ECOCARE: more sustainability and less plastic for absorbent hygiene products

EcoCare is the short name for a three-year research project (2019–2022) that developed and explored more sustainable material options for absorbent hygiene products (AHP) such as baby diapers, sanitary napkins and tampons.

The official full title is

"DEMONSTRATION OF IMPROVED ENVIRONMENTAL IMPACT OF AHP USING A SUSTAINABLE ECO-TECHNOLOGY."

The research at Procter & Gamble (P&G) in Germany was co-funded by the EU LIFE Environment and Resource Efficiency Programme 2019 under Grant No. LIFE18 ENV/DE/000137 ECOCARE (Procter and Gamble, no date a). This article represents the 'layman's report' at project completion.

During the last decade, AHP have been increasingly challenged in public discussions about waste management, lack of circular economy of materials, resource consumption and CO_2 emission. Activists have called for a complete removal of plastic and strongly push for reusable products.

Several related European Union environmental sustainability policies and regulations have been developed, such as the EU climate policy and the White Paper on Transport 2011, the 7th Environment Action Programme and the Roadmap for a Resource-Efficient Europe, the revised Waste Framework Directive (2018/851) and the revised Landfill Directive (EU 2018/850). In July of last year, the EU Directive on Single-Use Plastics (EU 2019/904) reached the application phase in the member states. Thus, the message is loud and clear: AHP should further increase their environmental sustainability. Most wanted by consumers (Figure 1):

- Reduce plastic in the product
- Make packaging recyclable and use recyclable or renewable resources
- Deliver the performance expected from a quality branded product.

Inspired by consumers

Figure 1: Consumer needs, P&G Market Research 2020, Copyright © Procter & Gamble. Unpublished.

Past efforts to develop or promote reusable or biodegradable products for the AHP sector have not always been commercially successful. Consumers do not want to miss the comfort and protection performance of the single-use product versions. In the case of menstrual protection products, hygiene considerations preclude public collection and disposal via biodegradation or recycling. In fact, alternative solutions account for about 5 per cent of the market, despite a growing interest in sustainable products.

How to improve the environmental profile of AHP?

P&G's answer: with a science-based approach and intelligent design—as for all consumer products in the portfolio over the last decades. P&G is a consumer goods company with more than 180 years of experience and is known for the statement, "The consumer is boss". This means P&G listens to consumers and designs products inspired by their input. Environmental impact assessments help determine which steps in the life of AHP (and other consumer products) have the biggest influence. A 'life cycle assessment' (LCA), according to ISO 14040 and ISO 14044, is a good tool for the start of a journey for all involved partners.

Thus, industry assessments have shown that more than 50 per cent of the environmental footprint of its AHP originated from raw material sourcing and production (Figure 2). Also, the disposal of the products has a considerable contribution. AHP finished product manufacturing, packaging and distribution comprise a smaller part of the footprint. Not surprisingly, product usage is only a very small factor for AHP—this is different compared with, e.g. clothes washing detergents, where most environmental impact is caused during the consumer use phase, especially by washing at high water temperatures.

Figure 2: Generic AHP product environmental impact assessment segments, 2020. Copyright © Procter & Gamble. Unpublished.

With the insights from the environmental impact assessment, P&G looked closely at specific AHP product types and started assessing which changes could best improve environmental sustainability.

Baby diapers and period protection products (sanitary napkins, pantyliners) consist of sophisticated liquid and odour absorption and retention technology (EDANA 2019a; EDANA 2019b) (Figures 3 and 4):

- top and intermediate layers of synthetic or nature-derived materials (such as polyethylene, polyester, polypropylene, viscose and cotton)
- an internal absorbent core of cellulose fluff, with or without polyacrylate super-absorber (SAP)
- a watertight bottom layer.

The material selection and sequence of layers are high-tech. Their key functions and functionality must be preserved. But research can target the efficiency of the materials used or search for alternative materials, or design reusable products—whereby for these, the additional environmental impact of, e.g. washing water and detergent must be considered.

For diapers, it is obvious—but the same is true for period products—that the absorbent core construction brings most of the product and material weight to the balance (Figure 3 and 4).

However, any material saving efforts must consider that for consumers, diapers are a 'risk' category because of the consequence of potential leaks. Anyone who had babies certainly experienced moments like this: when the toddler was sitting in the back of grandpa's new car with leather seats, and the reliability of the diaper was not to be questioned. Or when visiting the neighbours with their exquisite Persian carpets on which baby girl or boy was playing. This means that consumers will tend to select a product that promises the best performance and not necessarily choose environmental sustainability as the first selection criterium.

In the case of period protection products, it is also imperative that they do not leak and stay unnoticed due to the taboo and shame linked to menstruation.

