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Current situation and incentivization programs

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Abstract

Signage displays are placed in public areas and are designed to distribute information and other content to people in their immediate surroundings. Because of their broad range of possible uses, these displays are very popular and the number of installed devices has been growing over the last years as well as their associated energy consumption.

The present study provides an overview of the Signage display market, presents the existing efforts to regulate them and proposes measures for energy efficiency incentivization programs to promote energy efficient devices.

These products are still not subject to any energy efficiency requirements in European Union and in Switzerland. Although the Ecodesign Preparatory Study for Working Plan 3 recommended that they be included into the new Ecodesign Working Plan (2016-2019), signage displays do not figure on any regulatory agenda. To this day, only Energy Star has formulated energy efficiency requirements for signage displays. The European Commission announced in July 2017 that it would start a preparatory study on signage display.

The study highlights through data collected on signage display models currently on the market, the importance of consistent declared product information to be able to formulate any energy efficiency requirements.

Topten estimated that the saving potential for these devices can be up to 40% more ambitious than the power requirements that are formulated in the Energy Star Version 7.1 standard for displays. Furthermore, the requirements proposed in the draft version of the Ecodesign and Energy Label

regulation on displays are deemed satisfactory for the inclusion of signage displays in their scope. If there were any programs in place promoting the purchase of energy efficient devices, Topten estimates that the energy savings over the 8-year life of all displays purchased in 2017, could through such a program reach 123 GWh and save more than 24.5 million CHF in Switzerland only. Estimated savings for Germany amount to 580 GWh of saved energy and 170 million Euro over the lifetime of the displays purchased in 2017.

Zusammenfassung

Elektronische Anzeigetafeln sind in öffentlichen Räumen installiert und haben das Ziel, Informationen und andere Inhalte zu verteilen. Da die Anwendungen für diese Geräte vielfältig sind, kommen diese Bildschirme sehr häufig vor. Die Zahl der installierten Geräte ist in den letzten Jahren explodiert, ebenso ihr Energieverbrauch.

Die vorliegende Studie bietet eine Übersicht des Marktes für elektronische Anzeigetafeln, stellt bestehende Normen und Verordnungen für diese Geräte vor und macht Vorschläge für die Beschaffung effizienterer Geräte.

Es gibt zurzeit keine Energieeffizienzanforderungen für diese Geräte, weder in der Schweiz noch in der Europäischen Union. Obwohl die Ecodesign Working Plan 3 Vorstudie empfahl, diese Produktkategorie dem Working Plan 3 (2016-2019) beizufügen, liegen sie heute auf keinen legislativen Agenden. Bis heute hat nur Energy Star Energieeffizienzanforderungen für elektronische Anzeigetafeln formuliert. Die Europäische Union hat im Juli 2017 angekündigt, dass eine Vorstudie über diese Geräte lanciert werden soll.

Diese Studie hebt anhand der Energiedaten von elektronischen Anzeigetafeln auf dem Markt hervor, wie wichtig homogene Daten auf der Produktdeklaration für die Festlegung von Mindestenergieanforderungen sind.

Topten schätzt, dass das Ersparnispotenzial für diese Geräte um 40% höher liegt, als die Energy Star Grenzwerte, die in der Energy Star Version 7.1 für professionelle Bildschirme festgestellt wurden. Die Mindestanforderungen aus dem Entwurf der Ecodesign- und Energieetiketteverordnung, werden von Topten als befriedigend eingestuft. Sie erlauben die Inklusion von elektronischen Anzeigetafeln im Rahmen der Verordnung. Gäbe es ein Förderprogramm für die Beschaffung effizienter Geräte, so könnte, nach Meinung von Topten, bei einer Produktlebensdauer von 8 Jahren bei allen Geräten, die 2017 gekauft wurden, ein Verbrauch von 123 GWh erreicht und somit mehr als 24.5 Millionen CHF nur in der Schweiz eingespart werden. In Deutschland die Energie- und Stromkostenersparnisse belaufen sich auf 580 GWh respektive 170 Millionen Euro.

Résumé

Les écrans d'affichage dynamique sont installés dans les zones publiques et ont comme but la distribution d'informations et autres contenus aux personnes situées dans leur environnement immédiat. En raison du grand nombre de possibilités d'utilisation, ces écrans ont beaucoup de succès et c'est pour ceci que le nombre d'écran installé pendant ces dernières années a explosé, ainsi que leur consommation d'électricité.

Cette étude offre un aperçu du marché des écrans d'affichage dynamique, fait un état des lieux des règlementations et normes les concernant et propose des mesures d’encouragement pour favoriser l’achat de produits efficients.

Aujourd'hui, ces produits ne sont soumis à aucune règlementation limitant leur consommation énergétique. Bien que l'étude préparatoire Ecodesign du Working Plan 3 ait recommandé que ces produits soient inclus dans l’agenda Ecodesign (2016-2019), les écrans affichage dynamique ne sont

sur aucun agenda législatif. La Commission Européenne a tout de même annoncé en juillet 2017, qu'une étude préparatoire sera lancée sur le sujet.

Grâce à des données de consommation énergétique de modèles d'écrans d'affichage dynamique actuellement sur le marché, cette étude met en évidence l'importance d'avoir des données homogènes afin de pouvoir énoncer des critères minimums d'efficacité énergétique.

Topten estime que le potentiel d'économie d'électricité peut être jusqu'à 40% au-delà des critères minimums d'efficacité énergique formulés dans la version 7.1 du standard Energy Star pour les écrans professionnels. De plus, les critères minimums proposés dans les projets de loi pour la directive Ecodesign et l'étiquette énergétique pour écrans numériques sont considérés comme satisfaisants pour permettre l'inclusion des écrans d'affichage dynamique dans leur champ. Un programme d'encouragement financier favorisant les modèles les plus efficaces, pourrait sur la durée de vie de huit ans de tous les écrans achetés en 2017, aboutir à une économie de 123 GWh d'électricité et économiser plus de 24.5 millions CHF Suisse uniquement. En Allemagne, il est estimé que ces mesures pourraient économiser 580 GWh soit 170 millions d'euros.

Riassunto

Gli schermi di segnaletica digitale sono collocati nei luoghi pubblici e hanno il ruolo di distribuire informazioni ed altri contenuti alle persone nelle loro vicinanze. A causa delle molteplici possibilità di utilizzo, questi schermi hanno molto successo e negli ultimi anni il numero di schermi installati è esploso e parallelamente il loro consumo energetico.

