

THE SECOND A.I.S.E. “PRODUCT RESOURCE EFFICIENCY PROJECT” FOR LAUNDRY LIQUID DETERGENTS (PREP-L2)

CLOSEOUT REPORT



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Executive summary

This report presents the results of the *PREP-L2* initiative, which aimed to reduce the environmental impact of Low Suds (machine-wash) Liquid Detergents for household laundry in the European Union and the European Free Trade Association (EFTA). *PREP-L2* was initiated, promoted and deployed by A.I.S.E. (International Association for Soaps, Detergents and Maintenance products) with the support of its National Associations partners. This was done under full transparency, making participation entirely voluntary, and open to any company wishing to participate - whether a member of the association or not. A.I.S.E. also offered technical assistance on request to any company asking for it, to prevent possible exclusion of companies for technical reasons.

PREP-L2 was opened in April 2016, and implemented during one year from April 2017 until March 2018. It covered the European Union in addition to the four EFTA countries. The main commitment of the initiative was a compaction of liquid laundry detergents leading to a reduction of the standard recommended dose down to maximum 55 ml/wash. The product scope included traditional liquid detergents (heavy and light duty) as well as mono-dose capsules. In parallel, companies committed to keeping fill levels (as a minimum) in line with the situation before compaction. To ensure correct product use, clear communication of the dosage changes had to be implemented on pack, by means of standardised visuals.

The achieved liquid laundry detergent tonnage reduction was estimated by benchmarking the actual tonnage after the full implementation of compaction, against an extrapolated “no compaction” tonnage. This benchmark was determined from the calculated number of wash loads in 2019 (based on tonnage and average recommended dosage), which was subsequently used to extrapolate to the pre-compaction situation using the corresponding 2015 dosage data.

It must be emphasised that due to the assumptions made and due to inherent limitations of the data, whereas the calculated tonnage reductions are reasonable estimates, they cannot be considered as exact figures.

Compared to the dosage situation before *PREP-L2*, the traditional (free flowing) liquid laundry detergent tonnage reduction achieved as of 2019 is estimated to be 179,000 tonnes per year. This is an annual reduction by 11-12% relative to the ‘no compaction’ benchmark, that is materialised year after year following the compaction step. This was achieved to an equivalent proportion relative to the market size in Western Europe (163,000 tonnes/year) and Central Europe (16,000 tonnes/year). When also including market shift towards mono-dose liquids, the total compaction achievement adds up to a reduction of 260,000 tonnes per year across Europe.

The liquid laundry detergent tonnage reduction has important environmental benefits. For free-flowing traditional liquids, the packaging waste reduction is estimated at nearly 17,500 tonnes per year, including over 10,000 tonnes of plastic. The estimated annual truck transport reduction is 210 million tonne.km per year. This is equivalent to over 240 times around the earth with a heavy truck.

Key achievements

	<i>PREP-L2</i>
Deployment	2017 - 2018
Dosage reduction to max.	55 ml/wash
Detergent tonnage reduction	179,000 tonnes/year
Packaging waste reduction	17,500 tonnes per year (10,000 tonnes of plastic and 7,500 tonnes of cardboard)
Transport reduction	210 million tonne.km per year
Greenhouse gas reduction	No meaningful difference



Introduction and background

This closeout report presents and analyses the results of the **second “A.I.S.E. Product Resource Efficiency Project for Laundry Liquid Detergents” (PREP-L2)**¹. This is a voluntary industry initiative launched by A.I.S.E. that aimed to reduce the environmental impact of household liquid laundry detergents via a compaction of these products across the participating manufacturers.

More specifically, *PREP-L2* focused on:

- In the field of sustainable production: a reduction of the environmental impact of the laundry detergent sector across the whole of Europe, by promoting and encouraging the use of less water, packaging and energy in product making and delivery.
- In the field of sustainable consumption: an encouragement to consumers to correctly dose the products, through harmonised on-pack label information, as well as by making available material for off-pack use. Note that no joint industry media campaign was included in the initiative.

The *PREP-L2* initiative was opened on April 1, 2016. Its implementation in the market was started on April 1, 2017, and lasted one year until March 31, 2018. It was made available across the countries of European Union and the European Free Trade Association (EFTA).

This initiative came within the framework of the Association’s agenda for sustainability and the industry’s commitment to reducing the environmental impact of detergents². The first initiative in this area was the A.I.S.E. “Code of Good Environmental Practice” (which became a European Commission Recommendation - 98/480/EC) and the associated “Washright” campaign. Building on the positive outcome of the “Code” in Western Europe, in 2006 A.I.S.E. launched its first “Laundry Sustainability Project” (*LSP-1*), which focussed on compaction of household laundry powder detergents in Central Europe, where the “Code” had not been implemented. Recognizing the value of a common voluntary industry approach, the members of A.I.S.E. subsequently developed and implemented several more compaction initiatives. Household laundry powder detergents were taken to the next levels of compaction first via the *LSP-2* initiative and then via the “Product Resource Efficiency Project” for powders (referred to as *PREP-P3*). In parallel, compaction of household laundry liquid detergents was also addressed. This had become more and more relevant because of the steady share growth of the liquids segment – actually, liquids had become the most significant laundry product form by 2010. The first liquids compaction initiative (*LSP-L*) was implemented in 2010-2011 and achieved an overall detergent tonnage reduction of over 300,000 tonnes per year by moving to a dosage of maximum 75 ml/wash. A very substantial achievement, because previously a large proportion of the market was still in “dilute” liquids with dosages of 100 ml/wash or even up to 150 ml/wash. Nevertheless, at 75 ml/wash there was still room for further dosage reduction, and this led to the deployment of a second voluntary compaction step for liquid detergents, the “Product Resource Efficiency Project” *PREP-L2*.

¹ See Annex 1: Project Description.

² See www.aise.eu – (Our activities -> Sustainable Cleaning -> Product Resource Efficiency Projects).

Scope

Products

The *PREP-L2* initiative was aimed at all low suds liquid laundry detergents used for household laundry. This includes heavy duty as well as light duty products³. The scope is limited to low suds products, i.e. detergents for use in a washing machine. Hand wash detergents are not covered by the initiative.

The following product executions are, inter alia, included in the scope of this project - as agreed in the project description:

- Heavy duty and light duty low suds liquid detergents sold in traditional containers (e.g., bottles).
- Heavy duty and light duty liquid detergents sold in mono-doses.
- Heavy duty and light duty low suds liquid detergents sold solely in large containers to be used exclusively by retailers for selling product to consumers in refillable bottles.
- Heavy duty and light duty low suds liquid detergents for the Industrial & Institutional (I&I) sector which are sold in Cash & Carry markets and thus are easily available to consumers (even in the case they are sold in large sizes).

To maximize the potential for sustainability benefits and to minimize the possibility of consumer confusion, companies had to strive to deploy compaction for both the heavy and light duty product types. Nevertheless, it was left at the discretion of the individual signatory companies to choose whether to compact all of its liquid detergents, or only one of the two subcategories.

To note, whereas mono-dose products (i.e. liquid laundry detergent capsules) are within scope, these products were already highly compacted before the initiative. As such, further compaction would be limited and would not be driven by the PREP-L2 commitments. On the other hand, market share that moved from the less compact traditional liquid form to the more compact mono-dose form during the PREP-L2 initiative, could effectively be considered a relevant contribution. However, because this may be driven by other market dynamics rather than by the PREP-L2 commitments, in this report the achievements via the mono-dose form are assessed separately from the compaction of the traditional liquid form.

Geographical

PREP-L2 was made available in the 28 countries⁴ that were members of the European Union (EU) at the time of the initiative, plus the four countries of the European Free Trade Association (EFTA)⁵.

