Deposy

- Redefining Plastic Waste –

Description of a deposit system based on Distributed Ledger Technology

Deposy

BIOTA e.V. (i.G.)

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Wiescher Weg 58d

45472 Mülheim an der Ruhr

E-mail: info@Deposy.org

Deposy Project

1. summary

Since 1964 the production of plastic has increased twentyfold. Currently, 400 million tons of plastic are produced annually worldwide and plastic production is expected to double in the next 20 years.

According to a study by management consultants McKinsey, more than 30 percent of all plastic packaging does not enter an orderly recycling cycle, but is disposed elsewhere at the expense of nature. The experts estimate the resulting economic costs at 40 billion dollars per year. Microplastic particles produced during the decomposition of plastic waste are absorbed by humans and animals through food and breath. According to experts, this entails increased health risks. On this occasion, a group of committed people joined together in a newly founded association to offer an opportunity to solve the problem.

The association considers the global avoidance of plastics to be the greatest opportunity to restore the ecological balance. However, seen globally, this is unfortunately an illusion, as scientists assume that plastic production will increase in the next few years. In addition, the association sees reuse and recycling as a great opportunity for the environment. The deposit system planned by the association, which is based on a distributed ledger technology, is also based on these principles.

'Deposy' stands for "deposit system", a new deposit system for plastics based on the crypto currency IOTA. With this project, the association wants to use a special deposit system to encourage people to sort plastic waste and deposit it in specially designed containers. In order to make the system attractive, more money is returned than was previously paid in deposit. According to the association, this could be made possible by potential state subsidies and donations, as well as by the value that sorted plastic waste has for the further recycling process.

2. problem statement

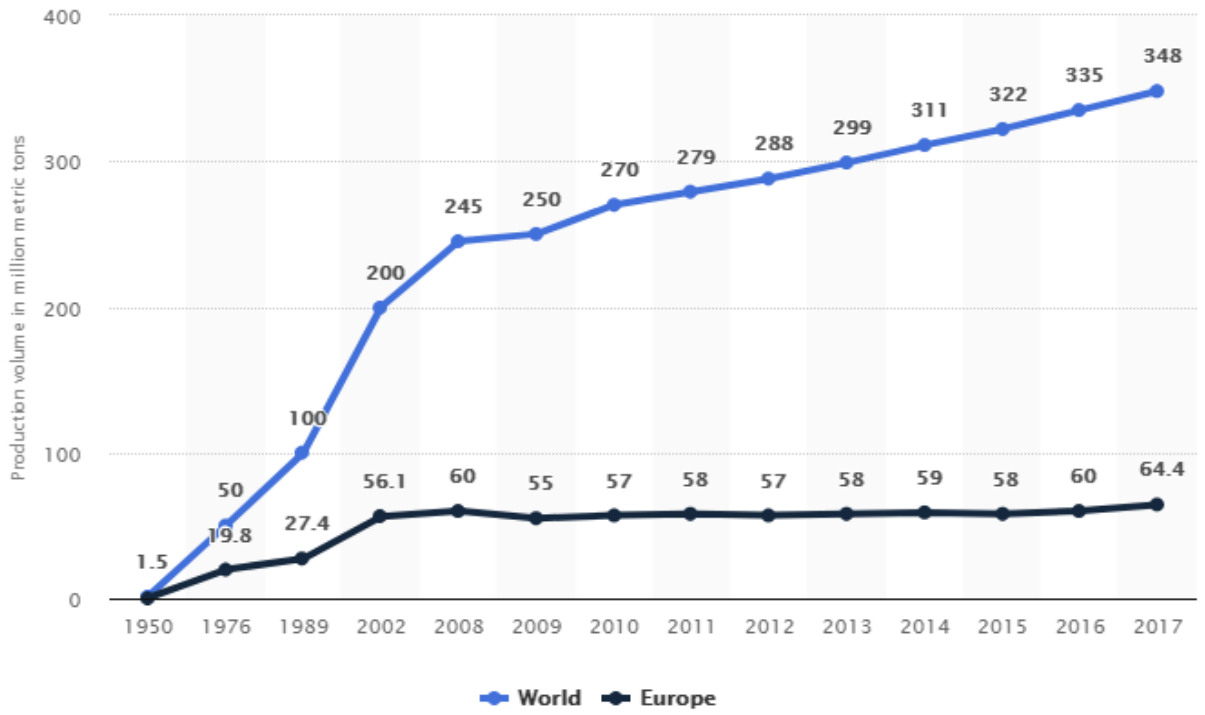
Plastic is omnipresent and it is hard to imagine our everyday life without it. We use plastic for life-saving medical devices, for clothing, toys and cosmetics as well as in industrial and agricultural products but also for packaging, cups and bottles. We have also known for some time about the growing risk posed by plastic waste in the environment, at landfills and in the oceans.