Questo studio fornisce un'idea generale del mercato degli schermi di segnaletica digitale, fa il punto sulle norme e la regolamentazione, e propone delle misure d'incentivazione per sostenere l'acquisto di prodotti efficienti.

Al momento attuale questi prodotti non sono sottomessi a nessuna regolamentazione che limiti il loro consumo energetico. Benché lo studio preparatorio Ecodesign per il Working Plan 3 abbia raccomandato che gli schermi di segnaletica digitale siano inclusi nell'agenda Ecodesign (2016-2019), questi prodotti non sono presi in considerazione in nessun programma di regolamentazione. La Commissione Europea ha annunciato nel luglio 2017 che verrà lanciato uno studio preparatorio su questo tema.

Grazie ai dati raccolti sul consumo energetico di modelli di schermi di segnaletica digitale ora sul mercato, questo studio mette in rilievo l'importanza di avere dati omogenei per potere formulare dei criteri minimi di efficienza energetica.

Topten stima che il potenziale di risparmio energetico possa superare del 40% i criteri minimi di efficienza energetica formulati nella versione 7.1 dello standard Energy Star per gli schermi professionali. Inoltre i criteri proposti nella bozza di regolamentazione Ecodesign e dell'etichetta energetica della Commissione Europea sono considerati soddisfacenti, permettendo l'inclusione degli schermi di segnaletica digitale nel loro campo. Un programma di sostegno finanziario che favorisca i modelli più efficienti potrebbe risultare, sulla durata di vita di otto anni di tutti gli apparecchi comperarti nel 2017, in un risparmio energetico di 123 GWh e permettere di risparmiare più di 24.5 milioni CHF solo in Svizzera. In Germania si stima che queste misure permetterebbero di risparmiare 580 GWh, cioè 170 milioni di euro.

1 Introduction

Signage displays are placed in public areas and are designed to distribute information and other content to people in their immediate surroundings. Among the large variety of uses for these electronic displays, the most common are for advertising (indoor or outdoor) and communication of up-to-date information.

With digitalization as their underlying trend, these displays have grown rapidly in the recent years and are becoming ubiquitous. Still unregulated within the European Union, these devices can operate up to 24 hours a day and consequently consume great quantities of energy.

This study will focus on signage displays in Europe and use the Swiss market as an example. After a short presentation of signage display technologies, the study gives an overview of the signage display market (Chapter 2) and existing regulation efforts (Chapter 3). Using existing product declarations and Energy Star data of displays available in Switzerland, the study will assess in Chapter 4 the accuracy of the product declaration and the performance of signage displays if they were to be included in the scope of the upcoming revision on electronic displays. Based on a stock model, Chapter 5 will assess the energy saving potential in Switzerland and Chapter 6 propose initial measures and selection criteria for purchasing of efficient signage displays.

2 Current situation and market

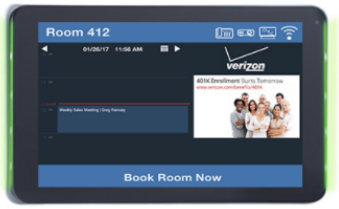
Because there exist many different types of signage displays, it is difficult to determine one clear encompassing definition for this product group. For most displays, the technology is usually a LCD screen with a LED backlight. The direct LED technology is developing fast and will lead to strong energy efficiency gains when put on the market.

Initially used to communicate simple messages through simple LED displays combining individual LEDs to form a picture, these displays are today more evolved and transmit all types of content for advertising, transportation, they are also present in schools, meeting rooms, hotels, stores and in many other locations. In advertising, video content is preferred to images as it is more efficient in attracting the attention of passers-by. Many displays include a wireless internet connection or are connected to a media player with wireless connection so that the projection of information can be performed from one central location and the content immediately updated. This technology is very interesting for advertisers as opposed to paper posters, as it drastically reduces staff costs.

Screen sizes vary from several inches in diagonal to screens over 100”. The size of signage displays is continuously increasing: while a few years ago a 42” screen was considered large, screens over 90” are now commonplace. For even larger display surfaces, it is possible to assemble screens together and create a screen mosaic. This is possible by using videowalls or conventional signage displays with thin bezels. The content is then displayed on the entire surface by the means of a media player or computer installed in the background. In recent years, smaller screens (< 32”) have gained relevance and offer many new opportunities for signage display providers.

Source: Coop

Source: Media Markt Group



Source: Visix

The Swiss retailer, Coop, has announced that all its 856 stores will be equipped with electronic shelf labels (ESL). An average-sized store requires approximatively 15'000 labels[1].	Over 1'000 Media Markt and Saturn stores across Europe rolled out over 10 million ESLs displaying product information and price[2].	Displays for meeting room management.

Figure 1: Examples of uses of small signage displays

In addition to displaying content, some displays may include additional features such as internal computers, touch screen technology or be integrated into other devices such as transparent displays. Furthermore, depending on where the display is situated, the luminance of the display needs to be sufficiently powerful to offset the light from the outside environment. According to stakeholders working in the field, the maximum luminance of most installed displays ranges from 500 to 800 cd/m^2 for indoor displays and 2'500 to 5'000 cd/m^2 for outdoor displays.

[1] https://www.blick.ch/news/wirtschaft/elektronische-preisschilder-markt-atmosphaere-wifi-coop-lueftet-geheimnis-um-das-neue-ladenkonzept-id5888652.html
[2] http://www.cetoday.ch/news/2017-02-24/10-millionen-elektronische-preisschilder-fuer-media-saturn

Public Displays	Videowall	Outdoor display
 Source: Topten	 Source: Tucana Global Technology	 Source: VDF Signage
Electronic displays can be used for any purpose. The bezel of these screens is continuously getting slimmer to be used as modules for videowalls.	Modular screens with super-narrow no bezel connected to each other for large display surfaces.	Characterized by a very high maximum luminance, these displays are intended for outside use.

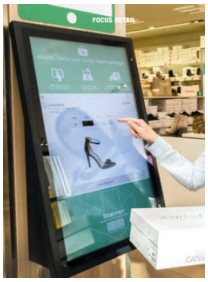
Touch Displays	Transparent Displays	LED Tiles
 Source: Invidis	 Source: Topten	 Source: stage.lv
Interactive screens with integrated software and computer processor.	Integrated into other devices but also standalone, these screens are completely see-through when content is not being displayed.	Dot-matrix displays where each pixel is a LED. Are used for very large displays surfaces such as stage lighting, stadiums.

