LIFE CYCLE ASSESSMENT OF UBQ™ MATERIAL

Advanced waste conversion technology and emissions reductions

Results reviewed and validated by

Quantis

WASTE IS ONE OF SOCIETY'S BIGGEST GLOBAL CHALLENGES

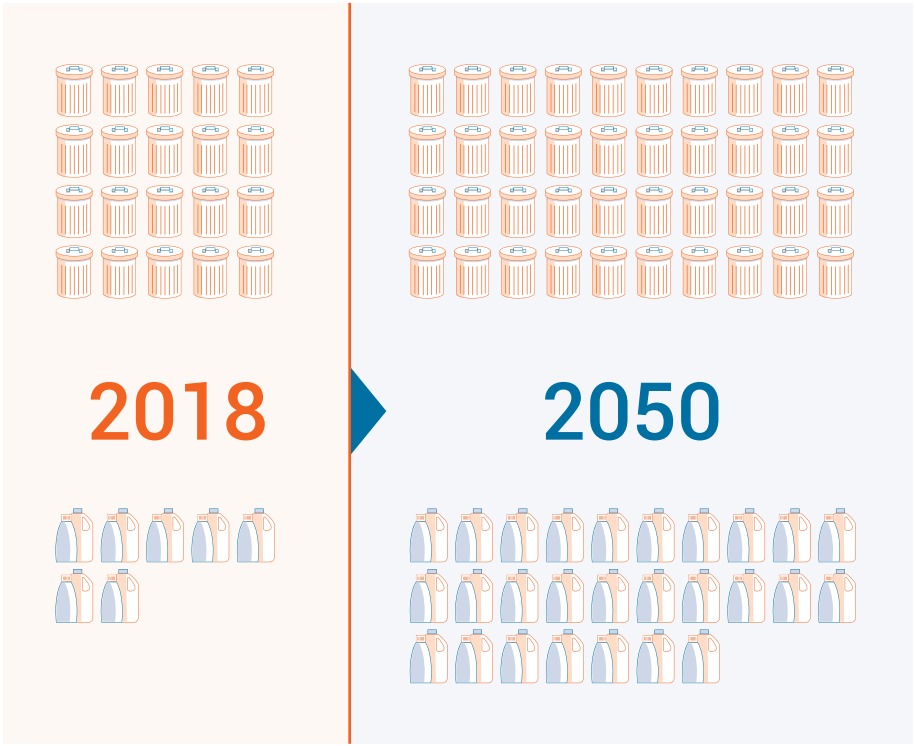
We generate ever-increasing waste. Global municipal solid waste generation exceeds **two billion tons per year** and is expected to **double by 2050**[1].

We produce ever-increasing plastic. Global annual production and consumption of plastics is expected to quadruple from the current **350 million tons to over 1.35 billion** tons by 2050[2].

We generate ever-increasing greenhouse gas emissions. Landfills emit massive volumes of methane and other pollutants that destroy our natural environment.

We need a solution to stop linear consumption and the ever-growing waste proliferation.

Properly managing waste and leveraging it as a renewable resource are critical to mitigate global warming below 1.5°C, as per the 2015 Paris Agreement[3] and the 2018 IPCC Special Report (SR15)[4].