2.1. plastic waste problem

US researchers have calculated that more than eight billion tons of plastic have been produced since the beginning of the 1950s. Of these, around five billion tons are waste today. This plastic waste is disposed of in landfills, in the wild or swallowed by marine animals in the ocean.

Three-quarters of the garbage in the sea consists of plastics, which can take centuries to decompose. The global input is estimated at 10 million tons per year. Countries in Southeast Asia (China, Indonesia, the Philippines, Thailand and Vietnam) are responsible for the majority of the plastic waste deposited in the seas.

It is estimated that there are now between 100 and 142 million tons of plastic waste in the oceans. About 70 % of the plastic waste sinks to the seabed, of the remaining 30 % about half is washed up on the beaches, the other half floats on the water surface. According to the UN Environment Program, an average of 13,000 plastic waste particles now float on every square kilometer of sea surface [1].



Quelle: Statista; Global plastic production from 1950 to 2017 (in million metric tons)

2.2. health aspects

After some time plastic disintegrates and becomes so-called micro-plastic, which is hardly visible in our drinking water. Scientific studies indicate that chemical compounds are released predominantly during the decomposition of a micro-plastic, which can cause serious damage to human health. The spectrum ranges from allergies and obesity to infertility or the development of cancer and heart disease. In addition, nano-sized disintegrating micro-plastic particles can be absorbed through the lungs, intestines or skin and cause inflammation [1].

3. current problem solutions

3.1 waste incineration

Most of the plastic waste is not sorted in the first place, but ends up directly in the waste incineration plants. Because there is untiring competition for plastic between the disposers and recyclers. This waste is delivered to where it makes the most money. And today it is usually cheaper to incinerate the waste than to recycle it. This is because recycling is more expensive. This is particularly complicated with mixed plastic waste. First of all, the waste has to be sorted, which, depending on the plant, costs around 90 euros per ton and many plants are not even able to implement it with the required precision. Then there are sorting residues, which have to be disposed of at high cost, and some sorted waste, which can be resold. If the waste is too dirty or otherwise not of good quality, the bill no longer works out and it is more likely to go to thermal recycling. In Germany, therefore, there is a price war raging between the incineration and recycling industries. The new Packaging Act is intended to bring about lasting changes here.

3.2. shipping to Asia

Until January 2018, China was the main destination for plastic waste. The exporting countries, mainly G7 countries, disposed its waste there. Since 1988, around half of the world's plastic waste has gone to China. There, it was melted and processed into pellets for recycling. This changed fundamentally when China announced that it would only accept plastic waste packages with less than 0.5 percent contamination by non-recyclable materials.

Asia's bans and restrictions and increasing plastic waste have prompted some countries to propose reforms. In May 2019, 187 countries agreed to amend the Basel Convention, which regulates trade in hazardous waste. The disposal of plastic waste is therefore subject to stricter controls. The amendment is expected to enter into force in 2021 and will increase accountability. However, its success depends on rigorous controls. [2]