Figure 2: Examples of existing signage displays and their uses

According to the Energy Star product specification for Professional Displays, there are two types of displays that differ in lifespan. The first category are displays with a lifespan of approximatively 50’000 hours. The other type of displays has a lifespan of over 100’000 hours and are intended to function 24/7. These displays are more expensive, have better contrast ratios and are brighter. The Working Plan 3 Preparatory Study (WP 3) estimates that despite the technical lifetime potential, the actual lifetime may in many cases be much shorter because of frequent refurbishment or changes in location. In these cases, the displays are mostly replaced with new ones and not reused. The study team estimates that the lifespan of these devices is closer to 5 years.

2.1 Market and segmentation

The market for signage displays has been growing steadily across Europe, the Middle East and Africa (EMEA) with approximatively 800'000 displays sold in 2016, which represents an increase of 12% in comparison to the previous year[3]. The market of the DACH region (Germany, Austria and Switzerland) represents 18% of the EMEA market, with a 2015/2016 growth rate of more than 10%.

The market for signage displays is valued at 1'117 million EUR in the DACH Region in 2016. The Digital Signage Market comprises the different service providers that are directly involved in the digital signage space (i.e. software development, planning and installation, content development).

Year	Displays	Integrators	Software	DooH	Media Player	Others	Total
2009	106	112	15	67	15	15	330
2010	100	135	18	96	19	21	389
2011	132	174	21	117	26	26	496
2012	157	186	24	145	30	31	573
2013	183	210	30	168	39	36	666
2014	190	235	35	218	44	40	762
2015	220	276	49	286	49	50	920
2016	250	345	56	353	55	58	1'117

Table 1: Digital Signage market revenues in the DACH Region (Germany, Austria and Switzerland) from 2009 to 2016 in million Euro. Invidis (2017).

The demand for signage displays continues to grow and a large portion of that demand is for larger screens that will be replacing video walls. However, the trend for UHD displays is not increasing despite the efforts of manufacturers to push these products on the market (Invidis, 2016). A possible reason for the weak demand may be the high costs associated with the development of UHD content for these displays.

2.2 Market players

With the increasing use of signage displays, there has been the emergence of specialized service providers working solely in the Digital Signage industry:

- Integrators:
  The installation of a display is a complex project that requires professional planning and panel installation by integrators. Integrators propose display solutions to their customer and choose what displays shall be used for a given project. Some full-service integrators also develop the content that will be presented onto the display.
- Software providers:
  Software for signage displays are used by signage display operators to manage content. The software is also used in interactive displays such as touch screen displays.
- DooH (Digital Out Of Home):

[3] Invidis (2016), Digital Signage and DOOH Yearbook 2017/2018, p. 8

The DooH market represent the providers and marketers of advertising surfaces that use digital displays as their advertisement platform.

- Media Player providers:
  The physical devices that play the content of the signage display without having to use a computer. Media players among other things, allow content to be displayed in high resolution formats and on mosaic displays.

According to the Invidis 2016-2017 Annual Yearbook, the main integrators in Switzerland according to their revenues are:

- JLS Digital
- Kilchenmann
- ScreenFOODnet
- Invertag
- Westiform Holding

Invidis also provides a list of the largest providers of DooH (Digital out of home, DOOH) screens for advertising (Appendix 1):

- Interdiscount/Coop 6'179 displays
- Media Saturn Holding 5'420 displays
- Migros-Genossenschafts-Bund 4'284 displays
- PassengerTV AG 4'092 displays
- APG|SGA 1'040 displays
- TPG Publicité (Geneva public transit) 960 displays
- Gasstationtv AG 710 displays

The market for the actual displays is very concentrated with only a few manufacturers producing almost all displays. According to Invidis (2017), the ten biggest manufacturers cover 94% of the market (Table 2).

Company	Market share in %
Samsung Electronics	43.0
NEC Displays	18.0
LG Electronics	16.0
Philips Professional Display Solutions	4.5
Data Modul Weikersheim	3.5
Sharp Electronics	3.5
Panasonic	2.5
Ilyama	1.0
BenQ	1.0
Toshiba	1.0
Other	6.0

Table 2: Vendors of Professional Display in Germany, Austria and Switzerland by 2015 revenues, Invidis 2017

3 Existing Policies or regulation

Currently, there are no energy efficiency requirements for signage displays in the European Union and in Switzerland. Although these devices are very similar to televisions and the WP 3 Study states that the technological options for improving the energy efficiency of the product are identical than those for televisions, these devices are still unregulated.

3.1 Regulation of Signage Displays in the Europe

The WP 3 Study identified signage displays as a product category where Ecodesign requirements would be feasible, yield strong energy savings and would not negatively impact the industrial competitiveness. The WP 3 study team recommended for this product group amongst other measures to establish 1) Minimum energy efficiency requirements, 2) an Energy Label.

The Ecodesign Working Plan stated that signage displays would “be taken up in the ongoing work on the revision of the existing implementing Ecodesign measures for televisions”[4], therefore not including them onto the product list of upcoming product categories pending for regulation. It was planned that the regulation for televisions would extend its scope to all electronic displays, therefore permitting the inclusion of signage displays into the scope. Despite the announcement in the Ecodesign Working Plan, signage displays were removed from the scope of the energy efficiency requirements in the upcoming electronic display regulation. The reason for this exemption was that these displays were technically different and have “distinct characteristics”[5] (long operating hours, broad viewing angles, outdoor use).

In the end, these devices were not included in any regulatory framework and will not be subject to any regulations for the next years, even though strong potential energy savings were identified.

[4] Ecodesign Working Plan 2016-2019, November 2016, p.8.
[5] Explanatory Notes to the consultation forum: Possible Ecodesign and Energy Labelling requirements for electronic displays, p.5

Considering the gap, the European Commission announced during the Consultation Forum for electronic displays in July 2017, that a preparatory study would be initiated for these products.

3.2 Existing legislation and labels

3.2.1 Revision of the regulation for electronic display

The scope of regulation 642/2008 was during the revision extended to electronic display. Currently, the scope of the revision comprises televisions and computer monitors. All other displays were exempted from the regulation.

