LAYMAN'S REPORT

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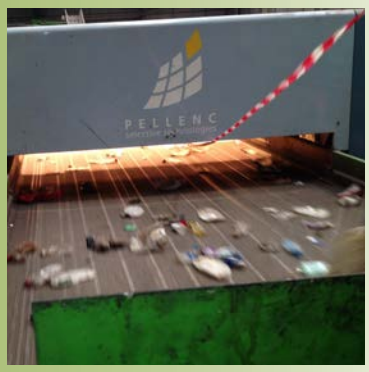





PLASTIC ZERO

PUBLIC PRIVATE COLLABORATIONS FOR AVOIDING PLASTIC AS A WASTE



LAYMAN'S REPORT

PLASTIC ZERO

CONTENTS

Photos: Colourbox

INTRODUCTION

This report presents the results of Plastic Zero with the hope to inspire further action to enhance plastic resource-efficiency. The overall objective of the Plastic Zero project was to reduce wasteful use of plastic made from fossil based oil, save non-renewable resources and enable carbon neutral energy production from waste. We investigated how to prevent waste plastics and increase the recycling rate. Additional information came from interviews with European stakeholders and site visits, plus review of literature in the field. Challenges and difficulties revealed in the process are equally important experiences and will also be discussed.

Based on the experiences from the process we have developed a guideline on how to make a road map. Our intention is to give inspiration on possible measures to tackle the issue in similar projects.

The main target group is local authorities, regional waste authorities and producer responsibility organizations in charge of plastic waste management. These actors are of special interest because they have the capacity to take regulatory initiatives.

OBJECTIVES OF PLASTIC ZERO

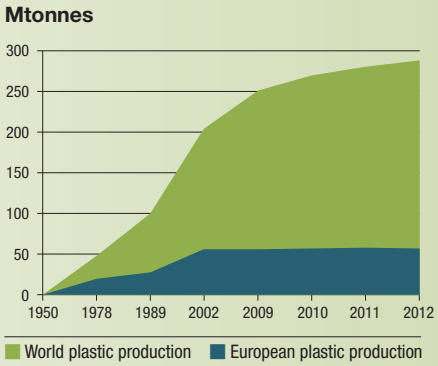
- To identify the main challenges and barriers for reducing waste plastics in the residual waste stream, in order to stimulate prevention and recycling of waste plastics
- To promote recycling of plastic polymers as a substitute for virgin plastic
- To divert waste plastics from incineration (enabling residual waste to become a carbon neutral energy source) and landfill.

An important feature of the Plastic Zero project has been to set up collaborative forums involving public and private stakeholders. The forums aim at identifying and analyzing relevant interfaces between the partners in the value chain, and providing the necessary support and incentives for setting up collaboration aimed at making value chains more sustainable. Involving all stakeholders in the value chain gives innovative opportunities to rethink product design.

Plastic Zero is a 3-year LIFE+ project started in September 2011 and finalised in August 2014. Partners are three cities, three waste management companies and one university.

SETTING THE SCENE

Plastics are one of the most multipurpose and universally used materials in the global economy. They have a wide range of marvellous qualities: Plastic can be moulded and coloured into almost any shape or colour, it is waterproof, lightweight and generally cheap. With a multitude of applications the use of plastic has exploded with an annual global increase of 9% since the 1950'ies. Consequently, waste plastics amounts have also drastically increased.



THE ISSUES AROUND WASTE PLASTICS

There are several environmental impacts of fossil based plastics. Here, we focus on energy consumption and CO2 emission.

Most plastics are produced from fossil oil, a scarce resource and a source of CO2 emission. 4% of all globally produced oil and gas is used in the production of plastics, and the production of virgin plastics emits 5% of all industrial carbon emissions. On top of this, the production process requires 70-80 MJ/kg plastic.

Due to the fossil oil base of (most) plastic, it is considered an energy carrier and in some countries the waste plastics content in residual waste is currently incinerated for energy recovery. Though the energy content of waste plastics is high relative to other waste materials, incineration is not an efficient way to exploit the energy content: Incineration yields 30-40 MJ/kg plastic. Thus the 70-80 MJ/kg required to produce plastic results in the production of 30-40MJ/kg energy, corresponding to a loss of 30-50 MJ/kg, about half the energy required for virgin plastic production.

Compared to virgin production of plastic, recycling saves 80-90% energy, resulting in proportionally large savings in CO2 emissions. Furthermore, recycling, when compared to incineration and disposal, gives net CO2 savings, normally in the range of 1.5-2 kg per kilogram of plastics.