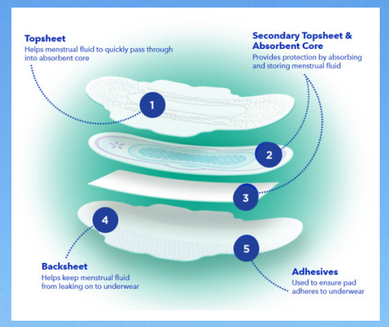

Figure 4: Generic P&G sanitary napkin technology 2021. Copyright © Procter & Gamble. Unpublished.

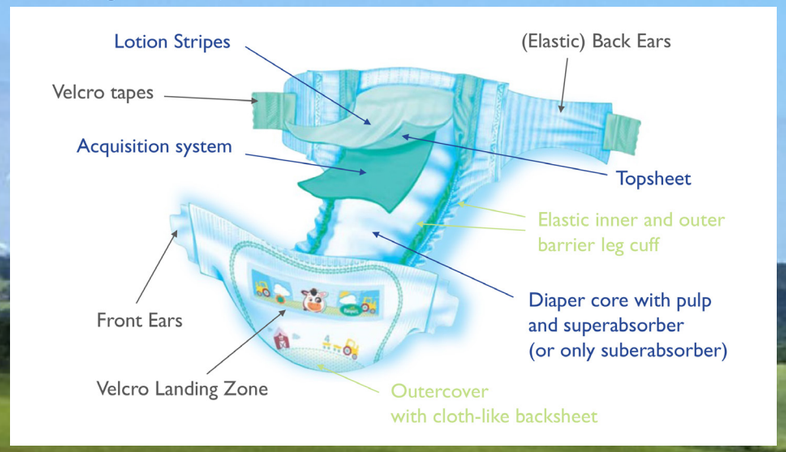

Figure 3: Generic P&G baby diaper technology 2021. Copyright © Procter & Gamble. Unpublished.

Thus, innovation must fulfil expectations regarding performance, product safety AND sustainability at the same time.

This leads to the science and technology behind the product development (Table 1, Figure 5).

Table 1: AHP Design Parameters
Performance, including safety – in figure 5, we see how the other parameters play as variables
Technical feasibility – the combination of materials and construction
Consumer evaluation – reality test
Cost – affordability
Sustainability

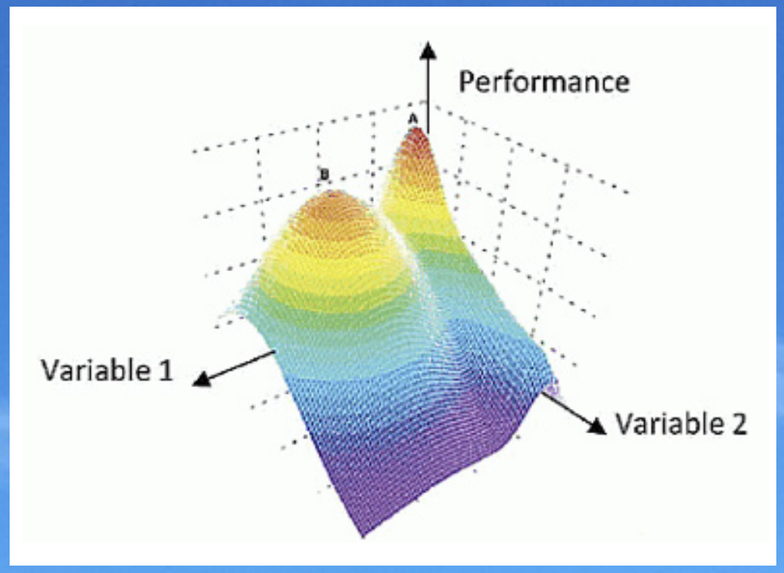

Figure 5: Interdependency of design variables, 2017. Copyright © Procter & Gamble. CELSTAB.

Exaggerated material saving can lead to 'under-design', create less effective products and cause an increased number of products used per day (e.g. diapers must be changed and disposed of more often). Thus, it may not necessarily result in a gain for sustainability. 'Over-design', on the other hand, increases material use and cost. It can also not contribute to more sustainability in the market, as other potentially more cost-effective but less sustainable products may be preferred by consumers.

Figure 6 shows an example of environmental impact or LCA scenarios to calculate. The scenarios are interdependent: if, for example, cotton is applied to replace synthetic (fossil-based) material, there will be a reduction in global warming, fossil energy and particulate matter, but on the other hand, land and water use will increase.