To define the Minimum Energy Performance Standards (MEPS), the Ecodesign draft proposes a new equation that applies to all display types. The equation includes a tangent formula that flattens out as the screen size increases, therefore avoiding the advantage that larger screens had over smaller ones in the previous regulation.

Equation 1: Proposed Ecodesign formula for electronic displays

$$EEI = \frac{(P_{measured} + 1)}{3 \times \left[90 \times \tanh\left(0.02 + 0.004 \times (A - 11)\right) + 4\right] + 3)}$$

$$A = Viewable\ display\ surface\ in\ dm^2$$

In this equation, only one variable is required to determine the minimum energy requirement. The energy efficiency index (EEI) is a function of each product's "$P_{measured}$" and "A". The maximum EEI allowed varies according to the implementation Tier and the display resolution (HD or UHD).

3.2.2 Energy Star

In the Energy Star program, signage displays are classified as Professional displays and are included in the Energy Star Version 7.1 standard for displays introduced on July 1st, 2016. According to Energy Star, a signage display is characterized by the following:

"An Electronic Display intended for multiple people to view in non-desk based environments, such as retail or department stores, restaurants, museums, hotels, outdoor venues, airports, conference rooms or classrooms. For the purposes of this specification, a Display shall be classified as a Signage Display if it meets two or more criteria listed below:
(1) Diagonal screen size is greater than 30 inches;
(2) Maximum Reported Luminance is greater than 400 candelas per square meter;
(3) Pixel density is less than or equal to 5,000 pixels per square inch; or
(4) Ships without a mounting stand. " [6]

For screens with a diagonal smaller than 30 inches, the requirements for televisions apply. These requirements are also more stringent.

Equation 2: Energy Star threshold formula for professional displays according to Version 7.1 of the Energy Star requirements for displays.

$$P_{\mathrm{ON_{MAX}}} = (4.0 \times 10^{-5} \times \ell \times A) + 119 * \tanh(0.0008 \times (A - 200) + 0.11) + 6$$

[6] ENERGY STAR Program Requirements for Displays Version 7.1 (2016)

$$\ell = Maximum\ Measured\ Luminance\ of\ the\ display\ in\ candela$$
$$A = Viewable\ screen\ area\ in\ square\ inches$$

The Energy Star requirements for displays uses a tangent function to determine the maximum power consumption threshold curve with maximum display luminance in candela per square meter and screen area in square inches as variables. The tangent curve flattens out as the screen size increases, making the requirements stronger for larger screens. However, when it reaches approximatively 2'100 square inches (70" display approximatively), the power consumption threshold curve thereafter steepens and the requirements are more favorable for larger displays (Figure 3).

Also, having two variables in the equation may be challenging as it makes comparison among signage displays more difficult: Displays need to have the same maximum luminance and surface to be directly compared with one another.

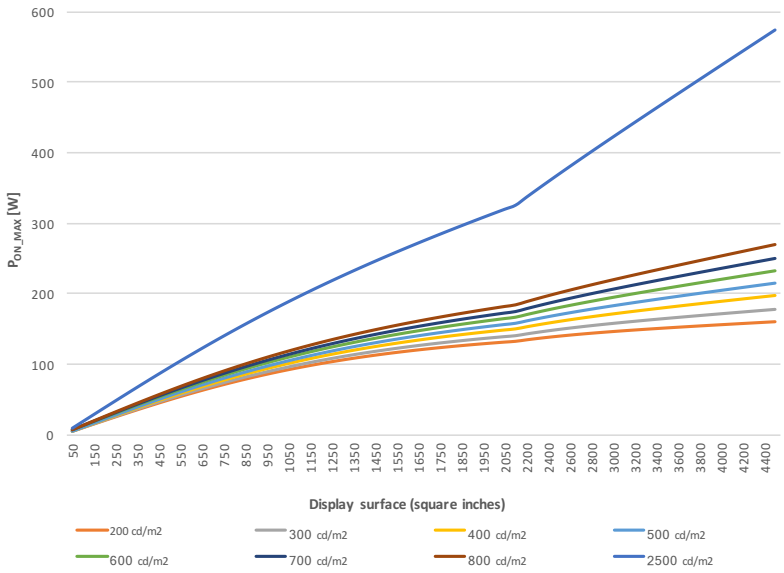


Figure 3: Energy Star threshold curves for fixed maximum luminance values (ℓ) and varying screen sizes

The on-mode power consumption is measured according to the same IEC measurement method as for televisions using a dynamic video test loop[7]. For both displays with Automatic Brightness Control (ABC) enabled or disabled when shipped, the picture level shall be adjusted:

"For Signage Displays, the product shall be tested with luminance set at a value greater than or equal to 65% of the manufacturer-reported maximum luminance (LMax_Reported). Luminance values shall be measured as per Section 6.2. This luminance value LOn shall be recorded".[8]

3.2.3 TCO Certified Label

Signage displays can receive the certification from TCO development[9]. To fulfill the energy consumption requirement, the display must comply with the latest Energy Star requirement for displays. In addition to the energy consumption requirements, displays need to comply with an extensive range of criteria covering ergonomics, electric and magnetic fields, noise, electrical safety,

[7] IEC 62087:2011 Section 11.6.1 "Measurement using dynamic broadcast-content video signal", https://webstore.iec.ch/publication/6448
[8] ENERGY STAR Program Requirements for Displays Version 7.1 (2016), p.11.
[9] http://tcocertified.com/

energy consumption, hazardous substances, lifetime, recyclability, and packaging along with Corporate Social Responsibility[10].

3.2.4 State of California

In the Californian standard for televisions that was adopted in 2009, signage displays with a display area up to 1'400 square inches (approximatively 57" diagonal) were included as "television monitors"[11]. Because of the ambiguous definition, it was not clear to some manufacturers if their products were covered by the 2009 television regulation. In 2012, the California Energy Commissions launched a rulemaking process for monitors, computers and signage displays to consider standards, test procedures, labelling requirements, and other efficiency measures to include into the State's "Appliance Efficiency Regulations". In the most recent proposal (Singh et al., 2016), the California Energy Commission reformulates the definition of signage displays, removing the previous uncertainty on the scope and uses the same linear function to set the minimum power requirements from the previous version of the regulation. In this proposal, displays with surfaces higher than 1'400 square inches remain unregulated even though demand for screens with diagonals broader than 57" is already high and is increasing.

