Environmental Product Declaration

according to ISO 14025 and EN 15804

Declaration holder:	The Jackfruit Company
Publisher:	Kiwa-Ecobility Experts
Programme operator:	Kiwa-Ecobility Experts
Registration number:	EPD-TheJackfruitCompany-264-EN
Date of issue:	13.12.2022
Valid until:	13.12.2027

IQF Jackfruit JF175

This Environmental Product Declaration (EPD) is based on the life cycle assessment of the „IQF Jackfruit JF175“ by The Jackfruit Company

1. General information

The Jackfruit Company

Programme operator:
Kiwa-Ecobility Experts
Voltastr. 5
13355 Berlin
Germany

Registration number:
EPD-TheJackfruitCompany-264-EN

Date of issue:
13.12.2022

Scope:
This EPD is based on the life cycle assessment of the „IQF Jackfruit JF175“ by The jackfruit Company.
The declaration holder is liable for the underlying information and evidence. Kiwa-Ecobility Experts is not liable for manufacturer information, life cycle assessment data and evidence.

Frank Huppertz
(Programme Management Kiwa-Ecobility Experts)

Prof. Dr Frank Heimbecher
(Chairman of the Independent Expert Committee of Kiwa-Ecobility Experts)

IQF Jackfruit JF175

Declaration holder:
The Jackfruit Company
PO Box 265
Boulder CO 80306
USA

Declared unit:
1 kg jackfruit product

Valid until:
13.12.2027

Product category rules:
PCR A - Calculation rules for the LCA and requirements for the background report
PCR B - Product Category Rules for food products from the EPD programme of Kiwa-Ecobility Experts; Requirements for Environmental Product Declarations for food products, Edition 2022-11-15 (draft)

Verification:
The CEN standard EN 15804:2012+A2:2019 serves as the core PCR.
Independent verification of the declaration and data according to EN ISO 14025:2011-10.
☐internal ☒external

Elisabet Amat
(Independent, third verifier by Greenize Projects)

2. Product details

2.1 Product description

Jackfruit is the world's largest tree-borne fruit! It belongs to the mulberry family and is a close relative of the breadfruit, but not the durian, despite a similar outward appearance.

The jackfruit is an unparalleled resource for food security. In Kerala, India, is has been documented that a standard jackfruit tree bears 250 to 300 10-kilogram fruits per year. That's 2.5 to 3 tons of food annually.

Beyond that, jackfruit is a boon for the environment. It grows organically, requiring no fertilizers or pesticides. It grows quickly, tolerates three to four months of drought, and has no major pests. It requires so little labor (in proper climates) that it is intercropped with various crops simply to provide them with shade.

The bulbs of a ripe jackfruit were the inspiration for Juicyfruit's original flavor. Their taste is a blend of mango, pineapple, and banana flavors. These bulbs are loaded with potassium, magnesium, fiber, vitamin A, and beta-carotene. The seeds of the jackfruit can be peeled, dried, and pulverized to produce gluten-free flour, chutney powder, or a thickening agent. When unripe, the whole inside of the jackfruit--seeds, bulbs, and protective fibers—can be sliced and diced and used as a "vegetable meat." In fact, where jackfruit grows, the unripe jackfruit is already used as a meat substitute in many delicious recipes, thanks to its meat-like taste and texture.

2.2 Raw materials

The only raw materials that is considered is jackfruit from India. The product does not include any candidate List of Substances of Very High Concern for authorization.

2.3 Manufacturing

As can be seen in the process flow diagram in Figure 1, the jackfruits are transported to the manufacturing site, inspected, cleaned, cut, peeled, processed with auxiliary materials, frozen and stored.