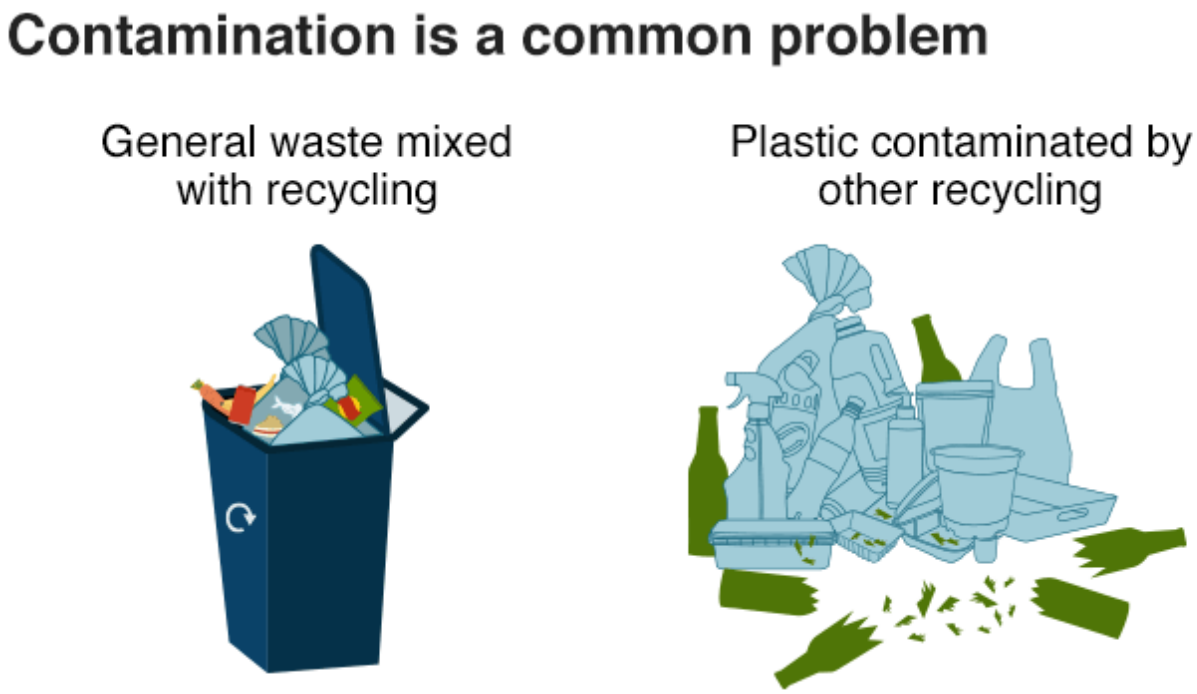
3.3. recycling

Recycling tries to stop this overexploitation of nature by using used packaging as a source of raw materials. This is because our packaging waste contains large quantities of high-quality plastics that can be reused using innovative technologies and serve as the basis for new packaging.

The dual systems in Germany are responsible for recycling packaging waste. These are recycling companies that specialize in collecting, sorting and processing recyclable waste. The best known of these is the Green Dot. In addition to glass, paper and metal, the recycling companies mainly collect old plastic from the yellow bags. Sorting plants then group the packaging and bottles according to type of material. This is important because the various types of plastic such as PET, PE and PP cannot be recycled together. This sorting step is very time-consuming and expensive, and it is at this point that it is often decided whether plastic waste will be recycled or whether it will be sent for thermal recycling.

After sorting, the individual types of plastic are shredded into flakes, cleaned, finely sorted again and finally melted into granulate. The resulting recycled material is a secondary raw material from which new bottles, trays and other types of packaging can be produced without the need to re-produce new plastic from fossil raw materials.

Without good waste separation and sorting, no recycling. Because everything that ends up in household waste is burned in waste incineration plants. However, if packaging waste ends up in the Yellow Sack or Yellow Bin in a slightly different way than packaging waste, this makes sorting and thus the entire recycling process more difficult. The sorting plants specialize in packaging, everything else is sorted out and incinerated. Unfortunately, this all too often leads to considerable loss of easily recyclable plastic [3].