4 Power consumption Analysis

4.1 Availability of the data

While the chapter on signage displays includes in the WP 3 study indicative power consumption for different types of displays, the data is not sufficient to be able to have a grasp on the state of the market. This is mainly because a measurement method for signage displays and information requirements have yet to be defined.

The Energy Star database on the other hand, provides consistent data for all devices that are certified Energy Star. For these devices, the power consumption was measured according to the measurement method defined by Energy Star, where the screen luminance is set at minimum 65% of the maximum luminance.

The data is available on the Energy Star website and was used as a basis to analyze signage displays available in Switzerland. The database contains other useful information such as maximum luminance, model features and product availability per country or region.

4.2 Declared Product Information

We collected data from over 250 models of signage displays available in Switzerland. The information on each model included the declared power consumption, screen diagonal, screen resolution and maximum brightness.

The displays were classified into the following categories according to their functionalities:

a. Video Walls
b. Public Signage
c. Touch Display

[10] TCO Development, TCO Certified Display 7.0 (2015).
[11] According to the 2015 Appliance Regulation of the California Energy Commission, (p.81) a "television monitor" means a TV that does not have an internal tuner/receiver or playback device.

d. Outdoor display

Some product declarations were accompanied by a tag qualifying the declared energy consumption. Some models referred in their product declaration to a measurement method (i.e. measurement method used for the Energy Star program), some displays provided a range and in some cases other models declared the energy consumption as “typical”, “eco” or “maximum”. The tags “typical” and “eco” were not defined and therefore it was not possible to know to what settings they refer to. Since signage displays need to be bright to attract attention, it is possible that the typical consumption refers to a display use with a high set luminance but this cannot be confirmed.

The variety of declarations is confusing for consumers and does not provide any indication on the true energy consumption of the product.

4.3 Product matching with Energy Star values

To understand the extent of the gap in energy consumption declaration, we matched the products that were in the Energy Star product database with the models that were sold in Switzerland and compared the difference in between the product declaration and the measured Energy Star values[12].

The cross-referencing exercise showed that there is no consistency in between the declared values and the measured values of the Energy Star products. We also found that there is no consistency in between models of one same brand (Table 3). It is therefore impossible to use declared values to assess the energy efficiency of displays.

[12] The Energy Star data set shows the countries in which a display is available.

Brand Name	Model	Declared Value [W]	Energy Star Value [W]	% Variation
LG	32SL5B	65	41	58%
LG	43SL5B	65	53	23%
LG	43SM3C-B	85	66	28%
LG	49SE3KB-B	65	60	8%
LG	49SL5B	75	66	14%
LG	55VM5B	220	105	110%
LG	65SE3B-B	95	87	9%
LG	65UH5C-B	134	114	17%
Philips	49BDL4050D	67	55	22%
Philips	55BDL4050D	76	64	19%
Philips	65BDL3000Q	176	122	44%
Philips	65BDL3010T	176	131	34%
Philips	65BDL4050D	103	97	6%
Philips	BDL4270EL	90	76	18%
Philips	BDL4777XL	86	101	-15%
Philips	BDL4988XL	110	92	20%
Philips	BDL5570EL	120	109	10%
Samsung	ED65E	253	123	106%
Samsung	PH55F	187	124	51%
Samsung	QM49F	154	89	73%
Samsung	QM55F	165	102	62%
Samsung	UH46F5	132	89	48%

Table 3: Overview of variations in between the declared energy consumption and the measured Energy Star power consumption for three large manufacturers of signage displays

4.3.1 Validity of Energy Star data

The Energy Star dataset is the only set of data that is available on signage displays with consistent information on energy consumption. A key question is whether the 65% luminance minimum setting is appropriate for the energy consumption measurement. Since signage displays are mostly installed by integrators or by professional installers, it is safe to assume that the luminance setting does not correspond to the out of the box default settings but it is tuned by the installer. This was confirmed during the interview with an integrator. Also, according to the interviewed integrator, the 65% luminance setting is an appropriate average value for the luminance setting. This statement confirms that the 65% luminance level can be used in the energy efficiency assessment of signage displays.

4.4 Comparison with the Ecodesign draft for electronic Displays

In the Ecodesign draft for electronic displays, the peak luminance ratio for televisions and monitors shall not be less than 65% of the peak luminance of the brightest on mode condition. Therefore, when measured, the luminance setting of the displays is set at a minimum of 65% of the total luminance. The IEC 62087 measurement method is used for both the Energy Star program and televisions in the EU. Both require the use of a dynamic video loop. The minimum prescribed luminance of 65% and dynamic video loop allow a one-to-one comparison of the Energy Star data with the proposed MEPS curves of the electronic display Ecodesign draft.

The data shows that already today, a fair share of existing displays perform very well even if they don't have to comply with any regulation and even reach in some cases the HD Tier 2 threshold (Figure 4). The positive results confirm that these displays could already be included in the upcoming revision for

electronic displays. If this isn't the case, then measures should be taken to promote low consuming displays.

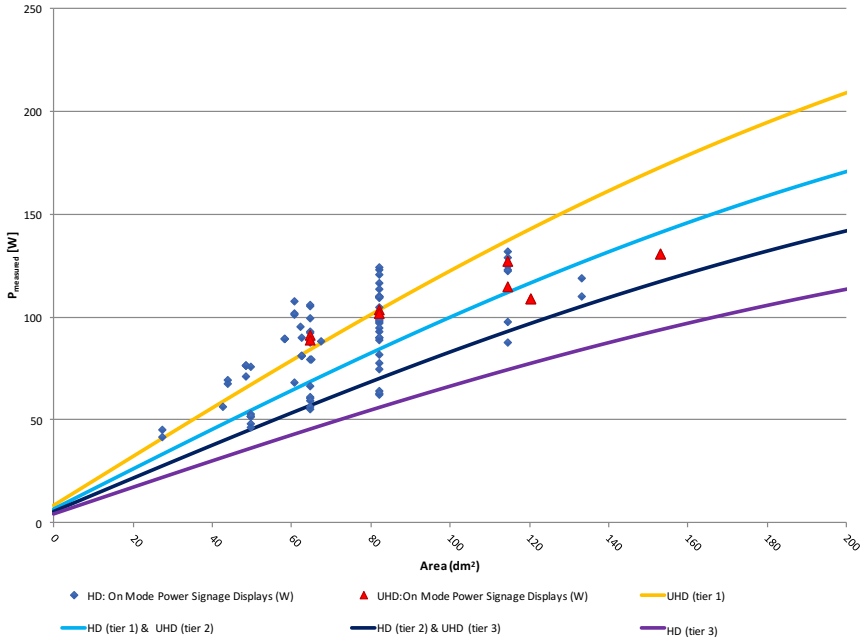


Figure 4: Energy Star Displays applied to the proposed electronic display Ecodesign MEPS

Signage displays also perform quite well when plotted against the proposed Energy Label classes with some displays reaching the E class without any regulatory push (Figure 5).