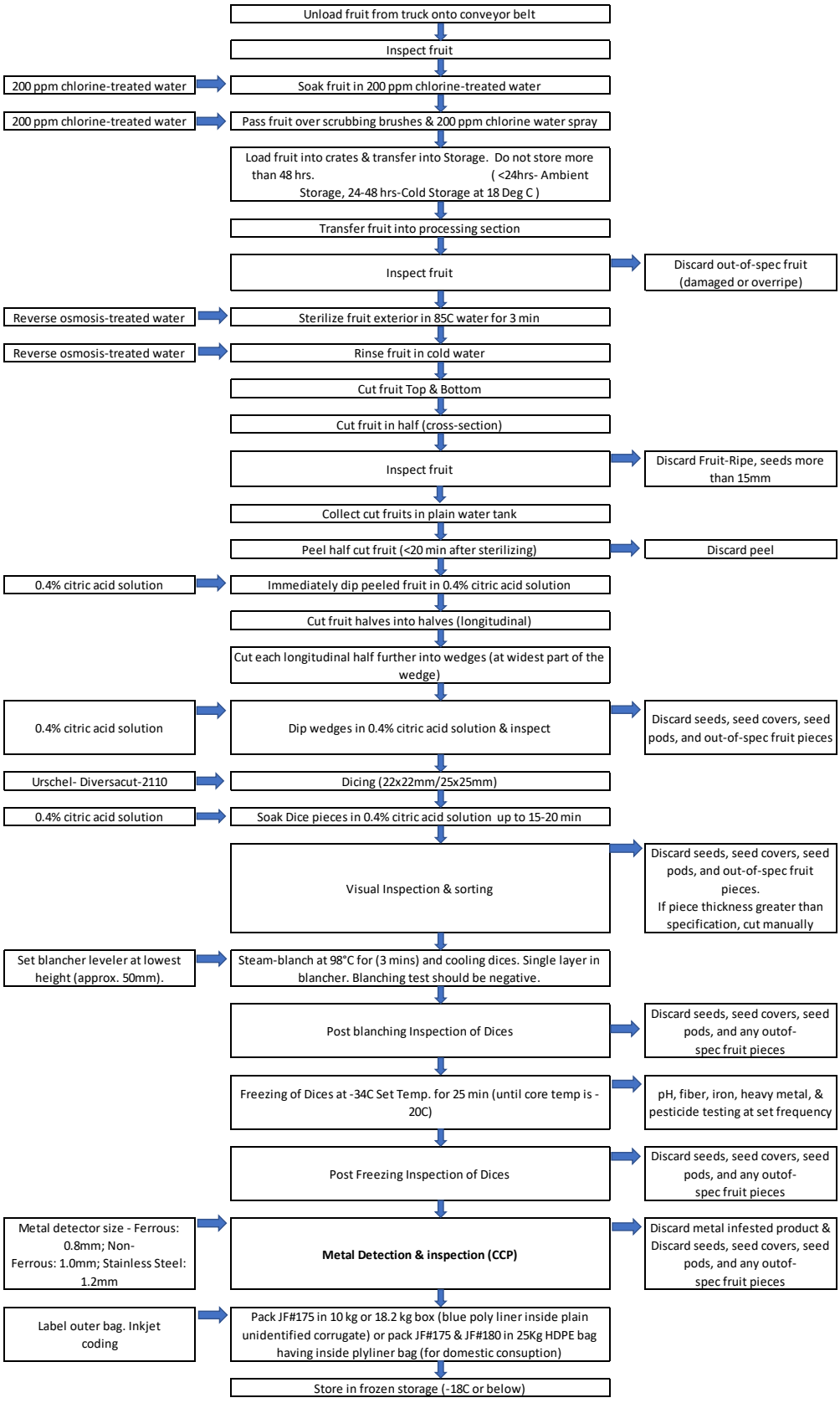

Figure 1: Process flow chart for IQF Jackfruit JF175

2.4 Reference service life (RSL)

Since “IQF Jackfruit JF175” is a semi-finished product, the use phase is not considered and therefore no reference service life is needed.

2.5 Packaging

For “IQF Jackfruit JF175” is no packaging considered, since it is a semi-finished product and is further processed in the USA.

2.6 Other information

Further information on the product can be found on the manufacturer's website (www.thejackfruitcompany.com).

3. LCA: Calculation rules

3.1 Declared unit

The declared unit for food products is according to "PCR B - Product Category Rules for food products from the EPD programme of Kiwa-Ecobility Experts; Requirements for Environmental Product Declarations for food products, Edition 2022-11-15 (draft)" 1 kg.

Parameter	Value	Unit
Declared unit	1	kg

3.2 System boundaries

This EPD was created in accordance with DIN EN 15804 and monitors the production stage. According to DIN EN 15804 this corresponds to the product phases A1-A3. Therefore, the type of the EPD is “cradle to gate”. Table 1 gives an overview of the declared information modules or product life phases, which are included in the LCA. Since “IQF Jackfruit JF175” is a semi-finished product, the use and the end-of-life stage are not considered.

