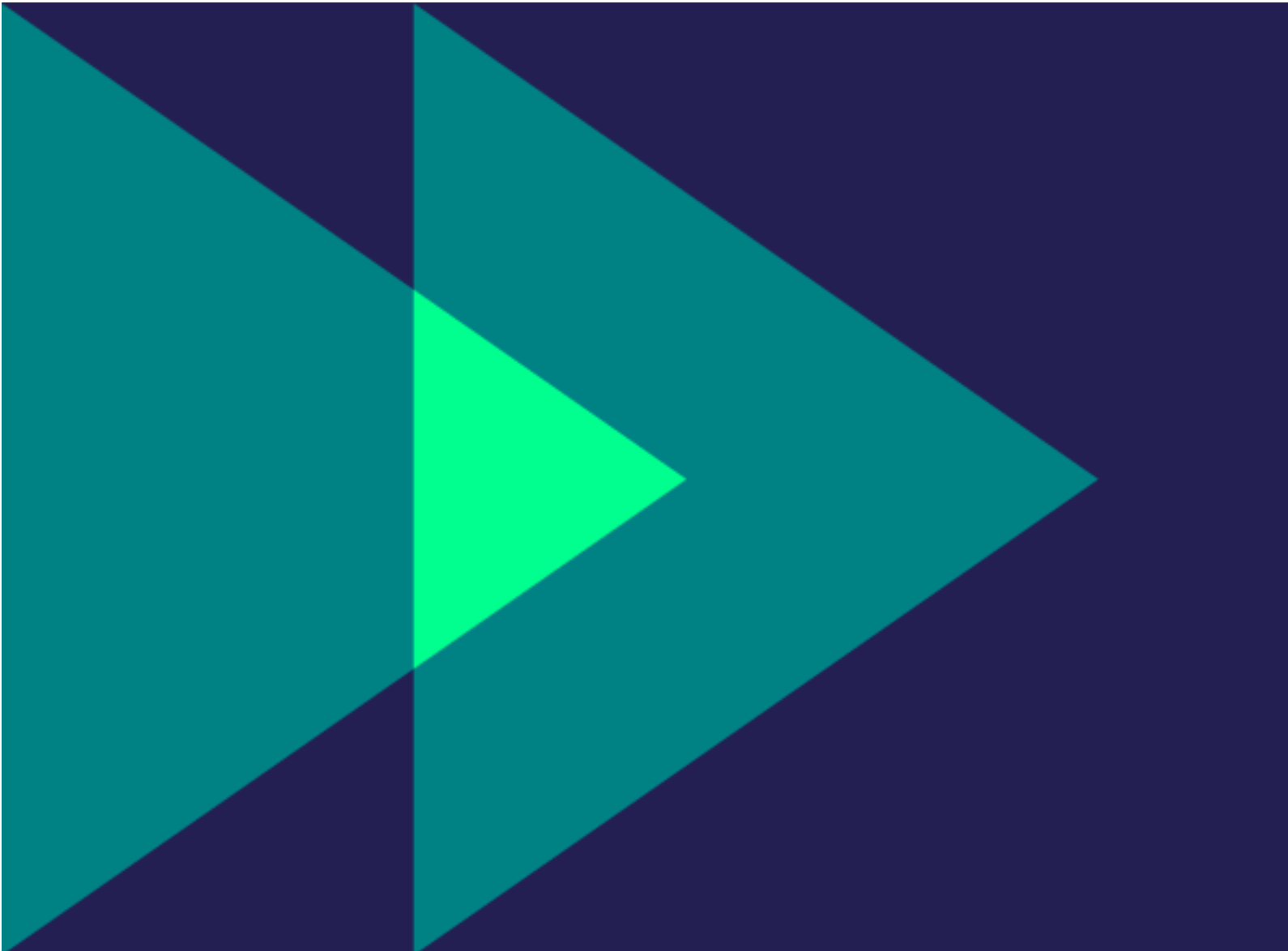


VALIDATION REPORT

Cleannest
2022 CDA036



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Details of the validation process

	Validation request	First review	Feedback call	Hand-in revisions	Final review	Wrap-up call
Date	12/07/22 20h27	21/07/22 00h01	25/07/22 11h00	09/08/22 10h35	09/08/22 17h00	TBA
Result	Invalid, positive and significant			Valid, positive and significant		

Colofon

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Introduction and definitions

This Validation report documents the Validation of a Climate Impact Forecast:

Validation is a review process performed by an impartial impact expert to determine if a CIF is Valid, Positive and Significant.