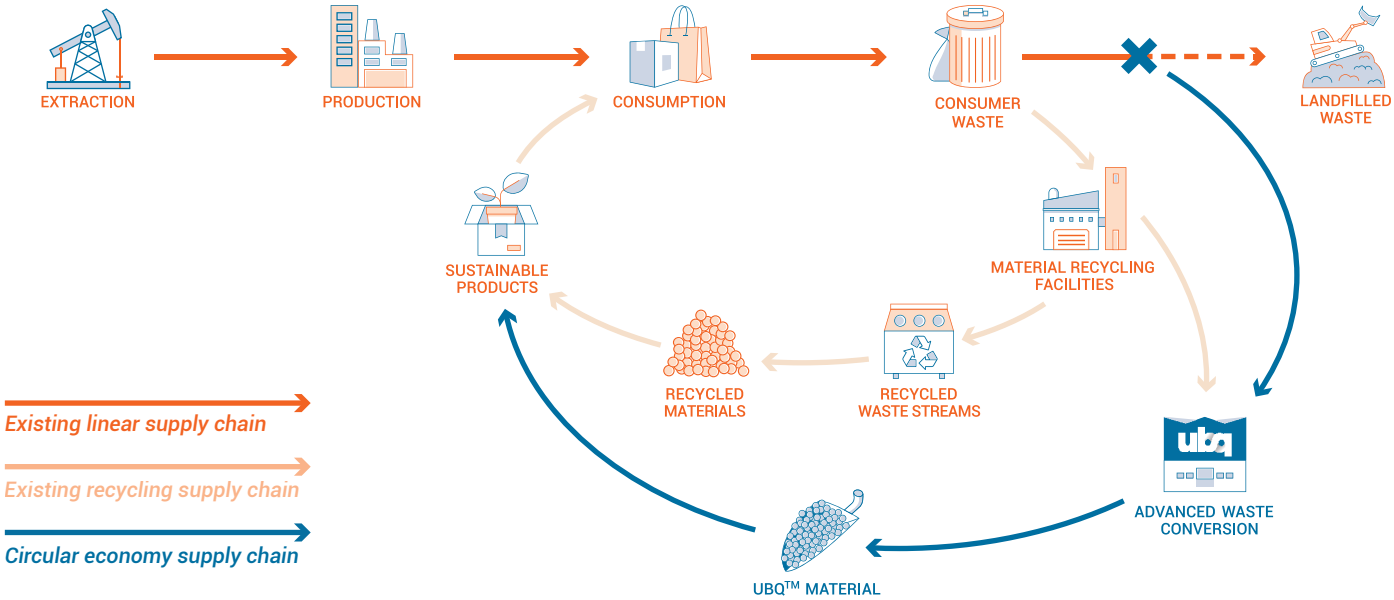
50 million tons of **municipal solid waste**

50 million tons of **plastic**

UBQ BREAKTHROUGH TECHNOLOGY CONVERTS WASTE TO A NEW RESOURCE

UBQ Materials Ltd. (UBQ) has developed a robust close-loop technology that valorizes municipal waste, including all organic waste, and converts it into safe, durable and recyclable thermoplastic materials.

UBQ plays an important role in the transition towards a low-carbon circular economy.



UBQ protects the environment by conserving finite resources and tackles global warming by avoiding landfill emissions and reducing pollution.

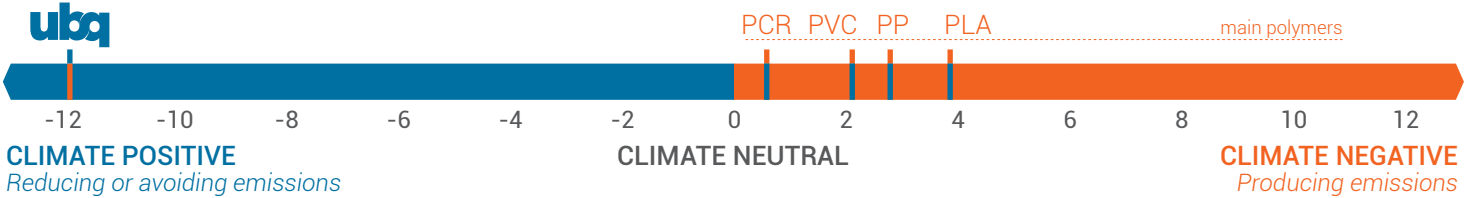
KEY ENVIRONMENTAL BENEFITS OF THE UBQ SOLUTION

01 Significant reduction of greenhouse gas emissions

The production of UBQ™ Material uses unsorted, residual municipal solid waste as its primary feedstock, diverting it from a high-emission destination: the landfill.

Since the UBQ waste conversion process is highly energy efficient, **the UBQ solution provides a substantial net benefit in the form of avoided greenhouse gas emissions[5].**

TO THE BEST OF OUR KNOWLEDGE, THIS POSITIONS THE UBQ™ MATERIAL AS THE MOST CLIMATE POSITIVE THERMOPLASTIC MATERIAL IN THE MARKET TODAY[6].



AVERAGE NET CARBON FOOTPRINT OF 1 kg OF **UBQ™ MATERIAL** **-11.7 kg/CO_2eq (GWP20)**

ENVIRONMENTAL BENEFIT **14.5 kg/CO_2eq** Total Offset Value

AVERAGE NET CARBON FOOTPRINT OF 1 kg OF **POLYPROPYLENE (PP)** **2.8 kg/CO_2eq (GWP20)**

NOTE A: When using GWP100, the benefit is less significant but still places the UBQ™ Material in the lead of the climate positive scale.