In the following 19 countries, there was active company participation: Austria, Belgium, Bulgaria, Croatia, Czech Republic, France, Germany, Greece, Hungary, Italy, Luxemburg, The Netherlands, Poland, Romania, Slovak Republic, Slovenia, Spain, Sweden.

³ A clarification of the definitions for “Heavy Duty” and “Light Duty” detergents can be found in Annex VIIB of the EU Regulation (EC) No 648/2004 of the European Parliament and of the Council of 31 March 2004 on detergents: “a detergent shall be considered to be a heavy-duty detergent unless the claims of the manufacturer predominantly promote fabric care i.e. low temperature wash, delicate fibres and colours.” The classification of a detergent in one or in the other category is normally made by the manufacturer and can be clearly identified from the way the legally required “number of standard washes” is calculated. In fact the same annex states: “The packaging of detergents sold to the general public intended to be used as laundry detergents shall ^[1]bear the following information: ^[2]for heavy-duty detergents, the number of standard washing machine loads of ‘normally soiled’ fabrics, and, for detergents for delicate fabrics, the number of standard washing machine loads of ‘lightly-soiled’ fabrics, that can be washed with the content of the package using water of medium hardness (....).”

⁴ this includes the United Kingdom.

⁵ The EFTA countries are Iceland, Liechtenstein, Norway and Switzerland.

To note, for several countries (i.e. the UK, Ireland and several Nordic countries), the absence of participation can be explained by the fact that in these countries the average recommended dosage of liquid detergents was already well below the PREP-L2 target.

Participating Companies

The PREP-L2 initiative was open to all companies manufacturing or placing on the market low suds liquid household detergents in the region covered by the initiative. In total, 14 companies signed up to the initiative: Albert Heijn, Bluesun, Bolton-Manitoba, Conad, Deco Industrie, Esselunga, Henkel, Herma Productos De Limpieza, Madel, Persan, Procter & Gamble, Reckitt Benckiser, Système U, and Unilever.

The participating companies represent about 60-65% of the total liquid detergents market in the region (based on Euromonitor company volume share information per country, tonnage-weighted across the region). The proportion of the market that was covered by the initiative varied between countries. For example in Bulgaria, Spain, Sweden and Switzerland this was just below 50%, while in Romania, Slovakia, France and Greece, a coverage of 75% was reached or exceeded. Participants include large multinational companies, SMEs, private label manufacturing companies / retailers, and I&I companies with products similar to the household liquid detergents.

PREP-L2 commitments

Each Company adhering to the PREP-L2 initiative committed to taking specific steps towards achieving the objectives of the project. It must be noted that companies were free to decide in which countries they wanted to participate to the initiative. Also, in a given country, they were free to decide whether to adhere to the project for both heavy and light duty products, or for just one of the two sub segments.

Recommended dosage

Each company that joined the PREP-L2 initiative had to ensure that all their low suds household laundry liquid detergents in a given country have recommended dosages **not greater than 55ml/wash** for a standard washing machine load⁶ to be washed using water of medium hardness. Importantly, when used at these lower dosages, detergents should deliver washing results at least equivalent to what the consumer is expecting from previous experience.

The 55 ml/wash maximum limit was based on an industry consultation that confirmed technical feasibility by all interested companies. Indeed, this requirement could be reached with conventional technologies, thus not representing a technical barrier to entry into the project for any company (including SMEs) who wishes to join. The decrease to 55 ml/wash was expected to represent a significant reduction in the recommended dosages versus the most common situation for this type of detergents before PREP-L2.

Packaging

Participating companies had to continue striving to optimize the usage of packaging materials. As the new formulations entail a reduced volume per wash, companies had to commit to a reduction of packaging materials, with fill levels remaining at least overall in line with the pre-compaction situation.

⁶ the standard washing machine loads are 4.5 kg of normally soiled dry fabric for heavy-duty detergents, and 2.5 kg of lightly soiled dry fabric for light-duty detergents (as defined in Annex VII of the Regulation (EC) No 648/2004 of the European Parliament and of the Council of 31 March 2004 on detergents).

Communication

To reach the desired sustainability benefits, not only did the manufacturers have to compact their products, but also the consumers had to adapt their dosing habits. Therefore, clear communication to consumers how to best achieve the intended sustainability improvements by encouraging the correct use of the new products was key. This was achieved by providing a uniform approach to consumer information regarding the concentration of the products.

On-pack label

For the compacted products, companies committing to the scheme had to use the on-pack patches which had been developed by A.I.S.E. This included a “front label” patch as well as a “back label” patch to be added to the products’ dosing table. Detailed guidelines for the on-pack label elements were provided in the Project Description. This included ‘comparative’ patches to be used for products that were compacted during the deployment of the initiative, as well as ‘non-comparative’ patches for products that already met the compaction criteria before the rollout of the initiative. Examples of monolingual executions are provided in Figure 1. In addition, ‘silent’ executions were also available. Note that for the ‘comparative’ patches, companies were encouraged to choose a graphic representation that represents their actual level of concentration relative to the previous version of the product.

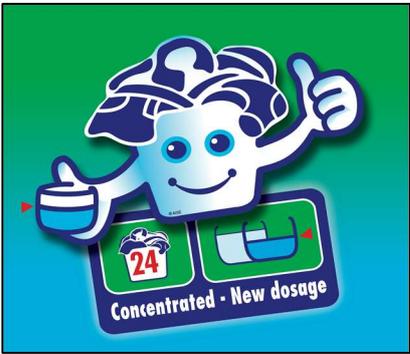
On-pack		Off-pack
Comparative	Non-Comparative	
Front label patches		
		
Back label patches (part of the dosing table)		
		

Figure 1. On-pack compaction pictograms and off-pack campaign visual

Off-pack communication

For the first liquid detergent compaction initiative, *LSP-L*, A.I.S.E. had developed a comprehensive toolkit for consumer communication. This included harmonised non-branded material to raise awareness among consumers about the benefits of using more concentrated products. This existing material, all centred around the “Mr Basket” visual (Figure 1), was again made available to the companies participating to *PREP-L2*.

In addition, A.I.S.E. provided its members with a template press release so that they could use it at the time best fitted to announce the presence of new compacted products on the market.

To note, no joint industry media advertising campaign was developed for *PREP-L2*.



Liquid laundry detergents market dynamics

Market value and tonnage information were obtained from Euromonitor (extracted from *Passport* on 18 February 2020).