The **Validation process** usually takes two weeks and includes a first review, a first feedback call between the team and validator, time for revisions if needed, a final review and a final results call. For a detailed description see www.impact-forecast.com/cif-validations

The **review** comprises a structured check using our CIF Validation tool, a sensitivity analysis and the writing of an Impact story. CIF trainers with LCA expertise are trained to perform this process in a uniform and objective way.

CIF Validations are made on the request of the project team, and possibly commissioned by an impact organisation. The results are used by teams and organisations to compare and communicate the climate impact of projects.

A **Climate Impact Forecast** or CIF is an LCA based calculation of the GHG reduction or climate adaptation potential of a project. Using our CIF tool, the project team found the net climate impact of the key differences between business as usual and their innovative solution.

The **Impact data** in this report, and in CIF in general, is calculated with information from the project team and from the CIF tool. Technical details, amounts and assumptions in the calculation are provided by the project team. Impact factors (LCI data), impact equivalents and the calculation itself are provided by the CIF tool.

The **CIF tool** is used by teams to improve their impact and support design and business decisions with impact data.

CIF results are the project's potential or actual avoided emissions in tCO₂eq.

Every CIF Validation result consists of three independent outcomes:

Valid

A CIF is valid if it is representative of the project, using appropriate data and well justified assumptions. Therefore, the CIF and its results are representative of the potential for the project to mitigate, enable or adapt to climate change.

Detailed requirements for validity are specified on www.impact-forecast.com/cif-validations. A CIF can be Valid, Plausible, Improbable and Invalid.

Positive

A CIF is positive when it shows that the project has a lower climate impact than business as usual, or improved climate resilience in the case of adaptation. A positive mitigation or enabler CIF shows the avoided GHG emissions in -tCO₂eq.

This outcome depends on a sensitivity assessment. CIF results can be Positive, Positive within limits, Unclear, Sensitive and Negative.

Significant

A CIF is significant when the project has a climate impact (positive or negative) greater than 5 tonnes of CO₂eq per year. This is roughly the global average annual CO₂ emissions per person, and the mass of a male African Elephant.

The threshold for significant impact can be set to a higher amount for a particular organisation or occasion. The result can be Significant or Marginal.

Impact story

An impact story is a summary of how a project makes a positive climate impact. It is written by the validating impact expert and contains the key impact data from the Climate Impact Forecast.

CUTTING BACK ON THE CARBON EMISSION OF NAPPIES BY INCREASING ABSORPTION CAPACITY WHILE DECREASING RAW MATERIAL NEEDS

The production of today's disposable nappies requires a significant amount of Super Absorbent Polymer (SAP) and chlorine dioxide while having an absorption capacity with room for improvement. Cleannest is here to cut back on production material needs and to increase absorption capacity while also replacing a synthetic ingredient with an organic one, for protecting the health of our babies and of our planet.

How does Cleannest make a positive climate impact? Compared to which baseline?

Cleannest – a company based in London, United Kingdom – develops and sells innovative nappies. Compared to traditional disposable nappies (the baseline of this forecast), the production of Cleannest's nappies requires less Super Absorbent Polymer (SAP) and no chlorine dioxide for bleaching. Since both of these two materials have a significant carbon footprint, Cleannest saves emission already by using less of these in its nappies. However, the company did not stop here – the SAP they use is 20% more absorbent than traditional SAP. This means that nappies need to be changed less often which results in 30% less nappies having to be used overall for each baby. Less nappies mean less SAP and fluff pulp having to be used in production, which further decreases the company's carbon footprint and increases its positive climate impact.

Co-benefits

Cleannest does not only aim to protect the health of our planet but the health of our babies too. The company uses polylactic acid (PLA) to replace the synthetic polypropylene (PP) core of traditional nappies. Given the relatively high carbon footprint of producing PLA, a bioplastic, this decision comes at a higher carbon cost for the company compared to just using PP. However, this is a conscious choice in order to protect babies from being exposed to phthalates, carcinogenic and asthmogenic chemicals traditionally applied to PP during its manufacture. Where Cleannest uses PP, the company sources materials from providers that ensure harmful chemicals are not used in the process.

How much impact, and what does it depend on?

With their innovative nappies, Cleannest has the potential to save around 93 kilogrammes of CO₂eq. emission per the amount of nappies used by 1 baby aged 0-12 months in 1 year. This would amount to a total carbon emission saving of 93 tonnes of CO₂eq. per 1000 customers per year for the company. The positive impact of the company mostly depends on how much SAP and PP they are able to save and to what extent the carbon footprint of the production of these materials could possibly decrease in the future. In case there will be newer, low-carbon ways for producing these two materials, the relative impact of Cleannest would decrease. However, the forecast is robust, not sensitive – the company would have a positive and significant climate impact even in the case of a

hypothetical 70% decrease in the relative carbon intensity of the baseline.