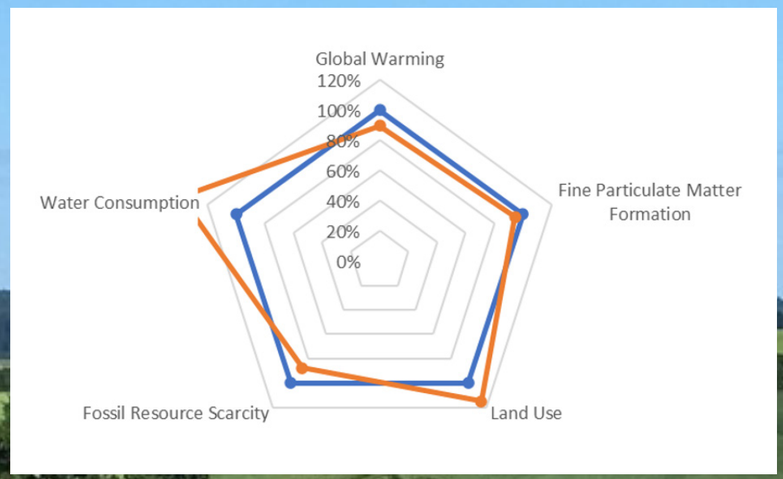

Figure 6: Example of trade-off in an LCA. Blue = reference product with synthetic materials. Orange = product with renewable materials. Copyright © Procter & Gamble. Unpublished.

With that in mind, the P&G research team selected product options for refining and testing, defined sustainability success criteria (Box 1: EcoCare research targets) and applied for EU co-funding.

Material efficiency: Get more with less

Sustainability benefit:

- Less materials (10–25%)
- Waste prevention and reduction (10–25%)
- GHG emission reduction (5–15%)
- Increased sustainable resources
  - Over 75% on weight basis in period products
  - Up to 50% on weight basis for baby diapers.

Box 1: EcoCare research targets, 2019. Copyright © Procter & Gamble. Unpublished.

EcoCare and the EU Commission's LIFE programme

The EcoCare project was approved as a three-year grant for research within the LIFE framework, led by **CINEA** (European Climate Infrastructure and Environment Executive Agency, no date). The LIFE programme is the EU instrument to fund research efforts for a better environment in several categories. Just this year, it celebrated its 30th birthday!

Companies of every size can apply and be accepted if the research proposal meets the programme criteria. The LIFE programme is not intended as basic economic support but to help push upstream research into initiatives to go to market.

For P&G, EcoCare allowed funding and resources for a defined part of upstream research on period products and baby diapers in R&D, namely in three areas:

- **Material reduction** – Smartly restructured fibre distribution through the internal layers of the absorbent core.
- **Integration of new materials into products** – Biobased, from renewable and recyclable resources, for example, cotton, cellulose, corn, bio-superabsorber, biobased naphtha, bio-PE/PP films and nonwovens.
- EU locally sourced fibres.

EcoCare results

This 'layman's report' provides a general summary of the EcoCare results and an outlook for the future on maintaining performance and gaining sustainability for AHP with intelligent design. The detailed composition of the involved products is proprietary to the raw material suppliers and P&G as a manufacturing company; thus will only be disclosed under a confidentiality agreement.

Figure 7: P&G ALWAYS pantyliner. Copyright © Procter & Gamble.

Actions

- A special absorbent core construction (Procter and Gamble, no date b) could be integrated into pantiliner prototypes for the first time (Figure 7).
- Diaper and period protection prototype options were designed with combinations of alternative sustainable materials.
- The research team at P&G analysed and evaluated the trade-off for different materials, processes and end-of-life solutions.
- The product development was accompanied by intensive consumer testing for comfort and efficacy in practice.
- Finally, achieved project targets were verified with the help of environmental impact assessments (Figure 8).

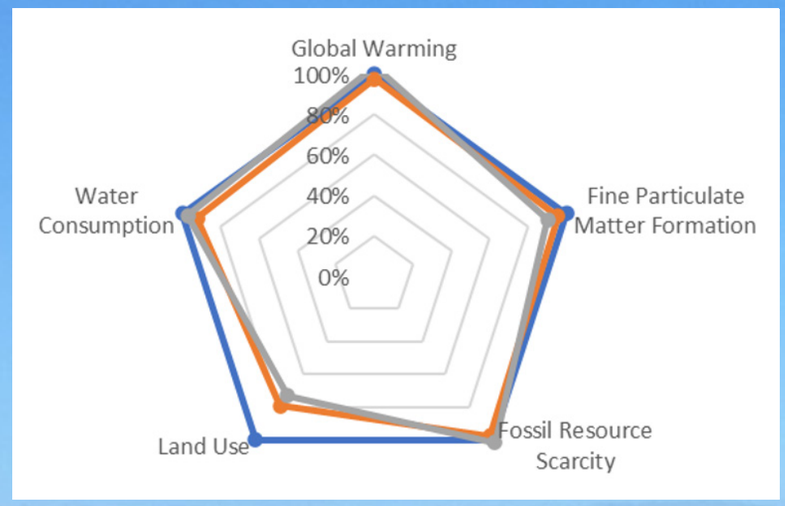

Figure 8: Example of material reduction LCA, 2022. Copyright © Procter & Gamble. Unpublished. Blue = reference product. Orange/grey = products with reduced material (by weight).