Quelle: Let´s Recycle

3.4. avoidance

We see global plastic avoidance as the greatest opportunity to restore the ecological balance. Anyone who wants to get involved here will find many valuable tips at the WWF: https://www.wwf.de/aktiv-werden/tipps-fuer-den-alltag/tipps-zur-plastikvermeidung/plastik-im-alltag-vermeiden/

4. problem solving with 'Deposy'

As just described, the recycling of plastic waste plays a major role in curbing the global plastic waste flood. The problem is that many things are not sorted by consumers and either end up in normal household waste or, in many cases, are disposed of directly in the environment. Another problem of the Dual System in Germany, for example, is that a large proportion of consumers do not handle waste separation properly and therefore the waste can be recycled in a time-consuming and unmixed manner.

Even the assessment that reusable systems are better for the environment than disposable systems is not always correct. Reusable packaging is usually heavier and requires more energy to produce and, of course, more fuel for transport due to its higher weight. Added to this are the consumption of water and detergent for washing dishes. In the example of cups, the sober conclusion is: "The advantages of returnable cups have not yet been proven". The Verbraucherzentrale NRW has compiled the pros and cons and came to the conclusion in a technical discussion that reusable cups only offer ecological advantages if they are used as frequently as possible, rinsed as ecologically as possible and transported as quickly as possible. This not only applies to cups, but also to many other types of packaging.

In the end, however, one discipline problem remains - thoughtless throwing away. According to a consumer center, up to 17 percent of the rubbish lying around on the streets and green areas is disposable. This is not only ugly, but also expensive. The University of Tübingen alone spent around 16,000 euros a year on collecting paper cups. The problem is that few consumers are motivated to sort things.

The 'Deposy' system offers an advantage for both variants, because the system provides an incentive to dispense the used packaging. To stick to the example just used, the Coffee-to-Go is a favorite child of the Germans. No matter whether disposable or reusable cups are used. On the one hand, it makes sense for disposable cups to be disposed of in certain dispensing systems and not simply in the environment or in normal household waste, and on the other hand, reusable cups only make sense if they are reused.

The 'Deposy' deposit system offers a solution for both disposable and reusable packaging by creating an incentive to dispose of the packaging (e.g. coffee-to-Go cups). Such a system is conceivable due to its simplicity, even in smaller areas. This system can also be used away from other deposit systems such as shops. If one thinks in a global scale, then this characteristic can be enormously important. The system becomes absolutely unique through the implementation of modern deposit payments. The developed system is based on the fully suitable features of IOTA, a distributed ledger technology. IOTA is a young crypto currency that enables a fast, secure and free transfer of data and finances. A conventional system, which would be handled by banks, would not meet the requirements of the system. So we imagine it to be uses for the production of special plastic packaging or cups