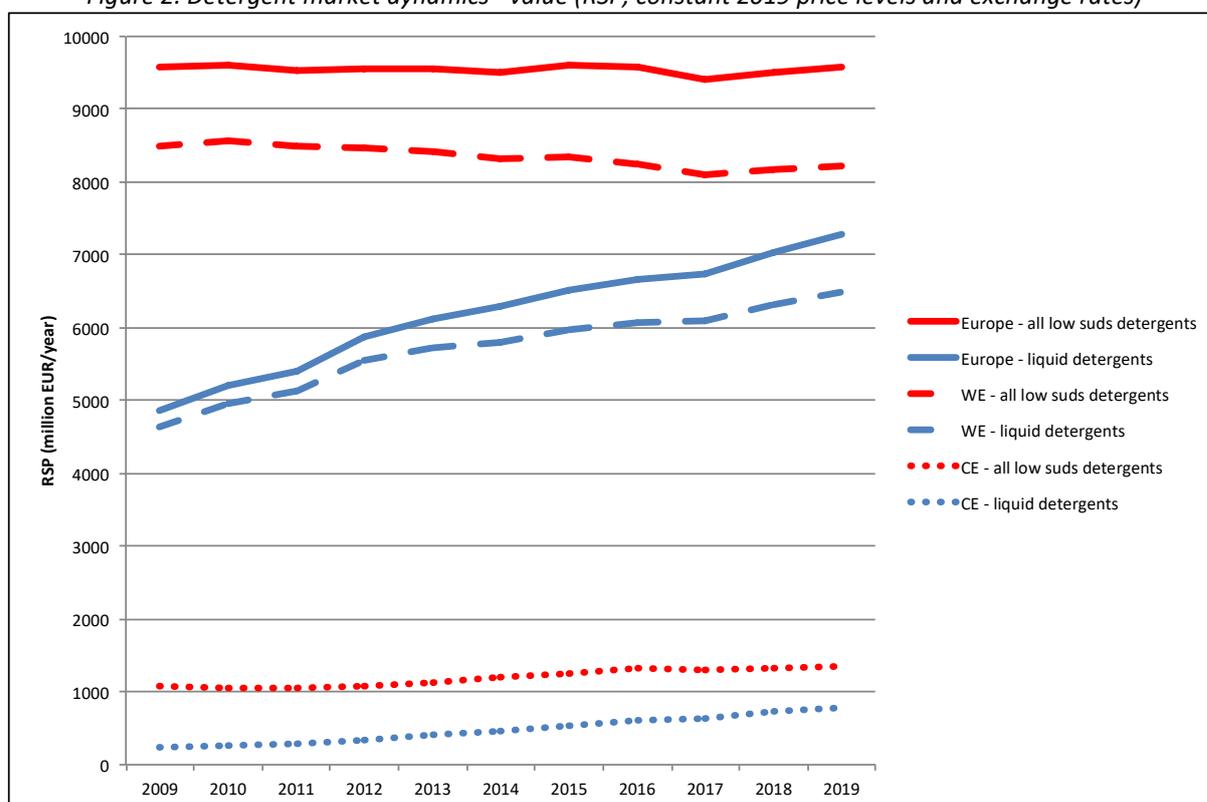
Value

Over the past decade (2009-2019), the total European machine-wash laundry detergents market value has remained stable overall. When expressing value as RSP (retail selling price, using constant 2019 price levels, and fixed 2019 exchange rates for countries outside the Euro zone), a slight decline (by 3-4%) is seen in Western Europe, while on the other hand, in Central Europe the market value increased by over 25%. Combined across both sub-regions, the value remained nearly identical between 2009 and 2019.

The dynamics of the liquid detergent segment, on the other hand, were very different. The market value of liquids grew by 50% across Europe over the past decade. In Western Europe, this was by a substantial 40%, while in Central Europe the liquid detergent market value expanded by over a factor three (335% in 2019 versus 2009).

The market value dynamics are shown in Figure 2.

Figure 2. Detergent market dynamics - value (RSP, constant 2019 price levels and exchange rates)



Importantly, the observation that the machine-wash detergents market value has remained stable over the past decade, implies that the several compaction initiatives during this period (*LSP-L* and *PREP-L2* for liquids, *LSP-2* and *PREP-P3* for powders) have not led to over-consumption of detergent. Indeed, if consumers would not have adapted their dosing habits according to the reduced recommended dosage, there would have been a higher detergent throughput in terms of 'standard doses' – and thus, an increase in market value. The fact that such increase is not observed, indicates that consumers have correctly moved to lower dosages as they started using detergents that were more compact.



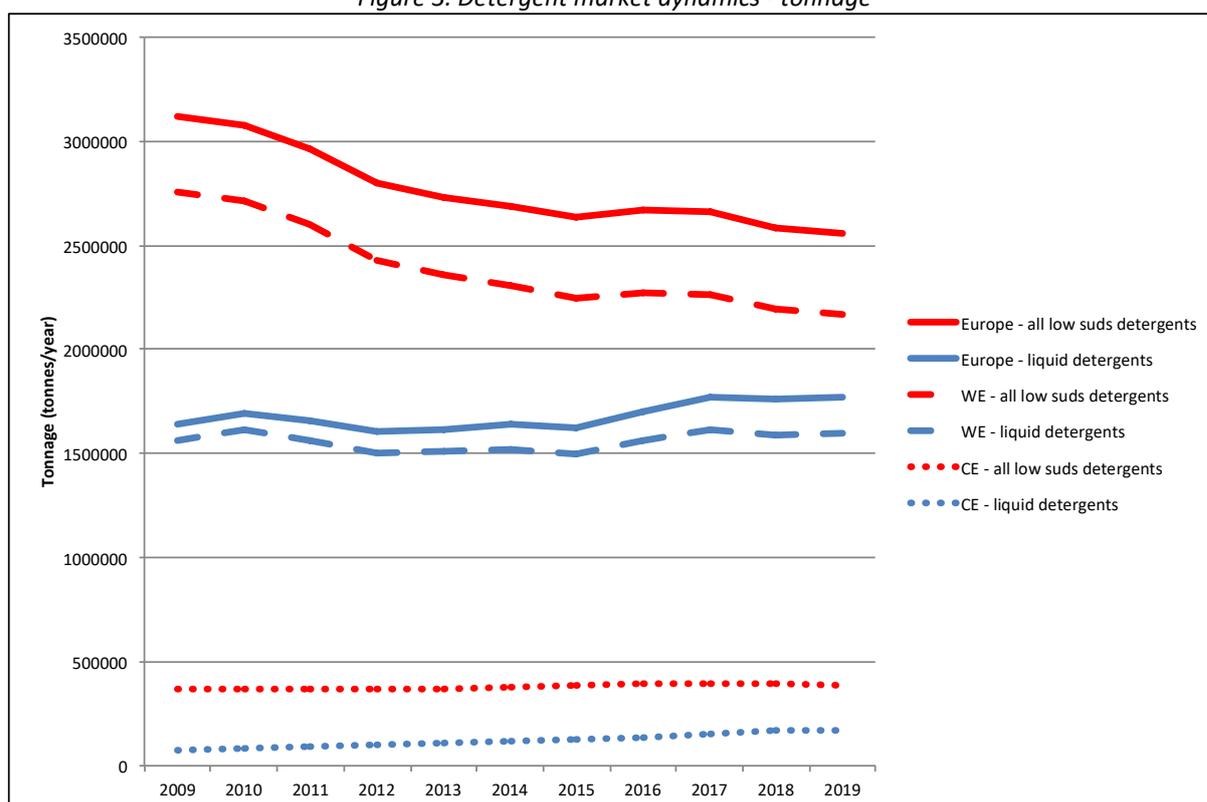
Tonnage

Between 2009 and 2019, there was a substantial reduction (by 18%) of the total machine-wash laundry detergent tonnage. This was driven by the dynamics in Western Europe, with a reduction of over 21%. In Central Europe, on the other hand, there was a tonnage increase by 6%.

For liquid detergents, the trend over the past decade is different, with a negligible increase (by 2.4%) in Western Europe, and substantial growth in Central Europe (by a factor 2.3). Across the whole of Europe this translates into an 8% increase.

The market tonnage dynamics are shown in Figure 3.

