



Deliverable 1.4:

Report of the methodology and of key performance indicator

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Introduction

Regulation (EU) 2017/1369 aims to promote the uptake of more efficient energy-related products, repealing Directive 2010/30/EU and the first Directive 92/75/EEC. Additional Commission Delegated Regulations (EU), which supplement Regulation (EU) 2017/1369, dictate the rescaling of energy labels. Unless properly managed, the rescaling of energy labels can create difficulties and confusion amongst all market actors, such as consumers, retailers and manufacturers. Washing machines, dishwashers, refrigerators, TVs, and lighting appliances, which are placed on the market from the 1st of March 2021 onwards, must have the new labels. The BELT project has the objective to facilitate the transition period informing and supporting all stakeholders, from manufacturers to consumers. In this context, it is important to understand the benefits of introducing the new energy labels at a European and country level, and the benefits of label at the appliance performance and user level. The objectives of this task is to develop tools to assess the environmental and cost implications of the new energy labels at European and country level, and at the appliance and user level. This task focuses on the following metrics to measure the impact of the introduction of the new labels: - Expected energy consumption reductions - Greenhouse gas emission reductions - Particulates and Volatile Organic Compounds (VOCs) emissions reductions - Economic cost savings Since energy consumption reductions depend on many factors, this study modelled different scenarios of future sales per energy label category. At the same time, it is important to note that the benefits estimated in this study are both due to the introduction of the labels, but also due to investments in cleaner and renewable energies. In order to be aligned to the national energetic context, the modelling includes changing energy mixes according to different EU energy mix scenarios. The outputs of the work is collated in an excel file that allows the modelling of different scenario. This task also provides the data necessary for consumers to understand the meaning of the new labels in terms of energy consumption, environmental impact, and energy consumption costs in the calculator available in a Web tool, result of WP2.6. The study focused on both the primary target countries (Spain, Portugal, Italy, Belgium, and Slovenia), secondary target countries (Ireland, Greece, Croatia, and Lithuania), as well as Europe as a whole, and all five product categories have been considered (washing machines, dishwashers, fridges, lamps, and TVs). This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N°847043. The information reported in this document reflect only the author's view and the European Commission is not responsible for any use that may be made of the information it contains. This report describes the data and methodology used to feed the tools developed in this task and gives a first estimation of the BELT project impact. These impact results will then be updated at a later stage of the project.

In this document we are going to explain the methodology and kpi's of the following Project Performance Indicators:



- Primary energy savings triggered by the project
- Reduction of greenhouse gas emissions
- Investments in sustainable energy triggered by the project
- Reduced compliance costs, maximize legal certainty and minimize errors during the transition periods for suppliers and dealers
- Number of stakeholders (e.g. public procurement personnel, businesses and consumers) informed by actions
- Number of manufacturers, suppliers and retailers engaged by actions aimed at improving their understanding of rescaled labels, minimizing the risk of confusion

Expected impacts of the project

Project Performance Indicator	within project duration	5 years after project ends	Measurement unit
Primary energy savings triggered by the project	170	510	GWh/year
Reduction of greenhouse gas emissions	70	200	ktCO ₂ -eq/year
Investments in sustainable energy triggered by the project	200	600	million EUR
Reduced compliance costs, maximise legal certainty and minimise errors during the transition periods for suppliers and dealers.	1.2	3.5	million EUR
Number of stakeholders (e.g. public procurement personnel, businesses and consumers) informed by actions	20		million
Number of manufacturers, suppliers and retailers engaged by actions aimed at improving their understanding of rescaled labels, minimising the risk of confusion	4.400		Number

Table 1 BELT performance indicators



Primary energy savings triggered by the project - Reduction of greenhouse gas emissions

This task focuses on the following metrics to measure the impact of the introduction of the new labels:

- Expected energy consumption reductions
- Greenhouse gas emission reductions
- Particulates and Volatile Organic Compounds (VOCs) emissions reductions
- Economic cost savings

Since energy consumption reductions depend on many factors, this study modelled different scenarios of future sales per energy label category. At the same time, it is important to note that the benefits estimated in this study are both due to the introduction of the labels, but also due to investments in cleaner and renewable energies. In order to be aligned to the national energetic context, the modelling includes changing energy mixes according to different EU energy mix scenarios.