The modules include:

- A1: Extraction of the raw material jackfruit
- A2: Transport of the raw material to the production site by the suppliers; Transport from the production site in India to the warehouse in the USA
- A3: Auxiliary materials and energy for the different processing steps; Production emissions and waste

For the declared life phases, all inputs (raw materials, intermediate products, energy and auxiliary materials) as well as the waste produced were considered. The production does not contain secondary materials or fuels. The construction of manufacturing capital goods and infrastructure, sales and marketing activities as well as other processes which are not directly related to the production are not considered.

3.3 Assumptions and estimates

Since there is no dataset available in the Ecoinvent 3.6 database for jackfruit, the environmental profile "mango production (RoW)" was adapted and used. The manufacturer The Jackfruit Company has confirmed that this is an appropriate assumption, as the conditions of the fruits are comparable. Since jackfruit trees grow wild in India and are not cultivated, the data set was adjusted accordingly.

Since no supplier data for the auxiliary materials was available, the transport types and distances were taken from the corresponding “market for” datasets from Ecoinvent 3.6. This should cover the worst-case scenarios.

The production waste scenarios are based on the “Nationale Milieudatabase” (NMD), the National Environmental Database of the Netherlands. This is due the fact that the used EPD & LCA tool R<THiNK is developed by NIBE in the Netherlands. Therefore, the Dutch electricity grid mix of 2019 is used for the energy recovery in module D.

For data protection reasons, the detailed assumptions made and data used are only explained in the background report accompanying this EPD.

3.4 Period under review

All product- and process-specific data were collected for the operating year 2021 and are therefore up-to-date.

3.5 Cut-off criteria

Potential environmental impacts were assigned to the material flows based on the Ecoinvent database version 3.6. All flows contributing to more than 1 percent of the total mass, energy or environmental impacts of the system were considered in the LCA. It can be assumed that the neglected processes would have contributed less than 5 percent to the impact categories considered.

Other operating resources and the corresponding waste were not considered part of the product system and accordingly not included in the balancing.

3.6 Data quality

To ensure the comparability of the results, only consistent background data from the Ecoinvent database version 3.6 (2019) was used in the LCA (e.g. data sets on energy, transports, auxiliary and operating materials). The database is regularly checked and thus complies with the requirements of EN 15804 (background data not older than 10 years). Almost all consistent data sets contained in the Ecoinvent database version 3.6 are documented and can be viewed in the online documentation.

The raw material data were converted into reference flows (input per declared unit).

The general rule was followed that specific data from specific production processes or average data derived from specific processes must have priority in the calculation of an LCA. Data for processes over which the manufacturer has no influence were assigned generic data.

The LCA calculation was carried out using Nibe's LCA & EPD tool R<THiNK.

3.7 Allocations

Specific information on allocations within the background data can be found in the documentation of the Ecoinvent database version 3.6 datasets.

The manufacturer provided data on mass allocation for incoming and outcoming flows of materials and processes. The mass allocation is performed per declared unit.

There was no need to mass allocate data between products because different products are produced in separate shifts of 8 hours, so that the energy consumption, production waste etc. can be allocated accordingly.

3.8 Comparability

In principle, a comparison or assessment of the environmental impact of different products is only possible if they have been produced in accordance with EN 15804. For the assessment of comparability, the following aspects in particular must be taken into account: PCR used, functional or declared unit, geographical reference, definition of the system boundary, declared modules, data selection (primary or secondary data, background database, data quality), scenarios used for use and disposal phases and the life cycle inventory (data collection, calculation methods, allocations, validity period). PCRs and general programme instructions of different EPDs programmes may differ. Comparability must be checked. Further guidance can be found in EN 15804+A2 (5.3 Comparability of EPDs for construction products) and ISO 14025 (6.7.2 Requirements for comparability).

3.9 Data collection

ISO 14044 section 4.3.2 was taken into account in the data collection.

The objective and the scope of the study were defined in consultation with The Jackfruit Company. The data collection took place with the help of an Excel data collection template provided by Kiwa GmbH. The collected data was checked by Kiwa GmbH, for example by critically questioning the assumptions made by The Jackfruit Company. In this way, some errors (e.g. unit errors) could be corrected in cooperation with The Jackfruit Company. Subsequently, the annual values were related to the declared unit of one kilogram with the help of corresponding calculations. In addition, suitable assumptions were made for the missing information and data and estimates were made.