Figure 3. Detergent market dynamics - tonnage



Liquids market share

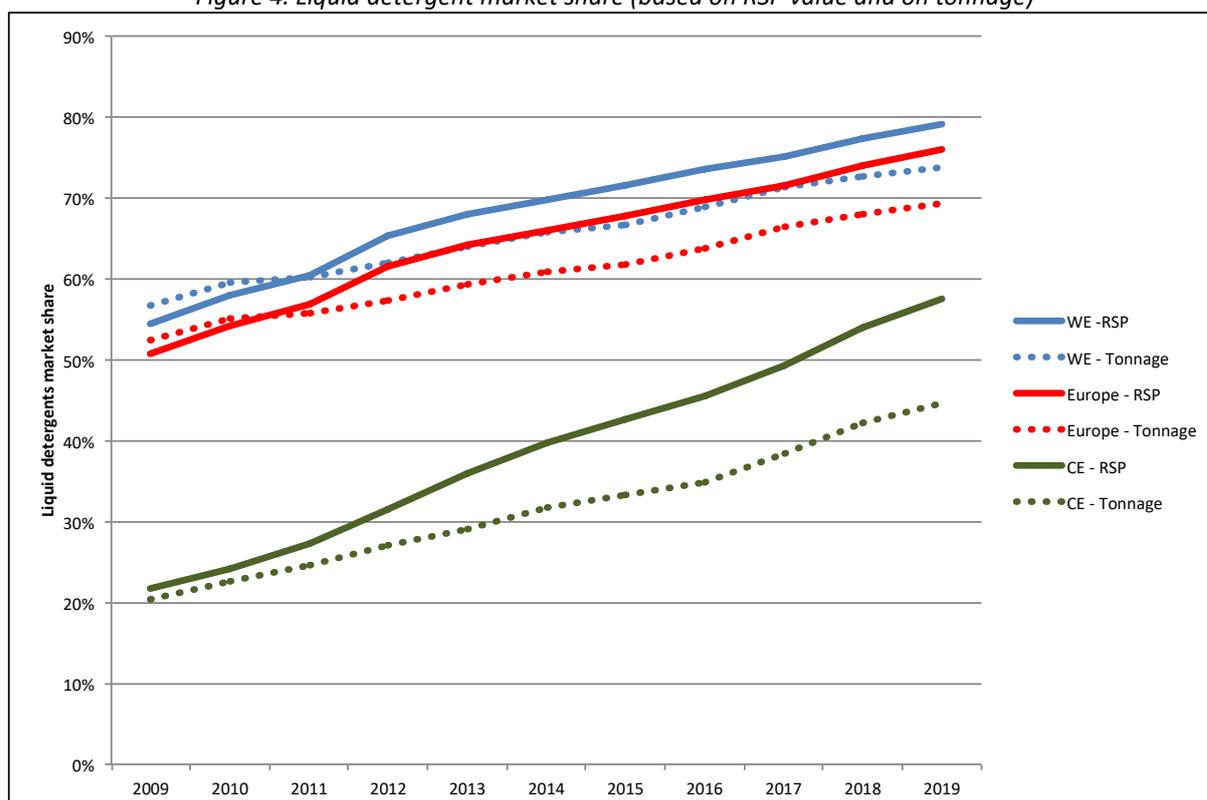
Over the previous ten-year period, liquids moved from a nearly equal value share with powders (i.e. 51% – with 54% in Western Europe and a modest 22% in Central Europe) to becoming the predominant form across the region, with over three-quarters of the retail value (79% in Western Europe, and 58% in Central Europe).

Also in terms of tonnage, liquids grew from a nearly equal share with powders (i.e. 52% – with 57% in Western Europe and 20% in Central Europe) to an overall tonnage share of 69% across the region (74% in Western Europe, and 45% in Central Europe).

The market share of machine-wash liquid laundry detergents is illustrated in Figure 4. Both in Western Europe and – more prominently – in Central Europe, the liquids' value share grew at a somewhat higher rate than the tonnage share. The stronger growth of liquids value share versus tonnage share may potentially be explained by a more prominent compaction of the liquid form versus the powders that it gradually replaced. Indeed, over the considered period, liquids moved from typically 100 ml/wash down to maximum 55 ml/wash under *PREP-L2*. During the same period, powders moved from a typical dosage of 100 g/wash to a maximum of 75 g/wash under *PREP-P3*. Also, within the liquids segment, the highly concentrated mono-dose form became gradually more important, further driving down the liquids tonnage. Thus, whereas this was not the case ten years ago, today there is a notable difference in dosage between liquids and powders, and this may explain the observations in Figure 4.



Figure 4. Liquid detergent market share (based on RSP value and on tonnage)

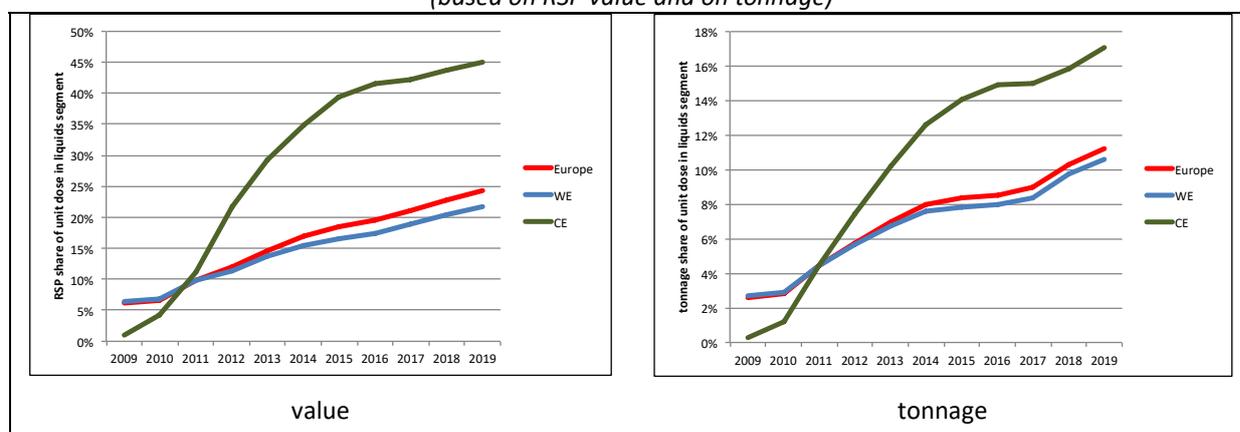


Note that light duty detergents are accountable for 9% of the liquids value and 11% of the tonnage across Europe. In Central Europe the light duty share is only half (respectively 4% of value and 6% of tonnage). The importance of light duty products decreased by about half over the past decade.

Mono-dose liquids

Mono-dose liquids (i.e. liquid laundry detergent capsules) have seen substantial growth over the past decade. In 2009, their market presence in Europe was negligible except for the UK and Ireland (where at that time they already represented one-third of the liquids segment value). Since then, the mono-dose value share within the liquids segment went from 6% across Europe to 24% in 2019 (22% in Western Europe, and 45% in Central Europe). Evidently, given their very high extent of compaction, the tonnage share of unit dose liquids is much lower (11% overall and in Western Europe, and 17% for Central Europe). This trend is illustrated in Figure 5.

Figure 5. Liquid laundry detergent capsules (mono-dose) share of the liquids market (based on RSP value and on tonnage)



While mono-dose liquids are within the scope of *PREP-L2*, evidently, the dosage of this super-concentrated product form is already well below the commitment of *PREP-L2*. As such, the share of mono-dose products already on the market in 2015 before the start of *PREP-L2*, would not be expected to contribute to the compaction initiative. On the other hand, moving market share from the traditional liquid form to the mono-dose form could be seen as a way of achieving compaction - albeit not directly driven by the *PREP-L2* initiative.

For transparency, in this report the compaction achievements within the traditional liquids segment are quantified and reported separately from compaction via a move to mono-dose liquids.

Recommended dose

On a country by country and annual basis, Euromonitor reports the average recommended dosage for each liquid detergent subcategory. Combined with the tonnage information for the respective subcategories, a weighted average dosage per country as well as across the participating countries can be determined (Table 1).

