energy	EU	16.04.2015
Bo	Hu	Topten China	China	12.05.2015
Bush	Eric	TIS	EU	09.04.2015
Carine	Boetsch	Coop	CH	28.05.2015
Carvalho	Laura	Quercus	EU,PT	19.05.2015
Coakley	Sue	Director, Northeast Energy Efficiency Partnerships, USA	USA	27.05.2015
De Franceschi	Peter	Procura, an ICLEI campaign on public procurement, with Topten as partner	EU	13.05.2015
Glanzmann	Sandro	Migros	CH	12.05.2015
Moser	Andreas	Migros	CH	03.06.2015
Moreno	Juan	European Commission	EU	17.06.2015
Hofstetter	Patrick	WWF Switzerland	CH	19.05.2015
Hug	Francine	Swiss embassy	China	13.05.2015
Krivosik	Juraj	Consultancy Seven =Topten Czech Republic	EU,CZ	21.05.2015
Meier	Felix	PUSCH	CH	20.05.2015
Michel	Anette	Topten CH and EU	EU,CH	26.05.2015
Nigro	Riccardo	Topten Italy	EU	22.05.2015
Nipkow	Jürgen	S.A.F.E.	EU	04.06.2015
Peterson	Jesper	Naturskyddsföreningen=Topten SE	EU,SE	26.05.2015
Sivitos	Stamatis	Senior policy officer EU Ecodesign and Energy Labelling Policies, ECOS	EU	11.05.2015
Zheng	Tan	Topten China	China	11.05.2015

Annex 2: Topten activities

Region	Name	First name	Institution	large buyers	retailers	producers	website
China							
	ZHENG	Tan	Topten China				
	BO	Hu	Topten China	+	+	+	++
	Hug	Francine	Swiss embassy				
EU-countries							
EU, PT	Carvalho	Laura	Topten Portugal	-	+	+	++
EU, IT	Nigro	Riccardo	Topten Italy	-	+	+	++
EU, CZ	KRIVOSIK	Juraj	Topten Czech Republic	-	+	+	++
EU, SE	PETERSON	Jesper	Topten Sweden	-	+	+	++
Switzerland							
	MEIER	Felix	Ex WWF				
	Michel	Anette	Topten CH and EU	++	++	+	++
USA							
	COAKLEY	Sue	Northeast Energy Efficiency Partnerships	-	+	+	++

-: no activity
 +: some activities
 ++: main focus

Qualitative evaluation of the interviews with Topten experts sorted according to geographic region.

Annex 3: Indicator matrix for policy impacts

Topic	Specification	Type of Answer
Duration that topten is actively influencing EU policy making for the		Number of years
The appliance is a focus area of topten work		Yes/No
Type of access to policy decision making	Dissemination of information (e.g. Focus newsletter, leaflets, etc.)	Yes/No
	Participation in legislative process by consultation	Yes/No
	Provision of technical inputs to ECOS	Yes/No
	Policy advocacy work (approaching decision makers individually)	Yes/No
	Developing technical groundwork that policy making was based on	Yes/No
Evidence of results from topten policy activities	Decision makers confirm that topten (or ECOS) is providing relevant and helpful information	Not true/partly true/true
	Decision makers confirm that topten (or ECOS) is directly influencing the their decisions	Not true/partly true/true
	Policy recommendations of topten are adopted 1:1 in regulatory text	Not true/partly true/true
	The regulatory text follows in what topten has recommended	Not true/partly true/true
	Regulations have not become weaker due to topten activities	Not true/partly true/true
Effectiveness of EU policy making in relation to the state of technology and market	Regulation came just in time and had clear impact on market structure	Not true/partly true/true
	Regulation came in parallel with market and/or technology shift. Impact in the longer run occurred nonetheless.	Not true/partly true/true
	No effects from regulation/labelling	Not true/partly