Methodology

The impacts triggered by the project in terms of energy savings and CO₂ emissions reductions are calculated applying the following methodology:

- Sales data are used to calculate the waste generated based on the disposal pattern derived from the common methodology adopted by the European Commission for the estimation of WEEE generated methodology¹. Stock is then calculated as the difference between cumulative sales per product label category and the cumulative disposal of products. When sales data was available per energy class, stock could also be estimated per energy class.
- The product of the average energy consumption and stock per year provides an estimate of the annual energy consumption, per country, per appliance. Energy consumption averages per appliance per energy label is determined considering market data and industry experts' opinion.
- Annual energy consumption is then translated into environmental impacts using LCA methodology designed to capture the impacts due to changes in energy demand (MJ primary energy); GHG emissions (CO₂, methane, etc.); and other air pollutants (particulate matters, VOCs, etc.).

¹ https://ec.europa.eu/environment/waste/weee/pdf/Final_Report_Art7_publication.pdf



Figure 1 illustrates the different steps in the calculation.

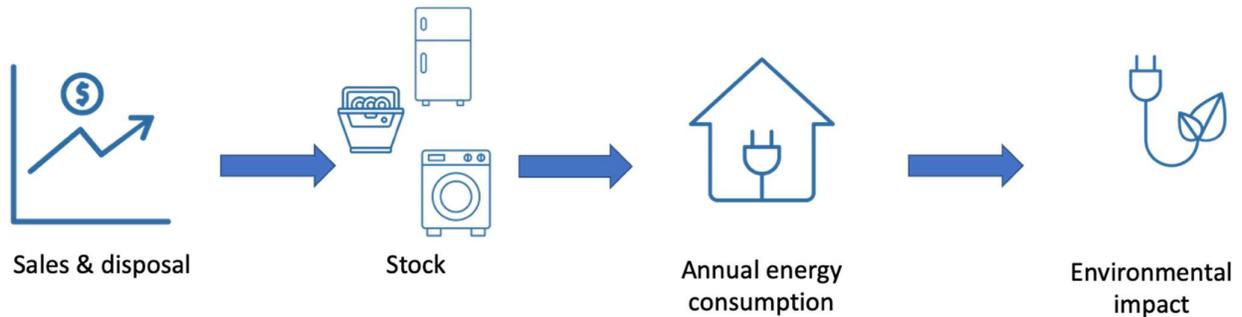


Figure 1: Methodology adopted

Estimation of energy saving potential is made by considering the current and future stock of appliances in the target countries and the breakdown by energy class. Breakdown per energy class was not available for each country so the breakdown obtained at EU level was assumed for each of the individual target countries.

DATA

Sales

Sales data for home appliances (washing machine, fridges, dishwasher) and breakdown per energy class were obtained from APPLIA at EU level.

Literature and market data obtained from industry experts were used for TVs and lamps.

Breakdown per target country was done according to the ratios available in the EU common Methodology dataset² (E-Tool EC) and considered constant. It was also assumed that the breakdown per energy class when available were similar from target countries to target country without more detailed information.

Projection of sales/current energy label shares were extrapolated from the current datasets to serve as baseline scenarios.

² EU Common Methodology dataset is available at: https://ec.europa.eu/environment/topics/waste-and-recycling/waste-electrical-and-electronic-equipment-weee/implementation-weee_en ; and the report can be found at: https://ec.europa.eu/environment/topics/waste-and-recycling/waste-electrical-and-electronic-equipment-weee/implementation-weee_en



Energy consumption

The current energy consumption per energy class for the current energy labels were obtained from literature. In particular, studies by ENEA³ and preparatory studies by the JRC^{4,5} were deemed particularly relevant.

The expected energy consumption under the new labels was estimated based on the formulas found in the corresponding different regulations, detailed in Table 2, of which some key parameters were fixed based on literature, and through a review containing market data and advice from industry experts.

For the scenario during the project and to 2030, the following initial and conservative assumptions have been made: annual consumption, per energy class, is considered to be constant, while it will depend on improvements in efficiency of the appliances themselves and on the use given by consumers;

Energy mix

The electricity mix for each of the primary and secondary target countries, as well as for the EU as a whole, was modelled using the latest EU Reference Scenario⁶. The EU Reference Scenario was selected as baseline energy mix supply for this study as its intended purpose is to provide a benchmark against which to compare new policies⁷. The selected scenario allows us to evaluate the impact of different degrees of adoption of the energy with the baseline electricity mix.