NOTE B: UBQ has used the widely recognized UNFCCC methodology[7] in conjunction with supporting IPCC data[8] to calculate the amount of methane that is avoided by diverting MSW from landfill using the UBQ solution. The company has also calculated the emissions related to their processing (principally energy use), following a standard life cycle assessment procedure (ISO 14040).

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02 Neutralize the carbon footprint of conventional polymers

When UBQ™ Material is combined with conventional (oil derived) polymers, the UBQ™ Material can offset the carbon footprint of the material blend[9].

This can result in carbon neutral or even carbon negative products.

As an example, when compounded with virgin polypropylene, a UBQ™ Material load of 20% can achieve carbon neutrality (GWP20). (On a long-term impact scale (GWP100), a UBQ loading level of 34% can achieve carbon neutrality).

03 Accelerate the transition to a circular economy

Through waste diversion, conversion and resource efficiency, the UBQ process up-cycles municipal waste into a valuable resource:

- Converting mixed organics and plastics into valuable materials
- Reducing the need to extract new fossil resources
- Creating a close-loop system that replaces the standard linear cradle-to-grave system
- UBQ™ thermoplastic composites are fully recyclable, further contributing to a circular economy.

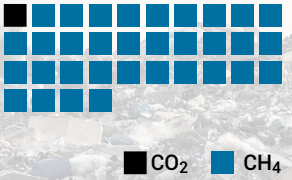
GLOBAL WARMING POTENTIAL FROM LANDFILL WASTE

In a landfill, waste decomposes in anaerobic conditions and produces methane. Methane, a potent greenhouse gas, is typically measured in "CO_2 equivalence" to quantify its climate impact compared to carbon dioxide. To understand the impact of carbon equivalence on earth's climate over time, referred to as Global Warming Potential (GWP), measurements are typically made using either a short- or long-term scale (20 or 100 years). Both scales allow scientists to calculate the carbon footprint of greenhouse gases. In the 20-year scale, methane has a significantly higher impact.

LONG-TERM IMPACT SCALE
[100 YEARS]

GWP100 (as in IPCC reports[10])

Used by most standards and published studies.



Methane is **34** times more harmful than CO_2

SHORT-TERM IMPACT SCALE
[20 YEARS]

GWP20 (as in IPCC reports)

Addressing the urgency we face to fight climate change.

Methane is **86** times more harmful than CO_2

Both approaches are equally valid from a scientific perspective.
The difference comes from the time scale at which decisions must be made.

UNIQUE PROPERTIES OF UBQ™ MATERIAL

BIO-BASED

UBQ™ Material is a composite thermoplastic material made from residual waste input, classified as third-generation feedstock[11].

Given the majority percentage of organic waste content (food leftovers, garden trims, mixed paper and cardboard) in UBQ™ Material, it is considered to be bio-based[12].

COMPATIBLE

UBQ™ Materials can be utilized on their own or blended with oil-derived and/or bio-based polymers.

UBQ™ Materials are applicable using standard manufacturing technologies. This enables their immediate implementation in thousands of different products across a diverse range of industries and segments.