LOCAL WASTE ANALYSIS
- composition & infrastructure

Assessing potential volumes of waste plastics, actually collected volumes and sources/types of collected plastic provides a baseline for monitoring the impact of initiatives.

Plastic Zero initially created an overview of local waste infrastructure with focus on:

- *Existing collection systems: collection point, recycling stations, containers, etc.*
- *Treatment plants, incinerators, landfills, cement kilns, etc.*
- *Regulation: responsibilities of resp. national and local authorities and businesses for products, waste and waste management.*

We also measured:

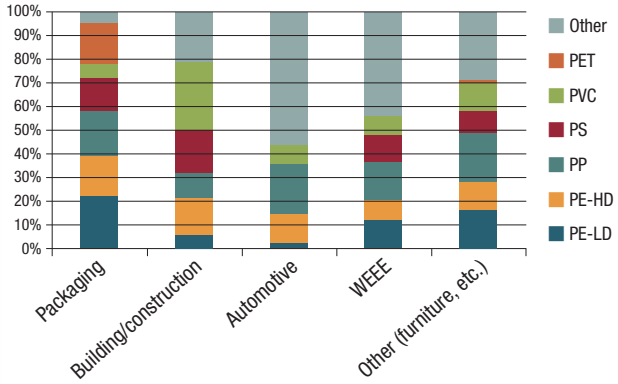
- *Local waste plastics composition*
- *Major local waste plastics flows from industry, retail and households*
- *Amounts separated and recycled; quality of recyclates*

For transferablity of results all these aspects of the local context must be taken into account.

WASTE PLASTICS STREAMS

Plastic comes in many types and has many applications as illustrated in the figure below. Waste plastics from all these sources cover a wide range of polymers. These must be separated into pure polymer fractions in order to produce high quality recyclates.

PLASTIC TYPES BY APPLICATION



Source: Plastic Zero (2012) based on data from PlasticsEurope and the mapping of waste plastic amounts among Plastic Zero partners.

Nearly 40 % of total plastics demand is used to produce packaging. As a so-called fast moving consumer good, packaging becomes waste within 12 months after purchase. For this reason plastic packaging is of special interest. Whereas other applications of plastics each account for around 5-7% of the plastic content of residual waste, almost 70% derives from packaging.

With 38 % of waste plastics being disposed at landfill and 36 % incinerated at EU level, there is a large unexploited potential for recycling waste plastics.

POTENTIAL FOR IMPROVEMENT

COMPARATIVE ASSESSMENT OF FIVE SORTING PLANTS

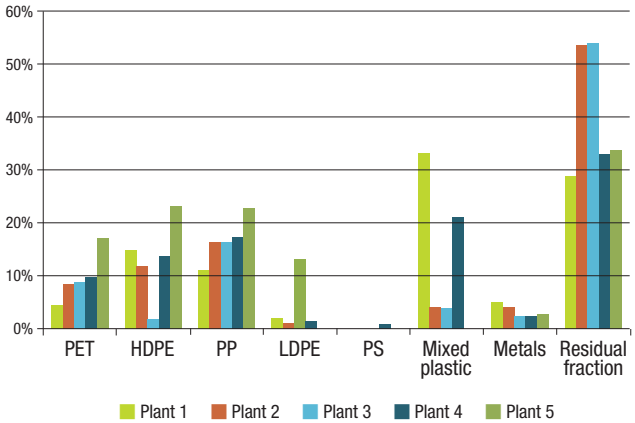
Five sorting facilities were tested in order to assess the five technologies and compare the recycling efficiencies of the facilities. Plant 1-4 are established sorting plants, while plant 5 is a test facility.

The graph clearly illustrates the huge differences in how the plants work. Summing up the separated polymer fractions shows that percentages for direct plastic recovery lay from 33-43% in the established plants, while the test plant achieved 63%.

The large differences in results from the sorting plants work give food for thought: The technological set-up does not only result in markedly different percentages of pure polymers. But assessing effectiveness of a plant requires looking at not only the residual fraction but also the mixed plastics fraction: While plant 1 produces the lowest percentage of residual waste, it produces the highest percentage of mixed plastics, giving a relatively poor total result compared to the other plants.

That plant 5, the test facility, has the overall best performance mirrors the fact that technologies are constantly advancing.

SORTING EFFICIENCY AT FIVE PLANTS



Though waste plastics are collected in many places, there is great potential for improving the exploitation of these waste resources.

Activities under the Plastic Zero project included site visits and collection of data on the efficiency of various technologies for the treatment of waste plastics.