Environmental impacts

Emission data in terms of primary energy, GHG emissions and other pollutants emissions was obtained from the Ecoinvent v3.6⁸ widely used among LCA practitioners due to its transparency and consistency by modelling in Simapro the energy mixes as described in the EU Reference Scenario.

The robust and well accepted impact assessment methods used in the study were: CML 2 baseline 2000, version 4.7, updated in 2016. The impact categories used were global warming potential (GWP100), implemented in the method according to IPCC2013, Primary energy, and Photochemical oxidation, linked to the creation of 'summer smog', and dependent mainly on

³ Energy consumption estimations per appliance: [https://www.energiaenergetica.enea.it/servizi-per/cittadini/interventi-di-efficienza-e-risparmio-energetico-nelle-abitazioni/etichetta-energetica/etichetta-energetica-apparecchi.html?filter_tag\[0\]=25](https://www.energiaenergetica.enea.it/servizi-per/cittadini/interventi-di-efficienza-e-risparmio-energetico-nelle-abitazioni/etichetta-energetica/etichetta-energetica-apparecchi.html?filter_tag[0]=25)

⁴ Boyano A., Moons H., Villanueva A., Graulich K., Rüdener I., Alborzi F., Hook I., Stamminger R., Follow-up for the preparatory study for Ecodesign and Energy Label for household dishwashers, EUR 28808 EN, doi:10.2760/0768

⁵ Boyano A., Espinosa, N., Villanueva A., Follow-up of the preparatory study for Ecodesign and Energy Label for household washing machines and household washer dryers, EUR 28807 EN, Publications Office of the European Union, Luxembourg, 2017, ISBN 978-92-79-73894-4, doi:10.2760/954441, JRC108583.

⁶ https://ec.europa.eu/energy/sites/ener/files/documents/20160713%20draft_publication_REF2016_v13.pdf

⁷ https://ec.europa.eu/energy/data-analysis/energy-modelling/eu-reference-scenario-2016_en

⁸ <https://www.ecoinvent.org/>



emissions of carbon monoxide (CO), sulphur dioxide (SO₂), nitrogen oxide (NO), ammonium and NMVOC (non-methane volatile organic compounds).⁹ Additionally, the ILCD Particulate matter impact category was used to measure the benefits in terms of particulate matter emission reductions.

Table 2: Overview of main sources used

Type of data for the assessment	Main sources
Sales data	<ul style="list-style-type: none"> • Dishwashers <ul style="list-style-type: none"> ○ APPLiA for the period 2008 – 2018 ○ Future sales estimations were obtained from VHK 2014. • Washing machines, Fridges <ul style="list-style-type: none"> ○ up to 2019: E-Tool EC data for the period 2008 – 2018 ○ Future sales estimations were obtained from VHK 2014 • Lamps <ul style="list-style-type: none"> ○ E-Tool EC for 2008-2020 ○ Extrapolations from the dataset to 2030 • TVs <ul style="list-style-type: none"> ○ VHK 2014 sales data and projection for the period 2008 – 2030 ○ Country breakdown sales proportions from E-Tool EC
Breakdown per country	<ul style="list-style-type: none"> • E-Tool EC
Breakdown per energy class	<ul style="list-style-type: none"> • Washing machines, dishwashers, fridges: APPLiA for the period 2008 – 2018 • TVs: Topten, European commission • Lamps: no data found
Annual energy consumption for	<ul style="list-style-type: none"> • Washing machines <ul style="list-style-type: none"> ○ Old energy labels – JRC 2017 ○ New energy labels – estimated • Dishwasher <ul style="list-style-type: none"> ○ Old energy labels – ENEA ○ New energy labels – estimated • Fridges <ul style="list-style-type: none"> ○ Old energy labels – ENEA ○ New energy labels – estimated • TVs <ul style="list-style-type: none"> ○ Old energy labels – ENEA ○ New energy labels – estimated • Lamps <ul style="list-style-type: none"> ○ No information found

⁹ Green Delta 2016. LCIA methods - Impact assessment methods in Life Cycle Assessment and their impact categories. Accessed at: <http://www.openlca.org/wp-content/uploads/2016/08/LCIA-METHODS-v.1.5.5.pdf>



