

Validation report

Innovatium Group

21.02.2024

Validation ID: CDA068

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Details of the validation process

Timestamps and results:

The validation documented in this report was delivered with the following time stamps and results:

Innovatium Group	Validation request	First review	Feedback call	Hand-in revisions	Final review	Wrap-up call
Date	31/01/24 13h58	02/02/24 16h05	06/02/24 12h00	13/02/24 16h56	16/02/24 16h29	TBA
Result	Invalid, unclear and significant			Valid, positive and significant		

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Colofon

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Introduction to CIF Validation

To determine the validity of self-assessed climate impact forecasts we provide CIF Validation, which is a third party verification of the calculation of the climate and environmental impact of an innovation, in order to conclude if the Climate Impact Forecast is valid, positive and significant.

Problem solved

There are areas of LCA expertise that can not be covered in the Climate Impact Forecast workshops or CIF Training, for example where domain knowledge and experience are required. With self-assessments there is also a risk of optimism bias. Validation assures that forecasts do not contain gaps, scoping errors, unsupported assumptions or inappropriate data sources. 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 validation process performed by an impartial impact expert, who has read about the innovation, seen the forecast and used a checklist to assess its validity. The validator provides detailed written feedback and offers the opportunity for a revision. The goal of this process is twofold: increase the quality of a forecast and to conclude if the forecast is suitable to draw conclusions about the positive climate impact of the innovation. This Validation report documents the results of that process.

Definitions of key terminology

Climate Impact Forecast (CIF)	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.
CIF Validation process	A review process delivered by a validator and guided by a structured check of the information entered into a CIF, a sensitivity analysis and the write-up of an Impact story. This 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.
Validator	Validations are delivered by Validators; CIF trainers with LCA expertise who are trained to perform this process in a uniform and objective way. Other than providing this service, Validators have no relationship with or obligations to the company or supporting organisation requesting the validation, assuring an impartial third party review.
Validation result	The CIF Validation result consists of three independent outcomes, which in the best case are valid, positive and significant. These qualifications and the alternative outcomes are explained on the next page.

The CIF Validation result consists of three independent outcomes

Validity of the forecast

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

Invalid

Reduction potential

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 file shows the avoided GHG emissions in $-tCO_2eq$.

This outcome depends on a sensitivity assessment. CIF results can be:

Positive

Positive within limits

Unclear

Sensitive

Negative

Impact threshold

A CIF is significant when the project has a climate impact (positive or negative) greater than 5 tonnes of CO_2eq per year. This is roughly the global average annual CO_2 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

Marginal

Innovatium Group CIF Validation

This validation consists of the following sections

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.

Climate Impact Forecast and Validation result

The Climate Impact Forecast shows the scope and parameters of the impact calculation. This includes the resources used and saved by the innovation, their amount and climate impact, the climate impact per unit of user, and the total climate and environmental impact for all units or users in the timeframe. Validator feedback is included on strong and weak points of the forecast as a whole, as well as the conclusion from the sensitivity assessment and the approval status of individual parameters. The conclusion of the validation process is noted in the Validation result.

Sources and assumptions

The differences (resources used and reduced by the innovation, compared to the baseline solution) and quantities (of materials, energy etc.) in the forecast are based on sources and assumptions specified in this section.

Compressor Integrated Energy Storage to replace inefficient industrial air compressors

Traditional industrial air compressors have long been a significant contributor to climate change due to their inefficiency and high energy consumption during peak hours. These compressors, used widely across many industries, operate continuously – even during peak hours when electricity costs are at their highest. This not only increases operational costs for industries but also puts a severe strain on the power grid, leading to increased carbon emissions due to the overreliance on fossil fuels to meet the high energy demand. Traditional air receivers also have a limited storage capacity, which leads to wastage of excess compressed air which could have otherwise been utilised.