Annex 4: Abbreviations

BAT: Best available technology

BAU: Business As Usual

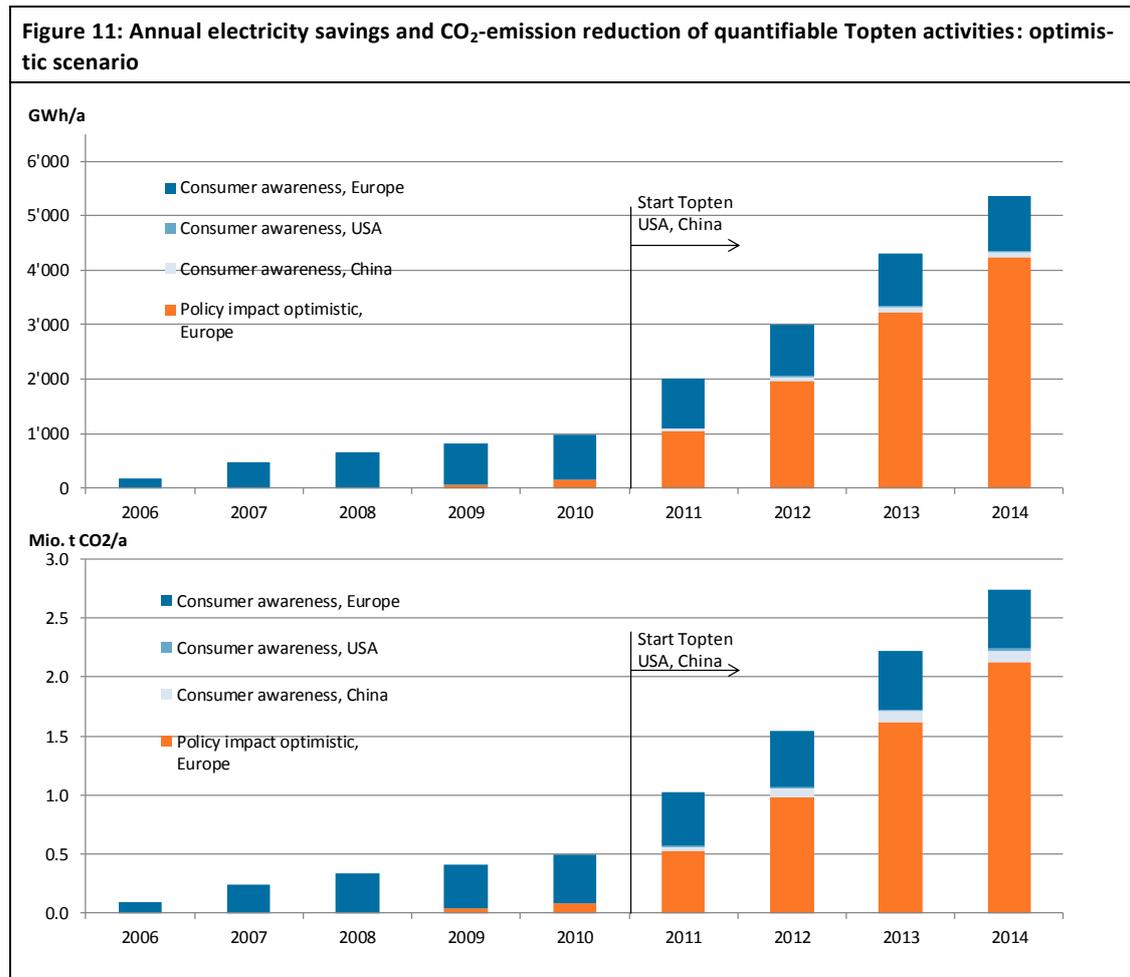
EC: European Commission

ED: Eco Design

EL: Energy Labelling

EU: European Union

Annex 5: Quantified impacts: optimistic scenario



Impacts due to activities addressed to consumers and to policy makers were assessed quantitatively. Due to a lack of quantitative data the quantitative impact assessment does not include impacts from activities addressed to large buyers, manufacturers and retailers. Additionally, also the estimation of policy impacts is limited by data availability. For example in China there is no quantitative basis to estimate policy impacts and therefore the data are to be considered as a conservative estimate of the total impact.