Estimation of stock	Study on collection rates of waste electrical and electronic equipment (WEEE), European Commission ¹⁰
Electricity mix (current projections) +	Reference scenario: EU Reference Scenario 2016. Energy, transport and GHG emissions. Trends to 2050.
CO ₂ , primary energy and pollutants emission factors	Ecoinvent v3.6 database
Regulations	<ul style="list-style-type: none"> • Washing machines <ul style="list-style-type: none"> ○ Old energy labels – Commission Delegated Regulation (EU) No 1061/2010 ○ New energy labels – Commission Delegated Regulation (EU) 2019/2014 of 11 March 2019 • Dishwasher <ul style="list-style-type: none"> ○ Old energy labels – Commission Delegated Regulation (EU) No 1059/2010 ○ New energy labels – Commission Delegated Regulation (EU) 2019/2017 • Fridges <ul style="list-style-type: none"> ○ New energy labels – Commission Delegated Regulation (EU) No 1060/2010 • TVs <ul style="list-style-type: none"> ○ New energy labels – Commission Regulation (EU) 2019/2021 • Lamps <ul style="list-style-type: none"> ○ Old energy labels – Commission Delegated Regulation (EU) No 874/2012 ○ New energy labels – Commission Delegated Regulation (EU) 2019/2015

¹⁰ https://ec.europa.eu/environment/waste/weee/pdf/Final_Report_Art7_publication.pdf



Primary energy savings triggered by the project

Evaluation of project impacts, particularly the energy-saving potential and the investments in sustainable energy triggered have been estimated considering assumptions that, over the course of the project, will be reviewed and updated, together with the development of dedicated modelling and data fed from stakeholders (e.g. APPLiA and so on).

The primary energy savings triggered by the project as well as investments in sustainable energy and reduction in compliance costs are calculated applying the following methodology:

Estimation of energy saving potential is made considering the current and future stock of appliances in the target countries and the breakdown by energy class. This can be estimated considering the cumulative sales per different product categories, their energy class and the disposal pattern (derived from the common methodology adopted by the European Commission for the estimation of WEEE generated¹¹); stock is calculated as the difference between accumulated sales and accumulated disposed products. For each product, per energy class, annual energy consumption is considered as suggested by ENEA¹², and for each product the average percentage of each class in stock is estimated considering the data derived from the JRC report¹³.

For the scenario during the project and till 2025, the following initial and conservative assumptions have been made:

- annual consumption, per energy class, is considered to be constant, as it will depend not only on improvements in efficiency of the appliances themselves, but also on the major or minor use by consumers;
- only products in the five target countries are considered
- Only three product categories have been used (fridges, washing machines, dishwashers) which are those that will probably be first on the market with the rescaled label. It does mean that our estimates are very cautious.

¹¹See: http://ec.europa.eu/environment/waste/weee/pdf/Final_Report_Art7_publication.pdf

³ See: <http://www.ufficienzaenergetica.enea.it/Cittadino/formazione/opuscolo-etichetta-energetica>

⁴ See: <http://publications.jrc.ec.europa.eu/repository/bitstream/JRC101177/Idna27972enn.pdf>



- the market penetration of energy efficient appliances, including the future A class will influence the current stock shifting in each class of 5% of the stock to the higher efficiency class;

To calculate GWh savings, as anticipated above, we estimated a 5% shift of the market towards less energy consuming products. For example, looking at the dishwashers, we can find an old A+++ with C (82 dw's;47,7%) or D (90dw's; 52,3%) in the new energy label. Therefore, in 2025 the 8% (3% + 5%) of sold products will be in the class B of the new label. And the new Class A in 2025 will include 5% (0% + 5%) of the products. Then, by attributing to each class of products the average annual energy consumption (as suggested by ENEA), it has been calculated GWh savings for each product category and total quantity for all products considered: 5,116 GWh of savings that will be obtained thanks to the new Energy label (in figure 4 an example of the calculation).