These data indicate that there is great room for improvement of our technologies if we are to become resource-efficient.

The data also illustrate the importance of not simplifying matters when assessing technologies: it is important to take all aspects of a facility's performance into consideration.

Please refer to the Plastic Zero reports to see calculations of potential for prevention and recycling of plastics as well as CO2-emissions for all individual demonstration projects under Plastic Zero.

ROAD MAPPING - ACTIVITIES ENTAILED

A road map can support transition towards an overall goal. Involving stakeholders in forums across the value-chain enables the creation of realistic strategies and solutions as a wide range of interests and perspectives come into play. Dialogue between stakeholders - the process of developing the road map - is just as important as the road map itself.

Road mapping activities comprise:

- *Producing a baseline - to give overview and a basis for documenting impact*
- *Communication, management and organisation - in order to establish collaborative forums and make them work*
- *Collaboration in iterative learning processes – to ensure co-creation and enhance results.*

See the Plastic Zero Road Map at www.plastic-zero.com

ELEMENTS OF A ROAD MAP

Review of evidence: This starting-point of the road map describes where we are today and what the main environmental impacts are. During this preliminary stage a baseline of waste plastics amounts and composition should be established.

Vision and objective: This is the destination the road map aims at, consisting of a normative description of where we want to be in, for instance, 2030.

Barriers and challenges: The bumps on the road that could make it difficult to accomplish the desired changes. Examples of barriers are legislation, collection scheme operating costs, absence of sorting facilities within reasonable distance, and waste management systems are not designed to accommodate manufacturers' requirements.

Activities or initiatives: The steps taken to create and enable changes leading towards the vision. These can be divided into three basic types:

Analyses/evidence: Information on new technologies, changes in attitudes and habits, costs, relevant stakeholders to be involved, etc. This helps define relevant pilots and leads to appropriate implementation measures

Pilots: Following analysis, various options for handling specific challenges can be tested in order to develop scalable measures

Implementation measures: The means to reach the visions and aims of the road map.

Determining which are the appropriate visions, barriers, and activities depends on the local and national context in which the road mapping is taking place. A road map must therefore be a flexible document, where visions, barriers and activities are updated iteratively as activities generate new knowledge.

ITERATIVE LEARNING

CREATING INNOVATIVE SOLUTIONS

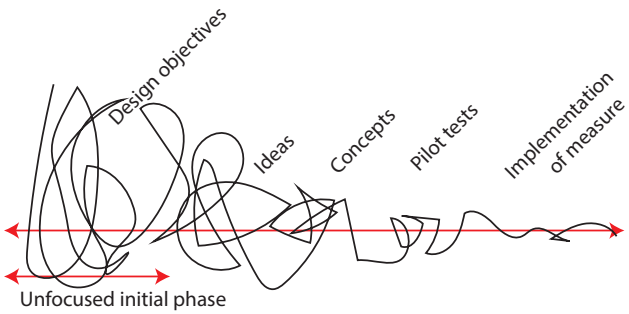
The road mapping process is at its core innovative, focusing on creating change, overcoming obstacles, and developing new solutions.

Regular monitoring and discussion of progress in each forum and demonstration project formed the basis for iterative learning in Plastic Zero and for identifying what would be interesting next steps.
Next steps could be as simple as getting specific stakeholders up- or downstream of the value chain to participate in forums. Or next steps could be to adjust previous assumptions about technical, economical or social dimensions of measures.

Iterative processes are about learning from experience and making adjustments on the way – a process also described as the observe-plan-do-check-adjust circle:

- Observe the situation
- Plan what to do
- Do it
- Check what happens
- Adjust plan

Iterative learning processes need to be somewhat open-ended as both goals and approaches may change on the way. The presentation of co-designing below illustrates the iterative learning process:



The process of developing a road map is iterative, meaning that progress in forums and demonstration projects is monitored and discussed with a view to throw light on lock-ins and create change.

The iterative process involves:

- *Monitoring and discussion - to pin-point necessary further analyses of problems and possible measures*
- *Demonstrations – to test new methods for waste prevention and management*
- *Implementation - new practices based on tests, monitoring and discussion*

ORGANISING COLLABORATIVEFORUMS AROUND VALUE CHAINS

Plastic Zero organised forums around plastic resource and waste flows with businesses that have committed to contribute to reduced environmental impacts. Forums focused on either prevention or collection, sorting and recycling.