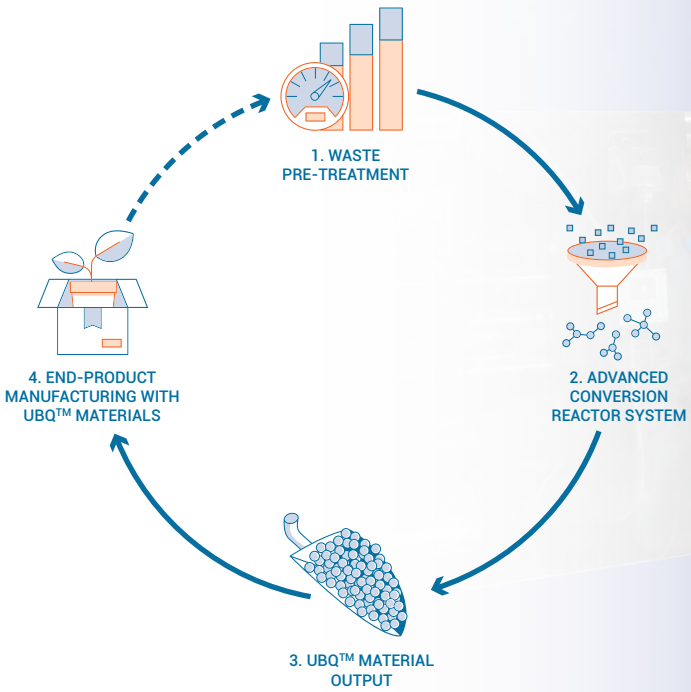
RECYCLABLE

When properly collected for recycling, products made with UBQ™ Material can be recycled multiple times[13].

Although UBQ™ Material is largely bio-based, it should not be assumed as biodegradable.

UBQ CONVERSION PROCESS

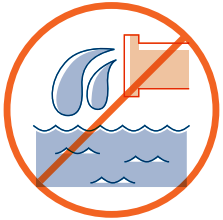
The UBQ conversion process creates a complete mechanical and chemical transformation of waste feedstock.



THE UBQ SOLUTION IS COMPLETELY SAFE AND COMPLIANT

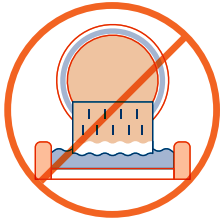
PROCESS

The UBQ facility abides by industry standards operating under all necessary permits, certifications and licenses required[14]. The UBQ conversion process, operating at low temperatures, is highly energy efficient and involves a closed-loop system that generates:



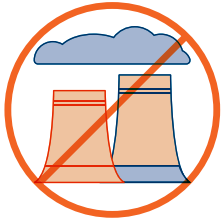
ZERO WATER CONSUMPTION

ZERO PRODUCTION WASTE



ZERO EFFLUENTS

ZERO COMBUSTION



ZERO HAZARDOUS FUMES

The complete mechanical and chemical transformation of waste in the conversion process does not allow the survival of microorganisms and neutralizes molecules related to material degradation.

UBQ operates its commercial facility in Israel with an annual production capacity of 5,000 metric tons of UBQ™ Material. The UBQ conversion process is an economically viable self-sustaining system[15].

MATERIAL

UBQ™ Material is safe for people and the environment and does not present any health or safety concerns[16]. Testing performed by leading independent laboratories, using the most stringent US and European hazardous waste rules, as well as Cradle-to-Cradle standards. It is also compliant under REACH[17].

The material is competitively priced compared to conventional plastics, while providing a significant environmental added value.

UBQ PROVIDES CLEAR ADDED VALUE

Actively contributes to a **circular economy**, diverting waste from landfills

Avoids significant greenhouse gas emissions, enabling **carbon neutral** and **climate positive** applications

Valorizes third-generation feedstocks as a **renewable resource**

Provides a **commercially viable**, bio-based composite material, compatible with other market **polymers**

ubq

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5. UBQ Materials Life Cycle Assessment: Impact, Context and Use of UBQ Material in Diverting Landfill Waste Disposal and Reducing Waste Related Emissions, Full Report, UBQ Materials, 2019
6. The comparative scaling uses the short-term (GWP20) for both UBQ and the generalized material data per the EcoInvent database with the following values: PCR(g) of 0.4 t/CO_2eq.; PVC(sp) of 2.2 t/CO2eq.; PP(g) of 2.8 t/CO_2eq.; and PLA(g) of 3.8 t/CO_2eq.
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8. IPCC Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories, 2009, Volume 5: Waste, Chapter 2: Waste Generation, Composition, and Management Data; Chapter 3: Solid Waste Disposal, Chapter 5: Waste, and Background Paper: CH_4 Emissions from Solid Waste Disposal
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11. [Terminology EN 16575] Third Generation Feedstocks: Relying on direct waste streams that typically have no other intended use and are either buried (landfilled) or burned (incinerated). Algae are also considered as 3rd generation. Agricultural waste is 2nd generation feedstock.
12. [Terminology EN 16575] Bio-Based Products: A product wholly or partly derived from biomass. Products can be an intermediate, material, semi-finished or final product.
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17. REACH Analysis Report: Impact on UBQ Products, ETHOS Architecture, Planning, & Environment Ltd, Dov Basel, Senior HSE Partner, 2014

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