Annex 6: Website statistics

Table 8: Website visitor statistics						
	Europe		China		USA	
year	# visitors in millions	data source and comments	# visitors in millions	data source and comments	# visitors in millions	data source and comments
2006	1.8	Euro Topten 2007, p 1	-	-	-	-
2007	3.6	Euro Topten 2007, p 1, extrapolation based on data for January to June.	-	-	-	-
2008	2.5	interpolated between 2007 and 2009	-	-	-	-
2009	1.3	Euro Topten 2012, p.18	-	-	-	-
2010	1.5	Euro Topten 2012, p.18	-	-	-	-
2011	1.8	Euro Topten 2012, p.18	0.7	Top10 China 2011, p. 8	0.3	assumption: 2011-2012 identical to 2013
2012	1.4	EURO-TOPTEN MAX 2013, p. 12 extrapolation based on data from July to December 2012	1.2	Top10 China 2012, p. 6	0.3	assumption: 2011-2012 identical to 2013
2013	1.4	EURO-TOPTEN MAX 2013, p. 12 extrapolation based on data from January to June 2013	1.0	Top10 China 2013, p. 7	0.3	email, D. Lis 24.6.2015
2014	1.8	EURO-TOPTEN MAX 2014, p. 2	0.8	Top10 China 2014, p. 7	0.2	email, D. Lis 24.6.2015

The number of website visitors is estimated based on data provided by different annual reports of Topten. Due to changes in the software used for extracting website statistics, the numbers are to be interpreted carefully.

Annex 7: Methodological approaches

The following chapters summarize the methodological approaches used to assess the impacts from the four main areas of Topten's activities, which consist of efforts to raise consumer awareness (Annex 7.1), policy advocacy (Annex 7.2), collaboration with large buyers (Annex 7.3) as well as with retailers and producers (Annex 7.4).

Annex 7.1: Activities intended to raise consumer awareness

Topten activities intended to raise consumer awareness encompass the collection of information on the most energy-efficient appliances and the development of product recommendations for various product groups in the form of product list on the country specific and EU-wide websites as well as other media activities such as newspapers articles, social media presence and public talks. A quantitative assessment of these activities is rather difficult, since their effect on the purchasing behaviour of the consumers is in most cases difficult to assess empirically. The quantitative assessment is therefore restricted to selected aspects that allow a quantitative approach.

Impacts achieved through activities intended to raise consumer awareness are to a certain extent dependent on electricity prices, which consists of an external factor that cannot be influenced by Topten. As electricity savings result in a direct economic benefit for the consumer, the incentive to invest in a more energy-efficient product tends to rise with increasing electricity prices. The quantitative estimate is therefore to be considered as a rough estimate of the Topten impact on electricity consumption.

Annex 7.2: Policy activities

A share of electricity savings resulting from energy efficiency regulations might be attributed to policy advocacy activities by Topten that aims at influencing them (e.g. provision of information, participation in public consultations, networking), as policy making and related politics are mainly based on social interactions and networks, information availability and interpretation and vested interests. Accordingly, the quantitative assessment of impacts resulting from policy related activities is intricate. Any such activity is qualitative and indirect. There is only little robust evidence to what extent advocacy work of Topten ultimately influenced decisions by policy makers and resulting regulation text. Also a variety of external effects such as advocacy activities by others and market or technological shifts clearly influence the regulatory setting in parallel. Given the qualitative setting, information about the role and impact of Topten is best available from stakeholders and decision makers that have been involved in the decision making process of energy regulations for a long time. Thus interviews and questionnaires are the main sources for approximate estimations. The information collected usually is

not of quantitative nature. Thus additional methodologies are required to combine qualitative information with quantitative data available.

Therefore, for this assessment a combination of various methodological approaches is applied that allow for triangulation of information and data available based on expert valuation and reports. This comprehensive assessment was only conducted for Topten activities in the EU, where Topten has been active for a long time and data required is available. For China only potential future impacts from policy activities identified in studies and from interviews are quantified while Topten USA did not directly contribute to any federal standards rulemaking in the years of activity.