Validity

The forecast is valid, positive and significant. The conclusions of the validation procedure: All checks are approved, no questions or concerns remain. Any external information checks out, and the impact is robust; a more detailed LCA should give results in the same range. The forecast shows that the innovation robustly reduces CO₂ impact. The impact is significant, meaning that it is greater than 5 tonnes per year, compensating for more than one average person.

Climate Impact Forecast and Validation result

Cleannest provides disposable nappies with more efficient materials and a higher proportion of natural content instead of conventional disposable diaper. The difference in impact is calculated per year and the total impact of Cleannest per year is calculated for 1000 times nappies used by 1 baby aged 0-12 months in 1 year.

Production | By looking at the number of diapers Pampers inserts into its monthly packs across sizes 1, 2, 3 and 4 to provide for babies aged 0-12 months, we calculated that $(104*1)+(252*2.5)+(234*3)+(210*6) = 2,696$ disposable nappies are used by 1 baby aged 0-12 months in 1 year (8) (multiplications by 2.5, 3 and 6 represent the amount of months a baby uses the respective size). On the contrary, due to higher quality and efficiency, a baby using Cleannest's nappies only requires 1,868 nappies in the first year. Hence, to supply one baby for a year, Cleannest requires far less raw materials that negatively impact the environment. On average, around 15g of fluff pulp is used in each nappy. (Source 10, end of page 18 and beginning of page 19) Through the same calculation we find that to supply 1 baby Cleannest uses $15*(2696 - 1868) = 12.4\text{kg}$ less of fluff pulp than the benchmark. Its LCI can be found here (1). Furthermore, Cleannest Super Absorbent Polymer (SAP) is 20% (1) more efficient than the benchmark. This allows us to use less SAP (8.8g instead of 11g), which is a non-biodegradable material (2). Using previous stipulations regarding the difference in the amount of nappies used by one baby in their first year, we can calculate that $(11*2696 - 8.8*1868 = 13.2\text{kg})$ SAP less is used by Cleannest to supply one child for a year. Its LCI was found by finding that 1 kg of a nappy is equivalent to 5.52 kg CO₂eq (under Table 3) and that SAP is responsible for 34.5% of a nappy's GWP (Table 3) (12). Further considering that an average nappy weighs 33g (5) and includes 11g of SAP (2) we can calculate that $5.52*0.345*3 = 5.7\text{ kgCO}_2\text{eq}$ per kg of SAP is its LCI (multiplied by 3 in the equation because you need 3 kg of nappies to gather 1 kg of SAP). Materials replacement and low impact materials production are key to our approach. An example of that is our use of Plant Based PLA core instead of Polypropylene (PP) which is a plastic material that can contribute to causing diseases such as cancer and asthma due to Phthalates (chemicals applied to PP during its manufacture). (3) On average, disposable nappies in UK consist of 16.6% PP (by weight) (4) which is 5.478g considering that an average nappy weighs 33g (5) $(5.478*2696=14.8\text{kg})$. Meanwhile Cleannest's nappies used by one child in total carry $5.478g*1868 = 10.2\text{kg}$ PLA. Lastly, Cleannest's nappies are Totally Chlorine Free (TCF), unlike the benchmark which is Elemental Chlorine Free (ECF), meaning the pulp is bleached with chlorine dioxide - a chlorine derivative that is a hazardous substance for the environment. (6) On average, over 9kg of chlorine are used to produce disposable diapers for 1 baby aged 0-12 months in 1 year. (7) *1000 active D2C subscriptions is Cleannest's year 1 target (1 subscription = 1 baby) (1) manufacturer (2) Yoo Jin Kim, Seok Ju Hong, Woo Seung Shin, Yong Rok Kwon, Seung Ho Lim, Hae Chan Kim, Jung Soo Kim, Jin