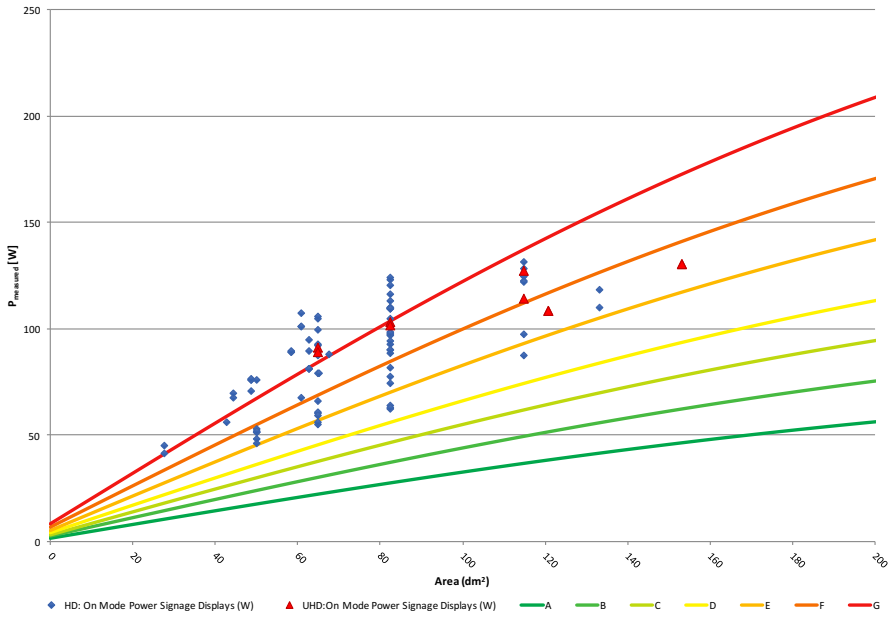


Figure 5: Energy Star signage display models against the energy classes of the draft regulation on electronic displays

When plotting the energy consumption of the displays that are available in Switzerland using declared information, the variation in energy consumption is much broader (Figure 6). Even if the declared information cannot be used to compare displays with one another, it does show that some displays can consume vast amounts of energy, therefore making it important to choose energy efficient displays.

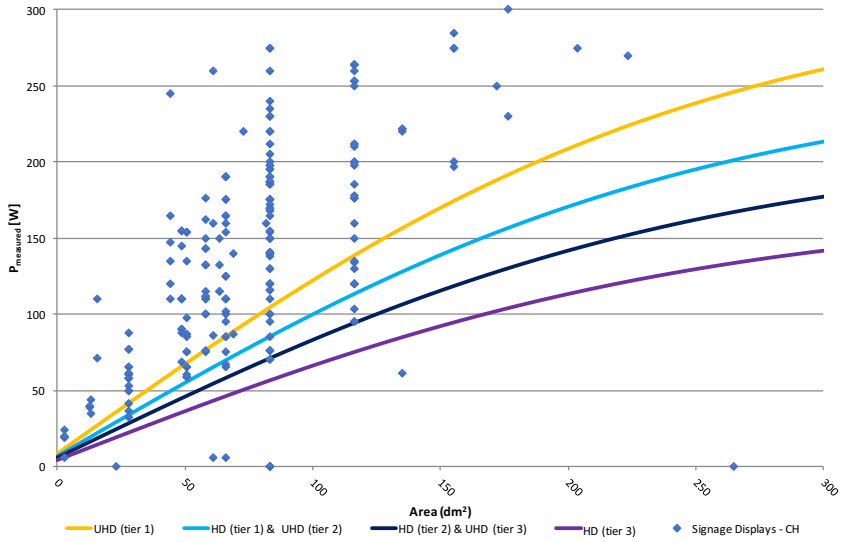


Figure 6: Distribution of displays sold in Switzerland according to manufacturer declaration

Since maximum luminance is a key criterion when purchasing a screen and since the Ecodesign equation does not factor in the maximum luminance of the screen, we verified if screens with higher luminance are disfavored by equations using only the surface as sole variable. To verify how energy consumption is influenced by the difference in maximum luminance, we analyzed the relation between luminance and energy consumption for one popular display size: the 55" screen. The results in Figure 7 show that although there is a positive correlation between screen luminance and power consumption, the energy consumption within one maximum luminance category varies greatly from one model to the other. In each luminance category, efficiency improvements can be expected.

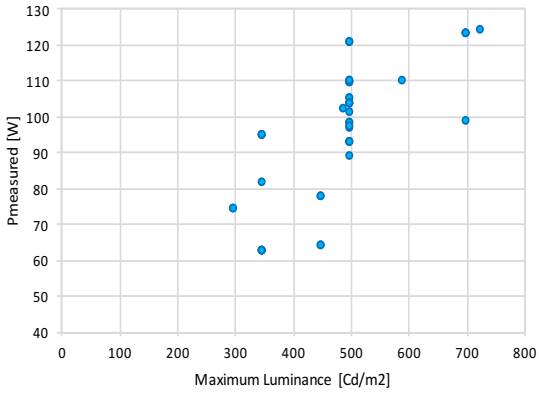


Figure 7: Power consumption of 55" displays for different maximum luminance levels, Energy Star 2017

The Energy Star model database does not include sufficient displays that are intended for outside use where the maximum luminance is particularly high (up to 5'000 cd/m^2). At the time of writing this report, only one outdoor display (maximum luminance of 3'000 cd/m^2) was Energy Star certified. Due to the lack of information, outdoor displays could be tackled separately.

5 Energy consumption and saving potential

5.1 Swiss stock estimate

The Swiss stock of signage displays was estimated using data from the 2017-2018 Invidis Annual Yearbook. Because signage display must be installed by professional installers, it was assumed that integrator revenues for each DACH regions represented an accurate proxy to assess the share of all displays sold in the DACH region that are destined for the Swiss market.