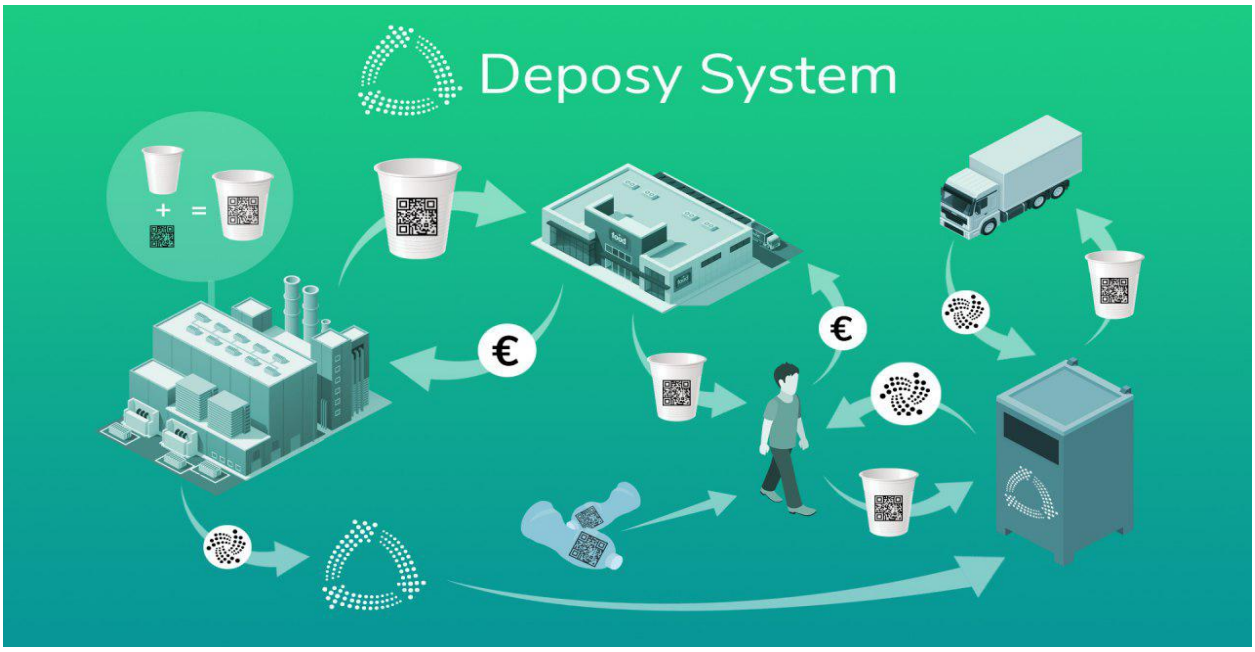
- in cities
- in schools & universities

- at events
- at supermarkets or retails shops
- at fast-food chains
- etc.

not only in Germany, but globally. Wherever it makes sense and it is useful to collect packaging again in order to reuse it or recycle it.

4.1. how the system works

Basically, the system works quite simply. When you buy a special product with a QR code, a deposit of a certain amount is charged. After use, the product can be returned to a special 'Deposy' vending machine. The person who returns it receives the deposit either as an IOTA payout on his wallet (i.e. his digital wallet - declaration under: Realization with IOTA) or via a cooperation partner in local currency on his account. In addition, the association is considering making the system even more attractive by receiving more money back on return than was previously paid in deposit. According to the association, this could be made possible by potential government subsidies and donations, as well as by the value of sorted plastic waste for the further recycling process.



Quelle: BIOTA e.V. (i.G.)

The 'Deposy' project aims to use this specially developed deposit system to obtain pure plastic waste and also to encourage people to collect and sort it. The developed system is based on the fully suitable properties of IOTA, a distributed ledger technology. IOTA is a young crypto currency that enables a fast, secure and free transfer of data and finances. A conventional system, which would be handled by banks, would not meet the requirements of the system. The basic prerequisites for a successful implementation are scalability without exponentially increasing costs, transparency of the system and decentralized, secure process control. Micropayments could be carried

out together with data exchange. Furthermore, this system can also be used away from the facilities otherwise required for deposit systems, e.g. shops. If one thinks on a global scale, then this characteristic can be enormously important. There are several things that make the system stand out:

- The population is given a financial incentive to collect, sort and dispose of plastic waste. More is paid back than the deposit was paid.
- The application is simple. It is based on IOTA, a modern distributed ledger technology and could be used worldwide.
- The collector gets the deposit either on his IOTA Wallet or thanks to a cooperation also in his local currency, e.g. Euro paid out to his account.
- The mechanical sorting of plastic waste is still complex today and also requires a lot of energy. Furthermore, a recycled plastic requires far less energy than a completely new production process. The deposit system thus helps to reduce CO2 emissions and achieve climate targets.
- This system makes it easier for industry to achieve its recycling targets because it eliminates the upstream step of expensive mechanical sorting.

4.2. costs

As there are currently no prototypes, it is difficult to estimate the costs in detail. However, it is important to us that we predominantly use inexpensive standard components. Furthermore, no special safety precautions are necessary, as there is no cash in the container which is paid out. These are the reasons why the costs for such a system should be in a manageable range.

5. repercussions

5.1. reduction of plastic waste

Depending on the place of use, this system (each 'Deposy' machine) can be used to collect several tons of plastic waste per year, sorted by type, which can then be reused.

5.2. source of income for collectors

For many people in poorer countries, garbage is a livelihood: garbage collectors keep their heads above water by sifting through garbage and reselling valuable objects or materials: Glass, paper, cardboard and metal as well as plastic packaging, bottles and bags. In cities in Africa, Latin America and Asia, they are part of everyday urban life. But they can also be found on the streets of North America and Europe.