Overall, in 2019, the weighted average recommended dosage for liquid detergents across all countries with *PREP-L2* participation was 55.2 ml/wash. For traditional liquid detergents (i.e. excluding mono-dose) this was 57.9 ml/wash.

Before *PREP-L2*, in 2015, the average was 62.8 ml/wash across the liquids segment, and 65.0 ml/wash for traditional liquids.

The observed decrease indicates that *PREP-L2* was successfully implemented in most of the participating countries. Nevertheless, in a few participating countries, there was only a limited dosage reduction of the traditional liquid detergents.

Table 1. Average recommended dosage for liquids detergents (before and after PREP-L2)

	Entire liquid segment		Excluding Mono-dose	
	2015	2019	2015	2019
Bulgaria	69.0	64.3	71.8	67.0
Czech Republic	64.1	51.5	69.3	57.0
Hungary	66.3	51.7	70.7	57.2
Poland	57.8	55.4	68.5	67.1
Romania	62.9	58.8	69.1	63.6
Slovakia	66.9	55.1	73.0	59.7
Central Europe	63.8	55.8	70.1	62.3
Austria	69.8	61.4	70.1	61.9
Belgium	60.6	50.8	62.9	53.1
France	56.2	50.3	59.5	53.6
Germany	72.2	61.2	72.6	62.7
Greece	62.4	51.5	65.5	54.1
Italy	64.2	53.2	65.5	55.0
Netherlands	53.8	48.5	56.0	51.7
Spain	59.8	58.9	61.8	61.7
Sweden	41.5	40.4	41.8	41.1
Switzerland	61.3	55.7	62.0	56.6
Western Europe	62.7	55.1	64.7	57.5
All PREP-L2 countries	62.8	55.2	65.0	57.9



Quantification of detergent tonnage reduction

Methodology

Several methodological options were considered and explored. The approach using an extrapolated ‘pre-compaction benchmark’ based on the number of washes in 2019 combined with the pre-compaction dosage from 2015 was found to be the most appropriate. The alternative approaches that were not retained are outlined in Annex 2.

“No Compaction” benchmark calculation

The actual post-compaction tonnage (i.e. the observed 2019 situation) can be re-scaled to what this tonnage would have been in case the *PREP-L2* dosage reduction had not taken place. This is done by calculating the number of standard laundry loads washed with liquid detergent in 2019, and subsequently by calculating the amount of detergent that would have been needed for this same number of washes in case of the pre-compaction dosage situation.

Per country, weighted average recommended dosage information for all sub-segments in the liquid detergent category are available from 2015 to 2019 (Euromonitor). The number of wash loads in 2019, and the corresponding extrapolated pre-compaction detergent tonnage (i.e. the benchmark) are calculated as follows:

$$N_{wash\ loads} = \text{tonnage}_{2019} / \text{dose}_{2019}$$

$$\text{tonnage}_{benchmark} = N_{wash\ loads} \times \text{dose}_{2015}$$

Note that this approach is applied separately for each sub-segment, and thus also separately for mono-dose capsules. This allows separating the compaction achievement accomplished via compaction of free-flowing liquids on the one hand, and via a shift from free-flowing to mono-dose liquids on the other hand.

As this approach is based on the actual reduction of the recommended dosage in the market, it does not depend on financials (that are influenced by multiple dynamics, as outlined in Annex 2). A potential vulnerability is that recommended dosage does not necessarily correspond exactly with the actual dosage by consumers, and as such does not provide conclusive evidence. However, there are multiple indications that, on average, actual dosage by consumers corresponds with the recommended dosage, as outlined below.

Actual consumer dosage relative to on-pack recommended dose

The following points support the assumption that on average, actual dosage by the consumer is closely correlated with the on-pack recommendation.

- In A.I.S.E.’s Habits & Practices study of 2020⁷, 82% of liquid detergent users said they find it easy to dose laundry detergents and 74% are aware of the dosing instructions on pack. The majority (61%) said they usually add the correct amount of detergent recommended by the manufacturer, while in parallel 26% said they add more detergent, and 26% that they add less (note that this does not add up to 100% due to some overlapping responses). Thus, these data indicate that most commonly a correct dosing is applied, and that under- and overdosing happen equally frequently and as such balance each other out.
- In a study with 236 German households, covering close to 2900 wash cycles, Kruschwitz *et al.* (2014)⁸ found that the consumers did not adjust the dosage to the textile type, load size, soil level and/or water hardness, and that this could lead to under- or overdosing depending on prevailing conditions. Thus, while dosing was far from perfect on an individual basis, there was no systematic deviation from the recommended dosage, neither upward nor downward.
- Across the entire detergent market (all product forms), the average actual dosage can be determined based on the total tonnage and the total number of wash loads. For 2019, the total automatic detergent tonnage in the EU 28+4 was 2.359 million tonnes⁹. The number of households in the EU28+4 was 231

⁷ Internal A.I.S.E. document, not yet published

⁸ Kruschwitz, A., Karle, A., Schmitz, A. and Stamminger, R. (2014). Consumer laundry practices in Germany. *International Journal of Consumer Studies* 38(3), 265-277.

⁹ Euromonitor Passport (accessed 15/5/2020)



million in 2019 (EU-28 data from Eurostat¹⁰, EFTA countries from other online sources¹¹). The average number of washes per household, across Europe, was 174.2 washes per household per year¹². Consequently, in total, 40.2 billion loads were washed in Europe, using 2.36 million tonnes of detergent. This means the actual average dose by consumers was 58.7 g/wash. The average recommended dosage was 55.2 ml/wash for the liquids segment, and 68.3 g/wash for powders¹³. With a 69/31 tonnage split between these two detergent forms, the overall average recommended dose across Europe is 59.2 g/wash - virtually identical to the real average consumer dosage.

- Furthermore, the overall detergent market value dynamics during the time when compaction was implemented suggest that consumers have indeed adopted the lower recommended doses. If consumers would not have adapted their dosing habits according to the reduced recommended dosage, there would have been a step change increase in market value, which is not observed (cf. above, section on market value dynamics).

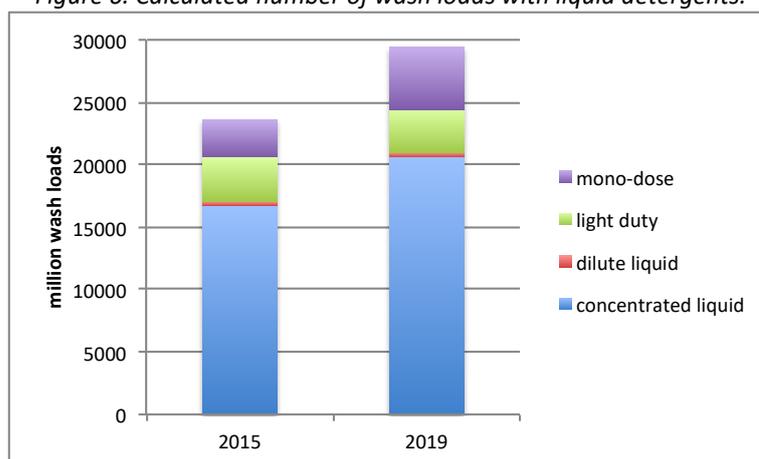
Estimation of the detergent tonnage reduction

Number of wash loads

For the different sub-segments of the machine-wash liquid detergent category, the average recommended dosages for 2015 (before *PREP-L2*) and for 2019 (after *PREP-L2*) are available for the majority of countries participating to *PREP-L2* (the exceptions are Luxembourg, Croatia and Slovenia). Note that the tonnage-weighted average recommended dosages across the liquids segment (both including and excluding mono-dose) are provided in Table 1 (see higher).