Local dialogue meeting in Tampere, Finland

LESSONS LEARNT ON STARTING NEW FORUMS

Experience from the Plastic Zero project point to the following tips for how to organise collaborative forums:

- Spend time on identifying stakeholders that are key to creating change in the value-chain. Research CSR- and environmental policies which are often form the basis for companies' involvement
- Expect the various stakeholders to have different interests in participating in forums
- Formulate benefits/reasons to participate that match stakeholders' interests. These may be related to position in the value-chain, CSR-policy etc.
- Businesses are often interested in entering into forums with municipalities or other public bodies who have access to and leverage over public authorities
- Be clear about the specific contributions expected from each stakeholder: Requirements on time, economic, communicative and other resources should be clearly stated, as should time-schedules and deadlines.
- Meetings must occur frequently enough to maintain momentum in the process, but not more often than stakeholders can find time for
- It is desirable for businesses to engage in projects and collaboration with public authorities because they give projects legitimacy and because public-private collaborations are often highly profiled.

COLLABORATIVE FORUMS
UNDER PLASTIC ZERO, EXAMPLES

Harmful Substances in Toys and other products for children, Malmö, Sweden. Topic: Prevention
A large stakeholder group, including retail, procurement companies, public procurers and consumers, met to address eradication of harmful substances, primarily in children's products.

Purpose and perspectives: Avoidance of harmful substances through criteria for procurement and cradle-to-cradle principles; to enable green procurement policies and improve quality of waste material for recycling.

Barriers/opportunities: It was a challenge to engage private sector stakeholders, mainly in retail. The scale of the issue could be overwhelming. Lack of knowledge, lack of incentive to address the issue in existing regulation and guidelines, and clashes between economic considerations and environmental/health concerns were barriers.

Results: After a year, a survey showed continued activity: participants had e.g. increased knowledge sharing on the issue, formed new partnerships, applied new procurement standards in their supply chain. Mandatory third-party controllers were suggested as a means to raise standards of procurements.

Recyclability of Packaging, Copenhagen, Denmark. Topic: Collection, sorting, and recycling
The forum focussed on primary plastics packaging. The forum covered the value-chain including a large Danish dairy producer, two supermarket chains and a waste plastics reprocessor.

Purpose and perspectives: To improve the quality of recycled plastics available to manufacturers, thereby contributing to a stable supply of high quality recycled plastics for manufacturers, and enhancing the exploitation of collected waste plastics.

Barriers/opportunities: A seminar for designers and packaging manufacturers indicated a need for raising awareness on design for recycling.

Bringing stakeholders from across the value-chain together enables change that actors cannot make happen alone. This is why a main element of the Plastic Zero project was to create collaborative forums.

On this page we describe two forums in detail.
Read about more forums on www.plastic-zero.com

It is the lowest level of recyclability that determines the packaging's final ranking					
Criteria / Recyclability	**Container** (Main component)	**Sub-components** (Closures, lids, seals, inserts, tamper resistance, labels and sleeves)	**Identification**	**Residues**	**Mark level:**
High	The container is made in mono-material (Either PET, PE, PP or PS). No colouring of the container, prints are reduced to a minimum, e.g. date only.	Sub-components are made of the same mono-material as the container. Adhesives are reduced to a minimum and are water soluble at max 80°C.	Labels and sleeves are made the in same mono-material as the container	No residues after use. Emptying only takes a rinsing in cold water.	☐
Good	The container is made in mono-material (Either PET, PE, PP or PS). Minimal colouring and prints.	Sub-components are compatible with the container. Adhesives are water soluble at max 80°C.	Labels and sleeves are compatible and does maximum cover 40 % on bottles and 60% on tubs, trays and pots.	Can be emptied in cold water or by use of a simple tool, e.g. a spoon.	☐
Uncertain	The container is made of compatible materials. The container is coloured and has prints on it.	Sub-components are compatible. Adhesives are water soluble.	Labels and sleeves cover more than respectively 40% and 60% of the surface.	The packaging require separation to be emptied.	☐
Not fit	The container is made of composite of non compatible materials. The container is black or heavy coloured.	Sub-components contain metals and/or paper. Adhesives are not water soluble.	Labels and sleeves are in a different material than the container and cover the entire surface.	The packaging cannot be emptied.	☐

Form to be used by packaging suppliers

Results: Three large retailers indicated an interest in taking active part or being kept posted on future developments; An adequate but simple-to-use guideline for procurers and manufacturers was produced, The Design for Recycling Guideline – Primary Packaging. A success criterion is if the supermarkets use this guideline in their purchasing policy.