Table 9: Methodological approach policy impact assessment			
Methodology	Purpose	Sources	Implementation
Desk research	<ul style="list-style-type: none"> ▪ Identify and assess already existing impact assessments of relevant regulations ▪ Find reports providing information of Topten activities and impacts 	<ul style="list-style-type: none"> ▪ EU regulatory websites ▪ Topten websites 	<ul style="list-style-type: none"> ▪ Screening impact assessment commissioned by the EU ▪ Screening Topten policy recommendations and studies ▪ Screening other studies (e.g. by ecofys and VHK)
Telephone interviews	<ul style="list-style-type: none"> ▪ Inquire key stakeholders that are knowledgeable about the EU/CN policy making process and Topten activities ▪ Pin down main policy strands that Topten might have influenced ▪ Gain insight to history and range of Topten involvement ▪ Understand political-, market-, and technological context of relevant electric appliances ▪ Identify case studies that can be used as flagship activities of Topten ▪ Consider personal experiences and estimates 	<ul style="list-style-type: none"> ▪ Stakeholder list provided by WWF ▪ Persons identified during research 	<ul style="list-style-type: none"> ▪ Initial interviews with key-stakeholders from Topten to obtain background information ▪ Conducting semi-structured telephone interviews following a questionnaire with more than 20 stakeholders (30-60min, questionnaire sent in advance) ▪ Documentation of answers and processing of interview results ▪ follow-up interviews if required
Top-down impact assessment	<ul style="list-style-type: none"> ▪ Determine contribution of Topten to total electricity savings from existing energy efficiency regulations for electric appliances compared to a business as usual baseline 	<ul style="list-style-type: none"> ▪ Results from telephone interviews ▪ Impact assessment reports ▪ Answers from stakeholders to indicator question matrix 	<ul style="list-style-type: none"> ▪ Identify expected overall electricity savings from regulations for appliances that are a focus area of Topten ▪ Semi-quantitative estimate of contribution of Topten to these overall expected savings by using information from interviews and rating of activities according to an ordinal indicator matrix ▪ Consideration of technological and market shift and external effects affecting impact
Bottom-up impact assessment	<ul style="list-style-type: none"> ▪ Identify case studies and flagship activities of Topten for which comprehensive information or even robust quantitative data is available ▪ Report on the impacts from these activities 	<ul style="list-style-type: none"> ▪ Results from telephone interviews 	<ul style="list-style-type: none"> ▪ Focussed questioning about case studies and their potential impacts ▪ Use expert estimates and calculations of impacts

The methodologies applied in the top-down approach need further explanation. The concept of top-down assessment foresees two steps:

First, the overall savings from policy regulations on electric appliances in the EU between 2006 and 2014 are determined for those appliances that are also in the focus of Topten activities.

Savings are determined by comparing energy consumption of appliances under the new/revised regulation and energy consumption in a business as usual scenario (BAU). Thus only regulations are considered that actually have come into force in this period. This information is gained from the list of regulations and respective revisions available from the European Commission (EC) website²⁴. From the interviews conducted it became clear that the electricity savings from following appliances are relevant in the Topten context: televisions, laundry dryers, room air conditioners, coffee machines and refrigerators/freezers. For these appliances the following reports were screened for quantitative information about impacts from EU policy regulations (Ecodesign and Energy Labelling (ED&EL)):

- Impact assessment studies²⁵ on regulations commissioned by the EU for these appliances
- VHK Ecodesign and labelling impact assessment (VHK, 2014)
- Estimation of potential best policy impacts. Data compilation from Topten interviews.
- Further studies on electricity savings or the overall ED & EL policy framework (EC, 2014; Ecofys 2014)

For validation reasons the electricity saving results for individual appliances were compared between the studies and revealed a good match. However, most of the studies build on one source, namely the impact assessment studies by the European Commission. From this analysis the overall electricity savings from ED & EL regulations for the above mentioned electric appliances are determined by comparing them to a BAU situation.

The second step now aims at identifying the share of Topten contribution to these savings. This can only be assessed in a semi-quantitative manner, say by estimates from experts and by a semi quantitative analysis of indicators that might reflect the direct involvement of Topten in respective regulation design and implementation. Interviewees mentioned either a significant, medium, little or no contribution of Topten activities to the policy design. In order to further substantiate these statements, an indicator matrix was developed (see Annex 3). For each relevant appliance the indicators cover the following aspects:

- Presence of Topten in EC policy making forum (years) and focus areas of Topten work
- Type of access to policy decision making e.g. through information dissemination, participation in consultations, direct advocacy work with decision makers
- Evidence of results from Topten activities
- Impacts from external effects such as technological or market shifts.