			2017	3%	15%	31%	40%	6%	4%	1%	100%	
				A+++	A++	A+	A	B	C	D		
Dishwashers	2018	2025	kWh/year	231	258	290	327	369	415	430		
BEL	2.621.037	2.681.910	GWh/year	18	100	232	337	57	43	11	798	
ESP	6.574.605	6.663.521	GWh/year	45	252	586	852	144	108	28	2.015	
ITA	11.359.979	11.317.312	GWh/year	79	439	1.021	1.485	251	188	49	3.512	
PRT	1.758.344	1.735.852	GWh/year	12	68	159	231	39	29	8	546	
SVN	321.882	324.083	GWh/year	2	12	29	42	7	5	1	99	
											6.971	
				A	B	C	D	E	F	G		
			2025	5%	8%	20%	35%	32%			100%	
			kWh/year		231	258	290	327	369	415		
			GWh/year	-	50	138	272	281	-	-	741	
			GWh/year	-	123	344	676	697	-	-	1.841	
			GWh/year	-	209	584	1.149	1.184	-	-	3.126	
			GWh/year	-	32	90	176	182	-	-	479	
			GWh/year	-	6	17	33	34	-	-	90	
											6.276	
			Difference between status quo and future									694



Washing Machines			kWh/year	154	173	196	226	256	289	300		
BEL	4.682.860	4.891.359	GWh/year	106	79	333	332	35	27	14	925	
ESP	16.621.041	16.421.246	GWh/year	388	290	1.217	1.214	129	97	50	3.386	
ITA	22.916.365	23.044.341	GWh/year	530	397	1.664	1.659	176	133	69	4.628	
PRT	3.679.267	3.727.195	GWh/year	85	63	266	265	28	21	11	740	
SVN	771.127	772.211	GWh/year	18	13	56	56	6	4	2	156	
			€/unit	500	325	262			0,0	0,0	9.835	
			2025			5%	20%	15%	43%	17%	100%	
			kWh/year				154	173	196	226		
			GWh/year			-	151	127	412	188	878	
			GWh/year			-	506	426	1.384	631	2.947	
			GWh/year			-	710	598	1.942	885	4.135	
			GWh/year			-	115	97	314	143	669	
			GWh/year			-	24	20	65	30	139	
			10% price decrease, +20% for A			600	450,0	292,5	235,8	0,0	8.767	
			Difference between status quo and future									1.067
			2017	3%	9%	45%	37%	3%	2%	1%	100%	
				A+++	A++	A+	A	B	C	D		
Fridges			kWh/year	138	205	274	343	468	593	687		
BEL	8.100.338	8.218.433	GWh/year	33	148	991	1.020	113	95	55	2.456	
ESP	25.414.601	25.270.831	GWh/year	106	471	3.151	3.243	359	303	176	7.808	
ITA	29.899.977	30.546.501	GWh/year	122	545	3.641	3.748	415	350	203	9.023	
PRT	7.588.018	7.551.137	GWh/year	32	140	939	966	107	90	52	2.326	
SVN	1.095.083	1.126.560	GWh/year	4	20	133	137	15	13	7	329	
											21.943	
			2025	5%	8%	14%	50%	23%			100%	
			kWh/year	A	B	C	D	E				
			GWh/year		138	205	274	343				
			GWh/year	-	91	236	1.126	648	2.101			
			GWh/year	-	279	725	3.462	1.994	6.460			
			GWh/year	-	337	877	4.185	2.410	7.809			
			GWh/year	-	83	217	1.035	596	1.930			
			GWh/year	-	12	32	154	89	288			
									18.588			
			Difference between status quo and future									3.355

Figure 2: example of calculation

Based on the total saving of 5,116 GWh, the corresponding saving in terms of tons of CO₂ has been calculated:

1,955 ktons CO₂. To reach this result we considered the energy production mix (i.e. how much CO₂ is produced for every kWh of energy produced) of each of the 5 Countries considered in our estimation.

Based on a direct impact of 10% directly linked to BELT project for three product categories in five countries, following data have been reported in the table above: **510 GWh/year** and **200 ktCO₂-eq/year**.



The BELT project will have an impact on 10% of the total investment for the three product categories in the five countries as explained earlier on this chapter.

Investments in sustainable energy triggered by the project

Regarding investments in sustainable energy, the average price of appliances, per energy class (source: GFK report 2017), has been considered for the 2017 scenario. In such case the baseline is calculated considering the actual sales in 2017 and the estimated total sales in 2025. As far as the trends in pricing of appliances are concerned, the scenario considered at this stage is based on the following, conservative assumptions:

- for appliances in the same class, an average price reduction of 10% has been considered, looking at the average trends of past years;
- prices of newer appliances (A class) have been estimated with a 20% increase compared to the A+++ of 2017

Reduced compliance costs maximise legal certainty and minimise errors during the transition periods for suppliers and dealers.