From the annual tonnage per country for each liquid detergent sub-segment, combined with the corresponding average recommended dosage, the number of wash loads was determined. The aggregation across all countries with *PREP-L2* participation is shown in Figure 6. Overall, the number of loads with liquid detergents increased by 24.4% between 2015 and 2019. This was driven by a 23.6% increase for concentrated traditional liquids (3.9 billion additional wash loads) and a 66% increase for mono-dose (2.0 billion additional loads). The number of loads with light duty products was essentially stable (4% decrease), while dilute liquids continued to gradually lose relevance (a 12% decrease, down to 1% of the total number of laundry loads with liquid detergent). *To note, as an exception, for Germany a 15% increase of the number of loads with dilute product was found (a trend that appears to have already started in 2012).*

Figure 6. Calculated number of wash loads with liquid detergents.



¹⁰ Eurostat

¹¹ www.ssb.no; www.helgilibrary.com; en.wikipedia.org; www.llv.li

¹² AISE H&P study 2020: 6.7 washes per household per 2 weeks

¹³ calculated from Euromonitor data on category average recommended dosage and tonnage, per country

Concentrated liquid detergents

For concentrated liquid detergents (Table 2), the equivalent pre-compaction tonnage for the number of wash loads in 2019 was calculated by means of the pre-compaction (2015) dosage.

For the vast majority of wash loads with concentrated liquid detergent in 2019, the corresponding pre-compaction product is also concentrated liquid (but with a somewhat higher dosage). However, because in 2015 the share of standard (dilute) liquid detergents was slightly higher than in 2019, a small percentage (0.4%) of the 2019 loads washed with concentrated liquid would have been washed with standard liquid back in 2015. This is of some relevance for Central Europe and for Italy. For this proportion of the 2019 loads, the 2015 dosage for standard (dilute) liquids was used as a benchmark.

Finally, the difference between the calculated benchmark and the actual 2019 tonnage reflects the estimated detergent reduction due to compaction.

Table 2. Concentrated traditional liquids - PREP-L2 tonnage reduction based on number of wash loads

	Million wash loads in 2019 (total)	Million wash loads in 2019 (from standard liquids)	Benchmark tonnage	2019 tonnage	Reduction
Bulgaria	233.8	2.4	16468.5	15404.6	1063.9
Czech Republic	307.9	0.9	21334.8	17149.6	4185.2
Hungary	449.3	4.1	30241.5	24263.4	5978.1
Poland	417.5	0.5	27987.1	27386.8	600.3
Romania	292.4	0.0	20205.9	18597.6	1608.3
Slovakia	155.1	0.4	11227.5	9215.2	2012.3
Central Europe	1856.0	8.3	127465.3	112017.2	15448.1
Austria	556.6	0.0	39073.3	34397.9	4675.4
Belgium	820.8	0.0	51466.6	43422.4	8044.2
France	5165.4	0.0	307342.7	274800.5	32542.2
Germany	3810.8	N.A.	269808.1	219886.0	49922.1
Greece	308.9	0.0	20297.6	16652.1	3645.5
Italy	4243.1	71.1	270996.7	229553.4	41443.3
Netherlands	727.1	0.0	41810.9	37375.3	4435.6
Spain	2452.6	0.0	160154.7	159664.2	490.5
Sweden	310.4	0.0	12944.6	12758.3	186.3
Switzerland	369.3	0.0	24118.4	21311.4	2807.0
Western Europe	18765.3	71.1	1198013.8	1049821.5	148192.3
All PREP-L2 countries	20621	79	1325479	1161839	163640

Light duty

A similar calculation was done for light duty detergents (Table 3) (for the light duty sub-segment, the additional complexity of considering the dilute product form was not required).

Mono-dose

For mono-dose liquid detergents (Table 4), only the incremental number of wash loads with this product category in 2019 versus the pre-compaction situation in 2015 is relevant to assess compaction benefits. Indeed, existing share of the mono-dose form in 2015 already far exceeded the PREP-L2 compaction targets and thus, the initiative did not drive any changes within this sub-segment. On the other hand, incremental volume in the mono-dose liquids sub-segment can be assumed to have replaced washes with the closest traditional product, i.e. concentrated liquid detergent.

The incremental number of wash loads is determined as the difference between the calculated number of loads with mono-dose in 2019 versus 2015. As a benchmark, the tonnage is determined for the scenario where this incremental number of mono-dose wash loads would be laundered with traditional liquid detergent using the pre-compaction dosage of concentrated liquids.

Table 3. Light duty liquids - PREP-L2 tonnage reduction based on number of wash loads

	Million wash loads (2019)	Benchmark tonnage	2019 tonnage	Reduction
Bulgaria	64.0	4829.2	4387.3	441.9
Czech Republic	38.5	2329.1	2225.2	103.9
Hungary	11.9	773.2	665.1	108.1
Poland	26.1	1761.3	1769.1	-7.8
Romania	0.7	43.6	44.1	-0.5
Slovakia	6.4	403.3	285.8	117.5
Central Europe	147.7	10139.8	9376.6	763.2
Austria	115.0	7959.1	7200.0	759.1
Belgium	63.9	4181.6	3567.8	613.8
France	401.9	23711.5	23390.0	321.5
Germany	1094.6	76074.6	70930.0	5144.6
Greece	6.8	421.8	418.4	3.4
Italy	618.7	43865.4	36008.0	7857.4
Netherlands	233.5	12116.6	12280.0	-163.4
Spain	597.1	22510.4	22689.5	-179.1
Sweden	8.1	358.2	332.4	25.8
Switzerland	128.2	6784.2	6797.0	-12.8
Western Europe	3267.8	197983.4	183613.1	14370.3
All PREP-L2 countries	3416	208123	192990	15134

Table 4. Mono-dose liquids - PREP-L2 tonnage reduction based on incremental number of wash loads

	Million incremental wash loads (2019 vs 2015)	Benchmark tonnage associated with incremental loads	2019 tonnage associated with incremental loads	Reduction
Bulgaria	15.5	1094.3	502.1	592.2
Czech Republic	65.2	4509.5	1661.7	2847.7
Hungary	142.2	9528.2	3626.4	5901.8
Poland	182.0	12196.6	4496.4	7700.3
Romania	41.7	2882.2	1330.6	1551.6
Slovakia	16.6	1197.3	423.9	773.4
Central Europe	463.2	31408.2	12041.1	19367.1
Austria	18.5	1301.5	495.0	806.5
Belgium	50.4	3161.5	1321.1	1840.4
France	375.1	22315.6	9301.3	13014.3
Germany	452.5	32033.8	8732.4	23301.4
Greece	31.8	2091.4	837.2	1254.2
Italy	262.0	16635.3	6863.7	9771.6
Netherlands	129.7	7455.7	3241.6	4214.1
Spain	213.0	13911.1	6604.0	7307.1
Sweden	10.1	421.3	272.8	148.5
Switzerland	9.0	587.3	238.3	348.9
Western Europe	1552.1	99914.4	37907.4	62007.0
All PREP-L2 countries	2015	131323	49950	81374



Total achievement

In total, across all participating countries, the compaction achievement for traditional (free-flowing) liquid detergents amounts to a reduction of 179,000 tonnes/year. Most of the savings came from heavy duty products, whereas light duty detergents contributed 8.5% of the total.

When also including the tonnage reduction due to the growth of the mono-dose sub-segment, this adds up to 260,000 tonnes per annum. Looking only at Central Europe, over half of the total savings (of 35,600 tonnes/year) are associated with the move to mono-dose. In Western Europe, the total achievement of 225,000 tonnes/year is for 72% due to traditional liquids (163,000 tonnes/year).