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

In an attempt to increase the efficiency and decrease the environmental footprint of industrial air compressors, Scottish company [Innovatium Group](#) has come up with an innovative and patented Compressor Integrated Energy Storage System (CIES) that brings a revolutionary change in how air compressors function. The company's device named PRISMA is a highly efficient air compressor that operates at cryogenic temperatures, stores up to 500 times the amount of air compared to traditional air receivers, and leverages cheaper off-peak electricity for charging. The system stores cold liquid air in a unique air liquefaction and storage vessel which, when needed, is converted back to usable ambient temperature compressed air. This not only reduces energy consumption and cost but also significantly lowers carbon emissions by allowing energy-hungry compressors to be shut

off during peak times, thereby effectively mitigating the greenhouse gas emissions caused by traditional industrial air compressors (the baseline solution of the forecast).

How much of a climate impact, and what does the impact depend on?

With their innovative solution, Innovatium Group has the potential to save around 0.004 kgCO₂eq. with every cubic metre of air that their devices discharge. This would result in a total GHG emission saving of 242 tCO₂eq. per year for the company, assuming that 50 devices are deployed which discharge a total of 58090183 cubic metres annually. The impact of the company is going to depend mostly on the potential future changes in the carbon intensity of industrial electricity production in Western Europe – in case it decreases, the relative climate advantage and therefore the positive climate impact of Innovatium Group is going to 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 60% decrease in the carbon footprint of industrial electricity in Western Europe.

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 the CO₂ emission of one average global citizen.

Notes

In this iteration of the forecast, the company did not account for the emission savings resulting from eliminating the need to produce and deploy traditional industrial air compressors. Had they done that, the result of their forecast would have been a slightly higher positive climate impact. It is recommended in a next iteration of the forecast that the company accounts for these differences as well, in order to achieve an even more precise and detailed comparison between the innovative solution and the baseline solution. Furthermore, it should be noted that the current outcome of the forecast applies to the short-term scenario of the company selling their devices on the Western European market. As the company expands their sales activities to the global market, including countries where industrial electricity production has a higher carbon footprint compared to countries in Western Europe, the per-unit positive impact of the company is likely going to increase as the electricity savings enabled by their devices are going to result in higher emission savings.

Climate Impact Forecast and Validation result

“Innovatium Group provides PRISMA with Compressor Integrated Energy Storage instead of compressed air usage and energy storage. The difference in impact is calculated per year and the total impact of Innovatium Group per year is calculated for 58090183 times 1 m³ air.”

Validation	By: Csaba Dudás, Started: Fri Feb 16 2024 16:22:30 GMT+0100 (Central European Standard Time), Completed: Fri Feb 16 2024 16:29:00 GMT+0100 (Central European Standard Time)												
Strong points	Well-built impact model, well-collected LCI												
Weak points	No weak points.												
Sensitivity	The company would have a positive and significant climate impact even in the case of a hypothetical 60% decrease in the carbon footprint of industrial electricity in Western Europe. Therefore it can be stated that the forecast is robust, not sensitive.												
Extraction													
+	Nitrogen, liquid	✓	0.2436 per kg	0,00002739 kg	✓	0.00001							
Production													
+	X2CrNiMo1712 (316L) 23% inox scrap (China)	✓	6.989 per kg	0,0003699 kg	✓	0.00259							
+	Container ship (min weight/volume ratio 0,1)	✓	0.00478 per tkm	5919,07 gkm	✓	0.00003							
+	Truck+container, 28 tons net (min weight/volume ratio 0,1)	✓	0.07758 per tkm	184,97 gkm	✓	0.00001							
Transport													
+	Truck+container, 28 tons net (min weight/volume ratio 0,1)	✓	0.07758 per tkm	92,49 gkm	✓	0.00001							
Use													
-	Electricity Industrial Western Europe	✓	0.1124 per MJ	0,06 MJ	✓	-0.00674							
Recycling													
+	Steel, recycling credit closed loop (56% virgin)	✓	-0.1738 per kg	0,0003699 kg	✓	-0.00006							
Innovatium Group's total impact per year													
<table border="1"> <tr> <td>eco-costs of human health euro</td> <td>-2583</td> </tr> <tr> <td>eco-costs of eco-toxicity euro</td> <td>4014</td> </tr> <tr> <td>eco-costs of resource depletion</td> <td>10826</td> </tr> <tr> <td>eco-costs of carbon footprint</td> <td>-29777</td> </tr> </table>					eco-costs of human health euro	-2583	eco-costs of eco-toxicity euro	4014	eco-costs of resource depletion	10826	eco-costs of carbon footprint	-29777	Carbon footprint CO ₂ -eq.
eco-costs of human health euro	-2583												
eco-costs of eco-toxicity euro	4014												
eco-costs of resource depletion	10826												
eco-costs of carbon footprint	-29777												
Impact per 1 m ³ air					-0.00417 kg								
Impact of 58090183 times 1 m ³ air					-242t								
Validation ID: CDA068													
Innovatium Group													
Mitigation project													
Validity of the forecast Valid ●													
Reduction potential Positive ●													
Impact threshold Significant ●													
Impact reduction potential -242 tCO ₂ eq./year													