Regarding the 'reduced compliance costs' indicator, and the 'maximise legal certainty and minimise errors during the transition periods for suppliers and dealers' indicator, the total EU/EEA-wide annual expenditure on equipment energy performance regulatory compliance appears to be about 7 million EUR¹⁴. Due to the fact that BELT will be the reference point to gather information in the primary and secondary target countries, we can proportionally estimate that 10% of that 7 million EUR per year will be saved.

Based on the energy mix of the involved countries¹⁵ (as in the EcoInven database) and on the GWh/year saving calculated above (512 GWh/year), we can calculate the CO₂ emission savings.

¹⁴ Enforcement of energy efficiency regulations for energy consuming equipment: findings from a new European study, Waide et.al., 2011

⁶ Study on WEEE recovery targets, preparation for re-use targets and on the method for calculation of the recovery targets



Number of stakeholders informed by actions and number of manufacturers, suppliers and retailers engaged by actions

The consortium is confident that it will be able to inform over 20 million stakeholders and engage over 4.400 market actors. These numbers are based on the reach of the consortium members and of the organizations supporting the project, for instance members of consumer organizations that will definitely receive the magazines, the number of PPP parts of the ICLEI and MCBO networks, the sum of the visits to the e-shops of retailers etc., plus specific communication activities such as the realization of the BELT website and the calculator, dedicated press releases, ad hoc campaigns, etc. even if we should take in account the cautious assumption that only a part of the total will be interested on the information on the new energy label.

In fact to reach these KPIs we count on consumer organizations strong, powerful, effective and established communication channels such as the main pages of the websites of the four product families involved in the rescaling (millions of yearly visits), the magazines (more than 1M of members receiving them) and social media channels (more than 2M followers).

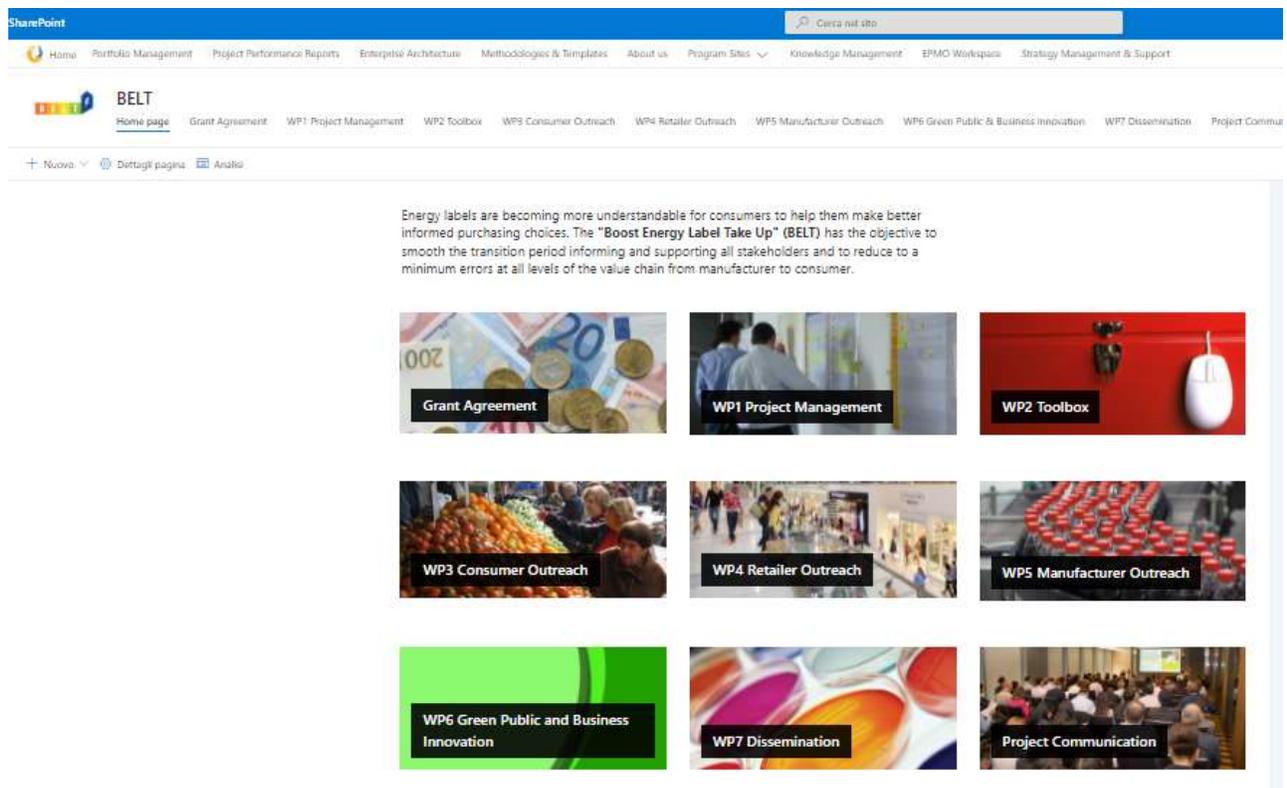
Besides consumer associations, retailers also play a key role, when it comes to help consumers to make informed choices, using its existing communication channels, both online and in-store such as displays, flyers, or thanks to the personnel. Due to the pandemic situation, many physical stores closed in many European countries, Worten (PT+SP) has 25 stores less and Auchan (Es) also closed 46 stores. This impacted the in-store communication but the online one had a consistently growth, website visits, in fact, have touched over 1 billion people.

