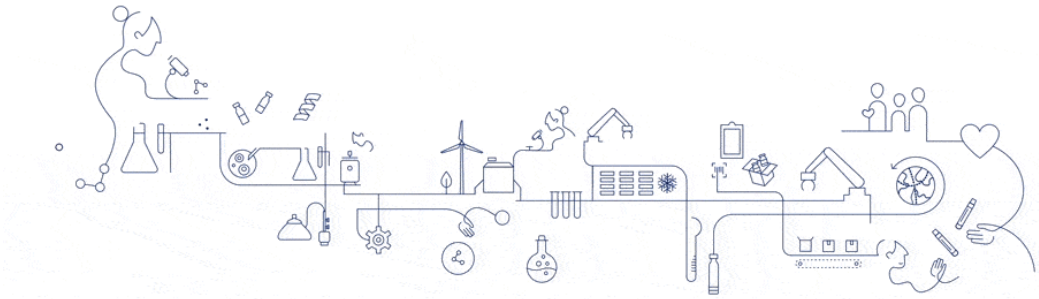
# NovoPen® 4 incl. Penfill® and needle

## product carbon footprint

version 3.2



Corporate Environmental Strategy

Sep 2021 (rev. 2023)

# 1. Background

Novo Nordisk analyses and understands carbon emissions at the product level. This document presents the Product Carbon Footprint of one-year treatment with NovoPen® in combination with a range of APIs, including the use of NovoFine® needle, hereafter referred to as the [API brand name] Penfill® and NovoPen® 4 carbon footprint, e.g. Levemir® Penfill® and NovoPen® 4.

Full carbon footprint reports for the APIs, device, cartridge and needle are available.

The data presented in this document supports marketing claims and Q&As about the product's carbon footprint. The data should not be used for comparison with competitor products or for claims related to 'green' or 'environmentally friendly' products.

# 2. Product carbon footprint methodology

The carbon footprint of a product is calculated by adding the greenhouse gas emissions (in kg $CO_2$ equivalents) from different stages of the product lifecycle as shown in the figure below. The product carbon footprint of one year of treatment is calculated by adding the contributions from the active pharmaceutical ingredient (API), the device and the needle[1].


The Novo Nordisk carbon footprint calculations follow the Greenhouse Gas Accounting Sector Guidance for Pharmaceutical Products and Medical Devices[2], which is built on international life cycle assessment standards. The reports are third-party reviewed by PricewaterhouseCoopers Advisory.

The carbon footprint calculations are based on production data from 2019 (except waste which is based on 2015 production data) and cover use in three major markets: Europe, the US and Japan. The calculations are made using Excel and the life cycle assessment tool GaBi.

The [API brand name] Penfill® NovoPen® 4 carbon footprint consists of four elements: API, device, cartridge and needle. The key assumptions for each of these elements are given below.

[1] Including the packaging for devices and needles.

[2] Greenhouse Gas Accounting Sector Guidance for Pharmaceutical Products and Medical Devices, GHG Protocol Product Life Cycle Accounting and Reporting Standard,November 2012. At: http://ghgprotocol.org/sites/default/files/ghgp/Summary-Document_Pharmaceutical-Product-and-Medical-Device-GHG-Accounting_November-2012_0.pdf. Accessed May 2018.

- **API:** The daily dose is 40 units of insulin, which corresponds to the WHO guidelines[3] for defined daily dose (DDD). The DDD is the assumed average maintenance dose per day for a drug used for its main indication in adults.
- **Device:** NovoPen® is a durable device designed for a lifetime of five years.
- **Cartridge:** A U100 cartridge contains 300 units of insulin.
- **Needle:** Novo Nordisk recommends discarding the needle after use. However, market research shows that most patients use the needle several times[4]. To reflect an average patient, the one-year treatment scenario is based on the use of one needle per day, which can be considered a conservative estimate.

# 3. Product carbon footprint of one-year treatment

The [API brand name] Penfill® NovoPen® 4 carbon footprint for insulin products is 6-12 kg of $CO_2$ equivalents per year, corresponding to 17-33 g of $CO_2$ equivalents per day. The results for each of the APIs and country scenarios are included in Appendix A.

To put this into perspective for a non-expert, it is possible to compare the carbon footprint to other consumables.

One year of treatment with [API brand name] Penfill® NovoPen® 4 corresponds to driving 51-103 km in an average new car in Europe. The $CO_2$ emissions per km data is based on an EU-28 average published by Eurostat[5].

It is estimated that the daily environmental impact (using carbon footprint as a proxy) of diabetes treatment using [API brand name] Penfill® NovoPen® 4 is equivalent to a cup of tea. According to Cichorowski et al. (2015), the cradle-to-grave carbon footprint of Darjeeling tea including cultivation and brewing is 0.15 kg of $CO_2$ equivalents per litre of tea[6]. A 40-cl cup of tea will thus have a carbon footprint of 60 g of $CO_2$ equivalents. It must be acknowledged that “a cup of tea” is an ambiguous measure and there are many different types of tea and brewing methods, but the calculation gives a good indication of the size of the impacts related to the treatment of diabetes.