Sources and assumptions

The differences and quantities in the forecast are based on the following sources and assumptions:

Extraction

"Basis of Calculations:

- 1 - Each PRISMA system has a working life of 25 years
- 2 - Each system produces 795.96m³ of air per discharge and discharges fully 4 times a day on average which equates to 29,045,092.84m³ of air over the life of each system
- 3 - Each system contains 10,745kg of 316 Stainless Steel
- 4 - 800 kg of Liquid Nitrogen is used once to commission each PRISMA system at the start of it's life.

Extraction Calculation (the amount of Liquid Nitrogen used per FU):

$$= 800\text{kg}/29,045,092.84\text{m}^3 = 0.00002739\text{kg}/\text{m}^3 \text{ air.}"$$

Production

"Basis of Calculations:

- 1 - 10,745kg of 316 Stainless Steel produced in China is used in the manufacture of the PRISMA system
- 2 - The raw steel used in producing each unit is shipped 16000 km from China to the UK port for manufacture
- 3 - The steel is then driven 500km by road from port to the manufacturer and then onto Innovatium HQ (post manufacture) for end of line testing

Extraction Calculation:

- 1- Raw Materials per FU = $10,745\text{kg}/29,045,092.84\text{m}^3 = 0.0003699\text{kg}/\text{m}^3 \text{ air}$
- 2 - Sea Transport per FU = $(10,745 \times 1000) \times 16,000 / 29,045,092.84\text{m}^3 = 5919.07\text{gkm}$
- 3 - Road Transport per FU = $(10,745 \times 1000) \times 500 / 29,045,092.84\text{m}^3 = 184.97\text{gkm}"$

Transport

"Basis of Calculations:

- 1 - Each unit is transported on average km by road from Innovatium HQ test to a UK client

Transport Calculation:

$$1 - \text{Road Transport per FU} = (10,745 \times 1000) \times 250 / 29,045,092.84\text{m}^3 = 92.49 \text{ gkm}"$$

Use

"Basis of Calculations:

1 - PRISMA reduces the energy consumed by the user to produce air by an average of 20% per site. From site audits, this equates to a reduction in the Specific Energy Consumption (SEC) of 1kW/m³/min of air produced.

Use Calculation:

1 - Energy Saving = 1kW/m³/min

- 1/60 = 0.01667m³/day

- 0.01667 x 795.96 (m³/discharge) x 4 (number of daily discharges) = 53.050kWh/day

- 53.050 x 365 (days) x 25 (life/years) = 484,084.88 kWh over life of each system

- 484,084.88 x 3,600,000/1,000,000 = 1,742,705.57 MJ over life of each system

- 1,742,705.57MJ/29,045,092.84m³ = 0.06 MJ/m³ of air"

Recycling

"The entire systems can be recycled at end of life."

More information

For more information about this validation, and Climate Impact Forecast Validation in general, reach out to Impact Forecast.

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