Table 5. Total PREP-L2 estimated tonnage reduction based on number of wash loads

	Traditional Liquids	Entire Liquid Segment (incl. move to mono-dose)
Bulgaria	1505.8	2098.0
Czech Republic	4289.2	7136.9
Hungary	6086.1	11988.0
Poland	592.5	8292.7
Romania	1607.8	3159.4
Slovakia	2129.9	2903.2
Central Europe	16211.3	35578.3
Austria	5434.5	6241.0
Belgium	8658.0	10498.5
France	32863.7	45878.0
Germany	55066.7	78368.2
Greece	3649.0	4903.2
Italy	49300.8	59072.4
Netherlands	4272.2	8486.2
Spain	311.4	7618.5
Sweden	212.1	360.6
Switzerland	2794.2	3143.2
Western Europe	162562.6	224569.6
All PREP-L2 countries	178774	260148

PREP-L2 achievements compared to LSP-L

As a reality check, the accomplishment of PREP-L2 was compared with the previous liquid detergent compaction initiative LSP-L (2011-2012). The estimated tonnage reduction of LSP-L amounted to 310,000 tonnes per year.

LSP-L focused on reducing the dosage of the 'standard' heavy duty liquid detergents across Europe - a segment with a volume of 750,000 tonnes/year in 2010. The dosage decrease was typically 25 ml/wash (from 100 to 75). Note that for several Western European countries LSP-L had limited practical relevance, because their market had previously already shifted to 'concentrated' heavy duty liquids with a dosage close to or below 75 ml/wash (e.g. the United Kingdom, Ireland, Germany, Austria, Switzerland, Belgium, Nordic countries). Also, the impact in Central Europe was limited because at the time, powders still covered most of the market. As such, 95% of the LSP-L achievements were materialised in only four countries: France, Italy, the Netherlands, and Spain.

PREP-L2 had a broader effective scope than LSP-L, impacting all heavy duty and light duty traditional liquids, across 19 countries. Importantly, the 'concentrated' heavy duty liquids were also subject to further compaction under PREP-L2. Consequently, the potentially impacted volume of PREP-L2 was almost the double: 1.3 million tonnes per year. On the other hand, the dosage reduction was more limited, typically 10 ml/wash (i.e. from 65 to 55).

Extrapolating the achievement of LSP-L to PREP-L2, considering the higher volume effectively within scope for compaction but also the more limited dosage reduction, the expected tonnage reduction for PREP-L2 would be 40% lower than for LSP-L, at approximately 220,000 tonnes/year. This extrapolation is in the middle between

the two estimated achievement results for *PREP-L2* (respectively including and excluding the contribution from the move to mono-dose). Thus, the calculations for *PREP-L2* are in line with the previous results for *LSP-L*.

This finding also validates the *PREP-L2* calculation approach that implicitly depends on dosage information. For *LSP-L* a different methodology was used (based on longer term linear extrapolation of market value and tonnage trends) that did not rely on dosage information. The fact that compatible results are found with the methodology that was applied for *PREP-L2* indicates that the underlying assumptions are plausible, and thus, that actual dosage on average correlates well with recommended dosage.



Sustainability Benefits

Compaction of liquid detergents is mainly achieved by using less water to formulate the product. This way the concentration of active ingredients is increased, and thus, a smaller dose contains the same amount of active ingredients per wash.

This brings about several sustainability benefits in addition to the water use reduction in the manufacturing step. The throughput of detergent volume through the production process is reduced, which leads to a reduction of the energy consumption at manufacturing. For an equivalent number of doses, smaller packaging can be used (or alternatively, more doses can be included in the same packaging). This leads to a reduction of packaging. Finally, because lower amounts of product need to be shipped from the producer to the retailer, a transport reduction is achieved.

The reported sustainability benefits refer only to compaction achieved within the traditional (free flowing) liquids form. Compaction through moving to the mono-dose form (liquid laundry detergent capsules) was not included in this assessment, because the sustainability aspects are not directly comparable.

Water Reduction

The tonnage reduction due to liquid laundry detergent compaction is assumed to be integrally achieved via the use of less water in the formula. Thus, the estimated tonnage reduction is equivalent to the amount of water saved at the detergent manufacturing sites. Across Europe, this is nearly 179,000 m³ per year.

Packaging Reduction

Due to compaction, a higher number of detergent doses can be contained in a bottle, or alternatively, smaller bottles can be used for the original number of doses. Either way, a reduction in packaging materials is achieved.

For the purpose of this assessment, the 2 L bottle size was used as a representative model (this was the most common size in the market, as confirmed by the participating companies). The total packaging weight for a 2 L bottle is on average about 195 g (average of aggregated information provided by several participating companies). This consists of 113 g of plastic for the bottle and the cap, and 82 g of cardboard for the transport packaging. Consequently, for each tonne of detergent volume reduced, a packaging reduction by 0.113 kg : 2 L x 1000 = 56.5 kg of plastic, and 0.082 kg : 2 L x 1000 = 41 kg of cardboard was assumed - or a total packaging reduction of 97.5 kg per tonne of detergent reduction.

Based on the estimated liquid detergent tonnage reduction by 179,000 tonnes/year across Europe, the corresponding packaging reduction amounts to almost 17,500 tonnes/year. This includes over 10,000 tonnes of plastic and nearly 7,500 tonnes of cardboard.

Transport Reduction

Transport reduction due to the compaction of liquid laundry detergents is driven by the finished product transport from the manufacturing site to the retailer. Upstream of the detergent manufacturing, there is no ingredient transport reduction because water (the ingredient of which the amount is reduced) is sourced locally.

Transport of detergent finished product to the retailers is assumed to be by truck, on average over a distance of 1,200 km (cf. the LCA study on powder detergents by PRé Consultants, 2014)¹⁴. Thus, every tonne of liquid detergent that is not to be shipped, is estimated to lead to a transport reduction of 1,200 tonne.km. This is equivalent to 54 km driven by a heavy truck with a typical load¹⁵ of 22 tonnes.

¹⁴ PRé Consultants. A.I.S.E Screening LCAs for Cleaning Products in Europe Compact powder and tablet laundry detergents. Report for A.I.S.E. February 2014.

¹⁵ For consistency, assumptions were reapplied from the Closeout Report - A.I.S.E. Laundry Sustainability Project # 1^{SEP} for Heavy Duty Low Suds Laundry Powder Detergents (LSP-1) (December 2009).

Based on the estimated liquid detergent tonnage reduction by 179,000 tonnes/year across Europe, the corresponding truck transport reduction amounts to over 210 million tonne.km/year. This is equivalent to avoiding close to 10 million heavy truck kilometres - or over 240 times around the earth's circumference with a loaded heavy truck.

Greenhouse Gas Reduction

The estimated greenhouse gas reduction associated with *PREP-L2* compaction, is determined as the difference between the CO₂ equivalent emissions associated with the pre-compaction product (i.e. pre-compaction liquid detergent dosed at about 65 ml/wash) and the emissions associated with the compacted product (dosed at 55 ml/wash). The functional unit for this comparison is one wash.

By far the primary driver of greenhouse gas emissions in the life cycle of laundry detergents is the energy to heat the water during the use phase (in the consumer's washing machine). However, this aspect is not impacted by compaction, thus, it can be disregarded in this context.