Plastic waste from packaging is also valuable, because sensibly collected plastic waste can contribute to saving economic costs through recycling or reuse. The negative health aspect caused by microplastics should also not be ignored. The 'Deposy' deposit system is also intended to encourage normal consumers to sort and dispense. In order to make the system attractive, the person who sorts and returns the plastic waste receives more money back than was previously paid as a deposit.

This could be made possible by potential government subsidies and donations, because the avoidance of plastic waste has an economic value, but also by the value that a sorted plastic waste has for the further recycling or reuse process.

Those who search, sort and dispose of such plastic waste on a larger scale ensure that the environment is relieved on the one hand and receive an additional small source of income on the other. The system therefore also has a social aspect, because it is often people on the margins of society who can improve their narrow budget by collecting, sorting and disposing of plastic waste.

5.3. realization with IOTA

IOTA (MIOTA) is a crypto currency that is a secure communication and payment protocol for the Internet, often referred to as Things (IOT). Instead of a classic blockchain, the system uses the so-called "tangle", which offers some advantages in terms of scalability and speed. There are a number of factors that make IOTA interesting. In summary, there are 5 areas in which IOTA clearly outperforms other crypto currencies:

- The transaction speed
- Scalability
- The feasibility of micropayments
- Efficiency
- The verifiable security against manipulation

The use of IOTA therefore offers clear advantages for the 'Deposy' system. There are no transaction fees for those who decide to pay on the IOTA Wallet. For this system, however, IOTA (MIOTA as a tradable unit) would have to be provided. If you think in terms of project size, there will be a large number of IOTA needed. Since there are a total of 2,779,530,283 MIOTA and these are also highly scalable, this is not a problem in this respect.

5.4 .CO2-Emission

'Deposy' can be used to collect reusable plastic and to recycle it for actual use. For example, when plastic cups are used - if the overall ecological balance makes sense and there is a significant reduction in CO2 emissions.

In addition, it can lead to the disposal of single-variety plastic waste, which can be recycled appropriately. Recycling not only conserves our natural resources by recovering valuable raw materials, it also relieves the climate. The use of secondary raw materials reduces the energy requirement in the production of plastic products by up to 50 percent. The fact that manufacturers can avoid new plastic thanks to high-quality recyclate also contributes to climate protection. Both have a positive effect on the CO2 balance. 'Deposy' can thus contribute to achieving the climate targets that have been set.

6. long-term view

6.1. next steps

In the near future we will have intensive discussions with manufacturers and recyclers. Furthermore we will filter out possible testbeds for our application. Interested parties have already registered for test applications.

6.2. from the idea to the test system

The construction of a first functional, real prototype costs a lot of money. The first step will be preliminary planning with equipment manufacturers and the relevant IT experts. After that, a detailed planning (construction) of such a machine will be carried out in order to have a prototype built in the next step. We hope to raise the necessary funds through donations and/or grants.

6.3. who could benefit and how?

There are many who could benefit from such a system. Some advantages have been worked out here.

Advantages for companies that use 'Deposy'

- Marketing (environmental awareness, image gain)
- Commitment to CO2 neutral production by 2050
- conservation of resources
- In some areas: deposit system saves manufacturing costs
- Government support programs
- Compliance with legal requirements

Advantage for those who participate (collectors)?

- Financial advantage (deposit) - possibly larger deposit return as deposit
- Good conscience (environmental awareness)
- Plus point for individual CO2 tax (dreams of the future)

Economic advantages (environment, state)

- Economic costs (40 billion per year)
- Achievement of national / international climate targets (Paris agreement) CO2 neutrality
- Health consequences

Sources:

[1] https://www.dguht.de/plastikmuell-risiko-fuer-mensch-und-umwelt/

[2] https://www.boell.de/sites/default/files/plastikatlas_2019_3._auflage.pdf?dimension1=ds_plastikatlas

[3] https://initiative-frosch.de/recycling-eine-erfolgsgeschichte/