Figure 9: New diaper prototype (right) against reference (left) showing product mass reduction with comparable performance and protection, 2021. Copyright © Procter & Gamble.

Results

- The key result is that the selected designed product options have met all the sustainability success criteria laid down in the EU LIFE grant application (Box 1: EcoCare research targets).
- The project research team has achieved the 10–25 per cent material reduction (by weight) in the absorbent structure of baby diapers and period products (Figure 9).
- One of the developed innovative material combinations for reduced-weight period protection products has been rolled out globally on the market since 2021.

  Calculated across the market volume, the material weight reduction for one year is estimated to be around 900000 tons. This is more than the weight of the Golden Gate Bridge in San Francisco as recorded in 1937 (Golden Gate Bridge, Highway and Transportation District, no date).
- The performance of the developed product options has successfully passed the in-use tests with consumers.

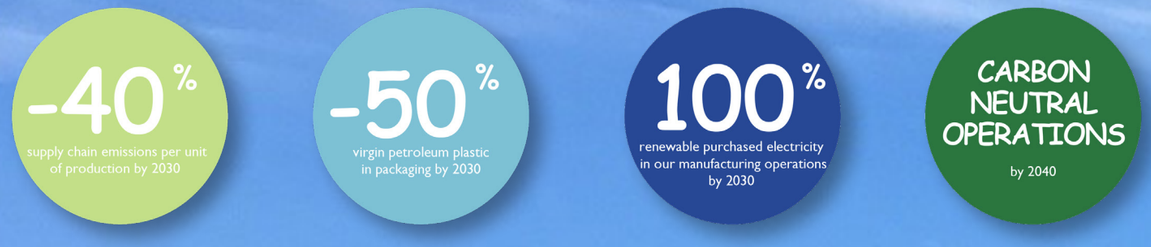

Figure 10: P&G Sustainability Goals, 2021. https://us.pg.com/environmental-sustainability/ Copyright © Procter & Gamble.

EcoCare outlook

EcoCare has been presented to industry and stakeholders at the EDANA International Nonwoven Symposium in Lyon in June 2022. Respective further dissemination aims to raise political awareness and use this industrial showcase to inspire more and similar projects in the AHP sector. For P&G, EcoCare and the AHP sustainability research are part of the company's effort to reach the corporate sustainability goals (Figure 10).

Conclusions at the completion of EcoCare

- Innovation in the AHP sector must fulfil expectations regarding performance, product safety AND sustainability to win with consumers in the market and have a sustainability impact.
- Consumer input AND solid science are the basis for sustainable product design to meet all independent criteria. This will help prevent greenwashing and defend valuable sustainability efforts.
- Upstream sustainability research projects waiting in the pipeline can be pushed forward into market initiatives with the help of EU funding.

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ECOCARE

PROJECT NAME

Demonstration of improved environmental impact of AHP using a sustainable eco-technology

PROJECT SUMMARY

The EU co-funded LIFE EcoCare research (2019–2022) explored sustainable design alternatives for absorbent hygiene products (AHP) such as baby diapers, sanitary napkins and tampons. The project achieved a 10–25 per cent material reduction for the absorbent structure. Sustainable material alternatives from renewable sources could be applied in functional layers and fully met success criteria for period protection products and baby diapers.

PROJECT LEAD PROFILE

The Procter & Gamble Company (P&G) was founded in 1837. Today P&G is a multinational consumer goods corporation with a huge portfolio of hygiene and household brands in more than 180 countries. P&G set the sustainability ambition for 2040 to achieve net zero greenhouse gas emissions across its operations and supply chain, including interim 2030 goals for progress in this decade.

P&G is aware of its responsibility as a driving force of innovation in the AHP sector. In the P&G Innovation Centre in Schwalbach, Germany, research groups are enhancing the absorbent system of baby diapers and menstrual protection. P&G research and development activities have led to several new patented applications that have the potential to reduce waste and improve environmental performance substantially.

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FUNDING

The EcoCare – SUSTAINABLE DESIGN FOR ABSORBENT HYGIENE PRODUCTS project has received funding from the European Union LIFE Environment & Resource Efficiency Programme 2019 under grant agreement No. LIFE18 ENV/DE/000137 ECOCARE.