Country	High estimate of revenues of integrators in million EUR	Share
Germany	277.5	75%
Switzerland	64	17%
Austria	28	8%
Total DACH region	369.5	100%

Table 4: Share of integrator revenues per country in the DACH Region

Based on the Swiss share of integrator revenues, we determined what share of display revenues is allocated to Switzerland. With the revenues covering the years 2009 to 2016, we extrapolated the revenues for 2017.

Using a sample of current display prices, we calculated the price per dm^2. This amount subsequently allowed us to calculate the amount of new display surface added in 2017.

To determine the amount of new displays added every year, we used the assumptions that were put forward in the WP 3 study to calculate the stock where they assumed that the average display was a 42" diagonal screen. Other assumptions from the WP 3 study pertaining to the stock were also included as they seem to be realistic (16 hours operating time per day, 365 days per year). In the study, product life has a 5-year operation time and after that 20% of the screens reach their end of life each following year. For the sake of simplicity, we assume 8 years.

Based on the model, revenues for Switzerland from signage displays reach approximatively 48 million CHF in 2017. According to the set assumptions, slightly more than 17'800 displays are added in 2017.

We assume that a typical display consumes 30% more than the Energy Star threshold and that for a 42" display there is a 40% improvement potential, we estimated the energy savings over the lifetime of one display and over all displays that were purchased in 2017. The 40% improvement potential was determined empirically by using the Energy Star product database. It still leaves a sufficiently wide range of choices of signage display models to select from.

	per year	over 4 years	over 8 years
Typical display consumption [kWh]	681	2'722	5'444
Efficient display consumption [kWh]	314	1'256	2'513
Energy savings [kWh]	366	1'466	2'931
Cost savings [CHF]	73	293	586

Table 5: Energy saving potential of one display over its lifetime (8 years)

	per year	over 4 years	over 8 years
Typical display consumption [kWh]	28'800'000	115'100'000	230'200'000
Efficient display consumption [kWh]	13'300'000	53'100'000	106'200'000
Energy savings [kWh]	15'500'000	62'000'000	124'000'000
Cost savings [CHF]	3'100'000	12'400'000	24'800'000

Table 6: Energy saving potential of all displays bought in 2017 over their lifetime in Switzerland (8 years)

Applying the same assumptions to the German market, 198'500 displays are sold in 2017. The energy saving over the lifetime of the purchased signage displays purchased:

	per year	over 4 years	over 8 years
Typical display consumption [kWh]	135'100'000	540'200'000	1'080'000'000
Efficient display consumption [kWh]	62'300'000	249'300'000	499'000'000
Energy savings [kWh]	72'700'000	290'900'000	582'000'000
Cost savings [EUR]	21'200'000	84'800'000	170'000'000

Table 7: Energy saving potential of all displays bought in 2017 over their lifetime in Germany (8 years)[13]

6 Conclusions and Suggested Measures

6.1 Scope definition of Signage Displays in the EU regulation

In addition to their display function, signage displays offer additional features such as internal computers, touch screen technology that might affect their energy performance. Some products might be penalized by a general power requirements, however this is also the case for televisions as they increasingly contain additional features that impact the general power consumption. "Smart" televisions for instance contain internal processors, hard disks and wireless internet to perform their software updates among other things. Despite this, these televisions are still in the scope of the electronic display regulation and therefore it is hard to justify why signage displays shall be considered as a separate product category.

[13] The average cost of electricity in Germany is 29.16 cts/kWh§. https://1-stromvergleich.com/strom-report/strompreis/

6.2 Minumum Energy Performance requirements

In this study, we used the Energy Star product specification criteria and energy consumption data as a reference because no other consistent and reliable data was available elsewhere.

Since there still is room for improvement in the Energy Star Standard for signage displays, if the European Commission decides to take over the Energy Star product requirements, it should add a correction to ensure that large screen sizes are not allowed to have high energy consumption requirements as is now the case (Figure 3).

The results in Figure 4 and Figure 5 showed that the current proposed formula for electronic displays is an appropriate solution to set the power requirements for signage displays. As the initial ambition of the regulation was to incorporate all electronic displays, the equation was developed for such a scope and is considered satisfactory. The Commission could consider including a correction factor for displays with a high maximum luminance (outdoor displays).

Before any step can be taken towards setting MEPS for signage displays, there must be a uniform product declaration. In the comments following the Consultation Forum on electronic displays in July 2017, Topten proposed to include information requirements for signage display in the regulation for electronic displays.

6.3 Energy Label

Topten deems the label for electronic displays suitable for signage displays as well. Figure 5 shows that already today some displays have reached the proposed E Class without any regulation incentivizing any energy efficiency improvement measures. If these displays were to be regulated, manufacturers would have enough time to make improvements to their products so that signage displays reach even higher label classes. The proposal made by the Commission is a straightforward foundation that permits the inclusion of signage display.

If the Energy Label were to use the Energy Star requirements, the resulting label would be very confusing as every display would need to comply with different threshold values determined by their maximum luminance and display surface. The proposal of the Commission is more straightforward and should be chosen going forward.

6.4 Incentivization programs

To promote the sale of more efficient displays, an incentivization program would help promote more efficient models and could achieve substantial energy savings. As the growth for these products will continue, the program would prevent high energy consuming products from getting onto the market.

To incentive purchases of efficient devices, a program such as the Swiss Prokilowatt program together with a Topten product list would be a useful tool. Topten, a project financed by the Horizon 2020 program, also recommends that these measures, are implementable on the short-term and should be established across Europe.

6.4.1 Selection criteria

The selection criteria for such a program could be based on the Energy Star product specification equation for professional displays (Equation 2) that considers display surface area and screen maximum luminance. The threshold of the incentivization program should be higher than the one of the Energy Star. For screens under 35”, the program threshold shall be 25% higher than Energy Star.

For screens over 35”, 40% higher (Table 8). The Energy Star formula is more severe for smaller size displays, hence the threshold for smaller displays is higher.

Display size	Additional threshold
≤ 35” diagonal	25%
> 35” diagonal	40%

Table 8: Incentivization program requirements based on the Energy Star threshold

Outdoor displays should be included in such a program as soon as there exists more information on their consumption. With such scarce information on energy consumption on these devices, it is not yet possible to determine appropriate selection criteria.