[3] WHO Collaborating Centre for Drug Statistics Methodology (WHOCC): DDD Definition and general considerations. http://www.whocc.no/ddd/definition_and_general_considera/. Accessed Sep 2021.
[4] Roper U.S. Diabetes 2014 Patient Study. Insulin devices market. GFK, November 2014
[5] Eurostat (2019). Average carbon dioxide emissions per km from new passenger cars. http:// http://ec.europa.eu/eurostat/tgm/table.do?tab=table&init=1&language=en&pcode=t2020_rk330&plugin=1. Accessed Sep 2021.
[6] Cichorowski et al. (2015). Scenario analysis of life cycle greenhouse gas emissions of Darjeeling tea. Int J Life Cycle Assess (2015) 20:426–439

A comparison with air travel shows that the carbon footprint of 26-51 years of treatment with [API brand name] Penfill® and NovoPen® 4 corresponds to a flight from London to New York. This is calculated on the basis of data from the ICAO Carbon Emissions Calculator[7].

The carbon footprint has inherent uncertainties and should be regarded as an indicative level and not as a precise measure. The uncertainties relate to the data collected from Novo Nordisk production, the data on carbon footprint for each of the processes (e.g. plastic granulate production), carbon footprint impact factors and the key assumptions (e.g. distribution patterns). Moreover, the calculations take into account that Novo Nordisk sources renewable energy through certificates, which results in a lower carbon footprint than if average electricity was used.

The plastic footprint from devices and needles (excluding packaging) in the treatment with NovoPen® 4 is 0.14 kg plastic per patient per year. Including packaging increases the plastic footprint to 0.47 - 0.53 kg plastic/patient/year (depending on the market). See Table 6 and Table 7 in Appendix A for more details.

# 4. Reducing the product's carbon footprint

Novo Nordisk strives to reduce carbon footprint throughout the product lifecycle, and the [API brand name] Penfill® NovoPen® 4 is produced with the environment in mind.

Our environmental strategy, Circular for Zero, and the certified ISO14001 Environmental Management System drive continuous improvements in our environmental performance by setting high ambitions and integrating environmental considerations into daily business activities. Moreover, life cycle assessment is an integrated part of our device product development process.

Novo Nordisk is using 100% renewable electricity at all production sites[8].

[7] ICAO (International Civil Aviation Organization) (June 2018). Carbon Emissions Calculator. http://www.icao.int/environmental-protection/CarbonOffset/Pages/default.aspx. Accessed Sep 2021.
[8] Novo Nordisk Annual Report 2020, p.12 - https://www.novonordisk.com/content/dam/nncorp/global/en/investors/irmaterial/annual_report/2021/Novo-Nordisk-Annual-Report-2020.pdf

# 5. Appendix A: Product carbon footprint results and comparisons

Table 1. Carbon footprint of treatment in the European market

| NovoPen® 4 and NovoFine® combined with [API brand name] | API [kg $CO_2$-eq./yr] | Device incl. cartridge [kg $CO_2$-eq./yr] | Needle [kg $CO_2$-eq./yr] | One year treatment [kg $CO_2$-eq./yr] | Daily treatment [g $CO_2$-eq./yr] |
|---|---|---|---|---|---|
| **NovoRapid® Penfill®** | 1.0 | 3.2 | 2.9 | 7 | 20 |
| **NovoMix® Penfill®** | 1.0 | 3.2 | 2.9 | 7 | 20 |
| **Fiasp® Penfill®** | 1.0 | 3.2 | 2.9 | 7 | 20 |
| **Tresiba® Penfill® U100** | 1.6 | 3.2 | 2.9 | 8 | 21 |
| **Levemir® Penfill®** | 5.7 | 3.2 | 2.9 | 12 | 33 |
| **Mixtard® Penfill®** | 0.9 | 3.2 | 2.9 | 7 | 19 |
| **Insulatard® Penfill®** | 0.9 | 3.2 | 2.9 | 7 | 19 |
| **Actrapid® Penfill®** | 0.9 | 3.2 | 2.9 | 7 | 19 |
| **Ryzodeg® Penfill®** | 1.4 | 3.2 | 2.9 | 8 | 21 |