3.10 Calculation method

For the life cycle assessment, the calculation procedures described in ISO 14044 section 4.3.3 were applied. The evaluation is carried out on the basis of the phases lying within the system boundaries and the processes contained therein.

4. LCA: scenarios and further technical information

No scenarios were used in this EPD.

5. LCA: Results

The following tables show the results of the life cycle assessment, more specifically for the environmental impact indicators, resource consumption, output flows and waste categories. The results presented here refer to the declared unit of 1 kg jackfruit product.

The results of the environmental impact indicators ETP-fw, HTP-c, HTP-nc, SQP, ADP-f, ADP-mm and WDP must be used with caution, as the uncertainties in these results are high or there is limited experience with the indicator.

The IRP impact category mainly addresses the potential effect of low dose ionising radiation on human health in the nuclear fuel cycle. It does not consider effects due to possible nuclear accidents and occupational exposure, nor does it consider the disposal of radioactive waste in underground facilities. Potential ionising radiation from soil, radon and some building materials is also not measured by this indicator.

Table 1: Overview of the considered information modules showing all phases of the life cycle according to DIN EN 15804

Indication of system boundaries (X = module declared; MND = module not declared)																
Production phase			**Construction phase**		**Use phase**							**Disposal phase**				**Credits and loads outside the system boundaries**
Raw material supply	Transport	Production	Transport	Installation	Use	Maintenance	Repair	Replacement	Conversion / Renewal	Operational energy use	Operational water use	Deconstruction	Transport	Waste treatment	Landfill	Reuse-, Recovery, Recycling potential
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
X	X	X	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND

Table 2: Results of the life cycle assessment - environmental impact indicators: IQF Jackfruit JF175 (1 kg)

Indicator	Unit	A1	A2	A3
AP	mol H+-eq.	1,22E-03	6,06E-03	8,37E-03
GWP-total	kg CO2-eq.	-2,13E-01	3,19E-01	1,30E+00
GWP-b	kg CO2-eq.	-2,85E-01	2,65E-05	6,20E-02
GWP-f	kg CO2-eq.	7,21E-02	3,18E-01	1,23E+00
GWP-luluc	kg CO2-eq.	1,89E-05	1,68E-04	4,79E-03
ETP-fw	CTUe	1,87E+00	3,46E+00	3,43E+01
PM	Occurrence of diseases	8,03E-09	1,93E-08	3,77E-08
EP-m	kg N-eq.	1,31E-03	1,59E-03	2,34E-03
EP-fw	kg PO4-eq.	4,13E-06	2,27E-06	6,83E-05
EP-t	mol N-eq.	5,01E-03	1,76E-02	2,04E-02
HTP-c	CTUh	2,64E-10	1,59E-10	4,95E-10
HTP-nc	CTUh	4,29E-09	3,40E-09	1,95E-08
IRP	kBq U235-eq.	9,47E-04	1,88E-02	2,22E-02
SQP	-	1,87E-01	2,38E+00	3,76E+00
ODP	kg CFC11-eq.	2,31E-09	6,71E-08	6,37E-08
POCP	kg NMVOC eq.	3,31E-04	4,66E-03	4,81E-03
ADP-f	MJ	6,10E-01	4,44E+00	1,47E+01
ADP-mm	kg Sb-eq.	3,11E-07	5,25E-06	9,22E-06
WDP	m3 World eq. withdrawn	5,29E+00	1,16E-02	2,33E+00

AP = Acidification potential, accumulated exceedance; GWP-total = Global warming potential, total; GWP-b = Global warming potential, biogenic; GWP-f = Global warming potential, fossil; GWP-luluc = Global warming potential, land use and land use change; ETP-fw = Ecotoxicity potential, freshwater; PM = Particulate matter emissions disease potential; EP-m = Eutrophication potential, fraction of nutrients reaching marine saltwater end compartment; EP-fw = Eutrophication potential, fraction of nutrients reaching freshwater end compartment; EP-t = Eutrophication potential, accumulated potential; HTP-c = Human toxicity potential, cancer effects; HTP-nc = Human toxicity potential, non-cancer effects; IRP = Ionizing radiation potential, human health; SQP = Soil quality potential; ODP = Depletion potential of the stratospheric ozone layer; POCP = Formation potential of tropospheric ozone; ADP-f = Abiotic depletion potential for fossil resources; ADP-mm = Abiotic depletion potential for non-fossil resources, minerals and metals; WDP = Water deprivation potential, deprivation-weighted water consumption