²⁴ http://ec.europa.eu/growth/single-market/european-standards/harmonised-standards/ecodesign/index_en.htm

²⁵ Example for tumble dryers: https://ec.europa.eu/energy/sites/ener/files/documents/td_impact_assessment.pdf

The indicator matrix was then sent out to key stakeholders within and outside Topten, asking for their personal estimate to what extent Topten activities contributed to the policy change for each appliance. These aspects were already discussed during the interviews, in the matrix now they were presented in a structured form and interviewees were required to provide a nominal rating.

The answers were then evaluated following a scoring system. This system is subsequently explained with an example: One indicator question of the matrix states that “decision makers confirm that Topten (or ECOS) provides relevant and helpful information”. The interviewees can answer this question with “not true” (0 points), “partly true” (5 points) and “true” (10 points).

For this scoring, information about the relevance of the indicators provided in the interviews was taken into account. Thus indicators that were considered more relevant for reflecting the involvement of Topten in the policy making process were weighted more than others. For example long time presence in the political forum is considered an important asset that builds trust and fosters possibilities to influence decision makers. Also some indicators would prove direct evidence of contribution from Topten, e.g. when legislation text closely follows recommendations by Topten or where decision makers clearly confirm the significant role of Topten. Further discount factors apply where correlation with external effects, contribution effects from other stakeholders to policy outcome and technological/market shifts or delayed compliance in EU countries are expected. The percentage of points achieved of the maximal score reflects then the contribution of Topten for each electric appliance in a semi-quantitative manner.

Thirdly, this share in contribution can then be attributed to the total savings from regulations identified in step 1 of this approach. For example total savings from a regulation on tumble dryer is determined to be 10 TWh and the Topten contribution assessment resulted in 10% then 1 TWh of electricity savings could be assigned to the impacts from Topten activities. If the results from the question matrix are diverging, the range of calculated impacts is provided.

This approach is very pragmatic and must be seen as a best guess attempt for quantifying policy involvement of Topten. Methodological drawbacks are amongst others:

- Indicators do not cover all aspects that influenced the outcome of a regulation
- Indicators might leave out relevant indirect effects from Topten activities
- Ordinal assessment with three possible answers leaves no room for differentiated discussion of complex circumstances of each case
- A standardized question matrix cannot be adapted to the individual expertise and background of the interviewees

- The matrix was sent to only a very small number of stakeholders of which some are working for Topten. The approach draws largely on the personal perception of interviewees and the sincerity of their answers.

Nevertheless, we think that the estimated figures give a first idea of the order of magnitude of the quantitative impact resulting from the policy activities of Topten at the EU level.

Annex 7.3: Collaboration with large buyers

Impacts from collaboration with large buyers are rather difficult to assess globally, since the different activities across countries and across different sectors cannot easily be generalized. Depending on whether a private company or a public institution is concerned the focus can be on multifunctional devices, cooling devices, lighting or household appliances and therefore the potential electricity savings might vary substantially. Additionally, collaboration with large buyers is not a focus area in all countries.

When collaborating with large buyers, Topten usually acts as a provider of information about energy-efficient products. It is in general not known to which extent this information is influencing the purchasing decision of large buyers. Therefore, it is difficult to isolate the contribution of Topten to the achieved electricity savings.

Due to these technical challenges in the quantitative assessment of the impacts, the study at hand only quantifies electricity savings from specific case studies but does not attempt an extrapolation to the regional scale.

Annex 7.4: Collaboration with producers and retailers

Topten activities addressed to producers and retailers are rather specific and the impacts are expected to vary across countries. Even though the impacts can be estimated relatively well for a particular retailer or manufacturer, an extrapolation to the regional scale is affected by high uncertainty. Therefore, the study at hand confines the quantitative assessment to some illustrative case studies and provides only a qualitative assessment at the regional scale.