Table 2. Carbon footprint of treatment in the US market

| NovoPen® 4 and NovoFine® combined with [API brand name] | API [kg $CO_2$-eq./yr] | Device incl. cartridge [kg $CO_2$-eq./yr] | Needle [kg $CO_2$-eq./yr] | One year treatment [kg $CO_2$-eq./yr] | Daily treatment [g $CO_2$-eq./yr] |
|---|---|---|---|---|---|
| **NovoRapid® Penfill®** | 1.0 | 2.5 | 2.6 | 6 | 17 |
| **NovoMix® Penfill®** | 1.0 | 2.5 | 2.6 | 6 | 17 |
| **Fiasp® Penfill®** | 1.0 | 2.5 | 2.6 | 6 | 17 |
| **Tresiba® Penfill® U100** | 1.6 | 2.5 | 2.6 | 7 | 19 |
| **Levemir® Penfill®** | 5.7 | 2.5 | 2.6 | 11 | 30 |
| **Mixtard® Penfill®** | 0.9 | 2.5 | 2.6 | 6 | 17 |
| **Insulatard® Penfill®** | 0.9 | 2.5 | 2.6 | 6 | 17 |
| **Actrapid® Penfill®** | 0.9 | 2.5 | 2.6 | 6 | 17 |
| **Ryzodeg® Penfill®** | 1.4 | 2.5 | 2.6 | 7 | 18 |

Table 3. Carbon footprint of treatment in the Japanese market

| NovoPen® 4 and NovoFine® combined with [API brand name] | API [kg $CO_2$-eq./yr] | Device incl. cartridge [kg $CO_2$-eq./yr] | Needle [kg $CO_2$-eq./yr] | One year treatment [kg $CO_2$-eq./yr] | Daily treatment [g $CO_2$-eq./yr] |
|---|---|---|---|---|---|
| **NovoRapid® Penfill®** | 1.0 | 3.3 | 3.2 | 8 | 21 |
| **NovoMix® Penfill®** | 1.0 | 3.3 | 3.2 | 8 | 21 |
| **Fiasp® Penfill®** | 1.0 | 3.3 | 3.2 | 8 | 21 |
| **Tresiba® Penfill® U100** | 1.6 | 3.3 | 3.2 | 8 | 22 |
| **Levemir® Penfill®** | 5.7 | 3.3 | 3.2 | 12 | 33 |
| **Mixtard® Penfill®** | 0.9 | 3.3 | 3.2 | 7 | 20 |
| **Insulatard® Penfill®** | 0.9 | 3.3 | 3.2 | 7 | 20 |
| **Actrapid® Penfill®** | 0.9 | 3.3 | 3.2 | 7 | 20 |
| **Ryzodeg® Penfill®** | 1.4 | 3.3 | 3.2 | 8 | 22 |

Table 4. Comparison with driving a car. Number of km travelled in an average new car.

| NovoPen® 4 and NovoFine® combined with [API brand name] | EU | US | JP |
|---|---|---|---|
| **NovoRapid® Penfill®** | 61 | 53 | 63 |
| **NovoMix® Penfill®** | 61 | 53 | 63 |
| **Fiasp® Penfill®** | 61 | 53 | 63 |
| **Tresiba® Penfill® U100** | 65 | 57 | 68 |
| **Levemir® Penfill®** | 100 | 92 | 103 |
| **Mixtard® Penfill®** | 59 | 51 | 62 |
| **Insulatard® Penfill®** | 59 | 51 | 62 |
| **Actrapid® Penfill®** | 59 | 51 | 62 |
| **Ryzodeg® Penfill®** | 64 | 56 | 67 |

Table 5. Comparison with air travel. Years of use corresponding to a flight from London to New York

| NovoPen® 4 and NovoFine® combined with [API brand name] | EU | US | JP |
|---|---|---|---|
| **NovoRapid® Penfill®** | 43 | 50 | 41 |
| **NovoMix® Penfill®** | 43 | 50 | 41 |
| **Fiasp® Penfill®** | 43 | 50 | 41 |
| **Tresiba® Penfill® U100** | 40 | 46 | 39 |
| **Levemir® Penfill®** | 26 | 28 | 26 |
| **Mixtard® Penfill®** | 44 | 51 | 42 |
| **Insulatard® Penfill®** | 44 | 51 | 42 |
| **Actrapid® Penfill®** | 44 | 51 | 42 |
| **Ryzodeg® Penfill®** | 41 | 47 | 39 |

Table 6. Plastic footprint for the different elements required for yearly treatment with NovoPen® 4 [g plastic/year]. *Note that FlexPen is a prefilled device and therefore the cartridge is already included within the device.*

| NovoPen® 4 and NovoFine® combined with [API brand name] | Device | Cartridge | Needle | Packaging | | |
|---|---|---|---|---|---|---|
| | | All | | EU | US | JP |
| **NovoRapid® Penfill®** | 15 | 62 | 62 | 332 | 332 | 394 |
| **NovoMix® Penfill®** | 15 | 62 | 62 | 332 | 332 | 394 |
| **Fiasp® Penfill®** | 15 | 62 | 62 | 332 | 332 | 394 |
| **Tresiba® Penfill® U100** | 15 | 62 | 62 | 332 | 332 | 394 |
| **Levemir® Penfill®** | 15 | 62 | 62 | 332 | 332 | 394 |
| **Mixtard® Penfill®** | 15 | 62 | 62 | 332 | 332 | 394 |
| **Insulatard® Penfill®** | 15 | 62 | 62 | 332 | 332 | 394 |
| **Actrapid® Penfill®** | 15 | 62 | 62 | 332 | 332 | 394 |
| **Ryzodeg® Penfill®** | 15 | 62 | 62 | 332 | 332 | 394 |