Table 3: LCA results - resource consumption, output streams & waste categories: IQF Jackfruit JF175 (1 kg)

Parameter	Unit	A1	A2	A3
PERE	MJ	2,53E+00	4,39E-02	1,86E+00
PERM	MJ	0,00E+00	0,00E+00	2,65E-02
PERT	MJ	2,53E+00	4,39E-02	1,89E+00
PENRE	MJ	6,44E-01	4,72E+00	1,56E+01
PENRM	MJ	0,00E+00	0,00E+00	0,00E+00
PENRT	MJ	6,44E-01	4,72E+00	1,56E+01
SM	kg	0,00E+00	0,00E+00	0,00E+00
RSF	MJ	0,00E+00	0,00E+00	0,00E+00
NRSF	MJ	0,00E+00	0,00E+00	0,00E+00
FW	m3	2,39E-01	4,00E-04	1,02E-01
HWD	kg	4,60E-07	7,99E-06	1,02E-05
NHWD	kg	5,24E-03	1,59E-01	1,69E-01
RWD	kg	1,13E-06	2,99E-05	2,62E-05
CRU	kg	0,00E+00	0,00E+00	0,00E+00
MFR	kg	0,00E+00	0,00E+00	0,00E+00
MER	kg	0,00E+00	0,00E+00	0,00E+00
EE-total	MJ	0,00E+00	0,00E+00	5,01E-06
EET	MJ	0,00E+00	0,00E+00	3,17E-06
EEE	MJ	0,00E+00	0,00E+00	1,84E-06

PERE = Use of renewable primary energy excluding renewable primary energy resources used as raw materials; PERM = Use of renewable primary energy resources used as raw materials; PERT = Total use of renewable primary energy resources; PENRE = Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials; PENRM = Use of non-renewable primary energy resources used as raw materials; PENRT = Total use of non-renewable primary energy resources; SM = Use of secondary material; RSF = Use of renewable secondary fuels; NRSF = Use of non-renewable secondary fuels; FW = Use of net fresh water; HWD = Hazardous waste disposed; NHWD = Non-hazardous waste disposed; RWD = Radioactive waste disposed; CRU = Components for re-use; MFR = Materials for recycling; MER = Materials for energy recovery; EE-total = Exported energy, total; EET = Exported energy, thermic; EEE = Exported energy, electric

6. LCA: Interpretation

For easier understanding, the results are presented graphically in order to be able to see correlations and connections between the data more clearly.

The following figure shows the shares of the different product life phases in the environmental impacts.