DEMOPROJECTS
UNDER PLASTIC ZERO, EXAMPLES

Demonstrations of new ways to prevent and manage waste plastics help clarify which solutions are both effective and socially and economically feasible.

Demonstrations can also help build support for new solutions and ideas.

Containers for waste separation, Liepaja

Citizens' willingness to separate plastic waste, Tampere RSWM Ltd., Finland. Topic: Sorting, collection and recycling
A tenth of residual waste was plastics, corresponding to 17,6 kg/cap./year. Due to coming legislation on producer responsibility for plastic packaging, a pilot with ten plastic packaging waste collection points was initiated.

Purpose and perspectives: To assess the potential that could be collected. The pilot focused on three aspects: people ' s willingness to sort plastic waste; how and where to set up the most efficient collection scheme; and environmental benefits and economic consequences of such a scheme.

Results: Ca. 4 tonnes of plastic waste were collected from the ten collection points each week. 18% of this was "unwanted types of waste", half of which, however, was "unwanted plastics". Wider implementation of the scheme awaits further data on environmental benefits of recycling various grades of waste plastics, as well as indications of the impact of the new producer responsibility legislation.

Awareness Raising - Source Separated Collection at Municipal Institutions, Liepajas RAS, Latvia. Topic: Sorting, collection and recycling
Liepaja City Council financed about 195 sets of containers for waste separation in public institutions. Paper/card-board, mixed plastics, and metal were collected. Some institutions added a container for residual waste to avoid contamination of the sorted waste.

Purpose and perspectives: Aims were to reduce residual waste quantities, promoting awareness of the necessity of source separation. Previously, there has been little focus on waste separation and recycling in Liepaja.

Barriers/opportunities: Large increases in separated waste plastics can be achieved by providing knowledge, awareness and opportunity. Private enterprises picked up on the idea as managers realised that better sorting reduces amounts of residual waste and decreases costs.

Results: The response has generally been positive: Children started to teach their parents about waste separation, and 27% of the municipal employees increased waste separation at home. The pilot has resulted in a permanent measure.

FACILITATING CHANGE IN COLLABORATIVE FORUMS

LESSONS LEARNT ON COLLABORATIVE FORUMS

IT TAKES EFFORT TO ESTABLISH INTERESTING FORUMS:
Identifying which companies it is relevant to include requires having an overview of the value-chain. Getting them to participate actively requires "translating" forum agendas so they match the individual company's environmental or CSR-policy is a useful approach.

FORUMS DO NOT RUN THEMSELVES:
A coordinator is necessary to keep the process on track. However, coordinators must not dominate or control processes, as this blocks the valuable innovation that can arise when participants across the value-chain create solutions together.

IT IS ESSENTIAL THAT PARTICIPANTS' EXPECTATIONS ARE ALIGNED:
Clear understanding of aims, deliverables, time plan, individual contribution of resources etc. is essential for successful collaboration.

COMMUNICATION IS CENTRAL:
Internal communication is key to keeping participants informed about issues, projects and progress. Monitoring reports should be used actively, and kept up-dated for this purpose.

IT HAS TO PAY OFF:
Companies need to think of the bottom-line. A good business case showing that measures or solutions are economically viable is therefore essential for keeping companies interested.

INNOVATION THRIVES FROM ITERATIVE PROCESSES:
Exploring issues in forums across value-chains is a learning process where old assumptions are challenged and plans and ideas may be repeatedly revised.

KEEP TRACK OF IMPACTS:
Establishing a baseline makes it possible to assess the impact of projects so that results can be used by others and contribute to the body of knowledge in the field of ressource-efficiency.

Forum meeting on black plastics, Copenhagen

Collaborative forums provide a space for analyses, idea generation and tests, gathering the stakeholders of a value chain to discuss possibilities and barriers to prevention and improved sorting/separation.

A large number of forums were established under Plastic Zero and many lessons were learnt on how to make forums work.

PLASTIC ZERO PROJECT PARTNERS

City of Copenhagen,
Denmark (Lead)

City of Malmö,
Sweden

Freie und Hansestadt
Hamburg, Germany

Liepajas RAS,
Latvia

I/S Amager Ressourcecenter,
Denmark

Pirkanmaan Jätehuolto Oy,
Finland

Aalborg Universitet,
Denmark

Photo: Colourbox

FURTHER INFORMATION, AT WWW.PLASTIC-ZERO.COM

ADMINISTRATIVE DATA

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Total budget	1,997,308.00 €	Contact	Mette Skovgaard – mette.skovgaard@tmf.kk.dk