Table 7. Plastic footprint of one-year treatment with NovoPen® 4 with and without packaging materials [kg plastic/year].

| **NovoPen® 4 and NovoFine® combined with [API brand name]** | **One year treatment excl. packaging** [device, cartridge, and needles] | **One-year treatment incl. packaging** [device, cartridge, needles, and packaging] | | |
|---|---|---|---|---|
| | **All** | **EU** | **US** | **JP** |
| **NovoRapid® Penfill®** | 0.14 | 0.47 | 0.47 | 0.53 |
| **NovoMix® Penfill®** | 0.14 | 0.47 | 0.47 | 0.53 |
| **Fiasp® Penfill®** | 0.14 | 0.47 | 0.47 | 0.53 |
| **Tresiba® Penfill® U100** | 0.14 | 0.47 | 0.47 | 0.53 |
| **Levemir® Penfill®** | 0.14 | 0.47 | 0.47 | 0.53 |
| **Mixtard® Penfill®** | 0.14 | 0.47 | 0.47 | 0.53 |
| **Insulatard® Penfill®** | 0.14 | 0.47 | 0.47 | 0.53 |
| **Actrapid® Penfill®** | 0.14 | 0.47 | 0.47 | 0.53 |
| **Ryzodeg® Penfill®** | 0.14 | 0.47 | 0.47 | 0.53 |

## References

Aspart carbon footprint, Novo Nordisk, Sep 2021
Degludec carbon footprint, Novo Nordisk, Sep 2021
Detemir carbon footprint, Novo Nordisk, Sep 2021
Human insulin carbon footprint, Novo Nordisk, Sep 2021
NovoPen® carbon footprint, Novo Nordisk, Sep 2021
NovoFine® carbon footprint, Novo Nordisk, Sep 2021

**Third party verification of Novo Nordisk Carbon Footprint reports**

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Novo Nordisk has commissioned PricewaterhouseCoopers Advisory (PwC) to review several carbon footprint reports for diabetes products prepared by Novo Nordisk. The critical review (CR) was done according to the ISO/TS 14 071[1], ISO 14 040[2], ISO 14 044[3] recommendations and also according to the "Greenhouse Gas Accounting Sector Guidance for Pharmaceutical Products and Medical Devices" recommendations. The CR expert is independent from Novo Nordisk and was not involved in the making of the study. To ensure consistency with the principles and requirements of the standards and guidance (ISO/TS 14 071, ISO 14 040, ISO 14 044, and Greenhouse Gas Accounting Sector Guidance for Pharmaceutical Products and Medical Devices) on life cycle assessment, the CR was performed by the following LCA expert of PwC: Christophe Drevelle.

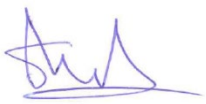
The CR of the study appraises the following:

- the methods used are consistent with the standards ISO 14040 and 14044 and Greenhouse Gas Accounting Sector Guidance for Pharmaceutical Products and Medical Devices;
- the methods used are scientifically and technically valid;
- the data used are appropriate and reasonable in relation to the goal and scope of the study;
- the interpretation reflects the limitations identified and the goal of the study;
- the report is transparent and consistent.

During this period, different oral and written exchanges have been held between PwC and Novo Nordisk, including clarification exchanges regarding the CR comments, and the production of new versions of the carbon footprint reports by Novo Nordisk. Novo Nordisk has taken into account all the comments and has modified and improved its report.

The 2020/2021 study is in conformity with the standards ISO 14040 and 14044 and Greenhouse Gas Accounting Sector Guidance for Pharmaceutical Products and Medical Devices.

*Note: this is an extraction of full version of verification report from PWC. The more detailed verification report is available.*



Neuilly-sur-Seine (France), December 22nd, 2021

Sylvain Lambert
Partner of Sustainable Development Department

[1] ISO/TS 14071 (2014): Environmental management -- Life cycle assessment -- Critical review processes and reviewer competencies: Additional requirements and guidelines to ISO 14044 (2006)
[2] ISO 14040 (2006):Environmental management -- Life cycle assessment -- Principles and framework
[3] ISO 14044 (2006): Environmental management -- Life cycle assessment -- Requirements and guidelines

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