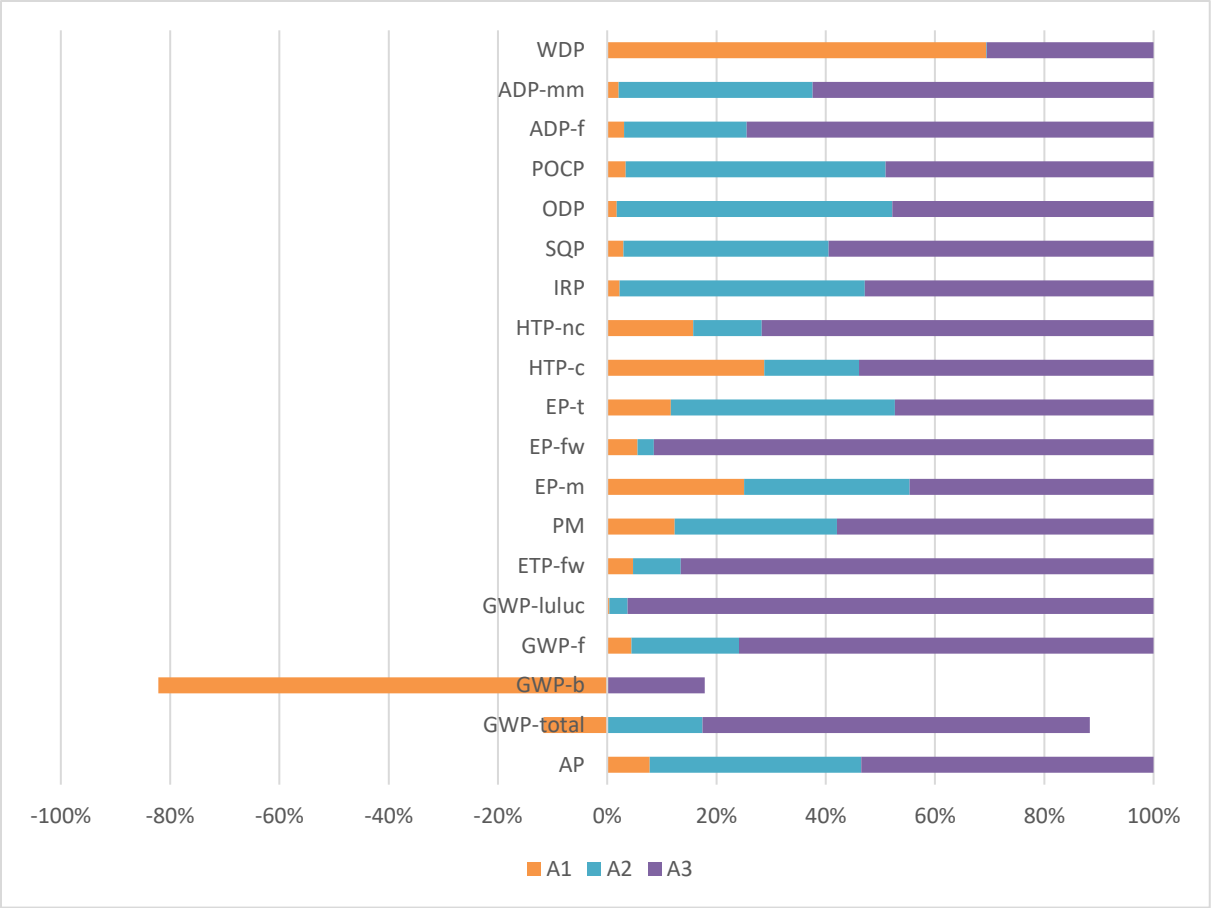

Figure 2: Percentage of the product phases in the environmental impact categories of IQF Jackfruit JF175

As can be seen in the graph, the processing (module A3) dominates in the production phase in almost all environmental impact categories. In module A3 the electricity, especially for the storage of 3 months, is the main contributor. The raw material jackfruit (module A1) has a negative value and therefore a benefit for the global warming potential (GWP).

7. References

Ecoinvent, 2019:	Ecoinvent database version 3.6, 2019
EN 15804:	EN 15804:2012+A2:2019: Sustainability of construction works - Environmental product declarations - Basic rules for the product category construction products
ISO 14025:	DIN EN ISO 14025:2011-10: Environmental labels and declarations - Type III environmental declarations - Principles and procedures
ISO 14040:	DIN EN ISO 14040:2006-10, Environmental management - Life cycle assessment - Principles and framework; EN ISO 14040:2006
ISO 14044:	DIN EN ISO 14044:2006-10, Environmental management - Life cycle assessment - Requirements and guidelines; EN ISO 14040:2006
PCR A:	General product category rules for building products from the EPD programme of Ecobility Experts GmbH: Calculation rules for the LCA and requirements for the background report
PCR B:	Product Category Rules for food products from the EPD programme of Ki-wa-Ecobility Experts; Requirements for Environmental Product Declarations for food products, Edition 2022-11-15 (draft)
R<THiNK, 2022 :	R<THiNK; Online LCA & EPD tool from Nibe; 2022

	Publisher: Kiwa-Ecobility Experts Voltastrasse 5 13355 Berlin Germany	Mail Web	EN.Ecobility.Experts@kiwa.com www.kiwa.com/de/de/themes/ecobility-experts/
	Programme holder: Kiwa-Ecobility Experts Voltastrasse 5 13355 Berlin Germany	Mail Web	EN.Ecobility.Experts@kiwa.com www.kiwa.com/de/de/themes/ecobility-experts/
	Preparer of the LCA: Kiwa GmbH Voltastrasse 5 13355 Berlin Germany	Tel Mail Web	+49 30 467761 43 DE.Nachhaltigkeit@kiwa.com www.kiwa.com
	Declaration Holder: The Jackfruit Company PO Box 265 Boulder CO 80306 USA	Mail Web	knowjack@thejackfruitcompany.com www.thejackfruitcompany.com

Kiwa-Ecobility Experts is established member of the