Woong Kim, Dong Hyun Kim (2019). Preparation of a biodegradable superabsorbent polymer and measurements of changes in absorption properties depending on the type of surface-crosslinker. <https://onlinelibrary.wiley.com/doi/abs/10.1002/pat.4767#> (3) Lisa Zimmermann, Georg Dierkes, Thomas A. Ternes, Carolin Völker, and Martin Wagner (2019). Benchmarking the in Vitro Toxicity and Chemical Composition of Plastic Consumer Products. <https://pubs.acs.org/doi/full/10.1021/acs.est.9b02293> (4) Simon Aumônier, Michael Collins and Peter Garrett (2008). An updated lifecycle assessment study for disposable and reusable nappies. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/291130/scho0808boir-e-e.pdf (5) Joan Manuel F.Mendozaa, Simona Andreea, Popaa Francesco D'Aponteb, Diego Gualtierib, Adisa Azapagic (2019). Improving resource efficiency and environmental impacts through novel design and manufacturing of disposable baby. [diapershttps://www.sciencedirect.com/science/article/abs/pii/S0959652618334462](https://www.sciencedirect.com/science/article/abs/pii/S0959652618334462) (6) What's the difference between TCF and ECF? Abby & Finn, <https://abbyandfinn.zendesk.com/hc/en-us/articles/360036633033-What-s-the-difference-between-TCF-and-ECF-#:~:text=Diapers%20that%20are%20marked%20using,itsself%20is%20a%20hazardous%20substance.> (7) Jelena Meseldzija, Danijela Poznanovic & Richard Frank (2013). Assessment of the differing environmental impacts between reusable and disposable diapers published by Dufferin Research. <https://www.dufferinresearch.com/images/sampled/data/documents/Environmental%20Impact%20Report%20-%20Cloth%20vs%20Disposable.pdf> (8) Amazon, Diapers Newborn/Size 1 (8-14 lb), https://www.amazon.com/Diapers-Newborn-Size-8-14-Count/dp/B07H38BPJX/ref=sr_1_2?keywords=pampers+month+supply+size+1&camp;camp;camp;qid=1656500005&camp;camp;camp;camp;camp;prefix=pampers+mont%2Caps%2C157&camp;camp;camp;camp;sr=8-2 (10) Plotka-Wasyłka, Justyna & Makoś-Chelstowska, Patrycja & Kurowska-Susdorf, Aleksandra & Treviño, María & Guzmán, Sergio & Mostafa, Heba & Cordella, Mauro. (2022). End-of-life management of single-use baby diapers: Analysis of technical, health and environment aspects. Science of The Total Environment. https://www.researchgate.net/publication/360077595_End-of-life_management_of_single-use_baby_diapers_Analysis_of_technical_health_and_environment_aspects (11) Rodrigo Buitrago-Tello, Richard A. Venditti, Hasan Jameel, Yuan Yao, and Darlene Echeverria (2022). Carbon Footprint of Bleached Softwood Fluff Pulp: Detailed Process Simulation and Environmental Life Cycle Assessment to Understand Carbon Emissions. <https://pubs.acs.org/doi/abs/10.1021/acsschemeng.2c00840> (12) Madeline J. Somers, Jose F. Alfaro, Geoffrey M. Lewis (2021). Feasibility of superabsorbent polymer recycling and reuse in disposable absorbent hygiene products. <https://doi.org/10.1016/j.jclepro.2021.127686>

Validation	By: Csaba Dudás, Started: Tue Aug 09 2022 16:01:22 CET, Completed: Tue Aug 09 2022 17:00:50 CET
Strong points	Well-built impact model, well-collected LCI.
Weak points	No weak points.
Sensitivity	The forecast is robust, not sensitive – the company would have a positive and significant climate impact even in case of a hypothetical 70% decrease in the relative carbon intensity of the baseline.

Production

Material	Current Intensity	Unit	Target Intensity	Unit	Change
Super Absorbent Polymer	5.7	per kg	13.2	kg	-75.24
Chlorine	1.203	per kg	9	kg	-10.83
PP (Polypropylene)	1.63	per kg	14.8	kg	-24.12
PLA (Polylactide, biodegradable)	3	per kg	10.2	kg	30.6
Fluff Pulp	1.1	per kg	12.4	kg	-13.64

Cleannest's total impact per year

eco-costs of human health euro	unknown	Impact per nappies used by 1 baby aged 0-12 months in 1 year	Carbon footprint CO ₂ eq.
eco-costs of eco-toxicity euro	unknown		-93.23 kg
eco-costs of resource depletion euro	unknown	Impact of 1000 times nappies used by 1 baby aged 0-12 months in 1 year	-93t
eco-costs of carbon footprint euro	unknown		

Equivalent to

Impact validation

VALID, POSITIVE AND SIGNIFICANT



All data and assumptions are approved.



4237 trees

19 Average humans

12	94	181	39	19	17
times driving a car around the world	passengers flying London-New York	barrels of oil burnt	EU households annual electricity	elephants mass (5t) of CO ₂	hot air balloons (2800 m ³) of CO ₂

Validation quality mark can be checked on: www.impact-forecast.com

validated in August 2022
validation id:

CDA036

Verifiable at
www.impact-forecast.com

CLEANNEST

Mitigates climate change with an impact reduction potential of:

-93

tCO₂eq / year

Validity of forecast

Valid

Impact compared to baseline

Positive

Magnitude of impact

Significant

More information

We help companies to know, show and grow their climate impact. More information about the validation process you can find on our website: www.impact-forecast.com