Thanks to the experience and the qualified networks of stakeholders, MCBO, ICLEI, ERION reach a large number of market actors, namely manufacturers, suppliers and retailers, at local and national level. As local public institution, for instance, MCBO has the potential capacity to reach over 1.000.000 citizens and spread communication at national level via the support of ANCI, the Italian National Association of Municipalities, with more than 7.000 municipalities associated.

Project communication activities of the consortium such as press releases bring further results of the outreach, and, in digital campaigns, we will monitor as well the number of impressions of the social media channels that goes beyond the fan base reach out.

The consortium has put in place means of verification and follow up of the KPIs since the project has started. Information on the activities of communication and dissemination and materials done are gathered through an xls file of a detailed communication plan.

The members of the consortium upload the information and the results obtained in a common Sharepoint of BELT, structured in workpackages.



The number of stakeholders and market actors is followed closely using the EU table in SyGMa on dissemination & communication activities by categories (e.g. conferences, workshops, events public participation, press releases outreach, dissemination of flyers and leaflets, social media interactions and impressions, online visitors and visits on specific pages, views on video, training, etc.) as well as the dissemination plan overview, table 8 of BELT project, listed below, to calculate the impact of the information provided by the consortium.

Activity	Timing	Audience	Use	KPI
Dynamic project website	M3	All target audiences	General dissemination, networking, informing stakeholders and the general public	Number of visits; number of downloaded deliverables
Partner websites	M6			
Project flyers	When appropriate			Number of flyers distributed; variety of stakeholders reached
Press releases				Number of press releases;
Posters				Number of posters presented; variety of stakeholders reached
Scientific publications	> 6 during project	Scientific audience	Presentation of results to the scientific world	Number of scientific publications

Non-scientific publications	> 6 during project	Non-scientific audience	Information provision, education	At least two articles in consumer magazines and websites per country
Technical documents and guidelines	M1-M30	Market actors	Information provision, training	Number of guidelines and technical documents developed
At least two workshops per stakeholder to share best practices	M9- M20 workshops	Market actors	Education, feedback, policy making, sharing best practices	Number of attendees; number of workshops; stakeholders represented
Networks of partners	M1-M30	Main stakeholders and market actors	Information provision to independent stakeholders within the networks of partners. Many associations have shown commitment to disseminating the project via their network as described by LOS	Number of stakeholders reached by the project within the partners' network: - consumers - retailers - manufacturers - green public procurement/cities or municipalities - Business public procurement
Conferences and events at national and European level	When appropriate	All target audiences	Presentation of results of the project	Number of conferences, number of presentations, number of participants.
Public procurement dissemination	Annually	Public procurement	Presentation of the progress and findings of the project to: - European Commission's Green Public Procurement Advisory Group , and Stakeholder Expert Group on Public Procurement -International Green Purchasing Network (IGPN)	Number of presentation/participations
Distilling policy lessons	At the end of the project	European and National professionals and policy making	Presentation of the results of the project and learning	Number of fact sheets Number of newsletters Number of awareness actions