The second most important driver is the carbon footprint of the active ingredients (such as surfactants) in the product. Whereas the percentage of active ingredients in a more compact product is higher, their amount per wash is in principle the same. An exception is the use of solvents. This was not yet a relevant aspect for earlier compaction initiatives, but at the higher levels of compaction introduced with *PREP-L2*, there is generally a need for increased use of organic solvent. This is to ensure formula stability and processing ability. While there may be a fairly broad range in practice, on average it can be assumed that in the order of 1 g/wash of extra solvent is needed. The greenhouse gas emissions associated with the production of 'mixed solvents' is about 2,000 kg CO₂eq per tonne of solvent¹⁶. With 1 g of incremental solvent consumption per wash, this translates to an increase of the climate impact by on average 2 g CO₂eq/wash. In terms of ingredients' impact, it should be noted that the climate impact of water in the formula is negligible compared to the other detergent ingredients. Thus, the fact that less water is to be sourced does not contribute to a meaningful climate benefit.

Finally, greenhouse gas reductions are achieved in the processing, packaging and transport of the detergent. This is due to the lower volumetric throughput in the production process, the use of less packaging material per wash, and a lower tonnage of finished product that has to be transported. While relevant in absolute terms, these processes do not represent a major contribution in the overall life cycle. Based on several LCA studies (public as well as proprietary) one may assume that per tonne of liquid detergent volume reduction, by moving from dilute to compact liquid detergents, in the order of 0.2 tonnes of CO₂eq is saved¹⁷. It should be noted that this value reflects the difference in greenhouse gas emissions between products with a different extent of compaction. The actual greenhouse gas emission associated with one tonne of detergent (excluding the use phase) is an order of magnitude higher. Thus, moving from an average pre-compaction dosage of about 65 ml/wash down to 55 ml/wash leads to a detergent reduction in the order of 10 ml = 10 g per wash. This corresponds with a climate benefit of 2 g CO₂eq/wash.

On the one hand, liquid detergent compaction under *PREP-L2* led to a climate benefit of about 2 g CO₂eq/wash due to the inherent benefits of compaction. On the other hand, this extent of compaction implied an incremental greenhouse gas emission of - on average - about 2 g CO₂eq/wash due to the increased use of solvents. In net, *PREP-L2* is expected to have not led to meaningful changes in the climate impact of liquid detergents.

¹⁶ Ecoinvent (2010) Ecoinvent v2.0 database. Swiss Centre for Life Cycle Inventories, Dübendorf, Switzerland; quoted in ETHOS (2013). Carbon Footprints of Recycled Solvents. Study for the European Solvent Recycler Group (ESRG). August 2013. data for 'mixed solvents'.

¹⁷ Gert Vanhoof, Procter & Gamble, personal communication (May 2018).

Conclusions

PREP-L2 has successfully continued to drive the momentum that had been introduced via the earlier *LSP-L* initiative. Across all participating countries and across the market (i.e. also including brands not committing to *PREP-L2*) an average dosage of traditional liquid detergents of 57.9 ml/wash was achieved - which is 11% lower than the average dosage of 65 ml/wash prior to the initiative.

The ongoing compaction of liquids is especially relevant in the current market where consumer preference has continued to shift towards the liquid form. Indeed, in 2019 over three-quarters of the market's retail value was in liquid detergents. In Western Europe the majority of the compaction benefits under *PREP-L2* were achieved by dosage reduction of traditional free-flowing liquid detergent. In Central Europe, the tonnage reduction achieved via traditional liquids was matched by the reduction associated with the move to mono-dose.

The achievements of *PREP-L2* demonstrate that the detergents industry continues to embrace the sustainability value of compaction. A majority of companies joined and actively supported the initiative, thus making it possible to reach a very large number of consumers across Europe. Likewise, the achievements also indicate that consumers have embraced the importance of dosage reduction.



Annex 1 - *PREP-L2* Project Description

The *LSP-L* project description can be found on the A.I.S.E. web site:

“Our activities” → “Sustainable cleaning” → “Product resource efficiency projects”

The direct link is:

www.aise.eu/preps



Annex 2 - Alternative methodologies to quantify tonnage reduction

The methodological options below were explored, but rejected because they were judged to be inappropriate.

Direct tonnage comparison

In the absence of any other dynamics in the market than compaction, the tonnage reduction due to the liquid detergent dosage reduction can be quantified by comparing the total tonnage of this detergent segment before and after the initiative.

However, as shown in Figure 2 and Figure 4 above, the liquid detergents market has not been stable between the year before *PREP-L2* compaction (2015) and the year following implementation of the initiative (2019). In parallel with compaction, the value share of the liquids segment has grown (from 68% to 76% across Europe). Furthermore, in Central Europe, the total detergent market value has increased by over 7%. Both aspects have contributed to a tonnage increase for liquid detergents, counteracting the tonnage decrease that happened in parallel due to compaction.

In conclusion, the observed tonnage difference between 2019 and 2015 reflects the net effect of opposite dynamics, and from this it is not possible to identify the actual achievement of compaction in isolation.

Ratio of tonnage to market value share of the liquids segment

The ratio of the liquid detergent tonnage relative the market share of this product form, can serve as an indication for the extent of compaction. Indeed, a lower tonnage : share ratio would imply that less detergent is used for an equivalent value, i.e. an equivalent number of washes. Thus, in general one can assume that a decrease of the tonnage : share ratio implies that compaction has taken place.

In principle, this approach is not influenced by growth of the market value share of the liquid detergent segment, because if the tonnage increases proportionally with the share growth, the ratio between both is constant. Only if the tonnage growth is less than the share growth, the ratio decreases, indicating compaction.

However, several other elements influence the market value share of liquid detergents, beyond just the number of wash loads with liquids. For example, when market share moves from powders to liquids, the market value per wash may be different between both forms, and thus, the change in value share does not correspond exactly with the change in number of wash loads. Furthermore, pricing differences between and within detergent forms are dynamic over time, which can result in changes in the value share independent of the number of washes. Finally, the total market size is dynamic (especially with growth in Central Europe) - which implies that a constant value share can nevertheless correspond with an increasing number of washes.

In conclusion, the difference in the “tonnage : share ratio” for liquids between 2019 and 2015 is influenced by different and evolving pricing between detergent forms, as well as by overall market growth dynamics. Thus, this metric is not expected to allow identifying the achievements of liquids compaction.

Benchmark based on market value scaling

A “pre-compaction” benchmark tonnage can be derived from the actual observed 2015 liquid detergent tonnage, by means of extrapolation using the liquid detergent market value growth since then. This approach aims to reflect what the tonnage would have been in 2019 if compaction had not taken place, but nevertheless liquids share growth (and if applicable, also overall market growth) had taken their normal course.

To achieve this, it is assumed that the market value per wash (i.e. retail selling price for one dose of liquid detergent) has been constant (when corrected for inflation). In other words, it is assumed that the number of wash loads with liquid detergent has increased proportionally with the increase of the liquid detergent segment’s market value. The 2015 tonnage is then scaled to 2019, based on the market value growth between 2015 and 2019. Thus, it is assumed that without compaction, the market value growth would have coincided with a tonnage increase by exactly the same proportion.

This approach takes into consideration the growth of the liquids segment, both through segment share growth and through overall market growth. Nevertheless, the metric for value (retail selling price of liquid detergents) will have been subject to other dynamics such as promotions, overall pricing strategy changes, shifts within the liquids segment (e.g. growth of the mono-dose form), evolutions in the retail landscape... As such, the



observed RSP value growth is not expected correlate directly with the increase of the number of laundry loads washed with liquid detergent.

In conclusion, an extrapolation of the pre-compaction tonnage based on changes in market value takes into account the growth of the liquids segment - but is expected to be unreliable due to pricing dynamics within the segment.