6.5 Further research and measurement projects

There are still many unknowns on the energy consumption of signage displays. We would recommend further research on the topic and notably testing of actual displays. Because these devices are intended to attract attention, their luminance could very likely be often set to the maximum. Energy consumption at that level of luminance should be further investigated. Furthermore, through a set of expert interviews and measures, the relevance of Automatic Brightness Control should be investigated to understand how much this feature is used in the field.

The product testing would help also determine the impact on the energy consumption of additional integrated features of signage displays and would establish if signage displays should be considered as a separate product category.

Finally, additional research should include some measurements of outdoor displays and LED tiles as the absolute energy consumption is very high and information on these displays is scarce.

The expected growth of these devices is high and will not diminish as over the last years, there has been a continuing shift towards digital platforms. It is therefore crucial to tackle this issue before vast quantities of energy-hungry devices reach the market.

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8 Appendix

Appendix 1 Top 30 Digital out of Home Networks 2017 – Switzerland

Networks	Owner	Marketer	Category	Locations	Displays
Interdiscount	Interdiscount/Div.v.Coop	Goldbach Media, Mediabox	Retail	189	6179
Media Markt	Media Saturn Holding	Goldbach Media, Mediabox	Retail	27	5420
melTV	Migros-Genossenschafts-Bund	Goldbach Media, Mediabox	Retail	102	4284
passengertv	passengertv AG	passengertv AG	Transport	2454	4092
Canal TPG	TPG Publicité	TPG Publicité, Goldbach Media, Mediabox	Transport	1	960
gasstationtv	gasstationtv AG	passengertv AG	Pump Stations	110	710
Neo Advertising Digital Shopping Media	Neo Advertising	Neo Advertising, Mediabox	Shopping Mall	54	686
APG|SGA TrafficMediaScreen	APG|SGA	APG|SGA	Transport	6	665
City Kanal Basel	Moving Media Basel	Goldbach Media, Mediabox	Transport	400	550
Healthcare & Beauty Channel	Excom Media	Excom Media	Healthcare	490	500
Adscreen Kinofoyer	WerbeWeischer Schweiz	WerbeWeischer	Leisure	55	433
CanalPoste	Die Schweizerische Post	Die Post, Goldbach Media, Mediabox	Retail	260	420
Tamoil Zapfsäulen und Shops	Tamoil	Goldbach Media, Mediabox	Pump Stations	48	271
Neo Advertising CoopPronto TV	Neo Advertising	Neo Advertising, Mediabox	Retail	223	223
Clear Channel Play Zurich Airport	Clear Channel	Clear Channel	Transport	7	212
kkiosk	Valora Schweiz AG	Goldbach Media, Mediabox	Retail	91	182
APG|SGA Shopping ePanel	APG|SGA	APG|SGA	Shopping Mall	25	164
Amscreen BP & Socar Tankstellen Shops	Amscreen Group	Goldbach Media, Mediabox	Retail	128	128
Avec.	Valora Schweiz AG	Goldbach Media, Mediabox	Retail	45	118
Signactive	Signactive	Goldbach Media, Mediabox	Leisure	30	108
APG|SGA Rail ePanel	APG|SGA	APG|SGA	Transport	13	76
APG|SGA Escalator ePanel	APG|SGA	APG|SGA	Transport	2	76
Clear Channel Digital Shopping Media	Clear Channel	Clear Channel	Shopping Mall	13	72
Avia Tankstellen	ROAD AG Media	Goldbach Media, Mediabox	Pump Stations	72	72
Neo Advertising Palexpo Coverage	Neo Advertising	Neo Advertising, Mediabox	Trade Shows	2	61
Press & Books	Valora Schweiz AG	Goldbach Media, Mediabox	Retail	30	60
Aperto Shops	ROAD AG Media	Goldbach Media, Mediabox	Retail	47	57
APG|SGA City ePanel	APG|SGA	APG|SGA	Outdoor	6	57
Migrolino Convenience Stores	Kilchenmann	Goldbach Media, Mediabox	Retail	53	53
Neo Advertising Airport Genf	Neo Advertising	Neo Advertising, Mediabox	Transport	5	48
Total					26'937

Appendix 2 Overview of common models and differences in product declaration

Brand name	Model	Declared value	Energy Star Value	% difference
Dell	C7016H	220	119	86%
LG	32SL5B	65	41	58%
LG	32SM5KC-B	60	45	34%
LG	43SE3B-B	60	48	25%
LG	43SE3KB	65	48	35%
LG	43SL5B	65	53	23%
LG	43SM3C-B	85	66	28%
LG	49SE3KB-B	65	60	8%
LG	49SL5B	75	66	14%
LG	49SM3C-B	95	78	23%
LG	49UH5B	100	91	10%
LG	49UH5C-B	102	91	12%
LG	55SE3B-B	70	62	12%
LG	55SE3KB-B	70	62	12%
LG	55SL5B	85	77	10%
LG	55SM3C-B	110	92	20%
LG	55UH5B	116	103	12%
LG	55UH5C-B	116	103	12%
LG	55VH7B	220	123	79%
LG	55VM5B	220	105	110%
LG	65SE3B-B	95	87	9%
LG	65SE3KB-B	95	87	9%
LG	65UH5B	130	114	14%
LG	65UH5C-B	134	114	17%
NEC	P554	175	113	55%
NEC	V554	150	97	55%
Philips	43BDL4050D	59	51	15%
Philips	49BDL4050D	67	55	22%
Philips	55BDL4050D	76	64	19%
Philips	65BDL3000Q	176	122	44%
Philips	65BDL3010T	176	131	34%
Philips	65BDL4050D	103	97	6%
Philips	BDL4270EL	90	76	18%
Philips	BDL4777XL	86	101	-15%
Philips	BDL4835QL	115	81	42%
Philips	BDL4988XL	110	92	20%

Philips	BDL5530QL	141	90	57%
Philips	BDL5535QL	141	90	57%
Philips	BDL5570EL	120	109	10%
Samsung	ED65E	253	123	106%
Samsung	EM65E	253	124	103%
Samsung	PH49F	165	105	57%
Samsung	PH55F	187	124	51%
Samsung	QM49F	154	89	73%
Samsung	QM55F	165	102	62%
Samsung	QM65F	198	127	56%
Samsung	UH46F5	132	89	48%